TEST REPORT

Reference No......	:	WTS16S0550710E
FCC ID.....	:	XBAFT118
Applicant.....	:	Aeon Labs LLC.
Address.....	:	1228 NORVELL ST.EL CERRITO, CA 94530 USA
Manufacturer	:	Fantem Technologies (Shenzhen) Co., Ltd.
Address.....	:	North, 3/F, Yitoa Technology Industrial Park, Baihua Yuan Rd., The Second Industrial Area, Guangming Sub-districtOffice, Guangming New District, Shenzhen, Guangdong, China.
Product Name.....	:	Range Extender,Range Extender 6 Plus,Range Extender 6,Range Extender Gen5
Model No.....	:	FT118-A01,ZW118-A01,ZW117-A01,ZW119-A01
Brand.....	:	AEOTEC, Fantem
Standards.....	:	FCC CFR47 Part 15 Section 15.249: 2015
Date of Receipt sample.....	:	May 17, 2016
Date of Test.....	:	May 18, – Aug. 05, 2016
Date of Issue.....	:	Aug. 19, 2016
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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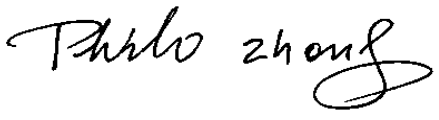
Approved by:



Philo Zhong / Manager

2 Contents

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS16S0550710E	May 17, 2016	May 18, – Aug. 05, 2016	Aug. 13, 2016	original	-	Replaced
WTS16S0550710E	May 17, 2016	May 18, – Aug. 05, 2016	Aug. 19, 2016	Revision1	Update Model Description	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name: Range Extender,Range Extender 6 Plus,Range Extender 6,Range Extender Gen5

Model No.: FT118-A01,ZW118-A01,ZW117-A01,ZW119-A01

Model Differences:

Name	Model	Country	Frequency	PA	NFC	RGB	Brand	Differences description
Range Extender 6	ZW117-A01	US	908.40MHz 908.42MHz	N	N	Y	AEOTEC	NFC IC（U3）vacancy PA IC （U5）vacancy
Range Extender Gen5	ZW119-A01	US	908.40MHz 908.42MHz	N	N	N	AEOTEC	NFC IC（U3）vacancy PA IC （U5）vacancy RGB IC（U4）vacancy
Range Extender 6 Plus	ZW118-A01	US	908.40MHz 908.42MHz	Y	N	Y	AEOTEC	NFC IC（U3）vacancy
Range Extender	FT118-A01	US	908.40MHz 908.42MHz	Y	Y	Y	FANTEM	Completed

Type of Modulation: FSK

Frequency Range: 908.40MHz,908.42MHz

The Lowest Oscillator: 32MHz

Antenna installation: Integrated Antenna

Antenna Gain: -3dBi

4.2 Details of E.U.T.

Technical Data: AC 120V, 60Hz, Max: 0.1A

4.3 Standards Applicable for Testing

The tests were performed according to following standards:

FCC CFR47 Part 15 Section 15.249: 2015 Telecommunication-RADIO FREQUENCY DEVICES-Intentional Radiators-Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.

4.4 Test Facility

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

- **IC – Registration No.:7760A-1**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A-1, Octorber 15, 2015.

- **FCC Test Site 1#– Registration No.: 880581**

  Waltek Services(Shenzhen) 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 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

  Waltek Services(Shenzhen) 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 328995, December 3, 2014

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests.

And according to FCC 47 CFR Section 15.203(m):

Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle.
1 to 10 MHz	2	1 near top and 1 near bottom.
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

So frequency range over 908.40MHz to 908.42MHz is 1MHz or less, only the Middle channel were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	908.40MHz	908.42MHz	N/AMHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions Test Site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.15,2015	Sep.14,2016
2.	LISN	R&S	ENV216	101215	Sep.15,2015	Sep.14,2016
3.	Cable	Top	TYPE16(3.5M)	-	Sep.15,2015	Sep.14,2016
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2015	Sep.14,2016
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2015	Sep.14,2016
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2016	Apr.18,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2015	Sep.14,2016
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2016	Apr.18,2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2016	Apr.18,2017
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2016	Mar.16,2017
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2016	Apr.09,2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	Sep.15,2015	Sep.14,2016
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.15,2015	Sep.14,2016
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2015	Sep.14,2016
4	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2015	Sep.14,2016
RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.15,2015	Sep.14,2016

2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.15,2015	Sep.14,2016
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.15,2015	Sep.14,2016

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	C
Radiated Emission	15.249(a) 15.209 15.205(a)	C
Periodic Operation	15.35(c)	C
Band Edge	15.249 15.205 15.209	C
20dB Bandwidth	15:215(c)	C
Antenna Requirement	15.203	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;ANSI C63.4:2014
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)
Test Result:	☑ Pass ☐ not applicable (Remark)

7.1 E.U.T. Operation

Operating Environment **:**

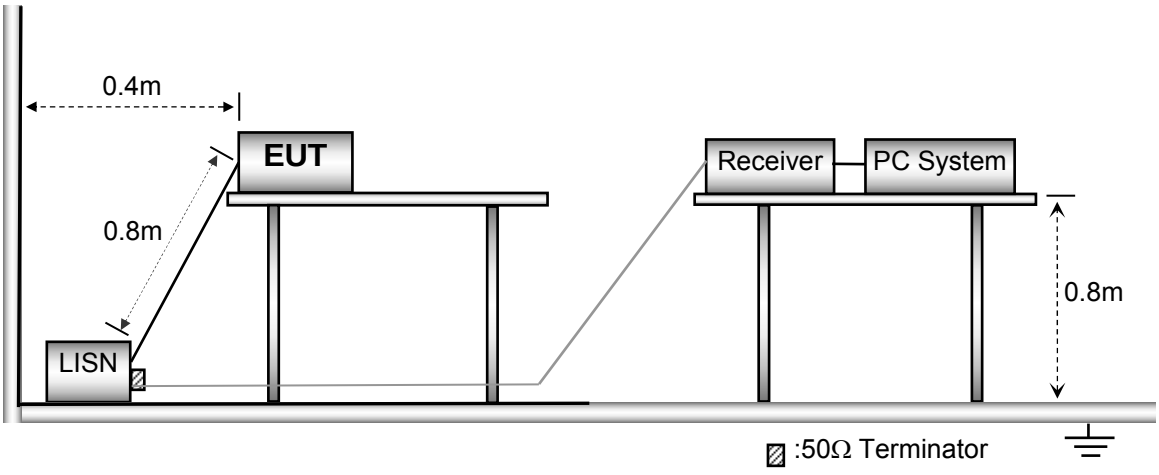
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

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 C63.10:2013

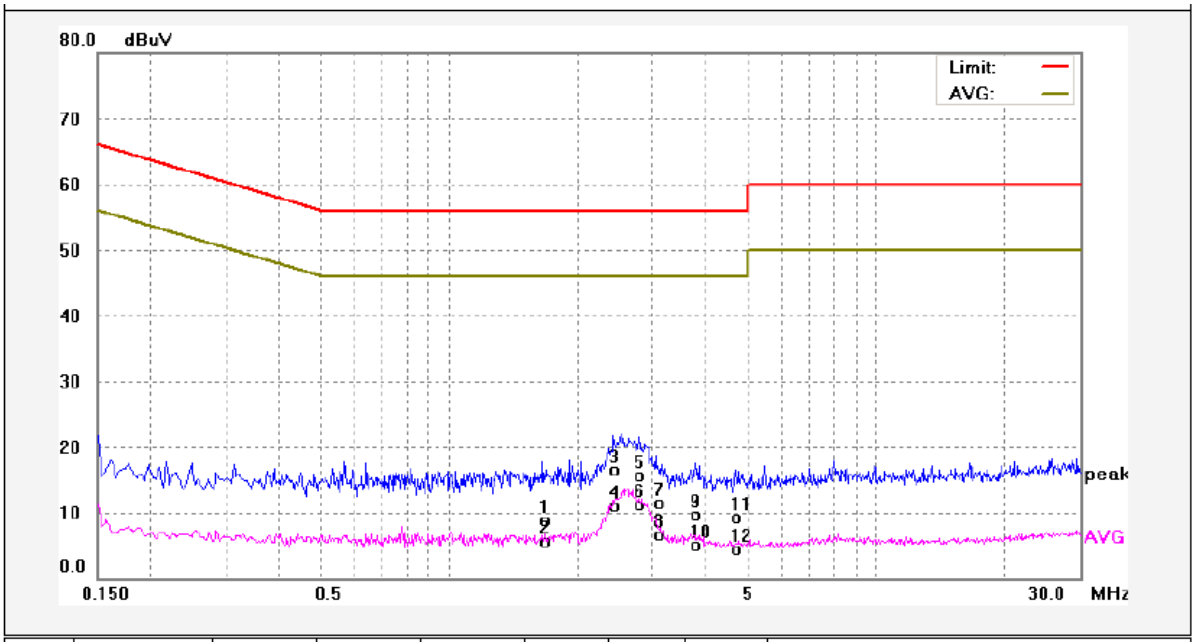


7.3 Measurement Description

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.

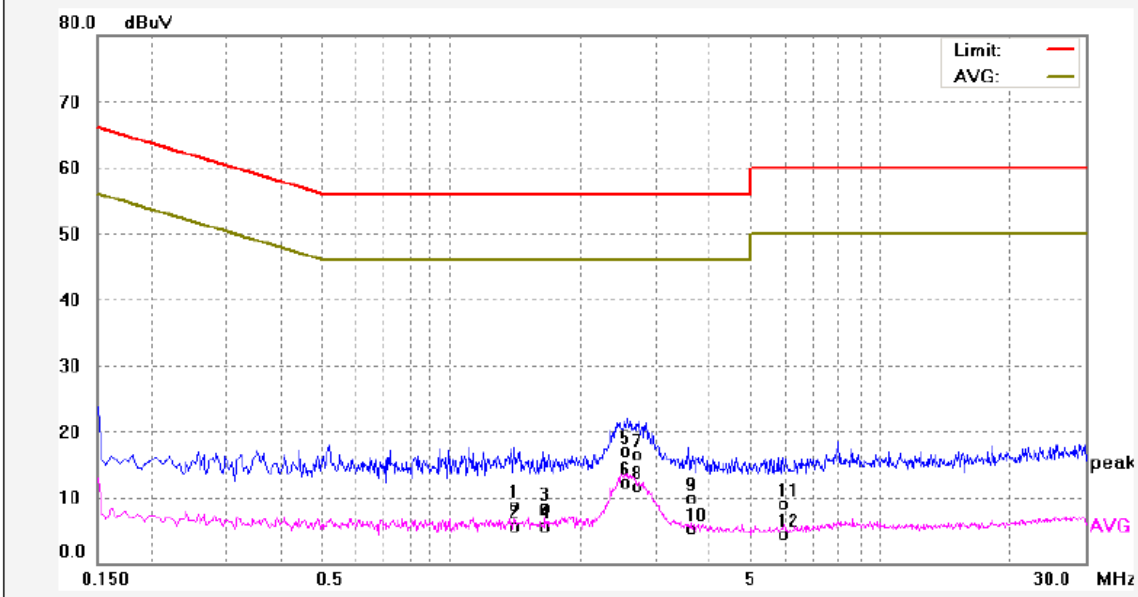
7.4 Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	1.6620	-1.02	9.85	8.83	56.00	-47.17	QP	
2	1.6620	-4.09	9.85	5.76	46.00	-40.24	AVG	
3	2.4260	6.54	9.91	16.45	56.00	-39.55	QP	
4	2.4260	1.25	9.91	11.16	46.00	-34.84	AVG	
5	2.7900	5.87	9.91	15.78	56.00	-40.22	QP	
6	2.7900	1.34	9.91	11.25	46.00	-34.75	AVG	
7	3.1420	1.53	9.91	11.44	56.00	-44.56	QP	
8	3.1420	-3.27	9.91	6.64	46.00	-39.36	AVG	
9	3.7900	-0.24	9.91	9.67	56.00	-46.33	QP	
10	3.7900	-4.86	9.91	5.05	46.00	-40.95	AVG	
11	4.7100	-0.72	9.97	9.25	56.00	-46.75	QP	
12	4.7100	-5.39	9.97	4.58	46.00	-41.42	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	1.4100	-0.92	9.83	8.91	56.00	-47.09	QP	
2	1.4100	-4.05	9.83	5.78	46.00	-40.22	AVG	
3	1.6380	-1.29	9.85	8.56	56.00	-47.44	QP	
4	1.6380	-4.10	9.85	5.75	46.00	-40.25	AVG	
5	2.5340	7.22	9.91	17.13	56.00	-38.87	QP	
6	2.5340	2.46	9.91	12.37	46.00	-33.63	AVG	
7	2.7500	6.57	9.91	16.48	56.00	-39.52	QP	
8	2.7500	1.71	9.91	11.62	46.00	-34.38	AVG	
9	3.5660	0.02	9.91	9.93	56.00	-46.07	QP	
10	3.5660	-4.65	9.91	5.26	46.00	-40.74	AVG	
11	5.9500	-0.95	10.04	9.09	60.00	-50.91	QP	
12	5.9500	-5.51	10.04	4.53	50.00	-45.47	AVG	

8 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249&15.209&15.205

Test Method: ANSI 63.10: 2013;ANSI C63.4:2014

Measurement Distance: 3m

Test Result: ☑Pass ☐Fail

15.249(a)Limit:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

15.209 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	$20\log^{(500)}$

Note: RF Voltage(dBuV)=20 $\log_{10}$ RF Voltage(uV)

8.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 51.1 % RH

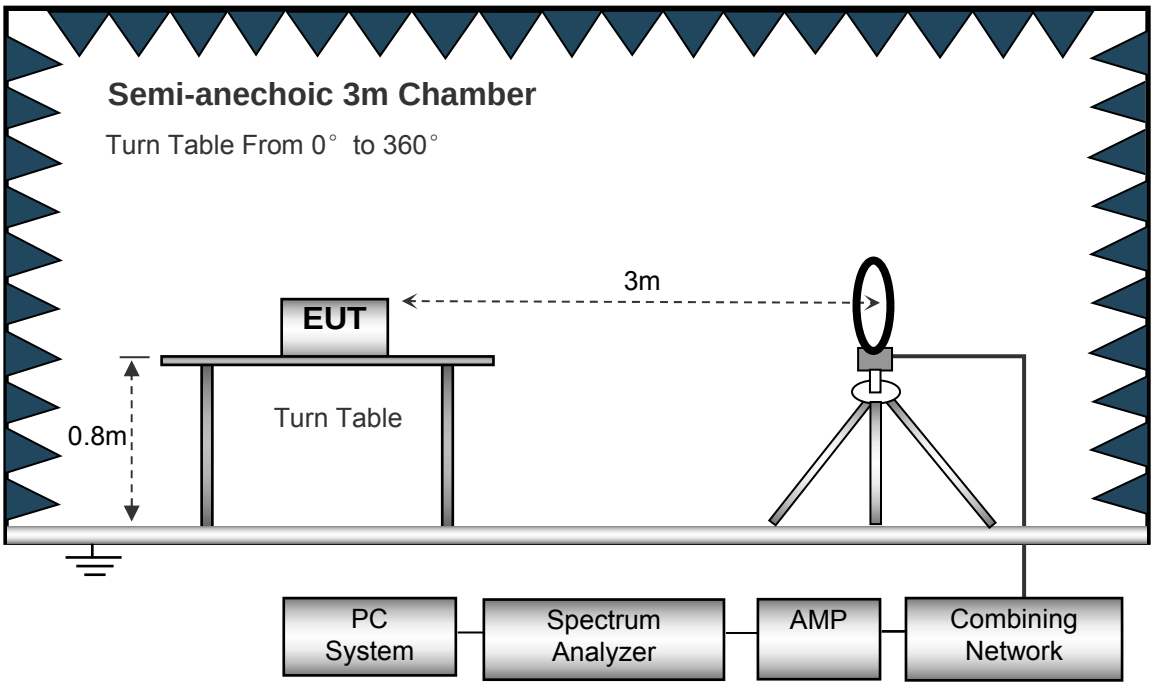
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

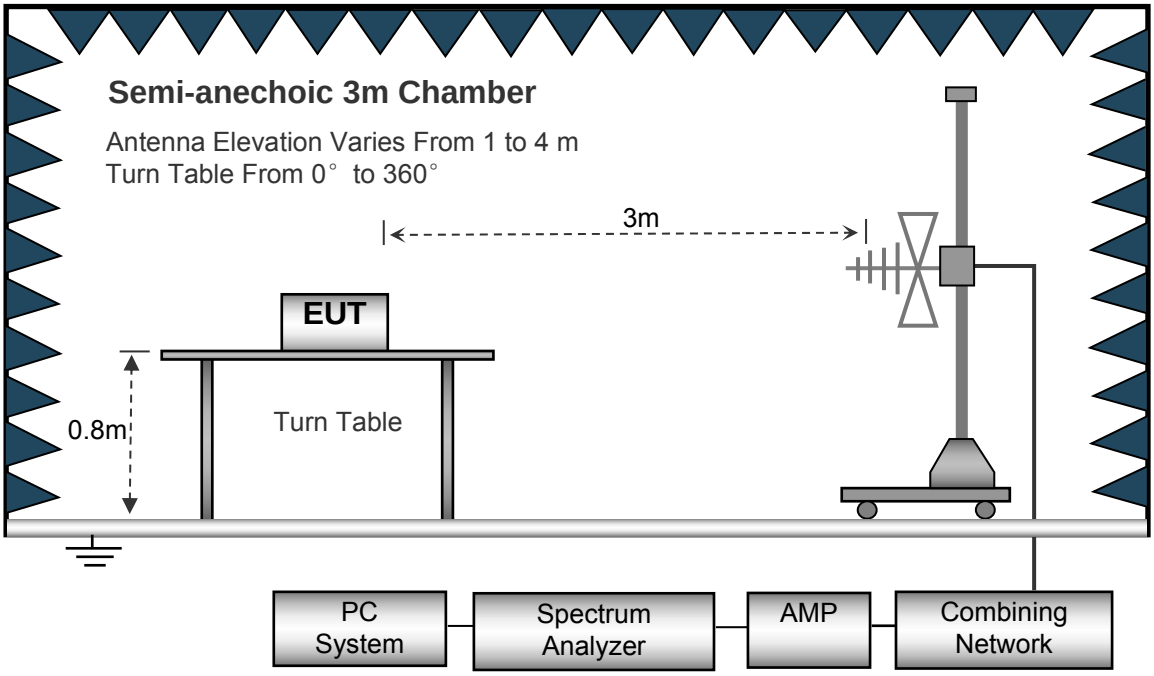
The test was performed in transmitting mode, the test data were shown in the report.

8.2 Test Setup

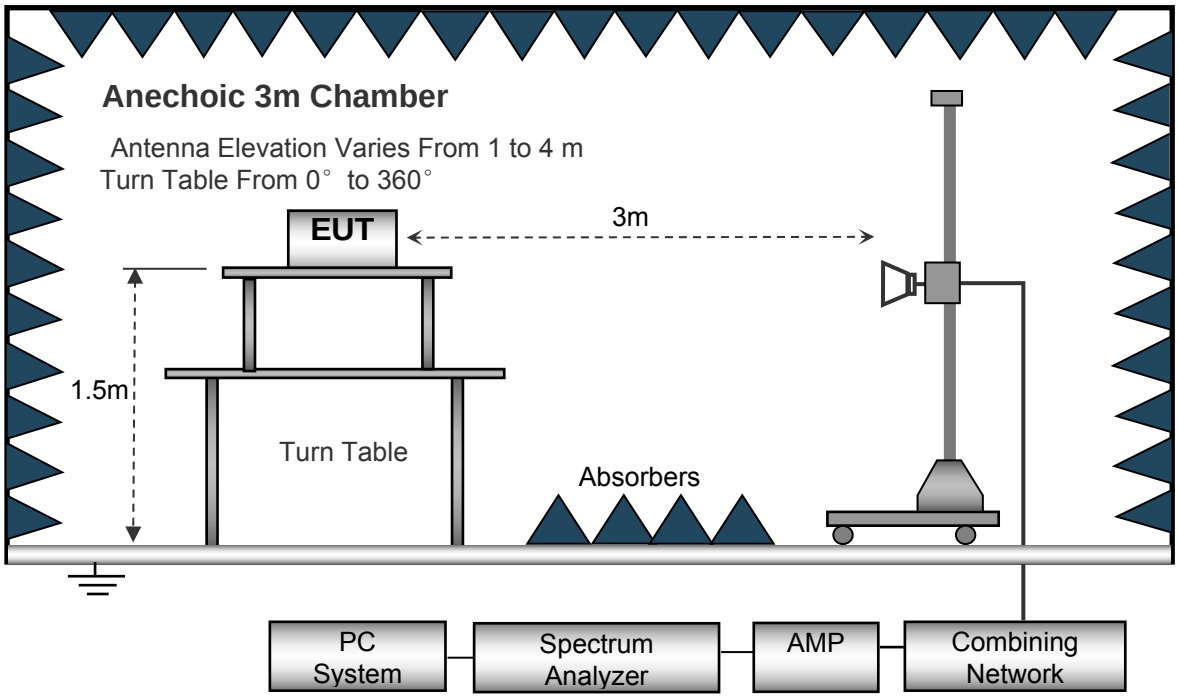
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.
The test setup for emission measurement below 30MHz.



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



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

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 above1GHz, 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. 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.

8.5 Frequency range of radiated measurements.

According to FCC 47 CFR Section 15.33:

(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

Result: So the Frequency range of radiated form: 4.906MHz to 10GHz.

8.6 Test Result

Test Frequency: 30MHz ~ 10GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
54.25	40.47	QP	291	1.3	V	-10.80	29.67	40.00	-10.33
908.42	84.80	PK	304	1.5	H	0.50	85.30	114.00	-28.70
908.42	84.97	PK	133	1.6	V	0.50	85.47	114.00	-28.53
1816.84	76.03	PK	81	1.2	H	-15.28	60.75	94.00	-33.25
1816.84	65.92	PK	215	1.4	V	-15.28	50.64	94.00	-43.36
2725.26	68.94	PK	260	1.8	H	-13.08	55.86	94.00	-38.14
2725.26	57.14	PK	68	1.8	V	-13.08	44.06	94.00	-49.94
5080.00	49.57	PK	158	1.2	H	-1.13	48.44	74.00	-25.56
5080.00	49.11	PK	2	1.9	V	-1.13	47.98	74.00	-26.02

AV = Peak +20Log10(duty cycle) =PK+(-18.89) [refer to section 9 for more detail]

Frequency	PK	RX Antenna Polar	Duty cycle Factor	AV	FCC Part 15.249/209/205	
					Limit	Margin
(MHz)	(dBμV/m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
54.25	85.30	H	-18.89	66.41	94.00	-27.59
908.42	85.47	V	-18.89	66.58	94.00	-27.42
908.42	60.75	H	-18.89	41.86	74.00	-32.14
1816.84	50.64	V	-18.89	31.75	74.00	-42.25
1816.84	55.86	H	-18.89	36.97	74.00	-37.03
2725.26	44.06	V	-18.89	25.17	74.00	-48.83
2725.26	48.44	H	-18.89	29.55	54.00	-24.45
5080.00	47.98	V	-18.89	29.09	54.00	-24.91

9 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity,the duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

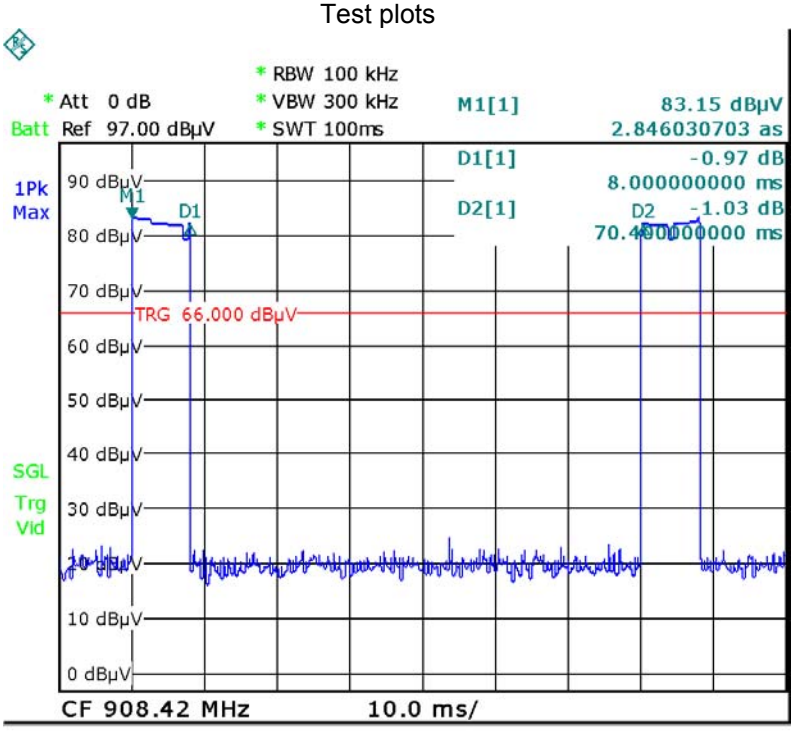
Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log_{10}(Duty Cycle)

Total transmission time(ms)	8.00
Length of a complete transmission period(ms)	70.40
Duty Cycle(%)	11.36
Duty Cycle Correction Factor(dB)	-18.89

Refer to the duty cycle plot (as below)

Test plots



10 Band Edge

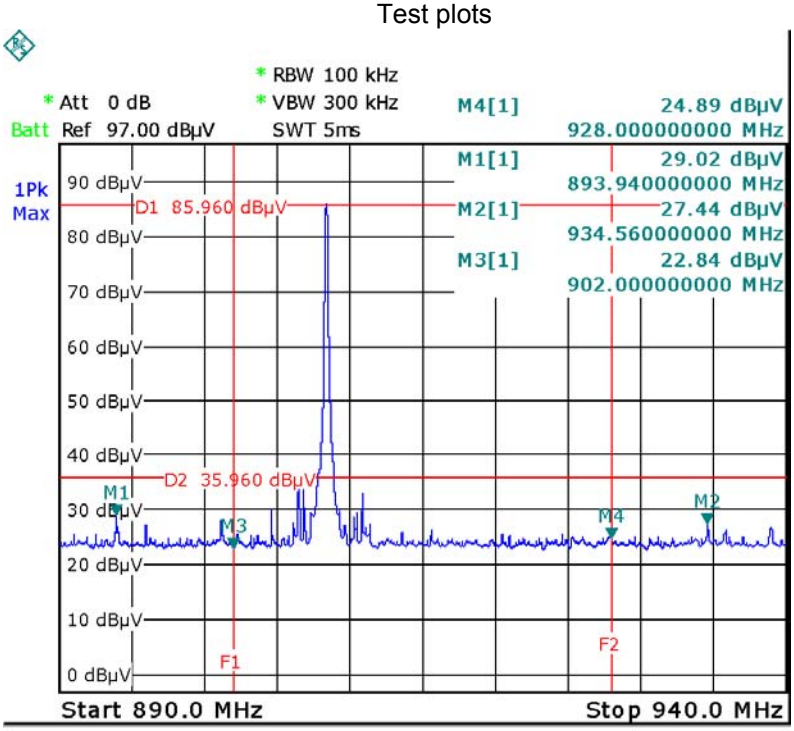
Test Requirement:	15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
Test Method:	ANSI C63.10:2013
Test Mode:	Transmitting

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, Sweep = auto
   Detector function = peak, Trace = max hold

10.2 Test Result

Test plots



11 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.215(c)

Test Method: ANSI C63.10:2013

Test Mode: Transmitting

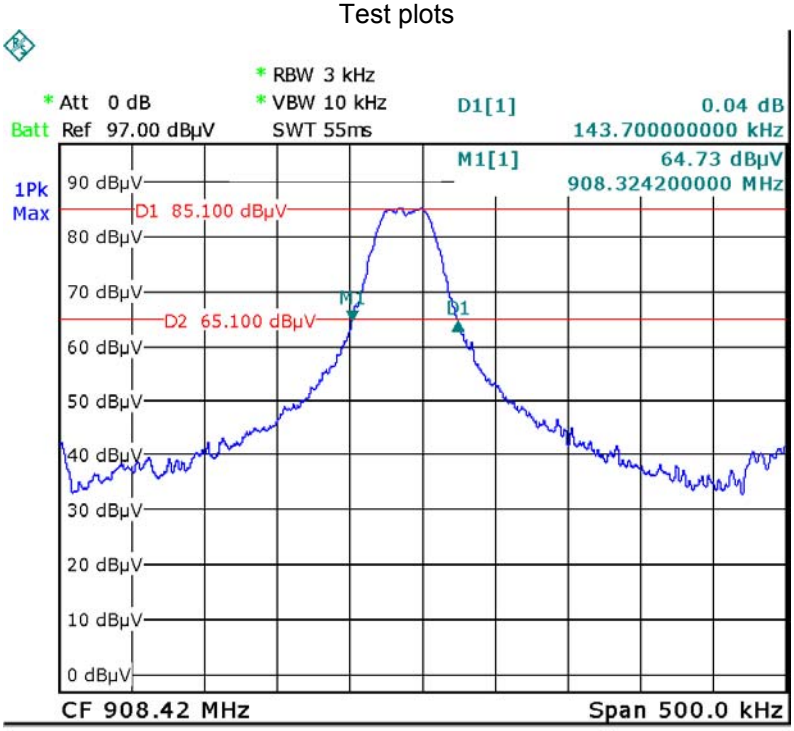
11.1 Test Procedure

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 = 3kHz, VBW = 10kHz

11.2 Test Result

Frequency (MHz)	Bandwidth Emission (kHz)
908.42	143.7

Test plots



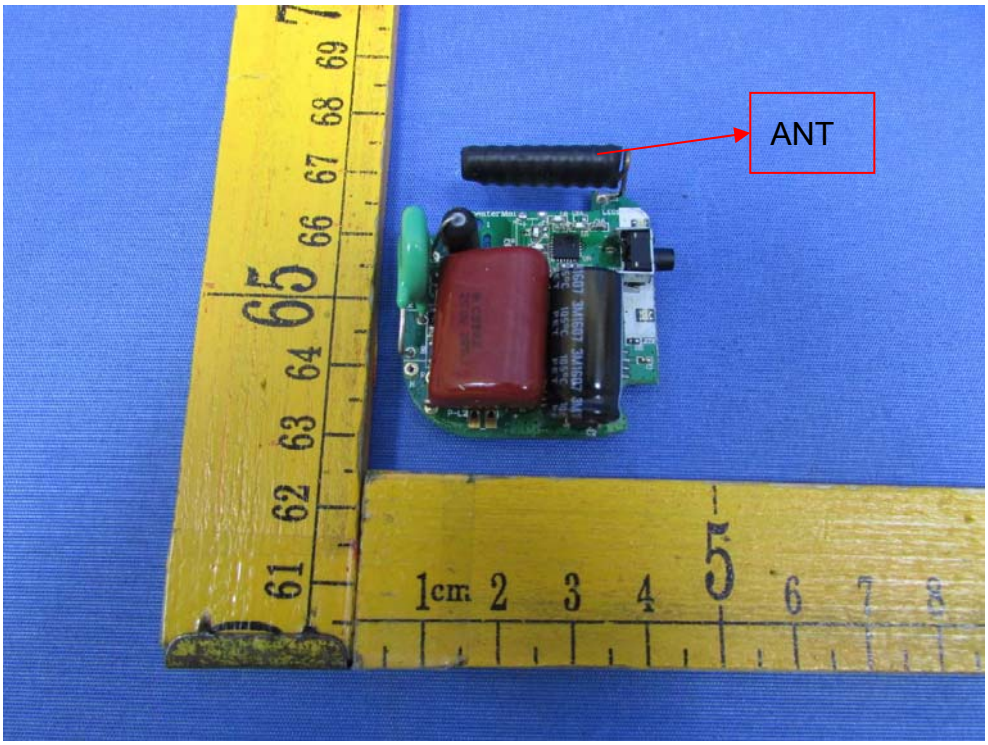
12 Antenna Requirement

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:

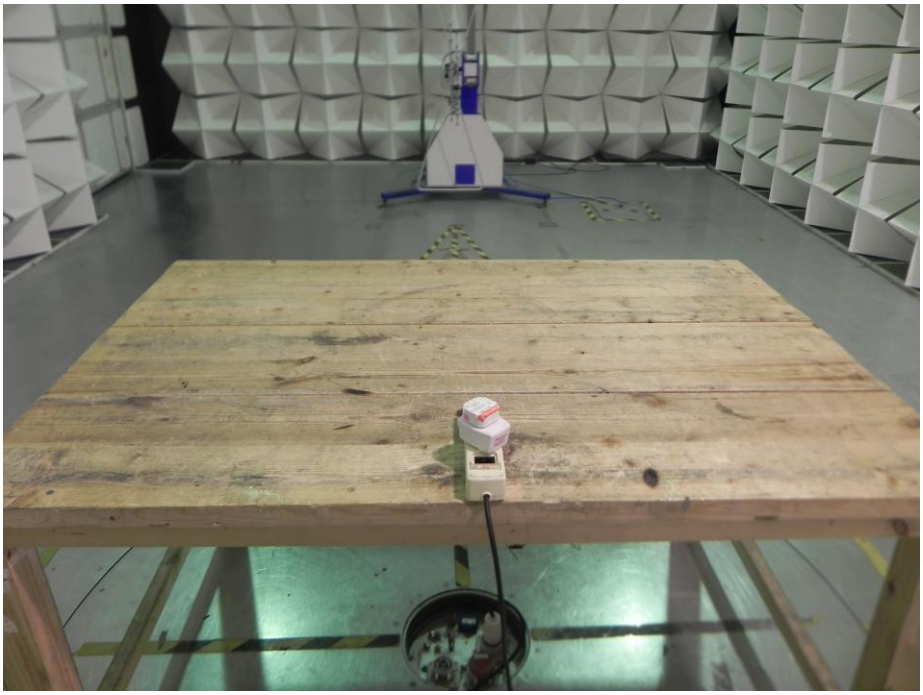
The EUT has one Integrated Antenna, the gain is -3dBi. meets the requirements of FCC 15.203.

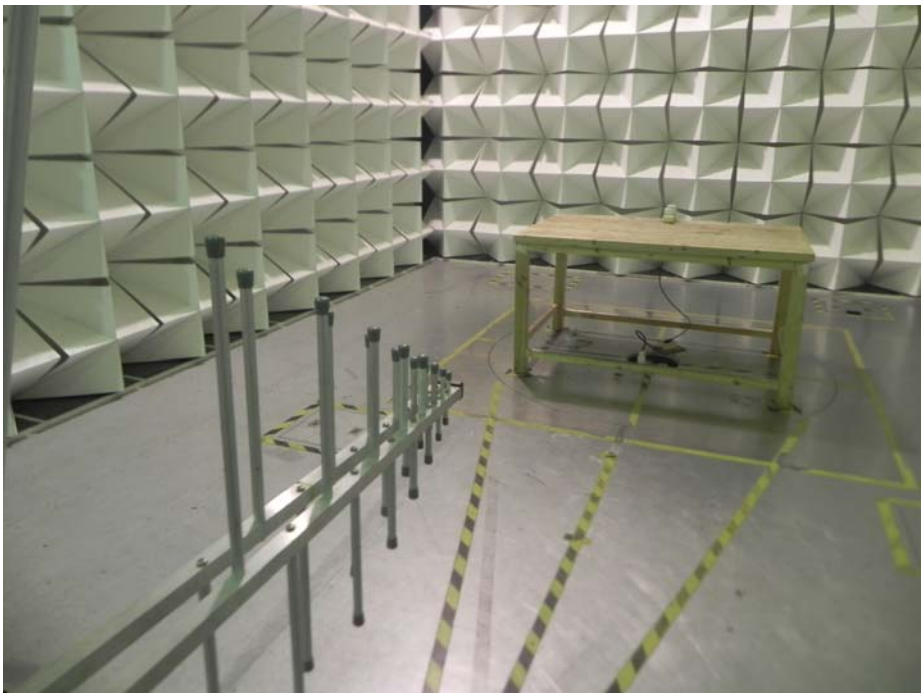


13 Photographs- Model FT118-A01 Test Setup Photos

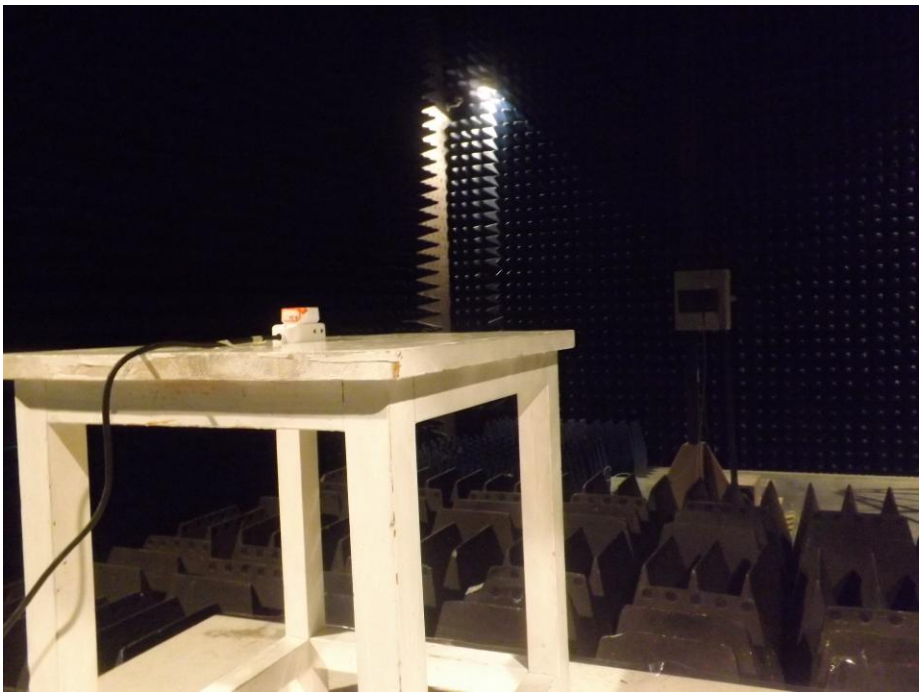
13.1 Photograph – Radiation Emission

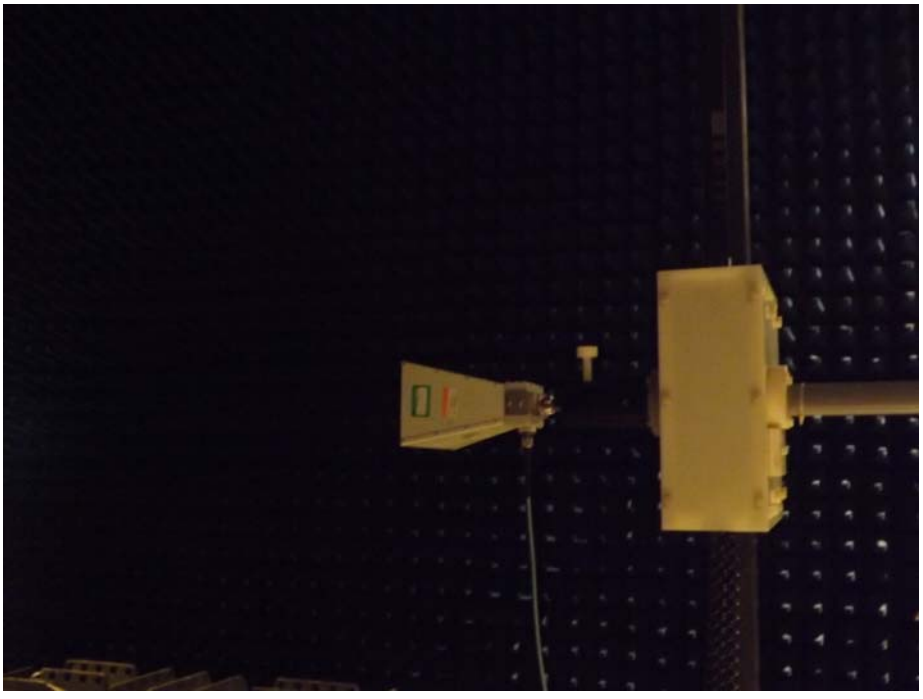
Test frequency from 30MHz to 1GHz at test site 2#





Test frequency above 1GHz at test site 1#

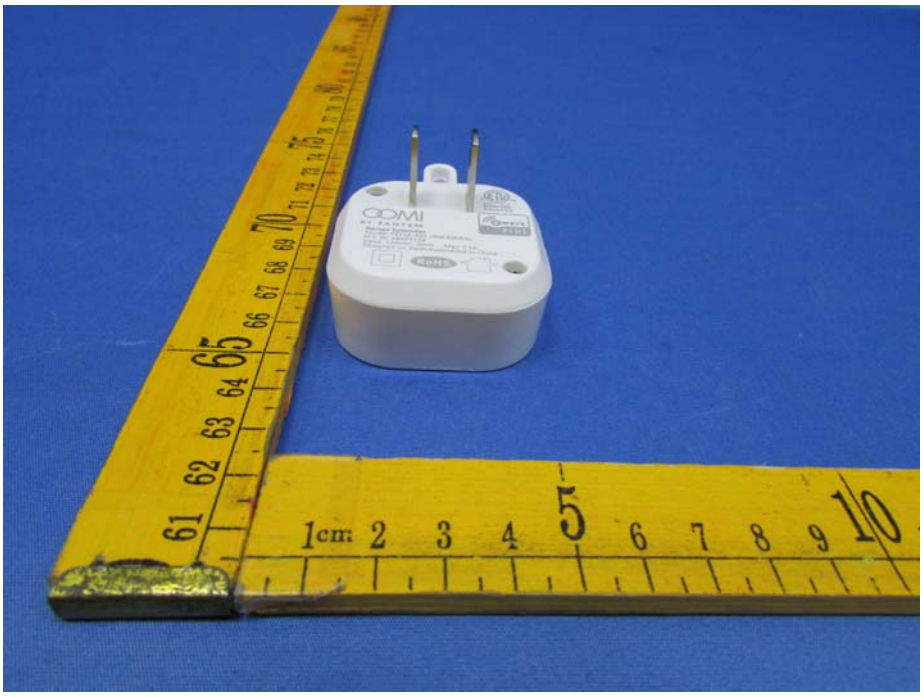


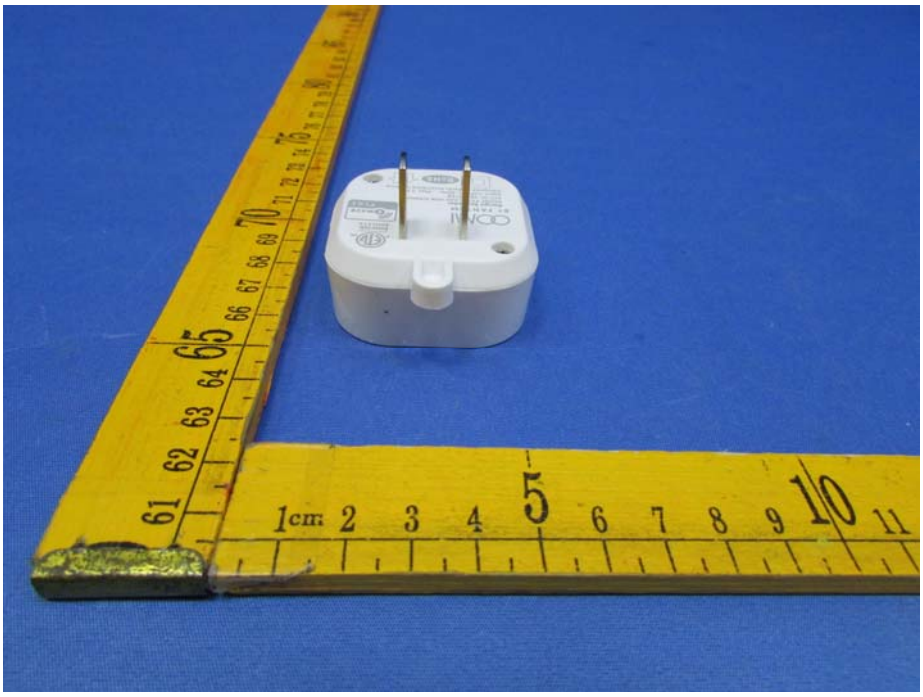


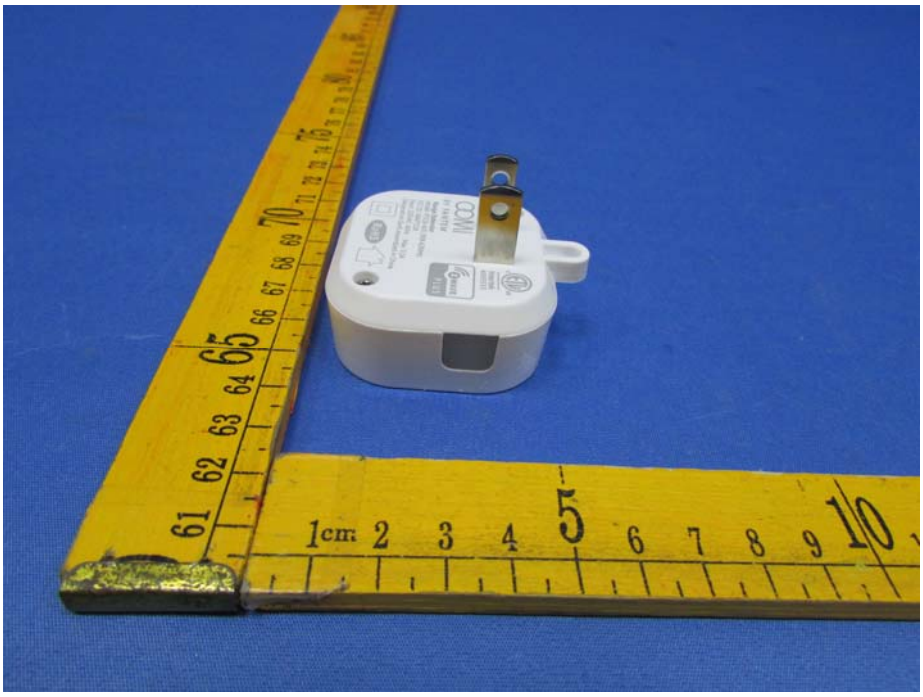
13.2 Photograph – Conducted Emission Test Setup at Test Site 2#

14 Photographs - Constructional Details

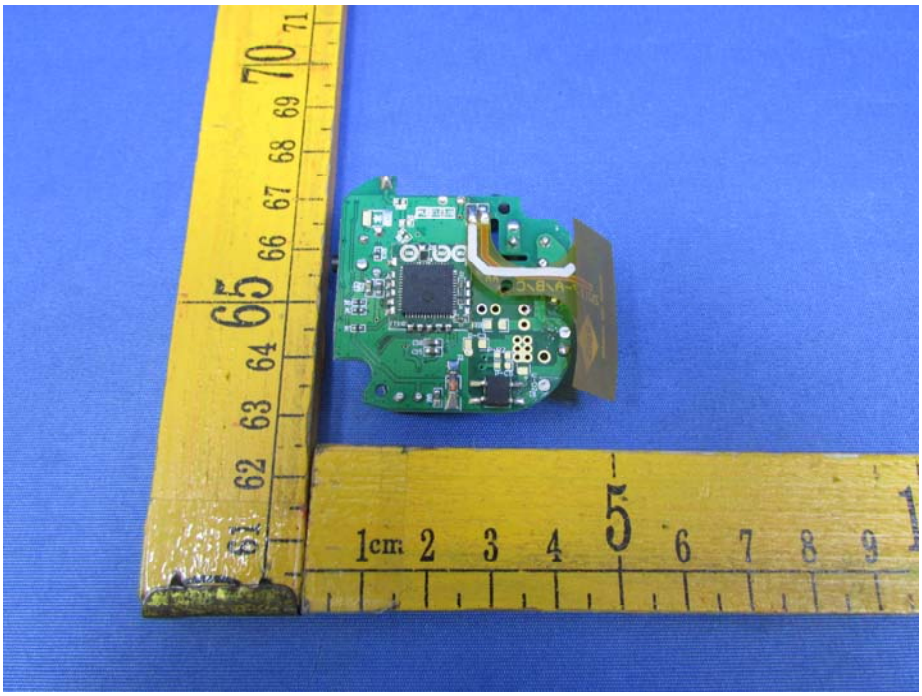
14.1 Model FT118-A01 - External Photos

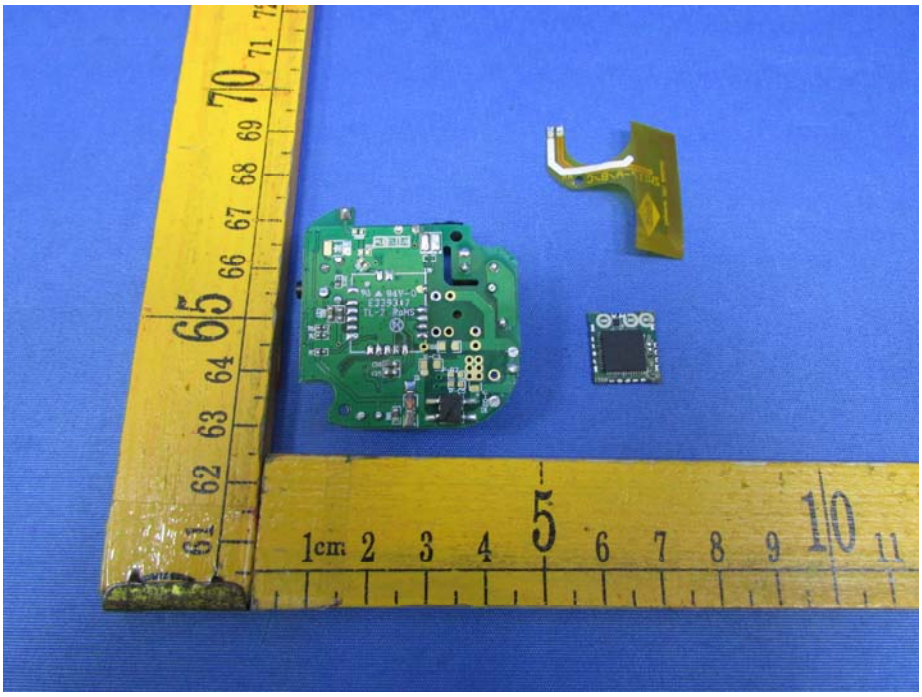


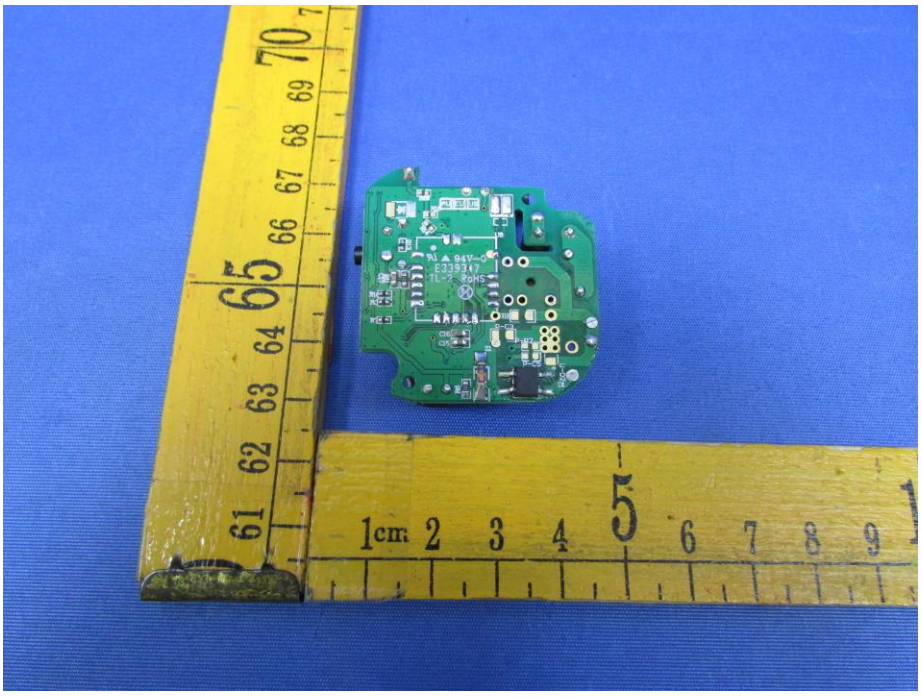


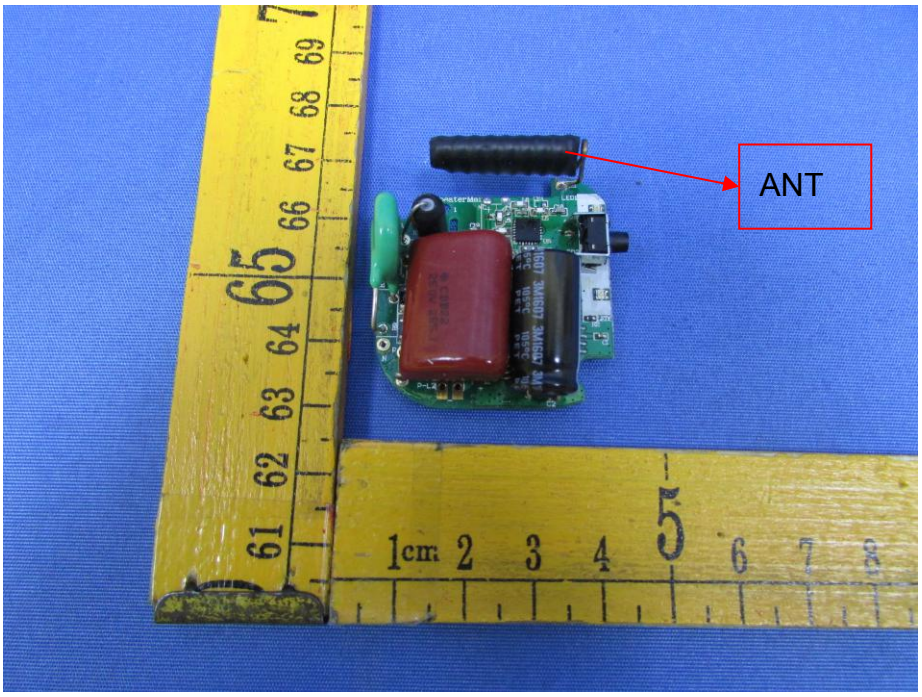


14.2 Model FT118-A01 - Internal Photos





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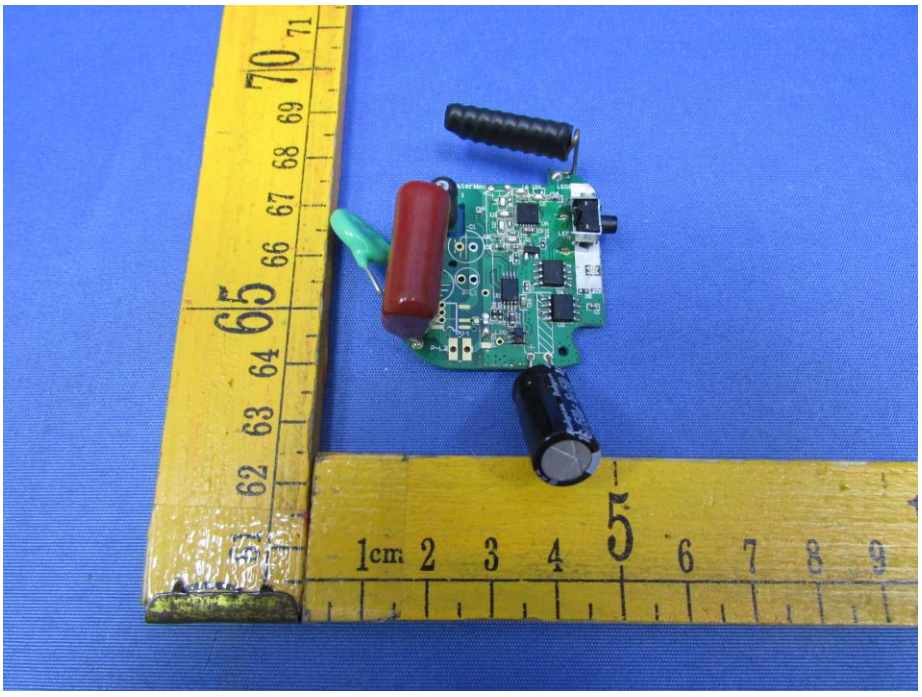
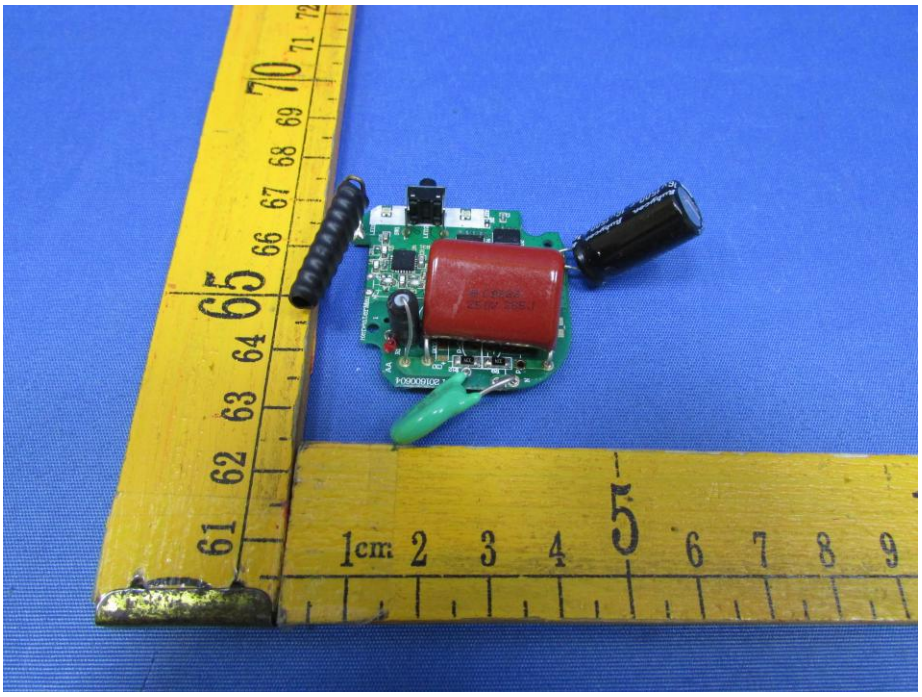
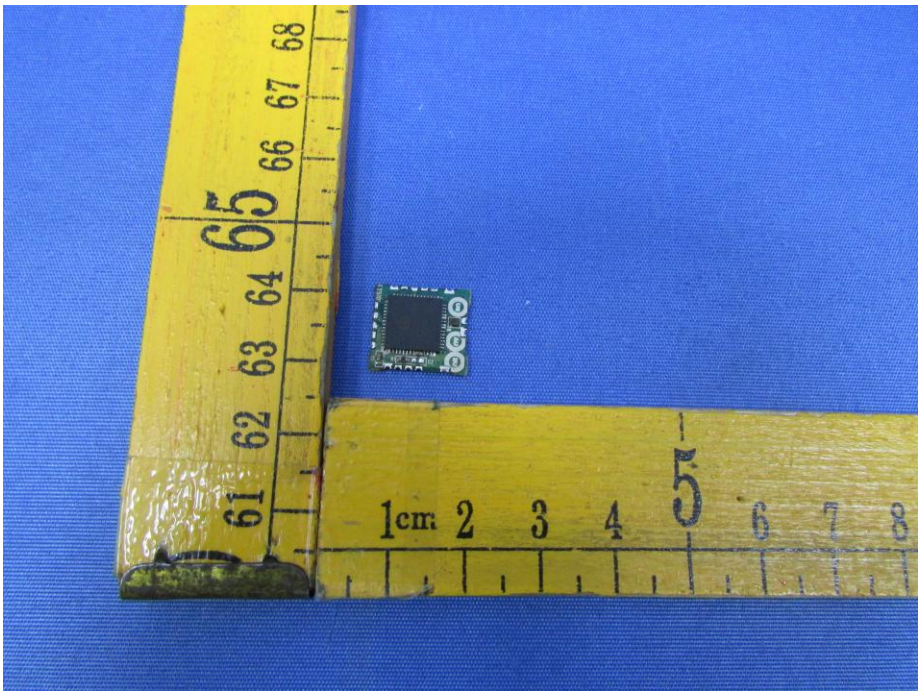
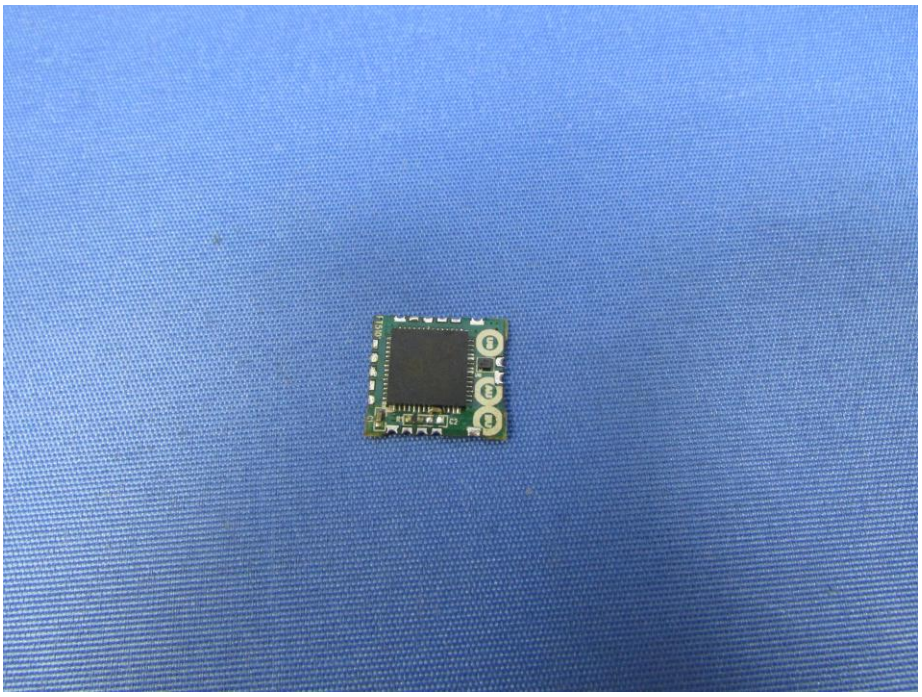
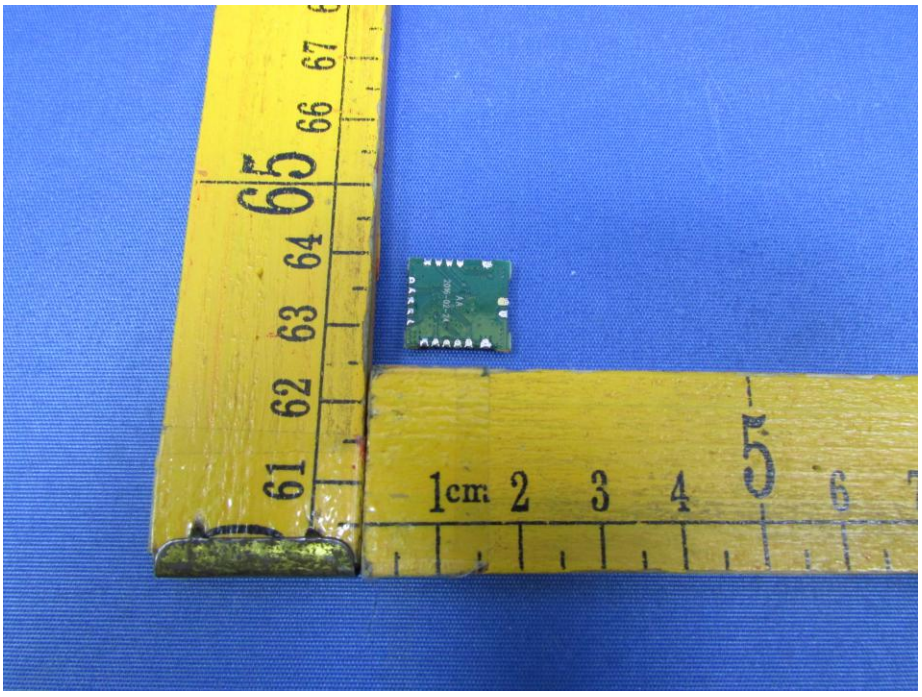



1cm 2 3 4 5 6 7 8 9


1cm 2 3 4 5 6 7 8





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