

TEST REPORT

Reference No...... : WTS15S0832451E
FCC ID : SJ8- CA531
Applicant..... : RDI Technology (Shenzhen) Co., Ltd.
Address..... : Building C1, Xintang Industrial Park East Baishixia, Fuyong, Baoan,
Shenzhen, Guangdong, China
Manufacturer : The same as above
Address..... : The same as above
Product Name..... : Digital Wireless Camera
Model No. : CA531
Standards..... : FCC CFR47 Part 15 Section 15.247:2014
Date of Receipt sample : Aug. 24, 2015
Date of Test..... : Aug. 25 – Sep. 22, 2015
Date of Issue..... : Sep. 24, 2015
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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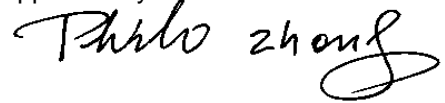
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Compiled by:



Zero Zhou /Test Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
20dB 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
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name:	Digital Wireless Camera
Model No.:	CA531
Model Description:	N/A
Frequency Range:	2406-2472.5MHz, 20 Channels in total
Type of Modulation:	GFSK
The lowest oscillator:	32.768KHz
Antenna installation:	Dipole antenna
Antenna Gain:	2.0dBi

4.2 Details of E.U.T.

Technical Data:	DC 5V, 1A powered by adapter (Adapter Input: 100-240V~50/60Hz, 200mA)
Adapter	: Manufacturer: Csec, M/N:CS6D050100FUF

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2406	2	2409.5	3	2413	4	2416.5
5	2420	6	2423.5	7	2427	8	2430.5
9	2434	10	2437.5	11	2441	12	2444.5
13	2448	14	2451.5	15	2455	16	2458.5
17	2462	18	2465.5	19	2469	20	2472.5

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.

Table 1 Tests Carried Out Under FCC part 15.247

Test mode	Low channel	Middle channel	High channel
Transmitting	2406MHz	2441MHz	2472.5MHz

4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

Waltek Services(Shenzhen) Co., Ltd. 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 7760A-1, July 12, 2012.

- **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.

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
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.15,2015	Sep.14,2016
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.15,2015	Sep.14,2016
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.15,2015	Sep.14,2016
4.	Cable	LARGE	RF300	-	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	Sep.15,2015	Apr.18,2016
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.19,2015	Apr.18,2016
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2015	Apr.18,2016
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2015	Mar.16,2016
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2015	Apr.09,2016
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	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated SpuriousEmissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB(Horn antenna 1000M~25000MHz)
Conducted SpuriousEmissions test	± 3.64 dB(AC mains 150KHz~30MHz)

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 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2014
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

6.1 E.U.T. Operation

Operating Environment :

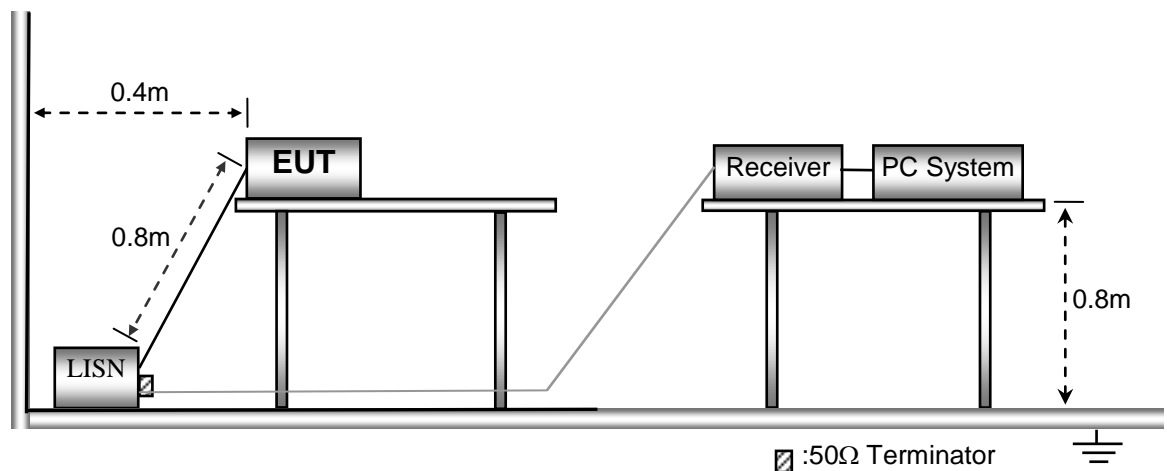
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2014.

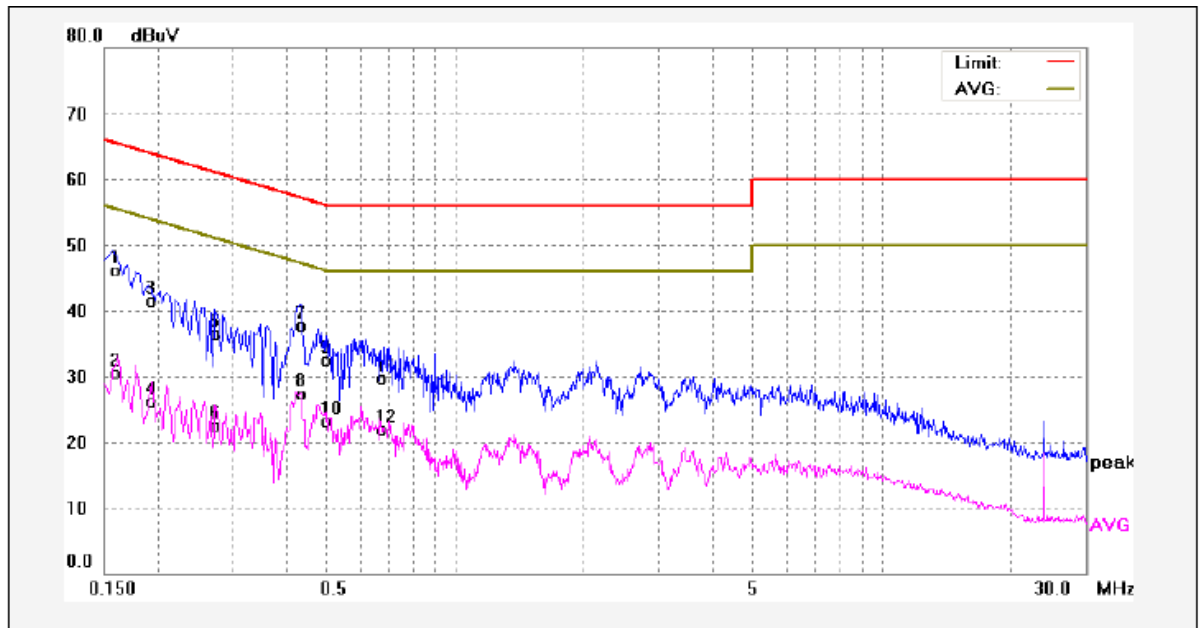


6.3 Measurement Description

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.

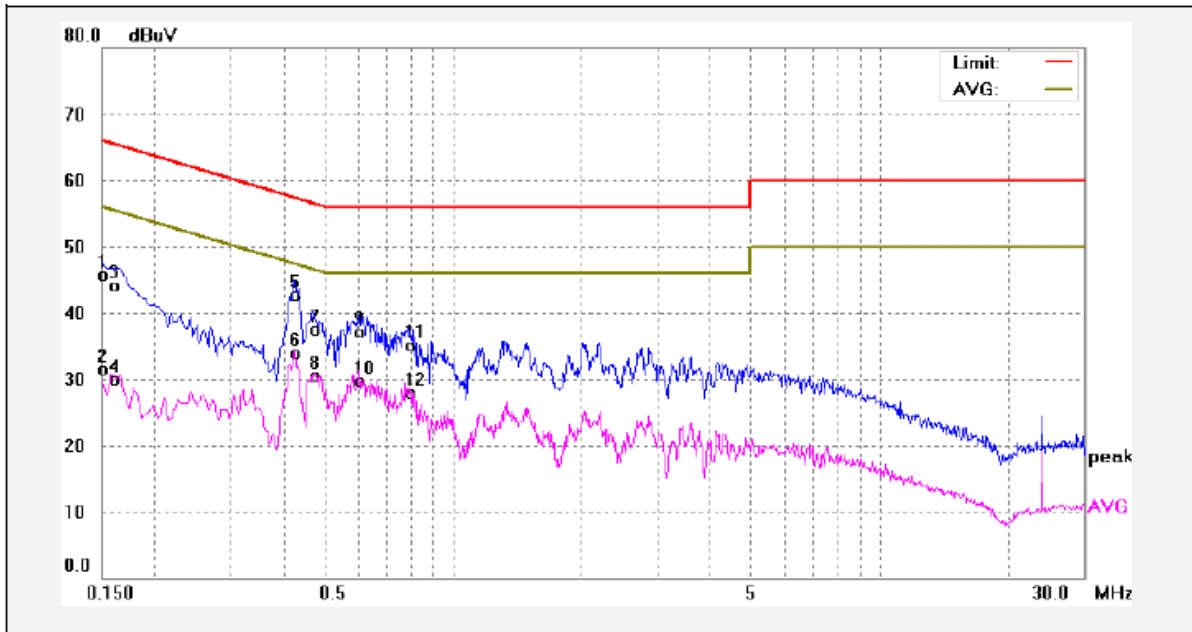
6.4 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1580	36.04	10.13	46.17	65.56	-19.39	QP	
2	0.1580	20.28	10.13	30.41	55.56	-25.15	AVG	
3	0.1904	31.36	10.15	41.51	64.01	-22.50	QP	
4	0.1904	15.92	10.15	26.07	54.01	-27.94	AVG	
5	0.2740	26.31	10.16	36.47	60.99	-24.52	QP	
6	0.2740	12.31	10.16	22.47	50.99	-28.52	AVG	
7	0.4340	27.52	10.18	37.70	57.18	-19.48	QP	
8	0.4340	17.07	10.18	27.25	47.18	-19.93	AVG	
9	0.4980	22.38	10.19	32.57	56.03	-23.46	QP	
10	0.4980	12.88	10.19	23.07	46.03	-22.96	AVG	
11	0.6780	19.57	10.21	29.78	56.00	-26.22	QP	
12	0.6780	11.62	10.21	21.83	46.00	-24.17	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	35.65	10.13	45.78	65.99	-20.21	QP	
2	0.1500	21.46	10.13	31.59	55.99	-24.40	AVG	
3	0.1620	33.99	10.13	44.12	65.36	-21.24	QP	
4	0.1620	19.72	10.13	29.85	55.36	-25.51	AVG	
5	0.4260	32.53	10.18	42.71	57.33	-14.62	QP	
6	0.4260	23.68	10.18	33.86	47.33	-13.47	AVG	
7	0.4700	27.36	10.19	37.55	56.51	-18.96	QP	
8	0.4700	20.23	10.19	30.42	46.51	-16.09	AVG	
9	0.6020	26.93	10.20	37.13	56.00	-18.87	QP	
10	0.6020	19.51	10.20	29.71	46.00	-16.29	AVG	
11	0.7860	24.98	10.21	35.19	56.00	-20.81	QP	
12	0.7860	17.67	10.21	27.88	46.00	-18.12	AVG	

7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705& 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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment:

Temperature: 23.5 °C

Humidity: 51.1% RH

Atmospheric Pressure: 101.2kPa

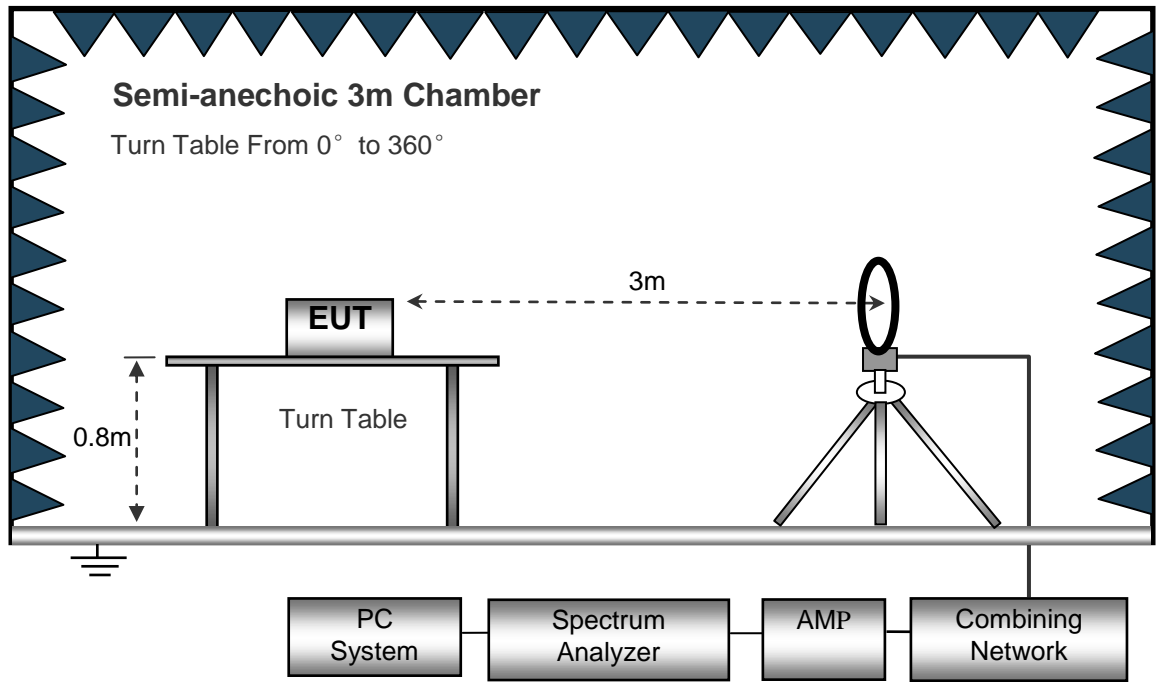
EUT Operation:

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

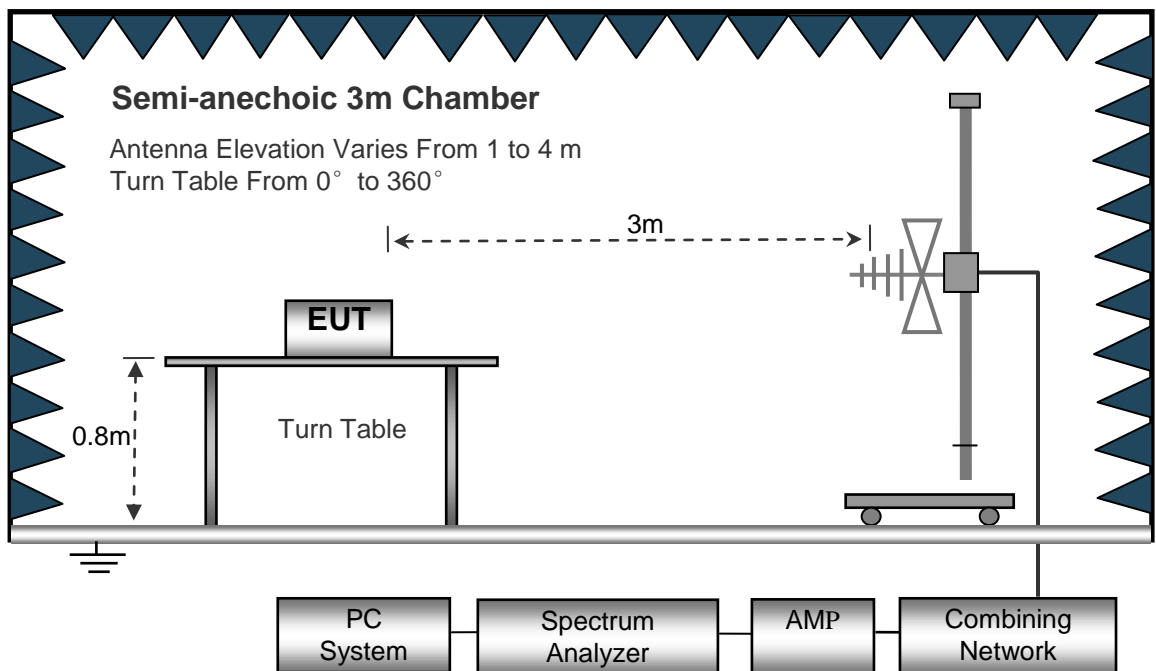
7.2 Test Setup

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

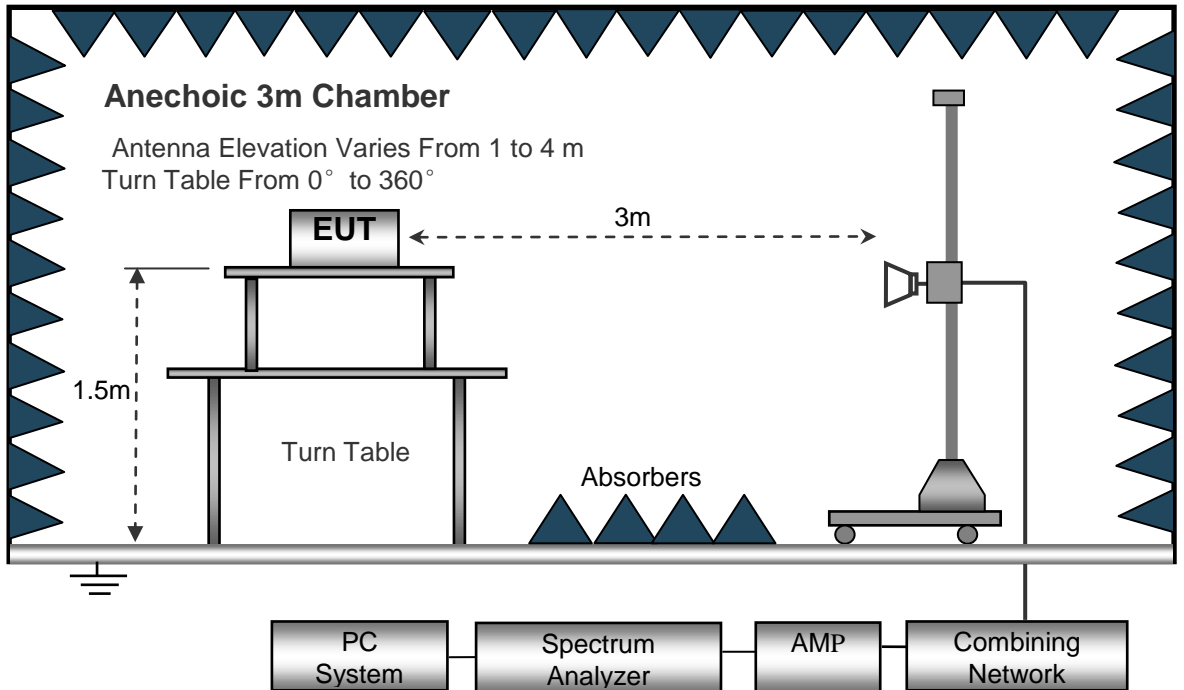
The test setup for emission measurement below 30MHz.



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 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

7.4 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. 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.

Test Frequency: Below 30MHz

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

Test Frequency: 30MHz ~ 18GHz

Test mode: transmitting mode

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Low Channel 2406MHz									
268.52	42.35	QP	213	1.4	H	-13.35	29.00	46.00	-17.00
268.52	43.19	QP	288	1.4	V	-13.35	29.84	46.00	-16.16
4812.00	52.47	PK	270	1.4	V	-1.06	51.41	74.00	-22.59
4812.00	41.74	Ave	270	1.4	V	-1.06	40.68	54.00	-13.32
7218.00	50.38	PK	338	1.0	H	1.33	51.71	74.00	-22.29
7218.00	45.23	Ave	338	1.0	H	1.33	46.56	54.00	-7.44
2320.77	45.73	PK	151	1.2	V	-13.19	32.54	74.00	-41.46
2320.77	38.07	Ave	151	1.2	V	-13.19	24.88	54.00	-29.12
2386.99	43.89	PK	257	1.5	H	-13.14	30.75	74.00	-43.25
2386.99	37.56	Ave	257	1.5	H	-13.14	24.42	54.00	-29.58
2484.56	43.58	PK	293	1.5	V	-13.08	30.50	74.00	-43.50
2484.56	37.61	Ave	293	1.5	V	-13.08	24.53	54.00	-29.47

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Middle Channel 2441MHz									
268.52	42.15	QP	157	1.5	H	-13.35	28.80	46.00	-17.20
268.52	43.20	QP	311	1.4	V	-13.35	29.85	46.00	-16.15
4882.00	53.40	PK	56	1.4	V	-0.62	52.78	74.00	-21.22
4882.00	42.46	Ave	56	1.4	V	-0.62	41.84	54.00	-12.16
7323.00	49.04	PK	16	1.6	H	2.21	51.25	74.00	-22.75
7323.00	44.11	Ave	16	1.6	H	2.21	46.32	54.00	-7.68
2315.13	45.19	PK	44	1.6	V	-13.19	32.00	74.00	-42.00
2315.13	37.39	Ave	44	1.6	V	-13.19	24.20	54.00	-29.80
2385.44	42.62	PK	132	1.5	H	-13.14	29.48	74.00	-44.52
2385.44	37.30	Ave	132	1.5	H	-13.14	24.16	54.00	-29.84
2485.63	43.35	PK	99	1.5	V	-13.08	30.27	74.00	-43.73
2485.63	37.10	Ave	99	1.5	V	-13.08	24.02	54.00	-29.98

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK High Channel 2472.5MHz									
268.52	40.79	QP	203	1.8	H	-13.35	27.44	46.00	-18.56
268.52	41.76	QP	63	1.4	V	-13.35	28.41	46.00	-17.59
4945.00	53.25	PK	93	1.9	V	-0.24	53.01	74.00	-20.99
4945.00	41.43	Ave	93	1.9	V	-0.24	41.19	54.00	-12.81
7417.50	48.61	PK	69	1.5	H	2.84	51.45	74.00	-22.55
7417.50	44.26	Ave	69	1.5	H	2.84	47.10	54.00	-6.90
2317.75	46.94	PK	75	1.7	V	-13.19	33.75	74.00	-40.25
2317.75	38.92	Ave	75	1.7	V	-13.19	25.73	54.00	-28.27
2387.78	42.73	PK	245	1.9	H	-13.14	29.59	74.00	-44.41
2387.78	37.73	Ave	245	1.9	H	-13.14	24.59	54.00	-29.41
2484.39	44.48	PK	268	1.2	V	-13.08	31.40	74.00	-42.60
2484.39	36.69	Ave	268	1.2	V	-13.08	23.61	54.00	-30.39

Test Frequency : Above 18GHz

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:	DA 00-705& 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

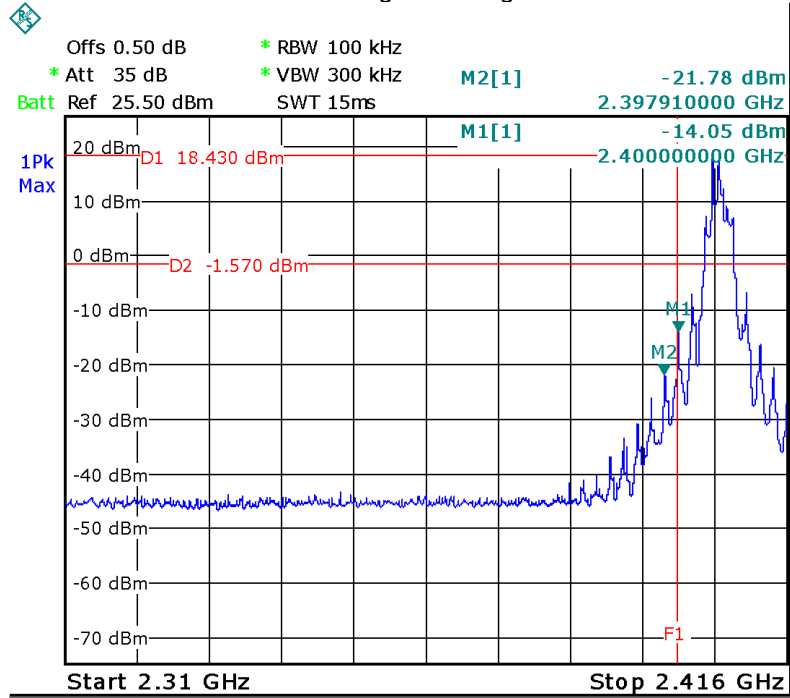
8.1 Test Procedure

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

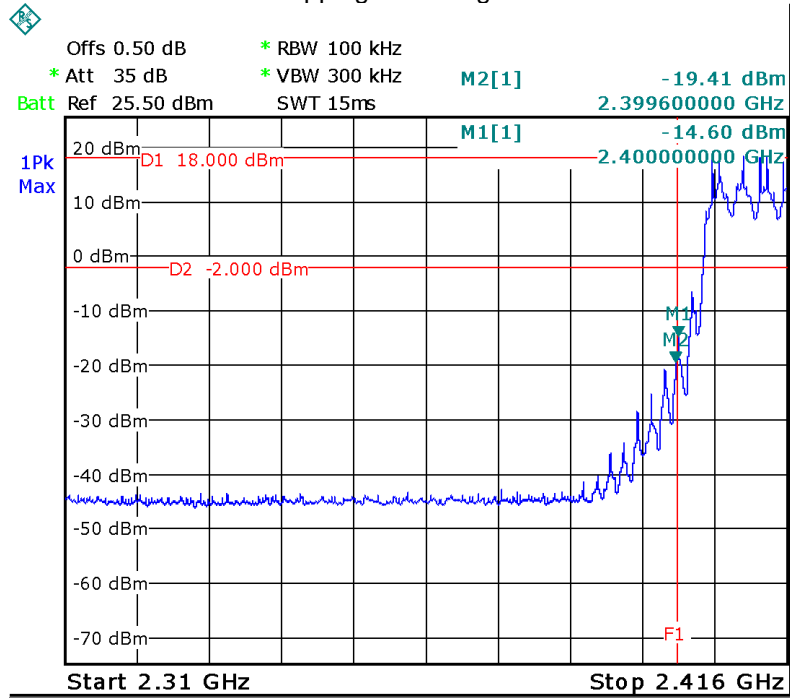
8.2 Test Result

Test plots

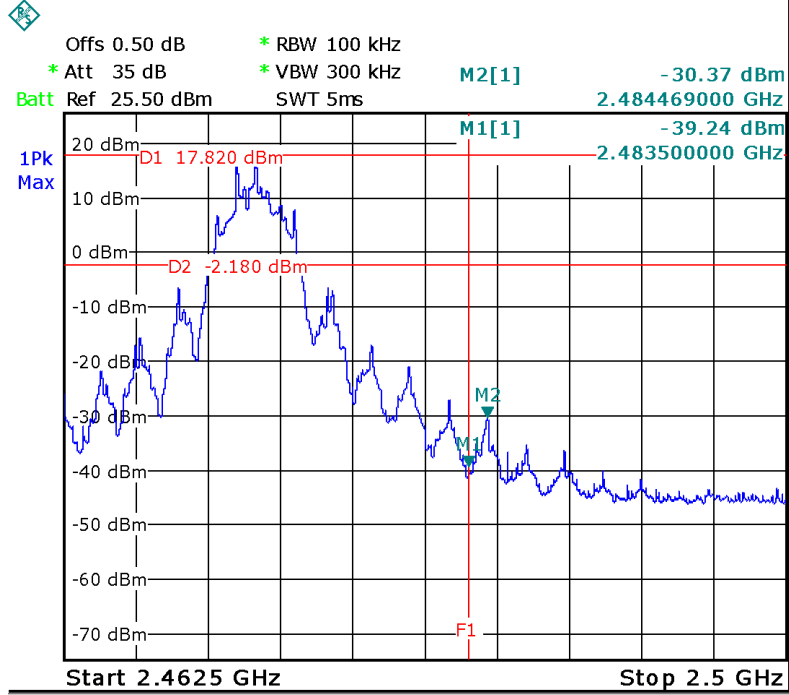
Transmitting Band edge-left side



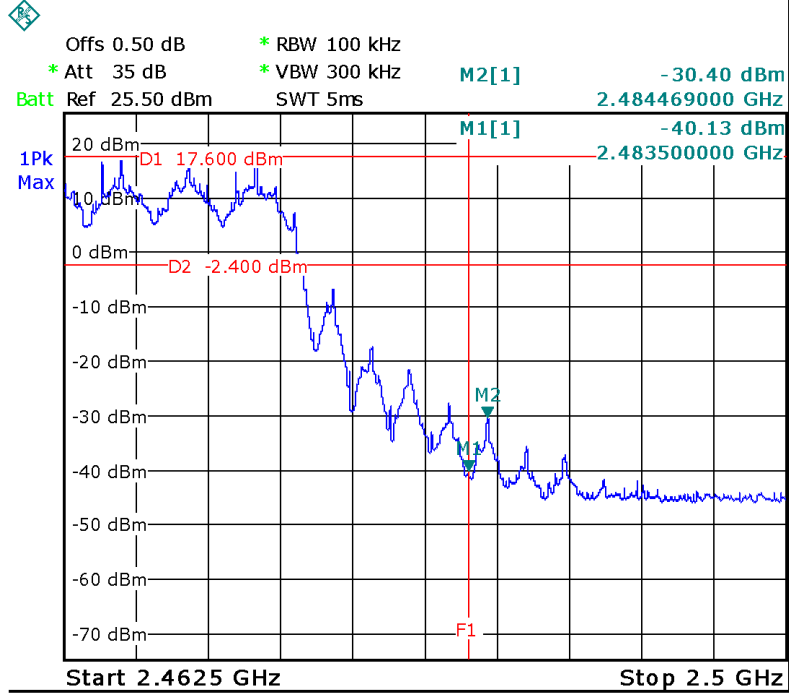
Hopping Band edge-left side



Transmitting Band edge-right side



Hopping Band edge-right side



9 20 dB Bandwidth Measurement

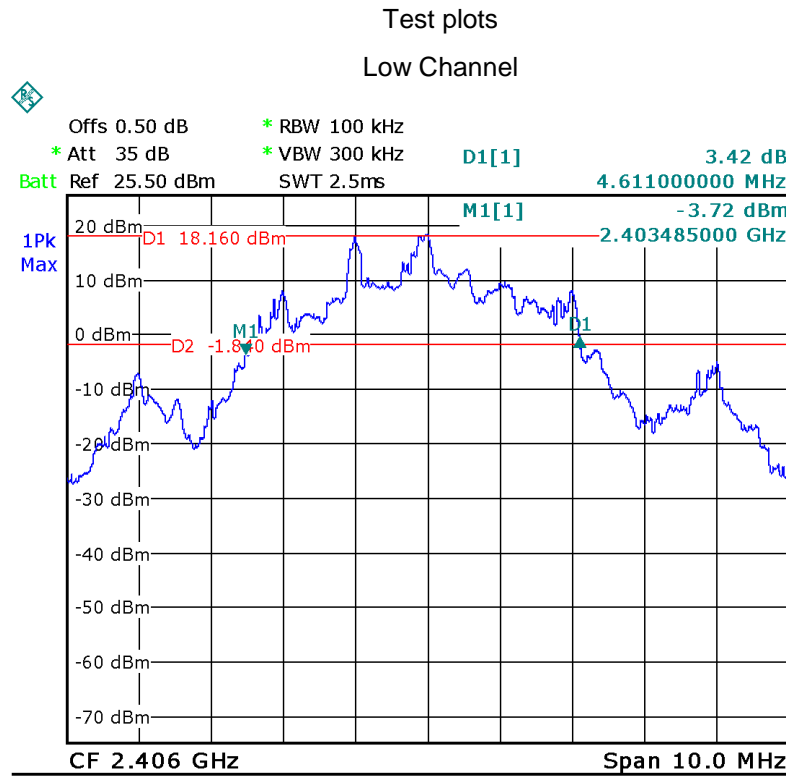
Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: DA 00-705& ANSI C63.10:2013
 Test Mode: Test in fixing operating frequency at low, Middle, high channel.

9.1 Test Procedure

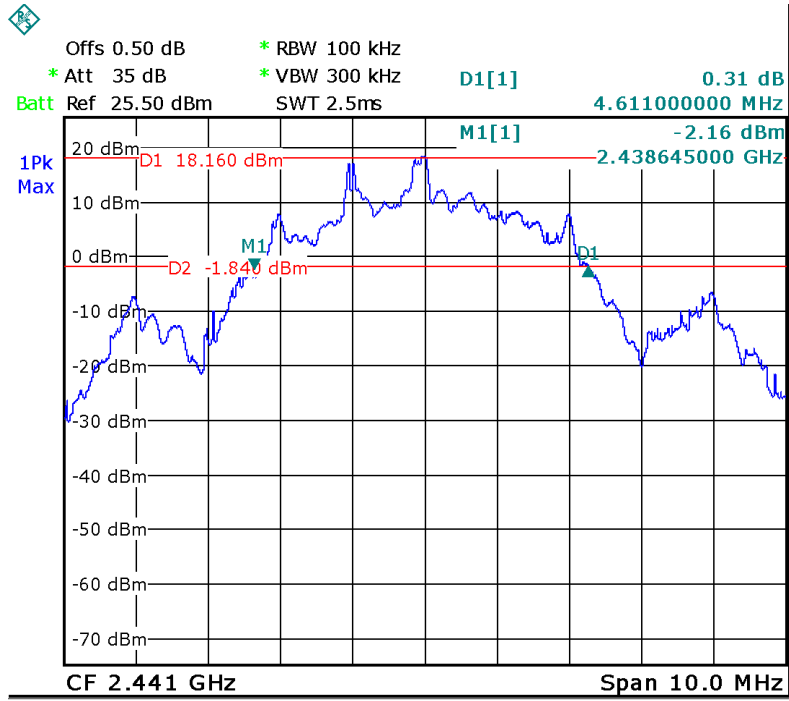
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

9.2 Test Result

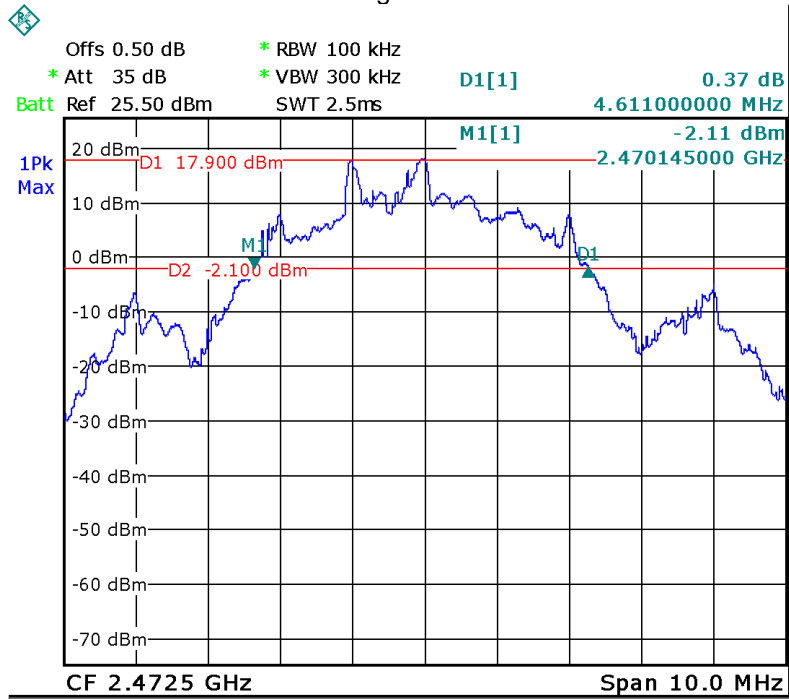
Modulation	Test Channel	Bandwidth
GFSK	Low	4.611MHz
GFSK	Middle	4.611MHz
GFSK	High	4.611MHz



Middle Channel



High Channel



10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705& ANSI 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

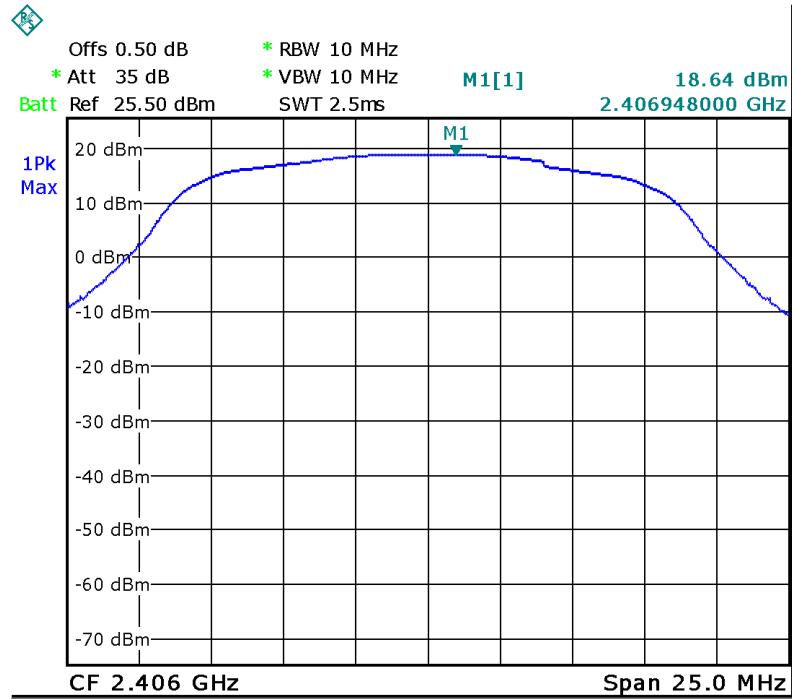
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 10MHz. VBW =10MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

10.2 Test Result

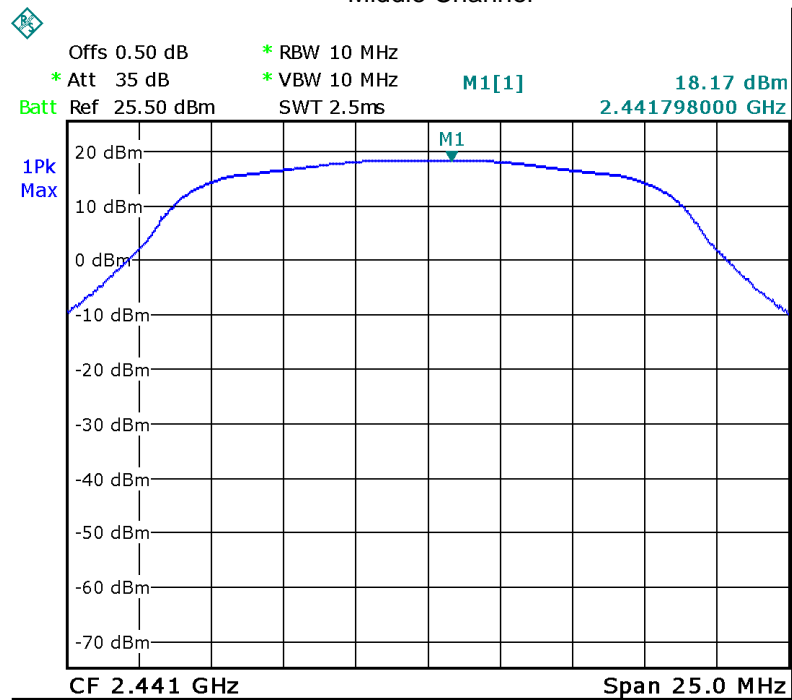
Test Channel	Output Power (dBm)	Limit (dBm)
Low	18.64	20.97
Middle	18.17	20.97
High	17.93	20.97

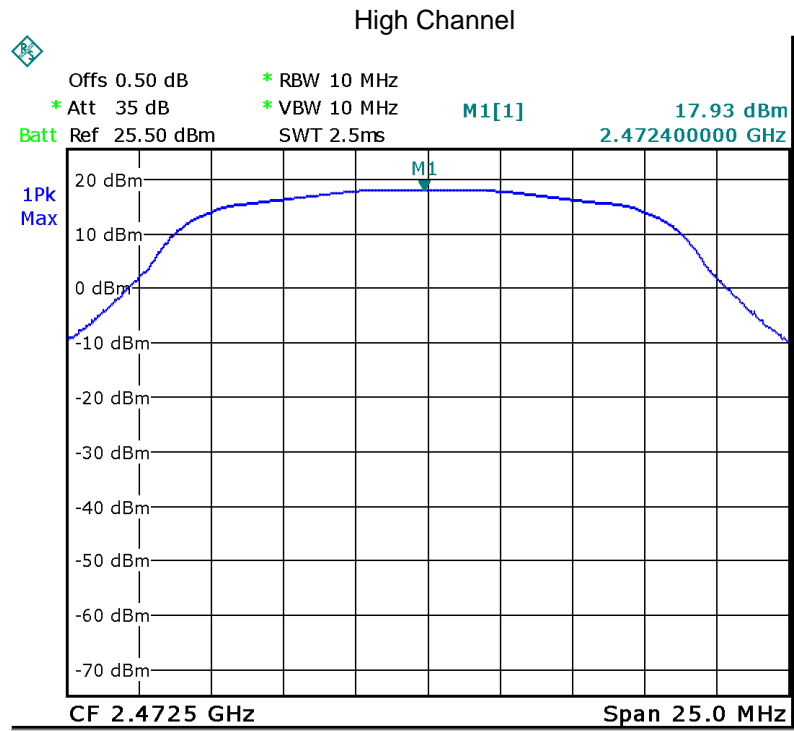
Test plots

Low Channel



Middle Channel





11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705& ANSI 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

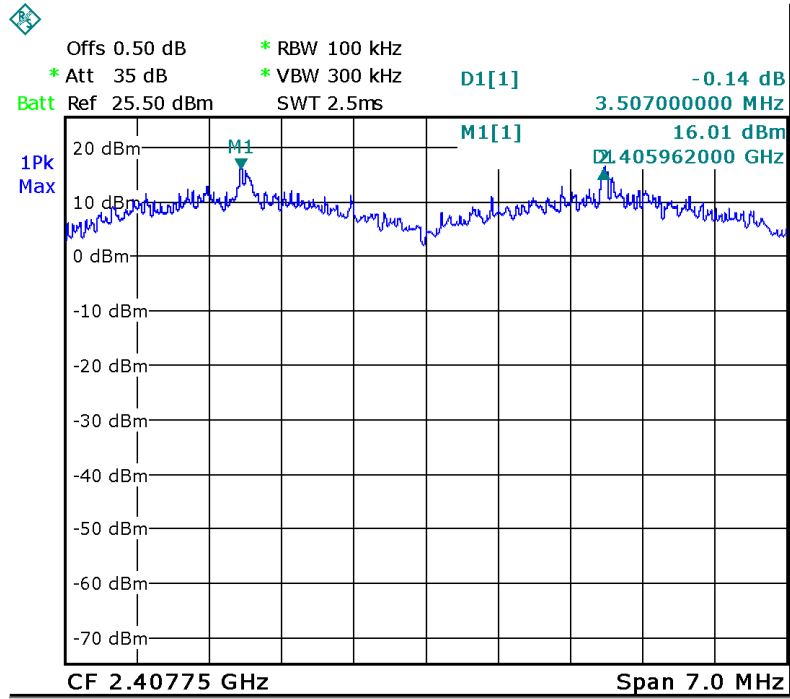
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz , Span = 10MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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 Result

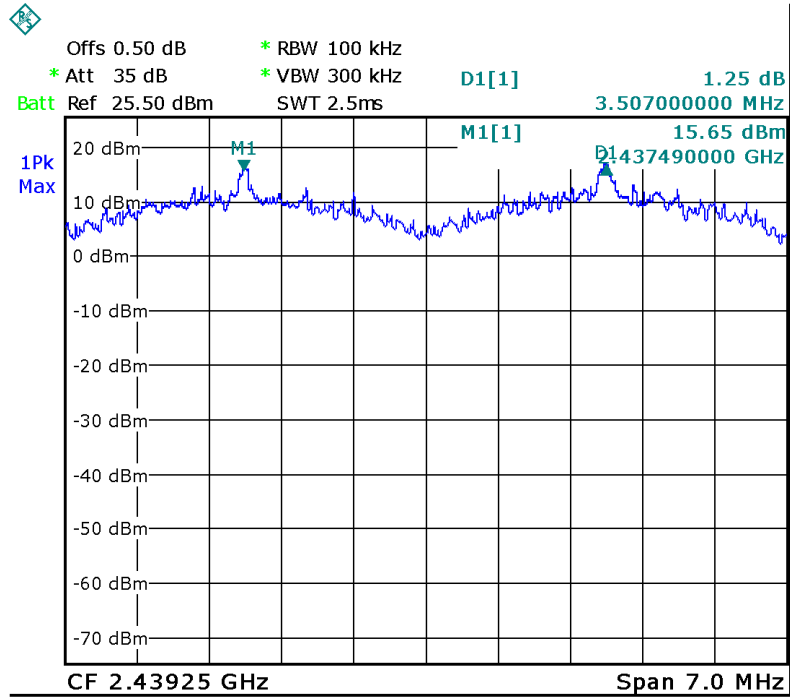
Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	3.507	PASS
GFSK	Middle	3.507	PASS
GFSK	High	3.507	PASS

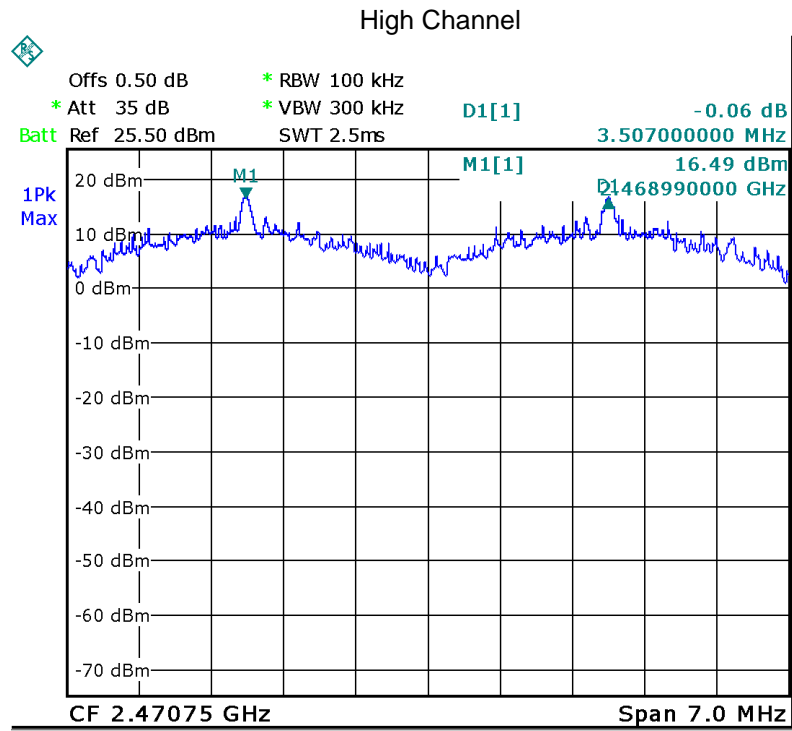
Test plots

Low Channel



Middle Channel





12 Number of Hopping Frequency

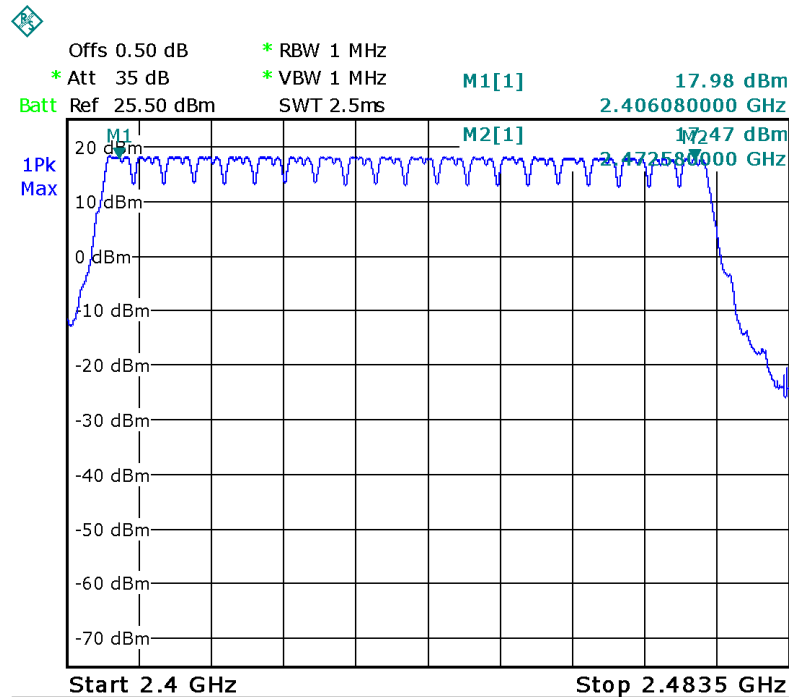
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705& ANSI C63.10:2013
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

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 = 1MHz. 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 = 2.483GHz. Sweep=auto;

12.2 Test Result

Test Plots: 20 Channels in total



13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705& ANSI 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

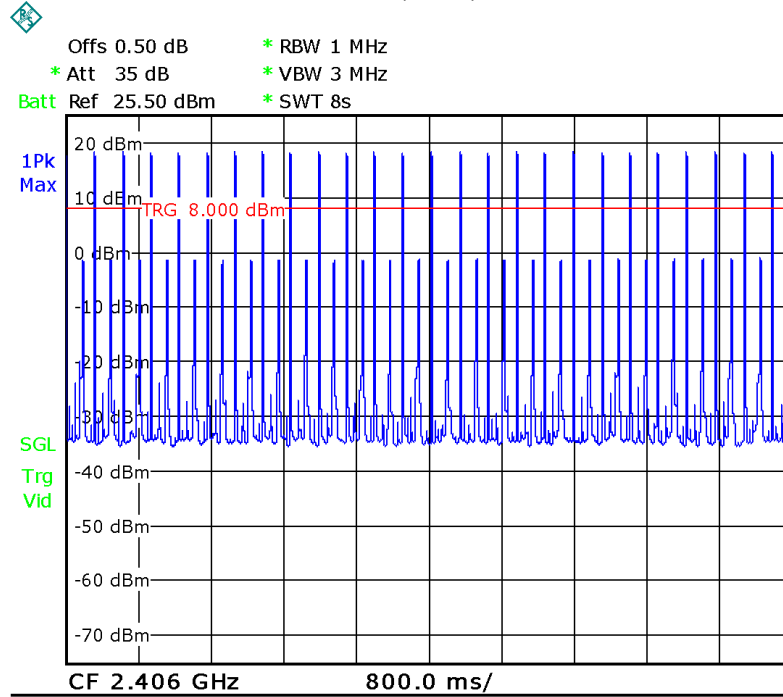
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centre on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel.
4. Use the marker-delta 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 Result

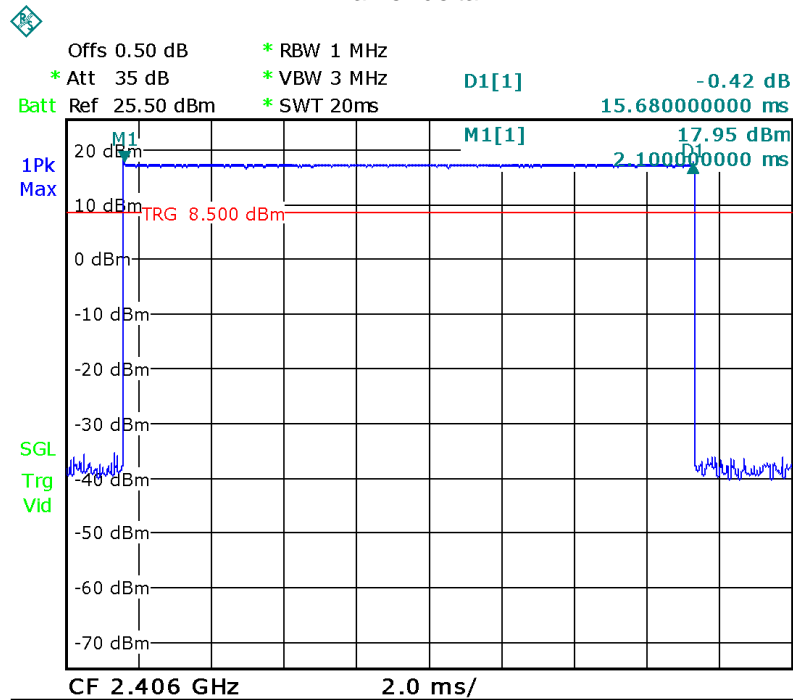
Channel	marker-delta (ms)	Observation Period(s)	Burst (times)	Dwell Time(s)	Limits (s)
Low	15.68	8.0	25	0.392	0.4
High	15.68	8.0	25	0.392	0.4
Calculation formula: $\text{Dwell time} = 0.4s * \text{Number of Hopping Frequency} * \text{Burst(Times)} * (\text{marker delta}/1000) / \text{Observation Period}$ Remark: Number of Hopping Frequency=20; Observation Period=8.0s; Low Channel=2406MHz; High Channel=2472.5MHz					

Test Plots
Low Channel

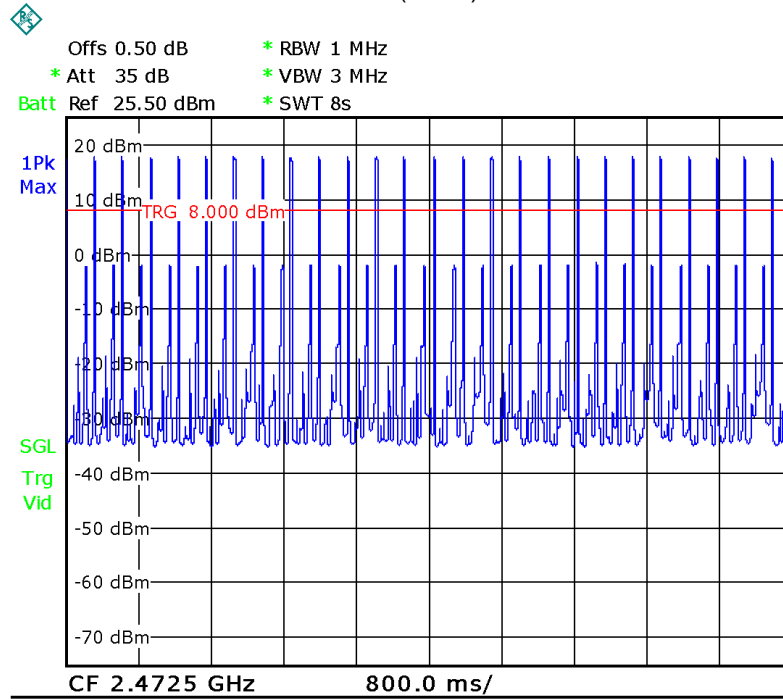
Burst (times)



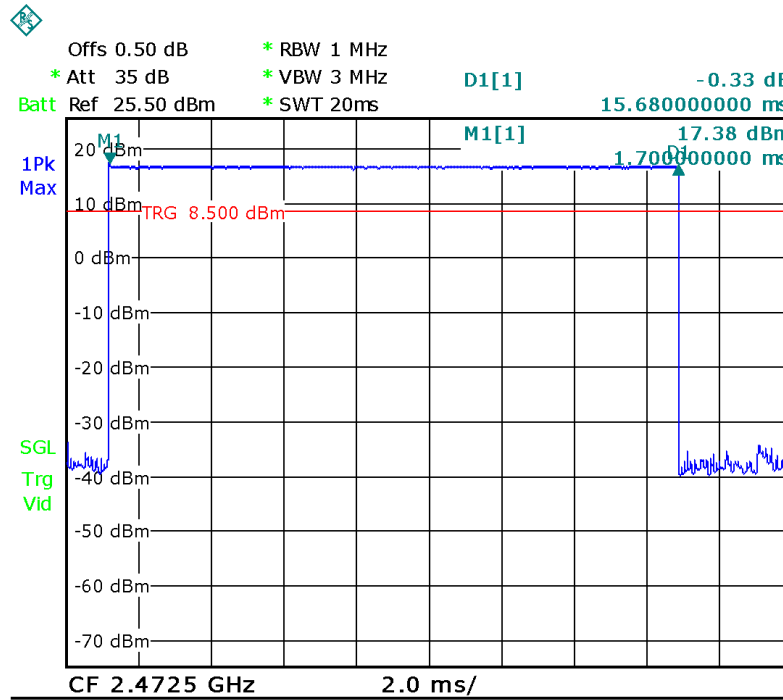
marker-delta



High Channel Burst (times)



marker-delta



14 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a Dipole antenna, fulfil the requirement of this section.

15 RF Exposure

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 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

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

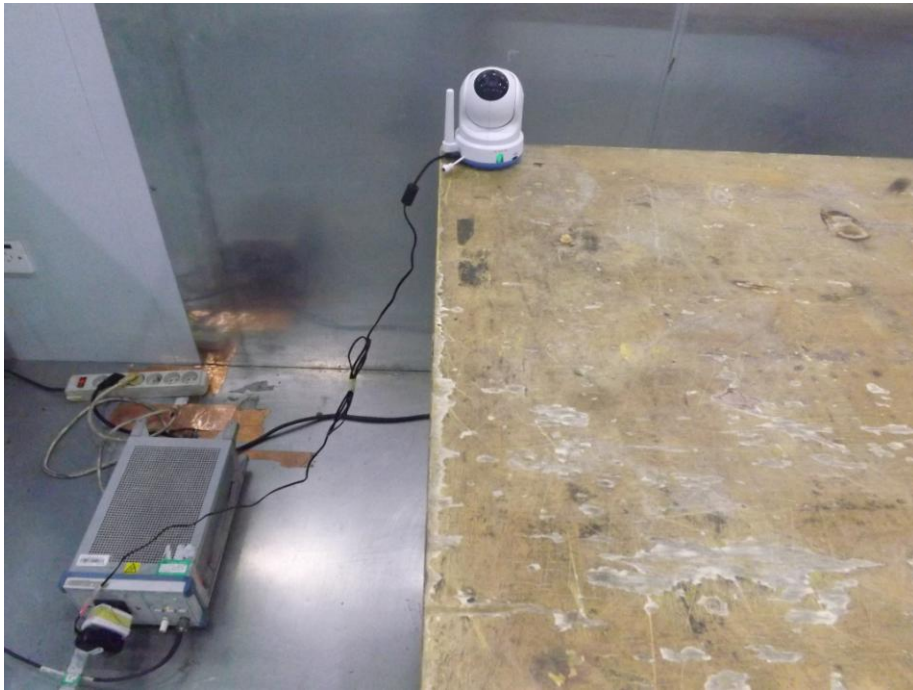
$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

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

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
2.0	1.585	18.64	73.114	0.023	1

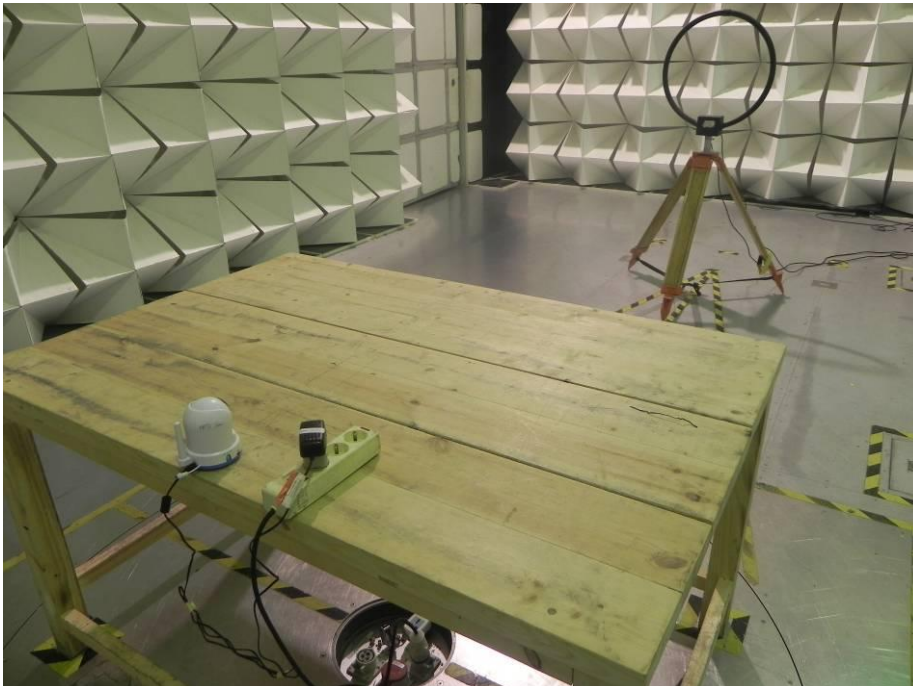
16 Photographs – Model CA531 Test Setup

16.1 Photograph – Conducted Emission Test Setup at Test Site 1#

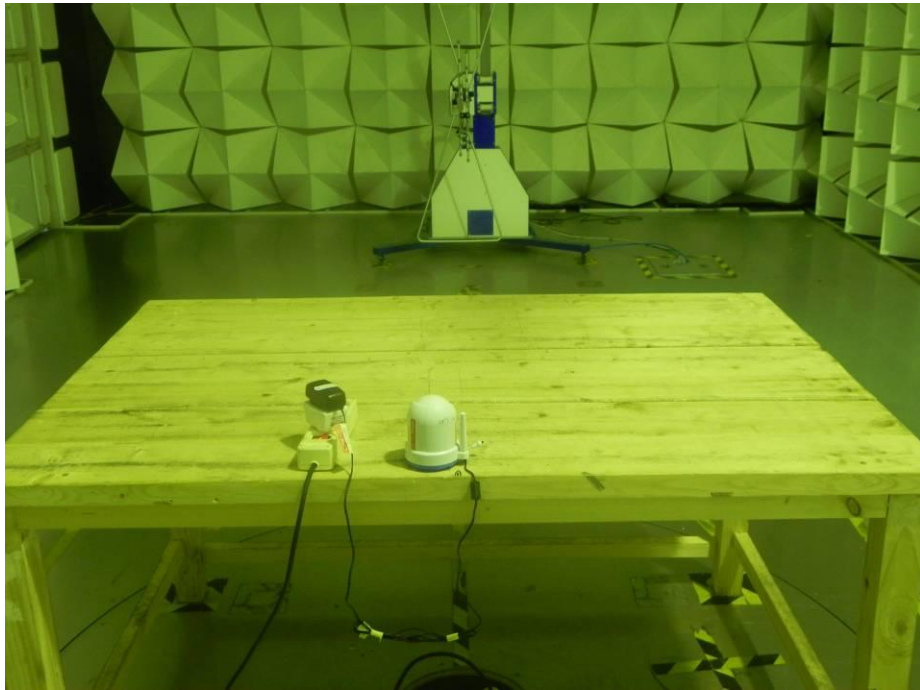


16.2 Photograph – Radiation Spurious Emission Test Setup

Below 30MHz at Test site 2#



30MHz-1GHz at Test Site 2#



Above 1GHz at Test Site 1#



17 Photographs - Constructional Details

17.1 Model CA531 -External Photos



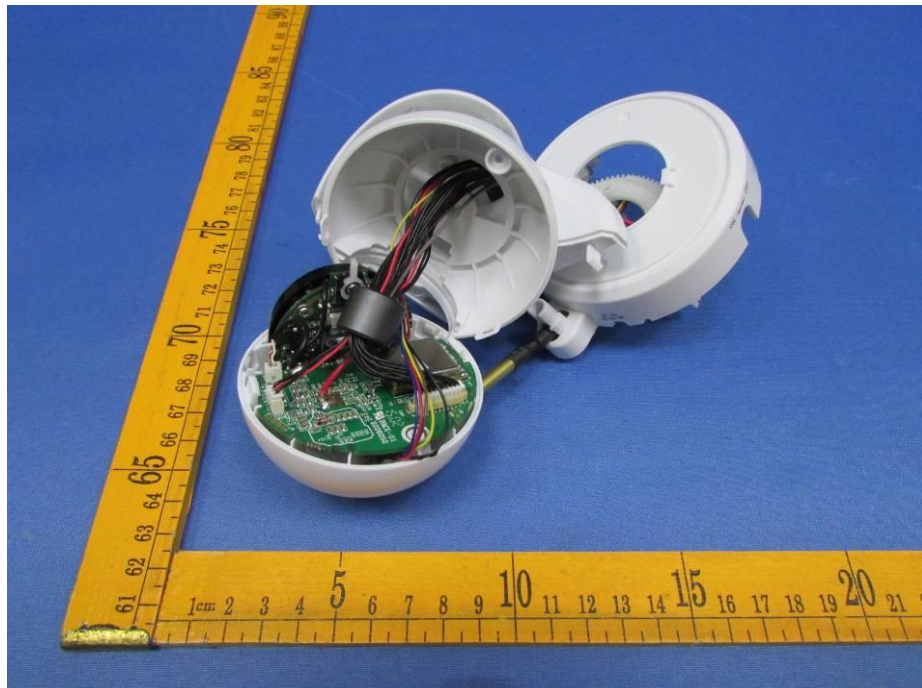
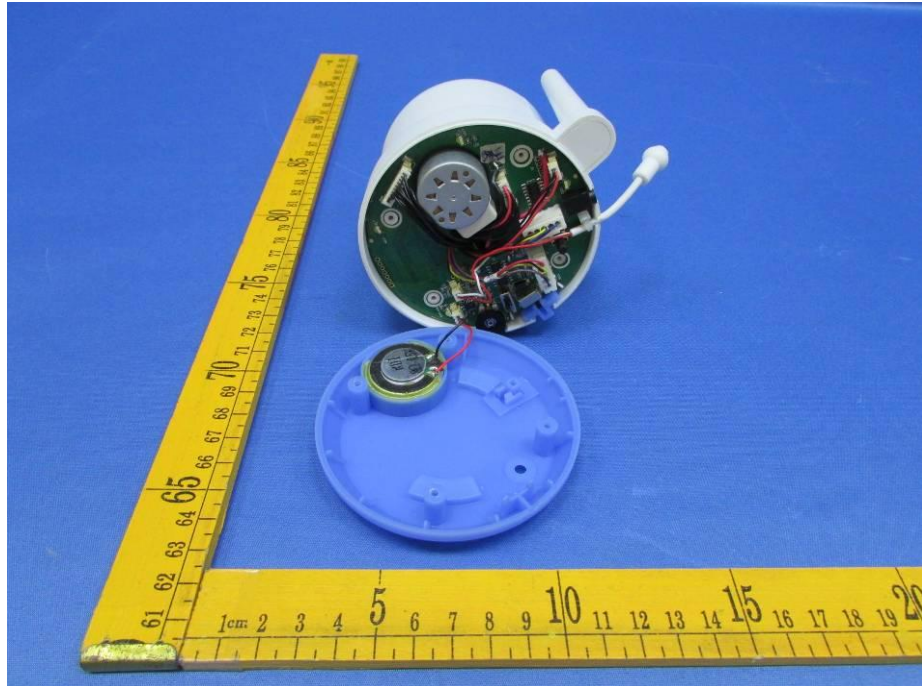


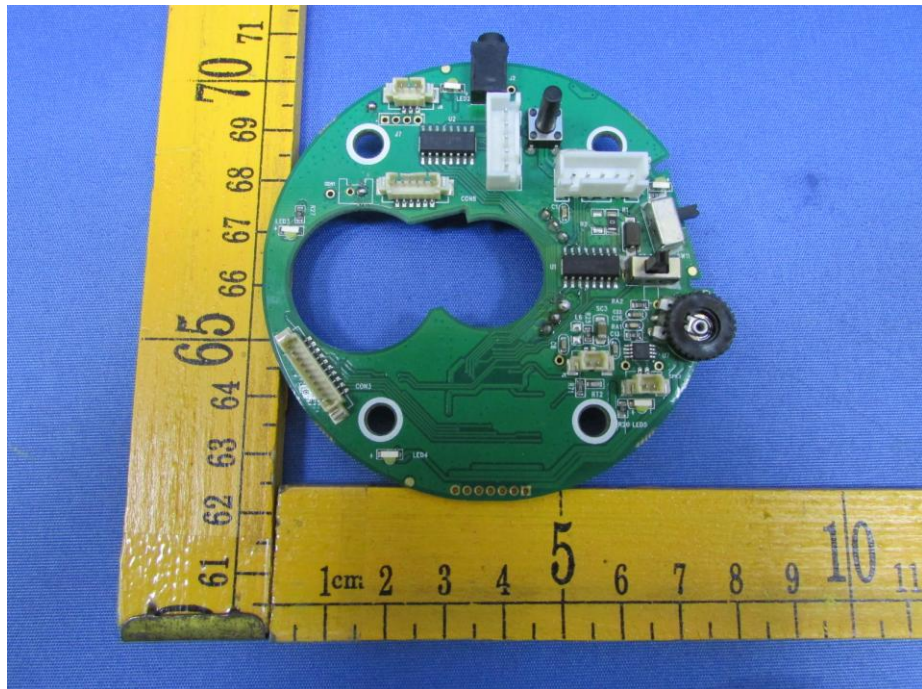
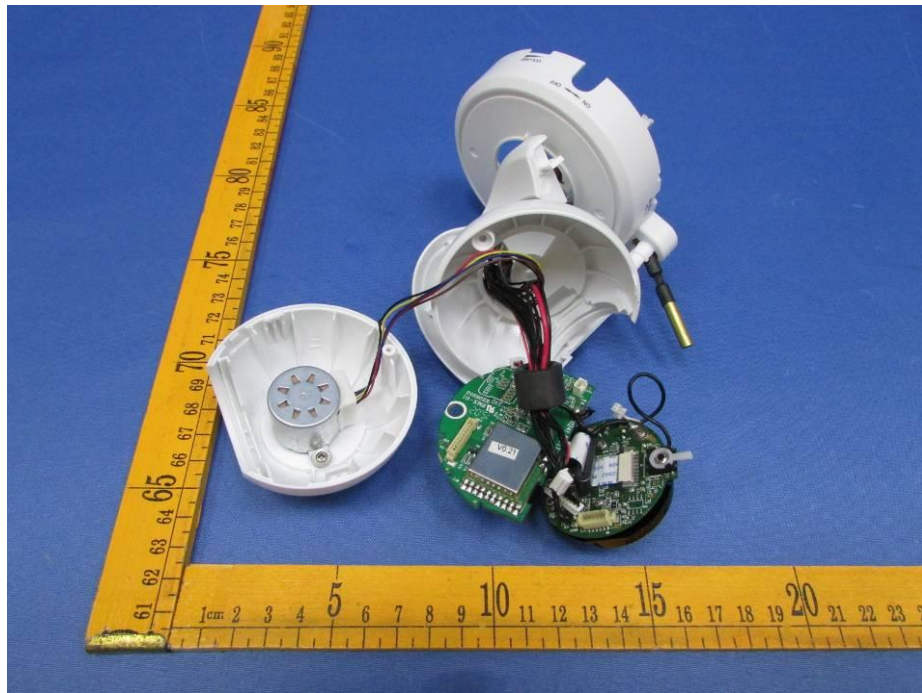


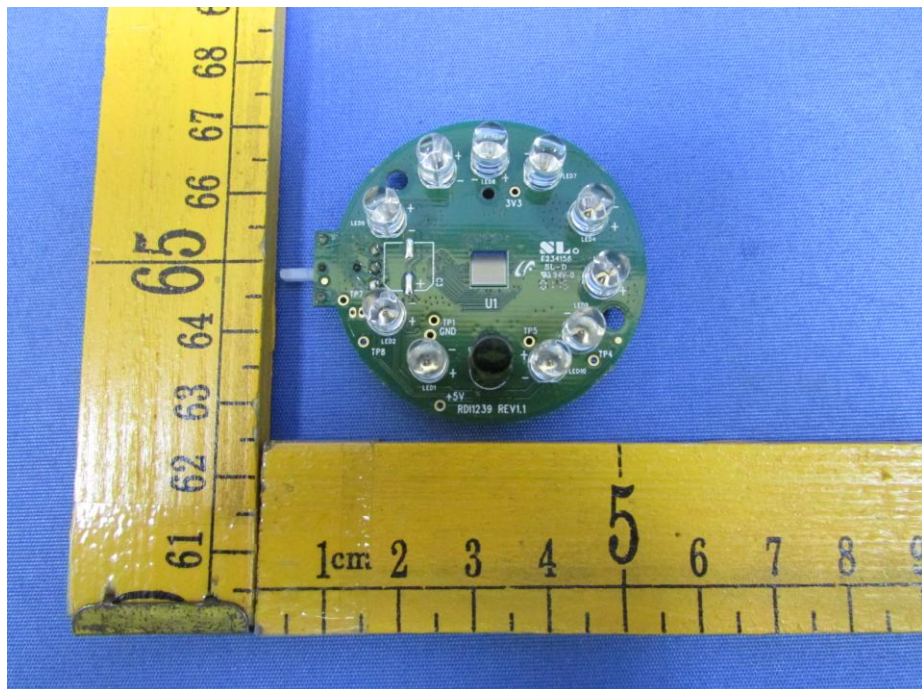
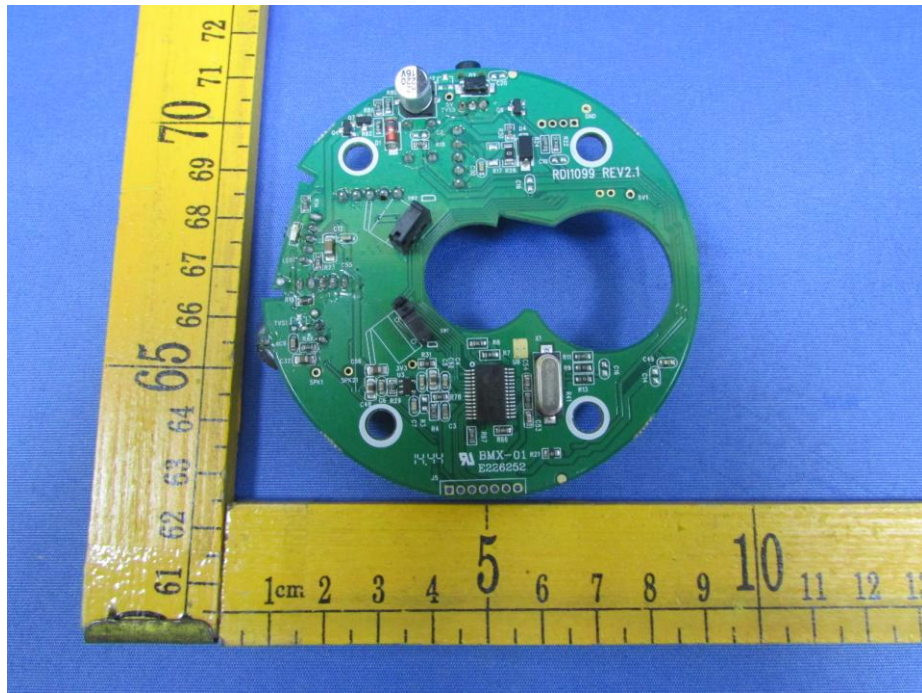


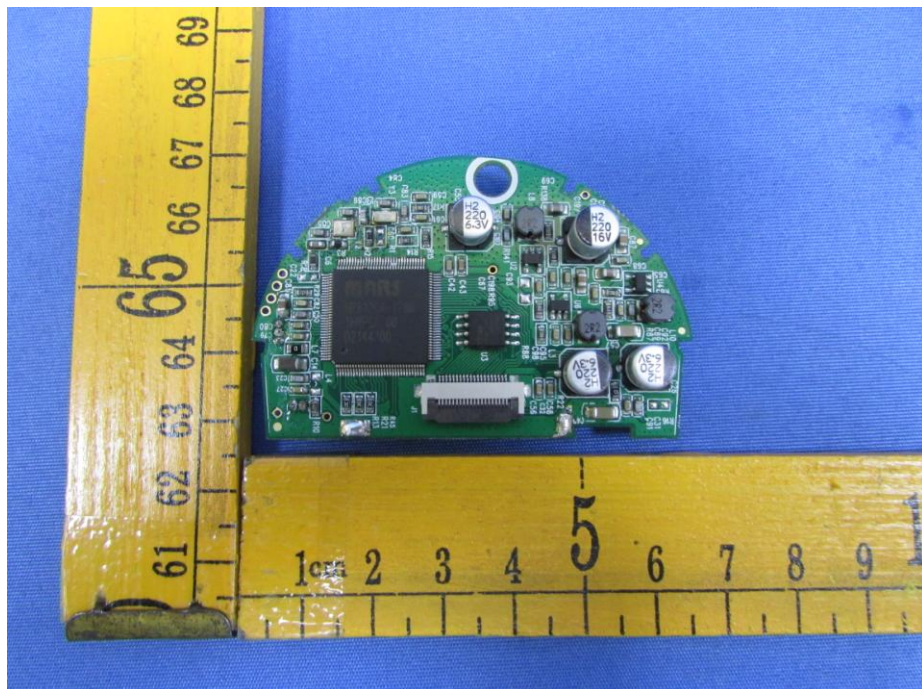
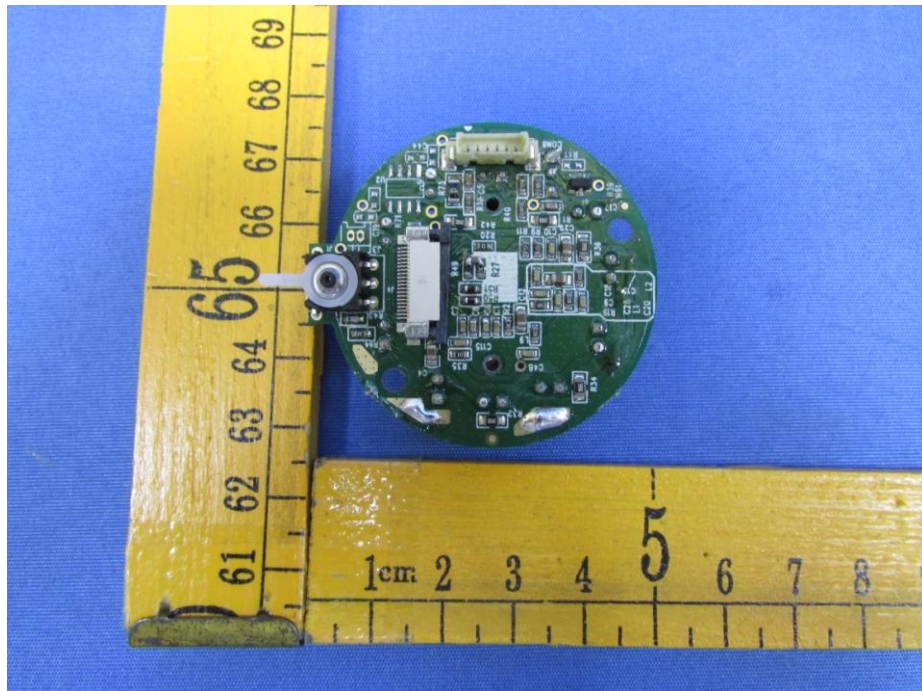


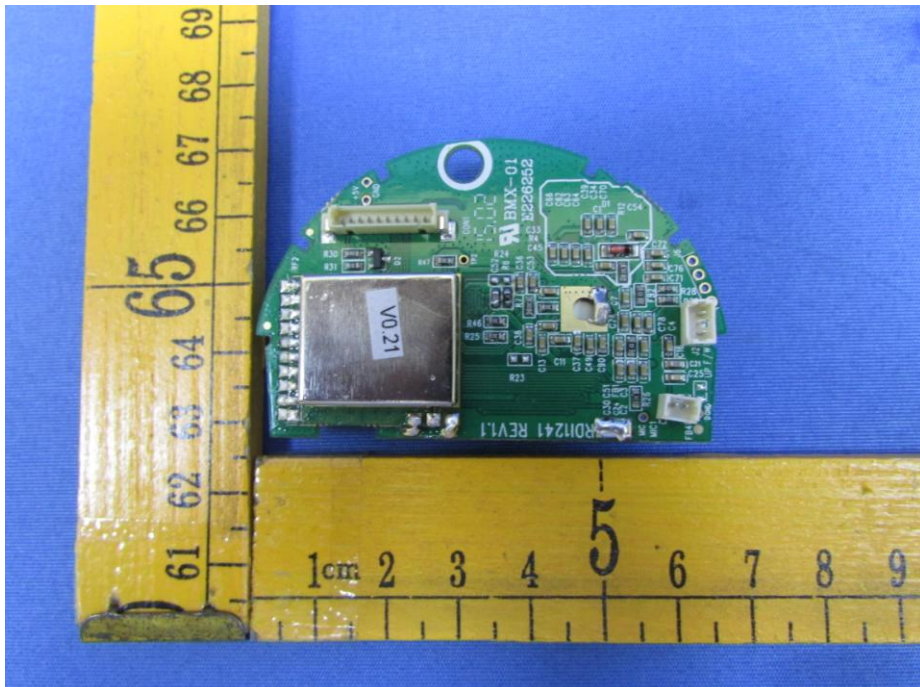
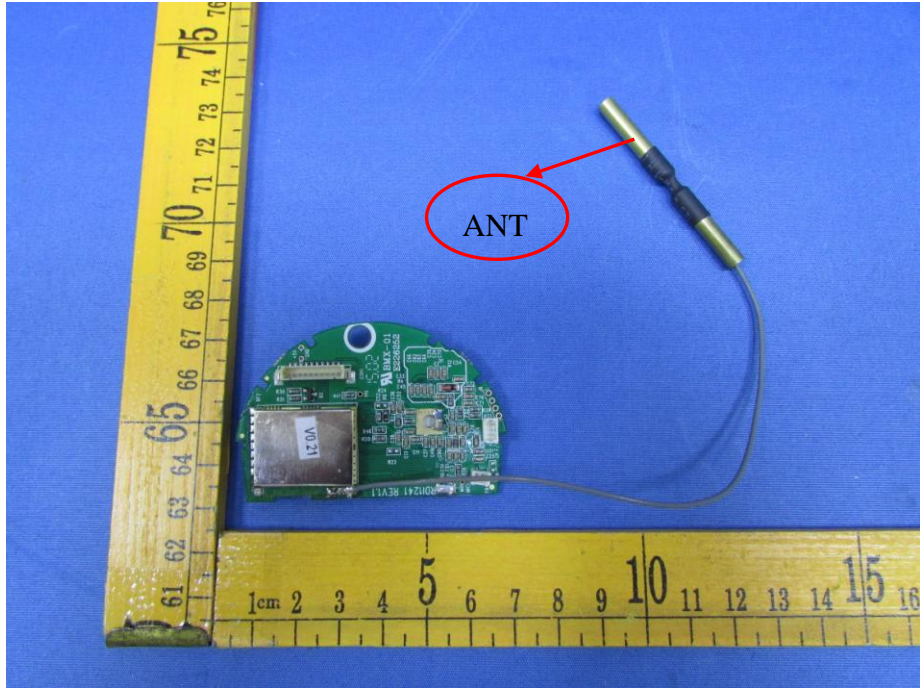
17.2 Model CA531 -Internal Photos

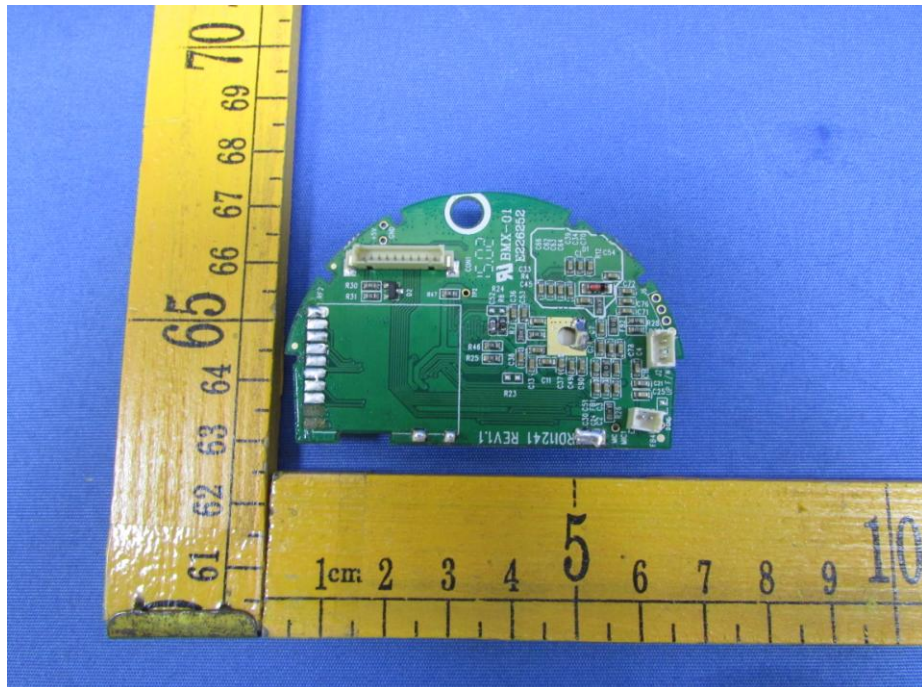
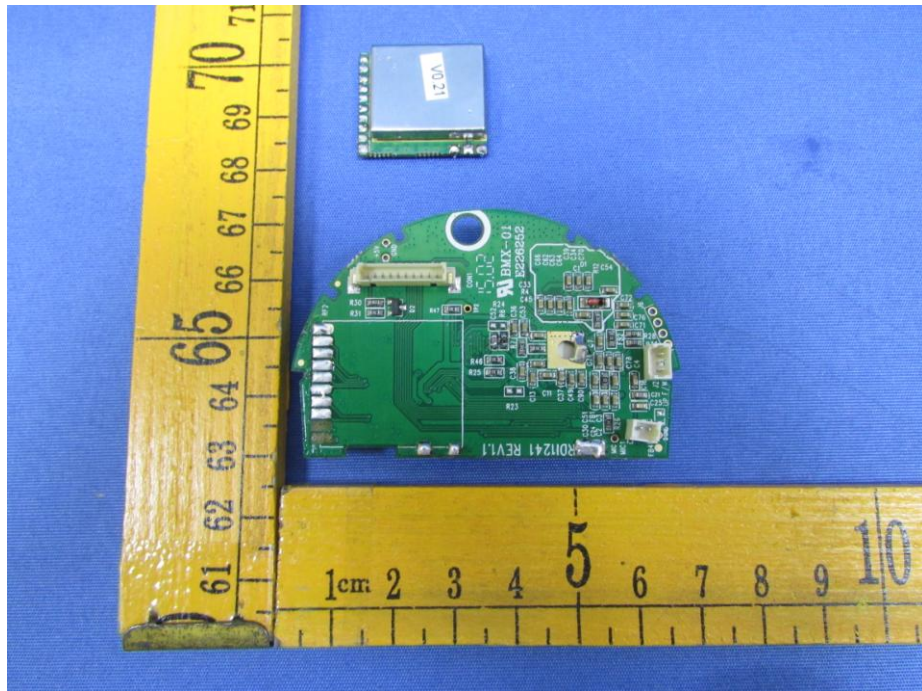


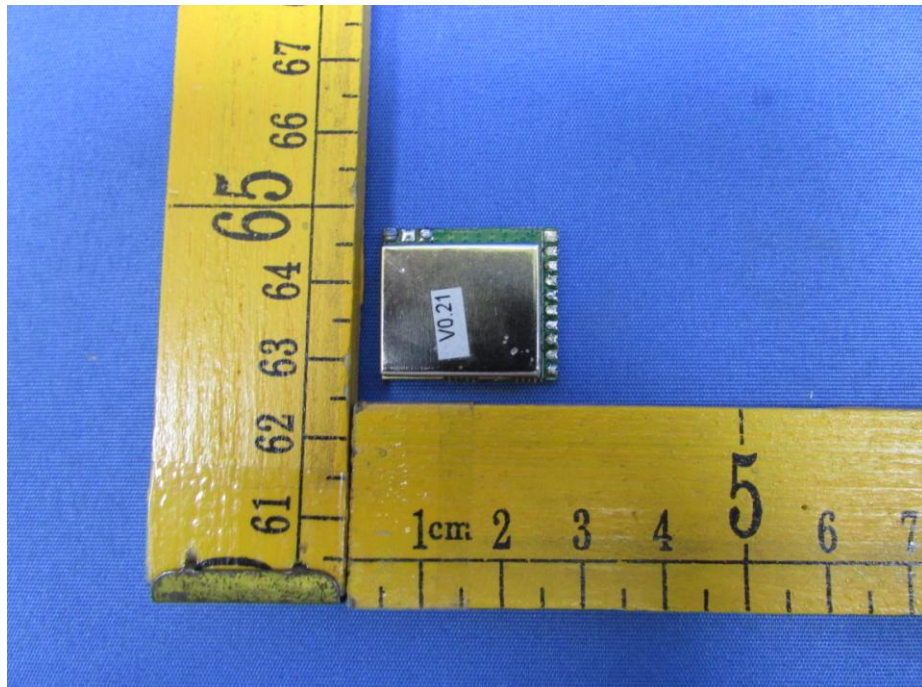
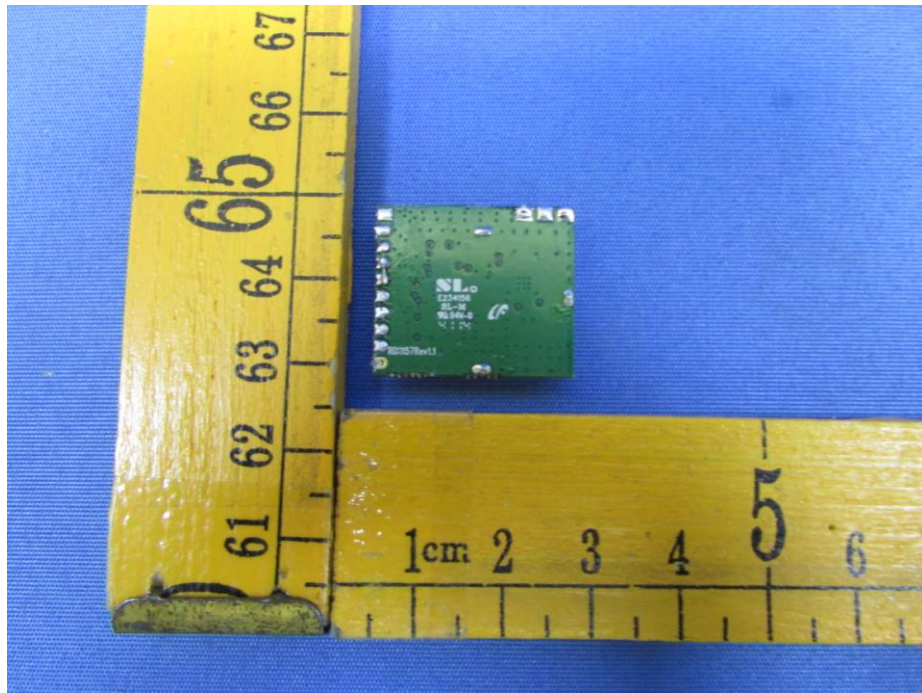


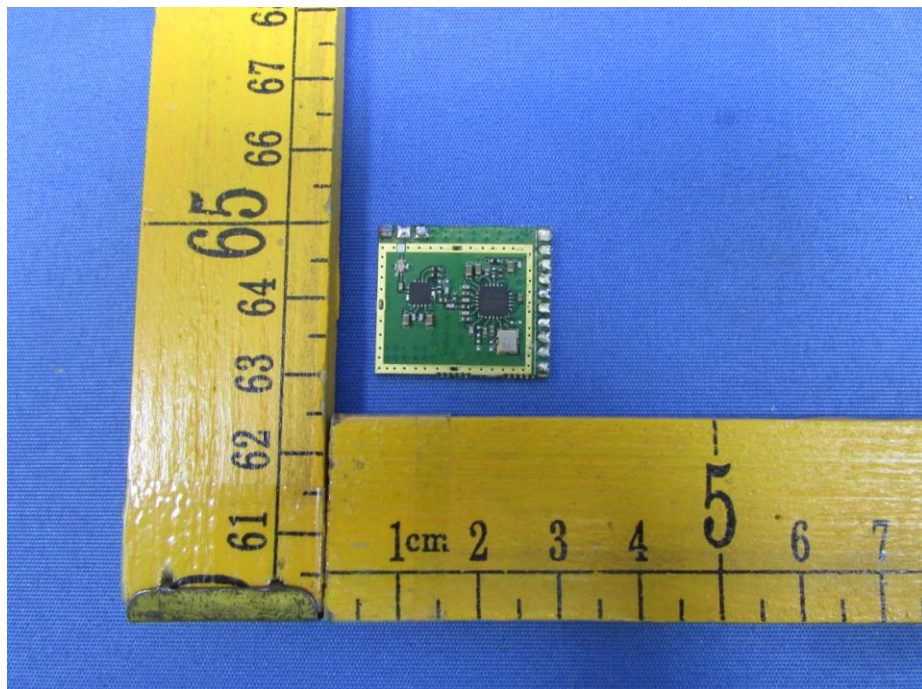
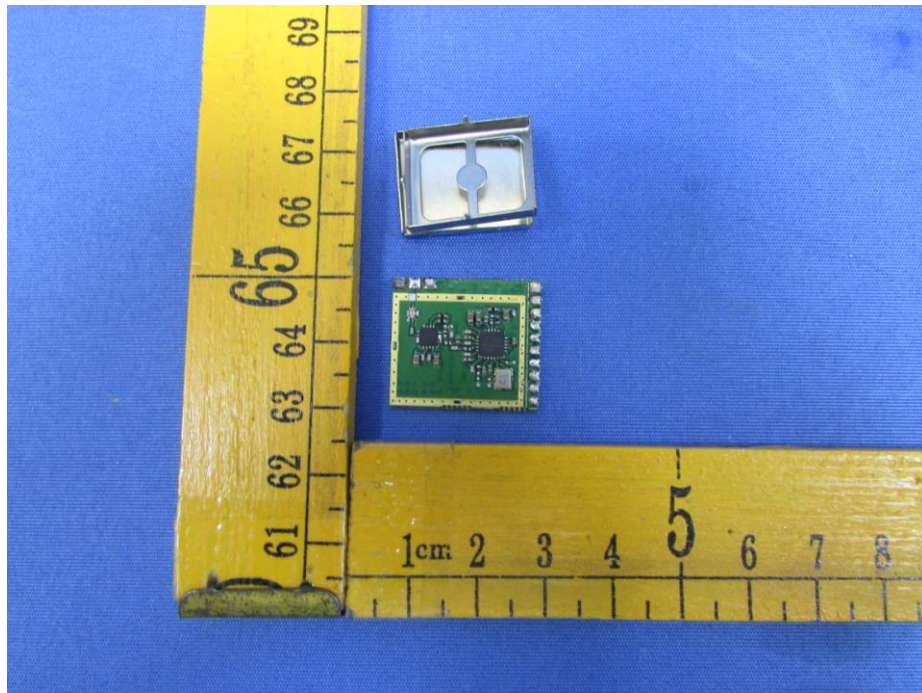


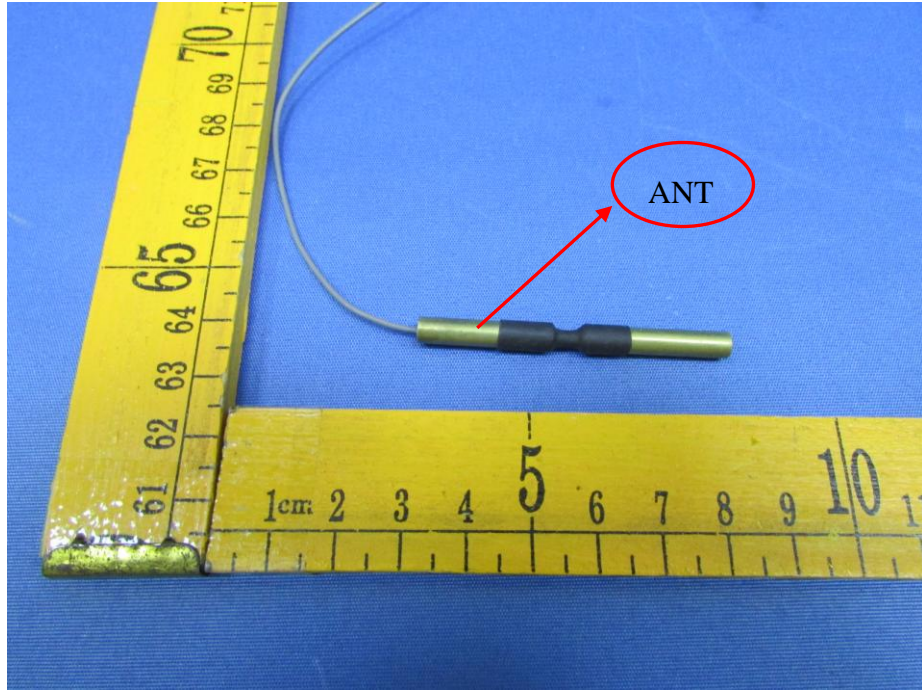












===== End of Report =====