

TEST REPORT

FCC ID : RIIVCMRFV01
Applicant : Unifat Technology Limited
Address : 7/Floor, Sui Hong Industrial Building, 547-549 Castle Peak Road, Kwai Chung, New Territories, HongKong
Manufacturer : DONGGUAN EASYFAT ELECTRONIC MFY.SIMA
Address : Sheima Sheung, Shueng ping chang, Dongguan China

Equipment Under Test (EUT) :

Product Name : 2.4G Digital review camera with monitor
Model No. : VCM43, VCM35, DWN30, BT53328F-1,BT53872F-1
Rules : FCC CFR47 Part 15 Subpart C: 2010,
FCC CFR47 Part 1 Section 1.1307: 2010
Date of Test : August 21 ~ 29, 2012
Date of Issue : August 29, 2012

Test Result	: PASS*
Remark: * The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.	

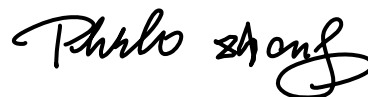
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Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	N/A
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	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)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	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	: 2.4G Digital review camera with monitor
Model No.	: VCM43, VCM35, DWN30, BT53328F-1,BT53872F-1
Model Description	: Only the model name is different.
Type of Modulation	: GFSK
Note	: N/A
Frequency Range	: 2414 MHz ~ 2465 MHz, 16Channels in total
Oscillator	: Crystal 27 MHz for IC TW9900; 12 MHz and 16 MHz for IC SN93331-001;18 MHz for RF module A7121
Antenna Gain	: 2dBi
Antenna installation	: Integrated Antenna
Max. Power	: 3 dBm

4.2 Details of E.U.T.

Technical Data	: Camera:DC12/24V 200mA
Adapter manufacturer	: N/A
M/N	: N/A

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2414.0	2	2417.4	3	2420.8	4	2424.2
5	2427.6	6	2431.0	7	2434.4	8	2437.8
9	2441.2	10	2444.6	11	2448.0	12	2451.4
13	2454.8	14	2458.2	15	2461.6	16	2465.0

4.4 Test Facility

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

- **IC – Registration No.: IC7760A**

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, July 10, 2012.

- **FCC – 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, May 26, 2011.

4.5 Test Location

All the tests were performed at:

Waltek Services (Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen, China

Waltek Services (Shenzhen) Co.,Ltd.

<http://www.waltek.com.cn>

4.6 General condition

Ambient Condition: 25.5 °C 58 %RH

4.6.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is not applicable

Test Voltage	Input voltage
Rated voltage-15%	
normal	
Rated voltage+15%	

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	New Battery 12V
Rated voltage	New Battery 24V

4.6.2 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	Lower channel	Middle channel	Upper channel
Transmitting	2414.0MHz	2448.0MHz	2465.0MHz
Receiving	2414.0MHz	2448.0MHz	2465.0MHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101178	Aug. 13,2012	Aug. 13,2013
2.	LISN	R&S	ENV216	101215	Aug. 13,2012	Aug. 13,2013
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	2230300	Aug.14,2012	Aug. 14,2013
4.	Switch	---	RSU/M2	---	Aug. 14,2012	Aug. 14,2013
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 13,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 13,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Aug. 13,2012	Aug. 13,2013
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 13,2013
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 13,2013
6.	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-254	Aug. 13,2012	Aug. 13,2013
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 13,2013
8.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 14,2012	Aug. 14,2013
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug. 14,2012	Aug. 14,2013
10.	Positioning Controller	C&C LAB	CC-C-IF	-	Aug. 14,2012	Aug. 14,2013
11.	Color Monitor	SUNSPPO	SP-14C	-	Aug. 14,2012	Aug. 14,2013

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 (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 2.46 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.

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6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4
Frequency Range:	150kHz to 30MHz
Class:	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) Quasi-Peak & Average if maximised peak within 6dB of Average Limit
Test Result:	N/A

6.1 Conducted Emission Test Result

Remark: Due to the eut powered by battery, and need not attend connecting to AC mains, this section is not applicable.

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7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: DA 00-705
 Test Result: PASS
 Frequency Range: 12MHz to 25GHz
 Measurement Distance: 3m
 15.209 Limit:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 -0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

15.247 (d) Limit:

(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.

7.1 EUT Operation:

Operating Environment:

Temperature: 25.5 °C
 Humidity: 51 % RH
 Atmospheric Pressure: 1012 mbar

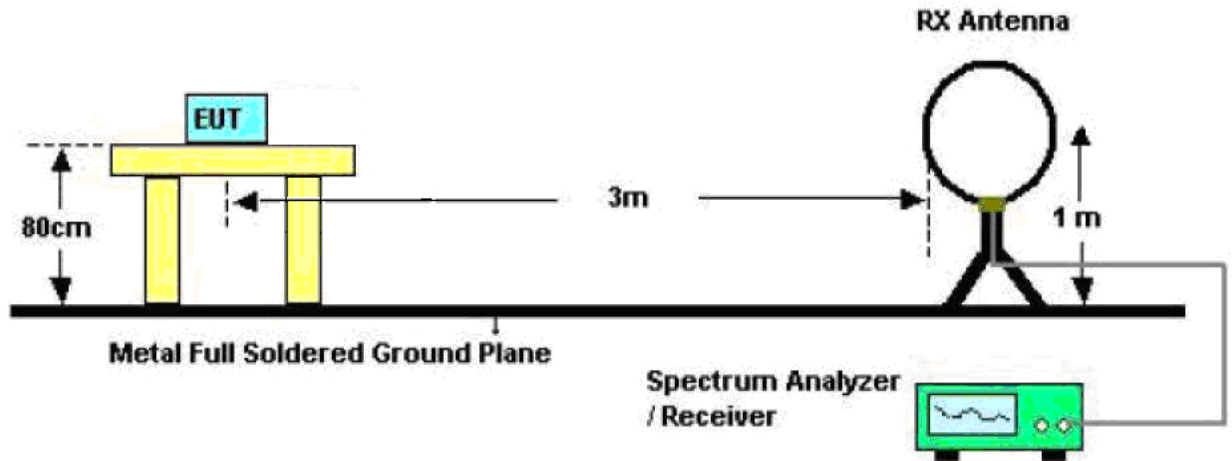
Operation Mode:

The EUT was tested in lower/middle/upper channels mode. The worst data were shown as follow.

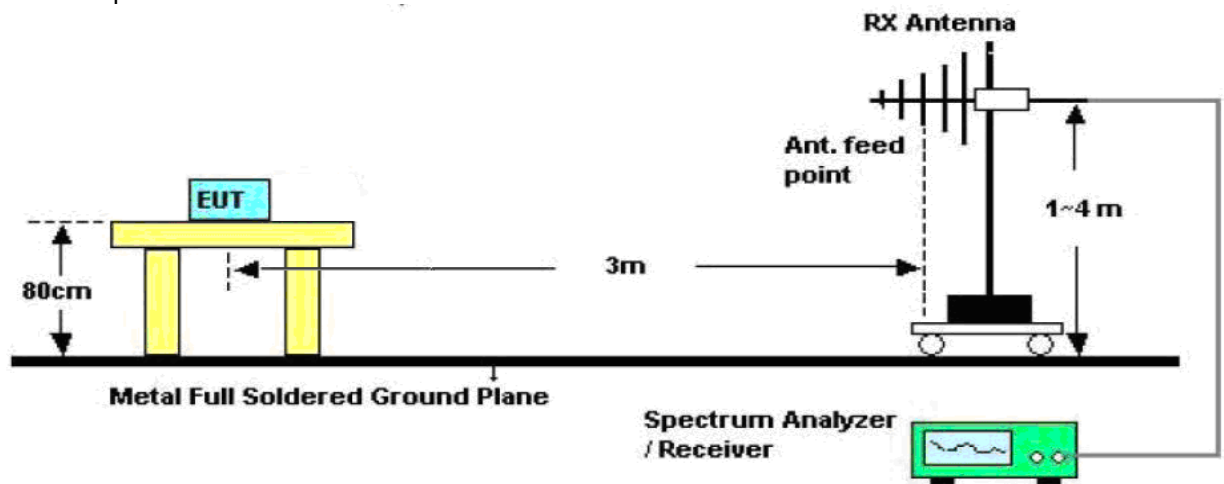
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

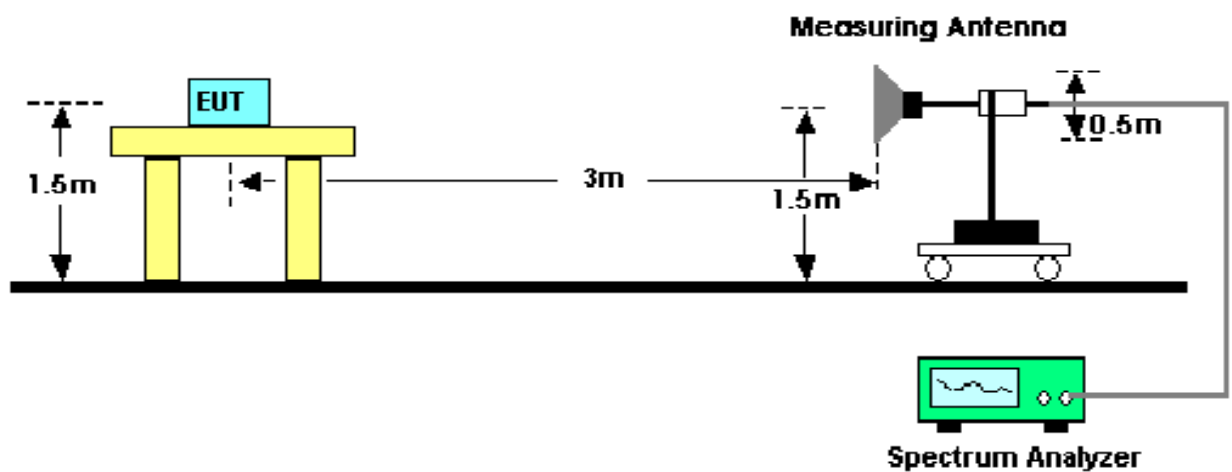
The test setup for emission measurement below 30MHz.



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

According to FCC Part15 Rules, the system was tested from 12 MHz to 25 GHz.

Below 30MHz

Sweep Speed	Auto
IF Bandwidth	10KHz
Video Bandwidth	10KHz
Resolution Bandwidth.....	10KHz

30MHz ~ 1GHz

Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth	100KHz
Quasi-Peak Adapter Bandwidth.....	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth.....	100KHz

Above 1GHz

Sweep Speed	Auto
IF Bandwidth	120 KHz
Video Bandwidth	3MHz
Quasi-Peak Adapter Bandwidth.....	120 KHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth.....	1MHz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are 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.

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:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - 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

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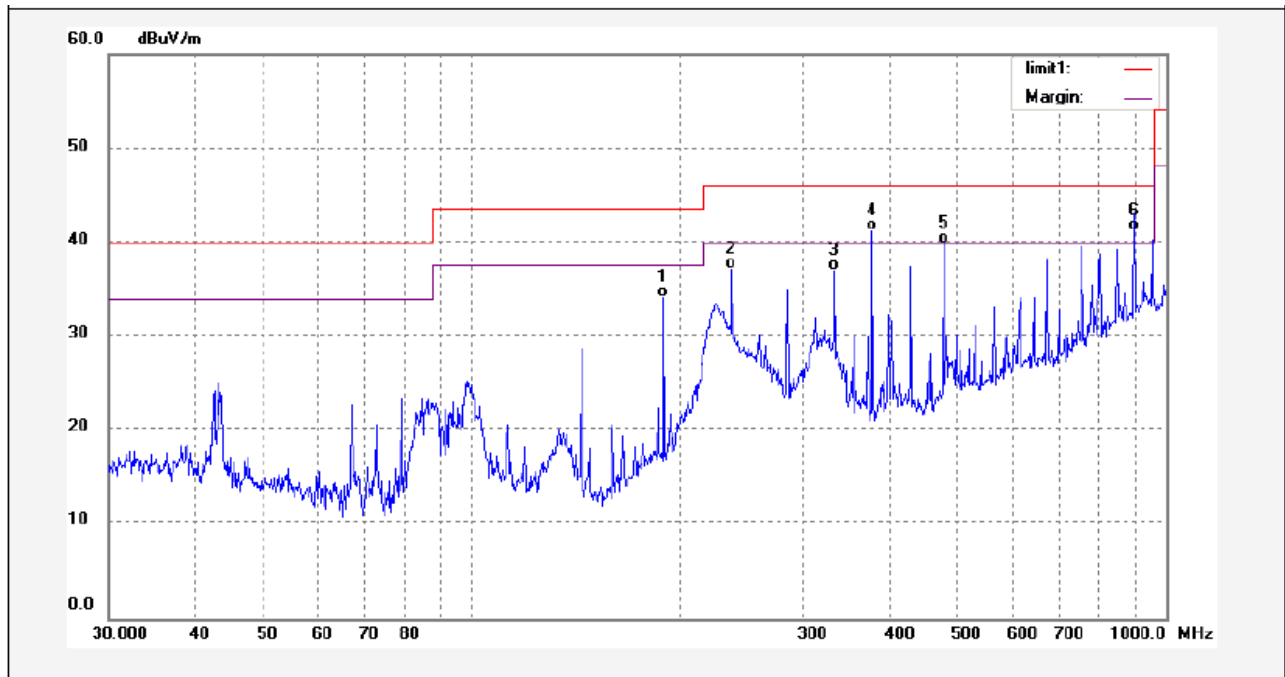
Test mode 1a: continuous receiving mode

Remark: the EUT were pretested at the upper, middle and lower channels, and the worst case was the middle Channel mode, so the data shown was the middle channel mode only.

Because the emissions below 30MHz are more than 20dB below the limit, the data is not shown in the report.

Test Frequency: 30MHz ~ 1000MHz

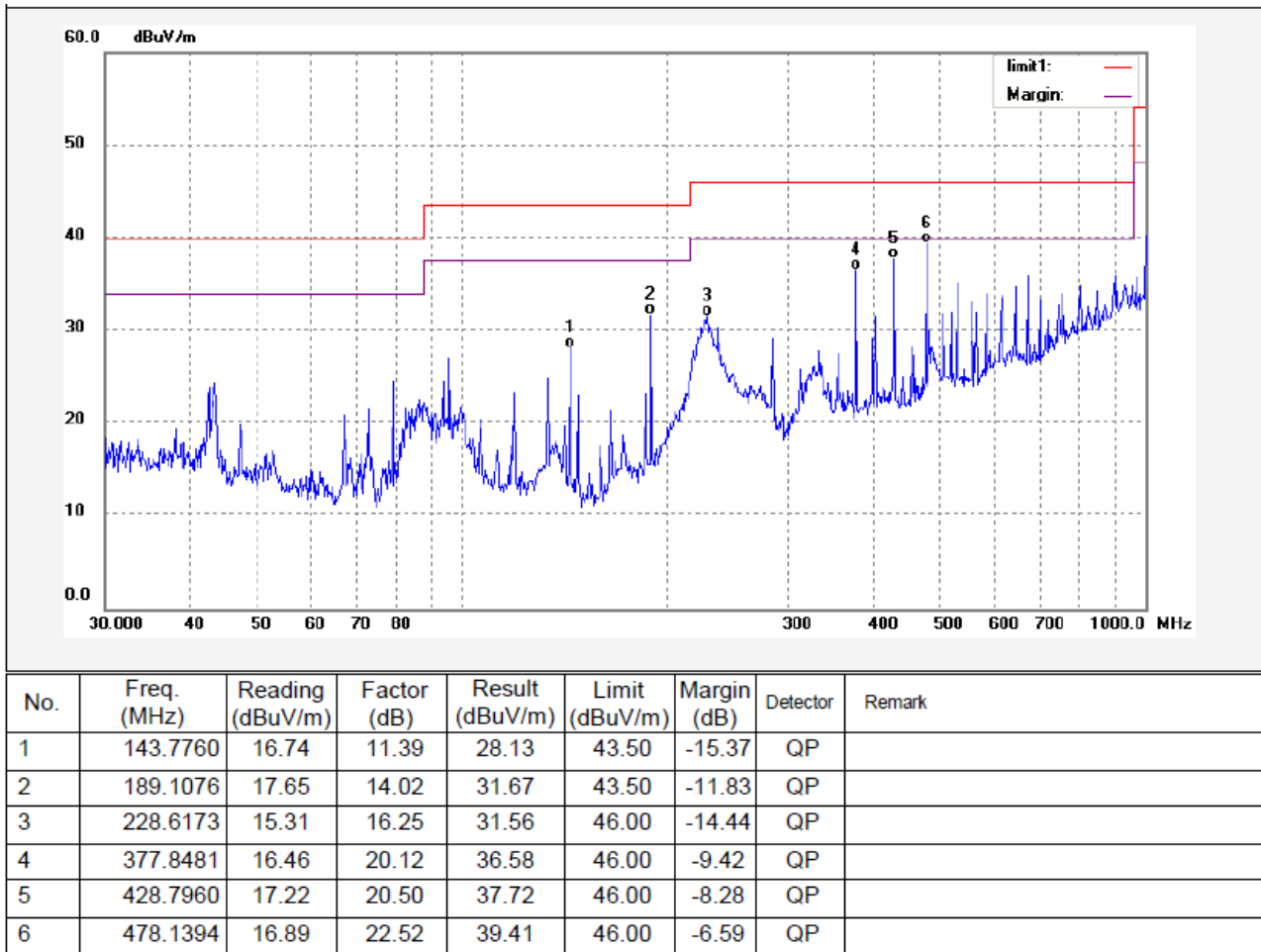
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	189.1075	20.12	14.02	34.14	43.50	-9.36	QP	
2	236.7927	21.52	15.66	37.18	46.00	-8.82	QP	
3	332.9534	17.50	19.46	36.96	46.00	-9.04	QP	
4	377.8480	21.10	20.12	41.22	46.00	-4.78	QP	
5	478.1394	17.33	22.52	39.85	46.00	-6.15	QP	
6	899.9577	10.25	30.88	41.13	46.00	-4.87	QP	

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Antenna polarization: Horizontal

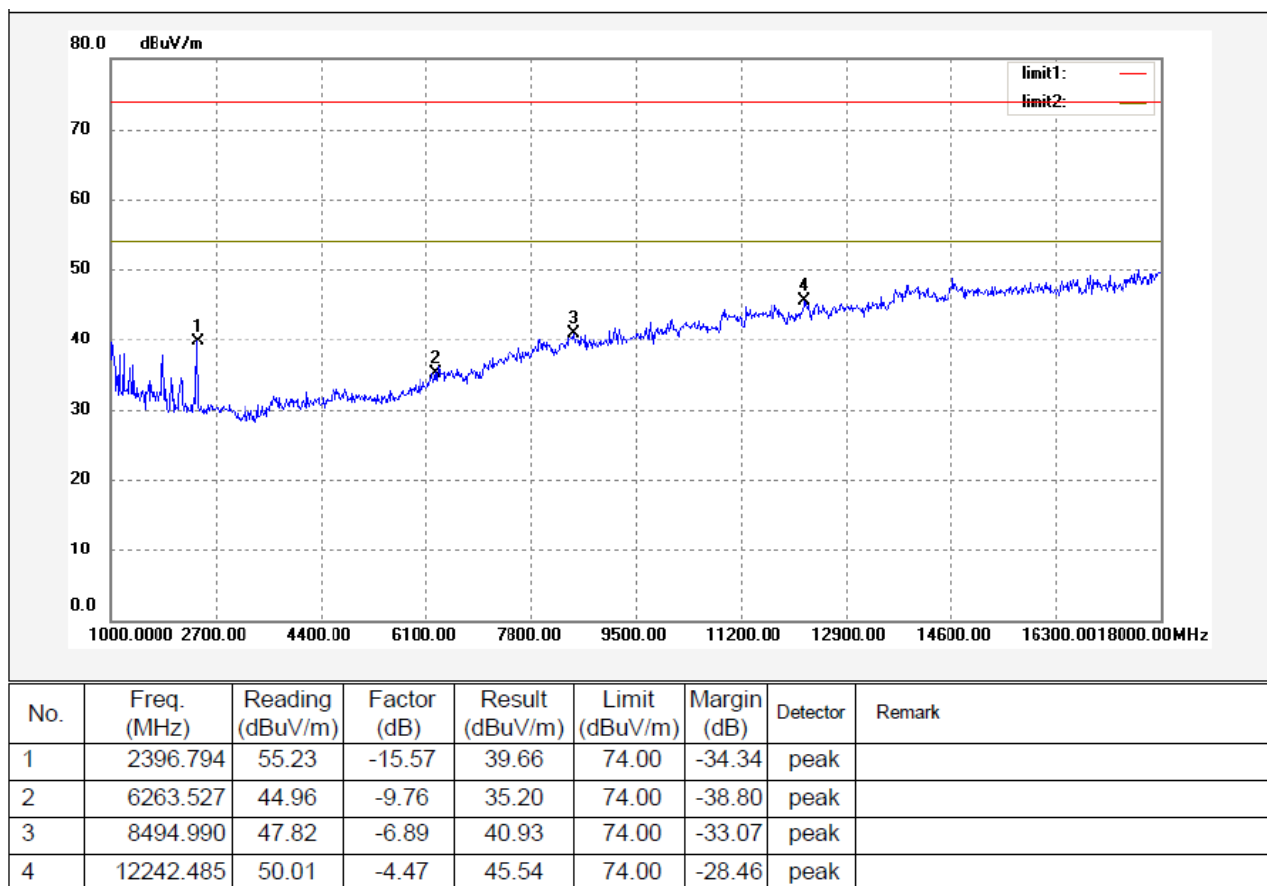


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Test Frequency: Above 1GHz radiation test data:

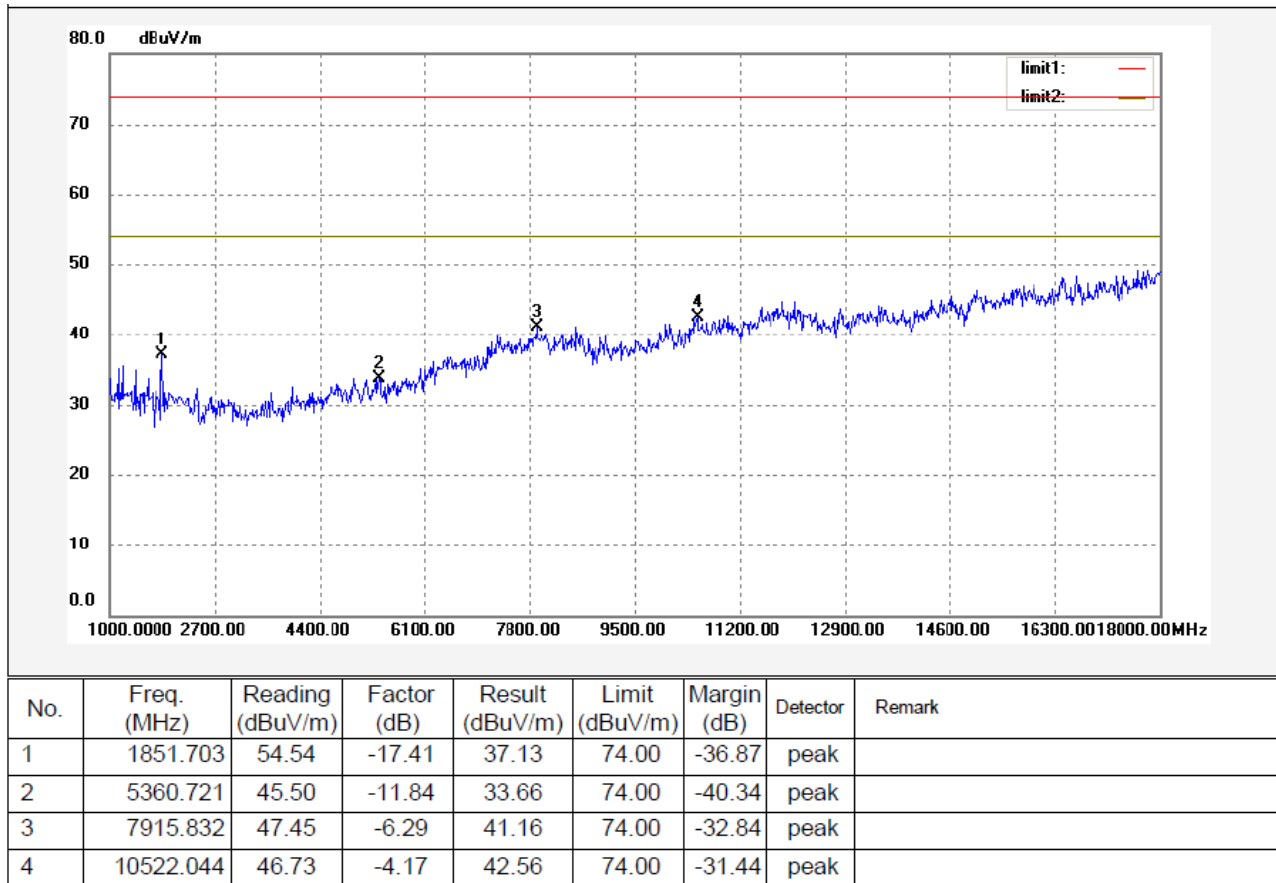
Remark: No any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not recorded.

Antenna polarization: Vertical



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Antenna polarization: Horizontal



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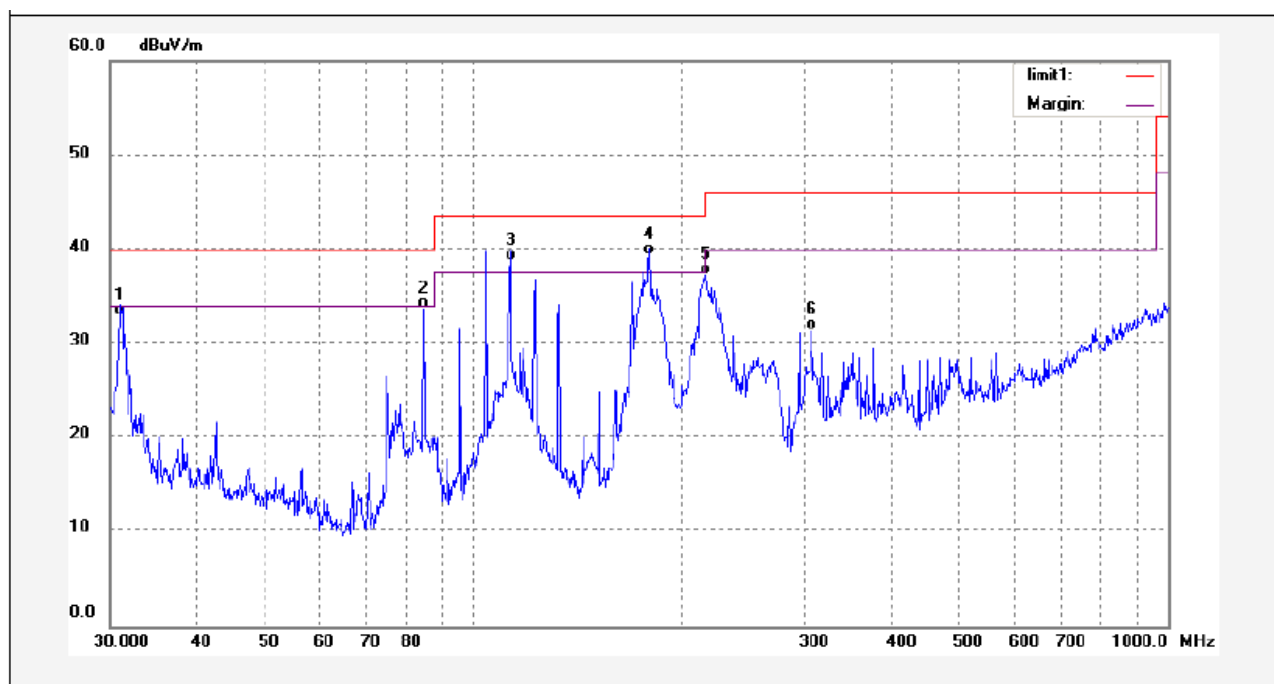
Test mode 1b: continuous transmitting mode

Remark: The pre-test were performed at the upper, middle and lower channels. And the worst case was the middle Channel mode, so the data shown was the middle channel mode only.

Because the emissions below 30MHz are more than 20dB below the limit, the data is not shown in the report.

Test Frequency: 30MHz ~ 1000MHz

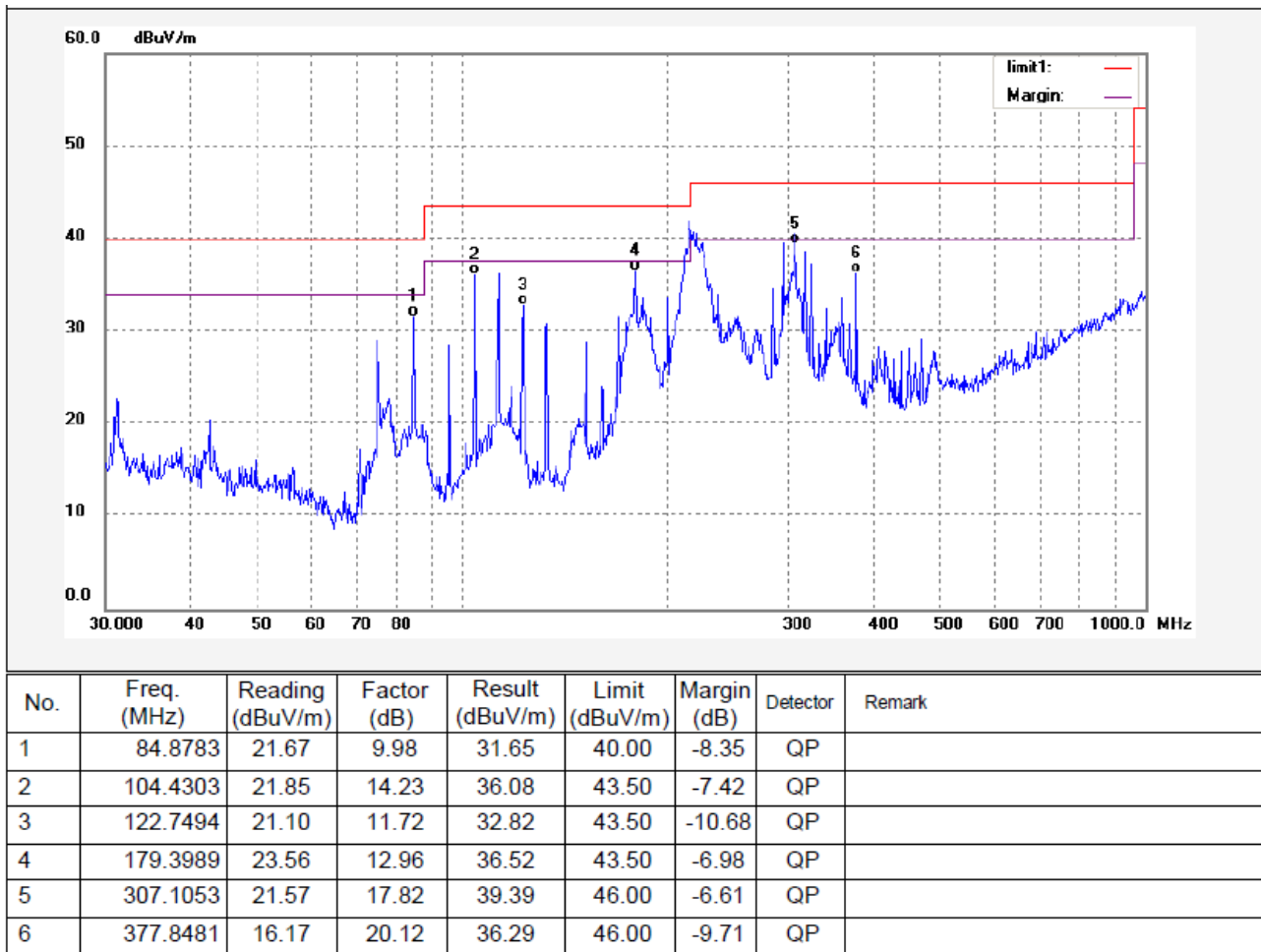
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	31.0728	16.51	16.38	32.89	40.00	-7.11	QP	
2	84.8783	23.63	9.98	33.61	40.00	-6.39	QP	
3	113.2200	25.75	13.02	38.77	43.50	-4.73	QP	
4	179.3989	26.42	12.96	39.38	43.50	-4.12	QP	
5	216.1197	21.95	15.33	37.28	46.00	-8.72	QP	
6	307.1053	13.53	17.82	31.35	46.00	-14.65	QP	

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Antenna polarization: Horizontal



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Test Frequency: 1GHz ~ 25GHz radiation test data
And the below is the Fundamental and Harmonic

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Lower frequency							
2414.0	AV	Vertical	100.18	N/A	(Fund.)	1.1	110
4828.0	AV	Vertical	41.02	54.00	13.98	1.4	140
7242.0	AV	Vertical	35.23	54.00	19.73	1.6	170
9656.0	AV	Vertical	32.52	54.00	21.48	1.4	130
12070.0	AV	Vertical	31.25	54.00	22.75	1.8	185
14484.0	AV	Vertical	31.01	54.00	22.99	1.2	195
16898.0	AV	Vertical	30.02	54.00	23.98	1.9	160
19312.0	AV	Vertical	30.67	54.00	23.33	1.4	140
21726.0	AV	Vertical	29.63	54.00	24.34	1.4	30
24140.0	AV	Vertical	29.01	54.00	24.99	1.1	145
2414.0	AV	Horizontal	99.62	N/A	(Fund.)	1.7	70
4828.0	AV	Horizontal	41.12	54.00	12.88	1.2	180
7242.0	AV	Horizontal	36.21	54.00	17.79	1.4	100
9656.0	AV	Horizontal	34.25	54.00	19.75	1.4	195
12070.0	AV	Horizontal	33.21	54.00	20.79	1.6	110
14484.0	AV	Horizontal	31.25	54.00	22.75	1.2	190
16898.0	AV	Horizontal	30.74	54.00	23.26	1.7	150
19312.0	AV	Horizontal	32.01	54.00	21.99	1.6	175
21726.0	AV	Horizontal	31.53	54.00	22.47	1.4	160
24140.0	AV	Horizontal	30.01	54.00	23.99	1.4	90
2414.0	PK	Vertical	109.68	N/A	(Fund.)	1.3	30
4828.0	PK	Vertical	45.21	74.00	29.64	1.7	145
7242.0	PK	Vertical	40.01	74.00	33.99	2.1	160
9656.0	PK	Vertical	37.42	74.00	36.58	1.2	240
12070.0	PK	Vertical	36.21	74.00	37.79	1.1	100
14484.0	PK	Vertical	32.01	74.00	41.99	1.4	155
16898.0	PK	Vertical	33.21	74.00	40.79	1.5	185
19312.0	PK	Vertical	30.10	74.00	43.90	1.1	190
21726.0	PK	Vertical	29.01	74.00	44.99	1.9	110
24140.0	PK	Vertical	29.01	74.00	44.99	1.2	165
2414.0	PK	Horizontal	105.13	N/A	(Fund.)	2.0	120
4828.0	PK	Horizontal	41.24	74.00	32.76	1.7	170

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Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
7242.0	PK	Horizontal	38.25	74.00	35.75	1.6	90
9656.0	PK	Horizontal	36.98	74.00	37.02	1.1	85
12070.0	PK	Horizontal	35.69	74.00	38.31	1.7	205
14484.0	PK	Horizontal	35.62	74.00	38.38	1.0	60
16898.0	PK	Horizontal	33.35	74.00	40.65	1.7	220
19312.0	PK	Horizontal	33.01	74.00	40.99	1.7	155
21726.0	PK	Horizontal	30.21	74.00	43.79	1.3	170
24140.0	PK	Horizontal	30.01	74.00	43.99	1.5	140
Middle frequency							
2448.0	AV	Vertical	98.66	N/A	(Fund.)	1.7	70
4896.0	AV	Vertical	39.02	54.00	14.98	1.4	185
7344.0	AV	Vertical	35.21	54.00	18.71	1.1	140
9792.0	AV	Vertical	33.33	54.00	20.67	1.5	70
12240.0	AV	Vertical	32.02	54.00	21.98	1.7	50
14688.0	AV	Vertical	32.01	54.00	21.99	1.4	225
17136.0	AV	Vertical	30.26	54.00	23.74	1.6	60
19584.0	AV	Vertical	30.01	54.00	23.99	1.5	80
22032.0	AV	Vertical	29.02	54.00	24.98	1.9	210
24480.0	AV	Vertical	28.23	54.00	25.77	1.7	175
2448.0	AV	Horizontal	95.18	N/A	(Fund.)	1.5	190
4896.0	AV	Horizontal	35.69	54.00	18.31	1.7	150
7344.0	AV	Horizontal	34.25	54.00	19.75	1.7	310
9792.0	AV	Horizontal	33.52	54.00	20.48	1.0	215
12240.0	AV	Horizontal	31.21	54.00	22.79	1.2	200
14688.0	AV	Horizontal	30.25	54.00	23.75	1.7	250
17136.0	AV	Horizontal	29.25	54.00	24.75	2.1	185
19584.0	AV	Horizontal	28.36	54.00	25.64	1.3	165
22032.0	AV	Horizontal	28.02	54.00	25.98	1.3	210
24480.0	AV	Horizontal	28.02	54.00	25.98	1.7	200
2448.0	PK	Vertical	110.23	N/A	(Fund.)	1.3	30
4896.0	PK	Vertical	44.21	74.00	29.79	1.7	175
7344.0	PK	Vertical	38.25	74.00	35.75	1.8	170
9792.0	PK	Vertical	37.94	74.00	36.06	1.4	180
12240.0	PK	Vertical	37.87	74.00	36.13	1.9	220

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Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
14688.0	PK	Vertical	36.10	74.00	38.90	1.0	95
17136.0	PK	Vertical	32.03	74.00	41.97	1.4	50
19584.0	PK	Vertical	30.21	74.00	43.79	1.9	190
22032.0	PK	Vertical	28.30	74.00	45.70	2.0	185
24480.0	PK	Vertical	28.30	74.00	45.70	1.4	195
2448.0	PK	Horizontal	109.67	N/A	(Fund.)	1.7	60
4896.0	PK	Horizontal	43.56	74.00	30.44	1.7	125
7344.0	PK	Horizontal	41.51	74.00	32.49	1.7	120
9792.0	PK	Horizontal	40.14	74.00	33.86	1.7	145
12240.0	PK	Horizontal	39.36	74.00	34.64	1.8	220
14688.0	PK	Horizontal	37.44	74.00	36.56	1.1	210
17136.0	PK	Horizontal	34.21	74.00	39.79	1.3	160
19584.0	PK	Horizontal	38.86	74.00	35.14	1.3	245
22032.0	PK	Horizontal	34.21	74.00	39.79	1.1	50
24480.0	PK	Horizontal	33.33	74.00	40.67	1.3	215
Upper frequency							
2465.0	AV	Vertical	96.18	N/A	(Fund.)	1.2	220
4930.0	AV	Vertical	36.25	54.00	17.75	1.4	95
7395.0	AV	Vertical	32.25	54.00	21.75	1.3	170
9860.0	AV	Vertical	30.26	54.00	23.74	1.1	130
12325.0	AV	Vertical	30.55	54.00	23.45	2.0	140
14790.0	AV	Vertical	30.34	54.00	23.66	1.5	195
17255.0	AV	Vertical	30.62	54.00	23.38	1.2	160
19720.0	AV	Vertical	30.13	54.00	23.87	1.1	260
22185.0	AV	Vertical	30.27	54.00	23.73	1.5	150
24650.0	AV	Vertical	28.25	54.00	25.75	1.0	220
2465.0	AV	Horizontal	95.33	N/A	(Fund.)	1.5	190
4930.0	AV	Horizontal	34.56	54.00	19.44	2.3	210
7395.0	AV	Horizontal	30.35	54.00	23.65	1.4	160
9860.0	AV	Horizontal	31.47	54.00	22.53	1.3	275
12325.0	AV	Horizontal	31.89	54.00	22.11	1.2	185
14790.0	AV	Horizontal	32.42	54.00	21.58	1.5	190
17255.0	AV	Horizontal	31.17	54.00	22.83	1.9	230
19720.0	AV	Horizontal	32.55	54.00	21.45	1.5	135

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Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
22185.0	AV	Horizontal	32.86	54.00	21.14	1.4	150
24650.0	AV	Horizontal	30.25	54.00	22.75	2.4	170
2465.0	PK	Vertical	108.98	N/A	(Fund.)	1.3	210
4930.0	PK	Vertical	44.21	74.00	29.79	1.0	115
7395.0	PK	Vertical	35.62	74.00	38.38	2.5	180
9860.0	PK	Vertical	35.35	74.00	38.65	1.1	160
12325.0	PK	Vertical	35.56	74.00	38.44	1.6	130
14790.0	PK	Vertical	34.21	74.00	39.79	1.0	155
17255.0	PK	Vertical	33.54	74.00	40.46	1.2	140
19720.0	PK	Vertical	36.26	74.00	37.74	1.6	190
22185.0	PK	Vertical	36.73	74.00	37.27	2.1	170
24650.0	PK	Vertical	30.21	74.00	43.99	1.0	210
2465.0	PK	Horizontal	106.72	N/A	(Fund.)	1.8	240
4930.0	PK	Horizontal	42.58	74.00	31.42	1.4	140
7395.0	PK	Horizontal	38.64	74.00	35.36	1.6	150
9860.0	PK	Horizontal	35.37	74.00	38.63	1.5	265
12325.0	PK	Horizontal	35.52	74.00	38.48	1.6	160
14790.0	PK	Horizontal	35.26	74.00	38.74	1.6	150
17255.0	PK	Horizontal	36.41	74.00	37.59	2.1	190
19720.0	PK	Horizontal	32.41	74.00	41.59	1.3	245
22185.0	PK	Horizontal	31.11	74.00	42.89	1.9	170
24650.0	PK	Horizontal	28.21	74.00	45.79	1.6	260

8 Band Edge Measurements

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
Measurement Distance:	3m
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz

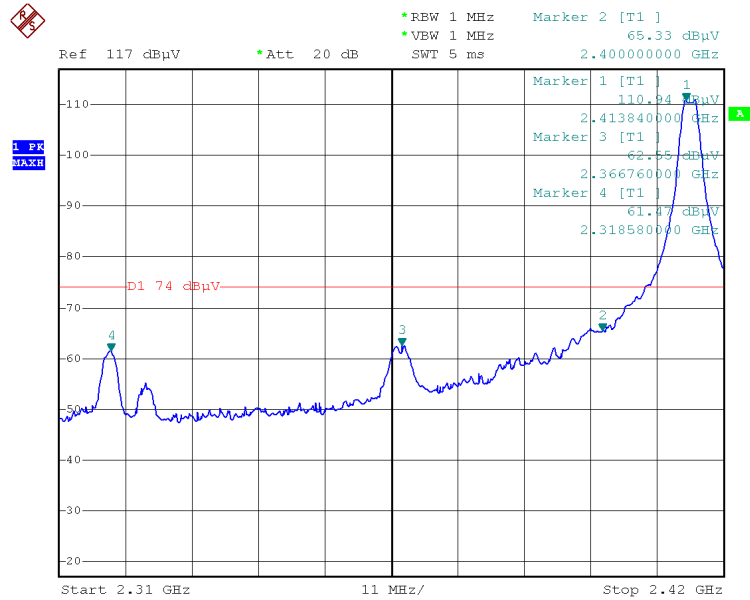
8.1 Test Procedure:

Detector:	For Peak value: RBW = 1 MHz for $f \geq 1$ GHz VBW $\geq$ RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for $f \geq 1$ GHz VBW = 10Hz; Sweep = auto Detector function = AVG Trace = max hold
Test mode:	Test in fixing operating frequency at lower, middle, upper channel.

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8.2 Test Result:

Lower Channel – Peak

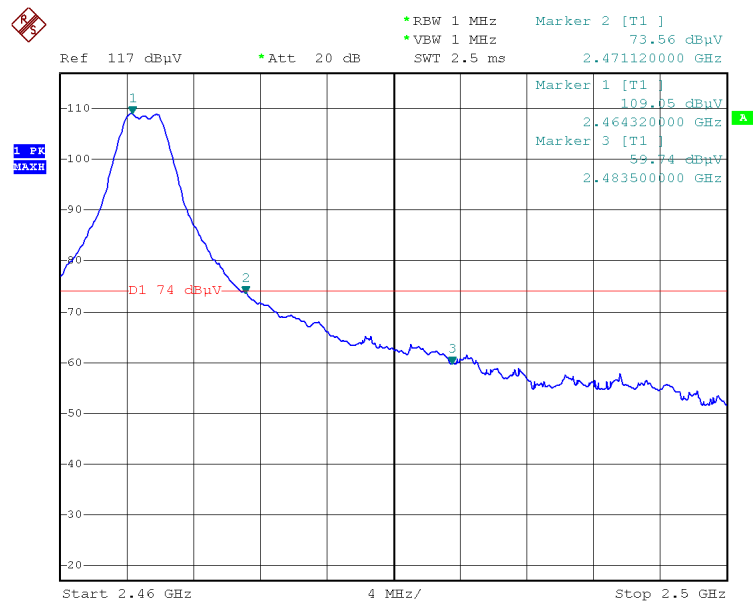


Lower Channel – AV

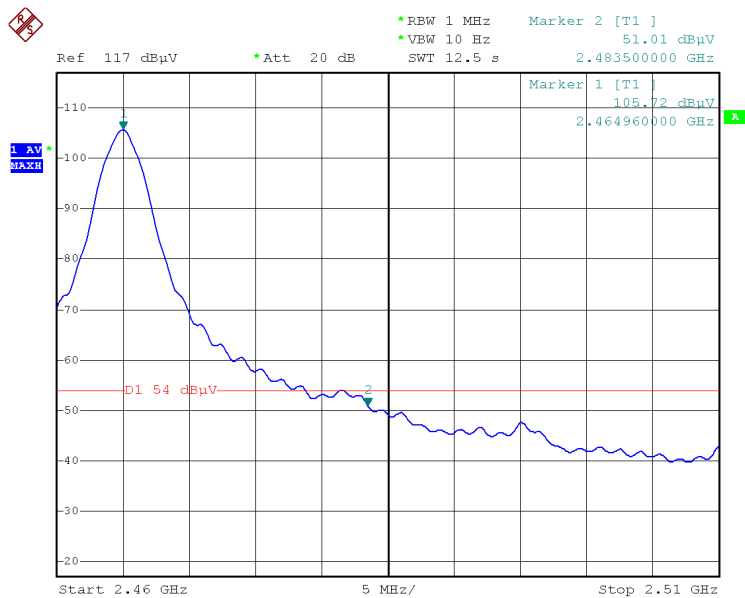


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Upper Channel – Peak



Upper Channel – AV



9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: DA 00-705
 Test Mode: Test in fixing operating frequency at lower, middle, upper channel.

9.1 Test Procedure:

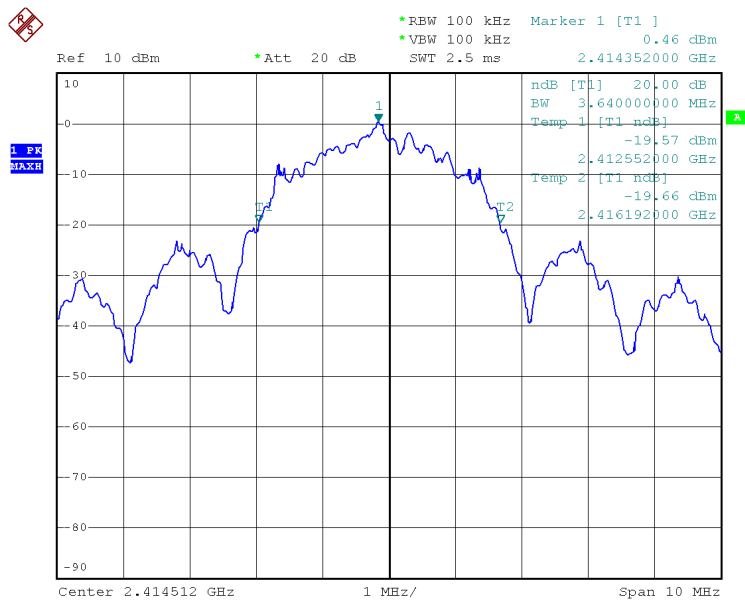
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1MHz, VBW = 1MHz

9.2 Test Result:

Test Channel	Bandwidth
Lower	3.64MHz
Middle	3.58MHz
Upper	3.58MHz

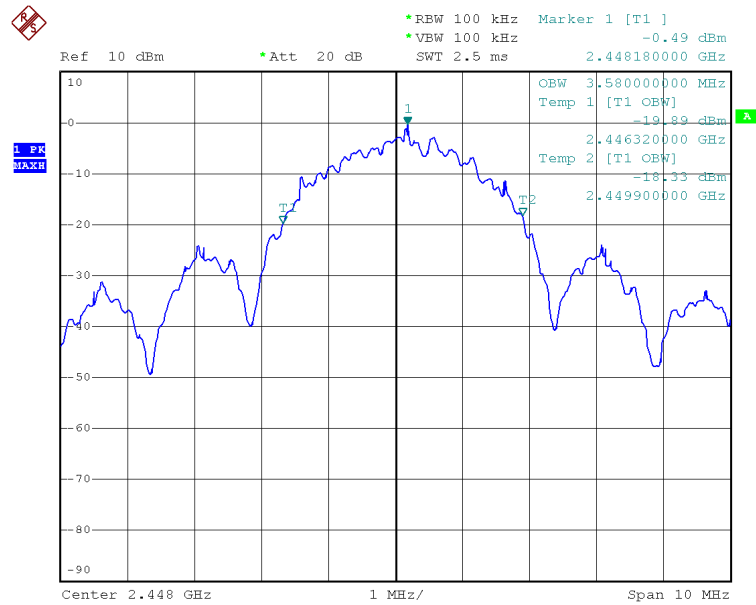
Test result plot as follows:

Lower Channel

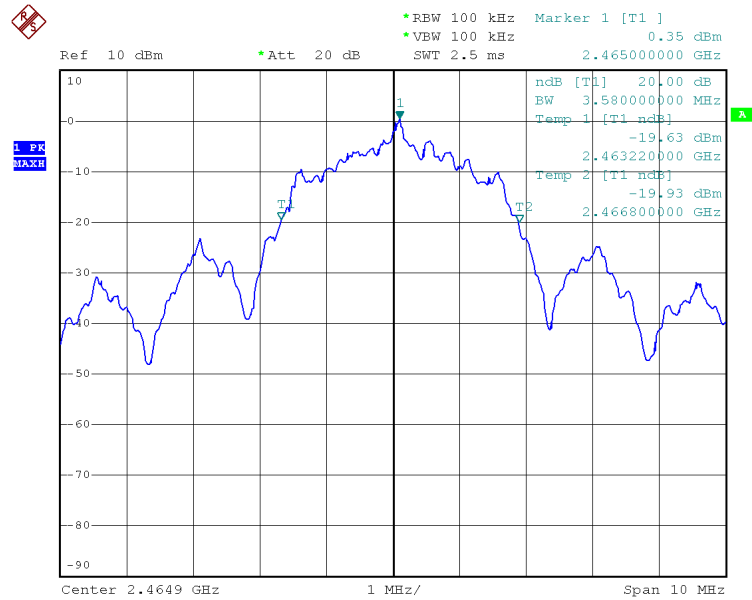


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Middle Channel



Upper Channel



10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.4
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 1watts (30 dBm) limit applies.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

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 = 10 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 Result:

Test Channel	Output Power (dBm)	Limit (dBm)
Lower	2.58	30
Middle	2.55	30
upper	2.53	30

11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
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 125 mW.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

11.1 Test Procedure:

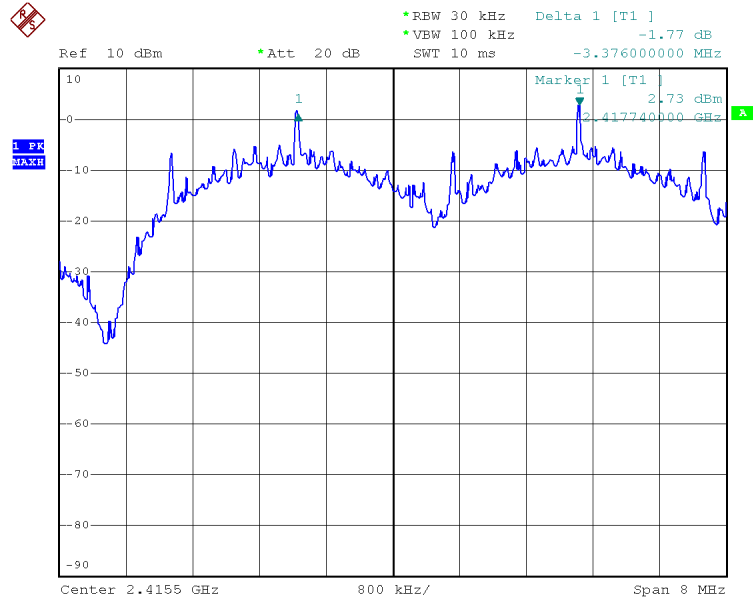
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz, Span = 2MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine 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:

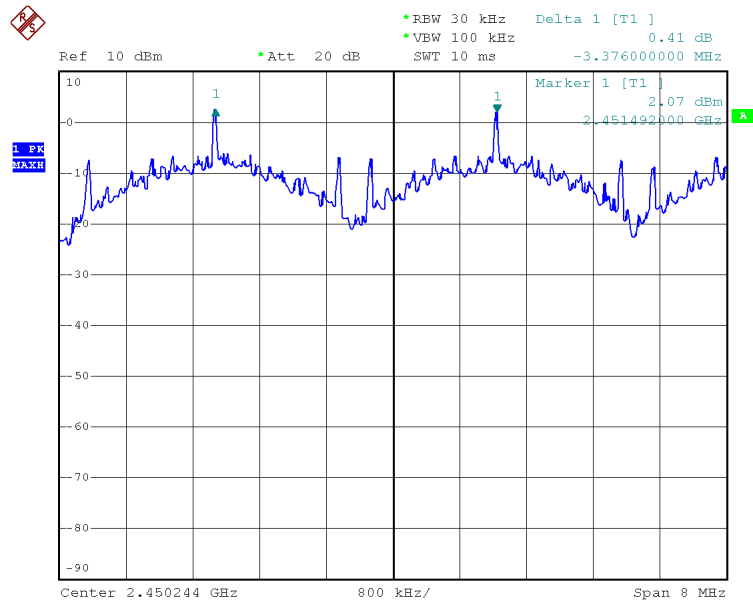
Test Channel	Separation (MHz)	Result
Lower	3.376	PASS
Middle	3.376	PASS
Upper	3.408	PASS

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Test result plot as follows:
Lower Channel:

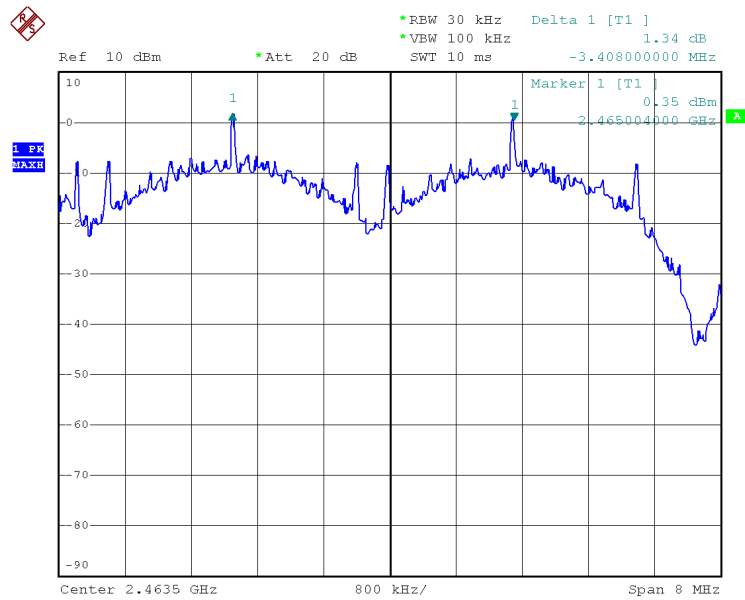


Middle Channel



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Upper Channel



12 Number of Hopping Frequency

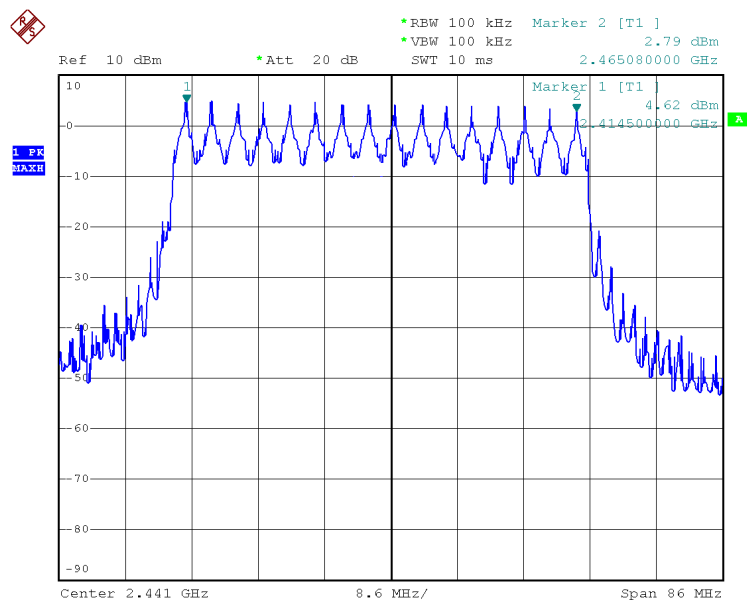
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

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 = 100 kHz. VBW = 100 kHz. 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: Center Frequency = 2441MHz, Span = 86MHz. Submit the test result graph.

12.2 Test Result:

Total Channels are 16 Channels



13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
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.
Test Mode:	Test in fixing operating frequency at lower, middle, upper channel.

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. Centered on a hopping channel;
3. Set RBW = 1MHz and VBW = 1MHz. 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:

The EUT output antenna port was connected to the spectrum analyzer. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz, and the frequency span to 0 Hz, measure the maximum time duration of one single pulse.

Formular $T = T_{on-time} * N_{times} / 1S * 0.4 * 16 \leq 0.4S$.

So, the Dwell Time can be calculated as follows:

Test frequency	Ton-time(second)	Dwell time (second)	Limit(second)
Lower channel	0.000342	0.0088	0.4
Middle channel	0.000332	0.0085	0.4
Upper channel	0.000344	0.0088	0.4

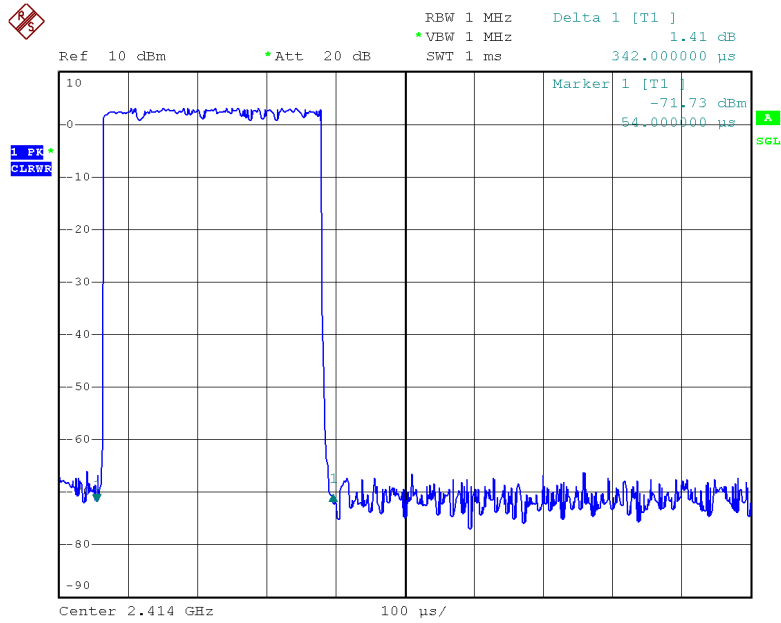
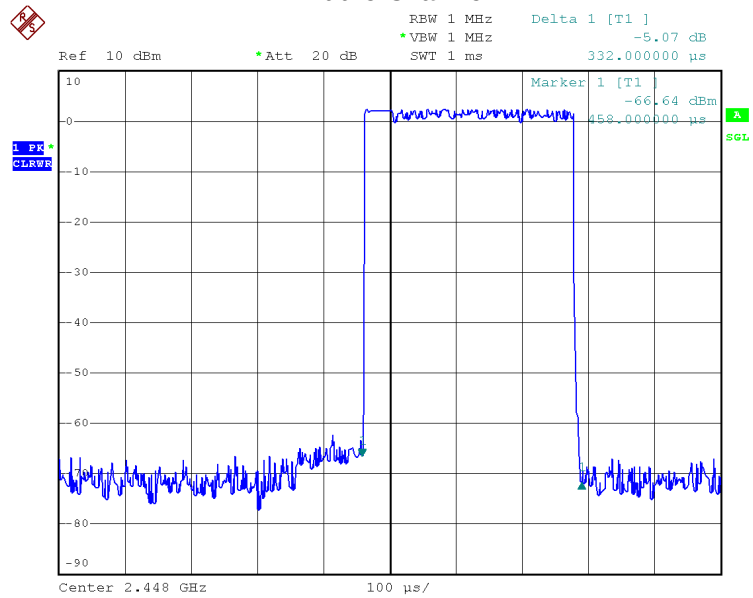
Remark: $N_{times} = 4$

After pretested with all condition, we found the data list above are the worst.

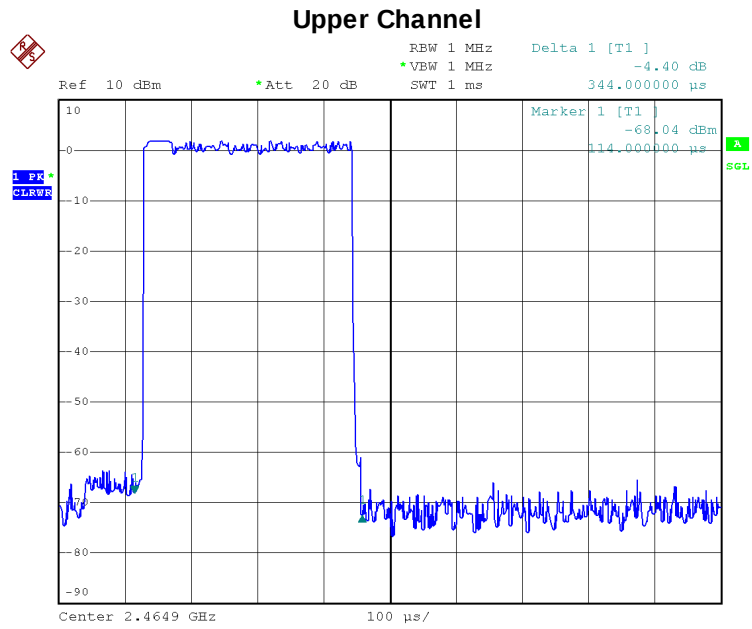
Please refer to the below photos for more details.

Note: Mkr Delta is once pulse time.

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Lower Channel**Middle Channel**

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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. 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. This product has an integrated antenna, fulfil the requirement of this section.

15 RF Exposure

15.1 Requirements:

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

15.2 Measurement Result:

Channel	Antenna Gain (dBi)	Antenna Gain (numeric)	Conducted Power (dBm)	Conducted Power (mW)
Lower	2	1.58	2.58	2.87
Middle	2	1.58	2.55	2.85
Upper	2	1.58	2.53	2.84

Formula: $\text{dBm} = 10\lg(\text{mw})$, $\text{Gain}_{\text{numeric}} = 10^{(\text{dBi}/10)}$

The EUT works on the 2.4GHz ISM band, and the max output power (conducted) of which is 2.87mW lower than low threshold 60/f (GHz) mW (25mW), d < 2.5cm in general population category.

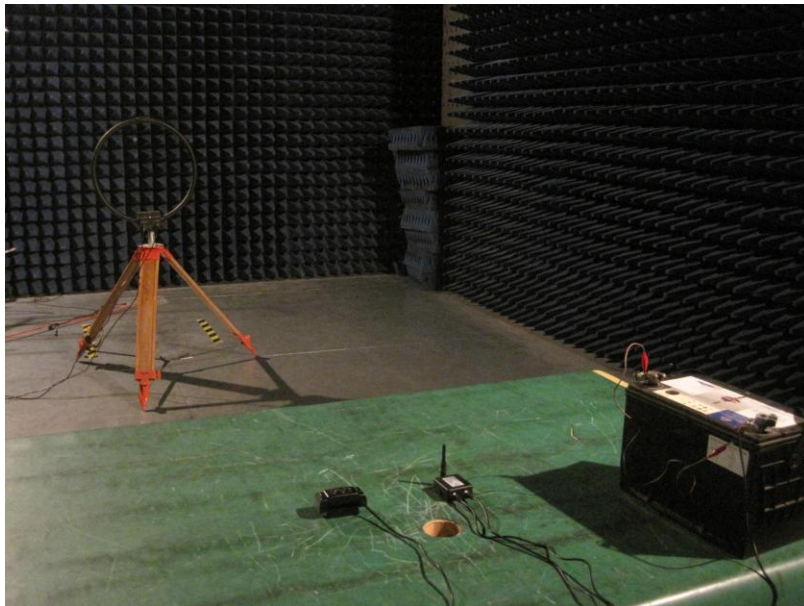
The SAR evaluation is not required.

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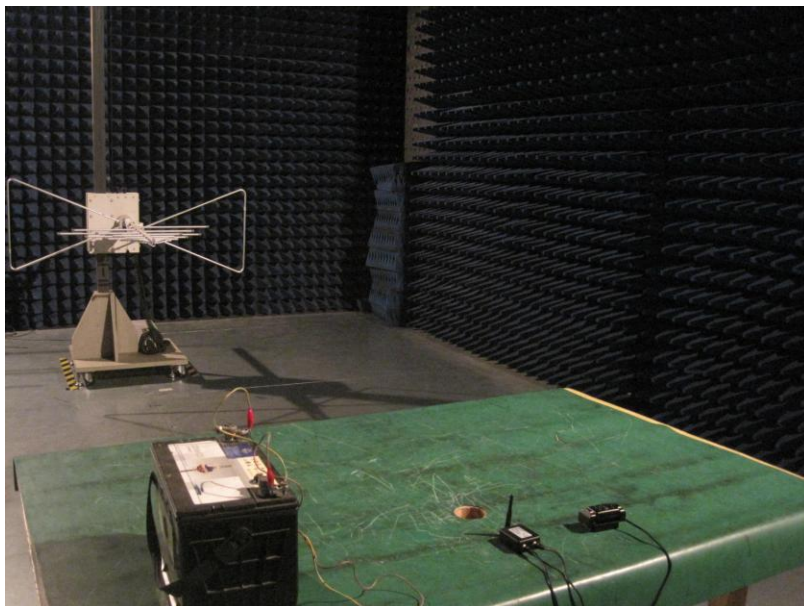
16 Photographs –Test Setup

16.1 Radiation Spurious Emission

Below 30MHz

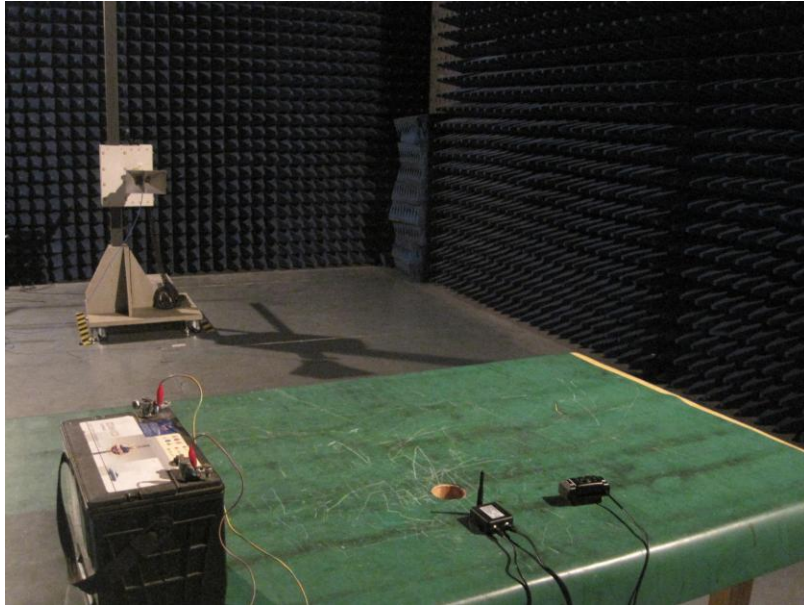


From 30-1000MHz



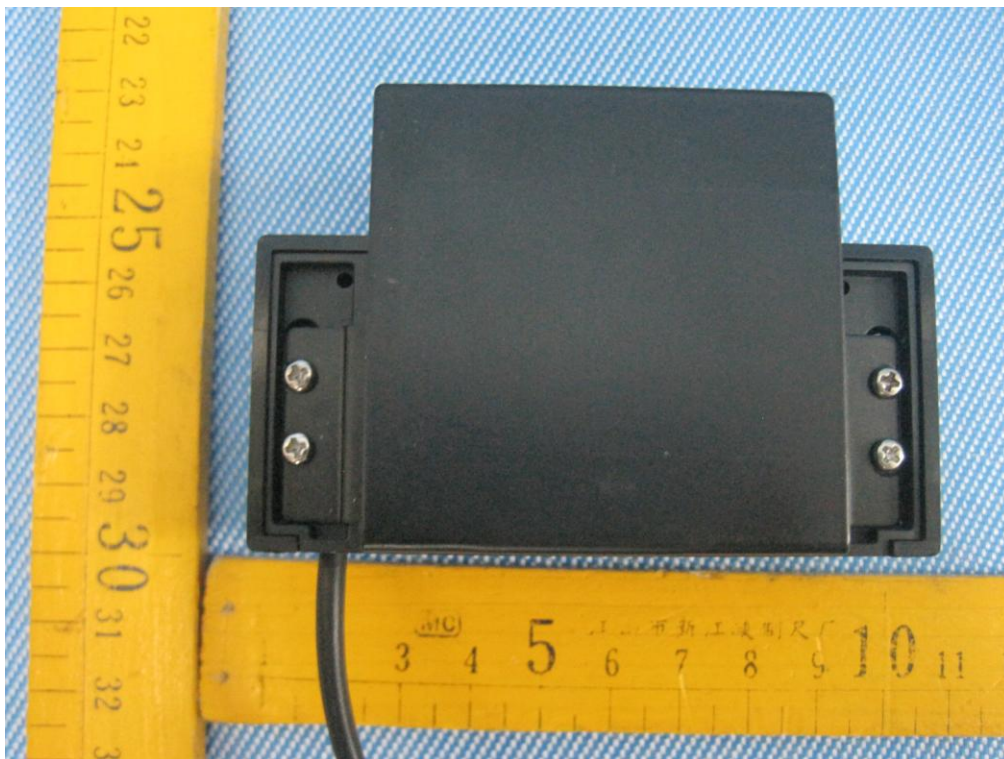
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Above 1GHz



17 Photographs - Constructional Details

17.1 Camera-Appearance View



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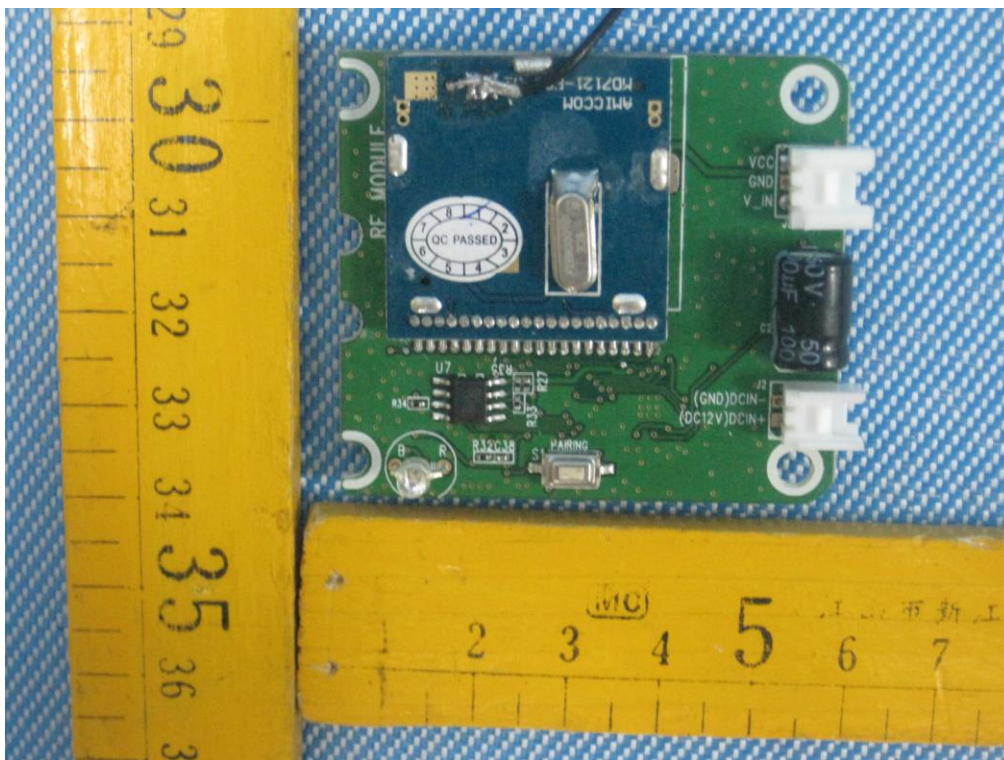
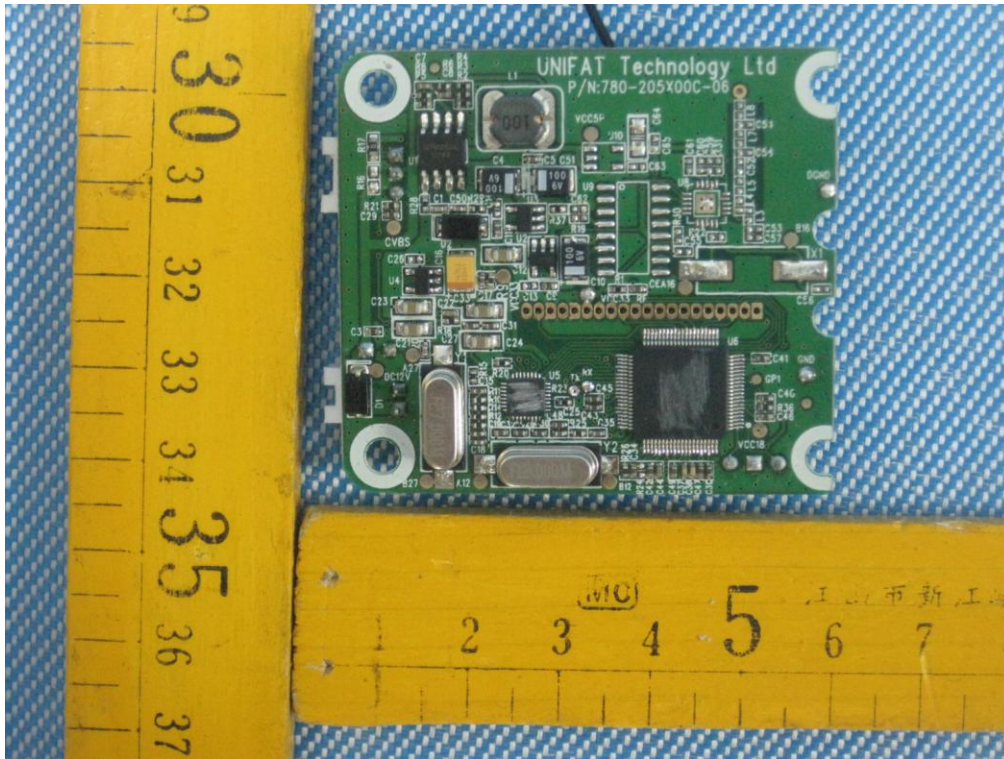


17.2 Camera – Open View



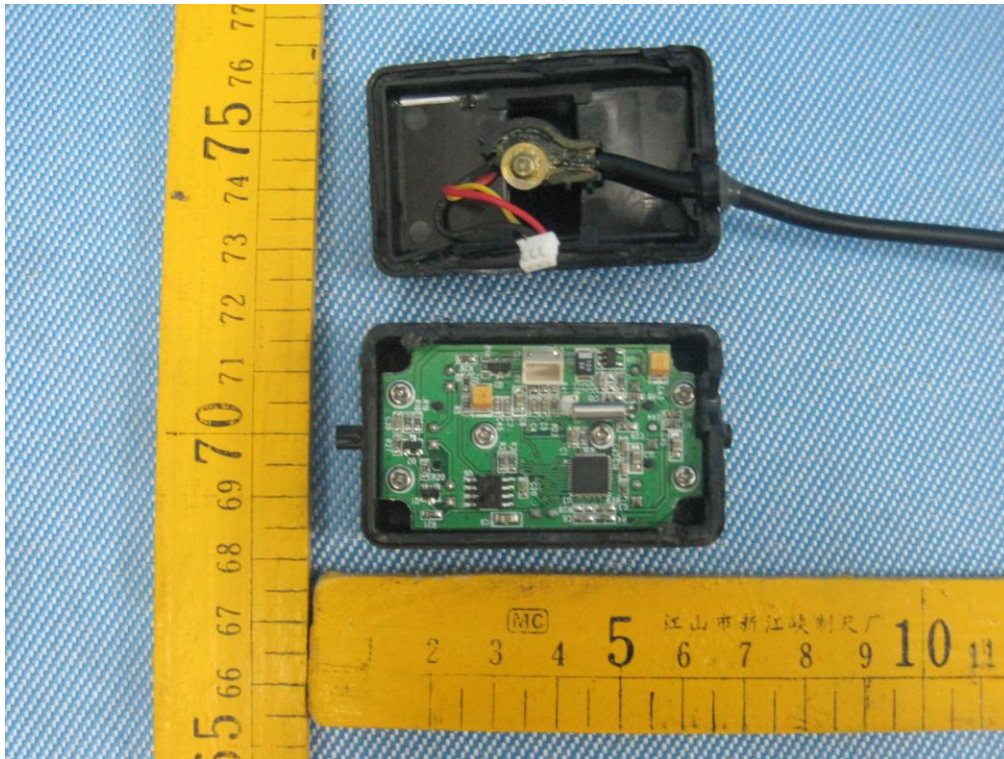
Report No.: WT12074920-S-S-F

17.3 Camera – PCB View

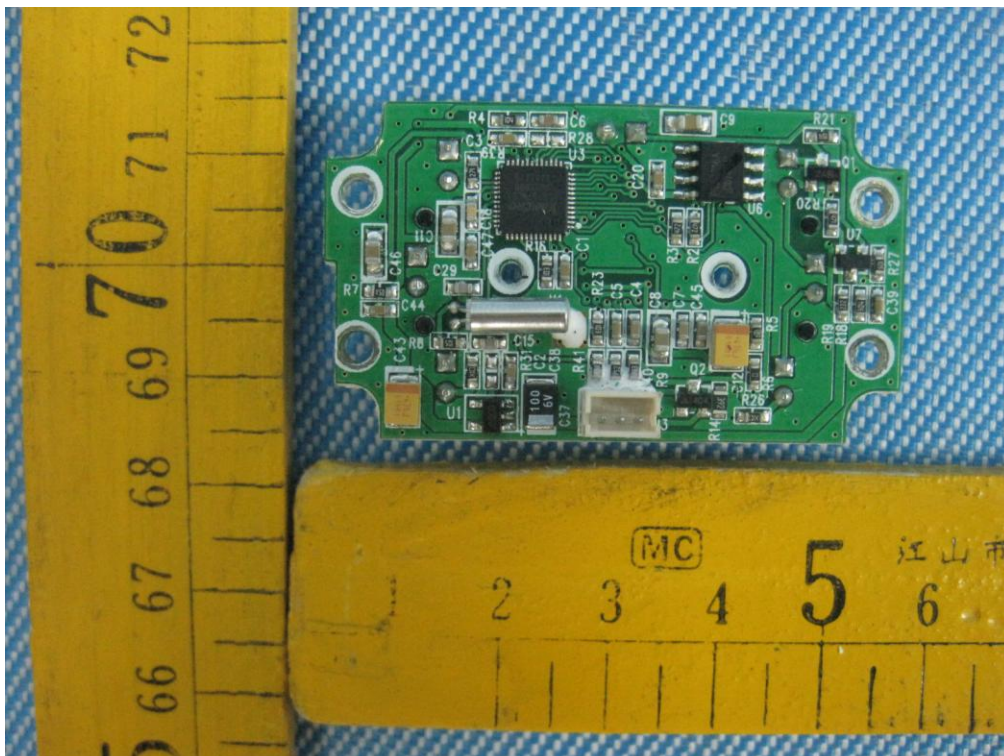


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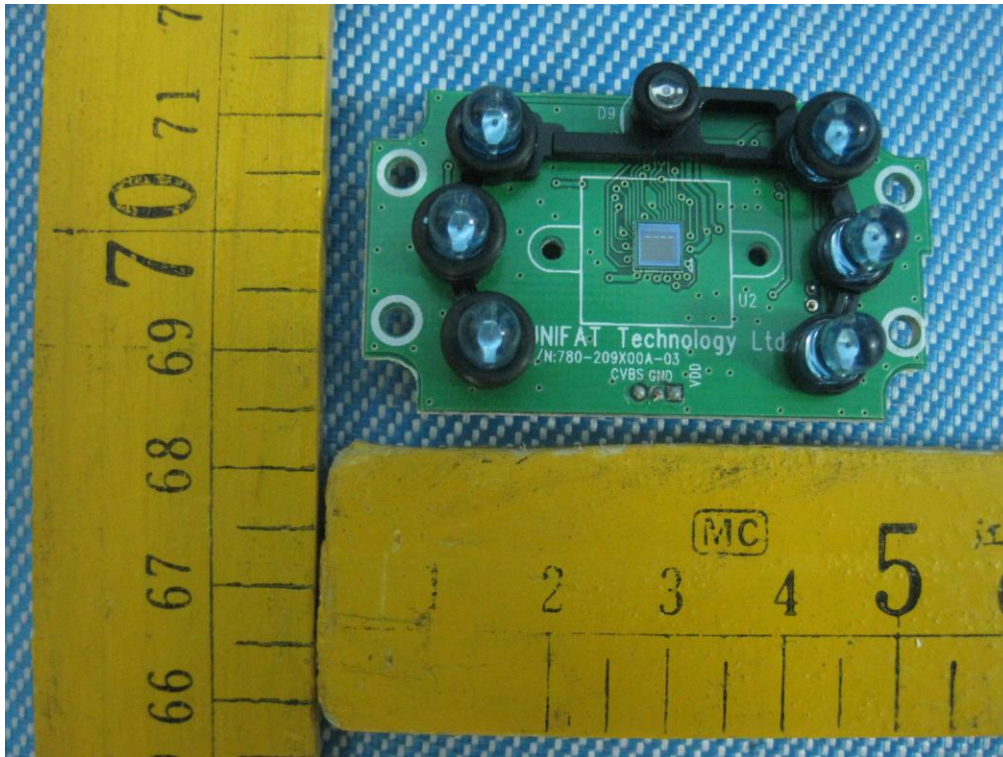
17.4 Lens – Open View



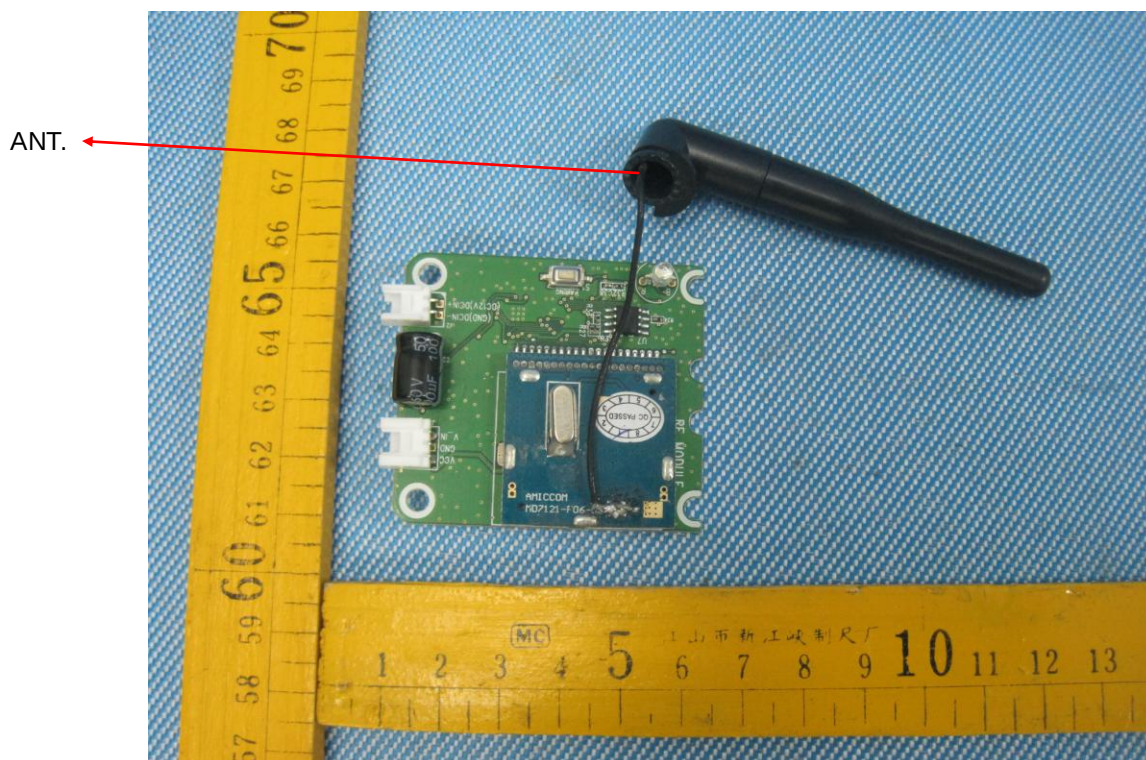
17.5 Lens – PCB View



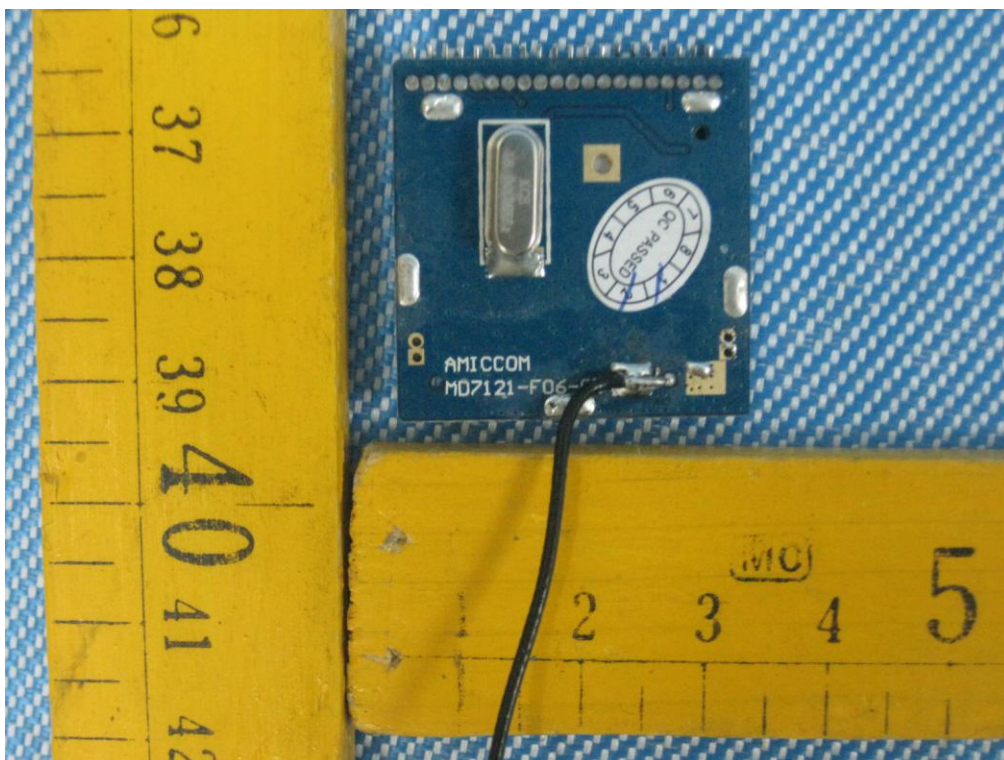
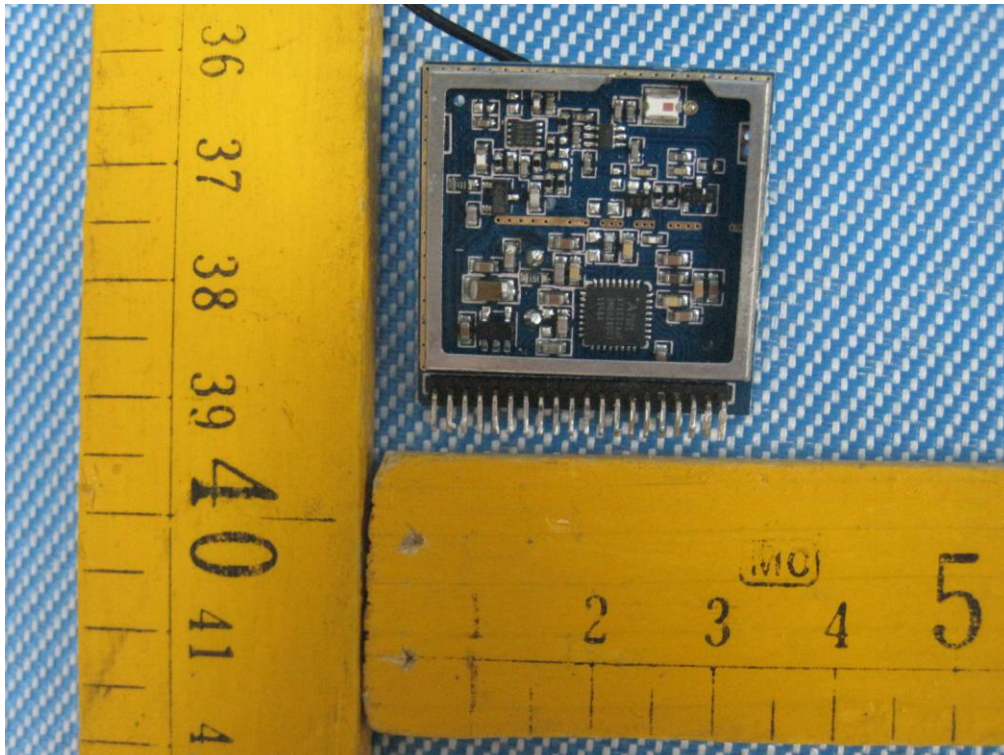
Report No.: WT12074920-S-S-F



17.6 RF module for Camera - View



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18 FCC Label

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT
EUT Back View/ proposed FCC Label Location

