SAR TEST REPORT

Reference No.	:	WTD24D01019176W005
FCC ID................................	:	2AQRM-MF3
Applicant	:	FOXX Development Inc.
Address	:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA
Manufacturer	:	FOXX Development Inc.
Address	:	3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA
Product	:	LTE MiFi Router
Model(s)..	:	MF3
Standards	:	FCC 47 CFR Part2(2.1093) IEEE Std. C95.1-2019 IEC/IEEE 62209-1528:2020
Date of Receipt sample....	:	2024-01-26
Date of Test	:	2024-02-19 to 2024-04-01
Date of Issue	:	2024-04-01
Test Result	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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2 Contents

Page

1 COVER PAGE 1
2 CONTENTS 2
3 REVISION HISTORY 3
4 GENERAL INFORMATION 4
4.1 GENERAL DESCRIPTION OF E.U.T. 4
4.2 DETAILS OF E.U.T. 4
4.3 TEST FACILITY 5
5 EQUIPMENT USED DURING TEST 6
5.1 EQUIPMENT LIST 6
6 SAR INTRODUCTION 7
6.1 INTRODUCTION 7
6.2 SAR DEFINITION 7
7 SAR MEASUREMENT SETUP 8
8 EXPOSURE LIMIT 17
9 SYSTEM AND LIQUID VALIDATION 18
9.1 SYSTEM VALIDATION 18
9.2 LIQUID VALIDATION 20
10 TYPE A MEASUREMENT UNCERTAINTY 28
11 OUTPUT POWER VERIFICATION 31
11.1 TEST CONDITION 31
11.2 TEST PROCEDURES 31
11.3 TEST RESULT 32
12 EXPOSURE CONDITIONS CONSIDERATION 64
12.1 EUT ANTENNA LOCATION 64
12.2 TEST POSITION CONSIDERATION 64
13 SAR TEST RESULTS 65
13.1 TEST CONDITION 65
13.2 GENERALLY TEST PROCEDURES 65
13.3 SAR SUMMARY TEST RESULT 66
14 SAR MEASUREMENT REFERENCE 76
14.1 REFERENCES 76
14.2 MAXIMUM SAR MEASUREMENT PLOTS 77
15 CALIBRATION REPORTS-PROBE AND DIPOLE 87
16 SAR SYSTEM PHOTOS 164
17 SETUP PHOTOS 165
18 EUT PHOTOS 165

3 Revision History

Test Report No.	Date of Receipt Sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD24D01019176W005	2024-01-26	2024-02-19 to 2024-04-01	2024-04-01	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	LTE MiFi Router
Model(s):	MF3
Model Description:	N/A
WCDMA Band(s):	FDD Band II/IV/V
LTE Band(s):	FDD Band 2/4/5/12/13/66
Wi-Fi Specification:	2.4G-802.11b/g/n/ax HT20/n/ax HT40
Hardware Version:	Mobile.M47.H01
Software Version:	Mobile.M47.B01

4.2 Details of E.U.T.

Operation Frequency:	2.4G Wi-Fi: 802.11b/g/n/ax HT20: 2412~2462MHz 802.11n/ax HT40: 2422~2452MHz WCDMA Band II: 1850~1910MHz WCDMA Band IV:1710~1755MHz WCDMA Band V: 824~849MHz LTE Band 2: 1850~1910MHz LTE Band 4: 1710~1755MHz LTE Band 5: 824~849MHz LTE Band 12: 699~716MHz LTE Band 13: 777~787MHz LTE Band 66: 1710~1780MHz
Max. RF output power:	2.4G Wi-Fi: 14.79dBm WCDMA Band II: 22.71dBm WCDMA Band IV: 22.95dBm WCDMA Band V: 22.30dBm LTE Band 2: 22.77dBm LTE Band 4: 22.71dBm LTE Band 5: 23.48dBm LTE Band 12: 23.15dBm LTE Band 13: 22.98dBm LTE Band 66: 22.78dBm
Max.SAR:	0.627W/kg 1g Body Tissue
Max Simultaneous SAR	0.743W/kg
Type of Modulation:	2.4G Wi-Fi: DSSS, OFDM WCDMA: QPSK LTE: QPSK, 16QAM,64QAM
Antenna installation	2.4G Wi-Fi: PCB printed antenna

	WCDMA/LTE: PCB printed antenna
Antenna Gain:	2.4G Wi-Fi: 2.8dBi WCDMA Band II: 3.2dBi WCDMA Band IV: 2.5dBi WCDMA Band V: 2.5dBi LTE Band 2:3.1dBi LTE Band 4: 3.2dBi LTE Band 5: 2.6dBi LTE Band 12: -1dBi LTE Band 13: -0.8dBi LTE Band 66: 3.2dBi

Note:
#: The antenna gain is provided by the applicant, and the applicant should be responsible for its authenticity, WALTEK lab has not verified the authenticity of its information.

Ratings:	Battery: DC 3.7V, 3000mAh, 11.1Wh
Adapter:	Input: 100-240V~, 50/60Hz, 0.2A Output: 5.0V⎓1.0A

4.3 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Testing Group Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Testing Group 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 number 523476, September 10, 2019.

5 Equipment Used during Test

5.1 Equipment List

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Date	Calibration Due
6 AXIS ROBOT	KUKA	KR6 R900 SIXX	502635	N/A	N/A
SATIMO Test Software	MVG	OPENSAR	OPENSAR V_4_02_27	N/A	N/A
PHANTOM TABLE	MVG	N/A	SAR_1215_01	N/A	N/A
SAM PHANTOM	MVG	SAM118	SN 11/15 SAM118	N/A	N/A
MultiMeter	Keithley	MiltiMeter 2000	4073942	2024-02-25	2025-02-24
S-Parameter Network Analyzer	Agilent	8753E	JP38160684	2023-09-15	2024-09-14
Universal Radio Communication Tester	ROHDE&SCHWARZ	CMU200	114798	2023-07-27	2024-07-26
Wideband Radio Communication Tester	ROHDE&SCHWARZ	CMW500	127818	2023-04-24	2024-04-23
E-Field Probe	MVG	SSE2	2523-EPGO-417	2023-07-31	2024-07-30
DIPOLE 750	MVG	SID750	SN 09/15 DIP 0G750-357	2023-08-08	2026-08-07
DIPOLE 835	MVG	SID835	SN 09/15 DIP 0G835-358	2023-08-08	2026-08-07
DIPOLE 1800	MVG	SID1800	SN 09/15 DIP 1G800-360	2023-08-08	2026-08-07
DIPOLE 1900	MVG	SID1900	SN 09/15 DIP 1G900-361	2023-08-08	2026-08-07
DIPOLE 2450	MVG	SID2450	SN 09/15 DIP 2G450-363	2023-08-08	2026-08-07
Limesar Dielectric Probe	MVG	SCLMP	SN 11/15 OCPG 69	2024-02-24	2025-02-23
Power Amplifier	BONN	BLWA 0830 -160/100/40D	128740	2023-07-27	2024-07-26
Signal Generator	R&S	SMB100A	105942	2023-07-27	2024-07-26
Power Meter	R&S	NRP2	102031	2023-07-27	2024-07-26
Power Meter	R&S	NRVD	102284	2023-07-27	2024-07-26
USB Wideband Power Sensor	Malaysia Keysight	U2021XA	MY54340009	2023-07-27	2024-07-26
USB Wideband Power Sensor	Malaysia Keysight	U2021XA	MY54340010	2023-07-27	2024-07-26

6 SAR Introduction

6.1 Introduction

This measurement report shows compliance of the EUT with ANSI/IEEE C95.1-2006 and FCC 47 CFR Part2 (2.1093).The test procedures, as described in IEC/IEEE 62209-1528: 2020 Standard for Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices –Part 1528: Human models, instrumentation, and procedures(Frequency range of 4 MHz to 10 GHz)

6.2 SAR Definition

- SAR : Specific Absorption Rate
- The SAR characterize the absorption of energy by a quantity of tissue
- This is related to a increase of the temperature of these tissues during a time period.

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

$$DAS = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dV}\right)$$

$$DAS = c_h \left.\frac{dT}{dt}\right|_{t=0}$$

SAR definition

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

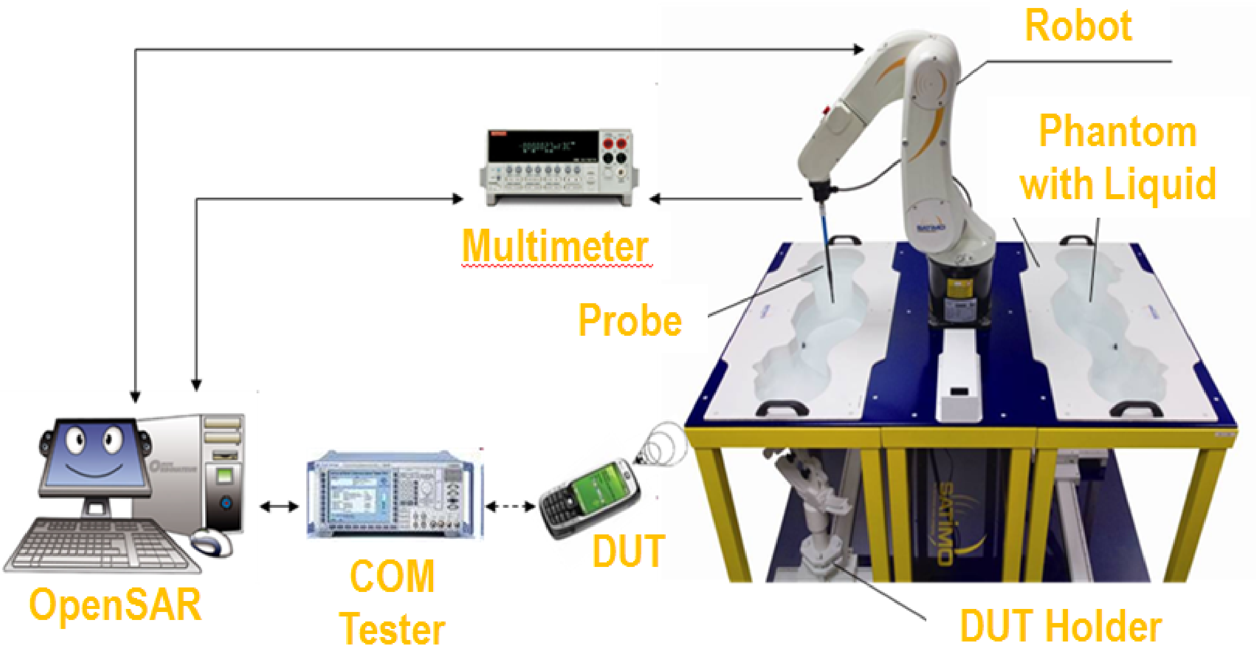
- SAR : Specific Absorption Rate
  - σ : Liquid conductivity
    - $\varepsilon_r = \varepsilon' - j\varepsilon''$ (complex permittivity of liquid)
    - $\sigma = \frac{\varepsilon'' \omega}{\varepsilon_0}$
  - ρ: Liquid density
    - ρ = 1000 g/L = 1000Kg/m^3

where:

σ = conductivity of the tissue (S/m)
ρ = mass density of the tissue (kg/m3)
E = rms electric field strength (V/m)

7 SAR Measurement Setup

SAR bench sub-systems



Scanning System (robot)

- It must be able to scan all the volume of the phantom to evaluate the tridimensional distribution of SAR.
- Must be able to set the probe orthogonal of the surface of the phantom (±30°).
- Detects stresses on the probe and stop itself if necessary to keep the integrity of the probe.

SAM Phantom (Specific Anthropomorphic Mannequin)

- The probe scanning of the E-Field is done in the 2 half of the normalized head.
- The normalized shape of the phantom corresponds to the dimensions of 90% of an adult head size.
- The materials for the phantom should not affect the radiation of the device under test (DUT)
  - Permittivity < 5
- The head is filled with tissue simulating liquid.
- The hand holding the DUT does not have to be modeled.

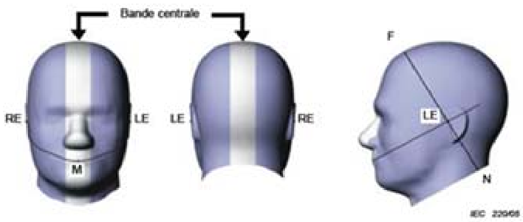
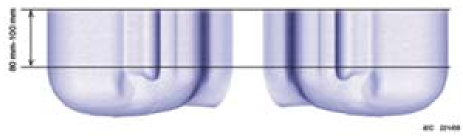
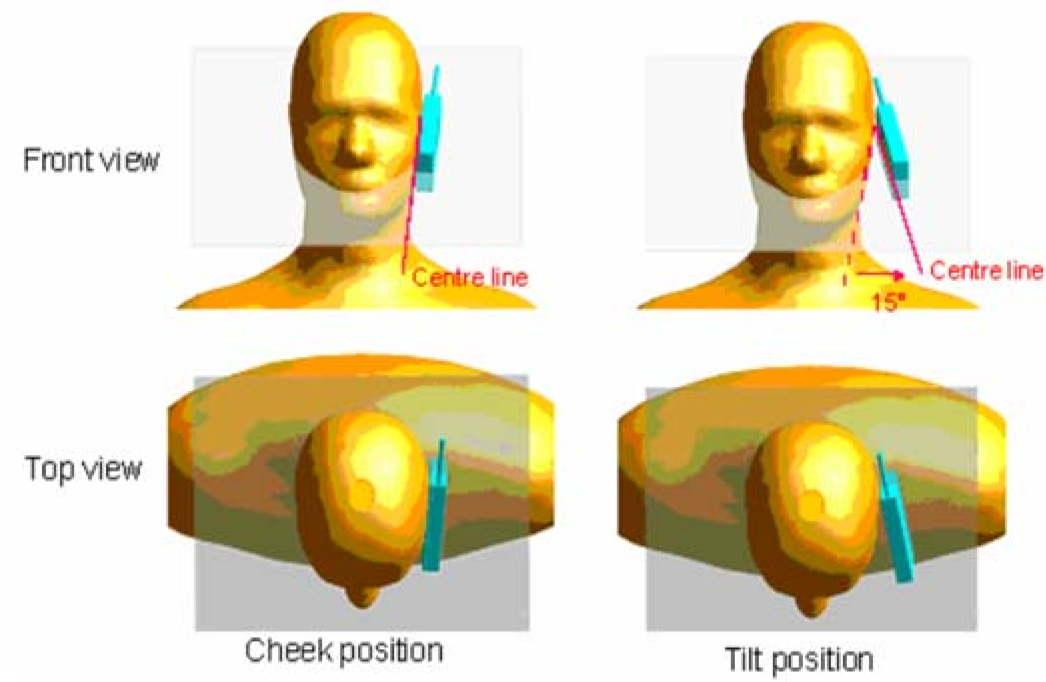


Illustration du fantôme donnant les points de référence des oreilles, RE et LE, le point de référence de la bouche, M, la ligne de référence N-F et la bande centrale



Bi-section sagittale du fantôme avec périmètre étendu (montrée sur le côté comme lors des essais de DAS de l'appareil)



The OPENSAR system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (KUKA) with controller and software.
2. KUKA Control Panel (KCP).
3. 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.
4. The functions of the PC plug-in card are to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.
5. A computer operating Windows 7.
6. OPENSAR software.
7. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
8. The SAM phantom enabling testing left-hand right-hand and body usage.
9. The Position device for handheld EUT.
10. Tissue simulating liquid mixed according to the given recipes (see Application Note).
11. System validation dipoles to validate the proper functioning of the system.

Data Evaluation

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

Probe Parameters	· Sensitivity	$Norm_i$
	· Conversion factor	ConvFi
	· Diode compression point Dcpi	
Device Parameter	· Frequency	f
	· Crest factor	cf
Media Parametrs	· Conductivity	σ
	· Density	ρ

These parameters must be set correctly in the software. They can either be found in the component documents or be imported into the software from the configuration files issued for the OPENSAR components.

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

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

Where V_i *= Compensated signal of channel i (i = x, y, z)*
U_i *= Input signal of channel i (i = x, y, z)*
cf = Crest factor of exciting field (DASY parameter)
dcp_i *= 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: $$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

Where V_i *= Compensated signal of channel i (i = x, y, z)*
$Norm_i$ *= Sensor sensitivity of channel i (i = x, y, z)*
μV/(V/m)2 for E0field Probes
ConvF = Sensitivity enhancement in solution
a_{ij} *= Sensor sensitivity factors for H-field probes*

f = *Carrier frequency (GHz)*
E_i = *Electric field strength of channel i in V/m*
H_i = *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.

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

where SAR = *local specific absorption rate in mW/g*
E_{tot} = *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.

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

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

where P_{pwe} = *Equivalent power density of a plane wave in mW/cm2*
E_{tot} = *total electric field strength in V/m*
H_{tot} = *total magnetic field strength in A/m*

SAR Evaluation – Peak Spatial - Average

The procedure for assessing the peak spatial-average SAR value consists of the following steps

- **Power Reference Measurement**

  The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

  The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in OPENSAR software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom.

When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

- **Zoom Scan**

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded.

SAR Evaluation – Peak SAR

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1528 standard. It can be conducted for 1 g and 10 g. The OPENSAR 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 maximum 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

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.
They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the fourth order least square polynomial method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Definition of Reference Points

Ear Reference Point

Figure 6.2 shows the front, back and side views of the SAM Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERPs are 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 6.1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 6.1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

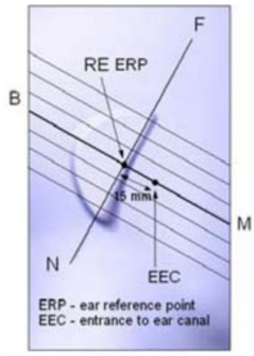


Figure 6.1 Close-up side view of ERP’s

Figure 6.2 Front, back and side view of SAM

Device Reference Points

Two imaginary lines on the device need to be established: the vertical centerline and the horizontal line. The test device is placed in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Fig. 6.3). The “test device reference point” is than located at the same level as the center of the ear reference point. The test device is positioned so that the “vertical centerline” is bisecting the front surface of the device at it’s top and bottom edges, positioning the “ear reference point” on the outer surface of both the left and right head phantoms on the ear reference point [5].

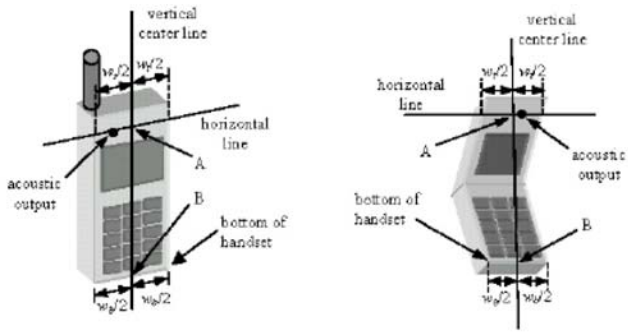


Figure 6.3 Handset Vertical Center & Horizontal Line Reference Points

Test Configuration – Positioning for Cheek / Touch

1. Position the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure below), such that the plane defined by the vertical center line and the horizontal line of the device is approximately parallel to the sagittal plane of the phantom

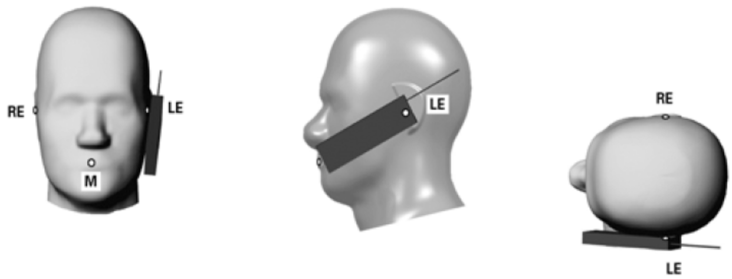


Figure 7.1 Front, Side and Top View of Cheek/Touch Position

2. Translate the device towards the phantom along the line passing through RE and LE until the device touches the ear.

3. While maintaining the device in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).
4. Rotate the device around the vertical centerline until the device (horizontal line) is symmetrical with respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the device contact with the ear, rotate the device about the line NF until any point on the device is in contact with a phantom point below the ear (cheek). See Figure below.

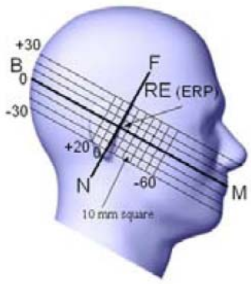


Figure 7.2 Side view w/ relevant markings

Test Configuration – Positioning for Ear / 15° Tilt

With the test device aligned in the Cheek/Touch Position":

1. While maintaining the orientation of the device, retracted the device parallel to the reference plane far enough to enable a rotation of the device by 15 degrees.

2. Rotate the device around the horizontal line by 15 degrees.

3. While maintaining the orientation of the device, move the device parallel to the reference plane until any part of the device touches the head. (In this position, point A is located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, the angle of the device shall be reduced. The tilted position is obtained when any part of the device is in contact with the ear as well as a second part of the device is in contact with the head (see Figure below).

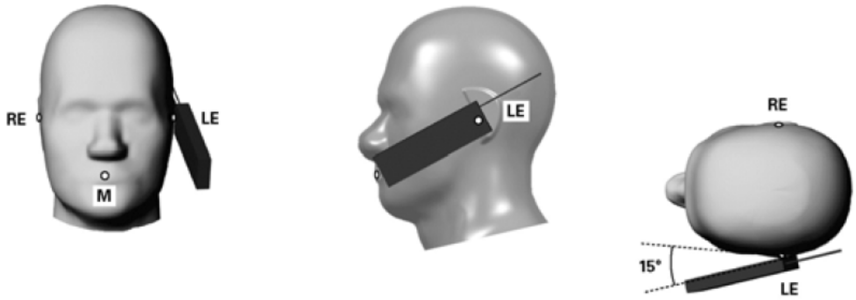
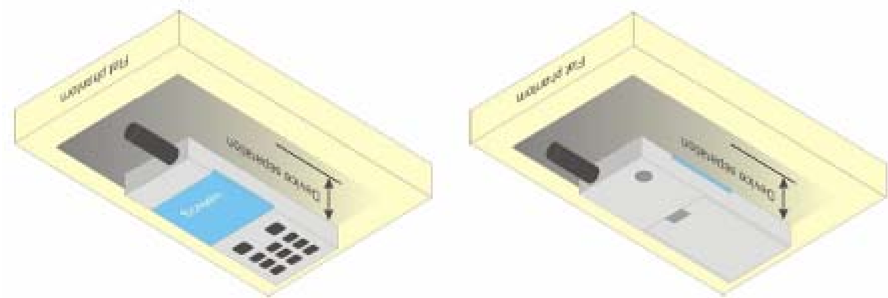


Figure 7.3 Front, Side and Top View of Ear/15° Tilt Position

Test Position – Body Configurations

Body Worn Position
(a) To position the device parallel to the phantom surface with either keypad up or down.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device surface and the flat phantom to 1.0 cm or holster surface and the flat phantom to 0 cm.



8 Exposure limit

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

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). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

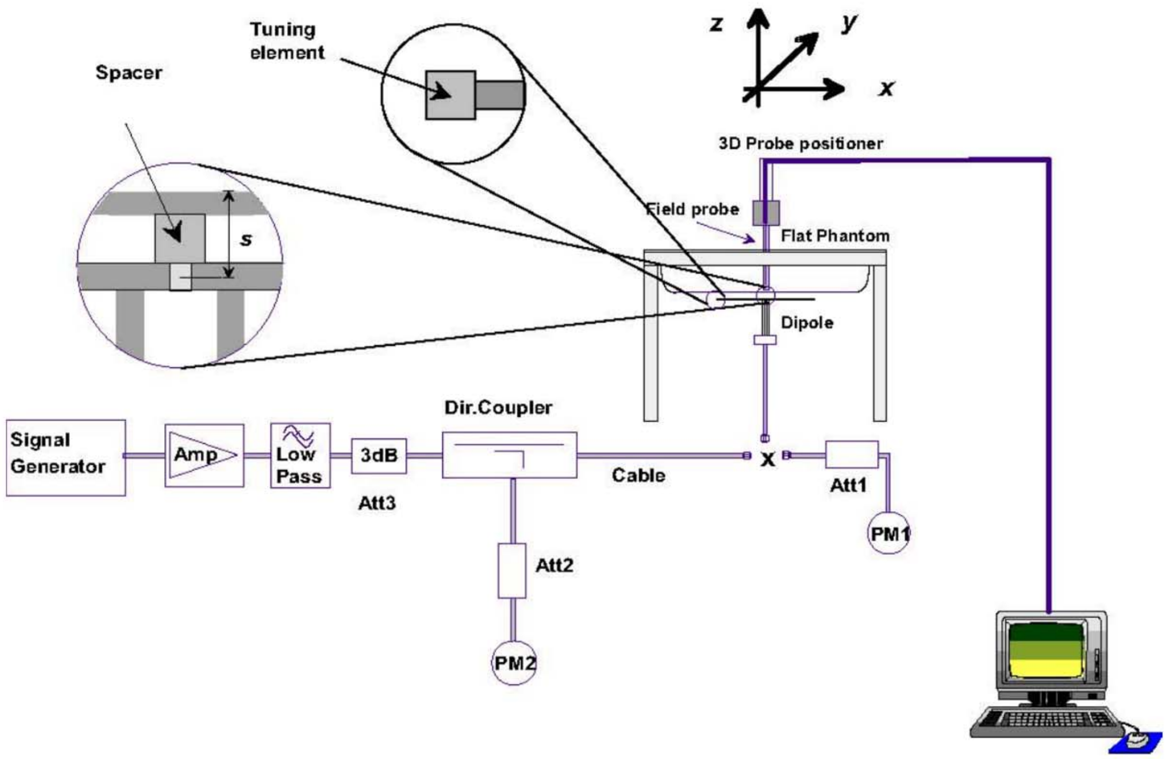
Table 8.1 Human Exposure Limits

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIROMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR[1] Brain	1.60	8.00
SPATIAL AVERAGE SAR[2] Whole Body	0.08	0.40
SPATIAL PEAK SAR[3] Hands, Feet, Ankles, Wrists	4.00	20.00

[1] 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.
[2] The Spatial Average value of the SAR averaged over the whole body.
[3] 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.

9 System and liquid validation

9.1 System validation



The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

The output power on dipole port must be calibrated to 30 dBm (1000 mW) before dipole is connected.

Numerical reference SAR values (W/kg) for reference dipole and flat phantom

Frequency (MHz)	1g SAR	10g SAR	Local SAR at surface(above feed-point)	Local SAR at surface(y = 2 cm offset from feedpoint)
300	3.02	2.04	4.40	2.10
450	4.92	3.28	7.20	3.20
750	8.49	5.55	12.6	4.59
835	9.56	6.22	14.1	4.90
900	10.9	6.99	16.4	5.40
1450	29.0	16.0	50.2	6.50
1800	38.4	20.1	69.5	6.80
1900	39.7	20.5	72.1	6.60
2000	41.1	21.1	74.6	6.50
2450	52.4	24.0	104	7.70
2600	55.3	24.6	113	8.29
3000	63.8	25.7	140	9.50

Table 1: system validation (1g)

Measurement Date	Frequency (MHz)	Liquid Type (head/body)	1W Target SAR1g (W/kg)	Measured SAR1g (W/kg)	1W Normalized SAR1g (W/kg)	Desired Tolerance (%)	Actual Tolerance (%)
2024-03-25	750	head	8.78	0.922	9.22	±10	5.01
2024-03-27	835	head	9.57	0.942	9.42	±10	-1.57
2024-03-26	1800	head	38.73	4.125	41.25	±10	6.51
2024-03-28	1900	head	39.51	3.990	39.90	±10	0.99
2024-03-29	2450	head	54.33	5.539	55.39	±10	1.95

Remark: 1. system check input power: 100mW.
2. Referring to IEEE 1528:2013, Section 8.2, The system check shall be performed at a test frequency that is within ±10% or ±100 MHz of the compliance test mid-band frequency, so the 1750 MHz system verification is made of 1800MHz Dipole.

9.2 liquid validation

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

KDB 865664 recommended Tissue Dielectric Parameters

The head and body tissue parameters given in this below table should be used to measure the SAR of transmitters operating in 100 MHz to 6 GHz frequency range. The tissue dielectric parameters of the tissue medium at the test frequency should be within the tolerance required in this document. The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

The head tissue dielectric parameters recommended by IEEE Std 1528-2013 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 a human head. Other head and body tissue parameters that have not been specified in 1528 are derived from tissue dielectric parameters computed from the 4-Cole-Cole equations described above and extrapolated according to the head parameters specified in 1528.

Target Frequency	Head Tissue		Body Tissue	
MHz	εr	Ơ (S/m)	εr	Ơ (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
750	**41.9**	**0.89**	**55.5**	**0.96**
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**
2600	39.0	1.96	52.5	2.16
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 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 Power drifts in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Table 2: Recommended Dielectric Performance of Tissue

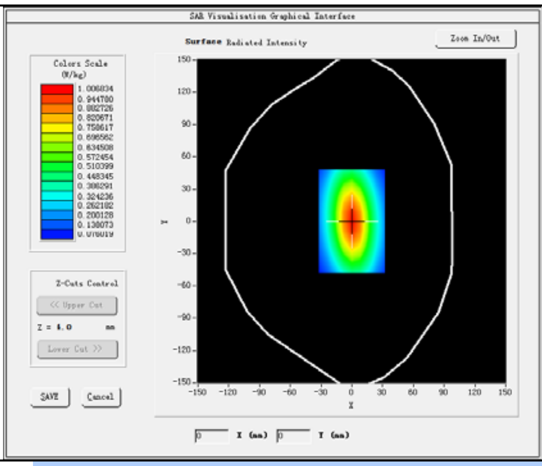
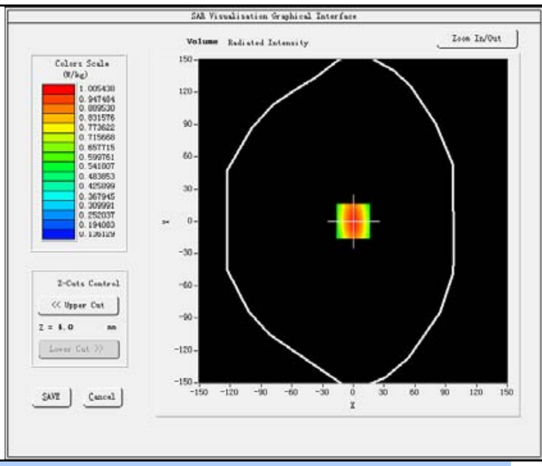
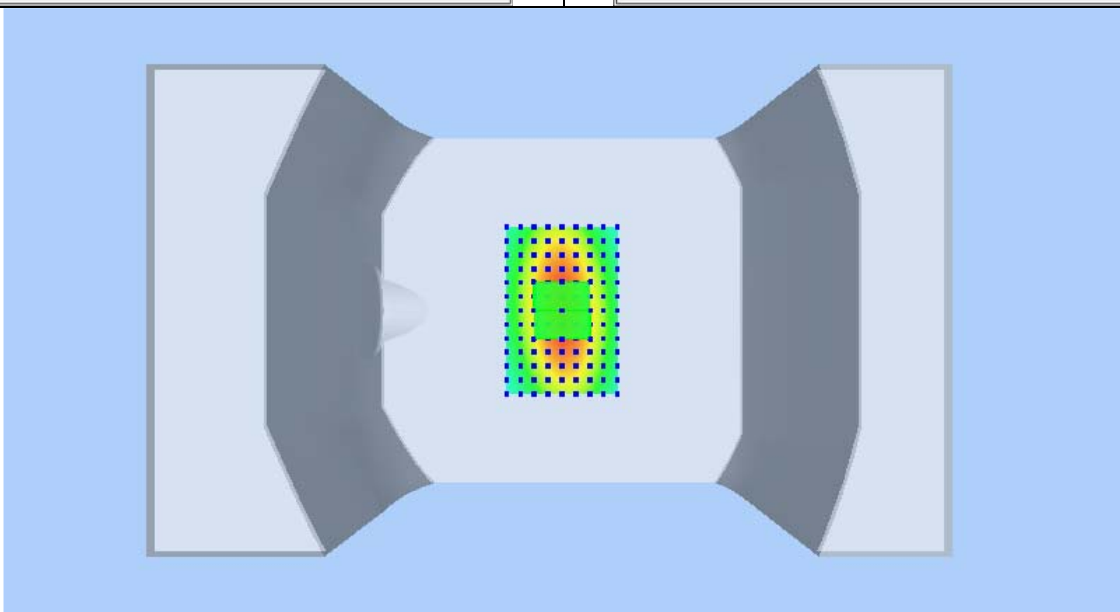
Recommended Dielectric Performance of Tissue					
Head/Body					
Ingredients (% by weight)	Frequency (MHz)				
	750	835	1800	1900	2450
Water	40.52	41.45	55.2	54.9	62.7
Salt (Nacl)	1.61	1.45	0.3	0.18	0.5
Sugar	57.67	56.0	0.0	0.0	0.0
HEC	0.1	1.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.0	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	36.8
DGBE	0.0	0.0	44.5	44.92	0.0
Dielectric	40.93	42.54	40.0	39.9	39.8
Conductivity	0.87	0.91	1.40	1.42	1.88

Table 3: Dielectric Performance of Head Tissue Simulating Liquid

Temperature: 23.9°C , Relative humidity: 52%				
Frequency(MHz)	**Measured Date**	**Description**	**Dielectric Parameters**	
			εr	**σ(s/m)**
750	2024-03-25	Target Value ±5% window	41.90 39.81 — 44.00	0.89 0.85 — 0.93
		Measurement Value	42.15	0.90
835	2024-03-27	Target Value ±5% window	41.50 39.43 — 43.58	0.90 0.86 — 0.95
		Measurement Value	41.95	0.89
1800	2024-03-26	Target Value ±5% window	40.00 38.00 — 42.00	1.40 1.33 — 1.47
		Measurement Value	38.73	1.39
1900	2024-03-28	Target Value ±5% window	40.00 38.00 — 42.00	1.40 1.33 — 1.47
		Measurement Value	40.13	1.36
2450	2024-03-29	Target Value ±5% window	39.2 37.24— 41.16	1.80 1.71 — 1.89
		Measurement Value	39.21	1.81

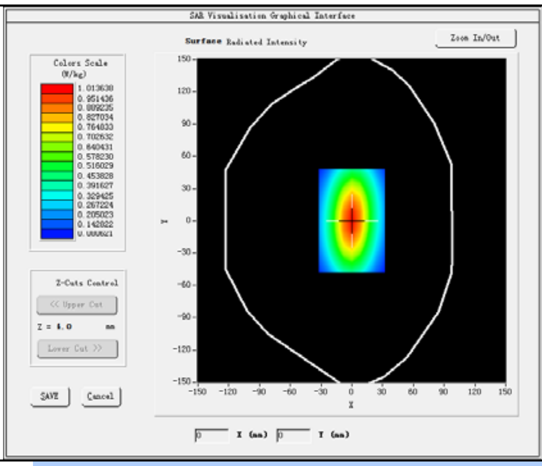
System Verification Plots

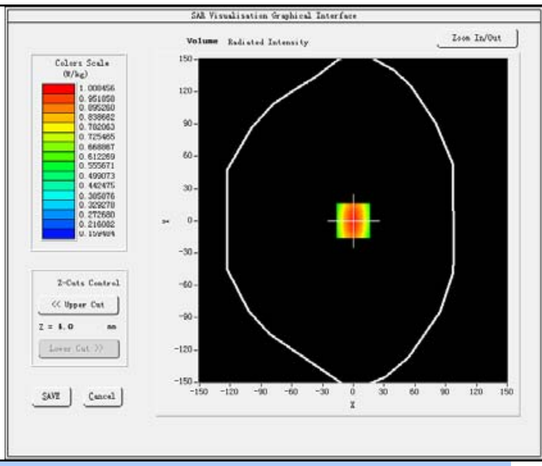
Product Description: Dipole
Model: SID750
Test Date: 2024-03-25

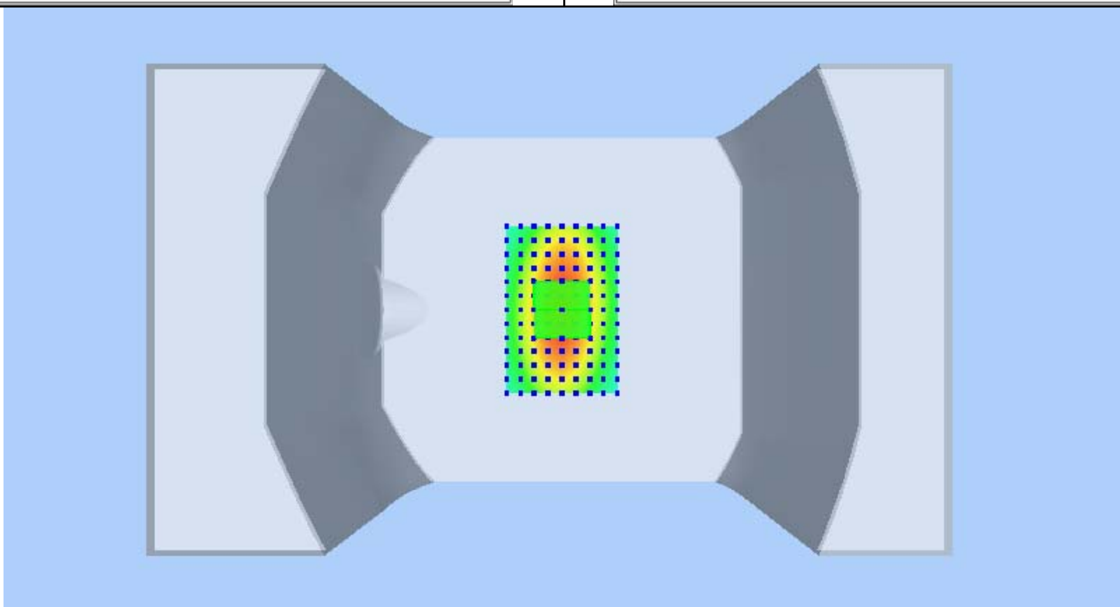
Medium(liquid type)	HL750
Frequency (MHz)	750.000
Relative permittivity (real part)	42.15
Conductivity (S/m)	0.90
Input power	100mW
Crest factor	1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.60
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.13
SAR 10g (W/kg)	0.590548
SAR 1g (W/kg)	0.922416
SURFACE SAR	**VOLUME SAR**
	
	

Product Description: Dipole
Model: SID835
Test Date: 2024-03-27

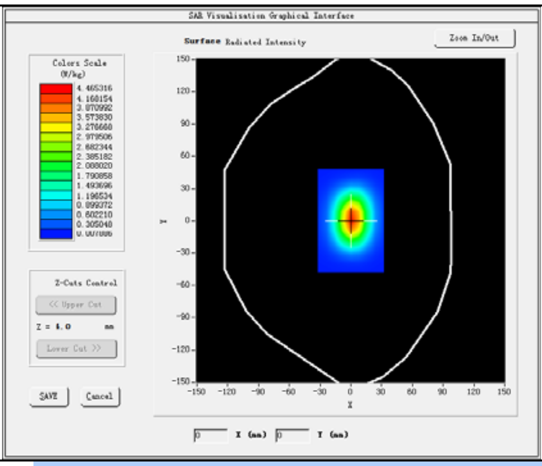
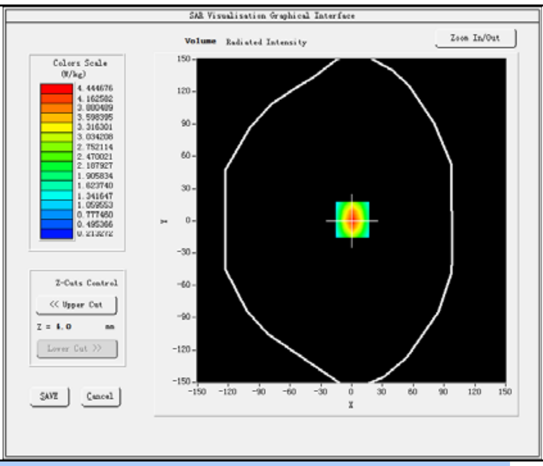
Medium(liquid type)	HL850
Frequency (MHz)	835.000
Relative permittivity (real part)	41.95
Conductivity (S/m)	0.89
Input power	100mW
Crest factor	1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.48
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.12
SAR 10g (W/kg)	0.612705
SAR 1g (W/kg)	0.941918
SURFACE SAR	**VOLUME SAR**

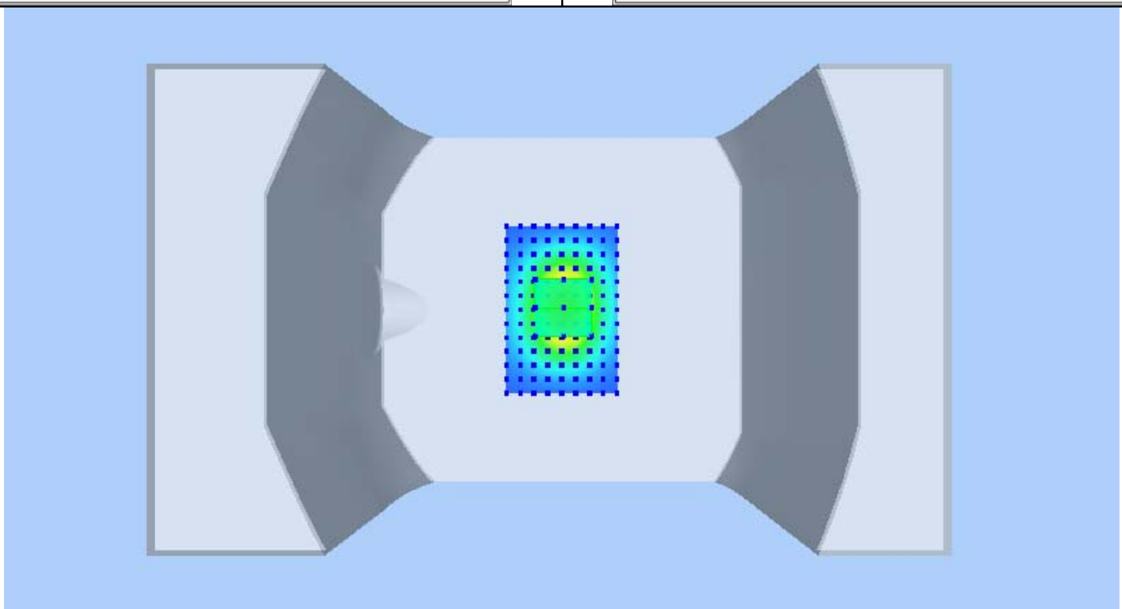




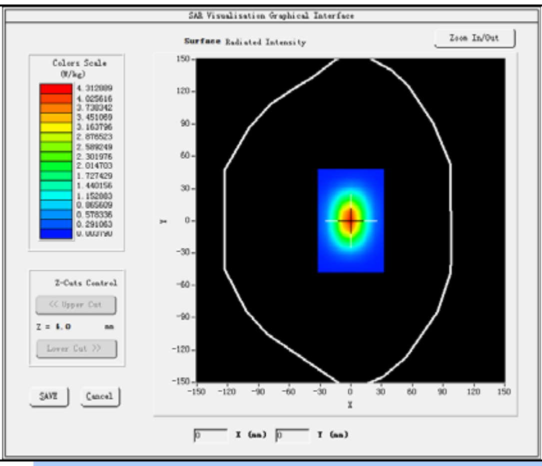
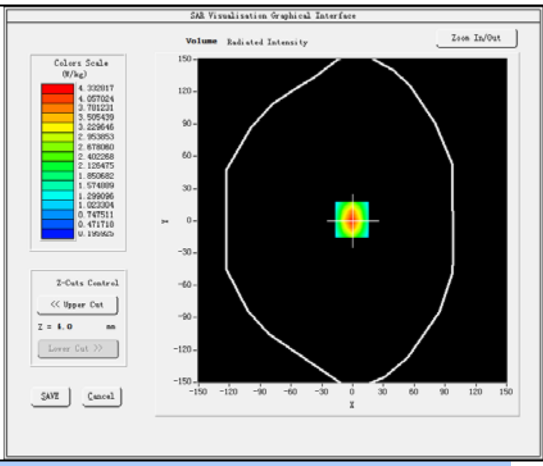


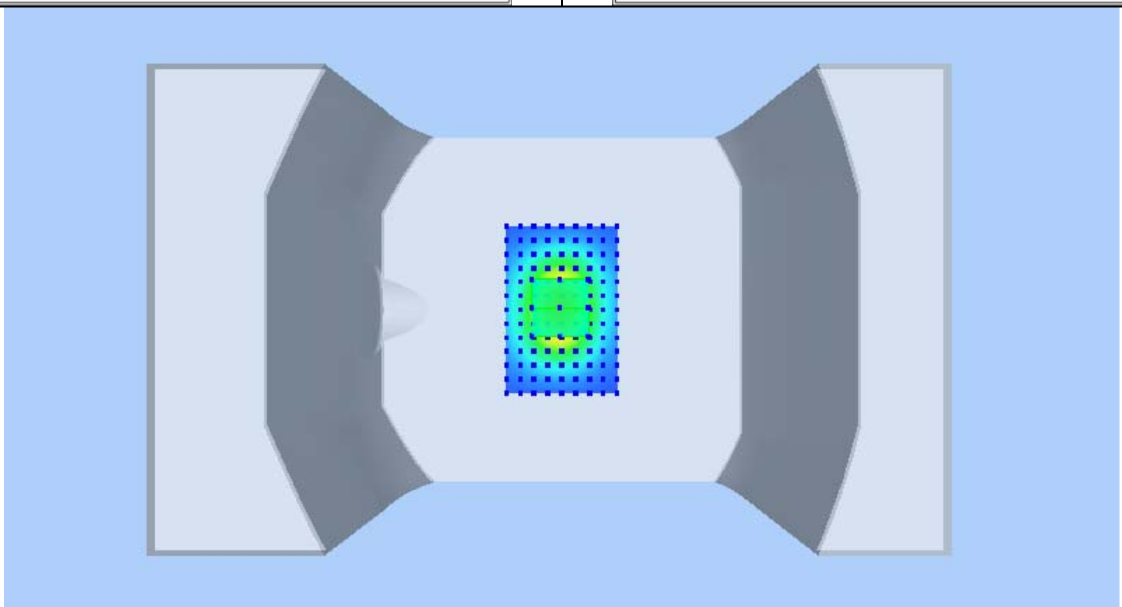
Product Description: Dipole
Model: SID1800
Test Date: 2024-03-26

Medium(liquid type)	HL1800
Frequency (MHz)	1800.000
Relative permittivity (real part)	38.73
Conductivity (S/m)	1.39
Input power	100mW
Crest factor	1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.65
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.18
SAR 10g (W/kg)	2.124195
SAR 1g (W/kg)	4.125013
SURFACE SAR	**VOLUME SAR**
	



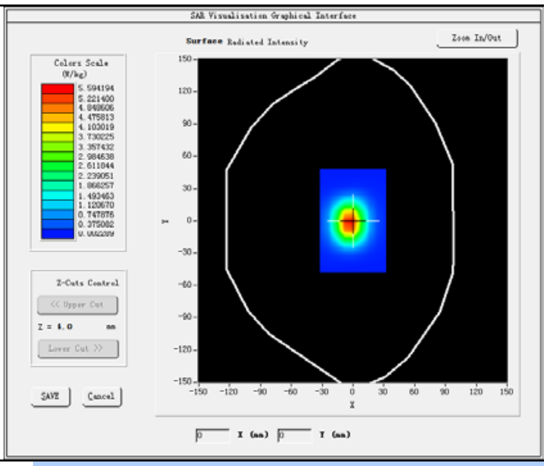
Product Description: Dipole
Model: SID1900
Test Date: 2024-03-28

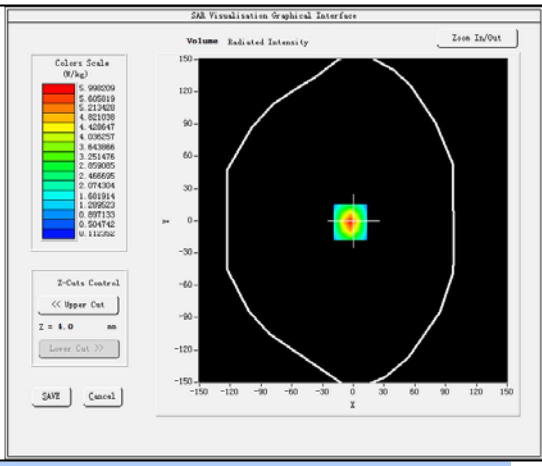
Medium(liquid type)	HL1900
Frequency (MHz)	1900.000
Relative permittivity (real part)	40.13
Conductivity (S/m)	1.36
Input power	100mW
Crest factor	1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.83
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.18
SAR 10g (W/kg)	2.104071
SAR 1g (W/kg)	3.990428
SURFACE SAR	**VOLUME SAR**
	

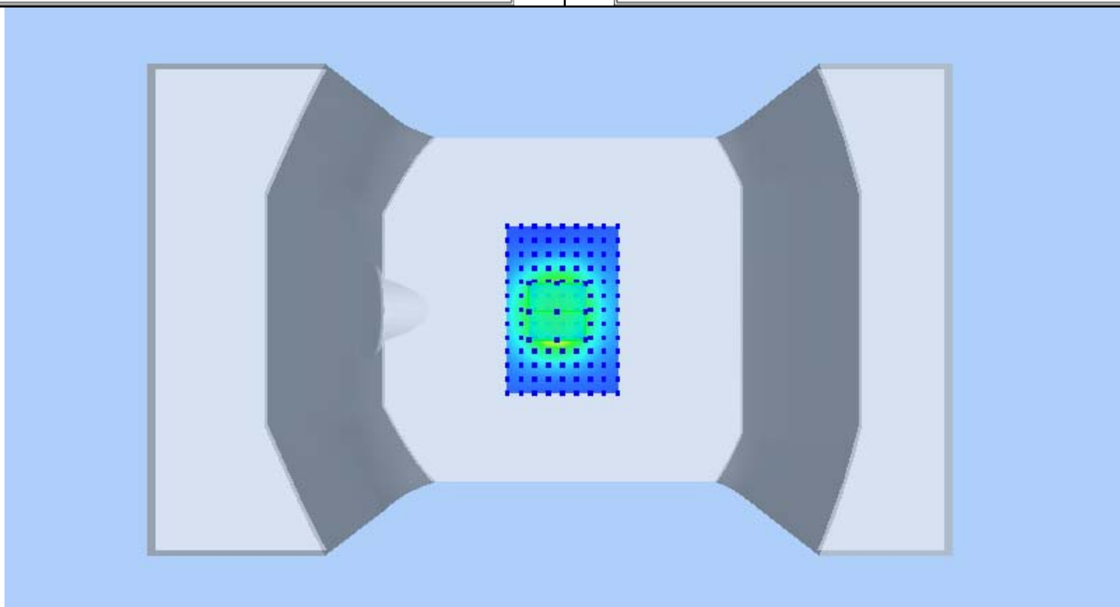


Product Description: Dipole
Model: SID2450
Test Date: 2024-03-29

Medium(liquid type)	HL2450
Frequency (MHz)	2450.000
Relative permittivity (real part)	39.21
Conductivity (S/m)	1.81
Input power	100mW
Crest factor	1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	3.03
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.12
SAR 10g (W/kg)	2.610327
SAR 1g (W/kg)	5.539138
SURFACE SAR	**VOLUME SAR**







10 Type a Measurement Uncertainty

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table below :

Uncertainty Distribution	Normal	Rectangle	Triangular	U Shape
Multi-plying Factor(a)	1/k(b)	1 / √3	1 / √6	1 / √2

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity
(b) κ is the coverage factor

Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type -sum-by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %.

The COMOSAR Uncertainty Budget is show in below table:

UNCERTAINTY FOR SYSTEM PERFORMANCE CHECK								
a	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	√3	(1_Cp)^1/2	(1_Cp)^1/2	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	√3	(Cp)^1/2	(Cp)^1/2	2.41	2.41	∞
Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	4.7	R	√ 3	1	1	2.71	2.71	∞
System detection limits	1.0	R	√3	1	1	0.58	0.58	∞
Modulation response	0.00	N	1	1	1	0.00	0.00	∞
Readout Electronics	0.50	N	1	1	1	0.50	0.50	∞
Reponse Time	0.0	R	√3	1	1	0.00	0.00	∞
Integration Time	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.40	R	√3	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	2.3	R	√3	1	1	1.33	1.33	∞
Dipole								
Deviation of experimental source from numerical source	4.00	N	1	1	1	4.00	4.00	∞
Input power and SAR drift measurement	5.00	R	√3	1	1	2.89	2.89	∞
Dipole axis to liquid Distance	2.00	R	√3	1	1	1.15	1.15	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (Shape and thickness tolerances)	4.00	R	√3	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation (in permittivity and conductivity)	2.00	N	1	1	1	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	2.50	N	1	0.78	0.71	1.95	1.77	∞
Liquid conductivity - measurement uncertainty	4.00	N	1	0.23	0.26	0.92	1.04	M
Liquid permittivity (temperature uncertainty)	2.50	N	1	0.78	0.71	1.95	1.77	∞
Liquid permittivity - measurement uncertainty	5.00	N	1	0.23	0.26	1.15	1.30	M
Combined Standard Uncertainty		RSS				10.21	10.12	
Expanded Uncertainty (95% Confidence interval)		k				19.91	19.73	

UNCERTAINTY EVALUATION FOR HANDSET SAR TEST								
a	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	√3	(1_Cp)^ 1/2	(1_Cp)^1/2	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	√3	(Cp)^ 1/2	(Cp)^ 1/2	2.41	2.41	∞
Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	4.7	R	√3	1	1	2.71	2.71	∞
System detection limits	1.0	R	√3	1	1	0.58	0.58	∞
Modulation response	3.00	N	1	1	1	3.00	3.00	∞
Readout Electronics	0.50	N	1	1	1	0.50	0.50	∞
Reponse Time	0.0	R	√3	1	1	0.00	0.00	∞
Integration Time	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.40	R	√3	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	2.3	R	√3	1	1	1.33	1.33	∞
Test sample Related								
Test sample positioning	2.60	N	1	1	1	2.60	2.60	N-1
Device Holder Uncertainty	3.00	N	1	1	1	3.00	3.00	N-1
Output power Variation - SAR drift measurement	5.00	R	√3	1	1	2.89	2.89	∞
SAR scaling	2.00	R	√3	1	1	1.15	1.15	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (Shape and thickness tolerances)	4.00	R	√3	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation (in permittivity and conductivity)	2.00	N	1	1	1	2.00	1.68	∞
Liquid conductivity (temperature uncertainty)	2.50	N	1	0.78	0.71	1.95	1.77	∞
Liquid conductivity - measurement uncertainty	4.00	N	1	0.23	0.26	0.92	1.04	M
Liquid permittivity (temperature uncertainty)	2.50	N	1	0.78	0.71	1.95	1.77	∞
Liquid permittivity - measurement uncertainty	5.00	N	1	0.23	0.26	1.15	1.30	M
Combined Standard Uncertainty		RSS				10.63	10.54	
Expanded Uncertainty (95% Confidence interval)		k				20.73	20.56	

11 Output Power Verification

11.1 Test Condition

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The base station simulator was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Environmental Conditions	Temperature	23.5^{o}C
	Relative Humidity	53%
	Atmospheric Pressure	1015mbar

11.2 Test Procedures

radio output power measurement

1. The transmitter output port was connected to base station emulator.
2. Establish communication link between emulator and EUT and set EUT to operate at maximum output power all the time.
3. Select lowest, middle, and highest channels for each band and different possible test mode.
4. Measure the conducted peak burst power and conducted average burst power from EUT antenna port.

Other radio output power measurement:

The output power was measured using power meter at low, mid, and hi channels.

Source-based Time Averaged Burst Power Calculation:

For TDMA, the following duty cycle factor was used to calculate the source-based time average power

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Duty cycle factor	-9.03 dB	-6.02 dB	-4.26 dB	-3.01 dB
Crest Factor	8	4	2.66	2

Remark: *Time slot duty cycle factor = 10 * log (Time Slot Duty Cycle)*
Source based time averaged power = Maximum burst averaged power (1 Uplink) – 9.03 dB
Source based time averaged power = Maximum burst averaged power (2 Uplink) – 6.02 dB
Source based time averaged power = Maximum burst averaged power (3 Uplink) – 4.26 dB
Source based time averaged power = Maximum burst averaged power (4 Uplink) – 3.01 dB

11.3 Test Result

WCDMA - Average Power (dBm)								
Band	**WCDMA Band II**				**WCDMA Band V**			
Channel	**9262**	**9400**	**9538**	**Tune up Power tolerant**	**4132**	**4183**	**4233**	**Tune up Power tolerant**
Frequency (MHz)	**1852.4**	**1880**	**1907.6**	**/**	**826.4**	**836.6**	**846.6**	**/**
RMC 12.2k	22.12	**22.71**	22.67	22.0±1	**22.30**	21.97	21.89	22.0±1
HSDPA Subtest-1	21.03	21.56	21.51	21.0±1	21.18	20.84	20.78	21.0±1
HSDPA Subtest-2	21.01	21.48	21.36	21.0±1	21.05	20.71	20.66	21.0±1
HSDPA Subtest-3	20.78	21.42	21.28	21.0±1	20.92	20.50	20.52	20.0±1
HSDPA Subtest-4	20.73	21.24	21.16	21.0±1	20.86	20.41	20.33	20.0±1
HSUPA Subtest-1	21.43	22.11	22.19	22.0±1	21.49	21.20	21.25	21.0±1
HSUPA Subtest-2	21.31	21.89	22.00	22.0±1	21.43	21.15	21.02	21.0±1
HSUPA Subtest-3	21.15	21.85	21.92	21.0±1	21.30	21.09	20.89	21.0±1
HSUPA Subtest-4	21.10	21.63	21.80	21.0±1	21.16	20.85	20.73	21.0±1
HSUPA Subtest-5	20.93	21.55	21.49	21.0±1	21.02	20.79	20.65	21.0±1

WCDMA - Average Power (dBm)				
Band	**WCDMA Band IV**			
Channel	**1312**	**1413**	**1513**	**Tune up Power tolerant**
Frequency (MHz)	**1712.4**	**1732.6**	**1752.6**	**/**
RMC 12.2k	**22.95**	22.56	22.81	22.0±1
HSDPA Subtest-1	22.10	21.58	21.36	22.0±1
HSDPA Subtest-2	22.04	21.41	21.27	22.0±1
HSDPA Subtest-3	21.92	21.30	21.14	21.0±1
HSDPA Subtest-4	21.81	21.26	21.02	21.0±1
HSUPA Subtest-1	22.43	21.88	21.90	22.0±1
HSUPA Subtest-2	22.24	21.73	21.78	22.0±1
HSUPA Subtest-3	22.13	21.56	21.55	22.0±1
HSUPA Subtest-4	22.09	21.44	21.37	22.0±1
HSUPA Subtest-5	20.91	21.28	21.13	21.0±1

LTE Power Reduction

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

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

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of “NS_01”.

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

LTE Band 2：

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
1.4MHz	18607	1850.7	QPSK	1	0	22.65	22.0±1	/
				1	2	22.47	22.0±1	/
				1	5	22.58	22.0±1	/
				3	0	22.47	22.0±1	/
				3	1	22.47	22.0±1	/
				3	2	22.45	22.0±1	/
				6	0	21.46	22.0±1	1.0
			16QAM	1	0	21.66	22.0±1	1.0
				1	2	21.57	22.0±1	1.0
				1	5	21.68	22.0±1	1.0
				3	0	21.55	22.0±1	1.0
				3	1	21.48	22.0±1	1.0
				3	2	21.46	22.0±1	1.0
				6	0	20.65	22.0±1	1.0
	18900	1880	QPSK	1	0	22.57	22.0±1	/
				1	2	22.43	22.0±1	/
				1	5	22.54	22.0±1	/
				3	0	22.37	22.0±1	/
				3	1	22.38	22.0±1	/
				3	2	22.37	22.0±1	/
				6	0	21.35	22.0±1	1.0
			16QAM	1	0	21.84	21.0±1	1.0
				1	2	21.74	21.0±1	1.0
				1	5	21.86	21.0±1	1.0
				3	0	21.53	21.0±1	1.0
				3	1	21.55	21.0±1	1.0
				3	2	21.54	21.0±1	1.0
				6	0	20.35	21.0±1	1.0
	19193	1909.3	QPSK	1	0	22.36	22.0±1	/
				1	2	22.25	22.0±1	/
				1	5	22.74	22.0±1	/
				3	0	22.17	22.0±1	/
				3	1	22.2	22.0±1	/
				3	2	22.19	22.0±1	/
				6	0	21.16	22.0±1	1.0
			16QAM	1	0	21.24	22.0±1	1.0
				1	2	21.22	22.0±1	1.0
				1	5	21.8	22.0±1	1.0
				3	0	21.33	22.0±1	1.0
				3	1	21.36	22.0±1	1.0
				3	2	21.36	22.0±1	1.0
				6	0	20.31	22.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
3MHz	18615	1851.5	QPSK	1	0	22.36	22.0±1	/
				1	8	22.38	22.0±1	/
				1	14	22.31	22.0±1	/
				6	0	21.36	22.0±1	1.0
				6	4	21.39	22.0±1	1.0
				6	9	21.37	22.0±1	1.0
				15	0	21.35	22.0±1	1.0
			16QAM	1	0	21.23	21.0±1	1.0
				1	8	21.35	21.0±1	1.0
				1	14	21.34	21.0±1	1.0
				6	0	20.59	21.0±1	1.0
				6	4	20.63	21.0±1	1.0
				6	9	20.61	21.0±1	1.0
				15	0	20.53	21.0±1	1.0
	18900	1880	QPSK	1	0	22.3	22.0±1	/
				1	8	22.4	22.0±1	/
				1	14	22.36	22.0±1	/
				6	0	21.3	22.0±1	1.0
				6	4	21.35	22.0±1	1.0
				6	9	21.35	22.0±1	1.0
				15	0	21.31	22.0±1	1.0
			16QAM	1	0	21.6	21.0±1	1.0
				1	8	21.73	21.0±1	1.0
				1	14	21.7	21.0±1	1.0
				6	0	20.46	21.0±1	1.0
				6	4	20.51	21.0±1	1.0
				6	9	20.51	21.0±1	1.0
				15	0	20.41	21.0±1	1.0
	19185	1908.5	QPSK	1	0	21.9	22.0±1	/
				1	8	22.11	22.0±1	/
				1	14	22.54	22.0±1	/
				6	0	20.94	22.0±1	1.0
				6	4	21.06	22.0±1	1.0
				6	9	21.08	22.0±1	1.0
				15	0	21	22.0±1	1.0
			16QAM	1	0	20.86	20.7±1	1.0
				1	8	21.11	20.7±1	1.0
				1	14	21.59	20.7±1	1.0
				6	0	19.95	20.7±1	1.0
				6	4	20.07	20.7±1	1.0
				6	9	20.1	20.7±1	1.0
				15	0	19.95	20.7±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
5MHz	18625	1852.5	QPSK	1	0	22.33	22.0±1	/
				1	12	22.38	22.0±1	/
				1	24	22.26	22.0±1	/
				12	0	21.26	22.0±1	1.0
				12	6	21.33	22.0±1	1.0
				12	11	21.27	22.0±1	1.0
				25	0	21.27	22.0±1	1.0
			16QAM	1	0	21.43	21.0±1	1.0
				1	12	21.52	21.0±1	1.0
				1	24	21.43	21.0±1	1.0
				12	0	20.43	21.0±1	1.0
				12	6	20.5	21.0±1	1.0
				12	11	20.44	21.0±1	1.0
				25	0	20.39	21.0±1	1.0
	18900	1880	QPSK	1	0	22.19	22.0±1	/
				1	12	22.37	22.0±1	/
				1	24	22.34	22.0±1	/
				12	0	21.21	22.0±1	1.0
				12	6	21.33	22.0±1	1.0
				12	11	21.32	22.0±1	1.0
				25	0	21.27	22.0±1	1.0
			16QAM	1	0	21.69	21.0±1	1.0
				1	12	21.87	21.0±1	1.0
				1	24	21.81	21.0±1	1.0
				12	0	20.43	21.0±1	1.0
				12	6	20.55	21.0±1	1.0
				12	11	20.54	21.0±1	1.0
				25	0	20.42	21.0±1	1.0
	19175	1907.5	QPSK	1	0	21.74	21.6±1	/
				1	12	22.06	21.6±1	/
				1	24	22.54	21.6±1	/
				12	0	20.7	21.6±1	1.0
				12	6	20.93	21.6±1	1.0
				12	11	20.98	21.6±1	1.0
				25	0	20.87	21.6±1	1.0
			16QAM	1	0	20.81	20.7±1	1.0
				1	12	21.11	20.7±1	1.0
				1	24	21.7	20.7±1	1.0
				12	0	19.73	20.7±1	1.0
				12	6	19.97	20.7±1	1.0
				12	11	20.02	20.7±1	1.0
				25	0	19.81	20.7±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
10MHz	18650	1855	QPSK	1	0	22.12	22.0±1	/
				1	24	22.24	22.0±1	/
				1	49	22.03	22.0±1	/
				25	0	21.12	22.0±1	1.0
				25	12	21.2	22.0±1	1.0
				25	24	21.14	22.0±1	1.0
				50	0	21.18	22.0±1	1.0
			16QAM	1	0	21.02	21.0±1	1.0
				1	24	21.17	21.0±1	1.0
				1	49	20.99	21.0±1	1.0
				25	0	20.23	21.0±1	1.0
				25	12	20.41	21.0±1	1.0
				25	24	20.26	21.0±1	1.0
				50	0	20.27	21.0±1	1.0
	18900	1880	QPSK	1	0	21.97	21.5±1	/
				1	24	22.23	21.5±1	/
				1	49	22.12	21.5±1	/
				25	0	20.92	21.5±1	1.0
				25	12	21.15	21.5±1	1.0
				25	24	21.09	21.5±1	1.0
				50	0	21.03	21.5±1	1.0
			16QAM	1	0	21.26	21.0±1	1.0
				1	24	21.58	21.0±1	1.0
				1	49	21.48	21.0±1	1.0
				25	0	20.03	21.0±1	1.0
				25	12	20.27	21.0±1	1.0
				25	24	20.2	21.0±1	1.0
				50	0	20.14	21.0±1	1.0
	19150	1905	QPSK	1	0	21.81	21.0±1	/
				1	24	21.61	21.0±1	/
				1	49	21.88	21.0±1	/
				25	0	20.51	21.0±1	1.0
				25	12	20.56	21.0±1	1.0
				25	24	20.6	21.0±1	1.0
				50	0	20.54	21.0±1	1.0
			16QAM	1	0	20.8	20.0±1	1.0
				1	24	20.63	20.0±1	1.0
				1	49	20.92	20.0±1	1.0
				25	0	19.59	20.0±1	1.0
				25	12	19.65	20.0±1	1.0
				25	24	19.67	20.0±1	1.0
				50	0	19.58	20.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
15MHz	18675	1857.5	QPSK	1	0	22.16	22.0±1	/
				1	37	22.3	22.0±1	/
				1	74	22.04	22.0±1	/
				36	0	21.27	22.0±1	1.0
				36	16	21.36	22.0±1	1.0
				36	35	21.24	22.0±1	1.0
				75	0	21.22	22.0±1	1.0
			16QAM	1	0	21.14	21.0±1	1.0
				1	37	21.32	21.0±1	1.0
				1	74	21.09	21.0±1	1.0
				36	0	20.36	21.0±1	1.0
				36	16	20.45	21.0±1	1.0
				36	35	20.34	21.0±1	1.0
				75	0	20.33	21.0±1	1.0
	18900	1880	QPSK	1	0	22.03	22.0±1	/
				1	37	22.26	22.0±1	/
				1	74	22.26	22.0±1	/
				36	0	21	22.0±1	1.0
				36	16	21.22	22.0±1	1.0
				36	35	21.27	22.0±1	1.0
				75	0	21.14	22.0±1	1.0
			16QAM	1	0	21.33	21.0±1	1.0
				1	37	21.61	21.0±1	1.0
				1	74	21.63	21.0±1	1.0
				36	0	20.13	21.0±1	1.0
				36	16	20.36	21.0±1	1.0
				36	35	20.41	21.0±1	1.0
				75	0	20.25	21.0±1	1.0
	19125	1902.5	QPSK	1	0	22.06	21.5±1	/
				1	37	21.71	21.5±1	/
				1	74	21.97	21.5±1	/
				36	0	20.95	21.5±1	1.0
				36	16	20.74	21.5±1	1.0
				36	35	20.61	21.5±1	1.0
				75	0	20.83	21.5±1	1.0
			16QAM	1	0	21.37	20.5±1	1.0
				1	37	21.14	20.5±1	1.0
				1	74	21.39	20.5±1	1.0
				36	0	19.93	20.5±1	1.0
				36	16	19.72	20.5±1	1.0
				36	35	19.58	20.5±1	1.0
				75	0	19.83	20.5±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
20MHz	18700	1860	QPSK	1	0	22.2	21.5±1	/
				1	49	22.26	21.5±1	/
				1	99	22.04	21.5±1	/
				50	0	21.15	21.5±1	1.0
				50	24	21.18	21.5±1	1.0
				50	49	21.09	21.5±1	1.0
				100	0	20.98	21.5±1	1.0
			16QAM	1	0	21.63	21.0±1	1.0
				1	49	21.75	21.0±1	1.0
				1	99	21.53	21.0±1	1.0
				50	0	20.32	21.0±1	1.0
				50	24	20.4	21.0±1	1.0
				50	49	20.22	21.0±1	1.0
				100	0	20.21	21.0±1	1.0
	18900	1880	QPSK	1	0	22.56	22.0±1	/
				1	49	**22.77**	22.0±1	/
				1	99	22.03	22.0±1	/
				50	0	20.87	21.0±1	1.0
				50	24	21.17	21.0±1	1.0
				50	49	21.13	21.0±1	1.0
				100	0	21.06	21.0±1	1.0
			16QAM	1	0	21.44	20.8±1	1.0
				1	49	21.68	20.8±1	1.0
				1	99	21.45	20.8±1	1.0
				50	0	19.98	20.8±1	1.0
				50	24	20.28	20.8±1	1.0
				50	49	20.25	20.8±1	1.0
				100	0	20.16	20.8±1	1.0
	19100	1900	QPSK	1	0	21.91	21.0±1	/
				1	49	21.92	21.0±1	/
				1	99	21.79	21.0±1	/
				50	0	20.91	21.0±1	1.0
				50	24	20.99	21.0±1	1.0
				50	49	20.56	21.0±1	1.0
				100	0	21.03	21.0±1	1.0
			16QAM	1	0	21.26	20.5±1	1.0
				1	49	21.34	20.5±1	1.0
				1	99	21.24	20.5±1	1.0
				50	0	19.89	20.5±1	1.0
				50	24	19.98	20.5±1	1.0
				50	49	19.54	20.5±1	1.0
				100	0	20.05	20.5±1	1.0

LTE Band 4:

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
1.4MHz	19957	1710.7	QPSK	1	0	22.70	22.0±1	/
				1	2	22.59	22.0±1	/
				1	5	22.68	22.0±1	/
				3	0	22.5	22.0±1	/
				3	1	22.53	22.0±1	/
				3	2	22.53	22.0±1	/
				6	0	21.46	22.0±1	1.0
			16QAM	1	0	21.71	21.0±1	1.0
				1	2	21.57	21.0±1	1.0
				1	5	21.7	21.0±1	1.0
				3	0	21.45	21.0±1	1.0
				3	1	21.5	21.0±1	1.0
				3	2	21.5	21.0±1	1.0
				6	0	20.65	21.0±1	1.0
	20175	1732.5	QPSK	1	0	22.34	22.0±1	/
				1	2	22.21	22.0±1	/
				1	5	22.26	22.0±1	/
				3	0	22.16	22.0±1	/
				3	1	22.17	22.0±1	/
				3	2	22.16	22.0±1	/
				6	0	21.25	22.0±1	1.0
			16QAM	1	0	21.74	21.0±1	1.0
				1	2	21.64	21.0±1	1.0
				1	5	21.71	21.0±1	1.0
				3	0	21.43	21.0±1	1.0
				3	1	21.45	21.0±1	1.0
				3	2	21.45	21.0±1	1.0
				6	0	20.24	21.0±1	1.0
	20393	1754.3	QPSK	1	0	21.97	21.0±1	/
				1	2	21.86	21.0±1	/
				1	5	21.9	21.0±1	/
				3	0	21.83	21.0±1	/
				3	1	21.83	21.0±1	/
				3	2	21.81	21.0±1	/
				6	0	20.95	21.0±1	1.0
			16QAM	1	0	21.1	21.0±1	1.0
				1	2	20.99	21.0±1	1.0
				1	5	21.1	21.0±1	1.0
				3	0	21.15	21.0±1	1.0
				3	1	21.16	21.0±1	1.0
				3	2	21.14	21.0±1	1.0
				6	0	20.19	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
3MHz	19965	1711.5	QPSK	1	0	22.49	22.0±1	/
				1	8	22.52	22.0±1	/
				1	14	22.47	22.0±1	/
				6	0	21.42	22.0±1	1.0
				6	4	21.45	22.0±1	1.0
				6	9	21.36	22.0±1	1.0
				15	0	21.4	22.0±1	1.0
			16QAM	1	0	21.24	21.0±1	1.0
				1	8	21.37	21.0±1	1.0
				1	14	21.34	21.0±1	1.0
				8	0	20.53	21.0±1	1.0
				8	4	20.62	21.0±1	1.0
				8	9	20.54	21.0±1	1.0
				15	0	20.51	21.0±1	1.0
	20175	1732.5	QPSK	1	0	22.18	22.0±1	/
				1	8	22.19	22.0±1	/
				1	14	22.11	22.0±1	/
				6	0	21.2	22.0±1	1.0
				6	4	21.25	22.0±1	1.0
				6	9	21.24	22.0±1	1.0
				15	0	21.21	22.0±1	1.0
			16QAM	1	0	21.59	21.0±1	1.0
				1	8	21.62	21.0±1	1.0
				1	14	21.56	21.0±1	1.0
				6	0	20.37	21.0±1	1.0
				6	4	20.42	21.0±1	1.0
				6	9	20.41	21.0±1	1.0
				15	0	20.32	21.0±1	1.0
	20385	1753.5	QPSK	1	0	21.91	21.0±1	/
				1	8	21.87	21.0±1	/
				1	14	21.75	21.0±1	/
				6	0	20.99	21.0±1	1.0
				6	4	21	21.0±1	1.0
				6	9	20.96	21.0±1	1.0
				15	0	20.98	21.0±1	1.0
			16QAM	1	0	21	21.0±1	1.0
				1	8	21	21.0±1	1.0
				1	14	20.96	21.0±1	1.0
				8	0	20.1	21.0±1	1.0
				8	4	20.11	21.0±1	1.0
				8	9	20.07	21.0±1	1.0
				15	0	20.01	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
5MHz	19975	1712.5	QPSK	1	0	22.48	22.0±1	/
				1	49	22.59	22.0±1	/
				1	99	22.44	22.0±1	/
				12	0	21.35	22.0±1	1.0
				12	24	21.4	22.0±1	1.0
				12	49	21.34	22.0±1	1.0
				25	0	21.33	22.0±1	1.0
			16QAM	1	0	21.47	21.0±1	1.0
				1	49	21.6	21.0±1	1.0
				1	99	21.48	21.0±1	1.0
				12	0	20.49	21.0±1	1.0
				12	24	20.54	21.0±1	1.0
				12	49	20.49	21.0±1	1.0
				25	0	20.42	21.0±1	1.0
	20175	1732.5	QPSK	1	0	22.15	22.0±1	/
				1	49	22.24	22.0±1	/
				1	99	22.14	22.0±1	/
				12	0	21.24	22.0±1	1.0
				12	24	21.25	22.0±1	1.0
				12	49	21.17	22.0±1	1.0
				25	0	21.19	22.0±1	1.0
			16QAM	1	0	21.65	21.0±1	1.0
				1	49	21.8	21.0±1	1.0
				1	99	21.72	21.0±1	1.0
				12	0	20.41	21.0±1	1.0
				12	24	20.49	21.0±1	1.0
				12	49	20.36	21.0±1	1.0
				25	0	20.35	21.0±1	1.0
	20375	1752.5	QPSK	1	0	21.96	21.0±1	/
				1	49	21.93	21.0±1	/
				1	99	21.74	21.0±1	/
				12	0	20.98	21.0±1	1.0
				12	24	21.03	21.0±1	1.0
				12	49	20.94	21.0±1	1.0
				25	0	20.97	21.0±1	1.0
			16QAM	1	0	21.16	20.5±1	1.0
				1	49	21.17	20.5±1	1.0
				1	99	21.05	20.5±1	1.0
				12	0	20.08	20.5±1	1.0
				12	24	20.15	20.5±1	1.0
				12	49	20.06	20.5±1	1.0
				25	0	19.99	20.5±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
10MHz	20000	1715	QPSK	1	0	22.34	22.0±1	/
				1	49	22.38	22.0±1	/
				1	99	22.17	22.0±1	/
				25	0	21.13	22.0±1	1.0
				25	24	21.29	22.0±1	1.0
				25	49	21.11	22.0±1	1.0
				50	0	21.15	22.0±1	1.0
			16QAM	1	0	21.12	21.0±1	1.0
				1	49	21.27	21.0±1	1.0
				1	99	21	21.0±1	1.0
				25	0	20.21	21.0±1	1.0
				25	24	20.37	21.0±1	1.0
				25	49	20.2	21.0±1	1.0
				50	0	20.21	21.0±1	1.0
	20175	1732.5	QPSK	1	0	22.02	21.5±1	/
				1	49	22.1	21.5±1	/
				1	99	21.83	21.5±1	/
				25	0	21	21.5±1	1.0
				25	24	21.12	21.5±1	1.0
				25	49	21.02	21.5±1	1.0
				50	0	20.98	21.5±1	1.0
			16QAM	1	0	21.32	21.0±1	1.0
				1	49	21.55	21.0±1	1.0
				1	99	21.27	21.0±1	1.0
				25	0	20.06	21.0±1	1.0
				25	24	20.24	21.0±1	1.0
				25	49	20.09	21.0±1	1.0
				50	0	20.1	21.0±1	1.0
	20350	1750	QPSK	1	0	21.79	21.0±1	/
				1	49	21.9	21.0±1	/
				1	99	21.57	21.0±1	/
				25	0	20.83	21.0±1	1.0
				25	24	20.96	21.0±1	1.0
				25	49	20.77	21.0±1	1.0
				50	0	20.83	21.0±1	1.0
			16QAM	1	0	20.92	20.5±1	1.0
				1	49	21.03	20.5±1	1.0
				1	99	20.72	20.5±1	1.0
				25	0	20.01	20.5±1	1.0
				25	24	20.14	20.5±1	1.0
				25	49	19.91	20.5±1	1.0
				50	0	19.96	20.5±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
15MHz	20025	1717.5	QPSK	1	0	22.38	22.0±1	/
				1	49	22.35	22.0±1	/
				1	99	22.16	22.0±1	/
				36	0	21.31	22.0±1	1.0
				36	24	21.31	22.0±1	1.0
				36	49	21.25	22.0±1	1.0
				75	0	21.21	21.0±1	1.0
			16QAM	1	0	21.24	21.0±1	1.0
				1	49	21.25	21.0±1	1.0
				1	99	21.13	21.0±1	1.0
				36	0	20.36	21.0±1	1.0
				36	24	20.38	21.0±1	1.0
				36	49	20.33	21.0±1	1.0
				75	0	20.29	21.0±1	1.0
	20175	1732.5	QPSK	1	0	22.25	22.0±1	/
				1	49	22.22	22.0±1	/
				1	99	21.99	22.0±1	/
				36	0	21.11	22.0±1	1.0
				36	24	21.27	22.0±1	1.0
				36	49	21.16	22.0±1	1.0
				75	0	21.16	22.0±1	1.0
			16QAM	1	0	21.56	21.0±1	1.0
				1	49	21.66	21.0±1	1.0
				1	99	21.44	21.0±1	1.0
				36	0	20.22	21.0±1	1.0
				36	24	20.36	21.0±1	1.0
				36	49	20.25	21.0±1	1.0
				75	0	20.23	21.0±1	1.0
	20325	1747.5	QPSK	1	0	21.99	21.0±1	/
				1	49	21.93	21.0±1	/
				1	99	21.73	21.0±1	/
				36	0	21.06	21.0±1	1.0
				36	24	21.11	21.0±1	1.0
				36	49	21.03	21.0±1	1.0
				75	0	21	21.0±1	1.0
			16QAM	1	0	21.46	21.0±1	1.0
				1	49	21.48	21.0±1	1.0
				1	99	21.27	21.0±1	1.0
				36	0	20.08	21.0±1	1.0
				36	24	20.14	21.0±1	1.0
				36	49	20.06	21.0±1	1.0
				75	0	20.06	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
20MHz	20050	1720	QPSK	1	0	**22.71**	22.0±1	/
				1	49	22.66	22.0±1	/
				1	99	22.07	22.0±1	/
				50	0	21.19	22.0±1	1.0
				50	24	21.24	22.0±1	1.0
				50	49	21.11	22.0±1	1.0
				100	0	21.11	22.0±1	1.0
			16QAM	1	0	21.77	21.0±1	1.0
				1	49	21.83	21.0±1	1.0
				1	99	21.55	21.0±1	1.0
				50	0	20.28	21.0±1	1.0
				50	24	20.33	21.0±1	1.0
				50	49	20.21	21.0±1	1.0
				100	0	20.21	21.0±1	1.0
	20175	1732.5	QPSK	1	0	22.27	22.0±1	/
				1	49	22.25	22.0±1	/
				1	99	21.96	22.0±1	/
				50	0	21.03	22.0±1	1.0
				50	24	21.23	22.0±1	1.0
				50	49	21.11	22.0±1	1.0
				100	0	21.1	22.0±1	1.0
			16QAM	1	0	21.53	21.0±1	1.0
				1	49	21.73	21.0±1	1.0
				1	99	21.45	21.0±1	1.0
				50	0	20.12	21.0±1	1.0
				50	24	20.29	21.0±1	1.0
				50	49	20.17	21.0±1	1.0
				100	0	20.15	21.0±1	1.0
	20300	1745	QPSK	1	0	21.87	21.5±1	/
				1	49	22.01	21.5±1	/
				1	99	21.7	21.5±1	/
				50	0	21	21.5±1	1.0
				50	24	21.13	21.5±1	1.0
				50	49	20.97	21.5±1	1.0
				100	0	20.99	21.5±1	1.0
			16QAM	1	0	21.36	20.6±1	1.0
				1	49	21.54	20.6±1	1.0
				1	99	21.21	20.6±1	1.0
				50	0	20.06	20.6±1	1.0
				50	24	20.15	20.6±1	1.0
				50	49	19.99	20.6±1	1.0
				100	0	20.04	20.6±1	1.0

LTE Band 5:

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
1.4MHz	20407	824.7	QPSK	1	0	23.45	23.0±1	/
				1	2	23.06	23.0±1	/
				1	5	23.14	23.0±1	/
				3	0	23.21	23.0±1	/
				3	1	23.01	23.0±1	/
				3	2	23.03	23.0±1	/
				6	0	22.08	23.0±1	1.0
			16QAM	1	0	22.44	22.0±1	1.0
				1	2	22.1	22.0±1	1.0
				1	5	22.26	22.0±1	1.0
				3	0	22.25	22.0±1	1.0
				3	1	22.04	22.0±1	1.0
				3	2	22.05	22.0±1	1.0
				6	0	21.17	22.0±1	1.0
	20525	836.5	QPSK	1	0	22.92	22.0±1	/
				1	2	22.82	22.0±1	/
				1	5	22.82	22.0±1	/
				3	0	22.83	22.0±1	/
				3	1	22.79	22.0±1	/
				3	2	22.75	22.0±1	/
				6	0	21.85	22.0±1	1.0
			16QAM	1	0	22.29	21.5±1	1.0
				1	2	22.18	21.5±1	1.0
				1	5	22.23	21.5±1	1.0
				3	0	22.03	21.5±1	1.0
				3	1	22	21.5±1	1.0
				3	2	21.97	21.5±1	1.0
				6	0	20.75	21.5±1	1.0
	20634	848.3	QPSK	1	0	22.85	22.0±1	/
				1	2	22.71	22.0±1	/
				1	5	22.86	22.0±1	/
				3	0	22.62	22.0±1	/
				3	1	22.69	22.0±1	/
				3	2	22.67	22.0±1	/
				6	0	21.66	22.0±1	1.0
			16QAM	1	0	21.83	21.0±1	1.0
				1	2	21.69	21.0±1	1.0
				1	5	21.83	21.0±1	1.0
				3	0	21.84	21.0±1	1.0
				3	1	21.85	21.0±1	1.0
				3	2	21.83	21.0±1	1.0
				6	0	20.89	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
3MHz	20415	825.5	QPSK	1	0	23.2	23.0±1	/
				1	8	23.03	23.0±1	/
				1	14	22.92	23.0±1	/
				6	0	22.01	23.0±1	1.0
				6	4	22.08	23.0±1	1.0
				6	9	22.05	23.0±1	1.0
				15	0	22.01	23.0±1	1.0
			16QAM	1	0	22.06	22.0±1	1.0
				1	8	21.98	22.0±1	1.0
				1	14	21.89	22.0±1	1.0
				8	0	21.09	22.0±1	1.0
				8	4	21.17	22.0±1	1.0
				8	9	21.14	22.0±1	1.0
				15	0	21.04	22.0±1	1.0
	20525	836.5	QPSK	1	0	22.92	23.0±1	/
				1	8	22.81	23.0±1	/
				1	14	22.67	23.0±1	/
				6	0	21.91	23.0±1	1.0
				6	4	21.87	23.0±1	1.0
				6	9	21.79	23.0±1	1.0
				15	0	21.83	23.0±1	1.0
			16QAM	1	0	22.25	21.5±1	1.0
				1	8	22.17	21.5±1	1.0
				1	14	22.09	21.5±1	1.0
				6	0	20.98	21.5±1	1.0
				6	4	20.95	21.5±1	1.0
				6	9	20.87	21.5±1	1.0
				15	0	20.88	21.5±1	1.0
	20635	847.5	QPSK	1	0	22.59	22.0±1	/
				1	8	22.75	22.0±1	/
				1	14	22.7	22.0±1	/
				6	0	21.7	22.0±1	1.0
				6	4	21.75	22.0±1	1.0
				6	9	21.68	22.0±1	1.0
				15	0	21.66	22.0±1	1.0
			16QAM	1	0	21.54	21.0±1	1.0
				1	8	21.78	21.0±1	1.0
				1	14	21.71	21.0±1	1.0
				8	0	20.73	21.0±1	1.0
				8	4	20.84	21.0±1	1.0
				8	9	20.77	21.0±1	1.0
				15	0	20.63	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
5MHz	20425	826.5	QPSK	1	0	23.2	22.5±1	/
				1	49	23.05	22.5±1	/
				1	99	22.7	22.5±1	/
				12	0	21.97	22.5±1	1.0
				12	24	22	22.5±1	1.0
				12	49	21.92	22.5±1	1.0
				25	0	21.91	22.5±1	1.0
			16QAM	1	0	22.24	21.5±1	1.0
				1	49	22.17	21.5±1	1.0
				1	99	21.89	21.5±1	1.0
				12	0	21.03	21.5±1	1.0
				12	24	21.06	21.5±1	1.0
				12	49	20.98	21.5±1	1.0
				25	0	20.92	22.0±1	1.0
	20525	836.5	QPSK	1	0	22.9	22.0±1	/
				1	49	22.84	22.0±1	/
				1	99	22.59	22.0±1	/
				12	0	21.91	22.0±1	1.0
				12	24	21.86	22.0±1	1.0
				12	49	21.77	22.0±1	1.0
				25	0	21.8	22.0±1	1.0
			16QAM	1	0	22.33	21.5±1	1.0
				1	49	22.34	21.5±1	1.0
				1	99	22.14	21.5±1	1.0
				12	0	21.05	21.5±1	1.0
				12	24	21.01	21.5±1	1.0
				12	49	20.92	21.5±1	1.0
				25	0	20.88	21.5±1	1.0
	20625	846.5	QPSK	1	0	22.34	22.0±1	/
				1	49	22.67	22.0±1	/
				1	99	22.72	22.0±1	/
				12	0	21.44	22.0±1	1.0
				12	24	21.63	22.0±1	1.0
				12	49	21.62	22.0±1	1.0
				25	0	21.53	22.0±1	1.0
			16QAM	1	0	21.46	21.0±1	1.0
				1	49	21.78	21.0±1	1.0
				1	99	21.79	21.0±1	1.0
				12	0	20.48	21.0±1	1.0
				12	24	20.73	21.0±1	1.0
				12	49	20.68	21.0±1	1.0
				25	0	20.54	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
10MHz	20450	829	QPSK	1	0	**23.48**	22.5±1	/
				1	49	22.92	22.5±1	/
				1	99	22.6	22.5±1	/
				25	0	21.7	22.5±1	1.0
				25	24	21.66	22.5±1	1.0
				25	49	21.55	22.5±1	1.0
				50	0	21.68	22.5±1	1.0
			16QAM	1	0	21.76	21.0±1	1.0
				1	49	21.53	21.0±1	1.0
				1	99	21.53	21.0±1	1.0
				25	0	20.71	21.0±1	1.0
				25	24	20.67	21.0±1	1.0
				25	49	20.57	21.0±1	1.0
				50	0	20.66	21.0±1	1.0
	20525	836.5	QPSK	1	0	22.64	22.0±1	/
				1	49	22.66	22.0±1	/
				1	99	22.11	22.0±1	/
				25	0	21.6	22.0±1	1.0
				25	24	21.7	22.0±1	1.0
				25	49	21.47	22.0±1	1.0
				50	0	21.49	22.0±1	1.0
			16QAM	1	0	21.99	21.6±1	1.0
				1	49	22.07	21.6±1	1.0
				1	99	21.54	21.6±1	1.0
				25	0	20.62	21.6±1	1.0
				25	24	20.73	21.6±1	1.0
				25	49	20.52	21.6±1	1.0
				50	0	20.52	21.6±1	1.0
	20600	844	QPSK	1	0	22.23	22.0±1	/
				1	49	22.26	22.0±1	/
				1	99	22.47	22.0±1	/
				25	0	21.2	22.0±1	1.0
				25	24	21.31	22.0±1	1.0
				25	49	21.22	22.0±1	1.0
				50	0	21.25	22.0±1	1.0
			16QAM	1	0	21.25	21.0±1	1.0
				1	49	21.28	21.0±1	1.0
				1	99	21.39	21.0±1	1.0
				25	0	20.32	21.0±1	1.0
				25	24	20.42	21.0±1	1.0
				25	49	20.36	21.0±1	1.0
				50	0	20.31	21.0±1	1.0

LTE Band 12:

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
1.4MHz	23017	699.7	QPSK	1	0	22.89	22.5±1	/
				1	2	22.99	22.5±1	/
				1	5	23.11	22.5±1	/
				3	0	22.83	22.5±1	/
				3	1	22.91	22.5±1	/
				3	2	22.94	22.5±1	/
				6	0	21.81	22.5±1	1.0
			16QAM	1	0	21.84	21.5±1	1.0
				1	2	21.89	21.5±1	1.0
				1	5	22.21	21.5±1	1.0
				3	0	21.76	21.5±1	1.0
				3	1	21.85	21.5±1	1.0
				3	2	21.92	21.5±1	1.0
				6	0	20.88	21.5±1	1.0
	23095	707.5	QPSK	1	0	23	22.5±1	/
				1	2	22.72	22.5±1	/
				1	5	22.84	22.5±1	/
				3	0	22.77	22.5±1	/
				3	1	22.67	22.5±1	/
				3	2	22.71	22.5±1	/
				6	0	21.85	22.5±1	1.0
			16QAM	1	0	22.43	21.5±1	1.0
				1	2	22.18	21.5±1	1.0
				1	5	22.22	21.5±1	1.0
				3	0	22.07	21.5±1	1.0
				3	1	21.98	21.5±1	1.0
				3	2	21.95	21.5±1	1.0
				6	0	20.68	21.5±1	1.0
	23173	715.3	QPSK	1	0	23.02	22.5±1	/
				1	2	22.73	22.5±1	/
				1	5	22.72	22.5±1	/
				3	0	22.75	22.5±1	/
				3	1	22.67	22.5±1	/
				3	2	22.59	22.5±1	/
				6	0	21.61	22.5±1	1.0
			16QAM	1	0	21.88	21.0±1	1.0
				1	2	21.68	21.0±1	1.0
				1	5	21.66	21.0±1	1.0
				3	0	21.89	21.0±1	1.0
				3	1	21.82	21.0±1	1.0
				3	2	21.76	21.0±1	1.0
				6	0	20.78	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
3MHz	23025	700.5	QPSK	1	0	22.72	22.5±1	/
				1	8	23.07	22.5±1	/
				1	14	22.89	22.5±1	/
				8	0	21.87	22.5±1	1.0
				8	4	21.97	22.5±1	1.0
				8	9	21.94	22.5±1	1.0
				15	0	21.85	22.5±1	1.0
			16QAM	1	0	21.49	21.0±1	1.0
				1	8	21.89	21.0±1	1.0
				1	14	21.82	21.0±1	1.0
				8	0	20.87	21.0±1	1.0
				8	4	20.99	21.0±1	1.0
				8	9	20.96	21.0±1	1.0
				15	0	20.81	21.0±1	1.0
	23095	707.5	QPSK	1	0	22.76	22.0±1	/
				1	8	22.65	22.0±1	/
				1	14	22.55	22.0±1	/
				8	0	21.79	22.0±1	1.0
				8	4	21.79	22.0±1	1.0
				8	9	21.76	22.0±1	1.0
				15	0	21.73	22.0±1	1.0
			16QAM	1	0	22.18	21.5±1	1.0
				1	8	22.13	21.5±1	1.0
				1	14	22.04	21.5±1	1.0
				8	0	20.9	21.5±1	1.0
				8	4	20.85	21.5±1	1.0
				8	9	20.77	21.5±1	1.0
				15	0	20.71	21.5±1	1.0
	23165	714.5	QPSK	1	0	22.85	22.0±1	/
				1	8	22.79	22.0±1	/
				1	14	22.49	22.0±1	/
				8	0	21.76	22.0±1	1.0
				8	4	21.75	22.0±1	1.0
				8	9	21.64	22.0±1	1.0
				15	0	21.69	22.0±1	1.0
			16QAM	1	0	21.68	21.0±1	1.0
				1	8	21.76	21.0±1	1.0
				1	14	21.41	21.0±1	1.0
				8	0	20.7	21.0±1	1.0
				8	4	20.7	21.0±1	1.0
				8	9	20.6	21.0±1	1.0
				15	0	20.56	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
5MHz	23035	701.5	QPSK	1	0	22.78	22.0±1	/
				1	49	22.97	22.0±1	/
				1	99	22.93	22.0±1	/
				12	0	21.84	22.0±1	1.0
				12	24	21.91	22.0±1	1.0
				12	49	21.94	22.0±1	1.0
				25	0	21.84	22.0±1	1.0
			16QAM	1	0	21.81	21.5±1	1.0
				1	49	22.16	21.5±1	1.0
				1	99	22.15	21.5±1	1.0
				12	0	20.92	21.5±1	1.0
				12	24	20.95	21.5±1	1.0
				12	49	20.94	21.5±1	1.0
				25	0	20.81	21.5±1	1.0
	23095	707.5	QPSK	1	0	22.87	22.0±1	/
				1	49	22.71	22.0±1	/
				1	99	22.58	22.0±1	/
				12	0	21.73	22.0±1	1.0
				12	24	21.7	22.0±1	1.0
				12	49	21.68	22.0±1	1.0
				25	0	21.59	22.0±1	1.0
			16QAM	1	0	22.34	21.5±1	1.0
				1	49	22.24	21.5±1	1.0
				1	99	22.13	21.5±1	1.0
				12	0	20.77	21.5±1	1.0
				12	24	20.8	21.5±1	1.0
				12	49	20.74	21.5±1	1.0
				25	0	20.62	21.5±1	1.0
	23155	713.5	QPSK	1	0	22.58	22.0±1	/
				1	49	22.88	22.0±1	/
				1	99	22.52	22.0±1	/
				12	0	21.57	22.0±1	1.0
				12	24	21.74	22.0±1	1.0
				12	49	21.64	22.0±1	1.0
				25	0	21.66	22.0±1	1.0
			16QAM	1	0	21.62	21.0±1	1.0
				1	49	21.91	21.0±1	1.0
				1	99	21.54	21.0±1	1.0
				12	0	20.61	21.0±1	1.0
				12	24	20.77	21.0±1	1.0
				12	49	20.64	21.0±1	1.0
				25	0	20.61	21.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
10MHz	23060	704	QPSK	1	0	22.61	22.3±1	/
				1	49	**23.15**	22.3±1	/
				1	99	22.94	22.3±1	/
				25	0	21.6	22.3±1	1.0
				25	24	21.6	22.3±1	1.0
				25	49	21.33	22.3±1	1.0
				50	0	21.35	22.3±1	1.0
			16QAM	1	0	21.38	21.0±1	1.0
				1	49	21.69	21.0±1	1.0
				1	99	21.07	21.0±1	1.0
				25	0	20.5	21.0±1	1.0
				25	24	20.56	21.0±1	1.0
				25	49	20.25	21.0±1	1.0
				50	0	20.23	21.0±1	1.0
	23095	707.5	QPSK	1	0	22.55	22.0±1	/
				1	49	22.39	22.0±1	/
				1	99	22.22	22.0±1	/
				25	0	21.43	22.0±1	1.0
				25	24	21.33	22.0±1	1.0
				25	49	21.24	22.0±1	1.0
				50	0	21.05	22.0±1	1.0
			16QAM	1	0	21.88	21.0±1	1.0
				1	49	21.79	21.0±1	1.0
				1	99	21.5	21.0±1	1.0
				25	0	20.35	21.0±1	1.0
				25	24	20.35	21.0±1	1.0
				25	49	20.26	21.0±1	1.0
				50	0	20.07	21.0±1	1.0
	23130	711	QPSK	1	0	22.46	22.0±1	/
				1	49	22.34	22.0±1	/
				1	99	22.32	22.0±1	/
				25	0	21.32	22.0±1	1.0
				25	24	21.39	22.0±1	1.0
				25	49	21.31	22.0±1	1.0
				50	0	21.41	22.0±1	1.0
			16QAM	1	0	21.48	21.0±1	1.0
				1	49	21.36	21.0±1	1.0
				1	99	21.26	21.0±1	1.0
				25	0	20.36	21.0±1	1.0
				25	24	20.43	21.0±1	1.0
				25	49	20.44	21.0±1	1.0
				50	0	20.41	21.0±1	1.0

LTE Band 13:

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
5MHz	23205	779.5	QPSK	1	0	22.95	22.0±1	/
				1	49	22.94	22.0±1	/
				1	99	22.87	22.0±1	/
				12	0	21.88	22.0±1	1.0
				12	24	21.89	22.0±1	1.0
				12	49	21.86	22.0±1	1.0
				25	0	21.84	22.0±1	1.0
			16QAM	1	0	22.06	21.5±1	1.0
				1	49	22.01	21.5±1	1.0
				1	99	21.97	21.5±1	1.0
				12	0	20.96	21.5±1	1.0
				12	24	20.97	21.5±1	1.0
				12	49	20.95	21.5±1	1.0
				25	0	20.83	21.5±1	1.0
	23230	782.0	QPSK	1	0	22.92	22.0±1	/
				1	49	22.9	22.0±1	/
				1	99	22.89	22.0±1	/
				12	0	21.83	22.0±1	1.0
				12	24	21.83	22.0±1	1.0
				12	49	21.84	22.0±1	1.0
				25	0	21.71	22.0±1	1.0
			16QAM	1	0	22.02	21.5±1	1.0
				1	49	22.06	21.5±1	1.0
				1	99	22.08	21.5±1	1.0
				12	0	20.95	21.5±1	1.0
				12	24	20.96	21.5±1	1.0
				12	49	20.97	21.5±1	1.0
				25	0	20.78	21.5±1	1.0
	23255	784.5	QPSK	1	0	22.91	22.0±1	/
				1	49	22.95	22.0±1	/
				1	99	22.96	22.0±1	/
				12	0	21.97	22.0±1	1.0
				12	24	21.98	22.0±1	1.0
				12	49	21.87	22.0±1	1.0
				25	0	21.95	22.0±1	1.0
			16QAM	1	0	22.35	22.0±1	1.0
				1	49	22.47	22.0±1	1.0
				1	99	22.46	22.0±1	1.0
				12	0	21.12	22.0±1	1.0
				12	24	21.14	22.0±1	1.0
				12	49	21.03	22.0±1	1.0
				25	0	21.03	22.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
10MHz	23230	782.0	QPSK	1	0	22.78	22.0±1	/
				1	49	**22.98**	22.0±1	/
				1	99	22.84	22.0±1	/
				25	0	21.49	22.0±1	1.0
				25	24	21.48	22.0±1	1.0
				25	49	21.54	22.0±1	1.0
				50	0	21.17	22.0±1	1.0
			16QAM	1	0	21.47	21.0±1	1.0
				1	49	21.57	21.0±1	1.0
				1	99	21.5	21.0±1	1.0
				25	0	20.57	21.0±1	1.0
				25	24	20.56	21.0±1	1.0
				25	49	20.62	21.0±1	1.0
				50	0	20.23	21.0±1	1.0

LTE Band 66:

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
1.4MHz	131979	1710.7	QPSK	1	0	22.75	22.0±1	/
				1	2	22.63	22.0±1	/
				1	5	22.76	22.0±1	/
				3	0	22.58	22.0±1	/
				3	1	22.57	22.0±1	/
				3	2	22.56	22.0±1	/
				6	0	21.46	22.0±1	1.0
			16QAM	1	0	21.71	21.0±1	1.0
				1	2	21.58	21.0±1	1.0
				1	5	21.75	21.0±1	1.0
				3	0	21.45	21.0±1	1.0
				3	1	21.5	21.0±1	1.0
				3	2	21.5	21.0±1	1.0
				6	0	20.61	21.0±1	1.0
	132321	1744.9	QPSK	1	0	22.37	22.0±1	/
				1	2	22.28	22.0±1	/
				1	5	22.28	22.0±1	/
				3	0	22.24	22.0±1	/
				3	1	22.24	22.0±1	/
				3	2	22.23	22.0±1	/
				6	0	21.27	22.0±1	1.0
			16QAM	1	0	21.7	21.0±1	1.0
				1	2	21.64	21.0±1	1.0
				1	5	21.7	21.0±1	1.0
				3	0	21.44	21.0±1	1.0
				3	1	21.45	21.0±1	1.0
				3	2	21.45	21.0±1	1.0
				6	0	20.18	21.0±1	1.0
	132664	1779.2	QPSK	1	0	21.81	21.0±1	/
				1	2	21.53	21.0±1	/
				1	5	21.61	21.0±1	/
				3	0	21.58	21.0±1	/
				3	1	21.53	21.0±1	/
				3	2	21.5	21.0±1	/
				6	0	20.55	21.0±1	1.0
			16QAM	1	0	20.77	20.0±1	1.0
				1	2	20.6	20.0±1	1.0
				1	5	20.68	20.0±1	1.0
				3	0	20.81	20.0±1	1.0
				3	1	20.78	20.0±1	1.0
				3	2	20.75	20.0±1	1.0
				6	0	19.84	20.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
3MHz	131987	1711.5	QPSK	1	0	22.52	22.0±1	/
				1	8	22.64	22.0±1	/
				1	14	22.6	22.0±1	/
				6	0	21.48	22.0±1	1.0
				6	4	21.57	22.0±1	1.0
				6	9	21.51	22.0±1	1.0
				15	0	21.51	22.0±1	1.0
			16QAM	1	0	21.34	21.0±1	1.0
				1	8	21.48	21.0±1	1.0
				1	14	21.45	21.0±1	1.0
				8	0	20.56	21.0±1	1.0
				8	4	20.63	21.0±1	1.0
				8	9	20.65	21.0±1	1.0
				15	0	20.52	21.0±1	1.0
	132321	1744.9	QPSK	1	0	22.28	22.0±1	/
				1	8	22.3	22.0±1	/
				1	14	22.2	22.0±1	/
				6	0	21.33	22.0±1	1.0
				6	4	21.37	22.0±1	1.0
				6	9	21.34	22.0±1	1.0
				15	0	21.33	22.0±1	1.0
			16QAM	1	0	21.65	21.0±1	1.0
				1	8	21.7	21.0±1	1.0
				1	14	21.62	21.0±1	1.0
				6	0	20.42	21.0±1	1.0
				6	4	20.45	21.0±1	1.0
				6	9	20.43	21.0±1	1.0
				15	0	20.36	21.0±1	1.0
	132656	1778.4	QPSK	1	0	21.91	21.0±1	/
				1	8	21.67	21.0±1	/
				1	14	21.51	21.0±1	/
				6	0	20.74	21.0±1	1.0
				6	4	20.68	21.0±1	1.0
				6	9	20.59	21.0±1	1.0
				15	0	20.66	21.0±1	1.0
			16QAM	1	0	20.78	20.0±1	1.0
				1	8	20.7	20.0±1	1.0
				1	14	20.49	20.0±1	1.0
				8	0	19.88	20.0±1	1.0
				8	4	19.83	20.0±1	1.0
				8	9	19.74	20.0±1	1.0
				15	0	19.74	20.0±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
5MHz	131997	1712.5	QPSK	1	0	22.55	22.0±1	/
				1	49	22.69	22.0±1	/
				1	99	22.71	22.0±1	/
				12	0	21.44	22.0±1	1.0
				12	24	21.53	22.0±1	1.0
				12	49	21.52	22.0±1	1.0
				25	0	21.46	22.0±1	1.0
			16QAM	1	0	21.53	21.0±1	1.0
				1	49	21.73	21.0±1	1.0
				1	99	21.77	21.0±1	1.0
				12	0	20.49	21.0±1	1.0
				12	24	20.63	21.0±1	1.0
				12	49	20.63	21.0±1	1.0
				25	0	20.51	21.0±1	1.0
	132321	1744.9	QPSK	1	0	22.26	22.0±1	/
				1	49	22.32	22.0±1	/
				1	99	22.14	22.0±1	/
				12	0	21.27	22.0±1	1.0
				12	24	21.35	22.0±1	1.0
				12	49	21.29	22.0±1	1.0
				25	0	21.29	22.0±1	1.0
			16QAM	1	0	21.7	21.0±1	1.0
				1	49	21.86	21.0±1	1.0
				1	99	21.69	21.0±1	1.0
				12	0	20.42	21.0±1	1.0
				12	24	20.5	21.0±1	1.0
				12	49	20.45	21.0±1	1.0
				25	0	20.37	21.0±1	1.0
	132646	1777.4	QPSK	1	0	22.07	21.5±1	/
				1	49	21.8	21.5±1	/
				1	99	21.49	21.5±1	/
				12	0	20.86	21.5±1	1.0
				12	24	20.79	21.5±1	1.0
				12	49	20.59	21.5±1	1.0
				25	0	20.73	21.5±1	1.0
			16QAM	1	0	21.09	20.5±1	1.0
				1	49	20.94	20.5±1	1.0
				1	99	20.62	20.5±1	1.0
				12	0	20.01	20.5±1	1.0
				12	24	19.96	20.5±1	1.0
				12	49	19.77	20.5±1	1.0
				25	0	19.81	20.5±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
10MHz	132022	1715	QPSK	1	0	22.43	22.0±1	/
				1	49	22.66	22.0±1	/
				1	99	22.55	22.0±1	/
				25	0	21.26	22.0±1	1.0
				25	24	21.47	22.0±1	1.0
				25	49	21.44	22.0±1	1.0
				50	0	21.33	22.0±1	1.0
			16QAM	1	0	21.18	21.0±1	1.0
				1	49	21.44	21.0±1	1.0
				1	99	21.38	21.0±1	1.0
				25	0	20.31	21.0±1	1.0
				25	24	20.52	21.0±1	1.0
				25	49	20.39	21.0±1	1.0
				50	0	20.35	21.0±1	1.0
	132321	1744.9	QPSK	1	0	22.08	22.0±1	/
				1	49	22.2	22.0±1	/
				1	99	21.9	22.0±1	/
				25	0	21.11	22.0±1	1.0
				25	24	21.22	22.0±1	1.0
				25	49	21.02	22.0±1	1.0
				50	0	21.09	22.0±1	1.0
			16QAM	1	0	21.4	21.0±1	1.0
				1	49	21.61	21.0±1	1.0
				1	99	21.33	21.0±1	1.0
				25	0	20.15	21.0±1	1.0
				25	24	20.26	21.0±1	1.0
				25	49	20.06	21.0±1	1.0
				50	0	20.13	21.0±1	1.0
	132621	1774.9	QPSK	1	0	21.84	21.0±1	/
				1	49	21.99	21.0±1	/
				1	99	21.43	21.0±1	/
				25	0	20.74	21.0±1	1.0
				25	24	20.92	21.0±1	1.0
				25	49	20.61	21.0±1	1.0
				50	0	20.79	21.0±1	1.0
			16QAM	1	0	20.75	20.5±1	1.0
				1	49	21.01	20.5±1	1.0
				1	99	20.37	20.5±1	1.0
				25	0	19.91	20.5±1	1.0
				25	24	20.11	20.5±1	1.0
				25	49	19.8	20.5±1	1.0
				50	0	19.93	20.5±1	1.0

BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
15MHz	132097	1722.5	QPSK	1	0	22.47	22.0±1	/
				1	49	22.64	22.0±1	/
				1	99	22.65	22.0±1	/
				36	0	21.5	22.0±1	1.0
				36	24	21.63	22.0±1	1.0
				36	49	21.67	22.0±1	1.0
				75	0	21.53	22.0±1	1.0
			16QAM	1	0	21.26	21.0±1	1.0
				1	49	21.56	21.0±1	1.0
				1	99	21.49	21.0±1	1.0
				36	0	20.45	21.0±1	1.0
				36	24	20.67	21.0±1	1.0
				36	49	20.65	21.0±1	1.0
				75	0	20.57	21.0±1	1.0
	132321	1744.9	QPSK	1	0	22.18	22.0±1	/
				1	49	22.22	22.0±1	/
				1	99	22.09	22.0±1	/
				36	0	21.22	22.0±1	1.0
				36	24	21.26	22.0±1	1.0
				36	49	21.12	22.0±1	1.0
				75	0	21.17	22.0±1	1.0
			16QAM	1	0	21.56	21.0±1	1.0
				1	49	21.64	21.0±1	1.0
				1	99	21.44	21.0±1	1.0
				36	0	20.26	21.0±1	1.0
				36	24	20.33	21.0±1	1.0
				36	49	20.19	21.0±1	1.0
				75	0	20.21	21.0±1	1.0
	132546	1767.4	QPSK	1	0	21.99	21.0±1	/
				1	49	21.99	21.0±1	/
				1	99	21.56	21.0±1	/
				36	0	20.9	21.0±1	1.0
				36	24	21	21.0±1	1.0
				36	49	20.91	21.0±1	1.0
				75	0	20.9	21.0±1	1.0
			16QAM	1	0	21.38	20.5±1	1.0
				1	49	21.43	20.5±1	1.0
				1	99	20.97	20.5±1	1.0
				36	0	19.9	20.5±1	1.0
				36	24	20.07	20.5±1	1.0
				36	49	19.95	20.5±1	1.0
				75	0	19.98	20.5±1	1.0

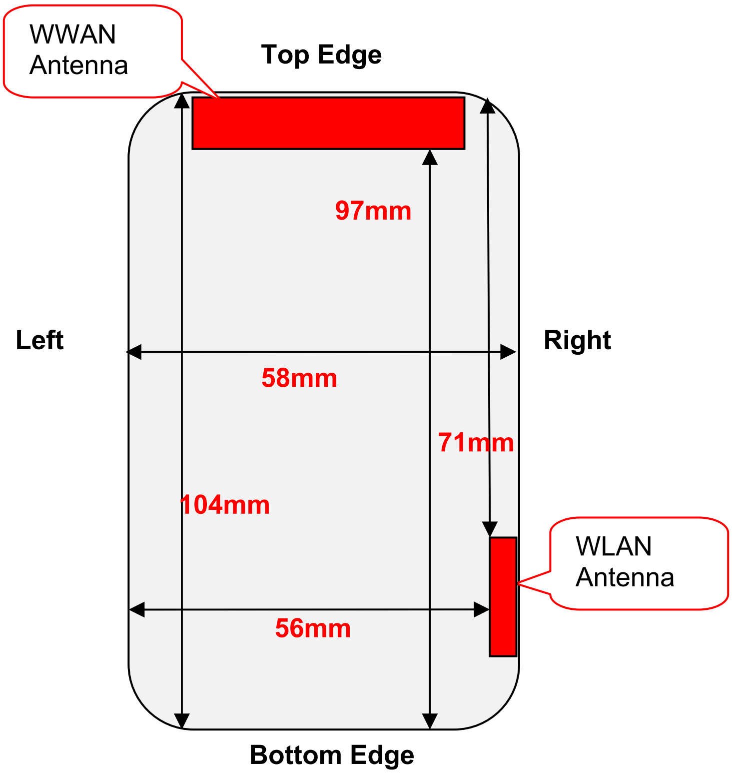
BW(MHz)	Ch	Freq(MHz)	Mode	UL RB Allocation	UL RB Offset	Average Power (dbm)	Tune up limited(dBm)	MPR (dB)
20MHz	132072	1720	QPSK	1	0	22.5	22.0±1	/
				1	49	**22.78**	22.0±1	/
				1	99	22.35	22.0±1	/
				50	0	21.36	22.0±1	1.0
				50	24	21.65	22.0±1	1.0
				50	49	21.37	22.0±1	1.0
				100	0	21.52	22.0±1	1.0
			16QAM	1	0	21.81	21.3±1	1.0
				1	49	22.18	21.3±1	1.0
				1	99	21.81	21.3±1	1.0
				50	0	20.41	21.3±1	1.0
				50	24	20.62	21.3±1	1.0
				50	49	20.45	21.3±1	1.0
				100	0	20.49	21.3±1	1.0
	132321	1744.9	QPSK	1	0	22.2	21.5±1	/
				1	49	22.24	21.5±1	/
				1	99	22	21.5±1	/
				50	0	21.09	21.5±1	1.0
				50	24	21.24	21.5±1	1.0
				50	49	20.99	21.5±1	1.0
				100	0	21.09	21.5±1	1.0
			16QAM	1	0	21.58	21.0±1	1.0
				1	49	21.7	21.0±1	1.0
				1	99	21.43	21.0±1	1.0
				50	0	20.12	21.0±1	1.0
				50	24	20.27	21.0±1	1.0
				50	49	20.03	21.0±1	1.0
				100	0	20.11	21.0±1	1.0
	132471	1759.9	QPSK	1	0	21.96	21.0±1	/
				1	49	21.9	21.0±1	/
				1	99	21.47	21.0±1	/
				50	0	20.83	21.0±1	1.0
				50	24	20.87	21.0±1	1.0
				50	49	20.82	21.0±1	1.0
				100	0	20.71	21.0±1	1.0
			16QAM	1	0	21.21	20.5±1	1.0
				1	49	21.32	20.5±1	1.0
				1	99	20.85	20.5±1	1.0
				50	0	19.82	20.5±1	1.0
				50	24	19.94	20.5±1	1.0
				50	49	19.91	20.5±1	1.0
				100	0	19.81	20.5±1	1.0

2.4G Wi-Fi:

Channel number	Frequency (MHz)	Average Output Power(dBm)	Tune up limited(dBm)
TX 11b	2412	12.74	13.0±1
	2437	13.27	13.0±1
	2462	13.05	13.0±1
TX 11g	2412	13.01	13.0±1
	2437	13.52	13.0±1
	2462	13.48	13.0±1
TX 11n HT20	2412	13.34	13.0±1
	2437	13.91	13.0±1
	2462	13.11	13.0±1
TX 11n HT40	2422	12.44	12.0±1
	2437	12.71	12.0±1
	2452	11.67	12.0±1
TX 11ax HT20	2412	13.90	14.0±1
	2437	**14.59**	14.0±1
	2462	13.35	14.0±1
TX 11ax HT40	2422	13.14	13.0±1
	2437	13.54	13.0±1
	2452	12.67	13.0±1

12 Exposure Conditions Consideration

12.1 EUT antenna location



< EUT Front Side View >

12.2 Test position consideration

Distance of EUT antenna-to-edge/surface(mm), Test distance:10mm						
Antennas	Back Side	Front Side	Left Edge	Right Edge	Top Edge	Bottom Edge
WWAN	<25	<25	<25	<25	<25	97
WLAN	<25	<25	56	<25	71	<25
Test distance:10mm						
Antennas	Back Side	Front Side	Left Edge	Right Edge	Top Edge	Bottom Edge
WWAN	YES	YES	YES	YES	YES	NO
WLAN	YES	YES	NO	YES	NO	YES

Note:
1. Body SAR mode assessments are required.
2. Referring to KDB 941225 D06v02r01, when the overall device length and width are ≥ 9cm * 5cm, the test distance is 10mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

13 SAR Test Results

13.1 Test Condition

1. SAR Measurement
   The distance between the EUT and the antenna of the emulator is more than 50 cm and the output power radiated from the emulator antenna is at least 30 dB less than the output power of EUT.

2	Environmental Conditions	Temperature	23.5°C
		Relative Humidity	53%
		Atmospheric Pressure	1015mbar

13.2 Generally Test Procedures

1. Establish communication link between EUT and base station emulation by air link.
2. Place the EUT in the selected test position as section 17.
3. Perform SAR testing at middle or highest output power channel under the selected test mode. If the measured 1-g SAR is ≤ 0.8 W/kg, then testing for the other channel will not be performed.
4. When SAR is<0.8W/kg, no repeated SAR measurement is required

For WCDMA test:

1. KDB941225 D01-Body SAR is not required for HSDPA when the average output of each RF channel with HSDPA active is less than 0.25dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC<75% of the SAR limit.
2. KDB941225 D01-Body SAR is not required for handset with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than 0.25dB higher than that measure without HSUPA/HSDPA using 12.2kbps RMC AND THE maximum SAR for 12.2kbps RMC is<75% of the SAR limit

For LTE test:

1. According to FCC KDB 941225 D05v02r05:
   a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
      i. The required channel and offset combination with the highest maximum output power is required for SAR.
      ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
      iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
   b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
   c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
   d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.
   e. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

13.3 SAR Summary Test Result

Table 4: SAR Values of 2.4G Wi-Fi

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
		CH.	MHz		Maximum Turn-up Power (dBm)	Measured output power (dBm)	Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Body-worn (10mm Separation)	Front Side	06	2437	802.11n HT20	15	14.59	1.099	0.106	0.116	--
	Back Side	06	2437	802.11n HT20	15	14.59	1.099	0.089	0.098	--
	Right Edge	06	2437	802.11n HT20	15	14.59	1.099	0.168	**0.185**	**1**
	Bottom Edge	06	2437	802.11n HT20	15	14.59	1.099	0.082	0.090	--

Table 5: SAR Values of WCDMA BAND Ⅱ

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power (dBm)	Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Body-worn (10mm Separation)	Front Side	9400	1880	RMC 12.2kbps	23	22.71	1.069	0.543	**0.580**	**2**
	Back Side	9400	1880	RMC 12.2kbps	23	22.71	1.069	0.458	0.490	--
	Left Edge	9400	1880	RMC 12.2kbps	23	22.71	1.069	0.230	0.246	--
	Right Edge	9400	1880	RMC 12.2kbps	23	22.71	1.069	0.354	0.378	--
	Top Edge	9400	1880	RMC 12.2kbps	23	22.71	1.069	0.219	0.234	--

Table 6: SAR Values of WCDMA BAND IV

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power (dBm)	Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Body-worn (10mm Separation)	Front Side	1312	1712.4	RMC 12.2kbps	23	22.95	1.012	0.099	0.100	--
	Back Side	1312	1712.4	RMC 12.2kbps	23	22.95	1.012	0.155	0.157	--
	Left Edge	1312	1712.4	RMC 12.2kbps	23	22.95	1.012	0.079	0.080	--
	Right Edge	1312	1712.4	RMC 12.2kbps	23	22.95	1.012	0.121	0.122	--
	Top Edge	1312	1712.4	RMC 12.2kbps	23	22.95	1.012	0.161	**0.163**	**3**

Table 7: SAR Values of WCDMA BAND V

Test Positions		Channel		Test Mode	Power(dBm)		SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
		CH.	MHz		Maximum Turn-up Power(dBm)	Measured output power (dBm)	Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
Body-worn (10mm Separation)	Front Side	4132	826.4	RMC 12.2kbps	23	22.30	1.175	0.492	**0.578**	**4**
	Back Side	4132	826.4	RMC 12.2kbps	23	22.30	1.175	0.389	0.457	--
	Left Edge	4132	826.4	RMC 12.2kbps	23	22.30	1.175	0.308	0.362	--
	Right Edge	4132	826.4	RMC 12.2kbps	23	22.30	1.175	0.252	0.296	--
	Top Edge	4132	826.4	RMC 12.2kbps	23	22.30	1.175	0.071	0.083	--

Table 8: SAR Values of LTE BAND 2, 20MHz ,QPSK

Test Mode	Test Positions		Channel		Power(dBm)		MPR (dB)	SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
			CH.	MHz	Maximum Turn-up Power (dBm)	Measured output power (dBm)		Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
1RB	Body-worn (10mm Separation)	Front Side	18900	1880	23	22.77	0	1.054	0.595	**0.627**	**5**
		Back Side	18900	1880	23	22.77	0	1.054	0.221	0.233	--
		Left Edge	18900	1880	23	22.77	0	1.054	0.315	0.332	--
		Right Edge	18900	1880	23	22.77	0	1.054	0.176	0.186	--
		Top Edge	18900	1880	23	22.77	0	1.054	0.229	0.241	--
50%RB	Body-worn (10mm Separation)	Front Side	18900	1880	23	22.77	1	1.054	0.571	0.602	--
		Back Side	18900	1880	23	22.77	1	1.054	0.219	0.231	--
		Left Edge	18900	1880	23	22.77	1	1.054	0.299	0.315	--
		Right Edge	18900	1880	23	22.77	1	1.054	0.161	0.170	--
		Top Edge	18900	1880	23	22.77	1	1.054	0.217	0.229	--

Table 9: SAR Values of LTE BAND 4, 20MHz ,QPSK

Test Mode	Test Positions		Channel		Power(dBm)		MPR (dB)	SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
			CH.	MHz	Maximum Turn-up Power (dBm)	Measured output power (dBm)		Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
1RB	Body-worn (10mm Separation)	Front Side	20050	1720	23	22.71	0	1.069	0.418	**0.447**	**6**
		Back Side	20050	1720	23	22.71	0	1.069	0.22	0.235	--
		Left Edge	20050	1720	23	22.71	0	1.069	0.084	0.090	--
		Right Edge	20050	1720	23	22.71	0	1.069	0.145	0.155	--
		Top Edge	20050	1720	23	22.71	0	1.069	0.157	0.168	--
50%RB	Body-worn (10mm Separation)	Front Side	20050	1720	23	22.71	1	1.069	0.409	0.437	--
		Back Side	20050	1720	23	22.71	1	1.069	0.215	0.230	--
		Left Edge	20050	1720	23	22.71	1	1.069	0.073	0.078	--
		Right Edge	20050	1720	23	22.71	1	1.069	0.129	0.138	--
		Top Edge	20050	1720	23	22.71	1	1.069	0.136	0.145	--

Table 10: SAR Values of LTE BAND 5, 20MHz ,QPSK

Test Mode	Test Positions		Channel		Power(dBm)		MPR (dB)	SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
			CH.	MHz	Maximum Turn-up Power (dBm)	Measured output power (dBm)		Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
1RB	Body-worn (10mm Separation)	Front Side	20450	829	23.5	23.48	0	1.005	0.364	**0.366**	**7**
		Back Side	20450	829	23.5	23.48	0	1.005	0.322	0.323	--
		Left Edge	20450	829	23.5	23.48	0	1.005	0.249	0.250	--
		Right Edge	20450	829	23.5	23.48	0	1.005	0.215	0.216	--
		Top Edge	20450	829	23.5	23.48	0	1.005	0.054	0.054	--
50%RB	Body-worn (10mm Separation)	Front Side	20450	829	23.5	23.48	1	1.005	0.344	0.346	--
		Back Side	20450	829	23.5	23.48	1	1.005	0.308	0.309	--
		Left Edge	20450	829	23.5	23.48	1	1.005	0.242	0.243	--
		Right Edge	20450	829	23.5	23.48	1	1.005	0.201	0.202	--
		Top Edge	20450	829	23.5	23.48	1	1.005	0.048	0.048	--

Table 11: SAR Values of LTE BAND 12, 20MHz ,QPSK

Test Mode	Test Positions		Channel		Power(dBm)		MPR (dB)	SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
			CH.	MHz	Maximum Turn-up Power (dBm)	Measured output power (dBm)		Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
1RB	Body-worn (10mm Separation)	Front Side	23060	704	23.3	23.15	0	1.035	0.203	**0.210**	**8**
		Back Side	23060	704	23.3	23.15	0	1.035	0.148	0.153	--
		Left Edge	23060	704	23.3	23.15	0	1.035	0.09	0.093	--
		Right Edge	23060	704	23.3	23.15	0	1.035	0.065	0.067	--
		Top Edge	23060	704	23.3	23.15	0	1.035	0.121	0.125	--
50%RB	Body-worn (10mm Separation)	Front Side	23060	704	23.3	23.15	1	1.035	0.187	0.194	--
		Back Side	23060	704	23.3	23.15	1	1.035	0.142	0.147	--
		Left Edge	23060	704	23.3	23.15	1	1.035	0.083	0.086	--
		Right Edge	23060	704	23.3	23.15	1	1.035	0.059	0.061	--
		Top Edge	23060	704	23.3	23.15	1	1.035	0.114	0.118	--

Table 12: SAR Values of LTE BAND 13, 20MHz ,QPSK

Test Mode	Test Positions		Channel		Power(dBm)		MPR (dB)	SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
			CH.	MHz	Maximum Turn-up Power (dBm)	Measured output power (dBm)		Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
1RB	Body-worn (10mm Separation)	Front Side	23230	782.0	23	22.98	0	1.005	0.495	**0.497**	**9**
		Back Side	23230	782.0	23	22.98	0	1.005	0.357	0.359	--
		Left Edge	23230	782.0	23	22.98	0	1.005	0.241	0.242	--
		Right Edge	23230	782.0	23	22.98	0	1.005	0.237	0.238	--
		Top Edge	23230	782.0	23	22.98	0	1.005	0.104	0.104	--
50%RB	Body-worn (10mm Separation)	Front Side	23230	782.0	23	22.98	1	1.005	0.481	0.483	--
		Back Side	23230	782.0	23	22.98	1	1.005	0.356	0.358	--
		Left Edge	23230	782.0	23	22.98	1	1.005	0.228	0.229	--
		Right Edge	23230	782.0	23	22.98	1	1.005	0.233	0.234	--
		Top Edge	23230	782.0	23	22.98	1	1.005	0.098	0.098	--

Table 13: SAR Values of LTE BAND 66, 20MHz ,QPSK

Test Mode	Test Positions		Channel		Power(dBm)		MPR (dB)	SAR 1g(W/kg), Limit(1.6W/kg)			Plot No.
			CH.	MHz	Maximum Turn-up Power (dBm)	Measured output power (dBm)		Scaling Factor	Measured SAR 1g(W/kg)	Scaled SAR 1g(W/kg)	
1RB	Body-worn (10mm Separation)	Front Side	132072	1720	23	22.78	0	1.052	0.496	**0.522**	**10**
		Back Side	132072	1720	23	22.78	0	1.052	0.361	0.380	--
		Left Edge	132072	1720	23	22.78	0	1.052	0.242	0.255	--
		Right Edge	132072	1720	23	22.78	0	1.052	0.238	0.250	--
		Top Edge	132072	1720	23	22.78	0	1.052	0.102	0.107	--
50%RB	Body-worn (10mm Separation)	Front Side	132072	1720	23	22.78	1	1.052	0.485	0.510	--
		Back Side	132072	1720	23	22.78	1	1.052	0.352	0.370	--
		Left Edge	132072	1720	23	22.78	1	1.052	0.228	0.240	--
		Right Edge	132072	1720	23	22.78	1	1.052	0.235	0.247	--
		Top Edge	132072	1720	23	22.78	1	1.052	0.096	0.101	--

Measurement variability consideration

According to KDB 865664 D01v01r04 section 2.8.1, repeated measurements are required following the procedures as below:

Repeated measurement is not required when the original highest measured SAR is < 0.80W/kg; steps 2) through 4) do not apply.

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 (~ 10% from the 1-g SAR limit).

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.

No Repeated SAR.

Simultaneous Transmission SAR Analysis.
List of Mode for Simultaneous Multi-band Transmission:

No.	Configurations	Body-worn SAR
1	WCDMA (Data) + WLAN 2.4GHz(Data)	Yes
2	LTE (Data) + WLAN 2.4GHz(Data)	Yes

Remark:
1. WCDMA/LTE share the same antenna, and cannot transmit simultaneously.
2. The maximum SAR summation is calculated based onthe same configuration and test position

WWAN and 2.4G Wi-Fi

Position	WWAN（maximum）		2.4G Wi-Fi (10mm)	Summed SAR (W/kg)
	Band	Scaled SAR (W/kg)	Scaled SAR (W/kg)	
Front	WCDMA	0.580	0.116	0.696
Back		0.490	0.098	0.588
Right		0.378	0.185	0.563
Left		0.362	-	0.362
Top		0.234	-	0.234
Bottom		-	0.090	0.090
Front	LTE	0.627	0.116	**0.743**
Back		0.380	0.098	0.478
Right		0.332	0.185	0.517
Left		0.255	-	0.255
Top		0.241	-	0.241
Bottom		-	0.09	0.090

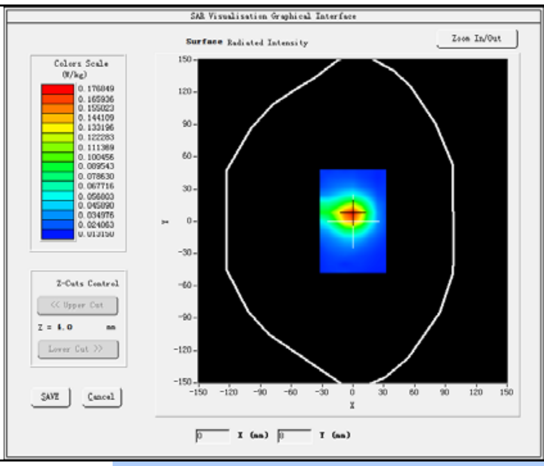
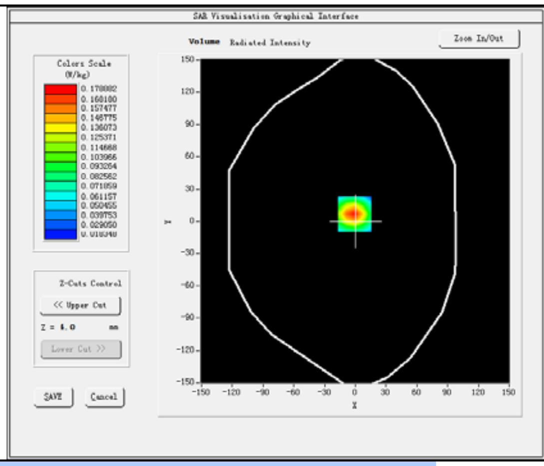
14 SAR Measurement Reference

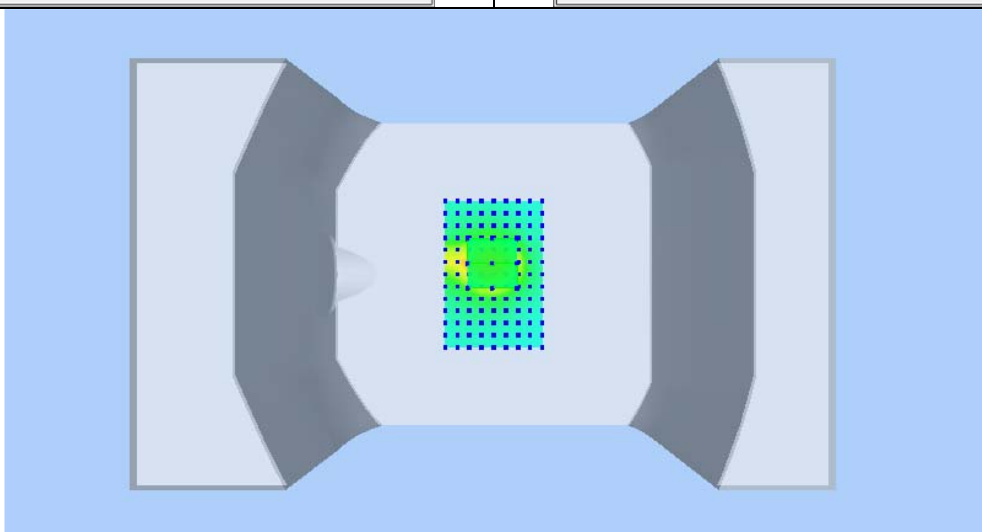
14.1 References

1. **FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"**
2. **IEEE Std. C95.1-2019, "IEEE Standards for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz"**
3. **IEC/IEEE 62209-1528:2020, Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices –Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)**
4. **FCC KDB 447498 D01 v06, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Oct 23th, 2015**
5. **FCC KDB 941225 D01 v03r01, "3G SAR Measurement Procedures", Oct 23th, 2015**
6. **FCC KDB 941225 D05 v02r05, "SAR Evaluation Considerations for LTE Devices", Dec 16th, 2015**
7. **FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 23th, 2015**
8. **FCC KDB865664 D01 v01r04, "SAR Measurement Requirements 100MHz to 6GHz", Aug 7th, 2015**
9. **FCC KDB865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations ", Oct 23th", 2015**
10. **FCC KDB648474 D04 v01r03, "SAR Evaluation Considerations for Wireless Handsets", Oct 23th", 2015**
11. **FCC KDB 248227 D01 v02r02, SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters, Oct 23th, 2015.**

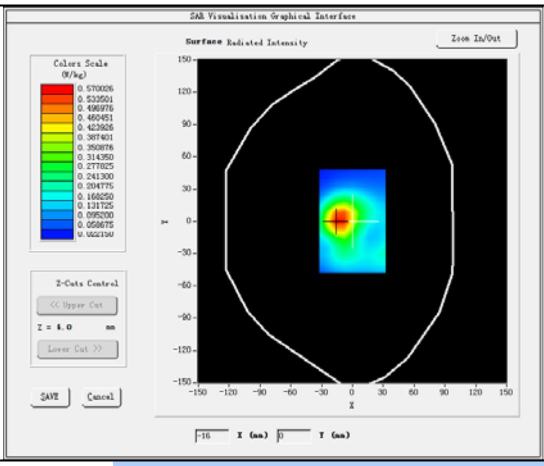
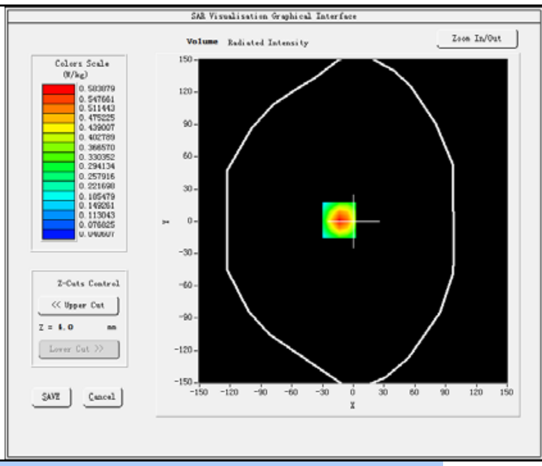
14.2 Maximum SAR measurement Plots

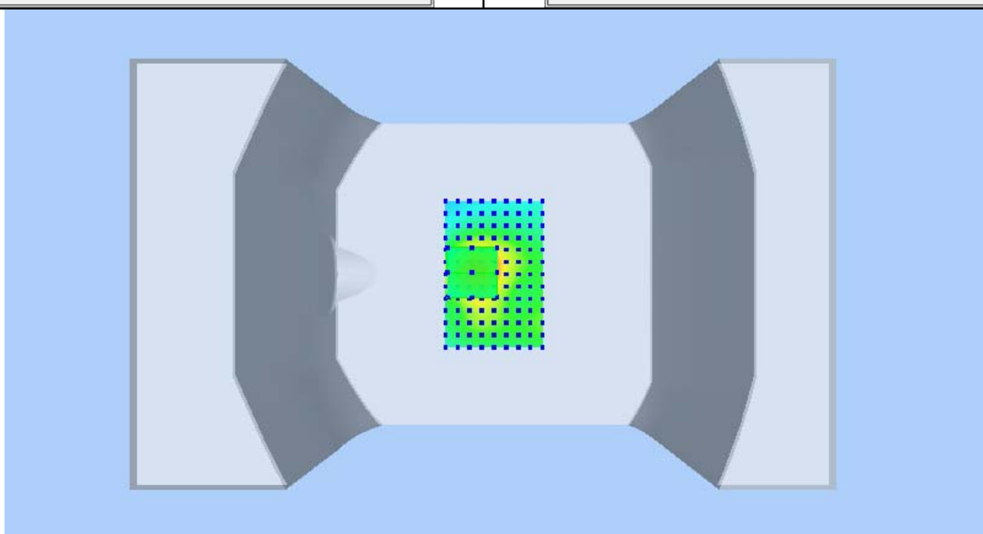
Plot 1: 2.4G Wi-Fi, Middle channel (Body-worn, Right Edge)
Product Description: LTE MiFi Router
Test Date: 2024-03-29

Medium(liquid type)	HL2450
Frequency (MHz)	2437.0000
Relative permittivity (real part)	39.21
Conductivity (S/m)	1.81
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	3.03
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.69
SAR 10g (W/kg)	0.091465
SAR 1g (W/kg)	0.168009
SURFACE SAR	**VOLUME SAR**
	



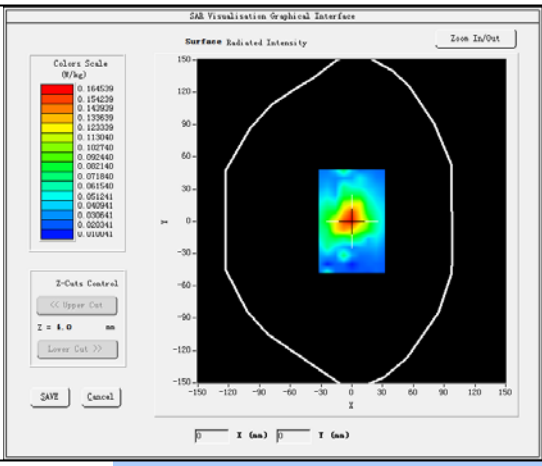
Plot 2: WCDMA BAND II, Middle channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-28

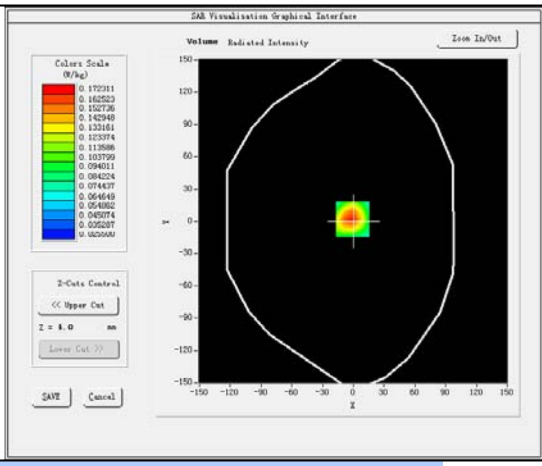
Medium(liquid type)	HL1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	40.13
Conductivity (S/m)	1.36
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.83
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.57
SAR 10g (W/kg)	0.316925
SAR 1g (W/kg)	0.543258
SURFACE SAR	**VOLUME SAR**
	

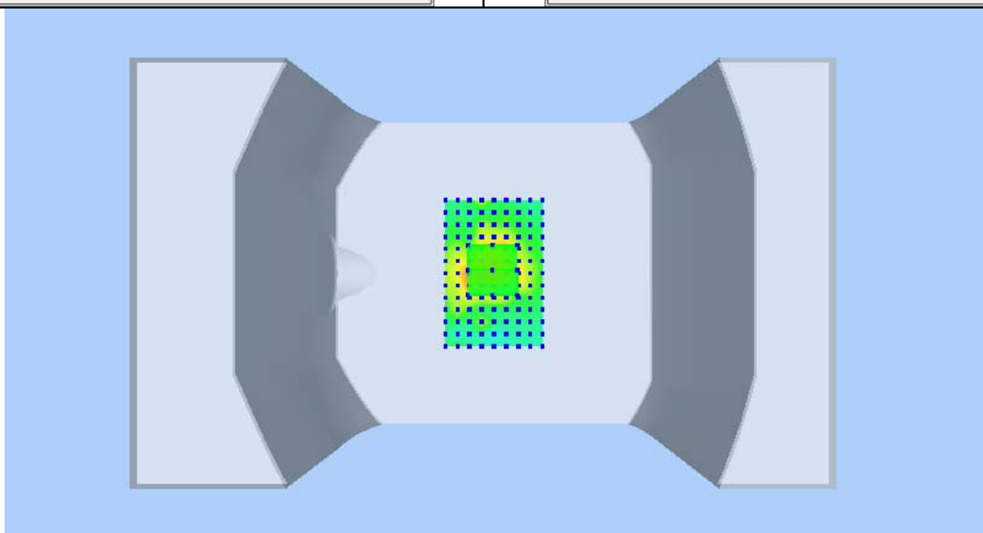


Plot 3: WCDMA BAND IV, Low channel (Body-worn, Top Edge)
Product Description: LTE MiFi Router
Test Date: 2024-03-26

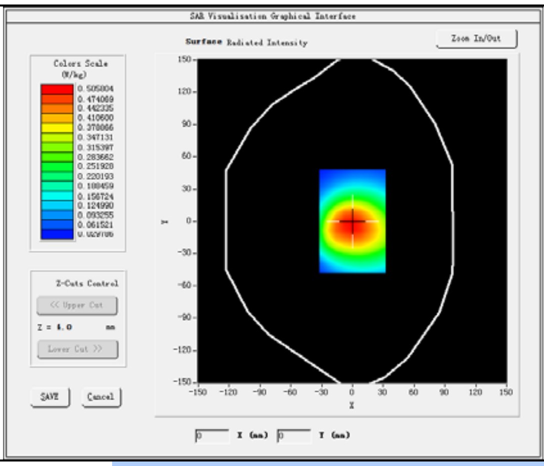
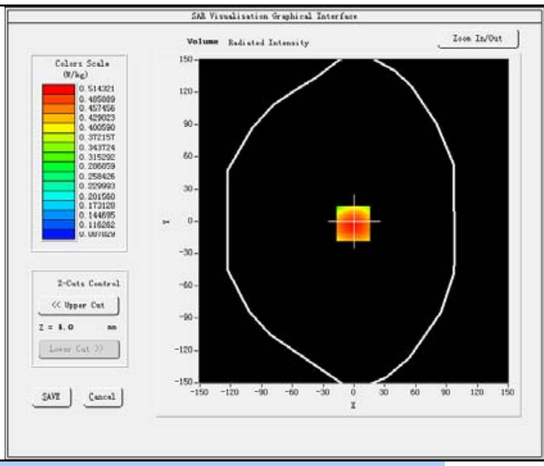
Medium(liquid type)	HL1800
Frequency (MHz)	1712.4000
Relative permittivity (real part)	38.73
Conductivity (S/m)	1.39
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.65
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-8.12
SAR 10g (W/kg)	0.100532
SAR 1g (W/kg)	0.161227
SURFACE SAR	**VOLUME SAR**

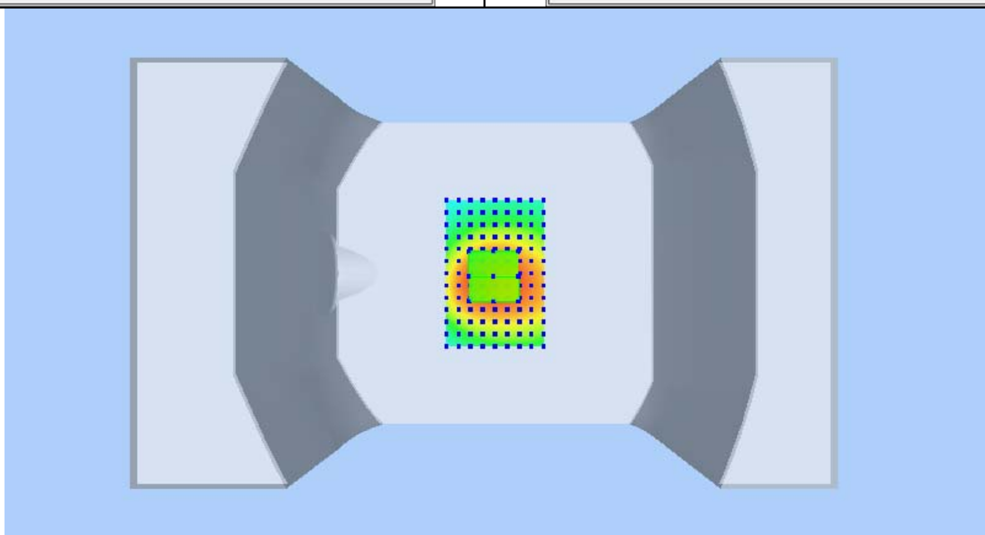






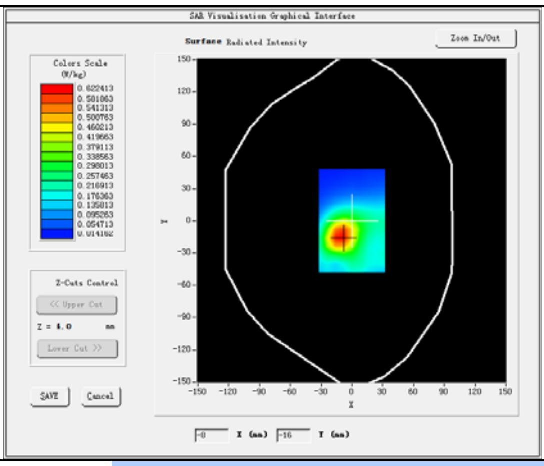
Plot 4: WCDMA BAND V, Low channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-27

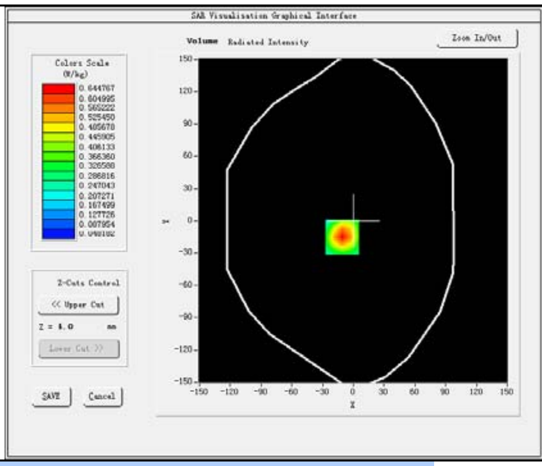
Medium(liquid type)	HL850
Frequency (MHz)	826.4000
Relative permittivity (real part)	41.95
Conductivity (S/m)	0.89
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.48
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.48
SAR 10g (W/kg)	0.351488
SAR 1g (W/kg)	0.491936
SURFACE SAR	**VOLUME SAR**
	

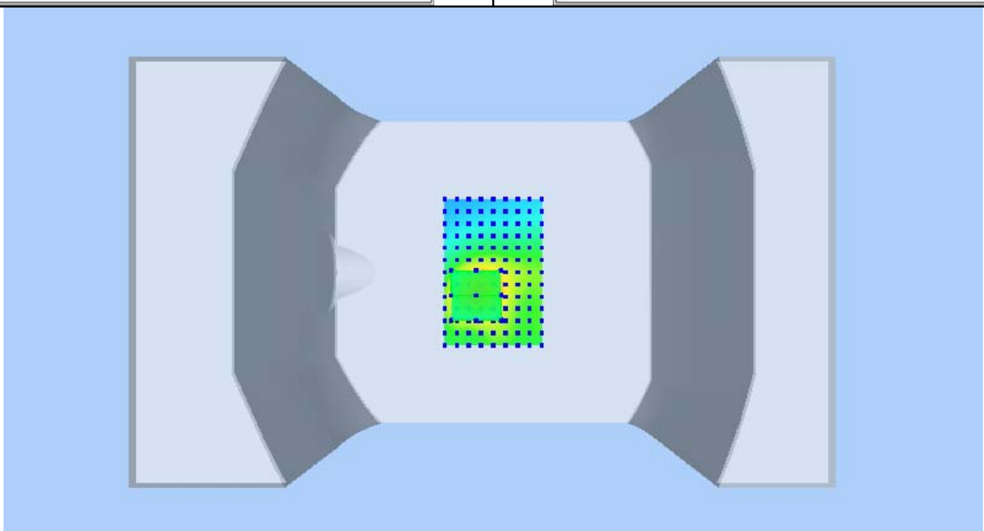


Plot 5: LTE BAND 2, Middle channel (Body-worn, Front Side)
Product Description:LTE MiFi Router
Test Date: 2024-03-28

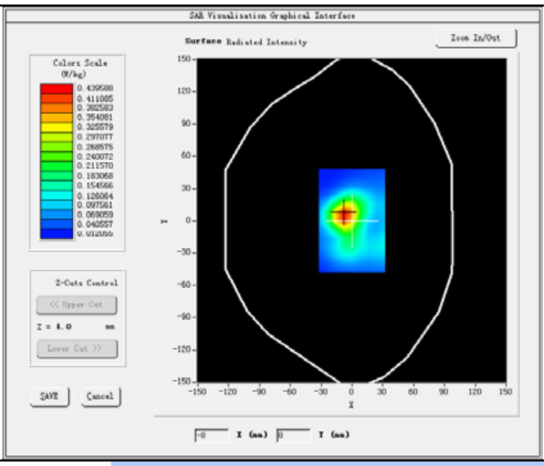
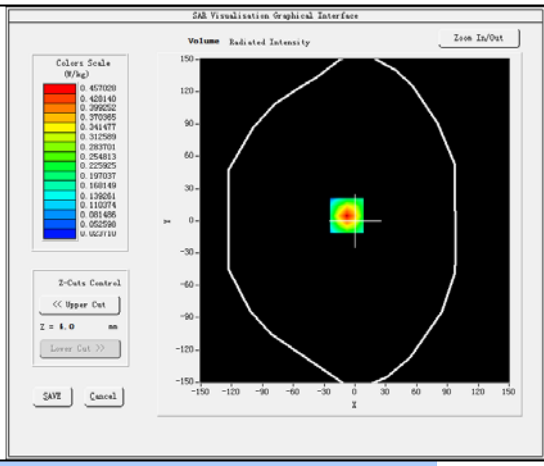
Medium(liquid type)	HL1900
Frequency (MHz)	1880.0000
Relative permittivity (real part)	40.13
Conductivity (S/m)	1.36
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.83
Bandwidth(MHz)	20
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.32
SAR 10g (W/kg)	0.344024
SAR 1g (W/kg)	0.595496
SURFACE SAR	**VOLUME SAR**

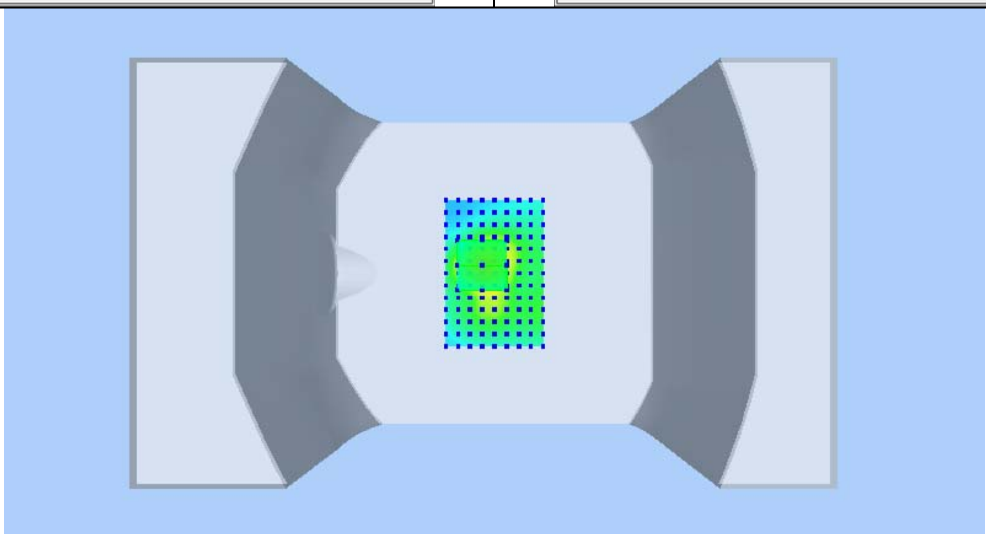




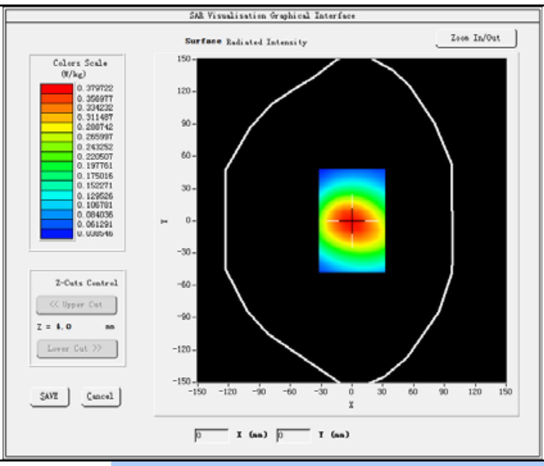
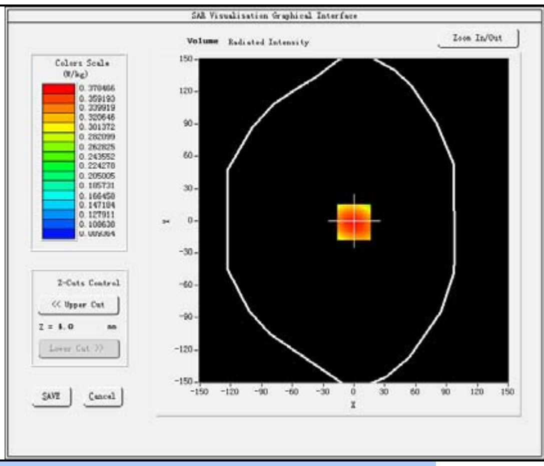


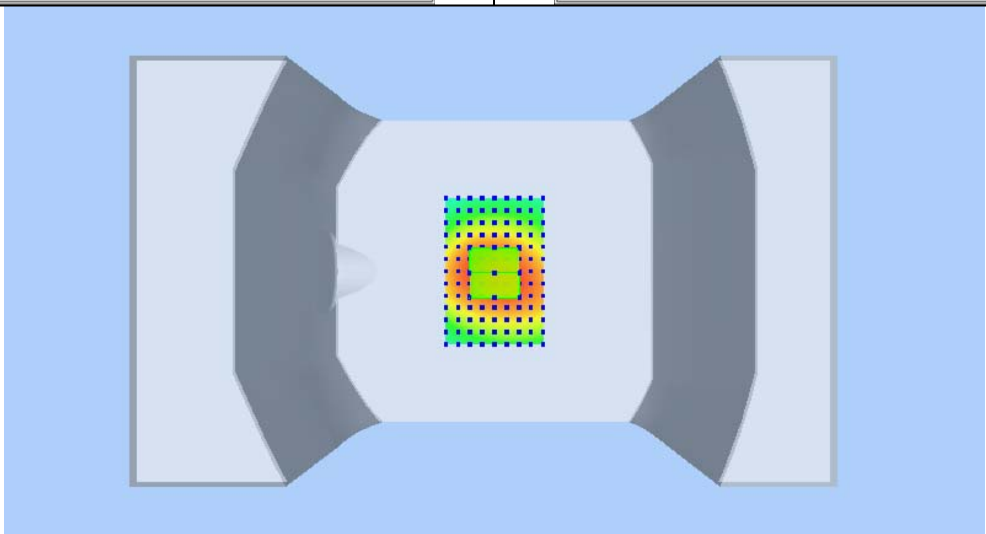
Plot 6: LTE BAND 4, Low channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-26

Medium(liquid type)	HL1800
Frequency (MHz)	1720.0000
Relative permittivity (real part)	38.73
Conductivity (S/m)	1.39
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.65
Bandwidth(MHz)	20
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.25
SAR 10g (W/kg)	0.234808
SAR 1g (W/kg)	0.417991
SURFACE SAR	**VOLUME SAR**
	

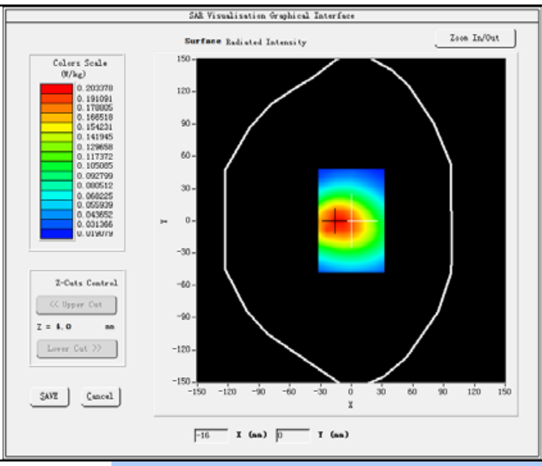
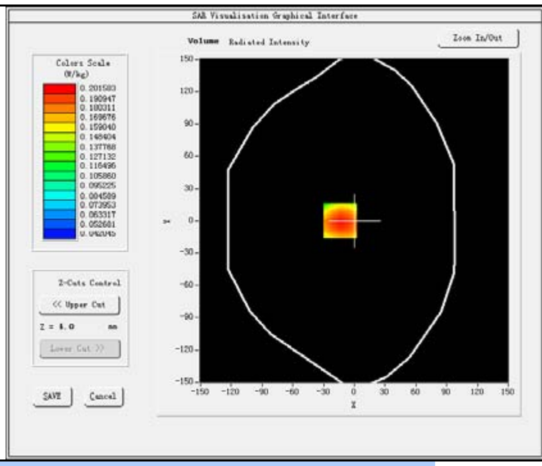
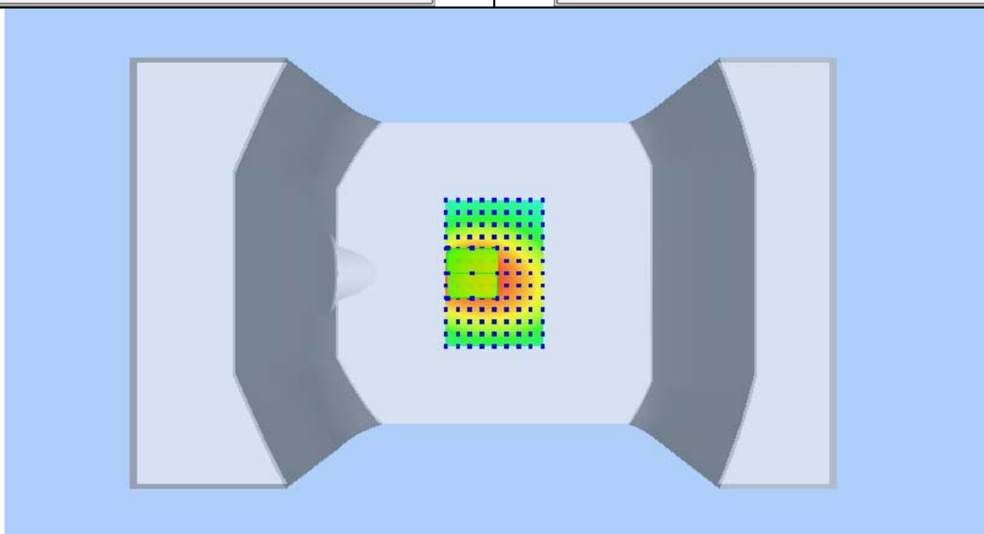


Plot 7: LTE BAND 5, Low channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-27

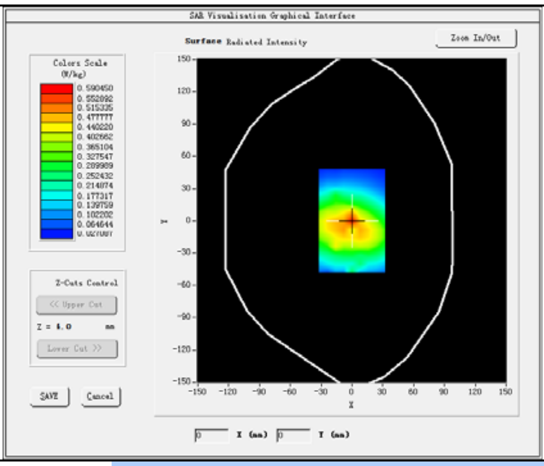
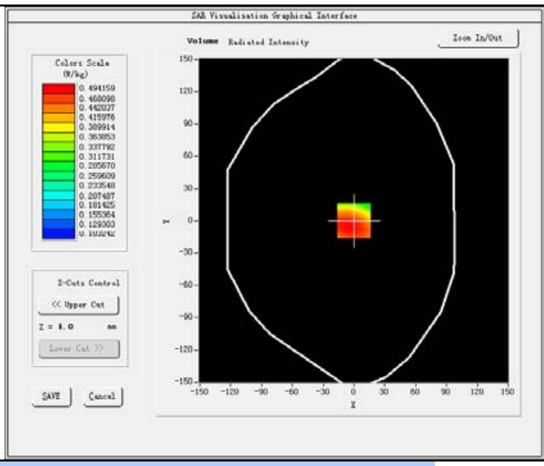
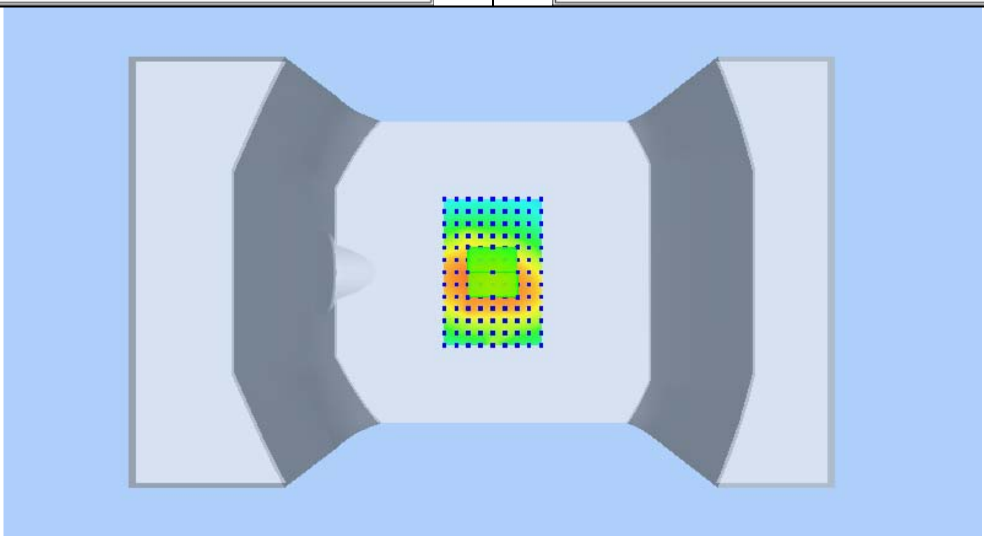
Medium(liquid type)	HL850
Frequency (MHz)	829.0000
Relative permittivity (real part)	41.95
Conductivity (S/m)	0.89
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.48
Bandwidth(MHz)	10
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.23
SAR 10g (W/kg)	0.270512
SAR 1g (W/kg)	0.364275
SURFACE SAR	**VOLUME SAR**
	



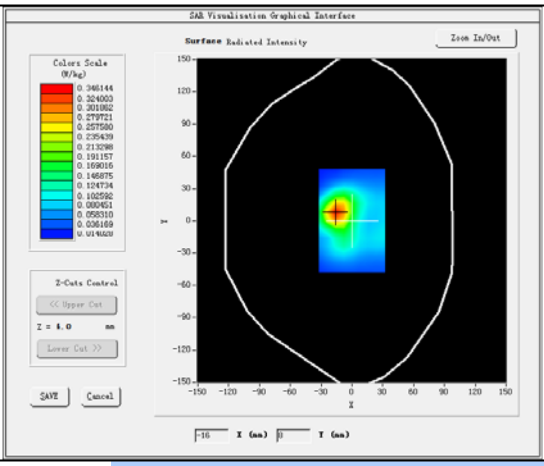
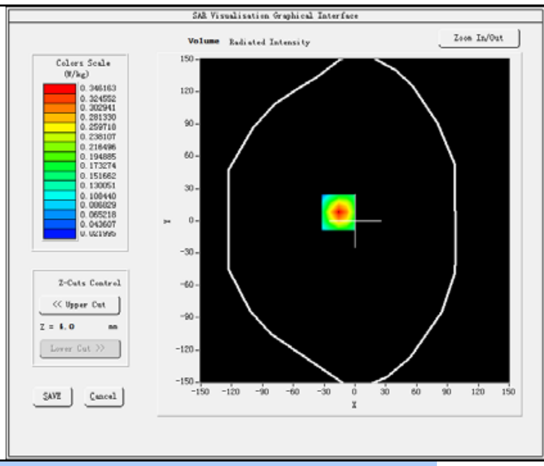
Plot 8: LTE BAND 12, Low channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-25

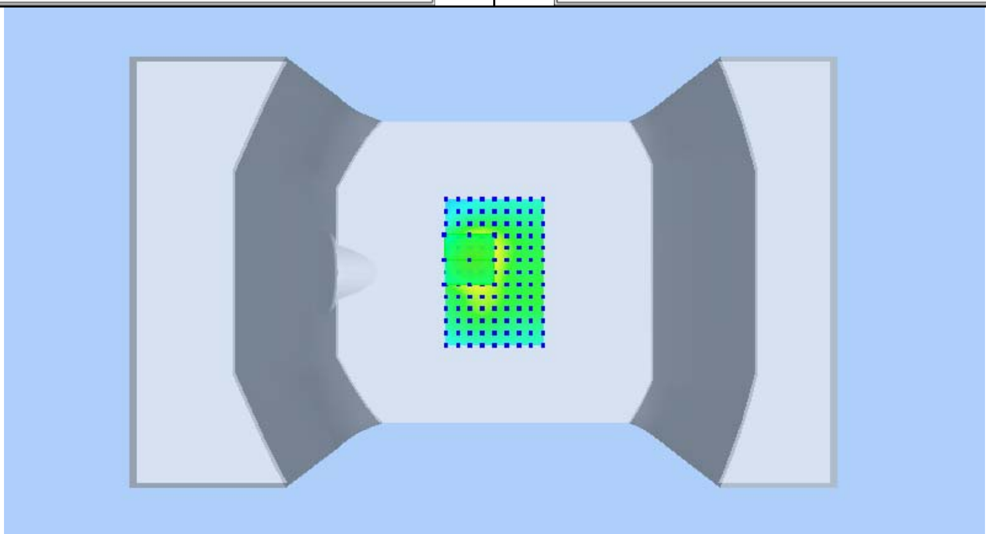
Medium(liquid type)	HL750
Frequency (MHz)	704.0000
Relative permittivity (real part)	42.15
Conductivity (S/m)	0.90
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.60
Bandwidth(MHz)	10
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.05
SAR 10g (W/kg)	0.149671
SAR 1g (W/kg)	0.203284
SURFACE SAR	**VOLUME SAR**
	
	

Plot 9: LTE BAND 13, Low channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-25

Medium(liquid type)	HL750
Frequency (MHz)	782.0000
Relative permittivity (real part)	42.15
Conductivity (S/m)	0.90
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.60
Bandwidth(MHz)	10
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.85
SAR 10g (W/kg)	0.370415
SAR 1g (W/kg)	0.494937
SURFACE SAR	**VOLUME SAR**
	
	

Plot 10: LTE BAND 66, Low channel (Body-worn, Front Side)
Product Description: LTE MiFi Router
Test Date: 2024-03-26

Medium(liquid type)	HL1800
Frequency (MHz)	1720.0000
Relative permittivity (real part)	38.73
Conductivity (S/m)	1.39
Signal	Crest factor: 1.0
E-Field Probe	2523-EPGO-417
Conversion Factor	2.65
Bandwidth(MHz)	20
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.28
SAR 10g (W/kg)	0.373718
SAR 1g (W/kg)	0.496015
SURFACE SAR	**VOLUME SAR**
	



15 Calibration Reports-Probe and Dipole

COMOSAR E-Field Probe Calibration Report

Ref : ACR.214.15.23.BES.B

Cancel and replace the report ACR.214.15.23.BES.A

WALTEK TESTING GROUP CO., LTD
NO,77, HOUJIE SECTION, GUANTAI ROAD, HOUJIE TOWN
DONGGUAN GUANGDONG 518105, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 2523-EPGO-417

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 07/31/2023

Accreditations #2-6789
Scope available on www.cofrac.fr

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).

	Name	Function	Date	Signature
Prepared by :	Cyrille ONNEE	Measurement Responsible	8/16/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	8/16/2023	
Authorized by:	Yann Toutain	Laboratory Director	8/30/2023	Yann TOUTAIN

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.08.30 14:35:50 +02'00'

	Customer Name
Distribution :	WALTEK TESTING GROUP CO., LTD

Issue	Name	Date	Modifications
A	Cyrille ONNEE	8/16/2023	Initial release
B	Cyrille ONNEE	8/30/2023	Customer Name change

TABLE OF CONTENTS

1 Device Under Test 4
2 Product Description 4
2.1 General Information 4
3 Measurement Method 4
3.1 Sensitivity 4
3.2 Linearity 5
3.3 Isotropy 5
3.4 Boundary Effect 5
4 Measurement Uncertainty 6
5 Calibration Results 6
5.1 Calibration in air 6
5.2 Calibration in liquid 7
6 Verification Results 8
7 List of Equipment 9

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	2523-EPGO-417
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.234 MΩ Dipole 2: R2=0.217 MΩ Dipole 3: R3=0.204 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.

Figure 1 – *MVG COMOSAR Dosimetric E field Probe*

Probe Length	330 mm
Length of Individual Dipoles	24.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.55 mm
Distance between dipoles / probe extremity	12.7 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their effect. All calibrations / measurements performed meet the fore-mentioned standards.

3.1 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards for frequency range 600-7500MHz and using the calorimeter cell method (transfer method) as outlined in the standards for frequency 150-450 MHz.

3.2 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.4 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty}[\%] = \delta SAR_{be}\frac{(d_{be}+d_{step})^2}{2d_{step}}\frac{(e^{-d_{be}/(\delta/2)})}{\delta/2} \quad \text{for } (d_{be}+d_{step}) < 10\text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest *zoom-scan* measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx$ 14 mm at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

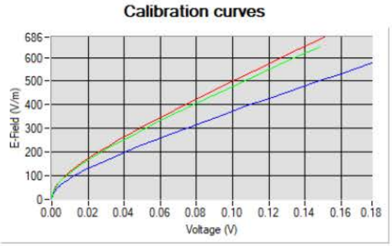
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

Ambient condition	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 CALIBRATION IN AIR

The following curve represents the measurement in waveguide of the voltage picked up by the probe toward the E-field generated inside the waveguide.



From this curve, the sensitivity in air is calculated using the below formula.

$$E^2 = \sum_{i=1}^{3} \frac{V_i\,(1 + V_i/DCP_i)}{Norm_i}$$

where
Vi=voltage readings on the 3 channels of the probe
DCPi=diode compression point given below for the 3 channels of the probe
Normi=dipole sensitivity given below for the 3 channels of the probe

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
0.80	1.34	0.85

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
101	117	107

5.2 CALIBRATION IN LIQUID

The calorimeter cell or the waveguide is used to determine the calibration in liquid using the formula below.

$$ConvF = \frac{E_{liquid}^2}{E_{air}^2}$$

The E-field in the liquid is determined from the SAR measurement according to the below formula.

$$E_{liquid}^2 = \frac{\rho\, SAR}{\sigma}$$

where
σ=the conductivity of the liquid
ρ=the volumetric density of the liquid
SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

For the calorimeter cell (150-450 MHz), the formula is:

$$SAR = c\frac{dT}{dt}$$

where
c=the specific heat for the liquid
dT/dt=the temperature rises over the time

For the waveguide setup (600-75000 MHz), the formula is:

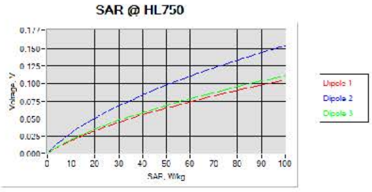
$$SAR = \frac{4P_W}{ab\delta}e^{\frac{-2z}{\delta}}$$

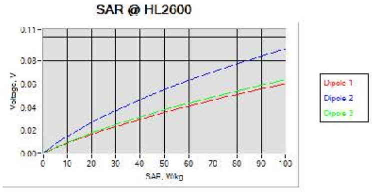
where
a=the larger cross-sectional of the waveguide
b=the smaller cross-sectional of the waveguide
δ=the skin depth for the liquid in the waveguide
Pw=the power delivered to the liquid

The below table summarize the ConvF for the calibrated liquid. The curves give examples for the measured SAR depending on the voltage in some liquid.

Liquid	Frequency (MHz*)	ConvF
HL750	750	2.60
HL850	835	2.48
HL900	900	2.64
HL1800	1800	2.65
HL1900	1900	2.83
HL2000	2000	3.00
HL2300	2300	2.90
HL2450	2450	3.03
HL2600	2600	2.73

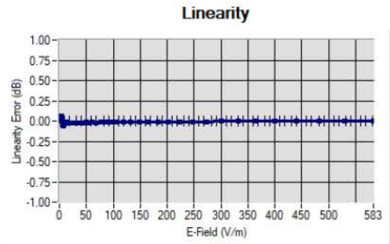
(*) Frequency validity is +/-50MHz below 600MHz, +/-100MHz from 600MHz to 6GHz and +/-700MHz above 6GHz



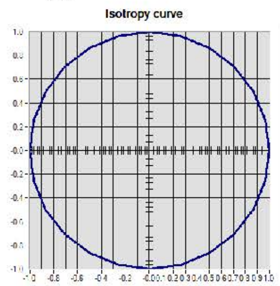


6 VERIFICATION RESULTS

The figures below represent the measured linearity and axial isotropy for this probe. The probe specification is +/-0.2 dB for linearity and +/-0.15 dB for axial isotropy.



Linearity:+/-1.43% (+/-0.06dB)



Isotropy:+/-0.14% (+/-0.01dB)

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2019	10/2023
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Fluoroptic Thermometer	LumaSense Luxtron 812	94264	09/2022	09/2025
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG2_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G600_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.

Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG14_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_7G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

SAR Reference Dipole Calibration Report

Ref : ACR.335.8.23.BES.A

WALTEK TESTING GROUP CO., LTD.
NO.77, HOUJIE SECTION, GUANTAI ROAD, HOUJIE TOWN,
DONGGUAN, GUANGDONG 518105 , CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 750MHZ
SERIAL NO.: SN 09/15 DIP 0G750-357

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 08/08/2023

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr
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Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.335.8.23.BES.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Luc	Technical Manager	8/8/2023	
Checked by :	Jérôme Luc	Technical Manager	8/8/2023	
Approved by :	Yann Toutain	Laboratory Director	8/8/2023	Yann TOUTAIN 2023.08.08 09:25:31 +01'00'

	Customer Name
Distribution :	Waltek Testing Group Co., Ltd.

Issue	Name	Date	Modifications
A	Jérôme Luc	8/8/2023	Initial release

TABLE OF CONTENTS

1 Introduction 4
2 Device Under Test 4
3 Product Description 4
3.1 General Information 4
4 Measurement Method 5
4.1 Return Loss Requirements 5
4.2 Mechanical Requirements 5
5 Measurement Uncertainty 5
5.1 Return Loss 5
5.2 Dimension Measurement 5
5.3 Validation Measurement 5
6 Calibration Measurement Results 6
6.1 Return Loss and Impedance In Head Liquid 6
6.2 Return Loss and Impedance In Body Liquid 6
6.3 Mechanical Dimensions 7
7 Validation measurement 7
7.1 Head Liquid Measurement 8
7.2 SAR Measurement Result With Head Liquid 8
7.3 Body Liquid Measurement 11
7.4 SAR Measurement Result With Body Liquid 12
8 List of Equipment 13

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 750 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID750
Serial Number	SN 09/15 DIP 0G750-357
Product Condition (new / used)	New

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.

Figure 1 – *MVG COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

4.2 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.10 LIN

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm
300 - 450	0.11 mm

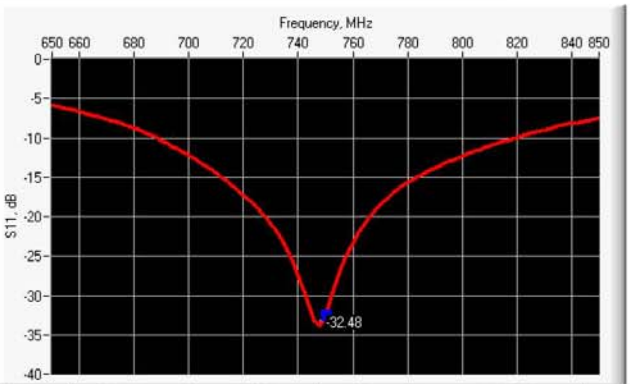
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 % (SAR)
10 g	20.1 % (SAR)

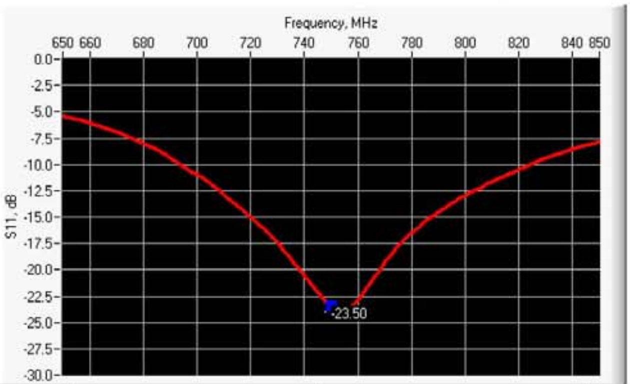
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-32.48	-20	51.6 Ω + 1.7 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-23.50	-20	48.8 Ω + 6.6 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.	176.65	100.0 ±1 %.	99.81	6.35 ±1 %.	6.38
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3300	-		-		-	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3900	-		-		-	
4200	-		-		-	
4600	-		-		-	
4900	-		-		-	

7 VALIDATION MEASUREMENT

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±10 %		0.87 ±10 %	
450	43.5 ±10 %		0.87 ±10 %	
750	41.9 ±10 %	40.9	0.89 ±10 %	0.91
835	41.5 ±10 %		0.90 ±10 %	
900	41.5 ±10 %		0.97 ±10 %	
1450	40.5 ±10 %		1.20 ±10 %	
1500	40.4 ±10 %		1.23 ±10 %	
1640	40.2 ±10 %		1.31 ±10 %	
1750	40.1 ±10 %		1.37 ±10 %	
1800	40.0 ±10 %		1.40 ±10 %	
1900	40.0 ±10 %		1.40 ±10 %	
1950	40.0 ±10 %		1.40 ±10 %	
2000	40.0 ±10 %		1.40 ±10 %	
2100	39.8 ±10 %		1.49 ±10 %	
2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3300	38.2 ±10 %		2.71 ±10 %	
3500	37.9 ±10 %		2.91±10 %	
3700	37.7 ±10 %		3.12 ±10 %	
3900	37.5 ±10 %		3.32±10 %	
4200	37.1 ±10 %		3.63±10 %	
4600	36.7 ±10 %		4.04 ±10 %	
4900	36.3±10 %		4.35 ±10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.