

FCC SAR Test Report

FCC ID: QISDIG-LX3

Project No. : 1612C149
Equipment : Smart Phone
Model Name : DIG-L23, DIG-L03
Applicant : Huawei Technologies Co.,Ltd.
Address : Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District Shenzhen China

Date of Receipt : Dec. 14, 2016
Date of Test : Dec. 15, 2016~ Dec. 28, 2016
Issued Date : Jan. 03, 2017
Tested by : BTL Inc.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCC SAR-1-1612C149	Original Issue	Jan. 03, 2017

1. GENERAL SUMMARY

Equipment	Smart Phone
Brand Name	HUAWEI
Model Name	DIG-L23, DIG-L03
Model difference	All hardwares of the model DIG-L23 and DIG-L03 are the same. These two models are only differ in SIM card that DIG-L23 has double cards of SIM 1 and SIM 2, while DIG-L03 has single card SIM 1 by software conductively-closed, model DIG-L23 has been evaluated completed, and the test datas of SIM 1 are re-used to model DIG-L03.
Manufacturer	Huawei Technologies Co., Ltd
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District Shenzhen China
Standard(s)	ANSI Std C95.1-1992 Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991) IEEE Std 1528-2013 Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques KDB941225 D01 3G SAR Procedures v03r01 KDB941225 D05 SAR for LTE Devices v02r05 KDB941225 D06 Hotspot Mode V02r01 KDB447498 D01 General RF Exposure Guidance v06 KDB648474 D04 Handset SAR v01r03 KDB248227 D01 802. 11 Wi-Fi SAR v02r02 KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04 KDB865664 D02 SAR Reporting v01r02 KDB690783 D01 SAR Listings on Grants v01r03

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCC SAR-1612C149) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

2. RF EMISSIONS MEASUREMENT

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **SAR room** at the location of No.3,Jinshagang 1st Road, ShiXia, Dalang Town,Dong Guan, China.523792

2.2 MEASUREMENT UNCERTAINTY

Note: Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

3. GENERAL INFORMATION

3.1 STATEMENT OF COMPLIANCE

Equipment Class	Mode	Highest Head SAR-1g (W/kg)	Highest Body-worn(15mm) SAR-1g(W/kg)*	Highest Hotspot(10mm) SAR-1g(W/kg)
PCE	GSM850	0.33	0.54	1.04
	GSM1900	0.20	0.16	0.43
	UMTS Band 2	0.32	0.37	0.66
	UMTS Band 5	0.36	0.56	0.59
	LTE Band 2	0.25	0.18	0.35
	LTE Band 4	0.39	0.53	1.19
	LTE Band 5	0.27	0.44	0.44
	LTE Band 7	0.30	0.39	1.41
	LTE Band 12	0.24	0.28	0.36
	LTE Band 17 (Note 2)	/	/	/
DTS	2.4G WLAN	0.29	0.02	0.07
Note : The highest reported SAR for head, body-worn accessory, product specific (hotspot), simultaneous transmission exposure conditions are 0.39W/kg, 0.56W/kg, 1.41W/kg and 1.41W/kg respectively.				

Note:

1)* For body-worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and that positions the handset a minimum of 15mm from the body. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The device is in compliance with Specific Absorption Rate(SAR)for general population uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI C95.1:1992/IEEE C95.1:1991, the NCRP Report Number 86 for uncontrolled environment, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 .

2) According to TCB workshop October, 2014 RF Exposure Procedures Update(Overlapping LTE Bands): SAR for LTE Band 17 (Frequency range:704-716 MHz) is covered by LTE Band 12 (Frequency range:699-716 MHz) due to similar frequency range, same maximum tune up limit and same channel bandwidth.

3.2 GENERAL DESCRIPTION OF EUT

Equipment	Smart Phone		
Model Name	DIG-L23, DIG-L03		
IMEI Code	Sample 1	IMEI 1:	863025030008364
		IMEI 2:	863025030008372
	Sample 2	IMEI 1:	863025030006111
		IMEI 2:	863025030006103
	Sample 3	IMEI 1:	863025030006780
		IMEI 2:	863025030006798
	Sample 4	IMEI 1:	863025030003688
		IMEI 2:	863025030003696
S/N	Sample 1	5GA29A704100500	
	Sample 2	5GA29A704100080	
	Sample 3	5GA29A704100488	
	Sample 4	5GC01A704100381	
HW Version	HL1DIGM		
SW Version	Diego-L23C469B005		
Modulation	GSM(GMSK/8PSK),UMTS(QPSK) LTE(QPSK/16QAM),WiFi(DSSS/OFDM), BT(GFSK/ π /4-DQPSK/8-DPSK)		
Operation Frequency Range(s)	Band	TX (MHz)	RX (MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	UMTS Band 2	1850-1910	1930-1990
	UMTS Band 5	824-849	869-894
	LTE Band 2	1850-1910	1930-1990
	LTE Band 4	1710-1755	2110-2155
	LTE Band 5	824-849	869-894
	LTE Band 7	2500-2570	2620-2690
	LTE Band 12	699-716	729-746
	LTE Band 17	704-716	734-746
	Bluetooth	2400 ~2483.5	
	2.4GWIFI	2400 ~2483.5	
GPRS/EDGE Multislot Class(12)	Max Number of Timeslots in Uplink:		4
	Max Number of Timeslots in Downlink:		4
	Max Total Timeslot:		5
GSM Device class	Class B		
HSDPA UE Category	14		
HSUPA UE Category	6		
DC-HSDPA UE Category	24		
Power Class:	4, tested with power level 5(GSM850)		
	1, tested with power level 0(GSM1900)		
	3, tested with power control “all 1”(UMTS Band 2/4/5)		
	3, tested with power control “all Max” (LTE Band 2/4/5/7/12/17)		

Test Channels (low-mid-high):	128-190-251 (GSM850)
	512-661-810 (GSM1900)
	9262-9400-9538(UMTS Band 2)
	4132-4182-4233 (UMTS Band 5)
	18700-18900-19100(LTE Band 2 BW=20MHz)
	20050-20175-20300(LTE Band 4 BW=20MHz)
	20450-20525-20600(LTE Band 5 BW=10MHz)
	20850-21100-21350(LTE Band 7 BW=20MHz)
	23060-23095-23130(LTE Band 12 BW=10MHz)
	23780-23790-23800(LTE Band 17 BW=10MHz)
	1-6 -11 (2.4G WIFI 802.11b/g/n HT20)
	00-39-78(Bluetooth EDR)
	00-19-39(Bluetooth Low Energy)
Other Information	
Battery	Huawei Technologies Co., Ltd. Battery Model: HB405979ECW Rated capacity: 2920mAh Nominal Voltage:  +3.82V Charging Voltage:  +4.4V 1. Sunwoda Electronic Co., LTD 2. Desay Battery Co., Ltd.
	1. JIANGXI LIANCHUANG HONGSHENG ELECTRONIC CO., LTD 2. BOLUO COUNTY QUANCHENG ELECTRONIC CO., LTD 3. Goer Tek Inc 4. MERRY ELECTRONICS (SHENZHEN) CO., LTD.
Earphone	

3.3 LABORATORY ENVIRONMENT

Temperature	Min. = 18°C, Max. = 25°C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

3.4 MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	Data Acquisition Electronics	Speag	DAE4	1390	Sep. 22, 2016	1 Year
2	E-field Probe	Speag	EX3DV4	3932	Feb. 19, 2016	1 Year
3	System Validation Dipole	Speag	D750V3	1095	Sep. 30, 2015	3 Years
4	System Validation Dipole	Speag	D835V2	4d160	Sep. 30, 2015	3 Years
5	System Validation Dipole	Speag	D1750V2	1101	Sep. 22, 2015	3 Years
6	System Validation Dipole	Speag	D1900V2	5d179	Sep. 29, 2015	3 Years
7	System Validation Dipole	Speag	D2450V2	919	Sep. 28, 2015	3 Years
8	System Validation Dipole	Speag	D2600V2	1067	Sep. 28, 2015	3 Years
9	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1784	N/A	N/A
10	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1896	N/A	N/A
11	8960 Series 10 Wireless Co m Test set	Agilent	E5515E	MY52112163	Sep. 04, 2016	1 Year
12 *	CMW500-Wideband Radio Communication Tester	RS	CMW500	152366	Mar. 27, 2016	1Year
13	CMW500-Wideband Radio Communication Tester	RS	CMW500	153083	May.04,2016	1Year
14	Power Amplifier	Mini-Circuits	ZHL-42W+	QA1333003	N/A	N/A
15	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 27, 2016	1 Year
16	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Sep. 04, 2016	1 Year
17	P-series power meter	Agilent	N1911A	MY45100473	Sep. 04, 2016	1 Year
18	wideband power sensor	Agilent	N1921A	MY51100041	Sep. 04, 2016	1 Year
19	power Meter	Anritsu	ML2495A	1128009	Mar. 27, 2016	1 Year
20	Pulse Power Sensor	Anritsu	MA 2411B	1027500	Mar. 27, 2016	1 Year
21	Dielectric Assessment Kit	Speag	DAK-3.5	1226	N/A	N/A
22	Dual directional coupler	Woken	TS-PCC0M-05	107090019	Mar. 16, 2016	1 Year

Remark: 1. "N/A" denotes no model name, serial No. or calibration specified.

2. 1) Per KDB865664 D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

- There is no physical damage on the dipole;
- System check with specific dipole is within 10% of calibrated value;
- The most recent return-loss result , measured at least annually, deviates by no more than 20% from the previous measurement;
- The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5 Ω from the previous measurement.

2) Network analyzer probe calibration against air, distilled water and a short block performed before measuring liquid parameters.

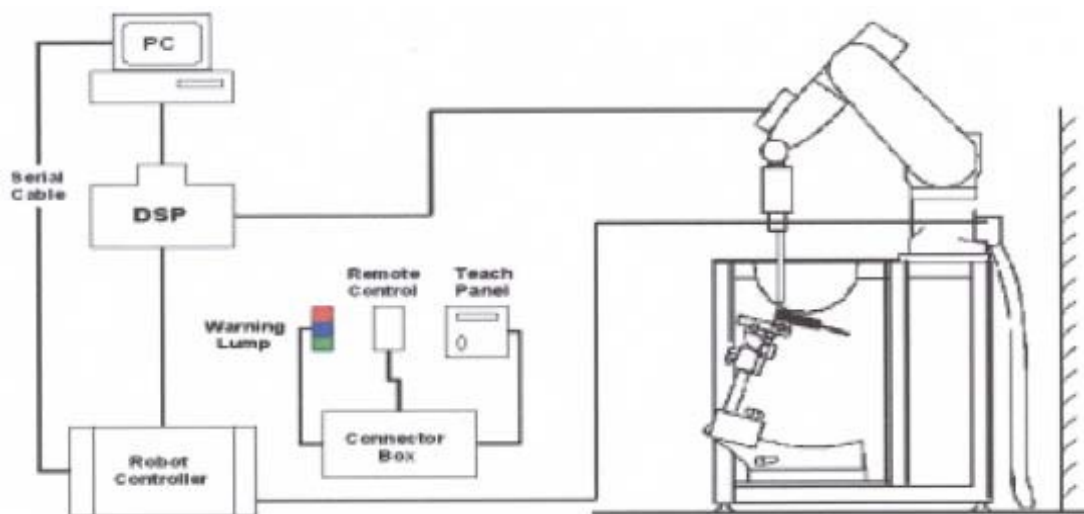
4. SAR MEASUREMENTS SYSTEM CONFIGURATION

4.1 SAR MEASUREMENT SET-UP

The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (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.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 7
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

4.1.1 Test Setup Layout

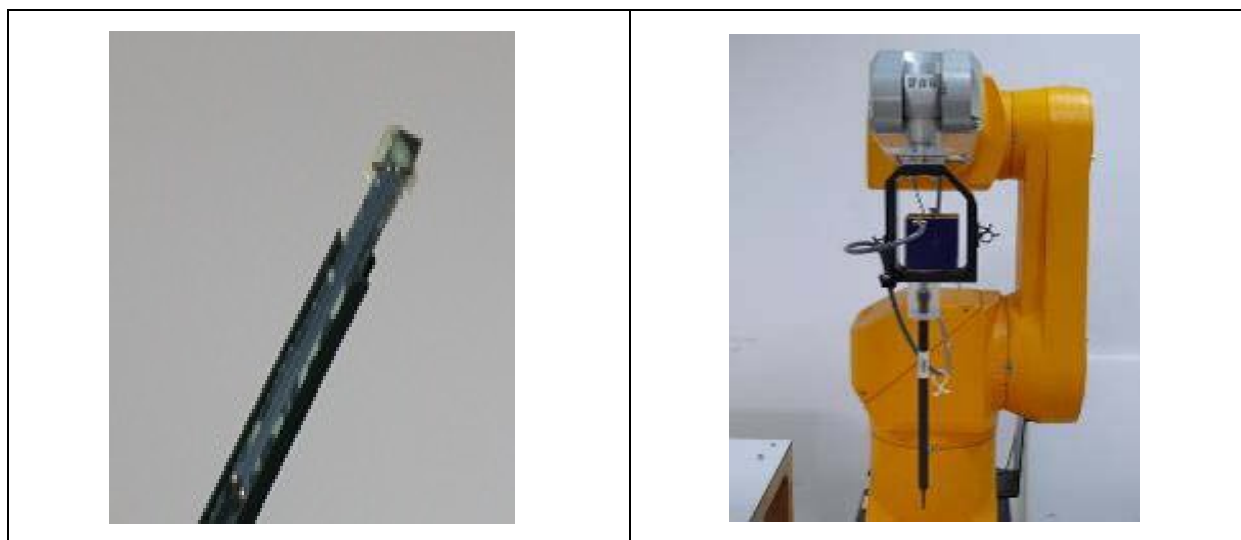


4.2 DASY5E-FIELDPROBESYSTEM

The SAR measurements were conducted with the dosimetric probe EX3DV4(manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

4.2.1 EX3DV4 PROBE SPECIFICATION

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 μ W/g to > 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm



EX3DV4 E-field Probe

4.2.2 E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated and found to be better than $\pm 0.25\text{dB}$. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where: Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

4.2.3 OTHER TEST EQUIPMENT

4.2.3.1. Device Holder for Transmitters

Construction: Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is light weight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

Material: POM, Acrylic glass, Foam

4.2.3.2 Phantom

Model	ELI4 Phantom	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Shell Thickness	2±0.1 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Length: 600 mm ; Width: 190mm Height: adjustable feet	
Available	Special	

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000mm; Width: 500mm Height: adjustable feet	
Available	Special	

4.2.4 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. $\pm 5\%$.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)

- Area Scan

The “area scan” measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension ($\leq 2\text{GHz}$), 12 mm in x- and y- dimension (2-4 GHz) and 10mm in x- and y- dimension (4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.

- Zoom Scan

A “zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous “coarse” scan. This is a fine grid with maximum scan spatial resolution: $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}} \leq 2\text{GHz} - \leq 8\text{mm}$, 2-4GHz $- \leq 5\text{mm}$ and 4-6 GHz $- \leq 4\text{mm}$; $\Delta z_{\text{zoom}} \leq 3\text{GHz} - \leq 5\text{mm}$, 3-4 GHz $- \leq 4\text{mm}$ and 4-6GHz $- \leq 2\text{mm}$ where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in Appendix B. Test results relevant for the specified standard (see chapter 1.4.) are shown in table form in chapter 7.2.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2 mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth.

The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

Frequency	Maximun Area Scan resolution ($\Delta x_{\text{area}}, \Delta y_{\text{area}}$)	Maximun Zoom Scan spatial resolution ($\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$)	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{\text{Zoom}}(n)$	$\Delta z_{\text{Zoom}}(1)^*$	$\Delta z_{\text{Zoom}}(n>1)^*$	
$\leq 2\text{GHz}$	$\leq 15\text{mm}$	$\leq 8\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 30\text{mm}$
2-3GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 30\text{mm}$
3-4GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 28\text{mm}$
4-5GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 2.5\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 25\text{mm}$
5-6GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 2\text{mm}$	$\leq 2\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 22\text{mm}$

4.2.5 SPATIAL PEAK SAR EVALUATION

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 5 x 5 x 7 points(with 8mm horizontal resolution) or 7 x 7 x 7 points(with 5mm horizontal resolution) or 8 x 8 x 7 points(with 4mm horizontal resolution). The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting "Graph Evaluated".
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY5 uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

4.2.6 DATA STORAGE AND EVALUATION

4.2.6.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

4.2.7 Data Evaluation by SEMCAD

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

Probe parameters:	Sensitivity	Normi, a_{i0} , a_{i1} , a_{i2}
	Conversion factor	ConvF _i
	Diode compression point	Dcp _i
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multi meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With	V_i = compensated signal of channel i	(i = x, y, z)
	U_i = input signal of channel i	(i = x, y, z)
	cf = crest factor of exciting field	(DASY parameter)
	dcp _i = diode compression point	(DASY parameter)

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

$$\text{E-field probes: } E_i = (V_i / \text{Norm}_i \cdot \text{ConvF})^{1/2}$$

$$\text{H-field probes: } H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2) / f$$

With V_i = compensated signal of channel i (i = x, y, z)

Norm_i = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)²] for E-field Probes

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

$$E_{\text{tot}} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$\text{SAR} = (E_{\text{tot}})^2 \cdot \sigma / (\rho \cdot 1000)$$

With SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m
= conductivity in [mho/m] or [Siemens/m]
= equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{\text{pwe}} = E_{\text{tot}}^2 / 3770 \text{ or } P_{\text{pwe}} = H_{\text{tot}}^2 \cdot 37.7$$

With P_{pwe} = equivalent power density of a plane wave in mW/cm²

E_{tot} = total field strength in V/m

H_{tot} = total magnetic field strength in A/m

5. SYSTEM VERIFICATION PROCEDURE

5.1 TISSUE VERIFICATION

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

The following materials are used for producing the tissue-equivalent materials.

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Head 750	0.2	-	0.2	1.5	56.0	-	42.1	-
Head 835	0.2	-	0.2	1.5	57.0	-	41.1	-
Head 1750	-	47.0	-	0.4	-	-	52.6	-
Head 1900	-	44.5	-	0.2	-	-	55.3	-
Head 2450	-	45.0	-	0.1	-	-	54.9	-
Head 2600	-	45.1	-	0.1	-	-	54.8	-

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Body 750	0.2	-	0.2	0.8	48.8	-	50.0	-
Body 835	0.2	-	0.2	0.9	48.5	-	50.2	-
Body 1750	-	31.0	-	0.2	-	-	68.8	-
Body 1900	-	29.5	-	0.3	-	-	70.2	-
Body 2450	-	31.4	-	0.1	-	-	68.5	-
Body 2600	-	31.8	-	0.1	-	-	68.1	-

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M + resistivity
 HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
 Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Tissue Verification									
Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (σ) (%)	Deviation Permittivity (εr) (%)	Date
Head	750	22.1	0.905	41.130	0.89	41.9	1.69	-1.84	Dec. 22, 2016
Head	835	22.4	0.892	42.420	0.90	41.5	-0.89	2.22	Dec. 15, 2016
Head	835	22.4	0.928	43.130	0.90	41.5	3.11	3.93	Dec. 21, 2016
Head	1750	22.3	1.408	41.230	1.37	40.1	2.77	2.82	Dec. 23, 2016
Head	1900	22.1	1.388	41.880	1.40	40.0	-0.86	4.70	Dec. 16, 2016
Head	1900	22.3	1.425	39.380	1.40	40.0	1.79	-1.55	Dec. 23, 2016
Head	2450	22.3	1.835	39.070	1.80	39.2	1.94	-0.33	Dec. 25, 2016
Head	2600	22.3	2.057	37.960	1.96	39.0	4.95	-2.67	Dec. 23, 2016
Body	750	22.2	0.974	56.620	0.96	55.5	1.46	2.02	Dec. 24, 2016
Body	835	22.4	1.008	55.790	0.97	55.2	3.92	1.07	Dec. 19, 2016
Body	835	22.3	1.017	55.710	0.97	55.2	4.85	0.92	Dec. 28, 2016
Body	1750	22.3	1.529	52.410	1.49	53.4	2.62	-1.85	Dec. 25, 2016
Body	1900	22.3	1.527	52.640	1.52	53.3	0.46	-1.24	Dec. 18, 2016
Body	1900	22.2	1.554	51.920	1.52	53.3	2.24	-2.59	Dec. 27, 2016
Body	2450	22.1	1.976	51.630	1.95	52.7	1.33	-2.03	Dec. 26, 2016
Body	2600	22.1	2.234	52.460	2.16	52.5	3.43	-0.08	Dec. 26, 2016

Note:

- 1)The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.
- 2)KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
- 3)The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

5.2 SYSTEM CHECK

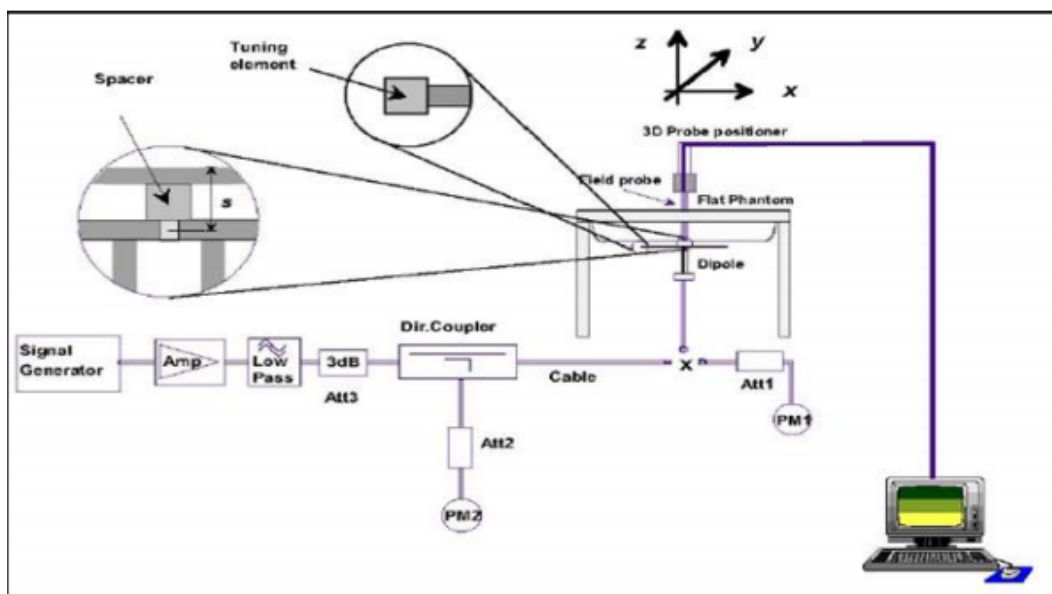
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests.

System Check	Date	Frequency (MHz)	Targeted SAR-1g (W/kg)	Measured SAR-1g (W/kg)	normalized SAR-1g (W/kg)	Deviation (%)	Dipole S/N
Head	Dec. 22, 2016	750	8.27	2.08	8.32	0.60	1095
Head	Dec. 15, 2016	835	9.50	2.27	9.08	-4.42	4d160
Head	Dec. 21, 2016	835	9.50	2.35	9.40	-1.05	4d160
Head	Dec. 23, 2016	1750	36.60	8.86	35.44	-3.17	1101
Head	Dec. 16, 2016	1900	39.70	9.93	39.72	0.05	5d179
Head	Dec. 23, 2016	1900	39.70	9.32	37.28	-6.10	5d179
Head	Dec. 25, 2016	2450	52.00	13.40	53.60	3.08	919
Head	Dec. 23, 2016	2600	56.80	14.00	56.00	-1.41	1067
Body	Dec. 24, 2016	750	8.65	2.18	8.72	0.81	1095
Body	Dec. 19, 2016	835	9.52	2.50	10.00	5.04	4d160
Body	Dec. 28, 2016	835	9.52	2.33	9.32	-2.10	4d160
Body	Dec. 25, 2016	1750	35.70	9.17	36.68	2.75	1101
Body	Dec. 18, 2016	1900	39.60	9.69	38.76	-2.12	5d179
Body	Dec. 27, 2016	1900	39.60	10.30	41.20	4.04	5d179
Body	Dec. 26, 2016	2450	51.10	12.50	50.00	-2.15	919
Body	Dec. 26, 2016	2600	54.10	13.80	55.20	2.03	1067

5.3 SYSTEM CHECK PROCEDURE

The system check is performed by using a system check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250 mW(below 5GHz) or 100mW(above 5GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system check to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test.

System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system ($\pm 10\%$).



6. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

6.1 SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, 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. The 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; steps 2) through 4) do not apply.
- 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 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.

The detailed repeated measurement results are shown in Section 8.2.

7. OPERATIONAL CONDITIONS DURING TEST

7.1 SAR TEST CONFIGURATION

7.1.1 GSM TEST CONFIGURATION

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using 8960 Series the power lever is set to “5” and “0” in SAR of GSM850 and GSM1900. The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5. When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot.

The allowed power reduction in the multi-slot configuration is as following:

Number of timeslots in uplink assignment		Reduction of maximum output power (dB)		
Band	Time Slots	GPRS (GMSK)	EGPRS (GMSK)	EGPRS (8PSK)
GSM850	1 TX slot	0	0	0
	2 TX slots	1	1	1
	3 TX slots	3	3	3
	4 TX slots	4	4	4
GSM1900	1 TX slot	0	0	0
	2 TX slots	1	1	1
	3 TX slots	3	3	3
	4 TX slots	4	4	4

7.1.2 UMTS TEST CONFIGURATION

1. Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the procedures description in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1s" for WCDMA/HSDPA or applying the required inner loop power control procedure to maintain maximum output power while HSUPA is active. Result for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) Should be tabulated in the SAR report. All configuration that are not supported by the DUT or cannot be measured due to technical or equipment limitation should be clearly identified.

2. WCDMA

(1). Head SAR Measurements

SAR for Head exposure configurations in voice mode is measured using a 12.2 kbps RMC with TPC bits configured to all "1s". SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than ¼ dB higher than that measured in 12.2 kbps RMC. Otherwise SAR is measured on the maximum output channel in 12.2 kbps AMR with 3.4 kbps SRB (signalling radio bearer) using the exposure configuration that results in the highest SAR in 12.2 kbps RMC for that RF channel.

(2). Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all "1s". SAR for other spreading codes and multiple DPDCHn, when supported by the EUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCHn configuration, are less than ¼ dB higher than those measured in 12.2 kbps RMC.

3. HSDPA

SAR for body exposure configurations is measured according to the "Body SAR Measurements" procedures of 3G device. In addition, body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the

below table, β_{hs} for HS-DPCCH is set automatically to the correct value when ΔACK , $\Delta NACK$,

$\Delta CQI = 8$. The variation of the β_c / β_d ratio causes a power reduction at sub-tests 2 - 4.

Sub-test ^o	β_c ^o	β_d ^o	β_d (SF) ^o	β_c / β_d ^o	β_{hs} (1) ^o	CM(dB)(2) ^o	MPR (dB) ^o
1 ^o	2/15 ^o	15/15 ^o	64 ^o	2/15 ^o	4/15 ^o	0.0 ^o	0 ^o
2 ^o	12/15(3) ^o	15/15(3) ^o	64 ^o	12/15(3) ^o	24/15 ^o	1.0 ^o	0 ^o
3 ^o	15/15 ^o	8/15 ^o	64 ^o	15/8 ^o	30/15 ^o	1.5 ^o	0.5 ^o
4 ^o	15/15 ^o	4/15 ^o	64 ^o	15/4 ^o	30/15 ^o	1.5 ^o	0.5 ^o

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs} / \beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM=1 for $\beta_c / \beta_d = 12/15$, $\beta_{hs} / \beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.^o

Note 3: For subtest 2 the β_c / β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$ ^o

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Settings of required H-Set 1 QPSK acc. to 3GPP 34.121

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI"s
Number of HARQ Processes	2 Processes
Information Bit Pay load	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

HSDPA UE category

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum HS-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

4. HSUPA

SAR for Body exposure configurations is measured according to the “Body SAR Measurements” procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq 1/4$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the primary mode and the adjusted SAR is $\leq 1.2W/kg$, SAR measurement is not required for the secondary mode.

Per KDB941225 D01, the 3G SAR test reduction procedures is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures for the highest reported body exposure SAR configuration in 12.2 kbps RMC.

Due to inner loop power control requirements in HSUPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSDPA should be configured according to the values indicated below as well as other applicable procedures described in the “WCDMA Handset” and „Release 5 HSDPA Data Device” sections of 3G device.

Subtests for WCDMA Release 6 HSUPA

Sub-test [ⓐ]	$\beta_{c\text{ⓐ}}$	$\beta_{d\text{ⓐ}}$	β_d (SF) [ⓐ]	β_c/β_d [ⓐ]	$\beta_{hs}^{(1)\text{ⓐ}}$	$\beta_{ec\text{ⓐ}}$	$\beta_{ed\text{ⓐ}}$	$\beta_{e\text{ⓐ}}$ (SF) [ⓐ]	$\beta_{ed\text{ⓐ}}$ (code) [ⓐ]	CM ^{(2)ⓐ} (dB) [ⓐ]	MP R [ⓐ] (dB) [ⓐ]	AG ^{(4)ⓐ} Index [ⓐ]	E-TFC I [ⓐ]
1 [ⓐ]	11/15 ^{(3)ⓐ}	15/15 ^{(3)ⓐ}	64 [ⓐ]	11/15 ^{(3)ⓐ}	22/15 [ⓐ]	209/225 [ⓐ]	1039/225 [ⓐ]	4 [ⓐ]	1 [ⓐ]	1.0 [ⓐ]	0.0 [ⓐ]	20 [ⓐ]	75 [ⓐ]
2 [ⓐ]	6/15 [ⓐ]	15/15 [ⓐ]	64 [ⓐ]	6/15 [ⓐ]	12/15 [ⓐ]	12/15 [ⓐ]	94/75 [ⓐ]	4 [ⓐ]	1 [ⓐ]	3.0 [ⓐ]	2.0 [ⓐ]	12 [ⓐ]	67 [ⓐ]
3 [ⓐ]	15/15 [ⓐ]	9/15 [ⓐ]	64 [ⓐ]	15/9 [ⓐ]	30/15 [ⓐ]	30/15 [ⓐ]	$\beta_{ed1}:47/15$ [ⓐ] $\beta_{ed2}:47/15$ [ⓐ]	4 [ⓐ]	2 [ⓐ]	2.0 [ⓐ]	1.0 [ⓐ]	15 [ⓐ]	92 [ⓐ]
4 [ⓐ]	2/15 [ⓐ]	15/15 [ⓐ]	64 [ⓐ]	2/15 [ⓐ]	4/15 [ⓐ]	2/15 [ⓐ]	56/75 [ⓐ]	4 [ⓐ]	1 [ⓐ]	3.0 [ⓐ]	2.0 [ⓐ]	17 [ⓐ]	71 [ⓐ]
5 [ⓐ]	15/15 ^{(4)ⓐ}	15/15 ^{(4)ⓐ}	64 [ⓐ]	15/15 ^{(4)ⓐ}	30/15 [ⓐ]	24/15 [ⓐ]	134/15 [ⓐ]	4 [ⓐ]	1 [ⓐ]	1.0 [ⓐ]	0.0 [ⓐ]	21 [ⓐ]	81 [ⓐ]
Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_{c\text{ⓐ}}$ Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference [ⓐ] Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$ [ⓐ] Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$ [ⓐ] Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g [ⓐ] Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value. [ⓐ]													

HSUPA UE category

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF4	22996	?
	4	4	10		20000	?

NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM. (TS25.306-7.3.0).

5. DC-HSDPA

In DC-HSDPA implementation of this device, the uplink parameters are the same as HSDPA. No additional channels and modulations (16 QAM, and 64 QAM) are supported in uplink. The difference is only in the downlink parameters, where two carriers are supported. HSDPA settings were used on uplink.

For Rel. 8 DC-HSDPA apply the four subtests from HSDPA Release 5 except use fixed reference channel H-Set 12 for DC-HSDPA. And we can apply the same SAR test exclusion criteria used for Rel. 6 HSPA for Rel. 7 HSPA+ and Rel. 8 DC-HSDPA. That is, if the HSPA, HSPA+, or the DC-HSDPA maximum output is not more than 0.25 dB higher than WCDMA, SAR measurement for those modes is not required.

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS 34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0 Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

The measurements were performed with a Fixed Reference Channel (FRC) H-Set 12 with QPSK

Parameter	Value
Nominal average inf. bit rate	60 kbit/s
Inter-TTI Distance	1 TTI"s
Number of HARQ Processes	6 Processes
Information Bit Payload	120 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	960 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	3200 SMLs
Coding Rate	0.15
Number of Physical Channel Codes	1

Note:

1.The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table above.

2.Maximum number of transmission is limited to 1,i.e.,retransmission is not allowed. The redundancy and constellation version 0 shall be used.

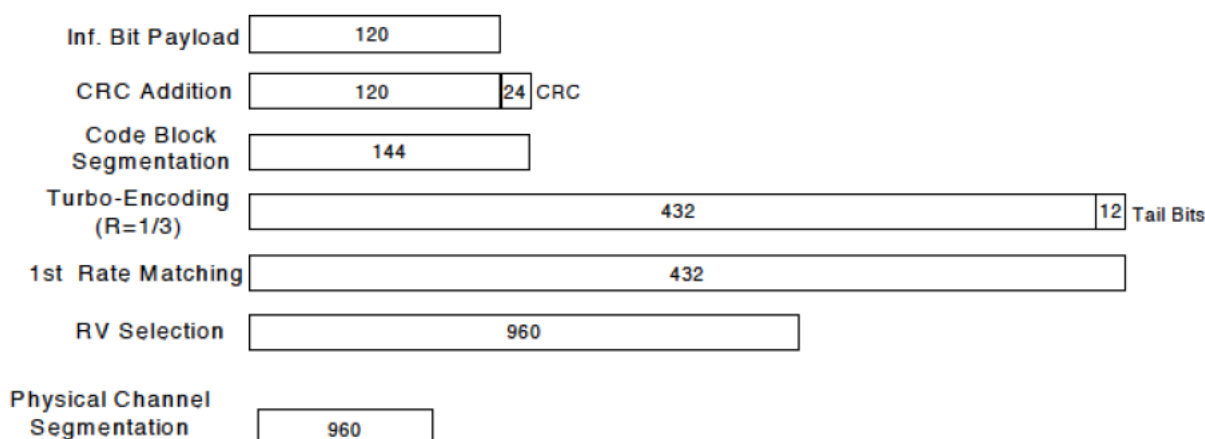


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 5 procedures. A summary of subtest settings are illustrated below:

Sub-test ¹	β_c ²	β_d ²	β_d (SF) ²	β_c/β_d ²	$\beta_{hs}(1)$ ²	CM(dB)(2) ²	MPR (dB) ²
1 ²	2/15 ²	15/15 ²	64 ²	2/15 ²	4/15 ²	0.0 ²	0 ²
2 ²	12/15(3) ²	15/15(3) ²	64 ²	12/15(3) ²	24/15 ²	1.0 ²	0 ²
3 ²	15/15 ²	8/15 ²	64 ²	15/8 ²	30/15 ²	1.5 ²	0.5 ²
4 ²	15/15 ²	4/15 ²	64 ²	15/4 ²	30/15 ²	1.5 ²	0.5 ²

Note 1: Δ ACK, Δ NACK and Δ CQI=8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$
Note 2: CM=1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$

Up commands are set continuously to set the UE to Max power.

Note:

- 1.The Dual Carriers transmission only applies to HSDPA physical channels
- 2.The Dual Carriers belong to the same Node and are on adjacent carriers.
- 3.The Dual Carriers do not support MIMO to serve UEs configured for dual cell operation
- 4.The Dual Carriers operate in the same frequency band .
- 5.The device doesn't support the modulation of 16QAM in uplink but 64QAM in downlink for DC-HSDPA mode.
- 6.The device doesn't support carrier aggregation for it just can operate in Release 8.

7.1.3 LTE TEST CONFIGURATION

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices. The CMW500 Wide Band Radio Communication Tester was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR test were performed with the same number of RB and RB offsets transmitting on all TTI frames(Maximum TTI)

1. Spectrum Plots for RB configurations

A properly configured base station simulator was used for LTE output power measurements and SAR testing. Therefore, spectrum plots for RB configurations were not required to be included in this report.

2. MPR

When MPR is implemented permanently within the UE, regardless of network requirements, only those RB configurations allowed by 3GPP for the channel bandwidth and modulation combinations may be tested with MPR active. Configurations with RB allocations less than the RB thresholds required by 3GPP must be tested without MPR.

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

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

Modulation	Channel bandwidth / Transmission bandwidth (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

3. A-MPR

A-MPR(Additional MPR) has been disabled for all SAR tests by using Network Signalling Value of "NS_01" on the base station simulator.

4. LTE procedures for SAR testing

A) Largest channel bandwidth standalone SAR test requirements

i) QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

ii) QPSK with 50% RB allocation

The procedures required for 1 RB allocation in i) are applied to measure the SAR for QPSK with 50% RB allocation

iii) QPSK with 100% RB allocation

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 in i) and ii) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

iv) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is $> \frac{1}{2}$ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

B) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is $> \frac{1}{2}$ 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.

7.1.4 WIFI TEST CONFIGURATION

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal.

Mode	802.11b	802.11g	802.11n HT20
Duty cycle	100%		
Crest factor	1		

For WiFi SAR testing, a communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227 D01 are applied.

7.1.4.1 2.4G SAR Test Requirements

802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

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.

- 1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) 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.

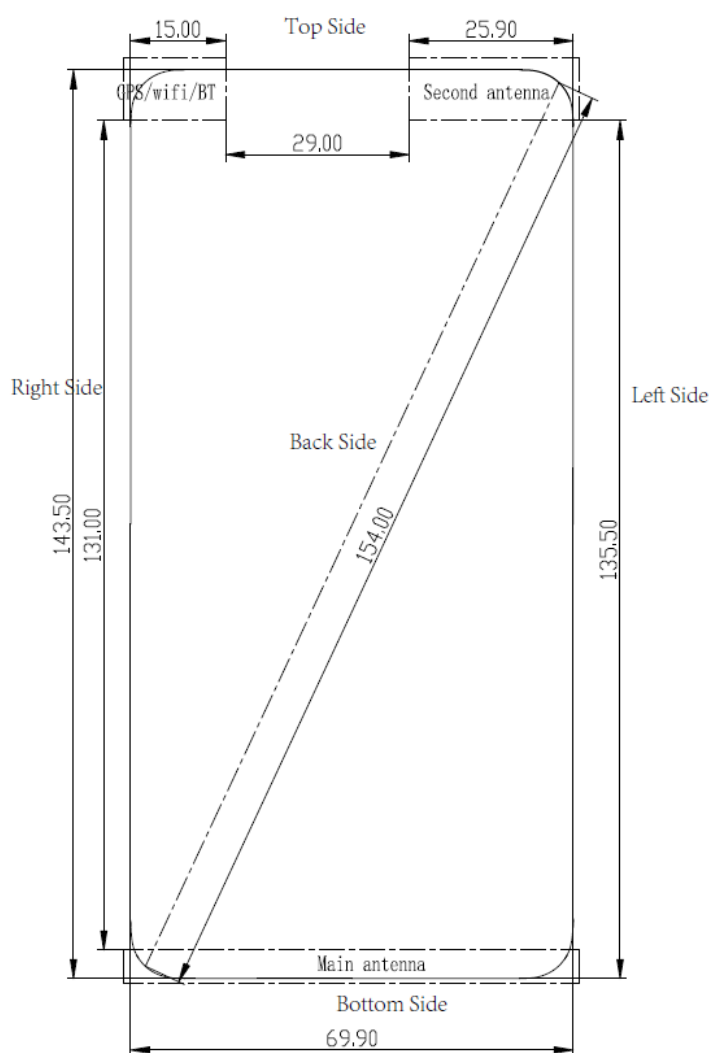
7.2 TEST POSITION

7.2.1 Head test configuration

Measurements were made in “cheek” and “tilt” positions on both the left hand and right hand sides of the phantom.

7.2.2 Body test configuration

The location of the antennas inside mobile phone is shown as below picture:



The length of the diagonal of the mobile phone is 154.00mm.

Table 7.2.2 Sides For Hotspot Testing

Mode	Exposure Condition	Front Side	Rear Side	Left Side	Right Side	Top Side	Bottom Side
2G/3G/4G	Hotspot	YES	YES	YES	YES	NO	YES
2.4GWiFi	Hotspot	YES	YES	NO	YES	YES	NO

Note: Per KDB 941225 D06, particular DUT edges were not required to be evaluated for Hotspot SAR if the antenna-to-edge distance is greater than 2.5cm.

8.TEST RESULT

8.1 CONDUCTED POWER RESULTS

8.1.1 CONDUCTED POWER MEASUREMENTS OF GSM850

1) Conducted power measurement results of GSM850

GSM850		Tune-up	Max Burst Average Power (dBm)			Tune-up	Max Frame Average Power (dBm)		
			128CH	190CH	251CH		128CH	190CH	251CH
			824.2MHz	836.6MHz	848.8MHz		824.2MHz	836.6MHz	848.8MHz
GSM (CS)		34.20	33.74	33.51	33.68	25.01	24.55	24.32	24.49
GPRS/ EDGE (GMSK)	1 Tx Slot	34.20	33.74	33.51	33.68	25.01	24.55	24.32	24.49
	2 Tx Slots	33.20	32.81	32.64	32.77	27.07	26.68	26.51	26.64
	3 Tx Slots	31.20	30.28	30.15	30.17	26.78	25.86	25.73	25.75
	4 Tx Slots	30.20	28.83	28.94	28.78	27.02	25.65	25.76	25.60
EDGE (8PSK)	1 Tx Slot	27.50	26.03	26.04	26.08	18.31	16.84	16.85	16.89
	2 Tx Slots	26.50	24.93	24.91	24.95	20.37	18.80	18.78	18.82
	3 Tx Slots	24.50	22.96	22.97	23.01	20.08	18.54	18.55	18.59
	4 Tx Slots	23.50	21.95	21.64	22.03	20.32	18.77	18.46	18.85

Note:

- 1) The conducted power of GSM850 is measured with RMS detector.
- 2) Frame-averaged output power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 time slots.
- 3) Per KDB941225 D01, the bolded GPRS2Tx mode was selected for SAR testing according to the highest frame –averaged output power table.
- 4) The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:

Frame-averaged power=10 x log(Burst-averaged power mW x Slot used/8)

8.1.2 CONDUCTED POWER MEASUREMENTS OF GSM1900

1) Conducted power measurement results of GSM1900

GSM1900		Tune-up	Max Burst Average Power (dBm)			Tune-up	Max Frame Average Power (dBm)		
			512CH	661CH	810CH		512CH	661CH	810CH
			1850.2MHz	1880MHz	1909.8MHz		1850.2MHz	1880MHz	1909.8MHz
GSM (CS)		31.30	30.42	30.34	30.32	22.11	21.23	21.15	21.13
GPRS /EDGE (GMSK)	1 Tx Slot	31.30	30.42	30.34	30.32	22.11	21.23	21.15	21.13
	2 Tx Slots	30.30	29.87	30.08	30.06	24.17	23.74	23.95	23.93
	3 Tx Slots	28.30	27.73	27.84	27.86	23.88	23.31	23.42	23.44
	4 Tx Slots	27.30	26.37	26.43	26.41	24.12	23.19	23.25	23.23
EDGE (8PSK)	1 Tx Slot	27.00	26.85	26.11	26.03	17.81	17.66	16.92	16.84
	2 Tx Slots	26.00	24.73	24.76	24.97	19.87	18.60	18.63	18.84
	3 Tx Slots	24.00	22.37	22.44	22.72	19.58	17.95	18.02	18.30
	4 Tx Slots	23.00	21.11	21.24	21.35	19.82	17.93	18.06	18.17

Note:

- 1) The conducted power of GSM1900 is measured with RMS detector.
- 2) Frame-averaged output power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 time slots.
- 3) Per KDB941225 D01, the bolded GPRS 2Tx mode was selected for SAR testing according to the highest frame –averaged output power table.
- 4) The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:

Frame-averaged power=10 x log(Burst-averaged power mW x Slot used/8)

8.1.3 CONDUCTED POWER MEASUREMENTS OF UMTS Band 2

1) Conducted power measurement results of UMTS Band 2

UMTS Band 2		Tune-up	SAR Conducted Power (dBm)		
			9262CH	9400CH	9538CH
			1852.4	1880	1907.6
WCDMA	12.2kbps RMC	23.50	22.48	22.41	22.32
	12.2kbps AMR	23.50	22.47	22.39	22.30
	64kbps RMC	23.50	22.49	22.39	22.33
	144kbps RMC	23.50	22.46	22.43	22.31
	384kbps RMC	23.50	22.47	22.38	22.32
HSDPA	Subtest 1	23.00	21.51	21.45	21.29
	Subtest 2	23.00	21.43	21.34	21.28
	Subtest 3	22.00	20.97	20.99	20.79
	Subtest 4	22.00	20.98	20.91	20.76
HSUPA	Subtest 1	22.00	21.28	21.26	21.07
	Subtest 2	21.50	20.51	20.44	20.29
	Subtest 3	22.00	20.54	20.54	20.33
	Subtest 4	21.50	19.88	19.92	19.72
	Subtest 5	22.00	21.35	21.40	21.32
DC-HSDPA	Subtest 1	23.00	21.51	21.45	21.29
	Subtest 2	23.00	21.43	21.34	21.28
	Subtest 3	22.00	20.97	20.99	20.79
	Subtest 4	22.00	20.98	20.91	20.76

HSPA+

Since 16QAM is not used for uplink, the uplink category and release is same as HSUPA, i.e., CAT6 Rel 6. Therefore, the RF conducted power is not measured.

Note:

1) The conducted power of UMTS Band 2 is measured with RMS detector.

2) Note: Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

8.1.4 CONDUCTED POWER MEASUREMENTS OF UMTS Band 5

1) Conducted power measurement results of UMTS Band 5

UMTS Band 5		Tune-up	SAR Conducted Power (dBm)		
			4132CH	4182CH	4233CH
			826.4	836.4	846.6
WCDMA	12.2kbps RMC	24.50	23.58	23.68	23.81
	12.2kbps AMR	24.50	23.55	23.67	23.78
	64kbps RMC	24.50	23.55	23.67	23.76
	144kbps RMC	24.50	23.56	23.68	23.75
	384kbps RMC	24.50	23.55	23.69	23.74
HSDPA	Subtest 1	24.00	22.62	22.67	22.79
	Subtest 2	24.00	22.61	22.62	22.63
	Subtest 3	23.00	22.06	22.09	22.13
	Subtest 4	23.00	22.11	22.20	22.23
HSUPA	Subtest 1	23.00	22.12	22.19	22.17
	Subtest 2	22.50	21.53	21.63	21.76
	Subtest 3	23.00	21.68	21.73	21.74
	Subtest 4	22.50	21.04	21.09	21.04
	Subtest 5	23.00	21.99	21.93	22.11
DC-HSDPA	Subtest 1	24.00	22.62	22.67	22.79
	Subtest 2	24.00	22.61	22.62	22.63
	Subtest 3	23.00	22.06	22.09	22.13
	Subtest 4	23.00	22.11	22.20	22.23

HSPA+

Since 16QAM is not used for uplink, the uplink category and release is same as HSUPA,i.e,CAT6 Rel 6. Therefore,the RF conducted power is not measured.

Note:

1) The conducted power of UMTS Band 5 is measured with RMS detector.

2)Note: Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

8.1.5 CONDUCTED POWER MEASUREMENTS OF LTE Band 2

1) Conducted power measurement results of LTE Band 2

FDD LTE B2					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18607	18900	19193
					1850.7	1880	1909.3
1.4MHz	QPSK	1	0	23.5	22.64	22.56	22.22
		1	2	23.5	22.72	22.79	22.09
		1	5	23.5	22.64	22.54	22.07
		3	0	23.5	22.72	22.66	22.19
		3	1	23.5	22.77	22.74	22.34
		3	3	23.5	22.66	22.67	22.52
		6	0	22.5	21.69	21.49	21.32
	16QAM	1	0	22.5	21.35	20.87	21.16
		1	2	22.5	21.82	20.99	21.40
		1	5	22.5	21.64	20.90	21.22
		3	0	22.5	21.55	21.38	21.45
		3	1	22.5	21.58	21.54	21.41
		3	3	22.5	21.57	21.50	21.39
		6	0	21.5	20.73	20.37	20.36
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18615	18900	19185
					1851.5	1880	1908.5
3MHz	QPSK	1	0	23.5	22.35	22.48	22.07
		1	7	23.5	22.72	22.54	22.25
		1	14	23.5	22.82	22.53	22.25
		8	0	22.5	21.69	21.62	21.24
		8	3	22.5	21.71	21.54	21.29
		8	7	22.5	21.67	21.56	21.22
		15	0	22.5	21.66	21.63	21.23
	16QAM	1	0	22.5	21.68	20.82	21.18
		1	7	22.5	21.71	20.87	21.28
		1	14	22.5	21.88	21.03	21.08
		8	0	21.5	20.78	20.71	20.05
		8	3	21.5	20.84	20.91	20.03
		8	7	21.5	20.80	20.86	20.13
		15	0	21.5	20.71	20.68	20.34

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18625	18900	19175
					1852.5	1880	1907.5
5MHz	QPSK	1	0	23.5	22.64	22.47	22.21
		1	12	23.5	22.72	22.28	22.15
		1	24	23.5	22.63	22.39	22.24
		12	0	22.5	21.67	21.50	21.26
		12	6	22.5	21.68	21.63	21.30
		12	13	22.5	21.71	21.61	21.29
		25	0	22.5	21.68	21.56	21.27
	16QAM	1	0	22.5	21.22	21.61	21.05
		1	12	22.5	20.92	21.60	21.07
		1	24	22.5	20.83	21.52	20.99
		12	0	21.5	20.78	20.51	20.17
		12	6	21.5	20.74	20.51	20.37
		12	13	21.5	20.67	20.66	20.43
		25	0	21.5	20.86	20.69	20.34
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18650	18900	19150
					1855	1880	1905
10MHz	QPSK	1	0	23.5	22.71	22.42	22.26
		1	24	23.5	22.75	22.80	22.36
		1	49	23.5	22.67	22.46	22.16
		25	0	22.5	21.78	21.58	21.49
		25	12	22.5	21.78	21.63	21.31
		25	25	22.5	21.57	21.61	21.24
		50	0	22.5	21.71	21.55	21.33
	16QAM	1	0	22.5	21.56	21.36	21.41
		1	24	22.5	21.62	21.32	21.15
		1	49	22.5	21.39	21.10	21.20
		25	0	21.5	20.80	20.55	20.53
		25	12	21.5	20.88	20.61	20.46
		25	25	21.5	20.82	20.61	20.46
		50	0	21.5	20.70	20.69	20.38

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18675	18900	19125
					1857.5	1880	1902.5
15MHz	QPSK	1	0	23.5	22.63	22.51	22.41
		1	38	23.5	22.48	22.88	22.26
		1	74	23.5	22.48	22.81	22.23
		36	0	22.5	21.70	22.37	21.40
		36	18	22.5	21.60	21.57	21.35
		36	39	22.5	21.53	21.57	21.22
		75	0	22.5	21.60	21.53	21.36
	16QAM	1	0	22.5	21.67	21.36	22.02
		1	38	22.5	21.53	21.44	22.07
		1	74	22.5	21.43	21.25	21.75
		36	0	21.5	20.74	21.25	20.43
		36	18	21.5	20.56	20.73	20.45
		36	39	21.5	20.58	20.66	20.28
		75	0	21.5	20.65	20.70	20.41
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18700	18900	19100
					1860	1880	1900
20MHz	QPSK	1	0	23.5	22.63	22.95	22.73
		1	50	23.5	22.63	21.92	22.43
		1	99	23.5	22.31	22.84	22.24
		50	0	22.5	21.58	21.52	21.43
		50	25	22.5	21.56	21.49	21.37
		50	50	22.5	21.53	21.51	21.22
		100	0	22.5	21.57	21.52	21.38
	16QAM	1	0	22.5	21.86	21.20	21.02
		1	50	22.5	21.84	20.74	21.10
		1	99	22.5	21.16	21.24	20.97
		50	0	21.5	20.84	20.64	20.49
		50	25	21.5	20.81	20.75	20.45
		50	50	21.5	20.74	20.68	20.35
		100	0	21.5	20.73	20.74	20.49

8.1.6 CONDUCTED POWER MEASUREMENTS OF LTE Band 4

1) Conducted power measurement results of LTE Band 4

FDD LTE B4					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					19957	20175	20393
					1710.7	1732.5	1754.3
1.4MHz	QPSK	1	0	23.5	22.10	21.80	22.13
		1	2	23.5	22.18	22.15	22.23
		1	5	23.5	22.04	21.78	22.16
		3	0	23.5	22.13	22.01	22.09
		3	1	23.5	22.06	22.12	22.12
		3	3	23.5	22.12	22.02	22.19
	16QAM	6	0	22.5	20.90	20.91	21.16
		1	0	22.5	20.70	20.69	20.99
		1	2	22.5	20.82	20.74	21.18
		1	5	22.5	20.82	20.58	21.08
		3	0	22.5	20.75	20.62	21.18
		3	1	22.5	20.72	20.67	21.27
		3	3	22.5	20.56	20.85	21.30
		6	0	21.5	19.71	19.68	20.27
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					19965	20175	20385
					1711.5	1732.5	1753.5
3MHz	QPSK	1	0	23.5	22.04	21.97	22.01
		1	7	23.5	22.06	21.98	22.25
		1	14	23.5	21.99	21.87	22.09
		8	0	22.5	20.94	20.87	21.07
		8	3	22.5	20.96	20.84	21.11
		8	7	22.5	20.88	20.79	21.03
		15	0	22.5	20.99	20.94	21.13
	16QAM	1	0	22.5	21.29	20.58	20.82
		1	7	22.5	20.82	21.10	21.11
		1	14	22.5	20.75	20.70	20.86
		8	0	21.5	19.94	20.00	20.03
		8	3	21.5	20.10	20.07	20.09
		8	7	21.5	20.06	19.91	20.12
		15	0	21.5	19.86	20.00	20.23

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					19975	20175	20375
					1712.5	1732.5	1752.5
5MHz	QPSK	1	0	23.5	22.01	21.66	22.29
		1	12	23.5	22.01	21.62	22.08
		1	24	23.5	21.97	21.69	22.17
		12	0	22.5	20.98	20.91	21.11
		12	6	22.5	20.99	20.92	21.15
		12	13	22.5	20.99	20.84	21.12
		25	0	22.5	20.94	20.93	21.07
	16QAM	1	0	22.5	20.65	20.93	20.89
		1	12	22.5	20.67	20.90	20.70
		1	24	22.5	20.63	20.67	20.79
		12	0	21.5	19.82	19.82	20.29
		12	6	21.5	20.09	19.91	20.27
		12	13	21.5	19.97	19.93	19.96
		25	0	21.5	20.05	19.98	20.03
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20000	20175	20350
					1715	1732.5	1750
10MHz	QPSK	1	0	23.5	22.15	21.81	22.32
		1	24	23.5	22.33	21.89	22.15
		1	49	23.5	22.13	22.03	22.17
		25	0	22.5	20.98	20.97	21.11
		25	12	22.5	20.97	20.87	21.06
		25	25	22.5	20.94	20.94	21.06
		50	0	22.5	20.93	20.97	21.06
	16QAM	1	0	22.5	20.87	20.61	20.93
		1	24	22.5	20.99	20.54	20.88
		1	49	22.5	20.73	20.63	21.13
		25	0	21.5	19.92	20.01	20.24
		25	12	21.5	20.00	20.01	20.28
		25	25	21.5	20.00	19.81	20.14
		50	0	21.5	19.94	19.80	20.07

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20025	20175	20325
					1717.5	1732.5	1747.5
15MHz	QPSK	1	0	23.5	22.09	22.00	22.18
		1	37	23.5	22.21	21.93	22.07
		1	74	23.5	22.06	22.15	22.25
		36	0	22.5	21.03	22.15	21.00
		36	19	22.5	20.99	20.92	21.07
		36	39	22.5	20.86	20.97	21.30
		75	0	22.5	20.93	20.90	21.04
	16QAM	1	0	22.5	21.05	20.78	21.68
		1	37	22.5	21.47	20.60	21.60
		1	74	22.5	20.82	20.77	21.70
		36	0	21.5	20.03	20.77	20.09
		36	19	21.5	19.91	19.85	19.98
		36	39	21.5	19.83	19.99	20.02
		75	0	21.5	19.96	20.03	19.99
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20050	20175	20300
					1720	1732.5	1745
20MHz	QPSK	1	0	23.5	22.06	22.34	22.08
		1	50	23.5	21.93	21.52	21.98
		1	99	23.5	21.61	22.27	21.95
		50	0	22.5	20.94	20.94	21.24
		50	25	22.5	20.98	20.90	21.02
		50	50	22.5	20.92	20.97	21.14
		100	0	22.5	20.94	21.02	21.07
	16QAM	1	0	22.5	20.55	21.20	20.71
		1	50	22.5	21.19	20.64	20.86
		1	99	22.5	20.54	20.62	20.86
		50	0	21.5	20.10	20.08	20.10
		50	25	21.5	20.03	19.95	20.10
		50	50	21.5	19.94	19.99	20.01
		100	0	21.5	19.93	20.03	20.23

8.1.7 CONDUCTED POWER MEASUREMENTS OF LTE Band 5

1) Conducted power measurement results of LTE Band 5

FDD LTE B5					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20407	20525	20643
					824.7	836.5	848.3
1.4MHz	QPSK	1	0	24.5	24.17	24.05	23.86
		1	2	24.5	24.19	24.16	24.19
		1	5	24.5	24.19	23.95	24.11
		3	0	24.5	24.23	24.05	24.01
		3	1	24.5	24.24	24.14	24.10
		3	3	24.5	24.16	24.06	24.14
		6	0	23.5	23.15	22.98	23.06
	16QAM	1	0	23.5	22.97	22.86	22.85
		1	2	23.5	23.35	22.88	23.05
		1	5	23.5	23.21	22.77	22.90
		3	0	23.5	23.24	22.80	23.21
		3	1	23.5	23.35	22.79	23.20
		3	3	23.5	23.35	22.95	23.19
		6	0	22.5	22.40	21.98	21.88
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20415	20525	20635
					825.5	836.5	847.5
3MHz	QPSK	1	0	24.5	24.09	24.21	23.78
		1	7	24.5	24.30	24.28	24.10
		1	14	24.5	24.15	24.13	24.06
		8	0	23.5	23.06	23.02	23.03
		8	3	23.5	23.20	23.02	23.01
		8	7	23.5	23.19	23.07	23.16
		15	0	23.5	23.15	23.01	22.81
	16QAM	1	0	23.5	23.39	22.51	22.69
		1	7	23.5	23.25	23.12	22.97
		1	14	23.5	23.41	22.84	22.82
		8	0	22.5	21.91	21.96	21.60
		8	3	22.5	22.22	22.03	21.71
		8	7	22.5	22.21	22.00	21.75
		15	0	22.5	21.90	22.08	21.74

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20425	20525	20625
					826.5	836.5	846.5
5MHz	QPSK	1	0	24.5	24.06	23.81	23.83
		1	12	24.5	24.25	23.66	24.14
		1	24	24.5	24.15	23.53	23.99
		12	0	23.5	23.12	22.97	22.92
		12	6	23.5	23.12	22.94	22.95
		12	13	23.5	22.92	23.04	22.98
		25	0	23.5	23.03	22.99	22.93
	16QAM	1	0	23.5	22.97	22.63	22.36
		1	12	23.5	22.55	22.78	22.65
		1	24	23.5	22.35	22.46	22.46
		12	0	22.5	22.09	21.76	21.86
		12	6	22.5	21.92	21.90	21.76
		12	13	22.5	21.63	21.98	21.82
		25	0	22.5	22.09	21.79	21.81
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20450	20525	20600
					829	836.5	844
10MHz	QPSK	1	0	24.5	24.30	24.18	23.89
		1	24	24.5	24.33	24.22	24.31
		1	49	24.5	24.14	23.91	24.09
		25	0	23.5	23.02	23.10	22.95
		25	12	23.5	23.01	22.94	22.97
		25	25	23.5	23.08	22.98	22.88
		50	0	23.5	23.13	22.97	22.97
	16QAM	1	0	23.5	23.01	23.04	22.75
		1	24	23.5	23.49	23.02	22.55
		1	49	23.5	23.34	22.75	22.72
		25	0	22.5	21.88	22.03	21.93
		25	12	22.5	21.72	21.92	21.97
		25	25	22.5	22.02	21.97	21.94
		50	0	22.5	21.93	22.02	21.85

8.1.8 CONDUCTED POWER MEASUREMENTS OF LTE Band 7

1) Conducted power measurement results of LTE Band 7

FDD LTE B7					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20775	21100	21425
					2502.5	2535	2567.5
5MHz	QPSK	1	0	23.5	21.95	21.81	21.78
		1	12	23.5	22.28	22.01	22.02
		1	24	23.5	22.07	21.87	21.78
		12	0	22.5	21.08	21.06	21.02
		12	6	22.5	21.17	21.09	21.08
		12	13	22.5	21.13	21.05	21.05
		25	0	22.5	21.11	21.10	21.00
	16QAM	1	0	22.5	20.63	20.59	20.95
		1	12	22.5	20.74	20.80	20.64
		1	24	22.5	20.56	20.52	20.66
		12	0	21.5	20.16	20.03	20.09
		12	6	21.5	20.36	20.33	20.15
		12	13	21.5	20.34	20.33	20.03
		25	0	21.5	20.28	20.40	20.07
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20800	21100	21400
					2505	2535	2565
10MHz	QPSK	1	0	23.5	22.16	22.07	21.87
		1	24	23.5	22.43	22.18	22.04
		1	49	23.5	22.29	21.96	22.04
		25	0	22.5	21.15	21.12	20.93
		25	12	22.5	21.12	21.07	21.02
		25	25	22.5	21.19	21.03	21.02
		50	0	22.5	21.14	21.08	20.99
	16QAM	1	0	22.5	20.83	20.81	21.05
		1	24	22.5	21.09	20.83	20.85
		1	49	22.5	20.90	20.88	20.64
		25	0	21.5	20.18	20.17	19.95
		25	12	21.5	20.20	20.26	20.25
		25	25	21.5	20.15	20.29	20.07
		50	0	21.5	20.09	20.19	19.89

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20825	21100	21375
					2507.5	2535	2562.5
15MHz	QPSK	1	0	23.5	22.09	22.13	22.00
		1	38	23.5	22.44	22.05	21.85
		1	74	23.5	22.17	21.97	21.94
		36	0	22.5	21.17	21.14	20.98
		36	18	22.5	21.12	21.10	20.96
		36	39	22.5	21.04	21.09	21.01
		75	0	22.5	21.21	21.11	21.00
	16QAM	1	0	22.5	20.92	20.96	21.50
		1	38	22.5	21.00	20.95	21.49
		1	74	22.5	21.00	20.60	21.57
		36	0	21.5	20.08	20.16	19.95
		36	18	21.5	20.06	20.16	19.91
		36	39	21.5	20.02	20.13	19.94
		75	0	21.5	20.16	20.13	19.97
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20850	21100	21350
					2510	2535	2560
20MHz	QPSK	1	0	23.5	21.96	22.14	22.13
		1	50	23.5	22.15	22.50	22.11
		1	99	23.5	21.88	21.82	22.16
		50	0	22.5	21.19	21.04	20.96
		50	25	22.5	21.23	21.06	20.99
		50	50	22.5	21.09	21.05	20.99
		100	0	22.5	21.21	21.08	20.98
	16QAM	1	0	22.5	20.68	20.60	20.56
		1	50	22.5	20.63	21.29	20.81
		1	99	22.5	20.68	20.52	20.60
		50	0	21.5	20.14	19.99	19.94
		50	25	21.5	20.07	20.19	19.90
		50	50	21.5	19.94	20.00	19.97
		100	0	21.5	20.15	20.13	19.97

8.1.9 CONDUCTED POWER MEASUREMENTS OF LTE Band 12

1) Conducted power measurement results of LTE Band 12

FDD LTE B12					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					23017	23095	23173
					699.7	707.5	715.3
1.4MHz	QPSK	1	0	24.5	23.24	22.98	23.06
		1	2	24.5	23.07	23.22	23.27
		1	5	24.5	23.29	23.07	23.25
		3	0	24.5	23.20	23.13	23.18
		3	1	24.5	23.26	23.31	23.20
		3	3	24.5	23.16	23.29	23.30
		6	0	23.5	22.14	22.20	22.12
	16QAM	1	0	23.5	21.97	21.95	22.10
		1	2	23.5	22.22	21.54	22.30
		1	5	23.5	21.99	21.57	22.17
		3	0	23.5	21.87	21.95	22.07
		3	1	23.5	21.99	22.00	22.01
		3	3	23.5	22.01	22.10	22.17
		6	0	22.5	21.18	20.91	21.15
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					23025	23095	23165
					700.5	707.5	714.5
3MHz	QPSK	1	0	24.5	23.17	23.26	22.91
		1	7	24.5	23.38	23.15	23.12
		1	14	24.5	23.40	23.04	23.19
		8	0	23.5	22.06	22.17	22.29
		8	3	23.5	22.22	22.14	22.22
		8	7	23.5	22.08	22.19	22.25
		15	0	23.5	22.10	22.20	22.18
	16QAM	1	0	23.5	21.87	21.99	22.05
		1	7	23.5	21.94	21.99	22.33
		1	14	23.5	21.89	21.90	22.10
		8	0	22.5	20.89	21.34	21.22
		8	3	22.5	20.93	21.36	21.18
		8	7	22.5	20.95	21.29	21.36
		15	0	22.5	21.04	21.17	21.02

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					23035	23095	23155
					701.5	707.5	713.5
5MHz	QPSK	1	0	24.5	23.14	22.99	23.03
		1	12	24.5	23.32	22.98	23.00
		1	24	24.5	23.02	22.80	23.09
		12	0	23.5	22.11	22.17	22.30
		12	6	23.5	22.15	22.16	22.31
		12	13	23.5	22.25	22.08	22.26
		25	0	23.5	22.09	22.07	22.12
	16QAM	1	0	23.5	21.52	21.72	21.72
		1	12	23.5	21.70	22.14	21.95
		1	24	23.5	21.58	21.61	21.60
		12	0	22.5	20.84	21.02	21.08
		12	6	22.5	21.18	21.17	21.05
		12	13	22.5	21.00	21.06	20.92
		25	0	22.5	21.23	21.08	21.05
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					23060	23095	23130
					704	707.5	711
10MHz	QPSK	1	0	24.5	23.31	22.90	22.76
		1	24	24.5	23.41	23.15	23.18
		1	49	24.5	23.16	23.13	23.05
		25	0	23.5	22.19	22.15	22.07
		25	12	23.5	22.10	22.07	22.16
		25	25	23.5	22.10	22.11	22.18
		50	0	23.5	22.12	22.05	22.10
	16QAM	1	0	23.5	21.88	21.87	21.80
		1	24	23.5	22.74	22.17	21.84
		1	49	23.5	21.89	21.88	22.02
		25	0	22.5	21.07	21.02	21.09
		25	12	22.5	21.14	21.06	21.35
		25	25	22.5	21.18	21.01	21.10
		50	0	22.5	21.14	21.06	21.11

8.1.10 CONDUCTED POWER MEASUREMENTS OF LTE Band 17

1) Conducted power measurement results of LTE Band 17

FDD LTE B17					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					23755	23790	23825
					706.5	710	713.5
5MHz	QPSK	1	0	24.5	22.85	22.90	23.06
		1	12	24.5	23.00	22.86	23.44
		1	24	24.5	23.11	23.11	23.16
		12	0	23.5	22.07	22.09	22.30
		12	6	23.5	22.12	22.18	22.30
		12	13	23.5	22.27	22.34	22.32
	16QAM	25	0	23.5	22.09	22.10	22.22
		1	0	23.5	21.60	22.07	21.62
		1	12	23.5	21.71	22.25	22.08
		1	24	23.5	21.58	22.31	21.56
		12	0	22.5	20.94	21.11	20.99
		12	6	22.5	20.95	20.85	21.00
		12	13	22.5	21.15	20.94	20.96
		25	0	22.5	20.89	21.08	20.95
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					23780	23790	23800
					709	710	711
10MHz	QPSK	1	0	24.5	23.36	23.14	22.88
		1	24	24.5	23.78	23.46	23.49
		1	49	24.5	23.61	23.23	22.99
		25	0	23.5	22.20	22.15	22.18
		25	12	23.5	22.17	22.11	22.10
		25	25	23.5	22.13	22.13	22.12
		50	0	23.5	22.29	22.20	22.01
	16QAM	1	0	23.5	22.08	21.94	21.87
		1	24	23.5	22.09	22.45	22.01
		1	49	23.5	22.23	22.43	22.00
		25	0	22.5	20.99	20.95	21.12
		25	12	22.5	21.07	20.90	20.94
		25	25	22.5	21.03	21.21	21.14
		50	0	22.5	20.87	21.08	20.88

8.1.11 CONDUCTED POWER MEASUREMENTS OF WiFi 2.4G

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	1	15.00	13.48	No
	6	2437		15.00	13.42	No
	11	2462		15.00	13.78	Yes
802.11g	1	2412	6	14.00	Not Required	No
	6	2437		14.00	Not Required	No
	11	2462		14.00	Not Required	No
802.11n HT20	1	2412	6.5	13.00	Not Required	No
	6	2437		13.00	Not Required	No
	11	2462		13.00	Not Required	No

Note:

- 1) The Average conducted power of WiFi is measured with RMS detector.
- 2) Per KDB248227 D01, for WiFi 2.4GHz, the highest measured maximum output power Channel for DSSS modes(802.11b)was selected for SAR measurement. SAR for OFDM modes(2.4GHz 802.11g/n) was not required When the highest reported SAR for DSSS is adjusted by the ratio of OFDM modes(802.11g/n)to DSSS modes(802.11b)specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

8.1.12 CONDUCTED POWER MEASUREMENTS OF BT

BT	Tune Up	Average Conducted Power (dBm)		
		CH00	CH39	CH78
DH5	10.00	9.07	9.34	8.89
2DH5	9.00	7.65	7.63	7.43
3DH5	9.00	7.63	7.91	7.53

BT	Tune Up	Average Conducted Power (dBm)		
		CH00	CH19	CH39
BLE	1.00	-0.43	0.56	-0.36

Note:

1) The conducted power of BT is measured with RMS detector.

8.2 SAR TEST RESULTS

General Notes:

- 1) Per KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
- 2) Per KDB447498 D01, 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. When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.
- 3) Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR < 1.45 W/kg, only one repeated measurement is required.
- 4) Per KDB941225 D06, the DUT Dimension is bigger than $9\text{ cm} \times 5\text{ cm}$, so 10 mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5 cm , such position does not need to be tested.
- 5) Per KDB648474 D04, SAR is evaluated without a headset connected to the device. When the standalone reported body-worn SAR is ≤ 1.2 W/kg, no additional SAR evaluations using a headset are required.
- 6) Per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing.

GSM Notes:

- 1) Per KDB648474 D04, body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
- 2) Per KDB941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

UMTS Notes:

Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

LTE notes:

- 1) The LTE test configurations are determined according to KDB941225 D05 SAR for LTE Devices. The general test procedures used for SAR testing can be found in Section 7.1.3.
- 2) A-MPR was disabled for all SAR test by setting NS_01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames(maximum TTI)

WLAN Notes:

1. For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated(peak)SAR is used as the initial test position. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 for 2.4GHZ WIFI single transmission chain operations, the highest measured maximum output power Channel for DSSS was selected for SAR measurement. SAR for OFDM modes(2.4GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.

8.2.1 SAR MEASUREMENT RESULT OF HEAD

1. Head SAR test results of GSM&UMTS

Test No.	Band	Mode	CH	Test Position	SIM	Battery	Sample	Tune up	Measured	Drift(dB)	SAR Value (W/kg)1-g	Reported SAR
T01	GSM850	GSM	190	Right Cheek	1	1	1	34.2	33.51	-0.07	0.268	0.314
T02	GSM850	GSM	190	Right Tilted	1	1	1	34.2	33.51	-0.02	0.221	0.259
T03	GSM850	GSM	190	Left Cheek	1	1	1	34.2	33.51	-0.02	0.281	0.329
T04	GSM850	GSM	190	Left Tilted	1	1	1	34.2	33.51	0.03	0.202	0.237
T05	GSM850	GSM	190	Left Cheek	2	1	1	34.2	33.51	0.07	0.273	0.320
T06	GSM850	GSM	190	Left Cheek	1	2	2	34.2	33.51	-0.01	0.274	0.321
T11	GSM1900	GSM	661	Right Cheek	1	1	1	31.3	30.34	-0.05	0.149	0.186
T12	GSM1900	GSM	661	Right Tilted	1	1	1	31.3	30.34	0.06	0.054	0.067
T13	GSM1900	GSM	661	Left Cheek	1	1	1	31.3	30.34	0.04	0.156	0.195
T14	GSM1900	GSM	661	Left Tilted	1	1	1	31.3	30.34	-0.07	0.078	0.097
T15	GSM1900	GSM	661	Left Cheek	2	1	1	31.3	30.34	-0.09	0.163	0.203
T16	GSM1900	GSM	661	Left Cheek	2	2	2	31.3	30.34	-0.02	0.143	0.178
T21	UMTS B2	RMC1 2.2K	9400	Right Cheek	1	1	1	23.5	22.41	-0.08	0.245	0.315
T22	UMTS B2	RMC1 2.2K	9400	Right Tilted	1	1	1	23.5	22.41	0.07	0.086	0.111
T23	UMTS B2	RMC1 2.2K	9400	Left Cheek	1	1	1	23.5	22.41	-0.01	0.236	0.303
T24	UMTS B2	RMC1 2.2K	9400	Left Tilted	1	1	1	23.5	22.41	-0.06	0.172	0.221
T25	UMTS B2	RMC1 2.2K	9400	Right Cheek	2	1	1	23.5	22.41	0.02	0.197	0.253
T26	UMTS B2	RMC1 2.2K	9400	Right Cheek	2	2	2	23.5	22.41	0.08	0.203	0.261
T31	UMTS B5	RMC1 2.2K	4182	Right Cheek	1	1	1	24.5	23.68	0.07	0.285	0.344
T32	UMTS B5	RMC1 2.2K	4182	Right Tilted	1	1	1	24.5	23.68	-0.01	0.218	0.263
T33	UMTS B5	RMC1 2.2K	4182	Left Cheek	1	1	1	24.5	23.68	0.01	0.296	0.358
T34	UMTS B5	RMC1 2.2K	4182	Left Tilted	1	1	1	24.5	23.68	0.06	0.193	0.233
T35	UMTS B5	RMC1 2.2K	4182	Left Cheek	2	1	1	24.5	23.68	0.01	0.287	0.347
T36	UMTS B5	RMC1 2.2K	4182	Left Cheek	1	2	2	24.5	23.68	-0.03	0.251	0.303

2. Head SAR test results of LTE

Test No.	Band	Mode	CH	RB	Offset	Test Position	SIM	Battery	Sample	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR
T151	LTE B2	QPSK2 0M	18900	1	0	Right Cheek	1	1	1	23.5	22.95	0.06	0.215	0.244
T152	LTE B2	QPSK2 0M	18900	1	0	Right Tilted	1	1	1	23.5	22.95	-0.07	0.082	0.093
T153	LTE B2	QPSK2 0M	18900	1	0	Left Cheek	1	1	1	23.5	22.95	-0.02	0.188	0.214
T154	LTE B2	QPSK2 0M	18900	1	0	Left Tilted	1	1	1	23.5	22.95	0	0.100	0.113
T155	LTE B2	QPSK2 0M	18700	50	0	Right Cheek	1	1	1	22.5	21.58	0.05	0.166	0.205
T156	LTE B2	QPSK2 0M	18700	50	0	Right Tilted	1	1	1	22.5	21.58	0.01	0.077	0.095
T157	LTE B2	QPSK2 0M	18700	50	0	Left Cheek	1	1	1	22.5	21.58	0.04	0.181	0.224
T158	LTE B2	QPSK2 0M	18700	50	0	Left Tilted	1	1	1	22.5	21.58	0.08	0.078	0.096
T159	LTE B2	QPSK2 0M	18900	1	0	Right Cheek	2	1	1	23.5	22.95	0.01	0.218	0.248
T160	LTE B2	QPSK2 0M	18900	1	0	Right Cheek	2	2	2	23.5	22.95	-0.08	0.212	0.241
T161	LTE B4	QPSK2 0M	20175	1	0	Right Cheek	1	1	1	23.5	22.34	0.02	0.287	0.375
T162	LTE B4	QPSK2 0M	20175	1	0	Right Tilted	1	1	1	23.5	22.34	-0.03	0.161	0.210
T163	LTE B4	QPSK2 0M	20175	1	0	Left Cheek	1	1	1	23.5	22.34	0.08	0.197	0.257
T164	LTE B4	QPSK2 0M	20175	1	0	Left Tilted	1	1	1	23.5	22.34	0.01	0.151	0.197
T165	LTE B4	QPSK2 0M	20300	50	0	Right Cheek	1	1	1	22.5	21.24	0.06	0.257	0.343
T166	LTE B4	QPSK2 0M	20300	50	0	Right Tilted	1	1	1	22.5	21.24	-0.05	0.142	0.190
T167	LTE B4	QPSK2 0M	20300	50	0	Left Cheek	1	1	1	22.5	21.24	0.03	0.183	0.244
T168	LTE B4	QPSK2 0M	20300	50	0	Left Tilted	1	1	1	22.5	21.24	0.06	0.131	0.175
T169	LTE B4	QPSK2 0M	20175	1	0	Right Cheek	2	1	1	23.5	22.34	-0.07	0.276	0.360
T170	LTE B4	QPSK2 0M	20175	1	0	Right Cheek	1	2	2	23.5	22.34	0.08	0.300	0.392
T171	LTE B5	QPSK1 0M	20450	1	24	Right Cheek	1	1	1	24.5	24.33	0.02	0.243	0.253
T172	LTE B5	QPSK1 0M	20450	1	24	Right Tilted	1	1	1	24.5	24.33	-0.03	0.214	0.223
T173	LTE B5	QPSK1 0M	20450	1	24	Left Cheek	1	1	1	24.5	24.33	0.04	0.257	0.268
T174	LTE B5	QPSK1 0M	20450	1	24	Left Tilted	1	1	1	24.5	24.33	-0.05	0.185	0.193
T175	LTE B5	QPSK1 0M	20525	25	0	Right Cheek	1	1	1	23.5	23.10	-0.01	0.216	0.237
T176	LTE B5	QPSK1 0M	20525	25	0	Right Tilted	1	1	1	23.5	23.10	0.06	0.173	0.190
T177	LTE B5	QPSK1 0M	20525	25	0	Left Cheek	1	1	1	23.5	23.10	0.08	0.224	0.245
T178	LTE B5	QPSK1 0M	20525	25	0	Left Tilted	1	1	1	23.5	23.10	-0.09	0.159	0.174
T179	LTE B5	QPSK1 0M	20450	1	24	Left Cheek	2	1	1	24.5	24.33	0.02	0.249	0.259
T180	LTE B5	QPSK1 0M	20450	1	24	Left Cheek	1	2	2	24.5	24.33	0.05	0.216	0.225
T181	LTE B7	QPSK2 0M	21100	1	50	Right Cheek	1	1	1	23.5	22.50	0.02	0.219	0.275
T182	LTE B7	QPSK2 0M	21100	1	50	Right Tilted	1	1	1	23.5	22.50	-0.06	0.047	0.059

Test No.	Band	Mode	CH	RB	Offset	Test Position	SIM	Battery	Sample	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR
T183	LTE B7	QPSK2 0M	21100	1	50	Left Cheek	1	1	1	23.5	22.50	0.05	0.075	0.094
T184	LTE B7	QPSK2 0M	21100	1	50	Left Tilted	1	1	1	23.5	22.50	0.04	0.066	0.082
T185	LTE B7	QPSK2 0M	20850	50	25	Right Cheek	1	1	1	22.5	21.23	-0.08	0.083	0.111
T186	LTE B7	QPSK2 0M	20850	50	25	Right Tilted	1	1	1	22.5	21.23	0.02	0.057	0.077
T187	LTE B7	QPSK2 0M	20850	50	25	Left Cheek	1	1	1	22.5	21.23	0.01	0.071	0.095
T188	LTE B7	QPSK2 0M	20850	50	25	Left Tilted	1	1	1	22.5	21.23	0.07	0.061	0.081
T189	LTE B7	QPSK2 0M	21100	1	50	Right Cheek	2	1	1	23.5	22.50	0.09	0.242	0.304
T190	LTE B7	QPSK2 0M	21100	1	50	Right Cheek	2	2	2	23.5	22.50	0.06	0.205	0.258
T191	LTE B12	QPSK1 0M	23060	1	24	Right Cheek	1	1	1	24.5	23.41	0.06	0.169	0.217
T192	LTE B12	QPSK1 0M	23060	1	24	Right Tilted	1	1	1	24.5	23.41	-0.05	0.122	0.157
T193	LTE B12	QPSK1 0M	23060	1	24	Left Cheek	1	1	1	24.5	23.41	0.02	0.185	0.238
T194	LTE B12	QPSK1 0M	23060	1	24	Left Tilted	1	1	1	24.5	23.41	0.09	0.122	0.157
T195	LTE B12	QPSK1 0M	23060	25	0	Right Cheek	1	1	1	23.5	22.19	0.02	0.132	0.178
T196	LTE B12	QPSK1 0M	23060	25	0	Right Tilted	1	1	1	23.5	22.19	0.03	0.103	0.139
T197	LTE B12	QPSK1 0M	23060	25	0	Left Cheek	1	1	1	23.5	22.19	0.07	0.145	0.196
T198	LTE B12	QPSK1 0M	23060	25	0	Left Tilted	1	1	1	23.5	22.19	-0.01	0.102	0.138
T199	LTE B12	QPSK1 0M	23060	1	24	Left Cheek	2	1	1	24.5	23.41	0.05	0.173	0.222
T200	LTE B12	QPSK1 0M	23060	1	24	Left Cheek	1	2	2	24.5	23.41	0.03	0.147	0.189

According to TCB workshop October, 2014 RF Exposure Procedures Update(Overlapping LTE Bands): SAR for LTE Band 17 (Frequency range:704-716 MHz) is covered by LTE Band 12 (Frequency range:699-716 MHz) due to similar frequency range, same maximum tune up limit and same channel bandwidth.

3. Head SAR test results of WIFI

Test No.	Band	CH	Test Position	Battery	Sample	Data Rate	Power Setting	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR
T320	802.11b	11	Right Cheek	1	1	1	15	15	13.78	0.06	0.124	0.164
T321	802.11b	11	Right Tilted	1	1	1	15	15	13.78	0.04	0.143	0.189
T322	802.11b	11	Left Cheek	1	1	1	15	15	13.78	-0.09	0.222	0.294
T323	802.11b	11	Left Tilted	1	1	1	15	15	13.78	0.03	0.214	0.283
T324	802.11b	11	Left Cheek	2	2	1	15	15	13.78	-0.02	0.168	0.222

8.2.2 SAR MEASUREMENT RESULT OF BODY-WORN

1. Body-worn SAR test results of GSM&UMTS

Test No.	Band	Mode	CH	Test Position (with 15mm)	Earp hone	SIM	Batter y	Sample	Tune up	Measured	Drift(dB)	SAR Value (W/kg)1-g	Reported SAR
T41	GSM850	GSM	190	Front Face	-	1	1	1	34.2	33.51	-0.02	0.335	0.393
T42	GSM850	GSM	190	Rear Face	-	1	1	1	34.2	33.51	-0.02	0.434	0.509
T43	GSM850	GSM	190	Rear Face	-	2	1	1	34.2	33.51	0.04	0.420	0.492
T44	GSM850	GSM	190	Rear Face	-	1	2	2	34.2	33.51	-0.02	0.462	0.542
T71	GSM1900	GSM	661	Front Face	-	1	1	1	31.3	30.34	0.01	0.123	0.153
T72	GSM1900	GSM	661	Rear Face	-	1	1	1	31.3	30.34	-0.06	0.100	0.125
T73	GSM1900	GSM	661	Front Face	-	2	1	1	31.3	30.34	0.03	0.127	0.158
T74	GSM1900	GSM	661	Front Face	-	2	2	2	31.3	30.34	0.05	0.105	0.131
T101	UMTS B2	RMC12.2K	9400	Front Face	-	1	1	1	23.5	22.41	-0.01	0.281	0.361
T102	UMTS B2	RMC12.2K	9400	Rear Face	-	1	1	1	23.5	22.41	-0.03	0.234	0.301
T103	UMTS B2	RMC12.2K	9400	Front Face	-	2	1	1	23.5	22.41	-0.04	0.285	0.366
T104	UMTS B2	RMC12.2K	9400	Front Face	-	2	2	2	23.5	22.41	0.02	0.235	0.302
T121	UMTS B5	RMC12.2K	4182	Front Face	-	1	1	1	24.5	23.68	0.01	0.352	0.425
T122	UMTS B5	RMC12.2K	4182	Rear Face	-	1	1	1	24.5	23.68	0.08	0.461	0.557
T123	UMTS B5	RMC12.2K	4182	Rear Face	-	2	1	1	24.5	23.68	-0.02	0.452	0.546
T124	UMTS B5	RMC12.2K	4182	Rear Face	-	1	2	2	24.5	23.68	0.04	0.417	0.504

2. Body-worn SAR test results of LTE

Test No.	Band	Mode	CH	RB	Offset	Test Position (with 15mm)	Earp hone	SIM	Battery	Sample	Tune up	Measu red	Drift (dB)	SAR Value (W/kg) 1-g	Report ed SAR
T201	LTE B2	QPSK 20M	18900	1	0	Front Face	-	1	1	1	23.5	22.95	0.02	0.158	0.179
T202	LTE B2	QPSK 20M	18900	1	0	Rear Face	-	1	1	1	23.5	22.95	-0.02	0.115	0.131
T203	LTE B2	QPSK 20M	18700	50	0	Front Face	-	1	1	1	22.5	21.58	0.05	0.122	0.151
T204	LTE B2	QPSK 20M	18700	50	0	Rear Face	-	1	1	1	22.5	21.58	0.1	0.110	0.136
T205	LTE B2	QPSK 20M	18900	1	0	Front Face	-	2	1	1	23.5	22.95	-0.07	0.161	0.183
T206	LTE B2	QPSK 20M	18900	1	0	Front Face	-	2	2	2	23.5	22.95	-0.07	0.143	0.162
T221	LTE B4	QPSK 20M	20175	1	0	Front Face	-	1	1	1	23.5	22.34	-0.02	0.251	0.328
T222	LTE B4	QPSK 20M	20175	1	0	Rear Face	-	1	1	1	23.5	22.34	0.03	0.364	0.475
T223	LTE B4	QPSK 20M	20300	50	0	Front Face	-	1	1	1	22.5	21.24	-0.02	0.213	0.284
T224	LTE B4	QPSK 20M	20300	50	0	Rear Face	-	1	1	1	22.5	21.24	0.01	0.276	0.368
T225	LTE B4	QPSK 20M	20175	1	0	Rear Face	-	2	1	1	23.5	22.34	0.07	0.369	0.482
T226	LTE B4	QPSK 20M	20175	1	0	Rear Face	-	2	2	2	23.5	22.34	0.02	0.408	0.533
T251	LTE B5	QPSK 10M	20450	1	24	Front Face	-	1	1	1	24.5	24.33	0.04	0.314	0.327
T252	LTE B5	QPSK 10M	20450	1	24	Rear Face	-	1	1	1	24.5	24.33	-0.03	0.389	0.405
T253	LTE B5	QPSK 10M	20525	25	0	Front Face	-	1	1	1	23.5	23.10	-0.08	0.262	0.287
T254	LTE B5	QPSK 10M	20525	25	0	Rear Face	-	1	1	1	23.5	23.10	-0.03	0.339	0.372
T255	LTE B5	QPSK 10M	20450	1	24	Rear Face	-	2	1	1	24.5	24.33	-0.05	0.420	0.437
T256	LTE B5	QPSK 10M	20450	1	24	Rear Face	-	2	2	2	24.5	24.33	0.04	0.338	0.351
T271	LTE B7	QPKS 20M	21100	1	50	Front Face	-	1	1	1	23.5	22.50	-0.02	0.269	0.339
T272	LTE B7	QPKS 20M	21100	1	50	Rear Face	-	1	1	1	23.5	22.50	0.04	0.282	0.355
T273	LTE B7	QPKS 20M	20850	50	25	Front Face	-	1	1	1	22.5	21.23	-0.01	0.265	0.355
T274	LTE B7	QPKS 20M	20850	50	25	Rear Face	-	1	1	1	22.5	21.23	0.06	0.263	0.352
T275	LTE B7	QPKS 20M	21100	1	50	Rear Face	-	2	1	1	23.5	22.50	0.03	0.306	0.385
T276	LTE B7	QPKS 20M	21100	1	50	Rear Face	-	2	2	2	23.5	22.50	0.03	0.225	0.283
T301	LTE B12	QPSK 10M	23060	1	24	Front Face	-	1	1	1	24.5	23.41	-0.03	0.190	0.244
T302	LTE B12	QPSK 10M	23060	1	24	Rear Face	-	1	1	1	24.5	23.41	0.02	0.217	0.279
T303	LTE B12	QPSK 10M	23060	25	0	Front Face	-	1	1	1	23.5	22.19	-0.05	0.153	0.207
T304	LTE B12	QPSK 10M	23060	25	0	Rear Face	-	1	1	1	23.5	22.19	0.07	0.181	0.245
T305	LTE B12	QPSK 10M	23060	1	24	Rear Face	-	2	1	1	24.5	23.41	0.06	0.205	0.263
T306	LTE B12	QPSK 10M	23060	1	24	Rear Face	-	2	2	2	24.5	23.41	-0.01	0.186	0.239

According to TCB workshop October, 2014 RF Exposure Procedures Update(Overlapping LTE Bands): SAR for LTE Band 17 (Frequency range:704-716 MHz) is covered by LTE Band 12 (Frequency range:699-716 MHz) due to similar frequency range, same maximum tune up limit and same channel bandwidth.

3. Body-worn SAR test results of WIFI

Test No.	Band	CH	Test Position (with 15mm)	Ear phone	Battery	Data Rate	Power Setting	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR
T330	802.11b	11	Front Face	-	1	1	1	15	13.78	-0.04	0.013	0.017
T331	802.11b	11	Rear Face	-	1	1	1	15	13.78	0.06	0.018	0.024
T332	802.11b	11	Rear Face	-	2	2	1	15	13.78	-0.03	0.012	0.016

8.2.3 SAR MEASUREMENT RESULT OF HOTSPOT

1. Hotspot SAR test results of GSM&UMTS

Test No.	Band	Mode	CH	Test Position (with 10mm)	Earp hone	SIM	Batter y	Sample	Tune up	Measured	Drift(dB)	SAR Value (W/kg)1-g	Reported SAR
T51	GSM850	GPRS 2TX	190	Front Face	-	1	1	3	33.2	32.64	-0.07	0.623	0.709
T52	GSM850	GPRS 2TX	190	Rear Face	-	1	1	3	33.2	32.64	-0.05	0.826	0.940
T53	GSM850	GPRS 2TX	190	Left Side	-	1	1	3	33.2	32.64	-0.01	0.914	1.040
T54	GSM850	GPRS 2TX	190	Right Side	-	1	1	3	33.2	32.64	0.03	0.878	0.999
T55	GSM850	GPRS 2TX	190	Bottom Side	-	1	1	3	33.2	32.64	-0.05	0.0428	0.049
T56	GSM850	GPRS 2TX	128	Rear Face	-	1	1	3	33.2	32.81	-0.01	0.777	0.850
T57	GSM850	GPRS 2TX	251	Rear Face	-	1	1	3	33.2	32.77	0.02	0.782	0.863
T58	GSM850	GPRS 2TX	128	Left Side	-	1	1	3	33.2	32.81	0.05	0.816	0.893
T59	GSM850	GPRS 2TX	251	Left Side	-	1	1	3	33.2	32.77	-0.04	0.803	0.887
T60	GSM850	GPRS 2TX	128	Right Side	-	1	1	3	33.2	32.81	0.03	0.834	0.912
T61	GSM850	GPRS 2TX	251	Right Side	-	1	1	3	33.2	32.77	0.07	0.769	0.849
T62	GSM850	GPRS 2TX	190	Left Side	-	2	1	3	33.2	32.77	0.05	0.721	0.796
T63	GSM850	GPRS 2TX	190	Left Side	-	1	2	4	33.2	32.77	0.01	0.837	0.924
T64	GSM850	GPRS 2TX	190	Left Side 1st repeat	-	1	1	3	33.2	32.64	-0.01	0.904	1.028
T81	GSM1900	GPRS 2TX	661	Front Face	-	1	1	3	30.3	30.08	0.02	0.338	0.356
T82	GSM1900	GPRS 2TX	661	Rear Face	-	1	1	3	30.3	30.08	-0.03	0.335	0.352
T83	GSM1900	GPRS 2TX	661	Left Side	-	1	1	3	30.3	30.08	-0.04	0.220	0.231
T84	GSM1900	GPRS 2TX	661	Right Side	-	1	1	3	30.3	30.08	0.01	0.124	0.130
T85	GSM1900	GPRS 2TX	661	Bottom Side	-	1	1	3	30.3	30.08	0.02	0.208	0.219
T86	GSM1900	GPRS 2TX	661	Front Face	-	2	1	3	30.3	30.08	-0.03	0.358	0.377
T87	GSM1900	GPRS 2TX	661	Front Face	-	2	2	4	30.3	30.08	-0.03	0.413	0.434
T111	UMTS B2	RMC12.2K	9400	Front Face	-	1	1	1	23.5	22.41	-0.08	0.513	0.659
T112	UMTS B2	RMC12.2K	9400	Rear Face	-	1	1	1	23.5	22.41	-0.02	0.382	0.491
T113	UMTS B2	RMC12.2K	9400	Left Side	-	1	1	1	23.5	22.41	0.01	0.230	0.296
T114	UMTS B2	RMC12.2K	9400	Right Side	-	1	1	1	23.5	22.41	-0.03	0.110	0.141
T115	UMTS B2	RMC12.2K	9400	Bottom Side	-	1	1	1	23.5	22.41	0.04	0.377	0.485
T116	UMTS B2	RMC12.2K	9400	Front Face	-	2	1	1	23.5	22.41	-0.06	0.510	0.655
T117	UMTS B2	RMC12.2K	9400	Front Face	-	1	2	2	23.5	22.41	0.01	0.409	0.526
T131	UMTS B5	RMC12.2K	4182	Front Face	-	1	1	1	24.5	23.68	-0.04	0.342	0.413
T132	UMTS B5	RMC12.2K	4182	Rear Face	-	1	1	1	24.5	23.68	0.02	0.474	0.573
T133	UMTS B5	RMC12.2K	4182	Left Side	-	1	1	1	24.5	23.68	0.02	0.376	0.454
T134	UMTS B5	RMC12.2K	4182	Right Side	-	1	1	1	24.5	23.68	0.01	0.394	0.476
T135	UMTS B5	RMC12.2K	4182	Bottom Side	-	1	1	1	24.5	23.68	0.01	0.022	0.026
T136	UMTS B5	RMC12.2K	4182	Rear Face	-	2	1	1	24.5	23.68	0.01	0.489	0.591
T137	UMTS B5	RMC12.2K	4182	Rear Face	-	2	2	2	24.5	23.68	0.07	0.421	0.508

2. Hotspot SAR test results of LTE

Test No.	Band	Mode	CH	RB	Offset	Test Position (with 10mm)	Earp hone	SIM	Battery	Sample	Tune up	Measu red	Drift (dB)	SAR Value (W/kg) 1-g	Report ed SAR
T207	LTE B2	QPSK 20M	18900	1	0	Front Face	-	1	1	1	23.5	22.95	0.07	0.293	0.333
T208	LTE B2	QPSK 20M	18900	1	0	Rear Face	-	1	1	1	23.5	22.95	-0.02	0.243	0.276
T209	LTE B2	QPSK 20M	18900	1	0	Left Side	-	1	1	1	23.5	22.95	0.05	0.113	0.128
T210	LTE B2	QPSK 20M	18900	1	0	Right Side	-	1	1	1	23.5	22.95	0.04	0.061	0.070
T211	LTE B2	QPSK 20M	18900	1	0	Bottom Side	-	1	1	1	23.5	22.95	-0.01	0.233	0.265
T212	LTE B2	QPSK 20M	18700	50	0	Front Face	-	1	1	1	22.5	21.58	0.01	0.252	0.312
T213	LTE B2	QPSK 20M	18700	50	0	Rear Face	-	1	1	1	22.5	21.58	0.04	0.194	0.240
T214	LTE B2	QPSK 20M	18700	50	0	Left Side	-	1	1	1	22.5	21.58	0.07	0.089	0.110
T215	LTE B2	QPSK 20M	18700	50	0	Right Side	-	1	1	1	22.5	21.58	-0.06	0.058	0.072
T216	LTE B2	QPSK 20M	18700	50	0	Bottom Side	-	1	1	1	22.5	21.58	0.07	0.210	0.260
T217	LTE B2	QPSK 20M	18900	1	0	Front Face	-	2	1	1	23.5	22.95	0.08	0.307	0.349
T218	LTE B2	QPSK 20M	18900	1	0	Front Face	-	2	2	2	23.5	22.95	0.03	0.248	0.282
T227	LTE B4	QPSK 20M	20175	1	0	Front Face	-	1	1	1	23.5	22.34	-0.04	0.440	0.575
T228	LTE B4	QPSK 20M	20175	1	0	Rear Face	-	1	1	1	23.5	22.34	0.01	0.828	1.082
T229	LTE B4	QPSK 20M	20175	1	0	Left Side	-	1	1	1	23.5	22.34	0.02	0.216	0.282
T230	LTE B4	QPSK 20M	20175	1	0	Right Side	-	1	1	1	23.5	22.34	0.03	0.264	0.345
T231	LTE B4	QPSK 20M	20175	1	0	Bottom Side	-	1	1	1	23.5	22.34	0.08	0.503	0.657
T232	LTE B4	QPSK 20M	20300	50	0	Front Face	-	1	1	1	22.5	21.24	-0.05	0.287	0.384
T233	LTE B4	QPSK 20M	20300	50	0	Rear Face	-	1	1	1	22.5	21.24	-0.09	0.54	0.722
T234	LTE B4	QPSK 20M	20300	50	0	Left Side	-	1	1	1	22.5	21.24	0.07	0.125	0.167
T235	LTE B4	QPSK 20M	20300	50	0	Right Side	-	1	1	1	22.5	21.24	0.04	0.164	0.219
T236	LTE B4	QPSK 20M	20300	50	0	Bottom Side	-	1	1	1	22.5	21.24	0.06	0.45	0.601
T237	LTE B4	QPSK 20M	20050	1	0	Rear Face	-	1	1	1	23.5	22.06	0.07	0.678	0.945
T238	LTE B4	QPSK 20M	20300	1	0	Rear Face	-	1	1	1	23.5	22.08	0.07	0.725	1.005
T239	LTE B4	QPSK 20M	20300	100	0	Rear Face	-	1	1	1	22.5	21.07	-0.07	0.519	0.721
T240	LTE B4	QPSK 20M	20175	1	0	Rear Face	-	2	1	1	23.5	22.34	-0.05	0.782	1.021
T241	LTE B4	QPSK 20M	20175	1	0	Rear Face	-	1	2	2	23.5	22.34	0.04	0.907	1.185
T242	LTE B4	QPSK 20M	20175	1	0	Rear Face 1st repeat	-	1	2	2	23.5	22.34	0.04	0.903	1.179

Test No.	Band	Mode	CH	RB	Offset	Test Position (with 10mm)	Earp hone	SIM	Battery	Sample	Tune up	Measured	Drift (dB)	SAR Value (W/kg) 1-g	Reported SAR
T257	LTE B5	QPSK 10M	20450	1	24	Front Face	-	1	1	1	24.5	24.33	0.01	0.304	0.316
T258	LTE B5	QPSK 10M	20450	1	24	Rear Face	-	1	1	1	24.5	24.33	-0.09	0.410	0.426
T259	LTE B5	QPSK 10M	20450	1	24	Left Side	-	1	1	1	24.5	24.33	-0.08	0.335	0.348
T260	LTE B5	QPSK 10M	20450	1	24	Right Side	-	1	1	1	24.5	24.33	0.06	0.365	0.380
T261	LTE B5	QPSK 10M	20450	1	24	Bottom Side	-	1	1	1	24.5	24.33	0.07	0.023	0.024
T262	LTE B5	QPSK 10M	20525	25	0	Front Face	-	1	1	1	23.5	23.10	0.02	0.276	0.303
T263	LTE B5	QPSK 10M	20525	25	0	Rear Face	-	1	1	1	23.5	23.10	0.02	0.389	0.427
T264	LTE B5	QPSK 10M	20525	25	0	Left Side	-	1	1	1	23.5	23.10	-0.02	0.307	0.337
T265	LTE B5	QPSK 10M	20525	25	0	Right Side	-	1	1	1	23.5	23.10	0.04	0.307	0.337
T266	LTE B5	QPSK 10M	20525	25	0	Bottom Side	-	1	1	1	23.5	23.10	-0.08	0.019	0.021
T267	LTE B5	QPSK 10M	20450	1	24	Rear Face	-	2	1	1	24.5	24.33	-0.08	0.427	0.444
T268	LTE B5	QPSK 10M	20450	1	24	Rear Face	-	1	2	2	24.5	24.33	0.06	0.385	0.400
T277	LTE B7	QPSK 20M	21100	1	50	Front Face	-	1	1	1	23.5	22.50	0.05	0.569	0.716
T278	LTE B7	QPSK 20M	21100	1	50	Rear Face	-	1	1	1	23.5	22.50	0.07	0.815	1.026
T279	LTE B7	QPSK 20M	21100	1	50	Left Side	-	1	1	1	23.5	22.50	-0.05	0.102	0.128
T280	LTE B7	QPSK 20M	21100	1	50	Right Side	-	1	1	1	23.5	22.50	-0.04	0.129	0.162
T281	LTE B7	QPSK 20M	21100	1	50	Bottom Side	-	1	1	1	23.5	22.50	0.03	0.915	1.152
T282	LTE B7	QPSK 20M	20850	50	25	Front Face	-	1	1	1	22.5	21.23	-0.01	0.583	0.781
T283	LTE B7	QPSK 20M	20850	50	25	Rear Face	-	1	1	1	22.5	21.23	0.01	0.651	0.872
T284	LTE B7	QPSK 20M	20850	50	25	Left Side	-	1	1	1	22.5	21.23	-0.05	0.111	0.149
T285	LTE B7	QPSK 20M	20850	50	25	Right Side	-	1	1	1	22.5	21.23	0.01	0.135	0.181
T286	LTE B7	QPSK 20M	20850	50	25	Bottom Side	-	1	1	1	22.5	21.23	0.02	0.772	1.034
T287	LTE B7	QPSK 20M	20850	1	50	Rear Face	-	1	1	1	23.5	22.15	0.05	0.877	1.197
T288	LTE B7	QPSK 20M	21350	1	99	Rear Face	-	1	1	1	23.5	22.16	-0.02	0.609	0.829
T289	LTE B7	QPSK 20M	20850	1	50	Bottom Side	-	1	1	1	23.5	22.15	-0.02	0.985	1.344
T290	LTE B7	QPSK 20M	21350	1	99	Bottom Side	-	1	1	1	23.5	22.16	0.02	0.662	0.901
T291	LTE B7	QPSK 20M	21100	50	25	Rear Face	-	1	1	1	22.5	21.06	0.06	0.701	0.976
T292	LTE B7	QPSK 20M	21350	50	50	Rear Face	-	1	1	1	22.5	20.99	0.03	0.673	0.953
T293	LTE B7	QPSK 20M	21100	50	25	Bottom Side	-	1	1	1	22.5	21.06	-0.01	0.705	0.982
T294	LTE B7	QPSK 20M	21350	50	50	Bottom Side	-	1	1	1	22.5	20.99	0.06	0.667	0.945
T295	LTE B7	QPSK 20M	20850	100	0	Rear Face	-	1	1	1	22.5	21.21	0.01	0.69	0.929
T296	LTE B7	QPSK 20M	20850	100	0	Bottom Side	-	1	1	1	22.5	21.21	0.04	0.827	1.114
T297	LTE B7	QPSK 20M	20850	1	50	Bottom Side	-	2	1	1	23.5	22.15	0	1.030	1.406
T298	LTE B7	QPSK 20M	20850	1	50	Bottom Side	-	2	2	2	23.5	22.15	0.03	0.938	1.280

Test No.	Band	Mode	CH	RB	Offset	Test Position (with 10mm)	Earp hone	SIM	Battery	Sample	Tune up	Measu red	Drift (dB)	SAR Value (W/kg) 1-g	Report ed SAR
T299	LTE B7	QPSK 20M	20850	1	50	Bottom Side -holder perturbation verification Note 2	-	2	1	1	23.5	22.15	-0.01	0.997	1.360
T300	LTE B7	QPSK 20M	20850	1	50	Bottom Side 1st repeat	-	2	1	1	23.5	22.15	0.02	1.010	1.378
T307	LTE B12	QPSK 10M	23060	1	24	Front Face	-	1	1	1	24.5	23.41	-0.03	0.220	0.283
T308	LTE B12	QPSK 10M	23060	1	24	Rear Face	-	1	1	1	24.5	23.41	-0.06	0.280	0.360
T309	LTE B12	QPSK 10M	23060	1	24	Left Side	-	1	1	1	24.5	23.41	0.04	0.200	0.257
T310	LTE B12	QPSK 10M	23060	1	24	Right Side	-	1	1	1	24.5	23.41	0.02	0.229	0.294
T311	LTE B12	QPSK 10M	23060	1	24	Bottom Side	-	1	1	1	24.5	23.41	-0.03	0.025	0.031
T312	LTE B12	QPSK 10M	23060	25	0	Front Face	-	1	1	1	23.5	22.19	-0.01	0.175	0.236
T313	LTE B12	QPSK 10M	23060	25	0	Rear Face	-	1	1	1	23.5	22.19	0.01	0.225	0.304
T314	LTE B12	QPSK 10M	23060	25	0	Left Side	-	1	1	1	23.5	22.19	0.03	0.171	0.231
T315	LTE B12	QPSK 10M	23060	25	0	Right Side	-	1	1	1	23.5	22.19	0.05	0.180	0.243
T316	LTE B12	QPSK 10M	23060	25	0	Bottom Side	-	1	1	1	23.5	22.19	-0.01	0.018	0.025
T317	LTE B12	QPSK 10M	23060	1	24	Rear Face	-	2	1	1	24.5	23.41	0.04	0.271	0.348
T318	LTE B12	QPSK 10M	23060	1	24	Rear Face	-	1	2	2	24.5	23.41	-0.05	0.233	0.299

Note:

- 1) According to TCB workshop October, 2014 RF Exposure Procedures Update(Overlapping LTE Bands): SAR for LTE Band 17 (Frequency range:704-716 MHz) is covered by LTE Band 12 (Frequency range:699-716 MHz) due to similar frequency range, same maximum tune up limit and same channel bandwidth.
- 2) According to 201610 FCC TCB workshop RF exposure slides, when the highest reported SAR of an antenna is > 1.2 W/kg, holder perturbation verification is required for each antenna, using the highest SAR configuration among all applicable frequency bands.

3. Hotspot SAR test results of WIFI

Test No.	Band	CH	Test Position (with 15mm)	Ear phone	Battery	Data Rate	Power Setting	Tune up	Measured	Drift(dB)	SAR Value (W/kg)1-g	Reported SAR
T333	802.11b	11	Front Face	-	1	1	1	15	13.78	-0.01	0.031	0.041
T334	802.11b	11	Rear Face	-	1	1	1	15	13.78	-0.03	0.052	0.069
T335	802.11b	11	Right Side	-	1	1	1	15	13.78	0.03	0.016	0.022
T336	802.11b	11	Top Side	-	1	1	1	15	13.78	-0.09	0.030	0.040
T337	802.11b	11	Rear Face	-	2	2	1	15	13.78	0.05	0.032	0.042

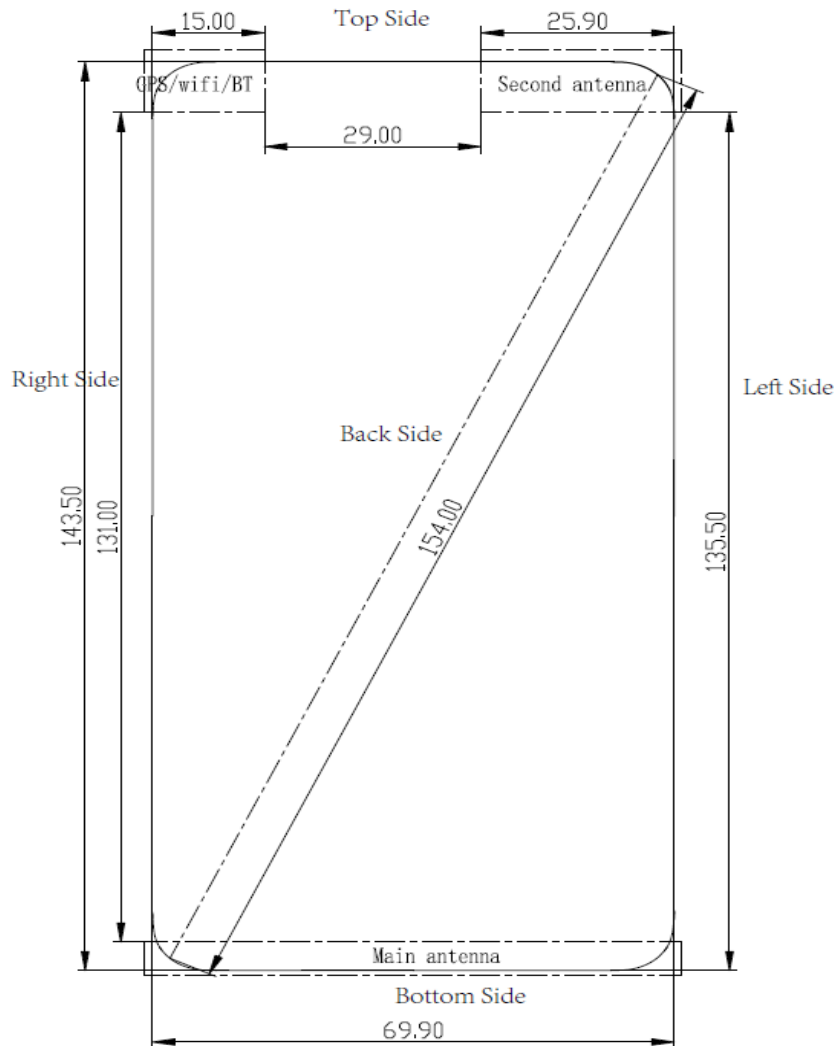
Note: Per KDB248227 D01, the highest SAR measured for the initial test position or initial test configuration should be used to determine SAR test exclusion according to the sum of 1-g SAR and SAR peak to location ratio provisions in KDB 447498. In addition, a test lab may also choose to perform standalone SAR measurements for test positions and 802.11 configurations that are not required by the initial test position or initial test configuration procedures and apply the results to determine simultaneous transmission SAR test exclusion, according to sum of 1-g and SAR peak to location ratio requirements to reduce the number of simultaneous transmission SAR measurements.

8.3 MULTIPLE TRANSMITTER EVALUATION

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498 D01 General RF Exposure Guidance.

The length of the diagonal of the mobile phone is 154.00mm.

The location of the antennas inside mobile phone is shown as below picture:



Note 1: The second antenna is used to improve the acceptance of performance of the main antenna, it does not have a transmitter function.

Note2: The model DIG-L23 under test is a Dual-SIM-Card Mobile Phone. SIM1 and SIM2 supports 2G/3G/LTE.

8.3.1 STAND-ALONE SAR TEST EXCLUSION

Per FCC KDB 447498 D01, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

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

Standalone SAR test exclusion for BT

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
BT	Body- Worn	10	10	15	2.48	1.05	3	Yes

Note:

- 1)* - maximum possible output power declared by manufacturer
- 2) Held to ear configurations are not applicable to Bluetooth for this device.

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:

$(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$ for test separation distances ≤ 50 mm, where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

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

According to KDB 447498 D01, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR was estimated according to following formula to result in substantially conservative SAR values of $\leq 0.4 \text{ W/kg}$ to determine simultaneous transmission SAR test exclusion.

$$\text{Estimated SAR} = \frac{\text{Max. Tune up Power}_{(\text{mW})}}{\text{Min. Test Separation Distance}_{(\text{mm})}} \times \frac{\sqrt{f_{(\text{GHz})}}}{7.5}$$

Estimated SAR calculation

Mode	Position	$P_{\max}$ (dBm)*	$P_{\max}$ (mW)	Distance (mm)	f (GHz)	X	Estimated SAR (W/kg)*
BT	Body- Worn	10	10	15	2.48	7.5	0.140

Note: * - maximum possible output power declared by manufacturer

8.3.2 STAND-ALONE SAR TEST EXCLUSION

Per FCC KDB 447498D01, SAR compliance for simultaneous transmission must be considered when the maximum duration of overlapping transmissions, including network hand-offs, is greater than 30 seconds. This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis.

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Head	Body-worn	Hotspot
1	GSM (Voice) + WiFi 2.4G	Yes	Yes	N/A
2	GPRS/EDGE (DATA) + WiFi 2.4G	N/A	N/A	Yes
3	GSM(Voice) +BT	N/A	Yes	N/A
4	GPRS/EDGE(DATA)+BT	N/A	N/A	N/A
5	UMTS(Voice)+WiFi 2.4G	Yes	Yes	N/A
6	UMTS (DATA)+WiFi 2.4G	N/A	Yes	Yes
7	UMTS (Voice)+BT	N/A	Yes	N/A
8	UMTS (DATA)+BT	N/A	Yes	N/A
9	LTE+WiFi 2.4G	Yes*	Yes*	Yes
10	LTE+BT	N/A	Yes*	N/A

Note:

- i)* VOIP 3rd party applications may possibly be installed and used by the end user.
- ii) Wi-Fi 2.4G and Bluetooth share the same antenna and can't transmit simultaneously.
- iii) 2G&3G&4G share the same antenna and can't transmit simultaneously.
- iv) The device does not support DTM function.
- v) Held to ear configurations are not applicable to Bluetooth and therefore were not considered for simultaneous transmission.
- vi) The device supports VoLTE function.

8.3.3 SAR SUMMATION SCENARIO

About BT/ WiFi and GSM/UMTS/LTE Main antenna

Test Position Reported SAR _{1g}	Head				Body-Worn		Hotspot					
	Right Cheek	Right Tilted	Left Cheek	Left Tilted	Front	Rear	Front	Rear	Left	Right	Top	Bottom
GSM 850	0.314	0.259	0.329	0.237	0.393	0.542	0.709	0.940	1.040	0.999	-	0.049
GSM 1900	0.186	0.067	0.203	0.097	0.158	0.125	0.434	0.352	0.231	0.130	-	0.219
UMTS B2	0.315	0.111	0.303	0.221	0.366	0.301	0.659	0.491	0.296	0.141	-	0.485
UMTS B5	0.344	0.263	0.358	0.233	0.425	0.557	0.413	0.591	0.454	0.476	-	0.026
LTE B2	0.248	0.095	0.214	0.113	0.183	0.136	0.349	0.276	0.128	0.072	-	0.265
LTE B4	0.392	0.210	0.257	0.197	0.328	0.533	0.575	1.185	0.282	0.345	-	0.657
LTE B5	0.253	0.223	0.268	0.193	0.327	0.437	0.316	0.444	0.348	0.380	-	0.024
LTE B7	0.304	0.077	0.095	0.082	0.355	0.385	0.781	1.197	0.149	0.181	-	1.406
LTE B12	0.217	0.157	0.238	0.157	0.244	0.279	0.283	0.360	0.257	0.294	-	0.031
BT	-	-	-	-	0.140	0.140	-	-	-	-	-	-
WiFi 2.4G	0.164	0.189	0.294	0.283	0.017	0.024	0.041	0.069	-	0.022	0.040	-
MAX Σ SAR _{1g}	0.556	0.453	0.652	0.520	0.565	0.697	0.822	1.266	1.040	1.020	0.040	1.406

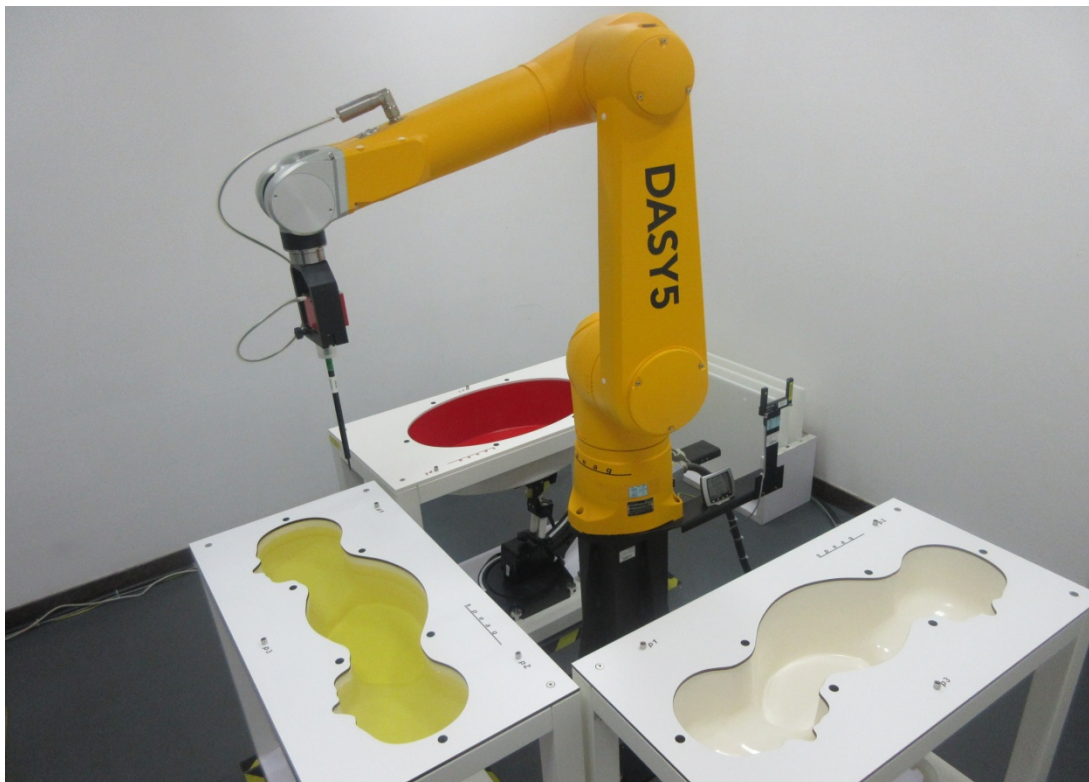
Note: 1) MAX. Σ SAR_{1g} < 1.6 W/kg, the SAR to peak location separation ratio should not be considered.

2) The highest simultaneous SAR value=1.406 W/kg, per KDB690783 D01

APPENDIX

1. Test Layout

Specific Absorption Rate Test Layout



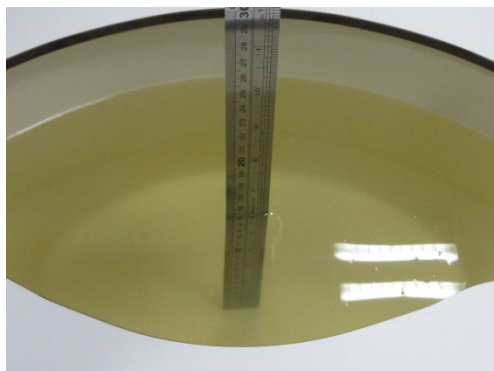
Liquid depth in the flat Phantom ($\geq 15\text{cm}$ depth)

Body(750MHz)_15.6cm

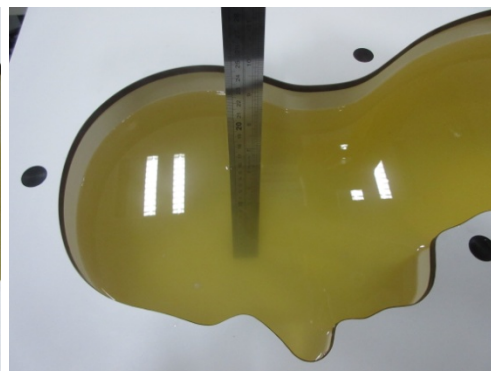
Head(750MHz) _15.6cm



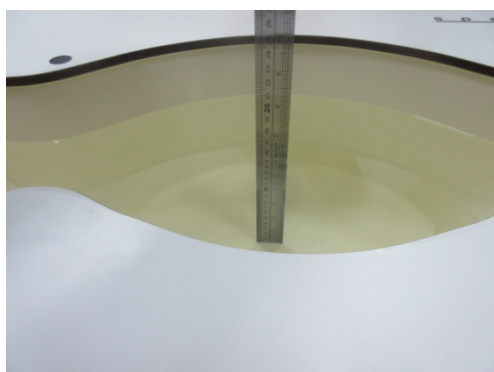
Body(835MHz) 15.5cm



Head(835MHz) 15.9cm



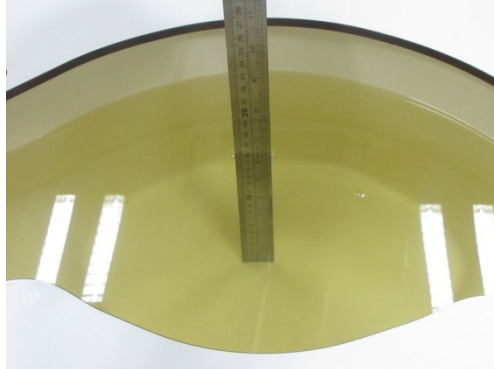
Body(1750MHz) 15.4cm



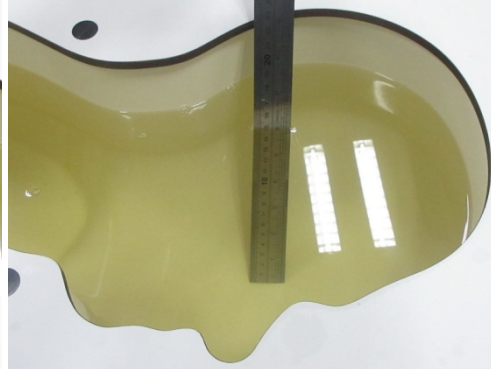
Head(1750MHz) 15.9cm



Body(1900MHz~2600 MHz) _15.4cm



Head (1900MHz~2600 MHz) _15.6cm



Appendix A. SAR Plots of System Verification

(Pls See Appendix A.)

Appendix B. SAR Plots of SAR Measurement

(Pls See Appendix b.)

Appendix C. Calibration Certificate for Probe and Dipole

(Pls See Appendix C.)

Appendix D. Photographs of the Test Set-Up

(Pls See Appendix D.)

End