FCC TEST REPORT

FOR

Shenzhen Dwason Technology Co.,Ltd

Wireless Mouse

Test Model: MC221

Additional Model No.: Please Refer to Page 6

Prepared for	:	Shenzhen Dwason Technology Co.,Ltd
Address	:	Room 103, 1 / F, Building 129, Shifeng Technology Park, 7th Industrial District, Mashantou Community, Gongming Street, Guangming New District, Shenzhen, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd
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Date of receipt of test sample	:	December 18, 2020
Number of tested samples	:	2
Sample No.	:	201218007A-1, 201218007A-2
Sample number	:	Prototype
Date of Test	:	December 18, 2020 ~ December 28, 2020
Date of Report	:	December 29, 2020

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FCC TEST REPORT

FCC CFR 47 PART 15 C (15.249)

Report Reference No.	**:**	**LCS201218007AEC**
Date of Issue.....	:	December 29, 2020
Testing Laboratory Name	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name	**:**	**Shenzhen Dwason Technology Co.,Ltd**
Address.....	:	Room 103, 1 / F, Building 129, Shifeng Technology Park, 7th Industrial District, Mashantou Community, Gongming Street, Guangming New District, Shenzhen, China
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.249) / ANSI C63.10: 2013
Test Report Form No.....	:	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

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Test Item Description.	**:**	**Wireless Mouse**
Trade Mark	:	N/A
Test Model.....	:	MC221
Ratings.....	:	Input: DC 5V, 0.5A Battery: DC 3.7V, 500mAh
Result	**:**	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Cherry Chen	Jin Wang	Gavin Liang
Cherry Chen/ Administrators	Jin Wang/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCS201218007AEC**	December 29, 2020 Date of issue

Test Model.....	: MC221
EUT.....	: Wireless Mouse
Applicant.....	**: Shenzhen Dwason Technology Co.,Ltd**
Address.....	: Room 103, 1 / F, Building 129, Shifeng Technology Park, 7th Industrial District, Mashantou Community, Gongming Street, Guangming New District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Dongguan Dwason Technology Company Limited**
Address.....	: Floor 3, B.D 10, No.996 Zhenxing avenue, Xiegang, DongGuan, GuangDong, P.R.C
Telephone.....	: /
Fax.....	: /
Factory.....	**: /**
Address.....	: /
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	December 29, 2020	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	: Wireless Mouse
Test Model	: MC221
Additional Model No	: RGB Wirless Mouse
Model Declaration	: PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	: Input: DC 5V, 0.5A Battery: DC 3.7V, 500mAh
Hardware Version	: BK3632
Software Version	: 5.1
Bluetooth	
Frequency Range	: 2402MHz ~ 2480MHz
Chanel Number	: 79 channels for Bluetooth V5.0(DSS) 40 channels for Bluetooth V5.0(DTS)
Chanel Spacing	: 1MHz for Bluetooth V5.0 (DSS) 2MHz for Bluetooth V5.0 (DTS)
Modulation Type	: GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V5.0(DSS) GFSK for Bluetooth V5.0(DTS)
Bluetoth Version	: V5.0
Antenna Description	: PCB Antenna, 0dBi(Max.)
2.4G Emission	
Frequency Range	: 2403MHz-2480MHz (2403, 2424, 2441, 2461, 2414, 2435, 2450, 2470, 2409, 2429, 2455, 2475, 2419, 2445, 2465, 2480（Unit: MHz）)
Channel Number	: 16
Modulation Type	: GFSK
Antenna Description	: PCB Antenna, 0dBi(max.)

1.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
Lenovo	ADAPTER for Notebook	ADLX65YCC3A	--	FCC
Lenovo	Notebook	TP00094A	--	FCC

1.3. External I/O

I/O Port Description	Quantity	Cable
Micro USB Port	1	N/A

1.4. Description of Test Facility

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

CNAS Registration Number is L4595.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

Operates in the unlicensed ISM Band at 2.4GHz. With basic data rate feature, the data rates can be up to 1 Mb/s by modulating the RF carrier using GFSK techniques. The EUT works in the X-axis, Y-axis, Z-axis. The following operating modes were applied for the related test items. All test modes were tested, only the result of the worst case was recorded in the report.

Mode of Operations	Frequency Range (MHz)	Data Rate (Mbps)
GFSK	2403	/
	2441	/
	2480	/
For Conducted Emission		
Test Mode	TX Mode	
For Radiated Emission		
Test Mode	TX Mode	

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2403**	8	2445
1	2409	9	2450
2	2414	10	2455
3	2419	11	2461
4	2424	12	2465
5	2429	13	2470
6	2435	14	2475
7	**2441**	15	**2480**

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane.According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz and 1.5 m above ground plane above 1GHz.The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

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3. CONNECTION DIAGRAM OF TEST SYSTEM

3.1. Justification

The system was configured for testing in a continuous transmit condition. Continuous transmitting was pre-programmed. It'll keep transmitting with modulated signal at the lowest channel by installing the batter. When press the "up" button, it'll move to the next channel. Repeat press "up" button, it'll transmitting at each of the channel used.

3.2. EUT Exercise Software

Press the corresponding button, and change the channel.

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

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4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C §15.249		
FCC Rules	**Description Of Test**	**Result**
§15.203	Antenna Requirement	Compliant
§15.207(a)	Power Line Conducted Emissions	Compliant
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.249 (d)	Band Edges Measurement	Compliant
§2.1049	99% and 20 dB Bandwidth	Compliant

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5. ANTENNA REQUIREMENT

5.1. Standard Applicable

According to § 15.203 and RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.2. Antenna Connected Construction

The EUT use PCB Antenna and maximum antenna gain is 0dBi, antenna cannot replacement, meets FCC Part §15.203 antenna requirement. Please see EUT photo for details.

5.3. Results

Compliance

6. POWER LINE CONDUCTED EMISSIONS

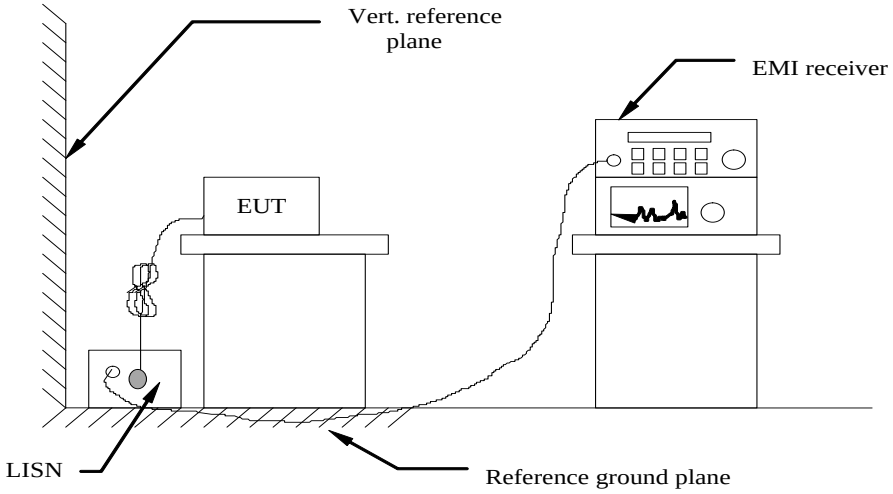
6.1. Standard Applicable

According to §15.207 (a) & RSS-Gen § 8.8: For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

6.2. Block Diagram of Test Setup



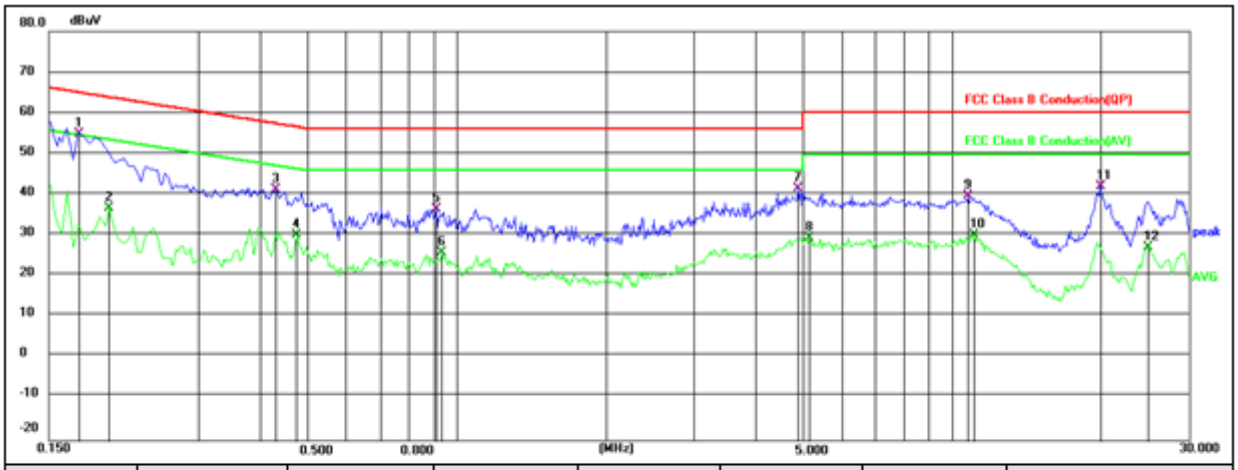
6.3. Test Results

PASS.

The test data please refer to following page.

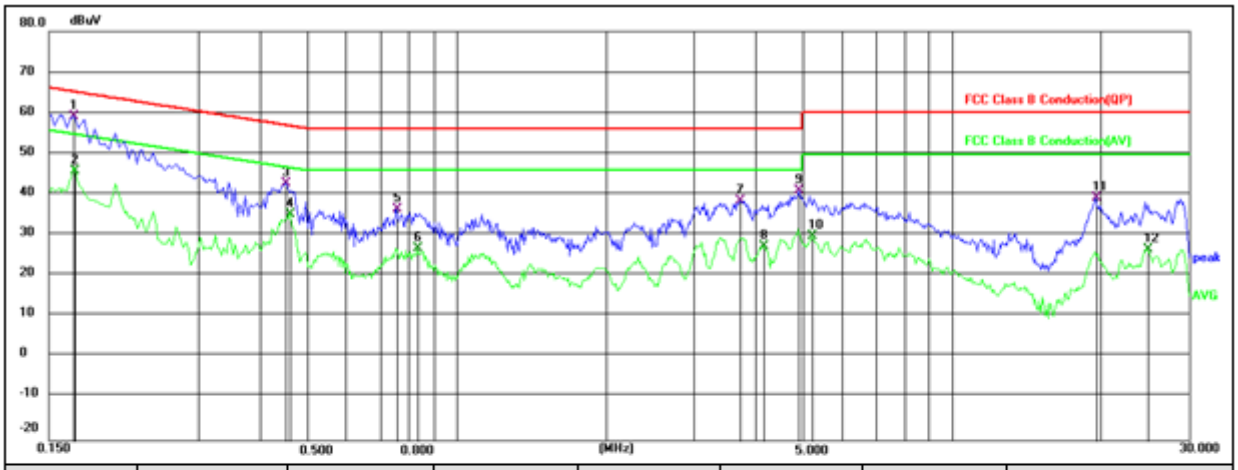
AC Conducted Emission of PC @ AC 120V/60Hz @ GFSK (Low Channel) (worst case)

Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1728	35.78	19.16	54.94	64.82	-9.88	QP
2	0.1995	17.50	19.18	36.68	53.63	-16.95	AVG
3	0.4304	22.05	19.32	41.37	57.24	-15.87	QP
4	0.4741	10.97	19.32	30.29	46.44	-16.15	AVG
5	0.9102	17.35	19.29	36.64	56.00	-19.36	QP
6	0.9375	6.70	19.29	25.99	46.00	-20.01	AVG
7	4.8929	22.07	19.49	41.56	56.00	-14.44	QP
8	5.1496	10.04	19.49	29.53	50.00	-20.47	AVG
9	10.7610	20.06	19.76	39.82	60.00	-20.18	QP
10	11.1211	10.44	19.79	30.23	50.00	-19.77	AVG
11	19.9363	21.70	20.30	42.00	60.00	-18.00	QP
12	24.9000	6.98	20.24	27.22	50.00	-22.78	AVG

Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1685	40.17	19.16	59.33	65.03	-5.70	QP
2	0.1693	26.77	19.16	45.93	54.99	-9.06	AVG
3	0.4516	23.64	19.31	42.95	56.85	-13.90	QP
4	0.4611	15.96	19.31	35.27	46.67	-11.40	AVG
5	0.7572	17.13	19.31	36.44	56.00	-19.56	QP
6	0.8337	7.59	19.29	26.88	46.00	-19.12	AVG
7	3.7501	19.21	19.46	38.67	56.00	-17.33	QP
8	4.1641	8.12	19.46	27.58	46.00	-18.42	AVG
9	4.9066	21.54	19.49	41.03	56.00	-14.97	QP
10	5.2214	10.52	19.50	30.02	50.00	-19.98	AVG
11	19.4863	19.30	20.07	39.37	60.00	-20.63	QP
12	24.7108	6.55	20.12	26.67	50.00	-23.33	AVG

****Note: Pre-scan all modes and recorded the worst case results in this report (GFSK (Low Channel).*

Result = Reading + Correct, Margin = Result – Limit.

7. RADIATED EMISSION MEASUREMENT

7.1. Standard Applicable

According to FCC § 15.249: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) and 15.249 limit in the table below has to be followed.

Fundamental Frequency	Field Strength of fundamental (millivolts/meter)	Field Strength of harmonics (microvolts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

According to RSS-210 B.10:

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

7.2. Instruments Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

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Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

7.3. Test Procedure

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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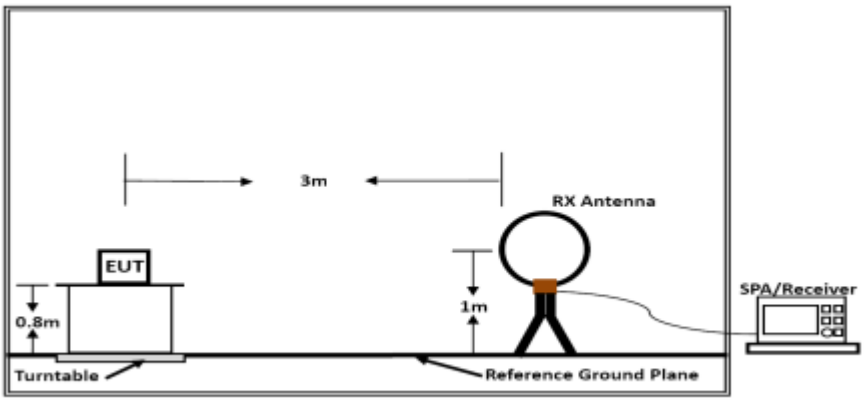
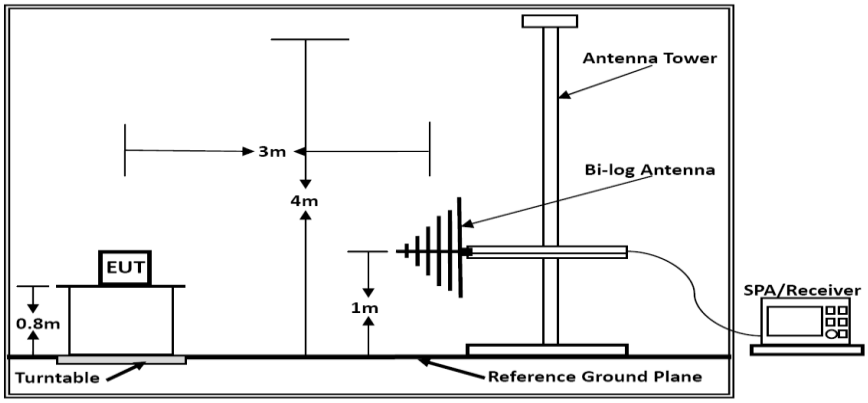
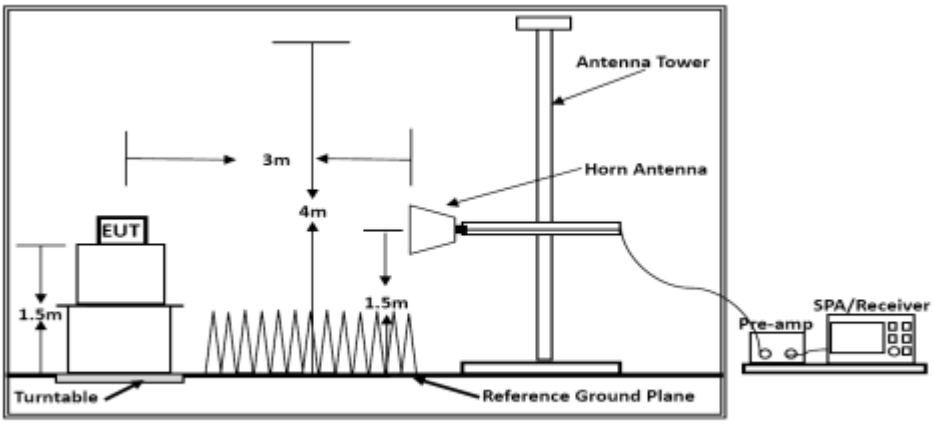
7.4. Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

7.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

7.6. Test Results of Radiated Emissions (9 KHz~30 MHz)

Temperature	24.6℃	Humidity	54.1%
Test Engineer	Carl Fu		

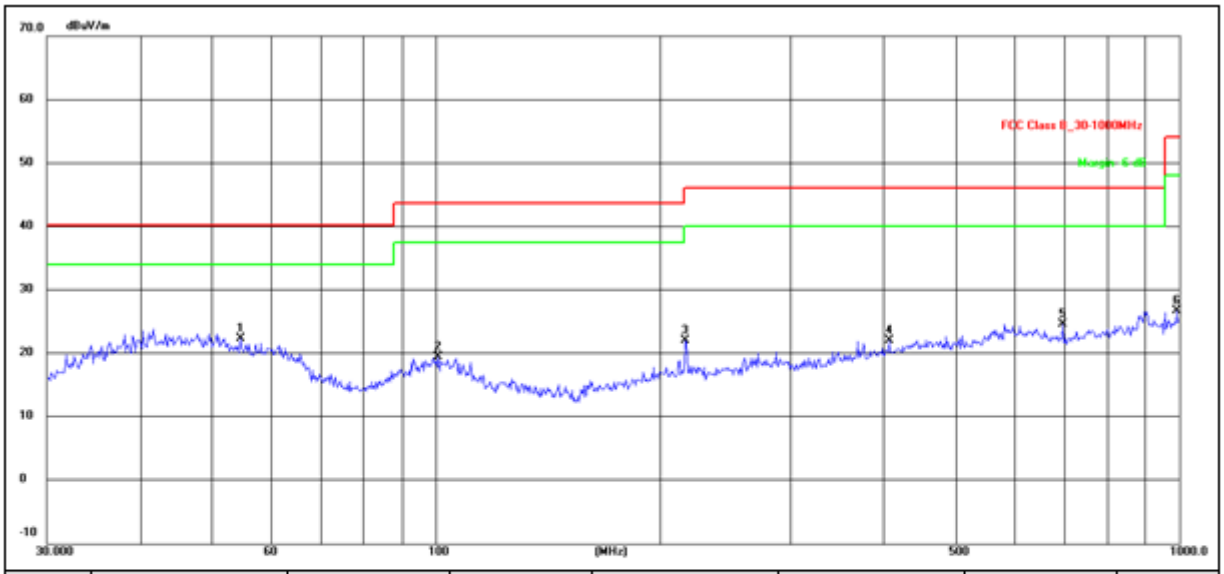
Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

7.7. Test Results of Radiated Emissions (30 MHz – 1000 MHz)

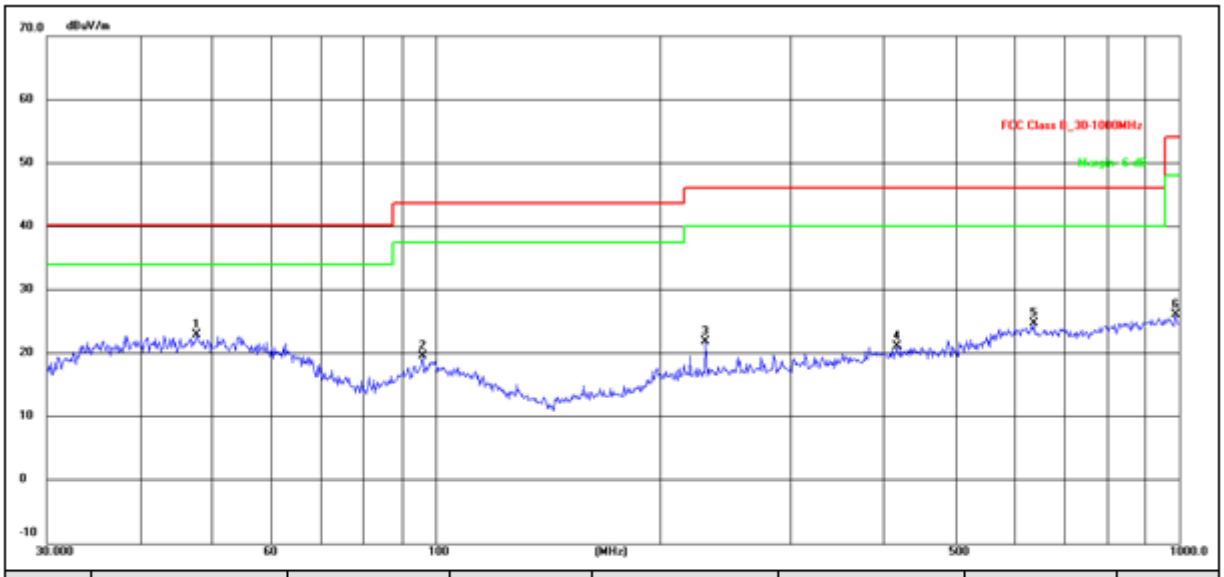
Temperature	24.6℃	Humidity	54.1%
Test Engineer	Carl Fu		

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	54.6428	51.22	-28.77	22.45	40.00	-17.55	QP
2	100.9338	49.67	-30.15	19.52	43.50	-23.98	QP
3	216.7828	51.52	-29.43	22.09	46.00	-23.91	QP
4	407.5144	46.98	-24.83	22.15	46.00	-23.85	QP
5	696.8567	45.99	-21.32	24.67	46.00	-21.33	QP
6	993.0113	45.02	-18.27	26.75	54.00	-27.25	QP

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	47.6584	51.10	-28.19	22.91	40.00	-17.09	QP
2	96.0985	50.50	-30.82	19.68	43.50	-23.82	QP
3	230.9067	50.91	-28.98	21.93	46.00	-24.07	QP
4	417.6409	45.82	-24.71	21.11	46.00	-24.89	QP
5	638.3686	45.92	-21.12	24.80	46.00	-21.20	QP
6	989.5353	44.46	-18.29	26.17	54.00	-27.83	QP

Note:

1). Pre-scan all modes and recorded the worst case results in this report (GFSK (Low Channel)).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Level = Reading + Factor, Margin = Level – Limit,
Factor = Antenna Factor + Cable Loss - Preamp Factor

7.8. Results for Radiated Emissions (1 – 26 GHz)

Field Strength of Fundamental (TX-2403 MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2403.00	H	102.49	87.31	114	94	Pass
2403.00	V	97.15	87.89	114	94	Pass

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4806.00	54.72	33.06	35.04	3.94	56.68	74.00	-17.32	Peak	Horizontal
4806.00	43.83	33.06	35.04	3.94	45.79	54.00	-8.21	Average	Horizontal
4806.00	60.67	33.06	35.04	3.94	62.63	74.00	-11.37	Peak	Vertical
4806.00	45.58	33.06	35.04	3.94	47.54	54.00	-6.46	Average	Vertical

Field Strength of Fundamental (TX-2441 MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2441.00	H	99.11	90.68	114	94	Pass
2441.00	V	97.49	90.14	114	94	Pass

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4882.00	59.01	33.16	35.15	3.96	60.98	74.00	-13.02	Peak	Horizontal
4882.00	43.77	33.16	35.15	3.96	45.74	54.00	-8.26	Average	Horizontal
4882.00	58.04	33.16	35.15	3.96	60.01	74.00	-13.99	Peak	Vertical
4882.00	41.45	33.16	35.15	3.96	43.42	54.00	-10.58	Average	Vertical

Field Strength of Fundamental (TX-2480 MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2480.00	H	99.18	90.63	114	94	Pass
2480.00	V	97.48	90.19	114	94	Pass

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4960.00	61.38	33.26	35.14	3.98	63.48	74.00	-10.52	Peak	Horizontal
4960.00	45.50	33.26	35.14	3.98	47.60	54.00	-6.40	Average	Horizontal
4960.00	59.79	33.26	35.14	3.98	61.89	74.00	-12.11	Peak	Vertical
4960.00	42.79	33.26	35.14	3.98	44.89	54.00	-9.11	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz - 10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9 KHz - 10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3). 18~25 GHz at least have 20dB margin. No recording in the test report.

4). Measured Level = Reading Level + Factor, Margin = Level – Limit,

Factor = Antenna Factor + Cable Loss - Preamp Factor

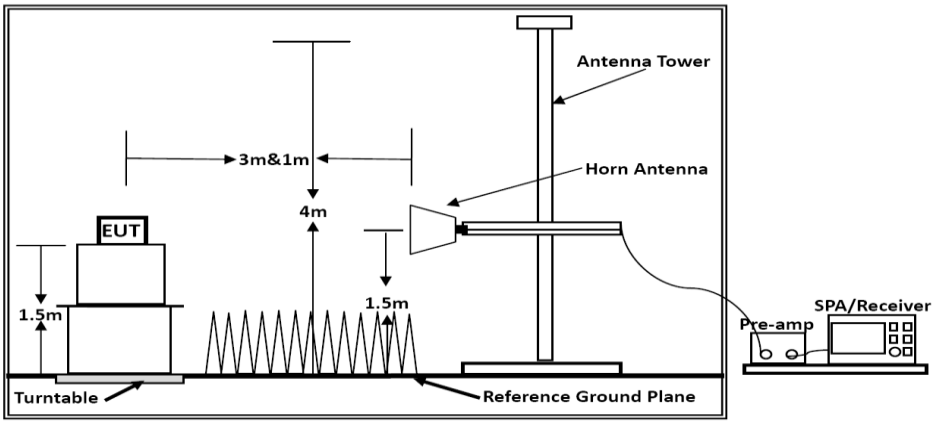
8. RESULTS FOR BAND EDGE TESTING

8.1. Standard Applicable

According to FCC §15.249 (d): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to RSS-210 B.10 (b): Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

8.2. Test Setup Layout



Above 1GHz

8.3. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

8.4. Test Procedures

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

8.5. Measuring Instruments and Setting

Temperature	24.6℃	Humidity	54.1%
Test Engineer	Carl Fu		

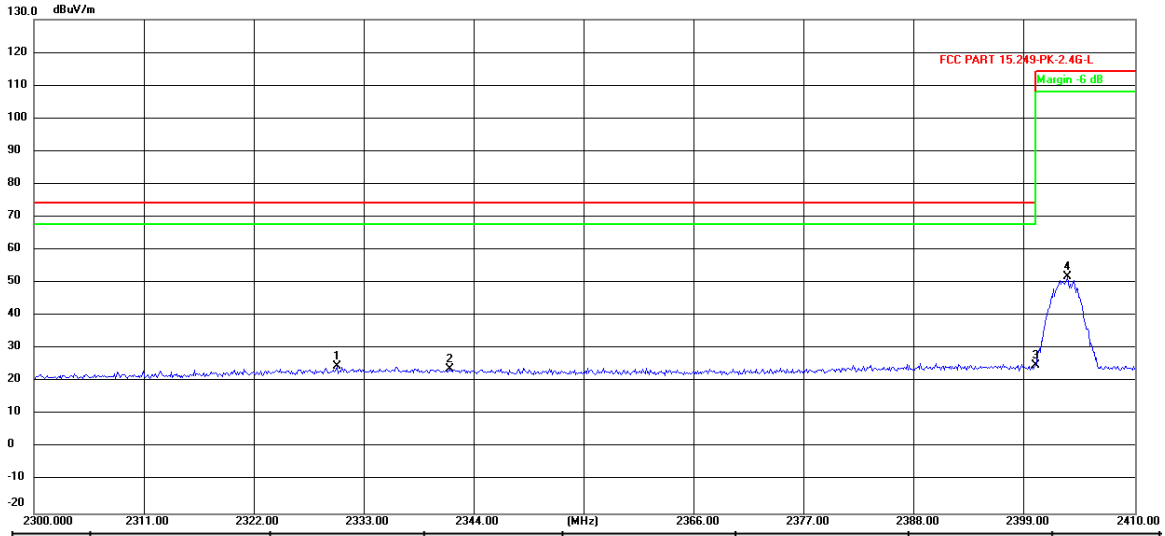
PASS

Remark:

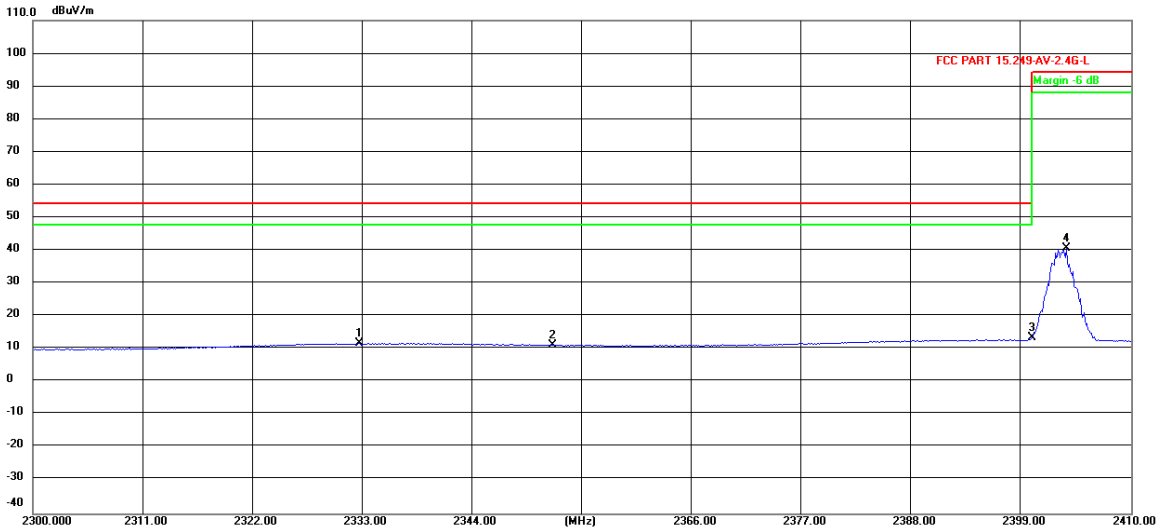
1. *The other emission levels were very low against the limit.*
2. *The average measurement was not performed when the peak measured data under the limit of average detection.*
3. *Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;*
4. *Please refer to following test plots;*

Channel 0 / 2403 MHz

Horizontal



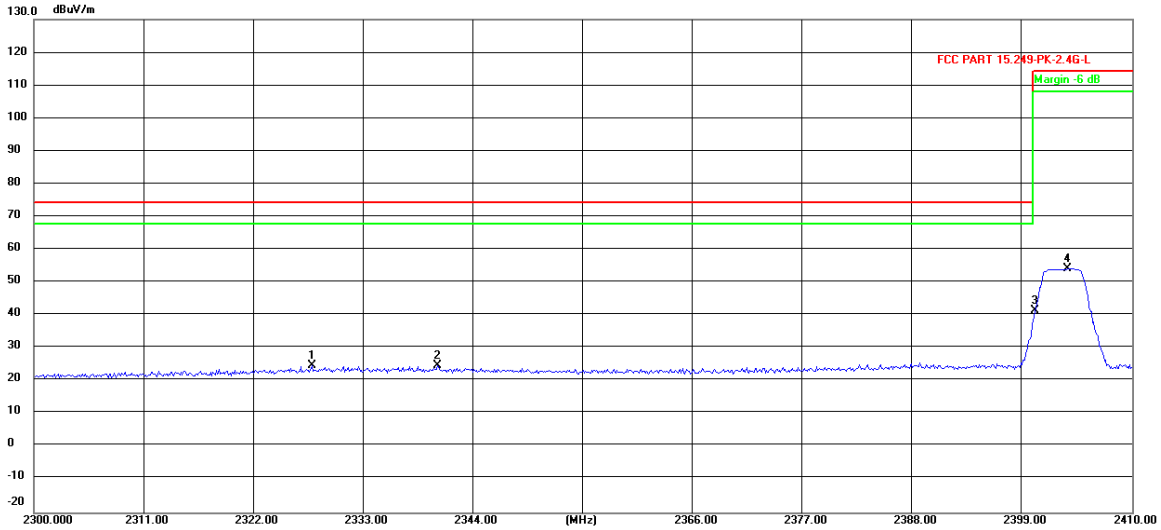
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1 *	2330.250	58.26	-33.53	24.73	74.00	-49.27	peak
2	2341.580	57.31	-33.32	23.99	74.00	-50.01	peak
3	2400.100	57.29	-32.28	25.01	114.00	-88.99	peak
4	2403.290	84.13	-32.23	51.90	114.00	-62.10	peak



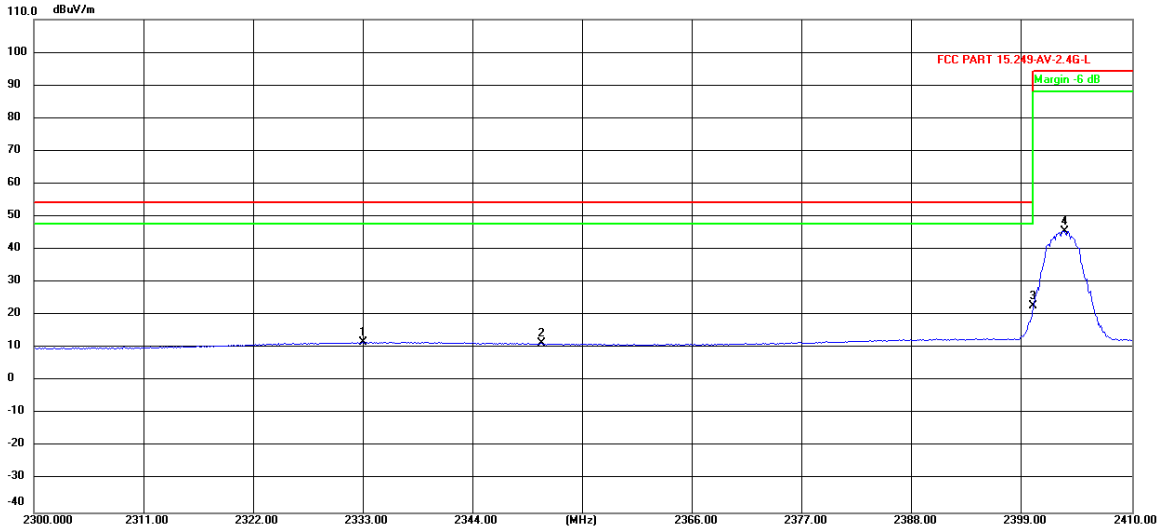
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1 *	2332.670	45.36	-33.48	11.88	54.00	-42.12	AVG
2	2352.030	44.62	-33.14	11.48	54.00	-42.52	AVG
3	2400.100	46.03	-32.28	13.75	94.00	-80.25	AVG
4	2403.510	73.06	-32.23	40.83	94.00	-53.17	AVG

Channel 0 / 2403 MHz

Vertical



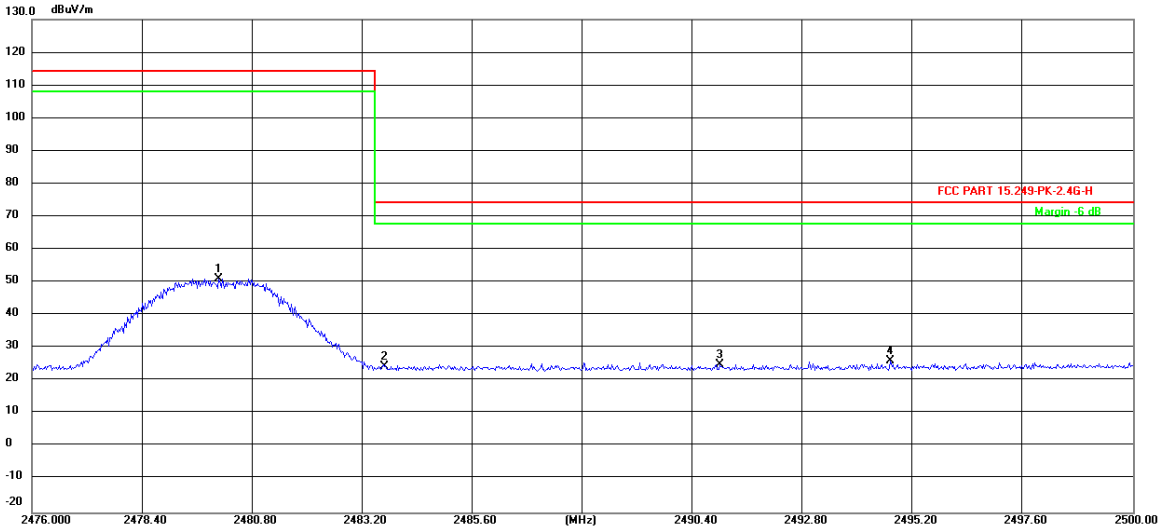
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2327.830	58.34	-33.57	24.77	74.00	-49.23	peak
2 *	2340.480	58.11	-33.33	24.78	74.00	-49.22	peak
3	2400.320	73.76	-32.28	41.48	114.00	-72.52	peak
4	2403.510	86.43	-32.23	54.20	114.00	-59.80	peak



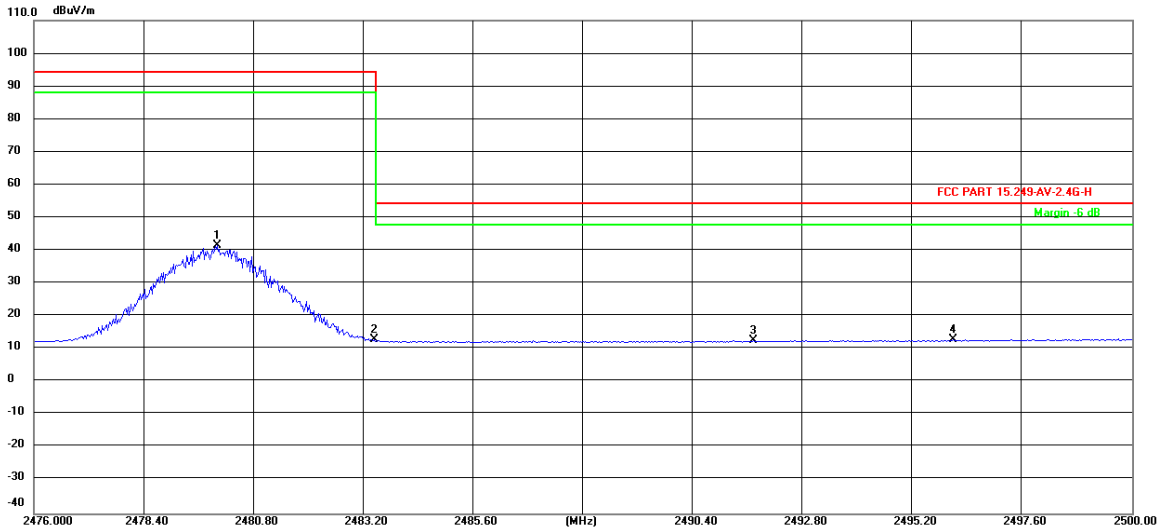
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1 *	2333.000	45.45	-33.47	11.98	54.00	-42.02	AVG
2	2350.820	44.67	-33.16	11.51	54.00	-42.49	AVG
3	2400.100	55.22	-32.28	22.94	94.00	-71.06	AVG
4	2403.290	77.92	-32.23	45.69	94.00	-48.31	AVG

Channel 30 / 2480MHz

Horizontal



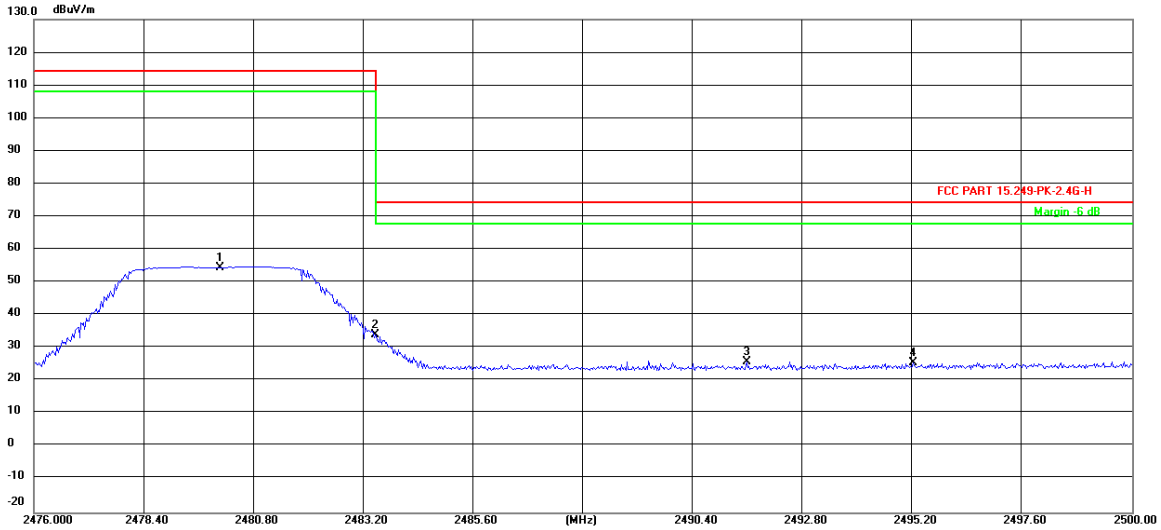
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2480.080	82.23	-30.94	51.29	114.00	-62.71	peak
2	2483.680	55.48	-30.87	24.61	74.00	-49.39	peak
3	2491.000	55.99	-30.74	25.25	74.00	-48.75	peak
4 *	2494.720	56.91	-30.68	26.23	74.00	-47.77	peak



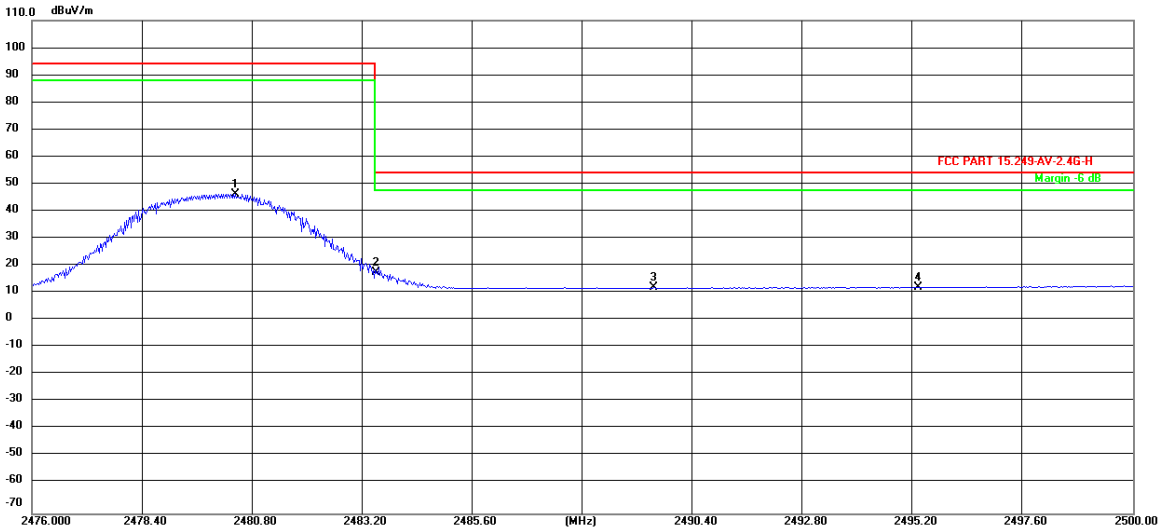
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2480.008	72.49	-30.94	41.55	94.00	-52.45	AVG
2	2483.440	43.90	-30.88	13.02	94.00	-80.98	AVG
3	2491.720	43.43	-30.73	12.70	54.00	-41.30	AVG
4 *	2496.088	43.64	-30.66	12.98	54.00	-41.02	AVG

Channel 30 / 2480MHz

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2480.080	85.49	-30.94	54.55	114.00	-59.45	peak
2	2483.464	64.98	-30.88	34.10	114.00	-79.90	peak
3 *	2491.576	56.69	-30.73	25.96	74.00	-48.04	peak
4	2495.224	56.49	-30.67	25.82	74.00	-48.18	peak



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	2480.440	77.64	-30.93	46.71	94.00	-47.29	AVG
2 *	2483.512	49.13	-30.87	18.26	54.00	-35.74	AVG
3	2489.560	43.47	-30.76	12.71	54.00	-41.29	AVG
4	2495.320	43.49	-30.67	12.82	54.00	-41.18	AVG

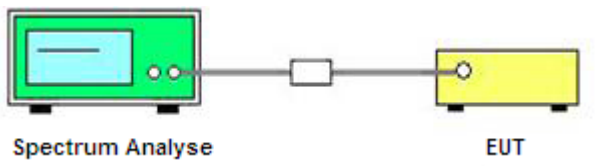
9. 99% OCCUPIED BANDWIDTH AND 20 DB BANDWIDTH MEASUREMENT

9.1. Standard Applicable

According to § 2.1049 and RSS-Gen section 6.7 “The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.”

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

9.2. Block Diagram of Test Setup



9.3. Test Procedure

Use the following spectrum analyzer settings:

Span = 4MHz

RBW = 51 KHz

VBW = 150 KHz

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

9.4. Test Results

Temperature	24.6℃	Humidity	54.1%
Test Engineer	Carl Fu		

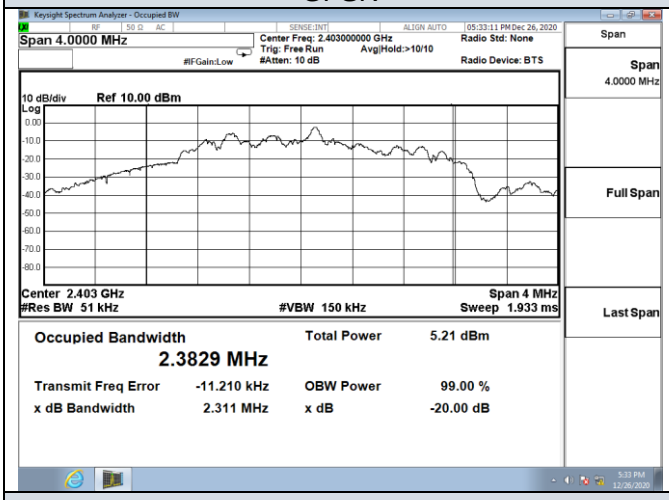
Test Result of 99% and 20dB Bandwidth Measurement			
Test Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
2403	2.311	2.3829	Non-Specified
2441	2.272	2.3410	Non-Specified
2480	2.290	2.2702	Non-Specified

Remark:

1. *Test results including cable loss;*
2. *Please refer following test plots;*

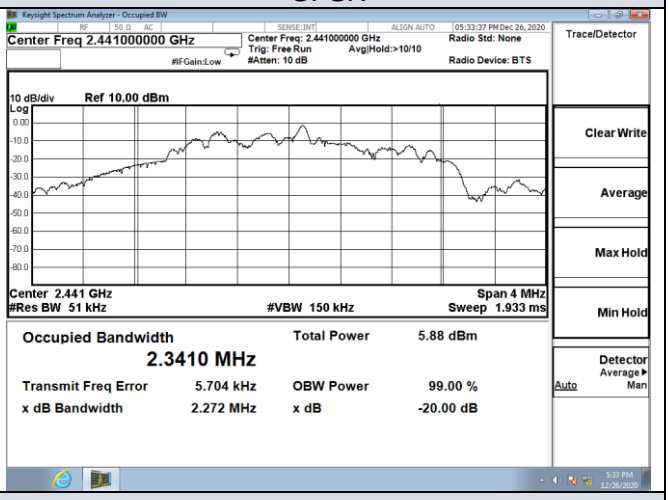
20dB Bandwidth and 99% Bandwidth

GFSK

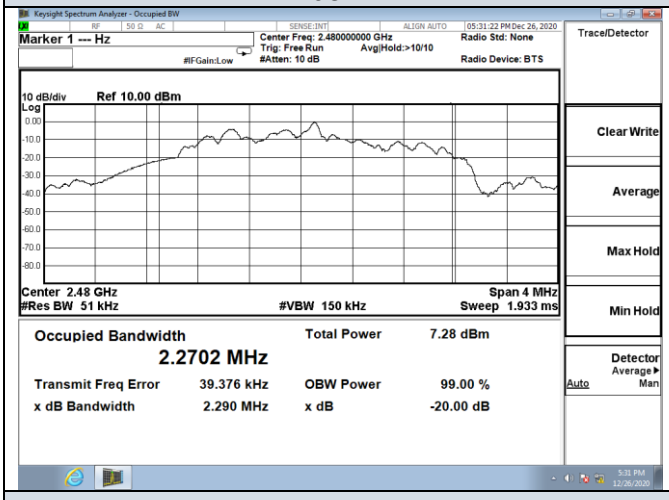


2403MHz

GFSK



2441MHz



2480MHz

10. LIST OF MEASURING EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2020-11-21	2021-11-20
2	DC Power Supply	Agilent	E3642A	N/A	2020-11-13	2021-11-12
3	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2020-10-08	2021-10-07
4	EMI Test Software	AUDIX	E3	/	N/A	N/A
5	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2020-06-22	2021-06-21
6	Positioning Controller	MF	MF7082	MF78020803	2020-06-22	2021-06-21
7	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2018-07-26	2021-07-25
8	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2018-07-26	2021-07-25
9	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2018-07-02	2021-07-01
10	EMI Test Receiver	R&S	ESR 7	101181	2020-06-22	2021-06-21
11	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2020-11-13	2021-11-12
12	Broadband Preamplifier	/	BP-01M18G	P190501	2020-06-22	2021-06-21
13	RF Cable-R03m	Jye Bao	RG142	CB021	2020-06-22	2021-06-21
14	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2020-06-22	2021-06-21
15	EMI Test Receiver	R&S	ESPI	101840	2020-06-22	2021-06-21
16	Artificial Mains	R&S	ENV216	101288	2020-06-22	2021-06-21
17	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2020-06-22	2021-06-21
Note: All equipment is calibrated through CHINA CEPREI LABORATORY and GUANGZHOU LISAI CALIBRATION AND TEST CO., LTD.						

11. TEST SETUP PHOTOGRAPHS OF THE EUT

Please refer to separated files for Test Setup Photos of the EUT.

12. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

13. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------THE END OF REPORT----------

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