

FCC TEST REPORT

FCC ID : SJ8-CA520M
Applicant : RDI Technology (Shenzhen) Co., Ltd.
Address : Building C1 Xingtang Industrial Park, East Baishixia, Fuyong,
Baoan, Shenzhen, China


Equipment Under Test (EUT) :

Product Name : Digital Wireless Pan/Tilt Camera
Model No. : CA520M

Standards : FCC CFR47 Part 15 Section 15.247:2010

Date of Test : December 23, 2011 ~ January 13, 2012

Date of Issue : February 6, 2012

Test Engineer : Hunk yan / Engineer 

Reviewed By : Philo zhong / Manager 

Test Result	: PASS
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Prepared By:

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2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions (9kHz to 25GHz)	15.205(a) 15.209 15.247(d)	PASS
Conduct Emission	15.207	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 Client Information

Applicant : RDI Technology (Shenzhen) Co., Ltd.
Address of Applicant : Building C1 Xingtang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, China

Manufacturer : RDI Technology (Shenzhen) Co., Ltd.
Address of Manufacturer : Building C1 Xingtang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, China

4.2 General Description of E.U.T.

Product Name : Digital Wireless Pan/Tilt Camera
Model No. : CA520M

4.3 Details of E.U.T.

Technical Data : Adapter Input: 100-240VAC, 50/60Hz, 0.3A
Adapter Output: 5.0VDC, 1.0A
Operation Frequency : 2402MHz ~ 2480MHz
Antenna Gain : 0 dBi

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Standards Applicable for Testing

The customer requested FCC tests for a Digital Wireless Pan/Tilt Camera. The standards used were FCC CFR47 Part 15 Section 15.203, Section 15.207, Section 15.209 and Section 15.247.

4.6 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, August 3, 2010.

- **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.

4.7 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

5 Equipment Used during Test

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY45114943	W2008001	9k-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Trilog Broadband Antenne	SCHWARZB ECK MESS- ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Broad-band Horn Antenna	SCHWARZB ECK MESS- ELEKTROM / BBHA 9120D(1201)	667	W2008003	1-18GHz	Aug. 2, 2011	Aug. 1, 2012	f < 10 GHz : ±1dB 10GHz < f < 18 GHz : ±1.5dB
Broadband Preamplifier	SCHWARZB ECK MESS- ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug. 2, 2011	Aug. 1, 2012	±1.2dB
Broad-band Horn Antenna	SCHWARZB ECK MESS- ELEKTROM / BBHA 9170	399	W2008005	15-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1.5dB
Broadband Preamplifier	SCHWARZB ECK MESS- ELEKTROM / BBV 9719	9719-254	W2008006	18-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1.2dB
10m Coaxial Cable with N-male Connectors	SCHWARZB ECK MESS- ELEKTROM / AK 9515 H	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
10m 50 Ohm Coaxial Cable	SCHWARZB ECK MESS- ELEKTROM / AK 9513	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Positioning Controller	C&C LAB/ CC-C-IF	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Color Monitor	SUNSP0/ SP-14C	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-

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RDI Technology (Shenzhen) Co., Ltd.

FCC ID: SJ8-CA520M

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Uncertainty
Test Receiver	ROHDE&SC HWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Two-Line V- Network	ROHDE&SC HWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug. 2, 2011	Aug. 1, 2012	±10%
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Fraq-range : 9K-1GHz RF voltage : - 60 dBm- +10dBm	Aug. 2, 2011	Aug. 1, 2012	Power_freq distinguish0. 1Hz RFelectricity distinguish 0.1B
Active Loop Antenna	Beijing Dazhi / ZN30900A	-	-	-	Aug. 2, 2011	Aug. 1, 2012	±1dB
AC Power Supply	TONGYUN/ DTDGC-4	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-

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WALTEK SERVICES

Reference No.: WT11127315-S-E-F

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
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

6.1 E.U.T. Operation

Operating Environment:

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

EUT Operation:

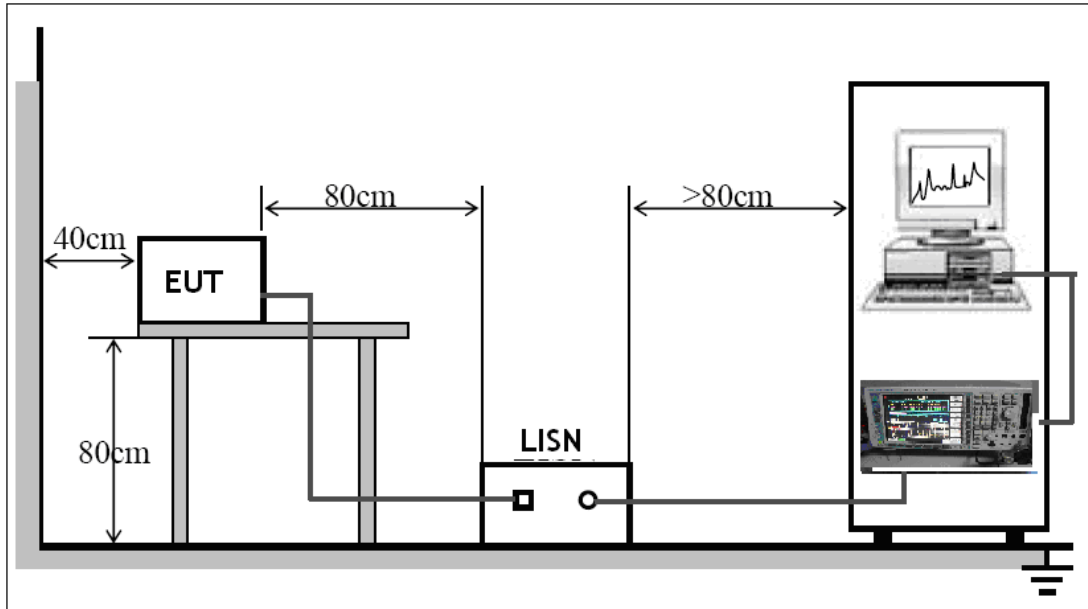
The pre-test was performed in normal link mode and continuously transmit mode, the worse mode is normal link mode, so the data show is that mode's only.

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

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.

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003, The specification used in this report was the FCC Part15.207 limits.

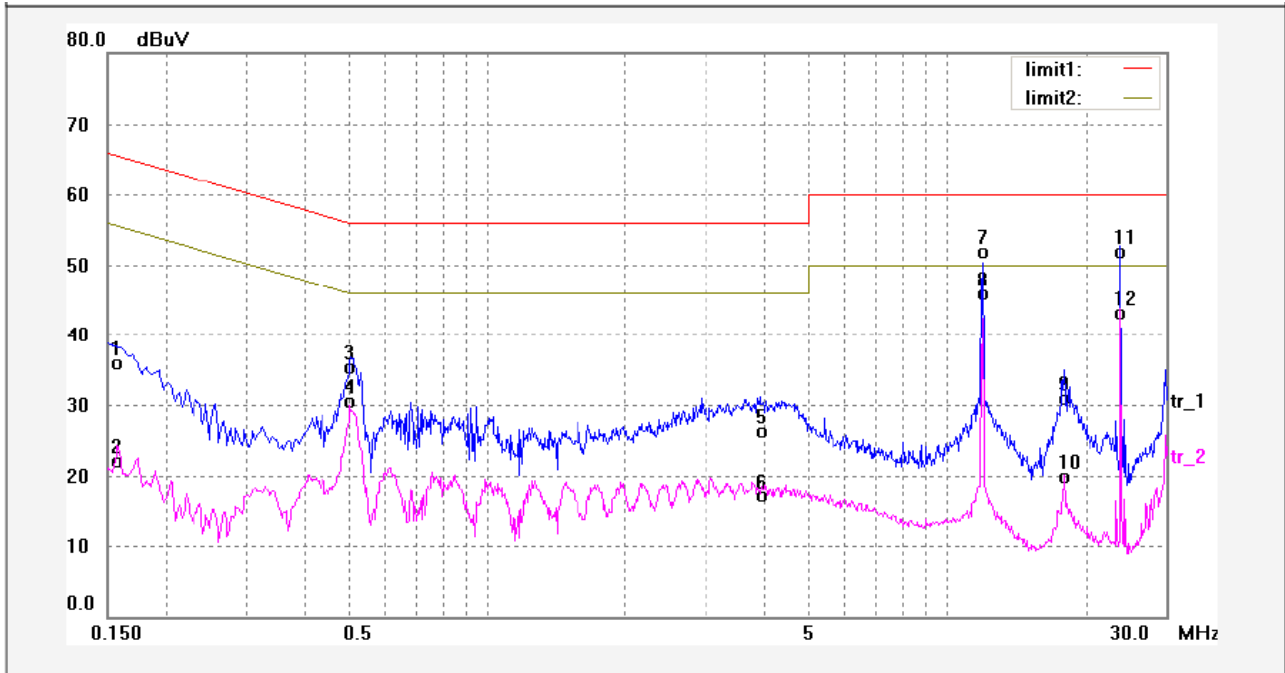


The EUT was placed on the test table in shielding room

6.3 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

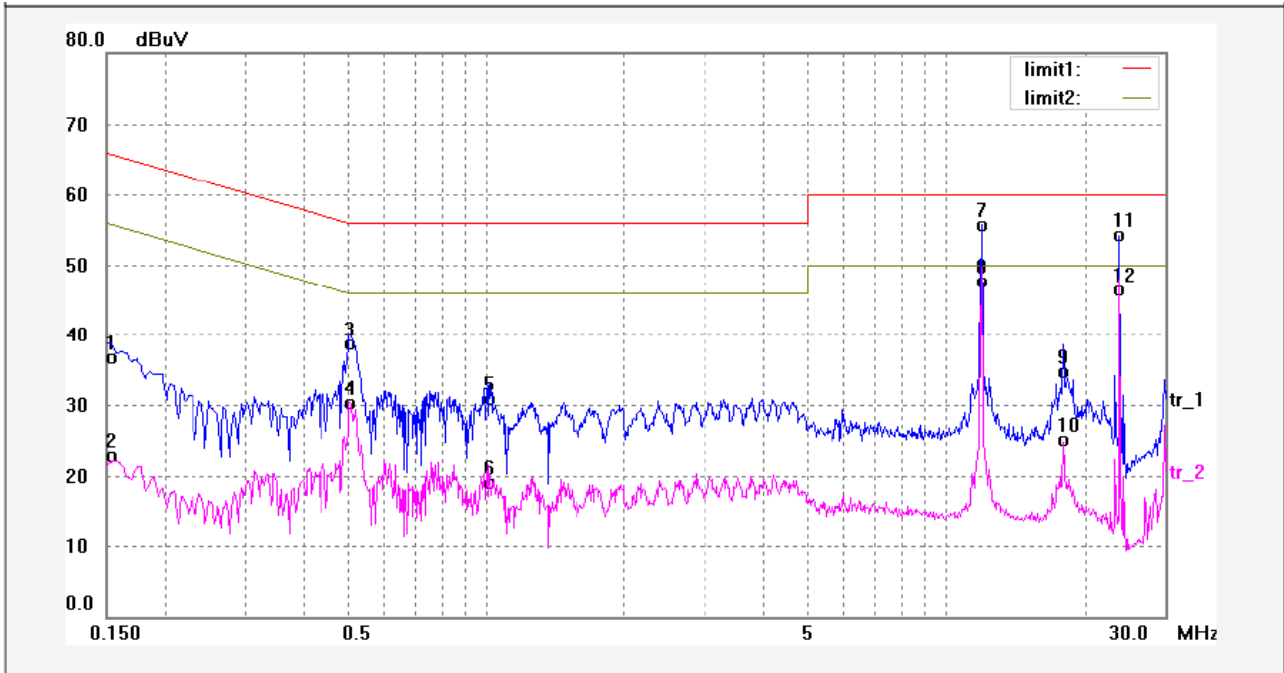
Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1590	24.73	10.35	35.08	65.51	-30.43	QP	
2	0.1590	10.89	10.35	21.24	55.51	-34.27	AVG	
3	0.5100	24.14	10.35	34.49	56.00	-21.51	QP	
4	0.5100	19.35	10.35	29.70	46.00	-16.30	AVG	
5	3.9380	15.21	10.39	25.60	56.00	-30.40	QP	
6	3.9380	5.83	10.39	16.22	46.00	-29.78	AVG	
7	12.0020	40.63	10.46	51.09	60.00	-8.91	QP	
8	12.0020	34.58	10.46	45.04	50.00	-4.96	AVG	
9	18.0300	19.72	10.45	30.17	60.00	-29.83	QP	
10	18.0300	8.64	10.45	19.09	50.00	-30.91	AVG	
11	24.0020	40.61	10.44	51.05	60.00	-8.95	QP	
12	24.0020	31.81	10.44	42.25	50.00	-7.75	AVG	

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Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	25.59	10.35	35.94	65.99	-30.05	QP	
2	0.1500	11.71	10.35	22.06	55.99	-33.93	AVG	
3	0.5100	27.62	10.35	37.97	56.00	-18.03	QP	
4	0.5100	19.07	10.35	29.42	46.00	-16.58	AVG	
5	1.0220	19.76	10.36	30.12	56.00	-25.88	QP	
6	1.0220	7.95	10.36	18.31	46.00	-27.69	AVG	
7	12.0020	44.46	10.46	54.92	60.00	-5.08	QP	
8	12.0020	36.41	10.46	46.87	50.00	-3.13	AVG	
9	17.9700	23.51	10.45	33.96	60.00	-26.04	QP	
10	17.9700	13.76	10.45	24.21	50.00	-25.79	AVG	
11	24.0020	43.16	10.44	53.60	60.00	-6.40	QP	
12	24.0020	35.20	10.44	45.64	50.00	-4.36	AVG	

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6.4 Photograph – Conducted Emission Test Setup



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7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: Based on DA 00-705
 Test Result: PASS
 Frequency Range: 9kHz to 25GHz
 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	$20\log^{(500)}$

Test mode: The EUT was tested in continuously Transmit mode.

7.1 EUT Operation :

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

7.2 Measurement Uncertainty

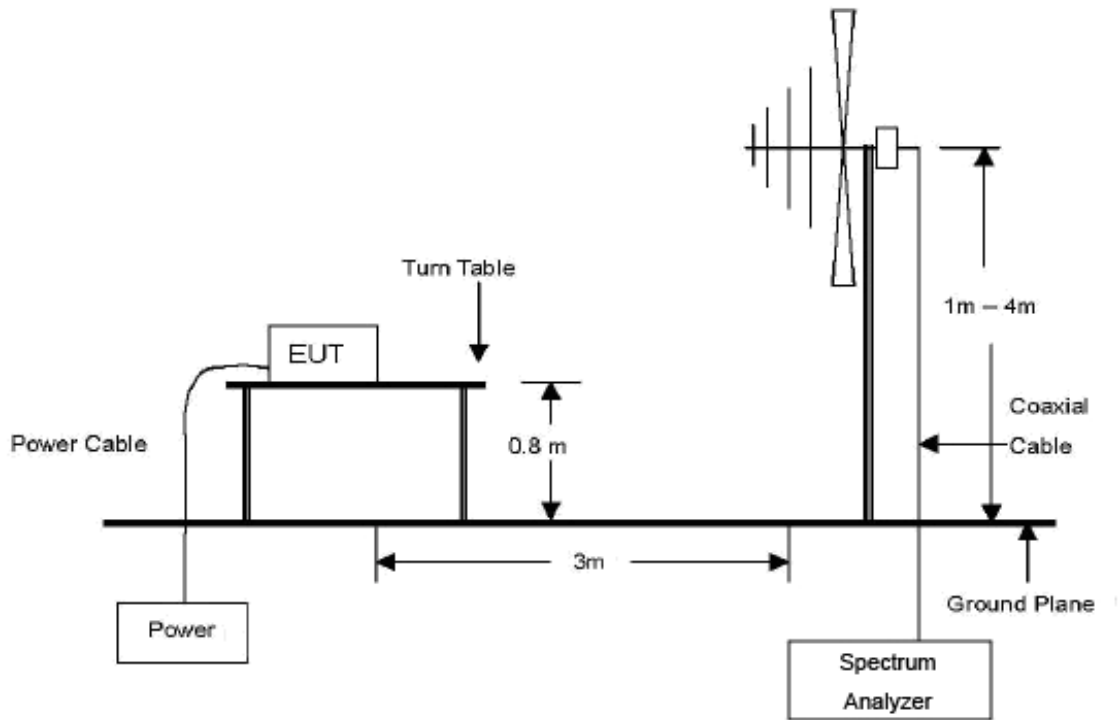
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Waltek EMC Lab is ± 5.03 dB.

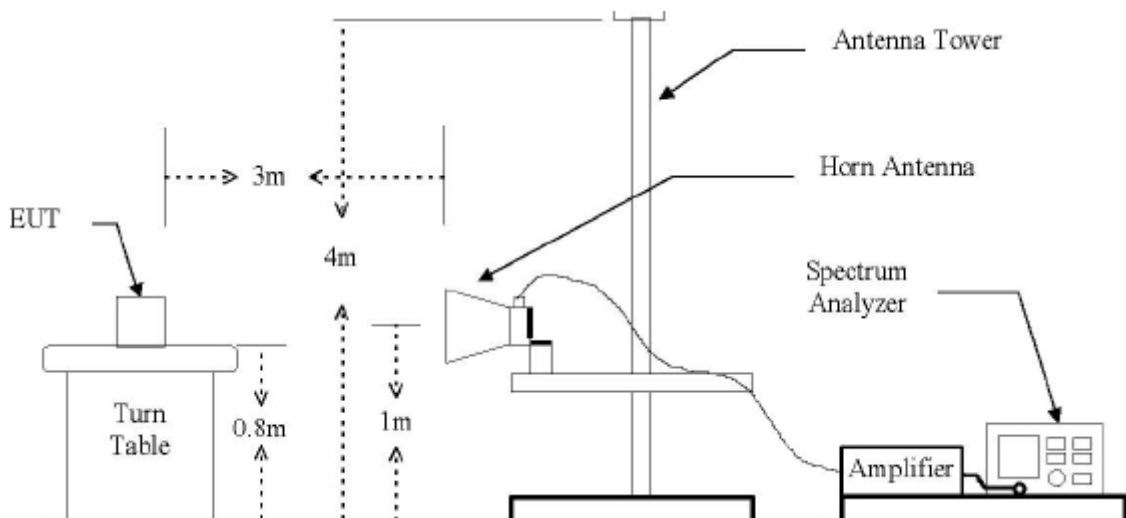
7.3 Test Setup

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 diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 25 GHz Emissions.



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7.4 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested 9kHz to 25000MHz.

9kHz ~ 30MHz

Start Frequency 9kHz
 Stop Frequency 30MHz
 Sweep Speed..... Auto
 IF Bandwidth..... 10KHz
 Video Bandwidth..... 10KHz
 Resolution Bandwidth..... 10KHz

30MHz ~ 1GHz

Start Frequency 30 MHz
 Stop Frequency 1000MHz
 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

Start Frequency 1000 MHz
 Stop Frequency 25000MHz
 Sweep Speed..... Auto
 IF Bandwidth..... 120 KHz
 Video Bandwidth..... 3MHz
 Quasi-Peak Adapter Bandwidth 120 KHz
 Quasi-Peak Adapter Mode Normal
 Resolution Bandwidth 1MHz

7.5 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 performed in X(normal uses) axis positioning. And all the modes was tested in the report. Only the worst case is shown in the report.

7.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

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

7.7 Summary of Test Results

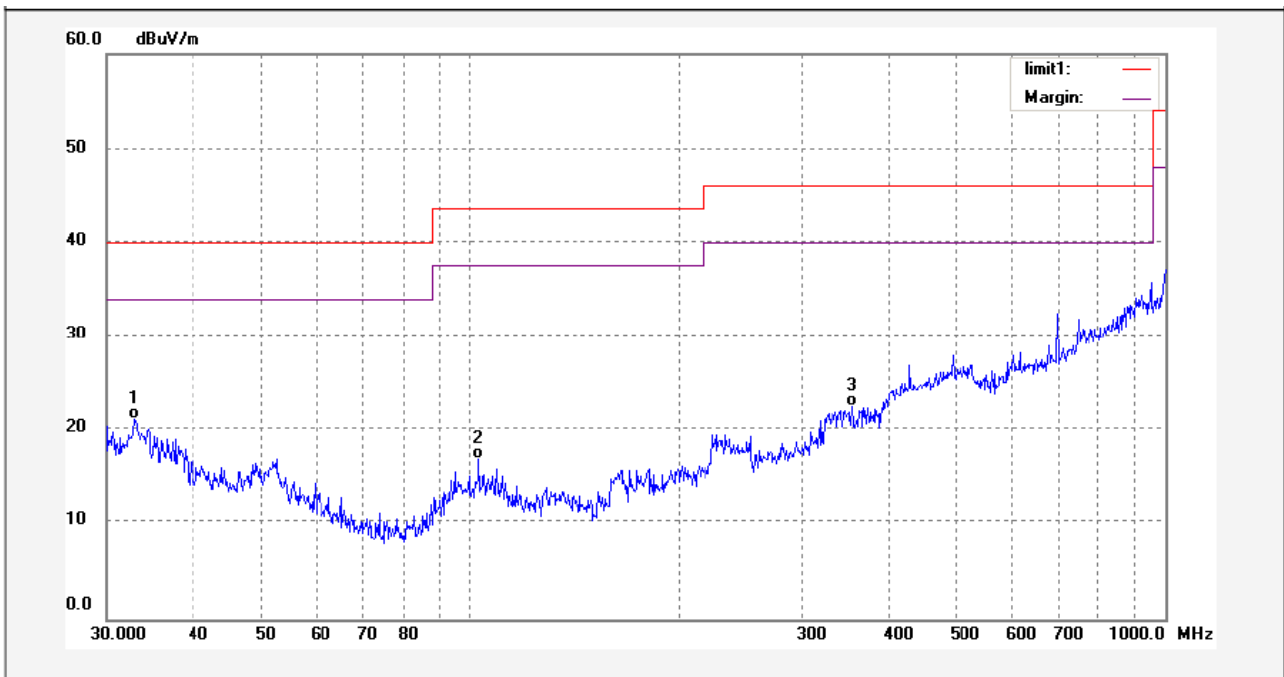
According to the data in this section, the EUT complied with the FCC CFR47 Part 15 Section 15.209 & 15.247 standards.

Test mode: continuously receive mode

Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only. Because the emissions below 30MHz are more than 20dB below the limit, the data is not show in the report.

Test Frequency : 30MHz ~ 1000MHz

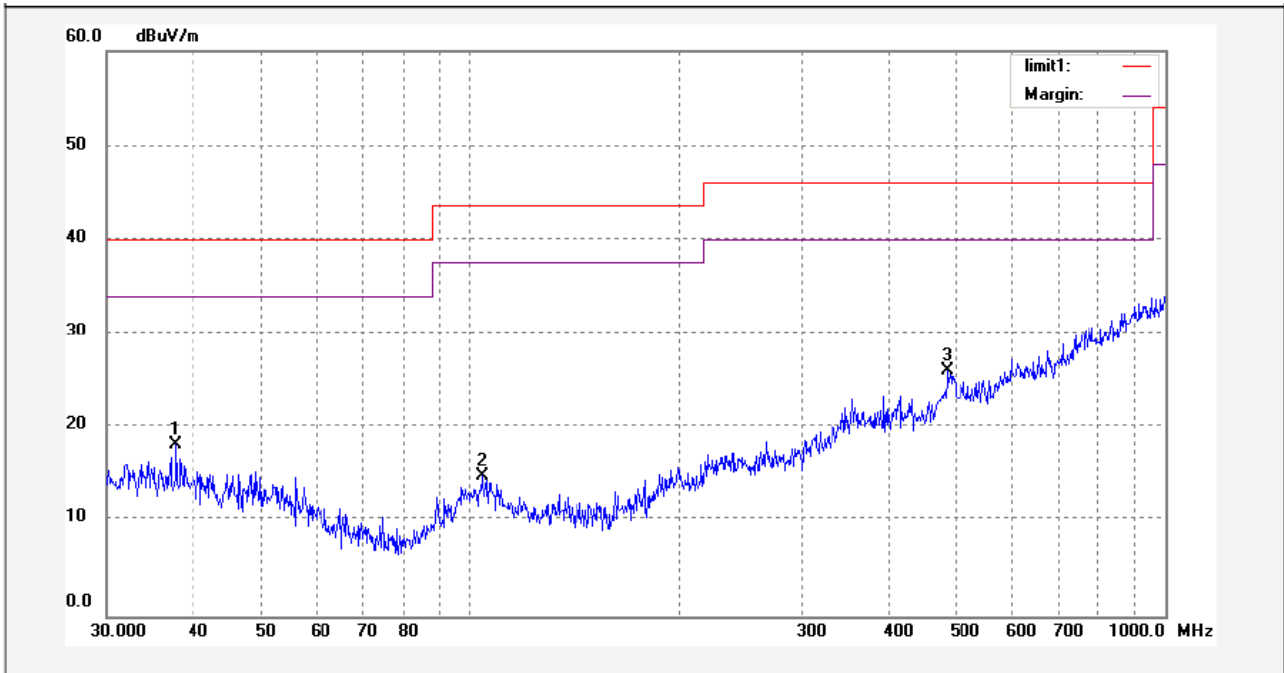
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	32.8697	4.61	16.57	21.18	40.00	-18.82	QP	
2	102.9728	2.88	14.15	17.03	43.50	-26.47	QP	
3	354.6911	2.18	20.43	22.61	46.00	-23.39	QP	

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Antenna polarization: Horizontal



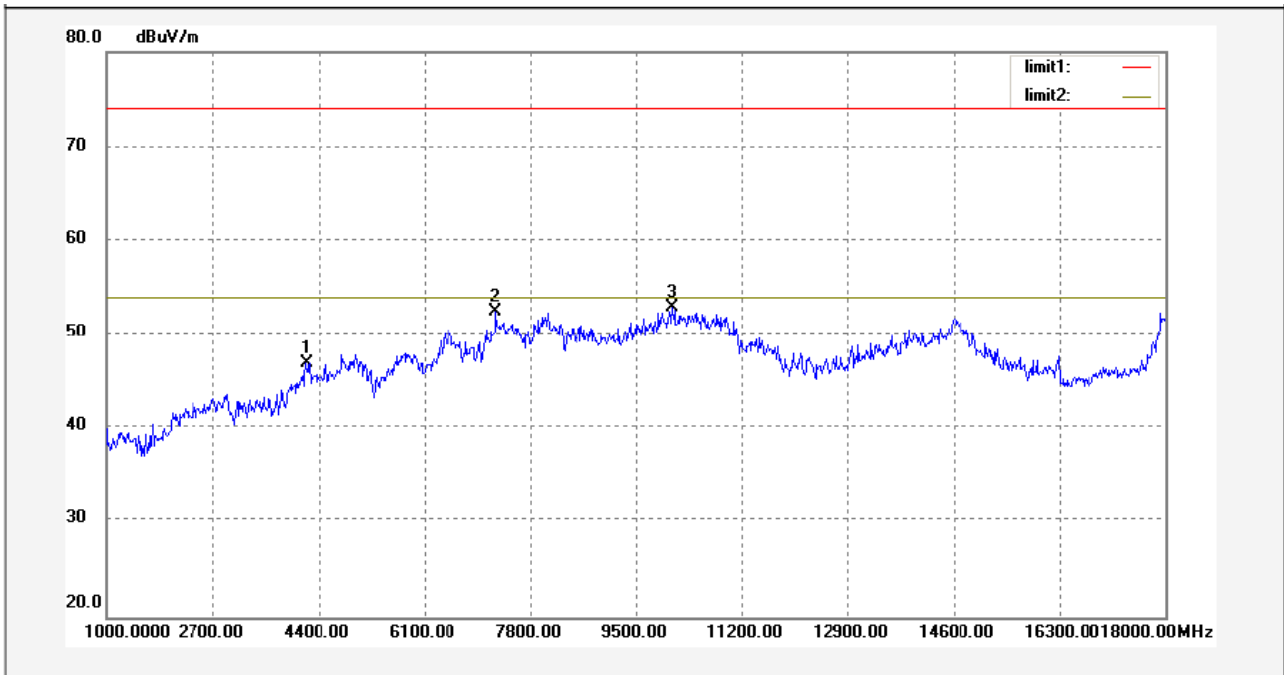
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	37.6970	1.54	16.64	18.18	40.00	-21.82	peak	
2	104.0640	0.69	14.20	14.89	43.50	-28.61	peak	
3	486.6136	1.32	24.72	26.04	46.00	-19.96	peak	

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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 record.

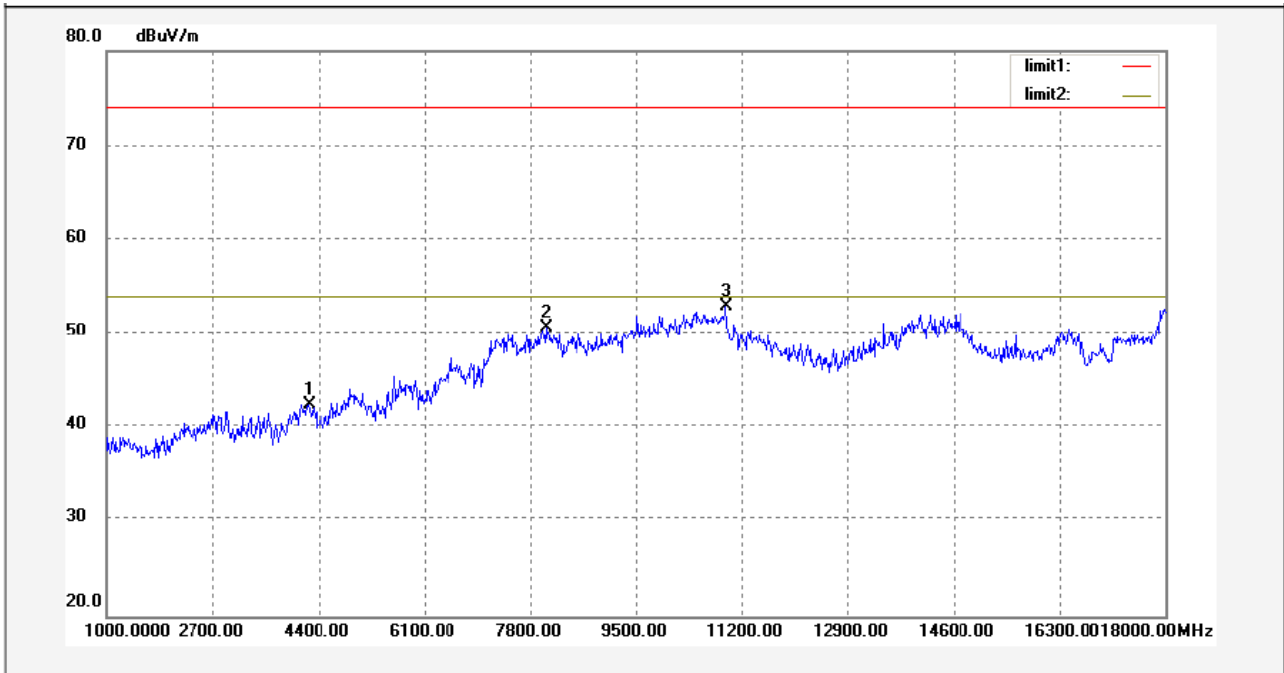
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4185.371	40.52	6.46	46.98	74.00	-27.02	peak	
2	7251.503	36.63	15.85	52.48	74.00	-21.52	peak	
3	10079.158	32.27	20.58	52.85	74.00	-21.15	peak	

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Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	4236.473	39.30	3.10	42.40	74.00	-31.60	peak	
2	8052.104	35.75	14.91	50.66	74.00	-23.34	peak	
3	10947.896	33.63	19.31	52.94	74.00	-21.06	peak	

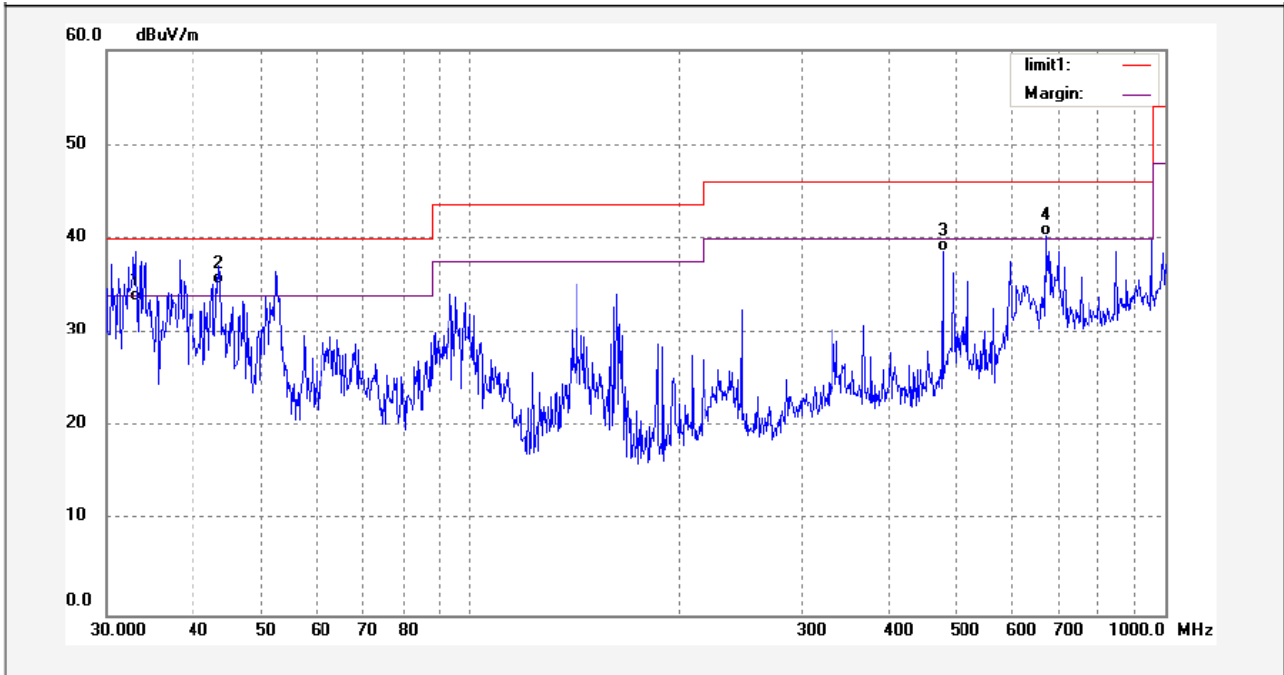
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Test mode: continuously transmit mode

Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only. Because the emissions below 30MHz are more than 20dB below the limit, the data is not show in the report.

Test Frequency : 30MHz ~ 1000MHz

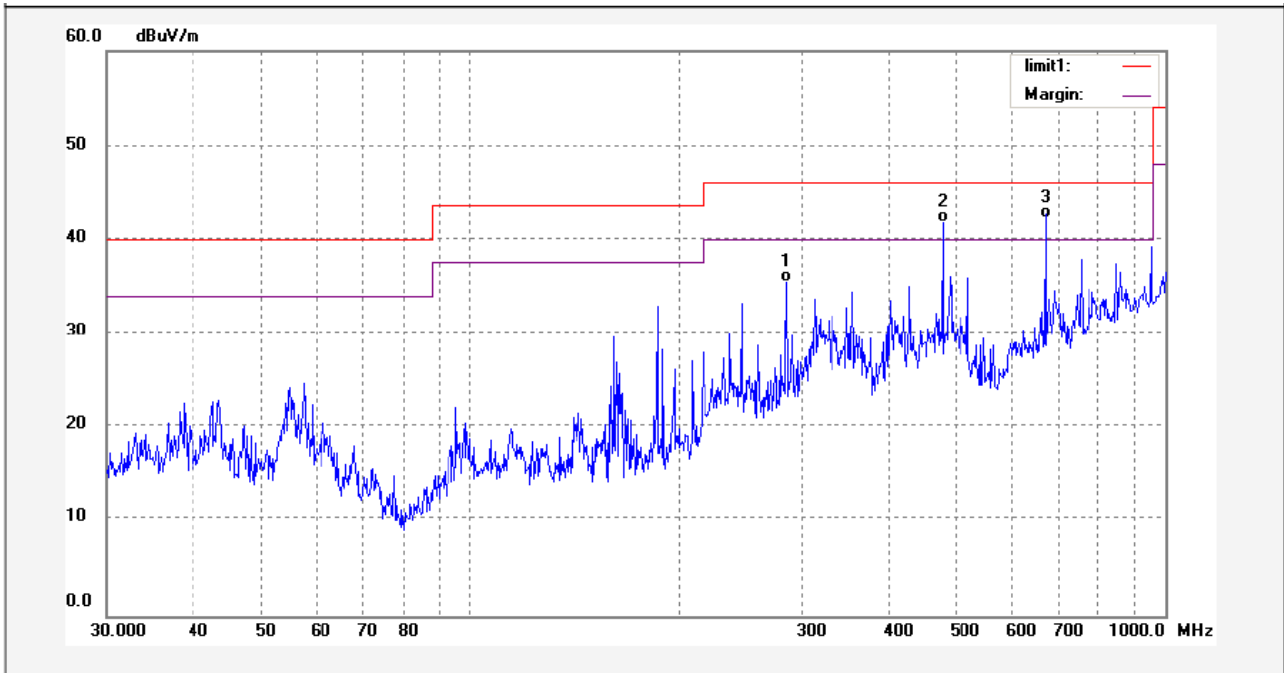
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	32.9854	16.87	16.57	33.44	40.00	-6.56	QP	
2	43.5380	20.00	15.12	35.12	40.00	-4.88	QP	
3	478.1394	16.11	22.52	38.63	46.00	-7.37	QP	
4	672.3104	14.14	26.19	40.33	46.00	-5.67	QP	

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Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	285.2611	18.94	16.51	35.45	46.00	-10.55	QP	
2	478.1394	19.27	22.52	41.79	46.00	-4.21	QP	
3	672.3104	16.00	26.19	42.19	46.00	-3.81	QP	

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Test Frequency: 1GHz ~ 25GHz

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 (°)
Low frequency							
2402.00	AV	Vertical	102.47		(Fund.)	1.1	20
4804.00	AV	Vertical	47.64	54.00	-6.36	1.3	75
7206.00	AV	Vertical	48.58	54.00	-5.42	1.4	150
9608.00	AV	Vertical	45.31	54.00	-8.69	1.9	80
12010.00	AV	Vertical	41.67	54.00	-12.33	1.5	170
14412.00	AV	Vertical	42.96	54.00	-11.04	1.5	140
16814.00	AV	Vertical	39.77	54.00	-14.23	1.6	130
19216.00	AV	Vertical	38.05	54.00	-15.95	1.6	90
21618.00	AV	Vertical	35.83	54.00	-18.17	1.5	20
24020.00	AV	Vertical	36.98	54.00	-17.02	1.3	95
2402.00	AV	Horizontal	96.20		(Fund.)	1.1	20
4804.00	AV	Horizontal	46.95	54.00	-7.05	1.3	150
7206.00	AV	Horizontal	44.70	54.00	-9.30	1.4	90
9608.00	AV	Horizontal	41.81	54.00	-12.19	1.3	120
12010.00	AV	Horizontal	43.79	54.00	-10.21	1.4	95
14412.00	AV	Horizontal	38.70	54.00	-15.30	1.3	140
16814.00	AV	Horizontal	44.80	54.00	-9.20	1.4	130
19216.00	AV	Horizontal	36.65	54.00	-17.35	1.9	130
21618.00	AV	Horizontal	37.98	54.00	-16.02	1.1	120
24020.00	AV	Horizontal	39.75	54.00	-14.25	1.6	45
2402.00	PK	Vertical	114.35		(Fund.)	1.4	20
4804.00	PK	Vertical	60.64	74.00	-13.36	1.9	90
7206.00	PK	Vertical	61.58	74.00	-12.42	1.5	120
9608.00	PK	Vertical	58.31	74.00	-15.69	1.5	200
12010.00	PK	Vertical	54.67	74.00	-19.33	1.1	95
14412.00	PK	Vertical	55.96	74.00	-18.04	1.3	80
16814.00	PK	Vertical	52.77	74.00	-21.23	1.3	165
19216.00	PK	Vertical	51.05	74.00	-22.95	1.3	150
21618.00	PK	Vertical	48.83	74.00	-25.17	1.6	80
24020.00	PK	Vertical	49.98	74.00	-24.02	1.5	125
2402.00	PK	Horizontal	107.70		(Fund.)	1.7	80
4804.00	PK	Horizontal	46.95	74.00	-27.05	1.9	120
7206.00	PK	Horizontal	44.70	74.00	-29.30	1.7	90
9608.00	PK	Horizontal	41.81	74.00	-32.19	1.3	20
12010.00	PK	Horizontal	43.79	74.00	-30.21	1.1	170
14412.00	PK	Horizontal	38.70	74.00	-35.30	1.6	20
16814.00	PK	Horizontal	44.80	74.00	-29.20	1.7	210
19216.00	PK	Horizontal	36.65	74.00	-37.35	1.6	90

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21618.00	PK	Horizontal	37.98	74.00	-36.02	1.1	140
24020.00	PK	Horizontal	39.75	74.00	-34.25	1.3	95
Middle frequency							
2440.00	AV	Vertical	103.12		(Fund.)	1.4	50
4880.00	AV	Vertical	47.19	54.00	-6.81	1.3	120
7320.00	AV	Vertical	45.30	54.00	-8.70	1.3	130
9760.00	AV	Vertical	44.16	54.00	-9.84	1.3	40
12200.00	AV	Vertical	47.40	54.00	-6.60	1.1	35
14640.00	AV	Vertical	40.07	54.00	-13.93	1.3	170
17080.00	AV	Vertical	43.32	54.00	-10.68	1.4	30
19520.00	AV	Vertical	38.13	54.00	-15.87	1.6	60
21960.00	AV	Vertical	42.12	54.00	-11.88	1.7	230
24400.00	AV	Vertical	35.18	54.00	-18.82	1.3	120
2440.00	AV	Horizontal	97.35		(Fund.)	1.2	160
4880.00	AV	Horizontal	45.26	54.00	-8.74	1.1	130
7320.00	AV	Horizontal	46.99	54.00	-7.01	1.4	305
9760.00	AV	Horizontal	41.10	54.00	-12.90	1.3	140
12200.00	AV	Horizontal	43.85	54.00	-10.15	1.1	180
14640.00	AV	Horizontal	39.25	54.00	-14.75	1.5	240
17080.00	AV	Horizontal	36.44	54.00	-17.56	1.5	185
19520.00	AV	Horizontal	39.13	54.00	-14.87	1.5	120
21960.00	AV	Horizontal	40.36	54.00	-13.64	1.1	190
24400.00	AV	Horizontal	35.04	54.00	-18.96	1.8	160
2440.00	PK	Vertical	113.08		(Fund.)	1.3	35
4880.00	PK	Vertical	63.19	74.00	-10.81	1.2	110
7320.00	PK	Vertical	61.30	74.00	-12.70	1.3	130
9760.00	PK	Vertical	57.16	74.00	-16.84	1.4	180
12200.00	PK	Vertical	60.40	74.00	-13.60	1.6	230
14640.00	PK	Vertical	53.07	74.00	-20.93	1.3	30
17080.00	PK	Vertical	56.32	74.00	-17.68	1.3	40
19520.00	PK	Vertical	51.13	74.00	-22.87	1.6	160
21960.00	PK	Vertical	55.12	74.00	-18.88	1.4	170
24400.00	PK	Vertical	48.18	74.00	-25.82	1.3	140
2440.00	PK	Horizontal	108.25		(Fund.)	1.4	30
4880.00	PK	Horizontal	58.26	74.00	-15.74	1.8	105
7320.00	PK	Horizontal	59.99	74.00	-14.01	1.5	140
9760.00	PK	Horizontal	54.10	74.00	-19.90	1.6	90
12200.00	PK	Horizontal	56.85	74.00	-17.15	1.3	190
14640.00	PK	Horizontal	52.25	74.00	-21.75	1.3	190
17080.00	PK	Horizontal	49.44	74.00	-24.56	1.0	155
19520.00	PK	Horizontal	52.13	74.00	-21.87	1.6	170
21960.00	PK	Horizontal	53.36	74.00	-20.64	1.0	30
24400.00	PK	Horizontal	48.04	74.00	-25.96	1.7	195
High frequency							

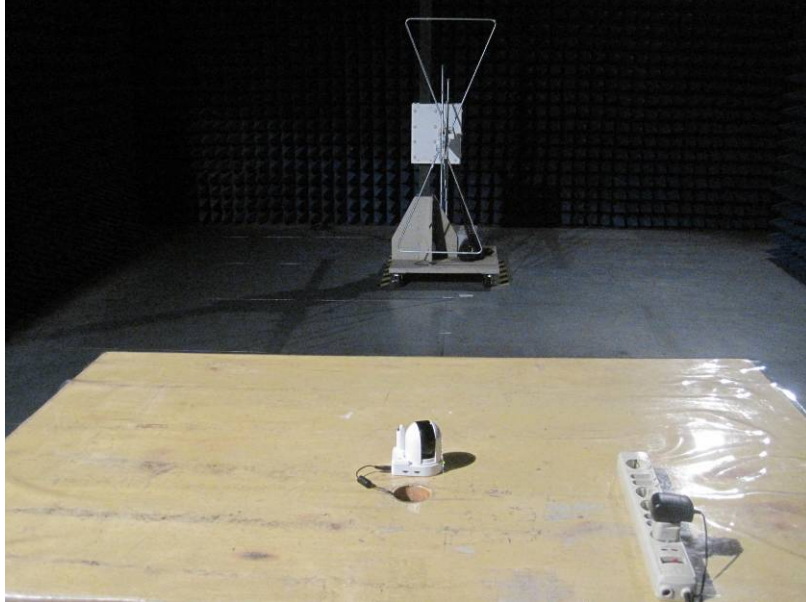
The results shown in this test report refer only to the sample(s) tested , This Test report cannot be reproduced, except in full, without prior written permission of the Company.

2480.00	AV	Vertical	103.75		(Fund.)	1.4	200
4960.00	AV	Vertical	49.05	54.00	-4.95	1.3	30
7440.00	AV	Vertical	45.48	54.00	-8.52	1.5	160
9920.00	AV	Vertical	47.94	54.00	-6.06	1.5	100
12400.00	AV	Vertical	43.04	54.00	-10.96	1.4	125
14880.00	AV	Vertical	49.59	54.00	-4.41	1.9	140
17360.00	AV	Vertical	43.62	54.00	-10.38	1.0	130
19840.00	AV	Vertical	44.49	54.00	-9.51	1.2	240
22320.00	AV	Vertical	42.81	54.00	-11.19	1.3	170
24800.00	AV	Vertical	36.43	54.00	-17.57	1.6	165
2480.00	AV	Horizontal	97.90		(Fund.)	1.2	160
4960.00	AV	Horizontal	45.44	54.00	-8.56	1.9	190
7440.00	AV	Horizontal	43.75	54.00	-10.25	1.1	155
9920.00	AV	Horizontal	44.57	54.00	-9.43	1.6	200
12400.00	AV	Horizontal	42.43	54.00	-11.57	1.1	165
14880.00	AV	Horizontal	36.62	54.00	-17.38	1.3	180
17360.00	AV	Horizontal	40.83	54.00	-13.17	1.3	230
19840.00	AV	Horizontal	35.50	54.00	-18.50	1.9	90
22320.00	AV	Horizontal	38.33	54.00	-15.67	1.2	130
24800.00	AV	Horizontal	33.71	54.00	-20.29	1.7	130
2480.00	PK	Vertical	112.43		(Fund.)	1.3	215
4960.00	PK	Vertical	62.05	74.00	-11.95	1.3	50
7440.00	PK	Vertical	58.48	74.00	-15.52	1.7	140
9920.00	PK	Vertical	60.94	74.00	-13.06	1.6	160
12400.00	PK	Vertical	56.04	74.00	-17.96	1.3	140
14880.00	PK	Vertical	62.59	74.00	-11.41	1.3	90
17360.00	PK	Vertical	56.62	74.00	-17.38	1.1	130
19840.00	PK	Vertical	57.49	74.00	-16.51	1.3	160
22320.00	PK	Vertical	55.81	74.00	-18.19	1.5	155
24800.00	PK	Vertical	49.43	74.00	-24.57	1.5	155
2480.00	PK	Horizontal	107.92		(Fund.)	1.5	210
4960.00	PK	Horizontal	58.44	74.00	-15.56	1.5	120
7440.00	PK	Horizontal	56.75	74.00	-17.25	1.4	170
9920.00	PK	Horizontal	57.57	74.00	-16.43	1.4	210
12400.00	PK	Horizontal	55.43	74.00	-18.57	1.1	130
14880.00	PK	Horizontal	49.62	74.00	-24.38	1.8	130
17360.00	PK	Horizontal	53.83	74.00	-20.17	1.7	185
19840.00	PK	Horizontal	48.50	74.00	-25.50	1.6	170
22320.00	PK	Horizontal	51.33	74.00	-22.67	1.7	150
24800.00	PK	Horizontal	46.71	74.00	-27.29	1.1	240

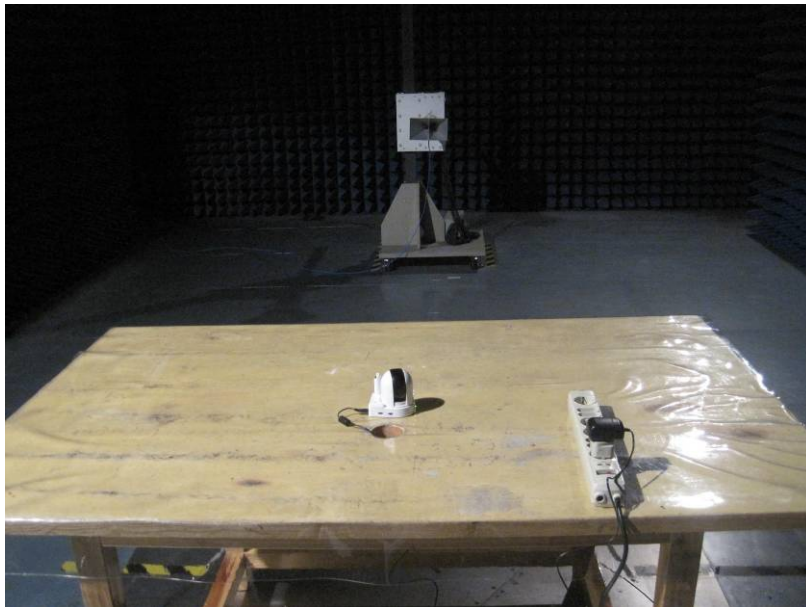
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7.8 Photograph – Radiation Spurious Emission Test Setup

Below 1GHz



Above 1GHz

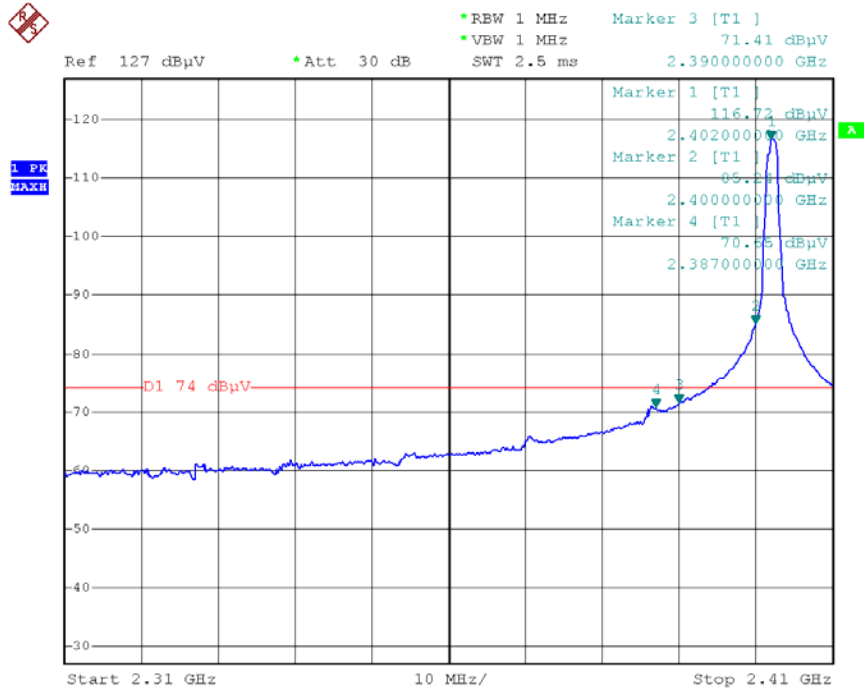


8 Band Edge Measurement

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:	Based on 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
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

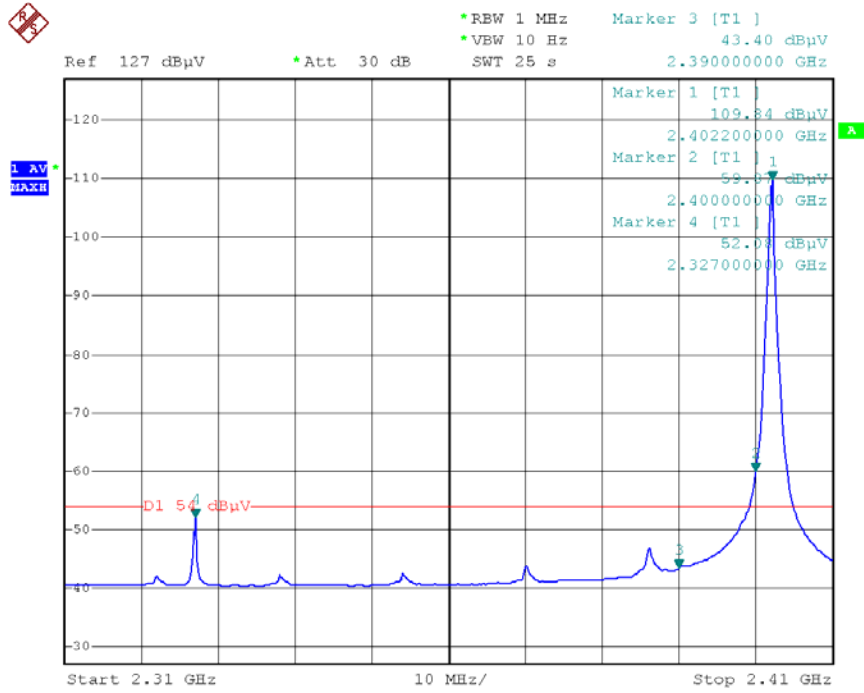
8.1 Test Result:

Low Channel – Peak



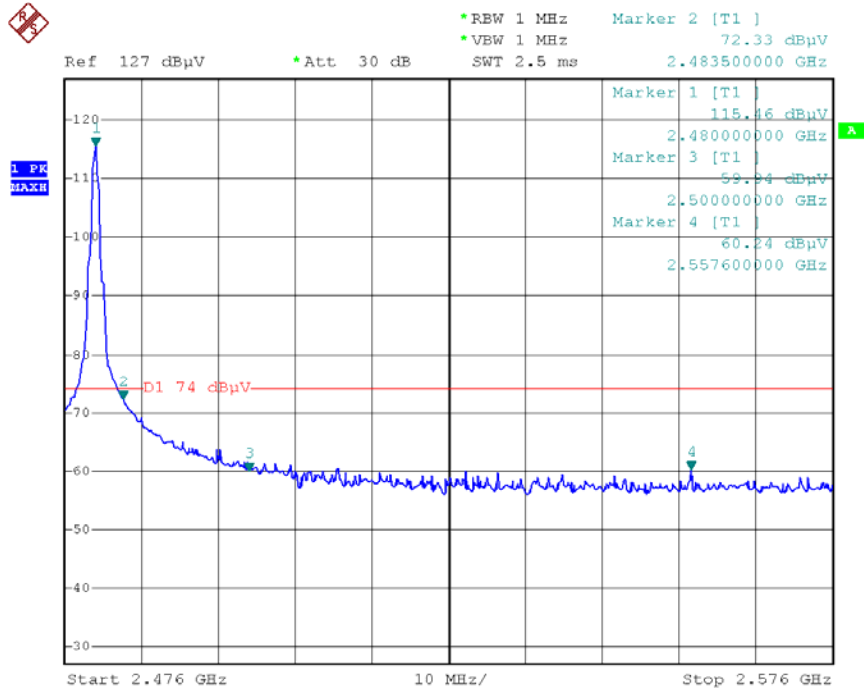
The results shown in this test report refer only to the sample(s) tested, This Test report cannot be reproduced, except in full, without prior written permission of the Company.

Low Channel – AV



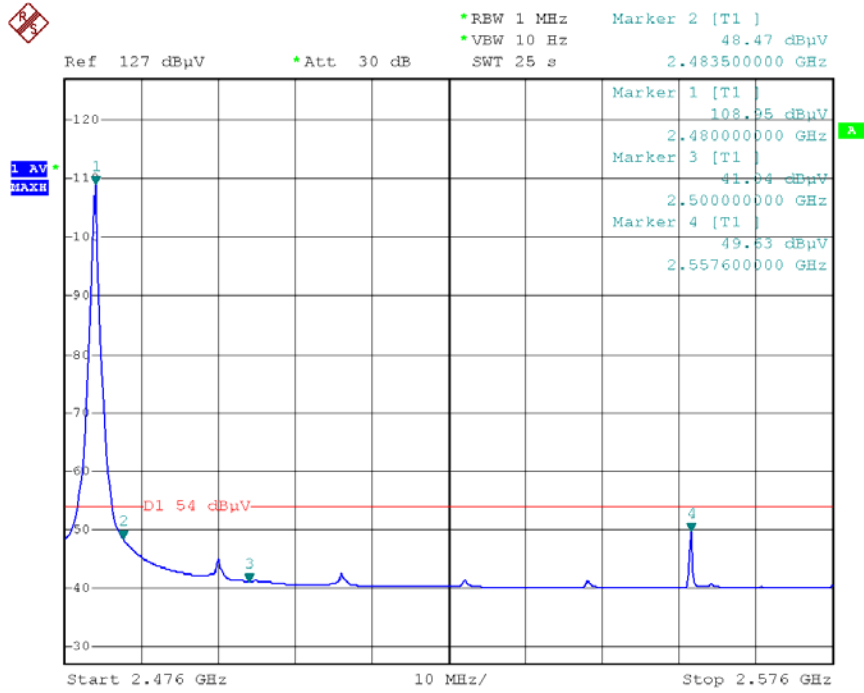
The results shown in this test report refer only to the sample(s) tested, This Test report cannot be reproduced, except in full, without prior written permission of the Company.

High Channel – Peak



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High Channel – AV



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9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: Based on DA 00-705
 Test Mode: Test in fixing operating frequency at low, Middle, high channel.

9.1 Test Procedure:

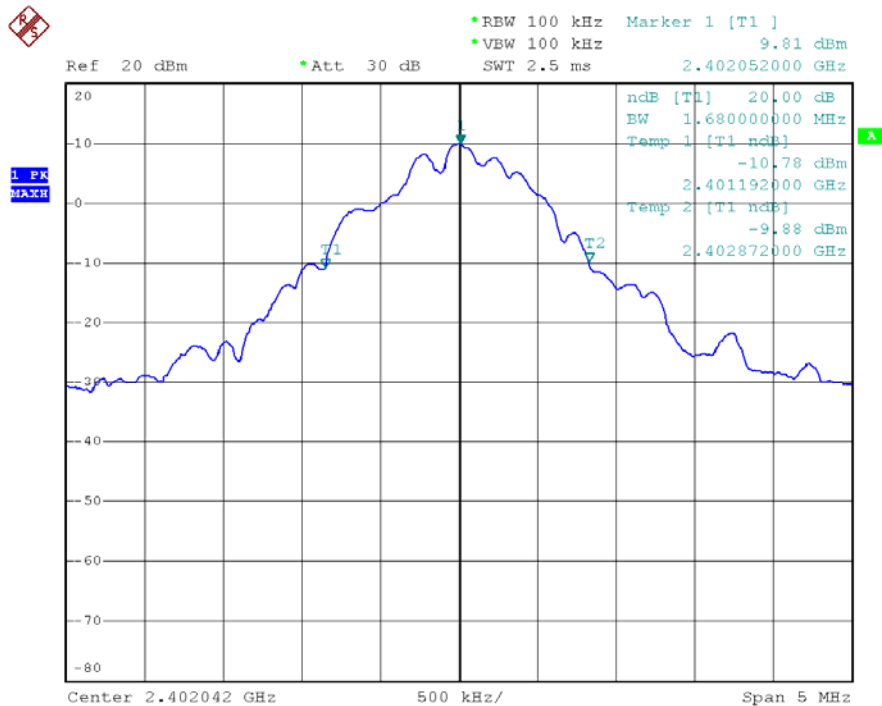
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

9.2 Test Result:

Test Channel	Bandwidth
Low	1.68MHz
Middle	1.49MHz
High	1.47MHz

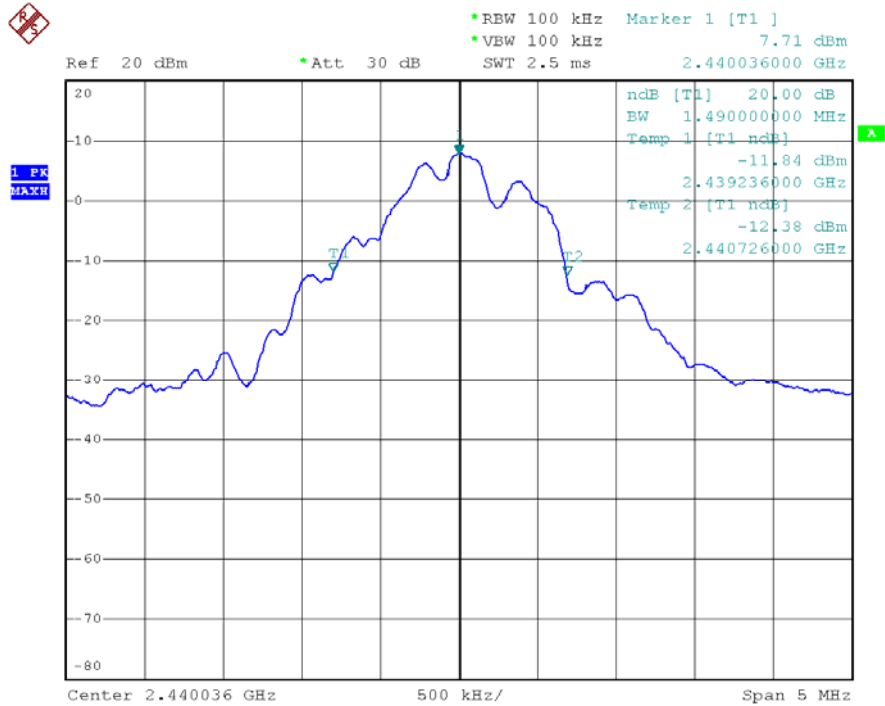
Test result plot as follows:

Low Channel

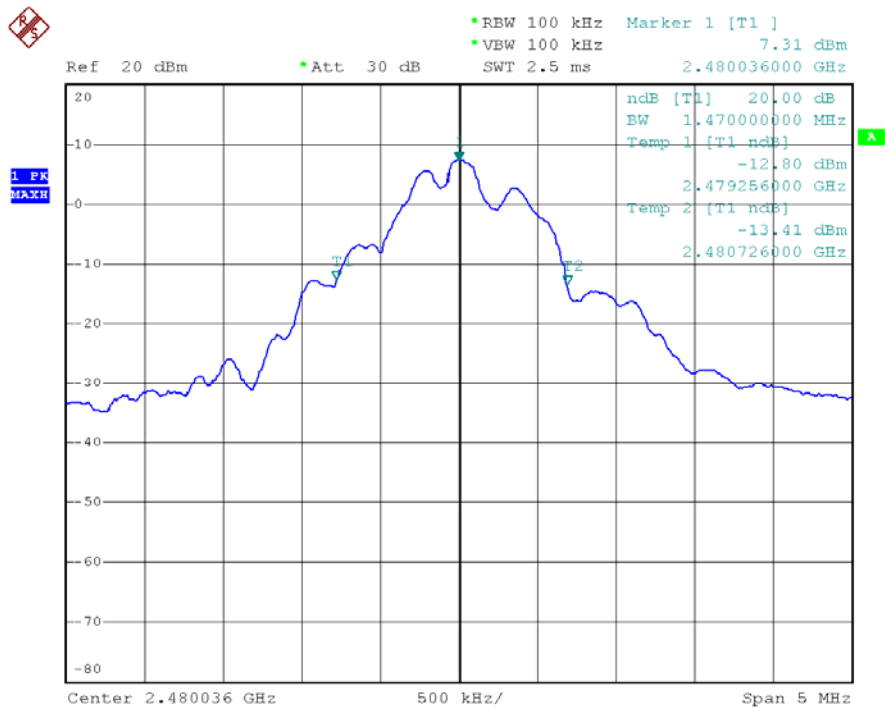


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Middle Channel



High Channel



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10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on ANSI C63.4:2003
Test Limit:	Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Refer to the result “Number of Hopping Frequency” of this document. The 0.125watts (20.97 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

10.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 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)
Low	10.46	20.97
Middle	8.16	20.97
High	7.75	20.97

11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on 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 1W.
Test Mode:	Test in hopping transmitting operating mode.

11.1 Test Procedure:

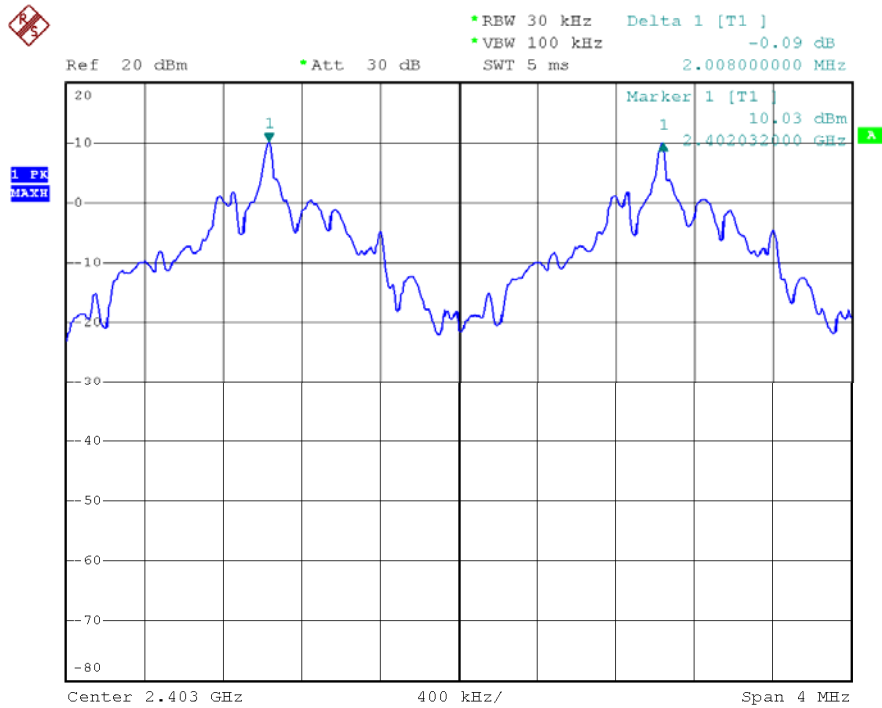
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 4MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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
Low	2.008	PASS
Middle	2.008	PASS
High	2.008	PASS

Test result plot as follows:

Low Channel:

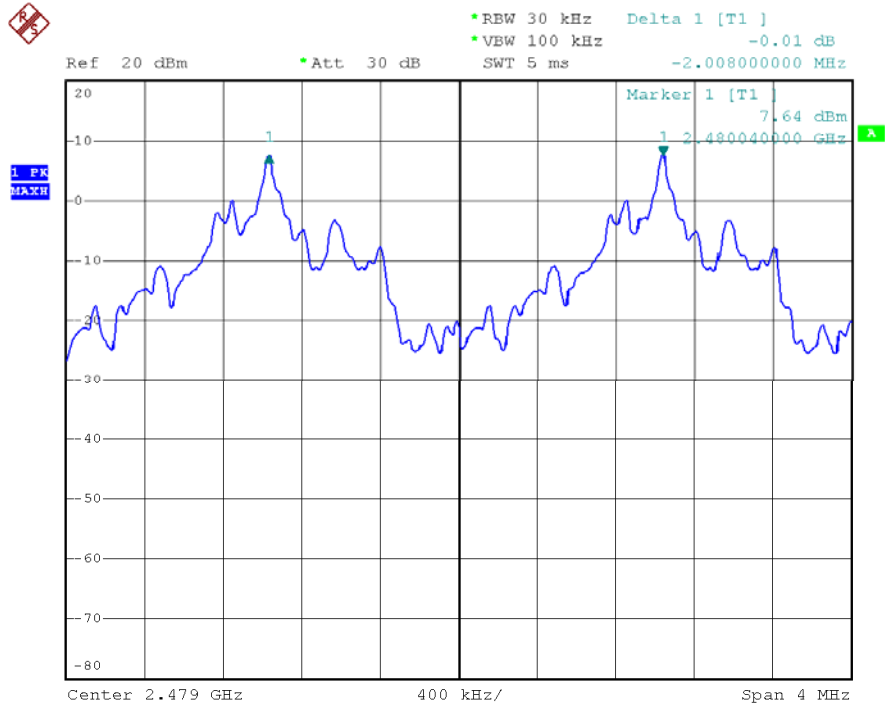


Middle Channel



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High Channel



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12 Number of Hopping Frequency

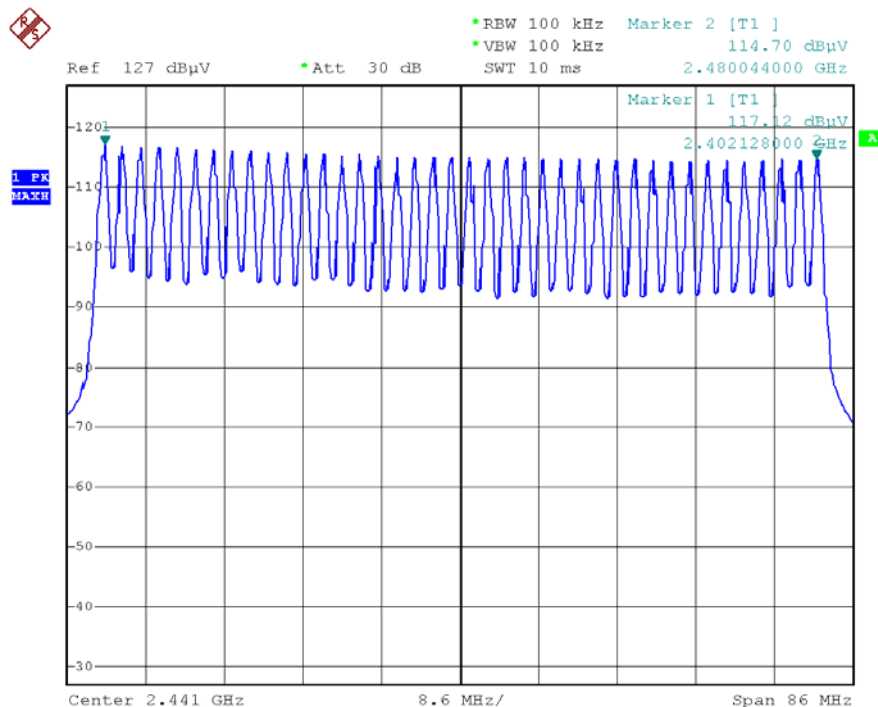
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

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 40 Channels.



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13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	Based on 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. 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. 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:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

The test period: $T = 0.4(s) * 40 = 16 (s)$

So, the Dwell Time can be calculated as follows:

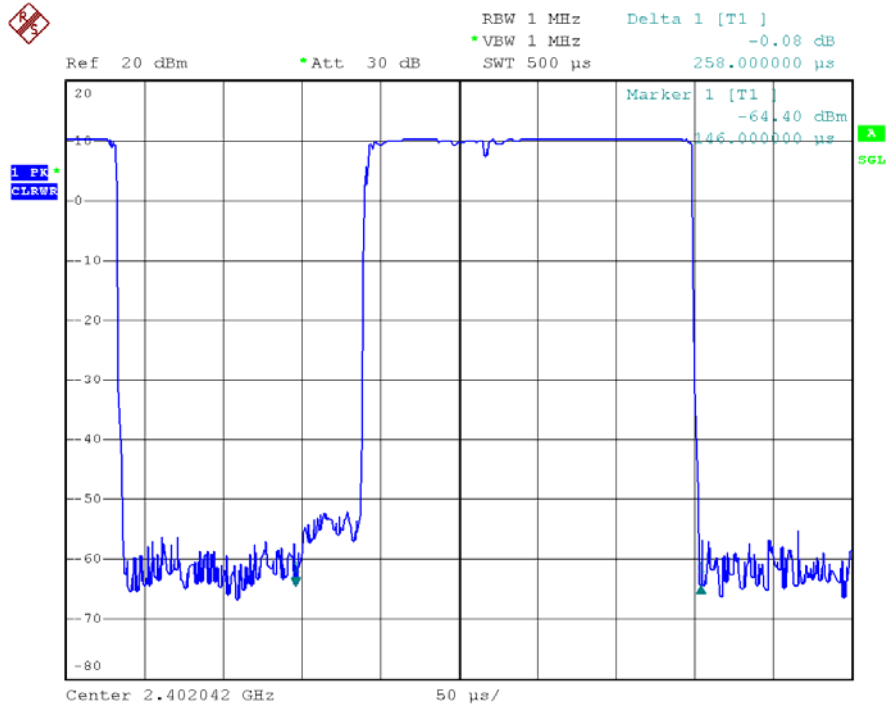
Dwell time = $31 * 16 * (MkrDelta) / 1000$

Note : Mkr Delta is once pulse time.

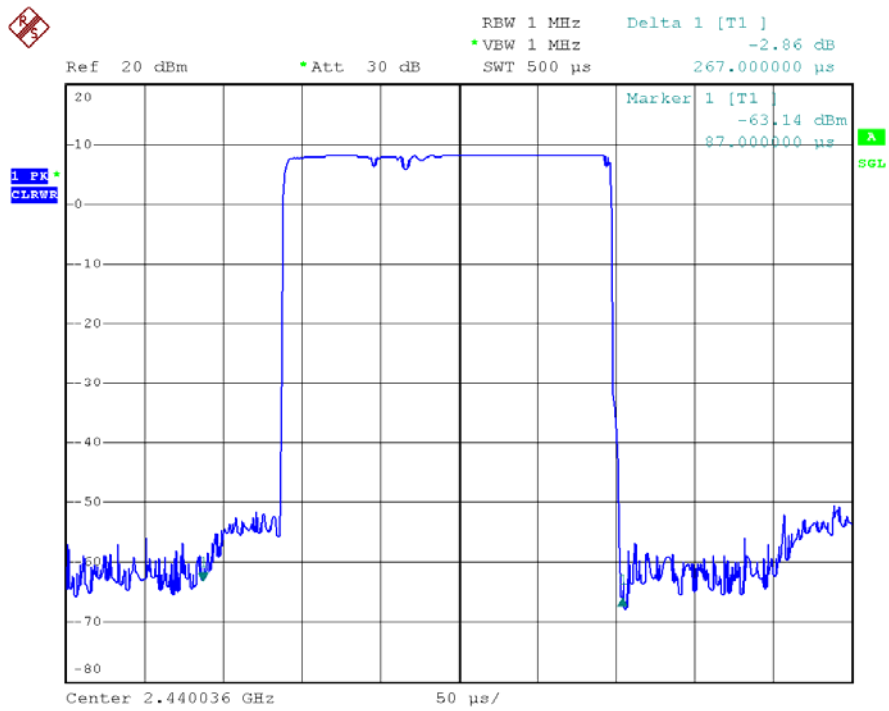
Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
2402 MHz	0.258	0.128	0.400	Pass
2440 MHz	0.267	0.132	0.400	Pass
2480 MHz	0.257	0.127	0.400	Pass

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Low Channel

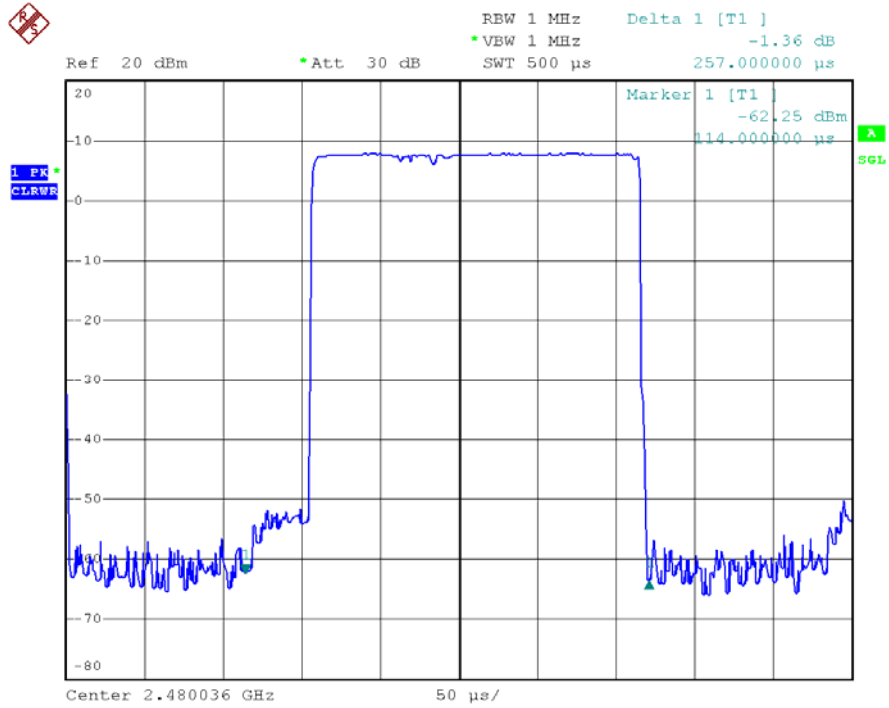


Middle Channel



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High 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 a permanent antenna, fulfill the requirement of this section.

15 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in test mode(Tx).

15.1 Requirments:

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=0.2m, 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 (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
0	1	10.46	11.117	0.0022	1	Complies
0	1	8.16	6.546	0.0013	1	Complies
0	1	7.75	5.957	0.0012	1	Complies

16 Photographs - Constructional Details

16.1 Product View

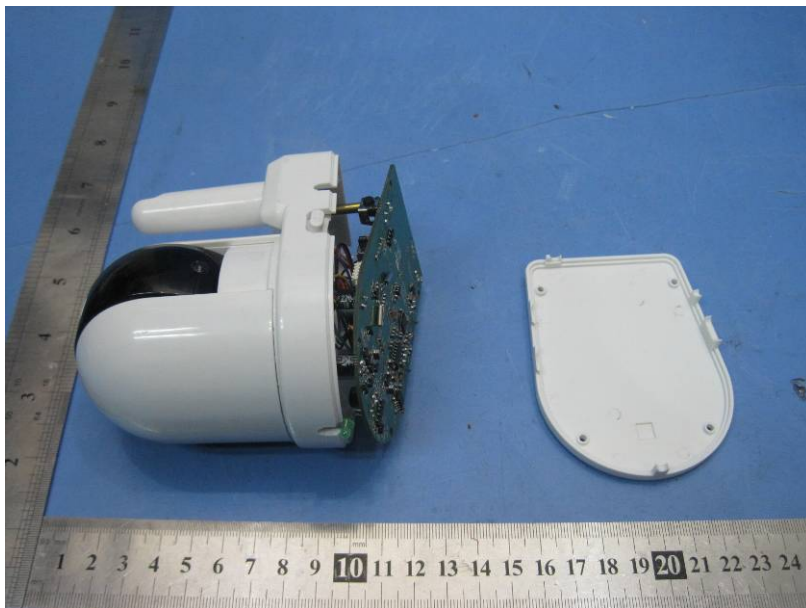


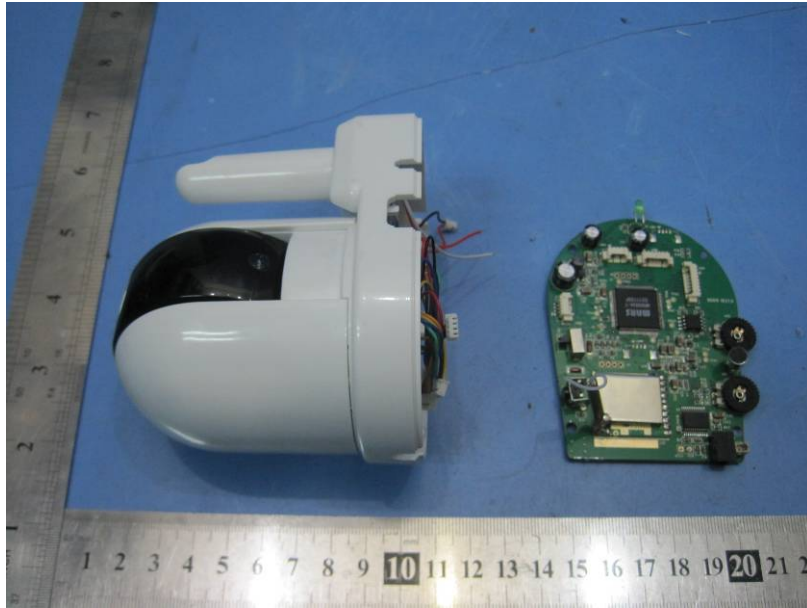
16.2 EUT – Appearance View



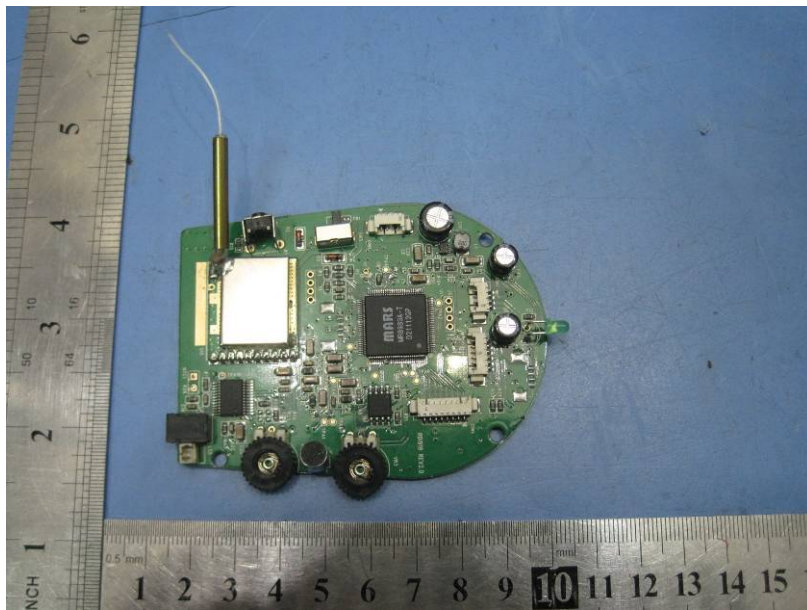


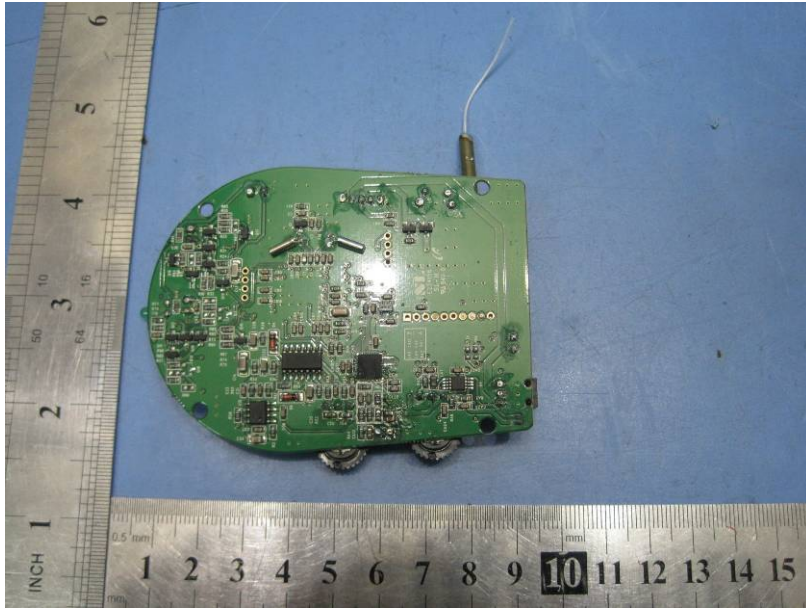
16.3 EUT – Open View



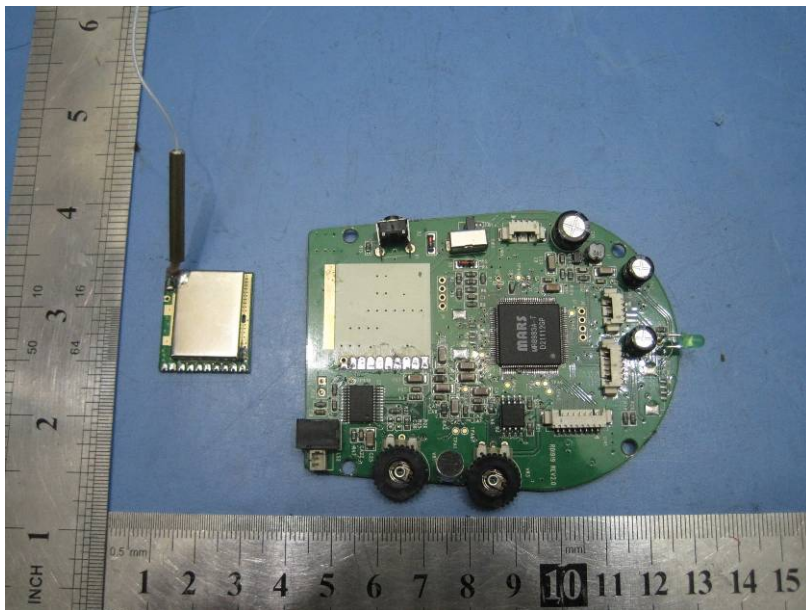


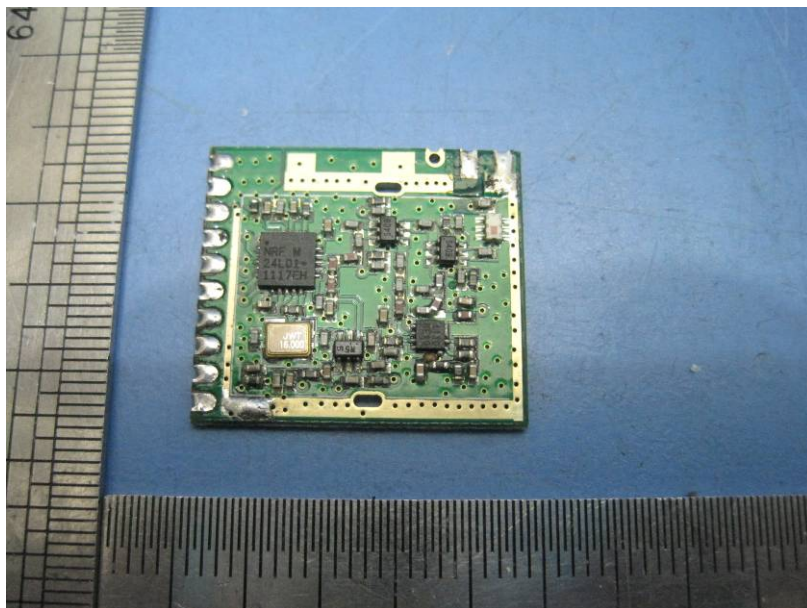
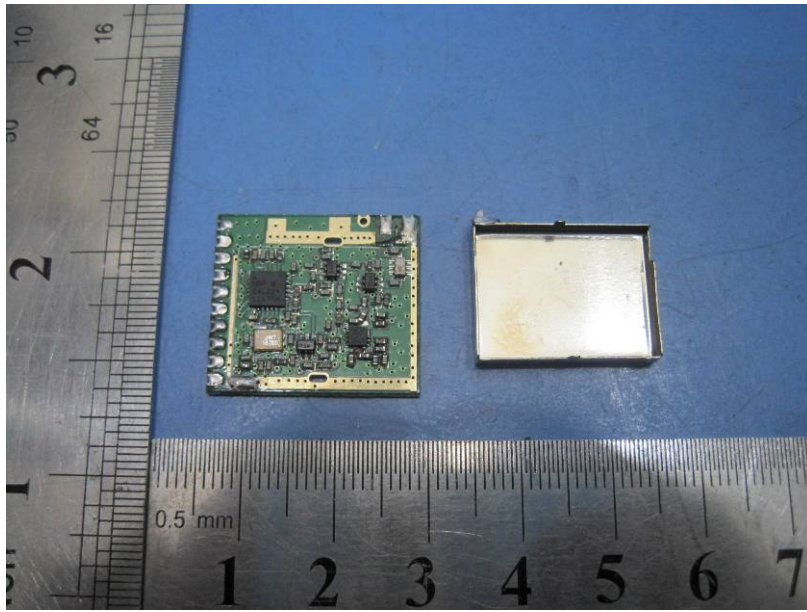
16.4 EUT – PCB View

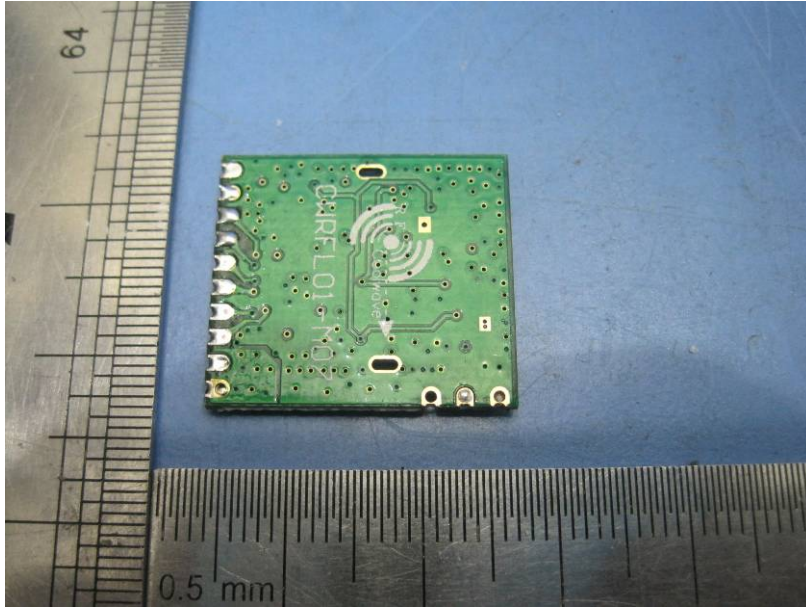




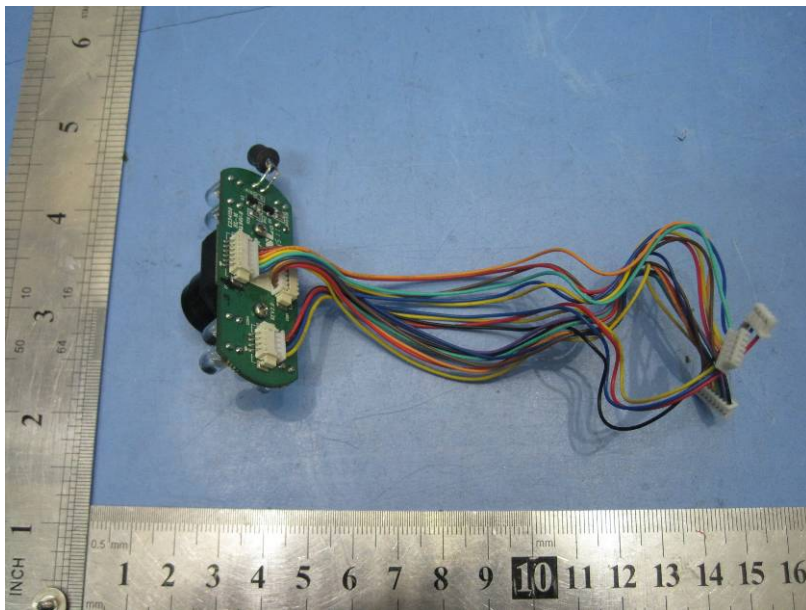
16.5 RF Module - View

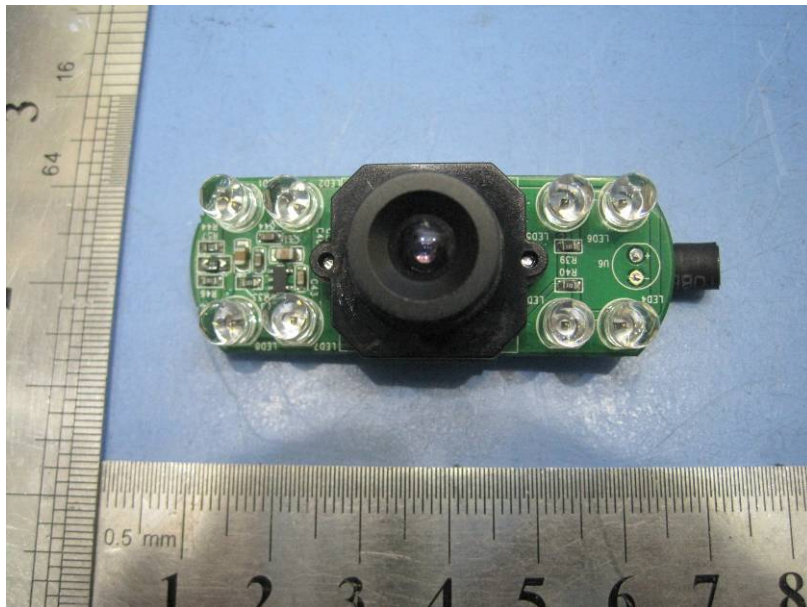
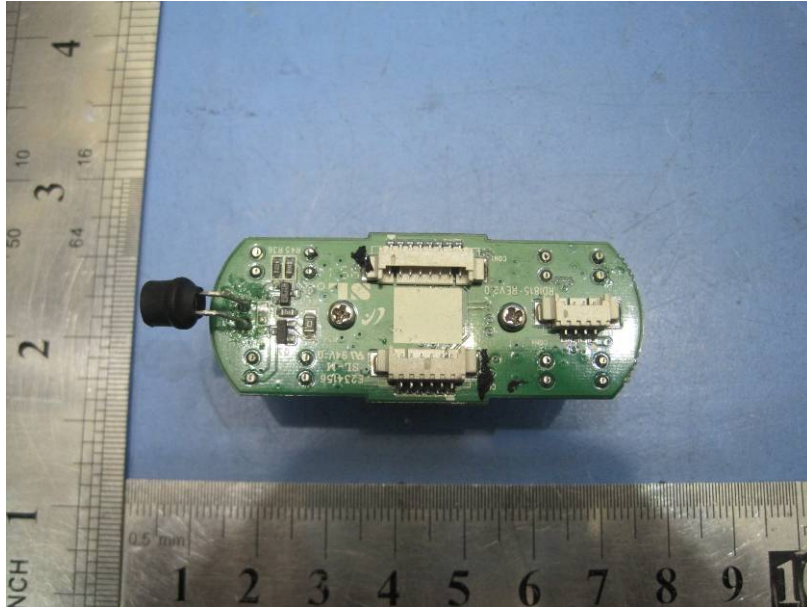






16.6 PCB of Camera - View





17 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 interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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 Bottom View/ proposed FCC Label Location

