SAR EVALUATION REPORT

For

Winmate Inc.

9F, No.111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan

FCC ID:PX9TOBYL201

Report Type:	**Product Type:**
Original Report	UMTS/LTE Data Module

Report Number: RTWA170511001-08C

Report Date: 2017-06-06

Reviewed By: Jerry Chang

Prepared By:
Bay Area Compliance Laboratories Corp.(Taiwan)
70, Lane 169, Sec. 2, Datong Road, Xizhi Dist.,
New Taipei City 22183, Taiwan, R.O.C.
Tel: +886 (2)2647 6898 Fax: +886 (2) 2647 6895
www.bacl.com.tw

Attestation of Test Results			
EUT Information	Company Name	Winmate Inc.	
	EUT Description	UMTS/LTE Data Module	
	Model Number	TOBY-L201	
	Serial Number	358502061000710	
	Test Date	2017-05-13/06-02/06-03	
MODE		Max. SAR Level(s) Reported(W/Kg)	Limit (W/Kg)
WCDMA V	1g Body SAR	0.999	1.6
WCDMA II	1g Body SAR	0.320	
LTE Band 13	1g Body SAR	0.382	
LTE Band 17	1g Body SAR	0.339	
LTE Band 5	1g Body SAR	0.983	
LTE Band 4	1g Body SAR	1.079	
LTE Band 2	1g Body SAR	0.431	
WLAN 2.4G	1g Body SAR	0.827	
Simultaneous	1g Body SAR	1.5	
Applicable Standards	**FCC 47 CFR part 2.1093** Radiofrequency radiation exposure evaluation: portable devices		
	IEEE1528:2013 Draft Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.		
	IEC62209-2:2010 Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)		
	KDB procedures KDB 248227 D01 802.11 Wi-Fi SAR v02r02 KDB 447498 D01 General RF Exposure Guidance v06. KDB 648474 D04 Handset SAR v01r03. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04 KDB 865664 D02 RF Exposure Reporting v01r02 KDB 941225 D01 3G SAR Procedures v03r01 KDB 941225 D05 SAR for LTE Devices v02r04 KDB 941225 D06 Hotspot Mode v02r01		

Note: This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) 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

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	RTWA170511001-08C	Original Report	2017-06-06

EUT DESCRIPTION

This report has been prepared on behalf of **Winmate Inc.** and their product, Model: **TOBY-L201** or the EUT (Equipment under Test) as referred to in the rest of this report.

Technical Specification

Product Type	Portable
Exposure Category:	Population / Uncontrolled
Antenna Type(s):	Internal Antenna
Body-Worn Accessories:	Headset
Face-Head Accessories:	None
Multi-slot Class:	None
Operation Mode :	WCDMA R99 (Data),HSUPA Rel 6,HSDPA Rel 5 FDD-LTE WLAN 2.4G Bluetooth LE
Frequency Band:	WCDMA Band 5: 824-849 MHz(TX) ; 869-894 MHz(RX) WCDMA Band 2: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) LTE Band 2: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) LTE Band 4: 1710-1755MHz(TX); 2110-2155MHz(RX) LTE Band 5: 824-849 MHz(TX) ; 869-894 MHz(RX) LTE Band 13: 777-787 MHz(TX) ; 746-756 MHz(RX) LTE Band 17: 704-716 MHz(TX) ; 734-746 MHz(RX) WLAN 2.4GHz Band: 2412 MHz - 2462 MHz Bluetooth LE : 2402 MHz - 2480 MHz
Antenna Gain(dBi):	WCDMA Band 5: -4.29 WCDMA Band 2: -0.79 LTE Band 2: -0.79 LTE Band 4: -0.14 LTE Band 5: -4.29 LTE Band 13: -0.5 LTE Band 17: 1.07 WLAN 2.4GHz:-2.91 Bluetooth LE : -2.91
Dimensions (L*W*H):	207mm (L) × 127 mm (W) × 20 mm (H)
Power Source:	3.7 V_{DC} Rechargeable Battery
Normal Operation:	Body-worn and Handheld

Note:

1.The overall diagonal dimension of the EUT＞200mm, so test procedures in KDB616217 should be applicable.

REFERENCE, STANDARDS, AND GUILDELINES

FCC:

The Report and 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 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by EN62209-1 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE Limit (10g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 10 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual 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).

General Population/Uncontrolled environments Spatial Peak limit 1.6W/kg (FCC) & 2 W/kg (CE) applied to the EUT.

FACILITIES

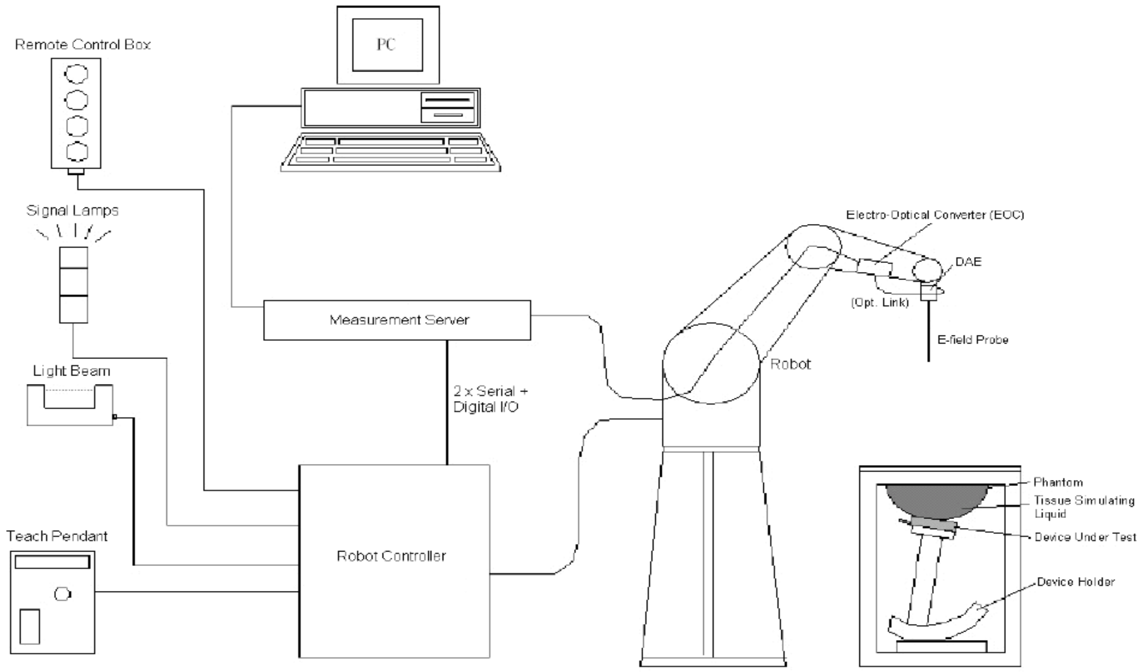
The test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on the 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG) which is the Fifth generation of the system shown in the figure hereinafter:

DASY4 System Description

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



- A standard high precision 6-axis robot (Staubli TX=RX family) 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 amplication, 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 Win7 professional operating system and the DASY42 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.

DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chip-disk and 128MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY4 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 of 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 an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized point out, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade pre-amplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a 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 both the DAE4 as well as of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 E-Field Probes

Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 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 to > 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
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
Compatibility	DASY3, DASY4, DASY42 SAR and higher, EASY4/MRI

SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6 mm). The phantom has three measurement areas:

_ Left hand
_ Right hand
_ Flat phantom

The phantom table for the DASY systems based on the TX90XL and RX160L robots have the size of 100 x 50 x 85 cm (L xWx H). The phantom table for the compact DASY systems based on the RX60L robot have the size of 100 x 75 x 91 cm (L xWx H); these tables are reinforced for mounting of the robot onto the table.
For easy dislocation these tables have fork lift cut outs at the bottom.
The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different liquids)
A white cover is provided to cover the phantom during o_-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible.
Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.

Robots

The DASY4 system uses the high precision industrial robots RX60XL from Staubli SA (France). The TX robot family is the successor of the well known RX robot family and offers the same features important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

The above mentioned robots are controlled by the Staubli CS8c robot controllers. All information regarding the use and maintenance of the robot arm and the robot controller is contained on the CDs delivered along with the robot. Paper manuals are available upon request direct from Staubli.

Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm2 step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

Zoom Scan (Cube Scan Averaging)

The averaging zoom scan volume utilized in the DASY4 software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm,with the side length of the 10 g cube 21,5mm.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 5x5x8 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 35mm in the Z axis.

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 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 P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

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

Recommended Tissue Dielectric Parameters for Head and Body

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	σ (S/m)	εr	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
5800	35.3	5.27	48.2	6.00

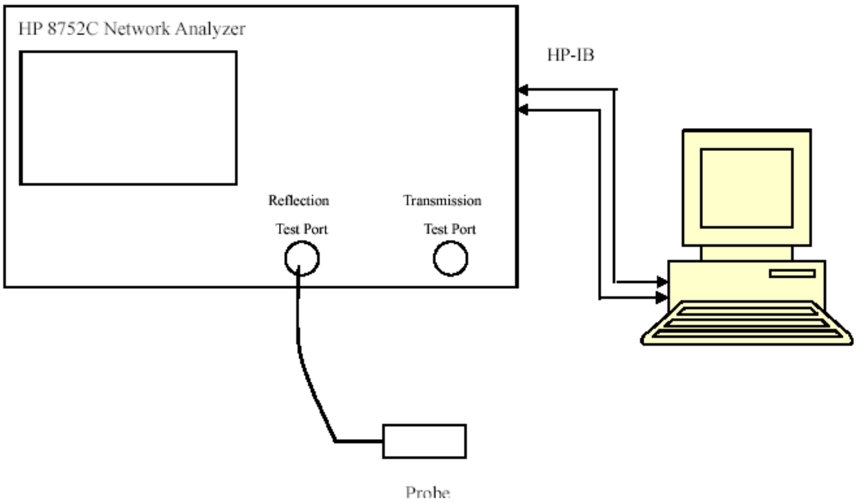
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Information

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Robot	RX60	5N26A1	N/A	N/A
DASY4 Test Software	DASY4.5	N/A	N/A	N/A
DASY4 Measurement Server	DASY 4.5.12	1470	N/A	N/A
Data Acquisition Electronics	DAE4	527	2016/10/19	2017/10/18
E-Field Probe	EX3DV4	7382	2016/10/26	2017/10/25
Dipole, 750 MHz	D750V3	1167	2016/11/08	2019/11/07
Dipole, 835 MHz	D835V2	454	2015/8/17	2018/8/16
Dipole, 1800 MHz	D1800V2	2d207	2015/7/9	2018/7/8
Dipole,1900MHz	D1900V2	5d207	2015/7/14	2018/7/13
Dipole,2450MHz	D2450V2	969	2015/7/8	2018/7/7
Wideband Radio Communication Tester	CMU-200	114196	2017/5/13	2018/5/12
Wideband Radio Communication Tester	CMW500	149170	2017/5/13	2018/5/12
Mounting Device	N/A	SD 000 H01 KA	N/A	N/A
Twin SAM	Twin SAM V5.0	1368	N/A	N/A
Simulated Tissue 750 MHz Body	TS-750-B	/	Each Time	/
Simulated Tissue 850 MHz Body	TS-850-B	/	Each Time	
Simulated Tissue1750 MHz Body	TS-1750-B	/	Each Time	/
Simulated Tissue1900 MHz Body	TS-1900-B	/	Each Time	/
Simulated Tissue 2450 MHz Body	TS-2450-B	/	Each Time	/
Network Analyzer	8753D	3410A05361	2017/3/24	2018/3/23
Signal Generator	83650D	3623A02870	2016/5/30	2017/5/29
Signal Generator	SMB100A	110700	2016/11/09	2017/11/08
Power Meter	E4418B	US39402167	2016/5/30	2017/5/29
Power Meter Sensor	E9300A	US39210953	2016/5/30	2017/5/29
Power Sensor	U2021XA	MY54080018	2017/3/21	2018/3/20
Power Amplifier	ZHL-42W+	329401642	2017/1/18	2018/1/17
Directional Coupler	488Z	N/A	N/A	N/A
Attenuator	20dB, 100W	N/A	N/A	N/A

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency (MHz)	Liquid Type	Liquid Parameter (σ)	Liquid Parameter (ε_r)	Target Value (σ)	Target Value (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)
2412	Body	1.91	51.7	1.91	52.75	0.00	-1.99	±5
2437	Body	1.95	51.6	1.94	52.72	0.52	-2.12	±5
2462	Body	1.98	51.6	1.97	52.68	0.51	-2.05	±5

*Liquid Verification was performed on 2017-5-13.

Frequency (MHz)	Liquid Type	Liquid Parameter (σ)	Liquid Parameter (ε_r)	Target Value (σ)	Target Value (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)
1720	Body	1.5	53.3	1.47	53.46	2.04	-0.37	±5
1732.5	Body	1.51	53.2	1.48	53.43	2.03	-0.37	±5
1745	Body	1.53	53.1	1.49	53.41	2.68	-0.56	±5
1860	Body	1.54	51.7	1.52	53.30	1.32	-3.00	±5
1880	Body	1.56	51.6	1.52	53.30	2.63	-3.19	±5
1900	Body	1.58	51.5	1.52	53.30	3.95	-3.38	±5
1852.4	Body	1.53	51.7	1.52	53.30	0.66	-3.00	±5
1880	Body	1.56	51.6	1.52	53.30	2.63	-3.19	±5
1907.6	Body	1.59	51.5	1.52	53.30	4.61	-3.38	±5

*Liquid Verification was performed on 2017-6-2.

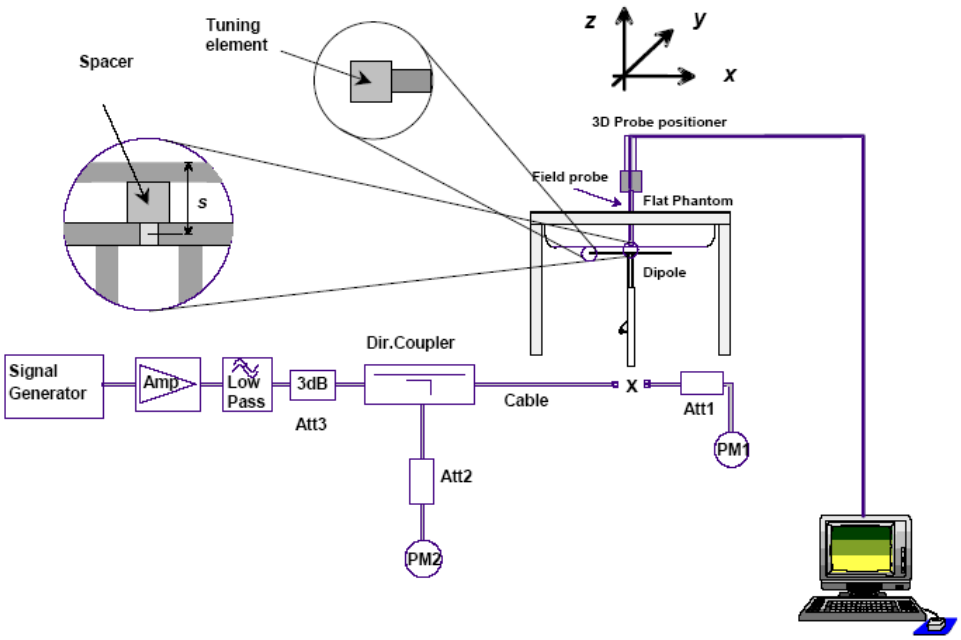
Frequency (MHz)	Liquid Type	Liquid Parameter (σ)	Liquid Parameter (ε_r)	Target Value (σ)	Target Value (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)
829	Body	0.99	57.60	0.97	55.22	2.06	4.31	±5
836.5	Body	1.00	57.60	0.97	55.20	3.09	4.35	±5
844	Body	1.00	57.50	0.98	55.17	2.04	4.22	±5
826.4	Body	0.99	57.70	0.97	55.23	2.06	4.47	±5
836.6	Body	1.00	57.60	0.97	55.20	3.09	4.35	±5
846.6	Body	1.01	57.60	0.98	55.16	3.06	4.42	±5
782	Body	0.996	54.4	0.96	55.39	3.75	-1.79	±5
709	Body	0.926	55.1	0.96	55.66	-3.54	-1.01	±5
710	Body	0.927	55.1	0.96	55.66	-3.44	-1.01	±5
711	Body	0.928	55.1	0.96	55.66	-3.33	-1.01	±5

*Liquid Verification was performed on 2017-6-3.

System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

System Verification Setup Block Diagram



System Accuracy Check Results

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 (%)	Tolerance (%)
2017/6/3	750	MSL	250	D750V3-1167	7382	527	2.17	8.58	8.68	1.17	±10
2017/6/3	835	MSL	250	D835V2-454	7382	527	2.53	9.59	10.12	5.53	±10
2017/6/2	1750	MSL	250	D1800V2-2d207	7382	527	10.10	37.20	40.4	8.60	±10
2017/6/2	1900	MSL	250	D1900V2-5d207	7382	527	10.80	40.40	43.2	6.93	±10
2017/5/13	2450	MSL	250	D2450V2-969	7382	527	13.40	51.70	53.6	3.68	±10

Note: The power inputted to dipole is 0.25Watt; the SAR values are normalized to 1 Watt forward power by multiplying 4 times.

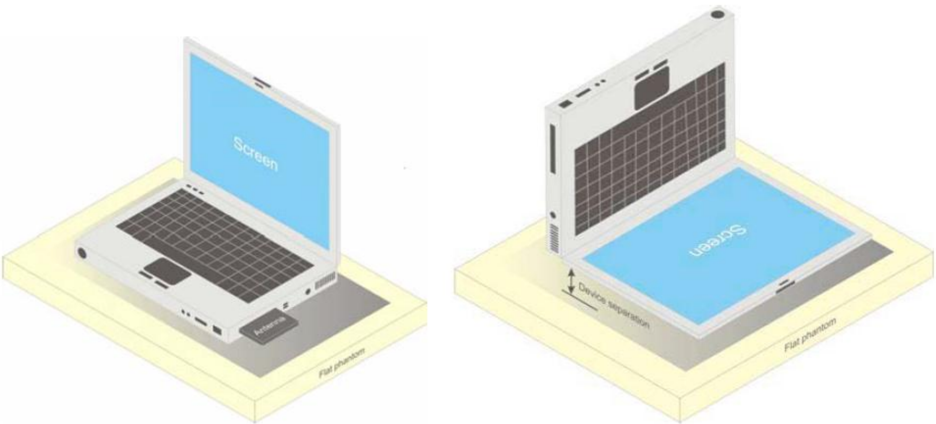
EUT TEST STRATEGY AND METHODOLOGY

Body-supported device

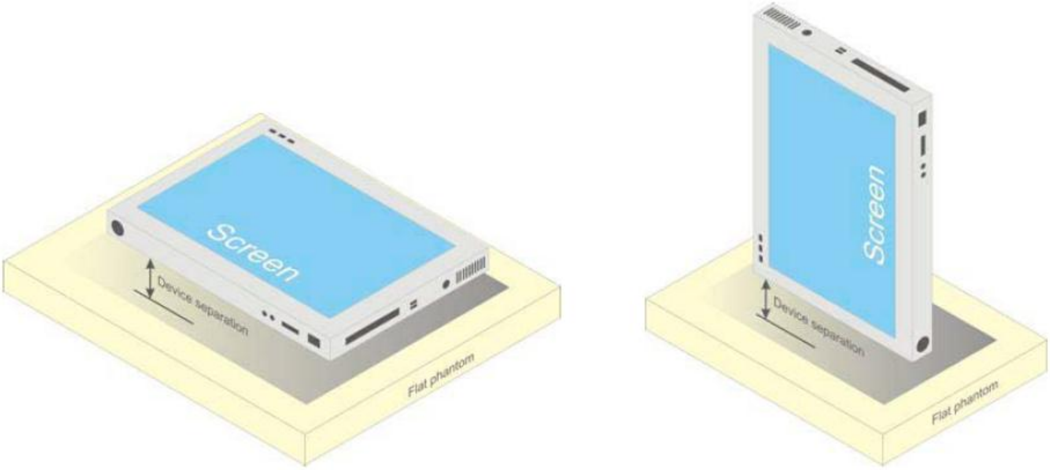
A typical example of a body supported device is a wireless enabled laptop device that among other orientations may be supported on the thighs of a sitting user. To represent this orientation, the device shall be positioned with its base against the flat phantom.

Other orientations may be specified by the manufacturer in the user instructions. If the intended use is not specified, the device shall be tested directly against the flat phantom in all usable orientations. The screen portion of the device shall be in an open position at a 90° angle as seen in Figure a (left side), or at an operating angle specified for intended use by the manufacturer in the operating instructions. Where a body supported device has an integral screen required for normal operation, then the screen-side will not need to be tested if it ordinarily remains 200 mm from the body. Where a screen mounted antenna is present, this position shall be repeated with the screen against the flat phantom as shown in Figure 7a) (right side), if this is consistent with the intended use.

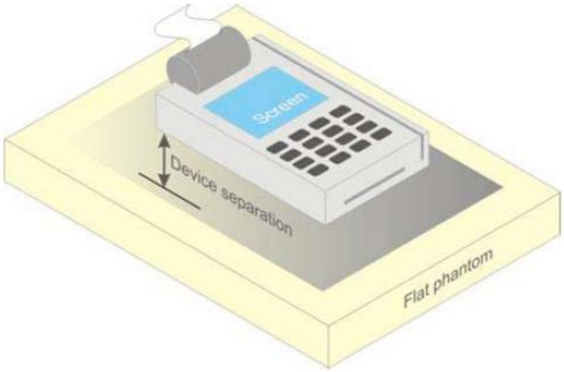
Other devices that fall into this category include tablet type portable computers and credit card transaction authorization terminals, point-of-sale and/or inventory terminals. Where these devices may be torso or limb-supported, the same principles for body-supported devices are applied. The example in Figure b) shows a tablet form factor portable computer for which SAR should be separately assessed with d) each surface and e) the separation distances positioned against the flat phantom that correspond to the intended use as specified by the manufacturer. If the intended use is not specified in the user instructions, the device shall be tested directly against the flat phantom in all usable orientations. Some body-supported devices may allow testing with an external power supply (e.g. a.c. adapter) supplemental to the battery, but it shall be verified and documented in the measurement report that SAR is still conservative.



a) Portable computer with external antenna plug-in-radio-card (left side) or with internal antenna located in screen section (right side)



b) Tablet form factor portable computer



c) Wireless credit card transaction authorisation terminal

Figure 7 – Test positions for body supported devices

Test positions for Hand-held device

Hand-held device means a portable device which is located in a user's hand during its intended use Hand-held usage of the device, not at the head or torso. The device shall be placed directly against the flat phantom as shown in Figure J.1, for those sides of the device that are in contact with the hand during intended use.

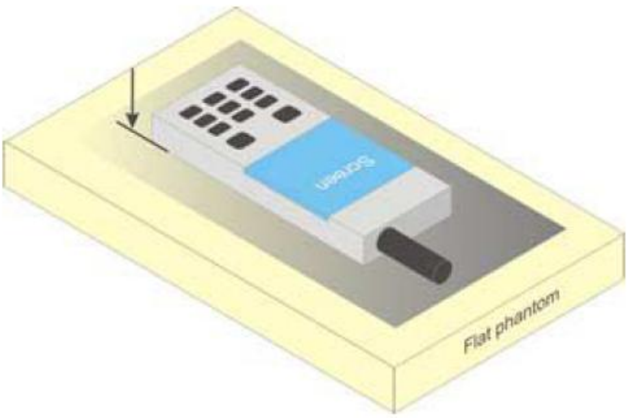


Figure J.1 – Test position for hand-held devices, not used at the head or torso

Test Distance for SAR Evaluation

For this case the DUT(Device Under Test) is set directly against the phantom, the test distance is 0 mm.

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or radiating structures of the EUT, the horizontal grid spacing was 15 mm x 15 mm, and the SAR distribution was determined by integrated grid of 1.5mm x 1.5mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the “Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

Test methodology

KDB 248227 D01 802.11 Wi-Fi SAR v02r02
KDB 447498 D01 General RF Exposure Guidance v06.
KDB 648474 D04 Handset SAR v01r03.
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02 RF Exposure Reporting v01r02
KDB 941225 D01 3G SAR Procedures v03r01
KDB 941225 D05 SAR for LTE Devices v02r04
KDB 941225 D06 Hotspot Mode v02r01
KDB 616217 D04 SAR for laptop and tablets v01r01

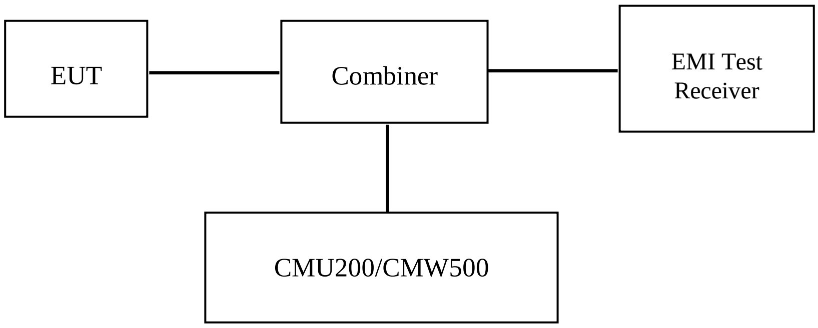
CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

Test Procedure

The RF output of the transmitter was connected to the input of the test equipment through Attenuator.



WCDMA/LTE

Radio Configuration

WCDMA Release 99

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification. The EUT has a nominal maximum output power of 24dBm (+1.7/-3.7).

WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc / βd	8/15

HSDPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subset	**1**	**2**	**3**	**4**
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/ βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs=βhs/ βc	30/15			

HSUPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	**HSUPA**	**HSUPA**	**HSUPA**	**HSUPA**	**HSUPA**
	Subset	**1**	**2**	**3**	**4**	**5**
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	-
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	CM(dB)	1.0	3.0	2.0	3.0	1.0
	MPR(dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	$A_{hs}=\beta_{hs}/\beta_c$	30/15				
HSUPA Specific Settings	DE-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_FCls	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	

LTE

For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

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

For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4.-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

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

Network Signalling value	Requirements (subclause)	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	N/A
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	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	
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	
NS_11	6.6.2.2.1	23	1.4, 3, 5, 10, 15, 20	Table 6.2.4-5	
NS_12	6.6.3.3.5	26	1.4, 3, 5	Table 6.2.4-6	
NS_13	6.6.3.3.6	26	5	Table 6.2.4-7	
NS_14	6.6.3.3.7	26	10, 15	Table 6.2.4-8	
NS_15	6.6.3.3.8	26	1.4, 3, 5, 10, 15	Table 6.2.4-9 Table 6.2.4-10	
NS_16	6.6.3.3.9	27	3, 5, 10	Table 6.2.4-11, Table 6.2.4-12, Table 6.2.4-13	
NS_17	6.6.3.3.10	28	5, 10	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	5	≥ 2	≤ 1
			10, 15, 20	≥ 1	≤ 4
NS_19	6.6.3.3.12	44	10, 15, 20	Table 6.2.4-14	
NS_20	6.2.2 6.6.2.2.1 6.6.3.2	23	5, 10, 15, 20	Table 6.2.4-15	
...					
NS_32	-	-	-	-	-

Maximum Output Power

Max Target Power for Production Unit (dBm)				
Mode/Band		Channel		
		Low	Middle	High
WCDMA Band 5	Rel 99	23.00	23.00	23.00
	HSDPA	22.50	22.50	22.50
	HSUPA	22.50	22.50	22.50
WCDMA Band 2	Rel 99	23.00	23.00	23.00
	HSDPA	22.50	22.50	22.50
	HSUPA	22.50	22.50	22.50
LTE Band 2		23.00	23.00	23.00
LTE Band 4		23.50	23.50	23.50
LTE Band 5		23.00	23.00	23.00
LTE Band 13		23.00	23.00	23.00
LTE Band 17		23.00	23.00	23.00
WLAN2.4G (802.11b)		12.5	14.5	15.5
WLAN2.4G (802.11g)		15.5	15.5	15.5
WLAN2.4G (802.11n HT20)		15.5	15.5	15.5
WLAN2.4G (802.11n HT40)		12.0	15.0	13.0
BLE		-1.0	-1.0	-1.0

Results (12.2kbps RMC)

WCDMA

Band	WCDMA V			WCDMA II		
TX Channel	4132	4182	4233	9262	9400	9538
Rx Channel	4357	4407	4458	9662	9800	9938
Frequency (MHz)	826.4	836.6	846.6	1852.4	1880	1907.6
RMC 12.2Kbps	22.39	22.25	22.20	22.12	22.13	22.09
HSDPA Subtest-1	21.47	21.08	21.41	21.27	21.28	21.21
HSDPA Subtest-2	21.34	21.08	21.30	21.26	21.24	21.23
HSDPA Subtest-3	20.78	20.80	20.85	20.73	20.77	20.68
HSDPA Subtest-4	20.53	20.65	20.87	20.63	20.76	20.67
HSUPA Subtest-1	21.09	21.09	20.97	20.92	20.94	20.86
HSUPA Subtest-2	20.45	20.33	20.09	20.25	20.24	20.18
HSUPA Subtest-3	19.95	20.21	20.09	20.10	20.14	20.07
HSUPA Subtest-4	20.31	20.22	20.09	20.21	20.25	20.20
HSUPA Subtest-5	21.04	21.26	21.25	21.21	21.20	21.17

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model 1.
2. KDB 941225 D01-Body SAR is not required for HSDPA/HSUPA when the maximum average output of each RF channel is less than ¼ dB higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

LTE Band 5

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.67	22.60	22.51	23	0
10	QPSK	1	25	22.58	22.56	22.30		
10	QPSK	1	49	22.53	22.55	22.39		
10	QPSK	25	0	21.77	21.51	21.49	22	1
10	QPSK	25	12	21.49	21.50	21.47		
10	QPSK	25	25	21.41	21.41	21.41		
10	QPSK	50	0	21.51	21.50	21.48		
10	16QAM	1	0	21.90	21.89	21.87	22	1
10	16QAM	1	25	21.76	21.78	21.71		
10	16QAM	1	49	21.81	21.78	21.85		
10	16QAM	25	0	20.48	20.47	20.46	21	2
10	16QAM	25	12	20.47	20.47	20.45		
10	16QAM	25	25	20.40	20.40	20.39		
10	16QAM	50	0	20.46	20.45	20.45		
Channel				20425	20525	20625	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.65	22.58	22.49	23	0
5	QPSK	1	12	22.56	22.54	22.28		
5	QPSK	1	24	22.51	22.53	22.37		
5	QPSK	12	0	21.75	21.49	21.47	22	1
5	QPSK	12	7	21.47	21.48	21.45		
5	QPSK	12	13	21.39	21.39	21.39		
5	QPSK	25	0	21.49	21.48	21.46		
5	16QAM	1	0	21.88	21.87	21.85	22	1
5	16QAM	1	12	21.74	21.76	21.69		
5	16QAM	1	24	21.79	21.76	21.83		
5	16QAM	12	0	20.46	20.45	20.44	21	2
5	16QAM	12	7	20.45	20.45	20.43		
5	16QAM	12	13	20.38	20.38	20.37		
5	16QAM	25	0	20.44	20.43	20.43		

Channel				20415	20525	20635	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.65	22.62	22.65	23	0
3	QPSK	1	8	22.58	22.58	22.58		
3	QPSK	1	14	22.61	22.61	22.62		
3	QPSK	8	0	21.58	21.55	21.54	22	1
3	QPSK	8	4	21.61	21.58	21.59		
3	QPSK	8	7	21.55	21.54	21.59		
3	QPSK	15	0	21.58	21.58	21.59		
3	16QAM	1	0	21.85	21.89	21.92	22	1
3	16QAM	1	8	21.81	21.76	21.86		
3	16QAM	1	14	21.81	21.88	21.84		
3	16QAM	8	0	20.60	20.59	20.55	21	2
3	16QAM	8	4	20.62	20.59	20.60		
3	16QAM	8	7	20.61	20.59	20.58		
3	16QAM	15	0	20.57	20.56	20.55		
Channel				20407	20525	20643	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.49	22.55	22.56	23	0
1.4	QPSK	1	3	22.36	22.50	22.52		
1.4	QPSK	1	5	22.45	22.46	22.49		
1.4	QPSK	3	0	22.36	22.33	22.37		
1.4	QPSK	3	1	22.42	22.44	22.46		
1.4	QPSK	3	3	22.31	22.26	22.29		
1.4	QPSK	6	0	21.33	21.33	21.34	22	1
1.4	16QAM	1	0	21.83	21.81	21.85	22	1
1.4	16QAM	1	3	21.71	21.66	21.71		
1.4	16QAM	1	5	21.82	21.80	21.84		
1.4	16QAM	3	0	21.43	21.41	21.43		
1.4	16QAM	3	1	21.42	21.38	21.41		
1.4	16QAM	3	3	21.38	21.29	21.38		
1.4	16QAM	6	0	20.35	20.36	20.38	21	2

LTE Band 2

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				18700	18900	19100		
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	0	22.07	22.38	22.13	23	0
20	QPSK	1	49	22.01	22.31	22.11		
20	QPSK	1	99	22.01	22.35	21.94		
20	QPSK	50	0	20.98	21.34	21.03	22	1
20	QPSK	50	24	20.97	21.29	21.02		
20	QPSK	50	50	20.91	21.23	20.91		
20	QPSK	100	0	20.96	21.31	20.97		
20	16QAM	1	0	21.32	21.66	21.34	22	1
20	16QAM	1	49	21.23	21.61	21.30		
20	16QAM	1	99	21.31	21.65	21.22		
20	16QAM	50	0	19.92	20.34	19.93	21	2
20	16QAM	50	24	19.93	20.29	19.96		
20	16QAM	50	50	19.88	20.20	19.91		
20	16QAM	100	0	19.92	20.29	19.92		
Channel				18675	18900	19125	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	0	21.95	22.29	22.17	23	0
15	QPSK	1	37	21.91	22.28	22.10		
15	QPSK	1	74	21.93	22.28	22.10		
15	QPSK	36	0	20.91	21.20	21.10	22	1
15	QPSK	36	20	20.93	21.28	21.13		
15	QPSK	36	39	20.91	21.23	21.11		
15	QPSK	75	0	20.93	21.24	21.16		
15	16QAM	1	0	21.26	21.66	21.57	22	1
15	16QAM	1	37	21.22	21.58	21.56		
15	16QAM	1	74	21.25	21.61	21.41		
15	16QAM	36	0	19.86	20.16	20.20	21	2
15	16QAM	36	20	19.91	20.13	20.13		
15	16QAM	36	39	19.88	20.14	20.01		
15	16QAM	75	0	19.91	20.26	20.13		

Channel				18650	18900	19150	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	0	22.17	22.25	22.12	23	0
10	QPSK	1	25	22.08	22.28	22.11		
10	QPSK	1	49	21.97	22.26	21.86		
10	QPSK	25	0	20.98	21.18	20.83	22	1
10	QPSK	25	12	21.01	21.22	20.88		
10	QPSK	25	25	20.97	21.22	20.85		
10	QPSK	50	0	20.99	21.22	20.87		
10	16QAM	1	0	21.28	21.58	21.27	22	1
10	16QAM	1	25	21.25	21.41	21.26		
10	16QAM	1	49	21.26	21.50	21.15		
10	16QAM	25	0	20.05	20.27	19.86	21	2
10	16QAM	25	12	20.08	20.29	19.89		
10	16QAM	25	25	20.08	20.27	19.91		
10	16QAM	50	0	20.02	20.24	19.84		
Channel				18625	18900	19175	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	0	22.09	22.32	22.09	23	0
5	QPSK	1	12	22.08	22.18	22.08		
5	QPSK	1	24	21.95	22.19	21.79		
5	QPSK	12	0	20.94	21.13	20.80	22	1
5	QPSK	12	7	20.92	21.20	20.88		
5	QPSK	12	13	20.96	21.14	20.75		
5	QPSK	25	0	20.91	21.17	20.79		
5	16QAM	1	0	21.24	21.53	21.19	22	1
5	16QAM	1	12	21.16	21.31	21.21		
5	16QAM	1	24	21.26	21.40	21.05		
5	16QAM	12	0	19.96	20.25	19.76	21	2
5	16QAM	12	7	20.07	20.20	19.80		
5	16QAM	12	13	20.01	20.21	19.87		
5	16QAM	25	0	19.92	20.20	19.74		

Channel				18615	18900	19185	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1851.5	1880	1908.5		
3	QPSK	1	0	21.87	22.10	21.82	23	0
3	QPSK	1	8	21.78	21.98	21.81		
3	QPSK	1	14	21.67	21.96	21.56		
3	QPSK	8	0	20.68	20.88	20.53	22	1
3	QPSK	8	4	20.71	20.92	20.58		
3	QPSK	8	7	20.67	20.92	20.55		
3	QPSK	15	0	20.69	20.92	20.57		
3	16QAM	1	0	20.98	21.28	20.97	22	1
3	16QAM	1	8	20.95	21.11	20.96		
3	16QAM	1	14	20.96	21.20	20.85		
3	16QAM	8	0	19.75	19.97	19.56	21	2
3	16QAM	8	4	19.78	19.99	19.59		
3	16QAM	8	7	19.78	19.97	19.61		
3	16QAM	15	0	19.69	19.88	19.52		
Channel				18607	18900	19193	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1850.7	1880	1909.3		
1.4	QPSK	1	0	22.06	22.29	22.06	23	0
1.4	QPSK	1	3	22.05	22.15	22.05		
1.4	QPSK	1	5	21.92	22.16	21.76		
1.4	QPSK	3	0	21.50	21.00	21.77		
1.4	QPSK	3	1	21.49	21.17	21.22		
1.4	QPSK	3	3	21.50	21.11	21.00		
1.4	QPSK	6	0	20.88	21.14	20.76	22	1
1.4	16QAM	1	0	21.21	21.50	21.16	22	1
1.4	16QAM	1	3	21.13	21.28	21.18		
1.4	16QAM	1	5	21.23	21.37	21.02		
1.4	16QAM	3	0	21.10	21.00	21.20		
1.4	16QAM	3	1	20.04	20.17	20.50		
1.4	16QAM	3	3	20.00	20.18	20.30		
1.4	16QAM	6	0	19.89	20.17	19.71	21	2

LTE Band 4

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	23.11	23.18	23.02	23.5	0
20	QPSK	1	49	23.03	23.10	22.97		
20	QPSK	1	99	23.05	23.06	23.01		
20	QPSK	50	0	22.10	22.22	22.01	22.5	1
20	QPSK	50	24	22.06	22.18	22.00		
20	QPSK	50	50	22.03	22.16	21.96		
20	QPSK	100	0	22.05	22.20	22.00		
20	16QAM	1	0	22.44	22.49	22.33	22.5	1
20	16QAM	1	49	22.23	22.48	22.14		
20	16QAM	1	99	22.13	22.20	22.16		
20	16QAM	50	0	21.13	21.31	21.00	21.5	2
20	16QAM	50	24	21.04	21.24	20.97		
20	16QAM	50	50	21.01	21.15	20.94		
20	16QAM	100	0	21.04	21.26	20.97		
Channel				20025	20175	20325	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	23.00	23.05	22.92	23.5	0
15	QPSK	1	37	23.01	23.01	22.96		
15	QPSK	1	74	23.02	22.97	23.01		
15	QPSK	36	0	22.01	22.12	21.99	22.5	1
15	QPSK	36	20	22.05	22.17	21.98		
15	QPSK	36	39	22.00	22.14	21.92		
15	QPSK	75	0	21.97	22.14	21.90		
15	16QAM	1	0	22.36	22.44	22.27	22.5	1
15	16QAM	1	37	22.13	22.45	22.04		
15	16QAM	1	74	22.11	22.11	22.15		
15	16QAM	36	0	21.13	21.29	20.97	21.5	2
15	16QAM	36	20	21.02	21.18	20.87		
15	16QAM	36	39	21.01	21.10	20.90		
15	16QAM	75	0	20.94	21.21	20.91		

Channel				20000	20175	20350	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	22.99	23.04	22.90	23.5	0
10	QPSK	1	25	23.00	23.01	22.92		
10	QPSK	1	49	22.93	22.87	22.98		
10	QPSK	25	0	21.94	22.05	21.98	22.5	1
10	QPSK	25	12	22.03	22.10	21.93		
10	QPSK	25	25	22.00	22.08	21.88		
10	QPSK	50	0	21.87	22.06	21.89		
10	16QAM	1	0	22.30	22.34	22.21	22.5	1
10	16QAM	1	25	22.05	22.35	21.98		
10	16QAM	1	49	22.07	22.01	22.08		
10	16QAM	25	0	21.05	21.25	20.91	21.5	2
10	16QAM	25	12	20.94	21.12	20.81		
10	16QAM	25	25	21.00	21.03	20.87		
10	16QAM	50	0	20.88	21.18	20.91		
Channel				19975	20175	20375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	22.90	22.98	22.92	23.5	0
5	QPSK	1	12	22.99	22.95	22.94		
5	QPSK	1	24	23.02	22.90	23.01		
5	QPSK	12	0	21.91	22.06	21.92	22.5	1
5	QPSK	12	7	21.99	22.14	21.90		
5	QPSK	12	13	21.91	22.11	21.84		
5	QPSK	25	0	21.91	22.08	21.87		
5	16QAM	1	0	22.35	22.35	22.19	22.5	1
5	16QAM	1	12	22.03	22.40	22.01		
5	16QAM	1	24	22.11	22.09	22.12		
5	16QAM	12	0	21.05	21.27	20.96	21.5	2
5	16QAM	12	7	20.96	21.11	20.83		
5	16QAM	12	13	21.01	21.09	20.84		
5	16QAM	25	0	20.90	21.15	20.85		

Channel				19965	20175	20385	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	22.93	22.98	22.90	23.5	0
3	QPSK	1	8	22.96	22.91	22.87		
3	QPSK	1	14	22.86	22.79	22.91		
3	QPSK	8	0	21.87	21.98	21.92	22.5	1
3	QPSK	8	4	21.96	22.10	21.86		
3	QPSK	8	7	21.94	21.98	21.78		
3	QPSK	15	0	21.81	21.98	21.86		
3	16QAM	1	0	22.23	22.30	22.13	22.5	1
3	16QAM	1	8	21.98	22.35	21.93		
3	16QAM	1	14	22.00	21.93	22.07		
3	16QAM	8	0	20.97	21.23	20.91	21.5	2
3	16QAM	8	4	20.85	21.02	20.75		
3	16QAM	8	7	20.95	20.97	20.82		
3	16QAM	15	0	20.94	21.12	20.91		
Channel				19957	20175	20393	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	22.98	23.01	22.90	23.5	0
1.4	QPSK	1	3	22.96	22.97	22.90		
1.4	QPSK	1	5	22.99	22.88	22.91		
1.4	QPSK	3	0	21.99	22.08	21.98		
1.4	QPSK	3	1	22.00	22.16	21.90		
1.4	QPSK	3	3	21.90	22.06	21.82		
1.4	QPSK	6	0	21.94	22.10	21.86	22.5	1
1.4	16QAM	1	0	22.34	22.39	22.21	22.5	1
1.4	16QAM	1	3	22.09	22.38	21.99		
1.4	16QAM	1	5	22.07	22.02	22.12		
1.4	16QAM	3	0	21.10	21.19	20.96		
1.4	16QAM	3	1	20.95	21.14	20.87		
1.4	16QAM	3	3	20.97	21.04	20.89		
1.4	16QAM	6	0	20.87	21.21	20.82	21.5	2

LTE Band 13

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel					23230			
Frequency (MHz)					782			
10	QPSK	1	0		22.23		23	0
10	QPSK	1	25		21.97			
10	QPSK	1	49		22.01			
10	QPSK	25	0		21.03		22	1
10	QPSK	25	12		21.01			
10	QPSK	25	25		20.95			
10	QPSK	50	0		20.97			
10	16QAM	1	0		21.33		22	1
10	16QAM	1	25		21.38			
10	16QAM	1	49		21.35			
10	16QAM	25	0		19.92		21	2
10	16QAM	25	12		19.94			
10	16QAM	25	25		19.90			
10	16QAM	50	0		19.97			
Channel				23205	23230	23255	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				779.5	782	784.5		
5	QPSK	1	0	22.07	22.20	22.15	23	0
5	QPSK	1	12	22.03	22.15	22.16		
5	QPSK	1	24	22.14	22.15	22.15		
5	QPSK	12	0	21.09	21.21	21.16	22	1
5	QPSK	12	7	21.08	21.22	21.25		
5	QPSK	12	13	21.01	21.14	21.13		
5	QPSK	25	0	21.02	21.22	21.24		
5	16QAM	1	0	21.40	21.51	21.55	22	1
5	16QAM	1	12	21.46	21.71	21.52		
5	16QAM	1	24	21.41	21.63	21.70		
5	16QAM	12	0	20.01	20.21	20.29	21	2
5	16QAM	12	7	19.97	20.22	20.31		
5	16QAM	12	13	19.89	20.21	20.23		
5	16QAM	25	0	20.02	20.29	20.17		

LTE Band 17

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				23780	23790	23800		
Frequency (MHz)				709	710	711		
10	QPSK	1	0	22.61	22.74	22.87	23	0
10	QPSK	1	25	22.56	22.71	22.76		
10	QPSK	1	49	22.56	22.68	22.80		
10	QPSK	25	0	21.53	21.73	21.74	22	1
10	QPSK	25	12	21.50	21.70	21.69		
10	QPSK	25	25	21.50	21.63	21.63		
10	QPSK	50	0	21.56	21.81	21.83		
10	16QAM	1	0	21.93	22.04	22.03	22	1
10	16QAM	1	25	21.93	22.13	22.10		
10	16QAM	1	49	21.95	22.12	22.15		
10	16QAM	25	0	20.49	20.68	20.81	21	2
10	16QAM	25	12	20.43	20.74	20.78		
10	16QAM	25	25	20.40	20.75	20.74		
10	16QAM	50	0	20.52	20.72	20.71		
Channel				23755	23790	23825	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				706.5	710	713.5		
5	QPSK	1	0	22.63	22.72	22.81	23	0
5	QPSK	1	12	22.47	22.68	22.74		
5	QPSK	1	24	22.64	22.73	22.86		
5	QPSK	12	0	21.57	21.72	21.67	22	1
5	QPSK	12	7	21.57	21.77	21.69		
5	QPSK	12	13	21.53	21.63	21.61		
5	QPSK	25	0	21.59	21.81	21.73		
5	16QAM	1	0	21.87	22.05	22.07	22	1
5	16QAM	1	12	22.00	22.18	22.07		
5	16QAM	1	24	21.94	22.09	22.15		
5	16QAM	12	0	20.56	20.70	20.79	21	2
5	16QAM	12	7	20.47	20.80	20.71		
5	16QAM	12	13	20.43	20.69	20.78		
5	16QAM	25	0	20.55	20.73	20.70		

Note:
1.SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02.
2.The CMW500 Wideband Radio Communication tester is used for LTE output power measurements and SAR testing. Closed loop power control is used to keep the radio transmitters the max output power during the test.
3.KDB941225D05v02- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg

WLAN2.4G

Mode	Channel	Frequency (MHz)	Conducted Average Output Power (dBm)
802.11b	CH 1	2412	12.19
	CH 6	2437	14.27
	CH 11	2462	15.22
802.11g	CH 1	2412	15.11
	CH 6	2437	15.14
	CH 11	2462	14.98
802.11n-HT20	CH 1	2412	15.03
	CH 6	2437	14.97
	CH 11	2462	14.79
802.11n-HT40	CH 3	2422	11.64
	CH 6	2437	14.94
	CH 9	2452	12.53

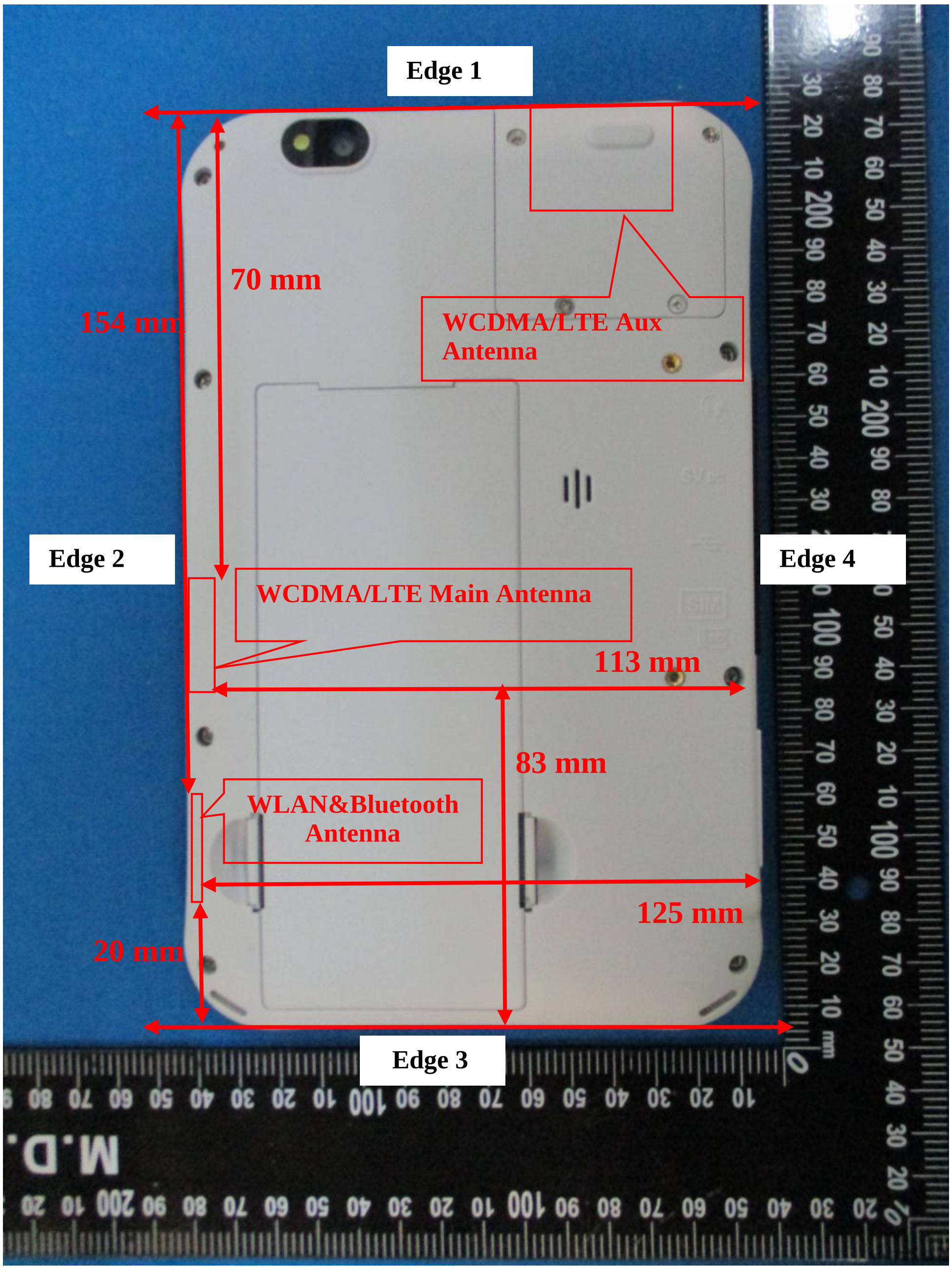
Note:

The output power was tested under data rate 1Mbps for 802.11b, 6Mbps for 802.11g, MCS0 for 802.11n mode.

Bluetooth LE

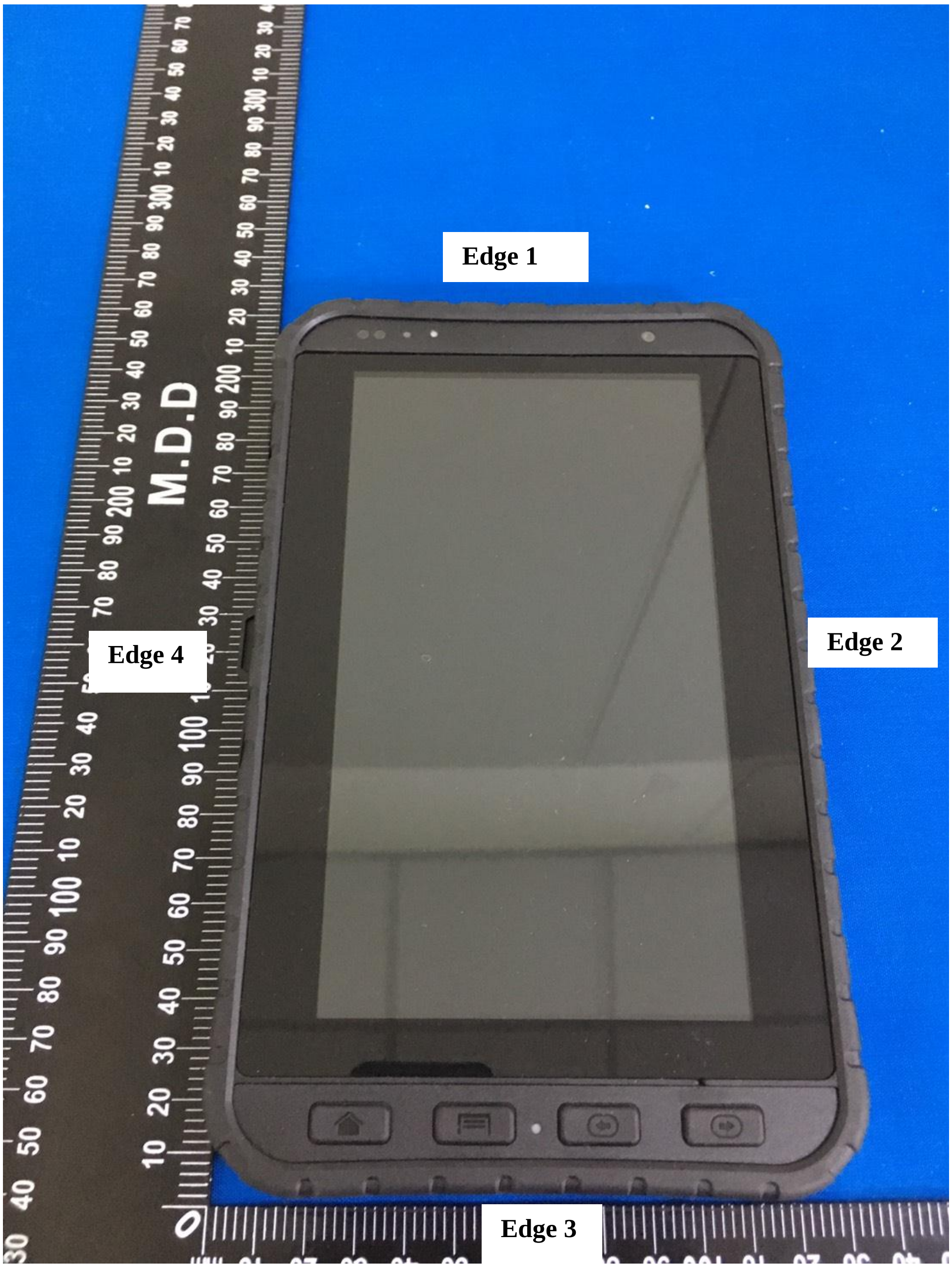
Mode	Channel	Frequency (MHz)	Conducted Average Output Power (dBm)
			GFSK
Bluetooth LE	CH 00	2402	-1.93
	CH 19	2440	-1.49
	CH 39	2480	-1.68

Antenna Location



Note: The WLAN and Bluetooth transmit and receive through the same antenna, they can not transmit simultaneously.

Sample Edge Location



Antenna Distance To Edge

Antenna Distance To Edge (mm)					
Antenna	**Back**	**Edge 1**	**Edge 2**	**Edge 3**	**Edge 4**
WCDMA/LTE	<5	70	<5	83	113
WLAN&Bluetooth LE	<5	154	<5	20	125

Standalone SAR test exclusion considerations

Mode	Frequency (MHz)	Tune-up Power (dBm)	Tune-up Power (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
WLAN	2462	15.5	35	0	10.98	3	NO
Bluetooth LE	2480	-1.0	0.79	0	0.25	3	YES

NOTE:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR, where

1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

SAR test exclusion for the EUT edge considerations Result

Antenna Distance To Edge					
Mode	**Back**	**Edge 1**	**Edge 2**	**Edge 3**	**Edge 4**
WCDMA/LTE	**Required**	**Judge**	**Required**	**Judge**	**Judge**
WLAN2.4G	**Required**	**Judge**	**Required**	**Judge**	**Judge**

Note:

Required: The distance is less than 5mm, the SAR test is required as Standalone SAR test exclusion considerations table.
Judge: Please refer the below tables for detail.

SAR test exclusion for the EUT edge considerations detail:

Distance< 50mm (To Edge)

Antenna	Edge	Frequency (MHz)	Tune-up Power (dBm)	Tune-up Power (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test required
WLAN	3	2462	15.5	35.0	20	2.8	3.0	**No**

NOTE:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Distance> 50mm (To Edges)

Antenna	Edge	Frequency (MHz)	Tune-up Power (dBm)	Tune-up Power (mW)	Distance (mm)	Test exclusion Threshold (mW)	SAR Test required
WCDMA V	1	846.6	23	200	70	276	**No**
WCDMA II	1	1907.6	23	200	70	309	**No**
LTE Band 13/17	1	713.5/784.5	23	200	70	273/274	**No**
LTE Band 5	1	848.3	23	200	70	276	**No**
LTE Band 4	1	1754.3	23.5	224	70	313	**No**
LTE Band 2	1	1909.3	23	200	70	309	**No**
WCDMA V	3	846.6	23	200	83	349	**No**
WCDMA II	3	1907.6	23	200	83	439	**No**
LTE Band 13/17	3	713.5/784.5	23	200	83	335/342	**No**
LTE Band 5	3	848.3	23	200	83	349	**No**
LTE Band 4	3	1754.3	23.5	224	83	443	**No**
LTE Band 2	3	1909.3	23	200	83	439	**No**
WCDMA V	3	846.6	23	200	113	518	**No**
WCDMA II	3	1907.6	23	200	113	739	**No**
LTE Band 13/17	3	713.5/784.5	23	200	113	477/499	**No**
LTE Band 5	3	848.3	23	200	113	519	**No**
LTE Band 4	3	1754.3	23.5	224	113	743	**No**
LTE Band 2	3	1909.3	23	200	113	739	**No**
WLAN	1	2462	15.5	35.0	154	1136.0	**No**
WLAN	4	2462	15.5	35.0	125	846.0	**No**

NOTE:

At 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following:

a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz

b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW, at > 1500 MHz and ≤ 6 GHz

Standalone SAR estimation:

Mode	Edge	Frequency (MHz)	Tune-up (dBm)	Tune-up (mW)	Distance (mm)	Estimated 1-g (W/kg)
Bluetooth	Back	2480	-1.0	0.79	5	0.033
	Edge 2	2480	-1.0	0.79	5	0.033

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

[(max. power of channel, including tune-up tolerance , mW)/(min. test separation distance, mm)] ·[√f(GHz)/x] W/kg for test separation distances ≤50 mm;

where x = 7.5 for 1-g SAR.

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion

Note: the maximum power was used for evaluation.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

Test Results:

Environmental Conditions:

Temperature:	22.3-23.7 ℃	22.123.5℃	22.223.2℃
Relative Humidity:	63 %	61%	66%
ATM Pressure:	1009 mbar	1000mbar	1003mbar
Test Date:	2017-05-13	2017-06-02	2017-06-03

WCDMA:

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	WCDMA V	RMC 12.2Kbps	Back	4132	826.4	22.39	23	1.151	0	0.830	0.955
02	WCDMA V	RMC 12.2Kbps	Back	4183	836.6	22.25	23	1.189	0	0.393	0.467
03	WCDMA V	RMC 12.2Kbps	Back	4233	846.6	22.2	23	1.202	0	0.831	**0.999**
04	WCDMA V	RMC 12.2Kbps	Edge 2	4132	826.4	22.39	23	1.151	0.012	0.068	0.078
05	WCDMA II	RMC 12.2Kbps	Back	9400	1880	22.13	23	1.222	0.079	0.262	**0.320**
06	WCDMA II	RMC 12.2Kbps	Edge 2	9400	1880	22.13	23	1.222	-0.083	0.059	0.072

Note:
1. When the 1-g SAR is≤ 0.8W/Kg, testing for other channels are optional.
2. The EUT transmit and receive through the same antenna while testing SAR.
3. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model.
4. KDB 941225 D01-Body SAR is not required for HSDPA/HSUPA/HSPA+/DC-HSDPA when the maximum average output of each RF channel is less than ¼ dB higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
5. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.

LTE

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	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 13	10M	QPSK	1	0	Back	23230	782	22.23	23	1.194	0.019	0.320	**0.382**
08	LTE Band 13	10M	QPSK	25	0	Back	23230	782	21.03	22	1.250	0.038	0.300	0.375
09	LTE Band 13	10M	QPSK	1	0	Edge 2	23230	782	22.23	23	1.194	-0.077	0.083	0.099
10	LTE Band 13	10M	QPSK	25	0	Edge 2	23230	782	21.03	22	1.250	-0.083	0.065	0.081
11	LTE Band 17	10M	QPSK	1	1	Back	23800	711	22.87	23	1.030	0.05	0.329	**0.339**
12	LTE Band 17	10M	QPSK	25	25	Back	23800	711	21.74	22	1.062	-0.021	0.285	0.303
13	LTE Band 17	10M	QPSK	1	1	Edge 2	23800	711	22.87	23	1.030	-0.15	0.074	0.076
14	LTE Band 17	10M	QPSK	25	25	Edge 2	23800	711	21.74	22	1.062	-0.127	0.059	0.063

Note:
1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02.
3. KDB941225D05- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg
4. KDB941225D05- For QPSK with 100% RB allocation, when the reported SAR measured for the Highest output power channel is <1.45 W/kg, tests for the remaining required test channels are optional.
5.KDB941225D05- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg.
6. KDB941225D05- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offset the upper edge, middle and lower edge of each required test channel.
7. KDB941225D05- other channel bandwidths SAR test is required when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.
8. Worst case SAR for 50% RB allocation is selected to be tested.

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	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)
15	LTE Band 5	10M	QPSK	1	0	Back	20450	829	22.67	23	1.079	0.038	0.911	**0.983**
16	LTE Band 5	10M	QPSK	1	0	Back	20525	836.5	22.6	23	1.096	0.031	0.445	0.488
17	LTE Band 5	10M	QPSK	1	0	Back	20600	844	22.51	23	1.119	0.014	0.537	0.601
18	LTE Band 5	10M	QPSK	25	0	Back	20450	829	21.77	22	1.054	0.022	0.728	0.768
19	LTE Band 5	10M	QPSK	50	0	Back	20450	829	21.51	22	1.119	0.01	0.577	0.646
20	LTE Band 5	10M	QPSK	1	0	Edge 2	20450	829	22.67	23	1.079	-0.184	0.438	0.473
21	LTE Band 5	10M	QPSK	25	0	Edge 2	20450	829	21.77	22	1.054	-0.117	0.364	0.384
22	LTE Band 4	20M	QPSK	1	0	Back	20175	1732.5	23.18	23.50	1.076	-0.021	0.770	0.829
23	LTE Band 4	20M	QPSK	1	0	Back	20050	1720	23.11	23.5	1.094	-0.026	0.979	1.071
24	LTE Band 4	20M	QPSK	1	0	Back	20300	1745	23.3	23.5	1.047	-0.02	1.030	1.079
25	LTE Band 4	20M	QPSK	50	0	Back	20175	1732.5	22.22	22.5	1.067	-0.05	0.733	0.782
26	LTE Band 4	20M	QPSK	100	0	Back	20175	1732.5	22	22.5	1.122	-0.013	0.589	0.661
27	LTE Band 4	20M	QPSK	1	0	Edge 2	20175	1732.5	23.18	23.50	1.076	-0.1	0.353	0.380
28	LTE Band 4	20M	QPSK	50	0	Edge 2	20175	1732.5	22.22	22.5	1.067	0.03	0.211	0.225
29	LTE Band 2	20M	QPSK	1	0	Back	18900	1880	22.38	23	1.153	-0.068	0.374	0.431
30	LTE Band 2	20M	QPSK	50	0	Back	18900	1880	21.34	22	1.164	-0.01	0.240	0.279
31	LTE Band 2	20M	QPSK	1	0	Edge 2	18900	1880	22.38	23	1.153	-0.074	0.102	0.118
32	LTE Band 2	20M	QPSK	50	0	Edge 2	18900	1880	21.34	22	1.164	0.063	0.062	0.072

Note:

1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02.
3. KDB941225D05- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg
4. KDB941225D05- For QPSK with 100% RB allocation, when the reported SAR measured for the Highest output power channel is <1.45 W/kg, tests for the remaining required test channels are optional.
5. KDB941225D05- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg.
6. KDB941225D05- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offset the upper edge, middle and lower edge of each required test channel.
7. KDB941225D05- other channel bandwidths SAR test is required when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.
8. Worst case SAR for 50% RB allocation is selected to be tested.

WLAN2.4G:

Plot No.	Mode	Test Position	CH	Freq. (MHz)	Measure Average Power (dBm)	Tune-Up Power (dBm)	Power Drift (dB)	Scaled Factor	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
33	802.11b	Back	11	2462	15.22	15.5	0.010	1.067	0.395	0.421
34	802.11b	Edge 2	11	2462	15.22	15.5	0.026	1.067	0.775	**0.827**
35	802.11b	Edge 2	1	2412	12.19	12.5	-0.023	1.074	0.286	0.307
36	802.11b	Edge 2	6	2437	14.27	14.5	0.00	1.054	0.317	0.334

Note:
1.When the 1-g SAR is≤ 0.8W/Kg, testing for other channels are optional.
2.When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance.
3.KDB248227-SAR is not required for 802.11g channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

WLAN2.4 GHz 802.11g/n SAR Test Exclusion Requirements

Mode	Tune-Up Power (dBm)	Tune-Up Power (mW)	Reported SAR(W/kg)	Adjusted SAR(W/kg)	Limit (W/kg)	SAR Test Exclusion
802.11b	15.5	35.48	0.827	/	/	/
802.11g	15.5	35.48	/	0.827	1.2	Yes
802.11n HT20	15.5	35.48	/	0.827	1.2	Yes
802.11n HT40	15.0	31.62	/	0.737	1.2	Yes

Note:

KDB 248227 D01-When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

a) When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.

b) 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.

SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg;
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

The Highest Measured SAR Configuration in Each Frequency Band

Body SAR

Frequency Band	Freq.(MHz)	EUT Position	Meas. SAR (W/kg)	
			Original	Repeated
(824-849 MHz) LTE Band 5	829	Body Back	0.911	0.901
(1710-1755 MHz) LTE Band 4	1745	Body Back	1.03	1.1

Note:

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.
2. The measured SAR results **do not** have to be scaled to the maximum tune-up tolerance to determine if repeated measurements are required.
3. SAR measurement variability must be assessed for each frequency band, which is determined by the **SAR probe calibration point and tissue-equivalent medium** used for the device measurements.

Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
LTE + WCDMA	×	×	0
WCDMA + Bluetooth	√	×	23
WCDMA + WLAN	√	√	23
LTE + Bluetooth	√	×	23
LTE + WLAN	√	√	23

Simultaneous SAR test exclusion considerations:

Mode(SAR1+SAR2)	Position	Reported SAR(W/kg)		ΣSAR < 1.6W/kg
		SAR1	SAR2	
WCDMA Band 5 + Bluetooth	Body Back	0.999	0.033	1.032
	Body Edge 2	0.078	0.033	0.111
WCDMA Band 2 + Bluetooth	Body Back	0.320	0.033	0.353
	Body Edge 2	0.072	0.033	0.105
LTE Band 13 + Bluetooth	Body Back	0.382	0.033	0.415
	Body Edge 2	0.099	0.033	0.132
LTE Band 17 + Bluetooth	Body Back	0.339	0.033	0.372
	Body Edge 2	0.076	0.033	0.109
LTE Band 5 + Bluetooth	Body Back	0.983	0.033	1.016
	Body Edge 2	0.473	0.033	0.506
LTE Band 4 + Bluetooth	Body Back	1.079	0.033	**1.112**
	Body Edge 2	0.380	0.033	0.413
LTE Band 2 + Bluetooth	Body Back	0.431	0.033	0.464
	Body Edge 2	0.118	0.033	0.151

Mode(SAR1+SAR2)	Position	Reported SAR(W/kg)		ΣSAR < 1.6W/kg
		SAR1	SAR2	
WCDMA Band 5 + WLAN	Body Back	0.999	0.421	1.42
	Body Edge 2	0.078	0.827	0.905
WCDMA Band 2 + WLAN	Body Back	0.320	0.421	0.741
	Body Edge 2	0.072	0.827	0.899
LTE Band 13 + WLAN	Body Back	0.382	0.421	0.803
	Body Edge 2	0.099	0.827	0.926
LTE Band 17 + WLAN	Body Back	0.339	0.421	0.76
	Body Edge 2	0.076	0.827	0.903
LTE Band 5 + WLAN	Body Back	0.983	0.421	1.404
	Body Edge 2	0.473	0.827	1.3
LTE Band 4 + WLAN	Body Back	1.079	0.421	**1.5**
	Body Edge 2	0.380	0.827	1.207
LTE Band 2 + WLAN	Body Back	0.431	0.421	0.852
	Body Edge 2	0.118	0.827	0.945

APPENDIX A MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the DASY4 measurement system and is given in the following Table.

DASY4 Uncertainty Budget According to IEEE 1528								
Error Description	Uncertainty Value	Prob. Dist.	Div.	(c i) 1g	(c i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v i) veff
Measurement System								
Probe Calibration	± 6.0 %	N	1	1	1	± 6.0 %	± 6.0 %	∝
Axial Isotropy	± 4.7 %	R	$\sqrt{3}$	0.7	0.7	± 1.9 %	± 1.9 %	∝
Hemispherical Isotropy	± 9.6 %	R	$\sqrt{3}$	0.7	0.7	± 3.9 %	± 3.9 %	∝
Boundary Effects	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Linearity	± 4.7 %	R	$\sqrt{3}$	1	1	± 2.7 %	± 2.7 %	∝
System Detection Limits	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∝
Response Time	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %	∝
Integration Time	± 2.6 %	R	$\sqrt{3}$	1	1	± 1.5 %	± 1.5 %	∝
RF Ambient Noise	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
RF Ambient Conditions	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Probe Positioner	± 0.4 %	R	$\sqrt{3}$	1	1	± 0.2 %	± 0.2 %	∝
Probe Positioning	± 2.9 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Max. SAR Eval.	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Test Sample Related								
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 2.6 %	5
Power Drift	± 5.0 %	R		1	1	± 2.9 %	± 2.9 %	∝
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∝
Liquid Conductivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.64	0.43	± 1.8 %	± 1.2 %	∝
Liquid Conductivity (meas.)	± 2.5 %	N	1	0.64	0.43	± 1.6 %	± 1.1 %	∝
Liquid Permittivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.6	0.49	± 1.7 %	± 1.4 %	∝
Liquid Permittivity (Target)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	± 1.0 %	∝
Combined Std. Uncertainty	-	-	-	-	-	± 10.7 %	± 10.4 %	330
Expanded STD Uncertainty	-	-	-	-	-	± 21.4 %	± 20.8 %	-

DASY4 Uncertainty Budget According to IEC 62209-2								
Error Description	Uncertainty Value	Prob. Dist.	Div.	(c i) 1g	(c i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v i) veff
Measurement System								
Probe Calibration	± 6.0 %	N	1	1	1	± 6.0 %	± 6.0 %	∝
Axial Isotropy	± 4.7 %	R	$\sqrt{3}$	0.7	0.7	± 1.9 %	± 1.9 %	∝
Boundary Effects	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Linearity	± 4.7 %	R	$\sqrt{3}$	1	1	± 2.7 %	± 2.7 %	∝
System Detection Limits	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∝
Response Time	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %	∝
Integration Time	± 2.6 %	R	$\sqrt{3}$	1	1	± 1.5 %	± 1.5 %	∝
RF Ambient Noise	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
RF Ambient Conditions	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Probe Positioner	± 0.4 %	R	$\sqrt{3}$	1	1	± 0.2 %	± 0.2 %	∝
Probe Positioning	± 2.9 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Max. SAR Eval.	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Test Sample Related								
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 2.6 %	5
Power Drift	± 5.0 %	R		1	1	± 2.9 %	± 2.9 %	∝
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∝
Liquid Conductivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.64	0.43	± 1.8 %	± 1.2 %	∝
Liquid Conductivity (meas.)	± 2.5 %	N	1	0.64	0.43	± 1.6 %	± 1.1 %	∝
Liquid Permittivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.6	0.49	± 1.7 %	± 1.4 %	∝
Liquid Permittivity (Target)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	± 1.0 %	∝
Combined Std. Uncertainty	-	-	-	-	-	± 10.7 %	± 10.4 %	330
Expanded STD Uncertainty	-	-	-	-	-	± 21.4 %	± 20.8 %	-