Testing Laboratory
1190

FCC SAR TEST REPORT

FCC ID	**:**	**IHDT56XS1**
Equipment	**:**	**Mobile Cellular Phone**
Brand Name	**:**	**Motorola**
Applicant	**:**	**Motorola Mobility LLC** **222 W,Merchandise Mart Plaza, Chicago IL 60654 USA**
Manufacturer	**:**	**Motorola Mobility LLC** **222 W,Merchandise Mart Plaza, Chicago IL 60654 USA**
Standard	**:**	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

The product was received on Apr. 18, 2019 and testing was started from Apr. 18, 2019 and completed on Apr. 19, 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 variant 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

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FA930415-06	01	Initial issue of report	Apr. 22, 2019

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Motorola Mobility LLC, Mobile Cellular Phone, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			
		Head (Separation 0mm)	Body-worn (Separation 5mm)	Hotspot (Separation 5mm)	Product Specific (Separation 0mm)
		1g SAR (W/kg)			10g SAR (W/kg)
Licensed	GSM850	0.18	0.54	0.54	1.78
	GSM1900	<0.10	0.36	0.36	2.51
	WCDMA II	0.11	0.59	0.59	2.94
	WCDMA V	0.14	0.71	0.71	1.19
	CDMA2000 BC0	0.14	0.54	0.55	1.42
	CDMA2000 BC1	0.13	0.57	1.27	3.28
	LTE Band 2	0.13	0.55	0.55	3.22
	LTE Band 5	0.19	0.69	0.69	1.53
	LTE Band 7	0.20	0.59	0.59	1.26
	LTE Band 12	0.13	0.57	0.57	0.91
	LTE Band 13	0.11	0.66	0.66	1.20
	LTE Band 4 / 66	0.23	0.70	0.70	1.80
DTS	2.4GHz WLAN	0.55	0.15	0.15	
NII	5GHz WLAN	0.98	0.33	0.33	0.65
DSS	Bluetooth	0.21	<0.10	<0.10	
Date of Testing:		2019/4/18 ~ 2019/4/19			

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

Reviewed by: Jason Wang
Report Producer: Wan Liu

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 648474 D03 Wireless Chargers Battery Cover v01r04
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D05A Rel.10 LTE SAR Test Guidance v01r02
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01

3. Equipment Under Test (EUT) Information

3.1 General Information

Product Feature & Specification	
Equipment Name	Mobile Cellular Phone
Brand Name	Motorola
FCC ID	IHDT56XS1
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz CDMA 2000 BC1: 1851.25 MHz ~ 1908.75 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz
Mode	GSM/GPRS/EGPRS AMR / RMC 12.2Kbps HSDPA HSUPA CDMA2000 : 1xRTT/1xEv-Do(Rel.0)/1xEv-Do(Rev.A) LTE: QPSK, 16QAM, 64QAM 802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE NFC:ASK
EUT Stage	Identical Prototype
Remark: 1. Add WPC accessory to include verification worst case found in the original report, FCC ID: IHDT56XS1 (Sporton Report No. FA8D2801-01) performed testing.	

3.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05	
FCC ID	IHDT56XS1
Equipment Name	Mobile Cellular Phone
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 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 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 05:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 07: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 13: 5MHz, 10MHz LTE Band 66:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK / 16QAM / 64QAM
LTE Voice / Data requirements	Voice and Data
LTE MPR permanently built-in by design	See Table 6.2.3-1 below
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.
Power reduction applied to satisfy SAR compliance	Yes, the power reduction application please refers to FCC ID: IHDT56XS1, Sporton Report No. FA8D2801-01
LTE Carrier Aggregation Combinations	Inter-Band and Intra-Band possible combinations and the detail power measurement please referred to FCC ID: IHDT56XS1, Sporton Report No. FA8D2801-01 section 13.
LTE Carrier Aggregation Additional Information	1. This device supports LTE Carrier Aggregation (CA) in the uplink for CA_5B with two component carriers in the uplink. SAR Measurements and conducted powers were evaluated per FCC Guidance in the FCC ID: IHDT56XS1, Sporton Report No. FA8D2801-01 2. This device supports maximum of 3 carriers in the downlink and 2 carriers in the uplink. Additional following LTE Release features are not supported: Relay, HetNet, Enhanced MIMO, eICI, WiFi Offloading, MDH, eMBMA, Cross-Carrier Scheduling, Enhanced SC-FDMA.

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

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

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

LTE Band 2

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

LTE Band 4

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 5								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 7								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

LTE Band 12								
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	23017	699.7	23025	700.5	23035	701.5	23060	704
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5
H	23173	715.3	23165	714.5	23155	713.5	23130	711

LTE Band 13				
	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq.(MHz)
L	23205	779.5		
M	23230	782	23230	782
H	23255	784.5		

LTE Band 66												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	131979	1710.7	131987	1711.5	131997	1712.5	132022	1715	132047	1717.5	132072	1720
M	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745
H	132665	1779.3	132657	1778.5	132647	1777.5	132622	1775	132597	1772.5	132572	1770

4. RF Exposure Limits

4.1 Uncontrolled Environment

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

4.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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

5. Specific Absorption Rate (SAR)

5.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

5.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

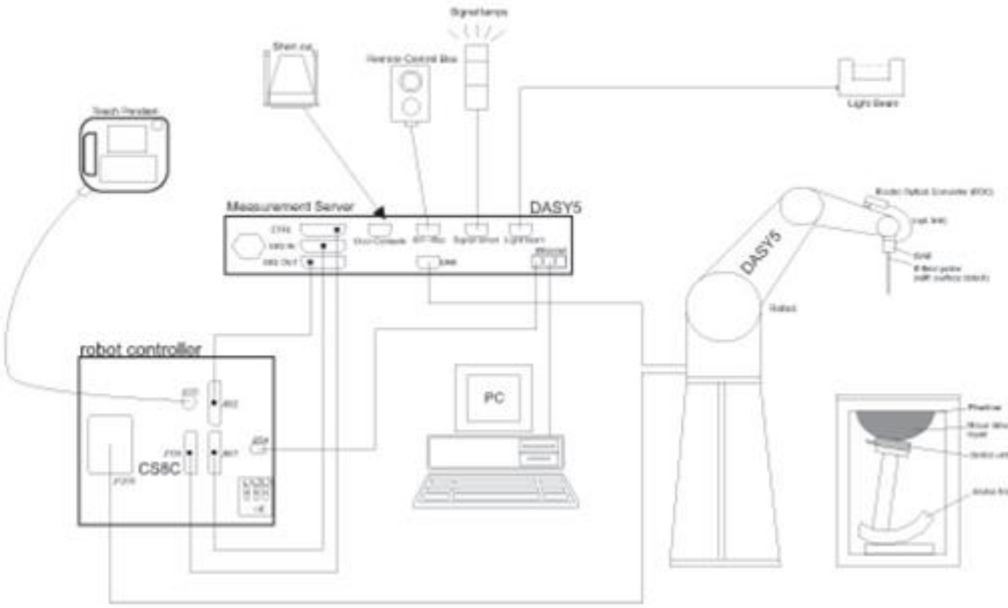
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

6. System Description and Setup

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

6.1 E-Field Probe

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

<ES3DV3 Probe>

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

<EX3DV4 Probe>

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

6.2 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.

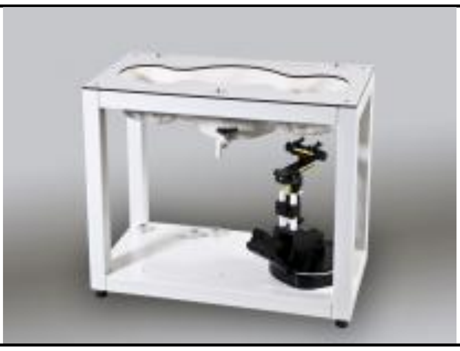
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.1 Photo of DAE

6.3 Phantom

<SAM Twin Phantom>

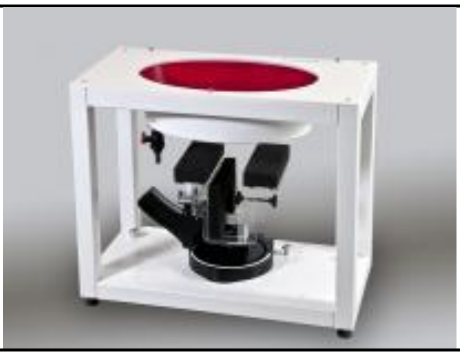
Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom



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 form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

7.2 Power Reference Measurement

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

7.3 Area Scan

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

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

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

7.4 Zoom Scan

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

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

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

7.5 Volume Scan Procedures

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

7.6 Power Drift Monitoring

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

8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1012	Sep. 05, 2018	Sep. 04, 2019
SPEAG	835MHz System Validation Kit	D835V2	499	Sep. 06, 2018	Sep. 05, 2019
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	2450MHz System Validation Kit	D2450V2	736	Aug. 31, 2018	Aug. 30, 2019
SPEAG	2600MHz System Validation Kit	D2600V2	1008	Aug. 31, 2018	Aug. 30, 2019
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Sep. 27, 2018	Sep. 26, 2019
SPEAG	Data Acquisition Electronics	DAE3	495	May. 24, 2018	May. 23, 2019
SPEAG	Data Acquisition Electronics	DAE4	1326	Sep. 18, 2018	Sep. 17, 2019
SPEAG	Data Acquisition Electronics	DAE4	1399	Nov. 16, 2018	Nov. 15, 2019
SPEAG	Dosimetric E-Field Probe	ES3DV3	3169	May. 28, 2018	May. 27, 2019
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 27, 2018	Sep. 26, 2019
SPEAG	Dosimetric E-Field Probe	EX3DV4	7306	Jul. 26, 2018	Jul. 25, 2019
RCPTWN	Thermometer	HTC-1	TM685-1	Nov. 12, 2018	Nov. 11, 2019
RCPTWN	Thermometer	HTC-1	TM560-2	Nov. 12, 2018	Nov. 11, 2019
Anritsu	Radio Communication Analyzer	MT8820C	6201381766	Jun. 21, 2018	Jun. 20, 2019
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 21, 2018	May. 20, 2019
R&S	BT Base Station	CBT32	100519	May. 30, 2018	May. 29, 2019
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	3169	Sep. 11, 2018	Sep. 10, 2019
Anritsu	Power Meter	ML2495A	1419002	May. 18, 2018	May. 17, 2019
Anritsu	Power Sensor	MA2411B	1339124	May. 18, 2018	May. 17, 2019
Anritsu	Power Meter	ML2495A	1240001	Sep. 13, 2018	Sep. 12, 2019
Anritsu	Power Sensor	MA2411B	1207349	Sep. 13, 2018	Sep. 12, 2019
Agilent	Spectrum Analyzer	E4408B	MY44211028	Aug. 28, 2018	Aug. 27, 2019
Anritsu	Spectrum Analyzer	MS2830A	6201396378	Jun. 23, 2018	Jun. 22, 2019
Mini-Circuits	Power Amplifier	ZVE-8G+	070501814	Oct. 08, 2018	Oct. 07, 2019
Mini-Circuits	Power Amplifier	ZVE-8G+	6382	Aug. 09, 2018	Aug. 08, 2019
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.

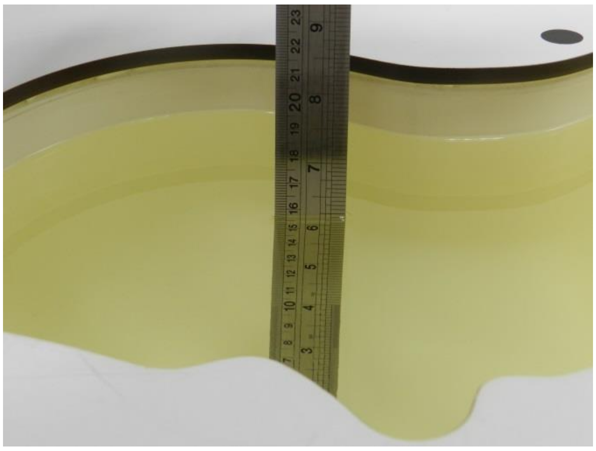


Fig 10.1Photo of Liquid Height for Head SAR

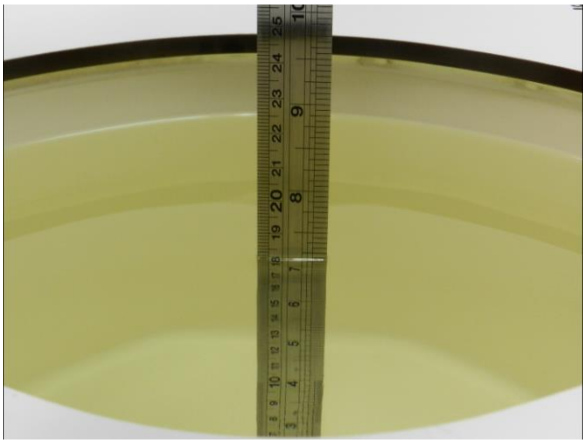


Fig 10.2 Photo of Liquid Height for Body SAR

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 (εr)
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. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
750	HSL	22.7	0.893	40.476	0.89	41.90	0.34	-3.40	±5	2019/4/18
750	MSL	22.4	0.964	55.230	0.96	55.50	0.42	-0.49	±5	2019/4/19
835	HSL	22.7	0.883	42.557	0.90	41.50	-1.89	2.55	±5	2019/4/18
835	MSL	22.4	0.989	56.869	0.97	55.20	1.96	3.02	±5	2019/4/19
1750	HSL	22.5	1.402	40.688	1.37	40.10	2.34	1.47	±5	2019/4/18
1750	MSL	22.7	1.517	54.061	1.49	53.40	1.81	1.24	±5	2019/4/19
1900	HSL	22.5	1.439	39.113	1.40	40.00	2.79	-2.22	±5	2019/4/18
1900	MSL	22.7	1.571	52.505	1.52	53.30	3.36	-1.49	±5	2019/4/19
2450	HSL	22.6	1.801	38.924	1.80	39.20	0.06	-0.70	±5	2019/4/18
2450	MSL	22.7	1.994	53.145	1.95	52.70	2.26	0.84	±5	2019/4/19
2600	HSL	22.6	1.971	38.337	1.96	39.00	0.56	-1.70	±5	2019/4/18
2600	MSL	22.7	2.195	52.645	2.16	52.50	1.62	0.28	±5	2019/4/19
5250	HSL	22.6	4.721	36.625	4.71	35.95	0.23	1.88	±5	2019/4/18
5250	MSL	22.8	5.361	48.304	5.36	48.95	0.02	-1.32	±5	2019/4/19
5600	HSL	22.6	5.083	36.149	5.07	35.50	0.26	1.83	±5	2019/4/18
5600	MSL	22.8	5.819	47.641	5.77	48.50	0.85	-1.77	±5	2019/4/19
5750	HSL	22.6	5.246	35.932	5.22	35.35	0.50	1.65	±5	2019/4/18
5750	MSL	22.8	6.047	47.428	5.94	48.28	1.80	-1.76	±5	2019/4/19

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 (%)
2019/4/18	750	HSL	250	D750V3-1012	ES3DV3 - SN3169	DAE4 Sn1326	1.91	8.47	7.64	-9.80
2019/4/19	750	MSL	250	D750V3-1012	ES3DV3 - SN3169	DAE4 Sn1326	2.30	8.76	9.2	5.02
2019/4/18	835	HSL	250	D835V2-499	ES3DV3 - SN3169	DAE4 Sn1326	2.35	9.59	9.4	-1.98
2019/4/19	835	MSL	250	D835V2-499	ES3DV3 - SN3169	DAE4 Sn1326	2.47	9.82	9.88	0.61
2019/4/18	1750	HSL	250	D1750V2-1068	ES3DV3 - SN3169	DAE4 Sn1326	9.34	37.10	37.36	0.70
2019/4/19	1750	MSL	250	D1750V2-1068	ES3DV3 - SN3169	DAE4 Sn1326	9.64	37.00	38.56	4.22
2019/4/18	1900	HSL	250	D1900V2-5d041	ES3DV3 - SN3169	DAE4 Sn1326	10.60	40.20	42.4	5.47
2019/4/19	1900	MSL	250	D1900V2-5d041	ES3DV3 - SN3169	DAE4 Sn1326	10.20	40.20	40.8	1.49
2019/4/18	2450	HSL	250	D2450V2-736	ES3DV3 - SN3169	DAE4 Sn1326	13.30	52.70	53.2	0.95
2019/4/19	2450	MSL	250	D2450V2-736	EX3DV4 - SN7306	DAE3 Sn495	12.40	51.50	49.6	-3.69
2019/4/18	2600	HSL	250	D2600V2-1008	ES3DV3 - SN3169	DAE4 Sn1326	13.40	56.40	53.6	-4.96
2019/4/19	2600	MSL	250	D2600V2-1008	EX3DV4 - SN7306	DAE3 Sn495	13.90	55.30	55.6	0.54
2019/4/18	5250	HSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	7.95	80.70	79.5	-1.49
2019/4/19	5250	MSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	7.75	78.30	77.5	-1.02
2019/4/18	5600	HSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	8.75	83.30	87.5	5.04
2019/4/19	5600	MSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	8.28	81.00	82.8	2.22
2019/4/18	5750	HSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	8.22	80.40	82.2	2.24
2019/4/19	5750	MSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	7.39	77.40	73.9	-4.52

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 (%)
2019/4/19	750	MSL	250	D750V3-1012	ES3DV3 - SN3169	DAE4 Sn1326	1.55	5.97	6.2	3.85
2019/4/19	835	MSL	250	D835V2-499	ES3DV3 - SN3169	DAE4 Sn1326	1.63	6.58	6.52	-0.91
2019/4/19	1750	MSL	250	D1750V2-1068	ES3DV3 - SN3169	DAE4 Sn1326	5.26	19.60	21.04	7.35
2019/4/19	1900	MSL	250	D1900V2-5d041	ES3DV3 - SN3169	DAE4 Sn1326	5.33	21.50	21.32	-0.84
2019/4/19	2600	MSL	250	D2600V2-1008	EX3DV4 - SN7306	DAE3 Sn495	6.22	24.70	24.88	0.73
2019/4/19	5250	MSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	2.17	21.70	21.7	0.00
2019/4/19	5600	MSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	2.28	22.50	22.8	1.33
2019/4/19	5750	MSL	100	D5GHzV2-1006	EX3DV4 - SN3931	DAE4 Sn1399	2.06	21.30	20.6	-3.29

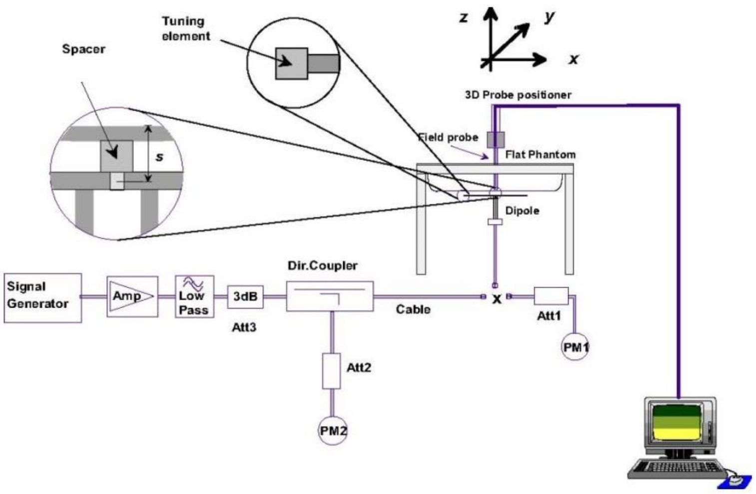
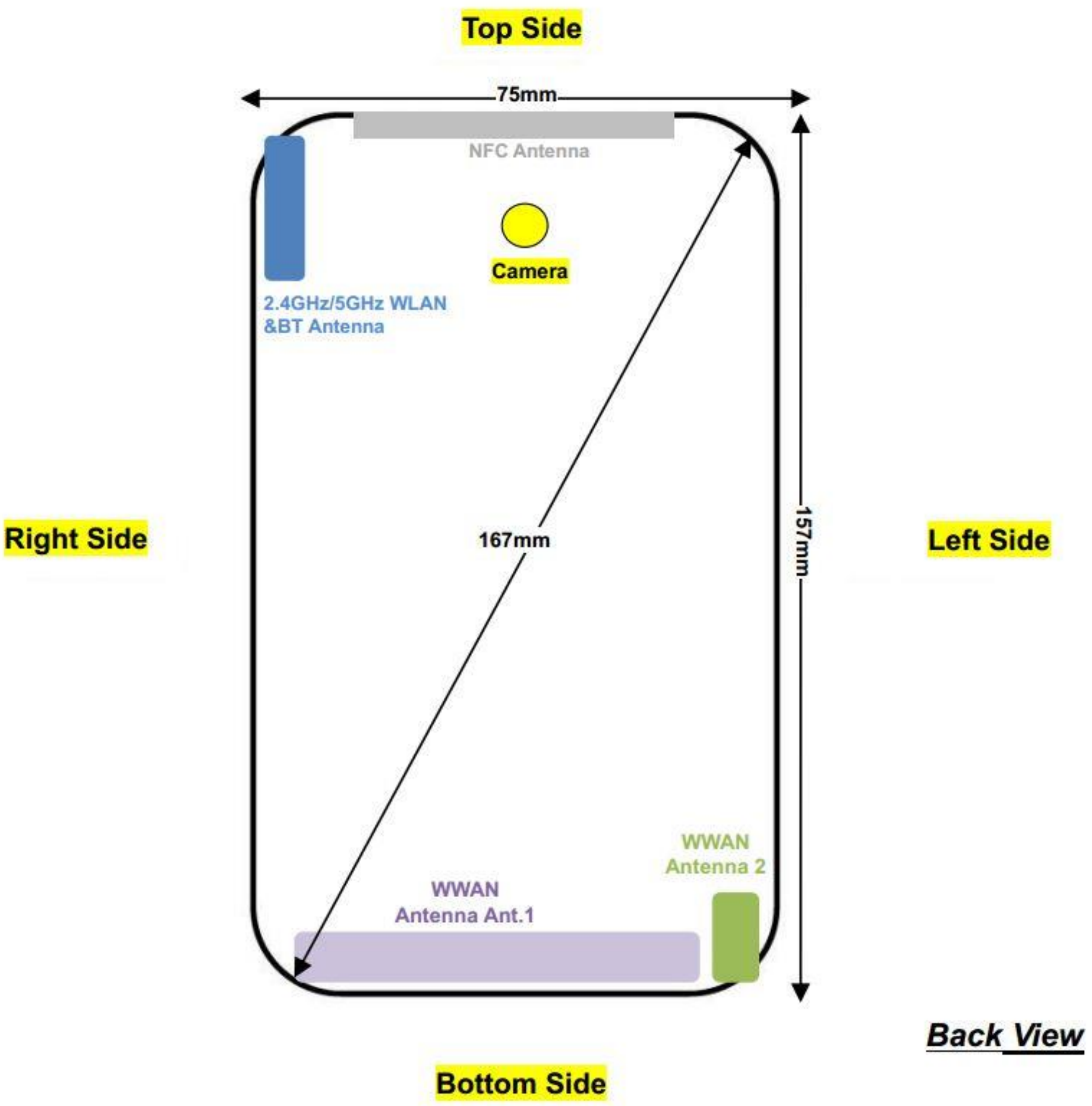


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

10. Antenna Location



11. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up 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 ≥0.8W/kg.
4. Initially, the handset must be tested according to all applicable SAR test procedures using the normal battery cover (without the wireless charging hardware). The highest SAR reported for each wireless technology (1xRTT, EVDO, WCDMA, GSM, Wi-Fi etc.), frequency band, operating mode (different modes/configurations within each wireless technology) and exposure condition (head, body-worn accessory, hotspot mode, etc.) must be repeated using the wireless charging battery cover.
5. In this report all the conducted power, tune-up, power reduction mechanism is referring to FCC ID: IHDT56XS1, Sporton Report No. FA8D2801-01 to be used for the testing.

11.1 Head SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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	GSM850	GPRS (2 Tx slots)	Right Cheek	0mm	Full	251	848.8	31.89	33.00	1.291	0.13	0.139	0.179
02	GSM1900	GPRS (2 Tx slots)	Left Cheek	0mm	Full	810	1909.8	28.95	30.00	1.274	0.15	0.053	0.067

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA II	RMC 12.2Kbps	Left Cheek	0mm	Full	9538	1907.6	23.41	24.00	1.146	0.16	0.096	0.110
04	WCDMA V	RMC 12.2Kbps	Right Cheek	0mm	Full	4132	826.4	23.53	24.00	1.114	0.16	0.128	0.143

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
05	CDMA2000 BC0	RC3 SO55	Right Cheek	0mm	Full	1013	824.7	24.67	25.50	1.211	0.02	0.118	0.143
06	CDMA2000 BC1	RC3 SO55	Left Cheek	0mm	Full	1175	1908.75	24.31	25.50	1.315	0.17	0.101	0.133

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Mode	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)
07	LTE Band 2	20M	QPSK	1	0	Left Cheek	0mm	Full	19100	1900	23.45	24.00	1.135	0.14	0.111	0.126
08	LTE Band 5	10M	QPSK	1	49	Right Cheek	0mm	Full	20525	836.5	23.02	24.00	1.253	0.04	0.152	0.190
09	LTE Band 7	20M	QPSK	1	0	Right Tilted	0mm	Full	20850	2510	23.04	24.00	1.247	0.09	0.161	0.201
10	LTE Band 12	10M	QPSK	1	0	Right Cheek	0mm	Full	23095	707.5	22.98	24.00	1.265	0.04	0.106	0.134
11	LTE Band 13	10M	QPSK	1	0	Right Cheek	0mm	Full	23230	782	23.05	24.00	1.245	-0.13	0.091	0.113
12	LTE Band 66	20M	QPSK	1	0	Left Cheek	0mm	Full	132072	1720	23.06	24.00	1.242	-0.16	0.183	0.227

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
13	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	6	2437	18.98	19.50	1.127	100	1.000	-0.12	0.485	0.547
14	WLAN5GHz	802.11a 6Mbps	Left Cheek	0mm	56	5280	17.23	18.00	1.194	98.28	1.018	0.08	0.228	0.277
15	WLAN5GHz	802.11a 6Mbps	Left Cheek	0mm	140	5700	17.06	17.50	1.107	98.28	1.018	-0.01	0.769	0.866
16	WLAN5GHz	802.11a 6Mbps	Left Cheek	0mm	157	5785	17.00	18.00	1.259	98.28	1.018	-0.17	0.763	0.978

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
17	Bluetooth	1Mbps	Left Cheek	0mm	0	2402	12.48	12.50	1.005	76.59	1.088	0.13	0.196	0.214

11.2 Hotspot SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
18	GSM850	GPRS (2 Tx slots)	Back	5mm	Hotspot on	189	836.4	28.57	29.5	1.239	-0.04	0.439	0.544
19	GSM1900	GPRS (2 Tx slots)	Back	5mm	Hotspot on	512	1850.2	23.01	24	1.256	-0.12	0.287	0.360

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
20	WCDMA II	RMC 12.2Kbps	Back	5mm	Hotspot on	9262	1852.4	16.68	17.5	1.208	0.04	0.491	0.593
21	WCDMA V	RMC 12.2Kbps	Back	5mm	Hotspot on	4182	836.4	20.22	21.5	1.343	0.03	0.529	0.710

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
22	CDMA2000 BC0	RTAP 153.6Kbps	Back	5mm	Hotspot on	777	848.31	21.92	22.5	1.143	-0.12	0.485	0.554
23	CDMA2000 BC1	RTAP 153.6Kbps	Bottom Side	5mm	Hotspot on	600	1880	16.29	17	1.178	-0.01	1.080	1.272

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Mode	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)
24	LTE Band 2	20M	QPSK	1	0	Back	5mm	Hotspot on	18700	1860	16.53	17	1.114	-0.03	0.495	0.552
25	LTE Band 5	10M	QPSK	1	49	Back	5mm	Hotspot on	20525	836.5	20.31	21.5	1.315	0.09	0.528	0.694
26	LTE Band 7	20M	QPSK	1	0	Back	5mm	Hotspot on	20850	2510	16.51	17.5	1.256	0.07	0.470	0.590
27	LTE Band 12	10M	QPSK	1	0	Back	5mm	Hotspot on	23095	707.5	22.18	23	1.208	0.09	0.472	0.570
28	LTE Band 13	10M	QPSK	1	0	Back	5mm	Hotspot on	23230	782	21.8	23	1.318	0.09	0.503	0.663
29	LTE Band 66	20M	QPSK	50	0	Back	5mm	Hotspot on	132572	1770	15.7	16.5	1.202	0.03	0.578	0.695

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
30	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	6	2437	18.98	19.5	1.127	100	1.000	0.02	0.134	0.151
31	WLAN5GHz	802.11a 6Mbps	Back	5mm	44	5220	17.29	18.00	1.178	98.28	1.018	-0.06	0.150	0.180
32	WLAN5GHz	802.11a 6Mbps	Back	5mm	165	5825	17.21	18.00	1.199	98.28	1.018	-0.07	0.271	0.331

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
33	Bluetooth	1Mbps	Back	5mm	0	2402	12.48	12.5	1.005	76.59	1.088	-0.12	0.063	0.069

11.3 Body Worn Accessory SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Power Mode	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)
34	GSM850	GPRS (2 Tx slots)	Back	5mm	-	P-Sensor on	189	836.4	28.57	29.5	1.239	-0.04	0.439	0.544
35	GSM1900	GPRS (2 Tx slots)	Back	5mm	-	P-Sensor on	512	1850.2	23.01	24	1.256	-0.12	0.287	0.360

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Power Mode	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)
36	WCDMA II	RMC 12.2Kbps	Back	5mm	-	P-Sensor on	9262	1852.4	16.68	17.5	1.208	0.04	0.491	0.593
37	WCDMA V	RMC 12.2Kbps	Back	5mm	-	P-Sensor on	4182	836.4	20.22	21.5	1.343	0.03	0.529	0.710

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Power Mode	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)
38	CDMA2000 BC0	RC3 SO32 (F+SCH)	Back	5mm	-	P-Sensor on	777	848.31	21.92	22.5	1.143	-0.09	0.470	0.537
39	CDMA2000 BC1	RC3 SO32 (F+SCH)	Back	5mm	-	P-Sensor on	25	1851.25	17.67	18.5	1.211	0.17	0.473	0.573

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Headset	Power Mode	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)
40	LTE Band 2	20M	QPSK	1	0	Back	5mm	-	P-Sensor on	18700	1860	16.53	17	1.114	-0.03	0.495	0.552
41	LTE Band 5	10M	QPSK	1	49	Back	5mm	-	P-Sensor on	20525	836.5	20.31	21.5	1.315	0.09	0.528	0.694
42	LTE Band 7	20M	QPSK	1	0	Back	5mm	-	P-Sensor on	20850	2510	16.51	17.5	1.256	0.07	0.470	0.590
43	LTE Band 12	10M	QPSK	1	0	Back	5mm	-	P-Sensor on	23095	707.5	22.18	23	1.208	0.09	0.472	0.570
44	LTE Band 13	10M	QPSK	1	0	Back	5mm	Headset	P-Sensor on	23230	782	21.8	23	1.318	0.09	0.503	0.663
45	LTE Band 66	20M	QPSK	50	0	Back	5mm	-	P-Sensor on	132572	1770	15.7	16.5	1.202	0.03	0.578	0.695

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
46	WLAN2.4GHz	802.11b 1Mbps	Back	5mm	-	6	2437	18.98	19.5	1.127	100	1.000	0.02	0.134	0.151
47	WLAN5GHz	802.11a 6Mbps	Back	5mm		56	5280	17.23	18.00	1.194	98.28	1.018	0.09	0.134	0.163
48	WLAN5GHz	802.11a 6Mbps	Front	5mm	-	140	5700	17.06	17.50	1.107	98.28	1.018	-0.05	0.246	0.277
49	WLAN5GHz	802.11a 6Mbps	Back	5mm	-	165	5825	17.21	18.00	1.199	98.28	1.018	-0.07	0.271	0.331

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
50	Bluetooth	1Mbps	Back	5mm	-	0	2402	12.48	12.5	1.005	76.59	1.088	-0.12	0.063	0.069

11.4 Product Specific SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
51	GSM850	GPRS (2 Tx slots)	Back	0mm	Full	251	848.8	31.89	33.00	1.291	-0.04	1.380	1.782
52	GSM1900	GPRS (2 Tx slots)	Bottom Side	0mm	Handheld on	512	1850.2	26.83	27.50	1.167	0.13	2.150	2.509

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
53	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	Handheld on	9262	1852.4	19.75	20.00	1.059	-0.05	2.773	2.937
54	WCDMA V	RMC 12.2Kbps	Back	0mm	Handheld on	4182	836.4	22.90	23.00	1.023	-0.17	1.167	1.194

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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)
55	CDMA2000 BC0	RTAP 153.6Kbps	Back	0mm	Handheld on	777	848.31	23.97	24.50	1.130	-0.08	1.260	1.424
56	CDMA2000 BC1	RTAP 153.6Kbps	Bottom Side	0mm	Handheld on	25	1851.25	20.77	21.50	1.183	0.12	2.769	3.276

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Mode	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)
57	LTE Band 2	20M	QPSK	1	0	Bottom Side	0mm	Handheld on	18700	1860	19.28	20.00	1.180	0.09	2.724	3.215
58	LTE Band 5	10M	QPSK	1	49	Back	0mm	Full	20525	836.5	23.02	24.00	1.253	-0.17	1.220	1.529
59	LTE Band 7	20M	QPSK	1	0	Back	0mm	Handheld on	21100	2535	19.24	20.00	1.191	-0.06	1.060	1.263
60	LTE Band 12	10M	QPSK	1	0	Back	0mm	Full	23095	707.5	22.98	24.00	1.265	-0.05	0.721	0.912
61	LTE Band 13	10M	QPSK	1	0	Back	0mm	Full	23230	782	23.05	24.00	1.245	-0.08	0.967	1.203
62	LTE Band 66	20M	QPSK	1	0	Back	0mm	Handheld on	132072	1720	19.30	20.00	1.175	0.05	1.530	1.798

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
63	WLAN5GHz	802.11a 6Mbps	Front	0mm	56	5280	17.23	18.00	1.194	98.28	1.018	-0.04	0.157	0.191
64	WLAN5GHz	802.11a 6Mbps	Front	0mm	140	5700	17.06	17.50	1.107	98.28	1.018	-0.05	0.576	0.649

11.5 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (mm)	Power Mode	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	CDMA2000 BC1	RTAP 153.6Kbps	Bottom Side	5mm	Hotspot on	600	1880	16.29	17	1.178	-0.01	1.080	-	1.272
2nd	CDMA2000 BC1	RTAP 153.6Kbps	Bottom Side	5mm	Hotspot on	600	1880	16.29	17	1.178	0.06	1.040	1.04	1.225

No.	Band	Mode	Test Position	Gap (mm)	Power Mode	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	Handheld on	9262	1852.4	19.75	20.00	1.059	-0.05	2.773	-	2.937
2nd	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	Handheld on	9262	1852.4	19.75	20.00	1.059	0.09	2.670	1.04	2.828

General Note:

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

Test Engineer： Neil Hsiang Randy Lin Andy Chiang Willy Yu Ted Shie and Carter Jhuang

12. Uncertainty Assessment

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

13. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

[6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[7] FCC KDB 648474 D03 v01r04, “Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers” Dec 2015.

[8] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.

[9] FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015

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

[11] FCC KDB 941225 D05A v01r02, “Rel. 10 LTE SAR Test Guidance and KDB Inquiries”, Oct 2015

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

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

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