FCC SAR TEST REPORT

FCC ID	**: APYHRO00322**
Equipment	**: Mobile Router**
Brand Name	**: SHARP**
Applicant	**: SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan**
Manufacturer	**: SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan**
Standard	**: FCC 47 CFR Part 2 (2.1093)**

The product was received on Sep. 08, 2022 and testing was started from Sep. 20, 2022 and completed on Sep. 28, 2022. 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. Laboratory, the test report shall not be reproduced except in full.

Cona Huang

Approved by: Cona Huang / Deputy Manager

ilac-MRA TAF Testing Laboratory 3786

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan

Table of Contents

History of this test report

Report No.	Version	Description	Issued Date
FA262909-02	01	Initial issue of report	Oct. 21, 2022

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) for SHARP CORPORATION, Mobile Router, are as follows.

Equipment Class	Frequency Band		Highest SAR Summary Hotspot (Separation 10mm) 1g SAR (W/kg)	Highest Simultaneous Transmission 1g SAR (W/kg)
Licensed	WCDMA	WCDMA V	0.46	1.49
	LTE	LTE Band 5	0.64	
		LTE Band 12	0.16	
		LTE Band 41/38	1.20	
DTS	WLAN	2.4GHz WLAN	0.29	
Date of Testing:			2022/9/20 ~ 2022/9/28	

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation and the FCC designation No. TW3786 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) 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: Paula Chen

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 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

3. Equipment Under Test (EUT) Information

3.1 General Information

Product Feature & Specification	
Equipment Name	Mobile Router
Brand Name	SHARP
FCC ID	APYHRO00322
S/N	359169420014086
Wireless Technology and Frequency Range	WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM, 64QAM WLAN: 802.11b/g/n/ac/ax HT20/HT40/VHT20/VHT40/HE20/HE40
EUT Stage	Identical Prototype

3.2 General LTE SAR Test and Reporting Considerations

<table>
<tr><th colspan="2">Summarized necessary items addressed in KDB 941225 D05 v02r05</th></tr>
<tr><td>FCC ID</td><td>APYHRO00322</td></tr>
<tr><td>Equipment Name</td><td>Mobile Router</td></tr>
<tr><td>Operating Frequency Range of each LTE transmission band</td><td>LTE Band 5: 824 MHz ~ 849 MHz
LTE Band 12: 699 MHz ~ 716 MHz
LTE Band 38: 2570 MHz ~ 2620 MHz
LTE Band 41: 2496 MHz ~ 2690 MHz</td></tr>
<tr><td>Channel Bandwidth</td><td>LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz</td></tr>
<tr><td>uplink modulations used</td><td>QPSK / 16QAM / 64QAM</td></tr>
<tr><td>LTE Voice / Data requirements</td><td>Data only</td></tr>
<tr><td>LTE MPR permanently built-in by design</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 3</td></tr>
<tr><td>256 QAM</td><td colspan="6">≥ 1</td><td>≤ 5</td></tr>
</table>
</td></tr>
<tr><td>LTE A-MPR</td><td>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)</td></tr>
<tr><td>Spectrum plots for RB configuration</td><td>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.</td></tr>
</table>

Transmission (H, M, L) channel numbers and frequencies in each LTE band								
LTE Band 5								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844
LTE Band 12								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	23017	699.7	23025	700.5	23035	701.5	23060	704
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5
H	23173	715.3	23165	714.5	23155	713.5	23130	711
LTE Band 38								
	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	37775	2572.5	37800	2575	37825	2577.5	37850	2580
M	38000	2595	38000	2595	38000	2595	38000	2595
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610
LTE Band 41								
	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	39675	2498.5	39700	2501	39725	2503.5	39750	2506
LM	40148	2545.8	40160	2547	40173	2548.3	40185	2549.5
M	40620	2593	40620	2593	40620	2593	40620	2593
HM	41093	2640.3	41080	2639	41068	2637.8	41055	2636.5
H	41565	2687.5	41540	2685	41515	2682.5	41490	2680

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:

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

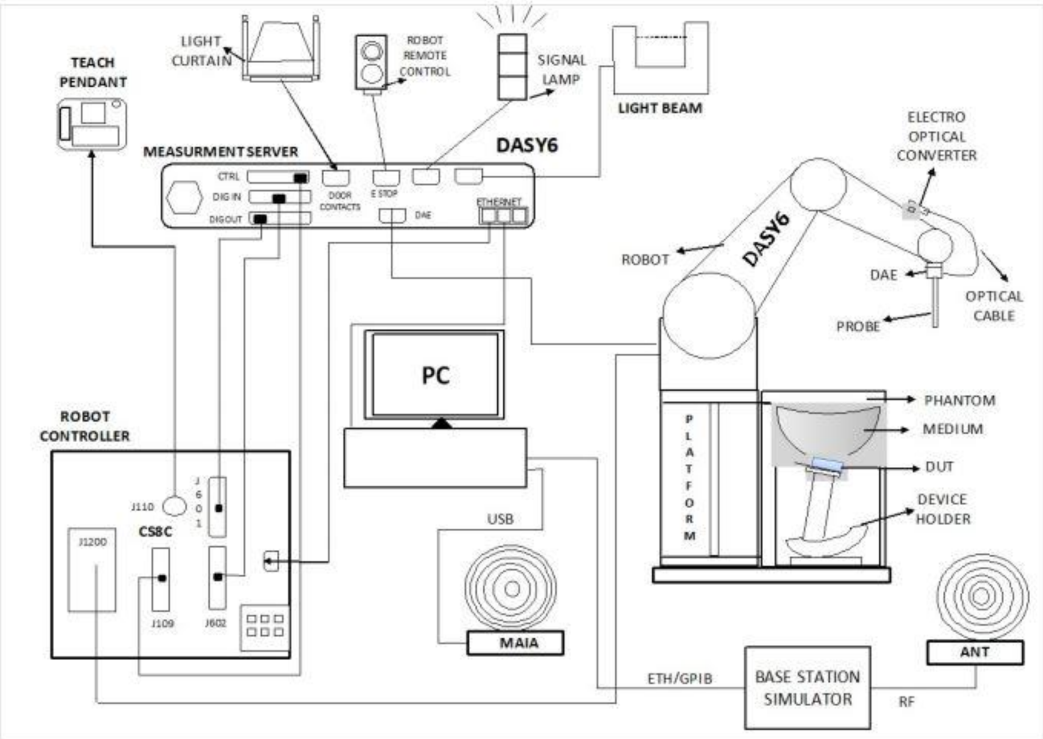
SAR is expressed in units of Watts per kilogram (W/kg)

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

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:



- The DASY system in SAR Configuration is shown above
- 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 windows software and the DASY 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 3786) and the FCC designation No. TW1190 and TW3786 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC test.

Test Site	EMC & Wireless Communications Laboratory		Wensan Laboratory		
Test Site Location	TW1190 No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan		TW3786 No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan		
Test Site No.	SAR01-HY	SAR03-HY	SAR08-HY	SAR09-HY	SAR15-HY
	SAR04-HY	SAR05-HY	SAR11-HY	SAR12-HY	
	SAR06-HY	SAR10-HY	SAR13-HY	SAR14-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)

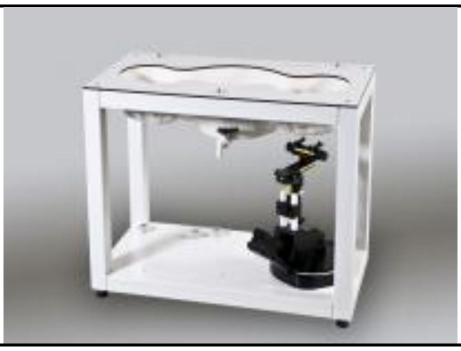
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an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

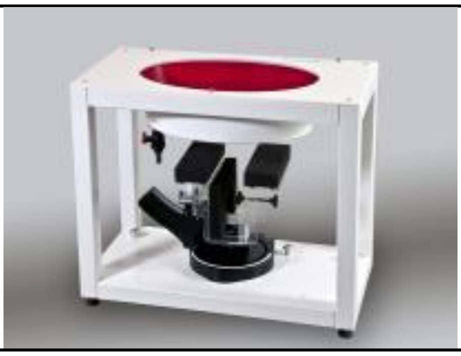
6.4 Phantom

<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:

(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.

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

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><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 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>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 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>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 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>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 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 $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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	750MHz System Validation Kit(2)	D750V3	1012	Aug. 18, 2021	Aug. 16, 2023
SPEAG	835MHz System Validation Kit(2)	D835V2	499	Aug. 18, 2021	Aug. 16, 2023
SPEAG	2450MHz System Validation Kit(2)	D2450V2	736	Aug. 17, 2021	Aug. 15, 2023
SPEAG	2600MHz System Validation Kit	D2600V2	1078	Jun. 23, 2022	Jun. 22, 2023
SPEAG	Data Acquisition Electronics	DAE4	1424	Jan. 20, 2022	Jan. 19, 2023
SPEAG	Data Acquisition Electronics	DAE4	1707	Jan. 12, 2022	Jan. 11, 2023
SPEAG	Dosimetric E-Field Probe	EX3DV4	3976	Jan. 27, 2022	Jan. 26, 2023
SPEAG	Dosimetric E-Field Probe	EX3DV4	7625	Jan. 27, 2022	Jan. 26, 2023
RCPTWN	Thermometer	HTC-1	TM685-1	Jun. 27, 2022	Jun. 26, 2023
RCPTWN	Thermometer	HTC-1	TM560-2	Mar. 15, 2022	Mar. 14, 2023
Anritsu	Radio Communication Analyzer	MT8821C	6201341950	Oct. 21, 2021	Oct. 20, 2022
Keysight	Wireless Communication Test Set	E5515C	MY50266977	May. 10, 2022	May. 09, 2023
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Oct. 24, 2021	Oct. 23, 2022
Keysight	ENA Network Analyzer	E5071C	MY46316648	Jul. 25, 2022	Jul. 24, 2023
SPEAG	Dielectric Probe Kit	DAK-3.5	1146	Jul. 25, 2022	Jul. 24, 2023
LINE SEIKI	Digital Thermometer	DTM3000-spezial	2942	Oct. 26, 2021	Oct. 25, 2022
Anritsu	Power Meter	ML2495A	1419002	Aug. 16, 2022	Aug. 15, 2023
Anritsu	Power Sensor	MA2411B	1911176	Aug. 16, 2022	Aug. 15, 2023
Anritsu	Power Meter	ML2495A	1804003	Oct. 09, 2021	Oct. 08, 2022
Anritsu	Power Sensor	MA2411B	1726150	Oct. 09, 2021	Oct. 08, 2022
Anritsu	Spectrum Analyzer	N9010A	MY53470118	Jan. 12, 2022	Jan. 11, 2023
Agilent	Spectrum Analyzer	E4408B	MY44211028	Aug. 19, 2021	Aug. 17, 2023
Mini-Circuits	Power Amplifier	ZVE-8G+	6418	Oct. 12, 2021	Oct. 11, 2022
Mini-Circuits	Power Amplifier	ZVE-3W-183+	072602118	Mar. 09, 2022	Mar. 08, 2023
ATM	Dual Directional Coupler	C122H-10	P610410z-02	Note 1	
Warison	Directional Coupler	WCOU-10-50S-10	WR889BMC4B1	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
750	22.2	0.905	42.194	0.89	41.90	1.69	0.70	±5	2022/9/20
835	22.2	0.941	41.898	0.90	41.50	4.56	0.96	±5	2022/9/20
2450	22.4	1.827	38.702	1.80	39.20	1.50	-1.27	±5	2022/9/28
2600	22.2	2.004	39.089	1.96	39.00	2.24	0.23	±5	2022/9/20

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.

Test Site	Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Power Drift (dB)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
SAR08	2022/9/20	750	50	D750V3-1012	EX3DV4 - SN7625	DAE4 Sn1424	-0.11	0.401	8.56	8.02	-6.31
SAR08	2022/9/20	835	50	D835V2-499	EX3DV4 - SN7625	DAE4 Sn1424	-0.06	0.470	9.68	9.4	-2.89
SAR08	2022/9/28	2450	50	D2450V2-736	EX3DV4 - SN3976	DAE4 Sn1707	-0.08	2.51	54.2	50.2	-7.38
SAR08	2022/9/20	2600	250	D2600V2-1078	EX3DV4 - SN7625	DAE4 Sn1424	-0.08	13.8	55.4	55.2	-0.36

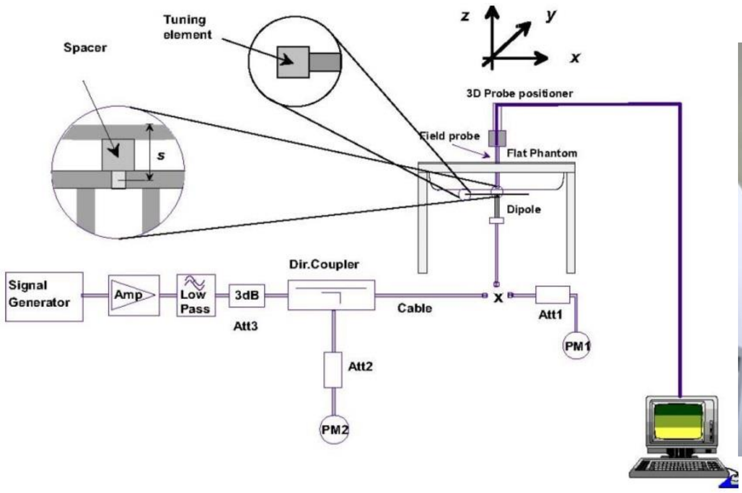


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

10. RF Exposure Positions

10.1 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 $\beta_{hs} = 30/15 * \beta_c$.

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 $\beta_{hs} = 30/15 * \beta_c$, and Δ_{CQI} = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.

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	Proces ses	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.		

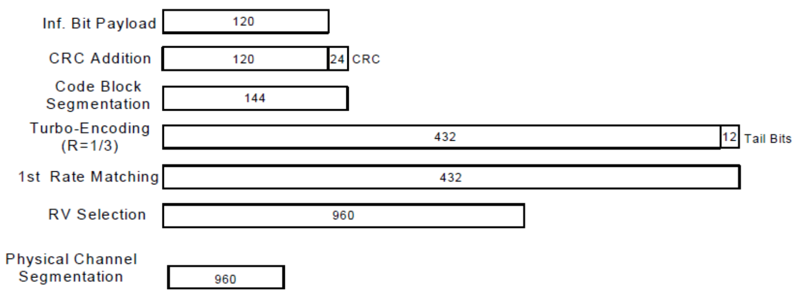


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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.

Band		WCDMA V_Main			Tune-up Limit (dBm)
TX Channel		4132	4182	4233	
Rx Channel		4357	4407	4458	
Frequency (MHz)		826.4	836.4	846.6	
3GPP Rel 99	RMC 12.2Kbps	22.69	22.75	22.73	23.00
3GPP Rel 6	HSDPA Subtest-1	21.71	21.74	21.71	22.00
3GPP Rel 6	HSDPA Subtest-2	21.70	21.73	21.72	22.00
3GPP Rel 6	HSDPA Subtest-3	21.20	21.21	21.21	21.50
3GPP Rel 6	HSDPA Subtest-4	21.19	21.21	21.20	21.50
3GPP Rel 8	DC-HSDPA Subtest-1	21.76	21.84	21.62	22.00
3GPP Rel 8	DC-HSDPA Subtest-2	21.68	21.82	21.75	22.00
3GPP Rel 8	DC-HSDPA Subtest-3	21.29	21.27	21.15	21.50
3GPP Rel 8	DC-HSDPA Subtest-4	21.20	21.28	21.10	21.50
3GPP Rel 6	HSUPA Subtest-1	21.82	21.58	21.49	22.00
3GPP Rel 6	HSUPA Subtest-2	19.91	19.69	19.47	20.00
3GPP Rel 6	HSUPA Subtest-3	20.83	20.67	20.57	21.00
3GPP Rel 6	HSUPA Subtest-4	19.70	19.64	19.38	20.00
3GPP Rel 6	HSUPA Subtest-5	21.80	21.64	21.44	22.00

<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. For LTE B5/B12 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, 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.
9. LTE band 38 SAR test was covered by Band 41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
    a. the maximum output power, including tolerance, for the smaller band is ≤ 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 Band 5_Main >

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				20450	20525	20600	
Frequency (MHz)				829	836.5	844	
10	QPSK	1	0	22.73	22.75	22.72	24
10	QPSK	1	25	22.64	22.65	22.64	
10	QPSK	1	49	22.59	22.58	22.58	
10	QPSK	25	0	22.57	22.63	22.58	23
10	QPSK	25	12	22.59	22.52	22.56	
10	QPSK	25	25	22.54	22.56	22.51	
10	QPSK	50	0	22.56	22.50	22.53	
10	16QAM	1	0	22.73	22.68	22.70	23
10	16QAM	1	25	22.71	22.66	22.70	
10	16QAM	1	49	22.71	22.71	22.66	
10	16QAM	25	0	21.52	21.53	21.51	22
10	16QAM	25	12	21.60	21.53	21.59	
10	16QAM	25	25	21.57	21.56	21.52	
10	16QAM	50	0	21.57	21.51	21.54	
10	64QAM	1	0	21.77	21.68	21.68	22
10	64QAM	1	25	21.78	21.77	21.73	
10	64QAM	1	49	21.76	21.77	21.68	
10	64QAM	25	0	20.51	20.53	20.48	21
10	64QAM	25	12	20.60	20.54	20.58	
10	64QAM	25	25	20.57	20.56	20.52	
10	64QAM	50	0	20.56	20.50	20.54	
Channel				20425	20525	20625	Tune-up limit (dBm)
Frequency (MHz)				826.5	836.5	846.5	
5	QPSK	1	0	22.65	22.55	22.52	24
5	QPSK	1	12	22.47	22.45	22.59	
5	QPSK	1	24	22.42	22.43	22.48	
5	QPSK	12	0	22.56	22.62	22.54	23
5	QPSK	12	7	22.51	22.37	22.45	
5	QPSK	12	13	22.49	22.38	22.34	
5	QPSK	25	0	22.46	22.39	22.38	
5	16QAM	1	0	22.63	22.50	22.69	23
5	16QAM	1	12	22.68	22.65	22.67	
5	16QAM	1	24	22.68	22.54	22.58	
5	16QAM	12	0	21.52	21.52	21.37	22
5	16QAM	12	7	21.57	21.42	21.46	
5	16QAM	12	13	21.45	21.42	21.35	
5	16QAM	25	0	21.53	21.49	21.48	
5	64QAM	1	0	21.72	21.67	21.63	22
5	64QAM	1	12	21.69	21.65	21.69	
5	64QAM	1	24	21.72	21.59	21.61	
5	64QAM	12	0	20.46	20.37	20.39	21
5	64QAM	12	7	20.60	20.42	20.40	
5	64QAM	12	13	20.54	20.50	20.38	
5	64QAM	25	0	20.36	20.37	20.40	
Channel				20415	20525	20635	Tune-up limit (dBm)
Frequency (MHz)				825.5	836.5	847.5	
3	QPSK	1	0	22.65	22.54	22.52	24
3	QPSK	1	8	22.53	22.61	22.45	
3	QPSK	1	14	22.55	22.50	22.45	
3	QPSK	8	0	22.56	22.43	22.52	23
3	QPSK	8	4	22.44	22.48	22.45	

3	QPSK	8	7	22.40	22.40	22.34	
3	QPSK	15	0	22.56	22.45	22.33	
3	16QAM	1	0	22.62	22.56	22.53	23
3	16QAM	1	8	22.58	22.49	22.67	
3	16QAM	1	14	22.64	22.62	22.66	
3	16QAM	8	0	21.37	21.44	21.42	22
3	16QAM	8	4	21.48	21.49	21.58	
3	16QAM	8	7	21.55	21.50	21.40	
3	16QAM	15	0	21.52	21.44	21.47	
3	64QAM	1	0	21.70	21.64	21.67	22
3	64QAM	1	8	21.66	21.69	21.57	
3	64QAM	1	14	21.73	21.72	21.68	
3	64QAM	8	0	20.34	20.42	20.28	21
3	64QAM	8	4	20.49	20.38	20.38	
3	64QAM	8	7	20.57	20.39	20.37	
3	64QAM	15	0	20.48	20.32	20.37	
Channel				20407	20525	20643	Tune-up limit (dBm)
Frequency (MHz)				824.7	836.5	848.3	
1.4	QPSK	1	0	22.58	22.61	22.56	24
1.4	QPSK	1	3	22.64	22.66	22.60	
1.4	QPSK	1	5	22.58	22.61	22.54	
1.4	QPSK	3	0	22.47	22.44	22.44	
1.4	QPSK	3	1	22.47	22.47	22.43	
1.4	QPSK	3	3	22.46	22.48	22.40	
1.4	QPSK	6	0	22.46	22.39	22.40	23
1.4	16QAM	1	0	22.64	22.65	22.62	23
1.4	16QAM	1	3	22.74	22.68	22.63	
1.4	16QAM	1	5	22.66	22.69	22.56	
1.4	16QAM	3	0	22.65	22.62	22.61	
1.4	16QAM	3	1	22.66	22.62	22.61	
1.4	16QAM	3	3	22.65	22.66	22.62	
1.4	16QAM	6	0	21.57	21.45	21.56	22
1.4	64QAM	1	0	21.65	21.62	21.63	22
1.4	64QAM	1	3	21.72	21.69	21.66	
1.4	64QAM	1	5	21.67	21.76	21.59	
1.4	64QAM	3	0	21.59	21.61	21.57	
1.4	64QAM	3	1	21.64	21.62	21.56	
1.4	64QAM	3	3	21.60	21.64	21.56	
1.4	64QAM	6	0	20.52	20.48	20.44	21

<LTE Band 12_Main>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				23060	23095	23130	
Frequency (MHz)				704	707.5	711	
10	QPSK	1	0	22.90	22.94	23.00	24
10	QPSK	1	25	22.85	22.85	22.80	
10	QPSK	1	49	22.92	22.83	22.83	
10	QPSK	25	0	22.85	22.88	22.86	23
10	QPSK	25	12	22.75	22.72	22.70	
10	QPSK	25	25	22.78	22.78	22.75	
10	QPSK	50	0	22.76	22.69	22.67	
10	16QAM	1	0	22.89	22.77	22.91	23
10	16QAM	1	25	22.84	22.90	22.77	
10	16QAM	1	49	22.96	22.92	22.89	
10	16QAM	25	0	21.63	21.68	21.67	22
10	16QAM	25	12	21.77	21.73	21.72	
10	16QAM	25	25	21.78	21.80	21.77	
10	16QAM	50	0	21.76	21.71	21.69	
10	64QAM	1	0	21.81	21.82	21.90	22
10	64QAM	1	25	21.90	21.96	21.98	
10	64QAM	1	49	21.96	21.93	21.95	
10	64QAM	25	0	20.66	20.69	20.42	21
10	64QAM	25	12	20.77	20.72	20.67	
10	64QAM	25	25	20.77	20.81	20.77	
10	64QAM	50	0	20.76	20.70	20.68	
Channel				23035	23095	23155	Tune-up limit (dBm)
Frequency (MHz)				701.5	707.5	713.5	
5	QPSK	1	0	22.75	22.93	22.97	24
5	QPSK	1	12	22.83	22.76	22.73	
5	QPSK	1	24	22.87	22.70	22.69	
5	QPSK	12	0	22.80	22.76	22.76	23
5	QPSK	12	7	22.61	22.67	22.54	
5	QPSK	12	13	22.63	22.69	22.67	
5	QPSK	25	0	22.56	22.67	22.59	
5	16QAM	1	0	22.83	22.76	22.74	23
5	16QAM	1	12	22.71	22.85	22.71	
5	16QAM	1	24	22.90	22.72	22.80	
5	16QAM	12	0	21.62	21.56	21.49	22
5	16QAM	12	7	21.67	21.57	21.65	
5	16QAM	12	13	21.72	21.63	21.60	
5	16QAM	25	0	21.61	21.54	21.69	
5	64QAM	1	0	21.67	21.74	21.70	22
5	64QAM	1	12	21.82	21.93	21.96	
5	64QAM	1	24	21.80	21.76	21.88	
5	64QAM	12	0	20.56	20.56	20.37	21
5	64QAM	12	7	20.77	20.66	20.63	
5	64QAM	12	13	20.67	20.75	20.63	
5	64QAM	25	0	20.65	20.65	20.67	
Channel				23025	23095	23165	Tune-up limit (dBm)
Frequency (MHz)				700.5	707.5	714.5	
3	QPSK	1	0	22.71	22.74	22.86	24
3	QPSK	1	8	22.83	22.69	22.64	
3	QPSK	1	14	22.88	22.68	22.78	
3	QPSK	8	0	22.76	22.82	22.80	23
3	QPSK	8	4	22.60	22.72	22.60	

3	QPSK	8	7	22.63	22.72	22.63	
3	QPSK	15	0	22.63	22.58	22.55	
3	16QAM	1	0	22.84	22.60	22.85	23
3	16QAM	1	8	22.81	22.90	22.66	
3	16QAM	1	14	22.84	22.76	22.76	
3	16QAM	8	0	21.55	21.53	21.58	22
3	16QAM	8	4	21.71	21.70	21.55	
3	16QAM	8	7	21.71	21.71	21.73	
3	16QAM	15	0	21.62	21.71	21.63	
3	64QAM	1	0	21.61	21.82	21.79	22
3	64QAM	1	8	21.74	21.82	21.80	
3	64QAM	1	14	21.96	21.79	21.88	
3	64QAM	8	0	20.66	20.49	20.22	21
3	64QAM	8	4	20.75	20.60	20.52	
3	64QAM	8	7	20.63	20.64	20.68	
3	64QAM	15	0	20.58	20.55	20.67	
Channel				23017	23095	23173	Tune-up limit (dBm)
Frequency (MHz)				699.7	707.5	715.3	
1.4	QPSK	1	0	22.75	22.77	22.74	24
1.4	QPSK	1	3	22.81	22.83	22.78	
1.4	QPSK	1	5	22.76	22.81	22.78	
1.4	QPSK	3	0	22.66	22.67	22.62	
1.4	QPSK	3	1	22.66	22.67	22.65	
1.4	QPSK	3	3	22.61	22.69	22.64	
1.4	QPSK	6	0	22.62	22.60	22.62	23
1.4	16QAM	1	0	22.91	22.87	22.87	23
1.4	16QAM	1	3	22.90	22.96	22.86	
1.4	16QAM	1	5	22.87	22.88	22.87	
1.4	16QAM	3	0	22.81	22.84	22.81	
1.4	16QAM	3	1	22.80	22.88	22.83	
1.4	16QAM	3	3	22.82	22.84	22.85	
1.4	16QAM	6	0	21.72	21.68	21.74	22
1.4	64QAM	1	0	21.85	21.81	21.87	22
1.4	64QAM	1	3	21.87	21.93	21.90	
1.4	64QAM	1	5	21.81	21.92	21.86	
1.4	64QAM	3	0	21.77	21.80	21.73	
1.4	64QAM	3	1	21.77	21.84	21.78	
1.4	64QAM	3	3	21.79	21.83	21.78	
1.4	64QAM	6	0	20.67	20.64	20.69	21

<TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement

SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

a. 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
b. “special subframe S” contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
c. Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.

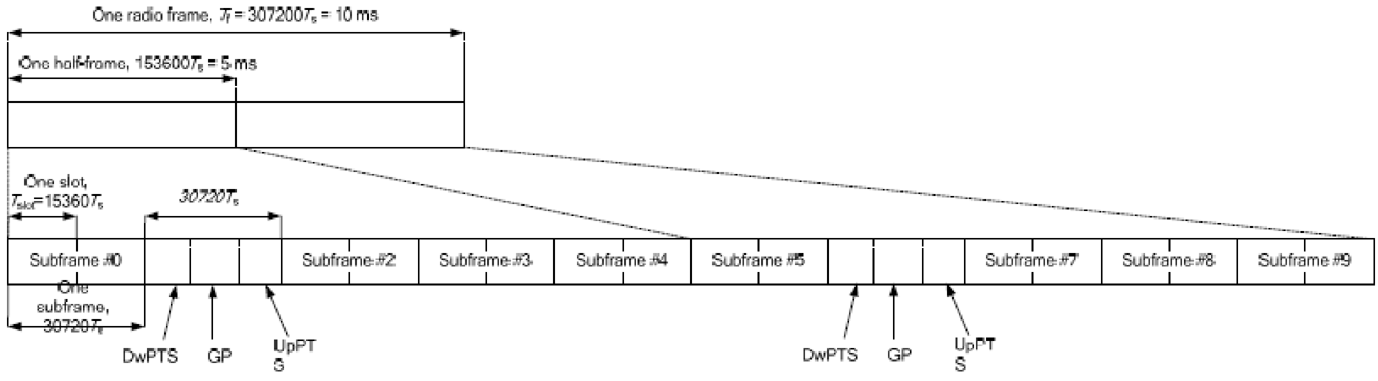


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

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

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

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Special subframe (30720·T_s): Normal cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	**Normal cyclic prefix in uplink**	**Extended cyclic prefix in uplink**
Uplink duty factor in one special subframe	**0~4**	7.13%	8.33%
	5~9	14.3%	16.7%

Special subframe(30720·T_s): Extended cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	**Normal cyclic prefix in uplink**	**Extended cyclic prefix in uplink**
Uplink duty factor in one special subframe	**0~3**	7.13%	8.33%
	4~7	14.3%	16.7%

The highest duty factor is resulted from:

i. Uplink-downlink configuration: 0. In a half-frame consisted of 5 subfames, uplink operation is in 3 uplink subframes and 1 special subframe.

ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink

iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.167)/5 = 63.3%

iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.143)/5 = 62.9%

v. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.

<LTE Band 38_Aux>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				37850	38000	38150	
Frequency (MHz)				2580	2595	2610	
20	QPSK	1	0	23.33	23.32	23.34	24
20	QPSK	1	49	23.20	23.21	23.25	
20	QPSK	1	99	23.24	23.30	23.31	
20	QPSK	50	0	22.36	22.35	22.37	23
20	QPSK	50	24	22.27	22.29	22.30	
20	QPSK	50	50	22.30	22.33	22.31	
20	QPSK	100	0	22.28	22.27	22.29	
20	16QAM	1	0	22.51	22.46	22.41	23
20	16QAM	1	49	22.72	22.79	22.87	
20	16QAM	1	99	22.50	22.52	22.66	
20	16QAM	50	0	21.27	21.26	21.25	22
20	16QAM	50	24	21.30	21.30	21.32	
20	16QAM	50	50	21.32	21.34	21.45	
20	16QAM	100	0	21.30	21.28	21.29	
20	64QAM	1	0	21.31	21.36	21.39	22
20	64QAM	1	49	21.50	21.44	21.51	
20	64QAM	1	99	21.44	21.49	21.46	
20	64QAM	50	0	20.25	20.25	20.26	21
20	64QAM	50	24	20.30	20.29	20.33	
20	64QAM	50	50	20.32	20.34	20.44	
20	64QAM	100	0	20.27	20.32	20.28	
Channel				37825	38000	38175	Tune-up limit (dBm)
Frequency (MHz)				2577.5	2595	2612.5	
15	QPSK	1	0	23.31	23.18	23.23	24
15	QPSK	1	37	23.13	23.18	23.06	
15	QPSK	1	74	23.09	23.21	23.29	
15	QPSK	36	0	22.16	22.19	22.30	23
15	QPSK	36	20	22.13	22.16	22.16	
15	QPSK	36	39	22.22	22.22	22.16	
15	QPSK	75	0	22.28	22.18	22.10	
15	16QAM	1	0	22.35	22.43	22.26	23
15	16QAM	1	37	22.70	22.71	22.67	
15	16QAM	1	74	22.47	22.40	22.59	
15	16QAM	36	0	21.07	21.26	21.14	22
15	16QAM	36	20	21.24	21.23	21.19	
15	16QAM	36	39	21.15	21.28	21.45	
15	16QAM	75	0	21.23	21.13	21.19	
15	64QAM	1	0	21.23	21.35	21.31	22
15	64QAM	1	37	21.48	21.29	21.34	
15	64QAM	1	74	21.30	21.35	21.38	
15	64QAM	36	0	20.15	20.17	20.24	21
15	64QAM	36	20	20.20	20.11	20.31	
15	64QAM	36	39	20.20	20.32	20.27	
15	64QAM	75	0	20.23	20.26	20.09	
Channel				37800	38000	38200	Tune-up limit (dBm)
Frequency (MHz)				2575	2595	2615	
10	QPSK	1	0	23.32	23.15	23.14	24
10	QPSK	1	25	23.02	23.09	23.09	
10	QPSK	1	49	23.10	23.10	23.13	
10	QPSK	25	0	22.35	22.34	22.34	23
10	QPSK	25	12	22.14	22.19	22.16	

10	QPSK	25	25	22.13	22.26	22.24	
10	QPSK	50	0	22.18	22.09	22.10	
10	16QAM	1	0	22.31	22.30	22.40	23
10	16QAM	1	25	22.55	22.67	22.67	
10	16QAM	1	49	22.44	22.43	22.46	
10	16QAM	25	0	21.17	21.18	21.16	22
10	16QAM	25	12	21.22	21.24	21.32	
10	16QAM	25	25	21.25	21.22	21.26	
10	16QAM	50	0	21.14	21.09	21.09	
10	64QAM	1	0	21.31	21.24	21.26	22
10	64QAM	1	25	21.37	21.44	21.49	
10	64QAM	1	49	21.31	21.42	21.43	
10	64QAM	25	0	20.18	20.17	20.09	21
10	64QAM	25	12	20.10	20.12	20.27	
10	64QAM	25	25	20.18	20.19	20.30	
10	64QAM	50	0	20.13	20.25	20.10	
Channel				37775	38000	38225	Tune-up limit (dBm)
Frequency (MHz)				2572.5	2595	2617.5	
5	QPSK	1	0	23.13	23.29	23.14	24
5	QPSK	1	12	23.06	23.12	23.25	
5	QPSK	1	24	23.07	23.21	23.14	
5	QPSK	12	0	22.28	22.23	22.24	23
5	QPSK	12	7	22.12	22.25	22.26	
5	QPSK	12	13	22.22	22.15	22.11	
5	QPSK	25	0	22.27	22.15	22.18	
5	16QAM	1	0	22.49	22.43	22.22	23
5	16QAM	1	12	22.53	22.69	22.71	
5	16QAM	1	24	22.48	22.50	22.46	
5	16QAM	12	0	21.12	21.13	21.11	22
5	16QAM	12	7	21.19	21.25	21.29	
5	16QAM	12	13	21.27	21.25	21.41	
5	16QAM	25	0	21.21	21.27	21.27	
5	64QAM	1	0	21.28	21.18	21.32	22
5	64QAM	1	12	21.38	21.27	21.33	
5	64QAM	1	24	21.39	21.30	21.42	
5	64QAM	12	0	20.22	20.10	20.08	21
5	64QAM	12	7	20.18	20.19	20.15	
5	64QAM	12	13	20.23	20.22	20.34	
5	64QAM	25	0	20.12	20.19	20.18	

<LTE Band 41_Aux>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Low Middle Ch. / Freq.	Power Middle Ch. / Freq.	Power High Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)
Channel				39750	40185	40620	41055	41490	
Frequency (MHz)				2506	2549.5	2593	2636.5	2680	
20	QPSK	1	0	23.69	23.34	23.36	23.38	23.15	24
20	QPSK	1	49	23.36	23.30	23.24	23.25	22.94	
20	QPSK	1	99	23.26	23.27	23.33	23.27	22.96	
20	QPSK	50	0	22.42	22.38	22.36	22.40	22.11	23
20	QPSK	50	24	22.40	22.37	22.28	22.35	22.05	
20	QPSK	50	50	22.39	22.33	22.35	22.27	22.02	
20	QPSK	100	0	22.39	22.35	22.25	22.33	22.03	
20	16QAM	1	0	22.65	22.52	22.50	22.54	22.29	23
20	16QAM	1	49	22.82	22.81	22.64	22.82	22.39	
20	16QAM	1	99	22.67	22.53	22.71	22.50	22.18	
20	16QAM	50	0	21.32	21.26	21.23	21.35	21.00	22
20	16QAM	50	24	21.43	21.36	21.27	21.38	21.07	
20	16QAM	50	50	21.43	21.34	21.38	21.29	21.05	
20	16QAM	100	0	21.41	21.34	21.28	21.33	21.05	
20	64QAM	1	0	21.49	21.41	21.38	21.44	21.17	22
20	64QAM	1	49	21.64	21.55	21.45	21.40	21.22	
20	64QAM	1	99	21.56	21.49	21.52	21.44	21.23	
20	64QAM	50	0	20.31	20.27	20.23	20.34	19.99	21
20	64QAM	50	24	20.44	20.37	20.27	20.36	20.07	
20	64QAM	50	50	20.40	20.35	20.38	20.29	20.08	
20	64QAM	100	0	20.40	20.33	20.24	20.34	20.07	
Channel				39725	40173	40620	41068	41515	Tune-up limit (dBm)
Frequency (MHz)				2503.5	2548.3	2593	2637.8	2682.5	
15	QPSK	1	0	23.33	23.15	23.25	23.18	23.07	24.00
15	QPSK	1	37	23.28	23.29	23.07	23.17	22.87	
15	QPSK	1	74	23.20	23.24	23.25	23.21	22.79	
15	QPSK	36	0	22.41	22.31	22.31	22.40	22.01	23
15	QPSK	36	20	22.23	22.25	22.08	22.17	22.01	
15	QPSK	36	39	22.34	22.31	22.27	22.27	21.86	
15	QPSK	75	0	22.34	22.34	22.17	22.28	22.01	
15	16QAM	1	0	22.58	22.35	22.47	22.54	22.16	23
15	16QAM	1	37	22.70	22.62	22.64	22.82	22.35	
15	16QAM	1	74	22.65	22.50	22.60	22.33	22.03	
15	16QAM	36	0	21.27	21.18	21.12	21.20	20.89	22
15	16QAM	36	20	21.28	21.16	21.08	21.34	21.01	
15	16QAM	36	39	21.35	21.32	21.19	21.19	21.04	
15	16QAM	75	0	21.30	21.28	21.10	21.30	20.91	
15	64QAM	1	0	21.34	21.28	21.34	21.30	20.97	22
15	64QAM	1	37	21.53	21.41	21.28	21.38	21.18	
15	64QAM	1	74	21.43	21.32	21.32	21.33	21.15	
15	64QAM	36	0	20.29	20.21	20.22	20.21	19.93	21
15	64QAM	36	20	20.44	20.23	20.26	20.34	20.05	
15	64QAM	36	39	20.20	20.18	20.29	20.19	19.91	
15	64QAM	75	0	20.22	20.15	20.15	20.27	19.91	
Channel				39700	40160	40620	41080	41540	Tune-up limit (dBm)
Frequency (MHz)				2501	2547	2593	2639	2685	
10	QPSK	1	0	23.35	23.30	23.31	23.36	23.03	24.00
10	QPSK	1	25	23.28	23.18	23.24	23.05	22.93	
10	QPSK	1	49	23.17	23.14	23.22	23.13	22.93	
10	QPSK	25	0	22.38	22.22	22.27	22.28	22.06	23
10	QPSK	25	12	22.21	22.34	22.11	22.29	21.98	

10	QPSK	25	25	22.28	22.16	22.23	22.13	22.00	
10	QPSK	50	0	22.33	22.23	22.12	22.19	21.85	
10	16QAM	1	0	22.65	22.49	22.44	22.43	22.14	23
10	16QAM	1	25	22.62	22.61	22.52	22.81	22.37	
10	16QAM	1	49	22.58	22.39	22.62	22.31	22.15	
10	16QAM	25	0	21.26	21.15	21.14	21.22	21.00	22
10	16QAM	25	12	21.34	21.30	21.17	21.18	21.07	
10	16QAM	25	25	21.39	21.16	21.27	21.18	20.95	
10	16QAM	50	0	21.31	21.32	21.09	21.21	21.04	
10	64QAM	1	0	21.34	21.40	21.31	21.42	21.02	22
10	64QAM	1	25	21.54	21.43	21.37	21.35	21.11	
10	64QAM	1	49	21.55	21.34	21.34	21.42	21.03	
10	64QAM	25	0	20.21	20.10	20.19	20.16	19.98	21
10	64QAM	25	12	20.31	20.37	20.19	20.21	19.88	
10	64QAM	25	25	20.23	20.35	20.24	20.15	19.93	
10	64QAM	50	0	20.30	20.24	20.04	20.15	19.91	
Channel				39675	40148	40620	41093	41565	Tune-up limit (dBm)
Frequency (MHz)				2498.5	2545.8	2593	2640.30	2687.5	
5	QPSK	1	0	23.30	23.28	23.12	23.24	23.03	24.00
5	QPSK	1	12	23.31	23.18	23.17	23.06	22.82	
5	QPSK	1	24	23.21	23.10	23.27	23.25	22.81	
5	QPSK	12	0	22.34	22.18	22.25	22.36	22.03	23
5	QPSK	12	7	22.31	22.19	22.10	22.28	21.85	
5	QPSK	12	13	22.22	22.27	22.23	22.25	22.01	
5	QPSK	25	0	22.31	22.30	22.15	22.27	21.92	
5	16QAM	1	0	22.59	22.43	22.40	22.47	22.19	23
5	16QAM	1	12	22.62	22.62	22.57	22.64	22.36	
5	16QAM	1	24	22.55	22.39	22.64	22.30	22.11	
5	16QAM	12	0	21.21	21.17	21.12	21.25	20.82	22
5	16QAM	12	7	21.27	21.22	21.18	21.30	20.87	
5	16QAM	12	13	21.24	21.30	21.22	21.18	21.01	
5	16QAM	25	0	21.37	21.27	21.28	21.26	20.94	
5	64QAM	1	0	21.37	21.40	21.22	21.29	21.13	22
5	64QAM	1	12	21.60	21.40	21.26	21.37	21.05	
5	64QAM	1	24	21.45	21.48	21.43	21.35	21.14	
5	64QAM	12	0	20.25	20.15	20.15	20.33	19.88	21
5	64QAM	12	7	20.31	20.21	20.25	20.17	20.00	
5	64QAM	12	13	20.35	20.22	20.30	20.09	20.03	
5	64QAM	25	0	20.34	20.24	20.17	20.18	20.06	

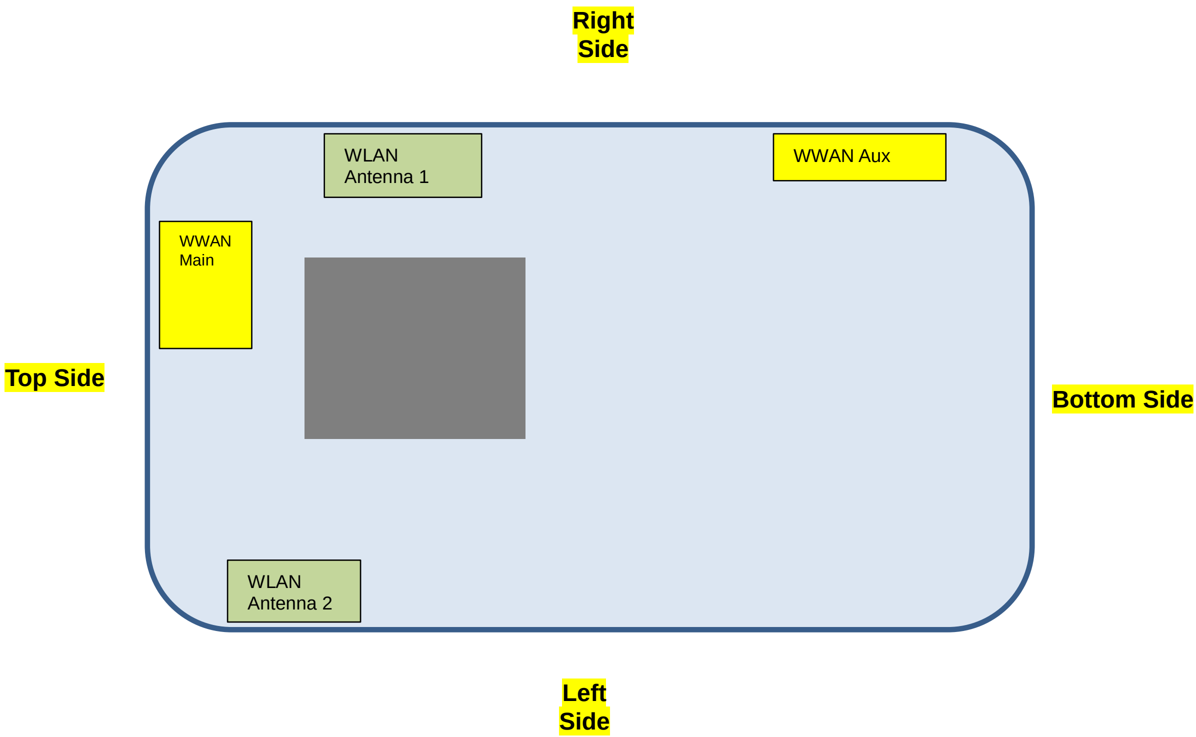
12. WiFi Output Power (Unit: dBm)

General Note:

1. For each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode.
2. Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6W/kg and SAR peak to location ratio ≤ 0.04, no additional SAR measurements for MIMO.
3. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, additional output power measurements were not necessary.
4. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
5. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
6. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
7. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
8. Per 201904 TCBC workshops, General principles of FCC KDB Publication 248227 D01 can be applied to determine the SAR Initial Test Configurations and test reduction for 802.11ax SAR testing. For the table below the 802.11ax maximum power is SU (non-OFDMA), and the SU maximum power also higher than RU (OFDMA)
9. In applying the test guidance, the IEEE 802.11 mode with the maximum output power (out of all modes) should be considered for testing
10. For modes with the same maximum output power, the guidance from section 5.3.2 a) of FCC KDB Publication 248227 D01 should be applied, with 802.11ax being considered as the highest 802.11 mode for the appropriate frequency bands
11. When SAR testing for 802.11ax is required
    a. If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power
    b. Otherwise, consider the fully allocated channel for SAR testing
    c. When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel

				Ant 1+2(1)		Ant 1+2(2)		Ant 1+2		
2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Average power (dBm)	Tune-Up Limit	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11b 1Mbps	1	2412	15.30	15.50	17.07	17.50	19.28	19.50	98.30
		6	2437	13.94	14.00	15.78	16.00	17.97	18.00	
		11	2462	15.46	16.00	17.38	18.00	19.54	20.00	
		12	2467	14.33	14.50	16.00	16.50	18.26	18.50	
		13	2472	14.84	15.50	16.46	16.50	18.74	19.00	
	802.11g 6Mbps	1	2412	Not Required	17.50	Not Required	19.00	Not Required	21.50	Not Required
		6	2437		17.00		18.00		20.50	
		11	2462		18.00		19.00		21.50	
		12	2467		15.00		16.50		19.00	
		13	2472		10.50		12.50		14.50	
	802.11n-HT20 MCS0	1	2412		17.50		19.00		21.50	
		6	2437		16.50		18.50		20.50	
		11	2462		18.00		19.00		21.50	
		12	2467		15.50		17.00		19.50	
		13	2472		7.00		8.50		11.00	
	802.11n-HT40 MCS0	3	2422		17.50		18.50		21.00	
		6	2437		16.50		18.50		20.50	
		9	2452		17.00		18.50		21.00	
		10	2457		16.00		17.00		19.50	
		11	2462		13.00		14.50		17.00	
	802.11ac-VHT20 MCS0	1	2412		17.50		19.00		21.50	
		6	2437		16.50		18.50		20.50	
		11	2462		18.00		19.00		21.50	
		12	2467		15.50		17.00		19.50	
		13	2472		7.00		8.50		11.00	
	802.11ac-VHT40 MCS0	3	2422		17.50		18.50		21.00	
		6	2437		16.50		18.50		20.50	
		9	2452		17.00		18.50		21.00	
		10	2457		16.00		17.00		19.50	
		11	2462		13.00		14.50		17.00	
	802.11ax-HE20 MCS0	1	2412		17.50		19.00		21.50	
		6	2437		16.50		18.50		20.50	
		11	2462		18.00		19.00		21.50	
		12	2467		15.50		17.00		19.50	
		13	2472		7.00		8.50		11.00	
	802.11ax-HE40 MCS0	3	2422		17.50		18.50		21.00	
		6	2437		16.50		18.50		20.50	
		9	2452		17.00		18.50		21.00	
		10	2457		16.00		17.00		19.50	
		11	2462		13.00		14.50		17.00	

13. Antenna Location



Front View

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Main	≤ 25mm	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	>25mm
WWAN Aux	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	≤ 25mm	>25mm
WLAN Ant1+2	≤ 25mm	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	≤ 25mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Main	Yes	Yes	Yes	No	Yes	No
WWAN Aux	Yes	Yes	No	Yes	Yes	No
WLAN Ant1+2	Yes	Yes	Yes	No	Yes	Yes

General Note:

1. Referring to KDB 941225 D06 v02r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

14. 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 SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
   e. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.

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.
6. For LTE B5/B12 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, 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 38 SAR test was covered by Band 41; 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 ≤ 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.

WLAN Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required 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 ≤ 1.2 W/kg.
2. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
3. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
4. For determination of the scaling factor for report SAR of MIMO mode, if the hot spots are separated the scaling factors are individually determined from each transmit chain. If the hot spots are not spatially separated, the scaling factor is determined from the worst number of each transmit chain.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

14.1 Hotspot 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)
01	WCDMA V_Main	RMC 12.2Kbps	Front	10mm	4182	836.4	22.75	23.00	1.059	-0.03	0.431	0.457
	WCDMA V_Main	RMC 12.2Kbps	Back	10mm	4182	836.4	22.75	23.00	1.059	0.02	0.426	0.451
	WCDMA V_Main	RMC 12.2Kbps	Right Side	10mm	4182	836.4	22.75	23.00	1.059	0	0.228	0.242
	WCDMA V_Main	RMC 12.2Kbps	Top Side	10mm	4182	836.4	22.75	23.00	1.059	-0.06	0.367	0.389

<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)
02	LTE Band 5_Main	10M	QPSK	1	0	Front	10mm	20525	836.5	22.75	24.00	1.334	-0.02	0.480	0.640
	LTE Band 5_Main	10M	QPSK	25	0	Front	10mm	20525	836.5	22.63	23.00	1.089	-0.11	0.474	0.516
	LTE Band 5_Main	10M	QPSK	1	0	Back	10mm	20525	836.5	22.75	24.00	1.334	-0.18	0.474	0.632
	LTE Band 5_Main	10M	QPSK	25	0	Back	10mm	20525	836.5	22.63	23.00	1.089	-0.09	0.470	0.512
	LTE Band 5_Main	10M	QPSK	1	0	Right Side	10mm	20525	836.5	22.75	24.00	1.334	0.17	0.250	0.333
	LTE Band 5_Main	10M	QPSK	25	0	Right Side	10mm	20525	836.5	22.63	23.00	1.089	-0.14	0.246	0.268
	LTE Band 5_Main	10M	QPSK	1	0	Top Side	10mm	20525	836.5	22.75	24.00	1.334	0.1	0.298	0.397
	LTE Band 5_Main	10M	QPSK	25	0	Top Side	10mm	20525	836.5	22.63	23.00	1.089	0.12	0.292	0.318
03	LTE Band 12_Main	10M	QPSK	1	0	Front	10mm	23095	707.5	22.94	24.00	1.276	-0.12	0.124	0.158
	LTE Band 12_Main	10M	QPSK	25	0	Front	10mm	23095	707.5	22.88	23.00	1.028	0.11	0.122	0.125
	LTE Band 12_Main	10M	QPSK	1	0	Back	10mm	23095	707.5	22.94	24.00	1.276	-0.16	0.120	0.153
	LTE Band 12_Main	10M	QPSK	25	0	Back	10mm	23095	707.5	22.88	23.00	1.028	0.14	0.119	0.122
	LTE Band 12_Main	10M	QPSK	1	0	Right Side	10mm	23095	707.5	22.94	24.00	1.276	-0.08	0.084	0.107
	LTE Band 12_Main	10M	QPSK	25	0	Right Side	10mm	23095	707.5	22.88	23.00	1.028	-0.12	0.083	0.085
	LTE Band 12_Main	10M	QPSK	1	0	Top Side	10mm	23095	707.5	22.94	24.00	1.276	0.04	0.001	0.001
	LTE Band 12_Main	10M	QPSK	25	0	Top Side	10mm	23095	707.5	22.88	23.00	1.028	0.06	0.001	0.001

<TDD 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	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
04	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	39750	2506	23.69	24.00	1.074	62.9	1.006	-0.07	1.110	1.199
	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	40185	2549.5	23.34	24.00	1.164	62.9	1.006	-0.06	0.936	1.096
	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	40620	2593	23.36	24.00	1.159	62.9	1.006	0.11	0.958	1.117
	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	41055	2636.5	23.38	24.00	1.153	62.9	1.006	-0.01	0.855	0.992
	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	41490	2680	23.15	24.00	1.216	62.9	1.006	-0.01	0.573	0.701
	LTE Band 41_Aux	20M	QPSK	50	0	Front	10mm	39750	2506	22.42	23.00	1.143	62.9	1.006	-0.01	0.921	1.059
	LTE Band 41_Aux	20M	QPSK	50	0	Front	10mm	40185	2549.5	22.38	23.00	1.153	62.9	1.006	0.11	0.783	0.909
	LTE Band 41_Aux	20M	QPSK	50	0	Front	10mm	40620	2593	22.36	23.00	1.159	62.9	1.006	0.06	0.753	0.878
	LTE Band 41_Aux	20M	QPSK	50	0	Front	10mm	41055	2636.5	22.40	23.00	1.148	62.9	1.006	-0.01	0.656	0.758
	LTE Band 41_Aux	20M	QPSK	50	0	Front	10mm	41490	2680	22.11	23.00	1.227	62.9	1.006	0.01	0.435	0.537
	LTE Band 41_Aux	20M	QPSK	100	0	Front	10mm	39750	2506	22.39	23.00	1.151	62.9	1.006	-0.14	0.902	1.044
	LTE Band 41_Aux	20M	QPSK	1	0	Back	10mm	39750	2506	23.69	24.00	1.074	62.9	1.006	-0.19	0.476	0.514
	LTE Band 41_Aux	20M	QPSK	50	0	Back	10mm	39750	2506	22.42	23.00	1.143	62.9	1.006	-0.05	0.366	0.421
	LTE Band 41_Aux	20M	QPSK	1	0	Right Side	10mm	39750	2506	23.69	24.00	1.074	62.9	1.006	0.05	0.301	0.325
	LTE Band 41_Aux	20M	QPSK	50	0	Right Side	10mm	39750	2506	22.42	23.00	1.143	62.9	1.006	-0.03	0.230	0.264
	LTE Band 41_Aux	20M	QPSK	1	0	Bottom Side	10mm	39750	2506	23.69	24.00	1.074	62.9	1.006	0.03	0.777	0.839
	LTE Band 41_Aux	20M	QPSK	50	0	Bottom Side	10mm	39750	2506	22.42	23.00	1.143	62.9	1.006	0.17	0.622	0.715

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(1)	11	2462	15.46	16.00	1.132	98.3	1.017	0.13	0.218	0.251
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(2)	11	2462	17.38	18.00	1.153	98.3	1.017	-0.03	0.136	0.160
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(1)	1	2412	15.30	15.50	1.047	98.3	1.017	-0.19	0.186	0.198
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(2)	1	2412	17.07	17.50	1.104	98.3	1.017	0.08	0.116	0.130
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(1)	6	2437	13.94	14.00	1.014	98.3	1.017	-0.19	0.231	0.238
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(2)	6	2437	15.78	16.00	1.052	98.3	1.017	-0.05	0.144	0.154
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(1)	12	2467	14.33	14.50	1.040	98.3	1.017	-0.05	0.238	0.252
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(2)	12	2467	16.00	16.50	1.122	98.3	1.017	-0.11	0.149	0.170
05	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(1)	13	2472	14.84	15.50	1.164	98.3	1.017	-0.09	0.248	0.294
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1+2(2)	13	2472	16.46	16.50	1.009	98.3	1.017	-0.09	0.155	0.159
	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	Ant 1+2(1)	11	2462	15.46	16.00	1.132	98.3	1.017	-0.19	0.117	0.135
	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	Ant 1+2(2)	11	2462	17.38	18.00	1.153	98.3	1.017	-0.04	0.073	0.086
	WLAN2.4GHz	802.11b 1Mbps	Left Side	10mm	Ant 1+2(1)	11	2462	15.46	16.00	1.132	98.3	1.017	0	0.075	0.054
	WLAN2.4GHz	802.11b 1Mbps	Left Side	10mm	Ant 1+2(2)	11	2462	17.38	18.00	1.153	98.3	1.017	-0.05	0.047	0.059
	WLAN2.4GHz	802.11b 1Mbps	Right Side	10mm	Ant 1+2(1)	11	2462	15.46	16.00	1.132	98.3	1.017	-0.08	0.050	0.058
	WLAN2.4GHz	802.11b 1Mbps	Right Side	10mm	Ant 1+2(2)	11	2462	17.38	18.00	1.153	98.3	1.017	0	0.080	0.094
	WLAN2.4GHz	802.11b 1Mbps	Top Side	10mm	Ant 1+2(1)	11	2462	15.46	16.00	1.132	98.3	1.017	0	0.135	0.155
	WLAN2.4GHz	802.11b 1Mbps	Top Side	10mm	Ant 1+2(2)	11	2462	17.38	18.00	1.153	98.3	1.017	-0.18	0.084	0.099

14.2 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	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	39750	2506	23.69	24.00	1.074	62.9	1.006	-0.07	1.110	-	1.199
2nd	LTE Band 41_Aux	20M	QPSK	1	0	Front	10mm	39750	2506	23.69	24.00	1.074	62.9	1.006	0.03	1.020	1.088	1.102

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. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Hotspot
1.	WWAN + WLAN2.4GHz Ant 1+2	Yes

General Note:

1. The worst case WLAN reported SAR for each configuration was used for SAR summation. Therefore, the following summations represent the absolute worst cases for simultaneous transmission with WLAN.
2. The Scaled SAR summation is calculated based on the same configuration and test position.
3. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

15.1 Hotspot Exposure Conditions

Exposure Position	1	2	1+2 Summed 1g SAR (W/kg)
	Maximum WWAN	WLAN2.4GHz Ant 1+2	
	1g SAR (W/kg)	1g SAR (W/kg)	
Front	1.199	0.294	**1.493**
Back	0.632	0.135	**0.767**
Left side		0.059	**0.059**
Right side	0.333	0.094	**0.427**
Top side	0.397	0.155	**0.552**
Bottom side	0.839		**0.839**

Test Engineer： Henry Chou, Jack Yang and Jay Jian

16. 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. 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.

17. 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 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015

[8] FCC KDB 941225 D05 v02r05, “SAR Evaluation Considerations for LTE Devices”, Dec 2015

[9] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.

[10] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[11] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.