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# TEST REPORT

## FCC PART 74H

Report Reference No. ....: CTL2009041012-WF

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*Ivan Xie*

Product Name.....: WIRELESS FULL-DUPLEX INTERCOM

Model/Type reference .....: AFDI-PT420

List Model(s).....: HDI-PT190, FDI-PT320

Trade Mark.....: N/A

FCC ID .....: 2AXNCPT420

Applicant's name .....: Shanghai Naya Intelligence Technology Co. , Ltd.

Address of applicant.....: Room 802, Building D, No.7001 Zhongchun Road, Minhang District, Shanghai, China

Test Firm.....: Shenzhen CTL Testing Technology Co., Ltd.

Address of Test Firm .....: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

Test specification.....:

Standard .....: FCC Part 74 Subpart H—Low Power Auxiliary Stations

TRF Originator .....: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF .....: Dated 2011-01

Date of receipt of test item .....: Sep. 15, 2020

Date of sampling.....: Sep. 15, 2020

Date of Test Date .....: Sep. 15, 2020 - Oct. 14, 2020

Date of Issue .....: Oct. 15, 2020

Result.....: Pass

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# TEST REPORT

<b>Test Report No. :</b>	<b>CTL2009041012-WF</b>	Oct. 15, 2020
		Date of issue

Equipment under Test : WIRELESS FULL-DUPLEX INTERCOM

Sample No. CTL200904101-1-S002

Model /Type : AFDI-PT420

Listed Models : HDI-PT190, FDI-PT320

**Applicant** : **Shanghai Naya Intelligence Technology Co. , Ltd.**

Address : Room 802, Building D, No.7001 Zhongchun Road,  
Minhang District, Shanghai, China

**Manufacturer** : **Shanghai Naya Intelligence Technology Co. , Ltd.**

Address : Room 802, Building D, No.7001 Zhongchun Road,  
Minhang District, Shanghai, China

<b>Test result</b>	<b>Pass *</b>
--------------------	---------------

\* In the configuration tested, the EUT complied with the standards specified page 5.

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.

## Modified History

[illegible]

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# 1 SUMMARY

## 1.1 Test Standards

The tests were performed according to following standards:

**FCC Part 74 Subpart H**—Low Power Auxiliary Stations

**TIA-603-E (2016)**-Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

**FCC Part 2:** FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

**ANSI C63.10:2013:** –American National Standard for Testing Unlicensed Wireless Devices

**ANSI C63.4: 2014:** –American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz  
Range of 9 kHz to 40GHz

## 1.2 Test Description

FCC Rules	Description of Test	Test Result
FCC section 74.861(e)(1), FCC part 2, section 2.1046	RF Output Power	Complies
FCC section 74.861(e)(3) , FCC part 2, section 2.1047	Modulation Characteristic	Complies
FCC section 74.861(e)(5) , FCC part 2, section 2.1049	Emission Bandwidth	Complies
FCC section 74.861(e)(6) , FCC part 2, section 2.1053	Field Strength of Spurious Emission	Complies
FCC section 74.861(e)(4) , FCC part 2, section 2.1055	Frequency Stability	Complies

## 1.3 Test Facility

### 1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

### 1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

#### **CNAS-Lab Code: L7497**

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### **A2LA-Lab Cert. No. 4343.01**

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### **IC Registration No.: 9618B**

#### **CAB identifier: CN0041**

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B on Jan. 22, 2019.

#### **FCC-Registration No.: 399832**

#### **Designation No.: CN1216**

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 399832, December 08, 2017.

## 1.4 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 Shenzhen CTL Testing Technology Co., Ltd. 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.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

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

## 2 GENERAL INFORMATION

### 2.1 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

### 2.2 General Description of EUT

Product Name:	WIRELESS FULL-DUPLEX INTERCOM
Model/Type reference:	AFDI-PT420
Power supply:	DC 3.7V from battery
<b>Wireless microphone</b>	
Alignment range:	470.4-550 MHz
Channel number:	200
Channel separation:	400KHz
Modulation Type:	GFSK
Antenna Type:	Integrated antenna
Antenna Gain:	0dBi

Note: For more details, please refer to the user's manual of the EUT.

### 2.3 Description of Test Modes and Test Frequency

This device worked in continuous transmitting (Duty Cycle more than 98%) when it turned on and all test conducted under this mode .

#### Frequency List

Channel	Frequency (MHz)
<b>01</b>	<b>470.40</b>
02	470.80
03	471.20
⋮	⋮
<b>100</b>	<b>510.00</b>
⋮	⋮
198	549.20
199	549.60
<b>200</b>	<b>550.00</b>

Note: In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test.

## 2.4 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2020/04/08	2021/04/07
Bilog Antenna	Sunol Sciences Corp.	JB1	A061714	2020/04/08	2021/04/07
EMI Test Receiver	R&S	ESCI	103710	2020/05/18	2021/05/17
Spectrum Analyzer	RS	FSP	1164.4391.38	2020/05/15	2021/05/14
Spectrum Analyzer	Agilent	N9020A	US46220290	2020/05/14	2021/05/13
Spectrum Analyzer	Keysight	N9020A	MY53420874	2020/05/14	2021/05/13
Controller	EM Electronics	Controller EM 1000	N/A	2020/05/20	2021/05/19
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2020/05/20	2021/05/19
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062014	2020/05/20	2021/05/19
Active Loop Antenna	SCHWARZBEC K	FMZB1519	1519-037	2020/05/20	2021/05/19
Amplifier	Agilent	8449B	3008A02306	2020/05/15	2021/05/14
Amplifier	Agilent	8447D	2944A10176	2020/05/15	2021/05/14
Temperature/Humidity Meter	Gangxing	CTH-608	02	2020/05/16	2021/05/15
Radio Communication Tester	HP	8920A	116250	2020/05/15	2021/05/14
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2020/05/15	2021/05/14
High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2020/05/15	2021/05/14
Climate Chamber	ESPEC	EL-10KA	A20120523	2020/05/20	2021/05/19
SIGNAL GENERATOR	Agilent	E4421B	US40051744	2020/05/20	2021/05/19
Directional Coupler	Agilent	87300B	3116A03638	2020/05/20	2021/05/19
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	2020/05/20	2021/05/19
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2020/05/20	2021/05/19
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2020/05/20	2021/05/19
RF Cable	Megalon	RF-A303	N/A	2020/05/20	2021/05/19

The calibration interval was one year

## 2.5 Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended to comply with FCC Part 74 Subpart H Rules.

## 2.6 Modifications

No modifications were implemented to meet testing criteria.

### 3 TEST CONDITIONS AND RESULTS

#### 3.1 Output Power Measurement

##### Limit

According to §74.861(e)(1)(ii), the operating frequency at 470-608 and 614-698 shall not exceed 250 mW conducted power.

##### Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum.

##### Test Configuration



##### Test Results

Type	Channel (MHz)	Output power (dBm)	Limit (dBm)	Result
GFSK	470.40	23.28	24.00	Pass
	510.00	23.16		
	550.00	23.20		

## 3.2 Modulation Characteristics

### Limit

Test Standard: FCC Part 74.861(e)(3)

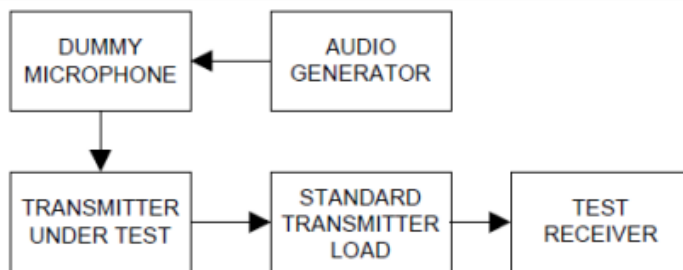
Any form of modulation may be used. A maximum deviation of  $\pm 75$  kHz is permitted when frequency modulation is employed.

Test Standard: FCC Part 2.1047(a) & (b)

(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

### Test Configuration



### Measurement Procedure

#### a) Audio Frequency Response

1. Connect the equipment as illustrated.
2. Set the test receiver to measure peak positive deviation. Set the audio bandwidth for  $\leq 50$  Hz to  $\geq 15,000$  Hz. Turn the de-emphasis function off.
3. Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
4. Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.
5. Set the test receiver to measure rms deviation and record the deviation reading as  $DEV_{REF}$ .
6. Set the audio frequency generator to the desired test frequency between 100Hz and 2000Hz.
7. Record the test receiver deviation reading as  $DEV_{FREQ}$ .
8. Calculate the audio frequency response at the present frequency as:

$$audio\ frequency\ response = 20 \log_{10} \left( \frac{DEV_{FREQ}}{DEV_{REF}} \right)$$

9. Repeat steps 6 through 8 for all the desired test frequencies.

#### b) Modulation Limiting

1. Connect the equipment as illustrated.
2. Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
3. Set the test receiver to measure peak positive deviation. Set the audio bandwidth for  $\leq 0.25$  Hz to  $\geq 15,000$  Hz. Turn the de-emphasis function off.
4. Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation.
5. Increase the level from the audio frequency generator by 20dB in one step (rise time between the 10% and 90% points shall be 0.1 second maximum).

6. Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.
7. With the level from the audio frequency generator held constant at the level obtained in step 5, slowly vary the audio frequency from 100Hz to 3000Hz and observe the steady-state deviation. Record the maximum deviation.
8. Set the test receiver to measure peak negative deviation and repeat steps 4 through 7.
9. The values recorded in steps 7 and 8 are the modulation limiting.

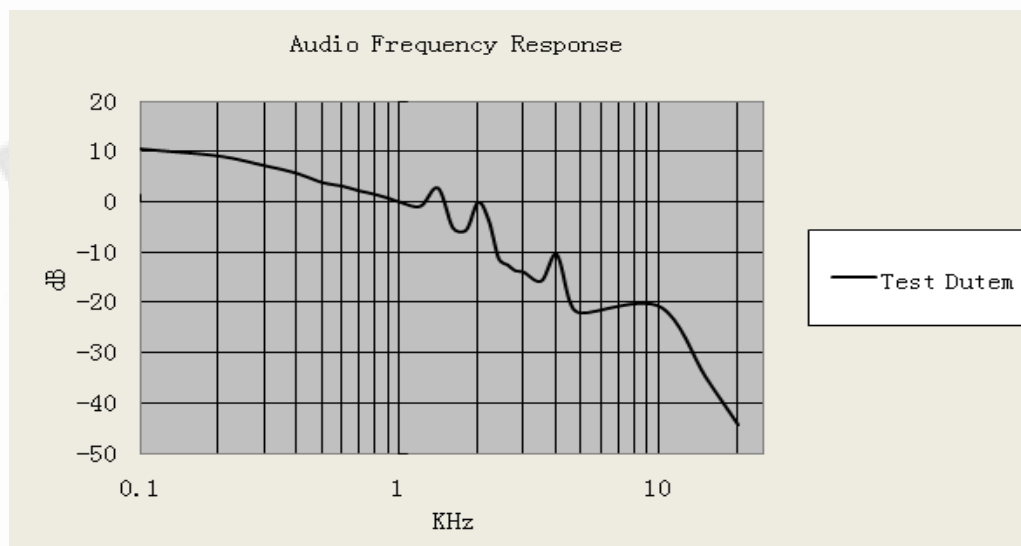
## TEST RESULTS

### Audio Frequency Response

**470.40MHz**

0dB=13mV at 1kHz (20% of the maximum rated system deviation.)

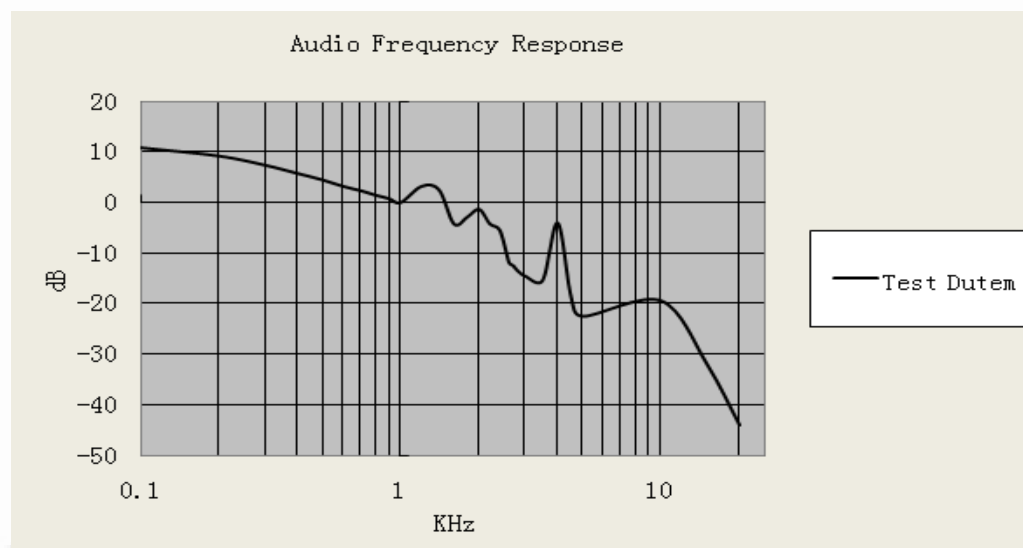
Frequency (KHz )	Frequency Deviation (KHz)	1KHz Refenerce Deviation (KHz)	Audio Frequency Response (dB)
0.1	5.57	1.65	10.57
0.2	4.74	1.65	9.17
0.3	3.81	1.65	7.27
0.4	3.20	1.65	5.75
0.5	2.59	1.65	3.92
0.6	2.38	1.65	3.18
0.7	2.13	1.65	2.22
0.8	1.97	1.65	1.54
0.9	1.81	1.65	0.80
1.0	1.65	1.65	0.00
1.2	1.50	1.65	-0.83
1.4	2.28	1.65	2.81
1.6	0.91	1.65	-5.17
1.8	0.87	1.65	-5.56
2.0	1.64	1.65	-0.05
2.2	1.07	1.65	-3.76
2.4	0.45	1.65	-11.29
2.6	0.39	1.65	-12.53
2.7	0.36	1.65	-13.22
2.8	0.34	1.65	-13.72
3.0	0.33	1.65	-13.98
3.5	0.27	1.65	-15.72
4.0	0.50	1.65	-10.37
4.5	0.17	1.65	-19.74
5.0	0.13	1.65	-22.07
10.0	0.15	1.65	-20.83
15.0	0.03	1.65	-34.81
20.0	0.01	1.65	-44.35



**510.00MHZ**

0dB=12mV at 1kHz (20% of the maximum rated system deviation.)

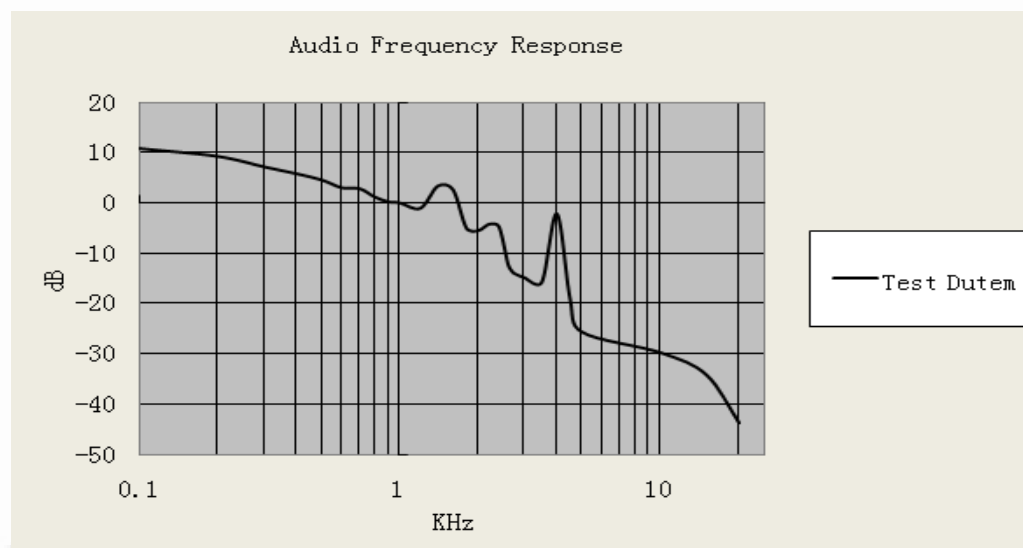
Frequency (KHz )	Frequency Deviation (KHz)	1KHz Refenerce Deviation (KHz)	Audio Frequency Response (dB)
0.1	5.58	1.60	10.85
0.2	4.62	1.60	9.21
0.3	3.75	1.60	7.40
0.4	3.11	1.60	5.77
0.5	2.68	1.60	4.48
0.6	2.31	1.60	3.19
0.7	2.10	1.60	2.36
0.8	1.89	1.60	1.45
0.9	1.75	1.60	0.78
1.0	1.60	1.60	0.00
1.2	2.31	1.60	3.19
1.4	2.14	1.60	2.53
1.6	0.98	1.60	-4.26
1.8	1.15	1.60	-2.87
2.0	1.37	1.60	-1.35
2.2	0.98	1.60	-4.26
2.4	0.85	1.60	-5.49
2.6	0.41	1.60	-11.83
2.7	0.38	1.60	-12.49
2.8	0.34	1.60	-13.45
3.0	0.30	1.60	-14.54
3.5	0.27	1.60	-15.46
4.0	1.01	1.60	-4.00
4.5	0.19	1.60	-18.51
5.0	0.12	1.60	-22.50
10.0	0.17	1.60	-19.47
15.0	0.04	1.60	-32.04
20.0	0.01	1.60	-44.08



**550.00MHZ**

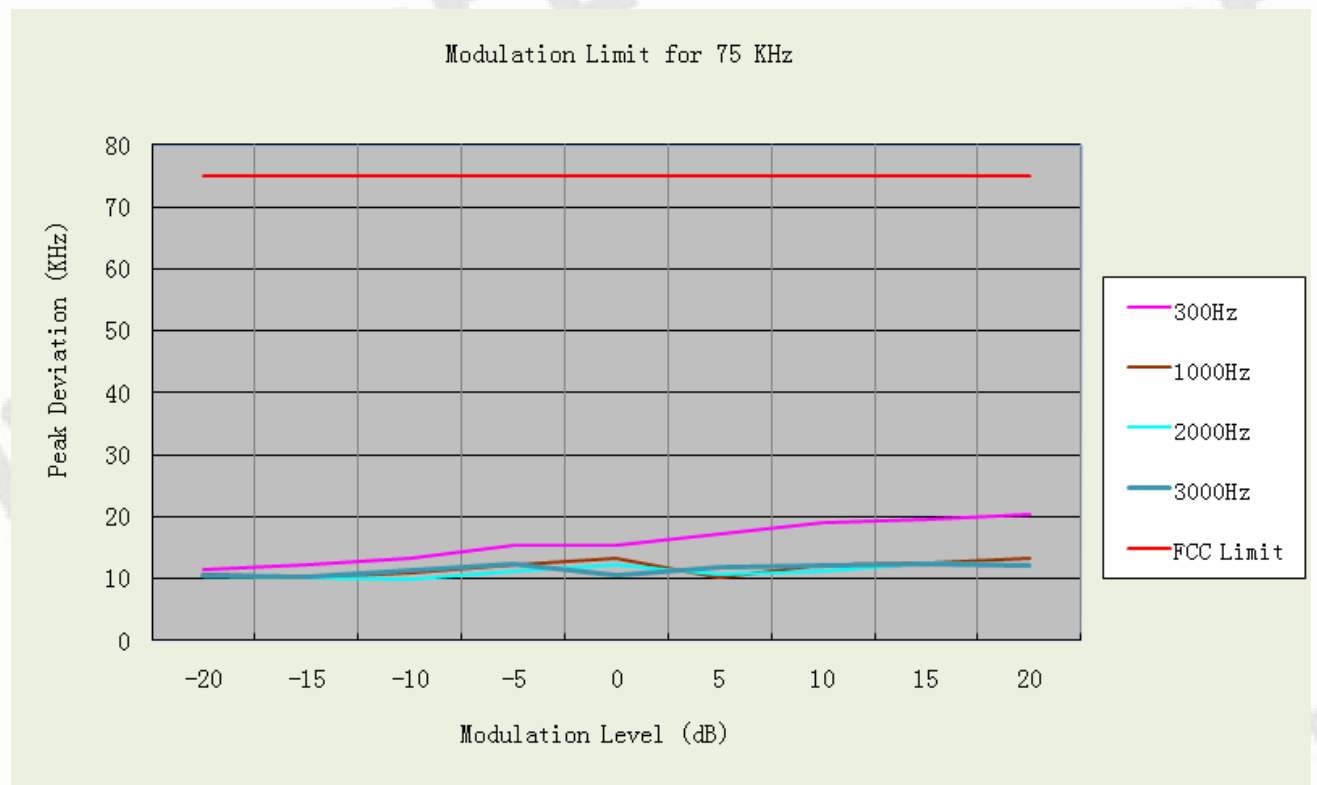
0dB=12mV at 1kHz (20% of the maximum rated system deviation.)

Frequency (KHz )	Frequency Deviation (KHz)	1KHz Refenerce Deviation (KHz)	Audio Frequency Response (dB)
0.1	5.39	1.55	10.83
0.2	4.50	1.55	9.26
0.3	3.55	1.55	7.20
0.4	3.03	1.55	5.82
0.5	2.63	1.55	4.59
0.6	2.19	1.55	3.00
0.7	2.15	1.55	2.84
0.8	1.78	1.55	1.20
0.9	1.59	1.55	0.22
1.0	1.55	1.55	0.00
1.2	1.37	1.55	-1.07
1.4	2.28	1.55	3.35
1.6	2.10	1.55	2.64
1.8	0.87	1.55	-5.02
2.0	0.82	1.55	-5.53
2.2	0.95	1.55	-4.25
2.4	0.90	1.55	-4.72
2.6	0.38	1.55	-12.21
2.7	0.32	1.55	-13.70
2.8	0.30	1.55	-14.26
3.0	0.28	1.55	-14.86
3.5	0.25	1.55	-15.85
4.0	1.21	1.55	-2.15
4.5	0.17	1.55	-19.20
5.0	0.08	1.55	-25.74
10.0	0.05	1.55	-29.83
15.0	0.03	1.55	-34.26
20.0	0.01	1.55	-43.81



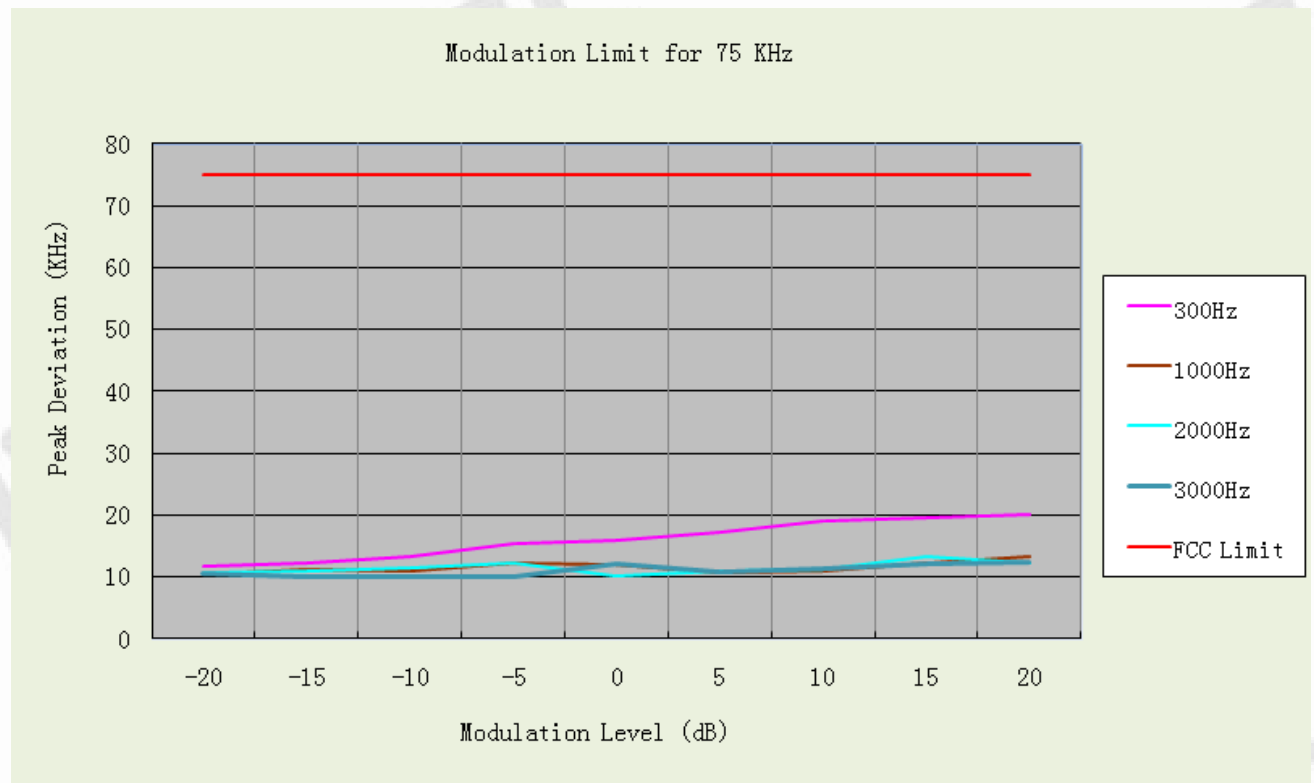
**Modulation Limit:****470.4MHz**

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1000Hz (KHz)	Peak Freq. Deviation At 2000Hz (KHz)	Peak Freq. Deviation At 3000 Hz (KHz)
-20	11.51	10.64	10.48	10.54
-15	12.17	10.22	10.24	10.30
-10	13.35	11.00	10.00	11.24
-5	15.32	12.35	11.22	12.29
0	15.48	13.22	12.22	10.49
+5	17.20	10.11	10.77	11.91
+10	19.10	12.20	11.28	12.05
+15	19.47	12.57	12.50	12.41
+20	20.31	13.41	12.39	12.03



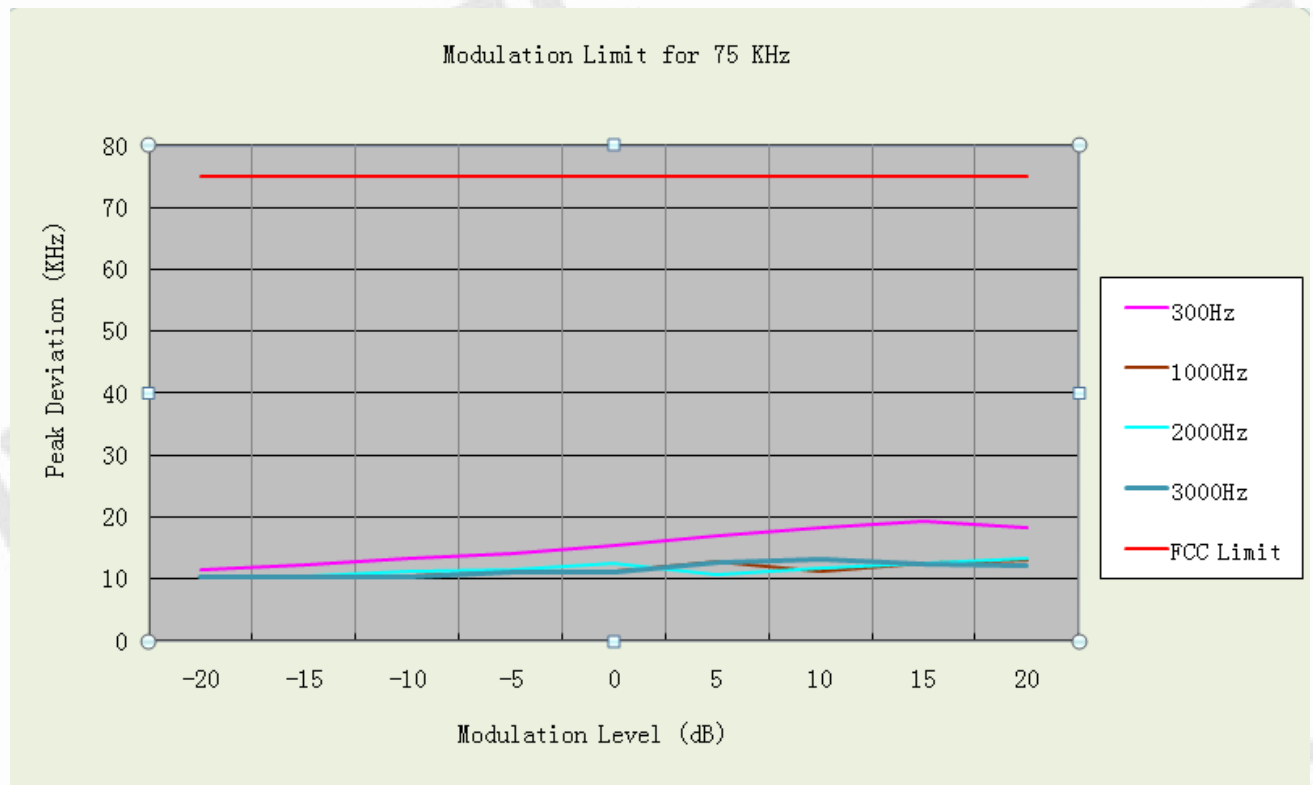
## 510.00MHz

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1000Hz (KHz)	Peak Freq. Deviation At 2000Hz (KHz)	Peak Freq. Deviation At 3000 Hz (KHz)
-20	11.73	10.49	10.62	10.56
-15	12.14	11.31	10.95	10.11
-10	13.29	11.05	11.49	10.01
-5	15.31	12.15	12.37	10.05
0	16.00	12.08	10.21	12.14
+5	17.13	10.62	11.07	10.82
+10	19.15	11.02	11.14	11.24
+15	19.46	12.14	13.20	12.18
+20	20.12	13.37	12.21	12.46



## 550.00MHz

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz (KHz)	Peak Freq. Deviation At 1000Hz (KHz)	Peak Freq. Deviation At 2000Hz (KHz)	Peak Freq. Deviation At 3000 Hz (KHz)
-20	11.42	10.35	10.49	10.39
-15	12.39	10.28	10.33	10.26
-10	13.18	10.33	11.31	10.27
-5	14.18	11.31	11.40	11.15
0	15.33	11.34	12.40	11.12
+5	16.93	12.90	10.64	12.76
+10	18.16	11.25	11.81	13.29
+15	19.24	12.46	12.55	12.27
+20	18.33	13.02	13.32	12.02



### 3.3 Operating Bandwidth and Emissions Mask

#### Limit

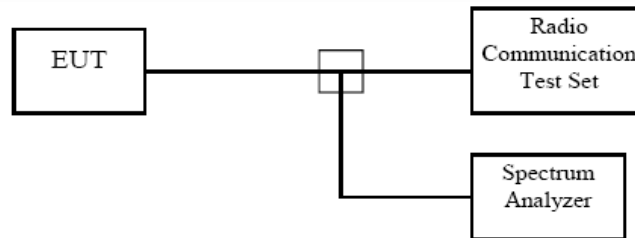
Test Standard: FCC Part 74.861(e)(5), (6)

(5) The operating bandwidth shall not exceed 200 kHz.

(6) The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (i) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 per-cent of the authorized bandwidth: at least 25 dB;
- (ii) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;
- (iii) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least  $43+10\log_{10}$  (mean output power in watts) dB.

#### Test Configuration



#### Measurement Procedure

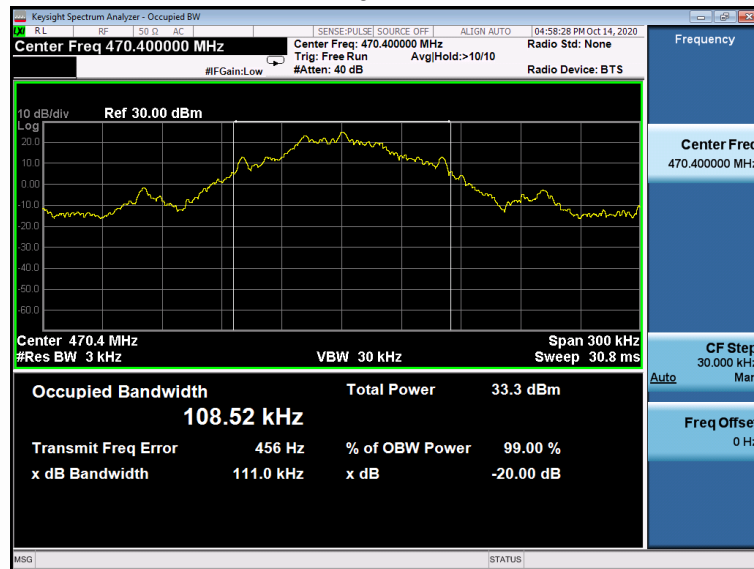
1. Connect the equipment as illustrated.
2. Adjust the spectrum analyzer for the following settings:  
 RBW = 3kHz, VBW = 30kHz  
 Sweep Speed slow enough to maintain measurement calibration.  
 Detector Mode = Positive Peak.  
 Span that will allow proper viewing of the test bandwidth
3. Set the center frequency of the spectrum analyzer to the assigned transmitter frequency. Turn on the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0 dB reference for the measurement.
4. Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.
5. Mark the 99% and 20dBm band bandwidth of peak frequency.
6. Repeat until all the rest channels are investigated.

#### Test Result

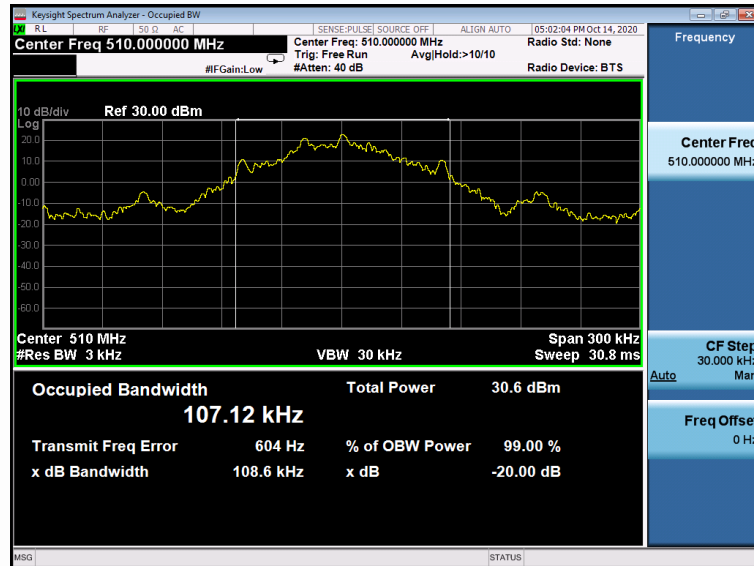
##### a) Operating Bandwidth:

Modulation	Frequency (MHz)	99% OBW (KHz)	20dB bandwidth (KHz)	Result
GFSK	470.40	108.52	101.0	Pass
	510.00	107.12	108.6	
	550.00	110.60	109.2	

## 470.4MHz



## 510.00MHz

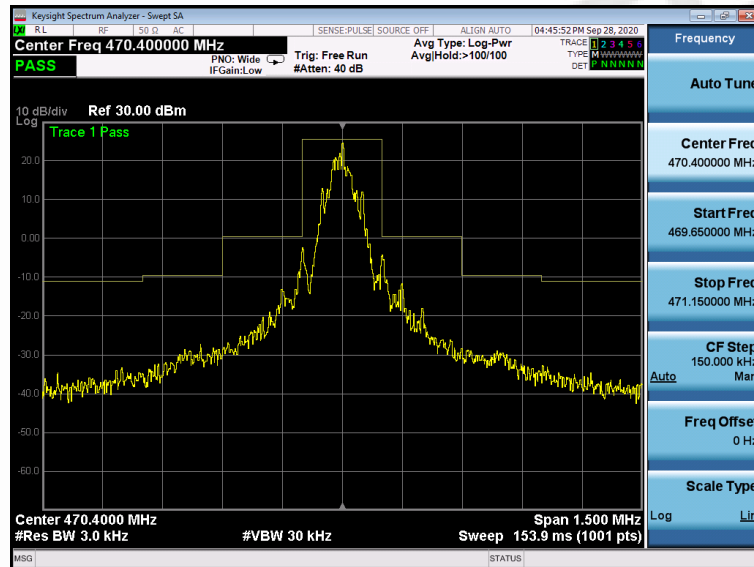


## 550.00.00MHz

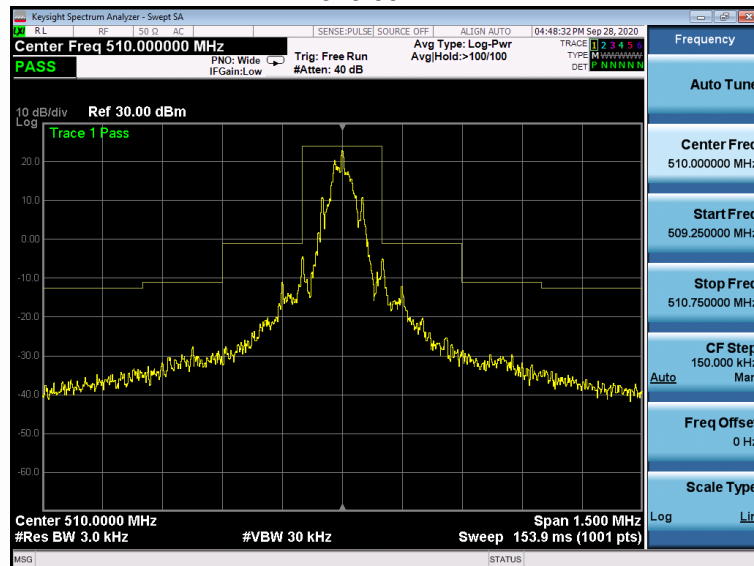


## b) Emission Mask:

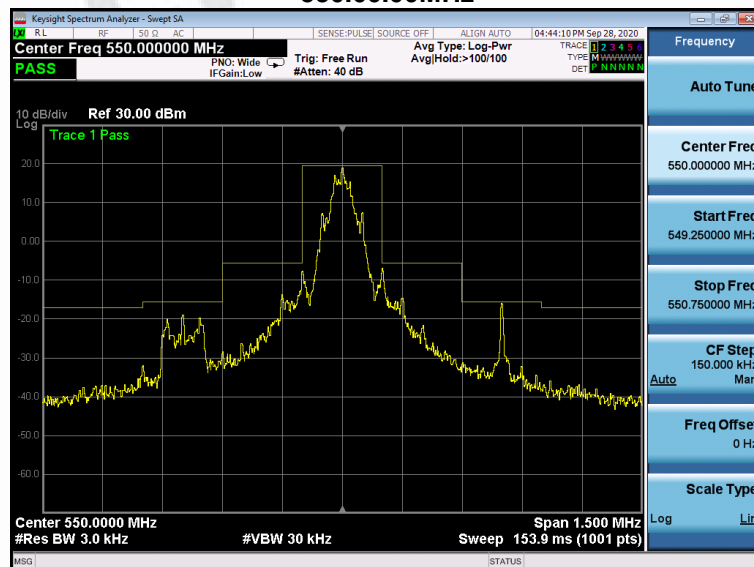
## 470.4MHz



## 510.00MHz



## 550.00.00MHz

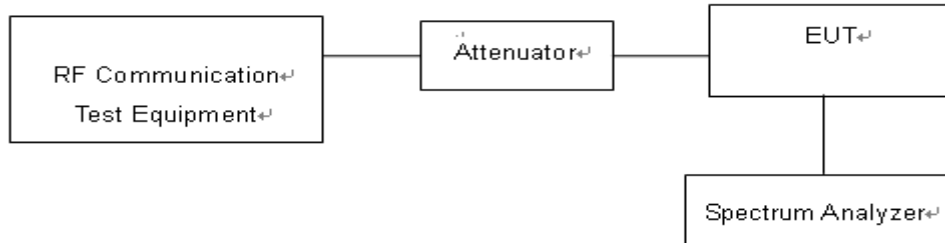


### 3.4 Emission Mask

#### LIMIT

Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08).

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. With the Low Frequency (LF) audio signal generator set to 500 Hz, the audio input level to the EUT shall be Adjusted to 8 dB below the limiting threshold (-8dB limit) as declared by the manufacturer.
2. The corresponding audio output level from the demodulator shall be measured and recorded.
3. The input impedance of the noise meter shall be sufficiently high to avoid more than 0.1 dB changes in input level when the meter is switched between input and output.
4. The audio input level shall be increased by 20 dB, i.e. to 12 dB (lim), and the corresponding change in output level shall be measured.
5. It shall be checked that the audio output level has increased by  $\leq 10$  dB.
6. If the step 5 is not met, the initial audio input level shall be increased from -8 dB (lim) in 1 dB steps until the above condition is fulfilled, and the input level recorded in the test report. This level replaces the value derived from the manufacturer's declaration and is defined as -8dB (lim).
7. Measure the input level at the transmitter required to give +12 dB (lim) and record the EUT output level test plots by the spectrum analyzer.
8. The transmitter RF output spectrum shall be measured, using a spectrum analyser with the following settings:

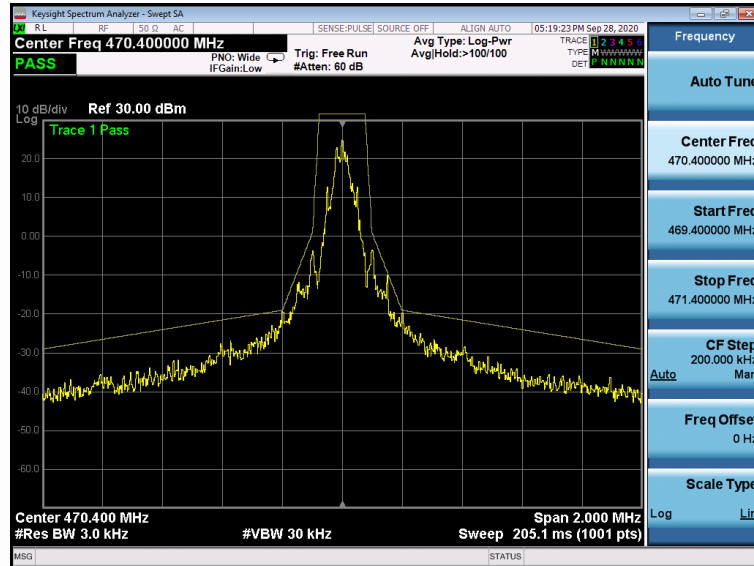
Centre frequency	Transmitter (Tx) nominal frequency
Span	$f_c - 1 \text{ MHz}$ to $f_c + 1 \text{ MHz}$
Resolution BandWidth (RBW)	1 kHz
Video BandWidth(VBW)	1 kHz
Detector	Peak hold

#### TEST RESULTS

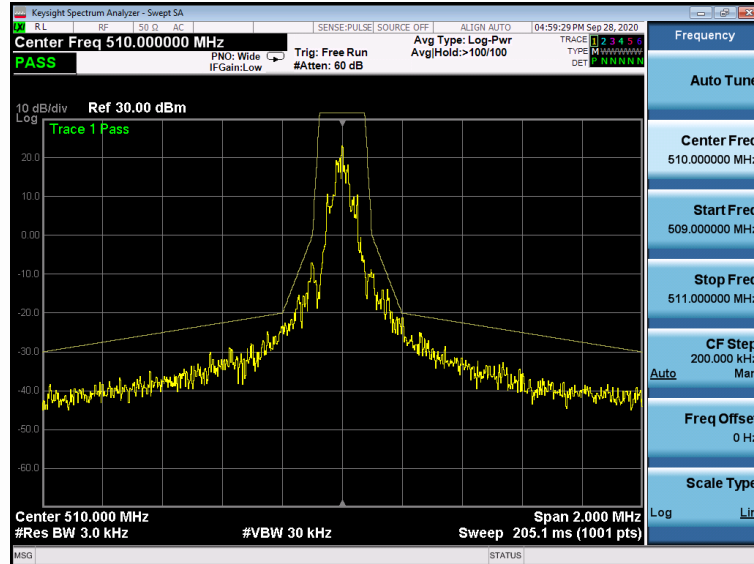
##### **Note:**

	<b>Bandwidth(B)</b>	<b>B/2</b>	<b>0.35B</b>
Manufacturer declare	200 KHz	100KHz	0.70 KHz

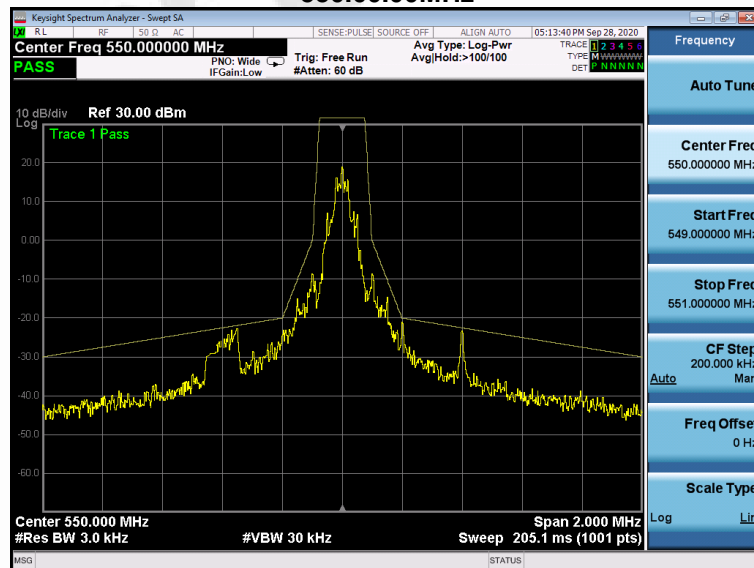
## 470.4MHz



## 510.00MHz



## 550.00.00MHz



### 3.5 Field Strength of Emission

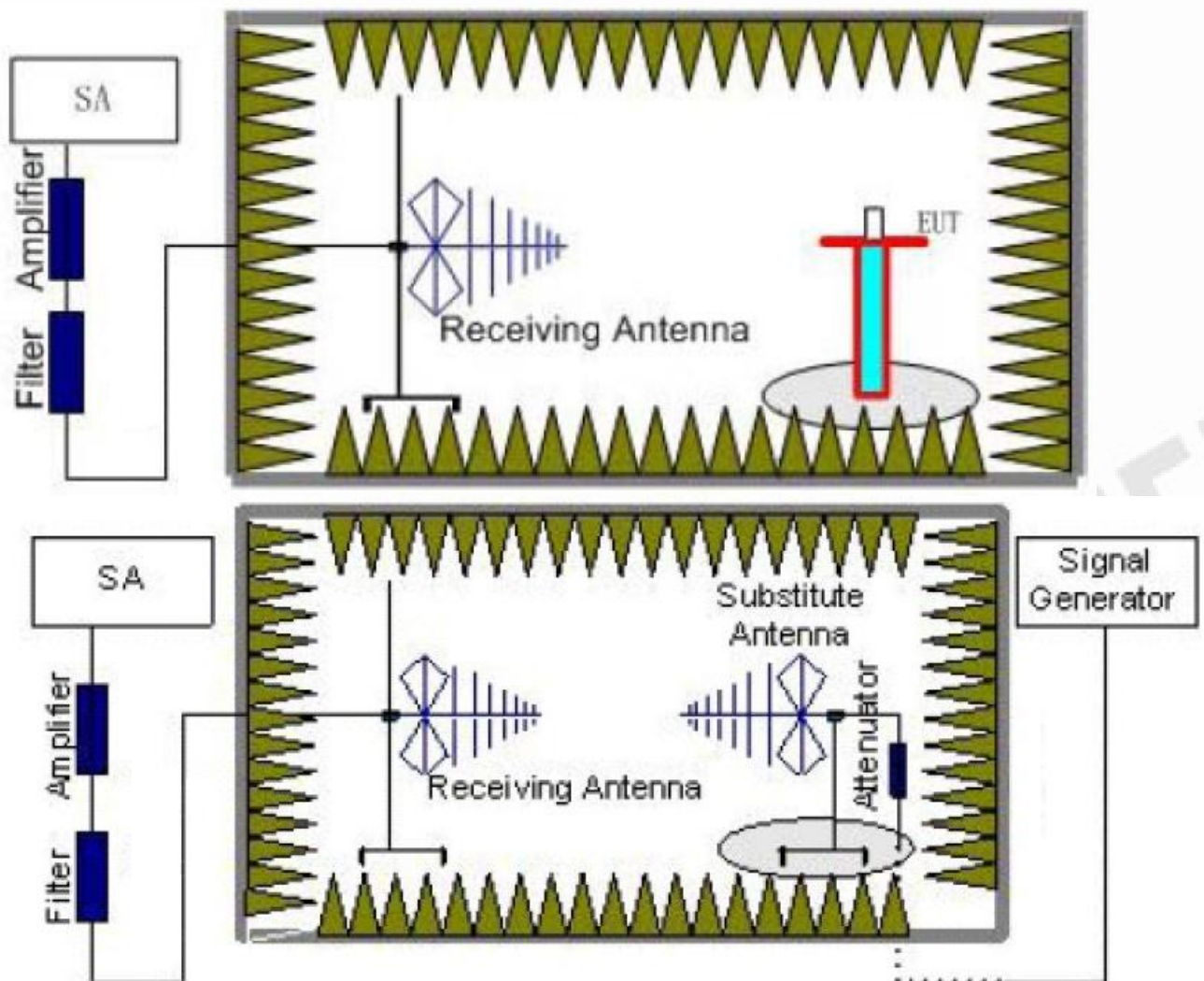
#### Limit

According to §2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to §74.861(e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (i) on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
- (ii) on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
- (iii) on any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth shall be attenuated below the unmodulated carrier by at least 43 plus 10 Log(output power in watts) dB.

#### Test Configuration



### Measurement Procedure

- EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.0m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all test transmit frequencies were measured with peak detector.
- A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
- The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum 100 kHz below 1GHz and 1MHz above 1GHz, Sweep from 30MHz to the 10th harmonic of the fundamental frequency; and recorded the level of the concerned spurious emission point as ( $P_r$ ).
- The EUT then replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization. The measurement results are obtained as described below:

$$\text{Power}_{(EIRP)} = P_{Mea} - P_{cl} + G_a$$

Where;

- $P_{Mea}$  is the recorded signal generator level
- $P_{cl}$  is the cable loss connect between instruments
- $G_a$  Substitution Antenna Gain

- This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
- ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .
- Test site anechoic chamber refer to ANSI C63.

### Test Result

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency; and worst spurious emissions recorded as below:

Test Frequency (MHz)	Frequency (MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	Distance (m)	$G_a$ Antenna Gain(dBi)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
470.40	940.80	-26.47	2.10	3.00	23.13	-16.12	-13.00	3.12	V
	1411.20	-31.87	2.44	3.00	25.87	-20.65	-13.00	7.65	V
	1881.60	-32.15	2.74	3.00	27.33	-22.44	-13.00	9.44	V
	2352.00	-37.12	3.05	3.00	29.57	-26.51	-13.00	13.51	V
	--	--	--	--	--	--	--	--	--
510.00	1020.00	-24.59	2.11	3.00	24.66	-17.09	-13.00	4.09	V
	1530.00	-28.88	2.53	3.00	26.24	-20.64	-13.00	7.64	V
	2040.00	-30.43	2.84	3.00	27.81	-23.66	-13.00	10.66	V
	2550.00	-34.88	3.18	3.00	29.64	-27.29	-13.00	14.29	V
	--	--	--	--	--	--	--	--	--
550.00	1100.00	-23.76	2.18	3.00	24.91	-16.17	-13.00	3.17	V
	1650.00	-27.49	2.60	3.00	26.58	-19.20	-13.00	6.20	V
	2200.00	-28.17	2.96	3.00	28.42	-21.36	-13.00	8.36	V
	2750.00	-32.71	3.26	3.00	30.36	-25.08	-13.00	12.08	V
	--	--	--	--	--	--	--	--	--

Remark:

- $EIRP = P_{Mea}(\text{dBm}) - P_{cl}(\text{dB}) + G_a(\text{dBi})$
- Means other points for values lower than limits and not recorded.
- Margin = Limit – EIRP

### 3.6 Frequency Stability Measurement

#### Limit

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.005\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

#### Measurement Procedure

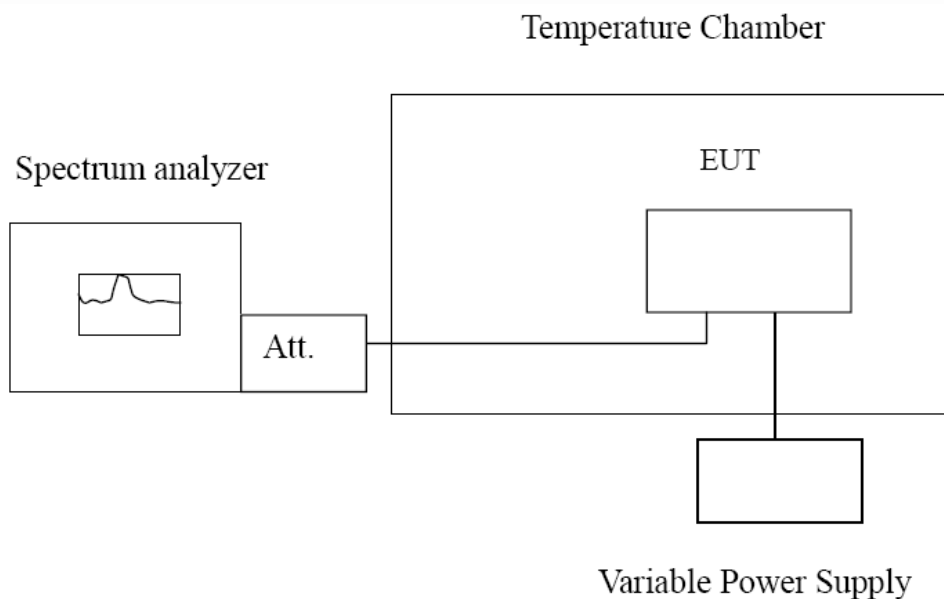
##### **a) Frequency stability versus environmental temperature**

1. Setup as Test Configuration for frequencies measured at ambient temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environmental chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used.
2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 3 kHz, VBW to 10kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to  $50^{\circ}\text{C}$ . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a  $10^{\circ}\text{C}$  decreased per stage until the lowest temperature  $-20^{\circ}\text{C}$  is measured, record all measurement frequencies.

##### **b) Frequency stability versus input voltage**

1. Setup as Test Configuration for frequencies measured at ambient temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environmental chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used. Install new batteries in the EUT.
2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 3kHz, VBW to 10kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. For non hand carried, battery operated device, supply the EUT primary voltage with 85 and 115 percent of the nominal value and record the frequency.

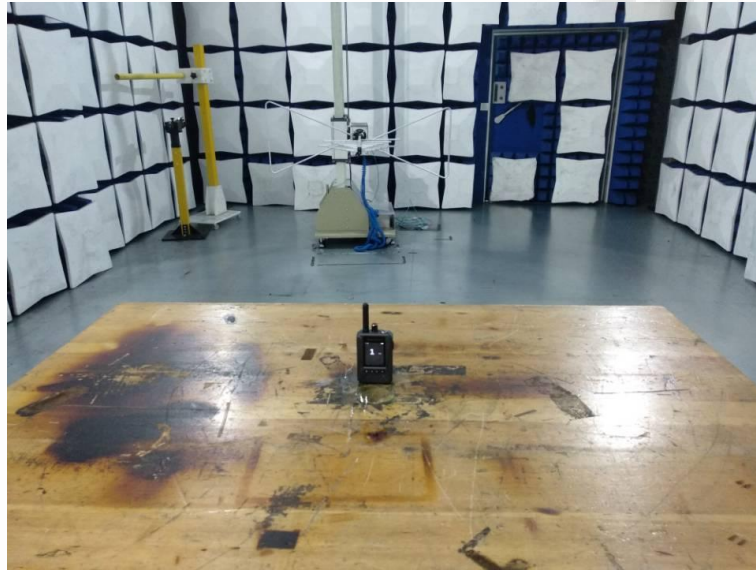
#### Test Configuration



**TEST RESULTS**

Reference Frequency: 550.00MHz					
Voltage ( V )	Temperature (°C)	Frequency error (MHz)	Frequency Tolerance (%)	Limit (%)	Result
3.7	-20	0.01919	0.00349%	±0.005%	PASS
	-10	0.01935	0.00352%		
	0	0.01961	0.00357%		
	10	0.01907	0.00347%		
	20	0.01980	0.00360%		
	30	0.01931	0.00351%		
	40	0.01920	0.00349%		
	50	0.01939	0.00353%		
3.45	25	0.01978	0.00360%	±0.005%	PASS
2.55	25	0.02058	0.00374%		

## 4 Test Setup Photos of the EUT



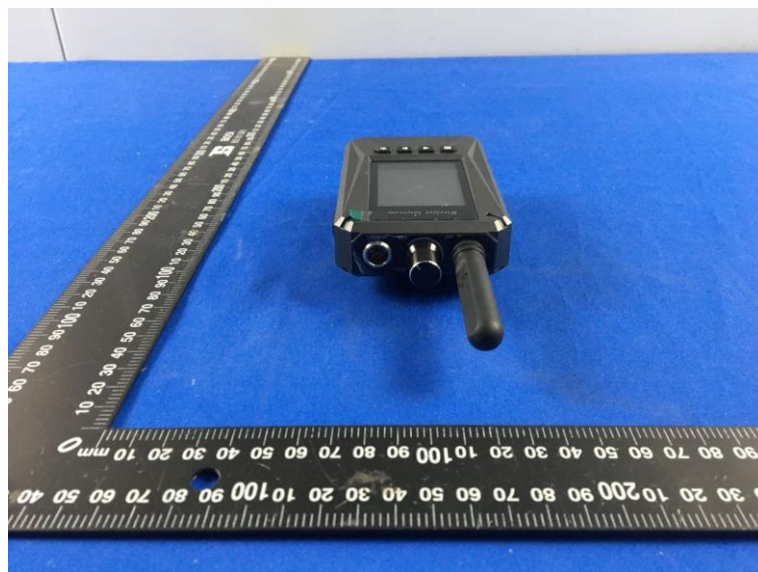
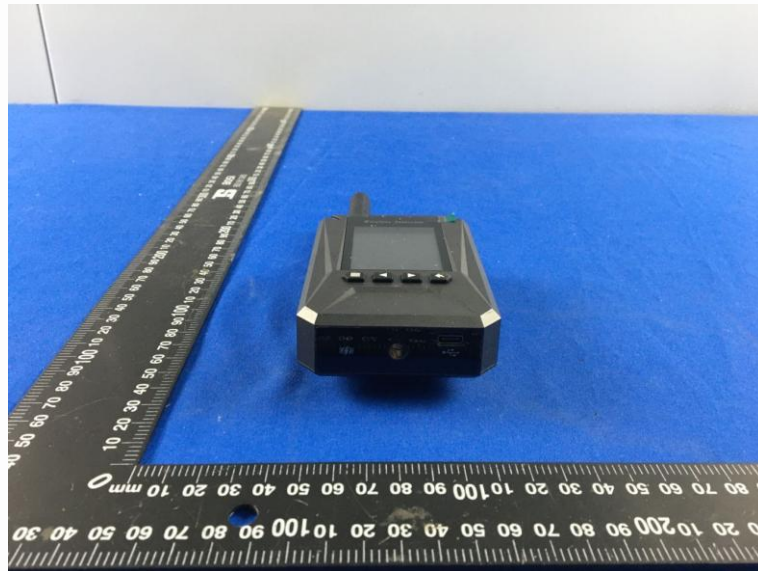
## 5 External and Internal Photos of the EUT

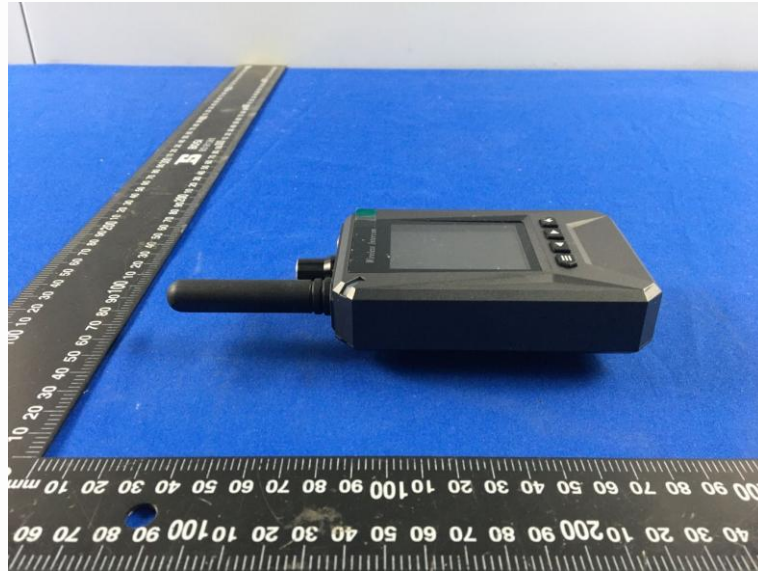
### External Photos

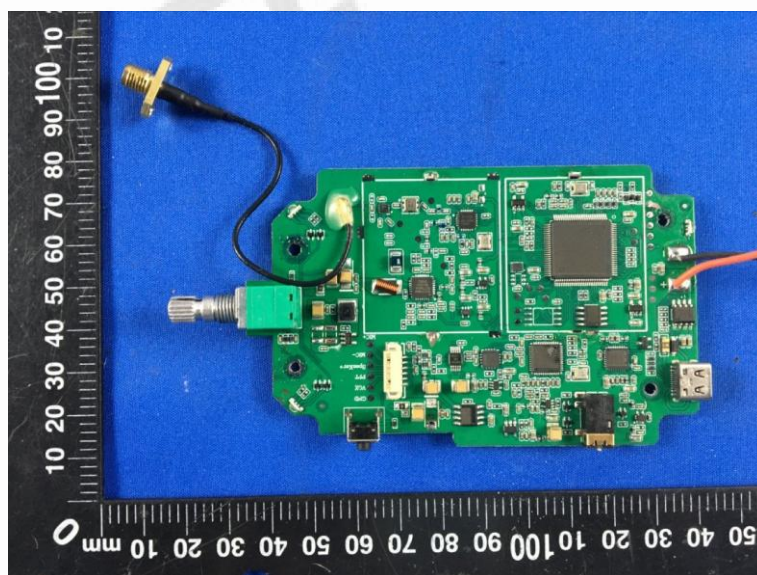
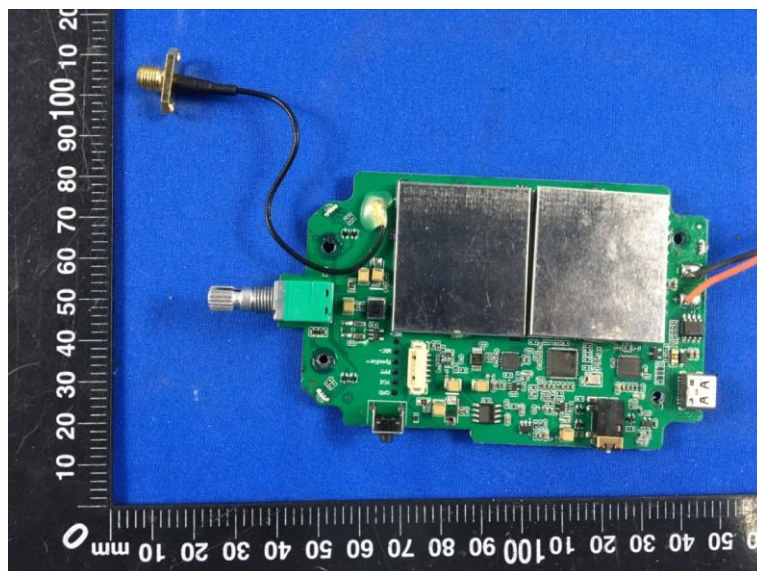
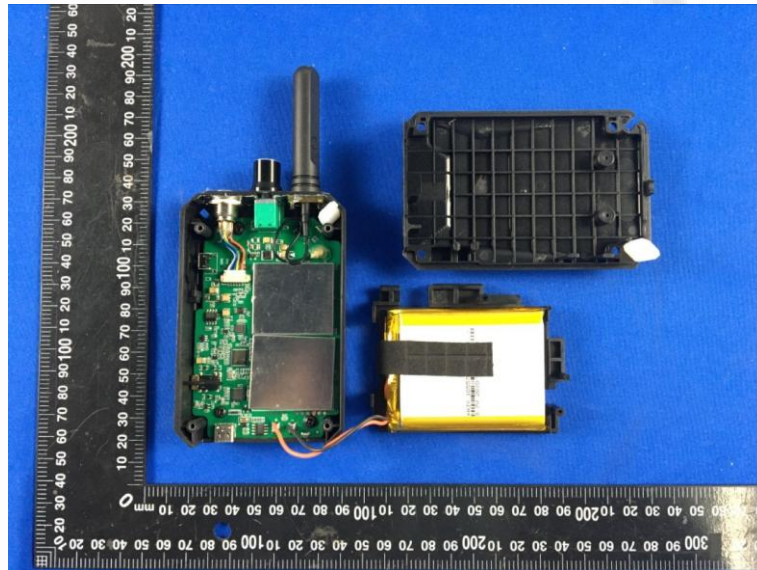


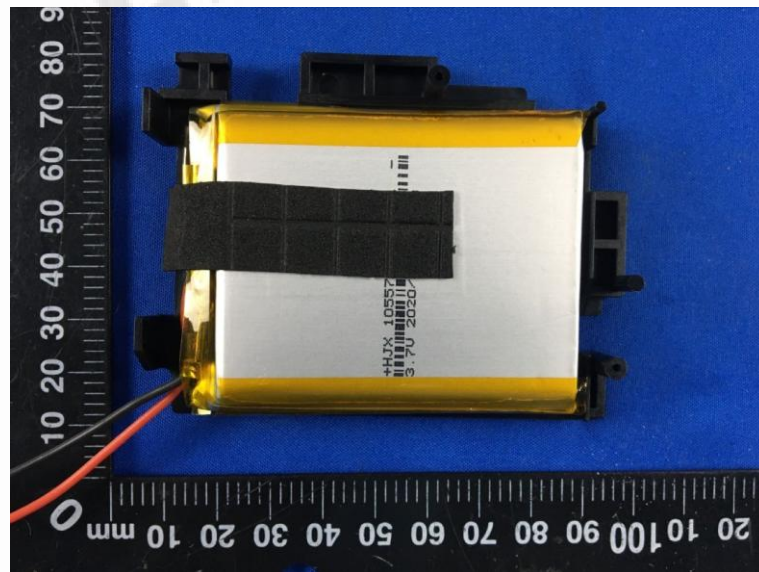
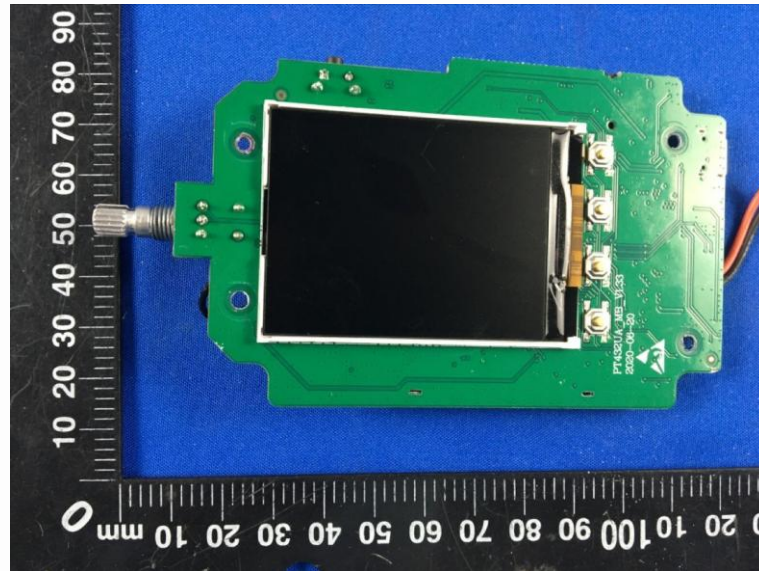
Antenna







Internal Photos



.....End of Report.....