DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

Test report No:
NIE: 67003RAN.011

Test report
IEEE Std 1528™-2013

(*) Identification of item tested	Telematic control unit with wireless technologies, used in automotive industry.
(*) Trademark	VW AG
(*) Model and /or type reference tested	TKCMOD12N00
(*) Derived model not tested	TKCMOD12E00, TKCMOD11000, TKCMOD12C00, TKCMOD12J00, TKCMOD12R00, TKCMOD12T00 and TKCMOD13C00
(*) Other identification of the product	IMEI TAC : 35194028 HW version: C2.3, SW Version: X152 FCC ID: T8GCONMOD Contains FCC ID: LHJ-FE5NA0020 IC: 6434A-CONMOD Contains IC: 2807E-FE5NA0020
(*) Features	GSM, UMTS, LTE, 5G, GNSS, Wi-Fi, BTLE, BT_EDR
Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY
Test method requested, standard	1. IEEE Std 1528™-2013: 2. FCC 47 CFR Part 2.1093.
Summary	Considering the results of the performed test, the item under test is IN COMPLIANCE with FCC 47CFR Part 2.1093 exposure limits. The maximum 1g volume averaged SAR found during this test have been 0.998 W/kg, for GPRS 850 MHz 2 slots mode.
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager  2023.01.13 12:29:28 +01'00'
Date of issue	2023-01-11
Report template No	FDT08_24 (*) "Data provided by the client"

Index

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

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", "Derived model not tested", “Other identification of the product”, “Features” and “Test sample description”).

2. Maximum output power and installation testing distance information.

3. Derived model not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

HARMAN AUTOMOTIVE DIVISION
HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STRASSE 16
76307 KARLSBAD, GERMANY

Declaration of similarity

To whom it may concern,

We, **Harman Becker Automotive Systems GmbH**, located in **Becker-Goering-Str. 16; 76307 Karlsbad, Germany**

Hereby declare that the following units: TKCMOD12E00, TKCMOD12N00, TKCMOD11000, TKCMOD12C00, TKCMOD12J00, TKCMOD12R00, TKCMOD12T00 and TKCMOD13C00

have integrated the same BT/Wifi chipset.

The different naming comes from country specific, features enabled or network access device type.

Targeted countries	Product Name	Type	NAD-HW	GNSS	Bluetooth WLAN	NAD Services	CV2X
Rest of the world (offline variant)	TKCMOD11000	V046	EU	x	x		
EU + some other countries	TKCMOD12E00	V037, V042, V043, V044, V049	EU	x	x	x	
Canada/Mexico/USA	TKCMOD12N00	V038, V039, V047	NA	x	x	x	
China (without CV2X)	TKCMOD12C00	V105	CN	x	x	x	
Japan	TKCMOD12J00	V045	RW	x	x	x	
Armenia/Belarus/Kazakhstan/Russia/Uzbekistan	TKCMOD12R00	V048	EU	x	x	x	
Turkey	TKCMOD12T00	V040	EU	x	x	x	
China (with CV2X)	TKCMOD13C00	V106	CN	x	x	x	x

This declaration is intended to be included in the test reports where applies

Regards

HARMAN AUTOMOTIVE DIVISION
Harman Becker Automotive Systems GmbH
Becker-Göring-Straße 16
76307 Karlsbad, Germany

i.V.

By: Andrei-Daniel CALIN
Title: Regulatory Product Compliance Expert
Company: Harman Becker
Telephone: +40 799 305 814
e-mail: andreidaniel.calin@harman.com

i.V.

By: Iulian-George Stoica
Title: Regulatory Product Compliance Expert
Company: Harman Becker
Telephone: +40799 306 699
e-mail: iulian.stoica@harman.com

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
67003/071	Module	VW CONMOD	351940280094139	2021/12/10
67003/223	LTE3 antenna	4M0.035.504.A		2022/05/12
67003/278	Module	TKCMOD12E00	351940280094139	2022/05/17
67003/017	BT_WLAN 2 antenna			2021/09/07

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

Test sample description

Description of product ..... :	Telematic control unit with wireless technologies, used in automotive industry.		
Software version ..... :	X152		
Hardware version ..... :	C2.3		
Mounting position ..... :	☐	Table top equipment	
	☐	Wall/Ceiling mounted equipment	
	☐	Equipment used next to the ear	
	☐	Hand-held equipment	
	☒	Other: Vehicular environment equipment	
Accessories (not part of the test item) ..... :	Description	Type	Manufacturer
	Charging adapter	---	
	USB cable	---	

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH

BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-05-05
Date (finish)	2022-07-19

Document history

Report number	Date	Description
67003RAN.011	2023-01-11	First release

Environmental conditions

Date	Max. Temp. ºC	Min. Temp. ºC	Max. Hum. %	Min. Hum. %	Limit
From 2022-05-05 to 2022-07-19	24.99	20.01	65.02	33.93	18-25 ºC, 30-70%

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. Testing of Bluetooth mode is not required according to FCC OET KDB D01 General RF Exposure Guidance v06, paragraph “4.3.1. Standalone SAR test exclusion considerations”.
4. Only the plots of the highest reported SAR for each test position and mode/band are included in appendix C.
5. The tests have been performed by the technical personnel: Francisco J. Sánchez and Ismael Gamarro.
6. References:

   The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093 and the following FCC Published RF exposure KDB procedures:

   - FCC OET KDB 447498 D01 General RF Exposure Guidance v06 (October 2015)
   - FCC OET KDB 865664 D01 - SAR Measurement Requirements for 100 MHz to 6 GHz v01r04 (August 2015).
   - FCC OET KDB 865664 D02 RF Exposure Reporting v01r02 (October 2015)
   - FCC OET KDB 941225 D01 3G SAR Procedures v03r01 (October 2015).
   - FCC OET KDB 248227 D01 802.11 Wi-Fi SAR v02r02 (October 2015).
7. The instrumentation utilized to perform the tests covered in this test report is listed in the following table:

Equipment	NC
Dosimetric E-field probe SPEAG EX3DV4	6125
Dosimetric E-field probe SPEAG ES3DV3	3431
Data acquisition device SPEAG DAE4	3430
Data acquisition device SPEAG DAE4	8876
SPEAG Mounting Device for Hand-held devices	3424
SPEAG Mounting Device for Laptop and Body-Worn Transmitters	3526
SAM head-body simulator TWIN SAM V4.0	3422
Oval flat phantom SPEAG ELI 4	3525
Electro-optical converter SPEAG EOC3	3438
Robot Stäubli RX60BL	3420
Robot controller Stäubli CS7MB	3436
Measurement server SPEAG DASY5 SE UMS 011 BS	3847
SAR measurement software SPEAG DASY52 V52.10.4.1527	3423
SAR postprocessing software SPEAG SEMCAD X	3423
Electro-optical converter SPEAG SE UMS 018 BB	8902
Robot Stäubli TX60L	8867
Robot controller STÄUBLI CS8C	8894
Measurement server SPEAG DASY6 SE UMS 028 CA	8895
SAR measurement software SPEAG cDASY6 16.0.0.116	8898
Head Tissue Equivalent Liquid for 900 MHz band	3631
Head Tissue Equivalent Liquid for 1700 MHz band	6028
Head Tissue Equivalent Liquid for 1900 MHz band	6028
Head Tissue Equivalent Liquid for 5GHz bands	3636
900 MHz dipole validation kit SPEAG D900V2	3426
1800 MHz dipole validation kit SPEAG D1800V2	3427
5 GHZ dipole validation kit SPEAG D5GHzV2	1071
Vector network analyzer Agilent FieldFox N9923A	4482
Dielectric probe kit SPEAG DAK-3.5	4171
SPEAG DAK software V1.10.325.10	4859
RF Generator R&S SMU200	3346
Power amplifier MITEQ AMF-4D-00400600-50-30P	3485
DC Power supply Agilent U8002A	4835
Dual directional coupler HP 778D	1084
Dual directional coupler NARDA 4227-16	3630
Power sensor Agilent E9300A	4391
Power sensor Agilent E9300A	4392
Power meter Agilent E4419B	4393
Power sensor DC 50 MHz to 18 GHz R&S model NRP-Z81	4164
Digital thermometer LKM Electronics model DTM300-Spezial	4170
Temperature and humidity probe HUMIDIPROBE Pico Technology	3453
Wideband Radio Communication Tester R&S CMW 500	3934
Wideband Radio Communication Tester R&S CMW 500	4804
Wideband Radio Communication Tester R&S CMW 500	4948

Testing verdicts

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

Summary

FCC 47CFR Part 2.1093	VERDICT			
	N/A	P	F	NM
GSM 850		P		
GSM 1900		P		
WCDMA II		P		
WCDMA IV		P		
WCDMA V		P		
802.11a/g/n/ac		P		
Bluetooth		P[1]		
1: Technology not subject to testing. Verdict has been determined through RF Exposure assessment (see Appendix B, 2.2 of this document for more details).				

Appendix A: Test configuration

Index

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).

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 fulfills the procedural and technical requirements described at the reference standards used.

1.4. Phantom requirements

The phantom model for head measurements is a simplified representation of the human anatomy and comprised of material with electrical properties similar to the corresponding tissues in human body. The human model has the following proportions:

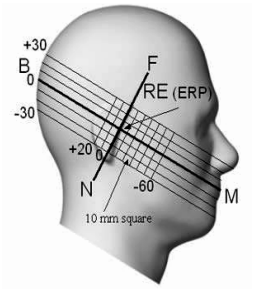


Figure 1: Proportions of Phantom

The shell model is a shaped container and it has the representation shown in the following figure:

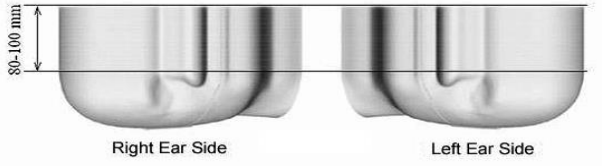


Figure 2: Proportions and shape of Phantom shell

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

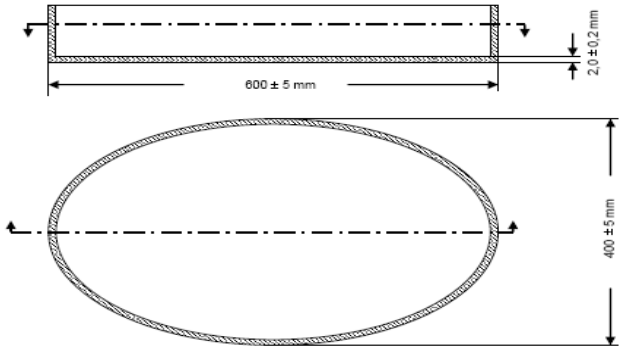


Figure 3: Proportions and shape of Phantom shell

1.5. Measurement Liquids requirements

The liquids used to simulate the human tissues, must fulfill the requirements of the dielectric properties required. These target dielectric properties are indicated into FCC OET KDB 865664 D01 Appendix A.

Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

Table 1: Liquid material requirements

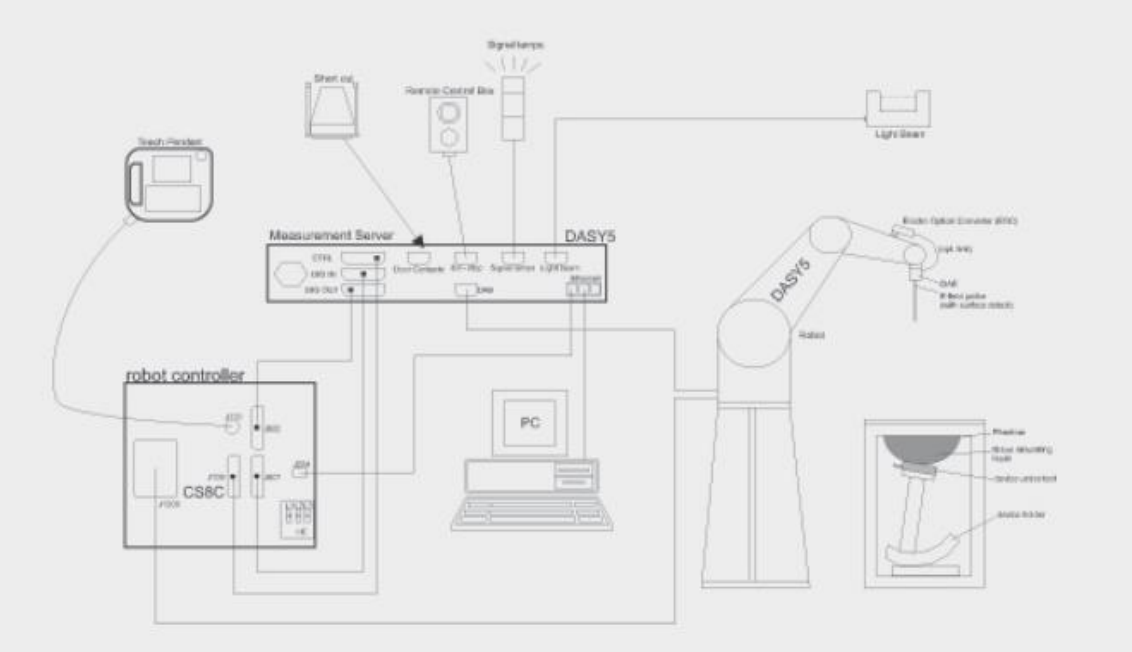
To minimize the effect of reflections on peak spatial-average SAR values, from the upper surface of the tissue equivalent liquid, the depth of the liquid should be at least 15 cm.

Dielectric porperties values of the Tissue Simulant Liquids used for SAR measurements are included in Appendix B, Section 3, of this document.

2. MEASUREMENT SYSTEM

2.1. Measurement System

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



The DASY6 system for performing compliance tests consists of the following items:

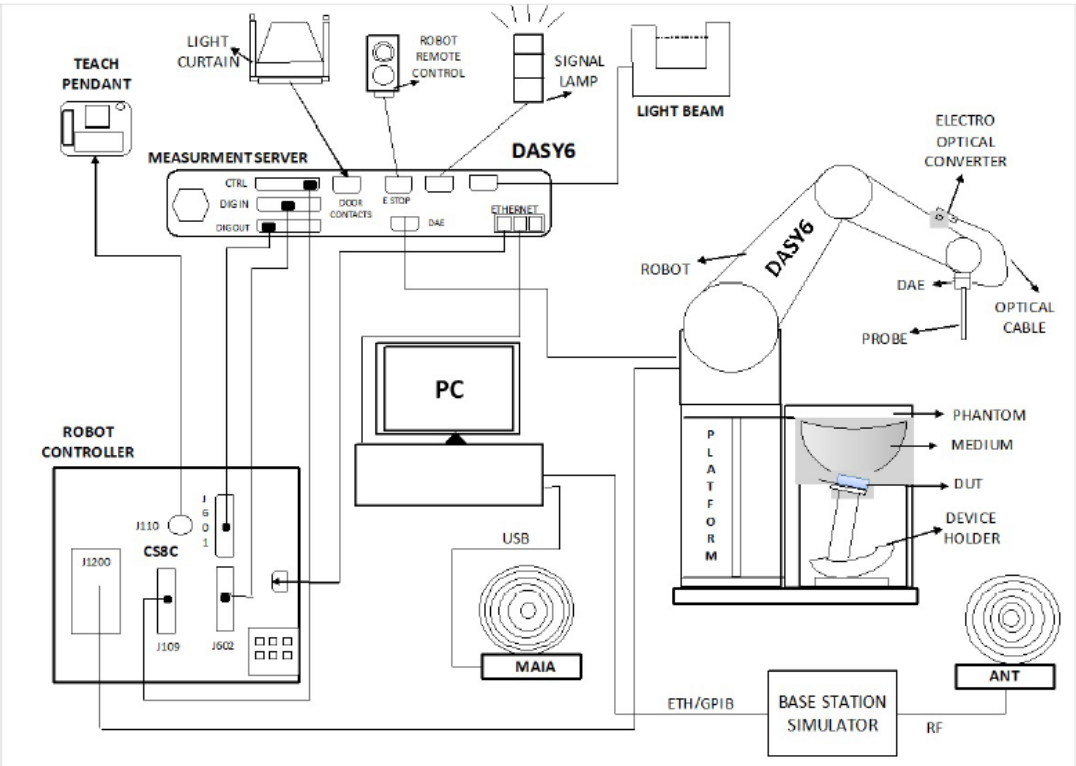
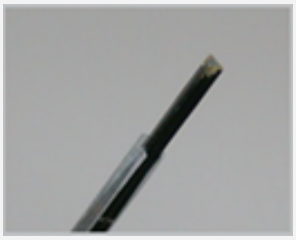


Figure 4: SAR Measurement system

- 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 DASY 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	ES3DV3
	**Construction**	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
	Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
	Directivity	± 0.2 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)
	Dynamic Range	5 µW/g to > 100 mW/g Linearity: ± 0.2 dB
	Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 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 Blas Current	< 50 fA

	**Model**	**Twin SAM**
	Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
	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 (6 ± 0.2 mm at ear point)
	Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet
	Filling Volume	Approx. 25 liters
	Wooden Support	SPEAG standard phantom table

	**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	Mounting Device for Laptop and Body-Worn Transmitters
	**Construction**	In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device (Body-worn) enables testing of transmitters devices according to IEC 62209-2 specifications. The device holder can be locked for positioning at flat phantom section.
	Material	Polyoxymethylene (POM), PET-G, Foam

	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
		D2300V2	56.3	290.0
		D2450V2	52.0	290.0
		D2600V2	49.2	290.0
		D3300V2	38.0	285.0
		D3500V2	37.0	285.0
		D3700V2	34.7	285.0
		D3900V2	32.0	280.0
		D4200V2	30.1	280.0
		D4600V2	27.0	280.0
		D4900V2	25.0	280.0
		D5GHzV2	20.6	300.0

2.2. Device Holder

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centre for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

The DASY Laptop Holder extension is lightweight and made of POM, PET-G acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.

2.3. Test Positions of device relative to body

The device is a Telematics control unit with wireless technologies, used in automotive, equipped with one modem, OEM. This unit was designed for automotive usage and contains the following features: GSM, UMTS, LTE, 5G, GNSS, Wifi (a, b, g, n, ac), Bluetooth Low Energy (BTLE) and Bluetooth EDR.

The equipment supports several antennas that can be used for transmission. It supports different configurations in which different antennas can be used for different purposes and transmit simultaneously:

Antenna	Tx - Bands	Position on vehicle	Installation distance (mm)
"LTE1" (Main cellular antenna)	GSM 850/1900 WCDMA II/IV/V LTE 2/4/5/7/12/13/14/17/25/26/41/66/71 5G n2/n5/n7/n66/n71	Rear mirror bracket	388
"LTE2" (Backup/e-call cellular antenna) *(Only for Backup/e-call mode)	n41/n77/n78 *(GSM 850/1900, WCDMA II/IV/V)	Rear bumper	1200
"LTE3" (Additional Backup/e-call cellular antenna) *(Only for Backup/e-call mode)	Only Rx *(GSM 850/1900, WCDMA II/IV/V)	Right rear window	180
"LTE4" (Additional Backup/e-call cellular antenna) *(Only for Backup/e-call mode)	Only Rx *(GSM 850/1900, WCDMA II/IV/V)	Front bumper	1500
Internal backup antenna	GSM 850/1900 WCDMA II/IV/V	Trunk - right side	400
"BT_WLAN1"	WLAN 2.4GHz	Rear mirror bracket	425
"BT_WLAN2"	Bluetooth EDR 2.4GHz WLAN 5GHz	Roof lining	112
"BT_LE_1"	Bluetooth Low Energy	Front & rearbumper	1500

Table 2: Antenna specifications and location.

Only two antennas will be installed close to car passangers at a distance minor to 20 cm, these antennas will be named as "LTE3" and one of the WLAN antennas named as "BT_WLAN2" antenna, which will be installed into the "C/D pilar/frame window backside" of the car with the following minimum declared installation distances.

These antennas were tested placed at the centre of the flat phantom. The LTE 3 antenna was placed at a conservative 15 mm testing distance for both antenna faces and the ”BT_WLAN2” antenna was placed at a conservative 10 mm testing distance for all antenna faces/edges except for its back face which has the antenna connector and results in a testing distance greater than 10 mm.

The rest of supported antennas which will be installed more than 20 cm away from any nearby passenger will be assessed according to FCC 47 CFR part 2.1091 into DEKRA Testing and Certification, S.A.U. test report num. 67003RAN.012.

2.4. Test to be performed

Test shall be performed for each test position previously described, using the channel producing the highest rated output power.

Additionally the other applicable test frequency channels must be measured for the test configuration providing the highest SAR for each applicable transmitting band.

2.5. 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 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 1mm 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.

2.6. 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 indicated in the previous points.

2.7. System Check

Prior to the SAR measurements, system verification is done daily to verify the system accuracy. As EN 62209-1 paragraph 6.1.2 “System Check” specifies, 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, if the highest measured 1-g SAR is < 1.5 W/kg, SAR measurement uncertainty analysis is not required to be included into SAR report, but it has been included for ISO 17025 accreditation.

Uncertainty for 300 MHz – 3 GHz

ERROR SOURCES (source of uncertainty)	Uncertainty value (%)	Prob. Dist.	Div.	*ci (1g)*	*ci (10g)*	*Standard uncertainty (1g) (%)*	*Standard uncertainty (10g) (%)*
Measurement Equipment							
Probe Calibration	13.30%	N	2	1	1	6.65%	6.65%
Probe calibration drift	11.35%	R	√3	1	1	6.55%	6.55%
Axial Isotropy	4.70%	R	√3	0.7	0.7	1.90%	1.90%
Hemisfericall Isotropy	9.60%	R	√3	0.7	0.7	3.88%	3.88%
Boundary effect	1.00%	R	√3	1	1	0.58%	0.58%
Linearity	4.70%	R	√3	1	1	2.71%	2.71%
System Detection limits	0.25%	R	√3	1	1	0.14%	0.14%
Probe modulation response	4.80%	N	1	1	1	4.80%	4.80%
Readout electronics	0.30%	N	1	1	1	0.30%	0.30%
Response time	1.01%	R	√3	1	1	0.58%	0.58%
Integration time	2.60%	R	√3	1	1	1.50%	1.50%
RF Ambient noise	3.00%	R	√3	1	1	1.73%	1.73%
RF Ambient reflections	3.00%	R	√3	1	1	1.73%	1.73%
Probe positioner mech. restrictions	0.40%	R	√3	1	1	0.23%	0.23%
Probe positioning with respect to phantom shell	2.90%	R	√3	1	1	1.67%	1.67%
Max. SAR Eval.	2.00%	R	√3	1	1	1.15%	1.15%
Test Sample Related							
Device holder uncertainty	3.60%	N	1	1	1	3.60%	3.60%
Test sample positioning	2.90%	N	1	1	1	2.90%	2.90%
Drift of output power	2.50%	N	1	1	1	2.50%	2.50%
System Validation source (dipole)							
Deviation of experimental dipole from numerical dipole	0.00%	N	1	0	0	0.00%	0.00%
Input power and SAR drift measurement	2.00%	R	√3	1	1	1.15%	1.15%
Dipole axis to liquid distance	3.40%	R	√3	1	1	1.96%	1.96%
Phantom and Setup							
Phantom uncertainty (shape and thickness tolerances)	6.10%	R	√3	1	1	3.52%	3.52%
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.90%	N	1	1	0.84	1.90%	1.60%
Liquid conductivity (meas.)	2.45%	N	1	0.78	0.71	1.91%	1.74%
Liquid permittivity (meas.)	2.45%	N	1	0.26	0.26	0.64%	0.64%
Liquid conductivity – temperature uncertainty	2.30%	R	√3	0.78	0.71	1.04%	0.94%
Liquid permittivity – temperature uncertainty	0.36%	R	√3	0.23	0.26	0.05%	0.05%
Combined standard uncertainty (Validation antenna)	$u_c = \sqrt{\sum_{i=1}^{m} c_i^2 \cdot u_i^2}$					11.62%	11.54%
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**23.25%**	**23.09%**
Combined standard uncertainty (DUT)	$u_c = \sqrt{\sum_{i=1}^{m} c_i^2 \cdot u_i^2}$					14.08%	14.01%
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**28.16%**	**28.03%**

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

Uncertainty for 3 GHz – 6 GHz

ERROR SOURCES (source of uncertainty)	Uncertainty value (%)	Prob. Dist.	Div.	*ci (1g)*	*ci (10g)*	*Standard uncertainty (1g) (%)*	*Standard uncertainty (10g) (%)*
Measurement Equipment							
Probe Calibration	13.10%	N	2	1	1	6.55%	6.55%
Probe calibration drift	11.15%	R	√3	1	1	6.44%	6.44%
Axial Isotropy	4.70%	R	√3	0.7	0.7	1.90%	1.90%
Hemisfericall Isotropy	9.60%	R	√3	0.7	0.7	3.88%	3.88%
Boundary effect	2.00%	R	√3	1	1	1.15%	1.15%
Linearity	4.70%	R	√3	1	1	2.71%	2.71%
System Detection limits	0.25%	R	√3	1	1	0.14%	0.14%
Probe modulation response	4.80%	N	1	1	1	4.80%	4.80%
Readout electronics	0.30%	N	1	1	1	0.30%	0.30%
Response time	1.01%	R	√3	1	1	0.58%	0.58%
Integration time	2.60%	R	√3	1	1	1.50%	1.50%
RF Ambient noise	3.00%	R	√3	1	1	1.73%	1.73%
RF Ambient reflections	3.00%	R	√3	1	1	1.73%	1.73%
Probe positioner mech. restrictions	0.40%	R	√3	1	1	0.23%	0.23%
Probe positioning with respect to phantom shell	6.70%	R	√3	1	1	3.87%	3.87%
Max. SAR Eval.	4.00%	R	√3	1	1	2.31%	2.31%
Test Sample Related							
Device holder uncertainty	3.60%	N	1	1	1	3.60%	3.60%
Test sample positioning	2.90%	N	1	1	1	2.90%	2.90%
Drift of output power	2.50%	N	1	1	1	2.50%	2.50%
System Validation source (dipole)							
Deviation of experimental dipole from numerical dipole	0.00%	N	1	0	0	0.00%	0.00%
Input power and SAR drift measurement	2.00%	R	√3	1	1	1.15%	1.15%
Dipole axis to liquid distance	3.40%	R	√3	1	1	1.96%	1.96%
Phantom and Setup							
Phantom uncertainty (shape and thickness tolerances)	6.60%	R	√3	1	1	3.81%	3.81%
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.90%	N	1	1	0.84	1.90%	1.60%
Liquid conductivity (meas.)	2.45%	N	1	0.78	0.71	1.91%	1.74%
Liquid permittivity (meas.)	2.45%	N	1	0.26	0.26	0.64%	0.64%
Liquid conductivity – temperature uncertainty	3.36%	R	√3	0.78	0.71	1.51%	1.38%
Liquid permittivity – temperature uncertainty	0.40%	R	√3	0.23	0.26	0.05%	0.06%
Combined standard uncertainty (Validation antenna)	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					12.36%	12.28%
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**24.72%**	**24.55%**
Combined standard uncertainty (DUT)	$u_c = \sqrt{\sum_{1=1}^{m} c_i^2 \cdot u_i^2}$					14.69%	14.62%
Expanded uncertainty (confidence interval of 95%)	*ue =2.00 uc*					**29.39%**	**29.25%**

Table 4: Uncertainty Assessment for 3 GHz – 6GHz.

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 1.1310, Paragraph (c)	General population/Uncontrolled	SAR 1-g.	1.6
FCC 47 CFR Part 1.1310, Paragraph (c)	General population/Uncontrolled Extremity	SAR 10-g.	4.0

Table 5: SAR limit

5. DEVICE UNDER TEST

5.1. Dimensions

Element	Length x Width x Height (mm)
TCU	260.0 x 130.0 x 25.0
LTE 3 antenna	115.0 x 20.0 x 5.0
BT_WLAN 2 antenna	110.0 x 20.0 x 15.0

Table 6: DUT dimensions

5.2. Wireless Technology

Wireless Technology	Frequency Bands	Modes	Duty Cycle used for SAR testing
GSM	850/1900	- Voice (GMSK) - GPRS (GMSK, Multi-slot class 33) - EGPRS (8PSK, Multi-slot class 33)	- GMSK: 12.5 % - GPRS/EGPRS 1 slot: 12.5 % - GPRS/EGPRS 2 slot: 25.0 % - GPRS/EGPRS 3 slot: 37.5 % - GPRS/EGPRS 4 slot: 50.0 %
WCDMA	II/IV/V	- UMTS Rel. 99 - HSDPA (Rel. 5) - HSPA (Rel. 6) - HSPA+ (Rel. 7)	- 100 %
WLAN	5 GHz	- 802.11b/g/n/ac (20MHz & 40MHz) - 802.11 ac (80MHz)	- 802.11a/n/ac/ax (20MHz): 80 % - 802.11a/n/ac/ax (40 MHz): 65 % - 802.11ac/ax(80): 45 %
Bluetooth	2.4 GHz	- Bluetooth	SAR Low-Power Exclusion compliant

Table 7: Supported modes

The supported transmitting technology for each antenna is:

Antenna	Wireless Technology	Frequency Bands	Modes
LTE3	GSM	850/1900	- Voice (GMSK) - GPRS (GMSK, Multi-slot class 33) - EGPRS (8PSK, Multi-slot class 33)
	WCDMA	II/IV/V	- UMTS Rel. 99 - HSDPA (Rel. 5) - HSPA (Rel. 6) - HSPA+ (Rel. 7)
BT_WLAN 2	Bluetooth	2.4GHz	- BT_EDR
	WLAN	UNII-1 & UNII-3	- 802.11b/g/n(20MHz & 40MHz) - 802.11 ac(80MHz)

Table 8: Antenna supported transmitting modes

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:

RF Exposure Condition	Simultaneous transmission configurations
Head/Body	WWAN (LTE3)+Wi-Fi 5GHz (BT_WLAN 2)

Table 9: DUT simultaneous transmission

5.4. Antenna Location

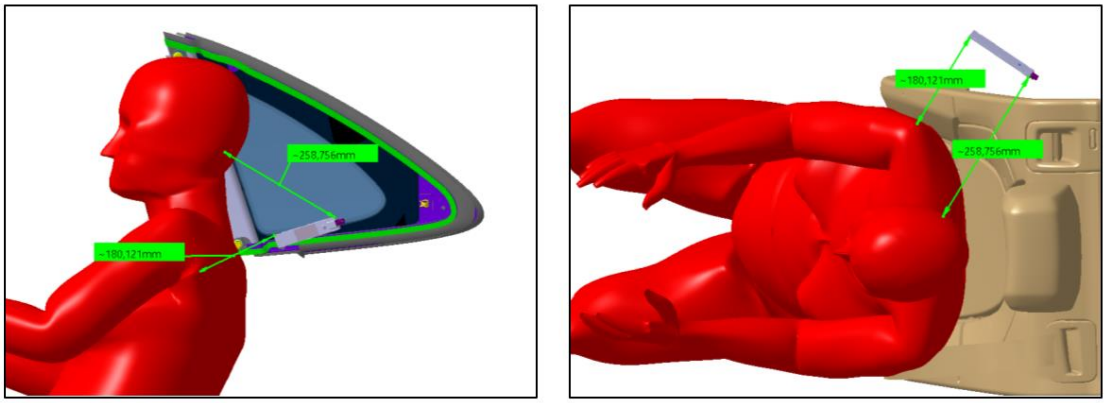


Figure 5: LTE3 antenna location.

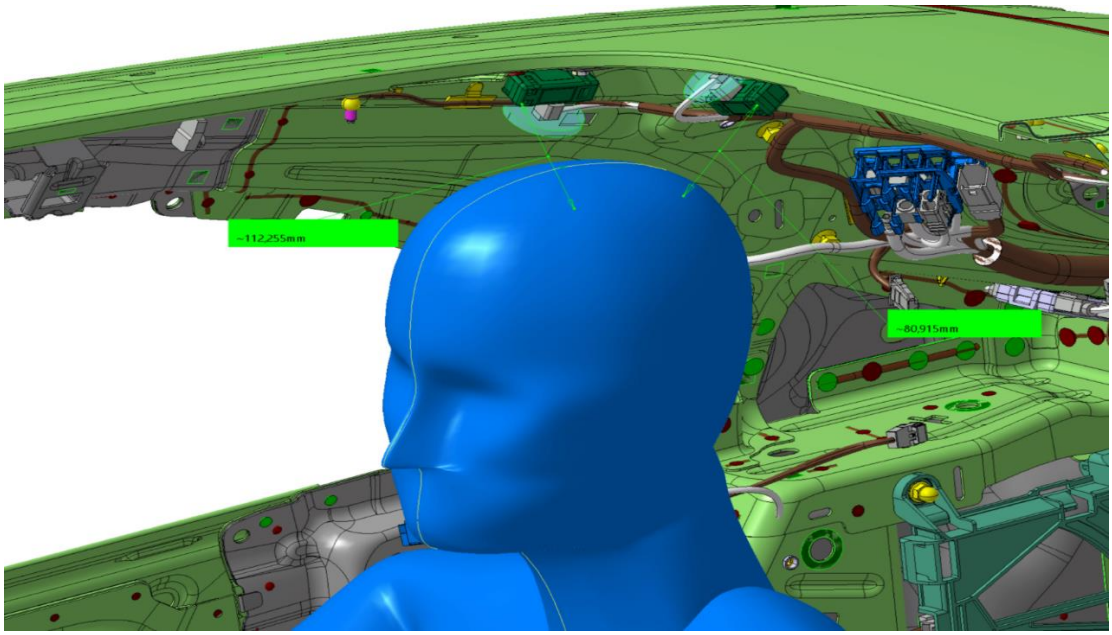


Figure 6: "BT_WLAN 2" antenna location.

Appendix B: Test results

Index

1. TEST CONDITIONS

1.1. Power supply (V):

Vn = 13.2 V
Type of power supply = DC Voltage from power supply.

1.2. Temperature (ºC):

Tn = +20.00 to +25.00
The subscript n indicates normal test conditions.

1.3. DUT information and test-site configurations

For all supported modes, the back and front face of the DUT was place facing the flat phantom surface using 15 mm test separation distance for measurements for the “LTE 3” antenna and all faces/edges except back face position using 10 mm test separation distance for measurements with the “BT_WLAN2 antenna”.

1.4. Test signal, Output Power and Frequencies

The sample was put into operation by using an R&S CMW 500 as base station simulator for 2G and 3G transmitting technologies.

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

The output power of the device was set to Power Control Level (PCL) maximum for all tests. In all operating bands and test positions, the measurements were performed on middle, lowest and highest channels.

The target power alignments for RF components declared by the manufacturer for each supported technology are:

Technology / Mode	Band	Frequency (MHz)	Maximum Burst Averaged Output Power (Incl. Tune-Up) (dBm)	Maximum Frame Averaged Output Power (Incl. Tune-Up) (dBm)
GSM	850	824 - 849	34.0	25.0
GPRS 1TX	850	824 - 849	34.0	25.0
GPRS 2TX	850	824 - 849	34.0	28.0
GPRS 3TX	850	824 - 849	34.0	29.75
GPRS 4TX	850	824 - 849	34.0	31.0
GSM	1900	1850 - 1910	31.0	22.0
GPRS 1TX	1900	1850 - 1910	31.0	22.0
GPRS 2TX	1900	1850 - 1910	31.0	25.0
GPRS 3TX	1900	1850 - 1910	31.0	26.75
GPRS 4TX	1900	1850 - 1910	31.0	28.0

Technology / Mode	Band	Frequency (MHz)	Maximum Output Power (Incl. Tune-Up) (dBm)
UMTS	II	1850 - 1910	25.0
UMTS	IV	1710 - 1755	25.0
UMTS	V	826 - 847	25.0

Maximum Output Power (dBm)			
Band	**802.11a**	**802.11n20/n40**	**802.11ac40/ac80**
UNII-3	10.8	10.8	10.8

Maximum Output Power (dBm)	
Band	**Bluetooth EDR**
2.4 GHz	10.0

2. CONDUCTED AVERAGE POWER MEASUREMENTS

2.1. LTE 3 ANTENNA

2.1.1. GSM/GPRS/EGPRS Bands

- GSM 850: For voice mode PCL 5 was set to allow max power transmission.

GSM 900 - Average Output Power					
Channel Number	**Frequency (MHz)**	**Frame Average Output Power (dBm)**	**Average Burst Output Power (dBm)**	**PCL**	**Modulation**
128	824.2	23.39	32.4	5	GMSK
190	836.6	23.60	32.6	5	GMSK
251	848.8	23.33	32.4	5	GMSK

- 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)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
128	824.2	23.11	23.81	23.79	23.38	5	GMSK-CS1
190	836.6	23.24	23.89	23.83	23.78	5	GMSK-CS1
251	848.8	23.07	23.63	23.60	22.88	5	GMSK-CS1

GPRS 850 - Average Burst Output Power							
Channel Number	**Frequency (MHz)**	**Power (dBm)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
128	824.2	32.1	29.8	28.1	26.4	5	GMSK-CS1
190	836.6	32.3	29.9	28.1	26.8	5	GMSK-CS1
251	848.8	32.1	29.7	27.9	25.9	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)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
128	824.2	17.48	18.88	19.59	19.67	8	8PSK-MCS5
190	836.6	17.57	18.84	19.65	19.74	8	8PSK-MCS5
251	848.8	17.39	18.86	19.47	19.60	8	8PSK-MCS5

EDGE 850 - Average Burst Output Power							
Channel Number	**Frequency (MHz)**	**Power (dBm)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
128	824.2	26.5	24.9	23.9	22.7	8	8PSK-MCS5
190	836.6	26.4	24.9	23.9	22.8	8	8PSK-MCS5
251	848.8	26.4	24.9	23.7	22.6	8	8PSK-MCS5

- GSM 1900: For voice mode PCL 0 was set to allow max power transmission.

GSM 1800 - Average Output Power					
Channel Number	**Frequency (MHz)**	**Frame Average Output Power (dBm)**	**Average Burst OutputPower (dBm)**	**PCL**	**Modulation**
512	1850.2	19.20	28.2	0	GMSK
661	1880.0	19.26	28.3	0	GMSK
810	1909.8	18.85	27.9	0	GMSK

- GPRS 1900: 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)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
512	1850.2	19.02	19.04	19.28	19.70	0	GMSK-CS1
661	1880.0	19.13	18.92	19.30	19.84	0	GMSK-CS1
810	1909.8	18.65	18.42	18.94	19.50	0	GMSK-CS1

GPRS 1900 - Average Burst Output Power							
Channel Number	**Frequency (MHz)**	**Power (dBm)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
512	1850.2	28.1	25.1	23.5	22.7	0	GMSK-CS1
661	1880.0	28.2	24.9	23.6	22.9	0	GMSK-CS1
810	1909.8	27.7	24.4	23.2	22.5	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)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
512	1850.2	15.46	16.48	17.63	17.69	2	8PSK-MCS5
661	1880.0	15.13	16.56	17.41	17.50	2	8PSK-MCS5
810	1909.8	14.73	16.20	17.07	17.19	2	8PSK-MCS5

EDGE 1900 - Average Burst Output Power							
Channel Number	**Frequency (MHz)**	**Power (dBm)**				**PCL**	**Modulation**
		1 Slot	**2 Slots**	**3 Slots**	**4 Slots**		
512	1850.2	24.5	22.5	21.9	20.7	2	8PSK-MCS5
661	1880.0	24.2	22.6	21.7	20.5	2	8PSK-MCS5
810	1909.8	23.8	22.2	21.3	20.2	2	8PSK-MCS5

2.1.2. WCDMA/HSDPA/HSPA/HSPA+ Bands

- <u>WCDMA:</u> 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	23.35
FDD II 1900	WCDMA	9400	1880.0	23.20
FDD II 1900	WCDMA	9538	1907.6	23.01

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD IV 1700	WCDMA	1312	1712.4	23.17
FDD IV 1700	WCDMA	1412	1732.6	23.38
FDD IV 1700	WCDMA	1512	1752.6	23.49

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD V 850	WCDMA	4132	826.4	23.62
FDD V 850	WCDMA	4182	836.4	23.52
FDD V 850	WCDMA	4233	846.6	23.48

- 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	22.49	22.39	21.91	20.96
FDD II 1900	HSDPA	9400	1880.0	22.26	22.22	21.53	20.72
FDD II 1900	HSDPA	9538	1907.6	22.05	22.03	21.26	20.53

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD IV 1700	HSDPA	1312	1712.4	22.14	21.77	21.80	20.73
FDD IV 1700	HSDPA	1412	1732.6	22.25	22.24	21.73	20.83
FDD IV 1700	HSDPA	1512	1752.6	22.35	22.36	21.97	20.45

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)			
				Subtest			
				1	2	3	4
FDD V 850	HSDPA	4132	826.4	22.60	22.61	22.10	22.10
FDD V 850	HSDPA	4182	836.4	22.19	22.16	21.73	21.74
FDD V 850	HSDPA	4233	846.6	22.48	22.49	22.00	21.98

- 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	22.28	22.17	21.86	22.47	22.06
FDD II 1900	HSPA	9400	1880.0	22.16	22.05	21.67	22.23	22.03
FDD II 1900	HSPA	9538	1907.6	21.95	21.82	21.49	22.05	21.63

Band	Mode	CH	Frequency (MHz)	Average Output Power (dBm)				
				Subtest				
				1	2	3	4	5
FDD IV 1700	HSPA	1312	1712.4	22.11	21.91	21.60	22.17	21.75
FDD IV 1700	HSPA	1412	1732.6	22.27	21.98	21.63	22.36	21.89
FDD IV 1700	HSPA	1512	1752.6	22.35	22.13	21.89	22.49	21.86

Band	Mode	CH	Frequency (MHz)	Average Output Power (dBm)				
				Subtest				
				1	2	3	4	5
FDD V 850	HSPA	4132	826.4	22.60	22.53	22.04	21.41	22.09
FDD V 850	HSPA	4182	836.4	22.58	22.55	21.99	21.62	22.05
FDD V 850	HSPA	4233	846.6	22.50	22.51	21.92	21.50	22.08

- 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

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD II 1900	HSPA+	9262	1852.4	23.20
FDD II 1900	HSPA+	9400	1880.0	23.35
FDD II 1900	HSPA+	9538	1907.6	23.01

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD IV 1700	HSPA+	1312	1712.4	23.17
FDD IV 1700	HSPA+	1412	1732.6	23.49
FDD IV 1700	HSPA+	1512	1752.6	23.38

Band	Mode	Channel Number	Frequency (MHz)	Average Output Power (dBm)
FDD V 850	HSPA+	4132	826.4	22.17
FDD V 850	HSPA+	4182	836.4	22.13
FDD V 850	HSPA+	4233	846.6	22.05

2.2. WLAN_BT2 ANTENNA

2.2.1. WLAN

Band	Mode	Channel / Freq (MHz)	Average Output Power (dBm)
U-NII-3	802.11a	149 / 5745	9.55
		157 / 5785	9.95
		165 / 5825	9.55
	802.11n20	149 / 5745	9.39
		157 / 5785	9.71
		165 / 5825	9.32
	802.11ac20	149 / 5745	9.85
		157 / 5785	9.73
		165 / 5825	9.21
	802.11n40	142 / 5710	9.40
		151 / 5755	9.37
		159 / 5795	9.27
		142 / 5710	9.34
	802.11ac40	151 / 5755	6.07
		159 / 5795	6.20
		155 / 5775	6.12
		149 / 5745	6.21
	802.11ac80	157 / 5785	6.08
		165 / 5825	6.25

2.2.2. Bluetooth

Band	Mode	Channel / Freq (MHz)	Max. Declared Output Power (dBm)
Bluetooth	EDR	0 / 2402	10.0
		19 / 2440	10.0
		39 / 2480	10.0

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 EDR	10.0	10.0	112.0	2.402 - 2.480	0.14	√

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 EDR	10.0	10.0	112.0	2.48	0.02

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]	
835	41.55	0.91	41.29	0.90	-0.63	-0.84	2022-06-20
900	41.50	0.97	40.54	0.97	-2.31	0.07	2022-06-20
1750	40.07	1.37	39.23	1.35	-2.09	-1.51	2022-07-11
1800	40.00	1.40	39.01	1.40	-2.46	0.02	2022-07-11
1800	40.00	1.40	41.19	1.35	2.96	-3.32	2022-06-13
1900	40.00	1.40	40.72	1.42	1.81	1.42	2022-06-13
5800	35.30	5.27	33.69	5.12	-4.56	-2.91	2022-07-18

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 HSL900/MSL900

Water	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 HBBL1550-1900V3/MBBL1550-1900V3

Water	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

Water	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	Estimated SAR (W/kg)	SAR (W/kg)	1 W Target SAR (W/kg)	1 W Norm. SAR (W/kg)	Drift (%)
2022/06/20	900	1 gr.	2.87	2.79	11.10	11.16	0.54
		10 gr.	1.87	1.78	7.07	7.12	0.71
2022/06/13	1800	1 gr.	9.25	8.97	39.30	36.51	-7.11
		10 gr.	4.93	4.69	20.40	19.09	-6.44
2022/07/11	1800	1 gr.	9.95	9.76	39.30	38.95	-0.89
		10 gr.	5.29	5.14	20.40	20.51	0.55
2022/07/04	5800	1 gr.	7.80	8.08	81.90	80.80	-1.34
		10 gr.	2.11	2.30	22.80	23.00	0.88

5. MEASUREMENT RESULTS FOR SAR (SPECIFIC ABSORPTION RATE)

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

Mode	Side / Position	Antenna	Channel (Frequency)	Reported SAR 1-g (W/kg)	Limit SAR 1-g (W/kg)
GPRS 2 slots 850 MHz	Back face/15 mm	LTE3	CH 128 (824.2 MHz)	0.998	1.6
GPRS 4 slots 1900 MHz	Back face/15 mm	LTE3	CH 810 (1909.8 MHz)	0.749	1.6
WCDMA Band II	Back face/15 mm	LTE3	CH 9538 (1907.6 MHz)	0.555	1.6
WCDMA Band IV	Front face/15 mm	LTE3	CH 1512 (1752.6 MHz)	0.525	1.6
WCDMA Band V	Back face/15 mm	LTE3	CH 4233 (846.6 MHz)	0.613	1.6
WLAN U-NII-3	Bottom edge/10 mm	BT_WLAN2	CH 159 (5795.0 MHz)	0.118	1.6
Bluetooth EDR	112 mm	BT_WLAN2	Estimated SAR	0.02	1.6

5.2. Result for simultaneous multi-band transmission

.

Transmission Modes	Σ SARi (W/kg)	Limit SAR 1-g (W/kg)	Verdict
GPRS 850 MHz (LTE3)+Wi-Fi 5GHz (BT_WLAN 2)+BTLE (BT_WLAN 2)	1.136	1.6	Pass

5.3. Results for GPRS 850 MHz band – 2 slots

- LTE3 Antenna

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.
Front face	15	CH 190 (836.6 MHz	0.381	0.363	-2.389	2.570	0.933	
Back face	15	CH 190 (836.6 MHz	0.372	0.372	0.809	2.570	0.956	
Back face	15	CH 128 (824.2 MHz)	0.392	0.381	-0.917	2.618	0.998	1
Back face	15	CH 251 (848.8 MHz)	0.366	0.364	-0.574	2.729	0.993	

5.4. Results for GPRS 1900 MHz Band – 4 slots

- LTE3 Antenna

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.
Front face	15	CH 661 (1880 MHz)	0.102	0.099	-4.060	3.281	0.325	
Back face	15	CH 661 (1880 MHz)	0.119	0.120	1.274	3.281	0.394	
Back face	15	CH 512 (1850.2 MHz)	0.167	0.170	0.925	3.388	0.576	
Back face	15	CH 810 (1909.8 MHz)	0.209	0.211	0.346	3.548	0.749	2

5.5. Results for WCDMA Band II

- LTE3 Antenna

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.
Front face	15	CH 9262 (1852.4 MHz)	0.258	0.257	-0.230	1.462	0.376	
Back face	15	CH 9262 (1852.4 MHz)	0.258	0.257	-0.459	1.462	0.376	
Back face	15	CH 9400 (1880 MHz)	0.266	0.265	0.115	1.514	0.401	
Back face	15	CH 9538 (1907.6 MHz)	0.350	0.351	0.115	1.581	0.555	3

5.6. Results for WCDMA Band IV

- LTE3 Antenna

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.
Front face	15	CH 1512 (1752.6 MHz)	0.376	0.371	-0.803	1.416	0.525	4
Back face	15	CH 1512 (1752.6 MHz)	0.269	0.268	0.231	1.416	0.379	
Front face	15	CH 1312 (1712.4 MHz)	0.212	0.211	0.115	1.524	0.322	
Front face	15	CH 1412 (1732.6 MHz)	0.257	0.253	-0.115	1.452	0.367	

5.7. Results for WCDMA Band V

- LTE3 Antenna

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	15	CH 4132 (826.4 MHz)	0.383	0.378	0.231	1.416	0.535	
Back face	15	CH 4132 (826.4 MHz)	0.398	0.396	0.231	1.416	0.561	
Back face	15	CH 4183 (836.6 MHz)	0.379	0.379	0.231	1.452	0.550	
Back face	15	CH 4233 (846.6 MHz)	0.403	0.402	0.346	1.524	0.613	5

5.8. Results for 802.11 Bands.

- BT_WLAN2 Antenna

  - U-NII-3 Band

Position	Dist (mm)	Mode	CH	Freq (MHz)	Estimated SAR 1-g (W/kg)	SAR 1-g (W/kg)	Power Drift (%)	Duty Cycle (%)	Scale factor	Reported SAR 10-g (W/kg)	Plot No.
Front face	10	802.11a	149	5745	0.018	0.016	4.472	80	1.000	0.020	
Left edge	10	802.11a	149	5745	0.010	0.007	-3.061	80	1.000	0.009	
Right edge	10	802.11a	149	5745	0.010	0.006	3.395	80	1.000	0.008	
Top edge	10	802.11a	149	5745	0.030	0.030	0.346	80	1.000	0.038	
Bottom edge	10	802.11a	149	5745	0.041	0.038	-1.258	80	1.000	0.048	
Bottom edge	10	802.11n20	149	5745	0.038	0.037	0.693	80	1.000	0.046	
Bottom edge	10	802.11ac20	132	5660	0.043	0.041	1.508	80	1.000	0.051	
Bottom edge	10	802.11n40	134	5670	0.039	0.038	3.992	65	1.000	0.059	
Bottom edge	10	802.11ac40	159	5795	0.043	0.040	-1.145	65	1.901	0.118	6
Bottom edge	10	802.11ac80	155	5775	0.018	0.018	-3.728	48	1.884	0.072	
Bottom edge	10	802.11ac40	149	5745	0.016	0.015	0.809	65	1.963	0.044	
Bottom edge	10	802.11ac40	165	5825	0.022	0.019	-1.372	65	1.905	0.057	

5.9. 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.

As all measured SAR values are below these values, no Variability measurements are needed for this device.

Appendix C: Measurement report

Plot Nº1

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
TKCMOD12E00, HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH	115.0 x 20.0 x 0.5		Headunit

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	FRONT, 15.00	GSM 850	GSM, 10024-DAC	824.2, 128	6.12	0.890	41.4

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V4.0 (20deg probe tilt) - 1060	HSL900V2 - 2022-06-20 , --	ES3DV3 - SN3052, 2021-09-22	DAE4 Sn1690, 2021-09-08

Scan Setup

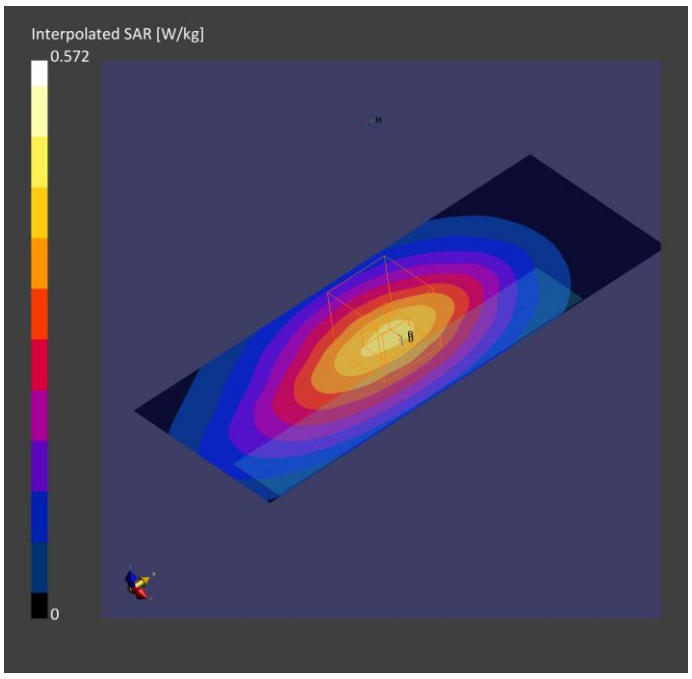
	Area Scan	Zoom Scan
Grid Extents [mm]	60.0 x 150.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	15.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	3.0
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-06-20, 11:21	2022-06-20, 11:28
psSAR1g [W/kg]	0.392	0.381
psSAR10g [W/kg]	0.262	0.254
Power Drift [dB]	-0.02	-0.02
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		89.0
Dist 3dB Peak [mm]		> 15.0

Warning(s) / Error(s)

Details	Area Scan	Zoom Scan
Warning(s)		
Error(s)		



Plot Nº2

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
TKCMOD12E00, HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH	115.0 x 20.0 x 0.5		Headunit

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 15.00	PCS 1900	GSM, 10028-DAC	1909.8, 810	5.28	1.43	40.7

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V4.0 (20deg probe tilt) - 1060	HBBL1550-1950V3-1900MHz-2022-06-13 , --	ES3DV3 - SN3052, 2021-09-22	DAE4 Sn1690, 2021-09-08

Scan Setup

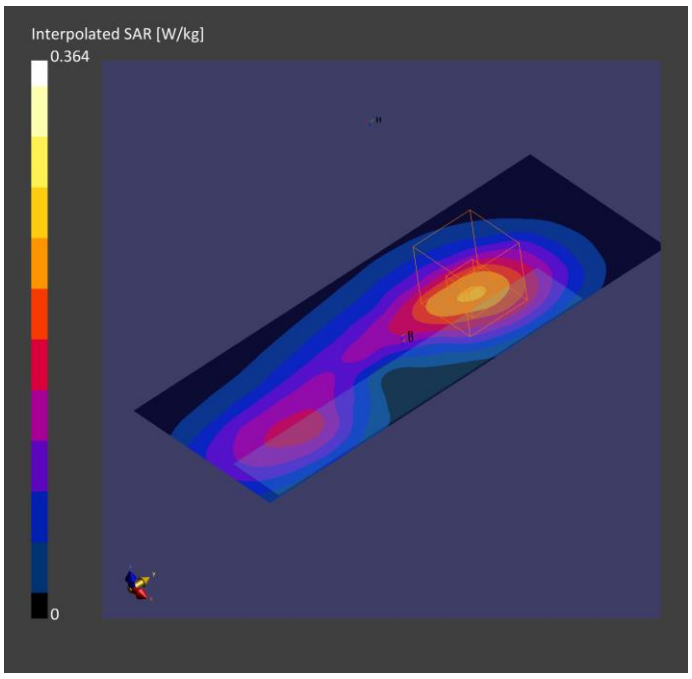
	Area Scan	Zoom Scan
Grid Extents [mm]	60.0 x 150.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	15.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	3.0
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	Y	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-06-13, 15:49	2022-06-13, 15:55
psSAR1g [W/kg]	0.209	0.211
psSAR10g [W/kg]	0.121	0.119
Power Drift [dB]	0.03	0.01
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		85.2
Dist 3dB Peak [mm]		14.8

Warning(s) / Error(s)

Details	Area Scan	Zoom Scan
Warning(s)		
Error(s)		



Plot Nº3

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
TKCMOD12E00, HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH	115.0 x 20.0 x 0.5		Headunit

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 15.00	Band 2, UTRA/FDD	WCDMA, 10011-CAB	1907.6, 9538	5.28	1.43	40.7

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V4.0 (20deg probe tilt) - 1060	HBBL1550-1950V3-1900MHz-2022-06-13 , --	ES3DV3 - SN3052, 2021-09-22	DAE4 Sn1690, 2021-09-08

Scan Setup

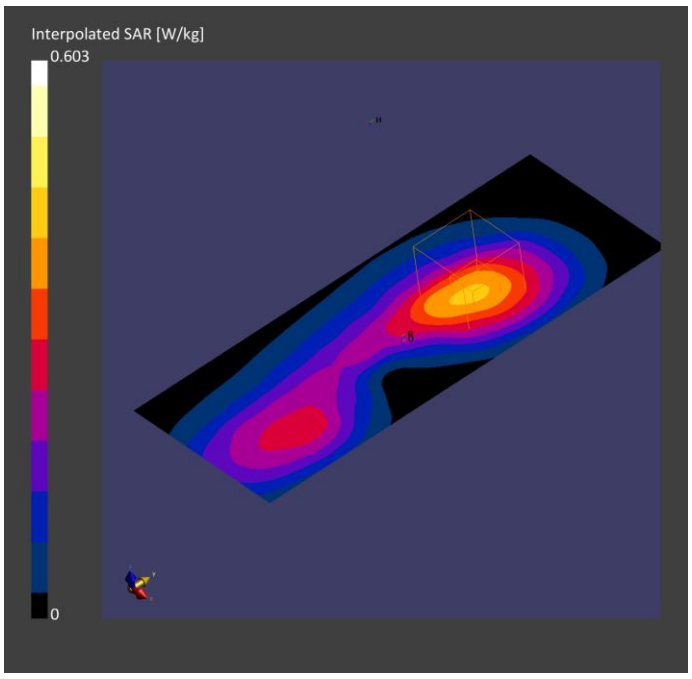
	Area Scan	Zoom Scan
Grid Extents [mm]	60.0 x 150.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	15.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	3.0
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-06-13, 15:31	2022-06-13, 15:37
psSAR1g [W/kg]	0.350	0.351
psSAR10g [W/kg]	0.203	0.199
Power Drift [dB]	0.03	0.01
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		85.3
Dist 3dB Peak [mm]		14.8

Warning(s) / Error(s)

Details	Area Scan	Zoom Scan
Warning(s)		
Error(s)		



Plot Nº4

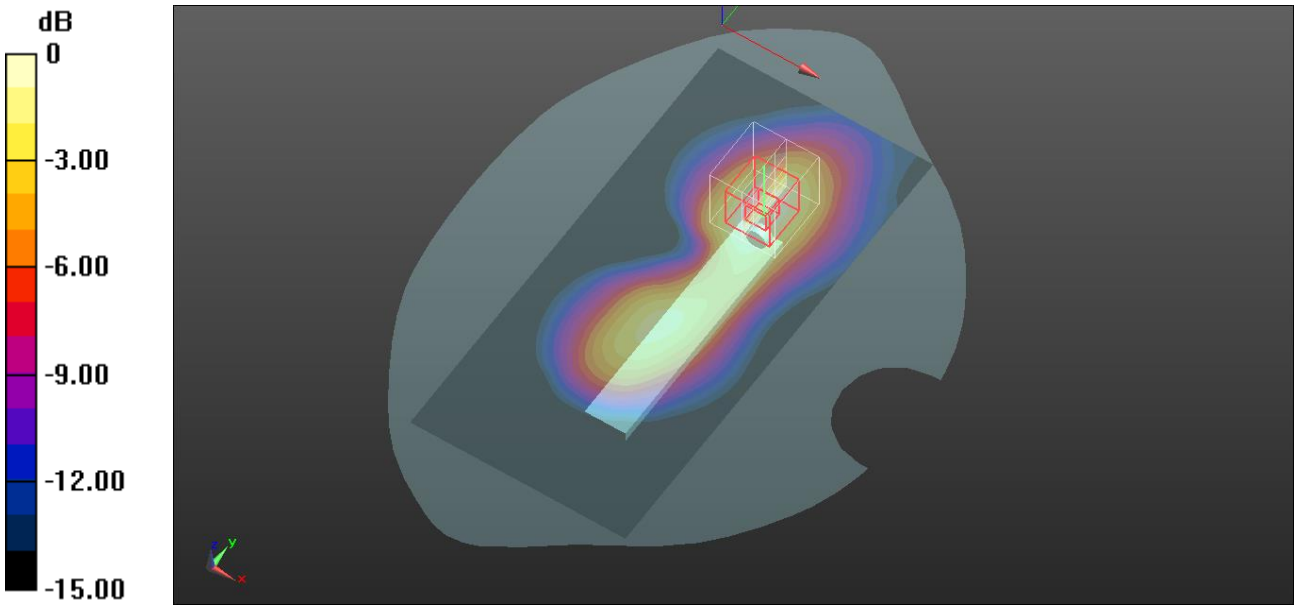
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 11/07/2022

DUT: Harman Conmod; Type: Headunit; Serial: V04519N109900005
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Frequency: 1752.6 MHz; Duty Cycle: 1:1.95434
Medium parameters used (interpolated): f = 1752.6 MHz; σ = 1.353 S/m; ε_r = 39.222; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(5.28, 5.28, 5.28) @ 1752.6 MHz; Calibrated: 22/09/2021
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1690; Calibrated: 08/09/2021
- Phantom: SAM head-body simulator ; Type: Twin SAM V4.0; Serial: ---
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Flat Phantom, d=15 mm, ANT LTE 3/WCDMA IV, High CH, Front Face/Area Scan (71x151x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.452 W/kg

Flat Phantom, d=15 mm, ANT LTE 3/WCDMA IV, High CH, Front Face/Zoom Scan (5x5x6)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=3mm
Reference Value = 14.10 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.592 W/kg
SAR(1 g) = 0.371 W/kg; SAR(10 g) = 0.217 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 15.1 mm
Ratio of SAR at M2 to SAR at M1 = 74.7%
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.448 W/kg



0 dB = 0.448 W/kg = -3.49 dBW/kg

Plot Nº5

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
TKCMOD12E00, HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH	115.0 x 20.0 x 0.5		Headunit

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 15.00	Band 5, UTRA/FDD	WCDMA, 10011-CAB	846.6, 4233	6.12	0.913	41.1

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V4.0 (20deg probe tilt) - 1060	HSL900V2 - 2022-06-20 , --	ES3DV3 - SN3052, 2021-09-22	DAE4 Sn1690, 2021-09-08

Scan Setup

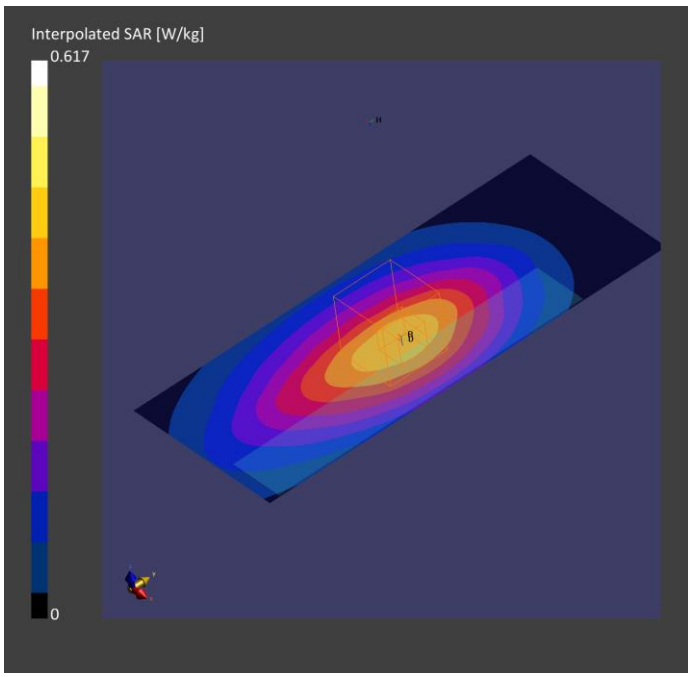
	Area Scan	Zoom Scan
Grid Extents [mm]	60.0 x 150.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	15.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	3.0
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-06-20, 13:17	2022-06-20, 13:23
psSAR1g [W/kg]	0.403	0.402
psSAR10g [W/kg]	0.271	0.265
Power Drift [dB]	0.01	0.02
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		87.9
Dist 3dB Peak [mm]		> 15.0

Warning(s) / Error(s)

Details	Area Scan	Zoom Scan
Warning(s)		
Error(s)		



Plot Nº6

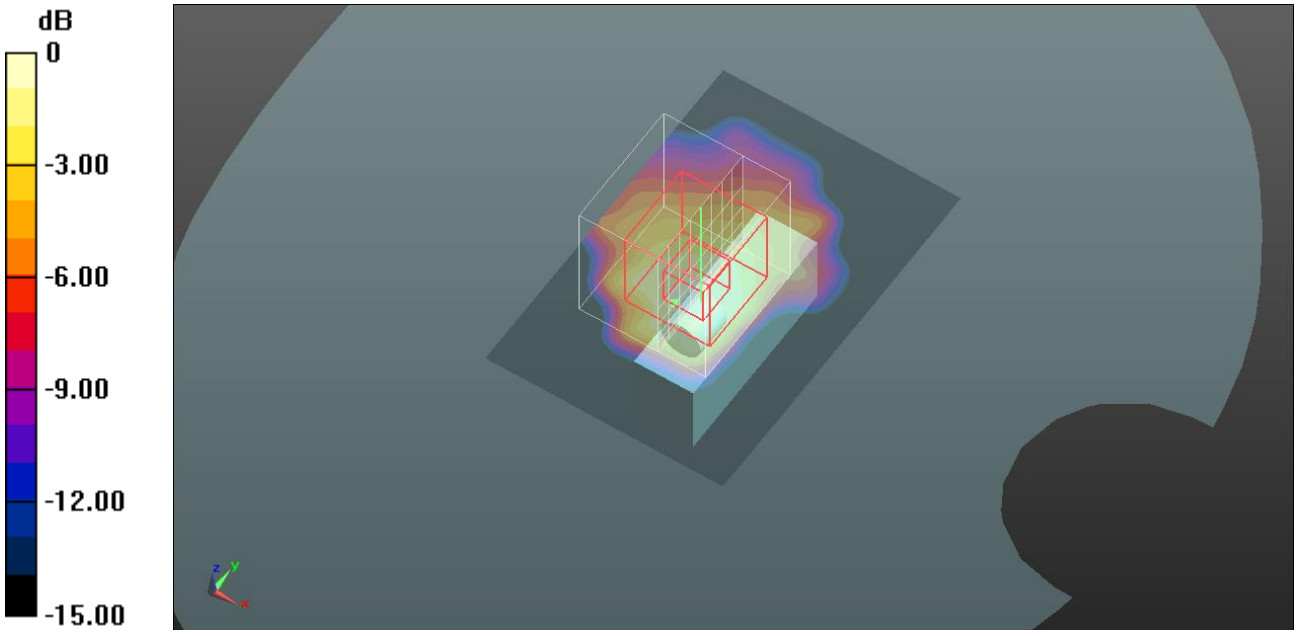
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 19/07/2022

DUT: Harman Conmod; Type: Headunit; Serial: V03799M250900006
Communication System: UID 10534 - AAC, IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle); Frequency: 5795 MHz; Duty Cycle: 1:7.00164
Medium parameters used (interpolated): f = 5795 MHz; σ = 5.115 S/m; ε_r = 33.697; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(5.15, 5.15, 5.15) @ 5795 MHz; Calibrated: 28/08/2020
- Sensor-Surface: 2mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 13/09/2021
- Phantom: SAM head-body simulator ; Type: Twin SAM V4.0; Serial: ---
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Flat Phantom, d=10 mm, 5800MHz/802.11ac40 , CH 159, Bottom edge/Area Scan (61x91x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0807 W/kg

Flat Phantom, d=10 mm, 5800MHz/802.11ac40 , CH 159, Bottom edge/Zoom Scan (9x9x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 3.952 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.151 W/kg
SAR(1 g) = 0.040 W/kg; SAR(10 g) = 0.015 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 62.4%
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0966 W/kg



0 dB = 0.0966 W/kg = -10.15 dBW/kg

Appendix D: System Validation Report

Validation results in 900 MHz Band for Head TSL

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
TKCMOD12E00, HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH	50.0 x 10.0 x 0.5		Dipole

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	,		, 0--	900.0, 0	6.12	0.970	40.5

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V4.0 (20deg probe tilt) - 1060	HSL900V2 - 2022-06-20 , --	ES3DV3 - SN3052, 2021-09-22	DAE4 Sn1690, 2021-09-08

Scan Setup

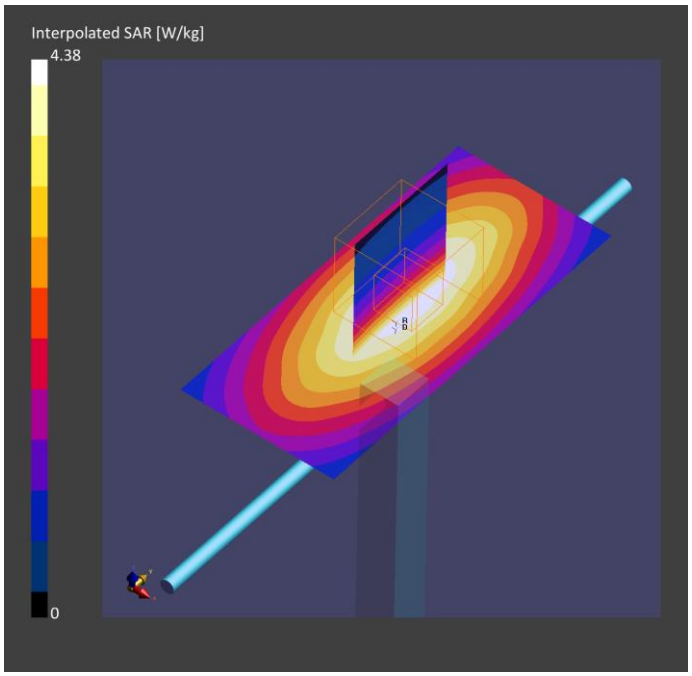
	Area Scan	Zoom Scan
Grid Extents [mm]	40.0 x 90.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	3.0
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-06-20, 10:19	2022-06-20, 10:24
psSAR1g [W/kg]	2.87	2.79
psSAR10g [W/kg]	1.87	1.78
Power Drift [dB]	0.02	0.01
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		88.1
Dist 3dB Peak [mm]		23.1

Warning(s) / Error(s)

Details	Area Scan	Zoom Scan
Warning(s)		
Error(s)		



Validation results in 1800 MHz Band for Head TSL

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
TKCMOD12E00, HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH	50.0 x 10.0 x 0.5		Dipole

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	,		, 0--	1800.0, 0	5.28	1.35	41.2

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V4.0 (20deg probe tilt) - 1060	HBBL1550-1950V3-1900MHz-2022-06-13 , --	ES3DV3 - SN3052, 2021-09-22	DAE4 Sn1690, 2021-09-08

Scan Setup

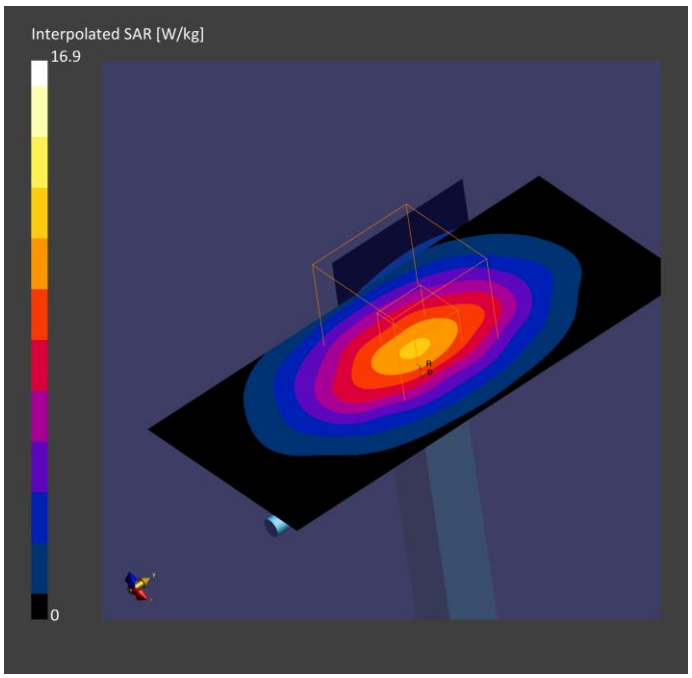
	Area Scan	Zoom Scan
Grid Extents [mm]	40.0 x 90.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 15.0	6.0 x 6.0 x 1.5
Sensor Surface [mm]	3.0	3.0
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2022-06-13, 11:09	2022-06-13, 11:14
psSAR1g [W/kg]	9.25	8.97
psSAR10g [W/kg]	4.93	4.69
Power Drift [dB]	0.01	0.00
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		83.9
Dist 3dB Peak [mm]		10.8

Warning(s) / Error(s)

Details	Area Scan	Zoom Scan
Warning(s)		
Error(s)		



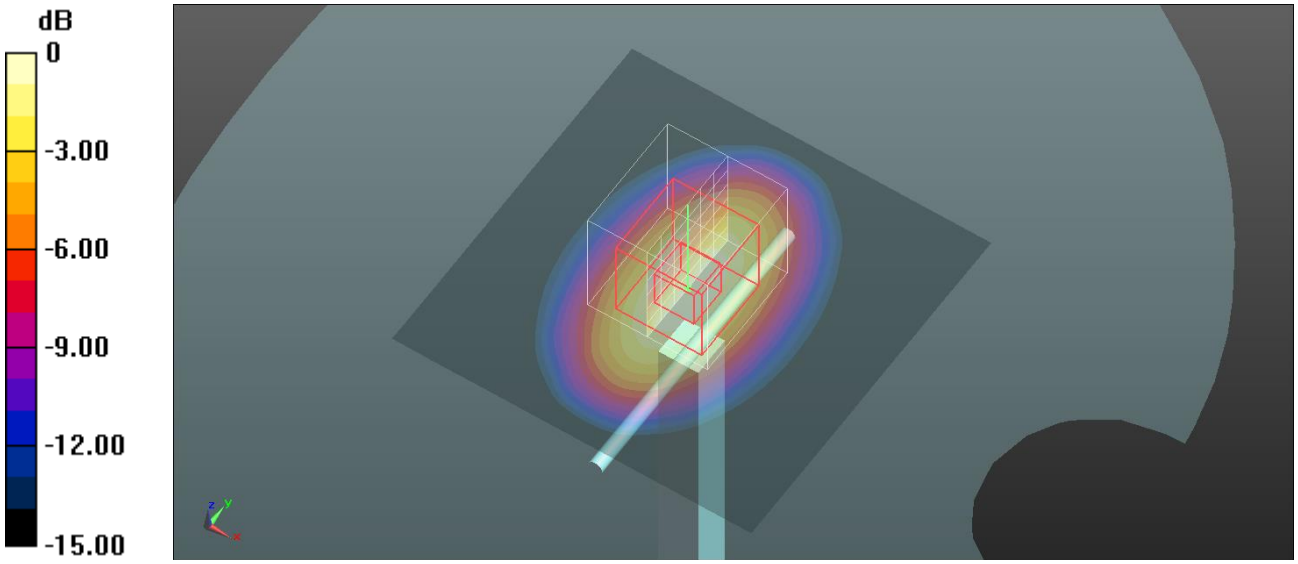
Validation results in 1800 MHz Band for Head TSL

Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 11/07/2022
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 = 1.4 S/m; ε_r = 39.01; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: ES3DV3 - SN3052; ConvF(5.28, 5.28, 5.28) @ 1800 MHz; Calibrated: 22/09/2021
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1690; Calibrated: 08/09/2021
- Phantom: SAM head-body simulator ; Type: Twin SAM V4.0; Serial: ---
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Configuration 1800MHz, 2022-07-11/d=10mm, Pin=250 mW/Area Scan (91x91x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 12.4 W/kg

Configuration 1800MHz, 2022-07-11/d=10mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.34 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 17.9 W/kg
SAR(1 g) = 9.76 W/kg; SAR(10 g) = 5.14 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 11 mm
Ratio of SAR at M2 to SAR at M1 = 55.4%
Maximum value of SAR (measured) = 12.5 W/kg



0 dB = 12.5 W/kg = 10.97 dBW/kg

Validation results in 5800 MHz Band for Head TSL

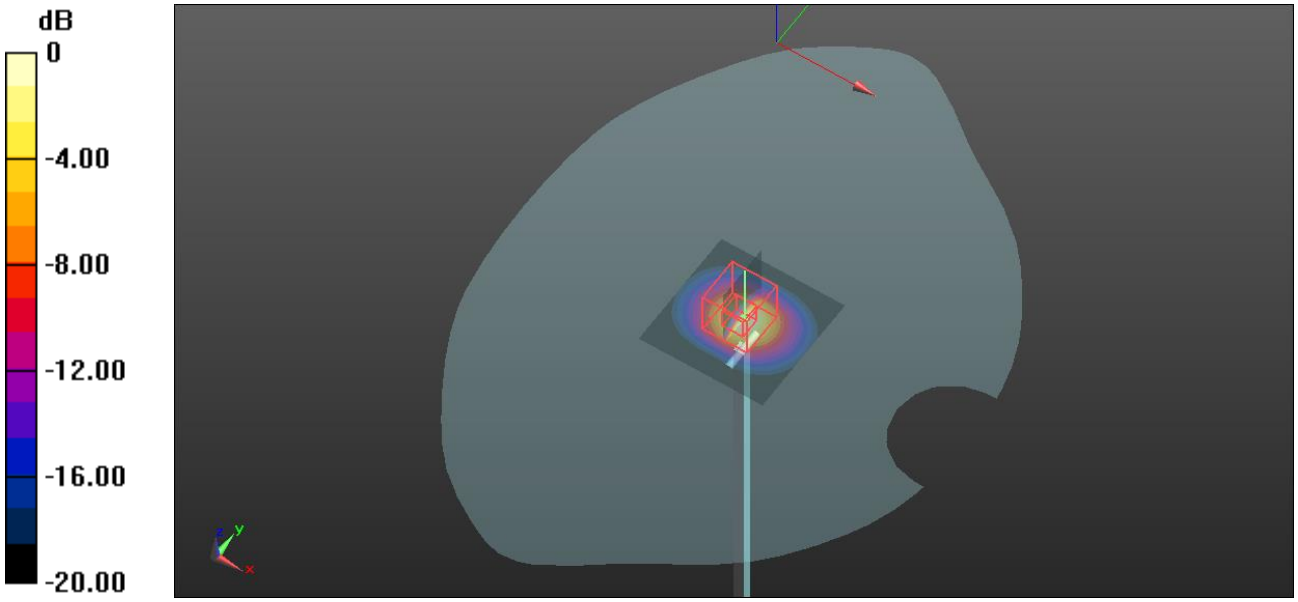
Test Laboratory: DEKRA Testing and Certification, S.A.U; Date: 18/07/2022

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 = 5.12 S/m; ε_r = 33.69; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
- Probe: EX3DV4 - SN7461; ConvF(5.15, 5.15, 5.15) @ 5800 MHz; Calibrated: 28/08/2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn669; Calibrated: 13/09/2021
- Phantom: SAM head-body simulator ; Type: Twin SAM V4.0; Serial: ---
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Configuration 5GHz, 2022-07-18/5800MHz, d=10mm, Pin=100 mW/Area Scan (61x61x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 22.2 W/kg

Configuration 5GHz, 2022-07-18/5800MHz, d=10mm, Pin=100 mW/Zoom Scan (8x8x8)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 49.30 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 35.5 W/kg
SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.3 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.1%
Maximum value of SAR (measured) = 20.4 W/kg



0 dB = 20.4 W/kg = 13.10 dBW/kg