Appendix G. – Dipole Calibration Data

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

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Swiss Calibration Service

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

Accreditation No.: **SCS 0108**

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D750V3-1014_May23**

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1014
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	May 23, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Sven Kühn	Technical Manager	S.K

Issued: May 23, 2023

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결재	담당자	확인자
재		
파트/성명	0L / 박신철	ES / 허승평
일자	2023 / 06.02	2023 / 06.02

Certificate No: D750V3-1014_May23 Page 1 of 6

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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.7 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.59 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.62 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω + 3.7 jΩ
Return Loss	- 24.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.038 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 23.05.2023

Test Laboratory: SPEAG, Zurich, Switzerland

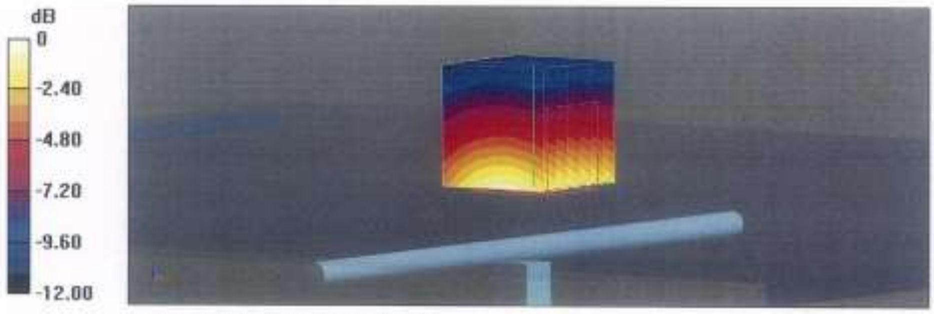
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1014

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.9 S/m; ε_r = 40.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

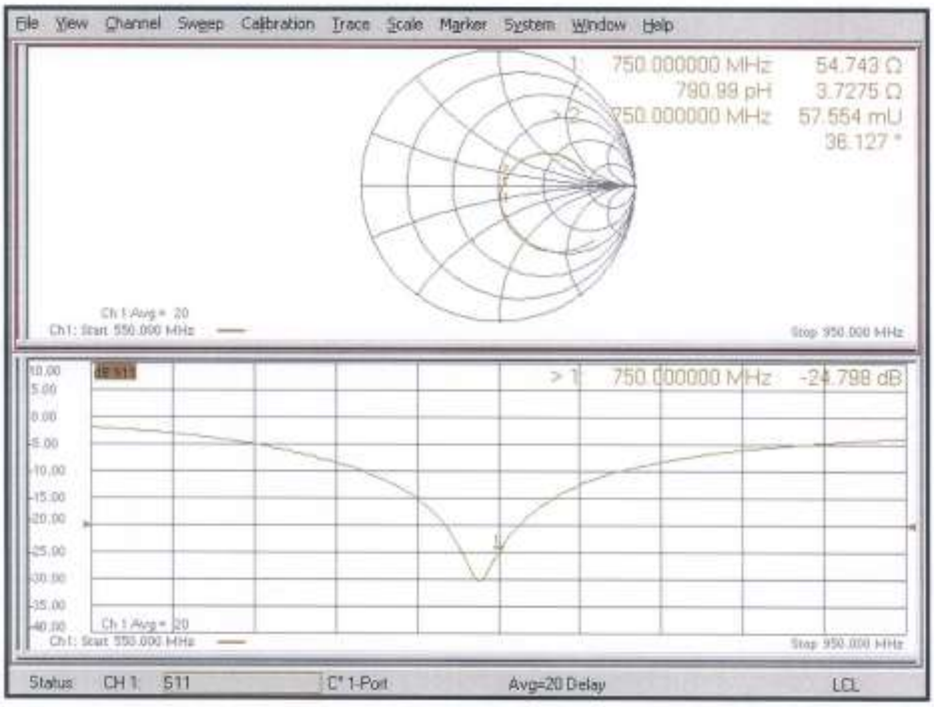
- Probe: EX3DV4 - SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 61.58 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.34 W/kg
SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.42 W/kg
Smallest distance from peaks to all points 3 dB below = 17.1 mm
Ratio of SAR at M2 to SAR at M1 = 64.9%
Maximum value of SAR (measured) = 2.90 W/kg



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

Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1014_May23 Page 6 of 6

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Accreditation No.: SCS 0108

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D835V2-4d165_May23**

CALIBRATION CERTIFICATE

Object	D835V2 - SN:4d165
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	May 23, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 23, 2023

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결재	담 당 자	확 인 자
직위/성명	DL / [illegible]	CJ / [illegible]
일 자	2023 / 06.02	2023 / 06.02

Certificate No: D835V2-4d165_May23 Page 1 of 6

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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.5 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.74 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.62 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.33 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 Ω - 3.2 jΩ
Return Loss	- 29.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 23.05.2023

Test Laboratory: SPEAG, Zurich, Switzerland

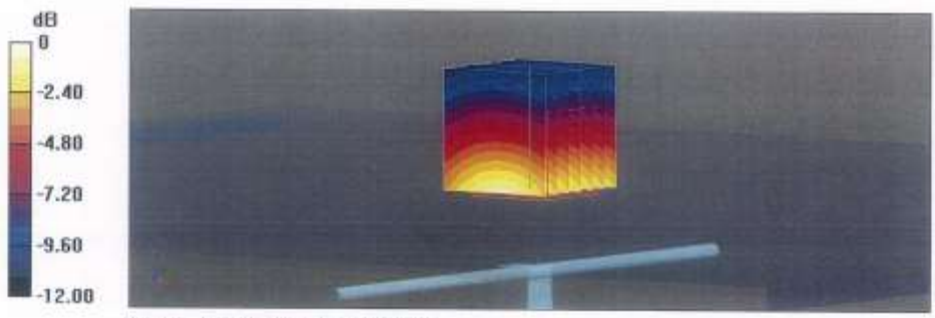
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d165

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.93 S/m; ε_r = 40.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

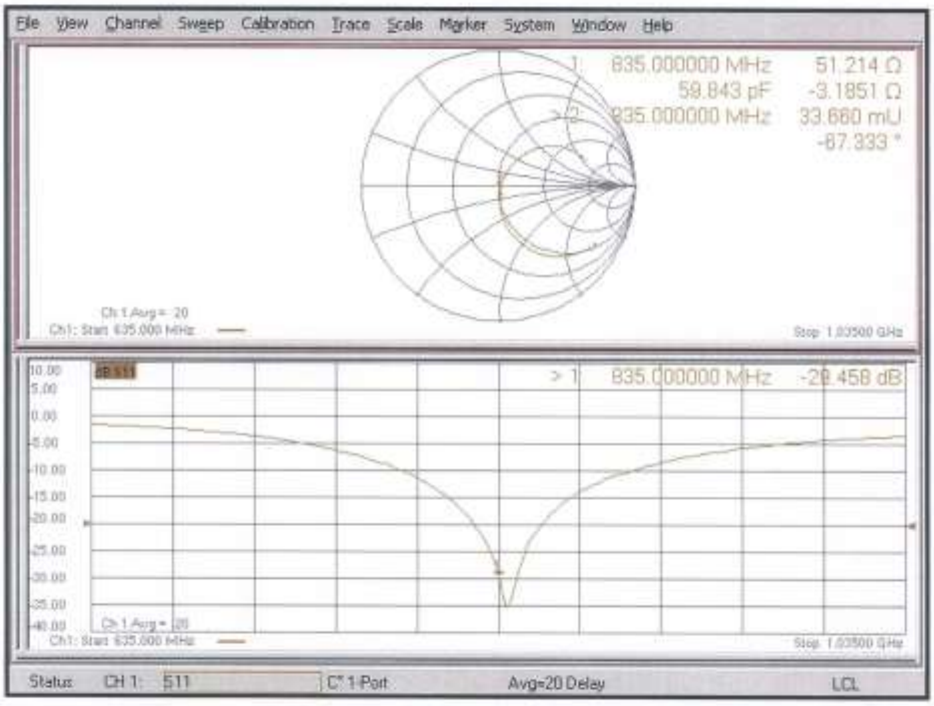
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 64.33 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.79 W/kg
SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.62 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 65.9%
Maximum value of SAR (measured) = 3.35 W/kg



0 dB = 3.35 W/kg = 5.25 dBW/kg

Certificate No: D835V2-4d165_May23 Page 5 of 6

Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 0108**

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D1800V2-2d015_May23**

CALIBRATION CERTIFICATE

Object	D1800V2 - SN:2d015
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	May 17, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Paulo Pina	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 25, 2023

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직위/성명	[illegible] / [illegible]	[illegible] / [illegible]
일 자	2023 / 06.02	2023 / 06.02

Certificate No: D1800V2-2d015_May23 Page 1 of 6

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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.5 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**37.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.92 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.9 Ω - 4.0 jΩ
Return Loss	- 27.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.214 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 17.05.2023

Test Laboratory: SPEAG, Zurich, Switzerland

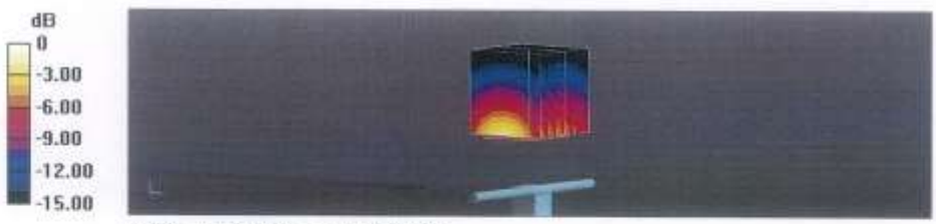
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d015

Communication System: UID 0 - CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.37 S/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

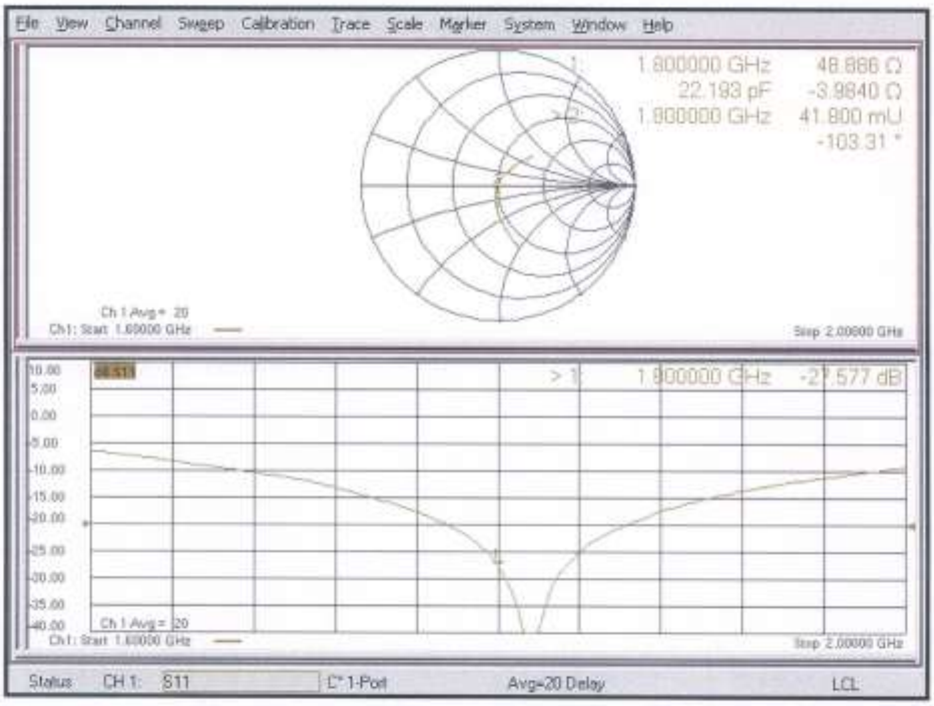
- Probe: EX3DV4 - SN7349; ConvF(8.63, 8.63, 8.63) @ 1800 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 109.2 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 9.42 W/kg; SAR(10 g) = 4.92 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 54.8%
Maximum value of SAR (measured) = 14.5 W/kg



0 dB = 14.5 W/kg = 11.61 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D1800V2-2d015_May23 Page 6 of 6

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Accreditation No.: SCS 0108

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D1900V2-5d032_Jan24**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d032
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	January 18, 2024

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	03-Oct-23 (No. DAE4-601_Oct23)	Oct-24

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Paulo Pina	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: January 18, 2024

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.0 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2 Ω + 6.8 jΩ
Return Loss	- 23.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.182 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 18.01.2024

Test Laboratory: SPEAG, Zurich, Switzerland

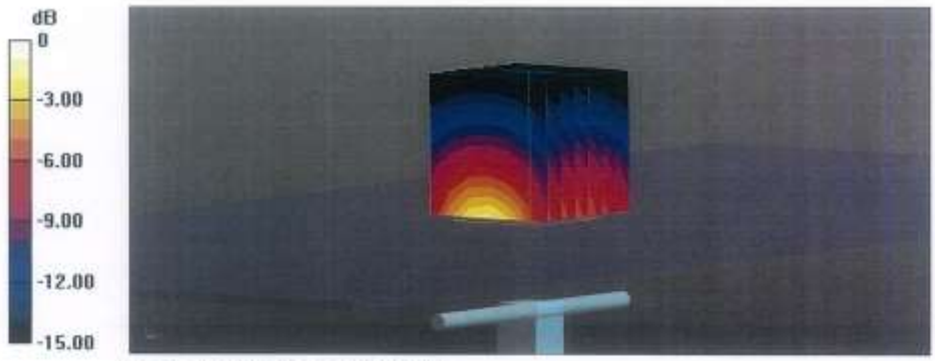
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d032

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.4 S/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

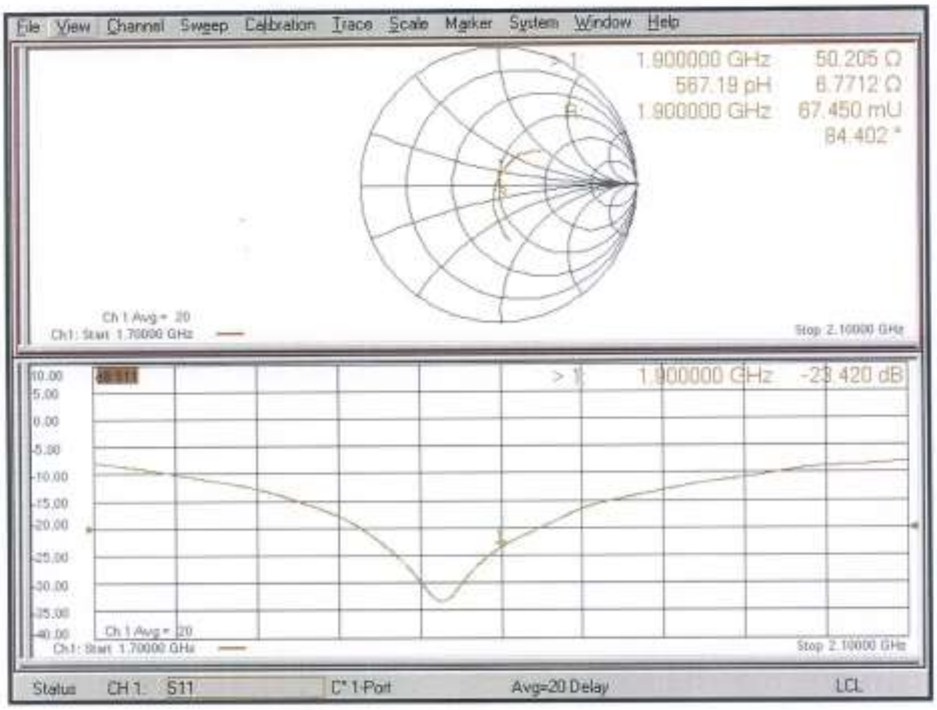
- Probe: EX3DV4 - SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 03.10.2023
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 109.9 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 18.3 W/kg
SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.22 W/kg
Smallest distance from peaks to all points 3 dB below = 9.8 mm
Ratio of SAR at M2 to SAR at M1 = 54.9%
Maximum value of SAR (measured) = 15.5 W/kg



0 dB = 15.5 W/kg = 11.90 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d032_Jan24 Page 6 of 6

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Accreditation No.: **SCS 0108**

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D2450V2-1049_Apr23**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:1049
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	April 25, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Sven Kühn	Technical Manager	i.a. [signature]

Issued: April 26, 2023

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재	[signature]	[signature]
직위/성명	DL / 박태홍	CJ / 허종호
일자	2023 / 05.09	2023 / 05.09

Certificate No: D2450V2-1049_Apr23 Page 1 of 7

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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.1 Ω + 8.8 jΩ
Return Loss	- 21.0 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

DASY5 Validation Report for Head TSL

Date: 25.04.2023

Test Laboratory: SPEAG, Zurich, Switzerland

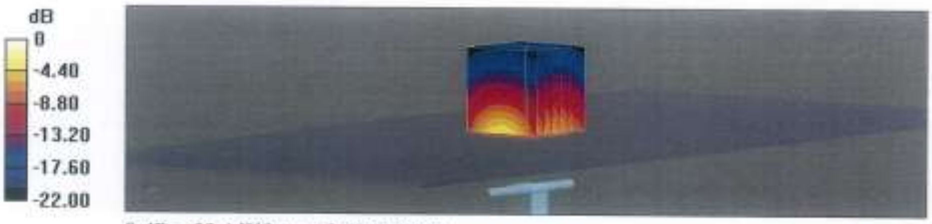
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 1049

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

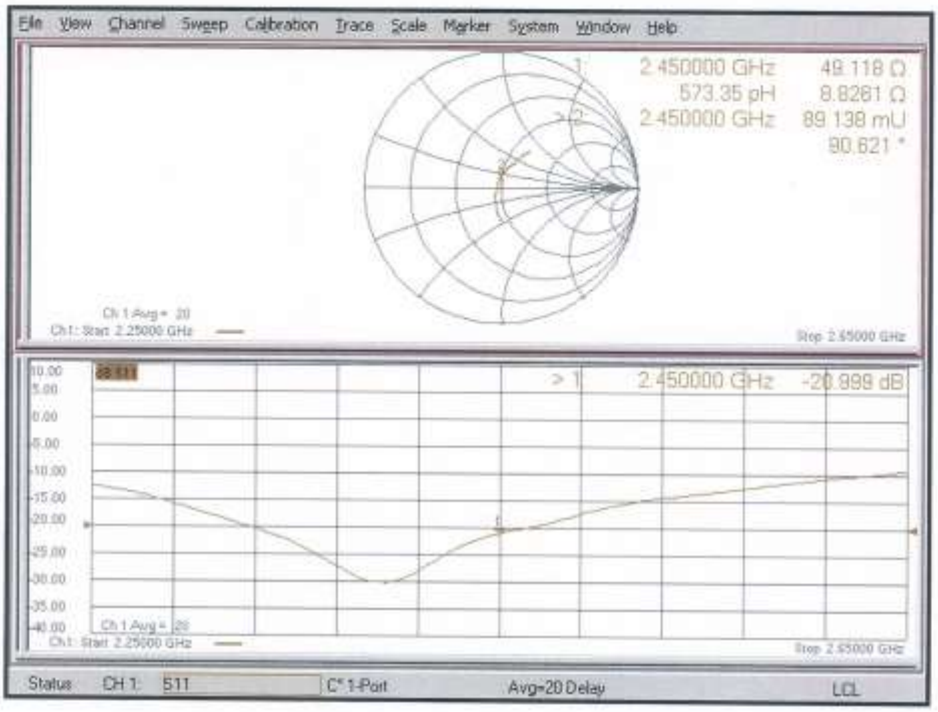
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 117.0 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.23 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 50.1%
Maximum value of SAR (measured) = 22.4 W/kg



0 dB = 22.4 W/kg = 13.50 dBW/kg

Certificate No: D2450V2-1049_Apr23 Page 5 of 7

Impedance Measurement Plot for Head TSL



Appendix: Transfer Calibration at Four Validation Locations on SAM Head[1]

Evaluation Condition

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L

SAR result with SAM Head (Top ≅ C0)

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**56.2 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**26.1 W/kg ± 16.9 % (k=2)**

SAR result with SAM Head (Mouth ≅ F90)

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**57.3 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**27.4 W/kg ± 16.9 % (k=2)**

SAR result with SAM Head (Neck ≅ H0)

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**54.0 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**25.0 W/kg ± 16.9 % (k=2)**

SAR result with SAM Head (Ear ≅ D90)

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**34.6 W/kg ± 17.5 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**17.4 W/kg ± 16.9 % (k=2)**

[1] Additional assessments outside the current scope of SCS 0108

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Accreditation No.: **SCS 0108**

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D2600V2-1106_May23**

CALIBRATION CERTIFICATE

Object	D2600V2 - SN:1106
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	May 24, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Paulo Pina	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 24, 2023

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	담당자	확인자
결재		
직위/성명		
일자	2023 / 06.02	2023 / 06.02

Certificate No: D2600V2-1106_May23 Page 1 of 6

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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	37.1 ± 6 %	2.00 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	14.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**55.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.1 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	48.9 Ω - 6.8 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 24.05.2023

Test Laboratory: SPEAG, Zurich, Switzerland

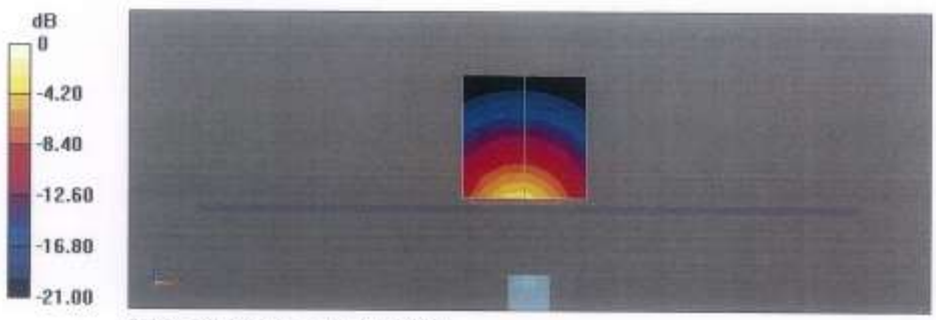
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1106

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2 S/m; ε_r = 37.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

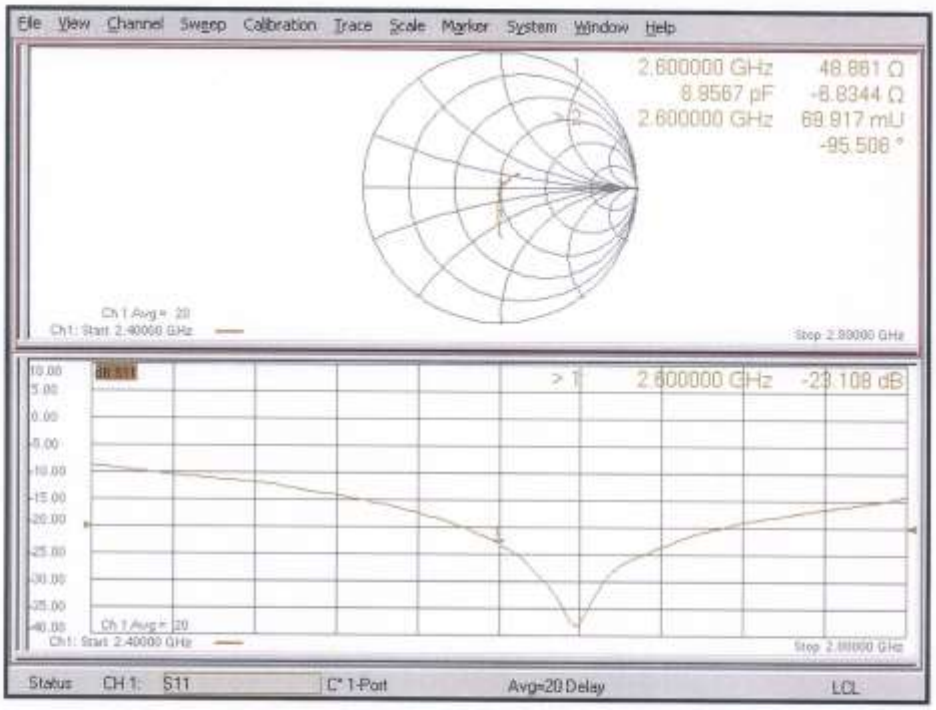
- Probe: EX3DV4 - SN7349; ConvF(7.68, 7.68, 7.68) @ 2600 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 117.6 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.37 W/kg
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 51.4%
Maximum value of SAR (measured) = 23.0 W/kg



0 dB = 23.0 W/kg = 13.62 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1106_May23 Page 6 of 6

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Accreditation No.: **SCS 0108**

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **D5GHzV2-1317_May23**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1317
Calibration procedure(s)	QA CAL-22.v7 Calibration Procedure for SAR Validation Sources between 3-10 GHz
Calibration date:	May 17, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3503	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Sven Kühn	Technical Manager	S. Kü

Issued: May 25, 2023

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

Certificate No: D5GHzV2-1317_May23 Page 1 of 11

Calibration Laboratory of
Schmid & Partner
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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 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	34.6 ± 6 %	4.97 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	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.0 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.1 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	34.3 ± 6 %	5.11 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	7.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.8 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	44.6 Ω - 2.0 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	48.0 Ω - 0.3 jΩ
Return Loss	- 33.6 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	47.2 Ω + 1.2 jΩ
Return Loss	- 30.0 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	46.0 Ω + 0.8 jΩ
Return Loss	- 27.4 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

DASY5 Validation Report for Head TSL

Date: 17.05.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1317

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5250 MHz; σ = 4.6 S/m; ε_r = 34.8; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 34.6; ρ = 1000 kg/m^3
Medium parameters used: f = 5750 MHz; σ = 5.08 S/m; ε_r = 34.4; ρ = 1000 kg/m^3
Medium parameters used: f = 5800 MHz; σ = 5.11 S/m; ε_r = 34.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

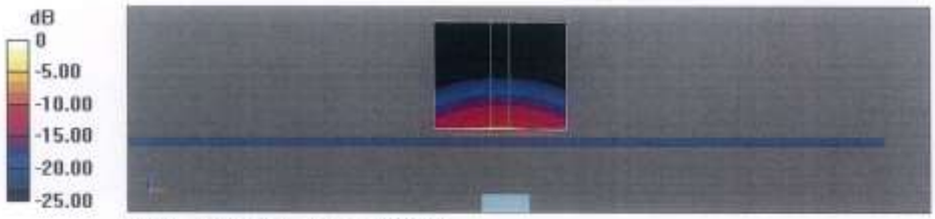
- Probe: EX3DV4 - SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.29 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.28 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 71.8%
Maximum value of SAR (measured) = 17.6 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 = 74.66 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 30.1 W/kg
SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.32 W/kg
Smallest distance from peaks to all points 3 dB below = 6.8 mm
Ratio of SAR at M2 to SAR at M1 = 68.8%
Maximum value of SAR (measured) = 18.8 W/kg

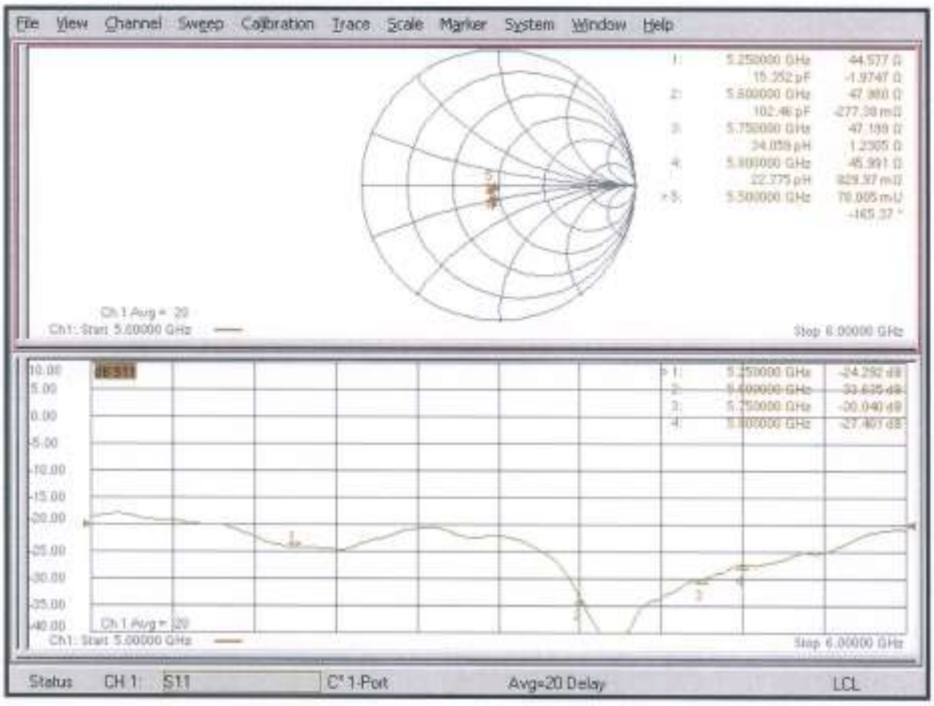
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.14 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.23 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 66.1%
Maximum value of SAR (measured) = 18.2 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 = 71.84 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 30.2 W/kg
SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.2 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.5%
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

Impedance Measurement Plot for Head TSL



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Appendix: Transfer Calibration at Four Validation Locations on SAM Head[1]

Evaluation Conditions (f=5250 MHz)

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L

SAR result with SAM Head (Top)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**84.3 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 19.9 % (k=2)**

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**83.5 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.9 % (k=2)**

SAR result with SAM Head (Neck)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**81.7 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.9 % (k=2)**

SAR result with SAM Head (Ear)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**52.8 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**17.9 W/kg ± 19.9 % (k=2)**

[1] Additional assessments outside the current scope of SCS 0108

Appendix: Transfer Calibration at Four Validation Locations on SAM Head[2]

Evaluation Conditions (f=5800 MHz)

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L

SAR result with SAM Head (Top)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**79.9 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.9 % (k=2)**

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**86.4 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 W/kg ± 19.9 % (k=2)**

SAR result with SAM Head (Neck)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**77.1 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**21.7 W/kg ± 19.9 % (k=2)**

SAR result with SAM Head (Ear)

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	**54.9 W/kg ± 20.3 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR for nominal Head TSL parameters	normalized to 1W	**18.4 W/kg ± 19.9 % (k=2)**

[2] Additional assessments outside the current scope of SCS 0108

Appendix H. – Power reduction verification

Per the May 2017 TCBC Workshop notes, demonstration of proper functioning of the power reduction mechanism is required to support the corresponding SAR Configurations.

Procedures for determining proximity sensor triggering distances

(KDB 616217 D04v01r02 §6.2)

The distance verification procedure was performed according to the following procedure:

1. A base station simulator was used to establish an RF connection and to monitor the power levels. The device being tested was placed below the relevant section of the phantom with the relevant side or edge of the device facing toward the phantom. For Licensed modes, the device UI was monitored to determine the triggering state.
2. The device was moved toward and away from the phantom to determine the distance at which the mechanism triggers and the output power is reduced, per KDB Publication 616217 D04v01r02.Each applicable test position was evaluated. The distance was conformed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
3. Step 1 and 2 were repeated for the relevant modes, as appropriate
4. Steps1 through 3 were repeated for all distance-based power reduction mechanisms.

For detailed measurement conducted power results, please refer to the Section .11

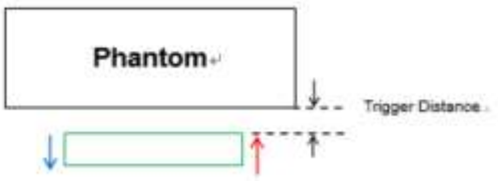
1. Power Reduction Verification for Main ANT

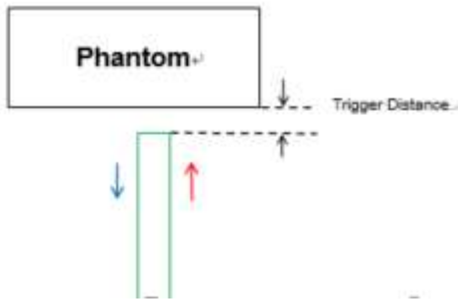
This device utilizes a power reduction mechanism for some wireless modes under some conditions when the device is being used in close proximity to the user's hand for Main ANT

FCC KDB Publication 616217D04v01r02 section 6 was used as a guideline for selection SAR test distances for this device when being used in Proximity use conditions.

Mechanism(s)	Mode/Band	Device State	
		Un-triggered (Grip Inactive, Max Power)	Triggered (Grip Active, Reduced Power)
Grip	GSM Band 850	28.33	19.47
Grip	GSM Band 1900	26.22	17.90
Grip	UMTS Band 2	23.01	13.33
Grip	UMTS Band 4	23.08	13.94
Grip	UMTS Band 5	23.11	16.27
Grip	LTE Band 2	23.70	14.36
Grip	LTE Band 4	23.86	14.81
Grip	LTE Band 5	24.12	17.30
Grip	LTE Band 12	23.69	18.69
Grip	LTE Band 17	23.75	18.69
Grip	LTE Band 25	23.70	14.40
Grip	LTE Band 26	24.14	17.24
Grip	LTE Band 41	23.41	14.85
Grip	LTE Band 66	23.88	14.49

1.1 Proximity sensor triggering Distance Verification.





Proximity Sensor Trigger Distance Assessment KDB 616217 D04 §6.2 (Rear / Top side)

LEGEND

→ Direction of DUT travel for determination of power reduction triggering point

→ Direction of DUT travel for determination of full power resumption triggering point

Tissue simulating liquid	Trigger distance Rear		Trigger distance Top	
	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]
750MHz	17	23	24	35
835MHz	17	23	24	35
1800 MHz	17	23	24	35
1900 MHz	17	23	24	35
2300 MHz	17	23	24	35
2600 MHz	17	23	24	35

Distance Measurement verification for Proximity sensor

Rear side – EUT Moving toward (trigger) to the Phantom

Distance	Distance to DUT Output power (dBm)									
	22	21	20	19	18	17	16	15	14	13
GSM Band 850	28.31	28.34	28.25	28.25	28.24	19.44	19.54	19.53	19.43	19.48
GSM Band 1900	26.28	26.29	26.32	26.23	26.20	17.95	17.84	17.97	17.99	17.87
UMTS Band 2	23.11	23.03	23.00	22.99	23.10	13.33	13.39	13.38	13.24	13.34
UMTS Band 4	23.02	23.16	23.05	22.99	23.12	13.92	13.86	13.89	13.86	14.02
UMTS Band 5	23.05	23.01	23.01	23.02	23.04	16.37	16.19	16.34	16.29	16.21
LTE Band 2	23.66	23.68	23.61	23.64	23.67	14.26	14.41	14.43	14.37	14.34
LTE Band 4	23.84	23.95	23.95	23.94	23.88	14.84	14.81	14.90	14.88	14.86
LTE Band 5	24.16	24.13	24.02	24.21	24.02	17.25	17.32	17.27	17.36	17.22
LTE Band 12	23.72	23.61	23.64	23.74	23.73	18.63	18.76	18.70	18.69	18.60
LTE Band 17	23.68	23.69	23.80	23.70	23.84	18.72	18.63	18.77	18.64	18.66
LTE Band 25	23.77	23.63	23.77	23.68	23.67	14.44	14.37	14.35	14.47	14.38
LTE Band 26	24.13	23.69	23.77	23.75	23.6	14.31	14.5	17.26	14.48	14.32
LTE Band 41	23.33	23.44	23.44	23.47	23.49	14.86	14.91	14.93	14.84	14.80
LTE Band 66	23.92	23.5	23.5	23.32	23.34	14.90	14.92	14.45	14.79	14.79

Rear side – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	19	20	21	22	23	24	25	26	27	28
GSM Band 850	19.55	19.53	19.53	19.54	19.37	28.31	28.25	28.37	28.30	28.29
GSM Band 1900	17.92	17.90	17.85	17.91	17.98	26.16	26.24	26.18	26.20	26.31
UMTS Band 2	13.24	13.35	13.27	13.34	13.37	23.08	23.06	22.93	22.95	22.95
UMTS Band 4	13.96	13.91	13.91	13.99	13.92	23.12	23.08	22.99	23.03	23.09
UMTS Band 5	16.18	16.29	16.37	16.33	16.27	23.09	23.10	23.18	23.14	23.13
LTE Band 2	14.31	14.38	14.39	14.41	14.44	23.68	23.70	23.65	23.75	23.66
LTE Band 4	14.77	14.86	14.71	14.73	14.71	23.94	23.95	23.83	23.88	23.87
LTE Band 5	17.21	17.29	17.37	17.31	17.34	24.02	24.17	24.02	24.18	24.05
LTE Band 12	18.64	18.78	18.69	18.73	18.73	23.64	23.74	23.68	23.70	23.60
LTE Band 17	18.64	18.68	18.67	18.63	18.70	23.73	23.78	23.68	23.67	23.66
LTE Band 25	14.44	14.39	14.46	14.31	14.39	23.76	23.69	23.60	23.70	23.60
LTE Band 26	14.45	14.41	17.18	14.40	14.40	24.24	23.67	23.62	23.74	23.61
LTE Band 41	14.79	14.83	14.83	14.92	14.77	23.40	23.47	23.41	23.33	23.48
LTE Band 66	14.92	14.91	14.43	14.77	14.92	23.9	23.45	23.46	23.39	23.39

Based on the most conservative measured triggering distance of 17mm, additional Body SAR measurements were required at 16mm from rear side for the above modes.

Top side – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	29	28	27	26	25	24	23	22	21	20
GSM Band 850	28.26	28.40	28.26	28.29	28.23	19.56	19.44	19.41	19.51	19.49
GSM Band 1900	26.31	26.18	26.17	26.25	26.14	17.87	17.86	17.97	17.88	17.99
UMTS Band 2	23.03	23.04	22.92	23.10	22.91	13.27	13.40	13.37	13.25	13.28
UMTS Band 4	23.14	23.09	23.18	23.03	23.16	13.95	13.93	13.91	14.01	13.96
UMTS Band 5	23.10	23.12	23.04	23.13	23.02	16.21	16.36	16.17	16.19	16.24
LTE Band 2	23.79	23.78	23.66	23.62	23.72	14.36	14.31	14.27	14.36	14.27
LTE Band 4	23.94	23.86	23.82	23.91	23.86	14.73	14.72	14.74	14.77	14.88
LTE Band 5	24.13	24.11	24.13	24.13	24.13	17.38	17.27	17.24	17.26	17.30
LTE Band 12	23.79	23.76	23.59	23.76	23.73	18.63	18.73	18.76	18.79	18.68
LTE Band 17	23.68	23.65	23.72	23.69	23.71	18.73	18.67	18.73	18.74	18.61
LTE Band 25	23.70	23.76	23.60	23.62	23.70	14.34	14.41	14.31	14.46	14.40
LTE Band 26	24.13	23.64	23.73	23.72	23.72	14.33	14.47	17.17	14.40	14.35
LTE Band 41	23.41	23.42	23.37	23.31	23.33	14.76	14.77	14.92	14.91	14.91
LTE Band 66	23.81	23.39	23.47	23.4	23.33	14.75	14.94	14.57	14.88	14.91

Top side – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	31	32	33	34	35	36	37	38	39	40
GSM Band 850	19.55	19.45	19.46	19.48	19.42	28.26	28.27	28.36	28.39	28.29
GSM Band 1900	17.94	17.96	17.86	17.92	17.91	26.26	26.31	26.12	26.15	26.18
UMTS Band 2	13.23	13.35	13.29	13.34	13.33	23.02	23.09	23.08	22.94	23.09
UMTS Band 4	13.93	14.03	13.87	13.91	13.95	22.99	23.00	23.01	23.03	23.06
UMTS Band 5	16.35	16.20	16.19	16.18	16.17	23.20	23.04	23.09	23.04	23.05
LTE Band 2	14.37	14.30	14.29	14.35	14.41	23.64	23.79	23.65	23.76	23.72
LTE Band 4	14.74	14.80	14.71	14.91	14.74	23.81	23.78	23.89	23.79	23.89
LTE Band 5	17.37	17.20	17.35	17.27	17.23	24.08	24.12	24.08	24.22	24.21
LTE Band 12	18.78	18.59	18.69	18.66	18.66	23.68	23.70	23.77	23.60	23.79
LTE Band 17	18.68	18.69	18.76	18.75	18.67	23.80	23.72	23.82	23.71	23.82
LTE Band 25	14.35	14.50	14.31	14.44	14.46	23.71	23.64	23.72	23.79	23.68
LTE Band 26	14.39	14.48	17.32	14.30	14.48	24.09	23.8	23.71	23.66	23.65
LTE Band 41	14.95	14.93	14.88	14.90	14.86	23.43	23.48	23.36	23.47	23.46
LTE Band 66	14.92	14.75	14.54	14.86	14.75	23.91	23.43	23.50	23.36	23.51

Based on the most conservative measured triggering distance of 24mm, additional Body SAR measurements were required at 23mm from top side for the above modes.

1.2 Proximity Sensor Coverage for SAR measurements

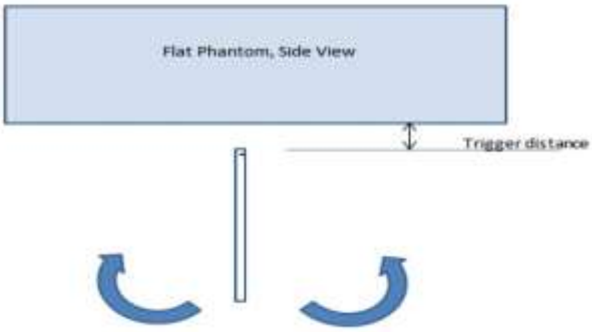
(KDB 616217 D04v01r02 §6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

1.3 Proximity Sensor Tilt Angle Assessment

(KDB 616217 D04v01r02 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Bottom side parallel to the base of the flat phantom for each band. The EUT was rotated about Bottom side for angles up to ±45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up ±45°.



Proxir

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Top side)

Band (MHz)	Minimum distance at which power reduction was maintained over-45°	Power reduction status										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
700MHz	24 mm	On	On	On	On	On	On	On	On	On	On	On
800MHz	24 mm	On	On	On	On	On	On	On	On	On	On	On
1750 MHz	24 mm	On	On	On	On	On	On	On	On	On	On	On
1900 MHz	24 mm	On	On	On	On	On	On	On	On	On	On	On
2600 MHz	24 mm	On	On	On	On	On	On	On	On	On	On	On

1.4 Resulting test positions for Body SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Body SAR [mm]
Main ANT	Rear	17	N/A	N/A	16
	Top	24	N/A	N/A	23

Note: FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device when being used in use conditions.

2. Power reduction Verification for WLAN ANT 0

This device uses a power reduction mechanism for SAR compliance for WLAN operations during Grip sensor is activated

Mechanism(s)	Mode/Band	Un-triggered (Max Power)	Triggered (Reduced Power)
Grip	2.4GHz 802.11b	14.08	11.51
Grip	2.4GHz 802.11g	13.45	10.50
Grip	2.4GHz 802.11n	13.87	10.88
Grip	5GHz 802.11n 20MHz	11.26	8.20
Grip	5GHz 802.11ac 20MHz	10.76	5.69
Grip	5GHz 802.11n 40MHz	8.01	7.52
Grip	5GHz 802.11ac 40MHz	8.29	6.03

Tissue simulating liquid	Trigger distance – Rear		Trigger distance – Right Side		Trigger distance – Top	
	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]
2450MHz	14	25	8	17	19	25
5000MHz	14	25	8	17	19	25

Rear – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	19	18	17	16	15	14	13	12	11	10
2.4GHz 802.11b	14.01	14.07	14.14	14.11	14.03	11.49	11.50	11.50	11.47	11.53
2.4GHz 802.11g	13.46	13.36	13.49	13.50	13.40	10.56	10.41	10.49	10.41	10.48
2.4GHz 802.11n	13.89	13.43	13.37	13.48	13.48	10.61	10.57	10.42	10.56	10.54
5GHz 802.11n 20MHz	11.20	11.19	11.36	11.36	11.29	8.30	8.28	8.21	8.27	8.19
5GHz 802.11ac 20MHz	10.83	10.67	10.66	10.71	10.73	5.76	5.74	5.62	5.66	5.65
5GHz 802.11n 40MHz	8.08	7.95	8.06	7.94	8.05	7.48	7.47	7.44	7.55	7.47
5GHz 802.11ac 40MHz	8.34	8.30	8.28	8.25	8.35	6.04	5.94	6.00	6.02	6.06

Rear – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	21	22	23	24	25	26	27	28	29	30
2.4GHz 802.11b	11.49	11.46	11.57	11.56	11.44	14.10	14.17	14.02	13.98	14.17
2.4GHz 802.11g	10.53	10.57	10.47	10.55	10.54	13.51	13.42	13.47	13.48	13.49
2.4GHz 802.11n	10.45	10.45	10.56	10.55	10.43	13.47	13.36	13.39	13.48	13.44
5GHz 802.11n 20MHz	8.12	8.26	8.10	8.23	8.24	11.26	11.31	11.33	11.32	11.27
5GHz 802.11ac 20MHz	5.75	5.66	5.74	5.74	5.65	10.85	10.85	10.85	10.73	10.78
5GHz 802.11n 40MHz	7.53	7.42	7.55	7.57	7.55	8.11	8.01	8.09	7.92	7.96
5GHz 802.11ac 40MHz	6.08	5.93	6.05	5.94	6.04	8.26	8.39	8.39	8.31	8.26

Based on the most conservative measured triggering distance of 14mm, additional Body SAR measurements were required at 13mm from rear side for the above modes.

Right side – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	13	12	11	10	9	8	7	6	5	4
2.4GHz 802.11b	14.02	14.00	14.23	14.19	13.97	11.55	11.45	11.54	11.55	11.59
2.4GHz 802.11g	13.37	13.34	13.49	13.49	13.30	10.48	10.40	10.51	10.40	10.40
2.4GHz 802.11n	13.87	13.50	13.40	13.42	13.42	10.54	10.52	10.42	10.55	10.64
5GHz 802.11n 20MHz	11.35	11.28	11.27	11.22	11.20	8.22	8.27	8.23	8.28	8.27
5GHz 802.11ac 20MHz	10.77	10.73	10.69	10.85	10.76	5.77	5.71	5.60	5.67	5.74
5GHz 802.11n 40MHz	7.91	8.10	8.03	7.94	8.00	7.44	7.44	7.42	7.55	7.58
5GHz 802.11ac 40MHz	8.37	8.28	8.19	8.36	8.21	5.97	6.02	6.13	6.06	6.08

Right side – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	13	14	15	16	17	18	19	20	21	22
2.4GHz 802.11b	11.56	11.51	11.66	11.63	11.38	14.13	14.23	14.07	13.92	14.11
2.4GHz 802.11g	10.53	10.59	10.49	10.47	10.60	13.50	13.39	13.53	13.54	13.50
2.4GHz 802.11n	10.49	10.44	10.58	10.62	10.38	13.43	13.35	13.40	13.47	13.45
5GHz 802.11n 20MHz	8.24	8.15	8.14	8.14	8.20	11.20	11.25	11.27	11.35	11.33
5GHz 802.11ac 20MHz	5.75	5.72	5.70	5.61	5.66	10.86	10.67	10.72	10.75	10.80
5GHz 802.11n 40MHz	7.60	7.49	7.61	7.52	7.62	8.09	8.03	8.01	7.91	8.00
5GHz 802.11ac 40MHz	6.07	6.12	6.12	5.99	6.08	8.37	8.23	8.34	8.34	8.24

Based on the most conservative measured triggering distance of 8mm, additional Body SAR measurements were required at 7mm from right side for the above modes.

Top side – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	24	23	22	21	20	19	18	17	16	15
2.4GHz 802.11g	14.10	14.10	14.11	14.21	13.97	11.52	11.54	11.44	11.41	11.60
2.4GHz 802.11b	13.39	13.46	13.52	13.59	13.45	10.51	10.51	10.52	10.40	10.47
2.4GHz 802.11n	13.94	13.41	13.47	13.56	13.44	10.65	10.50	10.52	10.59	10.45
5GHz 802.11n 20MHz	11.22	11.32	11.17	11.30	11.28	8.18	8.23	8.14	8.15	8.27
5GHz 802.11ac 20MHz	10.77	10.70	10.76	10.76	10.82	5.70	5.67	5.79	5.71	5.59
5GHz 802.11n 40MHz	8.08	8.01	8.09	7.98	7.98	7.45	7.61	7.48	7.51	7.57
5GHz 802.11ac 40MHz	8.19	8.36	8.23	8.28	8.24	5.96	5.93	6.02	6.01	5.95

Top side – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	21	22	23	24	25	26	27	28	29	30
2.4GHz 802.11g	11.50	11.44	11.54	11.54	11.42	14.14	14.22	14.06	13.89	14.27
2.4GHz 802.11b	10.54	10.59	10.38	10.49	10.50	13.45	13.46	13.40	13.57	13.41
2.4GHz 802.11n	10.38	10.49	10.66	10.52	10.41	13.41	13.35	13.40	13.51	13.41
5GHz 802.11n 20MHz	8.14	8.25	8.27	8.14	8.22	11.17	11.24	11.36	11.33	11.31
5GHz 802.11ac 20MHz	5.79	5.61	5.65	5.60	5.72	10.84	10.80	10.70	10.79	10.70
5GHz 802.11n 40MHz	7.61	7.61	7.48	7.42	7.49	8.11	8.01	8.08	7.97	8.10
5GHz 802.11ac 40MHz	5.99	6.07	6.05	5.95	6.06	8.33	8.35	8.38	8.30	8.37

Based on the most conservative measured triggering distance of 19mm, additional Body SAR measurements were required at 18mm from top side for the above modes.

2.1 Proximity Sensor Coverage for SAR measurements

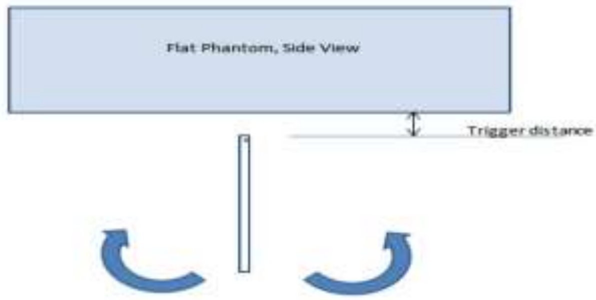
(KDB 616217 D04v01r02 §6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

2.2 Proximity Sensor Tilt Angle Assessment

(KDB 616217 D04v01r02 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Bottom side parallel to the base of the flat phantom for each band. The EUT was rotated about Bottom side for angles up to ±45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up ±45°.



Proximity sensor tilt angle assessment (Top side) KDB 616217 §6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Top side)

Band (MHz)	Minimum distance at which power reduction was maintained over-45°	Power reduction status										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
2450 MHz	19 mm	On	On	On	On	On	On	On	On	On	On	On
5000 MHz	19 mm	On	On	On	On	On	On	On	On	On	On	On

2.3 Resulting test positions for Body SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Body SAR [mm]
WLAN ANT 0	Rear	14	N/A	N/A	13
	Right	8	N/A	N/A	7
	Top	19	N/A	N/A	18

Note: FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device when being used in phablet use conditions.

3. Power reduction Verification for WLAN ANT 1

This device uses a power reduction mechanism for SAR compliance for WLAN operations during Grip sensor is activated.

Mechanism(s)	Mode/Band	Un-triggered (Max Power)	Triggerd (Reduced Power)
Grip	2.4GHz 802.11n	13.99	10.93
Grip	5GHz 802.11a	11.48	8.36
Grip	5GHz 802.11n 20MHz	11.93	6.99
Grip	5GHz 802.11ac 20MHz	11.50	6.84
Grip	5GHz 802.11n 40MHz	8.95	7.57
Grip	5GHz 802.11ac 40MHz	8.72	7.67

Tissue simulating liquid	Trigger distance – Rear		Trigger distance – Left Side		Trigger distance – Top	
	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]	Moving toward phantom [mm]	Moving away from phantom [mm]
2450 MHz	14	25	8	17	19	25
5000 MHz	14	25	8	17	19	25

Rear – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	19	18	17	16	15	14	13	12	11	10
2.4GHz 802.11n 20MHz	13.86	13.91	13.85	13.93	13.96	10.86	10.91	11.02	11.05	10.93
5GHz 802.11a	11.48	11.53	11.57	11.57	11.50	8.36	8.43	8.33	8.44	8.34
5GHz 802.11n 20MHz	11.93	11.84	11.89	11.94	11.95	6.99	7.01	7.03	7.08	7.04
5GHz 802.11ac 20MHz	11.5	11.49	11.44	11.5	11.56	6.84	6.87	6.78	6.78	6.79
5GHz 802.11n 40MHz	8.95	9.01	8.89	8.85	8.92	7.57	7.51	7.51	7.52	7.48
5GHz 802.11ac 40MHz	8.72	8.74	8.67	8.82	8.71	7.67	7.72	7.57	7.66	7.60

Rear – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	21	22	23	24	25	26	27	28	29	30
2.4GHz 802.11n 20MHz	10.77	10.79	10.85	10.83	10.94	13.69	13.88	13.76	13.81	13.92
5GHz 802.11a	8.36	8.15	7.54	8.64	9.43	11.43	11.70	11.60	11.87	11.89
5GHz 802.11n 20MHz	6.96	7.02	6.44	7.02	8.01	12.02	12.12	12.02	11.50	11.96
5GHz 802.11ac 20MHz	7.20	6.59	6.97	6.64	6.66	11.62	11.74	11.49	11.89	11.52
5GHz 802.11n 40MHz	7.72	7.13	7.90	7.92	7.26	8.76	8.45	8.65	9.47	8.82
5GHz 802.11ac 40MHz	7.83	7.74	7.29	8.14	7.87	8.43	8.86	8.95	8.76	8.75

Based on the most conservative measured triggering distance of 14mm, additional Body SAR measurements were required at 13mm from rear side for the above modes.

Left side – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	13	12	11	10	9	8	7	6	5	4
2.4GHz 802.11n 20MHz	13.80	13.90	13.83	13.86	13.82	10.82	10.96	10.94	10.84	10.88
5GHz 802.11a	11.54	10.12	11.15	11.07	11.44	8.34	8.00	8.07	8.81	7.95
5GHz 802.11n 20MHz	12.03	12.16	11.65	11.90	12.49	7.01	6.63	6.28	7.02	6.49
5GHz 802.11ac 20MHz	11.54	11.51	10.89	10.79	9.98	6.83	7.43	6.09	6.90	6.60
5GHz 802.11n 40MHz	8.95	8.05	7.45	8.05	8.58	7.67	6.43	7.61	6.97	7.99
5GHz 802.11ac 40MHz	8.72	7.92	8.29	8.35	8.35	7.65	7.80	7.98	7.62	8.16

Left side – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	13	14	15	16	17	18	19	20	21	22
2.4GHz 802.11n 20MHz	10.80	10.68	10.83	10.70	10.76	13.60	13.73	13.59	13.59	13.74
5GHz 802.11a	8.38	8.14	7.55	8.59	9.37	11.40	11.77	11.55	11.93	11.80
5GHz 802.11n 20MHz	6.94	7.06	6.45	7.09	7.95	11.88	12.08	12.03	11.48	11.93
5GHz 802.11ac 20MHz	6.86	6.53	6.98	6.73	6.61	11.44	11.77	11.44	11.96	11.52
5GHz 802.11n 40MHz	7.58	7.07	7.91	7.85	7.31	8.98	8.38	8.58	9.40	8.78
5GHz 802.11ac 40MHz	7.60	7.78	7.22	8.17	7.92	8.79	8.81	8.93	8.77	8.77

Based on the most conservative measured triggering distance of 8mm, additional Body SAR measurements were required at 7mm from left side for the above modes.

Top side – EUT Moving toward (trigger) to the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	24	23	22	21	20	19	18	17	16	15
2.4GHz 802.11n 20MHz	13.91	13.88	13.80	13.91	13.86	10.77	10.87	10.93	10.90	10.76
5GHz 802.11a	11.54	10.29	11.24	11.06	11.37	8.46	7.91	8.08	8.81	7.91
5GHz 802.11n 20MHz	11.92	12.30	11.66	11.88	12.51	6.98	6.77	6.21	7.02	6.45
5GHz 802.11ac 20MHz	11.56	11.50	10.86	10.81	10.13	6.77	7.52	6.07	6.85	6.75
5GHz 802.11n 40MHz	8.89	8.16	7.45	8.10	8.61	7.49	6.43	7.58	6.95	7.93
5GHz 802.11ac 40MHz	8.71	7.81	8.38	8.48	8.29	7.74	7.90	8.13	7.69	8.18

Top side – EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)									
	21	22	23	24	25	26	27	28	29	30
2.4GHz 802.11n 20MHz	10.82	10.81	10.74	10.73	10.67	13.69	13.77	13.79	13.76	13.62
5GHz 802.11a	8.41	8.24	7.56	8.62	9.47	11.40	11.72	11.68	11.95	11.94
5GHz 802.11n 20MHz	6.95	7.05	6.49	7.12	7.92	11.92	12.12	12.11	11.51	11.88
5GHz 802.11ac 20MHz	6.81	6.63	6.87	6.63	6.58	11.42	11.70	11.45	11.89	11.43
5GHz 802.11n 40MHz	7.66	7.12	7.93	7.86	7.25	8.98	8.53	8.57	9.46	8.75
5GHz 802.11ac 40MHz	7.71	7.80	7.35	8.18	7.92	8.75	8.80	9.00	8.83	8.75

Based on the most conservative measured triggering distance of 19mm, additional Body SAR measurements were required at 18mm from top side for the above modes.

3.1 Proximity Sensor Coverage for SAR measurements

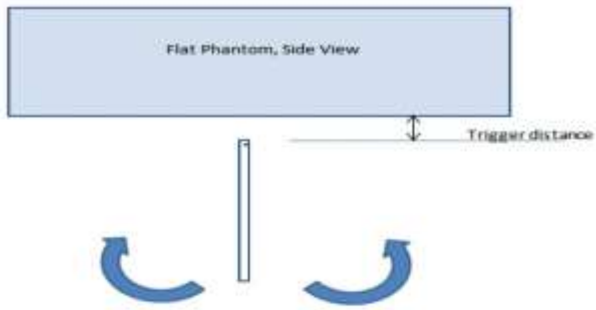
(KDB 616217 D04v01r02 §6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

3.2 Proximity Sensor Tilt Angle Assessment

(KDB 616217 D04v01r02 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Bottom side parallel to the base of the flat phantom for each band. The EUT was rotated about Bottom side for angles up to ±45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up ±45°.



Proximity sensor tilt angle assessment (Bottom side) KDB 616217 §6.4

Summary of Tablet Tilt Angle influence to Proximity Sensor Triggering (Top side)

Band (MHz)	Minimum distance at which power reduction was maintained over-45°	Power reduction status										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
2450 MHz	19 mm	On	On	On	On	On	On	On	On	On	On	On
5000 MHz	19 mm	On	On	On	On	On	On	On	On	On	On	On

3.3 Resulting test positions for Body SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance [mm]	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for Body SAR [mm]
WLAN ANT 1	Rear	14	N/A	N/A	13
	Left	8	N/A	N/A	7
	Top	19	N/A	N/A	18

Note: FCC KDB Publication 616217 D04v01r02 Section 6 was used as a guideline for selecting SAR test distances for this device when being used in phablet use conditions.

Appendix I. – Down-link CA Power Measurement

1. LTE Down-link Carrier Aggregation Conducted Powers

SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number component carriers(CCs) supported by test product implementation. For those configurations required by April 2018 TCBC Workshop notes, conducted power measurements with LTE Carrier Aggregation(CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s)(SCC) on the downlink only.

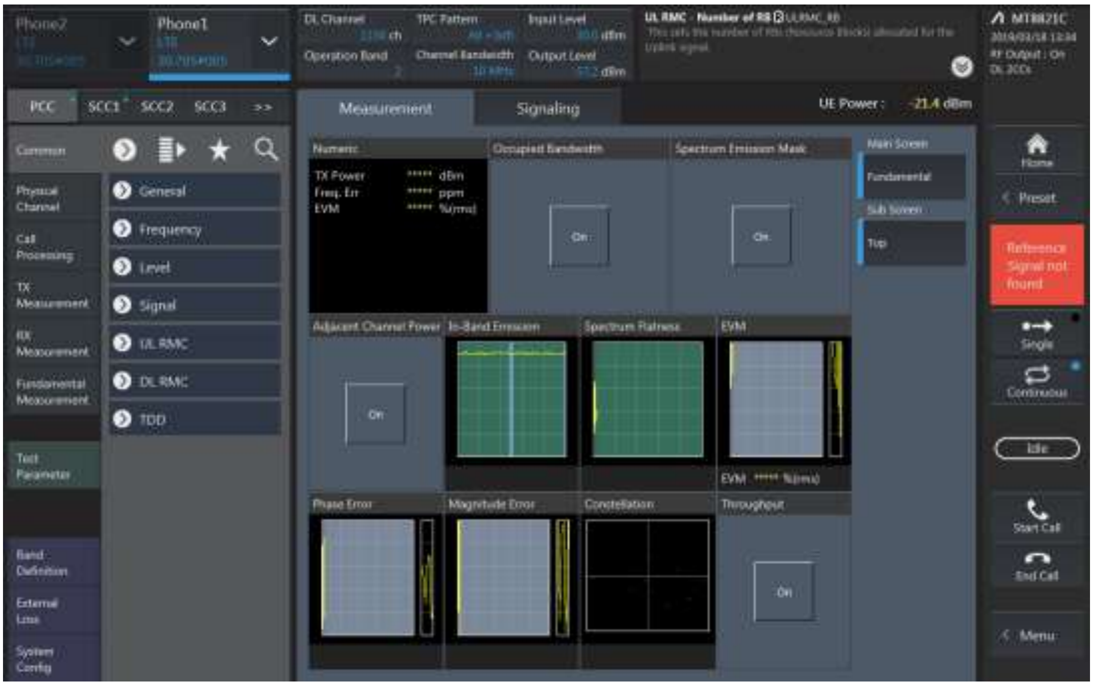
Downlink Carrier aggregation:

1. This device only supports downlink carrier aggregation. For every supported combination of downlink carrier aggregation, power measurements were performed with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band.
2. All control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
3. Per FCC KDB publication 941225 D05A v01r02, Section C)3)b)ii), PCC uplink channel was selected at downlink carrier aggregation combinations. The downlink PCC channel was paired with the selected PCC uplink channel according to normal configurations without carrier aggregation.
4. For continuous intra-band carrier aggregation, the downlink channel spacing between the component carriers was set to multiple of 300kHz less than the nominal channel spacing defined in section 5.4.1A of 3GPP TS 36.521.
5. For non-continuous intra-band carrier aggregation, the downlink channel spacing between the component carriers was set to be larger than the nominal channel spacing and provided maximum separation between the component carriers.
6. All selected downlink channels remained fully within the downlink transmission band of the respective component carrier.

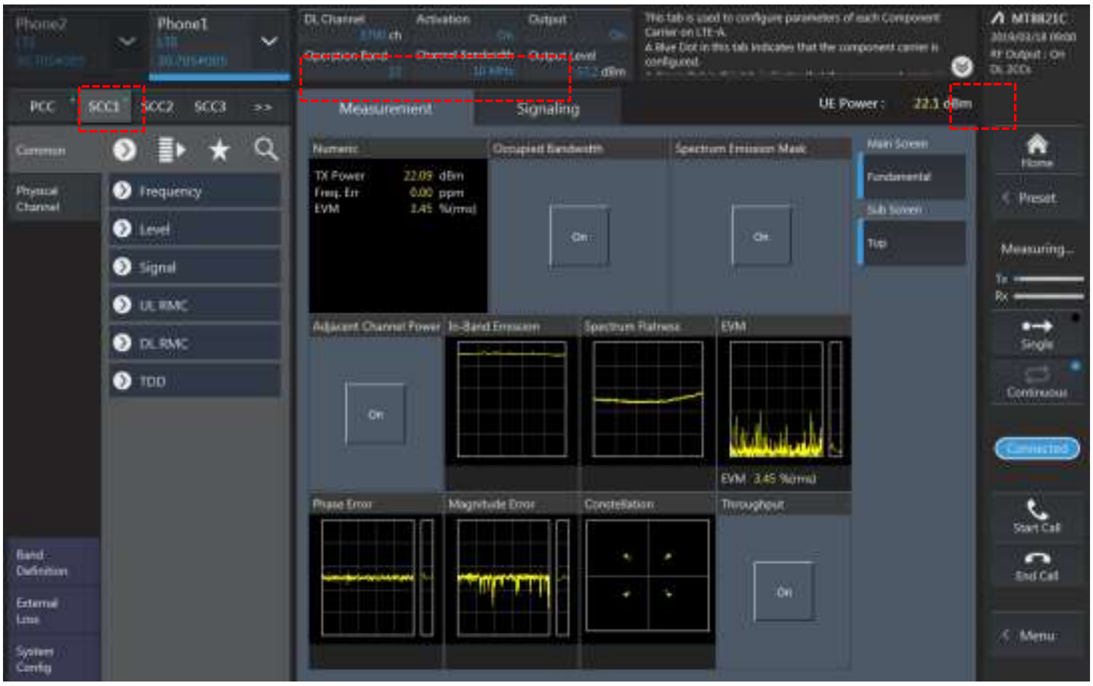
Power Measurement setup

LTE Down Link 2CA Call Setup

PCC Setting (Channel/ RB/ BW/ Modulation)



SCC Setting (Channel/ RB/ BW/ Modulation) and call Connection

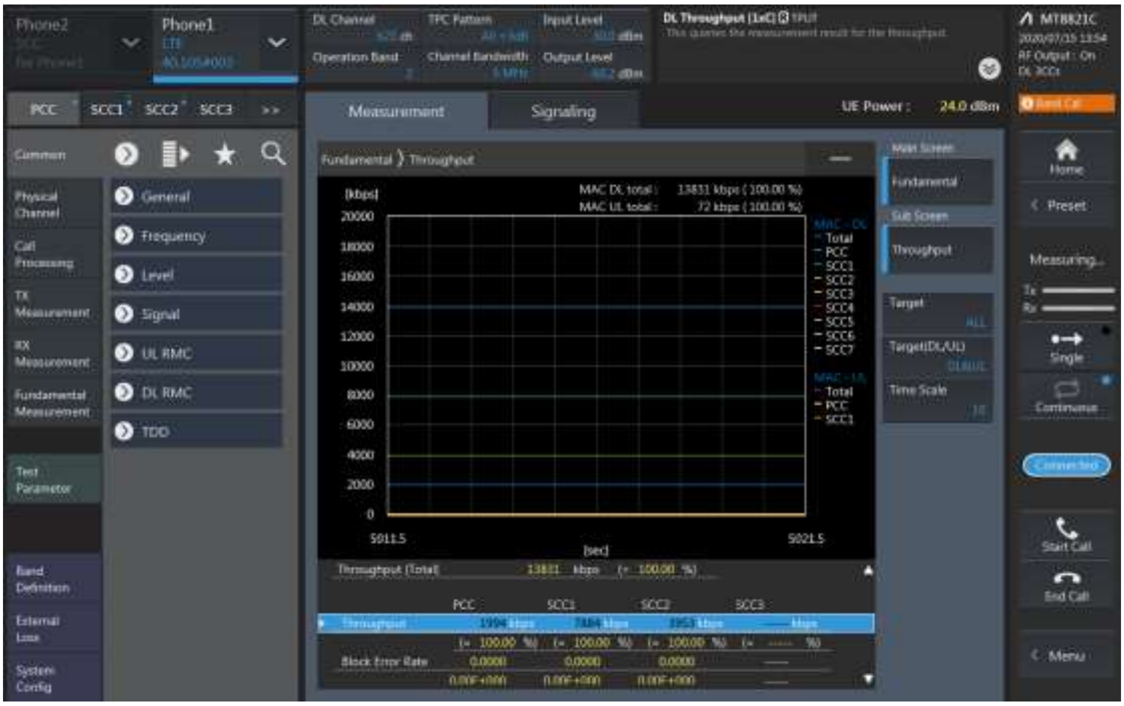


2CA Downlink Carrier aggregation Maximum conducted Powers

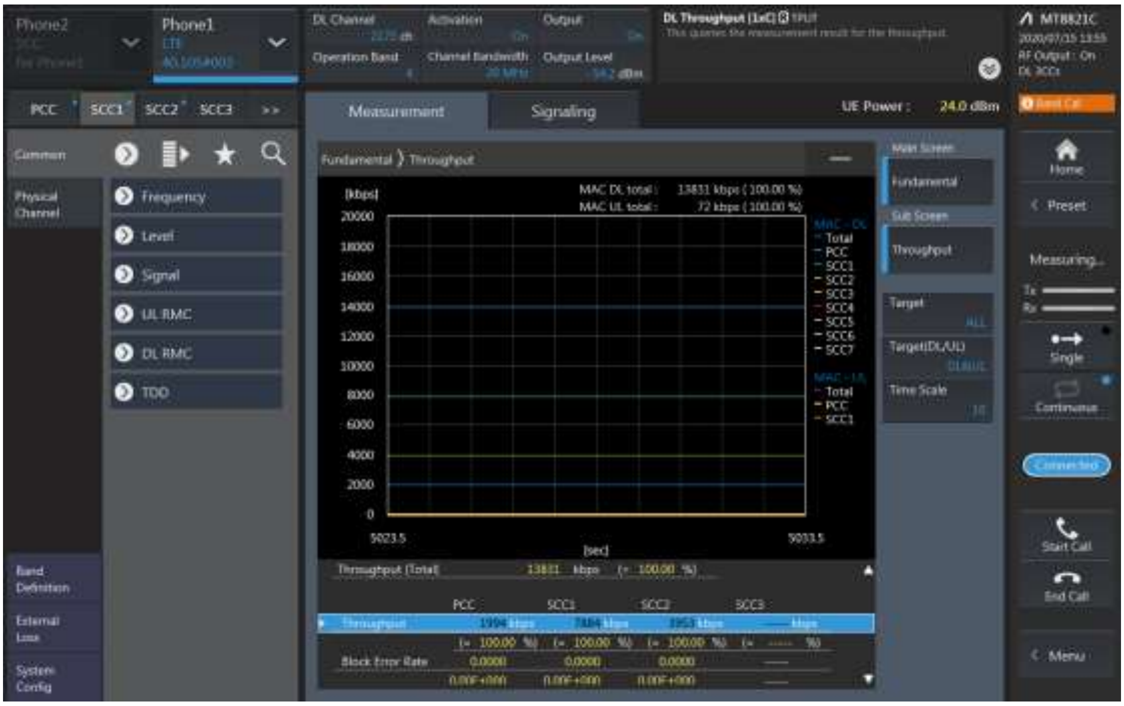
Combination	PCC									SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled(dBm) (2)	Deviaion (dB) (2)-(1)
2A-2A	2	20	18900	1880	900	1960	QPSK	1	99	2	20	700	1940	23.70	23.65	-0.05
2C	2	20	18900	1880	900	1960	QPSK	1	99	2	20	1098	1979.8	23.70	23.61	-0.09
2A-4A	2	20	18900	1880	900	1960	QPSK	1	99	4	20	2300	2145	23.70	23.64	-0.06
2A-4A	4	20	20175	1732.5	2175	2132.5	QPSK	1	99	2	20	1100	1980	23.86	23.65	-0.21
2A-5A	2	20	18900	1880	900	1960	QPSK	1	99	5	10	2600	889	23.70	23.68	-0.02
2A-5A	5	10	20525	836.5	2525	881.5	QPSK	1	0	2	20	700	1940	24.12	23.98	-0.14
2A-12A	2	20	18900	1880	900	1960	QPSK	1	99	12	10	5130	741	23.70	23.64	-0.06
2A-12A	12	10	23095	707.5	5095	737.5	QPSK	1	0	2	20	700	1940	23.69	23.65	-0.04
2A-66A	2	20	18900	1880	900	1960	QPSK	1	99	66	20	67036	2190	23.70	23.62	-0.08
2A-66A	66	20	132572	1770	67036	2190	QPSK	1	99	2	20	1100	1980	23.88	23.70	-0.18
4A-4A	4	20	20175	1732.5	2175	2132.5	QPSK	1	99	4	20	2300	2145	23.86	23.63	-0.23
4A-5A	4	20	20175	1732.5	2175	2132.5	QPSK	1	99	5	10	2600	889	23.86	23.57	-0.29
4A-5A	5	10	20525	836.5	2525	881.5	QPSK	1	0	4	20	2050	2120	24.12	24.05	-0.07
4A-12A	4	20	20175	1732.5	2175	2132.5	QPSK	1	99	12	10	5130	741	23.86	23.59	-0.27
4A-12A	12	10	23095	707.5	5095	737.5	QPSK	1	0	4	20	2050	2120	23.69	23.66	-0.03
4A-17A	4	10	20175	1732.5	2175	2132.5	QPSK	1	99	17	10	5790	740	23.86	23.50	-0.36
5A-41A	5	10	20525	836.5	2525	881.5	QPSK	1	0	41	20	40620	2593	24.12	23.85	-0.27
5A-66A	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	67036	2190	24.12	24.10	-0.02
5A-66A	66	20	132572	1770	67036	2190	QPSK	1	99	5	10	2600	889	23.88	23.81	-0.07
12A-66A	12	10	23095	707.5	5095	737.5	QPSK	1	0	66	20	67036	2190	23.69	23.65	-0.04
12A-66A	66	20	132572	1770	67036	2190	QPSK	1	99	12	10	5130	741	23.88	23.80	-0.08
26A-41A	26	15	26868	831.5	8865	876.5	QPSK	1	36	41	20	40620	2593	24.14	24.02	-0.12
41A-41A	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	41490	2680	23.41	23.14	-0.27
41C	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	39987	2529.7	23.41	23.21	-0.20
66A-66A	66	20	132572	1770	67036	2190	QPSK	1	99	66	20	66536	2140	23.88	23.85	-0.03
66B	66	10	132322	1745	66786	2165	QPSK	1	99	66	10	66687	2155.1	23.88	23.71	-0.17
66C	66	20	132572	1770	67036	2190	QPSK	1	99	66	20	66838	2170.2	23.88	23.81	-0.07

LTE Down Link 3CA Call Setup

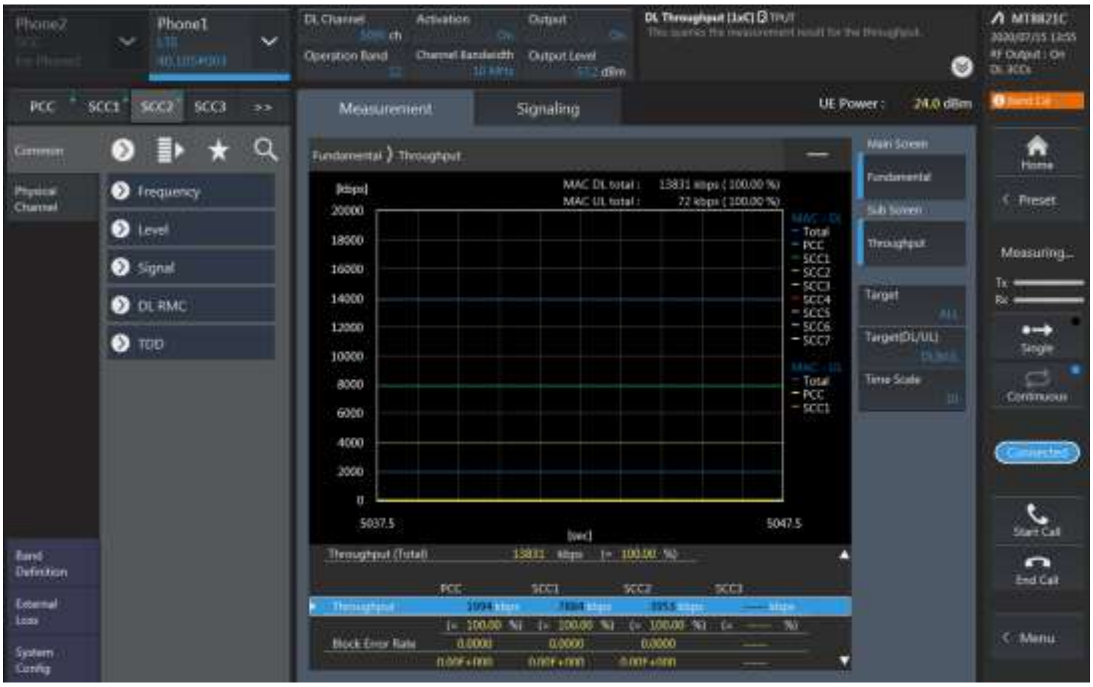
PCC Setting (Channel/ RB/ BW/ Modulation)



SCC1 Setting (Channel/ RB/ BW/ Modulation) and call Connection



SCC2 Setting (Channel/ RB/ BW/ Modulation) and call Connection

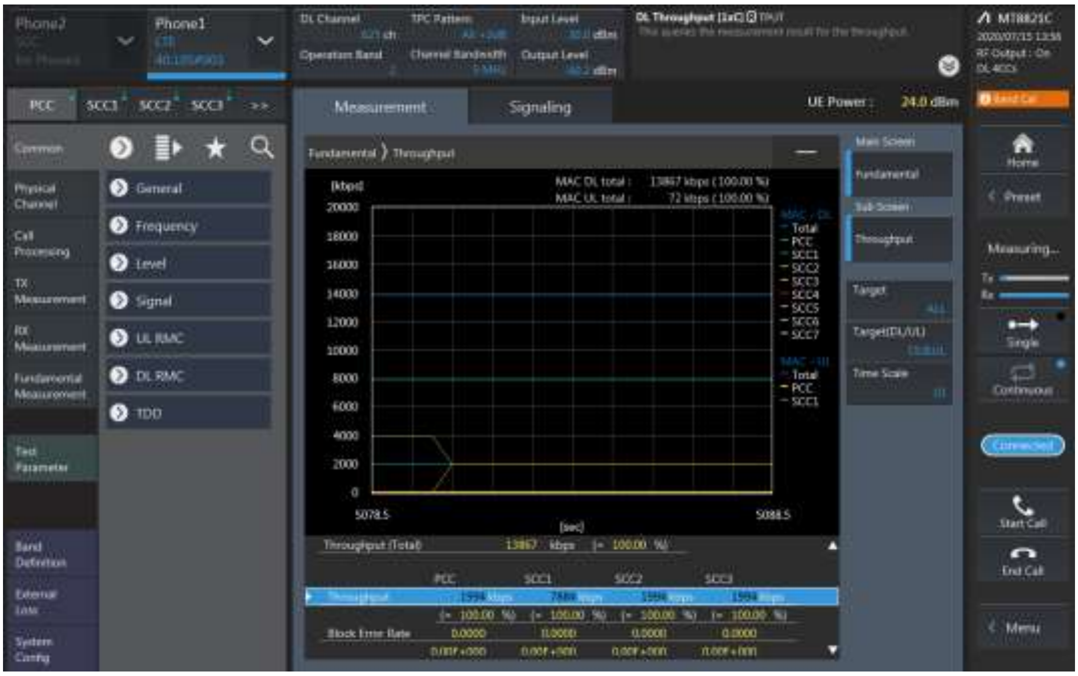


3CA Downlink Carrier aggregation conducted Powers

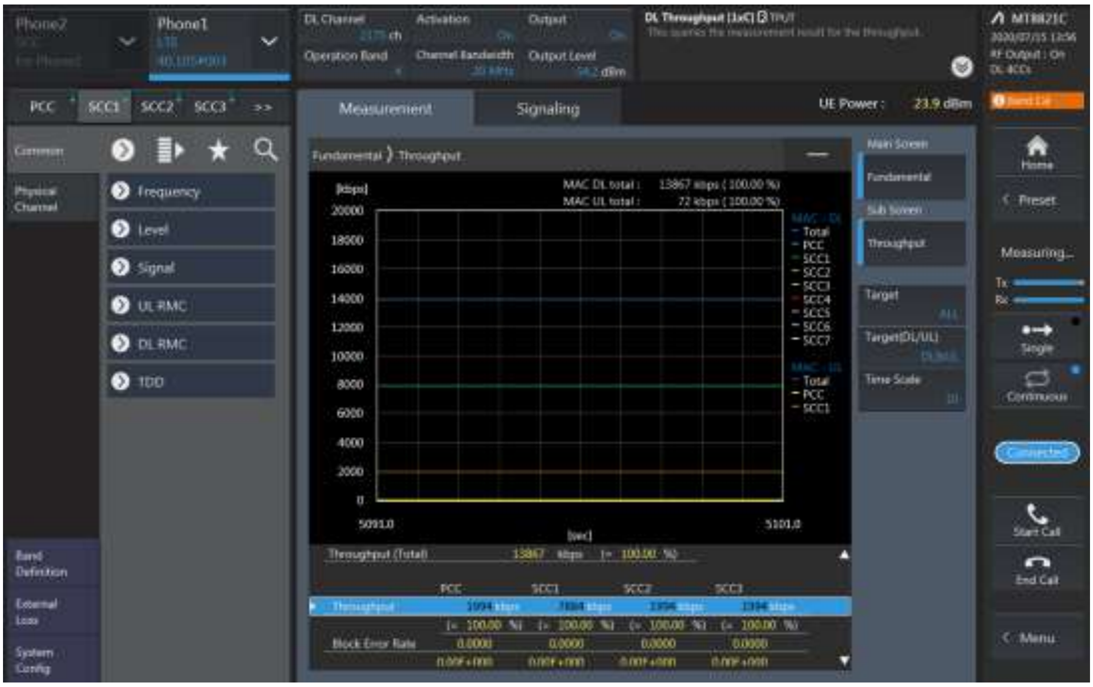
Combination	PCC									SCC				SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled (dBm) (2)	Deviaion (dB) (2)-(1)
4A-4A-12A	4	20	20175	1732.5	2175	2132.5	QPSK	1	99	4	20	2050	2120	12	10	5095	737.5	23.86	23.53	-0.33
4A-4A-12A	12	10	23095	707.5	5095	737.5	QPSK	1	0	4	20	2050	2120	4	20	2175	2132.5	23.69	23.65	-0.04
5A-66A-66A	5	10	20525	836.5	2525	881.5	QPSK	1	0	66	20	67036	2190	66	20	66536	2140	24.12	24.07	-0.05
5A-66A-66A	66	20	132572	1770	67036	2190	QPSK	1	99	66	20	66536	2140	5	10	2450	874	23.88	23.67	-0.21
12A-66A-66A	12	10	23095	707.5	5095	737.5	QPSK	1	0	66	20	67036	2190	66	20	66536	2140	23.69	23.66	-0.03
12A-66A-66A	66	20	132572	1770	67036	2190	QPSK	1	99	66	20	66536	2140	12	10	5095	737.5	23.88	23.85	-0.03
26A-41C	26	15	26868	831.5	8865	876.5	QPSK	1	36	41	20	40620	2593	41	20	40818	2612.8	24.14	24.02	-0.12
41A-41C	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	41490	2680	41	20	41292	2660.2	23.41	23.26	-0.15
41A-41C	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	39987	2529.7	41	20	41490	2680	23.41	23.22	-0.19
41D	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	39987	2529.7	41	20	39789	2509.9	23.41	23.21	-0.20

LTE Down Link 4CA Call Setup

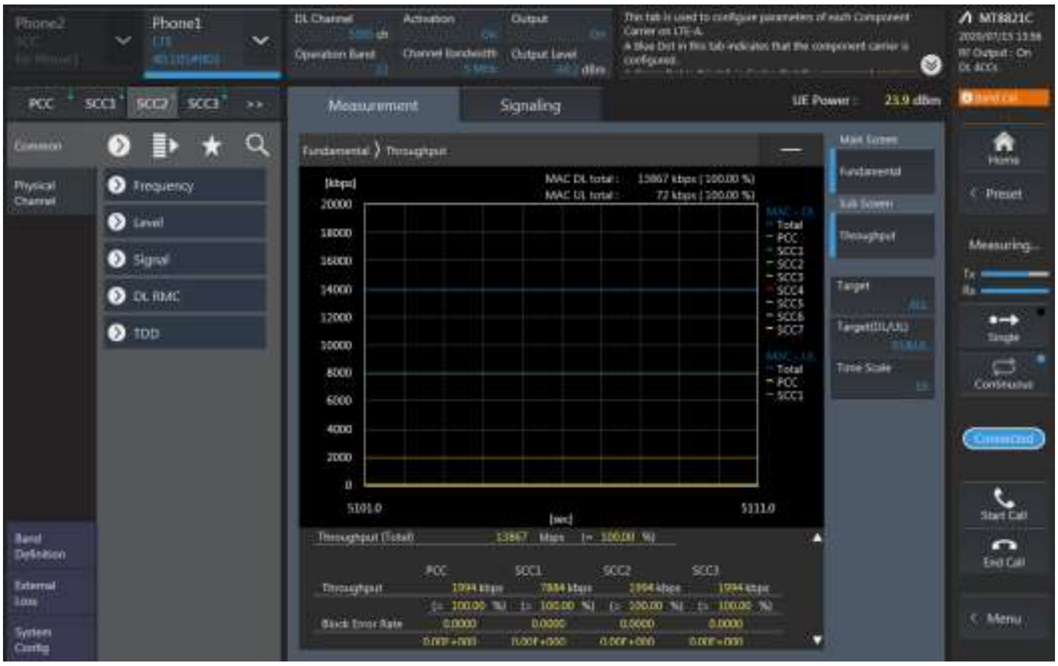
PCC Setting (Channel/ RB/ BW/ Modulation)



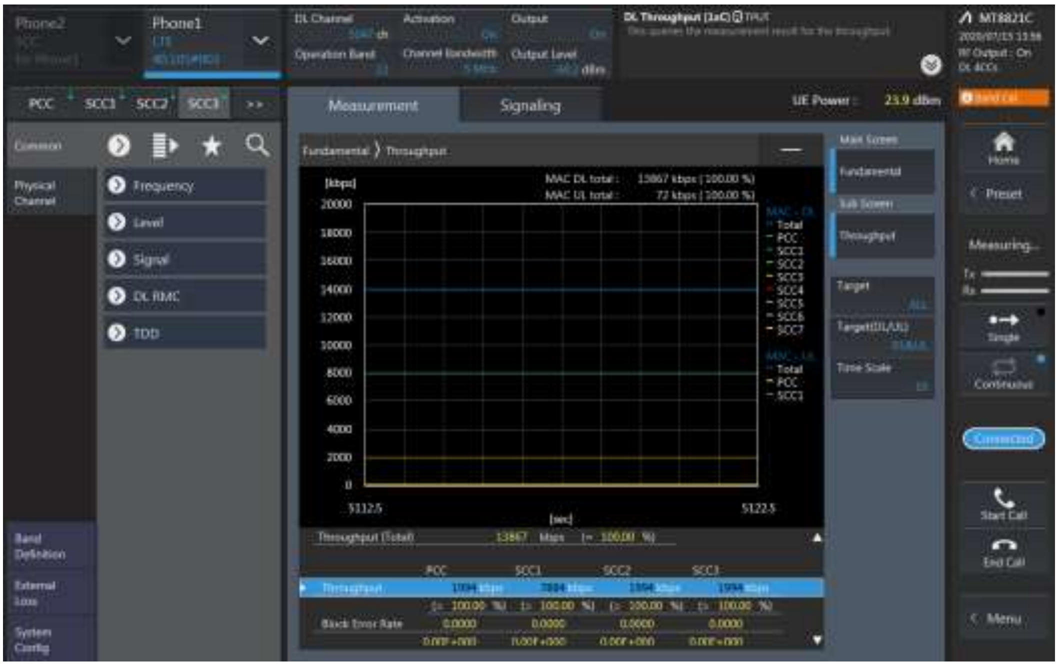
SCC1 Setting (Channel/ RB/ BW/ Modulation) and call Connection



SCC2 Setting (Channel/ RB/ BW/ Modulation) and call Connection



SCC3 Setting (Channel/ RB/ BW/ Modulation) and call Connection



4CA Downlink Carrier aggregation conducted Powers

Combination	PCC									SCC				SCC				SCC				Tx Power		
	Band	BW	PCC UL Channel	PCC UL Frequency	PCC DL Channel	PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel	SCC DL Frequency	LTE Single Carrier Tx Power (dBm) (1)	LTE Tx Power with DL CA Enabled (dBm) (2)	Deviaion (dB) (2)-(1)
41C-41C	41	20	41490	2680	41490	2680	QPSK	1	49	41	20	41292	2660.2	41	20	39750	2506	41	20	39948	2525.8	23.41	23.28	-0.13
41A-41D	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	41490	2680	41	20	41292	2660.2	41	20	41094	2640.4	23.41	23.30	-0.11
41A-41D	41	20	40185	2549.5	40185	2549.5	QPSK	1	99	41	20	40383	2569.3	41	20	40581	2589.1	41	20	39750	2506	23.41	23.40	-0.01
41E	41	20	41490	2680	41490	2680	QPSK	1	49	41	20	41292	2660.2	41	20	41094	2640.4	41	20	40896	2620.6	23.41	23.33	-0.08