FCC SAR Test Report

FCC ID: QISLUA-L21

Project No.	:	1601C010C
Equipment	:	Smart Phone
Model Name	:	HUAWEI LUA-L21
Applicant	:	Huawei Technologies Co., Ltd.
Address	:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District Shenzhen China
Date of Receipt	:	Jan. 07, 2016(HUAWEI LUA-L03); Jan. 05, 2017(HUAWEI LUA-L21)
Date of Test	:	Jan. 08, 2016 ~ Jan. 28, 2016(HUAWEI LUA-L03); Jan. 07, 2017 ~ Jan. 08, 2017(HUAWEI LUA-L21)
Issued Date	:	Jan. 16, 2017
Tested by	:	BTL Inc.

PREPARED BY : (Super Jiang/ Technical Engineer)

APPROVED BY : (Steven Lu / Technical Manager)

BTL INC.

No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

TEL: +86-769-8318-3000 FAX: +86-769-8319-6000

Testing Laboratory 2640

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCC SAR-1-1601C010	Original Report.	Feb. 15, 2016
BTL-FCC SAR-1-1601C010C	Compared with previous report (BTL-FCC SAR-1-1601C010), the differences please see the table below.	Jan. 16, 2017

Note: According to the differences description below, HUAWEI LUA-L21 shares the same test datas of HUAWEI LUA-L03. In addition, all the worst cases are evaluated and recorded in this test report. And the new added SIM2 Card of HUAWEI LUA-L21 is evaluated in the worst case and recorded in this test report.

The differences between HUAWEI LUA-L03 and HUAWEI LUA-L21 are shown as follows:

Model	HUAWEI LUA-L03	HUAWEI LUA-L21
Brand	HUAWEI	HUAWEI
	HUAWEI trade mark	HUAWEI trade mark
	Six sides figure：The same	Six sides figure：The same
2G Frequency	GSM/GPRS/EDEG 850/1900	GSM/GPRS/EDEG 850/1900
3G Frequency	UMTS: B2/B4/B5	UMTS: B2 (Software: The UMTS B4/B5 is disabled by the software.)
4G Frequency	FDD-LTE: B2/B4/B5/B7/B28 (Only B2/B4/B5/B7 test data included in this report)	LTE B8 (not be granted) (Software: The LTE B2/B4/B5/B7 is disabled by the software, and the B8 opened by software)
Hardware version	The same	The same
Software version	LUA-L03C00B005	LUA-L21C696B100
SIM Card	Single	Double
Dimensions	The same	The same
Appearance	The same	The same
main antenna	The same	The same
BT/Wi-Fi antenna	The same	The same
GPS antenna	The same	The same
PA(GSM)	The same(SKY77916)	The same(SKY77916)
PA(UMTS/FDD)	The same(SKY77643)	The same(SKY77643)
Adapter	The same	The same

1. GENERAL SUMMARY

Equipment	Smart Phone
Brand Name	HUAWEI
Model Name	HUAWEI LUA-L21
Model difference	N/A
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 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-1-1601C010C) 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 v01r04,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	0.43	0.68	1.33
	GSM1900	0.58	0.36	0.83
	UMTS Band 2	0.77	0.48	0.96
DTS	2.4G WLAN	0.98	0.12	0.22
Note：The highest reported SAR for head, body-worn accessory, product specific (hotspot), simultaneous transmission exposure conditions are 0.98W/kg, 0.68W/kg, 1.33W/kg and 1.55W/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 .

3.2 GENERAL DESCRIPTION OF EUT

Equipment	Smart Phone		
Model Name	HUAWEI LUA-L21		
IMEI Code	862716035000064		
	862716035001369		
S/N	WTM9KA96A1499746		
HW Version	VER.A		
SW Version	LUA-L21C696B100		
Modulation	GSM(GMSK/8PSK),UMTS(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
	Bluetooth	2400 ~2483.5	
	WIFI	2412 ~2462	
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	7		
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)		
Test Channels (low-mid-high):	128-190-251 (GSM850)		
	512-661-810 (GSM1900)		
	9262-9400-9538(UMTS Band 2)		
	1-6 -11 (2.4G WIFI 802.11b/g/n HT20)		
	3-6 - 9 (2.4G WIFI 802.11n HT40)		
Antenna Gain	BT/2.4G WiFi: 0.52dBi		
	GSM1900/ UMTS Band 2: 0.41dBi		
	GSM850: 1.33dBi		

Other Information	
Battery (HUAWEI LUA-L03)	Huawei Technologies Co., Ltd. Battery Model: HB505076RBC Nominal Voltage: ⎓ +3.8V Charging Voltage: ⎓ +4.35V 1. SCUD (FUJIAN) Electronics Co., Ltd Rated capacity: 2150mAh/8.2Wh 2. Sunwoda Electronic Co., LTD Rated capacity: 2150mAh/8.2Wh 3. Tianjin Lishen Battery Joint-Stock Co.,Ltd. Rated capacity: 2100mAh/8.0Wh 4. BYD LITHIUM BATTERY Co., LTD. Rated capacity: 2100mAh/8.0Wh
Battery (HUAWEI LUA-L21)	Huawei Technologies Co., Ltd. Battery Model: HB505076RBC Nominal Voltage: ⎓ +3.8V Charging Voltage: ⎓ +4.35V 1. Tianjin Lishen Battery Joint-Stock Co.,Ltd. Rated capacity: 2100mAh/8.0Wh 2. BYD LITHIUM BATTERY Co., LTD. Rated capacity: 2100mAh/8.0Wh
Earphone	1. Jiangxi Lianchuang Hongsheng Electronic Co., LTD. Model: MEMD1632B580A00 2. BOLUO COUNTY QUANCHENG ELECTRONIC Model: 1311-3291-3.5mm-178 3. GOERTEK INC. Model: HA1-3 4. Jiangxi Lianchuang Hongsheng Electronic Co., LTD. Model: MEMD1532B528000 5. BOLUO COUNTY QUANCHENG ELECTRONIC CO., LTD. Model: 1293#+3283#3.5MM-150

3.3 LABORATORY ENVIRONMENT

Temperature	Min. = 18ºC, Max. = 25ºC
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. 18, 2015	1 Year
*2	Data Acquisition Electronics	Speag	DAE4	1390	Sep. 22, 2016	1 Year
3	E-field Probe	Speag	EX3DV4	3932	Jan. 30, 2015	1 Year
*5	E-field Probe	Speag	EX3DV4	3932	Feb. 19, 2016	1 Year
6	System Validation Dipole	Speag	D835V2	4d160	Sep. 30, 2015	3 Year
7	System Validation Dipole	Speag	D1900V2	5d179	Sep. 29, 2015	3 Year
8	System Validation Dipole	Speag	D2450V2	919	Sep. 28, 2015	3 Year
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 Com Test set	Agilent	E5515E	MY52112163	Aug. 03, 2015	1 Year
*12	8960 Series 10 Wireless Com Test set	Agilent	E5515E	MY52112163	Sep. 04, 2016	1 Year
*13	Power Amplifier	Mini-Circuits	ZHL-42W+	QA1333003	N/A	N/A
*14	Power Amplifier	Mini-Circuits	ZVE-8G+	520701341	N/A	N/A
15	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 29, 2015	1 Year
*16	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 27, 2016	1 Year
17	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Nov. 02, 2015	1 Year
*18	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Sep. 04, 2016	1 Year
19	P-series power meter	Agilent	N1911A	MY45100473	Mar. 29, 2015	1 Year
*20	P-series power meter	Agilent	N1911A	MY45100473	Sep. 04, 2016	1 Year
21	wideband power sensor	Agilent	N1921A	MY51100041	Mar. 29, 2015	1 Year
*22	wideband power sensor	Agilent	N1921A	MY51100041	Sep. 04, 2016	1 Year
23	Power Meter	Anritsu	ML2487A	6K00004714	Mar. 16, 2015	1 Year
*24	power Meter	Anritsu	ML2495A	1128009	Mar. 27, 2016	1 Year
25	Power Meter Sensor	Anritsu	MA2491A	34138	Mar. 16, 2015	1 Year
*26	Pulse Power Sensor	Anritsu	MA 2411B	1027500	Mar. 27, 2016	1 Year
27	Dielectric Assessment Kit	Speag	DAK-3.5	1226	N/A	N/A
28	Dual directional coupler	Agilent	777D	50208	Mar. 29, 2015	1 Year
*29	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. * These test equipments have been recalibrated between the test periods. All these test equipments were within the valid period when the tests were performed.

3. 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.

a) There is no physical damage on the dipole;

b) System check with specific dipole is within 10% of calibrated value;

c) The most recent return-loss result , measured at least annually, deviates by no more than 20% from the previous measurement;

d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

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

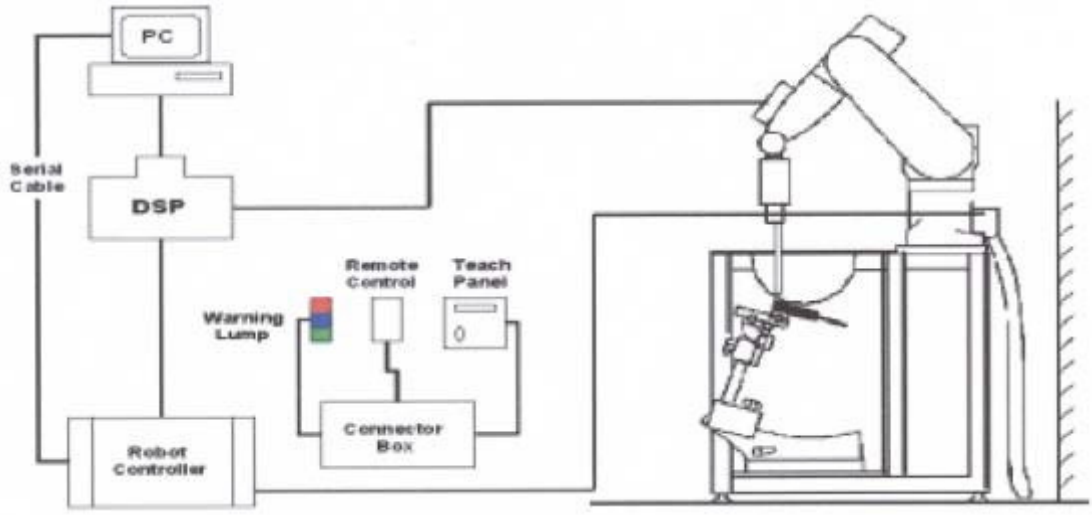
4. SAR MEASUREMENTS SYSTEM CONFIGURATION

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. TheDASY5 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.

4.1.1Test Setup Layout

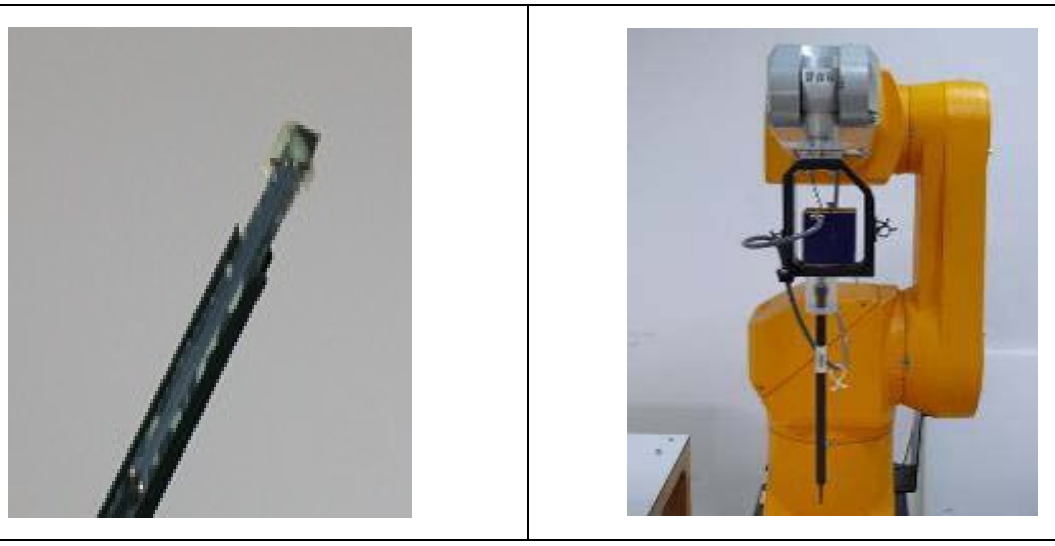


4.2 DASY5E-FIELDPROBESYSTEM

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 μW/g to > 100 mW/g Linearity:± 0.2dB
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 ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. 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 bellow 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.

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

Where: Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m3).

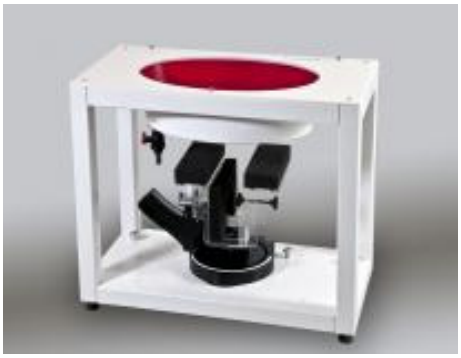
4.2.3 OTHER TEST EQUIPMENT

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, ELI4and SAM v6.0Phantoms.
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
Aailable	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
Aailable	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. ± 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 ± 0.1mm). 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 ± 30°.)

- 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(≤2GHz)，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: Δx_{zoom}, Δy_{zoom}≤ 2GHz -≤8mm, 2-4GHz -≤5 mm and 4-6 GHz-≤4mm; Δz_{zoom}≤3GHz -≤5 mm, 3-4 GHz-≤4mm and 4-6GHz-≤2mm 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 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 (Δx_{area}, Δy_{area})	Maximun Zoom Scan spatial resolution (Δx_{Zoom}, Δy_{Zoom})	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{Zoom}(n)$	$\Delta z_{Zoom}(1)$*	$\Delta z_{Zoom}(n>1)$*	
≤2GHz	≤15mm	≤8mm	≤5mm	≤4mm	≤1.5*Δz_{Zoom}(n-1)	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤1.5*Δz_{Zoom}(n-1)	≥30mm
3-4GHz	≤12mm	≤5mm	≤4mm	≤3mm	≤1.5*Δz_{Zoom}(n-1)	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤1.5*Δz_{Zoom}(n-1)	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤1.5*Δz_{Zoom}(n-1)	≥22mm

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 compansate 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.

4.6.2.2 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:

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

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

aij = 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):

$$E_{tot} = (E_X^2 + E_Y^2 + E_Z^2)^{1/2}$$

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

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

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/cm^3

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

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

With P_{pwe} = equivalent power density of a plane wave in mW/cm^2

E_{tot} = total 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 of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 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 835	0.2	-	0.2	1.5	57.0	-	41.1	-
Head 1900	-	44.5	-	0.2	-	-	55.3	-
Head 2450	-	45.0	-	0.1	-	-	54.9	-

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Body 835	0.2	-	0.2	0.9	48.5	-	50.2	-
Body 1900	-	29.5	-	0.3	-	-	70.2	-
Body 2450	-	31.4	-	0.1	-	-	68.5	-

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. (℃)	Conductivity (σ)	Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (σ) (%)	Deviation Permittivity (εr) (%)	Date
Head	835	22.1	0.902	42.400	0.90	41.5	0.19	2.17	Jan. 16, 2016
Head	835	22.3	0.933	43.200	0.90	41.5	3.67	4.10	Jan. 07, 2017
Head	1900	22.2	1.423	39.390	1.40	40.0	1.64	-1.53	Jan. 19, 2016
Head	1900	22.3	1.406	39.330	1.40	40.0	0.43	-1.68	Jan. 07, 2017
Head	2450	22.3	1.850	38.880	1.80	39.2	2.78	-0.82	Jan. 19, 2016
Head	2450	22.3	1.877	38.590	1.80	39.2	4.28	-1.56	Jan. 07, 2017
Body	835	22.1	0.973	54.290	0.97	55.2	0.30	-1.65	Jan. 15, 2016
Body	835	22.3	0.998	55.150	0.97	55.2	2.89	-0.09	Jan. 07, 2017
Body	1900	22.3	1.550	52.040	1.52	53.3	1.97	-2.36	Jan. 16, 2016
Body	1900	22.2	1.549	53.550	1.52	53.3	1.91	0.47	Jan. 08, 2017
Body	2450	22.2	1.995	53.100	1.95	52.7	2.31	0.76	Jan. 16, 2016
Body	2450	22.2	1.955	53.210	1.95	52.7	0.26	0.97	Jan. 08, 2017

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

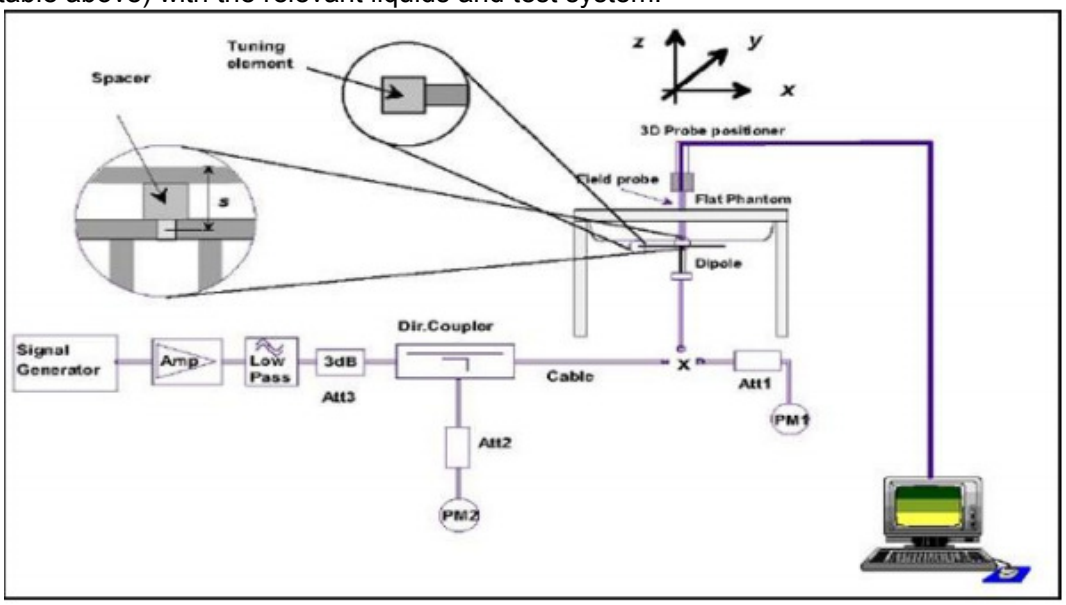
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands 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	Jan. 16, 2016	835	9.50	2.39	9.56	0.63	4d160
Head	Jan. 07, 2017	835	9.50	2.42	9.68	1.89	4d160
Head	Jan. 19, 2016	1900	39.70	10.02	40.08	0.96	5d179
Head	Jan. 07, 2017	1900	39.70	9.66	38.64	-2.67	5d179
Head	Jan. 19, 2016	2450	52.00	12.88	51.52	-0.92	919
Head	Jan. 07, 2017	2450	52.00	13.42	53.68	3.23	919
Body	Jan. 15, 2016	835	9.52	2.42	9.68	1.68	4d160
Body	Jan. 07, 2017	835	9.52	2.36	9.44	-0.84	4d160
Body	Jan. 16, 2016	1900	39.60	9.91	39.64	0.10	5d179
Body	Jan. 08, 2017	1900	39.60	9.58	38.32	-3.23	5d179
Body	Jan. 16, 2016	2450	51.10	13.30	53.20	4.11	919
Body	Jan. 08, 2017	2450	51.10	12.40	49.60	-2.94	919

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.



6. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

6.1 SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04, 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	0.5	0.5	1
	3 TX slots	2.5	2.5	3
	4 TX slots	3.5	3.5	4
GSM1900	1 TX slot	0	0	0
	2 TX slots	1	1	1
	3 TX slots	3.5	3.5	3
	4 TX slots	4.5	4.5	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 3.4kbps SRB(signalling radio bearer) using the exposure configuration that results in the highest SAR in12.2kbps 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 12.2kbps RMC or the maximum SAR 12.2kbps 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 12.2kbps 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, ΔNACK, ΔCQI = 8. The variation of the β_c /β_d ratio causes a power reduction at sub-tests 2 - 4.

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

Note 1: ΔACK, ΔNACK and ΔCQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$
Note 2 : CM=1 for β_c/β_d= 12/15, β_{hs}/β_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.
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 β_c = 11/15 and β_d = 15/15

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 Payload	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 ≤¼ 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 ≤ 1.2W/kg, SAR measurement is not required for the secondary mode.

Per KDB941225 D01v03r01, 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	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}(1)	β_{ec}	β_{ed}	β_{ec} (SF)	β_{ed} (code)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
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	β_{ed1}:47/15 β_{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: 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, 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 Speading 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.

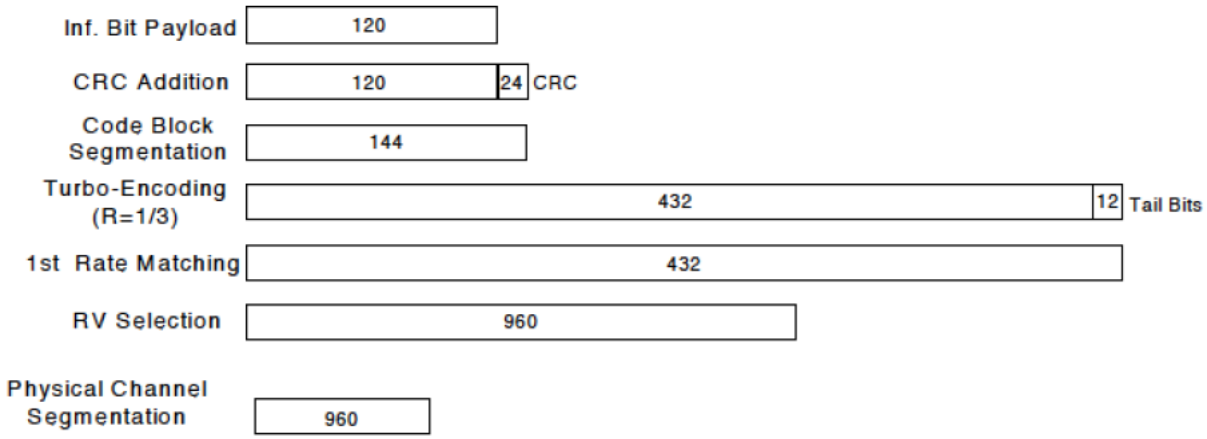


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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

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

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 β_c/β_d= 12/15, β_{hs}/β_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.
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 β_c = 11/15 and β_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.

6. HSPA+

When the maximum average output power of each RF channel with (uplink) HSPA+ active is ≤¼ dB higher than that measured without HSPA+ using 12.2 kbps RMC, SAR evaluation for HSPA+ is not required.

Table Sub-test1 setup for release 7 HSPA+ with 16QAM

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed}1: 30/15 β_{ed}2: 30/15	β_{ed}3: 24/15 β_{ed}4: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.

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	802.11n HT40
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

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

7.2.2 Body

The size of the mobile phone is132.7mm (length) X 65.2mm (width).

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

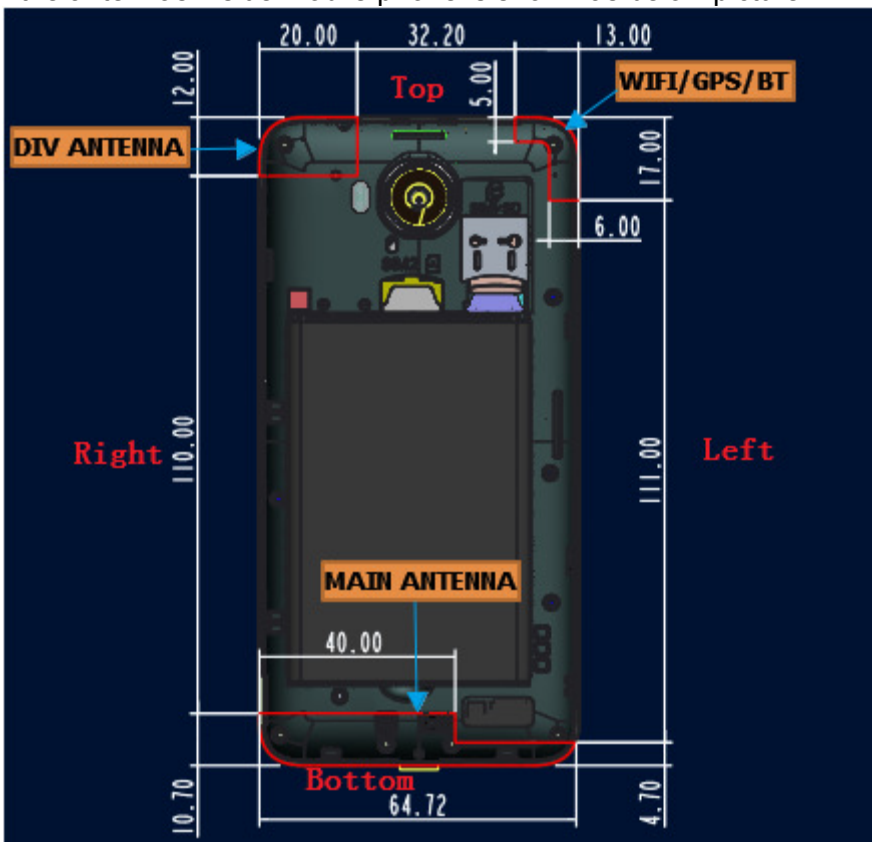


Table 7.2.2 Hotspot Side For SAR Testing

Mode	Exposure Condition	Front Side	Rear Side	Left Side	Right Side	Top Side	Bottom Side
GSM850/1900	Hotspot	YES	YES	YES	YES	NO	YES
WCDMA Band 2	Hotspot	YES	YES	YES	YES	NO	YES
2.4GWiFi	Hotspot	YES	YES	YES	NO	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

HUAWEI LUA-L03

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)		33.00	32.64	32.68	32.52	23.81	23.45	23.49	23.33
GPRS/ EDGE (GMSK)	1 Tx Slot	33.00	32.65	32.59	32.54	23.81	23.46	23.40	23.35
	2 Tx Slots	32.50	31.97	32.08	31.96	26.37	25.84	**25.95**	25.83
	3 Tx Slots	30.50	30.23	30.12	30.05	26.08	25.81	25.70	25.63
	4 Tx Slots	29.50	28.82	28.71	28.54	26.32	25.64	25.53	25.36
EDGE (8PSK)	1 Tx Slot	27.50	27.30	27.28	27.26	18.31	18.11	18.09	18.07
	2 Tx Slots	26.50	26.35	26.33	26.28	20.37	20.22	20.20	20.15
	3 Tx Slots	24.50	24.22	24.11	24.19	20.08	19.80	19.69	19.77
	4 Tx Slots	23.50	23.12	23.05	23.06	20.32	19.94	19.87	19.88

HUAWEI LUA-L21

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)		33.00	32.90	32.88	32.89	23.81	23.71	23.69	23.70
GPRS/ EDGE (GMSK)	1 Tx Slot	33.00	32.90	32.88	32.89	23.81	23.71	23.69	23.70
	2 Tx Slots	32.50	32.28	32.32	32.35	26.37	26.15	26.19	**26.22**
	3 Tx Slots	30.50	30.42	30.36	30.45	26.08	26.00	25.94	26.13
	4 Tx Slots	29.50	29.22	29.18	29.40	26.32	26.04	26.00	26.22
EDGE (8PSK)	1 Tx Slot	27.50	26.43	26.37	26.31	18.31	17.24	17.18	17.12
	2 Tx Slots	26.50	25.43	25.31	25.33	20.37	19.30	19.18	19.20
	3 Tx Slots	24.50	23.54	23.56	23.52	20.08	19.12	19.14	19.10
	4 Tx Slots	23.50	22.52	22.54	22.57	20.32	19.34	19.36	19.39

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 D01v03r01, 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

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)		30.50	29.94	29.96	29.90	21.31	20.75	20.77	20.71
GPRS /EDGE (GMSK)	1 Tx Slot	30.50	30.00	29.87	29.62	21.31	20.81	20.68	20.43
	2 Tx Slots	29.50	28.94	28.96	28.73	23.37	22.81	**22.83**	22.60
	3 Tx Slots	27.00	26.45	26.61	26.51	22.58	22.03	22.19	22.09
	4 Tx Slots	26.00	25.26	25.46	25.42	22.82	22.08	22.28	22.24
EDGE (8PSK)	1 Tx Slot	26.00	25.25	25.28	25.25	16.81	16.06	16.09	16.06
	2 Tx Slots	25.00	24.26	24.30	24.21	18.87	18.13	18.17	18.08
	3 Tx Slots	23.00	22.29	22.31	22.22	18.58	17.87	17.89	17.80
	4 Tx Slots	22.00	21.56	21.39	21.10	18.82	18.38	18.21	17.92

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 D01v03r01, 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

UMTS Band 2		Tune-up	SAR Conducted Power (dBm)		
			9262CH	9400CH	9538CH
			1852.4	1880	1907.6
WCDMA	12.2kbps RMC	23.00	22.78	**22.81**	22.71
	64kbps RMC	23.00	22.76	22.73	22.67
	144kbps RMC	23.00	22.74	22.72	22.64
	384kbps RMC	23.00	22.72	22.73	22.68
HSDPA	Subtest 1	22.00	21.46	21.54	21.33
	Subtest 2	22.00	21.87	21.85	21.83
	Subtest 3	22.00	21.48	21.34	21.35
	Subtest 4	22.00	21.51	21.32	21.32
HSUPA	Subtest 1	21.00	20.06	19.93	19.90
	Subtest 2	21.00	19.48	19.73	19.77
	Subtest 3	22.00	20.45	20.59	20.49
	Subtest 4	21.00	19.44	19.78	19.26
	Subtest 5	22.00	20.39	20.32	20.24
DC-HSDPA	Subtest 1	22.00	21.46	21.54	21.33
	Subtest 2	22.00	21.87	21.85	21.83
	Subtest 3	22.00	21.48	21.34	21.35
	Subtest 4	22.00	21.51	21.32	21.32
HSPA+	Subtest-1 (UL 16QAM)	21.00	20.40	20.23	20.37

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 ≤¼ 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.

8.1.10 CONDUCTED POWER MEASUREMENTS OF WiFi 2.4G

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Power Setting	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	1	18.00	17.00	16.27	Yes
	6	2437		18.00	17.00	16.92	Yes
	11	2462		18.00	17.00	16.67	Yes
802.11g	1	2412	6	Not Required	15.00	Not Required	No
	6	2437		Not Required	15.00	Not Required	No
	11	2462		Not Required	15.00	Not Required	No
802.11n HT20	1	2412	6.5	Not Required	15.00	Not Required	No
	6	2437		Not Required	15.00	Not Required	No
	11	2462		Not Required	15.00	Not Required	No
802.11n HT40	3	2422	13.5	Not Required	15.00	Not Required	No
	6	2437		Not Required	15.00	Not Required	No
	9	2452		Not Required	15.00	Not Required	No

Note:

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

2) Per KDB248227, 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.

8.1.11 CONDUCTED POWER MEASUREMENTS OF BT

BT	Tune Up	Average Conducted Power (dBm)		
		CH00	CH39	CH78
DH5	8.00	6.12	5.21	5.59
2DH5	8.00	6.41	6.03	5.62
3DH5	8.00	6.31	5.61	5.47

BT	Tune Up	Average Conducted Power (dBm)		
		CH00	CH19	CH39
BLE	-1.00	-3.53	-2.00	-2.60

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

8.2 SAR TEST RESULTS

General Notes:

1) Per KDB447498 D01v06, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.

2) Per KDB447498 D01v06, 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 > ½ dB, instead of the middle channel, the highest output power channel must be used.

3) Per KDB865664 D01v01r04,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg, only one repeated measurement is required.

4) Per KDB941225 D06v02r01, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested.

5) Per KDB648474 D04v01r03, 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 D02v01r02, 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 ≤¼ 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.

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&WCDMA

Test No.	Band	Mode	CH	Test Position	SIM	Battery	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR	Test Sample
T01	GSM850	GSM	190	Right Cheek	1	1	33	32.68	0.01	0.343	0.369	HUAWEI LUA-L03
T02	GSM850	GSM	190	Right Tilted	1	1	33	32.68	0.03	0.334	0.360	
T03	GSM850	GSM	190	Left Cheek	1	1	33	32.68	0.07	**0.359**	0.386	
T04	GSM850	GSM	190	Left Tilted	1	1	33	32.68	-0.09	0.308	0.332	
T05	GSM850	GSM	190	Left Cheek	1	2	33	32.68	-0.02	0.351	0.378	
T06	GSM850	GSM	190	Left Cheek	1	3	33	32.68	-0.08	0.349	0.376	
T07	GSM850	GSM	190	Left Cheek	1	4	33	32.68	0.04	0.346	0.372	
T501	GSM850	GSM	190	Left Cheek	1	3	33	32.88	0.03	0.417	0.429	HUAWEI LUA-L21
T502	GSM850	GSM	190	Left Cheek	2	3	33	32.88	-0.01	**0.422**	0.434	
T08	GSM1900	GSM	661	Right Cheek	1	1	30.5	29.96	-0.03	0.289	0.327	HUAWEI LUA-L03
T09	GSM1900	GSM	661	Right Tilted	1	1	30.5	29.96	-0.04	0.234	0.265	
T10	GSM1900	GSM	661	Left Cheek	1	1	30.5	29.96	0.09	0.359	0.407	
T11	GSM1900	GSM	661	Left Tilted	1	1	30.5	29.96	0.01	0.241	0.273	
T12	GSM1900	GSM	661	Left Cheek	1	2	30.5	29.96	0.05	0.362	0.410	
T13	GSM1900	GSM	661	Left Cheek	1	3	30.5	29.96	0.06	**0.371**	0.420	
T14	GSM1900	GSM	661	Left Cheek	1	4	30.5	29.96	-0.04	0.364	0.412	
T503	GSM1900	GSM	661	Left Cheek	1	3	30.5	29.96	0.02	0.492	0.557	HUAWEI LUA-L21
T504	GSM1900	GSM	661	Left Cheek	2	3	30.5	29.96	-0.03	**0.515**	0.583	
T15	UMTS B2	RMC12.2K	9400	Right Cheek	1	1	23	22.81	0.07	0.478	0.499	HUAWEI LUA-L03
T16	UMTS B2	RMC12.2K	9400	Right Tilted	1	1	23	22.81	0.05	0.454	0.474	
T17	UMTS B2	RMC12.2K	9400	Left Cheek	1	1	23	22.81	0.09	0.612	0.639	
T18	UMTS B2	RMC12.2K	9400	Left Tilted	1	1	23	22.81	-0.06	0.432	0.451	
T19	UMTS B2	RMC12.2K	9400	Left Cheek	1	2	23	22.81	-0.02	0.637	0.665	
T20	UMTS B2	RMC12.2K	9400	Left Cheek	1	3	23	22.81	0.06	**0.651**	0.680	
T21	UMTS B2	RMC12.2K	9400	Left Cheek	1	4	23	22.81	0.03	0.645	0.674	
T505	UMTS B2	RMC12.2K	9400	Left Cheek	1	3	23	22.81	0.06	0.721	0.753	HUAWEI LUA-L21
T506	UMTS B2	RMC12.2K	9400	Left Cheek	2	3	23	22.81	0.03	**0.738**	0.771	

2. Head SAR test results of WIFI

Test No.	Band	CH	Test Position	Battery	Tune up	Measured	Drift (dB)	Peak SAR of Area Scan(W/kg)	SAR Value (W/kg)1-g	Reported SAR	Test Sample
T400	802.11b	6	Right Cheek	1	17	16.92	-0.09	0.933	0.900	0.917	HUAWEI LUA-L03
T401	802.11b	6	Right Tilted	1	17	16.92	0.03	0.526	0.508	0.517	
T402	802.11b	6	Left Cheek	1	17	16.92	0.04	0.509	0.498	0.507	
T403	802.11b	6	Left Tilted	1	17	16.92	-0.02	0.638	0.618	0.629	
T405	802.11b	11	Right Cheek	1	17	16.67	-0.09	0.866	0.854	0.921	
T406	802.11b	6	Right Cheek	1	17	16.92	-0.01	0.828	0.807	0.822	
T407	802.11b	6	Right Cheek	2	17	16.92	0.06	0.982	**0.966**	0.984	
T408	802.11b	6	Right Cheek	3	17	16.92	0.06	0.836	0.817	0.832	
T409	802.11b	6	Right Cheek **(1st Repeated)**	4	17	16.92	-0.02	0.956	0.948	0.966	
T507	802.11b	6	Right Cheek	3	17	16.92	0.01	0.977	**0.966**	0.984	HUAWEI LUA-L21

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)	SIM	Battery	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR	Test Sample
T36	GSM850	GSM	190	Front Face	1	1	33	32.68	0.01	0.411	0.442	HUAWEI LUA-L03
T37	GSM850	GSM	190	Rear Face	1	1	33	32.68	-0.07	**0.515**	0.554	
T38	GSM850	GSM	190	Rear Face	1	2	33	32.68	-0.02	0.476	0.512	
T39	GSM850	GSM	190	Rear Face	1	3	33	32.68	-0.03	0.493	0.531	
T40	GSM850	GSM	190	Rear Face	1	4	33	32.68	0.04	0.507	0.546	
T508	GSM850	GSM	190	Rear Face	1	4	33	32.88	-0.02	**0.660**	0.678	HUAWEI LUA-L21
T509	GSM850	GSM	190	Rear Face	2	4	33	32.88	0.07	0.634	0.652	
T52	GSM1900	GSM	661	Front Face	1	1	30.5	29.96	0.08	**0.218**	0.247	HUAWEI LUA-L03
T53	GSM1900	GSM	661	Rear Face	1	1	30.5	29.96	0.09	0.198	0.224	
T54	GSM1900	GSM	661	Front Face	1	2	30.5	29.96	-0.06	0.193	0.219	
T55	GSM1900	GSM	661	Front Face	1	3	30.5	29.96	-0.05	0.216	0.245	
T56	GSM1900	GSM	661	Front Face	1	4	30.5	29.96	0.02	0.203	0.230	
T513	GSM1900	GSM	661	Front Face	1	3	30.5	29.96	0.01	**0.320**	0.362	HUAWEI LUA-L21
T514	GSM1900	GSM	661	Front Face	2	3	30.5	29.96	0.03	0.315	0.357	
T65	UMTS B2	RMC12.2K	9400	Front Face	1	1	23	22.81	0.04	**0.390**	0.407	HUAWEI LUA-L03
T66	UMTS B2	RMC12.2K	9400	Rear Face	1	1	23	22.81	-0.02	0.373	0.390	
T67	UMTS B2	RMC12.2K	9400	Front Face	1	2	23	22.81	0.08	0.364	0.380	
T68	UMTS B2	RMC12.2K	9400	Front Face	1	3	23	22.81	0.03	0.386	0.403	
T69	UMTS B2	RMC12.2K	9400	Front Face	1	4	23	22.81	-0.05	0.381	0.398	
T517	UMTS B2	RMC12.2K	9400	Front Face	1	3	23	22.81	0.01	**0.456**	0.476	HUAWEI LUA-L21
T518	UMTS B2	RMC12.2K	9400	Front Face	2	3	23	22.81	0.05	0.422	0.441	

2. Body-worn SAR test results of WIFI

Test No.	Band	CH	Test Position (with 15mm)	Battery	Tune up	Measured	Drift (dB)	Peak SAR of Area Scan(W/kg)	SAR Value (W/kg)1-g	Reported SAR	Test Sample
T410	802.11b	6	Front Face	1	17	16.92	-0.01	0.086	0.082	0.084	HUAWEI LUA-L03
T411	802.11b	6	Rear Face	1	17	16.92	0.01	0.090	**0.089**	0.091	
T412	802.11b	6	Rear Face	2	17	16.92	0.02	0.089	0.080	0.081	
T413	802.11b	6	Rear Face	3	17	16.92	-0.03	0.088	0.074	0.075	
T414	802.11b	6	Rear Face	4	17	16.92	0.04	0.084	0.070	0.071	
T524	802.11b	6	Rear Face	3	17	16.92	0.04	0.120	**0.120**	0.122	HUAWEI LUA-L21

8.2.3SAR MEASUREMENT RESULT OF HOTSPOT

1. Hotspot SAR test results of GSM&WCDMA

Test No.	Band	Mode	CH	Test Position (with 10mm)	SIM	Battery	Tune up	Measured	Drift (dB)	SAR Value (W/kg)1-g	Reported SAR	Test Sample
T41	GSM850	GPRS 2TX	190	Front Face	1	1	32.5	32.08	0.03	0.713	0.785	HUAWEI LUA-L03
T42	GSM850	GPRS 2TX	190	Rear Face	1	1	32.5	32.08	-0.02	0.938	1.033	
T43	GSM850	GPRS 2TX	190	Left Side	1	1	32.5	32.08	0.09	0.688	0.758	
T44	GSM850	GPRS 2TX	190	Right Side	1	1	32.5	32.08	-0.07	0.637	0.702	
T45	GSM850	GPRS 2TX	190	Bottom Side	1	1	32.5	32.08	-0.05	0.075	0.083	
T46	GSM850	GPRS 2TX	128	Rear Face	1	1	32.5	31.97	-0.02	0.927	1.047	
T47	GSM850	GPRS 2TX	251	Rear Face	1	1	32.5	31.96	0.07	0.937	1.061	
T48	GSM850	GPRS 2TX	190	Rear Face	1	2	32.5	32.08	0.03	0.917	1.010	
T49	GSM850	GPRS 2TX	190	Rear Face	1	3	32.5	32.08	0.02	0.915	1.008	
T50	GSM850	GPRS 2TX	190	Rear Face	1	4	32.5	32.08	-0.04	0.912	1.005	
T51	GSM850	GPRS 2TX	190	Rear Face **(1st Repeated)**	1	1	32.5	32.08	0.05	0.935	1.030	
T510	GSM850	GPRS 2TX	190	Rear Face	1	3	32.5	32.32	-0.03	**1.280**	1.334	HUAWEI LUA-L21
T511	GSM850	GPRS 2TX	190	Rear Face	2	3	32.5	32.32	-0.02	1.230	1.282	
T512	GSM850	GPRS 2TX	190	Rear Face **-holder perturbation verification**	2	3	32.5	32.32	0.01	1.250	1.303	
T526	GSM850	GPRS 2TX	190	Rear Face **(1st Repeated)**	2	3	32.5	32.32	-0.01	1.260	1.313	
T57	GSM1900	GPRS 2TX	661	Front Face	1	1	29.5	28.96	0.03	0.496	0.562	HUAWEI LUA-L03
T58	GSM1900	GPRS 2TX	661	Rear Face	1	1	29.5	28.96	0.01	**0.521**	0.590	
T59	GSM1900	GPRS 2TX	661	Left Side	1	1	29.5	28.96	-0.03	0.328	0.371	
T60	GSM1900	GPRS 2TX	661	Right Side	1	1	29.5	28.96	-0.06	0.265	0.300	
T61	GSM1900	GPRS 2TX	661	Bottom Side	1	1	29.5	28.96	0.04	0.433	0.490	
T62	GSM1900	GPRS 2TX	661	Rear Face	1	2	29.5	28.96	0.01	0.491	0.556	
T63	GSM1900	GPRS 2TX	661	Rear Face	1	3	29.5	28.96	0.05	0.497	0.563	
T64	GSM1900	GPRS 2TX	661	Rear Face	1	4	29.5	28.96	0.02	0.494	0.559	
T515	GSM1900	GPRS 2TX	661	Rear Face	1	3	28.5	28.31	-0.02	0.711	0.743	HUAWEI LUA-L21
T530	GSM1900	GPRS 2TX	512	Rear Face	1	3	29.5	28.94	0.02	0.667	0.759	
T531	GSM1900	GPRS 2TX	810	Rear Face	1	3	29.5	28.73	-0.03	0.693	0.827	
T516	GSM1900	GPRS 2TX	661	Rear Face	2	3	28.5	28.31	0.07	**0.762**	0.796	
T70	UMTS B2	RMC12.2K	9400	Front Face	1	1	23	22.81	0.09	0.566	0.591	HUAWEI LUA-L03
T71	UMTS B2	RMC12.2K	9400	Rear Face	1	1	23	22.81	-0.02	**0.595**	0.622	
T72	UMTS B2	RMC12.2K	9400	Left Side	1	1	23	22.81	-0.04	0.367	0.383	
T73	UMTS B2	RMC12.2K	9400	Right Side	1	1	23	22.81	0.08	0.355	0.371	
T74	UMTS B2	RMC12.2K	9400	Bottom Side	1	1	23	22.81	0.07	0.506	0.529	
T75	UMTS B2	RMC12.2K	9400	Rear Face	1	2	23	22.81	-0.04	0.569	0.594	
T76	UMTS B2	RMC12.2K	9400	Rear Face	1	3	23	22.81	-0.02	0.572	0.598	
T77	UMTS B2	RMC12.2K	9400	Rear Face	1	4	23	22.81	0.05	0.576	0.602	

T519	UMTS B2	RMC12.2K	9400	Rear Face	1	4	23	22.81	0.02	0.734	0.767	HUAWEI LUA-L21
T520	UMTS B2	RMC12.2K	9400	Rear Face	2	4	23	22.81	-0.04	0.772	0.807	
T521	UMTS B2	RMC12.2K	9262	Rear Face	2	4	23	22.78	0.07	**0.911**	0.958	
T522	UMTS B2	RMC12.2K	9538	Rear Face	2	4	23	22.71	0	0.761	0.814	
T523	UMTS B2	RMC12.2K	9262	Rear Face **(1st Repeated)**	2	4	23	22.78	0.02	0.901	0.948	

2. Hotspot SAR test results of WIFI

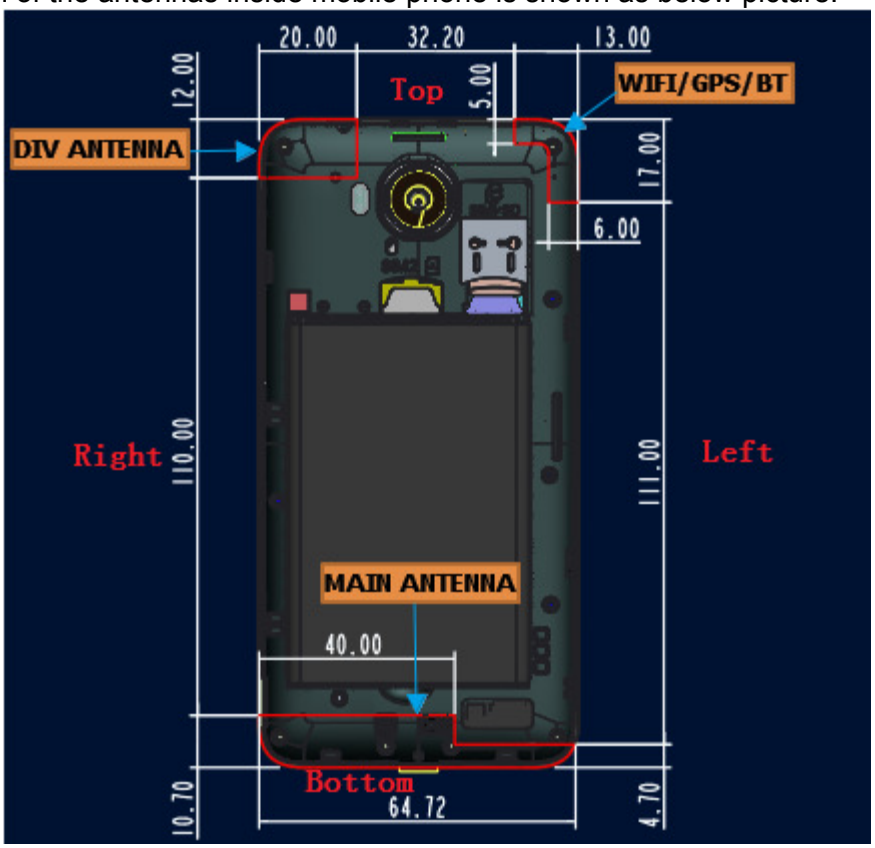
Test No.	Band	CH	Test Position (with 10mm)	Battery	Tune up	Measured	Drift (dB)	Peak SAR of Area Scan(W/kg)	SAR Value (W/kg)1-g	Reported SAR	Test Sample
T415	802.11b	6	Front Face	1	17	16.92	-0.02	0.151	0.140	0.143	HUAWEI LUA-L03
T416	802.11b	6	Rear Face	1	17	16.92	0.01	0.179	0.178	0.181	
T417	802.11b	6	Left Side	1	17	16.92	0.03	0.120	0.118	0.120	
T419	802.11b	6	Top Side	1	17	16.92	-0.02	0.033	0.029	0.030	
T420	802.11b	6	Rear Face	2	17	16.92	-0.06	0.175	0.164	0.167	
T421	802.11b	6	Rear Face	3	17	16.92	0.07	0.172	0.161	0.164	
T422	802.11b	6	Rear Face	4	17	16.92	-0.01	0.176	0.165	0.168	
T525	802.11b	6	Rear Face	4	17	16.92	0.01	0.242	**0.216**	0.220	HUAWEI LUA-L21

Note: Per KDB248227D01, 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 447498D01 General RF Exposure Guidance v06. The size of the mobile phone is132.7mm (length) X 65.2mm (width).

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



Note:

1. The Div antenna is used to improve the acceptance of performance of the main antenna, it does not have a transmitter function.
2. The mode HUAWEI LUA-L21 is a Dual-SIM-Card Mobile Phone, SIM1 and SMI2 supports 2G/3G, and the HUAWEI LUA-L03 only has one SIM card which supports 2G/3G/LTE.

8.3.1STAND-ALONE SAR TEST EXCLUSION

Per FCC KDB 447498D01v06, 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:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance,mm)][√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

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

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	8	6.31	15	2.48	0.66	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:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)/x] W/kg for test separation distances≤50 mm,where x = 7.5 for 1-g SAR 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 standslone SAR was estimated according to following formula to result in substantially conservative SAR values of≤0.4W/Kg to determine simultaneous transmission SAR test exclusion.

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

Estimated SAR calculation

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	X	Estimated SAR (W/Kg)*
BT	Front	8	6.31	15	2.48	7.5	0.088
	Rear	8	6.31	15	2.48	7.5	0.088

Note: * - maximum possible output power declared by manufacturer

8.3.2STAND-ALONE SAR TEST EXCLUSION

Per FCC KDB 447498D01v06, 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(DATA)+WiFi 2.4G	Yes*	Yes*	Yes
10	LTE(DATA)+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 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.

8.3.3 SAR SUMMATION SCENARIO

About BT/ WiFi and GSM/UMTS/LTE antenna

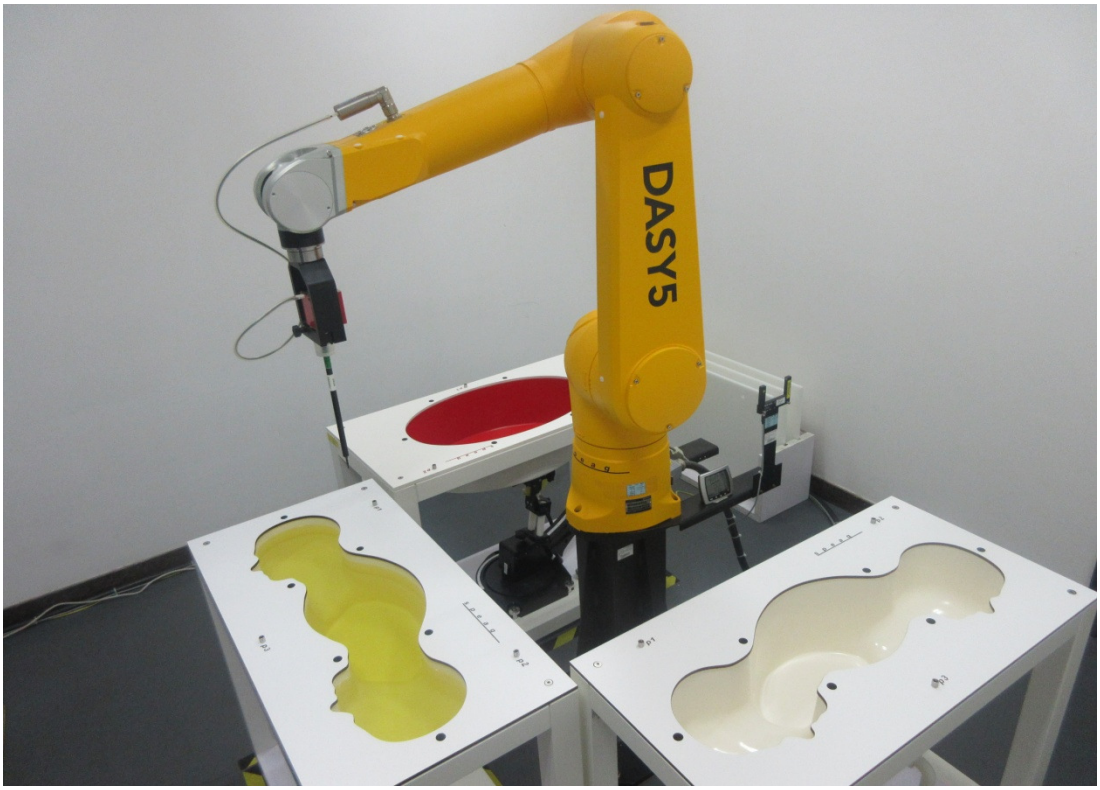
Test Position / Reported SAR_{1g}	Head				Body-Worn		Hotspot					
	Right Cheek	Right Tilted	Left Cheek	Left Tilted	Front	Rear	Front	Rear	Left	Right	Top	Bottom
GSM850	0.369	0.360	0.434	0.332	0.442	0.678	0.785	1.334	0.758	0.702	-	0.083
GSM1900	0.327	0.265	0.583	0.273	0.362	0.224	0.562	0.863	0.371	0.300	-	0.490
UMTS B2	0.499	0.474	0.771	0.451	0.476	0.390	0.591	0.958	0.383	0.371	-	0.529
WiFi 2.4G	0.984	0.511	0.501	0.624	0.084	0.122	0.157	0.220	0.124	0.055	0.033	-
BT	-	-	-	-	0.088	0.088	-	-	-	-	-	-
MAX∑SAR1g	1.483	0.986	1.272	1.076	0.564	0.801	0.942	**1.554**	0.882	0.757	0.033	0.529

Note: 1) MAX. $\sum SAR_{1g}$ <1.6 W/kg, the SAR to peak location separation ratio should not be considered.
2) The highest simultaneous SAR value=1.554 W/kg, per KDB690783 D01

APPENDIX

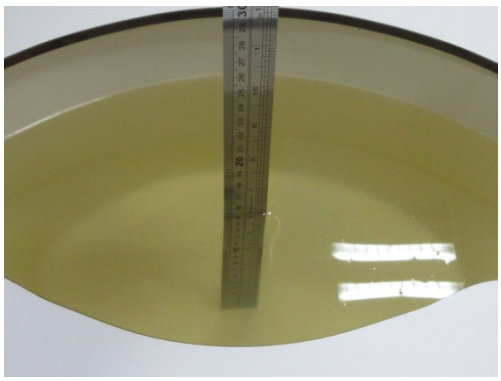
1. Test Layout

Specific Absorption Rate Test Layout

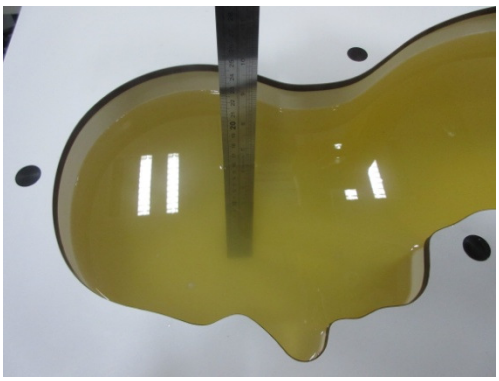


Liquid depth in the flat Phantom (≥15cm depth)

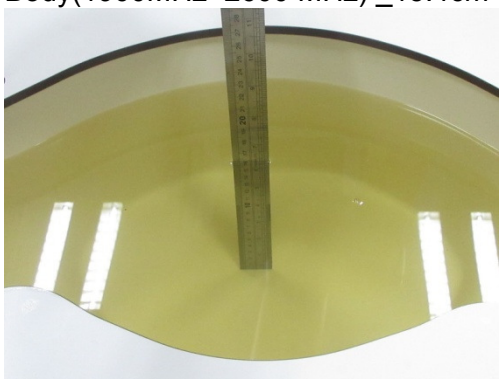
Body(835MHz) 15.5cm



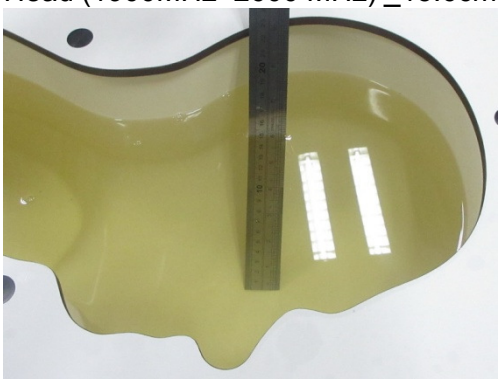
Head(835MHz) 15.9cm



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