DIPOLE CALIBRATION EXTENSION

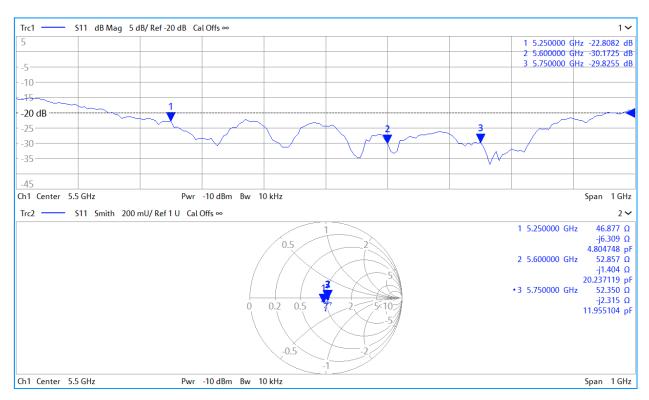
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

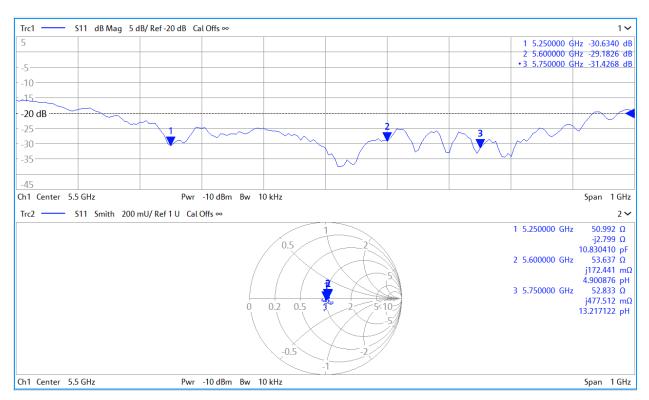
Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 17.0 dBm	Measured Head SAR (1g) W/kg @ 17.0 dBm		Certificate SAR Target Head (10g) W/kg @ 17.0 dBm	Measured Head SAR (10g) W/kg @ 17.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5250	1/16/2018	1/16/2020	1.203	3.96	3.72	-6.06%	1.14	1.05	-7.89%	50	46.9	3.1	-5.5	-6.3	0.8	-25.2	-22.8	9.50%	PASS
5600	1/16/2018	1/16/2020	1.203	4.205	3.91	-7.02%	1.2	1.11	-7.50%	54.7	52.9	1.8	-2.1	-1.4	0.7	-26.2	-30.2	-15.20%	PASS
5750	1/16/2018	1/16/2020	1.203	4.025	3.72	-7.58%	1.15	1.05	-8.70%	52.7	52.4	0.4	0	-2.3	2.3	-31.5	-29.8	5.30%	PASS
Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 17.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 17.0 dBm	Measured Body SAR (10g) W/kg @ 17.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5250	1/16/2018	1/16/2020	1.203	3.795	3.75	-1.19%	1.06	1.04	-1.42%	48.4	51	2.6	-3.9	-2.8	1.1	-27.4	-30.6	-11.80%	PASS
5600	1/16/2018	1/16/2020	1.203	3.995	3.98	-0.38%	1.12	1.1	-1.35%	55.3	53.6	1.7	-1.6	0.2	1.8	-25.6	-29.2	-14.00%	PASS
5750	1/16/2018	1/16/2020	1.203	3.835	3.87	0.91%	1.06	1.06	0.00%	52.6	52.8	0.2	1.1	0.5	0.6	-31.2	-31.4	-0.20%	PASS

Object:	Date Issued:	Page 2 of 4
D5GHzV2 – SN: 1057	01/16/2020	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dege 2 of 4
D5GHzV2 – SN: 1057	01/16/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Page 4 of 4
D5GHzV2 – SN: 1057	01/16/2020	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S С S

Schweizerischer Kalibrierdienst

- Service suisse d'étalonnage
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Accreditation No.; SCS 0108

Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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PC Test Client

Certificate No: D5GHzV2-1237_Aug18

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:12	237	· · ·	
	QA CAL-22.v3 Calibration procee	lure for dipole validation kits betw	veen 3-6 GHz 🕅	BNV 08/09/20
Calibration date:	August 10, 2018	· · · · · · · · · · · · · · · · · · ·		BN 08/09/20
The measurements and the uncerts	ainties with confidence pr	onal standards, which realize the physical units obability are given on the following pages and	l are part of the certifica	te.
All calibrations have been conducts Calibration Equipment used (M&TE		y facility: environment temperature (22 ± 3)°C	and numiony < 70%.	
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibr	ation
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19	
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19	
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19	ļ
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19	
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19	
Reference Probe EX3DV4	SN: 3503	30-Dec-17 (No. EX3-3503_Dec17)	Dec-18	
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18	
Secondary Standards	10 #	Check Date (in house)	Scheduled Chec	k İ
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (In house check Oct-16)	in house check:	Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check:	Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check:	Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check:	Oct-18
Network Analyzer Agilent E8358A		31-Mar-14 (in house check Oct-17)	in house check:	Oct-19
Calibrated by:	Name Manu Seitz	Function Laboratory Technician	Signature	5
Approved by:	Katja Pokovic	Technical Manager	T OU	Ţ_
		n full without written approval of the laboratory	Issued: August 1	7, 2018

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Schweizerischer Kalibrierdienst

C Service suisse d'étalonnage

Servizio svizzero di taratura

S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	4.61 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.5 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ±6 %	4.98 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	85.7 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	5.14 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.0 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.16 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.65 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.2 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	47.5 Ω - 3.5 jΩ
Return Loss	- 27.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	50.1 Ω + 4.7 jΩ
Return Loss	- 26.7 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	52.7 Ω + 0.8 jΩ
Return Loss	- 31.2 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	46.5 Ω - 1.3 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.1 Ω + 6.2 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	53.6 Ω + 2.1 jΩ
Return Loss	- 27.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction) 1,195 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufac	tured by	SPEAG
Manufac	tured on	May 04, 2015

DASY5 Validation Report for Head TSL

Date: 10.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1237

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Medium parameters used: f = 5250 MHz; σ = 4.61 S/m; ϵ_r = 35.6; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 4.98 S/m; ϵ_r = 35.1; ρ = 1000 kg/m³, Medium parameters used: f = 5750 MHz; σ = 5.14 S/m; ϵ_r = 34.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

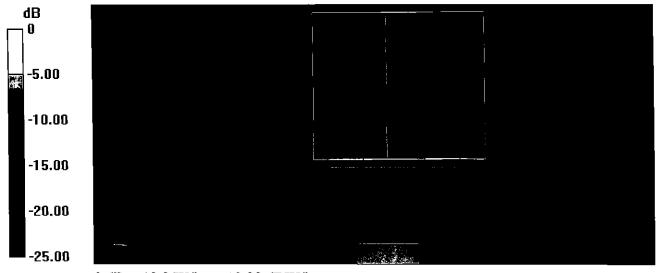
DASY52 Configuration:

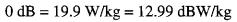
- Probe: EX3DV4 SN3503; ConvF(5.51, 5.51, 5.51) @ 5250 MHz, ConvF(5.05, 5.05, 5.05) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601 (5GHz); Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

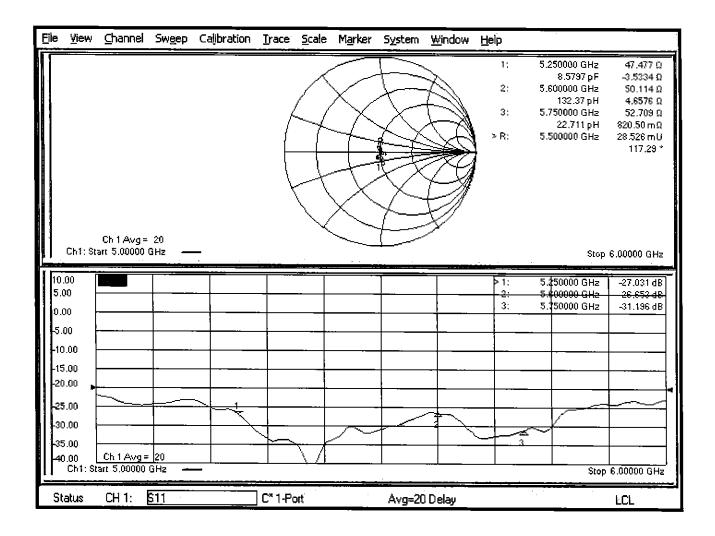
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 75.17 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 27.8 W/kg SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.36 W/kg Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 75.53 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 32.4 W/kg SAR(1 g) = 8.6 W/kg; SAR(10 g) = 2.46 W/kg Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 73.04 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 31.1 W/kg SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.32 W/kg Maximum value of SAR (measured) = 19.9 W/kg







DASY5 Validation Report for Body TSL

Date: 10.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1237

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Medium parameters used: f = 5250 MHz; σ = 5.49 S/m; ϵ_r = 46.9; ρ = 1000 kg/m³, Medium parameters used: f = 5600 MHz; σ = 5.96 S/m; ϵ_r = 46.3; ρ = 1000 kg/m³, Medium parameters used: f = 5750 MHz; σ = 6.16 S/m; ϵ_r = 46; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

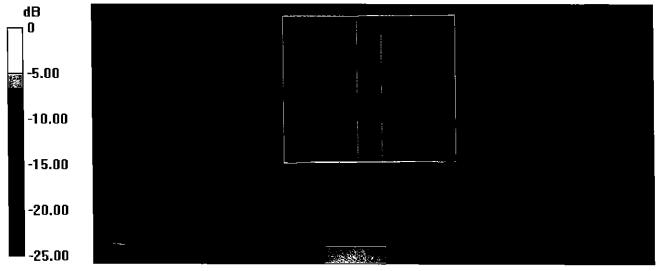
DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.26, 5.26, 5.26) @ 5250 MHz, ConvF(4.65, 4.65, 4.65) @ 5600 MHz, ConvF(4.57, 4.57, 4.57) @ 5750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601 (5GHz); Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.22 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 28.5 W/kg SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.14 W/kg Maximum value of SAR (measured) = 17.3 W/kg

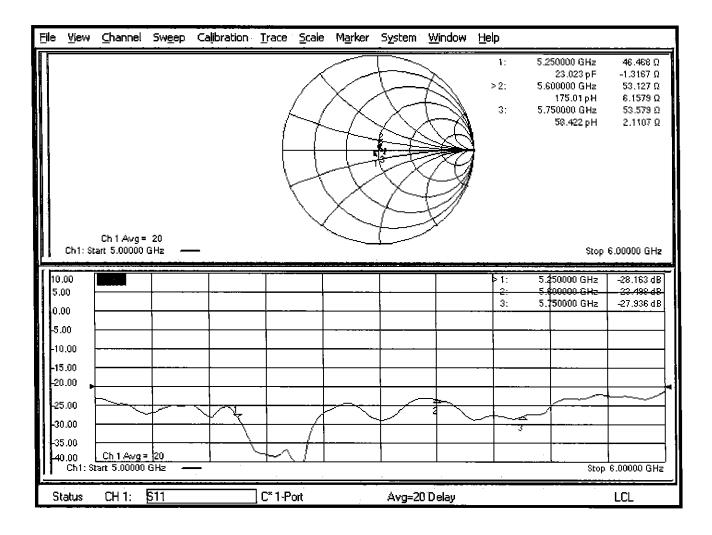
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.51 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 32.1 W/kg SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.22 W/kg Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 65.91 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 31.7 W/kg SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.14 W/kg Maximum value of SAR (measured) = 18.0 W/kg



0 dB = 18.0 W/kg = 12.55 dBW/kg

Impedance Measurement Plot for Body TSL





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http://www.pctest.com



Certification of Calibration

Object

D5GHzV2 - SN: 1237

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

08/09/2019

Extended Calibration date:

Description:

SAR Validation Dipole at 5GHz

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer		Annual	10/2/2019	US39170118
Agilent	N5182A	MXG Vector Signal Generator	6/27/2019	Annual	6/27/2020	US46240505
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1207470
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339007
Control Company	4040	Temperature / Humidity Monitor	2/28/2018	Biennial	2/28/2020	150761911
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330160
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	5/23/2018	Biennial	5/23/2020	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665
SPEAG	EX3DV4	SAR Probe	7/15/2019	Annual	7/15/2020	7547
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1323
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Daga 1 of 4	
D5GHzV2 – SN: 1237	08/09/2019	Page 1 of 4	

DIPOLE CALIBRATION EXTENSION

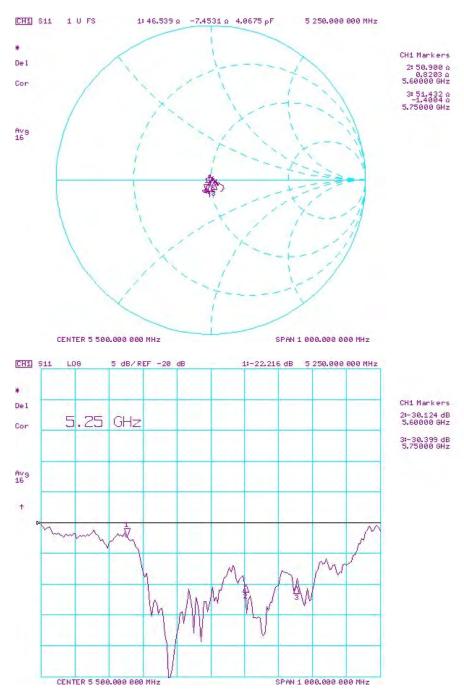
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

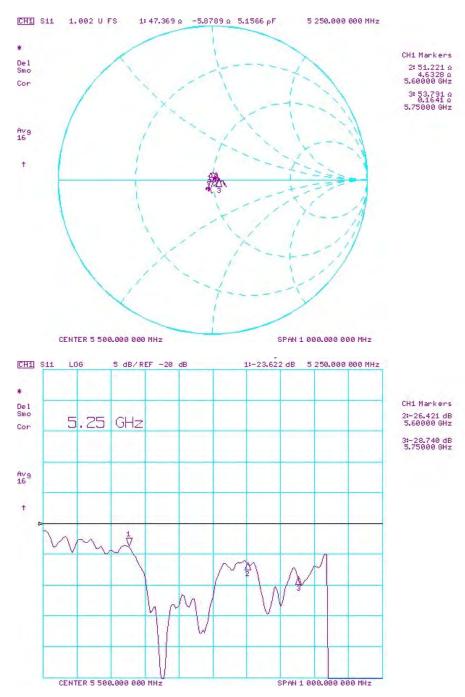
Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 17.0 dBm		Certificate SAR Target Head (10g) W/kg @ 17.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5250	8/10/2018	8/9/2019	1.195	4.065	3.81	-6.27%	1.18	1.09	-7.23%	47.5	46.5	1	-3.5	-7.5	4	-27	-22.2	17.70%	PASS
5600	8/10/2018	8/9/2019	1.195	4.285	4.06	-5.25%	1.23	1.15	-6.12%	50.1	50.9	0.8	4.7	0.8	3.9	-26.7	-30.1	-12.80%	PASS
5750	8/10/2018	8/9/2019	1.195	4.03	3.8	-5.71%	1.16	1.07	-7.36%	52.7	51.4	1.3	0.8	-1.4	2.2	-31.2	-30.4	2.60%	PASS
Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 17.0 dBm	Measured Body SAR (1g) W/kg @ 17.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 17.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5250	8/10/2018	8/9/2019	1.195	3.78	3.52	-6.88%	1.06	0.981	-7.45%	46.5	47.4	0.9	-1.3	-5.9	4.6	-28.2	-23.6	16.20%	PASS
5600	8/10/2018	8/9/2019	1.195	3.925	3.81	-2.93%	1.1	1.05	-4.55%	53.1	51.2	1.9	6.2	4.6	1.6	-23.5	-26.4	-12.40%	PASS
5750	8/10/2018	8/9/2019	1.195	3.795	3.58	-5.67%	1.06	1	-5.66%	53.6	53.8	0.2	2.1	0.2	1.9	-27.9	-28.7	-3.00%	PASS

Object:	Date Issued:	Daga 2 of 4
D5GHzV2 – SN: 1237	08/09/2019	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dere 2 of 4
D5GHzV2 – SN: 1237	08/09/2019	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Deris 4 of 4
D5GHzV2 – SN: 1237	08/09/2019	Page 4 of 4

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Accreditation No.: SCS 0108

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Certificate No: D750V3-1003_Mar20

PC Test Client

The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 03-Apr-19 (No. 217-02892/02893) Apr-20 Power sensor NRP-Z91 SN: 103244 03-Apr-19 (No. 217-02892) Apr-20 Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02893) Apr-20 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02895) Apr-20 Type-N mismatch combination SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Apr-20	4 1301 1
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.	4 1301 1
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.	<u>+</u> 13° 1
Calibration Equipment used (M&TE critical for calibration)Primary StandardsID #Cal Date (Certificate No.)Scheduled CalibrationPower meter NRPSN: 10477803-Apr-19 (No. 217-02892/02893)Apr-20Power sensor NRP-Z91SN: 10324403-Apr-19 (No. 217-02892)Apr-20Power sensor NRP-Z91SN: 10324503-Apr-19 (No. 217-02893)Apr-20Reference 20 dB AttenuatorSN: 5058 (20k)04-Apr-19 (No. 217-02894)Apr-20Type-N mismatch combinationSN: 5047.2 / 0632704-Apr-19 (No. 217-02895)Apr-20	
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ype-N mismatch combination SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Apr-20	
Inference Probe EX3DV4 SN: 7349 31-Dec-19 (No. EX3-7349_Dec19) Dec-20	
DAE4 SN: 601 27-Dec-19 (No. DAE4-601_Dec19) Dec-20	
Secondary Standards ID # Check Date (in house) Scheduled Check	
Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Feb-19) In house check: Oct-20	
Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20	
Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-18) In house check: Oct-20	
RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20	
Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-19) In house check: Oct-20	
Name Function Signature	
Calibrated by: Jeton Kastrati Laboratory Technician	
Approved by: Katja Pokovic Technical Manager	
Juny	

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power. •
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	······

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.5 ± 6 %	0.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.78 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.77 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54. 7 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		te da m ta

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	······································
SAR measured	250 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.61 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.67 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω - 0.1 jΩ
Return Loss	- 26.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.8 Ω - 2.4 jΩ
Return Loss	- 30.6 dB

General Antenna Parameters and Design

	Electrical Delay (one direction)	1.043 ns
_		

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 16.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1003

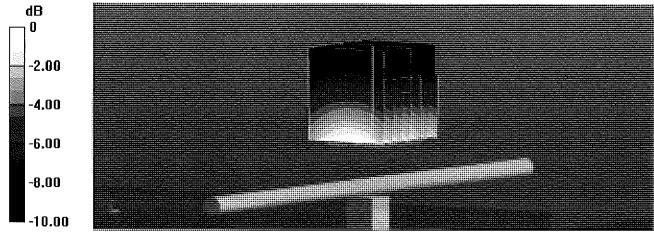
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; $\sigma = 0.88$ S/m; $\varepsilon_r = 42.5$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

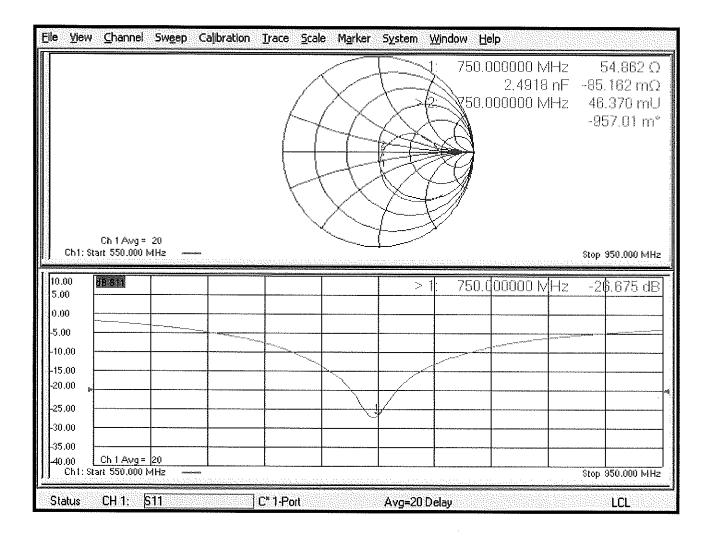
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 60.72 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 3.27 W/kg **SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.43 W/kg** Smallest distance from peaks to all points 3 dB below = 16.5 mm Ratio of SAR at M2 to SAR at M1 = 66.2% Maximum value of SAR (measured) = 2.90 W/kg



0 dB = 2.90 W/kg = 4.62 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.03.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1003

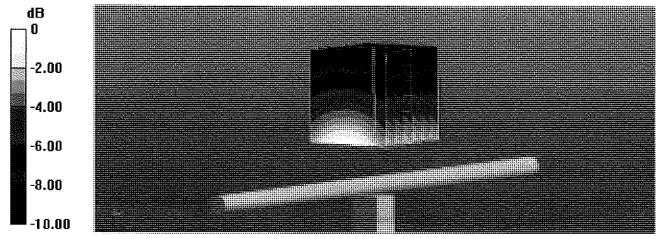
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; σ = 0.96 S/m; ϵ_r = 54.7; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.61, 10.61, 10.61) @ 750 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

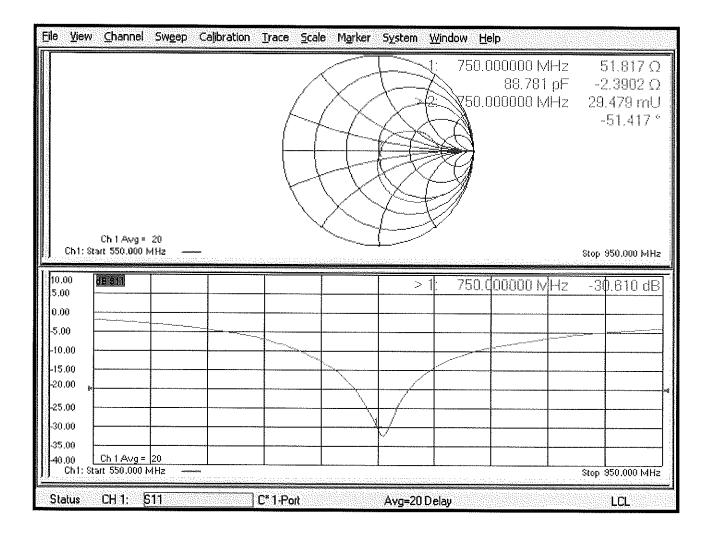
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 57.60 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 3.23 W/kg **SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.42 W/kg** Smallest distance from peaks to all points 3 dB below = 21.2 mm Ratio of SAR at M2 to SAR at M1 = 66.6% Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 4.58 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.:	SCS 0108

Certificate No: D750V3-1161_Oct18

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PC Test Client

Dbject	D750V3 - SN:11(51	
Calibration procedure(s)	QA CAL-05 v10		
	Calibration proce	dure for dipole validation kits abo	we 700 MHz
Calibration date:	October 19, 2018	1	BN $\sqrt{\frac{8}{10-30-20}}$ its of measurements (SI). BN $\sqrt{\frac{20-20}{20}}$ d are part of the certificate. $10-20-2$
		Carlos Addina an ann an Sannan an Sannan an Albhaile ann an Sannan an Sannan an Sannan an Sannan an Sannan an S	10-30-2018
		onal standards, which realize the physical uni	its of measurements (SI). BN^{\vee}
he measurements and the uncerta	ainties with confidence p	robability are given on the following pages an	d are part of the certificate. 10^{-20}
All calibrations have been conducte	ed in the closed laborato	ry facility: environment temperature (22 \pm 3)°(
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID #	Cai Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
ower sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
ower sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
ype-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
	011. 7040		
	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
DAE4		04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house)	Oct-19 Scheduled Check
DAE4 Secondary Standards Power meter EPM-442A	SN: 601	Check Date (in house) 07-Oct-15 (in house check Oct-18)	
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A	SN: 601 ID # SN: GB37480704 SN: US37292783	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: US37292783 SN: MY41092317 SN: 100972 SN: 100972 SN: US41080477	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name Manu Seitz	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function Laboratory Technician	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 601 ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19

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Accreditation No.: SCS 0108

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

· · · · · · · · · · · · · · · · · · ·		
DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	51 MF 24 56	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	2.02 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	8.03 W/kg ± 17.0 % (k=2)	
SAR averaged over 10 cm^3 (10 g) of Head TSL	condition		
SAR measured	250 mW input power	1.32 W/kg	

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.43 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.55 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.6 Ω - 1.9 jΩ
Return Loss	- 25.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.6 Ω - 4.2 jΩ
Return Loss	- 27.6 dB

General Antenna Parameters and Design

	Electrical Delay (one direction)	1.032 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 19, 2015

DASY5 Validation Report for Head TSL

Date: 19.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

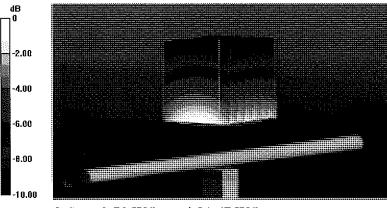
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; $\sigma = 0.89$ S/m; $\varepsilon_r = 40.8$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.22, 10.22, 10.22) @ 750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 58.51 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 3.04 W/kg SAR(1 g) = 2.02 W/kg; SAR(10 g) = 1.32 W/kg Maximum value of SAR (measured) = 2.70 W/kg



0 dB = 2.70 W/kg = 4.31 dBW/kg

Ch1: Start 550.000 MHz Stop 350.000 MHz 10.00 10.00 5.00 10.00 5.00 10.00 5.00 10.00 5.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 20.00 10.00 20.00 10.00 25.00 10.00 30.00 10.00 35.00 10.00 40.00 Ch1 Avg = 20 Ch1: Start 550.000 MHz Stop 950.000 MHz	<u>Eile View Channel Sweep Cal</u>	bration <u>Trace Scale Mark</u>	er System Window Help 1: 750.000000 MH 112.30 p 2: 50.000000 MH	F -1.8896 Ω
5.00 0.00 22.0101000 5.00				Stop 950.000 MHz
	5.00 0.00 -5.00 -10.00 -15.00 -20.00 -25.00 -25.00 -30.00 -35.00 -40.00 Ch 1 Avg = 20		> 1: 750.00000 MH	

DASY5 Validation Report for Body TSL

Date: 19.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1161

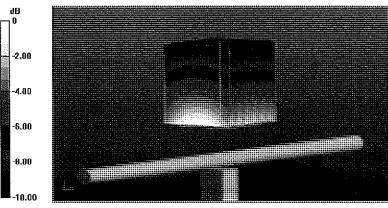
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; $\sigma = 0.96$ S/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.19, 10.19, 10.19) @ 750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 57.57 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.18 W/kg SAR(1 g) = 2.11 W/kg; SAR(10 g) = 1.39 W/kg Maximum value of SAR (measured) = 2.83 W/kg



0 dB = 2.83 W/kg = 4.52 dBW/kg

Impedance Measurement Plot for Body TSL

	alibration <u>Trace</u> <u>Scale</u> <u>Mark</u>	er System Window Help 1: 750,000000 MH 51,109 2: 50,000000 MH	pF -4.1521 Ω
Ch 1 Avg = 20 Ch1: Start 550,000 MHz			8top 950.000 MHz
10.00 10.00 5.00 0.00 5.00 0.00 -10.00 0.00 -10.00 0.00 -20.00 0.00 -25.00 0.00 -30.00 0.00 -35.00 0.00 -35.00 0.00 -11: Start 550.000 MHz 0.00		> 1: 750.00000 MI	Hz -27.595 dB



PCTEST ENGINEERING LABORATORY, INC. 7185 Oakland Mills Road, Columbia, MD 21046 USA

Tel. +1.410.290.6652 / Fax +1.410.290.6654 http://www.pctest.com



Certification of Calibration

Object

D750V3 – SN:1161

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: October 18, 2019

Description: S/

SAR Validation Dipole at 750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/13/2019	Annual	8/13/2020	1041
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	11/20/2018	Annual	11/20/2019	1039008
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	7357
SPEAG	EX3DV4	SAR Probe	7/16/2019	Annual	7/16/2020	7410
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Team Lead Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Dogo 1 of 4
D750V3 – SN:1161	10/18/2019	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

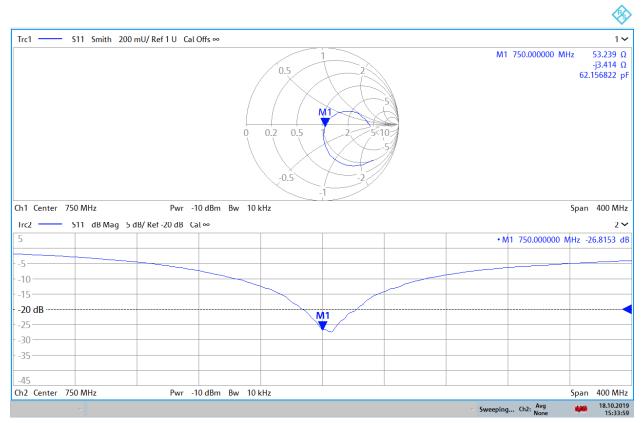
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Head SAR (1g)	(0/)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	(40-) 10/0-0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
10/19/2018	10/18/2019	1.032	1.61	1.64	2.12%	1.05	1.08	2.66%	55.6	53.2	2.4	-1.9	-3.4	1.5	-25	-26.8	-7.30%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0		(0/)	Certificate SAR Target Body (10g) W/kg @ 23.0	(40-) M///- @	Deviation 10g (%)		Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
			dBm	dDin		dBm	20.0 0.0111											

Object:	Date Issued:	Page 2 of 4
D750V3 – SN:1161	10/18/2019	Page 2 of 4

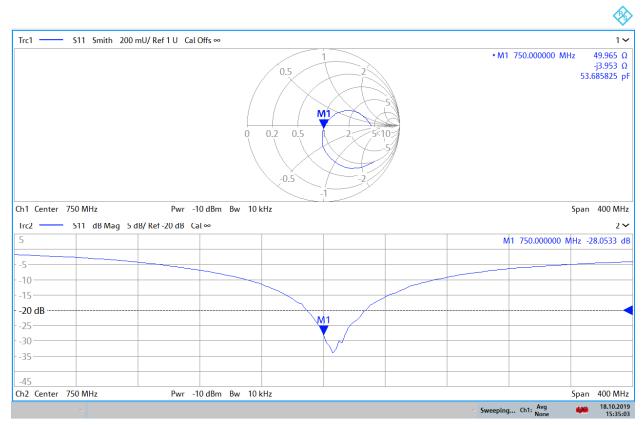
Impedance & Return-Loss Measurement Plot for Head TSL



15:34:00 18.10.2019

Object:	Date Issued:	Page 3 of 4
D750V3 – SN:1161	10/18/2019	Fage 5 01 4

Impedance & Return-Loss Measurement Plot for Body TSL



15:35:04 18.10.2019

Object:	Date Issued:	Dago 4 of 4
D750V3 – SN:1161	10/18/2019	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst

- Service suisse d'étalonnage
- C Servizio svizzero di taratura
- S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.:	SCS	0108

Certificate No: D835V2-4d132_Jan20 Client PC Test CALIBRATION CERTIFICATE D835V2 - SN:4d132 Object Calibration procedure(s) QA CALUE III in i cration BNY 2-05-2020 January 13, 2020 Calibration date: This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 03-Apr-19 (No. 217-02892/02893) Apr-20 Power sensor NRP-Z91 SN: 103244 03-Apr-19 (No. 217-02892) Apr-20 Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02893) Apr-20 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20 Type-N mismatch combination SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Apr-20 Reference Probe EX3DV4 SN: 7349 31-Dec-19 (No. EX3-7349 Dec19) Dec-20 DAE4 SN: 601 27-Dec-19 (No. DAE4-601_Dec19) Dec-20 ID # Secondary Standards Check Date (in house) Scheduled Check SN: GB39512475 Power meter E4419B 30-Oct-14 (in house check Feb-19) In house check: Oct-20 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20 Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-18) In house check: Oct-20 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-19) In house check: Oct-20 Name Function Signature Leif Klysner Calibrated by: Laboratory Technician Katla Pokovic Approved by: Technical Manager Issued: January 21, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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S Swiss Calibration Service

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole • positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. 0 No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power. 0
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna • connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	• • • •
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.6 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.65 W/kg ± 17.0 % (k=2)
	- I	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.30 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.1 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.96 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.68 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.64 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.4 Ω - 3.1 jΩ
Return Loss	- 30.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω - 5.5 jΩ
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction) 1.385 ns	

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG	
,		2
		Manufactured by SPEAG

DASY5 Validation Report for Head TSL

Date: 13.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

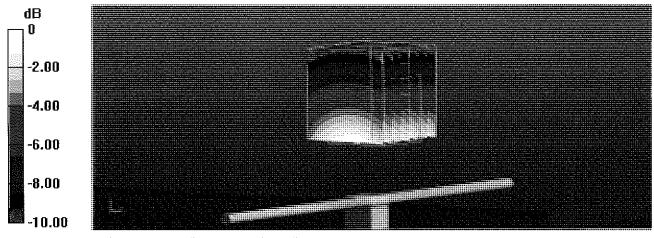
Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz; $\sigma = 0.91$ S/m; $\epsilon_r = 42.6$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.89, 9.89, 9.89) @ 835 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 62.94 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.60 W/kg SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.58 W/kg Smallest distance from peaks to all points 3 dB below = 16 mm Ratio of SAR at M2 to SAR at M1 = 67.1% Maximum value of SAR (measured) = 3.20 W/kg



0 dB = 3.20 W/kg = 5.05 dBW/kg

Impedance Measurement Plot for Head TSL

<u>File View C</u> hai	nnel Sw <u>e</u> ep Calibr	ation <u>Trace S</u> cale M <u>a</u> rk	er System <u>Wi</u> ndov	v <u>H</u> elp	
				35.000000 MHz 60.623 pF 35.000000 MHz	50.361 Ω -3.1441 Ω 31.518 mU -81.684 °
Ch 17 Ch1: Start 635	Avg ≠ 20 5.000 MHz		}		Stop 1.03500 GHz
10.00 5.00 0.00 -5.00 -10.00 -15.00 -25.00 -25.00 -30.00 -35.00 -40.00 -40.00 -11: Start 635				035.00000 MHz	-30.029 dB
Status CH 1	<u>§11</u>	C* 1-Port	Avg=20 Delay		LCL

DASY5 Validation Report for Body TSL

Date: 13.01.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d132

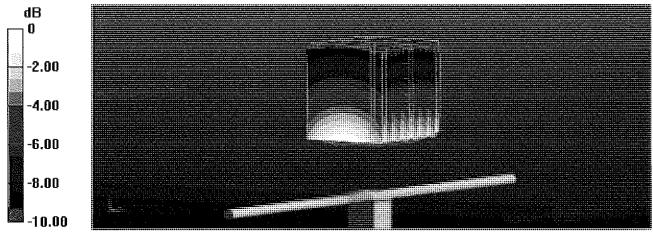
Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 55.1$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.16, 10.16, 10.16) @ 835 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 60.64 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 3.71 W/kg SAR(1 g) = 2.53 W/kg; SAR(10 g) = 1.68 W/kg Smallest distance from peaks to all points 3 dB below = 16.2 mm Ratio of SAR at M2 to SAR at M1 = 68.2% Maximum value of SAR (measured) = 3.33 W/kg



0 dB = 3.20 W/kg = 5.05 dBW/kg

Impedance Measurement Plot for Body TSL

<u>F</u> ile <u>V</u> iev	v <u>C</u> hannel	Sw <u>e</u> ep Calibrat	ion <u>T</u> race <u>S</u> cal	e M <u>a</u> rker S <u>v</u> s	item <u>W</u> indow) <u>H</u> elp	
						35.000000 MHz 34.503 pF 35.000000 MHz	-5.5242 Ω
Ch1:	Ch 1 Avg = Start 635.000 lv			~~		-	Stop 1.03500 GHz
10.00 5.00 -5.00 -10.00 -15.00 -20.00 -25.00 -30.00 -35.00 -40.00 Ch1:		20 1H2 connects			> 1 8	35.00000 MHz	-24.813 dB
Status	CH 1: 6	11	C* 1-Port	A۷	g=20 Delay		LCL

Appendix: Transfer Calibration at Four Validation Locations on SAM Head¹

Evaluation Condition

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
	SAW HEAU FHAILUM	TO USage with COARODVZ-R/L

SAR result with SAM Head (Top \cong C0)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	9.34 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Mouth \cong F90)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	9.80 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Neck \cong H0)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	9.32 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear \cong D90)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	8.01 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	5.40 W/kg ± 16.9 % (k=2)

 $^{^{1}}$ Additional assessments outside the current scope of SCS 0108

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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- S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Accreditation No.: SCS 0108

Client PC Test		e e e e e e e e e e e e e e e e e e e	Certificate No: D835V2-4d047_Mar19
CALIBRATIONIC	Enteloat		
Object	D835V2 - SN 4d	047	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validatio	n Sources between 0:7-3 GHz
Calibration date:	March 13, 2019		BN 04-12-2019
This calibration certificate docume	nts the traceability to nat	ional standards, which realize th	The physical units of measurements (SI). $04-12-20.19$ BNV Extends by BNV Extends BNV
		· · ·	wing pages and are part of the certificate. $'$ ture (22 ± 3)°C and humidity < 70%.
Calibration Equipment used (M&Ti		ту тасниу, елиногипент тепрета	ure (22 ± 5) O and Humany < 70%.
Primary Standards	1D#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02	
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	31-Dec-18 (No. EX3-7349_D	Dec-19
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_0	Oct-19
Secondary Standards	D #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	07-Oct-15 (in house check F	
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check C	,
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check O	
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check C	
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check C	•
	Name	Function	Signature
Calibrated by:	Manu:Seitz	Laboratory Tech	
Approved by:	Katja Poković	Technical Manac	
			issued: March 13, 2019

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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- S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power. •
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna • connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

· · · · · · · · · · · · · · · · · · ·		
DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	····
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.9 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.42 W/kg ± 17.0 % (k=2)
		· · · ·
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.13 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.3 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	****	

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.47 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.27 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Ω - 2.6 jΩ
Return Loss	- 30.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω - 6.1 jΩ
Return Loss	- 22.9 dB

General Antenna Parameters and Design

/ (one direction)	1.387 ns	

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

nufactured by	SPEAG
---------------	-------

DASY5 Validation Report for Head TSL

Date: 13.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d047

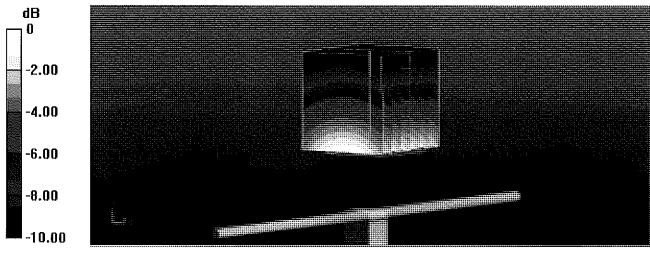
Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz; σ = 0.91 S/m; ϵ_r = 41.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10, 10, 10) @ 835 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

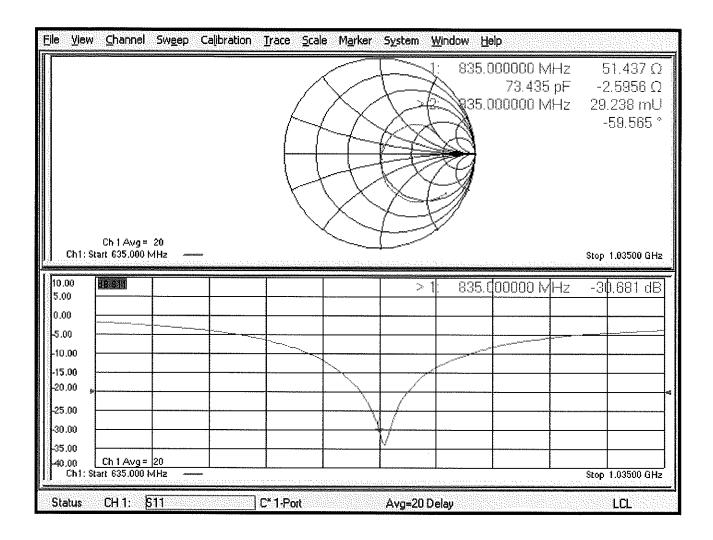
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 62.48 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 3.60 W/kg SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg Maximum value of SAR (measured) = 3.18 W/kg



0 dB = 3.18 W/kg = 5.02 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.03.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d047

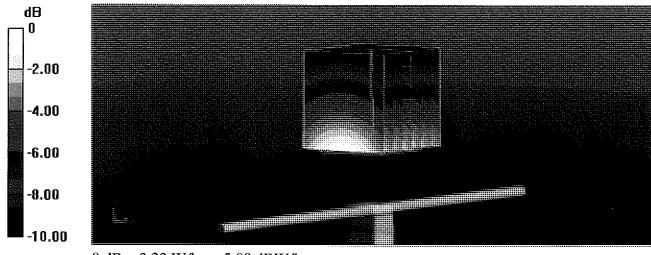
Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz; $\sigma = 1.01$ S/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.15, 10.15, 10.15) @ 835 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

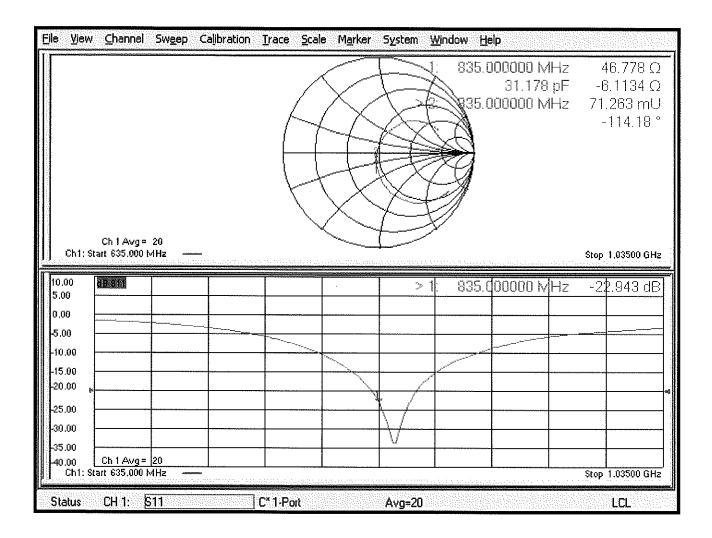
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 60.49 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.58 W/kg SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.61 W/kg Maximum value of SAR (measured) = 3.23 W/kg



0 dB = 3.23 W/kg = 5.09 dBW/kg

Impedance Measurement Plot for Body TSL







Certification of Calibration

Object

D835V2 - SN: 4d047

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 3/13/2020

Description:

SAR Validation Dipole at 835 MHz

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	9/19/2019	Annual	9/19/2020	7551
SPEAG	EX3DV4	SAR Probe	1/21/2020	Annual	1/21/2021	7488
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2019	Annual	9/17/2020	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2020	Annual	1/13/2021	1530

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 4
D835V2 – SN: 4d047	03/13/2020	Fage 1014

DIPOLE CALIBRATION EXTENSION

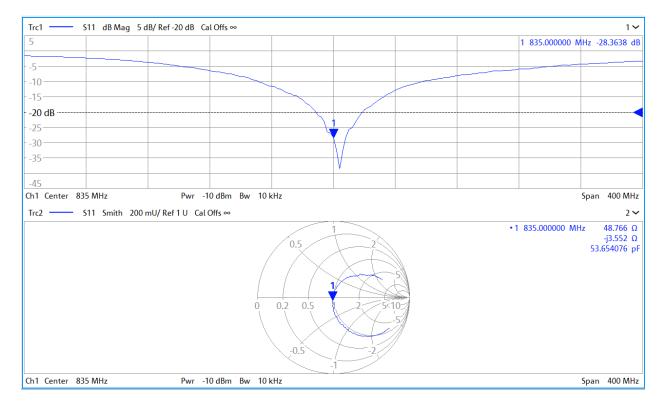
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

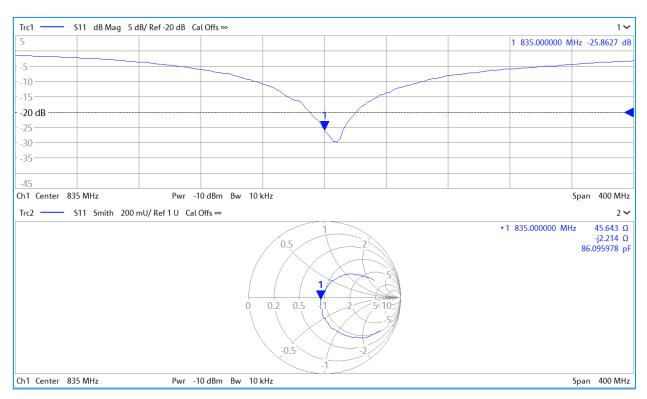
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
3/13/2019	3/13/2020	1.387	1.884	1.87	-0.74%	1.226	1.22	-0.49%	51.4	48.8	2.6	-2.6	-3.6	1.0	-30.7	-28.4	7.60%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	(0/)		(40-) 10/0	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
3/13/2019	3/13/2020	1.387	1.894	1.91	0.84%	1.254	1.26	0.48%	46.8	45.6	1.2	-6.1	-2.2	3.9	-22.9	-25.9	-12.90%	PASS

Object:	Date Issued:	Daga 2 of 4
D835V2 – SN: 4d047	03/13/2020	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Daga 2 of 4
D835V2 – SN: 4d047	03/13/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dege 4 of 4
D835V2 – SN: 4d047	03/13/2020	Page 4 of 4

Calibration Laboratory of

PC Test

Client

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland BC-MRA



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Accreditation No.: SCS 0108

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Certificate No	D1750	V2-1148	May20	ie de la
Certificate Nu		72-1140	IVIAVZU	a sector s

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:11	48	and the second second second at				
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz						
			BN 6-2-2020				
Calibration date:	May 12, 2020		internet in the second s				
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.							
Calibration Equipment used (M&TE		Cal Date (Certificate No.)	Scheduled Calibration				
Power meter NRP	SN: 104778						
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100/03101)	Apr-21				
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03100) 01-Apr-20 (No. 217-03101)	Apr-21				
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21 Apr-21				
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104)	Apr-21				
Reference Probe EX3DV4	SN: 7349	31-Dec-19 (No. EX3-7349_Dec19)	Dec-20				
DAE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20				
			200 20				
Secondary Standards	ID #	Check Date (in house)	Scheduled Check				
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20				
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20				
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20				
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20				
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20				
	Name	Function	Signature				
Calibrated by:	Jeffrey Katzman	Laboratory Technician	J. Kohn				
Approved by:	Katja Pokovic	Technical Manager	Alle				
This calibration certificate shall not	be reproduced except in	full without written approval of the laboratory.	Issued: May 13, 2020				

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Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	· · · · · · · · · · · · · · · · · · ·

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	1.35 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	35.9 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	4.69 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.1 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	·····
SAR measured	250 mW input power	8.98 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	36.3 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.80 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.3 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.2 Ω - 1.9 jΩ
Return Loss	- 33.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.0 Ω - 1.7 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by		SPEAG

DASY5 Validation Report for Head TSL

Date: 12.05.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1148

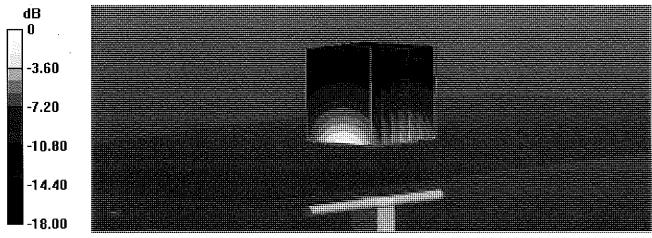
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.35 S/m; ϵ_r = 40.3; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.76, 8.76, 8.76) @ 1750 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 105.6 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 16.4 W/kg **SAR(1 g) = 8.88 W/kg; SAR(10 g) = 4.69 W/kg** Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.4% Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg = 11.40 dBW/kg

Impedance Measurement Plot for Head TSL

File	⊻iew	⊆hannel	Sw <u>e</u> ep	Calibration	<u>Irace S</u> ca	ale M <u>a</u> rker	System	Window	Help			
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DASY5 Validation Report for Body TSL

Date: 12.05.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1148

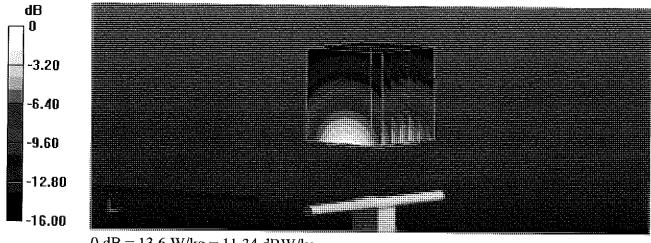
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; $\sigma = 1.47$ S/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.61, 8.61, 8.61) @ 1750 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 99.95 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 16.1 W/kg **SAR(1 g) = 8.98 W/kg; SAR(10 g) = 4.8 W/kg** Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 57.1% Maximum value of SAR (measured) = 13.6 W/kg



Impedance Measurement Plot for Body TSL

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-35.00 -40.00 Ch1: :	Ch I Avg = 20 Start 1.55000 GHz -								Stop 1.95000 GI	

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Client



Schweizerischer Kallbrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

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Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

PC Test

Certificate No: D1750V2-1150_Oct18

Accreditation No.: SCS 0108

CALIBRAT	ON CERTIFICATE	
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Object	D1750V2-SN-11	50	AN IN BRITANIAN.
Calibration procedure(s)	QA CAL-05.v10 Calibration proce	dure for dipole validation kits above 5	700 MHz
Calibration date:	October 22, 2018		BN1- 1013012018 BN1- 10-20-2019
	•	onal standards, which realize the physical units of robability are given on the following pages and are	measuraments (SI).
All calibrations have been conducte	ed in the closed laborator	y facility: environment temperature (22 \pm 3)°C and	humidity < 70%.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	D#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (In house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19
	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Techniclan	MWELET
Approved by:	Katja Pokovic	Technical Manager	EUG -
This calibration certificate shall not	be reproduced except in	full without written approval of the laboratory.	issued: October 22, 2018

Certificate No: D1750V2-1150_Oct18

Calibration Laboratory of

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland





Schweizerischer Kalibrierdienst

- S Service suisse d'étalonnage С
 - Servizio svizzero di taratura
- S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed • point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole ٠ positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. ٠ No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.8 ± 6 %	1.33 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.5 ± 6 %	1.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	36.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.82 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.4 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.9 Ω - 0.4 jΩ
Return Loss	- 40.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 0.1 jΩ
Return Loss	- 29.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.217 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 10, 2015

DASY5 Validation Report for Head TSL

Date: 22.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1150

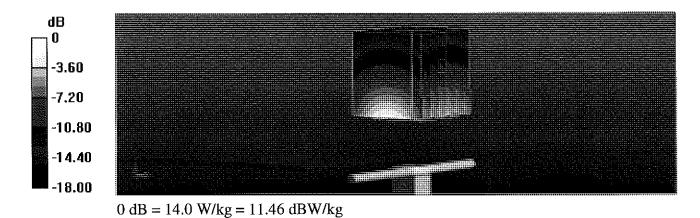
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; $\sigma = 1.33$ S/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

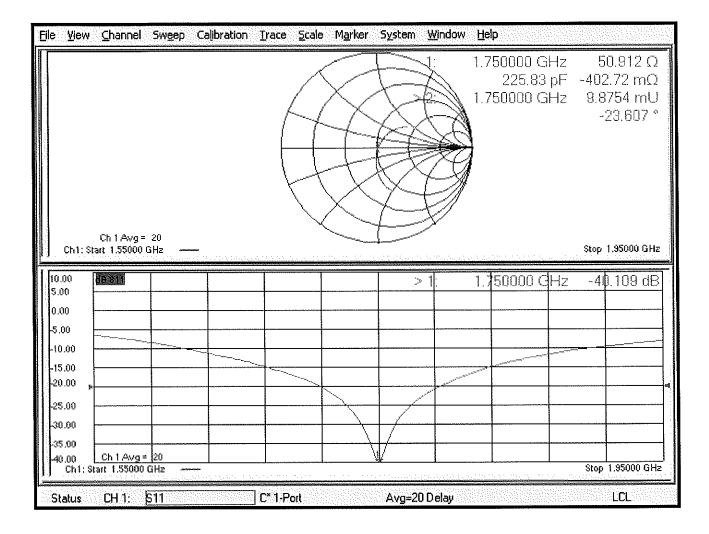
- Probe: EX3DV4 SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electromics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 108.1 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 16.7 W/kg SAR(1 g) = 9.02 W/kg; SAR(10 g) = 4.76 W/kg Maximum value of SAR (measured) = 14.0 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1150

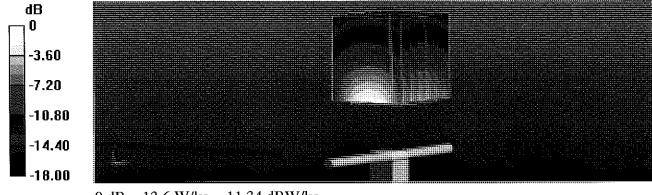
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.46 S/m; ϵ_r = 53.5; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

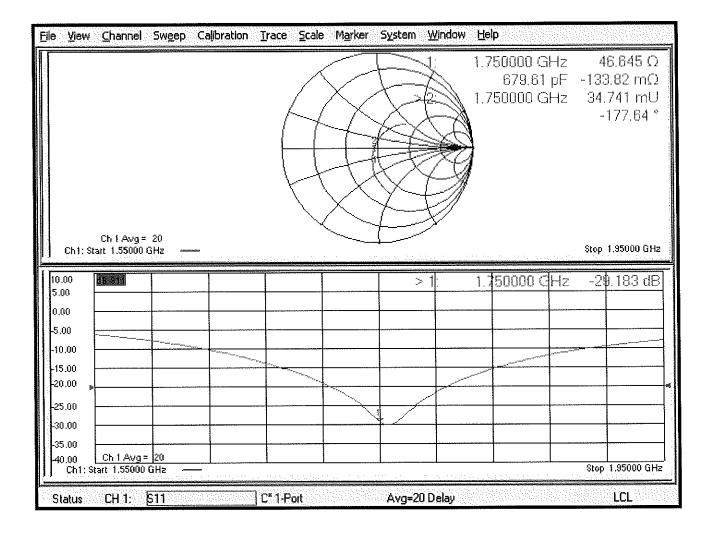
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 102.1 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 16.0 W/kg SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.82 W/kg Maximum value of SAR (measured) = 13.6 W/kg



0 dB = 13.6 W/kg = 11.34 dBW/kg

Impedance Measurement Plot for Body TSL





PCTEST ENGINEERING LABORATORY, INC. 7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654

http://www.pctest.com



Certification of Calibration

Object

D1750V2 - SN:1150

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

October 18, 2019

Extended Calibration date:

Description:

SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/13/2019	Annual	8/13/2020	1041
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	11/20/2018	Annual	11/20/2019	1039008
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	8/16/2019	Annual	8/16/2020	7308
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	7357
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/14/2019	Annual	8/14/2020	1450

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Team Lead Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Dogo 1 of 4
D1750V2 – SN:1150	10/18/2019	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

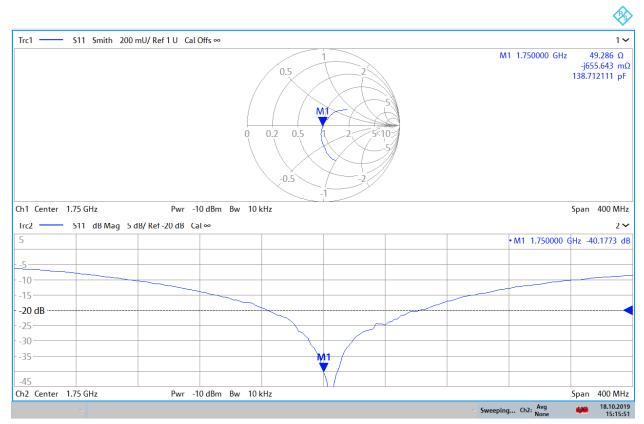
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Head SAR (1g)	(0/)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0-0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
10/22/2018	10/18/2019	1.217	3.65	3.8	4.11%	1.92	2	4.17%	50.9	49.3	1.6	0.4	-0.7	1.1	-40.1	-40.2	-0.20%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm		Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
10/22/2018	10/18/2019	1.217	3.66	3.82	4.37%	1.94	2.02	4.12%	46.6	44.7	1.9	-0.1	-0.8	0.7	-29.2	-25	14.40%	PASS

Object:	Date Issued:	Page 2 of 4
D1750V2 - SN:1150	10/18/2019	Faye 2 01 4

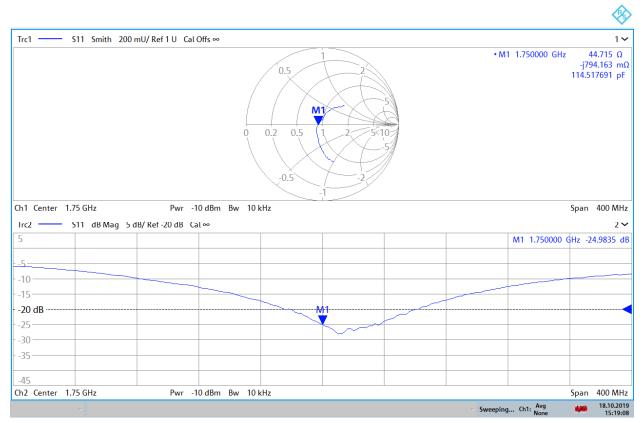
Impedance & Return-Loss Measurement Plot for Head TSL



15:15:52 18.10.2019

Object:	Date Issued:	Page 3 of 4
D1750V2 – SN:1150	10/18/2019	raye 5 01 4

Impedance & Return-Loss Measurement Plot for Body TSL



15:19:09 18.10.2019

Object:	Date Issued:	Daga 4 of 4
D1750V2 – SN:1150	10/18/2019	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

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The Swiss Accreditation Service is one of the signatories to the EA





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Swiss Calibration Service

Accreditation No.: SCS 0108

Multilateral Agreement for the recognition of calibration certificates Certificate No: D1765V2-1008 May18 Client PC Test GALIBRATION CERTIFICATE Object D1765V2 - SN.1008 QA CAL-05 v10 Calibration procedure(s) Calibration procedure for dipole validation kits above 700 MHz

May 23, 2018

Calibration date:

BNV 05/2012019 BNV 05/2012020 Extended This catibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	1D #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Od-18
Secondary Standards	1D#	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8461A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	in house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18
	Name	Function	Signature
Calibrated by:	Manu Seitz	Elaboratory Technician	Æ
			. The second
Approved by:	Katia Pokovic	Technical Manager	- AND

issued: May 23, 2018 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D1765V2-1008_May18

Page 1 of 11

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	······
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5.0 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.2 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.71 W/kg
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Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.9 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 6.5 jΩ
Return Loss	- 23.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.3 Ω - 6.0 jΩ
Return Loss	- 20.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.210 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

Appendix (Additional assessments outside the scope of SCS 0108)

Measurement Conditions

DASY system configuration, as far as not given on page 1 and 3.

Phantom SAM Head Phantom For usage with cSAR3DV	2-R/L
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SAR result with SAM Head (Top)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	37.4 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	4.95 W/kg

SAR result with SAM Head (Mouth)

Condition	
250 mW input power	9.47 W/kg
normalized to 1W	38.2 W/kg ± 17.5 % (k=2)
	250 mW input power

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Neck)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	37.4 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.2 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Ear)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	28.7 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	4.01 W/kg

DASY5 Validation Report for Head TSL

Date: 15.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN:1008

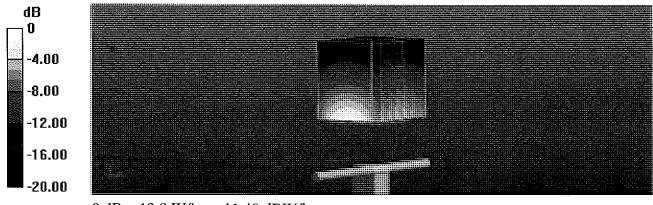
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ϵ _r = 39; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

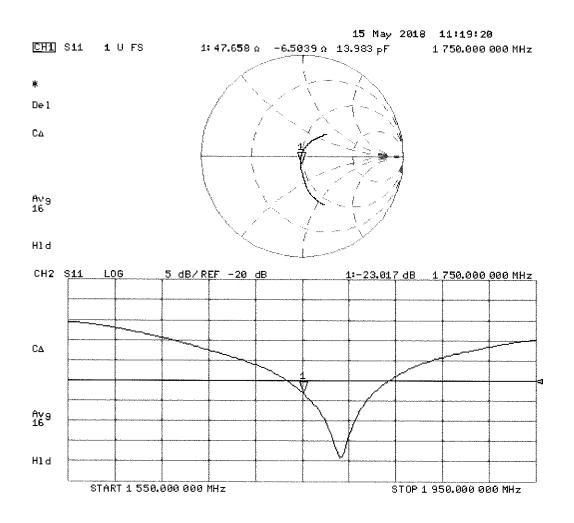
- Probe: EX3DV4 SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 106.6 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 16.4 W/kg SAR(1 g) = 8.94 W/kg; SAR(10 g) = 4.71 W/kg Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg = 11.40 dBW/kg



DASY5 Validation Report for Body TSL

Date: 15.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

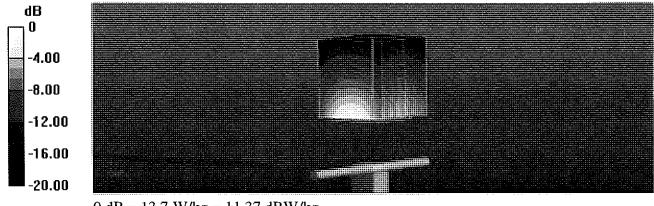
DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN:1008

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; σ = 1.46 S/m; ϵ_r = 53.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

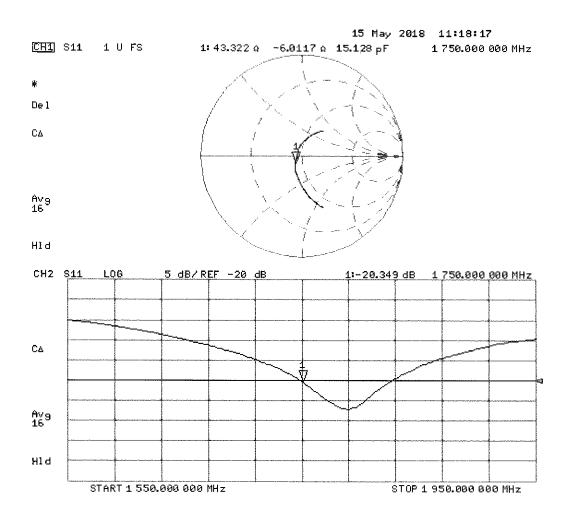
DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm Reference Value = 102.4 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 16.1 W/kg SAR(1 g) = 9.21 W/kg; SAR(10 g) = 4.92 W/kg Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg



DASY5 Validation Report for SAM Head

Date: 23.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN:1008

Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz; $\sigma = 1.37$ S/m; $\varepsilon_r = 41.8$; $\rho = 1000$ kg/m³ Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

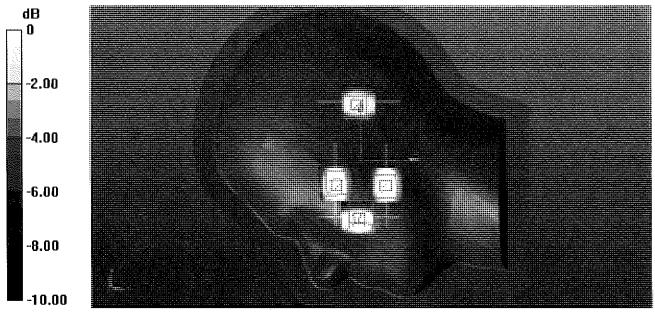
- Probe: EX3DV4 SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: SAM Head
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

SAM/Head/Top/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 105.8 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 16.4 W/kg SAR(1 g) = 9.26 W/kg; SAR(10 g) = 4.95 W/kg Maximum value of SAR (measured) = 13.9 W/kg

SAM/Head/Mouth/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 104.2 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 16.6 W/kg SAR(1 g) = 9.47 W/kg; SAR(10 g) = 5.06 W/kg Maximum value of SAR (measured) = 13.7 W/kg

SAM/Head/Neck/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 104.7 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 15.8 W/kg SAR(1 g) = 9.26 W/kg; SAR(10 g) = 5.02 W/kg Maximum value of SAR (measured) = 13.8 W/kg

SAM/Head/Ear/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 90.46 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 11.8 W/kg SAR(1 g) = 7.12 W/kg; SAR(10 g) = 4.01 W/kg Maximum value of SAR (measured) = 10.3 W/kg



0 dB = 10.3 W/kg = 10.13 dBW/kg



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http://www.pctest.com



Certification of Calibration

Object

D1765V2 - SN: 1008

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 5/17/2019

Description:

SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2019	Annual	3/11/2020	US39170122
Agilent	N5182A	MXG Vector Signal Generator	11/28/2018	Annual	11/28/2019	MY47420603
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1027293
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1126066
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647811
Control Company	4352	Ultra Long Stem Thermometer	6/6/2018	Biennial	6/6/2020	181334678
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 4
D1765V2 – SN: 1008	05/17/2019	Fage 1014

DIPOLE CALIBRATION EXTENSION

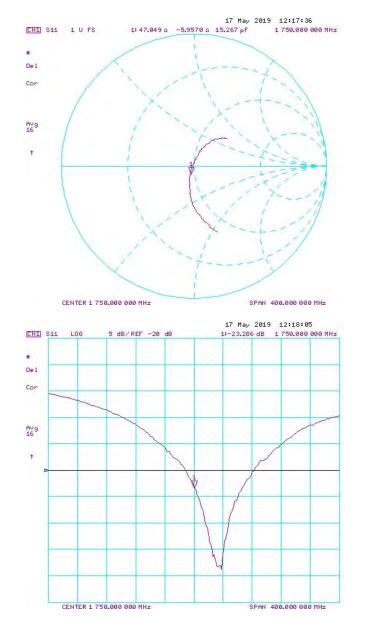
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

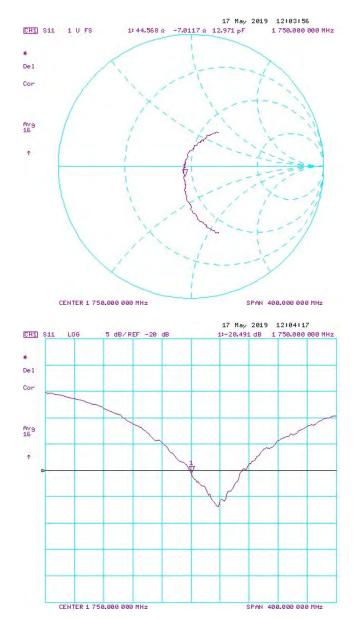
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(96)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5/23/2018	5/17/2019	1.21	3.62	3.63	0.28%	1.9	1.92	1.05%	47.7	47	0.7	-6.5	-6	0.5	-23	-23.3	-1.20%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	(9()	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)		Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5/23/2018	5/17/2019	1.21	3.74	3.95	5.61%	1.99	2.08	4.52%	43.3	44.6	1.3	-6	-7	1	-20.3	-20.5	-0.90%	PASS

Object:	Date Issued:	Dogo 2 of 4
D1765V2 – SN: 1008	05/17/2019	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dogo 2 of 4	
D1765V2 – SN: 1008	05/17/2019	Page 3 of 4	



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Page 4 of 4
D1765V2 – SN: 1008	05/17/2019	Page 4 of 4





Certification of Calibration

Object

D1765V2 - SN: 1008

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 5/23/2020

Description:

SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench (8" lb)	5/23/2018	Biennial	5/23/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	4/21/2020	Annual	4/21/2021	7357
SPEAG	EX3DV4	SAR Probe	7/16/2019	Annual	7/16/2020	7410
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/12/2020	Annual	3/12/2021	1368

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Page 1 of 4
D1765V2 – SN: 1008	05/23/2020	Fage 1014

DIPOLE CALIBRATION EXTENSION

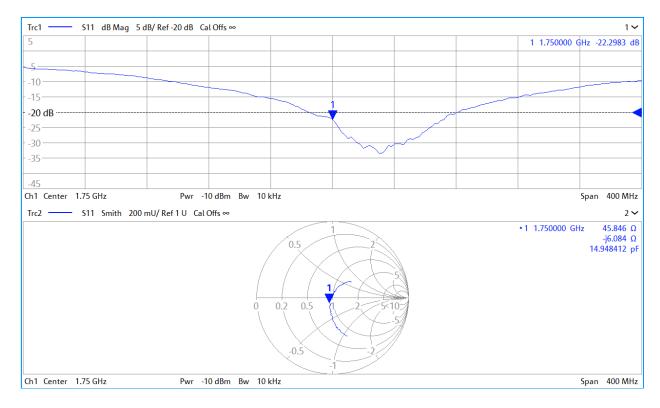
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

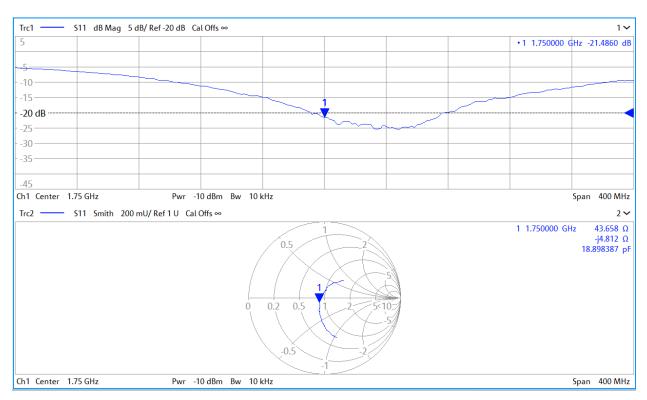
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 20.0 dBm		Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5/23/2018	5/23/2020	1.21	3.62	3.65	0.83%	1.90	1.94	2.11%	47.7	45.9	1.9	-6.5	-6.1	0.4	-23	-22.3	3.10%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm			(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5/23/2018	5/23/2020	1.21	3.74	4.00	6.95%	1.99	2.12	6.53%	43.3	43.7	0.4	-6.0	-4.8	1.2	-20.3	-21.5	-5.80%	PASS

Object:	Date Issued:	Page 2 of 4
D1765V2 – SN: 1008	05/23/2020	Fage 2 014



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Page 3 of 4
D1765V2 – SN: 1008	05/23/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dogo 4 of 4
D1765V2 – SN: 1008	05/23/2020	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: S	SCS 01	08
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Certificate No: D1900V2-5d080_Oct18

Client PC Test

	D1900V2 - SN:50	1080	
alibration procedure(s)	QA CAL-05.v10 Calibration proce	dure for dipole validation kits abo	
			$BN^{1/2}$ 10-30-2018 $BN^{1/2}$ ts of measurements (SI). $10-20-2$
alibration date:	October 23, 2018		10-30-2018
he measurements and the uncerta	aintles with confidence p ed in the closed laborato	onal standards, which realize the physical uni robability are given on the following pages an ry facility: environment temperature (22 \pm 3)°C	d are part of the certificate.
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
ower sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
ower sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
leference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
ype-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
eterence Probe EX3DV4		,	
	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 601	04-Oct-18 (No. DAE4-601_Oct18) Check Date (in house)	Oct-19 Scheduled Check
AE4 secondary Standards	1		
AE4 econdary Standards /ower meter EPM-442A	1D #	Check Date (in house)	Scheduled Check
AE4 econdary Standards ower meter EPM-442A ower sensor HP 8481A	ID # SN: GB37480704	Check Date (in house) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20
AE4 econdary Standards ower meter EPM-442A ower sensor HP 8481A ower sensor HP 8481A	ID # SN: GB37480704 SN: US37292783	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ID # SN: GB37480704 SN: US37292783 SN: MY41092317	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
DAE4 Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18)	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19
AE4 econdary Standards ower meter EPM-442A ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06 letwork Analyzer Agilent E8358A	ID # SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 Name	Check Date (in house) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-18) Function	Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Glossary:

TO	Atomical advantation of Hanviel
TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end • of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed • point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	VJZ.10.2
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.8 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω + 7.9 jΩ
Return Loss	- 21.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.1 Ω + 8.1 jΩ
Return Loss	- 21.5 dB

General Antenna Parameters and Design

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 28, 2006

DASY5 Validation Report for Head TSL

Date: 23.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

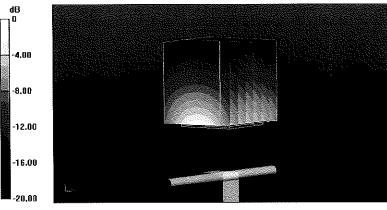
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; $\sigma = 1.4$ S/m; $\varepsilon_r = 40.3$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.18, 8.18, 8.18) @ 1900 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

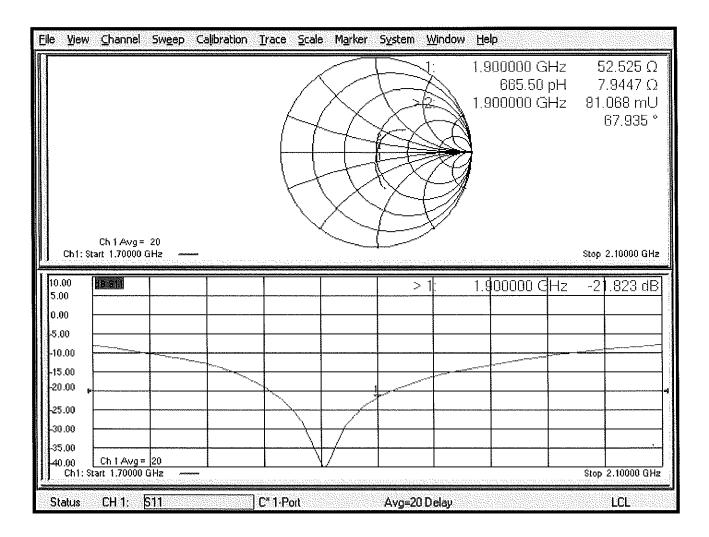
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 110.0 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 18.7 W/kg SAR(1 g) = 9.93 W/kg; SAR(10 g) = 5.18 W/kg Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d080

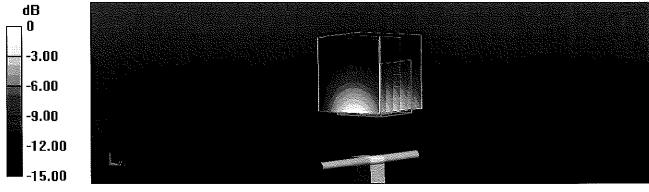
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.47 S/m; ϵ_r = 52.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

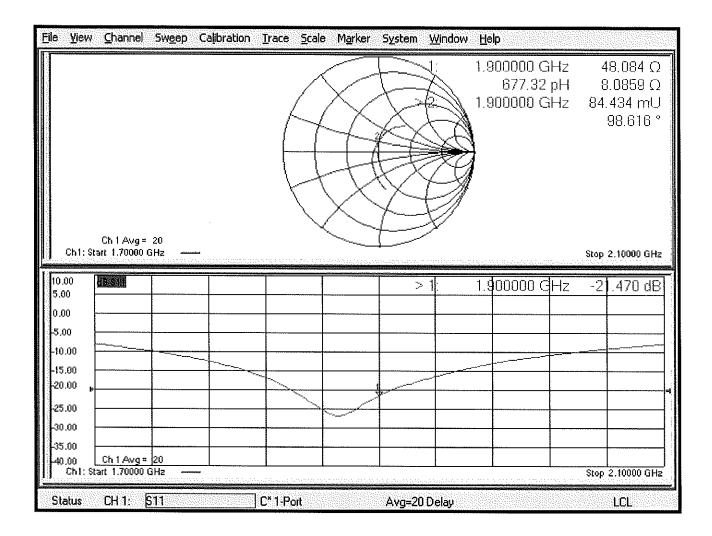
- Probe: EX3DV4 SN7349; ConvF(8.15, 8.15, 8.15) @ 1900 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 99.86 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 17.3 W/kg SAR(1 g) = 9.62 W/kg; SAR(10 g) = 5.09 W/kg Maximum value of SAR (measured) = 14.1 W/kg



0 dB = 14.1 W/kg = 11.49 dBW/kg





PCTEST ENGINEERING LABORATORY, INC. 7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654

http://www.pctest.com



Certification of Calibration

Object

D1900V2 - SN:5d080

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

October 18, 2019

Extended Calibration date:

Description:

SAR Validation Dipole at 1900 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/13/2019	Annual	8/13/2020	1041
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	11/20/2018	Annual	11/20/2019	1039008
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	EX3DV4	SAR Probe	5/16/2019	Annual	5/16/2020	7406
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/8/2019	Annual	5/8/2020	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Team Lead Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 4
D1900V2 – SN: 5d080	10/18/2019	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

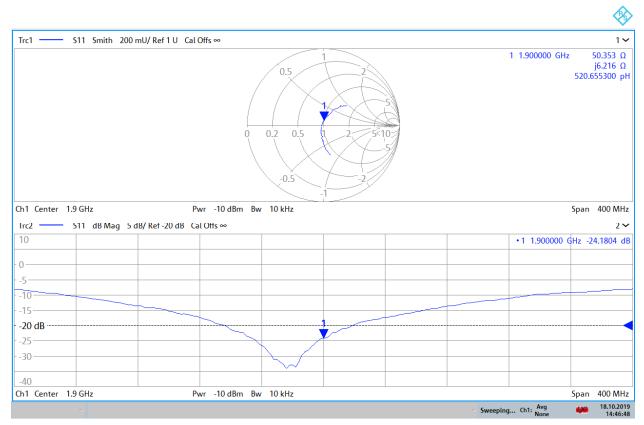
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(96)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
10/23/2018	10/18/2019	1.193	3.98	4.16	4.52%	2.07	2.13	2.90%	52.5	50.4	2.1	7.9	6.2	1.7	-21.8	-24.2	-10.90%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
10/23/2018	10/18/2019	1.193	3.92	4.21	7.40%	2.06	2.16	4.85%	48.1	46.5	1.6	8.1	6.6	1.5	-21.5	-22.2	-3.40%	PASS

Object:	Date Issued:	Dogo 2 of 4
D1900V2 – SN: 5d080	10/18/2019	Page 2 of 4

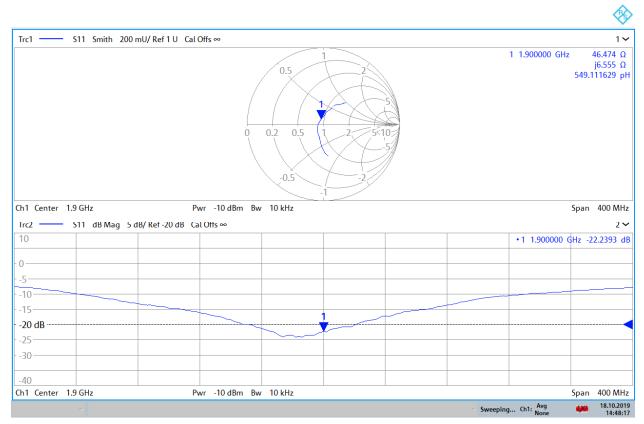
Impedance & Return-Loss Measurement Plot for Head TSL



14:46:49 18.10.2019

Object:	Date Issued:	Page 3 of 4
D1900V2 – SN: 5d080	10/18/2019	Fage 5 01 4

Impedance & Return-Loss Measurement Plot for Body TSL



14:48:18 18.10.2019

Object:	Date Issued:	Page 4 of 4
D1900V2 – SN: 5d080	10/18/2019	Fage 4 01 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

PC Test

Client





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Certificate No: D1900V2-5d148_Feb19

Accreditation No.: SCS 0108

CALIBRATIONEC	ERIFICAT		
Object	D1900V2 - SN:5	d148	
Calibration procedure(s)	QA CAL-05 v11 Calibration Proc	edure for SAR Validation Source	
Calibration date:	February 21, 20	9	inits of measurements (SI). $02-26^{-23}$
This calibration certificate docume	ots the traceability to pat	ional standarda which makes the short start	m2-26/2
The measurements and the uncert	tainties with confidence r	ional standards, which realize the physical u probability are given on the following pages a	Inits of measurements (SI).
		ry facility: environment temperature (22 ± 3)	
Calibration Equipment used (M&T		,	
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr~19
Type-N mlsmatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	31-Dec-18 (No. EX3-7349 Dec18)	Dec-19
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	07-Oct-15 (in house check Feb-19)	In house check; Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (In house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19
	Name	Function	Simeture
Calibrated by:	Manu Seltz	สพิทธิสิทธิสติสติสติสติสติสติสติสติสติสติสติสติสติ	Signature
		Laboratory Technician	ALL
Approved by:	Kalja Pokovic	Technical Manager	
			to to the
			Issued: February 21, 2019

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst

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S Swiss Calibration Service

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Glossary:

TSL	tissue simulating liquid
IOL	U
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.65 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.1 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.05 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.6 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.1 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.5 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω + 6.8 jΩ
Return Loss	- 23.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.4 Ω + 7.8 jΩ
Return Loss	- 21.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	
	1.170 ns
	1370115

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
	JEAG

DASY5 Validation Report for Head TSL

Date: 21.02.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d148

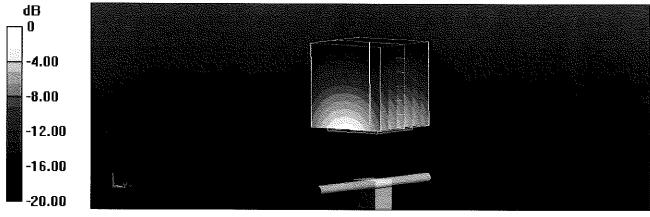
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; $\sigma = 1.38$ S/m; $\varepsilon_r = 40.9$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.26, 8.26, 8.26) @ 1900 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 109.4 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 17.8 W/kg **SAR(1 g) = 9.65 W/kg; SAR(10 g) = 5.05 W/kg** Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

Impedance Measurement Plot for Head TSL

<u>File Viev</u>	v <u>C</u> hannel Sw <u>e</u> e	ep Calibration <u>T</u> r	ace <u>S</u> cale M <u>a</u> r	'ker S <u>y</u> stem <u>Wi</u> ni	dow Help	
Ch1::	Ch 1 Awg = 20 Start 1.70000 GHz				1.900000 GHz 573.82 pH 1.900000 GHz	51.822 Ω 6.8503 Ω 69.458 mU 71.260 °
10.00 5.00 -5.00 -10.00 -15.00 -20.00 -25.00 -30.00 -35.00 -40.00 Ch1: 5	Ch 1 Avg = 20 3tart 1.70000 GHz				1.900000 GHz	-23.166 dB
Status	CH 1: <u>811</u>	C*-	1-Port	Avg=20 Delay		Stop 2.10000 GHz

DASY5 Validation Report for Body TSL

Date: 21.02.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d148

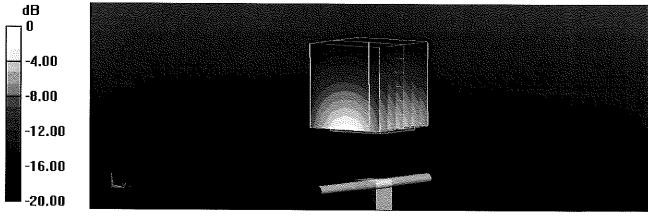
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; $\sigma = 1.47$ S/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.23, 8.23, 8.23) @ 1900 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 103.7 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 17.0 W/kg SAR(1 g) = 9.56 W/kg; SAR(10 g) = 5.05 W/kg Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

Impedance Measurement Plot for Body TSL

File	View	<u>C</u> hannel	Sweep	Calibration	<u>Trace</u> <u>S</u> c.	ale M <u>a</u> rker	System	Window	Help			
		Ch1Avg=				XXX			1.900000 G 652.32 1.900000 G	pН	48.446 Ω 7.7874 Ω 80.412 mU 96.762 °	
		rt 1.70000 (-4			S	top 2,10000 GHz	
10.0	no 16	THE REAL PROPERTY OF THE PROPERTY OF THE REAL PROPE	7			Contraction of the second s		The second se	The second s			
5.0 0.0 -5.0 -10. -15. -20. -25. -30. -35. -40. (Ch 1 Awg = rt 1.70000 c	20 3Hz				>				-21.894 dB	





Certification of Calibration

Object

D1900V2 - SN: 5d148

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

2/21/2020

Extension Calibration date:

Description:

SAR Validation Dipole at 1900 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	9/19/2019	Annual	9/19/2020	7551
SPEAG	EX3DV4	SAR Probe	7/16/2019	Annual	7/16/2020	7410
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2019	Annual	9/17/2020	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1322

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 4
D1900V2 – SN: 5d148	02/21/2020	Fage 1014

DIPOLE CALIBRATION EXTENSION

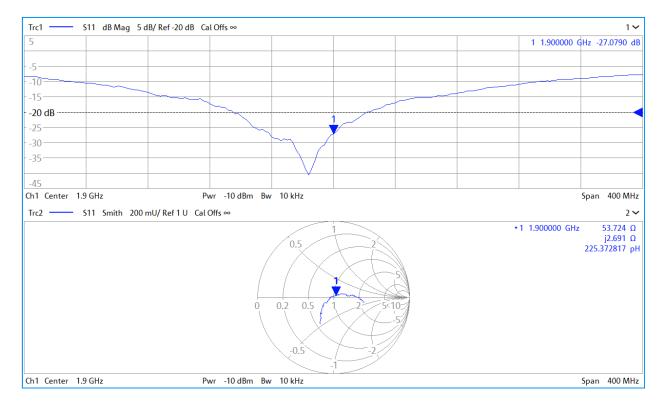
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
2/21/2019	2/21/2020	1.17	3.91	4.15	6.14%	2.04	2.13	4.41%	51.8	53.7	1.9	6.8	2.7	4.1	-23.2	-27.1	-16.70%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	(40-) 10/0	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
2/21/2019	2/21/2020	1.17	3.91	4.06	3.84%	2.05	2.08	1.46%	48.4	50.9	2.5	7.8	5.4	2.4	-21.9	-25.3	-15.60%	PASS

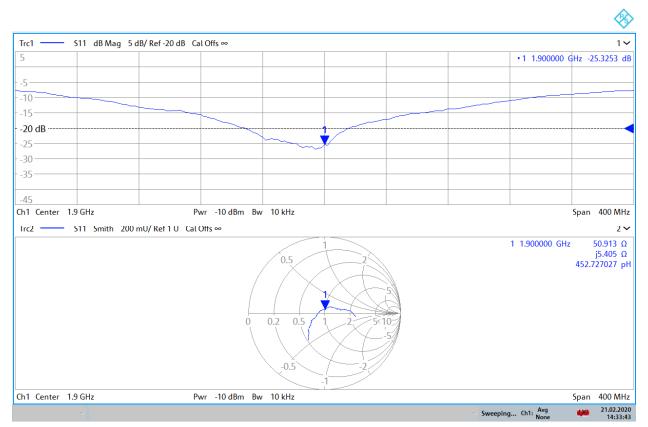
Object:	Date Issued:	Page 2 of 4
D1900V2 – SN: 5d148	02/21/2020	raye 2 01 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Daga 2 of 4
D1900V2 – SN: 5d148	02/21/2020	Page 3 of 4

Impedance & Return-Loss Measurement Plot for Body TSL



14:33:44 21.02.2020

Object:	Date Issued:	Page 4 of 4
D1900V2 – SN: 5d148	02/21/2020	Fage 4 01 4

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Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Swiss Calibration Service

Accreditation No.: SCS 0108

Certificate No: D1900V2-5d149_Oct18

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Client PC Test

CALIBRATION CI	ERITIEICATE		
Object	D1900V2-SN:50	1149	
Calibration procedure(s)	QA CAL-05.v10 Calibration proce	dure for dipole validation kits ab	
Calibration date:	October 23, 2018)	BNV 10-30-2018 BNV 10-20-201
	•	onal standards, which realize the physical ur robability are given on the following pages a	nits of measurements (SI).
Calibration Equipment used (M&TE		ry facility: environment temperature (22 \pm 3)°	G and numidity < 70%.
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19
	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	Q=
Approved by:	Katja Pokovic	Technical Manager	I CAG
This calibration cartificate shall not	he reproduced event in	full without written approval of the laborator	Issued: October 23, 2018

Calibration Laboratory of

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland





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Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossarv:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole • positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. • No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power. •
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the • nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.3 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
or a reading of the star (10 g) of field for	condition	
SAR measured	250 mW input power	5.11 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.68 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.7 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 Ω + 6.3 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 Ω + 8.2 jΩ
Return Loss	- 21.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.193 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 23.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d149

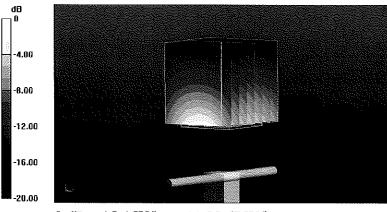
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; $\sigma = 1.4$ S/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.18, 8.18, 8.18) @ 1900 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

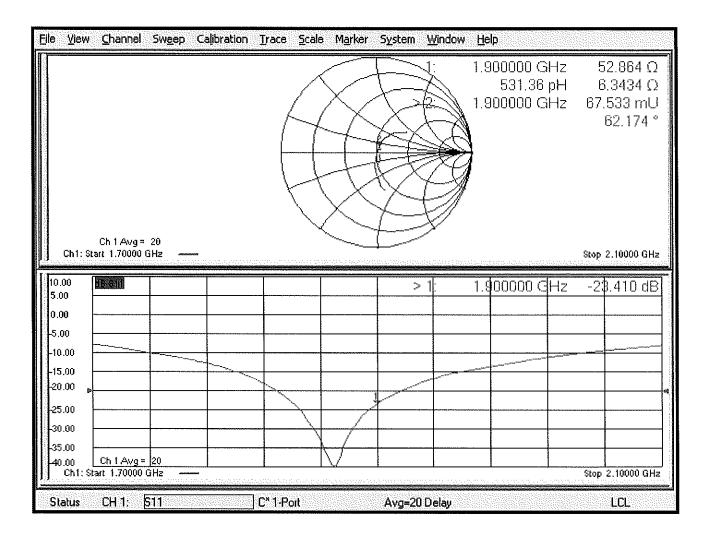
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 110.0 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 18.5 W/kg **SAR(1 g) = 9.8 W/kg; SAR(10 g) = 5.11 W/kg** Maximum value of SAR (measured) = 15.4 W/kg



0 dB = 15.4 W/kg = 11.88 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d149

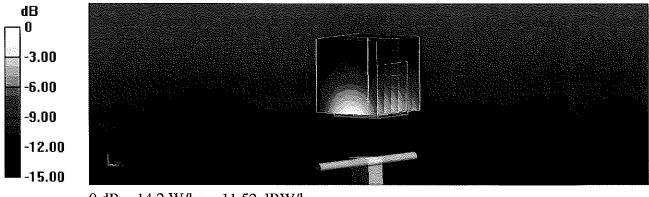
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.47 S/m; ϵ_r = 52.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.15, 8.15, 8.15) @ 1900 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 103.1 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 17.5 W/kg SAR(1 g) = 9.68 W/kg; SAR(10 g) = 5.11 W/kg Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

Impedance Measurement Plot for Body TSL

<u>File V</u> iew	<u>Channel Swe</u> ep (Calibration <u>T</u> race <u>S</u> cale M	arker System <u>W</u> indow <u>H</u> elp	
	Ch 1 Avg = 20		1: 1.90000 684. 1.900000	48 pH - 8.1713 Ω
Ch1: S	itart 1.70000 GHz			Stop 2.10000 GHz
10.00 5.00 -5.00 -10.00 -15.00 -20.00 -25.00 -30.00 -35.00 -40.00 Ch1: S	Ch 1 Avg = 20 tart 1.70000 GHz			CGHz -21.519 dB
Status	CH 1: 511	C* 1-Port	Avg=20 Delay	LCL



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Certification of Calibration

Object

D1900V2 - SN:5d149

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: October 18, 2019

Description: SAR Validation Dipole at 1900 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/13/2019	Annual	8/13/2020	1041
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	11/20/2018	Annual	11/20/2019	1039008
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	EX3DV4	SAR Probe	5/16/2019	Annual	5/16/2020	7406
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/8/2019	Annual	5/8/2020	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path.

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Team Lead Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Dogo 1 of 4
D1900V2 – SN: 5d149	10/18/2019	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

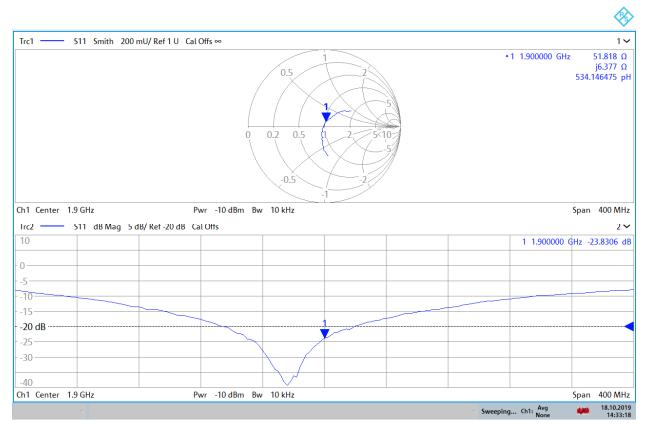
- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(96)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
10/23/2018	10/18/2019	1.193	3.93	4.24	7.89%	2.05	2.18	6.34%	52.9	51.8	1.1	6.3	6.4	0.1	-23.4	-23.8	-1.80%	Pass
		Certificate	Certificate	Measured		Certificate	Measured		Certificate	Measured		Certificate	Measured					
Calibration Date	Extension Date	Electrical Delay (ns)	SAR Target Body (1g) W/kg @ 20.0 dBm	Body SAR (1g)	(0/)	SAR Target Body (10g) W/kg @ 20.0 dBm		Deviation 10g (%)		Impedance Body (Ohm) Real	Difference (Ohm) Real	Impedance	Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL

Object:	Date Issued:	Page 2 of 4
D1900V2 – SN: 5d149	10/18/2019	raye 2 014

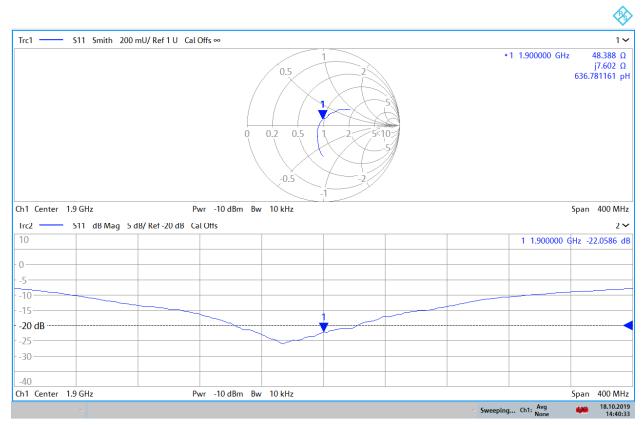
Impedance & Return-Loss Measurement Plot for Head TSL



14:33:19 18.10.2019

Object:	Date Issued:	Page 3 of 4
D1900V2 – SN: 5d149	10/18/2019	Fage 5 01 4

Impedance & Return-Loss Measurement Plot for Body TSL



14:40:34 18.10.2019

Object:	Date Issued:	Dage 4 of 4
D1900V2 – SN: 5d149	10/18/2019	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst C Service suisse d'étalonnage Servizio svizzero di taratura

S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client PC Test Certificate No: D2300V2-1073 Aug18 **IBRATION CERTIFICATE** CAI Object D2300V2 - SN:1073 Calibration procedure(s) QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz BNV 19-06-2018 BNV 08 10 120 Calibration date: August 13, 2018 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 04-Apr-18 (No. 217-02672/02673) Apr-19 Power sensor NRP-Z91 SN: 103244 04-Apr-18 (No. 217-02672) Apr-19 Power sensor NRP-Z91 SN: 103245 04-Apr-18 (No. 217-02673) Apr-19 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-18 (No. 217-02682) Apr-19 Type-N mismatch combination SN: 5047.2 / 06327 04-Apr-18 (No. 217-02683) Apr-19 Reference Probe EX3DV4 SN: 7349 30-Dec-17 (No. EX3-7349_Dec17) Dec-18 DAE4 SN: 601 26-Oct-17 (No. DAE4-601_Oct17) Oct-18 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter EPM-442A SN: GB37480704 07-Oct-15 (in house check Oct-16) In house check: Oct-18 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-16) In house check: Oct-18 Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-16) In house check: Oct-18 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-16) In house check: Oct-18 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-17) In house check: Oct-18 Name Function Calibrated by: Michael Weber Laboratory Technician Approved by: Katja Pokovic Technical Manager

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D2300V2-1073_Aug18

Issued: August 13, 2018

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S

Schweizerischer Kalibrierdienst

C Service suisse d'étalonnage

Servizio svizzero di taratura

S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

To	
TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.70 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	49.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.8 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.9	1.81 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	1.85 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	47.7 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.2 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.1 Ω - 5.2 jΩ
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.5 Ω - 4.1 jΩ
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (and dispation)	
Electrical Delay (one direction)	1.171 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 16, 2015

DASY5 Validation Report for Head TSL

Date: 13.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1073

Communication System: UID 0 - CW; Frequency: 2300 MHz Medium parameters used: f = 2300 MHz; σ = 1.7 S/m; ϵ_r = 38.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.08, 8.08, 8.08) @ 2300 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 115.9 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 24.1 W/kg SAR(1 g) = 12.5 W/kg; SAR(10 g) = 6.02 W/kg Maximum value of SAR (measured) = 20.2 W/kg



Impedance Measurement Plot for Head TSL

File	⊻iew	Channel	Sw <u>e</u> ep	Calibration	<u>T</u> race	<u>S</u> cale	M <u>a</u> rker	S <u>y</u> stem	<u>W</u> indow	<u>H</u> elp				
	01.1.0	Ch 1 Awg	20								3000 G 13,259 3000 G	рF	-5 52. -1	0.050 Ω .2189 Ω 094 mU 36.467 °
	Ch1:St	art 2,10000	GHz —					- 			- <u>-</u>		Stop 2	2.50000 GHz
-15 -20 -25 -30 -35	00 00 00 00 00 00 00	<u>Ch 1 Avg</u>	GHz —							2.30				2.50000 GHz
St	atus	CH 1:	S11		C* 1 Po	ut	·	Avg=20	Delay				•	LCL

DASY5 Validation Report for Body TSL

Date: 13.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1073

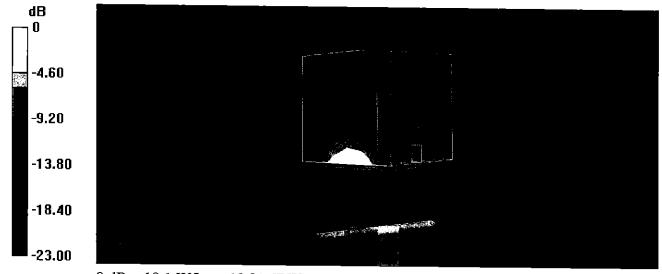
Communication System: UID 0 - CW; Frequency: 2300 MHz Medium parameters used: f = 2300 MHz; σ = 1.85 S/m; ϵ_r = 52.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

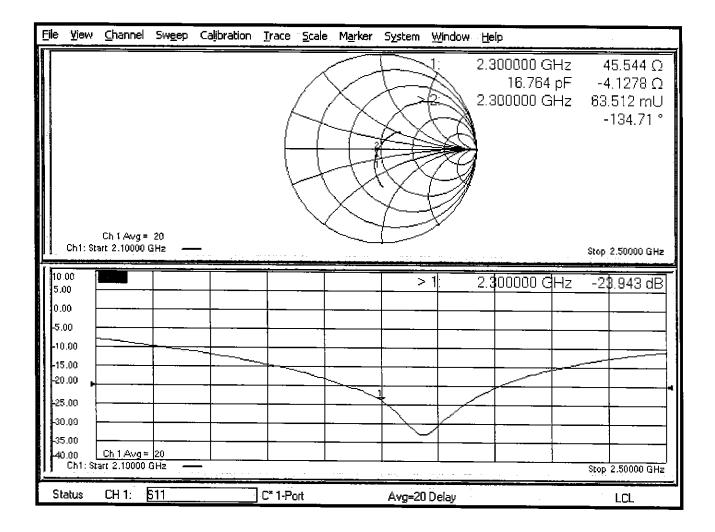
- Probe: EX3DV4 SN7349; ConvF(8.08, 8.08, 8.08) @ 2300 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 107.5 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 22.9 W/kg SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.86 W/kg Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.1 W/kg = 12.81 dBW/kg





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Certification of Calibration

Object

D2300V2 - SN: 1073

Calibration procedure(s)

Procedure for Calibration Extension for SAR Dipoles.

Calibration date:

08/09/2019

Description:

SAR Validation Dipole at 2300 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	10/2/2018	Annual	10/2/2019	US39170118
Agilent	N5182A	MXG Vector Signal Generator	6/27/2019	Annual	6/27/2020	US46240505
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1207470
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339007
Control Company	4040	Temperature / Humidity Monitor	2/28/2018	Biennial	2/28/2020	150761911
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330160
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	5/23/2018	Biennial	5/23/2020	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665
SPEAG	EX3DV4	SAR Probe	7/15/2019	Annual	7/15/2020	7547
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1323
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Page 1 of 4
D2300V2 – SN: 1073	08/09/2019	Page 1 of 4

DIPOLE CALIBRATION EXTENSION

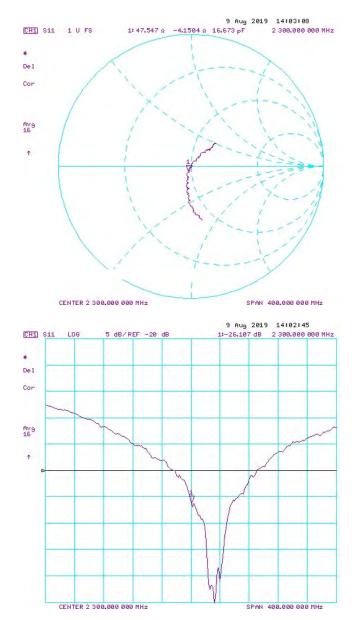
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

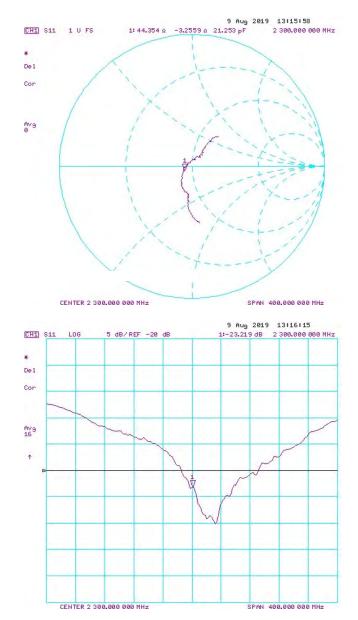
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 20.0 dBm	(96)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
8/13/2018	8/9/2019	1.171	4.92	5.21	5.89%	2.38	2.49	4.62%	50.1	47.5	2.6	-5.2	-4.2	1	-25.7	-26.1	-1.60%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
8/13/2018	8/9/2019	1.171	4.77	5.05	5.87%	2.32	2.4	3.45%	45.5	44.4	1.1	-4.1	-3.3	0.8	-23.9	-23.2	2.80%	PASS

Object:	Date Issued:	Page 2 of 4
D2300V2 – SN: 1073	08/09/2019	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Daga 2 of 4
D2300V2 – SN: 1073	08/09/2019	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

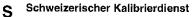
Object:	Date Issued:	Dago 4 of 4
D2300V2 – SN: 1073	08/09/2019	Page 4 of 4

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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Certificate No: D2450V2-719_Aug19

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:7	19	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources b	etween 0.7-3 GHz
Calibration date:	August 14, 2019		BNW 68 20 20 9
		onal standards, which realize the physical units or robability are given on the following pages and a	
All calibrations have been conducte	ed in the closed laborato	ry facility: environment temperature (22 \pm 3)°C a	nd humidity < 70%.
Calibration Equipment used (M&TE	E critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047,2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19
Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	tills
This calibration certificate shall not	be reproduced except in	full without written approval of the laboratory.	Issued: August 15, 2019

Calibration Laboratory of

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland





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Glossarv:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. • No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna • connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.1 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.25 W/kg

SAR measured	250 mW input power	6.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1 .95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.8 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.0 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6 Ω + 5.6 jΩ
Return Loss	- 23.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.0 Ω + 8.4 jΩ
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction) 1.150 ns	

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 14.08.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:719

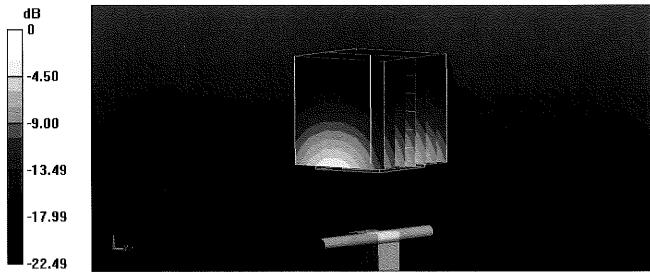
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; ϵ_r = 37.8; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.9, 7.9, 7.9) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

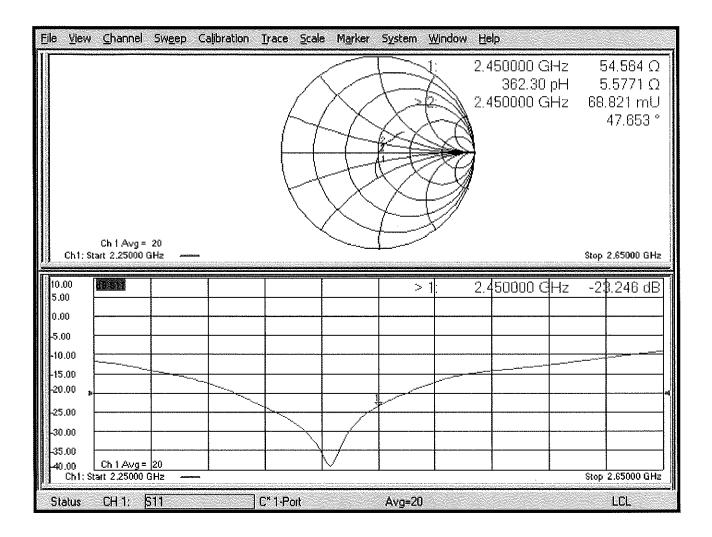
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 117.1 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 26.6 W/kg SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.25 W/kg Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.08.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:719

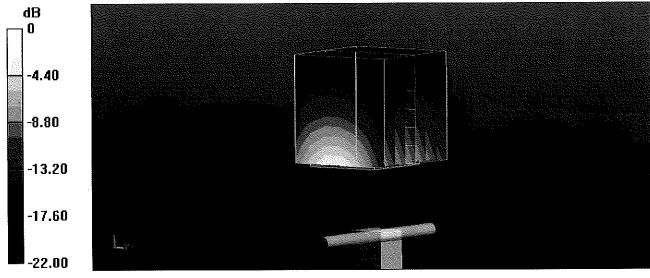
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 2.01 S/m; ϵ_r = 50.8; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.94, 7.94, 7.94) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 105.2 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 25.6 W/kg **SAR(1 g) = 13 W/kg; SAR(10 g) = 6.09 W/kg** Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

Impedance Measurement Plot for Body TSL

<u>File V</u> iew	<u>C</u> hannel Sv	v <u>e</u> ep Calibratio	n <u>T</u> race <u>S</u> cale	Marker S <u>y</u> s	tem <u>Wi</u> ndo	ow <u>H</u> elp			
Ch1: 3t2	Ch 1 Avg = 20 art 2.25000 GHz		A				0000 GHz 546.95 pH 0000 GHz	8 83. ;	1.000 Ω .4196 Ω 658 mU 78.464 °
	olouhe/weight databelere tagegottere ja	***************************************							
10.00					> 1;	2.45	60000 GHz	-2	.550 dB
10.00 5.00 0.00					> 1;	2.45	60000 GHz	-2	.550 dB
5.00 - 0.00 - -5.00 -					> 1;	2.45	0000 GHz	-2	.550 dB
5.00 - Q.00 -					> 1:	2.45	0000 GHz	-2	.550 dB
5.00 - 0.00 - -5.00 - -18.00 - -15.00 -					> 1:	2.45	0000 GHz	-2	.550 dB
5.00 - 0.00 - -5.00 - -10.00 - -15.00 -					> 1:	2.45	0000 GHz	-2	.550 dB
5.00 0.00 -5.00 -10.00 -15.00 -20.00 -25.00 -30.00 -35.00					> 1:	2.45	0000 GHz	-2	.550 dB
5.00 0.00 -5.00 -10.00 -15.00 -20.00 -25.00 -30.00 -35.00	Ch 1 Avg = 20 rart 2.25000 GHz				> 1:	2.45	0000 GHz		.550 dB

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Accreditation No.: SCS 0108

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Client PC Test

Certificate No: D2450V2-981_Aug18

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:9	81,	
			
Calibration procedure(s)	QA CAL-05.v10		
	Calibration proce	edure for dipole validation kits ab	ove 700 MHz
		and the second	RNIV
	•		DIA
		- · · · · · · ·	09-26/201
Calibration date:	August 16, 2018	·	
	•	**	BN / 09-26/201 BN/ 08/10/20
		•	01.0/25
This calibration certificate docume	nts the traceability to nat	ional standards, which realize the physical ur	08/10/~~
The measurements and the uncert	ainties with confidence r	probability are given on the following pages a	nits of measurements (SI).
		sobability are given on the following pages at	nd are part of the certificate. BN 08-20-20
All calibrations have been conduct	od in the stars of the sec	e	
sal canonadoris nave been conduct	ed in the closed laborato	ry facility: environment temperature (22 \pm 3)°	°C and humidity < 70%.
Calibration Equipment used (M&TI	= critical for calibration)		
Deleners Observice	l		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18
Secondary Standards	ID #	Oberla Deta (in b	
Power meter EPM-442A	SN: GB37480704	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	1	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: MY41092317 SN: 100972	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A		15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Hotront Analyzer Agnenic E6356A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18
	Name	Function	Signatura
Calibrated by:	Leif Klysner	Laboratory Technician	Signature
-			Sel Tille
			The former of the second secon
Approved by:	Katja Pokovic	Technical Manager	MA
	,	· · ·	All as-
			Issued: August 23, 2018

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S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossarv:

TSL ConvF N/A	tissue simulating liquid sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5.0 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.3 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.9 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.2 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.0 Ω + 2.3 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω + 4.7 jΩ
Return Loss	- 26.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	December 30, 2014	

Appendix (Additional assessments outside the scope of SCS 0108)

Measurement Conditions

DASY system configuration, as far as not given on page 1 and 3.

Phantom		
Filantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
		TO USAGE WILL COARSDVZ-R/L

SAR result with SAM Head (Top)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.0 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.0 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.3 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Neck)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.2 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg ± 16.9 % (k=2)

SAR result with SAM Head (Ear)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.74 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	34.7 W/kg ± 17.5 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	17.5 W/kg ± 16.9 % (k=2)

DASY5 Validation Report for Head TSL

Date: 13.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:981

Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ϵ_r = 37.7; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

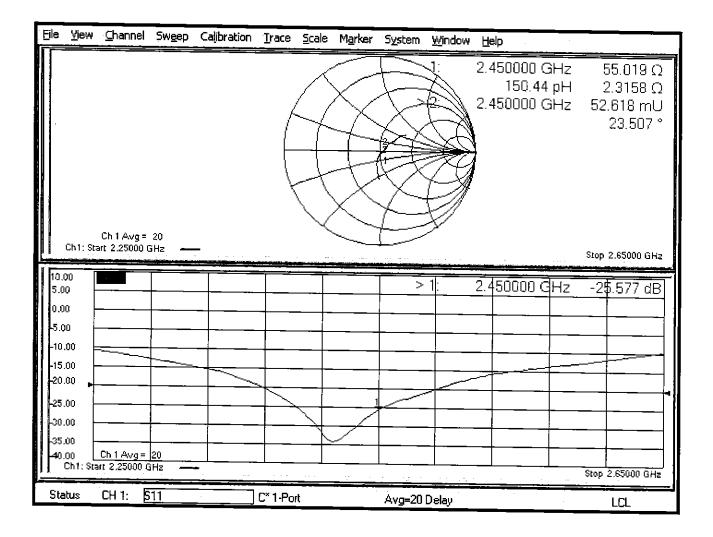
- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 116.6 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 26.7 W/kg SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg Maximum value of SAR (measured) = 22.1 W/kg



0 dB = 22.1 W/kg = 13.44 dBW/kg



DASY5 Validation Report for Body TSL

Date: 13.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:981

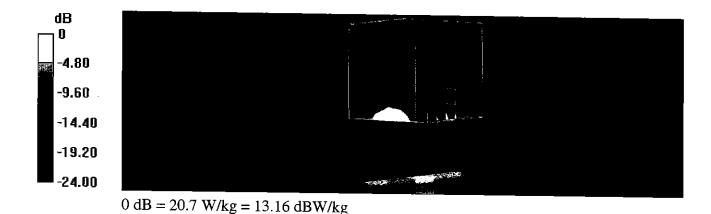
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ϵ_r = 51.8; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

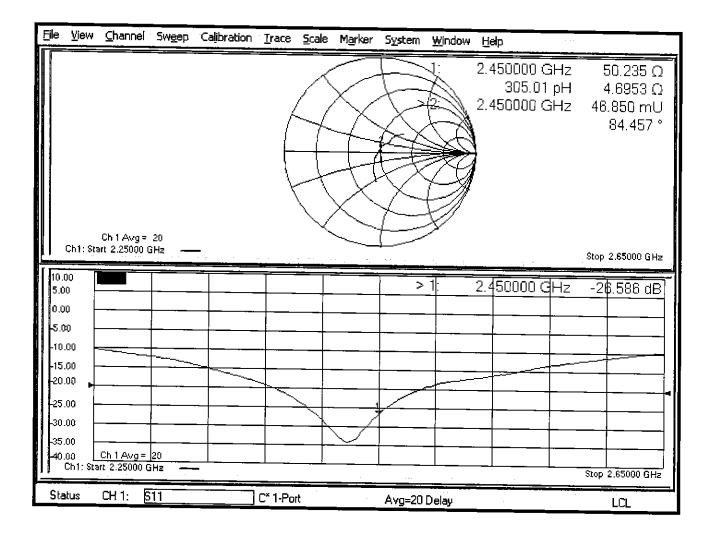
- Probe: EX3DV4 SN7349; ConvF(8.01, 8.01, 8.01) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 107.0 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 25.3 W/kg SAR(1 g) = 13 W/kg; SAR(10 g) = 6.11 W/kg Maximum value of SAR (measured) = 20.7 W/kg



Impedance Measurement Plot for Body TSL



Date: 16.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:981

Communication System: UID 0 - CW ; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ϵ_r = 40.2; ρ = 1000 kg/m³ Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

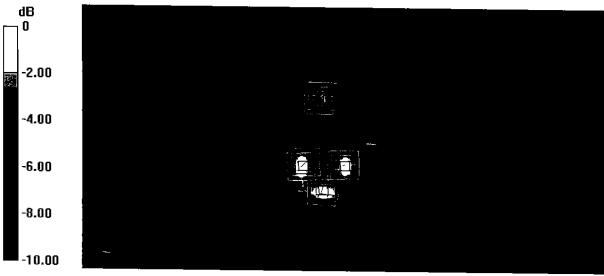
- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: SAM Head
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

SAM Head Top/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 116.2 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 26.4 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.33 W/kg Maximum value of SAR (measured) = 22.0 W/kg

SAM Head Mouth/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 116.9 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 26.3 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.35 W/kg Maximum value of SAR (measured) = 21.7 W/kg

SAM Head Neck/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 112.0 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 24.1 W/kg SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.11 W/kg Maximum value of SAR (measured) = 20.5 W/kg

SAM Head Ear/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 91.03 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 15.8 W/kg SAR(1 g) = 8.74 W/kg; SAR(10 g) = 4.4 W/kg Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 22.0 W/kg = 13.42 dBW/kg



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http://www.pctest.com



Certification of Calibration

Object

D2450V2 - SN: 981

08/09/2019

Calibration procedure(s)

Procedure for Calibration Extension for SAR Dipoles.

Calibration date:

Description:

SAR Validation Dipole at 2450 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	10/2/2018	Annual	10/2/2019	US39170118
Agilent	N5182A	MXG Vector Signal Generator	6/27/2019	Annual	6/27/2020	US46240505
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1207470
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339007
Control Company	4040	Temperature / Humidity Monitor	2/28/2018	Biennial	2/28/2020	150761911
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330160
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	5/23/2018	Biennial	5/23/2020	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665
SPEAG	EX3DV4	SAR Probe	7/15/2019	Annual	7/15/2020	7547
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1323
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Page 1 of 4	
D2450V2 – SN: 981	08/09/2019	Page 1 of 4	

DIPOLE CALIBRATION EXTENSION

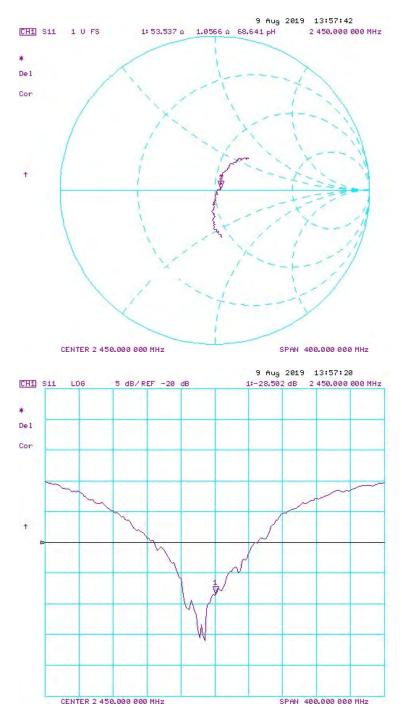
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

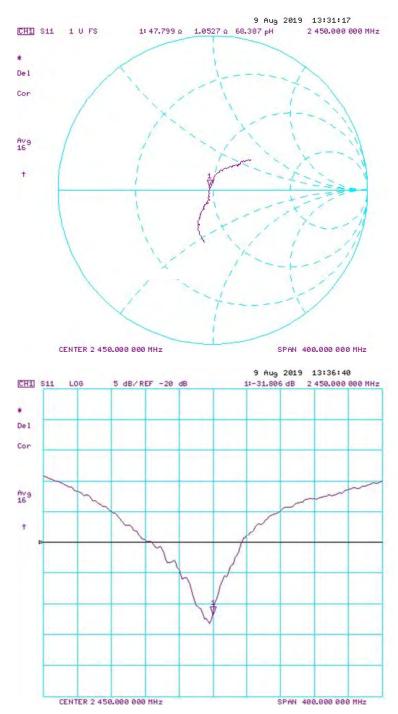
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Head (1g) W/kg @ 20.0 dBm	ubiii	(%)	dBm	(10g) W/kg @ 20.0 dBm		Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Head (dB)	Deviation (%)	
8/16/2018	8/9/2019	1.162	5.23	5.53	5.74%	2.44	2.56	4.92%	55	53.5	1.5	2.3	1.1	1.2	-25.6	-28.5	-11.30%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
8/16/2018	8/9/2019	1.162	5.09	4.98	-2.16%	2.42	2.28	-5.79%	50.2	47.8	2.4	4.7	1.1	3.6	-26.6	-31.8	-19.60%	PASS

Object:	Date Issued:	Page 2 of 4
D2450V2 – SN: 981	08/09/2019	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Daga 2 of 4
D2450V2 – SN: 981	08/09/2019	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Daga 4 of 4
D2450V2 – SN: 981	08/09/2019	Page 4 of 4





Certification of Calibration

Object

D2450V2 - SN: 981

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

8/16/2020

Extension Calibration date:

Description:

SAR Validation Dipole at 2450 MHz

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766816
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Agilent	85033E	3.5mm Standard Calibration Kit	6/6/2020	Annual	6/6/2021	MY53402352
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/27/2019	Annual	8/27/2020	1339027
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk Inc	NC-100	Torque Wrench	8/4/2020	Biennial	8/4/2022	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	1/21/2020	Annual	1/21/2021	3589
SPEAG	EX3DV4	SAR Probe	6/23/2020	Annual	6/23/2021	7409
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2020	Annual	6/18/2021	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/23/2020	Annual	1/13/2021	1558

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 4
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DIPOLE CALIBRATION EXTENSION

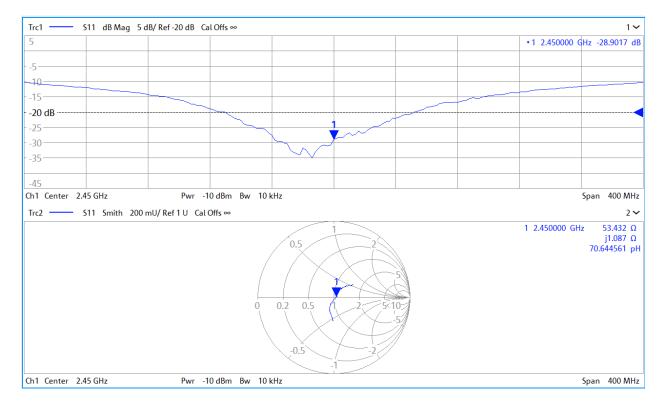
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

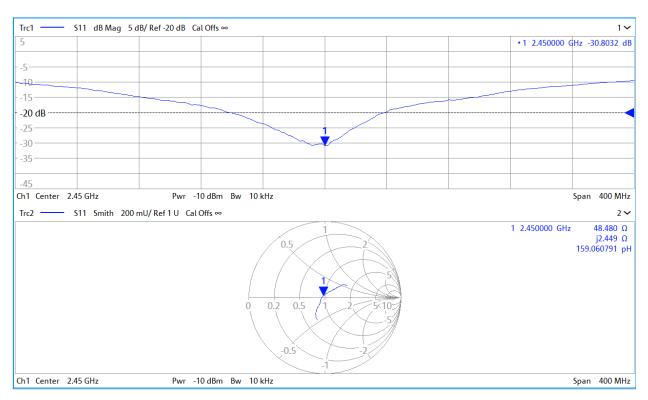
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Head (1g) W/kg @ 20.0 dBm	ubiii	(%)	dBm	(10a) W/ka @		Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Head (dB)	Deviation (%)	
8/16/2018	8/16/2020	1.162	5.23	5.31	1.53%	2.44	2.4	-1.64%	55	53.4	1.6	2.3	1.1	1.2	-25.6	-28.9	-12.90%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
8/16/2018	8/16/2020	1.162	5.09	5.3	4.13%	2.42	2.43	0.41%	50.2	48.5	1.7	4.7	2.4	2.3	-26.6	-30.8	-15.80%	PASS

Object:	Date Issued:	Dogo 2 of 4
D2450V2 – SN: 981	08/16/2020	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dogo 2 of 4
D2450V2 – SN: 981	08/16/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dogo 4 of 4
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Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst

Service suïsse d'étalonnage

Servizio svizzero di taratura Sissi Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client PC Test		C	ertificate'No: D2600V2=1004_Apr18	
OANE BERAVE ON RE	EDHEIGAHE			
Object	D2600V2-SN/10	04		
Calibration procedure(s)	QA GALEOS VID			
	Calibration proce	dure for dipole validatio		18 - Honde
Calibration date:	April 11, 2018		oh- BU	18 Extende 20-2019 108 12020 Extend
This calibration certificate docume The measurements and the uncer	nts the traceability to nati tainlies with confidence p	onal standards, which realize th robability are given on the follow	e physical units of measurements (SI). ving pages and are part of the certificate.	
			ure (22 \pm 3)°C and humidity < 70%.	128 Extend
Calibration Equipment used (M&T	E critical for calibration)			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/0	2673) Apr-19	
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19	
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19	
Reference 20 dB Attenuator	SN: 5058 (20K)	04-Apr-18 (No. 217-02682)	Apr-19	
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19	
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349[lec17) Dec-18	
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_0	Oct-18	
Secondary Standards	ID #	Check Date (in house)	Scheduled Check	
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check (Oct-16) in house check: Oct-18	
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check (Oct-16) In house check: Oct-18	
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check (Dct-16) In house check: Oct-18	
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check (Det-16) In house check: Oct-18	
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check (Oct-17) In house check: Oct-18	
	Name	Function	Signature	
Callbrated by:	Michael Weber	Laboratory Tec	nician Aless	
Approved by:	Katla Rokovic	Technical Man	gen status	
This calibration certificate shall n	ot be reproduced except	in full without written approval o	issued: April 12, 2018 the laboratory.	
		•		

Certificate No: D2600V2-1004_Apr18

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S

Schweizerischer Kalibrierdienst

- C Service suisse d'étalonnage
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- S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	2.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.9 W/kg ± 17.0 % (k=2)
	F	······································
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.1 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.1 ± 6 %	2.19 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		,

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	54.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.7 W/kg ± 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 5.7 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.0 Ω - 3.8 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 23, 2006

DASY5 Validation Report for Head TSL

Date: 11.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

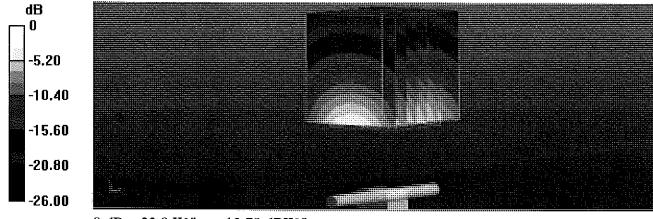
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; $\sigma = 2.03$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

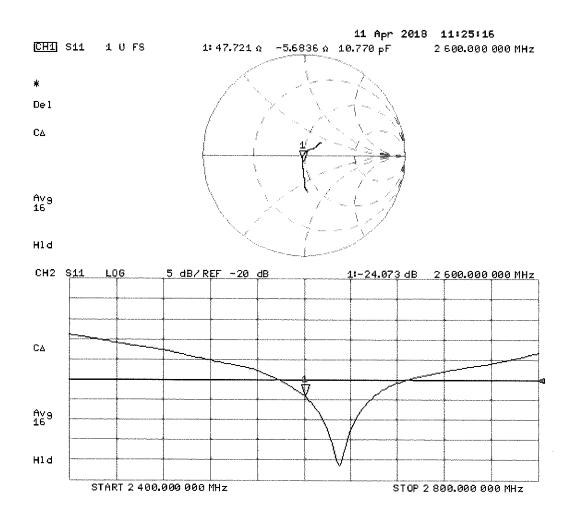
- Probe: EX3DV4 SN7349; ConvF(7.7, 7.7, 7.7); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 118.5 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 28.6 W/kg **SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.35 W/kg** Maximum value of SAR (measured) = 23.9 W/kg



0 dB = 23.9 W/kg = 13.78 dBW/kg



DASY5 Validation Report for Body TSL

Date: 11.04.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

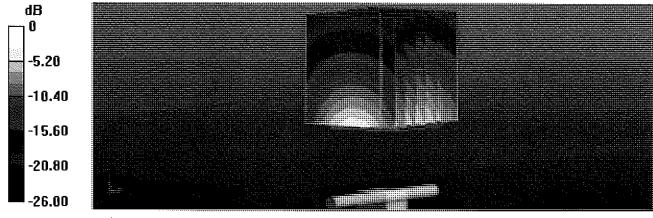
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; σ = 2.19 S/m; ϵ_r = 52.1; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

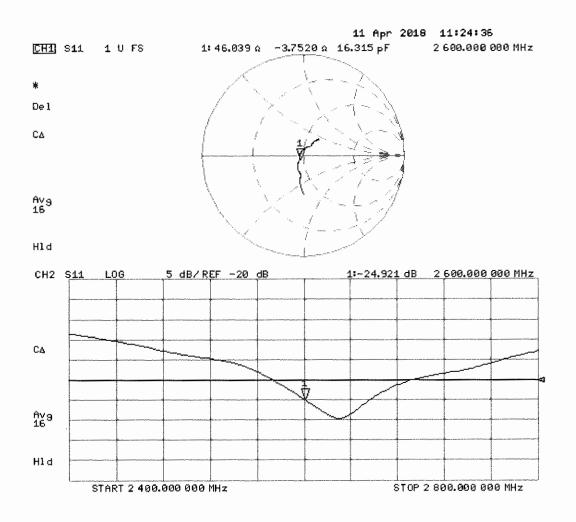
- Probe: EX3DV4 SN7349; ConvF(7.81, 7.81, 7.81); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 108.5 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 28.3 W/kg SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.2 W/kg Maximum value of SAR (measured) = 22.9 W/kg



0 dB = 22.9 W/kg = 13.60 dBW/kg





PCTEST ENGINEERING LABORATORY, INC. 7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654

http://www.pctest.com



Certification of Calibration

Object

D2600V2 - SN: 1004

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 4/11/2019

Description:

SAR Validation Dipole at 2600 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2020	US39170122		
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1027293
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1126066
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647811
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK-

Object:	Date Issued:	Page 1 of 4
D2600V2 – SN: 1004	04/11/2019	Fage 1014

DIPOLE CALIBRATION EXTENSION

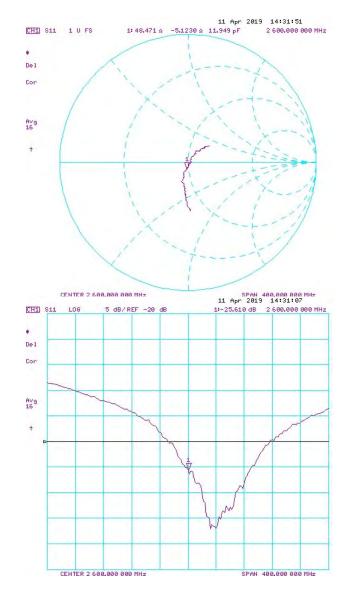
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

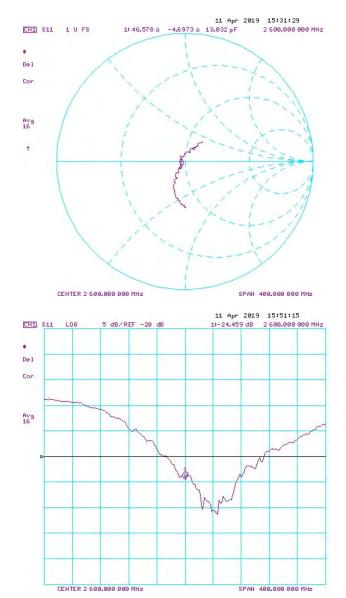
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
4/11/2018	4/11/2019	1.149	5.59	5.51	-1.43%	2.51	2.47	-1.59%	47.7	48.5	0.8	-5.7	-5.1	0.6	-24.1	-25.6	-6.30%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
4/11/2018	4/11/2019	1.149	5.48	5.65	3.10%	2.47	2.48	0.40%	46	46.6	0.6	-3.8	-4.7	0.9	-24.9	-24.5	1.80%	PASS

Object:	Date Issued:	Dogo 2 of 4
D2600V2 – SN: 1004	04/11/2019	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Page 3 of 4
D2600V2 – SN: 1004	04/11/2019	Page 5 01 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dogo 4 of 4
D2600V2 – SN: 1004	04/11/2019	Page 4 of 4





Certification of Calibration

Object

D2600V2 - SN: 1004

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

4/11/2020

Extension Calibration date:

Description:

SAR Validation Dipole at 2600 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2021	192291470		
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor 8/14/2019 A			8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench (8" lb)	5/23/2018	Biennial	5/23/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	1/21/2020	Annual	1/21/2021	3589
SPEAG	EX3DV4	SAR Probe	9/19/2019	Annual	9/19/2020	7552
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/12/2019	Annual	9/12/2020	1449
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2020	Annual	1/13/2021	1558

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Page 1 of 4
D2600V2 – SN: 1004	04/11/2020	Fage 1014

DIPOLE CALIBRATION EXTENSION

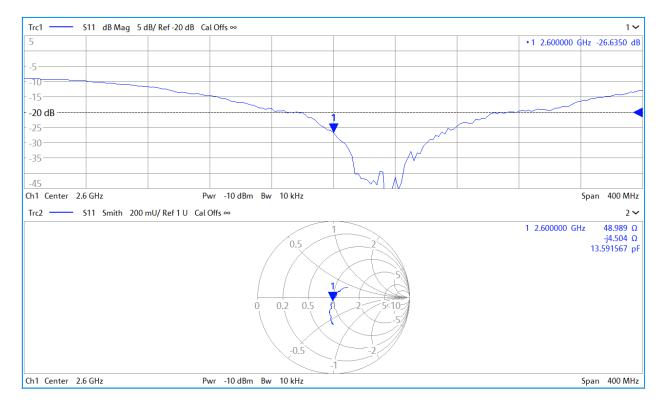
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

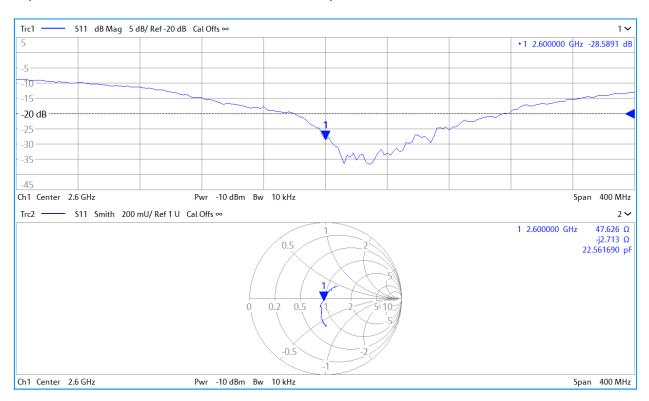
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0-0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
4/11/2018	4/11/2020	1.419	5.59	5.78	3.40%	2.51	2.59	3.19%	47.7	49.0	1.3	-5.7	-4.5	1.2	-24.1	-26.6	-10.50%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	(0/)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	(10-) (10-	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
4/11/2018	4/11/2020	1.149	5.48	5.16	-5.84%	2.47	2.36	-4.45%	46	47.6	1.6	-3.8	-2.7	1.1	-24.9	-28.6	-14.80%	PASS

Object:	Date Issued:	Dogo 2 of 4
D2600V2 – SN: 1004	04/11/2020	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dogo 2 of 4
D2600V2 – SN: 1004	04/11/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dege 4 of 4
D2600V2 – SN: 1004	04/11/2020	Page 4 of 4

Calibration Laboratory of

PC Test

Client

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst S

- Service suisse d'étalonnage C
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- S **Swiss Calibration Service**

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Certificate No: D2600V2-1064_Jun19

CALIBRATION CERTIFICATE

Object	D2600V2 - SN:10	164	
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			ANV
Calibration procedure(s)	QA CAL-05.v11		BNV BNV 181/2019
candiation procedure(s)			
	Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
			RN
			··· 06-70-30
Calibration date:	June 14, 2019		
	·····		
This calibration partificate documer	to the tracebility to not	and standards, which realize the shuries lur	ite of monourements (CI)
		onal standards, which realize the physical ur	
The measurements and the uncertain	ames wan connuence p	robability are given on the following pages ar	id are part of the certificate.
l			
All calibrations have been conducte	ed in the closed laborato	ry facility: environment temperature (22 \pm 3)°	C and humidity < 70%.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20
		00 Apr 10 (No. DAL+001_Apr 0)	Αμ-20
Secondary Standards	D#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06			In house check: Oct-20
0	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19
	•	–	
	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
			Miller
Approved by:	Katja Pokovic	Technical Manager	Clint
			/tent
			Issued: June 20, 2019
This calibration certificate shall not	be reproduced except in	full without written approval of the laboratory	,
			•

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S

Schweizerischer Kalibrierdienst

- Service suisse d'étalonnage С
- Servizio svizzero di taratura S

Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossarv:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end • of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	58.1 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	26.0 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.5 ± 6 %	2.22 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	55.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	25.0 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 6.9 jΩ
Return Loss	- 23.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 4.4 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 14.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1064

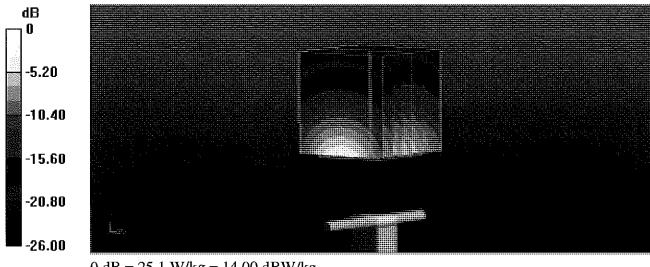
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; σ = 2.03 S/m; ϵ_r = 37.3; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.69, 7.69, 7.69) @ 2600 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 120.9 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 30.2 W/kg **SAR(1 g) = 14.9 W/kg; SAR(10 g) = 6.59 W/kg** Maximum value of SAR (measured) = 25.1 W/kg



Impedance Measurement Plot for Head TSL

File View	<u>C</u> hannel Sw <u>e</u> ep	o Ca <u>l</u> ibration <u>T</u>	race <u>S</u> cale I	M <u>a</u> rker S <u>y</u> stem	<u>W</u> indow <u>H</u> elp		
			X		A)0000 GHz 8.8630 pF)0000 GHz	49.847 Ω -6.9066 Ω 69.025 mU -87.316 °
Chi:S	Ch 1 Avg = 20 Start 2.40000 GHz						Stop 2.80000 GHz
10.00 5.00 -5.00 -10.00 -15.00 -20.00 -25.00 -35.00 -35.00 -40.00 -Ch1: S	Ch 1 Avg = 20 Start 2,40000 GHz =						-23.220 dB
Status	CH 1: 511	C	1-Port	Avg=20 [)elay		LCL

DASY5 Validation Report for Body TSL

Date: 14.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1064

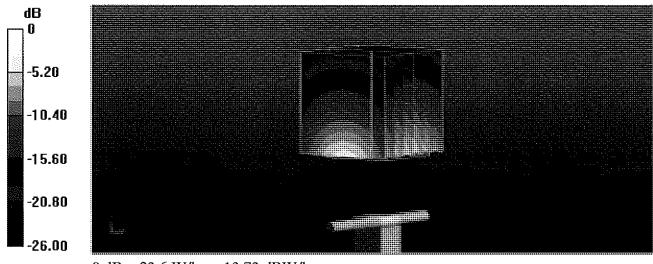
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; $\sigma = 2.22$ S/m; $\varepsilon_r = 50.5$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.8, 7.8, 7.8) @ 2600 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 110.6 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 28.9 W/kg SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.33 W/kg Maximum value of SAR (measured) = 23.6 W/kg



0 dB = 23.6 W/kg = 13.73 dBW/kg

Impedance Measurement Plot for Body TSL

File	View	<u>C</u> hannel	Sw <u>e</u> ep	Calibration	<u>T</u> race <u>S</u> cal	e M <u>a</u> rker	S <u>v</u> stem <u>W</u> ir	ndow <u>H</u>	elp		
		Ch 1 Avg =	20						600000 GHz 14.009 pF 600000 GHz	-4.3 56.9	645 Ω 1696 Ω 44 mU 24.93 °
	Ch1: St	art 2.40000								Stop 2.8	80000 GHz
10. 5.0		ALE AND					> 1;	2.	\$00000 dHz	-74 (391 dB
-30 -35 -40	00 00. 00. 00. 00. 00.	<u>Ch 1 Avg =</u> art 2.40000	20 3Hz —								





Certification of Calibration

Object

D2600V2 - SN: 1064

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

June 14, 2020

Extended Calibration date:

Description:

SAR Validation Dipole at 2600 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	7/18/2019	Annual	7/18/2020	N/A
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	1/21/2020	Annual	1/21/2021	3589
SPEAG	EX3DV4	SAR Probe	7/15/2019	Annual	7/15/2020	7547
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2020	Annual	1/13/2021	1558

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Test Engineer	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Managing Director	ROK

Object:	Date Issued:	Page 1 of 4	
D2600V2 – SN: 1064	6/14/2020	Page 1 of 4	

DIPOLE CALIBRATION EXTENSION

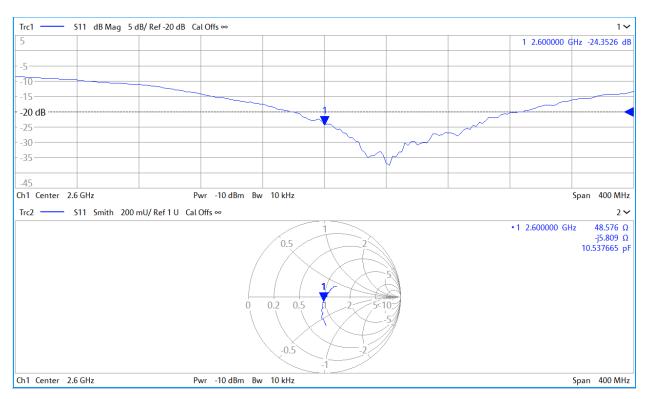
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

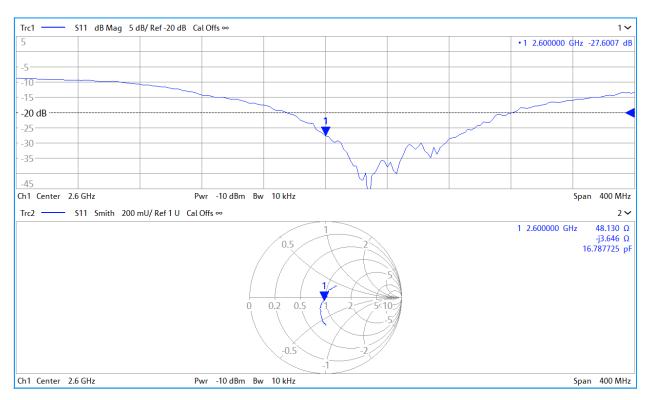
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 20.0 dBm		Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
6/14/2019	6/14/2020	1.151	5.81	5.68	-2.24%	2.6	2.56	-1.54%	49.8	48.6	1.2	-6.9	-5.8	1.1	-23.2	-24.4	-5.00%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm			(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
6/14/2019	6/14/2020	1.151	5.56	5.43	-2.34%	2.5	2.39	-4.40%	46.6	48.1	1.5	-4.4	-3.6	0.8	-24.9	-27.6	-10.80%	PASS

Object:	Date Issued:	Page 2 of 4	
D2600V2 – SN: 1064	6/14/2020	Fage 2 01 4	



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Daga 2 of 4	
D2600V2 – SN: 1064	6/14/2020	Page 3 of 4	



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Page 4 of 4	
D2600V2 – SN: 1064	6/14/2020	Fage 4 01 4	

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Schweizerischer Kallbrierdienst Service suisse d'étalonnage Servizio svizzero di taratura

S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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Client PC Test

Certificate No: D3500V2-1059_Jan18

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C

CALIBRATION CERTIFICATE

Calibration procedure(s) QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz Calibration date: January 11, 2018 Calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)*C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration OHIZT Power meter NRP SN: 104778 94-Apr-17 (No. 217-02521/02522) Apr-18
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity <70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration OI 1124
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration
All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration (11/2/2 Power meter NRP SN: 104778 04-Apr-17 (No. 217-0521) Apr-18
Calibration Equipment used (M&TE critical for calibration) HAC Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NBP SN: 104778 04-Apr-17 (No. 217-052) (M2522) Apr-18
Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration
Power meter NBP SN: 104778 04-Apr-77 (No. 217-0521/02523) Apr-19
Power sensor NRP-Z91 SN: 103244 04-Apr-17 (No. 217-02521) Apr-18
Power sensor NRP-Z91 SN: 103245 04-Apr-17 (No. 217-02522) Apr-18
Reference 20 dB Atlenuator SN: 5058 (20k) 07-Apr-17 (No. 217-02528) Apr-18
Type-N mismatch combination SN: 5047.2 / 06327 07-Apr-17 (No. 217-02529) Apr-18
Reference Probe EX3DV4 SN: 3503 30-Dec-17 (No. EX3-3503 Dec17) Dec-18
DAE4 SN: 601 26-Oct-17 (No. DAE4-601_Oct17) Oct-18
Secondary Standards ID # Check Date (in house) Scheduled Check
Power meter EPM-442A SN: GB37460704 07-Oct-15 (in house check Oct-16) In house check: Oct-18
Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-16) In house check: Oct-18
Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-16) In house check: Oct-18
RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-16) In house check: Oct-18
Network Analyzer HP 8753E SN: US37390585 18-Oct-01 (in house check Oct-17) In house check: Oct-18
Name Function Signature
Calibrated by: Michael Weber Laboratory Technician
Approved by: Kalja Pokovic Technical Manager
Issued: January 16, 2018 This calibration certificate shalf not be reproduced except in full without written approval of the laboratory.

Certificate No: D3500V2-1059_Jan18

Page 1 of 8

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





Schweizerischer Kalibrierdienst

- S Service suisse d'étalonnage С
 - Servizio svizzero di taratura
- S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossarv:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end • of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3500 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.5 ± 6 %	2.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	64.6 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg ± 19.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	51.3	3.31 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.0 ± 6 %	3.32 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	6.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	65.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.2 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.2 Ω - 7.1 jΩ
Return Loss	- 22.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	53.4 Ω - 4.5 jΩ
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.136 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 20, 2017

DASY5 Validation Report for Head TSL

Date: 11.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

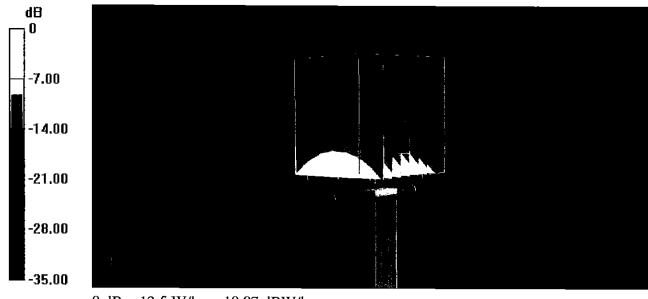
DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1059

Communication System: UID 0 - CW; Frequency: 3500 MHz Medium parameters used: f = 3500 MHz; $\sigma = 2.91$ S/m; $\varepsilon_r = 38.5$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

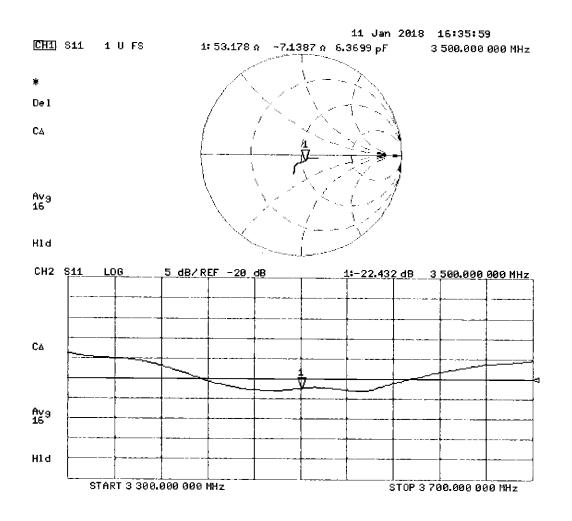
DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.8, 7.8, 7.8); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.59 V/m; Power Drift = -0.03 dB Peak SAR (extrapolated) = 17.6 W/kg SAR(1 g) = 6.44 W/kg; SAR(10 g) = 2.43 W/kg Maximum value of SAR (measured) = 12.5 W/kg



0 dB = 12.5 W/kg = 10.97 dBW/kg



DASY5 Validation Report for Body TSL

Date: 10.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

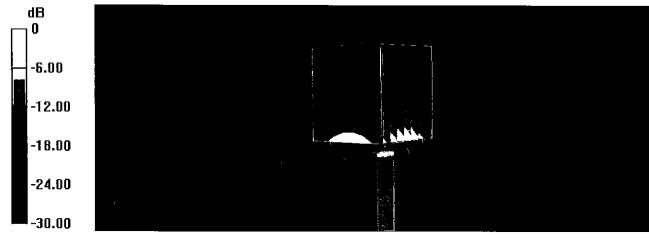
DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1059

Communication System: UID 0 - CW; Frequency: 3500 MHz Medium parameters used: f = 3500 MHz; $\sigma = 3.32$ S/m; $\varepsilon_r = 50$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

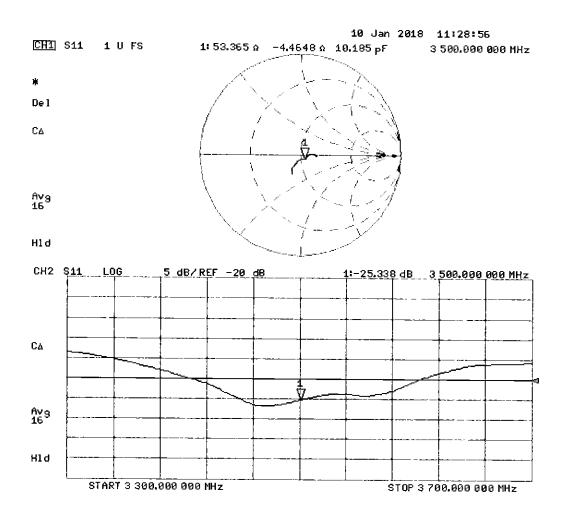
DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.43, 7.43, 7.43); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=100 mW, d=10mm/Zoom Scan , dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 66.18 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 17.9 W/kg SAR(1 g) = 6.55 W/kg; SAR(10 g) = 2.43 W/kg Maximum value of SAR (measured) = 12.6 W/kg



0 dB = 12.6 W/kg = 11.00 dBW/kg





PCTEST ENGINEERING LABORATORY, INC. 7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654

http://www.pctest.com



Certification of Calibration

Object

D3500V2 - SN: 1059

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

1/11/2019

Extension Calibration date:

Description:

SAR Validation Dipole at 3500 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	2/8/2018	Annual	2/8/2019	US39170122
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1339018
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/3/2018	Annual	10/3/2019	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091
SPEAG	EX3DV4	SAR Probe	2/14/2018	Annual	2/14/2019	3914
SPEAG	EX3DV4	SAR Probe	8/24/2018	Annual	8/24/2019	3949

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 5
D3500V2 – SN: 1059	01/11/2019	Page 1 of 5

DIPOLE CALIBRATION EXTENSION

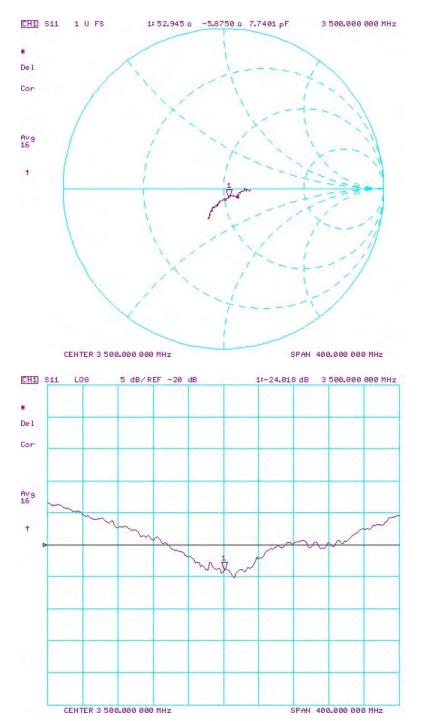
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

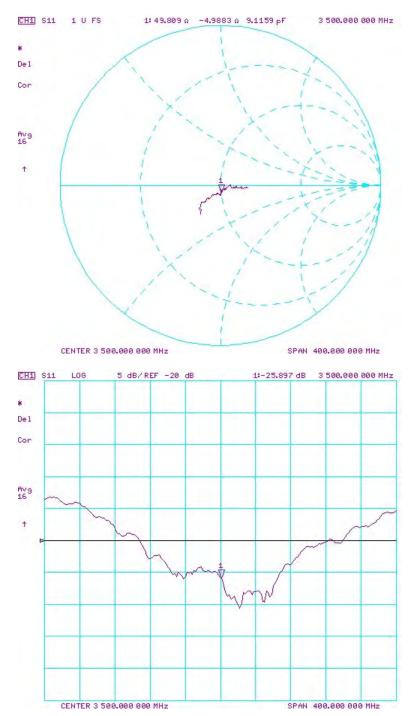
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	W/kg @ 20.0 dBm	dBm	(%)	W/kg @ 20.0 dBm	(10g) W/kg @ 20.0 dBm		Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Head (dB)	Deviation (%)	
1/11/2018	1/16/2019	1.136	6.46	6.23	-3.56%	2.44	2.34	-4.10%	53.2	52.9	0.3	-7.1	-5.9	1.2	-22.4	-24	-7.20%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	(9()	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/16/2019	1.136	6.51	6	-7.83%	2.42	2.26	-6.61%	53.4	49.8	3.6	-4.5	-5	0.5	-25.3	-25.9	-2.40%	PASS

Object:	Date Issued:	Page 2 of 5
D3500V2 – SN: 1059	01/11/2019	Faye 2 01 5



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Page 3 of 5
D3500V2 – SN: 1059	01/11/2019	Fage 5 01 5



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dago 4 of 5
D3500V2 – SN: 1059	01/11/2019	Page 4 of 5





Certification of Calibration

Object

D3500V2 - SN: 1059

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

1/11/2020

Extension Calibration date:

Description:

SAR Validation Dipole at 3500 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Page 1 of 4
D3500V2 – SN: 1059	01/11/2020	Fage 1014

DIPOLE CALIBRATION EXTENSION

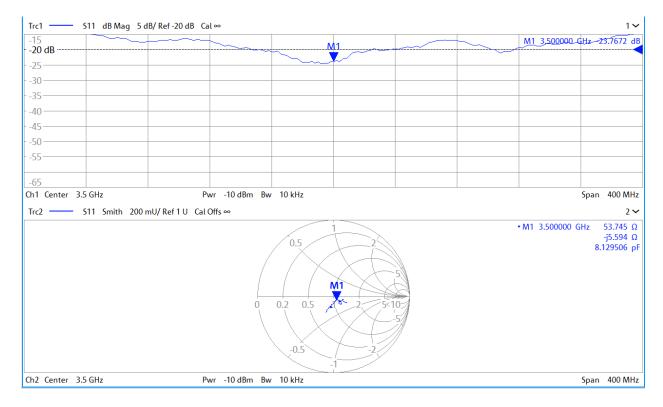
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

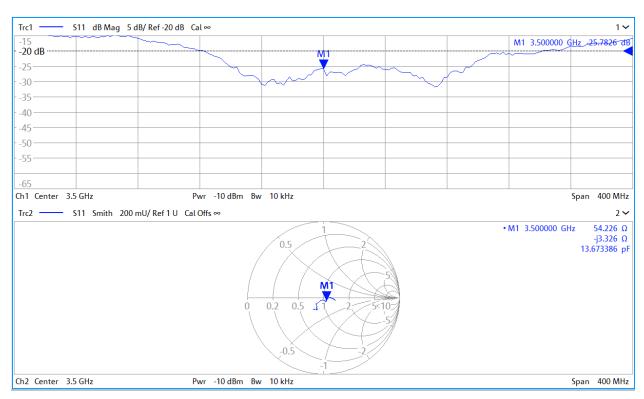
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 20.0 dBm	(96)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/11/2020	1.136	6.46	6.73	4.18%	2.44	2.56	4.92%	53.2	53.7	0.5	-7.1	-5.6	1.5	-22.4	-23.8	-6.10%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/11/2020	1.136	6.51	6.53	0.31%	2.42	2.4	-0.83%	53.4	54.2	0.8	-4.5	-3.3	1.2	-25.3	-25.8	-1.90%	PASS

Object:	Date Issued:	Dogo 2 of 4
D3500V2 – SN: 1059	01/11/2020	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dage 2 of 4
D3500V2 – SN: 1059	01/11/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Daga 4 of 4
D3500V2 – SN: 1059	01/11/2020	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst

C Service suisse d'étaionnage

Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

ALIBRATION C	ERTIFICATE		
zject	D3700V2 - SN:10	18	:
allbration procedure(s)	QA CAL-22.v2 Calibration process	iure for dipole validation kits betw	een 3-6 GHz
alibration date:	January 11, 2018		BN 01-26-2018
he measurements and the unc	entainties with confidence p	onal standards, which realize the physical unit robability are given on the following pages and p facility: environment temperature (22 ± 3)°C	1 are part of the centricate. 02/06/2 02/06/2
Calibration Equipment used (M8			01/12/
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18 ·
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2/06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 3503	30-Dec-17 (No. EX3-3503_Dec17)	Dec-18
	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18
DAE4			Scheduled Check
	lin #	Check Date (in house)	
Secondary Standards	ID #	Check Date (in house) 07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Secondary Standards Power mater EPM-442A	SN: GB37480704	07-Oct-15 (In house check Oct-16)	In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A	SN: GB37480704 SN: US37292783	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	SN: GB37480704 SN: US37292783 SN: MY41092317	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	In house check: Oct-18
	SN: GB37480704 SN: US37292783	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16)	In house check: Oct-18 In house check: Oct-18
Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-17) Function	In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-17)	In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18
Secondary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	SN: GB37480704 SN: US37292783 SN: MY41092317 SN: 100972 SN: US37390585 Name	07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 07-Oct-15 (in house check Oct-16) 15-Jun-15 (in house check Oct-16) 18-Oct-01 (in house check Oct-17) Function	In house check: Oct-18 In house check: Oct-18 In house check: Oct-18 In house check: Oct-18

Certificate No; D3700V2-1018_Jan18

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Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





Schweizerischer Kalibrierdienst

- S Service suisse d'étalonnage С
 - Servizio svizzero di taratura
- S **Swiss Calibration Service**

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossarv:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Accreditation No.: SCS 0108

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3700 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.3 ± 6 %	3.07 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.8 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	51.0	3.55 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.7 ± 6 %	3.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	6.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	64.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω - 8.3 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.5 Ω - 6.3 jΩ
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.144 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 18, 2015

DASY5 Validation Report for Head TSL

Date: 11.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

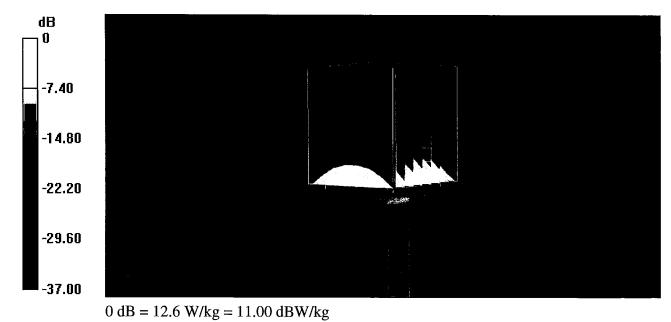
DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1018

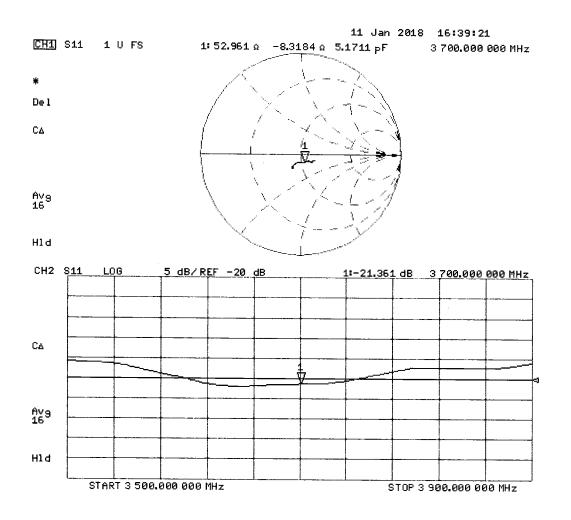
Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz; $\sigma = 3.07$ S/m; $\epsilon_r = 38.3$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.5, 7.5, 7.5); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.40 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.54 W/kg; SAR(10 g) = 2.41 W/kg Maximum value of SAR (measured) = 12.6 W/kg





DASY5 Validation Report for Body TSL

Date: 10.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1018

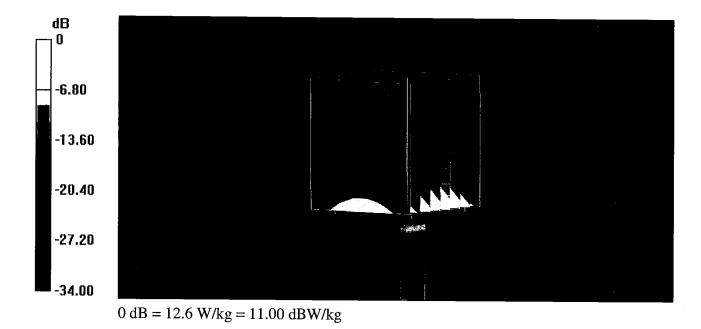
Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz; $\sigma = 3.53$ S/m; $\epsilon_r = 49.7$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

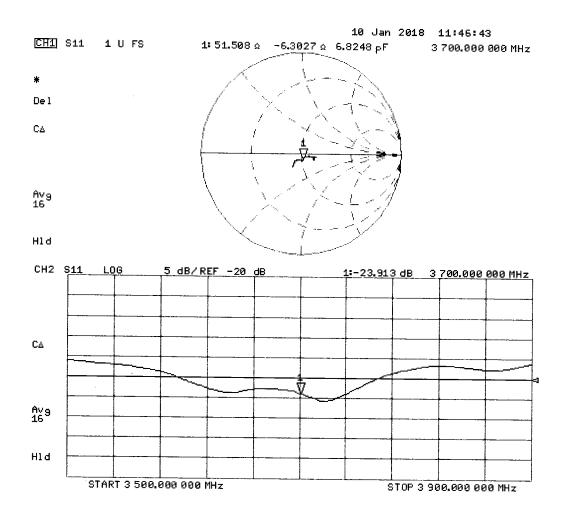
DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.28, 7.28, 7.28); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=100 mW, d=10mm/Zoom Scan , dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mmReference Value = 64.16 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 18.4 W/kg SAR(1 g) = 6.46 W/kg; SAR(10 g) = 2.32 W/kg Maximum value of SAR (measured) = 12.6 W/kg







PCTEST ENGINEERING LABORATORY, INC. 7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. +1.410.290.6652 / Fax +1.410.290.6654

http://www.pctest.com



Certification of Calibration

Object

D3700V2 - SN: 1018

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

1/11/2019

Extension Calibration date:

Description:

SAR Validation Dipole at 3500 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer		Annual	2/8/2019	US39170122
Agilent	N5182A	MXG Vector Signal Generator	4/18/2018	Annual	4/18/2019	MY47420800
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1207364
Anritsu	MA2411B	Pulse Power Sensor	3/2/2018	Annual	3/2/2019	1339018
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Control Company	4040	Therm./Clock/Humidity Monitor	3/31/2017	Biennial	3/31/2019	170232394
Control Company	4352	Ultra Long Stem Thermometer	5/2/2017	Biennial	5/2/2019	170330156
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/11/2018	Annual	7/11/2019	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/3/2018	Annual	10/3/2019	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	9/11/2018	Annual	9/11/2019	1091
SPEAG	EX3DV4	SAR Probe	2/14/2018	Annual	2/14/2019	3914
SPEAG	EX3DV4	SAR Probe	8/24/2018	Annual	8/24/2019	3949

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	XOK

Object:	Date Issued:	Page 1 of 4
D3700V2 – SN: 1018	01/11/2019	raye 1014

DIPOLE CALIBRATION EXTENSION

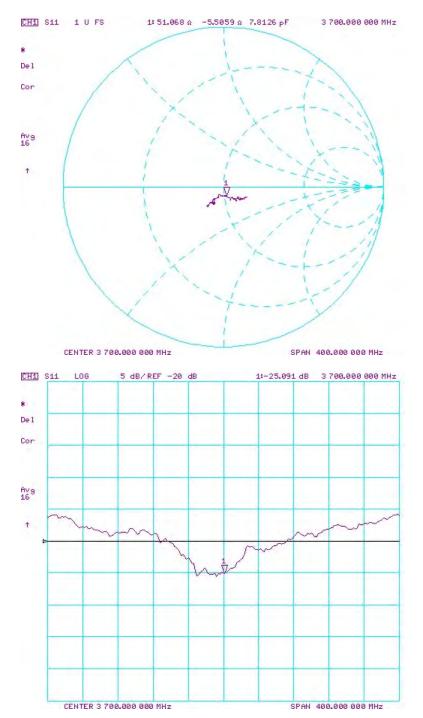
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

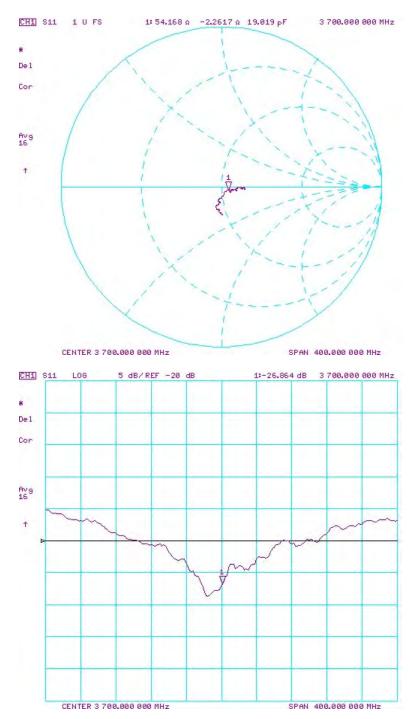
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 20.0 dBm	(96)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/11/2019	1.144	6.58	6.22	-5.47%	2.42	2.27	-6.20%	53	51.1	1.9	-8.3	-5.5	2.8	-21.4	-25.1	-17.20%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/11/2019	1.144	6.43	6.08	-5.44%	2.31	2.21	-4.33%	51.5	54.2	2.7	-6.3	-2.3	4	-23.9	-26.9	-12.40%	PASS

Object:	Date Issued:	Page 2 of 4
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Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dage 2 of 4
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Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Page 4 of 4
D3700V2 – SN: 1018	01/11/2019	Page 4 of 4





Certification of Calibration

Object

D3700V2 - SN: 1018

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

1/11/2020

Extension Calibration date:

Description:

SAR Validation Dipole at 3700 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181334684
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045
Anritsu	MA2411B	Pulse Power Sensor	8/14/2019	Annual	8/14/2020	1315051
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
MiniCircuits	ZHDC-16-63-S+	Bidirectional Coupler	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Brodie Halbfoster	Test Engineer	BRODIE HALBFOSTER
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	ROK

Object:	Date Issued:	Page 1 of 4	
D3700V2 – SN: 1018	01/11/2020	Fage 1014	

DIPOLE CALIBRATION EXTENSION

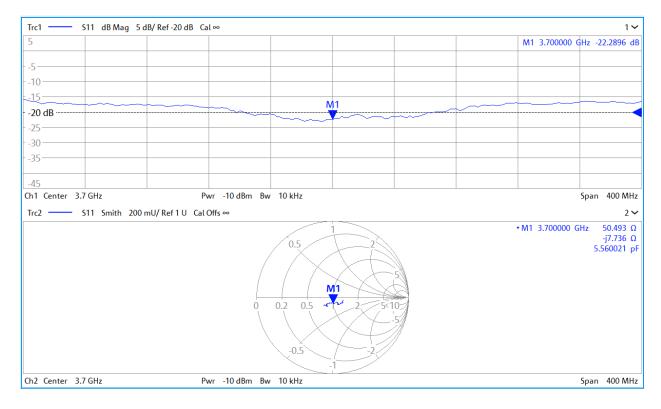
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

- 1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
- 2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
- 3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

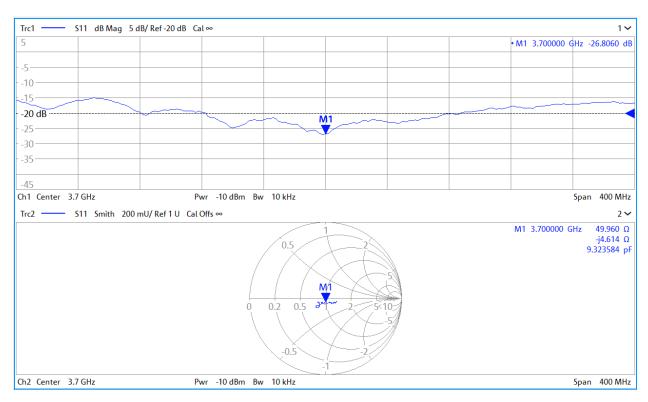
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Head SAR (1g) W/kg @ 20.0 dBm		Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	(40-) 10/0	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/11/2020	1.144	6.58	7.08	7.60%	2.42	2.6	7.44%	53	50.5	2.5	-8.3	-7.7	0.6	-21.4	-22.3	-4.20%	PASS
Calibration Date	Extension Date	Certificate Electrical Delay (ns)		Measured Body SAR (1g) W/kg @ 20.0 dBm			(10a) W/ka @	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
1/11/2018	1/11/2020	1.144	6.43	6.6	2.64%	2.31	2.36	2.16%	51.5	50	1.5	-6.3	-4.6	1.7	-23.9	-26.8	-12.20%	PASS

Object:	Date Issued:	Dogo 2 of 4
D3700V2 – SN: 1018	01/11/2020	Page 2 of 4



Impedance & Return-Loss Measurement Plot for Head TSL

Object:	Date Issued:	Dage 2 of 4
D3700V2 – SN: 1018	01/11/2020	Page 3 of 4



Impedance & Return-Loss Measurement Plot for Body TSL

Object:	Date Issued:	Dogo 4 of 4
D3700V2 – SN: 1018	01/11/2020	Page 4 of 4

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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С

Schweizerischer Kalibrierdienst

- Service suisse d'étalonnage Servizio svizzero di taratura
- Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client **PC Test**

Certificate No: EX3-3589_Jan20/2

CALIBRATION CERTIFICATE (Replacement of No: EX3-3589_Jan20)

Object	EX3DV4 - SN:3589	
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes BNV NH[30]205	20
Calibration date:	January 21, 2020	
	ents the traceability to national standards, which realize the physical units of measurements (SI). artainties with confidence probability are given on the following pages and are part of the certificate.	

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Colle
			Seef Mgr
Approved by:	Katja Pokovic	Technical Manager	1/11-
			aces
			Issued: March 31, 2020
This calibration certificate	e shall not be reproduced except in fu	Il without written approval of the labo	

Calibration Laboratory of

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland





Schweizerischer Kalibrierdienst S

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization 9	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center),
	i.e., $\vartheta = 0$ is normal to probe axis

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from handheld and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORMx, y, z; Assessed for E-field polarization $\vartheta = 0$ (f ≤ 900 MHz in TEM-cell; f > 1800 MHz; R22 waveguide). NORMx, y, z are only intermediate values, i.e., the uncertainties of NORMx, y, z does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y, z * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m) ²) ^A	0.44	0.40	0.39	± 10.1 %
DCP (mV) ^B	101.5	97.7	97.9	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Max dev.	Max Unc ^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	138.1	± 3.5 %	± 4.7 %
		Y	0.00	0.00	1.00		148.9		
		Z	0.00	0.00	1.00		137.1		
10352-	Pulse Waveform (200Hz, 10%)	X	20.00	93.40	23.88	10,00	60.0	± 1.9 %	±9.6 %
AAA		Y	20.00	90.04	21.55		60.0		
		Z	20.00	93.40	23.50	1	60.0		
10353-	Pulse Waveform (200Hz, 20%)	X	20.00	93.53	22.66	6.99	80.0	± 1.0 %	± 9.6 %
AAA		Y	20.00	90.11	20.16		80.0		
		Z	20.00	93,36	22.20		80.0		
10354-	Pulse Waveform (200Hz, 40%)	Х	20.00	95.38	22.01	3.98	95.0	± 1.0 %	± 9.6 %
AAA		Y	20.00	88.87	17.82		95.0		
		Z	20.00	94.79	21.35		95.0		
10355-	Pulse Waveform (200Hz, 60%)	X	20.00	102.43	23.98	2.22	120.0	± 1.1 %	± 9.6 %
AAA		Y	20.00	86.64	15.26		120.0	1	
		Z	20.00	97.99	21.51		120.0	1	
10387-	QPSK Waveform, 1 MHz	X	0.93	64.33	11.56	0.00	150.0	± 3.3 %	± 9.6 %
AAA		Y	0.54	60.00	7.11		150.0	1	
		Z	0.68	61.48	9.17		150.0	1	
10388-	QPSK Waveform, 10 MHz	X	2.38	69.01	16.27	0.00	150.0	± 1.3 %	± 9.6 %
AAA		Y	2.02	66.96	14.92		150.0	Ì	
		Z	2.15	67.54	15.53		150.0	1	
10396-	64-QAM Waveform, 100 kHz	X	3.79	73.46	20.06	3.01	150.0	± 0.6 %	± 9.6 %
AAA		Y	3.12	69.91	18.24		150.0		
		Z	4.11	75.05	20.59		150.0		
10399-	64-QAM Waveform, 40 MHz	X	3.59	67.56	16.03	0.00	150.0	± 2.5 %	± 9.6 %
AAA		Y	3.37	66.67	15.43		150.0]	1
		Z	3.46	66.93	15.67		150.0		
10414-	WLAN CCDF, 64-QAM, 40MHz	X	4.95	65.82	15.63	0.00	150.0	± 4.6 %	± 9.6 %
AAA		Y	4.77	65.46	15.41		150.0]	
		Z	4.80	65.52	15.45	1	150.0		

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6). ^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

	C1 fF	C2 fF	α V ⁻¹	T1 ms.V⁻²	T2 ms.V⁻¹	T3 ms	T4 V ⁻²	T5 V ⁻¹	Т6
X	52.5	386.65	34.73	26.61	1.15	5.10	1.30	0.45	1.01
Y	44.4	339.10	36.93	20.74	1.47	5.06	0.00	0.71	1.01
Z	44.1	325.90	34.85	22.88	1.09	5.07	1.71	0.36	1.01

Sensor Model Parameters

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-32.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm
	t

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	8.70	8.70	8.70	0.38	1.00	± 12.0 %
835	41.5	0.90	8.58	8.58	8.58	0.47	0.80	± 12.0 %
1750	40.1	1.37	7.55	7.55	7.55	0.52	0.87	± 12.0 %
1900	40.0	1.40	7.25	7.25	7.25	0.43	0.87	± 12.0 %
2300	39.5	1.67	7.11	7.11	7.11	0.45	0.86	± 12.0 %
2450	39.2	1.80	6.85	6.85	6.85	0.47	0.85	± 12.0 %
2600	39.0	1.96	6.60	6.60	6.60	0.41	0.86	± 12.0 %

Calibration Parameter Determined in Head Tissue Simulating Media

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. ^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to

^F At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

The ConvF uncertainty for indicated target tissue parameters. ^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than \pm 1% for frequencies below 3 GHz and below \pm 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

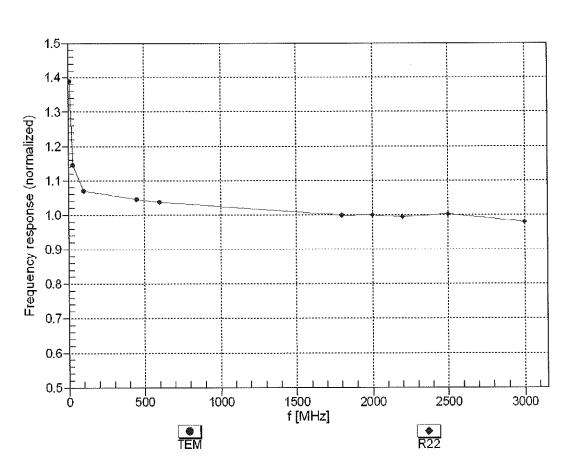
f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	8.49	8.49	8.49	0.49	0.81	± 12.0 %
835	55.2	0.97	8.27	8.27	8.27	0.29	1.03	± 12.0 %
1750	53.4	1.49	6.93	6.93	6.93	0.41	0.87	± 12.0 %
1900	53.3	1.52	6.72	6.72	6.72	0.35	0.87	± 12.0 %
2300	52.9	1.81	6.62	6.62	6.62	0.34	0.86	± 12.0 %
2450	52.7	1.95	6.60	6.60	6.60	0.40	0.86	± 12.0 %
2600	52.5	2.16	6.35	6.35	6.35	0.37	0.90	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. ^F At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to

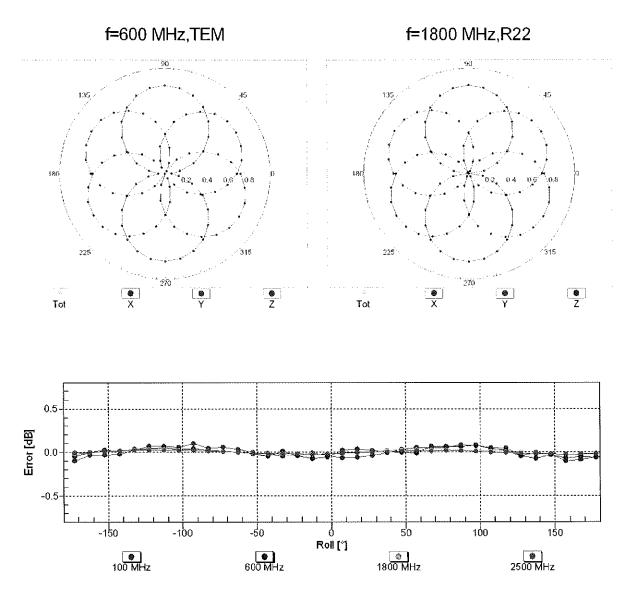
^F At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to \pm 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to \pm 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters. ^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



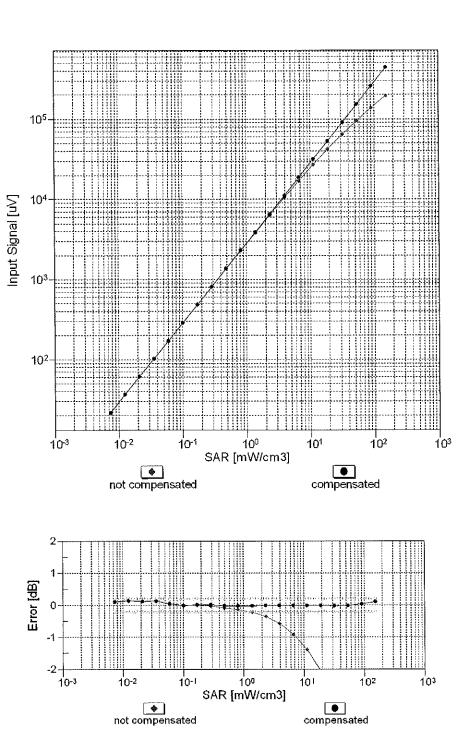
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)



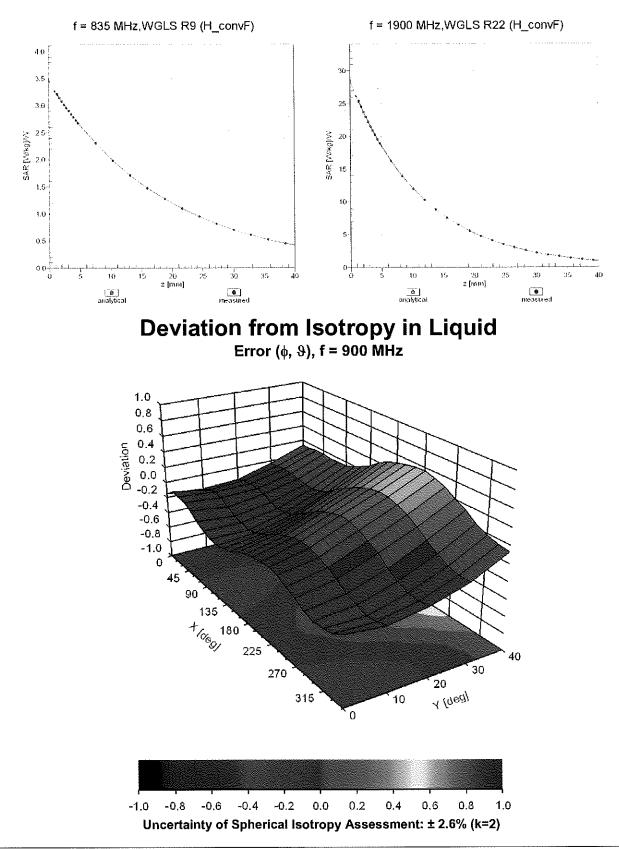
Receiving Pattern (ϕ), $\vartheta = 0^{\circ}$

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)



Dynamic Range f(SAR_{head}) (TEM cell , f_{eval}= 1900 MHz)

Uncertainty of Linearity Assessment: ± 0.6% (k=2)



Conversion Factor Assessment

Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR	Unc ^E
				(dB)	(k=2)
0		CW	CW	0.00	±4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	±9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WIFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM GSM	9.57	$\pm 9.6\%$
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56 12.62	±9.6 % ±9.6 %
10025 10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0) EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10026	DAC DAC	GPRS-FDD (TDMA, GPSK, TN 0-1)	GSM	4.80	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	$\pm 9.6\%$
10020	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10020	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802,15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	±9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	±9.6%
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	±9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	±9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	±9.6 %
10062	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	±9.6 %
10063	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	±9.6 %
10065	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	±9.6 %
10067	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	±9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	±9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	±9.6%
10073	CAB	IEEE 802.11g WIFI 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	±9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WIFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	±9.6%
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	±9.6%
10100	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	± 9.6 %
10101	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	$\pm 9.6\%$
10102		LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10103	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	$\pm 9.6\%$
10104		LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	$\pm 9.6\%$
10105	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD LTE-FDD	10.01	± 9.6 %
10108	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)		5.80	± 9.6 %

10109	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	±9.6%
10110	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	±9.6 %
10111	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	±9.6 %
10112	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	±9.6 %
10113	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	±9.6 %
10114	CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	±9.6 %
10115	CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	±9.6 %
10116	CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	±9.6 %
10117	CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	±9.6 %
10118	CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	± 9.6 %
10119	CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	±9.6 %
10140	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	±9.6 %
10141	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	±9.6 %
10142	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10143	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	±9.6 %
10144	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	± 9.6 %
10145	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	± 9.6 %
10146	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	±9.6 %
10147	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	±9.6 %
10149	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10149	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10150		LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	± 9.6 %
10151	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
			LTE-TDD	10.05	± 9.6 %
10153	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	5.75	± 9.6 %
10154	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	6.43	± 9.6 %
10155	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)			
10156	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	± 9.6 %
10157	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10158	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10159	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	±9.6 %
10160	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	± 9.6 %
10161	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10162	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	±9.6%
10166	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	± 9.6 %
10167	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	± 9.6 %
10168	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	±9.6 %
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10170	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	±9.6 %
10171	AAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	±9.6%
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	±9.6 %
10173	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10174	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	<u>± 9.6 %</u>
10175	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10176	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	±9.6 %
10177	CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	±9.6 %
10178	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	±9.6 %
10179	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	±9.6 %
10180	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6,50	± 9.6 %
10181	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	±96%
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	±9.6 %
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5,73	± 9.6 %
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	± 9.6 %
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10187		LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10189	CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	± 9.6 %
	_	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	± 9.6 %
10194	CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 10-QAM)	WLAN	8.21	± 9.6 %
10195	CAC		WLAN	8,10	$\pm 9.6\%$
10196	CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN		
10197		IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)		8.13	± 9.6 %
10198	CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN WLAN	8.27	± 9.6 %
10219	CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)		8.03	± 9.6 %

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10220	CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN WLAN	8.13	± 9.6 %
10221	CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.06	± 9.6 % ± 9.6 %
10222	CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.48	$\pm 9.6\%$
10223	CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM) IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	± 9.6 %
10224 10225	CAC	UMTS-FDD (HSPA+)	WCDMA	5.97	± 9.6 %
10225	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	± 9.6 %
10220	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	± 9.6 %
10228	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	± 9.6 %
10228	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10220	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10231	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	± 9.6 %
10232	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9,48	± 9.6 %
10233	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10234	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	±9.6 %
10235	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	±9.6 %
10236	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	±9.6 %
10237	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	±9.6 %
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10241	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	±9.6 %
10242	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	±9.6 %
10243	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	±9.6 %
10244	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10245	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	±9.6 %
10246	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	±9.6 %
10247	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9,91	±9.6%
10248	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	±9.6 %
10249	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10250	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	±9.6%
10251	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	±9.6%
10252	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	±9.6%
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	±9.6%
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	±9.6%
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	± 9.6 %
10256	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	±9.6%
10257	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	±9.6 %
10258	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	± 9.6 %
10259	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.98	± 9.6 %
10260	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	±9.6%
10261	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10262	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	±9.6 %
10263	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	± 9.6 %
10264	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	±9.6%
10265	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	$\pm 9.6\%$
10266	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	±9.6%
10267	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD LTE-TDD	9.30	$\pm 9.6\%$
10268		LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	±9.6 % ±9.6 %
10269	CAF CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM) LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	$\pm 9.6\%$ $\pm 9.6\%$
10270	CAP	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	4.87	$\pm 9.6\%$
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	3.96	$\pm 9.6\%$
10275		PHS (QPSK)	PHS	11.81	± 9.6 %
10277		PHS (QPSK, BW 884MHz, Rolloff 0.5)	PHS	11.81	± 9.6 %
10278		PHS (QPSK, BW 884MHz, Rolloff 0.38)	PHS	12.18	± 9.6 %
10279	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	± 9.6 %
10290	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	± 9.6 %
10291	AAB	CDMA2000, RC3, SO33, Full Rate	CDMA2000	3.39	± 9.6 %
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	± 9.6 %
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	± 9.6 %
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	± 9.6 %
		LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10298	AAD			1 0.72	1 1 0.0 %

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10300	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10301	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	WIMAX	12.03	±9.6 %
10302	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3CTRL)	WIMAX	12.57	<u>±9.6 %</u>
10303	AAA	IEEE 802.16e WIMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	WIMAX	12.52	±9.6 %
10304	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	WIMAX	11.86	± 9.6 %
10305	AAA	IEEE 802.16e WIMAX (31:15, 10ms, 10MHz, 64QAM, PUSC)	WIMAX	15.24	±9.6 %
10306	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 64QAM, PUSC)	WIMAX	14.67	± 9.6 %
10307	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, QPSK, PUSC)	WIMAX	14.49	± 9.6 %
10308	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	WIMAX	14.46	± 9.6 %
10309	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 16QAM,AMC 2x3)	WIMAX	14.58	± 9.6 %
10310	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3	WIMAX	14.57	± 9.6 %
10311	AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.06	± 9.6 %
10313	AAA	iDEN 1:3	IDEN	10.51	±9.6 %
10314	AAA	IDEN 1:6	IDEN	13.48	± 9.6 %
10315	AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc dc)	WLAN	1.71	± 9.6 %
10316	AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc dc)	WLAN	8,36	± 9.6 %
10317	AAC	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	±9.6 %
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	± 9.6 %
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	6.99	±9.6 %
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	±9.6 %
10355	AAA	Pulse Waveform (200Hz, 60%)	Generic	2.22	±9.6 %
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	0.97	±9.6 %
10387	AAA	QPSK Waveform, 1 MHz	Generic	5.10	±9.6 %
10388	AAA	QPSK Waveform, 10 MHz	Generic	5.22	±9.6%
10396	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	±9.6 %
10399	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	±9.6 %
10400	AAD	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc dc)	WLAN	8.37	± 9.6 %
10401	AAD	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc dc)	WLAN	8.60	±9.6 %
10402	AAD	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc dc)	WLAN	8.53	± 9.6 %
10403	AAB	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	±9.6%
10404	AAB	CDMA2000 (1xEV-DO, Rev. A)	CDMA2000	3.77	±9.6 %
10406	AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	CDMA2000	5.22	±9.6 %
10410	AAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10414	AAA	WLAN CCDF, 64-QAM, 40MHz	Generic	8.54	± 9.6 %
10415	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc dc)	WLAN	1.54	± 9.6 %
10416	AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10417	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10418	AAA	IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Long)	WLAN	8.14	± 9.6 %
10419	AAA	IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Short)	WLAN	8,19	± 9.6 %
10422	AAB	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.32	± 9.6 %
10423	AAB	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	± 9,6 %
10424	AAB	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.40	± 9.6 %
10425	AAB	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	± 9.6 %
10426	AAB	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	WLAN	8.45	± 9.6 %
10420	AAB	IEEE 802.11n (HT Greenfield, 30 Mbps, 10-GAM)	WLAN	8.41	± 9.6 %
10427	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	LTE-FDD	8.28	$\pm 9.6\%$
10430	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	± 9.6 %
10431	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10432	AAC	LTE-FDD (OFDMA, 13 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10433	AAA	W-CDMA (BS Test Model 1, 64 DPCH)	WCDMA	8.60	$\pm 9.6\%$
10434	AAA	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.82	$\pm 9.6\%$
10435	AAP	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.56	± 9.6 %
10447	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.53	$\pm 9.6\%$
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clippin 44%)	LTE-FDD	7.51	$\pm 9.6\%$
	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	$\pm 9.6\%$
1 10/60			WCDMA	7.59	
10450		W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%) Validation (Square, 10ms, 1ms)		\$	$\pm 9.6\%$
10451	_	I VARGARGE GODALE, IGUS, IUSI	Test	10.00	± 9.6 %
10451 10453	AAD			0 00	1 1000
10451 10453 10456	AAD AAB	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc)	WLAN	8.63	± 9.6 %
10451 10453 10456 10457	AAD AAB AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc) UMTS-FDD (DC-HSDPA)	WCDMA	6.62	± 9.6 %
10451 10453 10456 10457 10458	AAD AAB AAA AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc) UMTS-FDD (DC-HSDPA) CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	WCDMA CDMA2000	6.62 6.55	± 9.6 % ± 9.6 %
10451 10453 10456 10457 10458 10459	AAD AAB AAA AAA AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc) UMTS-FDD (DC-HSDPA) CDMA2000 (1xEV-DO, Rev. B, 2 carriers) CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	WCDMA CDMA2000 CDMA2000	6.62 6.55 8.25	± 9.6 % ± 9.6 % ± 9.6 %
10451 10453 10456 10457 10458 10459 10460	AAD AAB AAA AAA AAA AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc) UMTS-FDD (DC-HSDPA) CDMA2000 (1xEV-DO, Rev. B, 2 carriers) CDMA2000 (1xEV-DO, Rev. B, 3 carriers) UMTS-FDD (WCDMA, AMR)	WCDMA CDMA2000 CDMA2000 WCDMA	6.62 6.55 8.25 2.39	± 9.6 % ± 9.6 % ± 9.6 % ± 9.6 %
10451 10453 10456 10457 10458 10459	AAD AAB AAA AAA AAA	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc) UMTS-FDD (DC-HSDPA) CDMA2000 (1xEV-DO, Rev. B, 2 carriers) CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	WCDMA CDMA2000 CDMA2000	6.62 6.55 8.25	± 9.6 % ± 9.6 % ± 9.6 %

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10463 AAB LTE-TDD (SC-FDMA, TRB, 314Mt2, 4F-SAM, UL Sub) LTE-TDD 8.6 ± 9.6 % 10464 AAC LTE-TDD (SC-FDMA, TRB, 31MH2, 4F-SAM, UL Sub) LTE-TDD 8.2 ± 9.6 % 10465 AAC LTE-TDD (SC-FDMA, TRB, 31MH2, 4F-SAM, UL Sub) LTE-TDD 8.2 ± 9.6 % 10467 AAF LTE-TDD (SC-FDMA, TRB, 51MH2, 4F-SAM, UL Sub) LTE-TDD 7.82 ± 9.6 % 10468 AF LTE-TDD (SC-FDMA, TRB, 51MH2, 4F-SAM, UL Sub) LTE-TDD 7.82 ± 9.6 % 10468 AF LTE-TDD (SC-FDMA, TRB, 51MH2, 4F-SAM, UL Sub) LTE-TDD 7.82 ± 9.6 % 10477 AF LTE-TDD (SC-FDMA, TRB, 10 MH2, 4F-SAM, UL Sub) LTE-TDD 7.82 ± 9.6 % 10477 AF LTE-TDD (SC-FDMA, TRB, 10 MH2, 4F-SAM, UL Sub) LTE-TDD 7.82 ± 9.6 % 10477 AF LTE-TDD (SC-FDMA, TRB, 10 MH2, 4F-SAM, UL Sub) LTE-TDD 7.82 ± 9.6 % 10477 AF LTE-TDD (SC-FDMA, TRB, 10 MH2, 4F-SAM, UL Sub) LTE-TDD 7.72 ± 9.6 % 10477 AF LTE-						,,
10465 AAC LITE-TDD (GC-FDMA, 1 RB, 3 MHz, 46-AAM, UL Sub) LTE-TDD 8.57 1.9.6 % 10467 AAF LTTE-TDD (GC-FDMA, 1 RB, 5 MHz, 46-AAM, UL Sub) LTE-TDD 7.82 1.9.6 % 10488 AAF LTTE-TDD (GC-FDMA, 1 RB, 5 MHz, 46-AAM, UL Sub) LTE-TDD 8.32 1.9.6 % 10470 AAF LTE-TDD (GC-FDMA, 1 RB, 5 MHz, 46-AAM, UL Sub) LTE-TDD 8.52 1.9.6 % 10471 AAF LTE-TDD (GC-FDMA, 1 RB, 10 MHz, 16-AAM, UL Sub) LTE-TDD 8.52 1.9.6 % 10473 AAF LTE-TDD (GC-FDMA, 1 RB, 10 MHz, 67-AAM, UL Sub) LTE-TDD 8.52 1.9.6 % 10473 AAE LTE-TDD (GC-FDMA, 1 RB, 15 MHz, 67-AAM, UL Sub) LTE-TDD 8.22 1.9.6 % 10474 AAE LTE-TDD (GC-FDMA, 1 RB, 15 MHz, 67-AAM, UL Sub) LTE-TDD 8.22 1.9.6 % 10477 AAF LTE-TDD (GC-FDMA, 50% RB, 1.4 MHz, 16-AAM, UL Sub) LTE-TDD 7.7 1.9.6 % 10478 AAB LTE-TDD (GC-FDMA, 50% RB, 3.4 MHz, 16-AAM, UL Sub) LTE-TDD 7.7 1.9.6 % 10480 <	10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	f	±9.6%
10466 AAC LTE-TDD (SC-FDMA, 1 RB, 3 MH2, QF3AU, USub) LTE-TDD 7.82 1.9.6 % 10467 AAF LTE-TDD (SC-FDMA, 1 RB, 5 MH2, QF3AU, USub) LTE-TDD 8.56 1.9.6 % 10469 AAF LTE-TDD (SC-FDMA, 1 RB, 5 MH2, QF3AU, USub) LTE-TDD 8.56 1.9.6 % 10470 AAF LTE-TDD (SC-FDMA, 1 RB, 10 MH2, QF3K, UL Sub) LTE-TDD 8.52 1.9.6 % 10471 AAF LTE-TDD (SC-FDMA, 1 RB, 10 MH2, 16-QAN, UL Sub) LTE-TDD 8.52 1.9.6 % 10473 AAE LTE-TDD (SC-FDMA, 1 RB, 15 MH2, 16-QAN, UL Sub) LTE-TDD 8.57 1.9.6 % 10474 AAE LTE-TDD (SC-FDMA, 1 RB, 15 MH2, 16-QAN, UL Sub) LTE-TDD 8.57 1.9.6 % 10476 AAE LTE-TDD (SC-FDMA, 1 RB, 15 MH2, 4G-QAN, UL Sub) LTE-TDD 8.57 1.9.6 % 10477 AAE LTE-TDD (SC-FDMA, 50% RB, 1.4 MH2, QF3K, UL Sub) LTE-TDD 8.57 1.9.6 % 10478 AAB LTE-TDD (SC-FDMA, 50% RB, 1.4 MH2, QF3K, UL Sub) LTE-TDD 8.56 1.9.6 % 10480 AAC						
10467 AF LTE-TOD (SC-FDMA, 1 RB, 5 MH2, 40-2AM, UL Sub) LTE-TOD 7.82 1.9.6 % 10468 AF LTE-TOD (SC-FDMA, 1 RB, 5 MH2, 46-2AM, UL Sub) LTE-TOD 8.52 1.9.6 % 10470 AF LTE-TOD (SC-FDMA, 1 RB, 10 MH2, QPSK, UL Sub) LTE-TOD 8.52 1.9.6 % 10471 AF LTE-TOD (SC-FDMA, 1 RB, 10 MH2, QPSK, UL Sub) LTE-TOD 8.52 1.9.6 % 10473 AF LTE-TOD (SC-FDMA, 1 RB, 10 MH2, QPSK, UL Sub) LTE-TOD 8.52 1.9.6 % 10473 AF LTE-TOD (SC-FDMA, 1 RB, 10 MH2, QPSK, UL Sub) LTE-TOD 8.52 1.9.6 % 10474 AF LTE-TOD (SC-FDMA, 1 RB, 10 MH2, QPSK, UL Sub) LTE-TOD 8.52 1.9.6 % 10477 AF LTE-TOD (SC-FDMA, 1 RB, 20 MH2, G+CAM, UL Sub) LTE-TOD 8.57 1.9.6 % 10477 AF LTE-TOD (SC-FDMA, 30 RB, 81, 14 MH2, G-CAM, UL Sub) LTE-TOD 8.71 9.8 % 10480 AAE LTE-TOD (SC-FDMA, 30 RB, 81, 3 MH2, G-CAM, UL Sub) LTE-TOD 8.19 8 % 10481 AAE LTE-TOD (SC-FDMA,		<u>}</u>				
10488 AF LTE-TDD S.32 ± 9.6 % 10498 AF LTE-TDD S.56 ± 9.6 % 10470 AF LTE-TDD S.56 ± 9.6 % 10471 AF LTE-TDD S.57 ± 9.6 % 10472 AF LTE-TDD S.57 ± 9.6 % 10473 AAE LTE-TDD S.57 ± 9.6 % 10474 AAE LTE-TDD S.57 ± 9.6 % 10474 AAE LTE-TDD S.57 ± 9.6 % 10474 AAE LTE-TDD S.57 ± 9.6 % 10477 AAE LTE-TDD S.57 ± 9.6 % 10478 AAE LTE-TDD S.57 ± 9.6 % 10478 AAB LTE-TDD S.57 ± 9.6 % 10478 AAB LTE-TDD S.67 ± 9.6 % 10484 AAC LTE-TDD S.74 ± 9.6 % 10484 AAC LTE-TDD S.74 ± 9.6 % 104				LTE-TDD	8.57	
10469 AAF LTE-TDD S.66 ± 9.6 % 10470 AAF LTE-TDD F.762 ± 9.6 % 10471 AAF LTE-TDD F.762 ± 9.6 % 10471 AAF LTE-TDD F.762 ± 9.6 % 10472 AAF LTE-TDD S.67 ± 9.6 % 10473 AAE LTE-TDD S.72 ± 9.6 % 10473 AAE LTE-TDD S.72 ± 9.6 % 10474 AAE LTE-TDD S.72 ± 9.8 % 10475 AAE LTE-TDD S.72 ± 9.8 % 10477 AAE LTE-TDD S.72 ± 9.8 % 10478 AAF LTE-TDD S.72 ± 9.8 % 10479 AAB LTE-TDD S.72 ± 9.8 % 10481 AAB LTE-TDD S.74 MAR ± 9.8 % 10482 AAC LTE-TDD S.74 MAR ± 9.8 % 10484 AAB LTE-TDD S.74 MAR ± 9.8 %		<u> </u>			}	
10470 AAF LTE-TDD C-F2DA 19.0 MHz 10-F2DA 19.6 % 10471 AAF LTE-TDD SC-FPDA 18.0 MHz 46-OAM, UL Sub) LTE-TDD 8.37 19.6 % 10472 AAF LTE-TDD C-FPDA 18.6 MHz, OFSA, UL Sub) LTE-TDD 7.62 19.6 % 10474 AAE LTE-TDD 7.62 19.6 % 10.6 % 19.6 % 19.6 % 19.6 % 19.6 % 19.6 % 10.6 % 19.6 % 19.6 % 10.6 % 19.6 % 19.6 % 10.6 % 19.6 % 10.6 % 19.6 % 19.6 % 10.6 % 19.6 % 10.6 % 19.6 %				LTE-TDD	8.32	±9.6 %
10471 AAF LTE-TDD 9.32 19.6 % 10472 AAF LTE-TDD 8.7 × 9.6 % 10473 AAE LTE-TDD 8.7 × 9.6 % 10473 AAE LTE-TDD 8.7 × 9.6 % 10473 AAE LTE-TDD 8.6 × 9.6 % 10474 AAE LTE-TDD 8.5 × 9.6 % 10475 AAE LTE-TDD 8.5 × 9.6 % 10477 AAF LTE-TDD 8.5 × 9.6 % 10478 AAE LTE-TDD 8.5 × 9.6 % 10478 AAF LTE-TDD 8.5 × 9.6 % 10478 AAE LTE-TDD 8.6 × 9.6 % 10480 ABE LTE-TDD 8.1 % 9.6 % 10481 AAB LTE-TDD 8.1 % 9.6 % 10482 AAC LTE-TDD 8.1 % 9.6 % 10482 AAC LTE-TDD 8.7 × 9.6 % 9.6 % 10484 AAC LTE-TDD 8.7 × 9.6 % 9.6 % 10484 AAF				LTE-TDD	1	
10472 AAF LTE-TDD 5.67 5.95 10473 AAF LTE-TDD 7.82 9.85 10474 AAE LTE-TDD 7.82 9.85 10474 AAE LTE-TDD 7.82 9.85 10474 AAE LTE-TDD 8.57 9.85 10477 AAF LTE-TDD 8.57 9.85 10477 AAF LTE-TDD 8.57 9.85 10477 AAF LTE-TDD 8.57 9.85 10478 AAF LTE-TDD 8.57 9.85 10470 AAF LTE-TDD 8.67 9.85 10481 AAS LTE-TDD (SC-FDMA, 60% RB, 1.4 MHz, CPGAK, UL Sub) LTE-TDD 8.49 10482 AAC LTE-TDD (SC-FDMA, 60% RB, 5.1 MHz, CPGAK, UL Sub) LTE-TDD 8.49 10484 AAC LTE-TDD (SC-FDMA, 60% RB, 5.1 MHz, CPGAK, UL Sub) LTE-TDD 8.49 10484 AAC LTE-TDD (SC-FDMA, 60% RB, 5.1 MHz, CPGAK, UL Sub) LTE-TDD 8.49 9.6 %				LTE-TDD	7.82	±9.6 %
10473 AAE LTE-TDD (SC-FDMA, 1RB, 15 MHz, 26-SK, UL Sub) LTE-TDD 7.62 5.8 10474 AAE LTE-TDD (SC-FDMA, 1RB, 15 MHz, 64-OAM, UL Sub) LTE-TDD 8.67 2.9.6 %, 10475 AAE LTE-TDD (SC-FDMA, 1RB, 20 MHz, 16-OAM, UL Sub) LTE-TDD 8.67 2.9.6 %, 10476 AAF LTE-TDD (SC-FDMA, 1RB, 20 MHz, 16-OAM, UL Sub) LTE-TDD 8.37 1.9.6 %, 10473 AAB LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-OAM, UL Sub) LTE-TDD 8.45 1.9.6 %, 10440 AAB LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-OAM, UL Sub) LTE-TDD 8.45 1.9.6 %, 10441 AAB LTE-TDD (SC-FDMA, 50% RB, 3.1 MHz, 16-OAM, UL Sub) LTE-TDD 7.7.4 1.9.6 %, 10442 AAC LTE-TDD (SC-FDMA, 50% RB, 3.1 MHz, 16-OAM, UL Sub) LTE-TDD 7.5.9 4.9.6 %, 10444 AAF LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 0-PSK, UL Sub) LTE-TDD 8.3.8 4.9.6 %, 10446 AAF LTE-TDD (SC-FDMA, 50% RB, 1.5 MHz, 16-OAM, UL Sub) LTE-TDD 8.3.8 4.9.6 %, 10		AAF		LTE-TDD	8.32	±9.6 %
10474 ARE LTE-TDD ISC-PDMA, 1RB, 15 MHz, 46-OAM, UL Sub) LTE-TDD 8.32 19.6 % 10477 ARF LTE-TDD (SC-PDMA, 1RB, 20 MHz, 64-OAM, UL Sub) LTE-TDD 8.32 19.6 % 10477 ARF LTE-TDD (SC-PDMA, 1RB, 20 MHz, 64-OAM, UL Sub) LTE-TDD 8.32 19.6 % 10478 AAB LTE-TDD (SC-PDMA, 50% RB, 1.4 MHz, G-SK, UL Sub) LTE-TDD 8.18 19.6 % 10481 AAB LTE-TDD (SC-PDMA, 50% RB, 1.4 MHz, G-SK, UL Sub) LTE-TDD 8.18 19.6 % 10483 AAC LTE-TDD (SC-PDMA, 50% RB, 1.4 MHz, G-SK, UL Sub) LTE-TDD 8.34 19.6 % 10484 AAC LTE-TDD (SC-PDMA, 50% RB, 3 MHz, G-CAM, UL Sub) LTE-TDD 8.34 19.6 % 10485 AAF LTE-TDD (SC-PDMA, 50% RB, 5 MHz, G-CAM, UL Sub) LTE-TDD 8.38 19.6 % 10486 AAF LTE-TDD (SC-PDMA, 50% RB, 10 MHz, G-CAM, UL Sub) LTE-TDD 8.38 19.6 % 10486 AAF LTE-TDD (SC-PDMA, 50% RB, 10 MHz, G-CAM, UL Sub) LTE-TDD 8.36 19.6 % 10486	10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	±9.6 %
10475 AAE LTE-TDD (SC-FDMA, 1R8, 15 MHz, 64-OAM, UL Sub) LTE-TDD 8,57 ± 9,6 %, 10476 AAF LTE-TDD (SC-FDMA, 1R8, 20 MHz, 64-OAM, UL Sub) LTE-TDD 8,57 ± 9,6 %, 10476 AAB LTE-TDD (SC-FDMA, 50% RB, 14 MHz, 64-OAM, UL Sub) LTE-TDD 7,74 ± 9,6 %, 10480 AAB LTE-TDD (SC-FDMA, 50% RB, 14 MHz, 16-OAM, UL Sub) LTE-TDD 8,45 ± 9,6 %, 10481 AAB LTE-TDD (SC-FDMA, 50% RB, 14 MHz, 16-OAM, UL Sub) LTE-TDD 7,74 ± 9,6 %, 10482 AAC LTE-TDD (SC-FDMA, 50% RB, 31MLz, 16-OAM, UL Sub) LTE-TDD 7,39 ± 9,6 %, 10483 AAC LTE-TDD (SC-FDMA, 50% RB, 31MLz, 16-OAM, UL Sub) LTE-TDD 8,34 ± 9,6 %, 10484 AAF LTE-TDD (SC-FDMA, 50% RB, 51 MHz, 16-OAM, UL Sub) LTE-TDD 8,34 ± 9,6 %, 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 16 MHz, 16-OAM, UL Sub) LTE-TDD 8,34 ± 9,6 %, 10489 AAF LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 0F-OAM, UL Sub) LTE-TDD 8,31 ± 9,6 %, 1	10473	AAE		LTE-TDD	7.82	±9.6 %
10477 AAF ITE-TDD [SC-PDMA, 1R8, 20 MHz, 40-AM, UL Sub) ITE-TDD [SC-PDMA, 188, 20 MHz, 40-AM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 1.4 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 5 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 5 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 5 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 5 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 10 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 10 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 10 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 10 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 10 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 10 MHz, 0PSK, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 15 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 15 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 15 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 15 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 15 MHz, 16-QAM, UL Sub) ITE-TDD [SC-PDMA, 50% R8, 15 MHz, 40-QAM, UL Sub) ITE		AAE		LTE-TDD	8.32	± 9.6 %
10478 AAF LTE-TDD 15.77 1 0.6 1 1 1 1 0.6 1 0.6 1 0.6 1 0.6 1 0.6 1 0.6 0.6 1 0.6 0.6 1 0.6 0.6 1 0.6 0.6 1 0.6 0.6 1 0.6	10475	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	± 9.6 %
10479 AAB LTE-TDD (SC-FDMA, 50% RB, 14 MHz, 0PSK, UL Sub) LTE-TDD 8.18 ± 9.6 % 10481 AAB LTE-TDD (SC-FDMA, 50% RB, 14 MHz, 0PSK, UL Sub) LTE-TDD 8.18 ± 9.6 % 10482 AAC LTE-TDD (SC-FDMA, 50% RB, 31 MHz, 0PSK, UL Sub) LTE-TDD 8.45 ± 9.6 % 10482 AAC LTE-TDD (SC-FDMA, 50% RB, 31 MHz, 0PSK, UL Sub) LTE-TDD 8.39 ± 9.6 % 10484 AAC LTE-TDD (SC-FDMA, 50% RB, 51 MHz, 0PSK, UL Sub) LTE-TDD 8.39 ± 9.6 % 10485 AAF LTE-TDD (SC-FDMA, 50% RB, 51 MHz, 0PSK, UL Sub) LTE-TDD 8.38 ± 9.6 % 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 51 MHz, 0PSK, UL Sub) LTE-TDD 8.30 ± 9.6 % 10488 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 0PSK, UL Sub) LTE-TDD 8.30 ± 9.6 % 10488 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 0PSK, UL Sub) LTE-TDD 8.31 ± 9.6 % 10489 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 0FAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10491<	10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	± 9.6 %
10480 AAB LTE-TDD 8.16 9.06 10481 AAB LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 4F-AM, UL Sub) LTE-TDD 8.45 ± 9.6 % 10482 AAC LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 4F-AM, Sub) LTE-TDD 8.39 ± 9.6 % 10483 AAC LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 4F-AM, Sub) LTE-TDD 8.39 ± 9.6 % 10484 AAC LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 4F-AQM, UL Sub) LTE-TDD 8.39 ± 9.6 % 10485 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 4F-QAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 4F-QAM, UL Sub) LTE-TDD 8.30 ± 9.6 % 10489 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10489 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10489 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 4-QAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, U	10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	±9.6 %
10481 AAB LTE-TDD (Sc.FDMA, 50% RB, 14. MHz, 64-CAM, UL Sub) LTE-TDD 7.71 ± 9.6 % 10483 AAC LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-CAM, Sub) LTE-TDD 8.39 ± 9.6 % 10484 AAC LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-CAM, Sub) LTE-TDD 8.47 ± 9.6 % 10485 AAC LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-CAM, UL Sub) LTE-TDD 8.43 ± 9.6 % 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-CAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 50 MHz, 16-CAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10487 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 46-CAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10490 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 46-CAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-CAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-CAM, UL Sub) LTE-TDD 8.41 ± 9.6 %	10479	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.74	± 9.6 %
10482 AAC LTE-TDD 7.71 ± 9.6 % 10483 AAC LTE-TDD (7.71 ± 9.6 % 10484 AAC LTE-TDD (5.7-FDMA, 50% RB, 3MHz, 44-QAM, UL Sub) LTE-TDD 7.59 ± 9.6 % 10486 AAF LTE-TDD (5.6-FDMA, 50% RB, 5MHz, QPSK, UL Sub) LTE-TDD 7.59 ± 9.6 % 10486 AAF LTE-TDD (5.6-FDMA, 50% RB, 5MHz, QPSK, UL Sub) LTE-TDD 8.60 ± 9.6 % 10487 AAF LTE-TDD (5.6-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.31 ± 9.6 % 10488 AAF LTE-TDD (5.6-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (5.2-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.41 ± 9.6 % 10492 AAE LTE-TDD (5.6-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10494 AAF LTE-TDD (5.2-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub) LTE-TDD 8.74 ± 9.6 % 10494 <td>10480</td> <td>AAB</td> <td>LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Sub)</td> <td>LTE-TDD</td> <td>8.18</td> <td>± 9.6 %</td>	10480	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.18	± 9.6 %
10483 AAC LTE-TDD (S0, FEMAL, 50%, RB, 3 MHz, (S-GAM, Sub) LTE-TDD 8.39 ± 9.6 % 10484 AAC LTE-TDD (SC, FDMA, 50%, RB, 5 MHz, OPSK, UL Sub) LTE-TDD 8.47 ± 9.6 % 10486 AAF LTE-TDD (SC, FDMA, 50%, RB, 5 MHz, OPSK, UL Sub) LTE-TDD 8.38 ± 9.6 % 10486 AAF LTE-TDD (SC, FDMA, 50%, RB, 10 MHz, Q4-QAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10487 AAF LTE-TDD (SC, FDMA, 50%, RB, 10 MHz, Q4-QAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10489 AAF LTE-TDD (SC, FDMA, 50%, RB, 10 MHz, Q4-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC, FDMA, 50%, RB, 15 MHz, QFSK, UL Sub) LTE-TDD 8.54 ± 9.6 % 10492 AAE LTE-TDD (SC, FDMA, 50%, RB, 15 MHz, QFSK, UL Sub) LTE-TDD 8.54 ± 9.6 % 10493 AAE LTE-TDD (SC, FDMA, 50%, RB, 20 MHz, QFSK, UL Sub) LTE-TDD 8.54 ± 9.6 % 10494 AAF LTE-T	10481	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	± 9.6 %
10484 AAC LTE-TDD (52, FDMA, 50%, RB, 5 MHz, 64-QAM, UL Sub) LTE-TDD 7, 59 ± 9, 6% 10485 AAF LTE-TDD (52, FDMA, 50%, RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 8, 38 ± 9, 6% 10487 AAF LTE-TDD (52, FDMA, 50%, RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 8, 60 ± 9, 6% 10488 AAF LTE-TDD (52, FDMA, 50%, RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8, 31 ± 9, 6% 10499 AAF LTE-TDD (52, FDMA, 50%, RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8, 31 ± 9, 6% 10491 AAE LTE-TDD (52, FDMA, 50%, RB, 15 MHz, QPSK, UL Sub) LTE-TDD 8, 41 ± 9, 6% 10492 AAE LTE-TDD (52, FDMA, 50%, RB, 20 MHz, QPSK, UL Sub) LTE-TDD 7, 74 ± 9, 6% 10494 AAF LTE-TDD (52, FDMA, 50%, RB, 20 MHz, QPSK, UL Sub) LTE-TDD 8, 41 ± 9, 6% 10496 AAF LTE-TDD (52, FDMA, 50%, RB, 20 MHz, QPSK, UL Sub) LTE-TDD 8, 42 ± 9, 6% 10498 AAB	10482	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.71	±9.6 %
10444 AAC LTE-TDD 8.47 ± 9.6 % 10485 AAF LTE-TDD 152-FDMA, 50% RB, 5MHz, 16-OAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 5MHz, 16-OAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10487 AAF LTE-TDD (SC-FDMA, 50% RB, 0MHz, QPSK, UL Sub) LTE-TDD 8.60 ± 9.6 % 10488 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.31 ± 9.6 % 10499 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, G+CAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, G+CAM, UL Sub) LTE-TDD 7.74 ± 9.6 % 10492 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, G+CAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-CAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-CAM, UL Sub) LTE-TDD 8.74 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 100%	10483	AAC		LTE-TDD		
10485 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, (3-SK, UL Sub) LTE-TDD 7.50 ± 9.6 % 10486 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, (4-QAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10488 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, (4-QAM, UL Sub) LTE-TDD 7.70 ± 9.6 % 10489 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, (4-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10490 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, (4-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10492 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 0-SU, UL Sub) LTE-TDD 8.55 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.37 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 100% RB, 14 MHz, 4-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10496 <td>10484</td> <td>AAC</td> <td></td> <td></td> <td></td> <td></td>	10484	AAC				
10486 AAF LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 8.38 ± 9.6 % 10487 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.70 ± 9.6 % 10488 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.31 ± 9.6 % 10490 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 40-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, GPSK, UL Sub) LTE-TDD 7.74 ± 9.6 % 10492 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub) LTE-TDD 8.51 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.34 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 % 10497 AAB LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 % 10499 <td>10485</td> <td>AAF</td> <td></td> <td></td> <td></td> <td></td>	10485	AAF				
10487 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub) LTE-TDD 8.60 ± 9.6 % 10488 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 46-QAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10490 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 46-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 46-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10492 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 46-QAM, UL Sub) LTE-TDD 8.61 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.71 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.76 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, Q-PSK, UL Sub) LTE-TDD 7.67 ± 9.6 % 10498 AAB LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 40-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 % 10499 AAB LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 %	10486	AAF		LTE-TDD		
10488 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 0PSK, UL Sub) LTE-TDD 7,70 ± 9.6 % 10499 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 0PSK, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 0PSK, UL Sub) LTE-TDD 8.41 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 04-QAM, UL Sub) LTE-TDD 8.55 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 0FQAM, UL Sub) LTE-TDD 8.37 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10498 AAF LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10498 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 14-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10499 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 14-QAM, UL Sub) LTE-TDD 7.72 ± 9.6 % 10500 <td></td> <td></td> <td></td> <td></td> <td></td> <td><u> </u></td>						<u> </u>
10489 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub) LTE-TDD 8.31 ± 9.6 % 10490 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 46-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 10-QAM, UL Sub) LTE-TDD 7.74 ± 9.6 % 10492 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 10-QAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 40-AM, UL Sub) LTE-TDD 7.74 ± 9.6 % 10495 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 40-AM, UL Sub) LTE-TDD 8.37 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 100% RB, 14 MHz, QPSK, UL Sub) LTE-TDD 8.64 ± 9.6 % 10497 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 % 10496 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 % 10501 AAC LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 8.64 ± 9.6 % 10506<	10488					· · · · · · · · · · · · · · · · · · ·
10490 AAF LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Sub) LTE-TDD 8.41 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Sub) LTE-TDD 8.55 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub) LTE-TDD 8.55 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub) LTE-TDD 8.33 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Sub) LTE-TDD 8.54 ± 9.6 % 10497 AAB LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Sub) LTE-TDD 8.40 ± 9.6 % 10499 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10500 AAC LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10501 AAC LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 8.44 ± 9.6 % 10					;	
10491 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Sub) LTE-TDD 7.74 ± 9.6 % 10492 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10494 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub) LTE-TDD 8.55 ± 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub) LTE-TDD 8.37 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.37 ± 9.6 % 10497 AAB LTE-TDD (SC-FDMA, 100% RB, 14 MHz, QPSK, UL Sub) LTE-TDD 8.40 ± 9.6 % 10497 AAB LTE-TDD (SC-FDMA, 100% RB, 14 MHz, 16-QAM, UL Sub) LTE-TDD 8.46 ± 9.6 % 10498 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 26-QAM, UL Sub) LTE-TDD 8.46 ± 9.6 % 10501 AAC LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 26-QAM, UL Sub) LTE-TDD 7.74 ± 9.6 % 10502 AAC LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 20-AM, UL Sub) LTE-TDD 7.72 ± 9.6 % 10504		· ····			*****	
10492 AAE LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub) LTE-TDD 8.41 ± 9.6 % 10493 AAE LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 24-QAM, UL Sub) LTE-TDD 8.55 ± 9.6 % 10495 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 24-QAM, UL Sub) LTE-TDD 8.37 ± 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub) LTE-TDD 8.33 ± 9.6 % 10498 AAF LTE-TDD (SC-FDMA, 100% RB, 14 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10498 AAB LTE-TDD (SC-FDMA, 100% RB, 14 MHz, 16-QAM, UL Sub) LTE-TDD 8.40 ± 9.6 % 10499 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10500 AAC LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 ± 9.6 % 10501 AAC LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 7.62 ± 9.6 % 10502 AAC LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 8.52 ± 9.6 % 1					ł	
10493 AAE LTE-TDD SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Sub) LTE-TDD 8.56 1 9.6 % 10494 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub) LTE-TDD 7.74 1 9.6 % 10495 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, GP-QAM, UL Sub) LTE-TDD 8.54 1 9.6 % 10496 AAF LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub) LTE-TDD 8.54 1 9.6 % 10497 AAB LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub) LTE-TDD 7.67 1 9.6 % 10498 AAB LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub) LTE-TDD 8.68 1 9.6 % 10499 AAB LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 8.64 1 9.6 % 10501 AAC LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub) LTE-TDD 8.52 1 9.6 % 10502 AAC LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 7.72 1 9.6 % 10504 AAF LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub) LTE-TDD 8.54 1 9.6 % <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>						
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10527 AAB IEEE 802.11ac WiFi (20MHz, MCS2, 99pc dc) WLAN 8.21 ± 9.6 %						
	10527	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc dc)	WLAN	8.21	±9.6%

10529 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.43 1.9 10531 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.33 1.9 10532 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.33 1.9 10533 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.45 1.9 10535 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.45 1.9 10537 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.44 9 10537 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.44 9 10540 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.66 2.9 10541 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.66 2.9 10543 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.65 2.9 10544 AAB IEEE 802.11ac WFI (20MHz, MCSB, 99pc dc) WLAN 8.65 2.9						
10531 AAB IEEE 802.11ae WFI (20MHz, MCSR, 99pc dc) WLAN 8.4.3 8.9 10532 AAB IEEE 802.11ae WFI (20MHz, MCSR, 99pc dc) WLAN 8.2.8 1.9 10534 AAB IEEE 802.11ae WFI (20MHz, MCSR, 99pc dc) WLAN 8.4.6 1.9 10535 AAB IEEE 802.11ae WFI (40MHz, MCSR, 99pc dc) WLAN 8.4.6 1.9 10536 AAB IEEE 802.11ae WFI (40MHz, MCSR, 99pc dc) WLAN 8.4.4 1.9 10540 AAB IEEE 802.11ae WFI (40MHz, MCSR, 99pc dc) WLAN 8.5.4 2.9 10541 AAB IEEE 802.11ae WFI (40MHz, MCSR, 99pc dc) WLAN 8.5.6 2.9 10542 AAB IEEE 802.11ae WFI (40MHz, MCSR, 99pc dc) WLAN 8.6.6 2.9 10544 AAB IEEE 802.11ae WFI (40MHz, MCSR, 99pc dc) WLAN 8.4.6 2.9 10544 AAB IEEE 802.11ae WFI (80MHz, MCSR, 99pc dc) WLAN 8.4.7 2.9 10547 AAB IEEE 802.11ae WFI (80MHz, MCSR, 99pc dc) WLAN 8.4.7 2.9 <td></td> <td>AAB</td> <td>IEEE 802.11ac WiFi (20MHz, MCS3, 99pc dc)</td> <td>WLAN</td> <td>8.36</td> <td>± 9.6 %</td>		AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc dc)	WLAN	8.36	± 9.6 %
1052 AAB IEEE 802.11ac WIFI (20MHz, MCS9, 99pc dc) WLAN 8.29 4.9 10533 AAB IEEE 802.11ac WIFI (20MHz, MCS9, 99pc dc) WLAN 8.45 4.9 10535 AAB IEEE 802.11ac WIFI (20MHz, MCS9, 99pc dc) WLAN 8.45 4.9 10536 AAB IEEE 802.11ac WIFI (20MHz, MCS1, 99pc dc) WLAN 8.42 4.9 10537 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.44 4.9 10540 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.46 4.9 10541 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.46 4.9 10542 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.46 4.9 10544 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.35 1.9 10545 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.35 1.9 10547 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.46 4.9 <td>10529</td> <td>AAB</td> <td>IEEE 802.11ac WiFi (20MHz, MCS4, 99pc dc)</td> <td>WLAN</td> <td>8.36</td> <td>± 9.6 %</td>	10529	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc dc)	WLAN	8.36	± 9.6 %
10533 AAB IEEE 802.11ac WIFI (20MHz, MCS8, 99pc dc) WLAN 8.38 4.9 10535 AAB IEEE 802.11ac WIFI (20MHz, MCS1, 99pc dc) WLAN 8.45 4.9 10536 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.45 4.9 10537 AAB IEEE 802.11ac WIFI (20MHz, MCS3, 99pc dc) WLAN 8.44 4.9 10538 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 4.9 10541 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 4.9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 4.9 10544 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.45 4.9 10544 AAB IEEE 802.11ac WIFI (60MHz, MCS3, 99pc dc) WLAN 8.45 4.9 10547 AAB IEEE 802.11ac WIFI (60MHz, MCS3, 99pc dc) WLAN 8.45 4.9 10547 AAB IEEE 802.11ac WIFI (60MHz, MCS3, 99pc dc) WLAN 8.45 4.9 <td>10531</td> <td>AAB</td> <td>IEEE 802.11ac WiFi (20MHz, MCS6, 99pc dc)</td> <td>WLAN</td> <td>8.43</td> <td>±9.6 %</td>	10531	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc dc)	WLAN	8.43	±9.6 %
10534 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.45 45 10535 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 45 10537 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 49 10537 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 49 10540 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.46 ± 9 10541 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 ± 9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 ± 9 10544 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.55 ± 9 10545 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.35 ± 9 10546 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.36 ± 9 10546 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.36 ± 9	10532	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc dc)	WLAN	8.29	±9.6 %
1053 AAB IEEE 802.11ac WIFI (40MHz, MCS1, 99pc dc). WLAN 8.45 ± 9 10536 AAB IEEE 802.11ac WIFI (40MHz, MCS1, 99pc dc). WLAN 8.42 ± 9 10537 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc). WLAN 8.44 ± 9 10539 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc). WLAN 8.44 ± 9 10540 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc). WLAN 8.46 ± 9 10541 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc). WLAN 8.65 ± 9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc). WLAN 8.65 ± 9 10544 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc). WLAN 8.55 ± 9 10545 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc). WLAN 8.35 ± 9 10546 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc). WLAN 8.36 ± 9 10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc). WLAN 8.36	10533	AAB	IEEE 802.11ac WIFI (20MHz, MCS8, 99pc dc)	WLAN	8.38	±9.6 %
10555 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.45 45 10537 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 45 10538 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 45 10540 AAB IEEE 802.11ac WIFI (40MHz, MCS6, 99pc dc) WLAN 8.46 ±9 10541 AAB IEEE 802.11ac WIFI (40MHz, MCS6, 99pc dc) WLAN 8.65 ±9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 ±9 10543 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.45 ±9 10544 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.45 ±9 10545 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.35 ±9 10546 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.36 ±9 10556 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.36 ±9 <td>10534</td> <td>AAB</td> <td>IEEE 802,11ac WiFi (40MHz, MCS0, 99pc dc)</td> <td>WLAN</td> <td>8.45</td> <td>±9.6 %</td>	10534	AAB	IEEE 802,11ac WiFi (40MHz, MCS0, 99pc dc)	WLAN	8.45	±9.6 %
1058 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 4.9 10537 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 4.9 10540 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.36 4.9 10541 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.46 1.9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 1.9 10544 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.65 1.9 10544 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.47 1.9 10546 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.47 1.9 10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.43 1.9 10550 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.42 1.9 10551 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.45 1.9 <td></td> <td>AAB</td> <td></td> <td>WLAN</td> <td></td> <td>± 9.6 %</td>		AAB		WLAN		± 9.6 %
10537 AAB IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.44 1.9 10540 AAB IEEE 02.11ac WIFI (40MHz, MCS6, 99pc dc) WLAN 8.34 1.9 10541 AAB IEEE 02.11ac WIFI (40MHz, MCS6, 99pc dc) WLAN 8.46 ± 9 10542 AAB IEEE 02.11ac WIFI (40MHz, MCS8, 99pc dc) WLAN 8.65 ± 9 10543 AAB IEEE 02.11ac WIFI (40MHz, MCS8, 99pc dc) WLAN 8.65 ± 9 10544 AAB IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.65 ± 9 10545 AAB IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.47 ± 9 10547 AAB IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.48 ± 9 10547 AAB IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 ± 9 10550 AAB IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 ± 9 10551 AAC IEEE 02.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 ± 9 <td></td> <td></td> <td></td> <td>WLAN</td> <td>f</td> <td>± 9.6 %</td>				WLAN	f	± 9.6 %
1058 AAB IEEE 802.11ac WIFI (40MHz, MCSA, 99pc dc) WLAN 8.54 ± 9 10541 AAB IEEE 802.11ac WIFI (40MHz, MCS7, 99pc dc) WLAN 8.46 ± 9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.46 ± 9 10543 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.45 ± 9 10544 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.47 ± 9 10545 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.35 ± 9 10547 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.35 ± 9 10551 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.32 ± 9 10552 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 ± 9 10553 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 ± 9 10555 AAC IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.42 ± 9 <td>the second secon</td> <td></td> <td></td> <td></td> <td></td> <td>± 9.6 %</td>	the second secon					± 9.6 %
10540 AAB IEEE 902.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.48 1.9 10541 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.46 1.9 10542 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.65 ± 9 10543 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.47 ± 9 10544 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.55 ± 9 10546 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.47 ± 9 10546 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.37 ± 9 10557 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.42 ± 9 10558 AAB IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.42 ± 9 10557 AAC IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.42 ± 9 10556 AAC IEEE 002.11ac WIFI (400Htz, MCSR, 99pc dc) WLAN 8.42						± 9,6 %
10541 AAB IEEE 802.11ac WIFI (40MHz, MCS8, 99pc dc) WLAN 8.46 ± 9 10542 AAB IEEE 802.11ac WIFI (40MHz, MCS8, 99pc dc) WLAN 8.65 ± 9 10543 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.47 ± 9 10544 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.47 ± 9 10545 AAB IEEE 802.11ac WIFI (40MHz, MCS2, 99pc dc) WLAN 8.35 ± 9 10546 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.35 ± 9 10547 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.33 ± 9 10551 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.42 ± 9 10552 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.42 ± 9 10555 AAC IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.44 ± 9 10556 AAC IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.45 ± 9 <td></td> <td></td> <td></td> <td></td> <td></td> <td>± 9.6 %</td>						± 9.6 %
10642 AAB IEEE 802.11ac WIFI (40MHz, MCS8, 99pc dc) WLAN 8.65 1 9 10543 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.65 1 9 10544 AAB IEEE 802.11ac WIFI (40MHz, MCS1, 99pc dc) WLAN 8.457 1 9 10545 AAB IEEE 802.11ac WIFI (40MHz, MCS1, 99pc dc) WLAN 8.457 1 9 10547 AAB IEEE 802.11ac WIFI (40MHz, MCS3, 99pc dc) WLAN 8.43 1 9 10548 AAB IEEE 802.11ac WIFI (40MHz, MCS4, 99pc dc) WLAN 8.38 1 9 10551 AAB IEEE 802.11ac WIFI (40MHz, MCS4, 99pc dc) WLAN 8.42 1 9 10552 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.44 1 9 10554 AAC IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.45 1 9 10555 AAC IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.46 1 9 10556 AAC IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.52 1 9<	E					± 9.6 %
10543 AAB IEEE 802.11ac WIFI (40MHz, MCS9, 99pc dc) WLAN 8.65 1 9 10544 AAB IEEE 802.11ac WIFI (60MHz, MCS0, 99pc dc) WLAN 8.47 1 5 10546 AAB IEEE 802.11ac WIFI (60MHz, MCS2, 99pc dc) WLAN 8.35 1 9 10546 AAB IEEE 802.11ac WIFI (60MHz, MCS3, 99pc dc) WLAN 8.35 1 9 10547 AAB IEEE 802.11ac WIFI (60MHz, MCS4, 99pc dc) WLAN 8.37 1 9 10551 AAB IEEE 802.11ac WIFI (60MHz, MCS6, 99pc dc) WLAN 8.38 1 9 10551 AAB IEEE 802.11ac WIFI (60MHz, MCS7, 99pc dc) WLAN 8.42 1 9 10554 AAC IEEE 802.11ac WIFI (60MHz, MCS9, 99pc dc) WLAN 8.48 1 9 10555 AAC IEEE 802.11ac WIFI (60MHz, MCS9, 99pc dc) WLAN 8.47 1 9 10555 AAC IEEE 802.11ac WIFI (60MHz, MCS9, 99pc dc) WLAN 8.46 1 9 10555 AAC IEEE 802.11ac WIFI (60MHz, MCS9, 99pc dc) WLAN 8.50 1 9 <td></td> <td></td> <td></td> <td></td> <td></td> <td>$\pm 9.6\%$</td>						$\pm 9.6\%$
16544 AAB IEEE 802.11ac WIFI (80MHz, MCS0, 99pc dc) WLAN 8.47 ± 9 10545 AAB IEEE 802.11ac WIFI (80MHz, MCS2, 99pc dc) WLAN 8.55 ± 9 10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.49 ± 9 10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.49 ± 9 10556 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.38 ± 9 10557 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.45 ± 9 10553 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.45 ± 9 10554 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.45 ± 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.45 ± 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.52 ± 9 10557 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.61 ±	L					± 9.6 %
10546 AAB IEEE 802.11a WIFI (80MHz, MCS1, 99pc dc) WLAN 8.55 1 9 10546 AAB IEEE 802.11ac WIFI (80MHz, MCS2, 99pc dc) WLAN 8.35 1 9 10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.37 1 9 10548 AAB IEEE 802.11ac WIFI (80MHz, MCS4, 99pc dc) WLAN 8.38 1 9 10550 AAB IEEE 802.11ac WIFI (80MHz, MCS7, 99pc dc) WLAN 8.42 1 9 10553 AAB IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WLAN 8.46 1 9 10554 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.46 1 9 10555 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.46 1 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.47 1 9 10557 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.50 1 9 10566 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.73 1						
10546 AAB IEEE 802.11ac WIFI (80MHz, MCS2, 99pc dc) WLAN 8.35 ± 9 10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.37 ± 9 10556 AAB IEEE 802.11ac WIFI (80MHz, MCS4, 99pc dc) WLAN 8.37 ± 9 10551 AAB IEEE 802.11ac WIFI (80MHz, MCS4, 99pc dc) WLAN 8.38 ± 9 10552 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.45 ± 9 10553 AAB IEEE 802.11ac WIFI (80MHz, MCS0, 99pc dc) WLAN 8.44 ± 9 10554 AAC IEEE 802.11ac WIFI (160MHz, MCS0, 99pc dc) WLAN 8.47 ± 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.52 ± 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10567 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.73 ± 9 10568 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.73 ±						± 9.6 %
10547 AAB IEEE 802.11ac WIFI (80MHz, MCS3, 99pc dc) WLAN 8.49 ± 9 10548 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.37 ± 9 10550 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.38 ± 9 10551 AAB IEEE 802.11ac WIFI (80MHz, MCS7, 99pc dc) WLAN 8.42 ± 9 10553 AAB IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WLAN 8.45 ± 9 10554 AAC IEEE 802.11ac WIFI (180MHz, MCS1, 99pc dc) WLAN 8.45 ± 9 10555 AAC IEEE 802.11ac WIFI (180MHz, MCS2, 99pc dc) WLAN 8.45 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.51 ± 9 10566 AAC IEEE 802.11ac WIFI (180MHz, MCS4, 98pc dc) WLAN 8.61 ± 9 10568 AAC IEEE 802.11ac WIFI (180MHz, MCS8, 98pc dc) WLAN 8.61 ± 9 10566 AAC IEEE 802.11ac WIFI (180MHz, MCS8, 98pc dc) WLAN 8.61						± 9.6 %
10548 AAB IEEE 802.11ac WIFI (80MHz, MCS4, 99pc dc) WILAN 8.37 ± 9 10550 AAB IEEE 802.11ac WIFI (80MHz, MCS7, 99pc dc) WILAN 8.36 ± 9 10551 AAB IEEE 802.11ac WIFI (80MHz, MCS7, 99pc dc) WILAN 8.42 ± 9 10552 AAB IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WILAN 8.45 ± 9 10554 AAC IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WILAN 8.46 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WILAN 8.48 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 98pc dc) WILAN 8.52 ± 9 10557 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 98pc dc) WILAN 8.56 ± 9 10568 AAC IEEE 802.11ac WIFI (180MHz, MCS6, 99pc dc) WILAN 8.67 ± 9 10569 AAC IEEE 802.11ac WIFI (180MHz, MCS7, 98pc dc) WILAN 8.65 ± 9 10561 AAC IEEE 802.11ac WIFI (180MHz, MCS7, 98pc dc) WILAN 8.52						± 9.6 %
10560 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.38 ± 9 10551 AAB IEEE 802.11ac WIFI (80MHz, MCS6, 99pc dc) WLAN 8.42 ± 9 10553 AAB IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WLAN 8.42 ± 9 10554 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.44 ± 9 10555 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.47 ± 9 10555 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.47 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.52 ± 9 10557 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10560 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.62 ± 9 10561 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.65 ± 9 10564 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.65 <t< td=""><td></td><td></td><td></td><td></td><td></td><td>±9.6 %</td></t<>						±9.6 %
10551 AAB IEEE 802.11ac WIFI (80MHz, MCS7, 99pc dc) WLAN 8.50 ± 9 10552 AAB IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WLAN 8.42 ± 9 10554 AAC IEEE 802.11ac WIFI (80MHz, MCS9, 99pc dc) WLAN 8.45 ± 9 10555 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.45 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCS2, 99pc dc) WLAN 8.47 ± 9 10557 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.52 ± 9 10568 AAC IEEE 802.11ac WIFI (180MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10560 AAC IEEE 802.11ac WIFI (180MHz, MCS8, 99pc dc) WLAN 8.61 ± 9 10561 AAC IEEE 802.11ac WIFI (180MHz, MCS8, 99pc dc) WLAN 8.61 ± 9 10563 AAC IEEE 802.11ac WIFI (180MHz, MCS8, 99pc dc) WLAN 8.61 ± 9 10564 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mps, 99pc dc) WLAN 8.71 <td></td> <td></td> <td></td> <td></td> <td></td> <td>± 9.6 %</td>						± 9.6 %
10552 AAB IEEE 802.11ac WIFI (80MHz, MCSB, 99pc dc) WLAN 8.42 ± 9 10553 AAC IEEE 802.11ac WIFI (80MHz, MCSB, 99pc dc) WLAN 8.46 ± 9 10554 AAC IEEE 802.11ac WIFI (180MHz, MCSB, 99pc dc) WLAN 8.47 ± 9 10555 AAC IEEE 802.11ac WIFI (180MHz, MCSB, 99pc dc) WLAN 8.47 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCSB, 99pc dc) WLAN 8.50 ± 9 10556 AAC IEEE 802.11ac WIFI (180MHz, MCSB, 99pc dc) WLAN 8.61 ± 9 10560 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.73 ± 9 10561 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.75 ± 9 10562 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.75 ± 9 10564 AAC IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.75 ± 9 10565 AAA IEEE 802.11ac WIFI (180MHz, MCS9, 99pc dc) WLAN 8.15 <						±9.6 %
10553 AAB IEEE 802.11ac WiFI (80MHz, MCS9, 99pc dc) WLAN 8.45 ± 9 10554 AAC IEEE 802.11ac WiFI (80MHz, MCS1, 99pc dc) WLAN 8.44 ± 9 10555 AAC IEEE 802.11ac WiFI (160MHz, MCS1, 99pc dc) WLAN 8.50 ± 9 10556 AAC IEEE 802.11ac WiFI (160MHz, MCS2, 99pc dc) WLAN 8.52 ± 9 10557 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.52 ± 9 10558 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.73 ± 9 10560 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.76 ± 9 10561 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.75 ± 9 10564 AAA IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.75 ± 9 10564 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.15 ± 9 10565 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN		<u>}</u>				± 9.6 %
10554 AAC IEEE 802.11ac WiFI (180MHz, MCS0, 99pc dc) WLAN 8.46 ± 9 10555 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.47 ± 9 10556 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.50 ± 9 10557 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10558 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10561 AAC IEEE 802.11ac WiFI (160MHz, MCS7, 99pc dc) WLAN 8.66 ± 9 10562 AAC IEEE 802.11ac WiFI (160MHz, MCS7, 99pc dc) WLAN 8.66 ± 9 10563 AAC IEEE 802.11ac WiFI (24 GHz (DSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.46 ± 9 10564 AAA IEEE 802.11g WiFI 2.4 GHz (DSS-OFDM, 18 Mbps, 99pc dc) WLAN 8.46 ± 9 10566 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.37 ± 9 10567 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc)	10552	AAB			8.42	±9.6 %
10555 AAC IEEE 802.11ac WIFI (160MHz, MCS1, 99pc dc) WLAN 8.47 ± 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS2, 99pc dc) WLAN 8.50 ± 9 10557 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10558 AAC IEEE 802.11ac WIFI (160MHz, MCS4, 99pc dc) WLAN 8.61 ± 9 10561 AAC IEEE 802.11ac WIFI (160MHz, MCS4, 99pc dc) WLAN 8.66 ± 9 10562 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.68 ± 9 10564 AAA IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.77 ± 9 10564 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc)	10553	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc dc)	WLAN	8.45	±9.6 %
10555 AAC IEEE 802.11ac WIFI (160MHz, MCS1, 99pc dc) WLAN 8.47 ± 9 10556 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.50 ± 9 10557 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10558 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10561 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.63 ± 9 10562 AAC IEEE 802.11ac WIFI (160MHz, MCS3, 99pc dc) WLAN 8.66 ± 9 10564 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.25 ± 9 10564 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.45 ± 9 10565 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc)	10554	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc dc)	WLAN	8.48	±9.6 %
10556 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.50 ± 9 10557 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.52 ± 9 10558 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.61 ± 9 10560 AAC IEEE 802.11ac WiFI (160MHz, MCS3, 99pc dc) WLAN 8.66 ± 9 10561 AAC IEEE 802.11ac WiFI (160MHz, MCS9, 99pc dc) WLAN 8.66 ± 9 10563 AAC IEEE 802.11ac WiFI (160MHz, MCS9, 99pc dc) WLAN 8.67 ± 9 10564 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.37 ± 9 10568 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 54 Mbps, 9	10555	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc dc)	WLAN	8.47	±9.6 %
10557 AAC IEEE 802.11ac WiFi (160MHz, MCS3, 99pc dc) WLAN 8.52 ± 9 10558 AAC IEEE 802.11ac WiFi (160MHz, MCS4, 99pc dc) WLAN 8.61 ± 9 10560 AAC IEEE 802.11ac WiFi (160MHz, MCS7, 99pc dc) WLAN 8.66 ± 9 10561 AAC IEEE 802.11ac WiFi (160MHz, MCS7, 99pc dc) WLAN 8.66 ± 9 10562 AAC IEEE 802.11ac WiFi (160MHz, MCS9, 99pc dc) WLAN 8.68 ± 9 10564 AAA IEEE 802.11ac WiFi (160MHz, MCS9, 99pc dc) WLAN 8.25 ± 9 10564 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.37 ± 9 10568 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS, 5.1 Mbps, 90pc		AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc dc)			± 9.6 %
10558 AAC IEEE 802.11ac WIFI (160MHz, MCS4, 99pc dc) WLAN 8.61 ± 9 10560 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.73 ± 9 10561 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.66 ± 9 10562 AAC IEEE 802.11ac WIFI (160MHz, MCS8, 99pc dc) WLAN 8.67 ± 9 10563 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.25 ± 9 10564 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.13 ± 9 10565 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 8 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10568 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 8.30 ± 9 10572 AAA IEEE 802.11g WIFI 2.4 GHz (DS						± 9.6 %
10560 AAC IEEE 802.11ac WIFI (160MHz, MCS6, 99pc dc) WLAN 8.73 ± 9 10561 AAC IEEE 802.11ac WIFI (160MHz, MCS7, 99pc dc) WLAN 8.69 ± 9 10562 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.69 ± 9 10563 AAC IEEE 802.11ac WIFI (24 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.77 ± 9 10564 AAA IEEE 802.11ac WIFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.45 ± 9 10565 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.31 ± 9 10567 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10568 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS.OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.119 WIFI 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.119						± 9.6 %
10561 AAC IEEE 802.11ac WIFI (160MHz, MCS7, 99pc dc) WLAN 8.56 ± 9 10562 AAC IEEE 802.11ac WIFI (160MHz, MCS8, 99pc dc) WLAN 8.69 ± 9 10563 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.77 ± 9 10564 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.25 ± 9 10565 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc) WLAN 8.13 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.33 ± 9 10568 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 8.30 ± 9 10572 AAA IEEE 802.11b WIFI 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.99 ± 9 10576 AAA IEEE 802.11b WIFI 2					· · · · · · ·	±9.6 %
10562 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.69 ± 9 10563 AAC IEEE 802.11ac WIFI (160MHz, MCS9, 99pc dc) WLAN 8.77 ± 9 10564 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.25 ± 9 10565 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 14 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 34 Mbps, 99pc dc) WLAN 8.31 ± 9 10569 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.11g WIFI 2.4 GHz (DSSS, OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WIFI 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WIFI 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE		(±9.6 %
10563 AAC IEEE 802.11ac WiFi (160MHz, MCS8, 99pc dc) WLAN 8.77 ± 9 10564 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.25 ± 9 10565 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.15 ± 9 10566 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.30 ± 9 10568 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 <td< td=""><td>3</td><td>E</td><td></td><td></td><td></td><td>± 9.6 %</td></td<>	3	E				± 9.6 %
10564 AAA IEEE 802.11g WiFi 2.4 GHz (DSS-OFDM, 9 Mbps, 99pc dc) WLAN 8.25 ± 9 10565 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.37 ± 9 10568 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.37 ± 9 10569 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA		3				± 9.6 %
10565 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc) WLAN 8.45 ± 9 10566 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.00 ± 9 10568 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.37 ± 9 10569 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10570 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS, OFDM, 48 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10576						$\pm 9.6\%$
10566 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc) WLAN 8.13 ± 9 10567 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.00 ± 9 10568 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.37 ± 9 10569 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.10 ± 9 10570 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.70						± 9.6 %
10567 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc) WLAN 8.00 ± 9 10568 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.37 ± 9 10569 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.10 ± 9 10570 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WiFI 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 8.30 ± 9 10572 AAA IEEE 802.11b WiFI 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.60 ± 9 10575 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFI 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10578 AAA </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>± 9.6 %</td>						± 9.6 %
10568 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc) WLAN 8.37 ± 9 10569 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.10 ± 9 10570 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA <td></td> <td></td> <td></td> <td></td> <td></td> <td>± 9.6 %</td>						± 9.6 %
10569 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc) WLAN 8.10 ± 9 10570 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10579 AAA				1		$\pm 9.6\%$ $\pm 9.6\%$
10570 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc) WLAN 8.30 ± 9 10571 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10581 AAA		. .				
10571 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc) WLAN 1.99 ± 9 10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.67 <		4				± 9.6 %
10572 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc) WLAN 1.99 ± 9 10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.76 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67		;	· · · · · · · · · · · · · · · · · · ·			± 9.6 %
10573 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc) WLAN 1.98 ± 9 10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g /WiFi 2.4 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.67						± 9.6 %
10574 AAA IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc) WLAN 1.98 ± 9 10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11g WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.60						±9.6 %
10575 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 14 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.						± 9.6 %
10576 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.76 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.69 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49					· ·	±9.6 %
10577 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10578 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.69 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36					1	± 9.6 %
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10579 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.35 ± 9 10583 AAB IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.70 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 </td <td></td> <td></td> <td></td> <td>m.m.</td> <td></td> <td>± 9,6 %</td>				m.m.		± 9,6 %
10580 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.69 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10589 AAB I						± 9.6 %
10581 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.69 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10589 AAB IEEE 8					8.36	±9.6 %
10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.36 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9		L			8.76	±9.6 %
10582 AAA IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9 10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.60 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.36 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h Wi	10581	AAA	IEEE 802.11g WIFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc)	WLAN	8.35	±9.6 %
10583 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc) WLAN 8.59 ± 9 10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.36 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9	10582	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc)	WLAN		±9.6 %
10584 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc) WLAN 8.60 ± 9 10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9	10583	AAB		WLAN	8.59	± 9.6 %
10585 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc) WLAN 8.70 ± 9 10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9	10584	AAB		WLAN	1	±9.6 %
10586 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc) WLAN 8.49 ± 9 10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9						± 9.6 %
10587 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc) WLAN 8.36 ± 9 10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9						± 9.6 %
10588 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc) WLAN 8.76 ± 9 10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9						± 9.6 %
10589 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc) WLAN 8.35 ± 9 10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9						± 9.6 %
10590 AAB IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc) WLAN 8.67 ± 9						±9.6 %
	1	1				$\pm 9.6\%$
	10590	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc dc)	WLAN	8.63	$\pm 9.6\%$
						± 9.6 %
						± 9.6 %
					- <u> </u>	± 9.6 %
10595 AAB IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc dc) WLAN 8.74 ± 9	10595	AAB	IEEE 002.1111 (H1 MIX00, 20MHZ, MUS4, 90pc 0c)	WLAN	0.74	± 9.6 %

10596	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc dc)	WLAN	8.71	± 9.6 %
10597	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc dc)	WLAN	8.72	± 9.6 %
10598	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc dc)	WLAN	8.50	± 9.6 %
10599	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc dc)	WLAN	8.79	± 9.6 %
10600	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc dc)	WLAN	8.88	±9.6 %
10601	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc dc)	WLAN	8.82	±9.6 %
10602	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc dc)	WLAN	8.94	± 9.6 %
10603	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc dc)	WLAN	9.03	±9.6 %
10604	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc dc)	WLAN	8.76	± 9.6 %
10605	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc dc)	WLAN	8.97	± 9.6 %
10606	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc dc)	WLAN	8.82	± 9.6 %
10607	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc dc)	WLAN	8.64	± 9.6 %
10608	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc dc)	WLAN	8.77	± 9.6 %
10609	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc dc)	WLAN	8.57	±9.6%
10610	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc dc)	WLAN	8.78	±9.6 %
10611	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc dc)	WLAN	8.70	±9.6 %
10612	AAB	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc dc)	WLAN	8.77	±9.6%
10613	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc dc)	WLAN	8.94	±9.6 %
10614	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc dc)	WLAN	8.59	± 9.6 %
10615	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc dc)	WLAN	8.82	±9.6 %
10616	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc dc)	WLAN	8.82	± 9.6 %
10617	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc dc)	WLAN	8.81	±9.6%
10618	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc dc)	WLAN	8.58	±9.6%
10619	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc dc)	WLAN	8.86	±9.6%
10620	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc dc)	WLAN	8.87	± 9.6 %
10621	AAB	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc dc)	WLAN	8.77	± 9.6 %
10622	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc dc)	WLAN	8.68	± 9.6 %
10623	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc dc)	WLAN	8.82	± 9.6 %
10624	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc dc)	WLAN	8.96	± 9.6 %
10625	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc dc)	WLAN	8.96	± 9.6 %
10626	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc dc)	WLAN	8.83	± 9.6 %
10627	AAB	IEEE 802.11ac WIFI (80MHz, MCS1, 90pc dc)	WLAN	8.88	±9.6%
10628	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc dc)	WLAN	8.71	±9.6 %
10629	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc dc)	WLAN	8.85	± 9.6 %
10630	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc dc)	WLAN	8.72	± 9.6 %
10631	AAB	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc dc)	WLAN	8.81	± 9.6 %
10632	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc dc)	WLAN	8.74	± 9.6 %
10633	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc dc)	WLAN	8.83	± 9.6 %
10634	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc dc)	WLAN	8.80	± 9.6 %
10635	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc dc)	WLAN	8.81	± 9.6 %
10636	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc dc)	WLAN	8.83	± 9.6 %
10637	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc dc)	WLAN	8.79	± 9.6 %
10638	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc dc)	WLAN	8.86	± 9.6 %
10639	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc dc)	WLAN	8.85	± 9.6 %
10640	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc dc)	WLAN	8.98	$\pm 9.6\%$
10641	AAC	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc dc)	WLAN	9.06	± 9.6 %
10642	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc dc)	WLAN	9.06	± 9.6 %
10643	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc dc)	WLAN	8.89	± 9.6 %
10644	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc dc)	WLAN	9.05	± 9.6 %
10645	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc dc)	WLAN	9.05	± 9.6 %
10646	AAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub=2,7)	LTE-TDD	11.96	± 9.6 %
10647	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub=2,7)	LTE-TDD	11.96	± 9.6 %
10648		CDMA2000 (1x Advanced)	CDMA2000	3.45	± 9.6 %
10652	AAE	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.91	± 9.6 %
10653	AAE	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.42	± 9.6 %
10654	AAD	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.96	± 9.6 %
10655	AAE	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.21	± 9.6 %
10658	AAA	Pulse Waveform (200Hz, 10%)	Test	10.00	± 9.6 %
10659	AAA	Pulse Waveform (200Hz, 10%)	Test	6.99	± 9.6 %
10660	AAA	Pulse Waveform (200Hz, 20%)	Test	3.98	± 9.6 %
10661	AAA	Pulse Waveform (200Hz, 40%)	Test	2.22	± 9.6 %
************************	AAA	Pulse Waveform (200Hz, 80%)	Test	0.97	± 9.6 %
		1 GOO TRAVOIDIN (20012, 0070)	1001	1 0.31	J
10662			Bluetooth	2 10	+06%
10670 10671		Bluetooth Low Energy IEEE 802.11ax (20MHz, MCS0, 90pc dc)	Bluetooth WLAN	2.19 9.09	± 9.6 % ± 9.6 %

(0.57	+069/
10672	AAA	IEEE 802.11ax (20MHz, MCS1, 90pc dc)	WLAN	8.57	$\pm 9.6\%$
10673	AAA	1EEE 802.11ax (20MHz, MCS2, 90pc dc)	WLAN	8.78	±9.6%
10674	AAA	IEEE 802.11ax (20MHz, MCS3, 90pc dc)	WLAN	8.74	± 9.6 %
10675	AAA	IEEE 802.11ax (20MHz, MCS4, 90pc dc)	WLAN	8.90	± 9.6 %
10676	AAA	IEEE 802.11ax (20MHz, MCS5, 90pc dc)	WLAN	8.77	± 9.6 %
10677	AAA	IEEE 802.11ax (20MHz, MCS6, 90pc dc)	WLAN	8.73	± 9.6 %
10678	AAA	IEEE 802.11ax (20MHz, MCS7, 90pc dc)	WLAN	8.78	± 9.6 %
10679	AAA	IEEE 802.11ax (20MHz, MCS8, 90pc dc)	WLAN	8.89	± 9.6 %
10680	AAA	IEEE 802.11ax (20MHz, MCS9, 90pc dc)	WLAN	8.80	± 9.6 %
10681	AAA	1EEE 802.11ax (20MHz, MCS10, 90pc dc)	WLAN	8.62	± 9.6 %
10682	AAA	IEEE 802.11ax (20MHz, MCS11, 90pc dc)	WLAN	8.83	± 9.6 %
10683	AAA	IEEE 802.11ax (20MHz, MCS0, 99pc dc)	WLAN	8.42	± 9.6 %
10684	AAA	IEEE 802.11ax (20MHz, MCS1, 99pc dc)	WLAN	8.26	± 9.6 %
10685	AAA	IEEE 802.11ax (20MHz, MCS2, 99pc dc)	WLAN	8.33	± 9.6 %
10686	AAA	IEEE 802.11ax (20MHz, MCS3, 99pc dc)	WLAN	8.28	± 9.6 %
10687	AAA	IEEE 802.11ax (20MHz, MCS4, 99pc dc)	WLAN	8.45	± 9.6 %
10688	AAA	IEEE 802.11ax (20MHz, MCS5, 99pc dc)	WLAN	8.29	± 9.6 %
10689	AAA	IEEE 802.11ax (20MHz, MCS6, 99pc dc)	WLAN	8.55	± 9.6 %
10690	AAA	IEEE 802.11ax (20MHz, MCS7, 99pc dc)	WLAN	8.29	± 9.6 %
10691	AAA	IEEE 802.11ax (20MHz, MCS8, 99pc dc)	WLAN	8.25	± 9.6 %
10692	AAA	IEEE 802.11ax (20MHz, MCS9, 99pc dc)	WLAN	8.29	± 9.6 %
10693	AAA	IEEE 802.11ax (20MHz, MCS10, 99pc dc)	WLAN	8.25	± 9.6 %
10694	AAA	IEEE 802.11ax (20MHz, MCS11, 99pc dc)	WLAN	8.57	±9.6 %
10695	AAA	IEEE 802.11ax (40MHz, MCS0, 90pc dc)	WLAN	8.78	± 9.6 %
10696	AAA	IEEE 802.11ax (40MHz, MCS1, 90pc dc)	WLAN	8.91	± 9.6 %
10697	AAA	IEEE 802.11ax (40MHz, MCS2, 90pc dc)	WLAN	8.61	± 9.6 %
10698	AAA	IEEE 802.11ax (40MHz, MCS3, 90pc dc)	WLAN	8.89	± 9.6 %
10699	AAA	IEEE 802.11ax (40MHz, MCS4, 90pc dc)	WLAN	8.82	± 9.6 %
10700	AAA	IEEE 802.11ax (40MHz, MCS5, 90pc dc)	WLAN	8.73	± 9.6 %
10701	AAA	IEEE 802.11ax (40MHz, MCS6, 90pc dc)	WLAN	8.86	± 9.6 %
10702	AAA	IEEE 802.11ax (40MHz, MCS7, 90pc dc)	WLAN	8.70	± 9.6 %
10703	AAA	IEEE 802.11ax (40MHz, MCS8, 90pc dc)	WLAN	8.82	±9.6%
10704	AAA	IEEE 802.11ax (40MHz, MCS9, 90pc dc)	WLAN	8.56	± 9.6 %
10705	AAA	IEEE 802.11ax (40MHz, MCS10, 90pc dc)	WLAN	8.69	± 9.6 %
10706	AAA	IEEE 802.11ax (40MHz, MCS11, 90pc dc)	WLAN	8.66	± 9.6 %
10707	AAA	IEEE 802.11ax (40MHz, MCS0, 99pc dc)	WLAN	8.32	± 9.6 %
10708	AAA	IEEE 802.11ax (40MHz, MCS1, 99pc dc)	WLAN	8.55	± 9.6 %
10709	AAA	IEEE 802.11ax (40MHz, MCS2, 99pc dc)	WLAN	8.33	±9.6 %
10710	AAA	IEEE 802.11ax (40MHz, MCS3, 99pc dc)	WLAN	8.29	±9.6 %
10711	AAA	IEEE 802.11ax (40MHz, MCS4, 99pc dc)	WLAN	8.39	±9.6 %
10712	AAA	IEEE 802.11ax (40MHz, MCS5, 99pc dc)	WLAN	8.67	± 9.6 %
10713	AAA	IEEE 802.11ax (40MHz, MCS6, 99pc dc)	WLAN	8.33	± 9.6 %
10714	AAA	IEEE 802.11ax (40MHz, MCS7, 99pc dc)	WLAN	8.26	± 9.6 %
10715	AAA	IEEE 802.11ax (40MHz, MCS8, 99pc dc)	WLAN	8.45	± 9.6 %
10716	AAA	IEEE 802.11ax (40MHz, MCS9, 99pc dc)	WLAN	8.30	± 9.6 %
10717		IEEE 802.11ax (40MHz, MCS3, 35pc dc)	WLAN	8.48	± 9.6 %
10718	AAA	IEEE 802.11ax (40MHz, MCS10, 35pc dc)	WLAN	8.24	± 9.6 %
10718		IEEE 802.11ax (40MHz, MCS), 95pc dc)	WLAN	8.81	± 9.6 %
10719		IEEE 802.11ax (80MHz, MCS0, 90pc dc)	WLAN	8.87	± 9.6 %
10720		IEEE 802.11ax (80MHz, MCS1, 90pc dc)	WLAN	8.76	± 9.6 %
10721		IEEE 802.11ax (80MHz, MCS2, 90pc dc)	WLAN	8.55	± 9.6 %
			WLAN	8.70	± 9.6 %
10723		IEEE 802.11ax (80MHz, MCS4, 90pc dc) IEEE 802.11ax (80MHz, MCS5, 90pc dc)	WLAN	8.70	± 9.6 %
10724			WLAN	8.74	$\pm 9.6\%$ $\pm 9.6\%$
10725	AAA	IEEE 802.11ax (80MHz, MCS6, 90pc dc) IEEE 802.11ax (80MHz, MCS7, 90pc dc)	WLAN	8.74	$\pm 9.6\%$ $\pm 9.6\%$
10726			WLAN	8.66	± 9.6 %
10727		IEEE 802.11ax (80MHz, MCS8, 90pc dc)	WLAN		
10728	AAA	IEEE 802.11ax (80MHz, MCS9, 90pc dc)	WLAN	8.65	± 9.6 % ± 9.6 %
10729	AAA	IEEE 802.11ax (80MHz, MCS10, 90pc dc)			
10730	AAA	IEEE 802.11ax (80MHz, MCS11, 90pc dc)	WLAN WLAN	8.67	± 9.6 %
10731		IEEE 802.11ax (80MHz, MCS0, 99pc dc)	WLAN	8.42	± 9.6 %
10732		IEEE 802.11ax (80MHz, MCS1, 99pc dc)	WLAN	8.46	± 9.6 %
10733	AAA	IEEE 802.11ax (80MHz, MCS2, 99pc dc)	WLAN	8.40	± 9.6 %
10734	AAA	IEEE 802.11ax (80MHz, MCS3, 99pc dc)	WLAN MILAN	8.25	± 9.6 %
10735	AAA	IEEE 802.11ax (80MHz, MCS4, 99pc dc)	WLAN	8.33	± 9.6 %

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10736	AAA	IEEE 802.11ax (80MHz, MCS5, 99pc dc)	WLAN	8.27	± 9.6 %
10737	AAA	IEEE 802.11ax (80MHz, MCS6, 99pc dc)	WLAN	8.36	± 9.6 %
10738	AAA	IEEE 802.11ax (80MHz, MCS7, 99pc dc)	WLAN	8.42	± 9.6 %
10739	AAA	IEEE 802.11ax (80MHz, MCS8, 99pc dc)	WLAN	8,29	± 9.6 %
10740	AAA	IEEE 802.11ax (80MHz, MCS9, 99pc dc)	WLAN	8.48	±9.6 %
10741	AAA	IEEE 802.11ax (80MHz, MCS10, 99pc dc)	WLAN	8.40	±9.6 %
10742	AAA	IEEE 802.11ax (80MHz, MCS11, 99pc dc)	WLAN	8.43	±9.6 %
10743	AAA	IEEE 802.11ax (160MHz, MCS0, 90pc dc)	WLAN	8.94	± 9.6 %
10744	AAA	IEEE 802.11ax (160MHz, MCS1, 90pc dc)	WLAN	9.16	±9.6 %
10745	AAA	IEEE 802.11ax (160MHz, MCS2, 90pc dc)	WLAN	8.93	±9.6 %
10746	AAA	IEEE 802.11ax (160MHz, MCS3, 90pc dc)	WLAN	9.11	±9.6 %
10747	AAA	IEEE 802.11ax (160MHz, MCS4, 90pc dc)	WLAN	9.04	±9.6 %
10748	AAA	IEEE 802.11ax (160MHz, MCS5, 90pc dc)	WLAN	8.93	±9.6 %
10749	AAA	IEEE 802.11ax (160MHz, MCS6, 90pc dc)	WLAN	8.90	± 9.6 %
10750	AAA	IEEE 802.11ax (160MHz, MCS7, 90pc dc)	WLAN	8.79	± 9.6 %
10751	AAA	IEEE 802.11ax (160MHz, MCS8, 90pc dc)	WLAN	8.82	± 9.6 %
10752	AAA	IEEE 802.11ax (160MHz, MCS9, 90pc dc)	WLAN	8.81	±9.6%
10753		IEEE 802.11ax (160MHz, MCS10, 90pc dc)	WLAN	9.00	± 9.6 %
10754	AAA	IEEE 802.11ax (160MHz, MCS11, 90pc dc)	WLAN	8.94	±9.6 %
10755		IEEE 802.11ax (160MHz, MCS0, 99pc dc)	WLAN	8.64	± 9.6 %
10756	AAA	IEEE 802.11ax (160MHz, MCS1, 99pc dc)	WLAN	8.77	± 9.6 %
10757	AAA	IEEE 802.11ax (160MHz, MCS2, 99pc dc)	WLAN	8.77	±9.6 %
10758	AAA	IEEE 802.11ax (160MHz, MCS3, 99pc dc)	WLAN	8.69	± 9.6 %
10759		IEEE 802.11ax (160MHz, MCS4, 99pc dc)	WLAN	8.58	± 9.6 %
10760	AAA	IEEE 802.11ax (160MHz, MCS5, 99pc dc)	WLAN	8.49	± 9.6 %
10761		IEEE 802.11ax (160MHz, MCS6, 99pc dc)	WLAN	8.58	±9.6%
10762	AAA	IEEE 802.11ax (160MHz, MCS7, 99pc dc)	WLAN	8.49	± 9.6 %
10763	AAA	IEEE 802.11ax (160MHz, MCS8, 99pc dc)	WLAN	8.53	± 9.6 %
10764	AAA	IEEE 802.11ax (160MHz, MCS9, 99pc dc)	WLAN	8.54	±9.6%
10765		IEEE 802.11ax (160MHz, MCS10, 99pc dc)	WLAN	8.54	± 9.6 %
10766		IEEE 802.11ax (160MHz, MCS11, 99pc dc)	WLAN	8.51	±9.6%
10767 10768	AAC AAC	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	7.99	±9.6%
10768		5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.6%
10769	AAC AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD 5G NR FR1 TDD	8.01	±9.6%
10770	AAC	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz) 5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02 8.02	± 9.6 % ± 9.6 %
10772	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 KHz)	5G NR FR1 TDD	8.02	$\pm 9.6\%$ $\pm 9.6\%$
10772	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 KHz)	5G NR FR1 TDD	8.03	$\pm 9.6\%$ $\pm 9.6\%$
10773	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 KHz)	5G NR FR1 TDD	8.03	± 9.6 %
10774	AAB	5G NR (CP-OFDM, 17KB, 50 MHZ, QPSK, 15 KHZ)	5G NR FR1 TDD	8.31	$\pm 9.6\%$
10776	AAC	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.30	$\pm 9.6\%$
10777	AAC	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 KHz)	5G NR FR1 TDD	8.30	$\pm 9.6\%$
10778	AAC	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.34	±9.6%
10779	AAB	5G NR (CP-OFDM, 50% RB, 25 MHz, QPSK, 15 KHz)	5G NR FR1 TDD	8.42	$\pm 9.6\%$
10779	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 KHz)	5G NR FR1 TDD	8.38	$\pm 9.6\%$
10781	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	± 9.6 %
10782	AAC	5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	± 9.6 %
10783	AAC	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	± 9.6 %
10784	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.29	± 9.6 %
10785	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10786	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10787	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.44	± 9.6 %
10788	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10789	AAC	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10790	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10791	AAC	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	± 9.6 %
10792	AAC	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.92	± 9.6 %
10793	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.95	± 9.6 %
10794	AAC	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10795	AAC	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.84	± 9.6 %
10796	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10797	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.01	± 9.6 %
10798	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10799	AAC	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
	1.0.0			1.00	0.0 /0

10807 AAC 6 G NR [CP-OPEM, 1188, 80 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 7,88 9.8 % 10805 AAC 6 G NR [CP-OPEM, 1188, 100 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 7,83 19.6 % 10805 AAC 5G NR [CP-OPEM, 1188, 100 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,34 19.6 % 10806 AAC 5G NR [CP-OPEM, 50% RR, 10 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,34 19.6 % 10806 AAC 5G NR [CP-OPEM, 50% RR, 80 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,34 19.6 % 10810 AAC 6G NR [CP-OPEM, 50% RR, 80 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,34 19.6 % 10817 AAC 6G NR [CP-OPEM, 100% RR, 5D MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,34 19.6 % 10818 AAC 6G NR [CP-OPEM, 100% RR, 20 HHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,34 19.6 % 10822 AAC 6G NR [CP-OPEM, 100% RR, 20 HHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,44 9.6 % 10824 AAC 6G NR [CP-OPEM, 100% RR, 10 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8,44 9.6 %						
10903 AAC 56 NR (CP-OPIM, 198, 100 MHz, OPSK, 30 MHz) 56 NR (RFH TDD 8, 34 9, 9, 5% 10905 AAC 55 NR (CP-OPIM, 50% RB, 10 MHz, OPSK, 30 HHz) 56 NR (RF 1DD 8, 34 9, 9, 5% 10909 AAC 55 NR (CP-OFIM, 50% RB, 10 MHz, OPSK, 30 HHz) 56 NR (RF 1DD 8, 34 9, 9, 5% 10910 AAC 55 NR (CP-OFIM, 50% RB, 50 MHz, OPSK, 30 HHz) 55 NR (RF 1DD 8, 34 9, 9, 5% 10912 AAC 55 NR (CP-OFDM, 50% RB, 60 MHz, OPSK, 30 HHz) 55 NR (RF 1DD 8, 35 9, 9, 6% 10912 AAC 55 NR (CP-OFDM, 100% RB, 60 MHz, OPSK, 30 HHz) 55 NR (RF 1DD 8, 34 9, 9, 6% 10918 AAC 56 NR (CP-OFDM, 100% RB, 25 MHz, OPSK, 30 HHz) 55 NR (RF 1DD 8, 34 9, 9, 6% 10820 AAC 56 NR (CP-OFDM, 100% RB, 25 MHz, OPSK, 30 HHz) 56 NR (RF 1DD 8, 34 9, 9, 6% 10821 AAC 56 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 56 NR (RF 1DD 8, 44 9, 6 % 10824 AAC 56 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 50 HHz) 56 NR (RF 1DD 8, 44 9, 6 %						((
AAC Son R (CP-OPDM, 50% RB, 10 MHz, OPSK, 30 HHz) Son R FRI TDD 8.37 ± 9.6 % 10806 AAC Son R (CP-OPDM, 50% RB, 30 MHz, OPSK, 30 HHz) Son R FRI TDD 8.37 ± 9.6 % 10810 AAC Son R (CP-OFDM, 50% RB, 30 MHz, OPSK, 30 HHz) Son R FRI TDD 8.34 ± 9.6 % 10817 AAC Son R (CP-OFDM, 50% RB, 30 MHz, OPSK, 30 HHz) Son R FRI TDD 8.35 ± 9.6 % 10817 AAC Son R (CP-OFDM, 100% RB, 10 MHz, OPSK, 30 HHz) Son R FRI TDD 8.33 ± 9.6 % 10818 AAC Son R (CP-OFDM, 100% RB, 20 MHz, OPSK, 30 HHz) Son R FRI TDD 8.33 ± 9.6 % 10821 AAC Son R (CP-OFDM, 100% RB, 20 MHz, OPSK, 30 HHz) Son R FRI TDD 8.41 ± 9.6 % 10823 AAC Son R (CP-OFDM, 100% RB, 20 MHz, OPSK, 30 HHz) Son R FRI TDD 8.41 ± 9.6 % 10823 AAC Son R (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) Son R FRI TDD 8.42 ± 9.6 % 10823 AAC Son R (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) Son R FRI TDD 4.42 ± 9.6 %		ļ			7.87	
10806 AAC 65 NR (CP-OPDM, 50% RB, 15 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.37 ± 9.6 % 10810 AAC 55 NR (CP-OPDM, 50% RB, 40 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.34 ± 9.6 % 10812 AAC 55 NR (CP-OFDM, 50% RB, 60 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.35 ± 9.6 % 10817 AAC 55 NR (CP-OFDM, 100% RB, 56 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.33 ± 9.6 % 10818 AAC 55 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.33 ± 9.6 % 10820 AAC 55 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.33 ± 9.6 % 10821 AAC 55 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.41 ± 9.6 % 10822 AAC 55 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 55 NR FRI TDD 8.41 ± 9.6 % 10824 AAC 55 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 50 HHz) 55 NR FRI TDD 8.42 ± 9.6 % 10824 AAC 55 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 50 HHz) 55 NR FRI TDD 8.43 ± 9.6 % <td></td> <td></td> <td></td> <td></td> <td>7,93</td> <td>± 9.6 %</td>					7,93	± 9.6 %
19809 AAC SG NR (CP-OFDM, 698 KB, 30 MHz, QPSK, 30 KHz) SG NR (FR TDD) 8,34 ±9.6 % 10917 AAC SG NR (CP-OFDM, 698 KB, 60 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,35 ±9.6 % 10917 AAC SG NR (CP-OFDM, 699 KB, 56 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,35 ±9.6 % 10918 AAC SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,34 ±9.6 % 10919 AAC SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,34 ±9.6 % 10921 AAC SG NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,41 ±9.6 % 10923 AAC SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,41 ±9.6 % 10924 AAC SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,41 ±9.6 % 10923 AAC SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,42 ±9.6 % 10924 AAC SG NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 7,73 ±9.6 % <t< td=""><td></td><td></td><td></td><td></td><td>8.34</td><td>±9.6 %</td></t<>					8.34	±9.6 %
19910 AAC SG NR (2P-OFDM, 599K BB, 40 MHz, QPSK, 30 KHz) SG NR (FR TDD) 8,33 ±9,6 % 19917 AAC SG NR (2P-OFDM, 599K BB, 50 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,33 ±9,6 % 19918 AAC SG NR (2P-OFDM, 100% RB, 5 MHz, QPSK, 30 KHz) SG NR FR TDD) 8,33 ±9,6 % 19919 AAC SG NR (2P-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz) SG NR FR TDD) 8,33 ±9,6 % 19820 AAC SG NR (2P-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz) SG NR FR TDD) 8,34 ±9,6 % 19821 AAC SG NR (2P-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz) SG NR FR TDD) 8,41 ±9,6 % 19824 AAC SG NR (2P-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz) SG NR FR TDD) 8,38 ±9,6 % 19824 AAC SG NR (2P-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz) SG NR FR TDD) 8,41 ±9,6 % 19824 AAC SG NR (2P-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz) SG NR FR TDD) 8,43 ±9,6 % 19824 AAC SG NR (2P-OFDM, 100% RB, 20 MHz, QPSK, 50 kHz) SG NR FR TDD) 7,73 ±9,6 %				5G NR FR1 TDD	8.37	
10917 AAC SS NR (CP-OFEM, 100% RB, 60 MHz, QPSK, 30 HHz) SG NR FR TDD 8.35 ± 9.6 % 10917 AAC SG NR (CP-OFEM, 100% RB, 10 MHz, QPSK, 30 HHz) SG NR FR TDD 8.34 ± 9.6 % 10919 AAC SG NR (CP-OFEM, 100% RB, 15 MHz, QPSK, 30 HHz) SG NR FR TDD 8.34 ± 9.6 % 10920 AAC SG NR (CP-OFEM, 100% RB, 20 HHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10921 AAC SG NR (CP-OFEM, 100% RB, 20 HHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10923 AAC SG NR (CP-OFEM, 100% RB, 20 HHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10924 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10925 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 30 HHz) SG NR FR TDD 8.42 ± 9.6 % 10926 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 30 HHz) SG NR FR TDD 7.73 ± 9.6 % 10927 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 50 MHz) SG NR FR TDD 7.73 ± 9.6 %		AAC		5G NR FR1 TDD	8.34	±9.6 %
10917 AAC SS NR (CP-OFEM, 100% RB, 60 MHz, QPSK, 30 HHz) SG NR FR TDD 8.35 ± 9.6 % 10917 AAC SG NR (CP-OFEM, 100% RB, 10 MHz, QPSK, 30 HHz) SG NR FR TDD 8.34 ± 9.6 % 10919 AAC SG NR (CP-OFEM, 100% RB, 15 MHz, QPSK, 30 HHz) SG NR FR TDD 8.34 ± 9.6 % 10920 AAC SG NR (CP-OFEM, 100% RB, 20 HHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10921 AAC SG NR (CP-OFEM, 100% RB, 20 HHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10923 AAC SG NR (CP-OFEM, 100% RB, 20 HHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10924 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 30 HHz) SG NR FR TDD 8.41 ± 9.6 % 10925 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 30 HHz) SG NR FR TDD 8.42 ± 9.6 % 10926 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 30 HHz) SG NR FR TDD 7.73 ± 9.6 % 10927 AAC SG NR (CP-OFEM, 100% RB, 20 MHz, QPSK, 50 MHz) SG NR FR TDD 7.73 ± 9.6 %	10810	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	
10919 AAC 56 NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 6.33 ±9.6 % 10920 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.43 ±9.6 % 10821 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.44 ±9.6 % 10822 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.44 ±9.6 % 10823 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.41 ±9.6 % 10824 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.41 ±9.6 % 10825 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.42 ±9.6 % 10826 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 50 Hz) 5G NR FR1 TDD 8.43 ±9.6 % 10827 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 50 Mtz) 5G NR FR1 TDD 7.73 ±9.6 % 10828 AAC 5G NR (CP-OFDM, 108, 50 MHz, QPSK, 50 Mtz) 5G NR FR1 TDD 7.74 ±9.6 %	10812	AAC	5G NR (CP-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	±9.6 %
10818 AAC 5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.33 ±9.6 % 10820 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.30 ±9.6 % 10821 AAC 5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.41 ±9.6 % 10923 AAC 5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.43 ±9.6 % 10923 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.43 ±9.6 % 10924 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.42 ±9.6 % 10925 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 8.42 ±9.6 % 10828 AAC 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 Hz) 5G NR FR1 TDD 7.73 ±9.6 % 10830 AAC 5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 50 Hz) 5G NR FR1 TDD 7.74 ±9.6 % 10831 AAC 5G NR (CP-OFDM, 108, 60 MHz, QPSK, 60 Hz) 5G NR FR1 TDD 7.76 ±9.6 %	10817	AAC	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	±9.6 %
10e19 AAC GS NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 HHz) GS NR FR1 TDD 6.33 ± 9.6 % 10920 AAC GS NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10921 AAC GS NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.36 ± 9.6 % 10924 AAC GS NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.36 ± 9.6 % 10924 AAC GS NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10924 AAC SG NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10927 AAC SG NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10828 AAC SG NR (CP-OFDM, 100% RB, 00 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.73 ± 9.6 % 10830 AAC SG NR (CP-OFDM, 1RB, 20 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.70 ± 9.6 % 10830 AAC SG NR (CP-OFDM, 1RB, 20 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.70 ± 9.6 %	10818	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	
10820 AAC GS NR (CP-OPDM, 100% RB, 20 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.30 ± 9.6 % 10821 AAC GS NR (CP-OPDM, 100% RB, 20 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10823 AAC GS NR (CP-OPDM, 100% RB, 30 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10824 AAC GS NR (CP-OPDM, 100% RB, 50 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10825 AAC GS NR (CP-OPDM, 100% RB, 50 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.43 ± 9.6 % 10826 AAC GS NR (CP-OPDM, 100% RB, 50 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.43 ± 9.6 % 10827 AAC GS NR (CP-OPDM, 100% RB, 50 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.43 ± 9.6 % 10828 AAC GS NR (CP-OPDM, 110% RB, 100 MHz, OPSK, 30 HHz) GS NR FR1 TDD 7.73 ± 9.6 % 10831 AAC GS NR (CP-OPDM, 11RB, 20 MHz, OPSK, 60 Hz) GS NR FR1 TDD 7.74 ± 9.6 % 10833 AAC GS NR (CP-OPDM, 11RB, 20 MHz, OPSK, 60 Hz) GS NR FR1 TDD 7.75 ± 9.6 % 10834 AAC GS NR (CP-OPDM, 11RB, 50 MHz, OPSK, 60 Hz)	10819	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.33	
10821 AAC GS NR (CP-OPDM, 100% RB, 26 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.41 ± 9.6 % 10824 AAC GS NR (CP-OPDM, 100% RB, 30 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.36 ± 9.6 % 10824 AAC GS NR (CP-OPDM, 100% RB, 50 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.36 ± 9.6 % 10825 AAC GS NR (CP-OPDM, 100% RB, 50 MHz, OPSK, 30 HHz) GS NR FR1 TDD 8.42 ± 9.6 % 10828 AAC GS NR (CP-OPDM, 100% RB, 80 MHz, OPSK, 30 Hz) GS NR FR1 TDD 8.42 ± 9.6 % 10828 AAC GS NR (CP-OPDM, 100% RB, 80 MHz, OPSK, 30 Hz) GS NR FR1 TDD 8.40 ± 9.6 % 10828 AAC GS NR (CP-OPDM, 110% RB, 80 MHz, OPSK, 30 Hz) GS NR FR1 TDD 7.73 ± 9.6 % 10830 AAC GS NR (CP-OPDM, 1 RB, 10 MHz, OPSK, 60 Hz) GS NR FR1 TDD 7.70 ± 9.6 % 10831 AAC GS NR (CP-OPDM, 1 RB, 20 MHz, OPSK, 60 Hz) GS NR FR1 TDD 7.70 ± 9.6 % 10834 AAC GS NR (CP-OPDM, 1 RB, 40 MHz, OPSK, 60 Hz) GS NR FR1 TDD 7.70 ± 9.6 % 10834 AAC GS NR (CP-OPDM, 1 RB, 40 MHz, OPSK, 60 Hz) GS	10820	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.30	
10822 AAC GS NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 HHz) GS NR FR1 TDD 6.4.1 ± 9.6 % 10824 AAC GS NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.3.9 ± 9.6 % 10825 AAC GS NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.4.2 ± 9.6 % 10827 AAC GS NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.4.2 ± 9.6 % 10828 AAC GS NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 HHz) GS NR FR1 TDD 8.4.3 ± 9.6 % 10829 AAC GS NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.6.3 ± 9.6 % 10831 AAC GS NR (CP-OFDM, 1RB, 20 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.7.4 ± 9.6 % 10832 AAC GS NR (CP-OFDM, 1RB, 20 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.7.5 ± 9.6 % 10834 AAC GS NR RCP-OFDM, 1RB, 20 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.7.5 ± 9.6 % 10835 AAC GS NR (CP-OFDM, 1RB, 90 MHz, QPSK, 60 KHz) GS NR FR1 TDD 7.60 ± 9.6 %	10821	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD		
10823 AAC 56 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.39 ± 9.6 %, 10825 10824 AAC 56 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.41 ± 9.6 %, 10825 10825 AAC 56 NR (CP-OFDM, 100% RB, 60 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.42 ± 9.6 %, 10829 10826 AAC 56 NR (CP-OFDM, 100% RB, 60 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.43 ± 9.6 %, 10829 10830 AAC 56 NR (CP-OFDM, 180, 10 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.63 ± 9.6 %, 10833 10831 AAC 56 NR (CP-OFDM, 181, 10 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.74 ± 9.6 %, 10833 10832 AAC 56 NR (CP-OFDM, 182, 20 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.70 ± 9.6 %, 10833 10834 AAC 56 NR (CP-OFDM, 182, 30 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.76 ± 9.6 %, 10837 10835 AAC 56 NR (CP-OFDM, 182, 50 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.76 ± 9.6 %, 10837 10836 AAC 56 NR (CP-OFDM, 188, 50 MHz, OPSK, 60 KHz) 56 NR FR1	10822	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD		* ***********************************
10824 AAC 56 NR (CP-OFDM, 100% RB, 50 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.39 ± 9.6 %, 10827 AAC 56 NR (CP-OFDM, 100% RB, 80 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.41 ± 9.6 %, 10828 AAC 56 NR (CP-OFDM, 100% RB, 80 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.42 ± 9.6 %, 10829 AAC 56 NR (CP-OFDM, 100% RB, 100 MHz, OPSK, 80 KHz) 56 NR FR1 TDD 7.63 ± 9.6 %, 10831 AAC 56 NR (CP-OFDM, 18, 10 MHz, QPSK, 80 KHz) 56 NR FR1 TDD 7.73 ± 9.6 %, 10832 AAC 56 NR (CP-OFDM, 18, 20 MHz, QPSK, 80 KHz) 56 NR FR1 TDD 7.74 ± 9.6 %, 10833 AAC 56 NR (CP-OFDM, 18, 20 MHz, QPSK, 80 KHz) 56 NR FR1 TDD 7.76 ± 9.6 %, 10836 AAC 56 NR (CP-OFDM, 18, 40 MHz, QPSK, 80 KHz) 56 NR FR1 TDD 7.66 ± 9.6 %, 10837 AAC 56 NR (CP-OFDM, 18, 50 MHz, QPSK, 60 KHz) 56 NR FR1 TDD 7.66 ± 9.6 %, 10838 AAC 56 NR (CP-OFDM, 18, 50 MHz, QPSK, 60 KHz) 56 NR FR1 TDD 7.66 ± 9.6 %,	10823	AAC		5G NR FR1 TDD		h
10825 AAC 56 NR (CP-OFDM, 100% RB, 80 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.41 ± 9.6 % 10827 AAC 56 NR (CP-OFDM, 100% RB, 90 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.42 ± 9.6 % 10828 AAC 56 NR (CP-OFDM, 100% RB, 100 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.43 ± 9.6 % 10830 AAC 56 NR (CP-OFDM, 18R, 10 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.63 ± 9.6 % 10831 AAC 56 NR (CP-OFDM, 18R, 10 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.73 ± 9.6 % 10832 AAC 56 NR (CP-OFDM, 18R, 20 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.76 ± 9.6 % 10833 AAC 56 NR (CP-OFDM, 18R, 30 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.76 ± 9.6 % 10835 AAC 56 NR (CP-OFDM, 18R, 50 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.76 ± 9.6 % 10836 AAC 56 NR (CP-OFDM, 18R, 50 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.76 ± 9.6 % 10837 AAC 56 NR (CP-OFDM, 18R, 90 MHz, OPSK, 60 HHz) 56 NR FR1 TDD 7.77 ± 9.6 %	10824	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD		
10827 AAC 56 NR (CP-OFDM, 100% RB, 90 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.42 ± 9.6 % 10828 AAC 56 NR (CP-OFDM, 100% RB, 100 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 8.43 ± 9.6 % 10830 AAC 56 NR (CP-OFDM, 10%, RB, 100 MHz, OPSK, 30 HHz) 56 NR FR1 TDD 7.63 ± 9.6 % 10831 AAC 56 NR (CP-OFDM, 18, 16 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.73 ± 9.6 % 10832 AAC 56 NR (CP-OFDM, 18, 20 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.73 ± 9.6 % 10833 AAC 56 NR (CP-OFDM, 18, 20 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.70 ± 9.6 % 10835 AAC 56 NR (CP-OFDM, 18, 40 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.68 ± 9.6 % 10836 AAC 56 NR (CP-OFDM, 18, 50 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.68 ± 9.6 % 10837 AAC 56 NR (CP-OFDM, 18, 50 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.71 ± 9.6 % 10838 AAC 56 NR (CP-OFDM, 18, 70 MHz, OPSK, 60 KHz) 56 NR FR1 TDD 7.71 ± 9.6 % 10840<	10825	AAC				
10828 AAC 56 NR (CP-OPDM, 100% RB, 30 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 8.43 ± 9.6 % 10830 AAC 5G NR (CP-OPDM, 10% RB, 100 MHz, QPSK, 30 HHz) 5G NR FR1 TDD 7.63 ± 9.6 % 10830 AAC 5G NR (CP-OPDM, 1 RB, 10 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.73 ± 9.6 % 10831 AAC 5G NR (CP-OPDM, 1 RB, 20 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.74 ± 9.6 % 10833 AAC 5G NR (CP-OPDM, 1 RB, 20 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.70 ± 9.6 % 10834 AAC 5G NR (CP-OPDM, 1 RB, 50 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.70 ± 9.6 % 10835 AAC 5G NR (CP-OPDM, 1 RB, 50 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.66 ± 9.6 % 10837 AAC 5G NR (CP-OPDM, 1 RB, 50 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.71 ± 9.6 % 10840 AAC 5G NR (CP-OPDM, 1 RB, 90 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.71 ± 9.6 % 10841 AAC 5G NR (CP-OPDM, 1 RB, 90 MHz, QPSK, 60 HHz) 5G NR FR1 TDD 7.71 ± 9.6 % <		AAC				
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10885 AAD 5G NR (DFT-S-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz) 5G NR FR2 TDD 6.61 ± 9.6 %	<u>}</u>	-				
	10885		56 NR (DFT-S-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.61	±9.6%

10886	AAD	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.65	± 9.6 %
10887	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10888	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.35	± 9.6 %
10889	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.02	± 9.6 %
10890	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.40	± 9.6 %
10891	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.13	± 9.6 %
10892	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.41	± 9.6 %
10897	AAA	5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.66	± 9.6 %
10898	AAA	5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 30 KHz)	5G NR FR1 TDD	5.67	$\pm 9.6\%$
			5G NR FR1 TDD		
10899		5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)		5.67	$\pm 9.6\%$
10900		5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10901	AAA	5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10902		5G NR (DFT-s-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10903	AAA	5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10904	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10905	AAA	5G NR (DFT-s-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10906	AAA	5G NR (DFT-s-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10907	AAA	5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.78	± 9.6 %
10908	AAA	5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.93	± 9.6 %
10909	AAA	5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.96	±9.6%
10910	AAA	5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.83	± 9.6 %
10911	AAA	5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.93	±9.6 %
10912	AAA	5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	±9.6 %
10913	AAA	5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10914	AAA	5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.85	±9.6 %
10915	AAA	5G NR (DFT-s-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.83	± 9.6 %
10916	AAA	5G NR (DFT-s-OFDM, 50% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.87	± 9.6 %
10917	AAA	5G NR (DFT-s-OFDM, 50% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.94	± 9,6 %
10918	AAA	5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.86	± 9.6 %
10919	AAA	5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.86	± 9.6 %
10920	AAA	5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.87	± 9.6 %
10921	AAA	5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5,84	± 9.6 %
10922	AAA	5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.82	± 9.6 %
10923		5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10924	AAA	5G NR (DFT-s-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10925	AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 30 KHz)	5G NR FR1 TDD	5.95	± 9.6 %
			5G NR FR1 TDD	Į	4
10926	AAA	5G NR (DFT-s-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10927	AAA	5G NR (DFT-s-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)		5.94	
10928		5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.52	± 9.6 %
10929	AAA	5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.52	±9.6 %
10930	AAA	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.52	± 9.6 %
10931	AAA	5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10932	AAA	5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10933	AAA	5G NR (DFT-s-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10934	AAA	5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10935	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10936	AAA	5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.90	± 9.6 %
10937	AAA	5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.77	± 9.6 %
10938	AAA	5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.90	± 9.6 %
10939	AAA	5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.82	± 9.6 %
10940	AAA	5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.89	±9.6 %
10941	AAA	5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.83	±9.6 %
10942	AAA	5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.85	± 9.6 %
10943	AAA	5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.95	± 9.6 %
10944	AAA	5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.81	± 9.6 %
10945	AAA	5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.85	± 9.6 %
10946		5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.83	± 9.6 %
10940	AAA	5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.87	± 9.6 %
10947		5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 15 KHz)	5G NR FR1 FDD	5.94	± 9.6 %
10948		5G NR (DFT-s-OFDM, 100% RB, 25 MHZ, QPSK, 15 KHZ)	5G NR FR1 FDD	5.94	$\pm 9.6\%$
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10950	AAA	5G NR (DFT-s-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.94	± 9.6 %
10951	AAA AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.92	± 9.6 %
	1 444	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.25	± 9.6 %
10952 10953	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8,15	± 9.6 %

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10954	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.23	±9.6 %
10955	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.42	±9.6 %
10956	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.14	±9.6 %
10957	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.31	±9.6 %
10958	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.61	±9.6 %
10959	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.33	±9.6 %
10960	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.32	± 9.6 %
10961	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.36	±9.6 %
10962	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.40	± 9.6 %
10963	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.55	±9.6 %
10964	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.29	±9.6 %
10965	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.37	± 9.6 %
10966	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.55	± 9.6 %
10967	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.42	± 9.6 %
10968	AAA	5G NR DL (CP-OFDM, TM 3.1, 100 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.49	± 9.6 %

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Calibration Laboratory of

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



S

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PC Test Client

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CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7357	
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes	
Calibration date:	BN* April 21, 2020 빅 ろ이 ²⁰²	5

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: CC2552 (20x)	31-Mar-20 (No. 217-03106)	Арг-21
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	íD	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
			YEL
Approved by:	Katja Pokovic	Technical Manager	au
			Issued: April 21, 2020
This calibration certificate	shall not be reproduced except in ful	without written approval of the lal	boratory.

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Glossarv:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization 9	9 rotation around an axis that is in the plane normal to probe axis (at measurement center),
	i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- Techniques", June 2013
 b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from handheld and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORMx, y, z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx, y, z are only intermediate values, i.e., the uncertainties of NORMx, y, z does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y, z * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Accreditation No.: SCS 0108

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m) ²) ^A	0.37	0.48	0.40	± 10.1 %
DCP (mV) ^B	95.5	99.2	96.4	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dBõV	С	D dB	VR mV	Max dev.	Max Unc ^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	156.2	± 3.3 %	±4.7 %
		Y	0.00	0.00	1.00		141.1		
		Z	0.00	0.00	1.00		140.3		
10352-	Pulse Waveform (200Hz, 10%)	X	1.49	60.26	8.05	10.00	60.0	± 2.9 %	± 9.6 %
AAA		Y	20.00	90.70	20.05	Į	60.0	1	
		Z	2.86	66.88	11.41		60.0	1	
10353-	Pulse Waveform (200Hz, 20%)	X	1.17	61.48	7.19	6.99	80.0	±1.9 %	±9.6 %
AAA		Y	20.00	94.00	20.46	1	80.0]	
		Z	2.25	67.67	10.40	1	80.0		
10354-	Pulse Waveform (200Hz, 40%)	X	0.52	60.00	4.84	3.98	95.0	± 1.3 %	±9.6 %
AAA		Y	20.00	108.82	25.95]	95.0]	
		Z	0.59	61.41	6.05		95.0		
10355-	Pulse Waveform (200Hz, 60%)	X	0.33	60.00	3.18	2.22	120.0	± 1.5 %	± 9.6 %
AAA		Y	20.00	129.02	33.26		120.0		
		Z	0.27	60.00	3.64		120.0		
10387-	QPSK Waveform, 1 MHz	X	1.80	70.53	16.45	1,00	150.0	± 3.7 %	±9.6 %
AAA		Y	1.73	67.34	15.67		150.0]	
		Z	1.50	67.44	14.91		150.0		
10388-	QPSK Waveform, 10 MHz	X	2.20	69.69	16.83	0.00	150.0	±0.9%	± 9.6 %
AAA		Y	2.31	69.01	16.37		150.0		
		Z	2.03	68.14	15.83		150.0		
10396-	64-QAM Waveform, 100 kHz	X	2.40	69.28	18.92	3.01	150.0	± 1.8 %	± 9.6 %
AAA		Y	2.42	67.35	17.31]	150.0	1	
		Z	2.37	68.43	18.30		150.0		
10399-	64-QAM Waveform, 40 MHz	X	3.53	67.93	16.49	0.00	150.0	± 2.3 %	± 9.6 %
AAA		Y	3.54	67.47	16.05		150.0		
		Z	3.33	66.93	15.79		150.0		
10414-	WLAN CCDF, 64-QAM, 40MHz	X	4.78	66.12	16.12	0.00	150.0	± 4.4 %	±9.6 %
AAA		Y	4.85	65.79	15.69		150.0		
		Z	4.77	66.08	15.90		150.0		1

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6). ^B Numerical linearization parameter: uncertainty not required. ^E Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

α V⁻¹ **T2** Т3 **T4** Т5 **T6** C1 C2 T1 V-2 **V**⁻¹ <u>ms.V⁻²</u> ms.V⁻¹ fF fF ms 0.33 0.00 1.01 Х 34.1 271.92 40.14 5.37 0.70 5.00 1.00 Y 43.4 323.73 35.56 8.59 0.04 5.08 0.03 0.39 0.35 1.01 Ζ 34.8 269.09 37.94 4.60 0.50 5.05 0.00

Sensor Model Parameters

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	12.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
30	55.0	0.75	17.02	17.02	17.02	0.00	1.00	± 13.3 %
64	54.2	0.75	14.93	14.93	14.93	0.00	1.00	± 13.3 %
750	41.9	0.89	10.23	10.23	10.23	0.61	0.80	± 12.0 %
835	41.5	0.90	9.96	9.96	9.96	0.51	0.83	± 12.0 %
1750	40.1	1.37	8.69	8.69	8.69	0.30	0.86	± 12.0 %
1900	40.0	1.40	8.32	8.32	8.32	0.33	0.86	± 12.0 %
2300	39.5	1.67	7.92	7.92	7.92	0.28	0.90	± 12.0 %
2450	39.2	1.80	7.78	7.78	7.78	0.34	0.90	± 12.0 %
2600	39.0	1.96	7.43	7.43	7.43	0.38	0.90	± 12.0 %
3500	37.9	2.91	7.42	7.42	7.42	0.30	1.30	± 13.1 %
3700	37.7	3.12	7.28	7.28	7.28	0.30	1.30	± 13.1 %
5250	35.9	4.71	5.50	5.50	5.50	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.93	4.93	4.93	0.40	1.80	± 13.1 %
5750	35.4	5.22	5.05	5.05	5.05	0.40	1.80	± 13.1 %

Calibration Parameter Determined in Head Tissue Simulating Media

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. ^f At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters. ^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.