ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

DIGITAL WIRELESS CAMERA

MODEL No.: CM216

BRAND NAME: LYD

FCC ID: XZF-CM216

REPORT NO.: KAD101011009E

ISSUE DATE: October 28, 2010

Prepared for

SHENZHEN LYD TECHNOLOGY CO., LTD.

Building A, Cunnan Industrial Estate, Shuidou Laowei, Longhua Town, Bao'an District, Shenzhen, China.

Prepared by

DONGGUAN EMTEK CO., LTD.

No.281, Guantai Road, Nancheng District,
Dongguan, Guangdong, China
TEL: 86-769-22807078
FAX: 86-769-22807079

VERIFICATION OF COMPLIANCE

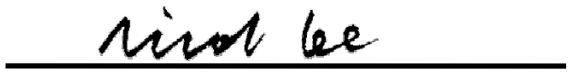
Applicant:	SHENZHEN LYD TECHNOLOGY CO., LTD. Building A, Cunnan Industrial Estate, Shuidou Laowei, Longhua Town, Bao'an District, Shenzhen, China.
Product Description:	DIGITAL WIRELESS CAMERA
Brand Name:	LYD
Model Number:	CM216
Serial Number:	N/A
File Number:	KAD101011009E
Date of Test:	October 11, 2010 October 28, 2010

We hereby certify that:

The above equipment was tested by DONGGUAN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2009) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

Approved By



Nicol Lee / Q.A. Manager
DONGGUAN EMTEK CO., LTD.

Table of Contents

GENERAL INFORMATION

1.1 Product Description

The SHENZHEN LYD TECHNOLOGY CO., LTD. Model: CM216 (referred to as the EUT in this report) The EUT is an short range, lower power, DIGITAL WIRELESS CAMERA designed as an " Input Device. It is designed by way of utilizing the GFSK modulation achieves the system operating.

A major technical descriptions of EUT is described as following:

A). Operation Frequency: 2405.250-2477.250MHz
B). Modulation: GFSK
C). Number of Channel: 65
D). Channel space: 1.125MHz
E). Rated RF Output Power: 10mW
F). BIT Rate of Transmission: 100kbps
G). Antenna Type: Internal Antenna
H). Antena GAIN: 0dBi(Peak)
I). Power Supply: AC 100-240V 50/60Hz Come from Adapter

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH00	2405.250	CH22	2430.000	CH44	2454.750
CH01	2406.375	CH23	2431.125	CH45	2455.875
CH02	2407.500	CH24	2432.250	CH46	2457.000
CH03	2408.625	CH25	2433.375	CH47	2458.125
CH04	2409.750	CH26	2434.500	CH48	2459.250
CH05	2410.875	CH27	2435.625	CH49	2460.375
CH06	2412.000	CH28	2436.750	CH50	2461.500
CH07	2413.125	CH29	2437.875	CH51	2462.625
CH08	2414.250	CH30	2439.000	CH52	2463.750
CH09	2415.375	CH31	2440.125	CH53	2464.875
CH10	2416.500	CH32	2441.250	CH54	2466.000
CH11	2417.625	CH33	2442.375	CH55	2467.125
CH12	2418.750	CH34	2443.500	CH56	2468.250
CH13	2419.875	CH35	2444.625	CH57	2469.375
CH14	2421.000	CH36	2445.750	CH58	2470.500
CH15	2422.125	CH37	2446.875	CH59	2471.625
CH16	2423.250	CH38	2448.000	CH60	2472.750
CH17	2424.375	CH39	2449.125	CH61	2473.875
CH18	2425.500	CH40	2450.250	CH62	2475.000
CH19	2426.625	CH41	2451.375	CH63	2476.125
CH20	2427.750	CH42	2452.500	CH64	2477.250
CH21	2428.875	CH43	2453.625		

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: XZF-CM216 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (receiver) is compliance with Subpart B is authorized under a DoC procedure.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2009). Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

EMC Lab. : Accredited by CNAS, 2005.11.02
The certificate is valid until 2010.11
The Laboratory has been assessed and proved to be in compliance with CNAS/CL01:2006(identical to ISO/IEC17025:2005)
The Certificate Registration Number is L2291

Accredited by TUV Rheinland Shenzhen, 2009.9
The certificate is valid until 2011.3
The Laboratory has been assessed according to the requirements ISO/IEC 17025

Accredited by FCC, Nov. 05, 2008
The Certificate Registration Number is 247565.

Accredited by Industry Canada, May 24, 2008
The Certificate Registration Number is 46405-4480

Name of Firm : DONGGUAN EMTEK CO., LTD

Site Location : No.281, Guantai Road, Nancheng District,
Dongguan, Guangdong, China

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. the Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions(Not apply in the report)

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-2009.Conducted emissions from the EUT measured in the **frequency range between 0.15 MHz and 30MHz** using **CISPR Quasi-Peak and average detector mode**.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2009.

2.4 Limitation

(1) Channel Separation test

FCC Part 15, Subpart C Section 15.247(a)(1). Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 Bandwidth of the hopping channel, whichever is greater.

Frequency Range (MHz)	Limit(kHz)
902-928	>25kHz
2400-2483.5	>25kHz
5725-5850	>25kHz

(2)

Frequency Range(MHz)	20dB Bandwidth Limit(kHz)			
Quantity of Hopping Channel	**50**	**25**	**15**	**75**
902-928	<250	>250	NA	NA
2400-2483.5	NA	NA	>1000	<1000

(3) Quantity of Hopping Channel

FCC Part 15, Subpart C Section 15.247

Frequency Range (MHz)	Limit(Quantity of Hopping Channel) 20dB bandwidth <250kHz	20dB bandwidth >250kHz	20dB bandwidth <1MHz	20dB bandwidth >1MHz
902-928	50	25	NA	NA
2400-2483.5	NA	NA	15	15
5725-5850	NA	NA	75	NA

(4) Time of Occupancy(Dwell Time)

FCC Part 15, Subpart C Section 15.247

Frequency Range (MHz)	LIMIT(rms) 20dB bandwidth <250kHz(50Channel)	20dB bandwidth >250kHz(25Channel)	20dB bandwidth <1MHz(75Channel)
902-928	400(20S)	400(10S)	NA
2400-2483.5	NA	NA	400(30S)
5725-5850	NA	NA	400(30S)

Note: The "()"is all channel's average time of occupancy.

(5) Maximum Peak Output Power

FCC Part 15, Subpart C Section 15.247

Frequency Range (MHz)	Quantity of Hopping Channel	LIMIT(W) 50	25	15	75
902-928		1(30dBm)	0.125(21dBm)	NA	NA
2400-2483.5		NA	NA	0.125(21dBm)	1(30dBm)
5725-5850		NA	NA	NA	1(30dBm)

(6) Band edge

FCC Part15, Subpart C Section 15.247, In any 100kHz bandwidth outside the frequency band in with the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, attenuation below the general limits specified in section 15.209(a) is not required. 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).

Operating Frequency Range(MHz)	Spurious emission frequency	Limit	
		Peak power ration to emission(dBc)	Emission level(dBuV/m)
902-928	<902	>20	NA
	>928	>20	NA
	960-1240	NA	54
2400-2483.5	<2400	>20	NA
	>2483.5-2500	NA	54
5725-5850	<5350-5460	NA	54
	<5725	>20	NA
	>5850	>20	NA

(7) Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

(8) Radiated Emission

FCC Part 15, Subpart C Section 15.209 limit of radiated emission for frequency below 1000MHz. The emissions from an intentional radiator shall not exceed the field strength level specified in the following table:

Frequency (MHz)	Field strength μV/m	Distance(m)	Field strength at 3m dBμV/m
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

Remark: 1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

FCC Part 15, Section 15.35(b) limit of radiated emission for frequency above 1000MHz

Frequency(MHz)	Class A(dBμV/m)(at 3m)		Class B(dBμV/m)(at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80.0	60.0	74.0	54.0

FCC Part 15, Subpart C Section 15.249. The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency(MHz)	Filed Strength of Fundamental(at 3m)		Filed Strength of Harmonics(at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
902-928	114	94	74.0	54.0
2400-2483.5	114	94	74.0	54.0
5725-5875	114	94	74.0	54.0
24000-24250	128	108	88.0	68.0

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

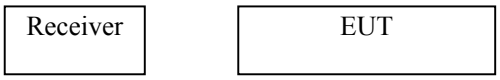


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
1.	DIGITAL WIRELESS CAMERA	LYD	CM216	XZF-CM216	N/A	***EUT***

Note:

(1) Unless otherwise denoted as EUT in『Remark』column , device(s) used in tested system is a support equipment.

3. Description of test modes

The EUT (DIGITAL WIRELESS CAMERA) has been tested under normal operating condition.
This EUT is a FHSS system, we use blue test to control the EUT with LPT1, Let EUT hopping on and transmit at every channel with highest power, Only output power use conducted method, others are using radiated method. After sirfdemo330R1 send the command to EUT, it can be removed, and the EUT keep hopping. 65 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for best.

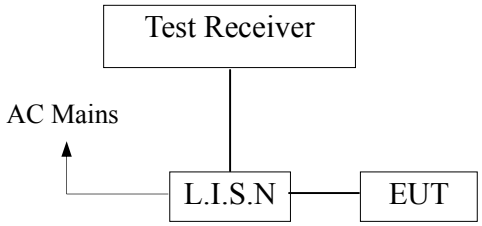
Channel	Frequency(MHz)
00	2405.250
33	2442.375
64	2477.250

4. Conducted Emissions Test

4.1 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

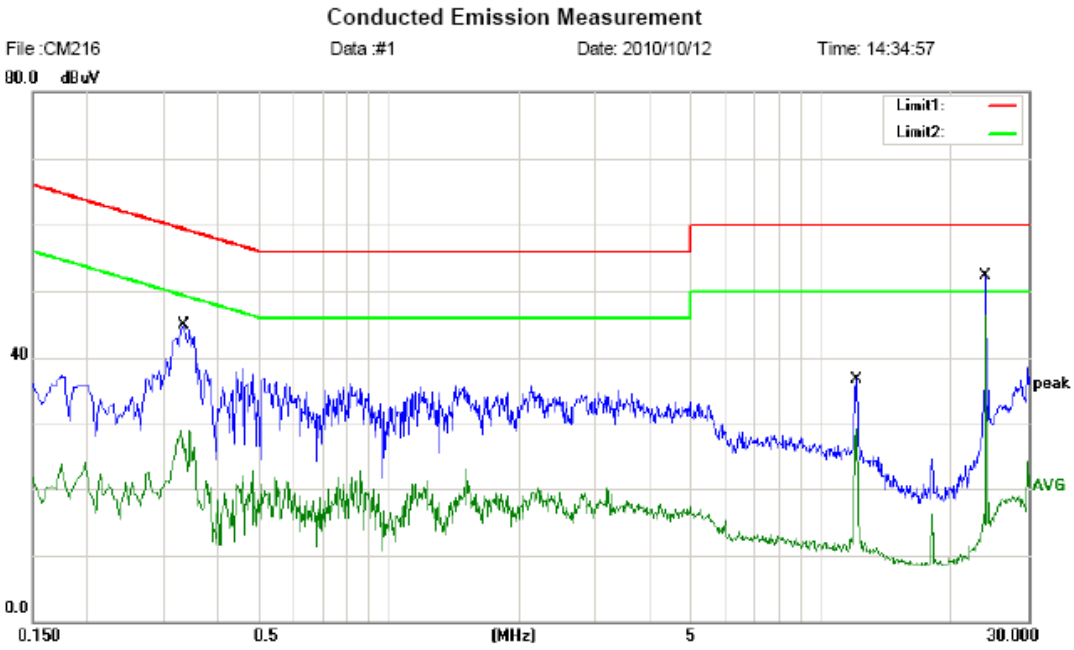
4.2 Test SET-UP (Block Diagram of Configuration)



4.3 Measurement Equipment Used:

Conducted Emission Test Site # 4					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/29/2010	05/29/2011
L.I.S.N	Rohde & Schwarz	ESH2-Z5	834549/005	05/29/2010	05/29/2011
50ΩCoaxial Switch	Anritsu	MP59B	M20531	05/29/2010	05/29/2011

4.4 Measurement Result:

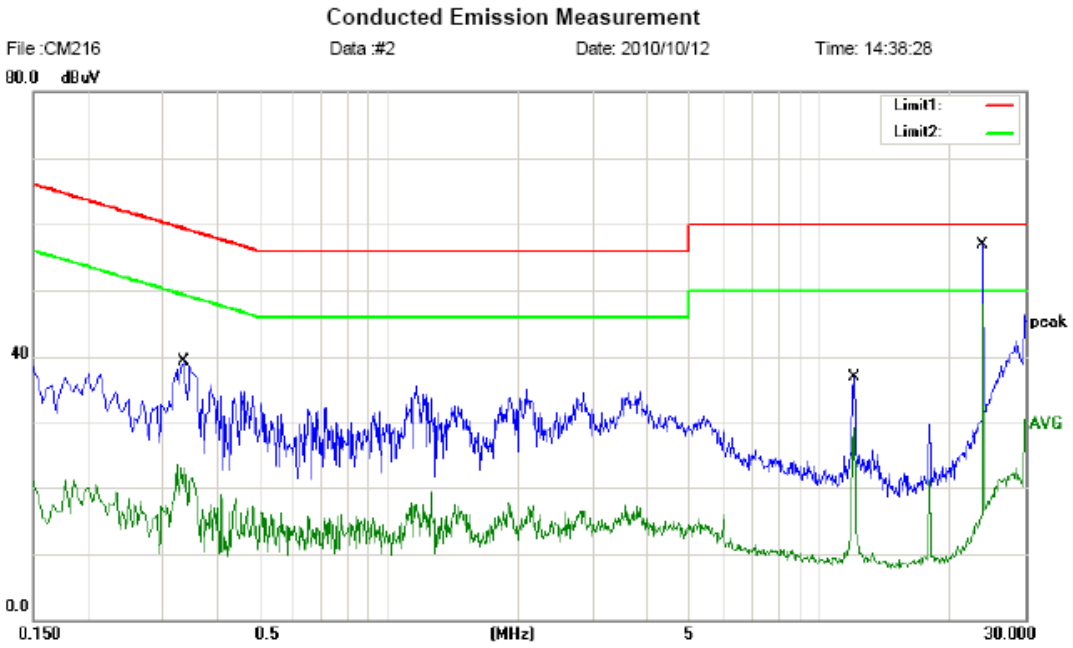


Site Chamber #1 Phase: *L1* Temperature: 26(C)
Limit: FCC Part 15 C (QP) Power: AC 120V/60Hz Humidity: 55 %
EUT: DIGITAL WIRELESS CAMERA
M/N: CM216
Mode: TX
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dB	dB	Detector	Comment
1		0.3339	40.65	0.00	40.65	59.35	-18.70	QP	
2		0.3339	29.07	0.00	29.07	49.35	-20.28	AVG	
3		12.0020	35.56	0.00	35.56	60.00	-24.44	QP	
4		12.0020	29.24	0.00	29.24	50.00	-20.76	AVG	
5		24.0020	50.65	0.00	50.65	60.00	-9.35	QP	
6	*	24.0020	46.51	0.00	46.51	50.00	-3.49	AVG	

*:Maximum data x:Over limit !:over margin (Reference Only

File :CM216\Data :#1 *Page: 1* Engineer Signature: Coular



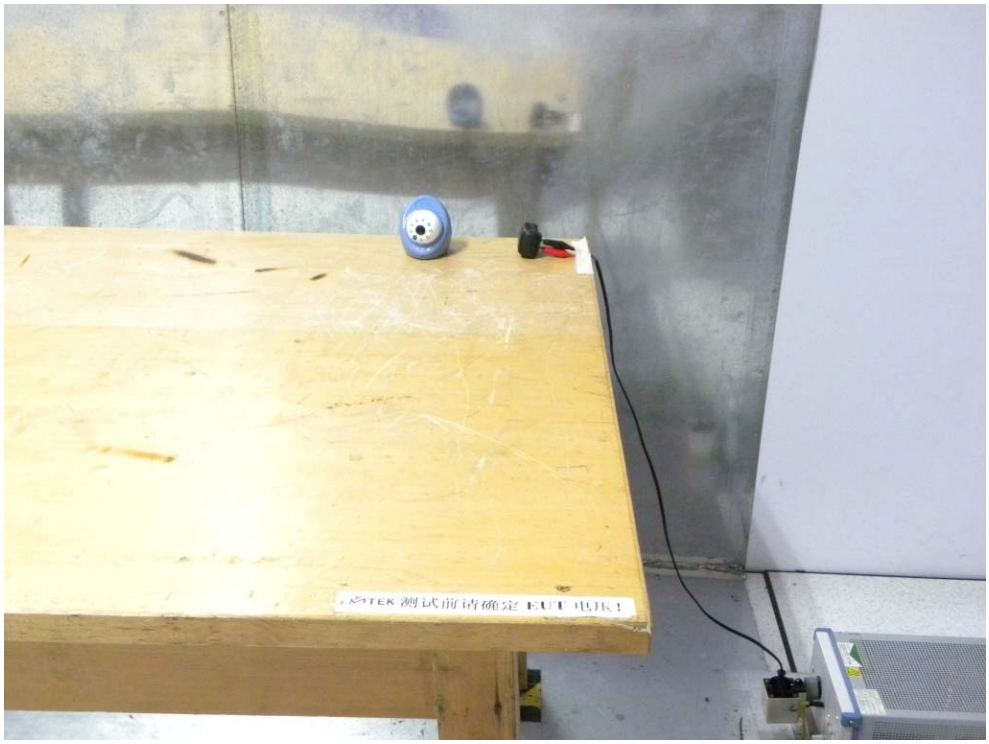
Site Chamber #1 Phase: *N* Temperature: 26(C)
Limit: FCC Part 15 C (QP) Power: AC 120V/60Hz Humidity: 55 %
EUT: DIGITAL WIRELESS CAMERA
M/N: CM216
Mode: TX
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dB	dB	Detector	Comment
1		0.3339	36.34	0.00	36.34	59.35	-23.01	QP	
2		0.3339	23.58	0.00	23.58	49.35	-25.77	AVG	
3		12.0020	35.26	0.00	35.26	60.00	-24.74	QP	
4		12.0020	29.29	0.00	29.29	50.00	-20.71	AVG	
5		24.0020	55.65	0.00	55.65	60.00	-4.35	QP	
6	*	24.0020	47.89	0.00	47.89	50.00	-2.11	AVG	

*:Maximum data x:Over limit !:over margin 〈Reference Only

File :CM216\Data :#2 *Page: 1* Engineer Signature: Coular

4.5 Conducted Measurement Photos:



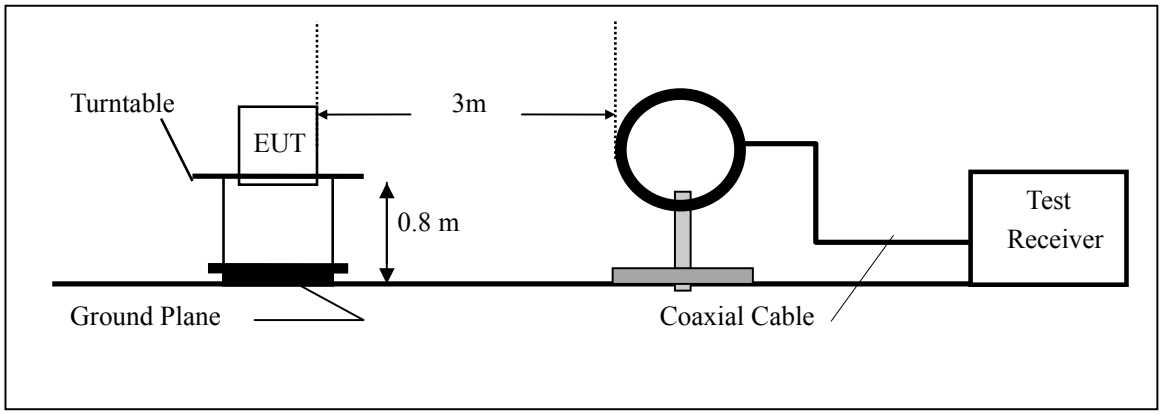
5. Radiated Emission Test

5.1 Measurement Procedure

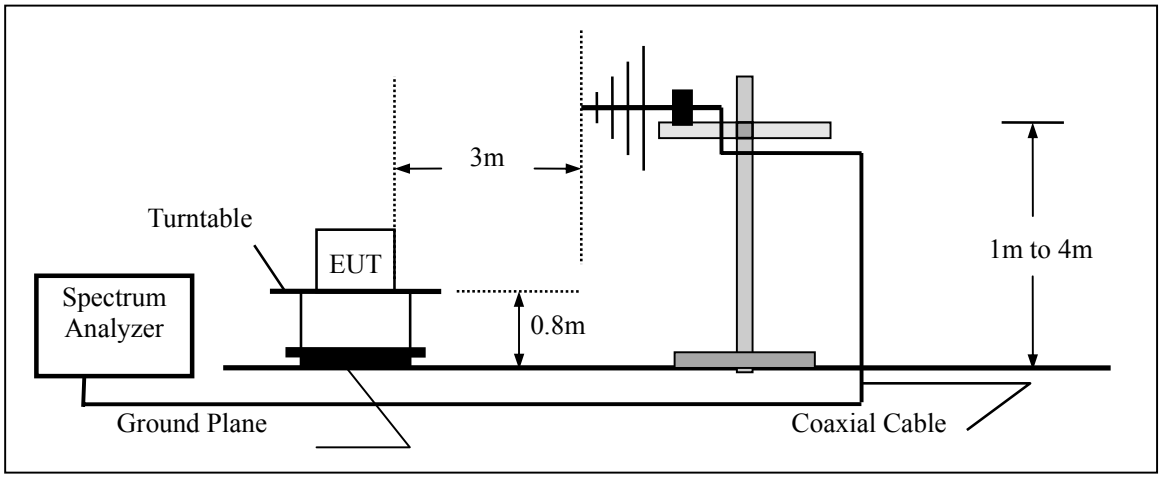
1 The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

5.2 Test SET-UP (Block Diagram of Configuration)

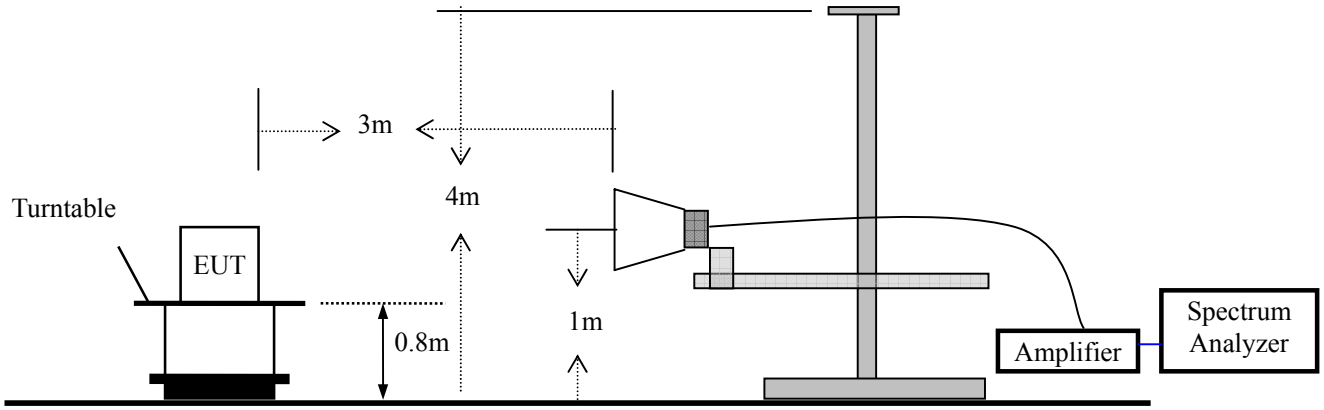
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



5.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSP7	839511/010	05/29/2010	05/29/2011
Spectrum Analyzer	HP	E4407B	839840481	05/29/2010	05/29/2011
EMI Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/29/2010	05/29/2011
Pre-Amplifier	HP	8447D	2944A07999	05/29/2010	05/29/2011
Bilog Antenna	Schwarzbeck	VULB9163	142	05/29/2010	05/29/2011
Loop Antenna	ARA	PLA-1030/B	1029	05/29/2010	05/29/2011
Horn Antenna	Electro-Metrics	EM-6961	103314	05/29/2010	05/29/2011
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/29/2010	05/29/2011

5.4 Measurement Result

Operation Mode:	TX Mode	Test Date :	October 15, 2010
Frequency Range:	30~1000MHz	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV)	Limit 3m (dBuV/m)	Margin (dB)	Note
84.550	V	32.82	40.00	-7.18	PK
151.376	V	34.47	43.50	-9.03	PK
188.800	V	31.35	43.50	-12.15	PK
252.462	V	32.77	46.00	-13.23	PK
532.050	V	32.62	46.00	-13.38	PK
620.870	V	30.15	46.00	-15.85	PK
86.627	H	30.71	40.00	-9.29	PK
152.252	H	32.26	43.50	-11.24	PK
192.163	H	32.08	43.50	-11.42	PK
252.320	H	31.32	46.00	-14.68	PK
534.023	H	30.62	46.00	-15.38	PK
622.390	H	36.33	46.00	-9.67	PK

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.209.

Note: (1) All Readings are Peak Value.

(2) Emission Level= Reading Level+Probe Factor +Cable Loss

(3) The average measurement was not performed when the peak measured data under the limit of average detection.

Operation Mode:	CH00: 2405.250Hz	Test Date :	October 15, 2010
Frequency Range:	1-25GHz	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	Andy

Freq.	Ant.Pol.	Emission Level(dBuV)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
2400.000	V	59.28	43.00	74	54	-14.72	-11.00
4810.500	V	63.80	42.79	74	54	-10.20	-11.21
7215.750	V	63.45	41.41	74	54	-10.55	-12.59
9621.000	V	59.75	42.34	74	54	-14.25	-11.66
12026.250	V	60.14	39.75	74	54	-13.86	-14.25
2400.000	H	60.74	45.23	74	54	-13.26	-8.77
4810.500	H	64.72	41.73	74	54	-9.28	-12.27
7215.750	H	63.24	40.04	74	54	-10.76	-13.96
9621.000	H	59.75	43.48	74	54	-14.25	-10.52
12026.250	H	61.22	40.55	74	54	-12.78	-13.45

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

Note: (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss
(3) The average measurement was not performed when the peak measured data under the limit of average detection.

Operation Mode:	CH33: 2442.375Hz	Test Date :	October 15, 2010
Frequency Range:	1-25GHz	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	Andy

Freq.	Ant.Pol.	Emission Level(dBuV)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4884.750	V	63.39	42.72	74	54	-10.61	-11.28
7327.125	V	64.86	39.40	74	54	-9.14	-14.60
9769.500	V	58.32	42.49	74	54	-15.68	-11.51
12211.875	V	59.61	42.33	74	54	-14.39	-11.67
4884.750	H	64.60	42.68	74	54	-9.40	-11.32
7327.125	H	63.69	40.32	74	54	-10.31	-13.68
9769.500	H	59.27	42.37	74	54	-14.73	-11.63
12211.875	H	59.52	41.41	74	54	-14.48	-12.59

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

Note: (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss
(3) The average measurement was not performed when the peak measured data under the limit of average detection.

Operation Mode:	CH64: 2477.250MHz	Test Date :	October 15, 2010
Frequency Range:	1-25GHz	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	Andy

Freq.	Ant.Pol.	Emission Level(dBuV)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
2483.500	V	58.50	46.21	74	54	-15.50	-7.79
4954.500	V	59.63	41.15	74	54	-14.37	-12.85
7431.750	V	61.17	42.56	74	54	-12.83	-11.44
9909.000	V	59.44	40.25	74	54	-14.56	-13.75
12386.250	V	60.66	38.88	74	54	-13.34	-15.12
2483.500	H	57.48	45.35	74	54	-16.52	-8.65
4954.500	H	59.71	40.30	74	54	-14.29	-13.70
7431.750	H	62.58	42.63	74	54	-11.42	-11.37
9909.000	H	60.79	40.34	74	54	-13.21	-13.66
12386.250	H	60.85	38.81	74	54	-13.15	-15.19

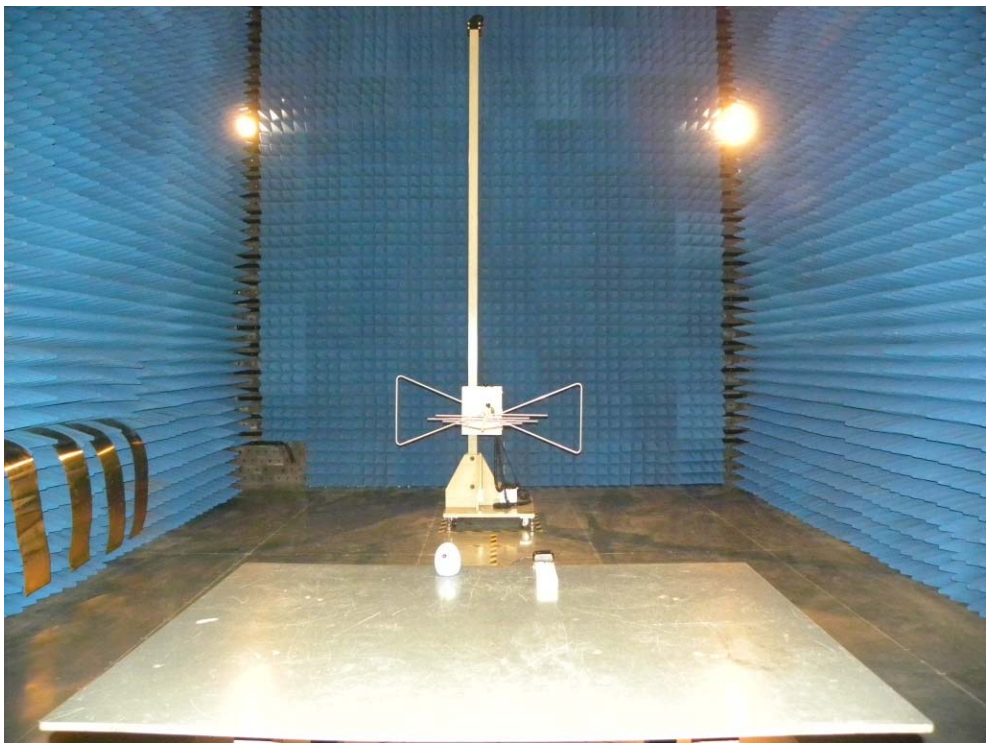
No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

Note: (1) All Readings are Peak Value and AV.

(2) Emission Level= Reading Level+Probe Factor +Cable Loss

(3) The average measurement was not performed when the peak measured data under the limit of average detection.

5.5 Radiated Measurement Photos:

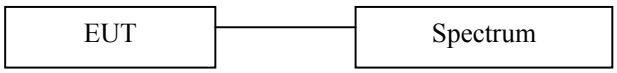


6. Channel Separation test

6.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Equipment Used:

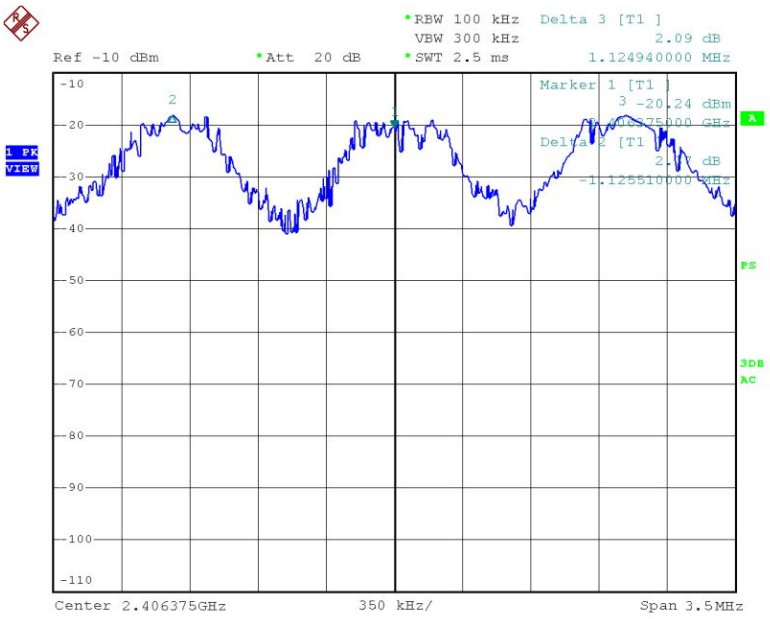
Same as 5.3 Radiated Emission Measurement.

6.4 Measurement Results:

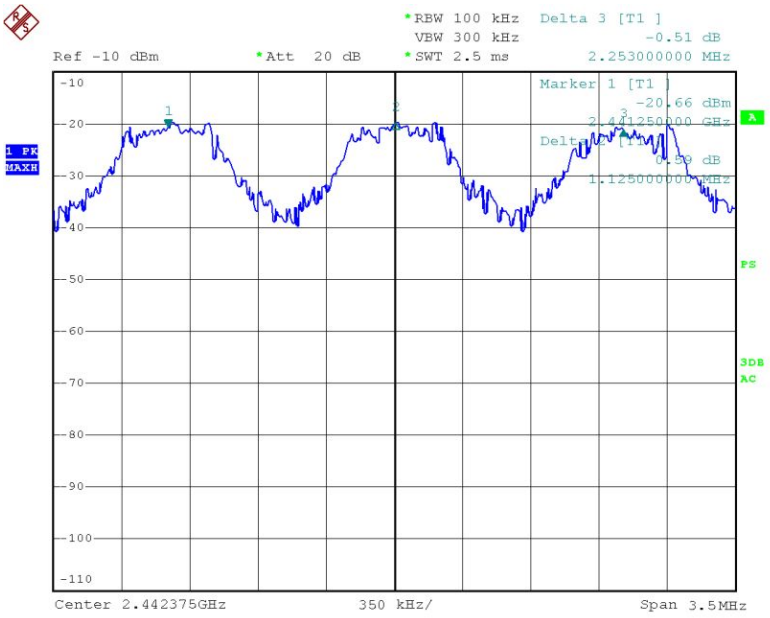
Refer to attached data chart.

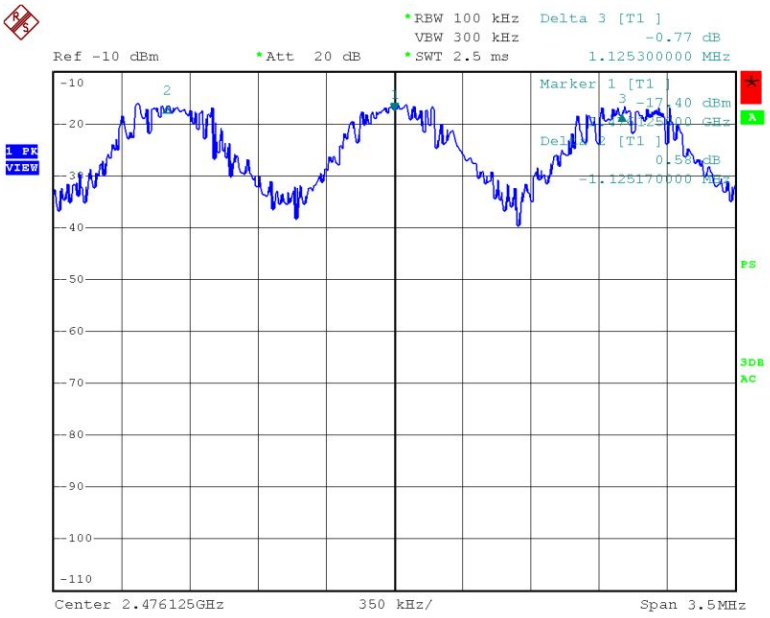
Spectrum Detector:	PK	Test Date :	October 15, 2010
Test By:	Andy	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %

Channel number	Channel frequency (MHz)	Separation Read Value (MHz)	20dB Down BW(MHz)	Separation Limit 2/3 20dB Down BW(MHz)
00	2405.250	1.125	1.080	>0.72
33	2442.375	1.125	1.095	>0.73
64	2477.250	1.125	1.095	>0.73



Date: 1.DEC.2008 19:16:39



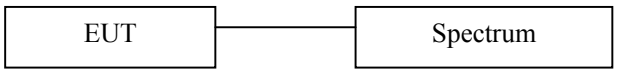

*RBW 100 kHz
VBW 300 kHz
*SWT 2.5 ms
Delta 3 [T1]
-0.77 dB
1.125300000 MHz
Ref -10 dBm
*Att 20 dB
Marker 1 [T1]
3 -17.40 dBm
Delta 2 [T1]
0.58 dB
-1.125170000 MHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
PS
3DB
AC
Center 2.476125GHz
350 kHz/
Span 3.5MHz

7. 20dB Bandwidth test

7.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

7.2 Test SET-UP (Block Diagram of Configuration)



7.3 Measurement Equipment Used:

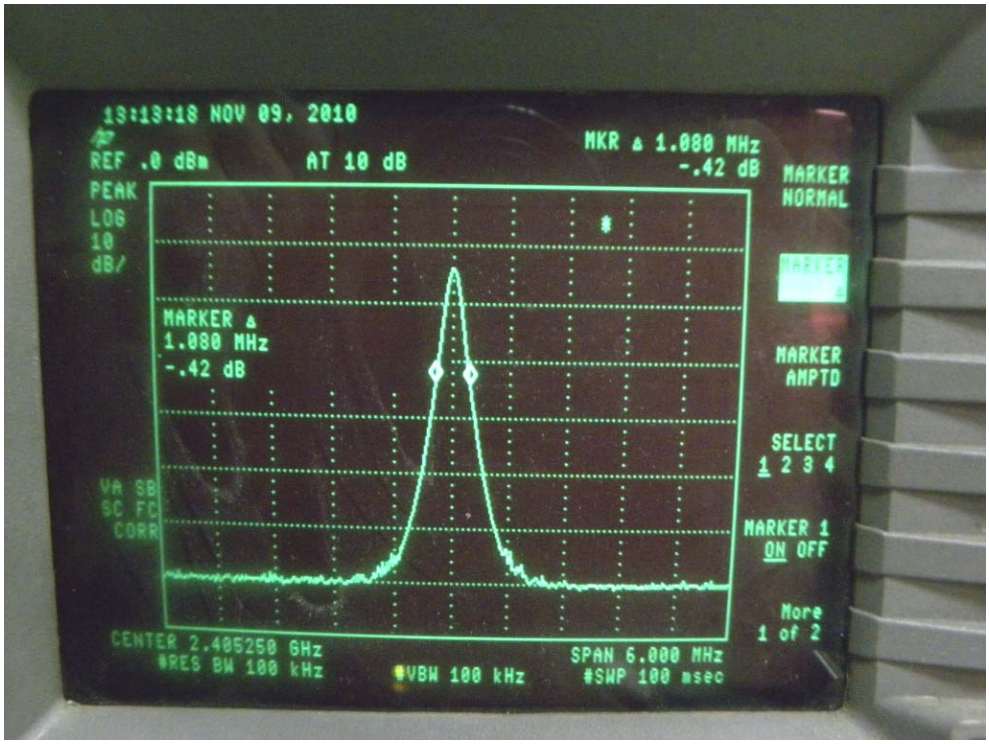
Same as 5.3 Radiated Emission Measurement.

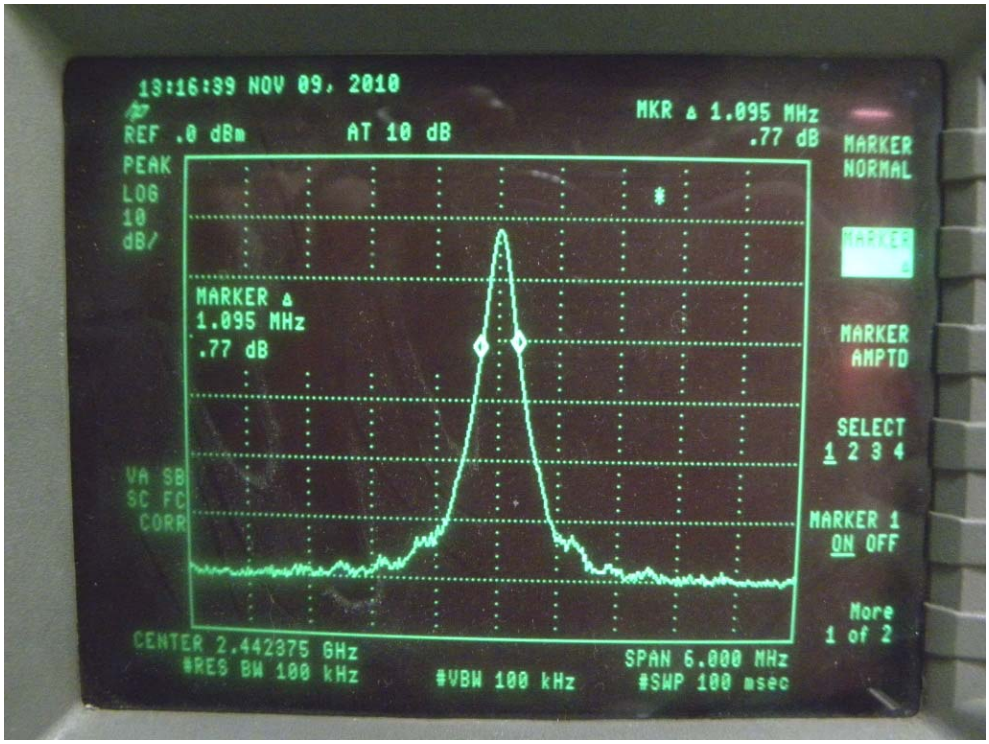
7.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	October 15, 2010
Test By:	Andy	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
00	2405.250	1080
33	2442.375	1095
64	2477.250	1095


13:13:18 NOV 09, 2010
REF .0 dBm
AT 10 dB
MKR Δ 1.080 MHz
-.42 dB
PEAK
LOG
10
dB/
MARKER Δ
1.080 MHz
-.42 dB
MARKER
NORMAL
MARKER
AMPTD
SELECT
1 2 3 4
MARKER 1
ON OFF
More
1 of 2
VA SB
SC FC
CORR
CENTER 2.405250 GHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 6.000 MHz
#SWP 100 msec


13:16:39 NOV 09, 2010
REF .0 dBm
AT 10 dB
MKR Δ 1.095 MHz
.77 dB
PEAK
LOG
10
dB/
MARKER Δ
1.095 MHz
.77 dB
MARKER
NORMAL
MARKER
AMPTD
SELECT
1 2 3 4
MARKER 1
ON OFF
More
1 of 2
VA SB
SC FC
CORR
CENTER 2.442375 GHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 6.000 MHz
#SWP 100 msec

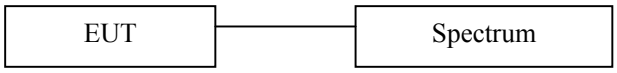

13:17:54 NOV 09, 2010
REF .0 dBm
AT 10 dB
MKR Δ 1.095 MHz
.11 dB
MARKER
NORMAL
PEAK
LOG
10
dB/
MARKER Δ
1.095 MHz
.11 dB
MARKER
AMPTD
SELECT
1 2 3 4
VA SB
SC FC
CORR
MARKER 1
ON OFF
More
1 of 2
CENTER 2.477250 GHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 6.000 MHz
#SWP 100 msec

8. Quantity of Hopping Channel Test

8.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

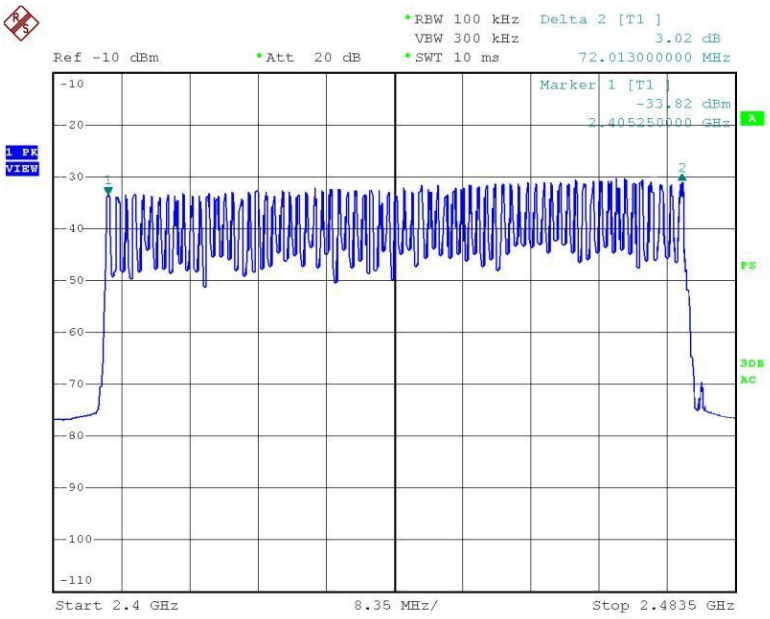
Same as 5.3 Radiated Emission Measurement.

8.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	October 15, 2010
Test By:	Andy	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel(Limit)
2405.250-2477.250MHz	65	>15

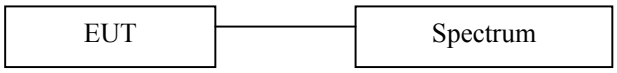

*RBW 100 kHz
VBW 300 kHz
*SWT 10 ms
Delta 2 [T1]
3.02 dB
72.013000000 MHz
Ref -10 dBm
*Att 20 dB
Marker 1 [T1]
-33.82 dBm
2.40525000 GHz
1 PK VIEW
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
Start 2.4 GHz
8.35 MHz/
Stop 2.4835 GHz

9. Time of Occupancy (Dwell Time) test

9.1 Measurement Procedure

a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

9.2 Test SET-UP (Block Diagram of Configuration)



9.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

9.4 Measurement Results:

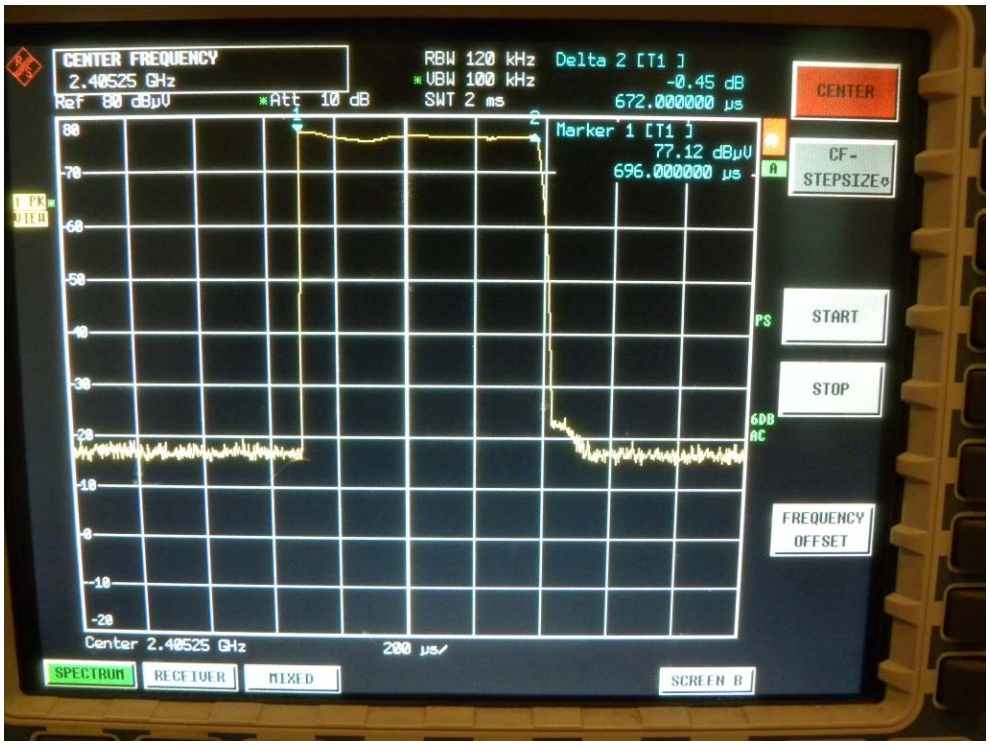
Number of hopping channels is 65.
A channel was used 107 times within 0.4*65=26S.

Sample calculation: In normal operation, there are 5 transmissions per 50mS.
Therefore, the dwell time for each channel is:

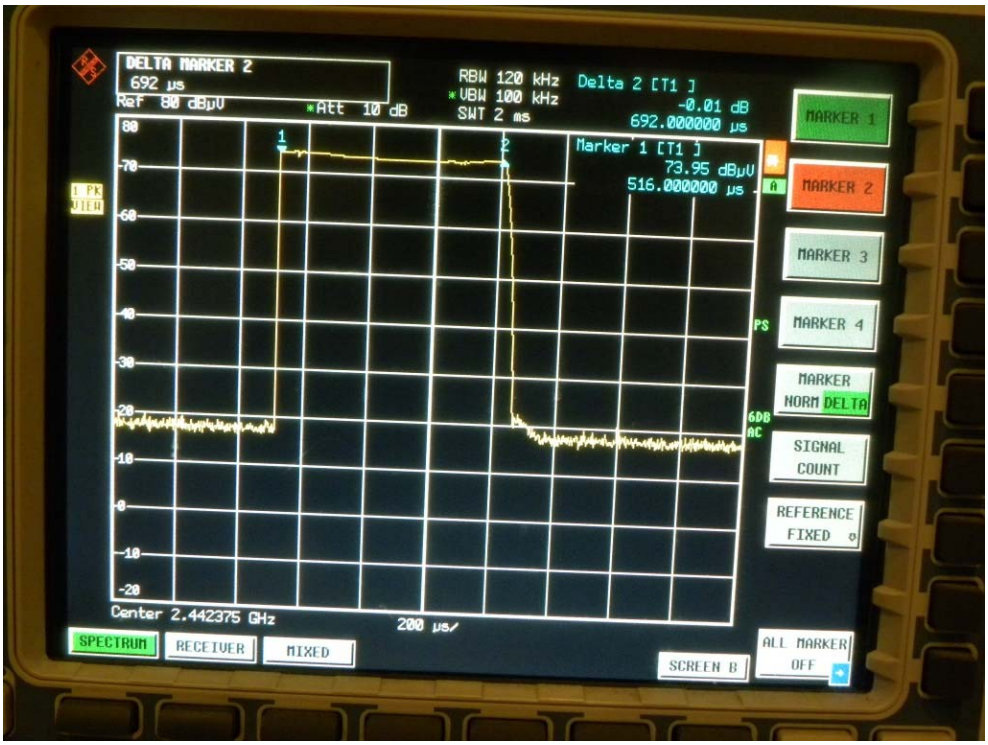
1. Low Channel: 0.672ms x (42/50ms x 26s)/80 = 0.1835 s < 0.4 s
2. Middle Channel: 0.692ms x (42/50ms x 26s)/80 = 0.1889 s < 0.4 s
3. High Channel: 0.652ms x (42/50ms x 26s)/80 = 0.1780 s< 0.4 s

The Results are not be greater than 0.4 seconds.

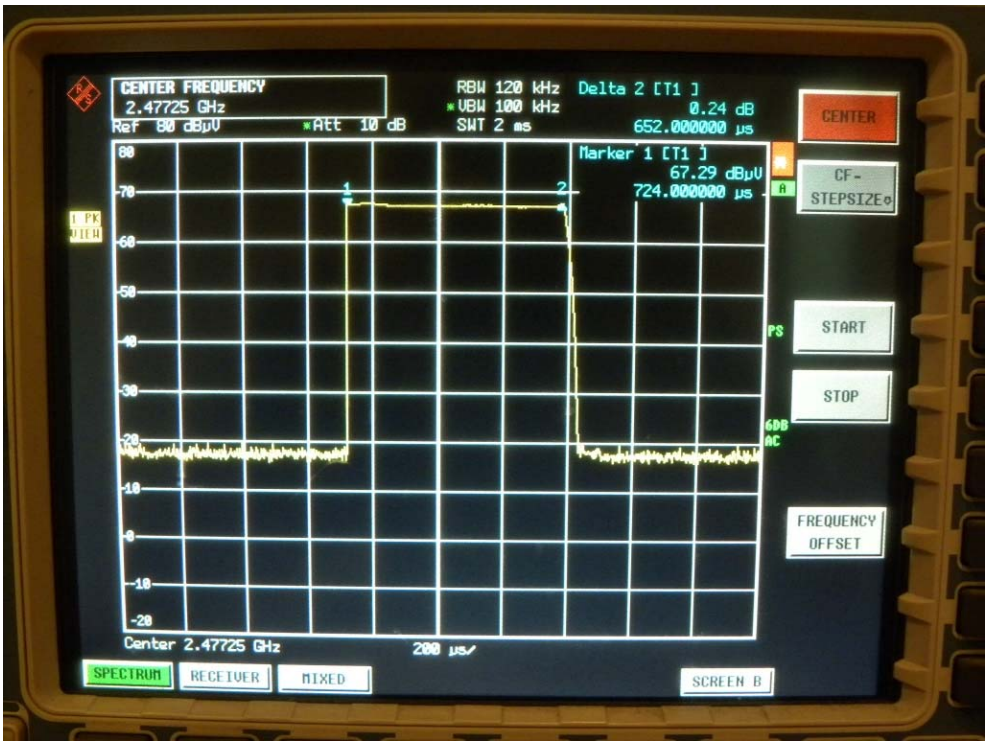
DH00


CENTER FREQUENCY
2.40525 GHz
Ref 80 dBµV
*Att 10 dB
RBW 120 kHz
*VBW 100 kHz
SWT 2 ms
Delta 2 [T1]
-0.45 dB
672.000000 µs
Marker 1 [T1]
77.12 dBµV
696.000000 µs
CENTER
CF-
STEPSIZE
START
STOP
FREQUENCY
OFFSET
Center 2.40525 GHz
200 µs/
SPECTRUM
RECEIVER
MIXED
SCREEN B

DH33


DELTA MARKER 2
692 µs
Ref 80 dBµV
*Att 10 dB
RBW 120 kHz
*VBW 100 kHz
SWT 2 ms
Delta 2 [T1]
-0.01 dB
692.000000 µs
Marker 1 [T1]
73.95 dBµV
516.000000 µs
MARKER 1
MARKER 2
MARKER 3
MARKER 4
MARKER
NORM DELTA
SIGNAL
COUNT
REFERENCE
FIXED
Center 2.442375 GHz
200 µs/
SPECTRUM
RECEIVER
MIXED
SCREEN B
ALL MARKER
OFF

DH64

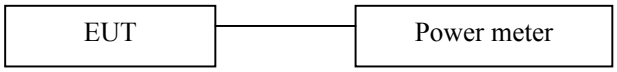

CENTER FREQUENCY
2.47725 GHz
Ref 80 dBµV
*Att 10 dB
RBW 120 kHz
*VBW 100 kHz
SWT 2 ms
Delta 2 [T1]
0.24 dB
652.000000 µs
Marker 1 [T1]
67.29 dBµV
724.000000 µs
CENTER
CF-
STEPSIZE
START
STOP
FREQUENCY
OFFSET
Center 2.47725 GHz
200 µs/
SPECTRUM
RECEIVER
MIXED
SCREEN B

10. M AX IMUM PEAK OUTPUT POWER TEST

10.1 Measurement Procedure

a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
d. Measure the captured power within the band and recording the plot.
e. Repeat above procedures until all frequencies required were complete.

10.2 Test SET-UP (Block Diagram of Configuration)



10.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power meter	Boonton	4232A	29001	05/29/2010	05/29/2011
Power sensor	Boonton	51011-EMC	31184	05/29/2010	05/29/2011

10.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	October 15, 2010
Test By:	Andy	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %

Channel number	Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Limit (mW)	Pass/Fail
00	2405.250	8.88	9.48	125	PASS
33	2442.375	7.50	8.75	125	PASS
64	2477.250	8.62	9.36	125	PASS

11. Band EDGE test

11.1 Measurement Procedure

1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured were complete.

11.2 Test SET-UP (Block Diagram of Configuration)

Same as 5.2 Radiated Emission Set-up.

11.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

11.4 Measurement Results:

Refer to attached data chart.

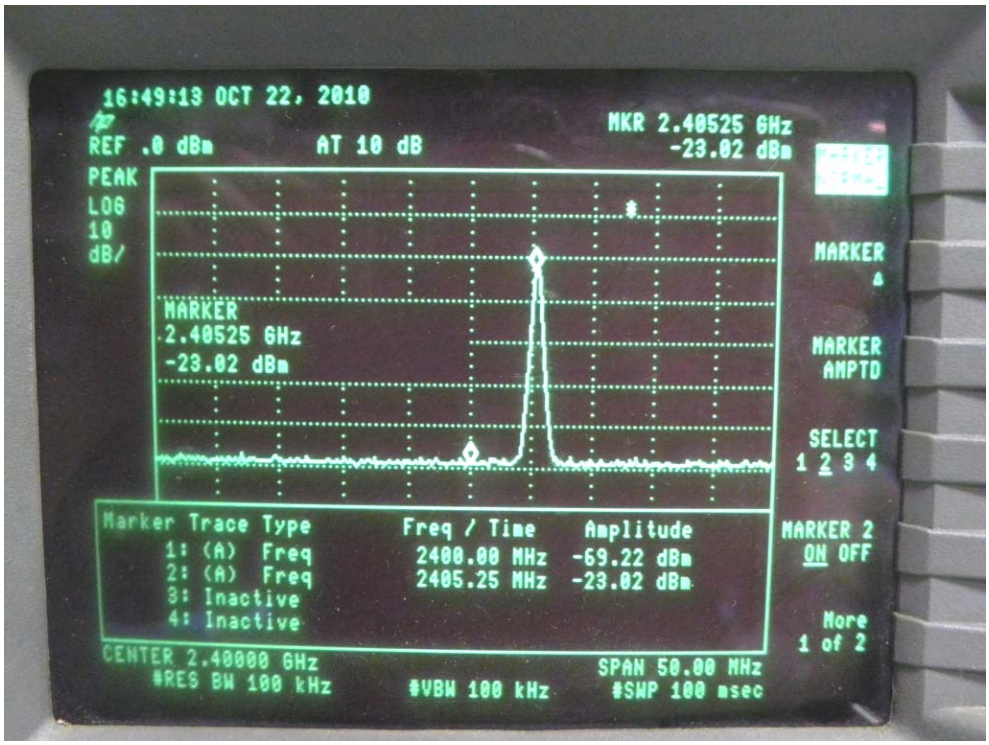
Spectrum Detector:	PK	Test Date :	October 15, 2010
Test By:	Andy	Temperature :	28 ℃
Test Result:	PASS	Humidity :	65 %

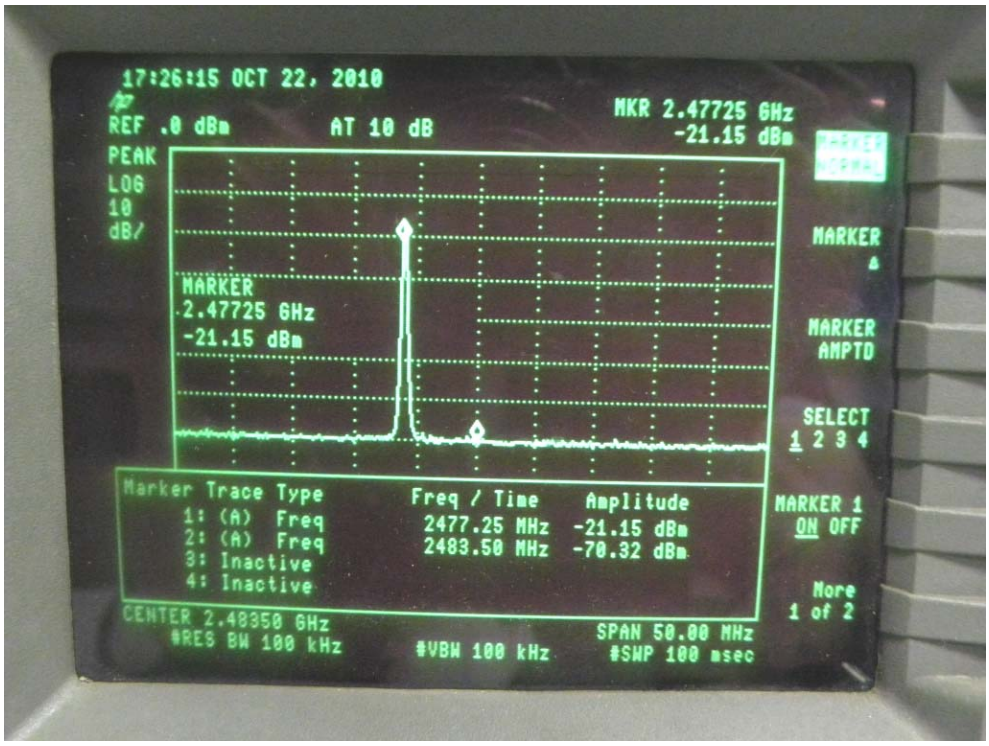
1.Conducted Test

Frequency (MHz)	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
<2400	-23.02	-69.22	46.20	>20dBc
>2483.5	-21.15	-70.32	49.17	>20dBc

2.Radiated emission test

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)	
		PK	AV	PK	AV
<2400	V	58.47	45.20	74.00	54.00
>2483.5	V	60.55	47.35	74.00	54.00


16:49:13 OCT 22, 2010
REF .0 dBm
AT 10 dB
MKR 2.40525 GHz
-23.02 dBm
PEAK
LOG
10
dB/
MARKER
2.40525 GHz
-23.02 dBm
MARKER
Δ
MARKER
AMPTD
SELECT
1 2 3 4
Marker Trace Type
1: (A) Freq
2: (A) Freq
3: Inactive
4: Inactive
Freq / Time
2400.00 MHz
2405.25 MHz
Amplitude
-69.22 dBm
-23.02 dBm
MARKER 2
ON OFF
More
1 of 2
CENTER 2.40000 GHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 50.00 MHz
#SWP 100 msec


17:26:15 OCT 22, 2010
REF .0 dBm
AT 10 dB
MKR 2.47725 GHz
-21.15 dBm
PEAK
LOG
10
dB/
MARKER
2.47725 GHz
-21.15 dBm
MARKER
Δ
MARKER
AMPTD
SELECT
1 2 3 4
Marker Trace Type
1: (A) Freq
2: (A) Freq
3: Inactive
4: Inactive
Freq / Time
2477.25 MHz
2483.50 MHz
Amplitude
-21.15 dBm
-70.32 dBm
MARKER 1
ON OFF
More
1 of 2
CENTER 2.48350 GHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 50.00 MHz
#SWP 100 msec

12. Antenna Application

12.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.240.

FCC part 15C section 15.247 requirements:
Systems operating in the 2.4GHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

12.2. Result

The unit is produced with a unique coupling from the transmitter to the whip antenna. The antenna is not replaceable or user serviceable. The requirements of 15.203 are met; there are no deviations or exceptions to the specification.

13. RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in § 1.1307(b)

Limits for Maximum Permissible Exposure(MPE)

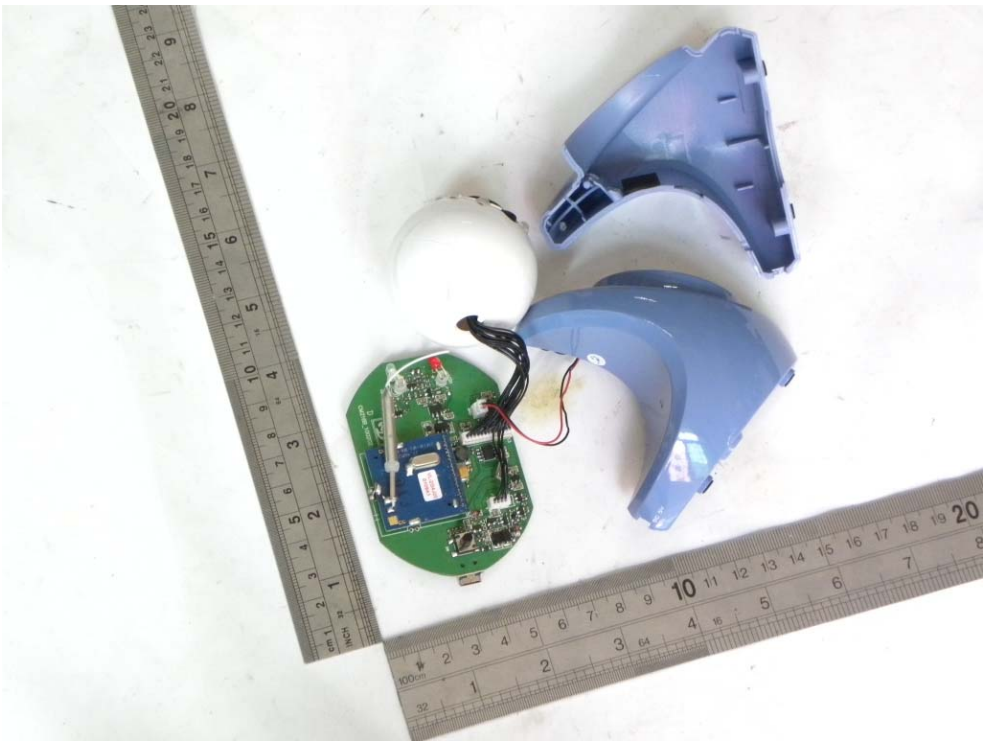
Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm^2)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	**--**	**--**	**F/300**	**6**
1500-100000	**--**	**--**	**5**	**6**
(B) Limits for General Population/Uncontrol Exposures				
300-1500	**--**	**--**	**F/1500**	**6**
1500-100000	**--**	**--**	**1**	**30**

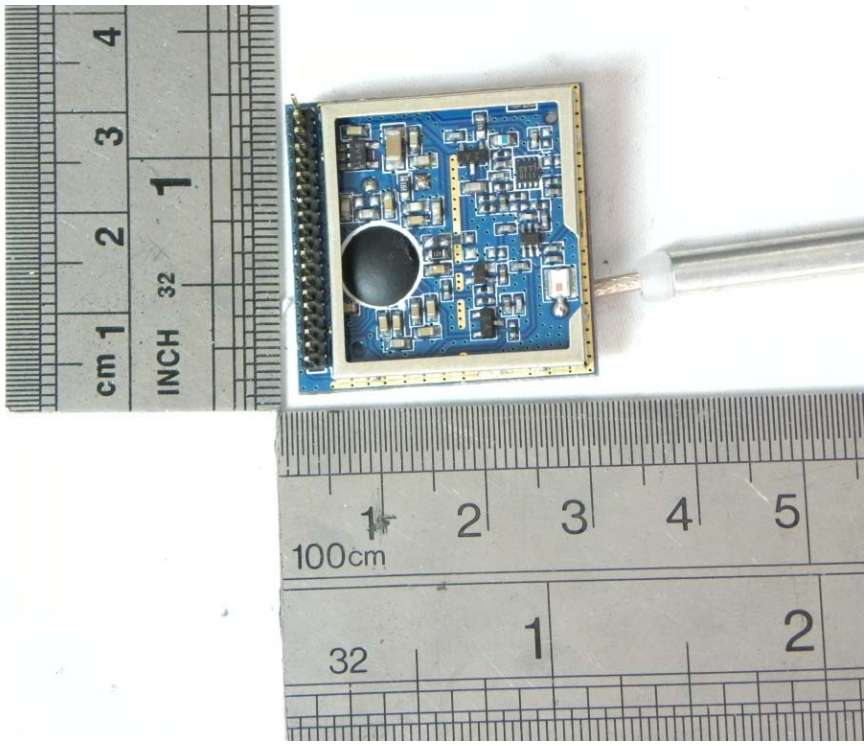
13.1 Friis transmission formula: Pd=(Pout*G)\(4*pi*R^2)

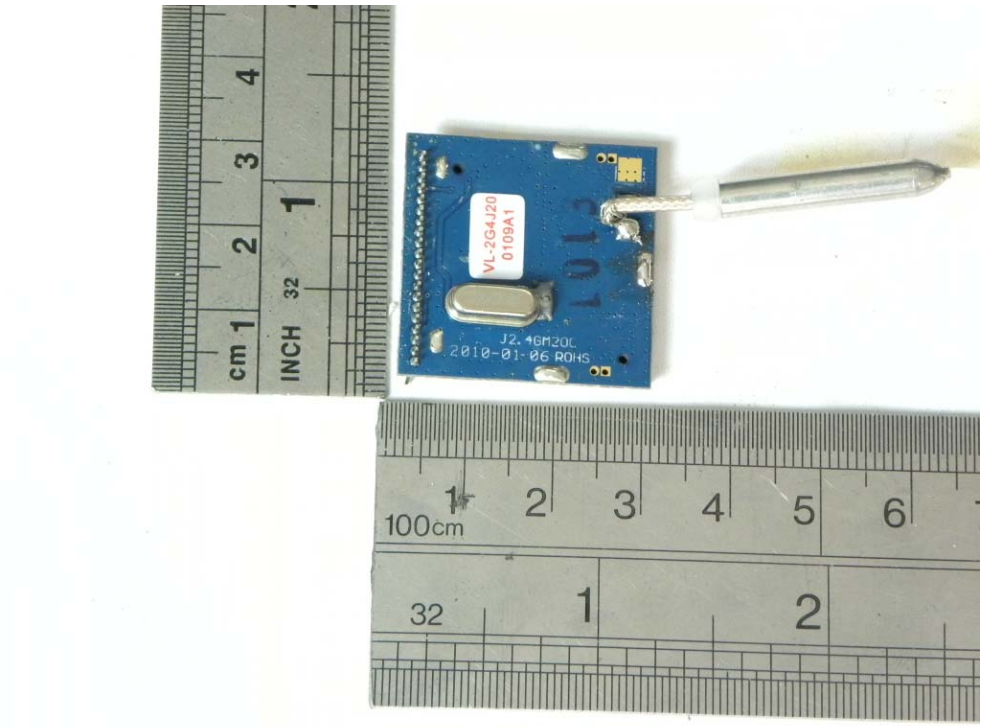
Where
Pd= Power density in mW/cm^2
Pout=output power to antenna in Mw
G= gain of antenna in linear scale
Pi=3.1416
R= distance between observation point and center of the radiator in cm
Pd the limit of MPE, 1mW/cm2. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

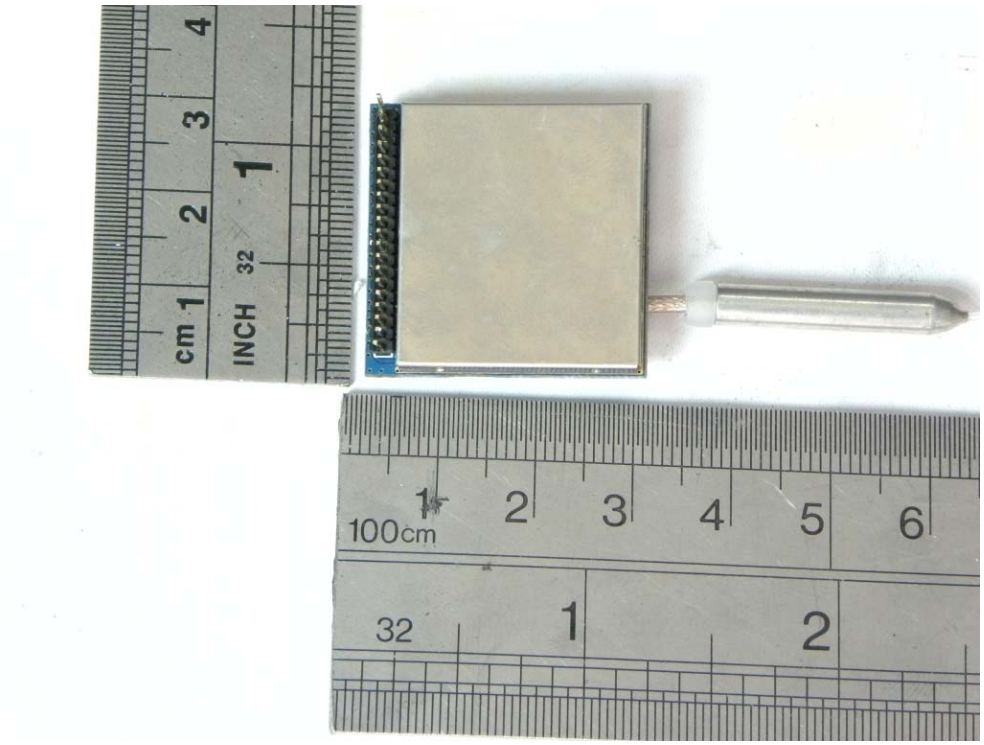
13.2 Measurement Result

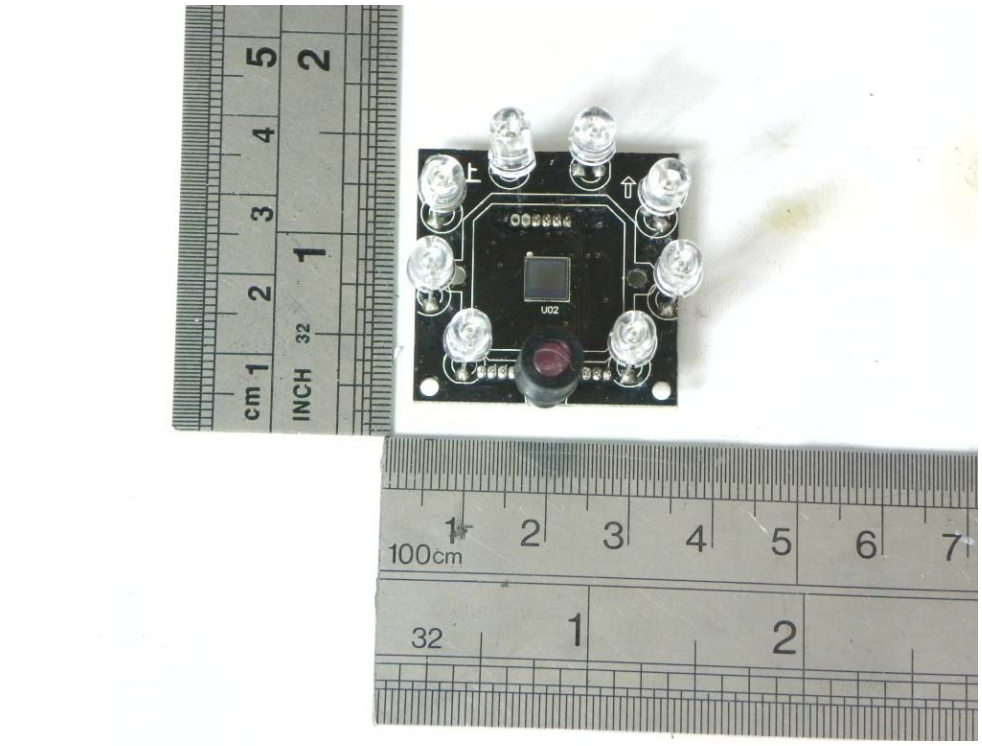
Channel	Channel Frequency (MHz)	Output Peak power (mW)	Antenna Gain (dBi)	Power density at 20cm (mW/cm^2)	Power density Limits (mW/cm^2)
Low	2405.250	8.88	0	0.0018	1
Middle	2442.375	7.50	0	0.0015	1
High	2477.250	8.62	0	0.0017	1

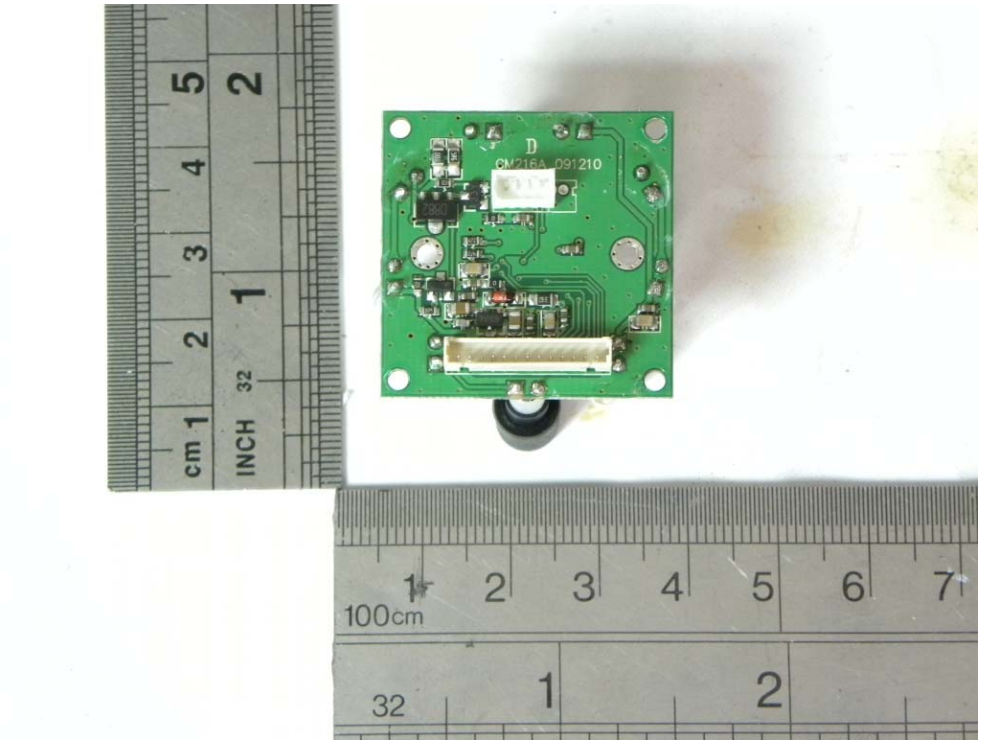





VL-2G4J20
0109A1
J2.4GM20C
2010-01-06 ROHS
cm 1
INCH 32
100cm


cm 1
INCH 32
100cm


U02
100cm


CM216A_091210
100cm