

TEST REPORT

Reference No...... : WTD19S08057875W
FCC ID..... : HSXBU02M
Applicant : The Whistler Group
Address : 168 Ayer Rd, Littleton, Massachusetts 01460, United States
Manufacturer : DongGuan Protronic Electronics Ltd.
Address : Protronic Industrial Park Xiangxi Village, Shipai Town, Dongguan, Guangdong, P.R.China
Product(s)..... : BACK-UP CAMERA
Product Marketing Name : Monitor
Model(s)..... : WBU-800
Hardware Version : WBU-800M
Identification Number.....
Standards : FCC CFR47 Part 15 Section 15.247:2019
Date of Receipt sample : 2019-09-17
Date of Test..... : 2019-09-18 to 2019-10-21
Date of Issue : 2019-10-22
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.

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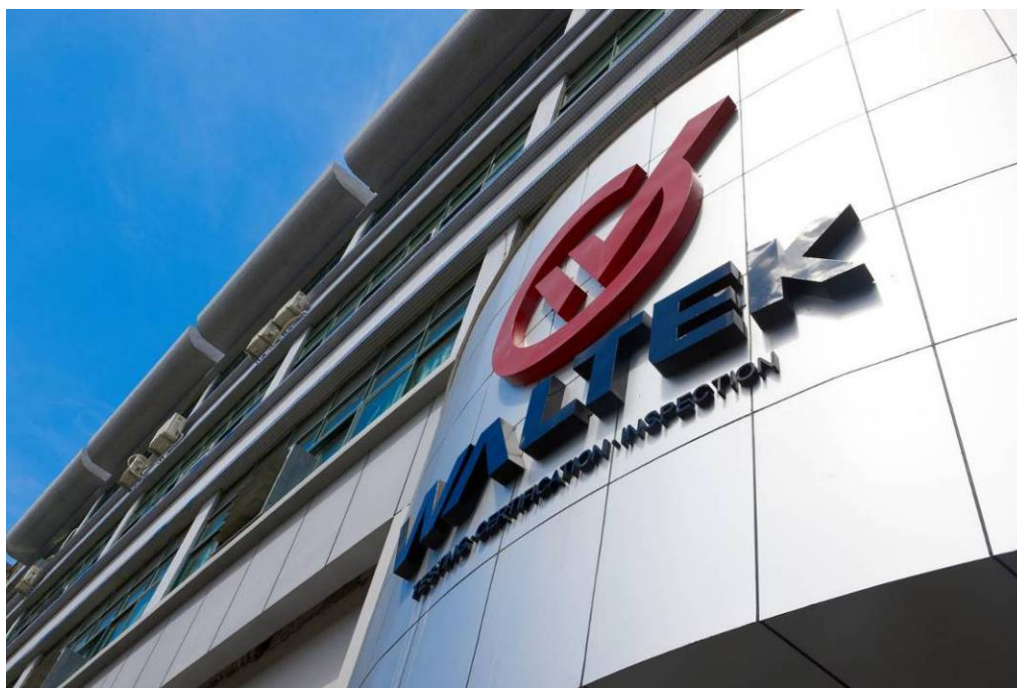


Philip Zhong

Philip 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)

in accordance with the Conformity Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ SDoC	1
Canada		IC ID \ SDoC	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
WTD19S08057875W	2019-09-17	2019-09-18 to 2019-10-21	2019-10-22	original	-	Valid

4 General Information

4.1 General Description of E.U.T

Product(s):	BACK-UP CAMERA
Product Marketing Name:	Monitor
Model(s):	WBU-800
Hardware Version Identification Number:	WBU-800M
Model difference:	N/A
Operation Frequency:	2410-2473MHz, 19 Channels in total
Antenna installation:	Internal Integral Antenna
Antenna Gain:	2dBi
Type of Modulation:	GFSK

4.2 Details of E.U.T

Ratings:	DC 12V/24V by battery
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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	2410	2	2413.5	3	2417	4	2420.5
5	2424	6	2427.5	7	2431	8	2434.5
9	2438	10	2441.5	11	2445	12	2448.5
13	2452	14	2455.5	15	2459	16	2462.5
17	2466	18	2469.5	19	2473	20	-

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting	2410MHz	2441.5MHz	2473MHz

Note: The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions(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)	Top	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	2019-09-17	2020-09-16
8	Cable	Top	18-40GHz	-	2018-10-25	2019-10-24
3m Semi-anechoic Chamber for Radiation Emissions(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)	-	2018-10-25	2019-10-24
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSL6	100959	2018-11-18	2019-11-17
2	Coaxial Cable	Top	10Hz-30GHz	-	2019-09-12	2020-09-11
3	Antenna Connector*	Realacc	45RSm	-	2019-09-12	2020-09-11
4	DC Block	Gwave	GDCB-3G-N-SMA	140307001	2019-09-12	2020-09-11
***: 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	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Confidence interval: 95%. Confidence factor:k=2	

5.3 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test Lab: N/A

Lab address: N/A

Test items: N/A

6 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	N/A*
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	Pass
Band edge	15.247(d) 15.205(a)	Pass
Bandwidth	15.247(a)(1)	Pass
Maximum Peak Output Power	15.247(b)(1)	Pass
Frequency Separation	15.247(a)(1)	Pass
Number of Hopping Frequency	15.247(a)(1)(iii)	Pass
Dwell time	15.247(a)(1)(iii)	Pass
Antenna Requirement	15.203	Pass
RF Exposure	1.1307(b)(1)	Pass
Note: Pass=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable. *: This requirement does not apply for device powered by battery		

7 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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature: 22.8 °C

Humidity: 54.3 % RH

Atmospheric Pressure: 101.8kPa

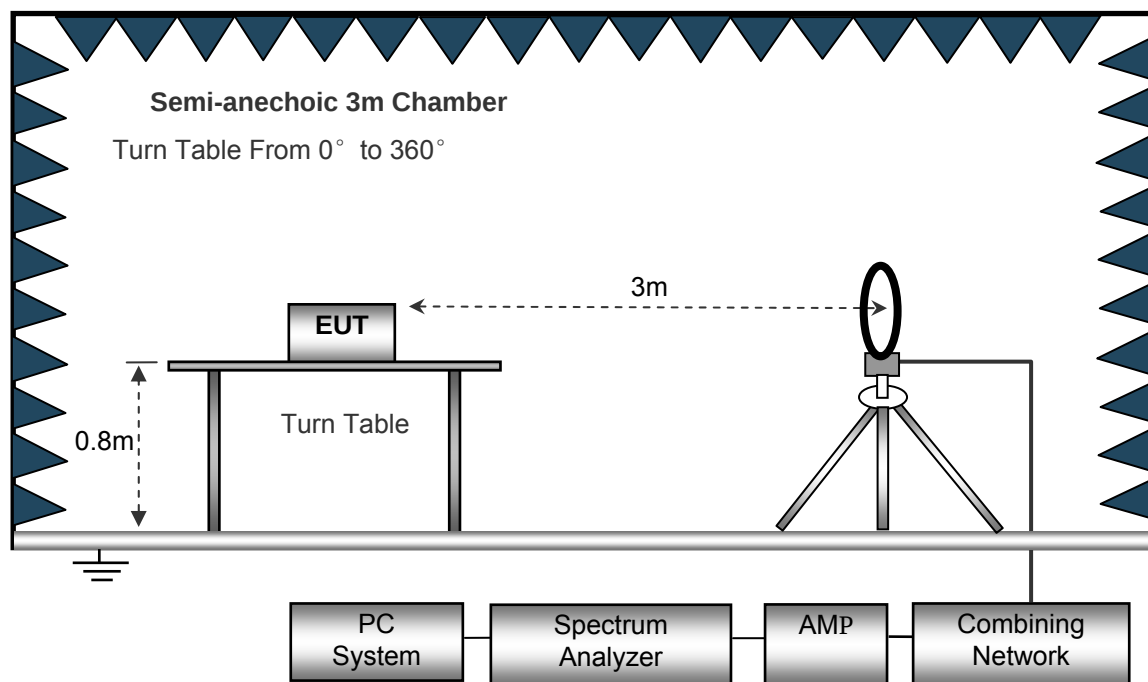
EUT Operation :

The test was performed in transmitting (DC 12V by battery) and transmitting (DC 24V by battery) mode, Only the worst case mode test data which transmitting (DC 12V by battery) were shown in the report.

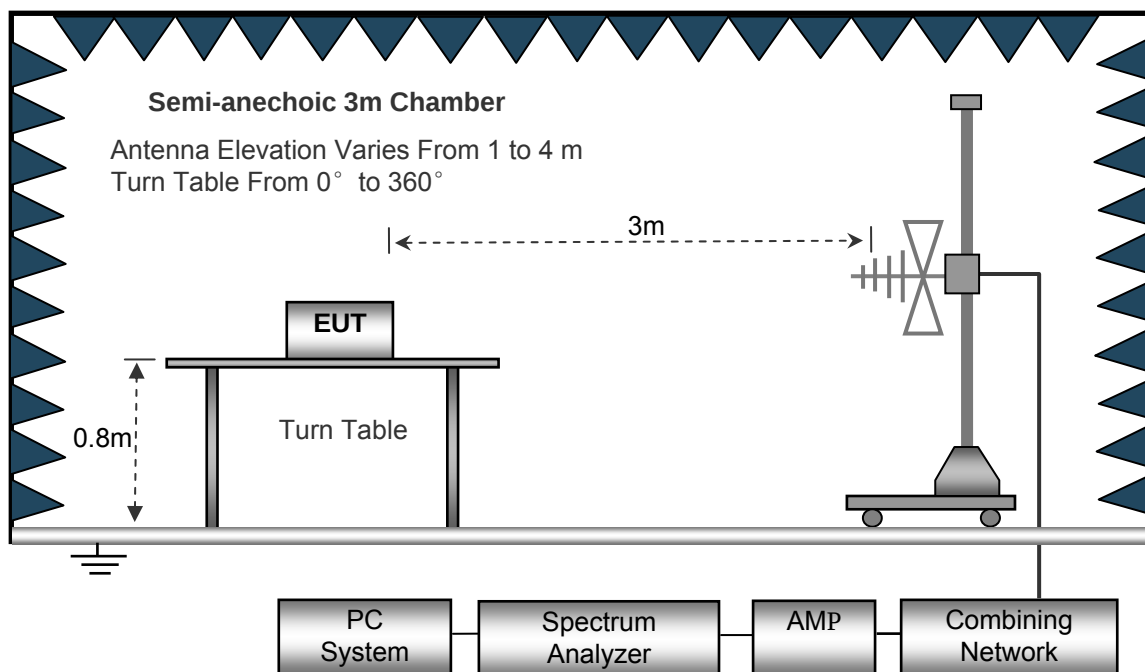
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

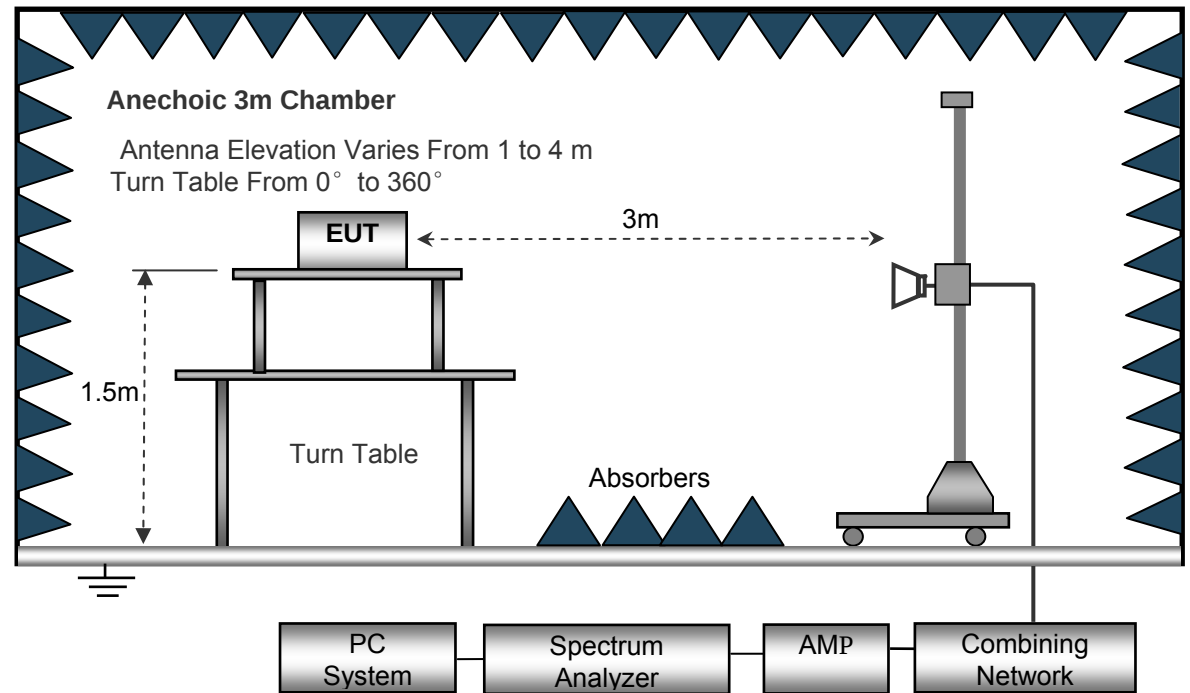
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
IF Bandwidth.....10kHz
Video Bandwidth.....10kHz
Resolution Bandwidth10kHz

30MHz ~ 1GHz

Sweep Speed Auto
DetectorPK
Resolution Bandwidth.....100kHz
Video Bandwidth.....300kHz

Above 1GHz

Sweep Speed Auto
DetectorPK
Resolution Bandwidth.....1MHz
Video Bandwidth.....3MHz
DetectorAve.
Resolution Bandwidth.....1MHz
Video Bandwidth.....10Hz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
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. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
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 tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.
8. For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

7.5 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:

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

7.6 Summary of Test Results

Test Frequency: 9 kHz ~ 30 MHz

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	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2410MHz									
77.87	51.36	QP	56	1.8	H	-20.86	30.50	40.00	-9.50
77.87	41.17	QP	43	1.1	V	-20.86	20.31	40.00	-19.69
4820.00	63.06	PK	122	1.5	V	-1.06	62.00	74.00	-12.00
4820.00	43.52	Ave	122	1.5	V	-1.06	42.46	54.00	-11.54
7230.00	58.73	PK	230	2.0	H	1.33	60.06	74.00	-13.94
7230.00	43.68	Ave	230	2.0	H	1.33	45.01	54.00	-8.99
2327.02	42.38	PK	112	1.3	V	-13.19	29.19	74.00	-44.81
2327.02	35.18	Ave	112	1.3	V	-13.19	21.99	54.00	-32.01
2378.77	42.11	PK	230	1.7	H	-13.14	28.97	74.00	-45.03
2378.77	34.85	Ave	230	1.7	H	-13.14	21.71	54.00	-32.29
2493.97	44.65	PK	95	1.7	V	-13.08	31.57	74.00	-42.43
2493.97	34.03	Ave	95	1.7	V	-13.08	20.95	54.00	-33.05

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2441.5MHz									
77.87	52.20	QP	23	1.3	H	-20.86	31.34	40.00	-8.66
77.87	42.03	QP	114	1.6	V	-20.86	21.17	40.00	-18.83
4883.00	63.69	PK	57	1.3	V	-0.62	63.07	74.00	-10.93
4883.00	43.95	Ave	57	1.3	V	-0.62	43.33	54.00	-10.67
7324.50	59.83	PK	28	1.0	H	2.21	62.04	74.00	-11.96
7324.50	42.26	Ave	28	1.0	H	2.21	44.47	54.00	-9.53
2313.39	45.37	PK	194	1.4	V	-13.19	32.18	74.00	-41.82
2313.39	33.50	Ave	194	1.4	V	-13.19	20.31	54.00	-33.69
2350.56	44.90	PK	331	1.8	H	-13.14	31.76	74.00	-42.24
2350.56	32.21	Ave	331	1.8	H	-13.14	19.07	54.00	-34.93
2493.13	44.66	PK	138	2.0	V	-13.08	31.58	74.00	-42.42
2493.13	34.69	Ave	138	2.0	V	-13.08	21.61	54.00	-32.39

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2473MHz									
77.87	49.45	QP	322	1.5	H	-20.86	28.59	40.00	-11.41
77.87	40.65	QP	194	1.7	V	-20.86	19.79	40.00	-20.21
4946.00	62.49	PK	202	1.4	V	-0.24	62.25	74.00	-11.75
4946.00	43.05	Ave	202	1.4	V	-0.24	42.81	54.00	-11.19
7419.00	59.60	PK	171	1.3	H	2.84	62.44	74.00	-11.56
7419.00	41.56	Ave	171	1.3	H	2.84	44.40	54.00	-9.60
2320.21	45.24	PK	205	1.5	V	-13.19	32.05	74.00	-41.95
2320.21	34.50	Ave	205	1.5	V	-13.19	21.31	54.00	-32.69
2378.31	42.23	PK	335	1.6	H	-13.14	29.09	74.00	-44.91
2378.31	32.93	Ave	335	1.6	H	-13.14	19.79	54.00	-34.21
2487.82	42.33	PK	96	1.8	V	-13.08	29.25	74.00	-44.75
2487.82	33.69	Ave	96	1.8	V	-13.08	20.61	54.00	-33.39

Test Frequency: 18GHz~25GHz

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

8 Band Edge Measurement

Test Requirement: Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Method: ANSI C63.10:2013

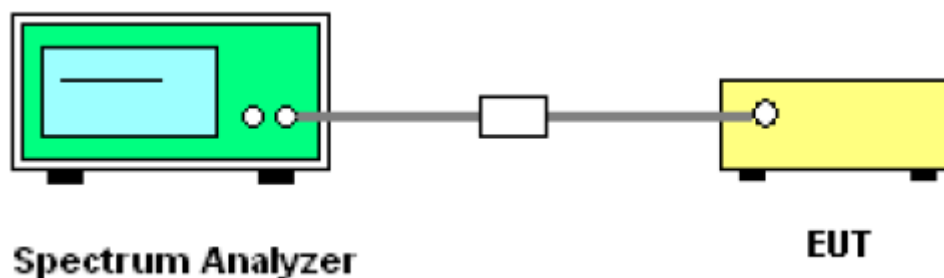
Test Limit: Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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 and Hopping

8.1 Test Procedure

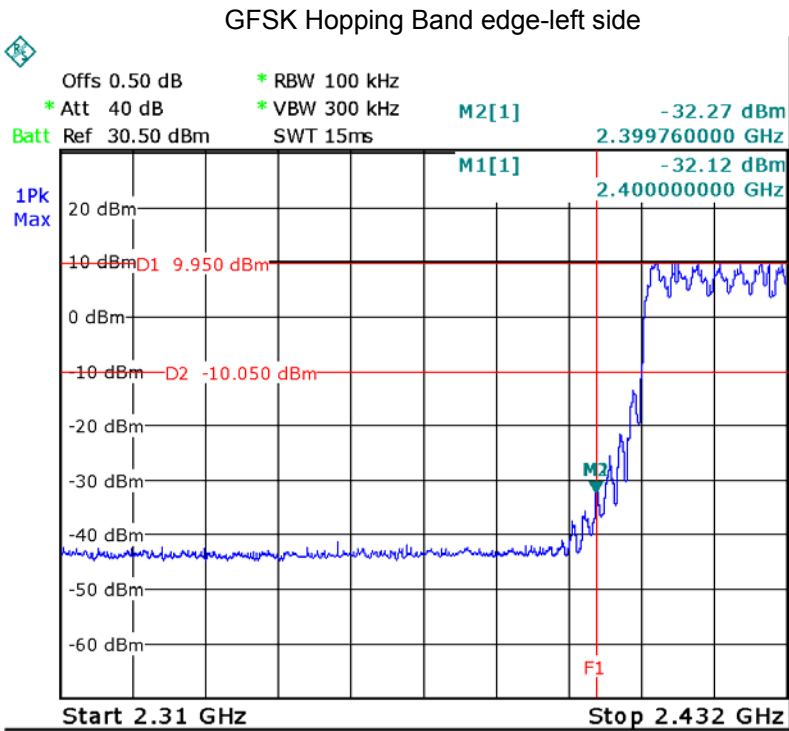
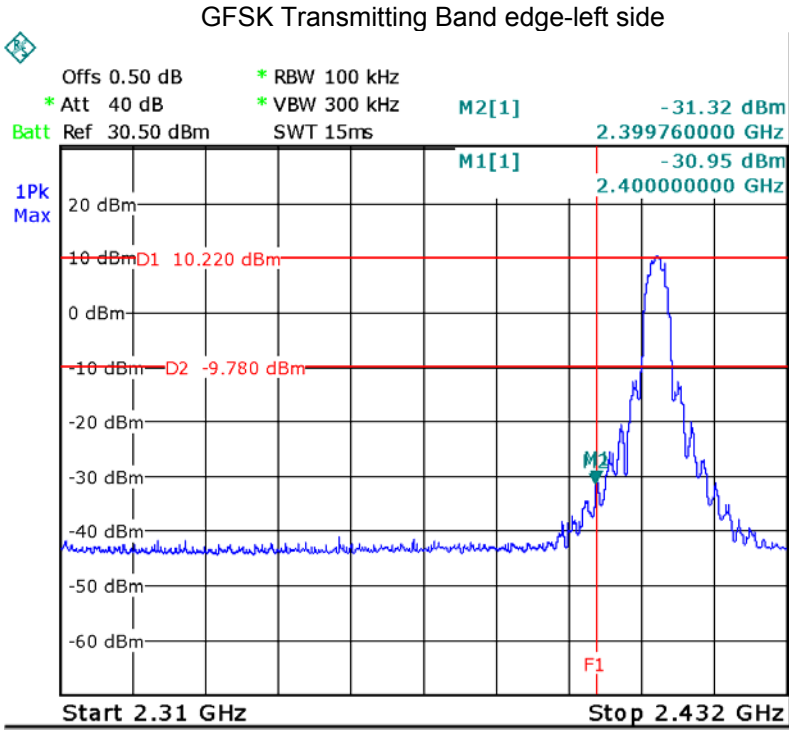
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

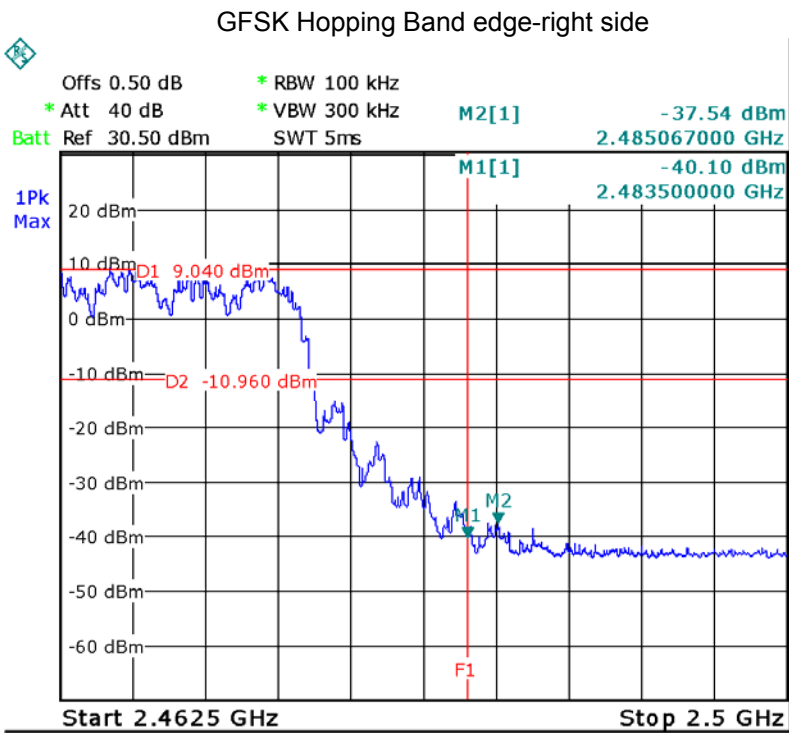
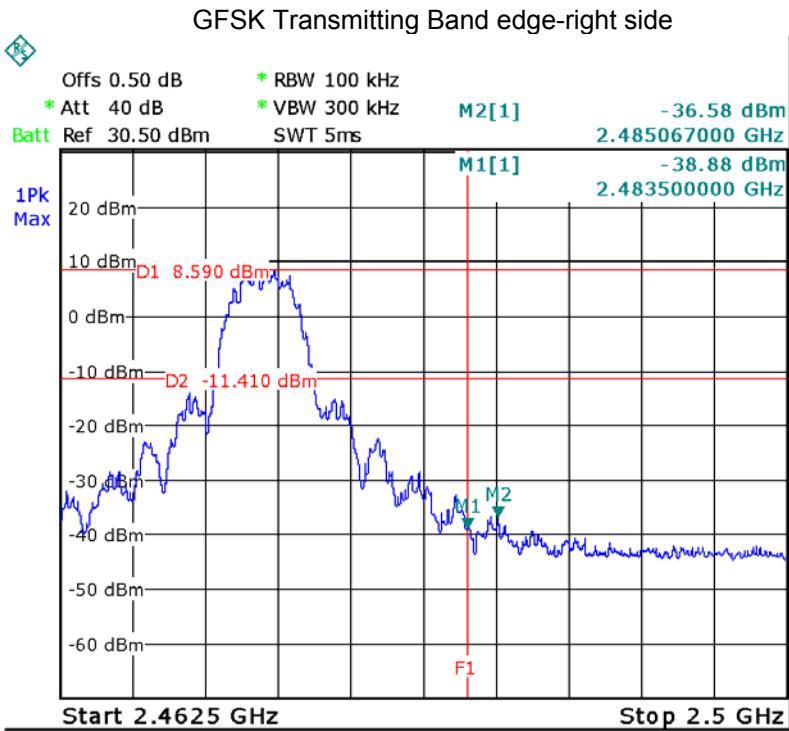
8.2 Test Setup



8.3 Test Result

Test plots





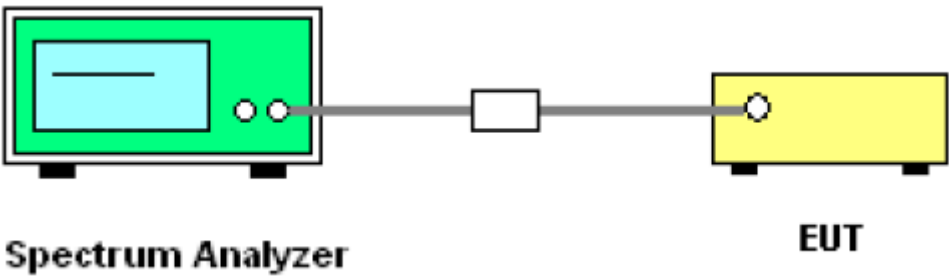
9 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: C63.10: 2013
Test Mode: Test in fixing operating frequency at low, Middle, high channel.

9.1 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 = 100 kHz, VBW = 300 kHz

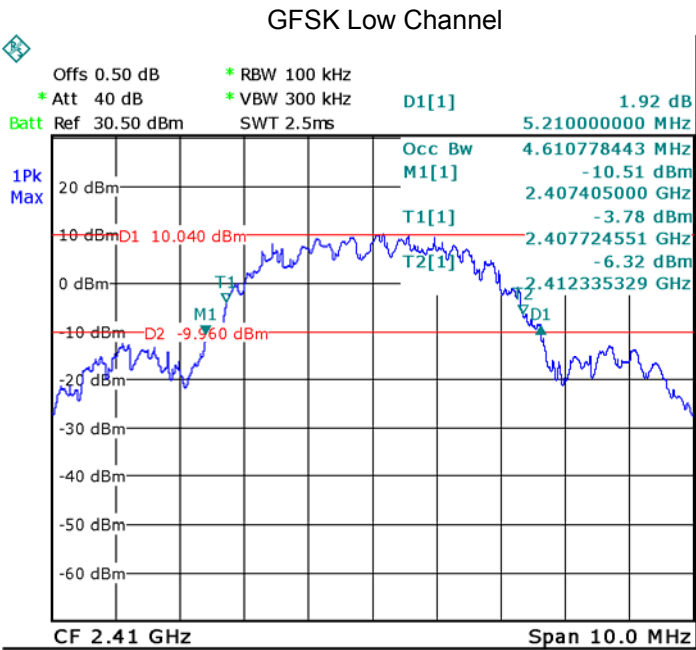
9.2 Test Setup

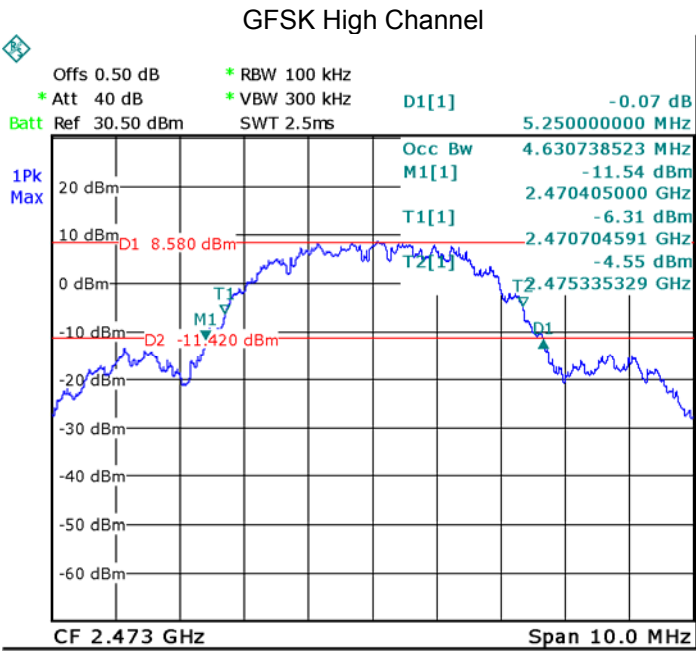
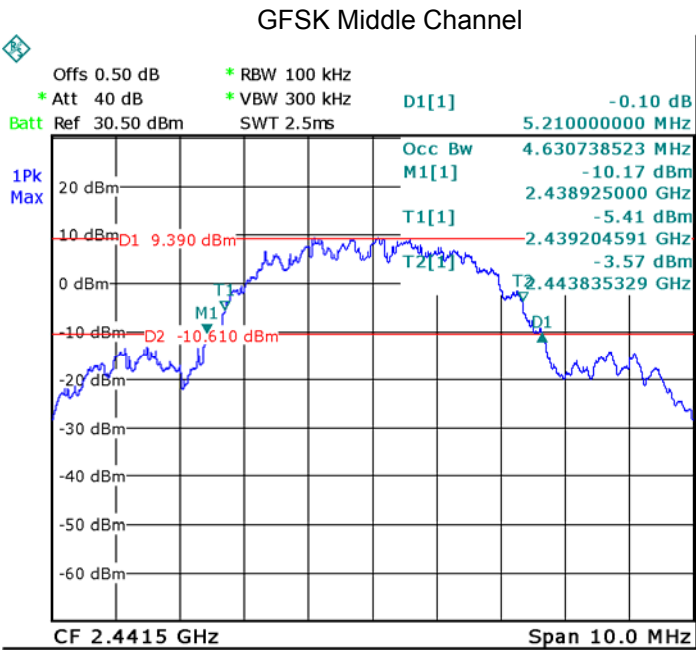


9.3 Test Result

Modulation	Test Channel	20 dB Bandwidth	99% Bandwidth
GFSK	Low	5.210MHz	4.611MHz
GFSK	Middle	5.210MHz	4.631MHz
GFSK	High	5.250MHz	4.631MHz

Test result plot as follows:





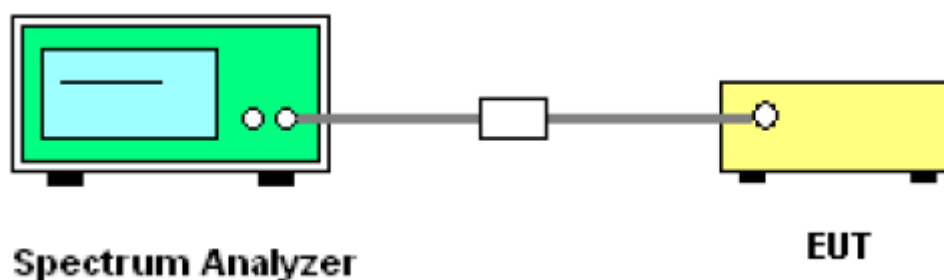
10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	C63.10:2013
Test Limit:	Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

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 = 3 MHz. VBW =3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

10.2 Test Setup

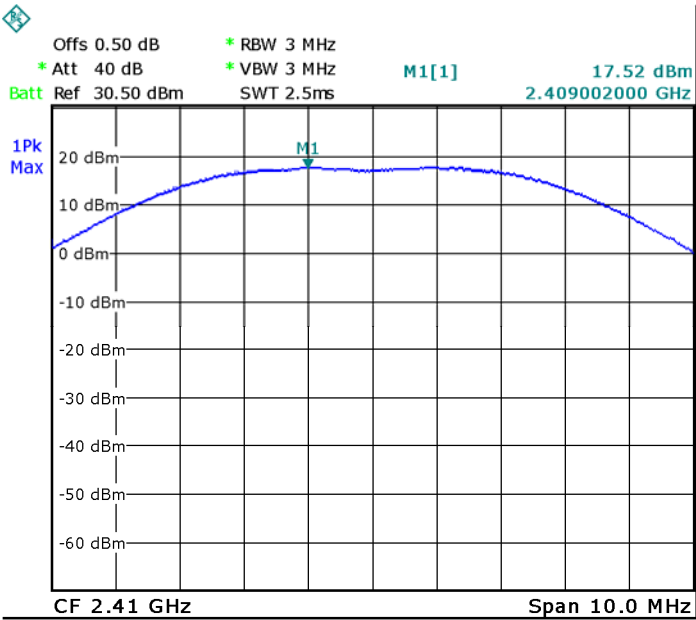


10.3 Test Result

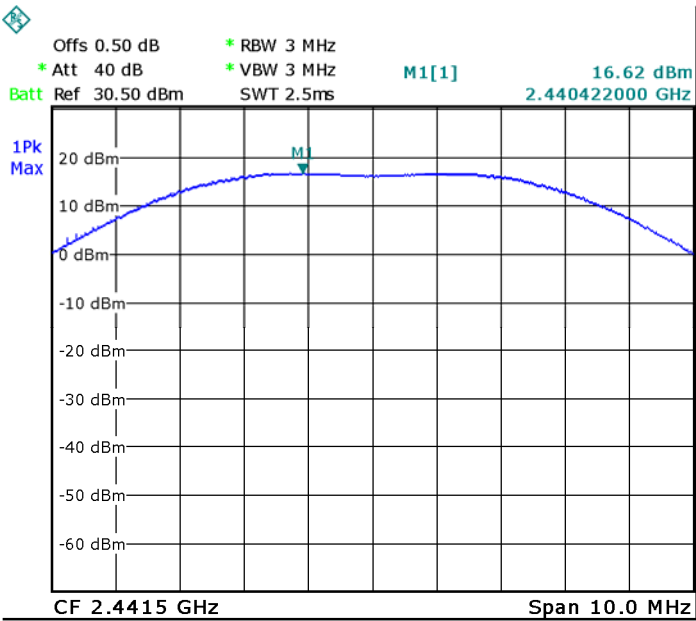
Test Mode	Data Rate	Peak Power(dBm)			Limit (dBm)
		Low Channel	Middle Channel	High Channel	
GFSK	1Mbps	17.52	16.62	15.73	20.97

Test result plot as follows:

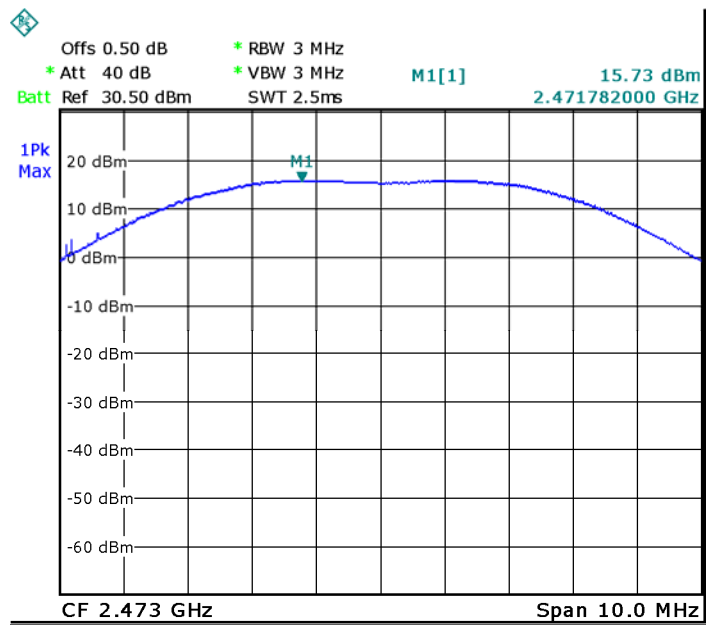
GFSK Low Channel



GFSK Middle Channel



GFSK High Channel



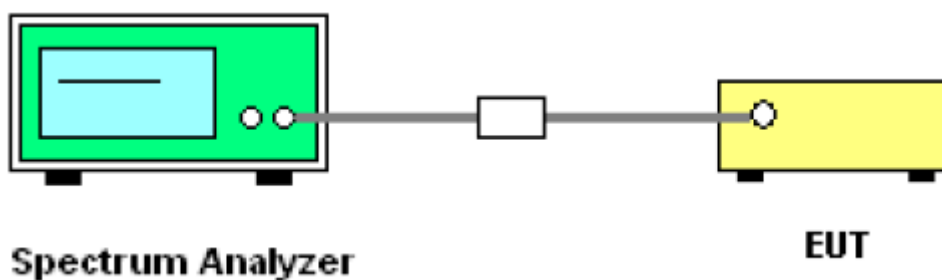
11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	C63.10:2013
Test Limit:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode:	Test in hopping transmitting operating mode.

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 = 100KHz. VBW = 300KHz , Span = 3MHz. 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.

11.2 Test Setup



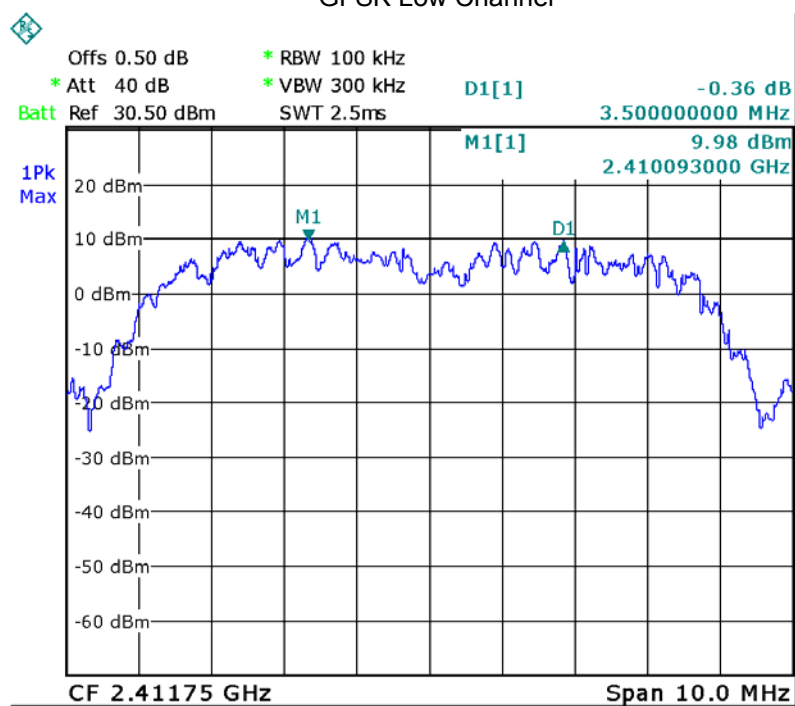
11.3 Test Result

Test result plot as follows:

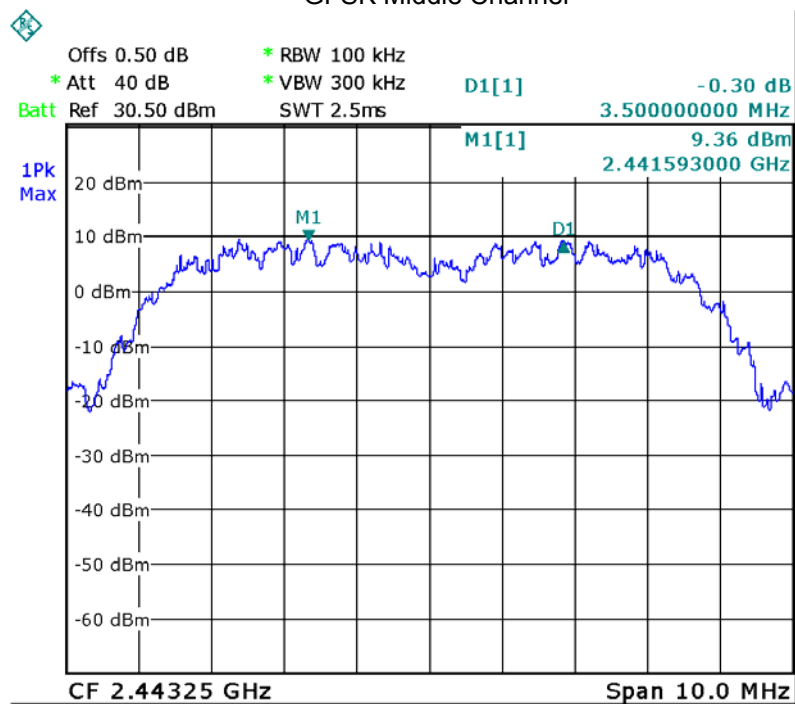
Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	3.5 MHz	PASS
GFSK	Middle	3.5 MHz	PASS
GFSK	High	3.5 MHz	PASS

Test plots

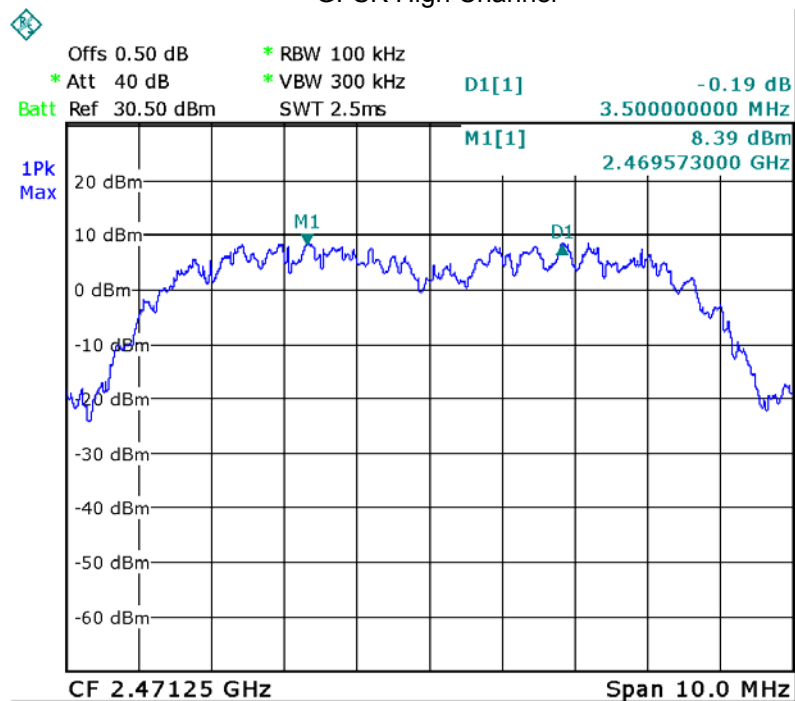
GFSK Low Channel



GFSK Middle Channel



GFSK High Channel



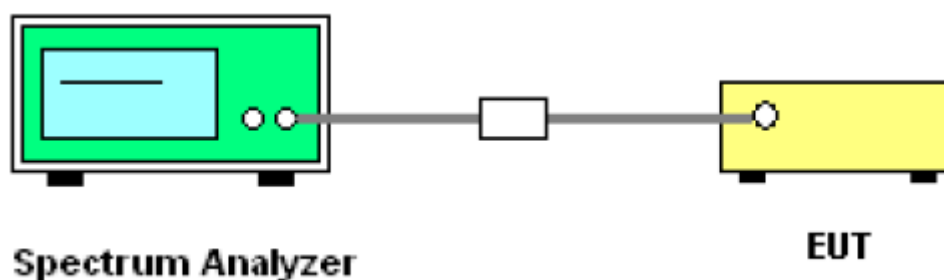
12 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	C63.10:2013
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

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 = 1MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

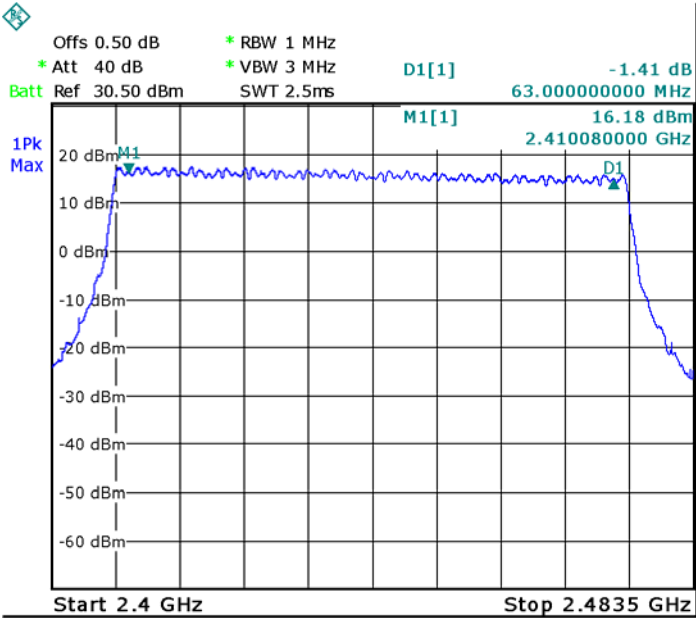
12.2 Test Setup



12.3 Test Result

Total Channels are 19 Channels.

Modulation: GFSK



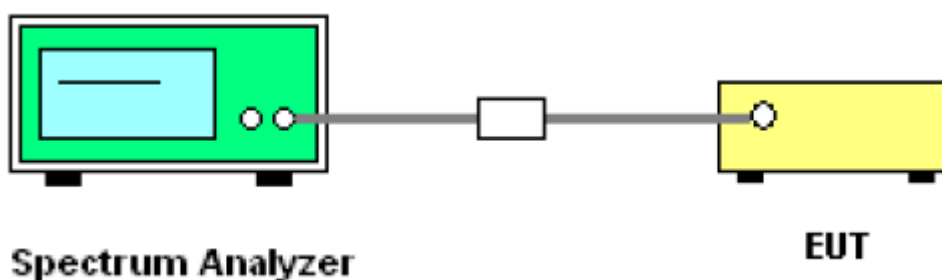
13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	C63.10:2013
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

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 spectrum analyzer span = 0. centred on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel.
- 4.Use the marker-delta function to determine the dwell time. 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).

13.2 Test Setup



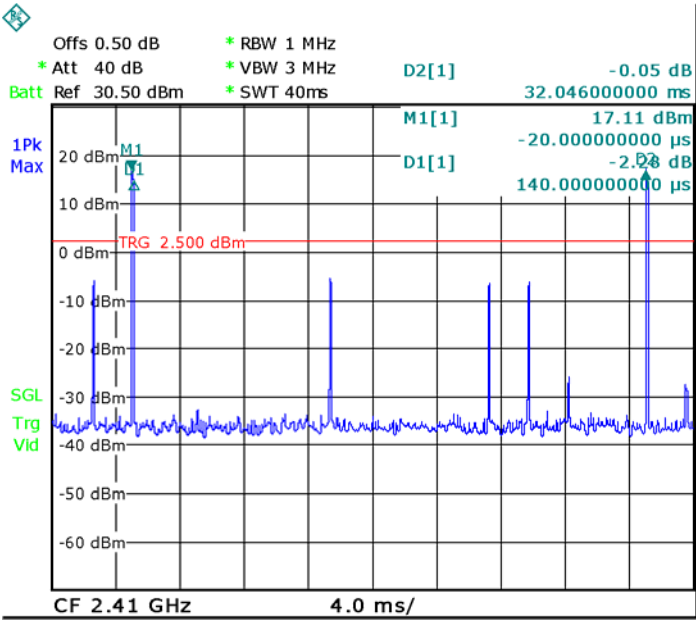
13.3 Test Result

Channel	T _{on} (ms)	T _{period} (ms)	N _(channels)	Dwell Time(ms)	Limits(ms)
Low	0.14	32.05	19	33.20	400
Middle	0.14	32.05	19	33.20	400
High	0.14	32.05	19	33.20	400

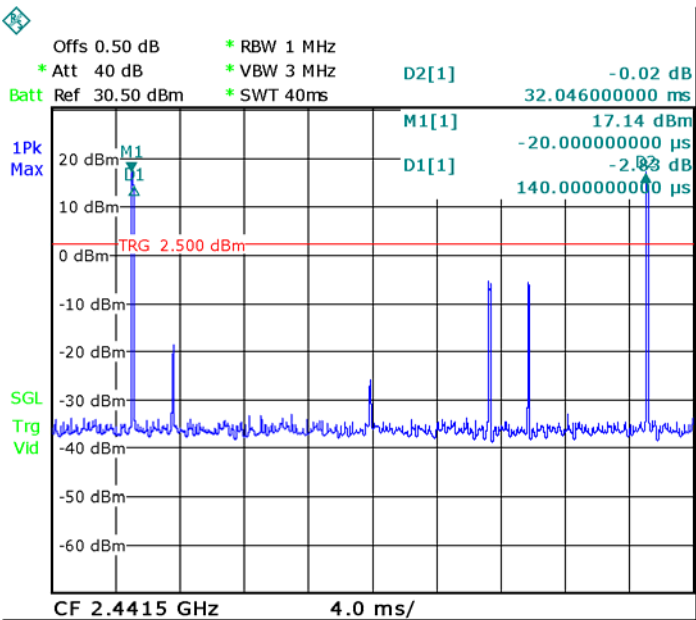
Remark: Dwell Time = T_{on} (ms)*1s/T_{period}(ms)*400ms*N_(channels)

Test Plots

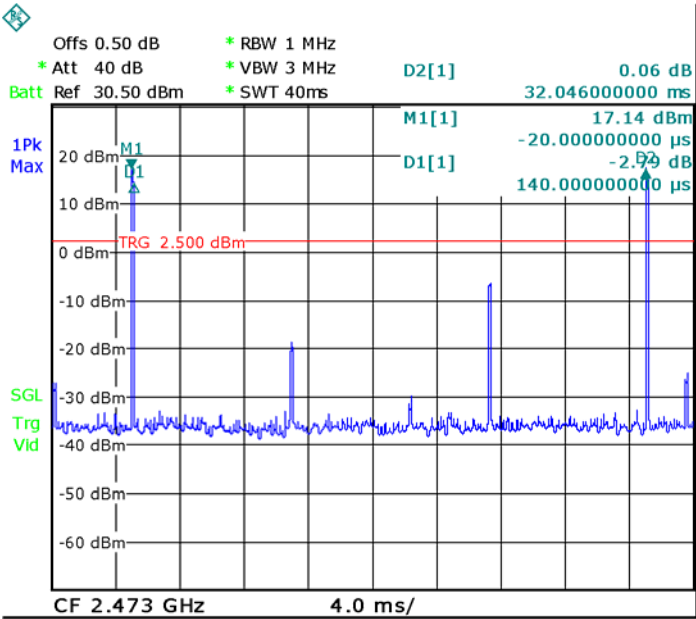
Low channel



Middle channel



High channel



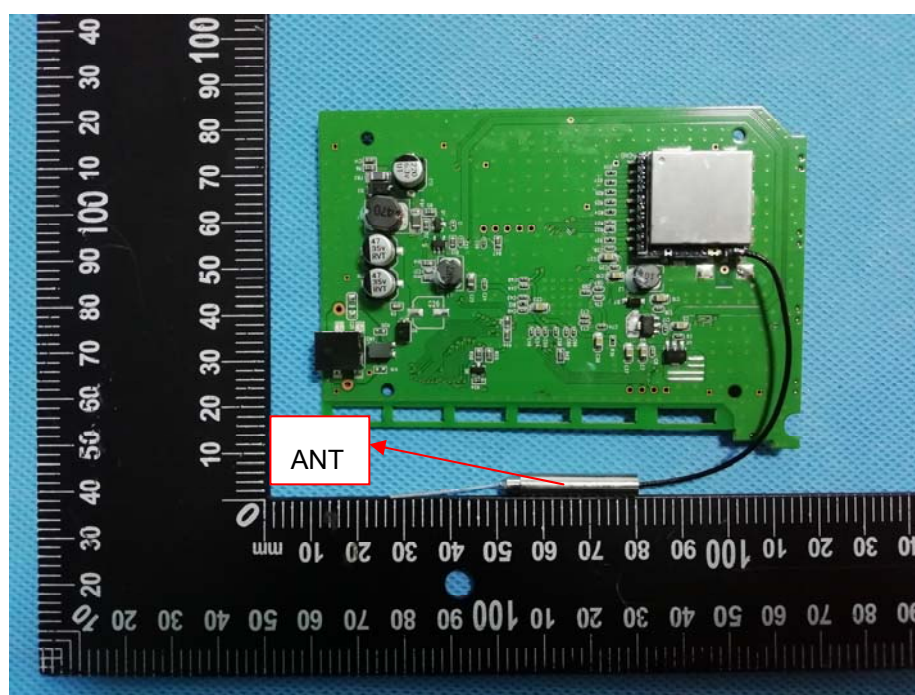
14 Antenna Requirement

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 one Internal Integral Antenna, the gain is 2 dBi. meets the requirements of FCC 15.203.



15 FCC ID: HSXBU02M RF Exposure Report

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091 & KDB 447498 D01 General RF Exposure Guidance v06

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 ²)	Averaging Time E ² , H ² 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 ²)	Averaging Time E ² , H ² 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

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = output power to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

From the peak EUT RF output power, the minimum mobile separation distance, R=20cm, as well as the gain of the used antenna, the RF power density can be obtained

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. conducted Output Power (dBm)	Max. conducted Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)	Result
2.0	1.585	17.52	56.49	0.0178	1	Compliance

15.4 Result: Compliance

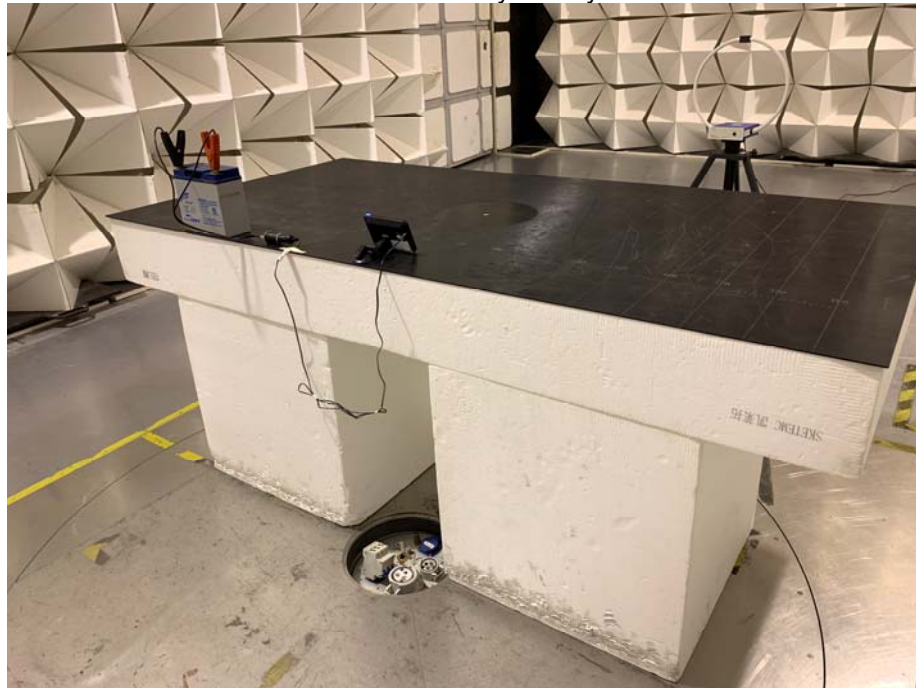
No SAR measurement is required.

16 Photographs – Model WBU-800M Test Setup Photos

16.1 Photograph – Radiation Spurious Emission Test Setup Photos

9 kHz to 30 MHz

DC 12V by battery

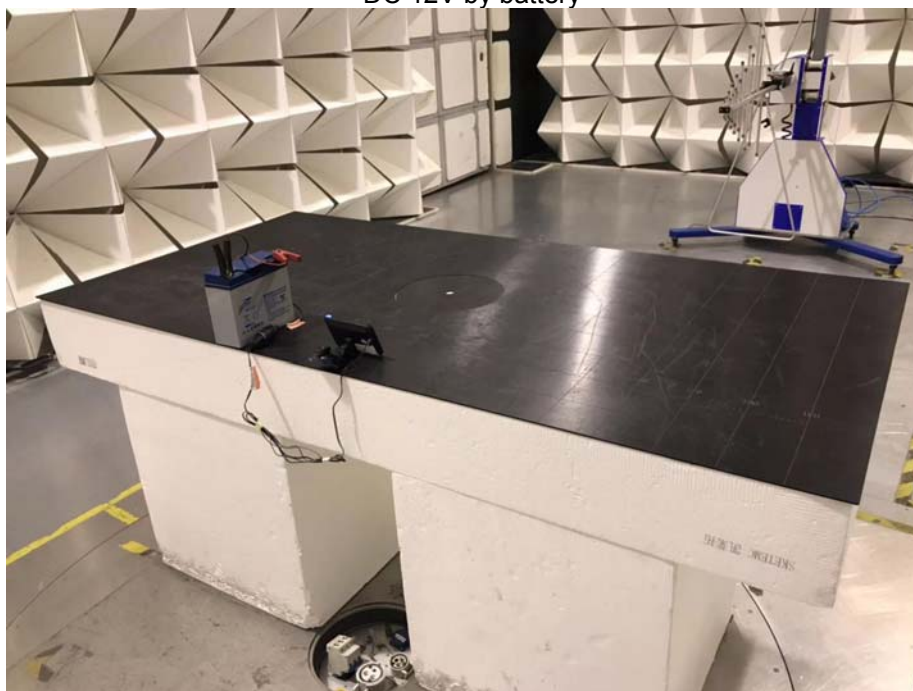


DC 24V by battery

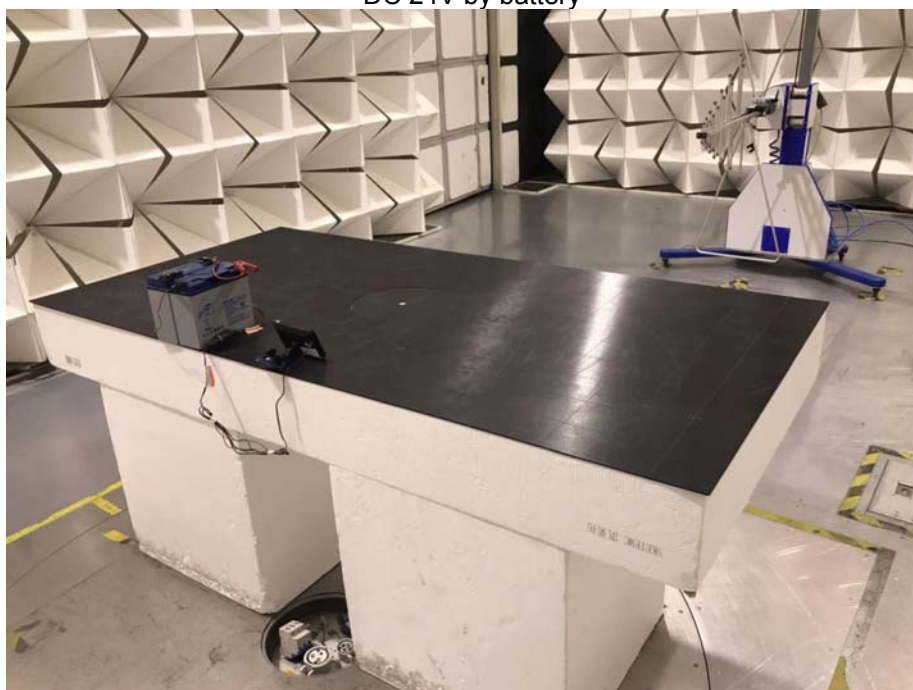


From 30 MHz to 1GHz

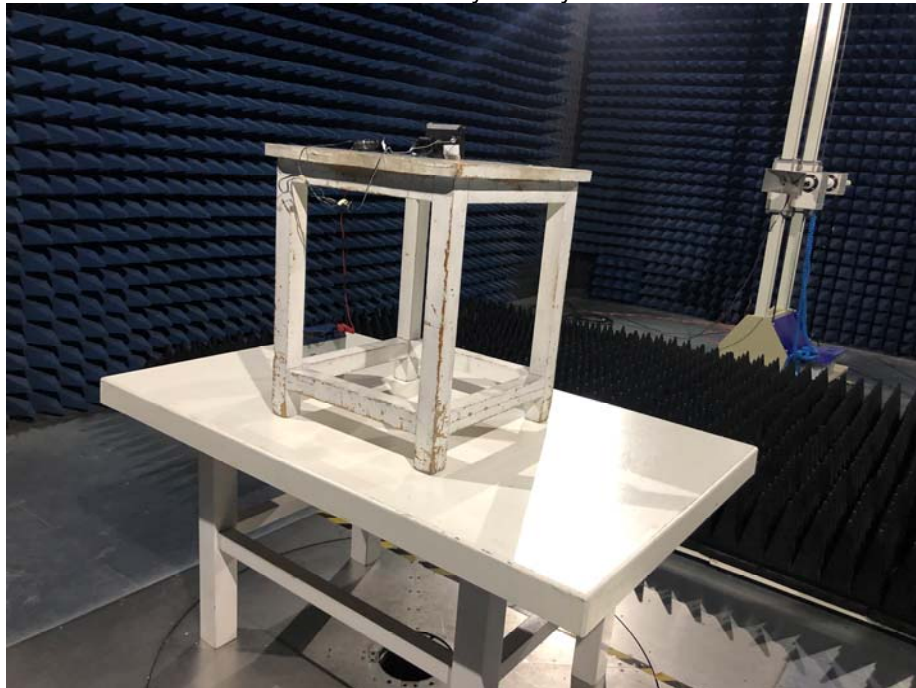
DC 12V by battery



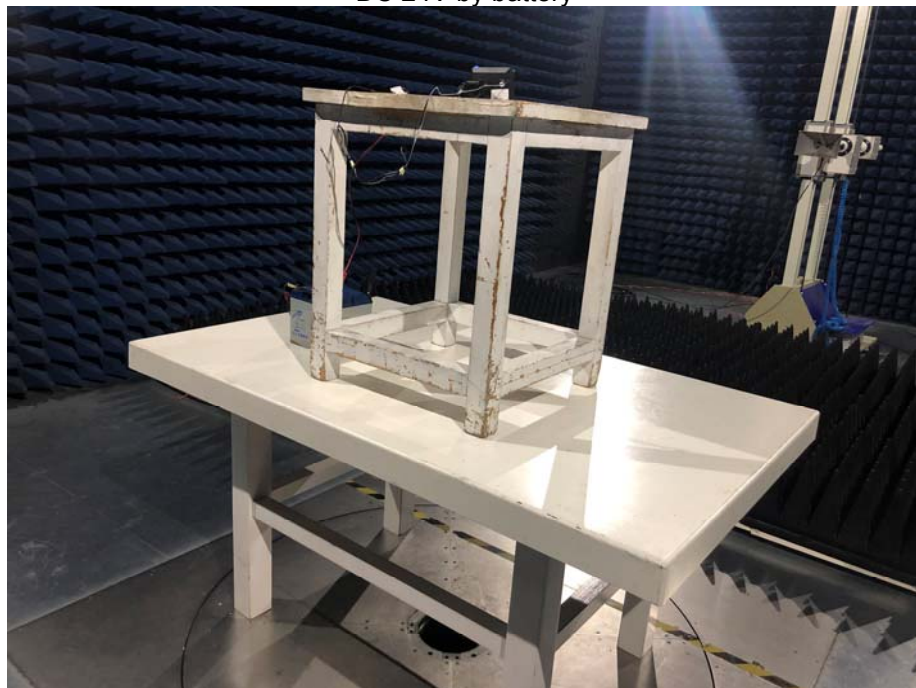
DC 24V by battery



Above 1GHz
DC 12V by battery



DC 24V by battery



17 Photographs - Constructional Details

17.1 Model WBU-800M - External Photos





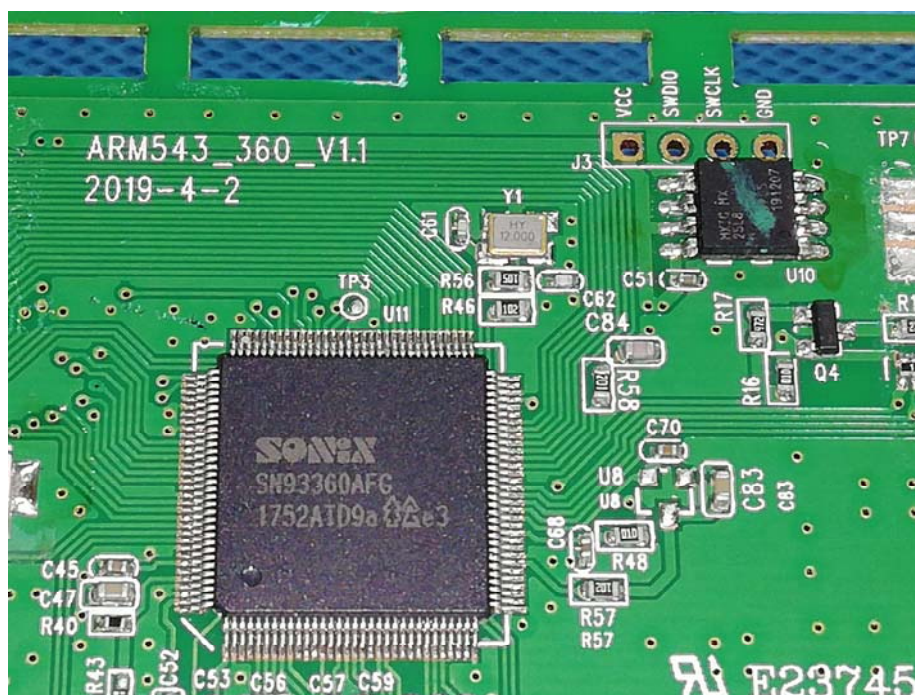
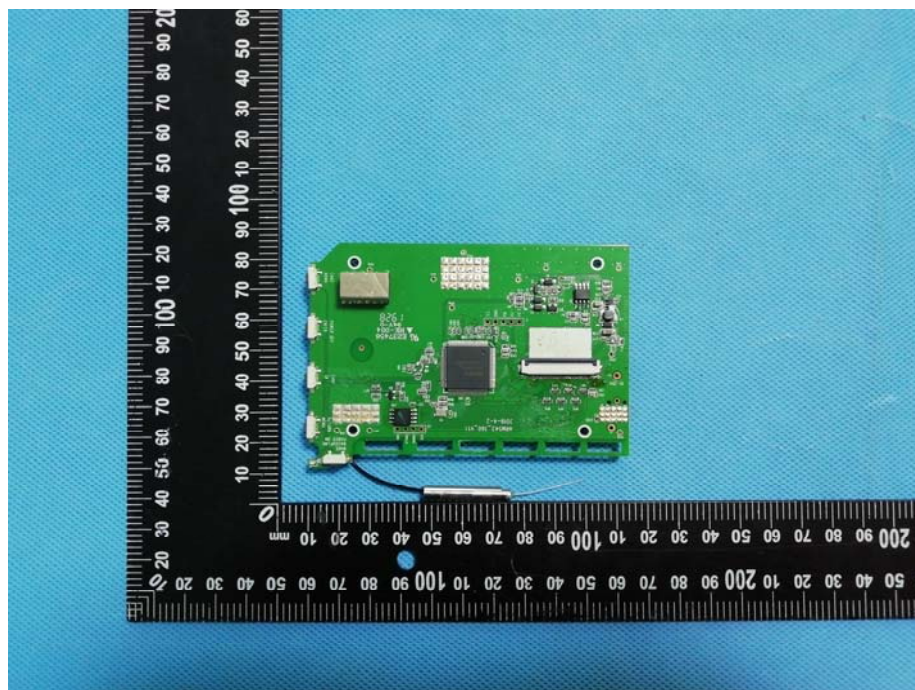


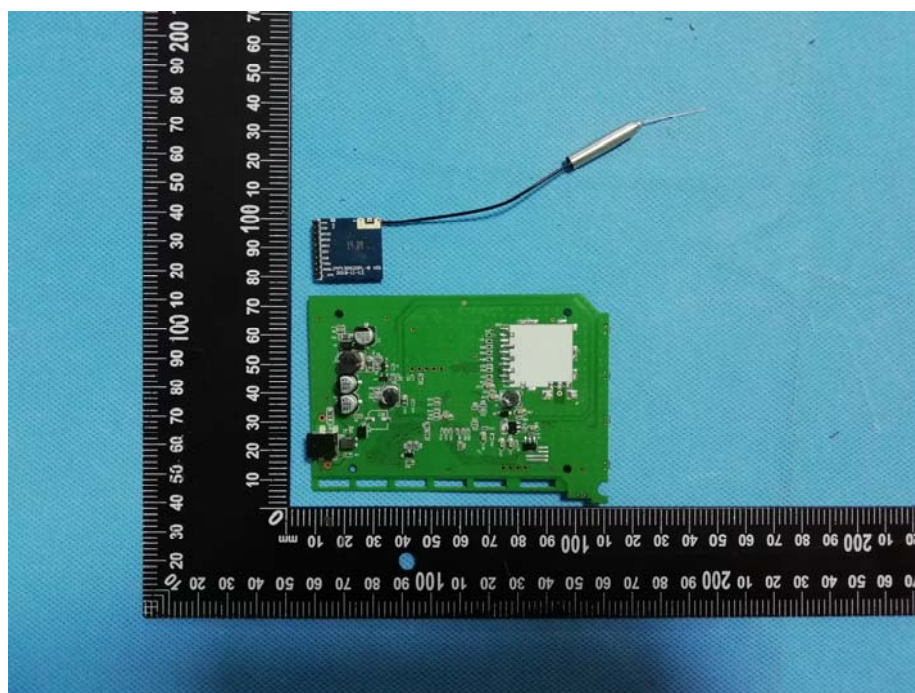
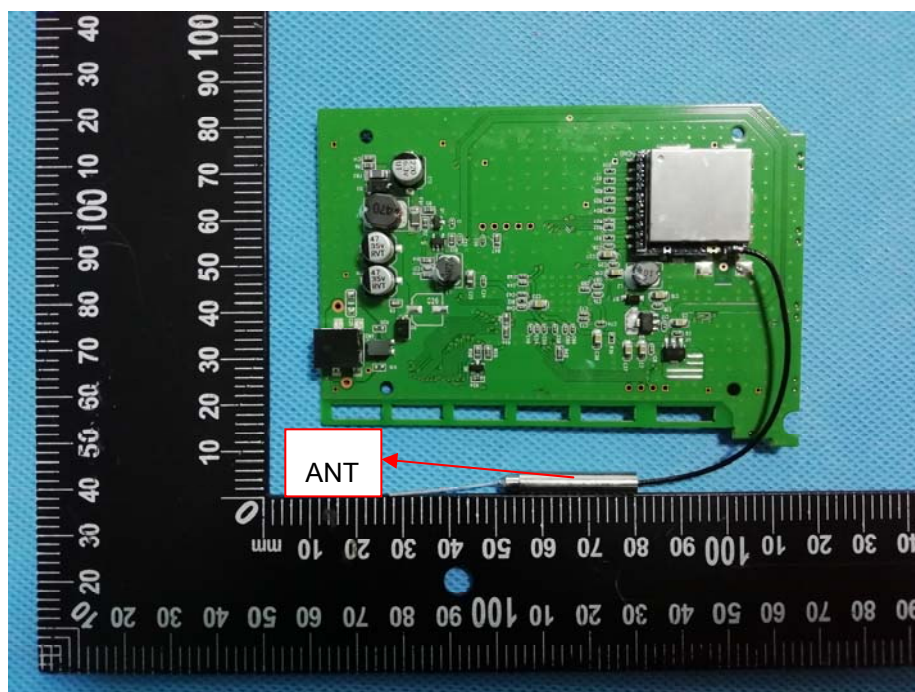


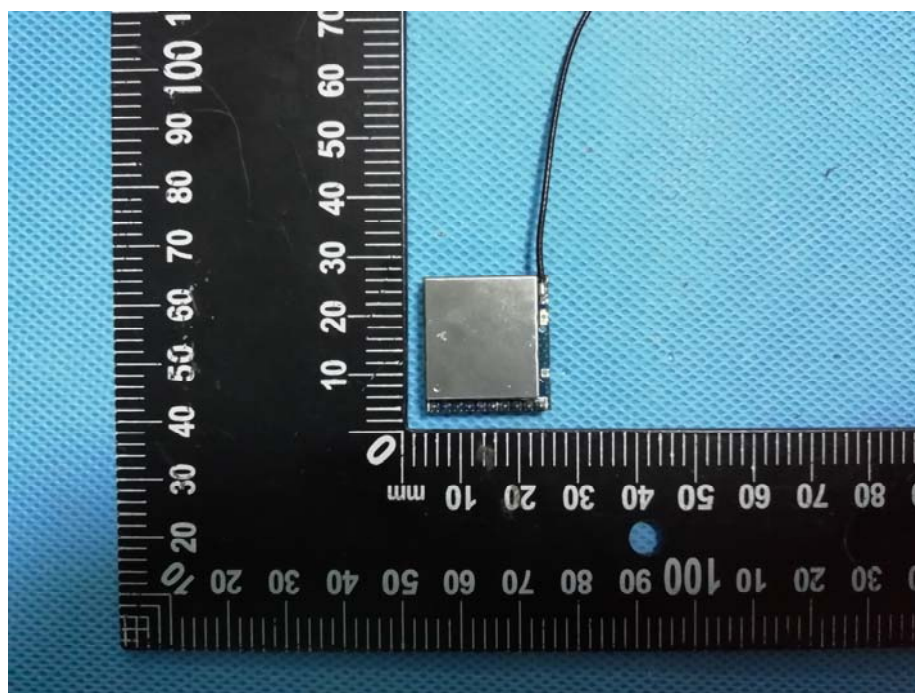
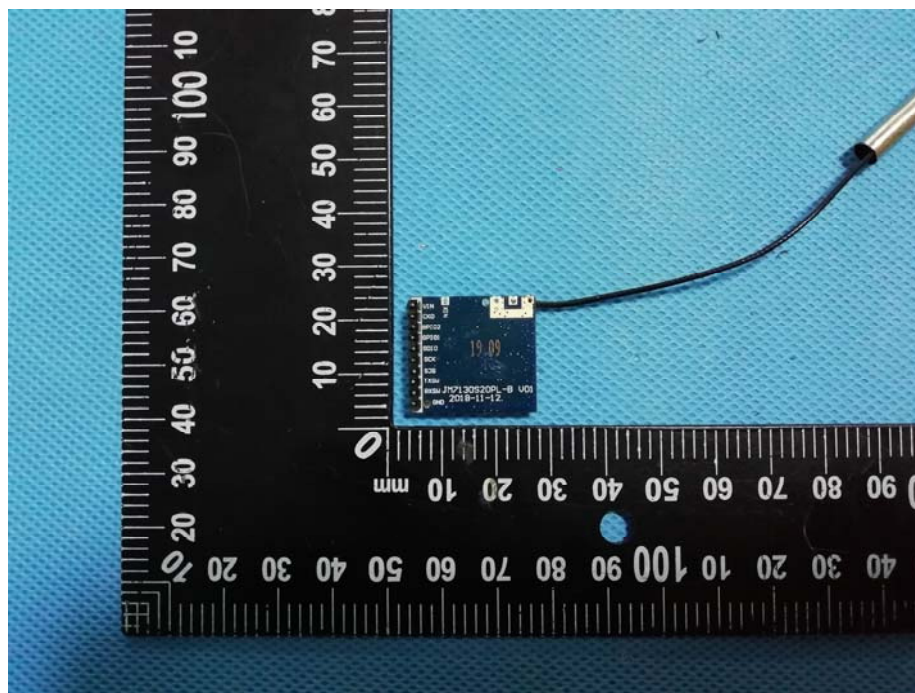


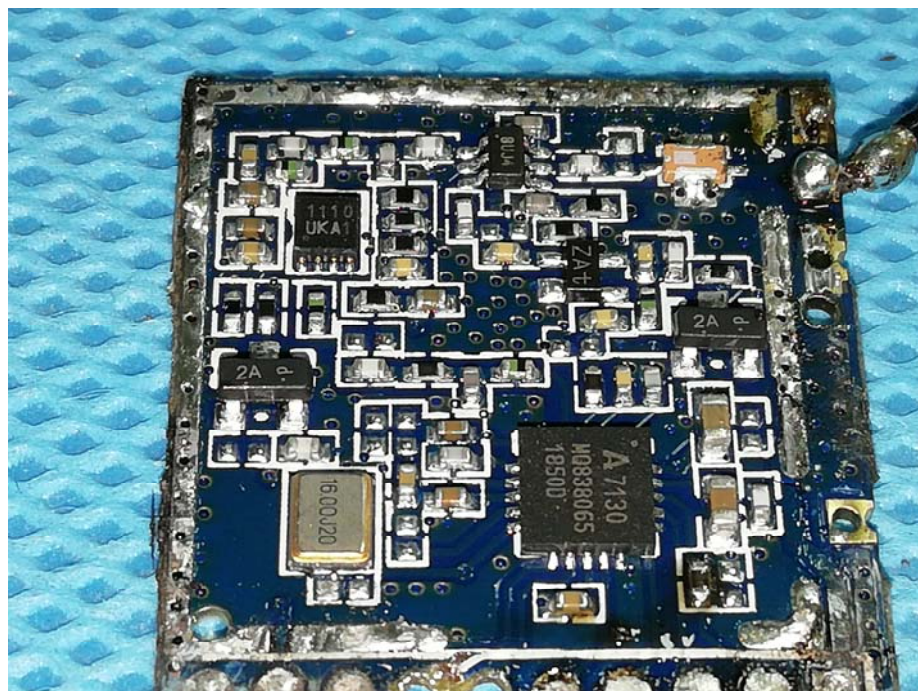
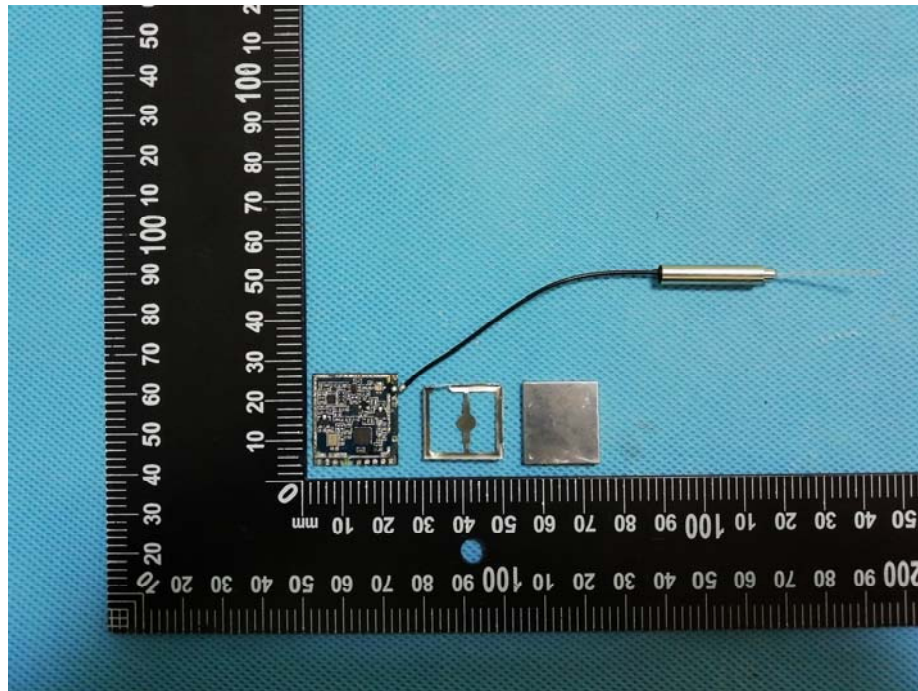
17.2 Model WBU-800M - Internal Photos











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