FCC SAR Compliance Test Report

Product Name: Mobile WiFi

Model: R226

Report No.: SYBH(Z-SAR)039052014-2

FCC ID: QISR226

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DATE	2014-07-17	2014-07-17

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2014-07-17	Gong Zhong

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for R226 is as below Table 1.

Band	Position	MAX Reported SAR_{1g} (W/kg)
GSM850	Body 10mm	0.795
GSM1900	Body 10mm	1.007
UMTS Band V	Body 10mm	**1.176**
UMTS Band II	Body 10mm	0.703
LTE Band V	Body 10mm	1.101
LTE Band VII	Body 10mm	1.154
WiFi 2.4G	Body 10mm	0.153
WiFi 5G	Body 10mm	0.300
The highest simultaneous SAR is 1.307W/kg per KDB690783 D01		

Table 1:Summary of test result

The device is in compliance with Specific Absorption Rate（SAR）for general population/uncontraolled exposure limits according to the FCC rule §2.1093, the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2003 & IEEE Std 1528a-2005.

1.2 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain/Body/Arms/Legs)	**1.60 mW/g**	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

Table 2: RF exposure limits

The limit applied in this test report is shown in **bold** letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation.

1.3 EUT Description

Device Information:			
Product Name:	Mobile WiFi		
Model:	R226		
FCC ID :	QISR226		
SN No.:	SAR1:N4W0114429000258 SAR2:N4W0114429000151		
Device Type :	Portable device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment / general population		
Hardware Version :	CL3E5786SM		
Software Version :	21.280.07.00.11		
Antenna Type :	Internal antenna		
Device Operating Configurations:			
Supporting Mode(s)	GSM850/1900, UMTS Band V/II, LTE Band V/VII, 2.4G WiFi,5G WiFi(tested)		
Test Modulation	GSM(GMSK/8PSK), UMTS(QPSK),LTE(QPSK,16QAM), WiFi(OFDM)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	UMTS Band V	824-849	869-894
	UMTS Band II	1850-1910	1930-1990
	LTE Band V	824-849	869-894
	LTE Band VII	2500-2570	2620-2690
	WiFi 2.4G	2412-2452	
	WiFi 5G	5170-5250 5735-5835	
GPRS Multislot Class(12)	Max Number of Timeslots in Uplink:		4
	Max Number of Timeslots in Downlink:		4
	Max Total Timeslot:		5
EGPRS Multislot Class(12)	Max Number of Timeslots in Uplink:		4
	Max Number of Timeslots in Downlink:		4
	Max Total Timeslot:		5
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 V)		
	3, tested with power control "all 1"(UMTS Band II)		
	3, tested with power control "all Max"(LTE Band V)		
	3, tested with power control "all Max"(LTE Band VII)		

Test Channels (low-mid-high):	128-190-251(GSM850)
	512-661-810(GSM1900)
	4132-4182-4233(UMTS Band V)
	9262-9400-9538(UMTS Band II)
	20425-20525-20625(LTE Band V BW=5MHz)
	20450-20525-20600(LTE Band V BW=10MHz)
	20775-21100-21425(LTE Band VII BW=5MHz)
	20800-21100-21400(LTE Band VII BW=10MHz)
	20825-21100-21375(LTE Band VII BW=15MHz)
	20850-21100-21350(LTE Band VII BW=20MHz)
	1-3-5-7-9(WiFi 2450)
	802.11a/ac/n 20M:36-40-44-48-149-153-157-161-165 802.11ac/n 40M:38-46-151-159 802.11ac 80M:42-155

Table 3:Device information and operating configuration

1.3.1 General Description

R226 is a LTE/UMTS/GSM triple mode and 2*2 WiFi Wireless mobile WiFi; it can be used as a WiFi hotspot based on standard of IEEE802.11a/b/g/n/ac. It supports 2G GSM，3G WCDMA and 4G LTE wireless internet accessing function. About 3G WCDMA wireless mode, it supports WCDMA and HSDPA/HSUPA/HSPA+/DC-HSPA+, operating in Band1 /2/5/8；and LTE, operating in Band3/5/7/20；and GSM mode supports EDGE/GPRS/GSM 1900MHz/1800MHz/850MHz/900MHz. The WiFi supports 2.4G 11b/g/n and 5G 11a/n/ac.
R226 supports 1Tx2Rx for WCDMA and LTE, WiFi supports 2Tx2Rx MIMO.
R226 supports carrier aggregation for LTE downlink from BS, the CA band is B3+B3，B3+B7, B3+B20, B7+B20 for VDF and B3+B3, B3+B5 for VHA by different software.

Battery：

Name	Manufacture	Serials number	Description
Li-ion Battery	HUAWEI	NA	Battery Mode: HB5P1H Rated capacity: 3000mAh Nominal Voltage: ⎓ +3.7V

LTE-CA specification:
The device only supports downlink LTE carrier aggregation between Europe LTE band and US LTE band or two Europe LTE bands (the CA band is B3+B3, B3+B7, B3+B20, B7+B20, B3+B5) . It does not support uplink carrier aggregation.It does not support LTE carrier aggregation between US LTE bands. A KDB inquiry has been submitted to FCC and the conclusion is that SAR testing is not required in bands or modes not intended/allowed for US operation.

	LTE CA for VDF (downlink only)	LTE CA for VHA (downlink only)
LTE Carrier Aggregation Possible Consideration	B3+B3	B3+B3
	B3+B7	B3+B5
	B3+B20	/
	B7+B20	/

1.4 Test specification(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 1528-2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEEE Std 1528a-2005	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques Amendment 1: CAD File for Human Head Model (SAM Phantom)
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB941225 D01	SAR test for 3G devices v02
KDB941225 D02	HSPA and 1x Advanced v02r02
KDB941225 D03	SAR Test Reduction GSM GPRS EDGE v01
KDB941225 D05	SAR for LTE Devices v02r03
KDB941225D05A	LTE Rel.10 KDB Inquiry Sheet v01
KDB941225 D06	Hot Spot SAR v01r01
KDB447498 D01	General RF Exposure Guidance v05r02
KDB248227 D01	SAR meas for 802.11 a/b/g v01r02
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r03
KDB865664 D02	SAR Reporting v01r01
KDB690783 D01	SAR Listings on Grants v01r03

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Zone K3,Huawei Industrial Base, Bantian Industry Area, Longgang District, Shenzhen, Guangdong, China
Telephone	+86 755 28780808
Fax	+86 755 89652518
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01

1.6 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

1.7 Application details

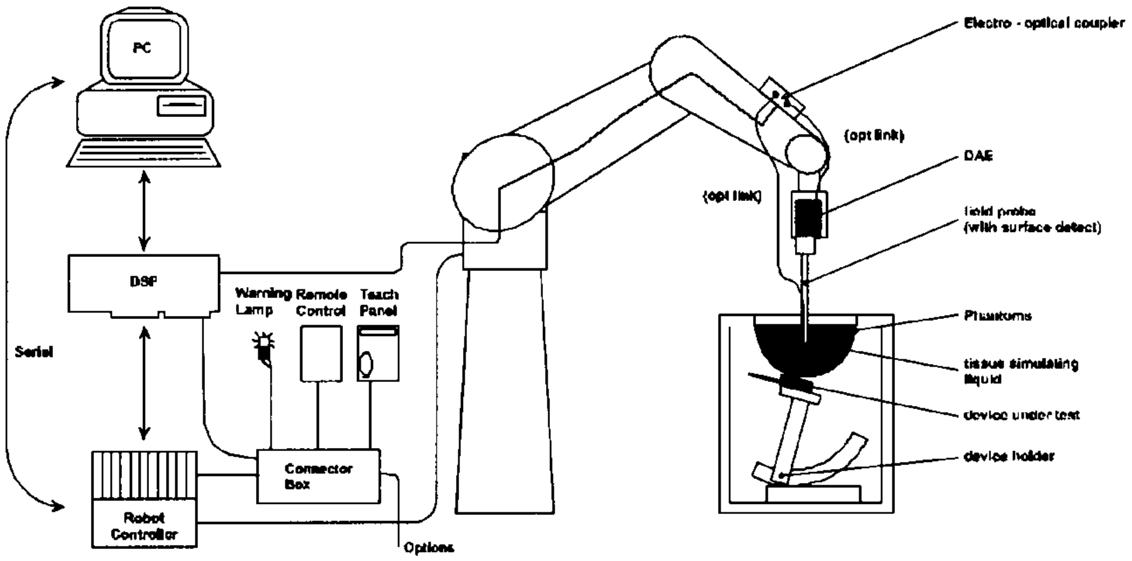
Start Date of test	2014-06-09
End Date of test	2014-07-16

1.8 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

2 SAR Measurement System

2.1 SAR Measurement Set-up



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

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

- 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.

- 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.
- A unit to operate the optical surface detector which is connected to the EOC.
- 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.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 7.
- DASY5 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System check dipoles allowing to validate the proper functioning of the system.

2.2 Test environment

The DASY5 measurement system is placed at the head end of a room with dimensions:
5 x 2.5 x 3 m³, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a 1.5 x 1.5 m² array of pyramid absorbers is installed to reduce reflections from the ceiling.
Picture 1 of the photo documentation shows a complete view of the test environment.
The system allows the measurement of SAR values larger than 0.005 mW/g.

2.3 Data Acquisition Electronics description

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

DAE4

Input Impedance	200MOhm	
The Inputs	symmetrical and floating	
Common mode rejection	above 80 dB	

2.4 Probe description

These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

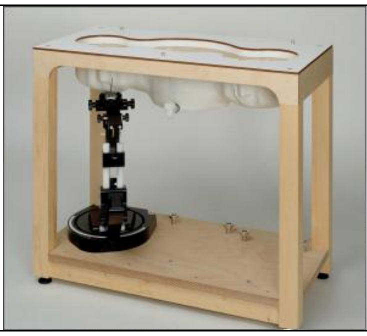
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones	

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

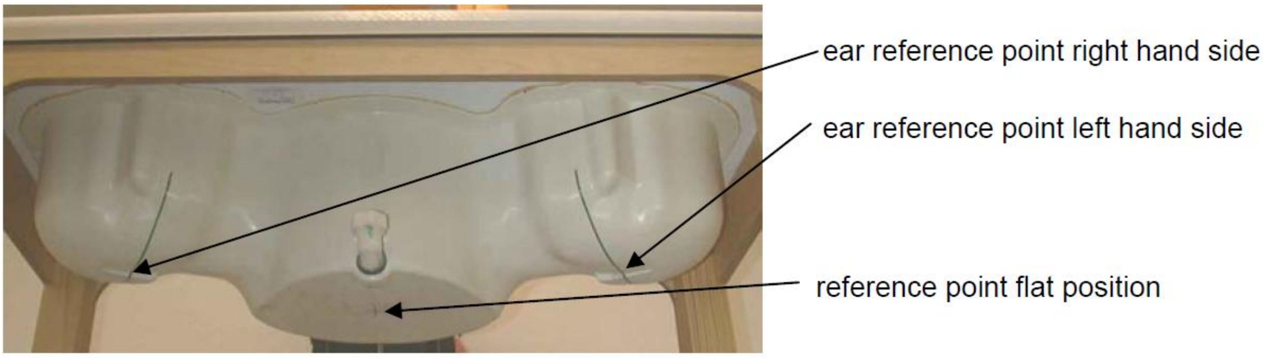
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 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: ± 0.2 dB(noise:typically<1µW/g)	
Dimensions	Overall length: 337 mm (Tip:20 mm) Tip diameter:2.5 mm (Body:12 mm) Typical distance from probe tip to dipole centers: 1mm	
Application	High precision dosimetric measurements in any exposure scenario(e.g.,very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%	

2.5 Phantom description

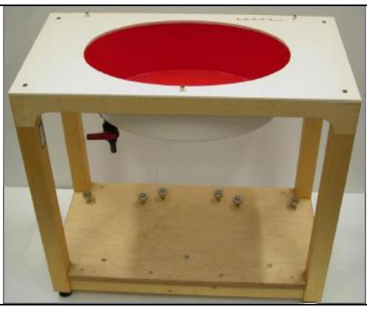
SAM Twin Phantom

Shell Thickness	2mm +/- 0.2 mm; The ear region: 6mm	
Filling Volume	Approximately 25 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Left hand Right hand Flat phantom	
The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible. Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.		

The following figure shows the definition of reference point:



ELI4 Phantom

Shell Thickness	2mm +/- 0.2 mm	
Filling Volume	Approximately 30 liters	
Dimensions	Major axis:600mm; Minor axis:400mm;	
Measurement Areas	Flat phantom	
The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.		

The phantom shell material is resistant to all ingredients used in the tissue-equivalent liquid recipes. The shell of the phantom including ear spacers is constructed from low permittivity and low loss material, with a relative permittivity $2 \le \varepsilon r \le 5$ at ≤3 GHz,$3 \le \varepsilon r \le 4$ at >3 GHz and and a loss tangent ≤0.05.

2.6 Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent σ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.
The device holder permits the device to be positioned with a tolerance of ±1° in the tilt angle.

Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.
Therefore those devices are normally only tested at the flat part of the SAM.

2.7 Test Equipment List

This table gives a complete overview of the SAR measurement equipment.
Devices used during the test described are marked ☒

	Manufacturer	Device	Type	Serial number	Date of last calibration	Valid period
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2014-04-24	One year
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3744	2013-07-26	One year
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3898	2014-03-10	One year
☒	SPEAG	835 MHz Dipole	D835V2	4d059	2013-05-02	Three years
☐	SPEAG	1800 MHz Dipole	D1800V2	2d157	2013-11-27	Three years
☒	SPEAG	1900 MHz Dipole	D1900V2	5d143	2011-09-26	Three years
☐	SPEAG	2000 MHz Dipole	D2000V2	1052	2011-03-10	Three years
☐	SPEAG	2300 MHz Dipole	D2300V2	1016	2011-11-22	Three years
☒	SPEAG	2450 MHz Dipole	D2450V2	860	2014-01-23	Three years
☒	SPEAG	2600 MHz Dipole	D2600V2	1021	2011-11-22	Three years
☒	SPEAG	5GHz Dipole	D5GHzV2	1155	2014-04-21	Three years
☒	SPEAG	Data acquisition electronics	DAE4	851	2013-07-31	One year
☒	SPEAG	Data acquisition electronics	DAE4	852	2014-04-30	One year
☒	SPEAG	Software	DASY 5	N/A	NCR	NCR
☐	SPEAG	Twin Phantom	SAM1	TP-1475	NCR	NCR
☐	SPEAG	Twin Phantom	SAM2	TP-1474	NCR	NCR
☒	SPEAG	Twin Phantom	SAM3	TP-1597	NCR	NCR
☒	SPEAG	Twin Phantom	SAM4	TP-1620	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1038	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	NCR	NCR
☒	R & S	Universal Radio Communication Tester	CMU 200	111379	2013-08-09	One year
☒	R & S	Universal Radio Communication Tester	CMW 500	126855	2013-08-10	Two years
☒	Agilent	Network Analyser	E5071C	MY46213349	2014-02-25	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
☒	Agilent	Signal Generator	N5181A	MY47420989	2014-01-18	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	NCR	NCR
☒	MINI-CIRCUITS	Amplifier	ZVE-8G+	129601322	NCR	NCR
☒	AR	Directional Coupler	DC7144M1	0423264	2014-04-02	One year
☒	R & S	Power Meter	NRP	MY44420359	2013-08-28	One year
☒	R & S	Power Meter Sensor	NRP-Z11	100740	2013-08-28	One year
☒	Agilent	Power Meter	E4417A	MY45101339	2014-01-18	One year
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2014-01-18	One year

Note:

1) Per KDB865664D01 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 shorting block performed before measuring liquid parameters.

3 SAR Measurement Procedure

3.1 Scanning procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and system check. 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°.)

- 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.
  Results of this coarse scan are shown in Appendix B.

- 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}, $\Delta y_{zoom} \leq$ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; $\Delta z_{zoom} \leq$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. A z-axis scan of the measurement with maximum SAR value is shown in Appendix B.

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

3.2 Spatial Peak SAR Evaluations

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.

3.3 Data Storage and Evaluation

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.

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	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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 multimeter 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
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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
σ = conductivity in [mho/m] or [Siemens/m]
ρ = 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.

$P_{pwe} = E_{tot}^2 / 3770$ 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 electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

4 System Verification Procedure

4.1 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.

Ingredients (% of weight)	Body Tissue					
Frequency Band (MHz)	450	**835**	1800	**1900**	**2450**	**2600**
Water	51.16	52.4	69.91	69.91	73.2	64.493
Salt (NaCl)	1.49	1.40	0.13	0.13	0.04	0.024
Sugar	46.78	45.0	0.0	0.0	0.0	0.0
HEC	0.52	1.0	0.0	0.0	0.0	0.0
Bactericide	0.05	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.7	32.252

Table 4: Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16MΩ+ 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

Simulating Body Liquid for 5G (MBBL3500-5800MHz),Manufactured by SPEAG:

Ingredients	(% by weight)
Water	60-80%
Esters,Emulsifiers,Inhibitors	20-40%
Sodium salt	0-1.5%

Tissue Type	Measured Frequency（MHz）	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.21	0.997	21.4°C	2014-06-09
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.12	1.007		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	53.98	1.021		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	53.98	0.995	21.5°C	2014-06-14
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	53.88	1.005		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	53.75	1.019		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.29	1.490	21.4°C	2014-06-09
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.27	1.520		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.22	1.546		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.19	1.560		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	51.37	1.911	21.3°C	2014-06-15
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	51.25	1.938		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.19	1.958		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.16	1.972		
2600B	2510	52.62 (49.99~55.25)	2.03 (1.93~2.13)	50.92	2.028	21.4°C	2014-07-01
	2535	52.59 (49.96~55.22)	2.07 (1.97~2.17)	50.78	2.068		
	2560	52.57 (49.94~55.20)	2.09 (1.99~2.19)	50.66	2.098		
	2600	52.5 (49.88~55.13)	2.16 (2.05~2.27)	50.59	2.127		
5G B	5200	49.0 (46.55~51.45)	5.30 (5.03~5.56)	47.29	5.240	21.6°C	2014-06-22
	5800	48.20 (45.79~50.61)	6.00 (5.70~6.30)	46.65	6.241	21.6°C	2014-06-22
	5800	48.20 (45.79~50.61)	6.00 (5.70~6.30)	46.65	6.241	21.6°C	2014-07-16
ε_r= Relative permittivity, σ= Conductivity							

Table 5:Measured Tissue Parameter

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.

4.2 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(Graphic Plot(s) see Appendix A).

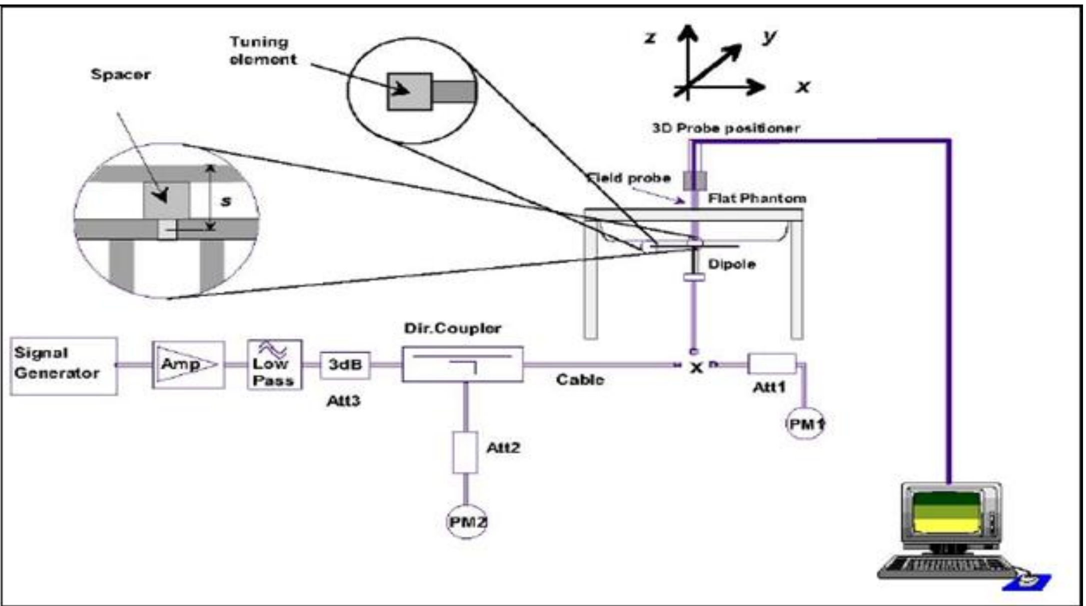
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	10.20	6.68	21.4°C	2014-06-09
D835V2 Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	10.16	6.72	21.5°C	2014-06-14
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	43.20	22.56	21.4°C	2014-06-09
D2450V2 Body	50.6 (45.54~55.66)	23.7 (21.33~26.07)	50.80	23.40	21.3°C	2014-06-15
D2600V2 Body	55.6 (50.04~61.16)	24.9 (22.41~27.39)	55.60	24.52	21.4°C	2014-07-01
D5200V2 Body	77.60 (69.84~85.36)	21.6 (19.44~23.76)	75.90	21.30	21.6°C	2014-06-22
D5800V2 Body	76.7 (69.03~84.37)	21.2 (19.08~23.32)	74.50	20.60	21.6°C	2014-06-22
D5800V2 Body	76.7 (69.03~84.37)	21.2 (19.08~23.32)	73.30	20.80	21.6°C	2014-07-16

Table 6:System Check Results

4.3 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 (result on plot).

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.



5 SAR measurement variability and uncertainty

5.1 SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r03, 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 7.2.

5.2 SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03,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 1528-2003 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.

6 SAR Test Configuration

6.1 GSM Test Configuration

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using CMU200 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	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

Table 7: The allowed power reduction in the multi-slot configuration of GSM

6.2 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

a.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.

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

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

Table 8: Sub-tests for UMTS Release 5 HSDPA

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

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

Table 9:settings of required H-Set 1 QPSK acc. to 3GPP 34.121

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

Table 10:HSDPA UE category

4) HSUPA

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 HSPA is measured with E-DCH Sub-test 5, using H-set 1 and QPSK for FRC and 12.2kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.

Due to inner loop power control requirements in HSDPA, 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.

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} (codes)	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 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.

Table 11:Subtests for UMTS Release 6 HSUPA

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).

Table 12:HSUPA UE category

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

Table 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

Table 13:settings of required H-Set 12 QPSK acc. to 3GPP 34.121
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.

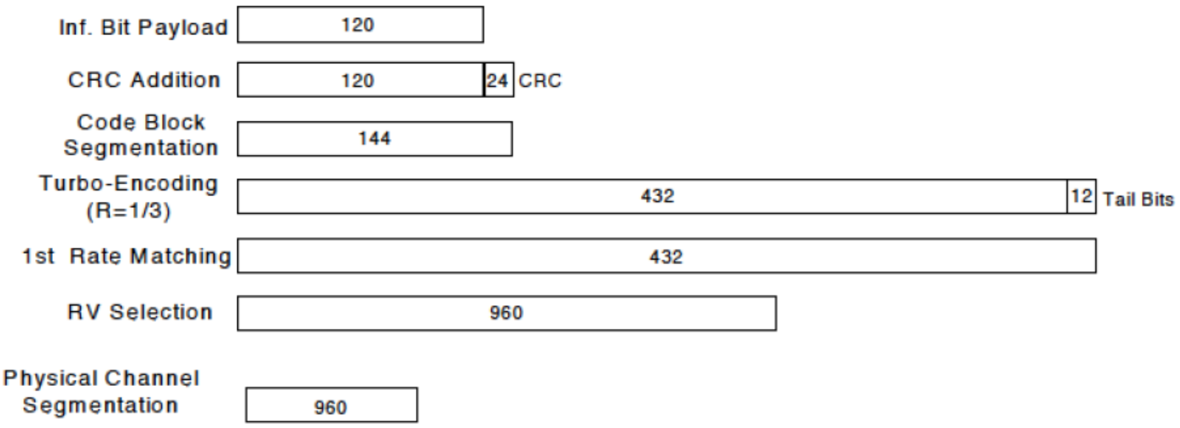


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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

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

Note:

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

6.3 LTE Test Configuration

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02r03. The CMW500 WideBand 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

The LTE Band V MPR of the device is as below:

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]		MPR
	5 MHz	10 MHz	
QPSK	≤8	≤ 12	0
QPSK	>8	> 12	1
16 QAM	≤8	≤ 12	0
16 QAM	>8	> 12	1

The LTE Band VII MPR of the device is as below:

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]				MPR
	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	≤8	≤ 12	≤16	≤ 18	0
QPSK	>8	> 12	>16	> 18	1
16 QAM	≤8	≤ 12	≤16	≤ 18	0
16 QAM	>8	> 12	>16	> 18	1

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.

6.4 WiFi 2.4G Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for WiFi mode test. The Absolute Radio Frequency Channel Number(ARFCN) is allocated to 1 ,6 and 11 respectively in the case of 2450 MHz.During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frquency band. 802.11b/g modes are tested on channel 1, 6, 11; however,if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1#	√	△
		2.437	6	√	△
		2.462	11#	√	△

Notes:
√ = "default test channels"
△= possible 802.11g channels with maximum average output ¼ dB the "default test channels"
= when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

802.11 Test Channels per FCC KDB 248227

For the 802.11a SAR tests, a communication link is set up with the test mode software for WiFi mode test. 802.11a operating modes are tested independently according to the service requirements in each 5G WiFi frquency band. During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

Per KDB248227,for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate. When 802.11n-HT20 and 11n-HT40 output power is less than 0.25dB higher than 802.11a, the SAR can be excluded.

The device supports 802.11ac with the following features:
a) Up to 80MHz Bandwidth only;
b) 2 Tx antenna output;
c) No channel/carrier aggregation configurations;
d) No new 5G channels;
Per April 2013 TCB workshop notes, full SAR evaluations for all 802.11ac configurations were not required when the maximum average output power for 802.11ac is not more than 1/4 dB higher than 802.11a. 802.11ac SAR was evaluated for highest 802.11a configuration in each 5 GHz band and each exposure condition.

7 SAR Measurement Results

7.1 Conducted power measurements

For the measurements a Rohde & Schwarz Radio Communication Tester CMU200&CMW500 was used.
SAR drift measured at the same position in liquid before and after each SAR test as below 7.2 chapter.
Note: CMU200 measures GSM peak and average output power for active timeslots.For SAR the timebased average power is relevant. The difference in between depends on the duty cycle of the TDMA signal :

No. of timeslots	1	2	3	4
Duty Cycle	1:8.3	1:4.1	1:2.77	1:2.08
timebased avg. power compared to slotted avg. power	-9.19dB	-6.13dB	-4.42dB	-3.18dB

The signalling modes differ as follows:

mode	coding scheme	modulation
GPRS	CS1 to CS4	GMSK
EDGE	MCS1 to MCS4	GMSK
EDGE	MCS5 to MCS9	8PSK

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal. Therefore one coding scheme per mode was selected for conducted power measurements.

7.1.1 Conducted power measurements of GSM850

GSM850		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		128CH	190CH	251CH		128CH	190CH	251CH
GPRS/ EDGE (GMSK)	1 Tx Slot	32.35	32.75	32.91	-9.19	23.16	23.56	23.72
	2 Tx Slots	29.22	30.31	30.58	-6.13	**23.09**	**24.18**	**24.45**
	3 Tx Slots	27.36	27.74	27.91	-4.42	22.94	23.32	23.49
	4 Tx Slots	26.24	26.54	26.61	-3.18	23.06	23.36	23.43
EDGE (8PSK)	1 Tx Slot	25.98	25.97	25.89	-9.19	16.79	16.78	16.7
	2 Tx Slots	23.98	23.95	23.91	-6.13	17.85	17.82	17.78
	3 Tx Slots	21.79	21.78	21.77	-4.42	17.37	17.36	17.35
	4 Tx Slots	19.69	19.67	19.64	-3.18	16.51	16.49	16.46

Table 14:Conducted power measurement results of GSM850

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 timesolts.

3) Per KDB 941225 D03v01,the bolded GPRS 2Tx mode was selected for SAR testing according to the highest frame –averaged output power table.

7.1.2 Conducted power measurements of GSM1900

GSM1900		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GPRS/ EDGE (GMSK)	1 Tx Slot	29.37	29.00	28.88	-9.19	20.18	19.81	19.69
	2 Tx Slots	27.19	26.95	26.99	-6.13	**21.06**	**20.82**	**20.86**
	3 Tx Slots	25.14	25.23	24.93	-4.42	20.72	20.81	20.51
	4 Tx Slots	23.01	23.08	22.75	-3.18	19.83	19.9	19.57
EDGE (8PSK)	1 Tx Slot	25.61	25.57	25.61	-9.19	16.42	16.38	16.42
	2 Tx Slots	23.56	23.42	23.26	-6.13	17.43	17.29	17.13
	3 Tx Slots	21.47	21.26	21.04	-4.42	17.05	16.84	16.62
	4 Tx Slots	19.13	18.96	18.78	-3.18	15.95	15.78	15.60

Table 15: Conducted power measurement results of GSM1900

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 timesolts.
3) Per KDB 941225 D03v01,the bolded GPRS 2Tx mode was selected for SAR testing according to the highest frame –averaged output power table.

7.1.3 Conducted power measurements of UMTS Band V

UMTS Band V		Conducted Power (dBm)		
		4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	21.92	22.00	21.88
	64kbps RMC	21.89	22.00	21.87
	144kbps RMC	21.95	22.04	21.86
	384kbps RMC	21.94	22.03	21.86
HSDPA	Subtest 1	21.78	21.86	21.78
	Subtest 2	21.25	21.26	21.17
	Subtest 3	20.84	20.94	20.83
	Subtest 4	20.89	20.89	20.83
HSUPA	Subtest 1	21.23	21.41	21.25
	Subtest 2	18.72	18.76	18.68
	Subtest 3	20.17	19.89	19.84
	Subtest 4	19.07	18.18	18.08
	Subtest 5	20.97	20.51	20.43
DC-HSDPA	Subtest 1	21.70	21.77	21.72
	Subtest 2	21.16	21.18	21.11
	Subtest 3	20.77	20.85	20.76
	Subtest 4	20.83	20.82	20.78

Table 16: Conducted power measurement results of UMTS Band V

Note:

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

2) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤ ¼ dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

3) Per KDB941225 D02v02r02, when the maximum average output power of each RF channel with (uplink) HSPA+/DC-HSDPA active is ≤1/4 dB higher than that measured without HSPA+/DC-HSDPA using 12.2 kbps RMC, or the maximum reported SAR for 12.2 kbps RMC without HSPA+/DC-HSDPA/ is ≤ 75% of the SAR limit, SAR evaluation for HSPA+/DC-HSDPA is not required.

7.1.4 Conducted power measurements of UMTS Band II

UMTS Band II		Conducted Power (dBm)		
		9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	22.32	22.01	21.85
	64kbps RMC	22.36	21.99	21.81
	144kbps RMC	22.34	21.98	21.85
	384kbps RMC	22.33	21.87	21.85
HSDPA	Subtest 1	22.12	21.64	21.63
	Subtest 2	21.53	21.06	21.04
	Subtest 3	21.23	20.81	20.79
	Subtest 4	21.26	20.78	20.77
HSUPA	Subtest 1	20.9	21.18	20.65
	Subtest 2	18.41	18.10	18.62
	Subtest 3	20.18	20.16	20.34
	Subtest 4	18.80	18.32	18.25
	Subtest 5	21.37	20.92	20.67
DC-HSDPA	Subtest 1	22.05	21.58	21.58
	Subtest 2	21.48	20.98	22.98
	Subtest 3	21.18	20.75	20.72
	Subtest 4	21.21	20.71	20.70

Table 17: Conducted power measurement results of UMTS Band II

Note:

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

2) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤ ¼ dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

3) Per KDB941225 D02v02r02, when the maximum average output power of each RF channel with (uplink) HSPA+/DC-HSDPA active is ≤1/4 dB higher than that measured without HSPA+/DC-HSDPA using 12.2 kbps RMC, or the maximum reported SAR for 12.2 kbps RMC without HSPA+/DC-HSDPA/ is ≤ 75% of the SAR limit, SAR evaluation for HSPA+/DC-HSDPA is not required.

7.1.1 Conducted power measurements of LTE Band V

Bandwidth	Modulation	RB size	RB offset	Channel 20425 CH	Channel 20525 CH	Channel 20625 CH
5MHz	QPSK	1	0	22.12	21.90	22.21
		1	13	22.83	22.69	22.81
		1	24	22.16	22.17	22.02
		12	0	21.59	21.81	21.69
		12	6	21.79	21.96	21.93
		12	13	21.61	21.78	21.60
		25	0	21.60	21.78	21.70
	16QAM	1	0	22.11	22.44	22.26
		1	13	22.82	22.84	22.82
		1	24	22.22	22.15	22.09
		12	0	21.43	21.48	21.42
		12	6	21.64	21.66	21.63
		12	13	21.47	21.48	21.32
		25	0	21.43	21.47	21.42
Bandwidth	Modulation	RB size	RB offset	Channel 20450 CH	Channel 20525 CH	Channel 20600 CH
10MHz	QPSK	1	0	21.95	22.21	21.73
		1	25	22.65	22.67	22.61
		1	49	22.15	22.07	22.03
		25	0	21.14	21.32	21.26
		25	13	21.44	21.45	21.44
		25	25	21.30	21.17	21.21
		50	0	21.21	21.18	21.17
	16QAM	1	0	22.07	22.28	21.77
		1	25	22.67	22.58	22.73
		1	49	22.26	22.12	22.09
		25	0	21.04	21.11	21.04
		25	13	21.32	21.23	21.21
		25	25	21.16	20.98	20.98
		50	0	21.08	20.99	20.96

Table 18: Conducted power measurement results of LTE Band V

7.1.1 Conducted power measurements of LTE Band VII

Bandwidth	Modulation	RB size	RB offset	Channel 20775CH	Channel 21100CH	Channel 21425CH
5MHz	QPSK	1	0	21.33	21.75	21.49
		1	13	22.22	22.38	21.85
		1	24	21.72	21.66	21.14
		12	0	21.25	21.41	21.01
		12	6	21.51	21.62	21.16
		12	13	21.25	21.38	20.84
		25	0	21.30	21.39	20.92
	16QAM	1	0	21.31	21.71	21.48
		1	13	22.00	22.31	22.05
		1	24	21.52	21.64	21.35
		12	0	20.95	21.16	21.00
		12	6	21.44	21.37	21.14
		12	13	21.17	21.13	20.83
		25	0	21.22	21.10	20.88
Bandwidth	Modulation	RB size	RB offset	Channel 20800CH	Channel 21100CH	Channel 21400CH
10MHz	QPSK	1	0	21.88	22.06	21.95
		1	25	22.40	22.56	22.11
		1	49	21.98	21.89	21.42
		25	0	21.18	21.36	20.92
		25	13	21.39	21.56	21.13
		25	25	21.09	21.24	20.81
		50	0	21.24	21.31	20.98
	16QAM	1	0	21.86	22.20	21.99
		1	25	22.40	22.68	22.30
		1	49	21.91	22.09	21.66
		25	0	21.14	21.34	20.97
		25	13	21.34	21.54	21.16
		25	25	21.06	21.24	20.87
		50	0	21.20	21.28	20.99

Bandwidth	Modulation	RB size	RB offset	Channel 20825CH	Channel 21100CH	Channel 21375CH
15MHz	QPSK	1	0	22.09	22.24	22.08
		1	38	22.56	22.47	22.23
		1	74	21.70	21.53	21.08
		36	0	21.37	21.47	21.13
		36	18	21.44	21.57	21.18
		36	39	21.23	21.27	20.93
		75	0	21.23	21.38	21.09
	16QAM	1	0	22.11	22.21	22.20
		1	38	22.59	22.46	22.34
		1	74	21.77	21.55	21.42
		36	0	21.25	21.31	21.19
		36	18	21.33	21.40	21.24
		36	39	21.11	21.11	20.99
		75	0	21.12	21.23	21.17
Bandwidth	Modulation	RB size	RB offset	Channel 20850CH	Channel 21100CH	Channel 21350CH
20MHz	QPSK	1	0	21.95	22.09	21.87
		1	50	21.86	21.93	21.67
		1	99	22.02	21.74	21.39
		50	0	20.70	20.82	20.78
		50	25	20.64	20.76	20.66
		50	50	20.76	20.66	20.45
		100	0	20.83	20.74	20.63
	16QAM	1	0	21.88	22.14	21.83
		1	50	21.81	21.95	21.64
		1	99	21.97	21.82	21.39
		50	0	20.54	20.68	20.86
		50	25	20.49	20.62	20.75
		50	50	20.61	20.53	20.55
		100	0	20.67	20.59	20.71

Table 19: Conducted power measurement results of LTE Band VII

7.1.2 Conducted power measurements of WiFi 2.4G

The output power of WiFi antenna is as following:

Wi-Fi 2450MHz	Ant	Channel	Average Power (dBm) for Data Rates (Mbps)							
			1	2	5.5	11	/	/	/	/
802.11b	Ant1	1	13.15	13.22	13.36	13.09	/	/	/	/
		5	13.27	13.41	13.42	13.24	/	/	/	/
		9	13.15	13.34	13.38	13.29	/	/	/	/
	Ant2	1	12.70	12.91	12.92	12.75	/	/	/	/
		5	13.71	13.81	13.82	13.65	/	/	/	/
		9	14.07	14.25	14.28	14.16	/	/	/	/
	Ant	Channel	6	9	12	18	24	36	48	54
802.11g	Ant1	1	12.13	11.85	11.87	11.79	11.58	11.45	10.93	10.83
		5	12.22	11.90	11.89	11.83	11.82	11.53	11.21	11.41
		9	12.37	12.07	12.18	12.06	12.09	11.49	11.27	11.15
	Ant2	1	11.85	11.45	11.50	11.47	11.54	11.17	10.81	10.57
		5	12.94	12.72	12.67	12.67	12.66	12.07	11.89	11.76
		9	13.16	12.85	12.92	12.84	12.83	12.44	12.23	12.19
	Ant	Channel	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n (HT20,800ns)	Ant1	1	11.12	10.65	10.35	10.72	10.44	10.14	10.04	10.04
		5	11.14	10.72	10.36	10.73	10.46	10.32	10.24	10.20
		9	11.52	11.11	10.76	11.02	10.91	10.76	10.65	10.49
	Ant2	1	11.04	10.76	10.52	10.56	10.29	9.93	9.90	9.90
		5	12.06	11.69	11.51	11.53	11.32	11.01	10.97	10.80
		9	12.33	11.89	11.75	11.83	11.59	11.48	11.41	11.38
	Ant	Channel	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n (HT40,800ns)	Ant1	3	11.46	11.20	10.89	10.66	10.29	9.86	9.81	9.71
		5	11.76	11.51	11.02	10.97	10.62	10.19	10.08	10.01
		7	11.43	11.08	10.86	10.64	10.31	9.82	9.64	9.55
	Ant2	3	11.80	11.53	11.02	10.91	10.51	10.13	10.04	9.93
		5	12.21	11.98	11.49	11.37	10.95	10.62	10.59	10.53
		7	12.24	12.01	11.54	11.42	10.86	10.75	10.61	10.29

	Ant	Channel	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11n 20M MIMO	Ant1	1	10.69	10.46	10.15	10.17	9.68	9.32	9.27	9.18
		5	11.05	10.82	10.51	10.53	10.05	9.69	9.63	9.42
		9	11.19	10.96	10.65	10.67	10.18	9.84	9.77	9.64
	Ant2	1	10.71	10.44	10.13	9.93	9.59	9.36	9.27	9.11
		5	11.86	11.58	11.27	11.08	10.76	10.61	10.51	10.15
		9	11.98	11.70	11.39	11.18	10.87	10.63	10.53	10.29
	Sum	1	13.71	13.46	13.15	13.06	12.65	12.35	12.28	12.16
		5	14.48	14.23	13.92	13.82	13.43	13.18	13.10	12.81
		9	14.61	14.36	14.05	13.94	13.55	13.26	13.18	12.99
	Ant	Channel	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11n 40M MIMO	Ant1	3	11.26	10.59	10.05	9.77	9.29	9.14	8.91	8.81
		5	11.42	10.82	10.32	10.01	9.53	9.34	9.01	8.87
		7	10.91	10.35	9.89	9.65	9.05	8.84	9.68	8.56
	Ant2	3	11.37	10.61	10.25	10.02	9.38	9.25	9.16	9.03
		5	12.24	11.45	11.21	10.95	10.23	10.14	9.89	9.68
		7	11.90	11.12	10.84	10.62	9.92	9.83	9.63	9.48
	Sum	3	14.33	13.61	13.16	12.91	12.35	12.21	12.05	11.93
		5	14.86	14.16	13.80	13.52	12.90	12.77	12.48	12.30
		7	14.44	13.76	13.40	13.17	12.52	12.37	12.67	12.05

Table 20: Conducted power measurement results of WiFi 2.4G.

Note:

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

2) Per KDB248227, for WiFi 2.4GHz, highest average RF output power channel for the lowest data rate of 802.11b mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11g/n) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11b mode.

7.1.1 Conducted power measurements of WiFi 5G

Wi-Fi 5G	Ant	Channel	Frequency (MHz)	Average Power (dBm) for Data Rates (Mbps)							
				6M	9M	12M	18M	24M	36M	48M	54M
802.11a	Ant1	CH 36	5180	9.74	9.28	9.25	9.11	9.17	8.86	8.65	8.56
		CH 40	5200	9.43	9.11	9.08	8.93	8.95	8.68	8.58	8.53
		CH 44	5220	9.40	9.02	8.95	8.82	8.84	8.59	8.56	8.55
		CH 48	5240	9.36	8.86	8.76	8.64	8.75	8.60	8.55	8.54
		CH 149	5745	9.47	9.03	8.92	8.82	8.99	8.74	8.65	8.55
		CH 153	5765	9.44	9.01	8.84	8.77	8.95	8.71	8.61	8.52
		CH 157	5785	9.71	9.31	9.12	9.02	9.46	9.26	9.08	8.64
		CH 161	5805	9.76	9.37	9.19	9.06	9.51	9.27	9.13	8.72
		CH 165	5825	9.73	9.32	9.15	9.04	9.44	9.21	9.08	8.71
	Ant2	CH 36	5180	9.82	9.43	9.42	9.32	9.34	9.07	8.86	8.52
		CH 40	5200	9.71	9.31	9.32	9.23	9.21	9.00	9.11	8.72
		CH 44	5220	9.62	9.21	9.23	9.15	9.18	9.01	9.18	8.80
		CH 48	5240	9.47	9.28	9.18	9.19	9.21	9.13	9.04	8.96
		CH 149	5745	9.27	8.98	8.85	8.67	8.71	8.50	8.38	8.25
		CH 153	5765	9.44	9.18	9.06	8.92	8.81	8.65	8.48	8.28
		CH 157	5785	9.48	9.34	9.26	9.04	8.93	8.82	8.65	8.48
		CH 161	5805	9.44	9.25	9.08	8.96	8.87	8.68	8.59	8.46
		CH 165	5825	9.49	9.33	9.08	8.96	8.87	8.68	8.59	8.53
	Ant	Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n HT20	Ant1	CH 36	5180	9.28	8.66	8.27	8.77	8.51	8.10	8.12	8.03
		CH 40	5200	9.16	8.54	8.25	8.66	8.43	7.92	7.99	7.92
		CH 44	5220	8.93	8.21	8.05	8.46	8.21	7.75	7.81	7.85
		CH 48	5240	8.87	8.17	8.01	8.38	8.14	7.68	7.77	7.92
		CH 149	5745	9.27	9.08	8.79	8.58	8.41	8.24	8.08	7.97
		CH 153	5765	9.13	8.89	8.81	8.62	8.49	8.26	8.15	8.06
		CH 157	5785	9.14	8.91	8.88	8.65	8.51	8.33	8.24	8.18
		CH 161	5805	9.42	9.22	8.96	8.79	8.71	8.51	8.41	8.28
		CH 165	5825	9.38	9.26	9.15	8.94	8.86	8.70	8.54	8.46
	Ant2	CH 36	5180	9.33	8.78	8.53	8.81	8.85	8.31	8.23	8.16
		CH 40	5200	9.27	8.75	8.47	8.86	8.89	8.34	8.27	8.24
		CH 44	5220	9.25	8.77	8.45	8.84	8.91	8.38	8.25	8.29
		CH 48	5240	9.21	8.79	8.54	8.91	9.02	8.45	8.36	8.48
		CH 149	5745	9.20	9.01	8.78	8.59	8.42	8.21	8.03	7.80
		CH 153	5765	8.82	8.74	8.61	8.50	8.34	8.11	7.99	7.86
		CH 157	5785	9.01	8.78	8.59	8.38	8.15	7.99	7.83	7.71
		CH 161	5805	9.09	8.96	8.85	8.74	8.51	8.31	8.15	8.01
		CH 165	5825	9.14	9.05	8.91	8.89	8.64	8.48	8.23	8.32

	Ant	Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n HT40	Ant1	CH 38	5190	9.78	9.31	9.18	9.11	8.58	8.31	8.07	7.91
		CH 46	5230	9.75	9.27	9.15	9.06	8.55	8.30	8.04	7.92
		CH 151	5755	9.67	9.05	8.87	8.79	8.29	8.03	7.85	7.71
		CH 159	5795	9.61	9.01	8.79	8.74	8.21	7.95	7.78	7.66
	Ant2	CH 38	5190	9.82	9.53	9.24	9.14	8.81	8.45	8.39	8.21
		CH 46	5230	9.81	9.35	9.02	8.95	8.64	8.26	8.23	8.01
		CH 151	5755	9.42	9.01	8.61	8.58	8.26	7.88	7.79	7.62
		CH 159	5795	9.58	9.15	8.77	8.68	8.41	7.99	7.95	7.79
	Ant	Channel	Frequency (MHz)	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11n 20M MIMO	Ant1	CH 36	5180	9.20	8.56	8.29	8.35	8.01	7.54	7.41	7.39
		CH 40	5200	9.21	8.44	8.27	8.30	7.94	7.41	7.28	7.17
		CH 44	5220	9.15	8.41	8.21	8.29	7.88	7.31	7.19	7.11
		CH 48	5240	9.10	8.38	8.16	8.27	7.86	7.29	7.15	7.12
		CH 149	5745	8.89	8.69	8.47	8.29	8.05	7.88	8.71	7.61
		CH 153	5765	9.09	8.74	8.41	8.09	7.88	7.64	7.41	7.25
		CH 157	5785	9.21	8.91	8.64	8.25	8.04	7.86	7.69	7.57
		CH 161	5805	9.28	8.99	8.68	8.29	8.14	7.97	7.88	7.81
		CH 165	5825	9.39	9.08	8.91	8.36	8.28	8.11	7.99	7.86
	Ant2	CH 36	5180	9.80	8.25	7.89	8.01	7.64	7.41	7.18	7.27
		CH 40	5200	9.74	8.19	7.91	8.06	7.70	7.38	7.15	7.28
		CH 44	5220	9.71	8.15	7.87	8.01	7.64	7.31	7.06	7.18
		CH 48	5240	9.80	8.26	7.91	8.10	7.81	7.44	7.19	7.41
		CH 149	5745	9.02	8.78	8.56	8.22	7.90	7.65	7.28	7.06
		CH 153	5765	9.06	8.81	8.51	8.15	7.83	7.46	7.13	6.85
		CH 157	5785	9.16	8.78	8.54	8.21	7.89	7.52	7.22	6.88
		CH 161	5805	9.25	8.95	8.69	8.41	8.09	7.78	7.55	7.39
		CH 165	5825	9.27	8.90	8.62	8.30	7.86	7.54	7.31	7.05
	Sum	CH 36	5180	12.52	11.42	11.10	11.19	10.84	10.49	10.31	10.34
		CH 40	5200	12.49	11.33	11.10	11.19	10.83	10.41	10.23	10.24
		CH 44	5220	12.45	11.29	11.05	11.16	10.77	10.32	10.14	10.16
		CH 48	5240	12.47	11.33	11.05	11.20	10.85	10.38	10.18	10.28
		CH 149	5745	11.97	11.75	11.53	11.27	10.99	10.78	11.06	10.35
		CH 153	5765	12.09	11.79	11.47	11.13	10.87	10.56	10.28	10.06
		CH 157	5785	12.20	11.86	11.60	11.24	10.98	10.70	10.47	10.25
		CH 161	5805	12.28	11.98	11.70	11.36	11.13	10.89	10.73	10.62
		CH 165	5825	12.34	12.00	11.78	11.34	11.09	10.84	10.67	10.48

	Ant	Channel	Frequency (MHz)	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11n 40M MIMO	Ant1	CH 38	5190	9.46	8.88	8.50	8.38	7.71	7.67	7.50	7.41
		CH 46	5230	9.30	8.71	8.35	8.25	7.54	7.48	7.39	7.19
		CH 151	5755	9.15	8.89	8.63	8.37	8.11	7.85	7.59	7.33
		CH 159	5795	9.28	9.04	7.77	8.48	8.26	7.99	7.71	7.62
	Ant2	CH 38	5190	9.79	9.01	8.52	8.51	8.22	7.72	7.31	7.17
		CH 46	5230	9.61	8.78	8.34	8.24	8.06	7.55	7.14	7.02
		CH 151	5755	9.14	8.24	7.88	7.75	7.56	7.01	6.69	6.58
		CH 159	5795	9.27	8.39	8.01	7.89	7.66	7.15	6.85	6.72
	Sum	CH 38	5190	12.64	11.96	11.52	11.46	10.98	10.71	10.42	10.30
		CH 46	5230	12.47	11.76	11.36	11.26	10.82	10.53	10.28	10.12
		CH 151	5755	12.16	11.59	11.28	11.08	10.85	10.46	10.17	9.98
		CH 159	5795	12.29	11.74	10.90	11.21	10.98	10.60	10.31	10.20
	Ant	Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11ac 20M	Ant1	CH 36	5180	9.77	9.01	8.86	9.17	8.86	8.34	8.22	8.17
		CH 40	5200	9.58	8.97	8.64	8.75	8.65	8.16	8.05	8.00
		CH 44	5220	9.43	8.82	8.38	8.62	8.41	8.33	7.97	7.84
		CH 48	5240	9.24	8.61	8.12	8.43	8.15	8.03	7.89	7.83
		CH 149	5745	9.31	8.94	8.82	8.74	8.69	8.61	8.57	8.46
		CH 153	5765	9.14	8.77	8.67	8.64	9.51	9.42	9.31	8.27
		CH 157	5785	9.41	8.99	8.81	8.74	8.71	8.64	8.48	8.42
		CH 161	5805	9.67	9.21	9.10	8.96	8.80	8.74	8.61	8.50
		CH 165	5825	9.68	9.25	9.12	8.92	8.82	8.77	8.64	8.53
	Ant2	CH 36	5180	9.78	8.71	8.52	8.82	8.47	8.23	8.11	8.05
		CH 40	5200	9.75	9.69	9.50	8.78	8.51	8.27	8.19	8.15
		CH 44	5220	9.74	9.67	9.52	8.75	8.47	8.29	8.24	8.19
		CH 48	5240	9.61	9.39	9.21	8.85	8.74	8.67	8.59	8.48
		CH 149	5745	9.11	8.95	8.83	8.75	8.61	8.37	8.21	7.93
		CH 153	5765	9.14	8.99	8.86	8.78	8.66	8.29	8.16	7.89
		CH 157	5785	9.11	8.94	8.85	8.77	8.59	8.34	8.17	8.02
		CH 161	5805	9.26	9.08	8.97	8.89	8.71	8.44	8.31	8.19
		CH 165	5825	9.34	9.19	9.04	8.96	8.78	8.53	8.36	8.27
	Ant	Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11ac 40M	Ant1	CH 38	5190	7.91	7.43	6.97	6.74	6.69	6.10	6.03	5.83
		CH 46	5230	7.66	7.15	6.75	6.59	6.38	5.86	5.76	5.71
		CH 151	5755	7.35	6.81	6.44	6.33	6.01	5.83	5.74	5.99
		CH 159	5795	7.73	6.88	6.49	6.39	6.07	5.97	5.83	6.11
	Ant2	CH 38	5190	8.10	7.26	6.91	6.88	6.45	6.09	6.05	6.02
		CH 46	5230	8.02	7.34	6.97	6.91	6.56	6.19	6.14	5.92
		CH 151	5755	7.36	6.79	6.41	6.34	6.01	5.87	5.79	5.75
		CH 159	5795	7.45	6.83	6.46	6.38	6.06	5.92	5.81	6.14

	Ant	Channel	Frequency (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11ac 80M	Ant1	CH 42	5210	7.42	6.29	5.83	5.92	5.38	5.11	4.82	4.08
		CH 155	5775	6.67	6.21	5.71	5.79	5.55	4.37	4.29	4.12
	Ant2	CH 42	5210	7.01	6.27	5.79	5.88	5.33	5.01	4.78	4.07
		CH 155	5775	6.92	6.22	5.73	5.85	5.28	4.97	4.69	4.03
	Ant	Channel	Frequency (MHz)	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11ac 20M MIMO	Ant1	CH 36	5180	9.49	8.82	8.49	8.35	8.12	7.92	7.68	7.51
		CH 40	5200	9.29	8.78	8.23	8.16	8.01	7.85	7.54	7.35
		CH 44	5220	9.21	8.75	8.21	8.14	7.95	7.76	7.51	7.31
		CH 48	5240	9.08	8.52	8.02	7.94	7.83	7.61	7.38	7.24
		CH 149	5745	8.97	8.44	7.91	7.81	7.72	7.51	7.15	7.08
		CH 153	5765	8.89	8.38	7.83	7.72	7.66	7.45	7.03	6.97
		CH 157	5785	9.06	8.55	8.05	7.97	7.88	7.66	7.42	7.26
		CH 161	5805	8.97	8.47	7.95	7.87	7.76	7.57	7.13	7.13
		CH 165	5825	9.24	8.78	8.27	8.15	7.97	7.81	7.75	7.48
	Ant2	CH 36	5180	9.81	9.21	8.92	9.02	8.56	8.44	8.43	8.11
		CH 40	5200	9.55	8.93	8.61	8.81	8.42	8.13	8.09	8.04
		CH 44	5220	9.48	8.89	8.55	8.76	8.36	8.06	8.05	8.04
		CH 48	5240	9.44	8.85	8.62	8.63	8.28	7.98	8.05	8.01
		CH 149	5745	8.98	8.40	8.18	8.15	8.09	8.02	7.92	7.88
		CH 153	5765	8.83	8.36	8.17	8.14	8.11	8.01	7.86	7.75
		CH 157	5785	9.09	8.44	8.23	8.21	8.15	8.09	7.99	7.92
		CH 161	5805	9.04	8.42	8.24	8.18	8.13	8.09	8.01	7.95
		CH 165	5825	9.26	8.61	8.43	8.36	8.33	8.29	8.15	7.91
	Sum	CH 36	5180	12.66	12.03	11.72	11.71	11.36	11.20	11.08	10.83
		CH 40	5200	12.43	11.87	11.43	11.51	11.23	11.00	10.83	10.72
		CH 44	5220	12.36	11.83	11.39	11.47	11.17	10.92	10.80	10.70
		CH 48	5240	12.27	11.70	11.34	11.31	11.07	10.81	10.74	10.65
		CH 149	5745	11.99	11.43	11.06	10.99	10.92	10.78	10.56	10.51
		CH 153	5765	11.87	11.38	11.01	10.95	10.90	10.75	10.48	10.39
		CH 157	5785	12.09	11.51	11.15	11.10	11.03	10.89	10.72	10.61
		CH 161	5805	12.02	11.46	11.11	11.04	10.96	10.85	10.60	10.57
		CH 165	5825	12.26	11.71	11.36	11.27	11.16	11.07	10.96	10.71

	Ant	Channel	Frequency (MHz)	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11ac 40M MIMO	Ant1	CH 38	5190	7.69	7.01	6.72	6.43	5.86	5.75	5.55	5.41
		CH 46	5230	7.28	6.62	6.36	6.14	5.52	5.47	5.15	5.09
		CH 151	5755	7.33	6.71	6.44	6.22	5.61	5.51	5.25	5.01
		CH 159	5795	7.44	7.03	6.56	6.33	5.74	5.70	5.35	5.15
	Ant2	CH 38	5190	7.89	7.42	6.76	6.72	6.21	5.95	5.64	5.59
		CH 46	5230	7.63	7.21	6.71	6.51	6.03	5.74	5.65	5.54
		CH 151	5755	7.29	6.93	6.38	6.26	5.55	5.52	5.45	5.38
		CH 159	5795	7.46	7.07	6.58	6.34	5.76	5.72	5.63	5.46
	Sum	CH 38	5190	10.80	10.23	9.75	9.59	9.05	8.86	8.61	8.51
		CH 46	5230	10.47	9.94	9.55	9.34	8.79	8.62	8.42	8.33
		CH 151	5755	10.32	9.83	9.42	9.25	8.59	8.53	8.36	8.21
		CH 159	5795	10.46	10.06	9.58	9.35	8.76	8.72	8.50	8.32
	Ant	Channel	Frequency (MHz)	MCS8	MCS9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
802.11ac 80M MIMO	Ant1	CH 42	5210	6.45	5.71	5.23	5.28	4.85	4.89	4.81	4.49
		CH 155	5775	6.27	5.52	5.08	5.03	4.53	4.71	4.59	4.45
	Ant2	CH 42	5210	6.73	6.03	5.56	5.57	5.18	5.23	5.03	4.71
		CH 155	5775	6.23	5.51	5.05	4.98	4.86	4.71	4.65	4.62
	Sum	CH 42	5210	9.60	8.88	8.41	8.44	8.03	8.07	7.93	7.61
		CH 155	5775	9.26	8.53	8.08	8.02	7.71	7.72	7.63	7.55

Table 21: Conducted power measurement results of WiFi 5G.

Note:

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

2) Per KDB248227D01v01r02 and October 2012/April 2013 FCC/TCB workshop meeting notes:for WiFi 5GHz, highest average RF output power channel for the lowest data rate of 802.11a mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11n 20MHz and 40MHz) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11a mode. Full SAR evaluations for all 802.11ac configurations were not required since the maximum average output power for 802.11ac is not more than 1/4 dB higher than 802.11a. 802.11ac SAR was evaluated for highest 802.11a configuration in each 5 GHz band and each exposure condition.

7.2 SAR measurement Results

General Notes:

1) The maximum reported SAR of each test band is shown in **bold** letters.

2) Per KDB447498 D01v05r02, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demostrate compliant.

3) Per KDB447498 D01v05r02, 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.

4) Per KDB941225 D06v01r01, 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 KDB 865664 D01v01,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.

6) Per KDB865664 D02v01r01, 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(Refer to appendix B for details).

GSM Notes:

1) Per KDB941225 D03v01, when multiple slots can be used, the GPRS/EDGE slot configuration with the highest frame–averaged output power was selected for SAR testing.

UMTS Notes:

1) Per KDB941225 D01v02, when maximum output of each RF channel with HSDPA/HSUPA active is ≤1/4 dB higher than without HSDPA/HSUPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75% of SAR limit, SAR evaluation for HSDPA/HSUPA is not required.

2) Per KDB941225 D02v02r02, when the maximum average output power of each RF channel with (uplink) HSPA+/DC-HSDPA active is ≤1/4 dB higher than that measured without HSPA+/DC-HSDPA using 12.2 kbps RMC, or the maximum reported SAR for 12.2 kbps RMC without HSPA+/DC-HSDPA/ is ≤ 75% of the SAR limit, SAR evaluation for HSPA+/DC-HSDPA is not required.

LTE notes:

1) The LTE test configurations are determined according to KDB941225 D05 SAR for LTE Devices v02r03.The general test procedures used for SAR testing can be found in Section 6.3.

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:

Per KDB248227D01v01r02 and October 2012/April 2013 FCC/TCB workshop meeting notes:

1) For WiFi 2.4GHz, highest average RF output power channel for the lowest data rate of 802.11b mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11g/n) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11b mode.

2) For WiFi 5GHz, highest average RF output power channel for the lowest data rate of 802.11a mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11n 20MHz and 40MHz) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11a mode.

3) The device supports 802.11ac with the following features:

a) Up to 80MHz Bandwidth only;

b) 2 Tx antenna output;

c) No channel/carrier aggregation configurations;

d) No new 5G channels;

Per April 2013 TCB workshop notes, full SAR evaluations for all 802.11ac configurations were not required since the maximum average output power for 802.11ac is not more than 1/4 dB higher than 802.11a. 802.11ac SAR was evaluated for highest 802.11a configuration in each 5 GHz band and each exposure condition.

7.2.1 SAR measurement Result of GSM850

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Front Side	190/836.6	GPRS 2TS	0.536	0.384	-0.110	30.31	31.00	0.628	21.4°C
Back Side	190/836.6	GPRS 2TS	0.678	0.471	0.080	30.31	31.00	**0.795**	21.4°C
Right Side	190/836.6	GPRS 2TS	0.090	0.054	-0.180	30.31	31.00	0.106	21.4°C
Top Side	190/836.6	GPRS 2TS	0.344	0.242	0.150	30.31	31.00	0.403	21.4°C
Bottom Side	190/836.6	GPRS 2TS	0.359	0.248	-0.020	30.31	31.00	0.421	21.4°C

Table 22: Body SAR test results of GSM850

7.2.2 SAR measurement Result of GSM1900

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Front Side	810/1909.8	GPRS 2TS	0.692	0.404	-0.100	26.99	28.00	0.873	21.4°C
Front Side	661/1880	GPRS 2TS	0.784	0.456	0.110	26.95	28.00	0.998	21.4°C
Front Side	512/1850.2	GPRS 2TS	0.772	0.449	0.160	27.19	28.00	0.930	21.4°C
Back Side	810/1909.8	GPRS 2TS	0.664	0.382	0.020	26.99	28.00	0.838	21.4°C
Back Side	661/1880	GPRS 2TS	0.791	0.453	-0.010	26.95	28.00	**1.007**	21.4°C
Back Side	512/1850.2	GPRS 2TS	0.749	0.430	0.030	27.19	28.00	0.903	21.4°C
Right Side	661/1880	GPRS 2TS	0.394	0.216	-0.140	26.95	28.00	0.502	21.4°C
Top Side	661/1880	GPRS 2TS	0.297	0.178	-0.030	26.95	28.00	0.378	21.4°C
Bottom Side	661/1880	GPRS 2TS	0.310	0.187	-0.040	29.95	28.00	0.198	21.4°C

Table 23: Body SAR test results of GSM1900

7.2.3 SAR measurement Result of UMTS Band V

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Front Side	4233/846.6	RMC	0.778	0.560	0.020	21.88	23.00	1.007	21.4°C
Front Side	4182/836.4	RMC	0.704	0.504	-0.020	22.00	23.00	0.886	21.4°C
Front Side	4132/826.4	RMC	0.659	0.472	0.040	21.92	23.00	0.845	21.4°C
Back Side	4233/846.6	RMC	0.890	0.622	0.080	21.88	23.00	1.152	21.4°C
Back Side-repeated*	4233/846.6	RMC	0.909	0.637	0.070	21.88	23.00	**1.176**	21.4°C
Back Side	4182/836.4	RMC	0.819	0.571	0.080	22.00	23.00	1.031	21.4°C
Back Side	4132/826.4	RMC	0.804	0.553	0.180	21.92	23.00	1.031	21.4°C
Right Side	4182/836.4	RMC	0.080	0.047	0.180	22.00	23.00	0.100	21.4°C
Top Side	4182/836.4	RMC	0.371	0.262	0.070	22.00	23.00	0.467	21.4°C
Bottom Side	4182/836.4	RMC	0.405	0.280	0.040	22.00	23.00	0.510	21.4°C

Table 24: Body SAR test results of UMTS Band V

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664.

7.2.4 SAR measurement Result of UMTS Band II

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Front Side	9400/1880	RMC	0.532	0.312	0.180	22.01	23.00	0.668	21.4°C
Back Side	9400/1880	RMC	0.560	0.320	-0.060	22.01	23.00	**0.703**	21.4°C
Right Side	9400/1880	RMC	0.294	0.161	0.060	22.01	23.00	0.369	21.4°C
Top Side	9400/1880	RMC	0.200	0.120	0.070	22.01	23.00	0.251	21.4°C
Bottom Side	9400/1880	RMC	0.208	0.126	0.170	22.01	23.00	0.261	21.4°C

Table 25: Body SAR test results of UMTS Band II

7.2.5 SAR measurement Result of LTE Band V

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	20525/836.5	10M QPSK 1RB#25	0.791	0.566	-0.050	22.67	23.00	0.853	21.5°C
Front Side	20600/844	10M QPSK 1RB#25	0.695	0.499	-0.060	22.61	23.00	0.760	21.5°C
Front Side	20450/829	10M QPSK 1RB#25	0.572	0.407	-0.090	22.65	23.00	0.620	21.5°C
Back Side	20525/836.5	10M QPSK 1RB#25	0.983	0.680	0.020	22.67	23.00	1.061	21.5°C
Back Side -repeated*	20525/836.5	10M QPSK 1RB#25	1.020	0.703	0.060	22.67	23.00	**1.101**	21.5°C
Back Side	20600/844	10M QPSK 1RB#25	0.884	0.614	0.060	22.61	23.00	0.967	21.5°C
Back Side	20450/829	10M QPSK 1RB#25	0.763	0.525	0.000	22.65	23.00	0.827	21.5°C
Right Side	20525/836.5	10M QPSK 1RB#25	0.089	0.055	0.190	22.67	23.00	0.096	21.5°C
Top Side	20525/836.5	10M QPSK 1RB#25	0.420	0.295	-0.020	22.67	23.00	0.453	21.5°C
Bottom Side	20525/836.5	10M QPSK 1RB#25	0.523	0.358	0.060	22.67	23.00	0.564	21.5°C
50%RB									
Front Side	20525/836.5	10M QPSK 50%RB#13	0.652	0.467	0.070	21.45	22.00	0.740	21.5°C
Back Side	20525/836.5	10M QPSK 50%RB#13	0.848	0.584	-0.130	21.45	22.00	0.962	21.5°C
Back Side	20600/844	10M QPSK 50%RB#13	0.934	0.649	0.190	21.44	22.00	1.063	21.5°C
Back Side	20450/829	10M QPSK 50%RB#13	0.788	0.542	-0.050	21.44	22.00	0.896	21.5°C
Right Side	20525/836.5	10M QPSK 50%RB#13	0.073	0.044	-0.060	21.45	22.00	0.083	21.5°C
Top Side	20525/836.5	10M QPSK 50%RB#13	0.335	0.235	-0.090	21.45	22.00	0.380	21.5°C
Bottom Side	20525/836.5	10M QPSK 50%RB#13	0.385	0.265	0.020	21.45	22.00	0.437	21.5°C
100%RB									
Front Side	20450/829	10M QPSK 100%RB#0	0.482	0.340	0.000	21.21	22.00	0.578	21.5°C
Back Side	20450/829	10M QPSK 100%RB#0	0.605	0.417	0.070	21.21	22.00	0.726	21.5°C

Table 26: Body SAR test results of LTE Band V

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664.

7.2.6 SAR measurement Result of LTE Band VII

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	21100/2535	20M QPSK 1RB#0	0.197	0.102	0.120	22.09	22.50	0.217	21.4°C
Back Side	21100/2535	20M QPSK 1RB#0	0.326	0.160	0.190	22.09	22.50	0.358	21.4°C
Right Side	21100/2535	20M QPSK 1RB#0	0.823	0.383	0.150	22.09	22.50	0.904	21.4°C
Right Side	20850/2510	20M QPSK 1RB#99	0.795	0.371	-0.170	22.02	22.50	0.888	21.4°C
Right Side	21350/2560	20M QPSK 1RB#0	0.958	0.444	0.140	21.87	22.50	1.108	21.4°C
Right Side -repeated*	21350/2560	20M QPSK 1RB#0	0.998	0.459	0.160	21.87	22.50	**1.154**	21.4°C
Top Side	21100/2535	20M QPSK 1RB#0	0.008	0.003	0.120	22.09	22.50	0.009	21.4°C
Bottom Side	21100/2535	20M QPSK 1RB#0	0.086	0.045	-0.040	22.09	22.50	0.095	21.4°C
50%RB									
Front Side	21100/2535	20M QPSK 50%RB#0	0.177	0.092	-0.140	20.82	21.50	0.207	21.4°C
Back Side	21100/2535	20M QPSK 50%RB#0	0.301	0.148	-0.080	20.82	21.50	0.352	21.4°C
Right Side	21100/2535	20M QPSK 50%RB#0	0.684	0.317	0.180	20.82	21.50	0.800	21.4°C
Right Side	20850/2510	20M QPSK 50%RB#50	0.578	0.269	0.130	20.78	21.50	0.682	21.4°C
Right Side	21350/2560	20M QPSK 50%RB#0	0.790	0.365	0.110	20.76	21.50	0.937	21.4°C
Top Side	21100/2535	20M QPSK 50%RB#0	0.009	0.003	0.000	20.82	21.50	0.011	21.4°C
Bottom Side	21100/2535	20M QPSK 50%RB#0	0.080	0.041	0.050	20.82	21.50	0.094	21.4°C
100%RB									
Right Side	20850/2510	20M QPSK 100%RB#0	0.624	0.289	0.140	20.83	21.50	0.728	21.4°C

Table 27: Body SAR test results of LTE Band VII

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664.

7.2.7 SAR measurement Result of WiFi 2.4G

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Ant1									
Front Side	5/2432	802.11 b	0.115	0.059	-0.130	13.27	14.50	**0.153**	21.3°C
Back Side	5/2432	802.11 b	0.024	0.013	-0.160	13.27	14.50	0.032	21.3°C
Left Side	5/2432	802.11 b	0.014	0.007	0.040	13.27	14.50	0.018	21.3°C
Bottom Side	5/2432	802.11 b	0.084	0.045	0.030	13.27	14.50	0.111	21.3°C
Ant2									
Front Side	9/2452	802.11 b	0.088	0.042	-0.110	14.07	14.50	0.097	21.3°C
Back Side	9/2452	802.11 b	0.028	0.014	0.190	14.07	14.50	0.031	21.3°C
Top Side	9/2452	802.11 b	0.004	0.001	0.100	14.07	14.50	0.004	21.3°C
20M MIMO									
Front Side	9/2452	802.11 n	0.054	0.026	0.100	14.61	15.50	0.067	21.3°C
Back Side	9/2452	802.11 n	0.021	0.010	0.060	14.61	15.50	0.026	21.3°C
Left Side	9/2452	802.11 n	0.009	0.003	0.030	14.61	15.50	0.011	21.3°C
Top Side	9/2452	802.11 n	0.018	0.009	-0.130	14.61	15.50	0.022	21.3°C
Bottom Side	9/2452	802.11 n	0.038	0.018	0.170	14.61	15.50	0.047	21.3°C
40M MIMO									
Front Side	5/2432	802.11 n	0.067	0.034	0.080	14.86	15.50	0.077	21.3°C
Back Side	5/2432	802.11 n	0.026	0.013	0.080	14.86	15.50	0.030	21.3°C
Left Side	5/2432	802.11 n	0.009	0.004	0.090	14.86	15.50	0.010	21.3°C
Top Side	5/2432	802.11 n	0.046	0.024	0.120	14.86	15.50	0.053	21.3°C
Bottom Side	5/2432	802.11 n	0.038	0.018	-0.040	14.86	15.50	0.044	21.3°C

Table 28: Body SAR test results of WiFi 2450MHz

7.2.1 SAR measurement Result of WiFi 5G

Test Position of Body with 10mm	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data of 5.2GHz band									
Ant1									
Front Side	36/5180	802.11 a	0.109	0.030	0.000	9.74	10.00	0.116	21.6°C
Back Side	36/5180	802.11 a	0.002	<0.001	0.000	9.74	10.00	0.002	21.6°C
Top Side	36/5180	802.11 a	0.063	0.020	0.120	9.74	10.00	0.067	21.6°C
Front Side	36/5180	802.11ac	0.112	0.031	0.000	9.77	10.00	0.118	21.6°C
Ant2									
Front Side	36/5180	802.11 a	0.154	0.043	0.000	9.82	10.00	0.161	21.6°C
Back Side	36/5180	802.11 a	0.016	0.004	0.000	9.82	10.00	0.017	21.6°C
Left Side	36/5180	802.11 a	<0.001	<0.001	0.000	9.82	10.00	<0.001	21.6°C
Bottom Side	36/5180	802.11 a	0.078	0.026	0.070	9.82	10.00	0.081	21.6°C
Front Side	36/5180	802.11ac	0.154	0.043	0.000	9.78	10.00	0.162	21.6°C
20M MIMO									
Front Side	36/5180	802.11 n	0.158	0.043	0.000	12.52	13.00	0.176	21.6°C
Back Side	36/5180	802.11 n	<0.001	<0.001	0.000	12.52	13.00	<0.001	21.6°C
Left Side	36/5180	802.11 n	<0.001	<0.001	0.000	12.52	13.00	<0.001	21.6°C
Top Side	36/5180	802.11 n	0.064	0.020	0.060	12.52	13.00	0.071	21.6°C
Bottom Side	36/5180	802.11 n	0.070	0.023	-0.010	12.52	13.00	0.078	21.6°C
Front Side	36/5180	802.11ac	0.146	0.041	0.000	12.66	13.00	0.158	21.6°C
Back Side	36/5180	802.11ac	<0.001	<0.001	0.000	12.66	13.00	<0.001	21.6°C
Left Side	36/5180	802.11ac	<0.001	<0.001	0.000	12.66	13.00	<0.001	21.6°C
Top Side	36/5180	802.11ac	0.064	0.020	0.060	12.66	13.00	0.069	21.6°C
Bottom Side	36/5180	802.11ac	0.078	0.026	0.070	12.66	13.00	0.084	21.6°C
40M MIMO									
Front Side	38/5190	802.11 n	0.159	0.043	0.000	12.64	13.50	0.194	21.6°C
Back Side	38/5190	802.11 n	<0.001	<0.001	0.000	12.64	13.50	<0.001	21.6°C
Left Side	38/5190	802.11 n	<0.001	<0.001	0.000	12.64	13.50	<0.001	21.6°C
Top Side	38/5190	802.11 n	0.079	0.025	-0.150	12.64	13.50	0.096	21.6°C
Bottom Side	38/5190	802.11 n	0.081	0.025	0.040	12.64	13.50	0.098	21.6°C
Front Side	38/5190	802.11ac	0.091	0.025	0.000	10.80	12.00	0.120	21.6°C
Back Side	38/5190	802.11ac	<0.001	<0.001	0.000	10.80	12.00	<0.001	21.6°C
Left Side	38/5190	802.11ac	<0.001	<0.001	0.000	10.80	12.00	<0.001	21.6°C
Top Side	38/5190	802.11ac	0.064	0.020	0.120	10.80	12.00	0.084	21.6°C
Bottom Side	38/5190	802.11ac	0.016	0.004	0.000	10.80	12.00	0.021	21.6°C
80M MIMO									
Front Side	42/5210	802.11ac	0.074	0.022	-0.010	9.60	11.00	0.103	21.6°C

Back Side	42/5210	802.11ac	<0.001	<0.001	0.060	9.60	11.00	<0.001	21.6°C
Left Side	42/5210	802.11ac	<0.001	<0.001	0.080	9.60	11.00	<0.001	21.6°C
Top Side	42/5210	802.11ac	0.074	0.026	-0.130	9.60	11.00	0.101	21.6°C
Bottom Side	42/5210	802.11ac	<0.001	<0.001	0.160	9.60	11.00	<0.001	21.6°C
Test data of 5.8GHz band									
Ant1									
Front Side	161/5805	802.11 a	0.150	0.042	0.000	9.76	10.00	0.159	21.6°C
Back Side	161/5805	802.11 a	<0.001	<0.001	0.000	9.76	10.00	<0.001	21.6°C
Top Side	161/5805	802.11 a	0.089	0.027	-0.170	9.76	10.00	0.094	21.6°C
Front Side	165/5825	802.11ac	0.130	0.036	0.000	9.68	10.00	0.140	21.6°C
Ant2									
Front Side	165/5825	802.11 a	0.219	0.063	0.000	9.49	10.00	0.246	21.6°C
Back Side	165/5825	802.11 a	<0.001	<0.001	0.000	9.49	10.00	<0.001	21.6°C
Left Side	165/5825	802.11 a	<0.001	<0.001	0.000	9.49	10.00	<0.001	21.6°C
Bottom Side	165/5825	802.11 a	0.104	0.035	-0.160	9.49	10.00	0.117	21.6°C
Front Side	165/5825	802.11ac	0.198	0.057	0.000	9.34	10.00	0.230	21.6°C
20M MIMO									
Front Side	165/5825	802.11 n	0.207	0.058	0.000	12.34	13.00	0.241	21.6°C
Back Side	165/5825	802.11 n	0.022	0.007	0.000	12.34	13.00	0.025	21.6°C
Left Side	165/5825	802.11 n	0.017	0.003	0.190	12.34	13.00	0.020	21.6°C
Top Side	165/5825	802.11 n	0.080	0.025	-0.150	12.34	13.00	0.093	21.6°C
Bottom Side	165/5825	802.11 n	0.094	0.031	0.030	12.34	13.00	0.109	21.6°C
Front Side	165/5825	802.11ac	0.214	0.064	-0.060	12.26	13.00	0.254	21.6°C
Back Side	165/5825	802.11ac	0.020	0.005	0.000	12.26	13.00	0.024	21.6°C
Left Side	165/5825	802.11ac	0.017	0.003	0.090	12.26	13.00	0.021	21.6°C
Top Side	165/5825	802.11ac	0.090	0.028	-0.170	12.26	13.00	0.107	21.6°C
Bottom Side	165/5825	802.11ac	0.104	0.035	-0.160	12.26	13.00	0.123	21.6°C
40M MIMO									
Front Side	159/5795	802.11 n	0.227	0.064	0.000	12.29	13.50	**0.300**	21.6°C
Back Side	159/5795	802.11 n	0.022	0.007	0.000	12.29	13.50	0.029	21.6°C
Left Side	159/5795	802.11 n	0.012	0.002	0.180	12.29	13.50	0.015	21.6°C
Top Side	159/5795	802.11 n	0.089	0.028	0.190	12.29	13.50	0.117	21.6°C
Bottom Side	159/5795	802.11 n	0.113	0.038	-0.160	12.29	13.50	0.149	21.6°C
Front Side	159/5795	802.11ac	0.180	0.056	0.180	10.46	12.00	0.257	21.6°C
Back Side	159/5795	802.11ac	<0.001	<0.001	-0.090	10.46	12.00	<0.001	21.6°C
Left Side	159/5795	802.11ac	<0.001	<0.001	0.000	10.46	12.00	<0.001	21.6°C
Top Side	159/5795	802.11ac	0.051	0.018	0.030	10.46	12.00	0.073	21.6°C
Bottom Side	159/5795	802.11ac	0.058	0.021	0.150	10.46	12.00	0.082	21.6°C
80M MIMO									
Front Side	155/5775	802.11ac	0.144	0.045	-0.110	9.26	11.00	0.215	21.6°C

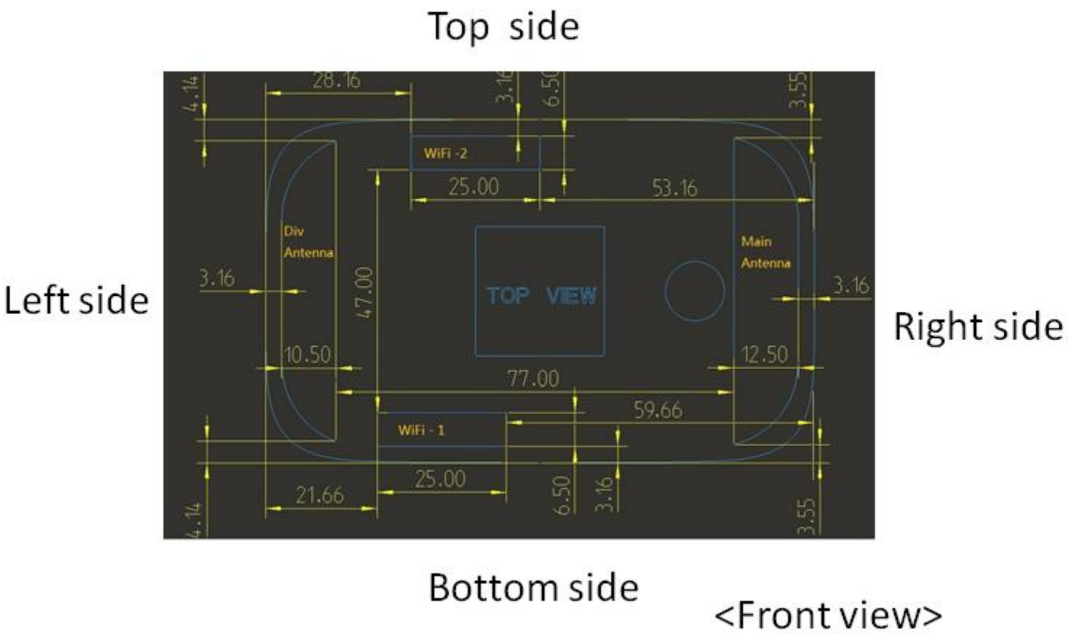
Back Side	155/5775	802.11ac	<0.001	<0.001	-0.090	9.26	11.00	<0.001	21.6°C
Left Side	155/5775	802.11ac	<0.001	<0.001	0.000	9.26	11.00	<0.001	21.6°C
Top Side	155/5775	802.11ac	0.050	0.018	0.070	9.26	11.00	0.075	21.6°C
Bottom Side	155/5775	802.11ac	0.057	0.021	-0.040	9.26	11.00	0.085	21.6°C

Table 29: Body SAR test results of WiFi 5G

7.3 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 v05r02.

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



Note:

1) Diversity antenna is used to improve the acceptance of performance of the main antenna. It does not have the transmitter function.

Band	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
2G/3G/4G	Yes	Yes	NO	Yes	Yes	Yes
WiFi Ant1	Yes	Yes	Yes	NO	NO	Yes
WiFi Ant2	Yes	Yes	NO	NO	Yes	NO
WiFi MIMO	Yes	Yes	Yes	NO	Yes	Yes

Table 30: Sides for SAR testing

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.

7.3.1 Simultaneous Transmission Possibilities

Per FCC KDB 447498D01v05 r02, SAR compliance for simultaneous transmission must be considered when the maximum duration of overlapping transmissions.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/EGPRS/UMTS/LTE + 2.4G WiFi SISO	Yes
2	GPRS/EGPRS/UMTS/LTE + 2.4G WiFi MIMO	Yes
3	GPRS/EGPRS/UMTS/LTE + 5G WiFi SISO	Yes
4	GPRS/EGPRS/UMTS/LTE + 5G WiFi MIMO	Yes

Table 31: Simultaneous Transmission Possibilities

7.3.2 SAR Summation Scenario

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	GSM850	0.628	0.795	/	0.106	0.403	0.421
	GSM1900	0.998	1.007	/	0.502	0.378	0.198
	UMTS Band V	1.007	1.176	/	0.100	0.467	0.510
	UMTS Band II	0.668	0.703	/	0.369	0.251	0.261
	LTE Band V	0.853	1.101	/	0.096	0.453	0.564
	LTE Band VII	0.217	0.358	/	1.154	0.011	0.095
	2.4G WiFi SISO	0.153	0.032	0.018	/	0.004	0.111
Σ1-g SAR(W/kg)		1.160	**1.208**	0.018	1.154	0.471	0.675

Table 32: Simultaneous Tx Combination of GSM/UMTS/LTE and 2.4G WiFi SISO.

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	GSM850	0.628	0.795	/	0.106	0.403	0.421
	GSM1900	0.998	1.007	/	0.502	0.378	0.198
	UMTS Band V	1.007	1.176	/	0.100	0.467	0.510
	UMTS Band II	0.668	0.703	/	0.369	0.251	0.261
	LTE Band V	0.853	1.101	/	0.096	0.453	0.564
	LTE Band VII	0.217	0.358	/	1.154	0.011	0.095
	2.4G WiFi MIMO	0.077	0.030	0.011	/	0.053	0.047
Σ1-g SAR(W/kg)		1.084	**1.206**	0.011	1.154	0.520	0.611

Table 33: Simultaneous Tx Combination of GSM/UMTS/LTE and 2.4G WiFi MIMO.

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	GSM850	0.628	0.795	/	0.106	0.403	0.421
	GSM1900	0.998	1.007	/	0.502	0.378	0.198
	UMTS Band V	1.007	1.176	/	0.100	0.467	0.510
	UMTS Band II	0.668	0.703	/	0.369	0.251	0.261
	LTE Band V	0.853	1.101	/	0.096	0.453	0.564
	LTE Band VII	0.217	0.358	/	1.154	0.011	0.095
	5G WiFi SISO	0.246	0.017	<0.001	/	0.094	0.117
Σ1-g SAR(W/kg)		**1.253**	1.193	<0.001	1.154	0.561	0.671

Table 34: Simultaneous Tx Combination of GSM/UMTS/LTE and 5G WiFi SISO.

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	GSM850	0.628	0.795	/	0.106	0.403	0.421
	GSM1900	0.998	1.007	/	0.502	0.378	0.198
	UMTS Band V	1.007	1.176	/	0.100	0.467	0.510
	UMTS Band II	0.668	0.703	/	0.369	0.251	0.261
	LTE Band V	0.853	1.101	/	0.096	0.453	0.564
	LTE Band VII	0.217	0.358	/	1.154	0.011	0.095
	5G WiFi MIMO	0.300	0.029	0.021	/	0.117	0.149
Σ1-g SAR(W/kg)		**1.307**	1.205	0.021	1.154	0.584	0.713

Table 35: Simultaneous Tx Combination of GSM/UMTS/LTE and 5G WiFi MIMO.

7.3.3 Simultaneous Transmission Conlcusion

The above numeral summed SAR results and/or SPLSR analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scans is not required per KDB 447498 D01v05r02.

Appendix A. System Check Plots

(Pls See Appendix A.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B.)

Appendix C. Calibration Certificate

(Pls See Appendix C.)

Appendix D. Photo documentation

(Pls See Appendix D.)

End