TEST REPORT

APPLICANT	:	Reliance Communications LLC
PRODUCT NAME	:	Orbic Speed 5G
MODEL NAME	:	R500L5
BRAND NAME	:	Orbic
FCC ID	:	2ABGH-R500L5
STANDARD(S)	:	FCC 47 CFR Part 2(2.1093) IEEE 1528-2013
RECEIPT DATE	:	2021-06-11
TEST DATE	:	2021-06-15 to 2021-07-09
ISSUE DATE	:	2021-10-12

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Changed History		
Version	**Date**	**Reason for Change**
1.0	2021-10-12	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 Body (Gap 10mm) 1g SAR (W/kg)
WCDMA	WCDMA Band II	0.364
	WCDMA Band IV	0.499
	WCDMA Band V	0.622
LTE	LTE Band 2	0.572
	LTE Band 4	0.555
	LTE Band 5	0.577
	LTE Band 12	0.378
	LTE Band 13	0.312
	LTE Band 48	0.770
	LTE Band 66	0.496
5G NR	n2	0.410
	n5 (NSA)	0.150
	n66	0.189
	n77 (NSA)	0.542
	n78	0.416
WLAN	2.4GHz WLAN	0.136
	5GHz WLAN	0.268

Max Scaled SAR_{1g} (W/Kg):	Body:	0.770 W/kg	Limit(W/kg): 1.6 W/kg

Highest Simultaneous Transmission SAR_{1g} (W/Kg):	1.309 W/kg	Limit(W/kg): 1.6 W/kg

Note:

1. This device is in compliance with Specific Absorption Rate (SAR) for general population or uncontrolled exposure limits (1.6W/kg as averaged over any 1 gram of tissue; specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.
2. When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.

2. Technical Information

Note: Provide by applicant.

2.1. Applicant and Manufacturer Information

Applicant:	Reliance Communications LLC
Applicant Address:	91 Colin Drive, Unit 1, HOLBROOK, New York 11741, United States
Manufacturer:	Unimaxcomm
Manufacturer Address:	Room 602, Floor 6th, Building B, Software Park T3,Hi-Tech Park South, Nanshan District, Shenzhen, P.R. China

2.2. Equipment under Test (EUT) Description

Product Name:	Orbic Speed 5G
Serial No.:	(N/A, marked 1#&2# by test site)
Hardware Version:	V1.2
Software Version:	ORB500L5_v1.0.1.3_BVZRT
Frequency Bands:	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 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 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: 1850 MHz ~ 1910 MHz 5G NR n5 (NSA): 824 MHz ~ 849 MHz 5G NR n66: 1710 MHz ~ 1780 MHz 5G NR n77 (NSA): 3300 MHz ~ 4200 MHz 5G NR n78: 3300 MHz ~ 3800 MHz WLAN 2.4GHz: 2412 MHz ~ 2472 MHz WLAN 5.2GHz: 5180 MHz ~ 5240 MHz WLAN 5.8GHz: 5745 MHz ~ 5825 MHz
Modulation Mode:	WCDMA: QPSK, 16QAM LTE: QPSK, 16QAM, 64QAM 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: OFDM 802.11ax-HEW20/40/80: OFDMA
Operation Class:	Class B
Carrier Aggregation:	Support
Hotspot Mode:	Support
WLAN MIMO:	Support
Antenna Type:	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna
SIM Cards Description:	WCDMA+LTE+5G NR
	Single SIM Card

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 %
Air Pressure:	980-1020 hPa

Test Frequency:	WCDMA Band II/IV/V FDD-LTE Band 2/4/5/12/13/66 TDD-LTE Band 48 5G NR n2/5(NSA)/66/77(NSA)/78 WLAN 2.4GHz WLAN 5GHz
Operation Mode:	Call established
Power Level:	WCDMA Band II/IV/V (All Up Bits) FDD-LTE Band 2/4/5/12/13/66 (Maximum output power) TDD-LTE Band 48 (Maximum output power) 5G NR n2/5(NSA)/66/77(NSA)/78 (Maximum output power) WLAN 2.4GHz WLAN 5GHz

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

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

3. Specific Absorption Rate (SAR)

3.1. Introduction

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

3.2. SAR Definition

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

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

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, $\delta\mathrm{T}$ is the temperature rise and $\delta\mathrm{t}$ 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 $|\mathrm{E}|$ is the rmselectrical field strength.

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

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4. RF Exposure Limits

4.1. Uncontrolled Environment

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

4.2. Controlled Environment

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

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

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

Note:

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.

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: The test item is not applicable. **Note 2:** Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.		

6. SAR Measurement System

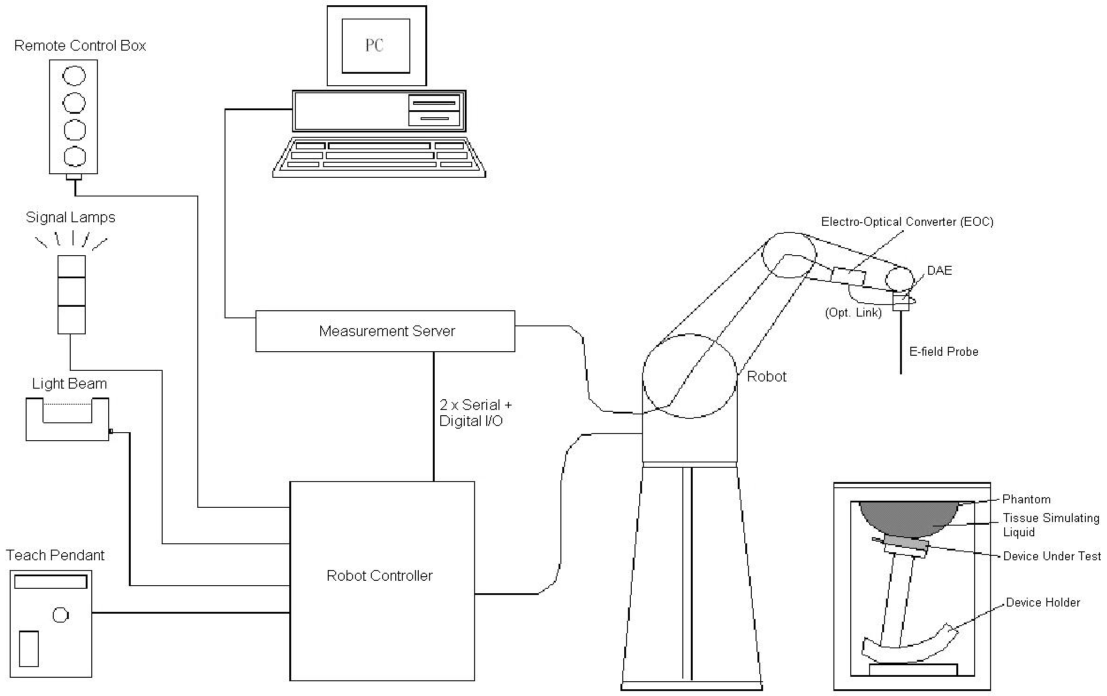

Fig 6.1 SPEAG DASY System Configurations

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

- A standard high precision 6-axis robot with controller, a teach pendant and software.
- A data acquisition electronic (DAE) attached to the robot arm extension.
- A dosimetric probe equipped with an optical surface detector system.
- The electro-optical converter (ECO) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning.
- A computer operating Windows XP.
- DASY software.
- Remove control with teach pendant and additional circuitry for robot safety such as 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.

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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 fast16 bit AD-converter and a command decoder and control logic unit. AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The input impedance of the DAE is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 6.4 Photo of DAE

6.3. Robot

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

High precision (repeatability ±0.035 mm)

High reliability (industrial design)

Jerk-free straight movements

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

Fig 6.5 Photo of DASY5

6.4. Measurement Server

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

Fig 6.6 Photo of Server for DASY5

6.5. Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Fig. 6.7 Photo of Light Beam

6.6. Phantom

<SAM Twin Phantom>

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

Fig. 6.8 Photo of SAM Phantom

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

6.7. Device Holder

<Device Holder for SAM Twin Phantom>

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

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

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

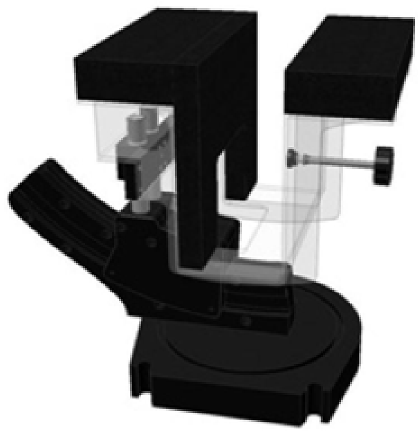

Fig 6.10 Laptop Extension Kit

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), μV/(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 Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1173	2021.06.21	2023.06.20
SPEAG	900MHz System Validation Kit	D900V2	1d064	2018.10.29	2021.10.28
SPEAG	1800MHz System Validation Kit	D1800V2	2d158	2018.10.31	2021.10.30
SPEAG	2000MHz System Validation Kit	D2000V2	1050	2018.10.31	2021.10.30
SPEAG	2300MHz System Validation Kit	D2300V2	1107	2020.06.03	2023.06.02
SPEAG	2450MHz System Validation Kit	D2450V2	805	2018.10.26	2021.10.25
SPEAG	3500MHz System Validation Kit	D3500V2	1104	2020.06.03	2023.06.02
SPEAG	3700MHz System Validation Kit	D3700V2	1076	2020.06.03	2023.06.02
SPEAG	3900MHz System Validation Kit	D3900V2	1046	2023.06.02	2023.06.01
SPEAG	5000MHz System Validation Kit	D5GHzV2	1176	2018.11.06	2021.11.05
SPEAG	DOSIMETRIC ASSESSMENT SYSTEM	DASY52	52.10.4.1527	NCR	NCR
SPEAG	Dosimetric E-Field Probe	EX3DV4	7608	2020.11.27	2021.11.26
SPEAG	Data Acquisition Electronics	DAE4	1643	2020.11.30	2021.11.29
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2020.11.03	2021.11.02
SPEAG	SAM-Twin	QD 000 P410 Ax	2020	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Network Emulator	CMW500	165755	2021.02.25	2022.02.24
Agilent	Network Analyzer	E5071B	MY42404762	2021.03.29	2022.03.28
mini-circuits	Amplifier	ZHL-42W+	608501717	NCR	NCR
mini-circuits	Amplifier	ZVE-8G+	754401735	NCR	NCR
Agilent	Signal Generator	N5182B	MY53050509	2021.03.25	2022.03.24
Agilent	Power Senor	N8482A	MY41090849	2020.10.19	2021.10.18
Agilent	Power Meter	E4416A	MY45102093	2020.10.19	2021.10.18
Anritsu	Power Sensor	MA2411B	N/A	2020.10.19	2021.10.18
Anritsu	Power Meter	NRVD	101066	2020.10.19	2021.10.18
Agilent	Dual Directional Coupler	778D	50422	NA	NA
MCL	Attenuation	351-218-010	N/A	NA	NA
KTJ	Thermo meter	TA298	N/A	2021.01.15	2022.01.14
N/A	Tissue Simulating Liquids	700-6000MHz	N/A	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.

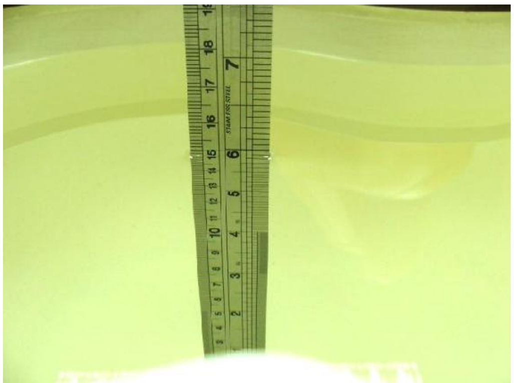

Fig 7.1 Photo of Liquid Height for Head SAR

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	0.909	0.89	2.13	±5	2021.06.15
900	HSL	22.1	0.925	0.90	-4.64	±5	2021.07.09
1800	HSL	22.2	1.418	1.37	1.29	±5	2021.07.05
2000	HSL	22.2	1.426	1.40	1.86	±5	2021.07.05
2450	HSL	22.1	1.866	1.80	3.67	±5	2021.07.03
3500	HSL	22.4	2.898	2.91	-0.41	±5	2021.07.08
3700	HSL	22.4	3.167	3.12	1.51	±5	2021.07.08
3900	HSL	22.4	3.369	3.33	1.17	±5	2021.07.08
5250	HSL	22.1	4.725	4.71	0.32	±5	2021.07.06
5750	HSL	22.2	5.361	5.22	2.70	±5	2021.07.07
Frequency (MHz)	**Tissue Type**	**Liquid Temp.(℃)**	**Permittivity (εr)**	**Permittivity Target (εr)**	**Delta (εr) (%)**	**Limit (%)**	**Date**
750	HSL	22.1	41.882	41.90	-0.04	±5	2021.06.15
900	HSL	22.1	41.693	41.50	0.47	±5	2021.07.09
1800	HSL	22.2	40.262	40.10	0.66	±5	2021.07.05
2000	HSL	22.2	40.159	40.00	0.40	±5	2021.07.05
2450	HSL	22.1	39.388	39.20	0.48	±5	2021.07.03
3500	HSL	22.4	38.234	37.90	0.88	±5	2021.07.08
3700	HSL	22.4	38.169	37.70	1.24	±5	2021.07.08
3900	HSL	22.4	38.212	37.50	1.90	±5	2021.07.08
5250	HSL	22.1	36.238	35.95	0.80	±5	2021.07.06
5750	HSL	22.2	35.479	35.35	0.36	±5	2021.07.07

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. 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.

8.2. 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

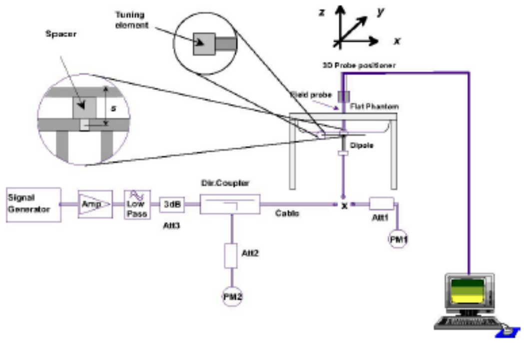

Fig 8.2 System Setup for System Evaluation

8.3. Validation Results

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

<Validation Setup>

Frequency (MHz)	Tissue Type	Input Power(mW)	Dipole S/N	Probe S/N	DAE S/N
750	HSL	250	D750V3-1173	7608	1643
835	HSL	250	D900V2-1d064	7608	1643
1750	HSL	250	D1800V2-2d158	7608	1643
1900	HSL	250	D2000V2-1050	7608	1643
2450	HSL	250	D750V3-1173	7608	1643
3500	HSL	100	D3500V2-1104	7608	1643
3700	HSL	100	D900V2-1d064	7608	1643
3900	HSL	100	D1800V2-2d158	7608	1643
5250	HSL	100	D2000V2-1050	7608	1643
5750	HSL	100	D750V3-1173	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 (%)
2021.06.15	750	HSL	250	2.09	8.26	8.36	1.21
2021.07.09	900	HSL	250	2.67	10.90	10.68	-2.02
2021.07.05	1800	HSL	250	9.51	39.30	38.04	-3.21
2021.07.05	2000	HSL	250	10.24	40.90	40.96	0.15
2021.07.03	2450	HSL	250	13.26	52.00	53.04	2.00
2021.07.08	3500	HSL	100	6.77	67.20	67.7	0.74
2021.07.08	3700	HSL	100	6.77	67.50	67.7	0.30
2021.07.08	3900	HSL	100	6.82	66.90	68.2	1.94
2021.07.06	5250	HSL	100	7.95	78.90	79.5	0.76
2021.07.07	5750	HSL	100	8.15	80.00	81.5	1.88

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Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2021.06.15	750	HSL	250	1.31	5.45	5.24	-3.85
2021.07.09	900	HSL	250	1.75	6.97	7	0.43
2021.07.05	1800	HSL	250	5.22	20.60	20.88	1.36
2021.07.05	2000	HSL	250	5.38	20.90	21.52	2.97
2021.07.03	2450	HSL	250	6.24	24.10	24.96	3.57
2021.07.08	3500	HSL	100	2.57	25.10	25.7	2.39
2021.07.08	3700	HSL	100	2.55	24.50	25.5	4.08
2021.07.08	3900	HSL	100	2.52	24.10	25.2	4.56
2021.07.06	5250	HSL	100	2.34	22.50	23.4	4.00
2021.07.07	5750	HSL	100	2.36	22.60	23.6	4.42

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

9. EUT Testing Position

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

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.

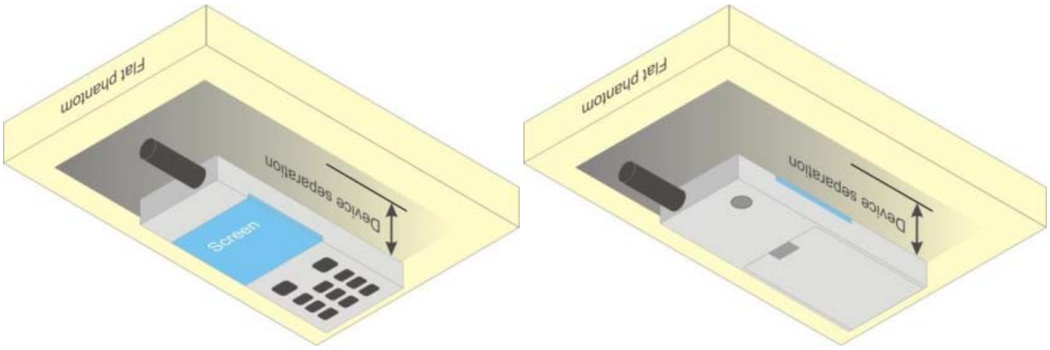

Fig 9.1 Illustration for Body Worn Position

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).

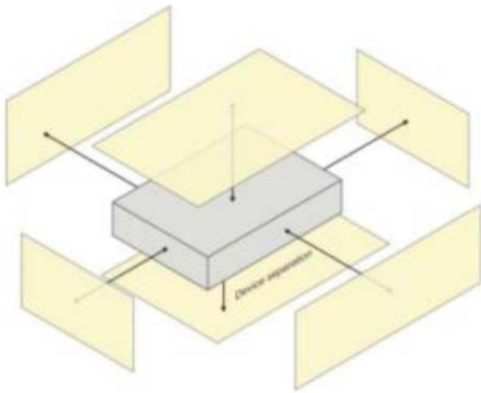

Fig 9.2 Illustration for Hotspot Position

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 a10mm^2 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/m^3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10 g cube 21,5mm.The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 5x5x7 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 30mm in the Z axis.

10.5. SAR Averaged Methods

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

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

10.6. Power Drift Monitoring

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

11. SAR Test Procedure

11.1. General Scan Requirements

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

<table>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>> 3 GHz</td></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>½·δ·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>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 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 $\leq$ 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>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 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>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 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>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 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 reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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

<GSM Mode>

A summary of these settings are illustrated below:
For GSM850 frequency band, the power control is set to 5 for GSM/GPRS mode (GSMK-CS1) and set to 8 for EDGE mode (MCS5); For GSM1900 frequency band, the power control is set to 0 for GSM/GPRS mode (GSMK-CS1) and set to 2 for EDGE mode (MCS5).

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

Timeslot consignations:

Remark:

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

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

<WCDMA Mode>

Summary of UMTS conducted power measurement:

1. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ 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.

HSDPA Setup Configuration

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 β_c/β_d =12/15, β_{hs}/β_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 β_c = 11/15 and β_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 $\Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.
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	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

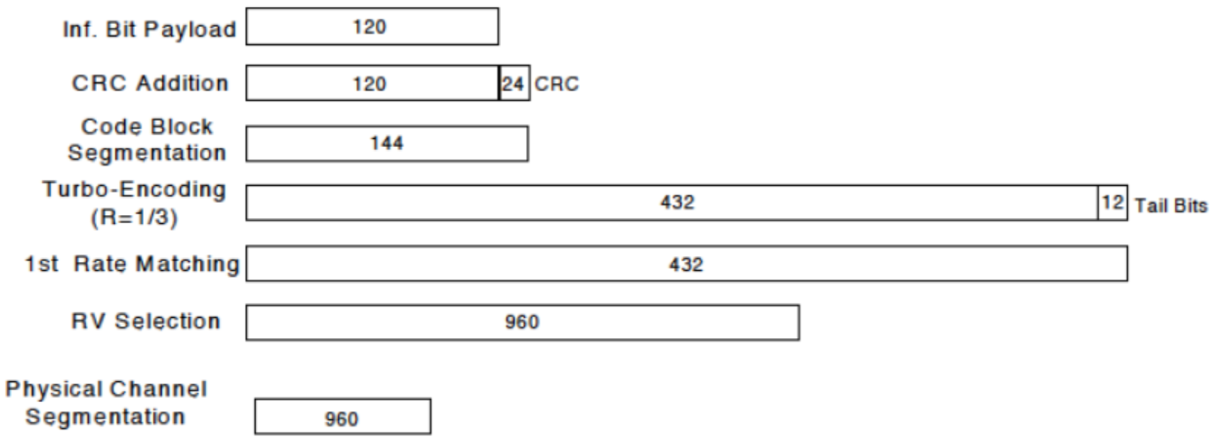

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

<CDMA Mode>

1xEV-DO Rev. B

Call box setup procedure

1xEV-DO Release B

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

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

3> 1xEV-DO Signaling On Window:

Under Access Network Control:

Band Class: BC0: US Cellular

RF Channel: 31

1xEV-DO Power: -70 dBm

4> 1xEV-DO Signaling Configuration Window

Under RF Frequency Band / Channel: Enter Ch. Frequency

- Under Carrier Configuration: RF Frequency

For Two Carriers: Low Channel (1013)

	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	✓	✓

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<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
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 GSM/WCDMA/LTE/5G NR refers to the annex E of this report.

14. LTE Carrier Aggregation

14.1. LTE Uplink Carrier Aggregation

<Intra-band>

2CC Uplink Carrier Aggregation for Intra-band				
No.	Combination	UL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_48C	48C	-	No
2	CA_66B	66B	-	No
3	CA_66C	66C	-	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>

NO.	Combination	UL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_2A-4A	2A-4A	-	No
2	CA_2A-5A	2A-5A	-	No
3	CA_2A-13A	2A-13A	-	No
4	CA_2A-66A	2A-66A	-	No
5	CA_4A-5A	4A-5A	-	No
6	CA_4A-13A	4A-13A	-	No
7	CA_5A-66A	5A-66A	-	No

8	CA_13A-66A	13A-66A	-	No

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 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_2A-2A	2A-2A	-	3CC-1
2	CA_2A-4A	2A, 4A, 2A-4A	-	3CC-6
3	CA_2A-5A	2A	-	3CC-12
4	CA_2A-13A	2A	-	3CC-14
5	CA_2A-66A	2A, 66A, 2A-66A	-	3CC-15
6	CA_2A-71A	2A	-	No
7	CA_4A-4A	4A-4A	-	3CC-16
8	CA_4A-5A	4A	-	3CC-20
9	CA_4A-13A	4A	-	3CC-18
10	CA_4A-71A	4A	-	No
11	CA_5A-5A	-	-	3CC-22
12	CA_5A-12A	-	-	No
13	CA_5A-66A	66A	-	3CC-23
14	CA_12B	-	-	3CC-21
15	CA_13A-66A	66A	-	3CC-26
16	CA_41A-41A	41A-41A	-	No
17	CA_66A-66A	66A-66A	-	3CC-26
18	CA_66B	66B	-	3CC-26
19	CA_66C	66C	-	3CC-26
20	CA_13A-48A	48A	-	No
21	CA_2A-48A	2A-48A	-	No
22	CA_48A-48A	48A-48A	-	No
23	CA_5A-48A	48A	-	No
24	CA_48A-66A	48A-66A	-	No

3CC Downlink Carrier Aggregation				
NO.	Combination	DL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_2A-2A-4A	2A-2A, 2A-4A	-	4CC-1
2	CA_2A-2A-5A	2A-2A	-	4CC-5
3	CA_2A-2A-12A	2A-2A	-	4CC-7
4	CA_2A-2A-13A	2A-2A	-	4CC-8
5	CA_2A-2A-66A	2A-2A, 2A-66A	-	4CC-9
6	CA_2A-4A-4A	2A-4A, 4A-4A	-	4CC-10
7	CA_2A-4A-5A	2A, 4A, 2A-4A	-	4CC-11
8	CA_2A-4A-12A	2A-4A	-	4CC-12
9	CA_2A-4A-13A	2A, 4A, 2A-4A	-	No
10	CA_2A-5B	2A	-	4CC-14
11	CA_2A-5A-12A	2A	-	4CC-4
12	CA_2A-5A-66A	2A, 66A, 2A-66A	-	4CC-14
13	CA_2A-12A-66A	2A-66A	-	4CC-15
14	CA_2A-13A-66A	2A, 66A, 2A-66A	-	4CC-16
15	CA_2A-66A-66A	2A-66A, 66A-66A	-	4CC-17
16	CA_4A-4A-5A	4A-4A	-	4CC-18
17	CA_4A-4A-12A	4A-4A	-	4CC-19
18	CA_4A-4A-13A	4A-4A	-	No
19	CA_4A-5A-12A	4A	-	4CC-12
20	CA_4A-5B	4A	-	4CC-18
21	CA_4A-12B	4A	-	4CC-19
22	CA_5A-5A-66A	66A	-	4CC-20
23	CA_5B-66A	66A	-	4CC-14
24	CA_5A-66A-66A	66A-66A	-	4CC-20
25	CA_12A-66A-66A	66A-66A	-	4CC-21
26	CA_13A-66A-66A	66A-66A	-	4CC-16
27	CA_13A-48A-48A	48A-48A	-	No
28	CA_13A-48C	48C	-	No
29	CA_2A-48A-48A	48A-48A	-	No
30	CA_48B-66A	48B-66A	-	No
31	CA_2A-48C	2A-48C	-	No
32	CA_4A-48C	4A-48C	-	No
33	CA_48C-66A	48C-66A	-	No
34	CA_48D	48D	-	No

35	CA_5A-48C	5A-48C	-	No
36	CA_13A-48A-66A	13A-48A-66A	-	No
37	CA_2A-48A-66A	2A-48A-66A	-	No
38	CA_48A-48A-66A	48A-48A-66A	-	No
39	CA_48A-66A-66A	48A-66A-66A	-	No
40	CA_5A-48A-66A	5A-48A-66A	-	No

4CC Downlink Carrier Aggregation				
NO.	Combination	DL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_2A-2A-4A-4A	2A-2A	-	No
2	CA_2A-2A-4A-5A	2A-2A	-	No
3	CA_2A-2A-4A-12A	2A-2A-4A	-	No
4	CA_2A-2A-5A-12A	2A-2A	-	No
5	CA_2A-2A-5B	2A-2A	-	No
6	CA_2A-2A-5A-12A	2A-2A	-	No
7	CA_2A-2A-12A-66A	2A-2A-66A	-	No
8	CA_2A-2A-13A-66A	2A-2A	-	No
9	CA_2A-2A-66A-66A	2A, 66A-66A	-	No
10	CA_2A-4A-4A-5A	4A-4A	-	No
11	CA_2A-4A-5B	2A, 4A, 2A-4A	-	No
12	CA_2A-4A-12B	2A-4A	-	No
13	CA_2A-5A-66A-66A	66A-66A	-	No
14	CA_2A-5B-66A	2A, 66A, 2A-66A	-	No
15	CA_2A-12A-66A-66A	2A-66A-66A	-	No
16	CA_2A-13A-66A-66A	66A-66A	-	No
17	CA_2A-66C-71A	2A, 66C	-	No
18	CA_4A-4A-5B	4A-4A	-	No
19	CA_4A-4A-12B	4A-4A	-	No
20	CA_5A-5A-66A-66A	66A-66A	-	No
21	CA_12B-66A-66A	66A-66A	-	No
21	CA_13A-48C-66A	48C, 66A	-	No
22	CA_48C-66A-66A	48C, 66A-66A	-	No
23	CA_2A-13A-48C	2A-13A-48C	-	No
24	CA_2A-48C-66A	2A-48C-66A	-	No
25	CA_4A-48D	4A-48D	-	No
26	CA_2A-48D	2A-48D	-	No
27	CA_13A-48A-48C	13A-48A-48C	-	No

28	CA_13A-48D	13A-48D	-	No
29	CA_48A-48C-66A	48A-48C-66A	-	No
30	CA_48D-66A	48D-66A	-	No
31	CA_48E	48E	-	No
32	CA_48C-66B	48C-66B	-	No
33	CA_48C-66C	48C-66C	-	No
34	CA_2A-5A-48C	2A-5A-48C	-	No
35	CA_5A-48C-66A	5A-48C-66A	-	No
36	CA_5A-48D	5A-48D	-	No
37	CA_13A-48A-48A-66A	13A-48A-48A-66A	-	No
38	CA_2A-13A-48A-66A	2A-13A-48A-66A	-	No
39	CA_2A-48A-48A-66A	2A-48A-48A-66A	-	No
40	CA_2A-48A-66A-66A	2A-48A-66A-66A	-	No
41	CA_2A-5A-48A-66A	2A-5A-48A-66A	-	No

5CC Downlink Carrier Aggregation				
NO.	Combination	DL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_2A-2A-13A-66A-66A	2A-2A-13A-66A-66A	-	No
2	CA_2A-2A-13A-66B	2A-2A-13A-66B	-	No
3	CA_2A-2A-5A-66A-66A	2A-2A-5A-66A-66A	-	No
4	CA_2A-2A-5A-66B	2A-2A-5A-66B	-	No
5	CA_2A-2A-5A-66C	2A-2A-5A-66C	-	No
6	CA_2A-5A-66B	2A-66B	-	No
7	CA_2A-5A-66C	2A-66C	-	No
8	CA_13A-48E-66A	13A-66A	-	No
9	CA_2A-48E-66A	48E,2A-66A	-	No
10	CA_2A-48E	2A-48E	-	No
11	CA_4A-48E	4A-48E	-	No
12	CA_13A-48A-48C-66A	13A-48A-48C-66A	-	No
13	CA_13A-48A-48D	13A-48A-48D	-	No
14	CA_13A-48C-48C	13A-48C-48C	-	No
15	CA_13A-48D-66A	13A-48D-66A	-	No
16	CA_13A-48E	13A, 48E	-	No
17	CA_2A-13A-48A-48C	2A-13A-48A-48C	-	No
18	CA_2A-13A-48C-66A	2A-13A-48C-66A	-	No
19	CA_2A-13A-48D	2A-13A-48D	-	No
20	CA_2A-48A-48C-66A	2A-48A-48C-66A	-	No

21	CA_2A-48A-48D	2A-48A-48D	-	No
22	CA_2A-48C-48C	2A-48C-48C	-	No
23	CA_2A-48D-66A	2A-48D-66A	-	No
24	CA_48C-48C-66A	48C-48C-66A	-	No
25	CA_48A-48C-66B	48A-48C-66B	-	No
26	CA_48A-48C-66C	48A-48C-66C	-	No
27	CA_48A-48D-66A	48A-48D-66A	-	No
28	CA_48C-48D	48C-48D	-	No
29	CA_48E-66A	48E-66A	-	No
30	CA_2A-5A-48C-66A	2A-5A-48C-66A	-	No
31	CA_2A-5A-48D	2A-5A-48D	-	No
32	CA_5A-48D-66A	5A-48D-66A	-	No
33	CA_2A-13A-48A-48A-66A	2A-48A-48A-66A, 2A-13A-48A-48A, 2A-13A-48A-66A, 13A-48A-48A-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 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 DL 4x4 MIMO (10L)	5G-NR DL 4x4 MIMO	4G UL	5G-NR UL
FDD	DC_2A-5A_n5A	2A	-	2A	n5A
FDD	DC_2A-66A_n5A	2A-66A	-	2A, 66A	n5A
FDD	DC_2A_n5A	2A	-	2A	n5A
FDD	DC_66A_n5A	66A	-	66A	n5A
FDD	DC_2A_n66A	2A	n66A	2A	n66A
FDD	DC_2A-2A_n5A	2A-2A	-	2A	n5A
FDD	DC_5A-66A_n5A	66A	-	66A	n5A
FDD	DC_66A-66A_n5A	66A-66A	-	66A	n5A
FDD	DC_2A-66A_n66A	2A, 66A	n66A	2A	n66A
FDD	DC_2A-2A-5A_n5A	2A-2A	-	2A	n5A
FDD	DC_2A-2A-66A_n5A	2A, 66A, 2A-2A	-	2A, 66A	n5A
FDD	DC_2A-66A-66A_n5A	2A, 66A, 66A-66A	-	2A, 66A	n5A
FDD	DC_5A-66A-66A_n5A	66A-66A	-	66A	n5A
FDD	DC_2A-2A-66A-66A_n5A	2A, 66A	-	2A, 66A	n5A

FDD	DC_66A_n2A	66A	n2A	66A	n2A
FDD	DC_2A-66A_n2A	2A, 66A	n2A	66A	n2A
TDD	DC_66A_n78A	66A	n78A	66A	n78A
TDD	DC_66A-66A_n78A	66A	n78A	66A	n78A
TDD	DC_2A_n78A	2A	n78A	2A	n78A
FDD	DC_13A-66A_n2A	66A	n2A	13A, 66A	n2A
FDD	DC_13A-66A_n5A	66A	-	66A	n5A
FDD	DC_2A-13A_n5A	2A	-	2A	n5A
FDD	DC_13A-66A-66A_n5A	66A-66A	-	66A	n5A
FDD	DC_2A-2A-13A_n5A	2A-2A	-	2A	n5A
FDD	DC_2A-2A_n66A	2A	n66A	2A	n66A
FDD	DC_13A_n66A	-	n66A	13A	n66A
FDD	DC_2A-13A_n66A	2A	n66A	2A, 13A	n66A
FDD	DC_13A-66A_n66A	66A	n66A	13A	n66A
FDD	DC_13A-66A-66A_n66A	66A-66A	n66A	13A	n66A
FDD	DC_2A-2A-13A-66A-66A_n5A	2A-2A-66A-66A	n5A	2A, 66A	n5A
FDD	DC_2A-2A-5A-66A-66A_n5A	2A-2A-66A-66A	n5A	2A, 66A	n5A
FDD	DC_2A-2A-13A-66A-66A_n66A	2A-2A-66A-66A	n66A	2A, 13A	n66A
FDD	DC_2A-2A-5A-66A-66A_n66A	2A-2A-66A-66A	n66A	2A, 5A	n66A
FDD	DC_2A-5B-66A-66A_n66A	2A-66A-66A	n66A	2A, 5A	n66A
FDD	DC_2A-5B-66A-66A_n2A	2A-66A-66A	n2A	5A, 66A	n2A
TDD	DC_2A_n77A	2A	n77A	2A	n77A
TDD	DC_5A_n77A	5A	n77A	5A	n77A
TDD	DC_13A_n77A	-	n77A	13A	n77A
TDD	DC_66A_n77A	66A	n77A	66A	n77A
TDD	DC_2A-5A_n77A	2A-5A	n77A	2A, 5A	n77A
TDD	DC_2A-13A_n77A	2A	n77A	2A, 13A	n77A
TDD	DC_2A-66A_n77A	2A-66A	n77A	2A, 66A	n77A
TDD	DC_5A-66A_n77A	5A-66A	n77A	5A, 66A	n77A
TDD	DC_13A-66A_n77A	66A	n77A	13A, 66A	n77A
TDD	DC_66A-66A_n77A	66A-66A	n77A	66A	n77A
TDD	DC_2A-2A_n77A	2A-2A	n77A	2A	n77A
TDD	DC_2A-5A-66A_n77A	2A-66A	n77A	2A, 5A, 66A	n77A
TDD	DC_2A-13A-66A_n77A	2A-66A	n77A	2A, 13A, 66A	n77A
TDD	DC_2A-66A-66A_n77A	2A-66A-66A	n77A	2A, 66A	n77A
TDD	DC_5A-66A-66A_n77A	66A-66A	n77A	5A, 66A	n77A
TDD	DC_13A-66A-66A_n77A	66A-66A	n77A	13A, 66A	n77A
TDD	DC_2A-2A-13A_n77A	2A-2A	n77A	2A, 13A	n77A
TDD	DC_2A-2A-66A_n77A	2A-2A-66A	n77A	2A, 66A	n77A
TDD	DC_66A-66A-66A_n77A	66A-66A-66A	n77A	66A	n77A

TDD	DC_2A-2A-5A_n77A	2A-2A	n77A	2A, 5A	n77A
FDD	DC_13A_n2A	-	n2A	13A	n2A
FDD	DC_5A_n2A	-	n2A	5A	n2A
FDD	DC_5A_n66A	-	n66A	5A	n66A
FDD	DC_48E-66A_n5A	48E-66A	n5A	48A, 66A	n5A
FDD	DC_13A-48E_n66A	48E	n66A	13A, 48A	n66A
FDD	DC_13A-48E_n2A	48E	n2A	13A, 48A	n2A

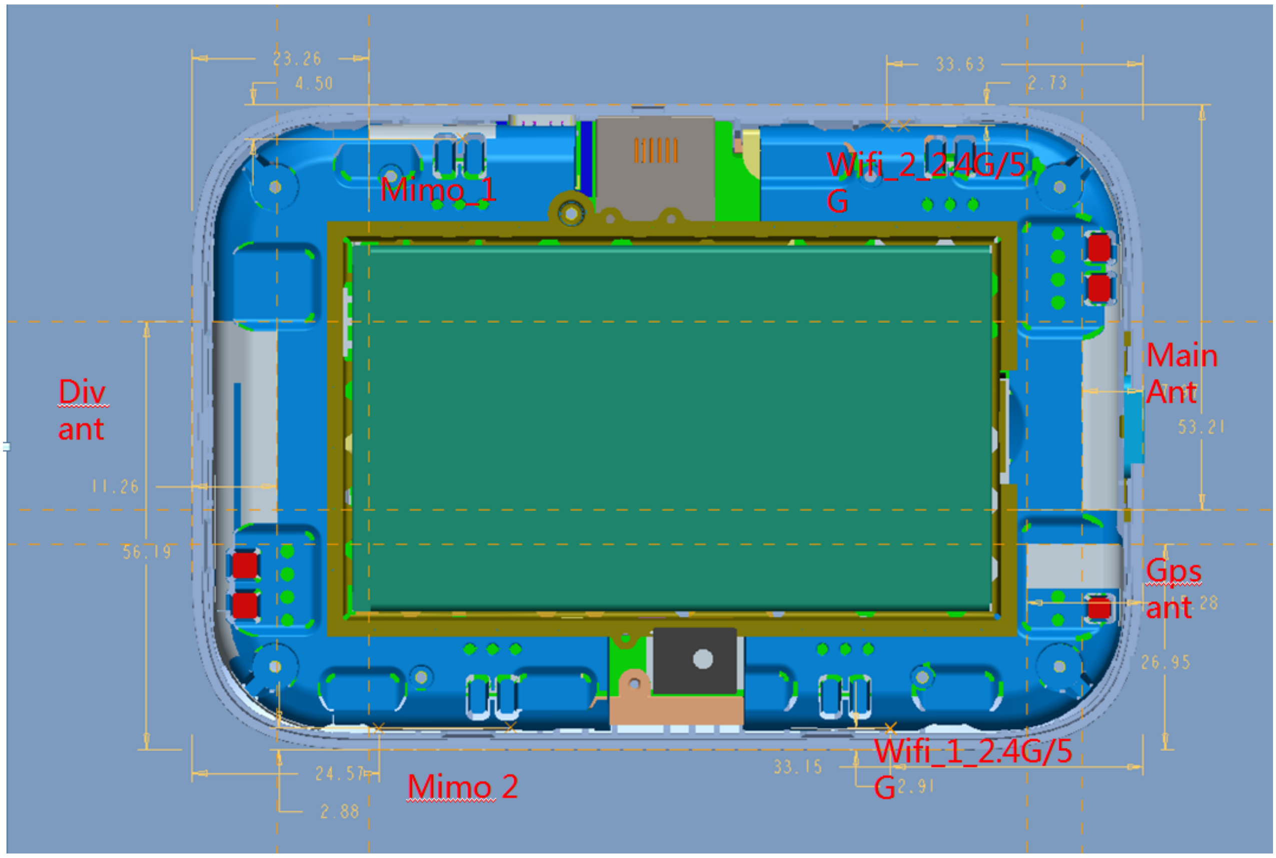
➢ **Maximum Power for EN-DC**

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_66A_n2	66	20	23.0	23.0	n2	20	25.0
EN-DC_66A_n5	66	20	23.0	24.0	n5	20	24.0
EN-DC_13A_n66	13	20	23.0	24.0	n66	20	25.0
EN-DC_2A_n77	2	20	23.0	24.0	n77	100	24.0

Note：The total power of EN-DC refers to SZ21060072W12.

16. EUT Antenna Location

➢ **EUT Antenna Location**



Main Antenna supports TX bands:
UMTS Band II/IV/V, LTE Band 2/4/5/12/13/48/66, 5G NR n2/5(NSA)/66/77(NSA)/78;
WLAN Antenna supports TX bands: WLAN 2.4GHz CH0/1, WLAN 5GHz CH0/1;

17. Block Diagram of the Tests to be Performed

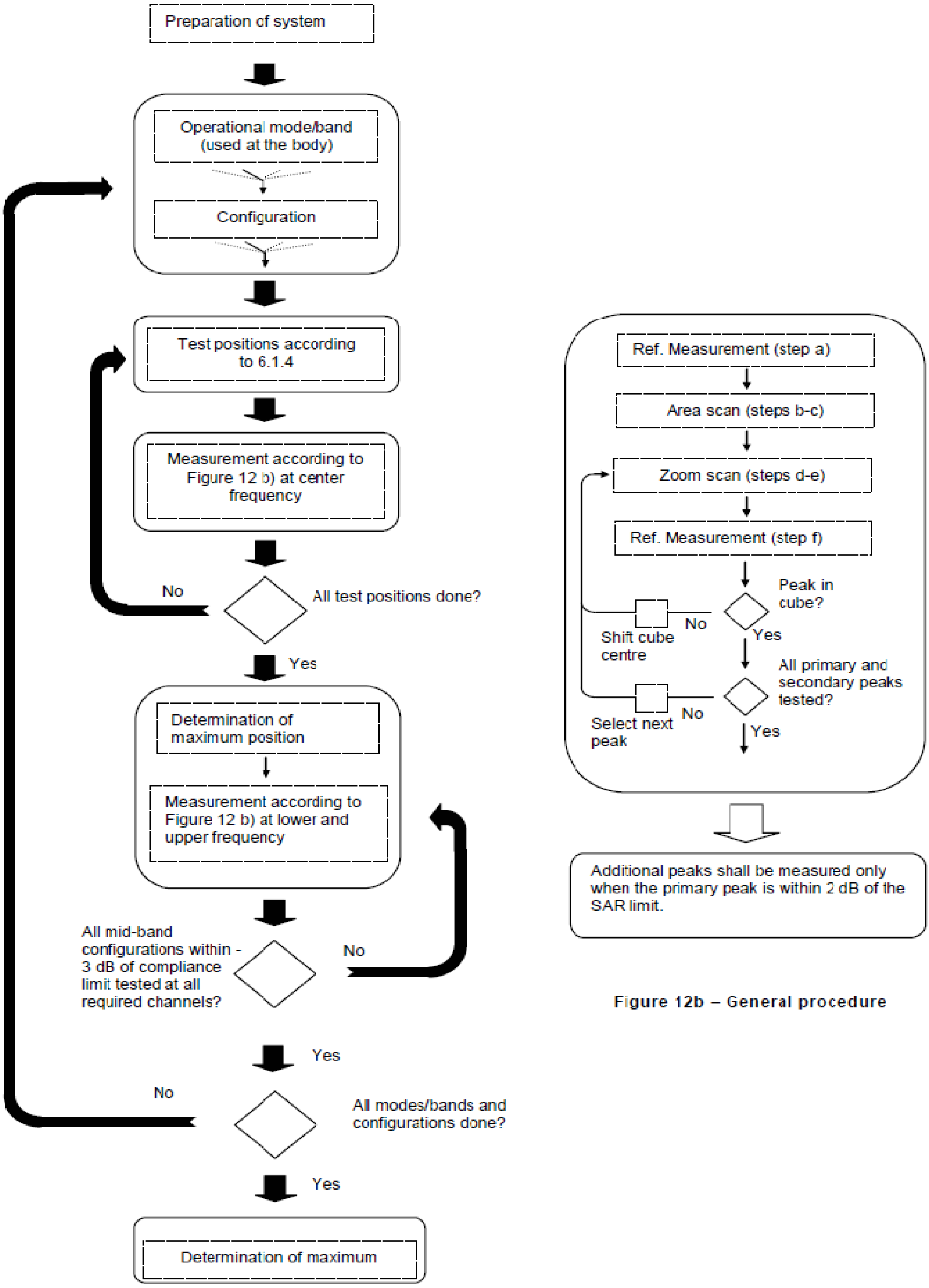


Figure 12b – General procedure

18. Test Results List

18.1. 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. 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.
10. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥ 0.8W/kg.
11. 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.
12. 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.
13. 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.

14. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
15. The WLAN Reported 1g SAR (W/kg) has been calculated together with the duty cycle scaling factor 1.0 for 2.4G WLAN, 1.009 for 5G WLAN 802.11ax-20, 1.007 for 5G WLAN 802.11802.11n-40 and 1.039 for Bluetooth.

18.2. Body SAR Data

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	Band II/RMC 12.2Kbps	Front Side	9262	22.45	23.00	1.135	0.293	0.333
1#	Band II/RMC 12.2Kbps	Back Side	9262	22.45	23.00	1.135	0.321	0.364
	Band II/RMC 12.2Kbps	Left Side	9262	22.45	23.00	1.135	0.103	0.117
	Band II/RMC 12.2Kbps	Right Side	9262	22.45	23.00	1.135	0.210	0.238
	Band II/RMC 12.2Kbps	Top Side	9262	22.45	23.00	1.135	0.163	0.185
	Band II/RMC 12.2Kbps	Bottom Side	9262	22.45	23.00	1.135	0.199	0.226
2#	Band IV/RMC 12.2Kbps	Front Side	1513	22.61	23.00	1.094	0.456	0.499
	Band IV/RMC 12.2Kbps	Back Side	1513	22.61	23.00	1.094	0.448	0.490
	Band IV/RMC 12.2Kbps	Left Side	1513	22.61	23.00	1.094	0.126	0.138
	Band IV/RMC 12.2Kbps	Right Side	1513	22.61	23.00	1.094	0.212	0.232
	Band IV/RMC 12.2Kbps	Top Side	1513	22.61	23.00	1.094	0.098	0.107
	Band IV/RMC 12.2Kbps	Bottom Side	1513	22.61	23.00	1.094	0.234	0.256
3#	Band V/RMC 12.2Kbps	Front Side	4132	22.34	23.00	1.164	0.534	0.622
	Band V/RMC 12.2Kbps	Back Side	4132	22.34	23.00	1.164	0.493	0.574
	Band V/RMC 12.2Kbps	Left Side	4132	22.34	23.00	1.164	0.035	0.041
	Band V/RMC 12.2Kbps	Right Side	4132	22.34	23.00	1.164	0.148	0.172
	Band V/RMC 12.2Kbps	Top Side	4132	22.34	23.00	1.164	0.210	0.244
	Band V/RMC 12.2Kbps	Bottom Side	4132	22.34	23.00	1.164	0.182	0.212
4#	LTE Band 2/1RB#0 20M	Front Side	18900	22.38	23.00	1.153	0.496	0.572
	LTE Band 2/1RB#0 20M	Back Side	18900	22.38	23.00	1.153	0.317	0.366
	LTE Band 2/1RB#0 20M	Left Side	18900	22.38	23.00	1.153	0.136	0.157
	LTE Band 2/1RB#0 20M	Right Side	18900	22.38	23.00	1.153	0.338	0.390
	LTE Band 2/1RB#0 20M	Top Side	18900	22.38	23.00	1.153	0.125	0.144
	LTE Band 2/1RB#0 20M	Bottom Side	18900	22.38	23.00	1.153	0.217	0.250

	LTE Band 2/50RB#0 20M	Front Side	18900	21.63	22.00	1.089	0.268	0.292
	LTE Band 2/50RB#0 20M	Back Side	18900	21.63	22.00	1.089	0.210	0.229
	LTE Band 2/50RB#0 20M	Left Side	18900	21.63	22.00	1.089	0.106	0.115
	LTE Band 2/50RB#0 20M	Right Side	18900	21.63	22.00	1.089	0.261	0.284
	LTE Band 2/50RB#0 20M	Top Side	18900	21.63	22.00	1.089	0.099	0.108
	LTE Band 2/50RB#0 20M	Bottom Side	18900	21.63	22.00	1.089	0.167	0.182
5#	LTE Band 4/1RB#0 20M	Front Side	20175	22.35	23.00	1.161	0.478	0.555
	LTE Band 4/1RB#0 20M	Back Side	20175	22.35	23.00	1.161	0.392	0.455
	LTE Band 4/1RB#0 20M	Left Side	20175	22.35	23.00	1.161	0.186	0.216
	LTE Band 4/1RB#0 20M	Right Side	20175	22.35	23.00	1.161	0.216	0.251
	LTE Band 4/1RB#0 20M	Top Side	20175	22.35	23.00	1.161	0.132	0.153
	LTE Band 4/1RB#0 20M	Bottom Side	20175	22.35	23.00	1.161	0.226	0.262
	LTE Band 4/50RB#0 20M	Front Side	20175	21.34	22.00	1.164	0.355	0.413
	LTE Band 4/50RB#0 20M	Back Side	20175	21.34	22.00	1.164	0.293	0.341
	LTE Band 4/50RB#0 20M	Left Side	20175	21.34	22.00	1.164	0.136	0.158
	LTE Band 4/50RB#0 20M	Right Side	20175	21.34	22.00	1.164	0.200	0.233
	LTE Band 4/50RB#0 20M	Top Side	20175	21.34	22.00	1.164	0.114	0.133
	LTE Band 4/50RB#0 20M	Bottom Side	20175	21.34	22.00	1.164	0.182	0.212
6#	LTE Band 5/1RB#0 10M	Front Side	20525	22.57	23.00	1.104	0.523	0.577
	LTE Band 5/1RB#0 10M	Back Side	20525	22.57	23.00	1.104	0.427	0.471
	LTE Band 5/1RB#0 10M	Left Side	20525	22.57	23.00	1.104	0.038	0.042
	LTE Band 5/1RB#0 10M	Right Side	20525	22.57	23.00	1.104	0.145	0.160
	LTE Band 5/1RB#0 10M	Top Side	20525	22.57	23.00	1.104	0.262	0.289
	LTE Band 5/1RB#0 10M	Bottom Side	20525	22.57	23.00	1.104	0.200	0.221
	LTE Band 5/25RB#0 10M	Front Side	20525	21.60	22.00	1.096	0.462	0.507
	LTE Band 5/25RB#0 10M	Back Side	20525	21.60	22.00	1.096	0.316	0.346
	LTE Band 5/25RB#0 10M	Left Side	20525	21.60	22.00	1.096	0.032	0.035
	LTE Band 5/25RB#0 10M	Right Side	20525	21.60	22.00	1.096	0.123	0.135
	LTE Band 5/25RB#0 10M	Top Side	20525	21.60	22.00	1.096	0.220	0.241
	LTE Band 5/25RB#0 10M	Bottom Side	20525	21.60	22.00	1.096	0.131	0.144
7#	LTE Band 12/1RB#0 10M	Front Side	23095	22.63	23.00	1.089	0.347	0.378
	LTE Band 12/1RB#0 10M	Back Side	23095	22.63	23.00	1.089	0.229	0.249

	LTE Band 12/1RB#0 10M	Left Side	23095	22.63	23.00	1.089	0.031	0.034
	LTE Band 12/1RB#0 10M	Right Side	23095	22.63	23.00	1.089	0.141	0.154
	LTE Band 12/1RB#0 10M	Top Side	23095	22.63	23.00	1.089	0.162	0.176
	LTE Band 12/1RB#0 10M	Bottom Side	23095	22.63	23.00	1.089	0.225	0.245
	LTE Band 12/25RB#0 10M	Front Side	23095	21.66	22.00	1.081	0.300	0.324
	LTE Band 12/25RB#0 10M	Back Side	23095	21.66	22.00	1.081	0.208	0.225
	LTE Band 12/25RB#0 10M	Left Side	23095	21.66	22.00	1.081	0.021	0.023
	LTE Band 12/25RB#0 10M	Right Side	23095	21.66	22.00	1.081	0.121	0.131
	LTE Band 12/25RB#0 10M	Top Side	23095	21.66	22.00	1.081	0.138	0.149
	LTE Band 12/25RB#0 10M	Bottom Side	23095	21.66	22.00	1.081	0.193	0.209
8#	LTE Band 13/1RB#0 10M	Front Side	23230	22.44	23.00	1.138	0.274	0.312
	LTE Band 13/1RB#0 10M	Back Side	23230	22.44	23.00	1.138	0.228	0.259
	LTE Band 13/1RB#0 10M	Left Side	23230	22.44	23.00	1.138	0.025	0.028
	LTE Band 13/1RB#0 10M	Right Side	23230	22.44	23.00	1.138	0.097	0.110
	LTE Band 13/1RB#0 10M	Top Side	23230	22.44	23.00	1.138	0.248	0.282
	LTE Band 13/1RB#0 10M	Bottom Side	23230	22.44	23.00	1.138	0.250	0.284
	LTE Band 13/25RB#0 10M	Front Side	23230	21.66	22.00	1.081	0.212	0.229
	LTE Band 13/25RB#0 10M	Back Side	23230	21.66	22.00	1.081	0.185	0.200
	LTE Band 13/25RB#0 10M	Left Side	23230	21.66	22.00	1.081	0.020	0.022
	LTE Band 13/25RB#0 10M	Right Side	23230	21.66	22.00	1.081	0.086	0.093
	LTE Band 13/25RB#0 10M	Top Side	23230	21.66	22.00	1.081	0.200	0.216
	LTE Band 13/25RB#0 10M	Bottom Side	23230	21.66	22.00	1.081	0.213	0.230
	LTE Band 48/1RB#0 20M	Front Side	56640	23.61	24.00	1.094	0.238	0.262
	LTE Band 48/1RB#0 20M	Back Side	56640	23.61	24.00	1.094	0.171	0.188
	LTE Band 48/1RB#0 20M	Left Side	56640	23.61	24.00	1.094	0.028	0.031
	LTE Band 48/1RB#0 20M	Right Side	56640	23.61	24.00	1.094	0.149	0.164
9#	LTE Band 48/1RB#0 20M	Top Side	56640	23.61	24.00	1.094	0.700	0.770
	LTE Band 48/1RB#0 20M	Bottom Side	56640	23.61	24.00	1.094	0.064	0.070
	LTE Band 48/50RB#0 20M	Front Side	56640	22.71	23.00	1.069	0.183	0.197
	LTE Band 48/50RB#0 20M	Back Side	56640	22.71	23.00	1.069	0.152	0.163
	LTE Band 48/50RB#0 20M	Left Side	56640	22.71	23.00	1.069	0.012	0.013
	LTE Band 48/50RB#0 20M	Right Side	56640	22.71	23.00	1.069	0.128	0.138
	LTE Band 48/50RB#0 20M	Top Side	56640	22.71	23.00	1.069	0.640	0.688

	LTE Band 48/50RB#0 20M	Bottom Side	56640	22.71	23.00	1.069	0.054	0.059
	LTE Band 48C/1RB#0 20M	Top Side	56442	23.24	24.00	1.191	0.620	0.743
10#	LTE Band 66/1RB#0 20M	Front Side	132322	22.31	23.00	1.172	0.423	0.496
	LTE Band 66/1RB#0 20M	Back Side	132322	22.31	23.00	1.172	0.362	0.424
	LTE Band 66/1RB#0 20M	Left Side	132322	22.31	23.00	1.172	0.168	0.197
	LTE Band 66/1RB#0 20M	Right Side	132322	22.31	23.00	1.172	0.312	0.366
	LTE Band 66/1RB#0 20M	Top Side	132322	22.31	23.00	1.172	0.146	0.171
	LTE Band 66/1RB#0 20M	Bottom Side	132322	22.31	23.00	1.172	0.255	0.299
	LTE Band 66/50RB#0 20M	Front Side	132322	21.55	22.00	1.109	0.362	0.402
	LTE Band 66/50RB#0 20M	Back Side	132322	21.55	22.00	1.109	0.286	0.317
	LTE Band 66/50RB#0 20M	Left Side	132322	21.55	22.00	1.109	0.130	0.144
	LTE Band 66/50RB#0 20M	Right Side	132322	21.55	22.00	1.109	0.262	0.291
	LTE Band 66/50RB#0 20M	Top Side	132322	21.55	22.00	1.109	0.134	0.149
	LTE Band 66/50RB#0 20M	Bottom Side	132322	21.55	22.00	1.109	0.200	0.222
	LTE Band 66B/1RB#0 20M	Front Side	132373	24.34	24.50	1.038	0.392	0.407
	LTE Band 66C/1RB#0 20M	Front Side	132323	24.17	24.50	1.079	0.412	0.445
11#	5G NR n2/1RB#1 20M	Front Side	376000	24.19	25.00	1.205	0.340	0.410
	5G NR n2/1RB#1 20M	Back Side	376000	24.19	25.00	1.205	0.275	0.331
	5G NR n2/1RB#1 20M	Left Side	376000	24.19	25.00	1.205	0.051	0.061
	5G NR n2/1RB#1 20M	Right Side	376000	24.19	25.00	1.205	0.206	0.248
	5G NR n2/1RB#1 20M	Top Side	376000	24.19	25.00	1.205	0.047	0.057
	5G NR n2/1RB#1 20M	Bottom Side	376000	24.19	25.00	1.205	0.140	0.169
	5G NR n2/50RB#1 20M	Front Side	376000	23.61	24.00	1.094	0.296	0.324
	5G NR n2/50RB#1 20M	Back Side	376000	23.61	24.00	1.094	0.198	0.217
	5G NR n2/50RB#1 20M	Left Side	376000	23.61	24.00	1.094	0.033	0.036
	5G NR n2/50RB#1 20M	Right Side	376000	23.61	24.00	1.094	0.175	0.191
	5G NR n2/50RB#1 20M	Top Side	376000	23.61	24.00	1.094	0.020	0.022
	5G NR n2/50RB#1 20M	Bottom Side	376000	23.61	24.00	1.094	0.110	0.120
	5G NR n5/1RB#1 20M	Front Side	167300	23.20	24.00	1.202	0.116	0.139
12#	5G NR n5/1RB#1 20M	Back Side	167300	23.20	24.00	1.202	0.125	0.150
	5G NR n5/1RB#1 20M	Left Side	167300	23.20	24.00	1.202	0.005	0.006

	5G NR n5/1RB#1 20M	Right Side	167300	23.20	24.00	1.202	0.045	0.054
	5G NR n5/1RB#1 20M	Top Side	167300	23.20	24.00	1.202	0.055	0.066
	5G NR n5/1RB#1 20M	Bottom Side	167300	23.20	24.00	1.202	0.043	0.051
	5G NR n5/50RB#1 20M	Front Side	167300	22.61	23.00	1.094	0.086	0.094
	5G NR n5/50RB#1 20M	Back Side	167300	22.61	23.00	1.094	0.093	0.102
	5G NR n5/50RB#1 20M	Left Side	167300	22.61	23.00	1.094	0.003	0.003
	5G NR n5/50RB#1 20M	Right Side	167300	22.61	23.00	1.094	0.034	0.037
	5G NR n5/50RB#1 20M	Top Side	167300	22.61	23.00	1.094	0.036	0.039
	5G NR n5/50RB#1 20M	Bottom Side	167300	22.61	23.00	1.094	0.030	0.033
13#	5G NR n66/1RB#1 20M	Front Side	349000	24.35	25.00	1.161	0.163	0.189
	5G NR n66/1RB#1 20M	Back Side	349000	24.35	25.00	1.161	0.132	0.153
	5G NR n66/1RB#1 20M	Left Side	349000	24.35	25.00	1.161	0.040	0.047
	5G NR n66/1RB#1 20M	Right Side	349000	24.35	25.00	1.161	0.140	0.163
	5G NR n66/1RB#1 20M	Top Side	349000	24.35	25.00	1.161	0.027	0.031
	5G NR n66/1RB#1 20M	Bottom Side	349000	24.35	25.00	1.161	0.109	0.127
	5G NR n66/50RB#1 20M	Front Side	349000	23.64	24.00	1.086	0.121	0.131
	5G NR n66/50RB#1 20M	Back Side	349000	23.64	24.00	1.086	0.110	0.120
	5G NR n66/50RB#1 20M	Left Side	349000	23.64	24.00	1.086	0.022	0.024
	5G NR n66/50RB#1 20M	Right Side	349000	23.64	24.00	1.086	0.115	0.125
	5G NR n66/50RB#1 20M	Top Side	349000	23.64	24.00	1.086	0.011	0.012
	5G NR n66/50RB#1 20M	Bottom Side	349000	23.64	24.00	1.086	0.088	0.096
14#	5G NR n77/1RB#1 100M	Front Side	656000	23.64	24.00	1.086	0.499	0.542
	5G NR n77/1RB#1 100M	Back Side	656000	23.64	24.00	1.086	0.137	0.149
	5G NR n77/1RB#1 100M	Left Side	656000	23.64	24.00	1.086	0.021	0.022
	5G NR n77/1RB#1 100M	Right Side	656000	23.64	24.00	1.086	0.265	0.288
	5G NR n77/1RB#1 100M	Top Side	656000	23.64	24.00	1.086	0.096	0.104
	5G NR n77/1RB#1 100M	Bottom Side	656000	23.64	24.00	1.086	0.258	0.280
	5G NR n77/135RB#1 100M	Front Side	656000	22.67	23.00	1.079	0.362	0.391
	5G NR n77/135RB#1 100M	Back Side	656000	22.67	23.00	1.079	0.096	0.104
	5G NR n77/135RB#1 100M	Left Side	656000	22.67	23.00	1.079	0.018	0.019
	5G NR n77/135RB#1 100M	Right Side	656000	22.67	23.00	1.079	0.212	0.229
	5G NR n77/135RB#1 100M	Top Side	656000	22.67	23.00	1.079	0.072	0.078
	5G NR n77/135RB#1 100M	Bottom Side	656000	22.67	23.00	1.079	0.200	0.216

15#	5G NR n78/1RB#1 100M	Front Side	650000	21.55	22.00	1.109	0.375	0.416
	5G NR n78/1RB#1 100M	Back Side	650000	21.55	22.00	1.109	0.136	0.151
	5G NR n78/1RB#1 100M	Left Side	650000	21.55	22.00	1.109	0.027	0.030
	5G NR n78/1RB#1 100M	Right Side	650000	21.55	22.00	1.109	0.271	0.301
	5G NR n78/1RB#1 100M	Top Side	650000	21.55	22.00	1.109	0.047	0.052
	5G NR n78/1RB#1 100M	Bottom Side	650000	21.55	22.00	1.109	0.219	0.243
	5G NR n78/135RB#1 100M	Front Side	650000	20.65	21.00	1.084	0.310	0.336
	5G NR n78/135RB#1 100M	Back Side	650000	20.65	21.00	1.084	0.110	0.119
	5G NR n78/135RB#1 100M	Left Side	650000	20.65	21.00	1.084	0.020	0.022
	5G NR n78/135RB#1 100M	Right Side	650000	20.65	21.00	1.084	0.233	0.253
	5G NR n78/135RB#1 100M	Top Side	650000	20.65	21.00	1.084	0.031	0.034
	5G NR n78/135RB#1 100M	Bottom Side	650000	20.65	21.00	1.084	0.196	0.212
Ant. 1								
	WLAN2.4GHz/802.11b	Front Side	7	15.96	16.5	1.132	0.027	0.031
	WLAN2.4GHz/802.11b	Back Side	7	15.96	16.5	1.132	0.084	0.095
	WLAN2.4GHz/802.11b	Left Side	7	15.96	16.5	1.132	0.028	0.032
	WLAN2.4GHz/802.11b	Right Side	7	15.96	16.5	1.132	0.030	0.034
	WLAN2.4GHz/802.11b	Top Side	7	15.96	16.5	1.132	0.040	0.045
	WLAN2.4GHz/802.11b	Bottom Side	7	15.96	16.5	1.132	0.011	0.012
Ant. 2								
	WLAN2.4GHz/802.11b	Front Side	1	15.82	16.5	1.169	0.039	0.046
	WLAN2.4GHz/802.11b	Back Side	1	15.82	16.5	1.169	0.051	0.060
	WLAN2.4GHz/802.11b	Left Side	1	15.82	16.5	1.169	0.004	0.005
	WLAN2.4GHz/802.11b	Right Side	1	15.82	16.5	1.169	0.013	0.015
	WLAN2.4GHz/802.11b	Top Side	1	15.82	16.5	1.169	0.003	0.004
16#	WLAN2.4GHz/802.11b	Bottom Side	1	15.82	16.5	1.169	0.116	0.136
Ant. 1								
	WLAN5.2GHz/802.11ax20 RU52	Front Side	48	12.62	13	1.091	0.081	0.088
	WLAN5.2GHz/802.11ax20 RU52	Back Side	48	12.62	13	1.091	0.105	0.115
	WLAN5.2GHz/802.11ax20 RU52	Left Side	48	12.62	13	1.091	0.001	0.001
	WLAN5.2GHz/802.11ax20 RU52	Right Side	48	12.62	13	1.091	0.024	0.026
	WLAN5.2GHz/802.11ax20 RU52	Top Side	48	12.62	13	1.091	0.005	0.005
	WLAN5.2GHz/802.11ax20 RU52	Bottom Side	48	12.62	13	1.091	0.001	0.001
Ant. 2								
	WLAN5.2GHz/802.11a	Front Side	48	11.82	12.5	1.169	0.048	0.056
17#	WLAN5.2GHz/802.11a	Back Side	48	11.82	12.5	1.169	0.229	0.268

	WLAN5.2GHz/802.11a	Left Side	48	11.82	12.5	1.169	0.005	0.006
	WLAN5.2GHz/802.11a	Right Side	48	11.82	12.5	1.169	0.035	0.041
	WLAN5.2GHz/802.11a	Top Side	48	11.82	12.5	1.169	0.005	0.006
	WLAN5.2GHz/802.11a	Bottom Side	48	11.82	12.5	1.169	0.181	0.212
Ant. 1								
	WLAN5.8GHz/802.11ax20 RU242	Front Side	149	12.37	13	1.156	0.017	0.020
18#	WLAN5.8GHz/802.11ax20 RU242	Back Side	149	12.37	13	1.156	0.066	0.076
	WLAN5.8GHz/802.11ax20 RU242	Left Side	149	12.37	13	1.156	0.001	0.001
	WLAN5.8GHz/802.11ax20 RU242	Right Side	149	12.37	13	1.156	0.027	0.031
	WLAN5.8GHz/802.11ax20 RU242	Top Side	149	12.37	13	1.156	0.064	0.074
	WLAN5.8GHz/802.11ax20 RU242	Bottom Side	149	12.37	13	1.156	0.008	0.009
Ant. 2								
	WLAN5.8GHz/802.11a	Front Side	165	12.27	13	1.183	0.031	0.037
	WLAN5.8GHz/802.11a	Back Side	165	12.27	13	1.183	0.032	0.038
	WLAN5.8GHz/802.11a	Left Side	165	12.27	13	1.183	0.003	0.004
	WLAN5.8GHz/802.11a	Right Side	165	12.27	13	1.183	0.023	0.027
	WLAN5.8GHz/802.11a	Top Side	165	12.27	13	1.183	0.009	0.011
	WLAN5.8GHz/802.11a	Bottom Side	165	12.27	13	1.183	0.028	0.033

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18.3. Repeated SAR Assessment

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

19. Simultaneous Transmission Evaluation

19.1. Simultaneous Transmission Consideration

No.	Simultaneous Transmission Consideration	Body
1	WWAN(3G/4G)+WLAN 2.4GHz/5GHz SISO	Yes
2	WWAN(5G FR1 SA/NSA)+WLAN 2.4GHz/5GHz SISO	Yes
3	WWAN(3G/4G)+WLAN 2.4GHz/5GHz MIMO	Yes
4	WWAN(5G FR1 SA/NSA)+WLAN 2.4GHz/5GHz 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. Simultaneous Transmission SAR evaluation is not required for BT and WLAN, because the software mechanism have been incorporated to guarantee that the WLAN and Bluetooth transmitters would not simultaneously operate.
4. 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.
5. 2.4G&5G MIMO SAR were combined standalone SAR of CH0 and CH1.
6. When it supports transmit simultaneously at WWAN+WLAN MIMO mode, the co-location SAR of WWAN+WLAN (standalone SAR) would not be recorded in this report.
7. This device does not support simultaneous transmission of WWAN(3/4G/SA/ENDC)+WLAN 2.4GHz+ WLAN 5 GHz mode.
8. The standalone SAR of EN-DC and simultaneous transmission SAR of WCDMA/LTE/5G NR (SA/NSA) refers to the annex F of this report.

19.2. Simultaneous Transmission Analysis

RF exposure compliance with WWAN +WLAN simultaneous transmission scenarios, 5G NR and LTE are managed and controlled by Qualcomm Smart Transmit.

Smart Transmit algorithm in WWAN adds directly the time-averaged RF exposure from LTE and time-averaged RF exposure from 5G FR1, i.e.,

Smart Transmit current implementation assumes hotspots from 5G NR and LTE are coll0cated. Therefore for a total of 1 exposure margin, if LTE uses x, then the exposure margin left for 5G NR is capped to (1-x). The compliance equation for LTE + 5G NR is

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

Here, "*x*A*" represents percentage of normalized time-averaged RF exposure from LTE, and x ranges between [0,1]; "*(1-x)*B*" is remaining percentage of RF exposure contribution from 5G NR (i.e., SAR exposure for 5G NR FR1 and PD exposure for 5G NR FR2). Smart Transmit controls '*x*' in real time such that the sum of these exposures never exceeds 1.0 normalized limit.

Note that mathematically:

$x * A + (1-x) * B \leq x * (A,) + (1-x) * B\ (A,B) \leq max(A,B)$ normalized limit
$x * A + (1-x) * B \leq 1.0$ for $x \in [0,1]$ (2)

Therefore, if below equations and are proven:

$$A + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit,$$
$$B + norm.SAR\ from\ WLAN \leq 1.0\ norm.limit,$$

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

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

20. Uncertainty Assessment

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

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

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

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

Standard Uncertainty for Assumed Distribution

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

(b) κ is the coverage factor

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

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

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

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

Annex A General Information

1. Identification of the Responsible Testing Laboratory

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