A Test Lab Techno Corp.

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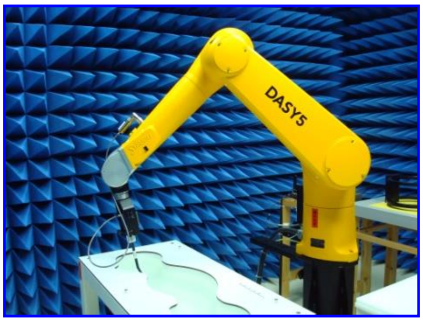
SAR EVALUATION REPORT

Test Report No.	:	1802FS11-01
Applicant	:	Netgear Incorporated
Product Type	:	Mobile Router
Trade Name	:	NETGEAR
Model Number	:	MR1100-330
Date of Received	:	Jan. 11, 2018
Test Period	:	Jan. 24 ~ Jan. 24, 2018
Date of Issued	:	Mar. 06, 2018
Test Environment	:	Ambient Temperature： 22 ±2 ° C Relative Humidity：40 - 70 %
Standard	:	ANSI/IEEE C95.1-1992 / IEEE Std. 1528-2013 47 CFR Part §2.1093 KDB 865664 D01 v01r04 / KDB 865664 D02 v01r02 KDB 447498 D01 v06 / KDB 941225 D01 v03r01 KDB 941225 D05 v02r05 / KDB 941225 D05A LTE v01r02 KDB 941225 D06 v02r01 / KDB 248227 D01 v02r02
Test Lab Location	:	Chang-an Lab
Test Firm MRA designation number	:	TW0010



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1. *Summary of Maximum Reported SAR Value*

Equipment Class	Mode	Highest Reported			
		Head SAR_{1g} (W/kg)	Body SAR_{1g} (W/kg)	Hotspot SAR_{1g} (W/kg)	Extremity SAR_{1g} (W/kg)
PCB	LTE Band 14	N/A	N/A	0.63	N/A
Highest Simultaneous Transmission SAR		Head SAR_{1g} (W/kg)	Body SAR_{1g} (W/kg)	Hotspot SAR_{1g} (W/kg)	Extremity SAR_{1g} (W/kg)
PCB+DTS+NII at test position side2		N/A	N/A	1.39	N/A

NOTE:
1. The SAR limit (Head & Body: SAR1g 1.6 W/kg) for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.
2. The maximum SAR value "0.63 1g (W / kg)" is less than the maximum SAR value of the original case "1.2 1g (W / kg)", while transmitting SAR value results, refer to the original case FCC ID PY317200378 of the report no. 1708FS16-01.

2. Description of Equipment under Test (EUT)

Applicant	Netgear Incorporated 350 East Plumeria Drive,San Jose, California, United States 95134	
Manufacture	Netgear Inc. Suite 168 - 10760 Shellbridge Way, Richmond, BC Canada V6X 3H1	
Product Type	Mobile Router	
Trade Name	NETGEAR	
Model Number	MR1100-330	
IMEI No.	015161000	
FCC ID	PY317200378	
Class II Permissive Change	1) Add LTE Band 14 by software. 2) The model name is also changed from MR1100-320 to MR1100-330.	
RF Function	Operate Bands	Operate Frequency (MHz)
	WCDMA(RMC 12.2K) / HSDPA / HSUPA Band II	1852.4 - 1907.6
	WCDMA (RMC 12.2K) / HSDPA / HSUPA Band V	826.4 - 846.6
	LTE Band 2 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1850.0 - 1910.0
	LTE Band 4 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1710.0 - 1754.9
	LTE Band 5 (BW 1.4, 3, 5, 10 MHz)	824.0 - 849.0
	LTE Band 7 (BW 5, 10, 15, 20 MHz)	2500.0 - 2570.0
	LTE Band 12 (BW 1.4, 3, 5, 10 MHz)	699.0 - 716.0
	LTE Band 14 (BW 5, 10 MHz)	788 - 798
	LTE Band 30 (BW 5, 10 MHz)	2305.0 - 2315.0
	LTE Band 66 (BW 1.4, 3, 5, 10, 15, 20 MHz)	1710.0 - 1755.0
	IEEE 802.11b / 802.11g IEEE 802.11n 2.4GHz 20MHz (256QAM)	2412 - 2462
	IEEE 802.11n 2.4GHz 40MHz (256QAM)	2422 - 2452
	IEEE 802.11a	5180 - 5825
	IEEE 802.11n 5GHz 20MHz IEEE 802.11ac 20MHz	5180 - 5825
	IEEE 802.11n 5GHz 40MHz IEEE 802.11ac 40MHz	5190 - 5795
	IEEE 802.11ac 80MHz	5210 - 5775
Antenna Type	PIFA Antenna	
Battery Option	Standard	
	(1) Trande mark: NETGEAR Model Name: W-10a Spec: 3.85V, 5040mAh (2) Trande mark: NETGEAR Model Name: W-10 Spec: 3.8V, 5040mAh	
Device Category	Portable Device	
Application Type	Certification	

Note:The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

EUT Modify Description：

1) Add LTE Band 14 by software. 2) The model name is also changed from MR1100-320 to MR1100-330. There are no modifications made to the hardware.
Original Report : 1708FS16-01 Modify : 1802FS11-01

3. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **Netgear Incorporated Trade Name：NETGEAR Model(s)：MR1100-330**. The test procedures, as described in American National Standards, Institute C95.1-1999〔1〕were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

3.1 SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dw) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

$$SAR = \frac{d}{dt}\left(\frac{dw}{dm}\right) = \frac{d}{dt}\left(\frac{dw}{\rho dv}\right)$$

Figure 2. **SAR Mathematical Equation**

SAR is expressed in units of Watts per kilogram (W/kg)

$$SAR = \frac{\sigma E^2}{\rho}$$

Where：

σ = conductivity of the tissue (S/m)

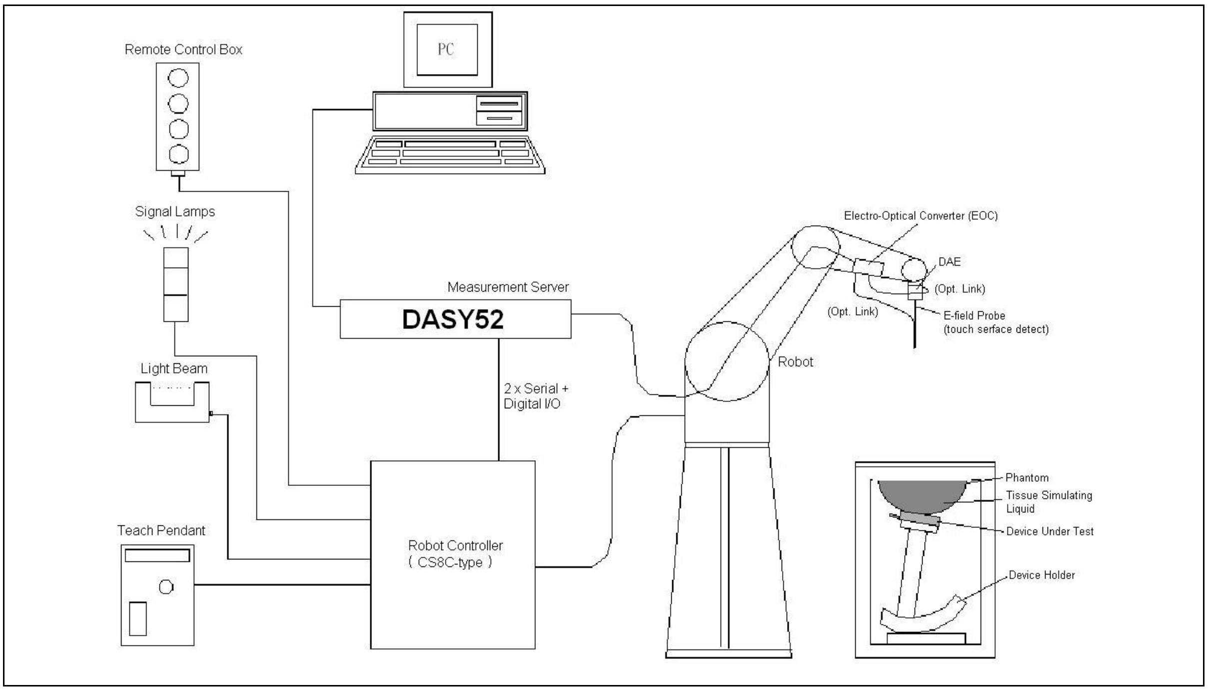
ρ = mass density of the tissue (kg/m3)

E = RMS electric field strength (V/m)

＊Note：

The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane〔2〕

4. SAR Measurement Setup



The DASY52 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. 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.
3. 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.
4. 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.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer operating Windows 2000 or Windows XP.
7. DASY52 software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The SAM twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. Validation dipole kits allowing validating the proper functioning of the system.

4.1 DASY E-Field Probe System

The SAR measurements were conducted with the dosimetric probe (manufactured by SPEAG), designed in the classical triangular configuration〔3〕and optimized for dosimetric evaluation. The probes is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

4.1.1 E-Field Probe Specification

Construction	Symmetrical design with triangular core
	Built-in shielding against static charges
	PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz
	Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	±0.3 dB in brain tissue (rotation around probe axis)
	±0.5 dB in brain tissue (rotation normal probe axis)
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 mm

Figure 3. E-field Probe

Figure 4. Probe setup on robot

4.1.2 E-Field Probe Calibration process

Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where：

Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (head or body),

ΔT = Temperature increase due to RF exposure.

Or $$SAR = \frac{|E|^2 \sigma}{\rho}$$

Where：

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

4.2 Data Acquisition Electronic (DAE) System

Model：	DAE3, DAE4
Construction：	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for 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：	< 5μV (with auto zero)
Input Bias Current：	< 50 fA
Dimensions：	60 x 60 x 68 mm

4.3 Robot

Positioner：	Stäubli Unimation Corp. Robot Model: TX90XL
Repeatability：	±0.02 mm
No. of Axis：	6

4.4 Measurement Server

Processor：	PC/104 with a 400MHz intel ULV Celeron
I/O-board：	Link to DAE4 (or DAE3) 16-bit A/D converter for surface detection system Digital I/O interface Serial link to robot Direct emergency stop output for robot

4.5 Device Holder

The DASY device holder is constructed 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.

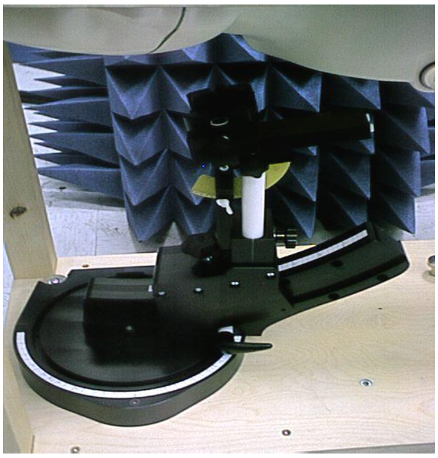


Figure 5. Device Holder

4.6 Oval Flat Phantom - ELI 5.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528-2013, CENELEC 50361 and IEC 62209-2. It enables the dosimetric evaluation of wireless portable device 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 manually teaching three points with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 30 liters
Dimensions	190×600×400 mm (H×L×W)

Table 1. Specification of ELI 5.0

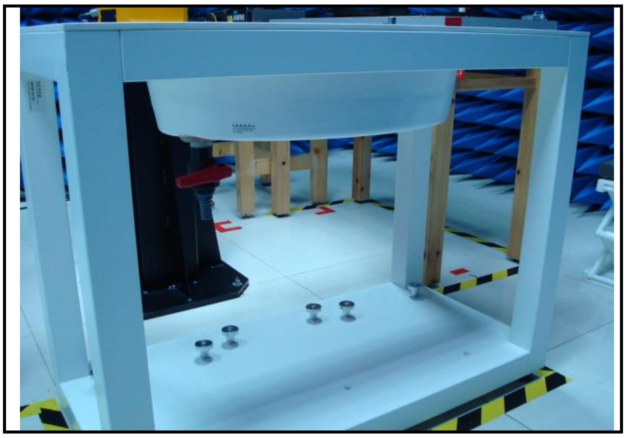


Figure 6. Oval Flat Phantom

4.7 Data Storage and Evaluation

4.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the 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 or DA5. The post processing 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 erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

4.7.2 Data Evaluation

The DASY post processing software (SEMCAD) 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 DASY 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：

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

With	*Vi*	= compensated signal of channel i (i = x, y, z)
	Ui	= input signal of channel i (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：

E-field probes：

$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes：

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

with *Vi* = compensated signal of channel i (i = x, y, z)
Normi= sensor sensitivity of channel i (i = x, y, z)
μV/(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.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with *SAR* = local specific absorption rate in mW/g
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 set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = \frac{H_{tot}^2}{37.7}$$

with *Ppwe* = equivalent power density of a plane wave in mW/cm2
Etot = total electric field strength in V/m
Htot = total magnetic field strength in A/m

5. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.
The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

Target Frequency	Head		Body	
(MHz)	εr	σ (S/m)	εr	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
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
(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)				

Table 2. Tissue dielectric parameters for head and body phantoms

5.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H_2O), resistivity ≥ 16 M Ω -as basis for the liquid
- Sugar: refied white sugar (typically 99.7 % sucrose, available as crystal sugar in food shops) -to reduce relative permittivity
- Salt: pure NaCl -to increase conductivity
- Cellulose: Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20°C), CAS # 54290 -to increase viscosity and to keep sugar in solution.
- Preservative: Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 -to prevent the spread of bacteria and molds
- DGBE: Diethylenglycol-monobuthyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

5.2 Recipes

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands.
Note: The goal dielectric parameters (at 22 ℃) must be achieved within a tolerance of ±5% for εand ±5% for σ.

Ingredients (% by weight)	Frequency (MHz)												Frequency (GHz)	
	750		835		1750		1900		2450		2600		5GHz	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	39.28	51.30	41.45	52.40	54.50	40.20	54.90	40.40	62.70	73.20	60.30	71.40	65.5	78.6
Salt (NaCl)	1.47	1.42	1.45	1.50	0.17	0.49	0.18	0.50	0.50	0.10	0.60	0.20	0.00	0.00
Sugar	58.15	46.18	56.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEC	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bactericide	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.2	10.7
DGBE	0.00	0.00	0.00	0.00	45.33	59.31	44.92	59.10	36.80	26.70	39.10	28.40	0.00	0.00
Dielectric Constant	41.88	54.60	42.54	56.10	40.10	53.60	39.90	54.00	39.80	52.50	39.80	52.50	0.00	0.00
Conductivity (S/m)	0.90	0.97	0.91	0.95	1.39	1.49	1.42	1.45	1.88	1.78	1.88	1.78	0.00	0.00
Diethylene Glycol Mono-hexlether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.3	10.7

Salt: 99^{+}% Pure Sodium Chloride   Sugar: 98^{+}% Pure Sucrose
Water: De-ionized, 16 $M\Omega^{+}$ resistivity   HEC: Hydroxyethyl Cellulose
DGBE: 99^{+}% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

5.3 Liquid Depth

According to KDB865664 ,the depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz.

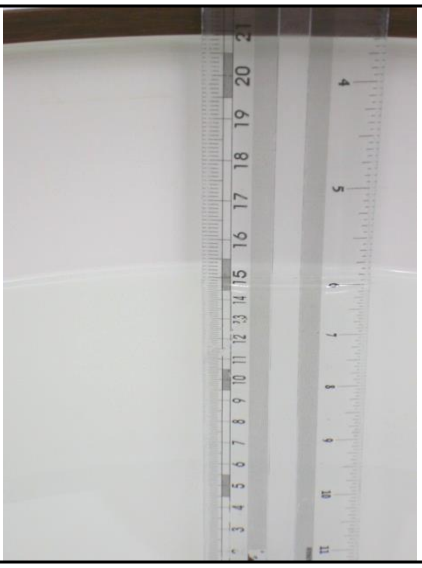


Figure 7. Body-Position

6. *SAR Testing with RF Transmitters*

6.1 SAR Testing with WCDMA Transmitters

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

- Step 1: set a Test Mode 1 loop back with a 12.2kbps Reference Measurement Channel (RMC).
- Step 2: set and send continuously up power control commands to the device.
- Step 3: measure the power at the device antenna connector using the power meter with average detector and test SAR

6.2 SAR Testing with HSDPA Transmitters

HSDPA Date Devices setup for SAR Measurement

HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors(βc, βd), and HS-DPCCH power offset parameters (ΔACK, ΔNACK, ΔCQI) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Setup for Release 5 HSDPA							
Sub-test	βc	βd	βd (SF)	βc/βd	βhs(1,2)	CM(3) (dB)	MRP(3) (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15(4)	15/15(4)	64	12/15(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} = 8 ⇔ Ahs = βhs/βc = 30/15 ⇔ βhs= 30/15 *βc
2. For theHS-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 βhs = 30/15 *βc and Δ_{CQI} = 24/15 with βhs = 24/15*βc
3. CM = 1 for βc/βd =12/15, βhs/βc=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.
4. For subtest 2 the βc/βd ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 11/15 and βd = 15/15.

HSPA Date Devices setup for SAR Measurement.

The following procedures are applicable to HSPA (HSUPA/HSDPA) data devices operating under 3GPP Release 6. Body exposure conditions generally apply to these devices, including handsets and data modems operating in various electronic devices. HSUPA operates in conjunction with WCDMA and HSDPA. SAR is initially measured in WCDMA test configurations without HSPA. The default test configuration is to establish a radio link between the DUT and a communication test set to configure a 12.2 kbps RMC (reference measurement channel) in Test Loop Mode 1. SAR for HSPA is selectively measured with HS-DPCCH, EDPCCH and E-DPDCH, all enabled, along with a 12.2 kbps RMC using the highest SAR configuration in WCDMA with 12.2 kbps RMC only. An FRC is configured according to HSDPCCH Sub-test 1 using H-set 1 and QPSK. HSPA is configured according to E-DCH Subtest 5 requirements. SAR for other HSPA sub-test configurations is also confirmed selectively according to output power, exposure conditions and E-DCH UE Category. Maximum output power is verified according to procedures in applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. The UE Categories for HSDPCCH and HSPA should be clearly identified in the SAR report. The following procedures are applicable only if Maximum Power Reduction (MPR) is implemented according to Cubic Metric (CM) requirements.

When voice transmission and head exposure conditions are applicable to a WCDMA/HSPA data device, head exposure is measured according to the 'Head SAR Measurements' procedures in the 'WCDMA Handsets' section of this document. SAR for body exposure configurations are measured according to the 'Body SAR Measurements' procedures in the 'WCDMA Handsets' section of this document. In addition, body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurements should be used to test for head exposure.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA should be configured according to the β values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of this document.

The highest body SAR measured in Antenna Extended & Retracted configurations on a channel in 12.2 kbps RMC. The possible channels are the High, Middle & Low channel. Contact the FCC Laboratory for test and approval requirements if the maximum output power measured in E-DCH Sub-test 2 - 4 is higher than Sub-test 5.

Setup for Release 6 HSPA / Release 7 HSPA+													
Sub-test	βc	βd	βd (SF)	βc/βd	βhs[1]	βec	βed	Bed (SF)	Bed (codes)	CM[2] (dB)	MPR (dB)	AG[4] Index	E-TFCI
1	11/15[3]	15/15[3]	64	11/15[3]	22/15	209/225	1039/225	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	βed1: 47/15 βed2: 47/15	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[4]	15/15[4]	64	15/15[4]	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note

1. Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ Ahs = βhs/βc = 30/15 ⇔ βhs= 30/15 *βc.
2. CM = 1 for βc/βd =12/15, βhs/βc=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.
3. For subtest 1 the βc/βd ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 10/15 and βd = 15/15.
4. For subtest 5 the βc/βd ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 14/15 and βd = 15/15.
5. Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
6. βed can not be set directly; it is set by Absolute Grant Value.

6.3 SAR Testing with LTE-FDD Transmitters

All SAR measurements for LTE were performed using the Anritsu MT8820C. A closed loop power control setting allowed the UE to transmit at the maximum output power during the SAR measurements.Configure the basestation to support LTE tests in respect to the 3GPP 36.521-1,and set ch , RB allocation number ,RB allocation offset , and send continuously Up power control commands to the device.

MPR was enabled for this device. A-MPR was disabled for all SAR test measurements.

6.4 SAR Testing with LTE-TDD Transmitters

All SAR measurements for LTE were performed using the Anritsu MT8820C. A closed loop power control setting allowed the UE to transmit at the maximum output power during the SAR measurements.Configure the basestation to support LTE tests in respect to the 3GPP 36.521-1,and set ch , TDD mode , RB allocation number ,RB allocation offset , and send continuously Up power control commands to the device.
MPR was enabled for this device. A-MPR was disabled for all SAR test measurements.
For 3GPP table 4.2.1 as below, support configurations and worst-case UpPTS information into the table.

3GPP Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink			EUT Support Special subframe	Worst case UpPTS
	DwPTS	UpPTS		DwPTS	UpPTS			
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		
0	6592×Ts	2192×Ts	2560×Ts	7680×Ts	2192×Ts	2560×Ts	☐	☐
1	19760×Ts			20480×Ts			☐	☐
2	21952×Ts			23040×Ts			☐	☐
3	24144×Ts			25600×Ts			■	☐
4	26336×Ts			7680×Ts	4384×Ts	5120×Ts	■	☐
5	6592×Ts	4384×Ts	5120×Ts	20480×Ts			☐	☐
6	19760×Ts			23040×Ts			☐	☐
7	21952×Ts			12800×Ts			■	■
8	24144×Ts			-	-	-	☐	☐
9	13168×Ts			-	-	-	☐	☐
							Duty cycle$_{(maximum)}$	43.33%

The EUT only supports the 40% case, which is Table 4.2.2, configuration #1 below.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number										Type of EUT
		0	1	2	3	4	5	6	7	8	9	
0	5ms	D	S	U	U	U	D	S	U	U	U	☐
1	5ms	D	S	U	U	D	D	S	U	U	D	■
2	5ms	D	S	U	D	D	D	S	U	D	D	☐
3	10ms	D	S	U	U	U	D	D	D	D	D	☐
4	10ms	D	S	U	U	D	D	D	D	D	D	☐
5	10ms	D	S	U	D	D	D	D	D	D	D	☐
6	5ms	D	S	U	U	U	D	S	U	U	D	☐

6.5 LTE Frequency range and channel bandwidth

Channel bandwidth support:

Band	BW (MHz)					
	1.4	3	5	10	15	20
LTE Band 14	---	---	V	V	---	---

LTE Band	Bandwidth (MHz)	Test requency ID	N_{UL}	Frequency of Uplink (MHz)
LTE Band 14	5	Low Range	23305	790.5
		Mid Range	23330	793
		High Range	23255	795.5
	10	Low Range	---	---
		Mid Range	23330	793
		High Range	---	---

6.5.1 Maximum power reduction (MPR)

Identify the LTE voice/data requirements in each operating mode and exposure condition with respect to head and body test configurations, antenna locations, handset flip-cover or slide positions, antenna diversity conditions etc.

The voice and data transmission:

- ◆ Data only device.

Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design:

- ◆ Maximum Power Reduction (MPR) is mandatory, i.e. built-in by design.
- ◆ A-MPR (additional MPR) must be disabled
- ◆ A-MPR was disabled during testing.

Maximum Power Reduction (MPR) for Power Class 3							
Channel bandwidth / Transmission bandwidth configuration (RB)							
Modulation	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20MHz	MPR (dB)
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

6.6 Power reduction

No power reduction issue.

6.7 SAR Testing with 802.11 Transmitters

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.

- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.

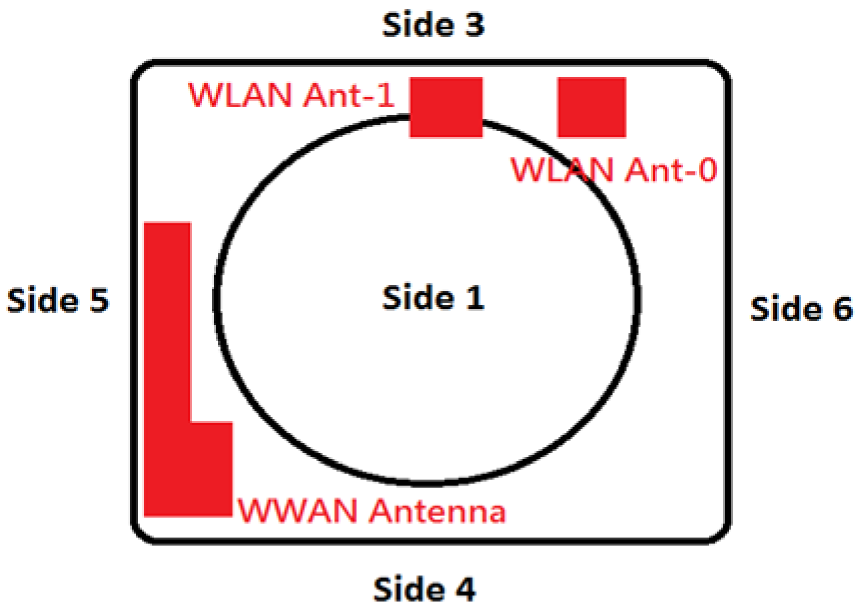
6.8 Conducted Power

Band	Channel Bandwidth	Modulation	Channel	Frequency (MHz)	RB Configuration		Average Power	
					Size	Offset	(dBm)	(W)
LTE Band 14	5MHz	QPSK	23305	790.5	1	0	22.81	0.191
					1	12	22.88	0.194
					1	24	**22.89**	**0.195**
					12	0	21.93	0.156
					12	6	21.96	0.157
					12	13	21.92	0.156
					25	0	21.93	0.156
			23330	793.0	1	0	22.84	0.192
					1	12	22.83	0.192
					1	24	22.86	0.193
					12	0	21.97	0.157
					12	6	21.97	0.157
					12	13	21.96	0.157
					25	0	21.91	0.155
			23355	795.5	1	0	22.86	0.193
					1	12	22.87	0.194
					1	24	22.87	0.194
					12	0	21.92	0.156
					12	6	22.00	0.158
					12	13	21.94	0.156
					25	0	21.94	0.156
		16QAM	23305	790.5	1	0	22.05	0.160
					1	12	22.04	0.160
					1	24	22.00	0.158
					12	0	20.81	0.121
					12	6	20.87	0.122
					12	13	20.84	0.121
					25	0	20.84	0.121
			23330	793.0	1	0	22.03	0.160
					1	12	21.98	0.158
					1	24	22.00	0.158
					12	0	20.85	0.122
					12	6	20.84	0.121
					12	13	20.82	0.121
					25	0	20.79	0.120
			23355	795.5	1	0	21.98	0.158
					1	12	22.01	0.159
					1	24	22.03	0.160
					12	0	20.81	0.121
					12	6	20.87	0.122
					12	11	20.85	0.122
					25	0	20.84	0.121

Band	Channel Bandwidth	Modulation	Channel	Frequency (MHz)	RB Configuration		Average Power	
					Size	Offset	(dBm)	(W)
LTE Band 14	10MHz	QPSK	23330	793	1	0	22.88	0.194
					1	24	22.92	0.196
					1	49	22.89	0.195
					25	0	21.9	0.155
					25	12	21.99	0.158
					25	25	21.94	0.156
					50	0	21.97	0.157
		16QAM	23330	793	1	0	22.02	0.159
					1	24	22.03	0.160
					1	49	22.01	0.159
					25	0	20.89	0.123
					25	12	20.87	0.122
					25	25	20.86	0.122
					50	0	20.84	0.121

6.9 Antenna location

Antenna-User						
Antenna	To Side 1 (mm)	To Side 2 (mm)	To Side 3 (mm)	To Side 4 (mm)	To Side 5 (mm)	To Side 6 (mm)
WWAN Ant	13	6	29	20	3	86
WLAN Ant-0	6	15	11	74	68	21
WLAN Ant-1	6	15	13	74	37	50



6.10 Stand-alone SAR Evaluate

Transmitter and antenna implementation as below:

Band	WWAN Ant	WLAN Ant
WWAN	V	---
WLAN	---	V

Stand-alone transmission configurations as below:

Band	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
LTE Band 14	V	V	V	V	V	---

Note: Note: The "-" on behalf of Stand-alone SAR is not required (Refer to KDB447498 D01 v06 4.3.1 for the Standalone SAR test exclusion considerations)

Ant. Used	Band	Channel	Frequency	Tune-Power		Distance of Ant. To User (mm)					
			(GHz)	(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
WWAN Ant	LTE Band 14	23330	0.793	23.5	224	13	6	29	20	5	86

Ant. Used	Band	Channel	Frequency	Tune-Power		Calculated value and evaluated result					
			(GHz)	(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
WWAN Ant	LTE Band 14	23330	0.793	23.5	224	15.3	33.2	6.9	10	39.9	358.8mW
						MEASURE	MEASURE	MEASURE	MEASURE	MEASURE	EXEMPT

Note:

1.Calculated Value include string "mW",that is meam through compare output power with threshold, if the output power more than threshold value the SAR test should be perform. Otherwise,the SAR test could be exempt. (> 50mm)

2. Calculated Value only inculde number format, that is mean through compare output power with threshold, if the Calculated value more than 3, the SAR test should be perform. Otherwise, the SAR test could be exempt. (<50mm)

3. When an antenna qualifies for the standalone SAR test exclusion of KDB 447498 section 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to KDB 447498 section "4.3.2. Simultaneous transmission SAR test exclusion considerations b) "

4. We used highest frequency and power,that result should be evaluated the worst case.

5. Power and distance are rounded to the nearest mW and mm before calculation.

6. The result is rounded to one decimal place for comparison.

6.11 Simultaneous Transmitting Evaluate

Simultaneous transmission configurations as below:

Condition	Side	Frequency Band		
		WWAN Ant	WLAN Ant-0	WLAN Ant-1
1	1	V	V	V
2	2	V	V	V
3	3	V	V	V
4	4	V	V	V
5	5	V	V	V
6	6	V	V	V

Estimated SAR

Ant. Used	Band	Channel	Frequency	Tune-Power		Estimated SAR 1-g (W/kg)					
			(GHz)	(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
WWAN Ant	LTE Band 14	23330	0.793	23.5	224	---	---	---	---	---	0.4

6.11.1 Sum of 1-g SAR of all simultaneously transmitting

When the sum of 1-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Sum of 1-g SAR of summary as below:

Phantom Position		Spacing (mm)	ASSY	WWAN Ant		2.4GHz WLAN Ant-0		2.4GHz WLAN Ant-1	
				Band	SAR1g (W/Kg)	Band	SAR1g (W/Kg)	Band	SAR1g (W/Kg)
Flat	Side 1	10	N/A	LTE Band 14	0.59	IEEE 802.11g	0.05	IEEE 802.11g	0.03
	Side 2	10	N/A	LTE Band 14	0.63	IEEE 802.11g	0.04	IEEE 802.11g	0.01
	Side 3	10	N/A	LTE Band 14	0.13	2.4GHz WLAN Band	*0.19	2.4GHz WLAN Band	*0.16
	Side 4	10	N/A	LTE Band 14	0.31	IEEE 802.11g	0	IEEE 802.11g	0
	Side 5	10	N/A	LTE Band 14	0.15	IEEE 802.11g	0	IEEE 802.11g	0.01
	Side 6	10	N/A	LTE Band 14	**0.4	2.4GHz WLAN Band	*0.1	2.4GHz WLAN Band	*0.04

Phantom Position		Spacing (mm)	ASSY	5GHz WLAN Ant-0		5GHz WLAN Ant-1		∑ SAR1g (W/Kg)	Event
				Band	SAR1g (W/Kg)	Band	SAR1g (W/Kg)		
Flat	Side 1	10	N/A	IEEE 802.11a	0.06	IEEE 802.11a	0.08	0.81	<1.6
	Side 2	10	N/A	IEEE 802.11a	0.11	IEEE 802.11a	0.03	0.82	<1.6
	Side 3	10	N/A	5GHz WLAN Band	*0.29	5GHz WLAN Band	*0.25	1.02	<1.6
	Side 4	10	N/A	IEEE 802.11a	0.01	IEEE 802.11a	0.01	0.33	<1.6
	Side 5	10	N/A	IEEE 802.11a	0.02	IEEE 802.11a	0.02	0.2	<1.6
	Side 6	10	N/A	5GHz WLAN Band	*0.15	5GHz WLAN Band	*0.06	0.75	<1.6

Note:
1. *=Estimated SAR
2. **The Estimated SAR 0.4W/Kg , test separation distances is > 50 mm .
3. When the sum of 1-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.
4. WLAN in the Ant-0 and Ant-1 of the SAR value reference to the FCC ID PY317200378 of the report no. 1708FS16-01.

6.11.2 SAR to peak location separation ratio (SPLSR)

When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by (SAR1 + SAR2)^1.5/Ri, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

All of sum of SAR < 1.6 W/kg, therefore SPLSR is not required.

6.12 SAR test reduction according to KDB

General:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC, Supplement C [June 2001], IEEE1528-2013.
- All modes of operation were investigated, and worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plots.
- Batteries are fully charged for all readings.
- When the Channel's SAR 1g of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.

KDB 447498:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to IEEE1528-2013.

KDB 865664:

- Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.
- When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 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 W/kg.
- Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

KDB 941225:

- When HSDPA & (HSUPA / HSPA+ uplink with QPSK) power are not more than WCDMA 12.2K RMC 0.25dB and the SAR value of WCDMA BII/BV<1.2 W/kg ,therefore HSDPA & HSUPA / HSPA+ Stand-alone SAR is not required.
- SAR for EVDO Rev. A is not required when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations.
- For 1xRTT SAR is not required when the maximum average output of each channel is less than 1/4 dB higher than that measured in EVDO Rev.0.
- When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation, otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel.
- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 5.2.1 and 5.2.2 are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

- SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.
- For smaller channel bandwidth SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.
- SAR must be measured for all sides and surfaces with a transmitting antenna located within 25 mm from that surface or edge.

KDB 248227:

- Refer 6.8 SAR Testing with 802.11 Transmitters.

7. *System Verification and Validation*

7.1 Symmetric Dipoles for System Verification

Construction	Symmetrical dipole with l/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	750 MHz
Return Loss	> 20 dB at specified verification position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D750V3: dipole length 177 mm; overall height 300 mm

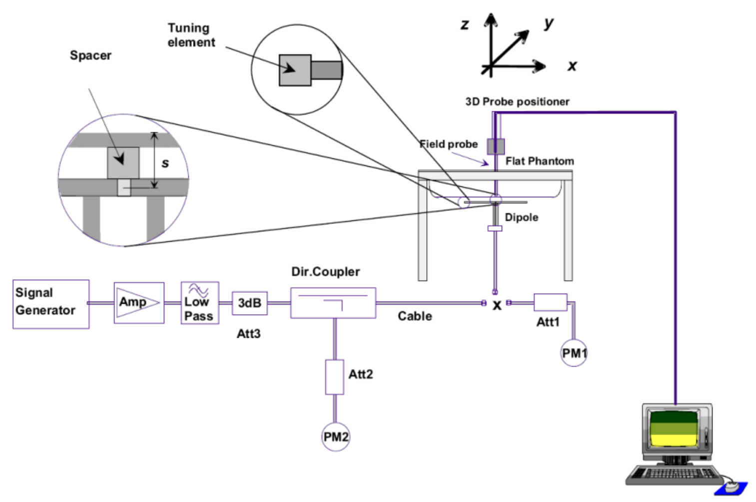


Figure 8. System Verification Setup Diagram

Figure 9. Validation Kit

7.2 Liquid Parameters

Liquid Verify								
Ambient Temperature： 22 ± 2 ℃；Relative Humidity：40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
750MHz (Body)	698MHz	22.0	εr	55.73	56.67	1.80%	± 5	Jan. 24, 2018
			σ	0.959	0.922	-4.17%	± 5	
	730MHz	22.0	εr	55.61	55.99	0.72%	± 5	
			σ	0.962	0.946	-1.04%	± 5	
	750MHz	22.0	εr	55.53	56.19	1.26%	± 5	
			σ	0.963	0.955	-1.04%	± 5	

Table 3. Measured Tissue dielectric parameters for body phantoms -1

7.3 Verification Summary

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ± 7%. The verification was performed at 750MHz.

Mixture Type	Frequency (MHz)	Power	SAR_{1g} (W/Kg)	SAR_{10g} (W/Kg)	Drift (dB)	Difference percentage		Probe	Dipole	1W Target		Date
						1g	10g	Model / Serial No.	Model / Serial No.	SAR_{1g} (mW/g)	SAR_{10g} (mW/g)	
Body	750	250 mW	2.2	1.49	-0.04	0.9%	4.2%	EX3DV4-SN3847	D750V3-SN1004	8.72	5.27	Jan. 24, 2018
		Normalize to 1 Watt	8.80	5.96								

7.4 Validation Summary

Per FCC KDB 865664 D02 v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2013 and FCC KDB 865664 D01v01r04. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters as below.

Probe Type Model / Serial No.	Prob Cal. Point (MHz)	Head / Body	Cond.	Perm.	CW Validation			Mod. Validation			Date
			εr	σ	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR	
EX3DV4 SN:3847	750	Body	56.19	0.955	Pass	Pass	Pass	QPSK	Pass	N/A	Jan. 24, 2018

8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Cal. Date	Cal.Period
SPEAG	750MHz System Validation Kit	D750V3	1004	08/21/2017	1 year
SPEAG	Dosimetric E-Field Probe	EX3DV4	3847	05/05/2017	1 year
SPEAG	Data Acquisition Electronics	DAE4	541	02/13/2017	1 year
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	
SPEAG	Device Holder	N/A	N/A	NCR	
SPEAG	Phantom	SAM V4.0	TP-1150	NCR	
SPEAG	Phantom	ELI V5.0	1133	NCR	
SPEAG	Robot	Staubli TX90XL	F07/564ZA1/A/01	NCR	
SPEAG	Software	DASY52 V52.8 (8)	N/A	NCR	
SPEAG	Software	SEMCAD X V14.6.10(7331)	N/A	NCR	
Anritsu	Radio Communication Analyzer	MT8821 C	6201641947	12/10/2017	1 year
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	
HILA	Digital Thermometer	TM-906	GF-006	08/17/2017	1 year
Agilent	Power Sensor	8481H	3318A20779	06/07/2017	1 year
Agilent	Power Meter	EDM Series E4418B	GB40206143	06/07/2017	1 year
Agilent	Signal Generator	E8257D	MY53050382	03/01/2017	1 year
Agilent	Dual Directional Coupler	778D	50334	NCR	
Woken	Dual Directional Coupler	0100AZ20200801O	11012409517	NCR	
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	
Aisi	Attenuator	IEAT 3dB	N/A	NCR	

Table 4. Test Equipment List

9. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR_{1g} to be less than ±21.76 % for 300MHz ~3GHz and 3GHz ~ 6GHz ±25.68 %〔8〕.

According to Std. C95.3〔9〕, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ±1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ±2dB can be expected.

Uncertainty of a Measure SAR of EUT with DASY System

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	c_i (1g)	c_i (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	v_i or V_{eff}
Measurement System									
u1	Probe Calibration (*k*=1)	±6.0%	Normal	1	1	1	±6.0%	±6.0%	∞
u2	Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
u3	Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	
u4	Boundary Effect	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u5	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u6	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u7	Readout Electronics	±0.3%	Normal	1	1	1	±0.3%	±0.3%	∞
u8	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u9	Integration Time	±1.9%	Rectangular	$\sqrt{3}$	1	1	±1.1%	±1.1%	∞
u10	RF Ambient Conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u11	RF Ambient Reflections	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u12	Probe Positioner Mechanical Tolerance	±0.4%	Rectangular	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
u13	Probe Positioning with respect to Phantom Shell	±2.9%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u14	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test sample Related									
u15	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u16	Device Holder Uncertainty	±2.7%	Normal	1	1	1	±2.7%	±2.7%	5
u17	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u18	Phantom Uncertainty (shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u19	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u20	Liquid Conductivity - measurement uncertainty	±2.5%	Normal	1	0.64	0.43	±1.6%	±1.08%	69
u21	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u22	Liquid Permittivity - measurement uncertainty	±2.5%	Normal	1	0.6	0.49	±1.5%	±1.23%	69
Combined standard uncertainty			RSS				±10.88%	±10.66%	313
Expanded uncertainty (95% CONFIDENCE LEVEL)			*k*=2				±21.76%	±21.31%	

Table 5. Uncertainty Budget for frequency range 300MHz to 3GHz

Uncertainty of a Measure SAR of EUT with DASY System

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	c_i (1g)	c_i (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	v_i or V_{eff}
Measurement System									
u1	Probe Calibration (*k*=1)	±6.5%	Normal	1	1	1	±6.5%	±6.5%	∞
u2	Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
u3	Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	
u4	Boundary Effect	±2.0%	Rectangular	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
u5	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u6	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u7	Readout Electronics	±0.0%	Normal	1	1	1	±0.0%	±0.0%	∞
u8	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u9	Integration Time	±2.8%	Rectangular	$\sqrt{3}$	1	1	±2.8%	±2.8%	∞
u10	RF Ambient Conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u11	RF Ambient Reflections	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u12	Probe Positioner Mechanical Tolerance	±0.7%	Rectangular	$\sqrt{3}$	1	1	±0.7%	±0.7%	∞
u13	Probe Positioning with respect to Phantom Shell	±9.9%	Rectangular	$\sqrt{3}$	1	1	±5.7%	±5.7%	∞
u14	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Test sample Related									
u15	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u16	Device Holder Uncertainty	±2.7%	Normal	1	1	1	±2.7%	±2.7%	5
u17	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u18	Phantom Uncertainty (shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u19	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u20	Liquid Conductivity - measurement uncertainty	±2.5%	Normal	1	0.64	0.43	±1.6%	±1.08%	69
u21	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u22	Liquid Permittivity - measurement uncertainty	±2.5%	Normal	1	0.6	0.49	±1.5%	±1.23%	69
Combined standard uncertainty			RSS				±12.84%	±12.65%	313
Expanded uncertainty (95% CONFIDENCE LEVEL)			*k*=2				±25.68%	±25.29%	

Table 6. ncertainty Budget for frequency range 3GHz to 6GHz

10. Measurement Procedure

The measurement procedures are as follows:

1. For WLAN function, engineering testing software installed on Notebook can provide continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

10.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages

1. Extraction of the measured data (grid and values) from the Zoom Scan
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. Generation of a high-resolution mesh within the measured volume
4. Interpolation of all measured values form the measurement grid to the high-resolution grid
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. Calculation of the averaged SAR within masses of 1g and 10g

10.2 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures points and step size follow as below. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

Grid Type	Frequency		Step size (mm)			X*Y*Z (Point)	Cube size			Step size		
			X	Y	Z		X	Y	Z	X	Y	Z
uniform grid	≦ 3GHz	≦2GHz	≤ 8	≤ 8	≤ 5	5*5*7	32	32	30	8	8	5
		2G - 3G	≤ 5	≤ 5	≤ 5	7*7*7	30	30	30	5	5	5
	3 - 6GHz	3 - 4GHz	≤ 5	≤ 5	≤ 4	7*7*8	30	30	28	5	5	4
		4 - 5GHz	≤ 4	≤ 4	≤ 3	8*8*10	28	28	27	4	4	3
		5 - 6GHz	≤ 4	≤ 4	≤ 2	8*8*12	28	28	22	4	4	2

(Our measure settings are refer KDB Publication 865664 D01v01r04)

10.3 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

10.4 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. 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. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

10.5 Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

11. SAR Test Results Summary

1. When the WWAN band channel's reported SAR1g of the position is > 0.8 W/kg, low, middle and high channel are supposed to be tested.
2. When the overall length and width of a device is > 9 cm x 5 cm (~3.5" x 2"), a test separation distance of 10 mm is required for hotspot mode SAR measurements.
3. Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge,middle and lower edge of each required test channel.
4. The procedures required for 1 RB allocation are applied to measure the SAR for QPSK with 50% RB allocation.
5. In other bands, the maximum SAR value verified by spot check is less than the maximum SAR value of the original case FCC ID PY317200378 of the report no 1708FS16-01 .

11.1 Head SAR Measurement

Evaluated head SAR is not available.

11.2 Body SAR Measurement

Evaluated body SAR is not available.

11.3 Hot-spot mode SAR Measurement

Index.	Band	Frequency		BW (MHz)	RB Size	RB Offset	Test Position	Spacing (mm)	SAR $_{1g}$ (W/kg)	Power Drift	Burst Avg Power	Max tune-up	Reported SAR $_{1g}$ (W/kg)
		Ch.	MHz										
#1	LTE Band 14	23330	793.0	10	1	24	Side1	10	0.518	0.02	22.92	23.5	0.59
#3	LTE Band 14	23330	793.0	10	1	24	Side2	10	0.547	0.03	22.92	23.5	**0.63**
#5	LTE Band 14	23330	793.0	10	1	24	Side3	10	0.11	0.04	22.92	23.5	0.13
#7	LTE Band 14	23330	793.0	10	1	24	Side4	10	0.268	-0.03	22.92	23.5	0.31
#9	LTE Band 14	23330	793.0	10	1	24	Side5	10	0.127	0.13	22.92	23.5	0.15
#2	LTE Band 14	23330	793.0	10	25	12	Side1	10	0.417	0	21.99	22.5	0.47
#4	LTE Band 14	23330	793.0	10	25	12	Side2	10	0.439	0.08	21.99	22.5	0.49
#6	LTE Band 14	23330	793.0	10	25	12	Side3	10	0.087	-0.02	21.99	22.5	0.10
#8	LTE Band 14	23330	793.0	10	25	12	Side4	10	0.216	-0.04	21.99	22.5	0.24
#10	LTE Band 14	23330	793.0	10	25	12	Side5	10	0.102	0.15	21.99	22.5	0.11

W10_3.8V Battery spot check															
Index.	Band	Frequency		Modulation	BW	RB Size	RB Offset	Test Position	Spacing (mm)	SAR 1g (W/Kg)	Power Drift	Burst Avg Powe	Max tune-up	Reported SAR 1g\ (W/kg)
		Ch.	MHz											
#11	LTE Band 14	23330	793.0	QPSK	10MHz	1	24	Side2	10	0.51	0.01	22.92	23.5	0.58

Note:

We choose the positions with higher results to test W10_3.8V battery, and the w10a_3.85V results is worst-case.

11.4 Extremity SAR Measurement

Evaluated extremity SAR is not available.

11.5 SAR Variability Measurement

Detailed evaluations please refer KDB 865664 on "SAR test reduction according to KDB" section.
SAR Measurement Variability is not available.

11.6 Std. C95.1-1992 RF Exposure Limit

Human Exposure	Population Uncontrolled Exposure (W/kg) or (mW/g)	Occupational Controlled Exposure (W/kg) or (mW/g)
Spatial Peak SAR* (head)	1.60	8.00
Spatial Peak SAR** (Whole Body)	0.08	0.40
Spatial Peak SAR*** (Partial-Body)	1.60	8.00
Spatial Peak SAR**** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 7. Safety Limits for Partial Body Exposure

Notes :

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole – body.

*** The Spatial Average value of the SAR averaged over the partial – body.

**** The Spatial Peak value of the SAR averaged over any 10 grams of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Population / Uncontrolled Environments **:** are defined as locations where there is the exposure of individuals 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 persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

12. References

[1] Std. C95.1-1999, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz",* New York.

[2] NCRP, National Council on Radiation Protection and Measurements, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields", NCRP report NO. 86, 1986.

[3] T. Schmid, O. Egger, and N. Kuster, "Automatic E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.

[4] K. Pokovi ć, T. Schmid, and N. Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.

[5] K. Pokovi ć, T. Schmid, and N. Kuster, "E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.

[6] N. Kuster, and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[7] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.

[8] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[9] Std. C95.3-1991, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, Aug. 1992.

[10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz, Jan. 1995.

[11] IEEE Std 1528™-2013 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques

Appendix A - System Performance Check

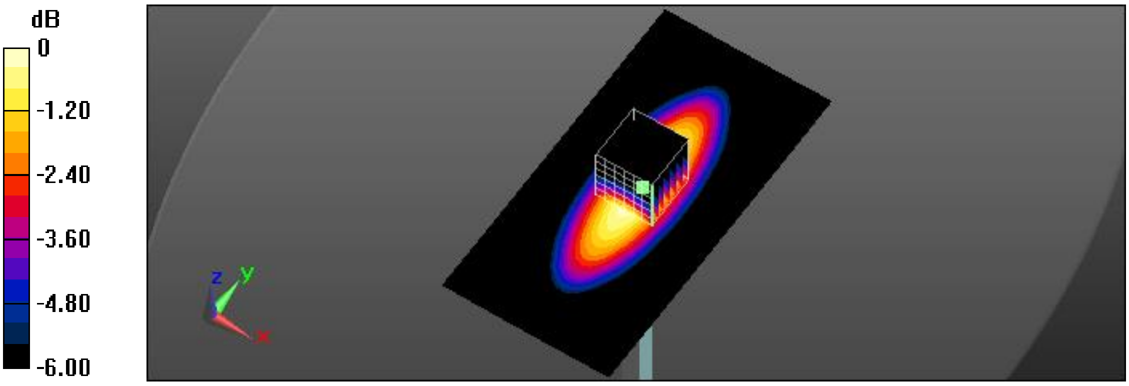
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 04:45:01 PM
System Performance Cheak at 750MHz_20180124_Body
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1004

Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.955 S/m; ε_r = 56.191; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Cheak at 750MHz/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.77 W/kg

System Performance Cheak at 750MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.79 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.19 W/kg
SAR(1 g) = 2.2 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg

Appendix B - SAR Measurement Data

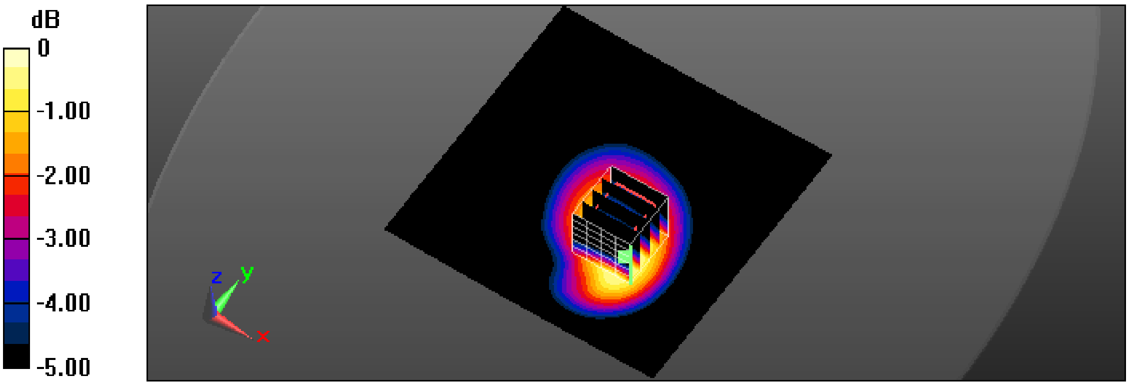
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 05:27:57 PM
1_LTE Band14 CH 23330_QPSK_BW 10MHz_1 RB size 24 RB offset_side1_10mm
DUT: MR1100-330; Type: Mobile Router; Serial: 015161000

Communication System: UID 0, Generic LTE (0); Frequency: 793 MHz;Duty Cycle: 1:1
Medium parameters used: f = 793 MHz; σ = 1.008 S/m; ε_r = 55.749; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat/Area Scan (101x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.619 W/kg

Flat/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.46 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.702 W/kg
SAR(1 g) = 0.518 W/kg; SAR(10 g) = 0.380 W/kg
Maximum value of SAR (measured) = 0.613 W/kg



0 dB = 0.613 W/kg = -2.13 dBW/kg

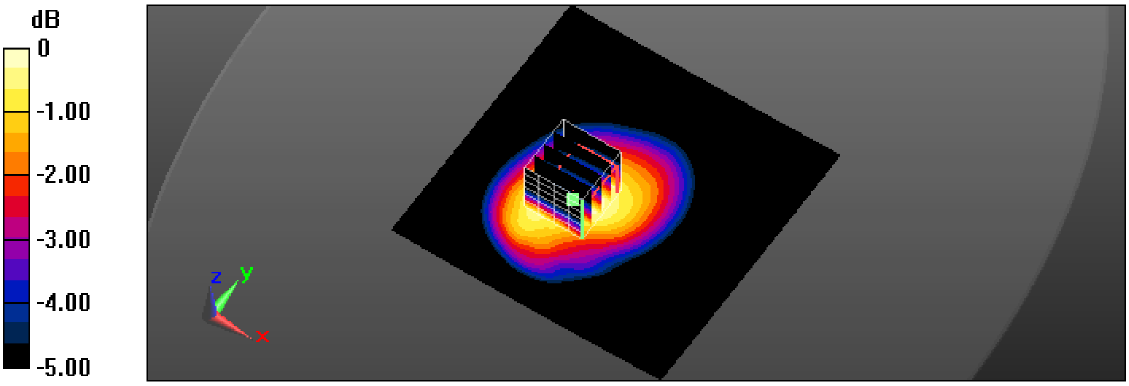
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 06:41:42 PM
3_LTE Band14 CH 23330_QPSK_BW 10MHz_1 RB size 24 RB offset_side2_10mm
DUT: MR1100-330; Type: Mobile Router; Serial: 015161000

Communication System: UID 0, Generic LTE (0); Frequency: 793 MHz;Duty Cycle: 1:1
Medium parameters used: f = 793 MHz; σ = 1.008 S/m; ε_r = 55.749; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat/Area Scan (101x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.637 W/kg

Flat/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.99 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.711 W/kg
SAR(1 g) = 0.547 W/kg; SAR(10 g) = 0.410 W/kg
Maximum value of SAR (measured) = 0.637 W/kg



0 dB = 0.637 W/kg = -1.96 dBW/kg

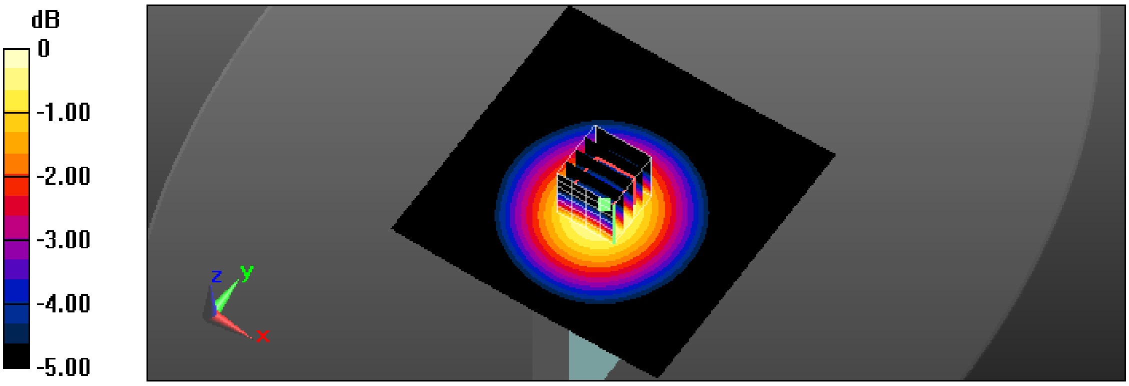
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 07:01:39 PM
5_LTE Band14 CH 23330_QPSK_BW 10MHz_1 RB size 24 RB offset_side3_10mm
DUT: MR1100-330; Type: Mobile Router; Serial: 015161000

Communication System: UID 0, Generic LTE (0); Frequency: 793 MHz;Duty Cycle: 1:1
Medium parameters used: f = 793 MHz; σ = 1.008 S/m; ε_r = 55.749; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat/Area Scan (101x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.127 W/kg

Flat/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.28 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.141 W/kg
SAR(1 g) = 0.110 W/kg; SAR(10 g) = 0.082 W/kg
Maximum value of SAR (measured) = 0.128 W/kg



0 dB = 0.128 W/kg = -8.93 dBW/kg

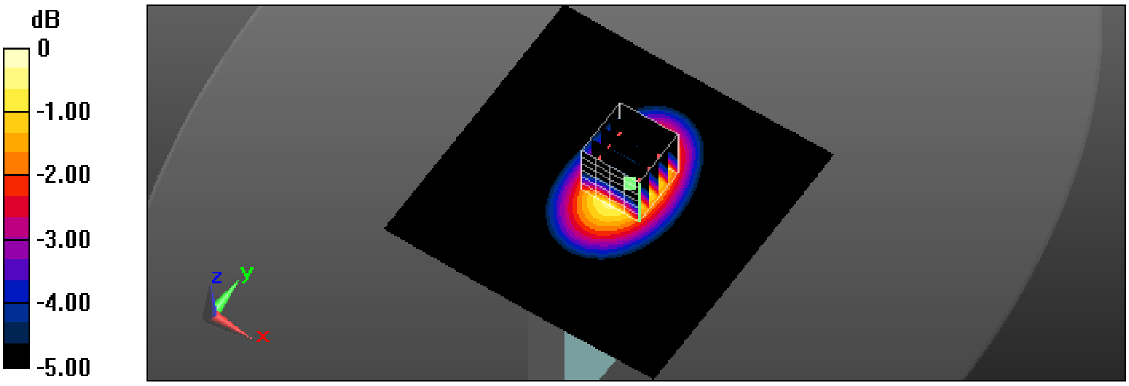
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 07:56:49 PM
7_LTE Band14 CH 23330_QPSK_BW 10MHz_1 RB size 24 RB offset_side4_10mm
DUT: MR1100-330; Type: Mobile Router; Serial: 015161000

Communication System: UID 0, Generic LTE (0); Frequency: 793 MHz;Duty Cycle: 1:1
Medium parameters used: f = 793 MHz; σ = 1.008 S/m; ε_r = 55.749; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat/Area Scan (101x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.326 W/kg

Flat/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.66 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.370 W/kg
SAR(1 g) = 0.268 W/kg; SAR(10 g) = 0.191 W/kg
Maximum value of SAR (measured) = 0.324 W/kg



0 dB = 0.324 W/kg = -4.89 dBW/kg

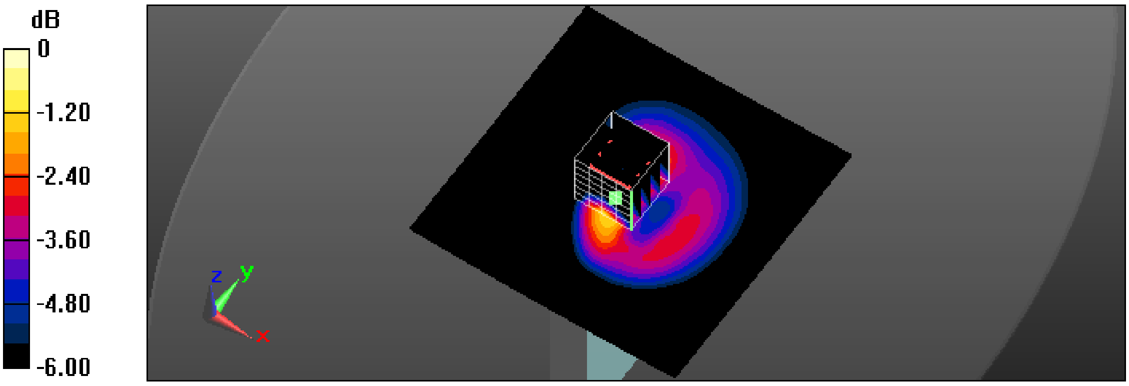
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 08:15:45 PM
9_LTE Band14 CH 23330_QPSK_BW 10MHz_1 RB size 24 RB offset_side5_10mm
DUT: MR1100-330; Type: Mobile Router; Serial: 015161000

Communication System: UID 0, Generic LTE (0); Frequency: 793 MHz;Duty Cycle: 1:1
Medium parameters used: f = 793 MHz; σ = 1.008 S/m; ε_r = 55.749; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat/Area Scan (101x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.142 W/kg

Flat/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.73 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.203 W/kg
SAR(1 g) = 0.127 W/kg; SAR(10 g) = 0.077 W/kg
Maximum value of SAR (measured) = 0.166 W/kg



0 dB = 0.166 W/kg = -7.80 dBW/kg

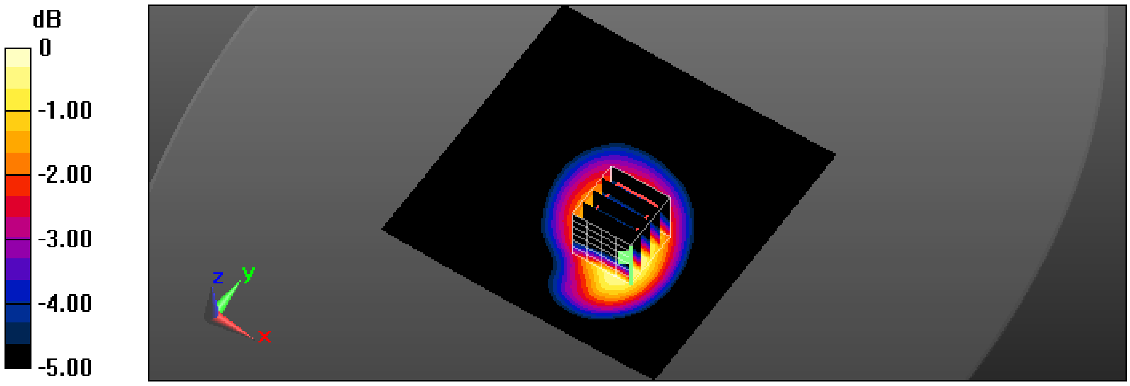
Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2018/1/24 05:49:02 PM
2_LTE Band14 CH 23330_QPSK_BW 10MHz_25 RB size 12 RB offset_side1_10mm
DUT: MR1100-330; Type: Mobile Router; Serial: 015161000

Communication System: UID 0, Generic LTE (0); Frequency: 793 MHz;Duty Cycle: 1:1
Medium parameters used: f = 793 MHz; σ = 1.008 S/m; ε_r = 55.749; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(10, 10, 10); Calibrated: 2017/5/5;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2017/2/13
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1133
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Flat/Area Scan (101x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.502 W/kg

Flat/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.24 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.565 W/kg
SAR(1 g) = 0.417 W/kg; SAR(10 g) = 0.305 W/kg
Maximum value of SAR (measured) = 0.494 W/kg



0 dB = 0.494 W/kg = -3.06 dBW/kg