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

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Accreditation No.: SCS 0108

Client **DT&C (Dymstec)**

Certificate No: D2450V2-726_Sep17

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:726
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 19, 2017

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-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: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-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 HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 19, 2017

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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:

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	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 %	1.86 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 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	51.9 ± 6 %	2.04 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	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.9 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	52.6 Ω + 4.0 jΩ
Return Loss	- 26.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.4 Ω + 6.5 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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 09, 2003

DASY5 Validation Report for Head TSL

Date: 19.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:726

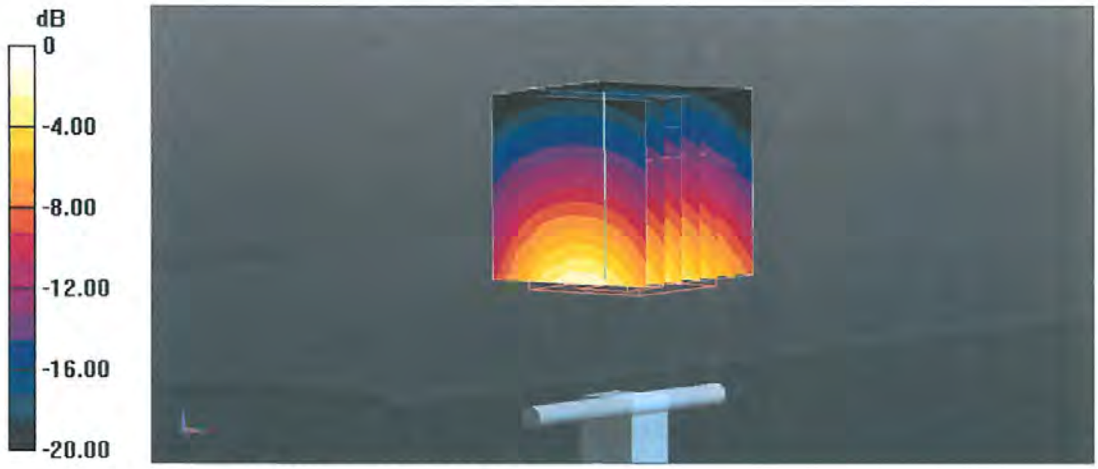
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.12, 8.12, 8.12); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

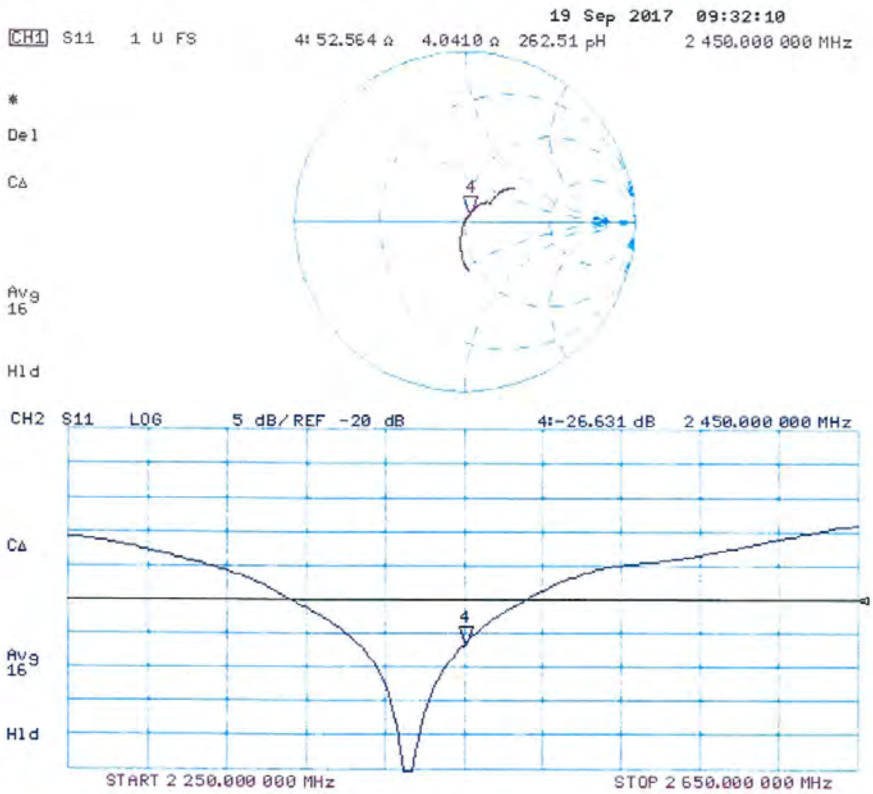
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 110.8 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.22 W/kg
Maximum value of SAR (measured) = 21.0 W/kg



0 dB = 21.0 W/kg = 13.22 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

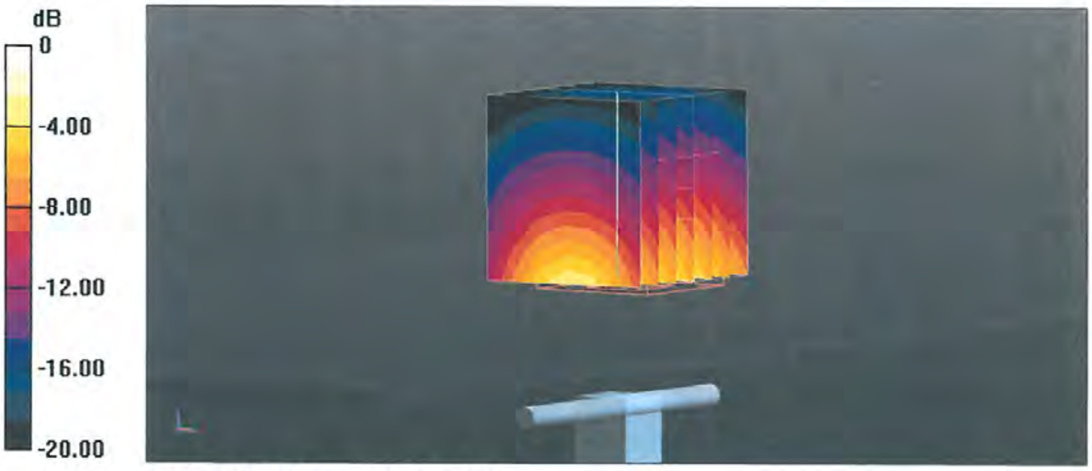
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:726

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.04 S/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

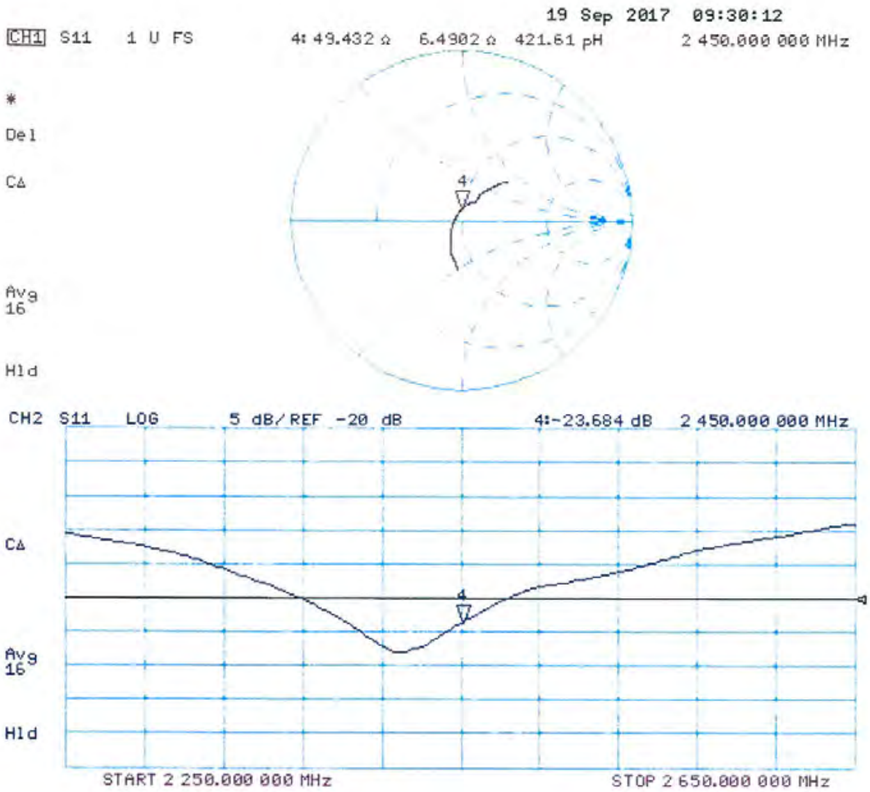
- Probe: EX3DV4 - SN7349; ConvF(8.1, 8.1, 8.1); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.9 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 25.4 W/kg
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.05 W/kg
Maximum value of SAR (measured) = 20.3 W/kg



0 dB = 20.3 W/kg = 13.07 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

Client **DT&C (Dymstec)**

Certificate No: **D2600V2-1103_Feb18**

CALIBRATION CERTIFICATE

Object	D2600V2 - SN:1103
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 16, 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-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: 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 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	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 19, 2018

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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:

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	37.3 ± 6 %	2.04 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	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**56.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.4 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	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 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	**55.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.29 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.9 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	49.1 Ω - 6.6 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.9 Ω - 4.1 jΩ
Return Loss	- 24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.147 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 13, 2015

DASY5 Validation Report for Head TSL

Date: 16.02.2018

Test Laboratory: SPEAG, Zurich, Switzerland

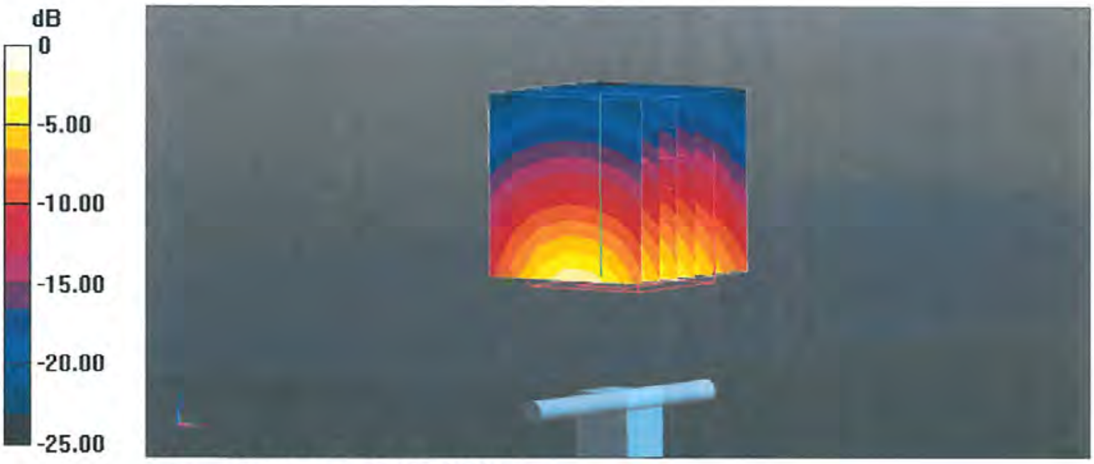
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1103

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.04 S/m; ε_r = 37.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

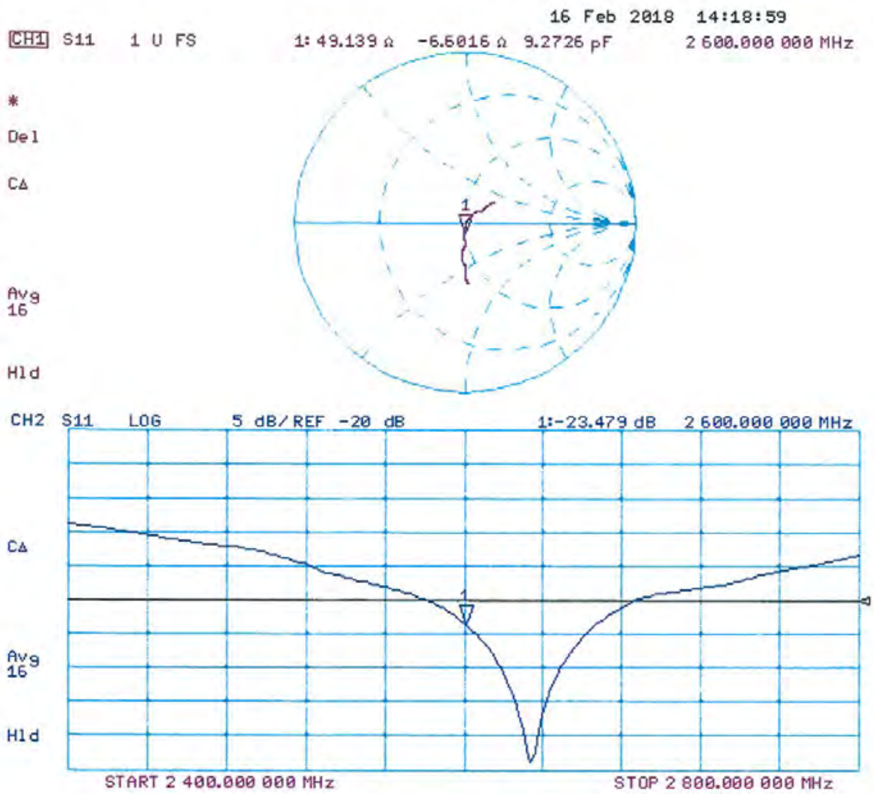
- Probe: EX3DV4 - SN7349; ConvF(7.7, 7.7, 7.7); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 116.0 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 29.2 W/kg
SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.45 W/kg
Maximum value of SAR (measured) = 23.2 W/kg



0 dB = 23.2 W/kg = 13.65 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.02.2018

Test Laboratory: SPEAG, Zurich, Switzerland

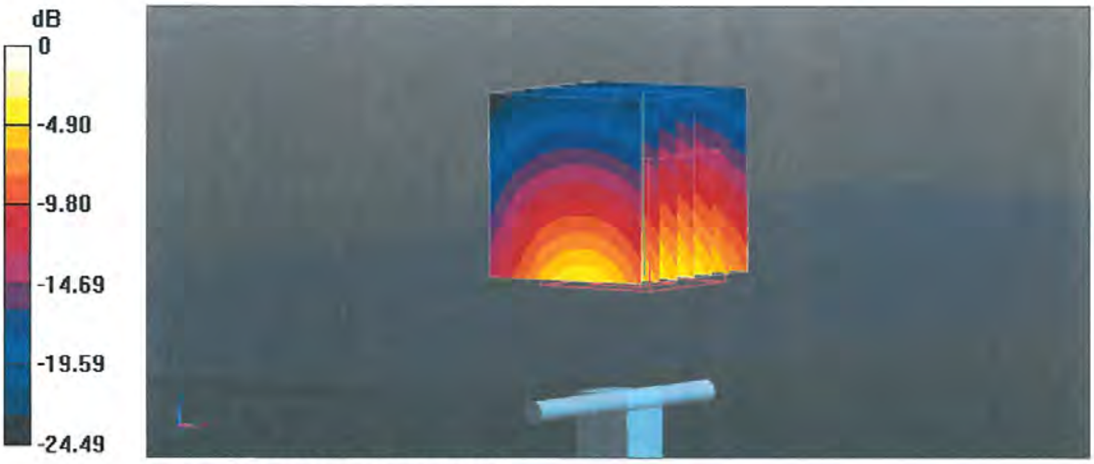
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1103

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.22 S/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

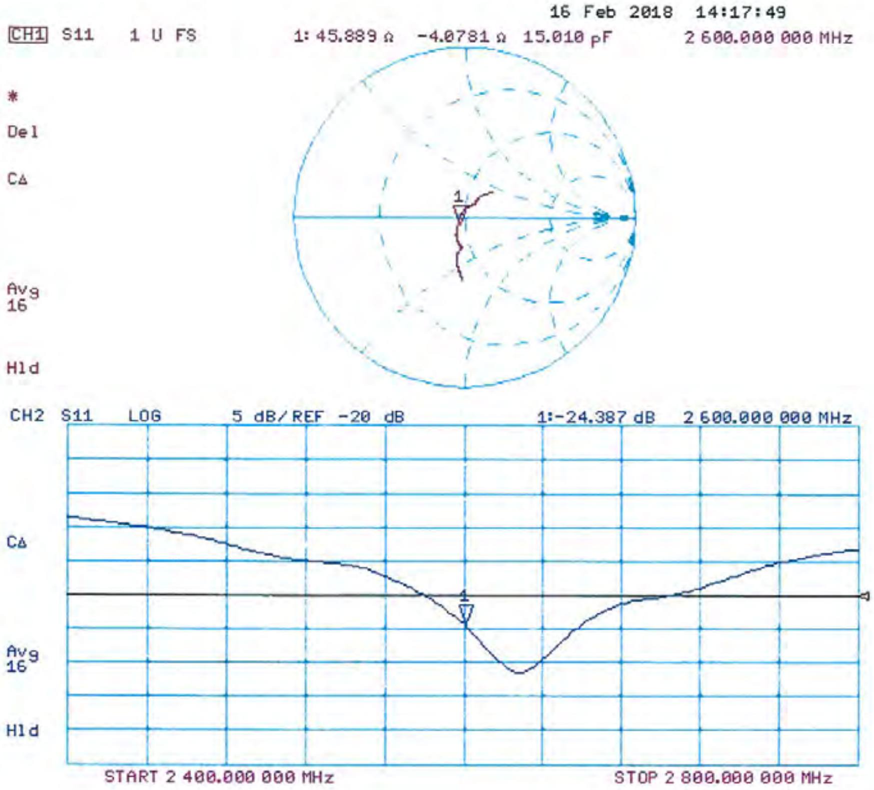
- Probe: EX3DV4 - SN7349; ConvF(7.81, 7.81, 7.81); Calibrated: 30.12.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.4 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.29 W/kg
Maximum value of SAR (measured) = 23.1 W/kg



0 dB = 23.1 W/kg = 13.64 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 0108**

Client **DT&C (Dymstec)**

Certificate No: **D5GHzV2-1212_Feb18**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN:1212

Calibration procedure(s): QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: February 15, 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-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
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 HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 21, 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

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

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 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	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.4 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.1 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	4.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 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	35.8 ± 6 %	4.95 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	8.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	5.16 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.5 ± 6 %	5.41 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**72.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.54 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.80 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 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	46.8 ± 6 %	5.95 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	7.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	6.23 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 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	**75.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	48.3 Ω - 3.7 jΩ
Return Loss	- 27.8 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	47.8 Ω - 0.1 jΩ
Return Loss	- 33.0 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	46.8 Ω + 1.4 jΩ
Return Loss	- 28.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	50.4 Ω + 3.1 jΩ
Return Loss	- 30.2 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	52.3 Ω + 3.2 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	47.9 Ω - 3.7 jΩ
Return Loss	- 27.3 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.6 Ω + 2.0 jΩ
Return Loss	- 32.0 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	47.4 Ω + 3.1 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	50.5 Ω + 4.0 jΩ
Return Loss	- 28.0 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	52.5 Ω + 4.4 jΩ
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 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 14, 2014

DASY5 Validation Report for Head TSL

Date: 14.02.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1212

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.53 S/m; ε_r = 36.4; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 4.64 S/m; ε_r = 36.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 4.84 S/m; ε_r = 36; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.95 S/m; ε_r = 35.8; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 5.16 S/m; ε_r = 35.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.75, 5.75, 5.75); Calibrated: 30.12.2017, ConvF(5.5, 5.5, 5.5); Calibrated: 30.12.2017, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2017, ConvF(5.05, 5.05, 5.05); Calibrated: 30.12.2017, ConvF(4.96, 4.96, 4.96); 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)

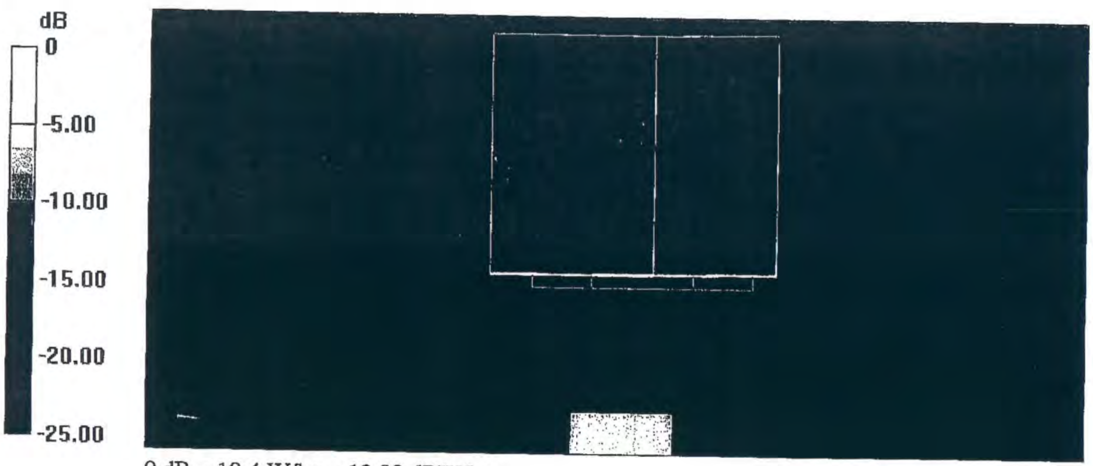
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.98 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.21 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 29.9 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.15 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 8.53 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

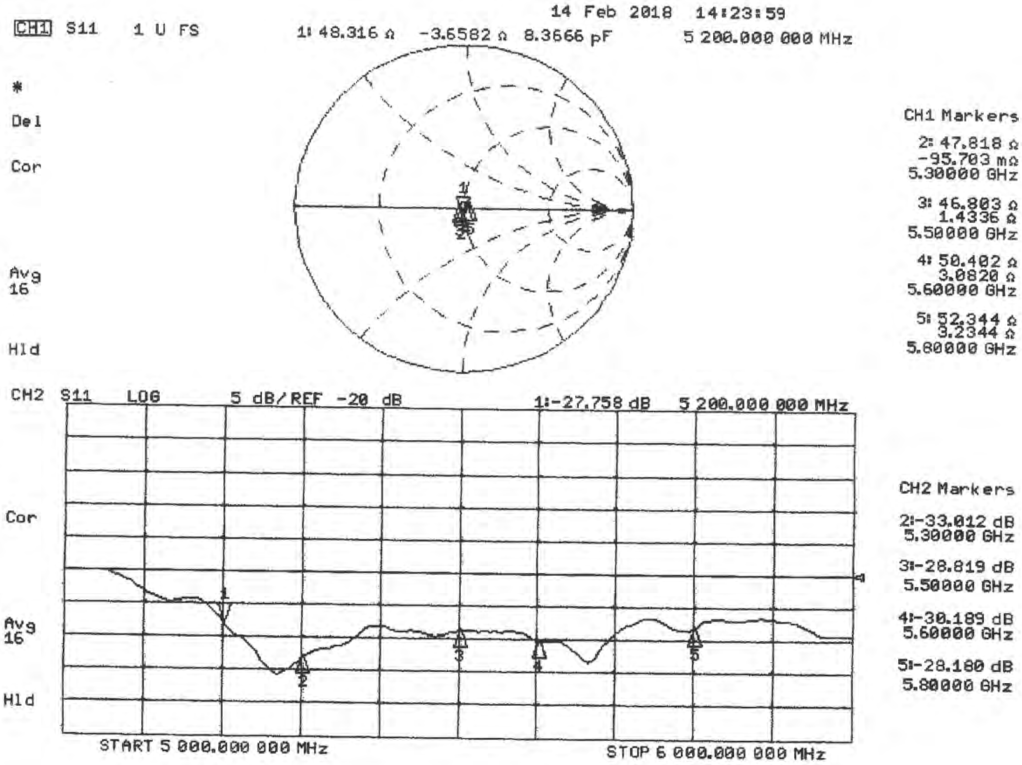
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.01 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 8.36 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 20.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.08 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.02.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1212

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.41 S/m; ε_r = 47.5; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 5.54 S/m; ε_r = 47.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 5.8 S/m; ε_r = 47; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 5.95 S/m; ε_r = 46.8; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 6.23 S/m; ε_r = 46.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.35, 5.35, 5.35); Calibrated: 30.12.2017, ConvF(5.15, 5.15, 5.15); Calibrated: 30.12.2017, ConvF(4.7, 4.7, 4.7); Calibrated: 30.12.2017, ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2017, ConvF(4.53, 4.53, 4.53); 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)

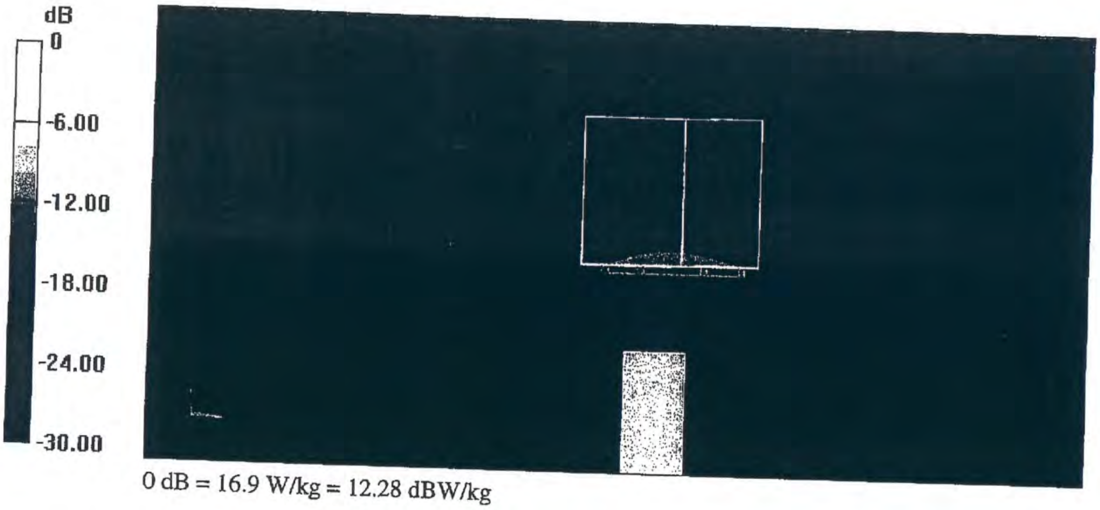
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.59 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 7.31 W/kg; SAR(10 g) = 2.03 W/kg
Maximum value of SAR (measured) = 16.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.99 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 17.7 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.88 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

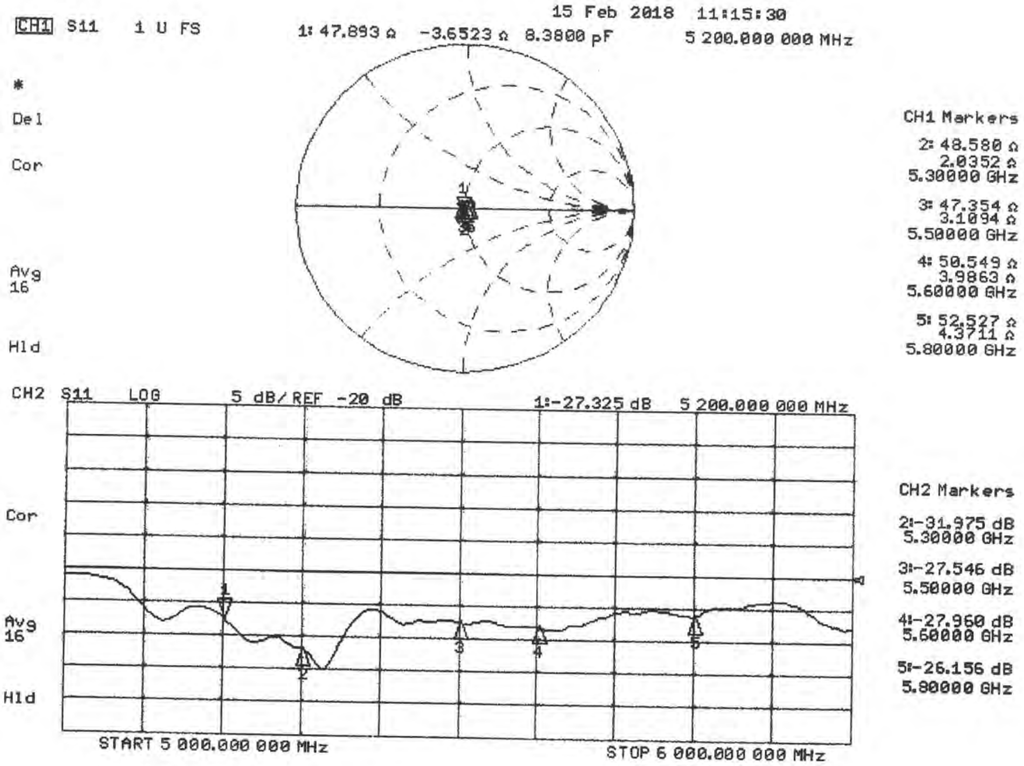
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.59 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 33.4 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.2 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.42 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

Impedance Measurement Plot for Body TSL



Attachment 3. – SAR SYSTEM VALIDATION

SAR System Validation

Per FCC KDB 865664 D02v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01v01r04 and IEEE 1528-2013.Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table Attachment 3.1 SAR System Validation Summary

SAR System	Freq. [MHz]	Date	Probe SN	Probe Type	Probe CAL. Point		PERM.	COND.	CW Validation			MOD. Validation		
							(εr)	(σ)	Sensi-tivity	Probe Linearity	Probe Isortopy	MOD. Type	Duty Factor	PAR
C	750	2017.10.16	3933	EX3DV4	750	Head	41.554	0.919	PASS	PASS	PASS	N/A	N/A	N/A
C	835	2017.10.17	3933	EX3DV4	835	Head	41.448	0.885	PASS	PASS	PASS	GMSK	PASS	N/A
C	1800	2017.10.18	3933	EX3DV4	1800	Head	38.945	1.385	PASS	PASS	PASS	N/A	N/A	N/A
C	1900	2017.10.19	3933	EX3DV4	1900	Head	39.115	1.377	PASS	PASS	PASS	GMSK	PASS	N/A
D	2450	2017.12.22	7337	EX3DV4	2450	Head	38.263	1.806	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
C	2600	2017.04.11	3328	ES3DV3	2600	Head	38.762	1.914	PASS	PASS	PASS	TDD	PASS	N/A
D	5200	2017.12.27	7337	EX3DV4	5200	Head	35.139	4.647	PASS	PASS	PASS	OFDM	N/A	PASS
D	5300	2017.12.27	7337	EX3DV4	5300	Head	35.007	4.759	PASS	PASS	PASS	OFDM	N/A	PASS
D	5500	2017.12.28	7337	EX3DV4	5500	Head	35.488	4.878	PASS	PASS	PASS	OFDM	N/A	PASS
D	5600	2017.12.28	7337	EX3DV4	5600	Head	35.348	4.982	PASS	PASS	PASS	OFDM	N/A	PASS
D	5800	2017.12.29	7337	EX3DV4	5800	Head	35.039	5.207	PASS	PASS	PASS	OFDM	N/A	PASS
C	750	2017.10.16	3933	EX3DV4	750	Body	54.876	0.974	PASS	PASS	PASS	N/A	N/A	N/A
C	835	2017.10.17	3933	EX3DV4	835	Body	54.715	0.982	PASS	PASS	PASS	GMSK	PASS	N/A
C	1800	2017.10.18	3933	EX3DV4	1800	Body	52.546	1.525	PASS	PASS	PASS	N/A	N/A	N/A
C	1900	2017.10.19	3933	EX3DV4	1900	Body	52.456	1.557	PASS	PASS	PASS	GMSK	PASS	N/A
D	2450	2017.12.22	7337	EX3DV4	2450	Body	50.751	2.012	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
C	2600	2017.10.23	3933	EX3DV4	2600	Body	51.547	2.202	PASS	PASS	PASS	TDD	PASS	N/A
D	5200	2017.12.27	7337	EX3DV4	5200	Body	49.485	5.244	PASS	PASS	PASS	OFDM	N/A	PASS
D	5300	2017.12.27	7337	EX3DV4	5300	Body	49.307	5.378	PASS	PASS	PASS	OFDM	N/A	PASS
D	5500	2017.12.28	7337	EX3DV4	5500	Body	48.319	5.594	PASS	PASS	PASS	OFDM	N/A	PASS
D	5600	2017.12.28	7337	EX3DV4	5600	Body	48.145	5.733	PASS	PASS	PASS	OFDM	N/A	PASS
D	5800	2017.12.29	7337	EX3DV4	5800	Body	47.810	6.013	PASS	PASS	PASS	OFDM	N/A	PASS

NOTE: While the probes have been calibrated for both a CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r04 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664.

Attachment 4. – LTE Band 7 Phablet SAR Evaluation with proximity sensor enabled

1. Reduced LTE Band 7 Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Modulated Average [dBm]
LTE Band 7	Maximum	24.5
	Nominal	24.0

Table 1.1 Nominal and Maximum Output Power Spec (Reduced Conducted Powers – Proximity Sensor Triggering Active)

LTE Band 7 Conducted Power– 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			20850 (2510.0 MHz)	21100 (2535.0 MHz)	21350 (2560.0 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.91	23.90	**23.92**	0	0
	1	50	23.78	23.77	23.79		
	1	99	23.65	23.77	23.79		
	50	0	23.75	23.71	**23.87**	0-1	0
	50	25	23.72	23.70	23.85		
	50	50	23.71	23.68	23.83		
	100	0	23.68	23.65	23.81	0-1	0
16QAM	1	0	23.77	23.72	23.88	0-1	0
	1	50	23.70	23.65	23.78		
	1	99	23.64	23.63	23.78		
	50	0	22.76	22.71	22.88	0-2	1
	50	25	22.75	22.70	22.87		
	50	50	22.74	22.69	22.82		
	100	0	22.71	22.70	22.75	0-2	1
64QAM	1	0	22.79	22.71	22.89	0-2	1
	1	50	22.73	22.68	22.83		
	1	99	22.70	22.66	22.82		
	50	0	21.75	21.71	21.89	0-3	2
	50	25	21.71	21.70	21.86		
	50	50	21.70	21.70	21.85		
	100	0	21.70	21.70	21.83	0-3	2

Table 1.2 LTE Conducted Power

LTE Band 7 Conducted Power– 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			20825 (2507.5 MHz)	21100 (2535.0 MHz)	21375 (2562.5 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	**23.91**	23.85	23.89	0	0
	1	36	23.73	23.81	23.64		
	1	74	23.71	23.79	23.61		
	36	0	23.83	23.81	23.82	0-1	0
	36	18	23.83	23.81	23.82		
	36	37	23.82	23.80	23.84		
	75	0	23.84	23.81	23.82	0-1	0
16QAM	1	0	23.83	23.75	23.84	0-1	0
	1	36	23.72	23.68	23.63		
	1	74	23.70	23.68	23.60		
	36	0	22.81	22.72	22.80	0-2	1
	36	18	22.83	22.74	22.79		
	36	37	22.83	22.75	22.84		
	75	0	22.78	22.70	22.82	0-2	1
64QAM	1	0	22.86	22.76	22.86	0-2	1
	1	36	22.76	22.67	22.67		
	1	74	22.76	22.69	22.65		
	36	0	21.83	21.71	21.82	0-3	2
	36	18	21.86	21.75	21.81		
	36	37	21.83	21.71	21.82		
	75	0	21.81	21.73	21.82	0-3	2

Table 1.3 LTE Conducted Power

LTE Band 7 Conducted Power– 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			20800 (2505.0 MHz)	21100 (2535.0 MHz)	21400 (2565.0 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.81	23.79	23.76	0	0
	1	25	23.78	23.78	23.80		
	1	49	23.64	23.76	23.61		
	25	0	23.72	23.72	23.71	0-1	0
	25	12	23.72	23.69	23.69		
	25	25	23.71	23.72	23.68		
	50	0	23.76	23.74	23.62	0-1	0
16QAM	1	0	23.71	23.76	23.74	0-1	0
	1	25	23.64	23.69	23.69		
	1	49	23.63	23.66	23.60		
	25	0	22.68	22.72	22.71	0-2	1
	25	12	22.66	22.74	22.73		
	25	25	22.69	22.71	22.72		
	50	0	22.69	22.74	22.66	0-2	1
64QAM	1	0	22.75	22.78	22.73	0-2	1
	1	25	22.66	22.68	22.67		
	1	49	22.66	22.69	22.65		
	25	0	21.72	21.73	21.71	0-3	2
	25	12	21.72	21.73	21.72		
	25	25	21.72	21.73	21.71		
	50	0	21.73	21.73	21.70	0-3	2

Table 1.4 LTE Conducted Power

LTE Band 7 Conducted Power– 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			20775 (2502.5 MHz)	21100 (2535.0 MHz)	21425 (2567.5 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.86	23.84	23.79	0	0
	1	12	23.65	23.87	23.78		
	1	24	23.61	23.80	23.81		
	12	0	23.78	23.78	23.71	0-1	0
	12	6	23.81	23.74	23.71		
	12	13	23.76	23.75	23.69		
	25	0	23.81	23.77	23.72	0-1	0
16QAM	1	0	23.83	23.75	23.76	0-1	0
	1	12	23.64	23.70	23.66		
	1	24	23.60	23.65	23.67		
	12	0	22.78	22.71	22.74	0-2	1
	12	6	22.82	22.73	22.74		
	12	13	22.80	22.75	22.74		
	25	0	22.80	22.75	22.74	0-2	1
64QAM	1	0	22.81	22.77	22.76	0-2	1
	1	12	22.68	22.71	22.71		
	1	24	22.65	22.70	22.70		
	12	0	21.81	21.72	21.71	0-3	2
	12	6	21.76	21.75	21.72		
	12	13	21.79	21.75	21.74		
	25	0	21.79	21.72	21.73	0-3	2

Table 1.5 LTE Conducted Power

2. Reduced LTE Band 7 DL Carrier Aggregation Conducted Powers

- Below downlink CA configurations were determined based on Manufacturer's information.

CA BW Class

Class	ATBC		Maximum number of CC
	$N_{RB,agg}$	MHz	
A	N <= 100	20	1
B	25 < N <= 100	20	2
C	100 < N <= 200	40	2
D	200 < N <= 300	60	3
E	300 < N <= 400	80	4
F	400 < N <= 500	100	5
I	700 < N <= 800	160	8

Table 2.1 Inter-band DL CA Configuration

2 bands / 2CC	2 bands / 3CC	2 bands / 4CC
CA_7A-46A (0)(1) Table 2.2	CA_7A-46C (0)(1) Table 2.3	CA_7A-46D (0)(1) Table 2.4

Table 2.2 LTE DL Carrier Aggregation Conducted Power for Inter-band DL CA Configuration (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A-46A (0)(1)]

PCC									SCC1				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	20	47290	5200	23.90<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	20	48290	5300	23.88<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	20	51290	5600	23.87<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	20	53140	5785	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	10	47290	5200	23.87<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	10	48290	5300	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	10	51290	5600	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	10	53140	5785	23.81<	23.92

Table 2.3 LTE DL Carrier Aggregation Conducted Power for Inter-band DL CA Configuration (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A-46C (0)(1)]

PCC									SCC1				SCC2				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	20	47290	5200	LTE B46$_A$	20	47488	5219.8	23.90<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	20	48290	5300	LTE B46$_B$	20	48488	5319.8	23.89<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	20	51290	5600	LTE B46$_C$	20	51488	5619.8	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	20	53140	5785	LTE B46$_D$	20	53338	5804.8	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	20	47290	5200	LTE B46$_A$	10	47434	5214.4	23.88<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	20	48290	5300	LTE B46$_B$	10	48434	5314.4	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	20	51290	5600	LTE B46$_C$	10	51434	5614.4	23.82<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	20	53140	5785	LTE B46$_D$	10	53284	5799.4	23.80<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	10	47290	5200	LTE B46$_A$	20	47434	5214.4	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	10	48290	5300	LTE B46$_B$	20	48434	5314.4	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	10	51290	5600	LTE B46$_C$	20	51434	5614.4	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	10	53140	5785	LTE B46$_D$	20	53284	5799.4	23.80<	23.92

Table 2.4 LTE DL Carrier Aggregation Conducted Power for Inter-band DL CA Configuration (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A-46D (0)(1)]

PCC									SCC1				SCC2				SCC3				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	20	47290	5200	LTE B46$_A$	20	47488	5219.8	LTE B46$_A$	20	47686	5239.6	23.87<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	20	48290	5300	LTE B46$_B$	20	48488	5319.8	LTE B46$_B$	20	48686	5339.6	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	20	51290	5600	LTE B46$_C$	20	51488	5619.8	LTE B46$_C$	20	51686	5639.6	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	20	53140	5785	LTE B46$_D$	20	53338	5804.8	LTE B46$_D$	20	53536	5824.6	23.82<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	20	47290	5200	LTE B46$_A$	20	47488	5219.8	LTE B46$_A$	10	47632	5234.2	23.87<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	20	48290	5300	LTE B46$_B$	20	48488	5319.8	LTE B46$_B$	10	48632	5334.2	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	20	51290	5600	LTE B46$_C$	20	51488	5619.8	LTE B46$_C$	10	51632	5634.2	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	20	53140	5785	LTE B46$_D$	20	53338	5804.8	LTE B46$_D$	10	53482	5819.2	23.80<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_A$	10	47290	5200	LTE B46$_A$	20	47434	5214.4	LTE B46$_A$	20	47632	5234.2	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_B$	10	48290	5300	LTE B46$_B$	20	48434	5314.4	LTE B46$_B$	20	48632	5334.2	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_C$	10	51290	5600	LTE B46$_C$	20	51434	5614.4	LTE B46$_C$	20	51632	5634.2	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B46$_D$	10	53140	5785	LTE B46$_D$	20	53284	5799.4	LTE B46$_D$	20	53482	5819.2	23.81<	23.92

Table 2.5 Intra-band (contiguous) DL CA Configuration

1 bands / 2CC	1 bands / 3CC	1 bands / 4CC
CA_7B (0) Table 2.6	N/A	N/A
CA_7C (0)(1)(2) Table 2.6	N/A	N/A

Table 2.4 LTE DL Carrier Aggregation Conducted Power for Intra-band (contiguous) DL CA Configuration (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7B (0) / CA_7C (0)(1)(2)]

PCC									SCC				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	15	20825	2507.5	QPSK	1	0	2825	2627.5	LTE B7	5	2918	2636.8	23.82<	23.91
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	20	3152	2660.2	23.90<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	15	3179	2662.9	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	10	3206	2665.6	23.83<	23.92

Table 2.7 Intra-band (non-contiguous) DL CA Configuration

1 bands / 2CC	1 bands / 3CC	1 bands / 4CC
CA_7A-7A (2) Table 2.8	N/A	N/A
CA_7A-7A (0)(1)(3) Table 2.8	N/A	N/A

Table 2.8 LTE DL Carrier Aggregation Conducted Power for Intra-band (non-contiguous) DL CA Configuration (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A-7A (2) /CA_7A-7A (0)(1)(3)]

PCC									SCC				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	20	2850	2630.0	23.90<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	15	2825	2627.5	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	10	2800	2625.0	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	5	2775	2622.5	23.84<	23.92

Table 2.9 LTE DL Carrier Aggregation Conducted Powers for comparing B7 DL 4X4 MIMO and B7 DL Intra-band CA (Reduced Conducted Powers - Proximity Sensor Triggering Active)

LTE Band	Maximum DL 4X4 MIMO Power (dBm]	Maximum DL Intra-band Contiguous DL CA Power (dBm)	Maximum DL Intra-band Non-Contiguous DL CA Power (dBm)
B7	23.88<	23.90	23.90

Note(s):

1. The device only supports downlink Carrier Aggregation. Uplink Carrier Aggregation is not supported. The DL carrier aggregation powers were measured according to the April 2018 TCB Workshop Notes (LTE Carrier Aggregation). Per Fall 2017 TCB Workshop Notes (LTE Carrier Aggregation) and FCC KDB Publication 941225 D05Av01r02, no further power measurements and SAR measurements are required for DL carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive.
2. For downlink carrier aggregation combinations, PCC uplink channel was selected based on section C.3)b)ii) of KDB 941225 D05Av01r02.

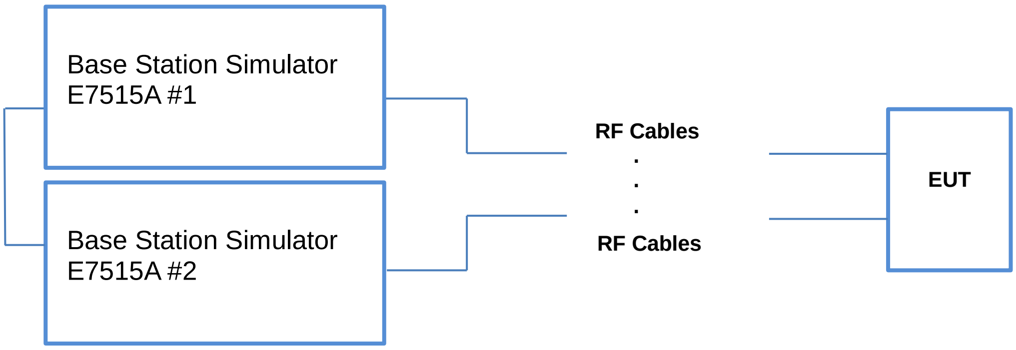


Figure 2.1 DL 4CA Power Measurement Setup

3. Reduced LTE Band 7 4x4 DL MIMO, LTE 4x4 DL MIMO with DL CA Conducted Powers

- **Below DL MIMO and DL CA configurations were determined based on Manufacturer's information.**

Table 3.1 DL 4X4 MIMO Configuration

LTE B7
7A[4X4] Table 3.2

Table 3.2 LTE DL 4X4 MIMO Conducted Power (Reduced Conducted Powers – Proximity Sensor Triggering Active)

PCC / DL 4X4 MIMO									Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	LTE Tx. Power with DL4X4 MIMO Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560.0	QPSK	1	0	3350	2680.0	23.88<	23.92
LTE B7	15	20825	2507.5	QPSK	1	0	2825	2627.5	23.84<	23.92
LTE B7	10	21100	2535.0	QPSK	1	25	3100	2655.0	23.81<	23.92
LTE B7	5	21100	2535.0	QPSK	1	12	3100	2655.0	23.79<	23.92

Note(s):
1. The device supports downlink 4X4 MIMO. The 4X4 MIMO powers were measured applying the May 2017 TCB Workshop Notes (LTE 4x4 Downlink MIMO). Per May 2017 TCB Workshop Notes (LTE 4x4 Downlink MIMO) and FCC KDB Publication 941225 D05Av01r02, no further power measurements and SAR measurements are required for DL MIMO configurations when the average output power with downlink MIMO active is not more than 0.25 dB higher than the average output power with downlink MIMO inactive.
2. PCC uplink channel was selected based on section C.3)b)ii) of KDB 941225 D05Av01r02.

Table 3.3 DL 4x4 MIMO with Inter-band DL CA Configuration

2 bands / 2CC	2 bands / 3CC	2 bands / 4CC
CA_7A[4x4]-46A (0)(1) Table 3.4	CA_7A[4x4]-46C (0)(1) Table 3.5	CA_7A[4x4]-46D (0)(1) Table 3.6

Table 3.4 DL 4X4 MIMO with Inter-band DL CA Configuration Powers (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A[4x4]-46A (0)(1)]

PCC									SCC				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	20	47290	5200	23.87<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	20	48290	5300	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	20	51290	5600	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	20	53140	5785	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	10	47290	5200	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	10	48290	5300	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	10	51290	5600	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	10	53140	5785	23.82<	23.92

Table 3.5 DL 4X4 MIMO with Inter-band DL CA Configuration Powers (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A[4x4]-46C (0)(1)]

PCC									SCC1				SCC2				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	20	47290	5200	LTE $B46_A$	20	47488	5219.8	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	20	48290	5300	LTE $B46_B$	20	48488	5319.8	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	20	51290	5600	LTE $B46_C$	20	51488	5619.8	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	20	53140	5785	LTE $B46_D$	20	53338	5804.8	23.82<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	20	47290	5200	LTE $B46_A$	10	47434	5214.4	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	20	48290	5300	LTE $B46_B$	10	48434	5314.4	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	20	51290	5600	LTE $B46_C$	10	51434	5614.4	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	20	53140	5785	LTE $B46_D$	10	53284	5799.4	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	10	47290	5200	LTE $B46_A$	20	47434	5214.4	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	10	48290	5300	LTE $B46_B$	20	48434	5314.4	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	10	51290	5600	LTE $B46_C$	20	51434	5614.4	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	10	53140	5785	LTE $B46_D$	20	53284	5799.4	23.80<	23.92

Table 3.6 DL 4X4 MIMO with Inter-band DL CA Configuration Powers (Reduced Conducted Powers - Proximity Sensor Triggering Active) [CA_7A[4x4]-46D (0)(1)]

PCC									SCC1				SCC2				SCC3				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	20	47290	5200	LTE $B46_A$	20	47488	5219.8	LTE $B46_A$	20	47686	5239.6	23.86<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	20	48290	5300	LTE $B46_B$	20	48488	5319.8	LTE $B46_B$	20	48686	5339.6	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	20	51290	5600	LTE $B46_C$	20	51488	5619.8	LTE $B46_C$	20	51686	5639.6	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	20	53140	5785	LTE $B46_D$	20	53338	5804.8	LTE $B46_D$	20	53536	5824.6	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	20	47290	5200	LTE $B46_A$	20	47488	5219.8	LTE $B46_A$	10	47632	5234.2	23.85<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	20	48290	5300	LTE $B46_B$	20	48488	5319.8	LTE $B46_B$	10	48632	5334.2	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	20	51290	5600	LTE $B46_C$	20	51488	5619.8	LTE $B46_C$	10	51632	5634.2	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	20	53140	5785	LTE $B46_D$	20	53338	5804.8	LTE $B46_D$	10	53482	5819.2	23.80<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_A$	10	47290	5200	LTE $B46_A$	20	47434	5214.4	LTE $B46_A$	20	47632	5234.2	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_B$	10	48290	5300	LTE $B46_B$	20	48434	5314.4	LTE $B46_B$	20	48632	5334.2	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_C$	10	51290	5600	LTE $B46_C$	20	51434	5614.4	LTE $B46_C$	20	51632	5634.2	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE $B46_D$	10	53140	5785	LTE $B46_D$	20	53284	5799.4	LTE $B46_D$	20	53482	5819.2	23.80<	23.92

Note(s):
1. The device supports DL 4X4 MIMO with DL Carrier Aggregation. Uplink MIMO and Carrier Aggregation is not supported. The 4X4 MIMO with DL carrier aggregation powers were measured applying the May 2017 TCB Workshop Notes (LTE 4x4 Downlink MIMO). Per May 2017 TCB Workshop Notes (LTE 4x4 Downlink MIMO) and FCC KDB Publication 941225 D05Av01r02, **no further power measurements and SAR measurements are required for DL 4X4 MIMO with DL carrier aggregation configurations** when the average output power with DL 4X4 MIMO with DL CA active is **not more than 0.25 dB higher than** the average output power with DL 4X4 MIMO with DL CA inactive.
2. For downlink carrier aggregation combinations, PCC uplink channel was selected based on section C.3)b)ii) of KDB 941225 D05Av01r02.

Table 3.7 DL 4x4 MIMO with Intra-band (contiguous) DL CA Configuration

1 bands / 2CC	1 bands / 3CC	1 bands / 4CC
CA_7B[4x4] (0) Table 3.8	N/A	N/A
CA_7C[4x4] (0)(1)(2) Table 3.8	N/A	N/A

Table 3.8 DL 4x4 MIMO with Intra-band (contiguous) DL CA Configuration Powers (Reduced Conducted Powers – Proximity Sensor Triggering Active) [CA_7B[4x4] (0) / CA_7C[4x4] (0)(1)(2)]

PCC									SCC				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	15	20825	2507.5	QPSK	1	0	2825	2627.5	LTE B7	5	2918	2636.8	23.72<	23.91
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	20	3152	2660.2	23.88<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	15	3179	2662.9	23.83<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	10	3206	2665.6	23.81<	23.92

Table 3.9 DL 4x4 MIMO with Intra-band (non-contiguous) DL CA Configuration

1 bands / 2CC	1 bands / 3CC	1 bands / 4CC
CA_7A[4x4]-7A (2) Table 3.10	N/A	N/A
CA_7A[4x4]-7A (0)(1)(3) Table 3.10	N/A	N/A

Table 3.10 DL 4x4 MIMO with Intra-band (non-contiguous) DL CA Configuration Powers (Reduced Conducted Powers – Proximity Sensor Triggering Active) [CA_7A[4x4]-7A (0)(1)(2)(3)]

PCC									SCC				Power	
PCC Band	PCC BW (MHz)	PCC (UL) CH.	PCC (UL) Freq. (MHz)	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) CH.	PCC (DL) Freq. (MHz)	SCC Band	SCC BW (MHz)	SCC (DL) CH.	SCC (DL) Freq. (MHz)	LTE Tx. Power with DL CA Enabled (dBm)	LTE Single Carrier Tx. Power (dBm)
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	20	2850	2630.0	23.88<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	15	2825	2627.5	23.84<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	10	2800	2625.0	23.81<	23.92
LTE B7	20	21350	2560	QPSK	1	0	3350	2680	LTE B7	5	2775	2622.5	23.80<	23.92

Note(s):

1. The device supports downlink 4X4 MIMO. The 4X4 MIMO powers were measured applying the May 2017 TCB Workshop Notes (LTE 4x4 Downlink MIMO). And Per May 2017 TCB Workshop Notes (LTE 4x4 Downlink MIMO) and FCC KDB Publication 941225 D05Av01r02, **no further power measurements and SAR measurements are required for DL MIMO configurations** when the average output power with downlink MIMO active is **not more than 0.25 dB higher than** the average output power with downlink MIMO inactive.

2 PCC uplink channel was selected based on section C.3)b)ii) of KDB 941225 D05Av01r02.

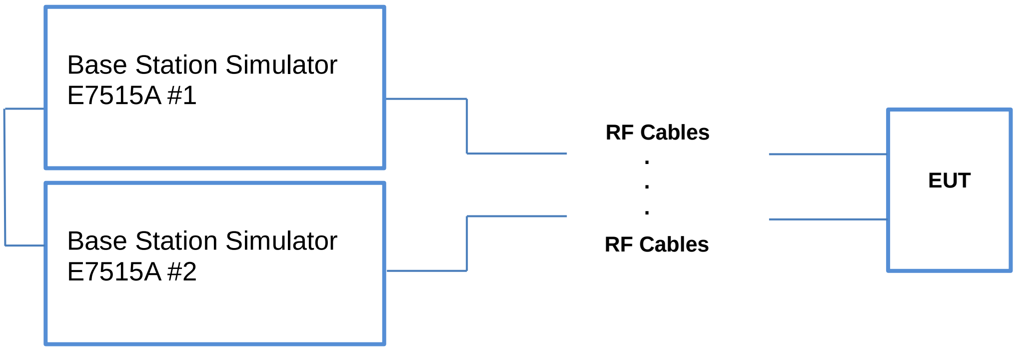


Figure 3.1 DL 4x4 MIMO, DL 4x4 MIMO with DL 4CA Power Measurement Setup

4. LTE Band 7 Cap Sensor (proximity sensor) Power Measurement, Triggering Distance

- Power reduction and Proximity Sensor information of ZNFG710EM

(1) Power reduction by proximity (capacitance) sensing: **LTE B7 only**

a) A proximity sensor for power reduction is implemented in this device to address RF exposure compliance about SAR requirement for protection of the human body.

(2) Proximity sensor detection area:

a) All proximity sensor pads are combined with the primary antenna pattern, therefore, they occupy the same area as the primary antenna.

b) The primary antenna and the proximity sensor pads are collocated and the peak SAR location is overlapping with the sensors, therefore do not need to measure proximity sensor coverage according to the KDB 616217 D04v01r02, section 6.3.

c) Power reduction mechanism is implemented in this device

i) Bottom surface, Front surface, Rear surface

d) The proximity sensor is triggered at the following distances when:

i) The bottom surface of the device is 7 mm for the trigger from the phantom.

ii) The front surface of the device is 3 mm for the trigger from the phantom.

iii) The rear surface of the device is 6 mm for the trigger from the phantom.

iv) Other surfaces (Right/Left edges) will be tested with the maximum powers.

e) When a certain object or human body approaches the DUT, if the measured capacitance is higher than certain capacitance, proximity sensor is triggered and power is reduced as follows.

Table 4.1 LTE Band 7 Proximity Sensor power information

Band	Proximity sensor state	Maximum	Power (dBm)	Normal	Power (dBm)
LTE B7	Inactive (Far)	Maximum	25.2	Normal	24.7
	Active (Near)	Maximum	24.2	Normal	23.7

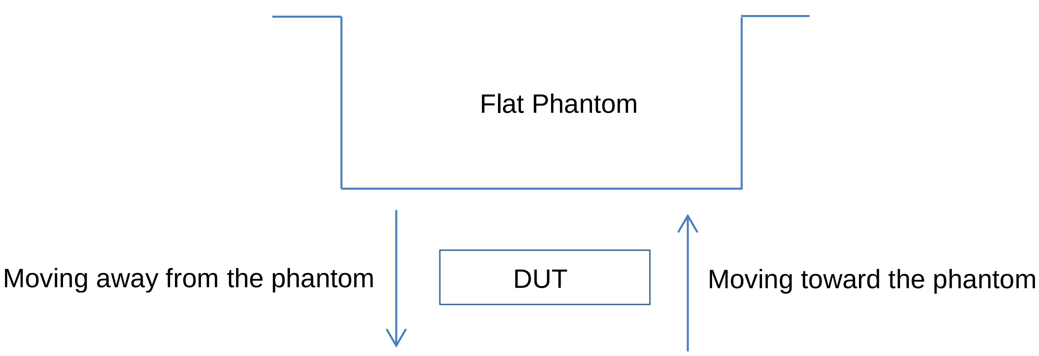


Figure 3.2 Proximity Sensor Triggering Distance Assessment

- Cap Sensor Power Measurement and Triggering Distance

As per the KDB616217 D04v01r02, section 6.2 and two parts power verification procedure is used to determine the triggering distances.

Using this procedure the most conservative sensor triggering distance was measured and SAR measurement distance is determined (The most conservative sensor triggering distance – 1 mm for each applicable sides and edges).

(1) Proximity sensor status table when DUT is moving towards/ moving away the phantom (Bottom)

Moving toward the phantom					Moving away from the phantom					Final SAR Measurement Distance (mm)
Dist. to the DUT (mm)	Capacitive Sensor Status (Bot. surface)	LTE Band 7 Cond. Power (dBm)	Trigg. dist. (mm)	SAR meas. Dist. (mm)	Dist. to the DUT (mm)	Capacitive Sensor Status (Bot. surface)	LTE Band 7 Cond. Power (dBm)	Trigg. dist. (mm)	SAR meas. Dist. (mm)	
27	Inactive (Far)	24.96	7	6	19	Inactive (Far)	24.96	7	6	6
24	Inactive (Far)				18	Inactive (Far)				
21	Inactive (Far)				17	Inactive (Far)				
18	Inactive (Far)				16	Inactive (Far)				
15	Inactive (Far)				15	Inactive (Far)				
12	Inactive (Far)				14	Inactive (Far)				
9	Inactive (Far)				13	Inactive (Far)				
8	Inactive (Far)				12	Inactive (Far)				
7	Active (Near)	23.92			11	Inactive (Far)				
6	Active (Near)				10	Inactive (Far)				
5	Active (Near)				9	Inactive (Far)				
4	Active (Near)				8	Inactive (Far)				
3	Active (Near)				7	Active (Near)	23.92			
2	Active (Near)				6	Active (Near)				
1	Active (Near)				3	Active (Near)				
0	Active (Near)				0	Active (Near)				

(2) Proximity sensor status table when DUT is moving towards/ moving away the phantom (Front)

Moving toward the phantom					Moving away from the phantom					Final SAR Measurement Distance (mm)
Dist. to the DUT (mm)	Capacitive Sensor Status (Front surface)	LTE Band 7 Cond. Power (dBm)	Trigg. dist. (mm)	SAR meas. Dist. (mm)	Dist. to the DUT (mm)	Capacitive Sensor Status (Front surface)	LTE Band 7 Cond. Power (dBm)	Trigg. dist. (mm)	SAR meas. Dist. (mm)	
23	Inactive (Far)	24.96	3	2	13	Inactive (Far)	24.96	3	2	2
20	Inactive (Far)				12	Inactive (Far)				
17	Inactive (Far)				11	Inactive (Far)				
14	Inactive (Far)				10	Inactive (Far)				
11	Inactive (Far)				9	Inactive (Far)				
8	Inactive (Far)				8	Inactive (Far)				
5	Inactive (Far)				7	Inactive (Far)				
4	Inactive (Far)				6	Inactive (Far)				
3	Active (Near)	23.92			5	Inactive (Far)				
2	Active (Near)				4	Inactive (Far)				
1	Active (Near)				3	Active (Near)	23.92			
0	Active (Near)				0	Active (Near)				

(3) Proximity sensor status table when DUT is moving towards/ moving away the phantom (Rear)

Moving toward the phantom					Moving away from the phantom					Final SAR meas. Dist. (mm)
Dist. to the DUT (mm)	Capacitive Sensor Status (Rear surface)	LTE Band 7 Cond. Power (dBm)	Trigg. dist. (mm)	SAR meas. Dist. (mm)	Dist. to the DUT (mm)	Capacitive Sensor Status (Rear surface)	LTE Band 7 Cond. Power (dBm)	Trigg. dist. (mm)	SAR meas. Dist. (mm)	
26	Inactive (Far)	24.96	6	5	18	Inactive (Far)	24.96	6	5	5
23	Inactive (Far)				17	Inactive (Far)				
20	Inactive (Far)				16	Inactive (Far)				
17	Inactive (Far)				15	Inactive (Far)				
14	Inactive (Far)				14	Inactive (Far)				
11	Inactive (Far)				13	Inactive (Far)				
8	Inactive (Far)				12	Inactive (Far)				
7	Inactive (Far)				11	Inactive (Far)				
6	Active (Near)	23.92			10	Inactive (Far)				
5	Active (Near)				9	Inactive (Far)				
4	Active (Near)				8	Inactive (Far)				
3	Active (Near)				7	Inactive (Far)				
2	Active (Near)				6	Active (Near)	23.92			
1	Active (Near)				3	Active (Near)				
0	Active (Near)				0	Active (Near)				

- **Cap Sensor SAR Test Plan for ZNFG710EM**

The smallest separation distance determined by the sensor triggering and sensor coverage for normal and/or tilt positions in KDB 616217 D04v01r02 section 6.2, 6.3 and 6.4 for front, back surface and edge triggering conditions, minus 1 mm, must be used as the test separation distance for SAR testing.

(1) The proximity sensor SAR will tested at the following distances when:

a) The **bottom surface** will be tested with the **maximum powers** of the device is **6 mm** from the phantom.

b) The **front surface** will be tested with the **maximum powers** of the device is **2 mm** from the phantom.

c) The **rear surface** will be tested with the **maximum powers** of the device is **5 mm** from the phantom.

d) **Other surfaces** (Left/Right edges) will be tested with the **maximum powers** of the device is **0 mm** from the phantom.

e) The **bottom surface** will be tested with the **reduction powers** of the device is **0 mm** from the phantom.

f) The **front surface** will be tested with the **reduction powers** of the device is **0 mm** from the phantom.

g) The **rear surface** will be tested with the **reduction powers** of the device is **0 mm** from the phantom.

Per FCC KDB Publication 616217 D04v01r02, this device was tested by test lab(DT&C) to determine the proximity sensor triggering distances for all applicable sides and edges of the device. The measured output power at distances within ± 5 mm of the triggering points (or until touching the phantom) is included for rear and front sides and each applicable edge per Step i) in Section 6.2 of the KDB. The technical descriptions in the filing contain the complete set of triggering data required by Section 6 of FCC Publication 616217 D04v01r02.

To ensure all production units are compliant, it is necessary to test SAR at a distance 1 mm less than the smallest distance between the device and SAR phantom (determined from the sensor triggering tests according to FCC KDB 616217 D04v01r02) with the device at the maximum output power (without power reduction). These SAR tests are included in addition to the SAR tests for the device touching the SAR phantom (at the reduced output power level).

The operational description contains information explaining how this device remains compliant in the event of a sensor malfunction.

5. Tissue Verification

MEASURED TISSUE PARAMETERS										
Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	Measured Frequency [MHz]	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	Er Deviation [%]	σ Deviation [%]
Mar. 30. 2018	2600 Body	22.3	22.0	2510.0	52.624	2.035	51.973	1.998	-1.24	-1.82
				2535.0	52.592	2.071	51.907	2.027	-1.30	-2.12
				2560.0	52.560	2.106	51.830	2.059	-1.39	-2.23
				2600.0	52.509	2.163	51.715	2.109	-1.51	-2.50

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB 865664 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

Measurement Procedure for Tissue verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity , for example from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{[\ln(b/a)]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

6. Test System Verification

Prior to assessment, the system is verified to the ± 10 % of the specifications at 2600 MHz by using the SAR Dipole kit(s). (Graphic Plots Attached)

Table 6.1 System Verification Results (10g)

SYSTEM DIPOLE VERIFICATION TARGET & MEASURED												
SAR System #	Freq. [MHz]	SAR Dipole kits	Date(s)	Tissue Type	Ambient Temp. [°C]	Liquid Temp. [°C]	Probe S/N	Input Power (mW)	1 W Target SAR_{10g} (W/kg)	Measured SAR_{10g} (W/kg)	1 W Normalized SAR_{10g} (W/kg)	Deviation [%]
C	2600	D2600V2, SN: 1103	Mar. 30. 2018	Body	22.3	22.0	3933	100	24.9	2.46	24.6	-1.20

Note1 : System Verification was measured with input 100 mW and normalized to 1W.
Note2 : Full system validation status and results can be found in Attachment 3.

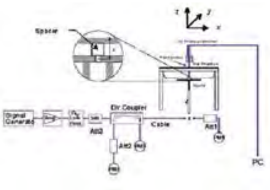
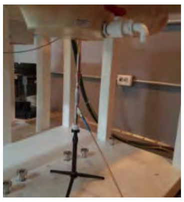



Figure 6.1 Dipole Verification Test Setup Diagram & Photo

7. Standalone Phablet SAR Results

MEASUREMENT RESULTS																	
FREQUENCY		Model/ Band	BW [MHz]	Max Allowed Power [dBm]	Cond. PWR [dBm]	Drift Power [dB]	MPR	Position	Device Serial Number	Mod.	RB Size	RB Offs.	Duty Cycle	10g SAR (W/kg)	Scaling Factor	10g Scaled SAR (W/kg)	Plots #
MHz	Ch																
2560.0	21350	LTE B7	20	25.20	24.96	0.150	0	6 mm [Bottom]	FCC #1	QPSK	1	0	1:1	0.560	1.057	0.592	
2560.0	21350	LTE B7	20	24.20	23.84	0.110	1	6 mm [Bottom]	FCC #1	QPSK	50	0	1:1	0.407	1.086	0.442	
2560.0	21350	LTE B7	20	25.20	24.96	-0.140	0	2 mm [Front]	FCC #1	QPSK	1	0	1:1	0.614	1.057	0.649	
2560.0	21350	LTE B7	20	24.20	23.84	-0.090	1	2 mm [Front]	FCC #1	QPSK	50	0	1:1	0.442	1.086	0.480	
2560.0	21350	LTE B7	20	25.20	24.96	-0.120	0	5 mm [Rear]	FCC #1	QPSK	1	0	1:1	0.872	1.057	0.922	
2560.0	21350	LTE B7	20	24.20	23.84	-0.140	1	5 mm [Rear]	FCC #1	QPSK	50	0	1:1	0.668	1.086	0.725	
2560.0	21350	LTE B7	20	25.20	24.96	-0.090	0	0 mm [Right]	FCC #1	QPSK	1	0	1:1	0.050	1.057	0.053	
2560.0	21350	LTE B7	20	24.20	23.84	-0.040	1	0 mm [Right]	FCC #1	QPSK	50	0	1:1	0.037	1.086	0.040	
2560.0	21350	LTE B7	20	25.20	24.96	0.020	0	0 mm [Left]	FCC #1	QPSK	1	0	1:1	0.061	1.057	0.064	
2560.0	21350	LTE B7	20	24.20	23.84	-0.060	1	0 mm [Left]	FCC #1	QPSK	50	0	1:1	0.047	1.086	0.051	
2560.0	21350	LTE B7	20	24.20	23.92	0.020	0	0 mm [Bottom]	FCC #1	QPSK	1	0	1:1	1.240	1.067	1.323	
2560.0	21350	LTE B7	20	24.20	23.87	-0.000	0	0 mm [Bottom]	FCC #1	QPSK	50	0	1:1	1.140	1.079	1.230	
2560.0	21350	LTE B7	20	24.20	23.92	-0.020	0	0 mm [Front]	FCC #1	QPSK	1	0	1:1	1.160	1.067	1.238	
2560.0	21350	LTE B7	20	24.20	23.87	0.070	0	0 mm [Front]	FCC #1	QPSK	50	0	1:1	1.040	1.079	1.122	
2560.0	21350	LTE B7	20	24.20	23.92	0.140	0	0 mm [Rear]	FCC #1	QPSK	1	0	1:1	1.410	1.067	**1.504**	A75
2560.0	21350	LTE B7	20	24.20	23.87	0.100	0	0 mm [Rear]	FCC #1	QPSK	50	0	1:1	1.340	1.079	1.446	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure									Phablet 4.0 W/kg (mW/g) averaged over 10 gram								

8. Phablet SAR Simultaneous Transmission Analysis with proximity sensor enabled

Table 8.1 Simultaneous Transmission Scenario : 4G + 5.3 GHz W-LAN Ant.1 (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.3G W-LAN Ant.1 SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.011	0.011
		Bottom	1.323	-	1.323
		Front	1.238	0.210	1.448
		Rear	1.504	0.226	**1.730**
		Right	0.053	-	0.053
		Left	0.064	0.045	0.109

Table 8.2 Simultaneous Transmission Scenario : 4G + 5.3 GHz W-LAN Ant.2 (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.3G W-LAN Ant.2 SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.008	0.008
		Bottom	1.323	-	1.323
		Front	1.238	0.037	1.275
		Rear	1.504	1.447	**2.951**
		Right	0.053	-	0.053
		Left	0.064	0.316	0.380

Table 8.3 Simultaneous Transmission Scenario : 4G + 5.3 GHz W-LAN MIMO (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.3G W-LAN MIMO SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.019	0.019
		Bottom	1.323	-	1.323
		Front	1.238	0.154	1.392
		Rear	1.504	1.767	**3.271**
		Right	0.053	-	0.053
		Left	0.064	0.333	0.397

Table 8.4 Simultaneous Transmission Scenario : 4G with 5.6 GHz W-LAN Ant.1 (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.6G W-LAN Ant.1 SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.022	0.022
		Bottom	1.323	-	1.323
		Front	1.238	0.210	1.448
		Rear	1.504	0.215	**1.719**
		Right	0.053	-	0.053
		Left	0.064	0.060	0.124

Table 8.5 Simultaneous Transmission Scenario : 4G + 5.6 GHz W-LAN Ant.2 (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.6G W-LAN Ant.2 SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.006	0.006
		Bottom	1.323	-	1.323
		Front	1.238	0.045	1.283
		Rear	1.504	1.438	**2.942**
		Right	0.053	-	0.053
		Left	0.064	0.334	0.398

Table 8.6 Simultaneous Transmission Scenario : 4G + 5.6 GHz W-LAN MIMO (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.6G W-LAN MIMO SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.022	0.022
		Bottom	1.323	-	1.323
		Front	1.238	0.177	1.415
		Rear	1.504	1.939	**3.443**
		Right	0.053	-	0.053
		Left	0.064	0.342	0.406

Table 8.7 Simultaneous Transmission Scenario : 4G + 5.8 GHz W-LAN Ant.1 (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.8G W-LAN Ant.1 SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.039	0.039
		Bottom	1.323	-	1.323
		Front	1.238	0.209	1.447
		Rear	1.504	0.276	**1.780**
		Right	0.053	-	0.053
		Left	0.064	0.056	0.120

Table 8.8 Simultaneous Transmission Scenario : 4G + 5.8 GHz W-LAN Ant.2 (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.8G W-LAN Ant.2 SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.007	0.007
		Bottom	1.323	-	1.323
		Front	1.238	0.080	1.317
		Rear	1.504	1.346	**2.851**
		Right	0.053	-	0.053
		Left	0.064	0.295	0.360

Table 8.9 Simultaneous Transmission Scenario : 4G + 5.8 GHz W-LAN MIMO (Phablet at 0 mm)

Exposure Condition	Mode	Configuration	4G SAR (W/kg)	5.8G W-LAN MIMO SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Phablet SAR	LTE Band 7	Top	-	0.030	0.030
		Bottom	1.323	-	1.323
		Front	1.238	0.233	1.470
		Rear	1.504	1.281	**2.785**
		Right	0.053	-	0.053
		Left	0.064	0.294	0.359

8.1 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE 1528-2013 Section 6.3.4.1.2.