



TEST REPORT

APPLICANT : Shenzhen Chainway Information Technology Co., Ltd.
PRODUCT NAME : Mobile Data Terminal
MODEL NAME : C6000
BRAND NAME : CHAINWAY
FCC ID : 2AC6AC6000B
STANDARD(S) : 47 CFR Part 2(2.1093)
IEEE 1528-2013
RECEIPT DATE : 2020-11-20
TEST DATE : 2020-12-11 to 2020-12-25
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Edited by : Gan Yueming
Gan Yueming (Rapporteur)

Approved by: Peng Huarui
Peng Huarui (Supervisor)

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Changed History		
Version	Date	Reason for Change
1.0	2021-01-13	First edition



1. SAR Results Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:

<Highest Reported SAR Summary>

Frequency Band		Highest SAR Summary			
		Head (Gap 0mm)	Body-worn (Gap 10mm)	Hotspot (Gap 10mm)	Extremity (Gap 0mm)
		1g SAR (W/kg)			10g SAR (W/kg)
GSM	GSM850	0.702	0.778	0.778	N/A
	GSM1900	0.259	0.812	0.921	N/A
WCDMA	Band II	0.276	0.677	0.867	N/A
	Band IV	0.224	0.349	0.405	N/A
	Band V	0.512	0.728	0.728	N/A
CDMA	BC 0	0.637	0.622	0.622	N/A
LTE	LTE Band 2	0.283	0.571	0.621	N/A
	LTE Band 4	0.219	0.354	0.437	N/A
	LTE Band 5	0.561	0.588	0.588	N/A
	LTE Band 7	0.247	0.747	0.747	N/A
	LTE Band 12/17	0.197	0.387	0.387	N/A
	LTE Band 38	0.166	0.598	0.598	N/A
	LTE Band 40A	0.029	0.309	0.309	N/A
	LTE Band 40B	0.025	0.411	0.411	N/A
WLAN	2.4GHz WLAN	0.170	0.731	0.731	N/A
	5GHz WLAN	0.707	0.394	0.394	0.229
2.4GHz Band	Bluetooth (Estimated)	N/A	0.187	N/A	N/A

Max Scaled SAR _{1g} (W/Kg):	Head:	0.707 W/kg	Limit(W/kg): 1.6 W/kg
	Body-worn:	0.812 W/kg	
	Hotspot:	0.921 W/kg	
Max Scaled SAR _{10g} (W/Kg):	Extremity:	0.229 W/kg	Limit(W/kg): 2.0 W/kg

Highest Simultaneous Transmission SAR _{1g} (W/Kg):	1.543 W/kg	Limit(W/kg): 1.6 W/kg
-------------------------------------------------------------	------------	-----------------------

Note:

1. This device is in compliance with Specific Absorption Rate (SAR) for general population or uncontrolled exposure limits (1.6W/kg as averaged over any 1 gram of tissue; specified in FCC 47



CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

- When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.

2. Technical Information

Note: Provide by applicant.

2.1. Applicant and Manufacturer Information

Applicant:	Shenzhen Chainway Information Technology Co., Ltd.
Applicant Address:	9F Building 2, Daqian Industrial Park, District 67, XingDong Community, Xin'an Street, Bao'an District, Shenzhen, Guangdong, China
Manufacturer:	Shenzhen Chainway Information Technology Co., Ltd.
Manufacturer Address:	9F Building 2, Daqian Industrial Park, District 67, XingDong Community, Xin'an Street, Bao'an District, Shenzhen, Guangdong, China

2.2. Equipment under Test (EUT) Description

Product Name:	Mobile Data Terminal
Hardware Version:	PCBA-C6000M-62MB-V20
Software Version:	H205XOA.C6000_E3AX.A3.AD10.WVGA.CN.FTM.MV3224.P1.20200921.ATA
Frequency Bands:	GSM 850: 824 MHz ~ 849 MHz GSM 1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz CDMA2000 BC 0: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 40A: 2305 MHz ~ 2315 MHz



	LTE Band 40B: 2350 MHz ~ 2360 MHz LTE Band 41: 2555 MHz ~ 2655 MHz WLAN 2.4GHz: 2412 MHz ~ 2472 MHz WLAN 5.2GHz: 5180 MHz ~ 5240 MHz WLAN 5.3GHz: 5260 MHz ~ 5320 MHz WLAN 5.8GHz: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz	
Modulation Mode:	GSM/GPRS: GMSK EDGE: 8PSK WCDMA: QPSK, 16QAM CDMA 1xRTT: QPSK CDMA 1xEVDO Rev0: QPSK, 8PSK LTE: QPSK, 16QAM, 64QAM 802.11b: DSSS 802.11a/g/n-HT20/HT40/ac-VHT20/40/80: OFDM BR+EDR: GFSK(1Mbps), $\pi/4$ -DQPSK(2Mbps), 8-DPSK(3Mbps) Bluetooth LE: GFSK(1Mbps) NFC: ASK	
Multi-slot Class:	GPRS: Multi-slot Class 12; EDGE: Multi-slot Class 12	
Operation Class:	Class B	
Hotspot Mode:	WWAN/2.4GHz WLAN/5G WLAN(Band 1&4)	
Antenna Type:	WWAN: Fixed Internal Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna NFC: PIFA Antenna	
SIM Cards Description:	SIM 1	GSM+ WCDMA+CDMA+LTE
	SIM 2	GSM+ WCDMA+CDMA +LTE
	For dual SIM card version, SIM 1 and SIM 2 are the same chipset unit and tested as a single chipset, the SIM 1 is selected for testing	

Note:

1. According to the declaration that there are two types of internal models for this device, both of them are different from the scan head. The model for 4710 would be used for the primary test model, and the other for 6603 would be verified the worst case of the primary model.
2. For a more detailed description, please refer to specification or user's manual supplied by the applicant and/or manufacturer.



2.3. Environment of Test Site/Conditions

Normal Temperature (NT):	20-25 °C
Relative Humidity:	30-75 %
Air Pressure:	980-1020 hPa

Test Frequency:	GSM 850MHz/1900MHz WCDMA Band II/IV/V CDMA2000 BC0 FDD-LTE Band 2/4/5/7/12/17 TDD-LTE Band 38/40A/40B/41 WLAN 2.4GHz WLAN 5GHz
Operation Mode:	Call established
Power Level:	GSM 850 MHz Maximum output power(level 5) GSM 1900MHz Maximum output power(level 0) WCDMA Band II/IV/V (All Up Bits) CDMA 2000 BC0 (All Up Bits) FDD-LTE Band 2/4/5/7/12/17 (Maximum output power) TDD-LTE Band 38/40A/40B/41 (Maximum output power) WLAN 2.4GHz WLAN 5GHz

During SAR test, EUT is in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established.

The EUT shall use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the Factory. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link is used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.

The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the handset by at least 35 dB.

3. Specific Absorption Rate (SAR)

3.1. Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational or controlled and general population or uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational or controlled exposure limits are Middle than the limits for general population or uncontrolled.

3.2. SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by(dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density. (ρ). The equation description is as below:

$$\text{SAR} = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho dv} \right)$$

SAR is expressed in units of Watts per kilogram (W/kg).

SAR measurement can be either related to the temperature elevation in tissue by,

$$\text{SAR} = C \left(\frac{\delta T}{\delta t} \right)$$

Where C is the specific head capacity, δT is the temperature rise and δt the exposure duration, or related to the electrical field in the tissue by

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

Where σ is the conductivity of the tissue, ρ is the mass density of the tissue and $|E|$ is the rmselectrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.



4. RF Exposure Limits

4.1. Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

4.2. Controlled Environment

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). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for General Population/Uncontrolled Exposure (W/kg)

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for head and trunk)	1.6 W/kg
Spatial Peak SAR (10g cube tissue for limbs)	4.0 W/kg
Spatial Peak SAR (1g cube tissue for whole body)	0.08 W/kg

Note:

- Occupational/Uncontrolled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).
- Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.



5. Applied Reference Documents

Leading reference documents for testing:

No.	Identity	Document Title	Method Determination /Remark
1	47 CFR Part 2(2.1093)	Radio Frequency Radiation Exposure Evaluation: Portable Devices	No deviation
2	IEEE 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	No deviation
3	KDB 447498 D01v06	General RF Exposure Guidance	No deviation
4	KDB 248227 D01v02r02	SAR Measurement Procedures for 802.11 Transmitters	No deviation
5	KDB 865664 D01v01r04	SAR Measurement 100 MHz to 6 GHz	No deviation
6	KDB 865664 D02v01r02	RF Exposure Reporting	No deviation
7	KDB 648474 D04v01r03	Handset SAR	No deviation
8	KDB 941225 D01v03r01	3G SAR MEAUREMENT PROCEDURES	No deviation
9	KDB 941225 D05v02r05	SAR Evaluation Consideration for LTE Devices	No deviation
10	KDB 941225 D06v02r01	SAR Evaluation Procedures For Portable Devices With Wireless Router Capabilities	No deviation

Note 1: The test item is not applicable.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

6. SAR Measurement System

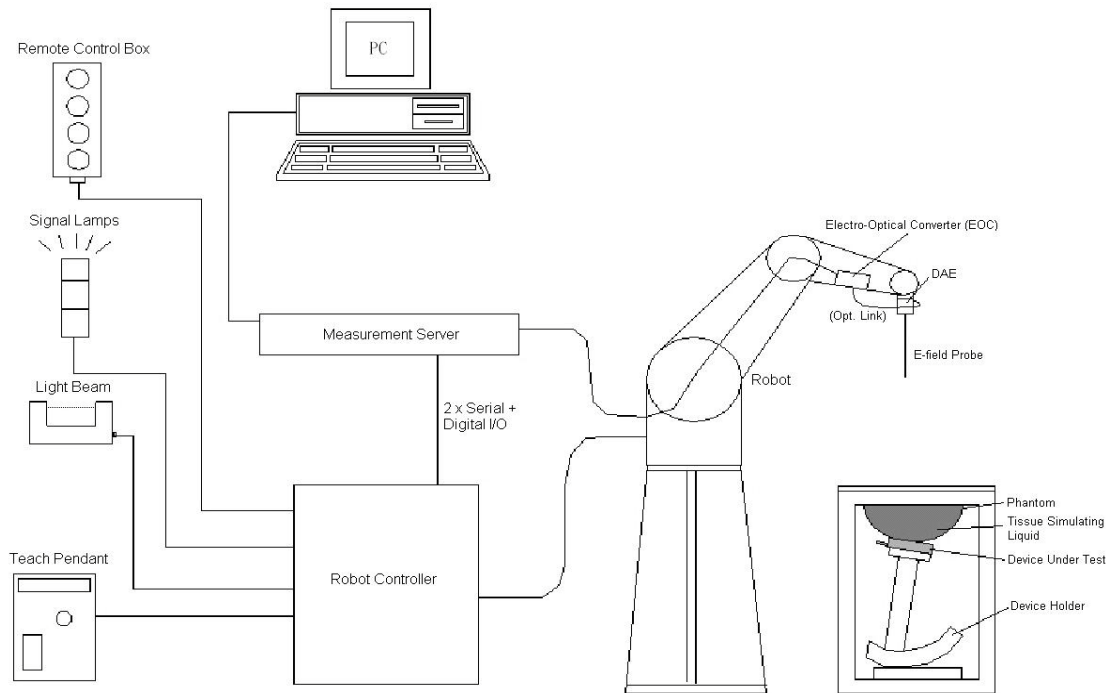


Fig 6.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software.
- A data acquisition electronic (DAE) attached to the robot arm extension.
- A dosimetric probe equipped with an optical surface detector system.
- The electro-optical converter (ECO) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning.
- A computer operating Windows XP.
- DASY software.
- Remove control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom.
- A device holder.
- Tissue simulating liquid.
- Dipole for evaluating the proper functioning of the system.
- Some of the components are described in details in the following sub-sections.

6.1. E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

E-Field Probe Specification

<ES3DV3 Probe>


Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)	
Dynamic Range	5 μ W/g to 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm	

Fig 6.2 Photo of ES3DV3

<EX3DV4 Probe>


Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 μ W/g to 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Fig 6.3 Photo of EX3DV4

E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

6.2. Data Acquisition Electronics (DAE)

The data acquisition electronics(DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. AD-converter and a command decoder and 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 input impedance of the DAE is 200M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

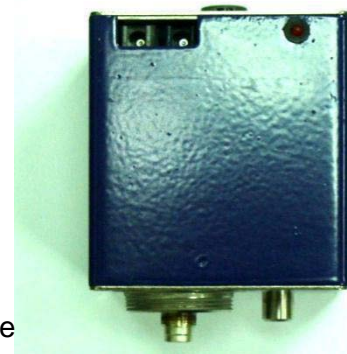


Fig 6.4 Photo of DAE

6.3. Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

High precision (repeatability ± 0.035 mm)

High reliability (industrial design)

Jerk-free straight movements

Low ELF interference (the closed metallic construction shields against motor control fields)



Fig 6.5 Photo of DASY5

6.4. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chip disk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.



Fig 6.6 Photo of Server for DASY5

6.5. Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.

The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.



Fig. 6.7 Photo of Light Beam

6.6. Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%) Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Head, Right Head, Flat Phantom



Fig. 6.8 Photo of SAM Phantom

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. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

6.7. Device Holder

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$. 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.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Fig 6.9 Device Holder

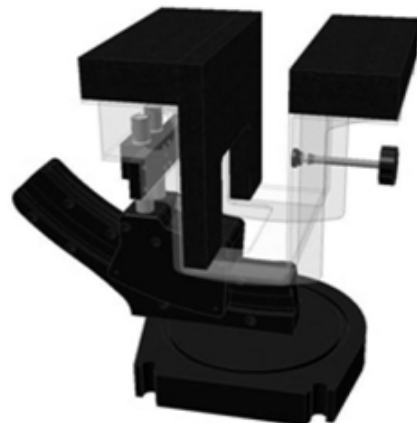


Fig 6.10 Laptop Extension Kit



6.8. Data Storage and Evaluation

➤ Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing 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 erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

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

➤ Data Evaluation

The DASY post-processing software (SEMCAD) 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 DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the



diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \times \frac{cf}{dcp_i}$$

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:

$$\text{E-field Probes: } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \times \text{ConvF}}}$$

$$\text{H-field Probes: } H_i = \sqrt{V_i} \times \frac{a_{i0} + a_{i1} + a_{i2}f^2}{f}$$

With V_i = compensated signal of channel i , ($i = x, y, z$)
 Norm_i = sensor sensitivity of channel i , ($i = x, y, z$), $\mu\text{V}/(\text{V/m})^2$ 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):

$$E_{\text{tot}} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$\text{SAR} = E_{\text{tot}}^2 \times \frac{\sigma}{\rho \times 1000}$$

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 set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.



6.9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1173	2018.06.21	2021.06.20
SPEAG	835MHz System Validation Kit	D835V2	4d227	2018.06.22	2021.06.21
SPEAG	1750MHz System Validation Kit	D1750V2	1160	2018.06.25	2021.06.24
SPEAG	1900MHz System Validation Kit	D1900V2	5d221	2018.06.22	2021.06.21
SPEAG	2300MHz System Validation Kit	D2300V2	1107	2020.06.03	2023.06.02
SPEAG	2450MHz System Validation Kit	D2450V2	805	2018.10.26	2021.10.25
SPEAG	2600MHz System Validation Kit	D2600V2	1139	2018.06.25	2021.06.24
SPEAG	5000MHz System Validation Kit	D5GHzV2	1176	2018.11.06	2021.11.05
SPEAG	Dosimetric E-Field Probe	EX3DV4	3823	2020.01.03	2021.01.02
SPEAG	Dosimetric E-Field Probe	EX3DV4	7515	2020.11.30	2021.11.29
SPEAG	Data Acquisition Electronics	DAE4	480	2020.06.02	2021.06.01
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2020.10.20	2021.10.19
SPEAG	SAM Twin Phantom 2	QD 000 P40 CB	TP-1464	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Network Emulator	CMW500	124534	2020.03.31	2021.03.30
Agilent	Network Analyzer	E5071B	MY42404762	2020.04.01	2021.03.31
mini-circuits	Amplifier	ZHL-42W+	608501717	NCR	NCR
mini-circuits	Amplifier	ZVE-8G+	754401735	NCR	NCR
Agilent	Signal Generator	N5182B	MY53050509	2020.03.31	2021.03.30
Agilent	Power Sensor	N8482A	MY41090849	2020.10.19	2021.10.18
Agilent	Power Meter	E4416A	MY45102093	2020.10.19	2021.10.18
Anritsu	Power Sensor	MA2411B	N/A	2020.10.19	2021.10.18
Anritsu	Power Meter	NRVD	101066	2020.10.19	2021.10.18
Agilent	Dual Directional Coupler	778D	50422	NA	NA
MCL	Attenuation1	351-218-010	N/A	NA	NA
THERMOMETER	Thermo meter	DC-803	N/A	2020.01.22	2021.01.21
N/A	Tissue Simulating Liquids	700-6000MHz	N/A	24H	

Note:

1. The calibration certificate of DASY can be referred to appendix E of this report.
2. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
3. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure



(calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Speag.

4. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it.
5. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
6. N.C.R means No Calibration Requirement.

7. Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm, which is shown in Fig. 7.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig.

7.2. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in below table.



Fig 7.1 Photo of Liquid Height for Head SAR



Fig 7.2 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquids

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG.

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

Note: Please refer to the validation results for dielectric parameters of each frequency band.



The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a SPEAG Dielectric Assessment KIT and an Agilent Network Analyzer.

Table 1: Dielectric Performance of Tissue Simulating Liquid

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Conductivity Target (σ)	Delta (σ) (%)	Limit (%)	Date
750	HSL	22.3	0.911	0.89	2.36	±5	2020.12.11
835	HSL	22.3	0.928	0.90	3.11	±5	2020.12.13
1750	HSL	22.6	1.411	1.37	2.99	±5	2020.12.16
1900	HSL	22.1	1.426	1.40	1.86	±5	2020.12.17
2300	HSL	22.2	1.682	1.67	0.72	±5	2020.12.22
2450	HSL	22.2	1.833	1.80	1.83	±5	2020.12.23
2600	HSL	22.4	1.997	1.96	1.89	±5	2020.12.24
5250	HSL	22.5	4.673	4.71	-0.79	±5	2020.12.25
5750	HSL	22.5	5.202	5.22	-0.34	±5	2020.12.25

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Permittivity (ϵ_r)	Permittivity Target (ϵ_r)	Delta (ϵ_r) (%)	Limit (%)	Date
750	HSL	22.3	42.192	41.90	0.70	±5	2020.12.11
835	HSL	22.3	42.764	41.50	3.05	±5	2020.12.13
1750	HSL	22.6	39.661	40.10	-1.09	±5	2020.12.16
1900	HSL	22.1	39.826	40.00	-0.43	±5	2020.12.17
2300	HSL	22.2	39.355	39.50	-0.37	±5	2020.12.22
2450	HSL	22.2	39.022	39.20	-0.45	±5	2020.12.23
2600	HSL	22.4	38.622	39.00	-0.97	±5	2020.12.24
5250	HSL	22.5	35.622	35.95	-0.91	±5	2020.12.25
5750	HSL	22.5	35.766	35.35	1.18	±5	2020.12.25



8. SAR System Verification

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

➤ System Validation

According to FCC KDB 865664 D02, SAR system verification is required to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles are used with the required tissue-equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point must be validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media. A tabulated summary of the system validation status, measurement frequencies, SAR probes, calibrated signal type(s) and tissue dielectric parameters has been included.

➤ Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

➤ System Setup

The output power on dipole port must be calibrated to 24 dBm (250 mW) before dipole is connected. In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



Fig 8.1 Photo of Dipole Setup

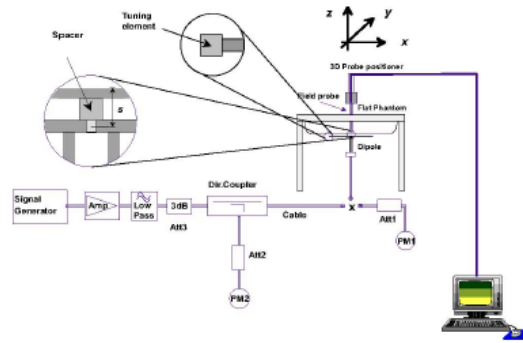


Fig 8.2 System Setup for System Evaluation

➤ **Validation Results**

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

<Validation Setup>

Frequency (MHz)	Tissue Type	Input Power(mW)	Dipole S/N	Probe S/N	DAE S/N
750	HSL	250	D750V3-1173	7515	480
835	HSL	250	D835V2-4d227	3823	480
1750	HSL	250	D1750V2-1160	3823	480
1900	HSL	250	D1900V2_5d221	3823	480
2300	HSL	250	D2300V2_1107	3823	480
2450	HSL	250	D2450V2-805	3823	480
2600	HSL	250	D2600V2-1139	3823	480
5250	HSL	100	D5GHzV2-1176-5250	3823	480
5750	HSL	100	D5GHzV2-1176-5750	3823	480

Frequency (MHz)	Tissue Type	Conductivity (σ)	Permittivity (ϵ_r)	CW Signal Validation		
				Sensitivity	Probe Linearity	Probe Isotropy
750	HSL	0.851	42.43	PASS	PASS	PASS
835	HSL	0.898	41.88	PASS	PASS	PASS
1750	HSL	1.386	39.91	PASS	PASS	PASS
1800	HSL	1.449	41.26	PASS	PASS	PASS
1900	HSL	1.435	39.65	PASS	PASS	PASS
2000	HSL	1.451	39.42	PASS	PASS	PASS
2300	HSL	1.764	38.99	PASS	PASS	PASS
2450	HSL	1.863	38.85	PASS	PASS	PASS



2600	HSL	1.973	38.58	PASS	PASS	PASS
5250	HSL	4.528	35.32	PASS	PASS	PASS
5600	HSL	4.905	34.89	PASS	PASS	PASS
5750	HSL	5.077	34.28	PASS	PASS	PASS

Frequency (MHz)	Tissue Type	Conductivity (σ)	Permittivity (ϵ_r)	Modulation Signal Validation		
				Mod. Type	Duty Factor	PAR
750	HSL	0.851	42.43	N/A	N/A	N/A
835	HSL	0.898	41.88	GMSK	PASS	N/A
1750	HSL	1.386	39.91	N/A	N/A	N/A
1800	HSL	1.449	41.26	N/A	N/A	N/A
1900	HSL	1.435	39.65	GMSK	PASS	N/A
2000	HSL	1.451	39.42	GMSK	PASS	N/A
2300	HSL	1.764	38.99	OFDM	PASS	PASS
2450	HSL	1.863	38.85	OFDM	PASS	PASS
2600	HSL	1.973	38.58	TDD	PASS	N/A
5250	HSL	4.528	35.32	OFDM	N/A	PASS
5600	HSL	4.905	34.89	OFDM	N/A	PASS
5750	HSL	5.077	34.28	OFDM	N/A	PASS

<Validation Results>

Date	Frequency (MHz)	Tissue Type	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2020.12.11	750	HSL	2.02	8.26	8.08	-2.18
2020.12.13	835	HSL	2.39	9.34	9.56	2.36
2020.12.16	1750	HSL	9.42	37.10	37.68	1.56
2020.12.17	1900	HSL	9.97	39.50	39.88	0.96
2020.12.22	2300	HSL	11.81	48.40	47.24	-2.40
2020.12.23	2450	HSL	13.40	52.00	53.6	3.08
2020.12.24	2600	HSL	13.89	54.00	55.56	2.89
2020.12.25	5250	HSL	7.86	78.90	78.6	-0.38
2020.12.25	5750	HSL	8.04	80.00	80.4	0.50



Date	Frequency (MHz)	Tissue Type	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2020.12.11	750	HSL	1.37	5.45	5.48	0.55
2020.12.13	835	HSL	1.57	6.07	6.28	3.46
2020.12.16	1750	HSL	4.94	20.00	19.76	-1.20
2020.12.17	1900	HSL	5.18	20.60	20.72	0.58
2020.12.22	2300	HSL	5.73	23.00	22.92	-0.35
2020.12.23	2450	HSL	6.18	24.10	24.72	2.57
2020.12.24	2600	HSL	6.25	24.50	25	2.04
2020.12.25	5250	HSL	2.19	22.50	21.9	-2.67
2020.12.25	5750	HSL	2.29	22.60	22.9	1.33

Note: System checks the specific test data please see Annex C.

9. EUT Testing Position

This EUT was tested in six different positions. They are right cheek/right tilted/left cheek/left tilted for head, Front/Back of the EUT with phantom 10 mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

➤ Handset Reference Points

The vertical centre line passes through two points on the front side of the handset – the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.

The horizontal line is perpendicular to the vertical centre line and passes the center of the acoustic output. The horizontal line is also tangential to the handset at point A.

The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centre line is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



Fig. 9.1 Illustration for Cheek Position

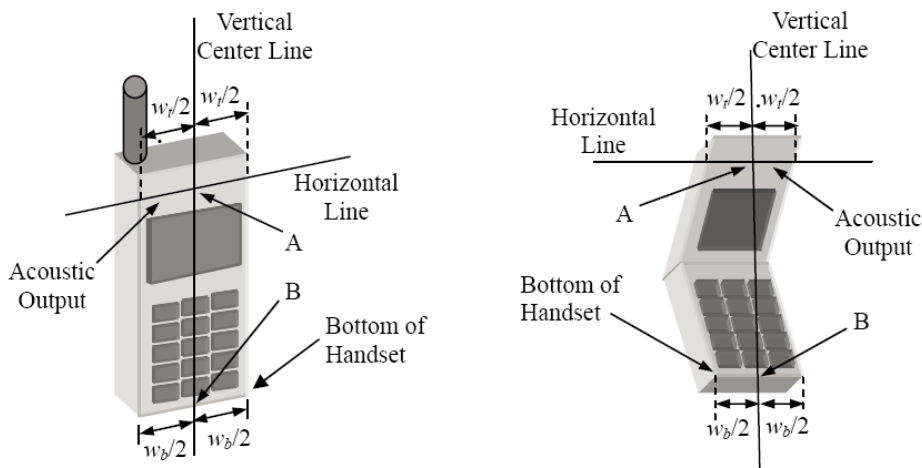


Fig. 9.2 Illustration for Handset Vertical and Horizontal Reference Lines

➤ **Positioning for Cheek / Touch**

To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see below figure)

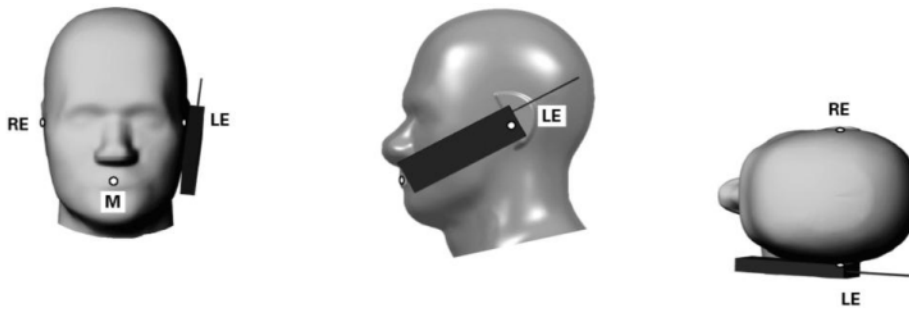


Fig 9.3 Illustration for Cheek Position

➤ **Positioning for Ear / 15° Tilt**

To position the device in the “cheek” position described above. While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see figure below).

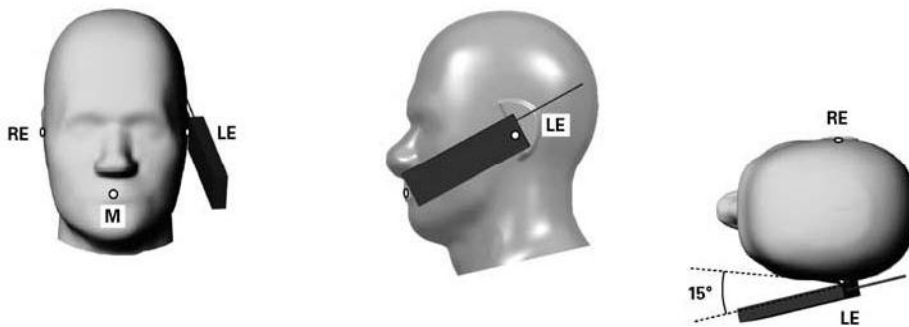


Fig 9.4 Illustration for Tilted Position

➤ **SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom**

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR locations identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

➤ **Body-worn Configurations**

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration. For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

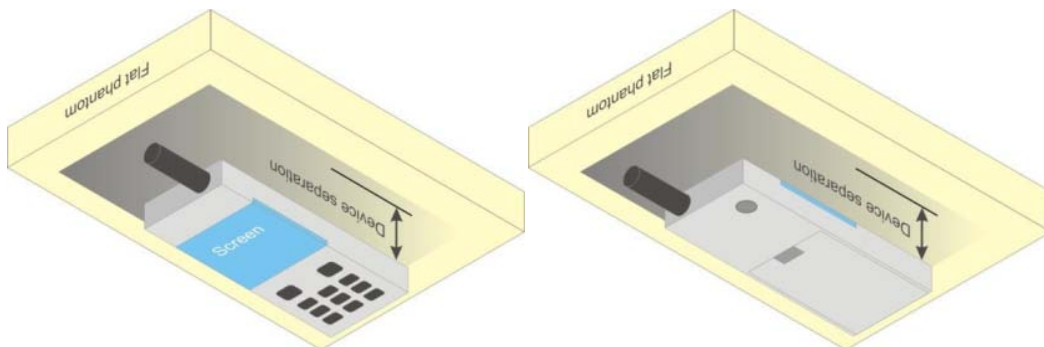


Fig 9.5 Illustration for Body Worn Position

➤ **Hotspot Mode Exposure Position Conditions**

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).

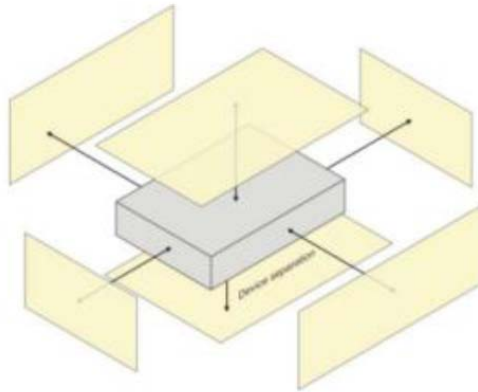


Fig 9.6 Illustration for Hotspot Position

10. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power.

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band.
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement.
- (b) Area scan.
- (c) Zoom scan.
- (d) Power drift measurement.

10.1. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.



The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan.
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).
- (c) Generation of a high-resolution mesh within the measured volume.
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid.
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface.
- (f) Calculation of the averaged SAR within masses of 1g and 10g.

10.2. Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

10.3. Area Scan Procedures

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm² step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima founding the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE1528-2003.

10.4. Zoom Scan Procedures

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m³ is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10 g cube 21,5mm. The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal



practice for typical test applications utilize a physical step of 5x5x7 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 30mm in the Z axis.

10.5. SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Sheppard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

10.6. Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

11. SAR Test Procedure

11.1. General Scan Requirements

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std. 1528-2013.

		≤ 3 GHz	> 3 GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 mm \pm 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm \pm 0.5 mm	
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30° \pm 1°	20° \pm 1°	
Maximum area scan spatial resolution: ΔX_{Area} , ΔY_{Area}		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm	
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.		
Maximum zoom scan spatial resolution: ΔX_{Zoom} , ΔY_{Zoom}		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta Z_{Zoom}(n)$	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm	
	graded grid	$\Delta Z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta Z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta Z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details. * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				



11.2. Test Procedure

The Following steps are used for each test position

1. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface.
2. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
3. Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
4. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

11.3. Description of Interpolation/Extrapolation Scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

11.4. Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) are based on a composite test separation distance of 10 from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the



body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.



12. SAR Test Configuration

<GSM Mode>

A summary of these settings are illustrated below:

For GSM850 frequency band, the power control is set to 5 for GSM/GPRS mode (GSMK-CS1) and set to 8 for EDGE mode (MCS5); For GSM1900 frequency band, the power control is set to 0 for GSM/GPRS mode (GSMK-CS1) and set to 2 for EDGE mode (MCS5).

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, SAR test reduction for GSM / GPRS / EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GPRS (4Tx slots) for GSM850/GSM1900 is considered as the primary mode.
3. Other configurations of GSM / GPRS / EDGE are considered as secondary modes.

Timeslot consignations:

Remark:

1. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots. The calculated method are shown as below:
The duty cycle "x" of different time slots as below:
1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8
Based on the calculation formula:
Frame-averaged power = Burst averaged power + 10 log (x)
So,
Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot)– 9.03
Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots)– 6.02
Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots)– 4.26
Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01
2. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

No. of Slots:	Slot 1	Slot 2	Slot 3	Slot 4
Slot Consignation:	1Up4Down	2Up3Down	3Up2Down	4Up1Down
Duty Cycle:	1:8.3	1:4.15	1:2.77	1:2.08
Correct Factor:	-9.03dB	-6.02dB	-4.26dB	-3.01dB



<WCDMA Mode>

Summary of UMTS conducted power measurement:

1. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode, SAR measurement is not required for the secondary mode.
2. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
3. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
4. For HSPA+ devices supporting 16 QAM in the uplink, power measurements procedure is according to the configurations in Table C.11.1.4 of 3GPP TS 34.121-1.
5. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA / HSPA+ is $\leq \frac{1}{4}$ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA / HSPA+ to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA / HSPA+) are less than $\frac{1}{4}$ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+.
6. A fixed level power reduction is applied for WCDMA Band II when handset open Hotspot mode, the power reduction triggered.

HSDPA Setup Configuration

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hr}^{(1)}$	CM (dB) ⁽²⁾
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 ⁽³⁾	15/15 ⁽³⁾	64	12/15 ⁽³⁾	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 8 \Leftrightarrow A_{hr} = \beta_{hr}/\beta_c = 30/15 \Leftrightarrow \beta_{hr} = 30/15 * \beta_c$
 Note 2: CM = 1 for $\beta_c/\beta_d = 12/15, \beta_{hr}/\beta_c = 24/15$.
 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 signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

HSUPA Setup Configuration

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

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

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 signaled 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 signaled 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} cannot be set directly; it is set by Absolute Grant Value.

HSPA+ 3GPP release 7 (uplink category 7) 16QAM. Setup Configuration:
Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_c (Note3)	β_d	β_{hs} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	$\beta_{ed1}: 30/15$ $\beta_{ed2}: 30/15$	$\beta_{ed3}: 24/15$ $\beta_{ed4}: 24/15$	3.5	2.5	14	105	105

Note 1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).

Note 3: DPDCH is not configured, therefore the β_c is set to 1 and $\beta_d = 0$ by default.

Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.

**DC-HSDPA Setup Configuration**

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 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.

Table E.5.0: Levels for HSDPA connection setup

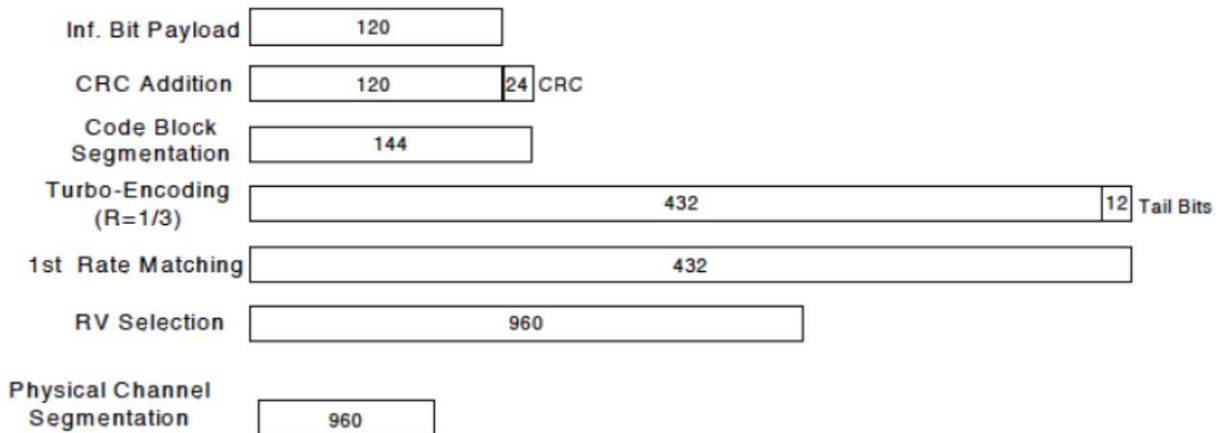
Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

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.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
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. Note 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)



<CDMA Mode>

1xEV-DO Rev. B

Call box setup procedure

1xEV-DO Release B

1> CMW 500 Signal Generator > 1xEV-DO Taskbar Enable

2> CMW 500 1xEV-DO Signaling Configuration Window >

3> 1xEV-DO Signaling On Window:

Under Access Network Control:

Band Class: BC0: US Cellular

RF Channel: 31

1xEV-DO Power: -70 dBm

4> 1xEV-DO Signaling Configuration Window

Under RF Frequency Band / Channel: Enter Ch. Frequency

- Under Carrier Configuration: RF Frequency
For Two Carriers: Low Channel (1013)

	<u>RF Channel</u>	<u>RF Channel Offset</u>
Carrier [0]	31	0
Carrier [1]	1013	982

- Under Carrier Configuration: RF Pilot
- | | <u>Carrier Sector</u> | <u>Active on AN</u> | <u>Assigned to AT</u> |
|-----------|-----------------------|---------------------|-----------------------|
| Pilot [0] | C0/S0 | ✓ | ✓ |
| | CA/S1 | ✓ | ✓ |

For Three Carriers: Low Channel (1013)

	<u>RF Channel</u>	<u>RF Channel Offset</u>
Carrier [0]	72	0
Carrier [1]	31	-41
Carrier [2]	1013	941

- Under Carrier Configuration: RF Pilot
- | | <u>Carrier Sector</u> | <u>Active on AN</u> | <u>Assigned to AT</u> |
|-----------|-----------------------|---------------------|-----------------------|
| Pilot [0] | C0/S0 | ✓ | ✓ |
| Pilot [1] | C1/S1 | ✓ | ✓ |
| Pilot [2] | C2/S2 | ✓ | ✓ |



<LTE Mode>

LTE Target MPR level

The device implements maximum power reduction per 3GPP 36.101 requirements where the MPR target is as below table. The MPR settings are implemented configured into firmware and cannot be disabled by the end user or LTE carrier network.

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR	3GPP
	1.4	3.0	5	10	15	20	Target	MPR
	MHz	MHz	MHz	MHz	MHz	MHz	(dB)	(dB)
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1	≤ 1
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2	≤ 2

Note: The measurement result showed some difference from the target MPR level, due to expected 0.5dB measurement tolerance

LTE Bands

LTE Bands	Channel bandwidth / Transmission bandwidth configuration [RB]					
	1.4	3.0	5	10	15	20
	MHz	MHz	MHz	MHz	MHz	MHz
2	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	N/A	N/A
7	N/A	N/A	✓	✓	✓	✓
12	✓	✓	✓	✓	N/A	N/A
17	N/A	N/A	✓	✓	N/A	N/A
38	N/A	N/A	✓	✓	✓	✓
40A	N/A	N/A	✓	✓	N/A	N/A
40B	N/A	N/A	✓	✓	N/A	N/A
41	N/A	N/A	✓	✓	✓	✓

Note:

1. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
2. Per KDB 941225 D05v02r05, 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.
3. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
4. Per KDB 941225 D05v02r05, 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 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.
5. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is $>$ not $\frac{1}{2}$ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB941225 D05v02r05, 16QAM/64QAM SAR testing is not required.
 6. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is $>$ not $\frac{1}{2}$ Db higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported band width is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
 7. For LTE B4 / B5 / B7 / B17 the maximum bandwidth does not support three non-overlapping channels, per KDB941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
 8. LTE band 12 SAR test was covered by Band 17; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
 - a. The maximum output power, including tolerance, for the smaller band is \leq the larger band to qualify for the SAR test exclusion.
 - b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.
 9. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >>constellation" mode of the device connect to the CMW500 base station, therefore, the device 64QAM and 16QAMsignal modulation are correct. Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design: only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards: b) A-MPR (additional MPR) must be disabled.
 10. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
 - c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
 - d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor *



Tune-up scaling factor

- e. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix $63.3\%/62.9\% = 1.006$ is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.
11. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1 -g or 10-g respectively, when the transmission band is ≤ 100 MHz ≤ 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
12. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.
13. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

<WLAN 2.4GHz>

1. SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:
- a. When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- b. When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.
2. 2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test configuration Procedures should be followed.
3. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
4. Justification for test configurations for WLAN per KDB Publication 248227 D02DR02-41929 for 2.4 GHz WI-FI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n)



was not required due to the maximum allowed powers and the highest reported DSSSSAR.

5. A fixed level power reduction is applied for WiFi when handset operates "held to the body" condition or "held to the ear" condition, the power reduction triggered by audio receiver detection and call establish status.
6. Per KDB 248227 D01v02r02, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR is not required for the following 2.4 GHz OFDM conditions:
 - a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
 - b. 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.

<WLAN 5GHz>

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.
4. 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.



5. The channel closest to mid-band frequency is selected for SAR measurement.
6. 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.



13. Conducted RF Output Power

> GSM Conducted Power

GSM850 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	128	190	251		128	190	251	
Frequency (MHz)	824.2	836.6	848.8		824.2	836.6	848.8	
GSM 1 Tx slot	30.83	30.81	30.78	31.50	21.83	21.81	21.78	22.50
GPRS 1 Tx slot	30.84	30.79	30.74	31.50	21.84	21.79	21.74	22.50
GPRS 2 Tx slots	29.45	29.43	29.38	31.00	23.45	23.43	23.38	25.00
GPRS 3 Tx slots	28.84	28.85	28.81	29.50	24.58	24.59	24.55	25.24
GPRS 4 Tx slots	28.19	28.20	28.12	29.00	25.19	25.20	25.12	26.00
EDGE 1 Tx slot	25.70	25.77	25.68	26.50	16.70	16.77	16.68	17.50
EDGE 2 Tx slots	24.50	24.46	24.54	25.00	18.50	18.46	18.54	19.00
EDGE 3 Tx slots	22.38	22.35	22.24	23.00	18.12	18.09	17.98	18.74
EDGE 4 Tx slots	20.86	20.79	20.81	21.50	17.86	17.79	17.81	18.50

GSM1900 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM 1 Tx slot	28.57	28.81	28.92	29.50	19.57	19.81	19.92	20.50
GPRS 1 Tx slot	28.56	28.84	28.93	29.50	19.56	19.84	19.93	20.50
GPRS 2 Tx slots	28.24	28.34	28.38	29.00	22.24	22.34	22.38	23.00
GPRS 3 Tx slots	26.44	26.51	26.69	27.00	22.18	22.25	22.43	22.74
GPRS 4 Tx slots	25.51	25.46	25.67	26.50	22.51	22.46	22.67	23.50
EDGE 1 Tx slot	23.16	23.14	23.14	24.00	14.16	14.14	14.14	15.00
EDGE 2 Tx slots	22.22	21.85	21.83	23.00	16.22	15.85	15.83	17.00
EDGE 3 Tx slots	19.99	19.63	19.64	20.50	15.73	15.37	15.38	16.24
EDGE 4 Tx slots	18.77	18.36	18.45	19.50	15.77	15.36	15.45	16.50

Timeslot consignations:

No. of Slots	Slot 1	Slot 2	Slot 3	Slot 4
Slot Consignation	1Up4Down	2Up3Down	3Up2Down	4Up1Down
Duty Cycle	1:8.3	1:4.15	1:2.77	1:2.08
Correct Factor	-9.03dB	-6.02dB	-4.26dB	-3.01dB



➤ **WCDMA Conducted Power**

Band		WCDMA II			Tune-up Limit (dBm)
TX Channel		9262	9400	9538	
Rx Channel		9662	9800	9938	
Frequency (MHz)		1852.4	1880	1907.6	
3GPP Rel 99	RMC 12.2Kbps	23.15	23.30	23.12	24.00
3GPP Rel 6	HSDPA Subtest-1	21.98	21.92	21.95	22.50
3GPP Rel 6	HSDPA Subtest-2	21.93	21.88	21.89	22.50
3GPP Rel 6	HSDPA Subtest-3	21.46	21.34	21.45	22.00
3GPP Rel 6	HSDPA Subtest-4	21.39	21.38	21.38	22.00
3GPP Rel 6	HSUPA Subtest-1	20.61	20.77	20.63	22.00
3GPP Rel 6	HSUPA Subtest-2	20.59	20.76	20.63	21.00
3GPP Rel 6	HSUPA Subtest-3	21.58	21.72	21.58	22.00
3GPP Rel 6	HSUPA Subtest-4	20.13	20.31	20.12	21.00
3GPP Rel 6	HSUPA Subtest-5	21.55	21.71	21.56	22.00
3GPP Rel 7	HSPA+ (16QAM) Subtest-1	21.31	21.45	21.29	22.00

Band		WCDMA IV			Tune-up Limit (dBm)
TX Channel		1312	1413	1513	
Rx Channel		1537	1638	1738	
Frequency (MHz)		1712.4	1732.6	1752.6	
3GPP Rel 99	RMC 12.2Kbps	23.32	23.44	23.36	24.00
3GPP Rel 6	HSDPA Subtest-1	22.31	22.29	22.40	23.00
3GPP Rel 6	HSDPA Subtest-2	22.29	22.27	22.35	23.00
3GPP Rel 6	HSDPA Subtest-3	21.80	21.81	21.89	22.50
3GPP Rel 6	HSDPA Subtest-4	21.77	21.79	21.89	22.50
3GPP Rel 6	HSUPA Subtest-1	20.30	20.28	20.38	22.00
3GPP Rel 6	HSUPA Subtest-2	20.29	20.26	20.37	21.00
3GPP Rel 6	HSUPA Subtest-3	21.27	21.26	21.35	22.00
3GPP Rel 6	HSUPA Subtest-4	19.82	19.78	19.88	20.00
3GPP Rel 6	HSUPA Subtest-5	21.26	21.23	21.32	22.00
3GPP Rel 7	HSPA+ (16QAM) Subtest-1	21.25	21.26	21.31	22.00



Band		WCDMA V			Tune-up Limit (dBm)
TX Channel		4132	4182	4233	
Rx Channel		4357	4407	4458	
Frequency (MHz)		826.4	836.4	846.6	
3GPP Rel 99	RMC 12.2Kbps	23.05	23.06	23.03	24.00
3GPP Rel 6	HSDPA Subtest-1	21.98	21.92	21.95	22.50
3GPP Rel 6	HSDPA Subtest-2	21.93	21.88	21.89	22.50
3GPP Rel 6	HSDPA Subtest-3	21.46	21.34	21.45	22.00
3GPP Rel 6	HSDPA Subtest-4	21.39	21.38	21.38	22.00
3GPP Rel 6	HSUPA Subtest-1	19.93	19.93	19.90	20.00
3GPP Rel 6	HSUPA Subtest-2	20.95	20.91	20.92	21.50
3GPP Rel 6	HSUPA Subtest-3	19.50	19.46	19.43	19.50
3GPP Rel 6	HSUPA Subtest-4	20.92	20.91	20.88	21.50
3GPP Rel 6	HSUPA Subtest-5	21.11	21.06	21.01	21.50
3GPP Rel 7	HSPA+ (16QAM) Subtest-1	21.98	21.92	21.95	22.50

➤ **CDMA2000 Conducted Power**

Band	CDMA2000 BC0			Tune-up Limit (dBm)
TX Channel	1013	384	777	
Frequency (MHz)	824.7	836.52	848.31	
RC1 SO55	23.65	23.74	23.82	24.50
RC3 SO55	23.71	23.79	23.86	24.50
RC3 SO32 (F+SCH)	23.51	23.52	23.64	24.50
RC3 SO32 (+SCH)	23.46	23.51	23.59	24.50
RTAP 153.6Kbps	23.32	23.41	23.65	24.00
RETAP 4096Bits	22.54	22.63	22.71	23.50



➤ LTE Conducted Power

<FDD-LTE Band 2>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				18700	18900	19100	
Frequency (MHz)				1860	1880	1900	
20	QPSK	1	0	23.46	23.31	23.22	24
20	QPSK	1	49	23.25	23.00	23.08	
20	QPSK	1	99	23.14	23.26	23.27	
20	QPSK	50	0	22.31	22.20	22.02	23
20	QPSK	50	24	22.27	22.10	22.05	
20	QPSK	50	50	22.20	22.17	22.12	
20	QPSK	100	0	22.24	22.05	22.15	
20	16QAM	1	0	22.37	22.11	22.01	23
20	16QAM	1	49	22.14	22.43	22.24	
20	16QAM	1	99	22.15	22.05	22.14	
20	16QAM	50	0	21.23	21.06	21.22	22
20	16QAM	50	24	21.19	21.16	21.34	
20	16QAM	50	50	21.35	21.04	21.00	
20	16QAM	100	0	21.28	21.04	21.24	
20	64QAM	1	0	21.32	21.44	21.32	22
20	64QAM	1	49	21.24	21.42	21.44	
20	64QAM	1	99	21.34	21.37	21.36	
20	64QAM	50	0	21.25	21.18	21.25	22
20	64QAM	50	24	21.19	21.13	21.03	
20	64QAM	50	50	21.24	21.07	21.34	
20	64QAM	100	0	21.24	21.04	21.35	
Channel				18675	18900	19125	Tune-up limit (dBm)
Frequency (MHz)				1857.5	1880	1902.5	
15	QPSK	1	0	23.31	23.21	23.12	24
15	QPSK	1	37	23.22	23.05	23.12	
15	QPSK	1	74	23.05	23.09	23.22	
15	QPSK	36	0	22.29	22.18	21.91	23
15	QPSK	36	20	22.34	22.03	22.02	
15	QPSK	36	39	22.22	22.06	22.27	
15	QPSK	75	0	22.32	22.09	22.35	
15	16QAM	1	0	22.38	22.19	22.34	23



15	16QAM	1	37	22.54	22.01	22.12	
15	16QAM	1	74	22.40	22.42	22.44	
15	16QAM	36	0	21.37	21.00	21.18	
15	16QAM	36	20	21.31	21.07	21.22	22
15	16QAM	36	39	21.23	21.03	21.17	
15	16QAM	75	0	21.26	21.14	21.19	
15	64QAM	1	0	21.08	21.24	21.37	22
15	64QAM	1	37	21.32	21.53	21.36	
15	64QAM	1	74	21.15	21.34	21.64	
15	64QAM	36	0	21.28	21.15	21.22	22
15	64QAM	36	20	21.27	21.01	21.25	
15	64QAM	36	39	21.21	21.22	21.23	
15	64QAM	75	0	21.26	21.07	21.17	
Channel				18650	18900	19150	Tune-up limit (dBm)
Frequency (MHz)				1855	1880	1905	
10	QPSK	1	0	23.24	23.09	23.24	24
10	QPSK	1	25	23.21	23.12	23.03	
10	QPSK	1	49	23.18	23.11	23.24	
10	QPSK	25	0	22.31	22.05	22.33	23
10	QPSK	25	12	22.28	22.04	22.24	
10	QPSK	25	25	22.26	22.09	22.34	
10	QPSK	50	0	22.24	22.02	22.04	
10	16QAM	1	0	22.30	22.26	21.88	23
10	16QAM	1	25	22.38	22.21	22.16	
10	16QAM	1	49	22.36	22.26	22.03	
10	16QAM	25	0	21.47	21.20	21.25	22
10	16QAM	25	12	21.29	21.17	21.23	
10	16QAM	25	25	21.33	21.03	21.14	
10	16QAM	50	0	21.35	21.02	21.11	
10	64QAM	1	0	21.32	21.24	21.22	22
10	64QAM	1	25	21.22	21.42	21.34	
10	64QAM	1	49	21.34	21.89	21.22	
10	64QAM	25	0	21.31	21.04	21.38	22
10	64QAM	25	12	21.27	21.10	21.28	
10	64QAM	25	25	21.33	21.00	21.34	
10	64QAM	50	0	21.32	21.08	21.37	
Channel				18625	18900	19175	Tune-up



Frequency (MHz)				1852.5	1880	1907.5	limit (dBm)
5	QPSK	1	0	23.09	23.14	23.12	24
5	QPSK	1	12	23.24	23.25	23.22	
5	QPSK	1	24	23.13	23.17	23.09	
5	QPSK	12	0	22.31	22.04	22.37	23
5	QPSK	12	7	22.33	22.03	22.21	
5	QPSK	12	13	22.21	22.01	22.29	
5	QPSK	25	0	22.29	22.19	22.44	
5	16QAM	1	0	22.50	22.12	22.47	23
5	16QAM	1	12	22.46	22.42	22.44	
5	16QAM	1	24	22.51	22.26	22.25	
5	16QAM	12	0	21.28	21.27	21.38	22
5	16QAM	12	7	21.30	21.07	21.26	
5	16QAM	12	13	21.20	21.19	21.33	
5	16QAM	25	0	21.36	21.10	21.29	
5	64QAM	1	0	21.22	21.29	21.34	22
5	64QAM	1	12	21.36	21.23	21.54	
5	64QAM	1	24	21.22	21.35	21.47	
5	64QAM	12	0	21.35	21.39	21.39	22
5	64QAM	12	7	21.29	21.24	21.36	
5	64QAM	12	13	21.27	21.35	21.44	
5	64QAM	25	0	21.29	21.34	21.30	
Channel				18615	18900	19185	Tune-up limit (dBm)
Frequency (MHz)				1851.5	1880	1908.5	limit (dBm)
3	QPSK	1	0	23.21	23.14	23.13	24
3	QPSK	1	8	23.17	23.16	23.17	
3	QPSK	1	14	23.15	23.09	23.23	
3	QPSK	8	0	22.22	22.05	22.24	23
3	QPSK	8	4	22.27	22.07	22.15	
3	QPSK	8	7	22.31	22.07	22.09	
3	QPSK	15	0	22.26	22.04	22.18	
3	16QAM	1	0	22.30	22.44	22.25	23
3	16QAM	1	8	22.39	22.19	22.23	
3	16QAM	1	14	22.35	22.21	22.44	
3	16QAM	8	0	21.47	21.04	21.18	22
3	16QAM	8	4	21.25	21.11	21.16	



3	16QAM	8	7	21.33	21.08	21.18	
3	16QAM	15	0	21.32	21.23	21.22	
3	64QAM	1	0	21.27	21.27	21.55	22
3	64QAM	1	8	21.22	21.32	21.42	
3	64QAM	1	14	21.34	21.34	21.63	
3	64QAM	8	0	21.24	21.09	21.22	22
3	64QAM	8	4	21.29	21.05	21.28	
3	64QAM	8	7	21.20	21.00	21.29	
3	64QAM	15	0	21.32	21.24	21.38	
Channel				18607	18900	19193	Tune-up limit (dBm)
Frequency (MHz)				1850.7	1880	1909.3	
1.4	QPSK	1	0	23.20	23.16	23.18	24
1.4	QPSK	1	3	23.21	23.10	23.11	
1.4	QPSK	1	5	23.08	23.24	23.13	
1.4	QPSK	3	0	23.25	23.03	23.19	
1.4	QPSK	3	1	23.27	23.14	23.18	
1.4	QPSK	3	3	23.22	23.09	23.08	
1.4	QPSK	6	0	22.26	22.09	22.08	23
1.4	16QAM	1	0	22.30	22.30	22.24	23
1.4	16QAM	1	3	22.37	22.35	22.01	
1.4	16QAM	1	5	22.31	22.36	22.01	
1.4	16QAM	3	0	22.29	22.22	22.26	
1.4	16QAM	3	1	22.47	22.21	22.28	
1.4	16QAM	3	3	22.33	22.15	22.31	
1.4	16QAM	6	0	21.13	21.17	21.14	22
1.4	64QAM	1	0	21.22	21.80	21.69	22
1.4	64QAM	1	3	21.23	21.24	21.27	
1.4	64QAM	1	5	21.16	21.22	21.72	
1.4	64QAM	3	0	21.11	21.25	21.64	
1.4	64QAM	3	1	21.34	21.11	21.70	
1.4	64QAM	3	3	21.22	21.25	21.71	
1.4	64QAM	6	0	21.36	21.02	21.26	22



<FDD-LTE Band 4>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				20050	20175	20300	
Frequency (MHz)				1720	1732.5	1745	
20	QPSK	1	0	23.62	23.63	23.84	24.5
20	QPSK	1	49	23.79	23.78	23.57	
20	QPSK	1	99	23.46	23.38	23.25	
20	QPSK	50	0	22.65	22.77	22.88	23.5
20	QPSK	50	24	22.73	22.69	22.84	
20	QPSK	50	50	22.62	22.64	22.59	
20	QPSK	100	0	22.66	22.79	22.77	
20	16QAM	1	0	22.84	22.58	22.71	23.5
20	16QAM	1	49	22.65	22.74	22.97	
20	16QAM	1	99	22.59	22.87	22.90	
20	16QAM	50	0	21.99	21.80	21.91	22.5
20	16QAM	50	24	21.93	21.83	21.76	
20	16QAM	50	50	21.86	21.67	21.64	
20	16QAM	100	0	21.88	21.74	21.78	
20	64QAM	1	0	21.44	21.67	21.55	22.5
20	64QAM	1	49	21.22	21.26	21.34	
20	64QAM	1	99	21.53	21.36	21.25	
20	64QAM	50	0	21.87	21.76	21.87	22.5
20	64QAM	50	24	21.86	21.86	21.82	
20	64QAM	50	50	21.77	21.75	21.61	
20	64QAM	100	0	21.90	21.78	21.71	
Channel				20025	20175	20325	
Frequency (MHz)				1717.5	1732.5	1747.5	
15	QPSK	1	0	23.82	23.77	23.65	24.5
15	QPSK	1	37	23.56	23.67	23.67	
15	QPSK	1	74	23.70	23.58	23.63	
15	QPSK	36	0	22.94	22.79	22.84	23.5
15	QPSK	36	20	22.95	22.87	22.85	
15	QPSK	36	39	22.87	22.85	22.76	
15	QPSK	75	0	22.97	22.80	22.85	
15	16QAM	1	0	22.56	22.78	22.66	23.5
15	16QAM	1	37	22.66	22.66	22.90	



15	16QAM	1	74	22.94	22.55	22.83	22.5
15	16QAM	36	0	21.93	21.82	21.79	
15	16QAM	36	20	21.86	21.81	21.82	
15	16QAM	36	39	21.82	21.73	21.67	
15	16QAM	75	0	21.92	21.79	21.74	
15	64QAM	1	0	21.91	21.85	21.55	22.5
15	64QAM	1	37	21.55	21.92	21.64	
15	64QAM	1	74	21.54	21.75	21.56	
15	64QAM	36	0	21.86	21.92	21.83	22.5
15	64QAM	36	20	21.83	21.77	21.75	
15	64QAM	36	39	21.87	21.73	21.77	
15	64QAM	75	0	21.92	21.77	21.84	
Channel				20000	20175	20350	Tune-up limit (dBm)
Frequency (MHz)				1715	1732.5	1750	
10	QPSK	1	0	23.51	23.78	23.70	24.5
10	QPSK	1	25	23.51	23.68	23.55	
10	QPSK	1	49	23.74	23.65	23.71	
10	QPSK	25	0	22.97	22.86	22.87	23.5
10	QPSK	25	12	23.01	22.91	22.80	
10	QPSK	25	25	22.90	22.80	22.81	
10	QPSK	50	0	22.94	22.87	22.92	
10	16QAM	1	0	22.55	22.58	22.87	23.5
10	16QAM	1	25	22.66	22.62	22.88	
10	16QAM	1	49	22.85	22.62	22.71	
10	16QAM	25	0	21.84	21.91	21.89	22.5
10	16QAM	25	12	21.56	21.98	21.81	
10	16QAM	25	25	21.83	21.88	21.83	
10	16QAM	50	0	21.95	21.79	21.83	
10	64QAM	1	0	21.77	21.67	21.85	22.5
10	64QAM	1	25	21.59	21.84	21.66	
10	64QAM	1	49	21.69	21.66	21.59	
10	64QAM	25	0	21.88	21.88	21.94	22.5
10	64QAM	25	12	21.84	21.83	21.93	
10	64QAM	25	25	21.93	21.85	21.82	
10	64QAM	50	0	21.89	21.84	21.85	
Channel				19975	20175	20375	Tune-up limit
Frequency (MHz)				1712.5	1732.5	1752.5	



							(dBm)
5	QPSK	1	0	23.80	23.65	23.63	24.5
5	QPSK	1	12	23.79	23.67	23.61	
5	QPSK	1	24	23.64	23.49	23.65	
5	QPSK	12	0	22.91	22.79	22.89	23.5
5	QPSK	12	7	22.97	22.84	22.80	
5	QPSK	12	13	22.89	22.77	22.86	
5	QPSK	25	0	22.91	22.85	22.88	
5	16QAM	1	0	22.67	22.59	22.79	23.5
5	16QAM	1	12	22.95	22.62	22.87	
5	16QAM	1	24	23.17	22.50	22.87	
5	16QAM	12	0	21.89	21.76	21.89	22.5
5	16QAM	12	7	21.87	21.89	21.96	
5	16QAM	12	13	21.79	21.80	21.78	
5	16QAM	25	0	21.86	21.69	21.88	
5	64QAM	1	0	21.66	21.88	21.58	22.5
5	64QAM	1	12	21.56	21.59	21.79	
5	64QAM	1	24	21.78	21.68	21.67	
5	64QAM	12	0	21.90	21.79	21.88	22.5
5	64QAM	12	7	21.89	21.96	21.88	
5	64QAM	12	13	21.88	21.79	21.76	
5	64QAM	25	0	21.86	21.75	21.79	
Channel				19965	20175	20385	Tune-up limit (dBm)
Frequency (MHz)				1711.5	1732.5	1753.5	
3	QPSK	1	0	23.62	23.73	23.75	24.5
3	QPSK	1	8	23.70	23.63	23.66	
3	QPSK	1	14	23.34	23.69	23.63	
3	QPSK	8	0	22.62	22.67	22.66	23.5
3	QPSK	8	4	22.66	22.66	22.71	
3	QPSK	8	7	22.55	22.88	22.56	
3	QPSK	15	0	22.22	22.59	22.73	
3	16QAM	1	0	22.56	22.65	22.36	23.5
3	16QAM	1	8	22.66	22.58	22.39	
3	16QAM	1	14	22.56	22.66	22.46	
3	16QAM	8	0	21.58	21.84	21.62	22.5
3	16QAM	8	4	21.62	21.54	21.58	
3	16QAM	8	7	21.55	21.78	21.59	



3	16QAM	15	0	21.61	21.66	21.89	22.5
3	64QAM	1	0	21.66	21.64	21.56	
3	64QAM	1	8	21.65	21.54	21.67	
3	64QAM	1	14	21.54	21.82	21.58	
3	64QAM	8	0	21.73	21.66	21.78	22.5
3	64QAM	8	4	21.60	21.86	21.68	
3	64QAM	8	7	21.61	21.64	21.87	
3	64QAM	15	0	21.54	21.70	21.80	
Channel				19957	20175	20393	Tune-up limit (dBm)
Frequency (MHz)				1710.7	1732.5	1754.3	
1.4	QPSK	1	0	23.75	23.70	23.58	24.5
1.4	QPSK	1	3	23.70	23.73	23.58	
1.4	QPSK	1	5	23.73	23.61	23.65	
1.4	QPSK	3	0	23.57	23.74	23.72	
1.4	QPSK	3	1	23.37	23.70	23.63	
1.4	QPSK	3	3	23.70	23.44	23.70	
1.4	QPSK	6	0	22.86	22.75	22.84	23.5
1.4	16QAM	1	0	22.89	22.69	22.55	23.5
1.4	16QAM	1	3	22.66	22.85	22.66	
1.4	16QAM	1	5	22.68	22.68	22.67	
1.4	16QAM	3	0	22.72	22.66	22.73	
1.4	16QAM	3	1	22.55	22.86	22.65	
1.4	16QAM	3	3	22.89	22.76	22.79	
1.4	16QAM	6	0	21.44	21.44	21.76	22.5
1.4	64QAM	1	0	21.55	21.55	21.64	22.5
1.4	64QAM	1	3	21.66	21.62	21.73	
1.4	64QAM	1	5	21.81	21.54	21.69	
1.4	64QAM	3	0	21.62	21.62	21.83	
1.4	64QAM	3	1	21.61	21.75	21.69	
1.4	64QAM	3	3	21.66	21.56	21.57	
1.4	64QAM	6	0	21.51	21.73	21.80	22.5



<FDD-LTE Band 5>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				20450	20525	20600	
Frequency (MHz)				829	836.5	844	
10	QPSK	1	0	23.18	23.11	23.31	24
10	QPSK	1	25	23.16	23.26	23.27	
10	QPSK	1	49	23.12	23.24	23.22	
10	QPSK	25	0	22.55	22.59	22.69	23
10	QPSK	25	12	22.62	22.55	22.62	
10	QPSK	25	25	22.54	22.62	22.54	
10	QPSK	50	0	22.66	22.53	22.37	23
10	16QAM	1	0	22.45	22.49	22.14	
10	16QAM	1	25	22.62	22.55	22.20	
10	16QAM	1	49	22.42	22.15	22.30	22
10	16QAM	25	0	21.55	21.77	21.69	
10	16QAM	25	12	21.87	21.74	21.66	
10	16QAM	25	25	21.69	21.76	21.58	22
10	16QAM	50	0	21.87	21.75	21.69	
10	64QAM	1	0	21.65	21.66	21.61	
10	64QAM	1	25	21.55	21.84	21.57	22
10	64QAM	1	49	21.69	21.69	21.53	
10	64QAM	25	0	20.85	20.83	20.88	
10	64QAM	25	12	20.84	20.71	20.56	21
10	64QAM	25	25	20.88	20.76	20.67	
10	64QAM	50	0	20.86	20.78	20.66	
Channel				20425	20525	20625	Tune-up limit (dBm)
Frequency (MHz)				826.5	836.5	846.5	
5	QPSK	1	0	22.69	23.22	23.24	24
5	QPSK	1	12	23.02	22.86	23.19	
5	QPSK	1	24	23.11	23.14	22.89	
5	QPSK	12	0	22.88	22.68	22.34	23
5	QPSK	12	7	22.64	22.71	22.29	
5	QPSK	12	13	22.58	22.62	22.36	
5	QPSK	25	0	22.44	22.73	22.08	23
5	16QAM	1	0	22.16	22.37	22.20	
5	16QAM	1	12	22.00	22.23	22.69	



5	16QAM	1	24	22.19	22.04	22.49	
5	16QAM	12	0	21.88	21.76	21.02	22
5	16QAM	12	7	21.62	21.58	21.03	
5	16QAM	12	13	21.55	21.65	21.07	
5	16QAM	25	0	21.62	21.62	21.10	
5	64QAM	1	0	21.81	21.72	21.99	
5	64QAM	1	12	21.66	21.45	21.53	22
5	64QAM	1	24	21.56	21.95	21.27	
5	64QAM	12	0	20.75	20.53	20.96	
5	64QAM	12	7	20.79	20.87	20.25	21
5	64QAM	12	13	20.78	20.85	20.37	
5	64QAM	25	0	20.89	20.74	20.35	
Channel				20415	20525	20635	
Frequency (MHz)				825.5	836.5	847.5	
3	QPSK	1	0	22.82	23.16	22.96	24
3	QPSK	1	8	22.82	23.11	23.04	
3	QPSK	1	14	22.82	23.24	23.02	
3	QPSK	8	0	22.55	22.45	22.66	23
3	QPSK	8	4	22.62	22.48	22.56	
3	QPSK	8	7	22.50	22.54	22.45	
3	QPSK	15	0	22.56	22.58	22.37	
3	16QAM	1	0	22.64	22.65	22.46	23
3	16QAM	1	8	22.05	22.83	22.36	
3	16QAM	1	14	22.13	22.64	22.44	
3	16QAM	8	0	21.56	21.72	21.54	22
3	16QAM	8	4	21.66	21.77	21.56	
3	16QAM	8	7	21.56	21.88	21.66	
3	16QAM	15	0	21.55	21.62	21.56	
3	64QAM	1	0	21.89	21.77	21.62	22
3	64QAM	1	8	21.57	21.82	21.26	
3	64QAM	1	14	21.62	21.71	21.57	
3	64QAM	8	0	20.83	20.67	20.66	21
3	64QAM	8	4	20.98	20.70	20.52	
3	64QAM	8	7	20.78	20.70	20.74	
3	64QAM	15	0	20.86	20.71	20.64	
Channel				20407	20525	20643	
Frequency (MHz)				824.7	836.5	848.3	



							(dBm)
1.4	QPSK	1	0	23.12	23.00	23.21	24
1.4	QPSK	1	3	23.31	23.06	23.21	
1.4	QPSK	1	5	23.20	22.90	22.98	
1.4	QPSK	3	0	23.19	23.06	23.08	
1.4	QPSK	3	1	23.04	23.14	23.15	
1.4	QPSK	3	3	23.13	23.06	23.15	
1.4	QPSK	6	0	22.66	22.44	22.61	23
1.4	16QAM	1	0	22.48	22.44	22.49	23
1.4	16QAM	1	3	22.55	22.22	22.54	
1.4	16QAM	1	5	22.33	22.24	22.54	
1.4	16QAM	3	0	22.29	22.08	22.57	
1.4	16QAM	3	1	22.49	22.11	22.34	
1.4	16QAM	3	3	22.37	22.15	22.24	
1.4	16QAM	6	0	21.01	21.55	21.11	22
1.4	64QAM	1	0	21.82	21.76	21.54	22
1.4	64QAM	1	3	21.56	21.90	21.66	
1.4	64QAM	1	5	21.57	21.73	21.57	
1.4	64QAM	3	0	21.58	21.62	21.97	
1.4	64QAM	3	1	21.58	21.73	21.56	
1.4	64QAM	3	3	21.66	21.92	21.62	
1.4	64QAM	6	0	20.89	20.86	20.62	21

<FDD-LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				20850	21100	21350	22.5
Frequency (MHz)				2510	2535	2560	
20	QPSK	1	0	21.12	21.15	21.46	22.5
20	QPSK	1	49	21.64	21.85	21.62	
20	QPSK	1	99	21.36	21.36	21.61	
20	QPSK	50	0	20.50	20.56	20.75	21.5
20	QPSK	50	24	20.62	20.84	20.76	
20	QPSK	50	50	20.80	20.64	20.72	
20	QPSK	100	0	20.57	20.64	20.80	
20	16QAM	1	0	20.37	20.35	21.00	21.5
20	16QAM	1	49	20.62	20.94	20.88	
20	16QAM	1	99	20.86	20.01	20.95	



20	16QAM	50	0	20.11	20.21	20.33	21.5
20	16QAM	50	24	20.08	20.13	20.32	
20	16QAM	50	50	20.17	20.04	20.43	
20	16QAM	100	0	20.12	19.92	20.30	
20	64QAM	1	0	20.19	20.03	20.87	21.5
20	64QAM	1	49	20.84	20.88	20.95	
20	64QAM	1	99	20.48	20.26	21.08	
20	64QAM	50	0	19.50	19.56	19.83	20.5
20	64QAM	50	24	19.53	19.57	19.87	
20	64QAM	50	50	19.80	19.43	19.81	
20	64QAM	100	0	19.61	19.46	19.75	
Channel				20825	21100	21375	Tune-up limit (dBm)
Frequency (MHz)				2507.5	2535	2562.5	
15	QPSK	1	0	21.20	21.28	21.45	22.5
15	QPSK	1	37	21.71	21.83	21.92	
15	QPSK	1	74	21.42	21.55	21.62	
15	QPSK	36	0	20.71	20.77	20.84	21.5
15	QPSK	36	20	20.81	20.85	20.93	
15	QPSK	36	39	20.91	20.80	20.78	
15	QPSK	75	0	20.73	20.76	20.63	
15	16QAM	1	0	20.57	20.55	20.32	21.5
15	16QAM	1	37	20.82	20.34	20.42	
15	16QAM	1	74	20.52	20.21	20.53	
15	16QAM	36	0	20.31	20.41	20.53	21.5
15	16QAM	36	20	20.28	20.33	20.52	
15	16QAM	36	39	20.37	20.24	20.63	
15	16QAM	75	0	20.32	20.12	20.50	
15	64QAM	1	0	20.39	20.23	20.24	21.5
15	64QAM	1	37	20.12	20.22	20.22	
15	64QAM	1	74	20.68	20.46	20.14	
15	64QAM	36	0	19.70	19.76	19.61	20.5
15	64QAM	36	20	19.73	19.77	19.64	
15	64QAM	36	39	19.55	19.63	19.52	
15	64QAM	75	0	19.81	19.66	19.95	
Channel				20800	21100	21400	Tune-up limit (dBm)
Frequency (MHz)				2505	2535	2565	



10	QPSK	1	0	21.05	21.13	21.30	22.5
10	QPSK	1	25	21.56	21.68	21.77	
10	QPSK	1	49	21.27	21.40	21.47	
10	QPSK	25	0	20.56	20.62	20.69	21.5
10	QPSK	25	12	20.66	20.70	20.78	
10	QPSK	25	25	20.76	20.65	20.63	
10	QPSK	50	0	20.58	20.61	20.48	
10	16QAM	1	0	20.27	20.30	20.17	21.5
10	16QAM	1	25	20.13	20.11	20.18	
10	16QAM	1	49	20.38	20.11	20.15	
10	16QAM	25	0	20.62	20.17	20.25	21.5
10	16QAM	25	12	20.22	20.06	20.18	
10	16QAM	25	25	20.32	20.28	20.17	
10	16QAM	50	0	20.22	20.18	20.28	
10	64QAM	1	0	20.17	20.17	20.15	21.5
10	64QAM	1	25	20.04	20.22	20.27	
10	64QAM	1	49	20.01	20.24	20.25	
10	64QAM	25	0	20.24	20.02	20.08	20.5
10	64QAM	25	12	19.26	19.32	19.59	
10	64QAM	25	25	19.29	19.33	19.25	
10	64QAM	50	0	19.56	19.19	19.57	
Channel				20775	21100	21425	Tune-up limit (dBm)
Frequency (MHz)				2502.5	2535	2567.5	
5	QPSK	1	0	21.11	21.19	21.36	22.5
5	QPSK	1	12	21.62	21.74	21.56	
5	QPSK	1	24	21.33	21.46	21.53	
5	QPSK	12	0	20.62	20.68	20.75	21.5
5	QPSK	12	7	20.72	20.76	20.84	
5	QPSK	12	13	20.82	20.71	20.69	
5	QPSK	25	0	20.64	20.67	20.54	
5	16QAM	1	0	20.50	20.48	20.55	21.5
5	16QAM	1	12	20.75	20.48	20.52	
5	16QAM	1	24	20.99	20.14	20.62	
5	16QAM	12	0	20.24	20.34	20.46	21.5
5	16QAM	12	7	20.21	20.26	20.45	
5	16QAM	12	13	20.30	20.17	20.56	
5	16QAM	25	0	20.25	20.05	20.43	



5	64QAM	1	0	20.32	20.16	20.55	21.5
5	64QAM	1	12	20.38	20.11	20.62	
5	64QAM	1	24	20.61	20.39	20.45	
5	64QAM	12	0	19.63	19.69	19.96	20.5
5	64QAM	12	7	19.66	19.70	19.62	
5	64QAM	12	13	19.93	19.56	19.94	
5	64QAM	25	0	19.74	19.59	19.88	

<FDD-LTE Band 12>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				23060	23095	23130	24
Frequency (MHz)				704	707.5	711	
10	QPSK	1	0	23.11	23.08	23.45	24
10	QPSK	1	25	23.22	23.37	23.31	
10	QPSK	1	49	23.19	23.37	23.24	
10	QPSK	25	0	22.18	22.05	22.42	23
10	QPSK	25	12	22.16	22.23	22.41	
10	QPSK	25	25	22.40	22.31	22.38	
10	QPSK	50	0	22.27	22.21	22.23	
10	16QAM	1	0	22.55	22.36	22.58	23
10	16QAM	1	25	22.58	22.73	22.59	
10	16QAM	1	49	22.77	22.66	22.61	
10	16QAM	25	0	21.29	21.17	21.25	22
10	16QAM	25	12	21.14	21.30	21.34	
10	16QAM	25	25	21.38	21.33	21.20	
10	16QAM	50	0	21.42	21.23	21.18	
10	64QAM	1	0	21.66	21.62	21.44	22
10	64QAM	1	25	21.42	21.55	21.53	
10	64QAM	1	49	21.55	21.54	21.62	
10	64QAM	25	0	21.21	21.14	21.23	22
10	64QAM	25	12	21.15	21.29	21.42	
10	64QAM	25	25	21.45	21.34	21.32	
10	64QAM	50	0	21.33	21.24	21.22	
Channel				23035	23095	23155	24
Frequency (MHz)				701.5	707.5	713.5	
5	QPSK	1	0	23.22	23.15	23.17	24



5	QPSK	1	12	23.04	23.36	23.33	
5	QPSK	1	24	23.05	23.22	23.25	
5	QPSK	12	0	22.05	22.10	22.34	
5	QPSK	12	7	22.04	22.25	22.37	23
5	QPSK	12	13	22.23	22.33	22.49	
5	QPSK	25	0	22.34	22.15	22.44	
5	16QAM	1	0	22.45	22.52	22.54	23
5	16QAM	1	12	22.51	22.75	22.52	
5	16QAM	1	24	22.47	22.53	22.76	
5	16QAM	12	0	21.06	21.08	21.40	22
5	16QAM	12	7	21.03	21.32	21.49	
5	16QAM	12	13	21.11	21.19	21.49	
5	16QAM	25	0	21.09	21.22	21.48	
5	64QAM	1	0	21.55	21.49	21.55	22
5	64QAM	1	12	21.62	21.55	21.42	
5	64QAM	1	24	21.55	21.56	21.66	
5	64QAM	12	0	21.55	21.61	21.38	22
5	64QAM	12	7	21.34	21.33	21.44	
5	64QAM	12	13	21.42	21.27	21.28	
5	64QAM	25	0	21.42	21.22	21.42	
Channel				23025	23095	23165	Tune-up limit (dBm)
Frequency (MHz)				700.5	707.5	714.5	
3	QPSK	1	0	22.93	23.21	23.34	24
3	QPSK	1	8	22.95	23.24	23.34	
3	QPSK	1	14	23.07	23.22	23.38	
3	QPSK	8	0	22.35	22.22	22.48	23
3	QPSK	8	4	22.53	22.33	22.55	
3	QPSK	8	7	22.54	22.27	22.46	
3	QPSK	15	0	22.57	22.14	22.49	
3	16QAM	1	0	22.42	22.73	22.56	23
3	16QAM	1	8	22.52	22.68	22.54	
3	16QAM	1	14	22.45	22.71	22.56	
3	16QAM	8	0	21.55	21.24	21.42	22
3	16QAM	8	4	21.14	21.29	21.40	
3	16QAM	8	7	21.32	21.43	21.58	
3	16QAM	15	0	21.16	21.26	21.55	
3	64QAM	1	0	21.78	21.59	21.55	22



3	64QAM	1	8	21.53	21.66	21.62	22
3	64QAM	1	14	21.37	21.53	21.42	
3	64QAM	8	0	21.42	21.18	21.39	
3	64QAM	8	4	21.25	21.35	21.68	
3	64QAM	8	7	21.54	21.28	21.45	
3	64QAM	15	0	21.66	21.42	21.44	
Channel				23017	23095	23173	Tune-up limit (dBm)
Frequency (MHz)				699.7	707.5	715.3	
1.4	QPSK	1	0	22.97	23.12	23.41	24
1.4	QPSK	1	3	22.91	23.18	23.24	
1.4	QPSK	1	5	22.95	23.22	23.32	
1.4	QPSK	3	0	23.06	23.26	23.24	
1.4	QPSK	3	1	22.98	23.29	23.11	
1.4	QPSK	3	3	23.13	23.30	23.22	
1.4	QPSK	6	0	22.55	22.34	22.51	23
1.4	16QAM	1	0	22.45	22.63	22.57	23
1.4	16QAM	1	3	22.36	22.43	22.43	
1.4	16QAM	1	5	22.42	22.34	22.53	
1.4	16QAM	3	0	22.52	22.25	22.26	
1.4	16QAM	3	1	22.46	22.37	22.41	
1.4	16QAM	3	3	22.40	22.21	22.48	
1.4	16QAM	6	0	21.36	21.38	21.69	22
1.4	64QAM	1	0	21.42	21.52	21.51	22
1.4	64QAM	1	3	21.48	21.70	21.68	
1.4	64QAM	1	5	21.26	21.53	21.63	
1.4	64QAM	3	0	21.44	21.33	21.70	
1.4	64QAM	3	1	21.52	21.31	21.70	
1.4	64QAM	3	3	21.55	21.34	21.74	
1.4	64QAM	6	0	21.32	21.20	21.24	22



<FDD-LTE Band 17>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				23780	23790	23800	
Frequency (MHz)				709	710	711	
10	QPSK	1	0	23.03	23.19	23.44	24
10	QPSK	1	25	23.07	23.24	22.96	
10	QPSK	1	49	23.23	23.29	23.33	
10	QPSK	25	0	23.23	22.27	22.57	23
10	QPSK	25	12	22.40	22.33	22.48	
10	QPSK	25	25	22.31	22.42	22.34	
10	QPSK	50	0	22.34	22.32	22.51	23
10	16QAM	1	0	22.51	22.71	22.55	
10	16QAM	1	25	22.55	22.44	22.45	
10	16QAM	1	49	22.68	22.75	22.45	22
10	16QAM	25	0	21.33	21.35	21.59	
10	16QAM	25	12	21.34	21.26	21.62	
10	16QAM	25	25	21.22	21.28	21.55	22
10	16QAM	50	0	21.51	21.55	21.53	
10	64QAM	1	0	21.52	21.26	21.62	
10	64QAM	1	25	21.35	21.55	21.55	22
10	64QAM	1	49	21.29	21.62	21.68	
10	64QAM	25	0	20.97	20.79	20.59	
10	64QAM	25	12	20.88	20.55	20.56	21
10	64QAM	25	25	20.84	20.62	20.56	
10	64QAM	50	0	20.58	20.54	20.55	
Channel				23755	23790	23825	Tune-up limit (dBm)
Frequency (MHz)				706.5	710	713.5	
5	QPSK	1	0	23.21	23.22	23.11	24
5	QPSK	1	12	23.24	23.11	23.41	
5	QPSK	1	24	23.15	23.06	23.35	
5	QPSK	12	0	22.21	22.34	22.21	23
5	QPSK	12	7	22.21	22.22	22.28	
5	QPSK	12	13	22.05	22.42	22.42	
5	QPSK	25	0	22.22	22.22	22.29	23
5	16QAM	1	0	22.40	22.51	22.54	
5	16QAM	1	12	22.78	22.56	22.85	



5	16QAM	1	24	22.51	22.61	22.52	
5	16QAM	12	0	21.11	21.28	21.12	22
5	16QAM	12	7	21.19	21.55	21.21	
5	16QAM	12	13	21.14	21.26	21.41	
5	16QAM	25	0	21.22	21.65	21.29	
5	64QAM	1	0	21.56	21.66	21.98	22
5	64QAM	1	12	21.55	21.66	21.62	
5	64QAM	1	24	21.72	21.54	21.56	
5	64QAM	12	0	20.44	20.68	20.51	21
5	64QAM	12	7	20.55	20.83	20.56	
5	64QAM	12	13	20.66	20.87	20.54	
5	64QAM	25	0	20.54	20.85	20.62	

<TDD-LTE Band 38>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				37850	38000	38150	
Frequency (MHz)				2580	2595	2610	
20	QPSK	1	0	24.12	24.36	24.23	25
20	QPSK	1	49	24.06	24.29	23.83	
20	QPSK	1	99	23.82	23.88	23.94	
20	QPSK	50	0	23.08	23.51	23.22	24
20	QPSK	50	24	23.20	23.40	23.35	
20	QPSK	50	50	23.22	23.34	23.51	
20	QPSK	100	0	23.27	23.34	22.91	
20	16QAM	1	0	23.14	23.09	23.07	24
20	16QAM	1	49	23.24	23.54	23.03	
20	16QAM	1	99	23.10	23.09	23.11	
20	16QAM	50	0	22.07	22.28	22.00	23
20	16QAM	50	24	22.17	22.39	22.56	
20	16QAM	50	50	22.22	22.42	22.55	
20	16QAM	100	0	22.21	22.36	22.62	
20	64QAM	1	0	22.68	22.99	22.54	23
20	64QAM	1	49	22.52	22.42	22.97	
20	64QAM	1	99	22.62	22.76	22.31	
20	64QAM	50	0	22.34	22.19	22.65	23
20	64QAM	50	24	22.62	22.26	22.45	



20	64QAM	50	50	22.23	22.29	22.51	
20	64QAM	100	0	22.25	22.36	22.62	
Channel				37825	38000	38175	Tune-up limit (dBm)
Frequency (MHz)				2577.5	2595	2612.5	
15	QPSK	1	0	23.83	24.11	23.80	25
15	QPSK	1	37	24.09	24.09	23.76	
15	QPSK	1	74	24.10	23.92	24.06	
15	QPSK	36	0	23.09	23.31	22.96	24
15	QPSK	36	20	23.10	23.37	22.91	
15	QPSK	36	39	23.12	23.36	23.01	
15	QPSK	75	0	23.15	23.28	22.80	24
15	16QAM	1	0	22.97	23.22	23.02	
15	16QAM	1	37	23.21	23.47	22.97	
15	16QAM	1	74	23.23	23.04	23.07	23
15	16QAM	36	0	22.03	22.25	22.26	
15	16QAM	36	20	22.05	22.33	22.27	
15	16QAM	36	39	22.08	22.21	22.22	23
15	16QAM	75	0	22.12	22.28	22.16	
15	64QAM	1	0	22.37	22.35	22.45	
15	64QAM	1	37	22.24	22.34	22.62	23
15	64QAM	1	74	22.52	22.22	22.50	
15	64QAM	36	0	22.10	22.28	22.54	
15	64QAM	36	20	22.16	22.35	22.34	23
15	64QAM	36	39	22.11	22.26	22.62	
15	64QAM	75	0	22.11	22.33	22.55	
Channel				37800	38000	38200	Tune-up limit (dBm)
Frequency (MHz)				2575	2595	2615	
10	QPSK	1	0	24.11	24.20	24.24	25
10	QPSK	1	25	24.16	24.32	24.11	
10	QPSK	1	49	23.94	24.07	24.09	
10	QPSK	25	0	23.07	23.37	23.24	24
10	QPSK	25	12	23.11	23.38	23.11	
10	QPSK	25	25	23.12	23.42	23.26	
10	QPSK	50	0	23.11	23.42	23.11	24
10	16QAM	1	0	23.04	23.41	23.55	
10	16QAM	1	25	23.21	23.56	23.07	



10	16QAM	1	49	23.10	23.37	23.11	
10	16QAM	25	0	22.10	22.40	22.27	23
10	16QAM	25	12	22.17	22.49	22.38	
10	16QAM	25	25	22.39	22.50	22.62	
10	16QAM	50	0	22.16	22.43	22.52	
10	64QAM	1	0	22.66	22.53	22.55	
10	64QAM	1	25	22.24	22.51	22.88	23
10	64QAM	1	49	22.59	22.30	22.66	
10	64QAM	25	0	22.62	22.30	22.48	
10	64QAM	25	12	22.34	22.38	22.38	23
10	64QAM	25	25	22.57	22.38	22.52	
10	64QAM	50	0	22.21	22.35	22.47	
Channel				37775	38000	38225	Tune-up limit (dBm)
Frequency (MHz)				2572.5	2595	2617.5	
5	QPSK	1	0	24.03	24.04	24.02	25
5	QPSK	1	12	23.90	24.28	23.96	
5	QPSK	1	24	23.76	24.06	24.01	
5	QPSK	12	0	23.09	23.34	23.35	24
5	QPSK	12	7	23.03	23.31	23.34	
5	QPSK	12	13	23.05	23.33	23.27	
5	QPSK	25	0	22.94	23.34	23.34	
5	16QAM	1	0	22.89	23.31	23.14	24
5	16QAM	1	12	23.01	23.49	23.11	
5	16QAM	1	24	23.03	23.24	23.12	
5	16QAM	12	0	22.24	22.36	22.42	23
5	16QAM	12	7	22.31	22.38	22.21	
5	16QAM	12	13	22.25	22.38	22.64	
5	16QAM	25	0	22.07	22.35	22.75	
5	64QAM	1	0	22.86	22.35	22.69	23
5	64QAM	1	12	22.54	22.52	22.77	
5	64QAM	1	24	22.59	22.54	22.46	
5	64QAM	12	0	22.12	22.27	22.42	23
5	64QAM	12	7	22.34	22.33	22.54	
5	64QAM	12	13	22.35	22.35	22.57	
5	64QAM	25	0	22.25	22.29	22.36	



<TDD-LTE Band 40A>

BW [MHz]	Modulation	RB Size	RB Offset	Middle Channel			Tune-up limit (dBm)
Channel				38750			
Frequency (MHz)				2310			
10	QPSK	1	0	22.78			23.5
10	QPSK	1	25	22.75			
10	QPSK	1	49	22.58			
10	QPSK	25	0	21.85			22.5
10	QPSK	25	12	21.84			
10	QPSK	25	25	21.82			
10	QPSK	50	0	21.75			
10	16QAM	1	0	21.66			22.5
10	16QAM	1	25	21.56			
10	16QAM	1	49	21.62			
10	16QAM	25	0	20.91			21.5
10	16QAM	25	12	20.83			
10	16QAM	25	25	20.84			
10	16QAM	50	0	20.88			
10	64QAM	1	0	20.88			21.5
10	64QAM	1	25	20.87			
10	64QAM	1	49	20.88			
10	64QAM	25	0	20.76			21.5
10	64QAM	25	12	20.78			
10	64QAM	25	25	20.77			
10	64QAM	50	0	20.81			
Channel				38725	38750	38775	Tune-up limit (dBm)
Frequency (MHz)				2307.5	2310	2312.5	
5	QPSK	1	0	22.59	22.63	22.60	23.5
5	QPSK	1	12	22.56	22.71	22.70	
5	QPSK	1	24	22.47	22.47	22.47	
5	QPSK	12	0	21.86	21.84	21.80	22.5
5	QPSK	12	7	21.85	21.82	21.84	
5	QPSK	12	13	21.80	21.83	21.73	
5	QPSK	25	0	21.75	21.77	21.66	
5	16QAM	1	0	21.80	21.77	21.81	22.5



5	16QAM	1	12	21.90	21.91	21.90	
5	16QAM	1	24	21.69	21.75	21.74	
5	16QAM	12	0	21.77	21.55	21.62	21.5
5	16QAM	12	7	21.55	21.62	21.55	
5	16QAM	12	13	21.62	21.55	21.54	
5	16QAM	25	0	21.55	21.64	21.56	
5	64QAM	1	0	21.74	21.80	21.69	
5	64QAM	1	12	21.86	21.80	21.84	21.5
5	64QAM	1	24	21.66	21.70	21.61	
5	64QAM	12	0	20.81	20.71	20.72	21.5
5	64QAM	12	7	20.71	20.71	20.76	
5	64QAM	12	13	20.75	20.75	20.72	
5	64QAM	25	0	20.74	20.71	20.71	

<TDD-LTE Band 40B>

BW [MHz]	Modulation	RB Size	RB Offset	Middle Channel	Tune-up limit (dBm)
Channel				39200	
Frequency (MHz)				2355	
10	QPSK	1	0	23.28	24
10	QPSK	1	25	23.25	
10	QPSK	1	49	23.08	
10	QPSK	25	0	22.35	23
10	QPSK	25	12	22.34	
10	QPSK	25	25	22.32	
10	QPSK	50	0	22.25	
10	16QAM	1	0	22.16	
10	16QAM	1	25	22.06	23
10	16QAM	1	49	22.12	
10	16QAM	25	0	21.41	
10	16QAM	25	12	21.33	22
10	16QAM	25	25	21.34	
10	16QAM	50	0	21.38	
10	64QAM	1	0	21.38	
10	64QAM	1	25	21.37	
10	64QAM	1	49	21.38	22
10	64QAM	25	0	21.26	



10	64QAM	25	12	21.28			
10	64QAM	25	25	21.27			
10	64QAM	50	0	21.31			
Channel				39175	39200	39225	Tune-up limit (dBm)
Frequency (MHz)				2352.5	2355	2357.5	
5	QPSK	1	0	23.09	23.13	23.10	24
5	QPSK	1	12	23.25	23.21	23.20	
5	QPSK	1	24	22.97	22.97	22.97	
5	QPSK	12	0	22.36	22.34	22.30	23
5	QPSK	12	7	22.35	22.32	22.34	
5	QPSK	12	13	22.30	22.33	22.23	
5	QPSK	25	0	22.25	22.27	22.16	
5	16QAM	1	0	22.30	22.27	22.31	23
5	16QAM	1	12	22.40	22.41	22.40	
5	16QAM	1	24	22.19	22.25	22.24	
5	16QAM	12	0	22.27	22.05	22.12	22
5	16QAM	12	7	22.05	22.12	22.05	
5	16QAM	12	13	22.12	22.05	22.04	
5	16QAM	25	0	22.05	22.14	22.06	
5	64QAM	1	0	22.24	22.30	22.19	22
5	64QAM	1	12	22.36	22.30	22.34	
5	64QAM	1	24	22.16	22.20	22.11	
5	64QAM	12	0	21.31	21.21	21.22	22
5	64QAM	12	7	21.21	21.21	21.26	
5	64QAM	12	13	21.25	21.25	21.22	
5	64QAM	25	0	21.24	21.21	21.21	



<TDD-LTE Band 41>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle-Low Channel	Middle Channel	Middle-High Channel	High Channel	Tune-up limit (dBm)
Channel				40340	40600	40740	40870	41140	
Frequency (MHz)				2565	2591	2605	2618	2645	
20	QPSK	1	0	23.87	23.62	23.60	23.70	24.39	25
20	QPSK	1	49	23.70	23.99	23.76	24.11	24.11	
20	QPSK	1	99	23.97	23.87	23.78	23.85	24.09	
20	QPSK	50	0	23.67	23.24	23.45	23.19	23.68	24
20	QPSK	50	24	23.66	23.06	23.12	23.28	23.42	
20	QPSK	50	50	23.57	23.15	23.10	23.21	23.64	
20	QPSK	100	0	23.63	23.11	23.13	23.24	23.54	
20	16QAM	1	0	23.23	23.24	23.07	23.34	23.11	24
20	16QAM	1	49	23.22	23.22	23.34	23.19	23.38	
20	16QAM	1	99	23.44	23.11	23.07	23.37	23.15	
20	16QAM	50	0	22.44	22.36	22.27	22.26	22.32	23
20	16QAM	50	24	22.65	22.25	22.31	22.35	22.43	
20	16QAM	50	50	22.34	22.34	22.30	22.45	22.53	
20	16QAM	100	0	22.52	22.35	22.39	22.36	22.48	
20	64QAM	1	0	22.44	22.45	22.38	22.45	22.42	23
20	64QAM	1	49	22.36	22.36	22.42	22.34	22.35	
20	64QAM	1	99	22.59	22.37	22.35	22.29	22.37	
20	64QAM	50	0	22.33	22.25	22.41	22.37	22.28	23
20	64QAM	50	24	22.42	22.34	22.22	22.38	22.37	
20	64QAM	50	50	22.13	22.36	22.30	22.28	22.49	
20	64QAM	100	0	22.36	22.37	22.33	22.17	22.52	
Channel				40315	40595	40740	40885	41165	Tune-up limit (dBm)
Frequency (MHz)				2562.5	2590.5	2605	2619.5	2647.5	
15	QPSK	1	0	23.39	23.75	23.70	23.97	24.21	25
15	QPSK	1	37	23.69	23.96	23.92	24.20	23.89	
15	QPSK	1	74	23.53	23.84	23.91	24.01	23.87	
15	QPSK	36	0	23.42	22.94	22.90	23.24	23.42	24
15	QPSK	36	20	23.42	22.98	22.90	23.28	23.50	
15	QPSK	36	39	23.21	23.02	23.06	23.23	23.59	
15	QPSK	75	0	23.42	22.96	22.91	23.26	23.48	
15	16QAM	1	0	23.11	22.90	22.94	23.13	23.27	24



15	16QAM	1	37	23.22	23.01	23.14	23.26	23.40	
15	16QAM	1	74	23.34	22.97	22.89	23.14	23.31	
15	16QAM	36	0	22.47	22.48	22.41	22.17	22.33	23
15	16QAM	36	20	22.22	22.39	22.34	22.18	22.48	
15	16QAM	36	39	22.34	22.56	22.50	22.13	22.42	
15	16QAM	75	0	22.56	22.62	22.57	22.21	22.44	
15	64QAM	1	0	22.53	22.57	22.52	22.24	22.20	
15	64QAM	1	37	22.45	22.46	22.40	22.27	22.42	23
15	64QAM	1	74	22.66	22.57	22.53	22.34	22.35	
15	64QAM	36	0	22.62	22.49	22.49	22.19	22.36	23
15	64QAM	36	20	22.37	22.69	22.63	22.17	22.44	
15	64QAM	36	39	22.56	22.64	22.60	22.19	22.46	
15	64QAM	75	0	22.57	22.29	22.23	22.22	22.34	
Channel				40290	40590	40740	40890	41190	
Frequency (MHz)				2560	2590	2605	2620	2650	limit (dBm)
10	QPSK	1	0	23.54	23.87	23.84	24.07	24.25	25
10	QPSK	1	25	23.62	23.96	23.93	24.22	24.19	
10	QPSK	1	49	23.51	23.84	23.80	24.16	24.34	
10	QPSK	25	0	23.14	22.93	22.90	23.29	23.43	24
10	QPSK	25	12	23.06	23.05	23.01	23.33	23.55	
10	QPSK	25	25	23.17	23.06	23.02	23.25	23.54	
10	QPSK	50	0	23.31	23.04	23.11	23.33	23.64	
10	16QAM	1	0	23.08	23.11	23.17	23.27	23.44	24
10	16QAM	1	25	23.17	23.17	23.13	23.42	23.51	
10	16QAM	1	49	23.37	22.98	22.90	23.25	23.41	
10	16QAM	25	0	22.44	22.51	22.48	22.30	22.42	23
10	16QAM	25	12	22.51	22.24	22.22	22.34	22.49	
10	16QAM	25	25	22.62	22.31	22.28	22.26	22.50	
10	16QAM	50	0	22.24	22.34	22.41	22.34	22.53	
10	64QAM	1	0	22.62	22.42	22.40	22.34	22.38	23
10	64QAM	1	25	22.75	22.24	22.20	22.29	22.42	
10	64QAM	1	49	22.70	22.97	22.82	22.27	22.51	
10	64QAM	25	0	22.57	22.51	22.48	22.22	22.30	23
10	64QAM	25	12	22.26	22.34	22.37	22.26	22.49	
10	64QAM	25	25	22.34	22.54	22.56	22.15	22.48	
10	64QAM	50	0	22.62	22.65	22.63	22.25	22.48	
Channel				40265	40585	40740	40905	41215	Tune-up



Frequency (MHz)				2557.5	2589.5	2605	2621.5	2652.5	limit (dBm)
5	QPSK	1	0	23.87	23.74	23.71	23.97	24.16	25
5	QPSK	1	12	23.77	23.92	23.90	24.13	24.11	
5	QPSK	1	24	23.68	23.72	23.81	24.09	24.35	
5	QPSK	12	0	23.11	22.99	22.92	23.32	23.51	24
5	QPSK	12	7	23.02	23.01	23.01	23.32	23.59	
5	QPSK	12	13	23.11	22.96	22.92	23.27	23.55	
5	QPSK	25	0	23.14	22.91	22.90	23.15	23.44	24
5	16QAM	1	0	22.99	22.85	22.80	23.17	23.26	
5	16QAM	1	12	23.14	23.12	23.21	23.29	23.42	
5	16QAM	1	24	23.29	22.92	22.89	23.03	23.31	23
5	16QAM	12	0	22.57	22.52	22.55	22.25	22.38	
5	16QAM	12	7	22.26	22.62	22.60	22.24	22.54	
5	16QAM	12	13	22.36	22.37	22.33	22.21	22.48	23
5	16QAM	25	0	22.51	22.54	22.59	22.31	22.44	
5	64QAM	1	0	22.42	22.36	22.38	22.26	22.42	
5	64QAM	1	12	22.52	22.42	22.40	22.34	22.36	23
5	64QAM	1	24	22.36	22.36	22.38	22.52	22.34	
5	64QAM	12	0	22.42	22.51	22.48	22.31	22.34	
5	64QAM	12	7	22.49	22.44	22.38	22.15	22.50	23
5	64QAM	12	13	22.62	22.37	22.32	22.14	22.44	
5	64QAM	25	0	22.53	22.35	22.42	22.24	22.29	

➤ **WLAN Conducted Power**

<2.4GHz WLAN>

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Power Setting	Duty Cycle %
	802.11b 1Mbps		CH 1	2412	18.42	19.0	
CH 7			2442	18.26	19.0		
CH 13			2472	17.82	18.5		
802.11g 6Mbps		CH 1	2412	15.90	16.5		96.86
		CH 7	2442	15.75	16.5		
		CH 13	2472	15.28	16.0		
802.11n-HT20 MCS0		CH 1	2412	15.13	16.0		96.65
		CH 7	2442	14.88	15.5		
		CH 13	2472	14.94	15.5		



	802.11n-HT40 MCS0	CH 3	2422	12.59	13.5	93.91
		CH 7	2442	12.42	13.0	
		CH 11	2462	12.28	13.0	

Note:

- Per KDB 248227 D01v02r02, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR is not required for the following 2.4 GHz OFDM conditions:
 - When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
 - 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.
- The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all mode were shown in report.
- Per KDB 248227 D01, A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling.

<5.2GHz WLAN>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Power Setting	Duty Cycle %
5.2GHz WLAN	802.11a 6Mbps	CH 36	5180	9.52	10.0	default	96.53
		CH 44	5220	10.12	10.5	default	
		CH 48	5240	10.95	11.5	default	
	802.11n-HT20 MCS0	CH 36	5180	10.26	10.5	default	97.01
		CH 44	5220	10.80	11.5	default	
		CH 48	5240	11.33	12.0	default	
	802.11n-HT40 MCS0	CH 38	5190	10.18	10.5	default	93.53
		CH 46	5230	10.64	11.0	default	
	802.11ac-VH T20 MCS0	CH 36	5180	10.04	10.5	default	98.13
		CH 44	5220	10.58	11.0	default	
		CH 48	5240	11.01	11.5	default	
	802.11ac-VH T40 MCS0	CH 38	5190	8.16	8.5	default	93.56
		CH 46	5230	8.72	9.0	default	
	802.11ac-VH T80 MCS0	CH 42	5210	7.64	8.0	default	88.04



<5.3GHz WLAN>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Power Setting	Duty Cycle %
5.3GHz WLAN	802.11a 6Mbps	CH 52	5260	10.33	11.5	default	96.53
		CH 60	5300	10.05	11.0	default	
		CH 64	5320	10.51	11.5	default	
	802.11n-HT20 MCS0	CH 52	5260	11.06	11.5	default	97.01
		CH 60	5300	10.68	11.5	default	
		CH 64	5320	10.83	11.5	default	
	802.11n-HT40 MCS0	CH 54	5270	10.60	11.5	default	95.53
		CH 62	5310	10.15	10.5	default	
	802.11ac-VH T20 MCS0	CH 52	5260	10.71	11.5	default	98.13
		CH 60	5300	10.48	11.5	default	
		CH 64	5320	10.71	11.5	default	
	802.11ac-VH T40 MCS0	CH 54	5270	8.55	9.0	default	93.56
CH 62		5310	8.26	9.0	default		
802.11ac-VH T80 MCS0	CH 58	5290	7.86	8.5	default	88.04	

<5.8GHz WLAN>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Power Setting	Duty Cycle %
5.8GHz WLAN	802.11a 6Mbps	CH 149	5745	7.47	8.0	default	96.53
		CH 157	5785	7.87	8.5	default	
		CH 165	5825	8.93	9.5	default	
	802.11n-HT20 MCS0	CH 149	5745	7.57	8.0	default	97.01
		CH 157	5785	8.14	9.0	default	
		CH 165	5825	8.99	9.5	default	
	802.11n-HT40 MCS0	CH 151	5755	7.34	8.0	default	95.53
		CH 159	5795	8.25	9.0	default	
	802.11ac-VH T20 MCS0	CH 149	5745	7.61	8.0	default	98.13
		CH 157	5785	8.10	9.0	default	
		CH 165	5825	8.89	9.5	default	
	802.11ac-VH T40 MCS0	CH 151	5755	5.35	6.0	default	93.53
CH 159		5795	8.97	9.5	default		



	802.11ac-VH T80 MCS0	CH 155	5775	4.96	5.5	default	88.04
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Note:

1. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all mode were shown in report.
2. Per KDB 248227 D01, A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. Therefore the 802.11a mode for 5.8GHz WLAN should be selected for SAR measurement.

➤ **Bluetooth Conducted Power**

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
BR / EDR	CH 00	2402	7.79	4.76	4.77
	CH 39	2441	7.22	3.96	3.87
	CH 78	2480	7.64	4.10	4.06
Tune-up Limit (dBm)			8.5	5.0	5.0
Duty Cycle %			76.8	76.8	77.33

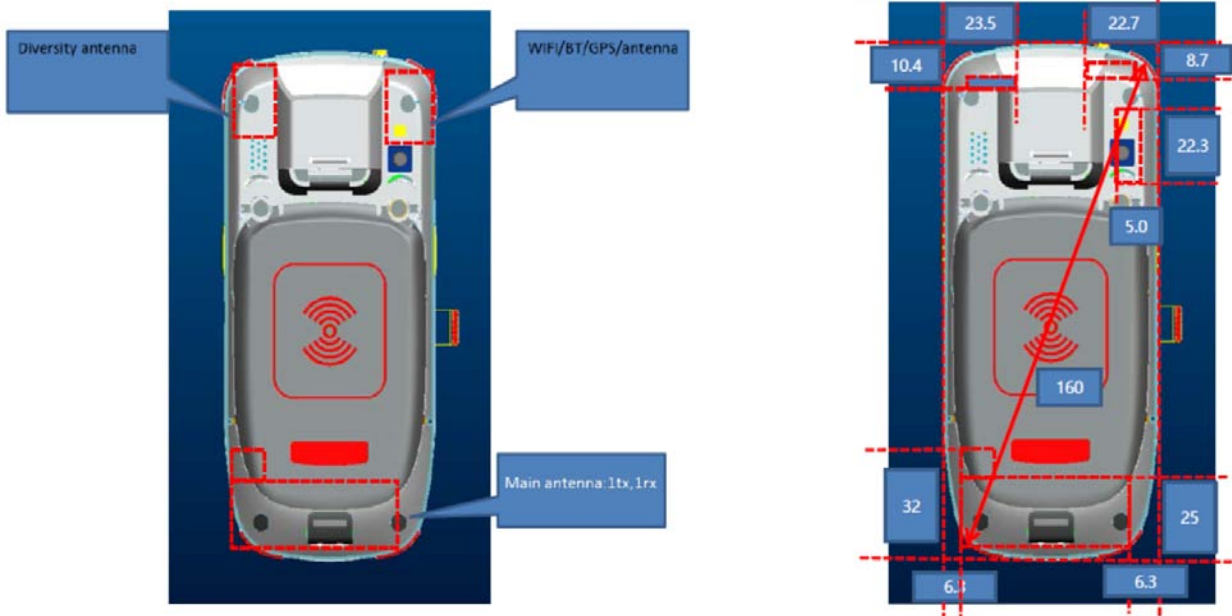
Mode	Channel	Frequency (MHz)	Average power (dBm)
			1Mbps
LE	CH 00	2402	-4.90
	CH 19	2440	-4.46
	CH 39	2480	-4.50
Tune-up Limit (dBm)			-4.0
Duty Cycle %			85.2

Note:

According to 2016 Oct. TCB workshop for Bluetooth SAR consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will bescaled up to the theoretical value of Bluetooth reported SAR calculation.

14. Hot-Spot Mode Evaluation Procedure

➤ EUT Antenna Location



➤ EUT Antenna Distance

Antenna Location	Front	Back	Left	Right	Top	Bottom
Main Antenna	<5mm	<5mm	<5mm	<5mm	>25mm	<5mm
WLAN/BT Antenna	<5mm	<5mm	<25mm	>25mm	<5mm	>25mm

➤ Hotspot Evaluation

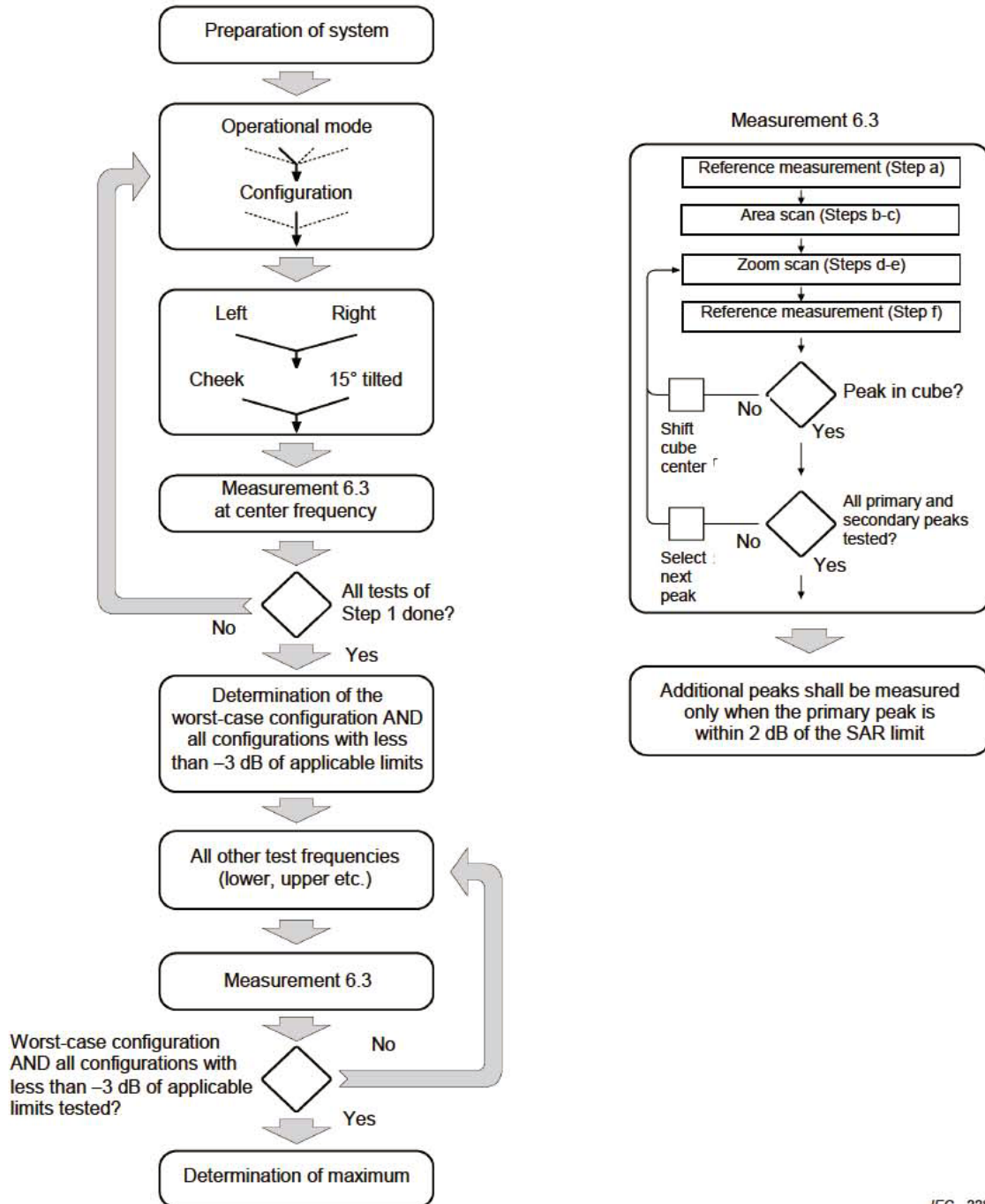
Assessment	Hotspot Side for SAR Test distance: 10mm					
Antennas	Front	Back	Left	Right	Top	Bottom
Main Antenna	Yes	Yes	Yes	Yes	No	Yes
WLAN/BT Antenna	Yes	Yes	Yes	No	Yes	No

Note :

1. The SAR evaluation procedures for Portable Devices with Wireless Router function is according to KDB 941225 D06 Hotspot SAR v02r01.
2. Head/Body-worn/Hotspot mode SAR assessments are required.
3. Referring to KDB 941225 D06, when the overall device length and width are 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

15. Block Diagram of the Tests to be Performed

15.1. Head



IEC 228/05

15.2. Body

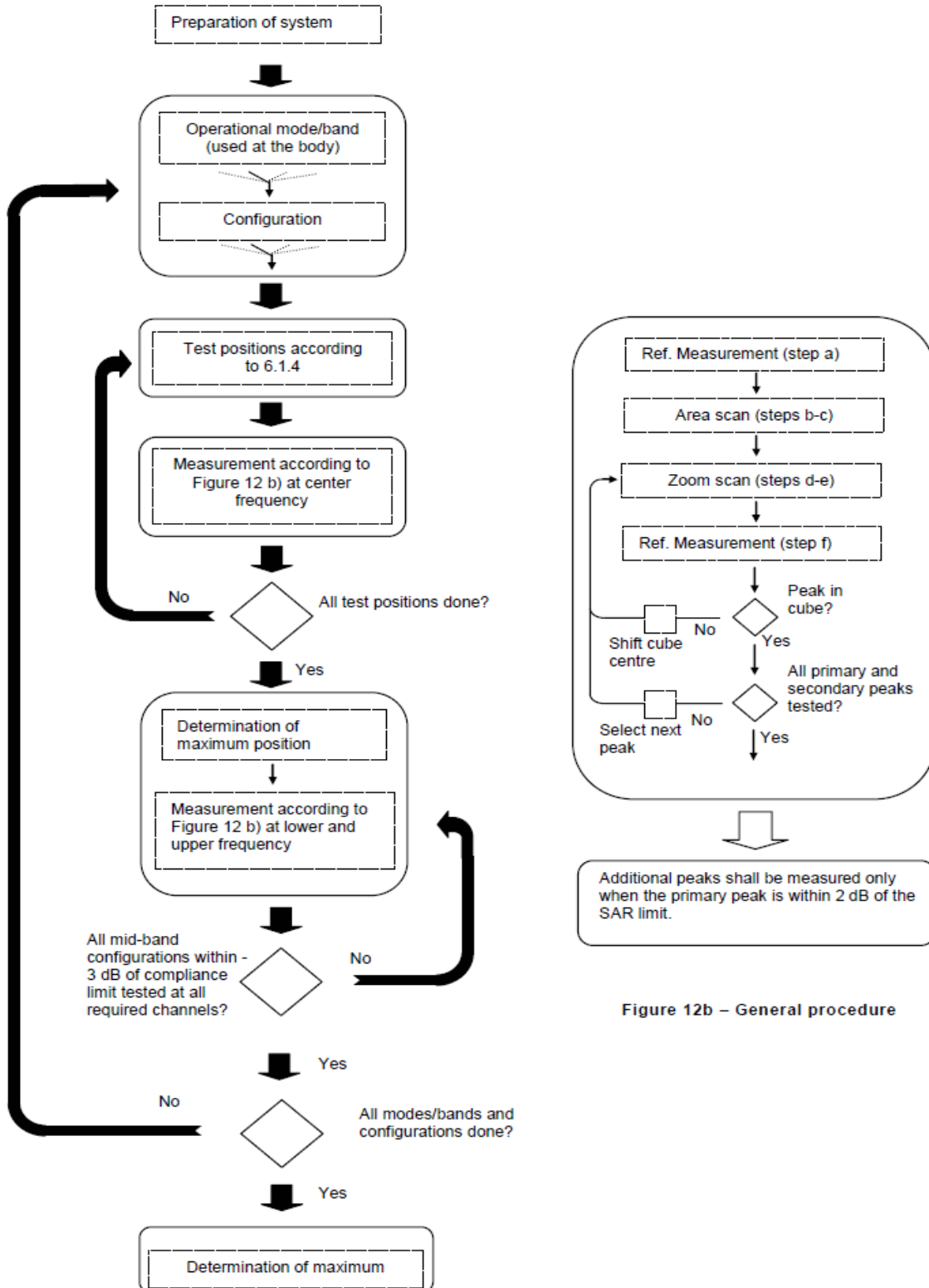


Figure 12b – General procedure



16. Test Results List

16.1. Test Guidance

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)".
 - c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor.
 - d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor.
2. Per KDB 447498 D01v06, for each exposure position, 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:
 - a. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - b. ≤ 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
 - c. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.
5. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for tablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
6. Per KDB248227 D01v02r02, a Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies required for operations in the U.S. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic transmission duty factor is required for current



generation SAR systems to measure SAR correctly. Unless it is permitted by specific KDB procedures or continuous transmission is specifically restricted by the device, the reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. When a device is not capable of sustaining continuous transmission or the output can become nonlinear, and it is limited by hardware design and unable to transmit at higher than 85% duty factor, a periodic duty factor within 15% of the maximum duty factor the device is capable of transmitting should be used. The reported SAR must be scaled to the maximum transmission duty factor to determine compliance. Descriptions of the procedures applied to establish the specific duty factor used for SAR testing are required in SAR reports to support the test results.

7. For TDD-LTE Band 40, the entire band is unable to be used that as per 27.5; only 2 paried block (2305 to 2315MHz, 2350 to 2360MHz) are allowed with regards to "TDD" operation. the channel allocation, and bandwidth covert to test channels shall be re-adjusted; furthermore, as per 27.50, the duty cycle must be adjusted that TDD in this band must not exceed 38%. Before testing, the special combination must be set in the base station before the periodic measurement can be carried out.
8. The maximum radiated emission at 3m of NFC that was recorded in SZ20110290W05 is 21.49 dB μ V/m which was converted to EIRP is closed to zero, therefore it is not required for RF exposure.



16.2. Head SAR Data

➤ GSM Head SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
1#	GPRS 850(4 TX slots)	Right Cheek	190	28.20	29.00	1.202	0.584	0.702
	GPRS 850(4 TX slots)	Right Tilt	190	28.20	29.00	1.202	0.465	0.559
	GPRS 850(4 TX slots)	Left Cheek	190	28.20	29.00	1.202	0.577	0.694
	GPRS 850(4 TX slots)	Left Tilt	190	28.20	29.00	1.202	0.430	0.517
	GPRS 1900(4 TX slots)	Right Cheek	810	25.67	26.50	1.211	0.205	0.248
	GPRS 1900(4 TX slots)	Right Tilt	810	25.67	26.50	1.211	0.116	0.140
2#	GPRS 1900(4 TX slots)	Left Cheek	810	25.67	26.50	1.211	0.214	0.259
	GPRS 1900(4 TX slots)	Left Tilt	810	25.67	26.50	1.211	0.182	0.220

➤ WCDMA Head SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	Band II/RMC 12.2Kbps	Right Cheek	9400	23.30	24.00	1.175	0.221	0.260
	Band II/RMC 12.2Kbps	Right Tilt	9400	23.30	24.00	1.175	0.140	0.164
3#	Band II/RMC 12.2Kbps	Left Cheek	9400	23.30	24.00	1.175	0.235	0.276
	Band II/RMC 12.2Kbps	Left Tilt	9400	23.30	24.00	1.175	0.187	0.220
	Band IV/RMC 12.2Kbps	Right Cheek	1413	23.44	24.00	1.138	0.115	0.131
	Band IV/RMC 12.2Kbps	Right Tilt	1413	23.44	24.00	1.138	0.066	0.075
4#	Band IV/RMC 12.2Kbps	Left Cheek	1413	23.44	24.00	1.138	0.197	0.224
	Band IV/RMC 12.2Kbps	Left Tilt	1413	23.44	24.00	1.138	0.090	0.102
5#	Band V/RMC 12.2Kbps	Right Cheek	4182	23.06	23.50	1.107	0.463	0.512
	Band V/RMC 12.2Kbps	Right Tilt	4182	23.06	23.50	1.107	0.342	0.378
	Band V/RMC 12.2Kbps	Left Cheek	4182	23.06	23.50	1.107	0.342	0.378
	Band V/RMC 12.2Kbps	Left Tilt	4182	23.06	23.50	1.107	0.268	0.297



➤ **CDMA2000 Head SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
6#	BC 0/ RC3 SO55	Right Cheek	777	23.86	24.50	1.159	0.550	0.637
	BC 0/ RC3 SO55	Right Tilt	777	23.86	24.50	1.159	0.278	0.322
	BC 0/ RC3 SO55	Left Cheek	777	23.86	24.50	1.159	0.521	0.604
	BC 0/ RC3 SO55	Left Tilt	777	23.86	24.50	1.159	0.297	0.344

➤ **LTE QPSK Head SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 2/1RB#0 20M	Right Cheek	18700	23.46	24.00	1.132	0.199	0.225
	LTE Band 2/1RB#0 20M	Right Tilt	18700	23.46	24.00	1.132	0.140	0.159
7#	LTE Band 2/1RB#0 20M	Left Cheek	18700	23.46	24.00	1.132	0.250	0.283
	LTE Band 2/1RB#0 20M	Left Tilt	18700	23.46	24.00	1.132	0.175	0.198
	LTE Band 2/50RB#0 20M	Right Cheek	18700	22.31	23.00	1.172	0.171	0.200
	LTE Band 2/50RB#0 20M	Right Tilt	18700	22.31	23.00	1.172	0.122	0.143
	LTE Band 2/50RB#0 20M	Left Cheek	18700	22.31	23.00	1.172	0.236	0.277
	LTE Band 2/50RB#0 20M	Left Tilt	18700	22.31	23.00	1.172	0.171	0.200
	LTE Band 4/1RB#0 20M	Right Cheek	20300	23.84	24.50	1.164	0.102	0.119
	LTE Band 4/1RB#0 20M	Right Tilt	20300	23.84	24.50	1.164	0.069	0.080
8#	LTE Band 4/1RB#0 20M	Left Cheek	20300	23.84	24.50	1.164	0.188	0.219
	LTE Band 4/1RB#0 20M	Left Tilt	20300	23.84	24.50	1.164	0.079	0.092
	LTE Band 4/50RB#0 20M	Right Cheek	20300	22.88	23.50	1.153	0.098	0.113
	LTE Band 4/50RB#0 20M	Right Tilt	20300	22.88	23.50	1.153	0.064	0.074
	LTE Band 4/50RB#0 20M	Left Cheek	20300	22.88	23.50	1.153	0.114	0.131
	LTE Band 4/50RB#0 20M	Left Tilt	20300	22.88	23.50	1.153	0.073	0.084
9#	LTE Band 5/1RB#0 10M	Right Cheek	20600	23.31	24.00	1.172	0.479	0.561
	LTE Band 5/1RB#0 10M	Right Tilt	20600	23.31	24.00	1.172	0.325	0.381
	LTE Band 5/1RB#0 10M	Left Cheek	20600	23.31	24.00	1.172	0.464	0.544
	LTE Band 5/1RB#0 10M	Left Tilt	20600	23.31	24.00	1.172	0.307	0.360



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 5/25RB#0 10M	Right Cheek	20600	22.69	23.00	1.074	0.434	0.466
	LTE Band 5/25RB#0 10M	Right Tilt	20600	22.69	23.00	1.074	0.258	0.277
	LTE Band 5/25RB#0 10M	Left Cheek	20600	22.69	23.00	1.074	0.405	0.435
	LTE Band 5/25RB#0 10M	Left Tilt	20600	22.69	23.00	1.074	0.250	0.268
	LTE Band 7/1RB#49 20M	Right Cheek	21100	21.85	22.50	1.161	0.165	0.192
	LTE Band 7/1RB#49 20M	Right Tilt	21100	21.85	22.50	1.161	0.033	0.038
10#	LTE Band 7/1RB#49 20M	Left Cheek	21100	21.85	22.50	1.161	0.213	0.247
	LTE Band 7/1RB#49 20M	Left Tilt	21100	21.85	22.50	1.161	0.071	0.082
	LTE Band 7/50RB#24 20M	Right Cheek	21100	20.84	21.50	1.164	0.078	0.091
	LTE Band 7/50RB#24 20M	Right Tilt	21100	20.84	21.50	1.164	0.038	0.044
	LTE Band 7/50RB#24 20M	Left Cheek	21100	20.84	21.50	1.164	0.090	0.105
	LTE Band 7/50RB#24 20M	Left Tilt	21100	20.84	21.50	1.164	0.063	0.073
11#	LTE Band 12/1RB#0 10M	Right Cheek	23130	23.45	24.00	1.135	0.174	0.197
	LTE Band 12/1RB#0 10M	Right Tilt	23130	23.45	24.00	1.135	0.102	0.116
	LTE Band 12/1RB#0 10M	Left Cheek	23130	23.45	24.00	1.135	0.159	0.180
	LTE Band 12/1RB#0 10M	Left Tilt	23130	23.45	24.00	1.135	0.096	0.109
	LTE Band 12/25RB#0 10M	Right Cheek	23130	22.42	23.00	1.143	0.150	0.171
	LTE Band 12/25RB#0 10M	Right Tilt	23130	22.42	23.00	1.143	0.088	0.101
	LTE Band 12/25RB#0 10M	Left Cheek	23130	22.42	23.00	1.143	0.150	0.171
	LTE Band 12/25RB#0 10M	Left Tilt	23130	22.42	23.00	1.143	0.079	0.090
	LTE Band 38/1RB#0 20M	Right Cheek	38000	24.36	25.00	1.159	0.108	0.126
	LTE Band 38/1RB#0 20M	Right Tilt	38000	24.36	25.00	1.159	0.034	0.040
12#	LTE Band 38/1RB#0 20M	Left Cheek	38000	24.36	25.00	1.159	0.143	0.166
	LTE Band 38/1RB#0 20M	Left Tilt	38000	24.36	25.00	1.159	0.052	0.061
	LTE Band 38/50RB#0 20M	Right Cheek	38000	23.51	24.00	1.119	0.049	0.055
	LTE Band 38/50RB#0 20M	Right Tilt	38000	23.51	24.00	1.119	0.030	0.034
	LTE Band 38/50RB#0 20M	Left Cheek	38000	23.51	24.00	1.119	0.063	0.071
	LTE Band 38/50RB#0 20M	Left Tilt	38000	23.51	24.00	1.119	0.047	0.053



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 40A/1RB#0 10M	Right Cheek	38750	22.78	23.50	1.180	0.018	0.021
	LTE Band 40A/1RB#0 10M	Right Tilt	38750	22.78	23.50	1.180	0.013	0.015
13#	LTE Band 40A/1RB#0 10M	Left Cheek	38750	22.78	23.50	1.180	0.025	0.029
	LTE Band 40A/1RB#0 10M	Left Tilt	38750	22.78	23.50	1.180	0.015	0.018
	LTE Band 40A/25RB#0 10M	Right Cheek	38750	21.85	22.50	1.161	0.014	0.016
	LTE Band 40A/25RB#0 10M	Right Tilt	38750	21.85	22.50	1.161	0.011	0.013
	LTE Band 40A/25RB#0 10M	Left Cheek	38750	21.85	22.50	1.161	0.017	0.020
	LTE Band 40A/25RB#0 10M	Left Tilt	38750	21.85	22.50	1.161	0.013	0.015
	LTE Band 40B/1RB#0 10M	Right Cheek	39200	23.28	24.00	1.180	0.015	0.018
	LTE Band 40B/1RB#0 10M	Right Tilt	39200	23.28	24.00	1.180	0.013	0.015
14#	LTE Band 40B/1RB#0 10M	Left Cheek	39200	23.28	24.00	1.180	0.021	0.025
	LTE Band 40B/1RB#0 10M	Left Tilt	39200	23.28	24.00	1.180	0.017	0.020
	LTE Band 40B/25RB#0 10M	Right Cheek	39200	22.35	23.00	1.161	0.014	0.016
	LTE Band 40B/25RB#0 10M	Right Tilt	39200	22.35	23.00	1.161	0.010	0.012
	LTE Band 40B/25RB#0 10M	Left Cheek	39200	22.35	23.00	1.161	0.018	0.021
	LTE Band 40B/25RB#0 10M	Left Tilt	39200	22.35	23.00	1.161	0.014	0.016
	LTE Band 41/1RB#0 20M	Right Cheek	41140	24.39	25.00	1.151	0.064	0.074
	LTE Band 41/1RB#0 20M	Right Tilt	41140	24.39	25.00	1.151	0.037	0.043
15#	LTE Band 41/1RB#0 20M	Left Cheek	41140	24.39	25.00	1.151	0.136	0.157
	LTE Band 41/1RB#0 20M	Left Tilt	41140	24.39	25.00	1.151	0.071	0.082
	LTE Band 41/50RB#0 20M	Right Cheek	41140	23.68	24.00	1.076	0.061	0.066
	LTE Band 41/50RB#0 20M	Right Tilt	41140	23.68	24.00	1.076	0.037	0.040
	LTE Band 41/50RB#0 20M	Left Cheek	41140	23.68	24.00	1.076	0.078	0.084
	LTE Band 41/50RB#0 20M	Left Tilt	41140	23.68	24.00	1.076	0.064	0.069



➤ WLAN Head SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN2.4GHz/802.11b	Right Cheek	1	18.42	19.00	1.143	0.146	0.167
16#	WLAN2.4GHz/802.11b	Right Tilt	1	18.42	19.00	1.143	0.149	0.170
	WLAN2.4GHz/802.11b	Left Cheek	1	18.42	19.00	1.143	0.125	0.143
	WLAN2.4GHz/802.11b	Left Tilt	1	18.42	19.00	1.143	0.128	0.146
	WLAN5.2GHz/802.11n20	Right Cheek	48	11.33	12.00	1.167	0.239	0.288
	WLAN5.2GHz/802.11n20	Right Tilt	48	11.33	12.00	1.167	0.240	0.289
	WLAN5.2GHz/802.11n20	Left Cheek	48	11.33	12.00	1.167	0.338	0.407
17#	WLAN5.2GHz/802.11n20	Left Tilt	48	11.33	12.00	1.167	0.370	0.445
	WLAN5.3GHz/802.11n20	Right Cheek	52	11.06	11.50	1.107	0.210	0.240
	WLAN5.3GHz/802.11n20	Right Tilt	52	11.06	11.50	1.107	0.207	0.236
	WLAN5.3GHz/802.11n20	Left Cheek	52	11.06	11.50	1.107	0.229	0.261
18#	WLAN5.3GHz/802.11n20	Left Tilt	52	11.06	11.50	1.107	0.239	0.273
19#	WLAN5.8GHz/802.11n20	Right Cheek	165	8.99	9.50	1.125	0.610	0.707
	WLAN5.8GHz/802.11n20	Right Tilt	165	8.99	9.50	1.125	0.597	0.692
	WLAN5.8GHz/802.11n20	Left Cheek	165	8.99	9.50	1.125	0.470	0.545
	WLAN5.8GHz/802.11n20	Left Tilt	165	8.99	9.50	1.125	0.580	0.672

Note:

- Per KDB 447498 D01v06, for each exposure position, if the highest output power channel Reported SAR \leq 0.8W/kg, other channels SAR testing is not necessary.
- Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is \geq 0.8W/kg.
- Per KDB 941225 D05v02r05, 100% RB allocation SAR measurement is not required when the highest reported SAR for 1 RB and 50% RB allocation are \leq 0.8 W/kg.
- Per KDB 248227 D01v02r02, for 802.11b DSSS, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is \leq 0.8 W/kg, no further SAR testing is required in that exposure configuration.
- Per KDB 248227 D01v02r02, OFDM SAR is not required 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 \leq 1.2 W/kg.
- According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
- The WLAN Reported 1g SAR (W/kg) has been calculated together with the duty cycle scaling factor 1.0 for 2.4G WLAN and 1.031 for 5G WLAN.



16.3. Body SAR Data

➤ **GSM Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	GPRS 850(4 TX slots)	Front Side	190	28.20	29.00	1.202	0.494	0.594
20#	GPRS 850(4 TX slots)	Back Side	190	28.20	29.00	1.202	0.647	0.778
	GPRS 850(4 TX slots)	Left Side	190	28.20	29.00	1.202	0.405	0.487
	GPRS 850(4 TX slots)	Right Side	190	28.20	29.00	1.202	0.506	0.608
	GPRS 850(4 TX slots)	Bottom Side	190	28.20	29.00	1.202	0.144	0.173
	GPRS 1900(4 TX slots)	Front Side	810	25.67	26.50	1.211	0.464	0.562
21#	GPRS 1900(4 TX slots)	Back Side	810	25.67	26.50	1.211	0.671	0.812
	GPRS 1900(4 TX slots)	Left Side	810	25.67	26.50	1.211	0.511	0.619
	GPRS 1900(4 TX slots)	Right Side	810	25.67	26.50	1.211	0.285	0.345
	GPRS 1900(4 TX slots)	Bottom Side	810	25.67	26.50	1.211	0.729	0.883
	GPRS 1900(4 TX slots)	Back Side	512	25.51	26.50	1.256	0.621	0.780
	GPRS 1900(4 TX slots)	Back Side	661	25.46	26.50	1.271	0.636	0.808
22#	GPRS 1900(4 TX slots)	Bottom Side	512	25.51	26.50	1.256	0.733	0.921
	GPRS 1900(4 TX slots)	Bottom Side	661	25.46	26.50	1.271	0.710	0.902

➤ **WCDMA Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	Band II/RMC 12.2Kbps	Front Side	9400	23.30	24.00	1.175	0.446	0.524
23#	Band II/RMC 12.2Kbps	Back Side	9400	23.30	24.00	1.175	0.576	0.677
	Band II/RMC 12.2Kbps	Left Side	9400	23.30	24.00	1.175	0.417	0.490
	Band II/RMC 12.2Kbps	Right Side	9400	23.30	24.00	1.175	0.281	0.330
	Band II/RMC 12.2Kbps	Bottom Side	9400	23.30	24.00	1.175	0.705	0.828
	Band II/RMC 12.2Kbps	Bottom Side	9262	23.15	24.00	1.216	0.588	0.715
24#	Band II/RMC 12.2Kbps	Bottom Side	9538	23.12	24.00	1.225	0.708	0.867
	Band IV/RMC 12.2Kbps	Front Side	1413	23.44	24.00	1.138	0.195	0.222
25#	Band IV/RMC 12.2Kbps	Back Side	1413	23.44	24.00	1.138	0.307	0.349
	Band IV/RMC 12.2Kbps	Left Side	1413	23.44	24.00	1.138	0.256	0.291
	Band IV/RMC 12.2Kbps	Right Side	1413	23.44	24.00	1.138	0.197	0.224
26#	Band IV/RMC 12.2Kbps	Bottom Side	1413	23.44	24.00	1.138	0.356	0.405



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	Band V/RMC 12.2Kbps	Front Side	4182	23.06	23.50	1.107	0.328	0.363
27#	Band V/RMC 12.2Kbps	Back Side	4182	23.06	23.50	1.107	0.658	0.728
	Band V/RMC 12.2Kbps	Left Side	4182	23.06	23.50	1.107	0.326	0.361
	Band V/RMC 12.2Kbps	Right Side	4182	23.06	23.50	1.107	0.467	0.517
	Band V/RMC 12.2Kbps	Bottom Side	4182	23.06	23.50	1.107	0.179	0.198

➤ **CDMA2000 Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	BC0/RTAP 153.6Kbps	Front Side	777	23.65	24.00	1.084	0.365	0.396
28#	BC0/RTAP 153.6Kbps	Back Side	777	23.65	24.00	1.084	0.574	0.622
	BC0/RTAP 153.6Kbps	Left Side	777	23.65	24.00	1.084	0.130	0.141
	BC0/RTAP 153.6Kbps	Right Side	777	23.65	24.00	1.084	0.222	0.241
	BC0/RTAP 153.6Kbps	Bottom Side	777	23.65	24.00	1.084	0.134	0.145

➤ **LTE QPSK Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
29#	LTE Band 2/1RB#0 20M	Front Side	18700	23.46	24.00	1.132	0.504	0.571
	LTE Band 2/1RB#0 20M	Back Side	18700	23.46	24.00	1.132	0.436	0.494
	LTE Band 2/1RB#0 20M	Left Side	18700	23.46	24.00	1.132	0.485	0.549
	LTE Band 2/1RB#0 20M	Right Side	18700	23.46	24.00	1.132	0.293	0.332
30#	LTE Band 2/1RB#0 20M	Bottom Side	18900	23.46	24.00	1.132	0.548	0.621
	LTE Band 2/50RB#0 20M	Front Side	18700	22.31	23.00	1.172	0.450	0.527
	LTE Band 2/50RB#0 20M	Back Side	18700	22.31	23.00	1.172	0.407	0.477
	LTE Band 2/50RB#0 20M	Left Side	18700	22.31	23.00	1.172	0.421	0.493
	LTE Band 2/50RB#0 20M	Right Side	18700	22.31	23.00	1.172	0.253	0.297
	LTE Band 2/50RB#0 20M	Bottom Side	18700	22.31	23.00	1.172	0.519	0.608



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 4/1RB#0 20M	Front Side	20300	23.84	24.50	1.164	0.238	0.277
31#	LTE Band 4/1RB#0 20M	Back Side	20300	23.84	24.50	1.164	0.304	0.354
	LTE Band 4/1RB#0 20M	Left Side	20300	23.84	24.50	1.164	0.293	0.341
	LTE Band 4/1RB#0 20M	Right Side	20300	23.84	24.50	1.164	0.275	0.320
32#	LTE Band 4/1RB#0 20M	Bottom Side	20300	23.84	24.50	1.164	0.375	0.437
	LTE Band 4/50RB#0 20M	Front Side	20300	22.88	23.50	1.153	0.199	0.230
	LTE Band 4/50RB#0 20M	Back Side	20300	22.88	23.50	1.153	0.259	0.299
	LTE Band 4/50RB#0 20M	Left Side	20300	22.88	23.50	1.153	0.227	0.262
	LTE Band 4/50RB#0 20M	Right Side	20300	22.88	23.50	1.153	0.183	0.211
	LTE Band 4/50RB#0 20M	Bottom Side	20300	22.88	23.50	1.153	0.317	0.366
	LTE Band 5/1RB#0 10M	Front Side	20600	23.31	24.00	1.172	0.363	0.426
33#	LTE Band 5/1RB#0 10M	Back Side	20600	23.31	24.00	1.172	0.502	0.588
	LTE Band 5/1RB#0 10M	Left Side	20600	23.31	24.00	1.172	0.302	0.354
	LTE Band 5/1RB#0 10M	Right Side	20600	23.31	24.00	1.172	0.450	0.527
	LTE Band 5/1RB#0 10M	Bottom Side	20600	23.31	24.00	1.172	0.113	0.132
	LTE Band 5/25RB#0 10M	Front Side	20600	22.69	23.00	1.074	0.292	0.314
	LTE Band 5/25RB#0 10M	Back Side	20600	22.69	23.00	1.074	0.400	0.430
	LTE Band 5/25RB#0 10M	Left Side	20600	22.69	23.00	1.074	0.236	0.253
	LTE Band 5/25RB#0 10M	Right Side	20600	22.69	23.00	1.074	0.356	0.382
	LTE Band 5/25RB#0 10M	Bottom Side	20600	22.69	23.00	1.074	0.094	0.101
	LTE Band 7/1RB#49 20M	Front Side	21100	21.85	22.50	1.161	0.099	0.114
34#	LTE Band 7/1RB#49 20M	Back Side	21100	21.85	22.50	1.161	0.643	0.747
	LTE Band 7/1RB#49 20M	Left Side	21100	21.85	22.50	1.161	0.462	0.537
	LTE Band 7/1RB#49 20M	Right Side	21100	21.85	22.50	1.161	0.129	0.150
	LTE Band 7/1RB#49 20M	Bottom Side	21100	21.85	22.50	1.161	0.321	0.373
	LTE Band 7/50RB#24 20M	Front Side	21100	20.84	21.50	1.164	0.082	0.095
	LTE Band 7/50RB#24 20M	Back Side	21100	20.84	21.50	1.164	0.484	0.563
	LTE Band 7/50RB#24 20M	Left Side	21100	20.84	21.50	1.164	0.376	0.438
	LTE Band 7/50RB#24 20M	Right Side	21100	20.84	21.50	1.164	0.107	0.125
	LTE Band 7/50RB#24 20M	Bottom Side	21100	20.84	21.50	1.164	0.265	0.308



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 12/1RB#0 10M	Front Side	23130	23.45	24.00	1.135	0.197	0.224
35#	LTE Band 12/1RB#0 10M	Back Side	23130	23.45	24.00	1.135	0.341	0.387
	LTE Band 12/1RB#0 10M	Left Side	23130	23.45	24.00	1.135	0.176	0.200
	LTE Band 12/1RB#0 10M	Right Side	23130	23.45	24.00	1.135	0.259	0.294
	LTE Band 12/1RB#0 10M	Bottom Side	23130	23.45	24.00	1.135	0.028	0.032
	LTE Band 12/25RB#0 10M	Front Side	23130	22.42	23.00	1.143	0.178	0.203
	LTE Band 12/25RB#0 10M	Back Side	23130	22.42	23.00	1.143	0.301	0.344
	LTE Band 12/25RB#0 10M	Left Side	23130	22.42	23.00	1.143	0.163	0.186
	LTE Band 12/25RB#0 10M	Right Side	23130	22.42	23.00	1.143	0.230	0.263
	LTE Band 12/25RB#0 10M	Bottom Side	23130	22.42	23.00	1.143	0.024	0.027
	LTE Band 38/1RB#0 20M	Front Side	38000	24.36	25.00	1.159	0.104	0.121
36#	LTE Band 38/1RB#0 20M	Back Side	38000	24.36	25.00	1.159	0.513	0.598
	LTE Band 38/1RB#0 20M	Left Side	38000	24.36	25.00	1.159	0.298	0.347
	LTE Band 38/1RB#0 20M	Right Side	38000	24.36	25.00	1.159	0.094	0.109
	LTE Band 38/1RB#0 20M	Bottom Side	38000	24.36	25.00	1.159	0.233	0.272
	LTE Band 38/50RB#0 20M	Front Side	38000	23.51	24.00	1.119	0.087	0.098
	LTE Band 38/50RB#0 20M	Back Side	38000	23.51	24.00	1.119	0.439	0.494
	LTE Band 38/50RB#0 20M	Left Side	38000	23.51	24.00	1.119	0.261	0.294
	LTE Band 38/50RB#0 20M	Right Side	38000	23.51	24.00	1.119	0.084	0.095
	LTE Band 38/50RB#0 20M	Bottom Side	38000	23.51	24.00	1.119	0.201	0.226
	LTE Band 40A/1RB#0 10M	Front Side	38750	22.78	23.50	1.180	0.027	0.032
37#	LTE Band 40A/1RB#0 10M	Back Side	38750	22.78	23.50	1.180	0.260	0.309
	LTE Band 40A/1RB#0 10M	Left Side	38750	22.78	23.50	1.180	0.054	0.064
	LTE Band 40A/1RB#0 10M	Right Side	38750	22.78	23.50	1.180	0.054	0.064
	LTE Band 40A/1RB#0 10M	Bottom Side	38750	22.78	23.50	1.180	0.220	0.261
	LTE Band 40A/25RB#0 10M	Front Side	38750	21.85	22.50	1.161	0.022	0.026
	LTE Band 40A/25RB#0 10M	Back Side	38750	21.85	22.50	1.161	0.206	0.241
	LTE Band 40A/25RB#0 10M	Left Side	38750	21.85	22.50	1.161	0.044	0.051
	LTE Band 40A/25RB#0 10M	Right Side	38750	21.85	22.50	1.161	0.046	0.054
	LTE Band 40A/25RB#0 10M	Bottom Side	38750	21.85	22.50	1.161	0.176	0.206



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 40B/1RB#0 10M	Front Side	39200	23.28	24.00	1.180	0.030	0.036
38#	LTE Band 40B/1RB#0 10M	Back Side	39200	23.28	24.00	1.180	0.346	0.411
	LTE Band 40B/1RB#0 10M	Left Side	39200	23.28	24.00	1.180	0.091	0.108
	LTE Band 40B/1RB#0 10M	Right Side	39200	23.28	24.00	1.180	0.057	0.068
	LTE Band 40B/1RB#0 10M	Bottom Side	39200	23.28	24.00	1.180	0.238	0.283
	LTE Band 40B/25RB#0 10M	Front Side	39200	22.35	23.00	1.161	0.026	0.030
	LTE Band 40B/25RB#0 10M	Back Side	39200	22.35	23.00	1.161	0.284	0.332
	LTE Band 40B/25RB#0 10M	Left Side	39200	22.35	23.00	1.161	0.074	0.087
	LTE Band 40B/25RB#0 10M	Right Side	39200	22.35	23.00	1.161	0.049	0.057
	LTE Band 40B/25RB#0 10M	Bottom Side	39200	22.35	23.00	1.161	0.193	0.226
	LTE Band 41/1RB#0 20M	Front Side	41140	24.39	25.00	1.151	0.118	0.137
39#	LTE Band 41/1RB#0 20M	Back Side	41140	24.39	25.00	1.151	0.547	0.633
	LTE Band 41/1RB#0 20M	Left Side	41140	24.39	25.00	1.151	0.329	0.381
	LTE Band 41/1RB#0 20M	Right Side	41140	24.39	25.00	1.151	0.102	0.118
	LTE Band 41/1RB#0 20M	Bottom Side	41140	24.39	25.00	1.151	0.225	0.260
	LTE Band 41/50RB#0 20M	Front Side	41140	23.68	24.00	1.076	0.107	0.116
	LTE Band 41/50RB#0 20M	Back Side	41140	23.68	24.00	1.076	0.458	0.496
	LTE Band 41/50RB#0 20M	Left Side	41140	23.68	24.00	1.076	0.295	0.319
	LTE Band 41/50RB#0 20M	Right Side	41140	23.68	24.00	1.076	0.093	0.101
	LTE Band 41/50RB#0 20M	Bottom Side	41140	23.68	24.00	1.076	0.201	0.218

➤ **WLAN Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN2.4GHz/802.11b	Front Side	1	18.42	19.00	1.143	0.060	0.068
40#	WLAN2.4GHz/802.11b	Back Side	1	18.42	19.00	1.143	0.640	0.731
	WLAN2.4GHz/802.11b	Left Side	1	18.42	19.00	1.143	0.168	0.192
	WLAN2.4GHz/802.11b	Top Side	1	18.42	19.00	1.143	0.097	0.111
	WLAN5.2GHz/802.11n20	Front Side	48	11.33	12.00	1.167	0.104	0.125
41#	WLAN5.2GHz/802.11n20	Back Side	48	11.33	12.00	1.167	0.198	0.238
	WLAN5.2GHz/802.11n20	Left Side	48	11.33	12.00	1.167	0.153	0.184
	WLAN5.2GHz/802.11n20	Top Side	48	11.33	12.00	1.167	0.191	0.230



Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN5.3GHz/802.11n20	Front Side	52	11.06	11.50	1.107	0.085	0.097
42#	WLAN5.3GHz/802.11n20	Back Side	52	11.06	11.50	1.107	0.175	0.200
	WLAN5.8GHz/802.11n20	Front Side	165	8.99	9.50	1.125	0.173	0.201
43#	WLAN5.8GHz/802.11n20	Back Side	165	8.99	9.50	1.125	0.340	0.394
	WLAN5.8GHz/802.11n20	Left Side	165	8.99	9.50	1.125	0.289	0.335
	WLAN5.8GHz/802.11n20	Top Side	165	8.99	9.50	1.125	0.323	0.375

Note:

The WLAN Reported 1g SAR (W/kg) has been calculated together with the duty cycle scaling factor 1.0 for 2.4G WLAN and 1.031 for 5GHz WLAN.

➤ **Bluetooth Body SAR**

When standalone SAR is not required to be measured, per FCC KDB 447498 D01v06 4.3.2), the following equation must be used to estimate the standalone 1g SAR.

$$\text{Estimated SAR} = \frac{\sqrt{f(\text{GHz})}}{7.5} \cdot \frac{\text{Max. power of channel, mW}}{\text{Min. Separation Distance, mm}}$$

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power(mW)	Test Distance (mm)	Result	Exclusion Thresholds for 1-g SAR
CH 0	2.401	8.5	7.08	10	1.10	3.0

Mode	Max. Tune-up Power (dBm)	Exposure Position	Body-Worn
		Test Distance (mm)	10
Bluetooth	8.5	Estimated SAR (W/kg)	0.146

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	Bluetooth/1Mbps	Front Side	0	7.79	8.50	1.178	0.146	0.187
	Bluetooth/1Mbps	Back Side	0	7.79	8.50	1.178	0.146	0.187

Note:

According to 2016 Oct. TCB workshop for Bluetooth SAR consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation. The duty cycle of Bluetooth is 76.8, Therefore the duty cycle scaling factor 1.085 should be used to calculating the reported SAR.



16.4. Repeated SAR Assessment

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These 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 .

16.5. Extremity SAR Assessment

Guidance:

1. According to KDB 648747 D04v01r03 The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the head-equivalent tissue dielectric parameters in KDB Publication 865664 D01 to address interactive hand use exposure conditions.
2. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR _{10g} (W/kg)	Reported SAR _{10g} (W/kg)
OR.	WLAN5.3GHz/802.11n20	Front Side	52	11.06	11.50	1.107	0.108	0.123
	WLAN5.3GHz/802.11n20	Back Side	52	11.06	11.50	1.107	0.201	0.229

17. Simultaneous Transmission Evaluation

17.1. Simultaneous Transmission Consideration

No.	Simultaneous Transmission Consideration	Head	Body-Worn	Hotspot
1	WWAN(2G/3G/4G)+WLAN 2.4GHz	Yes	Yes	Yes
2	WWAN(2G/3G/4G)+WLAN 5.2GHz/5.8GHz	Yes	Yes	Yes
3	WWAN(2G/3G/4G)+WLAN 5.3GHz	Yes	Yes	No
4	WWAN(2G/3G/4G)+Bluetooth	No	Yes	No

Note:

- When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the Wi-Fi transmitter and another WWAN transmitter. In general both the transmitters cannot transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. The "Portable Hotspot" feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.
- The hotspot SAR result may overlap with the body-worn accessory SAR requirements, per KDB 941225 D06, the more conservative configurations can be considered, thus excluding some unnecessary body-worn accessory SAR tests.
- Simultaneous Transmission SAR evaluation is not required for BT and Wi-Fi, because the software mechanism have been incorporated to guarantee that the WLAN and Bluetooth transmitters would not simultaneously operate.
- Per KDB 447498D01v06, simultaneous transmission SAR evaluation procedures is as followed:
 Step 1: If sum of 1 g SAR <1.6 W/kg, Simultaneous SAR measurement is not required.
 Step 2: If sum of 1 g SAR >1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.
 Step 3: If the ratio of SAR to peak separation distance is ≤ 0.04 , Simultaneous SAR measurement is not required.
 Step 4: If the ratio of SAR to peak separation distance is > 0.04 , Simultaneous SAR measurement is required and simultaneous transmission SAR value is calculated.
 (The ratio is determined by: $(SAR_1 + SAR_2) \wedge 1.5/R_i \leq 0.04$,
 R_i is the separation distance between the peak SAR locations for the antenna pair in mm.



17.2. Simultaneous Transmission Analysis

➤ Head Simultaneous Transmission for WWAN(2/3/4G)+WLAN(2.4GHz+5G)

WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN		
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM850	Right Cheek	0.702	0.167	0.707	0.869	1.409
	Right Tilt	0.559	0.170	0.692	0.729	1.251
	Left Cheek	0.694	0.143	0.545	0.837	1.239
	Left Tilt	0.517	0.146	0.672	0.663	1.189
GSM1900	Right Cheek	0.248	0.167	0.707	0.415	0.955
	Right Tilt	0.140	0.170	0.692	0.310	0.832
	Left Cheek	0.259	0.143	0.545	0.402	0.804
	Left Tilt	0.220	0.146	0.672	0.366	0.892
WCDMA II	Right Cheek	0.260	0.167	0.707	0.427	0.967
	Right Tilt	0.164	0.170	0.692	0.334	0.856
	Left Cheek	0.276	0.143	0.545	0.419	0.821
	Left Tilt	0.220	0.146	0.672	0.366	0.892
WCDMA IV	Right Cheek	0.131	0.167	0.707	0.298	0.838
	Right Tilt	0.075	0.170	0.692	0.245	0.767
	Left Cheek	0.224	0.143	0.545	0.367	0.769
	Left Tilt	0.102	0.146	0.672	0.248	0.774
WCDMA V	Right Cheek	0.512	0.167	0.707	0.679	1.219
	Right Tilt	0.378	0.170	0.692	0.548	1.070
	Left Cheek	0.378	0.143	0.545	0.521	0.923
	Left Tilt	0.297	0.146	0.672	0.443	0.969
CDMA 2000 BC0	Right Cheek	0.637	0.167	0.707	0.804	1.344
	Right Tilt	0.322	0.170	0.692	0.492	1.014
	Left Cheek	0.604	0.143	0.545	0.747	1.149
	Left Tilt	0.344	0.146	0.672	0.490	1.016
LTE Band 2	Right Cheek	0.225	0.167	0.707	0.392	0.932
	Right Tilt	0.159	0.170	0.692	0.329	0.851
	Left Cheek	0.283	0.143	0.545	0.426	0.828
	Left Tilt	0.200	0.146	0.672	0.346	0.872
LTE Band 4	Right Cheek	0.119	0.167	0.707	0.286	0.826
	Right Tilt	0.080	0.170	0.692	0.250	0.772
	Left Cheek	0.219	0.143	0.545	0.362	0.764
	Left Tilt	0.092	0.146	0.672	0.238	0.764



WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN		
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
LTE Band 5	Right Cheek	0.561	0.167	0.707	0.728	1.268
	Right Tilt	0.381	0.170	0.692	0.551	1.073
	Left Cheek	0.544	0.143	0.545	0.687	1.089
	Left Tilt	0.360	0.146	0.672	0.506	1.032
LTE Band 7	Right Cheek	0.192	0.167	0.707	0.359	0.899
	Right Tilt	0.044	0.170	0.692	0.214	0.736
	Left Cheek	0.247	0.143	0.545	0.390	0.792
	Left Tilt	0.082	0.146	0.672	0.228	0.754
LTE Band 12	Right Cheek	0.197	0.167	0.707	0.364	0.904
	Right Tilt	0.116	0.170	0.692	0.286	0.808
	Left Cheek	0.180	0.143	0.545	0.323	0.725
	Left Tilt	0.109	0.146	0.672	0.255	0.781
LTE Band 38	Right Cheek	0.126	0.167	0.707	0.293	0.833
	Right Tilt	0.040	0.170	0.692	0.210	0.732
	Left Cheek	0.166	0.143	0.545	0.309	0.711
	Left Tilt	0.061	0.146	0.672	0.207	0.733
LTE Band 40A	Right Cheek	0.021	0.167	0.707	0.188	0.728
	Right Tilt	0.015	0.170	0.692	0.185	0.707
	Left Cheek	0.029	0.143	0.545	0.172	0.574
	Left Tilt	0.018	0.146	0.672	0.164	0.690
LTE Band 40B	Right Cheek	0.018	0.167	0.707	0.185	0.725
	Right Tilt	0.015	0.170	0.692	0.185	0.707
	Left Cheek	0.025	0.143	0.545	0.168	0.570
	Left Tilt	0.020	0.146	0.672	0.166	0.692
LTE Band 41	Right Cheek	0.074	0.167	0.707	0.241	0.781
	Right Tilt	0.043	0.170	0.692	0.213	0.735
	Left Cheek	0.157	0.143	0.545	0.300	0.702
	Left Tilt	0.082	0.146	0.672	0.228	0.754



➤ **Hotspot Simultaneous Transmission for WWAN(2/3/4G)+WLAN(2.4GHz/5.2G&5.8G)**

WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN		
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM850	Front Side	0.594	0.068	0.201	0.662	0.795
	Back Side	0.778	0.731	0.394	1.509	1.172
	Left Side	0.487	0.192	0.335	0.679	0.822
	Right Side	0.608	0.038	0.067	0.646	0.675
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.173	0.000	0.000	0.173	0.173
GSM1900	Front Side	0.562	0.068	0.201	0.630	0.763
	Back Side	0.812	0.731	0.394	1.543	1.206
	Left Side	0.619	0.192	0.335	0.811	0.954
	Right Side	0.345	0.038	0.067	0.383	0.412
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.921	0.000	0.000	0.921	0.921
WCDMA II	Front Side	0.524	0.068	0.201	0.592	0.725
	Back Side	0.677	0.731	0.394	1.408	1.071
	Left Side	0.490	0.192	0.335	0.682	0.825
	Right Side	0.330	0.038	0.067	0.368	0.397
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.867	0.000	0.000	0.867	0.867
WCDMA IV	Front Side	0.222	0.068	0.201	0.290	0.423
	Back Side	0.349	0.731	0.394	1.080	0.743
	Left Side	0.291	0.192	0.335	0.483	0.626
	Right Side	0.224	0.038	0.067	0.262	0.291
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.405	0.000	0.000	0.405	0.405
WCDMA V	Front Side	0.363	0.068	0.201	0.431	0.564
	Back Side	0.728	0.731	0.394	1.459	1.122
	Left Side	0.361	0.192	0.335	0.553	0.696
	Right Side	0.517	0.038	0.067	0.555	0.584
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.198	0.000	0.000	0.198	0.198
CDMA2000 BC0	Front Side	0.483	0.068	0.201	0.551	0.684
	Back Side	0.622	0.731	0.394	1.353	1.016
	Left Side	0.141	0.192	0.335	0.333	0.476
	Right Side	0.241	0.038	0.067	0.279	0.308
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.145	0.000	0.000	0.145	0.145



WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN		
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
LTE Band 2	Front Side	0.571	0.068	0.201	0.639	0.772
	Back Side	0.494	0.731	0.394	1.225	0.888
	Left Side	0.549	0.192	0.335	0.741	0.884
	Right Side	0.332	0.038	0.067	0.370	0.399
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.621	0.000	0.000	0.621	0.621
LTE Band 4	Front Side	0.277	0.068	0.201	0.345	0.478
	Back Side	0.354	0.731	0.394	1.085	0.748
	Left Side	0.341	0.192	0.335	0.533	0.676
	Right Side	0.320	0.038	0.067	0.358	0.387
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.437	0.000	0.000	0.437	0.437
LTE Band 5	Front Side	0.426	0.068	0.201	0.494	0.627
	Back Side	0.588	0.731	0.394	1.319	0.982
	Left Side	0.354	0.192	0.335	0.546	0.689
	Right Side	0.527	0.038	0.067	0.565	0.594
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.132	0.000	0.000	0.132	0.132
LTE Band 7	Front Side	0.114	0.068	0.201	0.182	0.315
	Back Side	0.747	0.731	0.394	1.478	1.141
	Left Side	0.537	0.192	0.335	0.729	0.872
	Right Side	0.150	0.038	0.067	0.188	0.217
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.373	0.000	0.000	0.373	0.373
LTE Band 12	Front Side	0.224	0.068	0.201	0.292	0.425
	Back Side	0.387	0.731	0.394	1.118	0.781
	Left Side	0.200	0.192	0.335	0.392	0.535
	Right Side	0.294	0.038	0.067	0.332	0.361
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.032	0.000	0.000	0.032	0.032
LTE Band 38	Front Side	0.121	0.068	0.201	0.189	0.322
	Back Side	0.598	0.731	0.394	1.329	0.992
	Left Side	0.347	0.192	0.335	0.539	0.682
	Right Side	0.109	0.038	0.067	0.147	0.176
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.272	0.000	0.000	0.272	0.272



WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN Ant 1	5GHz WLAN Ant 1		
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
LTE Band 40A	Front Side	0.032	0.068	0.201	0.100	0.233
	Back Side	0.309	0.731	0.394	1.040	0.703
	Left Side	0.064	0.192	0.335	0.256	0.399
	Right Side	0.064	0.038	0.067	0.102	0.131
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.261	0.000	0.000	0.261	0.261
LTE Band 40B	Front Side	0.036	0.068	0.201	0.104	0.237
	Back Side	0.411	0.731	0.394	1.142	0.805
	Left Side	0.108	0.192	0.335	0.300	0.443
	Right Side	0.068	0.038	0.067	0.106	0.135
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.283	0.000	0.000	0.283	0.283
LTE Band 41	Front Side	0.137	0.068	0.201	0.205	0.338
	Back Side	0.633	0.731	0.394	1.364	1.027
	Left Side	0.381	0.192	0.335	0.573	0.716
	Right Side	0.118	0.038	0.067	0.156	0.185
	Top Side	0.000	0.111	0.375	0.111	0.375
	Bottom Side	0.260	0.000	0.000	0.260	0.260



➤ **Body-worn Simultaneous Transmission for WWAN(2/3/4G)+WLAN(2.4GHz/5G)**

WWAN Band	Exposure Position	1	2	3	4	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN	Bluetooth Estimated			
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)			
GSM850	Front Side	0.594	0.068	0.201	0.187	0.662	0.795	0.781
	Back Side	0.778	0.731	0.394	0.187	1.509	1.172	0.965
GSM1900	Front Side	0.562	0.068	0.201	0.187	0.630	0.763	0.749
	Back Side	0.812	0.731	0.394	0.187	1.543	1.206	0.999
WCDMA II	Front Side	0.524	0.068	0.201	0.187	0.592	0.725	0.711
	Back Side	0.677	0.731	0.394	0.187	1.408	1.071	0.864
WCDMA IV	Front Side	0.222	0.068	0.201	0.187	0.290	0.423	0.409
	Back Side	0.349	0.731	0.394	0.187	1.080	0.743	0.536
WCDMA V	Front Side	0.363	0.068	0.201	0.187	0.431	0.564	0.550
	Back Side	0.728	0.731	0.394	0.187	1.459	1.122	0.915
CDMA2000 BC0	Front Side	0.483	0.068	0.201	0.187	0.551	0.684	0.670
	Back Side	0.622	0.731	0.394	0.187	1.353	1.016	0.809
LTE Band 2	Front Side	0.571	0.068	0.201	0.187	0.639	0.772	0.758
	Back Side	0.494	0.731	0.394	0.187	1.225	0.888	0.681
LTE Band 4	Front Side	0.277	0.068	0.201	0.187	0.345	0.478	0.464
	Back Side	0.354	0.731	0.394	0.187	1.085	0.748	0.541
LTE Band 5	Front Side	0.426	0.068	0.201	0.187	0.494	0.627	0.613
	Back Side	0.588	0.731	0.394	0.187	1.319	0.982	0.775
LTE Band 7	Front Side	0.114	0.068	0.201	0.187	0.182	0.315	0.301
	Back Side	0.747	0.731	0.394	0.187	1.478	1.141	0.934
LTE Band 12	Front Side	0.224	0.068	0.201	0.187	0.292	0.425	0.411
	Back Side	0.387	0.731	0.394	0.187	1.118	0.781	0.574
LTE Band 38	Front Side	0.121	0.068	0.201	0.187	0.189	0.322	0.308
	Back Side	0.598	0.731	0.394	0.187	1.329	0.992	0.785
LTE Band 40A	Front Side	0.032	0.068	0.201	0.187	0.100	0.233	0.219
	Back Side	0.309	0.731	0.394	0.187	1.040	0.703	0.496
LTE Band 40B	Front Side	0.036	0.068	0.201	0.187	0.104	0.237	0.223
	Back Side	0.411	0.731	0.394	0.187	1.142	0.805	0.598
LTE Band 41	Front Side	0.137	0.068	0.201	0.187	0.205	0.338	0.324
	Back Side	0.633	0.731	0.394	0.187	1.364	1.027	0.820

18. Uncertainty Assessment

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

Uncertainty	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor ^(a)	1/ κ ^(b)	1/ $\sqrt{3}$	1/ $\sqrt{6}$	1/ $\sqrt{2}$

Standard Uncertainty for Assumed Distribution

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.



Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.0	N	1	1	1	6.0	6.0
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	0.089	0.089
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						11.4%	11.4%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						22.9%	22.7%



Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.55	N	1	1	1	6.0	6.0
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	2.0	R	1.732	1	1	1.2	1.2
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	6.7	R	1.732	1	1	3.9	3.9
Max. SAR Eval.	4.0	R	1.732	1	1	2.3	2.3
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	0.089	0.089
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.1	R	1.732	1	1	3.8	3.8
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						12.5%	12.5%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						25.1 %	25.1%



Annex A General Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

The FCC designation number is CN1192, the test firm registration number is 226174.

Note:

The main report is end here and the other Annex (B,C,D,E) will be submitted separately.

***** END OF MAIN REPORT *****