FCC SAR Compliance Test Report

Product Name:	Mobile WiFi
Model:	505HW
Report No.:	SYBH(Z-SAR)005102015-2
FCC ID:	QIS505HW

	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	Wei Huanbin	Li wei
DATE	2016-01-18	2016-01-18

Reliability Laboratory 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.

3. The laboratory (Reliability Lab of Huawei Technologies Co., Ltd) is also named as “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.

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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.

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2016-01-18	Li Wei

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for 505HW is as below Table 1.

Band	Position	Max Reported 1-g SAR SAR(W/kg)
UMTS Band II	Back side 10mm	1.27
UMTS Band IV	Back side 10mm	0.98
LTE Band II	Back side 10mm	**1.41**
LTE Band IV	Back side 10mm	1.33
LTE Band XXV	Back side 10mm	1.35
LTE Band XXVI	Back side 10mm	1.37
LTE Band XLI	Front side 10mm	0.41
WiFi 2.4G	Front side 10mm	0.13
WiFi 5G	Top side 10mm	0.15
The highest simultaneous SAR value is 1.56 W/kg per KDB690783 D01		

Table 1:Summary of test result

Note:

The device is in compliance with Specific Absorption Rate(SAR)for general population/uncontraolled exposure limits according to the FCC rule §2.1093, the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013

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:	Mobile WiFi		
Model:	505HW		
FCC ID :	QIS505HW		
IMEI:	869047020001849		
Device Type :	Portable device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment / general population		
Hardware Version :	CL1SB03MU		
Software Version :	21.270.11.01.643		
Antenna Type :	Internal antenna		
Device Operating Configurations:			
Supporting Mode(s)	UMTS Band II/IV, LTE Band II/IV/XXV/XXVI/XLI, WiFi 2.4G/5G(Tested);		
Test Modulation	UMTS(QPSK),LTE(QPSK/16QAM),WiFi(DSSS/OFDM)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	UMTS Band II	1850-1910	1930-1990
	UMTS Band IV	1710-1755	2110-2155
	LTE Band II	1850 -1910	1930 -1990
	LTE Band IV	1710 -1755	2110 -2155
	LTE Band XXV	1850-1915	1930-1995
	LTE Band XXVI	814-849	859-894
	LTE Band XLI	2496-2690	2496-2690
	WiFi 2.4G	2400-2483.5	
	WiFi 5G	5170-5250 5250-5330 5490-5710 5735-5835	
HSDPA UE Category	14		
HSUPA UE Category	6		
DC-HSDPA UE Category	24		
Power Class:	3, tested with power control “all 1”(UMTS Band II)		
	3, tested with power control “all 1”(UMTS Band IV)		
	3, tested with power control all Max.(LTE Band II)		
	3, tested with power control all Max.(LTE Band IV)		
	3, tested with power control all Max.(LTE Band XXV)		
	3, tested with power control all Max.(LTE Band XXVI)		
	3, tested with power control all Max.(LTE Band XLI)		

Test Channels (low-mid-high):	9262-9400-9538(UMTS Band II)
	1312-1413-1513(UMTS Band IV)
	18607-18900-19193(LTE Band II BW=1.4MHz)
	18615-18900-19185(LTE Band II BW=3MHz)
	18625-18900-19175(LTE Band II BW=5MHz)
	18650-18900-19150(LTE Band II BW=10MHz)
	18675-18900-19125(LTE Band II BW=15MHz)
	18700-18900-19100(LTE Band II BW=20MHz)
	19957-20175-20393(LTE Band IV BW=1.4MHz)
	19965-20175-20385(LTE Band IV BW=3MHz)
	19975-20175-20375(LTE Band IV BW=5MHz)
	20000-20175-20350(LTE Band IV BW=10MHz)
	20025-20175-20325(LTE Band IV BW=15MHz)
	20050-20175-20300(LTE Band IV BW=20MHz)
	26047-26365-26683(LTE Band XXV BW=1.4MHz)
	26055-26365-26675(LTE Band XXV BW=3MHz)
	26065-26365-26665(LTE Band XXV BW=5MHz)
	26090-26365-26640(LTE Band XXV BW=10MHz)
	26115-26365-26615(LTE Band XXV BW=15MHz)
	26140-26365-26590(LTE Band XXV BW=20MHz)
	26697-26865-27033(LTE Band XXVI BW=1.4MHz)
	26705-26865-27025(LTE Band XXVI BW=3MHz)
	26715-26865-27015(LTE Band XXVI BW=5MHz)
	26750-26865-26990(LTE Band XXVI BW=10MHz)
	26775-26865-26965(LTE Band XXVI BW=15MHz)
	39675-40148-40620-41093-41565(LTE Band XLI BW=5MHz)
	39700-40160-40620-41080-41540(LTE Band XLI BW=10MHz)
	39725-40173-40620-41068-41515(LTE Band XLI BW=15MHz)
	39750-40185-40620-41055-41490(LTE Band XLI BW=20MHz)
	802.11b/g/n 20M: 1-6-11 (WiFi 2.4G) 802.11n 40M: 3-6-9 (WiFi 2.4G)
	802.11a/n 20M: 36-40-44-48-52-56-60-64-100-104-108-112-116-120-124-128-132-136-140-149-153-157-161-165 802.11n/ac 40M: 38-46-54-62-102-110-118-126-134-142-151-159 802.11ac 80M: 42-58-106-122-138-155 (WiFi 5G)

Table 3:Device information and operating configuration

1.3.1 General Description

505HW which supports LTE B1,B2,B3,B4,B8,B25,B26,B41 ,B1+B8 CA , B41+B41 CA, and DC-HSDPA/HSPA+/HSDPA/HSUPA/WCDMA B1,B2,B4,B8 is subscriber equipment in the LTE/WCDMA system. 505HW implement such functions as RF signal receiving/ transmitting, LTE/WCDMA protocol processing, data service etc, and it can act as a Wi-Fi hotspot for user accessing to internet. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface.

Battery information:

Name	Manufacture	Serials number	Description
Rechargeable Li-ion	Huawei Technologies Co., Ltd.	SAIFA22X00000763	Battery Model: HWBBP1(HWBBN1) Rated capacity: 3000mAh Nominal Voltage: ⎓ +3.8V Charging Voltage: ⎓ +4.35V

1.3.2 TDD LTE specification

The device supports TDD LTE bands. According to KDB 941225 D05 SAR for LTE Devices v02r05, 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.
For this device, TDD LTE SAR should be tested with the highest transmission duty factor (63.33%) , which using Uplink-downlink configuration 0.The detailed TDD LTE test configuration description are provided in Section 6 of this report.

1.3.3 Downlink LTE CA specification

The device supports Rel. 10 downlink only LTE Carrier Aggregation and certain network enhancement features (UE Category: cat 11). It supports a maximum of 2 carriers in the downlink. Other Release 10 or higher features are not supported, including Uplink Carrier Aggregation, Enhanced SC-FDMA and Uplink MIMO or other antenna diversity configurations etc.

The possible downlink LTE CA combinations supported by this device are as below tables per 3GPP TS 36.101 V12.8.0. The detailed conducted power measurement results of downlink LTE CA are provided in Section 7 of the SAR report per 3GPP TS 36.521-1 V12.6.0. According to KDB 941225 D05A, the downlink only carrier aggregation conditions for this device can be excluded from SAR testing and PAG requirements..

intra-band contiguous CA (per 3GPP TS 36.101 V12.8.0 Table 5.6A.1-1)

E-UTRA CA configuration	Component carriers in order of increasing carrier frequency		Maximum aggregated bandwidth [MHz]	Bandwidth combination set
	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]		
CA_41C	10	20	40	0
	15	15, 20		
	20	10, 15, 20		

intra-band non-contiguous CA(per 3GPP TS 36.101 V12.8.0 Table 5.6A.1-3)

E-UTRA CA configuration	Component carriers in order of increasing carrier frequency		Maximum aggregated bandwidth [MHz]	Bandwidth combination set
	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]		
CA_41A-41A	10, 15, 20	10, 15, 20	40	0

Table: Test frequencies for CA_41C

Range	CC-Combo / N_{RB_agg} [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]	BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]
Low	50+100	50	39705	2501.5	100	39849	2515.9
		100	39750	2506	50	39894	2520.4
	75+75	75	39725	2503.5	75	39875	2518.5
	75+100	75	39728	2503.8	100	39899	2520.9
		100	39750	2506	75	39921	2523.1
	100+100	100	39750	2506	100	39948	2525.8
Mid	50+100	50	40526	2583.6	100	40670	2598.0
		100	40571	2588.1	50	40715	2602.5
	75+75	75	40545	2585.5	75	40695	2600.5
	75+100	75	40523	2583.3	100	40694	2600.4
		100	40546	2585.6	75	40717	2602.7
	100+100	100	40521	2583.1	100	40719	2602.9
High	50+100	50	41346	2665.6	100	41490	2680
		100	41391	2670.1	50	41535	2684.5
	75+75	75	41365	2667.5	75	41515	2682.5
	75+100	75	41319	2662.9	100	41490	2680
		100	41341	2665.1	75	41512	2682.2
	100+100	100	41292	2660.2	100	41490	2680
Note 1: Carriers in increasing frequency order.							

Range	CC-Combo / N_{RB_agg} [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]	BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]
Low-Mid	50+100	50	40116	2542.6	100	40260	2557
		100	40161	2547.1	50	40305	2561.5
	75+75	75	40135	2544.5	75	40285	2559.5
	75+100	75	40126	2543.6	100	40297	2560.7
		100	40148	2545.8	75	40319	2562.9
	100+100	100	40136	2544.6	100	40334	2564.4
Mid	50+100	50	40526	2583.6	100	40670	2598.0
		100	40571	2588.1	50	40715	2602.5
	75+75	75	40545	2585.5	75	40695	2600.5
	75+100	75	40523	2583.3	100	40694	2600.4
		100	40546	2585.6	75	40717	2602.7
	100+100	100	40521	2583.1	100	40719	2602.9
Mid-High	50+100	50	40936	2624.6	100	41080	2639
		100	40981	2629.1	50	41125	2643.5
	75+75	75	40955	2626.5	75	41105	2641.5
	75+100	75	40921	2623.1	100	41092	2640.2
		100	40944	2625.4	75	41115	2642.5
	100+100	100	40907	2621.7	100	41105	2641.5
Note 1: Carriers in increasing frequency order.							

Table: Test frequencies for CA_41A-41A

Range	CC-Combo / N_{RB_agg} [RB]	CC1 Note1			Wgap [MHz]	CC2 Note1		
		BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]		BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]
N/A	25+25	25	39675	2498.5	184	25	41565	2687.5
	25+50	25	39675	2498.5	179	50	41540	2685
		50	39700	2501	179	25	41565	2687.5
	25+75	25	39675	2498.5	174	75	41515	2682.5
		75	39725	2503.5	174	25	41565	2687.5
	50+50	50	39700	2501	174	50	41540	2685
	25+100	25	39675	2498.5	169	100	41490	2680
		100	39750	2506	169	25	41565	2687.5
	50+75	50	39700	2501	169	75	41515	2682.5
		75	39725	2503.5	169	50	41540	2685
	50+100	50	39700	2501	164	100	41490	2680
		100	39750	2506	164	50	41540	2685
	75+75	75	39725	2503.5	164	75	41515	2682.5
	75+100	75	39725	2503.5	159	100	41490	2680
		100	39750	2506	159	75	41515	2682.5
	100+100	100	39750	2506	154	100	41490	2680
Note 1: Carriers in increasing frequency order.								

Note:
1) All the listed bands above can be used as PCC or SCC.
2) The channel spacing and aggregated channel bandwidth for CA are identical to the associated specification in 3GPP TS 36.101 V12.8.0.
3) The reference test frequencies for CA refers to 3GPP TS 36.508 V12.5.0.

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
KDB941225 D01	3G SAR Procedures v03r01
KDB941225 D05	SAR for LTE Devices v02r05
KDB941225 D05A	LTE Rel.10 KDB Inquiry Sheet v01r02
KDB941225 D06	Hotspot SAR v02r01
KDB447498 D01	General RF Exposure Guidance v06
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

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

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

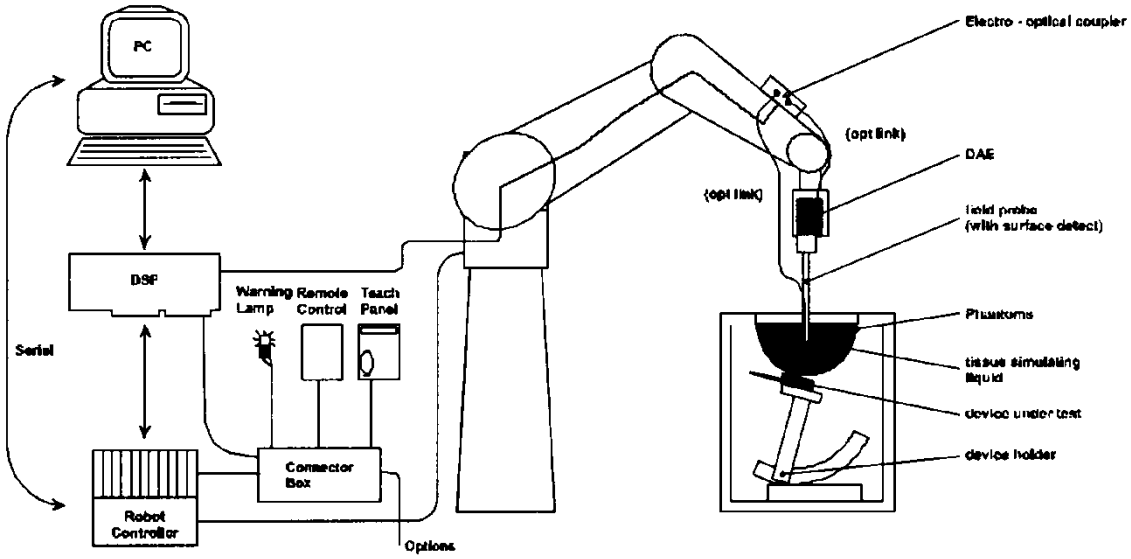
Start Date of test	2015-12-29
End Date of test	2016-01-06

1.8 Ambient Condition

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

2 SAR Measurement System

2.1 SAR Measurement Set-up



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

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

- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 7.
- DASY5 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System check dipoles allowing to validate the proper functioning of the system.

2.2 Test environment

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

2.3 Data Acquisition Electronics description

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

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

DAE4

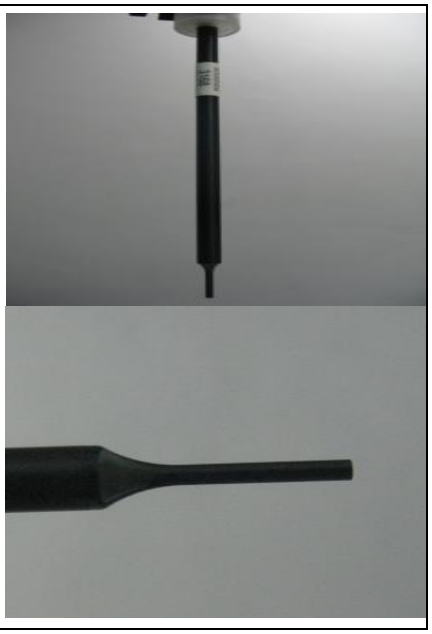
Input Impedance	200MOhm	
The Inputs	symmetrical and floating	
Common mode rejection	above 80 dB	

2.4 Probe description

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

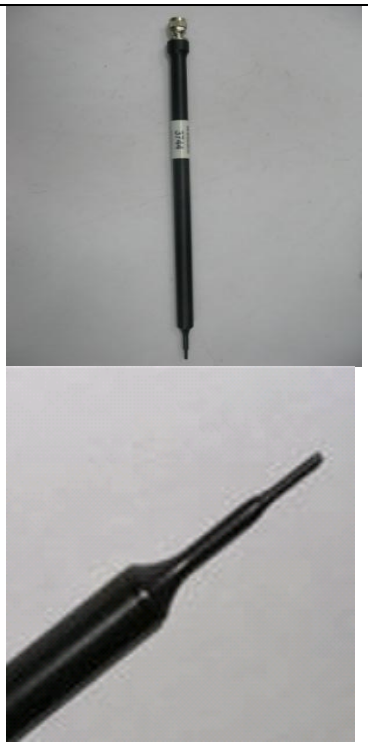
Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

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



Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic range	10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB(noise:typically<1µW/g)
Dimensions	Overall length: 337 mm (Tip:20 mm) Tip diameter:2.5 mm (Body:12 mm) Typical distance from probe tip to dipole centers: 1mm
Application	High precision dosimetric measurements in any exposure scenario(e.g.,very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%

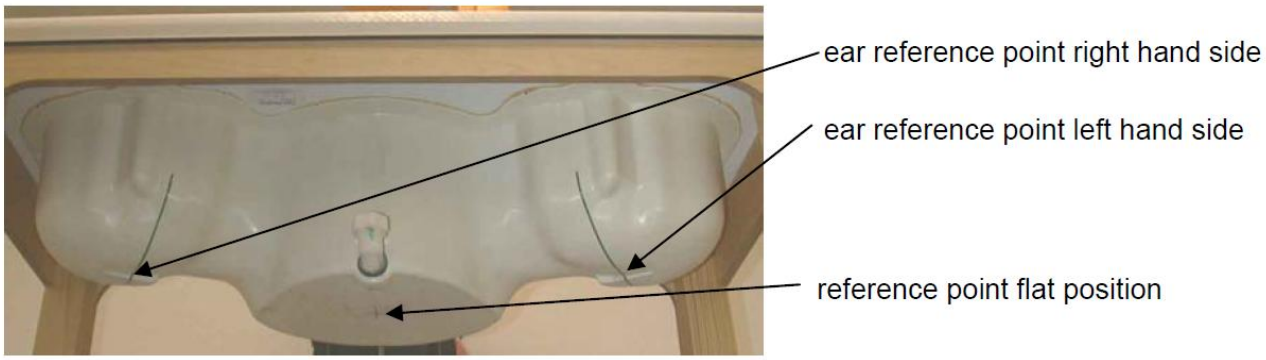


2.5 Phantom description

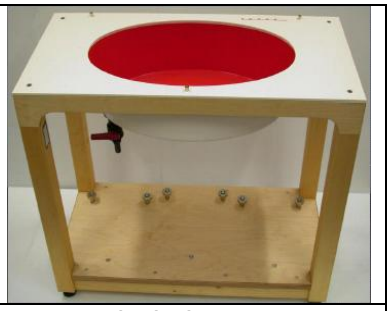
SAM Twin Phantom

Shell Thickness	2mm±0.2mm;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 $2 \leq \varepsilon r \leq 5$ at ≤3 GHz,$3 \leq \varepsilon r \leq 4$ at >3 GHz and and a loss tangent ⩽0.05.

2.6 Device holder description

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

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

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

2.7 Test Equipment List

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

	Manufacturer	Device	Type	Serial number	Date of last calibration*	Valid period
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3744	2015-07-24	One year
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2015-04-30	One year
☐	SPEAG	750MHz Dipole	D750V3	1044	2015-09-14	Three years
☒	SPEAG	835MHz Dipole	D835V2	4d059	2013-05-02	Three years
☒	SPEAG	1750MHz Dipole	D1750V2	1123	2014-07-08	Three years
☒	SPEAG	1900MHz Dipole	D1900V2	5d143	2014-09-23	Three years
☐	SPEAG	2300MHz Dipole	D2300V2	1016	2014-11-19	Three years
☒	SPEAG	2450MHz Dipole	D2450V2	869	2015-06-19	Three years
☒	SPEAG	2600MHz Dipole	D2600V2	1021	2015-07-24	Three years
☒	SPEAG	5GHz Dipole	D5GHzV2	1155	2015-04-27	Three years
☒	SPEAG	Data acquisition electronics	DAE4	852	2015-04-27	One year
☒	SPEAG	Software	DASY 5	N/A	NCR	NCR
☐	SPEAG	Twin Phantom	SAM1	TP-1475	NCR	NCR
☐	SPEAG	Twin Phantom	SAM2	TP-1474	NCR	NCR
☒	SPEAG	Twin Phantom	SAM3	TP-1597	NCR	NCR
☒	SPEAG	Twin Phantom	SAM4	TP-1620	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1038	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	NCR	NCR
☒	R & S	Universal Radio Communication Tester	CMU 200	113989	2015-05-18	One year
☒	R & S	Universal Radio Communication Tester	CMW 500	126855	2015-07-02	One year
☒	Agilent	Network Analyser	E5071C	MY46213349	2015-02-13	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
☒	Agilent	Signal Generator	N5181A	MY50145341	2015-10-30	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	NCR	NCR
☒	MINI-CIRCUITS	Amplifier	ZVE-8G+	N523101139	NCR	NCR
☒	AR	Directional Coupler	DC7144M1	0423264	2015-03-31	One year
☒	Agilent	Dual Directional Coupler	772D	MY52180173	2015-01-08	One year
☒	R & S	Power Meter	NRP	100740	2015-07-02	One year
☒	R & S	Power Meter Sensor	NRP-Z11	106288	2015-07-02	One year
☒	Agilent	Power Meter	E4417A	MY54100027	2015-03-31	One year
☒	Agilent	Power Meter Sensor	E9321A	MY54130001	2015-05-05	One year
☒	Agilent	Power Meter Sensor	E9321A	MY54130007	2015-05-05	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) * These equipments are within the calibration period when test is perfromed.

3 SAR Measurement Procedure

3.1 Scanning procedure

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

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

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

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

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

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

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

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

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 compansate boundary effects on E-field probes.

3.3 Data Storage and Evaluation

Data Storage

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

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

Data Evaluation by SEMCAD

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

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

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

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

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

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

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

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

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

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

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

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

ConvF = sensitivity enhancement in solution

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

f = carrier frequency [GHz]

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

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

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

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

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

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

with SAR = local specific absorption rate in mW/g

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

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

ρ = equivalent tissue density in g/cm^3

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

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

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

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

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

4 System Verification Procedure

4.1 Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 5% of the target values.

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

Ingredients (% of weight)	**Head Tissue**						
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**						
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, 16MΩ+ resistivity
HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

☐**Simulating 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		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
835B	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.46	0.985	21.5°C	2016-01-06
	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.37	0.994		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	54.24	1.009		
1750B	1710	53.5 (50.83~56.18)	1.46 (1.39~1.53)	51.99	1.412	21.8°C	2016-01-03
	1730	53.5 (50.83~56.18)	1.48 (1.41~1.55)	51.86	1.436		
	1750	53.4 (50.73~56.07)	1.49 (1.42~1.56)	51.81	1.462		
	1800	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.63	1.521		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.67	1.493	21.4°C	2015-12-31
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.58	1.532		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.50	1.552		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.46	1.561		
1900B	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.25	1.449	21.3°C	2016-01-05
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.17	1.469		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.12	1.488		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.09	1.498		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	51.72	1.902	21.4°C	2015-12-29
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	51.64	1.953		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.67	1.980		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.66	1.989		

2600B	2510	52.62 (49.99~55.25)	2.03 (1.93~2.13)	51.05	2.072	21.6°C	2016-01-05
	2535	52.59 (49.96~55.22)	2.07 (1.97~2.17)	50.96	2.105		
	2560	52.57 (49.94~55.20)	2.09 (1.99~2.19)	50.88	2.141		
	2600	52.5 (49.88~55.13)	2.16 (2.05~2.27)	50.75	2.196		
5G B	5300	48.9 (46.46~51.35)	5.42 (5.15~5.69)	49.30	5.463	21.4°C	2015-12-30
	5600	48.50 (46.08~50.92)	5.77 (5.48~6.05)	47.82	5.924		
	5800	48.20 (45.79~50.61)	6.00 (5.70~6.30)	48.26	6.193		
ε_r= Relative permittivity, σ= Conductivity							

Table 5:Measured Tissue Parameter

Note: 1)The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2°C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

2)KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.

3)The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

4.2 System Check

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

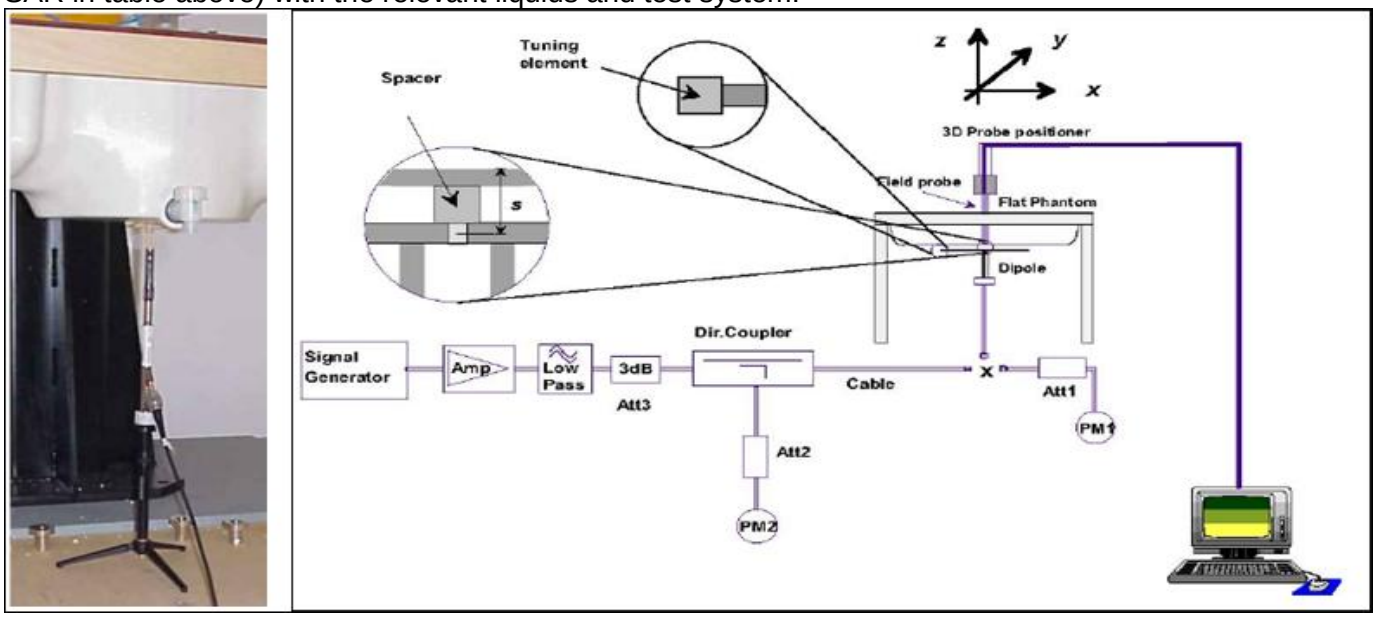
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
835MHz Body	9.42 (8.48~10.36)	6.19 (5.57~6.80)	10.00	6.52	21.5°C	2016-01-06
1750MHz Body	36.3 (32.67~39.93)	19.5 (17.55~21.45)	39.32	20.40	21.8°C	2016-01-03
1900MHz Body	40.20 (36.18~44.22)	21.30 (19.17~23.43)	42.40	22.04	21.4°C	2015-12-31
1900MHz Body	40.20 (36.18~44.22)	21.30 (19.17~23.43)	41.60	21.80	21.3°C	2016-01-05
2450MHz Body	52.40 (47.16~57.64)	24.70 (22.23~27.17)	53.20	24.52	21.4°C	2015-12-29
2600MHz Body	57.5 (51.75~63.25)	25.9 (23.31~28.49)	60.80	26.84	21.6°C	2016-01-05
5300MHz Body	75.0 (67.50~82.50)	21.0 (18.90~23.10)	81.30	22.50	21.4°C	2015-12-30
5600MHz Body	77.8 (70.02~85.58)	21.6 (19.44~23.76)	82.50	22.80	21.4°C	2015-12-30
5800MHz Body	76.2 (68.58~83.82)	21.0 (18.9~23.10)	72.50	20.20	21.4°C	2015-12-30

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 Wi-Fi and WWAN transmitters used for hotspot mode are usually built-in within the device, such as battery-operated personal wireless routers and wireless handsets.

Per FCC KDB 941225D06, The Body SAR test separation distance for hotspot mode is determined according to device form factor. When the overall length and width of a device is > 9 cm x 5 cm, a test separation distance of 10 mm is required for hotspot mode SAR measurements. A test separation distance of 5 mm or less is required for smaller devices. Hotspot mode SAR is measured for all edges and surfaces of the device with a transmitting antenna located within 25 mm from that surface or edge; for the data modes, wireless technologies and frequency bands supporting hotspot mode. The SAR results are used to determine simultaneous transmission SAR test exclusion for hotspot mode; otherwise, simultaneous transmission SAR measurement is required.

6.2 3G SAR Test Reduction Procedure

Per KDB941225 D01, 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 ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. 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 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 requied 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

a. Body SAR Measurements

SAR for body-worn 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 ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. 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 D01v03, the 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures for the highest reported SAR body exposure configuration in 12.2 kbps RMC.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the below table, β_{hs} for HS-DPCCH is set automatically to the correct value when ΔACK, ΔNACK, ΔCQI = 8. The variation of the β_c /β_d ratio causes a power reduction at sub-tests 2 - 4.

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

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

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

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

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 ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

Per KDB941225 D01v03, 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	β_{hs}(1)	β_{ec}	β_{ed}	β_{ec} (SF)	β_{ed} (code)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

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

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference

Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$

Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$

Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Table 10:Subtests for UMTS Release 6 HSUPA

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Speading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF4	22996	?
	4	4	10		20000	?
NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4.UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM.(TS25.306-7.3.0).						

Table 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.

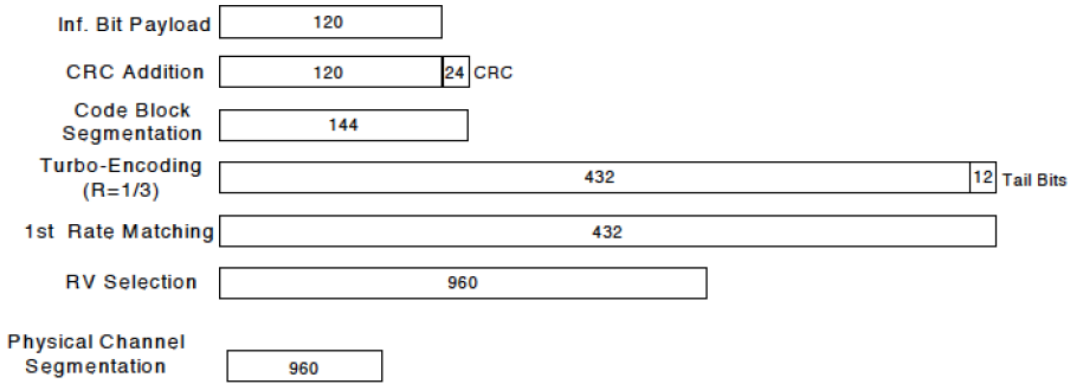


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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

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

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

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

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

Note:

1.The Dual Carriers transmission only applies to HSDPA physical channels

2.The Dual Carriers belong to the same Node and are on adjacent carriers.

3.The Dual Carriers do not support MIMO to serve UEs configured for dual cell operation

4.The Dual Carriers operate in the same frequency band .

5.The device doesn't support the modulation of 16QAM in uplink but 64QAM in downlink for DC-HSDPA mode.

6.The device doesn't support carrier aggregation for it just can operate in Release 8.

6.4 LTE Test Configuration

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02r04. 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 > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

B) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

5) TDD LTE test configuration

According to KDB 941225 D05 SAR for LTE Devices v02r03, 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 Band 41 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

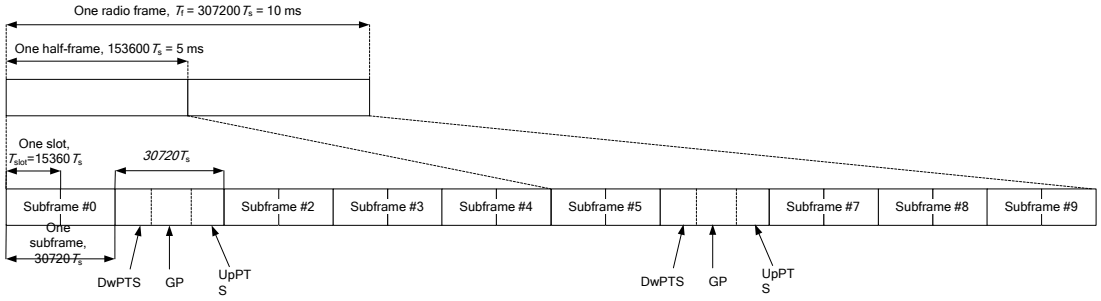


Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

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	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
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
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	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:

Duty cycle =(30720Ts*Ups+Uplink Component*Specials)/(307200Ts)

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

Uplink Component=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.

Duty cycle =[(30720Ts*Ups)+ UpPTS *Specials]/(307200Ts)

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.

6.5 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 RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227D01v02r02 are applied.

6.5.1 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 ≤ 0.4W/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 ≤ 0.8W/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.

6.5.2 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 248227D01v02). 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 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 ≤ 1.2 W/kg or all required channels are tested.

6.5.3 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 ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

6.5.4 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 248227D01v02) 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 248227D01v02r02). 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.

6.5.5 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.

6.5.6 MIMO SAR Considerations

Per KDB 248227D01v02, simultaneous transmission provisions in KDB Publication 447498 should be used to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1-g SAR single transmission SAR measurement is <1.6W/kg, no additional SAR measurements for MIMO are required. Alternatively,SAR for MIMO can be measured with all antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

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.

7.1.1 Conducted power measurements of UMTS Band IV

UMTS Band IV		Tune-up	Conducted Power (dBm)		
			1312CH	1413CH	1513CH
WCDMA	12.2kbps RMC	**23.5**	**23.04**	**23.11**	**23.00**
HSDPA	Subtest 1	23.5	22.99	23.09	23.01
	Subtest 2	23.5	22.58	22.66	22.57
	Subtest 3	23.0	22.09	22.18	22.05
	Subtest 4	23.0	22.07	22.17	21.99
HSUPA	Subtest 1	22.5	22.31	21.93	21.75
	Subtest 2	22.0	20.15	20.14	20.01
	Subtest 3	23.0	21.34	21.45	21.22
	Subtest 4	22.0	20.12	20.26	19.91
	Subtest 5	23.0	21.76	21.83	22.35
DC-HSDPA	Subtest 1	23.5	22.91	23.09	23.01
	Subtest 2	23.5	22.48	22.45	22.44
	Subtest 3	23.0	22.01	22.06	21.96
	Subtest 4	23.0	22.03	22.05	21.83

Table 13: Conducted power measurement results of UMTS Band IV

Note:

1) The conducted power of UMTS Band IV 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 ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of 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 II

UMTS Band II		Tune-up	Conducted Power (dBm)		
			9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	**23.5**	**23.13**	**22.89**	**22.88**
HSDPA	Subtest 1	23.5	23.15	23.04	23.01
	Subtest 2	23.5	22.74	22.60	22.60
	Subtest 3	23.0	22.27	22.13	22.00
	Subtest 4	23.0	22.26	22.10	21.99
HSUPA	Subtest 1	22.5	21.95	21.58	21.72
	Subtest 2	22.0	20.01	20.08	20.09
	Subtest 3	23.0	21.35	21.15	21.27
	Subtest 4	22.0	20.15	20.90	20.12
	Subtest 5	22.5	22.26	21.47	21.52
DC-HSDPA	Subtest 1	23.5	23.04	22.96	22.89
	Subtest 2	23.5	22.55	22.48	22.49
	Subtest 3	23.0	22.20	22.02	22.01
	Subtest 4	23.0	22.11	22.01	21.87

Table 14: 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 ≤ ¼ dB higher than the primary mode or when the highest *reported* SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

7.1.3 Conducted power measurements of LTE Band II

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					18607CH	18900CH	19193CH
1.4MHz	QPSK	1	0	23.0	21.61	22.34	22.15
		1	3	23.0	21.70	22.26	22.07
		1	5	23.0	21.65	22.15	21.93
		3	0	23.0	21.60	22.28	22.12
		3	2	23.0	21.67	22.22	22.02
		3	3	23.0	21.64	22.15	22.01
		6	0	22.5	20.72	21.26	21.10
	16QAM	1	0	22.7	20.73	21.48	21.25
		1	3	22.7	20.77	21.44	21.17
		1	5	22.7	20.73	21.29	21.11
		3	0	22.7	20.72	21.33	21.12
		3	2	22.7	20.77	21.37	21.03
		3	3	22.7	20.73	21.21	20.98
		6	0	21.7	20.65	21.23	21.00
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					18615CH	18900CH	19185CH
3MHz	QPSK	1	0	23.0	21.52	22.19	22.16
		1	7	23.0	21.77	22.32	22.12
		1	14	23.0	21.54	21.96	21.89
		8	0	22.5	20.70	21.34	21.18
		8	4	22.5	20.80	21.27	21.17
		8	7	22.5	20.71	21.13	21.02
		15	0	22.5	20.74	21.24	21.10
	16QAM	1	0	22.7	20.72	21.44	21.22
		1	7	22.7	20.93	21.50	21.25
		1	14	22.7	20.73	21.18	20.91
		8	0	21.7	20.69	21.30	21.12
		8	4	21.7	20.73	21.16	21.17
		8	7	21.7	20.65	21.02	21.02
		15	0	21.7	20.59	21.15	21.02

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					18625CH	18900CH	19175CH
5MHz	QPSK	1	0	23.0	21.67	22.49	22.50
		1	13	23.0	21.83	22.35	22.33
		1	24	23.0	21.89	22.21	22.08
		12	0	22.5	20.81	21.38	21.40
		12	6	22.5	20.88	21.39	21.30
		12	13	22.5	20.73	21.15	21.04
		25	0	22.5	20.82	21.26	21.32
	16QAM	1	0	22.7	20.86	21.70	21.57
		1	13	22.7	20.98	21.58	21.35
		1	24	22.7	21.11	21.42	21.22
		12	0	21.7	20.72	21.35	21.40
		12	6	21.7	20.86	21.35	21.28
		12	13	21.7	20.72	21.12	21.02
		25	0	21.7	20.73	21.18	21.28
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					18650CH	18900CH	19150CH
10MHz	QPSK	1	0	23.0	21.63	22.50	22.55
		1	25	23.0	21.86	22.36	22.59
		1	49	23.0	22.29	22.28	22.26
		25	0	22.5	20.72	21.44	21.54
		25	13	22.5	20.89	21.32	21.47
		25	25	22.5	20.85	21.08	21.36
		50	0	22.5	20.80	21.32	21.58
	16QAM	1	0	22.7	20.94	21.87	21.86
		1	25	22.7	21.33	21.70	21.89
		1	49	22.7	21.57	21.49	21.61
		25	0	21.7	20.62	21.36	21.52
		25	13	21.7	20.83	21.24	21.44
		25	25	21.7	20.73	20.99	21.36
		50	0	21.7	20.74	21.23	21.53

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					18675CH	18900CH	19125CH
15MHz	QPSK	1	0	23.0	21.57	22.53	22.13
		1	38	23.0	22.02	22.28	22.61
		1	74	23.0	22.45	21.92	22.01
		36	0	22.5	20.82	21.43	21.48
		36	18	22.5	21.07	21.37	21.58
		36	39	22.5	21.05	20.94	21.31
		75	0	22.5	21.02	21.16	21.45
	16QAM	1	0	22.7	20.76	21.84	21.41
		1	38	22.7	21.28	21.62	21.95
		1	74	22.7	21.61	21.20	21.35
		36	0	21.7	20.75	21.41	21.36
		36	18	21.7	20.92	21.34	21.47
		36	39	21.7	20.92	20.91	21.29
		75	0	21.7	20.87	21.10	21.32
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					18700CH	18900CH	19100CH
20MHz	QPSK	1	0	23.0	21.61	**22.54**	21.93
		1	50	23.0	22.28	22.38	**22.62**
		1	99	23.0	**22.91**	22.14	22.27
		50	0	22.5	20.82	**21.41**	21.08
		50	25	22.5	20.99	21.32	21.38
		50	50	22.5	**21.03**	20.80	**21.42**
		100	0	22.5	21.07	21.10	**21.17**
	16QAM	1	0	22.7	20.83	21.86	21.12
		1	50	22.7	21.52	21.72	21.87
		1	99	22.7	22.12	21.48	21.44
		50	0	21.7	20.71	21.34	21.04
		50	25	21.7	20.89	21.25	21.30
		50	50	21.7	20.94	20.74	21.37
		100	0	21.7	20.97	21.03	21.12

Table 15: Conducted power measurement results of LTE Band II

7.1.4 Conducted power measurements of LTE Band IV

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					19957CH	20175CH	20393CH
1.4MHz	QPSK	1	0	23.5	21.63	22.18	21.94
		1	3	23.5	21.62	22.17	21.79
		1	5	23.5	21.57	22.11	21.63
		3	0	23.0	21.59	22.21	21.95
		3	2	23.0	21.59	22.14	21.83
		3	3	23.0	21.54	22.13	21.71
		6	0	22.5	20.56	21.20	20.87
	16QAM	1	0	22.5	20.53	21.33	21.12
		1	3	22.5	20.57	21.37	21.00
		1	5	22.5	20.52	21.28	20.81
		3	0	22.5	20.54	21.29	21.05
		3	2	22.5	20.54	21.20	20.93
		3	3	22.5	20.51	21.25	20.81
		6	0	22.0	20.49	21.16	20.78
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					19965CH	20175CH	20385CH
3MHz	QPSK	1	0	23.5	21.52	22.06	22.01
		1	7	23.5	21.70	22.21	22.09
		1	14	23.5	21.52	21.96	21.53
		8	0	22.5	20.60	21.18	21.15
		8	4	22.5	20.65	21.18	21.05
		8	7	22.5	20.61	21.10	20.83
		15	0	22.5	20.61	21.14	21.01
	16QAM	1	0	22.5	20.53	21.26	21.20
		1	7	22.5	20.87	21.40	21.24
		1	14	22.5	20.56	21.08	20.62
		8	0	22.0	20.54	21.08	21.07
		8	4	22.0	20.58	21.08	20.97
		8	7	22.0	20.54	21.00	20.75
		15	0	22.0	20.56	21.08	20.92

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					19975CH	20175CH	20375CH
5MHz	QPSK	1	0	23.5	21.52	22.00	21.99
		1	13	23.5	21.80	22.18	22.19
		1	24	23.5	22.17	22.48	22.14
		12	0	22.5	20.66	21.27	21.19
		12	6	22.5	20.78	21.29	21.27
		12	13	22.5	20.67	21.10	20.90
		25	0	22.5	20.65	21.15	21.10
	16QAM	1	0	22.5	20.65	21.20	21.16
		1	13	22.5	21.03	21.36	21.37
		1	24	22.5	21.39	21.64	21.30
		12	0	22.0	20.60	21.21	21.13
		12	6	22.0	20.72	21.22	21.18
		12	13	22.0	20.61	21.05	20.83
		25	0	22.0	20.56	21.06	20.97
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20000CH	20175CH	20350CH
10MHz	QPSK	1	0	23.5	21.52	22.07	21.79
		1	25	23.5	22.61	22.98	22.93
		1	49	23.5	22.24	22.46	22.27
		25	0	22.5	20.73	21.24	21.08
		25	13	22.5	20.83	21.17	21.00
		25	25	22.5	21.48	21.77	21.64
		50	0	22.5	20.72	21.08	21.04
	16QAM	1	0	22.5	20.57	21.20	20.96
		1	25	22.5	21.81	22.15	22.05
		1	49	22.5	21.58	21.64	21.43
		25	0	22.0	20.62	21.17	20.98
		25	13	22.0	20.72	21.11	21.02
		25	25	22.0	21.48	21.71	21.54
		50	0	22.0	20.63	21.00	20.94

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20025CH	20175CH	20325CH
15MHz	QPSK	1	0	23.5	21.53	22.07	21.75
		1	38	23.5	21.94	22.22	22.05
		1	74	23.5	22.51	22.22	22.26
		36	0	22.5	20.77	21.31	20.94
		36	18	22.5	20.95	21.34	21.13
		36	39	22.5	21.02	21.09	21.14
		75	0	22.5	20.91	21.14	20.91
	16QAM	1	0	22.5	20.73	21.29	21.01
		1	38	22.5	21.22	21.45	21.35
		1	74	22.5	21.75	21.44	21.45
		36	0	22.0	20.66	21.21	20.93
		36	18	22.0	20.83	21.25	21.11
		36	39	22.0	21.01	21.00	21.10
		75	0	22.0	20.87	21.02	20.84
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					20050CH	20175CH	20300CH
20MHz	QPSK	1	0	23.5	21.55	21.98	**22.03**
		1	50	23.5	**22.05**	**22.17**	22.02
		1	99	23.5	21.85	21.57	21.63
		50	0	22.5	20.81	21.12	**21.04**
		50	25	22.5	21.01	20.97	20.85
		50	50	22.5	**21.13**	**21.14**	21.03
		100	0	22.5	20.95	**21.16**	21.00
	16QAM	1	0	22.5	20.88	21.47	21.50
		1	50	22.5	21.43	21.64	21.51
		1	99	22.5	21.27	21.02	21.09
		50	0	22.0	20.70	21.18	20.90
		50	25	22.0	20.89	21.06	20.79
		50	50	22.0	21.03	20.94	20.93
		100	0	22.0	20.93	21.04	20.88

Table 16: Conducted power measurement results of LTE Band IV

7.1.5 Conducted power measurements of LTE Band XXV

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26047CH	26365CH	26683CH
1.4MHz	QPSK	1	0	23.0	21.62	21.35	21.35
		1	3	23.0	21.41	21.27	21.07
		1	5	23.0	21.30	21.24	21.33
		3	0	23.0	21.06	21.33	21.09
		3	2	23.0	21.02	21.32	21.01
		3	3	23.0	21.05	21.23	21.05
		6	0	22.0	20.31	20.20	20.21
	16QAM	1	0	22.0	20.38	20.20	20.26
		1	3	22.0	20.51	20.19	20.35
		1	5	22.0	20.18	20.08	20.01
		3	0	22.0	20.50	20.25	20.36
		3	2	22.0	20.37	20.14	20.19
		3	3	22.0	20.25	20.05	20.17
		6	0	21.5	20.32	20.17	20.18
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26055CH	26365CH	26675CH
3MHz	QPSK	1	0	23.0	21.51	21.21	21.28
		1	7	23.0	21.33	21.22	21.11
		1	14	23.0	21.15	21.08	21.05
		8	0	22.0	20.37	20.32	20.27
		8	4	22.0	20.29	20.22	20.15
		8	7	22.0	20.16	20.12	20.08
		15	0	22.0	20.27	20.24	20.21
	16QAM	1	0	22.0	20.32	20.26	20.20
		1	7	22.0	20.39	20.31	20.32
		1	14	22.0	20.15	20.03	20.11
		8	0	21.5	20.41	20.34	20.27
		8	4	21.5	20.30	20.21	20.12
		8	7	21.5	20.17	20.13	20.09
		15	0	21.5	20.28	20.21	20.14

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26065CH	26365CH	26665CH
5MHz	QPSK	1	0	23.0	21.67	21.64	21.61
		1	13	23.0	21.75	21.71	21.67
		1	24	23.0	21.18	21.15	21.12
		12	0	22.0	20.76	20.74	20.72
		12	6	22.0	20.68	20.63	20.58
		12	13	22.0	20.49	20.45	20.41
		25	0	22.0	20.65	20.59	20.53
	16QAM	1	0	22.0	20.70	20.67	20.64
		1	13	22.0	20.76	20.72	20.68
		1	24	22.0	20.22	20.19	20.16
		12	0	21.5	20.75	20.73	20.71
		12	6	21.5	20.71	20.66	20.61
		12	13	21.5	20.49	20.45	20.41
		25	0	21.5	20.67	20.61	20.55
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26090CH	26365CH	26640CH
10MHz	QPSK	1	0	23.0	21.39	21.30	21.33
		1	25	23.0	21.43	21.34	21.46
		1	49	23.0	22.28	21.36	21.51
		25	0	22.0	20.02	20.39	20.43
		25	13	22.0	20.31	20.28	20.44
		25	25	22.0	20.12	20.01	20.09
		50	0	22.0	20.27	20.25	20.34
	16QAM	1	0	22.0	20.33	20.32	20.63
		1	25	22.0	20.63	20.35	20.83
		1	49	22.0	20.75	20.39	19.86
		25	0	21.5	20.20	20.38	20.51
		25	13	21.5	20.38	20.28	20.44
		25	25	21.5	20.33	20.07	20.12
		50	0	21.5	20.25	20.24	20.15

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26115CH	26365CH	26615CH
15MHz	QPSK	1	0	23.0	21.05	21.78	21.81
		1	38	23.0	21.76	21.36	21.54
		1	74	23.0	22.31	21.03	21.15
		36	0	22.0	20.07	20.48	20.54
		36	18	22.0	20.33	20.27	20.42
		36	39	22.0	20.36	20.01	20.25
		75	0	22.0	20.29	20.21	20.43
	16QAM	1	0	22.0	20.03	20.96	20.66
		1	38	22.0	20.67	20.56	20.87
		1	74	22.0	20.78	20.33	20.34
		36	0	21.5	20.22	20.41	20.53
		36	18	21.5	20.43	20.19	20.49
		36	39	21.5	20.37	19.98	20.16
		75	0	21.5	20.31	20.18	20.21
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26140CH	26365CH	26590CH
20MHz	QPSK	1	0	23.0	21.06	**21.84**	21.03
		1	50	23.0	21.71	21.49	**21.77**
		1	99	23.0	**22.08**	21.43	21.56
		50	0	22.0	20.18	**20.37**	**20.78**
		50	25	22.0	20.34	20.21	20.59
		50	50	22.0	**20.38**	20.05	20.27
		100	0	22.0	20.36	20.26	**20.65**
	16QAM	1	0	22.0	20.01	21.02	20.67
		1	50	22.0	20.55	20.46	20.87
		1	99	22.0	21.07	20.39	20.03
		50	0	21.5	20.05	20.55	20.62
		50	25	21.5	20.31	20.29	20.60
		50	50	21.5	20.33	20.01	20.28
		100	0	21.5	20.33	20.21	20.27

Table 17: Conducted power measurement results of LTE Band XXV

7.1.6 Conducted power measurements of LTE Band XXVI

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26697CH	26865CH	27033CH
1.4MHz	QPSK	1	0	23.6	22.45	22.31	22.24
		1	3	23.6	22.51	22.38	22.47
		1	5	23.6	22.29	22.31	22.23
		3	0	23.6	22.14	22.41	22.51
		3	2	23.6	22.15	22.45	22.54
		3	3	23.6	22.05	22.40	22.55
		6	0	22.5	21.45	21.43	21.35
	16QAM	1	0	23.0	21.69	21.65	21.72
		1	3	23.0	21.54	21.24	21.55
		1	5	23.0	21.26	21.30	21.21
		3	0	23.0	21.35	21.33	21.48
		3	2	23.0	21.35	21.31	21.37
		3	3	23.0	21.21	21.15	21.18
		6	0	22.5	21.44	21.28	21.34
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26705CH	26865CH	27025CH
3MHz	QPSK	1	0	23.6	22.58	22.44	22.35
		1	7	23.6	22.72	22.61	22.78
		1	14	23.6	22.33	22.35	22.21
		8	0	22.5	21.38	21.42	21.33
		8	4	22.5	21.51	21.47	21.46
		8	7	22.5	21.45	21.41	21.34
		15	0	22.5	21.36	21.37	21.24
	16QAM	1	0	23.0	21.88	21.86	21.97
		1	7	23.0	21.78	21.35	21.68
		1	14	23.0	21.31	21.38	21.19
		8	0	22.5	21.49	21.46	21.48
		8	4	22.5	21.44	21.39	21.44
		8	7	22.5	21.31	21.27	21.28
		15	0	22.5	21.38	21.28	21.29

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26715CH	26865CH	27015CH
5MHz	QPSK	1	0	23.6	23.03	22.94	22.85
		1	13	23.6	23.18	23.08	23.14
		1	24	23.6	22.67	22.72	22.54
		12	0	22.5	21.58	21.63	21.53
		12	6	22.5	21.66	21.61	21.63
		12	13	22.5	21.52	21.59	21.46
		25	0	22.5	21.63	21.62	21.59
	16QAM	1	0	23.0	21.64	21.52	21.77
		1	13	23.0	22.68	22.01	22.57
		1	24	23.0	21.65	21.54	21.35
		12	0	22.5	21.77	21.66	21.65
		12	6	22.5	21.78	21.69	21.72
		12	13	22.5	21.59	21.54	21.53
		25	0	22.5	21.67	21.56	21.68
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel	Channel	Channel
					26750CH	26865CH	26990CH
10MHz	QPSK	1	0	23.6	22.78	22.52	22.43
		1	25	23.6	23.24	23.01	23.12
		1	49	23.6	22.41	22.55	22.23
		25	0	22.5	21.76	21.73	21.71
		25	13	22.5	21.83	21.76	21.99
		25	25	22.5	21.42	21.63	21.54
		50	0	22.5	21.63	21.70	21.68
	16QAM	1	0	23.0	21.73	21.60	21.88
		1	25	23.0	22.63	22.08	22.58
		1	49	23.0	21.67	21.65	21.35
		25	0	22.5	21.74	21.75	21.72
		25	13	22.5	21.75	21.79	21.83
		25	25	22.5	21.68	21.66	21.74
		50	0	22.5	21.67	21.69	21.81

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 26775CH	Channel 26865CH	Channel 26965CH
15MHz	QPSK	1	0	23.6	22.23	21.94	22.37
		1	38	23.6	**22.88**	21.96	**22.82**
		1	74	23.6	21.97	**22.83**	22.28
		36	0	22.5	21.61	21.54	**21.66**
		36	18	22.5	**21.75**	**21.69**	21.61
		36	39	22.5	21.34	21.52	21.45
		75	0	22.5	21.52	**21.56**	21.53
	16QAM	1	0	23.0	22.37	22.24	22.48
		1	38	23.0	22.95	22.97	22.90
		1	74	23.0	22.18	22.16	22.27
		36	0	22.5	21.64	21.63	21.74
		36	18	22.5	21.78	21.71	21.70
		36	39	22.5	21.48	21.57	21.57
		75	0	22.5	21.58	21.58	21.63

Table 18: Conducted power measurement results of LTE Band XXVI

7.1.7 Conducted power measurements of LTE Band XLI

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 39675CH	Channel 40148CH	Channel 40620CH	Channel 41093CH	Channel 41565CH
5MHz	QPSK	1	0	23.0	21.49	21.39	21.67	21.44	21.88
		1	13	23.0	21.62	21.60	21.80	21.70	21.98
		1	24	23.0	21.15	21.14	21.36	21.28	21.57
		12	0	22.0	20.70	20.56	20.84	20.70	21.07
		12	6	22.0	20.66	20.65	20.84	20.72	21.08
		12	13	22.0	20.37	20.48	20.66	20.50	20.88
		25	0	22.0	20.52	20.51	20.71	20.61	21.00
	16QAM	1	0	22.0	20.23	20.27	20.34	20.50	20.73
		1	13	22.0	20.32	20.36	20.47	20.61	20.80
		1	24	22.0	20.02	20.05	20.01	20.30	20.38
		12	0	22.0	20.59	20.61	20.75	20.57	21.01
		12	6	22.0	20.53	20.52	20.73	20.63	21.01
		12	13	22.0	20.28	20.43	20.55	20.41	20.82
		25	0	22.0	20.38	20.44	20.59	20.48	20.90
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 39700CH	Channel 40160CH	Channel 40620CH	Channel 41080CH	Channel 41540CH
10MHz	QPSK	1	0	23.0	21.63	21.30	21.57	21.85	21.87
		1	25	23.0	21.59	21.63	21.84	22.11	22.14
		1	49	23.0	21.07	21.01	21.02	21.26	21.06
		25	0	22.0	20.55	20.57	20.82	21.06	21.18
		25	13	22.0	20.54	20.58	20.78	21.09	21.11
		25	25	22.0	20.39	20.55	20.64	20.99	20.90
		50	0	22.0	20.44	20.50	20.69	20.99	21.07
	16QAM	1	0	22.0	20.23	20.24	20.28	20.78	20.57
		1	25	22.0	20.25	20.76	20.59	21.00	21.01
		1	49	22.0	20.01	20.08	20.03	20.43	20.09
		25	0	22.0	20.46	20.56	20.72	21.06	21.12
		25	13	22.0	20.37	20.57	20.66	20.97	21.05
		25	25	22.0	20.29	20.49	20.53	20.96	20.84
		50	0	22.0	20.36	20.46	20.60	20.98	21.04

Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 39725CH	Channel 40173CH	Channel 40620CH	Channel 41068CH	Channel 41515CH
15MHz	QPSK	1	0	23.0	21.31	21.25	21.54	21.16	21.77
		1	38	23.0	21.59	21.72	21.81	21.70	22.17
		1	74	23.0	21.03	21.07	21.01	21.03	21.08
		36	0	22.0	20.47	20.59	20.70	20.56	21.24
		36	18	22.0	20.55	20.55	20.77	20.61	21.26
		36	39	22.0	20.47	20.51	20.53	20.53	20.96
		75	0	22.0	20.44	20.56	20.62	20.54	21.13
	16QAM	1	0	22.0	20.08	20.09	20.12	20.17	20.49
		1	38	22.0	20.13	20.54	20.63	20.71	21.03
		1	74	22.0	20.01	20.02	20.02	20.03	20.05
		36	0	22.0	20.36	20.45	20.62	20.46	21.18
		36	18	22.0	20.44	20.55	20.69	20.51	21.18
		36	39	22.0	20.36	20.39	20.44	20.44	20.89
		75	0	22.0	20.32	20.42	20.57	20.45	21.05
Bandwidth	Modulation	RB size	RB offset	Tune-up	Channel 39750CH	Channel 40185CH	Channel 40620CH	Channel 41055CH	Channel 41490CH
20MHz	QPSK	1	0	23.0	21.95	21.52	21.98	21.51	**22.71**
		1	50	23.0	21.88	21.68	21.92	21.68	22.43
		1	99	23.0	21.40	21.23	21.41	21.22	21.46
		50	0	22.0	20.76	20.63	20.96	20.61	**21.54**
		50	25	22.0	20.80	20.59	20.87	20.60	21.42
		50	50	22.0	20.80	20.56	20.76	20.59	21.24
		100	0	22.0	20.91	20.60	20.95	20.61	21.38
	16QAM	1	0	22.0	20.61	20.41	20.74	20.61	21.12
		1	50	22.0	20.53	20.74	20.81	20.86	21.24
		1	99	22.0	20.21	20.43	20.11	20.42	20.32
		50	0	22.0	20.40	20.46	20.75	20.54	21.29
		50	25	22.0	20.48	20.42	20.70	20.51	21.19
		50	50	22.0	20.43	20.41	20.55	20.49	20.96
		100	0	22.0	20.53	20.53	20.70	20.54	21.14

Table 19: Conducted power measurement results of LTE Band XLI

7.1.8 Conducted power measurements of Downlink LTE CA

In this section, the following conducted power measurement results of downlink LTE carrier aggregation are provided to quantify downlink only carrier aggregation SAR test exclusion per KDB 941225 D05A.

Uplink maximum output power is measured with downlink carrier aggregation active, using the channel with highest measured maximum output power when downlink carrier aggregation is inactive, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.

Power test equipment: a R&S Radio Communication Tester CMW500 was used.

Initial Conditions						
Test Environment as specified in TS 36.508[7] subclause 4.1			NC[, TL/VL, TL/VH, TH/VL, TH/VH]			
Test Frequencies as specified in TS36.508 [7] subclause 4.3.1 for different CA bandwidth classes.			A: Mid range for PCC and SCC			
Test CC Combination setting (N_{RB_agg}) as specified in subclause 5.4.2A.1 for the CA Configuration			Lowest N_{RB_agg} Highest N_{RB_agg}			
Test Parameters for CA Configurations						
CA Configuration / N_{RB_agg}		DL Allocation	CC MOD	UL Allocation		
PCC N_{RB}	SCCs N_{RB}	PCC & SCC RB allocation		N_{RB_alloc}	PCC RB allocations (L_{CRB} @ RB_{start})	
6	25	N/A for this test	QPSK	5	P_5@0	-
15	25		QPSK	4	P_4@0	-
25	50		QPSK	8	P_8@0	-
50	75		QPSK	12	P_12@0	-
75	100		QPSK	16	P_16@0	-
100	75		QPSK	18	P_18@0	-
Note 1: CA Configuration Test CC Combination settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.4.2A.1-1						

Table 20: Conducted power measurement setup of LTE CA per 3GPP TS 36.521-1 V12.6.0

The conducted power measurement results of downlink LTE CA Conduted Power are as below,so the downlink only carrier aggregation conditions for this device can be excluded from SAR testing:

DL LTE CA Class	PCC								SCC			Power	
	PCC Band	PCC Bandwidth (MHz)	PCC UL RB size	PCC UL RB offset	PCC DL RB size	PCC DL RB offset	PCC UL Channel	PCC DL Channel	SCC Band	SCC Bandwidth (MHz)	SCC DL Channel	Rel 8 LTE Tx Power(dBm)	Rel 10 DL LTE CA Tx Power(dBm)
CA_41C	LTE B41	20	1	0	100	0	41490	41490	LTE B41	20	41292	22.71	22.75
CA_41A-41A	LTE B41	20	1	0	100	0	41490	41490	LTE B41	20	39750	22.71	22.78

Note: Testing is not required in bands or modes not intended/allowed for US operation.

7.1.9 Conducted power measurements of WiFi 2.4G

Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	Ant 1	1	2412	1M	15.0	13.02	No
		6	2437		15.0	13.09	No
		11	2462		15.0	**13.63**	Yes
	Ant 2	1	2412		15.0	13.05	No
		6	2437		15.0	13.02	No
		11	2462		15.0	**13.16**	Yes
802.11g	Ant 1	1	2412	6M	14.0	Not Required	No
		6	2437		14.0	Not Required	No
		11	2462		14.0	Not Required	No
	Ant 2	1	2412		14.0	Not Required	No
		6	2437		14.0	Not Required	No
		11	2462		14.0	Not Required	No
802.11n 20M SISO	Ant 1	1	2412	6.5M	13.0	Not Required	No
		6	2437		13.0	Not Required	No
		11	2462		13.0	Not Required	No
	Ant 2	1	2412		13.0	Not Required	No
		6	2437		13.0	Not Required	No
		11	2462		13.0	Not Required	No
802.11n 40M SISO	Ant 1	3	2422	13.5M	13.0	Not Required	No
		6	2437		13.0	Not Required	No
		9	2452		13.0	Not Required	No
	Ant 2	3	2422	13.5M	13.0	Not Required	No
		6	2437		13.0	Not Required	No
		9	2452		13.0	Not Required	No
802.11n 20M MIMO	Sum	1	2412	13M	14.0	12.02	No
		6	2437		14.0	12.03	No
		11	2462		14.0	**12.19**	Yes
802.11n 40M MIMO	Sum	3	2422	27M	13.0	Not Required	No
		6	2437		13.0	Not Required	No
		9	2452		13.0	Not Required	No

Table 21: Conducted power measurement results of WiFi 2.4G

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

7.1.10 Conducted power measurements of WiFi 5G

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.2	802.11a	Ant 1	CH 36	5180	6M	11.0	Not Required	No
			CH 40	5200		11.0	Not Required	No
			CH 44	5220		11.0	Not Required	No
			CH 48	5240		11.0	Not Required	No
		Ant 2	CH 36	5180	6M	11.0	Not Required	No
			CH 40	5200		11.0	Not Required	No
			CH 44	5220		11.0	Not Required	No
			CH 48	5240		11.0	Not Required	No
	802.11n 20M	Ant 1	CH 36	5180	6.5M	11.0	Not Required	No
			CH 40	5200		11.0	Not Required	No
			CH 44	5220		11.0	Not Required	No
			CH 48	5240		11.0	Not Required	No
		Ant 2	CH 36	5180	6.5M	11.0	Not Required	No
			CH 40	5200		11.0	Not Required	No
			CH 44	5220		11.0	Not Required	No
			CH 48	5240		11.0	Not Required	No
	802.11n 40M	Ant 1	CH 38	5190	13.5M	11.0	Not Required	No
			CH 46	5230		11.0	Not Required	No
		Ant 2	CH 38	5190		11.0	Not Required	No
			CH 46	5230		11.0	Not Required	No
	802.11ac 20M	Ant 1	CH 36	5180	6.5M	10.9	Not Required	No
			CH 40	5200		10.9	Not Required	No
			CH 44	5220		10.9	Not Required	No
			CH 48	5240		10.9	Not Required	No
		Ant 2	CH 36	5180	6.5M	10.9	Not Required	No
			CH 40	5200		10.9	Not Required	No
			CH 44	5220		10.9	Not Required	No
			CH 48	5240		10.9	Not Required	No
	802.11ac 40M	Ant 1	CH 38	5190	13.5M	10.9	Not Required	No
			CH 46	5230		10.9	Not Required	No
		Ant 2	CH 38	5190	13.5M	10.9	Not Required	No
			CH 46	5230		10.9	Not Required	No
	802.11ac 80M	Ant 1	CH 42	5210	29.3M	10.9	Not Required	No
		Ant 2	CH 42	5210		10.9	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.3	802.11a	Ant 1	CH 52	5260	6M	11.0	Not Required	No
			CH 56	5280		11.0	Not Required	No
			CH 60	5300		11.0	Not Required	No
			CH 64	5320		11.0	Not Required	No
		Ant 2	CH 52	5260	6M	11.0	Not Required	No
			CH 56	5280		11.0	Not Required	No
			CH 60	5300		11.0	Not Required	No
			CH 64	5320		11.0	Not Required	No
	802.11n 20M	Ant 1	CH 52	5260	6.5M	11.0	Not Required	No
			CH 56	5280		11.0	Not Required	No
			CH 60	5300		11.0	Not Required	No
			CH 64	5320		11.0	Not Required	No
		Ant 2	CH 52	5260	6.5M	11.0	Not Required	No
			CH 56	5280		11.0	Not Required	No
			CH 60	5300		11.0	Not Required	No
			CH 64	5320		11.0	Not Required	No
	802.11n 40M	Ant 1	CH 54	5270	13.5M	11.0	**10.84**	Yes
			CH 62	5310		11.0	10.82	No
		Ant 2	CH 54	5270	13.5M	11.0	**10.53**	Yes
			CH 62	5310		11.0	10.29	No
	802.11ac 20M	Ant 1	CH 52	5260	6.5M	10.9	Not Required	No
			CH 56	5280		10.9	Not Required	No
			CH 60	5300		10.9	Not Required	No
			CH 64	5320		10.9	Not Required	No
		Ant 2	CH 52	5260	6.5M	10.9	Not Required	No
			CH 56	5280		10.9	Not Required	No
			CH 60	5300		10.9	Not Required	No
			CH 64	5320		10.9	Not Required	No
	802.11ac 40M	Ant 1	CH 54	5270	13.5M	10.9	Not Required	No
			CH 62	5310		10.9	Not Required	No
		Ant 2	CH 54	5270	13.5M	10.9	Not Required	No
			CH 62	5310		10.9	Not Required	No
	802.11ac 80M	Ant 1	CH 58	5290	29.3M	10.9	Not Required	No
		Ant 2	CH 58	5290	29.3M	10.9	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.5	802.11a	Ant 1	CH 100	5500	6M	11.0	Not Required	No
			CH 104	5520		11.0	Not Required	No
			CH 108	5540		11.0	Not Required	No
			CH 112	5560		11.0	Not Required	No
			CH 116	5580		11.0	Not Required	No
			CH 120	5600		11.0	Not Required	No
			CH 124	5620		11.0	Not Required	No
			CH 128	5640		11.0	Not Required	No
			CH 132	5660		11.0	Not Required	No
			CH 136	5680		11.0	Not Required	No
			CH 140	5700		11.0	Not Required	No
		Ant 2	CH 100	5500	6M	11.0	Not Required	No
			CH 104	5520		11.0	Not Required	No
			CH 108	5540		11.0	Not Required	No
			CH 112	5560		11.0	Not Required	No
			CH 116	5580		11.0	Not Required	No
			CH 120	5600		11.0	Not Required	No
			CH 124	5620		11.0	Not Required	No
			CH 128	5640		11.0	Not Required	No
			CH 132	5660		11.0	Not Required	No
			CH 136	5680		11.0	Not Required	No
			CH 140	5700		11.0	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.5	802.11n 20M	Ant 1	CH 100	5500	6.5M	11.0	Not Required	No
			CH 104	5520		11.0	Not Required	No
			CH 108	5540		11.0	Not Required	No
			CH 112	5560		11.0	Not Required	No
			CH 116	5580		11.0	Not Required	No
			CH 120	5600		11.0	Not Required	No
			CH 124	5620		11.0	Not Required	No
			CH 128	5640		11.0	Not Required	No
			CH 132	5660		11.0	Not Required	No
			CH 136	5680		11.0	Not Required	No
			CH 140	5700		11.0	Not Required	No
		Ant 2	CH 100	5500	6.5M	11.0	Not Required	No
			CH 104	5520		11.0	Not Required	No
			CH 108	5540		11.0	Not Required	No
			CH 112	5560		11.0	Not Required	No
			CH 116	5580		11.0	Not Required	No
			CH 120	5600		11.0	Not Required	No
			CH 124	5620		11.0	Not Required	No
			CH 128	5640		11.0	Not Required	No
			CH 132	5660		11.0	Not Required	No
			CH 136	5680		11.0	Not Required	No
			CH 140	5700		11.0	Not Required	No
	802.11n 40M	Ant 1	CH 102	5510	13.5M	11.0	9.76	No
			CH 110	5550		11.0	9.69	No
			CH 118	5590		11.0	9.81	No
			CH 126	5630		11.0	**10.04**	Yes
			CH 134	5670		11.0	9.61	No
			CH 142	5710		11.0	9.01	No
		Ant 2	CH 102	5510	13.5M	11.0	10.23	No
			CH 110	5550		11.0	10.40	No
			CH 118	5590		11.0	10.27	No
			CH 126	5630		11.0	**10.41**	Yes
			CH 134	5670		11.0	10.02	No
			CH 142	5710		11.0	9.91	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.5	802.11ac 20M	Ant 1	CH 100	5500	6.5M	10.9	Not Required	No
			CH 104	5520		10.9	Not Required	No
			CH 108	5540		10.9	Not Required	No
			CH 112	5560		10.9	Not Required	No
			CH 116	5580		10.9	Not Required	No
			CH 120	5600		10.9	Not Required	No
			CH 124	5620		10.9	Not Required	No
			CH 128	5640		10.9	Not Required	No
			CH 132	5660		10.9	Not Required	No
			CH 136	5680		10.9	Not Required	No
			CH 140	5700		10.9	Not Required	No
		Ant 2	CH 100	5500	6.5M	10.9	Not Required	No
			CH 104	5520		10.9	Not Required	No
			CH 108	5540		10.9	Not Required	No
			CH 112	5560		10.9	Not Required	No
			CH 116	5580		10.9	Not Required	No
			CH 120	5600		10.9	Not Required	No
			CH 124	5620		10.9	Not Required	No
			CH 128	5640		10.9	Not Required	No
			CH 132	5660		10.9	Not Required	No
			CH 136	5680		10.9	Not Required	No
			CH 140	5700		10.9	Not Required	No
	802.11ac 40M	Ant 1	CH 102	5510	13.5M	10.9	Not Required	No
			CH 110	5550		10.9	Not Required	No
			CH 118	5590		10.9	Not Required	No
			CH 126	5630		10.9	Not Required	No
			CH 134	5670		10.9	Not Required	No
			CH 142	5710		10.9	Not Required	No
		Ant 2	CH 102	5510	13.5M	10.9	Not Required	No
			CH 110	5550		10.9	Not Required	No
			CH 118	5590		10.9	Not Required	No
			CH 126	5630		10.9	Not Required	No
			CH 134	5670		10.9	Not Required	No
			CH 142	5710		10.9	Not Required	No
	802.11ac 80M	Ant 1	CH 106	5530	29.3M	10.9	Not Required	No
			CH 122	5610		10.9	Not Required	No
			CH 138	5690		10.9	Not Required	No
		Ant 2	CH 106	5530	29.3M	10.9	Not Required	No
			CH 122	5610		10.9	Not Required	No
			CH 138	5690		10.9	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.8	802.11a	Ant 1	CH 149	5745	6M	11.0	Not Required	No
			CH 153	5765		11.0	Not Required	No
			CH 157	5785		11.0	Not Required	No
			CH 161	5805		11.0	Not Required	No
		Ant 2	CH 149	5745	6M	11.0	Not Required	No
			CH 153	5765		11.0	Not Required	No
			CH 157	5785		11.0	Not Required	No
			CH 161	5805		11.0	Not Required	No
	802.11n 20M	Ant 1	CH 149	5745	6.5M	11.0	Not Required	No
			CH 153	5765		11.0	Not Required	No
			CH 157	5785		11.0	Not Required	No
			CH 161	5805		11.0	Not Required	No
		Ant 2	CH 149	5745	6.5M	11.0	Not Required	No
			CH 153	5765		11.0	Not Required	No
			CH 157	5785		11.0	Not Required	No
			CH 161	5805		11.0	Not Required	No
	802.11n 40M	Ant 1	CH 151	5755	13.5M	11.0	**9.10**	Yes
			CH 159	5795		11.0	9.08	No
		Ant 2	CH 151	5755	13.5M	11.0	**10.80**	Yes
			CH 159	5795		11.0	10.52	No
	802.11ac 20M	Ant 1	CH 149	5745	6.5M	10.9	Not Required	No
			CH 153	5765		10.9	Not Required	No
			CH 157	5785		10.9	Not Required	No
			CH 161	5805		10.9	Not Required	No
			CH 165	5825		10.9	Not Required	No
		Ant 2	CH 149	5745	6.5M	10.9	Not Required	No
			CH 153	5765		10.9	Not Required	No
			CH 157	5785		10.9	Not Required	No
			CH 161	5805		10.9	Not Required	No
			CH 165	5825		10.9	Not Required	No
	802.11ac 40M	Ant 1	CH 151	5755	13.5M	10.9	Not Required	No
			CH 159	5795		10.9	Not Required	No
		Ant 2	CH 151	5755	13.5M	10.9	Not Required	No
			CH 159	5795		10.9	Not Required	No
	802.11ac 80M	Ant 1	CH 155	5775	29.3M	10.9	Not Required	No
		Ant 2	CH 155	5775	29.3M	10.9	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.2	802.11n 20 MIMO	Sum	CH 36	5180	6M	14.4	Not Required	No
			CH 40	5200		14.4	Not Required	No
			CH 44	5220		14.4	Not Required	No
			CH 48	5240		14.4	Not Required	No
	802.11n 40M MIMO	Sum	CH 38	5190	13.5M	14.5	12.34	No
			CH 46	5230		14.5	12.93	No
	802.11ac 20M MIMO	Sum	CH 36	5180	6.5M	14.4	Not Required	No
			CH 40	5200		14.4	Not Required	No
			CH 44	5220		14.4	Not Required	No
			CH 48	5240		14.4	Not Required	No
	802.11ac 40M MIMO	Sum	CH 38	5190	13.5M	14.4	Not Required	No
			CH 46	5230		14.4	Not Required	No
	802.11ac 80M MIMO	Sum	CH 42	5210	29.3M	14.4	Not Required	No
Band (GHz)	**Mode**	**Ant**	**Channel**	**Frequency (MHz)**	**Data Rate (Mbps)**	**Tune-up**	**Average Power (dBm)**	**SAR Test (Yes/No)**
5.3	802.11n 20M MIMO	Sum	CH 52	5260	6M	14.4	Not Required	No
			CH 56	5280		14.4	Not Required	No
			CH 60	5300		14.4	Not Required	No
			CH 64	5320		14.4	Not Required	No
	802.11n 40M MIMO	Sum	CH 54	5270	13.5M	14.5	13.27	No
			CH 62	5310		14.5	**13.30**	Yes
	802.11ac 20M MIMO	Sum	CH 52	5260	6.5M	14.4	Not Required	No
			CH 56	5280		14.4	Not Required	No
			CH 60	5300		14.4	Not Required	No
			CH 64	5320		14.4	Not Required	No
	802.11ac 40M MIMO	Sum	CH 54	5270	13.5M	14.4	Not Required	No
			CH 62	5310		14.4	Not Required	No
	802.11ac 80M MIMO	Sum	CH 58	5290	29.3M	14.4	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.5	802.11n 20M MIMO	Sum	CH 100	5500	6.5M	14.4	Not Required	No
			CH 104	5520		14.4	Not Required	No
			CH 108	5540		14.4	Not Required	No
			CH 112	5560		14.4	Not Required	No
			CH 116	5580		14.4	Not Required	No
			CH 120	5600		14.4	Not Required	No
			CH 124	5620		14.4	Not Required	No
			CH 128	5640		14.4	Not Required	No
			CH 132	5660		14.4	Not Required	No
			CH 136	5680		14.4	Not Required	No
			CH 140	5700		14.4	Not Required	No
	802.11n 40M MIMO	Sum	CH 102	5510	13.5M	14.5	12.74	No
			CH 110	5550		14.5	12.53	No
			CH 118	5590		14.5	12.51	No
			CH 126	5630		14.5	**12.76**	Yes
			CH 134	5670		14.5	12.65	No
			CH 142	5710		14.5	12.52	No
	802.11ac 20M MIMO	Sum	CH 100	5500	6.5M	14.4	Not Required	No
			CH 104	5520		14.4	Not Required	No
			CH 108	5540		14.4	Not Required	No
			CH 112	5560		14.4	Not Required	No
			CH 116	5580		14.4	Not Required	No
			CH 120	5600		14.4	Not Required	No
			CH 124	5620		14.4	Not Required	No
			CH 128	5640		14.4	Not Required	No
			CH 132	5660		14.4	Not Required	No
			CH 136	5680		14.4	Not Required	No
			CH 140	5700		14.4	Not Required	No
	802.11ac 40M MIMO	Sum	CH 102	5510	13.5M	14.4	Not Required	No
			CH 110	5550		14.4	Not Required	No
			CH 118	5590		14.4	Not Required	No
			CH 126	5630		14.4	Not Required	No
			CH 134	5670		14.4	Not Required	No
			CH 142	5710		14.4	Not Required	No
	802.11ac 80M MIMO	Sum	CH 106	5530	29.3M	14.4	Not Required	No
			CH 122	5610		14.4	Not Required	No
			CH 138	5690		14.4	Not Required	No

Band (GHz)	Mode	Ant	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
5.8	802.11n 20M MIMO	Sum	CH 149	5745	6.5M	14.4	Not Required	No
			CH 153	5765		14.4	Not Required	No
			CH 157	5785		14.4	Not Required	No
			CH 161	5805		14.4	Not Required	No
	802.11n 40M MIMO	Sum	CH 151	5755	13.5M	14.5	**12.86**	Yes
			CH 159	5795		14.5	12.75	No
	802.11ac 20M MIMO	Sum	CH 149	5745	6.5M	14.4	Not Required	No
			CH 153	5765		14.4	Not Required	No
			CH 157	5785		14.4	Not Required	No
			CH 161	5805		14.4	Not Required	No
			CH 165	5825		14.4	Not Required	No
	802.11ac 40M MIMO	Sum	CH 151	5755	13.5M	14.4	Not Required	No
			CH 159	5795		14.4	Not Required	No
	802.11ac 80M MIMO	Sum	CH 155	5775	29.3M	14.4	Not Required	No

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

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

7.2 SAR measurement Results

General Notes:

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

2) Per KDB447498 D01v06, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

● ≤ 0.8W/kg for 1-g or 2.0W/kg for 10-g respectively, when the transmission band is ≤ 100MHz.

● ≤ 0.6 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.

● ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz.

When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

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

4) Per KDB941225 D06v02, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm,such position does not need to be tested.

5) Per KDB865664 D02v01r01, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to the blue SAR test results in the tables of Section 7.3 and appendix B for detailed SAR plots).

UMTS Notes:

1) Per KDB941225 D01v03r0, When the maximum output power and tune-up tolerance specified for production units in a Second mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of 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 v02r05.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)

3) According to KDB 941225 D05, for Time-Division Duplex (TDD) systems, SAR is tested using a fixed periodic duty factor according to the highest transmission duty factor (63.33%) implemented for the device and supported by the defined 3GPP LTE TDD configurations.

4)Per KDB 941225 D05A, for DL LTE-CA, the conducted power measurement results of downlink LTE carrier aggregation can quantify downlink only carrier aggregation SAR test exclusion.

WiFi Notes:

Per KDB248227D01:

1) When reported SAR for the initial test position is ≤ 0.4W/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 ≤ 0.8W/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) 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 447498D01. 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 UMTS Band II

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Front Side	9400/1880	RMC	0.440	0.250	0.040	22.89	23.50	0.506	21.4°C
Back Side	9400/1880	RMC	0.810	0.428	0.000	22.89	23.50	0.932	21.4°C
Back Side	9262/1852.4	RMC	0.741	0.395	0.000	23.13	23.50	0.807	21.4°C
Back Side	9538/1907.6	RMC	1.000	0.519	0.020	22.88	23.50	1.153	21.4°C
Back Side-Repeated	9538/1907.6	RMC	**1.100**	0.567	-0.040	22.88	23.50	**1.269**	21.4°C
Right Side	9400/1880	RMC	0.529	0.285	0.120	22.89	23.50	0.609	21.4°C
Top Side	9400/1880	RMC	0.211	0.121	-0.070	22.89	23.50	0.243	21.4°C
Bottom Side	9400/1880	RMC	0.063	0.038	0.100	22.89	23.50	0.072	21.4°C

Table 23: Body SAR test results of UMTS Band II

7.2.2 SAR measurement Result of UMTS Band IV

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
Front Side	1413/1732.6	RMC	0.560	0.323	-0.070	23.11	23.50	0.613	21.8°C
Back Side	1413/1732.6	RMC	0.811	0.438	0.040	23.11	23.50	0.887	21.8°C
Back Side	1312/1712.4	RMC	0.666	0.365	0.060	23.04	23.50	0.740	21.8°C
Back Side	1513/1752.6	RMC	**0.869**	0.468	0.020	23.00	23.50	**0.975**	21.8°C
Back Side-Repeated	1513/1752.6	RMC	0.748	0.357	0.070	23.00	23.50	0.839	21.8°C
Right Side	1413/1732.6	RMC	0.308	0.174	-0.110	23.11	23.50	0.337	21.8°C
Top Side	1413/1732.6	RMC	0.246	0.148	-0.110	23.11	23.50	0.269	21.8°C
Bottom Side	1413/1732.6	RMC	0.176	0.103	-0.100	23.11	23.50	0.193	21.8°C

Table 24: Body SAR test results of UMTS Band IV

7.2.3 SAR measurement Result of LTE Band II

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	18700/1860	20M QPSK 1RB#99	0.447	0.254	0.090	22.91	23.00	0.456	21.3°C
Back Side	18700/1860	20M QPSK 1RB#99	0.939	0.499	-0.010	22.91	23.00	0.959	21.3°C
Back Side	18900/1880	20M QPSK 1RB#0	0.814	0.432	0.010	22.54	23.00	0.905	21.3°C
Back Side	19100/1900	20M QPSK 1RB#50	1.200	0.624	0.070	22.62	23.00	1.310	21.3°C
Back Side-Repeated	19100/1900	20M QPSK 1RB#50	**1.290**	0.655	0.000	22.62	23.00	**1.408**	21.3°C
Right Side	18700/1860	20M QPSK 1RB#99	0.643	0.361	-0.090	22.91	23.00	0.656	21.3°C
Top Side	18700/1860	20M QPSK 1RB#99	0.157	0.094	0.080	22.91	23.00	0.160	21.3°C
Bottom Side	18700/1860	20M QPSK 1RB#99	0.060	0.037	0.120	22.91	23.00	0.061	21.3°C
50%RB									
Front Side	19100/1900	20M QPSK 50%RB#50	0.405	0.225	0.060	21.42	22.50	0.519	21.3°C
Back Side	19100/1900	20M QPSK 50%RB#50	0.936	0.482	0.050	21.42	22.50	1.200	21.3°C
Back Side	18700/1860	20M QPSK 50%RB#50	0.727	0.383	-0.140	21.03	22.50	1.020	21.3°C
Back Side	18900/1880	20M QPSK 50%RB#0	0.589	0.308	0.030	21.41	22.50	0.757	21.3°C
Right Side	19100/1900	20M QPSK 50%RB#50	0.670	0.368	0.020	21.42	22.50	0.859	21.3°C
Right Side	18700/1860	20M QPSK 50%RB#50	0.644	0.352	0.020	21.03	22.50	0.903	21.3°C
Right Side	18900/1880	20M QPSK 50%RB#0	0.658	0.361	0.020	21.41	22.50	0.846	21.3°C
Top Side	19100/1900	20M QPSK 50%RB#50	0.198	0.113	0.050	21.42	22.50	0.254	21.3°C
Bottom Side	19100/1900	20M QPSK 50%RB#50	0.045	0.027	0.130	21.42	22.50	0.057	21.3°C
100%RB									
Back Side	19100/1900	20M QPSK 100%RB#0	0.796	0.410	0.080	21.17	22.50	1.081	21.3°C
Right Side	19100/1900	20M QPSK 100%RB#0	0.600	0.314	0.030	21.17	22.50	0.815	21.3°C

Table 25: Body SAR test results of LTE Band II

7.2.4 SAR measurement Result of LTE Band IV

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	20175/1732.5	20M QPSK 1RB#50	0.728	0.401	0.020	22.17	23.50	0.989	21.8°C
Front Side	20050/1720	20M QPSK 1RB#50	0.728	0.401	-0.040	22.05	23.50	1.017	21.8°C
Front Side	20300/1745	20M QPSK 1RB#0	0.734	0.404	0.020	22.03	23.50	1.030	21.8°C
Back Side	20175/1732.5	20M QPSK 1RB#50	**0.956**	0.494	0.010	22.17	23.50	1.299	21.8°C
Back Side-Repeated	20175/1732.5	20M QPSK 1RB#50	0.965	0.498	0.040	22.17	23.50	1.311	21.8°C
Back Side	20050/1720	20M QPSK 1RB#50	0.946	0.489	0.040	22.05	23.50	1.321	21.8°C
Back Side	20300/1745	20M QPSK 1RB#0	0.950	0.473	0.030	22.03	23.50	**1.333**	21.8°C
Right Side	20175/1732.5	20M QPSK 1RB#50	0.370	0.211	-0.140	22.17	23.50	0.503	21.8°C
Top Side	20175/1732.5	20M QPSK 1RB#50	0.282	0.169	-0.090	22.17	23.50	0.383	21.8°C
Bottom Side	20175/1732.5	20M QPSK 1RB#50	0.197	0.115	0.000	22.17	23.50	0.268	21.8°C
50%RB									
Front Side	20175/1732.5	20M QPSK 50%RB#50	0.581	0.320	-0.020	21.14	22.50	0.795	21.8°C
Back Side	20175/1732.5	20M QPSK 50%RB#50	0.895	0.410	-0.030	21.14	22.50	1.224	21.8°C
Back Side	20050/1720	20M QPSK 50%RB#50	0.734	0.378	0.090	21.13	22.50	1.006	21.8°C
Back Side	20300/1745	20M QPSK 50%RB#0	0.763	0.392	0.040	21.04	22.50	1.068	21.8°C
Right Side	20175/1732.5	20M QPSK 50%RB#50	0.298	0.173	-0.160	21.14	22.50	0.408	21.8°C
Top Side	20175/1732.5	20M QPSK 50%RB#50	0.262	0.123	0.160	21.14	22.50	0.358	21.8°C
Bottom Side	20175/1732.5	20M QPSK 50%RB#50	0.148	0.088	-0.020	21.14	22.50	0.202	21.8°C
100%RB									
Front Side	20175/1732.5	20M QPSK 100%RB#0	0.592	0.329	0.010	21.16	22.50	0.806	21.8°C
Back Side	20175/1732.5	20M QPSK 100%RB#0	0.791	0.406	0.020	21.16	22.50	1.077	21.8°C

Table 26: Body SAR test results of LTE Band IV

7.2.5 SAR measurement Result of LTE Band XXV

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	26140/1860	20M QPSK 1RB#99	0.397	0.228	0.190	22.08	23.00	0.491	21.3°C
Back Side	26140/1860	20M QPSK 1RB#99	0.836	0.440	0.030	22.08	23.00	1.033	21.3°C
Back Side	26365/1882.5	20M QPSK 1RB#0	0.667	0.351	-0.030	21.84	23.00	0.871	21.3°C
Back Side	26590/1905	20M QPSK 1RB#50	**1.020**	0.524	-0.080	21.77	23.00	**1.354**	21.3°C
Back Side-Repeated	26590/1905	20M QPSK 1RB#50	1.000	0.520	-0.130	21.77	23.00	1.327	21.3°C
Right Side	26140/1860	20M QPSK 1RB#99	0.575	0.322	-0.100	22.08	23.00	0.711	21.3°C
Top Side	26140/1860	20M QPSK 1RB#99	0.148	0.089	0.130	22.08	23.00	0.183	21.3°C
Bottom Side	26140/1860	20M QPSK 1RB#99	0.057	0.035	0.150	22.08	23.00	0.071	21.3°C
50%RB									
Front Side	26590/1905	20M QPSK 50%RB#0	0.378	0.210	0.170	20.78	22.00	0.501	21.3°C
Back Side	26590/1905	20M QPSK 50%RB#0	0.789	0.406	-0.070	20.78	22.00	1.045	21.3°C
Back Side	26140/1860	20M QPSK 50%RB#50	0.618	0.325	0.020	20.38	22.00	0.897	21.3°C
Back Side	26365/1882.5	20M QPSK 50%RB#0	0.404	0.207	0.070	20.37	22.00	0.588	21.3°C
Right Side	26590/1905	20M QPSK 50%RB#0	0.598	0.329	-0.090	20.78	22.00	0.792	21.3°C
Top Side	26590/1905	20M QPSK 50%RB#0	0.198	0.112	0.020	20.78	22.00	0.262	21.3°C
Bottom Side	26590/1905	20M QPSK 50%RB#0	0.041	0.023	0.170	20.78	22.00	0.054	21.3°C
100%RB									
Back Side	26590/1905	20M QPSK 100%RB#0	0.714	0.367	-0.120	20.65	22.00	0.974	21.3°C

Table 27: Body SAR test results of LTE Band XXV

7.2.6 SAR measurement Result of LTE Band XXVI

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	26775/822.5	15M QPSK 1RB#38	0.898	0.652	0.030	22.88	23.60	1.060	21.5°C
Front Side	26865/831.5	15M QPSK 1RB#74	0.576	0.400	-0.050	22.83	23.60	0.688	21.5°C
Front Side	26965/841.5	15M QPSK 1RB#38	1.000	0.737	0.000	22.82	23.60	1.197	21.5°C
Back Side	26775/822.5	15M QPSK 1RB#38	**1.160**	0.847	-0.010	22.88	23.60	**1.369**	21.5°C
Back Side-Repeated	26775/822.5	15M QPSK 1RB#38	1.160	0.851	-0.050	22.88	23.60	1.369	21.5°C
Back Side	26865/831.5	15M QPSK 1RB#74	0.719	0.529	0.010	22.83	23.60	0.858	21.5°C
Back Side	26965/841.5	15M QPSK 1RB#38	1.120	0.826	-0.030	22.82	23.60	1.340	21.5°C
Right Side	26775/822.5	15M QPSK 1RB#38	0.060	0.040	0.080	22.88	23.60	0.070	21.5°C
Top Side	26775/822.5	15M QPSK 1RB#38	0.642	0.454	-0.010	22.88	23.60	0.758	21.5°C
Bottom Side	26775/822.5	15M QPSK 1RB#38	0.563	0.383	-0.110	22.88	23.60	0.665	21.5°C
Front Side	26775/822.5	15M QPSK 1RB#38	0.898	0.652	0.030	22.88	23.60	1.060	21.5°C
Front Side	26865/831.5	15M QPSK 1RB#74	0.576	0.400	-0.050	22.83	23.60	0.688	21.5°C
50%RB									
Front Side	26775/822.5	15M QPSK 50%RB#18	0.707	0.487	0.010	21.75	22.50	0.840	21.5°C
Front Side	26865/831.5	15M QPSK 50%RB#18	0.783	0.570	0.000	21.69	22.50	0.944	21.5°C
Front Side	26965/841.5	15M QPSK 50%RB#0	0.598	0.415	-0.020	21.66	22.50	0.726	21.5°C
Back Side	26775/822.5	15M QPSK 50%RB#18	0.863	0.632	-0.040	21.75	22.50	1.026	21.5°C
Back Side	26865/831.5	15M QPSK 50%RB#18	0.662	0.486	-0.010	21.69	22.50	0.798	21.5°C
Back Side	26965/841.5	15M QPSK 50%RB#0	0.711	0.523	0.000	21.66	22.50	0.863	21.5°C
Right Side	26775/822.5	15M QPSK 50%RB#18	0.046	0.032	0.000	21.75	22.50	0.055	21.5°C
Top Side	26775/822.5	15M QPSK 50%RB#18	0.479	0.328	-0.050	21.75	22.50	0.569	21.5°C
Bottom Side	26775/822.5	15M QPSK 50%RB#18	0.432	0.294	-0.050	21.75	22.50	0.513	21.5°C
100%RB									
Front Side	26865/831.5	15M QPSK 100%RB#0	0.725	0.501	-0.020	21.56	22.50	0.900	21.5°C
Back Side	26865/831.5	15M QPSK 100%RB#0	0.681	0.471	-0.010	21.56	22.50	0.846	21.5°C

Table 28: Body SAR test results of LTE Band XXVI

7.2.7 SAR measurement Result of LTE Band XLI

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g	10-g					
1RB									
Front Side	41490/2680	20M QPSK 1RB#0	**0.381**	0.192	0.160	22.71	23.00	**0.407**	21.6°C
Back Side	41490/2680	20M QPSK 1RB#0	0.323	0.169	0.120	22.71	23.00	0.345	21.6°C
Right Side	41490/2680	20M QPSK 1RB#0	0.018	0.010	-0.150	22.71	23.00	0.019	21.6°C
Top Side	41490/2680	20M QPSK 1RB#0	0.080	0.041	0.070	22.71	23.00	0.085	21.6°C
Bottom Side	41490/2680	20M QPSK 1RB#0	0.317	0.163	0.160	22.71	23.00	0.339	21.6°C
50%RB									
Front Side	41490/2680	20M QPSK 50%RB#0	0.304	0.159	0.070	21.54	22.00	0.338	21.6°C
Back Side	41490/2680	20M QPSK 50%RB#0	0.269	0.142	0.130	21.54	22.00	0.299	21.6°C
Right Side	41490/2680	20M QPSK 50%RB#0	0.015	0.008	0.140	21.54	22.00	0.017	21.6°C
Top Side	41490/2680	20M QPSK 50%RB#0	0.070	0.036	-0.030	21.54	22.00	0.078	21.6°C
Bottom Side	41490/2680	20M QPSK 50%RB#0	0.291	0.150	0.090	21.54	22.00	0.324	21.6°C

Table 29: Body SAR test results of LTE Band XLI

7.2.8 SAR measurement Result of WiFi 2.4G

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g Area scan	1-g Zoom scan					
SISO Ant 1									
Front Side	11/2462	802.11 b	0.033	/	0.090	13.63	15.00	/	21.4°C
Back Side	11/2462	802.11 b	0.039	0.040	-0.140	13.63	15.00	0.055	21.4°C
Left Side	11/2462	802.11 b	0.010	/	0.180	13.63	15.00	/	21.4°C
Bottom Side	11/2462	802.11 b	0.028	/	0.120	13.63	15.00	/	21.4°C
SISO Ant 2									
Front Side	11/2462	802.11 b	0.081	**0.082**	0.140	13.16	15.00	**0.126**	21.4°C
Back Side	11/2462	802.11 b	0.061	/	0.150	13.16	15.00	/	21.4°C
Left Side	11/2462	802.11 b	0.045	/	0.060	13.16	15.00	/	21.4°C
Top Side	11/2462	802.11 b	0.037	/	0.180	13.16	15.00	/	21.4°C
MIMO(802.11n 20M)									
Front Side	11/2462	802.11 n	0.045	0.046	0.160	12.19	14.00	0.069	21.4°C
Back Side	11/2462	802.11 n	0.041	/	0.150	12.19	14.00	/	21.4°C
Left Side	11/2462	802.11 n	0.020	/	-0.160	12.19	14.00	/	21.4°C
Top Side	11/2462	802.11 n	0.017	/	0.110	12.19	14.00	/	21.4°C
Bottom Side	11/2462	802.11 n	0.017	/	0.190	12.19	14.00	/	21.4°C

Table 30: Body SAR test results of WiFi 2450MHz

Note: Per KDB248227D01:

1) For WiFi 2.4G SISO, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure. As the highest reported SAR for DSSS is adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

2) For WiFi 2.4G MIMO, SAR is measured for 2.4 GHz 802.11n 20M MIMO using the initial test position procedure according to the specified maximum output power. As the the adjusted SAR is < 1.2 W/kg, so SAR test for OFDM 802.11 n 40M MIMO is not required.

7.2.9 SAR measurement Result of WiFi 5G

Test Position of Body 10mm	Test channel / Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR1-g (W/kg)	Liquid Temp.
			1-g Area scan	1-g Zoom scan					
802.11n 40M SISO Ant 1									
5.3G U-NII-2A Band									
Front Side	54/5270	802.11n	0.102	/	0.000	10.84	11.00	/	21.4°C
Back Side	54/5270	802.11n	0.020	/	0.000	10.84	11.00	/	21.4°C
Left Side	54/5270	802.11n	0.009	/	-0.150	10.84	11.00	/	21.4°C
Bottom Side	54/5270	802.11n	0.112	0.107	0.120	10.84	11.00	0.111	21.4°C
5.6G U-NII-2C Band									
Front Side	126/5630	802.11n	0.049	/	0.050	10.04	11.00	/	21.4°C
Back Side	126/5630	802.11n	0.011	/	-0.110	10.04	11.00	/	21.4°C
Left Side	126/5630	802.11n	0.005	/	-0.180	10.04	11.00	/	21.4°C
Bottom Side	126/5630	802.11n	0.058	0.051	0.020	10.04	11.00	0.064	21.4°C
5.8G U-NII-3 Band									
Front Side	151/5755	802.11n	0.076	/	0.000	9.10	11.00	/	21.4°C
Back Side	151/5755	802.11n	0.015	/	0.000	9.10	11.00	/	21.4°C
Left Side	151/5755	802.11n	0.007	/	-0.050	9.10	11.00	/	21.4°C
Bottom Side	151/5755	802.11n	0.079	0.067	0.040	9.10	11.00	0.103	21.4°C
802.11n 40M SISO Ant 2									
5.3G U-NII-2A Band									
Front Side	54/5270	802.11n	0.120	**0.113**	0.000	10.53	11.00	0.126	21.4°C
Back Side	54/5270	802.11n	0.036	/	0.190	10.53	11.00	/	21.4°C
Left Side	54/5270	802.11n	0.021	/	0.160	10.53	11.00	/	21.4°C
Top Side	54/5270	802.11n	0.051	/	0.180	10.53	11.00	/	21.4°C
5.6G U-NII-2C Band									
Front Side	126/5630	802.11n	0.115	0.089	0.110	10.41	11.00	0.102	21.4°C
Back Side	126/5630	802.11n	0.031	/	-0.080	10.41	11.00	/	21.4°C
Left Side	126/5630	802.11n	0.018	/	0.160	10.41	11.00	/	21.4°C
Top Side	126/5630	802.11n	0.047	/	-0.170	10.41	11.00	/	21.4°C
5.8G U-NII-3 Band									
Front Side	151/5755	802.11n	0.117	0.107	-0.150	10.80	11.00	0.112	21.4°C
Back Side	151/5755	802.11n	0.015	/	0.000	10.80	11.00	/	21.4°C
Left Side	151/5755	802.11n	0.001	/	0.130	10.80	11.00	/	21.4°C
Top Side	151/5755	802.11n	0.115	/	0.130	10.80	11.00	/	21.4°C

802.11n 40M MIMO									
5.3G U-NII-2A Band									
Front Side	62/5310	802.11n	0.098	/	0.000	13.30	14.50	/	21.4°C
Back Side	62/5310	802.11n	0.020	/	0.000	13.30	14.50	/	21.4°C
Left Side	62/5310	802.11n	0.018	/	0.000	13.30	14.50	/	21.4°C
Top Side	62/5310	802.11n	0.086	/	0.150	13.30	14.50	/	21.4°C
Bottom Side	62/5310	802.11n	0.102	0.099	0.010	13.30	14.50	0.130	21.4°C
5.6G U-NII-2C Band									
Front Side	126/5630	802.11n	0.090	0.081	0.150	12.76	14.50	0.120	21.4°C
Back Side	126/5630	802.11n	0.024	/	0.050	12.76	14.50	/	21.4°C
Left Side	126/5630	802.11n	0.010	/	0.180	12.76	14.50	/	21.4°C
Top Side	126/5630	802.11n	0.086	/	0.150	12.76	14.50	/	21.4°C
Bottom Side	126/5630	802.11n	0.058	/	0.090	12.76	14.50	/	21.4°C
5.8G U-NII-3 Band									
Front Side	151/5755	802.11n	0.097	/	0.120	12.86	14.50	/	21.4°C
Back Side	151/5755	802.11n	0.016	/	0.090	12.86	14.50	/	21.4°C
Left Side	151/5755	802.11n	0.013	/	0.190	12.86	14.50	/	21.4°C
Top Side	151/5755	802.11n	0.100	0.101	0.180	12.86	14.50	**0.147**	21.4°C
Bottom Side	151/5755	802.11n	0.067	/	0.070	12.86	14.50	/	21.4°C

Table 31: Body SAR test results of WiFi 5G

Note: Per KDB248227D01:

1) For WiFi 5G SISO,

a) the 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power and largest channel bandwidth. 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.

b) For WiFi 5G U-NII-1 and U-NII-2A bands, as the same maximum output power is specified for both 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 (802.11 mode and exposure condition).

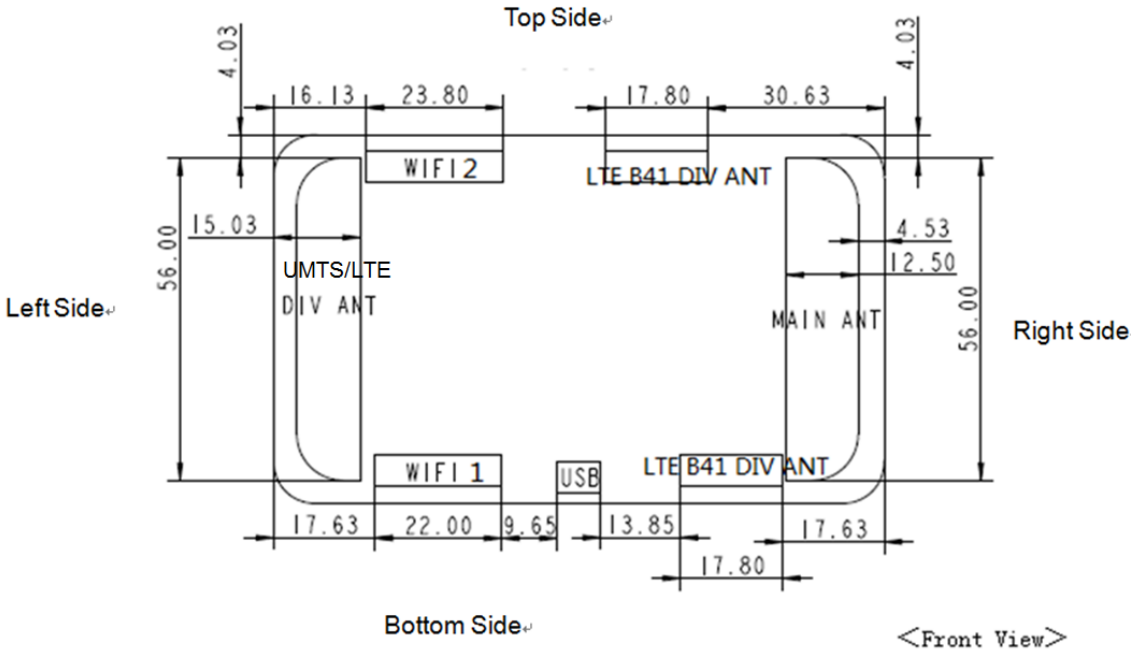
2) For WiFi 5G MIMO,

a) the 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power and largest channel bandwidth. 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.

b) For WiFi 5G U-NII-1 and U-NII-2A bands, as the same maximum output power is specified for both 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 (802.11 mode and exposure condition).

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 Div antenna does not have transmit function.

The SAR measurement Positions of each band are as below:

Mode	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Main antenna	Yes	Yes	No	Yes	Yes	Yes
WiFi 2.4G/5G Ant 1	Yes	Yes	Yes	No	No	Yes
WiFi 2.4G/5G Ant 2	Yes	Yes	Yes	No	Yes	No
WiFi 2.4G/5G MIMO	Yes	Yes	Yes	No	Yes	Yes

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

7.3.1 Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Body
1	UMTS/LTE + WiFi 2.4G SISO	Yes
2	UMTS/LTE + WiFi 2.4G MIMO	Yes
3	UMTS/LTE + WiFi 5G SISO	Yes
4	UMTS/LTE + WiFi 5G MIMO	Yes

Table 32: Simultaneous Transmission Possibilities

Note:

1) WiFi 2.4G and WiFi 5G can't transmit simutanously.

7.3.2 SAR Summation Scenario

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	UMTS Band II	0.506	1.269	/	0.609	0.243	0.072
	UMTS Band IV	0.613	0.975	/	0.337	0.269	0.193
	LTE Band II	0.519	1.408	/	0.903	0.254	0.061
	LTE Band IV	1.030	1.333	/	0.503	0.383	0.268
	LTE Band XXV	0.501	1.354	/	0.792	0.262	0.071
	LTE Band XXVI	1.197	1.369	/	0.070	0.758	0.665
	LTE Band XLI	0.407	0.345	/	0.019	0.085	0.339
	2.4G WiFi Ant1 SISO	0.055	0.055	0.055	/	/	0.055
Σ1-g SAR(W/kg)		1.252	**1.463**	0.055	0.903	0.758	0.720

Table 33: SAR Simultaneous Tx Combination of Main Antenna and WiFi 2.4G Ant1 SISO

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	UMTS Band II	0.506	1.269	/	0.609	0.243	0.072
	UMTS Band IV	0.613	0.975	/	0.337	0.269	0.193
	LTE Band II	0.519	1.408	/	0.903	0.254	0.061
	LTE Band IV	1.030	1.333	/	0.503	0.383	0.268
	LTE Band XXV	0.501	1.354	/	0.792	0.262	0.071
	LTE Band XXVI	1.197	1.369	/	0.070	0.758	0.665
	LTE Band XLI	0.407	0.345	/	0.019	0.085	0.339
	2.4G WiFi Ant2 SISO	0.126	0.126	0.126	/	0.126	/
Σ1-g SAR(W/kg)		1.323	**1.534**	0.126	0.903	0.884	0.665

Table 34: SAR Simultaneous Tx Combination of Main Antenna and WiFi 2.4G Ant2 SISO

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	UMTS Band II	0.506	1.269	/	0.609	0.243	0.072
	UMTS Band IV	0.613	0.975	/	0.337	0.269	0.193
	LTE Band II	0.519	1.408	/	0.903	0.254	0.061
	LTE Band IV	1.030	1.333	/	0.503	0.383	0.268
	LTE Band XXV	0.501	1.354	/	0.792	0.262	0.071
	LTE Band XXVI	1.197	1.369	/	0.070	0.758	0.665
	LTE Band XLI	0.407	0.345	/	0.019	0.085	0.339
	2.4G WiFi MIMO	0.069	0.069	0.069	/	0.069	0.069
Σ1-g SAR(W/kg)		1.266	**1.477**	0.069	0.903	0.827	0.734

Table 35: SAR Simultaneous Tx Combination of Main Antenna and WiFi 2.4G MIMO

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	UMTS Band II	0.506	1.269	/	0.609	0.243	0.072
	UMTS Band IV	0.613	0.975	/	0.337	0.269	0.193
	LTE Band II	0.519	1.408	/	0.903	0.254	0.061
	LTE Band IV	1.030	1.333	/	0.503	0.383	0.268
	LTE Band XXV	0.501	1.354	/	0.792	0.262	0.071
	LTE Band XXVI	1.197	1.369	/	0.070	0.758	0.665
	LTE Band XLI	0.407	0.345	/	0.019	0.085	0.339
	5G WiFi Ant1 SISO	0.111	0.111	0.111	/	/	0.111
Σ1-g SAR(W/kg)		1.308	**1.519**	0.111	0.903	0.758	0.776

Table 36: SAR Simultaneous Tx Combination of Main Antenna and WiFi 5G Ant1 SISO

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	UMTS Band II	0.506	1.269	/	0.609	0.243	0.072
	UMTS Band IV	0.613	0.975	/	0.337	0.269	0.193
	LTE Band II	0.519	1.408	/	0.903	0.254	0.061
	LTE Band IV	1.030	1.333	/	0.503	0.383	0.268
	LTE Band XXV	0.501	1.354	/	0.792	0.262	0.071
	LTE Band XXVI	1.197	1.369	/	0.070	0.758	0.665
	LTE Band XLI	0.407	0.345	/	0.019	0.085	0.339
	5G WiFi Ant2 SISO	0.126	0.126	0.126	/	0.126	0.126
Σ1-g SAR(W/kg)		1.323	**1.534**	0.126	0.903	0.758	0.791

Table 37: SAR Simultaneous Tx Combination of Main Antenna and WiFi 5G Ant2 SISO

Test Position		Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
MAX 1-g SAR (W/kg)	UMTS Band II	0.506	1.269	/	0.609	0.243	0.072
	UMTS Band IV	0.613	0.975	/	0.337	0.269	0.193
	LTE Band II	0.519	1.408	/	0.903	0.254	0.061
	LTE Band IV	1.030	1.333	/	0.503	0.383	0.268
	LTE Band XXV	0.501	1.354	/	0.792	0.262	0.071
	LTE Band XXVI	1.197	1.369	/	0.070	0.758	0.665
	LTE Band XLI	0.407	0.345	/	0.019	0.085	0.339
	5G WiFi MIMO	0.147	0.147	0.147	/	0.147	0.147
Σ1-g SAR(W/kg)		1.344	**1.555**	0.147	0.903	0.905	0.812

Table 38: SAR Simultaneous Tx Combination of Main Antenna and WiFi 5G MIMO

7.3.3 Simultaneous Transmission Conlcusion

The above numeral summed SAR results and/or SPLSR analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scans is not required per KDB 447498 D01v06.

Appendix A. System Check Plots
(Pls See Appendix A.)

Appendix B. SAR Measurement Plots
(Pls See Appendix B.)

Appendix C. Calibration Certificate
(Pls See Appendix C.)

Appendix D. Photo documentation
(Pls See Appendix D.)

End