

# TEST REPORT

**Reference No.** ..... : WTS19S09061462W  
**FCC ID**..... : 2AUJ3MIR-GA100  
**Applicant**..... : SHENZHEN MULTI IR TECHNOLOGY CO., LTD  
**Address** ..... : 3rd Floor, Building 2, Xixue Technology Park, Bantian Street, Longgang District, Shenzhen, China  
**Manufacturer** ..... : SHENZHEN MULTI IR TECHNOLOGY CO., LTD  
**Address** ..... : 3rd Floor, Building 2, Xixue Technology Park, Bantian Street, Longgang District, Shenzhen, China  
**Product(s)** ..... : Wireless Gas Detector  
**Model No.** ..... : MIR-GA100, MIR-GA100-TY, MIR-GA100-FB, MIR-GA100-RY, MI-GA200  
**Standards** ..... : FCC CFR47 Part 15 C Section 15.247:2019  
**Date of Receipt sample**..... : 2019-09-03  
**Date of Test**..... : 2019-09-04 to 2019-10-09  
**Date of Issue** ..... : 2019-10-10  
**Test Result** ..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.  
The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

**Prepared By:**

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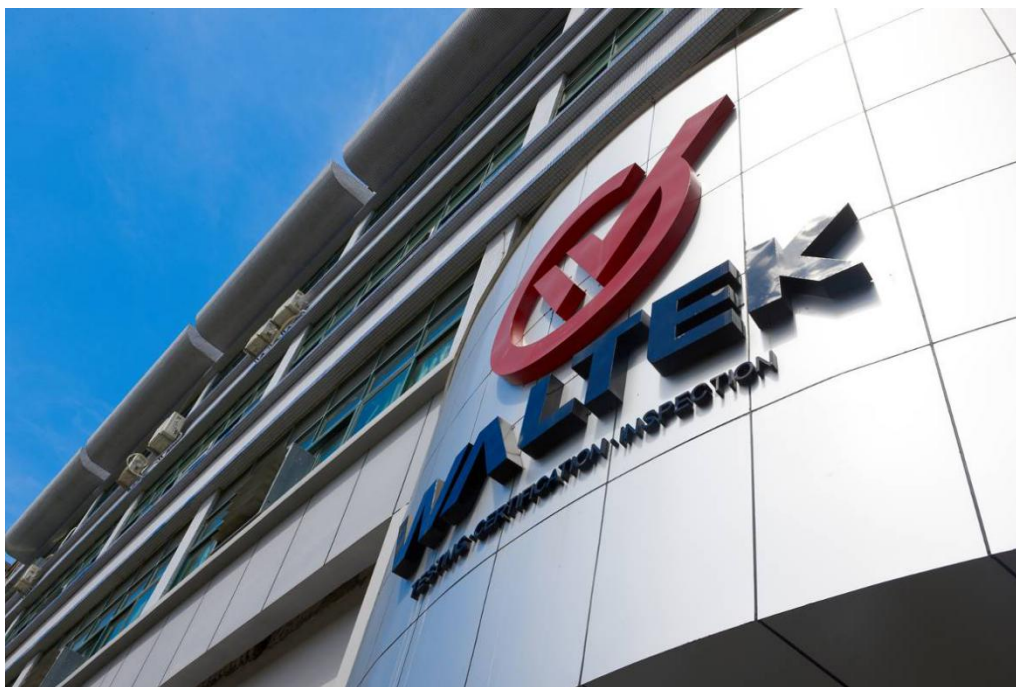


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Philo Zhong / Manager

## 1. Laboratories Introduction

**Waltek Services (Shenzhen) Co., Ltd** is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.



Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

## 1.1 Test Facility

### A. Accreditations for Conformity Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ SDoC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.			

### B.TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd.	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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### 3. Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS19S09061462W	2019-09-03	2019-09-04 to 2019-10-09	2019-10-10	Original	-	Valid

## 4. General Information

### 4.1 General Description of E.U.T

Product Name:	Wireless Gas Detector
Model No.:	MIR-GA100, MIR-GA100-TY, MIR-GA100-FB, MIR-GA100-RY, MI-GA200
Model Difference:	Only the model names are different. The model MIR-GA100 is the tested sample.
Operation Frequency:	2405-2480MHz
RF output power:	8.55dBm
Type of modulation:	O-QPSK
Antenna installation	PCB Printed Antenna
Antenna Gain:	-1dBi

### 4.2 Details of E.U.T.

Ratings:	DC 12V, 500mA power by Adapter
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### 4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2405	2	2410	3	2415	4	2420
5	2425	6	2430	7	2435	8	2440
9	2445	10	2450	11	2455	12	2460
13	2465	14	2470	15	2475	16	2480

### 4.4 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Channel	TX/RX
Maximum Peak Output Power	1/8/16	TX
Duty Cycle	1/8/16	TX
Conducted Emission	1/8/16	TX
Power Spectral Density	1/8/16	TX
Bandwidth	1/8/16	TX
Conducted Spurious Emission	1/8/16	TX
Band Edge	1/16	TX
Transmitter Spurious Emissions	1/8/16	TX

**Note** :Parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product.

## 5. Equipment Used during Test

### 5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMI Test Receiver	R&S	ESCI	101155	2019-08-15	2020-08-14
2	LISN	SCHWARZBECK	NSLK 8128	8128-259	2019-08-15	2020-08-14
3	Limiter	CYBERTEK	EM5010	261115-001-0024	2019-08-15	2020-08-14
4	Cable	Laplace	RF300	-	2019-07-18	2020-07-17
3m Semi-anechoic Chamber for Radiation Emissions Test site(SAEMC)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP30	100091	2019-04-19	2020-04-18
2	Broad-band Horn Antenna(1-18GHz)	SCHWARZBECK	BBHA 9120 D	667	2019-04-19	2020-04-18
3	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-19	2020-04-18
4	Coaxial Cable (above 1GHz)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	EW02014-7	2019-04-19	2020-04-18
5	Spectrum Analyzer	R&S	FSP40	100501	2018-11-13	2019-11-12
6	Broad-band Horn Antenna(18-40GHz)	SCHWARZBECK	BBHA 9170	335	2018-10-25	2019-10-24
7	Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	100472	2018-10-25	2019-10-24
8	Cable	Top	18-40GHz	-	2018-10-15	2019-10-14
3m Semi-anechoic Chamber for Radiation Emissions Test site(TDK)						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2019-04-20	2020-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-05-24	2020-05-23
3	Active Loop Antenna	Com-power	AL-130R	10160007	2019-04-28	2020-04-27
4	Amplifier	ANRITSU	MH648A	M43381	2019-04-19	2020-04-18
5	Cable	HUBER+SUHNER	CBL2	525178	2019-04-20	2020-04-19
6	Coaxial Cable (below 1GHz)	Top	TYPE16 (13M)	-	2018-10-15	2019-10-14



RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	Spectrum Analyzer	R&S	FSP30	100091	2019-04-19	2020-04-18
2	Coaxial Cable	Top	10Hz-30GHz	-	2019-08-15	2020-08-14
3	Antenna Connector*	Realacc	45RSm	-	2019-08-15	2020-08-14
4	DC Block	Gwave	GDCB-3G-N-SMA	140307001	2019-08-15	2020-08-14

“\*”: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

## 5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	$\pm 1.0$ dB
RF Power Density	$\pm 2.2$ dB
Radiated Spurious Emissions test	$\pm 5.03$ dB (30M~1000MHz)
	$\pm 5.47$ dB (1000M~25000MHz)
Conducted Spurious Emissions test	$\pm 3.64$ dB (AC mains 150KHz~30MHz)

## 5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave, Tianhe District, Guangzhou, Guangdong, China.

## 6. Test Summary

Test Items	Test Requirement	Result
Maximum Peak Output Power	15.247(b)	C
Maximum Average Output Power	15.247(b)	C
Duty Cycle	N/A	C
Power Spectral Density	15.247(e)	C
Bandwidth	15.247(a)	C
Conducted Spurious Emission	15.247(d)	C
Band Edge	15.247(d)	C
Conducted Emissions	15.207	C
Radiated Emissions	15.247(d) 15.209	C
Antenna Requirement	15.203	C
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	C
Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.		

## 7. Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB $\mu$ V between 0.15MHz & 0.5MHz 56 dB $\mu$ V between 0.5MHz & 5MHz 60 dB $\mu$ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

### 7.1 E.U.T. Operation

Operating Environment :

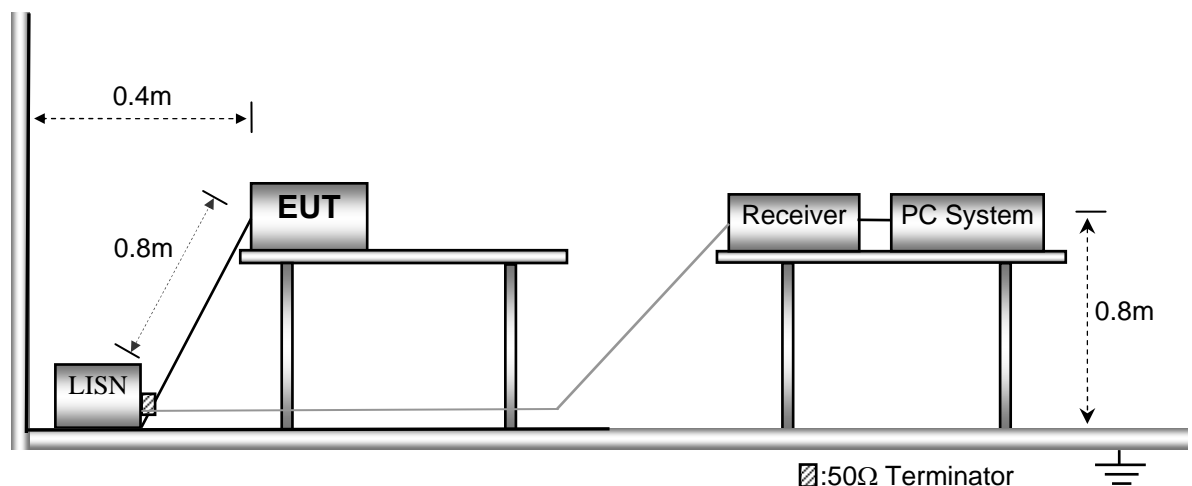
Temperature:	22.7 °C
Humidity:	52.5 % RH
Atmospheric Pressure:	101.8kPa

EUT Operation :

The test was performed in Transmitting mode, the test data were shown in the report.

### 7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10.



### 7.3 Measurement Description

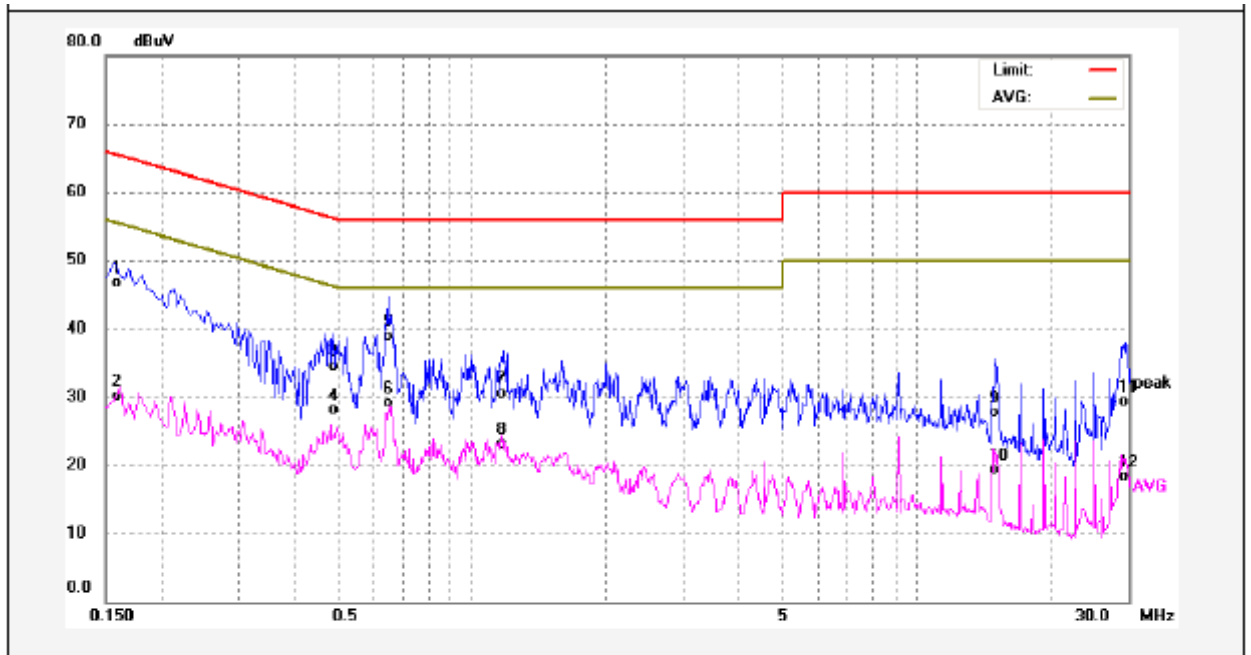
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

### 7.4 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

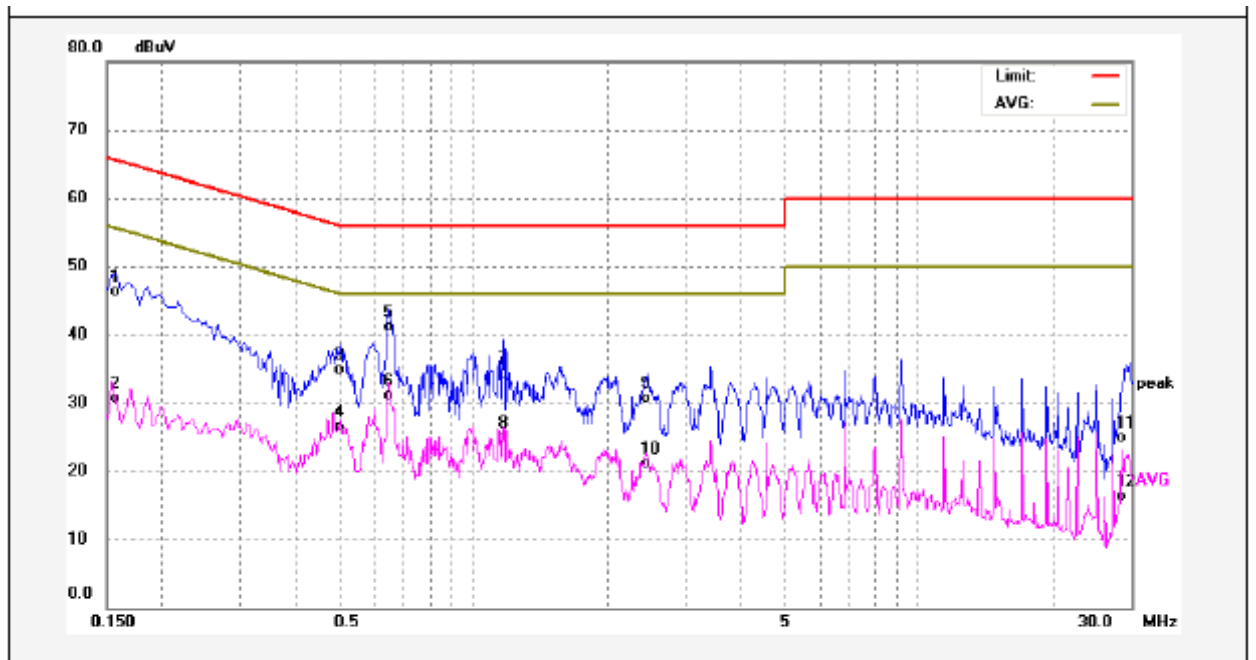
Only the worst case test data were record in the report.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1580	36.50	10.27	46.77	65.56	-18.79	QP	
2	0.1580	19.81	10.27	30.08	55.56	-25.48	AVG	
3	0.4900	24.02	10.42	34.44	56.17	-21.73	QP	
4	0.4900	17.76	10.42	28.18	46.17	-17.99	AVG	
5	0.6500	28.36	10.46	38.82	56.00	-17.18	QP	
6	0.6500	18.62	10.46	29.08	46.00	-16.92	AVG	
7	1.1820	20.10	10.44	30.54	56.00	-25.46	QP	
8	1.1820	12.66	10.44	23.10	46.00	-22.90	AVG	
9	15.0900	16.79	10.88	27.67	60.00	-32.33	QP	
10	15.0900	8.44	10.88	19.32	50.00	-30.68	AVG	
11	29.5420	19.11	10.29	29.40	60.00	-30.60	QP	
12	29.5420	7.97	10.29	18.26	50.00	-31.74	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1580	36.00	10.27	46.27	65.56	-19.29	QP	
2	0.1580	20.36	10.27	30.63	55.56	-24.93	AVG	
3	0.5060	24.41	10.42	34.83	56.00	-21.17	QP	
4	0.5060	16.08	10.42	26.50	46.00	-19.50	AVG	
5	0.6460	30.54	10.47	41.01	56.00	-14.99	QP	
6	0.6460	20.69	10.47	31.16	46.00	-14.84	AVG	
7	1.1660	23.94	10.44	34.38	56.00	-21.62	QP	
8	1.1660	14.49	10.44	24.93	46.00	-21.07	AVG	
9	2.4500	20.06	10.65	30.71	56.00	-25.29	QP	
10	2.4500	10.44	10.65	21.09	46.00	-24.91	AVG	
11	28.6780	14.63	10.33	24.96	60.00	-35.04	QP	
12	28.6780	6.05	10.33	16.38	50.00	-33.62	AVG	

## 8. Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

### 8.1 EUT Operation

Operating Environment :

Temperature: 23.0 °C

Humidity: 54.4 % RH

Atmospheric Pressure: 101.5kPa

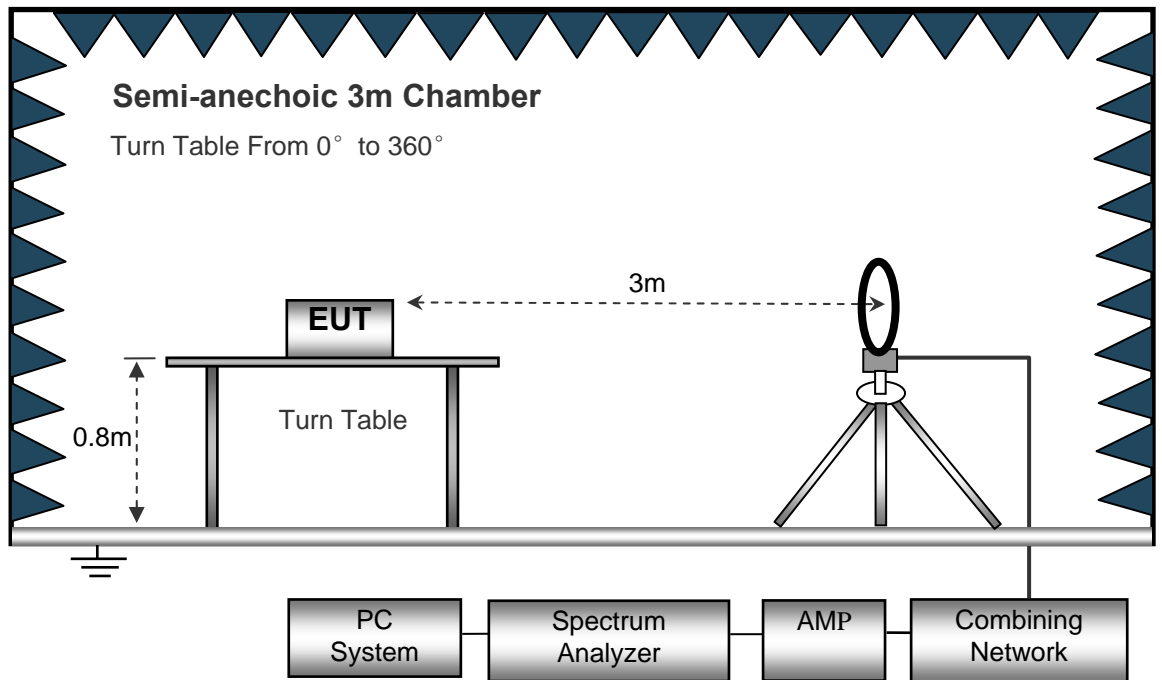
EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

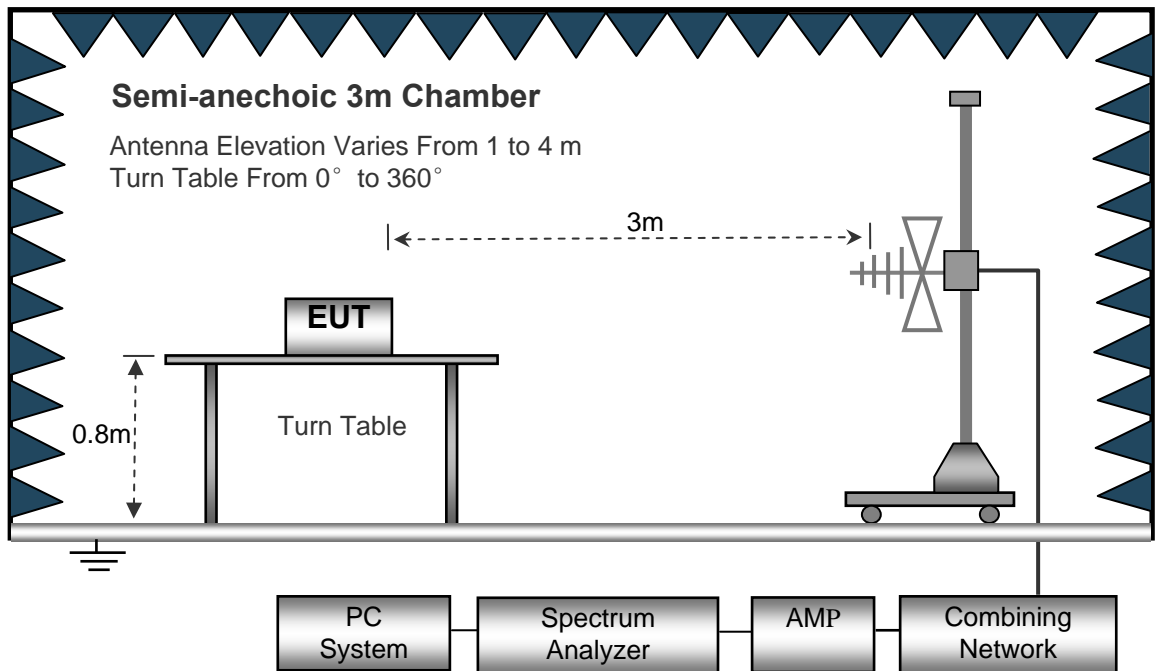
## 8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10.

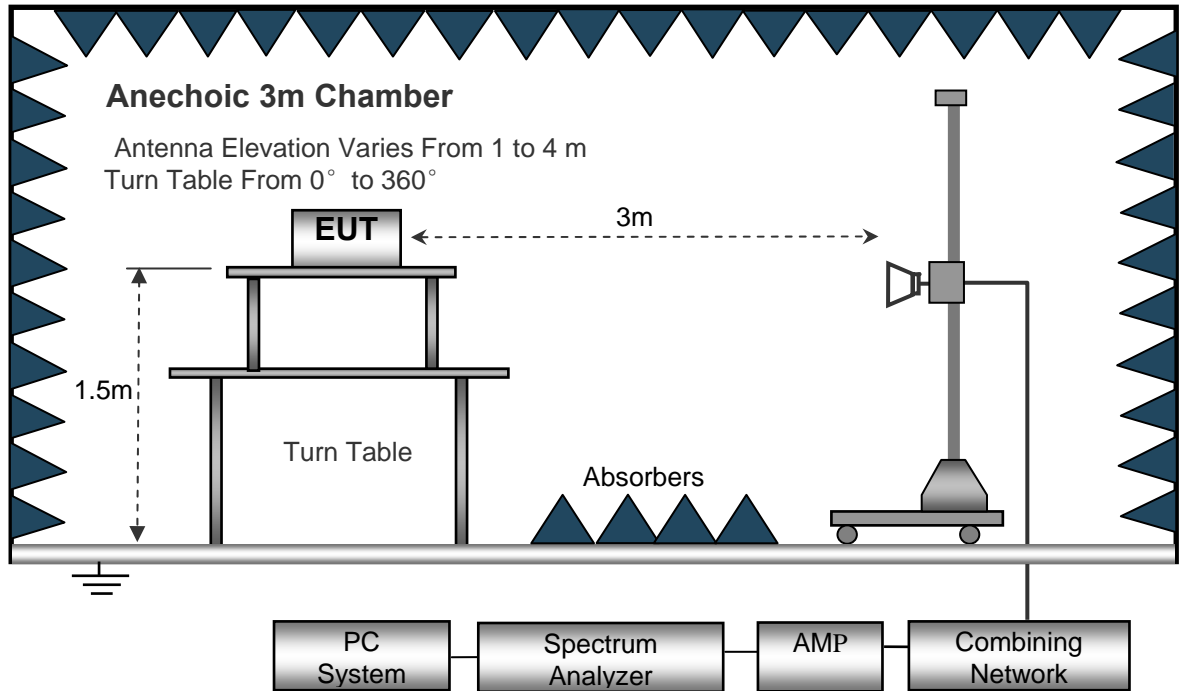
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



### 8.3 Spectrum Analyzer Setup

Below 30MHz

- Sweep Speed ..... Auto
- IF Bandwidth..... 10kHz
- Video Bandwidth..... 10kHz
- Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

- Sweep Speed ..... Auto
- Detector ..... PK
- Resolution Bandwidth..... 100kHz
- Video Bandwidth..... 300kHz

Above 1GHz

- Sweep Speed ..... Auto
- Detector ..... PK
- Resolution Bandwidth..... 1MHz
- Video Bandwidth..... 3MHz
- Detector ..... Ave.
- Resolution Bandwidth..... 1MHz
- Video Bandwidth..... 10Hz



## 8.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane;  
For above 1GHz, the EUT is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the EUT in X axis,so the worst data were shown as follow.
8. A 2.4GHz high-pass filter is used during radiated emissions above 1GHz measurement.

## 8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

## 8.6 Summary of Test Results

### Test Frequency : 9kHz ~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

### Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB $\mu$ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
<b>GFSK Low Channel 2405MHz</b>									
181.25	45.82	QP	115	1.0	H	-11.07	34.75	43.50	-8.75
181.25	44.59	QP	295	1.5	V	-11.07	33.52	43.50	-9.98
4812.00	63.78	PK	212	1.6	V	-1.06	62.72	74.00	-11.28
4812.00	46.11	Ave	212	1.6	V	-1.06	45.05	54.00	-8.95
7218.00	61.96	PK	247	1.5	H	1.33	63.29	74.00	-10.71
7218.00	44.65	Ave	247	1.5	H	1.33	45.98	54.00	-8.02

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB $\mu$ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
<b>GFSK Middle Channel 2440MHz</b>									
181.25	45.46	QP	218	1.8	H	-11.07	34.39	43.50	-9.11
181.25	43.15	QP	248	1.4	V	-11.07	32.08	43.50	-11.42
4894.00	63.35	PK	290	1.5	V	-0.62	62.73	74.00	-11.27
4894.00	46.29	Ave	290	1.5	V	-0.62	45.67	54.00	-8.33
7341.00	63.40	PK	323	1.3	H	2.21	65.61	74.00	-8.39
7341.00	45.28	Ave	323	1.3	H	2.21	47.49	54.00	-6.51

Frequency	Receiver Reading	Detector	Turntable Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB $\mu$ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
<b>GFSK High Channel 2480MHz</b>									
181.25	45.26	QP	162	1.3	H	-11.07	34.19	43.50	-9.31
181.25	43.99	QP	229	1.5	V	-11.07	32.92	43.50	-10.58
4952.00	61.98	PK	141	2.0	V	-0.24	61.74	74.00	-12.26
4952.00	47.02	Ave	141	2.0	V	-0.24	46.78	54.00	-7.22
7428.00	62.32	PK	112	1.1	H	2.84	65.16	74.00	-8.84
7428.00	46.26	Ave	112	1.1	H	2.84	49.10	54.00	-4.90

**Test Frequency: 18GHz~25GHz**

The measurements were more than 20 dB below the limit and not reported.

## 9. Band Edge Measurement

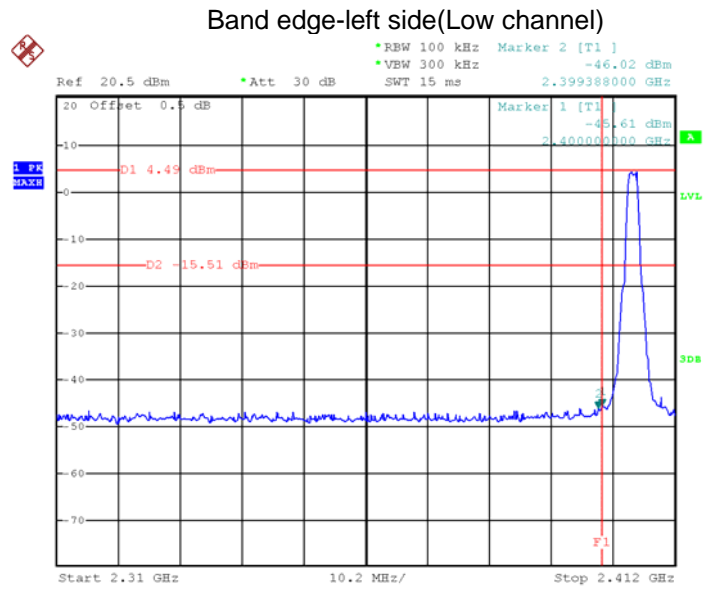
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

### 9.1 Test Produce

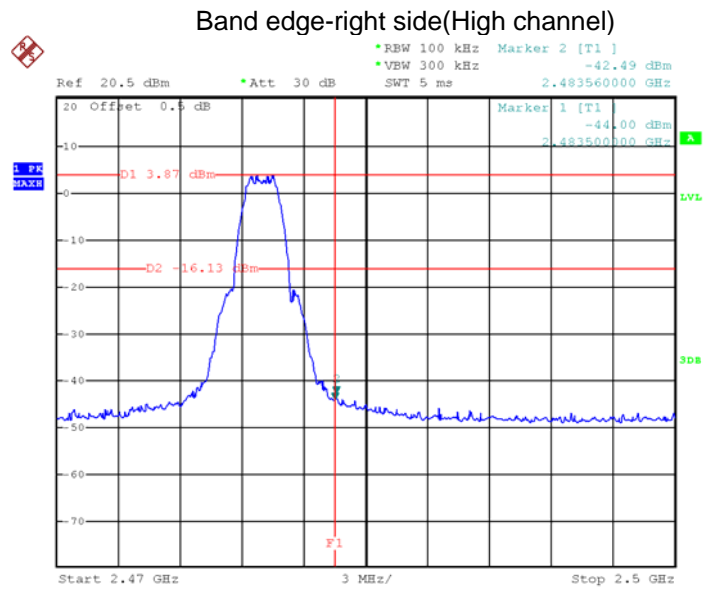
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### 9.2 Test Result

Test result plots shown as follows:



Date: 9.SEP.2019 03:05:26



Date: 9.SEP.2019 03:08:43

## 10. Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

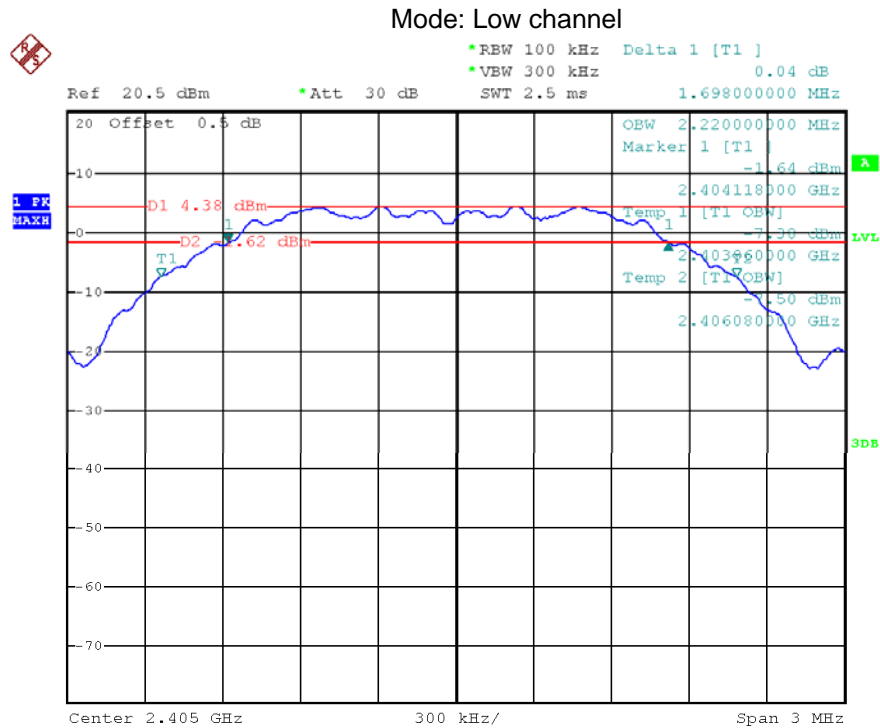
558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

### 10.1 Test Procedure

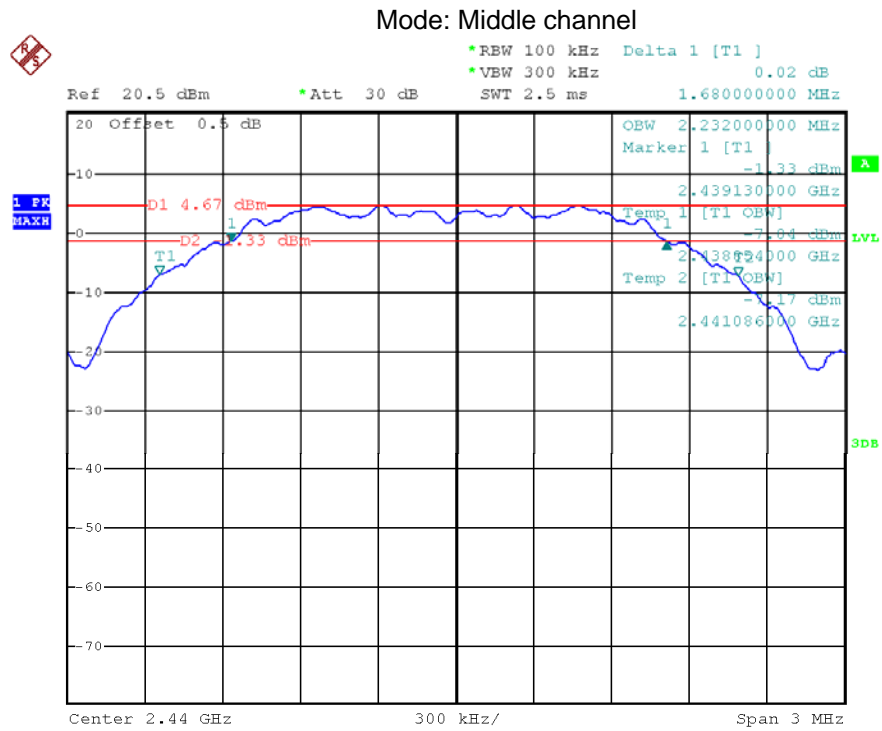
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

### 10.2 Test Result

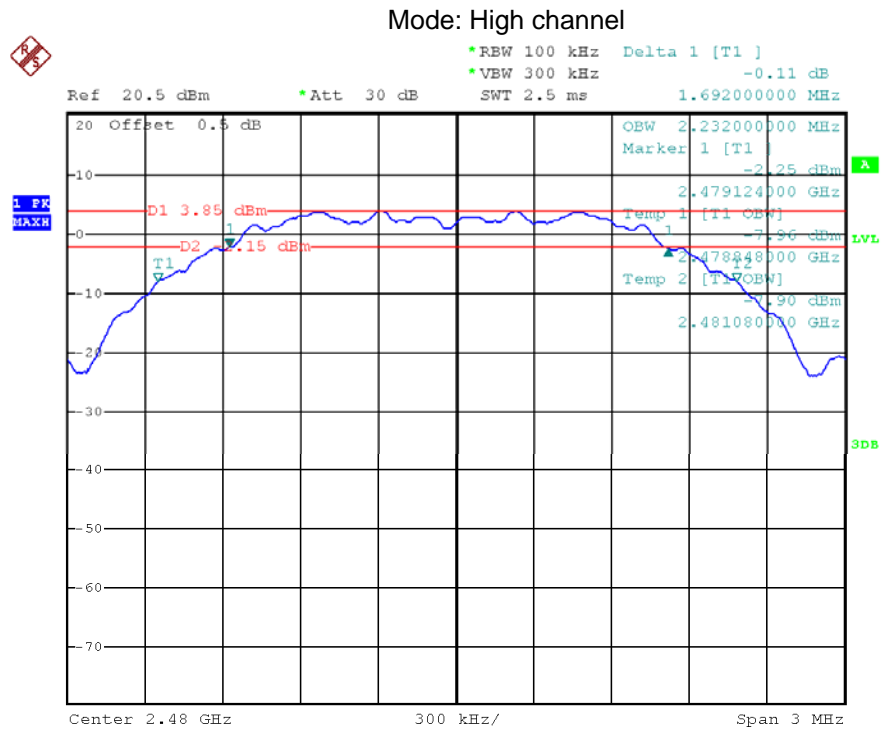
Operation mode	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low channel	1.70	2.22
Middle channel	1.68	2.23
High channel	1.70	2.23



Date: 9.SEP.2019 03:28:39



Date: 9.SEP.2019 03:34:54



Date: 9.SEP.2019 03:26:20

## 11. Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

### 11.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

### 11.2 Test Result

Maximum Peak Output Power (dBm)		
Low channel	Middle channel	High channel
8.37	<b>8.55</b>	7.76
Limit: 1W/30dBm		



## 12. Conducted spurious emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

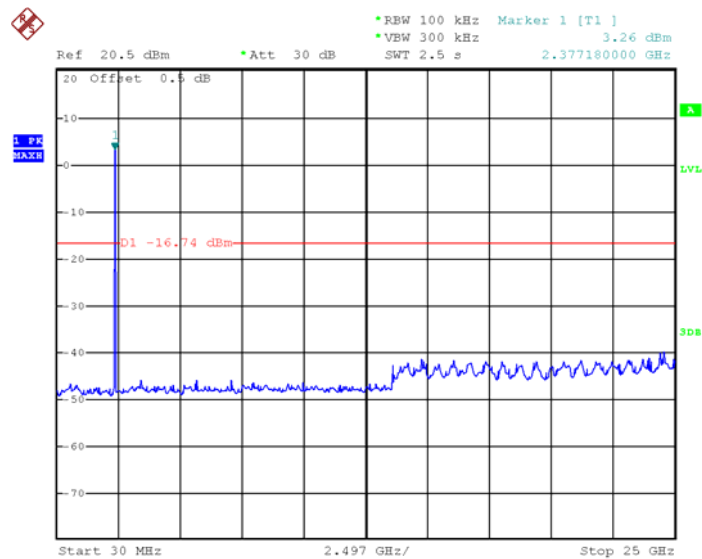
Test Method: 558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

### 12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Start=30MHz, Stop=25GHz  
Sweep = auto; Detector Function = Peak. Trace = Max hold.

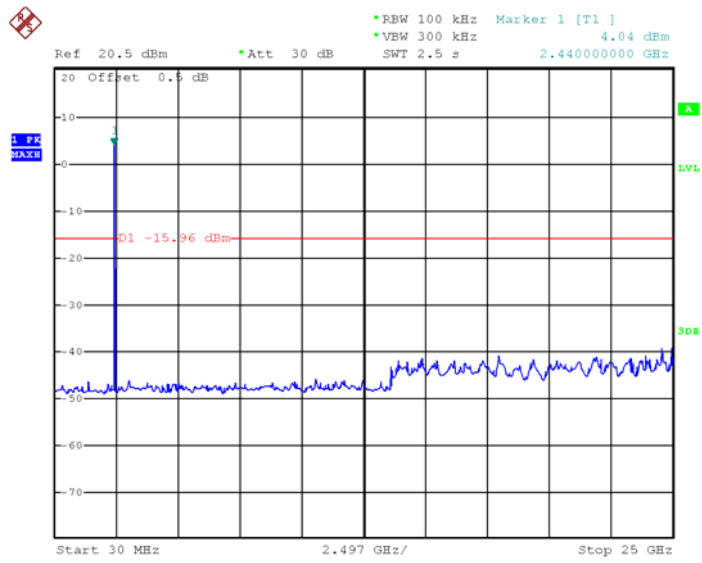
### 12.2 Test Result

Low channel



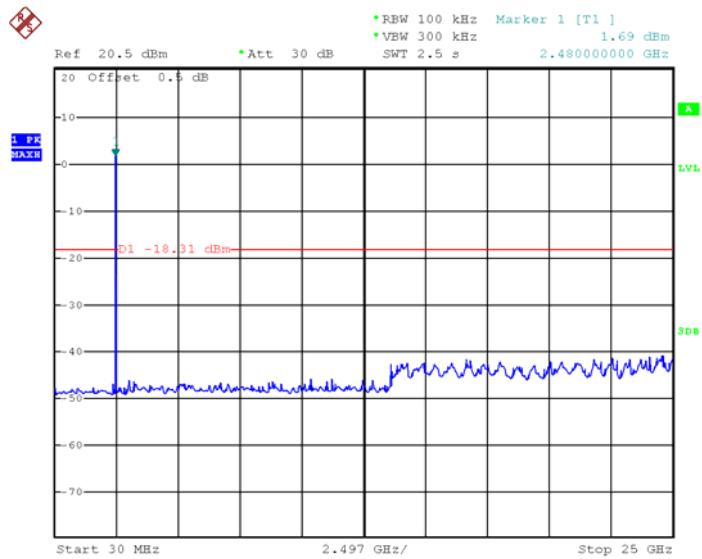
Date: 10.SEP.2019 00:46:54

### Middle channel



Date: 10.SEP.2019 00:45:38

### High channel



Date: 10.SEP.2019 00:44:19

### 13. Power Spectral density

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

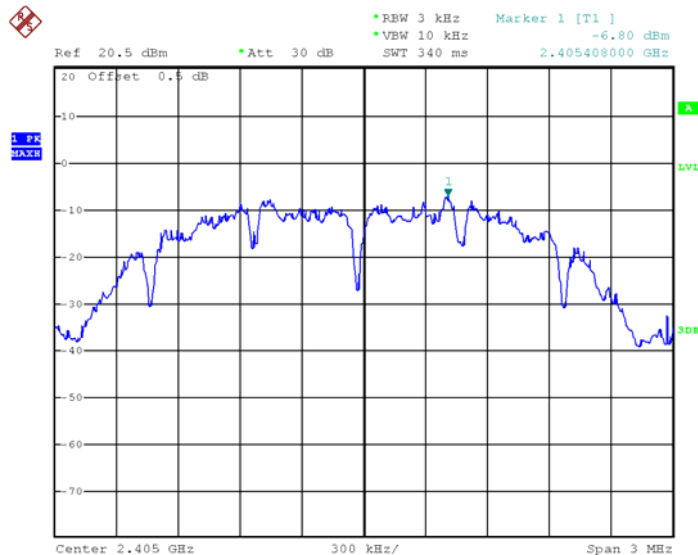
#### 13.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section  
Submit this plot.

#### 13.2 Test Result

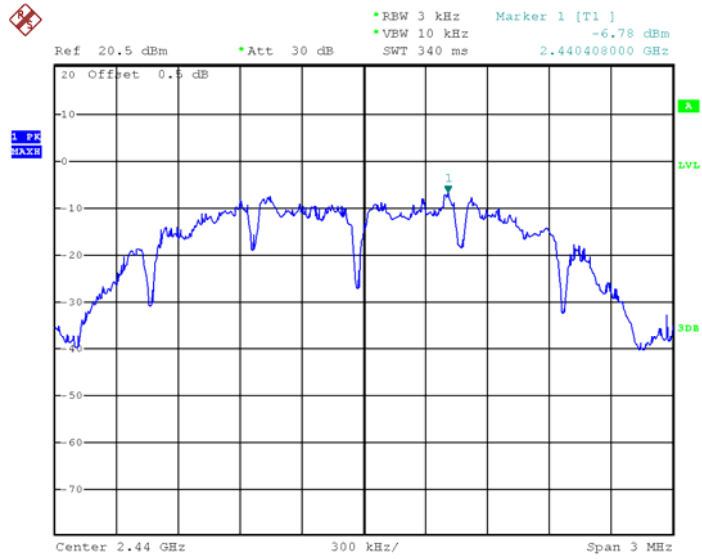
Power Spectral Density(dBm/3kHz)		
Low channel	Middle channel	High channel
-6.80	-6.78	-7.46
Limit: 8dBm per 3kHz		

Test mode: Low channel



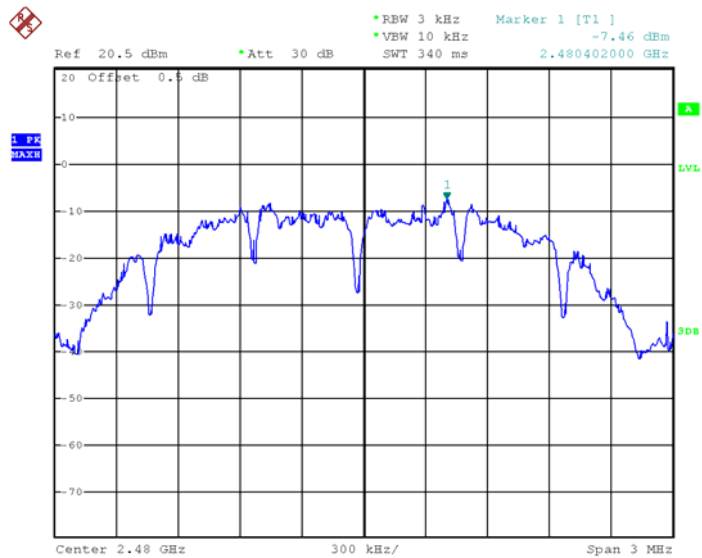
Date: 9.SEP.2019 03:19:32

Test mode: Middle channel



Date: 9.SEP.2019 03:17:36

Test mode: High channel



Date: 9.SEP.2019 03:21:49

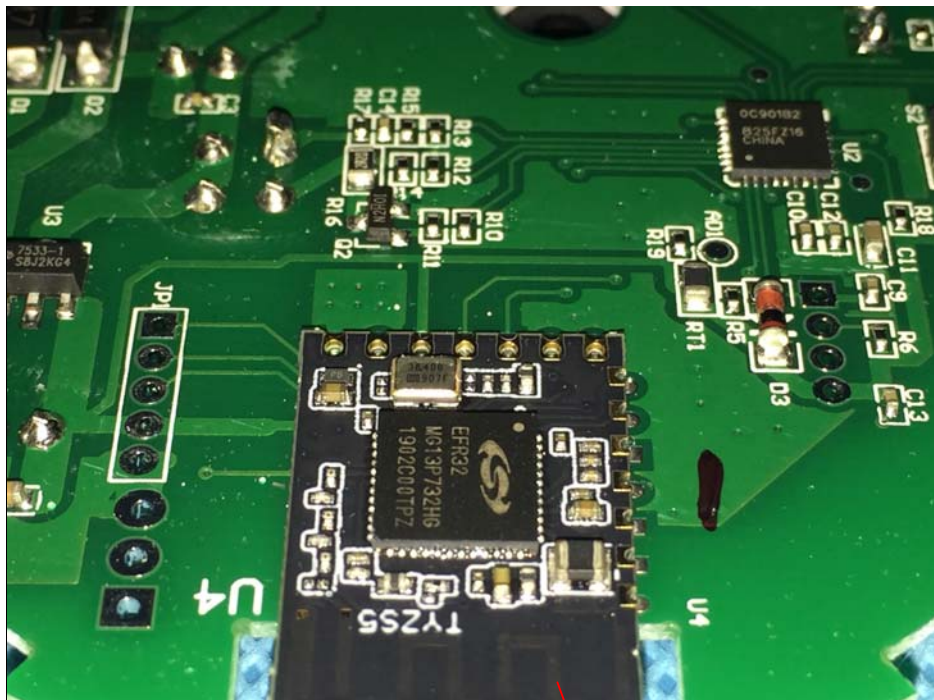
## 14. Antenna Requirement

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, 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.

Result:

The EUT has a PCB Printed Antenna, meets the requirements of FCC 15.203.



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## 15. RF Exposure Evaluation

Test Requirement: FCC Part 1.1307  
 Evaluation Method: FCC Part 2.1091

### 15.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

### 15.2 The procedures / limit

#### (A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

#### (B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

### 15.3 MPE Calculation Method

**P** = Peak RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**R** = Separation distance between radiator and human body (m)=0.2m

The formula can be changed to

$$Pd = P_{out} * G / (4 * \pi * R^2)$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

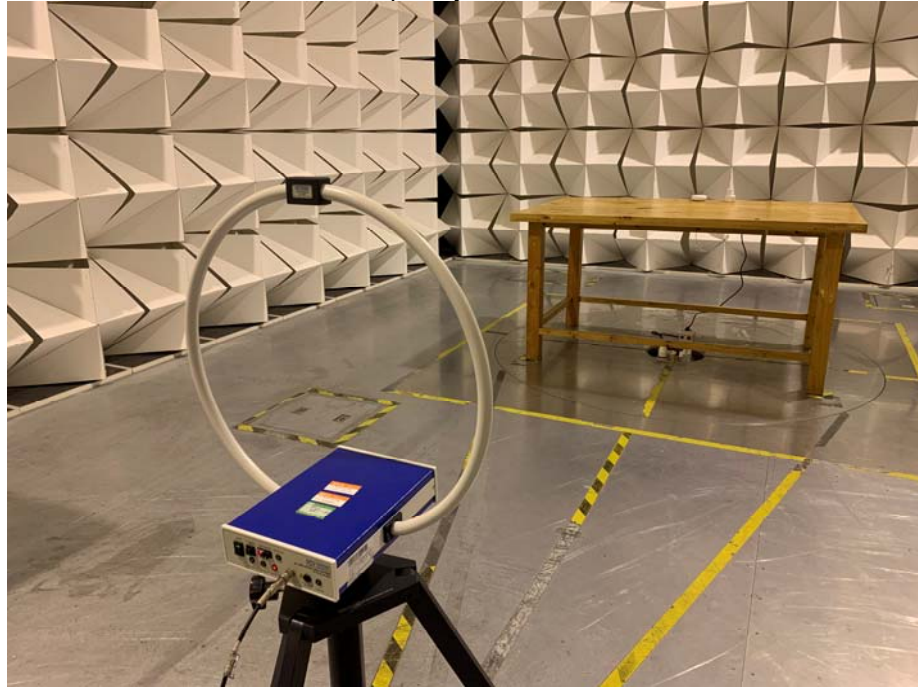
Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
-1	0.79	8.55	7.16	0.0011	1

Compliance.

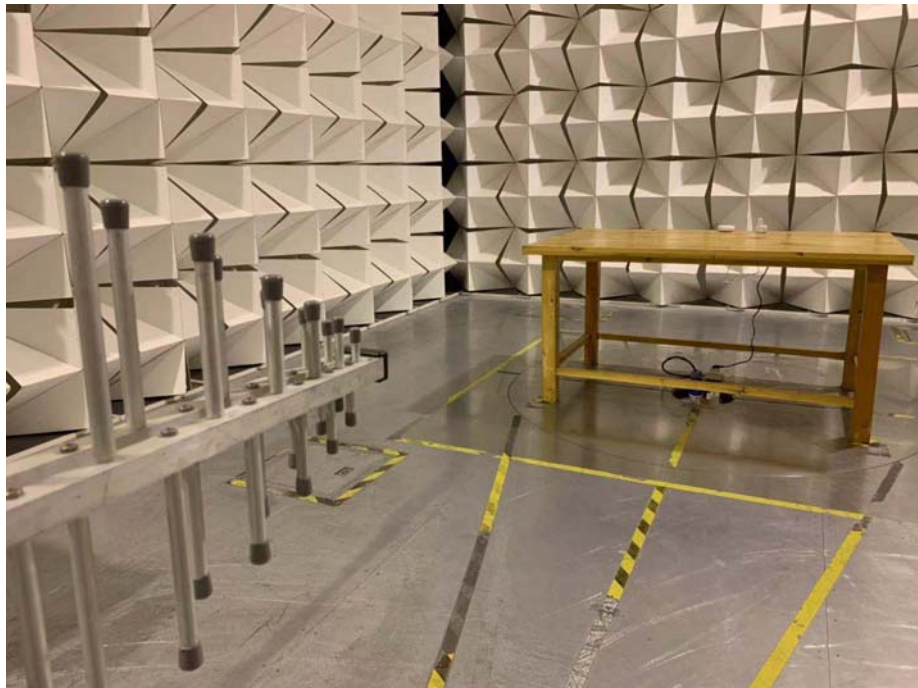
## 16. Photographs – Test Setup Photos

### 16.1 Radiated Emission

Test frequency Below 30MHz

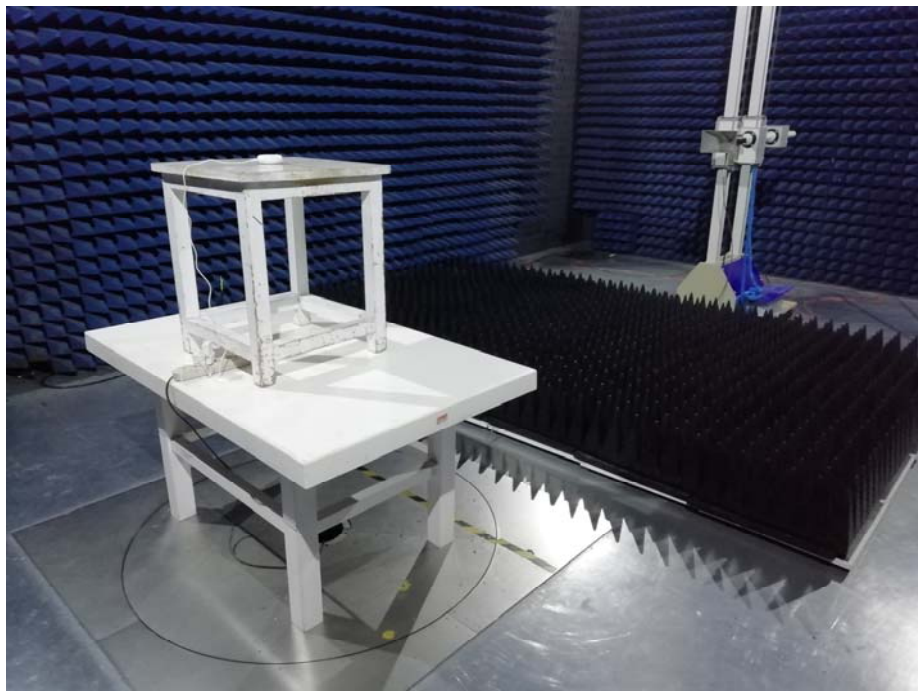


Test frequency from 30MHz to 1GHz





Test frequency above 1GHz



## 16.2 Conducted Emission

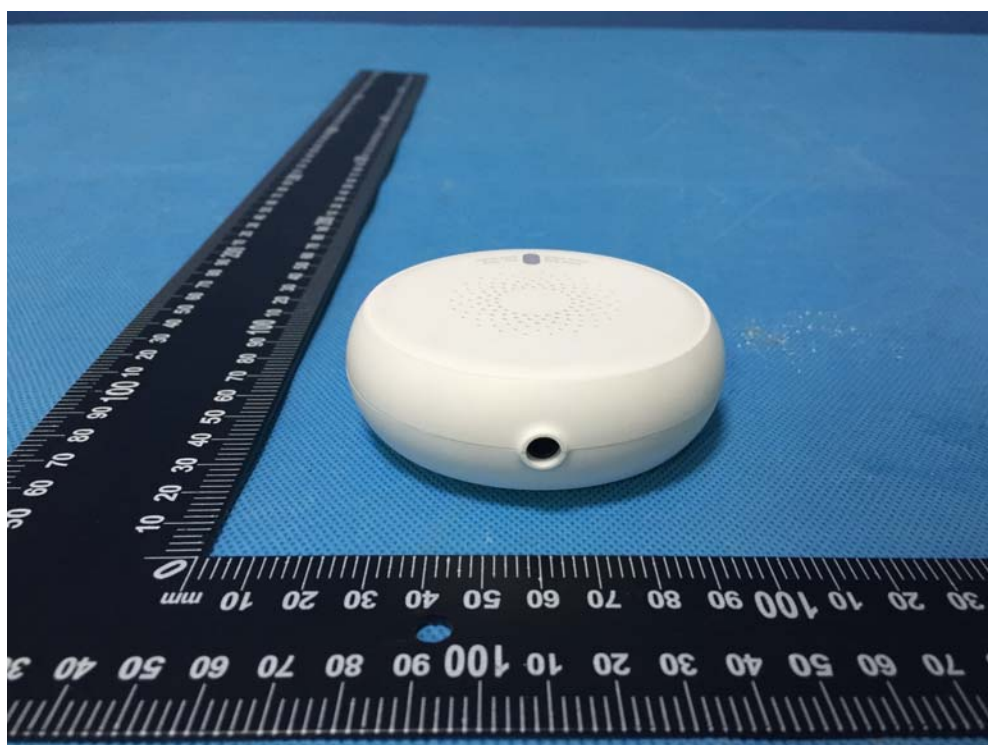


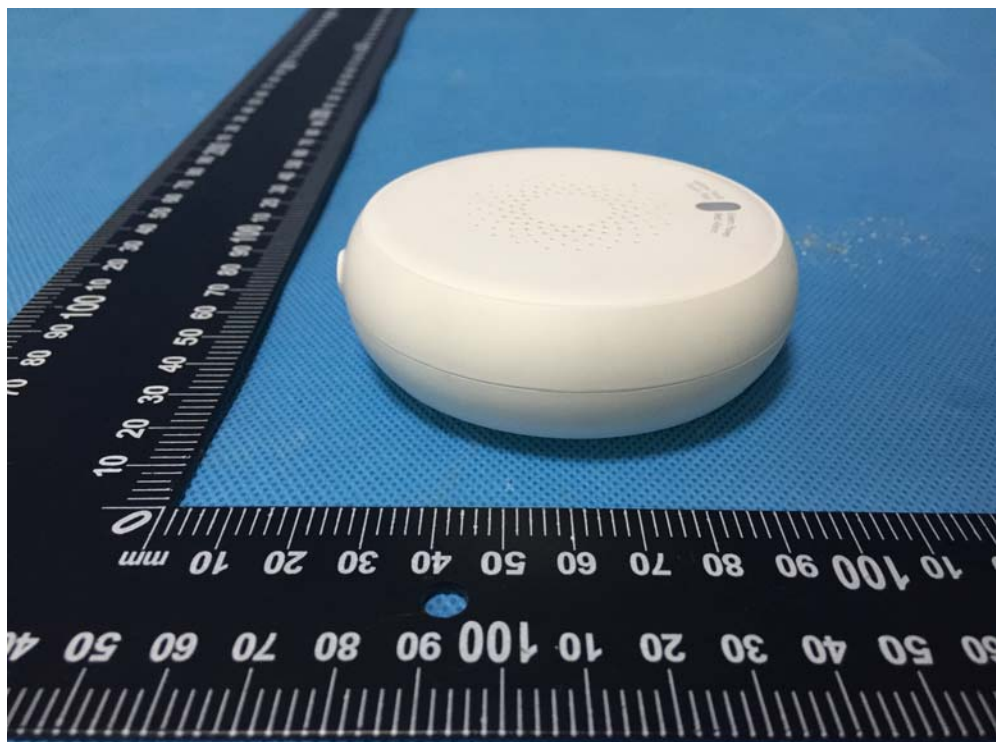
## 17. Photographs - Constructional Details

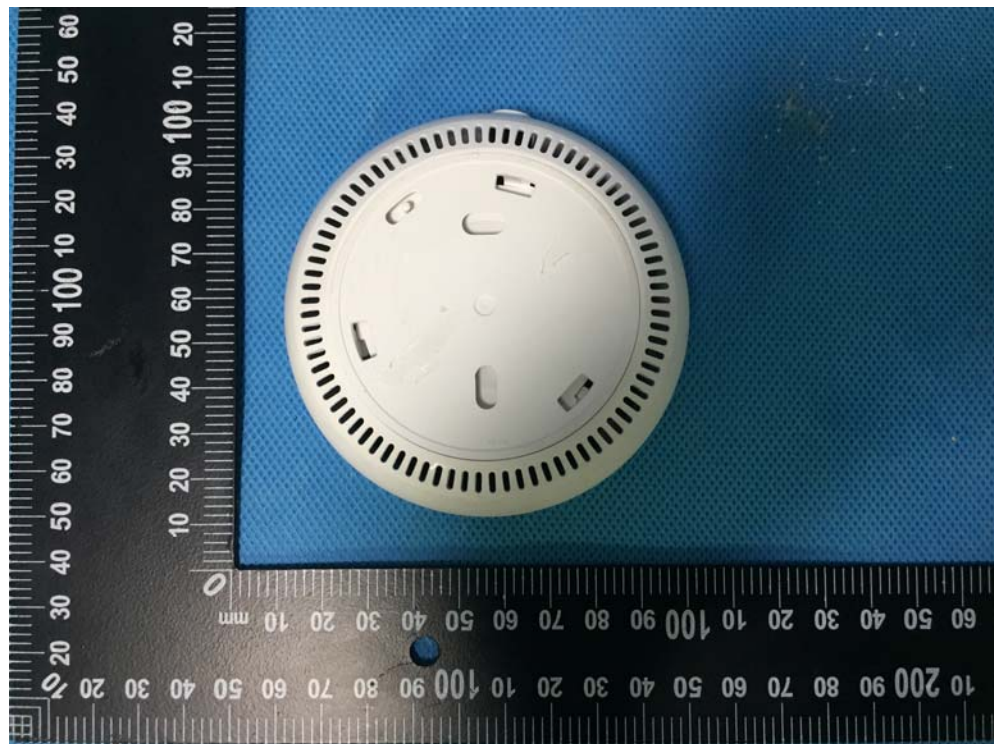
### 17.1 EUT – External View







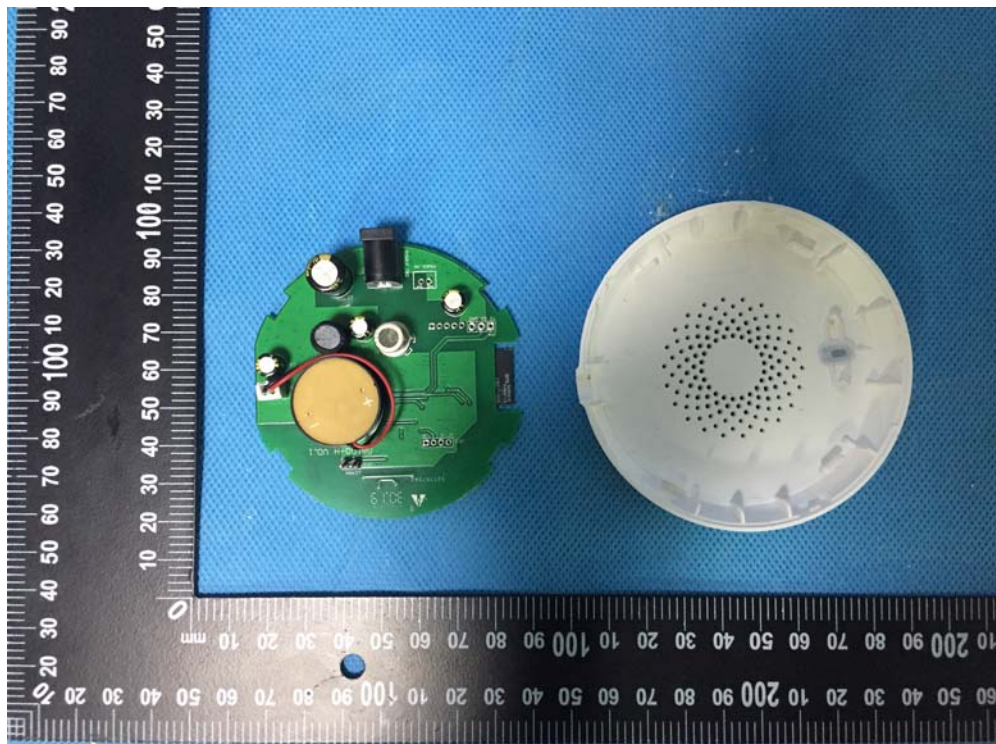
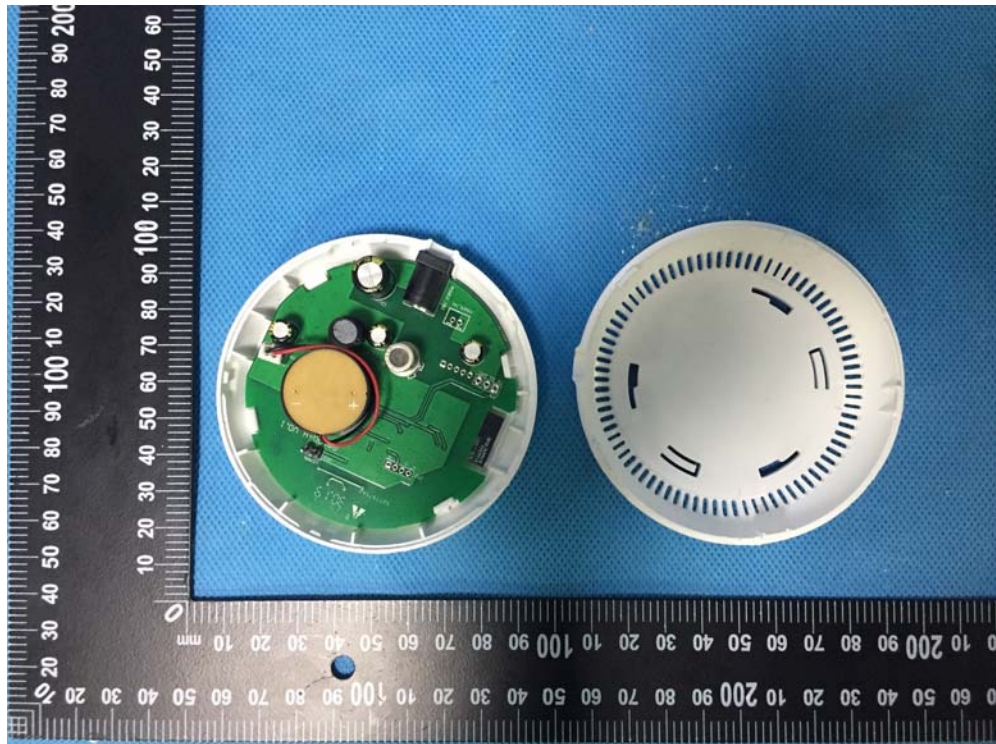




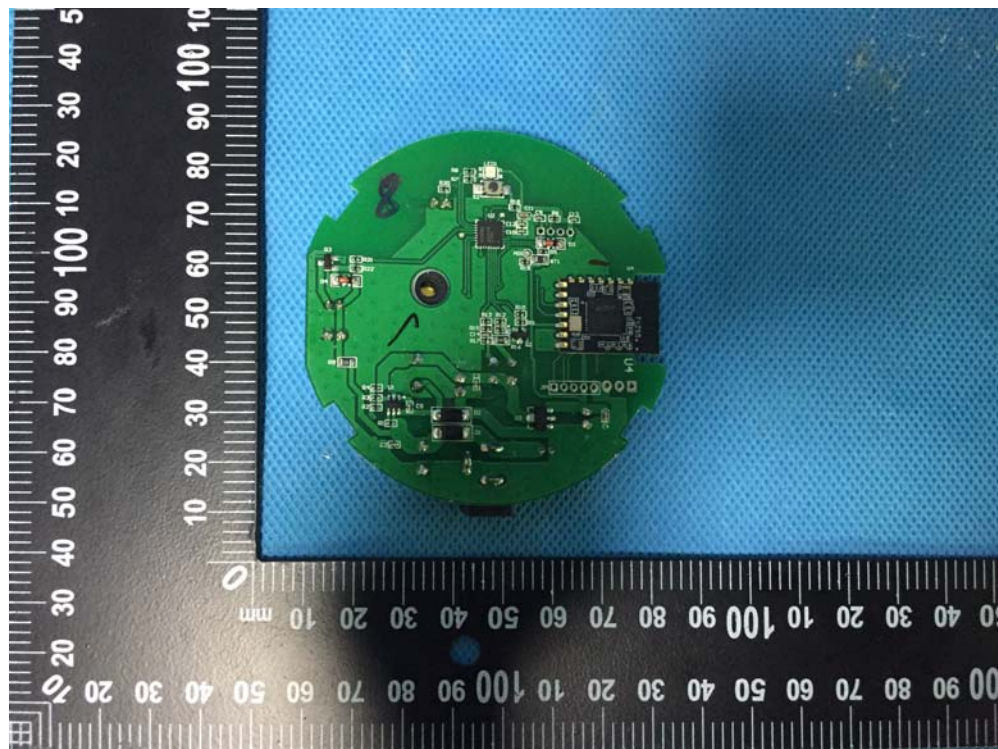
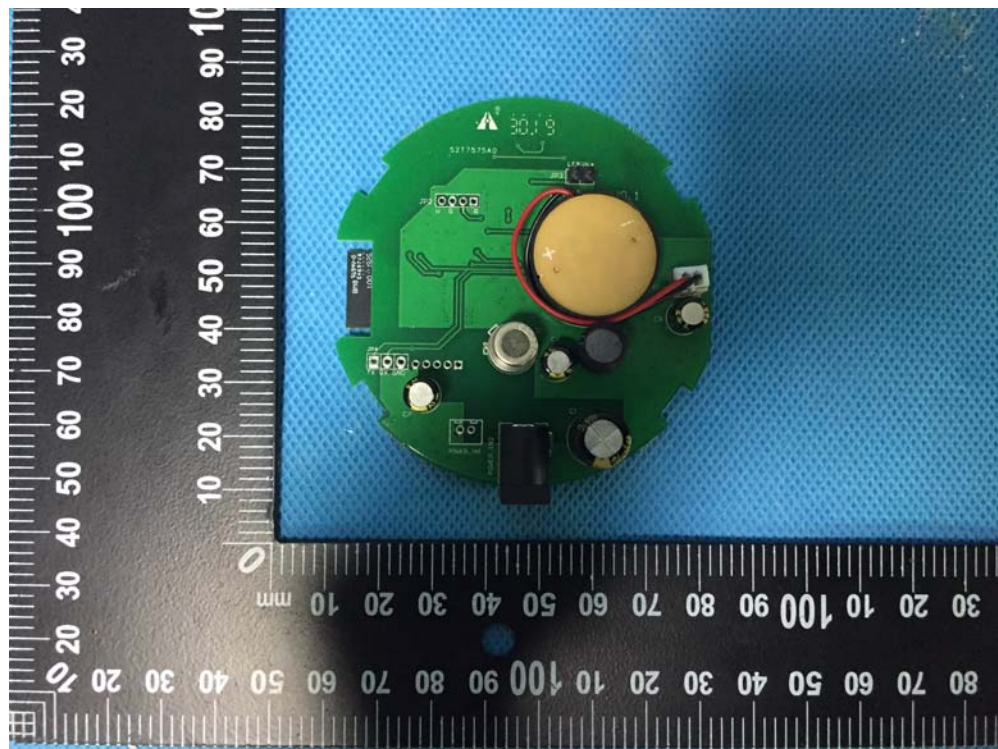




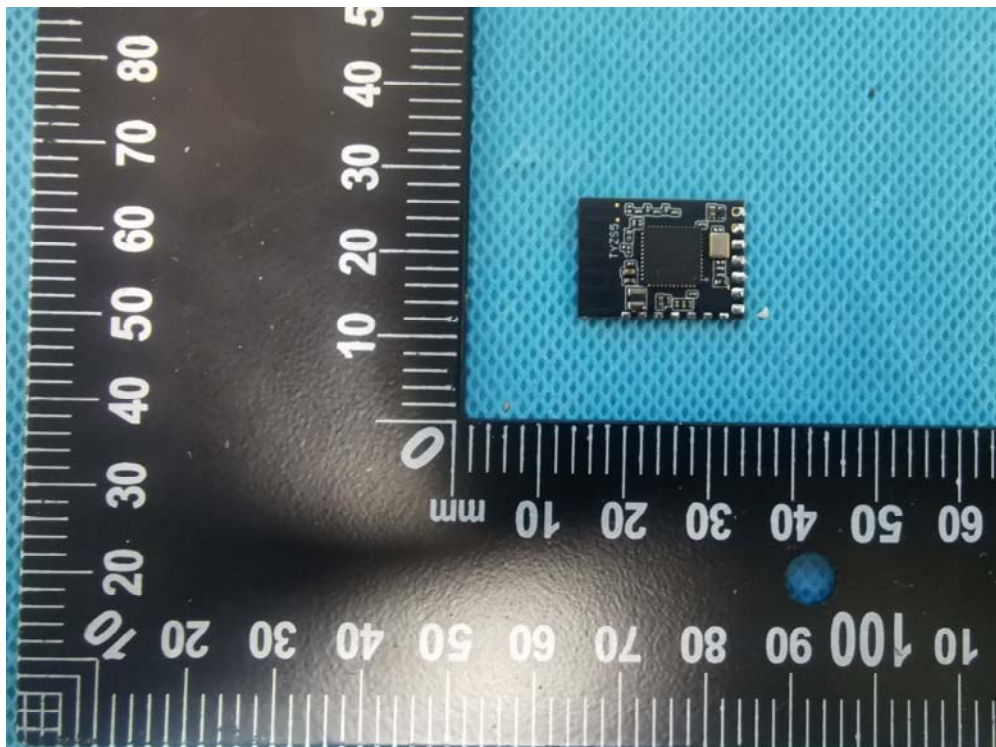
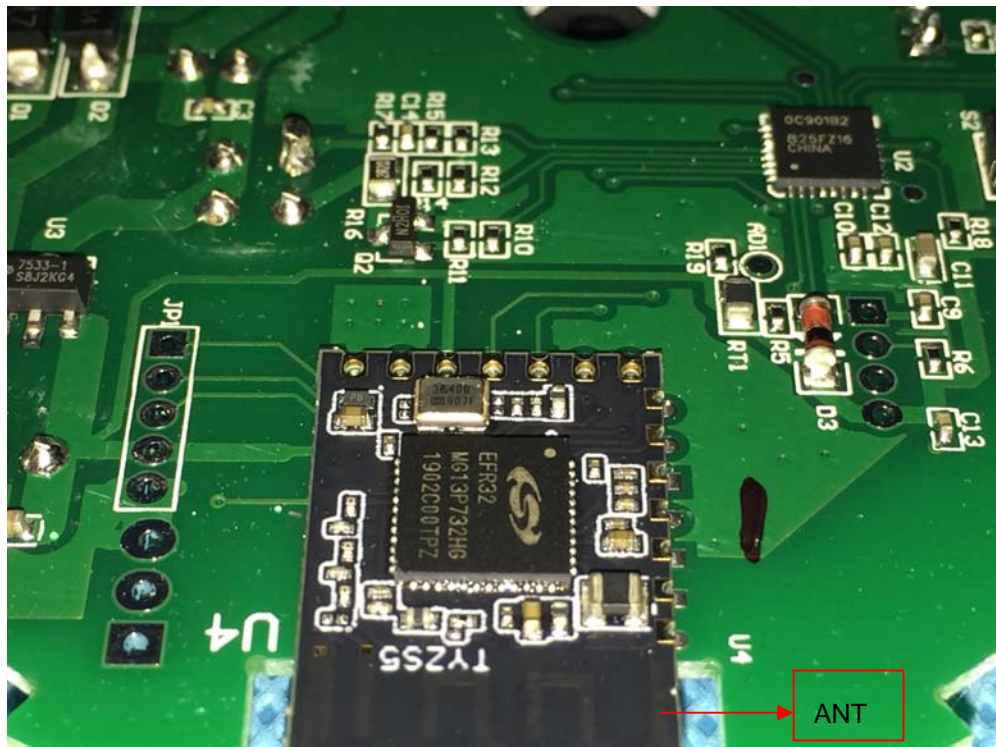
### 17.2 EUT – Internal View

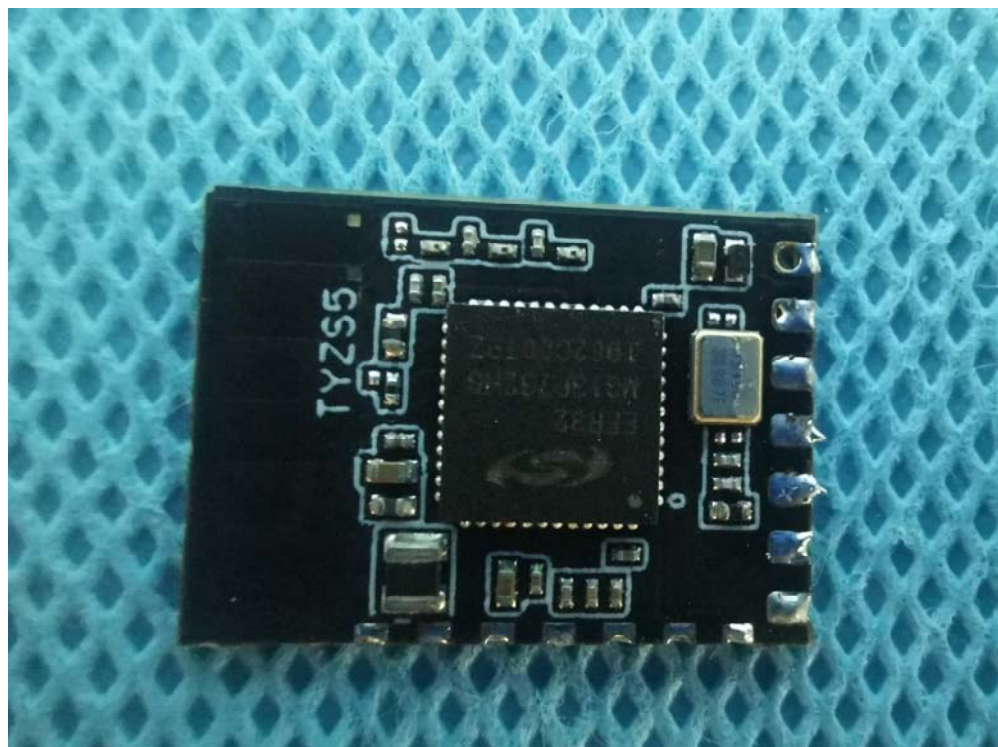
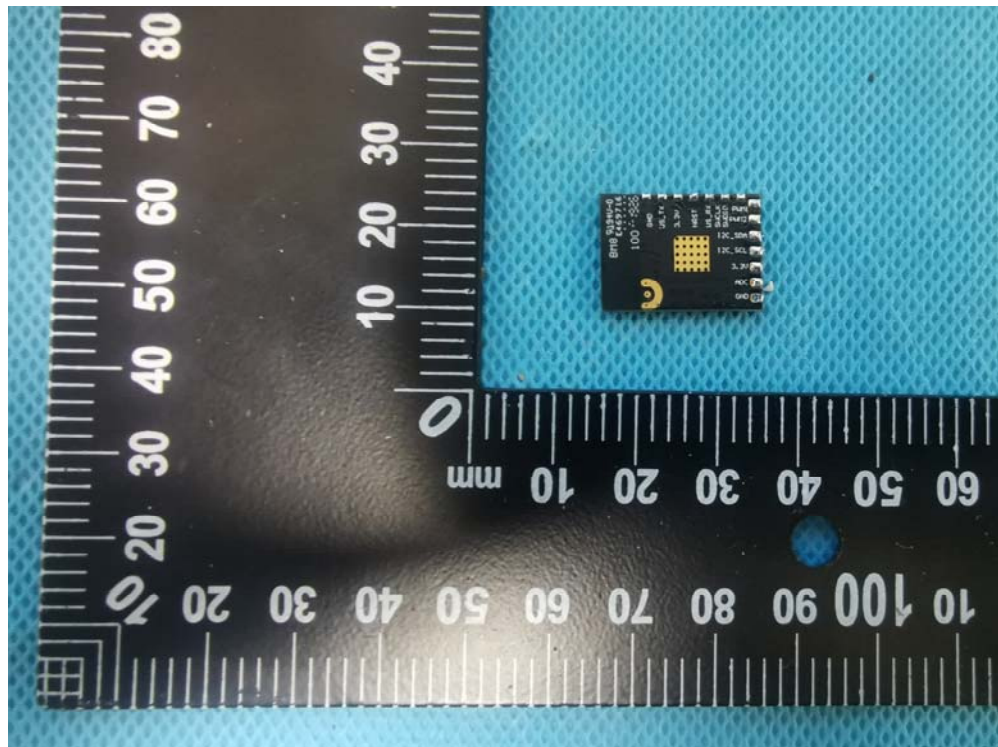












=====End of Report=====