

FCC SAR TEST REPORT

FCC ID : APYHRO00297
Equipment : Mobile Router
Brand Name : Sharp Mobile Router
Marketing Name : Japan
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 May 21, 2021 and testing was started from Jun 01, 2021 and completed on Jun 03, 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.



Approved by: Cona Huang / Deputy Manager



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History of this test report

Report No.	Version	Description	Issued Date
FA151401	01	Initial issue of report	Jun. 28, 2021

1. Statement of Compliance

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

Equipment Class	Frequency Band		Highest SAR Summary	Highest Simultaneous Transmission 1g SAR (W/kg)
			Hotspot (Separation 10mm)	
			1g SAR (W/kg)	
Licensed	WCDMA	WCDMA V	0.18	1.47
	LTE	LTE Band 4	1.26	
		LTE Band 5	0.19	
		LTE Band 7	0.91	
		LTE Band 12	0.78	
		LTE Band 38 / 41	0.60	
DTS	WLAN	2.4GHz WLAN	0.15	1.47
Date of Testing:			2021/6/1 ~ 2021/6/3	

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 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 Mobile Router
Marketing Name	Japan
FCC ID	APYHRO00297
IMEI Code	004401119012066
Wireless Technology and Frequency Range	WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz WLAN 2.4GHz Band: 2400 MHz ~ 2483.5 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA LTE: QPSK, 16QAM, 64QAM WLAN: 802.11b/g/n/ac HT20/HT40/VHT20/VHT40
HW Version	V025
SW Version	J03W040_R3.19.00

3.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05								
FCC ID	APYHRO00297							
Equipment Name	Mobile Router							
Operating Frequency Range of each LTE transmission band	LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz							
Channel Bandwidth	LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz							
uplink modulations used	QPSK / 16QAM / 64QAM							
LTE Voice / Data requirements	Data only							
LTE MPR permanently built-in by design	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
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.							

Transmission (H, M, L) channel numbers and frequencies in each LTE band												
LTE Band 4												
	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	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745
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)	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	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844				
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)	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	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560				
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)	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	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)	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	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)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	39675	2498.5	39700	2501	39725	2503.5	39750	2506				
L	40148	2545.8	40160	2547	40173	2548.3	40185	2549.5				
M	40620	2593	40620	2593	40620	2593	40620	2593	40620	2593	40620	2593
H	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:

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

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

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

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 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 μ W/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 μ W/g – >100 mW/g Linearity: ± 0.2 dB (noise: typically <1 μ W/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.

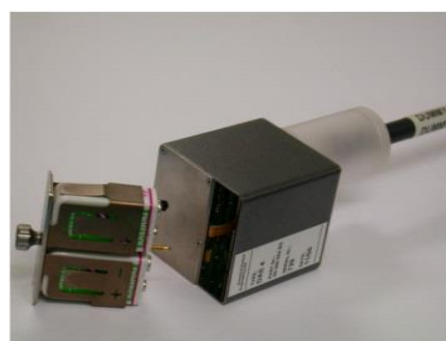



Fig 5.1 Photo of DAE


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 from 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 dB) 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	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
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 \leq 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 to 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 whose 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.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
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 <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> 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.				

7.5 Volume Scan Procedures

The volume scan is used to 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	1107	Mar. 08, 2019	Mar. 05, 2022
SPEAG	835MHz System Validation Kit ⁽²⁾	D835V2	4d167	Nov. 25, 2019	Nov. 23, 2021
SPEAG	1750MHz System Validation Kit ⁽²⁾	D1750V2	1112	Mar. 07, 2019	Mar. 04, 2022
SPEAG	2450MHz System Validation Kit ⁽²⁾	D2450V2	929	Nov. 21, 2019	Nov. 19, 2021
SPEAG	2600MHz System Validation Kit ⁽²⁾	D2600V2	1008	Aug. 31, 2018	Aug. 28, 2021
SPEAG	2600MHz System Validation Kit ⁽²⁾	D2600V2	1078	Mar. 06, 2019	Mar. 03, 2022
SPEAG	Data Acquisition Electronics	DAE3	495	Jul. 21, 2020	Jul. 20, 2021
SPEAG	Data Acquisition Electronics	DAE4	376	Nov. 23, 2020	Nov. 22, 2021
SPEAG	Dosimetric E-Field Probe	EX3DV4	7351	Jul. 06, 2020	Jul. 05, 2021
SPEAG	Dosimetric E-Field Probe	EX3DV4	7439	Feb. 23, 2021	Feb. 22, 2022
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. 21, 2021	Mar. 20, 2022
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	Jan. 15, 2021	Jan. 14, 2022
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°C to 25°C, 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°C to 25°C and within $\pm 2^\circ\text{C}$ 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. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
750	22.6	0.900	41.709	0.89	41.90	1.12	-0.46	± 5	2021/6/2
835	22.1	0.880	41.667	0.90	41.50	-2.22	0.40	± 5	2021/6/1
835	22.6	0.911	42.840	0.90	41.50	1.22	3.23	± 5	2021/6/2
1750	22.4	1.409	41.377	1.37	40.10	2.85	3.18	± 5	2021/6/1
2450	22.4	1.806	39.094	1.80	39.20	0.33	-0.27	± 5	2021/6/3
2600	22.3	1.992	38.660	1.96	39.00	1.63	-0.87	± 5	2021/6/2
2600	22.6	2.019	39.176	1.96	39.00	3.01	0.45	± 5	2021/6/2
2600	22.4	1.974	38.560	1.96	39.00	0.71	-1.13	± 5	2021/6/3

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 Side	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 (%)
SAR01	2021/6/2	750	250	D750V3-1107	EX3DV4 - SN7351	DAE3 Sn495	2.14	8.32	8.56	2.88
SAR05	2021/6/1	835	50	D835V2-4d167	EX3DV4 - SN7439	DAE4 Sn376	0.43	9.55	8.6	-9.95
SAR01	2021/6/2	835	250	D835V2-4d167	EX3DV4 - SN7351	DAE3 Sn495	2.46	9.55	9.84	3.04
SAR05	2021/6/1	1750	50	D1750V2-1112	EX3DV4 - SN7439	DAE4 Sn376	1.83	36.70	36.6	-0.27
SAR01	2021/6/3	2450	50	D2450V2-929	EX3DV4 - SN7351	DAE3 Sn495	2.50	53.10	50	-5.84
SAR05	2021/6/2	2600	50	D2600V2-1008	EX3DV4 - SN7439	DAE4 Sn376	2.98	56.40	59.6	5.67
SAR01	2021/6/2	2600	250	D2600V2-1078	EX3DV4 - SN7351	DAE3 Sn495	14.90	57.60	59.6	3.47
SAR01	2021/6/3	2600	250	D2600V2-1078	EX3DV4 - SN7351	DAE3 Sn495	14.60	57.60	58.4	1.39

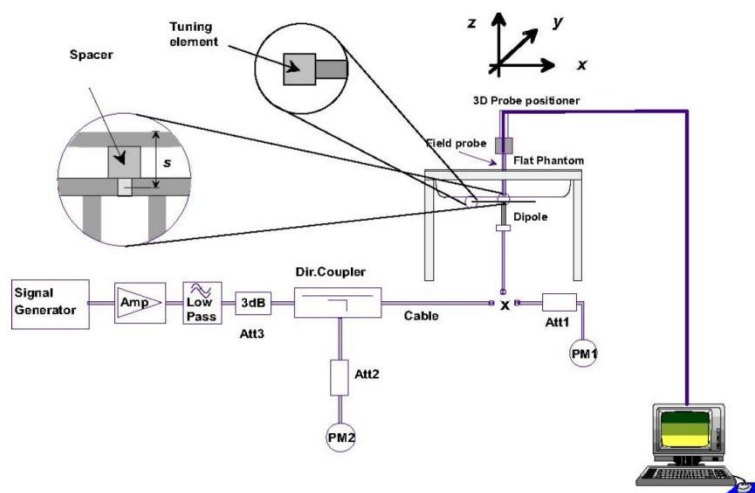


Fig 8.3.1 System Performance Check Setup



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 ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) 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 from 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.

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} (Note 1, 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 $\Delta_{CQI} = 30/15$ 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 $\Delta_{NACK} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCCH, 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 $\beta_c = 11/15$ and $\beta_d = 15/15$.

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} (Note 1)	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	209/25	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_{ed1} : 47/15 β_{ed2} : 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	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 $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 5/15$ with $\beta_{hs} = 5/15 * \beta_c$.

Note 2: CM = 1 for $\beta_d/\beta_c = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$.

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

<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 is $\leq \frac{1}{4}$ 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 to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA) are less than $\frac{1}{4}$ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA.

Band		WCDMA V			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	23.62	23.61	23.65	24.00
3GPP Rel 6	HSDPA Subtest-1	22.64	22.58	22.67	23.00
3GPP Rel 6	HSDPA Subtest-2	22.65	22.60	22.64	23.00
3GPP Rel 6	HSDPA Subtest-3	22.10	22.09	22.14	22.50
3GPP Rel 6	HSDPA Subtest-4	22.09	22.07	22.16	22.50
3GPP Rel 6	HSUPA Subtest-1	22.53	22.49	22.54	23.00
3GPP Rel 6	HSUPA Subtest-2	20.61	20.42	20.63	21.00
3GPP Rel 6	HSUPA Subtest-3	21.52	21.55	21.53	22.00
3GPP Rel 6	HSUPA Subtest-4	20.49	20.45	20.61	21.00
3GPP Rel 6	HSUPA Subtest-5	22.56	22.51	22.55	23.00

<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 $\frac{1}{2}$ 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 $\frac{1}{2}$ 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 B4/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 \leq the larger band to qualify for the SAR test exclusion
 - b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band
10. 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



<LTE Band 4>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	22.56	22.78	22.95		
20	QPSK	1	49	22.76	22.76	22.79	24	0
20	QPSK	1	99	22.81	22.69	22.69		
20	QPSK	50	0	21.99	21.93	21.96		
20	QPSK	50	24	21.96	21.99	22.02	23	1
20	QPSK	50	50	21.87	21.82	21.92		
20	QPSK	100	0	21.96	21.98	22.09		
20	16QAM	1	0	21.98	22.09	22.51	23	1
20	16QAM	1	49	22.02	22.05	22.07		
20	16QAM	1	99	22.01	22.38	21.76		
20	16QAM	50	0	21.00	21.01	21.01	22	2
20	16QAM	50	24	20.92	21.01	20.92		
20	16QAM	50	50	20.90	20.90	20.96		
20	16QAM	100	0	20.91	20.95	21.02	22	2
20	64QAM	1	0	20.80	21.14	20.86		
20	64QAM	1	49	20.82	20.99	20.88		
20	64QAM	1	99	20.89	21.00	20.87	21	3
20	64QAM	50	0	19.36	19.97	19.99		
20	64QAM	50	24	19.97	19.98	19.97		
20	64QAM	50	50	19.83	19.88	19.99	21	3
20	64QAM	50	50	19.83	19.88	19.99		
20	64QAM	100	0	19.85	19.94	20.03		
Channel				20025	20175	20325	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	22.46	22.69	22.85		
15	QPSK	1	37	22.74	22.72	22.73	24	0
15	QPSK	1	74	22.81	22.59	22.69		
15	QPSK	36	0	21.89	21.85	21.92	23	1
15	QPSK	36	20	21.91	21.94	22.01		
15	QPSK	36	39	21.78	21.78	21.85		
15	QPSK	75	0	21.95	21.88	22.09	23	1
15	16QAM	1	0	21.95	22.08	22.51		
15	16QAM	1	37	22.00	22.05	22.02		
15	16QAM	1	74	22.00	22.29	21.74	22	2
15	16QAM	36	0	20.91	21.00	20.91		
15	16QAM	36	20	20.85	20.95	20.89		
15	16QAM	36	39	20.84	20.86	20.88	22	2
15	16QAM	75	0	20.91	20.88	20.94		
15	64QAM	1	0	20.80	21.04	20.77		
15	64QAM	1	37	20.82	20.93	20.80	22	2
15	64QAM	1	74	20.87	20.98	20.77		
15	64QAM	36	0	19.27	19.89	19.92		
15	64QAM	36	20	19.95	19.91	19.87	21	3
15	64QAM	36	39	19.83	19.79	19.95		
15	64QAM	75	0	19.77	19.85	20.02		
Channel				20000	20175	20350	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	22.53	22.73	22.94		
10	QPSK	1	25	22.67	22.74	22.79	24	0
10	QPSK	1	49	22.74	22.63	22.69		
10	QPSK	25	0	21.98	21.86	21.93	23	1
10	QPSK	25	12	21.94	21.91	21.93		



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10	QPSK	25	25	21.78	21.78	21.87		
10	QPSK	50	0	21.88	21.96	22.01		
10	16QAM	1	0	21.90	22.02	22.47		
10	16QAM	1	25	21.93	22.00	21.97	23	1
10	16QAM	1	49	21.96	22.37	21.67		
10	16QAM	25	0	20.91	20.96	20.93		
10	16QAM	25	12	20.84	20.91	20.85	22	2
10	16QAM	25	25	20.90	20.82	20.95		
10	16QAM	50	0	20.90	20.95	20.99		
10	64QAM	1	0	20.78	21.05	20.82	22	2
10	64QAM	1	25	20.74	20.96	20.84		
10	64QAM	1	49	20.81	20.99	20.78		
10	64QAM	25	0	19.29	19.92	19.95	21	3
10	64QAM	25	12	19.90	19.90	19.93		
10	64QAM	25	25	19.75	19.79	19.94		
10	64QAM	50	0	19.83	19.85	19.93		
Channel				19975	20175	20375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	22.50	22.72	22.89	24	0
5	QPSK	1	12	22.69	22.75	22.79		
5	QPSK	1	24	22.76	22.67	22.68		
5	QPSK	12	0	21.89	21.89	21.88	23	1
5	QPSK	12	7	21.87	21.91	21.98		
5	QPSK	12	13	21.80	21.75	21.90		
5	QPSK	25	0	21.88	21.95	22.01	23	1
5	16QAM	1	0	21.98	22.02	22.46		
5	16QAM	1	12	22.01	22.01	22.00		
5	16QAM	1	24	21.95	22.36	21.69	22	2
5	16QAM	12	0	20.91	20.97	20.91		
5	16QAM	12	7	20.90	20.92	20.83		
5	16QAM	12	13	20.85	20.85	20.89	22	2
5	16QAM	25	0	20.91	20.89	21.02		
5	64QAM	1	0	20.70	21.09	20.84		
5	64QAM	1	12	20.81	20.93	20.78	22	2
5	64QAM	1	24	20.85	20.95	20.87		
5	64QAM	12	0	19.29	19.94	19.91		
5	64QAM	12	7	19.88	19.95	19.91	21	3
5	64QAM	12	13	19.81	19.87	19.90		
5	64QAM	25	0	19.81	19.94	19.96		
Channel				19965	20175	20385	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	22.55	22.72	22.87	24	0
3	QPSK	1	8	22.66	22.68	22.79		
3	QPSK	1	14	22.79	22.67	22.69		
3	QPSK	8	0	21.95	21.90	21.93	23	1
3	QPSK	8	4	21.90	21.98	21.99		
3	QPSK	8	7	21.83	21.82	21.83		
3	QPSK	15	0	21.87	21.96	22.01	23	1
3	16QAM	1	0	21.98	22.02	22.51		
3	16QAM	1	8	21.98	21.96	22.07		
3	16QAM	1	14	21.93	22.30	21.76	22	2
3	16QAM	8	0	20.97	20.92	20.96		
3	16QAM	8	4	20.87	21.00	20.82		
3	16QAM	8	7	20.81	20.88	20.91	22	2
3	16QAM	15	0	20.90	20.91	21.00		
3	64QAM	1	0	20.71	21.07	20.81	22	2

3	64QAM	1	8	20.78	20.93	20.85	21	3
3	64QAM	1	14	20.82	20.97	20.83		
3	64QAM	8	0	19.35	19.92	19.97		
3	64QAM	8	4	19.96	19.98	19.91		
3	64QAM	8	7	19.75	19.78	19.99		
3	64QAM	15	0	19.76	19.85	20.03		
Channel				19957	20175	20393	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	22.51	22.76	22.91	24	0
1.4	QPSK	1	3	22.73	22.68	22.69		
1.4	QPSK	1	5	22.77	22.68	22.59		
1.4	QPSK	3	0	22.50	22.72	22.92		
1.4	QPSK	3	1	22.72	22.69	22.73		
1.4	QPSK	3	3	22.79	22.68	22.68		
1.4	QPSK	6	0	21.88	21.97	22.02	23	1
1.4	16QAM	1	0	21.96	22.04	22.48	23	1
1.4	16QAM	1	3	21.98	21.96	22.02		
1.4	16QAM	1	5	21.98	22.32	21.68		
1.4	16QAM	3	0	21.95	22.01	22.44		
1.4	16QAM	3	1	22.01	21.96	21.97		
1.4	16QAM	3	3	21.91	22.38	21.73		
1.4	16QAM	6	0	20.85	20.91	20.97	22	2
1.4	64QAM	1	0	20.79	21.04	20.85	22	2
1.4	64QAM	1	3	20.74	20.98	20.80		
1.4	64QAM	1	5	20.79	20.97	20.81		
1.4	64QAM	3	0	20.72	21.10	20.82		
1.4	64QAM	3	1	20.81	20.90	20.88		
1.4	64QAM	3	3	20.85	21.00	20.82		
1.4	64QAM	6	0	19.82	19.94	20.03	21	3

<LTE Band 5>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.72	22.98	22.94	24	0
10	QPSK	1	25	22.90	22.78	22.84		
10	QPSK	1	49	22.72	22.85	22.85		
10	QPSK	25	0	21.87	21.82	21.80	23	1
10	QPSK	25	12	22.00	21.85	21.85		
10	QPSK	25	25	21.88	21.86	21.85		
10	QPSK	50	0	21.91	21.88	21.89		
10	16QAM	1	0	22.51	21.86	22.37	23	1
10	16QAM	1	25	22.31	21.93	22.35		
10	16QAM	1	49	22.53	21.64	22.27		
10	16QAM	25	0	20.86	20.82	20.79	22	2
10	16QAM	25	12	21.07	20.85	20.87		
10	16QAM	25	25	20.85	20.87	20.78		
10	16QAM	50	0	20.97	20.84	20.88		
10	64QAM	1	0	20.80	21.08	20.88	22	2
10	64QAM	1	25	20.74	21.14	21.06		
10	64QAM	1	49	20.68	21.45	21.10		
10	64QAM	25	0	19.97	19.84	19.87	21	3
10	64QAM	25	12	20.09	19.82	19.87		
10	64QAM	25	25	19.85	19.90	19.94		



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10	64QAM	50	0	19.95	19.90	19.80		
Channel				20425	20525	20625	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.72	22.94	22.91	24	0
5	QPSK	1	12	22.80	22.76	22.79		
5	QPSK	1	24	22.66	22.81	22.78		
5	QPSK	12	0	21.84	21.78	21.78	23	1
5	QPSK	12	7	21.97	21.75	21.80		
5	QPSK	12	13	21.79	21.86	21.75		
5	QPSK	25	0	21.86	21.80	21.87		
5	16QAM	1	0	22.44	21.82	22.31	23	1
5	16QAM	1	12	22.31	21.91	22.29		
5	16QAM	1	24	22.46	21.54	22.24		
5	16QAM	12	0	20.83	20.80	20.74	22	2
5	16QAM	12	7	21.00	20.77	20.80		
5	16QAM	12	13	20.83	20.77	20.78		
5	16QAM	25	0	20.87	20.83	20.81		
5	64QAM	1	0	20.72	20.98	20.84	22	2
5	64QAM	1	12	20.68	21.11	21.02		
5	64QAM	1	24	20.68	21.39	21.07		
5	64QAM	12	0	19.97	19.77	19.81	21	3
5	64QAM	12	7	20.08	19.73	19.85		
5	64QAM	12	13	19.77	19.85	19.94		
5	64QAM	25	0	19.85	19.80	19.71		
Channel				20415	20525	20635	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.67	22.90	22.90	24	0
3	QPSK	1	8	22.88	22.68	22.78		
3	QPSK	1	14	22.69	22.77	22.84		
3	QPSK	8	0	21.87	21.74	21.78	23	1
3	QPSK	8	4	21.92	21.82	21.80		
3	QPSK	8	7	21.79	21.85	21.79		
3	QPSK	15	0	21.85	21.88	21.81		
3	16QAM	1	0	22.41	21.84	22.37	23	1
3	16QAM	1	8	22.26	21.84	22.31		
3	16QAM	1	14	22.43	21.57	22.25		
3	16QAM	8	0	20.80	20.82	20.69	22	2
3	16QAM	8	4	21.02	20.80	20.84		
3	16QAM	8	7	20.85	20.82	20.73		
3	16QAM	15	0	20.96	20.83	20.79		
3	64QAM	1	0	20.78	20.98	20.80	22	2
3	64QAM	1	8	20.66	21.14	21.05		
3	64QAM	1	14	20.65	21.35	21.08		
3	64QAM	8	0	19.89	19.77	19.86	21	3
3	64QAM	8	4	20.05	19.76	19.80		
3	64QAM	8	7	19.83	19.89	19.94		
3	64QAM	15	0	19.90	19.85	19.75		
Channel				20407	20525	20643	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.67	22.92	22.85	24	0
1.4	QPSK	1	3	22.81	22.68	22.78		
1.4	QPSK	1	5	22.63	22.79	22.76		
1.4	QPSK	3	0	22.65	22.95	22.86		
1.4	QPSK	3	1	22.84	22.71	22.77		
1.4	QPSK	3	3	22.72	22.84	22.76		
1.4	QPSK	6	0	21.91	21.83	21.82	23	1

1.4	16QAM	1	0	22.51	21.79	22.34	23	1
1.4	16QAM	1	3	22.25	21.85	22.27		
1.4	16QAM	1	5	22.51	21.61	22.21		
1.4	16QAM	3	0	22.51	21.85	22.29		
1.4	16QAM	3	1	22.21	21.84	22.29		
1.4	16QAM	3	3	22.49	21.59	22.22	22	2
1.4	16QAM	6	0	20.94	20.75	20.82		
1.4	64QAM	1	0	20.78	21.05	20.79		
1.4	64QAM	1	3	20.66	21.14	20.99		
1.4	64QAM	1	5	20.65	21.37	21.00		
1.4	64QAM	3	0	20.74	21.01	20.87	22	2
1.4	64QAM	3	1	20.70	21.12	21.04		
1.4	64QAM	3	3	20.65	21.42	21.02		
1.4	64QAM	6	0	19.93	19.82	19.80		
1.4	64QAM	6	0	19.93	19.82	19.80	21	3

<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)	MPR (dB)
Channel				20850	21100	21350	24	0
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	22.50	22.60	22.49		
20	QPSK	1	49	22.56	22.52	22.54	23	1
20	QPSK	1	99	22.55	22.51	22.40		
20	QPSK	50	0	21.61	21.48	21.45		
20	QPSK	50	24	21.65	21.64	21.62		
20	QPSK	50	50	21.76	21.68	21.40		
20	QPSK	100	0	21.70	21.59	21.55	23	1
20	16QAM	1	0	21.92	21.80	21.61		
20	16QAM	1	49	21.77	21.87	21.43		
20	16QAM	1	99	21.67	21.82	21.44	22	2
20	16QAM	50	0	20.53	20.57	20.57		
20	16QAM	50	24	20.71	20.47	20.59		
20	16QAM	50	50	20.64	20.72	20.59		
20	16QAM	100	0	20.59	20.57	20.65		
20	64QAM	1	0	20.07	20.66	20.45	22	2
20	64QAM	1	49	20.56	20.53	20.70		
20	64QAM	1	99	20.90	20.82	20.40		
20	64QAM	50	0	19.50	19.26	19.62	21	3
20	64QAM	50	24	19.77	19.42	19.43		
20	64QAM	50	50	19.66	19.61	19.56		
20	64QAM	100	0	19.70	19.54	19.49		
Channel				20825	21100	21375	24	0
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	22.46	22.56	22.41		
15	QPSK	1	37	22.54	22.48	22.52	23	1
15	QPSK	1	74	22.46	22.51	22.39		
15	QPSK	36	0	21.56	21.38	21.41		
15	QPSK	36	20	21.55	21.57	21.55		
15	QPSK	36	39	21.71	21.67	21.34		
15	QPSK	75	0	21.68	21.59	21.54	23	1
15	16QAM	1	0	21.92	21.74	21.53		
15	16QAM	1	37	21.74	21.82	21.40		
15	16QAM	1	74	21.58	21.72	21.52		
15	16QAM	36	0	20.51	20.47	20.49		
15	16QAM	36	20	20.61	20.37	20.55	22	2



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15	16QAM	36	39	20.55	20.71	20.58		
15	16QAM	75	0	20.58	20.50	20.65		
15	64QAM	1	0	20.00	20.56	20.35		
15	64QAM	1	37	20.56	20.53	20.62	22	2
15	64QAM	1	74	20.82	20.78	20.32		
15	64QAM	36	0	19.44	19.17	19.56		
15	64QAM	36	20	19.71	19.42	19.34	21	3
15	64QAM	36	39	19.58	19.53	19.53		
15	64QAM	75	0	19.69	19.45	19.46		
Channel				20800	21100	21400	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	22.47	22.57	22.45	24	0
10	QPSK	1	25	22.48	22.51	22.50		
10	QPSK	1	49	22.45	22.44	22.32		
10	QPSK	25	0	21.60	21.43	21.36	23	1
10	QPSK	25	12	21.59	21.63	21.61		
10	QPSK	25	25	21.66	21.65	21.31		
10	QPSK	50	0	21.66	21.53	21.49	23	1
10	16QAM	1	0	21.91	21.75	21.61		
10	16QAM	1	25	21.69	21.82	21.35		
10	16QAM	1	49	21.62	21.74	21.22	22	2
10	16QAM	25	0	20.50	20.54	20.51		
10	16QAM	25	12	20.71	20.46	20.56		
10	16QAM	25	25	20.64	20.62	20.54	22	2
10	16QAM	50	0	20.59	20.53	20.59		
10	64QAM	1	0	20.01	20.65	20.36		
10	64QAM	1	25	20.48	20.47	20.67	22	2
10	64QAM	1	49	20.86	20.74	20.31		
10	64QAM	25	0	19.41	19.24	19.56		
10	64QAM	25	12	19.67	19.37	19.39	21	3
10	64QAM	25	25	19.60	19.59	19.52		
10	64QAM	50	0	19.69	19.48	19.45		
Channel				20775	21100	21425	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	22.50	22.58	22.44	24	0
5	QPSK	1	12	22.48	22.49	22.45		
5	QPSK	1	24	22.48	22.42	22.31		
5	QPSK	12	0	21.58	21.45	21.37	23	1
5	QPSK	12	7	21.59	21.54	21.61		
5	QPSK	12	13	21.72	21.65	21.36		
5	QPSK	25	0	21.68	21.58	21.51	23	1
5	16QAM	1	0	21.91	21.74	21.54		
5	16QAM	1	12	21.74	21.86	21.42		
5	16QAM	1	24	21.57	21.80	21.50	22	2
5	16QAM	12	0	20.46	20.48	20.48		
5	16QAM	12	7	20.71	20.45	20.57		
5	16QAM	12	13	20.54	20.62	20.52	22	2
5	16QAM	25	0	20.59	20.52	20.56		
5	64QAM	1	0	20.05	20.65	20.42		
5	64QAM	1	12	20.55	20.50	20.67	22	2
5	64QAM	1	24	20.89	20.74	20.35		
5	64QAM	12	0	19.44	19.26	19.59		
5	64QAM	12	7	19.76	19.37	19.39	21	3
5	64QAM	12	13	19.58	19.53	19.55		
5	64QAM	25	0	19.65	19.50	19.41		

<LTE Band 12>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				23060	23095	23130	24	0
Frequency (MHz)				704	707.5	711		
10	QPSK	1	0	22.98	23.08	23.02		
10	QPSK	1	25	22.89	22.83	22.96	23	1
10	QPSK	1	49	23.02	22.79	23.01		
10	QPSK	25	0	22.18	22.18	22.08		
10	QPSK	25	12	22.19	22.14	22.20	23	1
10	QPSK	25	25	22.07	22.22	22.10		
10	QPSK	50	0	22.23	22.25	22.16		
10	16QAM	1	0	22.39	22.39	22.06	23	1
10	16QAM	1	25	22.35	22.31	22.03		
10	16QAM	1	49	22.47	22.38	21.95		
10	16QAM	25	0	21.18	21.17	21.07	22	2
10	16QAM	25	12	21.14	21.24	21.21		
10	16QAM	25	25	21.25	21.12	21.12		
10	16QAM	50	0	21.26	21.12	21.21	22	2
10	64QAM	1	0	21.38	21.47	21.12		
10	64QAM	1	25	21.30	21.39	21.21		
10	64QAM	1	49	21.11	20.89	21.04	21	3
10	64QAM	25	0	20.18	20.17	20.13		
10	64QAM	25	12	20.27	20.30	20.21		
10	64QAM	25	25	20.18	20.22	20.32	21	3
10	64QAM	50	0	20.21	20.29	20.22		
Channel				23035	23095	23155	24	0
Frequency (MHz)				701.5	707.5	713.5		
5	QPSK	1	0	22.89	22.99	22.95		
5	QPSK	1	12	22.89	22.82	22.94	23	1
5	QPSK	1	24	22.92	22.72	22.96		
5	QPSK	12	0	22.09	22.17	22.06		
5	QPSK	12	7	22.10	22.07	22.16	23	1
5	QPSK	12	13	22.00	22.14	22.00		
5	QPSK	25	0	22.23	22.18	22.12		
5	16QAM	1	0	22.30	22.30	21.99	23	1
5	16QAM	1	12	22.26	22.24	21.97		
5	16QAM	1	24	22.44	22.34	21.93		
5	16QAM	12	0	21.16	21.09	21.05	22	2
5	16QAM	12	7	21.10	21.19	21.17		
5	16QAM	12	13	21.15	21.04	21.10		
5	16QAM	25	0	21.19	21.08	21.17	22	2
5	64QAM	1	0	21.32	21.42	21.07		
5	64QAM	1	12	21.21	21.31	21.14		
5	64QAM	1	24	21.03	20.88	20.99	21	3
5	64QAM	12	0	20.12	20.09	20.09		
5	64QAM	12	7	20.21	20.22	20.11		
5	64QAM	12	13	20.11	20.16	20.29	21	3
5	64QAM	25	0	20.18	20.22	20.21		
Channel				23025	23095	23165	24	0
Frequency (MHz)				700.5	707.5	714.5		
3	QPSK	1	0	22.89	22.99	22.92		
3	QPSK	1	8	22.86	22.78	22.94	24	0
3	QPSK	1	14	22.95	22.70	22.98		
3	QPSK	8	0	22.18	22.09	21.98	23	1
3	QPSK	8	4	22.10	22.14	22.18		



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3	QPSK	8	7	22.01	22.12	22.00		
3	QPSK	15	0	22.14	22.18	22.08		
3	16QAM	1	0	22.32	22.39	22.02		
3	16QAM	1	8	22.35	22.27	21.98	23	1
3	16QAM	1	14	22.45	22.38	21.87		
3	16QAM	8	0	21.18	21.14	20.98		
3	16QAM	8	4	21.10	21.23	21.12	22	2
3	16QAM	8	7	21.16	21.04	21.09		
3	16QAM	15	0	21.24	21.04	21.12		
3	64QAM	1	0	21.31	21.37	21.03	22	2
3	64QAM	1	8	21.28	21.29	21.19		
3	64QAM	1	14	21.04	20.83	20.99		
3	64QAM	8	0	20.13	20.11	20.05	21	3
3	64QAM	8	4	20.24	20.28	20.14		
3	64QAM	8	7	20.14	20.17	20.30		
3	64QAM	15	0	20.18	20.25	20.15		
Channel				23017	23095	23173	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				699.7	707.5	715.3		
1.4	QPSK	1	0	22.98	23.06	22.96	24	0
1.4	QPSK	1	3	22.84	22.79	22.92		
1.4	QPSK	1	5	22.92	22.73	22.97		
1.4	QPSK	3	0	22.94	23.05	22.97		
1.4	QPSK	3	1	22.89	22.80	22.93		
1.4	QPSK	3	3	22.93	22.72	22.98		
1.4	QPSK	6	0	22.14	22.24	22.11	23	1
1.4	16QAM	1	0	22.32	22.39	22.00	23	1
1.4	16QAM	1	3	22.27	22.28	21.96		
1.4	16QAM	1	5	22.40	22.36	21.93		
1.4	16QAM	3	0	22.39	22.39	22.00		
1.4	16QAM	3	1	22.26	22.26	21.99		
1.4	16QAM	3	3	22.39	22.37	21.90		
1.4	16QAM	6	0	21.17	21.12	21.16	22	2
1.4	64QAM	1	0	21.31	21.46	21.12	22	2
1.4	64QAM	1	3	21.26	21.39	21.21		
1.4	64QAM	1	5	21.01	20.85	21.01		
1.4	64QAM	3	0	21.32	21.38	21.07		
1.4	64QAM	3	1	21.24	21.37	21.20		
1.4	64QAM	3	3	21.09	20.79	21.04		
1.4	64QAM	6	0	20.21	20.24	20.19	21	3

<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.

- 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- “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
- 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.

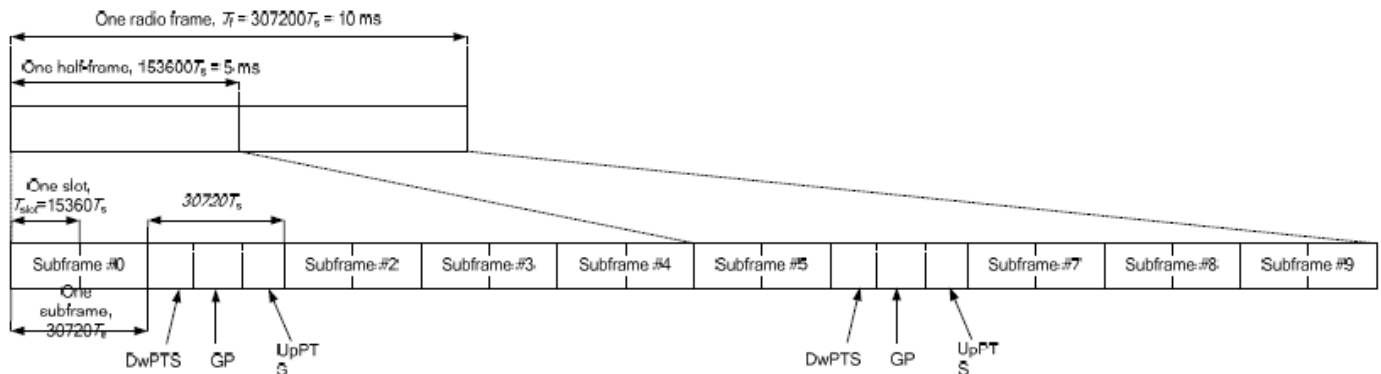


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

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	$26336 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$			$20480 \cdot T_s$		
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:

- Uplink-downlink configuration: 0. In a half-frame consisted of 5 subframes, uplink operation is in 3 uplink subframes and 1 special subframe.
- special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
- for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is:
 $(3+0.167)/5 = 63.3\%$
- for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is:
 $(3+0.143)/5 = 62.9\%$
- 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>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				37850	38000	38150		
Frequency (MHz)				2580	2595	2610		
20	QPSK	1	0	22.35	22.53	22.36	24	0
20	QPSK	1	49	22.33	22.30	22.46		
20	QPSK	1	99	22.28	22.35	22.46		
20	QPSK	50	0	21.54	21.54	21.53	23	1
20	QPSK	50	24	21.52	21.54	21.54		
20	QPSK	50	50	21.55	21.60	21.68		
20	QPSK	100	0	21.56	21.57	21.66	23	1
20	16QAM	1	0	21.73	21.59	21.43		
20	16QAM	1	49	21.35	21.54	21.52		
20	16QAM	1	99	21.43	21.65	21.64	22	2
20	16QAM	50	0	20.51	20.57	20.58		
20	16QAM	50	24	20.55	20.50	20.60		
20	16QAM	50	50	20.60	20.59	20.54	22	2
20	16QAM	100	0	20.51	20.61	20.70		
20	64QAM	1	0	20.30	20.24	20.27	22	2
20	64QAM	1	49	20.20	20.19	20.26		
20	64QAM	1	99	20.20	20.31	20.32		
20	64QAM	50	0	19.51	19.57	19.56	21	3
20	64QAM	50	24	19.57	19.58	19.57		
20	64QAM	50	50	19.60	19.52	19.62		
20	64QAM	100	0	19.52	19.56	19.65		
Channel				37825	38000	38175	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2577.5	2595	2612.5		
15	QPSK	1	0	22.32	22.50	22.30	24	0
15	QPSK	1	37	22.31	22.30	22.40		
15	QPSK	1	74	22.24	22.29	22.40		
15	QPSK	36	0	21.45	21.46	21.47	23	1
15	QPSK	36	20	21.43	21.49	21.44		
15	QPSK	36	39	21.53	21.52	21.60		
15	QPSK	75	0	21.52	21.56	21.57	23	1
15	16QAM	1	0	21.66	21.56	21.40		
15	16QAM	1	37	21.26	21.47	21.51		
15	16QAM	1	74	21.35	21.55	21.54	22	2
15	16QAM	36	0	20.51	20.47	20.50		
15	16QAM	36	20	20.52	20.50	20.53		
15	16QAM	36	39	20.50	20.51	20.50	22	2
15	16QAM	75	0	20.50	20.61	20.66		
15	64QAM	1	0	20.20	20.24	20.20		
15	64QAM	1	37	20.10	20.16	20.20	22	2
15	64QAM	1	74	20.20	20.23	20.30		
15	64QAM	36	0	19.42	19.53	19.49		
15	64QAM	36	20	19.53	19.58	19.48	21	3
15	64QAM	36	39	19.51	19.46	19.62		
15	64QAM	75	0	19.44	19.52	19.58		
Channel				37800	38000	38200	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2575	2595	2615		
10	QPSK	1	0	22.25	22.48	22.34	24	0
10	QPSK	1	25	22.23	22.29	22.43		
10	QPSK	1	49	22.27	22.28	22.46		
10	QPSK	25	0	21.52	21.47	21.53	23	1
10	QPSK	25	12	21.42	21.49	21.45		

10	QPSK	25	25	21.54	21.57	21.65		
10	QPSK	50	0	21.46	21.55	21.62		
10	16QAM	1	0	21.67	21.52	21.36		
10	16QAM	1	25	21.30	21.49	21.51	23	1
10	16QAM	1	49	21.33	21.56	21.54		
10	16QAM	25	0	20.50	20.54	20.58		
10	16QAM	25	12	20.52	20.49	20.57	22	2
10	16QAM	25	25	20.56	20.58	20.50		
10	16QAM	50	0	20.49	20.59	20.60		
10	64QAM	1	0	20.21	20.15	20.26	22	2
10	64QAM	1	25	20.13	20.16	20.17		
10	64QAM	1	49	20.10	20.31	20.22		
10	64QAM	25	0	19.45	19.53	19.55	21	3
10	64QAM	25	12	19.52	19.53	19.50		
10	64QAM	25	25	19.56	19.43	19.53		
10	64QAM	50	0	19.50	19.48	19.55		
Channel				37775	38000	38225	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2572.5	2595	2617.5		
5	QPSK	1	0	22.25	22.43	22.34	24	0
5	QPSK	1	12	22.23	22.27	22.46		
5	QPSK	1	24	22.23	22.32	22.41		
5	QPSK	12	0	21.52	21.54	21.51	23	1
5	QPSK	12	7	21.48	21.48	21.51		
5	QPSK	12	13	21.53	21.53	21.68		
5	QPSK	25	0	21.55	21.57	21.63	23	1
5	16QAM	1	0	21.68	21.57	21.39		
5	16QAM	1	12	21.27	21.50	21.42		
5	16QAM	1	24	21.37	21.57	21.60	22	2
5	16QAM	12	0	20.47	20.47	20.50		
5	16QAM	12	7	20.54	20.50	20.52		
5	16QAM	12	13	20.50	20.54	20.50	22	2
5	16QAM	25	0	20.50	20.58	20.68		
5	64QAM	1	0	20.24	20.17	20.26		
5	64QAM	1	12	20.17	20.09	20.23	21	3
5	64QAM	1	24	20.19	20.29	20.30		
5	64QAM	12	0	19.46	19.54	19.49		
5	64QAM	12	7	19.54	19.56	19.50	21	3
5	64QAM	12	13	19.60	19.52	19.57		
5	64QAM	25	0	19.48	19.56	19.63		

<LTE Band 41>

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)	MPR (dB)
Channel				39750	40185	40620	41055	41490		
Frequency (MHz)				2506	2549.5	2593	2636.5	2680		
20	QPSK	1	0	22.75	22.80	22.59	22.86	23.00	24	0
20	QPSK	1	49	22.78	22.68	22.57	22.74	22.87		
20	QPSK	1	99	22.76	22.65	22.77	22.94	22.77		
20	QPSK	50	0	21.84	21.86	21.63	21.90	22.08	23	1
20	QPSK	50	24	21.97	21.87	21.75	21.94	22.15		
20	QPSK	50	50	21.94	21.81	21.63	22.01	22.08		
20	QPSK	100	0	22.00	21.92	21.77	21.98	21.97	23	1
20	16QAM	1	0	22.02	21.89	21.74	21.98	22.24		
20	16QAM	1	49	21.76	21.81	21.61	21.86	21.91		
20	16QAM	1	99	21.83	21.81	21.80	22.03	21.90		

20	16QAM	50	0	20.92	20.80	20.69	21.04	21.04	22	2
20	16QAM	50	24	21.02	20.88	20.76	20.95	21.07		
20	16QAM	50	50	21.02	20.89	20.78	21.04	21.04		
20	16QAM	100	0	20.97	20.96	20.72	20.87	21.09		
20	64QAM	1	0	20.63	20.65	20.47	20.65	20.82	22	2
20	64QAM	1	49	20.57	20.59	20.36	20.60	20.66		
20	64QAM	1	99	20.58	20.44	20.53	20.72	20.64		
20	64QAM	50	0	19.98	19.90	19.73	19.93	20.13	21	3
20	64QAM	50	24	19.95	19.91	19.81	19.90	20.09		
20	64QAM	50	50	19.99	19.88	19.65	20.03	20.00		
20	64QAM	100	0	19.94	19.93	19.72	19.94	19.99		
Channel				39725	40173	40620	41068	41515	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2503.5	2548.3	2593	2637.8	2682.5		
15	QPSK	1	0	22.75	22.75	22.53	22.84	22.92	24.00	0
15	QPSK	1	37	22.70	22.61	22.53	22.64	22.78		
15	QPSK	1	74	22.69	22.58	22.68	22.93	22.67		
15	QPSK	36	0	21.80	21.83	21.62	21.88	22.05	23	1
15	QPSK	36	20	21.94	21.79	21.69	21.85	22.10		
15	QPSK	36	39	21.87	21.75	21.53	21.97	21.98		
15	QPSK	75	0	22.00	21.83	21.71	21.97	21.93		
15	16QAM	1	0	21.95	21.85	21.65	21.91	22.23	23	1
15	16QAM	1	37	21.71	21.79	21.51	21.85	21.81		
15	16QAM	1	74	21.73	21.72	21.75	21.94	21.81		
15	16QAM	36	0	20.82	20.79	20.67	20.98	20.96	22	2
15	16QAM	36	20	20.92	20.87	20.70	20.90	21.04		
15	16QAM	36	39	21.00	20.81	20.76	20.98	21.03		
15	16QAM	75	0	20.94	20.91	20.72	20.84	21.02		
15	64QAM	1	0	20.57	20.59	20.41	20.57	20.82	22	2
15	64QAM	1	37	20.48	20.55	20.28	20.59	20.58		
15	64QAM	1	74	20.48	20.41	20.44	20.66	20.62		
15	64QAM	36	0	19.91	19.88	19.65	19.83	20.05	21	3
15	64QAM	36	20	19.94	19.84	19.75	19.90	19.99		
15	64QAM	36	39	19.89	19.84	19.65	20.02	19.94		
15	64QAM	75	0	19.91	19.90	19.72	19.84	19.91		
Channel				39700	40160	40620	41080	41540	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2501	2547	2593	2639	2685		
10	QPSK	1	0	22.68	22.70	22.57	22.80	22.93	24.00	0
10	QPSK	1	25	22.75	22.66	22.55	22.73	22.83		
10	QPSK	1	49	22.74	22.57	22.74	22.84	22.71		
10	QPSK	25	0	21.84	21.82	21.55	21.84	22.00	23	1
10	QPSK	25	12	21.87	21.80	21.72	21.92	22.14		
10	QPSK	25	25	21.93	21.75	21.53	21.95	21.98		
10	QPSK	50	0	21.92	21.88	21.77	21.98	21.94		
10	16QAM	1	0	22.01	21.84	21.71	21.94	22.21	23	1
10	16QAM	1	25	21.73	21.72	21.52	21.76	21.90		
10	16QAM	1	49	21.76	21.73	21.76	22.00	21.82		
10	16QAM	25	0	20.92	20.77	20.62	21.04	20.95	22	2
10	16QAM	25	12	20.95	20.88	20.75	20.94	21.00		
10	16QAM	25	25	20.93	20.85	20.75	20.96	21.02		
10	16QAM	50	0	20.95	20.89	20.65	20.86	21.05		
10	64QAM	1	0	20.57	20.59	20.45	20.62	20.80	22	2
10	64QAM	1	25	20.50	20.55	20.32	20.56	20.62		
10	64QAM	1	49	20.49	20.37	20.48	20.64	20.60		
10	64QAM	25	0	19.93	19.89	19.65	19.85	20.06	21	3
10	64QAM	25	12	19.88	19.90	19.76	19.90	20.09		
10	64QAM	25	25	19.92	19.78	19.56	20.03	19.95		



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10	64QAM	50	0	19.87	19.89	19.66	19.88	19.97		
Channel				39675	40148	40620	41093	41565	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2498.5	2545.8	2593	2640.30	2687.5		
5	QPSK	1	0	22.74	22.80	22.50	22.77	22.98	24.00	0
5	QPSK	1	12	22.74	22.62	22.47	22.71	22.85		
5	QPSK	1	24	22.76	22.56	22.71	22.87	22.73		
5	QPSK	12	0	21.79	21.80	21.58	21.86	22.06	23	1
5	QPSK	12	7	21.87	21.82	21.72	21.91	22.12		
5	QPSK	12	13	21.89	21.71	21.56	21.92	22.03		
5	QPSK	25	0	21.99	21.83	21.76	21.91	21.91		
5	16QAM	1	0	22.02	21.80	21.68	21.89	22.24	23	1
5	16QAM	1	12	21.73	21.79	21.56	21.79	21.89		
5	16QAM	1	24	21.75	21.73	21.71	21.95	21.89		
5	16QAM	12	0	20.85	20.70	20.65	20.98	20.99	22	2
5	16QAM	12	7	20.95	20.87	20.70	20.95	21.06		
5	16QAM	12	13	20.97	20.88	20.73	20.96	20.98		
5	16QAM	25	0	20.88	20.91	20.69	20.80	21.09		
5	64QAM	1	0	20.57	20.60	20.46	20.57	20.77	22	2
5	64QAM	1	12	20.54	20.56	20.29	20.54	20.58		
5	64QAM	1	24	20.48	20.39	20.44	20.67	20.55		
5	64QAM	12	0	19.96	19.85	19.66	19.93	20.05	21	3
5	64QAM	12	7	19.93	19.88	19.80	19.88	20.02		
5	64QAM	12	13	19.90	19.86	19.63	19.94	19.94		
5	64QAM	25	0	19.89	19.86	19.66	19.94	19.89		

12. WiFi Output Power (Unit: dBm)

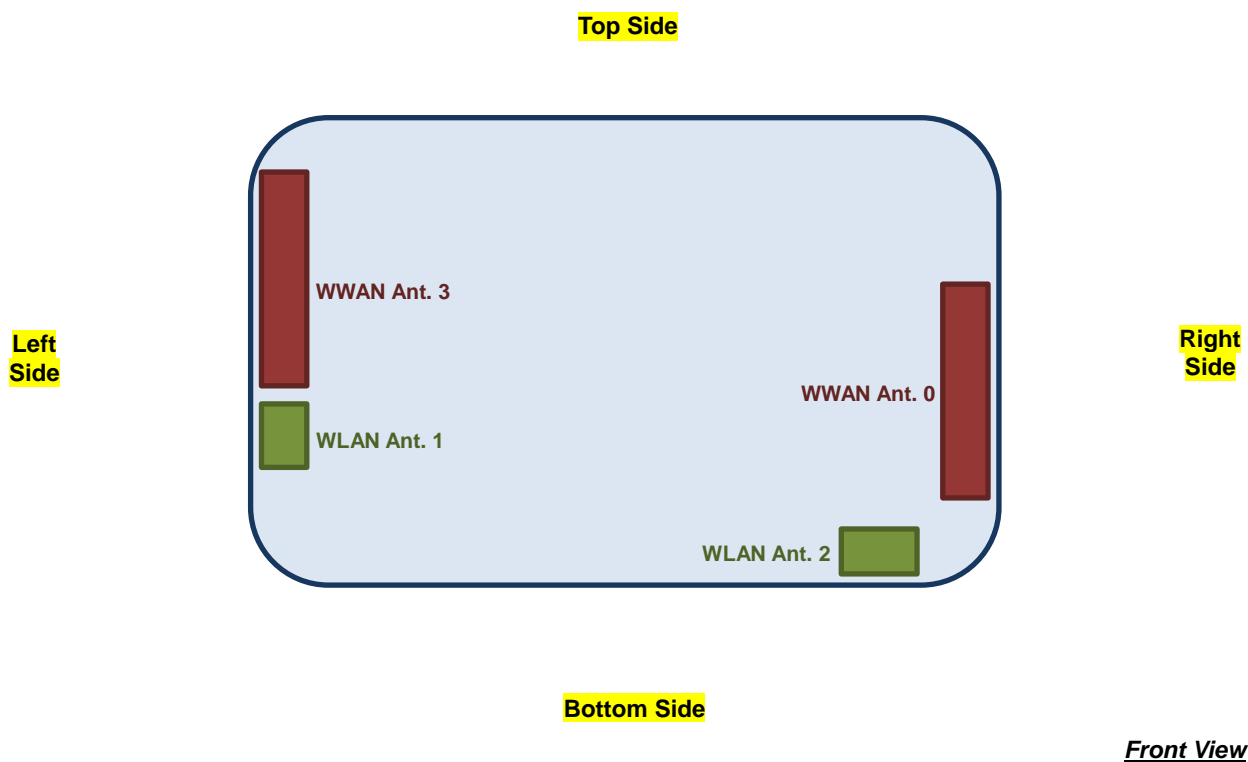
General Note:

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 $< 1.6\text{W/kg}$ and SAR peak to location ratio ≤ 0.04 , no additional SAR measurements for MIMO.
3. 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.
4. 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).
5. 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.
6. 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 $\leq 0.4\text{ W/kg}$, 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 $> 0.4\text{ W/kg}$, 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 $\leq 0.8\text{ W/kg}$ or all required test position are tested.
 - c. For all positions/configurations, when the reported SAR is $> 0.8\text{ W/kg}$, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is $\leq 1.2\text{ W/kg}$ or all required channels are tested.

<2.4GHz WLAN>

2.4GHz WLAN				Ant 1			Ant 2			Ant 1+2		
	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %	Average power (dBm)	Tune-Up Limit	Duty Cycle %	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	1	2412	14.30	14.50	98.01	15.20	15.50	98.01	17.88	18.00	98.01
		6	2437	14.00	14.50		14.70	15.50		17.67	18.00	
		11	2462	14.20	14.50		15.20	15.50		17.88	18.00	
	802.11g 6Mbps	1	2412	16.70	17.50	99.25	17.40	17.50	99.25	20.42	20.50	99.25
		6	2437	17.00	17.50		17.40	17.50		20.31	20.50	
		11	2462	16.80	17.50		17.30	17.50		20.33	20.50	
	802.11n-HT20 MCS0	1	2412	16.40	17.00	100.00	17.30	18.00	100.00	20.12	20.50	100.00
		6	2437	16.40	17.00		17.10	18.00		19.97	20.50	
		11	2462	16.40	17.00		17.10	18.00		19.98	20.50	
	802.11n-HT40 MCS0	3	2422	16.80	17.50	100.00	17.60	18.50	100.00	20.52	21.00	100.00
		6	2437	16.60	17.50		17.40	17.50		20.37	20.50	
		9	2452	16.80	17.50		17.80	18.00		20.44	20.50	
	802.11ac-VHT20 MCS0	1	2412	16.40	17.00	100.00	17.30	18.00	100.00	20.12	20.50	100.00
		6	2437	16.40	17.00		17.10	18.00		19.97	20.50	
		11	2462	16.40	17.00		17.10	18.00		19.98	20.50	
	802.11ac-VHT40 MCS0	3	2422	16.80	17.50	100.00	17.60	18.50	100.00	20.52	21.00	100.00
		6	2437	16.60	17.50		17.40	17.50		20.37	20.50	
		9	2452	16.80	17.50		17.80	18.00		20.44	20.50	

13. Antenna Location



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 ≥ 0.8 W/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 is $\leq \frac{1}{4}$ 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 to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than $\frac{1}{4}$ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA.

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 $\frac{1}{2}$ 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 $\frac{1}{2}$ 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 B4/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 \leq the larger band to qualify for the SAR test exclusion.
 - b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.

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 WLAN SAR testing was performed on single antenna RF power in SISO mode is larger or equal to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission exclusion analysis was performed with SAR test results of each antenna in SISO mode.
5. 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 < 1.6 W/kg and SAR peak to location ratio ≤ 0.04 , no additional SAR measurements for MIMO.
6. 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_ Ant 3	RMC 12.2Kbps	Front	10mm	4233	846.6	23.65	24.00	1.084	-0.15	0.141	0.153
	WCDMA V_ Ant 3	RMC 12.2Kbps	Front	10mm	4132	826.4	23.62	24.00	1.091	-0.19	0.163	0.178
	WCDMA V_ Ant 3	RMC 12.2Kbps	Front	10mm	4182	836.4	23.61	24.00	1.094	-0.09	0.152	0.166
	WCDMA V_ Ant 3	RMC 12.2Kbps	Back	10mm	4233	846.6	23.65	24.00	1.084	-0.07	0.103	0.112
	WCDMA V_ Ant 3	RMC 12.2Kbps	Left Side	10mm	4233	846.6	23.65	24.00	1.084	0.05	0.003	0.003
	WCDMA V_ Ant 3	RMC 12.2Kbps	Right Side	10mm	4233	846.6	23.65	24.00	1.084	-0.1	0.045	0.049
	WCDMA V_ Ant 3	RMC 12.2Kbps	Top Side	10mm	4233	846.6	23.65	24.00	1.084	-0.07	0.071	0.077
	WCDMA V_ Ant 3	RMC 12.2Kbps	Bottom Side	10mm	4233	846.6	23.65	24.00	1.084	0.05	0.037	0.040
	WCDMA V_ Ant 3	RMC 12.2Kbps	Bottom Side	10mm	4233	846.6	23.65	24.00	1.084	0.05	0.037	0.040

<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 4_ Ant 0	20M	QPSK	1	0	Front	10mm	20175	1732.5	22.78	24.00	1.324	-0.19	0.949	1.257
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Front	10mm	20175	1732.5	21.99	23.00	1.262	0.02	0.795	1.003
	LTE Band 4_ Ant 0	20M	QPSK	100	0	Front	10mm	20175	1732.5	21.98	23.00	1.265	-0.03	0.797	1.008
	LTE Band 4_ Ant 0	20M	QPSK	1	0	Back	10mm	20175	1732.5	22.78	24.00	1.324	0	0.667	0.883
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Back	10mm	20175	1732.5	21.99	23.00	1.262	0.05	0.543	0.685
	LTE Band 4_ Ant 0	20M	QPSK	100	0	Back	10mm	20175	1732.5	21.98	23.00	1.265	0.04	0.529	0.669
	LTE Band 4_ Ant 0	20M	QPSK	1	0	Left Side	10mm	20175	1732.5	22.78	24.00	1.324	0.01	0.312	0.413
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Left Side	10mm	20175	1732.5	21.99	23.00	1.262	-0.02	0.243	0.307
	LTE Band 4_ Ant 0	20M	QPSK	1	0	Right Side	10mm	20175	1732.5	22.78	24.00	1.324	0.05	0.067	0.089
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Right Side	10mm	20175	1732.5	21.99	23.00	1.262	-0.03	0.057	0.072
	LTE Band 4_ Ant 0	20M	QPSK	1	0	Top Side	10mm	20175	1732.5	22.78	24.00	1.324	0.09	0.761	1.008
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Top Side	10mm	20175	1732.5	21.99	23.00	1.262	-0.1	0.634	0.800
	LTE Band 4_ Ant 0	20M	QPSK	100	0	Top Side	10mm	20175	1732.5	21.98	23.00	1.265	0.11	0.664	0.840
	LTE Band 4_ Ant 0	20M	QPSK	1	0	Bottom Side	10mm	20175	1732.5	22.78	24.00	1.324	0.05	0.051	0.068
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Bottom Side	10mm	20175	1732.5	21.99	23.00	1.262	0.02	0.042	0.053
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Bottom Side	10mm	20175	1732.5	21.99	23.00	1.262	0.02	0.042	0.053
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Bottom Side	10mm	20175	1732.5	21.99	23.00	1.262	0.02	0.042	0.053
	LTE Band 4_ Ant 0	20M	QPSK	50	24	Bottom Side	10mm	20175	1732.5	21.99	23.00	1.262	0.02	0.042	0.053



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)
03	LTE Band 5_Ant 3	10M	QPSK	1	0	Front	10mm	20525	836.5	22.98	24.00	1.265	-0.07	0.153	0.194
	LTE Band 5_Ant 3	10M	QPSK	25	25	Front	10mm	20525	836.5	21.86	23.00	1.300	0.03	0.123	0.160
	LTE Band 5_Ant 3	10M	QPSK	1	0	Back	10mm	20525	836.5	22.98	24.00	1.265	-0.13	0.095	0.120
	LTE Band 5_Ant 3	10M	QPSK	25	25	Back	10mm	20525	836.5	21.86	23.00	1.300	-0.11	0.084	0.109
	LTE Band 5_Ant 3	10M	QPSK	1	0	Left Side	10mm	20525	836.5	22.98	24.00	1.265	-0.060	0.001	0.001
	LTE Band 5_Ant 3	10M	QPSK	25	25	Left Side	10mm	20525	836.5	21.86	23.00	1.300	0.07	0.001	0.001
	LTE Band 5_Ant 3	10M	QPSK	1	0	Right Side	10mm	20525	836.5	22.98	24.00	1.265	-0.06	0.044	0.056
	LTE Band 5_Ant 3	10M	QPSK	25	25	Right Side	10mm	20525	836.5	21.86	23.00	1.300	0.08	0.001	0.001
	LTE Band 5_Ant 3	10M	QPSK	1	0	Top Side	10mm	20525	836.5	22.98	24.00	1.265	-0.11	0.001	0.001
	LTE Band 5_Ant 3	10M	QPSK	25	25	Top Side	10mm	20525	836.5	21.86	23.00	1.300	0.01	0.001	0.001
	LTE Band 5_Ant 3	10M	QPSK	1	0	Bottom Side	10mm	20525	836.5	22.98	24.00	1.265	0.01	0.001	0.001
	LTE Band 5_Ant 3	10M	QPSK	25	25	Bottom Side	10mm	20525	836.5	21.86	23.00	1.300	-0.1	0.001	0.001
04	LTE Band 7_Ant 0	20M	QPSK	1	0	Front	10mm	21100	2535	22.60	24.00	1.380	-0.14	0.571	0.788
	LTE Band 7_Ant 0	20M	QPSK	1	49	Front	10mm	20850	2510	22.56	24.00	1.393	-0.15	0.654	0.911
	LTE Band 7_Ant 0	20M	QPSK	1	49	Front	10mm	21350	2560	22.54	24.00	1.400	0.01	0.433	0.606
	LTE Band 7_Ant 0	20M	QPSK	50	50	Front	10mm	20850	2510	21.76	23.00	1.330	0.18	0.495	0.659
	LTE Band 7_Ant 0	20M	QPSK	100	0	Front	10mm	20850	2510	21.70	23.00	1.349	0.02	0.542	0.731
	LTE Band 7_Ant 0	20M	QPSK	1	0	Back	10mm	21100	2535	22.60	24.00	1.380	0.06	0.379	0.523
	LTE Band 7_Ant 0	20M	QPSK	50	50	Back	10mm	20850	2510	21.76	23.00	1.330	0.04	0.343	0.456
	LTE Band 7_Ant 0	20M	QPSK	1	0	Left Side	10mm	21100	2535	22.60	24.00	1.380	0	0.129	0.178
	LTE Band 7_Ant 0	20M	QPSK	50	50	Left Side	10mm	20850	2510	21.76	23.00	1.330	0.01	0.104	0.138
	LTE Band 7_Ant 0	20M	QPSK	1	0	Right Side	10mm	21100	2535	22.60	24.00	1.380	0.06	0.101	0.139
	LTE Band 7_Ant 0	20M	QPSK	50	50	Right Side	10mm	20850	2510	21.76	23.00	1.330	-0.05	0.090	0.120
	LTE Band 7_Ant 0	20M	QPSK	1	0	Top Side	10mm	21100	2535	22.60	24.00	1.380	-0.03	0.488	0.674
05	LTE Band 12_Ant 3	10M	QPSK	1	0	Front	10mm	23095	707.5	23.08	24.00	1.236	-0.05	0.632	0.781
	LTE Band 12_Ant 3	10M	QPSK	25	25	Front	10mm	23095	707.5	22.22	23.00	1.197	-0.01	0.521	0.624
	LTE Band 12_Ant 3	10M	QPSK	1	0	Back	10mm	23095	707.5	23.08	24.00	1.236	0.05	0.395	0.488
	LTE Band 12_Ant 3	10M	QPSK	25	25	Back	10mm	23095	707.5	22.22	23.00	1.197	0.03	0.436	0.522
	LTE Band 12_Ant 3	10M	QPSK	1	0	Left Side	10mm	23095	707.5	23.08	24.00	1.236	0.09	0.001	0.001
	LTE Band 12_Ant 3	10M	QPSK	25	25	Left Side	10mm	23095	707.5	22.22	23.00	1.197	-0.15	0.001	0.001
	LTE Band 12_Ant 3	10M	QPSK	1	0	Right Side	10mm	23095	707.5	23.08	24.00	1.236	0.02	0.101	0.125
	LTE Band 12_Ant 3	10M	QPSK	25	25	Right Side	10mm	23095	707.5	22.22	23.00	1.197	0.07	0.087	0.104
	LTE Band 12_Ant 3	10M	QPSK	1	0	Top Side	10mm	23095	707.5	23.08	24.00	1.236	0.1	0.063	0.078
	LTE Band 12_Ant 3	10M	QPSK	25	25	Top Side	10mm	23095	707.5	22.22	23.00	1.197	0.05	0.072	0.086
	LTE Band 12_Ant 3	10M	QPSK	1	0	Bottom Side	10mm	23095	707.5	23.08	24.00	1.236	0.01	0.150	0.185
	LTE Band 12_Ant 3	10M	QPSK	25	25	Bottom Side	10mm	23095	707.5	22.22	23.00	1.197	0.01	0.187	0.224

<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)
06	LTE Band 41_Ant 0	20M	QPSK	1	0	Front	10mm	41490	2680	23.00	24.00	1.259	62.9	1.006	0.03	0.202	0.256
	LTE Band 41_Ant 0	20M	QPSK	1	49	Front	10mm	39750	2506	22.78	24.00	1.324	62.9	1.006	-0.01	0.448	0.597
	LTE Band 41_Ant 0	20M	QPSK	1	0	Front	10mm	40185	2549.5	22.80	24.00	1.318	62.9	1.006	0.04	0.374	0.496
	LTE Band 41_Ant 0	20M	QPSK	1	99	Front	10mm	40620	2593	22.77	24.00	1.327	62.9	1.006	-0.09	0.240	0.320
	LTE Band 41_Ant 0	20M	QPSK	1	99	Front	10mm	41055	2636.5	22.94	24.00	1.276	62.9	1.006	0.01	0.196	0.252
	LTE Band 41_Ant 0	20M	QPSK	50	24	Front	10mm	41490	2680	22.15	23.00	1.216	62.9	1.006	0.05	0.166	0.203
	LTE Band 41_Ant 0	20M	QPSK	1	0	Back	10mm	41490	2680	23.00	24.00	1.259	62.9	1.006	0.07	0.089	0.113
	LTE Band 41_Ant 0	20M	QPSK	50	24	Back	10mm	41490	2680	22.15	23.00	1.216	62.9	1.006	0.06	0.067	0.081
	LTE Band 41_Ant 0	20M	QPSK	1	0	Left Side	10mm	41490	2680	23.00	24.00	1.259	62.9	1.006	-0.03	0.057	0.072
	LTE Band 41_Ant 0	20M	QPSK	50	24	Left Side	10mm	41490	2680	22.15	23.00	1.216	62.9	1.006	-0.05	0.048	0.059
	LTE Band 41_Ant 0	20M	QPSK	1	0	Right Side	10mm	41490	2680	23.00	24.00	1.259	62.9	1.006	-0.14	0.001	0.001
	LTE Band 41_Ant 0	20M	QPSK	50	24	Right Side	10mm	41490	2680	22.15	23.00	1.216	62.9	1.006	-0.01	0.001	0.001
	LTE Band 41_Ant 0	20M	QPSK	1	0	Top Side	10mm	41490	2680	23.00	24.00	1.259	62.9	1.006	-0.1	0.156	0.198
	LTE Band 41_Ant 0	20M	QPSK	50	24	Top Side	10mm	41490	2680	22.15	23.00	1.216	62.9	1.006	0.06	0.119	0.146
	LTE Band 41_Ant 0	20M	QPSK	1	0	Bottom Side	10mm	41490	2680	23.00	24.00	1.259	62.9	1.006	0.03	0.048	0.061
	LTE Band 41_Ant 0	20M	QPSK	50	24	Bottom Side	10mm	41490	2680	22.15	23.00	1.216	62.9	1.006	0.04	0.001	0.001

<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)
07	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 1	1	2412	14.30	14.50	1.047	98.01	1.020	-0.06	0.077	0.082
	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	Ant 1	1	2412	14.30	14.50	1.047	98.01	1.020	-0.06	0.109	0.116
	WLAN2.4GHz	802.11b 1Mbps	Left Side	10mm	Ant 1	1	2412	14.30	14.50	1.047	98.01	1.020	-0.04	0.030	0.032
	WLAN2.4GHz	802.11b 1Mbps	Right Side	10mm	Ant 1	1	2412	14.30	14.50	1.047	98.01	1.020	-0.02	0.029	0.031
	WLAN2.4GHz	802.11b 1Mbps	Top Side	10mm	Ant 1	1	2412	14.30	14.50	1.047	98.01	1.020	0.02	0.009	0.010
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	10mm	Ant 1	1	2412	14.30	14.50	1.047	98.01	1.020	-0.02	0.048	0.051
	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 2	1	2412	15.20	15.50	1.072	98.01	1.020	-0.12	0.120	0.131
	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	Ant 2	1	2412	15.20	15.50	1.072	98.01	1.020	-0.02	0.081	0.089
	WLAN2.4GHz	802.11b 1Mbps	Left Side	10mm	Ant 2	1	2412	15.20	15.50	1.072	98.01	1.020	-0.11	0.018	0.020
	WLAN2.4GHz	802.11b 1Mbps	Right Side	10mm	Ant 2	1	2412	15.20	15.50	1.072	98.01	1.020	-0.17	0.018	0.020
	WLAN2.4GHz	802.11b 1Mbps	Top Side	10mm	Ant 2	1	2412	15.20	15.50	1.072	98.01	1.020	-0.03	0.007	0.008
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	10mm	Ant 2	1	2412	15.20	15.50	1.072	98.01	1.020	-0.18	0.137	0.150
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	10mm	Ant 2	6	2437	14.70	15.50	1.202	98.01	1.020	-0.16	0.097	0.119
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	10mm	Ant 2	11	2462	15.20	15.50	1.072	98.01	1.020	-0.01	0.099	0.108

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	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 4_Ant 0	20M	QPSK	1	0	Front	10mm	20175	1732.5	22.78	24.00	1.324	-0.19	0.949	-	1.257
2nd	LTE Band 4_Ant 0	20M	QPSK	1	0	Front	10mm	20175	1732.5	22.78	24.00	1.324	-0.09	0.936	1.01	1.240

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR < 1.45 W/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	Body
1.	WWAN + 2.4GHz WLAN Ant 1	Yes
2.	WWAN + 2.4GHz WLAN Ant 2	Yes
3.	WWAN + 2.4GHz WLAN Ant 1 + 2.4GHz WLAN Ant 2	Yes

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. 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 < 1.6 W/kg.
 - ii) $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$, 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 $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary.
 - iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6 W/kg.



15.1 Hotspot Exposure Conditions

WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	1+2+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN Ant 1	2.4GHz WLAN Ant 2			
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)			
WCDMA V_Ant 3	Front	0.178	0.082	0.131	0.260	0.309	0.391
	Back	0.112	0.116	0.089	0.228	0.201	0.317
	Left side	0.003	0.032	0.020	0.035	0.023	0.055
	Right side	0.049	0.031	0.020	0.080	0.069	0.100
	Top side	0.077	0.010	0.008	0.087	0.085	0.095
	Bottom side	0.040	0.051	0.150	0.091	0.190	0.241
LTE Band 4_Ant 0	Front	1.257	0.082	0.131	1.339	1.388	1.470
	Back	0.685	0.116	0.089	0.801	0.774	0.890
	Left side	0.413	0.032	0.020	0.445	0.433	0.465
	Right side	0.089	0.031	0.020	0.120	0.109	0.140
	Top side	1.008	0.010	0.008	1.018	1.016	1.026
	Bottom side	0.068	0.051	0.150	0.119	0.218	0.269
LTE Band 5_Ant 3	Front	0.194	0.082	0.131	0.276	0.325	0.407
	Back	0.120	0.116	0.089	0.236	0.209	0.325
	Left side	0.001	0.032	0.020	0.033	0.021	0.053
	Right side	0.056	0.031	0.020	0.087	0.076	0.107
	Top side	0.001	0.010	0.008	0.011	0.009	0.019
	Bottom side	0.001	0.051	0.150	0.052	0.151	0.202
LTE Band 7_Ant 0	Front	0.911	0.082	0.131	0.993	1.042	1.124
	Back	0.523	0.116	0.089	0.639	0.612	0.728
	Left side	0.178	0.032	0.020	0.210	0.198	0.230
	Right side	0.139	0.031	0.020	0.170	0.159	0.190
	Top side	0.674	0.010	0.008	0.684	0.682	0.692
	Bottom side	0.099	0.051	0.150	0.150	0.249	0.300
LTE Band 12_Ant 3	Front	0.781	0.082	0.131	0.863	0.912	0.994
	Back	0.522	0.116	0.089	0.638	0.611	0.727
	Left side	0.001	0.032	0.020	0.033	0.021	0.053
	Right side	0.125	0.031	0.020	0.156	0.145	0.176
	Top side	0.086	0.010	0.008	0.096	0.094	0.104
	Bottom side	0.224	0.051	0.150	0.275	0.374	0.425
LTE Band 41_Ant 0	Front	0.597	0.082	0.131	0.679	0.728	0.810
	Back	0.113	0.116	0.089	0.229	0.202	0.318
	Left side	0.072	0.032	0.020	0.104	0.092	0.124
	Right side	0.001	0.031	0.020	0.032	0.021	0.052
	Top side	0.198	0.010	0.008	0.208	0.206	0.216
	Bottom side	0.061	0.051	0.150	0.112	0.211	0.262

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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 $\leq 30\%$, 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 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 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [12] FCC KDB 865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations" Oct 2015.