FCC TEST REPORT

For

Body Worn Camera

Trade Name: Getac

Model: BC-03

Issued to

Getac Technology Corp.
5F, Building A2, No.209, Sec.1, Nangang Rd., Nangang Dist., Taipei City 11568, Taiwan.

Issued by

Compliance Certification Services Inc.
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City 24891,
Taiwan. (R.O.C.)
Issued Date: 2019/05/15

Testing Laboratory
1309

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Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		2019/05/15		Initial Issue	ALL	Stella Chang

Table of Contents

1 Certificate of Compliance (SAR Evaluation)

Applicant Getac Technology Corp

5F, Building A, No.209, Sec.1, Nangang Rd., Nangang Dist., Taipei City 11568, Taiwan.

Equipment Under Test: Body Worn Camera

Trade Name: Getac

Model Number: BC-03

Date of Test: April 29 ~ May 6, 2019

Device Category: Portable Devices

Exposure Category: General Population/Uncontrolled Exposure

Applicable Standards	
FCC	● IEEE 1528 2013 ● KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 ● KDB 865664 D02 RF Exposure Reporting v01r02 ● KDB 447498 D01 General RF Exposure Guidance v06 ● KDB 616217 D04 SAR for laptop and tablets v01r02 ● KDB 248227 D01 SAR Measurement Guidance for 802.11 Transmitters v02r02 ● KDB 941225 D05 SAR for LTE Device v02r05
Limit	
1.6 W/kg	
Test Result	
Pass	

The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Tested by:

Alex Wu
Section Manager
Compliance Certification Services Inc.

Stella Chang
SAR Engineer
Compliance Certification Services Inc.

2 Description of Equipment Under Test

Product	Body Worn Camera			
Trade Name	Getac			
Model Number	BC-03			
WWAN Module	Sierra		Model:	WP7601
Transmitter	LTE			
Modulation Technique	Operating Mode		TX Freq Range (MHz)	
	LTE Band 4		1710 ~ 1755	
	LTE Band 13		777 ~ 787	
WWAN Antenna Specification	Brand name	Getac		
	Type	PIFA		
Collocated Transmitter	AMPAK		Model:	AP-6255
	Wi-Fi & Bluetooth			
Collocated Transmitter Modulation Technique	Bluetooth:GFSK for 1Mbps;π/4-DQPSK for 2Mbps;8DPSK for 3Mbps			
	802.11a: Orthogonal Frequency Division Multiplexing (OFDM)			
	802.11b: Direct Sequence Spread Spectrum(DSSS)			
	802.11g: Orthogonal Frequency Division Multiplexing (OFDM)			
	802.11ac: Orthogonal Frequency Division Multiplexing (OFDM)			
	802.11n: Orthogonal Frequency Division Multiplexing (OFDM)			
WLAN Antenna Specification	Brand name	Getac		
	Type	PIFA		
Rechargeable Li-polymer Battery–alternate	Brand：Getac Model：BP151P3450P Rating：3.6V/13Wh			

Note:

1. The sample selected for test was prototype that representative to production product and was provided by manufacturer.

2.1 Summary of Highest SAR Values

Results for highest reported SAR values for each frequency band and mode

Technology/Band	Test configuration	Mode	Highest Reported 1g-SAR (W/kg)
LTE band 4	Edge 2	QPSK	1.183
LTE band 13	Edge 2	QPSK	0.263
WiFi 2.4 GHz	Edge 2	802.11b	0.225
WiFi 5.5 GHz	Edge 1	802.11a	0.241

Result for highest Simultaneous Transmission SAR values

Technology/Band	Test configuration	Mode	Sum of Highest Reported 1g-SAR (W/kg)
LTE band 4+WiFi 2.4 GHz	Edge 2	QPSK	1.408

3 Requirements for Compliance Testing Defined

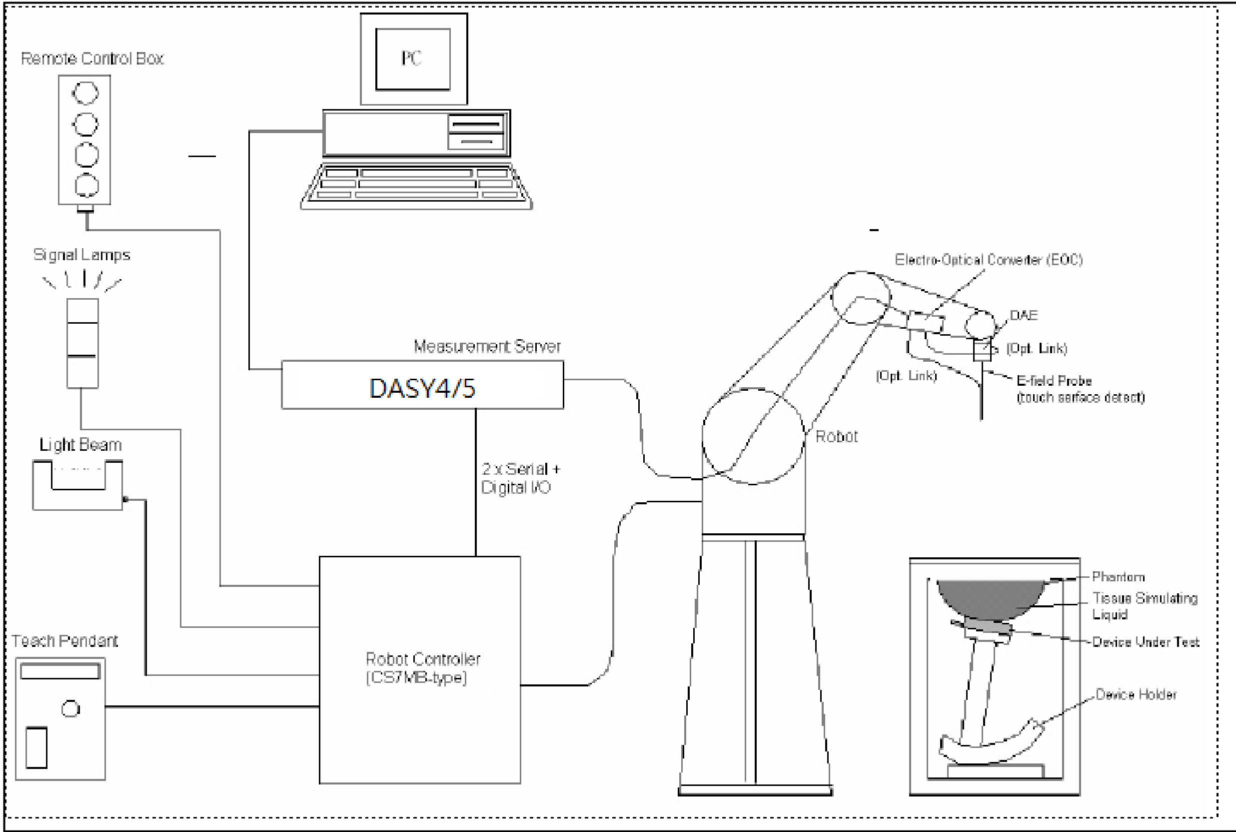
3.1 Requirements for Compliance Testing Defined by the FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1]. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/kg for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the FCC 47 CFR §2.1093 and IEEE Std 1528-2013.

4 Dosimetric Assessment System

These measurements were performed with the automated near-field scanning system DASY5 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m) which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetric probe EX3DV4-SN:7466 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE 1528 2013.

4.1 Measurement System Diagram



The DASY4/5 system for performing compliance tests consists of the following items:

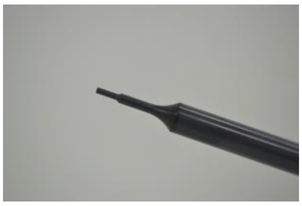
- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- 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 between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7 or Windows XP.
- DASY4 software version: 4.7, Build 80. DASY5 software version: 52.8.8.1222.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

4.2 System Components

DASY4/DASY5 Measurement Server	
	The DASY4/DASY5 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4/DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
	The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)	
	The data acquisition electronics (DAE4) 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 mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements



Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz.
Conversion Factors (CF) for HSL 900 and HSL 1800
CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in HSL (rotation normal to probe axis)

Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 µW/g)

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

SAM Phantom (V4.0)

Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 2013, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm

SAM Phantom (ELI4)

Construction: Phantom 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 the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5 and higher and is compatible with all SPEAG dosimetric probes and dipoles

Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

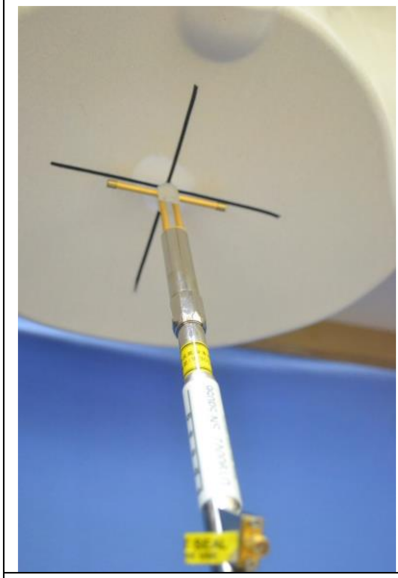
Filling Volume: Approx. 25 liters

Dimensions: Major ellipse axis: 600 mm
Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

System Validation Kits for SAM Phantom (V4.0)



Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 750, 835, 1750, 1900, 2450 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:
D750V3: dipole length: 178 mm; overall height: 330 mm
D1750V2: dipole length: 75.2 mm; overall height: 301.5 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

System Validation Kits for ELI4 phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 750 1750, 2450, 5300, 5600, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:
D750V3: dipole length: 178 mm; overall height: 330 mm
D1750V2: dipole length: 72.5 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GV2: dipole length: 20.6 mm; overall height: 300 mm

5 Evaluation Procedures

Data Evaluation

The DASY4/DASY5 post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with	V_i	= Compensated signal of channel i	(i = x, y, z)
	U_i	= Input signal of channel i	(i = x, y, z)
	cf	= Crest factor of exciting field	(DASY parameter)
	dcp_i	= Diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with	V_i	= Compensated signal of channel i	(i = x, y, z)
	$Norm_i$	= Sensor sensitivity of channel i	(i = x, y, z)

μV/(V/m)^2 for E0field Probes

$ConvF$	= Sensitivity enhancement in solution
aij	= Sensor sensitivity factors for H-field probes
f	= Carrier frequency (GHz)
Ei	= Electric field strength of channel i in V/m
Hi	= Magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with	*SAR*	= local specific absorption rate in W/kg
	E_{tot}	= total field strength in V/m
	σ	= conductivity in [mho/m] or [Siemens/m]
	ρ	= equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{377} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with	P_{pwe}	= Equivalent power density of a plane wave in mW/cm^2
	E_{tot}	= total electric field strength in V/m
	H_{tot}	= total magnetic field strength in A/m

6 SAR Measurement Procedures

6.1 Normal SAR Test Procedure

- **Power Reference Measurement**

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4/DASY5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, the grid resolution has to less than 15 mm by 15 mm at frequency ≤2GHz; the grid resolution has to less than 12mm by 12 mm at frequency between 2GHz to 4GHz; grid resolution has to less than 10 mm by 10 mm at frequency between 4GHz to 6GHz.

According to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

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

- **Zoom Scan**

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures points in accordance with the frequency can be divided into three parts. (1)The zoom scan volume was set to 5x5x7 points at frequency ≤ 2GHz. (2) The zoom scan volume was set to 7x7x7 points at frequency between 2GHz to 4GHz (3) The zoom scan volume was set to 7x7x12 points at frequency between 4GHz to 6GHz. The measures points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly.

According to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm</td><td>3 – 4 GHz: ≤ 5 mm
4 – 6 GHz: ≤ 4 mm</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">Uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$:between 1st two points losest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Maximum zoom scan volume</td><td>x, y, z</td><td>≥ 30 mm</td><td colspan="2">3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
</table>

- **Power Drift Measurement**

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY4/DASY5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

7 Measurement Uncertainty

According to KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz section 2.8.2, SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

8 Device Under Test

8.1 Wireless Technologies

Wireless technologies	Tx Frequency Bands	Operating mode	Duty Cycle used for testing
LTE	Band 4 Band 13	QPSK 16QAM	100%
Wi-Fi	2.4 / 5GHz Band	802.11b 802.11g 802.11n(HT20) 802.11n(HT40) 802.11a 802.11a(HT20) 802.11a (HT40) 802.11a (VHT80)	100%
Bluetooth	2.4GHz	2.1 4.0	NA

8.2 Maximum Tune-up Power

P-sensor off

Tolerance (dB): ± 1		RF Output Power (dBm)	
Band	Mode	Target	Max. tune-up power
LTE Band 4	QPSK	22.0	23.0
LTE Band 13	QPSK	22.0	23.0

P-sensor on

Tolerance (dB): ± 1		RF Output Power (dBm)	
Band	Mode	Target	Max. tune-up power
LTE Band 4	QPSK	16.0	17.0

Tolerance (dB): ±	1.5	RF Output Power (dBm)	
Band (GHz)	Mode	Target	Max. tune-up power
2.4	802.11b	16.00	17.50
	802.11g	15.00	16.50
	802.11n HT20	12.00	13.50
Tolerance (dB): ±	1.5	RF Output Power (dBm)	
Band (GHz)	Mode	Target	Max. tune-up power
5.2 (UNII-1)	802.11a	8.00	9.50
	802.11n HT20	4.00	5.50
	802.11n HT40	4.00	5.50
	802.11ac VHT80	4.00	5.50
5.3 (UNII-2A)	802.11a	8.00	9.50
	802.11n HT20	4.00	5.50
	802.11n HT40	4.00	5.50
	802.11ac VHT80	4.00	5.50
5.5 (UNII-2C)	802.11a	10.00	11.50
	802.11n HT20	5.00	6.50
	802.11n HT40	6.00	7.50
	802.11ac VHT80	6.00	7.50
5.8 (UNII-3)	802.11a	10.00	11.50
	802.11n HT20	5.00	6.50
	802.11n HT40	6.00	7.50
	802.11ac VHT80	6.00	7.50

Mode	Max. tune-up power(dBm)
Bluetooth	6.0
Bluetooth LE	6.0

8.3 Simultaneous Transmission

RF Exposure Condition	Transmit Configurations
WWAN + Wi-Fi	**LTE + Wi-Fi / BT** LTE Band 4/13 + BT (Chain 0) LTE Band 4/13+ 2.4GHz (Chain 0) LTE Band 4/13+ 5GHz (Chain 0) **Wi-Fi** 2.4GHz(Chain 0) 5GHz(Chain 0) **BT** BT (Chain 0)

Note(s):

1. For WWAN mode only Chain 0 can be used as transmitting and Chain 1 only be used as receiving.

9 General LTE SAR Test and Reporting Considerations

KDB 941225 D05 SAR for LTE Devices V02

Item	Description	Information						
1	Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 4	Channel Bandwidth					
			1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
		Low	19957/ 1710.7	19965/ 1711.5	19975/ 1712.5	20000/ 1715	20025/ 1717.5	20050/ 1720
		Mid	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5
		High	20392/ 1754.2	20384/ 1753.4	20375/ 1752.5	20350/ 1750	20325/ 1747.5	20300/ 1745
		Band 13	Channel Bandwidth					
			1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz
		Low			23205/ 779.5			
		Mid			23230/ 782	23230/ 782		
		High			23255/ 784.5			

Report No.: T181222W03-SF

KDB 941225 D05 SAR for LTE Devices V02 (Continued)

<table>
<tr><th>Item</th><th>Description</th><th>Information</th></tr>
<tr><td>2</td><td>Descriptions of the LTE transmitter and antenna implementation;</td><td>A single antenna is used for LTE Transmit and Receive.
A Secondary antenna is used for LTE Receive Only.</td></tr>
<tr><td>3</td><td>Maximum power reduction (MPR)</td><td>As per 3GPP 36.101 v9.11.0 (2012-03), Release 9
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
</table>
MPR is permanently built-in by design
A-MPR was disabled</td></tr>
<tr><td>4</td><td>Power Reduction</td><td>Yes</td></tr>
</table>

10 Power Reduction by Proximity Sensing

A proximity sensor for power reduction is implemented in this device to address RF exposure compliance when the cellular antenna is positioned close to the user's body. The sensor's mechanical structure is designed to fit within the enclosure design used in this device and also extended around the edge and top of the antenna element in order to optimize sensitivity in these orientations. This design combines the antenna printed directly on a plastic part and proximity sensor FPC (Flexible Printed Circuit) bonded together into one piece. According to KDB 616217 D04 SAR for laptop and tablets v01r02)

10.1 Procedures for determining proximity sensor triggering distances

The following procedures should be applied to determine proximity sensor triggering distances for the back surface and individual edges of a tablet. Conducted power is monitored qualitatively to identify the general triggering characteristics and recorded quantitatively, versus spacing, as required by the procedures. Unless there is built-in test software that reports the triggering conditions and enables the power levels to be confirmed separately, monitoring of conducted power during the triggering tests typically requires internal access to the antenna ports inside the tablet, which may interfere with the triggering tests.

(1) The relevant transmitter should be set to operate at its normal maximum output power.

(2) The entire back surface or edge of the tablet is positioned below a flat phantom filled with the required tissue-equivalent medium, and positioned at least 20 mm further than the distance that triggers power reduction.

(3) It should be ensured that the cables required for power measurements are not interfering with the proximity sensor. Cable losses should be properly compensated to report the measured power results.

(4) The back surface or edge is moved toward the phantom in 3 mm steps until the sensor triggers.

(5) The back surface or edge is then moved back (further away) from the phantom by at least 5 mm or until maximum output power is returned to the normal maximum level.

(6) The back surface or edge is again moved toward the phantom, but in 1 mm steps, until it is at least 5 mm past the triggering point or touching the phantom. If 1 mm resolution is not suitable for the sensor triggering sensitivity, a KDB inquiry should be submitted to determine alternative test configurations.

(7) If the tablet is not touching the phantom, it is moved in 3 mm steps until it touches the phantom to confirm that the sensor remains triggered and the maximum power stays reduced.

(8) The process is then reversed by moving the tablet away from the phantom according to steps 4) to 7), to determine triggering release, until it is at least 10 mm beyond the point that triggers the return of normal maximum power.

(9) The measured output power within ± 5 mm of the triggering points, or until the tablet is touching the phantom, for movements to and from the phantom should be tabulated in the SAR report.

(10) If the sensor design and implementation allow additional variations for triggering distance tolerances, multiple samples should be tested to determine the most conservative distance required for SAR evaluation.

(11) To ensure all production units are compliant, it is generally necessary to reduce the triggering distance determined from the triggering tests by 1 mm, or more if it is necessary, and use the smallest distance for movements to and from the phantom, minus 1 mm, as the sensor triggering distance for determining the SAR measurement distance.

10.2 Procedures for determining antenna and proximity sensor coverage

The sensing regions are usually limited to areas near the sensor element. If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. The following are used to determine if additional SAR measurements may be necessary due to sensor and antenna offset. 25 These procedures do not apply and are not required for configurations where the antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.

(1) The back surface or edge of the tablet is positioned at a test separation distance less than or equal to the distance required for back surface or edge triggering, with both the antenna and sensor pad located at least 20 mm laterally outside the edge (boundary) of the phantom, along the direction of maximum antenna and sensor offset. For the back surface, if the direction of maximum offset is not aligned with the tablet coordinates (physical edges) the tablet test position would not be aligned with the phantom coordinates (orientations). Each applicable tablet edge should be positioned perpendicularly to the phantom to determine sensor coverage. For antennas and/or sensors located near the corner of a tablet, both adjacent edges must be considered.

(2) The similar sequence of steps applied to determine sensor triggering distance in section 6.2 are used to verify back surface and edge sensor coverage by moving the tablet (sensor and antenna) horizontally toward the phantom while maintaining the same vertical separation between the back surface or edge and the phantom.

(3) After the exact location where triggering of power reduction is determined, with respect to the sensor and antenna, the tablet movement should be continued, in 3 mm increments, until both the sensor and antenna(s) are fully under the phantom and at least 20 mm inside the phantom edge.

(4) The process is then repeated from the opposite direction, starting at the other end of the maximum antenna and sensor offset, by rotating the tablet 180° along the vertical axis.

(5) The triggering points should be documented graphically, with the antenna and sensor clearly identified, along with all relevant dimensions.

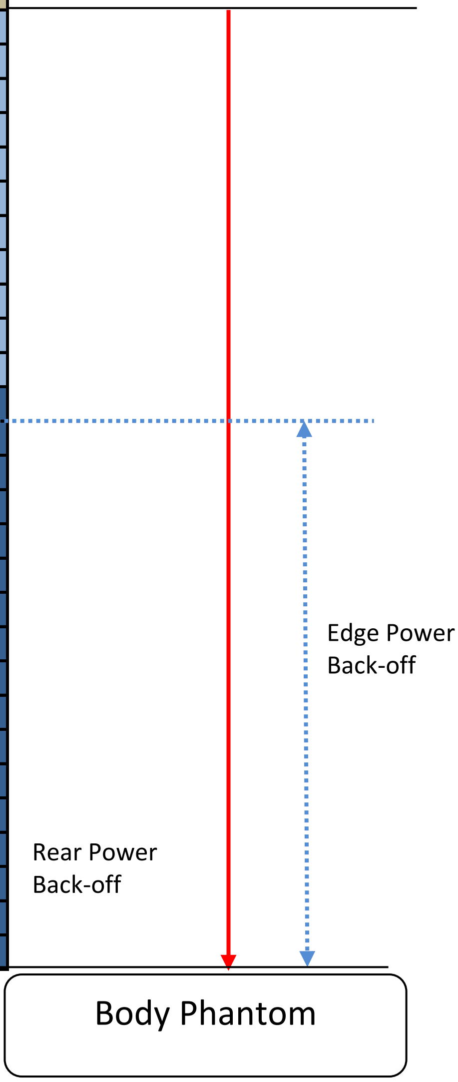
(6) If the subsequently measured peak SAR location for the antenna is not between the triggering points, established by the sensor coverage tests from opposite ends of the antenna and sensor, additional SAR tests may be required for conditions where only part of the back surface or edge of a tablet corresponding to the antenna is in proximity to the user and the sensor may not be triggering as desired. A KDB inquiry must be submitted by the test lab to determine if additional tests are required and the proper test configurations to use for testing. This may include situations where the sensor coverage region is too small for the antenna, the sensor is located too far away from the antenna, the sensor location is insufficient to cover multiple antennas or the antenna is at the corner of a tablet etc.

10.3 Proximity Sensor Status Table of trigger distance

As per the KDB 616217 D04 SAR for laptop and tablets v01r02, section 6.2, the following procedure is used to determine the triggering distances.

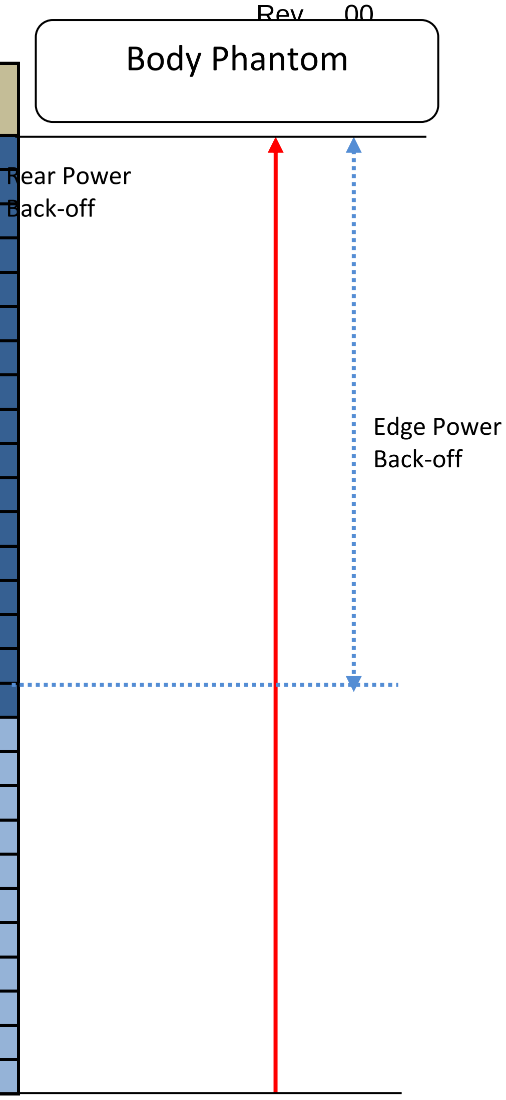
Proximity Sensor Status Table when DUT is moving towards the phantom

Distance to the DUT (mm)	Proximity Sensor Status – Rear Surface	Proximity Sensor Status – Top-Edge
30	OFF	OFF
27	OFF	OFF
25	OFF	OFF
24	OFF	OFF
23	OFF	OFF
22	OFF	OFF
21	OFF	OFF
20	OFF	OFF
19	OFF	OFF
18	OFF	OFF
17	OFF	OFF
16	OFF	ON
15	OFF	ON
14	OFF	ON
13	OFF	ON
12	OFF	ON
11	OFF	ON
10	OFF	ON
9	OFF	ON
8	OFF	ON
7	OFF	ON
6	OFF	ON
5	OFF	ON
4	OFF	ON
3	OFF	ON
2	OFF	ON
1	OFF	ON
0	OFF	ON



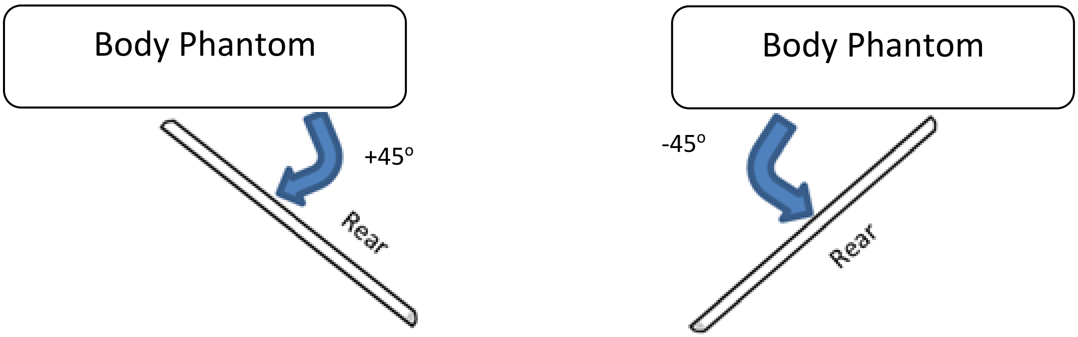
Proximity Sensor Status Table when DUT is moving away from the phantom

Distance to the DUT (mm)	Proximity Sensor Status – Rear Surface	Proximity Sensor Status – Top-Edge
0	OFF	ON
1	OFF	ON
2	OFF	ON
3	OFF	ON
4	OFF	ON
5	OFF	ON
6	OFF	ON
7	OFF	ON
8	OFF	ON
9	OFF	ON
10	OFF	ON
11	OFF	ON
12	OFF	ON
13	OFF	ON
14	OFF	ON
15	OFF	ON
16	OFF	ON
17	OFF	OFF
18	OFF	OFF
19	OFF	OFF
20	OFF	OFF
21	OFF	OFF
22	OFF	OFF
23	OFF	OFF
24	OFF	OFF
25	OFF	OFF
27	OFF	OFF
30	OFF	OFF



10.4 Tilt angle influences to proximity sensor triggering

As per the KDB 616217 D04 SAR for laptop and tablets v01r02, section 6.4, the following procedure is used to determine the tilt angle influences to proximity sensor triggering.

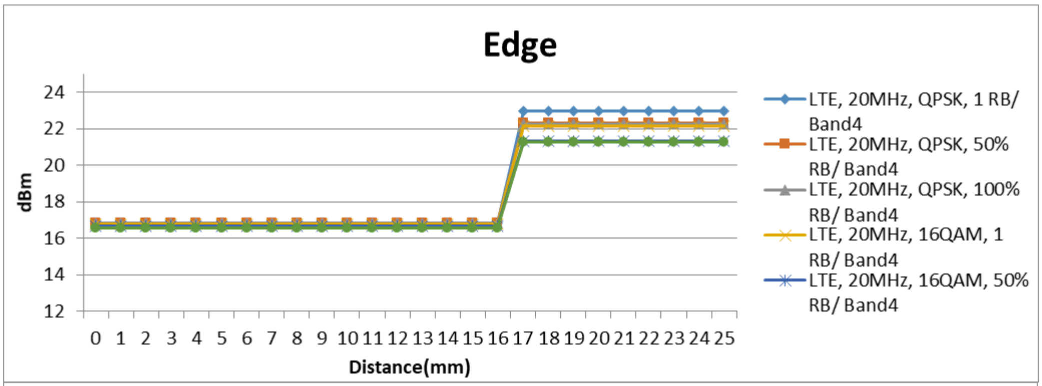


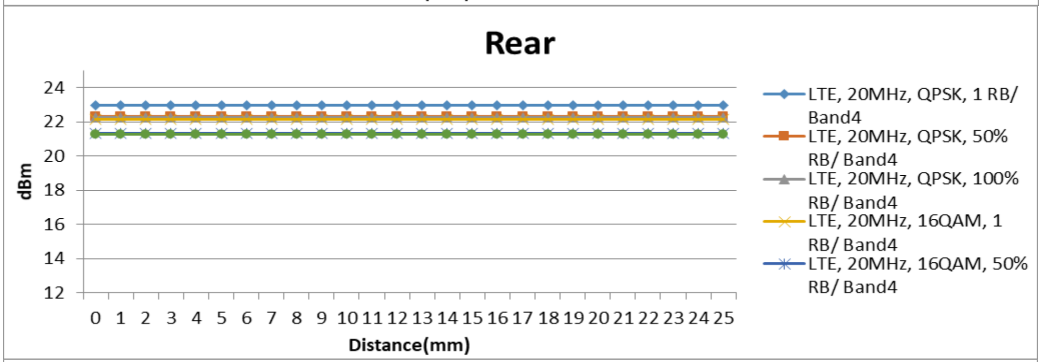
Distance to the DUT (mm)	Proximity Sensor Status 0° to +45°	Proximity Sensor Status 0° to -45°
16	ON	ON
15	ON	ON
14	ON	ON
13	ON	ON
12	ON	ON
11	ON	ON
10	ON	ON
9	ON	ON
8	ON	ON
7	ON	ON
6	ON	ON
5	ON	ON
4	ON	ON
3	ON	ON
2	ON	ON
1	ON	ON
0	ON	ON

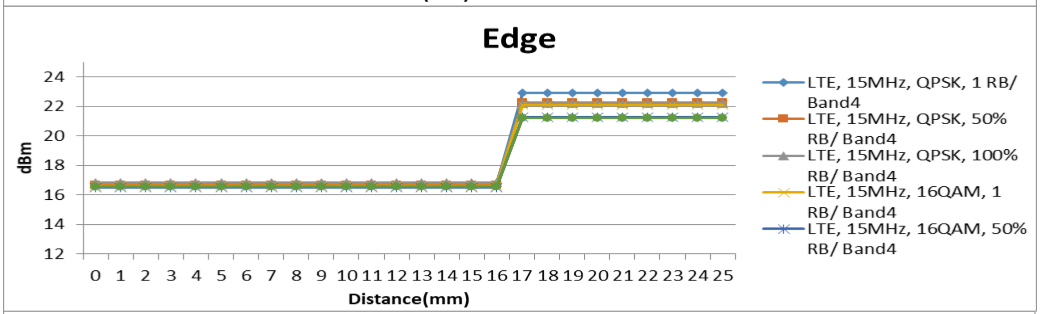
10.5 Power Reduction per Air-interface

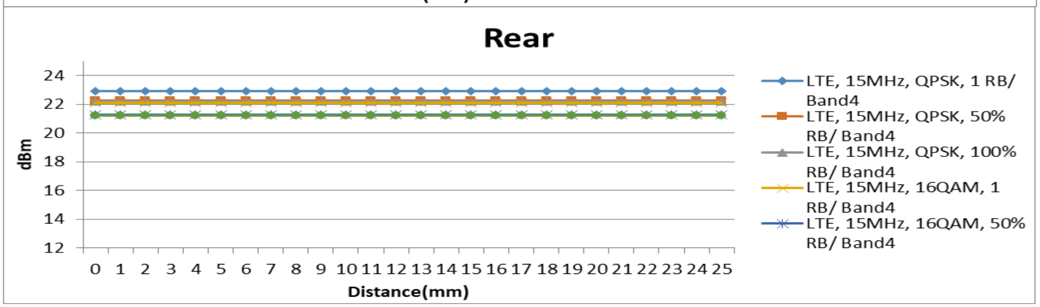
The following graphs show the power level and the distance from the DUT to the flat phantom for the Top-Edge and Rear Surface.

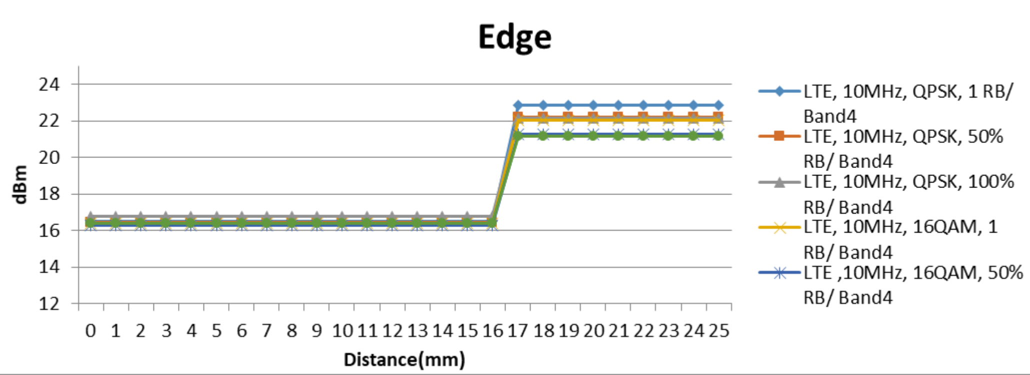
LTE Band 4

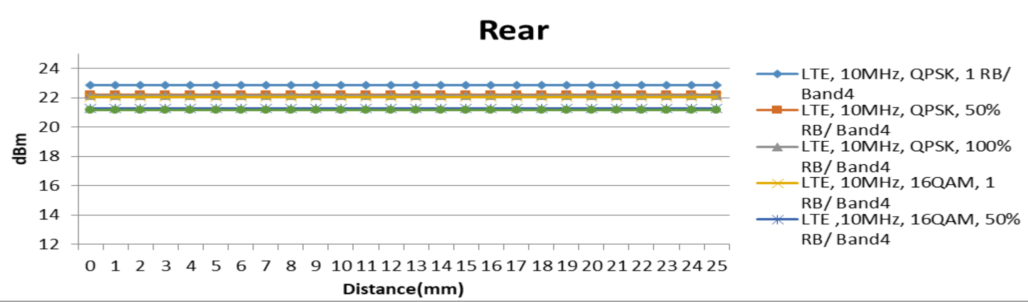


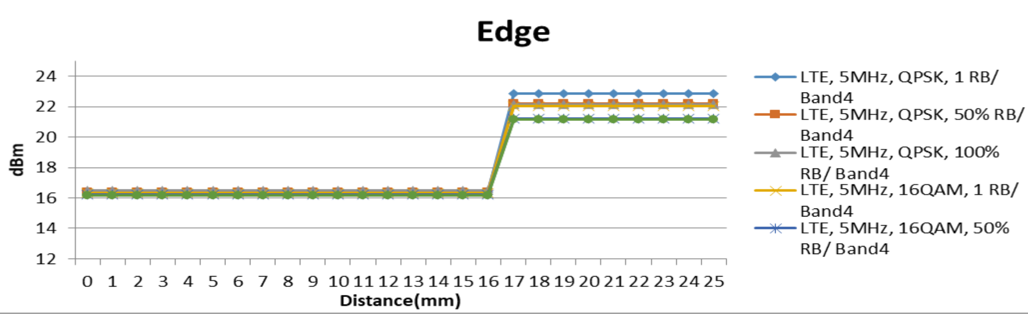


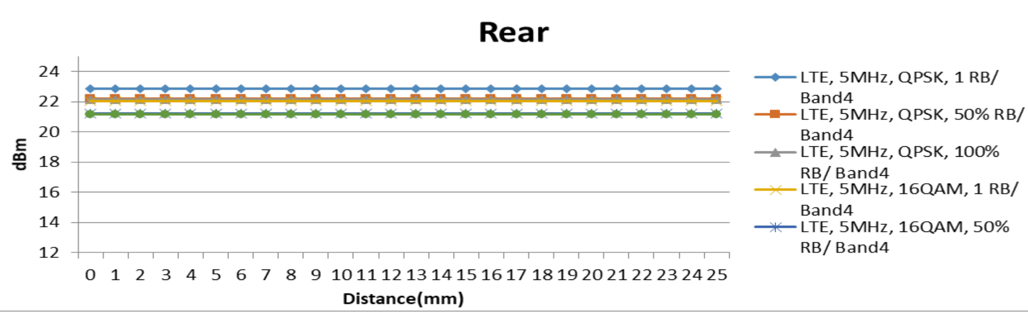


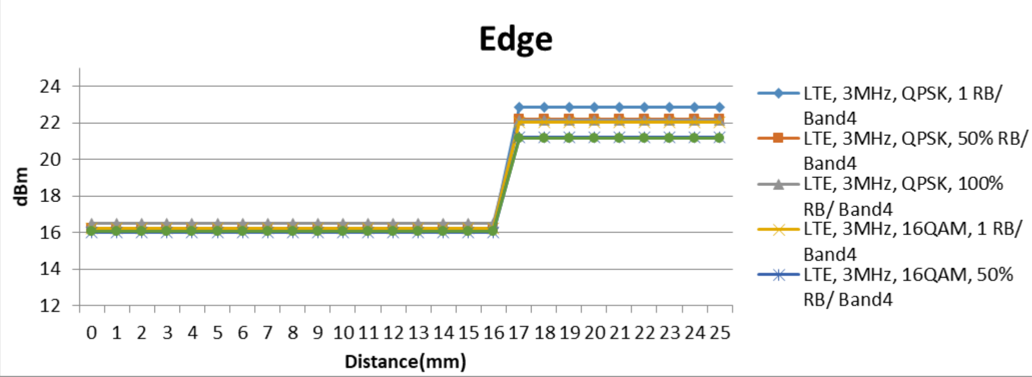


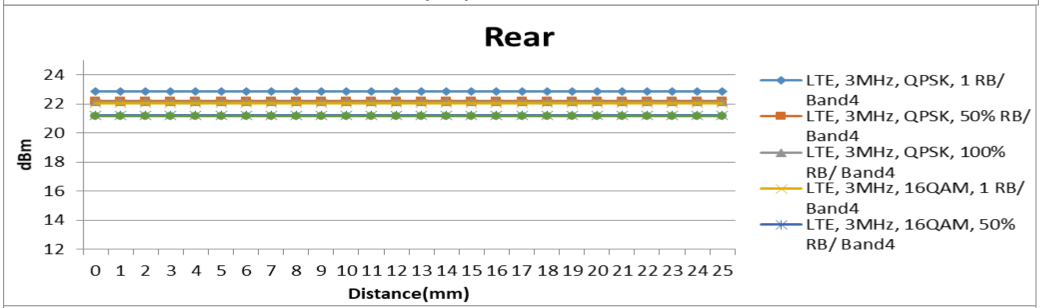

Edge
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 10MHz, QPSK, 1 RB/ Band4
LTE, 10MHz, QPSK, 50% RB/ Band4
LTE, 10MHz, QPSK, 100% RB/ Band4
LTE, 10MHz, 16QAM, 1 RB/ Band4
LTE ,10MHz, 16QAM, 50% RB/ Band4

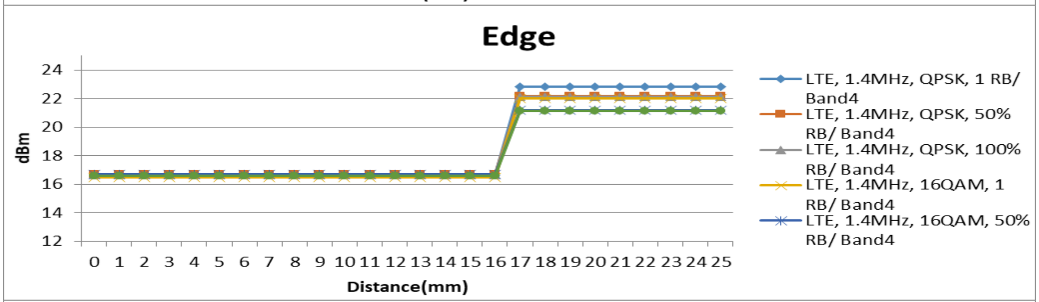

Rear
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 10MHz, QPSK, 1 RB/ Band4
LTE, 10MHz, QPSK, 50% RB/ Band4
LTE, 10MHz, QPSK, 100% RB/ Band4
LTE, 10MHz, 16QAM, 1 RB/ Band4
LTE ,10MHz, 16QAM, 50% RB/ Band4

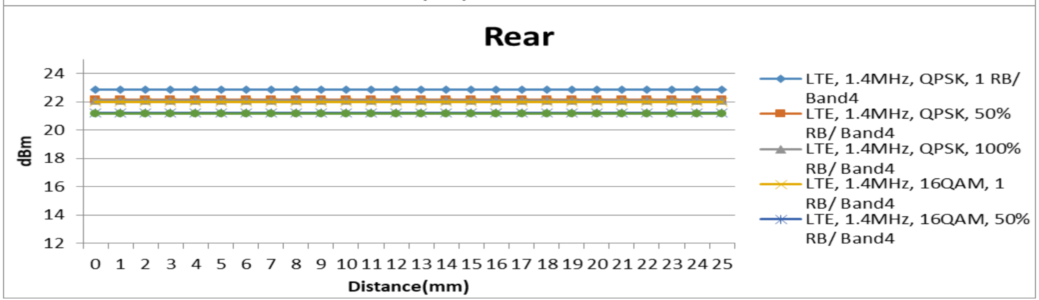

Edge
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 5MHz, QPSK, 1 RB/ Band4
LTE, 5MHz, QPSK, 50% RB/ Band4
LTE, 5MHz, QPSK, 100% RB/ Band4
LTE, 5MHz, 16QAM, 1 RB/ Band4
LTE, 5MHz, 16QAM, 50% RB/ Band4


Rear
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 5MHz, QPSK, 1 RB/ Band4
LTE, 5MHz, QPSK, 50% RB/ Band4
LTE, 5MHz, QPSK, 100% RB/ Band4
LTE, 5MHz, 16QAM, 1 RB/ Band4
LTE, 5MHz, 16QAM, 50% RB/ Band4


Edge
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 3MHz, QPSK, 1 RB/ Band4
LTE, 3MHz, QPSK, 50% RB/ Band4
LTE, 3MHz, QPSK, 100% RB/ Band4
LTE, 3MHz, 16QAM, 1 RB/ Band4
LTE, 3MHz, 16QAM, 50% RB/ Band4


Rear
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 3MHz, QPSK, 1 RB/ Band4
LTE, 3MHz, QPSK, 50% RB/ Band4
LTE, 3MHz, QPSK, 100% RB/ Band4
LTE, 3MHz, 16QAM, 1 RB/ Band4
LTE, 3MHz, 16QAM, 50% RB/ Band4


Edge
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 1.4MHz, QPSK, 1 RB/ Band4
LTE, 1.4MHz, QPSK, 50% RB/ Band4
LTE, 1.4MHz, QPSK, 100% RB/ Band4
LTE, 1.4MHz, 16QAM, 1 RB/ Band4
LTE, 1.4MHz, 16QAM, 50% RB/ Band4


Rear
dBm
24
22
20
18
16
14
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance(mm)
LTE, 1.4MHz, QPSK, 1 RB/ Band4
LTE, 1.4MHz, QPSK, 50% RB/ Band4
LTE, 1.4MHz, QPSK, 100% RB/ Band4
LTE, 1.4MHz, 16QAM, 1 RB/ Band4
LTE, 1.4MHz, 16QAM, 50% RB/ Band4

10.6 Proximity Sensor Coverage Area

According to KDB 616217 D04, Proximity Sensor Coverage Area of not request when the antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.

11 RF Output Power Measurement

Output power table

11.1 LTE

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (22 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

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

Modulation	Channel bandwidth / Transmission bandwidth (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

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of “NS_01”.

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

11.1.1 LTE Band 4

Output power table

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm)	
								W/o Power back-off	W/ Power back-off
4	1.4	19957	1710.7	QPSK	1	0	0	22.67	16.46
					1	2	0	22.60	16.56
					1	5	0	22.58	16.48
					3	0	1	21.71	16.43
					3	1	1	21.69	16.53
					3	2	1	21.79	16.42
					6	0	1	21.68	16.45
				16QAM	1	0	1	21.67	16.31
					1	2	1	21.61	16.40
					1	5	1	21.58	16.18
					3	0	2	20.68	16.47
					3	1	2	20.66	16.54
					3	2	2	20.76	16.53
					6	0	2	20.69	16.41
		20175	1732.5	QPSK	1	0	0	22.17	16.70
					1	2	0	22.20	16.77
					1	5	0	22.18	16.72
					3	0	1	21.45	16.67
					3	1	1	21.39	16.73
					3	2	1	21.29	16.71
					6	0	1	21.41	16.68
				16QAM	1	0	1	21.40	16.49
					1	2	1	21.26	16.61
					1	5	1	21.30	16.57
					3	0	2	20.26	16.72
					3	1	2	20.32	16.70
					3	2	2	20.36	16.63
					6	0	2	20.33	16.62
		20392	1754.2	QPSK	1	0	0	22.83	16.65
					1	2	0	22.78	16.80
					1	5	0	22.87	16.69
					3	0	1	22.17	16.67
					3	1	1	22.07	16.69
					3	2	1	22.04	16.73
					6	0	1	22.11	16.65
				16QAM	1	0	1	22.00	16.49
					1	2	1	22.06	16.58
					1	5	1	22.01	16.39
					3	0	2	21.20	16.69
					3	1	2	21.06	16.72
					3	2	2	21.15	16.66
					6	0	2	21.13	16.60

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm)	
								W/o Power back-off	W/ Power back-off
4	3	19965	1711.5	QPSK	1	0	0	22.68	15.98
					1	7	0	22.61	16.06
					1	14	0	22.59	16.15
					8	0	1	21.72	16.06
					8	4	1	21.70	16.00
					8	7	1	21.80	16.28
					15	0	1	21.69	16.10
				16QAM	1	0	1	21.68	15.77
					1	7	1	21.62	16.27
					1	14	1	21.59	15.69
					8	0	2	20.69	16.26
					8	4	2	20.67	16.22
					8	7	2	20.77	16.12
					15	0	2	20.70	16.05
		20175	1732.5	QPSK	1	0	0	22.18	16.21
					1	7	0	22.21	15.93
					1	14	0	22.19	16.12
					8	0	1	21.46	16.18
					8	4	1	21.40	16.26
					8	7	1	21.30	15.92
					15	0	1	21.42	15.94
				16QAM	1	0	1	21.41	15.89
					1	7	1	21.27	15.99
					1	14	1	21.31	15.90
					8	0	2	20.27	16.35
					8	4	2	20.33	16.31
					8	7	2	20.37	16.07
					15	0	2	20.34	16.21
		20384	1753.4	QPSK	1	0	0	22.84	16.23
					1	7	0	22.79	16.25
					1	14	0	22.88	16.56
					8	0	1	22.18	16.22
					8	4	1	22.08	15.94
					8	7	1	22.05	15.93
					15	0	1	22.12	16.50
				16QAM	1	0	1	22.01	16.21
					1	7	1	22.07	16.11
					1	14	1	22.02	16.17
					8	0	2	21.21	16.03
					8	4	2	21.07	15.83
					8	7	2	21.16	16.22
					15	0	2	21.14	16.06

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm)	
								W/o Power back-off	W/ Power back-off
4	5	19975	1712.5	QPSK	1	0	0	22.70	16.05
					1	12	0	22.63	16.26
					1	24	0	22.61	16.25
					12	0	1	21.74	16.27
					12	6	1	21.72	16.15
					12	11	1	21.82	16.46
					25	0	1	21.71	16.18
				16QAM	1	0	1	21.70	15.82
					1	12	1	21.64	16.30
					1	24	1	21.61	15.89
					12	0	2	20.71	16.40
					12	6	2	20.69	16.28
					12	11	2	20.79	16.17
					25	0	2	20.72	16.21
		20175	1732.5	QPSK	1	0	0	22.19	16.39
					1	12	0	22.22	16.11
					1	24	0	22.20	16.14
					12	0	1	21.47	16.30
					12	6	1	21.41	16.37
					12	11	1	21.31	16.08
					25	0	1	21.43	16.15
				16QAM	1	0	1	21.42	15.98
					1	12	1	21.28	16.20
					1	24	1	21.32	15.97
					12	0	2	20.28	16.49
					12	6	2	20.34	16.39
					12	11	2	20.38	16.17
					25	0	2	20.35	16.42
		20375	1752.5	QPSK	1	0	0	22.85	16.40
					1	12	0	22.80	16.31
					1	24	0	22.89	16.44
					12	0	1	22.19	16.36
					12	6	1	22.09	16.02
					12	11	1	22.06	16.13
					25	0	1	22.13	16.47
				16QAM	1	0	1	22.02	16.33
					1	12	1	22.08	16.27
					1	24	1	22.03	16.21
					12	0	2	21.22	16.24
					12	6	2	21.08	16.01
					12	11	2	21.17	16.28
					25	0	2	21.15	16.19

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm) W/o Power back-off	Average power(dBm) W/ Power back-off
4	10	20000	1715.0	QPSK	1	0	0	22.71	16.21
					1	24	0	22.64	16.36
					1	49	0	22.62	16.41
					25	0	1	21.75	16.29
					25	12	1	21.73	16.34
					25	24	1	21.83	16.49
					50	0	1	21.72	16.29
				16QAM	1	0	1	21.71	15.96
					1	24	1	21.65	16.45
					1	49	1	21.62	16.02
					25	0	2	20.72	16.48
					25	12	2	20.70	16.34
					25	24	2	20.80	16.27
					50	0	2	20.73	16.30
		20175	1732.5	QPSK	1	0	0	22.21	16.50
					1	24	0	22.24	16.27
					1	49	0	22.22	16.25
					25	0	1	21.49	16.49
					25	12	1	21.43	16.42
					25	24	1	21.33	16.27
					50	0	1	21.45	16.33
				16QAM	1	0	1	21.44	16.08
					1	24	1	21.30	16.29
					1	49	1	21.34	16.10
					25	0	2	20.30	16.50
					25	12	2	20.36	16.42
					25	24	2	20.40	16.34
					50	0	2	20.37	16.46
		20350	1750.0	QPSK	1	0	0	22.88	16.47
					1	24	0	22.83	16.37
					1	49	0	22.92	16.47
					25	0	1	22.22	16.44
					25	12	1	22.12	16.23
					25	24	1	22.09	16.32
					50	0	1	22.16	16.79
				16QAM	1	0	1	22.05	16.39
					1	24	1	22.11	16.45
					1	49	1	22.06	16.42
					25	0	2	21.25	16.26
					25	12	2	21.11	16.20
					25	24	2	21.20	16.35
					50	0	2	21.18	16.37

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm) W/o Power back-off	Average power(dBm) W/ Power back-off
4	15	20025	1717.5	QPSK	1	0	0	22.74	16.42
					1	37	0	22.67	16.52
					1	74	0	22.65	16.43
					36	0	1	21.78	16.36
					36	18	1	21.76	16.48
					36	35	1	21.86	16.61
					75	0	1	21.75	16.48
				16QAM	1	0	1	21.74	16.15
					1	37	1	21.68	16.51
					1	74	1	21.65	16.17
					36	0	2	20.75	16.53
					36	18	2	20.73	16.38
					36	35	2	20.83	16.48
					75	0	2	20.76	16.35
		20175	1732.5	QPSK	1	0	0	22.23	16.65
					1	37	0	22.26	16.45
					1	74	0	22.24	16.33
					36	0	1	21.51	16.59
					36	18	1	21.45	16.52
					36	35	1	21.35	16.45
					75	0	1	21.47	16.54
				16QAM	1	0	1	21.46	16.26
					1	37	1	21.32	16.50
					1	74	1	21.36	16.15
					36	0	2	20.32	16.68
					36	18	2	20.38	16.56
					36	35	2	20.42	16.46
					75	0	2	20.39	16.50
		20325	1747.5	QPSK	1	0	0	22.90	16.69
					1	37	0	22.85	16.61
					1	74	0	22.94	16.85
					36	0	1	22.24	16.66
					36	18	1	22.14	16.44
					36	35	1	22.11	16.38
					75	0	1	22.18	16.82
				16QAM	1	0	1	22.07	16.59
					1	37	1	22.13	16.62
					1	74	1	22.08	16.47
					36	0	2	21.27	16.47
					36	18	2	21.13	16.38
					36	35	2	21.22	16.47
					75	0	2	21.20	16.53

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm)	
								W/o Power back-off	W/ Power back-off
4	20	20050	1720.0	QPSK	1	0	0	22.82	16.58
					1	49	0	22.75	16.60
					1	99	0	22.73	16.62
					50	0	1	21.86	16.54
					50	24	1	21.84	16.51
					50	49	1	21.94	16.63
					100	0	1	21.83	16.51
				16QAM	1	0	1	21.82	16.36
					1	49	1	21.76	16.61
					1	99	1	21.73	16.37
					50	0	2	20.83	16.55
					50	24	2	20.81	16.55
					50	49	2	20.91	16.61
					100	0	2	20.84	16.54
		20175	1732.5	QPSK	1	0	0	22.29	16.69
					1	49	0	22.32	16.62
					1	99	0	22.30	16.51
					50	0	1	21.57	16.78
					50	24	1	21.51	16.66
					50	49	1	21.41	16.61
					100	0	1	21.53	16.65
				16QAM	1	0	1	21.52	16.44
					1	49	1	21.38	16.62
					1	99	1	21.42	16.33
					50	0	2	20.38	16.73
					50	24	2	20.44	16.71
					50	49	2	20.48	16.59
					100	0	2	20.45	16.63
		20300	1745.0	QPSK	1	0	0	22.95	16.83
					1	49	0	22.90	16.71
					1	99	0	22.99	16.95
					50	0	1	22.29	16.84
					50	24	1	22.19	16.52
					50	49	1	22.16	16.55
					100	0	1	22.23	16.85
				16QAM	1	0	1	22.12	16.77
					1	49	1	22.18	16.71
					1	99	1	22.13	16.62
					50	0	2	21.32	16.66
					50	24	2	21.18	16.52
					50	49	2	21.27	16.53
					100	0	2	21.25	16.56

11.1.2 LTE Band 13

Output power table

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm)	
								W/o Power back-off	W/ Power back-off
13	5	23205	779.5	QPSK	1	0	0	22.69	
					1	12	0	22.68	
					1	24	0	22.65	
					12	0	1	21.86	
					12	6	1	21.82	
					12	11	1	21.76	
					25	0	1	21.75	
				16QAM	1	0	1	21.81	
					1	12	1	21.77	
					1	24	1	21.88	
					12	0	2	20.72	
					12	6	2	20.69	
					12	11	2	20.66	
					25	0	2	20.69	
		23230	782.0	QPSK	1	0	0	22.66	
					1	12	0	22.67	
					1	24	0	22.63	
					12	0	1	21.84	
					12	6	1	21.80	
					12	11	1	21.74	
					25	0	1	21.73	
				16QAM	1	0	1	21.79	
					1	12	1	21.75	
					1	24	1	21.86	
					12	0	2	20.70	
					12	6	2	20.67	
					12	11	2	20.64	
					25	0	2	20.67	
		23255	784.5	QPSK	1	0	0	22.73	
					1	12	0	22.72	
					1	24	0	22.69	
					12	0	1	21.90	
					12	6	1	21.86	
					12	11	1	21.80	
					25	0	1	21.79	
				16QAM	1	0	1	21.85	
					1	12	1	21.81	
					1	24	1	21.92	
					12	0	2	20.76	
					12	6	2	20.73	
					12	11	2	20.70	
					25	0	2	20.73	

Band	BW (MHz)	Channel	Frequency (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Average power(dBm)	
								W/o Power back-off	W/ Power back-off
13	10	23230	782.0	QPSK	1	0	0	22.75	
					1	24	0	22.74	
					1	49	0	22.71	
					25	0	1	21.92	
					25	12	1	21.88	
					25	24	1	21.82	
					50	0	1	21.81	
				16QAM	1	0	1	21.87	
					1	24	1	21.83	
					1	49	1	21.94	
					25	0	2	20.78	
					25	12	2	20.75	
					25	24	2	20.72	
					50	0	2	20.75	

11.2 Wi-Fi (2.4GHz Band)

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Avg. Pwr (dBm)			Maximum Tune-up Pwr (dBm)			SAR Test (Yes/No)	Note
					Main	Aux	MIMO	Main	Aux	MIMO		
2.4	802.11b	1	1	2412	16.34			17.50			Yes	
			6	2437	16.77			17.50				
			11	2462	17.15			17.50				
	802.11g	6	1	2412	No Required			16.50			No	1
			6	2437				16.50				
			11	2462				16.50				
	802.11n HT20	MCS0	1	2412	No Required			13.50			No	1
			6	2437				13.50				
			11	2462				13.50				

Note(s):

1. Output Power and SAR is not required for 802.11 g/n HT20/n HT40 channels 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.

11.3 Wi-Fi (5GHz Band)

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Avg. Pwr (dBm)			Maximum Tune-up Pwr (dBm)			SAR Test (Yes/No)	Note
					Main	Aux	MIMO	Main	Aux	MIMO		
5.2 (U-NII 1)	802.11a	6	36-48	5180-5240	Not Required			9.50			No	1
	802.11n (HT20)	MCS0	36-48	5180-5240				5.50			No	1
	802.11n (HT40)	MCS0	38-46	5190-5230				5.50			No	1
	802.11ac (VHT80)	VHT0	42	5210				5.50			No	1
5.3 (U-NII 2A)	802.11a	6	52	5260	7.18			9.50			Yes	
		6	56	5280	7.58			9.50			Yes	
		6	60	5300	7.86			9.50			Yes	
		6	64	5320	8.13			9.50			Yes	
	802.11n (HT20)	MCS0	52-64	5260-5320	Not Required			5.50			No	2
	802.11n (HT40)	MCS0	54-62	5270-5310				5.50			No	2
	802.11ac (VHT80)	VHT0	58	5290				5.50			No	2

Note(s):

1. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
   - 2.1. ≤ 1.2 W/kg, SAR is not required for UNII band I.
   - 2.2. > 1.2 W/kg, both bands should be tested independently for SAR.
2. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11a .

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Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Avg. Pwr (dBm)			Maximum Tune-up Pwr (dBm)			SAR Test (Yes/No)	Note
					Main	Aux	MIMO	Main	Aux	MIMO		
5.5 (U-NII-2C)	802.11a	6	100	5500	9.05			11.50			Yes	
	802.11a	6	104	5520	9.37			11.50			Yes	
	802.11a	6	108	5540	9.65			11.50			Yes	
	802.11a	6	112	5560	9.85			11.50			Yes	
	802.11a	6	116	5580	9.90			11.50			Yes	
	802.11a	6	120	5600	10.10			11.50			Yes	
	802.11a	6	124	5620	10.13			11.50			Yes	
	802.11a	6	128	5640	9.96			11.50			Yes	
	802.11a	6	132	5660	9.98			11.50			Yes	
	802.11a	6	136	5680	9.85			11.50			Yes	
	802.11a	6	140	5700	9.76			11.50			Yes	
	802.11n (HT20)	MCS0	100-144	5500-5720	Not Required			6.50			No	1
	802.11n (HT40)	MCS0	102-142	5510-5710				7.50			No	1
	802.11ac (VHT80)	VHT0	106-138	5530-5690				7.50			No	1

Note(s):

1. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11n HT20/HT40/802.11ac and the measured SAR is ≤ 1.2 W/Kg.
2. Output Power and SAR measurement is not required for / 802.11n HT20/n HT40 /802.11ac channels when the specified maximum tune-up powers are less or same with 802.11 a.

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Avg. Pwr (dBm)			Maximum Tune-up Pwr (dBm)			SAR Test (Yes/No)	Note
					Main	Aux	MIMO	Main	Aux	MIMO		
5.8 (U-NII-3)	802.11a	6	149	5745	9.21			11.50			Yes	
		6	153	5765	9.25			11.50			Yes	
		6	157	5785	9.27			11.50			Yes	
		6	161	5805	9.22			11.50			Yes	
		6	165	5825	9.17			11.50			Yes	
	802.11n (HT20)	MCS0	149-165	5745-5825	Not Required			6.50			No	1
	802.11n (HT40)	MCS0	151-159	5755-5795				6.50			No	1
	802.11ac (VHT80)	VHT0	155	5775				6.50			No	1

Note(s):

1. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11n HT20/HT40/802.11ac and the measured SAR is ≤ 1.2 W/Kg.
2. Output Power and SAR measurement is not required for / 802.11n HT20/n HT40 /802.11ac channels when the specified maximum tune-up powers are less or same with 802.11 a.

11.4 Bluetooth

Modulation	Channel No.	Frequency(MHz)	Avg. power(dBm)
DH5	Low	2402	4.9
	Middle	2441	5.7
	High	2480	5.8
3DH5	Low	2402	-0.7
	Middle	2441	-0.3
	High	2480	0.0
BLE	Low	2402	4.3
	Middle	2440	5.4
	High	2480	5.7

Per exclusion calculations in Section 12, SAR testing for Bluetooth is not required.

12 Summary of SAR Test Exclusion Configurations

12.1 Standalone SAR Test Exclusion Calculations

Since the Dedicated Host Approach is applied, the standalone SAR test exclusion procedure in KDB 447498 section4.3.1 is applied in conjunction with KDB 616217 section 4.3 to determine the minimum test separation distance:

1. According to KDB 447498 Section 4.1 5) if the antenna is at close proximity to user then the outer surface of the DUT should be treated as the radiating surface. The test separation distance is then determined by the smallest distance between the outer surface of the device and the user. For the purposes of this report close proximity has been defined as closer than 50 mm. For antennas <50 mm from the rear or edge the separation distance used for the estimated SAR calculations is 0 mm.
2. When the minimum test separation distance is < 5mm, a distance of 5mm is applied to determine SAR test exclusion.
3. When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.
4. If the antenna to DUT adjacent edge or bottom separation distance >50mm the actual antenna to user separation distance is used to determine SAR exclusion and estimated SAR value.

Refer to Appendix for the specific details on the antenna-to-antenna and antenna-to-edge distances used for test exclusion calculations.

12.1.1 SAR Exclusion Calculations for Wi Fi Antenna < 50mm from the User

According to KDB 447498 v06 r02 in section 4.3.1, if the calculated threshold value is > 3 then SAR testing is required.

For WWAN

Full Power, Proximity Sensor Off.

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
	LTE Band 4	1720.0	23.0	200	10.00	6.00	1.00	7.00	70.00	26.23	43.72	262.3	37.47	3.75
	LTE Band 13	782.0	23.0	200	10.00	6.00	1.00	7.00	70.00	17.69	29.48	176.9	25.27	2.53

Power back off, Proximity Sensor On.

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
	LTE Band 4	1720.0	17.0	50	10.00	6.00	1.00	7.00	70.00	6.56	10.93	65.57	9.37	0.94

For WLAN

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	2437	17.5	56	10.00	6.31	10.27	61.45	52.33	8.74	13.85	8.51	>50mm	>50mm
Wi-Fi Main	5.3GHz U-NII-2A	5320	9.5	9	10.00	6.31	10.27	61.45	52.33	2.08	3.29	2.02	>50mm	>50mm
Wi-Fi Main	5.5GHz U-NII-2C	5500	11.5	14	10.00	6.31	10.27	61.45	52.33	3.28	5.20	3.20	>50mm	>50mm
Wi-Fi Main	5.8GHz U-NII-3	5785	11.5	14	10.00	6.31	10.27	61.45	52.33	3.37	5.34	3.28	>50mm	>50mm
Wi-Fi Main	BLE	2440	6.0	4	10.00	6.31	10.27	61.45	52.33	0.62	0.99	0.61	>50mm	>50mm

Note: Bluetooth Calculated Threshold Value not > 3, then SAR testing not required.

12.1.2 SAR Exclusion Calculations for Wi-Fi Antenna > 50mm from the User

According to KDB 447498 v06 r02, if the calculated Power threshold is less than the output power then SAR testing is required.

For WWAN

Full Power, Proximity Sensor Off.

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
	LTE Band 4	1720.0	23.0	200	10	6	1	7	70	<50mm	<50mm	<50mm	<50mm	314.37
	LTE Band 13	782.0	23.0	200	10	6	1	7	70	<50mm	<50mm	<50mm	<50mm	369.62

Power back off, Proximity Sensor On.

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
	LTE Band 4	1720.0	20.0	100	10	6	1	7	70	<50mm	<50mm	<50mm	<50mm	314.37

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For WLAN

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	2437	17.5	56	10	6.31	10.27	61.45	52.33	<50mm	<50mm	<50mm	210.59	119.39
Wi-Fi Main	5.3GHz U-NII-2A	5320	9.5	9	10	6.31	10.27	61.45	52.33	<50mm	<50mm	<50mm	179.53	88.33
Wi-Fi Main	5.5GHz U-NII-2C	5500	11.5	14	10	6.31	10.27	61.45	52.33	<50mm	<50mm	<50mm	178.46	87.26
Wi-Fi Main	5.8GHz U-NII-3	5785	11.5	14	10	6.31	10.27	61.45	52.33	<50mm	<50mm	<50mm	176.86	85.66
Wi-Fi Main	BLE	2440	6.0	4	10	6.31	10.27	61.45	52.33	<50mm	<50mm	<50mm	210.53	119.33

Note. Bluetooth Calculated Threshold Value not > 3, then SAR testing not required.

12.1.3 SAR Required Test Configuration

For WWAN

Full Power, Proximity Sensor Off

Test Configurations	Rear	Edge1	Edge2	Edge3	Edge4
LTE Band 4	Yes	Yes	Yes	Yes	Yes
LTE Band 13	Yes	Yes	Yes	Yes	No
Wi-Fi 2.4GHz	Yes	Yes	Yes	No	No
Bluetooth	No	No	No	No	No

Note(s):
1. Yes = SAR is required.
2. No = SAR is not required.

Power back off, Proximity Sensor On

Test Configurations	Rear	Edge1	Edge2	Edge3	Edge4
LTE Band 4	Yes	Yes	Yes	Yes	No
LTE Band 13	Yes	Yes	Yes	Yes	No

Note(s):
1. Yes = SAR is required.
2. No = SAR is not required.

13 Exposure Limit

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	2.0

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

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

NOTE: **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram 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.

Population/Uncontrolled Environments:

are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational/Controlled Environments:

are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

NOTE **GENERAL POPULATION/UNCONTROLLED EXPOSURE** **PARTIAL BODY LIMIT** **1.6 W/kg**

14 Tissue Dielectric Properties

14.1 Test Liquid Confirmation

Simulating Liquids Parameter Check

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values

The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below 5% may not be easily achieved at certain frequencies.

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE 1528 2013 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in IEEE 1528 2013 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE 1528 2013

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

14.2 Typical Composition of Ingredients for Liquid Tissue Phantoms

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.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

alt: 99^{+}% Pure Sodium Chloride Sugar: 98^{+}% Pure Sucrose
Water: De-ionized, 16 $M\Omega^{+}$ resistivity HEC: Hydroxy thyl Cellulose
DGBE: 99^{+}% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra-pure): Polyethylene glycol mono [4-(1, 1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

14.3 Simulating Liquids Parameter Check Results

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured e''	Measured Conductivity, σ (S/m)	% dev εr	% dev σ
Body	Apr, 29. 2019	750.00	55.531	0.963	57.440	23.29	0.972	-3.44%	-0.90%
		782.00	55.406	0.966	57.150	23.12	1.006	-3.15%	-4.15%
	Apr, 30. 2019	1745.00	53.445	1.485	51.507	14.77	1.434	3.63%	3.45%
		1750.00	53.432	1.488	51.480	14.76	1.437	3.65%	3.45%

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured e''	Measured Conductivity, σ (S/m)	% dev εr	% dev σ
Body	May, 06. 2019	2412.00	52.751	1.914	53.788	14.46	1.940	-1.97%	-1.37%
		2437.00	52.717	1.938	53.690	14.54	1.971	-1.85%	-1.72%
		2450.00	52.700	1.950	53.668	14.61	1.991	-1.84%	-2.10%
		2462.00	52.684	1.961	53.645	14.63	2.004	-1.82%	-2.17%
		5300.00	48.879	5.416	49.056	18.06	5.323	-0.36%	1.72%
		5320.00	48.851	5.439	48.939	18.09	5.353	-0.18%	1.59%
		5500.00	48.607	5.650	48.420	18.46	5.650	0.39%	-0.01%
		5600.00	48.471	5.766	48.093	18.64	5.806	0.78%	-0.69%
		5620.00	48.444	5.790	47.995	18.68	5.839	0.93%	-0.85%
		5700.00	48.336	5.883	47.733	18.83	5.971	1.25%	-1.49%
		5785.00	48.220	5.982	47.409	19.00	6.114	1.68%	-2.20%
		5800.00	48.200	6.000	47.392	19.04	6.143	1.68%	-2.38%

15 Measurement Uncertainty

According to KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz section 2.8.2, SAR measurement uncertainty analysis is required in SAR reports only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

16 System Performance Check

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm
- The DASY5 system with an E-field probe EX3DV4 SN: 7466 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx=dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 3.0 mm.
- The dipole input power (forward power) was 100 mW±3%.
- The results are normalized to 1 W input power.

Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D750V3	1015	2018/8/23	750	1g	8.23	8.62
				10g	5.34	5.71
D1750V2	1008	2018/8/30	1750	1g	36.50	37.00
				10g	19.30	19.80
D2450V2	869	2018/06/19	2450	1g	52.3	50.5
				10g	24.8	24.0
D5GHzV2	1040	2018/06/28	5300	1g	82.2	76.4
				10g	23.6	21.4
D5GHzV2	1040	2018/06/28	5600	1g	85.3	81.5
				10g	24.5	22.7
D5GHzV2	1040	2018/06/28	5800	1g	80.6	77.3
				10g	23.0	21.3

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16.1 System Performance Check Results

Date	System Dipole			Parameters	Target	Measured	Deviation[%]	Limited[%]
	Type	Serial No.	Liquid					
2019/4/29	D750V3	1015	Body	1g SAR:	8.62	8.32	-3.48	± 10
				10g SAR:	5.71	5.56	-2.63	± 10
2019/4/30	D1750V2	1008	Body	1g SAR:	37.00	36.08	-2.49	± 10
				10g SAR:	19.80	18.72	-5.45	± 10
2019/5/6	D2450V2	869	Body	1g SAR:	50.50	53.20	5.35	± 10
				10g SAR:	24.00	25.68	7.00	± 10
2019/5/6	D5GHzV2	1040	Body	1g SAR:	76.40	75.40	-1.31	± 10
				10g SAR:	21.40	21.10	-1.40	± 10
2019/5/6	D5GHzV2	1040	Body	1g SAR:	81.50	80.50	-1.23	± 10
				10g SAR:	22.70	22.40	-1.32	± 10
2019/5/6	D5GHzV2	1040	Body	1g SAR:	77.30	74.80	-3.23	± 10
				10g SAR:	21.30	20.80	-2.35	± 10

17 SAR Measurements Results

LTE Band 4 (20MHz Bandwidth):

Power back off (On/Off)	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	UL RB Allocation	UL RB Start	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note
								Tune up limit	Measured			
On	QPSK	Edge 2	20300	1745.0	5	1	99	17.00	16.95	1.080	1.093	
			20300	1745.0		50	0	17.00	16.84	1.140	1.183	
			20300	1745.0		100	0	17.00	16.85	1.140	1.180	
			20300	1745.0		50	0	17.00	16.84	1.130	1.172	
Off	QPSK	Edge1	20300	1745.0	5	1	99	23.00	22.99	0.040	0.040	
			20300	1745.0		50	0	23.00	22.29	0.033	0.039	
		Edge 2	20300	1745.0	15	1	99	23.00	22.99	1.050	1.052	
			20300	1745.0		50	0	23.00	22.29	0.723	0.851	
			20300	1745.0		100	0	23.00	22.23	0.623	0.744	
			20300	1745.0		1	99	23.00	22.99	1.080	1.082	
		Edge3	20300	1745.0	5	1	99	23.00	22.99	0.303	0.304	
			20300	1745.0		50	0	23.00	22.29	0.243	0.286	
		Edge4	20300	1745.0	5	1	99	23.00	22.99	0.130	0.130	
			20300	1745.0		50	0	23.00	22.29	0.112	0.132	
		Rear	20300	1745.0	5	1	99	23.00	22.99	0.377	0.378	
			20300	1745.0		50	0	23.00	22.29	0.307	0.362	

Note(s):

1. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. (Per KDB 941225 D05 v02r05)
2. The highest reported SAR for 1 RB and 50% RB allocation are ≥ 0.8 W/kg, SAR is required of 100% RB. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. (Per KDB 941225 D05 v02r05)
3. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)
   3.1 Original SAR = 1.180 W/kg, therefore two times repeat SAR is required.
   3.2 Repeat SAR = 1.172 W/kg < 1.45W/kg
   SAR variation= 0.67 % < 20%
   3.3 Original SAR = 1.052 W/kg, therefore two times repeat SAR is required.
   3.4 Repeat SAR = 1.082 W/kg < 1.45W/kg
   SAR variation= -2.85 % < 20%

LTE Band 13 (10MHz Bandwidth):

Power back off (On/Off)	Mode	Test Position	Channel	Freq. (MHz)	Dist. (mm)	UL RB Allocation	UL RB Start	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note
								Tune up limit	Measured			
Off	QPSK	Edge1	23230	782.0	5	1	0	23.00	22.75	0.031	0.033	
			23230	782.0		25	0	23.00	21.92	0.019	0.024	
		Edge2	23230	782.0	5	1	0	23.00	22.75	0.238	0.252	
			23230	782.0		25	0	23.00	21.92	0.205	0.263	
		Edge3	23230	782.0	5	1	0	23.00	22.75	0.030	0.032	
			23230	782.0		25	0	23.00	21.92	0.022	0.028	
		Edge4	23230	782.0	5	1	0	23.00	22.75	0.018	0.019	
			23230	782.0		25	0	23.00	21.92	0.015	0.019	
		Rear	23230	782.0	5	1	0	23.00	22.75	0.113	0.120	
			23230	782.0		25	0	23.00	21.92	0.097	0.124	

Note(s):

1. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. (Per KDB 941225 D05 v02r05)
2. The highest reported SAR for 1 RB and 50% RB allocation are ≥ 0.8 W/kg, SAR is required of 100% RB. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. (Per KDB 941225 D05 v02r05)
3. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)

Wi-Fi (2.4GHz Band):

Test Mode	Band (GHz)	Mode	Dist. (mm)	Test Position	Ch#	Freq. (MHz)	Chain	Power (dBm)		Area Scan 1g SAR (W/kg)	Zoom Scan 1g SAR (W/kg)	Reported SAR (W/kg)	Note	Plot No.
								Tune up limit	Meas.					
	2.4GHz	802.11b	5	Edge 1	11	2462	0	17.50	17.15	0.040	0.039	0.042		
			5	Edge 2	11	2462	0	17.50	17.15	0.123	0.133	0.144		
			5	Edge 2	1	2412	0	17.50	16.34	0.167	0.172	0.225		
			5	Edge 2	6	2437	0	17.50	16.77	0.160	0.167	0.198		
			5	Edge 3	11	2462	0	17.50	17.15	0.065	0.064	0.069		
			5	Edge 4	11	2462	0	17.50	17.15	0.004	0.002	0.003		
			5	Rear	11	2462	0	17.50	17.15	0.041	0.042	0.046		

Note(s):

1. According to Notice 2016-DRS001, based on the IEEE 1528 and IEC 62209 requirements, the high, mid and low channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured.

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Wi-Fi (5GHz Band):

Test Mode	Band (GHz)	Mode	Dist. (mm)	Test Position	Ch#	Freq. (MHz)	Chain	Power (dBm)		Area Scan 1g SAR (W/Kg)	Meas. 1g SAR (W/kg)	Reported SAR (W/kg)	Note	Plot No.
								Tune up limit	Meas.					
Tablet	5.3 (U-NII-2A)	802.11a	5	Edge 1	64	5320	0	9.5	8.13	0.059	0.065	0.089		
			5	Edge 2	64	5320	0	9.5	8.13	0.078	0.085	0.116		
			5	Edge 3	64	5320	0	9.5	8.13	0.010	0.011	0.015		
			5	Edge 4	64	5320	0	9.5	8.13	0.015	0.016	0.022		
			5	Rear	64	5320	0	9.5	8.13	0.034	0.033	0.045		
	5.5 (U-NII-2C)	802.11a	5	Edge 1	100	5500	0	11.5	9.05	0.134	0.137	0.241		
			5	Edge 1	124	5620	0	11.5	10.13	0.089	0.089	0.122		
			5	Edge 1	140	5700	0	11.5	9.76	0.072	0.065	0.096		
			5	Edge 2	124	5620	0	11.5	10.13	0.073	0.080	0.110		
			5	Edge 3	124	5620	0	11.5	10.13	0.016	0.016	0.022		
			5	Edge 4	124	5620	0	11.5	10.13	0.015	0.015	0.021		
			5	Rear	124	5620	0	11.5	10.13	0.031	0.023	0.032		
	5.8 (U-NII-3)	802.11a	5	Edge 1	157	5785	0	11.5	9.27	0.051	0.044	0.074		
			5	Edge 2	157	5785	0	11.5	9.27	0.040	0.042	0.070		
			5	Edge 3	157	5785	0	11.5	9.27	0.009	0.013	0.021		
			5	Edge 4	157	5785	0	11.5	9.27	0.011	0.012	0.021		
			5	Rear	157	5785	0	11.5	9.27	0.014	0.011	0.019		

Note(s):

1. According to Notice 2016-DRS001, based on the IEEE 1528 and IEC 62209 requirements, the high, mid and low channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured.

18 Simultaneous Transmission SAR Analysis

18.1 Sum of the SAR for Simultaneous Transmission Analysis

18.1.1 Sum of the SAR for WLAN & WWAN

LTE Band IV+2.4G Band

Test Position	Simulataneous Transmission Scenario		1+2 Summed 1g SAR(W/kg)	SPLSR (Yes/No)
	1	2		
	LTE Band IV	Wi-Fi Main 2.4 GHz Band		
Edge 2	1.183	0.225	1.408	No

Note(s):
As the Sum of the SAR is less than 1.6W/Kg, so SPLSR is not required.

LTE Band IV+5G Band

Test Position	Simulataneous Transmission Scenario		1+2 Summed 1g SAR(W/kg)	SPLSR (Yes/No)
	1	2		
	LTE Band IV	Wi-Fi Main 5 GHz Band		
Edge 2	1.183	0.085	1.268	No

Note(s):
As the Sum of the SAR is less than 1.6W/Kg, so SPLSR is not required.

LTE Band XXIII +2.4G Band

Test Position	Simulataneous Transmission Scenario		1+2 Summed 1g SAR(W/kg)	SPLSR (Yes/No)
	1	2		
	LTE Band XXIII	Wi-Fi Main 2.4 GHz Band		
Edge 2	0.263	0.225	0.488	No

Note(s):
As the Sum of the SAR is less than 1.6W/Kg, so SPLSR is not required.

LTE Band XXIII +5G Band

Test Position	Simulataneous Transmission Scenario		1+2 Summed 1g SAR(W/kg)	SPLSR (Yes/No)
	1	2		
	LTE Band XXIII	Wi-Fi Main 5 GHz Band		
Edge 2	0.263	0.085	0.348	No

Note(s):
As the Sum of the SAR is less than 1.6W/Kg, so SPLSR is not required.

19 Equipment List & Calibration Status

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(year)	Calibration Due
Wireless Communication Test Set	Agilent	E5515C 8960	MY48361017	1	2019/08/20
Radio Communication Analyzer	Anritsu	MT8820C	6201240043	1	2019/07/11
S-Parameter Network Analyzer	Agilent	E5071C	MY46316981	1	2019/01/09
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Power Meter	Agilent	E4416A	GB41291611	1	2019/08/19
Power Sensor	Agilent	8481H	MY41091956	1	2019/08/19
Data Acquisition Electronics (DAE)	SPEAG	DAE4	1336	1	2019/08/05
Dosimetric E-Field Probe	SPEAG	EX3DV4	7466	1	2020/02/03
750MHz System Validation Dipole	SPEAG	D750V	1015	1	2019/08/22
1750MHz System Validation Dipole	SPEAG	D1750V2	1008	1	2019/08/29
2450 MHz System Validation Dipole	SPEAG	D2450V2	869	1	2019/06/18
5000 MHz System Validation Dipole	SPEAG	D5GHzV2	1023	1	2019/06/27
Robot	Staubli	RX90L	F02/5T69A1/A/01	N/A	N/A
Amplifier	Mini-Circuit	ZVE-8G	665500309	N/A	N/A
Amplifier	Mini-Circuit	ZHL-1724HLN	D072602#2	N/A	N/A
Thermometer	Comet	S3120	12932714	1	2020/02/27
Signal Grenerator	Aglient	83630B	3844A01022	1	2020/05/27
Directional Couplers	Aglient	87301D	MY44350252	1	2019/07/23

20 Facilities

All measurement facilities used to collect the measurement data are located at

☐ No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

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22 Attachments

Exhibit	Content
1	System Performance Check Plots
2	SAR Test Data Plots
3	SAR Equipment calibration report
4	T181223W03-SF PHOTOs

END OF REPORT