

FCC TEST REPORT

FOR

Dongguan Haoyinliang Electronics Co., Ltd

2.4G wireless headphone

Test Model: h-RF801

Additional Model No.: 8081706,206077-01,206077-02

Prepared for : Dongguan Haoyinliang Electronics Co., Ltd
Address : No.46,Xinan Avenue,Ludong Community, Humen Town, Dongguan City, China

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd
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Date of receipt of test sample : May 27, 2019
Number of tested samples : 1
Sample number : Prototype
Date of Test : May 27, 2019~ June 05, 2019
Date of Report : June 28, 2019

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.249)

Report Reference No. : **LCS190621041AEA**

Date of Issue..... : June 28, 2019

Testing Laboratory Name : **Shenzhen LCS Compliance Testing Laboratory Ltd.**

Address..... : 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue,
Bao'an District, Shenzhen, Guangdong, China

Testing Location/ Procedure : Full application of Harmonised standards
Partial application of Harmonised standards
Other standard testing method

Applicant's Name : **Dongguan Haoyinliang Electronics Co., Ltd**

Address..... : No.46,Xinan Avenue,Ludong Community, Humen Town, Dongguan
City, China

Test Specification

Standard : FCC CFR 47 PART 15 C(15.249)

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..... : **2.4G wireless headphone**

Trade Mark : INVONS

Test Model..... : h-RF801

For Adapter:

Ratings..... : Input: AC100-240V, 50/60Hz, 150mA

Output: DC 5V/550mA

Result : **Positive**

Compiled by:

Peter Xiao

Peter Xiao/Administrators

Supervised by:

Aking Jin

Aking Jin /Technique principal

Approved by:

Gavin Liang

Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS190621041AEA	<u>June 28, 2019</u> Date of issue
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Test Model..... : h-RF801

EUT..... : 2.4G wireless headphone

Applicant..... : Dongguan Haoyinliang Electronics Co., Ltd

Address..... : No.46,Xinan Avenue,Ludong Community, Humen Town,
Dongguan City, China

Telephone..... : /

Fax..... : /

Manufacturer..... : Dongguan Haoyinliang Electronics Co., Ltd

Address..... : No.46, Xin'an Road, Ludong Village, Humen Town, Dongguan
City, Guangdong Province, China.

Telephone..... : /

Fax..... : /

Factory..... : /

Address..... : /

Telephone..... : /

Fax..... : /

Test Result	Positive
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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	June 28, 2019	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	: 2.4G wireless headphone
Test Model	: h-RF801
Additional Model No.	: 8081706,206077-01,206077-02
Model Declaration	: PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	: For Adapter: Input: AC100-240V, 50/60Hz, 150mA Output: DC 5V/550mA
Hardware Version	: V1.1 2017/0701
Software Version	: BACHTX-5DFE-8A79.bin/BACHTX-9B28-8A81.bin

SRD

Frequency Range	: 2406-2472 MHz
Channel Number	: GFSK
Modulation Type	: 31
Antenna Description	: Internal Antenna, -0.9dBi (Max.)

1.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
HUIZHOU TECHLONG Co., LTD	Adapter	TBA0050500055VU	--	VOC

1.3. External I/O

I/O Port Description	Quantity	Cable
DC IN Port	1	N/A
AUDIO IN Port	1	N/A
OPTICAL Port	1	N/A
SCAN Port	1	N/A

1.4. Description of Test Facility

FCC Registration Number is 254912.

Industry Canada Registration Number is 9642A-1.

EMSD Registration Number is ARCB0108.

UL Registration Number is 100571-492.

TUV SUD Registration Number is SCN1081.

TUV RH Registration Number is UA 50296516-001.

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier: CN0071

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	2406	/
	2440	/
	2472	/
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.

1.8. Frequency of Channels

Modulation Technology	Channel No.	Frequency	Channel No.	Frequency
		(MHz)		(MHz)
GFSK	1	2406	17	2444
	2	2408	18	2446
	3	2410	19	2448
	4	2412	20	2450
	5	2414	21	2452
	6	2416	22	2454
	7	2418	23	2456
	8	2420	24	2458
	9	2422	25	2460
	10	2424	26	2462
	11	2426	27	2464
	12	2428	28	2466
	13	2430	29	2468
	14	2432	30	2470
	15	2438	31	2472
	16	2440		

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 directly placed on the ground. 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 turntable, which is directly placed on the ground. 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.

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 PageUp 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.

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	Band Edges Measurement	Compliant
§15.249, §15.215	99% and 20 dB Bandwidth	Compliant

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 Internal antenna and maximum antenna gain is -0.9 dBi, antenna cannot replacement, meets FCC Part §15.203 or RSS-Gen antenna requirement. Please see EUT photo for details.

5.3. Results

Compliance

6. POWER LINE CONDUCTED EMISSIONS

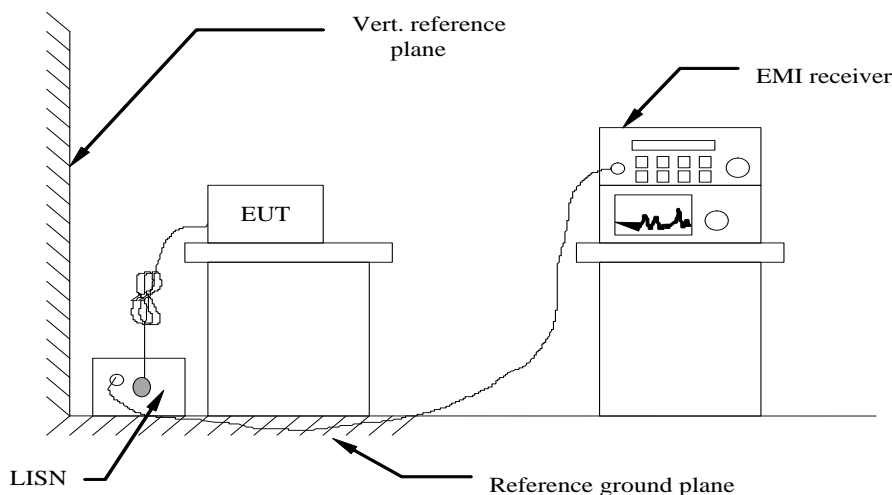
6.1. Standard Applicable

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



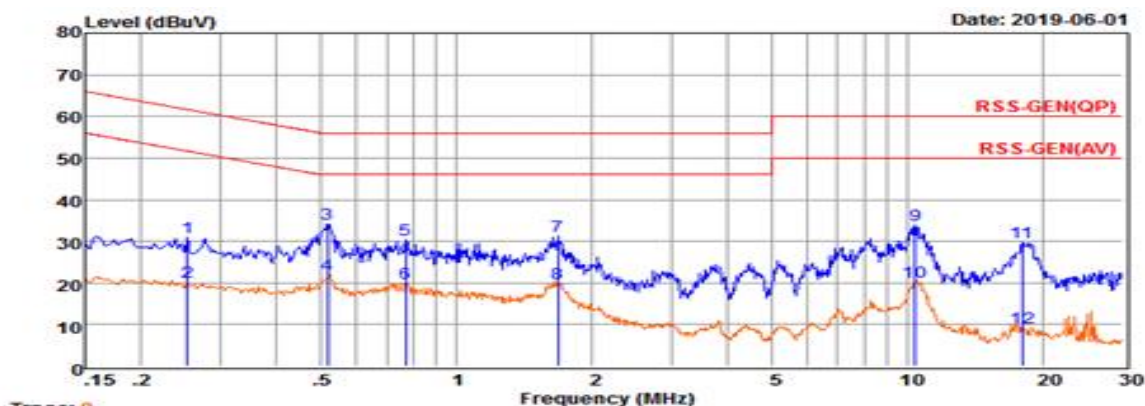
6.3. Test Results

The test data please refer to following page.

Temperature	24.5°C	Humidity	53.9%
Test Engineer	David Luo		

AC Power Line Conducted Emission (Power input to adapter @ AC 120V/60Hz (Worst Case))

Line

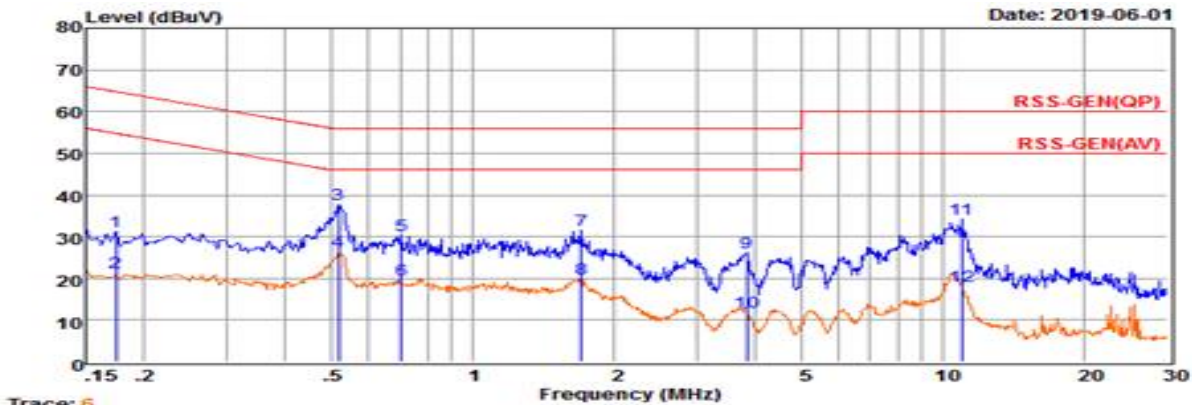


Trace: 8
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.25	11.35	9.63	0.03	10.00	31.01	61.64	-30.63	QP
2	0.25	0.44	9.63	0.03	10.00	20.10	51.64	-31.54	Average
3	0.52	14.63	9.62	0.04	10.00	34.29	56.00	-21.71	QP
4	0.52	2.34	9.62	0.04	10.00	22.00	46.00	-24.00	Average
5	0.77	10.55	9.64	0.04	10.00	30.23	56.00	-25.77	QP
6	0.77	0.18	9.64	0.04	10.00	19.86	46.00	-26.14	Average
7	1.68	11.42	9.64	0.05	10.00	31.11	56.00	-24.89	QP
8	1.68	0.20	9.64	0.05	10.00	19.89	46.00	-26.11	Average
9	10.40	14.17	9.69	0.08	10.00	33.94	60.00	-26.06	QP
10	10.40	0.37	9.69	0.08	10.00	20.14	50.00	-29.86	Average
11	17.94	9.75	9.74	0.11	10.00	29.60	60.00	-30.40	QP
12	17.95	-10.78	9.74	0.11	10.00	9.07	50.00	-40.93	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

Neutral



Trace: 6
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.17	11.44	9.64	0.02	10.00	31.10	64.77	-33.67	QP
2	0.17	1.77	9.64	0.02	10.00	21.43	54.76	-33.33	Average
3	0.52	18.23	9.62	0.04	10.00	37.89	56.00	-18.11	QP
4	0.52	6.71	9.62	0.04	10.00	26.37	46.00	-19.63	Average
5	0.70	10.52	9.63	0.04	10.00	30.19	56.00	-25.81	QP
6	0.70	-0.11	9.63	0.04	10.00	19.56	46.00	-26.44	Average
7	1.70	11.85	9.63	0.05	10.00	31.53	56.00	-24.47	QP
8	1.70	0.11	9.63	0.05	10.00	19.79	46.00	-26.21	Average
9	3.82	6.33	9.65	0.06	10.00	26.04	56.00	-29.96	QP
10	3.82	-7.73	9.65	0.06	10.00	11.98	46.00	-34.02	Average
11	10.96	14.23	9.73	0.09	10.00	34.05	60.00	-25.95	QP
12	10.96	-1.59	9.73	0.09	10.00	18.23	50.00	-31.77	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

***Note: Pre-scan all modes and recorded the worst case results in this report.

7. RADIATED EMISSION MEASUREMENT

7.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	M Hz	M Hz	GH z
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.5252	2483.5-2500	17.7-21.4
8.37625-8.38675	5	2690-2900	22.01-23.12
8.41425-8.41475	156.7-156.9	3260-3267	23.6-24.0
12.29-12.293	162.0125-167.17	3332-3339	31.2-31.8
12.51975-12.5202	167.72-173.2	3345.8-3358	36.43-36.5
5	240-285	3600-4400	(\2\)
12.57675-12.5772	322-335.4		
5			
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.249 (a): Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

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

* Field strength limits are specified at a distance of 3 meters.

* As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

* 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.

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	10 th 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

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.

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 ($\pm 45^\circ$) 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.

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 ($\pm 45^\circ$) 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.

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.

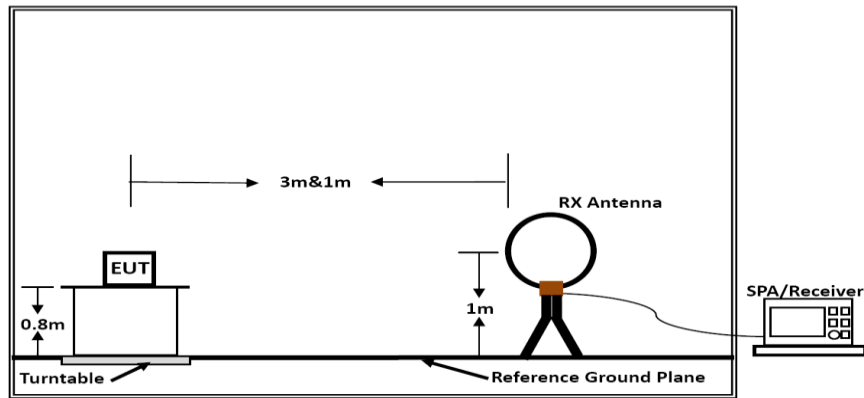
Premeasurement:

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

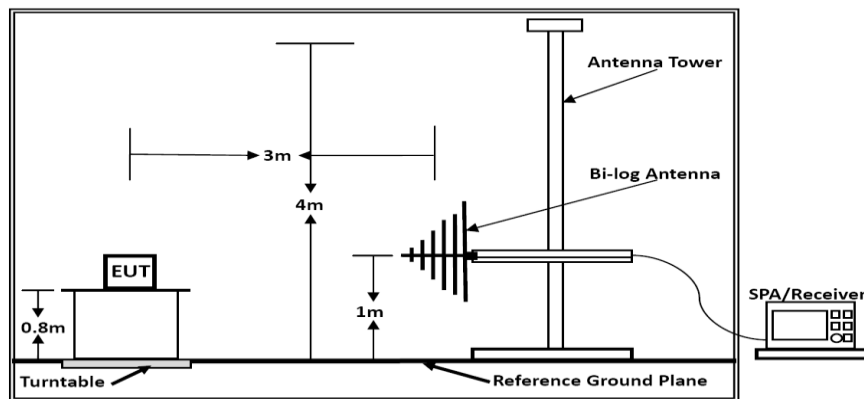
Final measurement:

- 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.

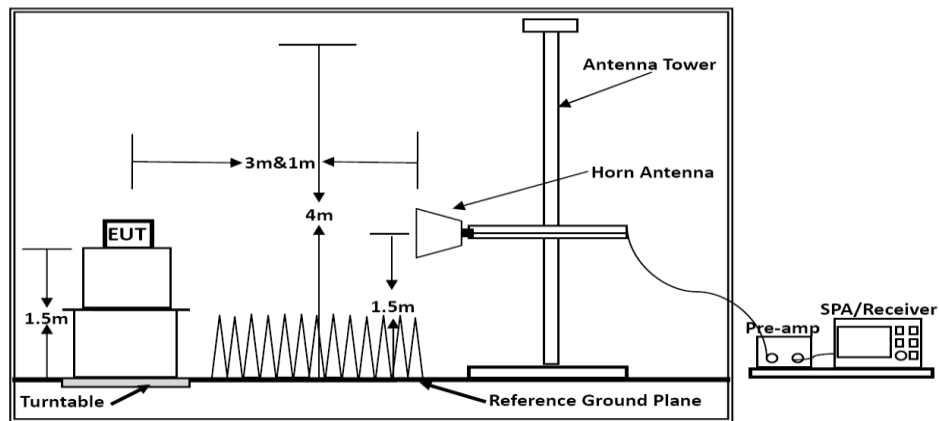
7.4. Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

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

Distance extrapolation factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1.5m]})$ (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	24.5°C	Humidity	54.2%
Test Engineer	David Luo	Configurations	GFSK

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.

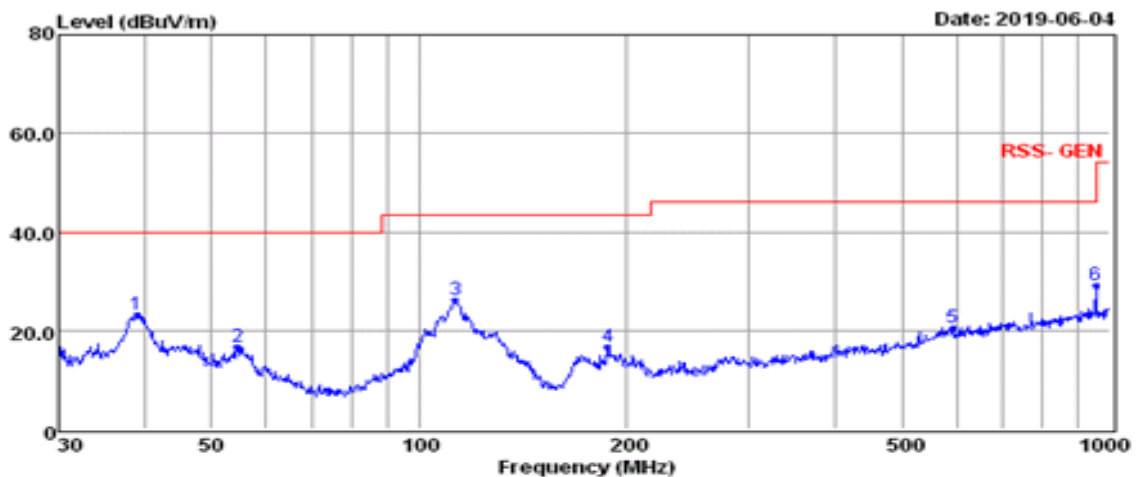
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

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

Temperature	24.5°C	Humidity	54.2%
Test Engineer	David Luo	Configurations	GFSK

Vertical



pol:

VERTICAL

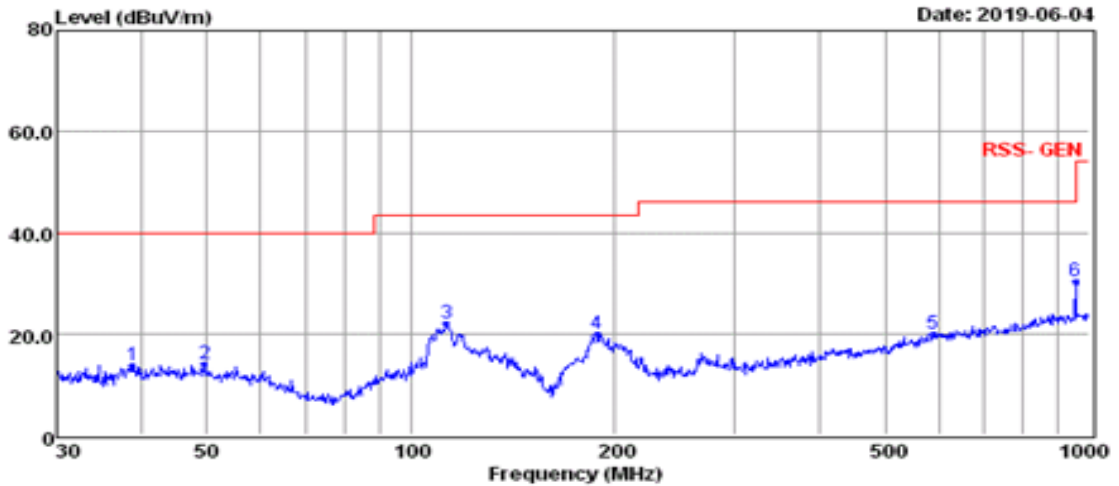
	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	39.02	9.39	0.38	13.33	23.10	40.00	-16.90	QP
2	54.45	3.25	0.46	13.05	16.76	40.00	-23.24	QP
3	112.92	13.87	0.65	11.73	26.25	43.50	-17.25	QP
4	187.75	5.19	0.98	10.36	16.53	43.50	-26.97	QP
5	593.05	0.73	1.51	18.32	20.56	46.00	-25.44	QP
6	955.44	5.76	1.89	21.45	29.10	46.00	-16.90	QP

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that are 20db below the official limit are not reported

Horizontal



pol:

HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	38.89	0.12	0.38	13.30	13.80	40.00	-26.20	QP
2	49.71	0.06	0.54	13.27	13.87	40.00	-26.13	QP
3	112.92	9.52	0.65	11.73	21.90	43.50	-21.60	QP
4	188.41	8.58	0.98	10.42	19.98	43.50	-23.52	QP
5	588.91	0.29	1.40	18.24	19.93	46.00	-26.07	QP
6	955.44	7.12	1.89	21.45	30.46	46.00	-15.54	QP

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported

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). Corrected Reading: Antenna Factor + Cable Loss + Read Level = Level.

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
2406.52	H	90.72	82.05	114	94	Pass
2406.52	V	88.63	79.17	114	94	Pass

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4812.32	52.97	33.06	35.04	3.94	54.93	74.00	-19.07	Peak	Horizontal
4812.32	39.58	33.06	35.04	3.94	41.54	54.00	-12.46	Average	Horizontal
7218.91	53.18	33.16	35.06	3.96	55.24	74.00	-18.76	Peak	Horizontal
7218.91	40.09	33.16	35.06	3.96	42.15	54.00	-11.85	Average	Horizontal
4812.32	52.29	33.06	35.04	3.94	54.25	74.00	-19.75	Peak	Vertical
4812.32	40.21	33.06	35.04	3.94	42.17	54.00	-11.83	Average	Vertical
7218.91	53.43	33.16	35.06	3.96	55.49	74.00	-18.51	Peak	Vertical
7218.91	40.25	33.16	35.06	3.96	42.31	54.00	-11.69	Average	Vertical

Field Strength of Fundamental (TX-2439 MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2440.21	H	89.37	80.37	114	94	Pass
2440.21	V	90.22	81.56	114	94	Pass

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4880.75	49.07	33.16	35.15	3.96	51.04	74.00	-22.96	Peak	Horizontal
4880.75	40.07	33.16	35.15	3.96	42.04	54.00	-11.96	Average	Horizontal
7320.43	52.24	33.26	35.17	3.98	54.31	74.00	-19.69	Peak	Horizontal
7320.43	40.85	33.26	35.17	3.98	42.92	54.00	-11.08	Average	Horizontal
4880.75	51.12	33.16	35.15	3.96	53.09	74.00	-20.91	Peak	Vertical
4880.75	35.92	33.16	35.15	3.96	37.89	54.00	-16.11	Average	Vertical
7320.43	53.62	33.26	35.17	3.98	55.69	74.00	-18.31	Peak	Vertical
7320.43	40.82	33.26	35.17	3.98	42.89	54.00	-11.11	Average	Vertical

Field Strength of Fundamental (TX-2478 MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2472.65	H	92.52	83.57	114	94	Pass
2472.65	V	93.74	84.19	114	94	Pass

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4944.28	50.84	33.26	35.14	3.98	52.94	74.00	-21.06	Peak	Horizontal
4944.28	40.56	33.26	35.14	3.98	42.66	54.00	-11.34	Average	Horizontal
7416.76	49.51	33.36	35.16	4.00	51.71	74.00	-22.29	Peak	Horizontal
7416.76	38.77	33.36	35.16	4.00	40.97	54.00	-13.03	Average	Horizontal
4944.28	51.73	33.26	35.14	3.98	53.83	74.00	-20.17	Peak	Vertical
4944.28	37.50	33.26	35.14	3.98	39.60	54.00	-14.40	Average	Vertical
7416.76	52.86	33.36	35.16	4.00	55.06	74.00	-18.94	Peak	Vertical
7416.76	37.29	33.36	35.16	4.00	39.49	54.00	-14.51	Average	Vertical

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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.*

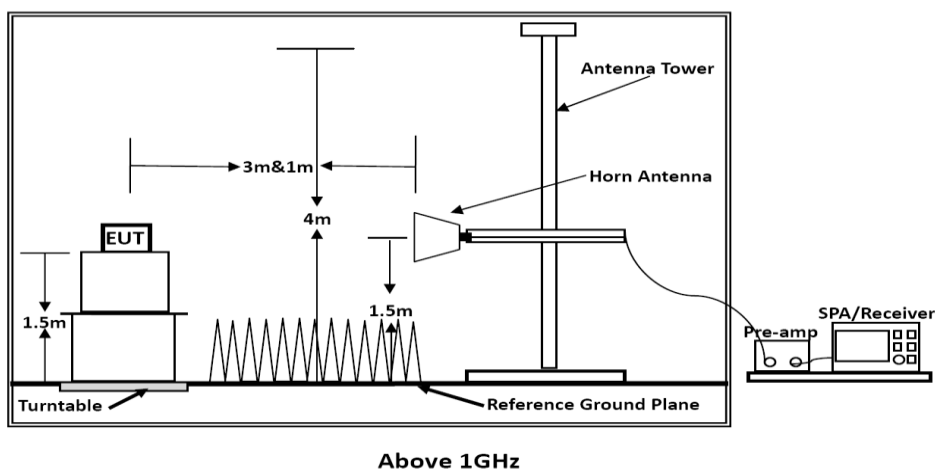
8. RESULTS FOR BAND EDGE TESTING

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



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 ($\pm 45^\circ$) 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	24.3°C	Humidity	53.6%
Test Engineer	David Luo		

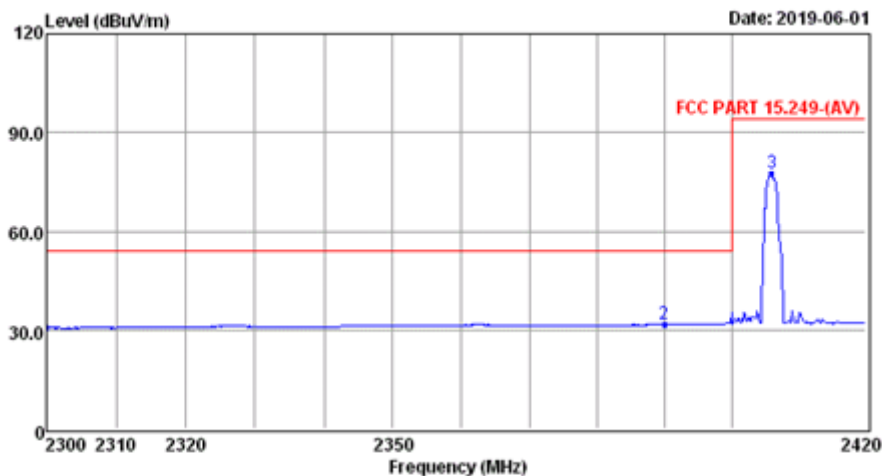
PASS

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 1 / 2406 MHz

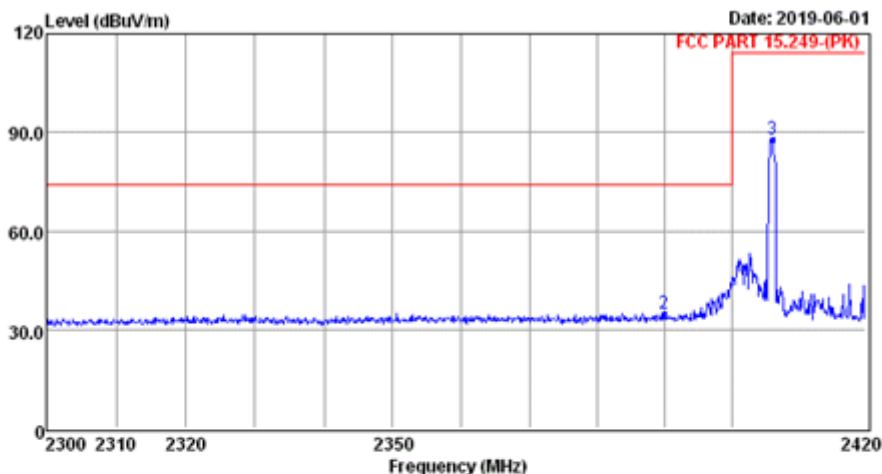
Horizontal



pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2300.00	-2.96	3.22	30.39	30.65	54.00	-23.35	Average
2	2390.00	-2.58	3.08	31.16	31.66	54.00	-22.34	Average
3	2406.01	43.30	2.94	31.26	77.50	94.00	-16.50	Average

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported



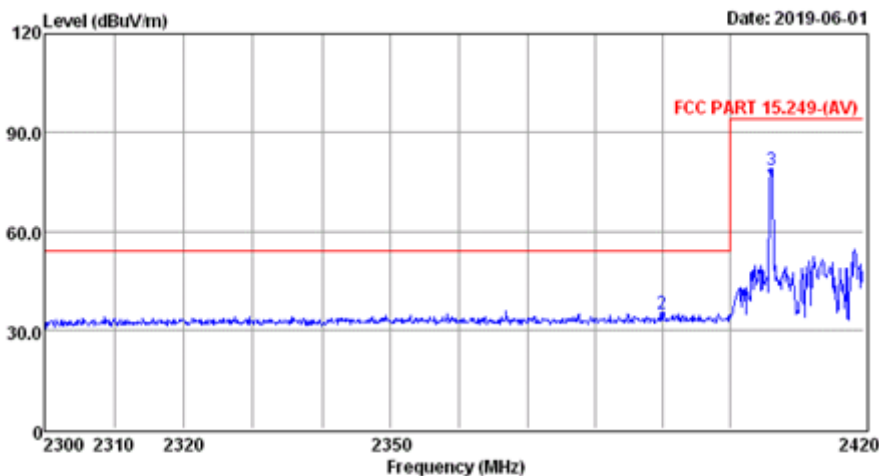
pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2300.00	-0.98	3.22	30.39	32.63	74.00	-41.37	Peak
2	2390.00	0.74	3.08	31.16	34.98	74.00	-39.02	Peak
3	2406.13	53.90	2.94	31.26	88.10	114.00	-25.90	Peak

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported

Channel 1 / 2406 MHz

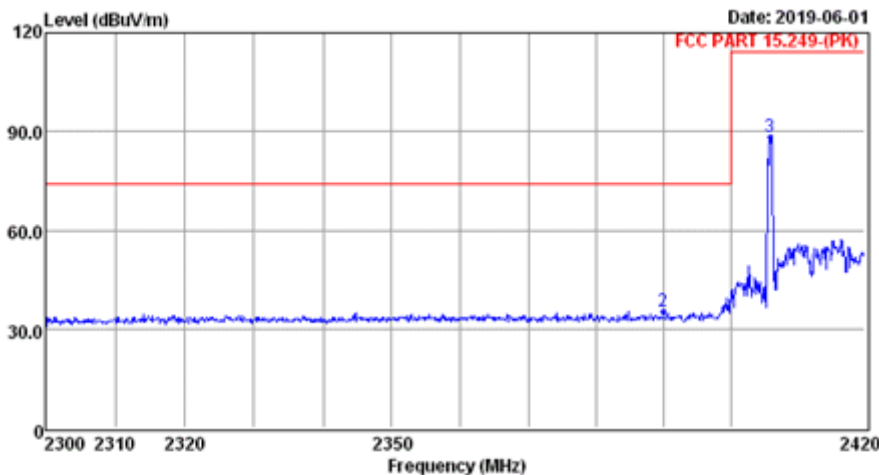
Vertical



pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2300.00	-2.17	3.22	30.39	31.44	54.00	-22.56	Average
2	2390.00	0.68	3.08	31.16	34.92	54.00	-19.08	Average
3	2406.26	44.23	2.94	31.26	78.43	94.00	-15.57	Average

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported



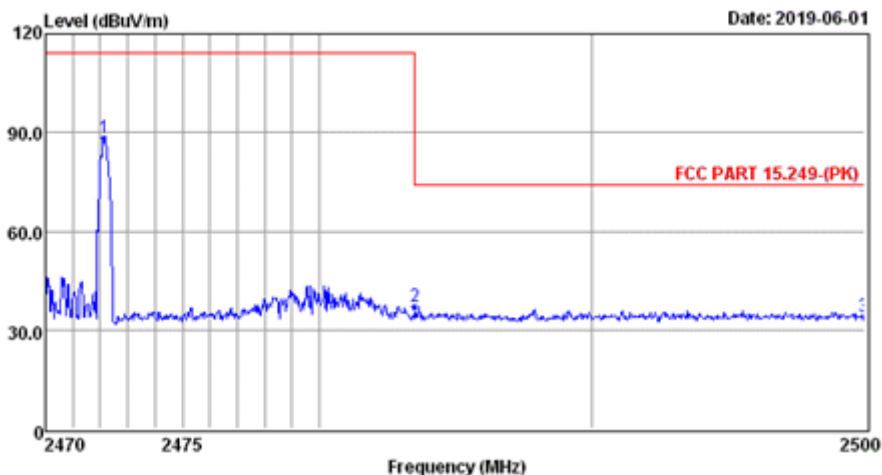
pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2300.00	-1.75	3.22	30.39	31.86	74.00	-42.14	Peak
2	2390.00	0.97	3.08	31.16	35.21	74.00	-38.79	Peak
3	2405.89	54.33	2.94	31.26	88.53	114.00	-25.47	Peak

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported

Channel 26 / 2472 MHz

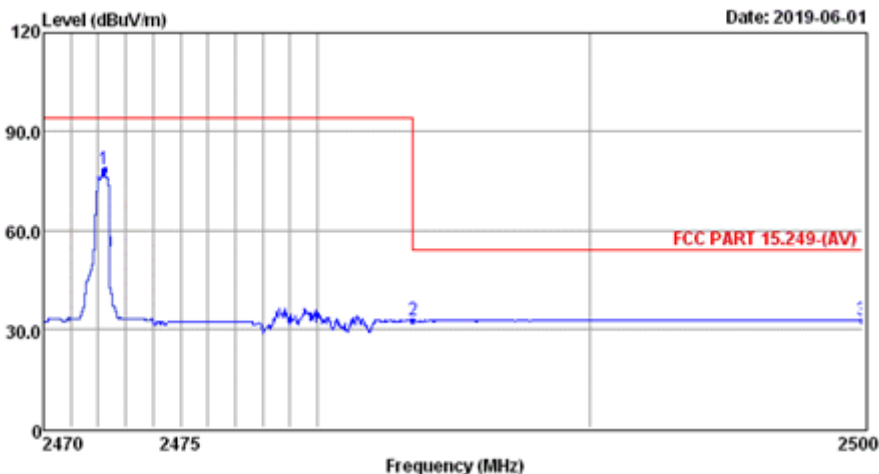
Horizontal



pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2472.15	53.65	3.09	31.49	88.23	114.00	-25.77	Peak
2	2483.50	2.16	3.23	31.53	36.92	74.00	-37.08	Peak
3	2500.00	-0.92	3.36	31.59	34.03	74.00	-39.97	Peak

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported



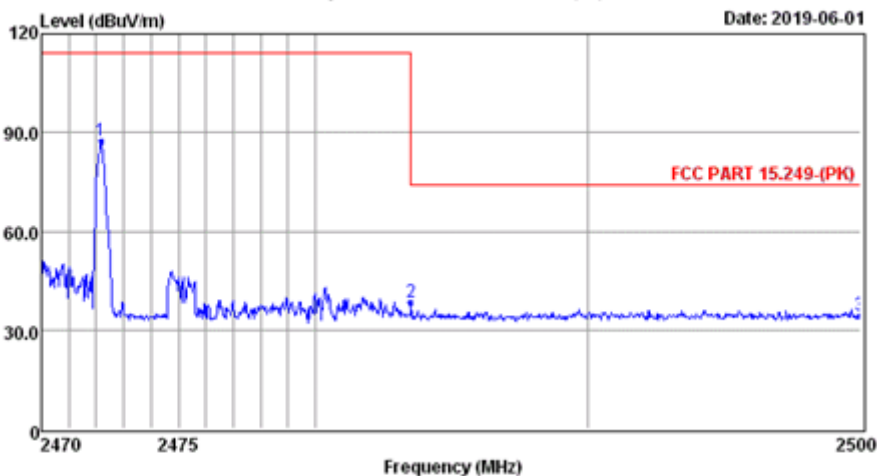
pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2472.24	43.74	3.09	31.49	78.32	94.00	-15.68	Average
2	2483.50	-2.07	3.23	31.53	32.69	54.00	-21.31	Average
3	2500.00	-2.21	3.36	31.59	32.74	54.00	-21.26	Average

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported

Channel 26 / 2472 MHz

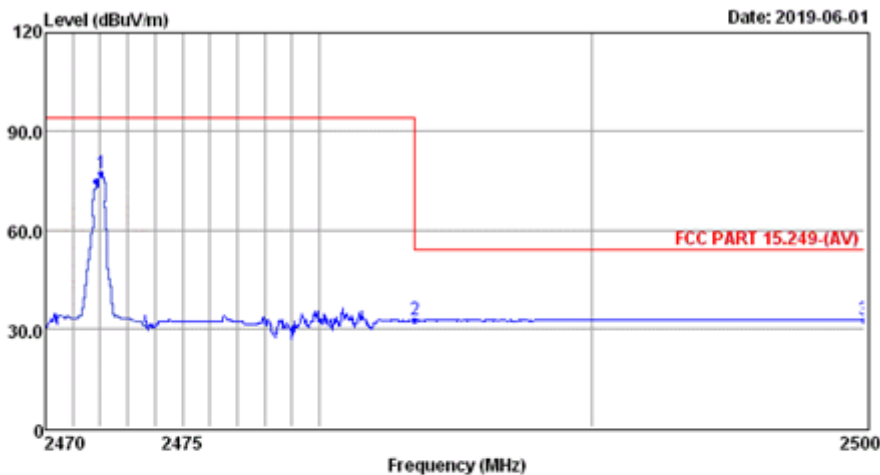
Vertical



pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2472.18	53.00	3.09	31.49	87.58	114.00	-26.42	Peak
2	2483.50	3.47	3.23	31.53	38.23	74.00	-35.77	Peak
3	2500.00	-0.65	3.36	31.59	34.30	74.00	-39.70	Peak

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported



pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2472.03	42.72	3.09	31.49	77.30	94.00	-16.70	Average
2	2483.50	-2.17	3.23	31.53	32.59	54.00	-21.41	Average
3	2500.00	-2.24	3.36	31.59	32.71	54.00	-21.29	Average

Note: 1. All readings are Quasi-peak values.
 2. Measured= Reading + Antenna Factor + Cable Loss
 3. The emission that are 20db below the official limit are not reported

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 = 3MHz

RBW = 100 KHz

VBW = 300 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).

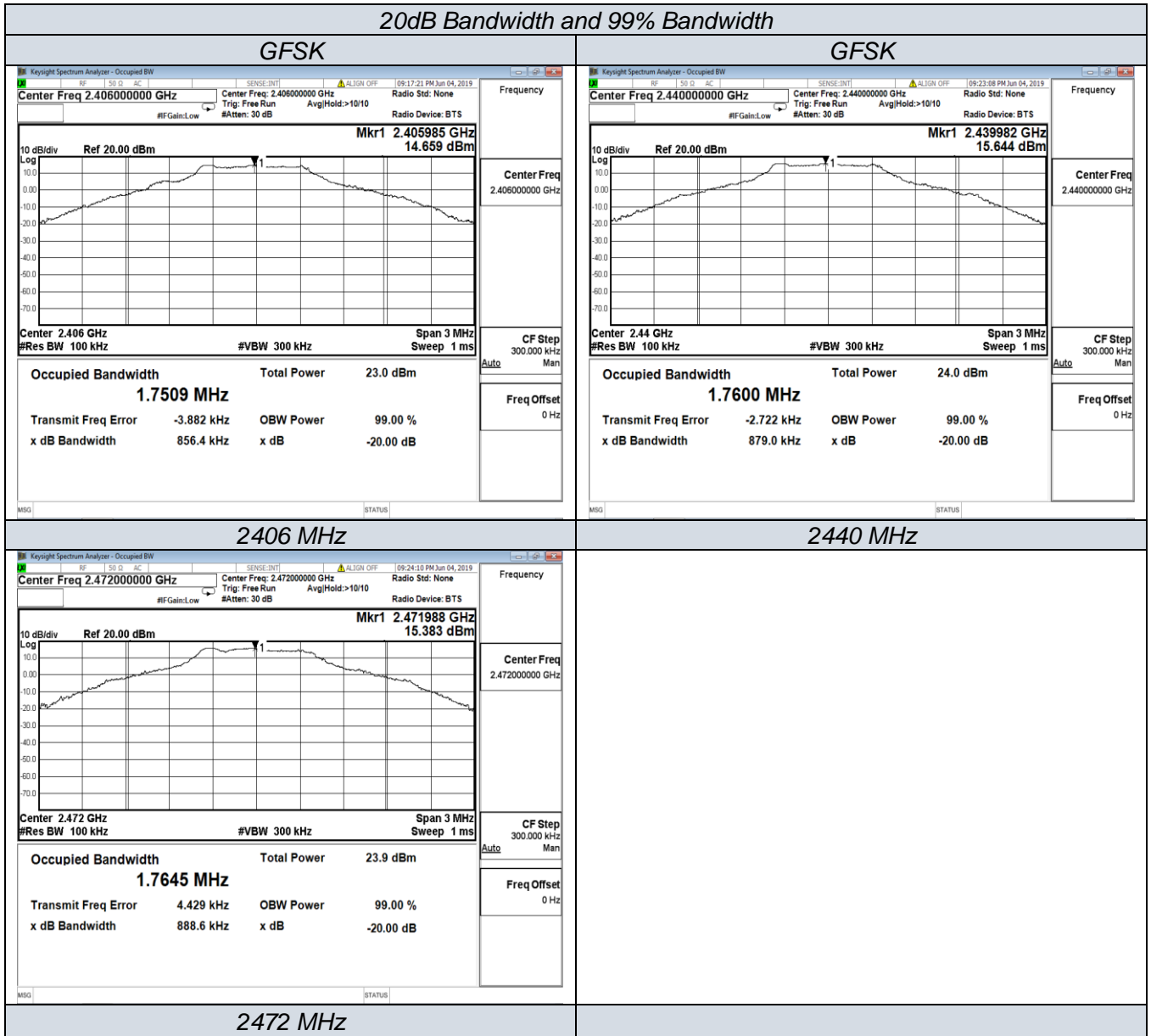
9.4. Test Results

Temperature	24.5°C	Humidity	53.4%
Test Engineer	David Luo		

Test Result of 99% and 20dB Bandwidth Measurement			
Test Frequency (MHz)	20dB Bandwidth (KHz)	99% Bandwidth (KHz)	Limit (MHz)
2406	856.40	1750.9	Non-Specified
2440	879.00	1760.0	Non-Specified
2472	888.60	1764.5	Non-Specified

Remark:

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



10. LIST OF MEASURING EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2018-11-15	2019-11-14
2	DC Power Supply	Agilent	E3642A	N/A	2018-11-15	2019-11-14
3	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2018-10-10	2019-10-09
4	EMI Test Software	AUDIX	E3	/	N/A	N/A
	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2018-06-16	2019-06-15
6	Positioning Controller	MF	MF-7082	/	2018-06-16	2019-06-15
7	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2018-07-26	2019-07-25
8	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2018-07-26	2019-07-25
9	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2018-07-02	2019-07-01
10	EMI Test Receiver	R&S	ESR 7	101181	2018-06-16	2019-06-15
11	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2018-11-15	2019-11-14
12	AMPLIFIER	QuieTek	QTK	CHM/0809065	2018-11-15	2019-11-14
13	RF Cable-R03m	Jye Bao	RG142	CB021	2018-06-16	2019-06-15
14	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2018-06-16	2019-06-15
15	EMI Test Receiver	R&S	ESPI	101840	2018-06-16	2019-06-15
16	Artificial Mains	R&S	ENV216	101288	2018-06-16	2019-06-15
17	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2018-06-16	2019-06-15

Note: All equipment is calibrated through 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-----