TEST REPORT

Reference No.	:	WTS16S0858771E
FCC ID	:	NDZACN300
Applicant.....	:	Precision Enterprise Ltd
Address.....	:	Unit J 33/F., COS Centre,56 Tsun Yip Street, Kwun Tong, Kowloon, Hong Kong
Manufacturer	:	DONGGUAN PROTRONIC ELECTRONICS LTD.
Address.....	:	Protronic Building, Xiangxi Village, Shipai Town, Dongguan City, Guangdong Province, P.R. China
Product Name.....	:	Wireless Rear View Backup System
Model No.	:	APH070Tx, ADS070Tx,ACN300,PKC0BU7-05Tx
Standards.....	:	FCC CFR47 Part 15 Section 15.247:2014
Date of Receipt sample	:	Aug. 19, 2016
Date of Test	:	Aug. 20 – Sep. 14, 2016
Date of Issue.....	:	Sep. 18, 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.

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2 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
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:	Wireless Rear View Backup System
Model No.:	APH070Tx, ADS070Tx,ACN300,PKC0BU7-05Tx
Model Description:	Only the model namesare different
Frequency Range:	2406-2472.5MHz, 20 Channels in total
Type of Modulation:	GFSK
The lowest oscillator:	32.768KHz
Antenna installation:	Dipole antenna
Antenna Gain:	0dBi

4.2 Details of E.U.T.

Technical Data:	Input:DC 8-30V,

4.4 Test Mode

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

Table 1 Tests Carried OutUnderFCC 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**

  WaltekServices(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**

  WaltekServices(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**

  WaltekServices(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

3m Semi-anechoic Chamber for Radiation EmissionsTest site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.14,2016	Sep.13,2017
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.14,2016	Sep.13,2017
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Sep.15,2016	Apr.18,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.14,2016	Sep.13,2017
5	Broad-bandHorn 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 RadiationEmissions Test site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	Sep.14,2016	Sep.13,2017
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.14,2016	Sep.13,2017
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.14,2016	Sep.13,2017
4	Cable	HUBER+SUHNER	CBL2	525178	Sep.14,2016	Sep.13,2017
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.14,2016	Sep.13,2017
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.14,2016	Sep.13,2017
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.14,2016	Sep.13,2017

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 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 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	$20\log^{(500)}$

6.1 EUT Operation

Operating Environment**:**

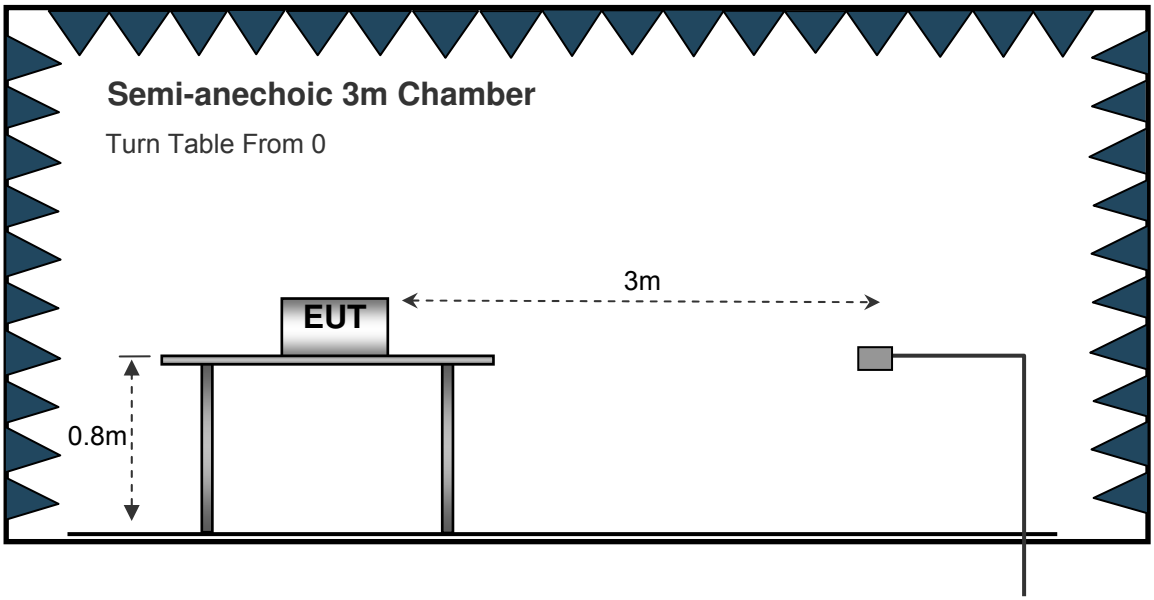
Temperature: 23.5 °C

Humidit

6.2 Test Setup

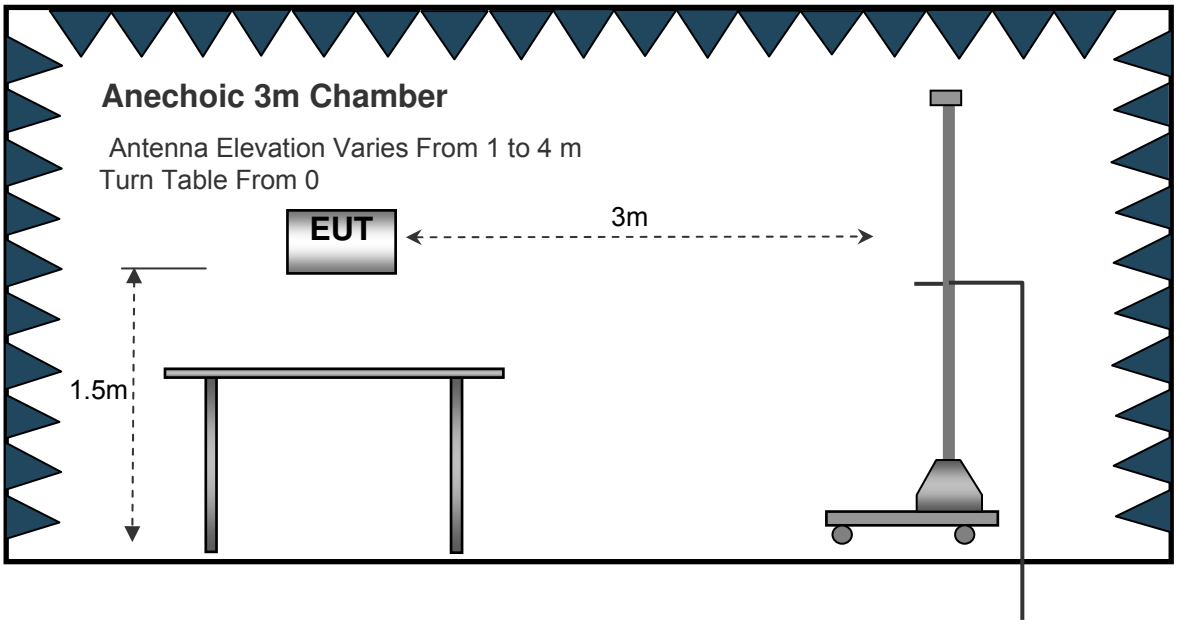
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

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.



6.3 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

6.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; Forabove1GHz, 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 tothe 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.

6.5 Summary of Test Results

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)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Low Channel 2406MHz									
254.02	22.32	QP	162	1.5	H	10.62	32.94	46.00	-13.06
254.02	19.04	QP	228	1.4	V	10.62	29.66	46.00	-16.34
4804.00	54.64	PK	2	1.0	V	-1.07	53.57	74.00	-20.43
4804.00	42.66	Ave	2	1.0	V	-1.07	41.59	54.00	-12.41
7206.00	50.97	PK	211	1.9	H	1.35	52.32	74.00	-21.68
7206.00	40.53	Ave	211	1.9	H	1.35	41.88	54.00	-12.12
2314.24	45.88	PK	275	1.8	V	-13.21	32.67	74.00	-41.33
2314.24	37.67	Ave	275	1.8	V	-13.21	24.46	54.00	-29.54
2358.94	44.26	PK	195	1.8	H	-13.19	31.07	74.00	-42.93
2358.94	37.31	Ave	195	1.8	H	-13.19	24.12	54.00	-29.88
2485.59	42.75	PK	293	1.1	V	-13.04	29.71	74.00	-44.29
2485.59	38.94	Ave	293	1.1	V	-13.04	25.90	54.00	-28.10

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK Middle Channel 2441MHz									
254.02	22.98	QP	277	1.6	H	10.62	33.60	46.00	-12.40
254.02	18.85	QP	130	1.1	V	10.62	29.47	46.00	-16.53
4882.00	51.47	PK	274	1.8	V	-0.68	50.79	74.00	-23.21
4882.00	43.08	Ave	274	1.8	V	-0.68	42.40	54.00	-11.60
7323.00	53.65	PK	10	1.4	H	2.12	55.77	74.00	-18.23
7323.00	40.76	Ave	10	1.4	H	2.12	42.88	54.00	-11.12
2311.95	45.19	PK	138	1.3	V	-13.24	31.95	74.00	-42.05
2311.95	39.77	Ave	138	1.3	V	-13.24	26.53	54.00	-27.47
2361.60	44.98	PK	294	1.9	H	-13.12	31.86	74.00	-42.14
2361.60	38.79	Ave	294	1.9	H	-13.12	25.67	54.00	-28.33
2492.04	42.37	PK	339	1.6	V	-13.09	29.28	74.00	-44.72
2492.04	36.03	Ave	339	1.6	V	-13.09	22.94	54.00	-31.06

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK High Channel 2472.5MHz									
254.02	20.07	QP	295	1.6	H	10.62	30.69	46.00	-15.31
254.02	20.54	QP	265	1.8	V	10.62	31.16	46.00	-14.84
4960.00	54.81	PK	279	1.4	V	-0.25	54.56	74.00	-19.44
4960.00	40.73	Ave	279	1.4	V	-0.25	40.48	54.00	-13.52
7440.00	54.38	PK	65	1.5	H	2.83	57.21	74.00	-16.79
7440.00	42.92	Ave	65	1.5	H	2.83	45.75	54.00	-8.25
2332.12	46.11	PK	140	1.6	V	-13.22	32.89	74.00	-41.11
2332.12	38.22	Ave	140	1.6	V	-13.22	25.00	54.00	-29.00
2358.15	44.47	PK	134	1.1	H	-13.15	31.32	74.00	-42.68
2358.15	36.73	Ave	134	1.1	H	-13.15	23.58	54.00	-30.42
2487.80	44.73	PK	304	1.8	V	-13.09	31.64	74.00	-42.36
2487.80	36.04	Ave	304	1.8	V	-13.09	22.95	54.00	-31.05

Test Frequency :Above 18GHz

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

7 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

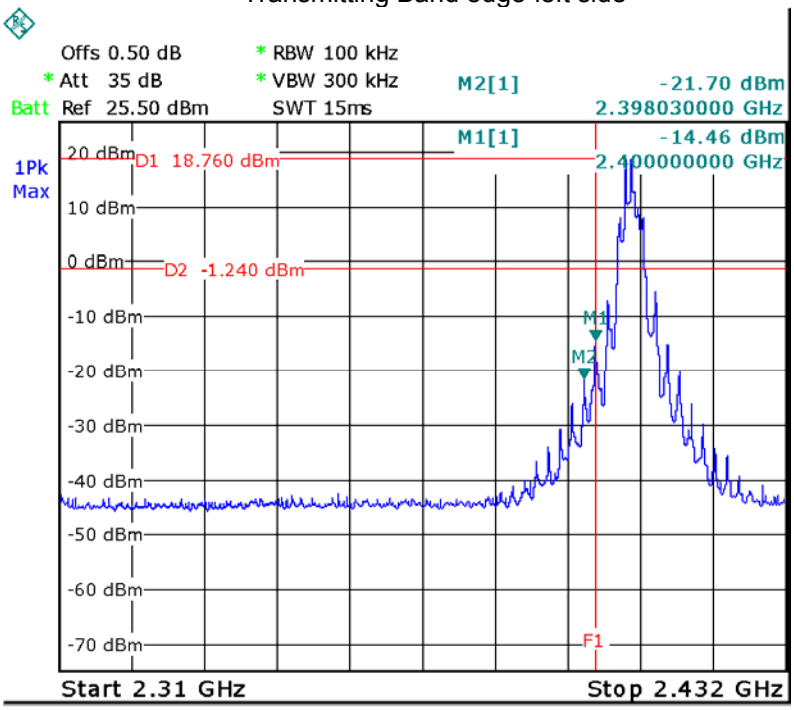
7.1 Test Procedure

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

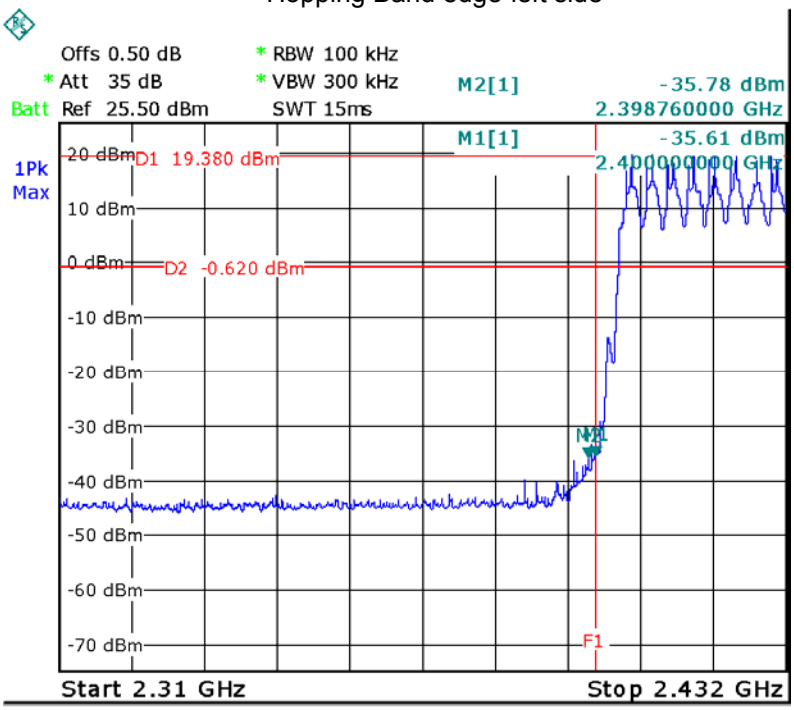
7.2 Test Result

Test plots

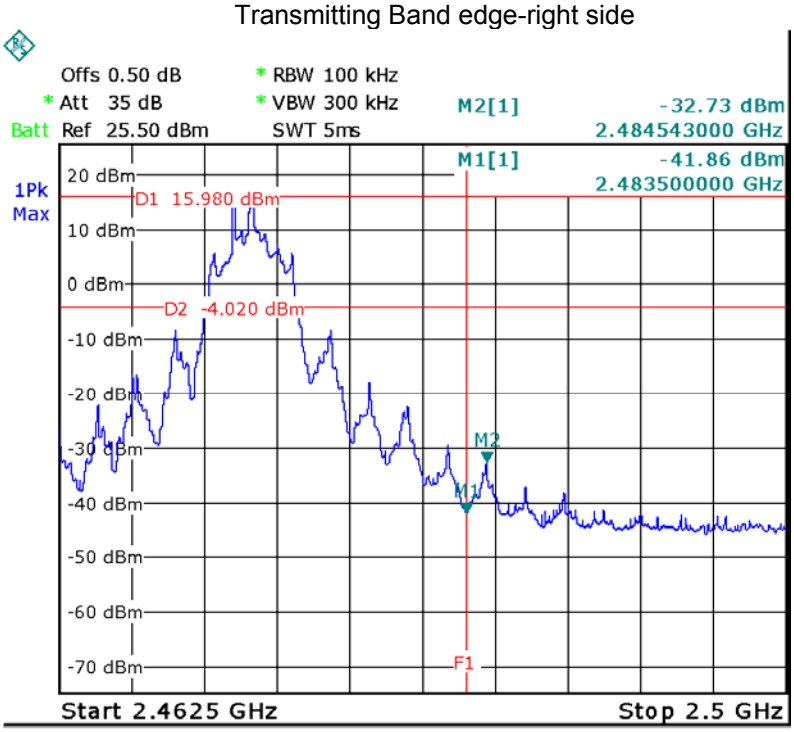
Transmitting Band edge-left side



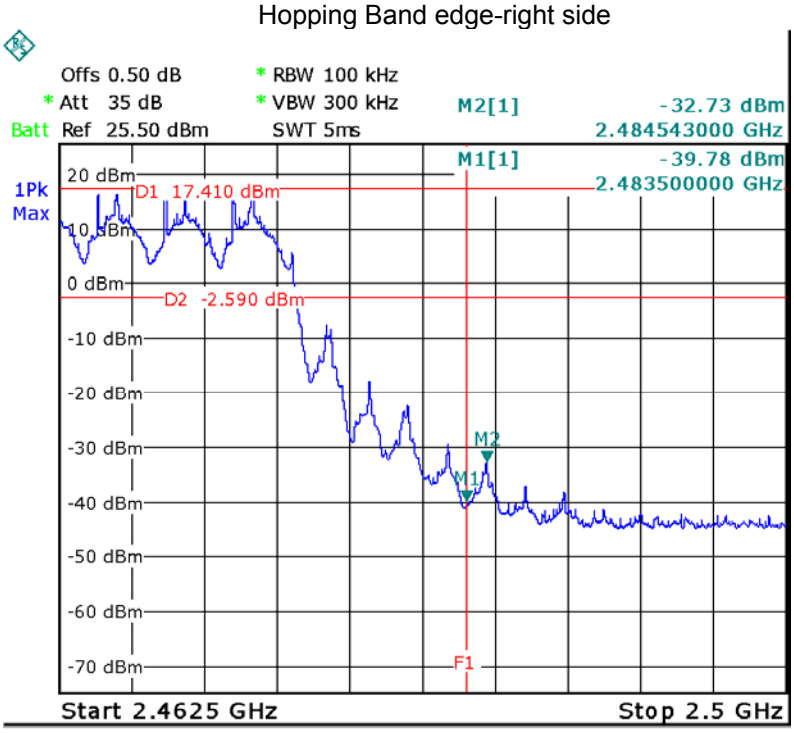
Hopping Band edge-left side



Transmitting Band edge-right side



Hopping Band edge-right side



8 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.

8.1 Test Procedure

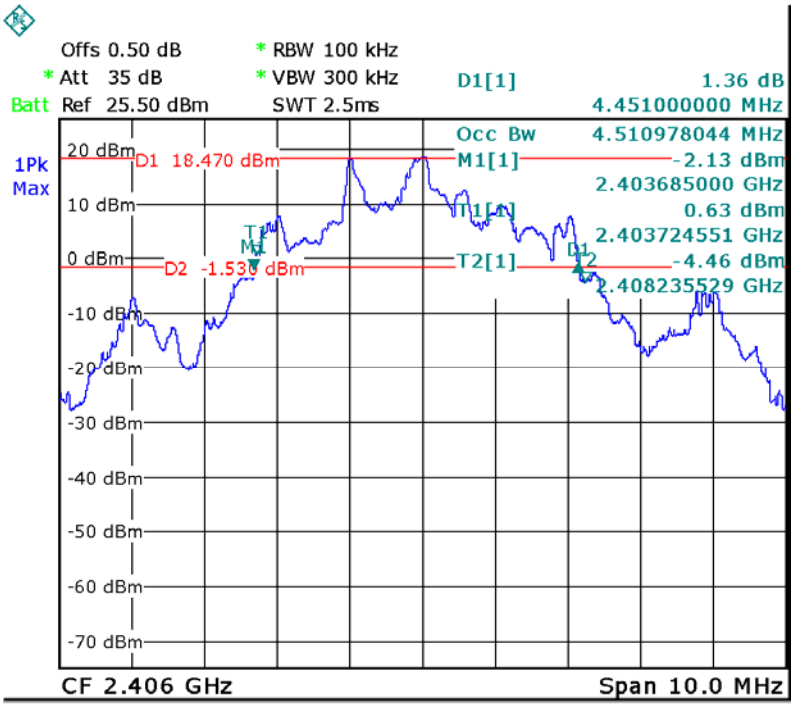
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

8.2 Test Result

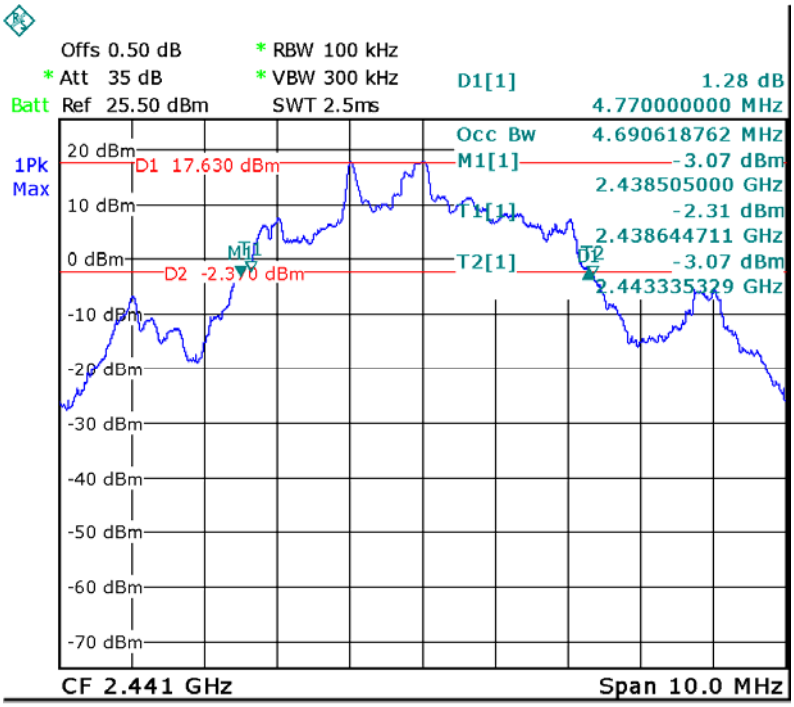
Modulation	Test Channel	Bandwidth
GFSK	Low	4.451MHz
GFSK	Middle	4.770MHz
GFSK	High	4.770MHz

Testplots

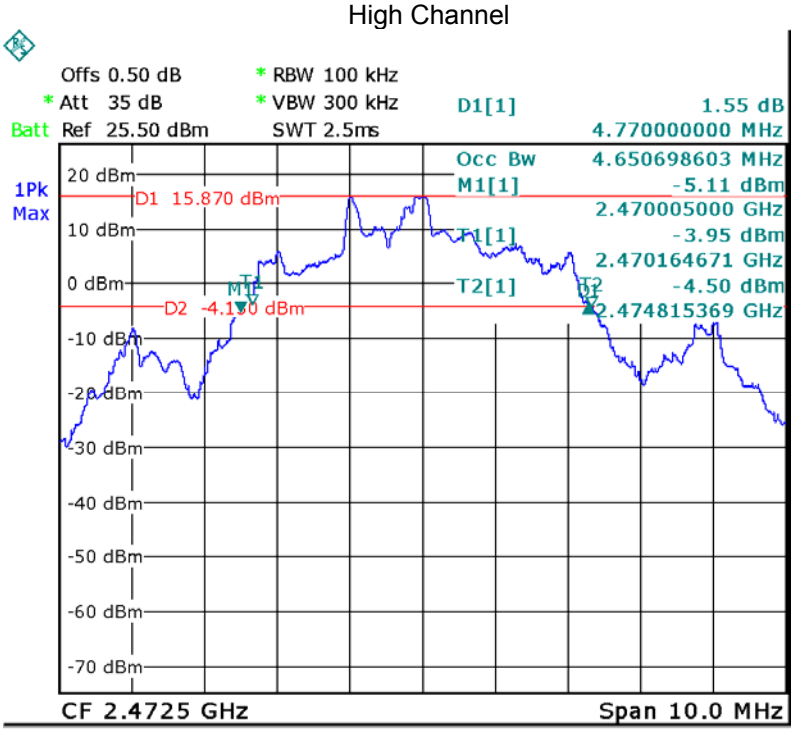
Low Channel



Middle Channel



High Channel



9 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. Forall 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.

9.1 Test Procedure

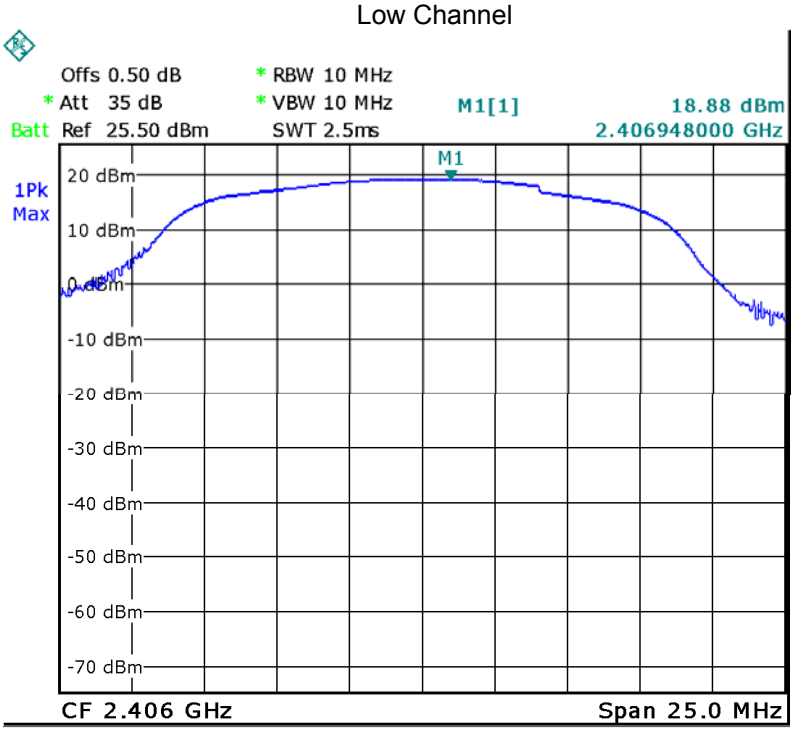
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 10MHz. VBW =10MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

9.2 Test Result

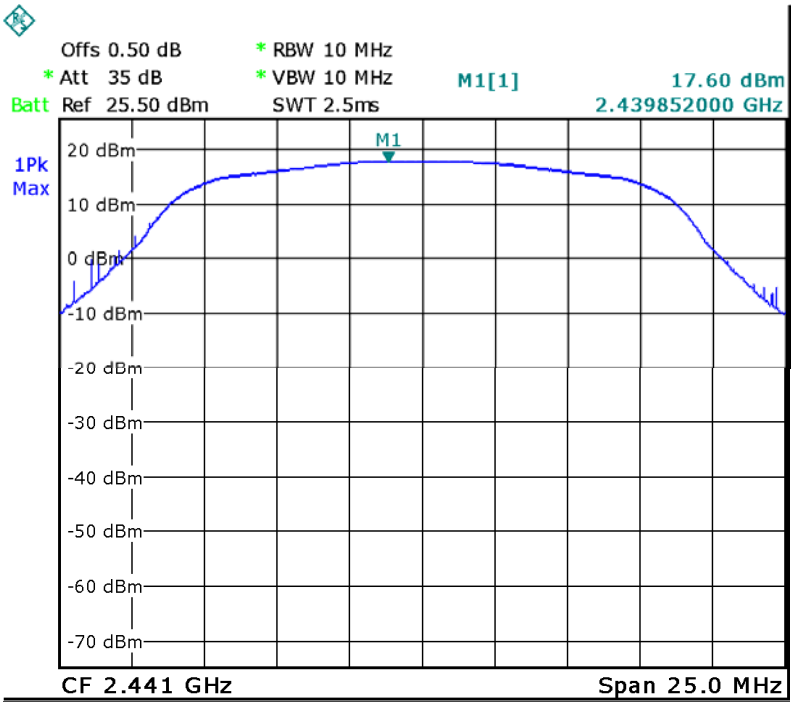
Test Channel	Output Power (dBm)	Limit (dBm)
Low	18.88	20.97
Middle	18.76	20.97
High	15.89	20.97

Testplots

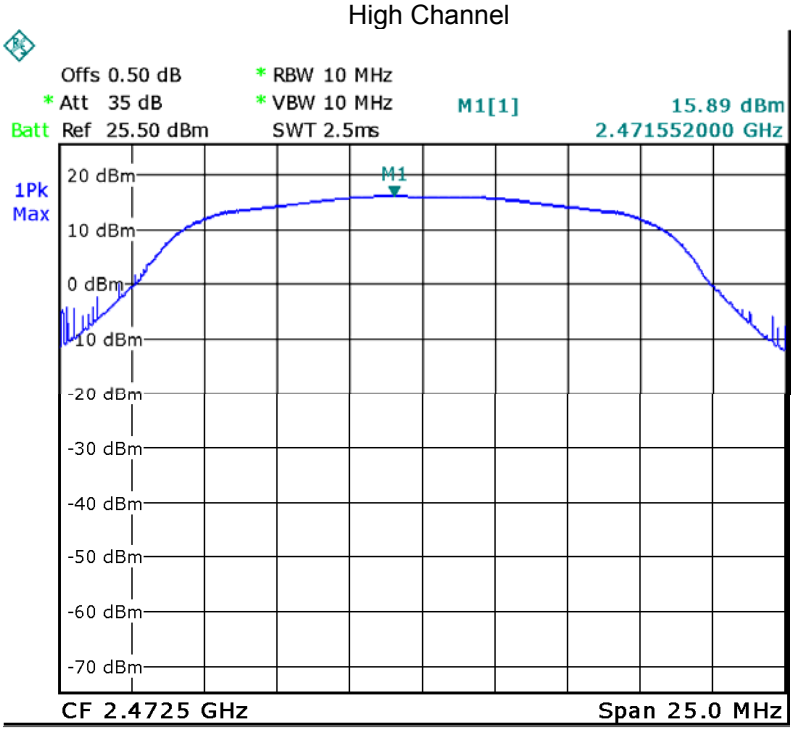
Low Channel



Middle Channel



High Channel



10 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.

10.1 Test Procedure

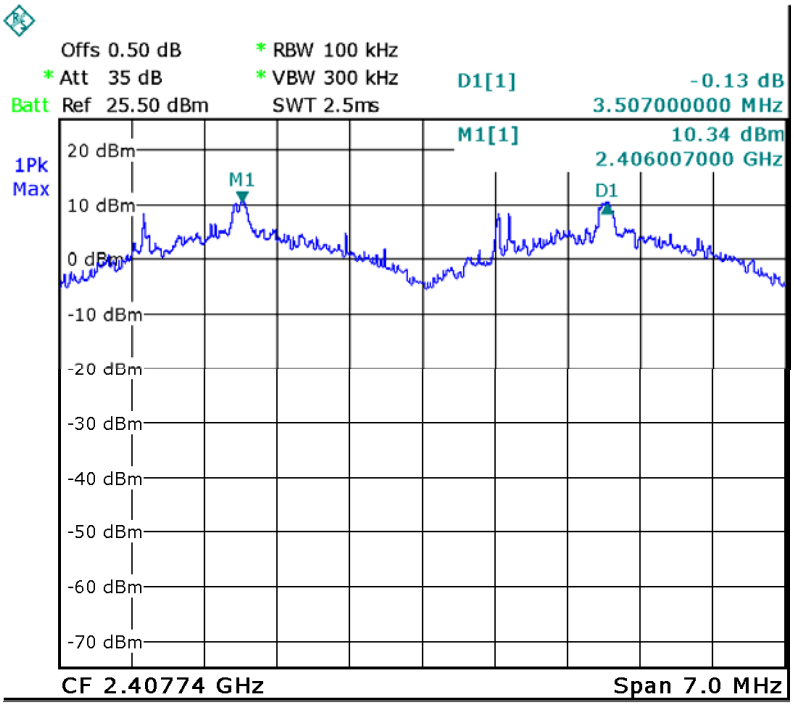
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz , Span = 7MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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.

10.2 Test Result

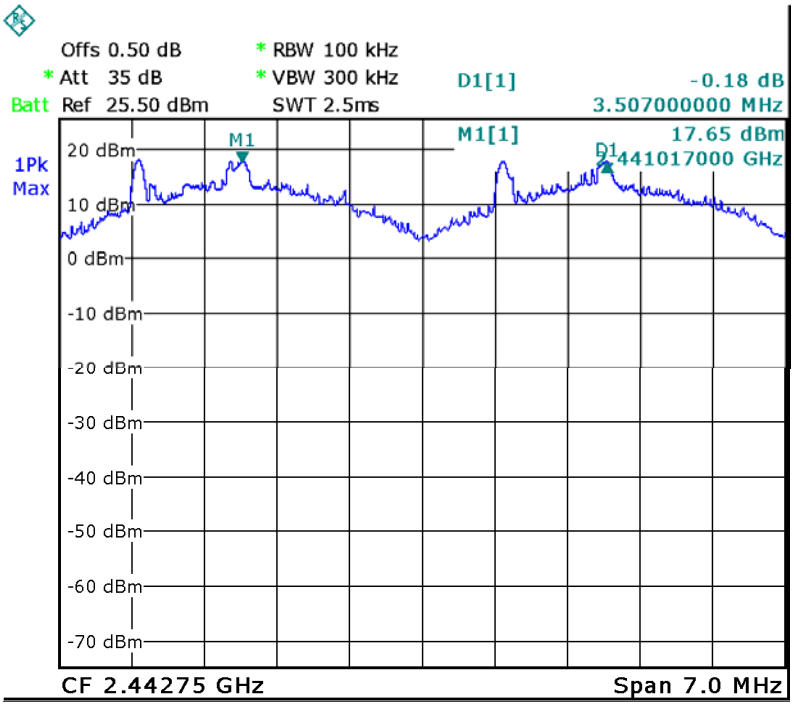
Modulation	Test Channel	Separation (MHz)	Result
GFSK	Low	3.507	PASS
GFSK	Middle	3.507	PASS
GFSK	High	3.507	PASS

Test plots

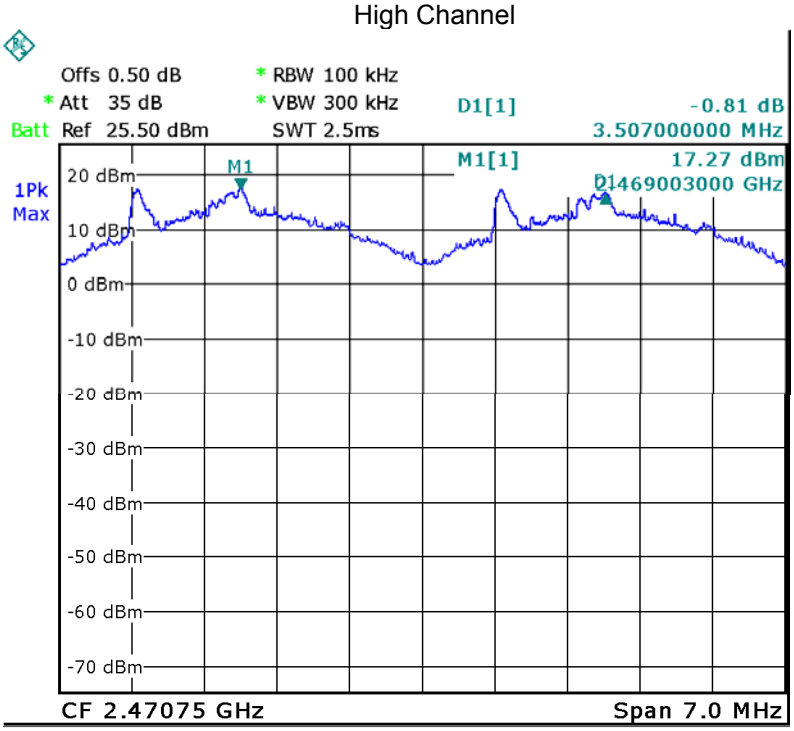
Low Channel



Middle Channel



High Channel



11 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.

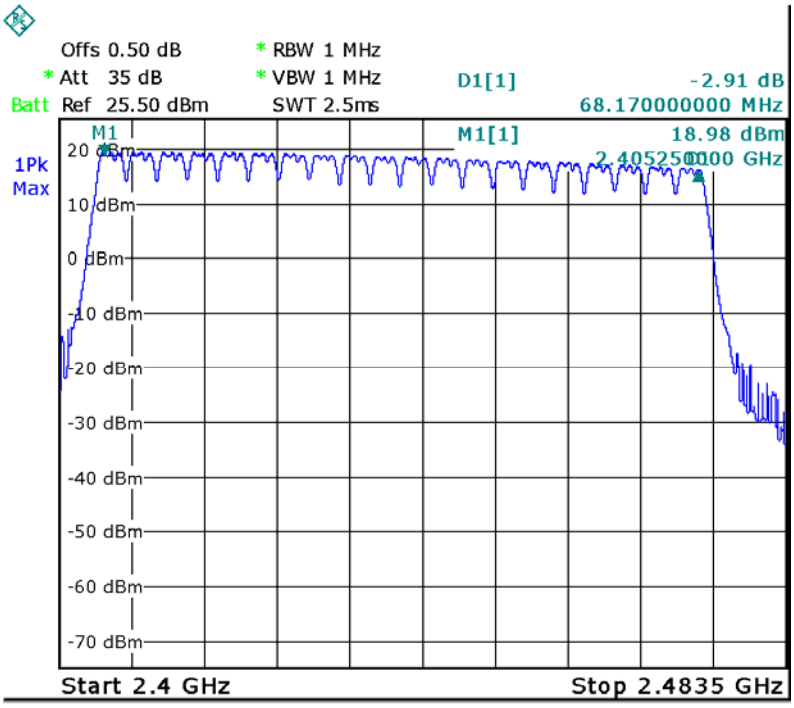
Test Mode: Test in hopping transmitting operating mode.

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 = 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;

11.2 Test Result

Test Plots: 20Channels in total



12 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.

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 spectrum analyzer span = 0. Centreon a hopping channel;

3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel.

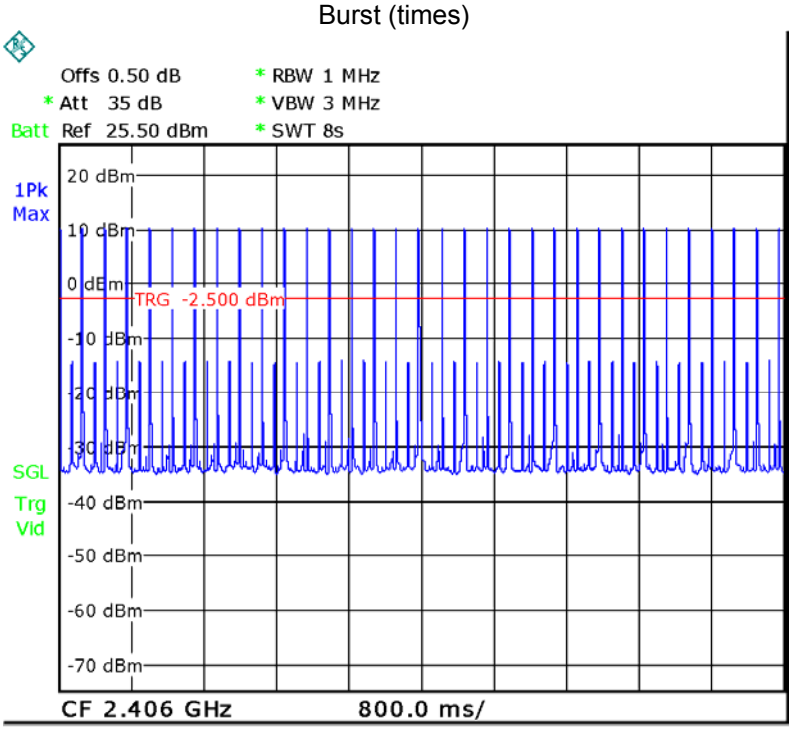
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

12.2 Test Result

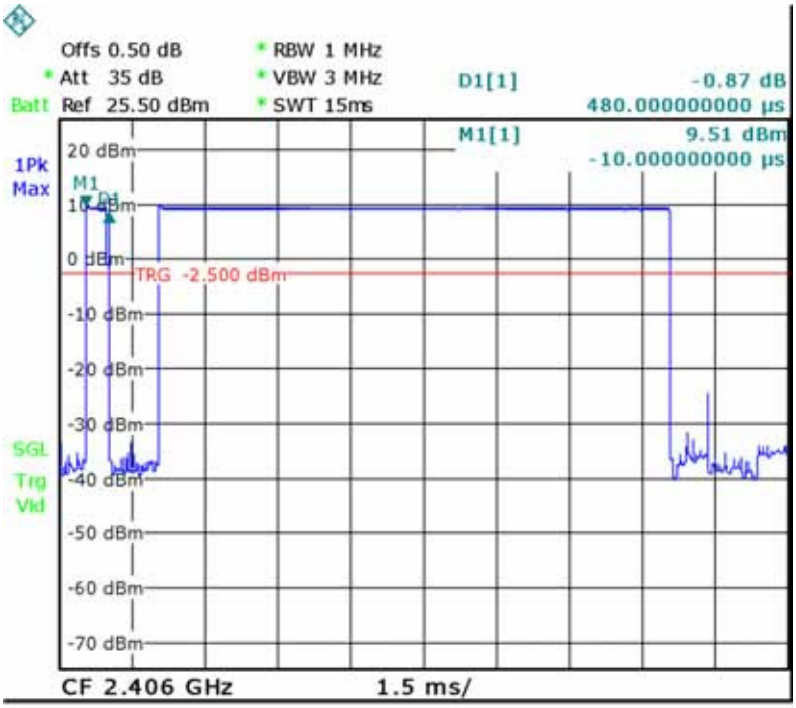
Channel	marker-delta(ms)	Observation Period(s)	Burst (times)	DwellTime(s)	Limits (s)
Low	10.98	8.0	33	0.362	0.4
High	10.95	8.0	33	0.361	0.4
Calculation formula: Dwell time=0.4s*Number ofHoppingFrequency*Burst(Times)*(markerdelta/1000)/ObservationPeriod Remark: Number ofHoppingFrequency=20; ObservationPeriod=8.0s; Low Channel=2406MHz; High Channel=2472.5MHz					

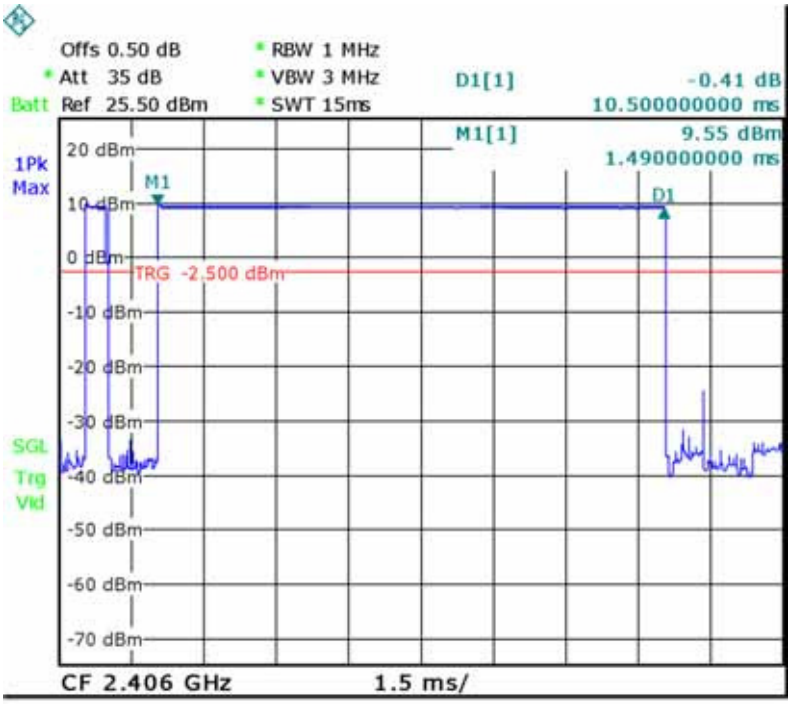
Test Plots
Low Channel

Burst (times)



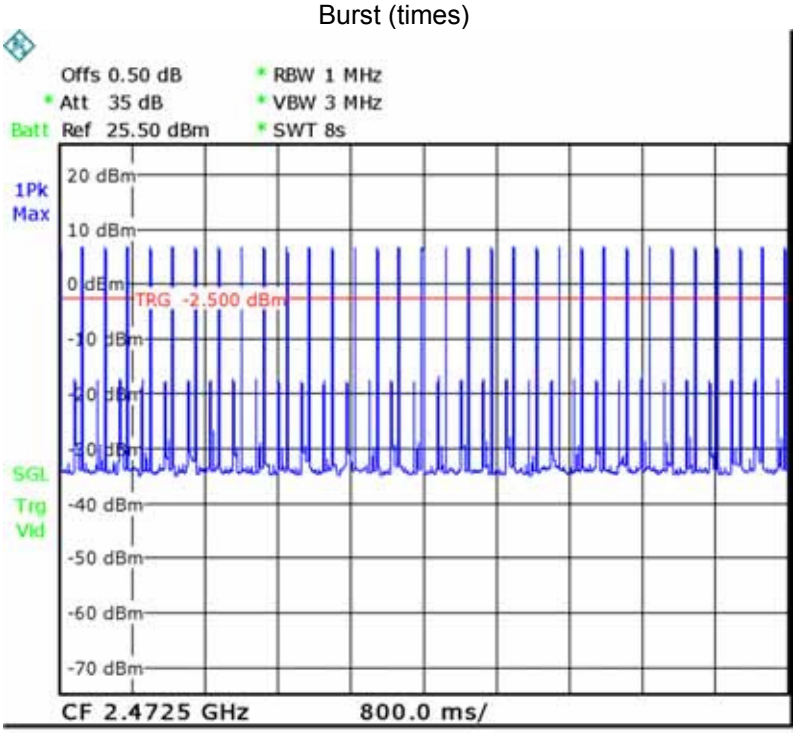
marker-delta



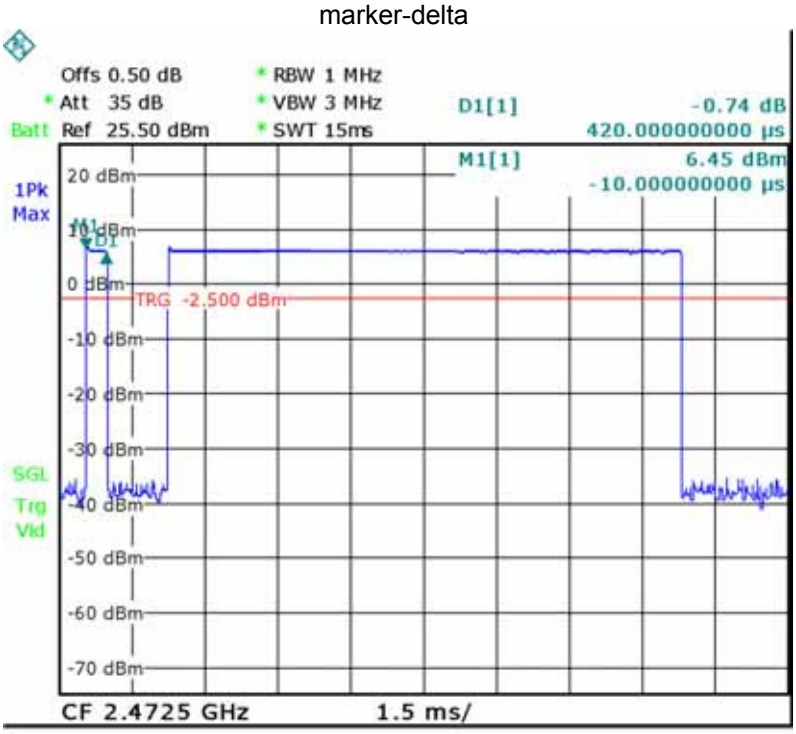


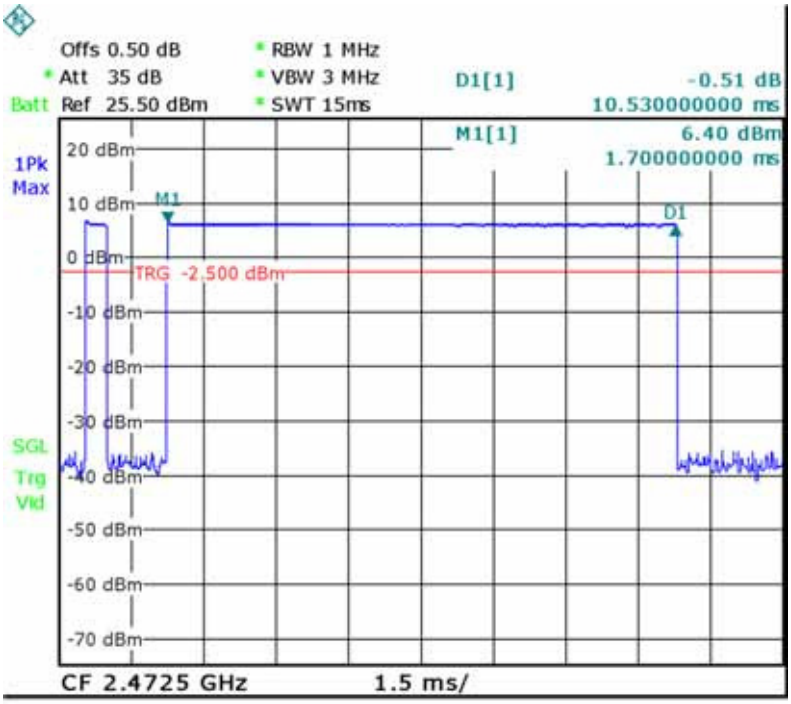
High Channel

Burst (times)



marker-delta





13 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 aDipole antenna, fulfil the requirement of this section.

14 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091

14.1 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.

14.2 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

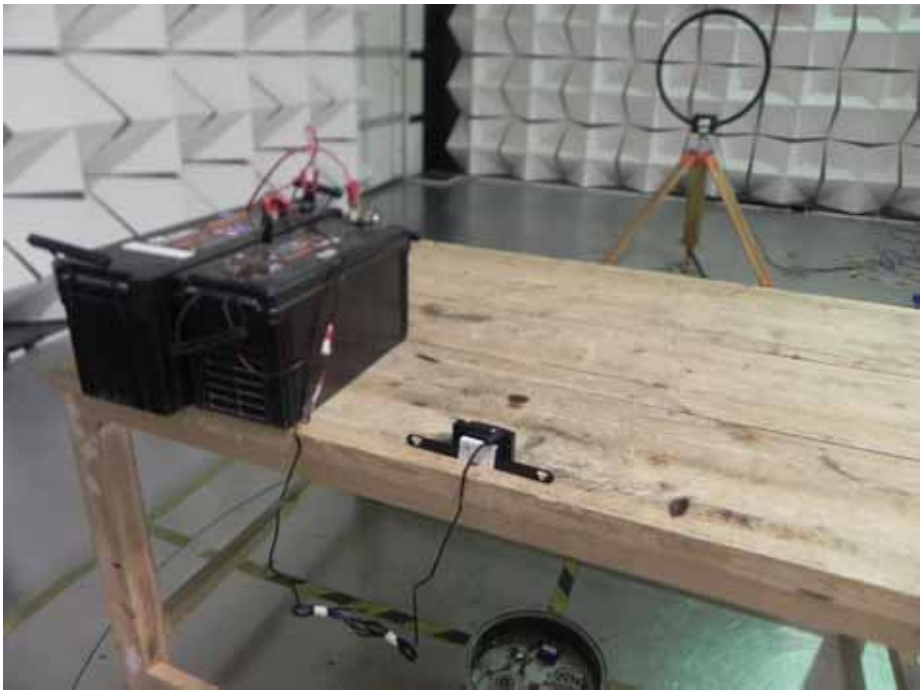
14.3 MPE Calculation Method

E (V/m)

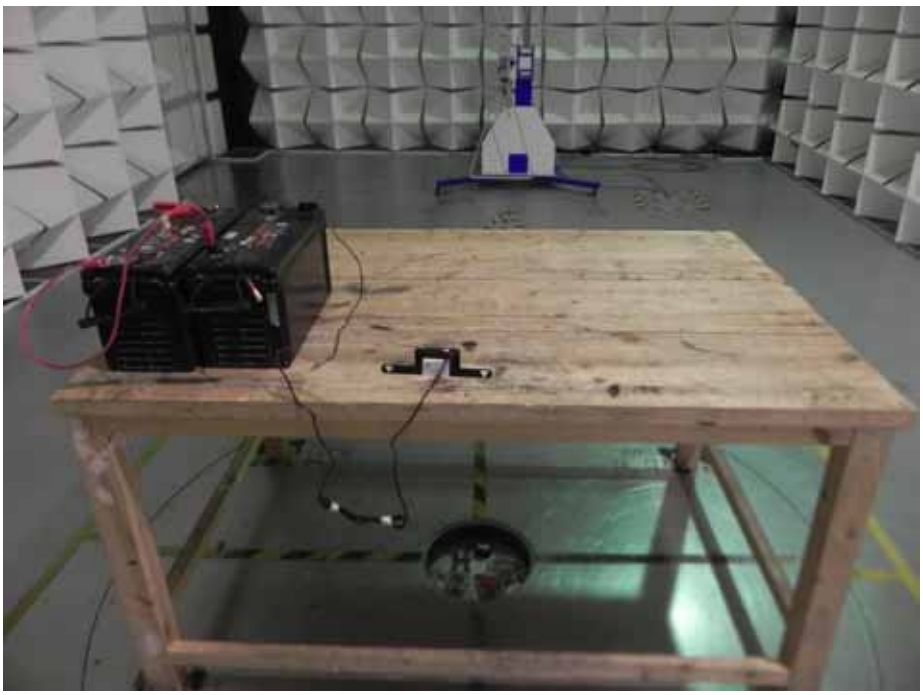
15 Photographs – Model APH070TxTest Setup

15.1 Photograph – Radiation Spurious Emission Test Setup

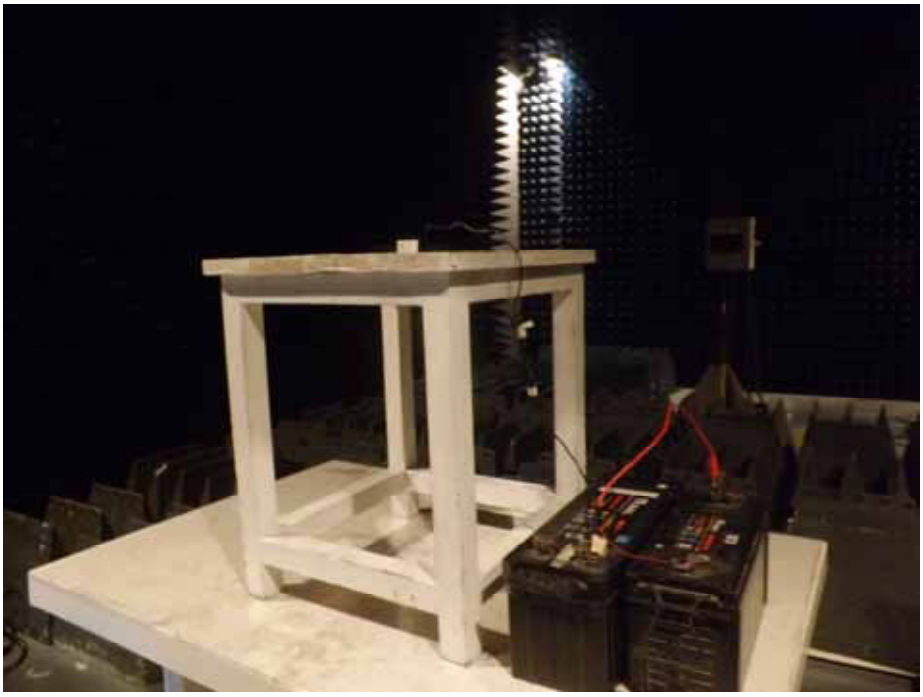
Below 30MHz at Test site 2#



30MHz-1GHz at Test Site 2#



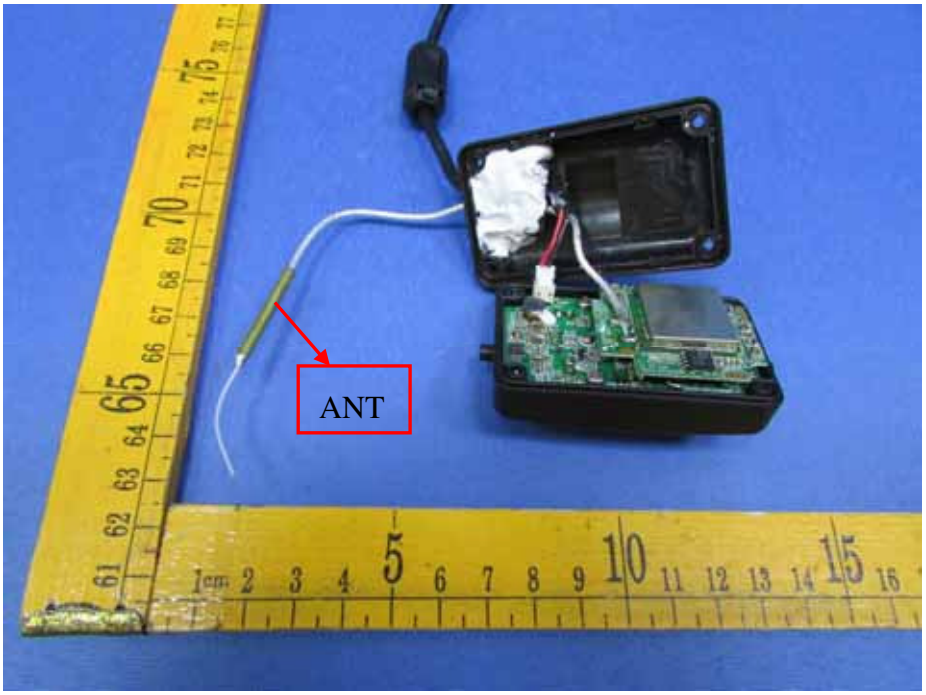
Above 1GHz at Test Site 1#

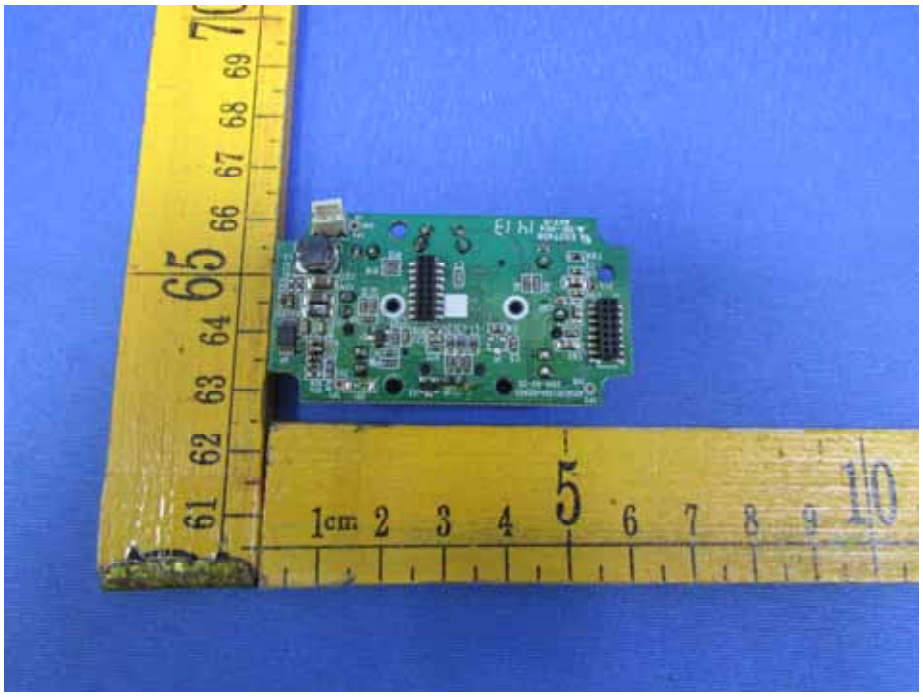


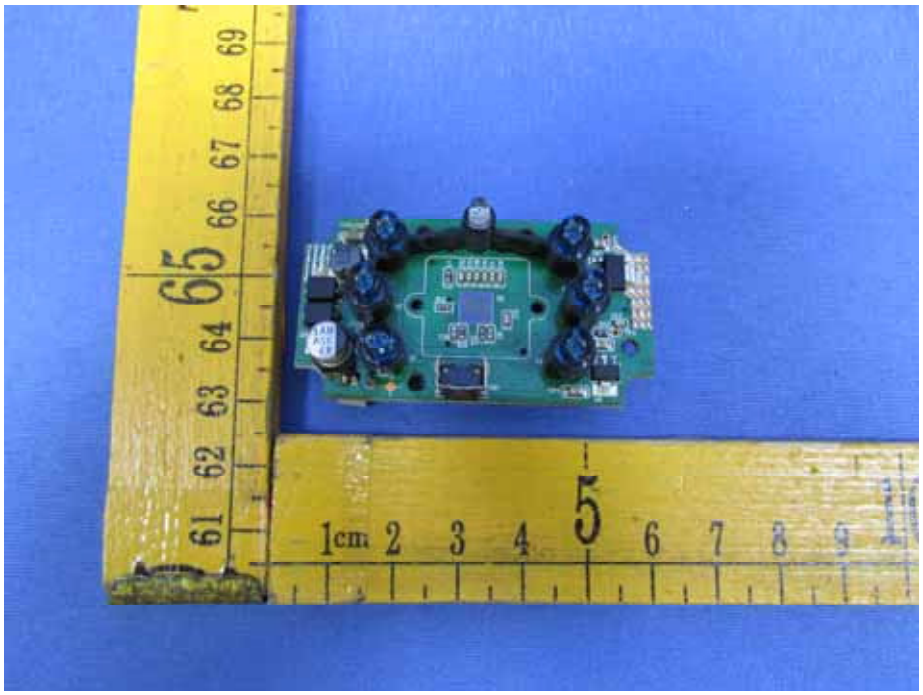
16 Photographs - Constructional Details

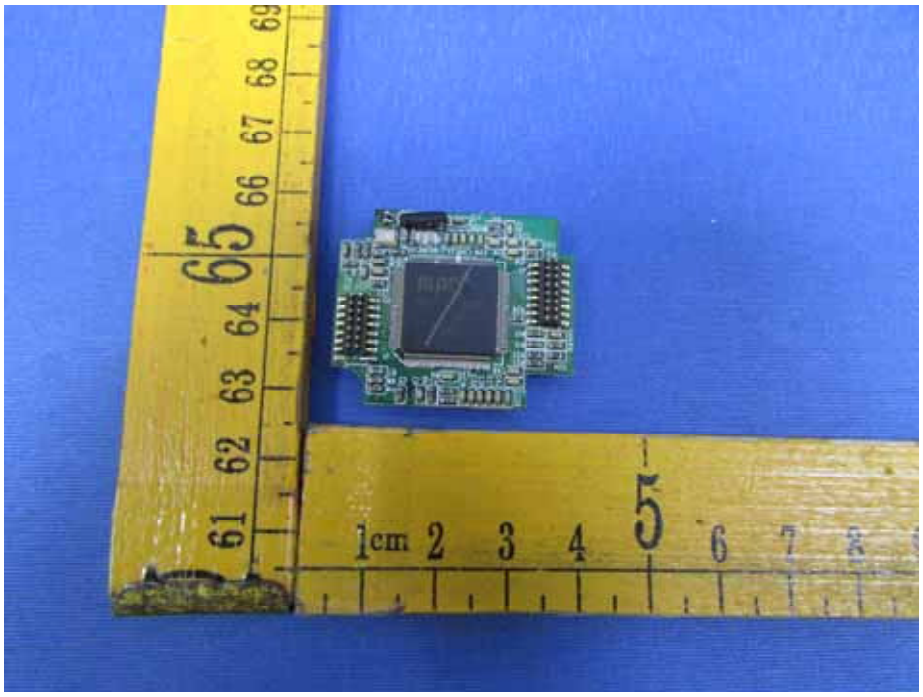
16.1 Model APH070Tx -External Photos

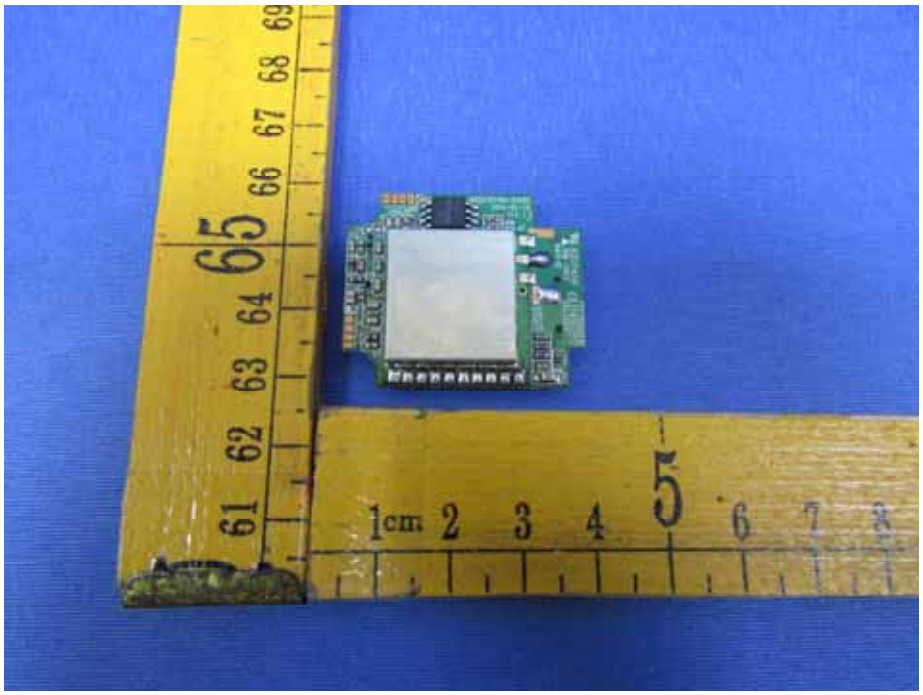
16.2 Model APH070Tx -Internal Photos

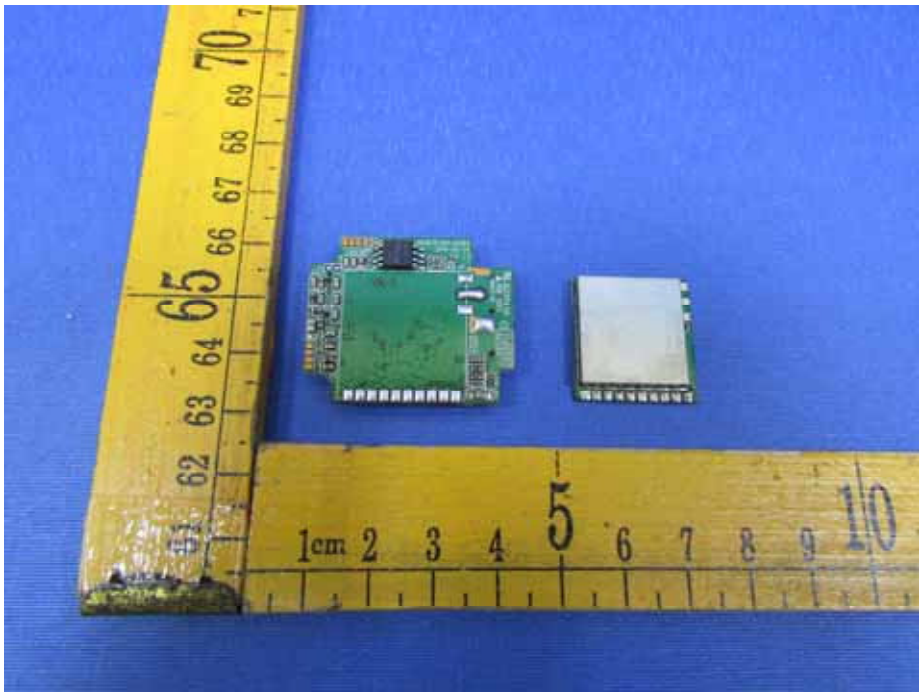


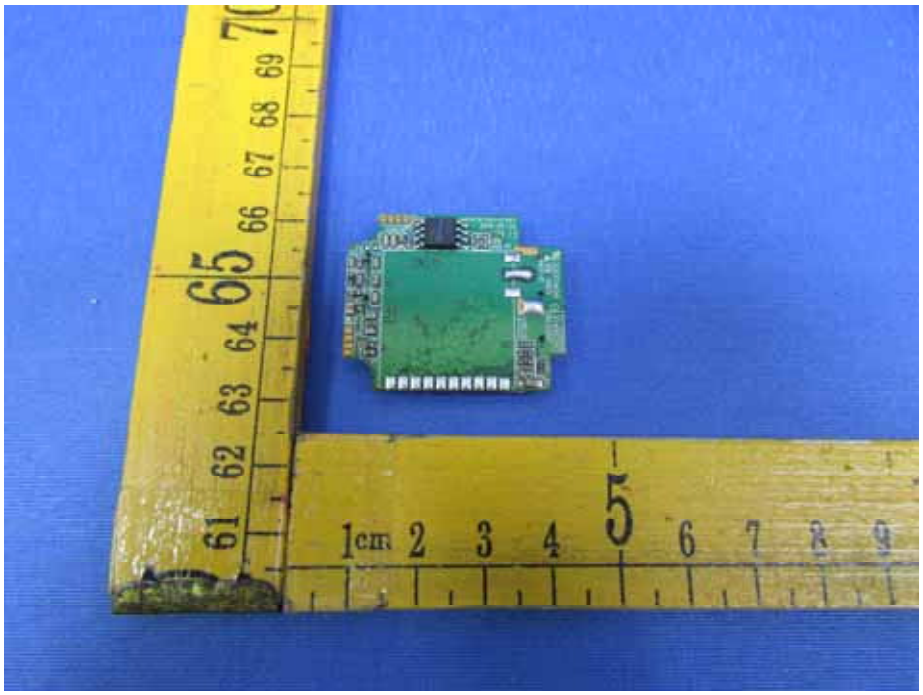


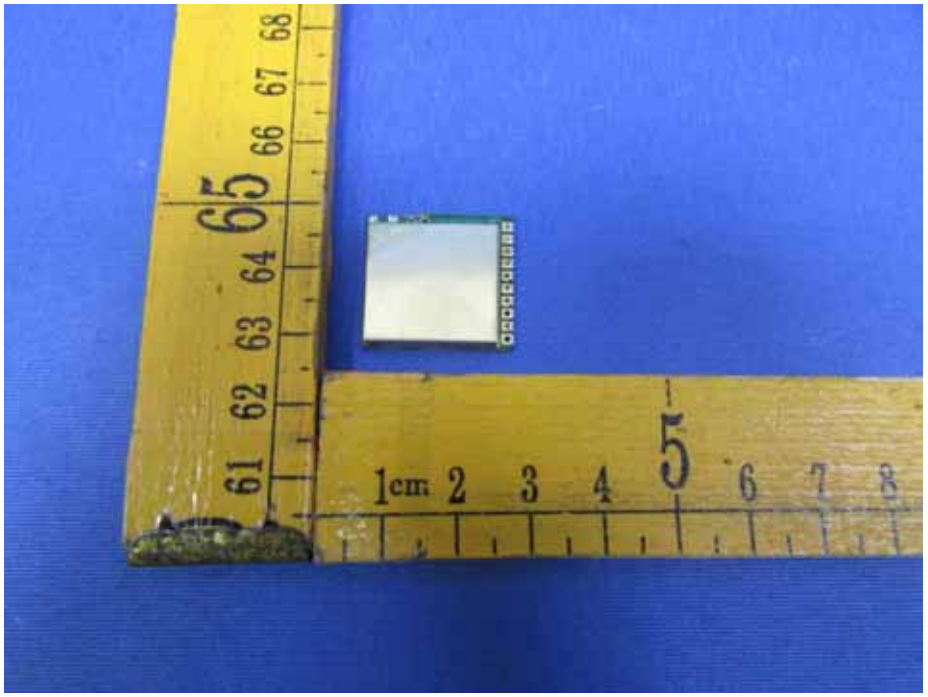


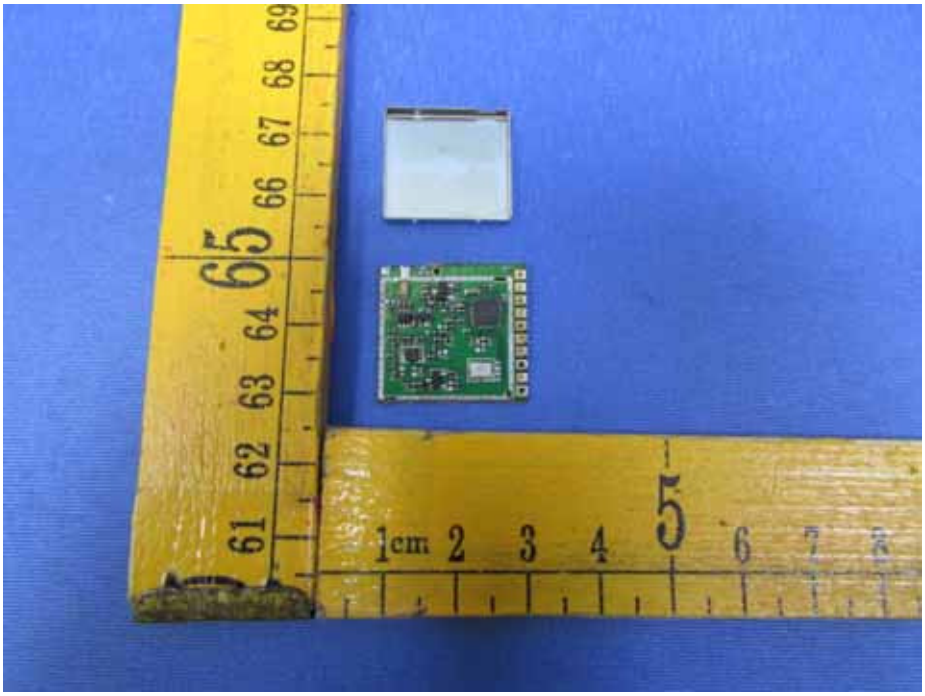


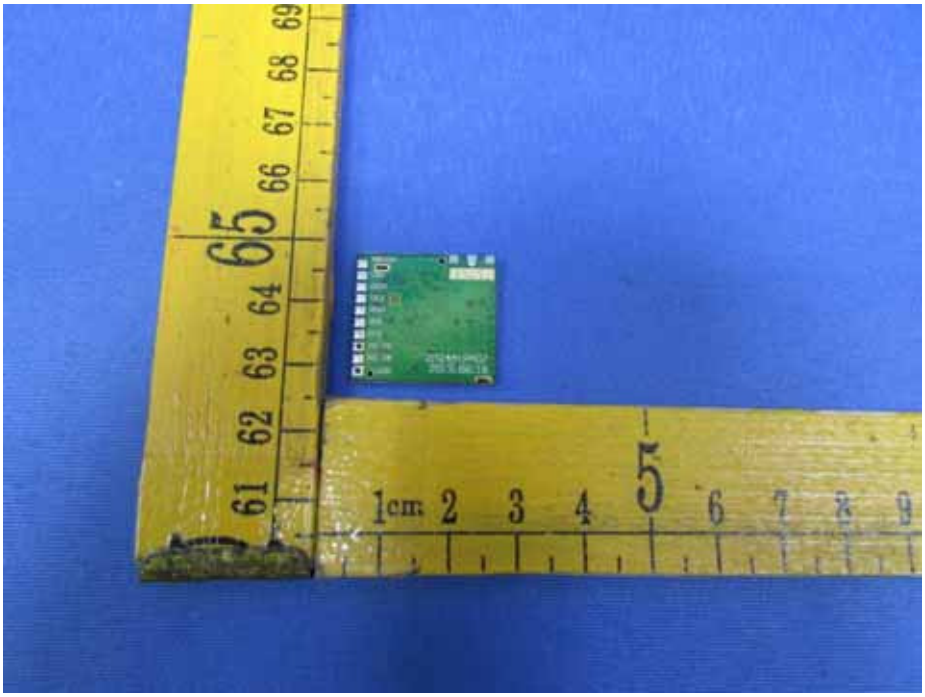












====== End of Report ======