FCC SAR TEST REPORT

FCC ID	**:**	**RWO-RZ350259**
Equipment	**:**	**Smartphone**
Brand Name	**:**	**RAZER**
Model Name	**:**	**RZ35-0259**
Applicant	**:**	**Razer Inc.** **9 Pasteur, Suite 100, Irvine, California, United States 92618**
Manufacturer	**:**	**Razer Inc.** **9 Pasteur, Suite 100, Irvine, California, United States 92618**
Standard	**:**	**FCC 47 CFR Part 2 (2.1093)**

The product was received on Jan 18, 2021 and testing was started from Jan 21, 2021 and completed on Feb 05, 2021. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample provide by manufacturer and the test data has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been pass the FCC requirement.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Cona Huang

Approved by: Cona Huang / Deputy Manager

ilac-MRA TAF Testing Laboratory 1190

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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History of this test report

Report No.	Version	Description	Issued Date
FA9D2015-03	01	Initial issue of report	Feb. 23, 2021

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Razer Inc., Smartphone, RZ35-0259, are as follows.

Frequency Band		Highest SAR Summary			
		Head (Separation 0mm)	Body-worn (Separation 15mm)	Hotspot (Separation 10mm)	Product Specific (Separation 0mm)
		1g SAR (W/kg)			10g SAR (W/kg)
WCDMA	WCDMA II		0.51	0.53	2.55
	WCDMA IV		0.43	0.46	2.35
LTE	LTE Band 2		0.59	0.55	2.28
	LTE Band 7	0.05	0.21	1.08	3.27
	LTE Band 30	0.07	0.42	0.44	3.28
	LTE Band 66		0.39	0.43	2.50
Date of Testing:		2021/1/21~2021/2/5			

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC test. This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR, 4.0 W/kg for Product Specific 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

Reviewed by: Jason Wang
Report Producer: Carlie Tsai

2. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards, the below KDB standard may not including in the TAF code without accreditation.

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01
- FCC KDB 941225 D07 UMPC Mini Tablet v01r02

3. Equipment Under Test (EUT) Information

3.1 General Information

Product Feature & Specification	
Equipment Name	Smartphone
Brand Name	RAZER
Model Name	RZ35-0259
FCC ID	RWO-RZ350259
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 14: 790.5 MHz ~ 795.5 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 26: 824.7 MHz ~ 848.3 MHz LTE Band 30: 2307.5 MHz ~ 2312.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz LTE Band 41: 2502.5 MHz ~ 2687.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 MHz LTE Band 71: 665.5 MHz ~ 695.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM, 64QAM WLAN 2.4GHz : 802.11b/g/n HT20/HT40 WLAN 5GHz : 802.11a/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE NFC:ASK
HW Version	4.0
SW Version	P-SMR7-RC003-RZR-210107.3225
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
Remark: 1. This report is a market spot check result that only contains the plans that need to be tested and showing section13. 2. For this report using the SW to reduce output power for LTE B7 and B30 for each exposure condition.	

3.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05	
FCC ID	RWO-RZ350259
Equipment Name	SMARTPHONE
Operating Frequency Range of each LTE transmission band	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 66: 1710 MHz ~ 1780 MHz
Channel Bandwidth	LTE Band 2: 20MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 30: 5MHz, 10MHz LTE Band 66: 20MHz
uplink modulations used	QPSK / 16QAM / 64QAM
LTE Voice / Data requirements	Voice and Data
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3 (see below)
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.
Power reduction applied to satisfy SAR compliance	Yes, when operating in hotspot mode that LTE B2 / B30 / B66 power reduction applied to satisfy SAR compliance.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 2

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

LTE Band 30

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq.(MHz)
L	27685	2307.5		
M	27710	2310	27710	2310
H	27735	2312.5		

LTE Band 66

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	131979	1710.7	131987	1711.5	131997	1712.5	132022	1715	132047	1717.5	132072	1720
M	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745
H	132665	1779.3	132657	1778.5	132647	1777.5	132622	1775	132597	1772.5	132572	1770

4. RF Exposure Limits

4.1 Uncontrolled Environment

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

4.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

5. Specific Absorption Rate (SAR)

5.1 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.

5.2 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 (ρ). The equation description is as below:

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

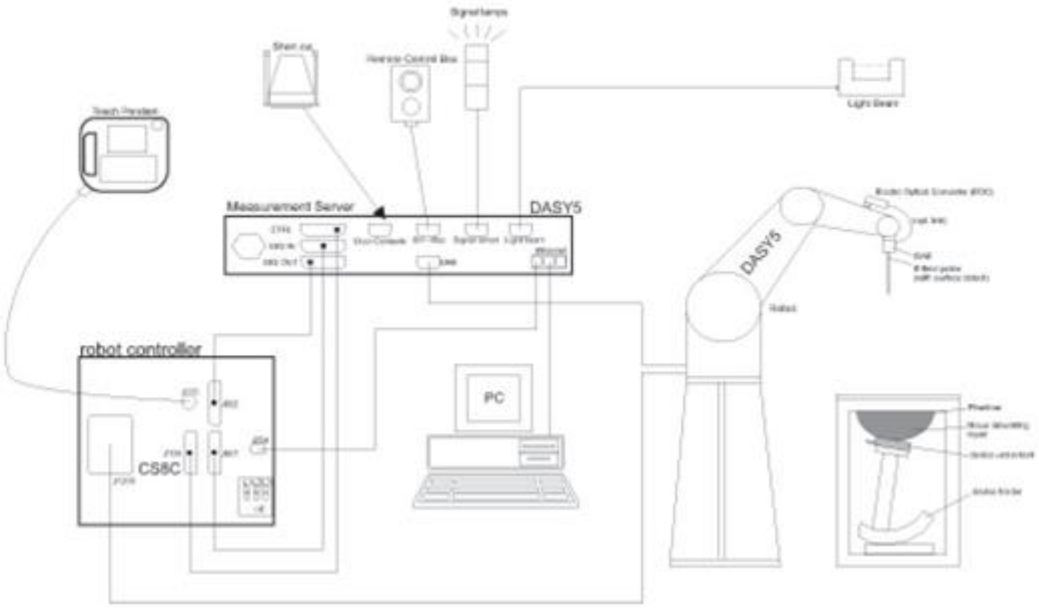
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

6. System Description and Setup

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



- A standard high precision 6-axis robot 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 or Win7 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.

6.1 Test Site Location

The SAR measurement facilities used to collect data are within both Sporton Lab list below test site location are accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190 and 0007) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC test.

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory			
Test Site Location	TW1190 No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, CHINESE TAIPEI		TW0007 No. 58, Aly. 75, Ln. 564, Wehnua 3rd, Rd., Guishan Dist., Taoyuan City, CHINESE TAIPEI	
Test Site No.	SAR01-HY	SAR03-HY	SAR08-HY	SAR09-HY
	SAR04-HY	SAR05-HY	SAR11-HY	SAR12-HY
	SAR06-HY	SAR10-HY		

6.2 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<ES3DV3 Probe>

Construction	Symmetric design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz – 4 GHz; Linearity: ±0.2 dB (30 MHz – 4 GHz)
Directivity	±0.2 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range	5 µW/g – >100 mW/g; Linearity: ±0.2 dB
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 3.9 mm (body: 12 mm) Distance from probe tip to dipole centers: 3.0 mm

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

6.3 Data Acquisition Electronics (DAE)

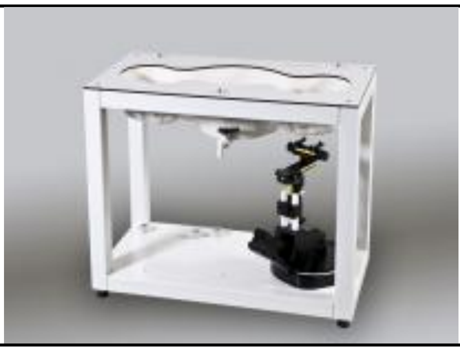
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an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

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

Fig 5.1 Photo of DAE

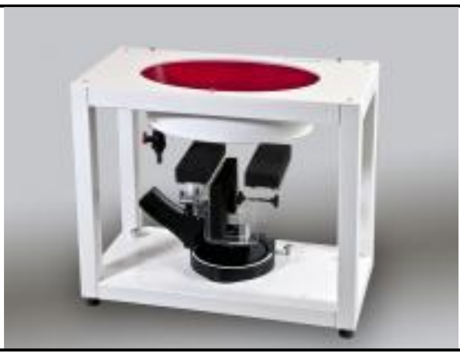
6.4 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

6.5 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.


Mounting Device for Hand-Held Transmitters


Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

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 positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.


Mounting Device for Laptops

7. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) 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

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

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

7.1 Spatial Peak SAR Evaluation

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

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

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

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

7.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

7.3 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 fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

7.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

7.5 Volume Scan Procedures

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

7.6 Power Drift Monitoring

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

8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	1750MHz System Validation Kit(2)	D1750V2	1112	Mar. 07, 2019	Mar. 05, 2021
SPEAG	1900MHz System Validation Kit(2)	D1900V2	5d041	Sep. 11, 2018	Sep. 08, 2021
SPEAG	1900MHz System Validation Kit(2)	D1900V2	5d185	Mar. 07, 2019	Mar. 05, 2021
SPEAG	2300MHz System Validation Kit(2)	D2300V2	1006	Jan. 28, 2019	Jan. 25, 2022
SPEAG	2600MHz System Validation Kit(2)	D2600V2	1008	Aug. 31, 2018	Aug. 28, 2021
SPEAG	Data Acquisition Electronics	DAE3	495	Jul. 21, 2020	Jul. 20, 2021
SPEAG	Data Acquisition Electronics	DAE4	699	Feb. 26, 2020	Feb. 25, 2021
SPEAG	Data Acquisition Electronics	DAE4	913	May. 06, 2020	May. 05, 2021
SPEAG	Data Acquisition Electronics	DAE4	914	Jun. 22, 2020	Jun. 21, 2021
SPEAG	Dosimetric E-Field Probe	ES3DV3	3184	Sep. 23, 2020	Sep. 22, 2021
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 23, 2020	Sep. 22, 2021
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Oct. 22, 2020	Oct. 21, 2021
RCPTWN	Thermometer	HTC-1	TM685-1	Nov. 10, 2020	Nov. 09, 2021
RCPTWN	Thermometer	HTC-1	TM560-2	Nov. 10, 2020	Nov. 09, 2021
Anritsu	Radio Communication Analyzer	MT8821C	6201341950	Nov. 10, 2020	Nov. 09, 2021
Keysight	Wireless Communication Test Set	E5515C	MY50267236	Mar. 18, 2020	Mar. 17, 2021
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Nov. 11, 2020	Nov. 10, 2021
Keysight	ENA Network Analyzer	E5071C	MY46101588	Jun. 10, 2020	Jun. 09, 2021
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Sep. 16, 2020	Sep. 15, 2021
LINE SEIKI	Digital Thermometer	DTM3000-spezial	2942	Nov. 06, 2020	Nov. 05, 2021
Anritsu	Power Meter	ML2495A	1419002	Aug. 19, 2020	Aug. 18, 2021
Anritsu	Power Sensor	MA2411B	1911176	Aug. 18, 2020	Aug. 17, 2021
Anritsu	Power Meter	ML2495A	1804003	Oct. 21, 2020	Oct. 20, 2021
Anritsu	Power Sensor	MA2411B	1726150	Oct. 21, 2020	Oct. 20, 2021
Anritsu	Spectrum Analyzer	MS2830A	6201396378	Jun. 30, 2020	Jun. 29, 2021
Anritsu	Spectrum Analyzer	N9010A	MY53470118	Mar. 12, 2020	Mar. 11, 2021
Mini-Circuits	Power Amplifier	ZVE-8G+	6418	Oct. 21, 2020	Oct. 20, 2021
Mini-Circuits	Power Amplifier	ZVE-8G+	479102029	Aug. 26, 2020	Aug. 25, 2021
ATM	Dual Directional Coupler	C122H-10	P610410z-02	Note 1	
Woken	Attenuator 1	WK0602-XX	N/A	Note 1	
PE	Attenuator 2	PE7005-10	N/A	Note 1	
PE	Attenuator 3	PE7005- 3	N/A	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. The dipole calibration interval can be extended to 3 years with justification according to KDB 865664 D01. The dipoles are also not physically damaged, or repaired during the interval. The justification data in appendix C can be found which the return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration for each dipole.

9. System Verification

9.1 Tissue Verification

The tissue dielectric parameters of tissue-equivalent media used for SAR measurements must be characterized within a temperature range of 18℃ to 25℃, measured with calibrated instruments and apparatuses, such as network analyzers and temperature probes. The temperature of the tissue-equivalent medium during SAR measurement must also be within 18℃ to 25℃ and within ± 2℃ of the temperature when the tissue parameters are characterized. The tissue dielectric measurement system must be calibrated before use. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements.
The liquid tissue depth was at least 15cm in the phantom for all SAR testing

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
1750	22.8	1.380	41.416	1.37	40.10	0.73	3.28	±5	2021/1/21
1750	22.9	1.392	39.645	1.37	40.10	1.61	-1.13	±5	2021/1/23
1900	22.8	1.408	41.386	1.40	40.00	0.57	3.47	±5	2021/1/21
1900	22.1	1.384	41.074	1.40	40.00	-1.14	2.69	±5	2021/1/22
1900	22.9	1.402	40.595	1.40	40.00	0.14	1.49	±5	2021/1/23
2300	22.1	1.641	40.815	1.67	39.50	-1.74	3.33	±5	2021/1/22
2300	22.4	1.645	39.520	1.67	39.50	-1.50	0.05	±5	2021/2/5
2600	22.6	1.927	38.640	1.96	39.00	-1.68	-0.92	±5	2021/1/22
2600	22.3	1.964	37.501	1.96	39.00	0.20	-3.84	±5	2021/1/22

9.2 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2021/1/21	1750	250	D1750V2-1112	ES3DV3 - SN3270	DAE3 Sn495	8.87	36.70	35.48	-3.32	4.76	19.40	19.04	-1.86
2021/1/23	1750	250	D1750V2-1112	ES3DV3 - SN3270	DAE3 Sn495	8.53	36.70	34.12	-7.03	4.58	19.40	18.32	-5.57
2021/1/21	1900	250	D1900V2-5d185	ES3DV3 - SN3270	DAE3 Sn495	9.75	39.40	39	-1.02	5.05	20.50	20.2	-1.46
2021/1/22	1900	250	D1900V2-5d185	ES3DV3 - SN3184	DAE4 Sn914	9.44	39.40	37.76	-4.16	5.03	20.50	20.12	-1.85
2021/1/23	1900	250	D1900V2-5d041	ES3DV3 - SN3270	DAE3 Sn495	10.20	40.20	40.8	1.49	5.24	21.20	20.96	-1.13
2021/1/22	2300	250	D2300V2-1006	ES3DV3 - SN3184	DAE4 Sn914	11.40	48.70	45.6	-6.37	5.50	23.20	22	-5.17
2021/2/5	2300	250	D2300V2-1006	ES3DV3 - SN3184	DAE4 Sn913	11.40	48.70	45.6	-6.37	5.50	23.20	22	-5.17
2021/1/22	2600	50	D2600V2-1008	EX3DV4 - SN3931	DAE4 Sn699	2.84	56.40	56.8	0.71	1.32	25.30	26.4	4.35
2021/1/22	2600	250	D2600V2-1008	ES3DV3 - SN3270	DAE3 Sn495	14.00	56.40	56	-0.71	6.27	25.30	25.08	-0.87

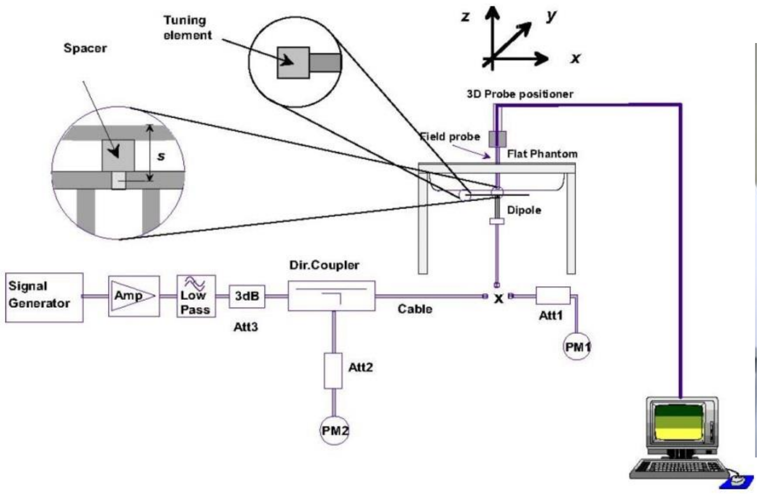


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

10. RF Exposure Positions

10.1 Ear and handset reference point

Figure 9.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 9.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 9.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 9.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

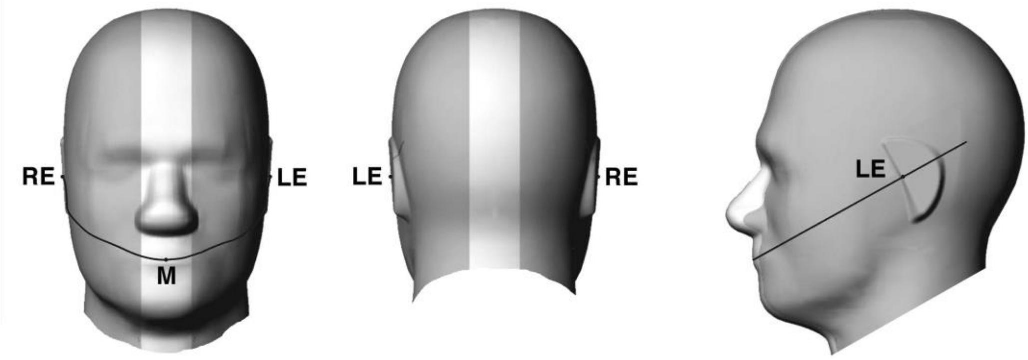


Fig 9.1.1 Front, back, and side views of SAM twin phantom

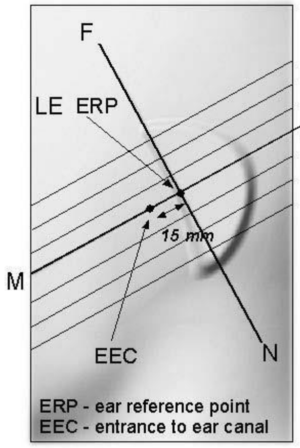


Fig 9.1.2 Close-up side view of phantom showing the ear region.

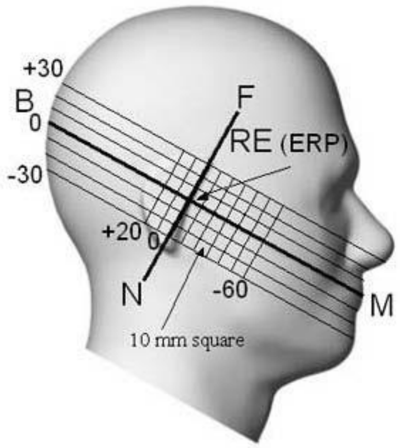


Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

10.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 9.2.1 and Figure 9.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 9.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 9.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 9.2.3. The actual rotation angles should be documented in the test report.

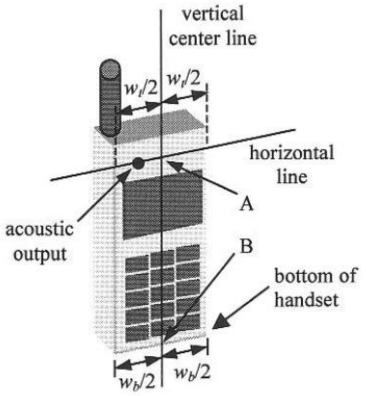


Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case

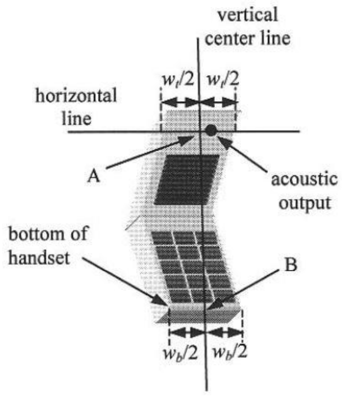


Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

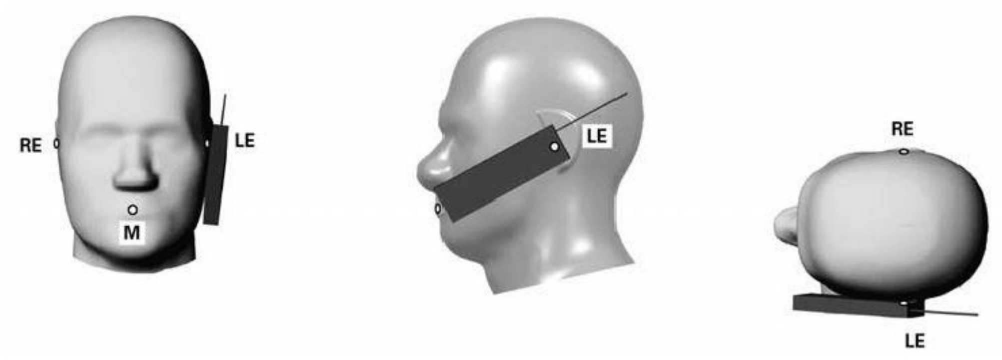


Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

10.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 9.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

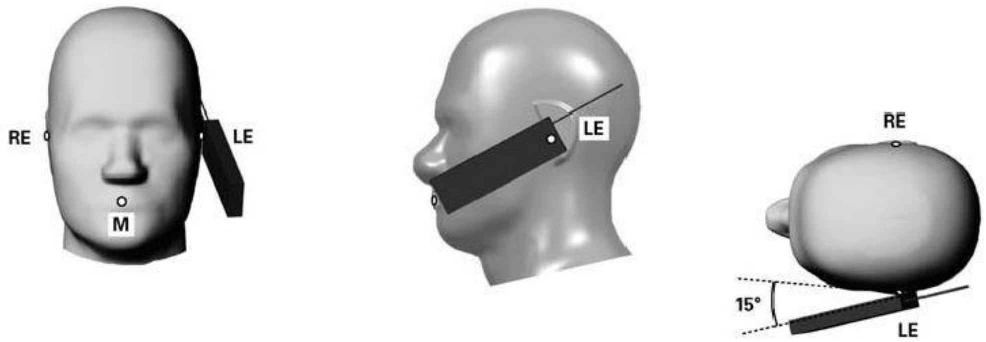


Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

10.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

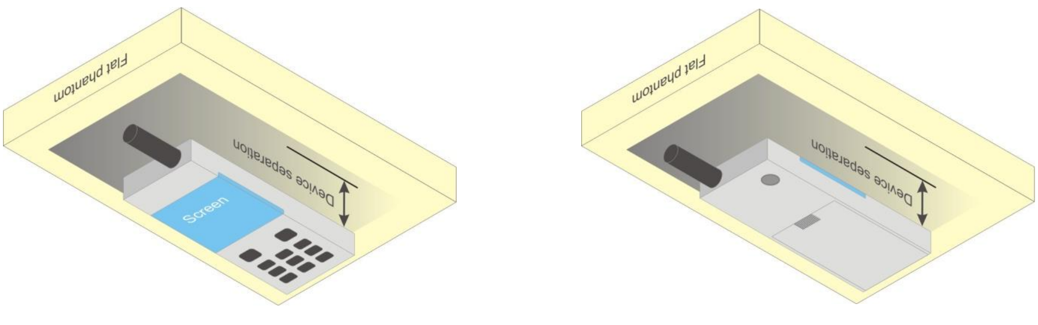


Fig 9.4 Body Worn Position

10.5 Extremity Exposure

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, According to KDB648474 D04v01r03, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.

2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions.6 The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

10.6 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

11. UMTS/LTE Output Power (Unit: dBm)

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

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

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

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

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

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

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

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

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

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 4) (Note 5)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM (dB) *(Note 2)*	MPR (dB) *(Note 2) (Note 6)*	*AG Index (Note 5)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with $\beta_{hs} = 5/15 * \beta_c$.

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

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

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

Setup Configuration

DC-HSDPA 3GPP release 8 Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
      a). Subtest 1: β_c/β_d=2/15
      b). Subtest 2: β_c/β_d=12/15
      c). Subtest 3: β_c/β_d=15/8
      d). Subtest 4: β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

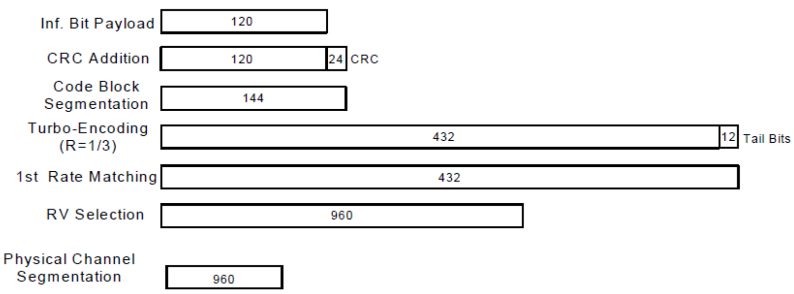


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”.
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

Default Power Mode

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513	
Rx Channel		9662	9800	9938		1537	1638	1738	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1732.6	1752.6	
3GPP Rel 99	RMC 12.2Kbps	22.38	22.33	22.30	22.50	21.84	21.83	21.72	22.00

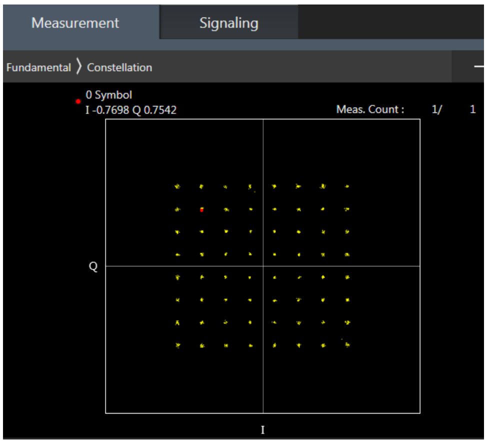
Reduced Power Mode

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513	
Rx Channel		9662	9800	9938		1537	1638	1738	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1732.6	1752.6	
3GPP Rel 99	RMC 12.2Kbps	17.77	17.74	17.72	19.50	19.05	18.98	18.90	19.50

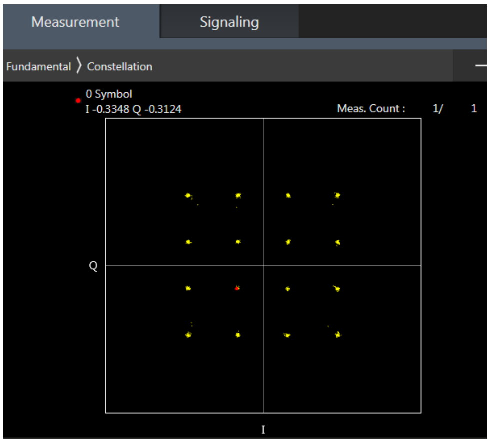
<LTE Conducted Power>

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, 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 ≤ 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.
6. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the MT8821C base station, therefore, the device 64QAM and 16QAM signal modulation are correct.



64QAM



16QAM

Default Power Mode

<LTE Band 2>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				18700	18900	19100	
Frequency (MHz)				1860	1880	1900	
20	QPSK	1	0	21.37	21.52	21.79	22
20	QPSK	1	49	21.37	21.49	21.55	
20	QPSK	1	99	21.24	21.54	21.78	
20	QPSK	50	0	20.47	20.63	20.83	21
20	QPSK	50	24	20.41	20.53	20.74	
20	QPSK	50	50	20.47	20.44	20.62	
20	QPSK	100	0	20.39	20.57	20.80	

<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				20850	21100	21350	
Frequency (MHz)				2510	2535	2560	
20	QPSK	1	0	21.70	21.64	21.90	22
20	QPSK	1	49	21.62	21.56	21.39	
20	QPSK	1	99	21.42	21.57	21.42	
20	QPSK	50	0	20.71	20.69	20.64	21
20	QPSK	50	24	20.63	20.62	20.52	
20	QPSK	50	50	20.59	20.47	20.46	
20	QPSK	100	0	20.58	20.60	20.56	
20	16QAM	1	0	20.75	20.69	20.95	21
20	16QAM	1	49	20.86	20.96	20.48	
20	16QAM	1	99	20.55	20.99	20.96	
20	16QAM	50	0	19.78	19.87	19.78	20
20	16QAM	50	24	19.67	19.68	19.65	
20	16QAM	50	50	19.71	19.62	19.62	
20	16QAM	100	0	19.64	19.67	19.65	
20	64QAM	1	0	19.99	19.89	20.00	20
20	64QAM	1	49	19.84	19.87	19.69	
20	64QAM	1	99	19.44	19.68	19.65	
20	64QAM	50	0	18.84	18.82	18.77	19
20	64QAM	50	24	18.73	18.75	18.69	
20	64QAM	50	50	18.58	18.61	18.62	
20	64QAM	100	0	18.70	18.61	18.62	
Channel				20825	21100	21375	Tune-up limit (dBm)
Frequency (MHz)				2507.5	2535	2562.5	
15	QPSK	1	0	21.56	21.74	21.65	22
15	QPSK	1	37	21.34	21.55	21.58	
15	QPSK	1	74	21.42	21.36	21.54	
15	QPSK	36	0	20.55	20.69	20.55	21
15	QPSK	36	20	20.60	20.61	20.60	
15	QPSK	36	39	20.52	20.47	20.50	
15	QPSK	75	0	20.63	20.57	20.49	
15	16QAM	1	0	20.91	20.93	20.99	21
15	16QAM	1	37	20.52	20.66	20.69	
15	16QAM	1	74	20.58	20.72	20.64	
15	16QAM	36	0	19.52	19.72	19.66	20

15	16QAM	36	20	19.60	19.65	19.72	
15	16QAM	36	39	19.56	19.55	19.62	
15	16QAM	75	0	19.65	19.70	19.54	
15	64QAM	1	0	20.00	19.73	19.95	20
15	64QAM	1	37	19.98	19.97	19.90	
15	64QAM	1	74	19.74	19.86	19.59	
15	64QAM	36	0	18.64	18.76	18.63	19
15	64QAM	36	20	18.72	18.66	18.69	
15	64QAM	36	39	18.62	18.61	18.64	
15	64QAM	75	0	18.71	18.61	18.63	
Channel				20800	21100	21400	Tune-up limit (dBm)
Frequency (MHz)				2505	2535	2565	
10	QPSK	1	0	21.54	21.61	21.52	22
10	QPSK	1	25	21.43	21.47	21.61	
10	QPSK	1	49	21.39	21.49	21.47	
10	QPSK	25	0	20.45	20.60	20.65	21
10	QPSK	25	12	20.47	20.56	20.54	
10	QPSK	25	25	20.56	20.46	20.60	
10	QPSK	50	0	20.58	20.61	20.57	
10	16QAM	1	0	21.00	20.78	20.99	21
10	16QAM	1	25	20.52	20.70	20.83	
10	16QAM	1	49	20.74	20.62	20.50	
10	16QAM	25	0	19.63	19.67	19.71	20
10	16QAM	25	12	19.69	19.78	19.71	
10	16QAM	25	25	19.60	19.70	19.59	
10	16QAM	50	0	19.70	19.60	19.73	
10	64QAM	1	0	19.62	19.86	19.89	20
10	64QAM	1	25	19.82	19.57	19.80	
10	64QAM	1	49	19.62	19.66	19.68	
10	64QAM	25	0	18.62	18.68	18.83	19
10	64QAM	25	12	18.54	18.75	18.67	
10	64QAM	25	25	18.64	18.56	18.57	
10	64QAM	50	0	18.78	18.73	18.70	
Channel				20775	21100	21425	Tune-up limit (dBm)
Frequency (MHz)				2502.5	2535	2567.5	
5	QPSK	1	0	21.48	21.56	21.52	22
5	QPSK	1	12	21.41	21.58	21.58	
5	QPSK	1	24	21.38	21.31	21.47	
5	QPSK	12	0	20.49	20.56	20.64	21
5	QPSK	12	7	20.47	20.56	20.65	
5	QPSK	12	13	20.44	20.52	20.57	
5	QPSK	25	0	20.42	20.52	20.53	
5	16QAM	1	0	21.00	20.98	20.73	21
5	16QAM	1	12	20.65	20.44	20.96	
5	16QAM	1	24	20.43	20.83	20.72	
5	16QAM	12	0	19.57	19.60	19.71	20
5	16QAM	12	7	19.56	19.73	19.70	
5	16QAM	12	13	19.45	19.59	19.65	
5	16QAM	25	0	19.56	19.60	19.67	
5	64QAM	1	0	19.79	19.76	19.85	20
5	64QAM	1	12	19.50	19.62	19.80	
5	64QAM	1	24	19.73	19.81	19.67	
5	64QAM	12	0	18.69	18.66	18.71	19
5	64QAM	12	7	18.70	18.76	18.66	
5	64QAM	12	13	18.68	18.59	18.64	
5	64QAM	25	0	18.50	18.57	18.57	

<u><LTE Band 30></u>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel					27710		
Frequency (MHz)					2310		
10	QPSK	1	0		22.15		22.5
10	QPSK	1	25		22.08		
10	QPSK	1	49		21.94		
10	QPSK	25	0		21.17		21.5
10	QPSK	25	12		21.14		
10	QPSK	25	25		21.09		
10	QPSK	50	0		21.15		
10	16QAM	1	0		21.45		21.5
10	16QAM	1	25		21.45		
10	16QAM	1	49		21.22		
10	16QAM	25	0		20.30		20.5
10	16QAM	25	12		20.24		
10	16QAM	25	25		20.17		
10	16QAM	50	0		20.25		
10	64QAM	1	0		20.35		20.5
10	64QAM	1	25		20.37		
10	64QAM	1	49		20.16		
10	64QAM	25	0		19.30		19.5
10	64QAM	25	12		19.28		
10	64QAM	25	25		19.24		
10	64QAM	50	0		19.31		
Channel				27685	27710	27735	Tune-up limit (dBm)
Frequency (MHz)				2307.5	2310	2312.5	
5	QPSK	1	0	22.05	22.03	22.14	22.5
5	QPSK	1	12	21.96	22.08	21.94	
5	QPSK	1	24	22.06	21.96	21.95	
5	QPSK	12	0	21.06	21.13	21.11	21.5
5	QPSK	12	7	21.17	21.16	21.02	
5	QPSK	12	13	21.12	21.13	21.00	
5	QPSK	25	0	21.13	21.13	21.11	
5	16QAM	1	0	21.38	21.41	21.49	21.5
5	16QAM	1	12	21.33	21.42	21.29	
5	16QAM	1	24	21.42	21.31	21.22	
5	16QAM	12	0	20.16	20.25	20.25	20.5
5	16QAM	12	7	20.25	20.26	20.14	
5	16QAM	12	13	20.21	20.20	20.10	
5	16QAM	25	0	20.23	20.21	20.22	
5	64QAM	1	0	20.33	20.33	20.41	20.5
5	64QAM	1	12	20.23	20.35	20.21	
5	64QAM	1	24	20.34	20.23	20.21	
5	64QAM	12	0	19.22	19.32	19.29	19.5
5	64QAM	12	7	19.32	19.31	19.20	
5	64QAM	12	13	19.26	19.27	19.15	
5	64QAM	25	0	19.25	19.24	19.25	

<LTE Band 66>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				132072	132322	132572	
Frequency (MHz)				1720	1745	1770	
20	QPSK	1	0	21.97	21.76	21.54	22
20	QPSK	1	49	21.82	21.52	21.43	
20	QPSK	1	99	21.68	21.47	21.48	
20	QPSK	50	0	20.92	20.75	20.59	21
20	QPSK	50	24	20.87	20.71	20.64	
20	QPSK	50	50	20.76	20.65	20.52	
20	QPSK	100	0	20.76	20.68	20.53	

Reduced Power Mode

<LTE Band 2>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				18700	18900	19100	
Frequency (MHz)				1860	1880	1900	
20	QPSK	1	0	17.40	17.53	17.94	19
20	QPSK	1	49	17.30	17.29	17.72	
20	QPSK	1	99	17.46	17.43	17.82	
20	QPSK	50	0	17.45	17.53	17.81	19
20	QPSK	50	24	17.43	17.52	17.74	
20	QPSK	50	50	17.45	17.41	17.67	
20	QPSK	100	0	17.43	17.51	17.82	

<LTE Band 30>

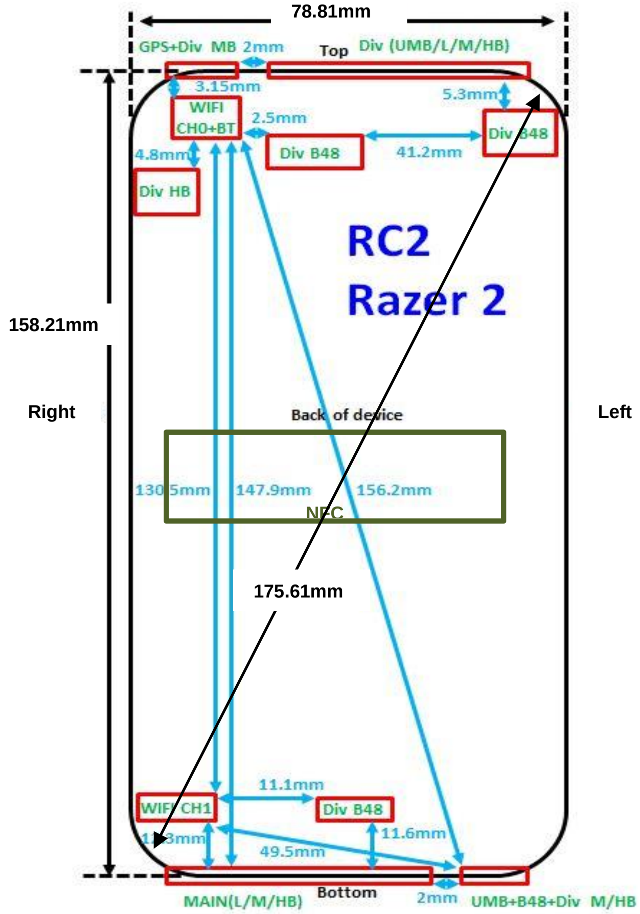
BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				27710			
Frequency (MHz)				2310			
10	QPSK	1	0		18.29		20
10	QPSK	1	25		18.20		
10	QPSK	1	49		18.01		
10	QPSK	25	0		18.27		20
10	QPSK	25	12		18.27		
10	QPSK	25	25		18.20		
10	QPSK	50	0		18.28		

<LTE Band 66>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				132072	132322	132572	
Frequency (MHz)				1720	1745	1770	
20	QPSK	1	0	18.68	18.39	18.30	19.5
20	QPSK	1	49	18.21	18.10	18.15	
20	QPSK	1	99	18.18	18.09	18.09	
20	QPSK	50	0	18.53	18.37	18.30	19.5
20	QPSK	50	24	18.38	18.24	18.24	
20	QPSK	50	50	18.28	18.19	18.14	
20	QPSK	100	0	18.38	18.26	18.13	

12. Antenna Location

<Mobile Phone>



13. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
2. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
3. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

UMTS Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

LTE Note:

1. Per KDB 941225 D05v02r05, 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. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05v02r05, 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 ≤ 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. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
5. Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.

13.1 Head SAR

<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	LTE Band 7	20M	QPSK	1	0	Right Cheek	0mm	21350	2560	21.90	22.00	1.023	-0.13	0.053	0.054
	LTE Band 7	20M	QPSK	50	0	Right Cheek	0mm	20850	2510	20.71	21.00	1.069	-0.12	0.038	0.041
	LTE Band 7	20M	QPSK	1	0	Right Tilted	0mm	21350	2560	21.90	22.00	1.023	0.16	0.042	0.043
	LTE Band 7	20M	QPSK	50	0	Right Tilted	0mm	20850	2510	20.71	21.00	1.069	0.18	0.035	0.037
	LTE Band 7	20M	QPSK	1	0	Left Cheek	0mm	21350	2560	21.90	22.00	1.023	0.08	0.021	0.021
	LTE Band 7	20M	QPSK	50	0	Left Cheek	0mm	20850	2510	20.71	21.00	1.069	0.05	0.015	0.016
	LTE Band 7	20M	QPSK	1	0	Left Tilted	0mm	21350	2560	21.90	22.00	1.023	0.08	0.010	0.010
	LTE Band 7	20M	QPSK	50	0	Left Tilted	0mm	20850	2510	20.71	21.00	1.069	0.01	0.009	0.010
02	LTE Band 30	10M	QPSK	1	0	Right Cheek	0mm	27710	2310	22.15	22.50	1.084	-0.16	0.061	0.066
	LTE Band 30	10M	QPSK	25	0	Right Cheek	0mm	27710	2310	21.17	21.50	1.079	0.05	0.049	0.053
	LTE Band 30	10M	QPSK	1	0	Right Tilted	0mm	27710	2310	22.15	22.50	1.084	-0.19	0.037	0.040
	LTE Band 30	10M	QPSK	25	0	Right Tilted	0mm	27710	2310	21.17	21.50	1.079	0.12	0.028	0.030
	LTE Band 30	10M	QPSK	1	0	Left Cheek	0mm	27710	2310	22.15	22.50	1.084	0.16	0.032	0.035
	LTE Band 30	10M	QPSK	25	0	Left Cheek	0mm	27710	2310	21.17	21.50	1.079	0.04	0.022	0.024
	LTE Band 30	10M	QPSK	1	0	Left Tilted	0mm	27710	2310	22.15	22.50	1.084	-0.01	0.023	0.025
	LTE Band 30	10M	QPSK	25	0	Left Tilted	0mm	27710	2310	21.17	21.50	1.079	0.11	0.017	0.018

13.2 Hotspot SAR

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA II	RMC 12.2Kbps	Back	10mm	ON	9262	1852.4	17.77	19.50	1.489	-0.09	0.354	0.527
04	WCDMA IV	RMC 12.2Kbps	Back	10mm	ON	1312	1712.4	19.05	19.50	1.109	-0.11	0.414	0.459

<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 2	20M	QPSK	1	0	Back	10mm	ON	19100	1900	17.94	19.00	1.276	-0.12	0.433	0.553
05	LTE Band 2	20M	QPSK	50	0	Back	10mm	ON	19100	1900	17.81	19.00	1.315	-0.13	0.421	0.554
	LTE Band 7	20M	QPSK	1	0	Front	10mm	OFF	21350	2560	21.90	22.00	1.023	0	0.586	0.600
	LTE Band 7	20M	QPSK	50	0	Front	10mm	OFF	20850	2510	20.71	21.00	1.069	-0.11	0.411	0.439
	LTE Band 7	20M	QPSK	1	0	Back	10mm	OFF	21350	2560	21.90	22.00	1.023	0.16	0.498	0.510
	LTE Band 7	20M	QPSK	50	0	Back	10mm	OFF	20850	2510	20.71	21.00	1.069	0.12	0.457	0.489
	LTE Band 7	20M	QPSK	1	0	Left Side	10mm	OFF	21350	2560	21.90	22.00	1.023	0.03	0.098	0.100
	LTE Band 7	20M	QPSK	50	0	Left Side	10mm	OFF	20850	2510	20.71	21.00	1.069	0.1	0.095	0.102
	LTE Band 7	20M	QPSK	1	0	Right Side	10mm	OFF	21350	2560	21.90	22.00	1.023	0.01	0.039	0.039
	LTE Band 7	20M	QPSK	50	0	Right Side	10mm	OFF	20850	2510	20.71	21.00	1.069	0.06	0.035	0.037
	LTE Band 7	20M	QPSK	1	0	Bottom Side	10mm	OFF	21350	2560	21.90	22.00	1.023	0.12	0.814	0.833
06	LTE Band 7	20M	QPSK	1	0	Bottom Side	10mm	OFF	20850	2510	21.70	22.00	1.072	0.15	1.010	1.082
	LTE Band 7	20M	QPSK	1	0	Bottom Side	10mm	OFF	21100	2535	21.64	22.00	1.086	0.04	0.882	0.958
	LTE Band 7	20M	QPSK	50	0	Bottom Side	10mm	OFF	20850	2510	20.71	21.00	1.069	0.09	0.784	0.838
	LTE Band 7	20M	QPSK	50	0	Bottom Side	10mm	OFF	21100	2535	20.69	21.00	1.074	0.09	0.693	0.744
	LTE Band 7	20M	QPSK	50	0	Bottom Side	10mm	OFF	21350	2560	20.64	21.00	1.086	0.17	0.633	0.688
	LTE Band 7	20M	QPSK	100	0	Bottom Side	10mm	OFF	21100	2535	20.60	21.00	1.096	0.13	0.663	0.727
	LTE Band 30	10M	QPSK	1	0	Back	10mm	ON	27710	2310	18.29	20.00	1.483	0.01	0.289	0.428
07	LTE Band 30	10M	QPSK	25	0	Back	10mm	ON	27710	2310	18.27	20.00	1.489	-0.01	0.295	0.439
	LTE Band 66	20M	QPSK	1	0	Front	10mm	ON	132072	1720	18.68	19.50	1.208	-0.11	0.342	0.413
08	LTE Band 66	20M	QPSK	50	0	Front	10mm	ON	132072	1720	18.53	19.50	1.250	-0.1	0.345	0.431

13.3 Body Worn Accessory SAR

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
09	WCDMA II	RMC 12.2Kbps	Back	15mm	9262	1852.4	22.38	22.50	1.028	-0.11	0.497	0.511
10	WCDMA IV	RMC 12.2Kbps	Back	15mm	1312	1712.4	21.84	22.00	1.038	-0.11	0.413	0.428

<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
11	LTE Band 2	20M	QPSK	1	0	Back	15mm	19100	1900	21.79	22.00	1.050	-0.13	0.561	0.589
	LTE Band 2	20M	QPSK	50	0	Back	15mm	19100	1900	20.83	21.00	1.040	-0.12	0.433	0.450
	LTE Band 7	20M	QPSK	1	0	Front	15mm	21350	2560	21.90	22.00	1.023	-0.01	0.199	0.204
12	LTE Band 7	20M	QPSK	50	0	Front	15mm	20850	2510	20.71	21.00	1.069	-0.13	0.197	0.211
	LTE Band 7	20M	QPSK	1	0	Back	15mm	21350	2560	21.90	22.00	1.023	-0.11	0.204	0.209
	LTE Band 7	20M	QPSK	50	0	Back	15mm	20850	2510	20.71	21.00	1.069	-0.08	0.192	0.205
	LTE Band 30	10M	QPSK	1	0	Front	15mm	27710	2310	22.15	22.50	1.084	0	0.366	0.397
	LTE Band 30	10M	QPSK	25	0	Front	15mm	27710	2310	21.17	21.50	1.079	-0.01	0.296	0.319
13	LTE Band 30	10M	QPSK	1	0	Back	15mm	27710	2310	22.15	22.50	1.084	-0.12	0.384	0.416
	LTE Band 30	10M	QPSK	25	0	Back	15mm	27710	2310	21.17	21.50	1.079	-0.14	0.309	0.333
14	LTE Band 66	20M	QPSK	1	0	Front	15mm	132072	1720	21.97	22.00	1.007	-0.12	0.383	0.386
	LTE Band 66	20M	QPSK	50	0	Front	15mm	132072	1720	20.92	21.00	1.019	-0.15	0.309	0.315

13.4 Product Specific SAR

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WCDMA II	RMC 12.2Kbps	Front	0mm	9262	1852.4	22.38	22.50	1.028	0.19	2.200	2.262
	WCDMA II	RMC 12.2Kbps	Front	0mm	9400	1880	22.33	22.50	1.040	0.15	2.240	2.329
	WCDMA II	RMC 12.2Kbps	Front	0mm	9538	1907.6	22.30	22.50	1.047	0.13	2.300	2.408
	WCDMA II	RMC 12.2Kbps	Back	0mm	9262	1852.4	22.38	22.50	1.028	-0.18	2.270	2.334
	WCDMA II	RMC 12.2Kbps	Back	0mm	9400	1880	22.33	22.50	1.040	-0.12	2.340	2.433
15	WCDMA II	RMC 12.2Kbps	Back	0mm	9538	1907.6	22.30	22.50	1.047	-0.13	2.430	2.545
	WCDMA IV	RMC 12.2Kbps	Front	0mm	1312	1712.4	21.84	22.00	1.038	-0.17	2.090	2.168
	WCDMA IV	RMC 12.2Kbps	Front	0mm	1413	1732.6	21.83	22.00	1.040	-0.16	2.090	2.173
	WCDMA IV	RMC 12.2Kbps	Front	0mm	1513	1752.6	21.72	22.00	1.067	-0.12	2.080	2.219
	WCDMA IV	RMC 12.2Kbps	Back	0mm	1312	1712.4	21.84	22.00	1.038	-0.1	2.180	2.262
	WCDMA IV	RMC 12.2Kbps	Back	0mm	1413	1732.6	21.83	22.00	1.040	-0.11	2.190	2.277
16	WCDMA IV	RMC 12.2Kbps	Back	0mm	1513	1752.6	21.72	22.00	1.067	-0.09	2.200	2.347

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	LTE Band 2	20M	QPSK	1	0	Front	0mm	19100	1900	21.79	22.00	1.050	0.13	2.030	2.131
	LTE Band 2	20M	QPSK	1	0	Front	0mm	18700	1860	21.37	22.00	1.156	0.17	1.820	2.104
	LTE Band 2	20M	QPSK	1	99	Front	0mm	18900	1880	21.54	22.00	1.112	0.16	1.770	1.968
	LTE Band 2	20M	QPSK	1	0	Back	0mm	19100	1900	21.79	22.00	1.050	-0.16	2.050	2.152
17	LTE Band 2	20M	QPSK	1	0	Back	0mm	18700	1860	21.37	22.00	1.156	-0.11	1.970	2.278
	LTE Band 2	20M	QPSK	1	99	Back	0mm	18900	1880	21.54	22.00	1.112	-0.13	1.820	2.023
	LTE Band 7	20M	QPSK	1	0	Front	0mm	21350	2560	21.90	22.00	1.023	0.12	2.740	2.804
	LTE Band 7	20M	QPSK	1	0	Front	0mm	20850	2510	21.70	22.00	1.072	0.04	2.760	2.957
	LTE Band 7	20M	QPSK	1	0	Front	0mm	21100	2535	21.64	22.00	1.086	0.04	2.710	2.944
	LTE Band 7	20M	QPSK	1	0	Back	0mm	21350	2560	21.90	22.00	1.023	0	2.980	3.049
18	LTE Band 7	20M	QPSK	1	0	Back	0mm	20850	2510	21.70	22.00	1.072	0.04	3.050	3.268
	LTE Band 7	20M	QPSK	1	0	Back	0mm	21100	2535	21.64	22.00	1.086	0.08	2.960	3.216
	LTE Band 7	20M	QPSK	1	0	Bottom Side	0mm	20850	2510	21.70	22.00	1.072	0.03	1.550	1.661
	LTE Band 30	10M	QPSK	1	0	Front	0mm	27710	2310	22.15	22.50	1.084	-0.02	2.450	2.656
19	LTE Band 30	10M	QPSK	1	0	Back	0mm	27710	2310	22.15	22.50	1.084	0.05	3.030	3.284
	LTE Band 30	10M	QPSK	1	0	Bottom Side	0mm	27710	2310	22.15	22.50	1.084	-0.15	1.820	1.973
	LTE Band 66	20M	QPSK	1	0	Front	0mm	132072	1720	21.97	22.00	1.007	-0.15	2.050	2.064
	LTE Band 66	20M	QPSK	1	0	Front	0mm	132322	1745	21.76	22.00	1.057	-0.12	2.050	2.166
20	LTE Band 66	20M	QPSK	1	0	Front	0mm	132572	1770	21.54	22.00	1.112	-0.12	2.250	2.501
	LTE Band 66	20M	QPSK	1	0	Back	0mm	132072	1720	21.97	22.00	1.007	0.17	2.040	2.054
	LTE Band 66	20M	QPSK	1	0	Back	0mm	132322	1745	21.76	22.00	1.057	0.17	2.080	2.198
	LTE Band 66	20M	QPSK	1	0	Back	0mm	132572	1770	21.54	22.00	1.112	0.13	2.240	2.490

13.5 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 7	20M	QPSK	1	0	Bottom Side	10mm	20850	2510	21.70	22.00	1.072	0.15	1.010		1.082
2nd	LTE Band 7	20M	QPSK	1	0	Bottom Side	10mm	20850	2510	21.70	22.00	1.072	0.16	0.998	1.01	1.069

No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	WCDMA II	RMC 12.2Kbps	Back	0mm	9538	1907.6	22.30	22.50	1.047	-0.13	2.430		2.545
2nd	WCDMA II	RMC 12.2Kbps	Back	0mm	9538	1907.6	22.30	22.50	1.047	0.05	2.310	1.05	2.419
1st	LTE Band 7	20M_QPSK_1_0	Back	0mm	20850	2510	21.70	22.00	1.072	0.04	3.050		3.268
2nd	LTE Band 7	20M_QPSK_1_0	Back	0mm	20850	2510	21.70	22.00	1.072	0.04	2.990	1.02	3.204
1st	LTE Band 30	10M_QPSK_1_0	Back	0mm	27710	2310	22.15	22.50	1.084	0.05	3.030		3.284
2nd	LTE Band 30	10M_QPSK_1_0	Back	0mm	27710	2310	22.15	22.50	1.084	0.09	3.010	1.01	3.263
1st	LTE Band 66	20M_QPSK_1_0	Front	0mm	132572	1770	21.54	22.00	1.112	-0.12	2.250		2.501
2nd	LTE Band 66	20M_QPSK_1_0	Front	0mm	132572	1770	21.54	22.00	1.112	0.05	2.200	1.03	2.446

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The ratio is the difference in percentage between original and repeated *measured SAR*.
5. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

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14. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

Declaration of Conformity:
The test results with all measurement uncertainty excluded is presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

15. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992
[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013
[4] SPEAG DASY System Handbook
[5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.
[6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015
[7] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.
[8] FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015
[9] FCC KDB 941225 D05 v02r05, “SAR Evaluation Considerations for LTE Devices”, Dec 2015
[10] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.
[11] FCC KDB 941225 D07 v01r02, " SAR Evaluation Procedures for UMPC Mini-Tablet Devices", Oct 2015.
[12] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
[13] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.