REPORT No.: SZ23070206S01

TEST REPORT

APPLICANT	:	Reliance Communications, LLC
PRODUCT NAME	:	Orbic Speed X 5G
MODEL NAME	:	R562L5
BRAND NAME	:	Orbic
FCC ID	:	2ABGH-R562L5
STANDARD(S)	:	FCC 47 CFR Part 2(2.1093) IEEE 1528-2013
RECEIPT DATE	:	2023-11-10
TEST DATE	:	2023-11-18 to 2023-12-30
ISSUE DATE	:	2024-04-09

Edited by : Xie Yiyun
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DIRECTORY

Changed History		
Version	**Date**	**Reason for Change**
1.0	2024-04-09	First edition

1. SAR Results Summary

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

<Highest Reported SAR Summary>

Frequency Band		Highest SAR Summary Hotspot (Gap 10mm) 1g SAR (W/kg)
WCDMA	WCDMA Band II	0.925
	WCDMA Band V	0.301
LTE	LTE Band 2	0.715
	LTE Band 5	0.390
	LTE Band 7	0.540
	LTE Band 12	0.557
	LTE Band 13	0.548
	LTE Band 48	0.226
	LTE Band 66/4	0.747
5G NR	n2 (NSA)	0.433
	n5 (NSA)	0.561
	n66 (NSA)	0.497
	n77 (NSA)	0.506
WLAN	2.4GHz WLAN	0.205
	5GHz WLAN	0.556

Highest Simultaneous Transmission SAR_{1g} (W/Kg):	1.127 W/kg	Limit (W/kg): 1.6 W/kg

Note:

1. This device is compliance with Specific Absorption Rate (SAR) for general population or uncontrolled exposure limits (1.6 W/kg for 1g SAR) specified in FCC 47 CFR part 1 (1.1310) and IEEE C95.1-1991), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013, TCBC workshop notes and FCC KDB publications.
2. For FDD-LTE Band 4 is full covered by FDD-LTE Band 66, therefore only FDD-LTE Band 66 was tested.
3. When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

2. Technical Information

Note: Provide by applicant.

2.1. Applicant and Manufacturer Information

Applicant:	Reliance Communications, LLC
Applicant Address:	555 Wireless Blvd. Hauppauge, NY 11788, USA
Manufacturer:	MeiG Smart Technology Co., Ltd
Manufacturer Address:	2nd Floor,Office Building,No.5 Lingxia Road,Fenghuang,Fuyong Street,Bao'an District,Shenzhen

2.2. Equipment under Test (EUT) Description

Product Name:	Orbic Speed X 5G
EUT IMEI:	357600960001564 357600960001796
Hardware Version:	SPEEDVZ_V1.02_PCB
Software Version:	R562L5_8.222.41_EQ103
Frequency Bands:	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz 5G NR n2 (NSA): 1850 MHz ~ 1910 MHz 5G NR n5 (NSA): 824 MHz ~ 849 MHz 5G NR n66 (NSA): 1710 MHz ~ 1780 MHz 5G NR n77 (NSA): 3450 MHz ~ 3550 MHz; 3700 MHz ~3980 MHz WLAN 2.4GHz: 2412 MHz ~ 2462 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
Modulation Mode:	WCDMA: QPSK, 16QAM LTE: QPSK, 16QAM, 64QAM, 256QAM

	5G NR: DFT-s-OFDM/CP-OFDM, PI/2 BPSK QPSK, 16QAM, 64QAM, 256QAM 802.11b: DSSS 802.11a/g/n-HT20/HT40/ac-VHT20/40/80/160: OFDM 802.11ax-HEW20/40/80/160: OFDMA
Carrier Aggregation:	Uplink & Downlink
WLAN MIMO:	Support
Antenna Type:	WWAN: PIFA Antenna WLAN: PIFA Antenna
SIM Cards Description:	WCDMA+LTE+5G NR

Note: For more detailed description, please refer to specification or user manual supplied by the applicant and/or manufacturer.

2.3. Environment of Test Site/Conditions

Normal Temperature (NT):	20-25 °C
Relative Humidity:	30-75 %

Test Frequency:	WCDMA Band II/V FDD-LTE Band 2/4/5/7/12/13/66 TDD-LTE 48 5G NR(NSA) n2/5/66/77 WLAN 2.4GHz WLAN 5GHz
Operation Mode:	Call established
Power Level:	WCDMA Band II/V (All Up Bits) FDD-LTE Band 2/4/5/7/12/13/66 (Maximum output power) TDD-LTE Band 48 (Maximum output power) 5G NR(NSA) n2/5/66/77 (Maximum output power) WLAN 2.4GHz/WLAN 5GHz Refers to Annex E in this report

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

The EUT shall use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the Factory. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link is used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.
The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the handset by at least 35 dB.

3. Specific Absorption Rate (SAR)

3.1. Introduction

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

3.2. SAR Definition

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

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

SAR is expressed in units of Watts per kilogram (W/kg).
SAR measurement can be either related to the temperature elevation in tissue by,

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

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

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

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

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

4. RF Exposure Limits

4.1. Uncontrolled Environment

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

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

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

Note:

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

4.2. Controlled Environment

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

5. Applied Reference Documents

Leading reference documents for testing:

Identity	Document Title	Method Determination /Remark
FCC 47CFR Part 2(2.1093)	Radio Frequency Radiation Exposure Evaluation: Portable Devices	No deviation
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
KDB 447498 D01v06	General RF Exposure Guidance	No deviation
KDB 248227 D01v02r02	SAR Measurement Procedures for 802.11 Transmitters	No deviation
KDB 865664 D01v01r04	SAR Measurement 100 MHz to 6 GHz	No deviation
KDB 865664 D02v01r02	RF Exposure Reporting	No deviation
KDB 648474 D04v01r03	Handset SAR	No deviation
KDB 941225 D01v03r01	3G SAR MEAUREMENT PROCEDURES	No deviation
KDB 941225 D05v02r05	SAR Evaluation Consideration for LTE Devices	No deviation
KDB 941225 D06v02r01	SAR Evaluation Procedures For Portable Devices With Wireless Router Capabilities	No deviation
Note 1: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.		

6. SAR Measurement System

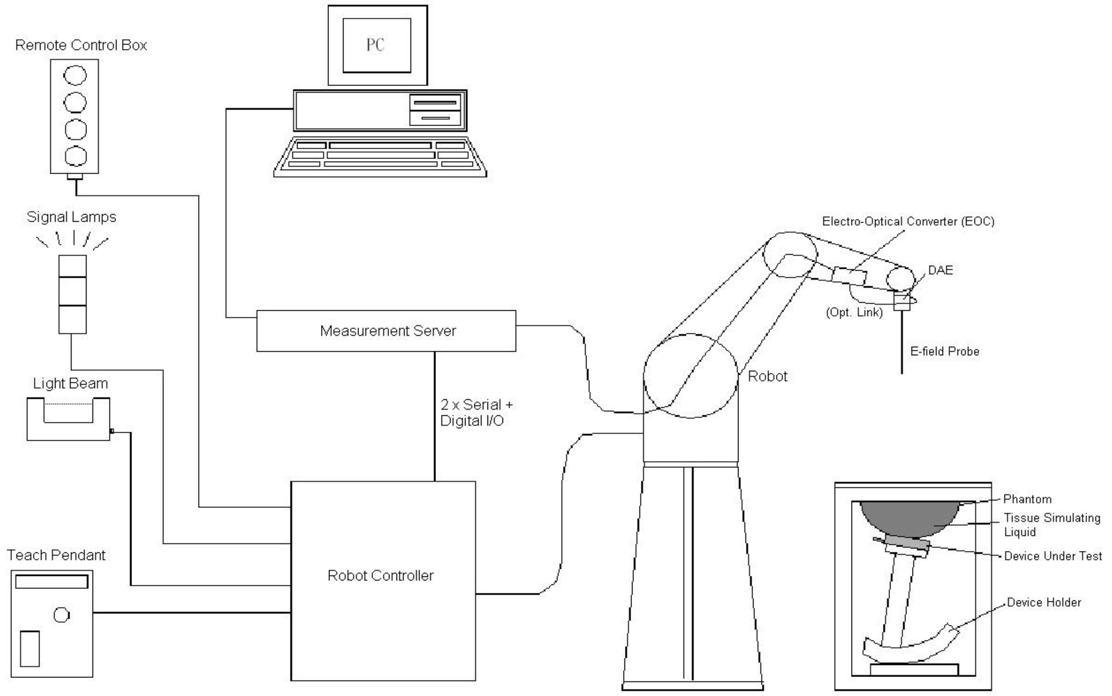

Fig 6.1 SPEAG DASY System Configurations

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

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

6.1. E-Field Probe

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

➢ **E-Field Probe Specification**

<ES3DV3 Probe>

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 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 (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

6.2. Data Acquisition Electronics (DAE)

The Data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. 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.

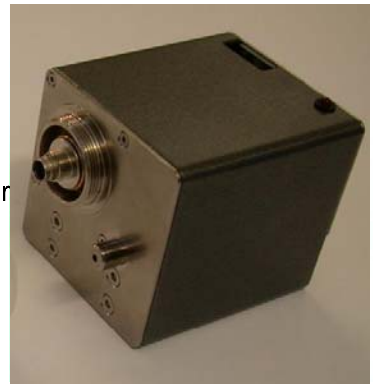

Fig 6.4 Photo of DAE

6.3. Robot

The SPEAG DASY system uses the high precision robots (DASY6: TX60XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY6: CS8c) from Stäubliis used. The Stäublirobot 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 (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chip disk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

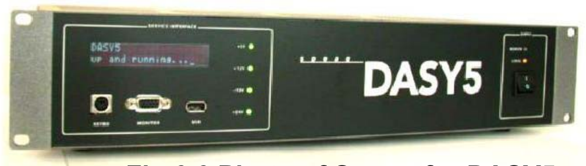

Fig 6.6 Photo of Server for DASY5

6.5. Light Beam Unit

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

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

Fig. 6.7 Photo of Light Beam

6.6. Phantom

<SAM Twin Phantom>

<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 (EPR). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity 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

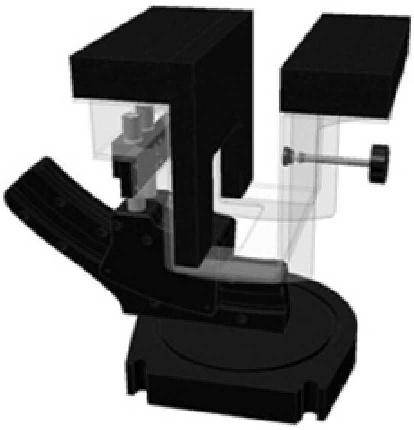

Fig 6.10 Laptop Extension Kit

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 verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.
The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

➢ **Data Evaluation**

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

Probe parameters：	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$

	- Diode compression point	dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

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

With Vi = 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:

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

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

With V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), $\mu V/(V/m)^2$ forE-field
Probes ConvF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

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

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

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

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

with SAR = local specific absorption rate in mW/g

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

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

ρ = equivalent tissue density in g/cm^3

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

6.9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial No./ SW Version	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1223	2022.08.22	2025.08.21
SPEAG	900MHz System Validation Kit	D900V2	1d064	2021.12.17	2024.12.16
SPEAG	1800MHz System Validation Kit	D1800V2	2d158	2021.12.17	2024.12.16
SPEAG	2000MHz System Validation Kit	D2000V2	1050	2021.12.18	2024.12.17
SPEAG	2450MHz System Validation Kit	D2450V2	805	2021.12.17	2024.12.16
SPEAG	2600MHz System Validation Kit	D2600V2	1198	2022.08.17	2025.08.16
SPEAG	3500MHz System Validation Kit	D3500V2	1104	2023.06.03	2026.06.02
SPEAG	3700MHz System Validation Kit	D3700V2	1076	2023.06.03	2026.06.02
SPEAG	3900MHz System Validation Kit	D3900V2	1046	2023.06.02	2026.06.01
SPEAG	5000MHz System Validation Kit	D5GHzV2	1176	2021.12.19	2024.12.18
SPEAG	5G Verification Source	10GHz	1019	2023.12.03	2026.12.02
SPEAG	DOSIMETRIC ASSESSMENT SYSTEM Software	DASY52	52.10.4.1527	NCR	NCR
SPEAG	Dosimetric E-Field Probe	EX3DV4	7608	2023.03.15	2024.03.14
SPEAG	Data Acquisition Electronics	DAE4	1643	2023.02.22	2024.02.21
SPEAG	Twin-SAM	QD 000 P41 Ax	2020	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Network Emulator	CMW500	165755	2023.02.09	2024.02.08
Anritsu	Network Emulator	MT8820C	6201274521	2023.02.09	2024.02.08
Anritsu	Network Emulator	MT8821C	6261830572	2023.02.09	2024.02.08
Anritsu	Network Emulator	MT8000A	6262148249	2023.06.27	2024.06.24
Agilent	Network Analyzer	E5071B	MY42404762	2023.02.09	2024.02.08
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2023.08.03	2024.08.02
mini-circuits	Amplifier	ZHL-42W+	608501717	NCR	NCR
mini-circuits	Amplifier	ZVE-8G+	754401735	NCR	NCR
Agilent	Signal Generator	N5182B	MY53050509	2023.09.19	2024.09.18
R&S	Power Senor	NRP8S	103215	2023.02.09	2024.02.08
Agilent	Power Meter	E4416A	MY45102093	2023.09.19	2024.09.18
R&S	Power Sensor	NRP8S	103240	2023.02.09	2024.02.08
Anritsu	Power Meter	E4418B	GB43318055	2023.06.21	2024.06.20
Agilent	Dual Directional Coupler	778D	50422	NA	NA

MCL	Attenuation	351-218-010	N/A	NA	NA
R&S	Spectrum Analyzer	N9030A	MY54170556	2023.10.07	2024.10.06
KTJ	Thermo meter	TA298	N/A	2023.11.22	2024.11.21
SPEAG	Tissue Simulating Liquids	HBBL600-10000V6		24H	

Note:

1. The calibration certificate of DASY can be referred to appendix G of this report.
2. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
3. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Speag.
4. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it.
5. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
6. N.C.R means No Calibration Requirement.

7. Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm.For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm, which is shown in Fig. 7.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 7.2.Thenominaldielectricvaluesofthe tissue simulating liquids in the phantom and the tolerance of 5%are listed in below table.

Fig 7.1 Photo of Liquid Height for Head SAR

Fig 7.2 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquids

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (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
Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800,1900,2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG.

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

Note: Please refer to the validation results for dielectric parameters of each frequency band.
The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a SPEAG Dielectric Assessment KIT and an Agilent Network Analyzer.

Table 1: Dielectric Performance of Tissue Simulating Liquid

Frequency (MHz)	Tissue Type	Liquid Temp.(℃)	Conductivity (σ)	Conductivity Target (σ)	Delta (σ) (%)	Limit (%)	Date
750	HSL	22.1	0.853	0.89	-4.16	±5	2023.11.24
900	HSL	22.1	0.974	0.97	0.41	±5	2023.11.22
1800	HSL	22.4	1.387	1.40	-0.93	±5	2023.12.29
1800	HSL	22.4	1.395	1.40	-0.36	±5	2023.12.30
2000	HSL	22.4	1.418	1.40	1.29	±5	2023.12.30
2450	HSL	22.3	1.744	1.80	-3.11	±5	2023.11.27
2600	HSL	22.2	1.878	1.96	-4.18	±5	2023.11.25
3500	HSL	22.3	2.883	2.91	-0.93	±5	2023.11.18
3700	HSL	22.3	3.117	3.05	2.20	±5	2023.11.19
3900	HSL	22.3	3.224	3.15	2.35	±5	2023.11.20
5250	HSL	22.4	4.850	4.71	2.97	±5	2023.11.28
5600	HSL	22.6	5.187	5.07	2.31	±5	2023.11.29
5750	HSL	22.3	5.226	5.22	0.11	±5	2023.11.30
Frequency (MHz)	**Tissue Type**	**Liquid Temp.(℃)**	**Permittivity (εr)**	**Permittivity Target (εr)**	**Delta (εr) (%)**	**Limit (%)**	**Date**
750	HSL	22.1	41.666	41.90	-0.56	±5	2023.11.24
900	HSL	22.1	43.057	41.50	3.75	±5	2023.11.22
1800	HSL	22.4	39.425	40.00	-1.44	±5	2023.12.29
1800	HSL	22.4	39.468	40.00	-1.33	±5	2023.12.30
2000	HSL	22.4	39.533	40.00	-1.17	±5	2023.12.30
2450	HSL	22.3	39.463	39.20	0.67	±5	2023.11.27
2600	HSL	22.2	39.225	39.00	0.58	±5	2023.11.25
3500	HSL	22.3	38.147	37.90	0.65	±5	2023.11.18
3700	HSL	22.3	38.094	37.90	0.51	±5	2023.11.19
3900	HSL	22.3	37.723	37.70	0.06	±5	2023.11.20
5250	HSL	22.4	36.122	35.95	0.48	±5	2023.11.28
5600	HSL	22.6	36.116	35.50	1.74	±5	2023.11.29
5750	HSL	22.3	35.494	35.35	0.41	±5	2023.11.30

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.

8.1. SAR System Performance Check

➢ **Purpose of System Performance check**

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

➢ **System Setup**

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

Fig 8.1 Photo of Dipole Setup

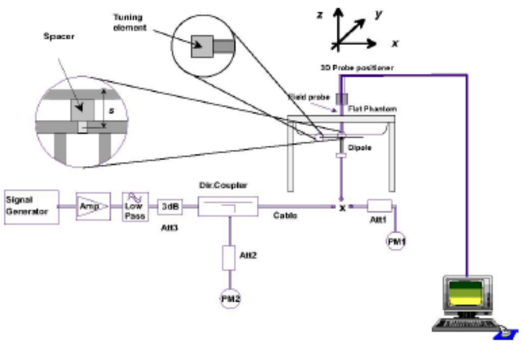

Fig 8.2 System Setup for System Evaluation

➢ **Validation Results**

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

<Validation Setup>

Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N
750	HSL	250	D750V3-1223	7608	1643
900	HSL	250	D900V2-1d064	7608	1643
1800	HSL	250	D1800V2-2d158	7608	1643
2000	HSL	250	D2000V2-1050	7608	1643
2450	HSL	250	D2450V2-805	7608	1643
2600	HSL	250	D2600V2-1198	7608	1643
3500	HSL	100	D3500V2-1104	7608	1643
3700	HSL	100	D3700V2-1076	7608	1643
3900	HSL	100	D3900V2-1176	7608	1643
5250	HSL	100	D5GHzV2-1176-5250	7608	1643
5600	HSL	100	D5GHzV2-1176-5600	7608	1643
5750	HSL	100	D5GHzV2-1176-5750	7608	1643

<System Validation>

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

<Validation Results>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2023.11.24	750	HSL	250	2.26	8.54	9.04	5.85
2023.11.22	900	HSL	250	2.92	11.20	11.68	4.29
2023.12.29	1800	HSL	250	9.34	39.20	37.36	-4.69
2023.12.30	1800	HSL	250	9.44	39.20	37.76	-3.67
2023.12.30	2000	HSL	250	10.26	41.60	41.04	-1.35
2023.11.27	2450	HSL	250	12.44	52.30	49.76	-4.86
2023.11.25	2600	HSL	250	13.97	57.00	55.88	-1.96
2023.11.18	3500	HSL	100	6.83	67.20	68.3	1.64
2023.11.19	3700	HSL	100	7.14	67.50	71.4	5.78
2023.11.20	3900	HSL	100	7.33	69.90	73.3	4.86
2023.11.28	5250	HSL	100	8.23	76.70	82.3	7.30
2023.11.29	5600	HSL	100	8.42	80.80	84.2	4.21
2023.11.30	5750	HSL	100	8.56	78.70	85.6	8.77

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2023.11.24	750	HSL	250	1.39	5.57	5.56	-0.18
2023.11.22	900	HSL	250	1.89	7.19	7.56	5.15
2023.12.29	1800	HSL	250	5.11	20.10	20.44	1.69
2023.12.30	1800	HSL	250	5.19	20.10	20.76	3.28
2023.12.30	2000	HSL	250	5.35	20.70	21.4	3.38
2023.11.27	2450	HSL	250	6.22	23.90	24.88	4.10
2023.11.25	2600	HSL	250	6.58	25.70	26.32	2.41
2023.11.18	3500	HSL	100	2.62	25.10	26.2	4.38
2023.11.19	3700	HSL	100	2.55	24.20	25.5	5.37
2023.11.20	3900	HSL	100	2.47	24.10	24.7	2.49
2023.11.28	5250	HSL	100	2.25	22.10	22.5	1.81
2023.11.29	5600	HSL	100	2.34	23.30	23.4	0.43
2023.11.30	5750	HSL	100	2.41	22.50	24.1	7.11

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

9. EUT Testing Position

This EUT was tested in six different positions. They are Front/Back/Left/Right/Top/Bottom of the EUT with phantom 10 mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

9.1. SAR Evaluation near the Mouth/Jaw Regions of the Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR locations identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

9.2. Body-worn Configurations

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration.

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

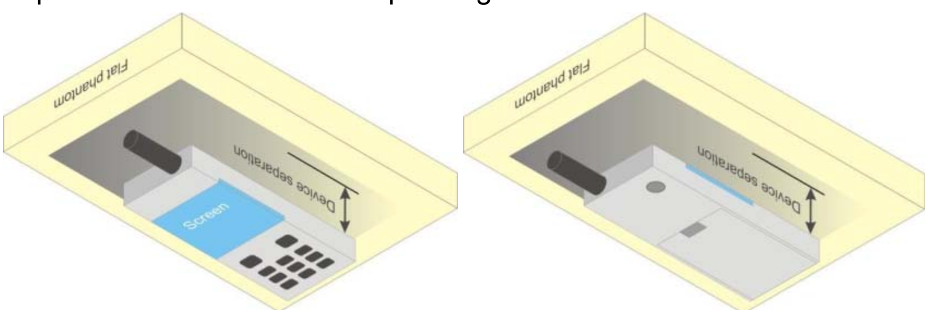

Fig 9.1 Illustration for Body Worn Position

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).

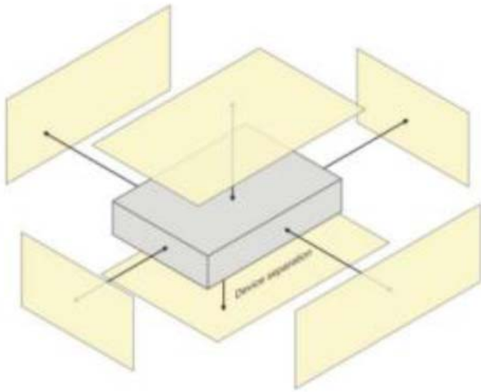

Fig 9.2 Illustration for Hotspot Position

10. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.

(b) Read the WWAN RF power level from the base station simulator.

(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.

(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power.

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.

(b) Place the EUT in the positions as Appendix D demonstrates.

(c) Set scan area, grid size and other setting on the DASY software.

(d) Measure SAR results for the highest power channel on each testing position.

(e) Find out the largest SAR result on these testing positions of each band.

(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg.

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

(a) Power reference measurement.

(b) Area scan.

(c) Zoom scan.

(d) Power drift measurement.

10.1. Spatial Peak SAR Evaluation

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

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

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

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

10.2. Power Reference Measurement

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

10.3. Area Scan Procedures

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a10mm² step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

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

10.4. Zoom Scan Procedures

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m³ is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10 g cube 21,5mm.The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 5x5x7 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 30mm in the Z axis.

10.5. SAR Averaged Methods

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

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

10.6. Power Drift Monitoring

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

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11. SAR Test Procedure

11.1. General Scan Requirements

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

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

11.2. Test Procedure

The Following steps are used for each test position

1. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface.
2. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
3. Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
4. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

11.3. Description of Interpolation/Extrapolation Scheme

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

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

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

11.4. Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

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

12. SAR Test Configuration

<WCDMA Mode>

Summary of UMTS conducted power measurement:

1. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode, SAR measurement is not required for the secondary mode.
2. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
3. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
4. For HSPA+ devices supporting 16 QAM in the uplink, power measurements procedure is according to the configurations in Table C.11.1.4 of 3GPP TS 34.121-1.
5. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA / HSPA+ is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA / HSPA+ to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA / HSPA+) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+.
6. A fixed level power reduction is applied for WCDMA Band II when handset open Hotspot mode, the power reduction triggered.

<u>HSDPA Setup Configuration</u>

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

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$
Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$.
Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

HSUPA Setup Configuration

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

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

HSPA+ 3GPP release 7 (uplink category 7) 16QAM, Setup Configuration:

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed}1: 30/15 β_{ed}2: 30/15	β_{ed}3: 24/15 β_{ed}4: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.

DC-HSDPA Setup Configuration

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.

Table E.5.0: Levels for HSDPA connection setup

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

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

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

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Proces ses	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

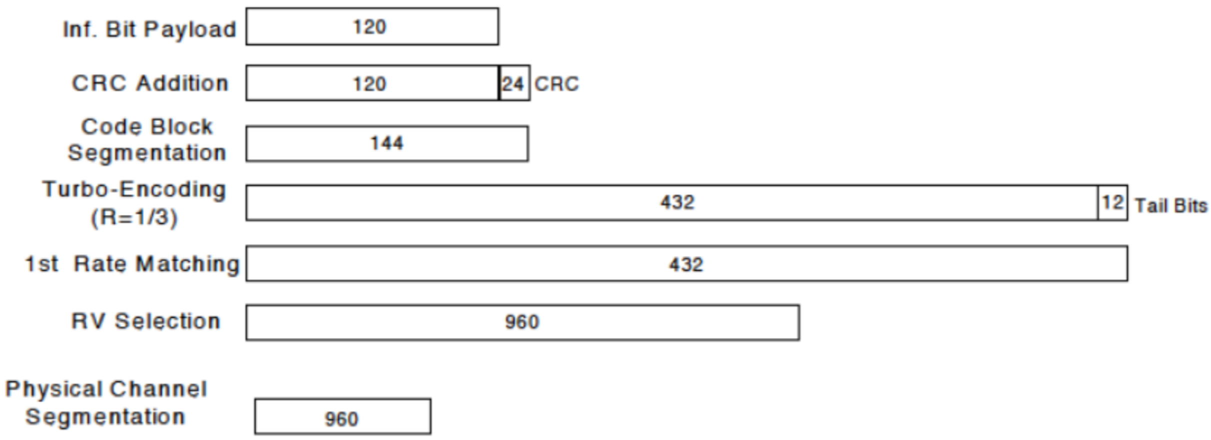


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

<CDMA Mode>

1xEV-DO Rev. B

Call box setup procedure

1xEV-DO Release B

1> CMW 500 Signal Generator > 1xEV-DO Taskbar Enable
2> CMW 500 1xEV-DO Signaling Configuration Window >
3> 1xEV-DO Signaling On Window:
Under Access Network Control:
Band Class: BC0: US Cellular
RF Channel: 31
1xEV-DO Power: -70 dBm
4> 1xEV-DO Signaling Configuration Window
Under RF Frequency Band / Channel: Enter Ch. Frequency

- Under Carrier Configuration: RF Frequency

For Two Carriers: Low Channel (1013)

	RF Channel	RF Channel Offset
Carrier [0]	31	0
Carrier [1]	1013	982

- Under Carrier Configuration: RF Pilot

	Carrier Sector	Active on AN	Assigned to AT
Pilot [0]	C0/S0	✓	✓
	CA/S1	✓	✓

For Three Carriers: Low Channel (1013)

	RF Channel	RF Channel Offset
Carrier [0]	72	0
Carrier [1]	31	-41
Carrier [2]	1013	941

- Under Carrier Configuration: RF Pilot

	Carrier Sector	Active on AN	Assigned to AT
Pilot [0]	C0/S0	✓	✓
Pilot [1]	C1/S1	✓	✓
Pilot [2]	C2/S2	✓	✓

<LTE Mode>

LTE Target MPR level

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

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR Target (dB)	3GPP MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
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	√	√	√	√	√	√
4	√	√	√	√	√	√
5	√	√	√	√	N/A	N/A
7	N/A	N/A	√	√	√	√
12	N/A	N/A	√	√	N/A	N/A
13	N/A	N/A	√	√	N/A	N/A
48	N/A	N/A	√	√	√	√
66	√	√	√	√	√	√

Note:

1. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
2. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
3. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
4. Per KDB 941225 D05v02r05, for QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation

are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

5. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is > not 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 Db higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported band width is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
7. For LTE B4 / B5 / B7 / B17 the maximum bandwidth does not support three non-overlapping channels, per KDB941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
8. LTE band 2 / 12 SAR test was covered by Band 25 / 17; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. The maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion.
   b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.
9. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >>constellation" mode of the device connect to the CMW500 base station, therefore, the device 64QAM and 16QAMsignal modulation are correct. Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design: only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards: b) A-MPR (additional MPR) must be disabled.
10. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
    a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
    b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
    c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
    d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor

e. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.

11. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
12. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
13. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

<WLAN 2.4GHz>

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

power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSSSAR.

5. A fixed level power reduction is applied for WiFi when handset operates "held to the body" condition or "held to the ear" condition, the power reduction triggered by audio receiver detection and call establish status.
6. Per KDB 248227 D01v02r02, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements.SAR is not required for the following 2.4 GHz OFDM conditions:
   a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
   b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

<WLAN 5GHz>

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

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

1. When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR.
2. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.
3. The two U-NII bands may be aggregated to support a 160 MHz channel on channel number 50.
4. Without additional testing, the maximum output power for this is limited to the lower of the maximum output power certified for the two bands. When SAR measurement is required for at least one of the bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is > 1.2 W/kg, SAR is required for the 160 MHz channel. This procedure does not apply to an aggregated band with maximum output higher than the standalone band(s); the aggregated band must be tested independently for SAR. SAR is not required when the 160 MHz channel is operating at a reduced maximum power and also qualifies for SAR test exclusion.

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

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

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

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

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

1. The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
2. If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
3. If multiple configurations have the same specified maximum output power, largest channel 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.

13. Conducted Power List

Remark: The output power of WCDMA/LTE/5G NR/WLAN refers to the annex E of this report.

14. LTE Carrier Aggregation

14.1. LTE Uplink Carrier Aggregation

➢ **Carrier Aggregation Configuration**

<Intra-band>

2CC Uplink Carrier Aggregation for Intra-band				
No.	Combination	MIMO	Restriction	Completely Covered by Measurement Superset
1	66B	-	-	No
2	66C	-	-	No
3	5B	-	-	No
4	48C	-	-	No

Note:

1. According to the 3GPP 36.101 table 6.2.2A-1 specifics that the aggregation maximum allowed output power is equivalent to the signal carrier scenario for intra-band contiguous carrier aggregation scenarios. When the non-contiguous RB allocation is applied the MPR shell complies with the table 6.2.3A defined in 3GPP 36.101.
2. According to the TCB Workshop publication, the output power of uplink CA would be measured with the wideband signal integration over the component carriers. And SAR measurement would be performed at the worst exposure condition of each band.
3. Additional SAR measurement for LTE UL CA with other DL CA combinations are not required when the maximum output power of this configuration is not ＞1/4 dB higher than the maximum output power for UL CA active.

<Inter-band>

2CC Uplink Carrier Aggregation for Intra-band				
No.	Combination	MIMO	Restriction	Completely Covered by Measurement Superset
1	13A-66A	-	-	No
2	2A-13A	-	-	No
3	2A-5A	-	-	No
4	4A-5A	-	-	No

5	2A-66A	-	-	No
6	5A-66A	-	-	No
7	2A-4A	-	-	No
8	4A-13A	-	-	No

Note:

According to October 2018 TCB Workshop publication, LTE uplink CA SAR assessment should follow:

1. If the signal uplink 1-g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1-g SAR values are less than 1.45 W/kg no additional measurements need to be performed.
2. If one or the signal uplink1-g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1-g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in FCC KDB Publication 865664 D01. And PAG is required for this case.
3. If the algebraic sum of the 1-g SAR values is > 1.45 W/kg additional measurements may have to be made. Submit a KDB inquiry for additional guidance. And PAG is required for this case.

14.2. LTE Downlink Carrier Aggregation

➢ **Carrier Aggregation Configuration**

For the device supports bands and bandwidths and configurations are provided as follow table was according to 3GPP.

2CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_13A-48A	48A	-	No
2	CA_13A-66A	66A	-	No
3	CA_2A-13A	2A	-	No
4	CA_2A-2A	2A-2A	-	No
5	CA_2A-48A	2A-48A	-	No
6	CA_2A-4A	2A-4A	-	No
7	CA_2A-5A	2A	-	No
8	CA_2A-66A	2A-66A	-	No
9	CA_48A-66A	48A-66A	-	No
10	CA_48C	48C	-	No
11	CA_4A-13A	4A	-	No
12	CA_4A-48A	4A-48A	-	No
13	CA_4A-4A	4A-4A	-	No
14	CA_4A-5A	4A	-	No
15	CA_5A-48A	48A	-	No
16	CA_5A-5A	-	-	No
17	CA_5A-66A	66A	-	No
18	CA_5B	-	-	No
19	CA_66A-66A	66A-66A	-	No
20	CA_66B	66B	-	No
21	CA_66C	66C	-	No

3CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_13A-48A-48A	48A-48A	-	No
2	CA_13A-48A-66A	48A-66A	-	No
3	CA_13A-48C	48C	-	No
4	CA_13A-66A-66A	66A-66A	-	No
5	CA_13A-66B	66B	-	No

6	CA_13A-66C	66C	-	No
7	CA_2A-13A-48A	2A-48A	-	No
8	CA_2A-13A-66A	2A-66A	-	No
9	CA_2A-2A-13A	2A-2A	-	No
10	CA_2A-2A-4A	2A-2A-4A	-	No
11	CA_2A-2A-5A	2A-2A	-	No
12	CA_2A-2A-66A	2A-2A-66A	-	No
13	CA_2A-48A-48A	2A-48A, 48A-48A	-	No
14	CA_2A-48A-66A	2A-48A, 2A-66A, 48A-66A	-	No
15	CA_2A-48C	2A-48C	-	No
16	CA_2A-4A-13A	2A-4A	-	No
17	CA_2A-4A-4A	2A-4A-4A	-	No
18	CA_2A-4A-5A	2A-4A	-	No
19	CA_2A-5A-48A	2A-48A	-	No
20	CA_2A-5A-66A	2A-66A	-	No
21	CA_2A-5B	2A	-	No
22	CA_2A-66A-66A	2A-66A-66A	-	No
23	CA_2A-66B	2A-66B	-	No
24	CA_2A-66C	2A-66C	-	No
25	CA_48A-48A-66A	48A-48A, 48A-66A	-	No
26	CA_48A-66A-66A	48A-66A-66A	-	No
27	CA_48A-66B	48A-66B	-	No
28	CA_48A-66C	48A-66C	-	No
29	CA_48C-66A	48C-66A	-	No
30	CA_48D	48D	-	No
31	CA_4A-48C	4A-48C	-	No
32	CA_4A-4A-13A	4A-4A	-	No
33	CA_4A-4A-5A	4A-4A	-	No
34	CA_4A-5B	4A	-	No
35	CA_5A-48A-66A	48A-66A	-	No
36	CA_5A-48C	48C	-	No
37	CA_5A-5A-66A	66A	-	No
38	CA_5A-66A-66A	66A-66A	-	No
39	CA_5A-66B	66B	-	No
40	CA_5A-66C	66C	-	No

41	CA_5B-66A	66A	-	No
42	CA_66A-66A-66A	66A-66A-66A	-	No
43	CA_66A-66C	66A-66C	-	No

4CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_13A-48A-48C	48A-48C	-	No
2	CA_13A-48A-66B	48A-66B	-	No
3	CA_13A-48A-66C	48A-66C	-	No
4	CA_13A-48C-66A	48C-66A	-	No
5	CA_13A-48D	48D	-	No
6	CA_2A-13A-48C	2A-48C	-	No
7	CA_2A-13A-66A-66A	2A-66A-66A	-	No
8	CA_2A-13A-66B	2A-66B	-	No
9	CA_2A-13A-66C	2A-66C	-	No
10	CA_2A-2A-13A-66A	2A-2A-66A	-	No
11	CA_2A-2A-4A-4A	2A-2A-4A-4A	-	No
12	CA_2A-2A-4A-5A	2A-2A-4A	-	No
13	CA_2A-2A-5A-66A	2A-2A-66A	-	No
14	CA_2A-2A-66A-66A	2A-2A-66A-66A	-	No
15	CA_2A-2A-66B	2A-2A-66B	-	No
16	CA_2A-2A-66C	2A-2A-66C	-	No
17	CA_2A-48A-48C	2A-48A, 2A-48C, 48A-48C	-	No
18	CA_2A-48C-66A	2A-48C, 2A-66A, 48C-66A	-	No
19	CA_2A-48D	2A-48D	-	No
20	CA_2A-4A-4A-5A	2A-4A-4A	-	No
21	CA_2A-4A-5B	2A-4A	-	No
22	CA_2A-5A-48C	2A-48C	-	No
23	CA_2A-5A-66A-66A	2A-66A-66A	-	No
24	CA_2A-5A-66B	2A-66B	-	No
25	CA_2A-5A-66C	2A-66C	-	No
26	CA_2A-5B-66A	2A-66A	-	No
27	CA_2A-66A-66A-66A	2A-66A-66A, 66A-66A-66A	-	No
28	CA_48A-48A-66A-66A	48A-48A,	-	No

		48A-66A-66A		
29	CA_48A-48A-66B	48A-48A, 48A-66B	-	No
30	CA_48A-48A-66C	48A-48A, 48A-66C	-	No
31	CA_48A-48C-66A	48A-48C, 48A-66A, 48C-66A	-	No
32	CA_48C-66A-66A	48C-66A-66A	-	No
33	CA_48C-66B	48C-66B	-	No
34	CA_48C-66C	48C-66C	-	No
35	CA_48D-66A	48D-66A	-	No
36	CA_48E	48E	-	No
37	CA_4A-48D	4A-48D	-	No
38	CA_4A-4A-5B	4A-4A	-	No
39	CA_5A-48C-66A	48C-66A	-	No
40	CA_5A-48D	48D	-	No
41	CA_5A-5A-66A-66A	66A-66A	-	No
42	CA_5A-5A-66B	66B	-	No
43	CA_5A-5A-66C	66C	-	No
44	CA_5B-66A-66A	66A-66A	-	No
45	CA_5B-66B	66B	-	No
46	CA_5B-66C	66C	-	No

5CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_13A-48A-48D	48D	-	No
2	CA_13A-48C-48C	48C	-	No
3	CA_13A-48D-66A	48D, 66A	-	No
4	CA_13A-48E	-	-	No
5	CA_2A-13A-48D	2A, 48D	-	No
6	CA_2A-13A-66A-66B	2A-66A, 2A-66B, 66A-66B	-	No
7	CA_2A-2A-13A-66A-66A	2A-2A-66A, 2A-66A-66A	-	No
8	CA_2A-2A-13A-66B	2A-2A, 2A-66B	-	No

9	CA_2A-2A-5A-66A-66A	2A-2A-66A, 2A-66A-66A	-	No
10	CA_2A-2A-5A-66B	2A-2A, 2A-66B	-	No
11	CA_2A-2A-5A-66C	2A-2A, 2A-66C	-	No
12	CA_2A-48A-48D	2A-48A, 48D	-	No
13	CA_2A-48C-48C	2A-48C	-	No
14	CA_2A-48D-66A	48D, 2A-66A	-	No
15	CA_2A-48E	2A	-	No
16	CA_2A-5A-48D	2A, 48D	-	No
17	CA_2A-5A-5A-66A-66A	2A-66A-66A	-	No
18	CA_2A-5B-66A-66A	2A-66A-66A	-	No
19	CA_2A-5B-66B	2A-66B	-	No
20	CA_2A-5B-66C	2A-66C	-	No
21	CA_48A-48C-66B	48A-48C, 48A-66B	-	No
22	CA_48A-48C-66C	48A-48C, 48A-66C	-	No
23	CA_48A-48D-66A	48D, 48A-66A	-	No
24	CA_48A-48E	48A	-	No
25	CA_48C-48C-66A	48C-66A	-	No
26	CA_48C-48D	48C, 48D	-	No
27	CA_48E-66A	66A	-	No
28	CA_4A-48E	4A	-	No
29	CA_5A-48D-66A	48D, 66A	-	No

➢ **LTE Downlink Carrier Aggregation Conducted Power**

1. According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink carrier aggregation active.
2. Uplink maximum output power with downlink carrier aggregation active does not show more than ¼ dB higher than the maximum output power without downlink carrier aggregation active, therefore SAR evaluation with downlink carrier aggregation active can be excluded.
3. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.

4. Selected highest measured power when downlink carrier aggregation is inactive for conducted power comparison with downlink carrier aggregation is active, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.
5. For non-contiguous intra-band CA, the SCC selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band.
6. For Intra-band, contiguous CA, the downlink channels selected to perform the uplink power measurement must satisfy
7. 3GPP channel spacing (5.4.1A of 3GPP TS 36.521 or equivalent) and channel bandwidth (5.4.2A) requirements.

$$\text{Nominal channel spacing} = \left\lfloor \frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1\left|BW_{Channel(1)} - BW_{Channel(2)}\right|}{0.6} \right\rfloor 0.3 \quad [\text{MHz}]$$

8. The output power of CA uplink & downlink refers to the annex E of this report.

15. 5G NR EN-DC Consideration

➢ **General Guidance**

1. It is only limited to operate at EN-DC (NSA) for 5G NR implementation according to the character of the device. SAR measurement should be performed separately for the limitations of the probe calculation factors.
2. When the EN-DC is active the output power of the LTE anchors is equal or less than the standalone carrier, therefore the LTE output power and SAR were estimated based on the standalone carrier to performed sim-TX analysis with 5G NR, WLAN and Bluetooth.
3. According to October 2020 TCB Workshop publication, EN-DC SAR assessment should follow:
   a. If the signal uplink 1-g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1-g SAR values are less than 1.45 W/kg no additional measurements need to be performed.
   b. If one or the signal uplink 1-g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1-g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in FCC KDB Publication 865664 D01. And PAG is required for this case.
   c. If the algebraic sum of the 1-g SAR values is > 1.45 W/kg additional measurements may have to be made. Submit a KDB inquiry for additional guidance and PAG is required for this case.
   d. When the algebraic sum of the 1-g SAR values is > 1.6 W/kg, SPLSR analysis procedure should be applied.

➢ **5G NR Anchor Combination**

5G-NR	EN-DC Combination	4G UL	5G-NR UL	SCS (kHz)	Maximum Bandwidth (MHz)
FDD	DC_2A-66A_n5A	2A, 66A	n5A	15	20
FDD	DC_13A_n66A	13A	n66A	15	40
FDD	DC_2A-13A_n66A	2A, 13A	n66A	15	40
FDD	DC_13A-66A_n66A	13A	n66A	15	40
FDD	DC_2A-66A-66A_n66A	2A	n66A	15	40
FDD	DC_5A-66A-66A_n66A	5A	n66A	15	40
FDD	DC_5A_n2A	5A	n2A	15	20
FDD	DC_2A_n5A	2A	n5A	15	20
FDD	DC_66A_n5A	66A	n5A	15	20
FDD	DC_2A_n66A	2A	n66A	15	40
FDD	DC_5A_n66A	5A	n66A	15	40
FDD	DC_2A-5A_n2A	5A	n2A	15	20
FDD	DC_5A-66A_n2A	5A, 66A	n2A	15	20
FDD	DC_2A-2A_n5A	2A	n5A	15	20
FDD	DC_66A-66A_n5A	66A	n5A	15	20

FDD	DC_2A-5A_n66A	2A, 5A	n66A	15	40
FDD	DC_2A-66A_n66A	2A	n66A	15	40
FDD	DC_5A-66A_n66A	5A	n66A	15	40
FDD	DC_2A-2A_n66A	2A	n66A	15	40
FDD	DC_5A-66A-66A_n2A	5A, 66A	n2A	15	20
FDD	DC_2A-2A-66A_n5A	2A, 66A	n5A	15	20
FDD	DC_2A-66A-66A_n5A	2A, 66A	n5A	15	20
FDD	DC_66A-66A-66A_n5A	66A	n5A	15	20
FDD	DC_2A-2A-5A_n66A	2A, 5A	n66A	15	40
FDD	DC_2A-2A-66A-66A_n5A	2A, 66A	n5A	15	20
FDD	DC_66A_n2A	66A	n2A	15	20
FDD	DC_2A-66A_n2A	66A	n2A	15	20
FDD	DC_13A_n2A	13A	n2A	15	20
FDD	DC_48A_n5A	48A	n5A	15	20
FDD	DC_13A-66A_n2A	13A, 66A	n2A	15	20
FDD	DC_2A-48A_n5A	2A	n5A	15	20
FDD	DC_2A-48A_n66A	2A	n66A	15	40
FDD	DC_48A-66A_n5A	66A	n5A	15	20
FDD	DC_13A-48A_n66A	13A	n66A	15	40
FDD	DC_13A-48A_n2A	13A	n2A	15	20
FDD	DC_48D-66A_n5A	66A	n5A	15	20
FDD	DC_13A-48D_n66A	13A	n66A	15	40
FDD	DC_13A-48D_n2A	13A	n2A	15	20
FDD	DC_2A-48D_n5A	2A	n5A	15	20
FDD	DC_2A-2A-66A_n66A	2A	n66A	15	40
FDD	DC_2A-13A_n2A	13A	n2A	15	20
FDD	DC_2A-2A-13A_n66A	2A, 13A	n66A	15	40
FDD	DC_13A-66A-66A_n66A	13A	n66A	15	40
FDD	DC_13A-66A-66A_n2A	13A, 66A	n2A	15	20
TDD	DC_2A_n77A	2A	n77A	30	100
TDD	DC_5A_n77A	5A	n77A	30	100
TDD	DC_13A_n77A	13A	n77A	30	100
TDD	DC_66A_n77A	66A	n77A	30	100
TDD	DC_2A-5A_n77A	2A, 5A	n77A	30	100
TDD	DC_2A-13A_n77A	2A, 13A	n77A	30	100
TDD	DC_2A-66A_n77A	2A, 66A	n77A	30	100
TDD	DC_5A-66A_n77A	5A, 66A	n77A	30	100
TDD	DC_13A-66A_n77A	13A, 66A	n77A	30	100
TDD	DC_66A-66A_n77A	66A	n77A	30	100
TDD	DC_2A-2A_n77A	2A	n77A	30	100
TDD	DC_2A-48A_n77A	2A	n77A	30	100
TDD	DC_13A-48A_n77A	13A	n77A	30	100
TDD	DC_48A-66A_n77A	66A	n77A	30	100

TDD	DC_2A-66A-66A_n77A	2A, 66A	n77A	30	100
TDD	DC_5A-66A-66A_n77A	5A, 66A	n77A	30	100
TDD	DC_13A-66A-66A_n77A	13A, 66A	n77A	30	100
TDD	DC_2A-2A-13A_n77A	2A, 13A	n77A	30	100
TDD	DC_2A-2A-66A_n77A	2A, 66A	n77A	30	100
TDD	DC_66A-66A-66A_n77A	66A	n77A	30	100
TDD	DC_2A-2A-5A_n77A	2A, 5A	n77A	30	100
FDD+TDD	DC_66A_n5A-n77A	66A	n5A/n5A, n77A	15/30	20/100
FDD+TDD	DC_2A_n5A-n77A	2A	n5A/n5A, n77A	15/30	20/100
FDD+TDD	DC_13A_n2A-n77A	13A	n2A/n2A, n77A	15/30	20/100
FDD+TDD	DC_66A-66A_n5A-n77A	66A	n5A/n5A, n77A	15/30	20/100
FDD	DC_66A-66A_n2A	66A	n2A	15	20
FDD	DC_2A-66A-66A_n2A	66A	n2A	15	20
FDD	DC_48C-66A_n5A	66A	n5A	15	20
FDD	DC_2A-48D_n66A	2A	n66A	15	40
FDD	DC_2A-48C_n66A	2A	n66A	15	40
FDD+TDD	DC_13A_n66A-n77A	13A	n66A/n66A, n77A	15/30	40/100
FDD+TDD	DC_66A_n2A-n77A	66A	n2A/n2A, n77A	15/30	20/100
TDD	DC_2A-2A-66A-66A_n77A	2A, 66A	n77A	30	100
FDD+TDD	DC_2A_n66A-n77A	2A	n66A/n66A, n77A	15/30	40/100
FDD	DC_2A-48C_n5A	2A	n5A	15	20
FDD	DC_2A-2A-66A-66A_n66A	2A	n66A	15	40
FDD+TDD	DC_5A_n2A-n77A	5A	n2A/n2A, n77A	15/30	20/100
FDD+TDD	DC_5A_n66A-n77A	5A	n66A/n66A, n77A	15/30	40/100
FDD+TDD	DC_66A-66A_n2A-n77A	66A	n2A/n2A, n77A	15/30	20/100
FDD+TDD	DC_2A-2A_n5A-n77A	2A	n5A/n5A, n77A	15/30	20/100
FDD+TDD	DC_2A-2A_n66A-n77A	2A	n66A/n66A, n77A	15/30	40/100
TDD	DC_2A-48D_n77A	2A	n77A	30	100
TDD	DC_48D-66A_n77A	66A	n77A	30	100
FDD	DC_48A-66A_n2A	66A	n2A	15	20
FDD	DC_48C_n5A	48A	n5A	15	20
FDD	DC_48C-66A_n2A	66A	n2A	15	20
FDD	DC_48D_n5A	48A	n5A	15	20
FDD	DC_48D-66A_n2A	66A	n2A	15	20
FDD	DC_48E_n5A	48A	n5A	15	20

TDD	DC_2A-48C_n77A	2A	n77A	30	100
TDD	DC_48C-66A_n77A	66A	n77A	30	100
FDD	DC_66A-66A-66A_n2A	66A	n2A	15	20
TDD	DC_5A-48A_n77A	5A	n77A	30	100
TDD	DC_5A-48C_n77A	5A	n77A	30	100
TDD	DC_13A-48C_n77A	13A	n77A	30	100
TDD	DC_5A-48D_n77A	5A	n77A	30	100
TDD	DC_13A-48D_n77A	13A	n77A	30	100
FDD	DC_48E-66A_n5A	66A	n5A	15	20
FDD	DC_13A-48E_n66A	13A	n66A	15	40
FDD	DC_13A-48E_n2A	13A	n2A	15	20
FDD	DC_2A-48E_n5A	2A	n5A	15	20
FDD	DC_2A-48E_n66A	2A	n66A	15	40
FDD	DC_48E-66A_n2A	66A	n2A	15	20
TDD	DC_2A-48E_n77A	2A	n77A	30	100
TDD	DC_48E-66A_n77A	66A	n77A	30	100

➢ **Maximum Power for EN-DC**

EN-DC Configuration	LTE Signal Carrier				5G NR		
	Band	BW (MHz)	Maximum Power(dBm)		Band	BW (MHz)	Maximum Power (dBm)
			Standalone	EN-DC Active			EN-DC Active
EN-DC_5A_n2	5	10	24.0	24.0	n2	20	21.5
EN-DC_13A_n2	13	10	23.0	23.0	n2	20	21.5
EN-DC_66A_n2	66	20	22.5	22.5	n2	20	21.5
EN-DC_2A_n5	2	20	22.5	22.5	n5	20	23
EN-DC_48A_n5	48	20	23.0	23.0	n5	20	23
EN-DC_66A_n5	66	20	22.5	22.5	n5	20	23
EN-DC_2A_n66	2	20	22.5	22.5	n66	40	21.5
EN-DC_5A_n66	5	10	24.0	24.0	n66	40	21.5
EN-DC_13A_n66	13	10	23.0	23.0	n66	40	21.5
EN-DC_2A_n77	2	20	22.5	22.5	n77	100	26
EN-DC_5A_n77	5	1	24.0	24.0	n77	100	26
EN-DC_13A_n77	13	10	23.0	23.0	n77	100	26
EN-DC_66A_n77	66	20	22.5	22.5	n77	100	26

16. Hotspot Mode Evaluation

➢ **EUT Antenna Location**

The location of antenna was recorded in annex B
SpeedX-ANT 0: TRX: WCDMA Band II/V; LTE Band 2/4/5/7/12/13/66; 5G NR (NSA) n5 SpeedX-ANT 1: DRX: WCDMA Band II/V; LTE Band 2/4/5/7/12/13/66; 5G NR (NSA) n5 SpeedX-ANT 2: TRX1: LTE Band 48; PRX: LTE Band 2/4/7/66 MIMO SpeedX-ANT 3: DRX: LTE Band 2/4/7/66/48 MIMO; 5G NR (NSA) n77 MIMO SpeedX-ANT 4: TRX1: LTE Band 2/4/66; 5G NR (NSA) n2/66 SpeedX-ANT 5: TRX0: LTE Band 48; 5G NR (NSA) n77 SpeedX-ANT 6: DRX: LTE Band 48; 5G NR (NSA) n77 GPS L1 SpeedX-WIFI 0: WLAN 2.4GHz/5GHz SpeedX-WIFI 1: WLAN 2.4GHz/5GHz Module: 5G n260/n261

- **EUT Antenna Distance**

Antenna Location	Front	Back	Left	Right	Top	Bottom
ANT 0	＜5mm	＜5mm	＜5mm	＞25mm	＜25mm	＞25mm
ANT 2	＜5mm	＜5mm	＞25mm	＞25mm	＞25mm	＜5mm
ANT 4	＜5mm	＜5mm	＞25mm	＞25mm	＞25mm	＜5mm
ANT 5	＜5mm	＜5mm	＞25mm	＞25mm	＜5mm	＞25mm
WIFI 0	＜5mm	＜5mm	＞25mm	＞25mm	＜5mm	＞25mm
WIFI 1	＜5mm	＜5mm	＞25mm	＞25mm	＞25mm	＜5mm

- **Hotspot Evaluation**

Assessment	Hotspot Side for SAR Test Distance: 10mm					
Antennas	Front	Back	Left	Right	Top	Bottom
ANT 0	Yes	Yes	Yes	No	Yes	No
ANT 2	Yes	Yes	No	No	No	Yes
ANT 4	Yes	Yes	No	No	No	Yes
ANT 5	Yes	Yes	No	No	Yes	No
WIFI 0	Yes	Yes	No	No	Yes	No
WIFI 1	Yes	Yes	No	No	No	Yes

Note :

1. The SAR evaluation procedures for Portable Devices with Wireless Router function is according to KDB 941225 D06 Hotspot SAR v02r01.
2. Head/Body-worn/Hotspot mode SAR assessments are required.
3. Referring to KDB 941225 D06, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.
4. For WWAN antennas, all of the surfaces or edges will be tested though they are greater than 25mm between the antennas and surfaces or edges in this report.
5. For WIFI 0 bands, all of surface or edges would be tested except the bottom side, left side and right side in this report.
6. For WIFI 1 bands, all of surface or edges would be tested except the top side, left side and right side in this report

17. Block Diagram of the Tests to be Performed

17.1. Body

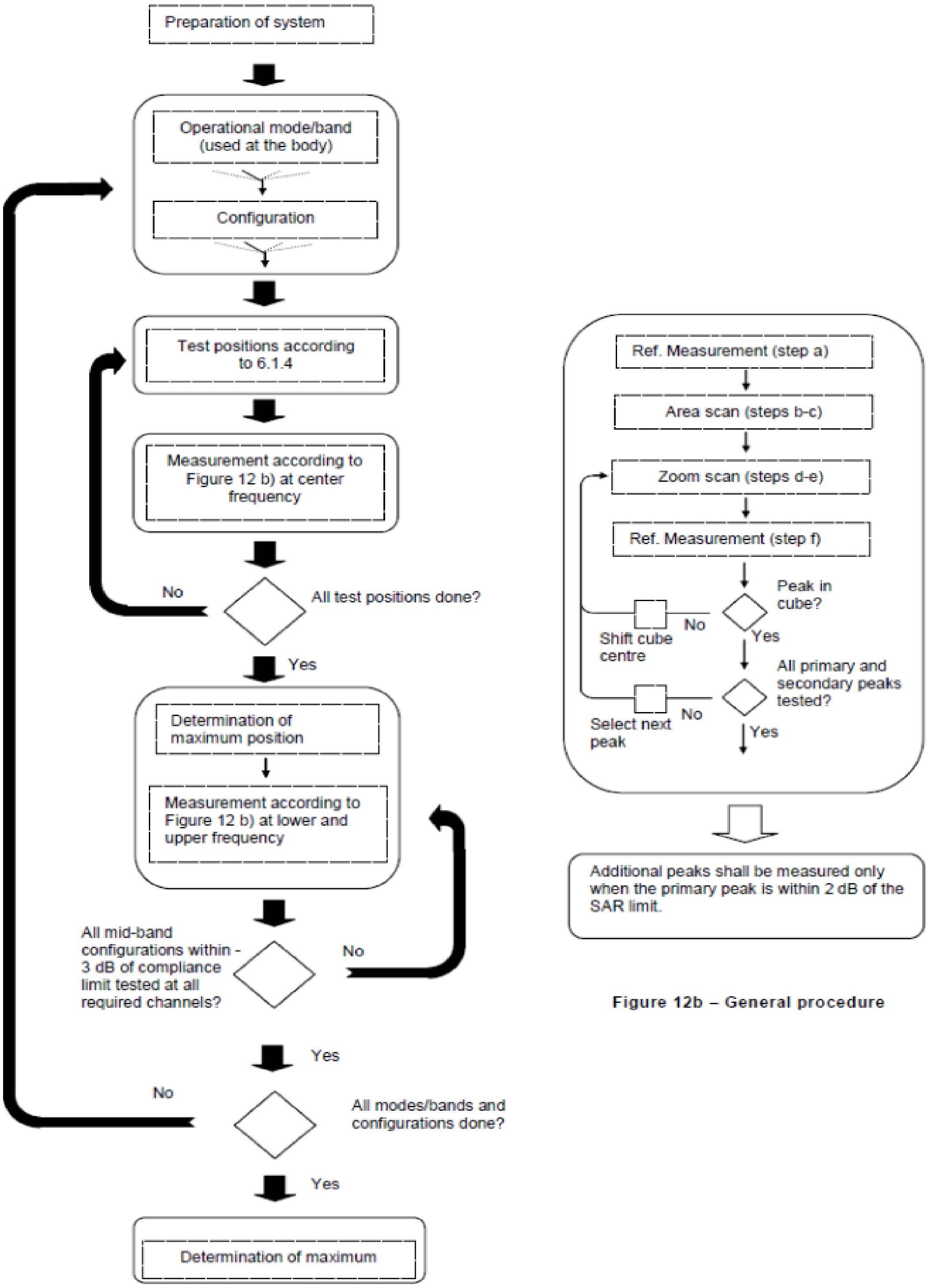


Figure 12b – General procedure

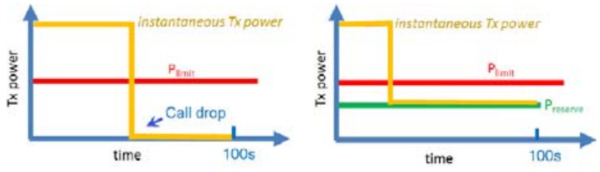
18. Smart Transmit Algorithm

FCC SAR limit is defined based on time average RF exposure. Qualcomm® Smart Transmit algorithm developed by Qualcomm, when running in a wireless device, will ensure the wireless device is in compliance with IN limit of SAR averaged over a defined time window, denoted as SAR_time_window, at all times. The Smart Transmit algorithm will not only ensure the wireless device to comply with RF exposure requirement, but also will improve the user experience and network performance.

For a given wireless device, once the SAR of the wireless device is characterized at a transmit power level via SAR measurement, SAR at a different power level for the characterized configuration(s) can be scaled by the change in the corresponding power level. Therefore, for a characterized device, SAR compliance can be achieved through transmit power control and management.

The basic concept of the Smart Transmit algorithm by Qualcomm is that if time-averaged transmit power approaches the Plimit, then the modem needs to limit instantaneous transmit power to make sure that the time-averaged transmit power does not exceed the Plimit in any SAR_time_window (i.e., the time-averaged SAR complies with the CE SAR limit in any SAR_time_window). The wireless device can instantaneously transmit at high transmit powers and exceed the Plimit for a short duration before limiting the power to maintain the time-averaged transmit power under the Plimit.

The Smart Transmit algorithm can be configured to manage the instantaneous transmit power (Tx power) to keep the time-averaged power to not exceed Plimit. To avoid dropping the radio link, Smart Transmit algorithm starts the power limiting enforcement earlier in time to back off the Tx power to a reserve level (denoted as Preserve) so that wireless device can maintain the radio link at a minimum reserve power level for as long as needed and at the same time ensure that the time-averaged Tx power over any SAR_time_window is less than Plimit at all times (see Figure 1-1(b)). At all times, Smart Transmit meets the below equation:



(a) (b)

$$time\ avg.Tx\ power = \frac{1}{T}\int_{t}^{t+T} inst.Tx\ power(t)\,dt \le P_{limit}$$

Figure 1-1 Smart Transmit Operation: (a) Transmit at high power when needed and permitted; (b) Transmit with reserve power to support continuous transmission at a minimum power level (Preserve)

where, □ime avg.□x power is the power averaged between t and t+T time period; T is SAR_time_window; inst. Tx power (t) is the instantaneous transmit power at t time instant; □limit is the predefined time averaged power limit.

19. Proximity Sensor Considerations

19.1. Proximity Sensor Triggering Distances

➢ **P-sensor Triggering Distance Testing**

The EUT should be moved further away from and toward the flat phantom that fill with the tissue simulating liquid to determine the proximity sensor triggering distances. Conducted power is monitored qualitatively to identify the general triggering characteristics and recorded quantitatively, versus spacing, as required by the procedures.

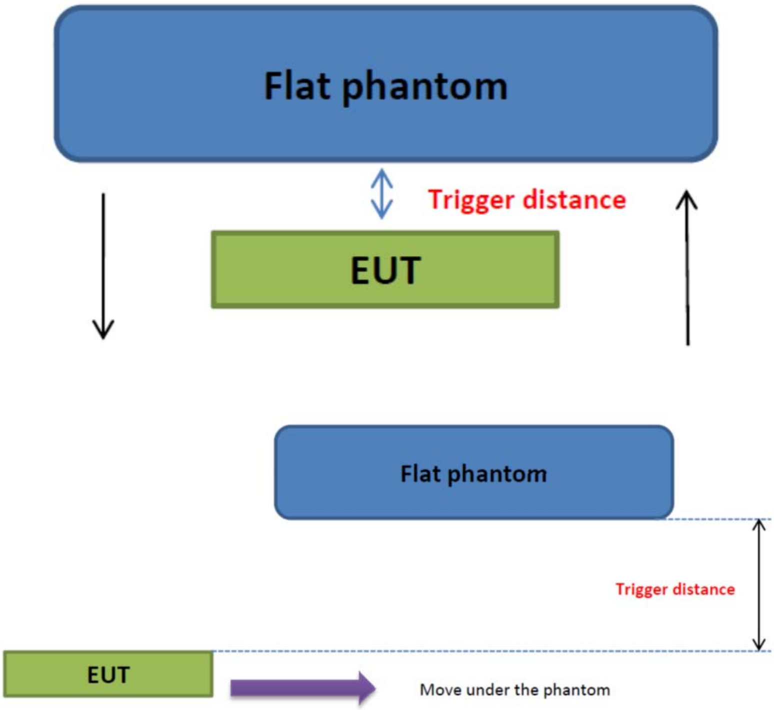


Fig.20.1 Illustration for proximity sensor trigger

➢ **P-sensor Triggering Distance**

< WWAN>

Proximity Sensor Trigger Distance (mm)						
Exposure Position	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Minimum	32	30	38	28	32	32

19.2. Proximity Sensor Coverage

Proximity sensors are not normally designed to cover the entire back surface or edges of a MIFI. The sensing regions are usually limited to areas near the sensor element. If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For P-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”. Illustrating in the internal photo exhibit, although the sensor spatially offset, there is no trigger condition where the antenna is next to the user, the sensor is laterally further away, therefore proximity sensor coverage testing is not required. This procedure is not required since the antenna, sensor and peak SAR location is overlapped with the sensor.

20. Test Results List

20.1. Test Guidance

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)".
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor.
   d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor.
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   a. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   b. ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   c. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.
5. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for tablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
6. Per KDB248227 D01v02r02, a Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies required for operations in the U.S. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic

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

7. For CA intra-band uplink, SAR measurement was performed at the worst condition of standalone carrier, and it was performed separately for CA inter-band uplink according to the TCB workshop publication in October 2018.
8. The CA intra-band uplink and 5G NR SAR measurement procedure should be followed the TCB workshop publication in October 2020:
   a. If the signal uplink 1-g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1-g SAR values are less than 1.45 W/kg no additional measurements need to be performed.
   b. If one or the signal uplink 1-g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1-g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in FCC KDB Publication 865664 D01. And PAG is required for this case.
   c. If the algebraic sum of the 1-g SAR values is > 1.45 W/kg additional measurements may have to be made. Submit a KDB inquiry for additional guidance and PAG is required for this case.
   d. When the algebraic sum of the 1-g SAR values is > 1.6 W/kg, SPLSR analysis procedure should be applied.
9. When this device is close to human body the sensor will be active automatically and the reduced power of WWAN applied.

20.2. Body SAR Data

➢ WCDMA Body SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Sensor on/Reduced Power for ANT 0								
	Band II/RMC 12.2Kbps	Front Side	9400	19.28	20.00	1.180	0.245	0.289
	Band II/RMC 12.2Kbps	Back Side	9400	19.28	20.00	1.180	0.491	0.580
1#	Band II/RMC 12.2Kbps	Left Side	9400	19.28	20.00	1.180	0.784	0.925
	Band II/RMC 12.2Kbps	Right Side	9400	19.28	20.00	1.180	0.136	0.161
	Band II/RMC 12.2Kbps	Top Side	9400	19.28	20.00	1.180	0.211	0.249
	Band II/RMC 12.2Kbps	Bottom Side	9400	19.28	20.00	1.180	0.031	0.037
	Band II/RMC 12.2Kbps	Left Side	9262	19.21	20.00	1.199	0.762	0.914
	Band II/RMC 12.2Kbps	Left Side	9538	19.25	20.00	1.189	0.635	0.755
Sensor off/Full Power for ANT 0								
	Band V/RMC 12.2Kbps	Front Side	4182	24.33	25.00	1.167	0.182	0.212
2#	Band V/RMC 12.2Kbps	Back Side	4182	24.33	25.00	1.167	0.258	0.301
	Band V/RMC 12.2Kbps	Left Side	4182	24.33	25.00	1.167	0.124	0.145
	Band V/RMC 12.2Kbps	Right Side	4182	24.33	25.00	1.167	0.110	0.128
	Band V/RMC 12.2Kbps	Top Side	4182	24.33	25.00	1.167	0.228	0.266
	Band V/RMC 12.2Kbps	Bottom Side	4182	24.33	25.00	1.167	0.247	0.288

➢ LTE QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Sensor on/Reduced Power for ANT 0								
	LTE Band 2/1RB#0 20M	Front Side	18900	18.59	19.50	1.233	0.215	0.265
	LTE Band 2/1RB#0 20M	Back Side	18900	18.59	19.50	1.233	0.451	0.556
3#	LTE Band 2/1RB#0 20M	Left Side	18900	18.59	19.50	1.233	0.580	0.715
	LTE Band 2/1RB#0 20M	Right Side	18900	18.59	19.50	1.233	0.100	0.123
	LTE Band 2/1RB#0 20M	Top Side	18900	18.59	19.50	1.233	0.175	0.216
	LTE Band 2/1RB#0 20M	Bottom Side	18900	18.59	19.50	1.233	0.030	0.037
	LTE Band 2/50RB#0 20M	Front Side	18900	17.65	18.50	1.216	0.178	0.216
	LTE Band 2/50RB#0 20M	Back Side	18900	17.65	18.50	1.216	0.381	0.463
	LTE Band 2/50RB#0 20M	Left Side	18900	17.65	18.50	1.216	0.433	0.527
	LTE Band 2/50RB#0 20M	Right Side	18900	17.65	18.50	1.216	0.082	0.100
	LTE Band 2/50RB#0 20M	Top Side	18900	17.65	18.50	1.216	0.154	0.187
	LTE Band 2/50RB#0 20M	Bottom Side	18900	17.65	18.50	1.216	0.025	0.030

Sensor on/Reduced Power for ANT 4								
	LTE Band 2/1RB#0 20M	Front Side	18900	21.63	22.50	1.222	0.281	0.343
	LTE Band 2/1RB#0 20M	Back Side	18900	21.63	22.50	1.222	0.362	0.442
	LTE Band 2/1RB#0 20M	Left Side	18900	21.63	22.50	1.222	0.052	0.064
	LTE Band 2/1RB#0 20M	Right Side	18900	21.63	22.50	1.222	0.164	0.200
	LTE Band 2/1RB#0 20M	Top Side	18900	21.63	22.50	1.222	0.044	0.054
	LTE Band 2/1RB#0 20M	Bottom Side	18900	21.63	22.50	1.222	0.384	0.469
	LTE Band 2/50RB#0 20M	Front Side	18900	20.69	21.50	1.205	0.232	0.280
	LTE Band 2/50RB#0 20M	Back Side	18900	20.69	21.50	1.205	0.306	0.369
	LTE Band 2/50RB#0 20M	Left Side	18900	20.69	21.50	1.205	0.034	0.041
	LTE Band 2/50RB#0 20M	Right Side	18900	20.69	21.50	1.205	0.144	0.174
	LTE Band 2/50RB#0 20M	Top Side	18900	20.69	21.50	1.205	0.038	0.046
	LTE Band 2/50RB#0 20M	Bottom Side	18900	20.69	21.50	1.205	0.322	0.388
Sensor off/Full Power for ANT 0								
	LTE Band 5/1RB#0 10M	Front Side	20525	23.37	24.00	1.156	0.271	0.313
4#	LTE Band 5/1RB#0 10M	Back Side	20525	23.37	24.00	1.156	0.337	0.390
	LTE Band 5/1RB#0 10M	Left Side	20525	23.37	24.00	1.156	0.090	0.104
	LTE Band 5/1RB#0 10M	Right Side	20525	23.37	24.00	1.156	0.085	0.098
	LTE Band 5/1RB#0 10M	Top Side	20525	23.37	24.00	1.156	0.297	0.343
	LTE Band 5/1RB#0 10M	Bottom Side	20525	23.37	24.00	1.156	0.311	0.360
	LTE Band 5/25RB#0 10M	Front Side	20525	22.35	23.00	1.161	0.177	0.206
	LTE Band 5/25RB#0 10M	Back Side	20525	22.35	23.00	1.161	0.266	0.309
	LTE Band 5/25RB#0 10M	Left Side	20525	22.35	23.00	1.161	0.055	0.064
	LTE Band 5/25RB#0 10M	Right Side	20525	22.35	23.00	1.161	0.046	0.053
	LTE Band 5/25RB#0 10M	Top Side	20525	22.35	23.00	1.161	0.231	0.268
	LTE Band 5/25RB#0 10M	Bottom Side	20525	22.35	23.00	1.161	0.250	0.290
	LTE Band 5B/1RB#0 10M+10M	Back Side	20476	23.11	24.00	1.227	0.300	0.368
Sensor on/Reduced Power for ANT 0								
	LTE Band 7/1RB#0 20M	Front Side	21100	21.06	22.00	1.242	0.217	0.269
5#	LTE Band 7/1RB#0 20M	Back Side	21100	21.06	22.00	1.242	0.435	0.540
	LTE Band 7/1RB#0 20M	Left Side	21100	21.06	22.00	1.242	0.200	0.248
	LTE Band 7/1RB#0 20M	Right Side	21100	21.06	22.00	1.242	0.049	0.061
	LTE Band 7/1RB#0 20M	Top Side	21100	21.06	22.00	1.242	0.219	0.272
	LTE Band 7/1RB#0 20M	Bottom Side	21100	21.06	22.00	1.242	0.059	0.073
	LTE Band 7/50RB#0 20M	Front Side	21100	20.19	21.00	1.205	0.176	0.212
	LTE Band 7/50RB#0 20M	Back Side	21100	20.19	21.00	1.205	0.330	0.398
	LTE Band 7/50RB#0 20M	Left Side	21100	20.19	21.00	1.205	0.156	0.188
	LTE Band 7/50RB#0 20M	Right Side	21100	20.19	21.00	1.205	0.026	0.031

	LTE Band 7/50RB#0 20M	Top Side	21100	20.19	21.00	1.205	0.193	0.233
	LTE Band 7/50RB#0 20M	Bottom Side	21100	20.19	21.00	1.205	0.033	0.040
Sensor on/Reduced Power for ANT 0								
	LTE Band 12/1RB#0 10M	Front Side	23095	22.47	23.00	1.130	0.412	0.465
6#	LTE Band 12/1RB#0 10M	Back Side	23095	22.47	23.00	1.130	0.493	0.557
	LTE Band 12/1RB#0 10M	Left Side	23095	22.47	23.00	1.130	0.047	0.053
	LTE Band 12/1RB#0 10M	Right Side	23095	22.47	23.00	1.130	0.035	0.040
	LTE Band 12/1RB#0 10M	Top Side	23095	22.47	23.00	1.130	0.329	0.372
	LTE Band 12/1RB#0 10M	Bottom Side	23095	22.47	23.00	1.130	0.299	0.338
	LTE Band 12/25RB#0 10M	Front Side	23095	21.63	22.00	1.089	0.392	0.427
	LTE Band 12/25RB#0 10M	Back Side	23095	21.63	22.00	1.089	0.432	0.470
	LTE Band 12/25RB#0 10M	Left Side	23095	21.63	22.00	1.089	0.040	0.044
	LTE Band 12/25RB#0 10M	Right Side	23095	21.63	22.00	1.089	0.026	0.028
	LTE Band 12/25RB#0 10M	Top Side	23095	21.63	22.00	1.089	0.263	0.286
	LTE Band 12/25RB#0 10M	Bottom Side	23095	21.63	22.00	1.089	0.242	0.264
Sensor on/Reduced Power for ANT 0								
	LTE Band 13/1RB#0 10M	Front Side	23230	22.41	23.00	1.146	0.423	0.485
7#	LTE Band 13/1RB#0 10M	Back Side	23230	22.41	23.00	1.146	0.478	0.548
	LTE Band 13/1RB#0 10M	Left Side	23230	22.41	23.00	1.146	0.062	0.071
	LTE Band 13/1RB#0 10M	Right Side	23230	22.41	23.00	1.146	0.053	0.061
	LTE Band 13/1RB#0 10M	Top Side	23230	22.41	23.00	1.146	0.296	0.339
	LTE Band 13/1RB#0 10M	Bottom Side	23230	22.41	23.00	1.146	0.316	0.362
	LTE Band 13/25RB#0 10M	Front Side	23230	21.50	22.00	1.122	0.422	0.473
	LTE Band 13/25RB#0 10M	Back Side	23230	21.50	22.00	1.122	0.433	0.486
	LTE Band 13/25RB#0 10M	Left Side	23230	21.50	22.00	1.122	0.052	0.058
	LTE Band 13/25RB#0 10M	Right Side	23230	21.50	22.00	1.122	0.033	0.037
	LTE Band 13/25RB#0 10M	Top Side	23230	21.50	22.00	1.122	0.237	0.266
	LTE Band 13/25RB#0 10M	Bottom Side	23230	21.50	22.00	1.122	0.257	0.288
Sensor off/Full Power for ANT 2								
	LTE Band 48/1RB#0 20M	Front Side	55990	22.15	23.00	1.216	0.151	0.185
	LTE Band 48/1RB#0 20M	Back Side	55990	22.15	23.00	1.216	0.170	0.208
	LTE Band 48/1RB#0 20M	Left Side	55990	22.15	23.00	1.216	0.075	0.092
	LTE Band 48/1RB#0 20M	Right Side	55990	22.15	23.00	1.216	0.069	0.084
	LTE Band 48/1RB#0 20M	Top Side	55990	22.15	23.00	1.216	0.147	0.180
	LTE Band 48/1RB#0 20M	Bottom Side	55990	22.15	23.00	1.216	0.075	0.092
	LTE Band 48/50RB#0 20M	Front Side	55990	21.17	22.00	1.211	0.139	0.169
	LTE Band 48/50RB#0 20M	Back Side	55990	21.17	22.00	1.211	0.160	0.195
	LTE Band 48/50RB#0 20M	Left Side	55990	21.17	22.00	1.211	0.066	0.080

	LTE Band 48/50RB#0 20M	Right Side	55990	21.17	22.00	1.211	0.056	0.068
	LTE Band 48/50RB#0 20M	Top Side	55990	21.17	22.00	1.211	0.128	0.156
	LTE Band 48/50RB#0 20M	Bottom Side	55990	21.17	22.00	1.211	0.063	0.077
Sensor off/Full Power for ANT 5								
	LTE Band 48/1RB#0 20M	Front Side	55990	22.03	23.00	1.250	0.148	0.186
8#	LTE Band 48/1RB#0 20M	Back Side	55990	22.03	23.00	1.250	0.180	0.226
	LTE Band 48/1RB#0 20M	Left Side	55990	22.03	23.00	1.250	0.059	0.074
	LTE Band 48/1RB#0 20M	Right Side	55990	22.03	23.00	1.250	0.173	0.218
	LTE Band 48/1RB#0 20M	Top Side	55990	22.03	23.00	1.250	0.149	0.187
	LTE Band 48/1RB#0 20M	Bottom Side	55990	22.03	23.00	1.250	0.060	0.075
	LTE Band 48/50RB#0 20M	Front Side	55990	21.21	22.00	1.199	0.122	0.147
	LTE Band 48/50RB#0 20M	Back Side	55990	21.21	22.00	1.199	0.173	0.209
	LTE Band 48/50RB#0 20M	Left Side	55990	21.21	22.00	1.199	0.043	0.052
	LTE Band 48/50RB#0 20M	Right Side	55990	21.21	22.00	1.199	0.132	0.159
	LTE Band 48/50RB#0 20M	Top Side	55990	21.21	22.00	1.199	0.111	0.134
	LTE Band 48/50RB#0 20M	Bottom Side	55990	21.21	22.00	1.199	0.045	0.054
	LTE Band 48C/1RB#0 20M+20M	Back Side	55891	22.12	23.00	1.225	0.172	0.212
Sensor on/Reduced Power for ANT 0								
	LTE Band 66/1RB#0 20M	Front Side	132322	16.62	17.50	1.225	0.201	0.246
	LTE Band 66/1RB#0 20M	Back Side	132322	16.62	17.50	1.225	0.433	0.530
9#	LTE Band 66/1RB#0 20M	Left Side	132322	16.62	17.50	1.225	0.610	0.747
	LTE Band 66/1RB#0 20M	Right Side	132322	16.62	17.50	1.225	0.034	0.042
	LTE Band 66/1RB#0 20M	Top Side	132322	16.62	17.50	1.225	0.110	0.135
	LTE Band 66/1RB#0 20M	Bottom Side	132322	16.62	17.50	1.225	0.043	0.053
	LTE Band 66/50RB#0 20M	Front Side	132322	15.56	16.50	1.242	0.154	0.191
	LTE Band 66/50RB#0 20M	Back Side	132322	15.56	16.50	1.242	0.345	0.428
	LTE Band 66/50RB#0 20M	Left Side	132322	15.56	16.50	1.242	0.452	0.561
	LTE Band 66/50RB#0 20M	Right Side	132322	15.56	16.50	1.242	0.041	0.051
	LTE Band 66/50RB#0 20M	Top Side	132322	15.56	16.50	1.242	0.063	0.078
	LTE Band 66/50RB#0 20M	Bottom Side	132322	15.56	16.50	1.242	0.025	0.031
	LTE Band 66B/1RB#0 15M+10M	Left Side	132398	16.75	17.50	1.189	0.583	0.693
	LTE Band 66C/50RB#0 20M+20M	Left Side	132323	16.78	17.50	1.180	0.596	0.703
Sensor on/Reduced Power for ANT 4								
	LTE Band 66/1RB#0 20M	Front Side	132322	21.75	22.50	1.189	0.301	0.358
	LTE Band 66/1RB#0 20M	Back Side	132322	21.75	22.50	1.189	0.347	0.412

	LTE Band 66/1RB#0 20M	Left Side	132322	21.75	22.50	1.189	0.052	0.062
	LTE Band 66/1RB#0 20M	Right Side	132322	21.75	22.50	1.189	0.076	0.090
	LTE Band 66/1RB#0 20M	Top Side	132322	21.75	22.50	1.189	0.048	0.057
	LTE Band 66/1RB#0 20M	Bottom Side	132322	21.75	22.50	1.189	0.388	0.461
	LTE Band 66/50RB#0 20M	Front Side	132322	20.69	21.50	1.205	0.283	0.341
	LTE Band 66/50RB#0 20M	Back Side	132322	20.69	21.50	1.205	0.312	0.376
	LTE Band 66/50RB#0 20M	Left Side	132322	20.69	21.50	1.205	0.036	0.043
	LTE Band 66/50RB#0 20M	Right Side	132322	20.69	21.50	1.205	0.047	0.057
	LTE Band 66/50RB#0 20M	Top Side	132322	20.69	21.50	1.205	0.039	0.047
	LTE Band 66/50RB#0 20M	Bottom Side	132322	20.69	21.50	1.205	0.322	0.388

➢ **5G NR DFT-s-QPSK Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Sensor on/Reduced Power for ANT 4								
	5G NR n2/1RB#1 20M	Front Side	376000	21.39	22.00	1.151	0.200	0.230
	5G NR n2/1RB#1 20M	Back Side	376000	21.39	22.00	1.151	0.313	0.360
	5G NR n2/1RB#1 20M	Left Side	376000	21.39	22.00	1.151	0.029	0.033
	5G NR n2/1RB#1 20M	Right Side	376000	21.39	22.00	1.151	0.177	0.204
	5G NR n2/1RB#1 20M	Top Side	376000	21.39	22.00	1.151	0.027	0.031
10#	5G NR n2/1RB#1 20M	Bottom Side	376000	21.39	22.00	1.151	0.376	0.433
	5G NR n2/50RB#1 20M	Front Side	376000	20.90	22.00	1.288	0.143	0.184
	5G NR n2/50RB#1 20M	Back Side	376000	20.90	22.00	1.288	0.189	0.243
	5G NR n2/50RB#1 20M	Left Side	376000	20.90	22.00	1.288	0.015	0.019
	5G NR n2/50RB#1 20M	Right Side	376000	20.90	22.00	1.288	0.088	0.113
	5G NR n2/50RB#1 20M	Top Side	376000	20.90	22.00	1.288	0.016	0.021
	5G NR n2/50RB#1 20M	Bottom Side	376000	20.90	22.00	1.288	0.210	0.271
Sensor off/Full Power for ANT 0								
	5G NR n5/1RB#1 20M	Front Side	167300	22.99	23.50	1.125	0.481	0.541
11#	5G NR n5/1RB#1 20M	Back Side	167300	22.99	23.50	1.125	0.499	0.561
	5G NR n5/1RB#1 20M	Left Side	167300	22.99	23.50	1.125	0.077	0.087
	5G NR n5/1RB#1 20M	Right Side	167300	22.99	23.50	1.125	0.052	0.058
	5G NR n5/1RB#1 20M	Top Side	167300	22.99	23.50	1.125	0.230	0.259
	5G NR n5/1RB#1 20M	Bottom Side	167300	22.99	23.50	1.125	0.239	0.269
	5G NR n5/50RB#1 20M	Front Side	167300	22.68	23.50	1.208	0.268	0.324
	5G NR n5/50RB#1 20M	Back Side	167300	22.68	23.50	1.208	0.347	0.419
	5G NR n5/50RB#1 20M	Left Side	167300	22.68	23.50	1.208	0.063	0.076
	5G NR n5/50RB#1 20M	Right Side	167300	22.68	23.50	1.208	0.042	0.051

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	5G NR n5/50RB#1 20M	Top Side	167300	22.68	23.50	1.208	0.144	0.174
	5G NR n5/50RB#1 20M	Bottom Side	167300	22.68	23.50	1.208	0.147	0.178
Sensor on/Reduced Power for ANT 4								
	5G NR n66/1RB#1 40M	Front Side	349000	21.33	22.00	1.167	0.255	0.298
	5G NR n66/1RB#1 40M	Back Side	349000	21.33	22.00	1.167	0.349	0.407
	5G NR n66/1RB#1 40M	Left Side	349000	21.33	22.00	1.167	0.035	0.041
	5G NR n66/1RB#1 40M	Right Side	349000	21.33	22.00	1.167	0.089	0.104
	5G NR n66/1RB#1 40M	Top Side	349000	21.33	22.00	1.167	0.045	0.053
12#	5G NR n66/1RB#1 40M	Bottom Side	349000	21.33	22.00	1.167	0.426	0.497
	5G NR n66/108RB#1 40M	Front Side	349000	21.02	22.00	1.253	0.175	0.219
	5G NR n66/108RB#1 40M	Back Side	349000	21.02	22.00	1.253	0.276	0.346
	5G NR n66/108RB#1 40M	Left Side	349000	21.02	22.00	1.253	0.026	0.033
	5G NR n66/108RB#1 40M	Right Side	349000	21.02	22.00	1.253	0.044	0.055
	5G NR n66/108RB#1 40M	Top Side	349000	21.02	22.00	1.253	0.034	0.043
	5G NR n66/108RB#1 40M	Bottom Side	349000	21.02	22.00	1.253	0.296	0.371
Sensor off/Full Power for ANT 5								
	5G NR n77/1RB#1 100M	Front Side	633334	26.33	27.00	1.167	0.327	0.382
13#	5G NR n77/1RB#1 100M	Back Side	633334	26.33	27.00	1.167	0.434	0.506
	5G NR n77/1RB#1 100M	Left Side	633334	26.33	27.00	1.167	0.109	0.127
	5G NR n77/1RB#1 100M	Right Side	633334	26.33	27.00	1.167	0.117	0.137
	5G NR n77/1RB#1 100M	Top Side	633334	26.33	27.00	1.167	0.295	0.344
	5G NR n77/1RB#1 100M	Bottom Side	633334	26.33	27.00	1.167	0.111	0.130
	5G NR n77/135RB#1 100M	Front Side	633334	25.95	27.00	1.274	0.242	0.308
	5G NR n77/135RB#1 100M	Back Side	633334	25.95	27.00	1.274	0.366	0.466
	5G NR n77/135RB#1 100M	Left Side	633334	25.95	27.00	1.274	0.091	0.116
	5G NR n77/135RB#1 100M	Right Side	633334	25.95	27.00	1.274	0.094	0.120
	5G NR n77/135RB#1 100M	Top Side	633334	25.95	27.00	1.274	0.226	0.288
	5G NR n77/135RB#1 100M	Bottom Side	633334	25.95	27.00	1.274	0.085	0.108
Sensor off/Full Power for ANT 5								
	5G NR n77/1RB#1 100M	Front Side	656000	26.24	27.00	1.191	0.215	0.256
	5G NR n77/1RB#1 100M	Back Side	656000	26.24	27.00	1.191	0.241	0.287
	5G NR n77/1RB#1 100M	Left Side	656000	26.24	27.00	1.191	0.090	0.107
	5G NR n77/1RB#1 100M	Right Side	656000	26.24	27.00	1.191	0.108	0.129
	5G NR n77/1RB#1 100M	Top Side	656000	26.24	27.00	1.191	0.217	0.258
	5G NR n77/1RB#1 100M	Bottom Side	656000	26.24	27.00	1.191	0.070	0.083
	5G NR n77/135RB#1 100M	Front Side	656000	25.98	27.00	1.265	0.172	0.218
	5G NR n77/135RB#1 100M	Back Side	656000	25.98	27.00	1.265	0.193	0.244
	5G NR n77/135RB#1 100M	Left Side	656000	25.98	27.00	1.265	0.072	0.091

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	5G NR n77/135RB#1 100M	Right Side	656000	25.98	27.00	1.265	0.085	0.108
	5G NR n77/135RB#1 100M	Top Side	656000	25.98	27.00	1.265	0.144	0.182
	5G NR n77/135RB#1 100M	Bottom Side	656000	25.98	27.00	1.265	0.059	0.075

➢ **WLAN 2.4GHz/5GHz Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Full Power for WIFI 0								
	WLAN2.4GHz/802.11b	Front Side	1	15.01	16.00	1.256	0.128	0.161
	WLAN2.4GHz/802.11b	Back Side	1	15.01	16.00	1.256	0.129	0.162
	WLAN2.4GHz/802.11b	Top Side	1	15.01	16.00	1.256	0.130	0.163
Full Power for WIFI 1								
	WLAN2.4GHz/802.11b	Front Side	1	15.17	16.00	1.211	0.127	0.154
14#	WLAN2.4GHz/802.11b	Back Side	1	15.17	16.00	1.211	0.169	0.205
	WLAN2.4GHz/802.11b	Bottom Side	1	15.17	16.00	1.211	0.084	0.102
Full Power for MIMO								
	WLAN2.4GHz/802.11n20	Front Side	1	17.72	18.50	1.197	0.135	0.162
	WLAN2.4GHz/802.11n20	Back Side	1	17.72	18.50	1.197	0.165	0.198
	WLAN2.4GHz/802.11n20	Top Side	1	17.72	18.50	1.197	0.088	0.106
	WLAN2.4GHz/802.11n20	Bottom Side	1	17.72	18.50	1.197	0.072	0.086
Full Power for WIFI 0								
	WLAN5.2GHz/802.11ac20	Front Side	36	13.61	14.50	1.227	0.104	0.128
	WLAN5.2GHz/802.11ac20	Back Side	36	13.61	14.50	1.227	0.110	0.135
15#	WLAN5.2GHz/802.11ac20	Top Side	36	13.61	14.50	1.227	0.269	0.331
Full Power for WIFI 1								
	WLAN5.2GHz/802.11a	Front Side	36	14.23	15.00	1.194	0.083	0.100
	WLAN5.2GHz/802.11a	Back Side	36	14.23	15.00	1.194	0.092	0.111
	WLAN5.2GHz/802.11a	Bottom Side	36	14.23	15.00	1.194	0.088	0.106
Full Power for MIMO								
	WLAN5.2GHz/802.11ac20	Front Side	36	17.15	18.00	1.216	0.079	0.096
	WLAN5.2GHz/802.11ac20	Back Side	36	17.15	18.00	1.216	0.118	0.144
	WLAN5.2GHz/802.11ac20	Top Side	36	17.15	18.00	1.216	0.241	0.294
	WLAN5.2GHz/802.11ac20	Bottom Side	36	17.15	18.00	1.216	0.133	0.162
Full Power for WIFI 0								
	WLAN5.3GHz/802.11ac40	Front Side	54	13.78	14.50	1.180	0.096	0.114
	WLAN5.3GHz/802.11ac40	Back Side	54	13.78	14.50	1.180	0.126	0.149
	WLAN5.3GHz/802.11ac40	Top Side	54	13.78	14.50	1.180	0.350	0.414
Full Power for WIFI 1								

	WLAN5.3GHz/802.11n20	Front Side	52	14.01	15.00	1.256	0.092	0.116
	WLAN5.3GHz/802.11n20	Back Side	52	14.01	15.00	1.256	0.107	0.135
	WLAN5.3GHz/802.11n20	Bottom Side	52	14.01	15.00	1.256	0.094	0.118
Full Power for MIMO								
	WLAN5.3GHz/802.11n40	Front Side	54	17.33	18.00	1.167	0.135	0.158
	WLAN5.3GHz/802.11n40	Back Side	54	17.33	18.00	1.167	0.144	0.169
16#	WLAN5.3GHz/802.11n40	Top Side	54	17.33	18.00	1.167	0.393	0.460
	WLAN5.3GHz/802.11n40	Bottom Side	54	17.33	18.00	1.167	0.179	0.209
Full Power for WIFI 0								
	WLAN5.5GHz/802.11n20	Front Side	100	14.14	15.00	1.219	0.102	0.125
	WLAN5.5GHz/802.11n20	Back Side	100	14.14	15.00	1.219	0.152	0.186
17#	WLAN5.5GHz/802.11n20	Top Side	100	14.14	15.00	1.219	0.455	0.556
Full Power for WIFI 1								
	WLAN5.5GHz/802.11ax80 RU484	Front Side	122	13.68	14.50	1.208	0.068	0.082
	WLAN5.5GHz/802.11ax80 RU484	Back Side	122	13.68	14.50	1.208	0.072	0.087
	WLAN5.5GHz/802.11ax80 RU484	Bottom Side	122	13.68	14.50	1.208	0.046	0.056
Full Power for MIMO								
	WLAN5.5GHz/802.11ax80 RU484	Front Side	122	16.71	17.50	1.199	0.135	0.164
	WLAN5.5GHz/802.11ax80 RU484	Back Side	122	16.71	17.50	1.199	0.194	0.235
	WLAN5.5GHz/802.11ax80 RU484	Top Side	122	16.71	17.50	1.199	0.203	0.246
	WLAN5.5GHz/802.11ax80 RU484	Bottom Side	122	16.71	17.50	1.199	0.187	0.227
Full Power for WIFI 0								
	WLAN5.8GHz/802.11a	Front Side	149	13.98	14.50	1.127	0.199	0.226
	WLAN5.8GHz/802.11a	Back Side	149	13.98	14.50	1.127	0.283	0.322
	WLAN5.8GHz/802.11a	Top Side	149	13.98	14.50	1.127	0.386	0.439
Full Power for WIFI 1								
	WLAN5.8GHz/802.11ac20	Front Side	149	13.62	14.50	1.225	0.081	0.099
	WLAN5.8GHz/802.11ac20	Back Side	149	13.62	14.50	1.225	0.156	0.192
	WLAN5.8GHz/802.11ac20	Bottom Side	149	13.62	14.50	1.225	0.092	0.113
Full Power for MIMO								
	WLAN5.8GHz/802.11ax40	Front Side	151	16.89	17.50	1.151	0.190	0.219

	WLAN5.8GHz/802.11ax40	Back Side	151	16.89	17.50	1.151	0.296	0.342
18#	WLAN5.8GHz/802.11ax40	Top Side	151	16.89	17.50	1.151	0.404	0.466
	WLAN5.8GHz/802.11ax40	Bottom Side	151	16.89	17.50	1.151	0.191	0.220

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 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥ 0.8W/kg.
3. Per KDB 941225 D05v02r05, 100% RB allocation SAR measurement is not required when the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg.
4. Per KDB 248227 D01v02r02, for 802.11b DSSS , when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required in that exposure configuration.
5. Per KDB 248227 D01v02r02, OFDM SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
6. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
7. For TDD-LTE, the reported SAR should be scaled with the duty cycle scaling factor 1.006.
8. The WLAN 2.4GHz 802.11b reported 1g SAR (W/kg) should be scaled with the duty cycle scaling factor 1.000, WLAN 2.4GHz 802.11n20 with 1.003, WLAN 5GHz 802.11a with 1.008, WLAN 5GHz 802.11n with 1.003, WLAN 5GHz 802.11ac with 1.003, WLAN 5GHz 802.11ax-HEW40 with 1.003 and WLAN 5GHz 802.11ax-HEW80(RU 484) with 1.001(WIFI 1)/1.011(MIMO).

21. Simultaneous Transmission Evaluation

21.1. Simultaneous Transmission Consideration

No.	Simultaneous Transmission Consideration	Body
1	WWAN(3G/4G)+WLAN 2.4GHz/5GHz (SISO/MIMO)	Yes
2	WWAN(3G/4G)+WLAN 2.4GHz (SISO/MIMO)+WLAN 5GHz (SISO/MIMO)	Yes
3	WWAN(5G FR1 NSA)+WLAN 2.4GHz/5GHz (SISO/MIMO)	Yes
4	WWAN(5G FR1 NSA)+WLAN 2.4GHz (SISO/MIMO)+WLAN 5GHz (SISO/MIMO)	Yes
5	WWAN(5G FR2 NSA)+WLAN 2.4GHz/5GHz (SISO/MIMO)	Yes
6	WWAN(5G FR2 NSA)+WLAN 2.4GHz (SISO/MIMO)+WLAN 5GHz (SISO/MIMO)	Yes

Note:

1. When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of the WWAN and WLAN transmitters. 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. 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.

21.2. Simultaneous Transmission Analysis

The EUT supports simultaneous transmission of multiple radios. RF exposure compliance in simultaneous transmission scenarios is evaluated in this section.

It must be noted here that Qualcomm Smart Transmit time-averaging algorithm was applied to only WWAN, where the time-averaged power level is controlled so that RF exposure is ≤ SAR_design_target for sub-6 WWAN. Since there is total design-related uncertainty arising from TxAGC and device-to-device variation, the worst-case RF exposure should be determined by accounting for this uncertainty in the corresponding design target, thus, with 1dB of device uncertainty for sub-6 WWAN. Therefore, the worst-case RF exposure for this EUT is:

Worst-case Time-averaged RF Exposure for WWAN

Title	WWAN Wireless System
	Sub-6G
Maximum time-averaged power level	Plimit
Maximum time-averaged exposure	SAR_design_target=0.8W/kg (1g SAR)
Maximum Design-related uncertainty	1.0 dB
Worst-case time-averaged RF exposure	Reported SAR =1.0W/kg (1g)

Note:

The highest SAR value obtained from UL FCC SAR Test Report. For scenarios where (P_{limit} + 1.0dB uncertainty) ≥ P_{max} (maximum RF tune-up output power), time-averaged SAR exposure from Smart Transmit enabled EUT (at P_{limi}t) cannot exceed reported SAR corresponding to P_{max}.

RF exposure compliance with WWAN+WLAN simultaneous transmission scenarios is demonstrated for various radio configurations using below equation:

Total norm. RF exposure = norm. RF exposure from Smart Transmit enabled WWAN (norm. SAR from 4G + norm. SAR from 5G sub-6G) + norm. SAR from WLAN ≤ 1.0 normalized limit (1)

Smart Transmit algorithm in WWAN adds directly the time-averaged RF exposure from 4G and time-averaged RF exposure from 5G sub-6G, i.e.,

norm. RF exposure from Smart Transmit enabled WWAN: (normalized SAR exposure from 4G) + (normalized PD exposure from 5G sub-6G) ≤ 1.0 normalized limit (2)

In other words, Smart Transmit algorithm controls the total RF exposure from both 4G radio and 5G sub-6G NR to not exceed CE limit. Smart transmit algorithm assumes hotspots are collocated (i.e., ignoring spatial distribution of hotspots) and directly adds normalized RF exposures from 4G and from 5G sub-6G, i.e.,

If A = max normalized time-averaged SAR exposure from 4G,
B = max normalized time-averaged SAR exposure from 5G sub-6G,

Then, equation (2) can be re-written as below because Smart Transmit assumes 4G hotspots are collocated with 5G sub-6G hotspot:

Smart Transmit enabled WWAN: x(t) * A + (1-x(t)) * B ≤ 1.0 normalized limit (3)

Here, "x(t)*A" represents percentage of normalized time-averaged RF exposure from 4G, and x(t) ranges between [0,1]; "(1-x(t))*B" is remaining percentage of RF exposure contribution from 5G sub-6G. Smart Transmit controls 'x' in real time such that the sum of these exposures never exceeds 1.0 normalized limit.
Note that mathematically:

$(t) * A + (1-(t)) * B \leq max(A,B) \leq 1.0\ normalized\ limit$ for x(t) ∈ [0,1] (4)

Therefore, if below equations (5a) and (5b) are proven:

$$A + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit \quad (5a),$$
$$B + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit \quad (5b),$$

Then, based on equation (4), below condition is also proved:

$$[(t) * A + (1-(t)) * B\ ] + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit \quad (5c)$$

Which is the same as equation (1), to demonstrate compliance for simultaneous transmission.

Additionally, it should be noted that in the absence of 5G sub-6G, Smart Transmit limits the maximum RF exposure contributed from 4G to 100% normalized exposure (i.e., x=1.0 in equation 3). Therefore:

Smart Transmit enabled WWAN: A=max (normalized SAR exposure from 4G) ≤ 1.0 normalized limit (6a)

Smart Transmit enabled WWAN: B=max (normalized SAR exposure from 5G sub-6G) ≤ 1.0 normalized limit (6b)

The compliance for simultaneous transmission scenarios of WWAN (4G/5G sub-6G) radio enabled with Smart Transmit and WLAN without Smart Transmit is re-evaluated for all transmission scenarios supported by this EUT.

As described in equation (7), simultaneous transmission analysis for WWAN + WLAN is performed in two parts:

4G WWAN + WLAN (i.e., Eq. (7a) with compliance demonstration in the main report

5G sub-6G WWAN + WLAN (i.e., Eq. (7b) with compliance demonstration in the main report

By combining above a. and b., the CE requirement expressed in Eq. (1), re-written below, is met:

Step 1: Total Exposure Ratio (TER) = LTE + WLAN + BT < 1

Step 2: Total Exposure Ratio (TER) = 5G NR + WLAN + BT < 1

21.3. Simultaneous Transmission Exposure Evaluation

Remark: The SAR simultaneous transmission data was recorded in annex F.

22. Uncertainty Assessment

According to KDB 865664 D01 SAR measurement 100 MHz to 6GHz, when the highest measured 1-g SAR is less than 1.5 W/kg and 10-g extremity SAR less than 3.75 W/kg, the expanded SAR measurement uncertainty must be less than 30% with a confidence interval of k=2. When these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE 1528-2013 is not required in the SAR report and submitted for equipment approval. For this device, both the 1-g SAR is less than 1.5 W/kg. Therefore the measurement uncertainty table is not required in this report.

23. 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.
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.
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,F,G) will be submitted separately.

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