



FCC SAR TEST REPORT

FCC ID : 2AP4W-ALITE
Equipment : mPERS
Brand Name : Belle
Model Name : Belle X ATT
Marketing Name : Belle X
Applicant : Freeus, LLC
640 W 1100 S Suite 4, Ogden, Utah, United States 84404
Manufacturer : Wistron Corporation
21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei
City 221, Taiwan R.O.C
Standard : FCC 47 CFR Part 2 (2.1093)
ANSI/IEEE C95.1-1992
IEEE 1528-2013

The product was received on Aug. 27, 2019 and testing was started from Sep. 04, 2019 and completed on Sep. 06, 2019. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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
FA982310	01	Initial issue of report	Oct. 16, 2019

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Freeus, LLC, mPERS, Belle X ATT**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)	Highest Simultaneous Transmission 10g SAR (W/kg)
		Head (Separation 10mm)	Body-worn (Separation 0mm)	Extremity (Separation 0mm)		
		1g SAR (W/kg)		10g SAR (W/kg)		
Licensed	LTE Band 2	1.09	0.48	2.60	1.36	2.64
	LTE Band 4	1.32	0.40	2.33		
	LTE Band 12	0.43	0.08	0.63		
Date of Testing:		2019/9/4 ~ 2019/9/6				

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 Extremity 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: Daisy Peng



2. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- 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 D05 SAR for LTE Devices v02r05

3. Equipment Under Test (EUT) Information

3.1 General Information

Product Feature & Specification	
Equipment Name	mPERS
Brand Name	Belle
Model Name	Belle X ATT
Marketing Name	Belle X
FCC ID	2AP4W-ALITE
IMEI Code	355972100013748
Wireless Technology and Frequency Range	LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz
Mode	WLAN: 802.11b/g/n HT20
HW Version	DVT2
EUT Stage	Identical prototype

3.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05												
FCC ID			2AP4W-ALITE									
Equipment Name			mPERS									
Operating Frequency Range of each LTE transmission band			LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz									
Channel Bandwidth			LTE Band 02:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 04:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz									
uplink modulations used			QPSK / 16QAM									
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 2												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900
LTE Band 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 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)		
L	23017	699.7	23025	700.5	23035	701.5	23060	704				
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5				
H	23173	715.3	23165	714.5	23155	713.5	23130	711				



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:

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

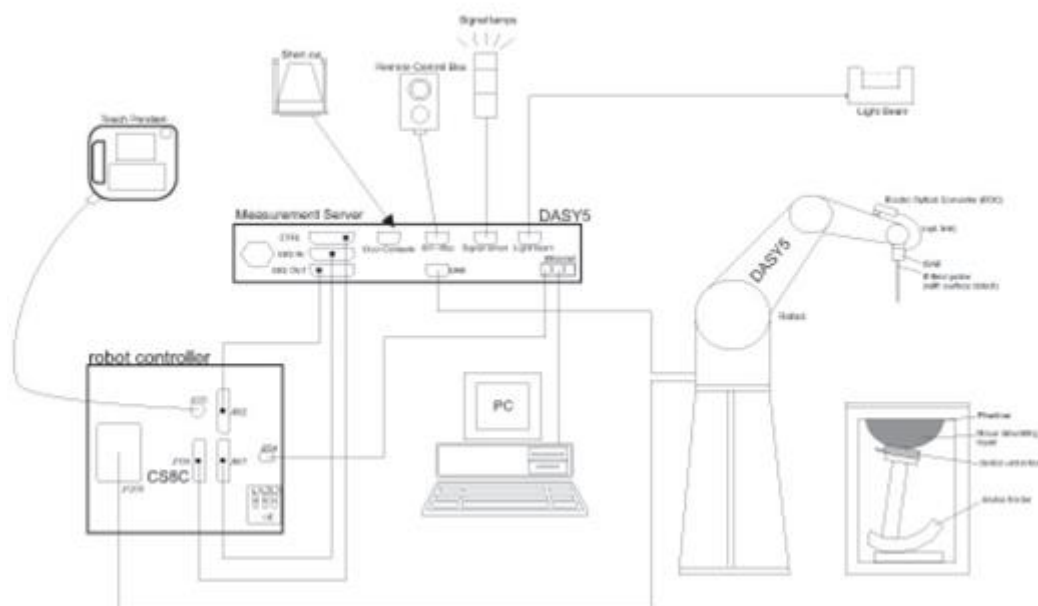
SAR is expressed in units of Watts per kilogram (W/kg)

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

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 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	

6.2 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

6.3 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.

6.4 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 dB0) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ 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	D750V3	1107	Mar. 08, 2019	Mar. 07, 2020
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Nov. 19, 2018	Nov. 18, 2019
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Sep. 11, 2018	Sep. 10, 2019
SPEAG	Data Acquisition Electronics	DAE4	854	May. 21, 2019	May. 20, 2020
SPEAG	Data Acquisition Electronics	DAE3	360	Oct. 29, 2018	Oct. 28, 2019
SPEAG	Data Acquisition Electronics	DAE4	1326	Sep. 18, 2018	Sep. 17, 2019
SPEAG	Dosimetric E-Field Probe	ES3DV3	3169	May. 24, 2019	May. 23, 2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	3642	Apr. 29, 2019	Apr. 28, 2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 27, 2018	Sep. 26, 2019
Anritsu	Radio Communication Analyzer	MT8820C	6201381766	Jun. 27, 2019	Jun. 26, 2020
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Dec. 11, 2018	Dec. 10, 2019
Agilent	ENA Network Analyzer	E5071C	MY46104758	Sep. 19, 2018	Sep. 18, 2019
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Sep. 19, 2018	Sep. 18, 2019
LINE SEIKI	Digital Thermometer	DTM3000-spezial	2942	Dec. 07, 2018	Dec. 06, 2019
Anritsu	Power Meter	ML2495A	1419002	May. 29, 2019	May. 28, 2020
Anritsu	Power Sensor	MA2411B	1339124	May. 29, 2019	May. 28, 2020
Anritsu	Spectrum Analyzer	MS2830A	6201396378	Jun. 27, 2019	Jun. 26, 2020
Mini-Circuits	Power Amplifier	ZVE-8G+	6382	Aug. 12, 2019	Aug. 11, 2020
Mini-Circuits	Power Amplifier	ZHL-42W+	321501827	Aug. 12, 2019	Aug. 11, 2020
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.

9. System Verification

9.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

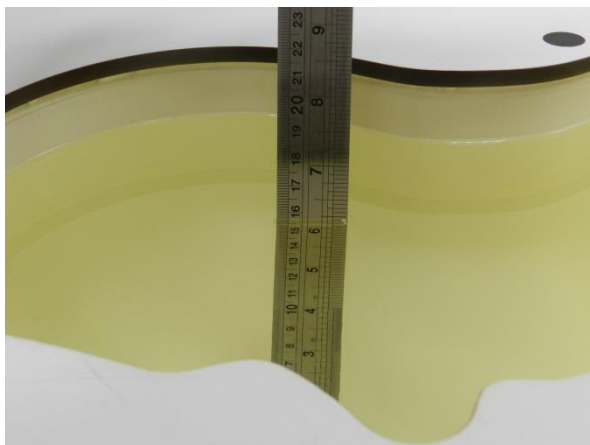


Fig 10.1 Photo of Liquid Height for Head SAR



Fig 10.2 Photo of Liquid Height for Body SAR

9.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
750	HSL	22.3	0.888	42.540	0.89	41.90	-0.22	1.53	±5	2019/9/6
750	MSL	22.7	0.967	55.253	0.96	55.50	0.73	-0.45	±5	2019/9/5
1750	HSL	22.7	1.351	40.638	1.37	40.10	-1.39	1.34	±5	2019/9/5
1750	HSL	22.5	1.358	40.842	1.37	40.10	-0.88	1.85	±5	2019/9/6
1750	MSL	22.6	1.490	54.668	1.49	53.40	0.00	2.37	±5	2019/9/4
1900	HSL	22.3	1.417	40.512	1.40	40.00	1.21	1.28	±5	2019/9/4
1900	HSL	22.2	1.449	39.742	1.40	40.00	3.50	-0.65	±5	2019/9/6
1900	MSL	22.6	1.551	52.056	1.52	53.30	2.04	-2.33	±5	2019/9/4

9.3 System Performance Check Results

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

Date	Frequency (MHz)	Tissue Type	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 (%)
2019/9/6	750	HSL	250	D750V3-1107	EX3DV4 - SN3931	DAE4 Sn1326	2.19	8.32	8.76	5.29
2019/9/5	750	MSL	250	D750V3-1107	EX3DV4 - SN3931	DAE4 Sn1326	2.25	8.45	9.00	6.51
2019/9/5	1750	HSL	250	D1750V2-1068	EX3DV4 - SN3931	DAE4 Sn1326	9.20	37.10	36.80	-0.81
2019/9/6	1750	HSL	250	D1750V2-1068	EX3DV4 - SN3642	DAE4 Sn854	9.52	37.10	38.08	2.64
2019/9/4	1750	MSL	250	D1750V2-1068	EX3DV4 - SN3931	DAE4 Sn1326	9.68	37.00	38.72	4.65
2019/9/4	1900	HSL	250	D1900V2-5d041	ES3DV3 - SN3169	DAE3 Sn360	10.10	40.20	40.40	0.50
2019/9/6	1900	HSL	250	D1900V2-5d041	EX3DV4 - SN3931	DAE4 Sn1326	10.70	40.20	42.80	6.47
2019/9/4	1900	MSL	250	D1900V2-5d041	EX3DV4 - SN3931	DAE4 Sn1326	10.20	40.20	40.80	1.49

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2019/9/5	750	MSL	250	D750V3-1107	EX3DV4 - SN3931	DAE4 Sn1326	1.51	5.65	6.04	6.90
2019/9/4	1750	MSL	250	D1750V2-1068	EX3DV4 - SN3931	DAE4 Sn1326	5.26	19.60	21.04	7.35
2019/9/4	1900	MSL	250	D1900V2-5d041	EX3DV4 - SN3931	DAE4 Sn1326	5.32	21.50	21.28	-1.02

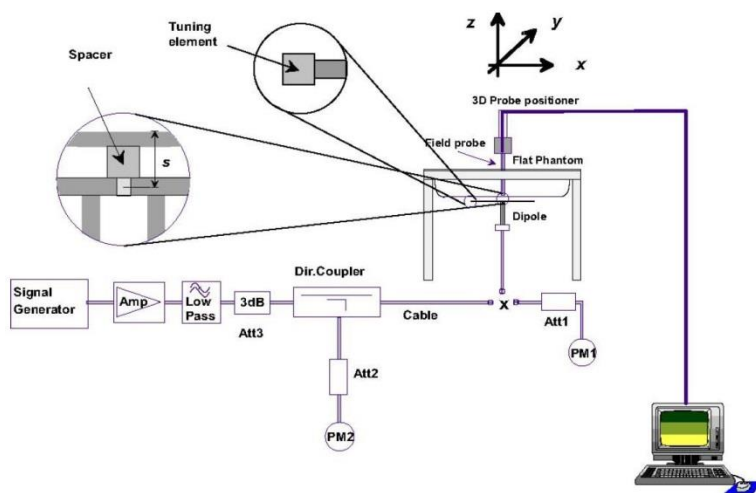


Fig 8.3.1 System Performance Check Setup



Fig 8.3.2 Setup Photo

10. Conducted RF Output Power (Unit: dBm)

<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 / 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.



<LTE Band 2>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				18700	18900	19100		
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	0	22.41	22.56	22.80	23	0
20	QPSK	1	49	22.28	22.43	22.37		
20	QPSK	1	99	22.29	22.45	22.61		
20	QPSK	50	0	21.47	21.53	21.76	22	1
20	QPSK	50	24	21.42	21.50	21.74		
20	QPSK	50	50	21.27	21.39	21.57		
20	QPSK	100	0	21.37	21.38	21.53		
Channel				18675	18900	19125		
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	0	22.20	22.24	22.54	23	0
15	QPSK	1	37	22.39	22.32	22.62		
15	QPSK	1	74	22.35	22.51	22.61		
15	QPSK	36	0	21.44	21.39	21.65	22	1
15	QPSK	36	20	21.39	21.41	21.74		
15	QPSK	36	39	21.34	21.49	21.76		
Channel				18650	18900	19150		
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	0	22.41	22.14	22.60	23	0
10	QPSK	1	25	22.53	22.60	22.69		
10	QPSK	1	49	22.47	22.54	22.40		
10	QPSK	25	0	21.34	21.38	21.62	22	1
10	QPSK	25	12	21.46	21.49	21.71		
10	QPSK	25	25	21.44	21.52	21.67		
10	16QAM	1	0	21.21	21.31	21.54	22	1
10	16QAM	1	25	21.53	21.36	21.74		
10	16QAM	1	49	21.30	21.47	21.49		
10	16QAM	25	0	20.49	20.51	20.76	21	2
10	16QAM	25	12	20.42	20.45	20.69		
10	16QAM	25	25	20.41	20.36	20.63		
Channel				18625	18900	19175		
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	0	21.98	22.36	22.74	23	0
5	QPSK	1	12	22.32	22.54	22.76		
5	QPSK	1	24	22.06	22.40	22.56		
5	QPSK	12	0	21.16	21.27	21.69	22	1
5	QPSK	12	7	21.26	21.29	21.74		
5	QPSK	12	13	21.35	21.43	21.73		
5	QPSK	25	0	21.22	21.40	21.74		
5	16QAM	1	0	20.95	21.19	21.56	22	1
5	16QAM	1	12	21.09	21.28	21.29		
5	16QAM	1	24	21.07	21.41	21.53		
5	16QAM	12	0	20.07	20.43	20.57	21	2
5	16QAM	12	7	20.34	20.27	20.62		
5	16QAM	12	13	20.32	20.25	20.81		
5	16QAM	25	0	20.38	20.34	20.83		

Channel				18615	18900	19185	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1851.5	1880	1908.5		
3	QPSK	1	0	22.24	22.25	22.54	23	0
3	QPSK	1	8	22.33	22.41	22.63		
3	QPSK	1	14	22.10	22.51	22.46		
3	QPSK	8	0	21.22	21.41	21.71	22	1
3	QPSK	8	4	21.30	21.42	21.66		
3	QPSK	8	7	21.41	21.44	21.70		
3	QPSK	15	0	21.18	21.36	21.73		
3	16QAM	1	0	21.05	21.13	21.61	22	1
3	16QAM	1	8	21.21	21.26	21.54		
3	16QAM	1	14	21.28	21.37	21.54		
3	16QAM	8	0	20.35	20.46	20.52	21	2
3	16QAM	8	4	20.45	20.58	20.67		
3	16QAM	8	7	20.61	20.41	20.75		
3	16QAM	15	0	20.42	20.39	20.60		
Channel				18607	18900	19193	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1850.7	1880	1909.3		
1.4	QPSK	1	0	22.25	22.15	22.69	23	0
1.4	QPSK	1	3	22.44	22.28	22.75		
1.4	QPSK	1	5	22.32	22.26	22.71		
1.4	QPSK	3	0	22.32	22.26	22.73		
1.4	QPSK	3	1	22.15	22.32	22.74		
1.4	QPSK	3	3	22.27	22.33	22.75		
1.4	QPSK	6	0	21.25	21.34	21.81	22	1
1.4	16QAM	1	0	21.18	21.23	21.64	22	1
1.4	16QAM	1	3	21.37	21.21	21.40		
1.4	16QAM	1	5	21.18	21.19	21.79		
1.4	16QAM	3	0	21.34	21.33	21.71		
1.4	16QAM	3	1	21.51	21.40	21.73		
1.4	16QAM	3	3	21.52	21.36	21.63		
1.4	16QAM	6	0	20.35	20.28	20.75	21	2



<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	23	0
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	22.97	23.00	22.99		
20	QPSK	1	49	22.93	22.82	22.94	22	1
20	QPSK	1	99	22.91	22.73	22.91		
20	QPSK	50	0	21.99	21.99	21.93		
20	QPSK	50	24	21.85	21.90	21.88	22	1
20	QPSK	50	50	21.90	21.98	21.92		
20	QPSK	100	0	21.88	21.92	21.89		
Channel				20025	20175	20325	23	0
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	22.74	22.63	22.88		
15	QPSK	1	37	22.98	22.95	22.88	22	1
15	QPSK	1	74	22.76	22.83	22.88		
15	QPSK	36	0	21.95	21.87	21.94		
15	QPSK	36	20	21.91	21.90	21.96	22	1
15	QPSK	36	39	21.88	21.95	21.91		
Channel				20000	20175	20350	23	0
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	22.65	22.54	22.75		
10	QPSK	1	25	22.96	22.75	22.87	22	1
10	QPSK	1	49	22.63	22.78	22.86		
10	QPSK	25	0	21.83	21.68	21.93		
10	QPSK	25	12	21.71	21.84	21.77	22	1
10	QPSK	25	25	21.85	21.94	21.81		
10	16QAM	1	0	21.85	21.86	21.90		
10	16QAM	1	25	21.93	21.97	21.89	21	2
10	16QAM	1	49	21.82	21.80	21.93		
10	16QAM	25	0	20.95	20.92	20.99		
10	16QAM	25	12	20.88	20.89	21.00	22	1
10	16QAM	25	25	20.92	20.90	20.87		
Channel				19975	20175	20375		
Frequency (MHz)				1712.5	1732.5	1752.5	23	0
5	QPSK	1	0	22.91	22.88	22.98		
5	QPSK	1	12	22.94	22.92	22.87		
5	QPSK	1	24	22.98	22.89	22.95	22	1
5	QPSK	12	0	22.00	21.97	21.82		
5	QPSK	12	7	21.98	21.92	21.90		
5	QPSK	12	13	21.97	21.94	21.95	22	1
5	QPSK	25	0	21.95	21.93	21.92		
5	16QAM	1	0	21.81	21.95	21.93		
5	16QAM	1	12	21.98	21.76	21.68	21	2
5	16QAM	1	24	21.92	21.82	21.74		
5	16QAM	12	0	20.95	20.96	20.88		
5	16QAM	12	7	20.97	20.93	20.76	21	2
5	16QAM	12	13	20.95	20.89	20.70		
5	16QAM	25	0	21.00	20.97	20.78		



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Channel				19965	20175	20385	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	22.74	22.73	22.80	23	0
3	QPSK	1	8	22.98	22.94	22.99		
3	QPSK	1	14	22.49	22.88	22.91		
3	QPSK	8	0	21.90	21.92	21.95	22	1
3	QPSK	8	4	21.86	21.98	21.90		
3	QPSK	8	7	21.97	21.94	21.99		
3	QPSK	15	0	21.97	21.91	21.93		
3	16QAM	1	0	21.66	21.67	21.92	22	1
3	16QAM	1	8	21.65	21.69	21.78		
3	16QAM	1	14	21.58	21.78	21.88		
3	16QAM	8	0	20.93	20.89	20.93	21	2
3	16QAM	8	4	20.89	20.95	20.86		
3	16QAM	8	7	20.94	20.90	20.96		
3	16QAM	15	0	20.78	20.96	20.98		
Channel				19957	20175	20393	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	22.88	22.77	22.81	23	0
1.4	QPSK	1	3	22.96	22.87	22.95		
1.4	QPSK	1	5	22.61	22.92	22.77		
1.4	QPSK	3	0	22.76	22.89	22.98		
1.4	QPSK	3	1	22.96	22.93	22.92		
1.4	QPSK	3	3	22.99	22.92	22.98		
1.4	QPSK	6	0	21.88	21.89	21.94	22	1
1.4	16QAM	1	0	21.86	21.76	21.79	22	1
1.4	16QAM	1	3	21.99	21.89	21.84		
1.4	16QAM	1	5	21.97	21.67	21.98		
1.4	16QAM	3	0	21.88	21.83	21.95		
1.4	16QAM	3	1	21.82	21.88	21.92		
1.4	16QAM	3	3	21.92	21.97	21.86		
1.4	16QAM	6	0	20.99	20.89	20.91	21	2



<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		
Frequency (MHz)				704	707.5	711		
10	QPSK	1	0	23.78	24.00	23.94	24	0
10	QPSK	1	25	23.26	23.59	23.38		
10	QPSK	1	49	23.31	23.80	23.53		
10	QPSK	25	0	22.62	22.78	22.87	23	1
10	QPSK	25	12	22.50	22.76	22.78		
10	QPSK	25	25	22.61	22.57	22.84		
10	QPSK	50	0	22.63	22.88	22.78	23	1
10	16QAM	1	0	22.38	22.46	22.56		
10	16QAM	1	25	22.62	22.73	22.80		
10	16QAM	1	49	22.49	22.68	22.70	22	2
10	16QAM	25	0	21.57	21.71	21.90		
10	16QAM	25	12	21.75	21.76	21.83		
10	16QAM	25	25	21.81	21.85	21.89		
Channel				23035	23095	23155		
Frequency (MHz)				701.5	707.5	713.5		
5	QPSK	1	0	23.24	23.62	23.40	24	0
5	QPSK	1	12	23.47	23.94	23.95		
5	QPSK	1	24	23.37	23.93	23.70		
5	QPSK	12	0	22.67	22.70	22.68	23	1
5	QPSK	12	7	22.75	22.86	22.71		
5	QPSK	12	13	22.55	22.81	22.79		
5	16QAM	1	0	22.48	22.47	22.49	23	1
5	16QAM	1	12	22.63	22.85	22.69		
5	16QAM	1	24	22.44	22.59	22.68		
5	16QAM	12	0	21.54	21.69	21.74	22	2
5	16QAM	12	7	21.67	21.83	21.72		
5	16QAM	12	13	21.47	21.87	21.71		
Channel				23025	23095	23165		
Frequency (MHz)				700.5	707.5	714.5		
3	QPSK	1	0	23.73	23.89	23.98	24	0
3	QPSK	1	8	23.66	23.88	23.97		
3	QPSK	1	14	23.48	23.88	23.99		
3	QPSK	8	0	22.70	22.84	22.90	23	1
3	QPSK	8	4	22.82	22.96	22.90		
3	QPSK	8	7	22.66	22.82	23.00		
3	16QAM	1	0	22.53	22.68	22.77	23	1
3	16QAM	1	8	22.50	22.53	22.73		
3	16QAM	1	14	22.51	22.70	22.91		
3	16QAM	8	0	21.71	21.94	21.91	22	2
3	16QAM	8	4	21.82	22.00	21.90		
3	16QAM	8	7	21.84	22.00	21.97		
3	16QAM	15	0	21.79	21.89	21.89		
Channel				23017	23095	23173		
Frequency (MHz)				699.7	707.5	715.3		
1.4	QPSK	1	0	23.70	23.83	23.93	24	0



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1.4	QPSK	1	3	23.50	23.78	23.98		
1.4	QPSK	1	5	23.47	23.74	23.80		
1.4	QPSK	3	0	22.64	22.64	22.96		
1.4	QPSK	3	1	22.82	22.84	23.01		
1.4	QPSK	3	3	22.52	22.66	22.96		
1.4	QPSK	6	0	22.55	22.72	23.00	23	1
1.4	16QAM	1	0	22.46	22.57	22.76	23	1
1.4	16QAM	1	3	22.38	22.41	22.69		
1.4	16QAM	1	5	22.33	22.68	22.83		
1.4	16QAM	3	0	21.61	21.76	22.01		
1.4	16QAM	3	1	21.64	22.04	22.02		
1.4	16QAM	3	3	21.77	21.94	21.92	22	2
1.4	16QAM	6	0	21.60	21.80	21.88		

<WLAN Conducted Power>
<2.4GHz WLAN >

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Tune-Up Limit
	802.11b 1Mbps	1	2412	3.00
		6	2437	3.00
		11	2462	3.00
	802.11g 6Mbps	1	2412	3.00
		6	2437	3.00
		11	2462	3.00
	802.11n-HT20 MCS0	1	2412	2.00
		6	2437	2.00
		11	2462	3.00

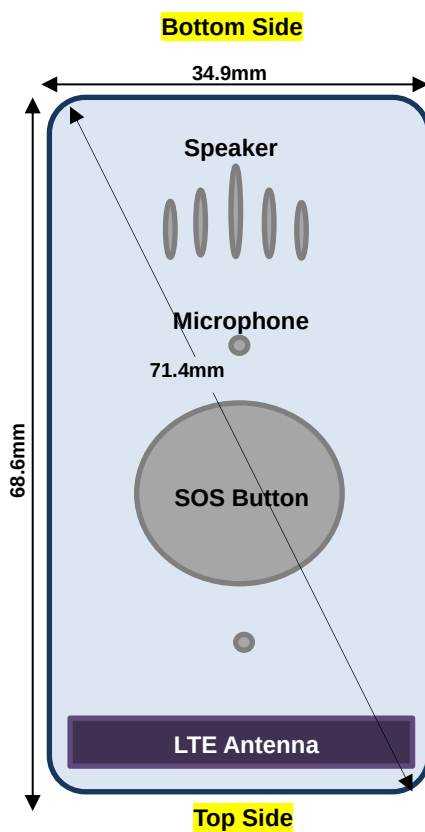
Note:

- Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$
 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
 - f(GHz) is the RF channel transmit frequency in GHz
 - Power and distance are rounded to the nearest mW and mm before calculation
 - The result is rounded to one decimal place for comparison

WLAN Max Power (dBm)	Exposure Position	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds	Exclusion Limit	SAR Testing
3	Head	10	2.62	0.31	3	No
3	Body-worn	< 5	2.62	0.63	3	No
3	Extremity	< 5	2.62	0.63	7.5	No

11. Antenna Location



Front View



12. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - b. For WWAN Head and Extremity condition: Reported SAR(W/kg)= Measured SAR(W/kg) * Tune-up Scaling Factor
 - c. For WWAN Body-worn condition: Reported SAR(W/kg)= Measured SAR(W/kg) * Tune-up Scaling Factor * Transmission Scaling Factor
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.
4. According to the SAR analysis exhibit, LTE B2/B4/B12 maximum tune-up power scaled down with the transmission factor is applied in body-worn reported SAR calculation.

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 B12 / B4 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.

**12.1 Head SAR****<LTE SAR>**

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	LTE Band 2	20M	QPSK	1	0	Front	10mm	19100	1900	22.80	23.00	1.047	-0.14	0.992	1.039
	LTE Band 2	20M	QPSK	1	0	Front	10mm	18700	1860	22.41	23.00	1.146	0.08	0.952	1.091
	LTE Band 2	20M	QPSK	1	0	Front	10mm	18900	1880	22.56	23.00	1.107	-0.04	0.939	1.039
	LTE Band 2	20M	QPSK	50	0	Front	10mm	19100	1900	21.76	22.00	1.057	0.12	0.811	0.857
	LTE Band 2	20M	QPSK	50	0	Front	10mm	18700	1860	21.47	22.00	1.130	0.09	0.778	0.879
	LTE Band 2	20M	QPSK	50	0	Front	10mm	18900	1880	21.53	22.00	1.114	-0.06	0.715	0.797
	LTE Band 2	20M	QPSK	1	0	Bottom Side	10mm	19100	1900	22.80	23.00	1.047	-0.09	0.116	0.121
	LTE Band 2	20M	QPSK	50	0	Bottom Side	10mm	19100	1900	21.76	22.00	1.057	0.03	0.091	0.096
02	LTE Band 4	20M	QPSK	1	0	Front	10mm	20175	1732.5	23.00	23.00	1.000	0.14	1.320	1.320
	LTE Band 4	20M	QPSK	50	0	Front	10mm	20175	1732.5	21.99	22.00	1.002	0.05	1.190	1.193
	LTE Band 4	20M	QPSK	100	0	Front	10mm	20175	1732.5	21.99	22.00	1.002	0.05	0.878	0.880
	LTE Band 4	20M	QPSK	1	0	Bottom Side	10mm	20175	1732.5	23.00	23.00	1.000	-0.13	0.077	0.077
	LTE Band 4	20M	QPSK	50	0	Bottom Side	10mm	20175	1732.5	21.99	22.00	1.002	-0.09	0.053	0.053
03	LTE Band 12	10M	QPSK	1	0	Front	10mm	23095	707.5	24.00	24.00	1.000	-0.09	0.434	0.434
	LTE Band 12	10M	QPSK	25	0	Front	10mm	23095	707.5	22.78	23.00	1.052	-0.12	0.350	0.368
	LTE Band 12	10M	QPSK	1	0	Bottom Side	10mm	23095	707.5	24.00	24.00	1.000	0.15	0.057	0.057
	LTE Band 12	10M	QPSK	25	0	Bottom Side	10mm	23095	707.5	22.78	23.00	1.052	-0.16	0.040	0.042

**12.2 Body Worn Accessory SAR****<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	Transmission Cycle %	Transmission Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
04	LTE Band 2	20M	QPSK	1	0	Front	0mm	19100	1900	22.80	23.00	1.047	8.1	0.081	-0.06	5.770	0.483
	LTE Band 2	20M	QPSK	1	0	Front	0mm	18700	1860	22.41	23.00	1.146	8.1	0.081	0.12	5.150	0.472
	LTE Band 2	20M	QPSK	1	0	Front	0mm	18900	1880	22.56	23.00	1.107	8.1	0.081	-0.13	4.870	0.431
	LTE Band 2	20M	QPSK	50	0	Front	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	0.07	4.460	0.377
	LTE Band 2	20M	QPSK	50	0	Front	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	0.07	4.460	0.377
	LTE Band 2	20M	QPSK	50	0	Front	0mm	18700	1860	21.47	22.00	1.130	8.1	0.081	0.13	4.120	0.372
	LTE Band 2	20M	QPSK	1	0	Back	0mm	19100	1900	22.80	23.00	1.047	8.1	0.081	-0.16	3.260	0.273
	LTE Band 2	20M	QPSK	50	0	Back	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	0.03	2.620	0.222
	LTE Band 2	20M	QPSK	1	0	Left Side	0mm	19100	1900	22.80	23.00	1.047	8.1	0.081	0.18	3.810	0.319
	LTE Band 2	20M	QPSK	50	0	Left Side	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	0.16	3.120	0.264
	LTE Band 2	20M	QPSK	1	0	Right Side	0mm	19100	1900	22.80	23.00	1.047	8.1	0.081	0.13	0.648	0.054
	LTE Band 2	20M	QPSK	50	0	Right Side	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	0.19	0.500	0.042
	LTE Band 2	20M	QPSK	1	0	Top Side	0mm	19100	1900	22.80	23.00	1.047	8.1	0.081	0.09	4.810	0.403
	LTE Band 2	20M	QPSK	50	0	Top Side	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	0.11	3.930	0.332
	LTE Band 2	20M	QPSK	1	0	Bottom Side	0mm	19100	1900	22.80	23.00	1.047	8.1	0.081	-0.11	0.294	0.025
	LTE Band 2	20M	QPSK	50	0	Bottom Side	0mm	19100	1900	21.76	22.00	1.057	8.1	0.081	-0.04	0.225	0.019
05	LTE Band 4	20M	QPSK	1	0	Front	0mm	20175	1732.5	23.00	23.00	1.000	8.1	0.081	0.13	5.030	0.402
	LTE Band 4	20M	QPSK	50	0	Front	0mm	20175	1732.5	21.99	22.00	1.002	8.1	0.081	-0.14	3.830	0.307
	LTE Band 4	20M	QPSK	1	0	Back	0mm	20175	1732.5	23.00	23.00	1.000	8.1	0.081	0.04	3.210	0.257
	LTE Band 4	20M	QPSK	50	0	Back	0mm	20175	1732.5	21.99	22.00	1.002	8.1	0.081	-0.1	2.510	0.201
	LTE Band 4	20M	QPSK	1	0	Left Side	0mm	20175	1732.5	23.00	23.00	1.000	8.1	0.081	-0.12	4.230	0.338
	LTE Band 4	20M	QPSK	50	0	Left Side	0mm	20175	1732.5	21.99	22.00	1.002	8.1	0.081	-0.18	3.340	0.268
	LTE Band 4	20M	QPSK	1	0	Right Side	0mm	20175	1732.5	23.00	23.00	1.000	8.1	0.081	0.19	0.587	0.047
	LTE Band 4	20M	QPSK	50	0	Right Side	0mm	20175	1732.5	21.99	22.00	1.002	8.1	0.081	0.09	0.398	0.032
	LTE Band 4	20M	QPSK	1	0	Top Side	0mm	20175	1732.5	23.00	23.00	1.000	8.1	0.081	0.15	2.550	0.204
	LTE Band 4	20M	QPSK	50	0	Top Side	0mm	20175	1732.5	21.99	22.00	1.002	8.1	0.081	0	1.530	0.123
	LTE Band 4	20M	QPSK	1	0	Bottom Side	0mm	20175	1732.5	23.00	23.00	1.000	8.1	0.081	-0.11	0.162	0.013
	LTE Band 4	20M	QPSK	50	0	Bottom Side	0mm	20175	1732.5	21.99	22.00	1.002	8.1	0.081	-0.04	0.129	0.010
	LTE Band 12	10M	QPSK	1	0	Front	0mm	23095	707.5	24.00	24.00	1.000	8.1	0.081	-0.16	0.974	0.078
	LTE Band 12	10M	QPSK	25	0	Front	0mm	23095	707.5	22.78	23.00	1.052	8.1	0.081	-0.09	0.762	0.064
06	LTE Band 12	10M	QPSK	1	0	Back	0mm	23095	707.5	24.00	24.00	1.000	8.1	0.081	0.1	0.982	0.079
	LTE Band 12	10M	QPSK	25	0	Back	0mm	23095	707.5	22.78	23.00	1.052	8.1	0.081	0.13	0.893	0.075
	LTE Band 12	10M	QPSK	1	0	Left Side	0mm	23095	707.5	24.00	24.00	1.000	8.1	0.081	-0.15	0.979	0.078
	LTE Band 12	10M	QPSK	25	0	Left Side	0mm	23095	707.5	22.78	23.00	1.052	8.1	0.081	-0.14	0.656	0.055
	LTE Band 12	10M	QPSK	1	0	Right Side	0mm	23095	707.5	24.00	24.00	1.000	8.1	0.081	-0.17	0.922	0.074
	LTE Band 12	10M	QPSK	25	0	Right Side	0mm	23095	707.5	22.78	23.00	1.052	8.1	0.081	0.16	0.459	0.039
	LTE Band 12	10M	QPSK	1	0	Top Side	0mm	23095	707.5	24.00	24.00	1.000	8.1	0.081	0.16	0.525	0.042
	LTE Band 12	10M	QPSK	25	0	Top Side	0mm	23095	707.5	22.78	23.00	1.052	8.1	0.081	-0.07	0.490	0.041
	LTE Band 12	10M	QPSK	1	0	Bottom Side	0mm	23095	707.5	24.00	24.00	1.000	8.1	0.081	-0.12	0.354	0.028
	LTE Band 12	10M	QPSK	25	0	Bottom Side	0mm	23095	707.5	22.78	23.00	1.052	8.1	0.081	-0.18	0.265	0.022



12.3 Extremity SAR

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
07	LTE Band 2	20M	QPSK	1	0	Front	0mm	19100	1900	22.80	23.00	1.047	-0.06	2.470	2.586
	LTE Band 2	20M	QPSK	1	0	Front	0mm	18700	1860	22.41	23.00	1.146	0.12	2.270	2.600
	LTE Band 2	20M	QPSK	1	0	Front	0mm	18900	1880	22.56	23.00	1.107	-0.13	2.110	2.335
	LTE Band 2	20M	QPSK	50	0	Front	0mm	19100	1900	21.76	22.00	1.057	0.07	1.920	2.029
	LTE Band 2	20M	QPSK	50	0	Front	0mm	18700	1860	21.47	22.00	1.130	0.13	1.760	1.988
	LTE Band 2	20M	QPSK	50	0	Front	0mm	18900	1880	21.53	22.00	1.114	-0.05	1.560	1.738
	LTE Band 2	20M	QPSK	1	0	Back	0mm	19100	1900	22.80	23.00	1.047	-0.16	1.730	1.812
	LTE Band 2	20M	QPSK	50	0	Back	0mm	19100	1900	21.76	22.00	1.057	0.03	1.380	1.458
	LTE Band 2	20M	QPSK	1	0	Left Side	0mm	19100	1900	22.80	23.00	1.047	0.18	1.670	1.749
	LTE Band 2	20M	QPSK	50	0	Left Side	0mm	19100	1900	21.76	22.00	1.057	0.16	1.350	1.427
	LTE Band 2	20M	QPSK	1	0	Right Side	0mm	19100	1900	22.80	23.00	1.047	0.13	0.311	0.326
	LTE Band 2	20M	QPSK	50	0	Right Side	0mm	19100	1900	21.76	22.00	1.057	0.19	0.241	0.255
	LTE Band 2	20M	QPSK	1	0	Top Side	0mm	19100	1900	22.80	23.00	1.047	0.09	1.850	1.937
	LTE Band 2	20M	QPSK	50	0	Top Side	0mm	19100	1900	21.76	22.00	1.057	0.11	1.480	1.564
	LTE Band 2	20M	QPSK	1	0	Bottom Side	0mm	19100	1900	22.80	23.00	1.047	-0.11	0.159	0.166
	LTE Band 2	20M	QPSK	50	0	Bottom Side	0mm	19100	1900	21.76	22.00	1.057	-0.04	0.124	0.131
08	LTE Band 4	20M	QPSK	1	0	Front	0mm	20175	1732.5	23.00	23.00	1.000	0.13	2.330	2.330
	LTE Band 4	20M	QPSK	50	0	Front	0mm	20175	1732.5	21.99	22.00	1.002	-0.14	1.760	1.764
	LTE Band 4	20M	QPSK	1	0	Back	0mm	20175	1732.5	23.00	23.00	1.000	0.04	1.930	1.930
	LTE Band 4	20M	QPSK	50	0	Back	0mm	20175	1732.5	21.99	22.00	1.002	-0.1	1.330	1.333
	LTE Band 4	20M	QPSK	1	0	Left Side	0mm	20175	1732.5	23.00	23.00	1.000	-0.12	1.850	1.850
	LTE Band 4	20M	QPSK	50	0	Left Side	0mm	20175	1732.5	21.99	22.00	1.002	-0.18	1.460	1.463
	LTE Band 4	20M	QPSK	1	0	Right Side	0mm	20175	1732.5	23.00	23.00	1.000	0.19	0.296	0.296
	LTE Band 4	20M	QPSK	50	0	Right Side	0mm	20175	1732.5	21.99	22.00	1.002	0.09	0.192	0.192
	LTE Band 4	20M	QPSK	1	0	Top Side	0mm	20175	1732.5	23.00	23.00	1.000	0.15	0.950	0.950
	LTE Band 4	20M	QPSK	50	0	Top Side	0mm	20175	1732.5	21.99	22.00	1.002	0	0.571	0.572
	LTE Band 4	20M	QPSK	1	0	Bottom Side	0mm	20175	1732.5	23.00	23.00	1.000	-0.11	0.082	0.082
	LTE Band 4	20M	QPSK	50	0	Bottom Side	0mm	20175	1732.5	21.99	22.00	1.002	-0.04	0.053	0.053
09	LTE Band 12	10M	QPSK	1	0	Front	0mm	23095	707.5	24.00	24.00	1.000	-0.16	0.539	0.539
	LTE Band 12	10M	QPSK	25	0	Front	0mm	23095	707.5	22.78	23.00	1.052	-0.09	0.436	0.459
	LTE Band 12	10M	QPSK	1	0	Back	0mm	23095	707.5	24.00	24.00	1.000	0.1	0.634	0.634
	LTE Band 12	10M	QPSK	25	0	Back	0mm	23095	707.5	22.78	23.00	1.052	0.13	0.571	0.601
	LTE Band 12	10M	QPSK	1	0	Left Side	0mm	23095	707.5	24.00	24.00	1.000	-0.15	0.463	0.463
	LTE Band 12	10M	QPSK	25	0	Left Side	0mm	23095	707.5	22.78	23.00	1.052	-0.14	0.310	0.326
	LTE Band 12	10M	QPSK	1	0	Right Side	0mm	23095	707.5	24.00	24.00	1.000	-0.17	0.273	0.273
	LTE Band 12	10M	QPSK	25	0	Right Side	0mm	23095	707.5	22.78	23.00	1.052	0.16	0.149	0.157
	LTE Band 12	10M	QPSK	1	0	Top Side	0mm	23095	707.5	24.00	24.00	1.000	0.16	0.178	0.178
	LTE Band 12	10M	QPSK	25	0	Top Side	0mm	23095	707.5	22.78	23.00	1.052	-0.07	0.145	0.153
	LTE Band 12	10M	QPSK	1	0	Bottom Side	0mm	23095	707.5	24.00	24.00	1.000	-0.12	0.129	0.129
	LTE Band 12	10M	QPSK	25	0	Bottom Side	0mm	23095	707.5	22.78	23.00	1.052	-0.18	0.101	0.106

12.4 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 2	20M	QPSK	1	0	Front	10mm	19100	1900	22.80	23.00	1.047	-0.14	0.992	-	1.039
2nd	LTE Band 2	20M	QPSK	1	0	Front	10mm	19100	1900	22.80	23.00	1.047	-0.06	0.947	1.05	0.992
1st	LTE Band 4	20M	QPSK	1	0	Front	10mm	20175	1732.5	23.00	23.00	1.000	0.14	1.320	-	1.320
2nd	LTE Band 4	20M	QPSK	1	0	Front	10mm	20175	1732.5	23.00	23.00	1.000	0.16	1.220	1.08	1.220

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	LTE Band 2	20M	QPSK	1	0	Front	0mm	19100	1900	22.80	23.00	1.047	-0.06	2.470	-	2.586
2nd	LTE Band 2	20M	QPSK	1	0	Front	0mm	19100	1900	22.80	23.00	1.047	-0.15	2.380	1.04	2.492
1st	LTE Band 4	20M	QPSK	1	0	Front	0mm	20175	1732.5	23.00	23.00	1.000	0.13	2.330	-	2.330
2nd	LTE Band 4	20M	QPSK	1	0	Front	0mm	20175	1732.5	23.00	23.00	1.000	-0.1	2.290	1.02	2.290

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. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The ratio is the difference in percentage between original and repeated *measured SAR*.
5. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

13. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Head	Body-worn	Extremity
1.	WWAN + WLAN2.4GHz	Yes	Yes	Yes

General Note:

1. All licensed modes share the same antenna part and cannot transmit simultaneously
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 $< 1.6 \text{ W/kg}$.
 - ii) $\text{SPLSR} = (\text{SAR1} + \text{SAR2})^{1.5} / (\text{min. separation distance, mm})$, 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 $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR measurement is not necessary.
 - iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR $< 1.6 \text{ W/kg}$.
4. For simultaneous transmission analysis, WLAN SAR is estimated per KDB 447498 D01v06 based on the formula below.
 - i) $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$; where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
 - ii) When the minimum separation distance is $< 5 \text{ mm}$, the distance is used 5mm to determine SAR test exclusion.
 - iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is $> 50 \text{ mm}$.

WLAN Max Power	Exposure Position	Head	Body worn	Extremity
	Test separation	10 mm	0 mm	0 mm
3 dBm	Estimated SAR (W/kg)	0.043 W/kg	0.086 W/kg	0.035 W/kg

13.1 Head Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	
			1g SAR (W/kg)	Estimated 1g SAR (W/kg)	
LTE	LTE Band 2	Front	1.091	0.043	1.134
		Bottom Side	0.121	0.043	0.164
	LTE Band 4	Front	1.320	0.043	1.363
		Bottom Side	0.077	0.043	0.120
	LTE Band 12	Front	0.434	0.043	0.477
		Bottom Side	0.057	0.043	0.100

13.2 Body-Worn Accessory Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	
			1g SAR (W/kg)	Estimated 1g SAR (W/kg)	
LTE	LTE Band 2	Front	0.483	0.086	0.569
		Back	0.273	0.086	0.359
		Left side	0.319	0.086	0.405
		Right side	0.054	0.086	0.140
		Top side	0.403	0.086	0.489
		Bottom side	0.025	0.086	0.111
	LTE Band 4	Front	0.402	0.086	0.488
		Back	0.257	0.086	0.343
		Left side	0.338	0.086	0.424
		Right side	0.047	0.086	0.133
		Top side	0.204	0.086	0.290
		Bottom side	0.013	0.086	0.099
	LTE Band 12	Front	0.078	0.086	0.164
		Back	0.079	0.086	0.165
		Left side	0.078	0.086	0.164
		Right side	0.074	0.086	0.160
		Top side	0.042	0.086	0.128
		Bottom side	0.028	0.086	0.114

13.3 Extremity Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2 Summed 10g SAR (W/kg)
			WWAN	2.4GHz WLAN	
			10g SAR (W/kg)	Estimated 10g SAR (W/kg)	
LTE	LTE Band 2_E	Front	2.600	0.035	2.635
		Back	1.812	0.035	1.847
		Left side	1.749	0.035	1.784
		Right side	0.326	0.035	0.361
		Top side	1.937	0.035	1.972
		Bottom side	0.166	0.035	0.201
	LTE Band 4_E	Front	2.330	0.035	2.365
		Back	1.930	0.035	1.965
		Left side	1.850	0.035	1.885
		Right side	0.296	0.035	0.331
		Top side	0.950	0.035	0.985
		Bottom side	0.082	0.035	0.117
	LTE Band 12_E	Front	0.539	0.035	0.574
		Back	0.634	0.035	0.669
		Left side	0.463	0.035	0.498
		Right side	0.273	0.035	0.308
		Top side	0.178	0.035	0.213
		Bottom side	0.129	0.035	0.164

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14. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be $\leq 30\%$, 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 and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

15. References

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