

Appendix G. – Dipole Calibration Data

F-TP22-03 (Rev. 05)

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Calibration Laboratory Schmid & Partner Engineering AG eughausstrasse 43, 8004 Zurich	, Switzerland		Reading and any distances of
ccredited by the Swiss Accreditation Service with a swiss Accreditation Service with a service	is one of the signatorie		Accreditation No.: SCS 0108
lient HCT		Certificate No.	D750V3-1014_May23
Gyeonggi-do, Republi			
ALIBRATION C	ERTIFICATI	6	
bject	D750V3 - SN:10	14	
alibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Source	s between 0.7-3 GHz
alibration date:	May 23, 2023		
he measurements and the uncerta	anties with confidence p ad in the closed laborato	onal standards, which realize the physical un robability are given on the following pages ar ny facility: environment temperature (22 ± 3)*	nd are part of the certificate.
rimary Standards		Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
ower sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
wer sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
ference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
pe-N mismatch combination rerence Probe EX3DV4	SN: 310962 / 06327 SN: 7349	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23)	Mar-24
AE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Jan-24 Dec-23
condary Standards	ID #	Check Date (in house)	Scheduled Check
wer mater E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
wer sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
ower sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Figenerator R&S SMT-06 atwork Analyzer Agilent EB358A	SN: 100972 SN: US41080477	15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	In house check: Oct-24 In house check: Oct-24
	Name	Function	Signature
alibrated by:	Michael Weber	Laboratory Technician	Milleses
pproved by:	Sven Kühn	Technical Manager	55
his calibration certificate shall not	be reproduced except in	full without written approval of the laboratory	lssued: May 23, 2023 사랑자 과 인 자



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





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Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

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Glossary:

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

Calibration is Performed According to the Following Standards:

- a) 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 ٠ connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the . nominal SAR result.

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

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Measurement Conditions

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

DASY Version	DASY52	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		1

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 ² (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.42 W/kg

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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

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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

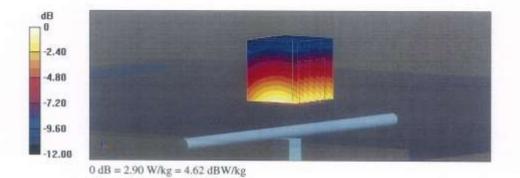
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; σ = 0.9 S/m; ϵ_r = 40.7; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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



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Impedance Measurement Plot for Head TSL

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lient HCT		Certificate N	D835V2-4d165 May23
Gyeonggi-do, Republi			
CALIBRATION C	ERTIFICATI		
Dbject	D835V2 - SN:4d	165	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Source	es between 0.7-3 GHz
alibration date:	May 23, 2023		
		onal standards, which realize the physical u robability are given on the following pages i	
a calibrations have been conducts		y facility: erwironment temperature (22 ± 3)	/°C and humidity < 70%.
himary Standards	10#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
ower sensor NRIP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
ower sensor NRP-291	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
eference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
ype-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
eference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan23)	Jan-24
AE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23
econdary Standards	ID #	Check Date (In house)	Scheduled Check
ower meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
ower sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
ower sensor HP 6481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Odt-24
F generator R&S SMT-06	SN: 100972	15-Jun-15 (In house check Oct-22)	In house check: Oct-24
etwork Analyzer Agilent E8358A	SN: U541080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
	Name	Function	Signature
albrated by:	Michael Weber	Laboratory Technician	Mees
pproved by:	Svan Kühn	Technical Manager	8.6
			Issued: May 23, 2023
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ertificate No: D835V2-4d165_N	flay23	Page 1 of 6 제	H Ar
			23 106 02 2023 100



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Accreditation No.: SCS 0108

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

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%.

Certificate No: D835V2-4d165_May23

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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	and the orthogonal
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	1-1-1	

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 averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	1.62 W/kg

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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
have been a second and the second	

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

Certificate No: D835V2-4d165_May23

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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

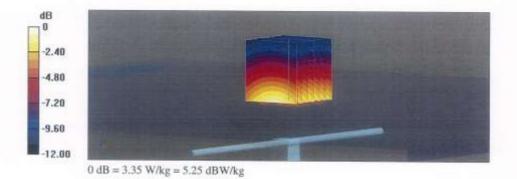
Communication System: UID 0 – CW; Frequency: 835 MHz Medium parameters used; f = 835 MHz; α = 0.93 S/m; ϵ_r = 40.5; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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



Certificate No: D835V2-4d165_May23

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Impedance Measurement Plot for Head TSL

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10.00 5.00 0.00 45.00 -10.00 -15.00	Start 635.00	= 20 3 MiHz						1 8	335.0	000001	MHz	-	-
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lient HCT		Certificate No	D1800V2-2d015_May23
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Dbject	D1800V2 - SN:2	1015	Salar III Nessa
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	dure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	May 17, 2023		
		robablity are given on the following pages a y facility: environment temperature (22 ± 3) ²	
Calibration Equipment used (M&TE	501299-0347901040672 144723		
Primary Standards Power meter NRP2	ID # SN: 104778	Cal Date (Certificate No.)	Scheduled Calibration
ower sensor NRP-291	SN: 103244	30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804)	Mar-24 Mar-24
Power sensor NRP-291	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: GB39612475	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 RF generator R&S SMT-06	SN: MY41093315 SN: 100972	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Vetwork Analyzer Agilent E8358A	SN: US41080477	15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	In house check: Oct-24 In house check: Oct-24
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Calibrated by: Approved by:	Paulo Pina Sven Kühn	Laboratory Technician Technical Manager	Solo Issued: May 25, 2023
Calibrated by:	Paulo Pina Sven Kühn	Laboratory Technician	S-Lo Issued: May 25, 2023
Calibrated by: Approved by:	Paulo Pina Sven Kühn be reproduced except in	Laboratory Technician Technical Manager	S- Lo Issued: May 25, 2023 (4 - 4) - 24 H H - 24 H - 25 H



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



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Accreditation No.: SCS 0108

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- 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%.

Certificate No: D1800V2-2d015_May23

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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)
CAD managed over 45 and 745 at at land TO	and then	
	condition	
SAR averaged over 10 cm ¹ (10 g) of Head TSL SAR measured	condition 250 mW input power	4.92 W/kg

Certificate No: D1800V2-2d015_May23

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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
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Certificate No: D1800V2-2d015_May23

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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

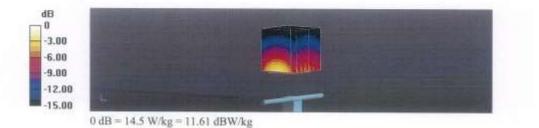
Communication System: UID 0 - CW; Frequency: 1800 MHz Medium parameters used: f = 1800 MHz; σ = 1.37 S/m; ϵ_r = 38.5; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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



Page 5 of 6



Impedance Measurement Plot for Head TSL

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Certificate No: D1800V2-2d015_May23

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





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Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura

Swiss Calibration Service Accreditation No.: SCS 0108

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

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%

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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	$41.3 \pm 6 \%$	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg ± 17.0 % (k=2)
	â	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	5.22 W/kg

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

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

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

Additional EUT Data

Manufactured by	SPEAG

Certilicate No: D1900V2-5d032_Jan24

Page 4 of 6



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

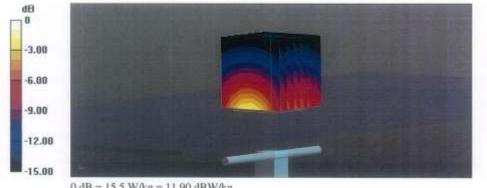
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; $\sigma = 1.4 \text{ S/m}$; $\epsilon_r = 41.3$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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

Certificate No: D1900V2-5d032 Jan24

Page 5 of 6



Impedance Measurement Plot for Head TSL

e Y)ew	Channel	Swgep.	Calbration	Trace	Scan	Mgiker	Sydem	Window	1.9000 56	08 GHz 7.19 pH 08 GHz	6.	. 205 C 7712 C 50 mL
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		Ch 1 Avg =	20			X	-	-	4				
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10.00 5.00 0.00 5.00 10.00 15.00	1:584	at 1,70000						2		1.9000	00 GHz	_	NO-DIA INC.
10.00 5.00 5.00 -10.00 -15.00 -25.00 -25.00 -30.00 -35.00		at 1,70000	GHz				/	>	*	1.9000	00 GHz	-23	10000 GH

Certificate No: D1900V2-5d032_Jan24

Page 6 of 6



Calibration Laborator Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zuric			S Schweizerischer Kalibrierdienst Service suisse d'étaionnage Servizio svizzero di taratura Swiss Calibration Service
Accredited by the Swiss Accredita The Swiss Accreditation Service Multilateral Agreement for the re	is one of the signatori		Accreditation No.: SCS 0108
Client HCT		Ce	rtificate No. D2450V2-1049_Apr23
Gyeonggi-do, Repub	lic of Korea		02430V2-1043_Apr23
CALIBRATION C	ERTIFICAT	E	
Object	D2450V2 - SN:1	049	and the state of the
Calibration procedure(a)	QA CAL-05.v12		
	Galibration Proci	edure for SAR Validation	Sources between 0.7-3 GHz
Calibration date:	April 25, 2023		
This calibration certificate docume the measurements and the uncert	nts the traceability to nati ainties with confidence p	ional standards, which realize the robability are given on the follows	physical units of measurements (SI). ng peges and are part of the certificate.
All calibrations have been conduct	ed in the closed laborato	ry facility: environment temperatu	re (22 ± 3)°C and humidity < 70%.
Calibration Equipment used (M&TE	E critical for calibration)		
himary Standards	1D #	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03	Contraction of the second
ower sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
ower sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
leference 20 dB Attenuator	5N: BH9394 (20k)	30-Mar-23 (No. 217-05809)	Mar-24
ype-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
aference Probe EX3DV4 AE4	SN: 7349	10-Jan-23 (No. EX3-7349_Jan	
NC4	SN: 601	19-Dec-22 (No. DAE4-601_De	c22) Dec-23
econdary Standards	ID A	Oheck Date (in house)	Scheduled Check
ower moter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct	-22) In house check: Oct-24
ower sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct	
ower sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct	
F generator R&S SMT-08 stwork Analyzer Agilent EB358A.	SN: 100972 SN: US41060477	15-Jun-15 (in house check Oct 31-Mar-14 (in house check Oct	The second
	Name	2000	
albrated by:	Michael Weber	Function	Signature
	And and Trough	Laboratory Technic	· Milling
pproved by:	Sven Kühn	Technical Manager	i.a. J. bolled
			Issued: April 26, 2023
his calibration certificate shall not l	be reproduced except in	full without written approval of the	
rtificate No: D2450V2-1049_A	pr23	Page 1 of 7	A PL Mi
			HU DE 14195 (3 1 HERE H 2011 105.00 2022 105.09



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



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

5 Swiss Calibration Service Accreditation No.: SCS 0108

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) 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%.

Certificate No: D2450V2-1049_Apr23

Page 2 of 7



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		(interior

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 averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	6.23 W/kg

Certificate No: D2450V2-1049_Apr23

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.1 Ω + 8.8 μΩ	
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	(2004) (2004)
- Manutactured by	SPEAG
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Certificate No: D2450V2-1049_Apr23

Page 4 of 7



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/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 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

Page 5 of 7



Impedance Measurement Plot for Head TSL

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Ch1: 5.00 6.00 -50.00 -55.00 -05.00 -20.00		atte	-				3		2.450000.0	3Hz	Rep 2,55000 GHz +20,899 dB

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Appendix: Transfer Calibration at Four Validation Locations on SAM Head1

Evaluation Condition

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

SAR result with SAM Head (Top ≅ C0)

SAR averaged over 1 cm ³ (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 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Mouth ≅ F90)

SAR averaged over 1 cm ³ (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 cm ² (10 g) of Head TSL	condition	

SAR result with SAM Head (Neck ≅ H0)

SAR averaged over 1 cm ³ (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 cm ² (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear ≅ D90)

SAR averaged over 1 cm ³ (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 cm ² (10 g) of Head TSL	condition		

Certificate No: D2450V2-1049_Apr23

Page 7 of 7

¹ Additional assessments outside the current scope of SCS 0108



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ccredited by the Swiss Accreditation he Swiss Accreditation Service fulfilateral Agreement for the rec	is one of the signatorie		Accreditation No.: SCS 0108
lient HCT		Certifi	cate No. D2600V2-1106_May23
Gyconggi-do, Republi	ic of Korea		
CALIBRATION C	ERTIFICATI	E	
Dbject	D2600V2 - SN:1	106	
Calibration procedure(s)	QA CAL-05.v12		
	Calibration Proce	edure for SAR Validation S	ources between 0.7-3 GHz
Calibration date:	May 24, 2023		
	ed in the closed laborator	robability are given on the following p ry facility: environment temperature (
rimary Standards		Col Data (Configurate March	
ower meter NRP2	SN: 104778	Cai Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805	Scheduled Calibration Mar-24
ower sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
ower sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
eference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
ype-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
eference Probe EX3DV4	SN: 7349	10-Jan-23 (No. EX3-7349 Jan23)	
AE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec2)	
econdary Standards	ID.#	Check Date (in house)	Scheduled Check
ower meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22) In house check: Oct-24
ower sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22	In house check: Oct-24
ower sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22	 In house check: Oct-24
F generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22	The second s
latwork Analyzer Agilent E8368A	SN: US41080477	31-Mar-14 (In house check Oct-2)	In house check: Oct-24
	Name	Function	Signature
alibrated by:	Paulo Pina	Laboratory Technician	
pproved by:	Sven Kübn	Technical Manager	*
		- con son manage	S.L
his calibration certificate shall rul i	be recroduced excert in	full without written concerned of the la	Issued: May 24, 2023
his calibration certificate shall not i	be reproduced except in	full without written approval of the la	
This calibration certificate shall not i ertificate No: D2600V2-1106_M	94 94 2019	Page 1 of 6	



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Accreditation No.: SCS 0108

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

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%.

Certificate No: D2600V2-1106 May23

Page 2 of 6



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)
CAD museum and and 10 and 10 at Mard TO	Concepto V	
SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR averaged over 10 cm ² (10 g) of Head TSL SAR measured	condition 250 mW input power	6.37 W/kg

Certificate No: D2600V2-1106_May23

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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
- 18		

Certificate No: D2600V2-1106_May23

Page 4 of 6



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

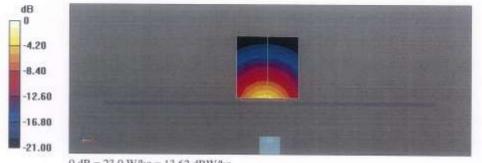
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; $\sigma = 2$ S/m; $\varepsilon_r = 37.1$; $\rho = 1000$ kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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

Certificate No: D2600V2-1106_May23

Page 5 of 6



Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1106_May23

Page 6 of 6



alibration Laboratory chmid & Partner Engineering AG sughausstresse 43, 8004 Zurich, 1			D s	Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
ccredited by the Swiss Accreditation he Swiss Accreditation Service in Iultilateral Agreement for the reco	s one of the signatorie			Accreditation No.: SCS 0108
lient HCT			Certificate No.	D5GHzV2-1317_May23
Gyeonggi-do, Republic		E		
Dbject	D5GHzV2 - SN:1	317		
Calibration procedure(s)	QA CAL-22.v7 Calibration Proce	dure for SAR Validat	ion Sources	between 3-10 GHz
Calibration date:	May 17, 2023			
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE	d in the closed laborator	All and the second second		
Primary Standards	ID #	Gal Date (Certificate No.)		Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-0380		Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-0380	4)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-0380)	5)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-0380	9)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-0381)	D)	Mar-24
Reference Probe EX3DV4 DAE4	SN: 3503 SN: 601	07-Mar-23 (No. EX3-3503 19-Dec-22 (No. DAE4-601		Mar-24 Dec-23
	A SAME A CAR			
Secondary Standards	ID #	Check Date (in house)		Scheduled Check
Power meter E44198 Power sensor HP 8481A	SN: GB39512475 SN: US37292783	30-Oct-14 (in house check 07-Oct-15 (in house check		In house check: Oct-24 In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check 07-Oct-15 (in house check		In house check: Oct-24 In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check		In house check: Oct-24
Network Analyzer Agilent EB358A	SN: US41080477	31-Mar-14 (in house chec		In house check: Oct-24
	Name	Function		Signature
Calibrated by:	Michael Weber	Laboratory Te	schrvician	Milder
Approved by:	Sven Kühn	Technical Ma	nager	5.6
Approved by: This calibration certificate shall not i				S. Co- Issued: May 25, 2023



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





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Accreditation No.: SCS 0108

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

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.
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- 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%.

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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)
		The light of the light of the light of the light of the
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.28 W/kg

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Head TSL parameters at 5600 MHz

	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 averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.32 W/kg

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 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	i and i	

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 ² (10 g) of Head TSL	condition	
SAR averaged over 10 cm ² (10 g) of Head TSL SAR measured	condition 100 mW input power	2.23 W/kg

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Head TSL parameters at 5800 MHz

	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	1102	

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 averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.20 W/kg

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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 μΩ
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

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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/m³ Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_{r} = 34.6; ρ = 1000 kg/m³ Medium parameters used: f = 5750 MHz; σ = 5.08 S/m; ε_{r} = 34.4; ρ = 1000 kg/m³ Medium parameters used: f = 5800 MHz; σ = 5.11 S/m; ε_{r} = 34.3; ρ = 1000 kg/m³ 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

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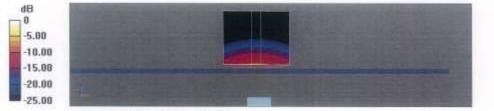
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 72.14 V/m; Power Drift = -0.04 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 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

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Impedance Measurement Plot for Head TSL

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10.0 5.00 5.00 -70.1 -70.1 -70.1	Ch1.Sn 0 0 00 00 00 00 00 00 00 00	nt 5.00000		-						2	5.55000 GHs 9.60000 GHs 5.25000 GHs 9.80000 GHs	-24.292.63 33.635.49 -00.040.69
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Appendix: Transfer Calibration at Four Validation Locations on SAM Head¹

Evaluation Conditions (f=5250 MHz)

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
No real teache		

SAR result with SAM Head (Top)

SAR averaged over 1 cm ² (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 ² (10 g) of Head TSL	condition	

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 ² (10 g) of Head TSL	condition	

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 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	

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¹ Additional assessments outside the current scope of SCS 0108



Appendix: Transfer Calibration at Four Validation Locations on SAM Head²

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 ² (10 g) of Head TSL	condition	

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 ² (10 g) of Head TSL	condition	

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 ² (10 g) of Head TSL	condition	

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	

² Additional assessments outside the current scope of SCS 0108

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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

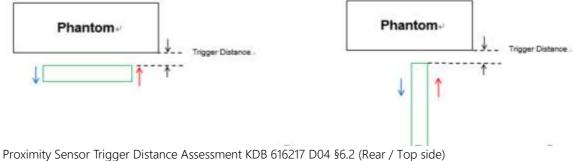
This device utilizes a power reduction mechanism for some wireless modes under some conditions when the device is being used in close proximity to the user's hand for Main ANT

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.

		Devic	e State
Mechanism(s)	Mode/Band	Un-triggered	Triggered
		(Grip Inactive, Max Power)	(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.



LEGEND

 $\xrightarrow{}$

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

		distance ear	Trigger distance Top			
Tissue simulating liquid	Moving toward Moving away from Moving toward phantom phantom phantom [mm] [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



Distance	Distance to DUT Output power (dBm)											
Distance	22	22 21 20 19 18 17 16							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 toward (trigger) to the Phantom



Distance	Distance to DUT Output power (dBm)										
Distance[mm]	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	

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

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.



	Distance to DUT Output power (dBm)											
Distance[mm]	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 toward (trigger) to the Phantom



Distance formal	Distance to DUT Output power (dBm)										
Distance[mm]	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	

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

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

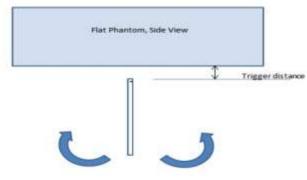
(KDB 616217 D04v01r02 §6.3)

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 $\pm 45^{\circ}$. 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 $\pm 45^{\circ}$.



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

Proxin

	Minimum						Power reduction status					
Band (MHz)	distance at which power reduction was maintained over-45°	-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



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

1.4 Resulting test positions for Body SAR measurements

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

		distance – ear		ance – Right de	Trigger distance – Top		
Tissue simulating liquid	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	



Distance[mm]	Distance to DUT Output power (dBm)										
Distance[mm]	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 toward (trigger) to the Phantom

Rear - EUT Moving away (Release) from the Phantom

Distance[mm]	Distance to DUT Output power (dBm)										
Distance[mm]	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.



Distance[mm]	Distance to DUT Output power (dBm)										
Distance[mm]	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 toward (trigger) to the Phantom

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

Distance[mm]	Distance to DUT Output power (dBm)										
Distance[mm]	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.



	Distance to DUT Output power (dBm)										
Distance[mm]	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 toward (trigger) to the Phantom

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

Distance[mm]	Distance to DUT Output power (dBm)										
Distance[mm]	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.

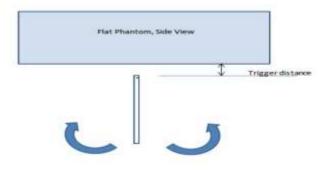


2.1 Proximity Sensor Coverage for SAR measurements

(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 $\pm 45^{\circ}$. 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 $\pm 45^{\circ}$.



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

	Minimum		nce to Proximity Sensor Triggering (Top side) Power reduction status									
Band (MHz)	distance at which power reduction was maintained over- 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]
	Rear	14	N/A	N/A	13
WLAN ANT 0	Right	8	N/A	N/A	7
	Тор	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

	Trigger distance – Rear			ice – Left Side	Trigger distance – Top		
Tissue simulating liquid	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	



	Distance to DUT Output power (dBm)											
Distance[mm]	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											
5GHz 802.11ac 40MHz	8.72 8.74 8.67 8.82 8.71 7.67 7.72 7.57 7.66 7											

Rear - EUT Moving toward (trigger) to the Phantom

Rear - EUT Moving away (Release) from the Phantom

	Distance to DUT Output power (dBm)											
Distance[mm]	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.



Distance[mm]	Distance to DUT Output power (dBm)												
Distance[mm]	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	7.61	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 toward (trigger) to the Phantom

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

	Distance to DUT Output power (dBm)											
Distance[mm]	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 8.7									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.



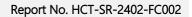
Distance[mm]	Distance to DUT Output power (dBm)												
Distance[mm]	24	23	22	21	20	19	18	17	16	15			
2.4GHz 802.11n 20MHz	13.91	13.88	13.80	13.91	13.86	10.77	10.87	10.93	10.90	10.76			
5GHz 802.11a	11.54	10.29	11.24	11.06	11.37	8.46	7.91	8.08	8.81	7.91			
5GHz 802.11n 20MHz	11.92	12.30	11.66	11.88	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									8.18			

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

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

	Distance to DUT Output power (dBm)											
Distance[mm]	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	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

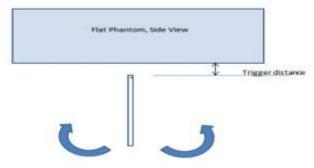
(KDB 616217 D04v01r02 §6.3)

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 $\pm 45^{\circ}$. 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 $\pm 45^{\circ}$.



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

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

	Minimum					Pow	er reduc	tion stat	us			
Band (MHz)	distance at which power reduction was maintained over- 45°	-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]
	Rear	14	N/A	N/A	13
WLAN ANT 1	Left	8	N/A	N/A	7
	Тор	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

F TP22-03 (Rev. 05)

The report shall not be (partly) reproduced except in full without approval of the laboratory.



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 D05Ă 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)

Phone2	~ Phone1 ~	Operation Band Channel Ban	Annual Level Annual Control Level Control Level Control Level	ULRIC - Number of BB (0.000, 10 The sets the service of the document for typical open.	ala alimated for the	A MTBB21C attractive table Br Duget I On Du 2004
PCC SI	(C1 SCC2 SCC3 ->>	Measurement	Signaling	UE Pr	wer: -21.4 dilm	
Common			Occupient Eventwette	Spectrum Emission Maske	Naki Solehi	1
Physical Channel	General	TX Fower Here dBm Freq. En Here ppm EVM Here Nord			Fundamental Sub Source	4. Presit
Call	Frequency		On		Tup	Reference
Processing	Devel					Signal not
TX Measurement	Signal					
EX Measurement	TIL RMC	Adjacent Channel Fower 15-3a	dEmsion Spectrum	Patres EVM		Single
Fundamental	DLRMC	1 7				Cominuous
Measurement	3 TOD	OW	2			
Tatt Parameter				EVM ***** %Jmil		Life
		Phase Error Magn	rtude Door Constella	tan Througheur		Start Call
Rand Definition						C Bul Cal
Externel				011		
System () Centig						.C. Menu:

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

Phone2	- Phone1 -		Cutput Andth - Cutput (evel	This tab is used to configure parameters o Carrier on LTE-A. A Blee Dot in this tab indicates that the co configured.		A MTREZEC abitis/da/ca/lead at/ Dicator Dicator
PCC	9001 SOC2 SCC3 >>	Measurement	Signaling	UE P	ower: 22.3 o <mark>t</mark> im	
Common	> I ★ Q	Nament	Ompiet Seiderth	Spectrum (minum Mark	Main Scient	^
Physical Charanel	Trequency	TX Power 22,09 dBm Frag. En 6,00 ppm EVM 1,45 %/mmd			Turdamental	< Preset
Cranteet	Level	EVM 1.45 Normal	On:) GH	Sub Soveri	
	Signal					Measuring
	DERMC					RX
	DLRMC	Adjacent Channel Fower 16-Ban	dEmain Spectrum	Ratnese EVM		Single
	TOD					Continuous
		C ON				And the second sec
						Cannication
		Phase Error Magn	rtude Dror Constella	EVM 3.45 Norma Ban Throughout		
		Terran () a				Start Call
Rend Definition						End Call
External				-04		
System						< Menu:
Centig		3-				





2CA Downlink Carrier aggregation Maximum conducted Powers

		РСС								SCC				Tx P	ower	
Combination	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)

Phone2 SEC for Proved	V Phonel V	Operation Band Channel Band	input Level anoth Output Level Units Catput Level	DL Throughput (LeC) 3 1717 The queries the resourcement	A MTBR21C adm/df/d5 1154 AF Output: On DL 2001	
PCC S	cca scca »»	Measurement	Signaling		UE Power : 24.0 dB	m Diamitar
Cammun		Fundamental) Throughput				A libra
Physical Channel	Seneral	(ktaps) 20000	MAC DL 1019 MAC UL 1058		Fundamental In Suit Sperm	(Preset
Call Processing	Trequency	31000			Total PCC SCC1	Measuring
TX Measurement	 Level Signal 	34000			SCC2 SCC3 SCC4 Target	:==
IIX Measurement	ULRMC	12000			- 5005 - 5006 - 5007 - 74/get(DL/U)	•→ Single
Fundamental	DL RMC	8020			Total - PCC	Continuent
- Hereite worten	100	4000			- sect	
Test Parametor		2000				(Cinne Sad)
		0 5911.5	land	5021	5	Start Call
Rand Definition		Throughput (Total)	>13811 Hbpo (+ 10			End Call
Estemat			Witten 7AD4-kines	C2 50C3 1953 Mare - Mare • 10000 Wa (+ W		
System Config		Alack Stray Rate 0.000 0.015+00	0.0000	0.0000 nF+000		< Menu

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

	Phonel	D. Channel Administer Operation Band Channel Band	Output Level	DL Throughput (LeC) (2117) This quarter the reasonances	at A nosit te the t		A MTB821C 2020/07/05 1355 RF Output: On D4 2005
PCC 1	soca scc2 scc3 >>	Measurement	Signaling		UE Pow	r : 24.0 dBm	O Amil Ca
Cammun	● ⊪ ★ Q	Fundamental) Throughput				water Surgerie	R
Physical	Trequency	(Kbps) 20000	MAC DL total MAC UL total			untamental Aut Scient	< Preset
	tevel	18000			Total - PCC - SCC1	Recuptout	Measuring
	 Signal ULRMC 	16000			- SCC2	anget	1k
	DL RMC	12000			- 5006	wget(Dt/U)	●> Single
	007 00	8000				ime Scale	Continuous
		2000					Connector
		5023.5	lsed	503	0.5		Start Call
Rand Definition		Termigtput (Total	- 13811 Abps (* 10		•		End Call
Estemat			Def Atura TADIA Atura	102 - 5003 1963 1944 - 194 • 10000 No. (+	ALC		
System Config		Block Enter Rate 0.000 0.000-400	0.0000	0.0000 NF+000	•		< Menu





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



3CA Downlink Carrier aggregation conducted Powers

								SCC				SCC		Tx P						
Combination	Band	BW	PCC UL Channel		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)		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

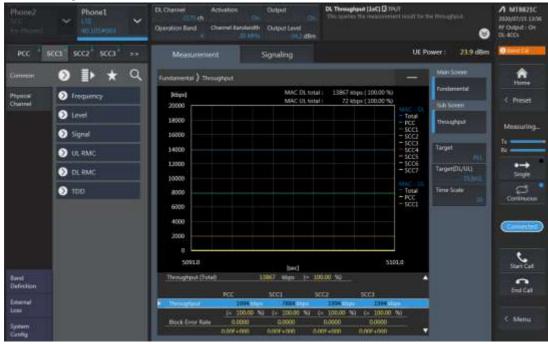


LTE Down Link 4CA Call Setup

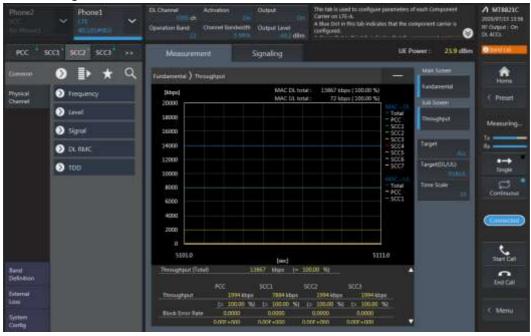
PCC Setting (Channel/ RB/ BW/ Modulation)



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

РСС								SCC						SCC		SCC				Tx Power			
Combination	Band BV	/			PCC DL Frequency	Modulation	RB	offset	Band	BW	SCC DL Channel		Band	BW	SCC DL Channel	SCC DL Frequency	Band	BW	SCC DL Channel		LTE Single Carrier Tx Power (dBm) (1)	Douvor	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