REPORT No.: SZ20090028S01

TEST REPORT

APPLICANT	:	HAJEN Co., Ltd
PRODUCT NAME	:	HAJEN_SPRINT AI Speaker
MODEL NAME	:	FIXTA
BRAND NAME	:	HAJEN CO
FCC ID	:	2ACFTRT1505NN
STANDARD(S)	:	FCC 47 CFR Part 2(2.1093)
RECEIPT DATE	:	2020-09-04
TEST DATE	:	2020-09-21 to 2020-12-08
ISSUE DATE	:	2020-12-09

Edited by: Gan Yueming (Rapporteur)

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Changed History		
Version	**Date**	**Reason for Change**
1.0	2020-12-09	First edition

1. SAR Results Summary

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

Frequency Band		Highest SAR Summary	
		Body (Separation 10mm)	Limbs-worn (Separation 0mm)
		1g(W/kg)	10g (W/kg)
LTE	LTE Band 12	0.324	0.734
	LTE Band 2/25	0.279	0.991
	LTE Band 4/66	0.613	1.059
	LTE Band 41	0.719	1.749
WLAN	WLAN 2.4GHz	0.333	1.676
	WLAN 5GHz	0.716	0.502
2.4GHz Band	Bluetooth (Estimated)	0.117	0.094

Max Scaled SAR (W/Kg)	Body	0.719 W/Kg	Limit: 1.6 W/Kg
	Limbs-worn	1.749 W/Kg	Limit: 4.0 W/Kg

Highest Simultaneous Transmission SAR (W/Kg)	Body	1.435 W/Kg	Limit: 1.6 W/Kg
	Limbs-worn	3.425 W/Kg	Limit: 4.0 W/Kg

Note:

1. The highest simultaneous transmission is scalar summation of Reported standalone SAR per FCC KDB 690783 D01 v01r03, and scalar SAR summation of all possible simultaneous transmission scenarios are< 1.6W/kg(for body mode) or <4.0W/kg(for limbs-worn mode).
2. This device is compliance with Specific Absorption Rate (SAR) for general population or uncontrolled exposure limits specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.
3. LTE band 2/4 SAR measurement was covered by Band 25/66, according to April 2015 TCB workshop, SAR measurement for overlapping LTE bands can be reduced if
   a. The maximum output power, including tolerance, for the smaller band is ≤ 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.

   The maximum tune-up limits of LTE band 2/4 are less than LTE Band 25/66, therefore SAR measurement of LTE Band 2/4 is not required.
4. 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:	HAJEN Co., Ltd
Applicant Address:	D-304 Digital Empire Bldg,. 16, Deogyeong-daero 1556beon-gil, Yeongtonggu, Suwon-si, South Korea
Manufacturer:	HAJEN Co., Ltd
Manufacturer Address:	D-304 Digital Empire Bldg,. 16, Deogyeong-daero 1556beon-gil, Yeongtonggu, Suwon-si, South Korea

2.2. Equipment Under Test (EUT) Description

EUT Name:	HAJEN_SPRINT AI Speaker
Hardware Version:	V03
Software Version:	3.6.138365.0
Operation Frequency:	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 66: 1710 MHz ~ 1780 MHz WLAN 2.4GHz: 2412 MHz ~ 2472 MHz WLAN 5.2GHz: 5180 MHz ~ 5240 MHz WLAN 5.3GHz: 5260 MHz ~ 5320 MHz WLAN 5.5GHz: 5500 MHz ~ 5720 MHz WLAN 5.8GHz: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Modulation Technology:	LTE: QPSK/16QAM 802.11b: DSSS 802.11a/g/n20/n40: OFDM 802.11ac-VHT20/VHT40/VHT80: OFDM Bluetooth:GFSK,π/4-DQPSK,8-DPSK
Antenna Type:	Internal FPC Antenna
SIM Card Description	LTE

Note:

1. This is a Class II permissive change report for FCC ID: 2ACFTRT1505NN, it was updated from the original report SZ19120121S01. According to the user manual, the LTE antenna was changed and the LTE Band 26 removed by software, therefore all of the WWAN bands should be retested and the WLAN bands verified the worst case of the original report.
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

Temperature:	18°C~25°C
Humidity:	35%~75% RH
Atmospheric Pressure:	1010 mbar
Test frequency:	LTE Band 12/25/41/66; WLAN 2.4GHz; WLAN 5GHz;
Operation mode:	Call established
Power Level:	LTE Band 12/25/41/66 (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. Introduction

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/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 higher 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:

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

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

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

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

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

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical 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 or 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. This 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 or 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.

4.3. RF Exposure Limits

SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

Note:

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of acube) and over the appropriate averaging time.

5. Applied Reference Documents

Leading reference documents for testing:

No.	Identity	Document Title	Method Determination /Remark
1	47 CFR Part 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 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

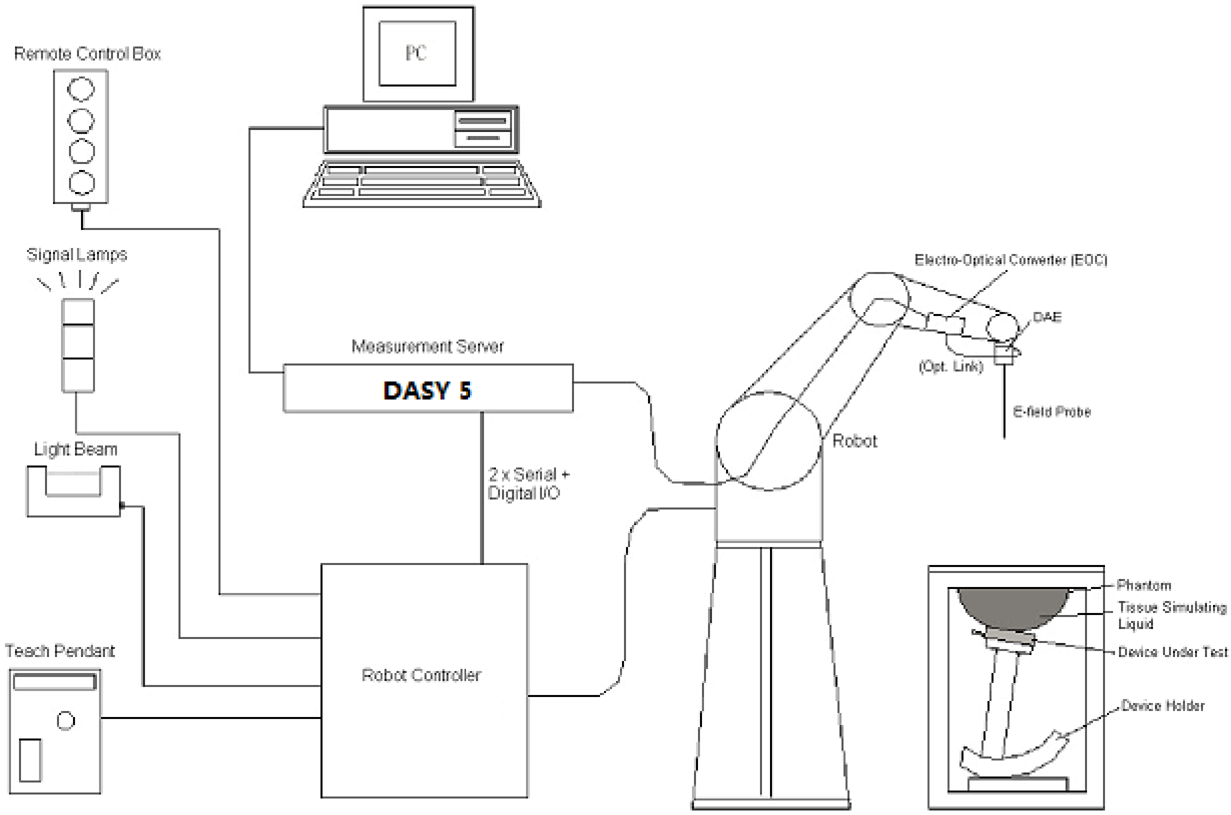


Fig.6.1 SPEAG DASY System Configurations

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 (EOC) 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 warming lamps, etc.
- The SAM twin phantom.
- A device holder.
- Tissue simulating liquid.
- Dipole for evaluating the proper functioning of the system.

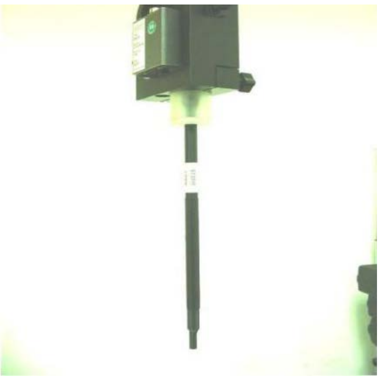
Component details are described in the following sub-sections.

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**

<EX3DV3 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 µW/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 µW/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 ±10%. The spherical isotropy shall be evaluated and within ±0.25 dB. The sensitivity parameters (Norm X, Norm Y and Norm Z), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to Annex E 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. 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 200 MOhm; 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 (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubliis used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; nobelt drives)
- Jerk-free straight movements
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

Fig. 6.5 Photo of Robot

6.4. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400MHz, Intel Celeron), chip-disk (DASY5: 128 MB), RAM (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

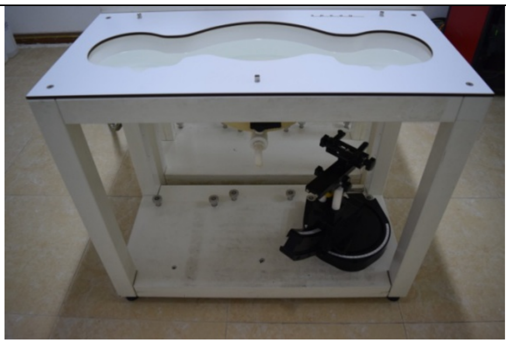
6.5. Light Beam Unit

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>

<table>
<tr><td>Shell Thickness</td><td>2 ± 0.2 mm (sagging: <1%)
Center ear point: 6 ± 0.2 mm</td><td rowspan="3">
Fig. 6.8 Photo of SAM Phantom</td></tr>
<tr><td>Filling Volume Dimensions</td><td>Approx. 25 liters
Length: 1000 mm; Width: 500 mm;
Height: adjustable feet</td></tr>
<tr><td>Measurement Areas</td><td>Left Head, Right Head, Flat phantom</td></tr>
</table>

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 (ERP).

Thus the device needs no repositioning when changing the angles.
The DASY device holder is constructed of low-low POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 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

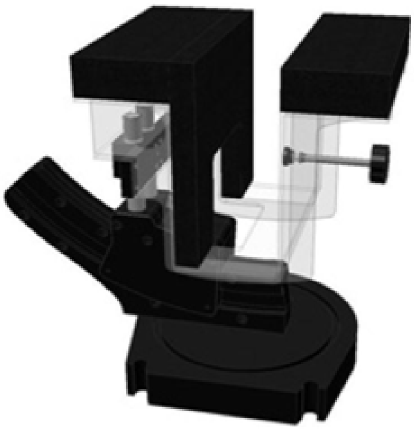


Fig 6.10 Laptop Extension Kit

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 verifications 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], [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	$ConvF_i$
	- Diode compression point	dcp_i
Device Parameters:	- Frequency	f
	- Crest	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:

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

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

Ui= input signal of channel i, (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcpi= diode compression point (DASY parameter)

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

E- Field Probes: $E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$

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

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

Normi= senor sensitivity of channel i, (i = x, y, z), µV/ (V/m) 2

ConvF = sensitivity enhancement in solution

aij = sensor sensitivity factors for H-field probes

f = carrier frequency (GHz)

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

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

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

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

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

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

With SAR = local specific absorption rate in mW/g

Etot= total field strength in V/m

σ = conductivity in (mho/m) or (Siemens/m)

ρ= equipment tissue density in g/cm3

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	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	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	3975	2020.05.20	2021.05.19
SPEAG	Dosimetric E-Field Probe	EX3DV4	3823	2020.01.03	2021.01.02
SPEAG	Data Acquisition Electronics	DAE4	480	2020.06.02	2021.06.01
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2019.11.03	2020.11.02
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2020.10.22	2021.10.21
SPEAG	SAM 2	QD000P40CC	1464	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Network Emulator	CMW500	124534	2020.04.01	2021.03.31
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	2020.04.01	2021.03.31
Agilent	Power Senor	N8482A	MY41090849	2019.10.28	2020.10.27
Agilent	Power Meter	E4416A	MY45102093	2019.10.28	2020.10.27
Anritsu	Power Sensor	MA2411B	N/A	2019.10.28	2020.10.27
Anritsu	Power Meter	NRVD	101066	2019.10.28	2020.10.27
Agilent	Power Senor	N8482A	MY41090849	2020.10.20	2021.10.19
Agilent	Power Meter	E4416A	MY45102093	2020.10.20	2021.10.19
Anritsu	Power Sensor	MA2411B	N/A	2020.10.20	2021.10.19
Anritsu	Power Meter	NRVD	101066	2020.10.20	2021.10.19
Agilent	Dual Directional Coupler	778D	50422	NA	NA
MCL	Attenuation1	351-218-010	N/A	NA	NA
THERMOMETER	Thermo meter	DC-803	N/A	2019.11.22	2020.11.21
THERMOMETER	Thermo meter	DC-803	N/A	2020.10.20	2021.10.19
N/A	Tissue Simulating Liquids	800-1800MHz	N/A	24H	

Note:

1. The calibration certificate of DASY can be referred to Annex C of this report.

2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. 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.
5. 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.
6. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
7. N.C.R means No Calibration Requirement.

7. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 7.1, for body SAR testing, the liquid height from the centre of the flat phantom to liquid top surface is larger than 15 cm, which is shown in Fig. 7.2.

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 (εr)
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

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%

The relative permittivity and conductivity of the tissue material should be within±5% of the values given in the table below recommended by the FCC OET 65supplement C and RSS 102 Issue 5.

Target Frequency	Head		Body	
(MHz)	ε r	σ (S/m)	ε r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

The dielectric parameters of liquids were verified prior to the SAR evaluation using a Speag Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Conductivity Target (σ)	Delta (σ)(%)	Limit (%)	Date
750	HSL	22.1	0.929	0.89	4.38	±5	2020.9.23
1750	HSL	22.4	1.388	1.37	1.31	±5	2020.9.21
1900	HSL	22.4	1.399	1.40	-0.07	±5	2020.9.21
2450	HSL	22.1	1.817	1.80	0.94	±5	2020.9.23
2450	HSL	22.4	1.811	1.80	0.61	±5	2020.12.8
2600	HSL	22.2	1.987	1.96	1.38	±5	2020.9.22
5750	HSL	22.1	5.030	5.22	-3.64	±5	2020.9.23
5750	HSL	22.1	5.374	5.22	2.95	±5	2020.12.7

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Permittivity (εr)	Permittivity Target (εr)	Delta (εr)(%)	Limit (%)	Date
750	HSL	22.1	42.139	41.90	0.57	±5	2020.9.23
1750	HSL	22.4	41.145	40.10	2.61	±5	2020.9.21
1900	HSL	22.4	39.745	40.00	-0.64	±5	2020.9.21
2450	HSL	22.1	38.801	39.20	-1.02	±5	2020.9.23
2450	HSL	22.4	38.792	39.20	-1.05	±5	2020.12.8
2600	HSL	22.2	38.294	39.00	-1.81	±5	2020.9.22
5750	HSL	22.1	34.288	35.35	-3.00	±5	2020.9.23
5750	HSL	22.1	35.896	35.35	1.54	±5	2020.12.7

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**

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that 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 equipment setup is shown below:

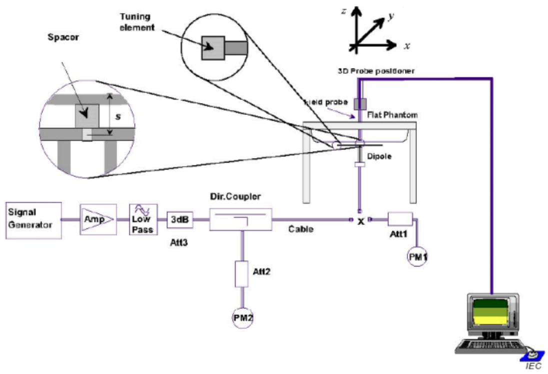


Fig.8.1 System Verification Setup Diagram

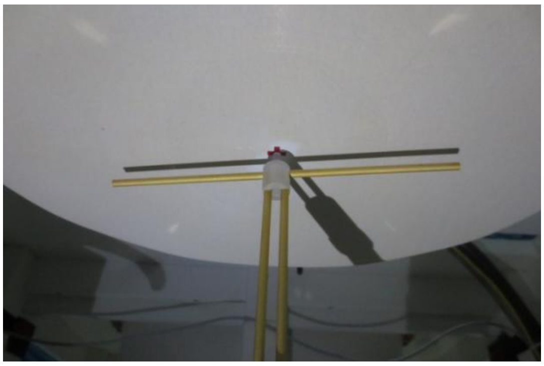


Fig.8.2 Photo of Dipole setup

➢ System Verification Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10%. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table as below indicates the system performance check can meet the variation criterion and the plots can be referred to Annex C of this report.

<System validation>

Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N
750	HSL	250	D750V2-1173	3823	480
835	HSL	250	D835V2-4d227	3823	480
1750	HSL	250	D1750V2-1160	3823	480
1800	HSL	250	D1800V2-2d158	3823	480
1900	HSL	250	D1900V2-5d22	3823	480
2000	HSL	250	D2000V2-1050	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	3823	480
5600	HSL	100	D5GHzV2-1176	3823	480
5750	HSL	100	D5GHzV2-1176	3823	480

Frequency (MHz)	Tissue Type	Conductivity (σ)	Permittivity (εr)	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 (εr)	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

<1g SAR>

Date	Freq. (MHz)	Tissue Type	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2020.9.23	750	HSL	250	2.04	8.26	8.16	-1.21
2020.9.21	1750	HSL	250	9.90	37.10	39.6	6.74
2020.9.21	1900	HSL	250	10.00	39.50	40	1.27
2020.9.23	2450	HSL	250	12.90	52.00	51.6	-0.77
2020.12.8	2450	HSL	250	12.40	52.00	49.6	-4.62
2020.9.22	2600	HSL	250	14.00	54.00	56	3.70
2020.9.23	5750	HSL	100	8.60	80.00	86	7.50
2020.12.7	5750	HSL	100	8.06	80.00	80.6	0.75

<10g SAR>

Date	Freq. (MHz)	Tissue Type	Input Power (mW)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2020.9.23	750	HSL	250	1.37	5.45	5.48	0.55
2020.9.21	1750	HSL	250	5.26	20.00	21.04	5.20
2020.9.21	1900	HSL	250	5.22	20.60	20.88	1.36
2020.9.23	2450	HSL	250	5.84	24.10	23.36	-3.07
2020.12.8	2450	HSL	250	5.62	24.10	22.48	-6.72
2020.9.22	2600	HSL	250	6.04	24.50	24.16	-1.39
2020.9.23	5750	HSL	100	2.41	22.60	24.1	6.64
2020.12.7	5750	HSL	100	2.28	22.60	22.8	0.88

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

9. EUT Testing Position

This EUT was tested in two different positions. They are front of face for head with phantom 10 mm gap, wrist-worn of the EUT with phantom 0 mm gap, as illustrated below, please refer to Annex B for the test setup photos.

9.1. SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Transmitters that are built-in within a wrist watch or similar wrist-worn devices typically operate in speaker mode for voice communication, with the device worn on the wrist and positioned next to the mouth. Next to the mouth exposure requires 1-g SAR and the wrist-worn condition requires 10-g extremity SAR. The 10-g extremity and 1-g SAR test exclusions may be applied to the wrist and face exposure conditions. When SAR evaluation is required, next to the mouth use is evaluated with the front of the device positioned at 10 mm from a flat phantom filled with head tissue-equivalent medium. The wrist bands should be strapped together to represent normal use conditions. SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled with body tissue-equivalent medium. The wrist bands should be unstrapped and touching the phantom. The space introduced by the watch or wrist bands and the phantom must be representative of actual use conditions; otherwise, if applicable, the neck or a curved head region of the SAM phantom may be used, provided the device positioning and SAR probe access issues have been addressed through a KDB inquiry. When other device positioning and SAR measurement considerations are necessary, a KDB inquiry is also required for the test results to be acceptable; for example, devices with rigid wrist bands or electronic circuitry and/or antenna(s) incorporated in the wrist bands. These test configurations are applicable only to devices that are worn on the wrist and cannot support other use conditions; therefore, the operating restrictions must be fully demonstrated in both the test reports and user manuals.

9.2. Limbs-worn Accessory Configurations

- To position the device parallel to the phantom surface with either keypad up or down.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 5 mm or holster surface and the flat phantom to 0 mm.

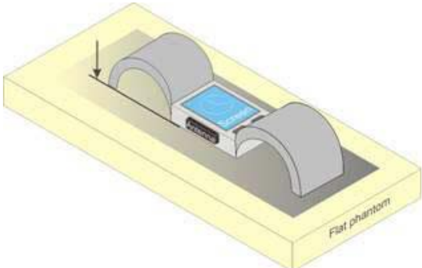


Fig.9.1 Illustration for Limbs-worn Position

9.3. 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).

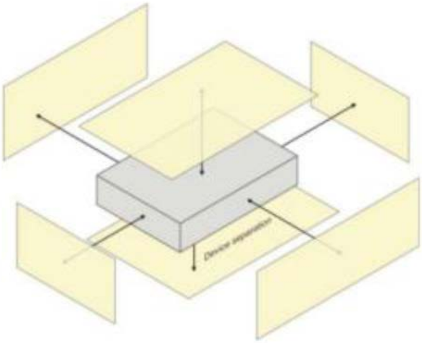


Fig 9.2 Illustration for Hotspot Position

10. Measurement Procedures

The measurement procedures are as bellows:

<Conducted power measurement>

- For WWAN power measurement, use base station simulator to configure EUT WWAN transition in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- Read the WWAN RF power level from the base station simulator.
- 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.
- Connect EUT RF port through RF cable to the power meter or spectrum analyzer, and measure WLAN/BT output power.

<Conducted power measurement>

- 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.
- Place the EUT in positions as Annex B demonstrates.
- Set scan area, grid size and other setting on the DASY software.
- Measure SAR results for the highest power channel on each testing position.
- Find out the largest SAR result on these testing positions of each band.
- Measure SAR results for other channels in worst SAR testing position if the Reported SAR or 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:

- Power reference measurement
- Area scan
- Zoom scan
- 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 10 g 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 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

10.2. Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement 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 & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r04 quoted below.

			$\le$ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			$\le$ 2 GHz: $\le$ 15 mm 2 – 3 GHz: $\le$ 12 mm	3 – 4 GHz: $\le$ 12 mm 4 – 6 GHz: $\le$ 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 $\le$ 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}			$\le$ 2 GHz: $\le$ 8 mm 2 – 3 GHz: $\le$ 5 mm*	3 – 4 GHz: $\le$ 5 mm* 4 – 6 GHz: $\le$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\le$ 5 mm	3 – 4 GHz: $\le$ 4 mm 4 – 5 GHz: $\le$ 3 mm 5 – 6 GHz: $\le$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\le$ 4 mm	3 – 4 GHz: $\le$ 3 mm 4 – 5 GHz: $\le$ 2.5 mm 5 – 6 GHz: $\le$ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\le 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\ge$ 30 mm	3 – 4 GHz: $\ge$ 28 mm 4 – 5 GHz: $\ge$ 25 mm 5 – 6 GHz: $\ge$ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is $\le$ 1.4 W/kg, $\le$ 8 mm, $\le$ 7 mm and $\le$ 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.				

10.4. Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD post-processor scan combine and subsequently superpose these measurement data to calculating the multiband SAR.

10.5. SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard'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 1g and 10g cubes, the extrapolation distance should not be larger than 5 mm.

10.6. Power Drift Monitoring

All SAR testing is under the EUT 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 EUT 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 drifts more than 5%, the SAR will be retested.

11. SAR Test Configuration

<LTE>

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 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Target (dB)	MPR (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 0.5dBmeasurement tolerance

LTE Bands

LTE Bands	Channel bandwidth / Transmission bandwidth configuration [RB]					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
2	v	v	v	v	v	v
4	v	v	v	v	v	v
12	v	v	v	v	N/A	N/A
25	v	v	v	v	v	v
41	N/A	N/A	v	v	v	v
66	v	v	v	v	v	v

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.

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5. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is > not ½ 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 ½ Dbhigher 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 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. 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.
9. 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.
10. 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

11. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
12. 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 GHz802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.
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. 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 band width 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 sametransmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction Vapplies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 bandare supported, the highest maximum output power transmission mode configuration and maximumoutput power channel across the bands must be used to determine SAR test reduction, accordingto the initial test configuration and subsequent test configuration requirements. In applying theinitial test configuration and subsequent test configuration procedures, the 802.11 transmissionconfiguration with the highest specified maximum output power and the channel within a testconfiguration with the highest measured maximum output power should be clearly distinguished toapply the procedures.

12. Conducted RF Output Power

➢ **LTE Conducted Power**

<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	15.62	15.82	15.81	16.00
20	QPSK	1	49	15.12	15.08	15.31	
20	QPSK	1	99	15.28	15.42	15.53	
20	QPSK	50	0	14.41	14.61	14.74	15.00
20	QPSK	50	24	14.02	14.32	14.23	
20	QPSK	50	50	14.15	14.29	14.28	
20	QPSK	100	0	14.57	14.45	14.24	
20	16QAM	1	0	14.55	14.25	14.03	15.00
20	16QAM	1	49	14.53	14.21	14.21	
20	16QAM	1	99	14.51	14.31	14.61	
20	16QAM	50	0	13.59	13.57	13.59	14.00
20	16QAM	50	24	13.23	13.22	13.28	
20	16QAM	50	50	13.43	13.28	13.27	
20	16QAM	100	0	13.35	13.32	13.18	
Channel				18675	18900	19125	Tune-up limit (dBm)
Frequency (MHz)				1857.5	1880	1902.5	
15	QPSK	1	0	15.69	15.59	15.58	16.00
15	QPSK	1	37	15.26	15.44	15.22	
15	QPSK	1	74	15.21	15.19	15.24	
15	QPSK	36	0	14.47	14.36	14.38	15.00
15	QPSK	36	20	14.16	13.99	14.25	
15	QPSK	36	39	14.18	14.03	14.17	
15	QPSK	75	0	14.31	14.21	14.22	
15	16QAM	1	0	14.43	14.23	14.26	15.00
15	16QAM	1	37	14.13	14.02	14.58	
15	16QAM	1	74	14.38	14.21	14.27	
15	16QAM	36	0	13.38	13.27	13.28	14.00
15	16QAM	36	20	13.08	13.19	13.16	
15	16QAM	36	39	13.11	13.02	13.42	
15	16QAM	75	0	13.31	13.21	13.14	
Channel				18650	18900	19150	Tune-up limit (dBm)
Frequency (MHz)				1855	1880	1905	
10	QPSK	1	0	15.39	15.23	15.12	16.00
10	QPSK	1	25	15.21	15.22	15.23	
10	QPSK	1	49	15.27	15.62	15.61	
10	QPSK	25	0	14.32	14.03	14.06	15.00
10	QPSK	25	12	14.13	14.21	14.02	

10	QPSK	25	25	14.11	13.81	14.11	
10	QPSK	50	0	14.16	14.37	14.59	
10	16QAM	1	0	14.54	14.68	14.65	15.00
10	16QAM	1	25	14.16	14.21	14.21	
10	16QAM	1	49	14.21	14.52	14.02	
10	16QAM	25	0	13.41	13.24	13.52	14.00
10	16QAM	25	12	13.23	13.62	13.27	
10	16QAM	25	25	13.27	13.53	13.15	
10	16QAM	50	0	13.39	13.51	13.41	
Channel				18625	18900	19175	Tune-up limit (dBm)
Frequency (MHz)				1852.5	1880	1907.5	
5	QPSK	1	0	15.37	15.15	15.26	16.00
5	QPSK	1	12	15.47	15.22	15.08	
5	QPSK	1	24	15.37	15.34	15.24	
5	QPSK	12	0	14.52	14.21	14.15	15.00
5	QPSK	12	7	14.21	14.27	14.21	
5	QPSK	12	13	14.12	14.14	14.04	
5	QPSK	25	0	14.16	14.12	14.22	
5	16QAM	1	0	14.03	14.22	14.36	15.00
5	16QAM	1	12	14.07	14.28	14.21	
5	16QAM	1	24	13.99	14.12	14.18	
5	16QAM	12	0	13.52	13.51	13.21	14.00
5	16QAM	12	7	13.16	13.22	13.51	
5	16QAM	12	13	13.09	13.24	13.24	
5	16QAM	25	0	13.05	13.24	13.12	
Channel				18615	18900	19185	Tune-up limit (dBm)
Frequency (MHz)				1851.5	1880	1908.5	
3	QPSK	1	0	15.05	15.12	15.24	16.00
3	QPSK	1	8	15.11	15.34	15.17	
3	QPSK	1	14	15.04	15.22	15.24	
3	QPSK	8	0	14.25	14.28	14.07	15.00
3	QPSK	8	4	14.11	14.34	14.13	
3	QPSK	8	7	14.08	14.36	14.09	
3	QPSK	15	0	14.09	14.35	14.15	
3	16QAM	1	0	14.42	14.32	14.27	15.00
3	16QAM	1	8	14.08	14.25	14.12	
3	16QAM	1	14	14.12	14.05	14.04	
3	16QAM	8	0	13.24	13.51	13.21	14.00
3	16QAM	8	4	13.11	13.24	13.31	
3	16QAM	8	7	13.14	13.28	13.21	
3	16QAM	15	0	13.15	13.37	13.32	
Channel				18607	18900	19193	Tune-up limit (dBm)
Frequency (MHz)				1850.7	1880	1909.3	
1.4	QPSK	1	0	15.05	15.11	15.07	16.00
1.4	QPSK	1	3	15.08	15.22	15.07	
1.4	QPSK	1	5	15.21	15.14	15.14	

1.4	QPSK	3	0	15.13	15.17	15.11	
1.4	QPSK	3	1	15.17	15.19	15.16	
1.4	QPSK	3	3	15.21	15.41	15.13	
1.4	QPSK	6	0	14.11	14.23	14.15	15.00
1.4	16QAM	1	0	14.06	14.21	14.18	15.00
1.4	16QAM	1	3	14.37	14.13	14.29	
1.4	16QAM	1	5	14.22	14.28	14.12	
1.4	16QAM	3	0	14.18	14.28	14.31	
1.4	16QAM	3	1	14.21	14.21	14.03	
1.4	16QAM	3	3	14.02	13.87	14.31	
1.4	16QAM	6	0	13.13	13.27	13.29	14.00

<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	1745.00	
20	QPSK	1	0	17.21	17.55	17.16	18.00
20	QPSK	1	49	17.07	17.19	17.12	
20	QPSK	1	99	17.10	17.21	17.05	
20	QPSK	50	0	16.29	16.36	16.25	17.00
20	QPSK	50	24	16.28	16.28	16.21	
20	QPSK	50	50	16.19	16.49	16.14	
20	QPSK	100	0	16.22	16.22	16.22	
20	16QAM	1	0	16.62	16.54	16.61	17.00
20	16QAM	1	49	16.54	16.47	16.54	
20	16QAM	1	99	16.42	16.38	16.30	
20	16QAM	50	0	15.48	15.44	15.26	16.00
20	16QAM	50	24	15.32	15.30	15.27	
20	16QAM	50	50	15.23	15.29	15.20	
20	16QAM	100	0	15.26	15.39	15.25	
Channel				20025	20175	20325.00	Tune-up limit (dBm)
Frequency (MHz)				1717.5	1732.5	1747.50	
15	QPSK	1	0	17.18	17.52	17.13	18.00
15	QPSK	1	37	17.04	17.16	17.09	
15	QPSK	1	74	17.07	17.18	17.02	
15	QPSK	36	0	16.26	16.33	16.22	17.00
15	QPSK	36	20	16.25	16.25	16.18	
15	QPSK	36	39	16.16	16.46	16.11	
15	QPSK	75	0	16.19	16.19	16.19	
15	16QAM	1	0	16.59	16.51	16.58	17.00
15	16QAM	1	37	16.51	16.44	16.51	
15	16QAM	1	74	16.39	16.35	16.27	
15	16QAM	36	0	15.45	15.41	15.23	16.00
15	16QAM	36	20	15.29	15.27	15.24	
15	16QAM	36	39	15.20	15.26	15.17	

15	16QAM	75	0	15.23	15.36	15.22	
Channel				20000	20175	20350.00	Tune-up limit (dBm)
Frequency (MHz)				1715	1732.5	1750.00	
10	QPSK	1	0	17.14	17.48	17.09	18.00
10	QPSK	1	25	17.00	17.12	17.05	
10	QPSK	1	49	17.03	17.14	16.98	
10	QPSK	25	0	16.22	16.29	16.18	17.00
10	QPSK	25	12	16.21	16.21	16.14	
10	QPSK	25	25	16.12	16.42	16.07	
10	QPSK	50	0	16.15	16.15	16.15	
10	16QAM	1	0	16.55	16.47	16.54	17.00
10	16QAM	1	25	16.47	16.40	16.47	
10	16QAM	1	49	16.35	16.31	16.23	
10	16QAM	25	0	15.41	15.37	15.19	16.00
10	16QAM	25	12	15.25	15.23	15.20	
10	16QAM	25	25	15.16	15.22	15.13	
10	16QAM	50	0	15.19	15.32	15.18	
Channel				19975	20175	20375.00	Tune-up limit (dBm)
Frequency (MHz)				1712.5	1732.5	1752.50	
5	QPSK	1	0	17.12	17.46	17.07	18.00
5	QPSK	1	12	16.98	17.10	17.03	
5	QPSK	1	24	17.01	17.12	16.96	
5	QPSK	12	0	16.20	16.27	16.16	18.00
5	QPSK	12	7	16.19	16.19	16.12	
5	QPSK	12	13	16.10	16.40	16.05	
5	QPSK	25	0	16.13	16.13	16.13	
5	16QAM	1	0	16.53	16.45	16.52	17.00
5	16QAM	1	12	16.45	16.38	16.45	
5	16QAM	1	24	16.33	16.29	16.21	
5	16QAM	12	0	15.39	15.35	15.17	16.00
5	16QAM	12	7	15.23	15.21	15.18	
5	16QAM	12	13	15.14	15.20	15.11	
5	16QAM	25	0	15.17	15.30	15.16	
Channel				19965	20175	20385.00	Tune-up limit (dBm)
Frequency (MHz)				1711.5	1732.5	1753.50	
3	QPSK	1	0	17.18	17.52	17.13	18.00
3	QPSK	1	8	17.04	17.16	17.09	
3	QPSK	1	14	17.07	17.18	17.02	
3	QPSK	8	0	16.26	16.33	16.22	17.00
3	QPSK	8	4	16.25	16.25	16.18	
3	QPSK	8	7	16.16	16.46	16.11	
3	QPSK	15	0	16.19	16.19	16.19	
3	16QAM	1	0	16.59	16.51	16.58	17.00
3	16QAM	1	8	16.51	16.44	16.51	
3	16QAM	1	14	16.39	16.35	16.27	
3	16QAM	8	0	15.45	15.41	15.23	16.00

3	16QAM	8	4	15.29	15.27	15.24	
3	16QAM	8	7	15.20	15.26	15.17	
3	16QAM	15	0	15.23	15.36	15.22	
Channel				19957	20175	20393.00	Tune-up limit (dBm)
Frequency (MHz)				1710.7	1732.5	1754.30	
1.4	QPSK	1	0	17.11	17.45	17.06	18.00
1.4	QPSK	1	3	16.97	17.09	17.02	
1.4	QPSK	1	5	17.00	17.11	16.95	
1.4	QPSK	3	0	16.19	16.26	16.15	
1.4	QPSK	3	1	16.18	16.18	16.11	
1.4	QPSK	3	3	16.09	16.39	16.04	
1.4	QPSK	6	0	16.12	16.12	16.12	17.00
1.4	16QAM	1	0	16.52	16.44	16.51	17.00
1.4	16QAM	1	3	16.44	16.37	16.44	
1.4	16QAM	1	5	16.32	16.28	16.20	
1.4	16QAM	3	0	15.38	15.34	15.16	
1.4	16QAM	3	1	15.22	15.20	15.17	
1.4	16QAM	3	3	15.13	15.19	15.10	
1.4	16QAM	6	0	15.16	15.29	15.15	16.00

<LTE Band 12>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				23060	23095	23130	
Frequency (MHz)				704	707.5	711	
10	QPSK	1	0	19.58	19.24	19.09	20.00
10	QPSK	1	25	19.42	19.14	19.16	
10	QPSK	1	49	19.25	19.19	19.17	
10	QPSK	25	0	19.41	19.38	19.27	20.00
10	QPSK	25	12	19.43	19.33	19.37	
10	QPSK	25	25	19.38	19.32	19.27	
10	QPSK	50	0	19.43	19.37	19.36	
10	16QAM	1	0	19.54	19.47	19.43	20.00
10	16QAM	1	25	19.51	19.42	19.41	
10	16QAM	1	49	19.46	19.41	19.52	
10	16QAM	25	0	19.34	19.38	19.27	20.00
10	16QAM	25	12	19.40	19.44	19.39	
10	16QAM	25	25	19.32	19.42	19.34	
10	16QAM	50	0	19.42	19.39	19.35	
Channel				23035	23095	23155	Tune-up limit (dBm)
Frequency (MHz)				701.5	707.5	713.5	
5	QPSK	1	0	19.35	19.21	19.06	20.00
5	QPSK	1	12	19.39	19.11	19.13	
5	QPSK	1	24	19.22	19.16	19.14	
5	QPSK	12	0	19.38	19.35	19.24	20.00
5	QPSK	12	7	19.40	19.30	19.34	
5	QPSK	12	13	19.35	19.29	19.24	

5	QPSK	25	0	19.40	19.34	19.33	
5	16QAM	1	0	19.51	19.44	19.40	
5	16QAM	1	12	19.48	19.39	19.38	20.00
5	16QAM	1	24	19.43	19.38	19.49	
5	16QAM	12	0	19.31	19.35	19.24	
5	16QAM	12	7	19.37	19.41	19.36	20.00
5	16QAM	12	13	19.29	19.39	19.31	
5	16QAM	25	0	19.39	19.36	19.32	
Channel				23025	23095	23165	Tune-up limit (dBm)
Frequency (MHz)				700.5	707.5	714.5	
3	QPSK	1	0	19.33	19.19	19.04	
3	QPSK	1	8	19.37	19.09	19.11	20.00
3	QPSK	1	14	19.20	19.14	19.12	
3	QPSK	8	0	19.36	19.33	19.22	
3	QPSK	8	4	19.38	19.28	19.32	20.00
3	QPSK	8	7	19.33	19.27	19.22	
3	QPSK	15	0	19.38	19.32	19.31	
3	16QAM	1	0	19.49	19.42	19.38	
3	16QAM	1	8	19.46	19.37	19.36	20.00
3	16QAM	1	14	19.41	19.36	19.47	
3	16QAM	8	0	19.29	19.33	19.22	
3	16QAM	8	4	19.35	19.39	19.34	20.00
3	16QAM	8	7	19.27	19.37	19.29	
3	16QAM	15	0	19.37	19.34	19.30	
Channel				23017	23095	23173	Tune-up limit (dBm)
Frequency (MHz)				699.7	707.5	715.3	
1.4	QPSK	1	0	19.30	19.16	19.01	
1.4	QPSK	1	3	19.34	19.06	19.08	
1.4	QPSK	1	5	19.17	19.11	19.09	20.00
1.4	QPSK	3	0	19.33	19.30	19.19	
1.4	QPSK	3	1	19.35	19.25	19.29	
1.4	QPSK	3	3	19.30	19.24	19.19	
1.4	QPSK	6	0	19.35	19.29	19.28	20.00
1.4	16QAM	1	0	19.46	19.39	19.35	
1.4	16QAM	1	3	19.43	19.34	19.33	
1.4	16QAM	1	5	19.38	19.33	19.44	
1.4	16QAM	3	0	19.26	19.30	19.19	20.00
1.4	16QAM	3	1	19.32	19.36	19.31	
1.4	16QAM	3	3	19.24	19.34	19.26	
1.4	16QAM	6	0	19.34	19.31	19.27	20.00

<LTE Band 25>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				26140	26365	26590	
Frequency (MHz)				1860	1882.5	1905	
20	QPSK	1	0	16.56	16.71	16.51	17.00
20	QPSK	1	49	16.36	16.55	16.22	
20	QPSK	1	99	16.17	16.25	16.41	
20	QPSK	50	0	15.25	15.37	15.24	16.00
20	QPSK	50	24	15.17	15.22	15.21	
20	QPSK	50	50	15.21	15.34	15.15	
20	QPSK	100	0	15.22	15.21	15.11	
20	16QAM	1	0	15.45	15.14	15.39	16.00
20	16QAM	1	49	15.24	15.21	15.15	
20	16QAM	1	99	15.41	15.11	15.12	
20	16QAM	50	0	14.22	14.05	14.21	15.00
20	16QAM	50	24	14.21	14.21	14.22	
20	16QAM	50	50	14.12	14.19	14.14	
20	16QAM	100	0	14.22	14.02	14.15	
Channel				26115	26365	26615	Tune-up limit (dBm)
Frequency (MHz)				1857.5	1882.5	1907.5	
15	QPSK	1	0	16.62	16.64	16.54	17.00
15	QPSK	1	37	16.18	16.21	16.02	
15	QPSK	1	74	16.19	16.41	16.47	
15	QPSK	36	0	15.48	15.36	15.51	16.00
15	QPSK	36	20	15.14	15.14	15.32	
15	QPSK	36	39	15.21	15.17	15.31	
15	QPSK	75	0	15.39	15.36	15.51	
15	16QAM	1	0	15.34	15.29	15.21	16.00
15	16QAM	1	37	15.05	15.44	15.09	
15	16QAM	1	74	15.78	15.55	15.51	
15	16QAM	36	0	14.41	14.52	14.55	15.00
15	16QAM	36	20	14.08	14.15	14.31	
15	16QAM	36	39	14.17	14.12	14.22	
15	16QAM	75	0	14.35	14.34	14.47	
Channel				26090	26365	26640	Tune-up limit (dBm)
Frequency (MHz)				1855	1882.5	1910	
10	QPSK	1	0	16.21	16.26	16.14	17.00
10	QPSK	1	25	16.11	16.21	16.31	
10	QPSK	1	49	16.06	16.09	16.39	
10	QPSK	25	0	15.19	15.11	15.25	16.00
10	QPSK	25	12	15.16	15.23	15.28	
10	QPSK	25	25	15.09	15.21	15.41	
10	QPSK	50	0	15.12	15.19	15.31	
10	16QAM	1	0	15.72	15.62	15.38	16.00

10	16QAM	1	25	15.06	15.46	15.24	
10	16QAM	1	49	15.34	15.31	15.93	
10	16QAM	25	0	14.17	14.14	14.09	15.00
10	16QAM	25	12	14.04	14.21	14.42	
10	16QAM	25	25	14.12	14.09	14.31	
10	16QAM	50	0	14.13	14.25	14.42	
Channel				26065	26365	26665	Tune-up limit (dBm)
Frequency (MHz)				1852.5	1882.5	1912.5	
5	QPSK	1	0	16.55	16.44	16.65	17.00
5	QPSK	1	12	16.51	16.22	16.25	
5	QPSK	1	24	16.19	16.05	16.19	
5	QPSK	12	0	15.23	15.14	15.29	16.00
5	QPSK	12	7	15.22	15.24	15.32	
5	QPSK	12	13	15.21	15.05	15.05	
5	QPSK	25	0	15.21	15.11	15.12	
5	16QAM	1	0	15.21	15.12	15.32	16.00
5	16QAM	1	12	15.22	15.07	15.31	
5	16QAM	1	24	15.02	15.39	15.51	
5	16QAM	12	0	14.16	14.14	14.13	15.00
5	16QAM	12	7	14.26	14.18	14.25	
5	16QAM	12	13	14.21	14.25	14.34	
5	16QAM	25	0	14.13	14.21	14.07	
Channel				26055	26365	26675	Tune-up limit (dBm)
Frequency (MHz)				1851.5	1882.5	1913.5	
3	QPSK	1	0	16.44	16.51	16.63	17.00
3	QPSK	1	8	16.25	16.24	16.56	
3	QPSK	1	14	16.09	16.05	16.13	
3	QPSK	8	0	15.29	15.21	15.22	16.00
3	QPSK	8	4	15.23	15.24	15.24	
3	QPSK	8	7	15.01	15.21	15.35	
3	QPSK	15	0	15.14	15.05	15.03	
3	16QAM	1	0	15.89	15.92	15.56	16.00
3	16QAM	1	8	15.04	15.23	15.24	
3	16QAM	1	14	15.16	15.16	15.75	
3	16QAM	8	0	14.21	14.16	14.27	15.00
3	16QAM	8	4	14.23	14.21	14.03	
3	16QAM	8	7	14.32	14.21	13.84	
3	16QAM	15	0	14.12	14.03	14.09	
Channel				26047	26365	26683	Tune-up limit (dBm)
Frequency (MHz)				1850.7	1882.5	1914.3	
1.4	QPSK	1	0	16.43	16.56	16.66	17.00
1.4	QPSK	1	3	16.21	16.24	16.21	
1.4	QPSK	1	5	16.37	16.11	16.21	
1.4	QPSK	3	0	16.24	16.21	16.22	
1.4	QPSK	3	1	16.23	16.24	16.23	
1.4	QPSK	3	3	16.34	16.34	16.31	

1.4	QPSK	6	0	15.21	15.24	15.22	16.00
1.4	16QAM	1	0	15.22	15.54	15.31	16.00
1.4	16QAM	1	3	15.21	15.21	15.22	
1.4	16QAM	1	5	15.26	15.54	15.43	
1.4	16QAM	3	0	15.22	15.12	15.31	
1.4	16QAM	3	1	15.12	15.22	15.21	
1.4	16QAM	3	3	15.11	15.14	15.11	
1.4	16QAM	6	0	14.09	14.21	14.04	15.00

<LTE Band 41>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Low Middle Channel	Middle Channel	High Middle Channel	High Channel	Tune-up limit (dBm)
Channel				39750	40185	40620	41055	41490	
Frequency (MHz)				2506	2549.5	2593	2636.5	2680	
20	QPSK	1	0	19.69	19.83	19.84	19.81	19.85	20.00
20	QPSK	1	49	19.77	19.67	19.58	19.65	19.62	
20	QPSK	1	99	19.33	19.41	19.43	19.45	19.19	
20	QPSK	50	0	18.17	18.39	18.43	18.47	18.52	19.00
20	QPSK	50	24	18.07	18.19	18.25	18.22	18.01	
20	QPSK	50	50	18.13	18.12	18.25	18.12	18.16	
20	QPSK	100	0	18.14	18.27	18.41	18.27	18.21	
20	16QAM	1	0	18.12	18.17	18.13	18.11	18.21	19.00
20	16QAM	1	49	18.02	18.03	18.21	18.11	18.06	
20	16QAM	1	99	18.17	18.17	18.18	18.19	18.44	
20	16QAM	50	0	17.33	17.41	17.44	17.41	17.43	18.00
20	16QAM	50	24	17.31	17.21	17.17	17.11	17.04	
20	16QAM	50	50	17.25	17.15	17.17	17.26	17.21	
20	16QAM	100	0	17.23	17.27	17.23	17.09	17.03	
Channel				39725	40173	40620	41068	41515	Tune-up limit (dBm)
Frequency (MHz)				2503.5	2548.3	2593	2637.8	2682.5	
15	QPSK	1	0	19.39	19.41	19.61	19.54	19.33	20.00
15	QPSK	1	37	19.21	18.67	19.11	18.83	19.22	
15	QPSK	1	74	19.26	19.27	19.17	19.06	19.04	
15	QPSK	36	0	18.29	18.45	18.41	18.38	18.21	19.00
15	QPSK	36	20	18.11	18.17	18.25	18.13	18.08	
15	QPSK	36	39	18.15	18.07	18.31	18.11	18.11	
15	QPSK	75	0	18.31	18.34	18.26	18.31	18.22	
15	16QAM	1	0	18.44	18.07	18.19	18.31	18.44	19.00
15	16QAM	1	37	18.25	18.24	18.12	18.39	18.52	
15	16QAM	1	74	18.47	18.22	18.44	18.39	18.38	
15	16QAM	36	0	17.27	17.31	17.40	17.38	17.34	18.00
15	16QAM	36	20	17.07	17.15	17.24	17.13	17.11	
15	16QAM	36	39	17.12	17.15	17.21	17.02	17.11	
15	16QAM	75	0	17.12	17.25	17.36	17.26	17.22	
Channel				39700	40160	40620	41080	41540	Tune-up

Frequency (MHz)				2501	2547	2593	2639	2685	limit (dBm)
10	QPSK	1	0	19.15	19.18	19.33	19.32	19.31	20.00
10	QPSK	1	25	18.95	18.77	18.98	19.02	19.11	
10	QPSK	1	49	18.79	18.91	19.14	19.11	19.04	
10	QPSK	25	0	18.27	18.19	18.31	18.32	18.31	19.00
10	QPSK	25	12	18.28	18.21	18.29	18.32	18.25	
10	QPSK	25	25	18.25	18.16	18.11	18.31	18.03	
10	QPSK	50	0	18.21	18.31	18.21	18.31	18.16	
10	16QAM	1	0	18.41	18.68	18.61	18.61	18.57	19.00
10	16QAM	1	25	18.13	18.18	18.27	18.31	18.08	
10	16QAM	1	49	18.23	18.39	18.41	18.38	18.21	
10	16QAM	25	0	17.21	17.22	17.36	17.39	17.26	18.00
10	16QAM	25	12	17.34	17.25	17.26	17.38	17.21	
10	16QAM	25	25	17.29	17.08	17.28	17.18	17.19	
10	16QAM	50	0	17.12	17.25	17.37	17.38	17.01	
Channel				39675	40148	40620	41093	41565	Tune-up limit (dBm)
Frequency (MHz)				2498.5	2545.8	2593	2640.30	2687.5	
5	QPSK	1	0	18.93	19.13	19.22	19.11	19.18	20.00
5	QPSK	1	12	18.94	18.92	19.03	19.15	19.12	
5	QPSK	1	24	18.89	18.86	19.09	19.16	18.98	
5	QPSK	12	0	18.06	18.04	18.25	18.35	18.14	19.00
5	QPSK	12	7	18.21	18.12	18.24	18.33	18.12	
5	QPSK	12	13	18.12	18.17	18.07	18.11	18.14	
5	QPSK	25	0	18.15	18.08	18.11	18.15	18.19	
5	16QAM	1	0	18.29	18.37	18.43	18.46	18.26	19.00
5	16QAM	1	12	18.13	18.17	18.27	18.30	18.34	
5	16QAM	1	24	18.18	18.25	18.36	18.35	18.17	
5	16QAM	12	0	17.11	17.07	17.29	17.18	17.11	18.00
5	16QAM	12	7	17.25	17.07	17.37	17.38	17.37	
5	16QAM	12	13	17.22	17.19	17.19	17.31	17.28	
5	16QAM	25	0	16.97	17.13	17.25	17.37	17.27	

<LTE Band 66>

BW [MHz]	Modulation	RB Size	RB Offset	Low Channel	Middle Channel	High Channel	Tune-up limit (dBm)
Channel				132072	132322	132572	
Frequency (MHz)				1720	1745	1770	
20	QPSK	1	0	17.41	17.47	17.72	18.50
20	QPSK	1	49	17.32	17.32	17.38	
20	QPSK	1	99	17.27	17.42	17.47	
20	QPSK	50	0	16.31	16.42	16.51	17.00
20	QPSK	50	24	16.29	16.34	16.42	
20	QPSK	50	50	16.27	16.31	16.41	
20	QPSK	100	0	16.28	16.38	16.45	
20	16QAM	1	0	16.63	16.86	16.85	17.50
20	16QAM	1	49	16.51	16.52	16.64	

20	16QAM	1	99	16.52	16.63	16.75	
20	16QAM	50	0	15.32	15.41	15.49	16.00
20	16QAM	50	24	15.33	15.35	15.46	
20	16QAM	50	50	15.29	15.31	15.38	
20	16QAM	100	0	15.30	15.34	15.44	
Channel				132047	132322	132597	Tune-up limit (dBm)
Frequency (MHz)				1717.5	1745	1772.5	
15	QPSK	1	0	17.39	17.45	17.70	18.50
15	QPSK	1	37	17.30	17.30	17.36	
15	QPSK	1	74	17.25	17.40	17.45	
15	QPSK	36	0	16.29	16.40	16.49	17.00
15	QPSK	36	20	16.27	16.32	16.40	
15	QPSK	36	39	16.25	16.29	16.39	
15	QPSK	75	0	16.26	16.36	16.43	
15	16QAM	1	0	16.61	16.84	16.83	17.50
15	16QAM	1	37	16.49	16.50	16.62	
15	16QAM	1	74	16.50	16.61	16.73	
15	16QAM	36	0	15.30	15.39	15.47	16.00
15	16QAM	36	20	15.31	15.33	15.44	
15	16QAM	36	39	15.27	15.29	15.36	
15	16QAM	75	0	15.28	15.32	15.42	
Channel				132022	132322	132622	Tune-up limit (dBm)
Frequency (MHz)				1715	1745	1775	
10	QPSK	1	0	17.37	17.43	17.68	17.50
10	QPSK	1	25	17.28	17.28	17.34	
10	QPSK	1	49	17.23	17.38	17.43	
10	QPSK	25	0	16.27	16.38	16.47	17.00
10	QPSK	25	12	16.25	16.30	16.38	
10	QPSK	25	25	16.23	16.27	16.37	
10	QPSK	50	0	16.24	16.34	16.41	
10	16QAM	1	0	16.59	16.82	16.81	17.00
10	16QAM	1	25	16.47	16.48	16.60	
10	16QAM	1	49	16.48	16.59	16.71	
10	16QAM	25	0	15.28	15.37	15.45	16.00
10	16QAM	25	12	15.29	15.31	15.42	
10	16QAM	25	25	15.25	15.27	15.34	
10	16QAM	50	0	15.26	15.30	15.40	
Channel				131997	132322	132647	Tune-up limit (dBm)
Frequency (MHz)				1712.5	1745	1777.5	
5	QPSK	1	0	17.34	17.40	17.65	18.50
5	QPSK	1	12	17.25	17.25	17.31	
5	QPSK	1	24	17.20	17.35	17.40	
5	QPSK	12	0	16.24	16.35	16.44	17.00
5	QPSK	12	7	16.22	16.27	16.35	
5	QPSK	12	13	16.20	16.24	16.34	
5	QPSK	25	0	16.21	16.31	16.38	

5	16QAM	1	0	16.56	16.79	16.78	17.50
5	16QAM	1	12	16.44	16.45	16.57	
5	16QAM	1	24	16.45	16.56	16.68	
5	16QAM	12	0	15.25	15.34	15.42	16.00
5	16QAM	12	7	15.26	15.28	15.39	
5	16QAM	12	13	15.22	15.24	15.31	
5	16QAM	25	0	15.23	15.27	15.37	
Channel				131987	132322	132657	Tune-up limit (dBm)
Frequency (MHz)				1711.5	1745	1778.5	
3	QPSK	1	0	17.32	17.38	17.63	18.00
3	QPSK	1	8	17.23	17.23	17.29	
3	QPSK	1	14	17.18	17.33	17.38	
3	QPSK	8	0	16.22	16.33	16.42	17.00
3	QPSK	8	4	16.20	16.25	16.33	
3	QPSK	8	7	16.18	16.22	16.32	
3	QPSK	15	0	16.19	16.29	16.36	
3	16QAM	1	0	16.54	16.77	16.76	17.50
3	16QAM	1	8	16.42	16.43	16.55	
3	16QAM	1	14	16.43	16.54	16.66	
3	16QAM	8	0	15.23	15.32	15.40	16.00
3	16QAM	8	4	15.24	15.26	15.37	
3	16QAM	8	7	15.20	15.22	15.29	
3	16QAM	15	0	15.21	15.25	15.35	
Channel				131979	132322	132665	Tune-up limit (dBm)
Frequency (MHz)				1710.7	1745	1779.3	
1.4	QPSK	1	0	17.30	17.36	17.61	18.00
1.4	QPSK	1	3	17.21	17.21	17.27	
1.4	QPSK	1	5	17.16	17.31	17.36	
1.4	QPSK	3	0	16.20	16.31	16.40	
1.4	QPSK	3	1	16.18	16.23	16.31	
1.4	QPSK	3	3	16.16	16.20	16.30	
1.4	QPSK	6	0	16.17	16.27	16.34	17.00
1.4	16QAM	1	0	16.52	16.75	16.74	17.00
1.4	16QAM	1	3	16.40	16.41	16.53	
1.4	16QAM	1	5	16.41	16.52	16.64	
1.4	16QAM	3	0	15.21	15.30	15.38	
1.4	16QAM	3	1	15.22	15.24	15.35	
1.4	16QAM	3	3	15.18	15.20	15.27	
1.4	16QAM	6	0	15.19	15.23	15.33	16.00

- **WLAN 2.4GHz Band Conducted Power**

	Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	CH 1	2412	18.13	18.50	99.06
		CH 7	2442	17.88	18.00	
		CH 13	2472	17.70	18.00	
	802.11g 6Mbps	CH 1	2412	17.90	18.50	93.00
		CH 7	2442	17.86	18.00	
		CH 13	2472	17.58	18.00	
	802.11n-HT20 MCS0	CH 1	2412	18.47	19.00	92.91
		CH 7	2442	18.12	18.50	
		CH 13	2472	17.98	18.50	

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
b/CH 1	2.412	18.50	70.79	10	10.99	3.0
n-HT20/CH1	2.412	19.00	79.43	10	12.34	3.0

2. Base on the result of note1, RF exposure evaluation of 802.11 b mode is required.
3. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
4. 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:
   1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
   2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
5. 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.
6. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 99.06%, so the duty cycle factor is 1.009.

- **WLAN 5GHz Band Conducted Power**

	Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11a 6Mbps	CH 36	5180	15.47	16.00	93.58
		CH 40	5200	15.19	15.50	
		CH 48	5240	15.08	15.50	
	802.11n-HT20 MCS0	CH 36	5180	15.09	15.50	92.61
		CH 40	5200	14.89	15.00	
		CH 48	5240	14.72	15.00	
	802.11n-HT40 MCS0	CH 38	5190	14.72	15.00	86.00
		CH 46	5230	14.74	15.00	
	802.11ac-VHT20 MCS0	CH 36	5180	14.99	15.50	92.66
		CH 40	5200	14.68	15.00	
		CH 48	5240	14.39	15.00	
	802.11ac-VHT40 MCS0	CH 38	5190	14.69	15.00	86.18
		CH 46	5230	14.64	15.00	
	802.11ac-VHT80 MCS0	CH 42	5210	13.68	14.00	76.06

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where

   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
CH 36	5.180	16.00	39.81	10	9.06	3.0

2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all of modes were shown in report.
4. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 93.58%, so the duty cycle factor is 1.069.

	Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11a 6Mbps	CH 52	5260	15.22	15.50	93.58
		CH 60	5300	14.98	15.50	
		CH 64	5320	14.67	15.00	
	802.11n-HT20 MCS0	CH 52	5260	14.82	15.00	92.61
		CH 60	5300	14.65	15.00	
		CH 64	5320	14.41	15.00	
	802.11n-HT40 MCS0	CH 54	5270	14.47	15.00	86.00
		CH 62	5310	14.18	14.50	
	802.11ac-VHT20 MCS0	CH 52	5260	14.87	15.00	92.66
		CH 60	5300	14.65	15.00	
		CH 64	5320	14.41	15.00	
	802.11ac-VHT40 MCS0	CH 54	5270	14.57	15.00	86.18
		CH 62	5310	14.45	15.00	
	802.11ac-VHT80 MCS0	CH 58	5290	13.37	14.00	76.06

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where

   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
CH 52	5.260	15.50	35.48	10	8.14	3.0

2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all of modes were shown in report.
4. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 93.58%, so the duty cycle factor is 1.069.

	Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a 6Mbps	CH 100	5500	13.63	14.00	93.58
		CH 120	5600	13.74	14.00	
		CH 144	5720	13.79	14.00	
	802.11n-HT20 MCS0	CH 100	5500	13.20	13.50	92.61
		CH 120	5600	13.34	13.50	
		CH 144	5720	13.47	14.00	
	802.11n-HT40 MCS0	CH 102	5510	13.08	13.50	86.00
		CH 126	5630	13.27	13.50	
		CH 142	5710	13.21	13.50	
	802.11ac-VHT20 MCS0	CH 100	5500	13.16	13.50	92.66
		CH 120	5600	12.99	13.50	
		CH 144	5720	12.85	13.00	
	802.11ac-VHT40 MCS0	CH 102	5510	13.06	13.50	86.18
		CH 126	5630	13.01	13.50	
		CH 142	5710	12.98	13.50	
	802.11ac-VHT80 MCS0	CH 106	5530	12.09	12.50	76.06
		CH 138	5690	11.87	12.00	

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
CH 144	5.720	14.00	25.12	10	6.01	3.0

2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all of modes were shown in report.
4. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 93.58%, so the duty cycle factor is 1.069.

	Mode	Channel	Frequency (MHz)	Average Power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11a MCS0	CH 149	5745	14.47	15.00	93.58
		CH 157	5785	14.22	14.50	
		CH 165	5825	13.56	14.00	
	802.11n-HT20 MCS0	CH 149	5745	14.03	14.50	92.61
		CH 157	5785	13.82	14.00	
		CH 165	5825	13.21	13.50	
	802.11n-HT40 MCS0	CH 151	5755	13.37	13.50	86.00
		CH 159	5795	13.11	13.50	
	802.11ac-VHT20 MCS0	CH 149	5745	13.86	14.00	92.66
		CH 157	5785	13.51	14.00	
		CH 165	5825	13.13	13.50	
	802.11ac-VHT40 MCS0	CH 151	5755	13.62	14.00	86.18
		CH 159	5795	13.16	13.50	
	802.11ac-VHT80 MCS0	CH 155	5775	12.25	12.50	76.06

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where

   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test Distance (mm)	Result	exclusion Thresholds for 1-g SAR
CH 149	5.745	15.00	31.61	10	7.58	3.0

2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. 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.
4. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 93.58%, so the duty cycle factor is 1.069.

- **Bluetooth Conducted Power**

Mode	Channel	Frequency (MHz)	Average Power (dBm)		
			1Mbps	2Mbps	3Mbps
BR / EDR	CH 00	2402	6.91	3.86	3.99
	CH 39	2441	7.18	4.17	4.13
	CH 78	2480	6.43	3.91	3.74
Tune-up Limit(dBm)			7.50	4.50	4.50

Mode	Channel	Frequency (MHz)	Average Power (dBm)	
			1Mbps	2Mbps
LE	CH 00	2402	4.63	0.84
	CH 19	2440	4.63	0.76
	CH 39	2480	4.36	0.54
Tune-up Limit			5.00	1.00

Note:

1. Per KDB 447498 D01v06, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤50 mm are determined by:

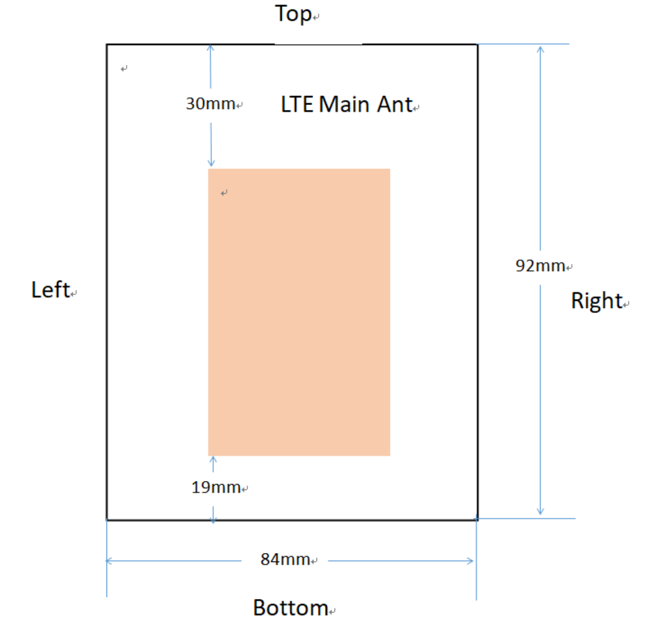
   [(*max. power of channel, including tune-up tolerance, mW*)/ (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for1-g SAR, where
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

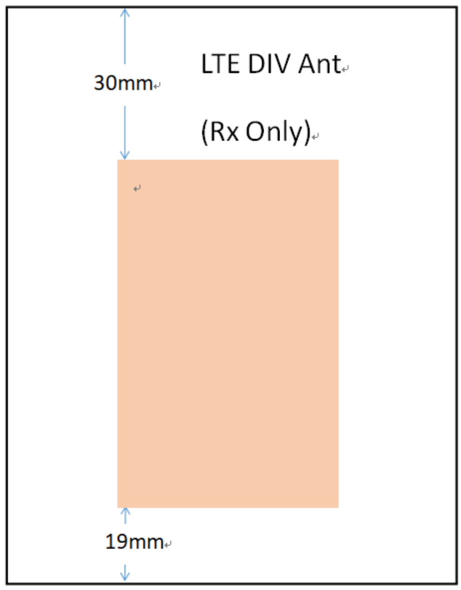
Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
CH 39	2.441	7.50	5.62	10	0.88	3.0

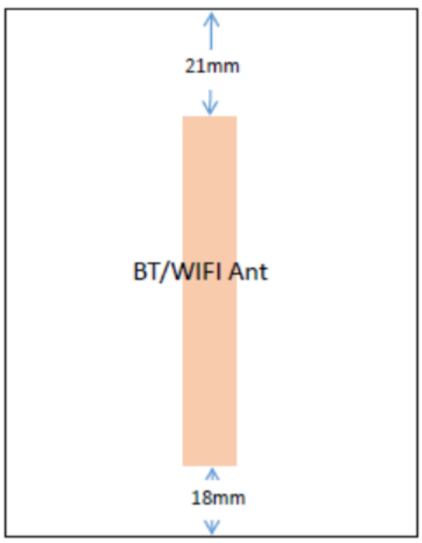
2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all mode were shown in report.
4. The Bluetooth SAR measurement is not required for the exclusion thresholds for 1-g SAR is less than 3.0

13. Exposure Positions Consideration

➢ **EUT Antenna Locations**







Main Antenna supported TX bands:
FDD LTE Band 2/4/12/25/66
TDD LTE Band 41
WLAN antenna supported bands:
2.4GHz/5GHz

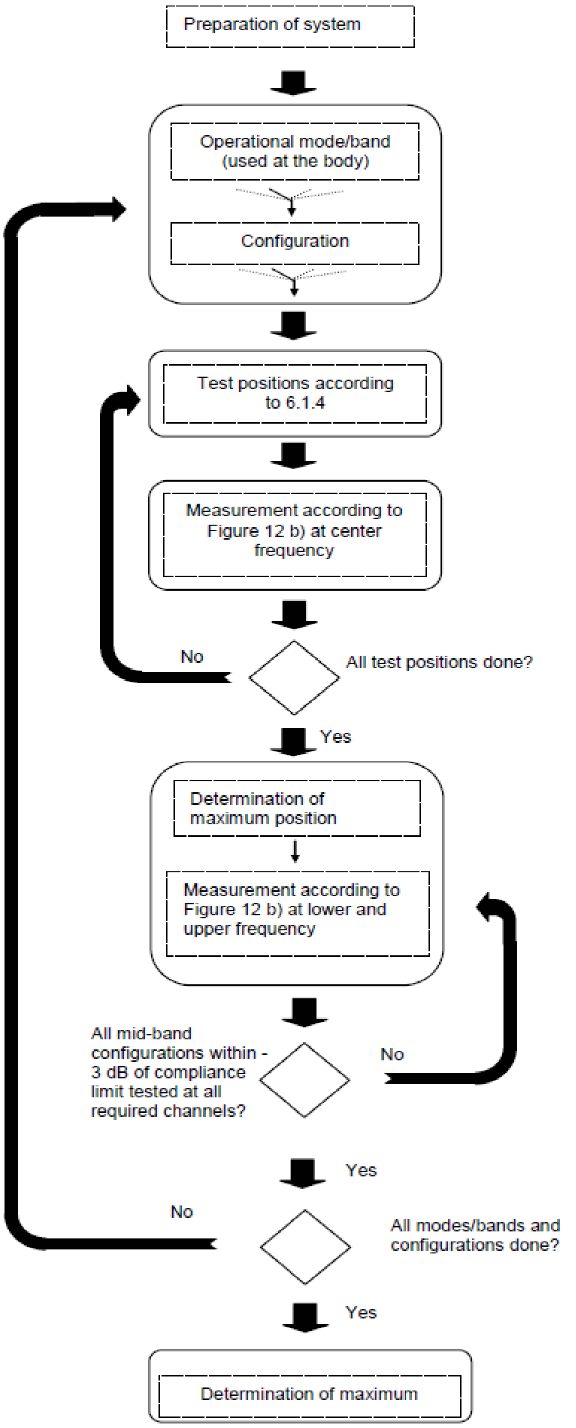
Fig.12.1 EUT Antenna Locations

Note:

1. The hotspot and limbs-worn mode SAR assessments are required.
2. Per KDB 447498 D01v06, When SAR evaluation is required, the body is evaluated with the front of the device positioned at 5mm from a flat phantom filled with head tissue-equivalent medium. SAR for limbs-worn exposure is evaluated with the back of the devices positioned in direct contact against a flat phantom fill with head tissue-equivalent medium.

14. Block Diagram of the Tests to be Performed

- **Body**



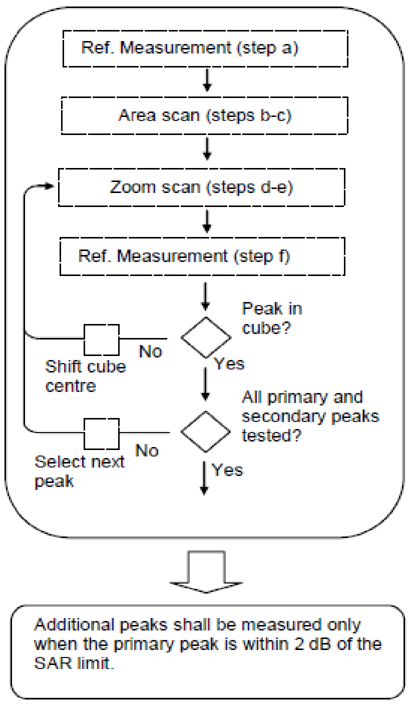


Figure 12b – General procedure

15. SAR Test Results Summary

15.1. 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:
   - ≤ 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
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. LTE band 2/4 SAR measurement was covered by Band 25/66, according to April 2015 TCB workshop, SAR measurement for overlapping LTE bands can be reduced if
   c. The maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion.
   d. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.

   The maximum tune-up limits of LTE band 2/4 are less than LTE Band 25/66, therefore SAR measurement of LTE Band 2/4 is not required.
5. 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.

6. Per KDB648474 D04v01r03, when the aggregate SAR from multiple antennas at any location in the combined SAR distribution is either ≤ 1.2 W/kg where at least 90% of the SAR is attributed to a single SAR distribution or ≤ 0.4 W/kg where no more than one SAR distribution is contributing > 0.1 W/kg, the antennas may be considered spatially separated. In this report, the MIMO mode SAR is not required for the SAR of the WLAN antennas on the top side and bottom side are less than 1.2 W/kg on 1-g.

15.2. Body SAR Data

- **LTE(QPSK) SAR Data**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR1g (W/kg)	Reported SAR1g (W/kg)
	LTE Band 12/1RB#0 10M	Front Side L	23060	19.58	20.00	1.102	0.168	0.185
	LTE Band 12/1RB#0 10M	Front Side M	23060	19.58	20.00	1.102	0.259	0.285
	LTE Band 12/1RB#0 10M	Front Side R	23060	19.58	20.00	1.102	0.254	0.280
	LTE Band 12/1RB#0 10M	Bottom Side	23060	19.58	20.00	1.102	0.085	0.094
	LTE Band 12/25RB#12 10M	Front Side L	23060	19.43	20.00	1.140	0.159	0.181
	LTE Band 12/25RB#12 10M	Front Side M	23060	19.43	20.00	1.140	0.270	0.308
1#	LTE Band 12/25RB#12 10M	Front Side R	23060	19.43	20.00	1.140	0.283	**0.323**
	LTE Band 12/25RB#12 10M	Bottom Side	23060	19.43	20.00	1.140	0.087	0.100
2#	LTE Band 25/1RB#0 20M	Front Side L	26365	16.71	17.00	1.069	0.261	**0.279**
	LTE Band 25/1RB#0 20M	Front Side M	26365	16.71	17.00	1.069	0.251	0.268
	LTE Band 25/1RB#0 20M	Front Side R	26365	16.71	17.00	1.069	0.135	0.144
	LTE Band 25/1RB#0 20M	Bottom Side	26365	16.71	17.00	1.069	0.057	0.061
	LTE Band 25/50RB#0 20M	Front Side L	26365	15.37	16.00	1.156	0.220	0.254
	LTE Band 25/50RB#0 20M	Front Side M	26365	15.37	16.00	1.156	0.231	0.267
	LTE Band 25/50RB#0 20M	Front Side R	26365	15.37	16.00	1.156	0.109	0.126
	LTE Band 25/50RB#0 20M	Bottom Side	26365	15.37	16.00	1.156	0.046	0.053
3#	LTE Band 41/1RB#0 20M	Front Side L	41490	19.85	20.50	1.161	0.615	**0.719**
	LTE Band 41/1RB#0 20M	Front Side M	41490	19.85	20.50	1.161	0.429	0.501
	LTE Band 41/1RB#0 20M	Front Side R	41490	19.85	20.50	1.161	0.125	0.146
	LTE Band 41/1RB#0 20M	Bottom Side	41490	19.85	20.50	1.161	0.053	0.062
	LTE Band 41/50RB#0 20M	Front Side L	41490	18.52	19.00	1.117	0.476	0.535
	LTE Band 41/50RB#0 20M	Front Side M	41490	18.52	19.00	1.117	0.288	0.324
	LTE Band 41/50RB#0 20M	Front Side R	41490	18.52	19.00	1.117	0.086	0.096
	LTE Band 41/50RB#0 20M	Bottom Side	41490	18.52	19.00	1.117	0.040	0.045

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR1g (W/kg)	Reported SAR1g (W/kg)
	LTE Band 66/1RB#0 20M	Front Side L	132572	17.72	18.50	1.197	0.445	0.533
4#	LTE Band 66/1RB#0 20M	Front Side M	132572	17.72	18.50	1.197	0.512	**0.613**
	LTE Band 66/1RB#0 20M	Front Side R	132572	17.72	18.50	1.197	0.305	0.365
	LTE Band 66/1RB#0 20M	Bottom Side	132572	17.72	18.50	1.197	0.123	0.147
	LTE Band 66/50RB#0 20M	Front Side L	132572	16.51	17.00	1.119	0.347	0.388
	LTE Band 66/50RB#0 20M	Front Side M	132572	16.51	17.00	1.119	0.438	0.490
	LTE Band 66/50RB#0 20M	Front Side R	132572	16.51	17.00	1.119	0.243	0.272
	LTE Band 66/50RB#0 20M	Bottom Side	132572	16.51	17.00	1.119	0.099	0.111

➢ **WLAN SAR Data**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR1g (W/kg)	Reported SAR1g (W/kg)
OR.	WLAN2.4GHz/802.11b	Front Side M	1	18.13	18.50	1.089	0.361	0.397
5#	WLAN2.4GHz/802.11b	Front Side M	1	18.13	18.50	1.089	0.303	**0.333**
OR.	WLAN5.8GHz/802.11a	Front Side R	149	14.47	15.00	1.130	0.613	0.740
6#	WLAN5.8GHz/802.11a	Front Side R	149	14.47	15.00	1.130	0.593	**0.716**

Note:

1. Per KDB 447498 D01v06, for each exposure position, if the highest output power channel Reported SAR ≤0.8W/kg, other channels SAR testing is not necessary.
2. Per KDB 447498 D01v06, the front side exposure requires 1-g SAR, and the limbs-worn condition requires 10-g extremity SAR.
3. Per KDB248227 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 ≤ 1.2 W/kg.

➢ **Limbs-worn SAR Data**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR10g (W/kg)	Reported SAR10g (W/kg)
7#	LTE Band 12/25RB#12 10M	Front Side R	23060	19.41	20.00	1.146	0.641	0.734
8#	LTE Band 25/1RB#0 20M	Front Side L	26365	16.71	17.00	1.069	0.927	0.991
9#	LTE Band 41/1RB#0 20M	Front Side L	41490	19.85	20.50	1.161	1.690	1.749
10#	LTE Band 66/1RB#0 20M	Front Side M	132572	17.72	18.50	1.197	0.885	1.059
11#	WLAN2.4GHz/802.11b	Front Side M	1	18.13	18.50	1.089	1.525	1.676
12#	WLAN5.8GHz/802.11a	Front Side R	149	14.47	15.00	1.130	0.444	0.502

Note:

1. Per KDB 447498 D01v06, for each exposure position, if the highest output channel Reported SAR ≤2.0W/kg, other channels SAR testing is not necessary.
2. Per KDB 447498 D01v06, When SAR evaluation is required, SAR for limbs-worn exposure is evaluated with the back of the devices positioned in direct contact against a flat phantom fill with head tissue-equivalent medium.
3. Per KDB 447498 D01v06, body exposure requires 1-g SAR, and the limbs-worn condition requires 10-g limbs-worm SAR.
4. The limbs-worn SAR was tested for the worst exposure condition of body SAR.

➢ **Bluetooth SAR Assessment**

The Bluetooth SAR measurement is not required in this report, per FCC KDB 447498 D01v06 4.3.2), the following equation must be used to estimate the standalone 1-g SAR.

$$\text{Estimated 1-g SAR} = \frac{\sqrt{f(GHz)}}{7.5} \cdot \frac{\text{Max. power of channel, mW}}{\text{Min. Separation Distance, mm}}$$

Mode	Max. Tune-up Power (dBm)	Exposure Position	Body
		Test Distance (mm)	10
Bluetooth	7.5	Estimated SAR (W/kg)	0.117

$$\text{Estimated 10-g SAR} = \frac{\sqrt{f(GHz)}}{18.75} \cdot \frac{\text{Max. power of channel, mW}}{\text{Min. Separation Distance, mm}}$$

Mode	Max. Tune-up Power (dBm)	Exposure Position	Limbs-worn
		Test Distance (mm)	0
Bluetooth	7.5	Estimated SAR (W/kg)	0.094

16. SAR Simultaneous Transmission Analysis

16.1. Simultaneous Evaluation

No.	Simultaneous Transmission Consideration	Body	Limbs-worn
1	WWAN + WLAN 2.4GHz	Yes	Yes
2	WWAN + WLAN 5GHz	Yes	Yes
3	WWAN + Bluetooth	Yes	Yes

Note:

1. 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. Both transmitter often do not 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.
2. 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.
3. GSM supports voice and data transmission, though not simultaneously. WCDMA supports voice and data transmission simultaneously.
4. 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.
5. 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: (SAR1 + SAR2) ^ 1.5/Ri ≤ 0.04,

Ri is the separation distance between the peak SAR locations for the antenna pair in mm.

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16.2. Simultaneous Transmission Analysis

➢ **Body Simultaneous Transmission**

WWAN Band	Exposure Position	1 WWAN	2 2.4GHz WLAN	3 5GHz WLAN	4 Bluetooth	1+2 Summed	1+3 Summed	1+4 Summed
		1g SAR (W/kg)						
Band 12	Front	0.323	0.333	0.716	0.117	0.656	1.039	0.440
Band 25/2	Front	0.279	0.333	0.716	0.117	0.612	0.995	0.396
Band 41	Front	0.719	0.333	0.716	0.117	1.052	1.435	0.836
Band 66/4	Front	0.613	0.333	0.716	0.117	0.946	1.329	0.73

➢ **Limbs-worn Simultaneous Transmission**

WWAN Band	Exposure Position	1 WWAN	2 2.4GHz WLAN	3 5GHz WLAN	4 Bluetooth	1+2 Summed	1+3 Summed	1+4 Summed
		10g SAR (W/kg)						
Band 12	Front	0.734	1.676	0.502	0.094	2.41	1.236	0.828
Band 25/2	Front	0.991	1.676	0.502	0.094	2.667	1.493	1.085
Band 41	Front	1.749	1.676	0.502	0.094	3.425	2.251	1.843
Band 66/4	Front	1.059	1.676	0.502	0.094	2.735	1.561	1.153

17. Measurement Uncertainty

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly 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 below Table.

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

Standard Uncertainty for Assumed Distribution

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%.

Uncertainty Evaluation For Handset SAR Test

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	j
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	5.83	N	1	1	1	5.83	5.83	∞
Axial Isotropy	E.2.2	3.5	R	$\sqrt{3}$	1	1	2.02	2.02	∞
Hemispherical Isotropy	E.2.2	5.9	R	$\sqrt{3}$	1	1	3.41	3.41	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation Response	E.2.4	4.1	R	$\sqrt{3}$	1	1	2.4	2.4	∞
Readout Electronics	E.2.6	0.5	N	1	1	1	0.5	0.5	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	3.0	3.0	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient Conditions	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probepositioning with respect to Phantom Shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5.2	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related									
Test sample positioning	E.4.2.1	2.6	N	1	1	1	2.6	2.6	N-1
Device Holder Uncertainty	E.4.1.1	3.0	N	1	1	1	3.0	3.0	N-1
Output power Power drift - SAR drift measurement	6.6.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid conductivity - deviation from target value	E.3.2	2.0	R	$\sqrt{3}$	0.64	0.43	1.69	1.13	∞
Liquid conductivity - measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	3.20	2.15	M
Liquid permittivity - deviation from target value	E.3.2	2.5	R	$\sqrt{3}$	0.6	0.49	1.28	1.04	∞
Liquid permittivity - measurement uncertainty	E.3.3	5.0	N	1	0.6	0.49	6.00	4.90	M
Liquid conductivity –temperature uncertainty	E.3.4		R	$\sqrt{3}$	0.78	0.41			∞

Liquid permittivity –temperature uncertainty	E.3.4		R	$\sqrt{3}$	0.23	0.26			∞
Combined Standard Uncertainty			RSS				11.55	12.07	
Expanded Uncertainty (95% Confidence interval)			K=2				±23.20	±24.17	

Uncertainty For System Performance Check

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	4.76	N	1	1	1	4.76	4.76	∞
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	1	1	1.44	1.41	∞
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	1	1	2.31	2.32	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
RF ambient Conditions	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole									
Dipole axis to liquid Distance	8,E.4.2	1.00	N	$\sqrt{3}$	1	1	0.58	0.58	∞
Input power and SAR drift measurement	8,6.6.2	4.04	R	$\sqrt{3}$	1	1	2.33	2.33	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Liquid conductivity - deviation from target value	E.3.2	4.57	R	$\sqrt{3}$	0.64	0.43	1.69	1.13	∞

Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	$\sqrt{3}$	0.64	0.43	1.85	1.24	M
Liquid permittivity - deviation from target value	E.3.2	3.69	R	$\sqrt{3}$	0.6	0.49	1.28	1.04	∞
Liquid permittivity - measurement uncertainty	E.3.3	10.00	N	$\sqrt{3}$	0.6	0.49	3.46	2.83	M
Combined Standard Uncertainty			RSS				8.83	8.37	
Expanded Uncertainty (95% Confidence interval)			K=2				17.66	16.73	

18. Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of FCC, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested. Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

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 ******