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E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Head TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1090

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.37$ S/m; $\epsilon_r = 41.27$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.38, 8.38, 8.38) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

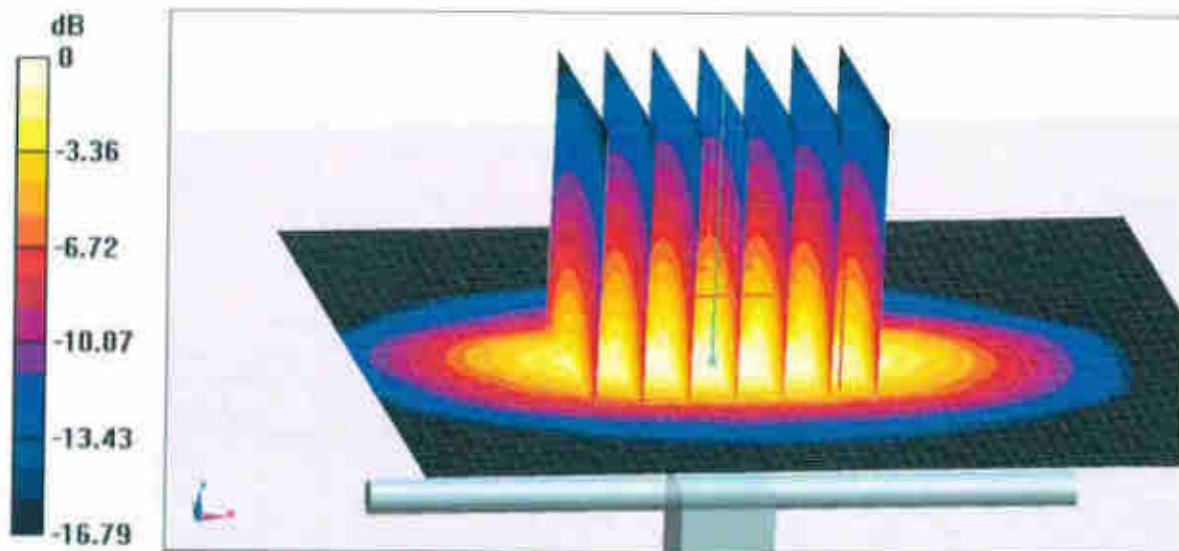
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
 $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 89.03 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.79 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



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



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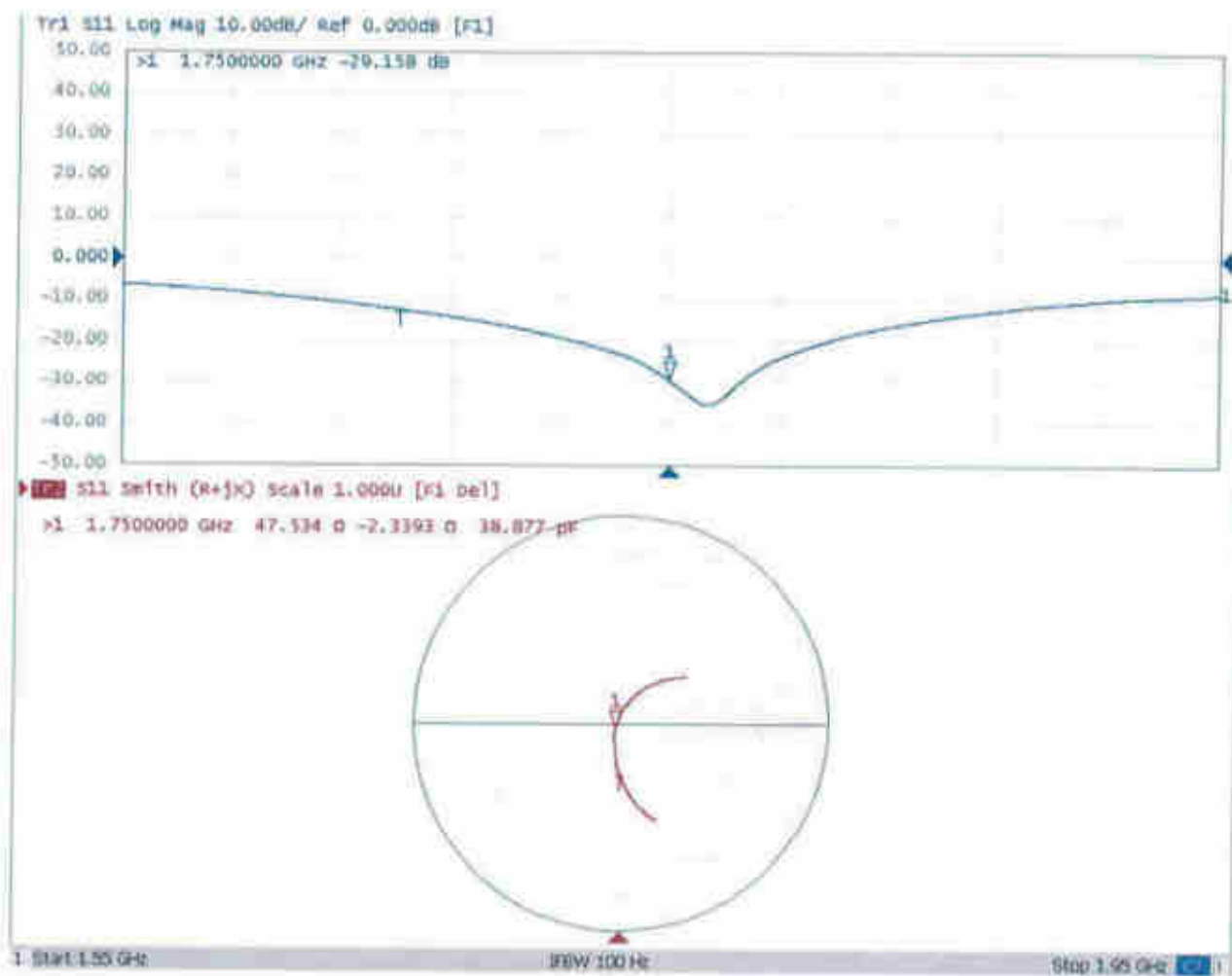
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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1090

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.449$ S/m; $\epsilon_r = 54.97$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.03, 8.03, 8.03) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

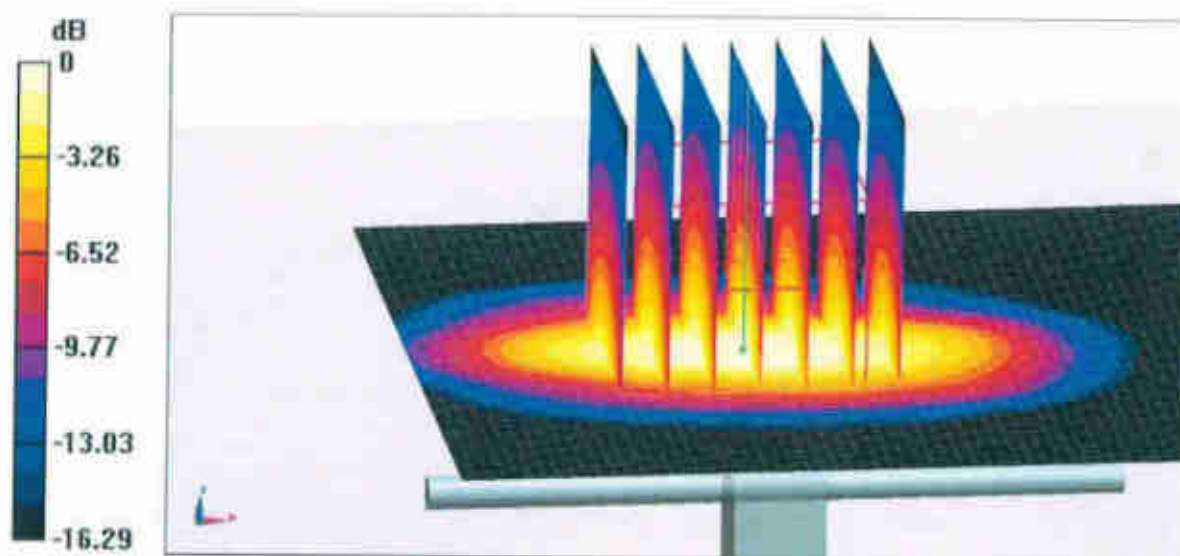
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 93.13 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.8 W/kg

SAR(1 g) = 9.21 W/kg; SAR(10 g) = 4.89 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



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



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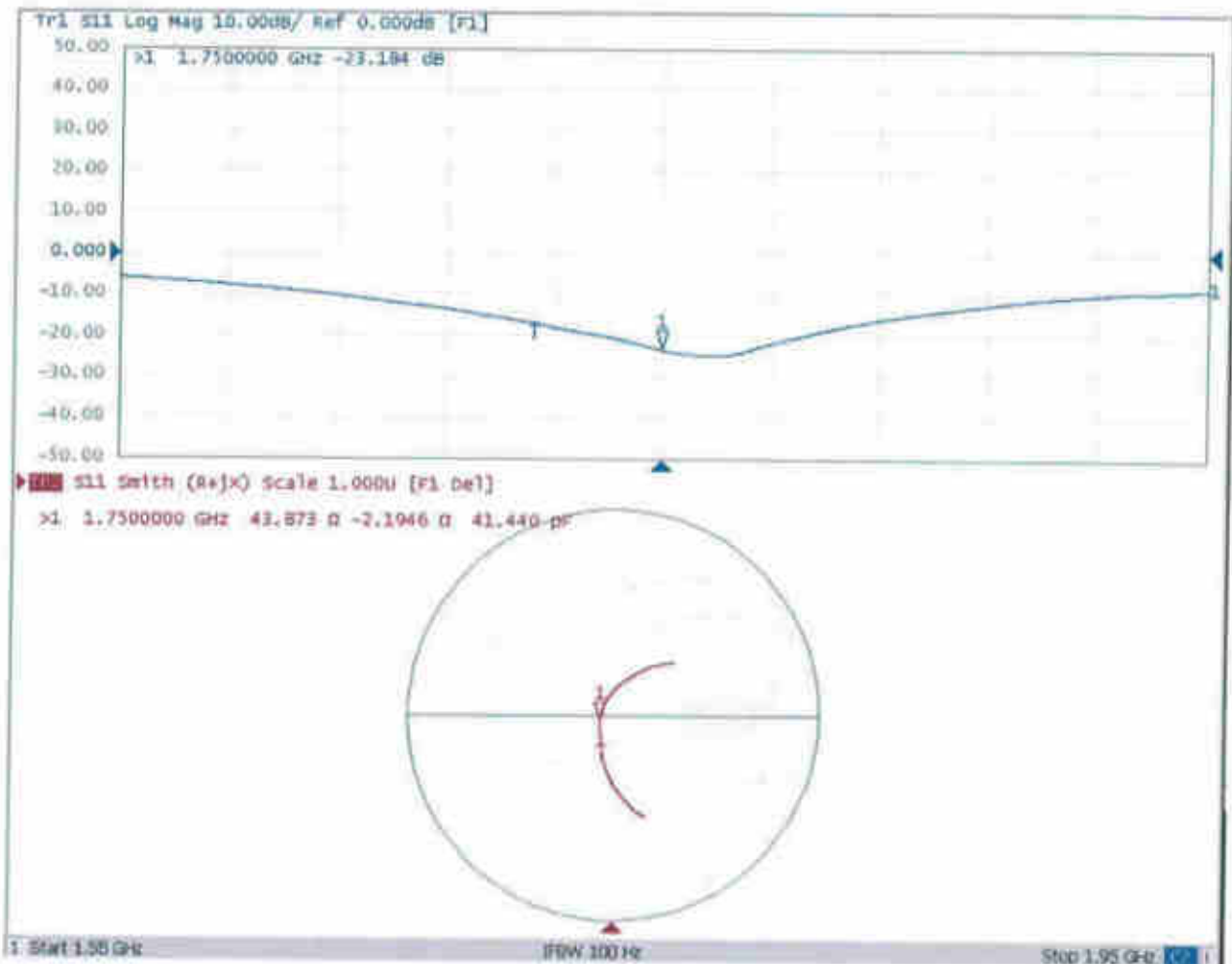
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Impedance Measurement Plot for Body TSL





D1750V2, Serial No. 1090 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss ($< -20\text{dB}$, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

1750V2 – serial no. 1090

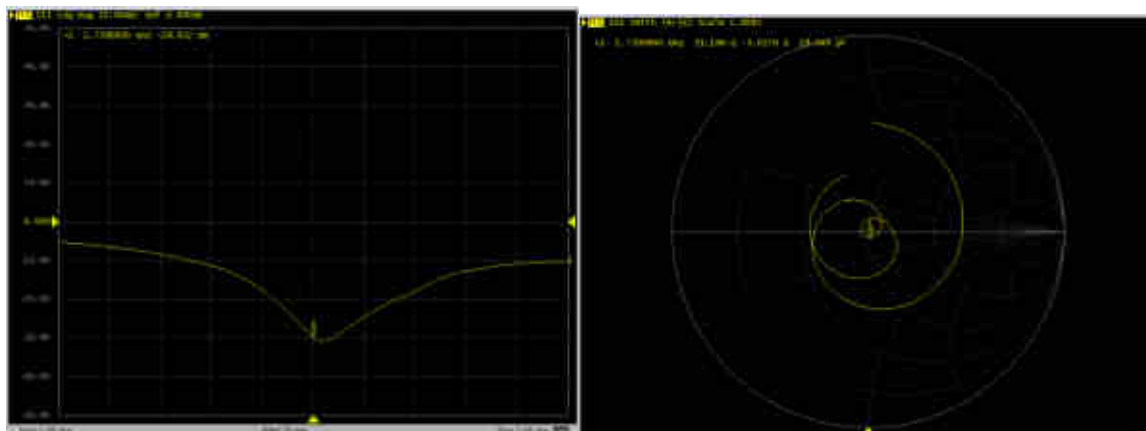
1750V2 – serial no. 1090												
1750 Head							1750 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.27	-29.2		47.5		-2.3		-23.2		43.9		-2.2	
2020.3.26	-29.8	-0.02	51.2	-3.66	-3.0	0.70	-25.0	-0.08	45.1	-1.22	-2.17	-0.02

<Justification of the extended calibration>

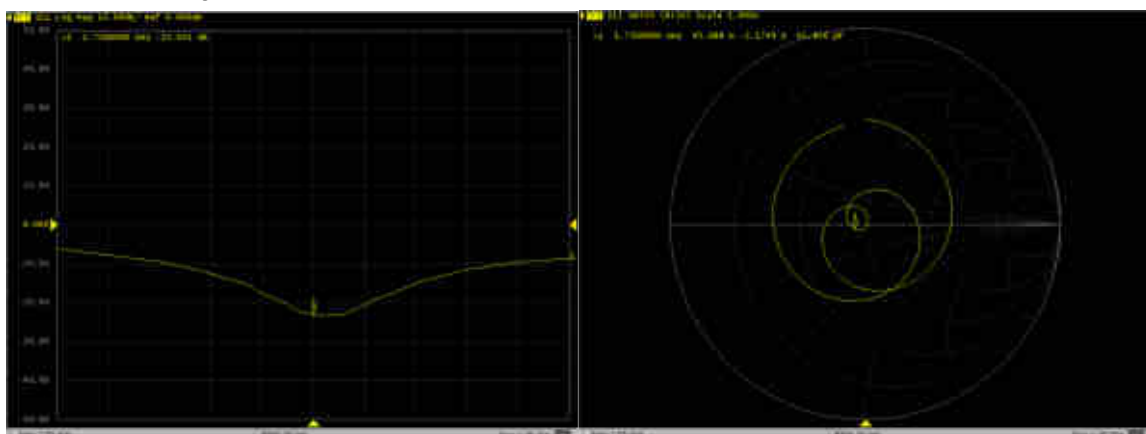
The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1750V2, serial no. 1090

1750MHz – Head



1750MHz – Body





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Client

Sporton

Certificate No: **Z19-60085**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d170**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **March 26, 2019**

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: March 29, 2019

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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:

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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%.



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Measurement Conditions

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

DASY Version	DASY52	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 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 $\pm$ 0.2) °C	40.5 $\pm$ 6 %	1.44 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.0 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.3 W/kg $\pm$ 18.7 % (k=2)

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 $\pm$ 0.2) °C	54.5 $\pm$ 6 %	1.56 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.0 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.0 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$51.7\Omega + 6.73j\Omega$
Return Loss	- 23.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$47.8\Omega + 6.72j\Omega$
Return Loss	- 22.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 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
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DASY5 Validation Report for Head TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.441$ S/m; $\epsilon_r = 40.48$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.14, 8.14, 8.14) @ 1900 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

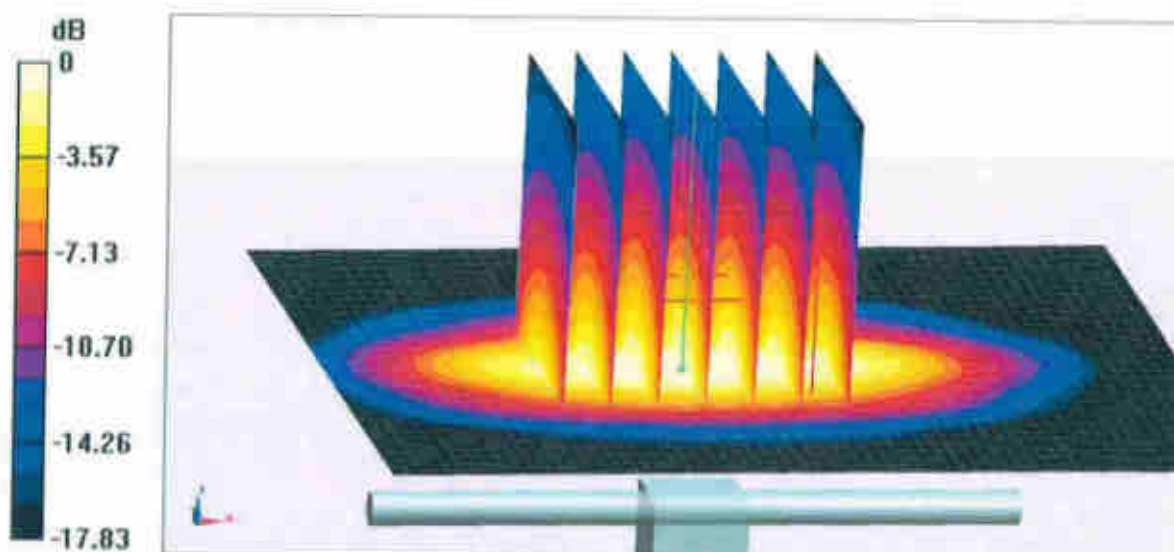
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
 $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 97.54 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5.12 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



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

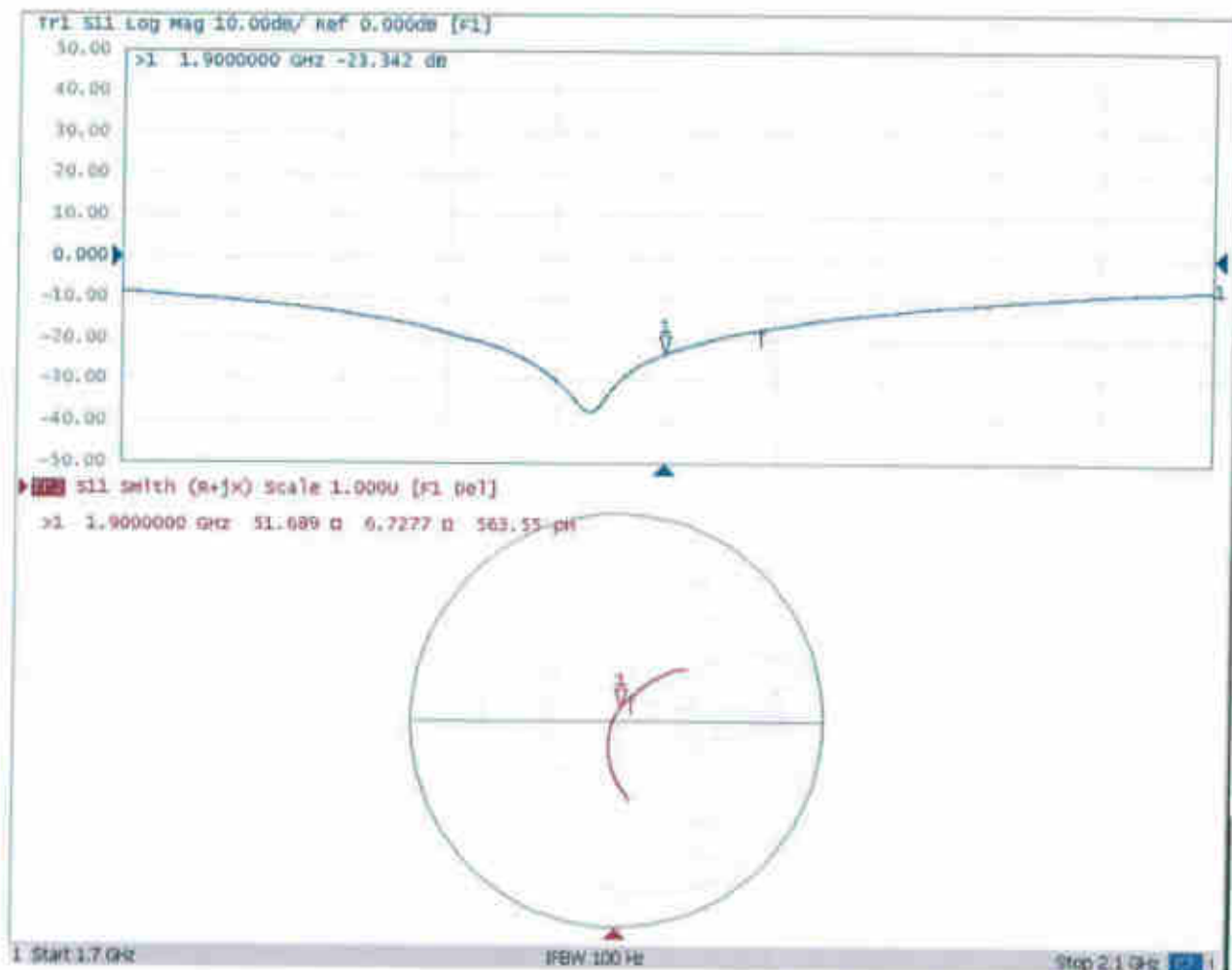


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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ S/m; $\epsilon_r = 54.52$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.78, 7.78, 7.78) @ 1900 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

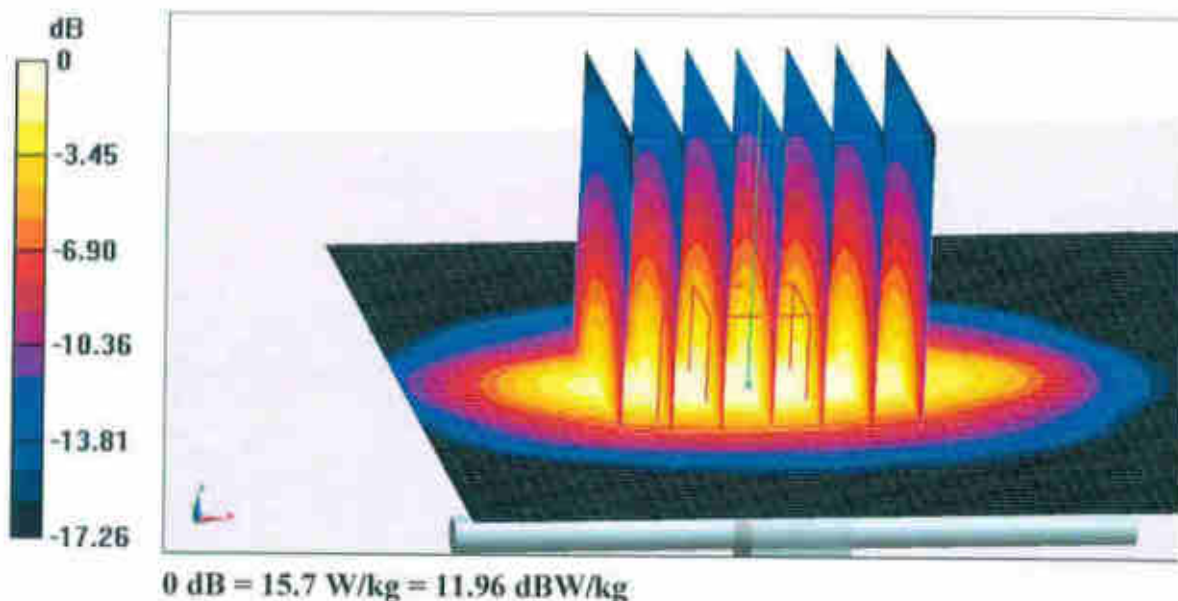
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 95.48 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 15.7 W/kg





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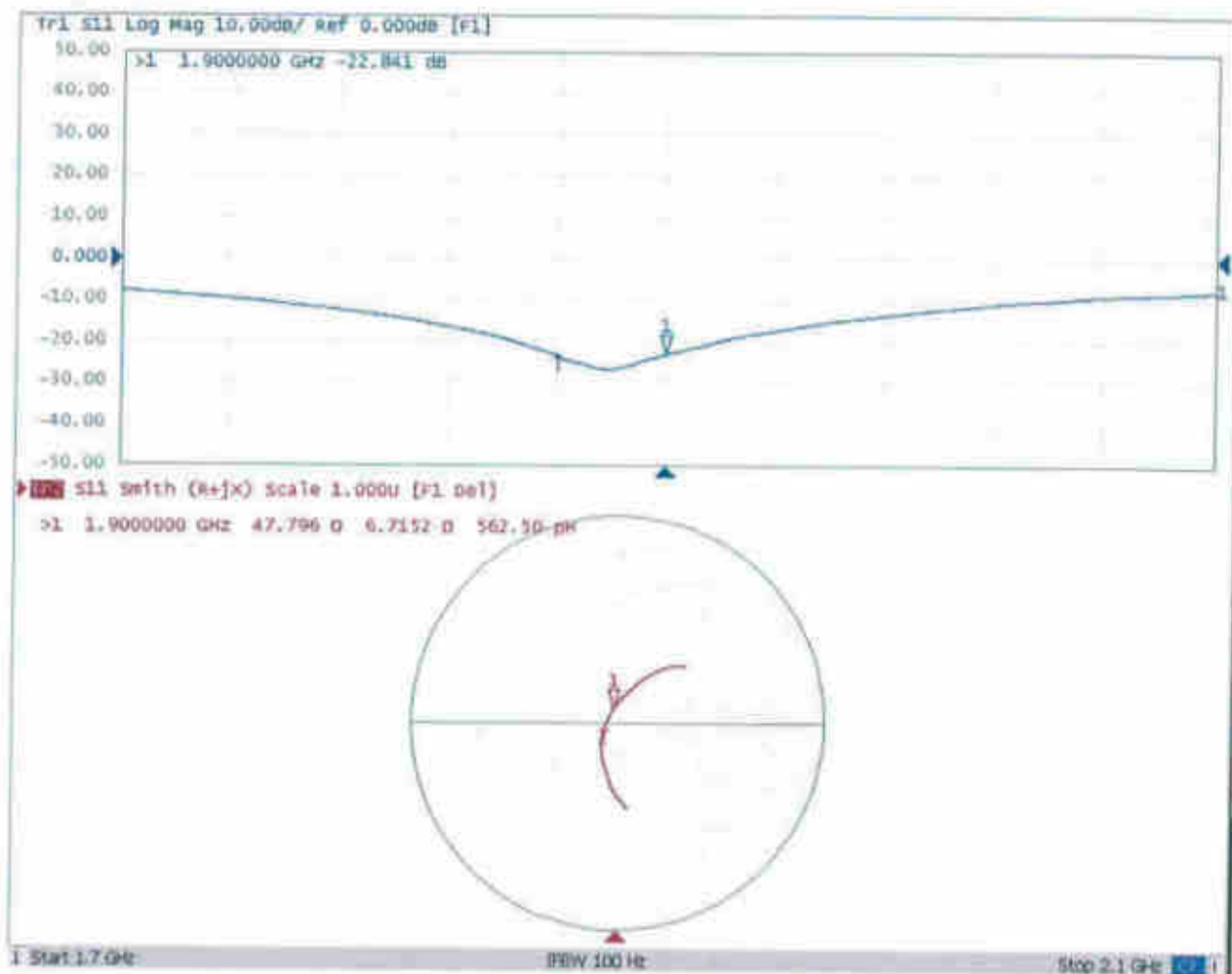
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Impedance Measurement Plot for Body TSL





D1900V2, Serial No. 5d170 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss ($< -20\text{dB}$, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

1900V2 – serial no. 5d170

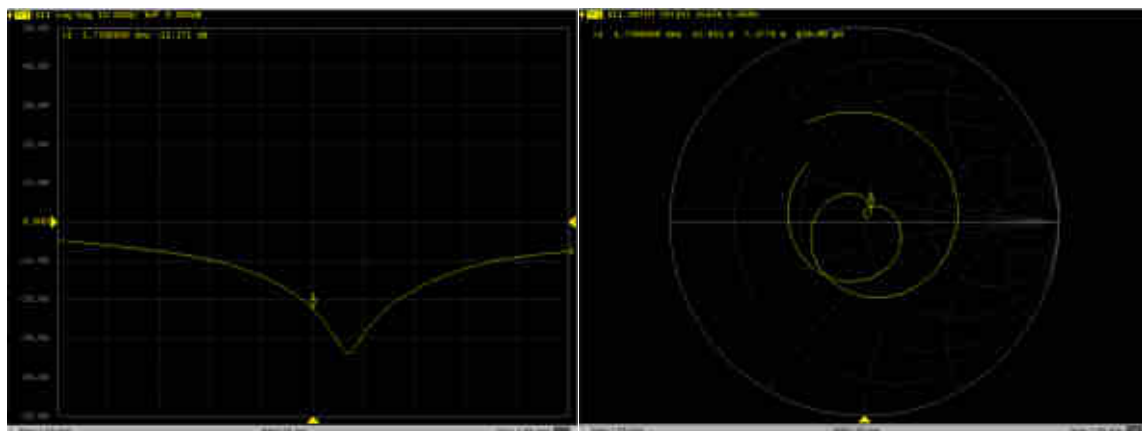
1900V2 – serial no. 5d170												
1900 Head							1900 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.26	-23.3		51.7		6.7		-22.8		47.8		6.7	
2020.3.25	-22.3	0.05	53.0	-1.26	7.4	-0.64	-22.5	0.01	49.2	-1.37	7.41	-0.69

<Justification of the extended calibration>

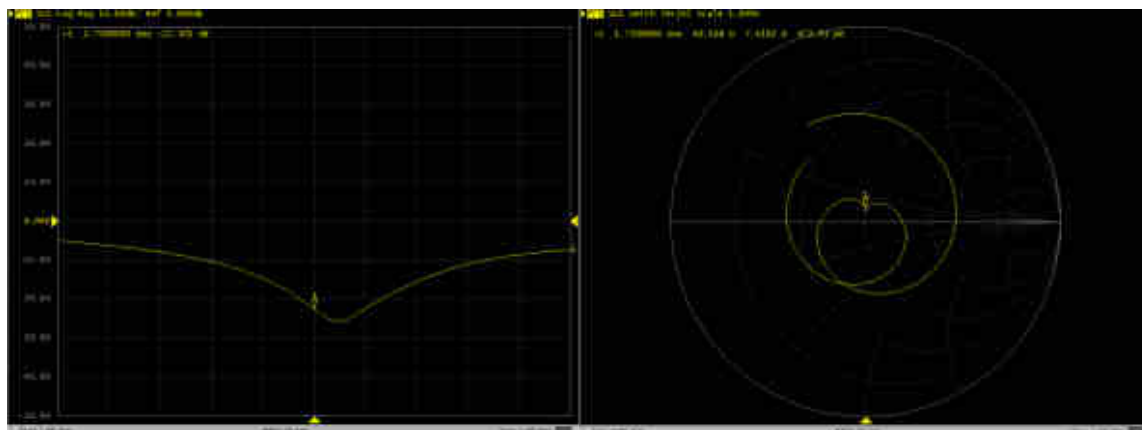
The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1900V2, serial no. 5d170

1900MHz – Head



1900MHz – Body





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Certificate No: **Z19-60087**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 908**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **March 25, 2019**

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 $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: March 28, 2019

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http://www.chinattl.cn

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:

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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%.



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Measurement Conditions

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

DASY Version	DASY52	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 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 $\pm$ 0.2) °C	39.6 $\pm$ 6 %	1.84 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.8 W/kg $\pm$ 18.6 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 W/kg $\pm$ 18.7 % (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 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	2.00 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$57.3\Omega + 5.18j\Omega$
Return Loss	- 21.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$52.6\Omega + 5.81j\Omega$
Return Loss	- 24.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.020 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: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.841$ S/m; $\epsilon_r = 39.63$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.62, 7.62, 7.62) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

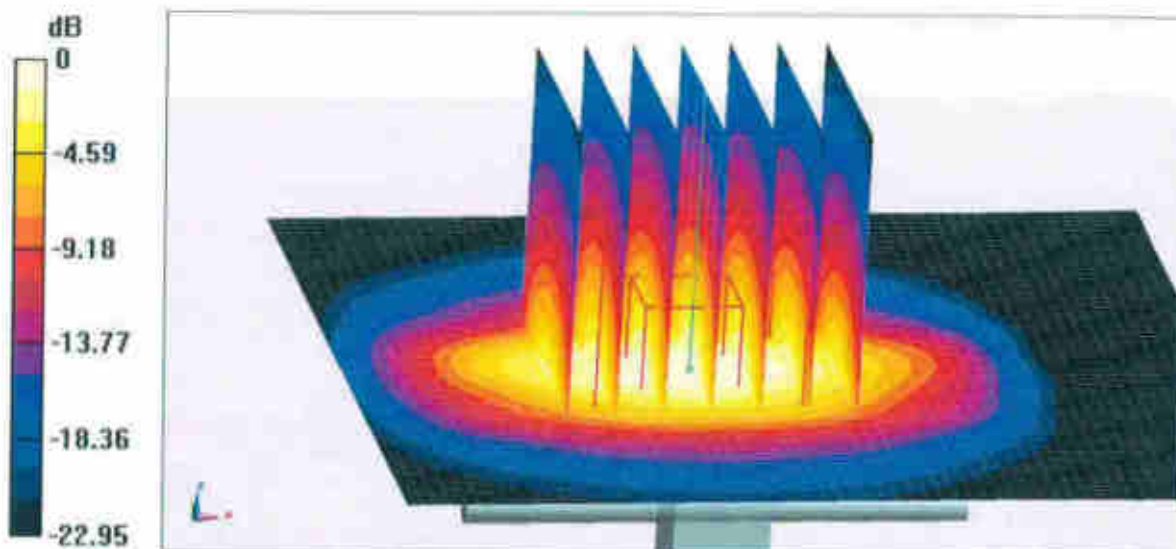
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.04 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 22.4 W/kg

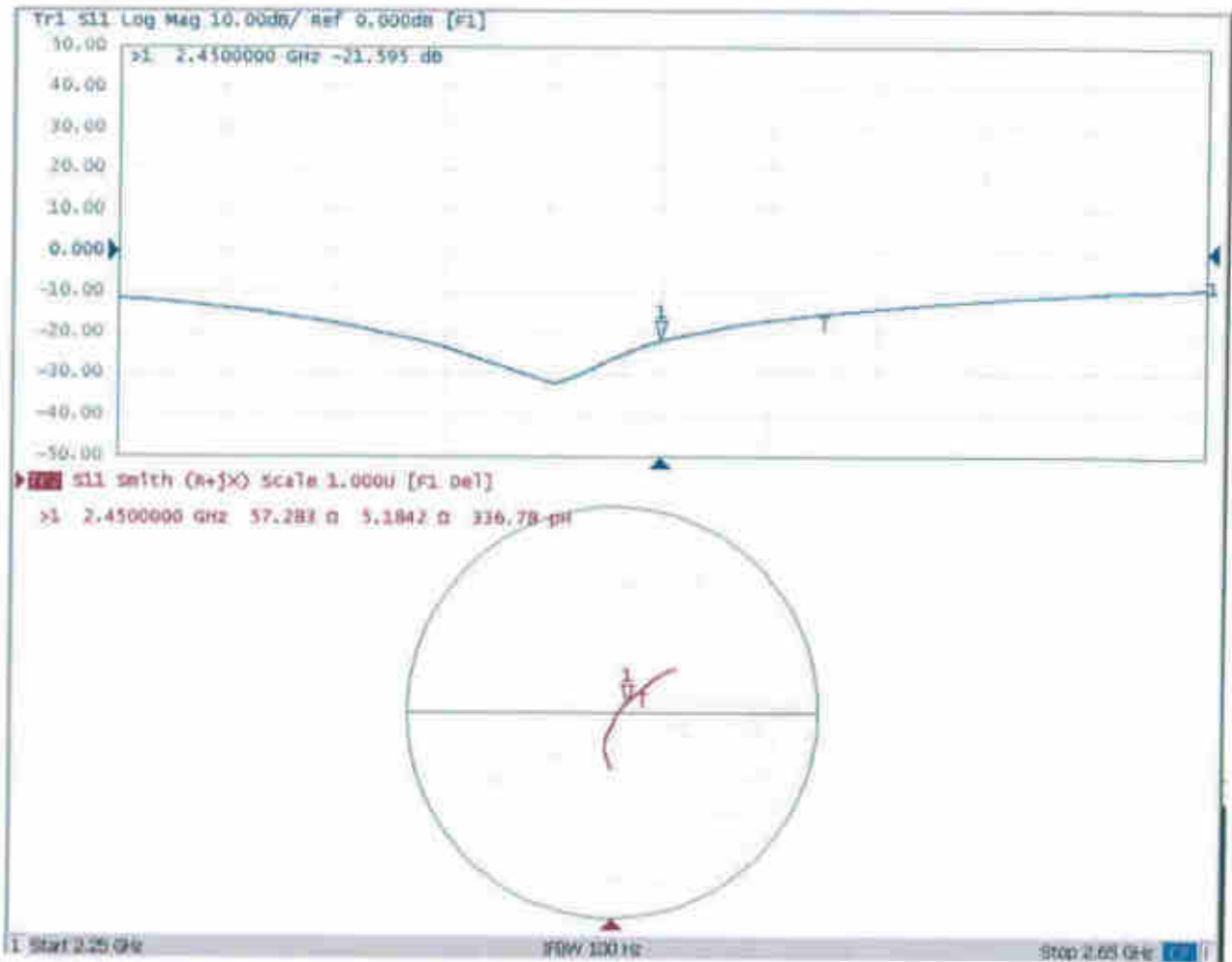




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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.003$ S/m; $\epsilon_r = 53.78$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.79, 7.79, 7.79) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

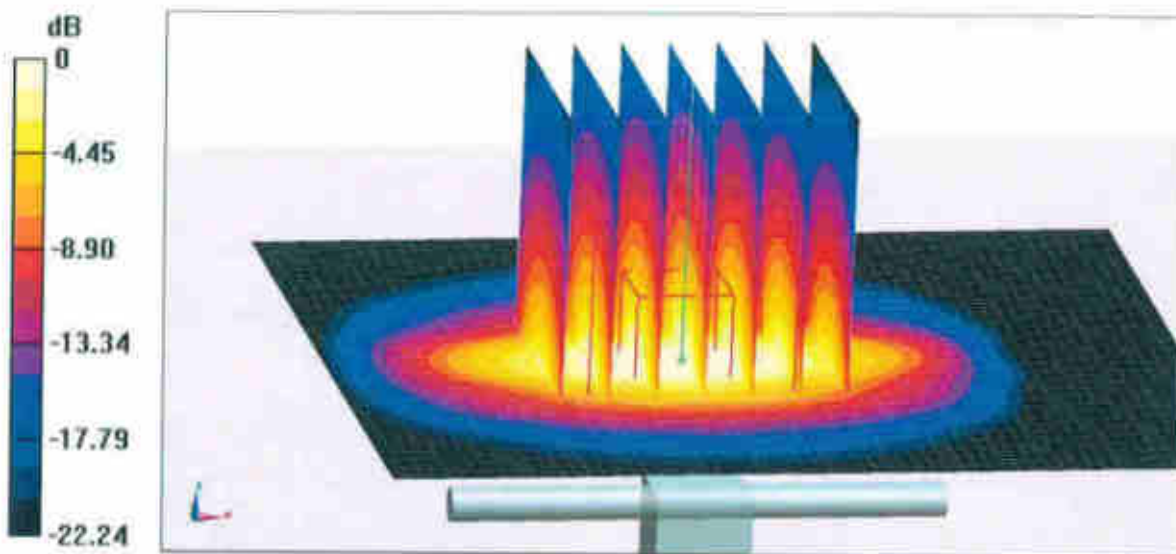
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.51 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.91 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg



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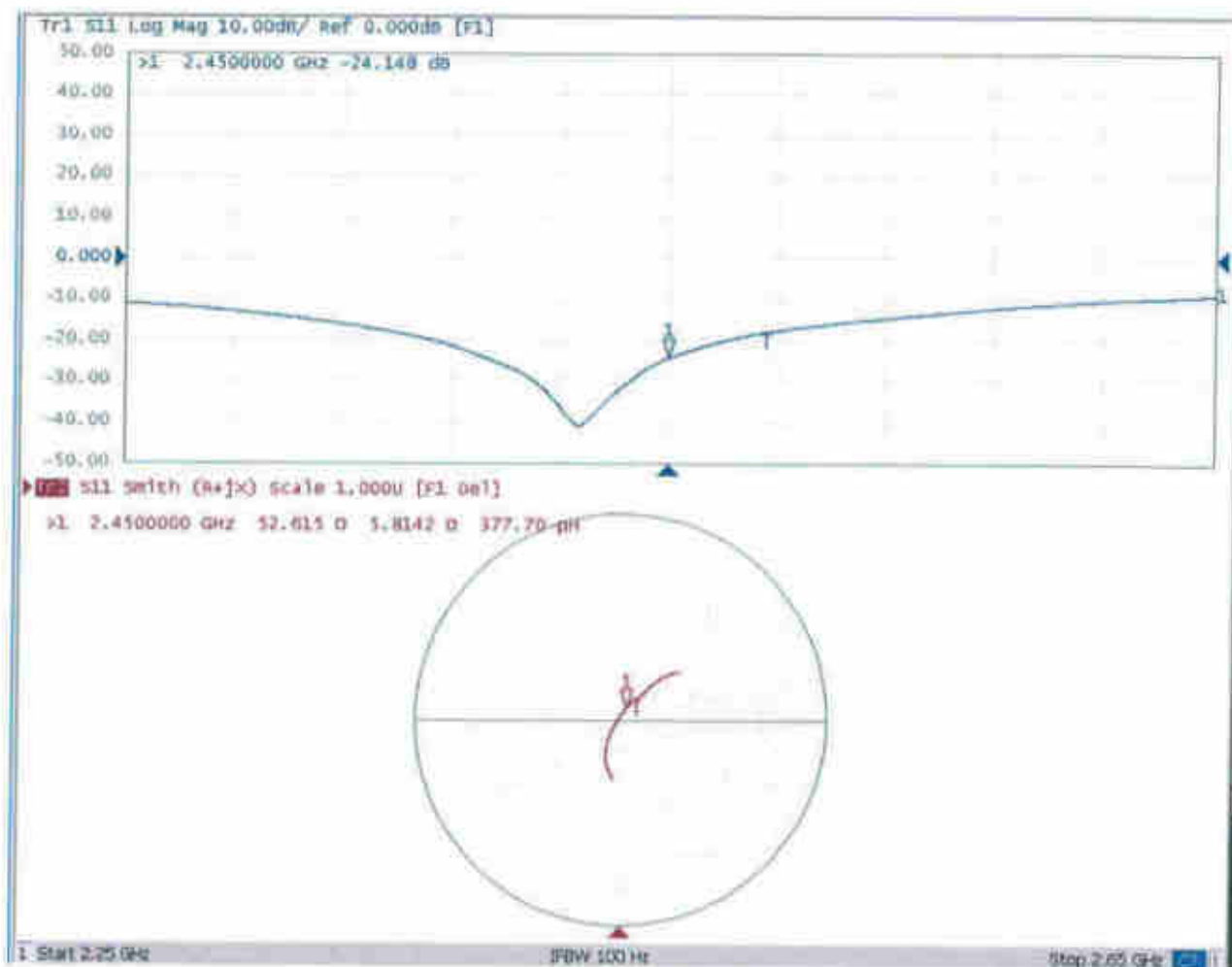
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Impedance Measurement Plot for Body TSL





D2450V2, Serial No. 908 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss ($< -20\text{dB}$, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

2450V2 – serial no. 908

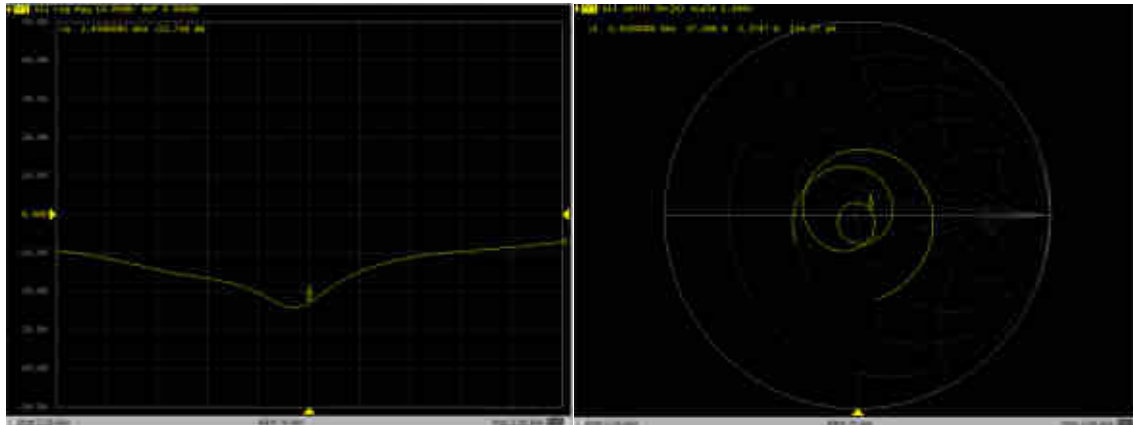
2450V2 – serial no. 908												
2450 Head							2450 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.25	-21.6		57.3		5.2		-24.1		52.6		5.8	
2020.3.24	-22.7	-0.05	57.5	-0.18	2.4	2.81	-26.1	-0.08	55.01	-2.40	1.493	4.32

<Justification of the extended calibration>

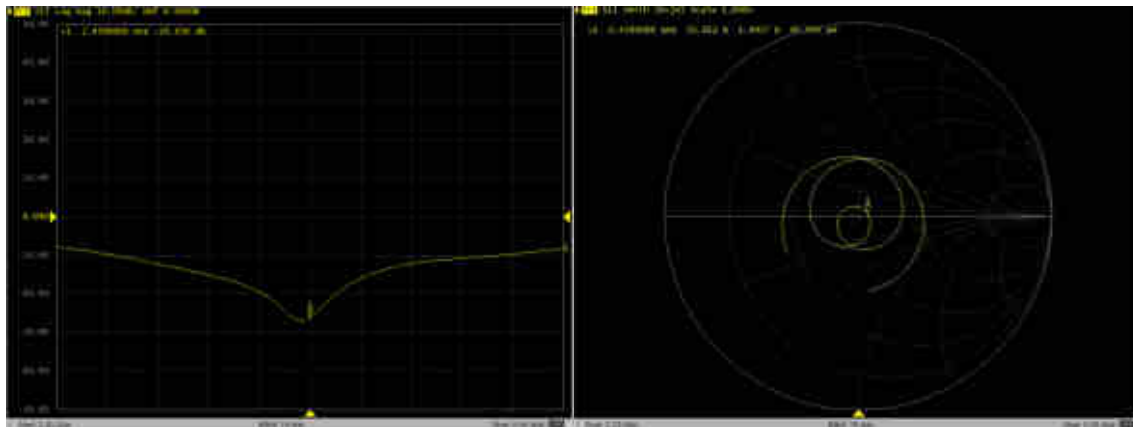
The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D2450V2, serial no. 908

2450MHz – Head



2450MHz – Body





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Accreditation No.: **SCS 0108**

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

Client **Sporton**

Certificate No: **D5GHzV2-1128_Dec19**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1128**

Calibration procedure(s) **QA CAL-22.v4**
Calibration Procedure for SAR Validation Sources between 3-6 GHz

Calibration date: **December 16, 2019**

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: 3503	25-Mar-19 (No. EX3-3503_Mar19)	Mar-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-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager
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Issued: December 17, 2019

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



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

Accreditation No.: **SCS 0108**

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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.10.3
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 $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5750 MHz $\pm$ 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 $\pm$ 0.2) °C	34.8 $\pm$ 6 %	4.48 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.0 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (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	22.9 W/kg $\pm$ 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 $\pm$ 0.2) °C	34.3 $\pm$ 6 %	4.83 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.4 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 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	34.1 ± 6 %	4.98 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 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	47.7 Ω - 6.4 j Ω
Return Loss	- 23.1 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.6 Ω - 3.5 j Ω
Return Loss	- 26.3 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.3 Ω - 3.5 j Ω
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.208 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: 16.12.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1128

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.48$ S/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.83$ S/m; $\epsilon_r = 34.3$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5750$ MHz; $\sigma = 4.98$ S/m; $\epsilon_r = 34.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.4, 5.4, 5.4) @ 5250 MHz, ConvF(4.95, 4.95, 4.95) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 25.03.2019
- 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 52.10.3(1513); SEMCAD X 14.6.13(7474)

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 = 77.60 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.32 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 69.9%

Maximum value of SAR (measured) = 18.2 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 = 77.23 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 8.32 W/kg; SAR(10 g) = 2.39 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 67.1%

Maximum value of SAR (measured) = 19.3 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 = 74.23 V/m; Power Drift = -0.07 dB

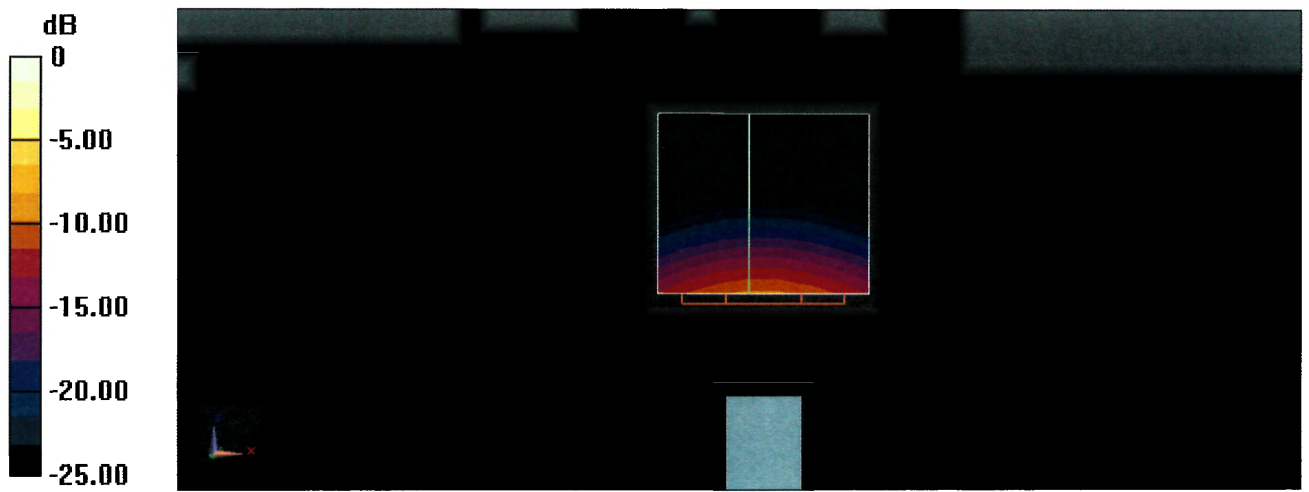
Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.29 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

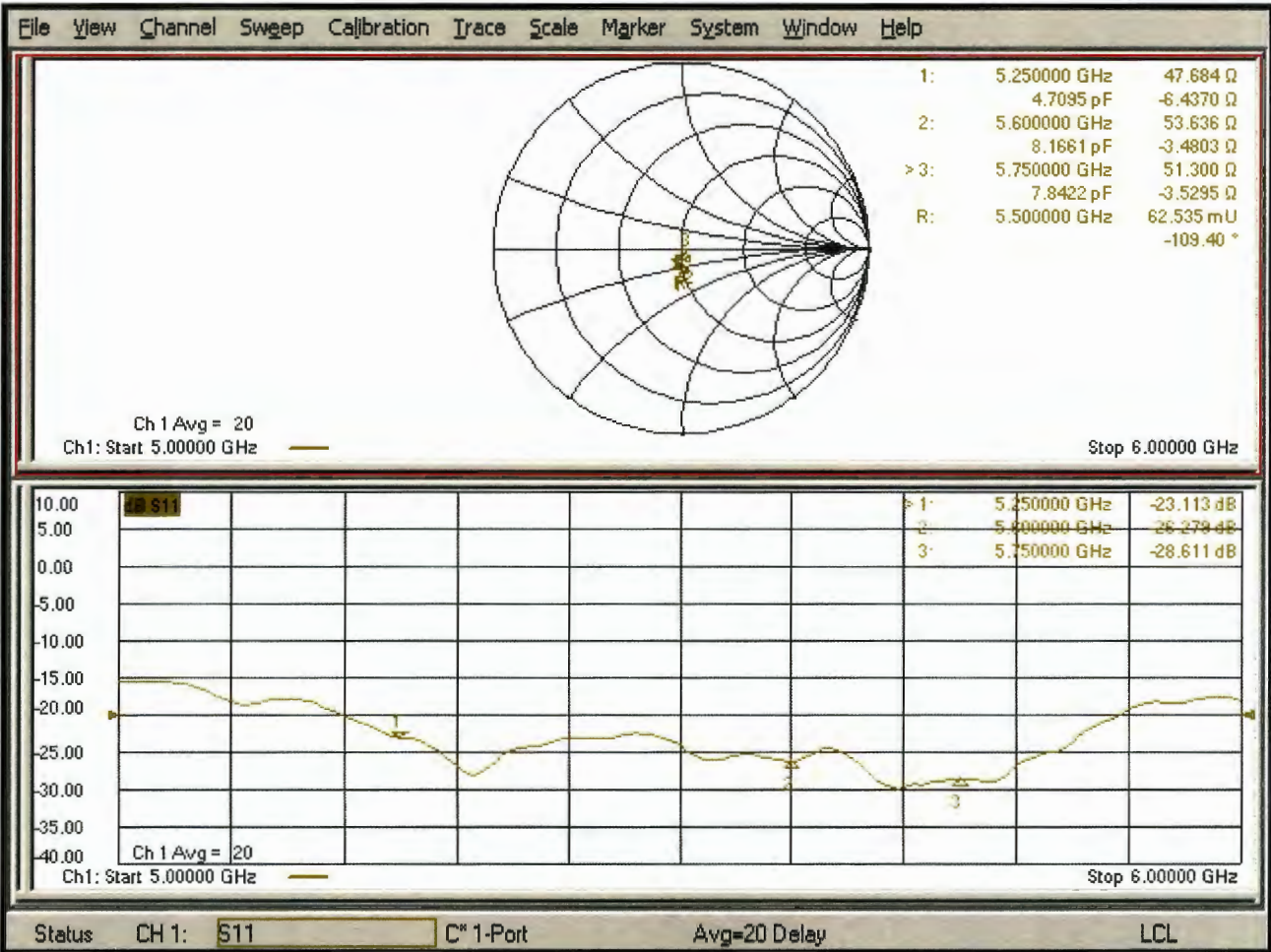
Ratio of SAR at M2 to SAR at M1 = 65.7%

Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.77 dBW/kg

Impedance Measurement Plot for Head TSL





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Client : **Sporton**

Certificate No: **Z19-60486**

CALIBRATION CERTIFICATE

Object **DAE4 - SN: 656**

Calibration Procedure(s) **FF-Z11-002-01**
Calibration Procedure for the Data Acquisition Electronics (DAEx)

Calibration date: **December 17, 2019**

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	24-Jun-19 (CTTL, No.J19X05126)	Jun-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: December 18, 2019

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Glossary:

DAE

data acquisition electronics

Connector angle

information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.164 ± 0.15% (k=2)	404.676 ± 0.15% (k=2)	404.945 ± 0.15% (k=2)
Low Range	3.95208 ± 0.7% (k=2)	3.96430 ± 0.7% (k=2)	3.93942 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	314° ± 1 °
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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.: **SCS 0108**

Client **Sporton**

Certificate No: **EX3-3843_Sep20**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3843**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7**
 Calibration procedure for dosimetric E-field probes

Calibration date: **September 23, 2020**

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)	Apr-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	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			Issued: September 30, 2020



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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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 ϑ	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:

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,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 $f \leq 800$ 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 NORM_{x,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 NORM_x (no uncertainty required).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3843

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.34	0.36	0.26	
DCP (mV) ^B	110.3	104.4	106.5	± 10.1 %

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	187.4	± 2.2 %	± 4.7 %
		Y	0.0	0.0	1.0		173.2		
		Z	0.0	0.0	1.0		179.7		

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 Page 5).

^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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3843

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	146.7
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

Note: Measurement distance from surface can be increased to 3-4 mm for an *Area Scan* job.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3843

Calibration Parameter Determined in Head Tissue Simulating Media

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	9.06	9.06	9.06	0.36	1.11	± 12.0 %
835	41.5	0.90	8.69	8.69	8.69	0.35	1.01	± 12.0 %
900	41.5	0.97	8.62	8.62	8.62	0.41	0.96	± 12.0 %
1450	40.5	1.20	7.82	7.82	7.82	0.47	0.80	± 12.0 %
1750	40.1	1.37	7.72	7.72	7.72	0.30	0.88	± 12.0 %
1900	40.0	1.40	7.41	7.41	7.41	0.27	0.88	± 12.0 %
2000	40.0	1.40	7.39	7.39	7.39	0.32	0.88	± 12.0 %
2300	39.5	1.67	7.06	7.06	7.06	0.28	0.90	± 12.0 %
2450	39.2	1.80	6.85	6.85	6.85	0.21	0.90	± 12.0 %
2600	39.0	1.96	6.76	6.76	6.76	0.41	0.90	± 12.0 %
5250	35.9	4.71	4.66	4.66	4.66	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.30	4.30	4.30	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.35	4.35	4.35	0.40	1.80	± 13.1 %

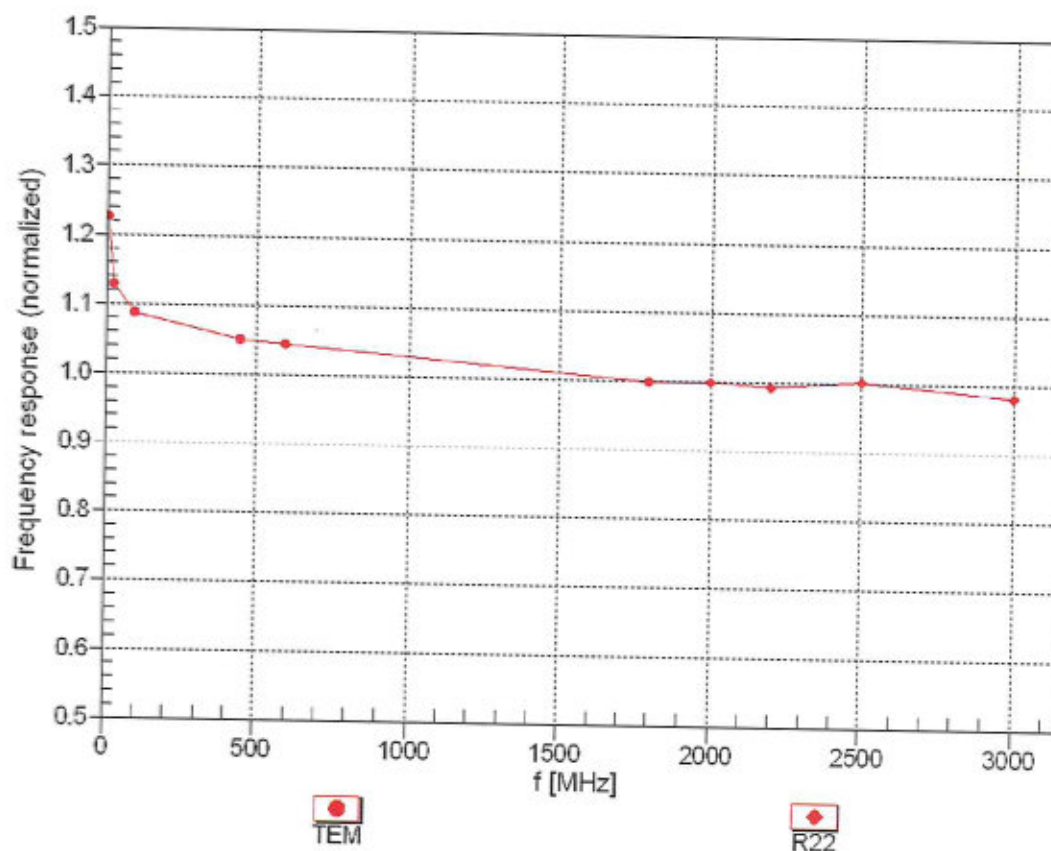
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 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 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 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

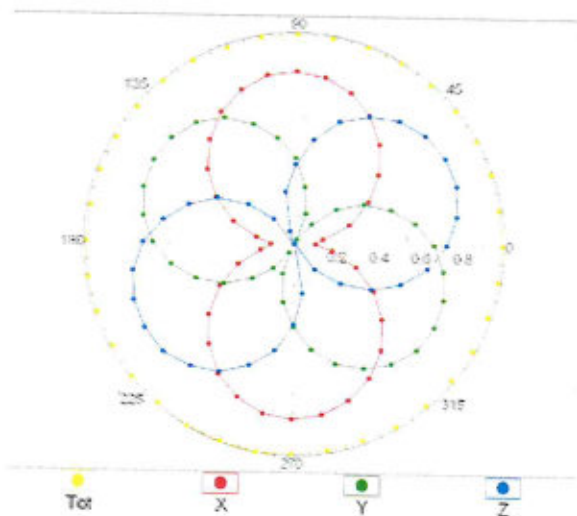
(TEM-Cell: ifi110 EXX, Waveguide: R22)



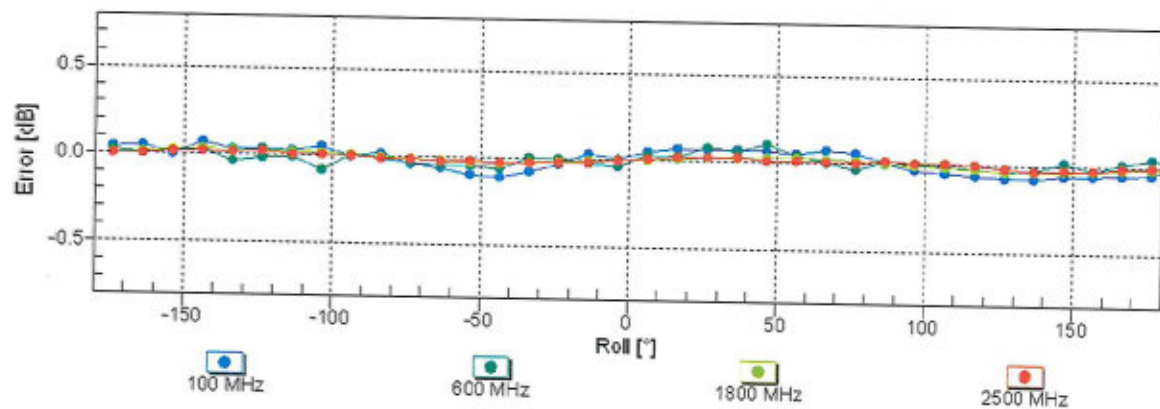
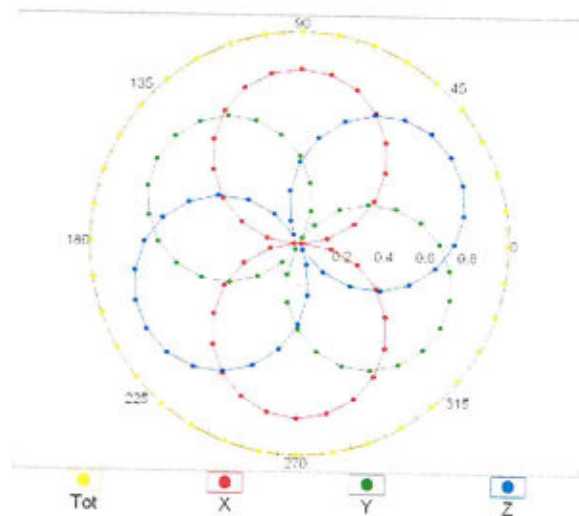
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz, TEM

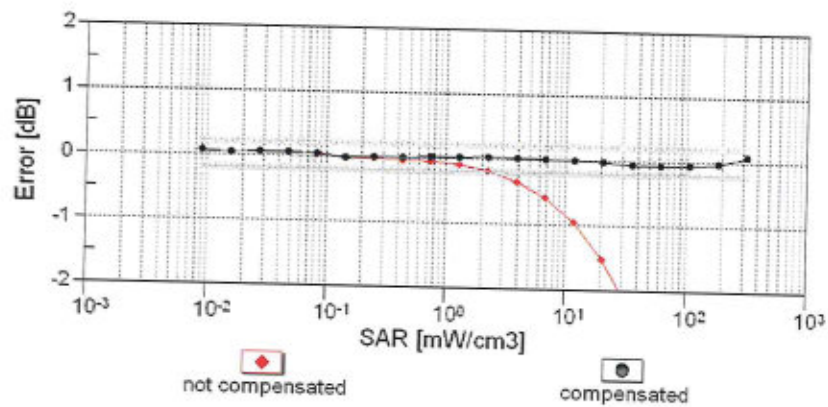
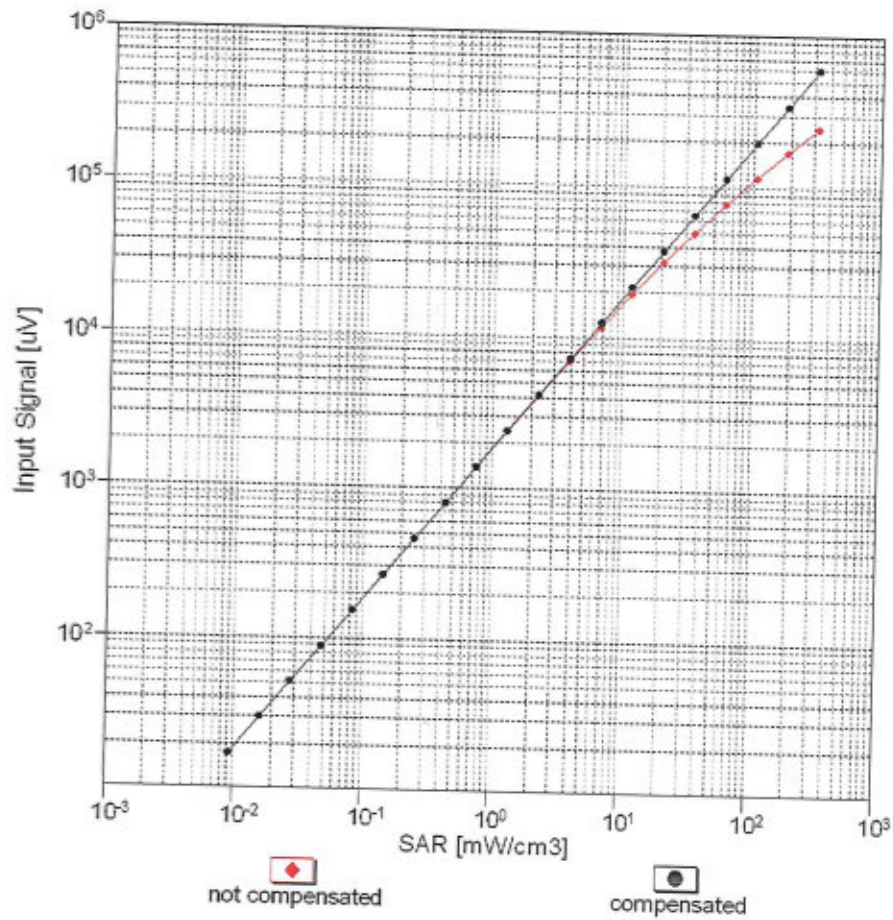


f=1800 MHz, R22



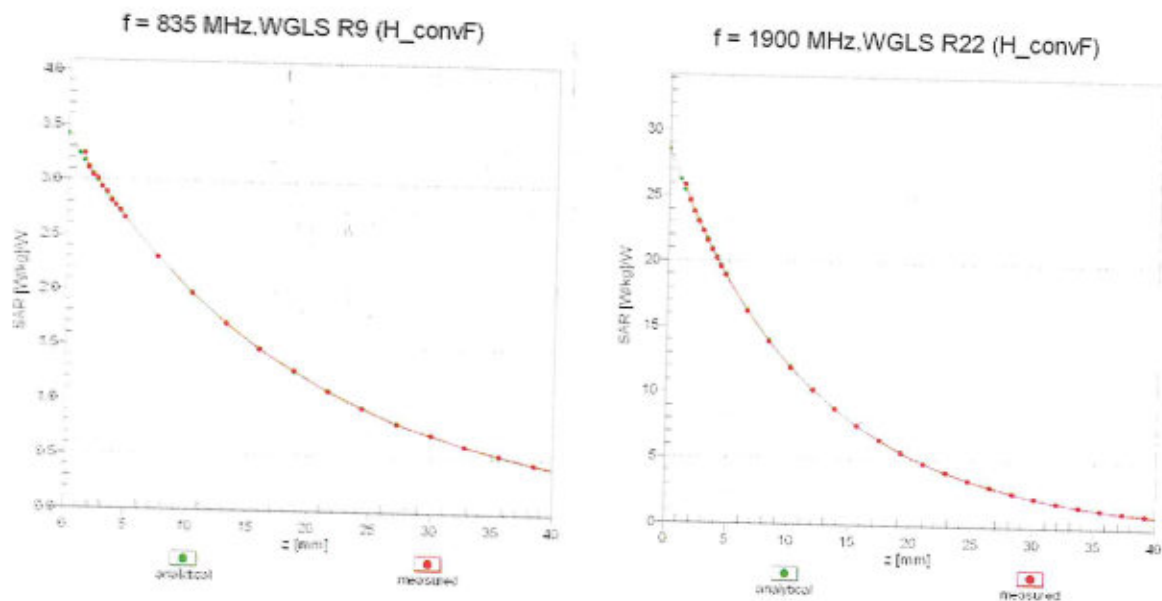
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$)



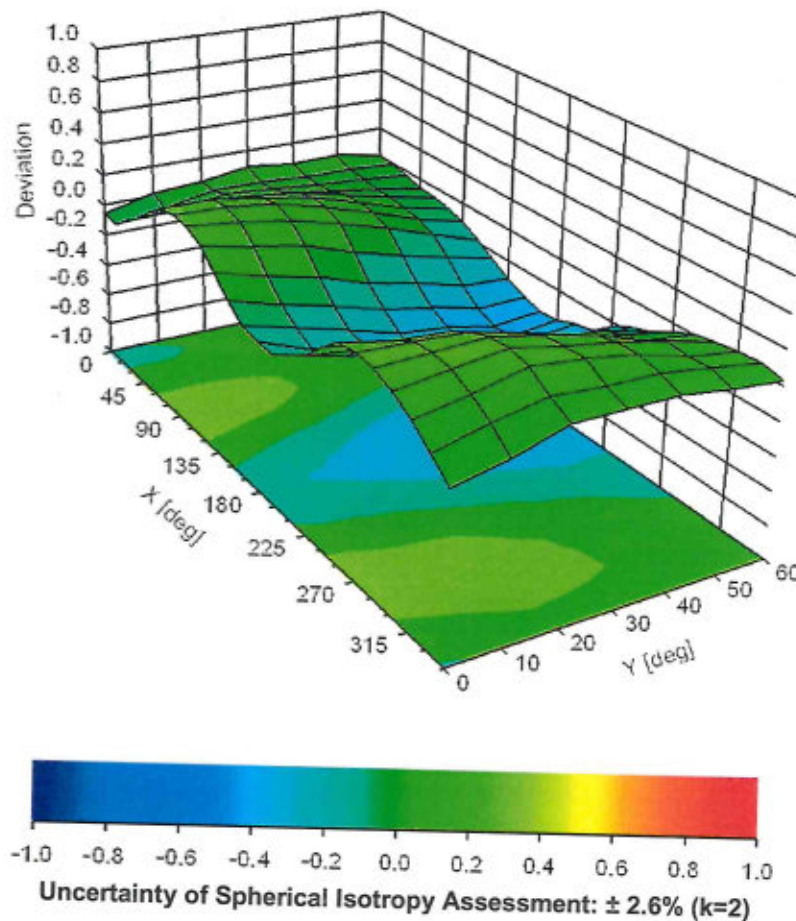
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$





Appendix E. Conducted RF Output Power Table

The detailed power tables are shown as follows.

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513		4132	4182	4233	
Rx Channel		9662	9800	9938		1537	1638	1738		4357	4407	4458	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1723.6	1752.4		326.4	336.4	340.6	
3GPP Rel 99	RM-C 12.2Kbps	22.42	22.57	22.58	24.00	22.57	22.65	22.60	24.00	22.79	22.82	22.75	24.00
3GPP Rel 6	HSDPA Subtest-1	21.42	21.58	21.49	23.00	21.56	21.60	21.55	23.00	21.77	21.72	21.82	23.00
3GPP Rel 6	HSDPA Subtest-2	21.49	21.57	21.51	23.00	21.59	21.71	21.59	23.00	21.75	21.75	21.86	23.00
3GPP Rel 6	HSDPA Subtest-3	21.02	21.10	21.05	22.50	21.11	21.26	21.13	22.50	21.29	21.30	21.31	22.50
3GPP Rel 6	HSDPA Subtest-4	21.01	21.09	21.05	22.50	21.11	21.26	21.13	22.50	21.28	21.30	21.31	22.50
3GPP Rel 6	DC-HSDPA Subtest-1	21.39	21.56	21.45	23.00	21.54	21.56	21.52	23.00	21.73	21.69	21.80	23.00
3GPP Rel 6	DC-HSDPA Subtest-2	21.46	21.55	21.47	23.00	21.57	21.67	21.56	23.00	21.71	21.72	21.84	23.00
3GPP Rel 6	DC-HSDPA Subtest-3	20.99	21.08	21.01	22.50	21.09	21.22	21.10	22.50	21.25	21.27	21.29	22.50
3GPP Rel 6	DC-HSDPA Subtest-4	20.98	21.07	21.01	22.50	21.09	21.22	21.10	22.50	21.24	21.27	21.29	22.50
3GPP Rel 6	HSUPA Subtest-1	21.99	21.89	21.97	23.00	22.13	22.20	22.12	23.00	21.78	21.88	22.03	23.00
3GPP Rel 6	HSUPA Subtest-2	20.08	20.34	20.06	21.00	20.02	20.21	20.18	21.00	19.67	19.99	20.01	21.00
3GPP Rel 6	HSUPA Subtest-3	20.98	21.10	21.14	22.00	21.01	20.99	20.89	22.00	20.98	20.99	20.87	22.00
3GPP Rel 6	HSUPA Subtest-4	20.03	19.80	19.98	21.00	20.15	20.27	20.20	21.00	20.01	19.89	20.23	21.00
3GPP Rel 6	HSUPA Subtest-5	21.98	22.02	22.01	23.00	21.90	21.80	22.00	23.00	21.88	21.70	21.80	23.00

Band 2 (1900MHz Band)												
Part 24E												
BW (MHz)	Modulation	RB Size	RB Offset	Power Low Mod Ch / Freq.	Power High Mod Ch / Freq.	Power High Mod Ch / Freq.	Turn-up time (sec)	MPE (dB)				
Channel												
Frequency (MHz)												
20	QPSK	1	0	22.93	23.07	22.77	24	0				
20	QPSK	1	49	22.82	22.89	22.73						
20	QPSK	1	99	22.84	22.89	22.89						
20	QPSK	50	0	21.75	21.86	21.83						
20	QPSK	50	24	21.76	21.82	21.78	23	1				
20	QPSK	50	50	21.71	21.79	21.78						
20	QPSK	100	0	21.73	21.86	21.79						
20	16QAM	1	0	21.88	21.82	21.87						
20	16QAM	1	49	21.88	21.88	21.77	23	1				
20	16QAM	1	99	21.87	21.89	21.76						
20	16QAM	50	0	21.77	21.81	21.85						
20	16QAM	50	24	20.70	20.77	20.82						
20	16QAM	50	50	20.64	20.63	20.70	22	2				
20	16QAM	75	0	20.79	20.77	20.77						
Channel												
Frequency (MHz)												
15	QPSK	1	0	22.93	22.96	22.94	24	0				
15	QPSK	1	37	22.93	22.94	22.86						
15	QPSK	1	74	22.71	22.70	22.74						
15	QPSK	36	0	21.77	21.81	21.85						
15	QPSK	36	20	21.84	21.80	21.84	23	1				
15	QPSK	36	39	21.74	21.86	21.85						
15	QPSK	36	59	21.78	21.81	21.85						
15	16QAM	1	0	21.39	21.58	21.44						
15	16QAM	1	37	21.33	21.51	21.40	23	1				
15	16QAM	1	74	21.24	21.41	21.29						
15	16QAM	36	0	20.73	20.88	20.71						
15	16QAM	36	20	20.63	20.63	20.82						
15	16QAM	36	39	20.74	20.81	20.83	22	2				
15	16QAM	36	59	20.69	20.69	20.72						
Channel												
Frequency (MHz)												
10	QPSK	1	0	22.97	22.99	22.76	24	0				
10	QPSK	1	25	22.84	22.89	22.87						
10	QPSK	1	50	22.81	22.84	22.84						
10	QPSK	25	0	21.73	22.02	21.79						
10	QPSK	25	12	21.83	21.82	21.84	23	1				
10	QPSK	25	19	21.78	21.84	21.76						
10	QPSK	50	0	21.81	21.91	21.78						
10	16QAM	1	0	21.41	21.65	21.36						
10	16QAM	1	49	21.47	21.73	21.58	23	1				
10	16QAM	1	49	21.27	21.48	21.43						
10	16QAM	25	0	20.80	21.04	20.77						
10	16QAM	25	12	20.81	21.02	20.83						
10	16QAM	25	25	20.76	20.90	20.76	22	2				
10	16QAM	50	0	20.74	20.85	20.83						
Channel												
Frequency (MHz)												
5	QPSK	1	0	22.99	22.94	22.94	24	0				
5	QPSK	1	12	22.80	22.81	22.82						
5	QPSK	1	24	22.89	22.48	22.86						
5	QPSK	12	0	21.86	21.77	21.73						
5	QPSK	12	7	21.85	21.86	21.87	23	1				
5	QPSK	12	13	21.75	21.70	21.81						
5	QPSK	25	0	21.74	21.73	21.72						
5	16QAM	1	0	21.43	21.42	21.44						
5	16QAM	1	12	21.09	21.42	21.41	23	1				
5	16QAM	1	24	21.29	21.36	21.35						
5	16QAM	12	0	20.81	20.76	20.84						
5	16QAM	12	7	20.44	20.50	20.77						
5	16QAM	12	13	20.84	20.52	20.81	22	2				
5	16QAM	25	0	20.77	20.64	20.66						
Channel												
Frequency (MHz)												
3	QPSK	1	0	22.99	22.98	22.92	24	0				
3	QPSK	1	8	22.66	22.70	22.80						
3	QPSK	1	14	22.84	22.77	22.83						
3	QPSK	8	0	21.78	21.86	21.71						
3	QPSK	8	4	21.82	21.87	21.74	23	1				
3	QPSK	8	7	21.78	21.82	21.69						
3	QPSK	15	0	21.79	21.83	21.70						
3	16QAM	1	0	21.49	21.50	21.42						
3	16QAM	1	8	21.41	21.87	21.41	23	1				
3	16QAM	1	14	21.41	21.81	21.45						
3	16QAM	8	0	20.73	20.82	20.75						
3	16QAM	8	4	20.86	20.84	20.81						
3	16QAM	8	7	20.76	20.95	20.70	22	2				
3	16QAM	15	0	20.77	20.81	20.82						
Channel												
Frequency (MHz)												
1.4	QPSK	1	0	22.90	22.93	22.92	24	0				
1.4	QPSK	1	3	22.83	22.94	22.93						
1.4	QPSK	1	5	22.83	22.93	22.95						
1.4	QPSK	3	0	22.92	22.93	22.72						
1.4	QPSK	3	1	22.75	22.87	22.86	23	1				
1.4	QPSK	3	1	22.80	22.89	22.75						
1.4	QPSK	6	0	21.71	22.07	21.80						
1.4	16QAM	1	0	21.83	21.89	21.48						
1.4	16QAM	1	3	21.84	21.87	21.86	23	1				
1.4	16QAM	1	5	21.78	21.83	21.73						
1.4	16QAM	3	0	21.84	22.07	21.79						
1.4	16QAM	3	1	21.87	22.10	21.76						
1.4	16QAM	3	3	21.84	22.12	21.76	22	2				
1.4	16QAM	5	0	20.77	21.00	20.82						

Band 4 (AWS Band)												
Part 27L (only on channel required)												
BW (MHz)	Modulation	RB Size	RB Offset	Power Low Mod Ch / Freq.	Power High Mod Ch / Freq.	Power High Mod Ch / Freq.	Turn-up time (sec)	MPE (dB)				
Channel												
Frequency (MHz)												
20	QPSK	1	0	22.93	23.04	22.74	24	0				
20	QPSK	1	49	22.80	22.90	22.89						
20	QPSK	1	99	22.88	23.03	22.84						
20	QPSK	50	0	21.88	22.16	22.15						
20	QPSK	50	24	21.81	21.79	22.08	23	1				
20	QPSK	50	50	21.78	21.96	21.78						
20	QPSK	100	0	21.80	21.87	22.07						
20	16QAM	1	0	21.87	21.89	21.89						
20	16QAM	1	49	21.87	21.88	21.74	23	1				
20	16QAM	1	99	21.86	21.76	21.76						
20	16QAM	50	0	22.00	21.90	22.07						
20	16QAM	50	24	20.87	20.77	21.06						
20	16QAM	50	50	20.74	20.89	20.76	22	2				
20	16QAM	100	0	20.89	20.82	21.03						
Channel												
Frequency (MHz)												
15	QPSK	1	0	22.93	22.92	22.83	24	0				
15	QPSK	1	37	22.70	23.00	23.01						
15	QPSK	1	74	22.67	22.96	22.78						
15	QPSK	36	0	22.00	21.90	22.07						
15	QPSK	36	20	21.86	21.97	21.88	23	1				
15	QPSK	36	39	21.80	22.02	21.79						
15	QPSK	36	59	21.78	21.83	21.89						
15	16QAM	1	0	21.71	21.59	21.83						
15	16QAM	1	37	21.69	21.90	21.63	23	1				
15	16QAM	1	74	21.51	21.59	21.65						
15	16QAM	36	0	21.05	20.90	21.13						
15	16QAM	36	20	20.84	20.91	20.85		22	2			
15	16QAM	36	39	20.87	20.99	20.88						
15	16QAM	100	0	20.89	20.82	21.03						
Channel												
Frequency (MHz)												
10	QPSK	1	0	22.93	22.92	22.83	24	0				
10	QPSK	1	25	22.82	22.94	22.71						
10	QPSK	1	49	22.85	22.68	22.84						
10	QPSK	36	0	21.86	21.98	21.83						
10	QPSK	36	12	21.96	21.80	21.81	23	1				
10	QPSK	36	25	21.81	21.88	21.81						
10	QPSK	36	37	21.83	21.93	21.82						
10	16QAM	1	0	21.89	21.44	21.75						
10	16QAM	1	25	21.74	21.71	21.73	23	1				
10	16QAM	1	49	21.60	21.62	21.61						
10	16QAM	36	0	21.00	20.98	20.98						
10	16QAM	36	12	20.99	20.89	20.96		22	2			
10	16QAM	36	25	20.78	20.79	20.78						
10	16QAM	50	0	21.00	20.79	20.96						
10	16QAM	50	25	20.97	20.97	20.96						
Channel												
Frequency (MHz)												
5	QPSK	1	0	22.93	22.79	22.75	24	0				
5	QPSK	1	12	22.81	22.88	22.72						
5	QPSK	1	24	22.40	22.79	22.54						
5	QPSK	12	0	21.80	21.94	21.84						
5	QPSK	12	7	21.98	21.51	21.85	23	1				
5	QPSK	12	19	21.58	21.58	21.60						
5	QPSK	25	0	21.85	21.90	21.87						
5	16QAM	1	0	21.87	21.78	21.69						
5	16QAM	1	12	21.86	21.69	21.71	23	1				
5	16QAM	1	24	21.43	21.66	21.57						
5	16QAM	12	0	20.88	20.93	20.88						
5	16QAM	12	7	20.90	20.90	20.87		22	2			
5	16QAM	12	19	20.85	20.97	20.73						
5	16QAM	25	0	20.89	20.92	20.82						
5	16QAM	25	0	20.89	20.92	20.82						
Channel												
Frequency (MHz)												
3	QPSK	1	0	22.72	22.63	22.63	24	0				
3	QPSK	1	8	22.68	22.67	22.63						
3	QPSK	1	16	22.72	22.72	22.68						
3	QPSK	8	0	21.82	21.90	21.80						
3	QPSK	8	4	21.88	21.99	21.84	23	1				
3	QPSK	8	12	21.85	21.91	21.91						
3	QPSK	16	0	21.83	21.87	21.78						
3	16QAM	1	0	21.77	21.67	21.68						
3	16QAM	1	8	21.69	21.56	21.48	23	1				
3	16QAM	1	16	21.79	21.56	21.71						
3	16QAM	8	0	21.71	21.70	21.70						
3	16QAM	8	4	20.93	20.94	20.93		22	2			
3	16QAM	8	12	20.93	20.94	20.93						
3	16QAM	8	7	20.92	21.08	20.74						
3	16QAM	16	0	20.95	20.95	20.95						
Channel												
Frequency (MHz)												
1.4	QPSK	1	0	22.59	22.70	22.79	24	0				
1.4	QPSK	1	7	22.78	22.88	22.78						
1.4	QPSK	1	8	22.71	22.80	22.62						
1.4	QPSK	3	0	22.62	22.97	22.62						
1.4	QPSK	3	7	22.65	23.01	22.76	23	1				
1.4	QPSK	3	8	22.75	22.87	22.87						
1.4	QPSK	6	0	21.79	21.86	22.02						
1.4	QPSK	6	7	21.87	21.96	21.86						
1.4	16QAM	1	0	21.82	21.82	21.70	23	1				
1.4	16QAM	1	7	21.60	21.48	21.62						
1.4	16QAM	1	8	21.73	21.70	21.73						
1.4	16QAM	3	1	21.69	21.95	21.68		22	2			
1.4	16QAM	3	7	20.91	20.91	20.91						
1.4	16QAM	3	8	20.80	20.84	20.95						
1.4	16QAM	6	0	20.80	20.84	20.95						



2.4GHz WLAN		Ant 1				
2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11b 1Mbps	1	2412	16.33	18.00	100.00
		6	2437	16.41	18.00	
		11	2462	16.37	18.00	
	802.11g 6Mbps	1	2412	12.22	13.50	97.94
		6	2437	12.27	13.50	
		11	2462	12.18	13.50	
	802.11n-HT20 MCS9	1	2412	11.99	13.50	98.16
		6	2437	12.01	13.50	
		11	2462	12.07	13.50	
	802.11n-HT40 MCS9	3	2422	11.28	12.50	94.93
		6	2437	11.44	12.50	
		9	2452	11.38	12.50	

5GHz WLAN		Ant 1				
5.2GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11a 6Mbps	36	5180	12.21	13.50	98.28
		40	5200	12.15	13.50	
		44	5220	11.77	13.50	
	802.11n-HT20 MCS9	48	5240	11.79	13.50	96.16
		36	5180	11.79	13.00	
		40	5200	11.76	13.00	
	802.11n-HT40 MCS9	44	5220	11.62	13.00	96.32
		48	5240	11.73	13.00	
		38	5190	10.91	12.50	
	802.11ac-VHT20 MCS9	46	5230	10.85	12.50	97.79
		36	5180	10.23	11.50	
		40	5200	10.02	11.50	
	802.11ac-VHT40 MCS9	44	5220	10.14	11.50	96.32
		48	5240	10.15	11.50	
		38	5190	10.03	11.50	
802.11ac-VHT80 MCS9	46	5230	9.93	11.50	93.28	

5GHz WLAN		Ant 1				
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11a 6Mbps	52	5260	12.00	13.50	98.28
		56	5280	12.04	13.50	
		60	5300	11.86	13.50	
	802.11n-HT20 MCS9	64	5320	11.96	13.50	96.16
		52	5260	11.72	13.00	
		56	5280	11.68	13.00	
	802.11n-HT40 MCS9	60	5300	11.80	13.00	96.32
		64	5320	11.68	13.00	
		54	5270	10.80	12.50	
	802.11ac-VHT20 MCS9	62	5310	10.71	12.50	97.79
		52	5260	10.01	11.50	
		56	5280	9.92	11.50	
	802.11ac-VHT40 MCS9	60	5300	9.71	11.50	96.32
		64	5320	9.90	11.50	
		54	5270	9.88	11.50	
802.11ac-VHT40 MCS9	62	5310	9.95	11.50	93.28	
802.11ac-VHT40 MCS9	58	5290	10.14	11.50		

5GHz WLAN		Ant 1				
	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a 6Mbps	100	5500	11.81	13.50	98.28
		116	5580	11.69	13.50	
		124	5620	11.68	13.50	
		132	5660	11.77	13.50	
	802.11n-HT20 MCS9	140	5700	11.67	13.50	96.16
		100	5500	11.97	13.50	
		116	5580	12.11	13.50	
		124	5620	12.04	13.50	
	802.11n-HT40 MCS9	132	5660	11.81	13.50	96.32
		140	5700	11.97	13.50	
		102	5510	10.93	12.00	
		110	5550	10.82	12.00	
	802.11ac-VHT20 MCS9	126	5630	10.91	12.00	97.79
		134	5670	10.73	12.00	
		100	5500	9.60	11.00	
		116	5580	9.95	11.00	
802.11ac-VHT40 MCS9	124	5620	10.07	11.00	96.32	
	132	5660	9.89	11.00		
	140	5700	10.01	11.00		
	102	5510	9.81	11.00		
802.11ac-VHT80 MCS9	110	5555	9.94	11.00	93.28	
	126	5630	9.86	11.00		
	134	5670	9.88	11.00		
	106	5530	10.09	11.00		
	122	5610	9.69	11.00		

5GHz WLAN		Ant 1				
Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %	
5.8GHz WLAN	802.11a 6Mbps	149	5745	11.89	13.50	98.28
		157	5785	12.11	13.50	
		165	5825	12.30	13.50	
	802.11n-HT20 MCS9	149	5745	11.89	13.00	96.16
		157	5785	12.02	13.00	
		165	5825	11.88	13.00	
	802.11n-HT40 MCS9	151	5755	10.75	12.50	96.32
		159	5795	10.84	12.50	
		149	5745	9.77	11.50	
	802.11ac-VHT20 MCS9	157	5785	9.72	11.50	97.79
		165	5825	9.69	11.50	
		151	5755	9.74	11.50	
802.11ac-VHT40 MCS9	159	5795	9.84	11.50	96.32	
	134	5670	9.88	11.00		
	106	5530	10.09	11.00		

5GHz WLAN		Ant 1				
5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11ac VHT80+80	42+106	5210+5530	10.39	11.00	86.95
		42+58	5210+5290	10.20	11.00	
		42+155	5210+5775	10.30	11.00	

BR/EDR		Average power (dBm)			
Mode	Channel	Frequency (MHz)	1Mbps	2Mbps	3Mbps
BR / EDR	CH 00	2402	10.88	8.03	8.26
	CH 19	2444	11.82	9.09	9.29
	CH 78	2452	10.46	8.88	9.02
	Tune-up Limit		12	9.5	9.5

BLE 4.0		Average power (dBm)			
Mode	Channel	Frequency (MHz)	GFSK		
LE	CH 00	2402	4.39		
	CH 19	2444	5.86		
	CH 39	2486	6.86		
	Tune-up Limit		7		

BLE 5.0		Average power (dBm)			
Mode	Channel	Frequency (MHz)	1Mbps	2Mbps	
LE	CH 00	2402	4.12		
	CH 19	2444	5.90		
	CH 39	2486	6.79		
	Tune-up Limit		7		

2.4GHz WLAN		Ant 2				
	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	1	2412	16.38	18.00	100.00
		6	2437	16.28	18.00	
		11	2462	16.42	18.00	
	802.11g 6Mbps	1	2412	12.10	13.50	98.28
		6	2437	12.35	13.50	
		11	2462	12.26	13.50	
	802.11n-HT20 MCS9	1	2412	11.87	13.50	98.16
		6	2437	12.40	13.50	
		11	2462	12.25	13.50	
	802.11n-HT40 MCS9	3	2422	11.19	13.00	94.93
		6	2437	11.21	13.00	
		9	2452	11.45	13.00	

5GHz WLAN		Ant 2					
	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %	
5.2GHz WLAN	802.11a 6Mbps	36	5180	12.02	13.50	98.28	
		40	5200	12.21	13.50		
		44	5220	12.12	13.50		
		48	5240	11.97	13.50		
	802.11n-HT20 MCS9	36	5180	11.81	13.00	98.90	
		40	5200	11.69	13.00		
		44	5220	11.72	13.00		
		48	5240	11.51	13.00		
	802.11n-HT40 MCS9	38	5190	10.81	12.00	96.32	
		46	5230	10.51	12.00		
		36	5180	10.24	11.50		
		40	5200	10.32	11.50		
	802.11ac-VHT20 MCS9	44	5220	10.07	11.50	98.53	
		48	5240	10.23	11.50		
	802.11ac-VHT40 MCS9	38	5190	9.82	11.00	96.32	
		46	5230	9.78	11.00		
802.11ac-VHT80 MCS9		42	5210	9.78	11.00		93.31

5GHz WLAN		Ant 2				
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11a 6Mbps	52	5260	12.23	13.50	98.28
		56	5280	12.18	13.50	
		60	5300	12.14	13.50	
	802.11n-HT20 MCS9	64	5320	12.19	13.50	98.90
		52	5260	11.72	13.00	
		56	5280	11.81	13.00	
	802.11n-HT40 MCS9	60	5300	11.64	13.00	96.32
		64	5320	11.72	13.00	
		54	5270	10.74	12.50	
	802.11ac-VHT20 MCS9	62	5310	10.59	12.50	98.53
		52	5260	10.37	12.00	
56		5280	10.94	12.00		
802.11ac-VHT40 MCS9	60	5300	10.22	12.00	96.32	
	64	5320	10.06	11.50		
	54	5270	9.92	11.50		
802.11AC-VHT40 MCS9	62	5310	9.83	11.50	93.31	
802.11AC-VHT40 MCS9	58	5290	9.58	11.50		