FCC SAR Test Report

FCC ID: QISE8372H-609

Project No.	:	1612C018A
Equipment	:	LTE Wingle
Model Name	:	E8372h-609
Applicant	:	Huawei Technologies Co.,Ltd.
Address	:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian,Longgang District, Shenzhen, 518129, P.R.C

Date of Receipt	:	Dec. 05, 2016
Date of Test	:	Dec. 11, 2016 ~ Dec. 13, 2016 Jan. 24, 2017
Issued Date	:	Jan. 25, 2017
Tested by	:	BTL Inc.

PREPARED BY : (Super Jiang/ Technical Engineer)

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Testing Laboratory 2640

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**), or National Institute of Standards and Technology (**NIST**) .

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Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCC SAR-1-1612C018	Original Issue.	Dec. 14, 2016
BTL-FCC SAR-1-1612C018A	Compared with the original report (BTL-FCC SAR-1-1612C018), added the LTE Band 2. The test data is recorded in this report.	Jan. 25, 2017

1. GENERAL SUMMARY

Equipment	LTE Wingle
Model Name	E8372h-609
Brand Name	HUAWEI
Manufacturer	Huawei Technologies Co.,Ltd.
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian,Longgang District, Shenzhen, 518129, P.R.C
Standard(s)	**FCC 47CFR §2.1093** Radio frequency Radiation Exposure Evaluation: Portable Devices **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 **KDB447498 D01** General RF Exposure Guidance v06 **KDB447498 D02** SAR Procedures for Dongle Xmtr v02r01 **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-1-1612C018A) 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 Body (5mm) SAR-1g(W/kg)
PCB	GSM850		0.88
	GSM1900		1.19
	UMTS B2		0.79
	LTE B2		1.12
	LTE B7		1.17
DTS	2.4G WLAN	802.11b Ant 1	0.18
		802.11b Ant 2	0.28
		802.11 n HT20 MIMO	0.11
Note：The highest reported SAR for body-worn and simultaneous transmission exposure conditions are 1.19W/kg and 1.47W/kg respectively.			

3.2 GENERAL DESCRIPTION OF EUT

Equipment	LTE Wingle		
Model Name	E8372h-609		
IMEI Code	Sample 1: 864070031111170		
	Sample 2: 864070031111113		
	Sample 3: 864070030001000		
S/N	Sample 1: R7EDW16421000021		
	Sample 2: R7EDW16421000026		
	Sample 3: YRFDU16C02000101		
HW Version	CL1E8372HM09		
SW Version	21.322.01.01.110		
Modulation	GSM(GMSK/8PSK),UMTS(QPSK),LTE(QPSK/16QAM), WiFi(DSSS/OFDM)		
Operation Frequency Range(s)	Band	TX (MHz)	RX (MHz)
	GSM 850	824-849	869-894
	GSM 1900	1850-1910	1930-1990
	UMTS Band 2	1850-1910	1930-1990
	LTE Band 2	1850-1910	1930-1990
	LTE Band 7	2500-2570	2620-2690
	2.4GWIFI	2412 -2442	
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)		
	3, tested with power control “all Max” (LTE Band 2/7)		
Test Channels (low-mid-high):	128-190-251 (GSM850)		
	512-661-810 (GSM1900)		
	9262-9400-9538(UMTS Band 2)		
	18700-18900-19100(LTE Band 2)		
	20850-21100-21350(LTE Band 7 BW=20MHz)		
	1-4-7 (2.4G WIFI 802.11b/g/n HT20)		
	3-4-5 (2.4G WIFI 802.11n HT40)		

3.3 LABORATORY ENVIRONMENT

Temperature	Min. = 18ºC, Max. = 25ºC
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5Ω
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	D835V2	4d160	Sep. 30, 2015	3 Years
4	System Validation Dipole	Speag	D1900V2	5d179	Sep. 29, 2015	3 Years
5	System Validation Dipole	Speag	D2450V2	919	Sep. 28, 2015	3 Years
6	System Validation Dipole	Speag	D2600V2	1067	Sep. 28, 2015	3 Years
7	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1784	N/A	N/A
8	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1896	N/A	N/A
9	8960 Series 10 Wireless Com Test set	Agilent	E5515E	MY52112163	Sep. 04, 2016	1 Year
10	CMW500-Wideband Radio Communication Tester	RS	CMW500	152366	Mar. 27, 2016	1 Year
11	CMW500-Wideband Radio Communication Tester	RS	CMW500	153083	May 04,2016	1 Year
12	Power Amplifier	Mini-Circuits	ZHL-42W+	QA1333003	N/A	N/A
13	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 27, 2016	1 Year
14	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Sep. 04, 2016	1 Year
15	P-series power meter	Agilent	N1911A	MY45100473	Sep. 04, 2016	1 Year
16	wideband power sensor	Agilent	N1921A	MY51100041	Sep. 04, 2016	1 Year
17	power Meter	Anritsu	ML2495A	1128009	Mar. 27, 2016	1 Year
18	Pulse Power Sensor	Anritsu	MA 2411B	1027500	Mar. 27, 2016	1 Year
19	Dielectric Assessment Kit	Speag	DAK-3.5	1226	N/A	N/A
20	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.
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.

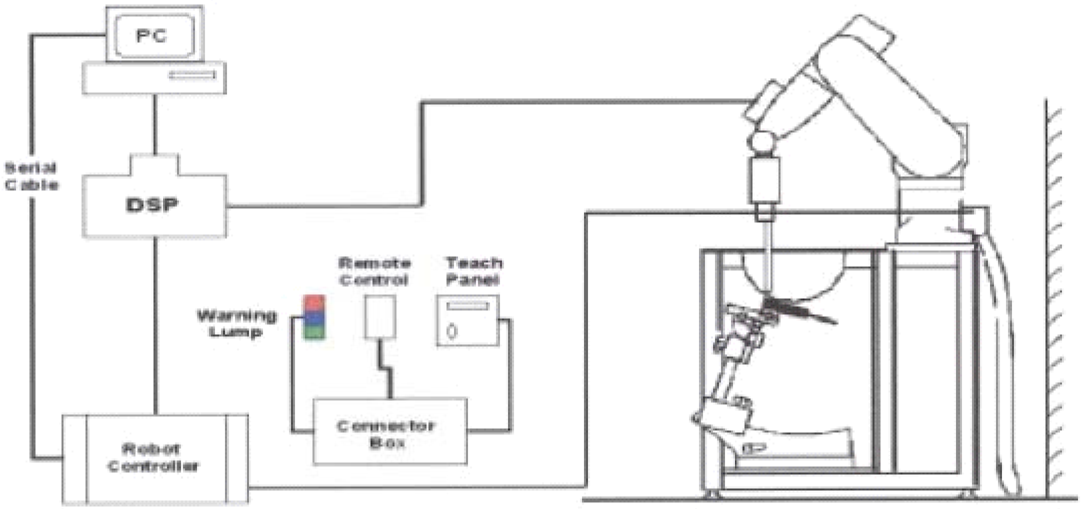
4.SAR MEASUREMENTS SYSTEM CONFIGURATION

4.1SAR 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



4.2DASY5E-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.

4.2.1EX3DV4 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

4.2.2E-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.

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

Where: Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m3).

4.2.3OTHER 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

4.2.4SCANNING 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) 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*$\Delta z_{Zoom}(n-1)$	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥30mm
3-4GHz	≤12mm	≤5mm	≤4mm	≤3mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤1.5*$\Delta z_{Zoom}(n-1)$	≥22mm

4.2.5SPATIAL 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.

4.2.6DATA STORAGE AND EVALUATION

4.2.6.1Data 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.

4.2.6.2 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
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	-
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. (℃)	Conductivity (σ)	Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (σ) (%)	Deviation Permittivity (εr) (%)	Date
Body	835	22.6	0.976	54.290	0.97	55.2	0.62	-1.65	Dec. 12, 2016
Body	1900	22.6	1.562	54.790	1.52	53.3	2.76	2.80	Dec. 12, 2016
Body	1900	22.5	1.543	53.160	1.52	53.3	1.51	-0.26	Jan. 24, 2017
Body	2450	22.1	1.958	51.420	1.95	52.7	0.41	-2.43	Dec. 11, 2016
Body	2600	22.4	2.210	52.370	2.16	52.5	2.31	-0.25	Dec. 13, 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

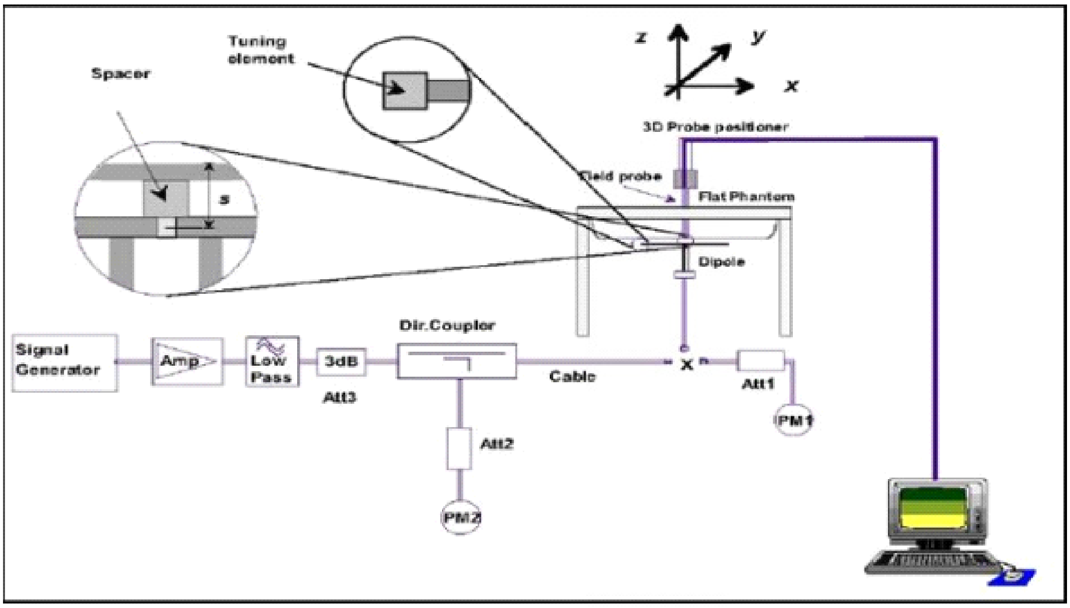
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands 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
Body	Dec. 12, 2016	835	9.52	2.23	8.92	-6.30	4d160
Body	Dec. 12, 2016	1900	39.60	10.30	41.20	4.04	5d179
Body	Jan. 24, 2017	1900	39.60	9.82	39.28	-0.81	5d179
Body	Dec. 11, 2016	2450	51.10	12.40	49.60	-2.94	919
Body	Dec. 13, 2016	2600	54.10	13.20	52.80	-2.40	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 (±10 %).



6.SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

6.1SAR 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 8PSK.

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	2	2	2
	3 TX slots	4	4	4
	4 TX slots	6	6	6
GSM1900	1 TX slot	0	0	0
	2 TX slots	2	2	2
	3 TX slots	4	4	4
	4 TX slots	6	6	6

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 by applying the required inner loop power control procedures 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

Body SAR Measurements
SAR for body-worn accessory is measured using the 12.2 kbps RMC with the TPC bits configured to all “1s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by handset with 12.2 kbps RMC as the primary mode.

3. HSDPA

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 adjusted SAR is ≤ 1.2W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

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

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 Δ ACK, Δ NACK, Δ CQI = 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 adjusted SAR is ≤ 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	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: ΔACK, ΔNACK and ΔCQI = 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 measurementperiod (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 measurementperiod (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

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel.5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a Second serving HS-DSCH cell are required to perform the power measurement and for the results to be acceptable.

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.

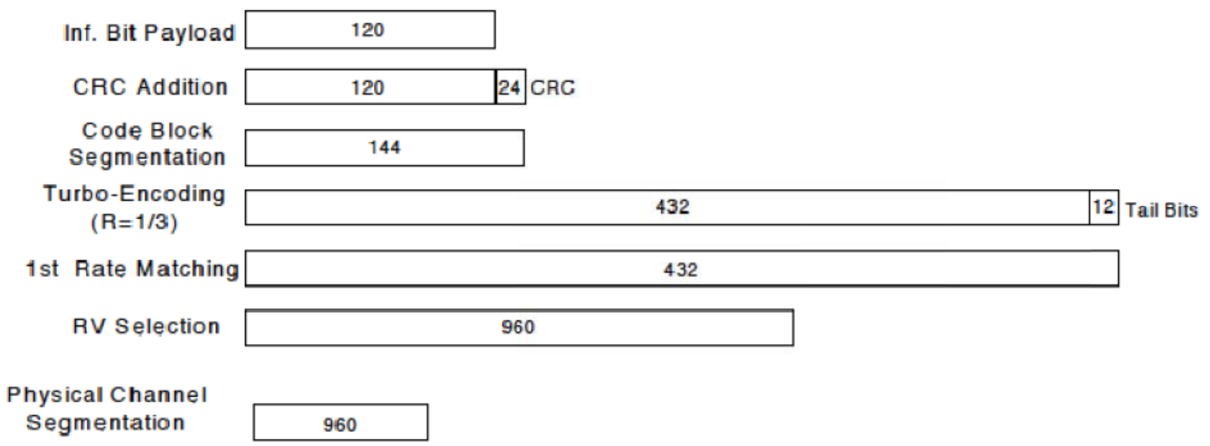


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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.

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 > ½ 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 > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

7.1.4 WIFI TEST CONFIGURATION

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

2.4G

Mode	802.11b		802.11g		802.11n HT20			802.11n HT40		
Ant	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	MIMO	Ant 1	Ant 2	MIMO
Duty cycle	1:1.0097	1:1.0162	1:1.0389	1:1.0585	1:1.0727	1:1.0679	1:1.1682	1:1.1660	1:1.0979	1:1.2702

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 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.

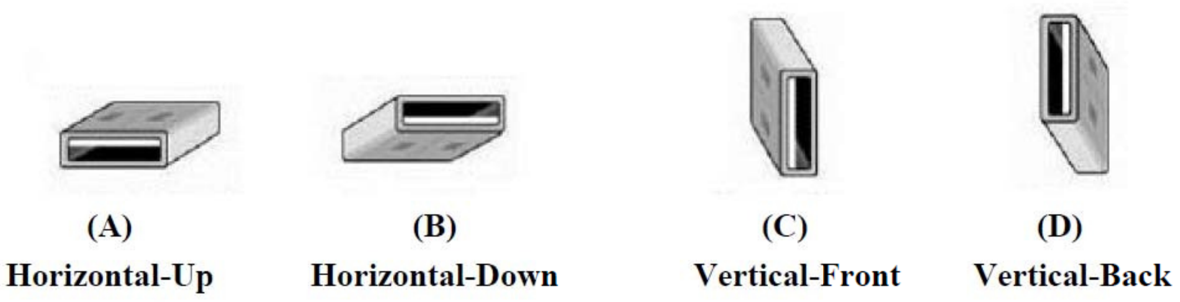
7.2 TEST POSITION

7.2.1 Head

The device does not have telephone receiver. Next to the ear operation is not supported. So additional Head SAR testing is not required.

7.2.1 Body

Per FCC KDB 447498 D02, simple dongle tests all USB orientations (see figure below (A) Horizontal-Up,(B) Horizontal-Down,(C)Vertical-Front, and (D) Vertical-Back) with a device-to-phantom separation distance of 5 mm or less, according to KDB447498 requirements.



Note: 1.These are the USB connector orientations on laptop computers; USB dongles have the reverse configuration for plugging into the corresponding laptop computers.
2. When the antenna is located near the tip of a dongle, it may operate at closer proximity to users in certain connector orientations where dongle tip testing may be required.

According to the antenna location is section 8.3, the distance between tip and antenna is more than 1cm. So the tip side isn’t tested.
This DUT was tested in 4 different positions. They are Horizontal-Up, Horizontal-Down, Vertical-Front and Vertical-Back. Refer to Appendix D.

8.TEST RESULT

8.1CONDUCTED POWER RESULTS

8.1.1CONDUCTED POWER MEASUREMENTS 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
GPRS/ EDGE (GMSK)	1 Tx Slot	33.00	31.73	31.86	31.95	23.81	22.54	22.67	22.76
	2 Tx Slot	31.00	29.35	29.49	29.60	24.87	23.22	23.36	23.47
	3 Tx Slot	29.00	27.54	27.75	27.86	24.58	23.12	23.33	23.44
	4 Tx Slot	27.00	26.21	26.34	26.43	23.82	23.03	23.16	23.25
EDGE (8PSK)	1 Tx Slot	26.50	25.41	25.47	25.56	17.31	16.22	16.28	16.37
	2 Tx Slot	24.50	23.68	23.82	23.95	18.37	17.55	17.69	17.82
	3 Tx Slot	22.50	21.83	22.14	22.21	18.08	17.41	17.72	17.79
	4 Tx Slot	20.50	20.07	20.29	20.36	17.32	16.89	17.11	17.18

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 GPRS 2Tx mode was selected for SAR testing according to the highest frame –averaged output power table.

8.1.2CONDUCTED 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
GPRS /EDGE (GMSK)	1 Tx Slot	30.00	28.81	28.67	28.66	20.81	19.62	19.48	19.47
	2 Tx Slots	28.00	26.85	26.73	26.71	21.87	20.72	20.60	20.58
	3 Tx Slots	26.00	25.31	25.18	25.13	21.58	20.89	20.76	20.71
	4 Tx Slots	24.00	23.83	23.67	23.60	20.82	20.65	20.49	20.42
EDGE (8PSK)	1 Tx Slot	26.00	25.67	25.61	25.71	16.81	16.48	16.42	16.52
	2 Tx Slots	24.00	23.54	23.39	23.42	17.87	17.41	17.26	17.29
	3 Tx Slots	22.00	21.51	21.32	21.30	17.58	17.09	16.90	16.88
	4 Tx Slots	20.00	19.72	19.76	19.92	16.82	16.54	16.58	16.74

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.

8.1.3CONDUCTED POWER MEASUREMENTS OF WCDMA1900 Band II

UMTS Band 2		Tune-up	SAR Conducted Power (dBm)		
			9262CH	9400CH	9538CH
			1852.4	1880	1907.6
WCDMA	12.2kbps RMC	23.00	22.56	22.51	22.28
	64kbps RMC	23.00	22.52	22.48	22.23
	144kbps RMC	23.00	22.51	22.49	22.08
	384kbps RMC	23.00	22.51	22.53	22.05
HSDPA	Subtest 1	23.00	22.52	22.42	22.28
	Subtest 2	23.00	22.51	22.41	22.20
	Subtest 3	22.50	22.00	21.91	21.67
	Subtest 4	22.50	21.97	21.92	21.62
HSUPA	Subtest 1	22.00	21.32	21.41	21.23
	Subtest 2	20.00	19.74	19.51	19.14
	Subtest 3	21.00	20.43	20.63	20.03
	Subtest 4	20.00	19.98	19.78	19.49
	Subtest 5	22.00	21.08	21.11	21.02
DC-HSDPA	Subtest 1	23.00	22.52	22.42	22.28
	Subtest 2	23.00	22.51	22.41	22.20
	Subtest 3	22.50	22.00	21.91	21.67
	Subtest 4	22.50	21.97	21.92	21.62

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.

8.1.4CONDUCTED POWER MEASUREMENTS OF LTE BAND 2

FDD LTE B2					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18625	18900	19175
					1852.5	1880	1907.5
5MHz	QPSK	1	0	23.50	22.58	22.00	22.40
		1	12	23.50	23.32	22.88	23.11
		1	24	23.50	23.04	22.26	22.30
		12	0	22.50	22.24	21.60	21.98
		12	6	22.50	22.28	21.92	22.10
		12	13	22.50	22.23	21.91	21.98
		25	0	22.50	22.35	21.70	21.75
	16QAM	1	0	23.00	22.11	21.84	22.09
		1	12	23.00	22.84	22.71	22.71
		1	24	23.00	22.73	22.13	21.89
		12	0	21.50	21.38	20.59	20.90
		12	6	21.50	21.33	20.93	21.01
		12	13	21.50	21.36	20.92	20.91
		25	0	21.50	21.24	20.71	20.72
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18650	18900	19150
					1855	1880	1905
10MHz	QPSK	1	0	23.50	23.33	22.71	22.87
		1	24	23.50	23.34	23.17	23.25
		1	49	23.50	23.33	23.19	22.75
		25	0	22.50	22.34	21.61	21.86
		25	12	22.50	22.38	21.92	22.00
		25	25	22.50	22.39	21.87	21.84
		50	0	22.50	22.40	21.78	21.77
	16QAM	1	0	23.00	22.84	22.41	22.66
		1	24	23.00	22.83	22.88	22.87
		1	49	23.00	22.76	22.88	22.35
		25	0	21.50	21.30	20.68	20.66
		25	12	21.50	21.32	21.01	20.76
		25	25	21.50	21.24	20.97	20.62
		50	0	21.50	21.24	20.81	20.57

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18675	18900	19125
					1857.5	1880	1902.5
15MHz	QPSK	1	0	23.50	23.13	22.27	22.76
		1	38	23.50	23.24	22.59	22.65
		1	74	23.50	22.45	22.94	22.28
		36	0	22.50	22.27	22.34	21.67
		36	18	22.50	22.24	21.46	21.56
		36	39	22.50	21.83	21.62	21.42
		75	0	22.50	22.05	21.48	21.44
	16QAM	1	0	23.00	22.84	22.08	22.44
		1	38	23.00	22.83	22.51	22.17
		1	74	23.00	22.08	22.89	21.77
		36	0	21.50	21.30	21.34	20.65
		36	18	21.50	21.25	20.62	20.54
		36	39	21.50	20.91	20.84	20.42
		75	0	21.50	21.11	20.66	20.42

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					18700	18900	19100
					1860	1880	1900
20MHz	QPSK	1	0	23.50	23.34	22.40	23.28
		1	50	23.50	22.75	21.58	22.37
		1	99	23.50	22.29	23.24	22.65
		50	0	22.50	22.18	21.21	22.00
		50	25	22.50	21.82	21.38	21.63
		50	50	22.50	21.58	21.87	21.49
		100	0	22.50	21.94	21.53	21.68
	16QAM	1	0	23.00	22.84	22.50	22.79
		1	50	23.00	22.52	21.51	22.18
		1	99	23.00	22.08	22.83	22.43
		50	0	21.50	21.17	20.68	20.91
		50	25	21.50	20.90	20.46	20.52
		50	50	21.50	20.61	20.97	20.40
		100	0	21.50	21.01	20.63	20.58

8.1.5CONDUCTED POWER MEASUREMENTS 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	21.17	21.46	21.40
		1	12	23	21.91	21.83	21.57
		1	24	23	21.43	21.33	21.28
		12	0	22	20.69	20.84	20.72
		12	6	22	21.02	21.54	20.91
		12	13	22	20.98	21.46	20.46
		25	0	22	20.72	21.28	20.40
	16QAM	1	0	23	21.10	21.29	21.07
		1	12	23	21.50	22.06	21.51
		1	24	23	21.54	21.24	21.04
		12	0	22	20.24	20.85	20.18
		12	6	22	20.57	21.10	20.41
		12	13	22	20.54	21.05	20.31
		25	0	22	20.29	20.90	20.26
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20800	21100	21400
					2505	2535	2565
10MHz	QPSK	1	0	23	21.59	22.17	21.85
		1	24	23	22.39	22.44	21.89
		1	49	23	22.10	22.01	21.16
		25	0	22	20.59	21.10	20.62
		25	12	22	21.05	21.36	20.76
		25	25	22	21.49	21.06	20.50
		50	0	22	21.24	21.10	20.52
	16QAM	1	0	23	21.59	22.01	21.69
		1	24	23	22.30	22.38	21.85
		1	49	23	22.08	21.83	21.15
		25	0	22	20.62	20.71	20.49
		25	12	22	21.06	20.95	20.63
		25	25	22	21.02	20.80	20.36
		50	0	22	20.74	21.01	20.42

Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20825	21100	21375
					2507.5	2535	2562.5
15MHz	QPSK	1	0	23	21.54	22.19	22.12
		1	38	23	22.43	22.39	21.67
		1	74	23	21.86	22.04	21.30
		36	0	22	20.79	21.07	20.89
		36	18	22	21.21	21.21	20.64
		36	39	22	21.40	21.04	20.35
		75	0	22	21.25	21.09	20.57
	16QAM	1	0	23	21.61	21.98	21.94
		1	38	23	22.42	22.20	21.57
		1	74	23	21.78	21.77	21.04
		36	0	22	20.77	20.77	20.72
		36	18	22	21.16	20.91	20.44
		36	39	22	21.00	20.74	20.37
		75	0	22	20.86	20.78	20.58
Bandwidth	Modulation	RB size	RB offset	Tune-up	Low	Mid	High
					20850	21100	21350
					2510	2535	2560
20MHz	QPSK	1	0	23	21.59	21.94	22.49
		1	50	23	22.23	22.25	22.55
		1	99	23	22.02	22.22	21.31
		50	0	22	20.83	21.01	21.12
		50	25	22	20.89	21.03	20.68
		50	50	22	20.94	21.01	20.41
		100	0	22	20.82	21.11	20.68
	16QAM	1	0	23	21.82	22.21	22.43
		1	50	23	22.46	22.19	21.68
		1	99	23	22.23	22.15	21.16
		50	0	22	20.84	20.77	20.94
		50	25	22	20.91	20.78	20.64
		50	50	22	20.94	20.84	20.37
		100	0	22	20.81	20.84	20.85

8.1.6CONDUCTED POWER MEASUREMENTS OF WiFi 2.4G

Mode		Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b Ant 0		1	2412	1	15.00	13.23	No
		4	2427		15.00	13.78	Yes
		7	2442		15.00	13.01	No
802.11b Ant 1		1	2412	1	14.50	12.61	No
		4	2427		14.50	12.87	Yes
		7	2442		14.50	12.86	No
802.11g Ant 0		1	2412	6	14.00	Not Required	No
		4	2427		14.00	Not Required	No
		7	2442		14.00	Not Required	No
802.11g Ant 1		1	2412	6	14.00	Not Required	No
		4	2427		14.00	Not Required	No
		7	2442		14.00	Not Required	No
802.11n HT20 SISO	Ant 0	1	2412	6.5	12.00	Not Required	No
		4	2427		12.00	Not Required	No
		7	2442		12.00	Not Required	No
	Ant 1	1	2412	6.5	12.00	Not Required	No
		4	2427		12.00	Not Required	No
		7	2442		12.00	Not Required	No
802.11n HT20 MIMO		1	2412	13	12.50	10.64	No
		4	2427		12.50	10.90	No
		7	2442		12.50	11.20	Yes
802.11n HT40 SISO	Ant 0	3	2422	13.5	12.00	Not Required	No
		4	2427		12.00	Not Required	No
		5	2432		12.00	Not Required	No
	Ant 1	3	2422	13.5	12.00	Not Required	No
		4	2427		12.00	Not Required	No
		5	2432		12.00	Not Required	No
802.11nHT40 MIMO		3	2422	27	12.40	Not Required	No
		4	2427		12.40	Not Required	No
		5	2432		12.40	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.

3) When SAR measurement is required for 802.11 g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

8.2SAR 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 > ½ 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 ⩾0.8W/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 D06, 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 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:

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.

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. See Section 7.1.4 for more information.

8.2.1 SAR MEASUREMENT RESULT

SAR test results of GSM&UMTS

Test No.	Band	Mode	CH	Test Position With 5mm	Tune up	Measured	Power Drift(dB)	SAR Value (W/kg)1-g	Reported SAR
T01	GSM850	GPRS 2TX	190	Horizontal-Down	31	29.49	-0.03	0.567	0.803
T02	GSM850	GPRS 2TX	190	Horizontal-Up	31	29.49	0.02	0.575	0.814
T03	GSM850	GPRS 2TX	190	Vertical-Back	31	29.49	-0.05	0.238	0.337
T04	GSM850	GPRS 2TX	190	Vertical-Front	31	29.49	-0.07	0.086	0.121
T05	GSM850	GPRS 2TX	128	Horizontal-Down	31	29.35	-0.05	0.526	0.769
T06	GSM850	GPRS 2TX	251	Horizontal-Down	31	29.60	-0.02	**0.638**	0.881
T07	GSM850	GPRS 2TX	128	Horizontal-Up	31	29.35	-0.04	0.583	0.852
T08	GSM850	GPRS 2TX	251	Horizontal-Up	31	29.60	-0.05	0.550	0.759
T10	GSM1900	GPRS 2TX	661	Horizontal-Down	28	26.73	0.03	0.513	0.687
T11	GSM1900	GPRS 2TX	661	Horizontal-Up	28	26.73	-0.01	0.773	1.036
T12	GSM1900	GPRS 2TX	661	Vertical-Back	28	26.73	0.09	0.443	0.593
T13	GSM1900	GPRS 2TX	661	Vertical-Front	28	26.73	0.02	0.148	0.198
T14	GSM1900	GPRS 2TX	512	Horizontal-Up	28	26.85	-0.08	**0.912**	1.188
T15	GSM1900	GPRS 2TX	810	Horizontal-Up	28	26.71	-0.06	0.630	0.848
T16	GSM1900	GPRS 2TX	512	Horizontal-Up (1^{st} repeated）	28	26.85	0.03	0.902	1.175
T30	UMTS B2	RMC12.2K	9400	Horizontal-Down	23	22.51	0.08	0.582	0.652
T31	UMTS B2	RMC12.2K	9400	Horizontal-Up	23	22.51	-0.04	0.700	0.784
T32	UMTS B2	RMC12.2K	9400	Vertical-Back	23	22.51	0.02	**0.704**	0.788
T33	UMTS B2	RMC12.2K	9400	Vertical-Front	23	22.51	0.02	0.320	0.358

Note: The value with boldface is the maximum SAR Value of each test band.

SAR test results of LTE

Test No.	Band	Mode	CH	RB	Offset	Test Position (with 5mm)	Tune up	Measured	Drift(dB)	SAR Value (W/kg)1-g	Reported SAR
T110	LTE B2	QPSK20M	18700	1	0	Horizontal-Down	23.5	23.34	0.06	0.754	0.782
T111	LTE B2	QPSK20M	18700	1	0	Horizontal-Up	23.5	23.34	-0.03	1.010	1.048
T112	LTE B2	QPSK20M	18700	1	0	Vertical-Back	23.5	23.34	0.01	0.576	0.598
T113	LTE B2	QPSK20M	18700	1	0	Vertical-Front	23.5	23.34	-0.02	0.173	0.179
T114	LTE B2	QPSK20M	18700	50	0	Horizontal-Down	22.5	22.18	0.04	0.680	0.732
T115	LTE B2	QPSK20M	18700	50	0	Horizontal-Up	22.5	22.18	-0.09	0.919	0.989
T116	LTE B2	QPSK20M	18700	50	0	Vertical-Back	22.5	22.18	0.04	0.566	0.609
T117	LTE B2	QPSK20M	18700	50	0	Vertical-Front	22.5	22.18	0.03	0.142	0.153
T118	LTE B2	QPSK20M	18900	1	99	Horizontal-Up	23.5	23.24	-0.01	1.050	1.115
T119	LTE B2	QPSK20M	19100	1	0	Horizontal-Up	23.5	23.28	-0.02	**1.060**	1.115
T120	LTE B2	QPSK20M	18900	50	50	Horizontal-Up	22.5	21.87	-0.03	0.759	0.877
T121	LTE B2	QPSK20M	19100	50	0	Horizontal-Up	22.5	22	-0.07	0.794	0.891
T122	LTE B2	QPSK20M	18700	100	0	Horizontal-Up	22.5	21.94	-0.05	0.919	1.045
T123	LTE B2	QPSK20M	19100	1	0	Horizontal-Up (1ST repeated)	23.5	23.28	0.02	1.050	1.105
T50	LTE B7	QPSK20M	21350	1	50	Horizontal-Down	23	22.55	0.09	0.530	0.588
T51	LTE B7	QPSK20M	21350	1	50	Horizontal-Up	23	22.55	-0.08	0.738	0.819
T52	LTE B7	QPSK20M	21350	1	50	Vertical-Back	23	22.55	0.05	0.733	0.813
T53	LTE B7	QPSK20M	21350	1	50	Vertical-Front	23	22.55	-0.02	0.335	0.372
T54	LTE B7	QPSK20M	21350	50	0	Horizontal-Down	22	21.12	-0.01	0.589	0.721
T55	LTE B7	QPSK20M	21350	50	0	Horizontal-Up	22	21.12	-0.09	0.744	0.911
T56	LTE B7	QPSK20M	21350	50	0	Vertical-Back	22	21.12	-0.02	0.680	0.833
T57	LTE B7	QPSK20M	21350	50	0	Vertical-Front	22	21.12	-0.01	0.321	0.393
T58	LTE B7	QPSK20M	20850	1	50	Horizontal-Up	23	22.23	0.05	0.843	1.007
T59	LTE B7	QPSK20M	21100	1	50	Horizontal-Up	23	22.25	-0.07	0.932	1.108
T60	LTE B7	QPSK20M	20850	1	50	Vertical-Back	23	22.23	0.06	0.796	0.950
T61	LTE B7	QPSK20M	21100	1	50	Vertical-Back	23	22.25	-0.01	0.764	0.908
T62	LTE B7	QPSK20M	20850	50	50	Horizontal-Up	22	20.94	-0.06	0.714	0.911
T63	LTE B7	QPSK20M	21100	50	25	Horizontal-Up	22	21.03	-0.09	**0.935**	1.169
T64	LTE B7	QPSK20M	20850	50	50	Vertical-Back	22	20.94	0.04	0.625	0.798
T65	LTE B7	QPSK20M	21100	50	25	Vertical-Back	22	21.03	-0.09	0.725	0.906
T66	LTE B7	QPSK20M	21100	100	0	Horizontal-Up	22	21.11	0.03	0.846	1.038
T67	LTE B7	QPSK20M	21100	100	0	Vertical-Back	22	21.11	0.04	0.693	0.851
T68	LTE B7	QPSK20M	21100	50	25	Horizontal-Up (1ST repeated)	23	22.23	0.01	0.931	1.112

Note: The value with boldface is the maximum SAR Value of each test band.

SAR test results of WIFI

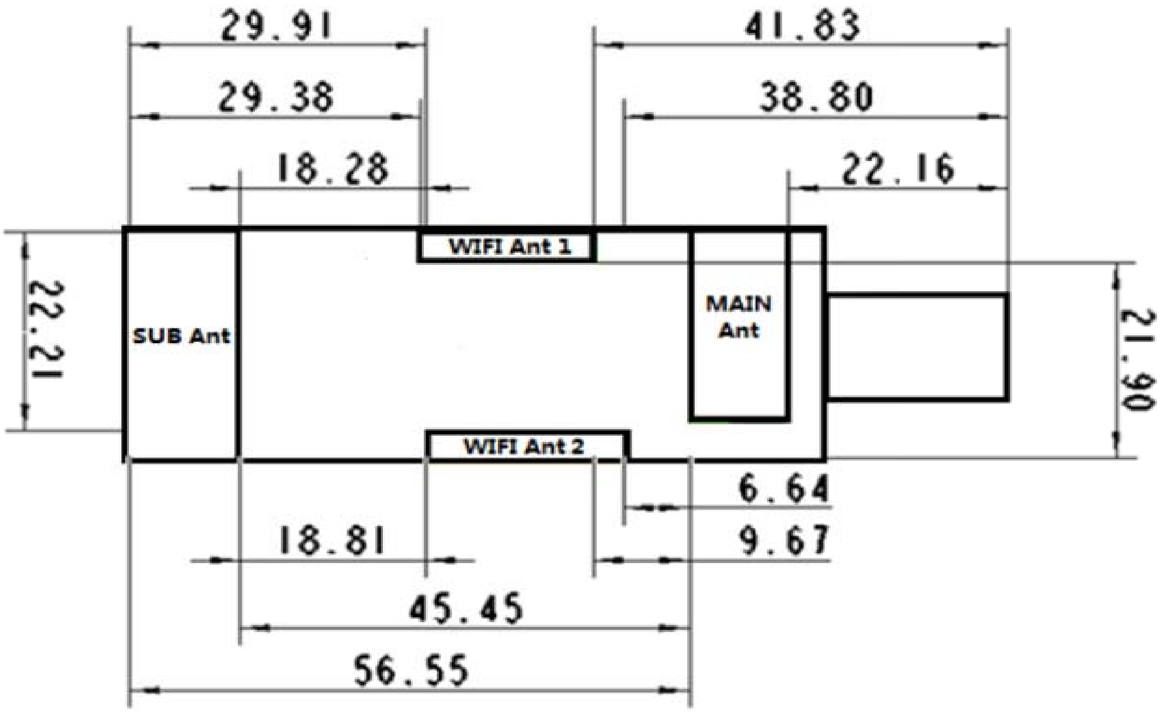
Test No.	Band	CH	Test Position (with 5mm)	Ant	Data Rate	Power Setting	Tune up	Measured	Drift(dB)	SAR Value (W/kg)1-g	Scaled 1-g SAR	Actual duty factor	Reported 1-g SAR
T81	802.11b	4	Horizontal-Down	1	1	13	15	13.78	-0.09	**0.137**	0.181	99.040%	0.183
T82	802.11b	4	Horizontal-Up	1	1	13	15	13.78	0.08	0.084	0.111	99.040%	0.112
T83	802.11b	4	Vertical-Back	1	1	13	15	13.78	0.01	0.066	0.088	99.040%	0.089
T84	802.11b	4	Vertical-Front	1	1	13	15	13.78	0.01	0.016	0.021	99.040%	0.022
T91	802.11b	4	Horizontal-Down	2	1	13	14.5	12.87	-0.08	0.138	0.201	98.410%	0.204
T92	802.11b	4	Horizontal-Up	2	1	13	14.5	12.87	-0.01	**0.188**	0.274	98.410%	0.278
T93	802.11b	4	Vertical-Back	2	1	13	14.5	12.87	0.09	0.022	0.032	98.410%	0.033
T94	802.11b	4	Vertical-Front	2	1	13	14.5	12.87	-0.02	0.101	0.147	98.410%	0.150
T101	802.11n20	7	Horizontal-Down	1+2	13	9	12.5	11.20	-0.08	**0.068**	0.092	85.600%	0.107
T102	802.11n20	7	Horizontal-Up	1+2	13	9	12.5	11.20	0.05	0.061	0.082	85.600%	0.096
T103	802.11n20	7	Vertical-Back	1+2	13	9	12.5	11.20	0.01	0.026	0.036	85.600%	0.042
T104	802.11n20	7	Vertical-Front	1+2	13	9	12.5	11.20	-0.08	0.042	0.057	85.600%	0.066

Note: Per KDB 248227 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 location of the antennas inside mobile phone is shown as below picture:



Note: The SUB Ant only has the receiver function.

8.3.1STAND-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	Body
1	GPRS/EDGE (DATA) + WiFi 2.4G	Yes
2	UMTS(DATA)+ WiFi 2.4G	Yes
3	LTE(DATA)+ WiFi 2.4G	Yes

Note: 2G&3G&4G share the same antenna and can't transmit simultaneously.

8.3.2 SAR SUMMATION SCENARIO

About WiFi and GSM/UMTS/LTE antenna

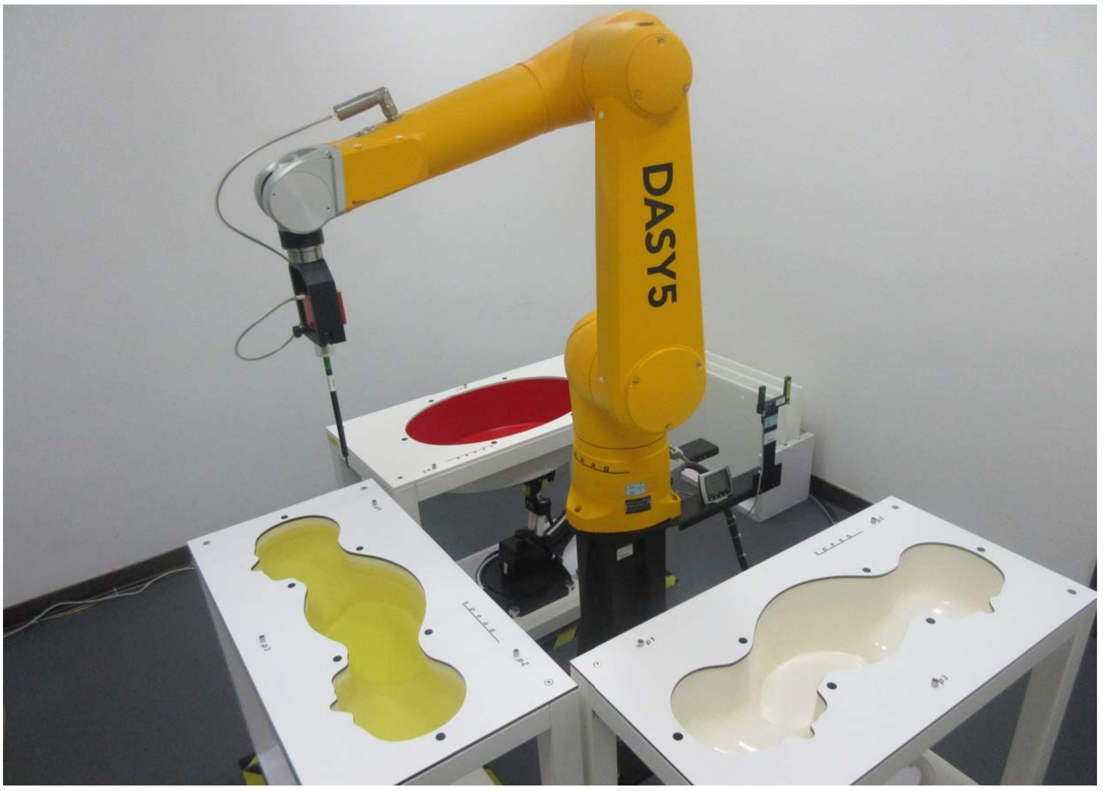
Test Position / Reported SAR_{1g}	Body			
	Horizontal-Down	Horizontal-Up	Vertical-Back	Vertical-Front
GSM850	0.881	0.852	0.337	0.121
GSM1900	0.687	1.188	0.593	0.198
UMTS B2	0.652	0.784	0.788	0.358
LTE B2	0.782	1.115	0.609	0.179
LTE B7	0.721	1.169	0.950	0.393
WiFi 2.4G	0.204	0.278	0.089	0.150
MAX∑SAR1g	1.085	**1.466**	1.039	0.543

MAX. $\sum SAR_{1g}$=1.466W/kg<1.6 W/kg, so the SAR to peak location separation ratio should not be considered.

APPENDIX

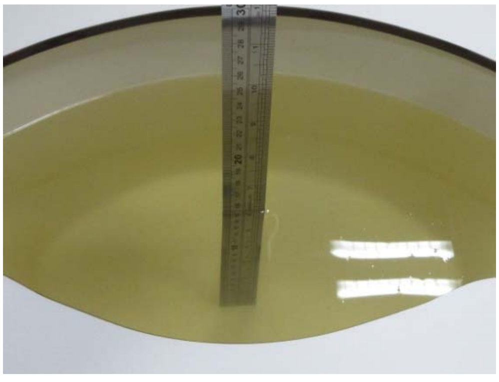
1. Test Layout

Specific Absorption Rate Test Layout

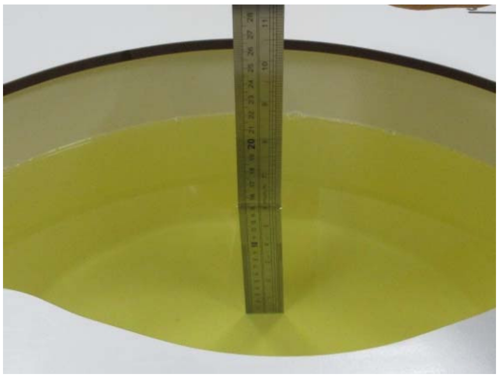


Liquid depth in the flat Phantom (≥15cm depth)

Body(835MHz) 15.5cm



Body (1900MHz~2600 MHz) 15.5cm



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