REPORT No.: SZ24030252S01

TEST REPORT

APPLICANT	:	Horizon Powered USA Inc.
PRODUCT NAME	:	5G/LTE CBRS USB-C Dongle
MODEL NAME	:	DG505G
BRAND NAME	:	Horizon
FCC ID	:	2BE94DG505G
STANDARD(S)	:	FCC 47 CFR Part 2(2.1093) IEEE 1528-2013
RECEIPT DATE	:	2024-04-07
TEST DATE	:	2024-05-10 to 2024-07-09
ISSUE DATE	:	2024-07-22

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Changed History		
Version	**Date**	**Reason for Change**
1.0	2024-06-20	First edition
2.0	2024-07-22	Increase the combination of carrier aggregation and replaced version 1.0

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 5mm) 1g SAR (W/kg)
LTE	LTE Band 41	1.068
	LTE Band 48	0.434
5G NR	n41	1.194
	n48	1.133
	n77	1.162
	n78	1.170

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 1 (1.1310) and IEEE C95.1-1991), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 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% confidence intervals.

2. Technical Information

Note: Provide by applicant.

2.1. Applicant and Manufacturer Information

Applicant:	Horizon Powered USA Inc.
Applicant Address:	8350 NW 52nd Terrace, Suite 301 Miami, Florida 33166 United States
Manufacturer:	Horizon Powered USA Inc.
Manufacturer Address:	8350 NW 52nd Terrace, Suite 301 Miami, Florida 33166 United States

2.2. Equipment under Test (EUT) Description

Product Name:	5G/LTE CBRS USB-C Dongle
EUT IMEI.:	354076120014743 354076120012754
Hardware Version:	E
Software Version:	DG505G.V2.00_420406D
Frequency Bands:	LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 48: 3550 MHz ~ 3700 MHz 5G NR n41: 2496 MHz ~ 2690 MHz 5G NR n48: 3550 MHz ~ 3700 MHz 5G NR n77: 3450 MHz ~ 3550 MHz; 3700 MHz ~ 3980 MHz 5G NR n78: 3450 MHz ~ 3550 MHz; 3700 MHz ~ 3800 MHz
Modulation Mode:	LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR: DFT-s-OFDM/CP-OFDM, PI/2 BPSK QPSK, 16QAM, 64QAM, 256QAM
Operation Class:	Class B
Carrier Aggregation:	Uplink & Downlink
Antenna Type:	WWAN: PIFA Internal Antenna
SIM Cards Description:	LTE+5G NR

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

2.3. Environment of Test Site/Conditions

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

Test Frequency:	TDD-LTE 41/48 5G NR n41/48/77/78
Operation Mode:	Call established
Power Level:	TDD-LTE Band 41/48 (Maximum output power) 5G NR n41/48/77/78 (Maximum output power)

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.

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 47 CFR 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 447498 D02v02r01	SAR Procedures for Dongle Xmtr	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 D06v02r01	SAR Evaluation Procedures For Portable Devices With Wireless Router Capabilities	No deviation
Note 1: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.		

6. SAR Measurement System

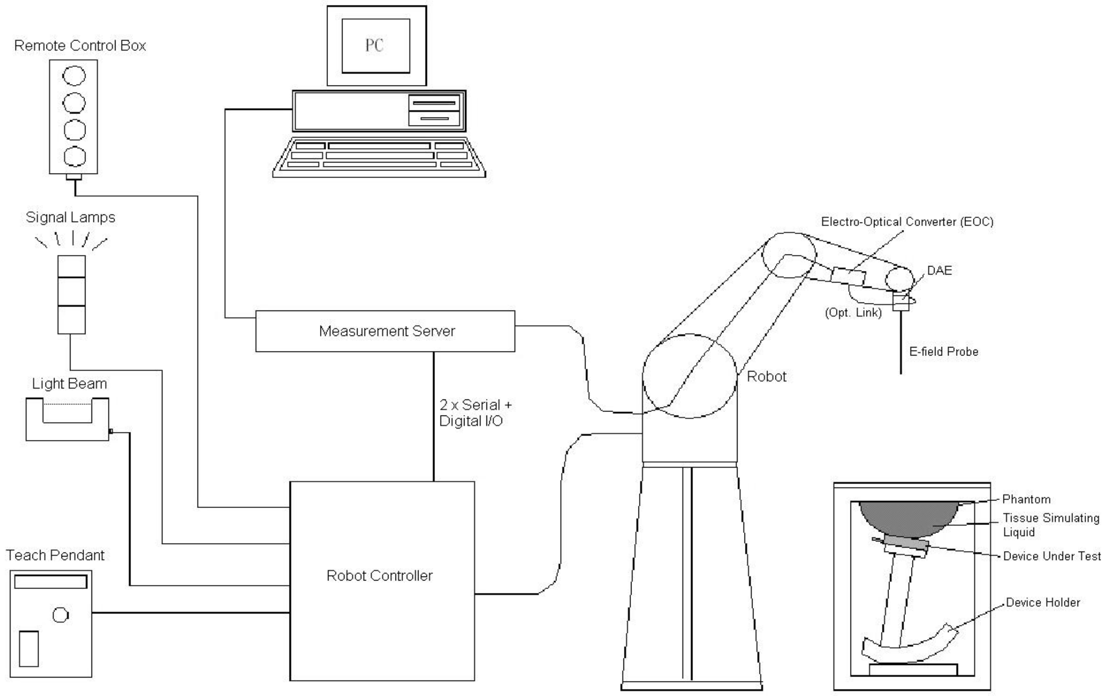


Fig 6.1 SPEAG DASY System Configurations

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

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

6.1. E-Field Probe

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

➢ **E-Field Probe Specification**

<ES3DV3 Probe>

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)	
Dynamic Range	5 μW/g to 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm	**Fig 6.2 Photo of ES3DV3**

<EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 μW/g to 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	**Fig 6.3 Photo of EX3DV4**

➢ **E-Field Probe Calibration**

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

6.2. Data Acquisition Electronics (DAE)

The data acquisition electronics(DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a 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

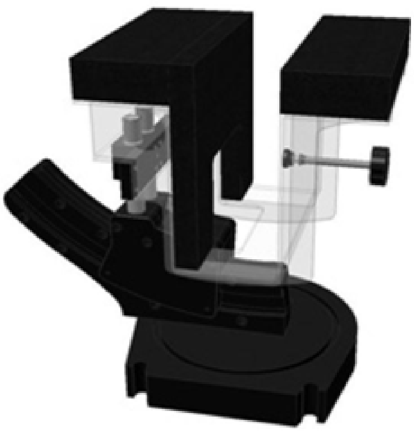


Fig 6.10 Laptop Extension Kit

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 No./ SW Version	Calibration	
				Last Cal.	Due Date
SPEAG	2600MHz System Validation Kit	D2600V2	1198	2022.08.17	2025.08.16
SPEAG	3500MHz System Validation Kit	D3500V2	1104	2023.06.03	2026.06.02
SPEAG	3700MHz System Validation Kit	D3700V2	1076	2023.06.03	2026.06.02
SPEAG	3900MHz System Validation Kit	D3900V2	1046	2023.06.02	2026.06.01
SPEAG	DOSIMETRIC ASSESSMENT SYSTEM Software	DASY52	52.10.4.1527	NCR	NCR
SPEAG	Dosimetric E-Field Probe	EX3DV4	7608	2024.03.21	2025.03.20
SPEAG	Data Acquisition Electronics	DAE4	1643	2024.03.27	2025.03.26
SPEAG	SAM Twin Phantom 2	QD000P40CC	TP-1464	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Network Emulator	CMW500	165755	2024.01.25	2025.01.24
Anritsu	Network Emulator	MT8820C	6201274521	2024.01.25	2025.01.24
Anritsu	Network Emulator	MT8821C	6261830572	2024.01.25	2025.01.24
Anritsu	Network Emulator	MT8000A	6262148249	2023.06.27	2024.06.24
Anritsu	Network Emulator	MT8000A	6262148249	2024.06.30	2025.06.29
Agilent	Network Analyzer	E5071B	MY42404762	2024.01.25	2025.01.24
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2024.03.18	2025.03.17
mini-circuits	Amplifier	ZHL-42W+	608501717	NCR	NCR
Agilent	Signal Generator	N5182B	MY53050509	2023.09.19	2024.09.18
R&S	Power Senor	NRP8S	103215	2024.01.25	2025.01.24
Agilent	Power Meter	E4416A	MY45102093	2023.09.19	2024.09.18
R&S	Power Sensor	NRP8S	103240	2024.01.25	2025.01.24
Anritsu	Power Meter	E4418B	GB43318055	2023.06.21	2024.06.20
Anritsu	Power Meter	E4418B	GB43318055	2024.05.30	2025.05.29
Agilent	Dual Directional Coupler	778D	50422	NA	NA
MCL	Attenuation	351-218-010	N/A	NA	NA
R&S	Spectrum Analyzer	N9030A	MY54170556	2023.10.07	2024.10.06
KTJ	Thermo meter	TA298	N/A	2023.11.22	2024.11.21
SPEAG	Tissue Simulating Liquids	HBBL600-10000V6		24H	

Note:

1. The calibration certificate of DASY can be referred to appendix E of this report.
2. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via

the network analyzer and compensated during system check.

3. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Speag.
4. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio 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
2600	HSL	22.1	1.956	1.96	-0.20	±5	2024.05.11
2600	HSL	22.1	1.965	1.96	0.26	±5	2024.05.13
2600	HSL	22.1	1.980	1.96	1.02	±5	2024.07.09
3500	HSL	22.1	2.933	2.91	0.79	±5	2024.05.10
3700	HSL	22.1	3.118	3.05	2.23	±5	2024.05.12
3700	HSL	22.3	3.051	3.05	0.03	±5	2024.05.14
3900	HSL	22.2	3.102	3.15	-1.52	±5	2024.05.15
Frequency (MHz)	**Tissue Type**	**Liquid Temp. (℃)**	**Permittivity (εr)**	**Permittivity Target (εr)**	**Delta (εr) (%)**	**Limit (%)**	**Date**
2600	HSL	22.1	38.238	39.00	-1.95	±5	2024.05.11
2600	HSL	22.1	38.155	39.00	-2.17	±5	2024.05.13
2600	HSL	22.1	38.249	39.00	-1.93	±5	2024.07.09
3500	HSL	22.1	37.274	37.90	-1.65	±5	2024.05.10
3700	HSL	22.1	37.570	37.70	-0.34	±5	2024.05.12
3700	HSL	22.3	37.663	37.70	-0.10	±5	2024.05.14
3900	HSL	22.2	36.719	37.50	-2.08	±5	2024.05.15

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

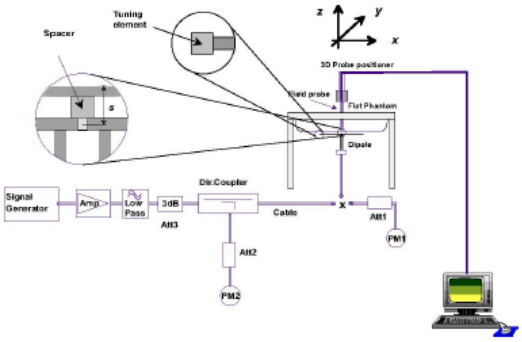


Fig 8.2 System Setup for System Evaluation

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
2600	HSL	250	D2600V2-1198	7608	1643
3500	HSL	100	D3500V2-1104	7608	1643
3700	HSL	100	D3700V2-1076	7608	1643
3900	HSL	100	D3900V2-1176	7608	1643

<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
3400	HSL	2.88	38.10	PASS	PASS	PASS
3500	HSL	2.91	37.90	PASS	PASS	PASS
3700	HSL	3.05	37.70	PASS	PASS	PASS
3900	HSL	3.15	37.50	PASS	PASS	PASS
4100	HSL	3.25	37.20	PASS	PASS	PASS
4200	HSL	3.34	37.00	PASS	PASS	PASS
4400	HSL	3.58	36.70	PASS	PASS	PASS
4600	HSL	3.70	36.60	PASS	PASS	PASS
4800	HSL	3.82	36.40	PASS	PASS	PASS
4900	HSL	3.96	36.20	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
3400	HSL	2.88	38.10	OFDM	PASS	PASS
3500	HSL	2.91	37.90	OFDM	PASS	PASS
3700	HSL	3.05	37.70	OFDM	PASS	PASS
3900	HSL	3.15	37.50	OFDM	PASS	PASS
4100	HSL	3.25	37.20	OFDM	PASS	PASS
4200	HSL	3.34	37.00	OFDM	PASS	PASS
4400	HSL	3.58	36.70	OFDM	PASS	PASS
4600	HSL	3.70	36.60	OFDM	PASS	PASS
4800	HSL	3.82	36.40	OFDM	PASS	PASS
4900	HSL	3.96	36.20	OFDM	PASS	PASS
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 (%)
2024.05.11	2600	HSL	250	14.60	57.00	58.4	2.46
2024.05.13	2600	HSL	250	15.31	57.00	61.24	7.44
2024.07.09	2600	HSL	250	15.18	57.00	60.72	6.53
2024.05.10	3500	HSL	100	7.31	67.20	73.1	8.78
2024.05.12	3700	HSL	100	7.08	67.50	70.8	4.89
2024.05.14	3700	HSL	100	7.19	67.50	71.9	6.52
2024.05.15	3900	HSL	100	7.31	69.90	73.1	4.58

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2024.05.11	2600	HSL	250	6.52	25.70	26.08	1.48
2024.05.13	2600	HSL	250	6.59	25.70	26.36	2.57
2024.07.09	2600	HSL	250	7.02	25.70	28.08	9.26
2024.05.10	3500	HSL	100	2.62	25.10	26.2	4.38
2024.05.12	3700	HSL	100	2.49	24.20	24.9	2.89
2024.05.14	3700	HSL	100	2.35	24.20	23.5	-2.89
2024.05.15	3900	HSL	100	2.28	24.10	22.8	-5.39

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

9. EUT Testing Position

9.1. Simple Dongle Procedure

Test all USB orientations [see figure below: (A) Horizontal-Up, (B) Horizontal-Down, (C) Vertical-Front, and (D) Vertical-Back] with a device-to-phantom separation distance of 5 mm or less, according to KDB Publication 447498 D01 requirements.

The same test separation distance must be used to test all frequency bands and modes in each USB orientation. The typical Horizontal-Up USB connection (A), found in the majority of host computers, must be tested using an appropriate host computer. A host computer with either Vertical-Front (C) or Vertical-Back (D) USB connection should be used to test one of the vertical USB orientations. If a suitable host computer is not available for testing the Horizontal-Down (B) or the remaining Vertical USB orientation, a high quality USB cable, 12 inches or less, may be used for testing these other orientations. It must be documented that the USB cable does not influence the radiating characteristics and output power of the transmitter.

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.

9.2. Exposure Position Conditions

USB dongles have a rather small footprint; therefore, the SAR scan resolutions should be smaller than those typically used for testing devices with larger form factors, to maintain acceptable uncertainty for the interpolation and extrapolation algorithms used in the 1-g SAR analysis. In addition, when USB cables are used to connect a dongle to the host for SAR testing, the dongle should be supported in several cm of foamed polystyrene (e.g., Styrofoam) to minimize any field perturbation effects due to test device holder used to position the dongle for SAR testing. Dongles with certain spacers, contours or tapering added to the housing should generally be tested according to the 5 mm test separation requirement required for simple dongles, which is based on overall host platform, device and user operating configurations and exposure conditions of a peripheral device as compared to individual use conditions.

USB dongle transmitters must show compliance at a test separation distance of 5 mm. When the SAR is ≥ 1.2 W/kg, applications for equipment certification require a KDB inquiry for equipment approval.2 Preliminary data submitted through KDB inquiries showing compliance at test distances greater than 5 mm are usually inapplicable and insufficient for the FCC to determine if potential exposure concerns may be eliminated to enable the device to satisfy compliance. The information must clearly demonstrate that the likelihood of non-compliance is remote. When the SAR is ≥ 1.2 W/kg, especially for SAR > 1.5 W/kg, certain caution statements, labels and other means to ensure compliance may be required.

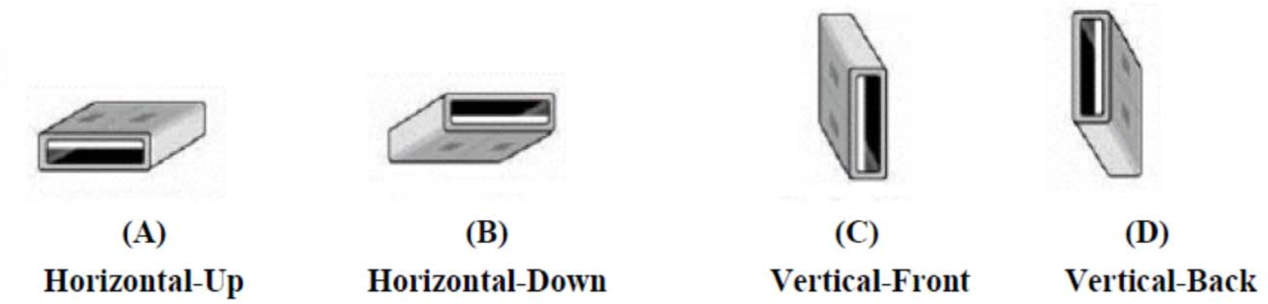


Fig 9.6 USB Connector Orientations Implemented on Laptop Computers

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

11.2. Test Procedure

The Following steps are used for each test position

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

11.3. Description of Interpolation/Extrapolation Scheme

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

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

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

11.4. Wireless Router

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

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

12. SAR Test Configuration

<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
41	N/A	N/A	√	√	√	√
48	N/A	N/A	√	√	√	√

Note:

1. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
2. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
3. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
4. Per KDB 941225 D05v02r05, for QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
5. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration

is > not 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.

13. Conducted Power List

Remark: The output power of WWAN refers to the annex E of this report.

14. Carrier Aggregation

14.1. LTE Uplink Carrier Aggregation

➢ **Carrier Aggregation Configuration**

<Intra-band>

2CC Uplink Carrier Aggregation for Intra-band				
No.	Combination	MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_41C	-	-	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.

14.2. LTE Downlink Carrier Aggregation

➢ **Carrier Aggregation Configuration**

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

2CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_41A-41A	41A-41A	-	No
2	CA_41C	41C	-	No
3	CA_48A-48A	48A-48A	-	No
4	CA_48C	48C	-	No

3CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_41D	41D	-	No
2	CA_48A-48C	48A-48C	-	No
3	CA_48D	48D	-	No

4CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_48E	48E	-	No
2	CA_48C-48C	48C-48C	-	No
3	CA_48A-48D	48A-48D	-	No

5CC Downlink Carrier Aggregation				
NO.	Combination	DL 4X4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_48A-48E	48A	-	No

➢ **LTE Downlink Carrier Aggregation Conducted Power**

1. According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink carrier

aggregation active.

2. Uplink maximum output power with downlink carrier aggregation active does not show more than ¼ dB higher than the maximum output power without downlink carrier aggregation active, therefore SAR evaluation with downlink carrier aggregation active can be excluded.
3. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
4. Selected highest measured power when downlink carrier aggregation is inactive for conducted power comparison with downlink carrier aggregation is active, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.
5. For non-contiguous intra-band CA, the SCC selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band.
6. For Intra-band, contiguous CA, the downlink channels selected to perform the uplink power measurement must satisfy
7. 3GPP channel spacing (5.4.1A of 3GPP TS 36.521 or equivalent) and channel bandwidth (5.4.2A) requirements.

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

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

14.3. 5G NR Carrier Aggregation

➢ **Downlink 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	5G-NR DL 4x4 MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_n41(2A)	n41A-n41A	-	No
2	CA_n78A-n78A	n78A-n78A	-	No
3	CA_n41C	n41C	-	No

Note:

1. 3GPP channel spacing (5.4.1A of 3GPP TS 38.521 or equivalent) and channel bandwidth (5.3.2A) requirements.

For NR operating bands with 100 kHz channel raster:

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

For NR operating bands with 15 kHz channel raster:

$$\text{Nominal channel spacing} = \left\lfloor \frac{BW_{Channel(1)} + BW_{Channel(2)} - 2\left|GB_{Channel(1)} - GB_{Channel(2)}\right|}{0.015 * 2^{n+1}} \right\rfloor 0.015 * 2^{n} \text{ [MHz]}$$

2. The output power of CA downlink refers to the annex E of this report.

15. Hotspot Mode Evaluation Procedure

➢ **EUT Antenna Location**

The location of antenna was recorded in annex B
ANT 0: TX0/PRX: LTE Band 41 DRX: 5G NR n41 ANT 1: DRX3: 5G NR n48/77/78 ANT 2: DRX1: LTE Band 41 DRX2: 5G NR n48/77/78 ANT 3: TX0: 5G NR n48 PRX: LTE Band 48 DRX1: LTE Band 48; 5G NR n48/77/78 ANT 5: TX0: LTE Band 48, 5G NR n41/77/78 PRX: 5G NR n41/48/77/78

➢ **EUT Antenna Distance**

Antenna Location	Horizontal -Down	Horizontal -Up	Vertical-Front	Vertical-Back	Tip Face
ANT 0	< 5mm	< 5mm	< 5mm	< 5mm	< 5mm
ANT 3	< 5mm	< 5mm	>25mm	< 5mm	>25mm
ANT 5	< 5mm	< 5mm	< 5mm	>25mm	>25mm

➢ **Hotspot Evaluation**

Assessment	Hotspot Side for SAR Test Distance: 5mm				
Antennas	Horizontal -Down	Horizontal -Up	Vertical-Front	Vertical-Back	Tip Face
ANT 0	Yes	Yes	Yes	Yes	Yes
ANT 3	Yes	Yes	No	Yes	No
ANT 5	Yes	Yes	Yes	No	No

Note :

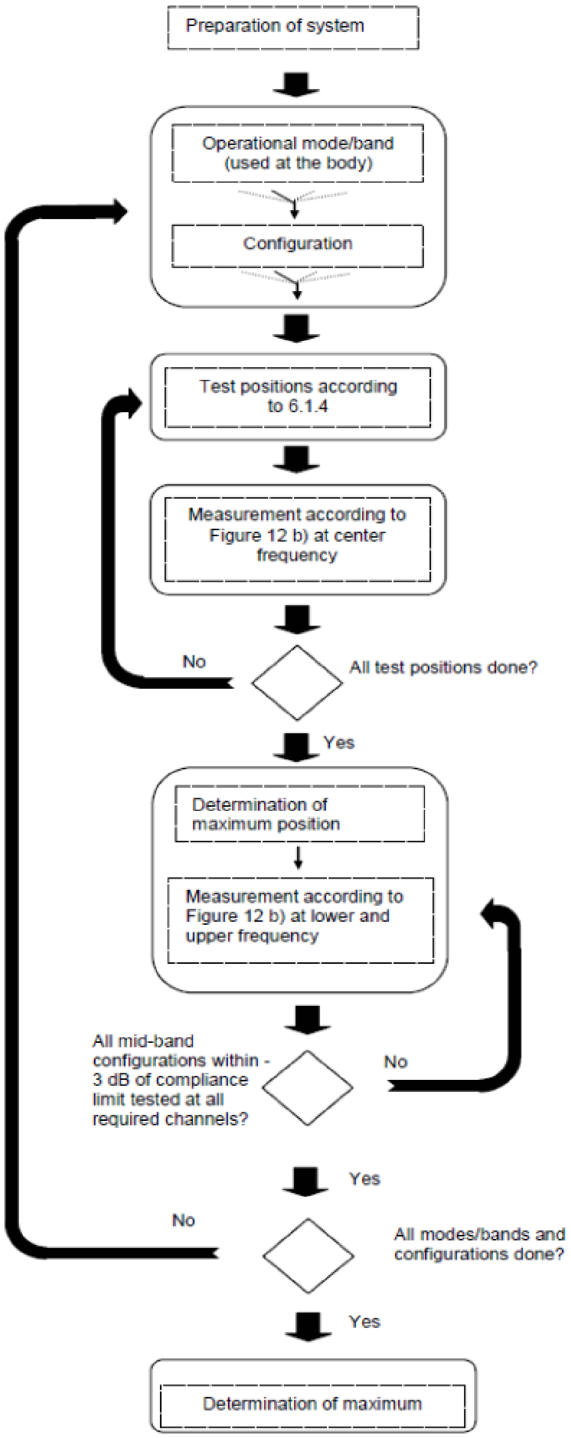
1. The SAR evaluation procedures for Portable Devices with Wireless Router function is according to KDB 941225 D06 Hotspot SAR v02r01.
2. Head/Body-worn/Hotspot mode SAR assessments are required.
3. Referring to KDB 941225 D06, when the overall device length and width are≤9cm*5cm, the test distance is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

located within 25mm from that surface or edge.

4. For WWAN bands, all of Horizontal-Down & Horizontal-Up & Vertical-Front & Vertical-Back & Tip Face would be tested in this report.

16. Block Diagram of the Tests to be Performed

16.1. Body



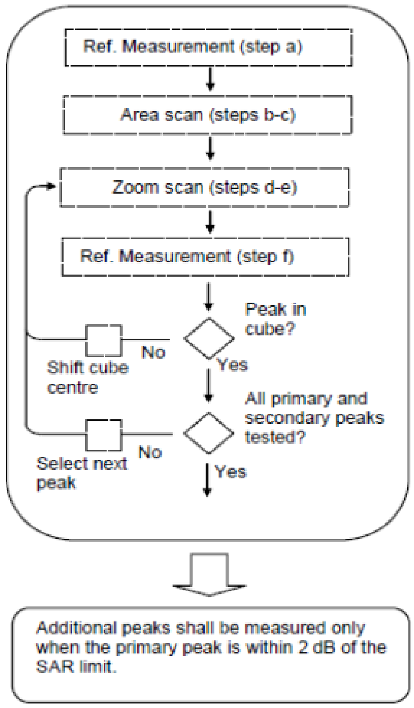


Figure 12b – General procedure

17. Proximity Sensor Considerations

17.1. Proximity Sensor Triggering Distances

➢ **P-sensor Triggering Distance Testing**

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

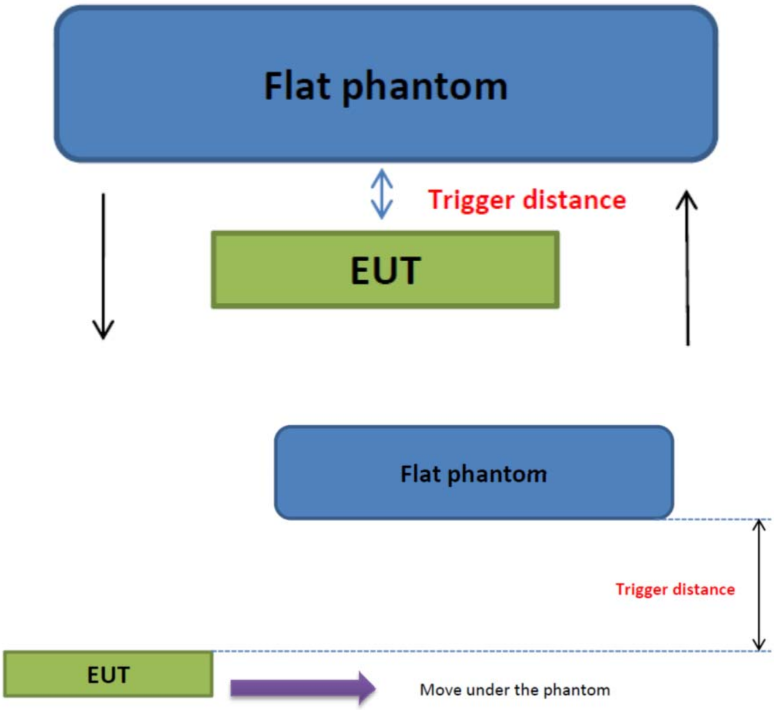


Fig.17.1 Illustration for proximity sensor trigger

➢ **P-sensor Triggering Distance**

Proximity Sensor Trigger Distance (mm)					
Exposure Position	Horizontal-Down	Horizontal-Up	Vertical-Front	Vertical-Back	Tip Face
Minimum	18	16	11	10	16

17.2. Proximity Sensor Coverage

Proximity sensors are not normally designed to cover the entire back surface or edges of the 5G USB dongle. The sensing regions are usually limited to areas near the sensor element. If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For P-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”. Illustrating in the internal photo exhibit, although the sensor spatially offset, there is no trigger condition where the antenna is next to the user, the sensor is laterally further away, therefore proximity sensor coverage testing is not required. This procedure is not required since the antenna, sensor and peak SAR location is overlapped with the sensor.

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 WLAN: 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 UL SAR measurement, the worst condition of standalone transmission would be tested.
8. When this device is close to human the sensor will be active automatically, the tissue will change the capacitance and the reduced power of WWAN applied.

18.2. Body SAR Data

- **LTE QPSK Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Sensor on/Reduced Power (ANT 0)								
	LTE Band 41/1RB#0 20M	Horizontal-Up	40620	20.57	21.50	1.239	0.815	1.016
	LTE Band 41/1RB#0 20M	Horizontal-Down	40620	20.57	21.50	1.239	0.824	1.027
	LTE Band 41/1RB#0 20M	Vertical-Front	40620	20.57	21.50	1.239	0.125	0.156
	LTE Band 41/1RB#0 20M	Vertical-Back	40620	20.57	21.50	1.239	0.502	0.625
	LTE Band 41/1RB#0 20M	Tip Face	40620	20.57	21.50	1.239	0.201	0.250
	LTE Band 41/1RB#0 20M	Horizontal-Up	39750	20.53	21.50	1.250	0.704	0.885
	LTE Band 41/1RB#0 20M	Horizontal-Up	40185	20.5	21.50	1.259	0.704	0.891
1#	LTE Band 41/1RB#0 20M	Horizontal-Up	41055	20.49	21.50	1.262	0.841	1.068
	LTE Band 41/1RB#0 20M	Horizontal-Up	41490	20.48	21.50	1.265	0.742	0.944
	LTE Band 41/1RB#0 20M	Horizontal-Down	39750	20.53	21.50	1.250	0.831	1.045
	LTE Band 41/1RB#0 20M	Horizontal-Down	40185	20.5	21.50	1.259	0.794	1.005
	LTE Band 41/1RB#0 20M	Horizontal-Down	41055	20.49	21.50	1.262	0.794	1.008
	LTE Band 41/1RB#0 20M	Horizontal-Down	41490	20.48	21.50	1.265	0.734	0.934
	LTE Band 41/50RB#0 20M	Horizontal-Up	40620	19.61	20.50	1.227	0.644	0.795
	LTE Band 41/50RB#0 20M	Horizontal-Down	40620	19.61	20.50	1.227	0.651	0.804
	LTE Band 41/50RB#0 20M	Vertical-Front	40620	19.61	20.50	1.227	0.099	0.122
	LTE Band 41/50RB#0 20M	Vertical-Back	40620	19.61	20.50	1.227	0.396	0.489
	LTE Band 41/50RB#0 20M	Tip Face	40620	19.61	20.50	1.227	0.115	0.142

	LTE Band 41/50RB#0 20M	Horizontal-Down	39750	19.6	20.50	1.230	0.648	0.802
	LTE Band 41/50RB#0 20M	Horizontal-Down	40185	19.59	20.50	1.233	0.619	0.768
	LTE Band 41/50RB#0 20M	Horizontal-Down	41055	19.54	20.50	1.247	0.619	0.777
	LTE Band 41/50RB#0 20M	Horizontal-Down	41490	19.55	20.50	1.245	0.572	0.717
	LTE Band 41/100RB#0 20M	Horizontal-Up	41055	19.58	20.50	1.236	0.628	0.781
	LTE Band 41C/1RB#0 20M+20M	Horizontal-Up	41292	20.38	21.50	1.294	0.819	1.066
Sensor on/Reduced Power (ANT 5)								
	LTE Band 48/1RB#0 20M	Horizontal-Up	55990	18.72	19.50	1.197	0.328	0.395
2#	LTE Band 48/1RB#0 20M	Horizontal-Down	55990	18.72	19.50	1.197	0.360	0.434
	LTE Band 48/1RB#0 20M	Vertical-Front	55990	18.72	19.50	1.197	0.200	0.241
	LTE Band 48/1RB#0 20M	Vertical-Back	55990	18.72	19.50	1.197	0.038	0.046
	LTE Band 48/1RB#0 20M	Tip Face	55990	18.72	19.50	1.197	0.027	0.033
	LTE Band 48/50RB#0 20M	Horizontal-Up	55990	17.79	18.50	1.178	0.328	0.388
	LTE Band 48/50RB#0 20M	Horizontal-Down	55990	17.79	18.50	1.178	0.360	0.427
	LTE Band 48/50RB#0 20M	Vertical-Front	55990	17.79	18.50	1.178	0.200	0.237
	LTE Band 48/50RB#0 20M	Vertical-Back	55990	17.79	18.50	1.178	0.038	0.045
	LTE Band 48/50RB#0 20M	Tip Face	55990	17.79	18.50	1.178	0.018	0.021

➢ **5G NR DFT-s-QPSK Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Sensor on/Reduced Power (ANT 5)								
	5G NR n41/1RB#1 100M	Horizontal-Up	518598	16.38	17.00	1.153	0.835	0.963
	5G NR n41/1RB#1 100M	Horizontal-Down	518598	16.38	17.00	1.153	0.926	1.068
	5G NR n41/1RB#1 100M	Vertical-Front	518598	16.38	17.00	1.153	0.190	0.219
	5G NR n41/1RB#1 100M	Vertical-Back	518598	16.38	17.00	1.153	0.140	0.161
	5G NR n41/1RB#1 100M	Tip Face	518598	16.38	17.00	1.153	0.081	0.093
	5G NR n41/1RB#1 100M	Horizontal-Up	509202	16.24	17.00	1.191	0.845	1.007
	5G NR n41/1RB#1 100M	Horizontal-Up	513900	16.22	17.00	1.197	0.826	0.989
	5G NR n41/1RB#1 100M	Horizontal-Up	523296	16.19	17.00	1.205	0.942	1.135
	5G NR n41/1RB#1 100M	Horizontal-Up	528000	16.36	17.00	1.159	0.937	1.086
	5G NR n41/1RB#1 100M	Horizontal-Down	509202	16.24	17.00	1.191	0.853	1.016
	5G NR n41/1RB#1 100M	Horizontal-Down	513900	16.22	17.00	1.197	0.906	1.084
	5G NR n41/1RB#1 100M	Horizontal-Down	523296	16.19	17.00	1.205	0.937	1.129
3#	5G NR n41/1RB#1 100M	Horizontal-Down	528000	16.36	17.00	1.159	1.030	1.194
	5G NR n41/135RB#1 100M	Horizontal-Up	518598	16.09	17.00	1.233	0.753	0.929

	5G NR n41/135RB#1 100M	Horizontal-Down	518598	16.09	17.00	1.233	0.818	1.009
	5G NR n41/135RB#1 100M	Vertical-Front	518598	16.09	17.00	1.233	0.169	0.208
	5G NR n41/135RB#1 100M	Vertical-Back	518598	16.09	17.00	1.233	0.125	0.154
	5G NR n41/135RB#1 100M	Tip Face	518598	16.09	17.00	1.233	0.063	0.078
	5G NR n41/135RB#1 100M	Horizontal-Up	509202	16.01	17.00	1.256	0.794	0.997
	5G NR n41/135RB#1 100M	Horizontal-Up	513900	15.93	17.00	1.279	0.739	0.945
	5G NR n41/135RB#1 100M	Horizontal-Up	523296	15.92	17.00	1.282	0.801	1.027
	5G NR n41/135RB#1 100M	Horizontal-Up	528000	15.95	17.00	1.274	0.834	1.062
	5G NR n41/135RB#1 100M	Horizontal-Down	509202	16.01	17.00	1.256	0.809	1.016
	5G NR n41/135RB#1 100M	Horizontal-Down	513900	15.93	17.00	1.279	0.814	1.041
	5G NR n41/135RB#1 100M	Horizontal-Down	523296	15.92	17.00	1.282	0.826	1.059
	5G NR n41/135RB#1 100M	Horizontal-Down	528000	15.95	17.00	1.274	0.917	1.168
	5G NR n41/270RB#0 100M	Horizontal-Down	518598	16.07	17.00	1.239	0.781	0.968
Sensor on/Reduced Power (ANT 3)								
	5G NR n48/1RB#1 100M	Horizontal-Up	641666	15.61	16.50	1.227	0.729	0.894
4#	5G NR n48/1RB#1 100M	Horizontal-Down	641666	15.61	16.50	1.227	0.923	1.133
	5G NR n48/1RB#1 100M	Vertical-Front	641666	15.61	16.50	1.227	0.115	0.142
	5G NR n48/1RB#1 100M	Vertical-Back	641666	15.61	16.50	1.227	0.327	0.402
	5G NR n48/1RB#1 100M	Tip Face	641666	15.61	16.50	1.227	0.132	0.162
	5G NR n48/1RB#1 100M	Horizontal-Up	640000	15.44	16.50	1.276	0.771	0.985
	5G NR n48/1RB#1 100M	Horizontal-Up	640834	15.54	16.50	1.247	0.769	0.959
	5G NR n48/1RB#1 100M	Horizontal-Up	642500	15.39	16.50	1.291	0.747	0.965
	5G NR n48/1RB#1 100M	Horizontal-Up	643332	15.57	16.50	1.239	0.732	0.907
	5G NR n48/1RB#1 100M	Horizontal-Down	640000	15.44	16.50	1.276	0.839	1.071
	5G NR n48/1RB#1 100M	Horizontal-Down	640834	15.54	16.50	1.247	0.850	1.060
	5G NR n48/1RB#1 100M	Horizontal-Down	642500	15.39	16.50	1.291	0.827	1.067
	5G NR n48/1RB#1 100M	Horizontal-Down	643332	15.57	16.50	1.239	0.789	0.978
	5G NR n48/135RB#1 100M	Horizontal-Up	641666	15.53	16.50	1.250	0.633	0.791
	5G NR n48/135RB#1 100M	Horizontal-Down	641666	15.53	16.50	1.250	0.832	1.041
	5G NR n48/135RB#1 100M	Vertical-Front	641666	15.53	16.50	1.250	0.080	0.100
	5G NR n48/135RB#1 100M	Vertical-Back	641666	15.53	16.50	1.250	0.293	0.367
	5G NR n48/135RB#1 100M	Tip Face	641666	15.53	16.50	1.250	0.102	0.128
	5G NR n48/135RB#1 100M	Horizontal-Down	640000	15.39	16.50	1.291	0.793	1.024
	5G NR n48/135RB#1 100M	Horizontal-Down	640834	15.45	16.50	1.274	0.801	1.020
	5G NR n48/135RB#1 100M	Horizontal-Down	642500	15.47	16.50	1.268	0.789	1.000
	5G NR n48/135RB#1 100M	Horizontal-Down	643332	15.35	16.50	1.303	0.791	1.031
	5G NR n48/270RB#0 100M	Horizontal-Down	640000	15.50	16.50	1.259	0.816	1.027
Sensor on/Reduced Power (ANT 5)								

	5G NR n77/1RB#0 100M	Horizontal-Up	633334	14.88	15.50	1.153	0.683	0.788
	5G NR n77/1RB#0 100M	Horizontal-Down	633334	14.88	15.50	1.153	0.908	1.047
	5G NR n77/1RB#0 100M	Vertical-Front	633334	14.88	15.50	1.153	0.285	0.329
	5G NR n77/1RB#0 100M	Vertical-Back	633334	14.88	15.50	1.153	0.065	0.075
	5G NR n77/1RB#0 100M	Tip Face	633334	14.88	15.50	1.153	0.034	0.039
	5G NR n77/135RB#1 100M	Horizontal-Up	633334	14.11	14.50	1.094	0.627	0.686
	5G NR n77/135RB#1 100M	Horizontal-Down	633334	14.11	14.50	1.094	0.863	0.944
	5G NR n77/135RB#1 100M	Vertical-Front	633334	14.11	14.50	1.094	0.172	0.188
	5G NR n77/135RB#1 100M	Vertical-Back	633334	14.11	14.50	1.094	0.052	0.057
	5G NR n77/135RB#1 100M	Tip Face	633334	14.11	14.50	1.094	0.021	0.023
	5G NR n77/270RB#0 100M	Horizontal-Down	633334	14.07	14.50	1.104	0.832	0.919
Sensor on/Reduced Power (ANT 5)								
	5G NR n77/1RB#0 100M	Horizontal-Up	656000	14.33	15.00	1.167	0.929	1.084
5#	5G NR n77/1RB#0 100M	Horizontal-Down	656000	14.33	15.00	1.167	0.996	1.162
	5G NR n77/1RB#0 100M	Vertical-Front	656000	14.33	15.00	1.167	0.211	0.246
	5G NR n77/1RB#0 100M	Vertical-Back	656000	14.33	15.00	1.167	0.266	0.310
	5G NR n77/1RB#0 100M	Tip Face	656000	14.33	15.00	1.167	0.134	0.156
	5G NR n77/1RB#0 100M	Horizontal-Up	650000	14.06	15.00	1.242	0.888	1.103
	5G NR n77/1RB#0 100M	Horizontal-Up	653000	14.17	15.00	1.211	0.953	1.154
	5G NR n77/1RB#0 100M	Horizontal-Up	659000	14.09	15.00	1.233	0.913	1.126
	5G NR n77/1RB#0 100M	Horizontal-Up	662000	14.12	15.00	1.225	0.926	1.134
	5G NR n77/1RB#0 100M	Horizontal-Down	650000	14.06	15.00	1.242	0.928	1.152
	5G NR n77/1RB#0 100M	Horizontal-Down	653000	14.17	15.00	1.211	0.916	1.109
	5G NR n77/1RB#0 100M	Horizontal-Down	659000	14.09	15.00	1.233	0.905	1.116
	5G NR n77/1RB#0 100M	Horizontal-Down	662000	14.12	15.00	1.225	0.944	1.156
	5G NR n77/135RB#1 100M	Horizontal-Up	656000	13.82	14.50	1.169	0.931	1.089
	5G NR n77/135RB#1 100M	Horizontal-Down	656000	13.82	14.50	1.169	0.940	1.099
	5G NR n77/135RB#1 100M	Vertical-Front	656000	13.82	14.50	1.169	0.117	0.137
	5G NR n77/135RB#1 100M	Vertical-Back	656000	13.82	14.50	1.169	0.174	0.203
	5G NR n77/135RB#1 100M	Tip Face	656000	13.82	14.50	1.169	0.091	0.106
	5G NR n77/135RB#1 100M	Horizontal-Up	650000	13.74	14.50	1.191	0.945	1.126
	5G NR n77/135RB#1 100M	Horizontal-Up	653000	13.75	14.50	1.189	0.926	1.101
	5G NR n77/135RB#1 100M	Horizontal-Up	659000	13.78	14.50	1.180	0.915	1.080
	5G NR n77/135RB#1 100M	Horizontal-Up	662000	13.80	14.50	1.175	0.904	1.062
	5G NR n77/135RB#1 100M	Horizontal-Down	650000	13.74	14.50	1.191	0.895	1.066
	5G NR n77/135RB#1 100M	Horizontal-Down	653000	13.75	14.50	1.189	0.913	1.085
	5G NR n77/135RB#1 100M	Horizontal-Down	659000	13.78	14.50	1.180	0.925	1.092
	5G NR n77/135RB#1 100M	Horizontal-Down	662000	13.80	14.50	1.175	0.937	1.101

	5G NR n77/270RB#0 100M	Horizontal-Down	659000	13.71	14.50	1.199	0.873	1.047
Sensor on/Reduced Power (ANT 5)								
	5G NR n78/1RB#0 100M	Horizontal-Up	633334	14.74	15.50	1.191	0.738	0.879
	5G NR n78/1RB#0 100M	Horizontal-Down	633334	14.74	15.50	1.191	0.861	1.026
	5G NR n78/1RB#0 100M	Vertical-Front	633334	14.74	15.50	1.191	0.136	0.162
	5G NR n78/1RB#0 100M	Vertical-Back	633334	14.74	15.50	1.191	0.139	0.166
	5G NR n78/1RB#0 100M	Tip Face	633334	14.74	15.50	1.191	0.105	0.125
	5G NR n78/135RB#1 100M	Horizontal-Up	633334	14.06	15.00	1.242	0.775	0.962
	5G NR n78/135RB#1 100M	Horizontal-Down	633334	14.06	15.00	1.242	0.817	1.014
	5G NR n78/135RB#1 100M	Vertical-Front	633334	14.06	15.00	1.242	0.108	0.134
	5G NR n78/135RB#1 100M	Vertical-Back	633334	14.06	15.00	1.242	0.090	0.112
	5G NR n78/135RB#1 100M	Tip Face	633334	14.06	15.00	1.242	0.061	0.076
	5G NR n78/270RB#0 100M	Horizontal-Down	633334	13.89	15.00	1.291	0.735	0.949
Sensor on/Reduced Power (ANT 5)								
	5G NR n78/1RB#0 100M	Horizontal-Up	650000	15.03	15.50	1.114	0.949	1.057
6#	5G NR n78/1RB#0 100M	Horizontal-Down	650000	15.03	15.50	1.114	1.050	1.170
	5G NR n78/1RB#0 100M	Vertical-Front	650000	15.03	15.50	1.114	0.289	0.322
	5G NR n78/1RB#0 100M	Vertical-Back	650000	15.03	15.50	1.114	0.049	0.055
	5G NR n78/1RB#0 100M	Tip Face	650000	15.03	15.50	1.114	0.071	0.079
	5G NR n78/135RB#1 100M	Horizontal-Up	650000	14.49	15.00	1.125	0.833	0.937
	5G NR n78/135RB#1 100M	Horizontal-Down	650000	14.49	15.00	1.125	0.878	0.987
	5G NR n78/135RB#1 100M	Vertical-Front	650000	14.49	15.00	1.125	0.269	0.303
	5G NR n78/135RB#1 100M	Vertical-Back	650000	14.49	15.00	1.125	0.048	0.054
	5G NR n78/135RB#1 100M	Tip Face	650000	14.49	15.00	1.125	0.043	0.048
	5G NR n78/270RB#0 100M	Horizontal-Down	650000	14.34	15.00	1.164	0.791	0.921

Note: For TDD-LTE, the reported SAR should be scaled with the duty cycle scaling factor 1.006.

18.3. Repeated SAR Assessment

➢ **General Note**

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.

➢ **Test Results**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Sensor on/Reduced Power (ANT 0)								
OR.	LTE Band 41/1RB#0 20M	Horizontal-Up	41055	20.49	21.50	1.262	0.841	1.068
1st	LTE Band 41/1RB#0 20M	Horizontal-Up	41055	20.49	21.50	1.262	0.826	1.049
Sensor on/Reduced Power (ANT 5)								
OR.	5G NR n41/1RB#1 100M	Horizontal-Down	528000	16.36	17.00	1.159	1.030	1.194
1st	5G NR n41/135RB#1 100M	Horizontal-Down	528000	16.36	17.00	1.159	0.984	1.140
Sensor on/Reduced Power (ANT 3)								
OR.	5G NR n48/1RB#1 100M	Horizontal-Down	641666	15.61	16.50	1.227	0.923	1.133
1st	5G NR n48/1RB#1 100M	Horizontal-Down	641666	15.61	16.50	1.227	0.902	1.107
Sensor on/Reduced Power (ANT 5)								
OR.	5G NR n77/1RB#0 100M	Horizontal-Down	633334	14.88	15.50	1.153	0.908	1.047
1st	5G NR n77/1RB#0 100M	Horizontal-Down	633334	14.88	15.50	1.153	0.892	1.029
Sensor on/Reduced Power (ANT 5)								
OR.	5G NR n77/1RB#0 100M	Horizontal-Down	656000	14.33	15.00	1.167	0.996	1.162
1st	5G NR n77/1RB#0 100M	Horizontal-Down	656000	14.33	15.00	1.167	0.986	1.150
Sensor on/Reduced Power (ANT 5)								
OR.	5G NR n78/1RB#0 100M	Horizontal-Down	633334	14.74	15.50	1.191	0.861	1.026

1st	5G NR n78/1RB#0 100M	Horizontal-Down	633334	14.74	15.50	1.191	0.837	0.997
Sensor on/Reduced Power (ANT 5)								
OR.	5G NR n78/1RB#0 100M	Horizontal-Down	650000	15.03	15.50	1.114	1.050	1.170
1st	5G NR n78/1RB#0 100M	Horizontal-Down	650000	15.03	15.50	1.114	1.021	1.138

19. Simultaneous Transmission Evaluation

Remark: There is only one WWAN transmitter in this device, so simultaneous transmission is not required.

20. Uncertainty Assessment

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

Annex A General Information

1. Identification of the Responsible Testing Laboratory

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

2. Identification of the Responsible Testing Location

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

3. Facilities and Accreditations

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

Note:

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

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