



## TEST REPORT

No. I20D00114-SAR01

*For*

**Client: MobiWire SAS**

**Production: 4G Smart Phone**

**Model Name: MobiWire Sora |H5024,Smart E11 (H5024)**

**Brand Name: MobiWire,Vodafone**

**FCC ID: QPN-SORA**

**Hardware Version: V01A**

**Software Version: SORA\_V01\_200520**

**Issued date: 2020-09-11**

## NOTE

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3. KDB has not been approved by A2LA.
4. It has been confirmed with the customer that the Tune-up Power information provided by the customer may affect the validity of the measurement results in this report, and the impact and consequences will be borne by the customer.
5. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

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**Revision Version**

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|-----------------|----------|------------|---------------------------------|
| I20D00114-SAR01 | 00       | 2020-08-19 | Initial creation of test report |
| I20D00114-SAR01 | 01       | 2020-09-09 | Second creation of test report  |
| I20D00114-SAR01 | 02       | 2020-09-11 | Third creation of test report   |

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## 1. Test Laboratory

### 1.1. Testing Location

|              |                                                                  |
|--------------|------------------------------------------------------------------|
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| Address      | Building 4, No. 766, Jingang Road, Pudong, Shanghai, P. R. China |
| Postal Code  | 201206                                                           |
| Telephone    | +86 21 63843300                                                  |
| Fax          | +86 21 63843301                                                  |

### 1.2. Testing Environment

|                    |             |
|--------------------|-------------|
| Normal Temperature | 18°C-25°C   |
| Relative Humidity  | 25%RH-75%RH |

### 1.3. Project Data

|                    |            |
|--------------------|------------|
| Project Leader     | Yu Anlu    |
| Testing Start Date | 2020-08-05 |
| Testing End Date   | 2020-08-05 |

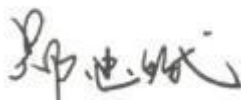
### 1.4. Signature



Gong Jiawei  
(Prepared this test report)



Yan Hang  
(Reviewed this test report)



Zheng Zhongbin  
(Approved this test report)

## 2. Client Information

### 2.1. Applicant Information

|              |                                                 |
|--------------|-------------------------------------------------|
| Company Name | MobiWire SAS                                    |
| Address      | 79 avenue Francois Arago, 92000 NANTERRE France |
| Telephone    | +33668018722                                    |
| Postcode     | N/A                                             |

### 2.2. Manufacturer Information

|              |                                                 |
|--------------|-------------------------------------------------|
| Company Name | MobiWire SAS                                    |
| Address      | 79 avenue Francois Arago, 92000 NANTERRE France |
| Telephone    | +33668018722                                    |
| Postcode     | N/A                                             |

### 3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

|                                       |                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description:                          | 4G Smart Phone                                                                                                                                                                                                                                                                                                                         |
| Model name:                           | MobiWire Sora  H5024,Smart E11 (H5024)                                                                                                                                                                                                                                                                                                 |
| Operation Model(s):                   | GSM850/GSM900/GSM1800/GSM1900<br>WCDMA Band I/Band II/Band V/Band VIII<br>LTE 1/3/7/28B;<br>BT4.2,BLE;WiFi 802.11a/b/g/n<br>GPS;GLONASS;                                                                                                                                                                                               |
| Tx Frequency:                         | 824-849MHz(GSM850)<br>1850-1910MHz ( GSM1900 )<br>1850-1910 MHz (WCDMA Band II)<br>824-849MHz (WCDMA Band V)<br>1850 -1910 MHz (LTE Band 2)<br>2500 – 2570 MHz (LTE Band 7)<br>2412- 2462 MHz (WiFi)<br>5150~5250 MHz(U-NII-1)<br>5250~5350 MHz(U-NII-2A)<br>5470~5725 MHz(U-NII-2C)<br>5725~5850 MHz(U-NII-3)<br>2402 – 2480 MHz (BT) |
| Test device Production information:   | Production unit                                                                                                                                                                                                                                                                                                                        |
| GPRS/EGPRS Class Mode:                | B                                                                                                                                                                                                                                                                                                                                      |
| GPRS/ EGPRS Multislot Class:          | 12                                                                                                                                                                                                                                                                                                                                     |
| Device type:                          | Portable device                                                                                                                                                                                                                                                                                                                        |
| Antenna type:                         | Inner antenna                                                                                                                                                                                                                                                                                                                          |
| Accessories/Body-worn configurations: | Battery                                                                                                                                                                                                                                                                                                                                |
| Dimensions:                           | 140.75x67.65x10.3(mm)                                                                                                                                                                                                                                                                                                                  |
| Hotspot Mode:                         | Support                                                                                                                                                                                                                                                                                                                                |

### 3.2. Internal Identification of EUT used during the test

| EUT ID* | SN or IMEI      | HW Version | SW Version      | Date of receipt |
|---------|-----------------|------------|-----------------|-----------------|
| N01     | 354128300001121 | V10A       | SORA_V01_200520 | 2020-07-27      |

\*EUT ID: is used to identify the test sample in the lab internally.

### 3.3. Internal Identification of AE used during the test

| AE ID* | Description | Type | Manufacturer |
|--------|-------------|------|--------------|
| BA29   | Battery     | --   | --           |

\*AE ID: is used to identify the test sample in the lab internally.

## 4. Reference Documents

### 4.1. Documents supplied by applicant

All technical documents are supplied by the client or manufacturer, which is the basis of testing.

### 4.2. Reference Documents

The following documents listed in this section are referred for testing.

| Reference         | Title                                                                                                                                                                           | Version           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>ANSI C95.1</b> | IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.                                                     | <b>1999</b>       |
| <b>IEEE 1528</b>  | Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques. | <b>2013</b>       |
| <b>KDB648474</b>  | Handset SAR                                                                                                                                                                     | <b>D04 v01r03</b> |
| <b>KDB648474</b>  | Wireless Chargers Battery Cover                                                                                                                                                 | <b>D03 v01r04</b> |
| <b>KDB248227</b>  | 802.11 WiFi SAR                                                                                                                                                                 | <b>D01 v02r02</b> |
| <b>KDB447498</b>  | General RF Exposure Guidance                                                                                                                                                    | <b>D01 v06</b>    |
| <b>KDB865664</b>  | SAR Measurement 100 MHz to 6 GHz                                                                                                                                                | <b>D01 v01r04</b> |
| <b>KDB865664</b>  | RF Exposure Reporting                                                                                                                                                           | <b>D02 v01r02</b> |
| <b>KDB941225</b>  | 3G SAR Procedures                                                                                                                                                               | <b>D01 v03r01</b> |
| <b>KDB941225</b>  | SAR for LTE Devices                                                                                                                                                             | <b>D05 v02r05</b> |
| <b>KDB941225</b>  | Hotspot SAR                                                                                                                                                                     | <b>D06 v02r01</b> |
| <b>KDB616217</b>  | SAR for laptop and tablets                                                                                                                                                      | <b>D04 v01r02</b> |

### 4.3. Criterion

At frequencies between 100 kHz and 6 GHz, the MPE (Maximum Permissible Exposure) in population/uncontrolled environments for electromagnetic field strengths may be exceeded if

- The exposure conditions can be shown by appropriate techniques to produce SARs below 0.08W/kg, as averaged over the whole body, and spatial peak SAR values not exceeding 1.6 W/kg, as averaged over any 1g of tissue (defined as a tissue volume in the shape of a cube), except for the hands, wrists, feet, and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10g of tissue (defined as a tissue volume in the shape of a cube); and
- The induced currents in the body conform with the MPE in table 2, Part B in ANSI C95.1-1999.

## 5. Test Summary and Statement of Compliance

### 5.1. Test Summary

The maximum results of Specific Absorption Rate (SAR) in standalone mode are as follows.

**Table 5.1: Standalone Max. Reported SAR**

| Band        | SAR 1g(W/Kg) |                 |                  |
|-------------|--------------|-----------------|------------------|
|             | Head         | Body worn(10mm) | Hotspot(10mm)    |
| GSM 850     | 0.184        | 0.511           | 0.511            |
| GSM 1900    | 0.350        | 1.176           | 1.256            |
| WCDMA Band2 | 0.352        | 0.722           | 0.948            |
| WCDMA Band5 | 0.192        | 0.295           | 0.295            |
| LTE Band7   | 0.285        | 0.808           | 1.329(variation) |
| 2.4G WiFi   | 0.407        | 0.109           | 0.109            |
| 5G WiFi     | 0.219        | 0.093           | 0.120            |

**Table 2.2: Simultaneous SAR**

| Highest SAR 1g(W/kg) |                 |                      |
|----------------------|-----------------|----------------------|
| Mode                 | Position        | Highest SAR 1g(W/kg) |
| GSM1900&WIFI2.4G     | Head Side       | 0.714                |
| GSM1900&BT           | Body worn(10mm) | 1.308                |
| LTE B7&BT            | Hotspot(10mm)   | 1.461                |

Note: The **MobiWire Sora |H5024,Smart E11 (H5024)**, supporting 2G/3G /4G/WLAN, manufactured by **MobiWire SAS** is a variant product for testing. According to the Product Change Description, SAR test is only required in worse case. Test data are reflected from test report **I19D00035-SAR01**, which is the test report for the initial product.

## 5.2. Statement of Compliance

The **MobiWire Sora |H5024,Smart E11 (H5024)** manufactured by **MobiWire SAS** is a parent model for testing.

ECIT has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

For body worn operation mode, this device with any accessory that contained in this report has been tested and the values meet FCC RF exposure guidelines. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

## 6. Specific Absorption Rate (SAR)

### 6.1. Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

### 6.2. SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy ( $dW$ ) absorbed by (dissipated in) an incremental mass ( $dm$ ) contained in a volume element ( $dv$ ) of a given density ( $\rho$ ). The equation description is as below:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c \left( \frac{\delta T}{\delta t} \right)$$

Where:  $C$  is the specific heat capacity,  $\delta T$  is the temperature rise and  $\delta t$  is the exposure duration, or related to the electrical field in the tissue by

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

Where:

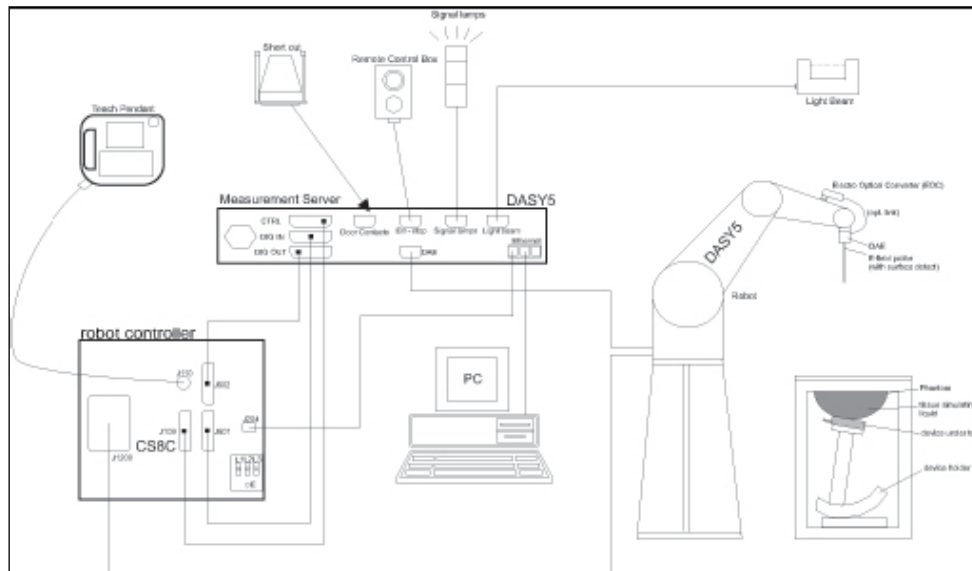
- $\sigma$  is the conductivity of the tissue
- $\rho$  is the mass density of tissue, which is normally set to  $1\text{g/cm}^3$
- $E$  is the RMS electrical field strength

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

## 7. SAR Measurement System Introduction

### 7.1. Measurement Set-up

The DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:



**Picture 7-1 SAR Measurement Set-up**

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

## 7.2. E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY5 software reads the reflection during a software approach and looks for the maximum using 2<sup>nd</sup> ord curve fitting. The approach is stopped at reaching the maximum.

| Probe Specifications: |                                                                                                   |
|-----------------------|---------------------------------------------------------------------------------------------------|
| Model:                | ES3DV3,EX3DV4                                                                                     |
| Frequency Range:      | 10MHz — 6GHz(EX3DV4)                                                                              |
|                       | 10MHz — 4GHz(ES3DV3)                                                                              |
| Calibration:          | In head and body simulating tissue at frequency from 650MHz to 5900MHz                            |
| Linearity:            | ± 0.2 dB(30 MHz to 4 GHz) for ES3DV3<br>± 0.2 dB(30 MHz to 6 GHz) for EX3DV4                      |
| Dynamic Range:        | 10 mW/kg — 100 W/kg                                                                               |
| Probe Length:         | 330 mm                                                                                            |
| Probe Tip Length:     | 20 mm                                                                                             |
| Body Diameter:        | 12 mm                                                                                             |
| Tip Diameter:         | 2.5 mm (3.9 mm for ES3DV3)                                                                        |
| Tip-Center:           | 1 mm (2.0mm for ES3DV3)                                                                           |
| Application:          | SAR Dosimetry Testing<br>Compliance tests of mobile phones<br>Dosimetry in strong gradient fields |



Picture 7-2 Detail of Probe



Picture 7-3 E-field Probe

## 7.3. E-field Probe Calibration

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

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies

above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm<sup>2</sup>.

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

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

Where:

$\Delta t$  = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

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

Where:

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).

## 7.4. Other Test Equipment

### 7.4.1. Data Acquisition Electronics (DAE)

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



**Picture 7-4: DAE**

### 7.4.2. Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90) type from Stäubli SA (France).

For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchronal motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)



**Picture 7-5: DASY 5**

### 7.4.3. Measurement Server

The Measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chip disk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.



**Picture 7-6: Server for DASY 5**

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

#### 7.4.4. Device Holder for Phantom

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

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

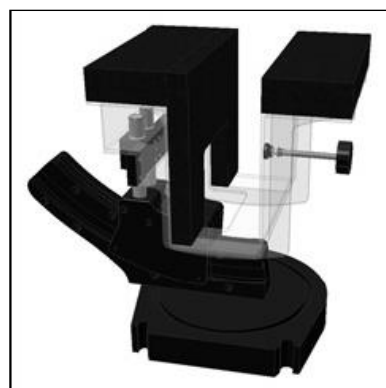
The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon = 3$  and loss tangent  $\delta = 0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested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



**Picture 7-7: Device Holder**

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

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



**Picture 7-8: Laptop Extension Kit**

#### 7.4.5. Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the

shell is based on data from an anatomical study designed to represent the 90<sup>th</sup> percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

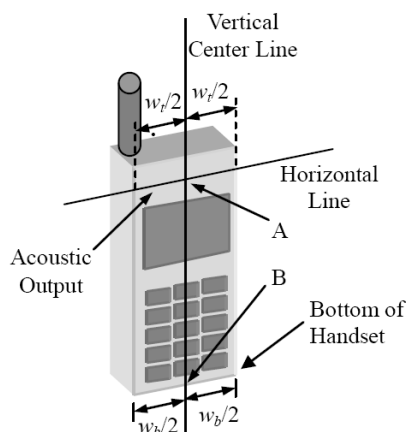
|                  |                                 |                                                                                    |
|------------------|---------------------------------|------------------------------------------------------------------------------------|
| Shell Thickness: | $2 \pm 0.2$ mm                  |  |
| Available:       | Special                         |                                                                                    |
| Filling Volume:  | Approx. 25 liters               |                                                                                    |
| Dimensions:      | 810 x 1000 x 500 mm (H x L x W) |                                                                                    |

**Picture 7-9: SAM Twin Phantom**

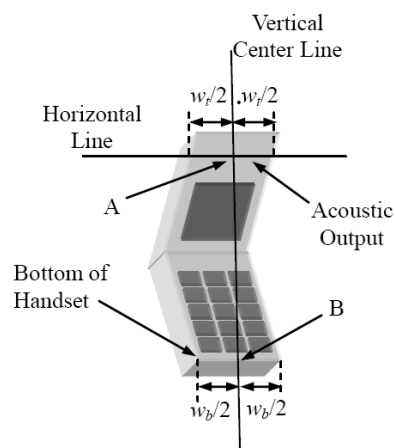
## 8. Test Position in Relation to the Phantom

### 8.1. General considerations

This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.

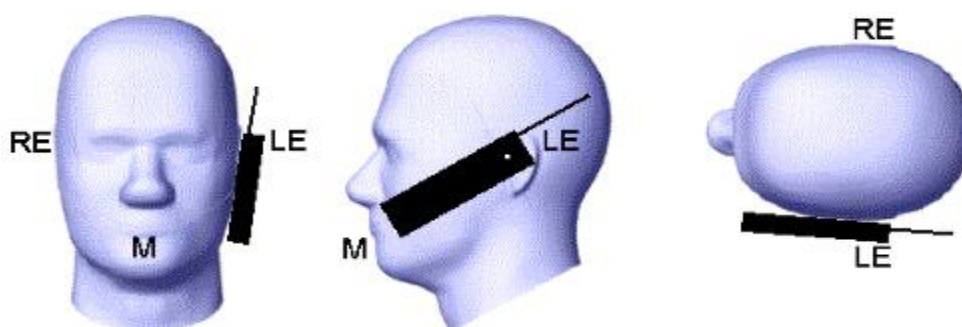


Picture 8-1 Typical “fixed” case handset

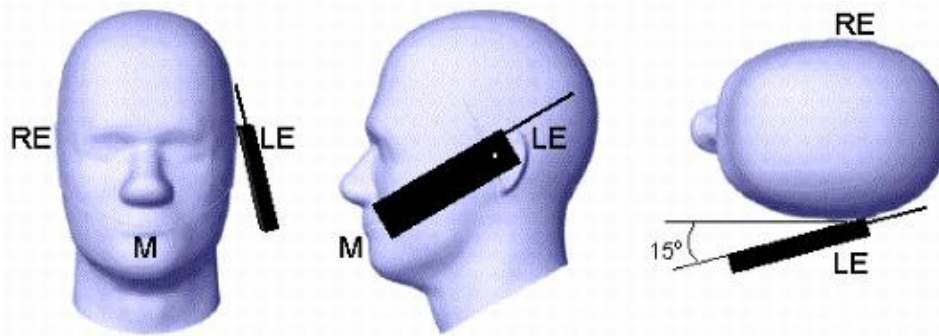


Picture 8-2 Typical “clam-shell” case handset

|       |                                                                                |
|-------|--------------------------------------------------------------------------------|
| $W_t$ | Width of the handset at the level of the acoustic                              |
| $W_b$ | Width of the bottom of the handset                                             |
| A     | Midpoint of the width $W_t$ of the handset at the level of the acoustic output |
| B     | Midpoint of the width $W_b$ of the bottom of the handset                       |



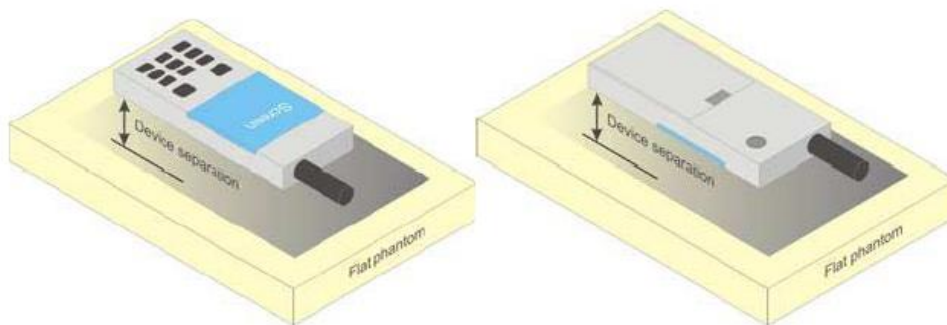
Picture 8-3 Cheek position of the wireless device on the left side of SAM



**Picture 8-4 Tilt position of the wireless device on the left side of SAM**

## 8.2. Body-worn device

A typical example of a body-worn device is a mobile phone, wireless enabled PDA (personal digital assistant) or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



**Picture 8-5 Test positions for body-worn devices**

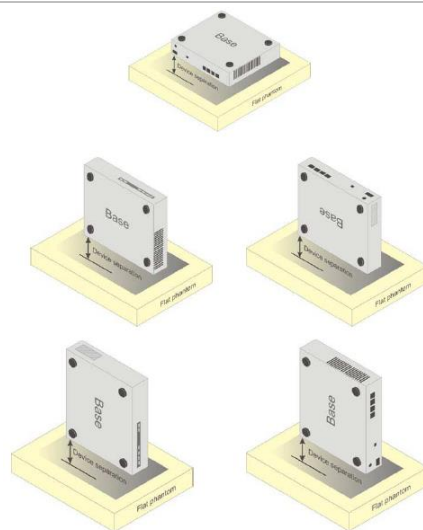
## 8.3. Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions.

Tests shall be performed for all antenna positions specified.

Picture 8-6 shows positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.



**Picture 8-6 Test positions for desktop devices**

## 9. Tissue Simulating Liquids

### 9.1. Equivalent Tissues Composition

The liquid used for the frequency range of 650-6000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 9.1 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

**Table 9.1: Composition of the Head Tissue Equivalent Matter**

| Frequency (MHz)                    | 835                              | 900                              | 1800                             | 1950                             | 2300                             | 2450                             | 2600                             | 5800                             |
|------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Ingredients (% by weight)          |                                  |                                  |                                  |                                  |                                  |                                  |                                  |                                  |
| Water                              | 41.45                            | 40.92                            | 55.242                           | 54.89                            | 56.34                            | 58.79                            | 58.79                            | 65.53                            |
| Sugar                              | 56.0                             | 56.5                             | /                                | /                                | /                                | /                                | /                                |                                  |
| Salt                               | 1.45                             | 1.48                             | 0.306                            | 0.18                             | 0.14                             | 0.06                             | 0.06                             |                                  |
| Preventol                          | 0.1                              | 0.1                              | /                                | /                                | /                                | /                                | /                                |                                  |
| Cellulose                          | 1.0                              | 1.0                              | /                                | /                                | /                                | /                                | /                                |                                  |
| GlycolMonobutyl                    | /                                | /                                | 44.452                           | 44.93                            | 43.52                            | 41.15                            | 41.15                            |                                  |
| Diethylenglycol momohexylether     | /                                | /                                | /                                | /                                | /                                | /                                | /                                | 17.24                            |
| Triton X-100                       | /                                | /                                | /                                | /                                | /                                | /                                | /                                | 17.23                            |
| Dielectric Parameters Target Value | $\epsilon=41.5$<br>$\sigma=0.90$ | $\epsilon=41.5$<br>$\sigma=0.97$ | $\epsilon=40.0$<br>$\sigma=1.40$ | $\epsilon=40.0$<br>$\sigma=1.40$ | $\epsilon=39.5$<br>$\sigma=1.67$ | $\epsilon=39.2$<br>$\sigma=1.80$ | $\epsilon=39.0$<br>$\sigma=1.96$ | $\epsilon=35.3$<br>$\sigma=5.27$ |

**Table 9.2: Targets for tissue simulating liquid**

| Frequency (MHz) | Liquid Type | Conductivity ( $\sigma$ ) | $\pm 5\%$ Range | Permittivity ( $\epsilon$ ) | $\pm 5\%$ Range |
|-----------------|-------------|---------------------------|-----------------|-----------------------------|-----------------|
| 835             | Head        | 0.90                      | 0.874~0.97      | 41.5                        | 39.4~43.6       |
| 900             | Head        | 0.97                      | 0.92~1.02       | 41.5                        | 39.4~43.6       |
| 1800            | Head        | 1.40                      | 1.33~1.47       | 40.0                        | 38.0~42.0       |
| 1950            | Head        | 1.40                      | 1.33~1.47       | 40.0                        | 38.0~42.0       |
| 2300            | Head        | 1.67                      | 1.59~1.75       | 39.5                        | 37.5~41.4       |
| 2450            | Head        | 1.80                      | 1.71~1.89       | 39.2                        | 37.2~41.2       |
| 2600            | Head        | 1.96                      | 1.86~2.06       | 39.0                        | 37.5~40.95      |
| 5200            | Head        | 4.66                      | 4.43~4.89       | 35.99                       | 34.19~37.79     |
| 5300            | Head        | 4.76                      | 4.52~4.99       | 35.87                       | 34.08~37.66     |
| 5500            | Head        | 4.96                      | 4.71~5.2        | 35.6                        | 33.82~37.38     |
| 5600            | Head        | 5.07                      | 4.82~5.32       | 35.53                       | 33.75~37.30     |
| 5800            | Head        | 5.27                      | 5.01~5.53       | 35.3                        | 33.54~37.05     |

Note: Effective February 19, 2019, FCC has permitted the use of single head-tissue simulating liquid specified in IEC 62209-1 for all SAR tests.

## 9.2. Dielectric Performance of TSL

**Table 9.3: Dielectric Performance of Head Tissue Simulating Liquid**

| Tissue Simulating Liquid |                            |                          |             |          |                            |                          |                            |                          |
|--------------------------|----------------------------|--------------------------|-------------|----------|----------------------------|--------------------------|----------------------------|--------------------------|
| Frequency<br>(MHz)       | Head(Standard)             |                          | Temperature | Date     | Test Result                |                          | Deviation (%)              |                          |
|                          | Permittivity<br>$\epsilon$ | Conductivity<br>$\sigma$ |             |          | Permittivity<br>$\epsilon$ | Conductivity<br>$\sigma$ | Permittivity<br>$\epsilon$ | Conductivity<br>$\sigma$ |
| 2600                     | 39.00                      | 1.96                     | 22.6°C      | 2020/8/5 | 38.054                     | 1.922                    | -2.43%                     | -1.94%                   |

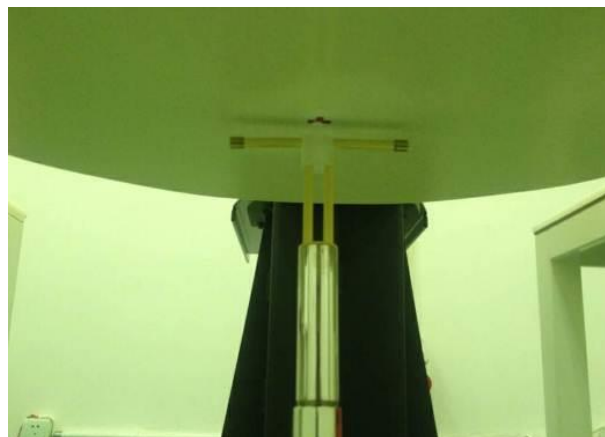
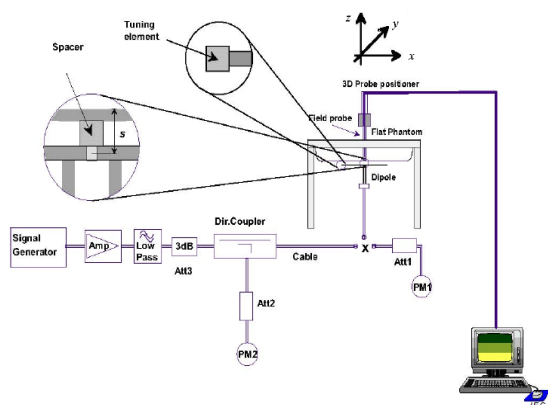
## 10. System Validation

## 10.1. System Validation

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

## 10.2. System Setup

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:



### Picture 10-1 Setup for System Evaluation

### Picture 10-2. Setup for Dipole

### 10.3. System Validation Result

**Table 10.1: System Validation Result of SAR**

| SAR System Validation                          |                                |      |             |          |                       |      |               |       |
|------------------------------------------------|--------------------------------|------|-------------|----------|-----------------------|------|---------------|-------|
| Frequency<br>(MHz)                             | Average Target Value<br>(w/kg) |      | Temperature | Date     | Test Result<br>(w/kg) |      | Deviation (%) |       |
|                                                | 10g                            | 1g   |             |          | 10g                   | 1g   | 10g           | 1g    |
| 2600                                           | 25.4                           | 57.2 | 22.6°C      | 2020/8/5 | 26.24                 | 57.6 | 3.31%         | 0.70% |
| Note:The input power level is equivalent to 1w |                                |      |             |          |                       |      |               |       |

## 11. Measurement Procedures

### 11.1. Test Steps

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

#### (a) Power reference measurement

The reference and drift jobs are useful for monitoring the power drift of the device under test in the batch process. Both jobs measure the electric field strength 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.

#### (b) 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 DASY 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 15mm \* 15mm and can be edited by users.

#### (c) Zoom scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1g and 10g of simulated tissue. The default zoom scan measures 5 \* 5 \* 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 than one maximum, the number of Zoom Scans has to be enlarged accordingly.

#### (d) 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 setting. 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 within a batch process. In the properties of the drift job, the user can specify a limit for the drift and have DASY software stop the measurements if this limit is exceeded. This ensures that the power drift during one measurement is within 5%.

The SAR measurement procedures for each of test conditions are as follows:

- (a) Make EUT to transmit its maximum output power
- (b) Measure conducted output power through RF cable
- (c) Place the EUT in the specific position of phantom
- (d) Measure SAR results for Middle channel or the highest power channel on each testing position
- (e) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg
- (f) Record the SAR value

## 11.2. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1g and 10g.

The DASY system allows evaluations that combine measured data and robot positions, such as:

### a) Maximum Search

During a maximum search, global and local maximum searches are automatically performed in 2D 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 -2dB of the global maxima for all SAR distributions.

### b) 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. Extrapolation routines require at least 10 measurement points in 3D space. 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 modified Quadratic Shepard's method for extrapolation. For a grid using 5\*5\*5 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10 cubes.

### c) Boundary effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosi-metric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_0 + S_b * \exp\left(-\frac{z}{a}\right) * \cos\left(\pi \frac{z}{\lambda}\right)$$

Since the decay of the boundary effect dominates for small probe ( $a \ll \lambda$ ), the cos-term can be omitted. Factors  $S_b$  (parameter Alpha in the DASY software) and  $a$  (parameter Delta in the DASY software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- The boundary curvature is small
- The probe axis is angled less than 30° to the boundary normal
- The distance between probe and boundary is larger than 25% of the probe diameter
- The probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

### 11.3. General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

**Table 11.1: Test Resolution Requirement**

| Items                                                           |                          |                                                                           | ≤3GHz                                                                                                                                                                                                                                              | >3GHz                                           |
|-----------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Maximum Distance                                                |                          |                                                                           | 5mm ±1mm                                                                                                                                                                                                                                           | $\frac{1}{2} * \delta * \ln(2)$ mm ±0.5mm       |
| Maximum probe angle                                             |                          |                                                                           | 30±1°                                                                                                                                                                                                                                              | 20±1°                                           |
| Maximum Area Scan spatial resolution:<br>Δ XArea , Δ yArea      |                          |                                                                           | ≤2GHz: ≤15mm                                                                                                                                                                                                                                       | 3-4GHz: ≤12mm                                   |
|                                                                 |                          |                                                                           | 2-3GHz: ≤12mm                                                                                                                                                                                                                                      | 4-6GHz: ≤10mm                                   |
|                                                                 |                          |                                                                           | when the x or y dimension of the device , in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the device with at least one measurement point on the device |                                                 |
| Maximum Zoom Scan spatial resolution:<br>Δ XZoom , Δ yZoom      |                          |                                                                           | ≤2GHz: ≤8mm                                                                                                                                                                                                                                        | 3-4GHz: ≤5mm                                    |
|                                                                 |                          |                                                                           | 2-3GHz: ≤5mm                                                                                                                                                                                                                                       | 4-6GHz: ≤4mm                                    |
| maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: Δ ZZoom(n) |                                                                           | ≤5mm                                                                                                                                                                                                                                               | 3-4GHz: ≤4mm<br>4-5GHz: ≤3mm<br>5-6GHz: ≤2mm    |
|                                                                 | graded grid              | Δ ZZoom(1): between 1 <sup>st</sup> two points closest to phantom surface | ≤4mm                                                                                                                                                                                                                                               | 3-4GHz: ≤3mm<br>4-5GHz: ≤2.5mm<br>5-6GHz: ≤2mm  |
|                                                                 |                          | Δ ZZoom(n >1) between subsequent points                                   | ≤1.5*                                                                                                                                                                                                                                              |                                                 |
| minimum zoom scan volume                                        | x, y, z                  |                                                                           | ≥30mm                                                                                                                                                                                                                                              | 3-4GHz: ≥28mm<br>4-5GHz: ≥25mm<br>5-6GHz: ≥22mm |

**Notes:**

$\delta$  is the penetration depth of a plane-wave at normal incidence to the tissue medium in IEEE 1528-2013.

When Zoom Scan is required and reported SAR from the Area Scan based 1-g SAR estimation procedure of KDB publication 447498 is  $\leq 1.4$  W/kg,  $\leq 8$ mm for 2GHz-3GHz,  $\leq 7$ mm for 3GHz-4GHz,  $\leq 5$ mm for 4GHz-6GHz Zoom Scan resolution may be applied.

## 11.4. WCDMA Measurement Procedures

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & DPDCHn), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

**Table 11.2: HSDPA setting for Release 5**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c / \beta_d$ | $\beta_{hs}$ | CM (dB) | MPR (dB) |
|----------|-----------|-----------|----------------|---------------------|--------------|---------|----------|
| 1        | 2/15      | 15/15     | 64             | 2/15                | 4/15         | 1.5     | 0.5      |
| 2        | 12/15     | 15/15     | 64             | 12/15               | 24/25        | 2.0     | 1        |
| 3        | 15/15     | 8/15      | 64             | 15/8                | 30/15        | 2.0     | 1        |
| 4        | 15/15     | 4/15      | 64             | 15/4                | 30/15        | 2.0     | 1        |

**Table 11.3: HSUPA setting for Release 6**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c / \beta_d$ | $\beta_{hs}$ | $\beta_{ec}$ | $\beta_{ed}$                                 | $\beta_{ed}$ (SF) | $\beta_{ed}$ (codes) | CM (dB) | MPR (dB) | AG Index | E-TFCI |
|----------|-----------|-----------|----------------|---------------------|--------------|--------------|----------------------------------------------|-------------------|----------------------|---------|----------|----------|--------|
| 1        | 11/15     | 15/15     | 64             | 11/15               | 22/15        | 209/225      | 1039/225                                     | 4                 | 1                    | 2.0     | 1.0      | 20       | 75     |
| 2        | 6/15      | 15/15     | 64             | 6/15                | 12/15        | 12/15        | 12/15                                        | 4                 | 1                    | 3.0     | 2.0      | 12       | 67     |
| 3        | 15/15     | 9/15      | 64             | 15/9                | 30/15        | 30/15        | $\beta_{ed1}: 47/15$<br>$\beta_{ed2}: 47/15$ | 4                 | 2                    | 3.0     | 2.0      | 15       | 92     |
| 4        | 2/15      | 15/15     | 64             | 2/15                | 4/15         | 4/15         | 56/75                                        | 4                 | 1                    | 2.0     | 1.0      | 17       | 71     |
| 5        | 15/15     | 15/15     | 64             | 15/15               | 24/15        | 30/15        | 134/15                                       | 4                 | 1                    | 2.0     | 1.0      | 21       | 81     |

**Note:**

A KDB inquiry is required to address test and approval requirements when the maximum output power measured in HS-DPCCH Sub-test 2 – 4 is higher than Sub-test 1.

A KDB inquiry is required to determine test and approval requirements when the maximum output power measured in E-DCH Sub-test 2 – 4 is higher than Sub-test 5.

### 11.5. LTE Measurement Procedure

SAR tests for LTE are performed with a base station simulator. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

1. Per KDB 941225 D05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.

2. 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.

3. For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.

4. 16QAM/64QAM output power for each RB allocation configuration is  $> \text{not } \frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; 16QAM/64QAM SAR testing is not required.

5. Smaller bandwidth output power for each RB allocation configuration is  $> \text{not } \frac{1}{2}$  dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is  $\leq 1.45$  W/kg; smaller bandwidth SAR testing is not required.

6. For LTE B12 / B26 the maximum bandwidth does not support three non-overlapping channels, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

7. LTE band 17 / 2 / 5 / 38 / 4 SAR test was covered by Band 12 / 25 / 26 / 41 / 66; according to TCB workshop, SAR test for overlapping LTE bands can be reduced if

a. The maximum output power, including tolerance, for the smaller band is  $\leq$  the larger band to qualify for the SAR test exclusion.

b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.

#### LTE Carrier Aggregation Conducted Power (Downlink)

According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than  $\frac{1}{4}$  dB higher than the maximum output measured without downlink carrier aggregation active.

#### LTE TDD Considerations

According to KDB 941225 D05 SAR for LTE Devices, for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented

for the device and supported by the defined 3GPP LTE TDD configurations.

SAR was tested with the highest transmission duty factor (63.33%) using Uplink-downlink configuration 0 and Special sub-frame configuration 7.

LTE TDD Band 41 supports 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special sub-frame configurations.

**Table 11.4 Calculated Duty Cycle for LTE TDD**

| Uplink-Downlink Configuration |             | Sub-frame Number |   |   |   |   |   |   |   |   |    | Calculated     |
|-------------------------------|-------------|------------------|---|---|---|---|---|---|---|---|----|----------------|
|                               | Periodicity | 1                | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Duty Cycle (%) |
| 0                             | 5 ms        | D                | S | U | U | U | D | S | U | U | U  | 63.33          |
| 1                             | 5 ms        | D                | S | U | U | D | D | S | U | U | D  | 43.33          |
| 2                             | 5 ms        | D                | S | U | D | D | D | S | U | D | D  | 23.33          |
| 3                             | 10 ms       | D                | S | U | U | U | D | D | D | D | D  | 31.67          |
| 4                             | 10 ms       | D                | S | U | U | D | D | D | D | D | D  | 21.67          |
| 5                             | 10 ms       | D                | S | U | D | D | D | D | D | D | D  | 11.67          |
| 6                             | 5 ms        | D                | S | U | U | U | D | S | U | U | D  | 53.33          |

Example for Calculated Duty Cycle for Uplink-Downlink Configuration 0:

Calculated Duty Cycle =  $(5120 \times T_s \times 2 + 6 \text{ ms}) / 10 \text{ ms} = 63.33\%$

Where

$T_s = 1/(15000 \times 2048)$  seconds

## 11.6. Bluetooth & WiFi Measurement Procedures

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

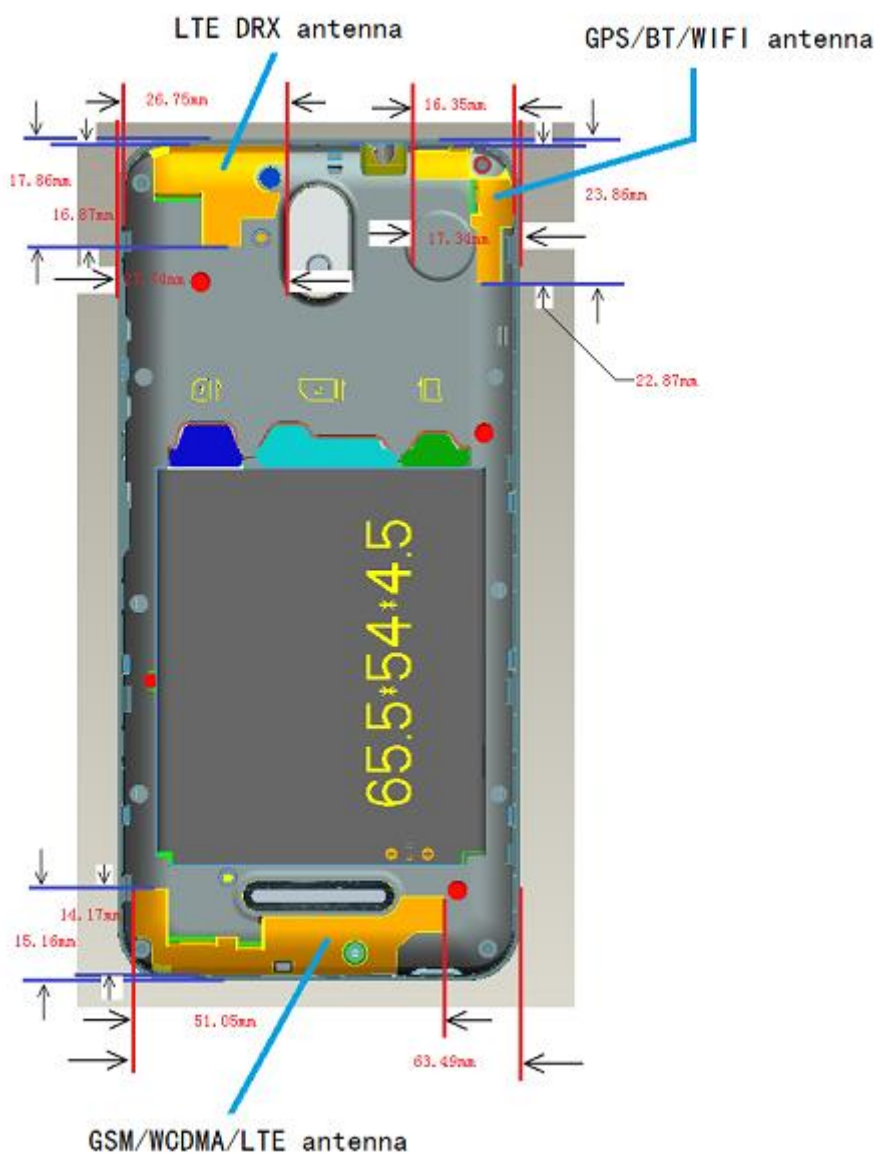
Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

## 12. Simultaneous Transmission SAR Considerations

### 12.1. Reference Document

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

### 12.2. Antenna Separation Distances



Picture 12-1 Antenna Locations

### 12.3. SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR v01, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

**Table 12.1: SAR measurement Positions**

| Antenna Mode | Front | Back | Left | Right | Top | Bottom |
|--------------|-------|------|------|-------|-----|--------|
| 2/3/4G       | Yes   | Yes  | Yes  | Yes   | No  | Yes    |
| BT/WiFi      | Yes   | Yes  | No   | Yes   | Yes | No     |

### 12.4. Low Power Transmitters SAR Consideration

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation for low power transmitters is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$$\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} * \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

Where

- Frequency(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

According to the KDB447498 appendix A, the SAR test exclusion threshold for 2450MHz at 5mm test separation distances is 10mW. That means the transmitters with tune-up power below 10mW are excluded for SAR measurement.

### 12.5. Simultaneous Transmission Analysis

KDB 447498 D01 General RF Exposure Guidance introduces a new formula for calculating the SPLSR (SAR to Peak Location Ratio) between pairs of simultaneously transmitting antennas:

$$\text{SPLSR} = \sqrt{(\text{SAR1} + \text{SAR2})^3 / R_i}$$

Where

- SAR1 is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition.
- SAR2 is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first.
- Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of

$$(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2$$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$\sqrt{(SAR1 + SAR2)^3/R_i} < 0.04$$

## 12.6. Simultaneous Transmission Table

**Table 12.2: Simultaneous Transmission Configurations**

| Items                                                                                                                                                                                                                                                                                                                            | Capable Transmit Configurations     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                | GSM/EGPRS/EDGE + BT                 |
| 2                                                                                                                                                                                                                                                                                                                                | GSM/EGPRS/EDGE + WiFi 2.4G/ WiFi 5G |
| 3                                                                                                                                                                                                                                                                                                                                | WCDMA + BT                          |
| 4                                                                                                                                                                                                                                                                                                                                | WCDMA+ WiFi 2.4G/ WiFi 5G           |
| 5                                                                                                                                                                                                                                                                                                                                | LTE + BT                            |
| 6                                                                                                                                                                                                                                                                                                                                | LTE + WiFi 2.4G/ WiFi 5G            |
| Note: For the DUT, the WLAN and BT modules sharing a single antenna, and so these two modules can't transmit signal simultaneously. LTE / WCDMA and GSM modules sharing a single antenna, so these two modules can't transmit signal simultaneously.<br>So we can get above combination that can transmit signal simultaneously. |                                     |

## 13. Conducted Output Power

### 13.1. Manufacturing tolerance

**Table 12.1: GSM Speech**

| GSM 850                    |             |             |             |
|----------------------------|-------------|-------------|-------------|
| Channel                    | Channel 128 | Channel 190 | Channel 251 |
| Maximum Target Value (dBm) | 33          | 33          | 33          |
| GSM1900                    |             |             |             |
| Channel                    | Channel 512 | Channel 661 | Channel 810 |
| Maximum Target Value (dBm) | 30          | 30          | 30          |

**Table 12.2: GPRS (GMSK Modulation)**

| GSM 850   |                            |      |      |      |
|-----------|----------------------------|------|------|------|
| Channel   |                            | 128  | 190  | 251  |
| 1 Txslots | Maximum Target Value (dBm) | 33   | 33   | 33   |
| 2 Txslots | Maximum Target Value (dBm) | 32   | 32   | 32   |
| 3 Txslots | Maximum Target Value (dBm) | 30.5 | 30.5 | 30.5 |
| 4 Txslots | Maximum Target Value (dBm) | 29.5 | 29.5 | 29.5 |
| GSM 1900  |                            |      |      |      |
| Channel   |                            | 512  | 661  | 810  |
| 1 Txslots | Maximum Target Value (dBm) | 30   | 30   | 30   |
| 2 Txslots | Maximum Target Value (dBm) | 29.5 | 29.5 | 29.5 |
| 3 Txslots | Maximum Target Value (dBm) | 27.5 | 27.5 | 27.5 |
| 4 Txslots | Maximum Target Value (dBm) | 26.5 | 26.5 | 26.5 |

**Table 12.3: EGPRS (8-PSK Modulation)**

| GSM 850   |                            |      |      |      |
|-----------|----------------------------|------|------|------|
| Channel   |                            | 128  | 190  | 251  |
| 1 Txslots | Maximum Target Value (dBm) | 28   | 28   | 28   |
| 2 Txslots | Maximum Target Value (dBm) | 26   | 26   | 26   |
| 3 Txslots | Maximum Target Value (dBm) | 24   | 24   | 24   |
| 4 Txslots | Maximum Target Value (dBm) | 23   | 23   | 23   |
| GSM 1900  |                            |      |      |      |
| Channel   |                            | 512  | 661  | 810  |
| 1 Txslots | Maximum Target Value (dBm) | 27   | 27   | 27   |
| 2 Txslots | Maximum Target Value (dBm) | 26   | 26   | 26   |
| 3 Txslots | Maximum Target Value (dBm) | 24.5 | 24.5 | 24.5 |
| 4 Txslots | Maximum Target Value (dBm) | 23.5 | 23.5 | 23.5 |

**Table 12.4: WCDMA**

| WCDMA Band II              |              |              |              |
|----------------------------|--------------|--------------|--------------|
| Channel                    | Channel 9262 | Channel 9400 | Channel 9538 |
| Maximum Target Value (dBm) | 22.5         | 22.5         | 22.5         |

| WCDMA Band II HSDPA |                            |      |      |      |
|---------------------|----------------------------|------|------|------|
| Channel             |                            | 9262 | 9400 | 9538 |
| 1                   | Maximum Target Value (dBm) | 21.5 | 21.5 | 21.5 |
| 2                   | Maximum Target Value (dBm) | 21.5 | 21.5 | 21.5 |
| 3                   | Maximum Target Value (dBm) | 21   | 21   | 21   |
| 4                   | Maximum Target Value (dBm) | 21   | 21   | 21   |
| WCDMA Band II HSUPA |                            |      |      |      |
| Channel             |                            | 9262 | 9400 | 9538 |
| 1                   | Maximum Target Value (dBm) | 21   | 21   | 21   |

|   |                            |      |      |      |
|---|----------------------------|------|------|------|
| 2 | Maximum Target Value (dBm) | 21.5 | 21.5 | 21.5 |
| 3 | Maximum Target Value (dBm) | 21   | 21   | 21   |
| 4 | Maximum Target Value (dBm) | 21.5 | 21.5 | 21.5 |
| 5 | Maximum Target Value (dBm) | 21.5 | 21.5 | 21.5 |

**Table 12.5: WCDMA**

| WCDMA Band V               |      |      |      |
|----------------------------|------|------|------|
| Channel                    | 4132 | 4183 | 4233 |
| Maximum Target Value (dBm) | 23   | 23   | 23   |

| WCDMA Band V HSDPA |                            |      |      |      |
|--------------------|----------------------------|------|------|------|
| Channel            |                            | 4132 | 4183 | 4233 |
| 1                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| 2                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| 3                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| 4                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| WCDMA Band V HSUPA |                            |      |      |      |
| Channel            |                            | 4132 | 4183 | 4233 |
| 1                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| 2                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| 3                  | Maximum Target Value (dBm) | 21   | 21   | 21   |
| 4                  | Maximum Target Value (dBm) | 22   | 22   | 22   |
| 5                  | Maximum Target Value (dBm) | 22   | 22   | 22   |

**Table 12.6: LTE**

| LTE Band7                  |      |      |      |
|----------------------------|------|------|------|
| RB Size                    | 1    | 50%  | 100% |
| Maximum Target Value (dBm) | 19.5 | 18.5 | 18.5 |

**Table 12.7: WiFi**

| WiFi 802.11b 2.4G          |           |           |            |         |
|----------------------------|-----------|-----------|------------|---------|
| Channel                    | Channel 1 | Channel 6 | Channel 11 |         |
| Maximum Target Value (dBm) | 19.5      | 19.5      | 19.5       |         |
| WiFi 802.11g 2.4G          |           |           |            |         |
| Channel                    | Channel 1 | Channel 6 | Channel 11 |         |
| Maximum Target Value (dBm) | 18        | 18        | 18         |         |
| WiFi 802.11n 20M 2.4G      |           |           |            |         |
| Channel                    | Channel 1 | Channel 6 | Channel 11 |         |
| Maximum Target Value (dBm) | 17        | 17        | 17         |         |
| WiFi 802.11n 40M 2.4G      |           |           |            |         |
| Channel                    | Channel 3 | Channel 6 | Channel 9  |         |
| Maximum Target Value (dBm) | 16        | 16        | 16         |         |
| WiFi 802.11a               |           |           |            |         |
| Band                       | U-NII-1   | U-NII-2A  | U-NII-2C   | U-NII-3 |
| Maximum Target Value (dBm) | 14        | 14        | 13         | 12      |
| WiFi 802.11n HT20          |           |           |            |         |
| Band                       | U-NII-1   | U-NII-2A  | U-NII-2C   | U-NII-3 |
| Maximum Target Value (dBm) | 14        | 14        | 13         | 12      |
| WiFi 802.11n HT40          |           |           |            |         |
| Band                       | U-NII-1   | U-NII-2A  | U-NII-2C   | U-NII-3 |
| Maximum Target Value (dBm) | 14        | 14        | 13         | 13      |

**Table 12.8: Bluetooth**

| Bluetooth                  |           |            |            |
|----------------------------|-----------|------------|------------|
| Channel                    | Channel 0 | Channel 39 | Channel 78 |
| Maximum Target Value (dBm) | 8         | 8          | 8          |

**Table 12.9: BLE**

| Bluetooth                  |           |            |            |
|----------------------------|-----------|------------|------------|
| Channel                    | Channel 0 | Channel 19 | Channel 39 |
| Maximum Target Value (dBm) | 8         | 8          | 8          |

## 13.2. GSM Measurement result

**Table 12.10: The conducted power measurement results for GSM**

| GSM<br>850MHZ  | Conducted Power (dBm)  |                       |                        |
|----------------|------------------------|-----------------------|------------------------|
|                | Channel 128(824.2MHz)  | Channel 190(836.6MHz) | Channel 251(848.8MHz)  |
|                | 32.52                  | 32.58                 | 32.51                  |
| GSM<br>1900MHZ | Conducted Power(dBm)   |                       |                        |
|                | Channel 512(1850.2MHz) | Channel 661(1880 MHz) | Channel 810(1909.8MHz) |
|                | 29.89                  | 29.86                 | 29.65                  |

**Table 12.11: The conducted power measurement results for GPRS/EGPRS**

| GSM 850<br>GMSK  | Measured Power (dBm) |       |       | calculation | Averaged Power (dBm) |       |       |
|------------------|----------------------|-------|-------|-------------|----------------------|-------|-------|
|                  | 128                  | 190   | 251   |             | 128                  | 190   | 251   |
| 1 Txslot         | 32.52                | 32.59 | 32.57 | -9.03dB     | 23.49                | 23.56 | 23.54 |
| 2 Txslots        | 31.25                | 31.2  | 31.3  | -6.02dB     | 25.23                | 25.18 | 25.28 |
| 3 Txslots        | 29.32                | 29.27 | 29.36 | -4.26dB     | 25.06                | 25.01 | 25.1  |
| 4 Txslots        | 28.21                | 28.17 | 28.25 | -3.01dB     | 25.2                 | 25.16 | 25.24 |
| GSM 1900<br>GMSK | Measured Power (dBm) |       |       | calculation | Averaged Power (dBm) |       |       |
|                  | 512                  | 661   | 810   |             | 512                  | 661   | 810   |
| 1 Txslot         | 29.89                | 29.83 | 29.61 | -9.03dB     | 20.86                | 20.8  | 20.58 |
| 2 Txslots        | 29.08                | 29.04 | 28.83 | -6.02dB     | 23.06                | 23.02 | 22.81 |
| 3Txslots         | 27.25                | 27.23 | 27.03 | -4.26dB     | 22.99                | 22.97 | 22.77 |
| 4 Txslots        | 26.23                | 26.21 | 26.01 | -3.01dB     | 23.22                | 23.2  | 23    |

**Table 12.12: The conducted power measurement results for E-GPRS**

| GSM 850<br>8-PSK  | Measured Power (dBm) |       |       | calculation | Averaged Power (dBm) |       |       |
|-------------------|----------------------|-------|-------|-------------|----------------------|-------|-------|
|                   | 128                  | 190   | 251   |             | 128                  | 190   | 251   |
| 1 Txslot          | 26.2                 | 26.31 | 26.02 | -9.03dB     | 17.17                | 17.28 | 16.99 |
| 2 Txslots         | 25.04                | 24.75 | 24.62 | -6.02dB     | 19.02                | 18.73 | 18.6  |
| 3 Txslots         | 22.74                | 22.86 | 23.13 | -4.26dB     | 18.48                | 18.6  | 18.87 |
| 4 Txslots         | 21.98                | 22.1  | 21.82 | -3.01dB     | 18.97                | 19.09 | 18.81 |
| GSM 1900<br>8-PSK | Measured Power (dBm) |       |       | calculation | Averaged Power (dBm) |       |       |
|                   | 512                  | 661   | 810   |             | 512                  | 661   | 810   |
| 1 Txslot          | 26.71                | 26.9  | 26.71 | -9.03dB     | 17.68                | 17.87 | 17.68 |
| 2 Txslots         | 25.72                | 25.77 | 25.78 | -6.02dB     | 19.7                 | 19.75 | 19.76 |
| 3 Txslots         | 24.12                | 23.99 | 23.76 | -4.26dB     | 19.86                | 19.73 | 19.5  |
| 4 Txslots         | 22.99                | 23.03 | 22.84 | -3.01dB     | 19.98                | 20.02 | 19.83 |

**NOTES:**
**1) Division Factors**

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

**According to the conducted power as above, the body measurements are performed with 2Txslots for 850MHz ; 4Txslots for 1900MHz;**

### 13.3. WCDMA Measurement result

Table 12.13: The conducted Power for WCDMA

| Item  | band  | WCDMA BAND II result(dBm)  |                            |                            |
|-------|-------|----------------------------|----------------------------|----------------------------|
|       | ARFCN | 9262<br>(1852.4MHz)        | 9400<br>(1880.0MHz)        | 9538<br>(1907.6MHz)        |
| WCDMA | \     | 22.36                      | 22.21                      | 22.12                      |
| HSDPA | 1     | 21.44                      | 21.43                      | 21.4                       |
|       | 2     | 21.35                      | 21.34                      | 21.32                      |
|       | 3     | 20.95                      | 20.96                      | 20.98                      |
|       | 4     | 20.93                      | 20.94                      | 20.97                      |
| HSUPA | 1     | 20.88                      | 20.89                      | 20.86                      |
|       | 2     | 21.41                      | 21.43                      | 21.44                      |
|       | 3     | 20.48                      | 20.49                      | 20.43                      |
|       | 4     | 21.44                      | 21.43                      | 21.49                      |
|       | 5     | 21.38                      | 21.39                      | 21.36                      |
| Item  | band  | WCDMA BAND V result(dBm)   |                            |                            |
|       | ARFCN | Channel 4132<br>(826.4MHz) | Channel 4183<br>(836.6MHz) | Channel 4233<br>(846.6MHz) |
| WCDMA | \     | 22.47                      | 22.49                      | 22.58                      |
| HSDPA | 1     | 21.63                      | 21.64                      | 21.59                      |
|       | 2     | 21.6                       | 21.58                      | 21.61                      |
|       | 3     | 21.21                      | 21.24                      | 21.23                      |
|       | 4     | 21.14                      | 21.16                      | 21.18                      |
| HSUPA | 1     | 21.14                      | 21.17                      | 21.13                      |
|       | 2     | 21.66                      | 21.67                      | 21.68                      |
|       | 3     | 20.84                      | 20.86                      | 20.83                      |
|       | 4     | 21.67                      | 21.69                      | 21.7                       |
|       | 5     | 21.63                      | 21.61                      | 21.64                      |

### 13.4. LTE Measurement result

**Table 12.14: The conducted Power for LTE Band 7**

| LTE-FDD Band 7 |                      |            | Actual output Power (dBm) |        |       |       |        |       |
|----------------|----------------------|------------|---------------------------|--------|-------|-------|--------|-------|
|                |                      |            | High                      | Middle | Low   | High  | Middle | Low   |
| RB allocation  | RB offset (Start RB) | Modulation | 5MHz                      |        |       | 10MHz |        |       |
|                |                      |            | 21425                     | 21100  | 20775 | 21400 | 21100  | 20800 |
| 1RB            | High                 | QPSK       | 18.43                     | 18.39  | 18.35 | 18.55 | 18.49  | 18.52 |
|                |                      | 16QAM      | 17.76                     | 17.72  | 17.63 | 17.84 | 17.83  | 17.84 |
|                | Middle               | QPSK       | 18.70                     | 18.62  | 18.63 | 18.63 | 18.63  | 18.60 |
|                |                      | 16QAM      | 18.05                     | 17.97  | 17.93 | 17.94 | 17.94  | 17.94 |
|                | Low                  | QPSK       | 18.42                     | 18.35  | 18.43 | 18.49 | 18.47  | 18.48 |
|                |                      | 16QAM      | 17.76                     | 17.68  | 17.74 | 17.76 | 17.77  | 17.83 |
| 50%RB          | High                 | QPSK       | 17.64                     | 17.60  | 17.58 | 17.78 | 17.73  | 17.73 |
|                |                      | 16QAM      | 16.64                     | 16.62  | 16.58 | 16.75 | 16.70  | 16.67 |
|                | Middle               | QPSK       | 17.70                     | 17.65  | 17.66 | 17.73 | 17.69  | 17.72 |
|                |                      | 16QAM      | 16.71                     | 16.64  | 16.63 | 16.69 | 16.66  | 16.66 |
|                | Low                  | QPSK       | 17.61                     | 17.56  | 17.58 | 17.74 | 17.66  | 17.71 |
|                |                      | 16QAM      | 16.62                     | 16.61  | 16.55 | 16.70 | 16.61  | 16.66 |
| 100%RB         | /                    | QPSK       | 17.67                     | 17.62  | 17.61 | 17.77 | 17.72  | 17.73 |
|                |                      | 16QAM      | 16.61                     | 16.56  | 16.56 | 16.72 | 16.65  | 16.68 |
| RB allocation  | RB offset (Start RB) | Modulation | 15MHz                     |        |       | 20MHz |        |       |
|                |                      |            | 21375                     | 21100  | 20825 | 21350 | 21100  | 20850 |
| 1RB            | High                 | QPSK       | 18.52                     | 18.47  | 18.42 | 18.32 | 18.26  | 18.28 |
|                |                      | 16QAM      | 17.81                     | 17.78  | 17.75 | 17.59 | 17.65  | 17.60 |
|                | Middle               | QPSK       | 18.54                     | 18.52  | 18.54 | 18.61 | 18.62  | 18.60 |
|                |                      | 16QAM      | 17.81                     | 17.86  | 17.81 | 17.85 | 17.97  | 17.96 |
|                | Low                  | QPSK       | 18.43                     | 18.37  | 18.46 | 18.22 | 18.20  | 18.25 |
|                |                      | 16QAM      | 17.65                     | 17.73  | 17.74 | 17.56 | 17.57  | 17.61 |
| 50%RB          | High                 | QPSK       | 17.77                     | 17.73  | 17.72 | 17.71 | 17.72  | 17.71 |
|                |                      | 16QAM      | 17.14                     | 16.65  | 16.66 | 16.75 | 16.67  | 16.68 |
|                | Middle               | QPSK       | 17.74                     | 17.69  | 17.69 | 17.77 | 17.71  | 17.69 |
|                |                      | 16QAM      | 16.65                     | 16.62  | 16.62 | 16.72 | 16.69  | 16.69 |
|                | Low                  | QPSK       | 17.70                     | 17.64  | 17.65 | 17.66 | 17.60  | 17.58 |
|                |                      | 16QAM      | 16.59                     | 16.58  | 16.60 | 16.61 | 16.55  | 16.54 |

|        |   |       |       |       |       |       |       |       |
|--------|---|-------|-------|-------|-------|-------|-------|-------|
| 100%RB | / | QPSK  | 17.77 | 17.69 | 17.70 | 17.74 | 17.63 | 17.66 |
|        |   | 16QAM | 16.66 | 16.59 | 16.60 | 16.66 | 16.60 | 16.60 |

### 13.5. WiFi and BT Measurement result

**Table 12.15: The conducted power for Bluetooth**

| GFSK                         |                |                |                |
|------------------------------|----------------|----------------|----------------|
| Channel                      | Ch0 (2402 MHz) | Ch39 (2441MHz) | CH78 (2480MHz) |
| Conducted Output Power (dBm) | 6.65           | 7.81           | 6.77           |
| $\pi/4$ DQPSK                |                |                |                |
| Channel                      | Ch0 (2402 MHz) | Ch39 (2441MHz) | CH78 (2480MHz) |
| Conducted Output Power (dBm) | 5.41           | 6.52           | 5.42           |
| 8DPSK                        |                |                |                |
| Channel                      | Ch0 (2402 MHz) | Ch39 (2441MHz) | CH78 (2480MHz) |
| Conducted Output Power (dBm) | 5.41           | 6.49           | 5.42           |

**Table 12.16: The conducted power for BLE**

| GFSK                         |                |                |                |
|------------------------------|----------------|----------------|----------------|
| Channel                      | Ch0 (2402 MHz) | Ch19 (2440MHz) | CH39 (2480MHz) |
| Conducted Output Power (dBm) | 6.7            | 7.8            | 6.8            |

**NOTE:** According to KDB447498 D01 BT standalone SAR are not required, because maximum average output power is less than 10mW.

Evaluation=1.987 < 3.0

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

$$SAR = \frac{P(\text{Max. Power of channel, including tuneup tolerance, mW})}{D(\text{Min. test separation distance, mm})} * \frac{\sqrt{\text{frequency(GHz)}}}{x}$$

Where

- D (Min, test separation distances, mm) is always set to 50 mm for Head SAR evaluation
- Frequency(GHz) is the center frequency in GHz
- where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR

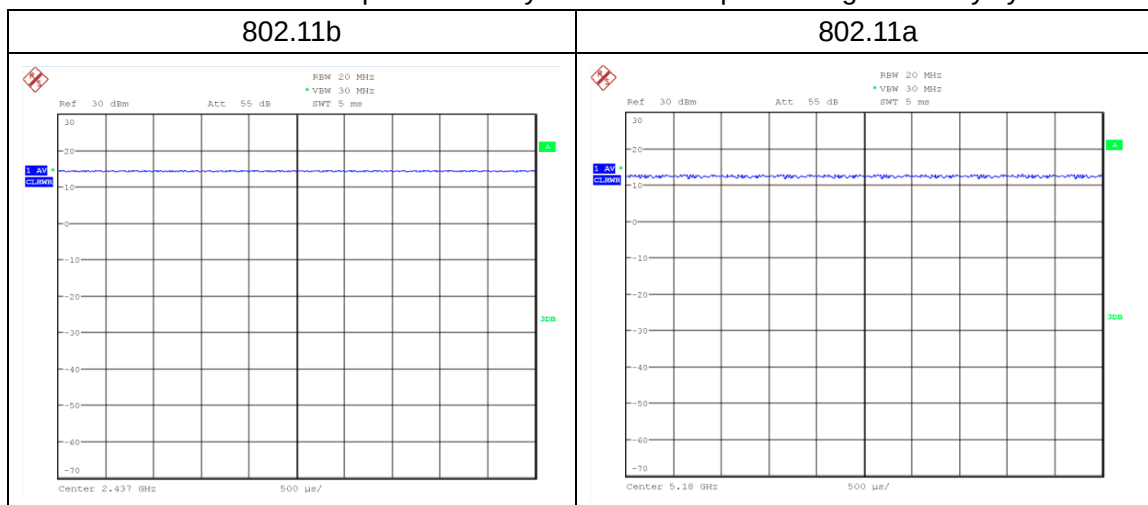
Therefor

- SAR head value of BT is 0.265 W/Kg where D is set to 5mm
- SAR body value of BT is 0.132 W/Kg for 1g where D is set to 10mm

#### The default power measurement procedures are:

- a) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.
- b) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.
  - 1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.
  - 2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.
- c) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting, the duty cycle is 100%.



**Table 12.17: The average conducted power for WiFi**

| Mode            | Channel | Frequency | Average power(dBm) |
|-----------------|---------|-----------|--------------------|
| 802.11 b        | 1       | 2412 MHZ  | 19.32              |
|                 | 6       | 2437 MHZ  | 18.97              |
|                 | 11      | 2462 MHZ  | 19.02              |
| 802.11 g        | 1       | 2412 MHZ  | 16.13              |
|                 | 6       | 2437 MHZ  | 17.50              |
|                 | 11      | 2462 MHZ  | 15.95              |
| 802.11 n<br>20M | 1       | 2412 MHZ  | 15.88              |
|                 | 6       | 2437 MHZ  | 16.97              |
|                 | 11      | 2462 MHZ  | 15.78              |
| 802.11 n<br>40M | 3       | 2422 MHZ  | 14.09              |
|                 | 6       | 2437 MHZ  | 15.94              |
|                 | 9       | 2452 MHZ  | 13.96              |

| Mode    | Channel | Frequency<br>MHz | Average Power (dBm) |
|---------|---------|------------------|---------------------|
| 802.11a | 36      | 5180             | 13.22               |
|         | 40      | 5200             | 13.18               |
|         | 44      | 5220             | 13.02               |
|         | 48      | 5240             | 13.66               |
|         | 52      | 5260             | 13.49               |
|         | 56      | 5280             | 12.40               |
|         | 60      | 5300             | 13.23               |
|         | 64      | 5320             | 13.22               |
|         | 100     | 5500             | 12.27               |
|         | 104     | 5520             | 12.64               |

|                        |     |      |       |
|------------------------|-----|------|-------|
|                        | 108 | 5540 | 12.17 |
|                        | 112 | 5560 | 12.71 |
|                        | 116 | 5580 | 12.18 |
|                        | 132 | 5660 | 11.89 |
|                        | 136 | 5680 | 12.10 |
|                        | 140 | 5700 | 11.53 |
|                        | 149 | 5745 | 11.75 |
|                        | 153 | 5765 | 11.75 |
|                        | 157 | 5785 | 11.58 |
|                        | 161 | 5805 | 11.92 |
|                        | 165 | 5825 | 12.17 |
| <b>802.11n<br/>20M</b> | 36  | 5180 | 13.33 |
|                        | 40  | 5200 | 13.33 |
|                        | 44  | 5220 | 13.37 |
|                        | 48  | 5240 | 13.74 |
|                        | 52  | 5260 | 13.53 |
|                        | 56  | 5280 | 12.42 |
|                        | 60  | 5300 | 13.4  |
|                        | 64  | 5320 | 13.28 |
|                        | 100 | 5500 | 12.38 |
|                        | 104 | 5520 | 12.18 |
|                        | 108 | 5540 | 12.08 |
|                        | 112 | 5560 | 12.19 |
|                        | 116 | 5580 | 12.74 |
|                        | 132 | 5660 | 12.04 |
|                        | 136 | 5680 | 12.00 |
|                        | 140 | 5700 | 11.5  |
|                        | 149 | 5745 | 11.32 |
|                        | 153 | 5765 | 11.66 |
|                        | 157 | 5785 | 11.6  |
|                        | 161 | 5805 | 11.83 |
|                        | 165 | 5825 | 12.17 |
| <b>802.11n<br/>40M</b> | 38  | 5190 | 13.53 |
|                        | 46  | 5230 | 13.93 |
|                        | 54  | 5270 | 13.85 |
|                        | 62  | 5310 | 13.67 |
|                        | 102 | 5510 | 12.78 |
|                        | 110 | 5550 | 12.13 |
|                        | 134 | 5670 | 12.17 |
|                        | 151 | 5755 | 12.26 |
|                        | 159 | 5795 | 12.16 |

## 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

- a) When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.
- b) When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.

## 5GHz 802.11a/n OFDM SAR Test Exclusion Requirements

For devices that operate in both U-NII-1 and U-NII-2A bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.

2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is  $\leq 1.2$  W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

The highest reported SAR for Main Antenna is adjusted by the ratio of U-NII-1 to U-NII-2A specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg . So WiFi Antenna U-NII-1 mode is not required.

## 14. SAR Measurement Result

### 14.1. SAR Test Result For I19D00035-SAR01

**Table 14.1: SAR Values(GSM 850 MHz Band-Head)**

| Frequency |     | Mode /Band | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch. |            |       |               |            |                              |                             |                |                         |                         |                  |
| 836.6     | 190 | GSM850     | Left  | Touch         | 1          | 32.58                        | 33                          | 1.102          | 0.167                   | 0.184                   | 0.02             |
| 836.6     | 190 | GSM850     | Left  | Tilt          | /          | 32.58                        | 33                          | 1.102          | 0.06                    | 0.066                   | 0.03             |
| 836.6     | 190 | GSM850     | Right | Touch         | /          | 32.58                        | 33                          | 1.102          | 0.153                   | 0.169                   | -0.07            |
| 836.6     | 190 | GSM850     | Right | Tilt          | /          | 32.58                        | 33                          | 1.102          | 0.077                   | 0.085                   | 0.12             |

**Table 14.2: SAR Values (GSM 850 MHz Band-Body)**

| Frequen<br>cy       |         | Mod<br>e<br>/Band | Servic<br>e<br>/Heads<br>et | Test<br>Positi<br>on  | Spaci<br>ng<br>(mm) | Figur<br>e No. | Measur<br>ed<br>average<br>power<br>(dBm) | Maximu<br>m<br>allowed<br>Power<br>(dBm) | Scali<br>ng<br>factor | Measur<br>ed<br>SAR(1g<br>) (W/kg) | Report<br>ed<br>SAR(1g<br>)<br>(W/kg) | Pow<br>er<br>Drift<br>(dB) |
|---------------------|---------|-------------------|-----------------------------|-----------------------|---------------------|----------------|-------------------------------------------|------------------------------------------|-----------------------|------------------------------------|---------------------------------------|----------------------------|
| MH<br>z             | C<br>h. |                   |                             |                       |                     |                |                                           |                                          |                       |                                    |                                       |                            |
| Hotspot & Body worn |         |                   |                             |                       |                     |                |                                           |                                          |                       |                                    |                                       |                            |
| 836.<br>6           | 19<br>0 | GPR<br>S<br>2TS   | Class12                     | Toward<br>Phanto<br>m | 10                  | /              | 31.2                                      | 32                                       | 1.202                 | 0.234                              | 0.281                                 | 0.05                       |
| 836.<br>6           | 19<br>0 | GPR<br>S<br>2TS   | Class12                     | Toward<br>Ground      | 10                  | 2              | 31.2                                      | 32                                       | 1.202                 | 0.425                              | 0.511                                 | 0.12                       |
| Hotspot             |         |                   |                             |                       |                     |                |                                           |                                          |                       |                                    |                                       |                            |
| 836.<br>6           | 19<br>0 | GPR<br>S<br>2TS   | Class12                     | Toward<br>Left        | 10                  | /              | 31.2                                      | 32                                       | 1.202                 | 0.146                              | 0.176                                 | 0.04                       |
| 836.<br>6           | 19<br>0 | GPR<br>S<br>2TS   | Class12                     | Toward<br>Right       | 10                  | /              | 31.2                                      | 32                                       | 1.202                 | 0.091                              | 0.109                                 | 0.13                       |

|           |         |                 |         |                  |    |   |      |    |       |       |       |      |
|-----------|---------|-----------------|---------|------------------|----|---|------|----|-------|-------|-------|------|
| 836.<br>6 | 19<br>0 | GPR<br>S<br>2TS | Class12 | Toward<br>Bottom | 10 | / | 31.2 | 32 | 1.202 | 0.135 | 0.162 | 0.06 |
|-----------|---------|-----------------|---------|------------------|----|---|------|----|-------|-------|-------|------|

Table 14.3: SAR Values(GSM 1900 MHz Band-Head)

| Frequency |     | Mode /Band | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch  |            |       |               |            |                              |                             |                |                         |                         |                  |
| 1850.2    | 512 | GSM1900    | Left  | Touch         | /          | 29.86                        | 30                          | 1.033          | 0.297                   | 0.307                   | 0.14             |
| 1850.2    | 512 | GSM1900    | Left  | Tilt          | /          | 29.86                        | 30                          | 1.033          | 0.109                   | 0.113                   | -0.06            |
| 1850.2    | 512 | GSM1900    | Right | Touch         | 3          | 29.86                        | 30                          | 1.033          | 0.339                   | 0.350                   | -0.11            |
| 1850.2    | 512 | GSM1900    | Right | Tilt          | /          | 29.86                        | 30                          | 1.033          | 0.0915                  | 0.094                   | 0.08             |

Table 14.4: SAR Values (GSM 1900 MHz Band-Body)

| Frequency           |     | Mode /Band | Service /Headset | Test Position  | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|---------------------|-----|------------|------------------|----------------|--------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz                 | Ch. |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| Hotspot & Body worn |     |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 1850.2              | 512 | GPRS 4TS   | Class12          | Toward Phantom | 10           | /          | 26.23                        | 26.5                        | 1.064          | 1.000                   | 1.064                   | 0.17             |
| 1909.8              | 810 | GPRS 4TS   | Class12          | Toward Phantom | 10           | /          | 26.23                        | 26.5                        | 1.064          | 0.626                   | 0.666                   | 0.08             |
| 1880                | 661 | GPRS 4TS   | Class12          | Toward Phantom | 10           | /          | 26.23                        | 26.5                        | 1.064          | 0.791                   | 0.842                   | -0.02            |
| 1850.2              | 512 | GPRS 4TS   | Class12          | Toward Ground  | 10           | /          | 26.23                        | 26.5                        | 1.064          | 0.861                   | 0.916                   | 0.08             |
| 1909.8              | 810 | GPRS 4TS   | Class12          | Toward Ground  | 10           | /          | 26.01                        | 26.5                        | 1.119          | 0.903                   | 1.011                   | 0.07             |
| 1880                | 661 | GPRS 4TS   | Class12          | Toward Ground  | 10           | /          | 26.21                        | 26.5                        | 1.069          | 1.100                   | 1.176                   | 0.03             |

| Hotspot  |     |          |         |               |    |   |       |      |       |       |       |       |
|----------|-----|----------|---------|---------------|----|---|-------|------|-------|-------|-------|-------|
| 1850.2   | 512 | GPRS 4TS | Class12 | Toward Left   | 10 | / | 26.23 | 26.5 | 1.064 | 0.791 | 0.842 | -0.02 |
| 1850.2   | 512 | GPRS 4TS | Class12 | Toward Right  | 10 | / | 26.23 | 26.5 | 1.064 | 0.180 | 0.192 | 0.07  |
| 1850.2   | 512 | GPRS 4TS | Class12 | Toward Bottom | 10 | 4 | 26.23 | 26.5 | 1.064 | 1.180 | 1.256 | -0.03 |
| 1909.8   | 810 | GPRS 4TS | Class12 | Toward Bottom | 10 | / | 26.01 | 26.5 | 1.119 | 0.820 | 0.918 | 0.07  |
| 1880     | 661 | GPRS 4TS | Class12 | Toward Bottom | 10 | / | 26.21 | 26.5 | 1.069 | 0.642 | 0.686 | 0.05  |
| Repeated |     |          |         |               |    |   |       |      |       |       |       |       |
| 1850.2   | 512 | GPRS 4TS | Class12 | Toward Bottom | 10 | / | 26.23 | 26.5 | 1.064 | 1.080 | 1.149 | -0.15 |

Table 14.5: SAR Values(WCDMA Band II-Head)

| Frequency |      | Mode /Band | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|------|------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch.  |            |       |               |            |                              |                             |                |                         |                         |                  |
| 1880      | 9400 | Band II    | Left  | Touch         | /          | 22.21                        | 22.5                        | 1.069          | 0.252                   | 0.269                   | 0.19             |
| 1880      | 9400 | Band II    | Left  | Tilt          | /          | 22.21                        | 22.5                        | 1.069          | 0.0711                  | 0.076                   | -0.11            |
| 1880      | 9400 | Band II    | Right | Touch         | 5          | 22.21                        | 22.5                        | 1.069          | 0.329                   | 0.352                   | 0.14             |
| 1880      | 9400 | Band II    | Right | Tilt          | /          | 22.21                        | 22.5                        | 1.069          | 0.0835                  | 0.089                   | 0.04             |

Table 14.6: SAR Values (WCDMA Band II-Body)

| Frequency |     | Mode /Band | Service /Headset | Test Position | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|------------|------------------|---------------|--------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch. |            |                  |               |              |            |                              |                             |                |                         |                         |                  |

| Hotspot & Body worn |          |            |                  |                   |    |   |       |      |       |       |       |       |
|---------------------|----------|------------|------------------|-------------------|----|---|-------|------|-------|-------|-------|-------|
| 1880                | 940<br>0 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Phantom | 10 | / | 22.21 | 22.5 | 1.069 | 0.675 | 0.722 | 0.04  |
| 1880                | 940<br>0 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Ground  | 10 | / | 22.21 | 22.5 | 1.069 | 0.506 | 0.541 | 0.10  |
| Hotspot             |          |            |                  |                   |    |   |       |      |       |       |       |       |
| 1880                | 940<br>0 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Left    | 10 | / | 22.21 | 22.5 | 1.069 | 0.106 | 0.113 | -0.01 |
| 1880                | 940<br>0 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Right   | 10 | / | 22.21 | 22.5 | 1.069 | 0.175 | 0.187 | 0.10  |
| 1880                | 940<br>0 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Bottom  | 10 | / | 22.21 | 22.5 | 1.069 | 0.814 | 0.870 | 0.00  |
| 1907<br>.6          | 953<br>8 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Bottom  | 10 | / | 22.12 | 22.5 | 1.091 | 0.832 | 0.908 | 0.05  |
| 1852<br>.4          | 926<br>2 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Bottom  | 10 | / | 22.36 | 22.5 | 1.033 | 0.880 | 0.909 | 0.09  |
| Repeated            |          |            |                  |                   |    |   |       |      |       |       |       |       |
| 1852<br>.4          | 926<br>2 | Band<br>II | 12.2kbp<br>s RMC | Toward<br>Bottom  | 10 | 6 | 22.36 | 22.5 | 1.033 | 0.918 | 0.948 | 0.09  |

Table 14.7: SAR Values(WCDMA Band V-Head)

| Frequency |      | Mode /Band | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|------|------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch.  |            |       |               |            |                              |                             |                |                         |                         |                  |
| 836.6     | 4183 | Band V     | Left  | Touch         | 7          | 22.49                        | 23                          | 1.125          | 0.171                   | 0.192                   | 0.07             |
| 836.6     | 4183 | Band V     | Left  | Tilt          | /          | 22.49                        | 23                          | 1.125          | 0.0836                  | 0.094                   | 0.08             |
| 836.6     | 4183 | Band V     | Right | Touch         | /          | 22.49                        | 23                          | 1.125          | 0.157                   | 0.177                   | 0.08.            |
| 836.6     | 4183 | Band V     | Right | Tilt          | /          | 22.49                        | 23                          | 1.125          | 0.0706                  | 0.079                   | 0.09             |

Table 14.8: SAR Values (WCDMA Band V-Body)

| Frequency           |         | Mode /Band | Service /Headset | Test Position  | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|---------------------|---------|------------|------------------|----------------|--------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz                 | Channel |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| Hotspot & Body worn |         |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 836.6               | 4183    | Band V     | 12.2kbps RMC     | Toward Phantom | 10           | /          | 22.49                        | 23                          | 1.125          | 0.144                   | 0.162                   | -0.02            |
| 836.6               | 4183    | Band V     | 12.2kbps RMC     | Toward Ground  | 10           | /          | 22.49                        | 23                          | 1.125          | 0.231                   | 0.260                   | 0.02             |
| 846.6               | 4233    | Band V     | 12.2kbps RMC     | Toward Ground  | 10           | 8          | 22.40                        | 23                          | 1.148          | 0.257                   | 0.295                   | -0.06            |
| 826.4               | 4132    | Band V     | 12.2kbps RMC     | Toward Ground  | 10           | /          | 22.33                        | 23                          | 1.167          | 0.193                   | 0.225                   | 0.05             |
| Hotspot             |         |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 836.6               | 4183    | Band V     | 12.2kbps RMC     | Toward Left    | 10           | /          | 22.49                        | 23                          | 1.125          | 0.106                   | 0.119                   | -0.03            |
| 836.6               | 4183    | Band V     | 12.2kbps RMC     | Toward Right   | 10           | /          | 22.49                        | 23                          | 1.125          | 0.0643                  | 0.072                   | 0.10             |
| 836.6               | 4183    | Band V     | 12.2kbps RMC     | Toward Bottom  | 10           | /          | 22.49                        | 23                          | 1.125          | 0.0702                  | 0.079                   | 0.13             |

Table 14.11: SAR Values (LTE Band 7 - Head)

| Frequency |       | Configuration                    | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-------|----------------------------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch.   |                                  |       |               |            |                              |                             |                |                         |                         |                  |
| 2535      | 21100 | QPSK_20MHz_1RB_50 offset Middle  | Left  | Touch         | /          | 18.62                        | 19.5                        | 1.225          | 0.096                   | 0.118                   | 0.03             |
| 2535      | 21100 | QPSK_20MHz_1RB_50 offset Middle  | Left  | Tilt          | /          | 18.62                        | 19.5                        | 1.225          | 0.064                   | 0.078                   | 0.07             |
| 2535      | 21100 | QPSK_20MHz_1RB_50 offset Middle  | Right | Touch         | 11         | 18.62                        | 19.5                        | 1.225          | 0.233                   | 0.285                   | 0.06             |
| 2535      | 21100 | QPSK_20MHz_1RB_50 offset Middle  | Right | Tilt          | /          | 18.62                        | 19.5                        | 1.225          | 0.039                   | 0.048                   | -0.15            |
| 2535      | 21100 | QPSK_20MHz_50RB_50 offset Middle | Left  | Touch         | /          | 17.72                        | 18.5                        | 1.197          | 0.090                   | 0.108                   | 0.01             |
| 2535      | 21100 | QPSK_20MHz_50RB_50 offset Middle | Left  | Tilt          | /          | 17.72                        | 18.5                        | 1.197          | 0.049                   | 0.059                   | 0.01             |
| 2535      | 21100 | QPSK_20MHz_50RB_50 offset Middle | Right | Touch         | /          | 17.72                        | 18.5                        | 1.197          | 0.181                   | 0.217                   | 0.02             |
| 2535      | 21100 | QPSK_20MHz_50RB_25 offset Middle | Right | Tilt          | /          | 17.72                        | 18.5                        | 1.197          | 0.030                   | 0.036                   | 0.03             |

Table 14.12: SAR Values (LTE Band 7 - Body)

| Frequency           |      | Configuration                    | Test Position  | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|---------------------|------|----------------------------------|----------------|--------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz                 | Ch.  |                                  |                |              |            |                              |                             |                |                         |                         |                  |
| Hotspot & Body worn |      |                                  |                |              |            |                              |                             |                |                         |                         |                  |
| 2535                | 2110 | QPSK_20MHz_1RB_50 offset Middle  | Toward Phantom | 10           | /          | 18.62                        | 19.5                        | 1.225          | 0.364                   | 0.446                   | 0.07             |
| 2535                | 2110 | QPSK_20MHz_1RB_50 offset Middle  | Toward Ground  | 10           | /          | 18.62                        | 19.5                        | 1.225          | 0.660                   | 0.808                   | 0.18             |
| 2535                | 2110 | QPSK_20MHz_50RB_50 offset Middle | Toward Phantom | 10           | /          | 17.72                        | 18.5                        | 1.197          | 0.282                   | 0.337                   | 0.16             |
| 2535                | 2110 | QPSK_20MHz_50RB_50 offset Middle | Toward Ground  | 10           | /          | 17.72                        | 18.5                        | 1.197          | 0.517                   | 0.619                   | 0.07             |
| Hotspot             |      |                                  |                |              |            |                              |                             |                |                         |                         |                  |
| 2535                | 2110 | QPSK_20MHz_1RB_50 offset Middle  | Toward Left    | 10           | /          | 18.62                        | 19.5                        | 1.225          | 0.054                   | 0.066                   | 0.13             |
| 2535                | 2110 | QPSK_20MHz_1RB_50 offset Middle  | Toward Right   | 10           | /          | 18.62                        | 19.5                        | 1.225          | 0.090                   | 0.110                   | -0.11            |
| 2535                | 2110 | QPSK_20MHz_1RB_50 offset Middle  | Toward Bottom  | 10           | /          | 18.62                        | 19.5                        | 1.225          | 0.993                   | 1.216                   | -0.07            |
| 2510                | 2085 | QPSK_20MHz_1RB_50 offset Low     | Toward Bottom  | 10           | 12         | 18.60                        | 19.5                        | 1.230          | 1.05                    | 1.292                   | 0.07             |
| 2560                | 2135 | QPSK_20MHz_1RB_50 offset High    | Toward Bottom  | 10           | /          | 18.61                        | 19.5                        | 1.227          | 0.939                   | 1.153                   | -0.06            |
| 2535                | 2110 | QPSK_20MHz_50RB_50 offset Middle | Toward Left    | 10           | /          | 17.72                        | 18.5                        | 1.197          | 0.042                   | 0.050                   | -0.14            |
| 2535                | 2110 | QPSK_20MHz_50RB_50 offset Middle | Toward Right   | 10           | /          | 17.72                        | 18.5                        | 1.197          | 0.069                   | 0.083                   | -0.07            |
| 2535                | 2110 | QPSK_20MHz_50RB_50 offset Middle | Toward Bottom  | 10           | /          | 17.72                        | 18.5                        | 1.197          | 0.776                   | 0.929                   | 0.11             |
| 2510                | 2085 | QPSK_20MHz_50RB_50 offset Low    | Toward Bottom  | 10           | /          | 17.71                        | 18.5                        | 1.199          | 0.764                   | 0.916                   | 0.12             |
| 2560                | 2135 | QPSK_20MHz_50RB_50 offset Low    | Toward Bottom  | 10           | /          | 17.71                        | 18.5                        | 1.199          | 0.821                   | 0.985                   | 0.14             |

|          |           |                                          |                  |    |   |       |      |       |       |       |      |
|----------|-----------|------------------------------------------|------------------|----|---|-------|------|-------|-------|-------|------|
|          |           | 50 offset High                           |                  |    |   |       |      |       |       |       |      |
| 253<br>5 | 2110<br>0 | QPSK_20MHz_100R<br>B_<br>0 offset Middle | Toward<br>Bottom | 10 | / | 17.63 | 18.5 | 1.222 | 0.828 | 1.012 | 0.09 |
| Repeated |           |                                          |                  |    |   |       |      |       |       |       |      |
| 251<br>0 | 2085<br>0 | QPSK_20MHz_1RB_<br>50 offset Low         | Toward<br>Bottom | 10 | / | 18.60 | 19.5 | 1.230 | 1.05  | 1.292 | 0.09 |

Table 14.13: SAR Values (WiFi 802.11b - Head)

| Frequency |     | Mode /Band | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch. |            |       |               |            |                              |                             |                |                         |                         |                  |
| 2412      | 1   | WiFi 2450  | Left  | Touch         | /          | 19.32                        | 19.5                        | 1.042          | 0.206                   | 0.215                   | -0.18            |
| 2412      | 1   | WiFi 2450  | Left  | Tilt          | /          | 19.32                        | 19.5                        | 1.042          | 0.127                   | 0.132                   | 0.12             |
| 2412      | 1   | WiFi 2450  | Right | Touch         | /          | 19.32                        | 19.5                        | 1.042          | 0.336                   | 0.350                   | 0.14             |
| 2412      | 1   | WiFi 2450  | Right | Tilt          | /          | 19.32                        | 19.5                        | 1.042          | 0.208                   | 0.217                   | 0.15             |
| 2462      | 11  | WiFi 2450  | Right | Touch         | 13         | 19.02                        | 19.5                        | 1.117          | 0.364                   | 0.407                   | 0.12             |
| 2437      | 6   | WiFi 2450  | Right | Touch         | /          | 18.97                        | 19.5                        | 1.130          | 0.348                   | 0.393                   | 0.03             |

Table 14.14: SAR Values (WiFi 802.11b - Body)

| Frequency           |     | Mode /Band | Service /Headset | Test Position  | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|---------------------|-----|------------|------------------|----------------|--------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz                 | Ch. |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| Hotspot & Body worn |     |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 2412                | 1   | WiFi 2450  | 802.11b          | Toward Phantom | 10           | /          | 19.32                        | 19.5                        | 1.042          | 0.0546                  | 0.057                   | 0.04             |
| 2412                | 1   | WiFi 2450  | 802.11b          | Toward Ground  | 10           | /          | 19.32                        | 19.5                        | 1.042          | 0.0758                  | 0.079                   | 0.01             |
| 2462                | 11  | WiFi 2450  | 802.11b          | Toward Ground  | 10           | /          | 19.02                        | 19.5                        | 1.117          | 0.0848                  | 0.095                   | 0.12             |
| 2437                | 6   | WiFi 2450  | 802.11b          | Toward Ground  | 10           | 14         | 18.97                        | 19.5                        | 1.130          | 0.0968                  | 0.109                   | 0.03             |
| Hotspot             |     |            |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 2412                | 1   | WiFi 2450  | 802.11b          | Toward Left    | 10           | /          | 19.32                        | 19.5                        | 1.042          | 0.0420                  | 0.044                   | 0.01             |
| 2412                | 1   | WiFi 2450  | 802.11b          | Toward Right   | 10           | /          | 19.32                        | 19.5                        | 1.042          | 0.00849                 | 0.009                   | 0.09             |
| 2412                | 1   | WiFi 2450  | 802.11b          | Toward Top     | 10           | 12         | 19.32                        | 19.5                        | 1.042          | 0.0368                  | 0.038                   | -0.01            |

**Table 14.15: SAR Values (WiFi 802.11n - Head)**

| Frequency |     | Mode /Band    | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|---------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch. |               |       |               |            |                              |                             |                |                         |                         |                  |
| 5270      | 54  | WiFi U-NII-2A | Left  | Touch         | /          | 13.85                        | 14                          | 1.035          | 0.076                   | 0.079                   | 0.03             |
| 5270      | 54  | WiFi U-NII-2A | Left  | Tilt          | /          | 13.85                        | 14                          | 1.035          | 0.073                   | 0.076                   | 0.01             |
| 5270      | 54  | WiFi U-NII-2A | Right | Touch         | 15         | 13.85                        | 14                          | 1.035          | 0.212                   | 0.219                   | 0.03             |
| 5270      | 54  | WiFi U-NII-2A | Right | Tilt          | /          | 13.85                        | 14                          | 1.035          | 0.147                   | 0.152                   | 0.05             |

**Table 14.16: SAR Values (WiFi 802.11n - Body)**

| Frequency           |         | Mode /Band    | Service /Headset | Test Position  | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|---------------------|---------|---------------|------------------|----------------|--------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz                 | Channel |               |                  |                |              |            |                              |                             |                |                         |                         |                  |
| Hotspot & Body worn |         |               |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 5270                | 54      | WiFi U-NII-2A | 802.11n          | Toward Phantom | 10           | /          | 13.85                        | 14                          | 1.035          | 0.09                    | 0.093                   | -0.03            |
| 5270                | 54      | WiFi U-NII-2A | 802.11n          | Toward Ground  | 10           | /          | 13.85                        | 14                          | 1.035          | 0.087                   | 0.090                   | 0.03             |
| Hotspot             |         |               |                  |                |              |            |                              |                             |                |                         |                         |                  |
| 5270                | 54      | WiFi U-NII-2A | 802.11n          | Toward Left    | 10           | 16         | 13.85                        | 14                          | 1.035          | 0.116                   | 0.120                   | -0.01            |
| 5270                | 54      | WiFi U-NII-2A | 802.11n          | Toward Right   | 10           | /          | 13.85                        | 14                          | 1.035          | <0.01                   | <0.01                   | 0.01             |
| 5270                | 54      | WiFi U-NII-2A | 802.11n          | Toward Top     | 10           | /          | 13.85                        | 14                          | 1.035          | 0.044                   | 0.046                   | -0.03            |

Table 14.17: SAR Values (WiFi 802.11n - Head)

| Frequency |     | Mode /Band    | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|---------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch. |               |       |               |            |                              |                             |                |                         |                         |                  |
| 5510      | 102 | WiFi U-NII-2C | Left  | Touch         | /          | 12.78                        | 14                          | 1.324          | 0.046                   | 0.061                   | 0.01             |
| 5510      | 102 | WiFi U-NII-2C | Left  | Tilt          | /          | 12.78                        | 14                          | 1.324          | 0.038                   | 0.050                   | 0.02             |
| 5510      | 102 | WiFi U-NII-2C | Right | Touch         | 17         | 12.78                        | 14                          | 1.324          | 0.12                    | 0.159                   | 0.04             |
| 5510      | 102 | WiFi U-NII-2C | Right | Tilt          | /          | 12.78                        | 14                          | 1.324          | 0.106                   | 0.140                   | -0.03            |

Table 14.18: SAR Values (WiFi 802.11n - Body)

| Frequen<br>cy       |         | Mod<br>e<br>/Band    | Servic<br>e<br>/Headset | Test<br>Positi<br>on  | Spaci<br>ng<br>(mm) | Figur<br>e No. | Measur<br>ed<br>average<br>power<br>(dBm) | Maximu<br>m<br>allowed<br>Power<br>(dBm) | Scali<br>ng<br>factor | Measur<br>ed<br>SAR(1g<br>) (W/kg) | Report<br>ed<br>SAR(1g<br>)<br>(W/kg) | Pow<br>er<br>Drift<br>(dB) |
|---------------------|---------|----------------------|-------------------------|-----------------------|---------------------|----------------|-------------------------------------------|------------------------------------------|-----------------------|------------------------------------|---------------------------------------|----------------------------|
| MH<br>z             | Ch<br>. |                      |                         |                       |                     |                |                                           |                                          |                       |                                    |                                       |                            |
| Hotspot & Body worn |         |                      |                         |                       |                     |                |                                           |                                          |                       |                                    |                                       |                            |
| 5510                | 10<br>2 | WiFi<br>U-NII-<br>2C | 802.11N                 | Toward<br>Phanto<br>m | 10                  | /              | 12.78                                     | 14                                       | 1.324                 | <0.01                              | <0.01                                 | 0.02                       |
| 5510                | 10<br>2 | WiFi<br>U-NII-<br>2C | 802.11N                 | Toward<br>Ground      | 10                  | /              | 12.78                                     | 14                                       | 1.324                 | 0.03                               | 0.040                                 | -0.03                      |
| Hotspot             |         |                      |                         |                       |                     |                |                                           |                                          |                       |                                    |                                       |                            |
| 5510                | 10<br>2 | WiFi<br>U-NII-<br>2C | 802.11N                 | Toward<br>Left        | 10                  | 18             | 12.78                                     | 14                                       | 1.324                 | 0.04                               | 0.053                                 | 0.01                       |
| 5510                | 10<br>2 | WiFi<br>U-NII-<br>2C | 802.11N                 | Toward<br>Right       | 10                  | /              | 12.78                                     | 14                                       | 1.324                 | <0.01                              | <0.01                                 | 0.03                       |
| 5510                | 10<br>2 | WiFi<br>U-NII-<br>2C | 802.11N                 | Toward<br>Top         | 10                  | /              | 12.78                                     | 14                                       | 1.324                 | 0.009                              | 0.012                                 | 0.01                       |

Table 14.19: SAR Values (WiFi 802.11n - Head)

| Frequency |     | Mode /Band   | Side  | Test Position | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) |
|-----------|-----|--------------|-------|---------------|------------|------------------------------|-----------------------------|----------------|-------------------------|-------------------------|------------------|
| MHz       | Ch. |              |       |               |            |                              |                             |                |                         |                         |                  |
| 5755      | 151 | WiFi U-NII-3 | Left  | Touch         | /          | 12.26                        | 14                          | 1.493          | 0.052                   | 0.078                   | 0.01             |
| 5755      | 151 | WiFi U-NII-3 | Left  | Tilt          | /          | 12.26                        | 14                          | 1.493          | <0.01                   | <0.01                   | 0.03             |
| 5755      | 151 | WiFi U-NII-3 | Right | Touch         | 19         | 12.26                        | 14                          | 1.493          | 0.077                   | 0.115                   | 0.01             |
| 5755      | 151 | WiFi U-NII-3 | Right | Tilt          | /          | 12.26                        | 14                          | 1.493          | 0.070                   | 0.105                   | 0.01             |

Table 14.20: SAR Values (WiFi 802.11n - Body)

| Frequency           |      | Mode /Band   | Service /Heads et | Test Position  | Spacing (mm) | Figure No. | Measured average power (dBm) | Maximum allowed Power (dBm) | Scaling factor | Measured SAR(1g ) (W/kg) | Report ed SAR(1g ) (W/kg) | Pow er Drift (dB) |
|---------------------|------|--------------|-------------------|----------------|--------------|------------|------------------------------|-----------------------------|----------------|--------------------------|---------------------------|-------------------|
| MHz                 | Ch . |              |                   |                |              |            |                              |                             |                |                          |                           |                   |
| Hotspot & Body worn |      |              |                   |                |              |            |                              |                             |                |                          |                           |                   |
| 5755                | 151  | WiFi U-NII-3 | 802.11N           | Toward Phantom | 10           | /          | 12.26                        | 14                          | 1.493          | <0.01                    | <0.01                     | -0.03             |
| 5755                | 151  | WiFi U-NII-3 | 802.11N           | Toward Ground  | 10           | /          | 12.26                        | 14                          | 1.493          | 0.035                    | 0.052                     | 0.01              |
| Hotspot             |      |              |                   |                |              |            |                              |                             |                |                          |                           |                   |
| 5755                | 151  | WiFi U-NII-3 | 802.11N           | Toward Left    | 10           | 20         | 12.26                        | 14                          | 1.493          | 0.036                    | 0.054                     | 0.00              |
| 5755                | 151  | WiFi U-NII-3 | 802.11N           | Toward Right   | 10           | /          | 12.26                        | 14                          | 1.493          | <0.01                    | <0.01                     | 0.05              |
| 5755                | 151  | WiFi U-NII-3 | 802.11N           | Toward Top     | 10           | /          | 12.26                        | 14                          | 1.493          | 0.011                    | 0.016                     | 0.03              |

## 14.2. Standalone SAR Test Result For I20D00114-SAR01

**Table 14.21: SAR Values for LTE B7**

| Band            | Test Position | Mode                     | Channel | Frequency (MHz) | Measured power (dBm) | Tune-up (dBm) | Power Drift (dB) | Limit of 1gSAR 1.6 W/kg (mW/g) |                |              | Figure No. |
|-----------------|---------------|--------------------------|---------|-----------------|----------------------|---------------|------------------|--------------------------------|----------------|--------------|------------|
|                 |               |                          |         |                 |                      |               |                  | Measured SAR1g                 | Scaling Factor | Report SAR1g |            |
| Body SAR (10mm) |               |                          |         |                 |                      |               |                  |                                |                |              |            |
| LTE B7          | Bottom Side   | QPSK_20MHz_1RB_50 offset | 20850   | 2510            | 18.6                 | 19.5          | 0                | 1.080                          | 1.230          | 1.329        | 1          |
| LTE B7          | Bottom Side   | QPSK_20MHz_1RB_50 offset | 21100   | 2535            | 18.62                | 19.5          | -0.02            | 1.070                          | 1.225          | 1.310        | /          |
| LTE B7          | Bottom Side   | QPSK_20MHz_1RB_50 offset | 21350   | 2560            | 18.61                | 19.5          | -0.09            | 0.992                          | 1.227          | 1.218        | /          |
| Repeated        |               |                          |         |                 |                      |               |                  |                                |                |              |            |
| LTE B7          | Bottom Side   | OPSK_20MHz_1RB_50 offset | 20850   | 2510            | 18.6                 | 19.5          | 0.02             | 1.070                          | 1.230          | 1.316        | /          |

## 14.3. Simultaneous SAR Evaluation

**Table 14.22: Simultaneous transmission SAR**

| Standalone SAR for 2G(W/Kg) |              |          |         |          |             |
|-----------------------------|--------------|----------|---------|----------|-------------|
| Test Position               |              |          | GSM 850 | GSM 1900 | Highest SAR |
| Head                        | Left         | Cheek    | 0.184   | 0.307    | 0.307       |
|                             |              | Tilt 15° | 0.066   | 0.113    | 0.113       |
|                             | Right        | Cheek    | 0.169   | 0.350    | 0.35        |
|                             |              | Tilt 15° | 0.085   | 0.094    | 0.094       |
| Hotspot &Body- worn 10 mm   | Phantom Side |          | 0.281   | 1.064    | 1.064       |
|                             | Ground Side  |          | 0.511   | 1.176    | 1.176       |
| Hotspot 10 mm               | Left Side    |          | 0.176   | 0.842    | 0.842       |
|                             | Right Side   |          | 0.109   | 0.192    | 0.192       |
|                             | Top Side     |          | --      | --       | --          |
|                             | Bottom Side  |          | 0.162   | 1.256    | 1.256       |

| Standalone SAR for 3G(W/Kg) |              |          |               |             |             |
|-----------------------------|--------------|----------|---------------|-------------|-------------|
| Test Position               |              |          | WCDMA Band II | WCDMA BandV | Highest SAR |
| Head                        | Left         | Cheek    | 0.269         | 0.192       | 0.269       |
|                             |              | Tilt 15° | 0.076         | 0.094       | 0.094       |
|                             | Right        | Cheek    | 0.352         | 0.177       | 0.352       |
|                             |              | Tilt 15° | 0.089         | 0.079       | 0.089       |
| Hotspot &Body- worn 10 mm   | Phantom Side |          | 0.722         | 0.162       | 0.722       |

|               |             |       |       |       |
|---------------|-------------|-------|-------|-------|
|               | Ground Side | 0.541 | 0.295 | 0.541 |
| Hotspot 10 mm | Left Side   | 0.113 | 0.119 | 0.119 |
|               | Right Side  | 0.187 | 0.072 | 0.187 |
|               | Top Side    | --    | --    | --    |
|               | Bottom Side | 0.948 | 0.079 | 0.948 |

| Standalone SAR for 4G (W/Kg) |              |          |            |             |
|------------------------------|--------------|----------|------------|-------------|
| Test Position                |              |          | LTE Band 7 | Highest SAR |
| Head                         | Left         | Cheek    | 0.118      | 0.118       |
|                              |              | Tilt 15° | 0.078      | 0.078       |
|                              | Right        | Cheek    | 0.285      | 0.285       |
|                              |              | Tilt 15° | 0.048      | 0.048       |
| Hotspot &Body- worn 10 mm    | Phantom Side |          | 0.446      | 0.916       |
|                              | Ground Side  |          | 0.808      | 0.808       |
| Hotspot 10 mm                | Left Side    |          | 0.066      | 0.136       |
|                              | Right Side   |          | 0.110      | 0.23        |
|                              | Top Side     |          | --         | --          |
|                              | Bottom Side  |          | 1.329      | 1.329       |

| Simultaneous multi-band transmission |              |          |       |       |       |        |       |       |       |
|--------------------------------------|--------------|----------|-------|-------|-------|--------|-------|-------|-------|
| Test Position                        |              |          | 2G    | 3G    | 4G    | 2.4GHz |       | 5GHz  | SUM   |
|                                      |              |          |       |       |       | BT     | WiFi  | WiFi  |       |
| Head(1g)                             | Left         | Cheek    | 0.307 | 0.269 | 0.118 | 0.265  | 0.407 | 0.079 | 0.714 |
|                                      |              | Tilt 15° | 0.113 | 0.094 | 0.078 | 0.265  | 0.132 | 0.076 | 0.378 |
|                                      | Right        | Cheek    | 0.35  | 0.352 | 0.285 | 0.265  | 0.350 | 0.219 | 0.702 |
|                                      |              | Tilt 15° | 0.094 | 0.089 | 0.048 | 0.265  | 0.217 | 0.152 | 0.359 |
| Hotspot &Body- worn 10 mm(1g)        | Phantom Side |          | 1.064 | 0.722 | 0.916 | 0.132  | 0.057 | 0.093 | 1.196 |
|                                      | Ground Side  |          | 1.176 | 0.541 | 0.808 | 0.132  | 0.109 | 0.090 | 1.308 |
| Hotspot 10 mm(1g)                    | Left Side    |          | 0.842 | 0.119 | 0.136 | 0.132  | 0.044 | 0.120 | 0.974 |
|                                      | Right Side   |          | 0.192 | 0.187 | 0.23  | 0.132  | 0.009 | 0.01  | 0.362 |
|                                      | Top Side     |          | --    | --    | --    | 0.132  | 0.038 | 0.046 | 0.132 |

|  |             |       |       |       |       |    |    |       |
|--|-------------|-------|-------|-------|-------|----|----|-------|
|  | Bottom Side | 1.256 | 0.948 | 1.329 | 0.132 | -- | -- | 1.461 |
|--|-------------|-------|-------|-------|-------|----|----|-------|

According to the conducted power measurement result, we can draw the conclusion that: stand-alone SAR for WiFi should be performed. Then, simultaneous transmission SAR for WiFi/BT is considered with measurement results of GSM/WCDMA/LTE/CDMA and WiFi/BT. According to the above table, the sum of reported SAR values for GSM/WCDMA/LTECDMA and WiFi<1.6W/kg. So the simultaneous transmission SAR is not required for WiFi/BT transmitter.

#### 14.4. SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

- 1) Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

**Table 14.23: SAR Measurement Variability (1g)**

| Frequency |       | Configuration                | Test Position | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio |
|-----------|-------|------------------------------|---------------|---------------------|---------------------------|-----------|
| MHz       | Ch.   |                              |               |                     |                           |           |
| 2510      | 20850 | QPSK_20MHz_1RB_50 offset Low | Bottom        | 1.08                | 1.07                      | 1.009     |

**Note:** According to the KDB 865664 D01 repeated measurement is not required when the original highest measured SAR is  $< 0.8$  W/kg.

## 15. Test Equipment Utilized

**Table 15.1 SAR Test System Equipment List**

| Item | Instrument Name       | Type           | Serial Number | Manufacturer | Cal. Date                | Cal. interval |
|------|-----------------------|----------------|---------------|--------------|--------------------------|---------------|
| 1    | Network analyzer      | N5242A         | MY51221755    | Agilent      | 2019-12-11               | 1 year        |
| 2    | Power meter           | NRVD           | 102257        | RS           | 2020-5-10                | 1 year        |
| 3    | Power sensor          | NRV-Z5         | 100241        |              |                          |               |
|      |                       |                | 100644        |              |                          |               |
| 4    | Signal Generator      | E4438C         | MY49072044    | Agilent      | 2020-5-10                | 1 Year        |
| 5    | Amplifier             | NTWPA-0086010F | 12023024      | rflight      | No Calibration Requested |               |
| 6    | Coupler               | 778D           | MY4825551     | Agilent      | 2020-5-10                | 1 year        |
| 7    | BTS                   | E5515C         | MY50266468    | Agilent      | 2019-12-11               | 1 year        |
|      |                       | MT8820C        | 6201240338    | Anritsu      | 2019-12-11               | 1 year        |
| 8    | E-field Probe         | EX3DV4         | 7401          | SPEAG        | 2020-4-1                 | 1 year        |
| 9    | DAE                   | SPEAG DAE4     | 1581          | SPEAG        | 2020-5-6                 | 1 year        |
| 10   | Dipole Validation Kit | SPEAG D2600V2  | 1031          | SPEAG        | 2018-11-1                | 3 year        |

## 16. Measurement Uncertainty

**Table 16.1 Measurement Uncertainty Evaluation for SAR test**

| Error Description            | Uncert. Value                               | Prob. Dist. | Div. | (Ci) | (Ci) | Std. Unc.[%] | Std. Unc.[%] | (Ui) ueff |
|------------------------------|---------------------------------------------|-------------|------|------|------|--------------|--------------|-----------|
|                              |                                             |             |      | 1g   | 10g  | (1g)         | (10g)        |           |
| Measurement System           |                                             |             |      |      |      |              |              |           |
| Probe Calibration            | 13.3                                        | N           | 2    | 1    | 1    | 6.65         | 6.65         | ∞         |
| Axial Isotropy               | 4.7                                         | R           | √3   | 0.7  | 0.7  | 1.90         | 1.90         | ∞         |
| Hemispherical Isotropy       | 9.6                                         | R           | √3   | 0.7  | 0.7  | 3.88         | 3.88         | ∞         |
| Boundary effects             | 1                                           | R           | √3   | 1    | 1    | 0.58         | 0.58         | ∞         |
| Linearity                    | 4.7                                         | R           | √3   | 1    | 1    | 2.70         | 2.70         | ∞         |
| System Detection Limits      | 1                                           | R           | √3   | 1    | 1    | 0.58         | 0.58         | ∞         |
| Readout Electronics          | 0.7                                         | N           | 1    | 1    | 1    | 0.70         | 0.70         | ∞         |
| Response Time                | 0.8                                         | R           | √3   | 1    | 1    | 0.50         | 0.50         | ∞         |
| Integration Time             | 2.6                                         | R           | √3   | 1    | 1    | 1.50         | 1.50         | ∞         |
| RF Ambient Noise             | 3                                           | R           | √3   | 1    | 1    | 1.70         | 1.70         | ∞         |
| RF Ambient Reflections       | 3                                           | R           | √3   | 1    | 1    | 1.70         | 1.70         | ∞         |
| Probe Positioner             | 0.4                                         | R           | √3   | 1    | 1    | 0.20         | 0.20         | ∞         |
| Probe Positioning            | 2.9                                         | R           | √3   | 1    | 1    | 1.70         | 1.70         | ∞         |
| Post-processing              | 4                                           | R           | √3   | 1    | 1    | 2.30         | 2.30         | ∞         |
| Test Sample Related          |                                             |             |      |      |      |              |              |           |
| Device Holder                | 2.55                                        | N           | 1    | 1    | 1    | 2.55         | 2.55         | 71        |
| Test sample Positioning      | 1.34                                        | N           | 1    | 1    | 1    | 1.34         | 1.34         | 3         |
| Power Drift                  | 5                                           | R           | √3   | 1    | 1    | 2.9          | 2.9          | ∞         |
| Phantom and Setup            |                                             |             |      |      |      |              |              |           |
| Phantom Uncertainty          | 4                                           | R           | √3   | 1    | 1    | 2.3          | 2.3          | ∞         |
| Liquid Conductivity (target) | 5                                           | R           | √3   | 0.64 | 0.43 | 2.9          | 2.9          | ∞         |
| Liquid Conductivity (meas.)  | 5                                           | N           | 1    | 0.64 | 0.43 | 5            | 5            | ∞         |
| Liquid Permittivity (target) | 5                                           | R           | √3   | 0.6  | 0.49 | 2.9          | 2.9          | ∞         |
| Liquid Permittivity (meas.)  | 5                                           | N           | 1    | 0.6  | 0.49 | 5            | 5            | ∞         |
| Combined Std. Uncertainty    | $U_c' = \sqrt{\sum_{i=1}^{23} C_i^2 U_i^2}$ |             |      |      |      | 11.23        | 10.70        |           |
| Expanded STD Uncertainty     | $U_c = 2U_c'$                               |             |      |      |      | 22.45        | 21.40        |           |

**Table 16.2 Measurement Uncertainty Evaluation for System Validation**

| Error Description             | Uncert. Value                            | Prob. Dist. | Div.       | (Ci) | (Ci) | Std. Unc.[%] | Std. Unc.[%] | (Ui) ueff |
|-------------------------------|------------------------------------------|-------------|------------|------|------|--------------|--------------|-----------|
|                               |                                          |             |            | 1g   | 10g  | (1g)         | (10g)        |           |
| Measurement System            |                                          |             |            |      |      |              |              |           |
| Probe Calibration             | 13.3                                     | N           | 2          | 1    | 1    | 6.65         | 6.65         | ∞         |
| Axial Isotropy                | 4.7                                      | R           | $\sqrt{3}$ | 0.7  | 0.7  | 1.90         | 1.90         | ∞         |
| Hemispherical Isotropy        | 9.6                                      | R           | $\sqrt{3}$ | 0.7  | 0.7  | 3.88         | 3.88         | ∞         |
| Boundary effects              | 1                                        | R           | $\sqrt{3}$ | 1    | 1    | 0.58         | 0.58         | ∞         |
| Linearity                     | 4.7                                      | R           | $\sqrt{3}$ | 1    | 1    | 2.70         | 2.70         | ∞         |
| System Detection Limits       | 1                                        | R           | $\sqrt{3}$ | 1    | 1    | 0.58         | 0.58         | ∞         |
| Readout Electronics           | 0.7                                      | N           | 1          | 1    | 1    | 0.70         | 0.70         | ∞         |
| Response Time                 | 0.8                                      | R           | $\sqrt{3}$ | 1    | 1    | 0.50         | 0.50         | ∞         |
| Integration Time              | 2.6                                      | R           | $\sqrt{3}$ | 1    | 1    | 1.50         | 1.50         | ∞         |
| RF Ambient Noise              | 3                                        | R           | $\sqrt{3}$ | 1    | 1    | 1.70         | 1.70         | ∞         |
| RF Ambient Reflections        | 3                                        | R           | $\sqrt{3}$ | 1    | 1    | 1.70         | 1.70         | ∞         |
| Probe Positioner              | 0.4                                      | R           | $\sqrt{3}$ | 1    | 1    | 0.20         | 0.20         | ∞         |
| Probe Positioning             | 2.9                                      | R           | $\sqrt{3}$ | 1    | 1    | 1.70         | 1.70         | ∞         |
| Post-processing               | 4                                        | R           | $\sqrt{3}$ | 1    | 1    | 2.30         | 2.30         | ∞         |
| Test Sample Related           |                                          |             |            |      |      |              |              |           |
| Validation Dipole Positioning | 2                                        | N           | 1          | 1    | 1    | 2            | 2            |           |
| Dipole Input Power            | 5                                        | N           | 1          | 1    | 1    | 5            | 5            |           |
| Power Drift                   | 5                                        | R           | $\sqrt{3}$ | 1    | 1    | 2.9          | 2.9          | ∞         |
| Phantom and Setup             |                                          |             |            |      |      |              |              |           |
| Phantom Uncertainty           | 4                                        | R           | $\sqrt{3}$ | 1    | 1    | 2.3          | 2.3          | ∞         |
| Liquid Conductivity (target)  | 5                                        | R           | $\sqrt{3}$ | 0.64 | 0.43 | 2.9          | 2.9          | ∞         |
| Liquid Conductivity (meas.)   | 5                                        | N           | 1          | 0.64 | 0.43 | 5            | 5            | ∞         |
| Liquid Permittivity (target)  | 5                                        | R           | $\sqrt{3}$ | 0.6  | 0.49 | 2.9          | 2.9          | ∞         |
| Liquid Permittivity (meas.)   | 5                                        | N           | 1          | 0.6  | 0.49 | 5            | 5            | ∞         |
| Combined Std. Uncertainty     | $U_C' = \sqrt{\sum_{i=1}^{23} Ci^2Ui^2}$ |             |            |      |      | 12.11        | 11.63        |           |
| Expanded STD Uncertainty      | $U_C = 2U_C'$                            |             |            |      |      | 24.23        | 23.26        |           |

\*\*\*END OF REPORT BODY\*\*\*

## ANNEX A. Graph Results

**Fig.1 LTE B7 20M 1RB 50offset Bottom Mode Low**

Date/Time: 2020/8/5

Electronics: DAE4 Sn1581

Medium parameters used (interpolated):  $f = 2510$  MHz;  $\sigma = 1.855$  S/m;  $\epsilon_r = 38.191$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.6°C Liquid Temperature: 22.6°C

Communication System: LTE B7 2600MHz; Frequency: 2510 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN7401ConvF(7.85, 7.85, 7.85) @ 2510 MHz

**LTE B7 20M 1RB 50offset Bottom Mode Low 2 2/Area Scan (51x81x1):**

Measurement grid:  $dx=10$  mm,  $dy=10$  mm

Maximum value of SAR (Measurement) = 1.74 W/kg

**LTE B7 20M 1RB 50offset Bottom Mode Low 2 2/Zoom Scan (7x7x7)/Cube 0:**

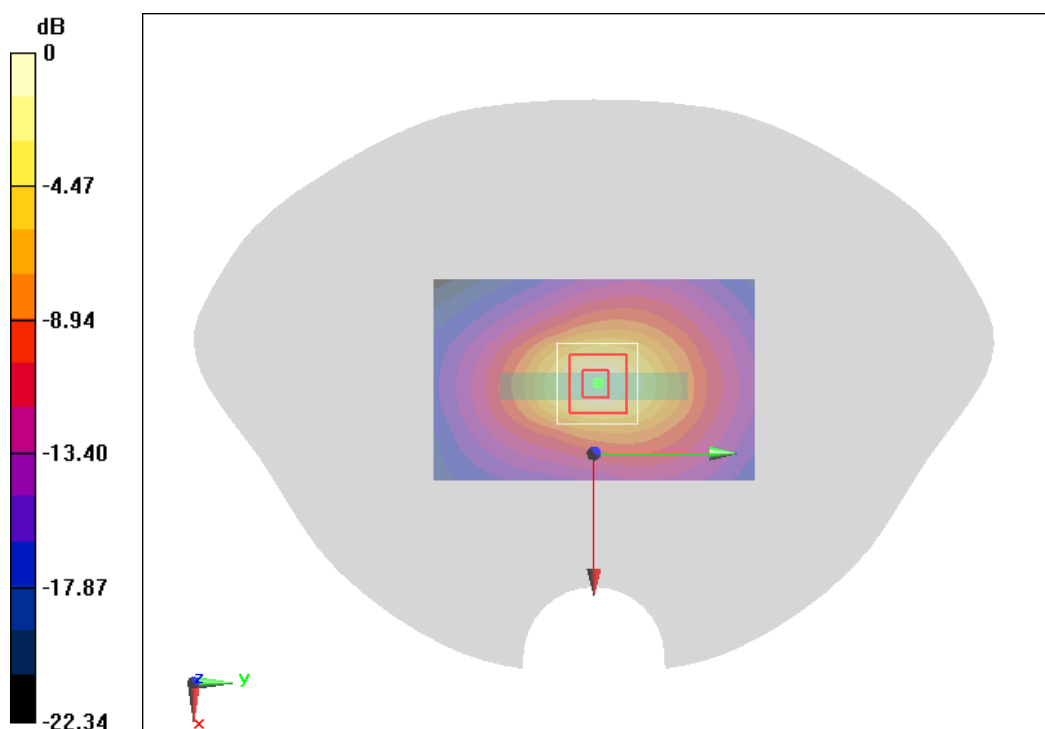
Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 32.06 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 2.18 W/kg

SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.520 W/kg

Maximum value of SAR (measured) = 1.77 W/kg



## ANNEX B. System Validation Plot

### Head 2600MHz

Date/Time: 2020/8/5

Electronics: DAE4 Sn1581

Medium parameters used:  $f = 2600 \text{ MHz}$ ;  $\sigma = 1.922 \text{ S/m}$ ;  $\epsilon_r = 38.054$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature:  $22.6^\circ\text{C}$  Liquid Temperature:  $22.6^\circ\text{C}$

Communication System: CW 2600MHz; Frequency: 2600 MHz; Duty Cycle: 1:1

Probe: EX3DV4 - SN7401ConvF(7.6, 7.6, 7.6) @ 2600 MHz

#### Head 2600MHz/Area Scan (81x71x1):

Measurement grid:  $dx=10 \text{ mm}$ ,  $dy=10 \text{ mm}$

Maximum value of SAR (Measurement) =  $17.4 \text{ W/kg}$

#### Head 2600MHz /Zoom Scan (7x7x7)/Cube 0:

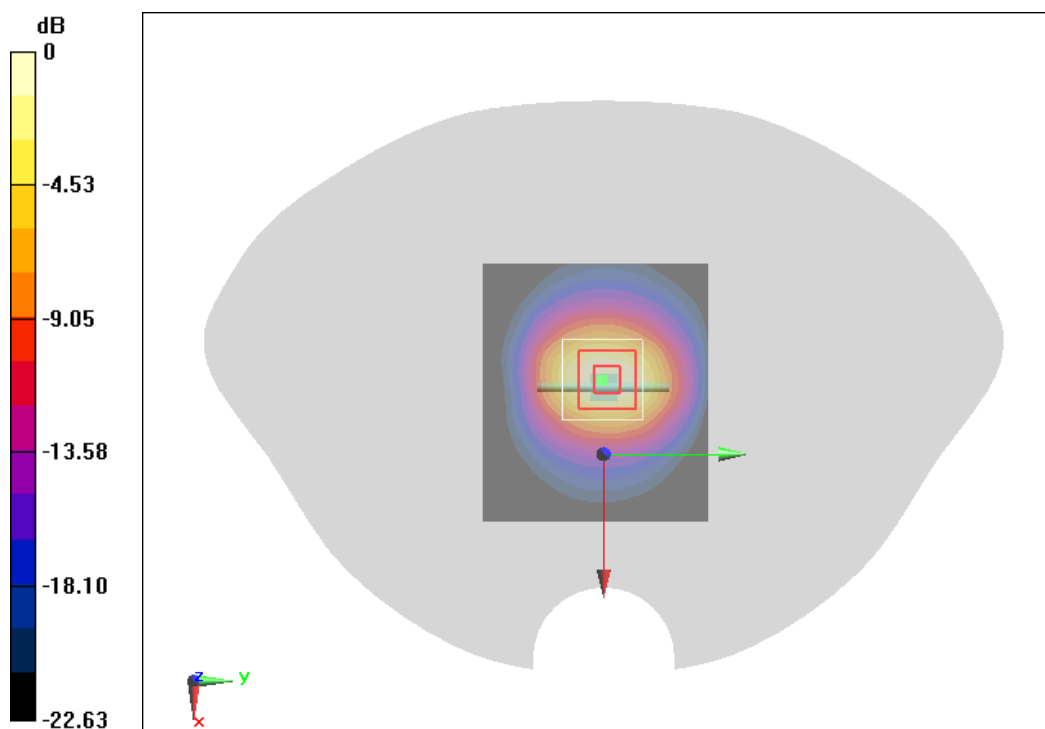
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $91.39 \text{ V/m}$ ; Power Drift =  $-0.18 \text{ dB}$

Peak SAR (extrapolated) =  $31.8 \text{ W/kg}$

SAR(1 g) =  $14.4 \text{ W/kg}$ ; SAR(10 g) =  $6.56 \text{ W/kg}$

Maximum value of SAR (measured) =  $16.2 \text{ W/kg}$



## ANNEX C. Calibration Certification



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Client : **CTTL-SH**

Certificate No: **Z20-60180**

### CALIBRATION CERTIFICATE

Object **DAE4 - SN: 1581**

Calibration Procedure(s) **FF-Z11-002-01**  
**Calibration Procedure for the Data Acquisition Electronics (DAEx)**

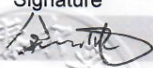
Calibration date: **May 06, 2020**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards      | ID #    | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------|---------|------------------------------------------|-----------------------|
| Process Calibrator 753 | 1971018 | 24-Jun-19 (CTTL, No.J19X05126)           | Jun-20                |

|                | Name        | Function           | Signature                                                                             |
|----------------|-------------|--------------------|---------------------------------------------------------------------------------------|
| Calibrated by: | Yu Zongying | SAR Test Engineer  |  |
| Reviewed by:   | Lin Hao     | SAR Test Engineer  |  |
| Approved by:   | Qi Dianyuan | SAR Project Leader |  |

Issued: May 08, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z20-60180

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