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ENSAYOS Nº 51/LE147

Test report No:
NIE: 59830RAN.003A2

Test report
IEEE Std 1528™-2013

(*) Identification of item tested	TCAM: Telematics and Connectivity Antenna Module
(*) Trademark	Continental
(*) Model and /or type reference tested	TCAM1NA0
Other identification of the product	Hw version: E4.2 Sw version: PI007.1 FCC ID: KR5TCAM1NA0 IC: 7812D-TCAM1NA0
(*) Features	2G, 3G, LTE, GNSS, WLAN, BLE, ISM Receiver
Manufacturer	Continental Automotive GmbH Siemensstrasse 12, 93055 Regensburg, Germany
Test method requested, standard	1. IEEE Std 1528™-2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques. 2. FCC 47 CFR Part 2.1093. (10-1-15 Edition) Radiofrequency radiation exposure evaluation: portable devices. 3. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Summary	Considering the results of the performed test according to IEEE Std 1528™-2013, the item under test is IN COMPLIANCE with FCC 47CFR Part 2.1093 and IC RSS-102 Issue 5 exposure limits. The maximum 1-g SAR found during this test has been 0.722 W/kg, for GPRS 850, 4 slots mode. The maximum 1-g SAR for multiband transmission found during this test has been 0.88 W/kg.
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager RAFAEL LÓPEZ MARTÍN 2020.07.17 13:56:30 +02'00'

Date of issue	2020-07-17
Report template No	FDT08_22 (*) "Data provided by the client"

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Uncertainty

Uncertainty (factor k=2) was calculated according to the following documents:

1. DEKRA Testing and Certification S.A.U. internal document PODT000.
2. FCC OET KDB 865664 D01 - SAR Measurement Requirements for 100 MHz to 6 GHz v01r04 (August 2015).

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested".

2. Maximum output power, conducted samples cable attenuation and testing distance.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: the client

Sample M/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
59830B/04	WWAN conducted	TCAM1NA0	SNRD004295	2019/10/22
59830B/20	WLAN conducted	TCAM1EU0	SNRD004547	2019/10/22

Sample M/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
59830B/10	WWAN radiated	TCAM1NA0	SNRD004291	2019/10/22
59830B/17	WLAN radiated	TCAM1NA0	SNRD004296	2019/10/22

1. Sample M/01 has undergone the test(s) specified in subclause “Test method requested”: Conducted average output power.
2. Sample M/02 has undergone the test(s) specified in subclause “Test method requested”: SAR evaluation for 2G, 3G, LTE and Wi-Fi.

Test sample description

Description of product ..... :	TCAM: Telematics and Connectivity Antenna Module		
Software version..... :	PI007.1		
Hardware version ..... :	E4.2		
Mounting position ..... :	☐	Table top equipment	
	☐	Wall/Ceiling mounted equipment	
	☐	Floor standing equipment	
	☐	Hand-held equipment	
	☒	Other: Vehicular environment equipment (Car Roof)	
Accessories (not part of the test item)..... :	Description	Type	Manufacturer
	Charging adapter	---	
	USB cable	---	

Identification of the client

Continental Automotive GmbH

Siemensstrasse 12, 93055 Regensburg, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-11-12
Date (finish)	2020-03-19

Document history

Report number	Date	Description
59830RAN.003	2020-04-20	First release
59830RAN.003A1	2020-07-14	Second release. Tune-up information and conducted samples cable attenuation updated. This modification test report cancels and replaces the test report 59830RAN.003.
59830RAN.003A2	2020-07-17	Third release. According to TCB/FCB request, calculations for Wi-Fi 2.4GHz OFDM SAR test exclusion has been included and Wi-Fi 5GHz supported bands information have been updated. This modification test report cancels and replaces the test report 59830RAN.003A1.

Environmental conditions

Date	Max. Temp.	Min. Temp.	Max. Hum.	Min. Hum.	Limit
	ºC	ºC	%	%	
From 2019-11-12 to 2019-03-19	24.99	20.09	63.22	30.04	18-25 ºC, 30-70%

References

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IC RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) and the following FCC Published RF exposure KDB procedures:

1. FCC OET KDB 447498 D01 General RF Exposure Guidance v06 (October 2015)
2. FCC OET KDB 865664 D01 - SAR Measurement Requirements for 100 MHz to 6 GHz v01r04 (August 2015).
3. FCC OET KDB 865664 D02 RF Exposure Reporting v01r02 (October 2015)
4. FCC OET KDB 941225 D01 3G SAR Procedures v03r01 (October 2015).
5. FCC OET KDB 941225 D05 SAR for LTE Devices v02r05 (October 2015).
6. FCC OET KDB 248227 D01 802.11 Wi-Fi SAR v02r02 (October 2015).

Remarks and comments

1: Testing of GPRS EDGE mode is not required according to test reductions mentioned in FCC OET KDB 941225 D01 3G SAR Procedures, paragraph “5. GSM, GPRS and EDGE”

2: Testing of HSDPA/HSPA/HSPA+/DC-HSPA modes are not required according to paragraph “2.1 3G SAR test reduction procedure” mentioned in FCC OET KDB 941225 D01 3G SAR Procedures.

3: Only the plots of the highest reported SAR for each test position and mode/band are included in appendix C.

4: According to ISED requirements, the low, mid and high frequency channels for the configuration with the highest SAR value has been tested regardless of the SAR value measured.

5: The tests have been performed by the technical personnel: Francisco J. Sánchez.

4: The instrumentation utilized to perform the tests covered in this test report is listed in the following table:

Equipment	S/N
Dosimetric E-field probe SPEAG EX3DV4	7461
Data acquisition device SPEAG DAE4	669
Electro-optical converter SPEAG EOC3	391
Robot Stäubli RX60BL, Robot controller Stäubli CS7MB	F04/SOP5A1/A/01
Measurement server SPEAG DASY5 SE UMS 011 BS	1227
Oval flat phantom SPEAG ELI 4	1060
SAR measurement software SPEAG DASY52 V52.8.8.1222	-
SAR postprocessing software SPEAG SEMCAD X	-
750 MHz dipole validation kit SPEAG D750V3	1036
900 MHz dipole validation kit SPEAG D900V2	1D007
1800 MHz dipole validation kit SPEAG D1800V2	2D099
2450 MHz dipole validation kit SPEAG D2450V2	756
2600 MHz dipole validation kit SPEAG D2600V2	1023
5 GHZ dipole validation kit SEPAG D5GHzV2	1071
Body Tissue Equivalent Liquids for 750 MHz, 850MHz, 1700 MHz, 1900 MHz, 2450 MHz, 2600 MHz and 5 GHz bands	-
Universal Radio Communication Tester R&S CMW 500	1201.0002K50-113616-jG
Vector network analyzer Agilent FieldFox N9923A	US49470126
Dielectric probe kit SPEAG DAK-3.5	1080
Power meter Agilent E4419B	MY45103349
RF Generator R&S SMU200	102234
DC Power supply Agilent U8002A	MY53500016
Dual directional coupler HP 778D	15821
Dual directional coupler NARDA 4227-16	-
Power amplifier MITEQ AMF-4D-00400600-50-30P	1456425
6 dB attenuator Weinschel 75 A-6-11	902
SPEAG Mounting Device for Hand-held devices.	-
Power sensor DC 50 MHz to 18 GHz R&S model NRP-Z81	100527
Digital thermometer LKM Electronics model DTM300-Spezial	2989
Temperature and humidity probe HUMIDIPROBE Pico Technology	UAL02/077

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

FCC 47CFR Part 2.1093 & ISED RSS-102 Issue 5	VERDICT			
	N/A	P	F	NM
GSM 850		P		
GSM 1900		P		
WCDMA II		P		
WCDMA IV		P		
WCDMA V		P		
LTE 2		P		
LTE 4		P		
LTE 5		P		
LTE 7		P		
LTE 12		P		
LTE 13		P		
LTE 17		P		
802.11b/g/n		P		
802.11a/g/n/ac		P		
Bluetooth		P		

Appendix A: Test configuration

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1. GENERAL INTRODUCTION

1.1. Application Standard

The Federal Communications Commission (FCC) sets the limits for General Population/Uncontrolled exposure to radio frequency electromagnetic fields for transmitting devices designed to be used within 20 centimetres of the body of the user under FCC 47 CFR Part 2.1093 - "Radiofrequency radiation exposure evaluation: portable devices", paragraph (d)(2).

Industry of Canada (ISED) sets the limits for General Population/Uncontrolled environment when the expsosure occurs at a distance of 0.2 m or less into the RSS-102 Issue 5, paragraph 4 "Exposure Limits", Table 3.

1.2. General requirements

The SAR measurement has been performed continuing the following considerations and environment conditions:

- The ambient temperature shall be in the range of 18ºC to 25ºC and the variation shall not exceed +/- 2ºC during the test.
- The ambient humidity shall be in the range of and 30% - 70%.
- The device battery shall be fully charged before each measurement.

1.3. Measurement system requirements

The measurement system used for SAR tests fulfils the procedural and technical requirements described at the reference standards used.

1.4. Phantom requirements

The phantom model for body measurements is an elliptical open-top container with a flat bottom, with the following shape and dimensions:

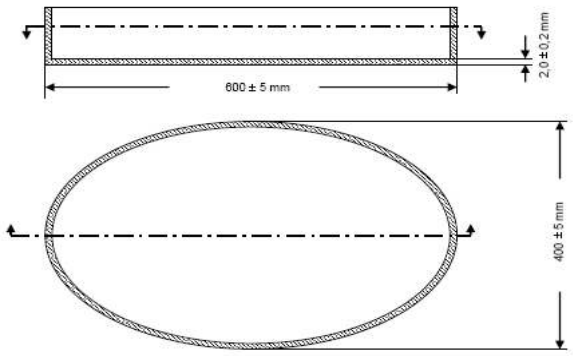


Figure 1: Proportions and shape of Phantom shell

1.5. Measurement Liquids requirements.

The liquids used to simulate the human tissues, must fulfils the requirements of the dielectric properties required. These target dielectric properties per FCC OET KDB 865664 D01 instructions come from the dipole and probe calibration data which are included in Appendix B, Section 3, of this document.

To minimize the effect of reflections on peak spatial-average SAR values, from the upper surface of the tissue-equivalent liquid, the depth of the liquid should be at least 15 cm.

2. MEASUREMENT SYSTEM

2.1. Measurement System

The DASY5 system for performing compliance tests consists of the following items:

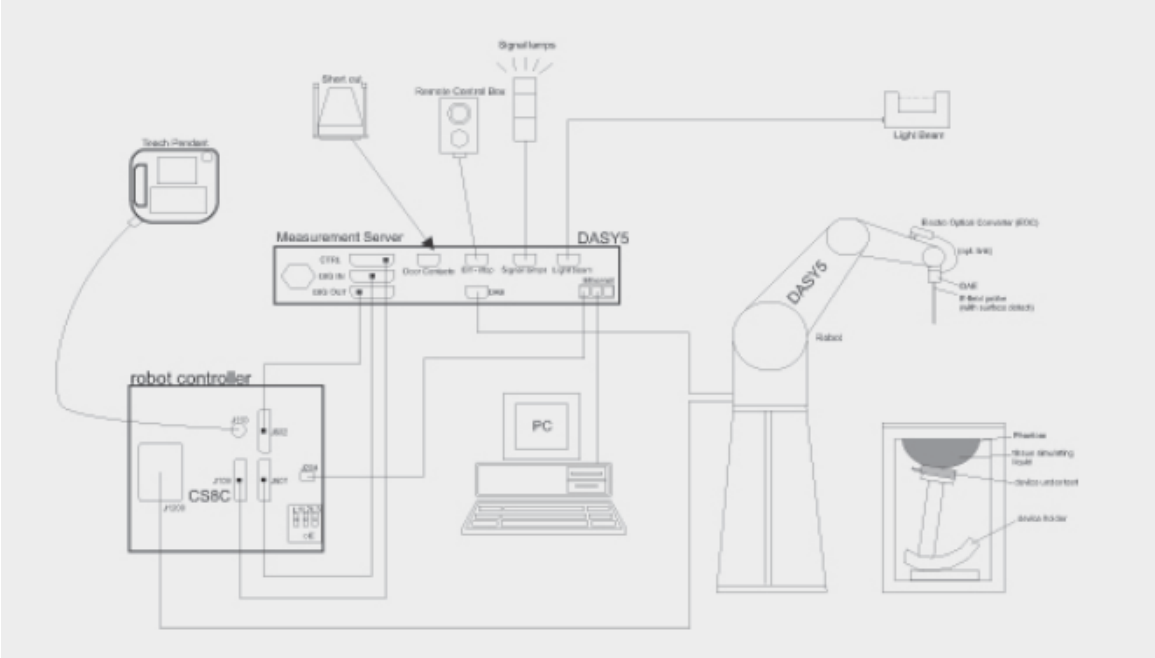


Figure 2: SAR Measurement system

A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

An isotropic field probe optimized and calibrated for the targeted measurement.

A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.

The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.

A computer running the DASY5 software.

Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.

The phantom, the device holder and other accessories according to the targeted measurement.

Model	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1.0 mm

Model	DAE4
Construction	Signal amplifier, multiplexer, A/D converter, and control logic. Serial optical link communication with DASY4/5 embedded system (fully remote controlled). Two-step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5 µV (with auto zero)
Input Resistance	200 MOhm
Input Bias Current	< 50 fA

Model	ELI
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	Approx. 30 liters
Wooden Support	SPEAG standard phantom table

Model	Mounting Device for Hand-Held Transmitters
Construction	In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).
Material	Polyoxymethylene (POM)

Model	System Validations Kits 450 MHz – 6 GHz		
Construction	Symmetrical dipole with I/4 balun. Enables measurement of feedpoint impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.		
Frequency	450 MHz to 5800 MHz		
Return Loss	20 dB at specified validation position		
Dimensions (length and overall height in mm)	**Product**	**Dipole length**	**Overall height**
	D450V3	290.0	330.0
	D750V3	179.0	330.0
	D900V2	148.5	340.0
	D1800V2	72.5	300.0
	D2000V2	65.0	300.0
	D2450V2	52.0	290.0
	D2600V2	49.2	290.0
	D5GHzV2	20.6	300.0

2.2. Test Positions of device relative to body

The device under test consists of a shark fin antenna which will be installed on the roof of an specific car model into a fixed position, over the rear seat row at the center of the roof close to the rear window. The device has two transmitting antennas, the main antenna (external) which will be situated outside the car roof once installed, and the backup antenna (internal) which will be used only if there were any problem with the main antenna, and it is situated in the interior of the car.

As the main antenna is outside the metallic roof of the car body, measurements have been performed for the internal antenna as a worst case condition for the passengers of the car.

Once installed, according to the manufacturer, the closer distance between the internal antenna and the interior roof surface of the car will be 24.62 mm.

The device has been tested placed at the centre of the flat phantom with its back side facing the flat phantom surface simulating the normal use conditions, at a testing distance of 24 mm.

2.3. Test to be performed

Test shall be performed at test position previously described, using the centre frequency, the low-end and the high-end frequencies of each transmitting band supported by the device under test.

2.4. Description of interpolation/extrapolation scheme

The local SAR inside the Phantom is measured using small dipole sensing elements inside a probe element. The probe tip must not be in contact with the Phantoms surface in order to minimise measurement errors, but the highest local SAR is obtained from measurements at a certain distances from the shell trough extrapolation. The accurate assessment of the maximum SAR averaged over 1 gr and 10 gr. requires a very fine resolution in the three dimensional scanned data array. Since the measurements have to be performed over a limited time, the measured data have to be interpolated to provide an array of sufficient resolution.

The interpolation of 2D area scan is used after the initial area scan, at a fixed distance from the Phantom shell wall. The initial scan data is collected with approx. 15 mm spatial resolution and this interpolation is used to find the location of the local maximum for positioning the subsequent 3D scanning within a 1 mm resolution.

For the 3D scan, data is collected on a spatially regular 3D grid having 5 mm steps in both directions. After the data collection by the SAR probe, the data are extrapolated in the depth direction to assign values to points in the 3D array closer to the shell wall. A notional extrapolation value is also assigned to the first point outside the shell wall so that subsequent interpolation schemes will be applicable right up to the shell wall boundary.

2.5. Determination of the largest peak spatial-average SAR

To determine the maximum value of the peak spatial-average SAR of a DUT, all device positions, configurations and operational modes should be tested for each frequency band.

The averaging volume shall be chosen as 1gr. of contiguous tissue. The cubic volumes, over which the SAR measurements are averaged after extrapolation and interpolation, are chosen in order to include the highest values of local SAR.

The maximum SAR level for the DUT will be the maximum level obtained of the performed measurements, and indicated in the previous points.

2.6. System Validation

Prior to the SAR measurements, system verification is done to verify the system accuracy. A complete SAR evaluation is done using a half-wavelength dipole as source with the frequency of the mid-band channel of the operating band, or within 10% of this channel.

The measured 1 gr. and 10 gr. SAR should be within 10% of the expected target values specified in the calibration certificate of the dipole, for the specific tissue and frequency used.

3. UNCERTAINTY

According to FCC OET KDB 865664 D01 - SAR Measurement Requirements for 100 MHz to 6 GHz v01r04 (August 2015), as the highest measured 1-g SAR has been < 1.5 W/kg, SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in the actual SAR report, but it has been included for ISO 17025 accreditation.

Uncertainty for 300 MHz – 3 GHz

ERROR SOURCES	Uncertainty value (± %)	Probability distribution	Divisor	(c_i) 1g	(c_i) 10g	Standard uncertainty (1g) (± %)	Standard uncertainty (10g) (± %)
Measurement Equipment							
Probe Calibration	6.650	6.650	N	1	1	1	6.650
Axial Isotropy	3.500	3.500	R	√3	0.7	0.7	1.415
Hemisfericall Isotropy	2.320	2.320	R	√3	0.7	0.7	0.938
Boundary effect	1.000	1.000	R	√3	1	1	0.577
Linearity	4.700	4.700	R	√3	1	1	2.714
System Detection limits	0.250	0.250	R	√3	1	1	0.144
Probe modulation response	4.800	4.800	N	1	1	1	4.800
Readout electronics	0.300	0.300	N	1	1	1	0.300
Response time	1.010	1.010	R	√3	1	1	0.583
Integration time	2.600	2.600	R	√3	1	1	1.501
RF Ambient noise	3.000	3.000	R	√3	1	1	1.732
RF Ambient reflections	3.000	3.000	R	√3	1	1	1.732
Probe positioner mech. restrictions	0.400	0.400	R	√3	1	1	0.231
Probe positioning with respect to phantom shell	2.900	2.900	R	√3	1	1	1.674
Max. SAR Eval.	2.000	2.000	R	√3	1	1	1.155
Test Sample Related							
Device holder uncertainty	2.900	N	1	1	1	2.900	2.900
Test sample positioning	3.600	N	1	1	1	3.600	3.600
Drift of output power	5.000	R	√3	1	1	2.887	2.887
Phantom and Setup							
Phantom uncertainty (shape and thickness tolerances)	6.100	R	√3	1	1	3.522	3.522
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.900	R	√3	1	0.84	1.097	0.921
Liquid conductivity (meas.)	2.454	N	1	0.78	0.71	1.914	1.742
Liquid permittivity (meas.)	2.454	N	1	0.26	0.26	0.638	0.638
Liquid conductivity – temperature uncertainty	5.220	R	√3	0.78	0.71	2.351	2.140
Liquid permittivity – temperature uncertainty	0.840	R	√3	0.23	0.26	0.112	0.126
Combined standard uncertainty	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					**12.00**	**11.92**
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**24.00**	**23.84**

Table 1: Uncertainty Assessment for 300 MHz - 3 GHz.

Uncertainty for 3 GHz – 6 GHz

ERROR SOURCES	Uncertainty value (± %)	Probability distribution	Divisor	(c_i) 1g	(c_i) 10g	Standard uncertainty (1g) (± %)	Standard uncertainty (10g) (± %)
Measurement Equipment							
Probe Calibration	7.000	N	1	1	1	7.000	7.000
Axial Isotropy	3.500	R	√3	0.7	0.7	1.415	1.415
Hemisfericall Isotropy	2.320	R	√3	0.7	0.7	0.938	0.938
Boundary effect	2.000	R	√3	1	1	1.155	1.155
Linearity	4.700	R	√3	1	1	2.714	2.714
System Detection limits	0.250	R	√3	1	1	0.144	0.144
Probe modulation response	4.800	N	1	1	1	4.800	4.800
Readout electronics	0.300	N	1	1	1	0.300	0.300
Response time	1.010	R	√3	1	1	0.583	0.583
Integration time	2.600	R	√3	1	1	1.501	1.501
RF Ambient noise	3.000	R	√3	1	1	1.732	1.732
RF Ambient reflections	3.000	R	√3	1	1	1.732	1.732
Probe positioner mech. restrictions	0.400	R	√3	1	1	0.231	0.231
Probe positioning with respect to phantom shell	6.700	R	√3	1	1	3.868	3.868
Max. SAR Eval.	4.000	R	√3	1	1	2.309	2.309
Test Sample Related							
Device holder uncertainty	2.900	N	1	1	1	2.900	2.900
Test sample positioning	3.600	N	1	1	1	3.600	3.600
Drift of output power	5.000	R	√3	1	1	2.887	2.887
Phantom and Setup							
Phantom uncertainty (shape and thickness tolerances)	6.600	R	√3	1	1	3.811	3.811
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.900	R	√3	1	0.84	1.097	0.921
Liquid conductivity (meas.)	2.454	N	1	0.78	0.71	1.914	1.742
Liquid permittivity (meas.)	2.454	N	1	0.26	0.26	0.638	0.638
Liquid conductivity – temperature uncertainty	3.360	R	√3	0.78	0.71	1.513	1.377
Liquid permittivity – temperature uncertainty	0.780	R	√3	0.23	0.26	0.104	0.117
Combined standard uncertainty	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					**12.84**	**12.79**
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**25.68**	**25.57**

Table 2: Uncertainty Assessment for 3 GHz - 6 GHz.

4. SAR LIMIT

Having a worst case measurement, the SAR limit is valid for general population/uncontrolled exposure.

The SAR values have to be averaged over a mass of 1 gr. (SAR 1 gr.) with the shape of a cube and averaged over a mass of 10 gr (Extremity SAR 10 gr). These levels could not exceed the values indicated in the application Standard:

Standard	Exposure	SAR	SAR Limit (W/kg)
FCC 47 CFR Part 2.1093, Paragraph (d)(2) RSS-102 Issue 5 (2015-03), Paragraph 4	General population/Uncontrolled	SAR 1-g.	1.6
FCC 47 CFR Part 2.1093, Paragraph (d)(2) RSS-102 Issue 5 (2015-03), Paragraph 4	General population/Uncontrolled Extremity	SAR 10-g.	4.0

Table 3: SAR limit

5. DEVICE UNDER TEST

5.1. Dimensions

Dimensions	Millimetres
Length x Width x Height	155.0 x 105.0 x 20.0
Length x Width x Height (including ext antenna)	155.0 x 105.0 x 90.0

Table 4: Dimensions

5.2. Wireless Technology

Wireless Technology	SAR Testing	Frequency Bands	Modes
GSM	Required	850 / 1900	- Voice (GMSK) - GPRS (GMSK, Multi-slot class 33) - EGPRS (8PSK, Multi-slot class 33)
W-CDMA	Required	II/IV/V	- UMTS Rel. 99 - HSDPA (Rel. 5) - HSPA (Rel. 6) - HSPA+ (Rel. 7) - DC-HSDPA (Rel. 8)
LTE	Required	2/4/5/7/12/13/17	- QPSK and 16-QAM (Rel. 9)
Wi-Fi	Required	2.4 GHz	- 802.11b/g/n20/n40/ac20
	Required	5 GHz	- 802.11a/n20/n40/ac80
Bluetooth	Not Required*	2.4 GHz	- Bluetooth LE

Table 5: Supported modes

* See Appendix B section 2.5. Bluetooth of this document for more details

5.3. Simultaneous Transmission

Simultaneous transmission evaluation was performed according to FCC OET KDB 447498 D01 General RF Exposure Guidance v06 (October 2015). The detailed simultaneous transmission combination is:

Capable Transmit Configurations
WWAN+WLAN+BT

Table 6: Simultaneous transmission

5.4. Antenna Location

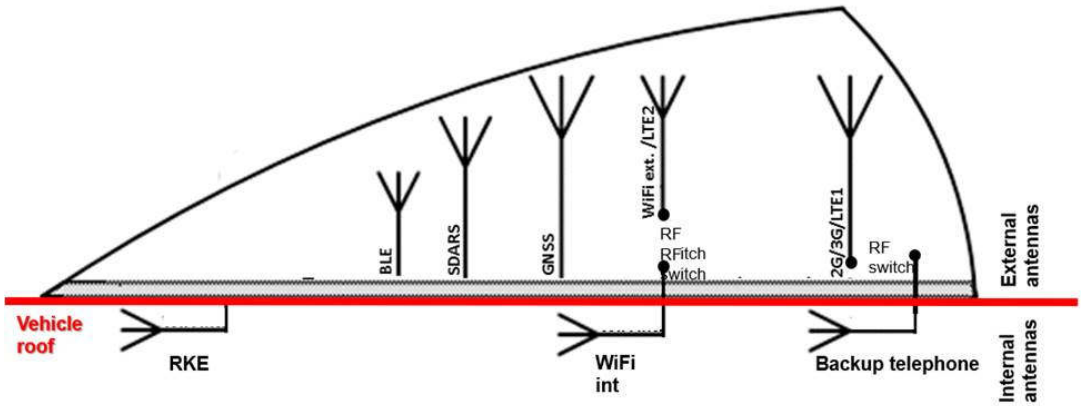


Figure 3: Antenna diagram location sketch

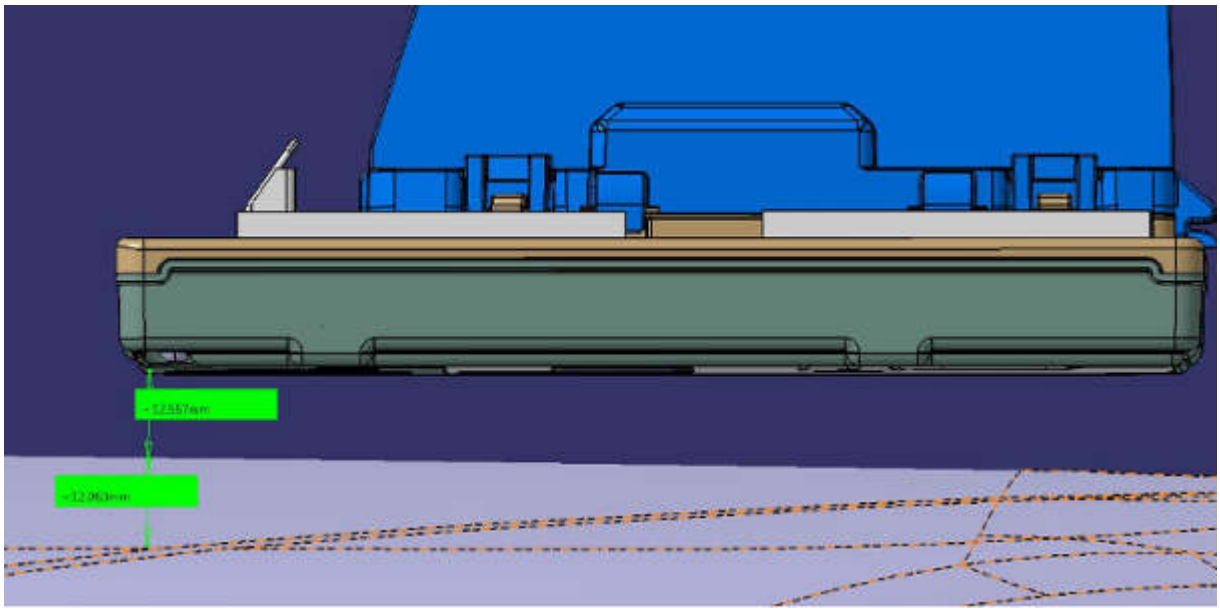


Figure 4: Minimum distance between the device and interior roof surface of the car.

Appendix B: Test results

INDEX

1. TEST CONDITIONS

1.1. Power supply (V):

Vn = 12 V rechargeable battery

Type of power supply = DC Voltage from power supply.

1.2. Temperature (ºC):

T_n = +20.00 to +25.00

The subscript n indicates normal test conditions.

1.3. Test signal, Output Power and Frequencies

The sample was put into operation by using a R&S CMW 500 as base station simulator. The output power of the device was set to Power Control Level (PCL) maximum for all tests.

For the 802.11a/b/g/n/ac modes, the device was put into operation by using a manufacturer proprietary test mode, setting the maximum output power for each mode. The duty factor was set to maximum (aprox. 100%).

In all operating bands and test positions, the measurements were performed on middle, lowest and highest channels.

The actual SAR sample does not have accessible antenna connectors for conducted measurements, so the conducted average output power was measured using others identical samples (M/01) provided by the manufacturer with auxiliary external connectors that makes the measurements representative and applicable for all the tested samples. See 'usage of samples' paragraph of this report.

The maximum conducted time-averaged power of the device for each mode was measured with a power sensor R&S NRP-Z81.

The target power alignments, including tune-up tolerance, for RF components declared by the manufacturer for each supported technology are:

Band	Burst Averaged Output Power (dBm)				Frame Averaged Output Power (dBm)			
	1 Tx slot	2 Tx slots	3 Tx slots	4 Tx Slots	1 Tx slot	2 Tx slots	3 Tx slots	4 Tx slots
GSM/GPRS 850	35.0	33.5	31.5	30.5	25.97	27.48	27.24	27.49
E-GPRS 850	27.5	25.5	24.5	23.5	18.47	19.48	20.24	20.49
GSM/GPRS 1900	32.0	30.5	28.5	27.5	22.97	24.49	24.24	24.49
E-GPRS 1900	26.5	24.5	23.5	22.5	17.47	18.48	19.24	19.49

Output Power (dBm)	Transmission Mode		
	WCDMA II	WCDMA IV	WCDMA V
Maximum	25.0	25.0	25.0

Output Power (dBm)	Transmission Mode						
	LTE B2	LTE B4	LTE B5	LTE B7	LTE B12	LTE B13	LTE B17
Maximum	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Band	Output Power (dBm)	Transmission Mode	
		802.11b/g/n20/n40	Bluetooth LE
2.45 GHz	Maximum	18.5	4.0

Band	Output Power (dBm)	Transmission Mode
		802.11a/n20/n40/ac20/ac40/ac80
5 GHz	Maximum	14.5

1.4. DUT and test-site configurations

For all supported modes, a test separation distance between the back face of the DUT and flat phantom surface of 24 mm was set to perform measurements.

2. CONDUCTED AVERAGE POWER MEASUREMENTS

2.1. GSM/GPRS/EGPRS Bands

- GPRS 850: For data mode. PCL 5, CS1 coding scheme and Gamma 3 were set to allow DUT's max power transmission for each slot.

GPRS 850 - Frame Average Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
128	824.2	22.2	24.9	26.4	27.5	5	GMSK-CS1
190	836.6	22.3	25.1	26.5	27.6	5	GMSK-CS1
251	848.8	22.6	25.3	26.8	27.7	5	GMSK-CS1

GPRS 850 - Average Burst Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
128	824.2	31.2	30.9	30.6	30.5	5	GMSK-CS1
190	836.6	31.4	31.1	30.8	30.6	5	GMSK-CS1
251	848.8	31.6	31.3	31.0	30.7	5	GMSK-CS1

- EGPRS 850: For data mode. PCL 8, MCS5 coding scheme and Gamma 6 were set to allow DUT's max power transmission for each slot.

EDGE 850 - Frame Average Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
128	824.2	16.4	19.1	20.5	21.4	8	8PSK-MCS5
190	836.6	16.4	19.0	20.4	21.3	8	8PSK-MCS5
251	848.8	16.6	19.1	20.5	21.4	8	8PSK-MCS5

EDGE 850 - Average Burst Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
128	824.2	25.5	25.1	24.7	24.4	8	8PSK-MCS5
190	836.6	25.4	25.0	24.6	24.3	8	8PSK-MCS5
251	848.8	25.6	25.2	24.8	24.5	8	8PSK-MCS5

- GPRS1900: For data mode. PCL 0, CS1 coding scheme and Gamma 3 were set to allow max power transmission for each slot.

GPRS 1900 - Frame Average Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
512	1850.2	18.6	21.3	22.8	23.7	0	GMSK-CS1
661	1880.0	18.4	21.1	22.7	23.9	0	GMSK-CS1
810	1909.8	18.4	21.1	22.7	23.7	0	GMSK-CS1

GPRS 1900 - Average Burst Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
512	1850.2	27.6	27.3	27.1	26.7	0	GMSK-CS1
661	1880.0	27.5	27.2	27.0	26.9	0	GMSK-CS1
810	1909.8	27.4	27.2	26.9	26.7	0	GMSK-CS1

- EGPRS 1900: For data mode, PCL 2, MCS5 coding scheme and Gamma 5 were set to allow max power transmission for each slot.

EDGE 1900 - Frame Average Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
512	1850.2	15.4	18.1	19.5	20.4	2	8PSK-MCS5
661	1880.0	15.3	17.9	19.4	20.3	2	8PSK-MCS5
810	1909.8	15.2	17.9	19.3	20.3	2	8PSK-MCS5

EDGE 1900 - Average Burst Output Power							
Channel Number	Frequency (MHz)	Power (dBm) 1 Slot	Power (dBm) 2 Slots	Power (dBm) 3 Slots	Power (dBm) 4 Slots	PCL	Modulation
512	1850.2	24.4	24.1	23.8	23.4	2	8PSK-MCS5
661	1880.0	24.3	23.9	23.6	23.3	2	8PSK-MCS5
810	1909.8	24.2	23.9	23.5	23.3	2	8PSK-MCS5

2.2. WCDMA/HSDPA/HSPA/HSPA+ Bands

- WCDMA: The DUT supports power Class 3, with a nominal maximum output power of 24 dBm. Tests were completed according to 3GPP TS34.121, section 5.

Mode	Subtest	Rel99
WCDMA	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2Kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD II 1900	WCDMA	9262	1852.4	21.99
FDD II 1900	WCDMA	9400	1880.0	23.03
FDD II 1900	WCDMA	9538	1907.6	22.95

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD IV 1700	WCDMA	1312	1712.4	23.76
FDD IV 1700	WCDMA	1412	1732.6	23.47
FDD IV 1700	WCDMA	1512	1752.6	23.66

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD V 850	WCDMA	4132	826.4	22.95
FDD V 850	WCDMA	4182	836.4	23.13
FDD V 850	WCDMA	4233	846.6	23.21

- HSDPA:

Mode	Subtest	1	2	3	4
HSDPA	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2Kbps RMC			
	HSDPA FRC	H-Set1			
	HSUPA Test	HSUPA Loopback			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64	64	64	64
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR	0	0	0.5	0.5
	Dack	8			
	Dnak	8			
	Ack-Nack repetition factor	3			
	DCQI	8			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs =βhs/βc	30/15			

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD II 1900	HSDPA	9262	1852.4	21.96	21.86	21.46	21.47
FDD II 1900	HSDPA	9400	1880.0	22.08	22.07	21.45	21.38
FDD II 1900	HSDPA	9538	1907.6	22.02	22.00	21.48	21.41

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD IV 1700	HSDPA	1312	1712.4	22.79	22.72	22.36	22.33
FDD IV 1700	HSDPA	1412	1732.6	22.68	22.64	22.11	22.12
FDD IV 1700	HSDPA	1512	1752.6	22.76	22.70	22.37	22.33

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD V 850	HSDPA	4132	826.4	21.96	21.87	21.42	21.34
FDD V 850	HSDPA	4182	836.4	22.15	21.97	21.59	21.47
FDD V 850	HSDPA	4233	846.6	22.23	22.14	21.66	21.58

- HSPA:

Mode	Subtest	1	2	3	4	5
HSPA	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2Kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm 2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15	56/75	134/15
	MPR (dB)	0	2	1	2	0
	Dack	8				
	Dnak	8				
	Ack-Nack repetition factor	3				
	DCQI	8				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	Ahs =βhs/βc	30/15				
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL DataRate Kbps	242.1	174.9	482.8	205.8	308.9

Band	Mode	CH	Frequency (MHz)	Average Output Power (dBm)				
				Subtest				
				1	2	3	4	5
FDD II 1900	HSPA	9262	1852.4	21.91	21.46	22.01	21.87	21.93
FDD II 1900	HSPA	9400	1880.0	22.01	21.37	22.03	21.88	22.05
FDD II 1900	HSPA	9538	1907.6	21.93	21.29	22.01	21.91	22.03

Band	Mode	CH	Frequency (MHz)	Average Output Power (dBm)				
				Subtest				
				1	2	3	4	5
FDD IV 1700	HSPA	1312	1712.4	22.81	22.16	22.78	22.74	22.84
FDD IV 1700	HSPA	1412	1732.6	22.58	21.96	22.57	22.47	22.62
FDD IV 1700	HSPA	1512	1752.6	22.81	22.28	22.79	22.62	22.84

Band	Mode	CH	Frequency (MHz)	Average Output Power (dBm)				
				Subtest				
				1	2	3	4	5
FDD V 850	HSPA	4132	826.4	22.02	21.28	22.04	21.80	22.04
FDD V 850	HSPA	4182	836.4	22.12	21.49	22.12	21.95	22.18
FDD V 850	HSPA	4233	846.6	22.15	21.52	22.18	22.03	22.23

- HSPA+

Mode	Subtest	1
HSPA+	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2Kbps RMC
	HSDPA FRC	H-Set1
	HSUPA Test	HSUPA Loopback
	Power Control Algorithm	Algorithm 2
	βc	1
	βd	0
	βec	30/15
	βhs	30/15
	βed (2xSF2)	βed1: 30/15
		βed2: 30/15
	βed (2xSF4)	βed3: 24/15
		βed4: 24/15
	CM (dB)	3.5
	MPR (dB)	2.5
	D E-DPCCH	7
	AG Index	14
	ETFCI	105

The DUT doesn't support 16QAM for uplink, so the uplink category and release was the same as HSPA, therefore the RF conducted power for HSPA+ was not measured.

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD II 1900	HSPA+	9262	1852.4	22.98
FDD II 1900	HSPA+	9400	1880.0	23.02
FDD II 1900	HSPA+	9538	1907.6	22.90

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD IV 1700	HSPA+	1312	1712.4	23.78
FDD IV 1700	HSPA+	1412	1732.6	23.54
FDD IV 1700	HSPA+	1512	1752.6	23.76

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD V 850	HSPA+	4132	826.4	22.92
FDD V 850	HSPA+	4182	836.4	23.05
FDD V 850	HSPA+	4233	846.6	23.16

- DC-HSDPA

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	**1**	**2**	**3**	**4**
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2 Kbps RMC			
	HSDPA FRC	H-Set 12			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	CM (dB)	0	1	1.5	1.5
	MPR	0.0	0.0	0.5	0.5
HSDPA Specific Settings	Dack	8			
	Dnak	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs =βhs/βc	30/15			

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD II 1900	DC-HSDPA	9262	1852.4	21.49	21.46	21.38	21.47
FDD II 1900	DC-HSDPA	9400	1880.0	21.53	21.45	21.41	21.48
FDD II 1900	DC-HSDPA	9538	1907.6	21.54	21.39	21.43	21.49

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD IV 1700	DC-HSDPA	1312	1712.4	22.33	22.18	22.19	22.29
FDD IV 1700	DC-HSDPA	1412	1732.6	22.03	21.98	22.00	22.00
FDD IV 1700	DC-HSDPA	1512	1752.6	22.29	22.13	22.26	22.29

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD V 850	DC-HSDPA	4132	826.4	21.48	21.30	21.29	21.33
FDD V 850	DC-HSDPA	4182	836.4	21.69	21.55	21.49	21.42
FDD V 850	DC-HSDPA	4233	846.6	21.79	21.53	21.60	21.62

2.3. LTE Bands.

LTE MPR is permanently implemented for the device. A-MPR was disabled for all SAR tests. The following power reductions are used for higher RB allocations and 16-QAM modulation:

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

- LTE B2

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1860.0 MHz	**1880.0 MHz**	**1900.0 MHz**
LTE B2	20 MHz	QPSK	1RB Low	0	22.03	22.18	22.37
			1RB Mid	0	22.22	22.17	22.46
			1RB High	0	22.12	21.94	22.38
			50% Low	1	21.25	21.12	21.28
			50% Mid	1	21.27	21.18	21.21
			50% High	1	21.21	21.15	21.14
			100%	1	21.19	21.25	21.17
		16-QAM	1RB Low	1	21.29	21.30	21.15
			1RB Mid	1	21.52	21.45	21.31
			1RB High	1	21.37	21.13	21.17
			50% Low	2	20.26	20.11	20.28
			50% Mid	2	20.28	20.15	20.22
			50% High	2	20.26	20.18	20.18
			100%	2	20.24	20.10	20.20
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1857.5 MHz	**1880.0 MHz**	**1902.5 MHz**
LTE B2	15 MHz	QPSK	1RB Low	0	22.15	22.25	22.42
			1RB Mid	0	22.40	22.59	22.57
			1RB High	0	22.26	22.22	22.45
			50% Low	1	21.41	21.33	21.26
			50% Mid	1	21.39	21.40	21.18
			50% High	1	21.33	21.33	21.25
			100%	1	21.37	21.33	21.25
		16-QAM	1RB Low	1	21.23	21.30	21.24
			1RB Mid	1	21.55	21.51	21.44
			1RB High	1	21.37	21.24	21.28
			50% Low	2	20.34	20.34	20.32
			50% Mid	2	20.35	20.33	20.24
			50% High	2	20.36	20.34	20.26
			100%	2	20.32	20.32	20.24

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1855.0 MHz	**1880.0MHz**	**1905.0 MHz**
LTE B2	10 MHz	QPSK	1RB Low	0	22.44	22.13	22.51
			1RB Mid	0	22.51	22.31	22.48
			1RB High	0	22.52	22.18	22.49
			50% Low	1	21.23	21.32	21.23
			50% Mid	1	21.43	21.38	21.27
			50% High	1	21.39	21.34	21.25
			100%	1	21.36	21.37	21.28
		16-QAM	1RB Low	1	21.44	21.23	21.31
			1RB Mid	1	21.60	21.38	21.27
			1RB High	1	21.55	21.22	21.29
			50% Low	2	20.23	20.36	20.26
			50% Mid	2	20.35	20.37	20.28
			50% High	2	20.35	20.35	20.29
			100%	2	20.34	20.34	20.26
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1852.5 MHz	**1880.0 MHz**	**1907.5 MHz**
LTE B2	5 MHz	QPSK	1RB Low	0	22.20	22.14	22.07
			1RB Mid	0	22.31	22.52	22.48
			1RB High	0	22.16	22.16	22.17
			50% Low	1	21.24	21.34	21.25
			50% Mid	1	21.28	21.36	21.28
			50% High	1	21.25	21.32	21.29
			100%	1	21.18	21.31	21.28
		16-QAM	1RB Low	1	21.36	21.36	21.22
			1RB Mid	1	21.57	21.66	21.59
			1RB High	1	21.40	21.38	21.31
			50% Low	2	20.22	20.32	20.28
			50% Mid	2	20.24	20.28	20.26
			50% High	2	20.22	20.30	20.26
			100%	2	20.21	20.31	20.27

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1851.5 MHz	**1880.0 MHz**	**1908.5 MHz**
LTE B2	3 MHz	QPSK	1RB Low	0	22.31	22.22	22.41
			1RB Mid	0	22.53	22.56	22.63
			1RB High	0	22.29	22.22	22.43
			50% Low	1	21.25	21.34	21.24
			50% Mid	1	21.23	21.35	21.30
			50% High	1	21.27	21.34	21.27
			100%	1	21.23	21.32	21.27
		16-QAM	1RB Low	1	21.39	21.26	21.19
			1RB Mid	1	21.58	21.44	21.44
			1RB High	1	21.32	21.24	21.25
			50% Low	2	20.27	20.35	20.27
			50% Mid	2	20.29	20.33	20.28
			50% High	2	20.24	20.34	20.31
			100%	2	20.24	20.32	20.28
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1850.7 MHz	**1880.0 MHz**	**1909.3 MHz**
LTE B2	1.4 MHz	QPSK	1RB Low	0	22.27	22.17	22.41
			1RB Mid	0	22.35	22.32	22.49
			1RB High	0	22.29	22.19	22.38
			50% Low	1	22.24	22.28	22.30
			50% Mid	1	22.26	22.33	22.35
			50% High	1	22.25	22.33	22.36
			100%	1	21.21	21.32	21.27
		16-QAM	1RB Low	1	21.41	21.25	21.33
			1RB Mid	1	21.53	21.43	21.53
			1RB High	1	21.38	21.28	21.43
			50% Low	2	21.31	21.33	21.21
			50% Mid	2	21.35	21.34	21.30
			50% High	2	21.35	21.34	21.28
			100%	2	20.28	20.35	20.25

- **LTE B4**

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1720.0 MHz	**1732.5 MHz**	**1745.0 MHz**
LTE B4	20 MHz	QPSK	1RB Low	0	23.02	23.07	23.18
			1RB Mid	0	23.03	23.18	23.26
			1RB High	0	23.01	23.22	23.15
			50% Low	1	21.98	22.13	22.18
			50% Mid	1	21.96	22.06	22.22
			50% High	1	22.06	22.18	22.14
			100%	1	22.07	22.12	22.19
		16-QAM	1RB Low	1	22.02	22.20	22.28
			1RB Mid	1	22.08	22.18	22.36
			1RB High	1	22.15	21.99	22.32
			50% Low	2	21.03	21.07	21.19
			50% Mid	2	20.94	21.08	21.16
			50% High	2	21.03	21.12	21.15
			100%	2	21.11	21.03	21.17
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1717.5 MHz	**1732.5 MHz**	**1747.5 MHz**
LTE B4	15 MHz	QPSK	1RB Low	0	23.02	23.03	23.12
			1RB Mid	0	23.14	23.31	23.42
			1RB High	0	23.01	23.22	23.23
			50% Low	1	22.05	22.03	22.09
			50% Mid	1	21.93	22.05	22.13
			50% High	1	21.91	22.14	22.15
			100%	1	21.93	22.04	22.12
		16-QAM	1RB Low	1	22.07	22.08	22.18
			1RB Mid	1	22.17	22.31	22.32
			1RB High	1	22.06	22.11	22.23
			50% Low	2	21.05	21.08	21.07
			50% Mid	2	20.98	22.03	21.16
			50% High	2	20.97	22.13	21.15
			100%	2	20.94	21.04	21.15

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1715.0 MHz	**1732.5MHz**	**1750.0 MHz**
LTE B4	10 MHz	QPSK	1RB Low	0	23.25	23.24	23.05
			1RB Mid	0	23.21	23.22	23.18
			1RB High	0	23.17	23.13	23.21
			50% Low	1	22.09	22.10	22.14
			50% Mid	1	21.96	22.11	22.21
			50% High	1	21.98	22.04	22.14
			100%	1	21.92	22.02	22.11
		16-QAM	1RB Low	1	22.21	22.21	22.11
			1RB Mid	1	22.24	22.33	22.25
			1RB High	1	22.11	22.12	22.23
			50% Low	2	21.05	21.07	21.16
			50% Mid	2	20.97	21.10	21.18
			50% High	2	20.98	21.03	21.17
			100%	2	20.93	21.04	21.14
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1712.5 MHz	**1732.5MHz**	**1752.5 MHz**
LTE B4	5 MHz	QPSK	1RB Low	0	22.98	22.92	23.04
			1RB Mid	0	23.13	23.24	23.33
			1RB High	0	22.78	23.06	23.18
			50% Low	1	21.99	22.02	22.05
			50% Mid	1	22.04	22.20	22.02
			50% High	1	22.05	22.19	22.18
			100%	1	22.07	22.14	22.11
		16-QAM	1RB Low	1	22.12	22.16	22.18
			1RB Mid	1	22.34	22.44	22.51
			1RB High	1	21.95	22.27	22.44
			50% Low	2	20.98	21.04	21.04
			50% Mid	2	21.04	21.19	21.04
			50% High	2	21.05	21.17	21.16
			100%	2	21.03	21.12	21.13

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1711.5 MHz	**1732.5MHz**	**1753.5 MHz**
LTE B4	3 MHz	QPSK	1RB Low	0	23.08	23.17	23.07
			1RB Mid	0	23.16	23.37	23.47
			1RB High	0	22.96	23.29	23.29
			50% Low	1	22.03	22.04	22.04
			50% Mid	1	22.03	22.19	22.01
			50% High	1	22.08	22.18	22.14
			100%	1	21.99	22.15	21.94
		16-QAM	1RB Low	1	22.07	22.17	22.03
			1RB Mid	1	22.13	22.44	22.44
			1RB High	1	21.91	22.31	22.34
			50% Low	2	21.03	21.06	20.99
			50% Mid	2	21.01	21.16	21.01
			50% High	2	21.03	21.16	21.12
			100%	2	21.00	21.13	20.98
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					1710.7 MHz	**1732.5MHz**	**1754.3 MHz**
LTE B4	1.4 MHz	QPSK	1RB Low	0	23.15	23.06	23.02
			1RB Mid	0	23.19	23.18	23.24
			1RB High	0	23.13	23.23	23.25
			50% Low	1	23.05	23.07	23.10
			50% Mid	1	23.09	23.23	23.12
			50% High	1	23.10	23.22	23.13
			100%	1	22.02	22.17	22.11
		16-QAM	1RB Low	1	22.22	22.18	22.04
			1RB Mid	1	22.31	22.34	22.36
			1RB High	1	22.15	22.27	22.35
			50% Low	2	22.09	22.11	22.12
			50% Mid	2	22.11	22.21	22.16
			50% High	2	22.10	22.22	22.15
			100%	2	20.98	21.13	21.09

- **LTE B5**

Band	BW	Modulation	Mode	MPR	Average Output Power (dBm)		
					Low CH	Mid CH	High CH
					829.0 MHz	836.5 MHz	844.0 MHz
LTE B5	10 MHz	QPSK	1RB Low	0	22.81	23.14	23.04
			1RB Mid	0	22.94	23.02	23.23
			1RB High	0	22.95	23.13	23.06
			50% Low	1	21.98	22.00	22.17
			50% Mid	1	21.95	21.99	22.29
			50% High	1	21.97	22.10	22.26
			100%	1	21.96	22.11	22.16
		16-QAM	1RB Low	1	21.85	22.17	22.09
			1RB Mid	1	22.05	22.19	22.32
			1RB High	1	22.02	22.24	22.16
			50% Low	2	21.02	20.99	21.16
			50% Mid	2	21.01	21.00	21.27
			50% High	2	20.99	21.08	21.28
			100%	2	21.01	21.09	21.18
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					826.5 MHz	**836.5 MHz**	**846.5 MHz**
LTE B5	5 MHz	QPSK	1RB Low	0	22.73	22.89	23.08
			1RB Mid	0	23.11	22.98	23.29
			1RB High	0	22.86	22.82	22.98
			50% Low	1	21.87	21.89	22.25
			50% Mid	1	22.05	21.96	22.24
			50% High	1	22.04	21.95	22.25
			100%	1	22.07	21.98	22.26
		16-QAM	1RB Low	1	21.91	22.04	22.26
			1RB Mid	1	22.32	22.28	22.54
			1RB High	1	21.99	22.12	22.15
			50% Low	2	20.90	20.94	21.26
			50% Mid	2	21.11	20.96	21.27
			50% High	2	21.10	20.98	21.24
			100%	2	21.07	20.96	21.31

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					825.5 MHz	**836.5 MHz**	**847.4 MHz**
LTE B5	3 MHz	QPSK	1RB Low	0	22.84	23.02	23.21
			1RB Mid	0	23.11	23.23	23.42
			1RB High	0	23.05	23.07	23.18
			50% Low	1	21.88	21.97	22.26
			50% Mid	1	21.98	21.96	22.28
			50% High	1	22.05	21.95	22.22
			100%	1	21.91	21.97	22.28
		16-QAM	1RB Low	1	21.92	21.97	22.36
			1RB Mid	1	22.20	22.23	22.45
			1RB High	1	22.17	22.12	22.22
			50% Low	2	20.94	20.94	21.23
			50% Mid	2	21.01	20.95	21.25
			50% High	2	21.10	20.95	21.15
			100%	2	20.97	20.96	21.25
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					824.7 MHz	**836.5 MHz**	**848.2 MHz**
LTE B5	1.4 MHz	QPSK	1RB Low	0	22.89	22.96	22.96
			1RB Mid	0	23.00	23.06	23.05
			1RB High	0	22.92	22.99	23.01
			50% Low	1	22.88	22.93	23.09
			50% Mid	1	22.94	22.98	23.13
			50% High	1	22.93	22.98	23.14
			100%	1	21.90	21.92	22.15
		16-QAM	1RB Low	1	21.96	21.98	22.12
			1RB Mid	1	22.13	22.17	22.23
			1RB High	1	22.05	22.06	22.07
			50% Low	2	21.95	21.88	22.11
			50% Mid	2	21.99	21.98	22.16
			50% High	2	22.01	21.97	22.16
			100%	2	20.91	21.02	21.09

- **LTE B7**

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					2510.0 MHz	**2535.0 MHz**	**2560.0 MHz**
LTE B7	20 MHz	QPSK	1RB Low	0	22.41	22.19	22.43
			1RB Mid	0	22.61	22.15	22.48
			1RB High	0	22.02	22.16	22.09
			50% Low	1	21.67	21.30	21.64
			50% Mid	1	21.54	21.17	21.51
			50% High	1	21.34	21.21	21.28
			100%	1	21.50	21.22	21.53
		16-QAM	1RB Low	1	21.33	21.35	21.59
			1RB Mid	1	21.72	21.30	21.71
			1RB High	1	21.19	21.33	21.22
			50% Low	2	20.61	20.24	20.62
			50% Mid	2	20.67	20.27	20.61
			50% High	2	20.43	20.31	20.37
			100%	2	20.49	20.26	20.47
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					2507.5 MHz	**2535.0 MHz**	**2562.5 MHz**
LTE B7	15 MHz	QPSK	1RB Low	0	22.41	22.10	22.64
			1RB Mid	0	22.66	22.18	22.61
			1RB High	0	22.25	22.16	22.29
			50% Low	1	21.57	21.11	21.65
			50% Mid	1	21.66	21.27	21.61
			50% High	1	21.55	21.27	21.45
			100%	1	21.58	21.14	21.55
		16-QAM	1RB Low	1	21.49	21.32	21.56
			1RB Mid	1	21.81	21.32	21.64
			1RB High	1	21.39	21.33	21.33
			50% Low	2	20.61	20.24	20.65
			50% Mid	2	20.64	20.25	20.48
			50% High	2	20.57	20.24	20.45
			100%	2	20.53	20.21	20.63

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					2505.0 MHz	**2535.0 MHz**	**2565.0 MHz**
LTE B7	10 MHz	QPSK	1RB Low	0	22.36	22.39	22.61
			1RB Mid	0	22.53	22.43	22.59
			1RB High	0	22.57	22.56	22.47
			50% Low	1	21.82	21.38	21.45
			50% Mid	1	21.66	21.34	21.44
			50% High	1	21.74	21.28	21.33
			100%	1	21.72	21.33	21.36
		16-QAM	1RB Low	1	21.45	21.43	21.37
			1RB Mid	1	21.76	21.55	21.41
			1RB High	1	21.65	21.61	21.28
			50% Low	2	20.79	20.26	20.49
			50% Mid	2	20.73	20.32	20.39
			50% High	2	20.77	20.31	20.35
			100%	2	20.69	20.27	20.48
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					2502.5 MHz	**2535.0 MHz**	**2567.5 MHz**
LTE B7	5 MHz	QPSK	1RB Low	0	22.39	22.08	22.14
			1RB Mid	0	22.71	22.27	22.42
			1RB High	0	22.42	22.06	22.05
			50% Low	1	21.59	21.24	21.30
			50% Mid	1	21.64	21.27	21.30
			50% High	1	21.73	21.27	21.29
			100%	1	21.74	21.23	21.28
		16-QAM	1RB Low	1	21.67	21.32	21.35
			1RB Mid	1	21.99	21.62	21.69
			1RB High	1	21.75	21.33	21.34
			50% Low	2	20.63	20.19	20.32
			50% Mid	2	20.61	20.22	20.29
			50% High	2	20.68	20.24	20.30
			100%	2	20.65	20.22	20.28

- **LTE B12**

Band	BW	Modulation	Mode	MPR	Average Output Power (dBm)		
					Low CH	Mid CH	High CH
					-	707.5 MHz	-
LTE B12	10 MHz	QPSK	1RB Low	0	-	23.12	-
			1RB Mid	0	-	23.02	-
			1RB High	0	-	22.96	-
			50% Low	1	-	21.94	-
			50% Mid	1	-	21.91	-
			50% High	1	-	21.90	-
			100%	1	-	21.92	-
		16-QAM	1RB Low	1	-	22.07	-
			1RB Mid	1	-	22.17	-
			1RB High	1	-	22.01	-
			50% Low	2	-	20.94	-
			50% Mid	2	-	20.93	-
			50% High	2	-	20.91	-
			100%	2	-	20.92	-
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					701.5 MHz	**707.5 MHz**	**713.5 MHz**
LTE B12	5 MHz	QPSK	1RB Low	0	22.95	22.76	22.75
			1RB Mid	0	23.07	23.02	23.09
			1RB High	0	22.88	22.64	22.72
			50% Low	1	22.00	21.91	21.97
			50% Mid	1	21.95	21.89	22.06
			50% High	1	21.94	21.95	21.89
			100%	1	22.06	21.88	22.01
		16-QAM	1RB Low	1	22.13	21.92	21.96
			1RB Mid	1	22.33	22.19	22.35
			1RB High	1	22.12	21.83	22.07
			50% Low	2	21.03	20.90	20.94
			50% Mid	2	20.98	20.90	21.11
			50% High	2	20.95	20.93	21.00
			100%	2	21.02	20.92	20.95

Note: According to KDB941225 D05 SAR for LTE Devices, for LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

					Average Output Power (dBm)		
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					700.5 MHz	**707.5 MHz**	**714.5 MHz**
LTE B12	3 MHz	QPSK	1RB Low	0	22.93	23.02	23.16
			1RB Mid	0	23.20	23.31	23.35
			1RB High	0	22.82	22.92	23.09
			50% Low	1	22.07	21.95	22.17
			50% Mid	1	22.05	21.96	22.09
			50% High	1	22.08	21.95	22.05
			100%	1	22.08	21.91	22.07
		16-QAM	1RB Low	1	22.01	22.08	22.27
			1RB Mid	1	22.22	22.23	22.28
			1RB High	1	21.86	21.92	22.15
			50% Low	2	21.05	20.93	21.14
			50% Mid	2	21.05	20.95	21.06
			50% High	2	21.06	20.89	21.05
			100%	2	21.06	20.92	21.03
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					699.7 MHz	**707.5 MHz**	**715.3 MHz**
LTE B12	1.4 MHz	QPSK	1RB Low	0	23.06	22.92	22.81
			1RB Mid	0	23.15	22.97	23.07
			1RB High	0	23.07	22.91	23.05
			50% Low	1	22.96	22.83	22.88
			50% Mid	1	23.04	22.92	22.93
			50% High	1	23.04	22.89	22.92
			100%	1	22.02	21.97	22.02
		16-QAM	1RB Low	1	22.12	21.99	21.87
			1RB Mid	1	22.28	22.12	22.19
			1RB High	1	22.14	22.02	22.03
			50% Low	2	22.02	21.87	21.90
			50% Mid	2	22.03	21.95	21.97
			50% High	2	22.04	21.93	21.92
			100%	2	21.03	21.87	20.99

- **LTE B13**

Band	BW	Modulation	Mode	MPR	Average Output Power (dBm)		
					Low CH	Mid CH	High CH
					-	782.0 MHz	-
LTE B13	10 MHz	QPSK	1RB Low	0	-	22.95	-
			1RB Mid	0	-	22.93	-
			1RB High	0	-	22.91	-
			50% Low	1	-	21.91	-
			50% Mid	1	-	21.89	-
			50% High	1	-	21.88	-
			100%	1	-	21.87	-
		16-QAM	1RB Low	1	-	21.91	-
			1RB Mid	1	-	21.88	-
			1RB High	1	-	21.81	-
			50% Low	2	-	20.84	-
			50% Mid	2	-	20.89	-
			50% High	2	-	20.87	-
			100%	2	-	20.91	-
Band	**BW**	**Modulation**	**Mode**	**MPR**	**Low CH**	**Mid CH**	**High CH**
					779.5 MHz	**782.0 MHz**	**784.5 MHz**
LTE B13	5 MHz	QPSK	1RB Low	0	-	22.92	-
			1RB Mid	0	-	22.99	-
			1RB High	0	-	22.66	-
			50% Low	1	-	21.84	-
			50% Mid	1	-	21.79	-
			50% High	1	-	21.81	-
			100%	1	-	21.82	-
		16-QAM	1RB Low	1	-	21.86	-
			1RB Mid	1	-	22.06	-
			1RB High	1	-	21.74	-
			50% Low	2	-	20.89	-
			50% Mid	2	-	20.88	-
			50% High	2	-	20.83	-
			100%	2	-	20.86	-

Note: According to KDB941225 D05 SAR for LTE Devices, for LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

- **LTE B17**

Conducted output power for LTE Band 17 has not been measured because it is covered by LTE Band 12 due to overlapping frequency range (LTE Band 17 frequency range: 704 – 716 MHz, LTE Band 12 frequency range: 699 – 716 MHz) and same maximum tune-up and channel bandwidth.

2.4. Wi-Fi

- 2.4 GHz Band:

Band	Mode	Channel / Freq (MHz)	Average Output Power (dBm)
2.4 GHz	802.11b	1/2412	15.93
		6/2437	16.35
		11/2462	17.92
	802.11g	1/2412	14.62
		6/2437	14.87
		11/2462	15.40
	802.11n20	1/2412	13.48
		6/2437	13.65
		11/2462	14.28
	802.11n40	3/2422	12.30
		6/2437	12.15
		9/2452	10.83

- 5 GHz U-NII-1 Band:

Band	Mode	Channel / Freq (MHz)	Average Output Power (dBm)
U-NII-1	802.11a	36/5180	11.67
		40/5200	11.65
		44/5200	11.66
		48/5240	11.79
	802.11n20	36/5180	11.40
		40/5200	11.42
		44/5200	11.45
		48/5240	11.57
	802.11ac20	36/5180	11.41
		40/5200	11.40
		44/5200	11.42
		48/5240	11.56
	802.11n40	38/5190	10.70
		46/5230	10.64
	802.11ac40	38/5190	10.71
		46/5230	10.65
	802.11ac80	42/5210	7.75

- 5 GHz U-NII-3 Band:

Band	Mode	Channel / Freq (MHz)	Average Output Power (dBm)
U-NII-3	802.11a	132/5660	12.47
		149/5745	12.81
		165/5825	12.75
	802.11n20	132/5660	12.23
		149/5745	12.56
		165/5825	12.52
	802.11ac20	132/5660	12.23
		149/5745	12.57
		165/5825	12.51
	802.11n40	134/5670	11.48
		142/5710	10.88
		151/5755	11.70
		159/5795	11.16
	802.11ac40	134/5670	11.47
		142/5710	10.86
		151/5755	11.71
		159/5795	11.15
	802.11ac80	138/5690	8.22
		155/5775	8.75

2.5. Bluetooth

Band	Mode	Channel / Freq (MHz)	Average Output Power (dBm)
2.4 GHz	Bluetooth LE	0 / 2402	0.73
		39 / 2440	1.71
		78 / 2480	-0.38

Based on paragraph "4.3.1 Standalone SAR test exclusion considerations" of the KDB 447498 D01 - General RF Exposure Guidance:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)]≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

Protocol	Max. Declared Output Power		Min. Test separation distance (mm)	Frequency (GHz)	Result	Test Exclusion
	(dBm)	(mW)				
Bluetooth LE	4.0	2.512	24.0	2.402 - 2.480	0.16	√

The computed value for Bluetooth is < 3.0, so Bluetooth mode qualifies for Standalone SAR test exclusion for 1-g SAR and 10-g SAR.

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR and x= 18,75 for 10-g extremity SAR

Estimated SAR					
Protocol	Max. Output Power		Min. Test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR
	(dBm)	(mW)			
Bluetooth LE	4.0	2.512	24.0	2.48	0.022

According to ISED RSS-102 Issue 5 (2015-03), paragraph 2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation, if the device operates below the applicable output power level (adjusted for tune-up tolerance), for the specified separation distance defined in Table 1, SAR evaluation is not required . Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

The DUT has an antenna with a gain of 1.7 dBi, so the isotropically radiated power (e.i.r.p.) source-based, time-averaged output power is 5.7 dBm → 3.72 mW, and a separation distance of 24 mm:

Technology	Band	Frequency (MHz)	Separation Distance (cm)	Maximum E.I.R.P. (mW)	SAR Low-power exclusion level (mW)	SAR Test Exclusion
Bluetooth LE	ISM	2402	2.4	3.72	51.26	Pass
		2440	2.4	3.72	51.06	Pass
		2480	2.4	3.72	46.95	Pass

Therefore, SAR testing is not needed for Bluetooth LE according to ISED RSS-102 Issue 5 (2015-03).

3. TISSUE PARAMETERS MEASUREMENTS

Frequency (MHz)	Target Head Tissue		Measured Head Tissue		Deviation %		Measured Date
	Permittivity ε	Conductivity σ [S/m]	Permittivity ε	Conductivity σ [S/m]	Permittivity ε	Conductivity σ [S/m]	
750	41.94	0.89	40.83	0.89	-2.64	-0.22	2019-11-12
750	41.94	0.89	41.42	0.88	-1.25	-0.33	2020-01-31
835	41.50	0.90	42.59	0.92	2.62	1.87	2020-01-20
900	41.50	0.97	41.51	0.97	0.03	0.20	2020-01-20
835	41.50	0.90	42.79	0.93	3.11	3.33	2020-01-27
900	41.50	0.97	41.71	0.98	0.51	1.12	2020-01-27
1750	40.07	1.37	41.61	1.40	3.84	1.90	2020-01-29
1800	40.00	1.40	41.48	1.45	3.69	3.54	2020-01-29
1800	40.00	1.40	41.93	1.36	4.82	-2.68	2020-01-29
1900	40.07	1.37	41.53	1.46	3.82	4.15	2020-01-29
2450	39.20	1.80	40.69	1.85	3.80	2.81	2020-03-17
2600	39.00	1.96	38.38	2.03	-1.60	3.57	2019-11-14
5200	36.00	4.66	36.69	4.78	1.90	2.51	2020-03-18
5500	35.65	4.97	36.27	5.09	1.74	2.46	2020-03-18
5800	35.30	5.27	35.81	5.40	1.43	2.47	2020-03-19

Note: The dielectric properties have been measured by the contact probe method at 22° C.

- Composition / Information on ingredients

Head and Muscle Tissue Simulation Liquids HSL750V2/MSL750V2

H_2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40 – 60%
NaCl	Sodium Chloride, 0 – 6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7%

Head and Muscle Tissue Simulation Liquids HSL900/MSL900

H_2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40 – 60%
NaCl	Sodium Chloride, 0 – 6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7%

Head and Muscle Tissue Simulation Liquids HBBL1350-1850V3/M HBBL1350-1850V3

H_2O	50 – 73 %
Non-ionic detergents	27 – 50 % polyoxyethylenesorbitan monolaurate
NaCl	0 – 2 %
Preservative	0.05 – 0.1% Preventol-D7
Safety relevant ingredients:	
CAS-No. 55965-84-9	< 0.1 % aqueous preparation, containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone
CAS-No. 9005-64-5	<50 % polyoxyethylenesorbitan monolaurate

Head and Muscle Tissue Simulation Liquids HSL1800/MSL1800

H_2O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25 – 48%
	(CAS-No. 112-34-5, EC-No. 203-961-6, EC-index-No. 603-096-00-8)
NaCl	Sodium Chloride, <1.0%

Head and Muscle Tissue Simulation Liquids HBBL1900-3800V3/M HBBL1900-3800V3

H_2O	50 – 73 %
Non-ionic detergents	27 – 50 % polyoxyethylenesorbitan monolaurate
NaCl	0 – 2 %
Preservative	0.05 – 0.1% Preventol-D7
Safety relevant ingredients:	
CAS-No. 55965-84-9	< 0.1 % aqueous preparation, containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone
CAS-No. 9005-64-5	<50 % polyoxyethylenesorbitan monolaurate

Head and Muscle Tissue Simulation Liquids HBBL5GHzV2

H_2O	76 – 80 %
Mineral Oil	10 – 12 %
Emulsifiers	8 – 10 %
Additives and Salt	1 – 3%

4. SYSTEM CHECK MEASUREMENTS

4.1. Validation results for Head TSL

Date	Frequency (MHz)	SAR over	Fast SAR (W/kg)	SAR (W/kg)	1 W Target SAR (W/kg)	1 W Norm. SAR (W/kg)	Drift (%)
2019-11-12	750	1 gr.	2.03	2.03	8.64	8.20	-5.04
		10 gr.	1.33	1.33	5.65	5.38	-4.86
2020-01-30	750	1 gr.	2.10	2.10	8.64	8.40	-2.78
		10 gr.	1.44	1.37	5.65	5.48	-3.01
2020-01-21	900	1 gr.	2.74	2.76	11.30	11.04	-2.30
		10 gr.	1.84	1.78	7.23	7.12	-1.52
2020-01-27	900	1 gr.	2.75	2.71	11.30	10.86	-3.85
		10 gr.	1.84	1.74	7.23	6.98	-3.51
2020-01-29	1800	1 gr.	9.74	9.44	38.80	37.93	-2.23
		10 gr.	5.16	4.85	20.20	19.49	-3.52
2020-01-29	1800	1 gr.	9.41	9.22	38.80	37.22	-4.07
		10 gr.	4.94	4.69	20.20	18.93	-6.27
2020-03-17	2450	1 gr.	13.00	12.80	53.40	51.20	-4.12
		10 gr.	6.00	5.87	25.00	23.48	-6.08
2019-11-14	2600	1 gr.	15.20	14.50	57.60	58.31	1.24
		10 gr.	6.79	6.30	25.70	25.34	-1.42
2020-03-18	5200	1 gr.	7.08	7.50	78.40	75.17	-4.12
		10 gr.	1.98	2.16	22.40	21.65	-3.35
2020-03-19	5800	1 gr.	7.10	7.69	81.60	77.08	-5.54
		10 gr.	1.97	2.18	23.10	21.85	-5.41

5. MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)

5.1. Summary maximum results for 1-g Head SAR measurements.

Mode	Side / Position	Channel (Frequency)	Reported SAR 1-g (W/kg)	Limit SAR 1-g (W/kg)
GPRS 4 slots 850 MHz	Back face/24 mm	CH 251 (848.8 MHz)	0.722	1.6
GPRS 4 slots 1900 MHz	Back face/24 mm	CH 661 (1880 MHz)	0.121	1.6
WCDMA Band II	Back face/24 mm	CH 9262 (1852.4 MHz)	0.154	1.6
WCDMA Band IV	Back face/24 mm	CH 1412 (1732.6 MHz)	0.164	1.6
WCDMA Band V	Back face/24 mm	CH 4183 (836.6 MHz)	0.391	1.6
LTE Band 2	Back face/24 mm	CH 18900 (1880 MHz)	0.145	1.6
LTE Band 4	Back face/24 mm	CH 20175 (1732.5 MHz)	0.151	1.6
LTE Band 5	Back face/24 mm	CH 4183 (836.6 MHz)	0.370	1.6
LTE Band 7	Back face/24 mm	CH 20850 (2510 MHz)	0.314	1.6
LTE Band 12	Back face/24 mm	CH 23095 (707.5 MHz)	0.112	1.6
LTE Band 13	Back face/24 mm	CH 23230 (782.0 MHz)	0.125	1.6
Wi-Fi 2.4 GHz	Back face/24 mm	CH 1 (2412.0 MHz)	0.116	1.6
Wi-Fi 5.2 GHz	Back face/24 mm	CH 40 (5200.0 MHz)	0.130	1.6
Wi-Fi 5.8 GHz	Back face/24 mm	CH 157 (5785.0 MHz)	0.027	1.6
Bluetooth	Estimated SAR	CH 78 (2480.0 MHz)	0.022	1.6

5.2. Result for simultaneous multi-band transmission

Transmission Modes	Position	Σ SARi (W/kg)	Total SAR 1-g (W/kg)	Limit SAR 1-g (W/kg)	Verdict
GPRS 850+Wi-Fi +BT	Back Face	0.722+0.130+0.022	0.88	1.6	Pass

5.3. Results for GPRS 850 MHz band – 4 slots.

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 190 (836.6 MHz)	0.606	0.615	0.462	1.000	0.615	
Back face	24	CH 128 (824.2 MHz)	0.655	0.669	0.346	1.000	0.669	
Back face	24	CH 251 (848.8 MHz)	0.715	0.722	0.346	1.000	0.722	1

5.4. Results for GPRS 1900 MHz Band – 4 slots.

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 661 (1880 MHz)	0.107	0.101	3.276	1.199	0.121	2
Back face	24	CH 512 (1850.2 MHz)	0.097	0.097	3.039	1.146	0.111	
Back face	24	CH 810 (1909.8 MHz)	0.090	0.086	2.565	1.199	0.103	

5.5. Results for WCDMA Band II

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 9400 (1880 MHz)	0.092	0.093	3.633	1.574	0.146	
Back face	24	CH 9262 (1852.4 MHz)	0.082	0.077	-0.574	2.000	0.154	3
Back face	24	CH 9538 (1907.6 MHz)	0.092	0.087	0.809	1.603	0.139	

5.6. Results for WCDMA Band IV

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 1412 (1732.6 MHz)	0.117	0.115	1.742	1.422	0.164	4
Back face	24	CH 1312 (1712.4 MHz)	0.123	0.120	2.565	1.330	0.154	
Back face	24	CH 1512 (1752.6 MHz)	0.116	0.115	-0.115	1.361	0.157	

5.7. Results for WCDMA Band V

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 4183 (836.6 MHz)	0.252	0.254	-1.031	1.538	0.391	5
Back face	24	CH 4132 (826.4 MHz)	0.236	0.239	-0.459	1.603	0.383	
Back face	24	CH 4233 (846.6 MHz)	0.243	0.249	1.625	1.510	0.376	

5.8. Results for LTE Band 2 (1 RB, 20 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 18900 (1880 MHz)	0.077	0.074	2.212	1.950	0.145	6
Back face	24	CH 18700 (1860 MHz)	0.069	0.070	0.809	1.897	0.133	
Back face	24	CH 19100 (1900 MHz)	0.081	0.079	3.514	1.795	0.142	

5.9. Results for LTE Band 2 (50% RB, 20 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 19100 (1900 MHz)	0.066	0.066	1.976	1.871	0.123	

Testing of additional LTE configurations is not required due to the SAR test procedures mentioned in FCC OET KDB 941225 D05 – SAR for LTE Devices v02r05.

5.10. Results for LTE Band 4 (1 RB, 20 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 20175 (1732.5 MHz)	0.101	0.100	2.565	1.507	0.151	7
Back face	24	CH 20050 (1720 MHz)	0.098	0.095	-0.230	1.574	0.149	
Back face	24	CH 20300 (1745 MHz)	0.097	0.099	1.859	1.493	0.147	

5.11. Results for LTE Band 4 (50% RB, 20 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 20300 (1745 MHz)	0.076	0.075	2.683	1.374	0.103	

Testing of additional LTE configurations is not required due to the SAR test procedures mentioned in FCC OET KDB 941225 D05 – SAR for LTE Devices v02r05.

5.12. Results for LTE Band 5 (1 RB, 10 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 20525 (836.5 MHz)	0.232	0.241	0.577	1.535	0.370	8
Back face	24	CH 20450 (829 MHz)	0.220	0.226	0.346	1.603	0.362	
Back face	24	CH 20600 (844 MHz)	0.214	0.219	0.231	1.503	0.329	

5.13. Results for LTE Band 5 (50% RB, 10 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 20600 (844 MHz)	0.181	0.186	0.577	1.483	0.276	

Testing of additional LTE configurations is not required due to the SAR test procedures mentioned in FCC OET KDB 941225 D05 – SAR for LTE Devices v02r05.

5.14. Results for LTE Band 7 (1 RB, 20 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 21100 (2535 MHz)	0.142	0.137	1.859	1.910	0.262	
Back face	24	CH 20850 (2510 MHz)	0.189	0.181	1.742	1.734	0.314	9
Back face	24	CH 21350 (2560 MHz)	0.175	0.165	-0.230	1.786	0.295	

5.15. Results for LTE Band 7 (50% RB, 20 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 20850 (2510 MHz)	0.136	0.131	3.276	1.710	0.224	

Testing of additional LTE configurations is not required due to the SAR test procedures mentioned in FCC OET KDB 941225 D05 – SAR for LTE Devices v02r05.

5.16. Results for LTE Band 12 (1 RB, 10 MHz, QPSK)

Note: According to KDB941225 D05 SAR for LTE Devices, for LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, the middle channel of the group of overlapping channels should be selected for testing.

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 23095 (707.5 MHz)	0.072	0.073	0.577	1.542	0.112	10

5.17. Results for LTE Band 12 (50% RB, 10 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 23095 (707.5 MHz)	0.063	0.064	-0.230	1.607	0.103	

Testing of additional LTE configurations is not required due to the SAR test procedures mentioned in FCC OET KDB 941225 D05 – SAR for LTE Devices v02r05.

5.18. Results for LTE Band 13 (1 RB, 10 MHz, QPSK)

Note: According to KDB941225 D05 SAR for LTE Devices, for LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, the middle channel of the group of overlapping channels should be selected for testing.

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 23230 (782.0 MHz)	0.077	0.078	0.577	1.603	0.125	11

5.19. Results for LTE Band 13 (50% RB, 10 MHz, QPSK)

Position	Dist (mm)	Channel (Frequency)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	CH 23230 (782.0 MHz)	0.068	0.068	-0.230	1.618	0.111	

Testing of additional LTE configurations is not required due to the SAR test procedures mentioned in FCC OET KDB 941225 D05 – SAR for LTE Devices v02r05.

5.20. Results for LTE Band 17 (1 RB, 10 MHz, QPSK)

SAR for LTE Band 17 has not been measured because it is covered by LTE Band 12 due to overlapping frequency range (LTE Band 17 frequency range: 704 – 716 MHz, LTE Band 12 frequency range: 699 – 716 MHz) and same maximum tune-up and channel bandwidth.

5.21. Results for Wi-Fi 2450 MHz Band

Position	Dist (mm)	Mode	CH	Freq (MHz)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	802.11b	6	2437	0.048	0.047	1.042	1.641	0.077	
Back face	24	802.11b	1	2412	0.064	0.064	-0.345	1.807	0.116	12
Back face	24	802.11b	11	2462	0.064	0.065	1.042	1.143	0.074	

Testing subsequent test configurations are not required due to the testing reduction mentioned in FCC OET KDB 248227 D01 802.11 Wi-Fi SAR v02r02, paragraph “5.1.1 Initial Test Position SAR Test Reduction Procedure”.

- 2.4 GHz 802.11g/n OFDM modes

The highest reported SAR for the 802.11b mode has been 0.116 W/kg, therefore taking into account this 802.11b SAR value:

802.11b Max declared Power = 18.5 dBm → 70.79 mW
802.11g Max declared Power = 17.5 dBm → 56.23 mW
802.11n20 Max declared Power = 16.5 dBm → 44.67 mW
802.11n40 Max declared Power = 14.5 dBm → 28.18 mW

Adjusted SAR for 802.11g: 0.116 W/Kg x (56.23/70.79) = 0.092 W/kg
Adjusted SAR for 802.11n20: 0.116 W/Kg x (44.67/70.79) = 0.073 W/kg
Adjusted SAR for 802.11n40: 0.116 W/Kg x (28.18/70.79) = 0.046 W/kg

As the Adjusted SAR value for all 2.4 GHz 802.11g/n OFDM modes is ≤ 1.2 W/Kg, SAR measurements are not required for these 802.11 g/n OFDM modes.

5.22. Results for Wi-Fi 5200 MHz Band

Position	Dist (mm)	Mode	CH	Freq (MHz)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	802.11a	40	5200	0.079	0.067	1.158	1.928	0.130	13
Back face	24	802.11a	36	5180	0.070	0.059	2.564	1.919	0.114	
Back face	24	802.11a	48	5240	0.077	0.061	1.042	1.866	0.113	

Testing subsequent test configurations are not required due to the testing reduction mentioned in FCC OET KDB 248227 D01 802.11 Wi-Fi SAR v02r02, paragraph “5.1.1 Initial Test Position SAR Test Reduction Procedure”.

5.23. Results for Wi-Fi 5800 MHz Band

Position	Dist (mm)	Mode	CH	Freq (MHz)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Scale factor	Reported SAR 1-g (W/kg)	Plot No.
Back face	24	802.11a	157	5785	0.012	0.007	4.232	1.476	0.010	
Back face	24	802.11a	149	5745	0.037	0.017	2.683	1.596	0.027	14
Back face	24	802.11a	165	5825	0.014	0.009	-1.712	1.496	0.013	

Testing subsequent test configurations are not required due to the testing reduction mentioned in FCC OET KDB 248227 D01 802.11 Wi-Fi SAR v02r02, paragraph “5.1.1 Initial Test Position SAR Test Reduction Procedure”.

5.24. Variability results

According to KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, paragraph “2.8.1. SAR measurement variability”, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements.

Repeated measurements are required only when the measured 1-g SAR is ≥ 0.80 W/kg, or 10-g SAR is ≥ 2.0 W/kg, using the highest measured SAR configuration for that tissue-equivalent medium, therefore no Variability measurements are needed for this device.

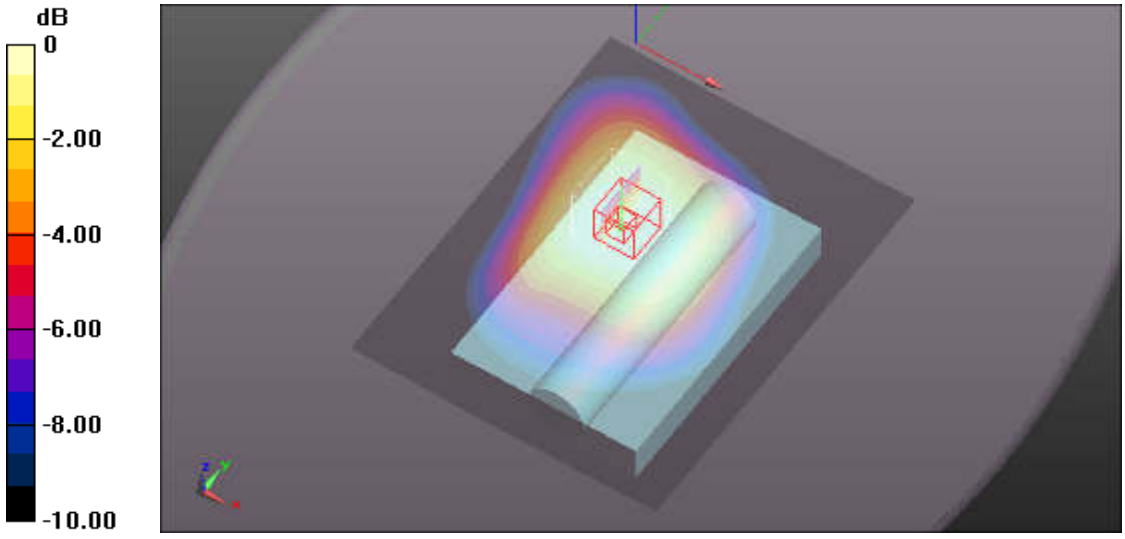
Appendix C: Measurement Reports

Plot Nº 1

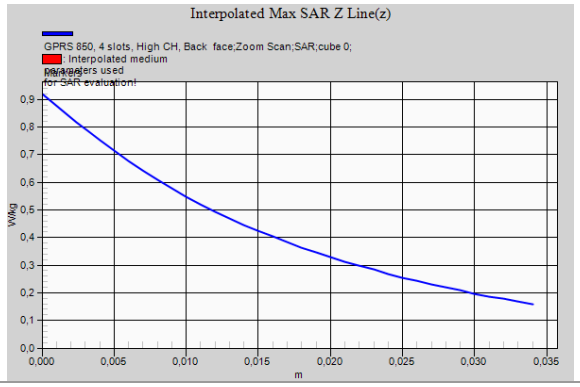
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-22

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10028 - DAC, GPRS-FDD (TDMA, GMSK, TN 0-1-2-3); Frequency: 848.6 MHz; Duty Cycle: 1:2.26464
Medium parameters used (interpolated): f = 848.6 MHz; σ = 0.93 S/m; ε_r = 42.662; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(9.56, 9.56, 9.56); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/GPRS 850, 4 slots, High CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.810 W/kg
Flat Phantom, Faces, d=24mm/GPRS 850, 4 slots, High CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.85 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.920 W/kg
SAR(1 g) = 0.722 W/kg; SAR(10 g) = 0.553 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.756 W/kg



0 dB = 0.756 W/kg = -1.21 dBW/kg

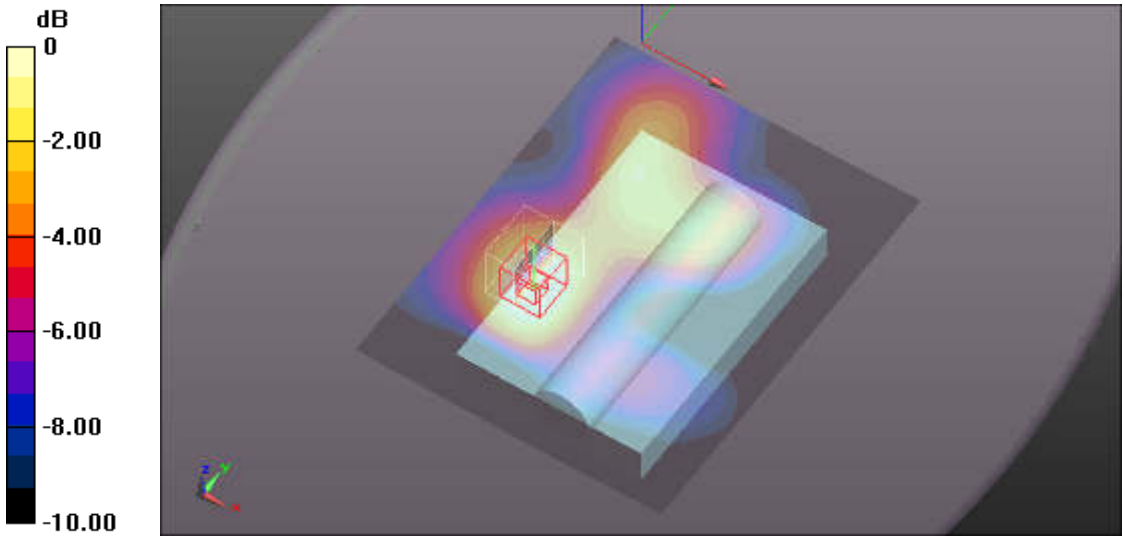


Plot Nº 2

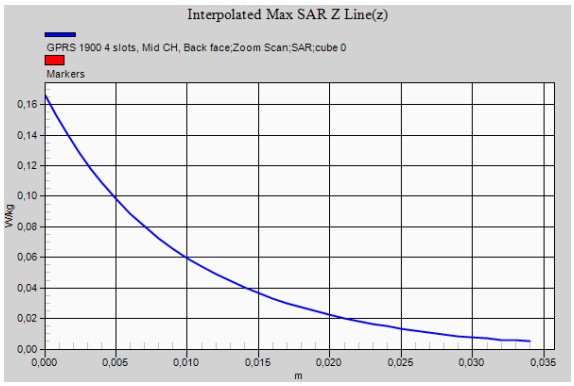
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-30

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10028 - DAC, GPRS-FDD (TDMA, GMSK, TN 0-1-2-3); Frequency: 1880 MHz; Duty Cycle: 1:2.26464
Medium parameters used: f = 1880 MHz; σ = 1.44 S/m; ε_r = 41.58; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24mm/GPRS 1900 4 slots, Mid CH, Back face/Area Scan (111x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.128 W/kg
Flat Phantom, d=24mm/GPRS 1900 4 slots, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.241 V/m; Power Drift = 0.28 dB
Peak SAR (extrapolated) = 0.166 W/kg
SAR(1 g) = 0.101 W/kg; SAR(10 g) = 0.060 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.109 W/kg



0 dB = 0.109 W/kg = -9.63 dBW/kg

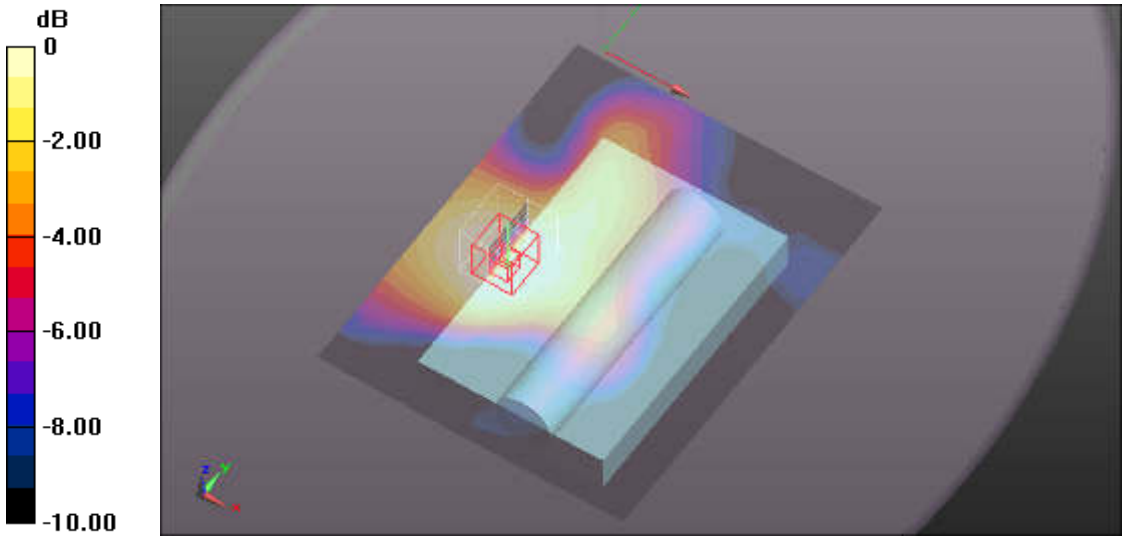


Plot Nº 3

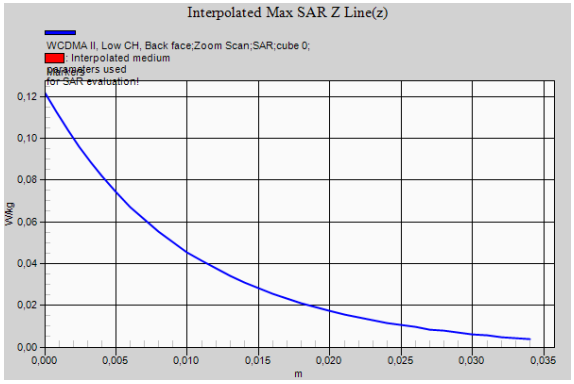
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-30

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Frequency: 1852.4 MHz; Duty Cycle: 1:1.95434
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.412 S/m; ε_r = 41.678; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24mm/WCDMA II, Low CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0964 W/kg
Flat Phantom, d=24mm/WCDMA II, Low CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.093 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.122 W/kg
SAR(1 g) = 0.077 W/kg; SAR(10 g) = 0.049 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0818 W/kg



0 dB = 0.0818 W/kg = -10.87 dBW/kg

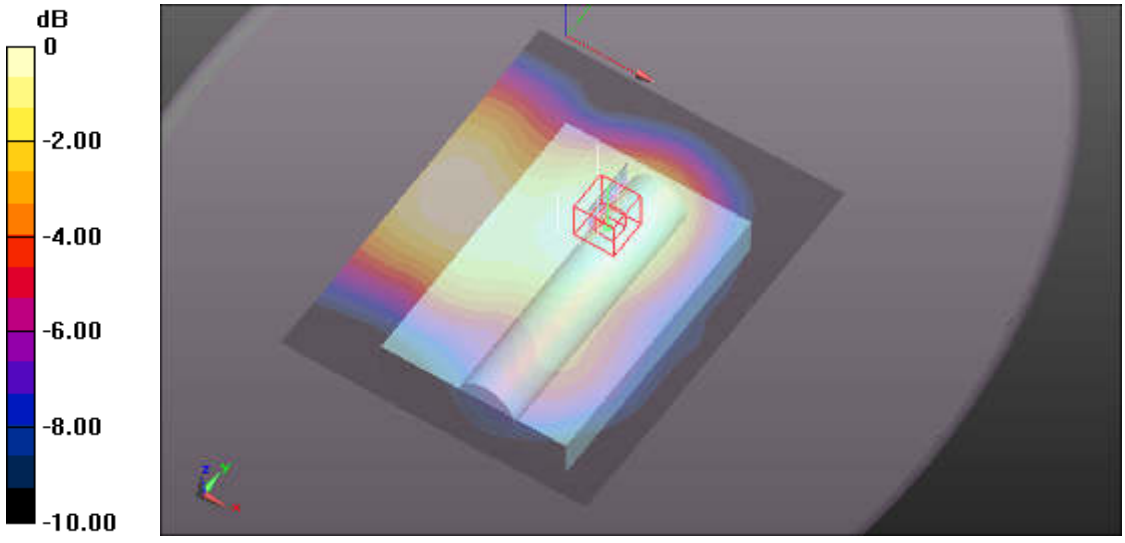


Plot Nº 4

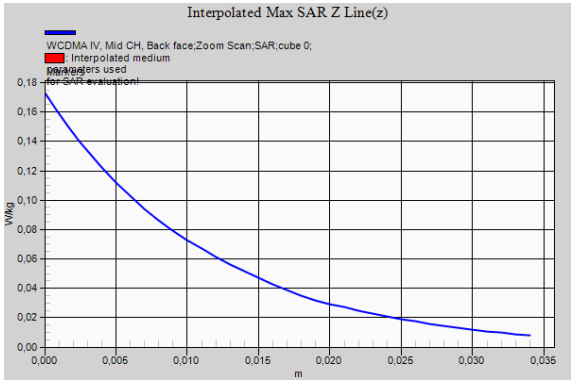
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-29

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Frequency: 1732.6 MHz; Duty Cycle: 1:1.95434
Medium parameters used (interpolated): f = 1732.6 MHz; σ = 1.383 S/m; ε_r = 41.714; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/WCDMA IV, Mid CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.137 W/kg
Flat Phantom, Faces, d=24mm/WCDMA IV, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.105 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.173 W/kg
SAR(1 g) = 0.115 W/kg; SAR(10 g) = 0.075 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.122 W/kg



0 dB = 0.122 W/kg = -9.14 dBW/kg

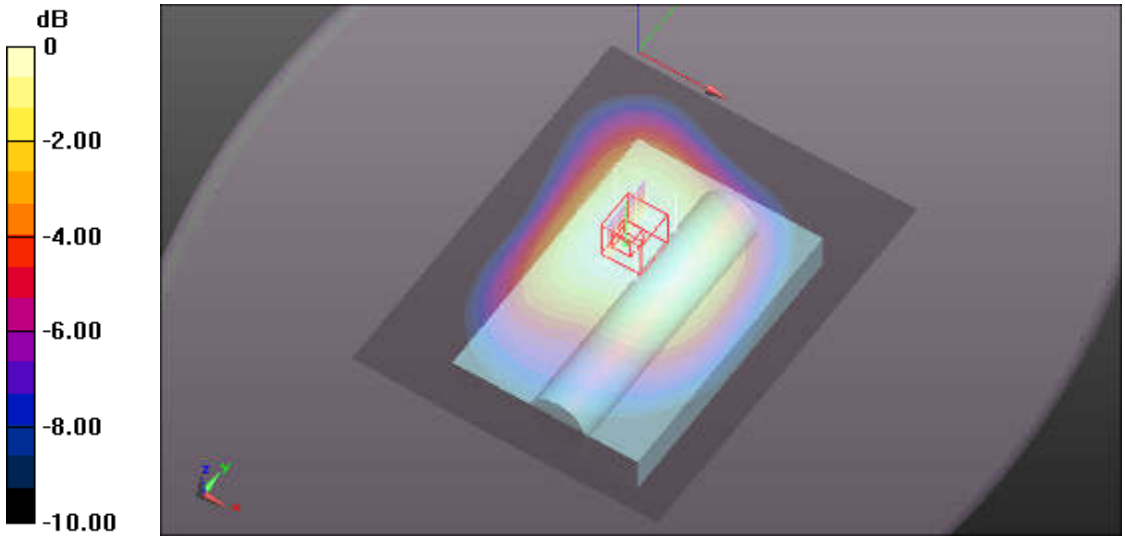


Plot Nº 5

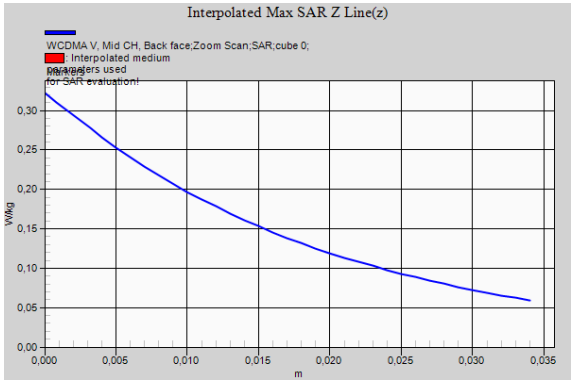
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-28

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1.95434
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.93 S/m; ε_r = 42.777; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(9.56, 9.56, 9.56); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/WCDMA V, Mid CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.286 W/kg
Flat Phantom, Faces, d=24mm/WCDMA V, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.95 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.322 W/kg
SAR(1 g) = 0.254 W/kg; SAR(10 g) = 0.194 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.267 W/kg



0 dB = 0.267 W/kg = -5.73 dBW/kg

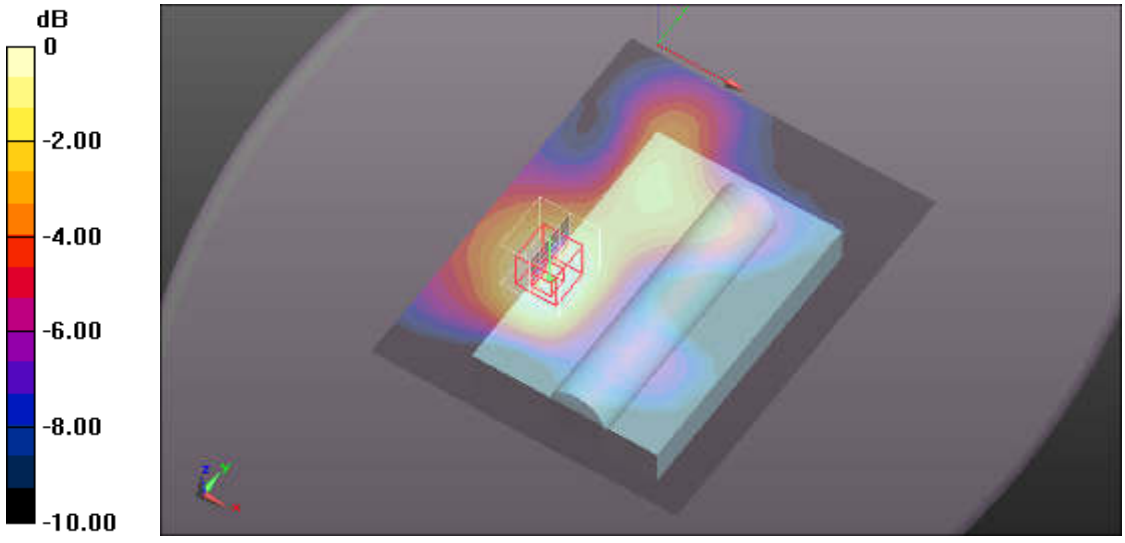


Plot Nº 6

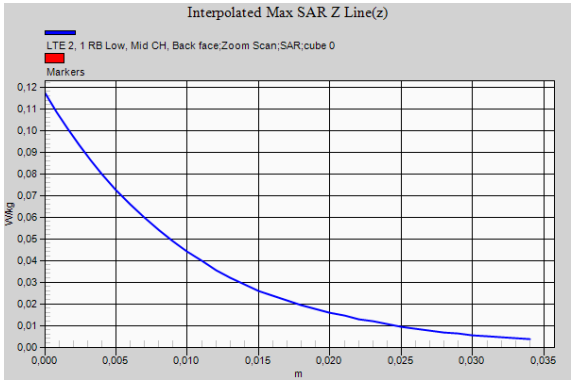
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-30

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10169 - CAD, LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1880 MHz; Duty Cycle: 1:3.74111
Medium parameters used: f = 1880 MHz; σ = 1.44 S/m; ε_r = 41.58; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24mm/LTE, 1 RB Low, Mid CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0919 W/kg
Flat Phantom, d=24mm/LTE, 1 RB Low, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.107 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.117 W/kg
SAR(1 g) = 0.074 W/kg; SAR(10 g) = 0.045 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.0802 W/kg



0 dB = 0.0802 W/kg = -10.96 dBW/kg

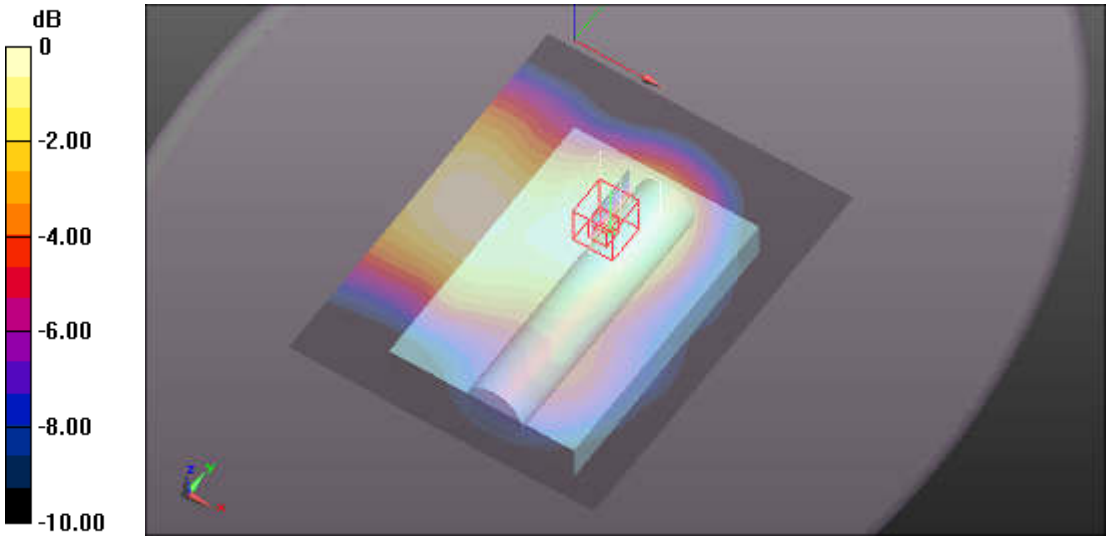


Plot Nº 7

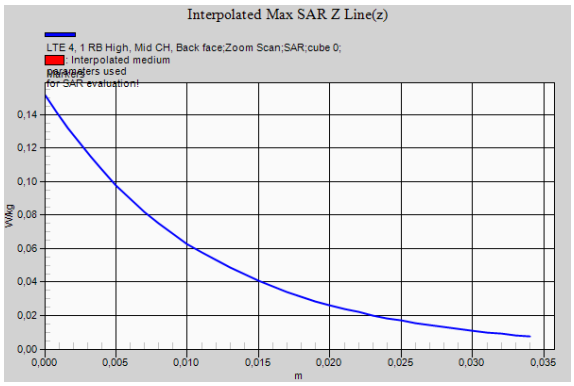
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-29

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10169 - CAD, LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1732.5 MHz; Duty Cycle: 1:3.74111
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.382 S/m; ε_r = 41.715; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/LTE 4, 1 RB High, Mid CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.119 W/kg
Flat Phantom, Faces, d=24mm/LTE 4, 1 RB High, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.627 V/m; Power Drift = 0.22 dB
Peak SAR (extrapolated) = 0.152 W/kg
SAR(1 g) = 0.100 W/kg; SAR(10 g) = 0.066 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.107 W/kg



0 dB = 0.107 W/kg = -9.71 dBW/kg

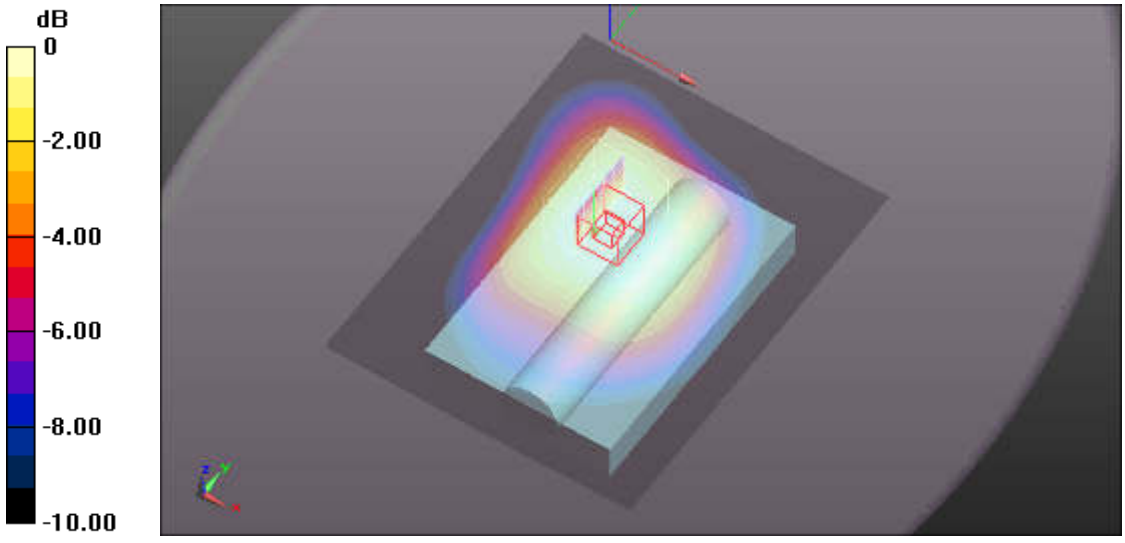


Plot Nº 8

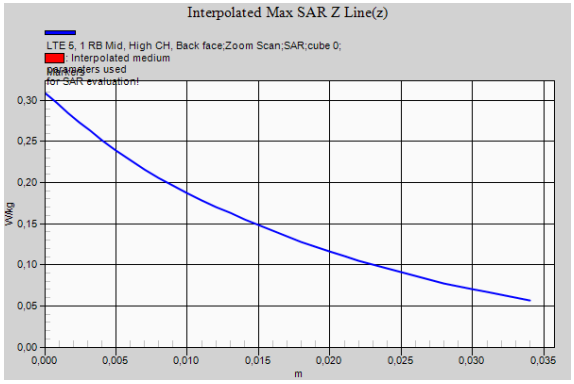
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-28

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 843.9 MHz; Duty Cycle: 1:3.7325
Medium parameters used (interpolated): f = 843.9 MHz; σ = 0.93 S/m; ε_r = 42.703; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(9.56, 9.56, 9.56); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/LTE 5, 1 RB Mid, High CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.264 W/kg
Flat Phantom, Faces, d=24mm/LTE 5, 1 RB Mid, High CH, Back face/Zoom Scan (6x6x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.38 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.309 W/kg
SAR(1 g) = 0.241 W/kg; SAR(10 g) = 0.185 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.251 W/kg



0 dB = 0.251 W/kg = -6.00 dBW/kg



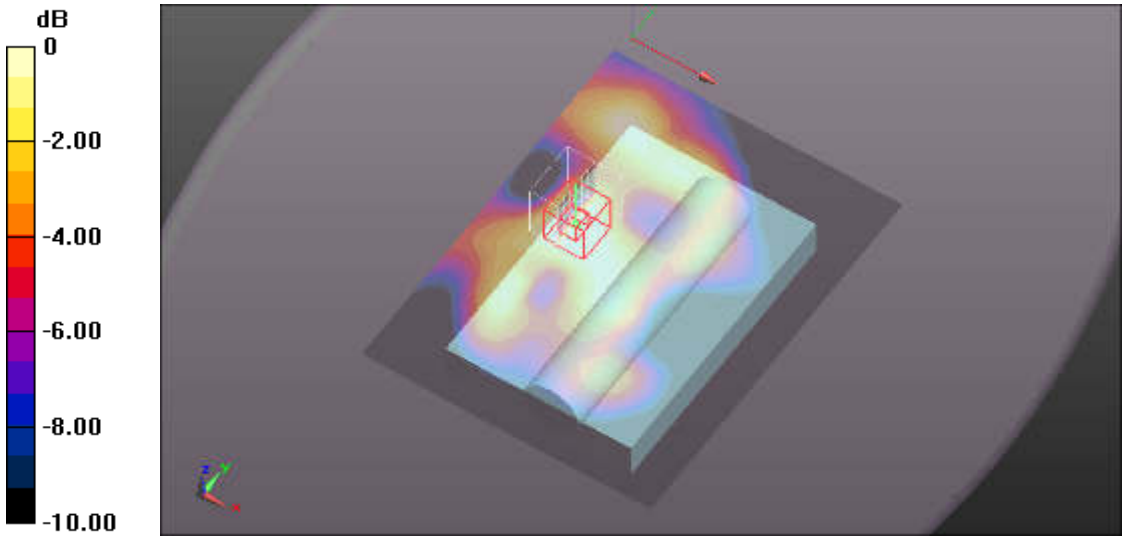
Plot Nº 9

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2019-11-15

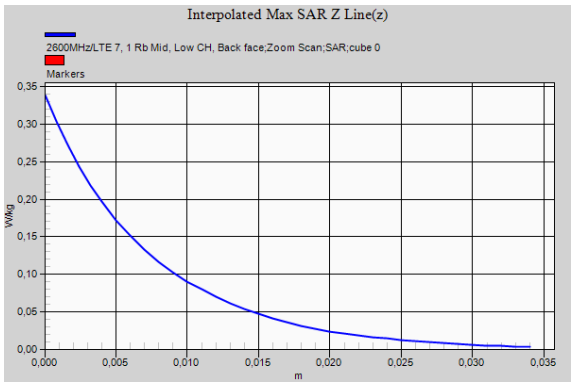
DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10169 - CAE, LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 2510 MHz; Duty Cycle: 1:3.74111
Medium parameters used: f = 2510 MHz; σ = 1.92 S/m; ε_r = 38.72; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(7.45, 7.45, 7.45); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24 mm/2600MHz/LTE 7, 1 Rb Mid, Low CH, Back face/Area Scan (131x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.240 W/kg

Flat Phantom, d=24 mm/2600MHz/LTE 7, 1 Rb Mid, Low CH, Back face/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.961 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.339 W/kg
SAR(1 g) = 0.181 W/kg; SAR(10 g) = 0.100 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.198 W/kg



0 dB = 0.198 W/kg = -7.03 dBW/kg

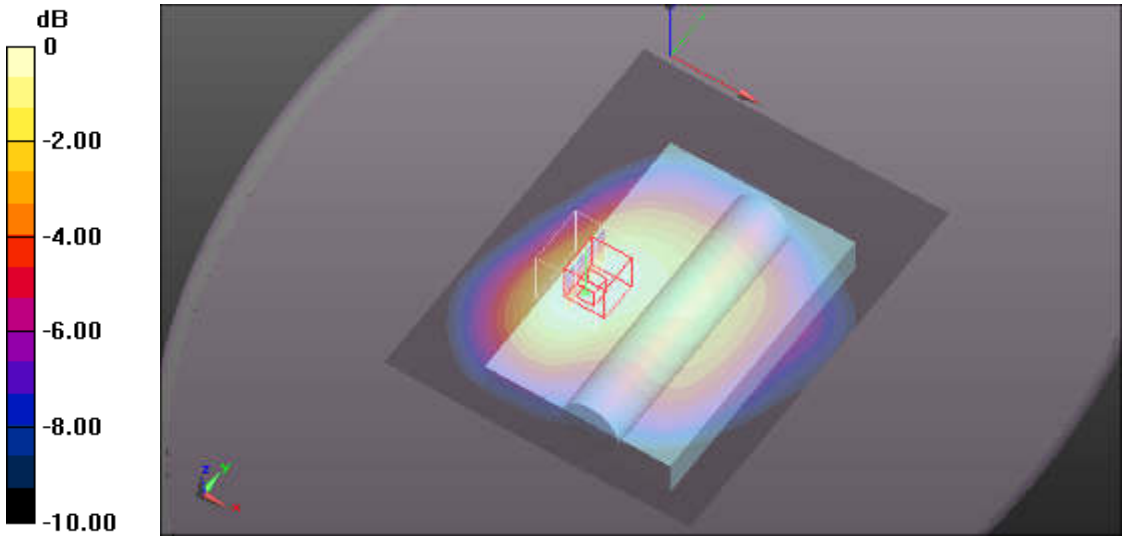


Plot Nº 10

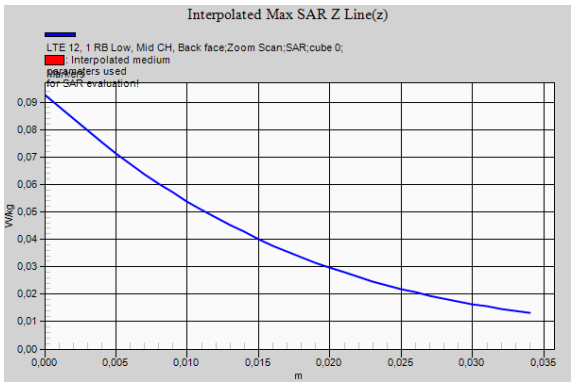
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-31

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10175 - CAE, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 707.5 MHz;
Duty Cycle: 1:3.7325
Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.86 S/m; ε_r = 42.115; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(10.03, 10.03, 10.03); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/LTE 12, 1 RB Low, Mid CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0802 W/kg
Flat Phantom, Faces, d=24mm/LTE 12, 1 RB Low, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.737 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.0930 W/kg
SAR(1 g) = 0.073 W/kg; SAR(10 g) = 0.052 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0752 W/kg



0 dB = 0.0752 W/kg = -11.24 dBW/kg

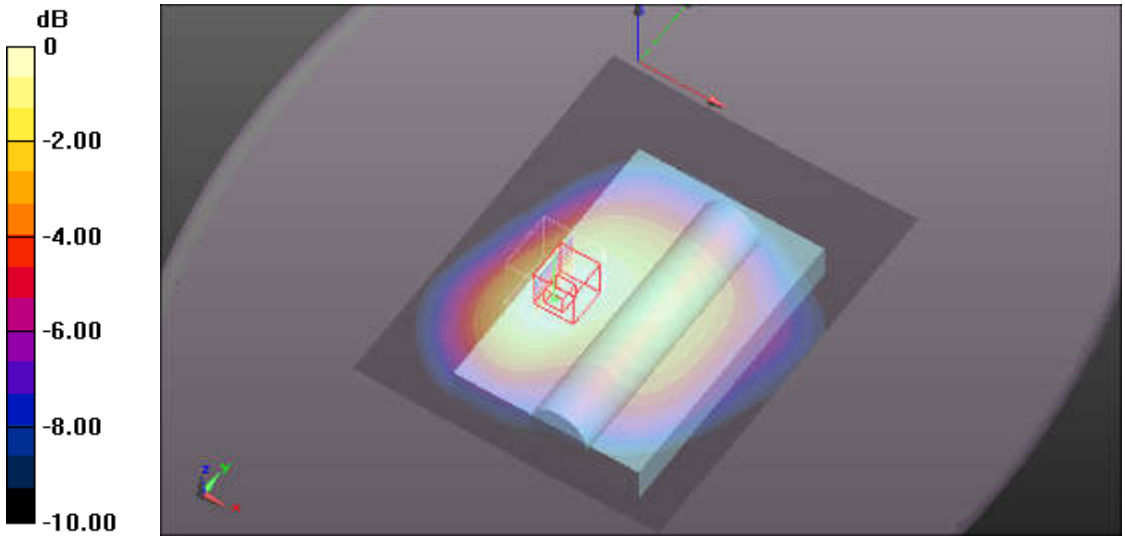


Plot Nº 11

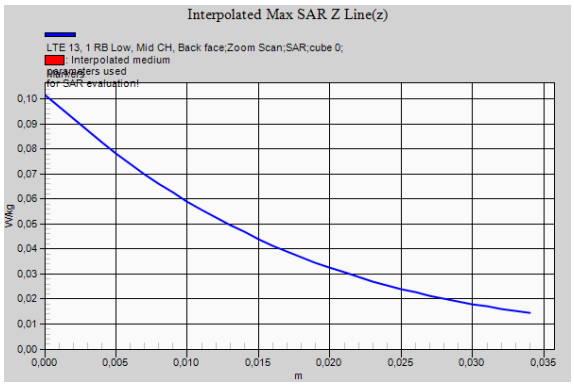
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-31

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004291
Communication System: UID 10175 - CAG, LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz;
Duty Cycle: 1:3.7325
Medium parameters used (interpolated): f = 782 MHz; σ = 0.92 S/m; ε_r = 41.12; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(10.03, 10.03, 10.03); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, Faces, d=24mm/LTE 13, 1 RB Low, Mid CH, Back face/Area Scan (111x141x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0879 W/kg
Flat Phantom, Faces, d=24mm/LTE 13, 1 RB Low, Mid CH, Back face/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.833 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.102 W/kg
SAR(1 g) = 0.078 W/kg; SAR(10 g) = 0.056 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0825 W/kg



0 dB = 0.0825 W/kg = -10.84 dBW/kg

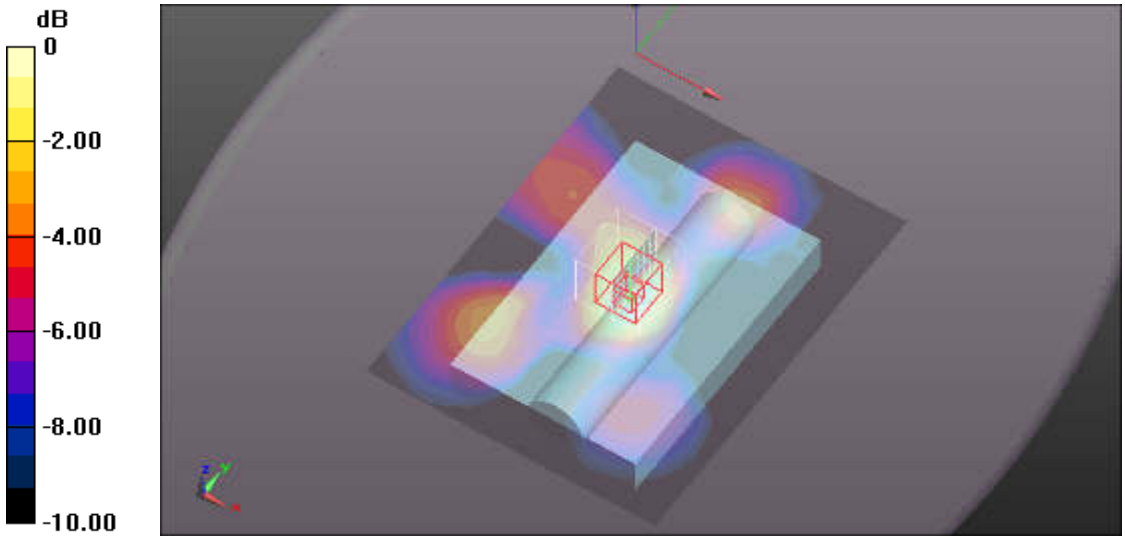


Plot Nº 12

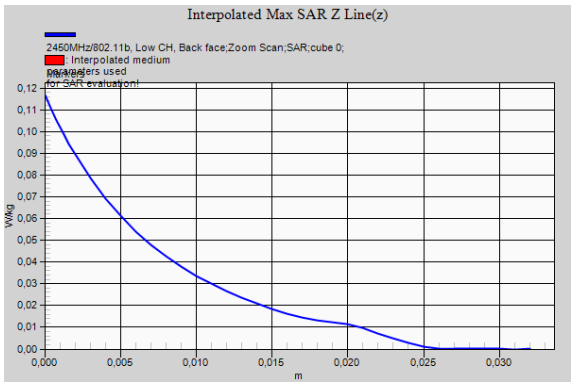
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-03-17

DUT: TCAM E4.2 NA; Type: Shark fin Antenna; Serial: SNRD004296
Communication System: UID 10415 - AAA, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle);
Frequency: 2412 MHz; Duty Cycle: 1:1.42561
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.83 S/m; ε_r = 40.822; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(7.54, 7.54, 7.54); Calibrated: 2019-08-20;
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24 mm/2450MHz/802.11b, Low CH, Back face/Area Scan (131x171x1):
Interpolated grid: dx=1.200 mm, dy=1.200 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0884 W/kg
Flat Phantom, d=24 mm/2450MHz/802.11b, Low CH, Back face/Zoom Scan (8x8x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.036 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.117 W/kg
SAR(1 g) = 0.064 W/kg; SAR(10 g) = 0.035 W/kg (SAR corrected for target medium)
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0892 W/kg



0 dB = 0.0892 W/kg = -10.50 dBW/kg

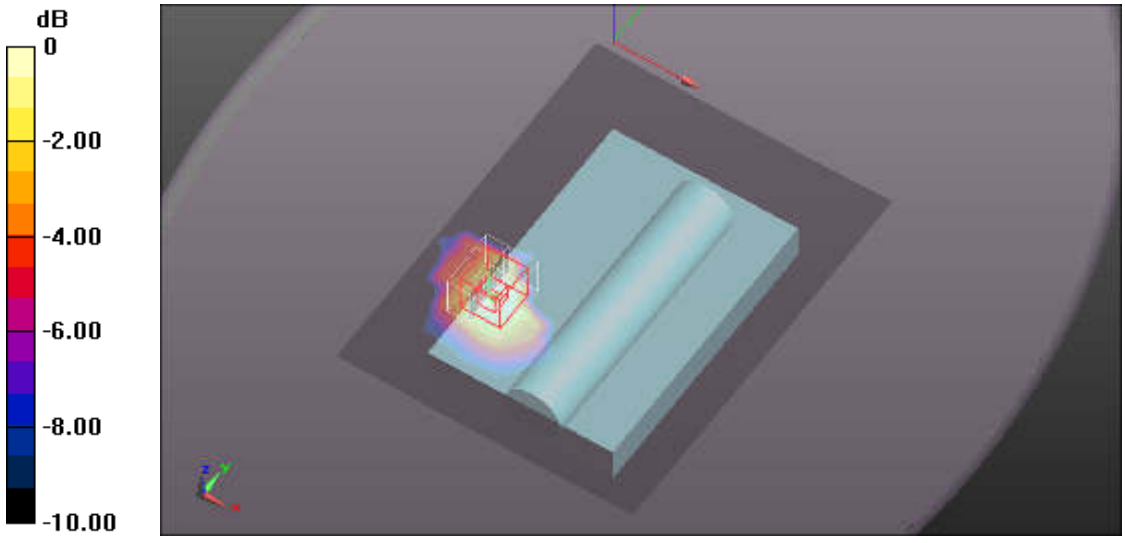


Plot Nº 13

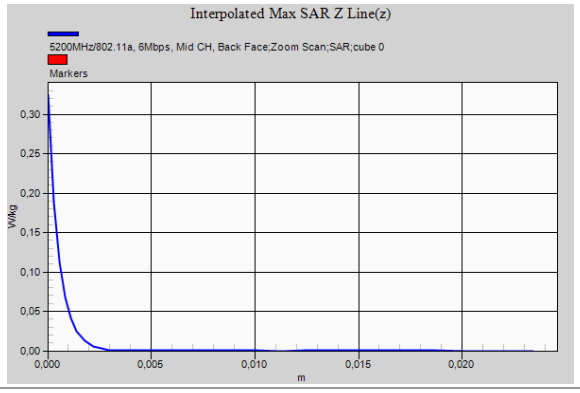
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-03-19

DUT: TCAM E4.2 Wifi; Type: Shark fin Antenna; Serial: SNRD004296
Communication System: UID 10417 - AAB, IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle);
Frequency: 5200 MHz; Duty Cycle: 1:6.65273
Medium parameters used: f = 5200 MHz; σ = 4.78 S/m; ε_r = 36.69; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(5.87, 5.87, 5.87) @ 5200 MHz; Calibrated: 2019-08-20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24 mm FCC/5200MHz/802.11a, 6Mbps, Mid CH, Back Face/Area Scan (161x211x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.164 W/kg
Flat Phantom, d=24 mm FCC/5200MHz/802.11a, 6Mbps, Mid CH, Back Face/Zoom Scan (8x9x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.796 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.325 W/kg
SAR(1 g) = 0.067 W/kg; SAR(10 g) = 0.026 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.160 W/kg



0 dB = 0.160 W/kg = -7.96 dBW/kg

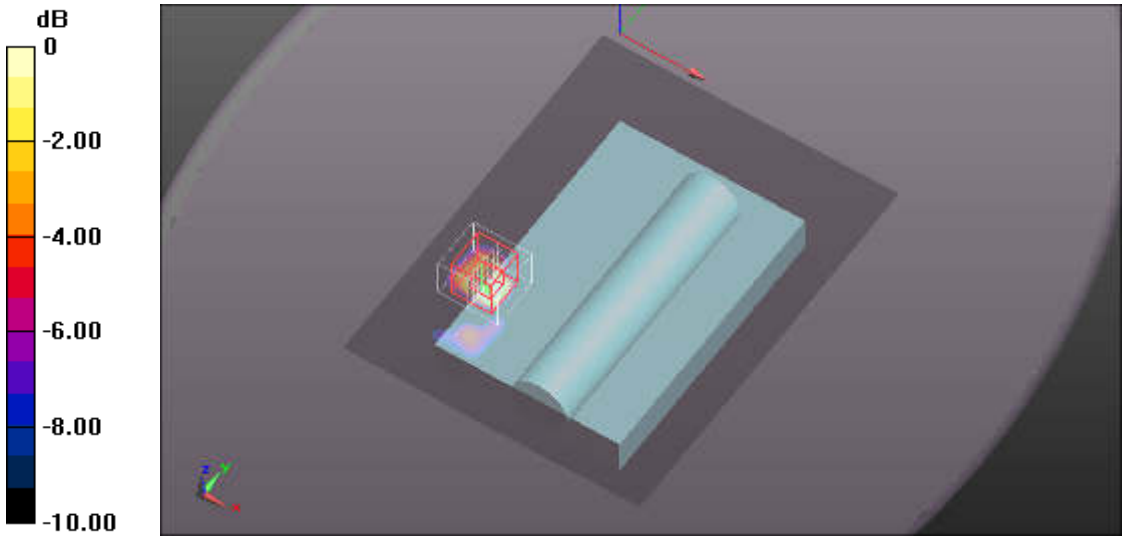


Plot Nº 14

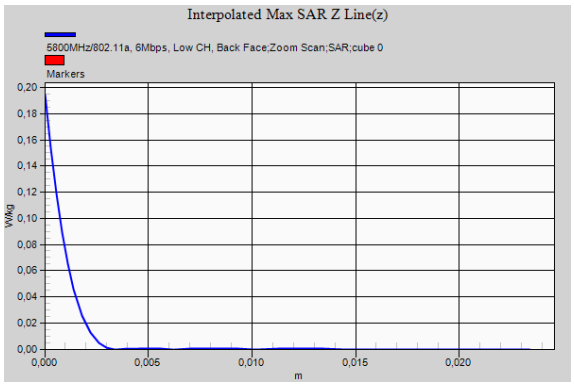
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-03-19

DUT: TCAM E4.2 Wifi; Type: Shark fin Antenna; Serial: SNRD004296
Communication System: UID 10417 - AAB, IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle);
Frequency: 5660 MHz; Duty Cycle: 1:6.65273
Medium parameters used: f = 5660 MHz; σ = 5.25 S/m; ε_r = 36; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(5, 5, 5); Calibrated: 2019-08-20;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat Phantom, d=24 mm FCC/5800MHz/802.11a, 6Mbps, Low CH, Back Face/Area Scan (161x211x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0594 W/kg
Flat Phantom, d=24 mm FCC/5800MHz/802.11a, 6Mbps, Low CH, Back Face/Zoom Scan (9x8x6)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.918 V/m; Power Drift = 0.23 dB
Peak SAR (extrapolated) = 0.194 W/kg
SAR(1 g) = 0.017 W/kg; SAR(10 g) = 0.00585 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.0490 W/kg



0 dB = 0.0490 W/kg = -13.10 dBW/kg



Appendix D: System Validation Reports

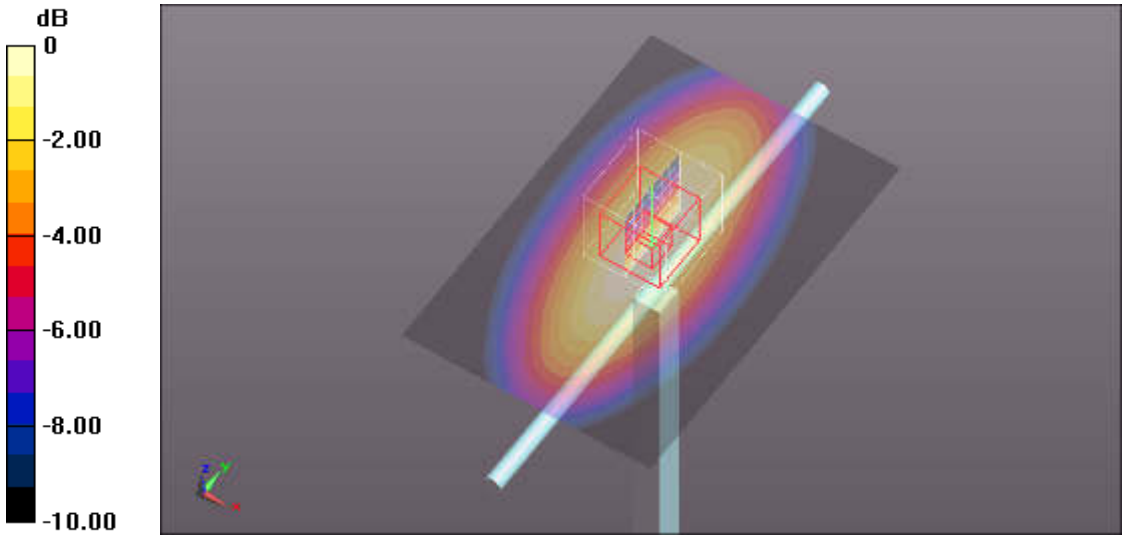
Validation results in 750 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2019-11-12

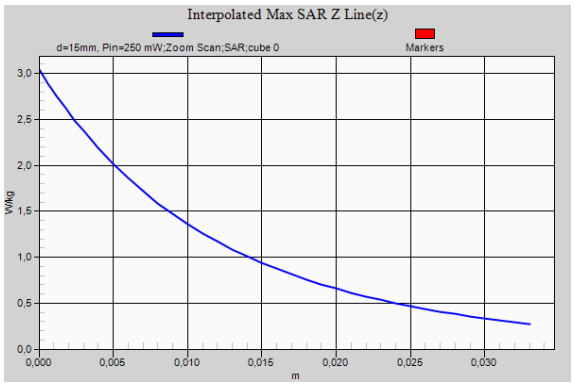
DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:1036
Communication System: UID 0, CW (0); Frequency: 750 MHz; Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 40.83; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(10.03, 10.03, 10.03); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 750MHz, 2019-11-12/d=15mm, Pin=250 mW/Area Scan (61x91x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.38 W/kg

Configuration 750MHz, 2019-11-12/d=15mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.41 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 3.04 W/kg
SAR(1 g) = 2.03 W/kg; SAR(10 g) = 1.33 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.36 W/kg



0 dB = 2.36 W/kg = 3.73 dBW/kg



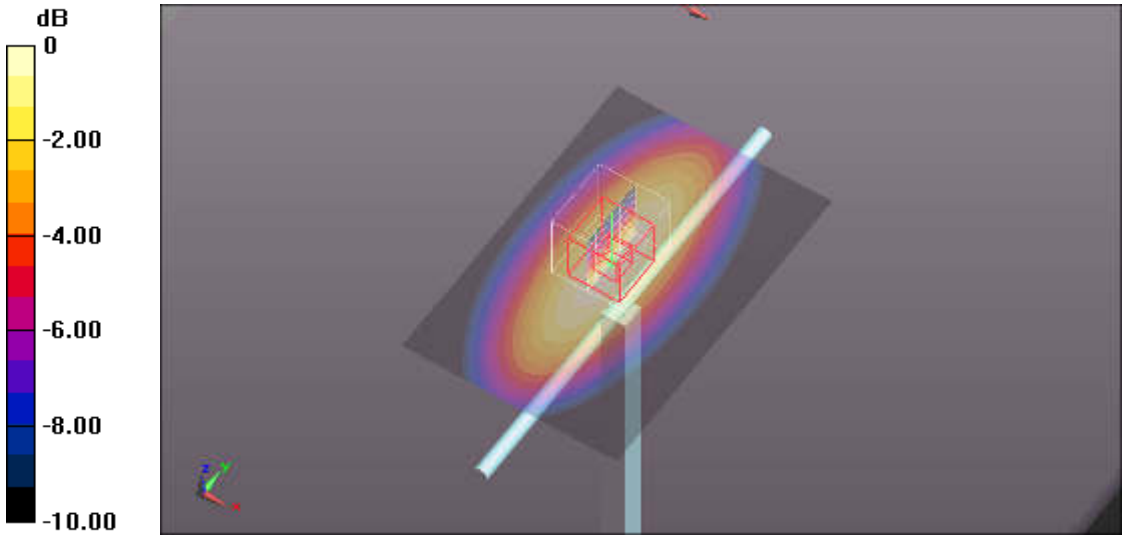
Validation results in 750 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-31

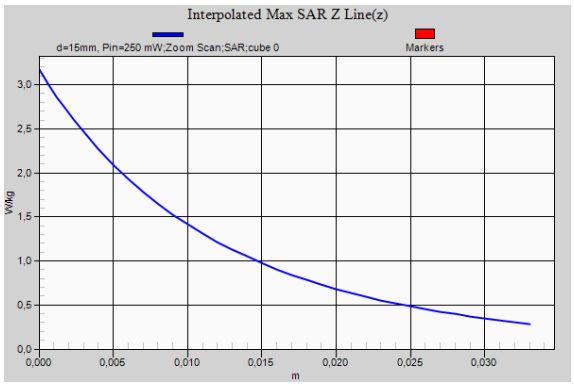
DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:1036
Communication System: UID 0, CW (0); Frequency: 750 MHz; Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 41.42; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(10.03, 10.03, 10.03); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 750MHz, 2020-01-31/d=15mm, Pin=250 mW/Area Scan (61x91x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.41 W/kg

Configuration 750MHz, 2020-01-31/d=15mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.48 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.17 W/kg
SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.37 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.47 W/kg



0 dB = 2.47 W/kg = 3.93 dBW/kg



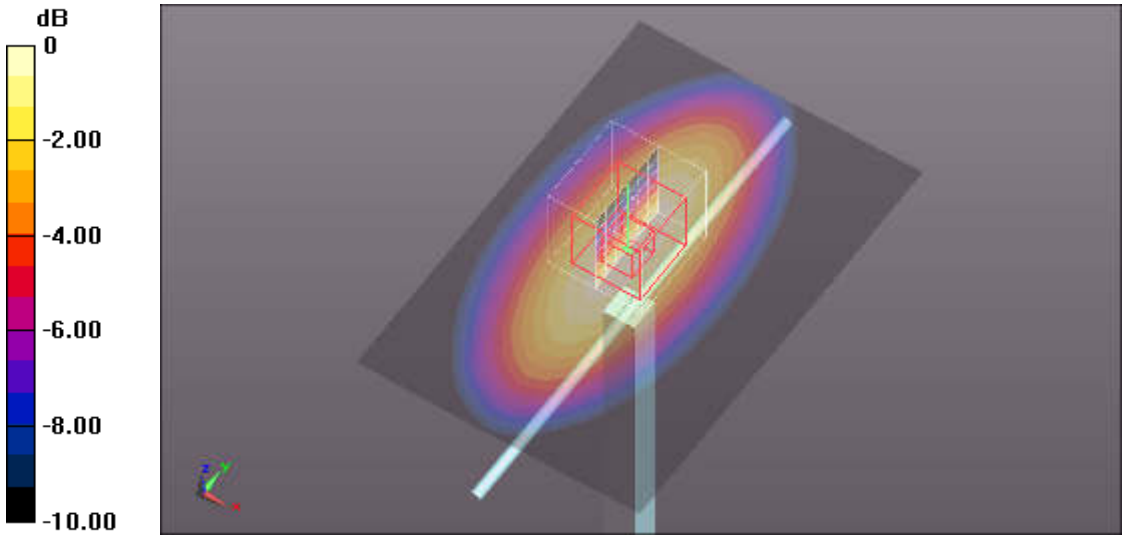
Validation results in 900 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-21

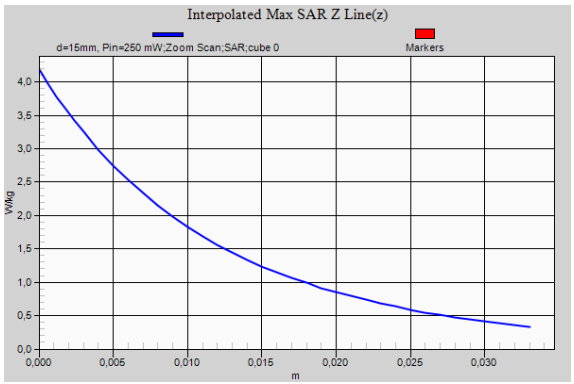
DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d007
Communication System: UID 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 0.98 S/m; ε_r = 41.74; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(9.56, 9.56, 9.56); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 900MHz, 2020-01-21/d=15mm, Pin=250 mW/Area Scan (61x91x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.16 W/kg

Configuration 900MHz, 2020-01-21/d=15mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.50 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 4.18 W/kg
SAR(1 g) = 2.76 W/kg; SAR(10 g) = 1.78 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 3.25 W/kg



0 dB = 3.25 W/kg = 5.12 dBW/kg



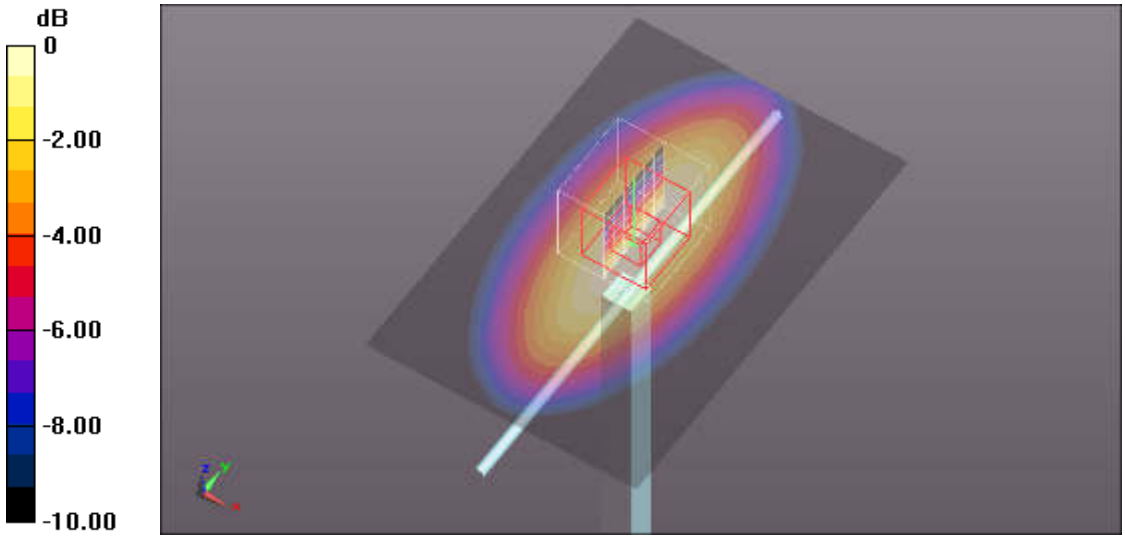
Validation results in 900 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-27

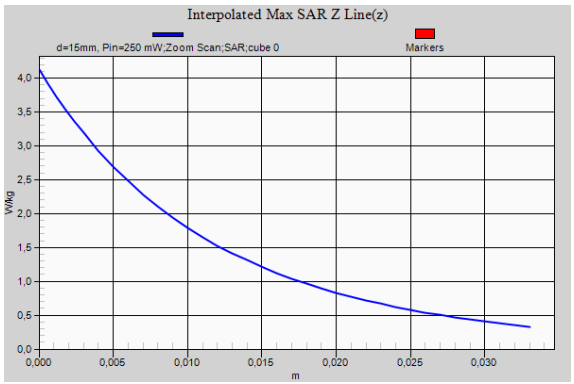
DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d007
Communication System: UID 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 0.98 S/m; ε_r = 41.71; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(9.56, 9.56, 9.56); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 900MHz, 2020-01-27/d=15mm, Pin=250 mW/Area Scan (61x91x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.18 W/kg

Configuration 900MHz, 2020-01-27/d=15mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.07 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 4.12 W/kg
SAR(1 g) = 2.71 W/kg; SAR(10 g) = 1.74 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 3.19 W/kg



0 dB = 3.19 W/kg = 5.04 dBW/kg



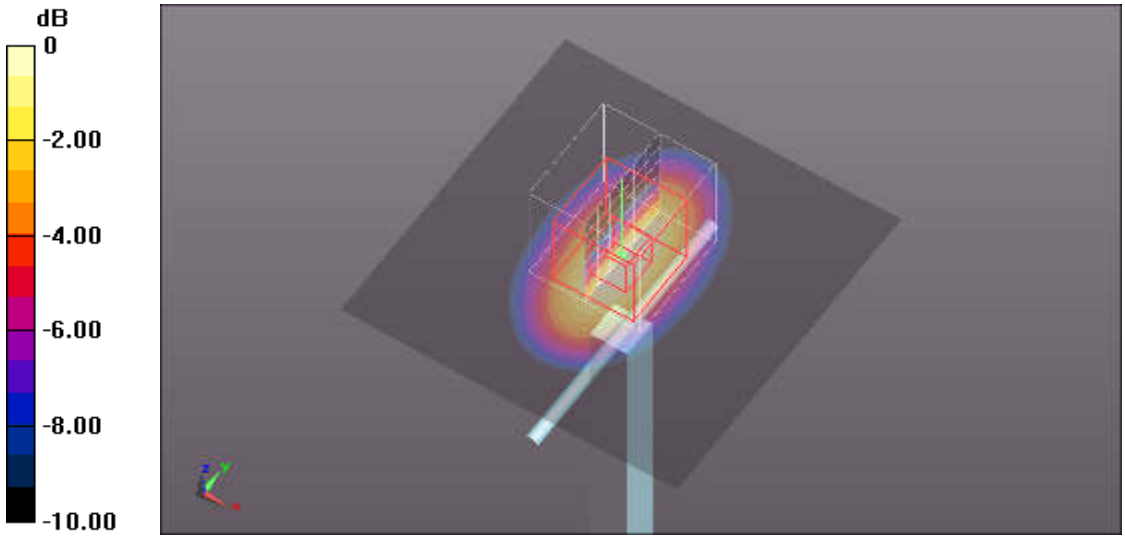
Validation results in 1800 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-29

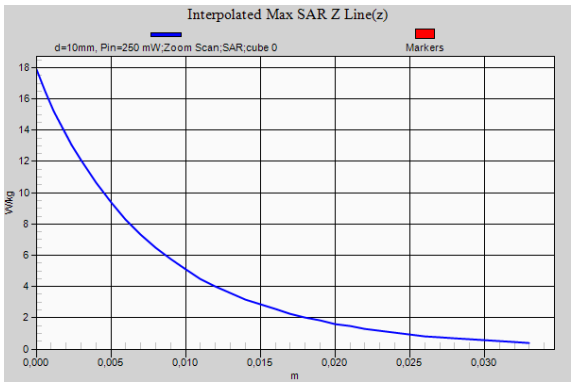
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:2d099
Communication System: UID 0, CW (0); Frequency: 1800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.45 S/m; ε_r = 41.48; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 1800MHz, 2020-01-29_1/d=10mm, Pin=250 mW/Area Scan (91x91x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 12.1 W/kg

Configuration 1800MHz, 2020-01-29_1/d=10mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.56 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 17.9 W/kg
SAR(1 g) = 9.44 W/kg; SAR(10 g) = 4.85 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 12.1 W/kg



0 dB = 12.1 W/kg = 10.83 dBW/kg



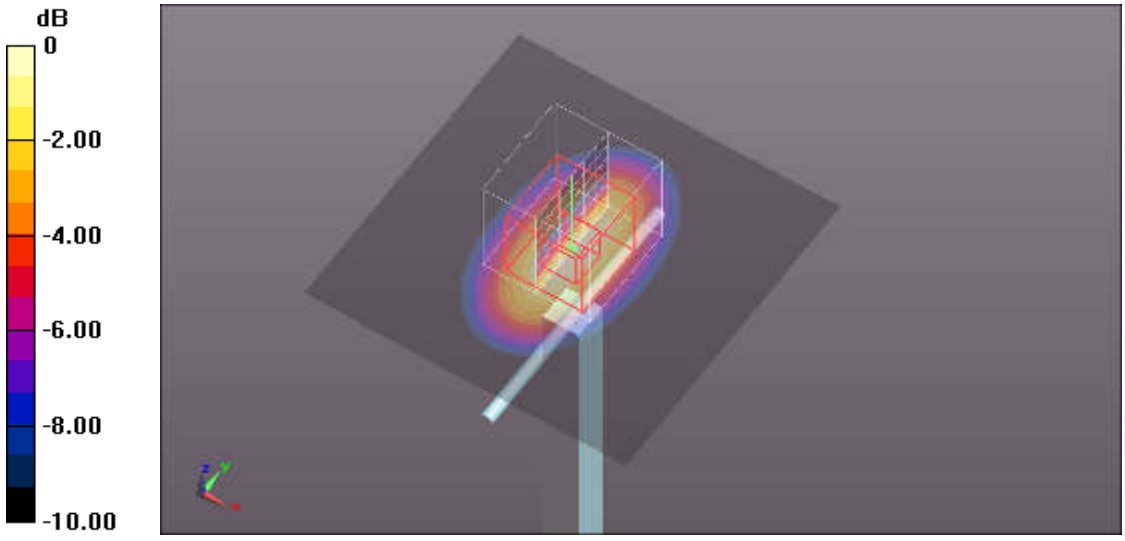
Validation results in 1800 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-01-29

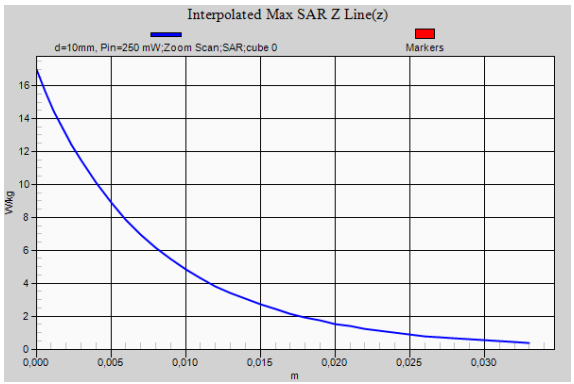
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:2d099
Communication System: UID 0, CW (0); Frequency: 1800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.36 S/m; ε_r = 41.93; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(8.38, 8.38, 8.38); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 1800MHz, 2020-01-29_2/d=10mm, Pin=250 mW/Area Scan (91x91x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 11.4 W/kg

Configuration 1800MHz, 2020-01-29_2/d=10mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.15 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 9.22 W/kg; SAR(10 g) = 4.69 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 11.5 W/kg



0 dB = 11.5 W/kg = 10.61 dBW/kg



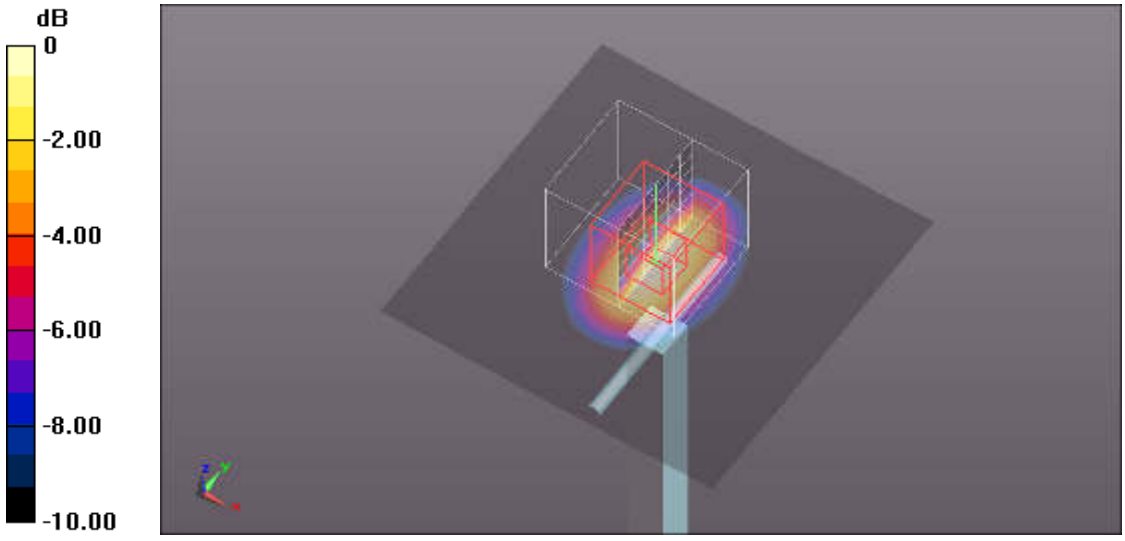
Validation results in 2450 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-03-17

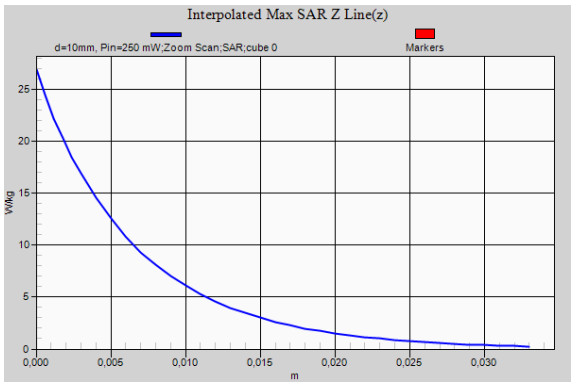
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:756
Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 40.69; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(7.54, 7.54, 7.54); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 2450MHz, 2019-03-17/d=10mm, Pin=250 mW/Area Scan (91x91x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.1 W/kg

Configuration 2450MHz, 2019-03-17/d=10mm, Pin=250 mW/Zoom Scan (8x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.19 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.87 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 16.9 W/kg



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



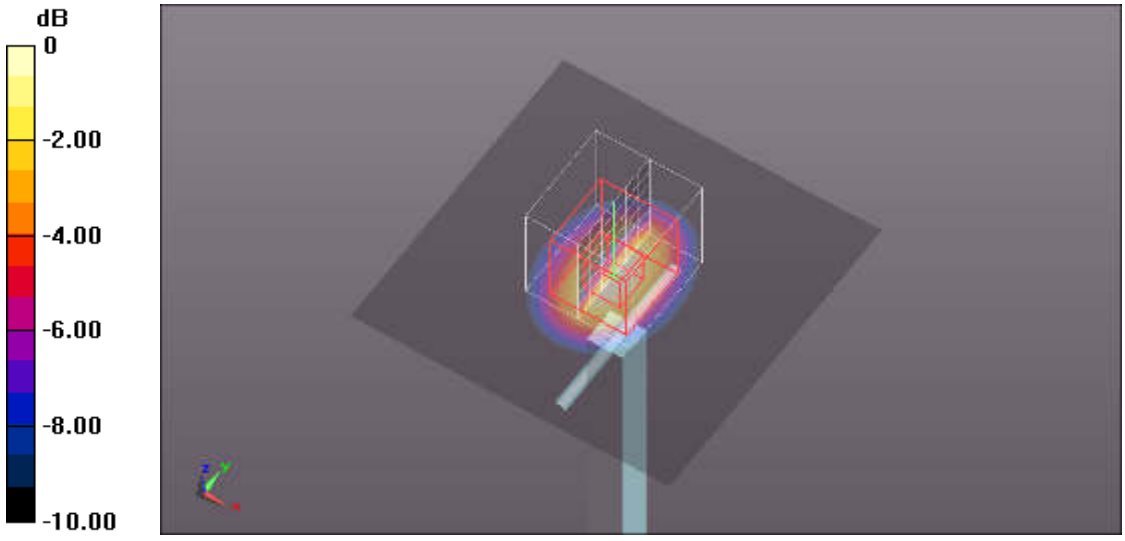
Validation results in 2600 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2019-11-14

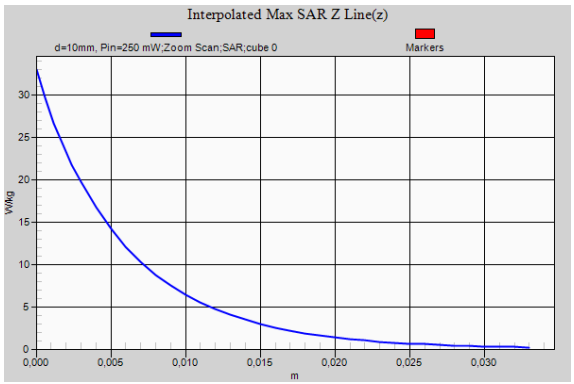
DUT: Dipole 2600 MHz D2600V2; Type: D2600V2; Serial: D2600V2 - SN:1023
Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.03 S/m; ε_r = 38.38; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(7.45, 7.45, 7.45); Calibrated: 2019-08-20;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 2600MHz, 2019-11-14/d=10mm, Pin=250 mW/Area Scan (91x91x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.2 W/kg

Configuration 2600MHz, 2019-11-14/d=10mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.41 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.3 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

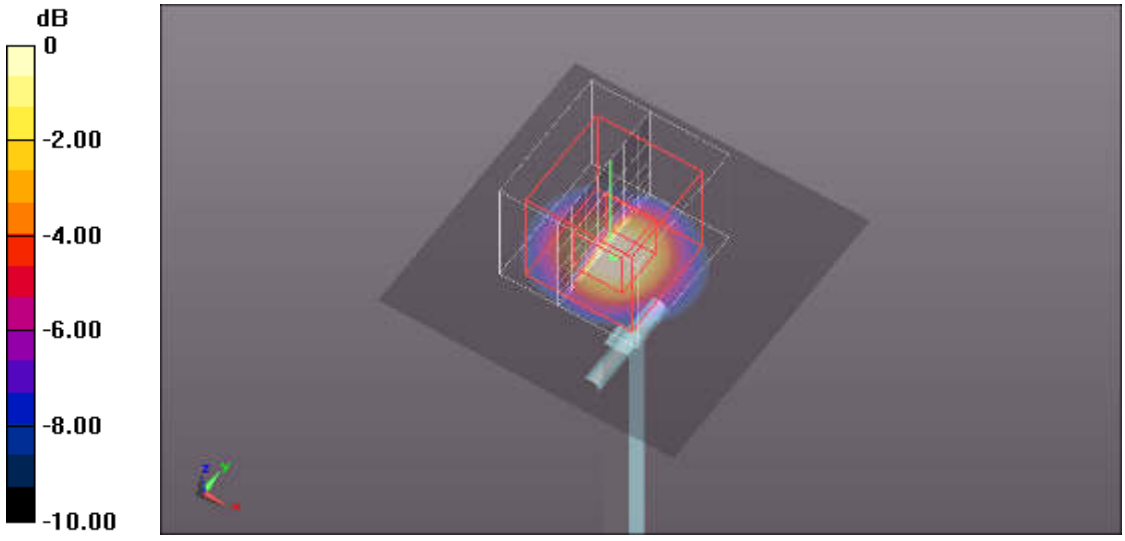


Validation results in 5200 MHz Band for Head TSL

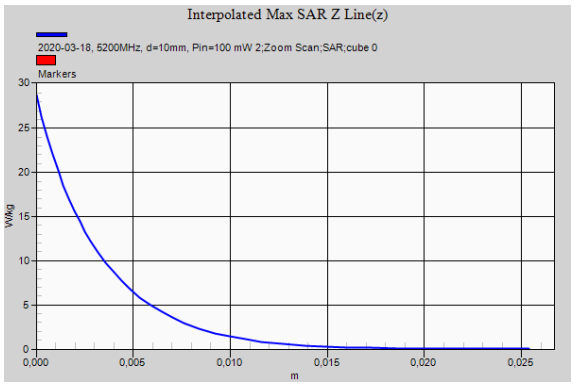
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-03-18

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1071
Communication System: UID 0, CW (0); Frequency: 5200 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 4.78 S/m; ε_r = 36.69; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(5.87, 5.87, 5.87); Calibrated: 2019-08-20;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 5GHz/2020-03-18, 5200MHz, d=10mm, Pin=100 mW 2/Area Scan (61x61x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.6 W/kg
Configuration 5GHz/2020-03-18, 5200MHz, d=10mm, Pin=100 mW 2/Zoom Scan (8x8x7)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.02 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 28.8 W/kg
SAR(1 g) = 7.5 W/kg; SAR(10 g) = 2.16 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 16.9 W/kg



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



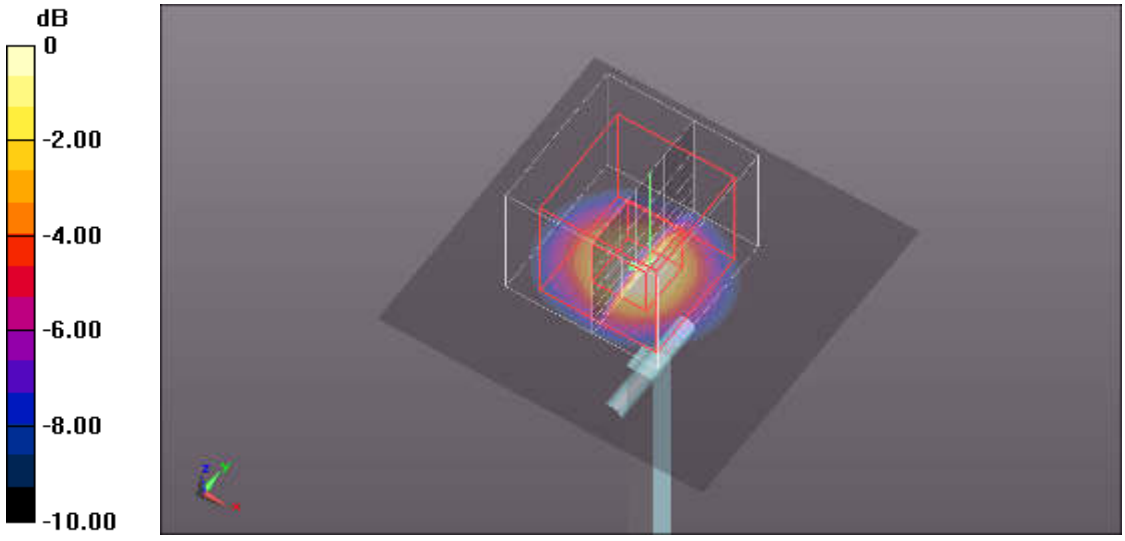
Validation results in 5850 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 2020-03-19

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1071
Communication System: UID 0, CW (0); Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.4 S/m; ε_r = 35.81; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(5.11, 5.11, 5.11); Calibrated: 2019-08-20;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 2019-08-14
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1060
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration 5GHz/2020-03-19, 5800MHz, d=10mm, Pin=100 mW/Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.2 W/kg

Configuration 5GHz/2020-03-19, 5800MHz, d=10mm, Pin=100 mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 45.81 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 34.3 W/kg
SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.18 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 18.8 W/kg



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