RF EXPOSURE EVALUATION REPORT

APPLICANT	:	Reliance Communications LLC
PRODUCT NAME	:	Orbic Tab10R 5G
MODEL NAME	:	R10L5TR
BRAND NAME	:	Orbic
FCC ID	:	2ABGH-R10L5TR
STANDARD(S)	:	FCC 47 CFR Part 2(2.1093)
RECEIPT DATE	:	2021-12-24
TEST DATE	:	2022-01-26 to 2022-01-29
ISSUE DATE	:	2022-01-29

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Approved by: Shen Junsheng
Shen Junsheng (Supervisor)

DIRECTORY

Changed History		
Version	**Date**	**Reason for Change**
1.0	2022-02-29	First edition

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1. Power Density Summary

The maximum results of power density found during test as bellows:

<Highest Total Power Density>

Frequency Band		Standalone Transmission	
		Total PD over 4cm^2 (mW/cm^2)	Limit (FCC Part 1.310) (mW/cm^2)
5G NR	n260	0.136	1.0
	n261	0.241	

Highest Simultaneous Transmission with Multiple transmitters	Total Exposure Radio
SAR & Power Density	0.795

Note:

1. This device is in compliance with power density for general population or uncontrolled exposure limits (1.0 mW/cm^2 specified in FCC 47 CFR part 1.310), and had been tested in accordance with the measurement methods and procedures specified in TCBC workshop notes and IEC TR 63170.
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:	Reliance Communications LLC
Applicant Address:	91 Colin Drive, Unit 1, HOLBROOK, New York 11741, United States
Manufacturer:	ZJY RIGHT SOURCE INDIA PRIVATE LIMITED
Manufacturer Address:	MIDC industrial Area, Shiravane, Nerul, India

2.2. Equipment under Test (EUT) Description

Product Name:	Orbic Tab10R 5G
EUT No.:	7#
Hardware Version:	V1.1
Software Version:	ORB10L5TR_v1.0.5_BVZ
Frequency Bands:	5G NR n260(120kHz): 37 GHz ~ 40 GHz 5G NR n261(120kHz): 27.5 GHz ~ 28.35 GHz
Modulation Mode:	5G NR: QPSK, 16QAM, 64QAM for CP-OFDM and DFT-s-OFDM
Channel Bandwidth:	50MHz, 100MHz
Maximum Number of Contiguous Component Carriers:	8CC
SCS	120kHz
5G NR Operation:	NSA
Antenna Information:	Fixed Internal Antenna

Note: For a 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:	5G NR n260/261
Operation Mode:	Call established
Power Level:	TDD 5G NR n260/261(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. RF Exposure Limits

3.1. Uncontrolled Environment

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

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

3.2. 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.

4. 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
KDB 447498 D01v06	General RF Exposure Guidance	No deviation
KDB 616217 D04v01r02	SAR Evaluation Consideration for Laptop, Notebook, Netbook and Tablet computers	No deviation
KDB 648474 D04v01r03	SAR Evaluation Consideration for Wireless Handset	No deviation
KDB 865664 D01v01r04	SAR Measurement 100 MHz to 6 GHz	No deviation
KDB 865664 D02v01r02	RF Exposure Reporting	No deviation
KDB 941225 D06v02r01	SAR Evaluation procedure for portable devices with wireless router capabilities	No deviation
IEC TR 63170:2018	Measurement procedure for the evaluation of power density related to human exposure to radio frequency fields from wireless communication devices operating between 6 GHz and 100 GHz	No deviation
The November 2019, TCB Workshop presentation	RF Exposure Procedures	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.

5. Power Density Measurement System

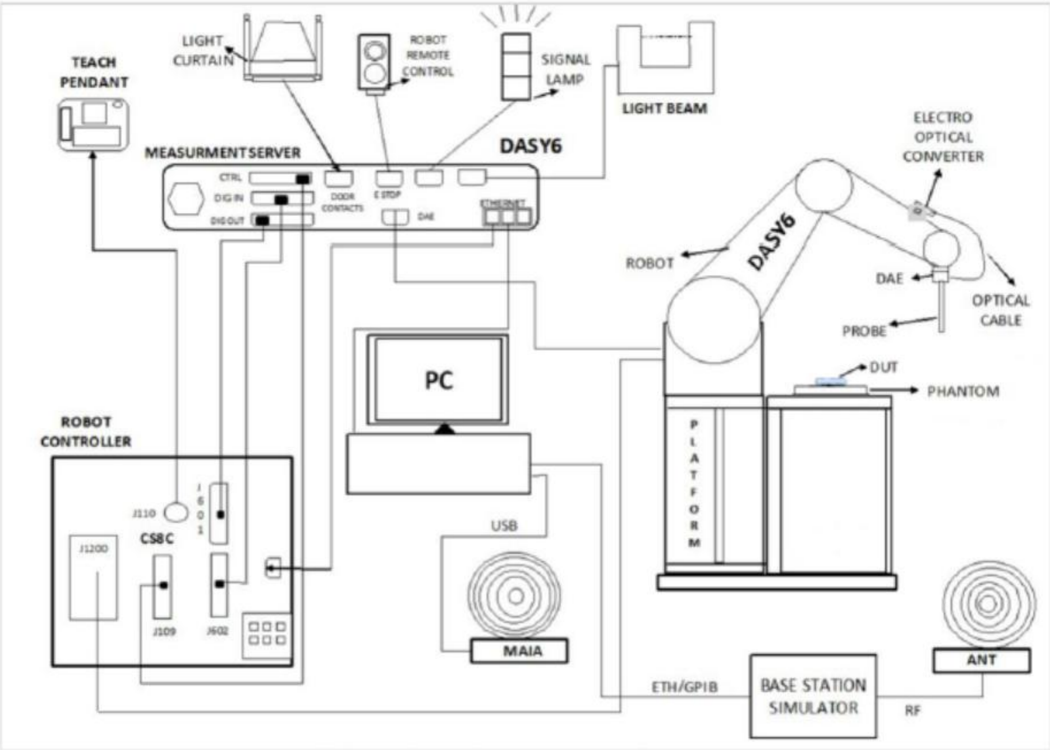


Fig 5.1 SPEAG DASY System Configurations

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.

5.1. EUmmWave Probe

The probe designed allows measurement at distances as small as 2mm from the sensor to the surface of EUT. The typical senor to the tip of probe is 1.5mm.

Frequency	750 MHz ~110 GHz
Probe Overall Length	320 mm
Probe Body Diameter	8.0 mm
Tip Length	23.0 mm
Tip Diameter	8.0 mm
Two dipoles' Length of Probe	0.9 mm – Diode located
Dynamic Range	＜20 V/m – 10000 V/m with PRE-10 (min ＜50 V/m – 3000 V/m)
Linearity	＜0.2 dB
Position Precision	＜0.2 mm
Distance between Diode Sensors and Probe's tip	1.5 mm
Minimum Mechanical Separation between Probe Tip and a Surface	0.5 mm
Applications	E-field measurement of mm-Wave transmitters operating above 10 GHz in ＜ 2mm distance from device (free-space) power density H-field and far-field analysis using total field reconstruction.
Compatibility	cDASY 6 + 5G Module SW1.0 and higher

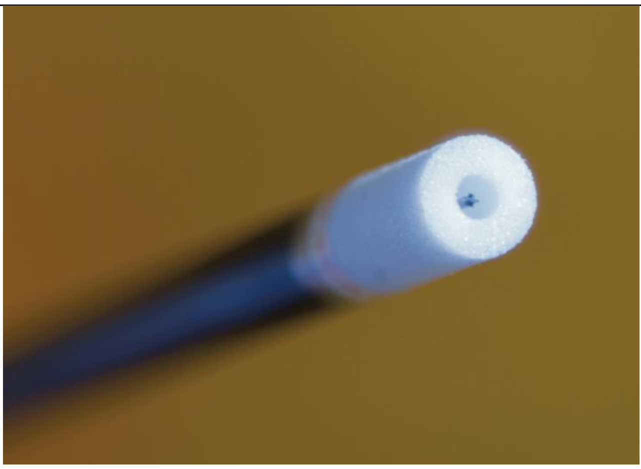
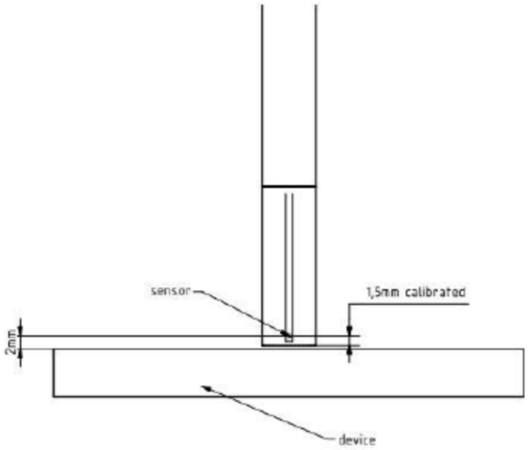


Fig 5.2 Photo of EUmmWave Probe



5.2. 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 5.3 Photo of DAE

5.3. 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 5.4 Photo of DASY6

5.4. 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.

5.5. 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:

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

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

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

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

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

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

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

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

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

5.6. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	DOSIMETRIC ASSESSMENT SYSTEM	cDASY6 mmWave	V2.0.2.34	N/A	N/A
SPEAG	5G Verification Source	30GHz	1077	2020.12.02	2023.12.01
SPEAG	EUmmWave Probe	EUmmMV4	9602	2021.11.02	2022.11.01
SPEAG	Data Acquisition Electronics	DAE4	1353	2021.10.19	2022.10.18
R&S	Spectrum Analyzer	E4445A	MY44300685	2021.10.20	2022.10.19
KTJ	Thermo meter	TA298	N/A	2021.12.21	2022.12.20

Note:

The calibration certificate of DASY can be referred to annex E of this report.

6. System Verification Source

The system verification sources at 30GHz and above comprise born-antennas and very stable signal generators.

Model	Ka-band born antenna
Calibrated Frequency	30GHz and above at 10mm from the case surface
Frequency Accuracy	±100 MHz
E-field Polarization	Linear
Harmonics	-20dBc
Total Radio Power	14dBm
Power Stability	0.05 dB
Power Consumption	5W
Size	100 x 100 x 100 mm
Weight	1 kg

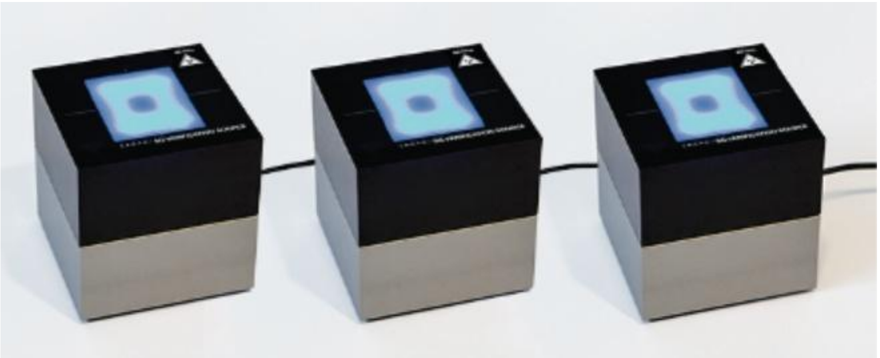


Fig 6.1 Photos of Verification Sources

7. Power Density System Verification

➢ **General description**

The EUT is replaced by a calibrated source, the same spatial resolution, measurement region and test separation used in the calibration was applied to system check. Through visual inspection into the measured power density distribution, both the spatially (shape) and numerically (level) have no noticeable difference. The measurement results should be within ±10% of the calibrated targets.

Frequency [GHz]	Grid step	Grid extent X/Y [mm]	Measurement points
10	$0.25\ (\frac{\lambda}{4})$	120/120	16×16
30	$0.25\ (\frac{\lambda}{4})$	60/60	24×24
60	$0.25\ (\frac{\lambda}{4})$	32.5/32.5	26×26
90	$0.25\ (\frac{\lambda}{4})$	30/30	36×36

Setting for measurement of verification sources

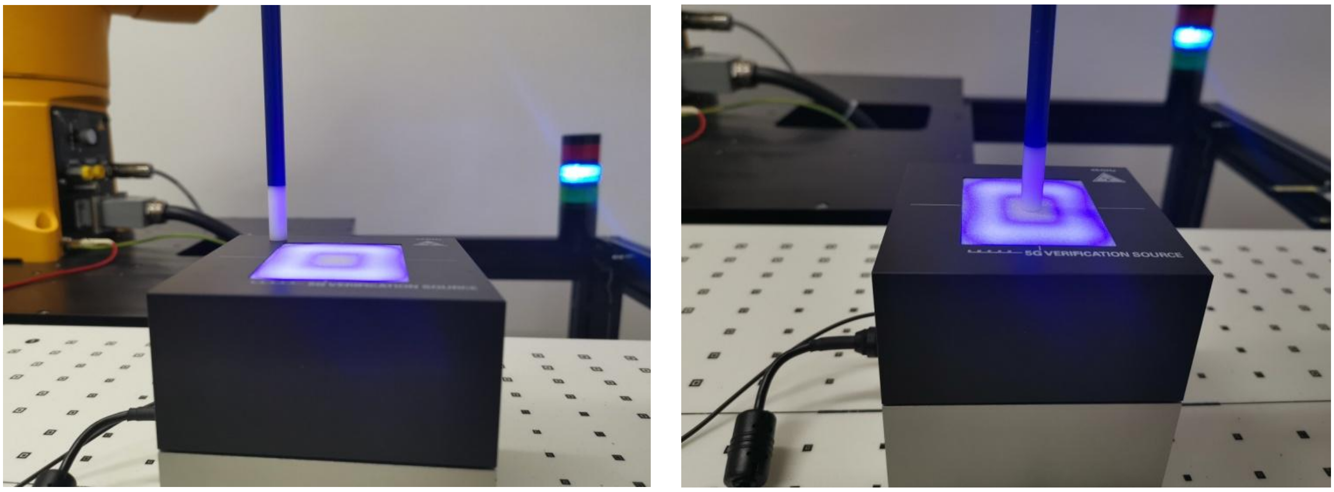


Fig 7.1 Photos of Verification Setup

➢ **Validation Results**

After system check testing, the results of power density will be compared with the reference value derived from the certificate report. The deviation of system check should be within ±10%.

<Validation Setup>

Frequency (GHz)	5G Verification Source	Probe S/N	DAE S/N
30	30GHz-SN 1077	9602	1353

<Validation Results>

Date	Frequency (GHz)	Test Ditance (mm)	Measured 4cm² (W/m²)	Targeted 4cm² (W/m²)	Deviation (%)
2022.01.26	30	5.55	26.1	28.4	-6.79

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

➢ Computation of the Electric Field Polarization Ellipse

For the numerical description of an arbitrarily oriented ellipse in three-dimensional space, five parameters are needed: the semi-major axis (a), the semi-minor axis (b), two angles describing the orientation of the normal vector of the ellipse (ϕ, θ), and one angle describing the tilt of the semi-major axis (Ψ). For the two extreme cases, i.e. circular and linear polarizations, three parameters only (a, ϕ and θ) are sufficient for the description of the incident field.

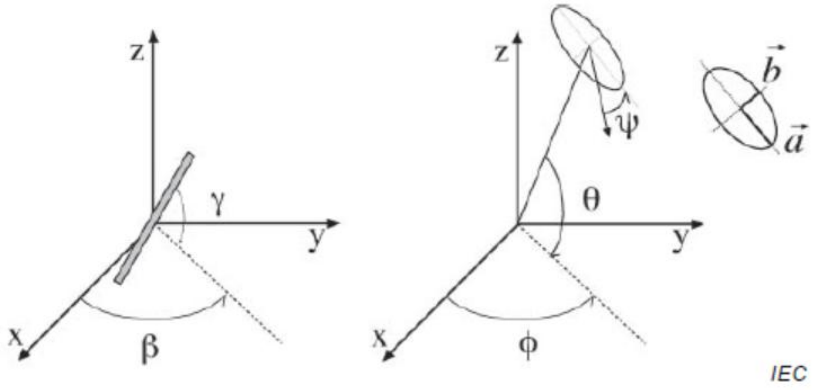


Fig 9.1 Illustration of the angles used for the numerical description of the sensor and the orientation of an ellipse in 3-D space

For the construction of the ellipse parameters from measured data, the problem can be reformulated as a nonlinear search problem. The semi-major and semi-minor axes of an elliptical field can be express as functions of the three angles (ϕ, θ and Ψ). The parameters can be uniquely determined towards minimizing the error based on least-squares for the given set of angles and the measured data. In this way, the numbers of three parameters is reduced from five to three, which means that least three sensors readings are necessary to gain sufficient information for the reconstruction of ellipse parameters. However, to suppress the noise and increase the reconstruction accuracy, it is desirable to have an over determined system of equations. The solution to use a probe consisting of two sensors angled by γ_1 and γ_2 toward the probe axis and to perform measurements at three angular positions of the probe, i.e. at β_1, β_2 and β_3, results in over determination of two. If there is a need for more information or increased accuracy, more rotation angles can be added.

The reconstruction of ellipse parameters can be separated into linear and non-linear parts that are best solved by the givens algorithm combined with a downhill simplex algorithm. To minimize the mutual coupling, sensor angles are set with a 90° shift ($\gamma_1 = \gamma_2 + 90°$), and, to simplify, the first rotation angle of the probe (β_1) can be set to 0°.

- **Total Field and Power Density Reconstruction**

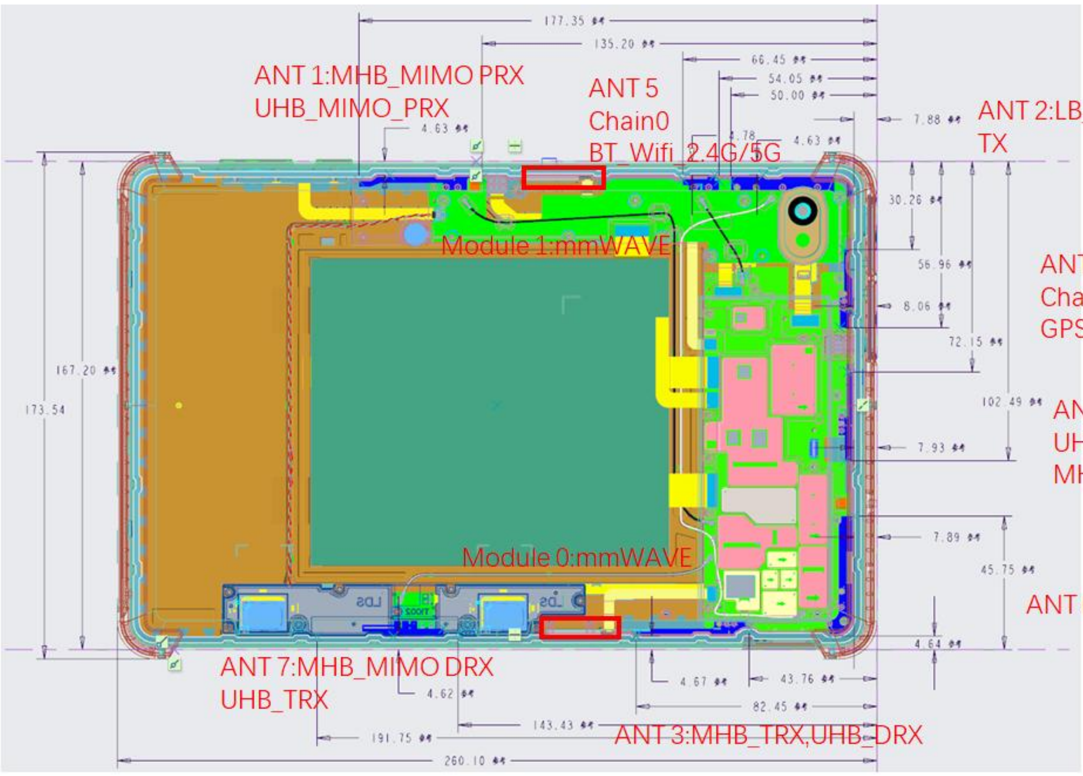
Computation of the power density in general requires knowledge of the electric and magnetic field amplitudes and phases in the plane of incidence. Reconstruction of these quantities from pseudo-vector E-field measurements is feasible, as they are constrained by Maxwell's equations. SPEAG have developed a reconstruction approach based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWV2 probe.
The average of the reconstructed power density is evaluated over a circular area in each measurement plane. Two average power density values can be computed, the average total power density and the average incident power density, and the average total power density is used to determine compliance.

- $|Re\{S\}|$ is the total Poynting vector
- $n \cdot Re\{S\}$ is the normal Poything vector

The software post-processing reports to values, “S avg tot” and “S avg inc”. “S avg tot” represents average total power density (all three xyz components included), and “S avg inc” represents average normal power density. The average total power density “S avg tot” is reported to determine the device compliance.

8. Antenna Information

8.1. Antenna Location



➢ **TX Location**

ANT NUM	Description	WCDMA	LTE	NR	WIFI	BT
ANT0	LB_TRX	B5	B5/B12/B13	N5		
ANT1	MHB_PRX MIMO, UHB-PRX MIMO					
ANT2	LB_DRX,LB-TX(ENDC),		B5（ENDC）	N5		
ANT3	MHB_TRX,UHB_DRX	B2/B4	B2/B4/B66	N2/N66		
ANT4	MHB_DRX,MHB-TX(ENDC), UHB-DRX MIMO		B2/B66（ENDC）	N2/N66		
ANT5	CH0_WIFI2.4G 5G BT2.4G				WIFI2.4G 5G	2.4G
ANT6	CH1_WIFI2.4G 5G GPS				WIFI2.4G 5G	
ANT7	MHB_MIMO DRX,UHB_TRX		B48	N77		

Module 0: mmWave, n260/n261 (NSA only)

Module 1: mmWave, n260/n261 (NSA only)

8.2. Test Positions

Antenna Module	Measurement Plane at 2mm					
	Front Surface	Bottom Surface	Left Side	Right Side	Top Side	Bottom Side
Module 0	Yes	Yes	Yes	No	No	No
Module 1	Yes	Yes	No	Yes	No	No

Note:

1. From the Part0 report, beam IDs with the highest PD and corresponding input.power.limit were selected to be tested for each antenna module and frequency bands.
2. The test result of front and bottom surface were recorded in the Part0.

9. Power Density Assessment

➤ **General Description**

1. The 5G NR mmWave signal under testing was configured by the test tool of Qualcomm Software, and it is only limited to operate at EN-DC for 5G NR implementation according to the character of the device.
2. This device would be configured to maximum power when transmitting and tested at the maximum duty cycle for each RB configuration, modulation, bandwidth, and channel.
3. According to the manufacturer that summation for different antenna modules and exposure planes, the worst case would be selected for power density measurement.

➤ **mmWave EN-DC Combination**

EN_DC Combination	mmWave (FR2) 4G DL 4x4 MIMO	4G UL	5G_NR UL
DC_2A_n261A	2A	2A	n261A
DC_2A_n261(2A)	2A	2A	n261A
DC_13A_n261A	-	13A	n261A
DC_13A_n261(2A)	-	13A	n261A
DC_66A_n261A	66A	66A	n261A
DC_66A_n261(2A)	66A	66A	n261A
DC_2A_5A_n261A	-	2A, 5A	n261A
DC_2A_13A_n261A	-	2A, 13A	n261A
DC_2A_13A_n261(2A)	-	2A, 13A	n261A
DC_2A_66A_n261A	-	2A, 66A	n261A
DC_2A_66A_n261(2A)	-	2A, 66A	n261A
DC_5A_66A_n261A	-	5A, 66A	n261A
DC_13A_66A_n261A	-	13A, 66A	n261A
DC_13A_66A_n261(2A)	-	13A, 66A	n261A
DC_66A_66A_n261A	-	66A	n261A
DC_66A_66A_n261(2A)	-	66A	n261A
DC_2A_n260A	2A	2A	n260A
DC_13A_n260A	-	13A	n260A
DC_66A_n260A	66A	66A	n260A
DC_2A_5A_n260A	-	2A, 5A	n260A
DC_2A_13A_n260A	-	2A, 13A	n260A
DC_2A_66A_n260A	-	2A, 66A	n260A
DC_5A_66A_n260A	-	5A, 66A	n260A

DC_13A_66A_n260A	-	13A, 66A	n260A
DC_66A_66A_n260A	-	66A	n260A
DC_48A_n261A	48A	48A	n261A
DC_48A_n260A	48A	48A	n260A

➢ **PD Measurement Plan**

<n260>

Antenna Module	Channel	Beam ID		BW (MHz)	RB offset	Exposure Position	Input Power Limit (dBm)
		AG0(V)	AG1(H)				
Module 0	2254165	36	-	100	22#20	Left Side	-0.48
	2254165	-	161	100	22#20	Left Side	-0.48
	2254165	36	164	100	22#20	Left Side	-4.07
	2254165	36	164	100	22#20	Left Side	-4.07
Module 1	2254165	32	-	100	22#20	Right Side	-0.3
	2254165	-	160	100	22#20	Right Side	-0.3
	2254165	29	157	100	22#20	Right Side	-3.77
	2254165	29	157	100	22#20	Right Side	-3.77

<n261>

Antenna Module	Channel	Beam ID		BW (MHz)	RB offset	Exposure Position	Input Power Limit (dBm)
		AG0(V)	AG1(H)				
Module 0	2077915	24	-	100	22#20	Left Side	-0.79
	2077915	-	152	100	22#20	Left Side	-0.79
	2077915	24	152	100	22#20	Left Side	-4.17
	2077915	24	152	100	22#20	Left Side	-4.17
Module 1	2077915	28	-	100	22#20	Right Side	0
	2077915	-	157	100	22#20	Right Side	0
	2077915	28	156	100	22#20	Right Side	-3.42
	2077915	28	156	100	22#20	Right Side	-3.42

Note:

For MIMO transmission, the power density would be tested under TAV on and TAV off.

10. Test Results of RF Exposure

➢ **General Note**

1. The worst beam ID from Part 0 would be selected for power density testing according to the antenna information.
2. The power density measurement was performed at 2mm separation distance between the sensor and EUT surface.
3. According to TCB Workshop publications in Oct. 2018, 4cm^2 averaging area total power density should be recorded in the test report.
4. There is a protrusion less than 5mm on the bottom of this device, and the 0mm distance with its thickness was tested.
5. For 5G mmWave, there is total design-related uncertainty arising from TxAGC and device-to-device variation, the worst condition RF exposure should be determined by accounting for the uncertainty 2.1dB, as well as n260/261 PD design target of 0.462 mW/cm^2 for antenna module 0/1. Smart Transmit algorithm limits PD exposure to 75% of maximum to provide at least 25% margin allocated for LTE anchor.
6. For EFS version 16 or higher, secondary radio (5G NR mmWave) can get up to 100% reserve factor irrespective of reserve_power_margin setting. Therefore 5G NR mmWave RF exposure for this device is evaluated by reported PD calculated follows:

Reported PD=PD design target + 2.1dB=0.75 mW/cm^2

➢ **Test Results**

<n260>

Antenna Module	Channel	Beam ID		BW (MHz)	RB offset	Exposure Position	Measured Total psPD over 4cm^2 (W/m^2)
		AG0(V)	AG1(H)				
Module 0	2254165	36	-	100	22#20	Left Side	0.77
	2254165	-	161	100	22#20	Left Side	1.36
	2254165	36	164	100	22#20	Left Side	0.95
	2254165	36	164	100	22#20	Left Side	1.10
Module 1	2254165	32	-	100	22#20	Right Side	0.75
	2254165	-	160	100	22#20	Right Side	0.80
	2254165	29	157	100	22#20	Right Side	0.98
	2254165	29	157	100	22#20	Right Side	1.04

<n261>

Antenna Module	Channel	Beam ID		BW (MHz)	RB offset	Exposure Position	Measured Total psPD over 4cm^2 (W/m^2)
		AG0(V)	AG1(H)				
Module 0	2077915	24	-	100	22#20	Left Side	0.44
	2077915	-	152	100	22#20	Left Side	0.43
	2077915	24	152	100	22#20	Left Side	1.67
	2077915	24	152	100	22#20	Left Side	1.61
Module 1	2077915	28	-	100	22#20	Right Side	2.41
	2077915	-	157	100	22#20	Right Side	2.35
	2077915	28	156	100	22#20	Right Side	2.36
	2077915	28	156	100	22#20	Right Side	2.10

11. Simultaneous Transmission Assessment

11.1. Simultaneous Transmission Consideration

No.	Simultaneous Transmission Consideration	Exposure Position
		Body
1	WWAN (WCDMA/LTE)+WLAN 2.4GHz/5GHz (SISO/MIMO)	Yes
2	WWAN (WCDMA/LTE)+Bluetooth	Yes
3	WWAN (5G FR1 SA/NSA)+WLAN 2.4GHz/5GHz (SISO/MIMO)	Yes
4	WWAN (5G FR1 SA/NSA)+Bluetooth	Yes
5	WWAN (LTE+5G FR2)+WLAN 2.4GHz/5GHz (SISO/MIMO)	Yes
6	WWAN (LTE+5G FR2)+Bluetooth	Yes
7	WWAN (LTE+5G FR2)+WLAN 5GHz (SISO)+Bluetooth	Yes

Note:

The WWAN (Sub-6G), WLAN and Bluetooth SAR test results were recorded in the FCC SAR report SZ21100132S01.

11.2. Total Exposure Radio Analysis

The fields generated by the antennas can be correlated or uncorrelated. At different frequencies, fields are always uncorrelated, and the aggregate power density contributions can be summed according to spatially averaged values of corresponding sources at any point in space, r, to determine the total exposure ratio (TER). Assuming I sources, the TER at each point in space is equal to

$$TER^{uncorr}(r) = \sum_{i=1}^{I} ER_i = \sum_{i=1}^{I} \frac{S_{av,i}(r, f_i)}{S_{lim}(f_i)}$$

Where $S_{av,i}$ is the power density for the source I operating at a frequency f_i and S_{lim} is the power density limit as specified by the relevant standard.

Exposure from transmitters operating above and below 6GHz, where 6GHz denotes the transmission frequency where the basic restrictions change from being defined in terms of SAR to being defined in terms of power density, therefore uncorrelated and the TER is determined as

$$TER^{uncorr}(r) = \sum_{i=1}^{I} ER_i = \sum_{i=1}^{I} \frac{S_{av,i}(r, f_i)}{S_{lim}(f_i)}$$

According to the FCC guidance in TCBC workshop and IEC TR 63170, the total exposure ratio calculated by taking ratio of maximum reported SAR divided by SAR limit and adding it to maximum measured power density by its limit. Numerical sum of the ratios should be less or equal to 1. Therefore the simultaneous transmission should be follows:

$$TER = \sum_{n=1}^{N} \frac{SAR_n}{SAR_{n,limit}} + \sum_{n=1}^{N} \frac{S_{m,avg}}{S_{m,limit}} < 1$$

➢ **Body SAR for WLAN MIMO**

Exposure Position	Distance (mm)	1	2	3	4	1+2	3+4
		2.4GHz WLAN ANT 5	2.4GHz WLAN ANT 6	5GHz WLAN ANT 5	5GHz WLAN ANT 6	2.4GHz WLAN	5GHz WLAN
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
Bottom Surface	0	0.321	0.356	0.387	0.337	0.677	0.724
Edge 1	0	0.143	0.253	0.135	0.406	0.396	0.541
Edge 2	0	N/A	N/A	N/A	N/A	N/A	N/A
Edge 3	0	0.203	0.105	0.312	0.153	0.308	0.465
Edge 4	0	N/A	N/A	N/A	N/A	N/A	N/A

Note:

The WLAN SAR results are from the SAR report SZ21100132S01.

➢ **Total Ratio for LTE+mmW+WLAN MIMO**

LTE Bands	Exposure Position	1	2	3	4	1+2+3	1+2+4
		LTE	n260	2.4GHz WLAN	5GHz WLAN	Total Ratio PD/10+SAR/1.6	Total Ratio PD/10+SAR/1.6
		1g SAR (W/kg)	4cm^2 (W/m^2)	1g SAR (W/kg)	1g SAR (W/kg)		
LTE Band 2	Bottom Surface	0.416		0.677	0.724	0.683	0.713
	Edge 1	0.144		0.396	0.541	0.338	0.428
	Edge 2		1.04			0.104	0.104
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.125	1.36			0.214	0.214
LTE Band 5	Bottom Surface	0.349		0.677	0.724	0.641	0.671
	Edge 1	0.195		0.396	0.541	0.369	0.460
	Edge 2	0.187	1.04			0.221	0.221
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.094	1.36			0.195	0.195
LTE Band 13	Bottom Surface	0.342		0.677	0.724	0.637	0.666

	Edge 1	0.274		0.396	0.541	0.419	0.509
	Edge 2	0.249	1.04			0.260	0.260
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.081	1.36			0.187	0.187
LTE Band 66	Bottom Surface	0.409		0.677	0.724	0.679	0.708
	Edge 1	0.302		0.396	0.541	0.436	0.527
	Edge 2		1.04			0.104	0.104
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.255	1.36			0.295	0.295

LTE Bands	Exposure Position	1	2	3	4	1+2+3	1+2+4
		LTE	n261	2.4GHz WLAN	5GHz WLAN	Total Ratio PD/10+SAR/1.6	Total Ratio PD/10+SAR/1.6
		1g SAR (W/kg)	4cm^2 (W/m^2)	1g SAR (W/kg)	1g SAR (W/kg)		
LTE Band 2	Bottom Surface	0.416		0.677	0.724	0.683	0.713
	Edge 1	0.144		0.396	0.541	0.338	0.428
	Edge 2		1.67			0.167	0.167
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.125	2.41			0.319	0.319
LTE Band 5	Bottom Surface	0.349		0.677	0.724	0.641	0.671
	Edge 1	0.195		0.396	0.541	0.369	0.460
	Edge 2	0.187	1.67			0.284	0.284
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.094	2.41			0.300	0.300
LTE Band 13	Bottom Surface	0.342		0.677	0.724	0.637	0.666
	Edge 1	0.274		0.396	0.541	0.419	0.509
	Edge 2	0.249	1.67			0.323	0.323
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.081	2.41			0.292	0.292
LTE Band 66	Bottom Surface	0.409		0.677	0.724	0.679	0.708
	Edge 1	0.302		0.396	0.541	0.436	0.527
	Edge 2		1.67			0.167	0.167
	Edge 3			0.308	0.465	0.193	0.291
	Edge 4	0.255	2.41			0.400	0.400

➢ **Total Ratio for LTE+mmW+WLAN 5GHz(SISO)+Bluetooth**

LTE Bands	Exposure Position	1	2	3	4	1+2+3
		LTE	n260	5GHz WLAN	Bluetooth	Total Ratio PD/10+SAR/1.6
		1g SAR (W/kg)	4cm² (W/m²)	1g SAR (W/kg)	1g SAR (W/kg)	
LTE Band 2	Bottom Surface	0.416		0.387	0.469	0.795
	Edge 1	0.144		0.409	0.134	0.429
	Edge 2		1.04	0.312	0.153	0.395
	Edge 3					
	Edge 4	0.125	1.36			0.214
LTE Band 5	Bottom Surface	0.349		0.387	0.469	0.753
	Edge 1	0.195		0.409	0.134	0.461
	Edge 2	0.187	1.04	0.312	0.153	0.512
	Edge 3					
	Edge 4	0.094	1.36			0.195
LTE Band 13	Bottom Surface	0.342		0.387	0.469	0.749
	Edge 1	0.274		0.409	0.134	0.511
	Edge 2	0.249	1.04	0.312	0.153	0.550
	Edge 3					
	Edge 4	0.081	1.36			0.187
LTE Band 66	Bottom Surface	0.409		0.387	0.469	0.791
	Edge 1	0.302		0.409	0.134	0.528
	Edge 2		1.04	0.312	0.153	0.395
	Edge 3					
	Edge 4	0.255	1.36			0.295

LTE Bands	Exposure Position	1	2	3	4	1+2+3
		LTE	n261	5GHz WLAN	Bluetooth	Total Ratio PD/10+SAR/1.6
		1g SAR (W/kg)	4cm² (W/m²)	1g SAR (W/kg)	1g SAR (W/kg)	
LTE Band 2	Bottom Surface	0.416		0.387	0.469	0.795
	Edge 1	0.144		0.409	0.134	0.429
	Edge 2		1.67	0.312	0.153	0.458
	Edge 3					
	Edge 4	0.125	2.41			0.319
LTE Band 5	Bottom Surface	0.349		0.387	0.469	0.753
	Edge 1	0.195		0.409	0.134	0.461
	Edge 2	0.187	1.67	0.312	0.153	0.575
	Edge 3					

	Edge 4	0.094	2.41			0.300
LTE Band 13	Bottom Surface	0.342		0.387	0.469	0.749
	Edge 1	0.274		0.409	0.134	0.511
	Edge 2	0.249	1.67	0.312	0.153	0.613
	Edge 3					
	Edge 4	0.081	2.41			0.292
LTE Band 66	Bottom Surface	0.409		0.387	0.469	0.791
	Edge 1	0.302		0.409	0.134	0.528
	Edge 2		1.67	0.312	0.153	0.458
	Edge 3					
	Edge 4	0.255	2.41			0.400

Note:

1. The Bluetooth SAR results are from the SAR report SZ21100132S01.
2. For PD test report, the exposure of Top Side, Bottom Side, Left Side and Right Side means Edge 1, Edge 2, Edge 3 and Edge 4 recorded in SAR report.

12. Uncertainty Assessment

The budget is valid for evaluation distance >λ /2π. For specific tests and configurations, the uncertainty can be considered smaller.

Error Description	**Uncertainty ± %**	**Probability**	**Divisor**	***ci***	**Standard Uncertainty (±%)**	ν_i **or** ν_{eff}
Uncertainty terms dependent on the measurement system						
Probe calibration	0.43	1	R	1	0.49	∞
Probe correction	0.48	1.732	R	0.7	0.49	∞
Isotropy	0.48	1.732	R	0.7	0.29	∞
Multiple reflections	0.19	1.732	R	1	0.12	∞
System linearity	0.24	1.732	R	1	0.12	∞
Probe positioning	0.28	1.732	R	1	0.17	∞
Sensor location	0.2	1.732	R	1	0.18	∞
Amplitude and phase drift	0.02	1	R	1	0.0	∞
Amplitude and phase noise	0.18	1.732	R	1	0.12	∞
Data point spacing	0.06	1.732	R	1	0.08	∞
Measurement area truncation	0.63	1.732	R	1	0.6	∞
Reconstruction algorithms	0.04	1.732	R	1	0.05	∞
Uncertainty terms dependent on the DUT and environmental factors						
Probe coupling with DUT	0.05	1.732	R	1	0.08	∞
Modulation response	0.34	1.732	R	1	0.23	∞
Integration time	0.01	1	R	1	0.00	∞
DUT alignment	0.12	1.732	R	1	0.3	∞
RF ambient conditions	0.20	1.732	R	1	0.12	∞
Immunity / secondary reception	0.03	1.732	R	1	0.04	∞
Drift of the DUT	0.06	1	R	1	0.01	∞
Combined standard uncertainty					0.71 dB	∞
Coverage Factor for 95%					K=2	N/A
Expanded standard uncertainty					1.52 dB	

Annex A General Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.1-3, 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.

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