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TEST REPORT

Report Reference No. ..... :	**TRE18070076**	R/C…….:	96660
FCC ID ..... :	**2AL9H-M7L**		
Applicant's name ..... :	**TR Controls Inc.**		
Address.....:	955 Green Valley Road, London city, Ontario Canada, N6N 1E4		
Manufacturer.....:	Positioning Universal		
Address.....:	4660 La Jolla Village Drive, Suite 1100, San Diego, CA92122		
Test item description ..... :	**M7 LTE Vehicle Telematics Unit**		
Trade Mark .....:	-		
Model/Type reference.....:	M7L		
Listed Model(s) .....:	-		
Standard ..... :	**FCC 47 CFR Part2.1093** **ANSI/IEEE C95.1: 1999**		
Date of receipt of test sample…….:	Jul.16,2018		
Date of testing……...:	Jul.20,2018- Jul.25,2018		
Date of issue…….:	Jul.26,2018		
Result..... ……..:	**PASS**		

Compiled by (position+printedname+signature)...:	File administrators:Xiaodong Zhao	Xiaodong Zhao
Supervised by (position+printedname+signature)...:	Test Engineer: Xiaodong Zhao	Xiaodong Zhao
Approved by (position+printedname+signature)...:	Manager: Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd**
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The test report merely correspond to the test sample.

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1 . Test Standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

FCC 47 Part 2.1093 Radiofrequency Radiation Exposure Evaluation:Portable Devices
IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
KDB 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 941225 D01 3G SAR Procedures v03r01: SAR Measurement Procedures for 3G Devices
KDB 941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

1.2. Report version

Revision No.	Date of issue	Description
N/A	2018-07-26	Original

2. Summary

2.1. Client Information

Applicant:	TR Controls Inc.
Address:	955 Green Valley Road, London city, Ontario Canada, N6N 1E4
Manufacturer:	Positioning Universal
Address:	4660 La Jolla Village Drive, Suite 1100, San Diego, CA92122

2.2. Product Description

Name of EUT:	M7 LTE Vehicle Telematics Unit			
Trade Mark:	-			
Model No.:	M7L			
Listed Model(s):	-			
Power supply:	DC 12V			
Device Category:	Portable			
Product stage:	Production unit			
RF Exposure Environment:	General Population / Uncontrolled			
Hardware version:	P2			
Software version:	20.00.524			
Maximum SAR Value				
Separation Distance:	Body: 0mm			
Max Report SAR Value (1g):	Test location:	PCB	Bluetooth	Simultaneous TX
	Body:	1.298 W/Kg	0.013 W/Kg	1.311 W/Kg
WCDMA				
Operation Band:	WCDMA Band II,WCDMA Band V			
Power Class:	Power Class 3			
Modulation Type:	QPSK/HSUPA/HSDPA			
DC-HSUPA Release Version:	Not Supported			
Antenna type:	integral			
LTE				
Operation Band:	FDD Band 2,FDD Band 4,FDD Band 5, FDD Band 12,FDD Band 13			
Modulation Type:	QPSK,16QAM			
Antenna type:	integral			

Bluetooth-BLE	
Version:	Supported BT4.0+BLE
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	integral
Remark: *1. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power*	

3. Test Environment

3.1. Test laboratory

Laboratory:Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

3.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 762235.

IC-Registration No.: 5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Cal.	Last Cal.
Data Acquisition Electronics DAEx	SPEAG	DAE4	1549	2018/04/25	2019/04/24
E-field Probe	SPEAG	EX3DV4	7494	2018/02/26	2019/02/25
System Validation Dipole	SPEAG	D750V3	1180	2018/02/07	2021/02/06
System Validation Dipole	SPEAG	D835V2	4d238	2018/02/19	2021/02/18
System Validation Dipole	SPEAG	D1750V2	1164	2018/02/06	2021/02/05
System Validation Dipole	SPEAG	D1900V2	5d226	2018/02/22	2021/02/21
Dielectric Assessment Kit	SPEAG	DAK-3.5	1267	2018/03/01	2019/02/28
Network analyzer	Agilent	N9923A	MY51491493	2017/09/05	2018/09/04
Universal Radio Communication Tester	ROHDE & SCHWARZ	CMW500	155690	2017/04/17	2018/04/16
Signal Generator	ROHDE & SCHWARZ	SMB100A	175248	2017/09/02	2018/09/01
Power meter	Agilent	N1914A	MY52090010	2018/03/22	2019/03/21
Power sensor	Agilent	E9304A	MY52140008	2018/03/22	2019/03/21
Power sensor	Agilent	E9301H	MY54470001	2018/03/22	2019/03/21
Power Amplifier	Mini-Circuits	ZHL-42W	QA1202003	2017/11/27	2018/11/26
Dual Directional Coupler	Agilent	778D	MY48220612	2018/03/22	2019/03/21

Note:

1. *The Probe,Dipole and DAE calibration reference to the Appendix A and B.*
2. *Referring to KDB865664 D01, the dipole calibration interval can be extended to 3 years with justifcatio. The dipole are also not physically damaged or repaired during the interval.*

5. Measurement Uncertainty

Measurement Uncertainty										
No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.0%	N	1	1	1	6.0%	6.0%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.90%	3.90%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.70%	2.70%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
7	RF ambient conditions-noise	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	RF ambient conditions-reflection	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Response time	B	0.80%	R	$\sqrt{3}$	1	1	0.50%	0.50%	∞
10	Integration time	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
11	RF ambient	B	3.00%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
12	Probe positioned mech. restrictions	B	0.40%	R	$\sqrt{3}$	1	1	0.20%	0.20%	∞
13	Probe positioning with respect to phantom shell	B	2.90%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
14	Max.SAR evalation	B	3.90%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
Test Sample Related										
15	Test sample positioning	A	1.86%	N	1	1	1	1.86%	1.86%	∞
16	Device holder uncertainty	A	1.70%	N	1	1	1	1.70%	1.70%	∞
17	Drift of output power	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
19	Liquid conductivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
20	Liquid conductivity (meas.)	A	0.50%	N	1	0.64	0.43	0.32%	0.26%	∞
21	Liquid permittivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
22	Liquid cpermittivity (meas.)	A	0.16%	N	1	0.64	0.43	0.10%	0.07%	∞
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	9.79%	9.67%	∞
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		R	K=2	/	/	19.57%	19.34%	∞

System Check Uncertainty										
No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.0%	N	1	1	1	6.0%	6.0%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.90%	3.90%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.70%	2.70%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
7	RF ambient conditions-noise	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	RF ambient conditions-reflection	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Response time	B	0.80%	R	$\sqrt{3}$	1	1	0.50%	0.50%	∞
10	Integration time	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
11	RF ambient	B	3.00%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
12	Probe positioned mech. restrictions	B	0.40%	R	$\sqrt{3}$	1	1	0.20%	0.20%	∞
13	Probe positioning with respect to phantom shell	B	2.90%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
14	Max.SAR evalation	B	3.90%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
System validation source-dipole										
15	Deviation of experimental dipole from numerical dipole	A	1.58%	N	1	1	1	1.58%	1.58%	∞
16	Dipole axis to liquid distance	A	1.35%	N	1	1	1	1.35%	1.35%	∞
17	Input power and SAR drift	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
20	Liquid conductivity (meas.)	A	0.50%	N	1	0.64	0.43	0.32%	0.26%	∞
22	Liquid cpermittivity (meas.)	A	0.16%	N	1	0.64	0.43	0.10%	0.07%	∞
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	8.80%	8.79%	∞
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		R	K=2	/	/	17.59%	17.58%	∞

6. SAR Measurements System Configuration

6.1. SAR Measurement Set-up

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

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

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronic (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.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

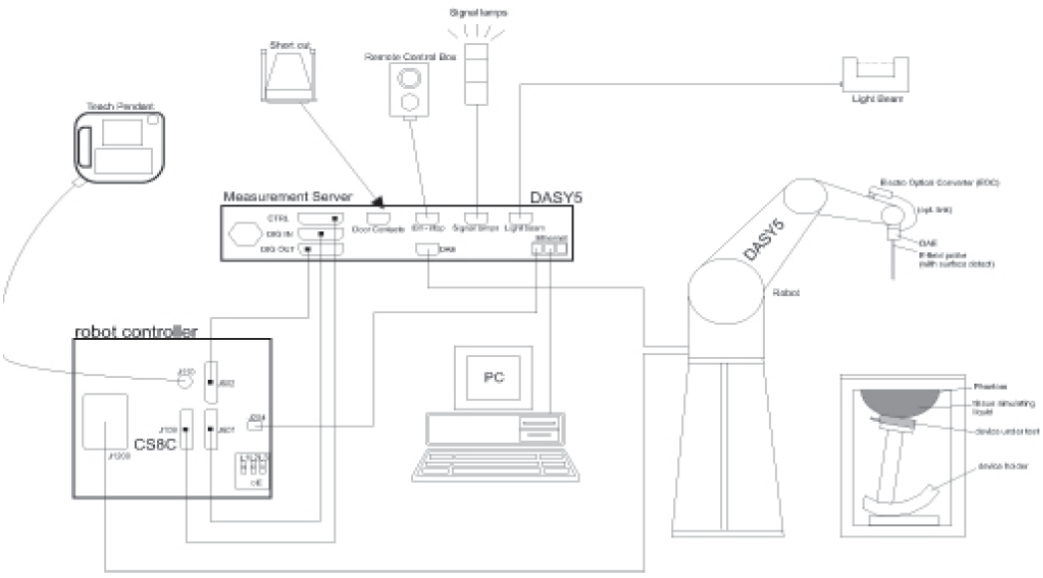
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld Mobile Phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



6.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

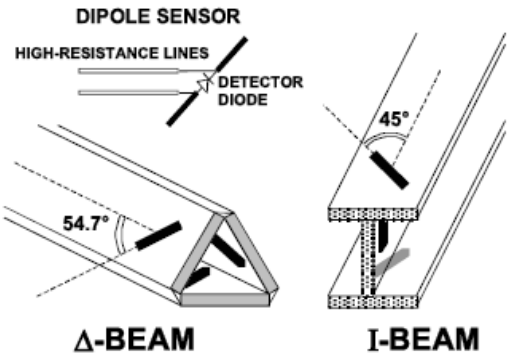
- **Probe Specification**

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	4 MHz to 10 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 W/kg; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 6 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

- **Isotropic E-Field Probe**

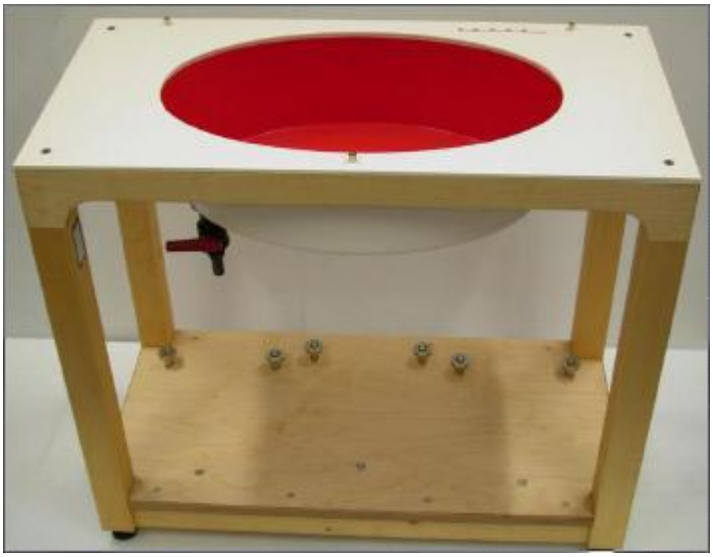
The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



6.3. Phantoms

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI isfully compatible with standard and all known tissuesimulating liquids. ELI has been optimized regarding its performance and can beintegrated into our standard phantom tables. A cover prevents evaporation ofthe liquid. Reference markings on the phantom allow installation of thecomplete setup, including all predefined phantom positions and measurementgrids, by teaching three points. The phantom is compatible with all SPEAGdosimetric probes and dipoles.



ELI4 Phantom

6.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

7. SAR Test Procedure

7.1. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v04

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm ± 1 mm	½·δ·ln(2) mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

7.2. Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors),s together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DA4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [W/kg], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	Sensitivity:	Normi, ai0, ai1, ai2
	Conversion factor:	ConvFi
	Diode compression point:	Dcpi
Device parameters:	Frequency:	f
	Crest factor:	cf
Media parameters:	Conductivity:	σ
	Density:	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

Vi: compensated signal of channel (i = x, y, z)
Ui: input signal of channel (i = x, y, z)
cf: crest factor of exciting field (DASY parameter)
dcpi: diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\mathrm{E-fieldprobes}: \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\mathrm{H-fieldprobes}: \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

Vi: compensated signal of channel (i = x, y, z)
Normi: sensor sensitivity of channel (i = x, y, z), [mV/(V/m)2] for E-field Probes
ConvF: sensitivity enhancement in solution
aij: sensor sensitivity factors for H-field probes
f: carrier frequency [GHz]
Ei: electric field strength of channel i in V/m
Hi: magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

SAR: local specific absorption rate in W/kg
Etot: total field strength in V/m
σ: conductivity in [mho/m] or [Siemens/m]
ρ: equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

8. Position of the wireless device in relation to the phantom

8.1. Body Position

For a device that can not be categorized as any of the other specific device types , it shall be considered to be a generic device;i.e. represented by a closed box incorporating at least one internal RF transmitter and antenna.
The SAR evaluation shall be performed for all surfaces of the DUT that are accessible during intended use, as indicated in Figure 4. The separation distance in testing shall correspond to the intended use distance as specified in the user instructions provided by the manufacturer.If the intended use is not specified, all surfaces of the DUT shall be tested directly against the flat phantom.
The surface of the generic device (or the surface of the carry accessory holding the DUT) pointing towards the flat phantom shall be parallel to the surface of the phantom.

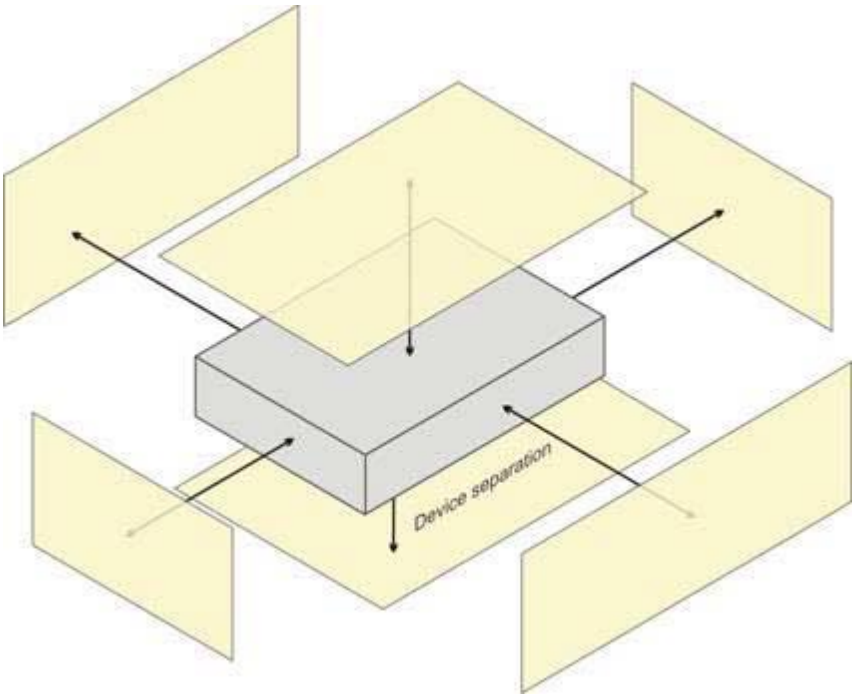


Figure 4 – Test positions for a generic device

9. System Check

9.1. Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.
It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

Tissue dielectric parameters for Body		
Target Frequency	Body	
(MHz)	εr	εr
750	55.5	0.96
835	55.2	55.2
1750	53.4	53.4
1800-2000	53.3	53.3

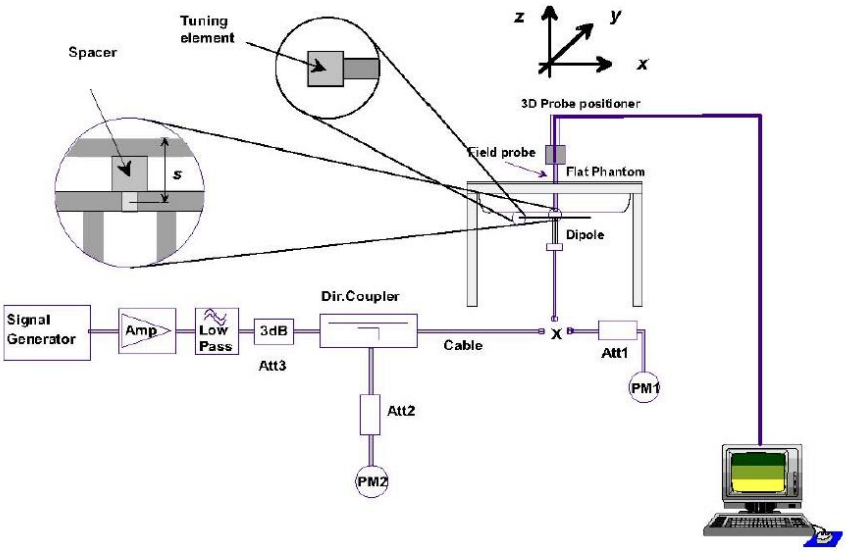
Check Result:

Dielectric performance of Body tissue simulating liquid									
Frequency (MHz)	εr		σ(s/m)		Delta (εr)	Delta (σ)	Limit	Temp (℃)	Date
	Target	Measured	Target	Measured					
750	55.50	55.63	0.96	0.94	0.23%	-2.60%	±10%	22	2018-07-25
835	55.20	55.40	0.97	0.97	0.36%	-0.41%	±10%	22	2018-07-20
1750	53.40	53.91	1.49	1.44	0.96%	-3.36%	±10%	22	2018-07-24
1900	53.30	53.72	1.52	1.55	0.79%	1.97%	±10%	22	2018-07-23

9.2. SAR System Check

The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10%).
System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



System Performance Check Setup

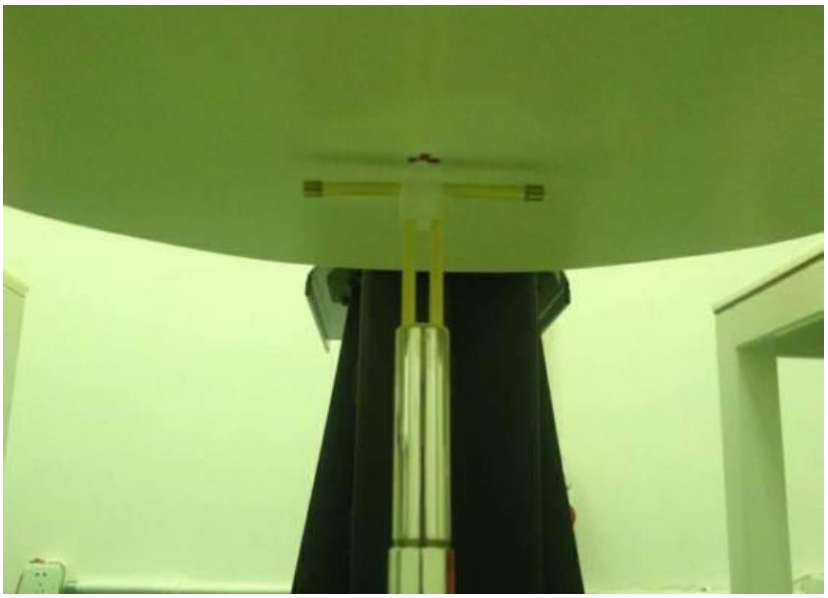


Photo of Dipole Setup

Check Result:

Body											
Frequency (MHz)	1g SAR			10g SAR			Delta (1g)	Delta (10g)	Limit	Temp (℃)	Date
	Target 1W	Normalize to 1W	Measured 250mW	Target 1W	Normalize to 1W	Measured 250mW					
750	8.55	8.40	2.10	5.68	5.60	1.40	-1.75%	-1.41%	±10%	22	2018-07-25
835	9.64	10.08	2.52	6.32	6.64	1.66	4.56%	5.06%	±10%	22	2018-07-20
1750	36.70	37.56	9.39	19.50	20.16	5.04	2.34%	3.38%	±10%	22	2018-07-24
1900	39.80	41.60	10.40	20.90	21.68	5.42	4.52%	3.73%	±10%	22	2018-07-23

Note:

1. the graph results see follow.

Plots of System Performance Check

System Performance Check-Body 750MHz

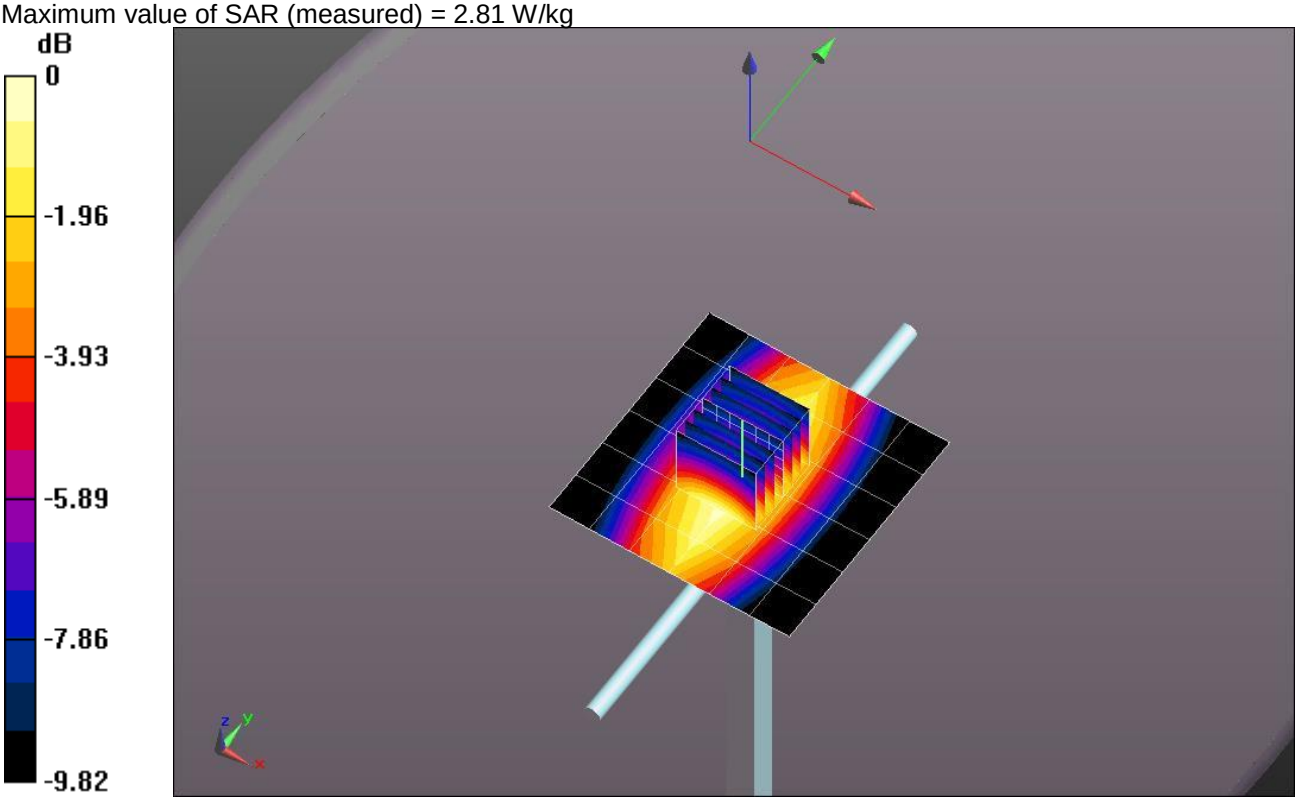
DUT: D750V3; Type: D750V3; Serial: 1180
Date: 2018-07-25
Communication System: UID 0, CW (0); Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.935 S/m; ε_r = 55.625; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494;ConvF(10.87, 10.87, 10.87); Calibrated: 2/26/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.0(1446); SEMCAD X 14.6.11(7437)

Body/d=15mm,Pin=250mW/Area Scan (41x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.80 W/kg

Body/d=15mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.06 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.4 W/kg
Maximum value of SAR (measured) = 2.81 W/kg



0 dB = 1.10 W/kg = 0.41 dBW/kg

System Performance Check-Body 835MHz

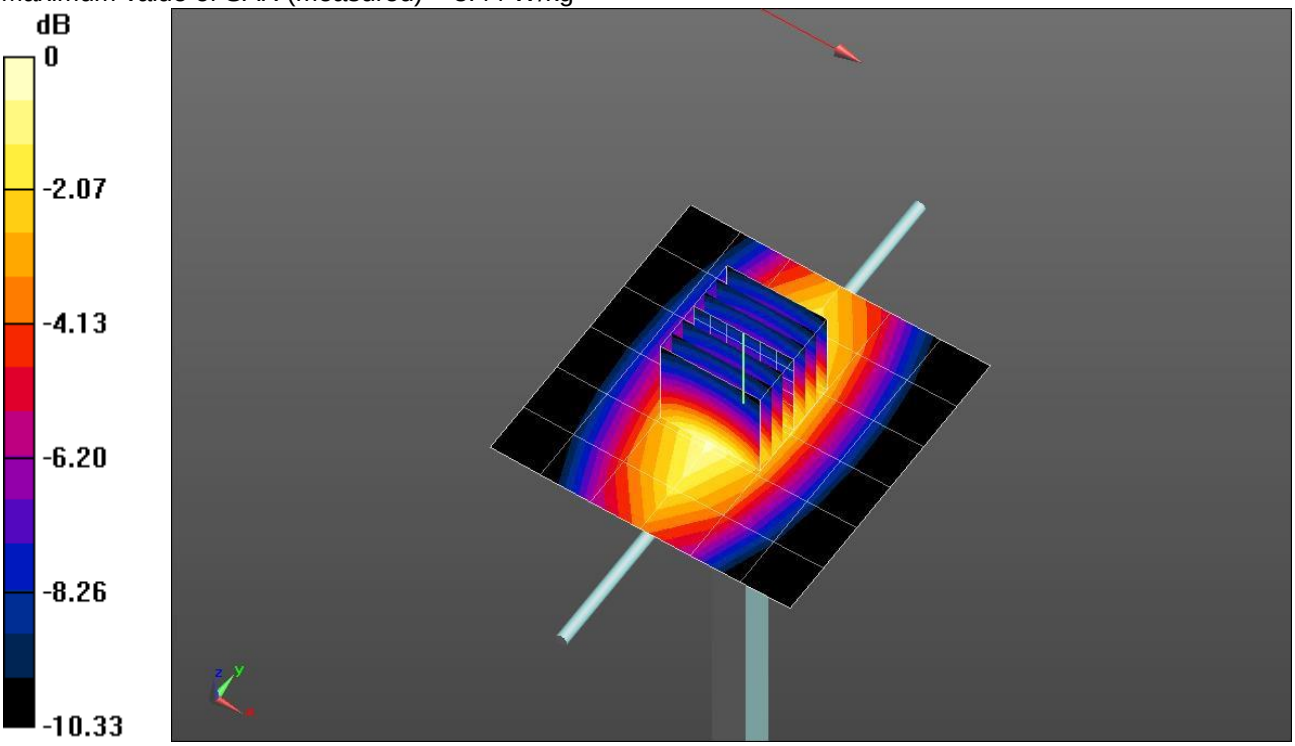
DUT: D835V2; Type: D835V2; Serial: 4d238
Date: 2018-07-20
Communication System: UID 0, CW (0); Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.966 S/m; ε_r = 55.403; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.5, 10.5, 10.5); Calibrated: 2/26/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Body/d=15mm,Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.40 W/kg

Body/d=15mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 61.67 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.97 W/kg
SAR(1 g) = 2.52 W/kg; SAR(10 g) = 1.66 W/kg
Maximum value of SAR (measured) = 3.44 W/kg



0 dB = 1.23 W/kg = 0.90 dBW/kg

System Performance Check-Body 1750MHz

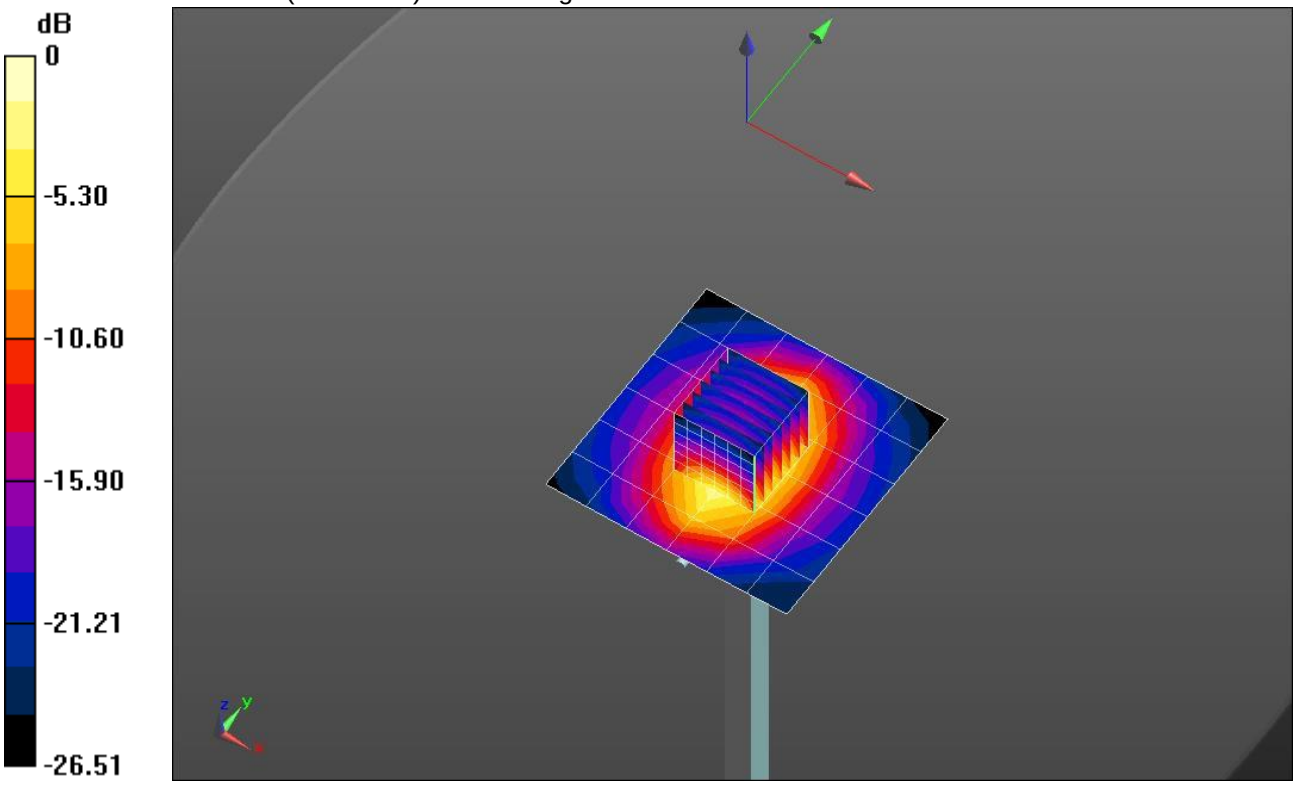
DUT: D1750V2; Type: D1750V2; Serial: 1164
Date: 2018-07-24
Communication System: UID 0, CW (0); Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.441 S/m; ε_r = 53.908; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.77, 8.77, 8.77); Calibrated: 2/26/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Body/d=10mm,Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.7 W/kg

Body/d=10mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 102.2 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 16.8 W/kg
SAR(1 g) = 9.39 W/kg; SAR(10 g) = 5.04 W/kg
Maximum value of SAR (measured) = 14.1 W/kg



0 dB = 5.20 W/kg = 7.16 dBW/kg

System Performance Check-Body 1900MHz

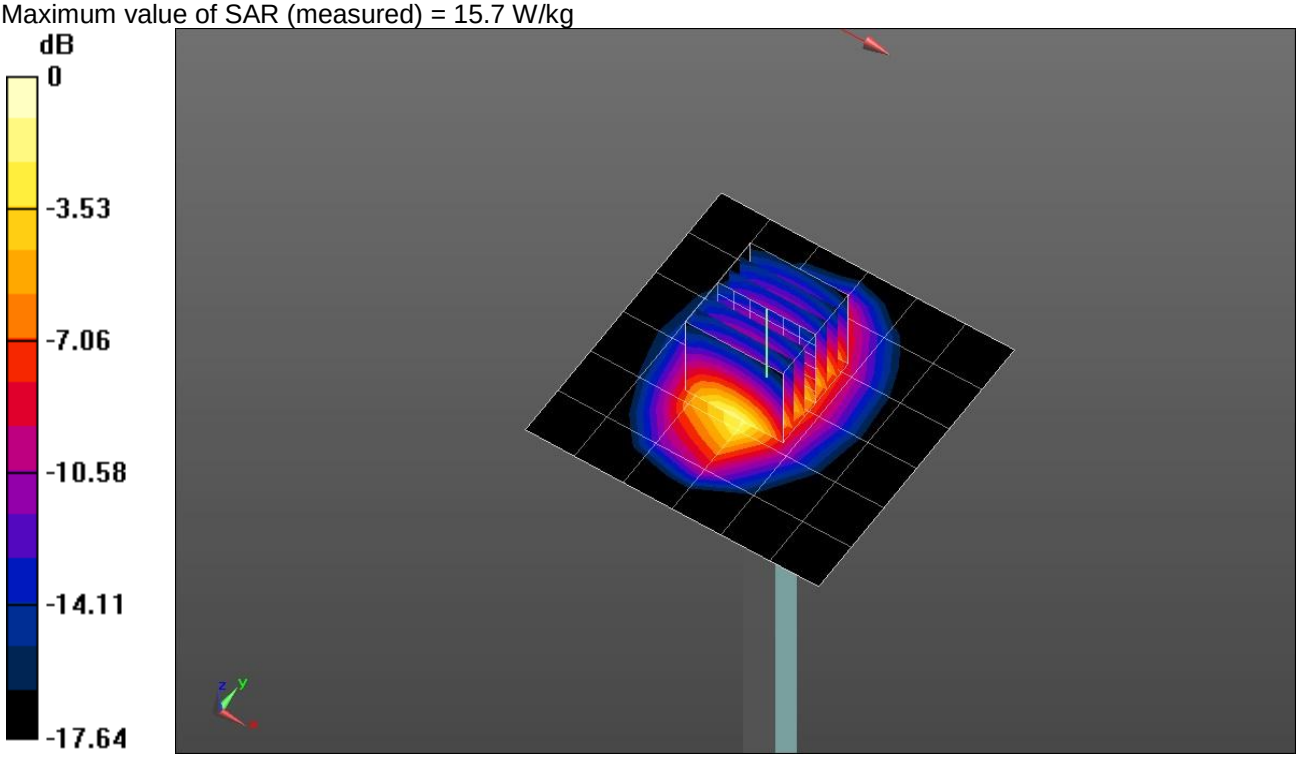
DUT: D1900V2; Type: D1900V2; Serial: 5d226
Date:2018-07-23
Communication System: UID 0, CW (0); Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.553 S/m; ε_r = 53.719; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.42, 8.42, 8.42); Calibrated: 2/26/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Body/d=10mm,Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 16.4 W/kg

Body/d=10mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 105.9 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 18.9 W/kg
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.42 W/kg
Maximum value of SAR (measured) = 15.7 W/kg



0 dB = 5.46 W/kg = 7.37 dBW/kg

10. SAR Exposure Limits

SAR assessments have been made in line with the requirements of ANSI/IEEE C95.1-1992

Type Exposure	Limit (W/kg)	
	General Population / Uncontrolled Exposure Environment	Occupational / Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (1g cube tissue for head and trunk)	1.6	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

Population/Uncontrolled Environments: are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

11. Conducted Power Measurement Results

WCDMA Conducted Power

1. *The following tests were conducted according to the test requirements outlines in 3GPP TS34.121 specification.*
2. *The procedures in KDB 941225 D01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode to determine SAR test exclusion*

A summary of thest setting are illustrated belowe:

HSDPA Setup Configureation:

a) The EUT was connected to base station RS CMU200 referred to the setup configuration
b) The RF path losses were compensated into the measurements
c) A call was established between EUT and base station with following setting:
   i. Set Gain Factors (βc and βd) and parameters were set according to each specific sub-test in the following table, C10.1.4, Quoted from the TS 34.121
   ii. Set RMC 12.2Kbps + HSDPA mode
   iii. Set Cell Power=-86dBm
   iv. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   v. Select HSDPA uplink parameters
   vi. Set Delta ACK, Delta NACK and Delta CQI=8
   vii. Set Ack-Nack repetition Factor to 3
   viii. Set CQI Feedback Cycle (K) to 4ms
   ix. Set CQI repetition factor to 2
   x. Power ctrl mode= all up bits
d) The transmitter maximum output power waw recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configureation:

a) The EUT was connected to base station RS CMU200 referred to the setup configuration
b) The RF path losses were compensated into the measurements
c) A call was established between EUT and base station with following setting:
   i. Call configs = 5.2b, 5.9b, 5.10b, and 5.13.2B with QPSK
   ii. Set Gain Factors (βc and βd) and parameters (AG index) were set according to each specific sub-test in the following table, C11.1.3, Quoted from the TS 34.121
   iii. Set Cell Power=-86dBm
   iv. Set channel type= 12.2Kbps + HSPA mode
   v. Set UE Target power
   vi. Set Ctrl mode=Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal the target E-TFCI of 75 for Sub-test 1, and other subtest's E-TFCI
d) The transmitter maximum output power waw recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

General Note:

1. Per KDB 941225 D01, SAR for Head / Hotsport / Body-worn Exposure is measured using a 12.2Kbps RMC with TPC bit ocnfigured to all 1s
2. Per KDB 941225 D01 RMC12.2Kbps setting is used to evaluate SAR. If the maximum output power and Tune-up tolerance specified for production units in HSDPA/HSUPA is ≦1/4dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio fo specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC 12.2Kbps and the adjusted SAR is ≦1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA.

Mode		WCDMA Band II			WCDMA Band V		
		Conducted Power (dBm)			Conducted Power (dBm)		
		CH9262	CH9400	CH9538	CH4132	CH4183	CH4233
		1852.4	1880.0	1907.6	826.4	836.6	846.6
AMR 12.2K		21.04	21.21	21.56	22.72	22.28	22.56
RMC 12.2K		21.40	21.36	21.16	22.40	22.36	22.29
HSDPA	Subtest-1	21.16	21.09	20.98	22.18	22.16	22.11
	Subtest-2	21.67	21.38	21.96	21.72	21.52	21.71
	Subtest-3	21.94	21.02	21.33	21.83	21.77	22.98
	Subtest-4	21.55	21.51	21.98	21.56	21.55	21.29
HSUPA	Subtest-1	21.28	21.14	20.99	22.72	22.28	22.56
	Subtest-2	21.52	21.97	21.72	22.09	22.79	21.86
	Subtest-3	21.52	21.78	21.48	22.42	21.13	22.09
	Subtest-4	21.47	21.30	21.27	21.89	21.26	21.08
	Subtest-5	21.67	21.22	21.35	22.04	21.88	22.31

LTE Conducted Power

General Note:

1. CMW500 base station simulator was used to setup the connection with EUT; the frequency band, channel,bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUTtransmitting at maximum power and at different configurations which are requested to be reported to FCC, forconducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and powermeasurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RBallocation, using the RB offset and required test channel combination with the highest maximum output power for RBoffsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximumoutput power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations andthe highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highestoutput power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also betested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than thesame configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, smaller bandwidth output power for each RB allocation configuration is > not ½ dBhigher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supportedbandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

LTE-FDD Band 2				Actual output Power (dBm)		
Band-width	Modulation	RB allocation	RB offset	Low	Middle	High
1.4	QPSK	1	0	21.93	21.26	21.92
			2	21.07	21.94	21.26
			5	21.06	21.54	21.64
		3	0	21.08	21.70	21.55
			1	21.17	21.66	21.73
			3	21.71	21.44	21.71
		6	0	21.59	21.07	21.72
	16QAM	1	0	21.90	21.59	21.45
			2	21.78	21.36	21.19
			5	21.40	21.70	21.72
		3	0	21.36	21.72	21.58
			1	21.31	21.87	21.41
			3	21.31	21.70	21.69
		6	0	21.09	21.80	21.66
3	QPSK	1	0	21.47	21.98	21.61
			8	21.08	21.20	21.82
			14	21.66	21.89	21.76
		8	0	21.43	21.97	21.07
			4	21.24	21.63	21.99
			7	21.87	21.73	21.02
		15	0	21.41	21.42	21.41
	16QAM	1	0	21.33	21.76	21.61
			8	21.98	21.87	21.29
			14	21.60	21.28	21.04
		8	0	21.20	21.11	21.85
			4	21.83	21.55	21.28
			7	21.29	21.04	21.99
		15	0	21.29	21.17	21.60

5	QPSK	1	0	21.76	21.30	21.77
			12	21.45	21.66	21.81
			24	21.64	21.10	21.26
		12	0	21.24	21.99	21.86
			6	21.24	21.64	21.25
			13	21.65	21.25	21.03
		25	0	21.69	21.14	21.11
	16QAM	1	0	21.28	21.19	21.08
			12	21.11	21.41	21.49
			24	21.27	21.53	21.04
		12	0	21.24	21.56	21.66
			6	21.95	21.64	21.99
			13	21.90	21.60	21.31
		25	0	21.62	21.66	21.32
10	QPSK	1	0	21.11	21.24	21.06
			24	21.31	21.04	21.46
			49	21.82	21.14	21.90
		25	0	21.77	21.19	21.16
			12	21.75	21.71	21.04
			25	21.98	21.66	21.03
		50	0	21.92	21.18	21.52
	16QAM	1	0	21.14	21.42	21.02
			24	21.47	21.46	21.74
			49	21.97	21.68	21.29
		25	0	21.35	21.13	21.80
			12	21.46	21.91	21.38
			25	21.33	21.75	21.95
		50	0	21.02	21.00	21.45

15	QPSK	1	0	21.53	21.72	21.99
			38	21.90	21.34	21.47
			74	21.74	21.11	21.96
		38	0	21.33	21.98	21.73
			18	21.01	21.49	21.72
			37	21.34	21.16	21.30
		75	0	21.44	21.96	21.60
	16QAM	1	0	21.19	21.40	21.38
			38	21.72	21.12	21.35
			74	21.69	21.59	21.39
		38	0	21.86	21.56	21.38
			18	21.64	21.75	21.37
			37	21.71	21.85	21.12
		75	0	21.72	21.99	21.76
20	QPSK	1	0	21.13	21.93	21.09
			49	21.94	21.02	21.81
			99	21.19	21.66	21.05
		50	0	21.25	21.57	21.29
			25	21.99	21.91	21.31
			50	21.46	21.21	21.89
		100	0	21.72	21.86	21.17
	16QAM	1	0	21.11	21.39	21.25
			49	21.31	21.82	21.25
			99	21.80	21.79	21.03
		50	0	21.93	21.26	21.87
			25	21.04	21.70	21.11
			50	21.79	21.33	21.13
		100	0	21.66	21.25	21.20

LTE-FDD Band 4				Actual output Power (dBm)		
Band-width	Modulation	RB allocation	RB offset	Low	Middle	High
1.4	QPSK	1	0	21.59	21.24	21.20
			2	21.13	21.71	21.09
			5	21.10	21.22	21.70
		3	0	21.72	21.43	21.59
			1	21.28	21.63	21.78
			3	21.23	21.64	21.43
		6	0	21.79	21.46	21.30
	16QAM	1	0	21.81	21.90	21.65
			2	21.90	21.78	21.73
			5	21.82	21.44	21.05
		3	0	21.81	21.35	21.05
			1	21.74	21.19	21.92
			3	21.84	21.42	21.20
		6	0	21.77	21.72	21.30
3	QPSK	1	0	21.70	21.29	21.19
			8	21.65	21.68	21.09
			14	21.65	21.56	21.43
		8	0	21.36	21.46	21.52
			4	21.32	21.27	21.98
			7	21.02	21.63	21.59
		15	0	21.77	21.60	21.86
	16QAM	1	0	21.23	21.14	21.89
			8	21.28	21.71	21.09
			14	21.98	21.71	21.31
		8	0	21.29	21.10	21.26
			4	21.33	21.72	21.54
			7	21.23	21.08	21.62
		15	0	21.95	21.82	21.07

5	QPSK	1	0	21.69	21.75	21.26
			12	21.51	21.70	21.92
			24	21.91	21.43	21.50
		12	0	21.12	21.01	21.42
			6	21.83	21.45	21.70
			13	21.81	21.90	21.17
		25	0	21.61	21.57	21.05
	16QAM	1	0	21.35	21.90	21.77
			12	21.27	21.98	21.13
			24	21.50	21.47	21.75
		12	0	21.40	21.60	21.65
			6	21.15	21.02	21.50
			13	21.55	21.87	21.43
		25	0	21.98	21.72	21.73
10	QPSK	1	0	21.46	21.58	21.66
			24	21.77	21.83	21.44
			49	21.17	21.91	21.64
		25	0	21.95	21.93	21.49
			12	21.61	21.28	21.21
			25	21.89	21.17	21.97
		50	0	21.58	21.66	21.03
	16QAM	1	0	21.41	21.58	21.30
			24	21.58	21.22	21.27
			49	21.11	21.95	21.02
		25	0	21.52	21.80	21.37
			12	21.11	21.45	21.85
			25	21.65	21.35	21.81
		50	0	21.26	21.33	21.75

15	QPSK	1	0	21.79	21.97	21.14
			38	21.87	21.39	21.16
			74	21.11	21.23	21.08
		38	0	21.57	21.53	21.22
			18	21.09	21.58	21.39
			37	21.40	21.02	21.15
		75	0	21.10	21.21	21.94
	16QAM	1	0	21.11	21.49	21.29
			38	21.97	21.77	21.36
			74	21.13	21.94	21.20
		38	0	21.36	21.80	21.79
			18	21.09	21.11	21.12
			37	21.12	21.68	21.44
		75	0	21.07	21.33	21.98
20	QPSK	1	0	21.89	21.06	21.04
			49	21.53	21.11	21.25
			99	21.63	21.15	21.02
		50	0	21.33	21.20	21.82
			25	21.39	21.88	21.36
			50	21.92	21.18	21.38
		100	0	21.69	21.34	21.56
	16QAM	1	0	21.16	21.21	21.16
			49	21.54	21.82	21.35
			99	21.23	21.49	21.22
		50	0	21.68	21.96	21.76
			25	21.31	21.39	21.14
			50	21.15	21.08	21.37
		100	0	21.66	21.03	21.61

LTE-FDD Band 5				Actual output Power (dBm)		
Band-width	Modulation	RB allocation	RB offset	Low	Middle	High
1.4	QPSK	1	0	21.26	21.48	21.22
			2	21.49	21.02	21.95
			5	21.43	21.45	21.22
		3	0	21.88	21.73	21.13
			1	21.83	21.53	21.00
			3	21.85	21.06	21.92
		6	0	21.85	21.69	21.68
	16QAM	1	0	21.68	21.04	21.50
			2	21.97	21.88	21.69
			5	21.85	21.51	21.52
		3	0	21.25	21.46	21.63
			1	21.60	21.04	21.62
			3	21.14	21.71	21.54
		6	0	21.36	21.40	21.07
3	QPSK	1	0	21.43	21.13	21.30
			8	21.48	21.46	21.43
			14	21.81	21.40	21.15
		8	0	21.32	21.95	21.06
			4	21.48	21.88	21.10
			7	21.54	21.14	21.71
		15	0	21.68	21.19	21.10
	16QAM	1	0	21.15	21.85	21.02
			8	21.18	21.88	21.36
			14	22.00	21.38	21.28
		8	0	21.57	21.87	21.18
			4	21.02	21.26	21.54
			7	21.03	21.68	21.42
		15	0	21.65	21.65	21.11

5	QPSK	1	0	21.93	21.74	21.22
			12	21.64	21.77	21.11
			24	21.37	21.19	21.47
		12	0	21.26	21.60	21.90
			6	21.59	21.59	21.34
			13	21.37	21.51	21.76
		25	0	21.11	21.59	21.36
	16QAM	1	0	21.74	21.64	21.74
			12	21.06	21.53	21.96
			24	21.39	21.17	21.61
		12	0	21.99	21.28	21.29
			6	21.88	21.43	21.46
			13	21.59	21.55	21.65
		25	0	21.93	21.43	21.43
10	QPSK	1	0	21.16	21.43	21.87
			24	21.67	21.68	21.85
			49	21.20	21.27	21.65
		25	0	21.64	21.92	21.68
			12	21.39	21.60	21.57
			25	21.04	21.68	21.28
		50	0	21.96	21.17	21.98
	16QAM	1	0	21.93	21.87	21.31
			24	21.16	21.63	21.11
			49	21.53	21.62	21.72
		25	0	21.62	21.37	21.90
			12	21.50	21.73	21.48
			25	21.97	21.29	21.43
		50	0	21.54	21.21	21.42

LTE-FDD Band 12				Actual output Power (dBm)		
Band-width	Modulation	RB allocation	RB offset	Low	Middle	High
1.4	QPSK	1	0	21.26	21.18	21.18
			2	21.90	21.20	21.39
			5	21.20	21.16	21.33
		3	0	21.98	21.61	21.71
			1	21.04	21.44	21.60
			3	21.38	21.05	21.09
		6	0	21.17	21.67	21.59
	16QAM	1	0	21.19	21.90	21.11
			2	21.71	21.16	21.74
			5	21.41	21.29	21.92
		3	0	21.77	21.28	21.04
			1	21.40	21.92	21.83
			3	21.09	21.83	21.27
		6	0	21.39	21.44	21.05
3	QPSK	1	0	21.06	21.08	21.50
			8	21.63	21.83	21.69
			14	21.92	21.51	21.71
		8	0	21.11	21.42	21.02
			4	21.38	21.86	21.51
			7	21.80	21.83	21.99
		15	0	21.73	21.65	21.50
	16QAM	1	0	21.98	21.53	21.87
			8	21.13	21.31	21.60
			14	21.86	21.66	21.71
		8	0	21.10	21.27	21.46
			4	21.89	21.44	21.27
			7	21.35	21.46	21.29
		15	0	21.71	21.89	21.03

5	QPSK	1	0	21.92	21.98	21.19
			12	21.17	21.85	21.10
			24	21.17	21.70	21.87
		12	0	21.34	21.80	21.57
			6	21.21	21.57	21.90
			13	21.63	21.25	21.09
		25	0	21.39	21.57	21.07
	16QAM	1	0	21.49	21.41	21.68
			12	21.40	21.42	21.93
			24	21.62	21.12	21.37
		12	0	21.25	21.00	21.80
			6	21.07	21.98	21.37
			13	21.04	21.35	21.78
		25	0	21.84	21.57	21.03
10	QPSK	1	0	21.54	21.03	21.47
			24	21.91	21.08	21.45
			49	21.62	21.28	21.10
		25	0	21.35	21.63	21.29
			12	21.93	21.48	21.25
			25	21.04	21.39	21.22
		50	0	21.83	21.03	21.02
	16QAM	1	0	21.31	21.83	21.17
			24	21.47	21.83	21.83
			49	21.43	21.04	21.26
		25	0	21.94	21.57	21.87
			12	21.69	21.63	21.86
			25	21.83	21.09	21.47
		50	0	21.71	21.40	21.15

LTE-FDD Band 13				Actual output Power (dBm)		
Band-width	Modulation	RB allocation	RB offset	Low	Middle	High
5	QPSK	1	0	21.86	21.10	21.09
			12	21.98	21.79	21.35
			24	21.31	21.09	21.85
		12	0	21.49	21.71	21.17
			6	21.85	21.25	21.55
			13	21.24	21.43	21.39
		25	0	21.00	21.51	21.94
	16QAM	1	0	21.84	21.42	21.45
			12	21.27	21.75	21.18
			24	21.30	21.45	21.92
		12	0	21.02	21.94	21.97
			6	21.04	21.14	21.88
			13	21.61	21.29	21.94
		25	0	21.92	21.43	21.37
10	QPSK	1	0	/	21.97	/
			24	/	21.31	/
			49	/	21.37	/
		25	0	/	21.97	/
			12	/	21.09	/
			25	/	21.54	/
		50	0	/	21.25	/
	16QAM	1	0	/	21.29	/
			24	/	21.84	/
			49	/	21.75	/
		25	0	/	21.21	/
			12	/	21.26	/
			25	/	21.75	/
		50	0	/	21.25	/

Bluetooth Conducted Power

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
BLE	0	2402	-5.49
	19	2440	-5.53
	39	2480	-6.02

12. Maximum Tune-up Limit

WCDMA		
Mode	Maximum Tune-up (dBm)	
	WCDMA Band II	WCDMA Band V
AMR 12.2Kbps	22.00	23.00
RMC 12.2Kbps	22.00	23.00
HSDPA Subtest-1	22.00	23.00
HSDPA Subtest-2	22.00	23.00
HSDPA Subtest-3	22.00	23.00
HSDPA Subtest-4	22.00	23.00
HSUPA Subtest-1	22.00	23.00
HSUPA Subtest-2	22.00	23.00
HSUPA Subtest-3	22.00	23.00
HSUPA Subtest-4	22.00	23.00
HSUPA Subtest-5	22.00	23.00

LTE				
Fequency Band	Band-width(MHz)	Modulation	RB allocation	Maximum Tune-up (dBm)
LTE Band 2	1.4	QPSK	1	22.00
			3	22.00
			6	22.00
		16QAM	1	22.00
			3	22.00
			6	22.00
	3	QPSK	1	22.00
			8	22.00
			15	22.00
		16QAM	1	22.00
			8	22.00
			15	22.00
	5	QPSK	1	22.00
			12	22.00
			25	22.00
		16QAM	1	22.00
			12	22.00
			25	22.00
	10	QPSK	1	22.00
			25	22.00
			50	22.00
		16QAM	1	22.00
			25	22.00
			50	22.00
	15	QPSK	1	22.00
			38	22.00
			75	22.00
		16QAM	1	22.00
			38	22.00
			75	22.00
	20	QPSK	1	22.00
			50	22.00
			100	22.00
		16QAM	1	22.00
			50	22.00
			100	22.00

LTE				
Fequency Band	Band-width(MHz)	Modulation	RB allocation	Maximum Tune-up (dBm)
LTE Band 4	1.4	QPSK	1	22.00
			3	22.00
			6	22.00
		16QAM	1	22.00
			3	22.00
			6	22.00
	3	QPSK	1	22.00
			8	22.00
			15	22.00
		16QAM	1	22.00
			8	22.00
			15	22.00
	5	QPSK	1	22.00
			12	22.00
			25	22.00
		16QAM	1	22.00
			12	22.00
			25	22.00
	10	QPSK	1	22.00
			25	22.00
			50	22.00
		16QAM	1	22.00
			25	22.00
			50	22.00
	15	QPSK	1	22.00
			38	22.00
			75	22.00
		16QAM	1	22.00
			38	22.00
			75	22.00
	20	QPSK	1	22.00
			50	22.00
			100	22.00
		16QAM	1	22.00
			50	22.00
			100	22.00

LTE				
Fequency Band	Band-width(MHz)	Modulation	RB allocation	Maximum Tune-up (dBm)
LTE Band 5	1.4	QPSK	1	22.00
			3	22.00
			6	22.00
		16QAM	1	22.00
			3	22.00
			6	22.00
	3	QPSK	1	22.00
			8	22.00
			15	22.00
		16QAM	1	22.00
			8	22.00
			15	22.00
	5	QPSK	1	22.00
			12	22.00
			25	22.00
		16QAM	1	22.00
			12	22.00
			25	22.00
	10	QPSK	1	22.00
			25	22.00
			50	22.00
		16QAM	1	22.00
			25	22.00
			50	22.00

LTE				
Fequency Band	Band-width(MHz)	Modulation	RB allocation	Maximum Tune-up (dBm)
LTE Band 12	1.4	QPSK	1	22.00
			3	22.00
			6	22.00
		16QAM	1	22.00
			3	22.00
			6	22.00
	3	QPSK	1	22.00
			8	22.00
			15	22.00
		16QAM	1	22.00
			8	22.00
			15	22.00
	5	QPSK	1	22.00
			12	22.00
			25	22.00
		16QAM	1	22.00
			12	22.00
			25	22.00
	10	QPSK	1	22.00
			25	22.00
			50	22.00
		16QAM	1	22.00
			25	22.00
			50	22.00

LTE				
Fequency Band	Band-width(MHz)	Modulation	RB allocation	Maximum Tune-up (dBm)
LTE Band 13	5	QPSK	1	22.00
			12	22.00
			25	22.00
		16QAM	1	22.00
			12	22.00
			25	22.00
	10	QPSK	1	22.00
			25	22.00
			50	22.00
		16QAM	1	22.00
			25	22.00
			50	22.00

LTE MPR will followup 3GPP setting as below:

Modulation	Channel bandwidth / Transmission bandwidth (NRB)						MPR (dB)
	1.4MHz	3.0MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	0
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

Bluetooth	
Mode	Maximum Tune-up (dBm)
BLE	-5.00

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≦50mm are determined by:

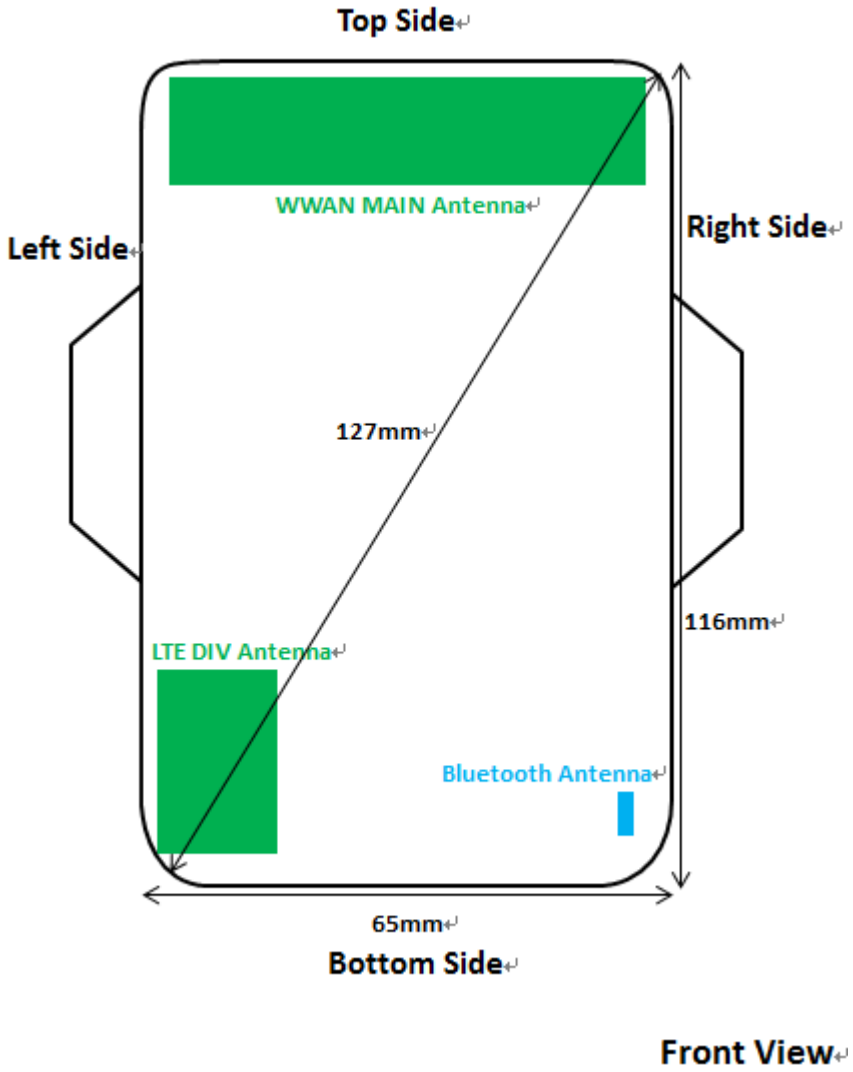
[(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)] ≦3.0 for 1-g SAR

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.45	Body	10	-5.00	0.32	Yes

Per KDB 447498 D01, when the minimum test separation distance is <5mm, a distance of 5mm is applied to determine SAR test exclusion.

The test exclusion thereshold is ≦3, SAR testing is not required.

13. Antenna Location



14. SAR Measurement Results

WCDMA Band II										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
RMC 12.2Kbps	Front	9262	1852.4	21.40	22.00	1.15	0.12	1.080	1.240	-
		9400	1880.0	21.36	22.00	1.16	0.06	1.120	1.298	B1
		9538	1907.6	21.16	22.00	1.21	-0.03	1.030	1.250	-
	Left	9400	1880.0	21.36	22.00	1.16	0.15	0.041	0.048	-
	Right	9400	1880.0	21.36	22.00	1.16	0.13	0.042	0.049	-
	Top	9400	1880.0	21.36	22.00	1.16	-0.17	0.307	0.356	-

WCDMA Band V										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
RMC 12.2Kbps	Front	4132	826.4	22.40	23.00	1.15	-	-	-	-
		4183	836.6	22.36	23.00	1.16	0.04	0.643	0.745	B2
		4233	846.6	22.29	23.00	1.18	-	-	-	-
	Left	4183	836.6	22.36	23.00	1.16	0.01	0.253	0.293	-
	Right	4183	836.6	22.36	23.00	1.16	0.04	0.104	0.121	-
	Top	4183	836.6	22.36	23.00	1.16	-0.05	0.177	0.205	-

LTE Band 2										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
20M_1RB	Front	18700	1860.0	21.94	22.00	1.01	-0.10	1.140	1.156	-
		18900	1880.0	21.02	22.00	1.25	0.15	0.994	1.246	B3
		19100	1900.0	21.81	22.00	1.04	-0.01	1.100	1.149	-
	Left	18700	1860.0	21.94	22.00	1.01	-0.09	0.057	0.058	-
	Right	18700	1860.0	21.94	22.00	1.01	0.05	0.059	0.060	-
	Top	18700	1860.0	21.94	22.00	1.01	0.18	0.299	0.303	-
20M_50RB	Front	18700	1860.0	21.99	22.00	1.00	-0.08	1.100	1.103	-
		18900	1880.0	21.91	22.00	1.02	0.07	1.080	1.103	-
		19100	1900.0	21.31	22.00	1.17	-0.12	1.010	1.184	-
	Left	18700	1860.0	21.99	22.00	1.00	-0.09	0.061	0.061	-
	Right	18700	1860.0	21.99	22.00	1.00	0.01	0.062	0.062	-
	Top	18700	1860.0	21.99	22.00	1.00	0.06	0.304	0.305	-

Note:

1. Per KDB865664 D01v01r04, Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg
2. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximumoutput power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations andthe highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highestoutput power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also betested.

LTE Band 4										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
20M_1RB	Front	20050	1720.0	21.89	22.00	1.03	0.20	1.030	1.056	-
		20175	1732.5	21.06	22.00	1.24	0.06	0.969	1.203	B4
		20300	1745.0	21.04	22.00	1.25	0.15	0.963	1.201	-
	Left	20175	1732.5	21.89	22.00	1.03	-0.05	0.077	0.079	-
	Right	20175	1732.5	21.89	22.00	1.03	0.01	0.080	0.082	-
	Top	20175	1732.5	21.89	22.00	1.03	0.11	0.318	0.326	-
20M_50RB	Front	20050	1720.0	21.92	22.00	1.02	0.02	1.010	1.029	-
		20175	1732.5	21.18	22.00	1.21	0.11	0.977	1.180	-
		20300	1745.0	21.38	22.00	1.15	-0.14	0.981	1.132	-
	Left	20050	1720.0	21.92	22.00	1.02	0.09	0.081	0.083	-
	Right	20050	1720.0	21.92	22.00	1.02	0.17	0.086	0.088	-
	Top	20050	1720.0	21.92	22.00	1.02	-0.08	0.336	0.342	-

LTE Band 5										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
10M_1RB	Front	20450	829.0	21.16	22.00	1.21	-	-	-	-
		20525	836.5	21.43	22.00	1.14	-	-	-	-
		20600	844.0	21.87	22.00	1.03	-0.16	0.502	0.517	B5
	Left	20600	844.0	21.87	22.00	1.03	0.01	0.201	0.207	-
	Right	20600	844.0	21.87	22.00	1.03	0.12	0.091	0.094	-
	Top	20600	844.0	21.87	22.00	1.03	-0.08	0.131	0.135	-
10M_25RB	Front	20450	829.0	21.64	22.00	1.09	-	-	-	-
		20525	836.5	21.92	22.00	1.02	0.14	0.507	0.516	-
		20600	844.0	21.68	22.00	1.08	-	-	-	-
	Left	20525	836.5	21.92	22.00	1.02	-0.11	0.200	0.204	-
	Right	20525	836.5	21.92	22.00	1.02	0.05	0.094	0.096	-
	Top	20525	836.5	21.92	22.00	1.02	0.17	0.139	0.142	-

Note:

1. Per KDB865664 D01v01r04, Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg
2. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximumoutput power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations andthe highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highestoutput power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also betested.

LTE Band 12										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
10M_1RB	Front	23060	704.0	21.91	22.00	1.02	0.04	0.705	0.720	B6
		23095	707.5	21.08	22.00	-	-	-	-	-
		23130	711.0	21.45	22.00	-	-	-	-	-
	Left	23060	704.0	21.91	22.00	1.02	0.14	0.286	0.292	-
	Right	23060	704.0	21.91	22.00	1.02	0.11	0.110	0.112	-
	Top	23060	704.0	21.91	22.00	1.02	-0.12	0.204	0.208	-
10M_25RB	Front	23060	704.0	21.93	22.00	1.02	0.09	0.701	0.712	-
		23095	707.5	21.48	22.00	-	-	-	-	-
		23130	711.0	21.25	22.00	-	-	-	-	-
	Left	23060	704.0	21.93	22.00	1.02	0.17	0.283	0.288	-
	Right	23060	704.0	21.93	22.00	1.02	-0.11	0.109	0.111	-
	Top	23060	704.0	21.93	22.00	1.02	0.08	0.210	0.213	-

LTE Band 13										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Test Plot
		CH	MHz							
10M_1RB	Front	23230	782.0	21.97	22.00	1.01	-0.04	0.662	0.667	B7
	Left	23230	782.0	21.97	22.00	1.01	0.11	0.284	0.286	-
	Right	23230	782.0	21.97	22.00	1.01	-0.05	0.103	0.104	-
	Top	23230	782.0	21.97	22.00	1.01	0.12	0.339	0.341	-
10M_25RB	Front	23230	782.0	21.97	22.00	1.01	0.11	0.655	0.660	-
	Left	23230	782.0	21.97	22.00	1.01	0.14	0.276	0.278	-
	Right	23230	782.0	21.97	22.00	1.01	0.07	0.101	0.102	-
	Top	23230	782.0	21.97	22.00	1.01	-0.15	0.329	0.331	-

Note:

1. Per KDB865664 D01v01r04, Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg
2. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximumoutput power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations andthe highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highestoutput power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also betested.

SAR Test Data Plots

Test mode:	WCDMA Band II	Test Position:	Front	Test Plot:	B1

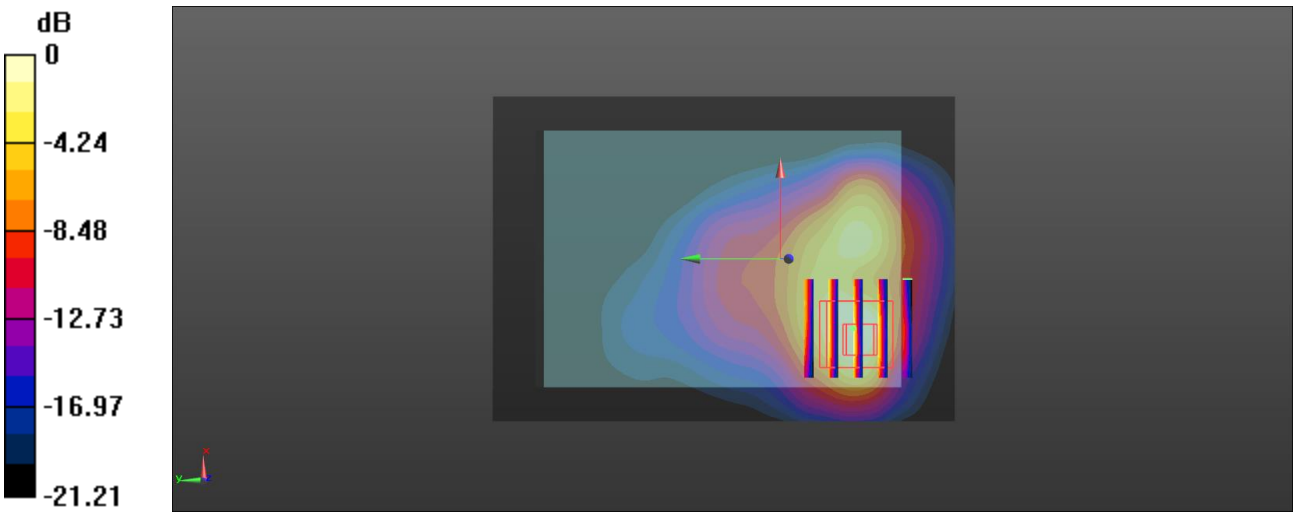
Date:2018-07-20
Communication System: UID 0, Generic UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.539 S/m; ε_r = 53.741; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.42, 8.42, 8.42) @ 1880 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.44 W/kg

Front/Procedure/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.21 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 2.81 W/kg
SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.638 W/kg
Maximum value of SAR (measured) = 1.46 W/kg



0 dB = 2.88 W/kg = 4.59 dBW/kg

Test mode:	WCDMA Band V	Test Position:	Front	Test Plot:	B2

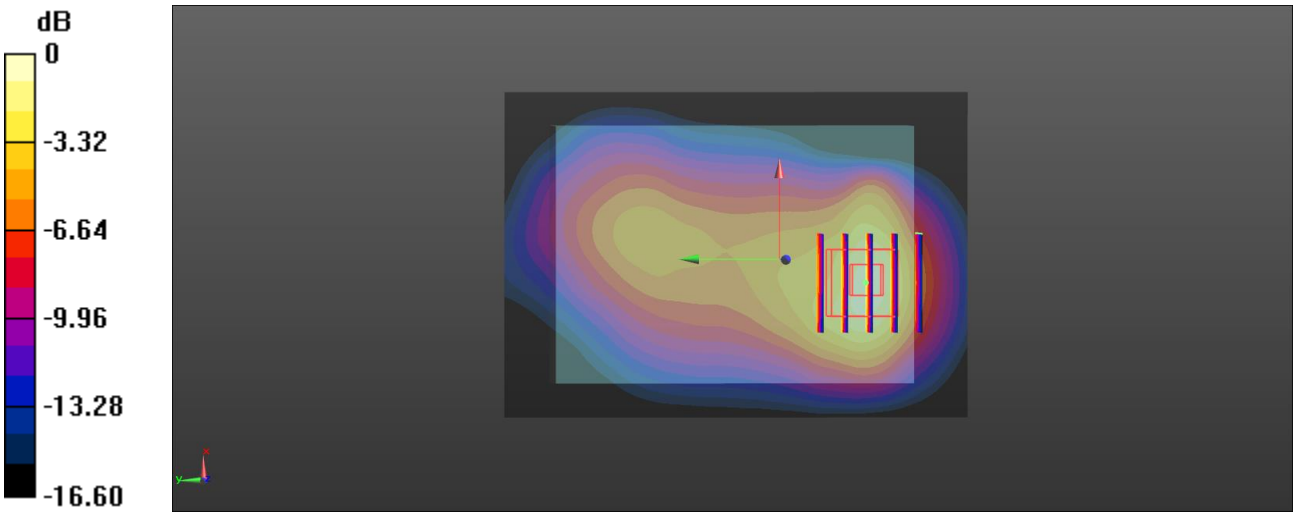
Date:2018-07-23
Communication System: UID 0, Generic UMTS (0); Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.967 S/m; ε_r = 55.399; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.5, 10.5, 10.5) @ 836.6 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.04 W/kg

Front/Procedure/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.63 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.51 W/kg
SAR(1 g) = 0.643 W/kg; SAR(10 g) = 0.348 W/kg
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.12 W/kg



0 dB = 1.12 W/kg = 0.49 dBW/kg

Test mode:	LTE Band 2	Test Position:	Front	Test Plot:	B3

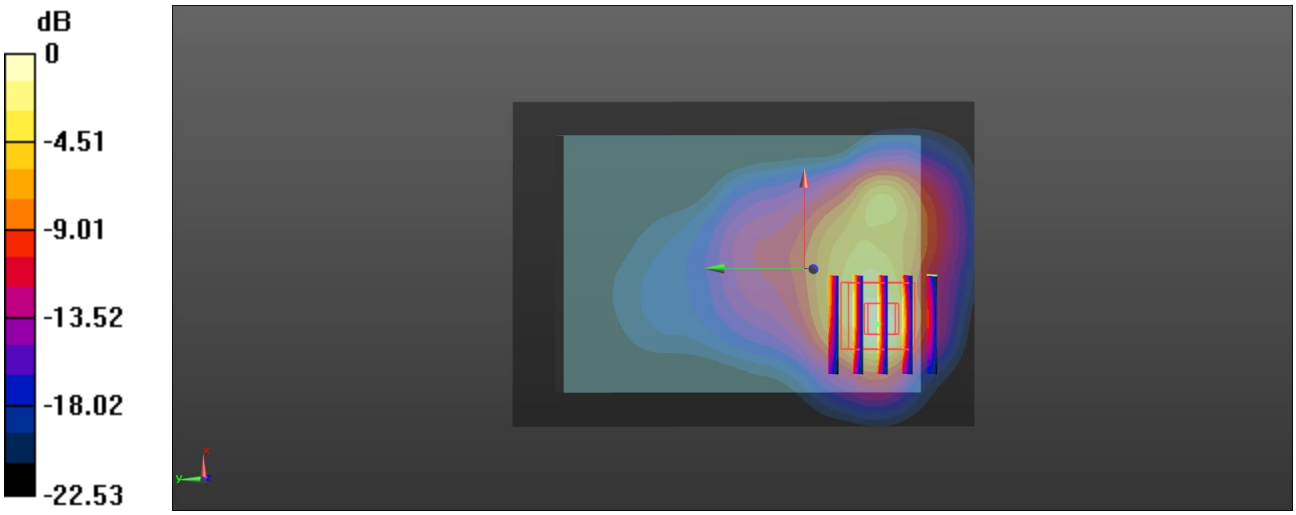
Date:2018-07-20
Communication System: UID 0, Generic LTE-FDD (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.539 S/m; ε_r = 53.741; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.42, 8.42, 8.42) @ 1880 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.27 W/kg

Front/Procedure/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.65 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 0.994 W/kg; SAR(10 g) = 0.565 W/kg
Maximum value of SAR (measured) = 1.27 W/kg



0 dB = 4.27 W/kg = 6.30 dBW/kg

Test mode:	LTE Band 4	Test Position:	Front	Test Plot:	B4

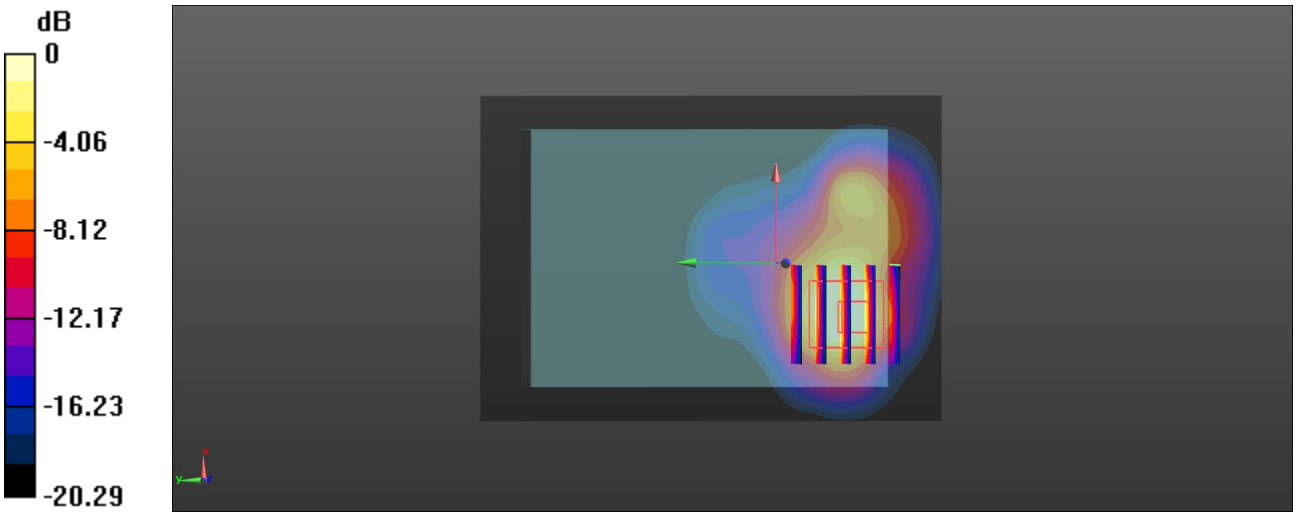
Date:2018-07-24
Communication System: UID 0, Generic LTE-FDD (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.43 S/m; ε_r = 53.892; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.77, 8.77, 8.77) @ 1732.5 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 2.64 W/kg

Front/Procedure/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.842 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 2.66 W/kg
SAR(1 g) = 0.969 W/kg; SAR(10 g) = 0.476 W/kg
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.80 W/kg



0 dB = 1.80 W/kg = 2.55 dBW/kg

Test mode:	LTE Band 5	Test Position:	Front	Test Plot:	B5

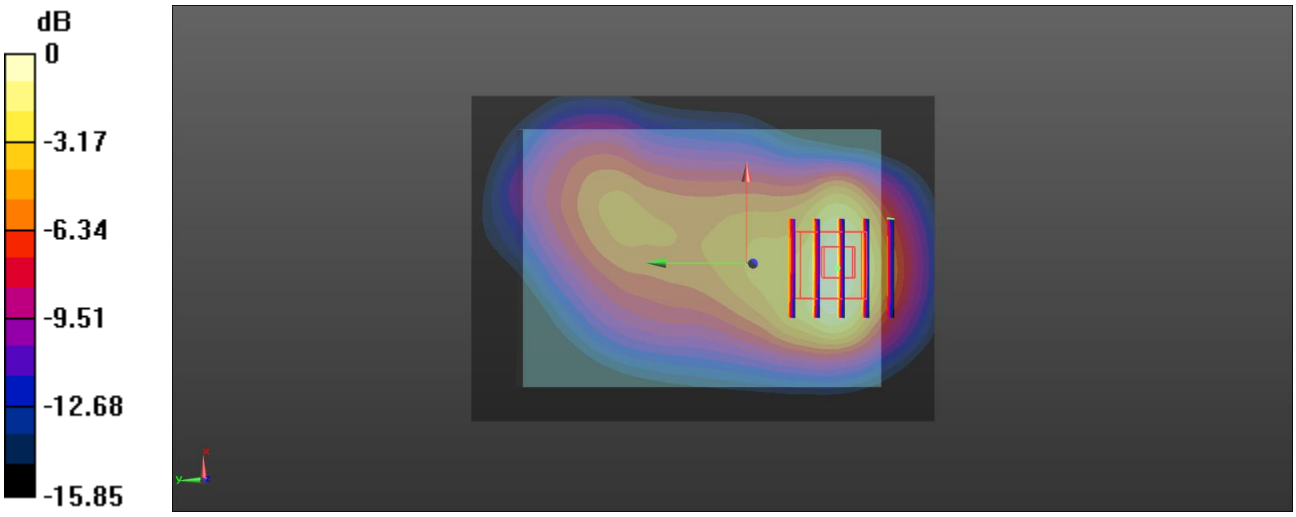
Date:2018-07-23
Communication System: UID 0, Generic LTE-FDD (0); Frequency: 844 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 844 MHz; σ = 0.967 S/m; ε_r = 55.399; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.5, 10.5, 10.5) @ 844 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.818 W/kg

Front/Procedure/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.47 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.502 W/kg; SAR(10 g) = 0.279 W/kg
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.855 W/kg



0 dB = 0.855 W/kg = -0.68 dBW/kg

Test mode:	LTE Band 12	Test Position:	Front	Test Plot:	B6

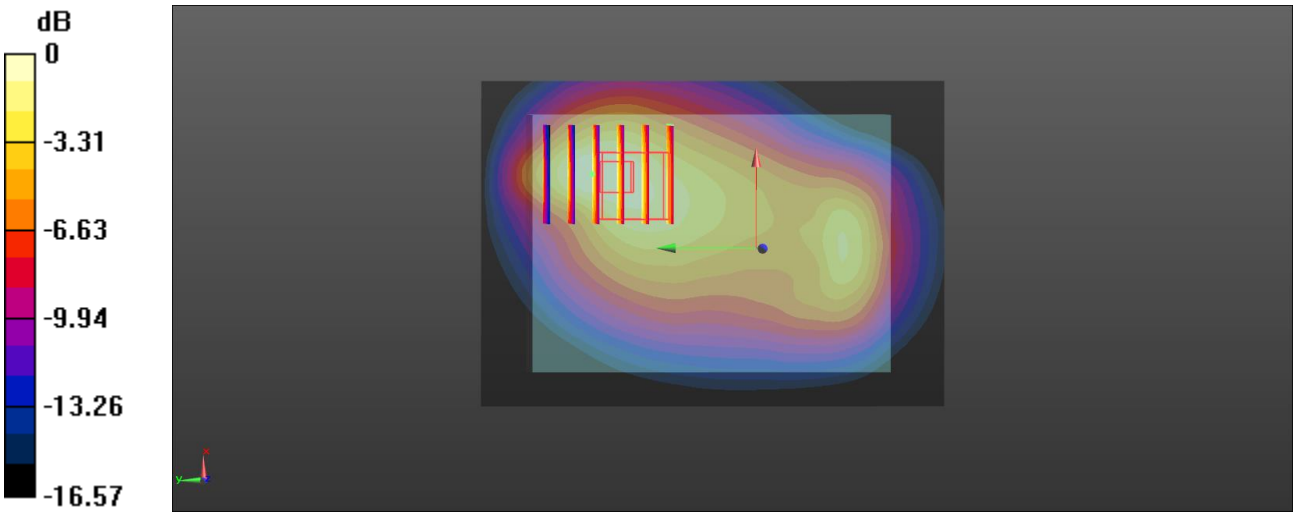
Date:2018-08-25
Communication System: UID 0, Generic LTE-FDD (0); Frequency: 704 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 704 MHz; σ = 0.919 S/m; ε_r = 55.74; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.87, 10.87, 10.87) @ 704 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.06 W/kg

Front/Procedure/Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.14 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.29 W/kg
SAR(1 g) = 0.705 W/kg; SAR(10 g) = 0.453 W/kg
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.02 W/kg



0 dB = 1.02 W/kg = 0.09 dBW/kg

Test mode:	LTE Band 13	Test Position:	Front	Test Plot:	B7

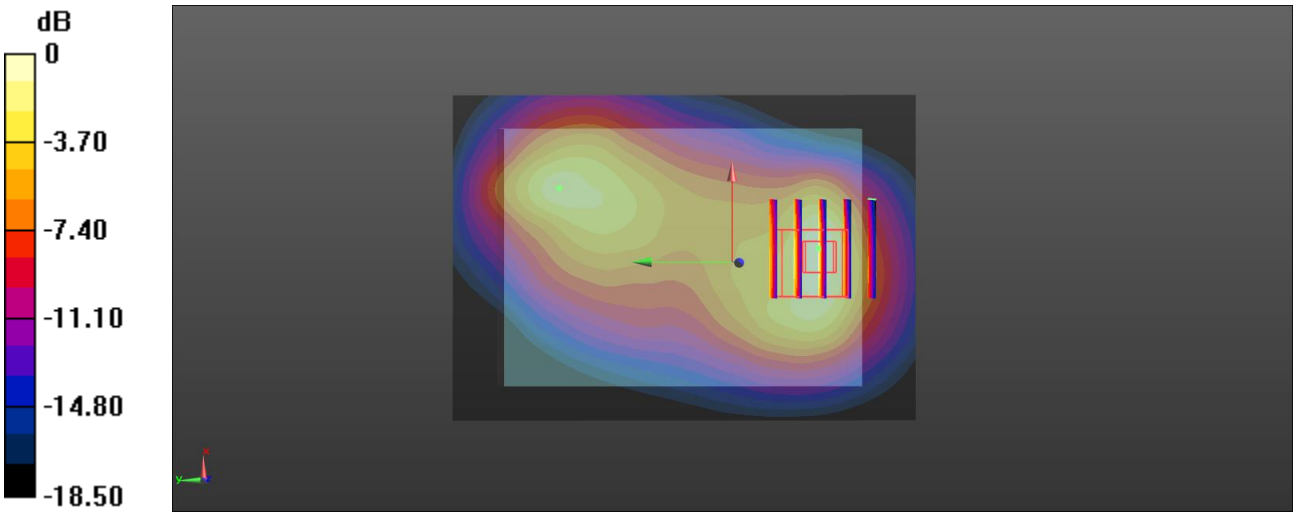
Date:2018-07-25
Communication System: UID 0, Generic LTE-FDD (0); Frequency: 782 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 782 MHz; σ = 0.946 S/m; ε_r = 55.542; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(10.87, 10.87, 10.87) @ 782 MHz; Calibrated: 2/26/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1549; Calibrated: 4/25/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Front/Procedure/Area Scan (71x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.14 W/kg

Front/Procedure/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.59 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 0.662 W/kg; SAR(10 g) = 0.347 W/kg
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.20 W/kg



0 dB = 1.20 W/kg = 0.79 dBW/kg

15. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Band	Test Position	Frequency		Highest Measured SAR (W/kg)	First Repeated		Second Repeated	
		CH	MHz		Measured SAR(W/kg)	Largest to Smallest SAR Ratio	Measured SAR(W/kg)	Largest to Smallest SAR Ratio
WCDMA Band II	Front	9400	1880	1.12	1.09	1.03	N/A	N/A
LTE Band 2	Front	18700	1860	1.14	1.10	1.04	N/A	N/A
LTE Band 4	Front	20500	1720	1.03	0.996	1.03	N/A	N/A

16. Simultaneous Transmission analysis

No.	Simultaneous Transmission Configurations	Body	Note
7	WCDMA (data) + Bluetooth (data)	Yes	
9	LTE + Bluetooth (data)	Yes	

General note:

1. EUT will choose either GSM or WCDMA LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
2. The reported SAR summation is calculated based on the same configuration and test position
3. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below
   a) [(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)/x]W/kg for test separation distances ≦50mm; whetn x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR.
   b) When the minimum separation distance is <5mm, the distance is used 5mm to determine SAR test exclusion
   c) 0.4 W/kg for 1-g SAR and 1.0W/kg for 10-g SAR, when the test separation distances is >50mm.

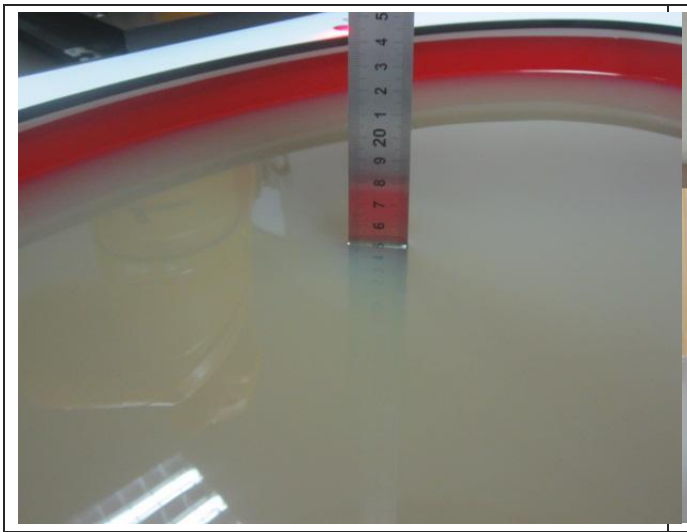
Bluetooth Max power	Exposure position	Body
	Test separation	0mm
-5.00 dBm	Estimated SAR (W/kg)	0.013

Maximum reported SAR value for Body mode

WWAN PCB + Bluetooth					
WWAN Band		Exposure Position	Max SAR (W/kg)		Summed SAR
			WWAN PCB	Bluetooth	(W/kg)
WCDMA	Band II	Front	1.298	0.013	**1.311**
		Left side	0.048	0.013	0.061
		Right side	0.049	0.013	0.062
		Top side	0.356	0.013	0.369
	Band V	Front	0.745	0.013	0.758
		Left side	0.293	0.013	0.306
		Right side	0.121	0.013	0.134
		Top side	0.205	0.013	0.218
LTE	B2 1RB	Front	1.246	0.013	1.259
		Left side	0.058	0.013	0.071
		Right side	0.060	0.013	0.073
		Top side	0.303	0.013	0.316
	B2 50RB	Front	1.103	0.013	1.116
		Left side	0.061	0.013	0.074
		Right side	0.062	0.013	0.075
		Top side	0.305	0.013	0.318
	B4 1RB	Front	1.203	0.013	1.216
		Left side	0.079	0.013	0.092
		Right side	0.082	0.013	0.095
		Top side	0.326	0.013	0.339
	B4 50RB	Front	1.180	0.013	1.193
		Left side	0.083	0.013	0.096
		Right side	0.088	0.013	0.101
		Top side	0.342	0.013	0.355
	B5 1RB	Front	0.517	0.013	0.530
		Left side	0.207	0.013	0.220
		Right side	0.094	0.013	0.107
		Top side	0.142	0.013	0.155
	B5 25RB	Front	0.516	0.013	0.529
		Left side	0.204	0.013	0.217
		Right side	0.096	0.013	0.109
		Top side	0.142	0.013	0.155

LTE	B12 1RB	Front	0.720	0.013	0.733
		Left side	0.292	0.013	0.305
		Right side	0.112	0.013	0.125
		Top side	0.208	0.013	0.221
	B12 25RB	Front	0.712	0.013	0.725
		Left side	0.288	0.013	0.301
		Right side	0.111	0.013	0.124
		Top side	0.213	0.013	0.226
	B13 1RB	Front	0.667	0.013	0.680
		Left side	0.286	0.013	0.299
		Right side	0.104	0.013	0.117
		Top side	0.341	0.013	0.354
	B13 25RB	Front	0.660	0.013	0.673
		Left side	0.278	0.013	0.291
		Right side	0.102	0.013	0.115
		Top side	0.331	0.013	0.344

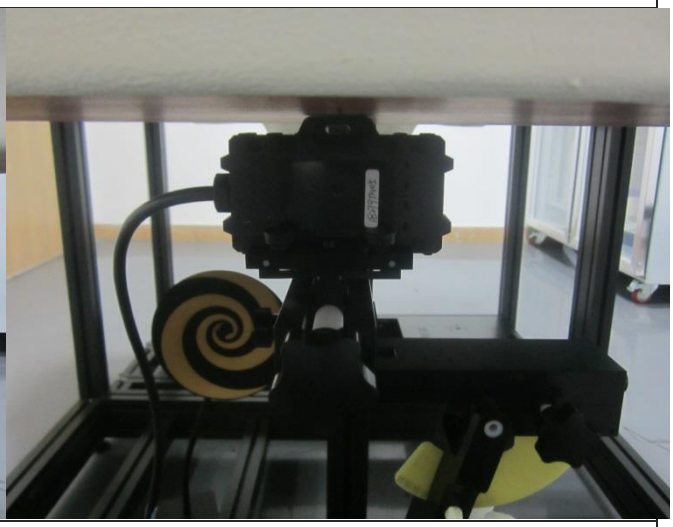
17. TestSetup Photos



Liquid depth in the ELI phantom

Front (0mm)

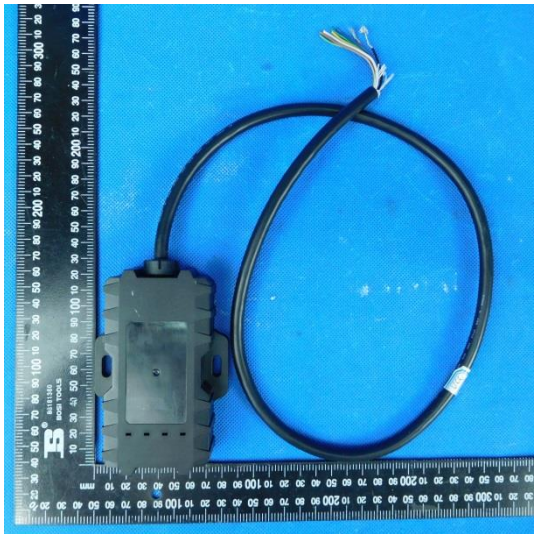
Top Side (0mm)

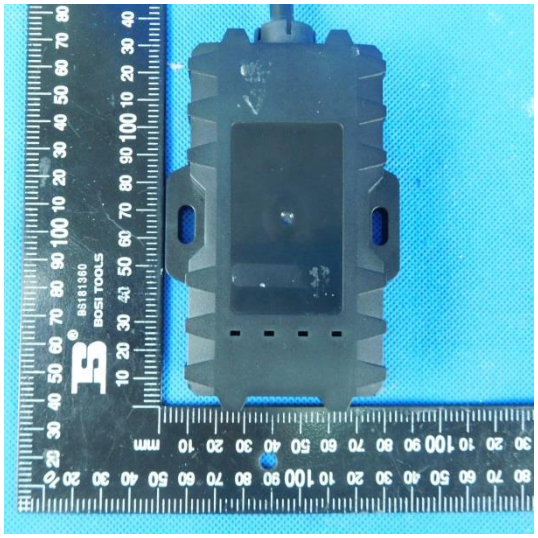


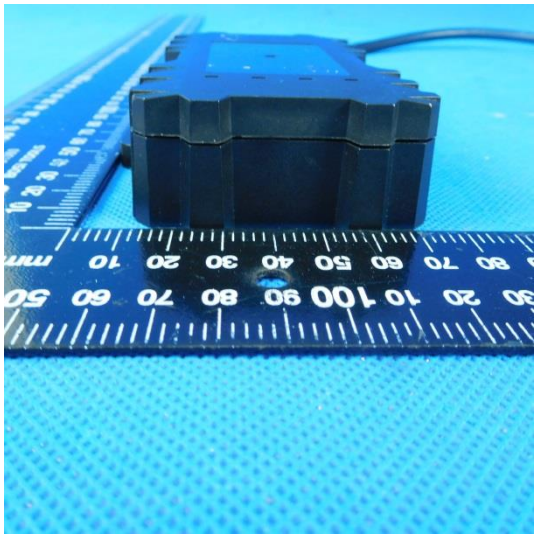
Left Side (0mm)

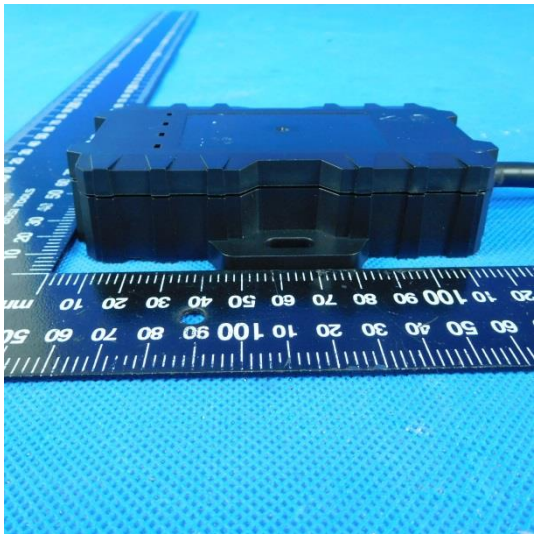
Right Side (0mm)

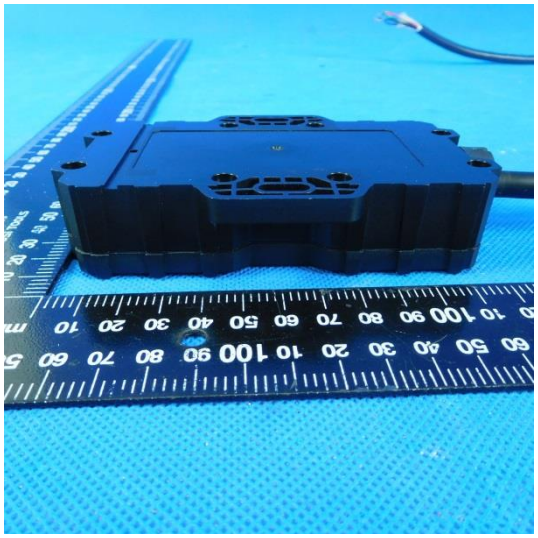
18. External Photos of the EUT

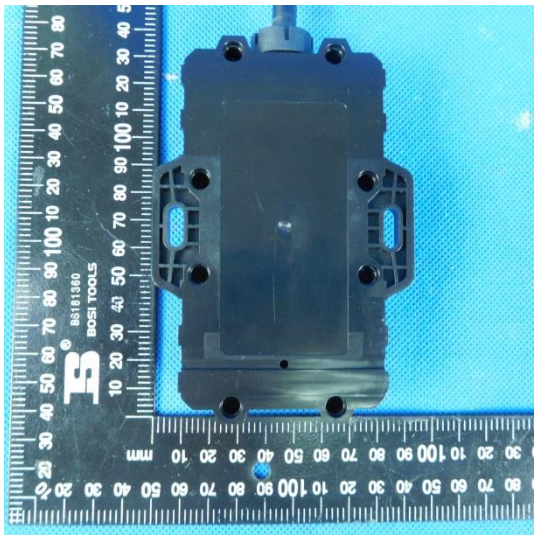












---------End of Report----------