



中国认可
国际互认
检测
TESTING
CNAS L0310



FCC SAR Compliance Test Report

Product Name: HUAWEI MediaPad M3

Model: BTV-DL09

Report No.: SYBH(Z-SAR)023072016-2

FCC ID: QISBTV-DL09

	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	<i>Wei Huanbin</i>	<i>Deng Zhao</i>
DATE	2016-08-19	2016-08-19

Reliability Laboratory of Huawei Technologies Co., Ltd.

(Global Compliance and Testing Center of Huawei Technologies Co., Ltd)

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District,
Shenzhen, 518129, P.R.C

Tel: +86 755 28780808 Fax: +86 755 89652518

※ ※ **Notice** ※ ※

1. The laboratory has passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01 & 2174.02 & 2174.03
3. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named “Global Compliance and Testing Center of Huawei Technologies Co., Ltd”, the both names have coexisted since 2009.
4. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
5. The test report is invalid if there is any evidence of erasure and/or falsification.
6. The test report is only valid for the test samples.
7. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

Table of Contents

1	General Information.....	6
1.1	Statement of Compliance	6
1.2	RF exposure limits	7
1.3	EUT Description	8
1.3.1	General Description	10
1.4	Test specification(s)	11
1.5	Testing laboratory	11
1.6	Applicant and Manufacturer	11
1.7	Application details	11
1.8	Ambient Condition.....	11
2	SAR Measurement System	12
2.1	SAR Measurement Set-up.....	12
2.2	Test environment	13
2.3	Data Acquisition Electronics description.....	13
2.4	Probe description	14
2.5	Phantom description	15
2.6	Device holder description	16
2.7	Test Equipment List	17
3	SAR Measurement Procedure	18
3.1	Scanning procedure.....	18
3.2	Spatial Peak SAR Evaluation	19
3.3	Data Storage and Evaluation.....	20
4	System Verification Procedure	22
4.1	Tissue Verification.....	22
4.2	System Check.....	24
4.3	System check Procedure	25
5	SAR measurement variability and uncertainty	26
5.1	SAR measurement variability	26
5.2	SAR measurement uncertainty.....	26
6	SAR Test Configuration.....	27
6.1	Test Positions Configuration	27
6.2	3G SAR Test Reduction Procedure	27
6.3	GSM Test Configuration	28
6.4	UMTS Test Configuration	28
6.5	LTE Test Configuration	34
6.6	WiFi Test Configuration	37
6.6.1	Initial Test Position Procedure	37
6.6.2	Initial Test Configuration Procedure	37
6.6.3	Sub Test Configuration Procedure	37
6.6.4	WiFi 2.4G SAR Test Procedures	38
6.6.5	WiFi 5G SAR Test Procedures	38
7	SAR Measurement Results	41
7.1	Conducted power measurements.....	41
7.1.1	Conducted power measurements of GSM850	42
7.1.2	Conducted power measurements of GSM1900	43
7.1.1	Conducted power measurements of UMTS Band II	44
7.1.2	Conducted power measurements of UMTS Band V.....	45
7.1.1	Conducted power measurements of LTE Band V	46
7.1.2	Conducted power measurements of LTE Band VII	48
7.1.3	Conducted power measurements of LTE Band XXXVIII	50
7.1.1	Conducted power measurements of LTE Band XLI	52
7.1.2	Conducted power measurements of WiFi 2.4G.....	54
7.1.1	Conducted power measurements of WiFi 5G.....	55
7.1.2	Conducted power measurements of BT	58
7.2	SAR measurement Results	59
7.2.1	SAR measurement Result of GSM850.....	61
7.2.2	SAR measurement Result of GSM1900.....	62

7.2.3	SAR measurement Result of UMTS Band II	63
7.2.4	SAR measurement Result of UMTS Band V	64
7.2.5	SAR measurement Result of LTE Band V.....	65
7.2.6	SAR measurement Result of LTE Band VII.....	66
7.2.7	SAR measurement Result of LTE Band XXXVIII	67
7.2.8	SAR measurement Result of LTE Band XLI.....	68
7.2.1	SAR measurement Result of WiFi 2.4G	69
7.2.2	SAR measurement Result of WiFi 5G	70
7.3	Multiple Transmitter Evaluation	71
7.3.1	Standalone SAR exclusion calculation	72
7.3.1	Simultaneous Transmission Possibilities.....	74
7.3.1	SAR Summation Scenario	74
7.3.2	SPLSR Evaluation Analysis	76
7.3.3	Simultaneous Transmission Conclusion.....	92
	Appendix A. System Check Plots.....	93
	Appendix B. SAR Measurement Plots.....	93
	Appendix C. Calibration Certificate	93
	Appendix D. Photo documentation.....	93

※ ※ **Modified History** ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2016-08-19	Deng Zhao

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for BTV-DL09 is as below Table 1.

Band	Max Reported 1-g SAR (W/kg)
	Body(0mm)
GSM850	1.11
GSM1900	0.80
UMTS Band II	0.73
UMTS Band V	0.80
LTE Band V	1.19
LTE Band VII	0.72
LTE Band XXXVIII	0.76
LTE Band XLI	0.78
WiFi 2.4G	1.44
WiFi 5G	1.19
BT	/
The highest body SAR and simultaneous SAR value is 1.44W/kg and 1.56W/kg.	

Table 1:Summary of test result

Note: BT SAR test is not required per KDB447498D01.

The device is in compliance with Specific Absorption Rate(SAR)for general population/uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI/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 1528-2013

1.2 RF exposure limits

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

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:	HUAWEI MediaPad M3		
Model:	BTV-DL09		
FCC ID :	QISBTV-DL09		
SN No.:	1#:861695030004308 2#:861695030003920 3#:861695030004274 4#:861695030004795		
Device Type :	Portable device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment / general population		
Hardware Version :	SH1BTVDL09M		
Software Version :	BTV-DL09C001B102		
Antenna Type :	Internal antenna		
Device Operating Configurations:			
Supporting Mode(s)	GSM850/1900, UMTS Band II/V, LTE Band V/VII/XXXVIII/XLI, WiFi 2.4G/5G, BT		
Test Modulation	GSM(GMSK/8PSK),UMTS(QPSK), LTE(QPSK/16QAM), WiFi(DSSS/OFDM),BT(GFSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM850	824MHz-849MHz	869MHz-894MHz
	GSM1900	1850MHz-1910MHz	1930MHz-1990MHz
	UMTS Band II	1850MHz-1910MHz	1930MHz-1990MHz
	UMTS Band V	824MHz-849MHz	869MHz-894MHz
	LTE Band V	824MHz-849MHz	869MHz-894MHz
	LTE Band VII	2500MHz-2570MHz	2620MHz-2690MHz
	LTE Band XXXVIII	2570MHz-2620MHz	2570MHz-2620MHz
	LTE Band XLI	2555MHz-2655 MHz	2555MHZ-2655MHZ
	WiFi 5G	5150-5250 5250-5350 5470-5725 5725-5850	
	WiFi 2.4G	2412-2462	
BT	2402-2480		
GPRS Multislot Class:	12		
EGPRS Multislot Class:	12		
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 II)		
	3, tested with power control "all 1"(UMTS Band V)		
	3, tested with power control all Max.(LTE Band V)		
	3, tested with power control all Max.(LTE Band VII)		
	3, tested with power control all Max.(LTE Band XXVIII)		
	3, tested with power control all Max.(LTE Band XLI)		

Test Channels (low-mid-high):	128-190-251(GSM850)
	512-661-810(GSM1900)
	9262-9400-9538(UMTS Band II)
	4132-4182-4233(UMTS Band V)
	20407-20525-20643(LTE Band V BW=1.4MHz)
	20415-20525-20635(LTE Band V BW=3MHz)
	20425-20525-20625(LTE Band V BW=5MHz)
	20450-20525-20600(LTE Band V BW=10MHz)
	20755-21100-21425(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)
	37775-38000-38225(LTE Band XXXVIII BW=5MHz)
	37800-38000-38200(LTE Band XXXVIII BW=10MHz)
	37825-38000-38175(LTE Band XXXVIII BW=15MHz)
	37850-38000-38150(LTE Band XXXVIII BW=20MHz)
	40265-40740-41215(LTE Band XLI BW=5MHz)
	40290-40740-41190(LTE Band XLI BW=10MHz)
	40315-40740-41165(LTE Band XLI BW=15MHz)
	40340-40740-41140(LTE Band XLI BW=20MHz)
	802.11b/g/n 20M:1-6-11
	802.11n 40M:3-6-9(WiFi 2.4G)
	802.11a/n/ac 20M: 36-40-44-48-52-56-60-64-100-104-108-112-116-120-124-128-132-136-140-149-153-157-161-165
	802.11 n/ac 40M: 38-46-54-62-102-110-118-126-134-151-159
	802.11ac 80M: 42-58-106-122-138-155(WiFi 5G)
	0-39-78(BT)
	0-19-39(BT 4.1)

Table 3: Device information and operating configuration

1.3.1 General Description

The HUAWEI MediaPad M3 is a 8.4-inch tablet that boasts a proprietary HiSilicon octa-core processor and high-speed LTE, 3G, 2G and Wi-Fi network connectivity.

The HUAWEI MediaPad M3 features a 2560 x 1600 pixel IPS display; 8 MP rear camera and HD video; 8 MP front camera; high-speed Internet connectivity; high definition voice calling; 1080p video hardware decoding; office productivity suite; and GPS.

Battery information:

Name	Manufacture	Serials number	Description
Li-ion	Sunwoda Electronic Co., LTD.	/	Battery Model: HB2899C0ECW Rated capacity: 4980 mAh Nominal Voltage: --- +3.82V Charging Voltage: --- +4.4V
	SCUD (FUJIAN) Electronics Co., Ltd.		
	Harbin Coslight Power Co., Ltd.		

1.4 Test specification(s)

ANSI C95.1:1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
IEEE Std 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 5 of March 2015)
KDB447498 D01	General RF Exposure Guidance v06
KDB616217 D04	SAR for laptop and tablets v01r02
KDB248227 D01	SAR Guidance for IEEE 802 11 Wi-Fi SAR v02r02
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r04
KDB865664 D02	SAR Reporting v01r02
KDB690783 D01	SAR Listings on Grants v01r03
KDB941225 D01	3G SAR Procedures v03r01
KDB941225 D05	SAR for LTE Devices v02r05

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Section G1,Huawei Base Bantian, Longgang District, Shenzhen 518129, P.R. 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 & 2174.02 & 2174.03

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

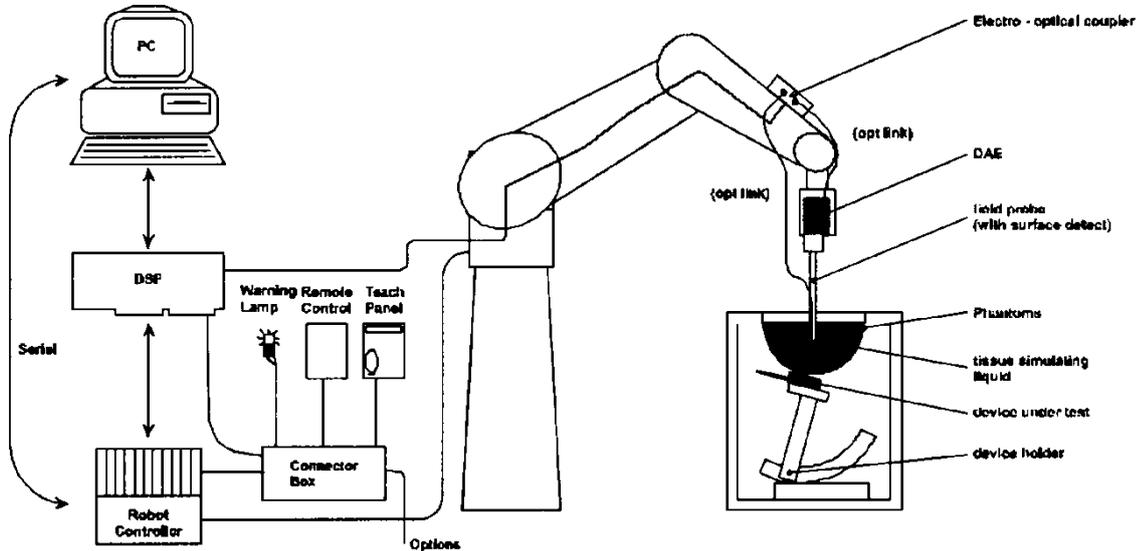
Start Date of test	2016-07-21
End Date of test	2016-08-05

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.

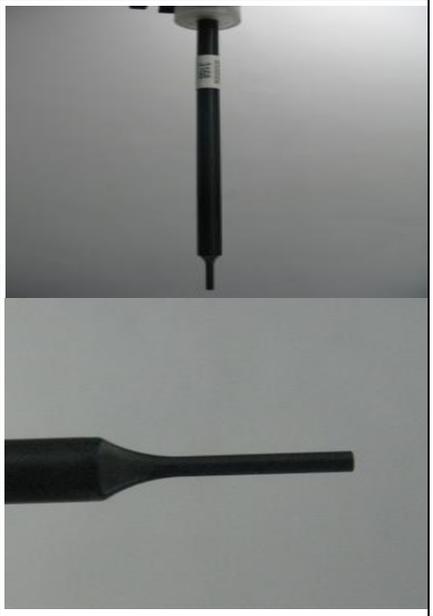
DAE4

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 μ W/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 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%	

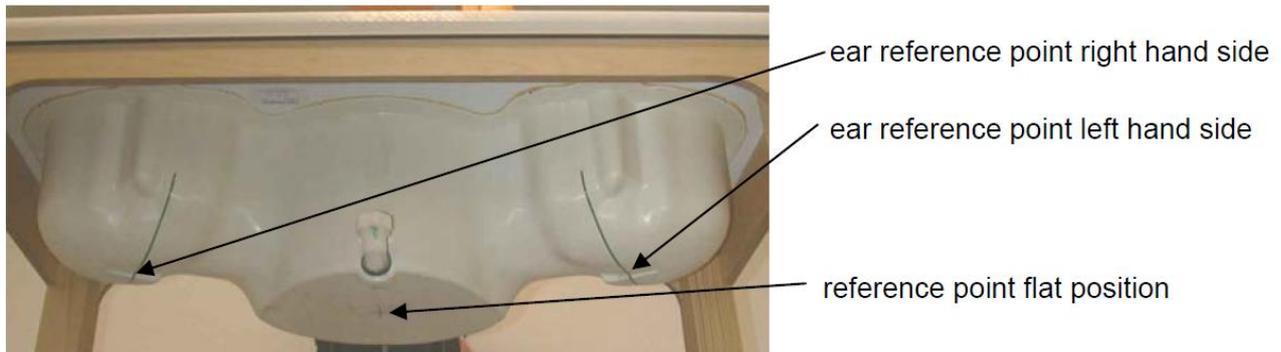
2.5 Phantom description

SAM Twin Phantom

Shell Thickness	2mm±0.2mm;The ear region:6.0±0.2mm	
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±0.2mm	
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 $2 \leq \epsilon_r \leq 5$ at ≤ 3 GHz, $3 \leq \epsilon_r \leq 4$ at > 3 GHz 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 $\epsilon = 3$ and loss tangent $\sigma = 0.02$. 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 $\pm 1^\circ$ 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
<input checked="" type="checkbox"/>	SPEAG	Dosimetric E-Field Probe	EX3DV4	7351	2015-10-30	One year
<input checked="" type="checkbox"/>	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2016-04-26	One year
<input checked="" type="checkbox"/>	SPEAG	835MHz Dipole	D835V2	4d059	2016-04-20	Three years
<input checked="" type="checkbox"/>	SPEAG	1900MHz Dipole	D1900V2	5d091	2015-09-21	Three years
<input checked="" type="checkbox"/>	SPEAG	2450MHz Dipole	D2450V2	860	2015-11-25	Three years
<input checked="" type="checkbox"/>	SPEAG	2600MHz Dipole	D2600V2	1058	2016-06-22	Three years
<input checked="" type="checkbox"/>	SPEAG	5GHz Dipole	D5GHZV2	1155	2016-04-26	Three years
<input checked="" type="checkbox"/>	SPEAG	Data acquisition electronics	DAE4	1236	2015-11-23	One year
<input checked="" type="checkbox"/>	SPEAG	Software	DASY 5	N/A	NCR	NCR
<input type="checkbox"/>	SPEAG	Twin Phantom	SAM1	TP-1475	NCR	NCR
<input type="checkbox"/>	SPEAG	Twin Phantom	SAM2	TP-1474	NCR	NCR
<input type="checkbox"/>	SPEAG	Twin Phantom	SAM3	TP-1597	NCR	NCR
<input type="checkbox"/>	SPEAG	Twin Phantom	SAM4	TP-1620	NCR	NCR
<input type="checkbox"/>	SPEAG	Flat Phantom	ELI 4.0	TP-1038	NCR	NCR
<input checked="" type="checkbox"/>	SPEAG	Flat Phantom	ELI 5.0	TP-1111	NCR	NCR
<input checked="" type="checkbox"/>	R & S	Universal Radio Communication Tester	CMU 200	111379	2015-12-23	One year
<input checked="" type="checkbox"/>	R & S	Universal Radio Communication Tester	CMW 500	126854	2016-01-08	One year
<input checked="" type="checkbox"/>	Agilent	Network Analyser	E5071C	MY46213349	2016-01-08	One year
<input checked="" type="checkbox"/>	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
<input checked="" type="checkbox"/>	Agilent	Signal Generator	N5181A	MY47420989	2015-10-30	One year
<input checked="" type="checkbox"/>	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	NCR	NCR
<input checked="" type="checkbox"/>	MINI-CIRCUITS	Amplifier	ZVE-8G+	N523101139	NCR	NCR
<input checked="" type="checkbox"/>	AR	Directional Coupler	DC7144M1	31190	2016-05-13	One year
<input checked="" type="checkbox"/>	Agilent	Dual Directional Coupler	772D	MY52180173	2016-01-06	One year
<input checked="" type="checkbox"/>	Agilent	Power Meter	E4417A	MY54100027	2016-03-31	One year
<input checked="" type="checkbox"/>	Agilent	Power Meter Sensor	E9321A	MY54130007	2016-03-31	One year
<input checked="" type="checkbox"/>	Agilent	Power Meter	E4417A	MY45101339	2016-01-06	One year
<input checked="" type="checkbox"/>	Agilent	Power Meter Sensor	E9321A	MY44420359	2016-01-06	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) *All the equipments are within the valid period when the tests are performed.

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 $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)
- The “area scan” measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension ($\leq 2\text{GHz}$), 12 mm in x- and y- dimension (2-4 GHz) and 10mm in x- and y- dimension (4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. 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} , $\Delta y_{\text{zoom}} \leq 2\text{GHz} - \leq 8\text{mm}$, 2-4GHz - $\leq 5\text{ mm}$ and 4-6 GHz- $\leq 4\text{mm}$; $\Delta z_{\text{zoom}} \leq 3\text{GHz} - \leq 5\text{ mm}$, 3-4 GHz- $\leq 4\text{mm}$ and 4-6GHz- $\leq 2\text{mm}$ where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in Appendix B. Test results relevant for the specified standard (see chapter 1.4.) are shown in table form in chapter 7.2.
- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2 mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth. 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 ($\Delta x_{area}, \Delta y_{area}$)	Maximun Zoom Scan spatial resolution ($\Delta x_{zoom}, \Delta y_{zoom}$)	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	$\leq 1.5 * \Delta z_{zoom}(n-1)$	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	$\leq 1.5 * \Delta z_{zoom}(n-1)$	≥30mm
3-4GHz	≤12mm	≤5mm	≤4mm	≤3mm	$\leq 1.5 * \Delta z_{zoom}(n-1)$	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	$\leq 1.5 * \Delta z_{zoom}(n-1)$	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	$\leq 1.5 * \Delta z_{zoom}(n-1)$	≥22mm

3.2 Spatial Peak SAR Evaluation

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

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

Extrapolation

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

Interpolation

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

Volume Averaging

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

Advanced Extrapolation

DASY5 uses the advanced extrapolation option which is able to compensates 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 ₁₀ , a ₁₁ , a ₁₂
	- 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:

$$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$

$$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$$

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/cm³

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

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm²
 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 if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

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

Ingredients (% of weight)	Head Tissue						
	750	835	1750	1900	2300	2450	2600
Frequency Band (MHz)	750	835	1750	1900	2300	2450	2600
Water	39.2	41.45	52.64	55.242	62.82	62.7	55.242
Salt (NaCl)	2.7	1.45	0.36	0.306	0.51	0.5	0.306
Sugar	57.0	56.0	0.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	47.0	44.542	36.67	36.8	44.452
Ingredients (% of weight)	Body Tissue						
	750	835	1750	1900	2300	2450	2600
Frequency Band (MHz)	750	835	1750	1900	2300	2450	2600
Water	50.3	52.4	69.91	69.91	73.32	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.06	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.62	26.7	32.252

Table 4: Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M Ω + 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 Head Liquid for 5G(HBBL3500-5800MHz), Manufactured by SPEAG:

Ingredients	(% by weight)
Water	50-65%
Mineral oil	10-30%
Emulsifiers	8-25%
Sodium salt	0-1.5%

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		Deviation (Within +/-5%)		Liquid Temp.	Test Date
		ϵ_r	σ (S/m)	ϵ_r	σ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$		
835MHz Body	825	55.20	0.97	53.84	0.987	-2.46%	1.74%	21.5°C	2016-07-26
	835	55.20	0.97	53.73	0.997	-2.66%	2.79%		
	850	55.20	0.99	53.56	1.013	-2.97%	2.32%		
835MHz Body	825	55.20	0.97	53.49	0.989	-3.10%	1.91%	21.4°C	2016-08-04
	835	55.20	0.97	53.37	0.998	-3.32%	2.91%		
	850	55.20	0.99	53.20	1.014	-3.62%	2.42%		
1900MHz Body	1850	53.30	1.52	52.22	1.526	-2.03%	0.39%	21.6°C	2016-08-04
	1880	53.30	1.52	52.07	1.559	-2.31%	2.57%		
	1900	53.30	1.52	52.11	1.577	-2.23%	3.75%		
	1910	53.30	1.52	52.02	1.584	-2.40%	4.21%		
2450MHz Body	2410	52.80	1.91	51.38	1.914	-2.69%	0.21%	21.7°C	2016-07-29
	2435	52.70	1.94	51.30	1.945	-2.66%	0.26%		
	2450	52.70	1.95	51.26	1.965	-2.73%	0.77%		
	2460	52.70	1.96	51.22	1.977	-2.81%	0.87%		
2600MHz Body	2510	52.62	2.03	51.05	2.092	-2.98%	3.05%	21.4°C	2016-07-29
	2535	52.59	2.07	51.15	2.125	-2.74%	2.66%		
	2560	52.57	2.09	50.95	2.142	-3.08%	2.49%		
	2600	52.50	2.16	50.82	2.221	-3.20%	2.82%		
2600MHz Body	2510	52.62	2.03	51.41	2.104	-2.30%	3.65%	21.5°C	2016-08-04
	2535	52.59	2.07	51.32	2.138	-2.41%	3.29%		
	2560	52.57	2.09	51.24	2.173	-2.53%	3.97%		
	2600	52.50	2.16	51.10	2.229	-2.67%	3.19%		
5GMHz Body	5250	48.90	5.36	50.37	5.422	3.01%	1.16%	21.4°C	2016-07-21
	5600	48.50	5.77	48.34	5.901	-0.33%	2.27%	21.4°C	2016-07-21
	5750	48.30	5.94	46.87	6.010	-2.96%	1.18%	21.4°C	2016-07-21

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).

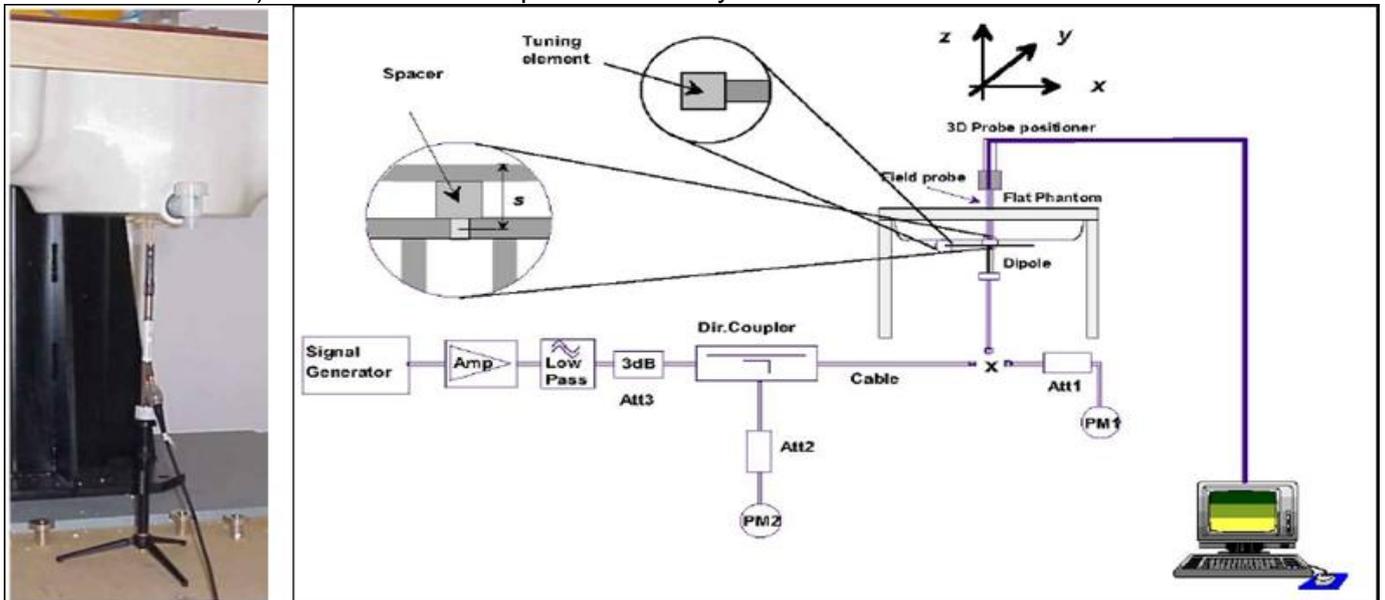
System Check	Target SAR (1W)		Measured SAR (Normalized to 1W)		Deviation (Within +/-10%)		Liquid Temp.	Test Date
	1-g (W/kg)	10-g (W/kg)	1-g (W/kg)	10-g (W/kg)	Δ 1-g	Δ 10-g		
835MHz Body	9.41	6.20	9.72	6.52	3.29%	5.16%	21.5°C	2016-07-26
835MHz Body	9.41	6.20	10.08	6.76	7.12%	9.03%	21.4°C	2016-08-04
1900MHz Body	39.90	21.00	40.00	21.36	0.25%	1.71%	21.6°C	2016-08-04
2450MHz Body	51.90	24.30	53.60	25.48	3.28%	4.86%	21.7°C	2016-07-29
2600MHz Body	53.20	23.80	56.40	25.12	6.02%	5.55%	21.4°C	2016-07-29
2600MHz Body	53.20	23.80	56.80	24.92	6.77%	4.71%	21.4°C	2016-08-04
5250MHz Body	72.20	20.40	72.60	20.40	0.55%	0.00%	21.4°C	2016-07-21
5600MHz Body	76.40	21.50	76.40	21.20	0.00%	-1.40%	21.4°C	2016-07-21
5750MHz Body	73.20	20.60	68.20	18.90	-6.83%	-8.25%	21.4°C	2016-07-21

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 v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 7.2.

5.2 SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

6 SAR Test Configuration

6.1 Test Positions Configuration

The overall diagonal dimension of the tablet is > 20 cm. Per FCC KDB616217D04, the back side and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498D01 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

The device does not have telephone receiver. Next to the ear operation is not supported. Voice mode is limited to speaker mode and headset operations only, so additional Head SAR testing for this type of voice use is not required per KDB616217D04.

6.2 3G SAR Test Reduction Procedure

Per KDB941225 D01v03, in the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

6.3 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 level 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.

6.4 UMTS Test Configuration

1) Output Power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1’s” for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) are required in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

2) WCDMA

Body SAR Measurements

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

3) HSDPA

SAR for body exposure configurations is measured according to the “Body SAR Measurements” procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

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

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ 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 $\Delta ACK, \Delta NACK, \Delta CQI = 8$. The variation of the β_c / β_d ratio causes a power reduction at sub-tests 2 - 4.

Sub-test [Ⓢ]	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: $\Delta ACK, \Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs} / \beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$
 Note 2 : CM=1 for $\beta_c / \beta_d = 12/15, \beta_{hs} / \beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
 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 $\beta_d = 15/15$

Table 7: 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 8: 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 9:HSDPA UE category

4) HSUPA

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

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

Due to inner loop power control requirements in 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 [⌘]	$\beta_{hs}^{(1)}$ [⌘]	β_{ec} [⌘]	β_{ed} [⌘]	β_e [⌘] (SF) [⌘]	β_{ed} [⌘] (code) [⌘]	CM ⁽²⁾ [⌘] (dB) [⌘]	MP R [⌘] (dB) [⌘]	AG ⁽⁴⁾ [⌘] Index [⌘]	E-TFC I [⌘]
1 [⌘]	11/15 ⁽³⁾ [⌘]	15/15 ⁽³⁾ [⌘]	64 [⌘]	11/15 ⁽³⁾ [⌘]	22/15 [⌘]	209/225 [⌘]	1039/225 [⌘]	4 [⌘]	1 [⌘]	1.0 [⌘]	0.0 [⌘]	20 [⌘]	75 [⌘]
2 [⌘]	6/15 [⌘]	15/15 [⌘]	64 [⌘]	6/15 [⌘]	12/15 [⌘]	12/15 [⌘]	94/75 [⌘]	4 [⌘]	1 [⌘]	3.0 [⌘]	2.0 [⌘]	12 [⌘]	67 [⌘]
3 [⌘]	15/15 [⌘]	9/15 [⌘]	64 [⌘]	15/9 [⌘]	30/15 [⌘]	30/15 [⌘]	$\beta_{ed1}:47/15$ [⌘] $\beta_{ed2}:47/15$ [⌘]	4 [⌘]	2 [⌘]	2.0 [⌘]	1.0 [⌘]	15 [⌘]	92 [⌘]
4 [⌘]	2/15 [⌘]	15/15 [⌘]	64 [⌘]	2/15 [⌘]	4/15 [⌘]	2/15 [⌘]	56/75 [⌘]	4 [⌘]	1 [⌘]	3.0 [⌘]	2.0 [⌘]	17 [⌘]	71 [⌘]
5 [⌘]	15/15 ⁽⁴⁾ [⌘]	15/15 ⁽⁴⁾ [⌘]	64 [⌘]	15/15 ⁽⁴⁾ [⌘]	30/15 [⌘]	24/15 [⌘]	134/15 [⌘]	4 [⌘]	1 [⌘]	1.0 [⌘]	0.0 [⌘]	21 [⌘]	81 [⌘]

Note 1: Δ ACK, Δ NACK and Δ CQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$
Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference[⌘]
Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$ [⌘]
Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$ [⌘]
Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g[⌘]
Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.[⌘]

Table 10:Subtests for UMTS Release 6 HSUPA

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	of E-DCH TTI(ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF	11484	5.76
	4	4	2	4	20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF	22996	?
	4	4	10	4	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 11:HSUPA UE category

5) DC-HSDPA

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

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

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

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 12: 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.

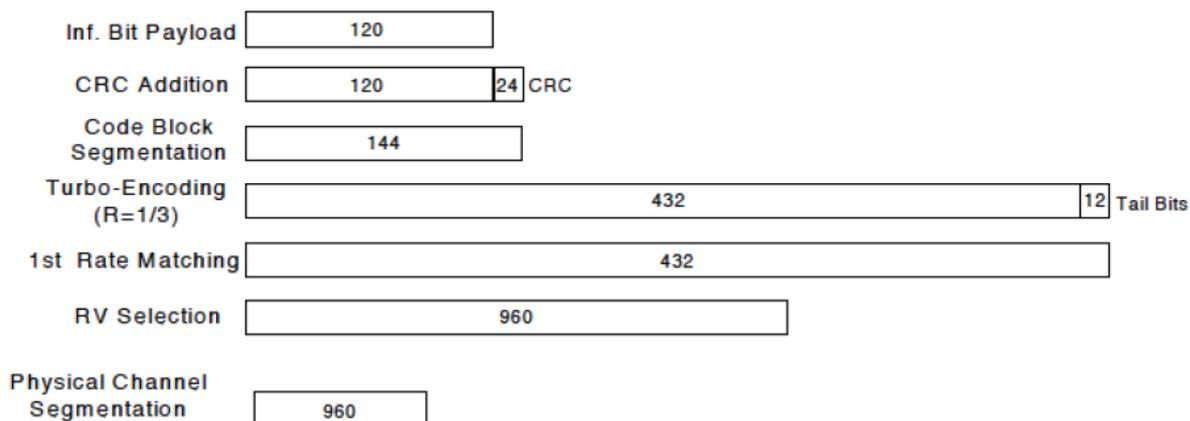


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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 [Ⓛ]	$\beta_{hs}(1)$ [Ⓛ]	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 , $\Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$ [Ⓛ]

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

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.

6.5 LTE Test Configuration

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05. 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 (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

3) A-MPR

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

4) LTE procedures for SAR testing

A) Largest channel bandwidth standalone SAR test requirements

i) QPSK with 1 RB allocation

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

ii) QPSK with 50% RB allocation

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

iii) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in i) and ii) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

iv) Higher order modulations

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

B) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is $> \frac{1}{2}$ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

5) TDD LTE test configuration

According to KDB 941225 D05, for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

TDD LTE supports 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special subframe configurations.

Figure 4.2-1: Frame structure type 2

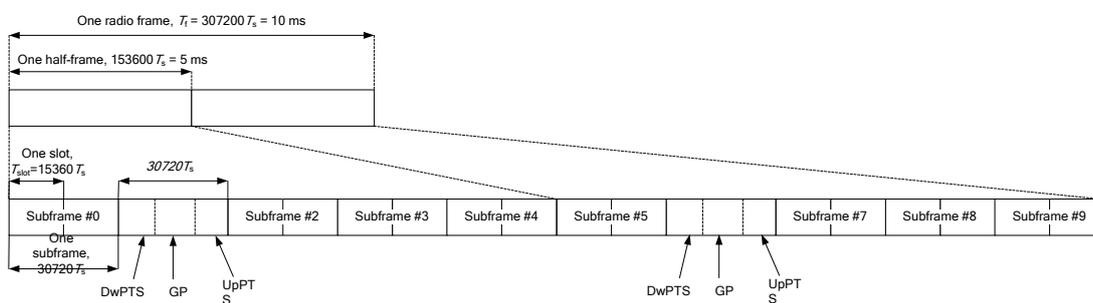


Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

Special subframe configuration	Normal cyclic prefix in downlink				Extended cyclic prefix in downlink			
	DwPTS		UpPTS		DwPTS		UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$		
1	$19760 \cdot T_s$			$20480 \cdot T_s$				
2	$21952 \cdot T_s$			$23040 \cdot T_s$				
3	$24144 \cdot T_s$			$25600 \cdot T_s$				
4	$26336 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$		
5	$6592 \cdot T_s$			$20480 \cdot T_s$				
6	$19760 \cdot T_s$			$23040 \cdot T_s$				
7	$21952 \cdot T_s$			$12800 \cdot T_s$				
8	$24144 \cdot T_s$			-				
9	$13168 \cdot T_s$	-						

Table 4.2-2: Uplink-downlink configurations

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number											
		0	1	2	3	4	5	6	7	8	9		
0	5 ms	D	S	U	U	U	D	S	U	U	U	U	
1	5 ms	D	S	U	U	D	D	S	U	U	D	D	
2	5 ms	D	S	U	D	D	D	S	U	D	D	D	
3	10 ms	D	S	U	U	U	D	D	D	D	D	D	
4	10 ms	D	S	U	U	D	D	D	D	D	D	D	
5	10 ms	D	S	U	D	D	D	D	D	D	D	D	
6	5 ms	D	S	U	U	U	D	S	U	U	D	D	

According to Figure 4.2-1, one radio frame is configured by 10 subframes, which consist of Uplink-subframe, Downlink-subframe and Special subframe. For TDD-LTE, the Duty Cycle should be calculated on Uplink-subframes and Special subframes, due to Special subframe containing both Uplink transmissions. So for one radio frame, Duty Cycle can be calculated with formula as below. The count of Uplink subframes are according to Table 4.2-2:

$$\text{Duty cycle} = (30720T_s \cdot \text{Ups} + \text{Uplink Component} \cdot \text{Specials}) / (307200T_s)$$

About the uplink component of Special subframes, we can figure out by Table 4.2-1:

$$\text{Uplink Component} = \text{UpPTS}$$

In conclusion, for the TDD LTE Band, Duty Cycle can be calculated with formula as below .all these sets are ok when we test, or we can set as below.

$$\text{Duty cycle} = [(30720T_s \cdot \text{Ups}) + \text{UpPTS} \cdot \text{Specials}] / (307200T_s)$$

And we can get different Duty cycles under different configurations:

Uplink-downlink configuration	Subframe number			Configuration of special subframe							
				Normal cyclic prefix in downlink				Extended cyclic prefix in downlink			
	Normal cyclic prefix in uplink		Extended cyclic prefix in uplink		Normal cyclic prefix in uplink		Extended cyclic prefix in uplink				
	D	S	U	configuration 0~4	configuration 5~9	configuration 0~4	configuration 5~9	configuration 0~3	configuration 4~7	configuration 0~3	configuration 4~7
0	2	2	6	61.43%	62.85%	61.67%	63.33%	61.43%	62.85%	61.67%	63.33%
1	4	2	4	41.43%	42.85%	41.67%	43.33%	41.43%	42.85%	41.67%	43.33%
2	6	2	2	21.43%	22.85%	21.67%	23.33%	21.43%	22.85%	21.67%	23.33%
3	6	1	3	30.71%	31.43%	30.83%	31.67%	30.71%	31.43%	30.83%	31.67%
4	7	1	2	20.71%	21.43%	20.83%	21.67%	20.71%	21.43%	20.83%	21.67%
5	8	1	1	10.71%	11.43%	10.83%	11.67%	10.71%	11.43%	10.83%	11.67%
6	3	2	5	51.43%	52.85%	51.67%	53.33%	51.43%	52.85%	51.67%	53.33%

For TDD LTE, SAR should be tested with the highest transmission duty factor (63.33%) using Uplink-downlink configuration 0 and Special subframe configuration 7 for Frame structure type 2.

6.6 WiFi Test Configuration

For WiFi SAR testing, a communication link is set up with the testing software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The test procedures in KDB 248227D01 are applied.

6.6.1 Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is $\leq 0.4\text{W/kg}$, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is $\leq 0.8\text{W/kg}$ or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is $> 0.8\text{ W/kg}$, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is $\leq 1.2\text{ W/kg}$ or all required channels are tested.

6.6.2 Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01). SAR test reduction of subsequent highest output test channels is based on the *reported* SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.

When the *reported* SAR of the initial test configuration is $> 0.8\text{ W/kg}$, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the *reported* SAR is $\leq 1.2\text{ W/kg}$ or all required channels are tested.

6.6.3 Sub Test Configuration Procedure

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.

When the highest reported SAR for the initial test configuration, according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is $\leq 1.2\text{ W/kg}$, SAR is not required for that subsequent test configuration.

6.6.4 WiFi 2.4G SAR Test Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A) 802.11b DSSS SAR Test Requirements

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

- 1) When the *reported* SAR of the highest measured maximum output power channel (section 3.1 of of KDB 248227D01) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the *reported* SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any *reported* SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

B) 2.4GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3 of of KDB 248227D01). SAR is not required for the following 2.4 GHz OFDM conditions.

- 1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

C) SAR Test Requirements for OFDM configurations

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

6.6.5 WiFi 5G SAR Test Procedures

A) U-NII-1 and U-NII-2A Bands

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following:

- 1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR.
- 2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested

configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.

3) The two U-NII bands may be aggregated to support a 160 MHz channel on channel number 50. Without additional testing, the maximum output power for this is limited to the lower of the maximum output power certified for the two bands. When SAR measurement is required for at least one of the bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is > 1.2 W/kg, SAR is required for the 160 MHz channel. This procedure does not apply to an aggregated band with maximum output higher than the standalone band(s); the aggregated band must be tested independently for SAR. SAR is not required when the 160 MHz channel is operating at a reduced maximum power and also qualifies for SAR test exclusion.

B) U-NII-2C and U-NII-3 Bands

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, all channels that operate at 5.60 – 5.65 GHz must be included to apply the SAR test reduction and measurement procedures.

When the same transmitter and antenna(s) are used for U-NII-2C band and U-NII-3 band or 5.8 GHz band of §15.247, the bands may be aggregated to enable additional channels with 20, 40 or 80 MHz bandwidth to span across the band gap, as illustrated in Appendix B. The maximum output power for the additional band gap channels is limited to the lower of those certified for the bands. Unless band gap channels are permanently disabled, they must be considered for SAR testing. The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels. When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

C) OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements

The initial test configuration for 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

- 1) The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
 - 2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
 - 3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
 - 4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.
- After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.
- 1) The channel closest to mid-band frequency is selected for SAR measurement.
 - 2) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

D) SAR Test Requirements for OFDM configurations

When SAR measurement is required for 802.11 a/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

7 SAR Measurement Results

7.1 Conducted power measurements

For the measurements a Rohde & Schwarz Radio Communication Tester CMU 200&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)			
		Tune-up	128CH	190CH	251CH		Tune-up	128CH	190CH	251CH
GSM (CS)		34.00	32.73	32.74	32.79	-9.19	24.81	23.54	23.55	23.60
GPRS/ EDGE (GMSK)	1 Tx Slot	34.00	32.75	32.78	32.76	-9.19	24.81	23.56	23.59	23.57
	2 Tx Slots	31.50	30.53	30.68	30.72	-6.13	25.37	24.40	24.55	24.59
	3 Tx Slots	31.00	29.41	29.40	29.43	-4.42	26.58	24.99	24.98	25.01
	4 Tx Slots	29.50	28.03	28.18	28.13	-3.18	26.32	24.85	25.00	24.95
EDGE (8PSK)	1 Tx Slot	27.50	26.15	26.27	26.33	-9.19	18.31	16.96	17.08	17.14
	2 Tx Slots	25.50	24.10	24.23	24.22	-6.13	19.37	17.97	18.10	18.09
	3 Tx Slots	23.50	21.94	22.17	22.20	-4.42	19.08	17.52	17.75	17.78
	4 Tx Slots	21.50	20.18	20.33	20.28	-3.18	18.32	17.00	17.15	17.10

Table 13: 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 timeslots.
- 3) Per KDB941225 D01v03, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

7.1.2 Conducted power measurements of GSM1900

GSM1900		Burst-Averaged output Power (dBm)				Division Factors	Frame-Averaged output Power (dBm)			
		Tune-up	512CH	661CH	810CH		Tune-up	512CH	661CH	810CH
GSM (CS)		31.00	30.32	30.17	30.05	-9.19	21.81	21.13	20.98	20.86
GPRS/ EDGE (GMSK)	1 Tx Slot	31.00	30.32	30.14	30.04	-9.19	21.81	21.13	20.95	20.85
	2 Tx Slots	29.50	28.06	28.01	28.04	-6.13	23.37	21.93	21.88	21.91
	3 Tx Slots	28.00	26.85	26.94	26.98	-4.42	23.58	22.43	22.52	22.56
	4 Tx Slots	27.00	25.67	25.78	25.77	-3.18	23.82	22.49	22.60	22.59
EDGE (8PSK)	1 Tx Slot	27.00	26.01	26.03	26.08	-9.19	17.81	16.82	16.84	16.89
	2 Tx Slots	25.00	23.75	23.78	23.80	-6.13	18.87	17.62	17.65	17.67
	3 Tx Slots	23.00	21.65	21.77	21.78	-4.42	18.58	17.23	17.35	17.36
	4 Tx Slots	21.00	19.86	19.95	20.03	-3.18	17.82	16.68	16.77	16.85

Table 14: 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 timeslots.
- 3) Per KDB941225 D01v03, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

7.1.1 Conducted power measurements of UMTS Band II

UMTS Band II		Tune-up	Conducted Power (dBm)		
			9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	24.00	22.94	22.89	23.01
	12.2kbps AMR	24.00	22.90	22.88	22.95
HSDPA	Subtest 1	24.00	22.94	22.88	22.99
	Subtest 2	23.80	22.69	22.69	22.77
	Subtest 3	23.30	22.12	22.10	22.22
	Subtest 4	23.30	22.11	22.10	22.20
HSUPA	Subtest 1	23.00	21.90	21.91	22.08
	Subtest 2	21.00	19.86	19.85	19.97
	Subtest 3	22.50	21.52	21.42	21.37
	Subtest 4	21.50	20.54	20.40	20.42
	Subtest 5	23.50	22.23	22.55	22.65
DC-HSDPA	Subtest 1	24.00	22.88	22.91	22.97
	Subtest 2	23.80	22.96	22.66	22.73
	Subtest 3	23.30	22.73	22.13	22.14
	Subtest 4	23.30	22.16	22.08	22.13

Table 15: Conducted power measurement results of UMTS Band II

Note:

- 1) The conducted power of UMTS Band II is measured with RMS detector.
- 2) The bolded 12.2kbps RMC mode was selected for SAR testing(the primary mode).
- 3) Per KDB941225 D01v03, When the maximum output power and tune-up tolerance specified for production units in a Second mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

7.1.2 Conducted power measurements of UMTS Band V

UMTS Band V		Tune-up	Conducted Power (dBm)		
			4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	24.00	22.94	22.95	23.01
	12.2kbps AMR	24.00	22.96	22.93	22.98
HSDPA	Subtest 1	24.00	22.96	22.92	22.96
	Subtest 2	23.80	22.74	22.72	22.77
	Subtest 3	23.00	22.04	22.05	22.08
	Subtest 4	23.00	22.03	22.04	22.07
HSUPA	Subtest 1	23.00	21.77	21.77	21.74
	Subtest 2	21.00	20.02	19.92	19.87
	Subtest 3	22.50	21.23	21.24	21.20
	Subtest 4	21.00	20.35	20.34	20.33
	Subtest 5	23.50	22.34	22.46	22.32
DC-HSDPA	Subtest 1	24.00	22.90	22.90	22.91
	Subtest 2	23.80	22.69	22.77	22.82
	Subtest 3	23.00	22.11	22.13	22.11
	Subtest 4	23.00	22.08	22.09	22.03

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) The bolded 12.2kbps RMC mode was selected for SAR testing(the primary mode).
- 3) Per KDB941225 D01v03, When the maximum output power and tune-up tolerance specified for production units in a Second mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

7.1.1 Conducted power measurements of LTE Band V

LTE Band V					Conducted Power(dBm)		
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20407CH	20525CH	20643CH
1.4MHz	QPSK	1	0	23.50	22.71	22.88	22.88
		1	3	23.50	22.80	22.85	22.90
		1	5	23.50	22.71	22.72	22.72
		3	0	23.50	22.75	22.83	22.87
		3	2	23.50	22.78	22.78	22.87
		3	3	23.50	22.74	22.75	22.76
	16QAM	6	0	22.80	22.30	22.34	22.39
		1	0	23.20	22.17	22.17	22.56
		1	3	23.20	22.26	22.15	22.55
		1	5	23.20	22.17	22.48	22.36
		3	0	23.20	22.33	22.44	22.33
		3	2	23.20	22.32	22.41	22.34
		3	3	23.20	22.33	22.37	22.26
		6	0	22.50	21.84	21.86	21.81
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20415CH	20525CH	20635CH
3MHz	QPSK	1	0	23.50	22.60	22.79	22.90
		1	7	23.50	22.96	22.91	23.00
		1	14	23.50	22.65	22.75	22.60
		8	0	22.80	22.36	22.35	22.36
		8	4	22.80	22.42	22.38	22.41
		8	7	22.80	22.30	22.32	22.32
		15	0	22.80	22.36	22.34	22.37
	16QAM	1	0	23.20	22.06	22.57	22.40
		1	7	23.20	22.49	22.29	22.62
		1	14	23.20	22.14	22.47	22.23
		8	0	22.50	21.78	21.84	21.76
		8	4	22.50	21.91	21.78	21.75
		8	7	22.50	21.79	21.74	21.67
		15	0	22.50	21.75	21.73	21.71

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20425CH	20525CH	20625CH
5MHz	QPSK	1	0	23.50	22.62	22.74	22.74
		1	13	23.50	22.96	22.88	22.93
		1	24	23.50	22.56	22.57	22.42
		12	0	22.80	22.38	22.39	22.38
		12	6	22.80	22.42	22.44	22.42
		12	13	22.80	22.24	22.31	22.26
		25	0	22.80	22.33	22.31	22.29
	16QAM	1	0	23.20	22.14	22.33	22.45
		1	13	23.20	22.44	22.49	22.65
		1	24	23.20	22.09	22.09	22.21
		12	0	22.50	21.84	21.79	21.88
		12	6	22.50	21.89	21.84	21.93
		12	13	22.50	21.70	21.70	21.72
		25	0	22.50	21.72	21.70	21.74
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20450CH	20525CH	20600CH
10MHz	QPSK	1	0	23.50	22.36	22.62	22.40
		1	25	23.50	22.88	22.84	22.97
		1	49	23.50	22.31	22.29	22.37
		25	0	22.80	22.29	22.27	22.23
		25	13	22.80	22.38	22.31	22.30
		25	25	22.80	22.19	22.10	22.13
		50	0	22.80	22.24	22.21	22.20
	16QAM	1	0	23.20	22.12	22.44	21.86
		1	25	23.20	22.65	22.69	22.41
		1	49	23.20	22.02	22.04	21.85
		25	0	22.50	21.69	21.69	21.60
		25	13	22.50	21.79	21.74	21.70
		25	25	22.50	21.60	21.52	21.52
		50	0	22.50	21.64	21.62	21.61

Table 17: Conducted power measurement results of LTE Band V

7.1.2 Conducted power measurements of LTE Band VII

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20775CH	21100CH	21425CH
5MHz	QPSK	1	0	23.00	21.01	21.50	21.69
		1	13	23.00	21.11	21.51	21.76
		1	24	23.00	21.08	21.17	21.36
		12	0	22.50	20.59	21.19	21.33
		12	6	22.50	20.66	21.12	21.33
		12	13	22.50	20.59	20.88	21.13
		25	0	22.50	20.59	21.07	21.27
	16QAM	1	0	23.00	21.16	21.58	21.89
		1	13	23.00	21.23	21.56	21.96
		1	24	23.00	21.01	21.19	21.57
		12	0	22.00	20.13	20.60	20.88
		12	6	22.00	20.18	20.57	20.89
		12	13	22.00	20.13	20.35	20.70
		25	0	22.00	20.08	20.62	20.79
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20800CH	21100CH	21400CH
10MHz	QPSK	1	0	23.00	21.06	21.48	21.72
		1	25	23.00	21.25	21.58	21.79
		1	49	23.00	21.17	21.19	21.44
		25	0	22.50	20.68	21.10	21.35
		25	13	22.50	20.86	21.14	21.34
		25	25	22.50	20.84	20.95	21.23
		50	0	22.50	20.64	21.14	21.32
	16QAM	1	0	23.00	21.13	21.71	21.97
		1	25	23.00	21.39	21.79	22.02
		1	49	23.00	21.35	21.43	21.67
		25	0	22.00	20.21	20.65	20.88
		25	13	22.00	20.39	20.67	20.88
		25	25	22.00	20.37	20.49	20.77
		50	0	22.00	20.21	20.65	20.85

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20825CH	21100CH	21375CH
15MHz	QPSK	1	0	23.00	21.07	21.39	21.62
		1	38	23.00	21.26	21.56	21.84
		1	74	23.00	21.30	21.09	21.32
		36	0	22.50	20.63	21.08	21.34
		36	18	22.50	20.94	21.12	21.37
		36	39	22.50	20.99	20.96	21.22
		75	0	22.50	20.80	21.06	21.30
	16QAM	1	0	23.00	21.01	21.61	21.85
		1	38	23.00	21.53	21.78	22.05
		1	74	23.00	21.59	21.41	21.55
		36	0	22.00	20.20	20.62	20.83
		36	18	22.00	20.46	20.70	20.87
		36	39	22.00	20.56	20.50	20.72
		75	0	22.00	20.37	20.64	20.86
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20850CH	21100CH	21350CH
20MHz	QPSK	1	0	23.00	21.08	21.61	21.69
		1	50	23.00	21.48	21.59	21.98
		1	99	23.00	21.58	21.34	21.50
		50	0	22.50	20.76	21.33	21.27
		50	25	22.50	21.10	21.22	21.30
		50	50	22.50	21.35	20.99	21.32
		100	0	22.50	21.04	21.16	21.30
	16QAM	1	0	23.00	21.38	21.90	22.00
		1	50	23.00	21.82	21.84	22.12
		1	99	23.00	21.97	21.64	21.81
		50	0	22.00	20.28	20.85	20.79
		50	25	22.00	20.64	20.73	20.85
		50	50	22.00	20.84	20.51	20.82
		100	0	22.00	20.54	20.76	20.83

Table 18: Conducted power measurement results of LTE Band VII

7.1.3 Conducted power measurements of LTE Band XXXVIII

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					37775CH	38000CH	38225CH
5MHz	QPSK	1	0	23.50	21.77	22.48	22.38
		1	13	23.50	22.03	22.65	22.52
		1	24	23.50	21.67	22.23	22.13
		12	0	23.40	21.51	22.22	22.11
		12	6	23.40	21.59	22.21	22.09
		12	13	23.40	21.45	22.10	21.90
		25	0	23.40	21.46	22.07	22.06
	16QAM	1	0	23.40	21.62	22.53	22.30
		1	13	23.40	21.86	22.72	22.43
		1	24	23.40	21.52	22.30	22.06
		12	0	22.80	20.90	21.71	21.50
		12	6	22.80	21.00	21.71	21.48
		12	13	22.80	20.87	21.52	21.39
		25	0	22.80	20.94	21.49	21.57
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					37800CH	38000CH	38200CH
10MHz	QPSK	1	0	23.50	21.81	22.36	22.33
		1	25	23.50	22.13	22.69	22.57
		1	49	23.50	22.00	22.30	22.15
		25	0	23.40	21.47	22.12	22.11
		25	13	23.40	21.60	22.14	22.14
		25	25	23.40	21.66	22.08	22.01
		50	0	23.40	21.53	22.18	22.24
	16QAM	1	0	23.40	21.75	22.32	22.26
		1	25	23.40	22.10	22.65	22.53
		1	49	23.40	21.98	22.27	22.11
		25	0	22.80	20.98	21.59	21.54
		25	13	22.80	21.10	21.52	21.57
		25	25	22.80	21.12	21.46	21.54
		50	0	22.80	21.03	21.68	21.75

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					37825CH	38000CH	38175CH
15MHz	QPSK	1	0	23.50	21.59	22.11	22.32
		1	38	23.50	22.23	22.61	22.57
		1	74	23.50	21.95	21.97	22.05
		36	0	23.40	21.44	21.95	21.94
		36	18	23.40	21.81	22.13	22.17
		36	39	23.40	21.69	22.02	22.09
		75	0	23.40	21.57	22.01	22.10
	16QAM	1	0	23.40	21.90	22.40	22.52
		1	38	23.40	22.55	22.86	22.76
		1	74	23.40	22.27	22.23	22.26
		36	0	22.80	20.95	21.52	21.36
		36	18	22.80	21.27	21.62	21.56
		36	39	22.80	21.21	21.50	21.56
		75	0	22.80	21.02	21.46	21.51
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					37850CH	38000CH	38150CH
20MHz	QPSK	1	0	23.50	21.97	22.40	22.48
		1	50	23.50	22.54	22.85	22.68
		1	99	23.50	22.42	22.46	22.29
		50	0	23.40	21.70	22.10	22.22
		50	25	23.40	21.92	22.35	22.09
		50	50	23.40	21.86	22.19	22.34
		100	0	23.40	21.79	22.18	22.28
	16QAM	1	0	23.40	22.13	22.73	22.69
		1	50	23.40	22.74	22.96	22.88
		1	99	23.40	22.66	22.77	22.50
		50	0	22.80	21.18	21.60	21.65
		50	25	22.80	21.43	21.85	21.51
		50	50	22.80	21.31	21.61	21.82
		100	0	22.80	21.26	21.57	21.68

Table 19: Conducted power measurement results of LTE Band XXXVIII

7.1.1 Conducted power measurements of LTE Band XLI

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					40265CH	40740CH	41215CH
5MHz	QPSK	1	0	24.00	22.20	22.77	22.91
		1	13	24.00	22.04	22.63	22.46
		1	24	24.00	22.07	22.61	22.61
		12	0	23.50	22.59	23.35	23.28
		12	6	23.50	22.63	23.33	23.27
		12	13	23.50	22.53	23.22	23.06
		25	0	23.50	22.53	23.27	23.21
	16QAM	1	0	23.30	22.65	23.17	23.21
		1	13	23.30	22.30	23.01	22.76
		1	24	23.30	22.53	22.99	22.92
		12	0	23.00	22.30	22.74	22.72
		12	6	23.00	22.34	22.82	22.71
		12	13	23.00	22.25	22.62	22.51
		25	0	23.00	22.33	22.71	22.71
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					40290CH	40740CH	41190CH
10MHz	QPSK	1	0	24.00	22.08	22.59	22.99
		1	25	24.00	22.09	22.36	22.40
		1	49	24.00	22.20	22.54	22.75
		25	0	23.50	22.58	23.21	23.28
		25	13	23.50	22.63	23.33	23.31
		25	25	23.50	22.63	23.18	23.11
		50	0	23.50	22.45	23.19	23.27
	16QAM	1	0	23.30	22.61	22.98	23.10
		1	25	23.30	22.26	22.76	22.52
		1	49	23.30	22.73	22.93	22.86
		25	0	23.00	22.38	22.62	22.81
		25	13	23.00	22.43	22.74	22.76
		25	25	23.00	22.45	22.59	22.56
		50	0	23.00	22.27	22.60	22.70

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					40315CH	40740CH	41165CH
15MHz	QPSK	1	0	24.00	22.36	22.72	22.68
		1	38	24.00	22.40	22.59	22.81
		1	74	24.00	22.69	22.38	22.61
		36	0	23.50	22.89	23.11	23.16
		36	18	23.50	23.15	23.29	23.22
		36	39	23.50	23.06	23.08	23.13
		75	0	23.50	22.84	23.12	23.09
	16QAM	1	0	23.30	22.56	22.98	22.89
		1	38	23.30	22.59	22.84	23.00
		1	74	23.30	22.89	22.62	22.80
		36	0	23.00	22.37	22.52	22.56
		36	18	23.00	22.64	22.69	22.63
		36	39	23.00	22.55	22.48	22.55
		75	0	23.00	22.25	22.55	22.56
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					40340CH	40740CH	41140CH
20MHz	QPSK	1	0	24.00	22.12	22.72	22.80
		1	50	24.00	22.35	22.86	22.83
		1	99	24.00	22.31	22.68	22.74
		50	0	23.50	22.64	23.18	23.16
		50	25	23.50	22.83	23.27	23.24
		50	50	23.50	22.65	23.12	23.19
		100	0	23.50	22.61	23.16	23.22
	16QAM	1	0	23.30	22.55	23.08	23.15
		1	50	23.30	22.51	22.79	22.81
		1	99	23.30	22.86	22.95	22.98
		50	0	23.00	22.07	22.62	22.60
		50	25	23.00	22.27	22.71	22.68
		50	50	23.00	22.10	22.57	22.65
		100	0	23.00	22.03	22.59	22.65

Table 20: Conducted power measurement results of LTE Band XLI

7.1.2 Conducted power measurements of WiFi 2.4G

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	11.50	9.56	Yes
	6	2437	11.50	10.27	
	11	2462	11.50	10.45	
802.11g	1	2412	11.50	9.64	No
	6	2437	11.50	10.30	
	11	2462	11.50	10.32	
802.11n 20M	1	2412	11.50	9.56	No
	6	2437	11.50	10.27	
	11	2462	11.50	10.26	
802.11n 40M	3	2422	11.50	9.59	Yes
	6	2437	11.50	9.56	
	9	2452	11.50	10.32	

Table 21: Conducted power measurement results of WiFi 2.4G

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

7.1.1 Conducted power measurements of WiFi 5G

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11a	CH 36	5180*	7.00	5.41	NO
	CH 40	5200	7.00	5.05	
	CH 44	5220	7.00	5.02	
	CH 48	5240*	7.00	5.07	
	CH 52	5260*	7.00	5.04	NO
	CH 56	5280	7.00	5.12	
	CH 60	5300	7.00	5.06	
	CH 64	5320*	7.00	5.10	
	CH 100	5500	7.00	5.05	NO
	CH 104	5520*	7.00	5.10	
	CH 108	5540	7.00	5.20	
	CH 112	5560	7.00	5.06	
	CH 116	5580*	7.00	5.08	
	CH 120	5600	7.00	5.09	
	CH 124	5620	7.00	5.06	
	CH 128	5640	7.00	5.04	
	CH 132	5660	7.00	5.10	
	CH 136	5680*	7.00	5.12	
	CH 140	5700	7.00	5.13	No
	CH 144	5720	7.00	5.07	
CH 149	5745*	7.00	5.05		
CH 153	5765	7.00	5.03		
CH 157	5785	7.00	5.04		
CH 161	5805*	7.00	5.06		
CH 165	5825	7.00	5.07		

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11n 20M (5GHz)	CH 36	5180	7.00	5.13	No
	CH 40	5200	7.00	5.10	
	CH 44	5220	7.00	5.12	
	CH 48	5240	7.00	5.11	No
	CH 52	5260	7.00	5.05	
	CH 56	5280	7.00	5.16	
	CH 60	5300	7.00	5.10	
	CH 64	5320	7.00	5.14	
	CH 100	5500	7.00	5.09	No
	CH 104	5520	7.00	5.06	
	CH 108	5540	7.00	5.08	
	CH 112	5560	7.00	5.04	
	CH 116	5580	7.00	5.06	
	CH 120	5600	7.00	5.07	
	CH 124	5620	7.00	5.04	
	CH 128	5640	7.00	5.07	
	CH 132	5660	7.00	5.08	
	CH 136	5680	7.00	5.01	
	CH 140	5700	7.00	5.11	No
	CH 144	5720	7.00	5.12	
CH 149	5745	7.00	5.08		
CH 153	5765	7.00	5.09		
CH 157	5785	7.00	5.14		
CH 161	5805	7.00	5.16		
CH 165	5825	7.00	5.17		

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11n 40M (5GHz)	CH 38	5190	7.00	5.12	No
	CH 46	5230	7.00	5.11	
	CH 54	5270	7.00	5.14	No
	CH 62	5310	7.00	5.10	
	CH 102	5510	7.00	5.12	No
	CH 110	5550	7.00	5.13	
	CH 118	5590	7.00	5.04	
	CH 126	5630	7.00	5.02	
	CH 134	5670	7.00	5.10	
	CH 142	5710	7.00	5.12	
	CH 151	5755	7.00	5.14	No
	CH 159	5795	7.00	5.11	

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11ac-20M (5GHz)	CH 36	5180	7.00	5.12	No
	CH 40	5200	7.00	5.08	
	CH 44	5220	7.00	5.11	
	CH 48	5240	7.00	5.04	
	CH 52	5260	7.00	5.08	No
	CH 56	5280	7.00	5.06	
	CH 60	5300	7.00	5.11	
	CH 64	5320	7.00	5.12	
	CH 100	5500	7.00	5.13	No
	CH 104	5520	7.00	5.04	
	CH 108	5540	7.00	5.06	
	CH 112	5560	7.00	5.11	
	CH 116	5580	7.00	5.14	
	CH 120	5600	7.00	5.10	
	CH 124	5620	7.00	5.07	
	CH 128	5640	7.00	5.03	
	CH 132	5660	7.00	5.08	
	CH 136	5680	7.00	5.04	
	CH 140	5700	7.00	5.06	No
	CH 144	5720	7.00	5.08	
CH 149	5745	7.00	5.11		
CH 153	5765	7.00	5.12		
CH 157	5785	7.00	5.10		
CH 161	5805	7.00	5.12		
CH 165	5825	7.00	5.08		

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11ac-40M (5GHz)	CH 38	5190	7.00	5.11	No
	CH 46	5230	7.00	5.12	
	CH 54	5270	7.00	5.16	
	No	CH 62	5310	7.00	5.17
		CH 102	5510	7.00	5.14
		CH 110	5550	7.00	5.08
		CH 118	5590	7.00	5.09
		CH 126	5630	7.00	5.11
		CH 134	5670	7.00	5.07
		CH 142	5710	7.00	5.05
	No	CH 151	5755	7.00	5.12
		CH 159	5795	7.00	5.08

Mode	Channel	Frequency (MHz)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11ac 80M (5GHz)	CH 42	5210	7.00	5.62	No
	CH 58	5290	7.00	5.64	Yes
	Yes	CH 106	5530	7.00	5.47
		CH 122	5610	7.00	5.69
	CH 138	5690	7.00	5.71	
	CH 155	5775	7.00	5.41	Yes

Table 22: Conducted power measurement results of WiFi 5G (Full power).

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

7.1.2 Conducted power measurements of BT

The output power of BT antenna is as following:

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	39CH	78CH
DH5	9.50	5.45	7.04	7.89
2DH5	9.50	3.29	5.06	6.04
3DH5	9.50	3.41	5.10	5.97

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	19CH	39CH
BLE	9.50	7.62	8.19	7.67

Table 23: Conducted power measurement results of BT.

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

7.2 SAR measurement Results

General Notes:

- 1) Per KDB447498 D01, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.
- 2) Per KDB447498 D01, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- $\leq 0.8\text{W/kg}$ for 1-g or 2.0W/kg for 10-g respectively, when the transmission band is $\leq 100\text{MHz}$.
- $\leq 0.6\text{ W/kg}$ or 1.5 W/kg , for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.
- $\leq 0.4\text{ W/kg}$ or 1.0 W/kg , for 1-g or 10-g respectively, when the transmission band is $\geq 200\text{ MHz}$.

When the maximum output power variation across the required test channels is $> \frac{1}{2}\text{ dB}$, instead of the middle channel, the highest output power channel must be used.

- 3) Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8\text{W/Kg}$; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR $< 1.45\text{W/Kg}$, only one repeated measurement is required.
- 4) Per KDB648474 D04, SAR is evaluated without a headset connected to the device. When the standalone reported body SAR is $\leq 1.2\text{ W/kg}$, no additional SAR evaluations using a headset are required.
- 5) Per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is $> 1.5\text{ W/kg}$, or $> 7.0\text{ W/kg}$ 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 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

UMTS Notes:

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

LTE Notes:

1) The LTE test configurations are determined according to KDB941225 D05 SAR for LTE Devices .The general test procedures used for SAR testing can be found in Section 6.5.

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)

WiFi Notes:

Per KDB248227D01:

1) When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8 W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested..

2) When the DSSS *reported* SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

3) When the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations

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

7.2.1 SAR measurement Result of GSM850

Test Position of Body 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR1-g (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
Back Side	190/836.6	GPRS 3TS	0.429	0.233	0.11	29.40	31.00	0.620	Yes
Left Side	190/836.6	GPRS 3TS	0.737	0.325	-0.08	29.40	31.00	1.065	/
Left Side	128/824.2	GPRS 3TS	0.766	0.322	-0.13	29.41	31.00	1.105	Yes
Left Side	251/848.8	GPRS 3TS	0.640	0.276	-0.19	29.43	31.00	0.919	/
Right Side	190/836.6	GPRS 3TS	0.065	0.059	-0.18	29.40	31.00	0.094	/
Top Side	190/836.6	GPRS 3TS	0.540	0.318	-0.05	29.40	31.00	0.781	/
Tested at the worst position with Battery 2#									
Left Side	128/824.2	GPRS 3TS	0.633	0.301	-0.18	29.41	31.00	0.913	/
Tested at the worst position with Battery 3#									
Left Side	128/824.2	GPRS 3TS	0.725	0.319	-0.18	29.41	31.00	1.046	/

Table 24: SAR test results of GSM850

7.2.2 SAR measurement Result of GSM1900

Test Position of Body 0mm	Test chann*#del /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR1-g (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
Back Side	661/1880	GPRS 4TS	0.602	0.264	-0.11	25.78	27.00	0.797	Yes
Left Side	661/1880	GPRS 4TS	0.224	0.094	-0.19	25.78	27.00	0.297	/
Top Side	661/1880	GPRS 4TS	0.306	0.149	0.10	25.78	27.00	0.405	/
Tested at the worst position with Battery 2#									
Back Side	661/1880	GPRS 4TS	0.552	0.245	-0.12	25.78	27.00	0.731	/
Tested at the worst position with Battery 3#									
Back Side	661/1880	GPRS 4TS	0.567	0.251	-0.02	25.78	27.00	0.751	/

Table 25: SAR test results of GSM1900

7.2.3 SAR measurement Result of UMTS Band II

Test Position of Body 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducte d Power (dBm)	Tune-up Power (dBm)	Reported SAR1-g (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
Back Side	9400/1880	RMC	0.563	0.262	0.10	22.89	24.00	0.727	Yes
Left Side	9400/1880	RMC	0.242	0.102	-0.11	22.89	24.00	0.312	/
Top Side	9400/1880	RMC	0.336	0.135	-0.08	22.89	24.00	0.434	/
Tested at the worst position with Battery 2#									
Back Side	9400/1880	RMC	0.525	0.255	-0.18	22.89	24.00	0.678	/
Tested at the worst position with Battery 3#									
Back Side	9400/1880	RMC	0.547	0.255	0.16	22.89	24.00	0.706	/

Table 26: SAR test results of UMTS Band II

7.2.4 SAR measurement Result of UMTS Band V

Test Position of Body 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducte d Power (dBm)	Tune-up Power (dBm)	Reported SAR1-g (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
Back Side	4182/836.4	RMC	0.461	0.233	0.09	22.95	24.00	0.587	Yes
Left Side	4182/836.4	RMC	0.631	0.279	-0.19	22.95	24.00	0.804	Yes
Left Side	4132/826.4	RMC	0.628	0.270	-0.06	22.94	24.00	0.802	/
Left Side	4233/846.6	RMC	0.570	0.245	-0.09	23.01	24.00	0.716	/
Right Side	4182/836.4	RMC	0.065	0.040	-0.17	22.95	24.00	0.083	/
Top Side	4182/836.4	RMC	0.292	0.109	-0.16	22.95	24.00	0.372	/
Tested at the worst position with Battery 2#									
Left Side	4182/836.4	RMC	0.550	0.241	-0.16	22.95	24.00	0.700	/
Tested at the worst position with Battery 3#									
Left Side	4182/836.4	RMC	0.616	0.262	-0.16	22.95	24.00	0.784	/

Table 27: SAR test results of UMTS Band V

7.2.5 SAR measurement Result of LTE Band V

Test Position of Body 0mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR _{1-g} (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
1RB									
Back Side	20600/889	10M QPSK 1RB#25	0.517	0.269	0.17	22.97	23.50	0.584	Yes
Left Side	20600/889	10M QPSK 1RB#25	0.917	0.324	-0.11	22.97	23.50	1.036	/
Left Side	20450/874	10M QPSK 1RB#25	0.949	0.340	-0.15	22.88	23.50	1.095	/
Left Side	20525/881.5	10M QPSK 1RB#25	1.020	0.400	-0.12	22.84	23.50	1.187	Yes
Left Side-Repeated	20525/881.5	10M QPSK 1RB#25	0.952	0.385	-0.15	22.84	23.50	1.108	/
Right Side	20600/889	10M QPSK 1RB#25	0.077	0.047	-0.15	22.97	23.50	0.087	/
Top Side	20600/889	10M QPSK 1RB#25	0.346	0.130	-0.06	22.97	23.50	0.391	/
50%RB									
Back Side	20450/874	10M QPSK 50%RB#13	0.419	0.215	0.01	22.38	22.80	0.462	/
Left Side	20450/874	10M QPSK 50%RB#13	0.822	0.291	-0.16	22.38	22.80	0.905	/
Left Side	20525/881.5	10M QPSK 50%RB#13	0.777	0.289	-0.14	22.31	22.80	0.870	/
Left Side	20600/889	10M QPSK 50%RB#13	0.743	0.276	-0.11	22.30	22.80	0.834	/
Top Side	20450/874	10M QPSK 50%RB#13	0.266	0.099	-0.05	22.38	22.80	0.293	/
100%RB									
Left Side	20450/874	10M QPSK 100%RB#0	0.474	0.253	-0.06	22.24	22.80	0.539	/
Tested at the worst position with Battery 2#									
Left Side	20525/881.5	10M QPSK 1RB#25	0.882	0.372	-0.09	22.84	23.50	1.027	/
Tested at the worst position with Battery 3#									
Left Side	20525/881.5	10M QPSK 1RB#25	0.841	0.365	0.19	22.84	23.50	0.979	/

Table 28: SAR test results of LTE Band V

7.2.6 SAR measurement Result of LTE Band VII

Test Position of Body 0mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR _{1-g} (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
1RB									
Back Side	21350/2560	20M QPSK 1RB#50	0.560	0.221	0.00	21.98	23.00	0.708	/
Left Side	21350/2560	20M QPSK 1RB#50	0.185	0.078	-0.10	21.98	23.00	0.234	/
Top Side	21350/2560	20M QPSK 1RB#50	0.164	0.052	-0.10	21.98	23.00	0.207	/
50%RB									
Back Side	20850/2510	20M QPSK 50%RB#50	0.327	0.128	-0.17	21.35	22.50	0.426	/
Left Side	20850/2510	20M QPSK 50%RB#50	0.143	0.061	-0.13	21.35	22.50	0.186	/
Top Side	20850/2510	20M QPSK 50%RB#50	0.104	0.034	-0.13	21.35	22.50	0.136	/
Tested at the worst position with Battery 2#									
Back Side	21350/2560	20M QPSK 1RB#50	0.470	0.186	0.00	21.98	23.00	0.594	/
Tested at the worst position with Battery 3#									
Back Side	21350/2560	20M QPSK 1RB#50	0.572	0.224	0.00	21.98	23.00	0.723	Yes

Table 29: SAR test results of LTE Band VII

7.2.7 SAR measurement Result of LTE Band XXXVIII

Test Position of Body 0mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR _{1-g} (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
1RB									
Back Side	38000/2595	20M QPSK 1RB#50	0.658	0.248	0.10	22.85	23.50	0.764	Yes
Left Side	38000/2595	20M QPSK 1RB#50	0.205	0.078	0.18	22.85	23.50	0.238	/
Top Side	38000/2595	20M QPSK 1RB#50	0.102	0.044	0.19	22.85	23.50	0.118	/
50%RB									
Back Side	38000/2595	20M QPSK 50%RB#25	0.399	0.137	-0.12	22.35	22.50	0.413	/
Left Side	38000/2595	20M QPSK 50%RB#25	0.125	0.048	-0.11	22.35	22.50	0.129	/
Top Side	38000/2595	20M QPSK 50%RB#25	0.063	0.027	0.16	22.35	22.50	0.065	/
Tested at the worst position with Battery 2#									
Back Side	37850/2580	20M QPSK 1RB#50	0.616	0.235	0.19	22.85	23.50	0.715	/
Tested at the worst position with Battery 3#									
Back Side	37850/2580	20M QPSK 1RB#50	0.631	0.239	0.00	22.85	23.50	0.733	/

Table 30: SAR test results of LTE Band XXXVIII

7.2.8 SAR measurement Result of LTE Band XLI

Test Position of Body 0mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR _{1-g} (W/kg)	SAR Plot
			1-g	10-g					
Test data with battery 1#									
1RB									
Back Side	40740/2605	20M QPSK 1RB#50	0.578	0.216	0.07	22.86	24.00	0.751	/
Left Side	40740/2605	20M QPSK 1RB#50	0.294	0.109	-0.07	22.86	24.00	0.382	/
Right Side	40740/2605	20M QPSK 1RB#50	0.006	0.003	0.00	22.86	24.00	0.008	/
Top Side	40740/2605	20M QPSK 1RB#50	0.248	0.066	0.13	22.86	24.00	0.322	/
50%RB									
Back Side	40740/2605	20M QPSK 50%RB#25	0.480	0.174	0.10	23.27	23.50	0.506	/
Left Side	40740/2605	20M QPSK 50%RB#25	0.153	0.063	0.13	23.27	23.50	0.161	/
Right Side	40740/2605	20M QPSK 50%RB#25	0.006	0.003	0.00	23.27	23.50	0.007	/
Top Side	40740/2605	20M QPSK 50%RB#25	0.261	0.094	-0.17	23.27	23.50	0.275	/
Tested at the worst position with Battery 2#									
Back Side	40740/2605	20M QPSK 1RB#50	0.508	0.192	0.00	22.86	24.00	0.660	/
Tested at the worst position with Battery 3#									
Back Side	40740/2605	20M QPSK 1RB#50	0.598	0.224	0.16	22.86	24.00	0.778	Yes

Table 31: SAR test results of LTE Band XLI

7.2.1 SAR measurement Result of WiFi 2.4G

Test Position of Body 0mm	Test channel /Freq. (MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled 1-g SAR (W/kg)	Actual duty factor	Reported SAR1-g (W/kg)	SAR Plot.
			Area Scan	Zoom Scan							
			1-g	1-g							
802.11b											
Back Side	11/2462	802.11b	1.150	0.897	0.11	10.45	11.50	1.142	99.60%	1.147	/
Back Side	6/2437	802.11b	1.370	1.020	0.19	10.27	11.50	1.354	99.60%	1.359	/
Back Side with Headset	6/2437	802.11b	1.300	1.050	0.00	10.27	11.50	1.394	99.60%	1.399	/
Back Side-Repeated	6/2437	802.11b	1.340	1.080	0.14	10.27	11.50	1.434	99.60%	1.439	Yes
Back Side	1/2412	802.11b	1.100	0.854	0.11	9.56	11.50	1.335	99.60%	1.340	/
Right Side	11/2462	802.11b	0.319	0.378	-0.17	10.45	11.50	0.481	99.60%	0.483	/
Top Side	11/2462	802.11b	0.268	0.299	-0.19	10.45	11.50	0.381	99.60%	0.382	/
802.11n											
Back Side	9/2452	802.11n 40M	0.640	0.883	0.00	10.32	11.50	1.159	99.60%	1.163	/
Back Side	3/2422	802.11n 40M	0.643	0.762	0.19	9.59	11.50	1.183	99.60%	1.188	/
Right Side	9/2452	802.11n 40M	0.313	0.377	0.15	10.32	11.50	0.495	99.60%	0.497	/
Top Side	9/2452	802.11n 40M	0.266	0.296	-0.09	10.32	11.50	0.388	99.60%	0.390	/
Tested at the worst position with battery 2#											
Back Side	6/2437	802.11b	0.972	0.785	0.11	10.27	11.50	1.042	99.60%	1.046	/
Tested at the worst position with battery 3#											
Back Side	6/2437	802.11b	0.953	0.840	0.19	10.27	11.50	1.115	99.60%	1.119	/

Table 32: SAR test results of WiFi 2450MHz

Note:

- 1) As the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is > 1.2 W/kg. SAR measurement is not required for 2.4 GHz OFDM configurations
- 2) When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. The 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power and maximum bandwidth .

3) SAR for 2.4G 802.11g/11n (20M) is not required with the highest reported SAR for 2.4G 802.11n(40M) adjusted by the ratio of 802.11n(40M) to 802.11g/11n (20M) specified maximum output power and the adjusted SAR is <1.2 W/kg.

7.2.2 SAR measurement Result of WiFi 5G

Test Position of Body 0mm	Test channel /Freq. (MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled 1-g SAR (W/kg)	Actual duty factor	Reported SAR1-g (W/kg)	SAR Plot.
			Area Scan	Zoom Scan							
			1-g	1-g							
Test data of 5.3GHz band											
Back Side	58/5290	802.11ac 80M	0.498	0.650	0.19	5.64	7.00	0.889	97.00%	0.917	/
Right Side	58/5290	802.11ac 80M	0.257	0.270	0.11	5.64	7.00	0.369	97.00%	0.381	/
Top Side	58/5290	802.11ac 80M	0.092	0.108	0.19	5.64	7.00	0.148	97.00%	0.152	/
Test data of 5.5GHz band											
Back Side	138/5690	802.11ac 80M	0.654	0.759	0.12	5.71	7.00	1.022	97.00%	1.053	/
Back Side	122/5610	802.11ac 80M	0.660	0.760	0.16	5.69	7.00	1.028	97.00%	1.059	/
Right Side	138/5690	802.11ac 80M	0.176	0.239	0.14	5.71	7.00	0.322	97.00%	0.332	/
Top Side	138/5690	802.11ac 80M	0.091	0.106	0.00	5.71	7.00	0.143	97.00%	0.147	/
Test data of 5.8GHz band											
Back Side	155/5775	802.11ac 80M	0.537	0.695	0.16	5.41	7.00	1.002	97.00%	1.033	/
Right Side	155/5775	802.11ac 80M	0.194	0.199	0.11	5.41	7.00	0.287	97.00%	0.296	/
Top Side	155/5775	802.11ac 80M	0.089	0.104	0.00	5.41	7.00	0.150	97.00%	0.155	/
Test at the worst position with battery 2#											
Back Side	122/5610	802.11ac 80M	0.457	0.618	0.17	5.69	7.00	0.836	97.00%	0.861	/
Test at the worst position with battery 3#											
Back Side	122/5610	802.11ac 80M	0.615	0.853	0.19	5.69	7.00	1.153	97.00%	1.189	Yes
Back Side-Repeated	122/5610	802.11ac 80M	0.561	0.770	0.19	5.69	7.00	1.041	97.00%	1.073	/

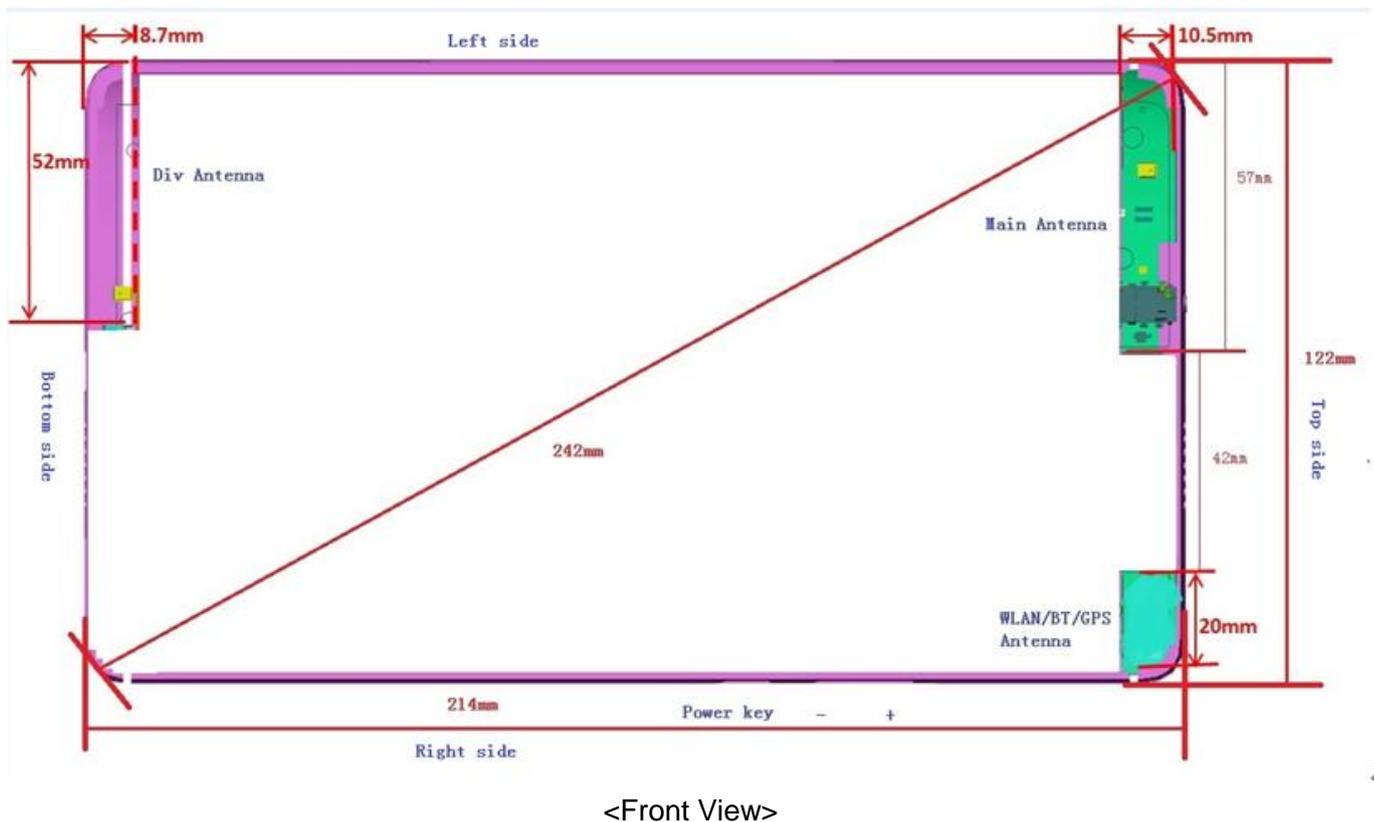
Table 33: SAR test results of WiFi 5GHz

Note :

- 1) Per KDB 248227D01, as the same maximum output power is specified for U-NII-1(5.2G) and U-NII-2A(5.3G) bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. as the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration.
- 2)The 802.11ac (80M) mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power and maximum bandwidth.
- 3)As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is < 1.2 W/kg, SAR test for the other 802.11 modes are not required.

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 447498 D01 General RF Exposure Guidance v06. The location of the antennas inside the device is shown as below picture:



Note:

- 1) The overall dimension of the device (Length* Width) is 214mm*122mm . Per KDB 616217, because the diagonal Length is > 200 mm, it is considered a “ tablet” device and need to test 0mm 1g Body SAR.
- 2) The Div antenna does not have Tx function

7.3.1 Standalone SAR exclusion calculation

Per FCC KDB 447498D01v06:

1) The 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

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

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

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

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

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

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

Band	Exposure Condition	f(GHz)	Pmax (dBm)*	Pmax (mW)	Seperation Distance(mm)					Calculated Value					SAR Test(yes or no)				
					Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side
GSM850 GPRS 3TS	Body 0mm	0.850	31.00	454.49	5.0	5.0	65.0	5.0	203.5	83.803	83.803	>50mm	83.803	>50mm	Yes	Yes	>50mm	Yes	>50mm
GSM1900 GPRS 4TS	Body 0mm	1.900	27.00	240.96	5.0	5.0	65.0	5.0	203.5	66.427	66.427	>50mm	66.427	>50mm	Yes	Yes	>50mm	Yes	>50mm
UMTS B2	Body 0mm	1.900	24.00	251.19	5.0	5.0	65.0	5.0	203.5	69.248	69.248	>50mm	69.248	>50mm	Yes	Yes	>50mm	Yes	>50mm
UMTS B5	Body 0mm	0.850	24.00	251.19	5.0	5.0	65.0	5.0	203.5	46.317	46.317	>50mm	46.317	>50mm	Yes	Yes	>50mm	Yes	>50mm
LTE B5	Body 0mm	0.850	23.50	223.87	5.0	5.0	65.0	5.0	203.5	41.280	41.280	>50mm	41.280	>50mm	Yes	Yes	>50mm	Yes	>50mm
LTE B7	Body 0mm	2.600	23.00	199.53	5.0	5.0	65.0	5.0	203.5	64.345	64.345	>50mm	64.345	>50mm	Yes	Yes	>50mm	Yes	>50mm
LTE B38	Body 0mm	2.600	23.50	223.87	5.0	5.0	65.0	5.0	203.5	72.197	72.197	>50mm	72.197	>50mm	Yes	Yes	>50mm	Yes	>50mm
LTE B41	Body 0mm	2.600	24.00	251.19	5.0	5.0	65.0	5.0	203.5	81.006	81.006	>50mm	81.006	>50mm	Yes	Yes	>50mm	Yes	>50mm
WiFi 2.4G	Body 0mm	2.450	11.50	14.13	5.0	99.0	5.0	5.0	203.5	4.422	>50mm	4.422	4.422	>50mm	Yes	>50mm	Yes	Yes	>50mm
WiFi 5G	Body 0mm	5.800	7.00	5.01	5.0	99.0	5.0	5.0	203.5	2.414	>50mm	2.414	2.414	>50mm	No	>50mm	No	No	>50mm
BT	Body 0mm	2.450	9.50	8.91	5.0	99.0	5.0	5.0	203.5	2.790	>50mm	2.790	2.790	>50mm	No	>50mm	No	No	>50mm

(Antenna to adjacent sides <50mm)

Band	Exposure Condition	f(GHz)	Pmax (dBm)*	Pmax (mW)	Seperation Distance(mm)					Calculated Threshold Value					SAR Test(yes or no)				
					Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side
GSM850 GPRS 3TS	Body 0mm	0.850	31.00	454.49	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	249.00	<50mm	1033.83	<50mm	<50mm	Yes	<50mm	No
GSM1900 GPRS 4TS	Body 0mm	1.900	27.00	240.96	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	259.00	<50mm	1644.00	<50mm	<50mm	No	<50mm	No
UMTS B2	Body 0mm	1.900	24.00	251.19	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	259.00	<50mm	1644.00	<50mm	<50mm	No	<50mm	No
UMTS B5	Body 0mm	0.850	24.00	251.19	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	249.00	<50mm	1033.83	<50mm	<50mm	Yes	<50mm	No
LTE B5	Body 0mm	0.850	23.50	223.87	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	249.00	<50mm	969.83	<50mm	<50mm	Yes	<50mm	No
LTE B7	Body 0mm	2.600	23.00	199.53	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	243.03	<50mm	1628.03	<50mm	<50mm	No	<50mm	No
LTE B38	Body 0mm	2.600	23.50	223.87	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	243.03	<50mm	1628.03	<50mm	<50mm	No	<50mm	No
LTE B41	Body 0mm	2.600	24.00	251.19	5.0	5.0	65.0	5.0	203.5	<50mm	<50mm	243.03	<50mm	1628.03	<50mm	<50mm	Yes	<50mm	No
WiFi 2.4G	Body 0mm	2.450	11.50	14.13	5.0	99.0	5.0	5.0	203.5	<50mm	586.00	<50mm	<50mm	1631.00	<50mm	No	<50mm	<50mm	No
WiFi 5G	Body 0mm	5.800	7.00	5.01	5.0	99.0	5.0	5.0	203.5	<50mm	552.00	<50mm	<50mm	1597.00	<50mm	No	<50mm	<50mm	No
BT	Body 0mm	2.450	9.50	8.91	5.0	99.0	5.0	5.0	203.5	<50mm	586.00	<50mm	<50mm	1631.00	<50mm	No	<50mm	<50mm	No

(Antenna to adjacent sides >50mm)

According to the table above, the WiFi 5G SAR test can be excluded, but it is still tested in this report for simultaneous transmission. The standalone test configurations required for this device are as below:

Test configurations	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
GSM850 GPRS 3TS	No	Yes	Yes	Yes	Yes	No
GSM1900 GPRS 4TS	No	Yes	Yes	No	Yes	No
UMTS Band II	No	Yes	Yes	No	Yes	No
UMTS Band V	No	Yes	Yes	Yes	Yes	No
LTE Band V	No	Yes	Yes	Yes	Yes	No
LTE Band VII	No	Yes	Yes	No	Yes	No
LTE Band XXXVIII	No	Yes	Yes	No	Yes	No
LTE Band XLI	No	Yes	Yes	No	Yes	No
WiFi 2.4G	No	Yes	No	Yes	Yes	No
WiFi 5G	No	Yes	No	Yes	Yes	No
BT	No	No	No	No	No	No

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

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

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

Mode	Position	P _{max} (dBm)*	P _{max} (mW)	Distance (mm)	f (GHz)	X	Estimated SAR (W/kg)*
BT	Body	9.50	8.91	5	2.480	7.50	0.374

Table 34: Estimated SAR calculation for BT

Note:

- 1) * - maximum possible output power declared by manufacturer

7.3.1 Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Body (0mm)
1	GSM Voice + WiFi	Yes
2	GSM Data + WiFi	Yes
3	GSM Voice + BT	Yes
4	GSM Data + BT	Yes
5	UMTS Voice + WiFi	Yes
6	UMTS Data + WiFi	Yes
7	UMTS Voice + BT	Yes
8	UMTS Data + BT	Yes
9	LTE + WiFi	Yes
10	LTE + BT	Yes

Table 35: Simultaneous Transmission Possibilities

Note:

- 1) WiFi 2.4G and WiFi 5G can't transmit simutanously.
- 2) WiFi 2.4G/5G and BT can't transmit simutanously.
- 3) The device does not support GSM DTM .

7.3.1 SAR Summation Scenario

The sum SAR is as below:

Test Position		Main antenna SAR _{Max}								WiFi/BT antenna SAR _{Max}			Σ1-g SAR (1.6W/kg Limit)	SPLSR	Volume scan
		GSM 850	GSM 1900	UMTS Band II	UMTS Band V	LTE Band V	LTE Band VII	LTE Band XXXVIII	LTE Band XLI	WiFi 2.4G	WiFi 5G	BT			
Body 0mm	Back side	0.620	0.797	0.727	0.587	0.584	0.723	0.764	0.778	1.439	1.189	0.374	2.236	Yes	N/A
	Left side	1.105	0.297	0.312	0.804	1.187	0.234	0.238	0.382	/	/	0.374	1.561	N/A	N/A
	Right side	0.094	/	/	0.083	0.087	/	/	0.007	0.497	0.381	0.374	0.591	N/A	N/A
	Top side	0.781	0.405	0.434	0.372	0.391	0.207	0.118	0.322	0.390	0.155	0.374	1.171	N/A	N/A
	Bottom side	/	/	/	/	/	/	/	/	/	/	0.374	0.374	N/A	N/A

Table 36: 1-g SAR Simultaneous Tx Combination of GSM/UMTS/LTE and WiFi/BT.

Test Position		Main antenna SAR _{Max}							WiFi/BT antenna SAR _{Max}			Σ1-g SAR (1.6W/kg Limit)	SPLSR	Volume scan	
		GSM 850	GSM 1900	UMTS Band II	UMTS Band V	LTE Band V	LTE Band VII	LTE Band XXXVIII	LTE Band XLI	WiFi 2.4G	WiFi 5G				BT
Body Omm	Back side	0.620	/	/	/	/	/	/	/	1.439	/	/	2.059	0.031	NA
		/	0.797	/	/	/	/	/	/	1.439	/	/	2.236	0.034	NA
		/	/	0.727	/	/	/	/	/	1.439	/	/	2.166	0.031	NA
		/	/	/	0.587	/	/	/	/	1.439	/	/	2.026	0.029	NA
		/	/	/	/	0.584	/	/	/	1.439	/	/	2.023	0.030	NA
		/	/	/	/	/	0.723	/	/	1.439	/	/	2.162	0.033	NA
		/	/	/	/	/	/	0.764	/	1.439	/	/	2.203	0.033	NA
		/	/	/	/	/	/	/	0.778	1.439	/	/	2.217	0.035	NA

Table 37: 1-g SAR Simultaneous Tx Combination of GSM/UMTS/LTE and WiFi 2.4G on Back side position.

Test Position		Main antenna SAR _{Max}							WiFi/BT antenna SAR _{Max}			Σ1-g SAR (1.6W/kg Limit)	SPLSR	Volume scan	
		GSM 850	GSM 1900	UMTS Band II	UMTS Band V	LTE Band V	LTE Band VII	LTE Band XXXVIII	LTE Band XLI	WiFi 2.4G	WiFi 5G				BT
Body Omm	Back side	0.620	/	/	/	/	/	/	/	/	1.189	/	1.809	0.027	NA
		/	0.797	/	/	/	/	/	/	/	1.189	/	1.986	0.031	NA
		/	/	0.727	/	/	/	/	/	/	1.189	/	1.916	0.027	NA
		/	/	/	0.587	/	/	/	/	/	1.189	/	1.776	0.025	NA
		/	/	/	/	0.584	/	/	/	/	1.189	/	1.773	0.026	NA
		/	/	/	/	/	0.723	/	/	/	1.189	/	1.912	0.030	NA
		/	/	/	/	/	/	0.764	/	/	1.189	/	1.953	0.029	NA
		/	/	/	/	/	/	/	0.778	/	1.189	/	1.967	0.031	NA

Table 38: 1-g SAR Simultaneous Tx Combination of GSM/UMTS/LTE and WiFi 5G on Back side position.

Test Position		Main antenna SAR _{Max}							WiFi/BT antenna SAR _{Max}			Σ1-g SAR (1.6W/kg Limit)	SPLSR	Volume scan	
		GSM 850	GSM 1900	UMTS Band II	UMTS Band V	LTE Band V	LTE Band VII	LTE Band XXXVIII	LTE Band XLI	WiFi 2.4G	WiFi 5G				BT
Body Omm	Back side	0.620	/	/	/	/	/	/	/	/	/	0.374	0.994	NA	NA
		/	0.797	/	/	/	/	/	/	/	/	0.374	1.171	NA	NA
		/	/	0.727	/	/	/	/	/	/	/	0.374	1.101	NA	NA
		/	/	/	0.587	/	/	/	/	/	/	0.374	0.961	NA	NA
		/	/	/	/	0.584	/	/	/	/	/	0.374	0.958	NA	NA
		/	/	/	/	/	0.723	/	/	/	/	0.374	1.097	NA	NA
		/	/	/	/	/	/	0.764	/	/	/	0.374	1.138	NA	NA
		/	/	/	/	/	/	/	0.778	/	/	0.374	1.152	NA	NA

Table 39: 1-g SAR Simultaneous Tx Combination of GSM/UMTS/LTE and BT on Back side position.

7.3.2 SPLSR Evaluation Analysis

According to KDB447498 D01, When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio(SPLSR).When the SAR to peak location ratio for each pair of antennas is $\leq 1\text{-g } 0.04$ and $10\text{-g } 0.10$, simultaneous SAR evaluation is not required. When SAR is measured for both antennas in the pair, the peak location separation distance is computed by the following fomula:

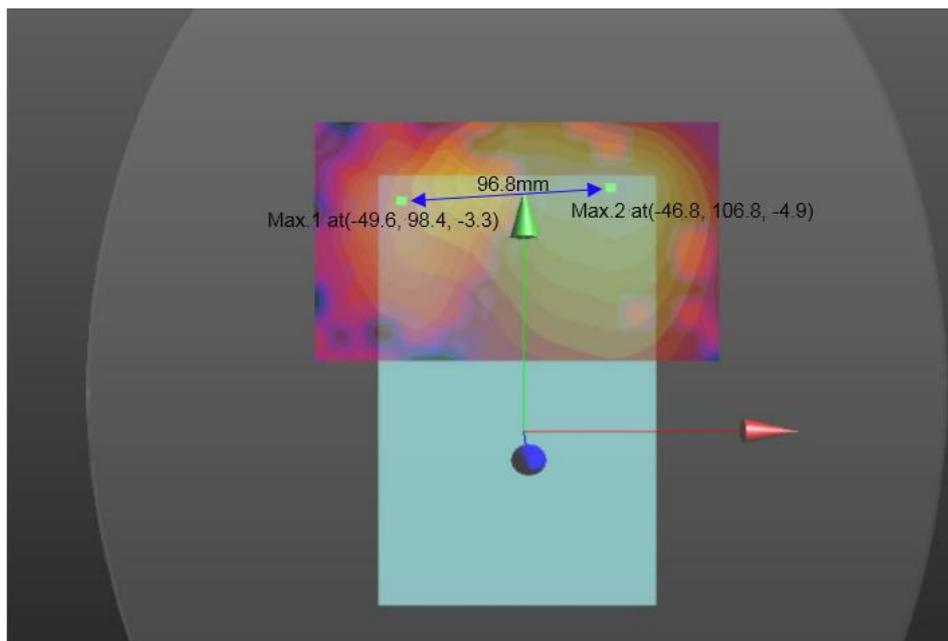
$$\text{Distance}_{\text{TX1-TX2}} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

$$\text{SPLS Ratio} = (\text{SAR}_1 + \text{SAR}_2)^{1.5}/R_i$$

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna.

- 1) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with GSM850 and WiFi 2.4G.

The Peak SAR location plot is as below:

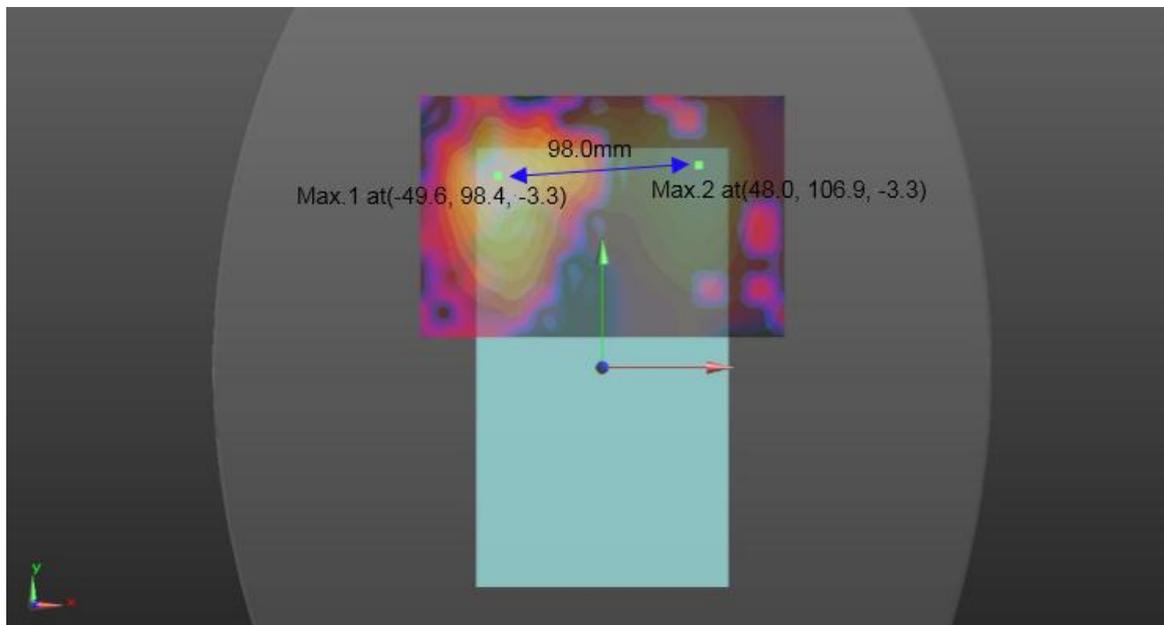


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
1	Body 0mm	Back side	GSM850	0.620	2.059	96.8	0.031	0.04	Not required
			WiFi 2.4G	1.439					

- 2) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with GSM1900 and WiFi 2.4G.

The Peak SAR location plot is as below:

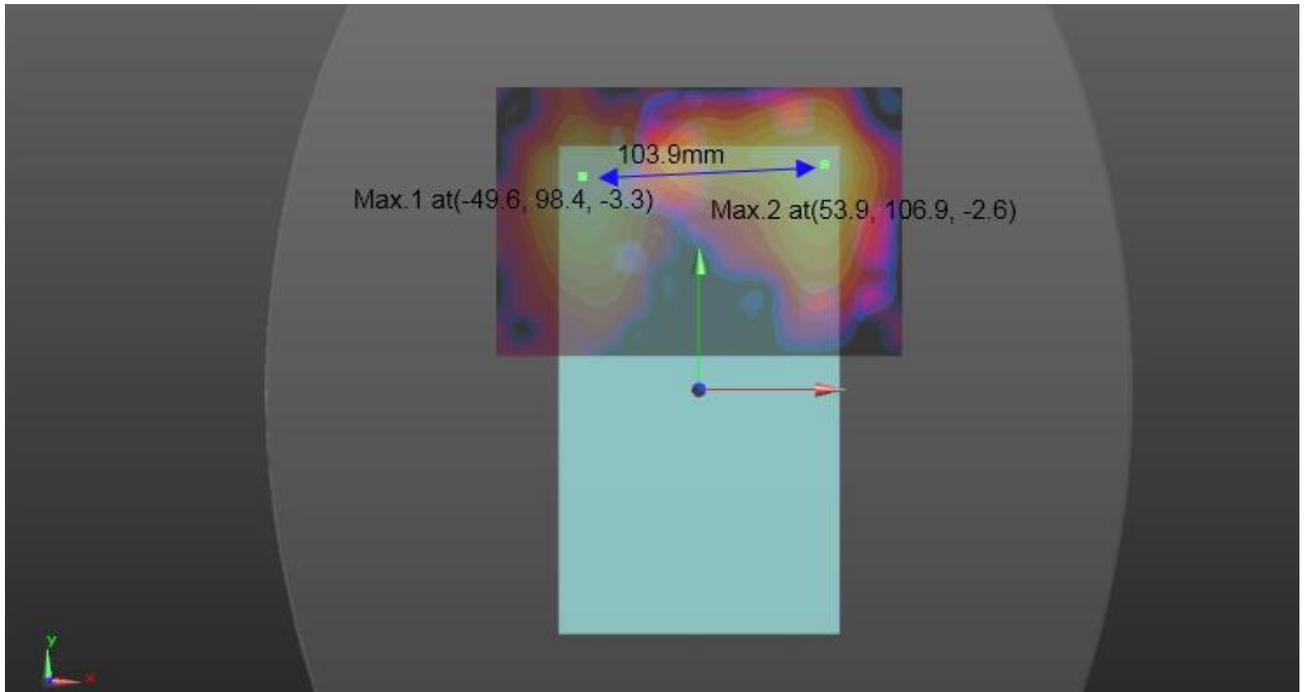


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
2	Body 0mm	Back side	GSM1900	0.797	2.236	98.0	0.034	0.04	Not required
			WiFi 2.4G	1.439					

- 3) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with UMTS Band II and WiFi 2.4G.

The Peak SAR location plot is as below:

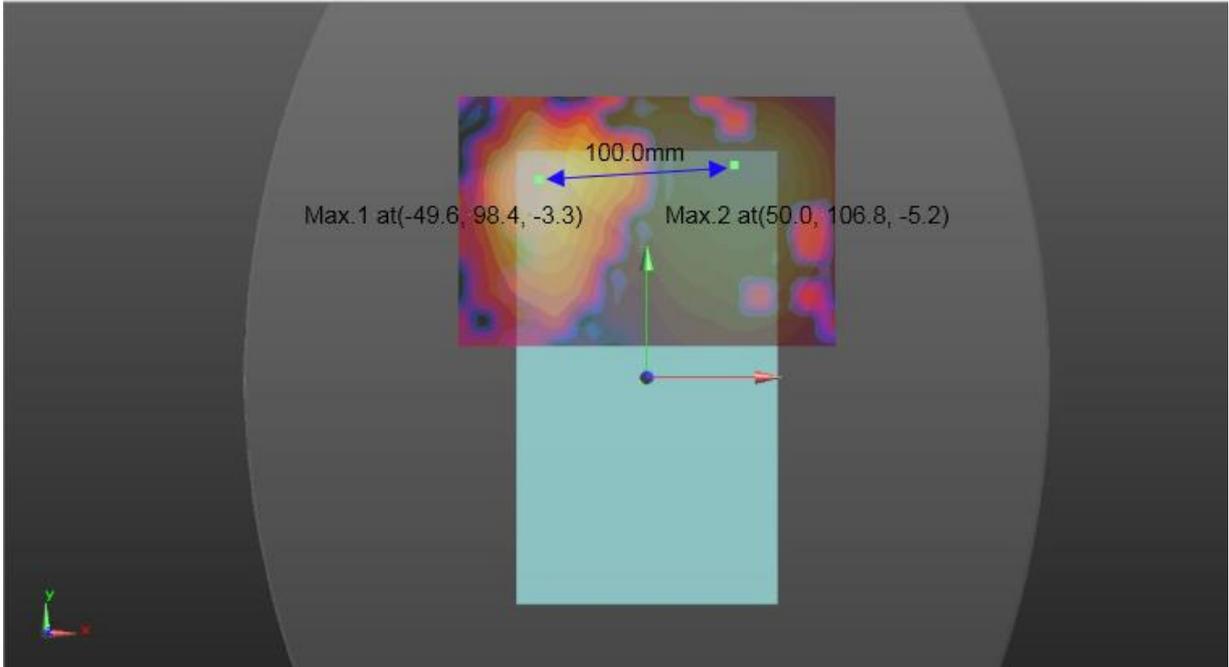


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
3	Body 0mm	Back side	UMTS B2	0.727	2.166	103.9	0.031	0.04	Not required
			WiFi 2.4G	1.439					

- 4) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with UMTS Band V and WiFi 2.4G.

The Peak SAR location plot is as below:

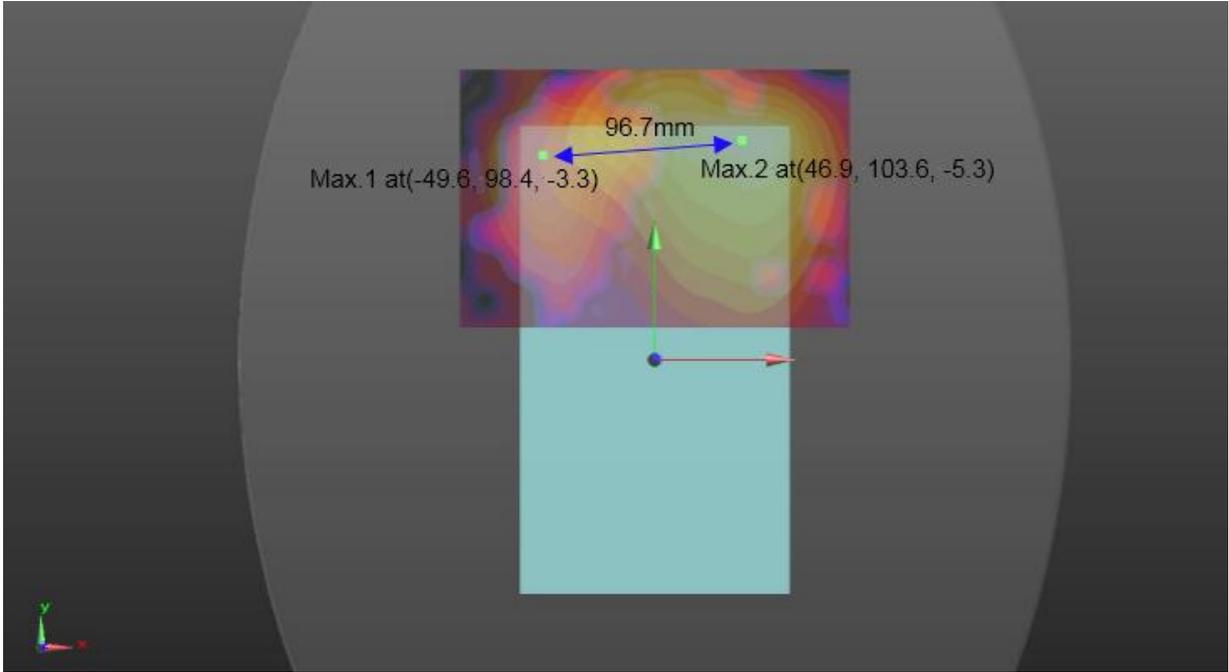


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
4	Body 0mm	Back side	UMTS B5	0.587	2.026	100.0	0.029	0.04	Not required
			WiFi 2.4G	1.439					

- 5) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band V and WiFi 2.4G.

The Peak SAR location plot is as below:

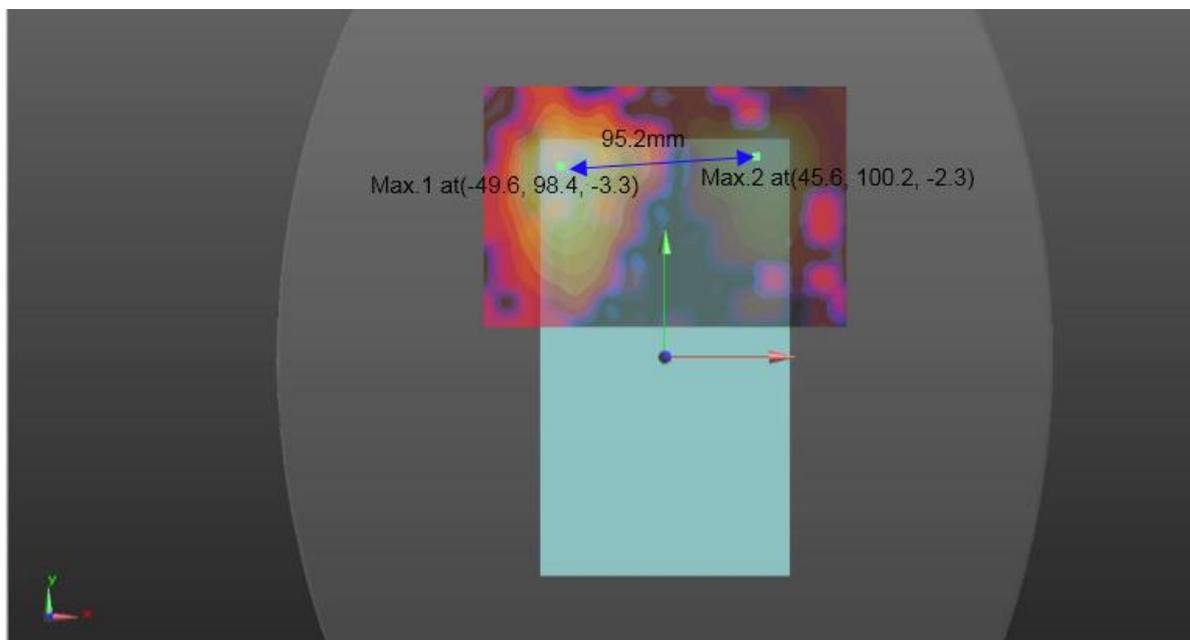


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
5	Body 0mm	Back side	LTE B5	0.584	2.023	96.7	0.030	0.04	Not required
			WiFi 2.4G	1.439					

- 6) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band VII and WiFi 2.4G.

The Peak SAR location plot is as below:

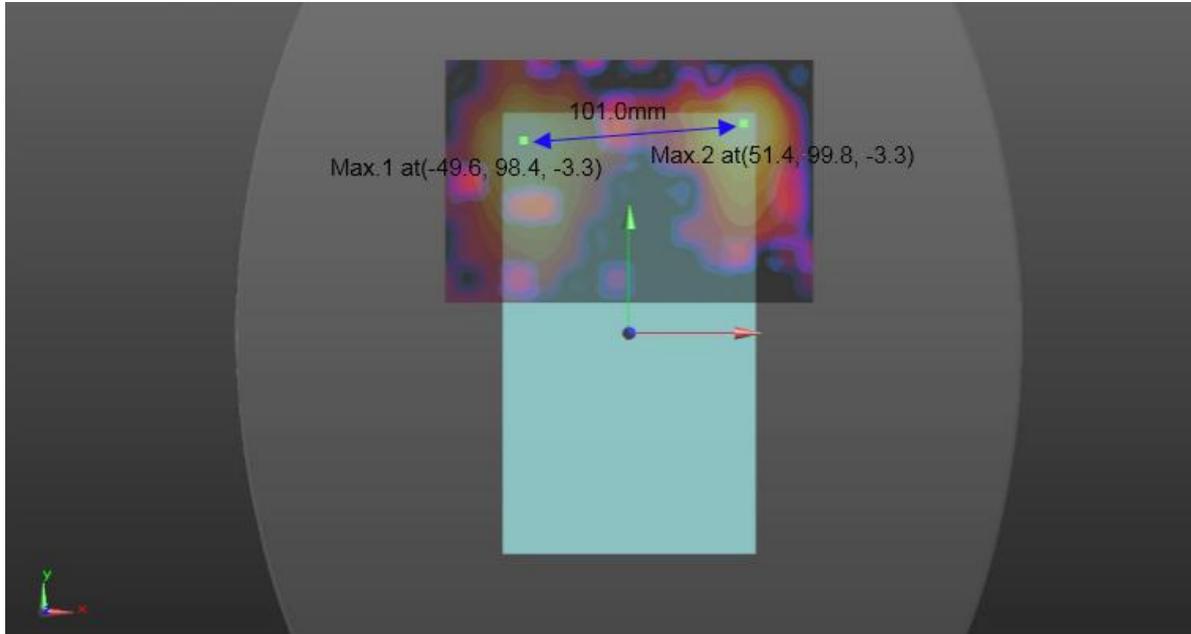


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
6	Body 0mm	Back side	LTE B7	0.723	2.162	95.2	0.033	0.04	Not required
			WiFi 2.4G	1.439					

- 7) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band XXXVIII and WiFi 2.4G.

The Peak SAR location plot is as below:

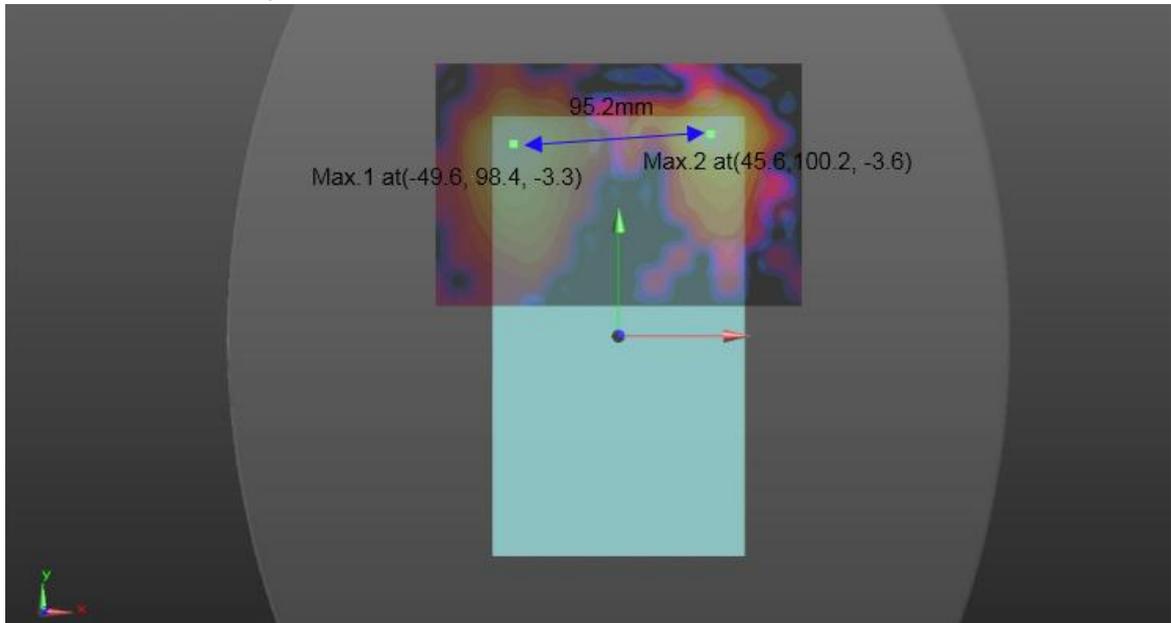


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
7	Body 0mm	Back side	LTE B38	0.764	2.203	101.0	0.032	0.04	Not required
			WiFi 2.4G	1.439					

- 8) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band XLI and WiFi 2.4G.

The Peak SAR location plot is as below:

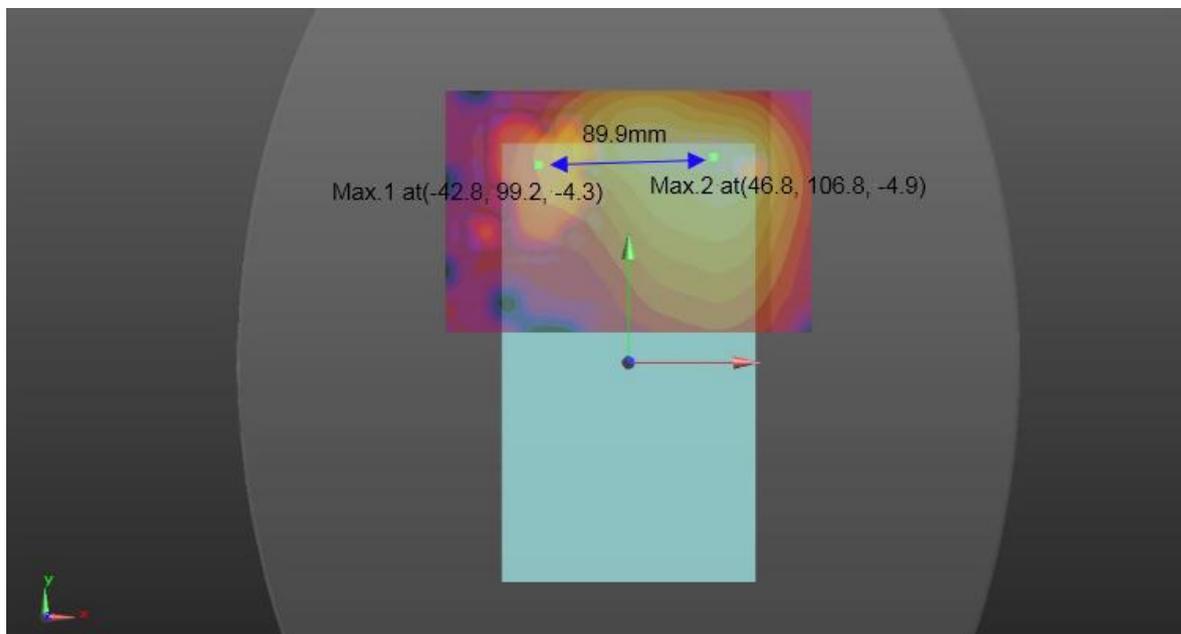


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
8	Body 0mm	Back side	LTE B41	0.778	2.217	95.2	0.035	0.04	Not required
			WiFi 2.4G	1.439					

9) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with GSM850 and WiFi 5G.

The Peak SAR location plot is as below:

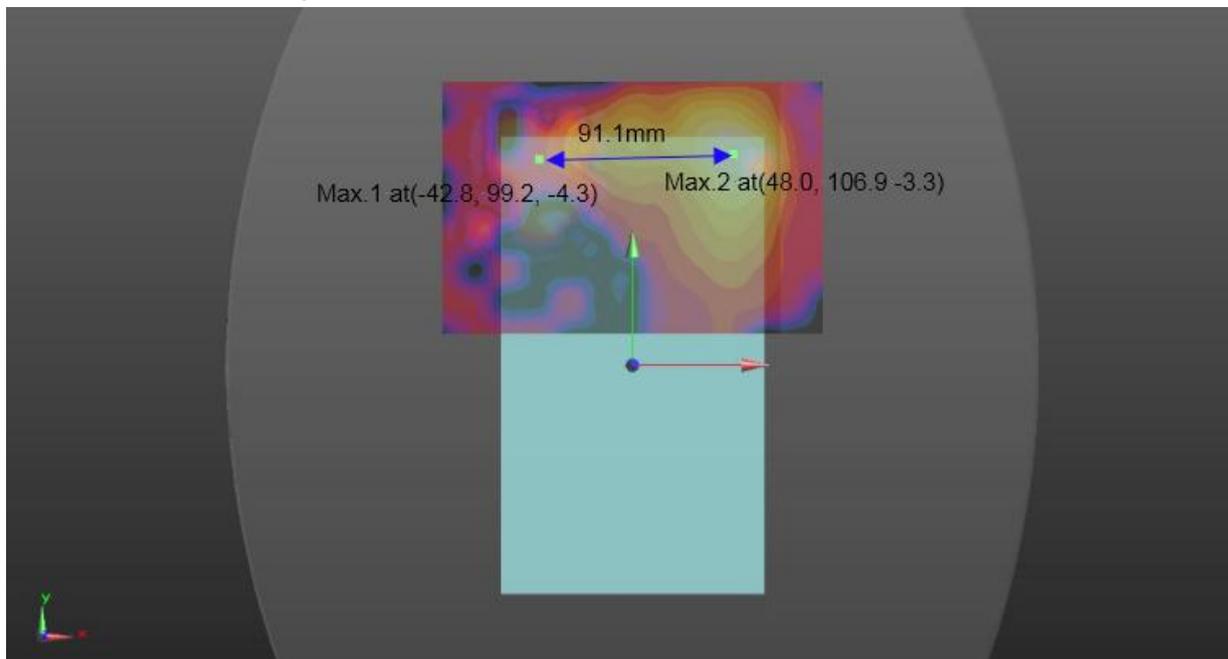


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
9	Body 0mm	Back side	GSM850	0.620	1.809	89.9	0.027	0.04	Not required
			WiFi 5G	1.189					

10) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with GSM1900 and WiFi 5G.

The Peak SAR location plot is as below:

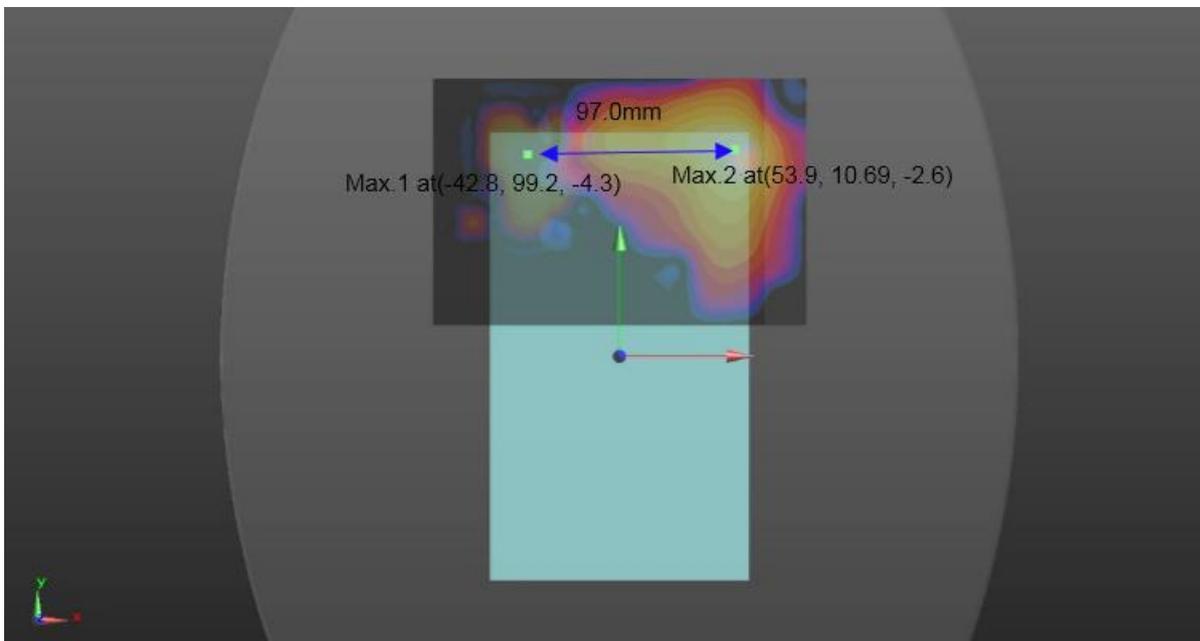


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
10	Body 0mm	Back side	GSM1900	0.797	1.986	91.1	0.031	0.04	Not required
			WiFi 5G	1.189					

11) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with UMTS Band II and WiFi 5G.

The Peak SAR location plot is as below:

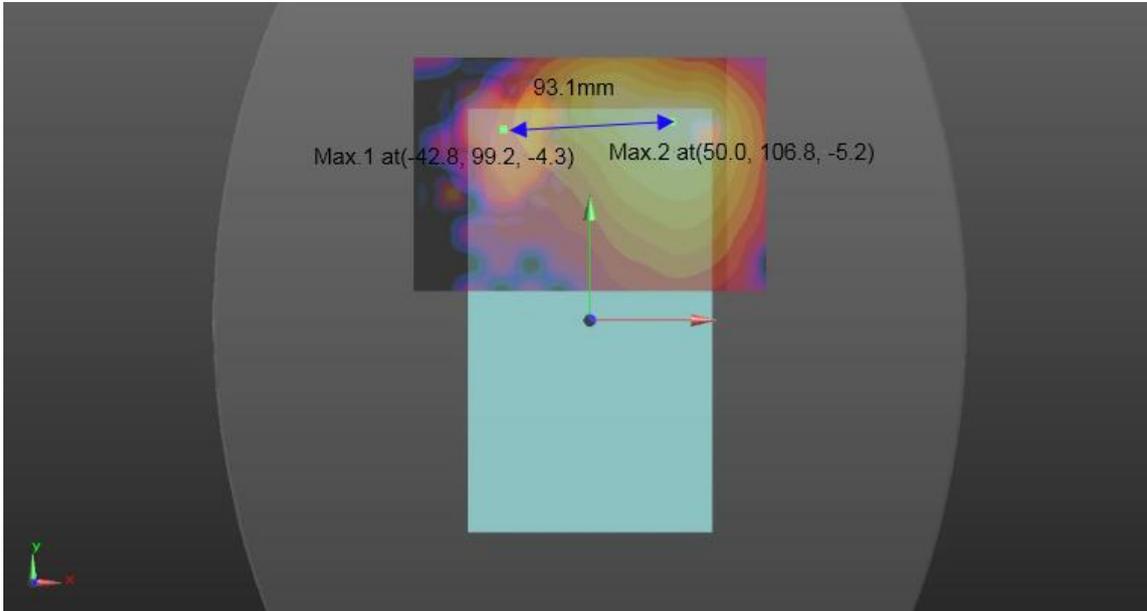


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
11	Body 0mm	Back side	UMTS B2	0.727	1.916	97.0	0.027	0.04	Not required
			WiFi 5G	1.189					

12) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with UMTS Band V and WiFi 5G.

The Peak SAR location plot is as below:

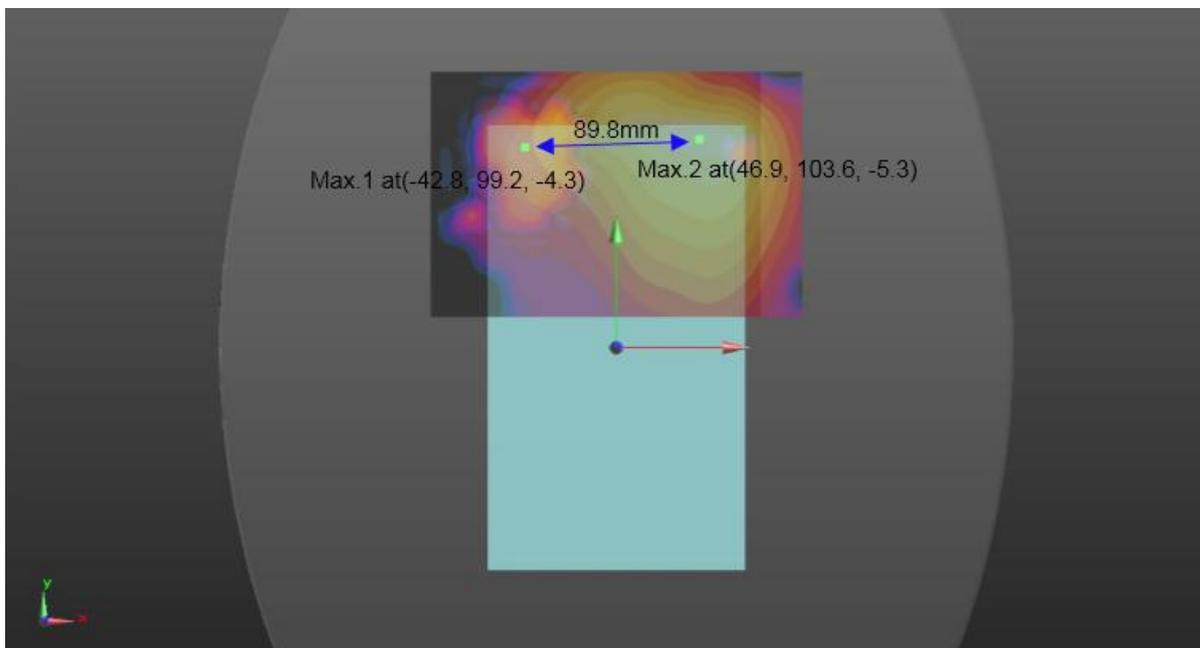


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
12	Body 0mm	Back side	UMTS B5	0.587	1.776	93.1	0.025	0.04	Not required
			WiFi 5G	1.189					

13) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band V and WiFi 5G.

The Peak SAR location plot is as below:

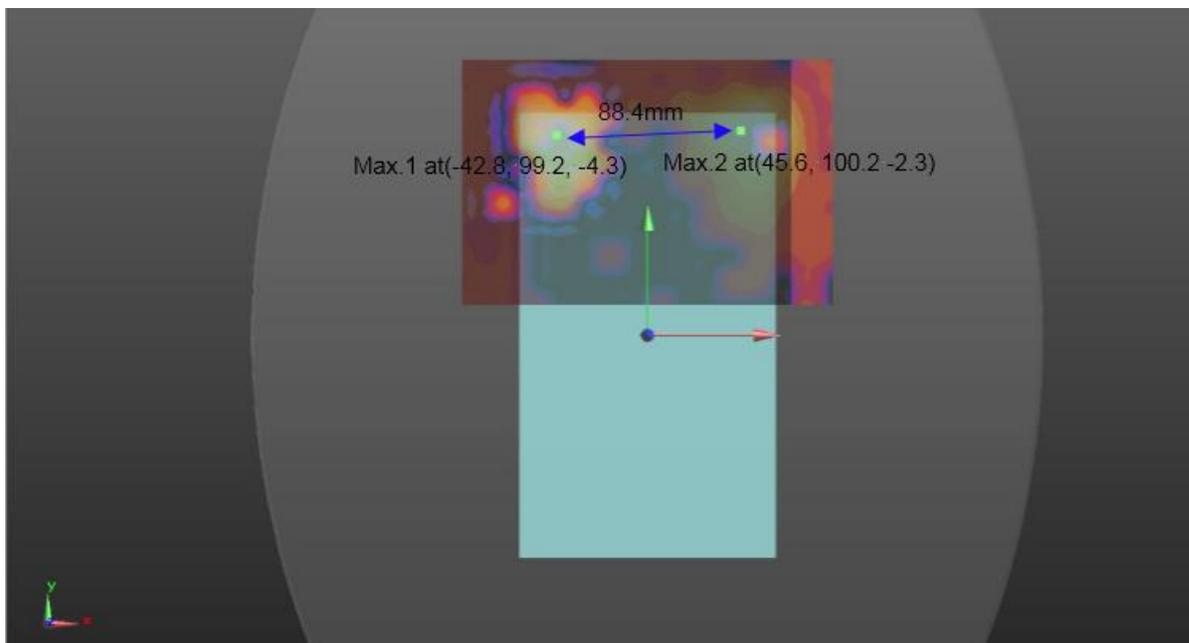


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
13	Body 0mm	Back side	LTE B5	0.584	1.773	89.8	0.026	0.04	Not required
			WiFi 5G	1.189					

14) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band VII and WiFi 5G.

The Peak SAR location plot is as below:

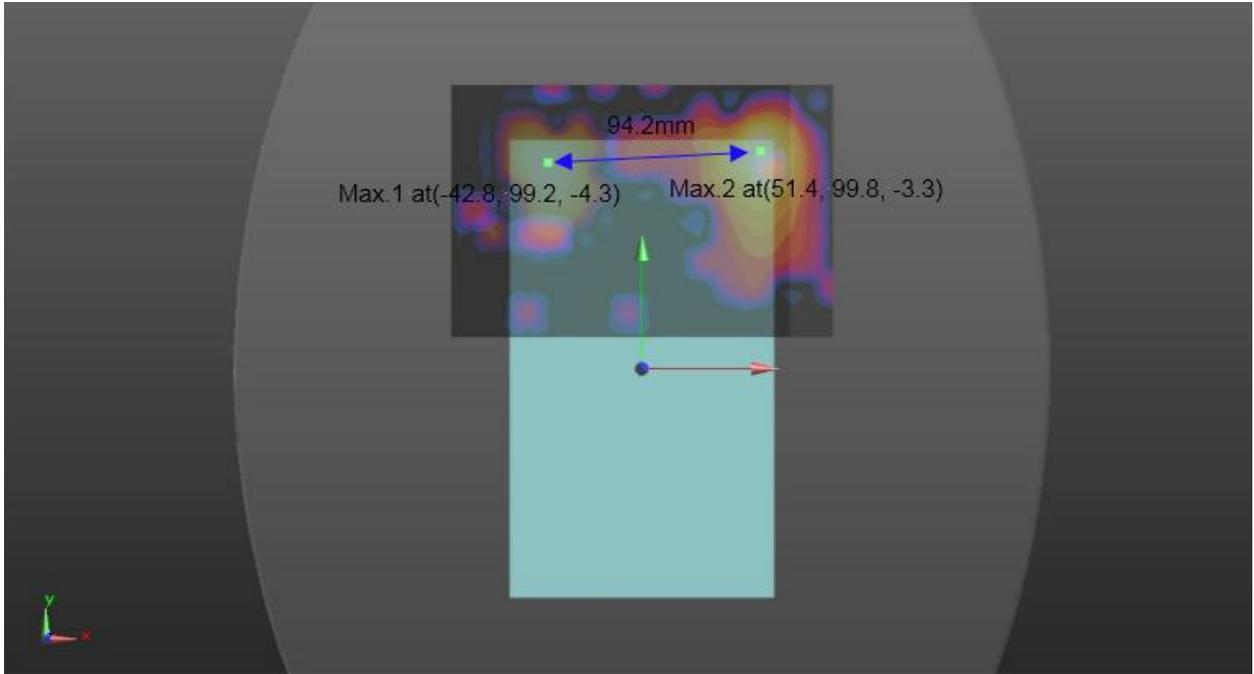


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
14	Body 0mm	Back side	LTE B7	0.723	1.912	88.4	0.030	0.04	Not required
			WiFi 5G	1.189					

15) The sum of aggregate 1-g SAR was above 1.6W/kg for Back side configuration with LTE Band XXXVIII and WiFi 5G.

The Peak SAR location plot is as below:

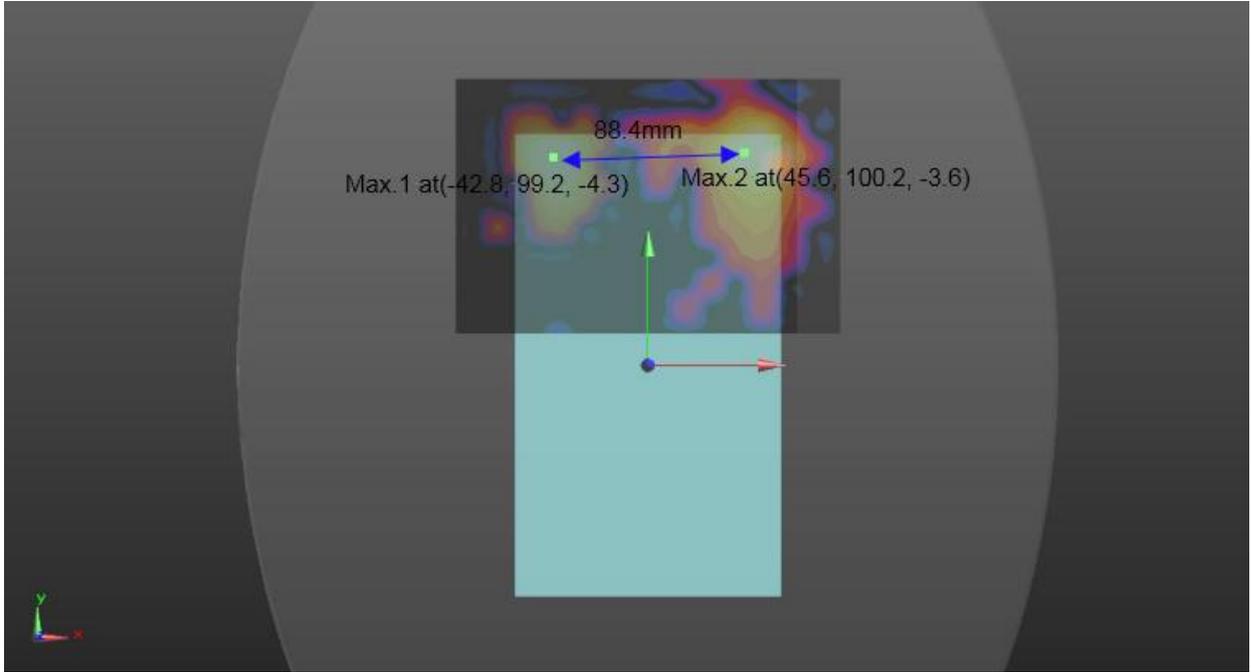


The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
15	Body 0mm	Back side	LTE B38	0.764	1.953	94.2	0.029	0.04	Not required
			WiFi 5G	1.189					

16) The sum of aggregate 1-g SAR was above 1.6W/Kg for Back side configuration with LTE Band XLI and WiFi 5G.

The Peak SAR location plot is as below:



The SAR to peak location ratio calculation is as below:

Case No.	Exposure Condition	Test Position	Band	MAX Scaled SAR (W/kg)	Σ SAR (W/kg)	Ri(mm)	SPLSR	Ratio Limit	Volum scan Simultaneous SAR
16	Body 0mm	Back side	LTE B41	0.778	1.967	88.4	0.031	0.04	Not required
			WiFi 5G	1.189					

7.3.3 Simultaneous Transmission Conclusion

The above numeral summed SAR results and 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 D01

Appendix A. System Check Plots

(Pls See Appendix No.: SYBH(Z-SAR)023072016-2A, total: 10 pages)

Appendix B. SAR Measurement Plots

(Pls See Appendix No.: SYBH(Z-SAR)023072016-2B, total: 14 pages)

Appendix C. Calibration Certificate

(Pls See Appendix No.: SYBH(Z-SAR)023072016-2C, total: 74 pages)

Appendix D. Photo documentation

(Pls See Appendix No.: SYBH(Z-SAR)024072016-2D, total: 5 pages)

End