4.7. Band Edge Emissions Measurement

4.7.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.7.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	100 KHz /100 KHz for Peak

4.7.3. Test Procedures

1. The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around bandedges.
2. In case the emission is fail due to the used RB/VB is too wide, marker-delta method of FCC Public Notice DA00-705 will be followed.

4.7.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.6.4.

4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.7.7. Test Result of Band Edge and Fundamental Emissions

<For Antenna A>

Temperature	23°C	Humidity	56%
Test Engineer	Alan Huang	Configurations	Channel 0, 39, 78 / Ant. A
Test Date	Nov. 30, 2009		

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2390.00	44.20	54.00	-9.80	13.27	2.76	28.17	0.00	110	100	Average	VERTICAL
2	2390.00	55.24	74.00	-18.76	24.31	2.76	28.17	0.00	110	100	Peak	VERTICAL
3 p	2401.88	105.90	74.00			2.76	28.21	0.00	110	100	Peak	VERTICAL
4 a	2402.24	65.84	54.00			2.76	28.21	0.00	110	100	Average	VERTICAL

Item 3, 4 are the fundamental frequency at 2402 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2440.82	103.61	74.00			2.78	28.29	0.00	111	101	Peak	VERTICAL
2 a	2441.12	64.79	54.00			2.78	28.29	0.00	111	101	Average	VERTICAL

Item 1, 2 are the fundamental frequency at 2441 MHz.

Channel 78

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2479.88	104.50	74.00			2.81	28.37	0.00	334	100	Peak	VERTICAL
2 a	2480.18	65.22	54.00			2.81	28.37	0.00	334	100	Average	VERTICAL
3 !	2483.50	50.59	54.00	-3.41	19.41	2.81	28.37	0.00	334	100	Average	VERTICAL
4	2483.50	67.17	74.00	-6.83	35.99	2.81	28.37	0.00	334	100	Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

<For Antenna B>

Temperature	23°C	Humidity	56%
Test Engineer	Alan Huang	Configurations	Channel 0, 39, 78 / Ant. B
Test Date	Dec. 01, 2009		

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2389.76	53.87	74.00	-20.13	22.94	2.76	28.17	0.00	187	106	Peak	VERTICAL
2	2390.00	43.61	54.00	-10.39	12.68	2.76	28.17	0.00	187	106	Average	VERTICAL
3 a	2402.12	64.43	54.00			2.76	28.21	0.00	187	106	Average	VERTICAL
4 p	2402.24	101.76	74.00			2.76	28.21	0.00	187	106	Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 2402 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2440.88	100.66	74.00			2.78	28.29	0.00	336	100	Peak	VERTICAL
2 a	2441.12	63.37	54.00			2.78	28.29	0.00	336	100	Average	VERTICAL

Item 1, 2 are the fundamental frequency at 2441 MHz.

Channel 78

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2479.89	100.77	74.00			2.81	28.37	0.00	274	101	Peak	VERTICAL
2 a	2480.13	63.49	54.00			2.81	28.37	0.00	274	101	Average	VERTICAL
3 !	2483.50	48.98	54.00	-5.02	17.80	2.81	28.37	0.00	274	101	Average	VERTICAL
4	2483.50	63.08	74.00	-10.92	31.90	2.81	28.37	0.00	274	101	Peak	VERTICAL

Item 3, 4 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

<For Antenna C>

Temperature	23°C	Humidity	56%
Test Engineer	Alan Huang	Configurations	Channel 0, 39, 78 / Ant. C
Test Date	Dec. 31, 2009		

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2388.03	55.89	74.00	-18.11	24.96	2.76	28.17	0.00	330	100	Peak	VERTICAL
2	2390.00	46.19	54.00	-7.81	15.26	2.76	28.17	0.00	330	100	Average	VERTICAL
3 p	2402.14	107.28	74.00			2.76	28.21	0.00	330	100	Peak	VERTICAL
4 a	2402.29	68.38	54.00			2.76	28.21	0.00	330	100	Average	VERTICAL

Item 3, 4 are the fundamental frequency at 2402 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2441.05	104.70	74.00			2.78	28.29	0.00	52	100	Peak	VERTICAL
2 a	2441.14	67.26	54.00			2.78	28.29	0.00	52	100	Average	VERTICAL

Item 1, 2 are the fundamental frequency at 2441 MHz.

Channel 78

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 a	2480.19	66.62	54.00			2.81	28.37	0.00	325	100	Average	VERTICAL
2 p	2480.24	104.33	74.00			2.81	28.37	0.00	325	100	Peak	VERTICAL
3 !	2483.50	51.24	54.00	-2.76	20.06	2.81	28.37	0.00	325	100	Average	VERTICAL
4	2483.50	65.42	74.00	-8.58	34.24	2.81	28.37	0.00	325	100	Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

<For Antenna D>

Temperature	23°C	Humidity	56%
Test Engineer	Alan Huang	Configurations	Channel 0, 39, 78 / Ant. D
Test Date	Dec. 01, 2009		

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	2389.81	55.05	74.00	-18.95	24.12	2.76	28.17	0.00	287	100	Peak	VERTICAL
2	2390.00	45.92	54.00	-8.08	14.99	2.76	28.17	0.00	287	100	Average	VERTICAL
3 p	2402.05	99.85	74.00			2.76	28.21	0.00	287	100	Peak	VERTICAL
4 a	2402.10	64.47	54.00			2.76	28.21	0.00	287	100	Average	VERTICAL

Item 1, 2 are the fundamental frequency at 2402 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2440.90	101.45	74.00			2.78	28.29	0.00	80	130	Peak	VERTICAL
2 a	2441.10	65.98	54.00			2.78	28.29	0.00	80	130	Average	VERTICAL

Item 1, 2 are the fundamental frequency at 2441 MHz.

Channel 78

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1 p	2480.05	97.50	74.00			2.81	28.37	0.00	291	100	Peak	VERTICAL
2 a	2480.10	64.62	54.00			2.81	28.37	0.00	291	100	Average	VERTICAL
3 !	2483.50	49.18	54.00	-4.82	18.00	2.81	28.37	0.00	291	100	Average	VERTICAL
4	2483.50	59.94	74.00	-14.06	28.76	2.81	28.37	0.00	291	100	Peak	VERTICAL

Item 3, 4 are the fundamental frequency at 2480 MHz.

Note:

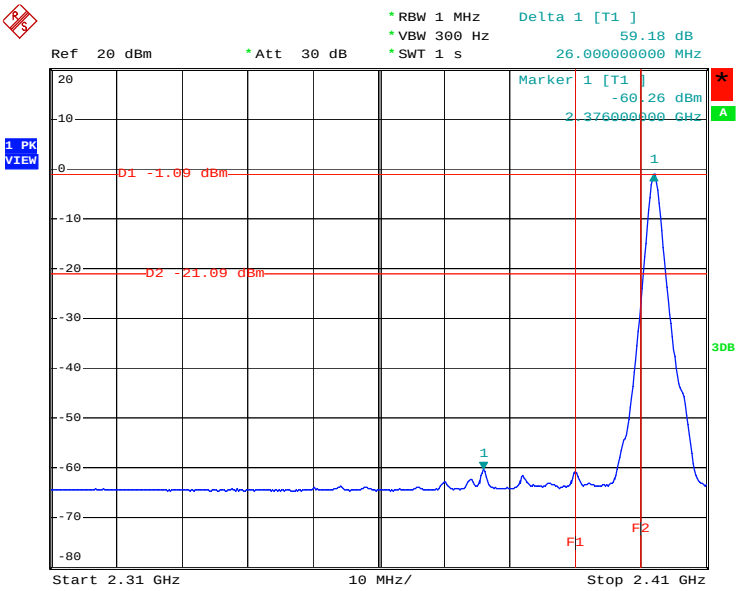
Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

For Emission not in Restricted Band

<For Antenna A>

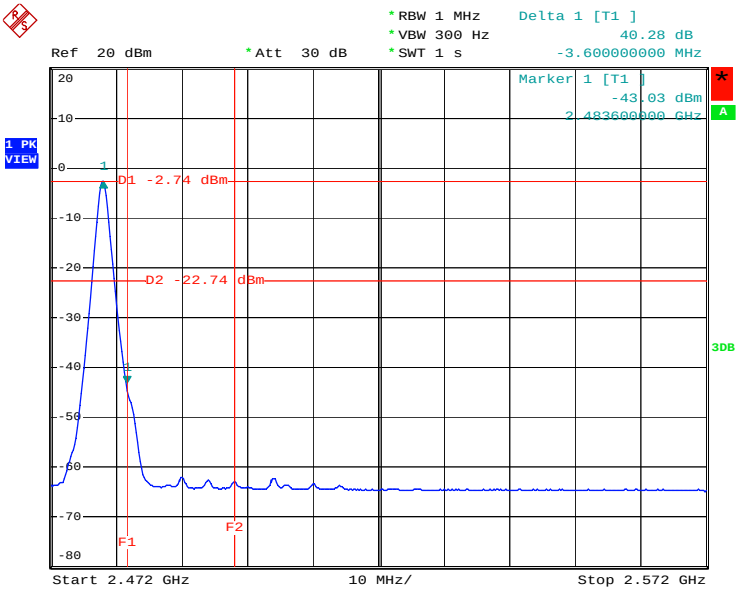
Low Band Edge Plot on Channel 0 Ant. A / 2402 MHz



TVjf

Date: 2.DEC.2009 13:55:17

High Band Edge Plot on Channel 78 Ant. A / 2480 MHz

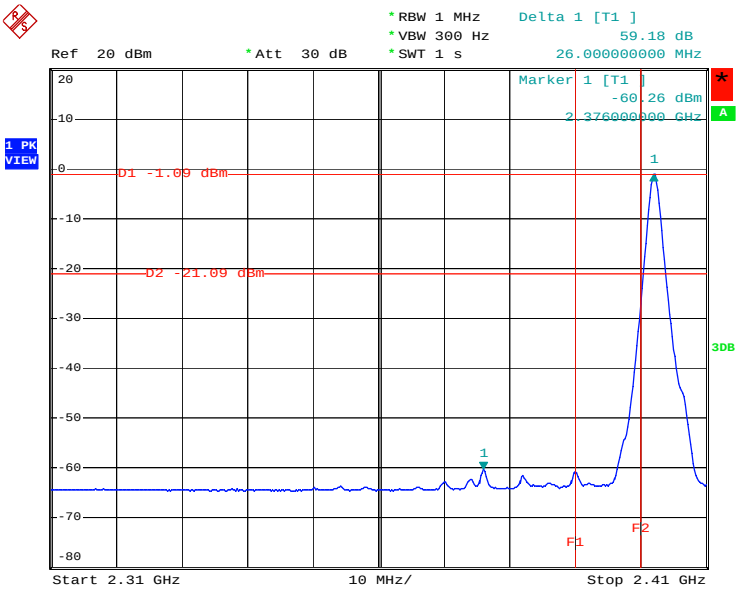


TVjf

Date: 2.DEC.2009 13:59:09

<For Antenna B>

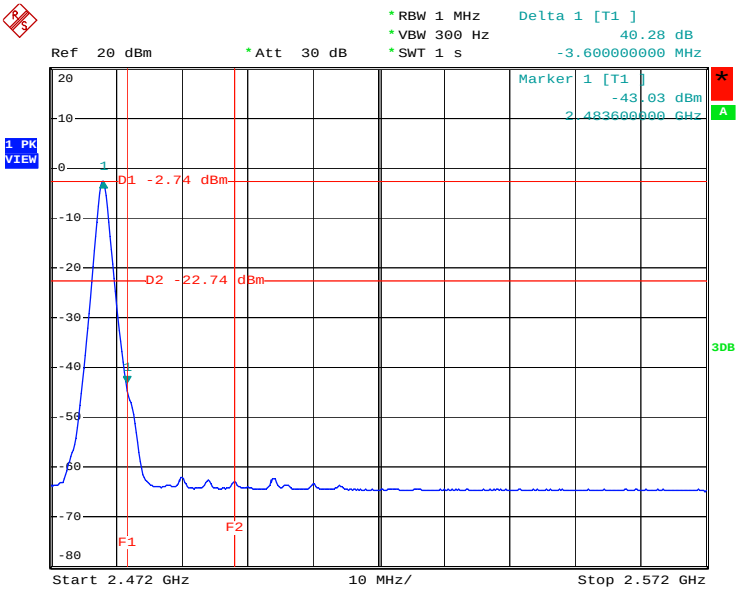
Low Band Edge Plot on Channel 0 Ant. B / 2402 MHz



TVjf

Date: 2.DEC.2009 13:55:17

High Band Edge Plot on Channel 78 Ant. B / 2480 MHz

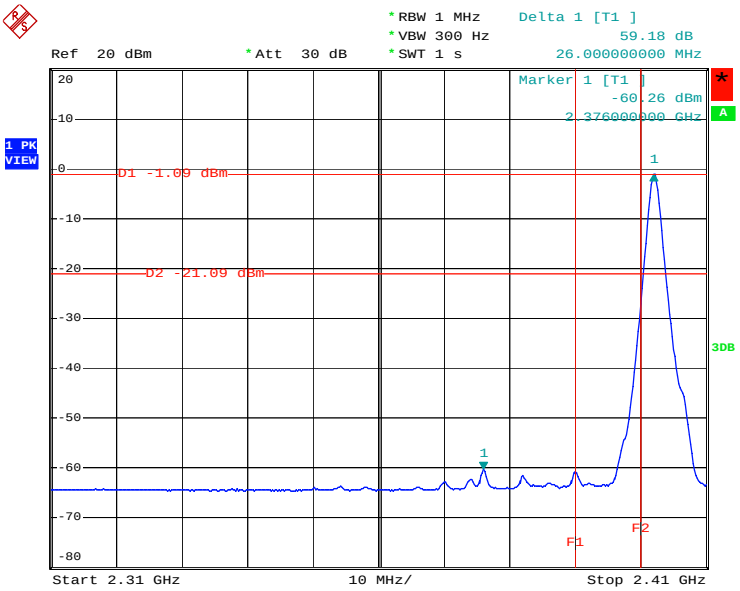


TVjf

Date: 2.DEC.2009 13:59:09

<For Antenna C>

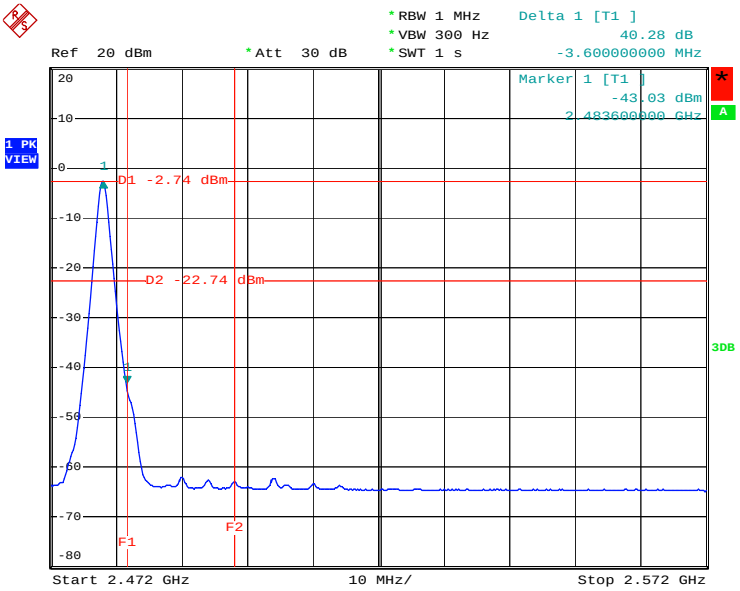
Low Band Edge Plot on Channel 0 Ant. C / 2402 MHz



TVjf

Date: 2.DEC.2009 13:55:17

High Band Edge Plot on Channel 78 Ant. C / 2480 MHz

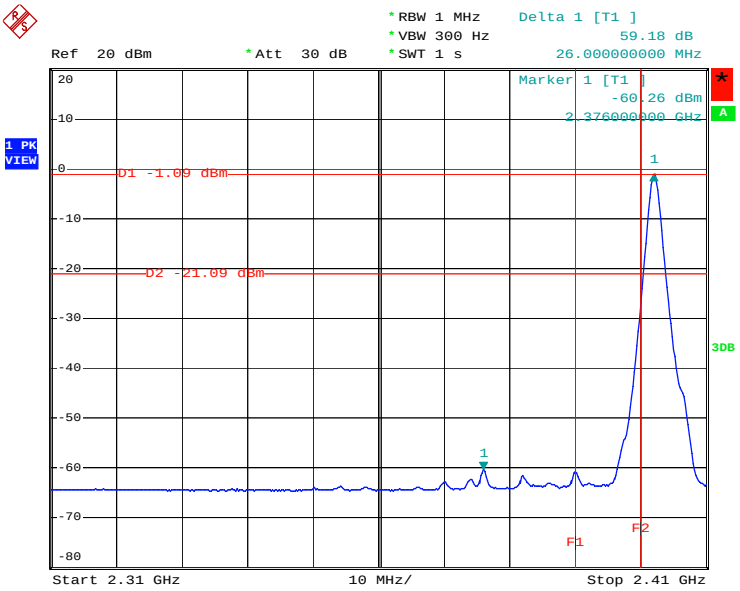


TVjf

Date: 2.DEC.2009 13:59:09

<For Antenna D>

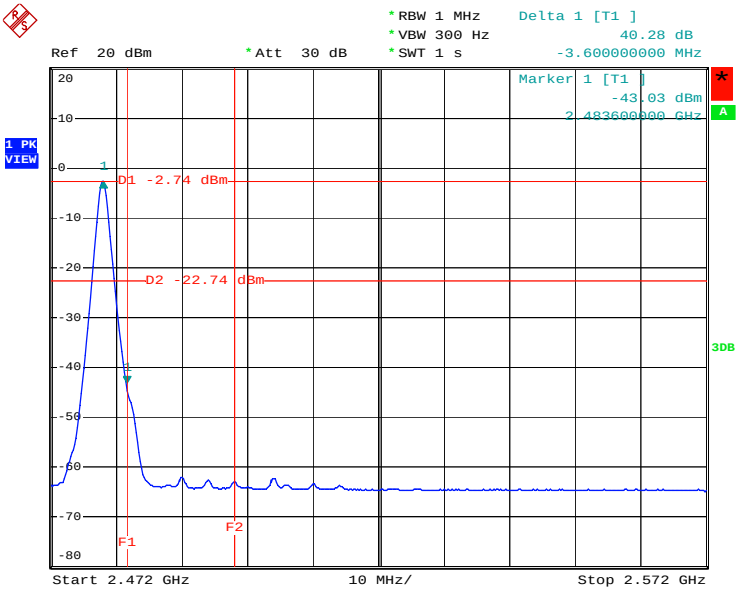
Low Band Edge Plot on Channel 0 Ant. D / 2402 MHz



TVjf

Date: 2.DEC.2009 13:55:17

High Band Edge Plot on Channel 78 Ant. D / 2480 MHz



TVjf

Date: 2.DEC.2009 13:59:09

4.8. Antenna Requirements

4.8.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.8.2. Antenna Connector Construction

Please refer to section 3.3 in this test report, antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	Apr. 15, 2009	Conduction (CO04-HY)
LISN	MessTec	NNB-2/16Z	99079	9kHz – 30MHz	Mar. 23, 2009	Conduction (CO04-HY)
LISN (Support Unit)	EMCO	3810/2NM	9703-1839	9kHz – 30MHz	Mar. 22, 2009	Conduction (CO04-HY)
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9kHz – 30MHz	Apr. 20, 2009	Conduction (CO04-HY)
ISN	SCHAFFNER	ISN T400	21653	9kHz –30MHz	Jun. 11, 2009	Conduction (CO04-HY)
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	Conduction (CO04-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30 MHz - 1 GHz 3m	Jun. 07, 2009	Radiation (03CH03-HY)
Amplifier	SCHAFFNER	COA9231A	18667	9 kHz - 2 GHz	Jan. 23, 2009	Radiation (03CH03-HY)
Amplifier	Agilent	8449B	3008A02120	1 GHz - 26.5 GHz	Jul. 21, 2009	Radiation (03CH03-HY)
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5 GHz - 40 GHz	Apr. 06, 2009*	Radiation (03CH03-HY)
Spectrum Analyzer	R&S	FSP30	100305	9 kHz - 40 GHz	Feb. 03, 2009	Radiation (03CH03-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz - 30 MHz	Jul. 28, 2008*	Radiation (03CH03-HY)
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30 MHz – 1 GHz	Sep. 26, 2009	Radiation (03CH03-HY)
Horn Antenna	EMCO	3115	6741	1GHz ~ 18GHz	Apr. 28, 2009	Radiation (03CH03-HY)
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15 GHz - 40 GHz	Jan.16, 2009	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30 MHz - 1 GHz	Jan. 05, 2009	Radiation (03CH03-HY)
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1 GHz - 40 GHz	Jan. 05, 2009	Radiation (03CH03-HY)
Turn Table	HD	DS 420	420/650/00	0 – 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
Spectrum Analyzer	R&S	FSU26.5	100015	20Hz ~ 26.5GHz	Oct. 29, 2009	Conducted (TH01-HY)
Power Meter	R&S	NRVS	100444	DC ~ 40GHz	Jul. 31, 2009	Conducted (TH01-HY)
Power Sensor	R&S	NRV-Z51	100666	DC ~ 30GHz	Aug. 05, 2009	Conducted (TH01-HY)
Power Sensor	R&S	NRV-Z32	100057	30MHz ~ 6GHz	Jul. 31, 2009	Conducted (TH01-HY)
AC Power Source	HPC	HPA-500W	HPA-9100024	AC 0 ~ 300V	Jul. 12, 2009*	Conducted (TH01-HY)
DC Power Source	G.W.	GPC-6030D	C671845	DC 1V ~ 60V	Mar. 13, 2009	Conducted (TH01-HY)
Temp. and Humidity Chamber	Giant Force	GTH-225-20-S	MAB0103-001	N/A	Aug. 06, 2009	Conducted (TH01-HY)
RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz ~ 7GHz	Dec. 01, 2008	Conducted (TH01-HY)
RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz ~ 7GHz	Dec. 01, 2009	Conducted (TH01-HY)
RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz ~ 1GHz	Dec. 01, 2008	Conducted (TH01-HY)
RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz ~ 1GHz	Dec. 01, 2009	Conducted (TH01-HY)
Vector Signal Generator	R&S	SMU200A	102098	100kHz ~ 6GHz	Feb. 13, 2009	Conducted (TH01-HY)
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Mar. 25, 2009	Conducted (TH01-HY)

Note: Calibration Interval of instruments listed above is one year.

Note: Calibration Interval of instruments listed above is two year.

6. TEST LOCATION

SHIJR	ADD	:	6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C.
	TEL	:	886-2-2696-2468
	FAX	:	886-2-2696-2255
HWA YA	ADD	:	No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
	TEL	:	886-3-327-3456
	FAX	:	886-3-318-0055
LINKOU	ADD	:	No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C
	TEL	:	886-2-2601-1640
	FAX	:	886-2-2601-1695
DUNGHU	ADD	:	No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C.
	TEL	:	886-2-2631-4739
	FAX	:	886-2-2631-9740
JUNGHE	ADD	:	7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C.
	TEL	:	886-2-8227-2020
	FAX	:	886-2-8227-2626
NEIHU	ADD	:	4Fl., No. 339, Hsin Hu 2nd Rd., Taipei 114, Taiwan, R.O.C.
	TEL	:	886-2-2794-8886
	FAX	:	886-2-2794-9777
JHUBEI	ADD	:	No.8, Lane 728, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.
	TEL	:	886-3-656-9065
	FAX	:	886-3-656-9085

7. TAF CERTIFICATE OF ACCREDITATION

Certificate No. : L1190-070110

財團法人全國認證基金會
Taiwan Accreditation Foundation

Certificate of Accreditation

This is to certify that

Sporton International Inc.
EMC & Wireless Communications Laboratory
No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

is accredited in respect of laboratory

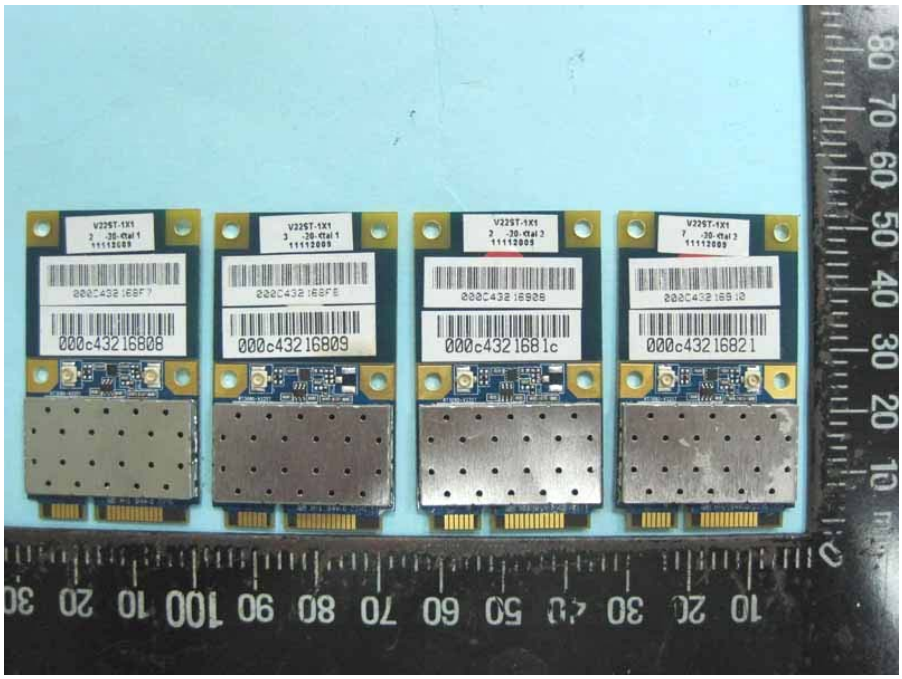
Accreditation Criteria	:	ISO/IEC 17025:2005
Accreditation Number	:	1190
Originally Accredited	:	December 15, 2003
Effective Period	:	January 10, 2007 to January 09, 2010
Accredited Scope	:	Testing Field, see described in the Appendix
Specific Accreditation Program	:	Accreditation Program for Designated Testing Laboratory for Commodities Inspection Accreditation Program for Telecommunication Equipment Testing Laboratory

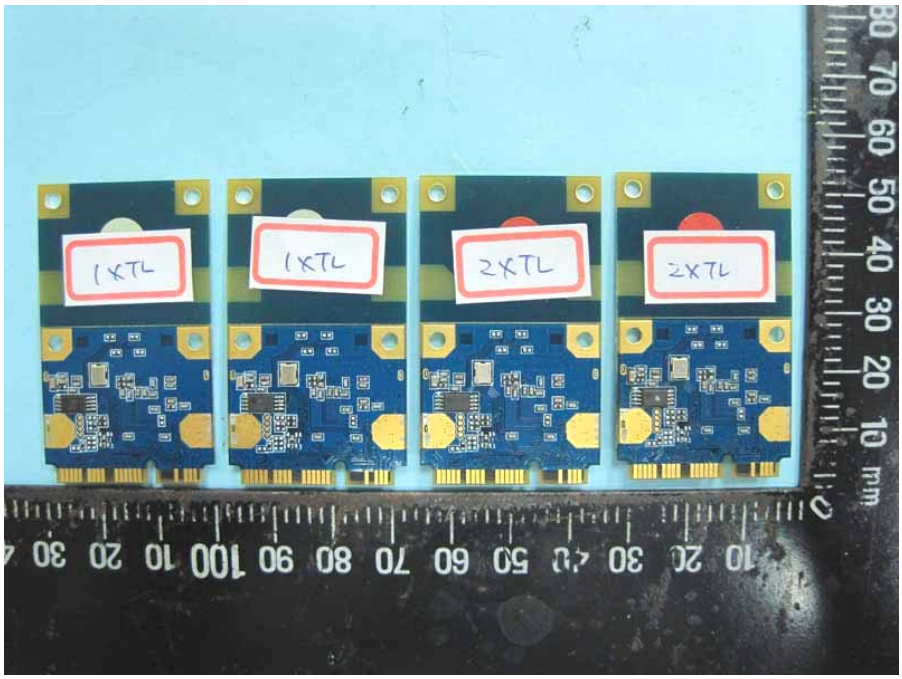
Jay-San Chen
President, Taiwan Accreditation Foundation
Date : January 10, 2007

P1, total 9 pages

The Appendix forms an integral part of this Certificate, which shall be invalid when used without the Appendix.

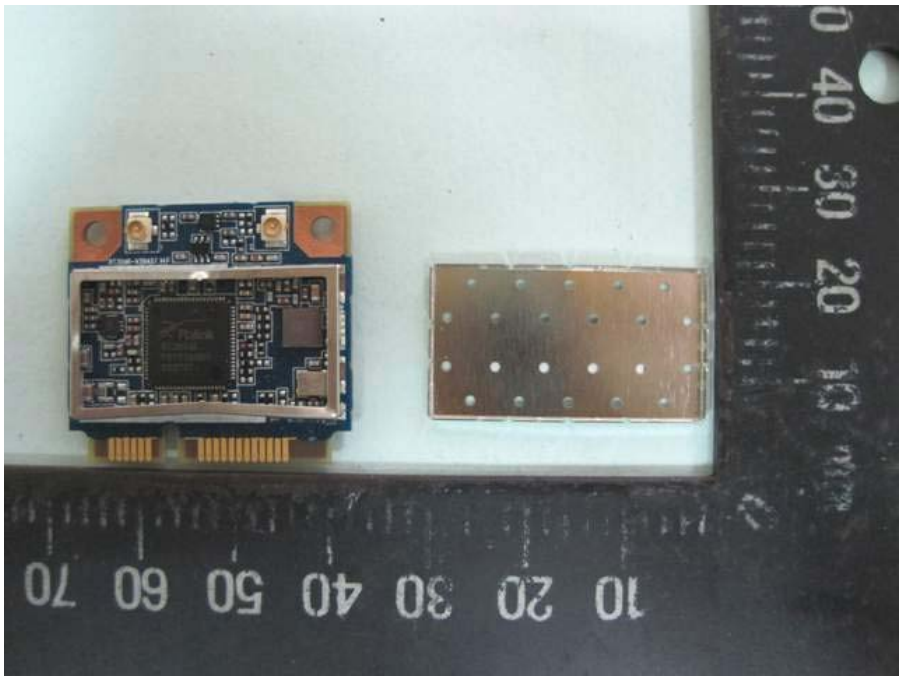
APPENDIX A. Photographs of EUT





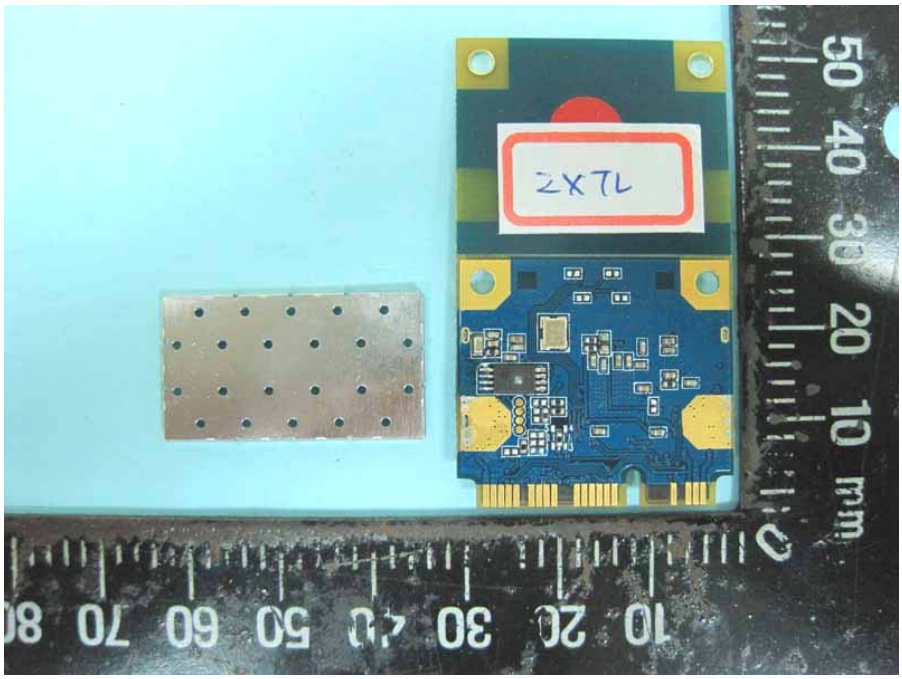

045809CWA5059

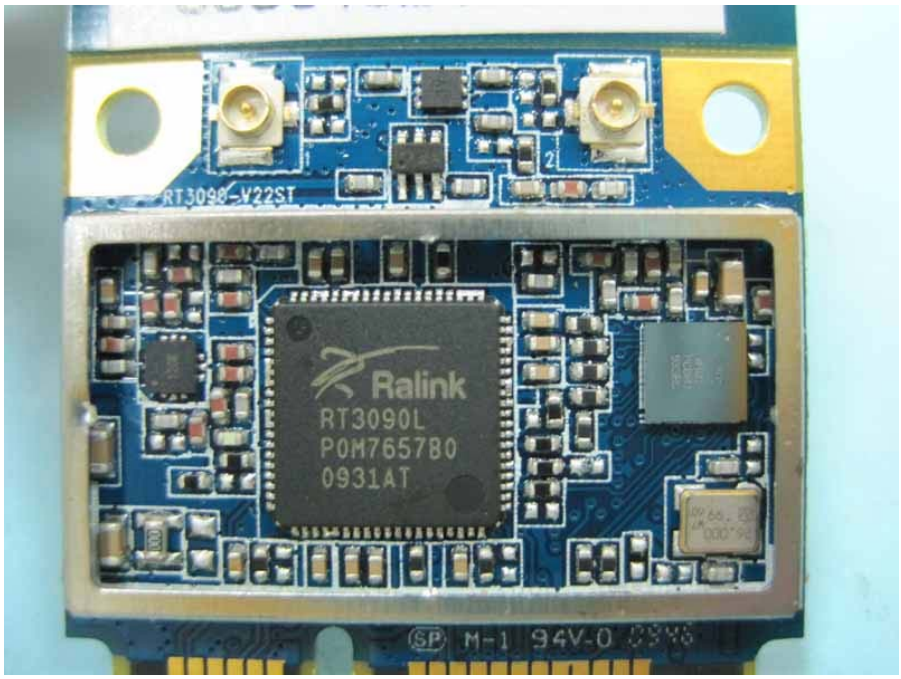

CT: GBFGD000TYF02E
BT MAC: 000C4364309B
WLAN MAC: 00247E878710
SPS# 602992-001 AS# 602639-001 Product of China

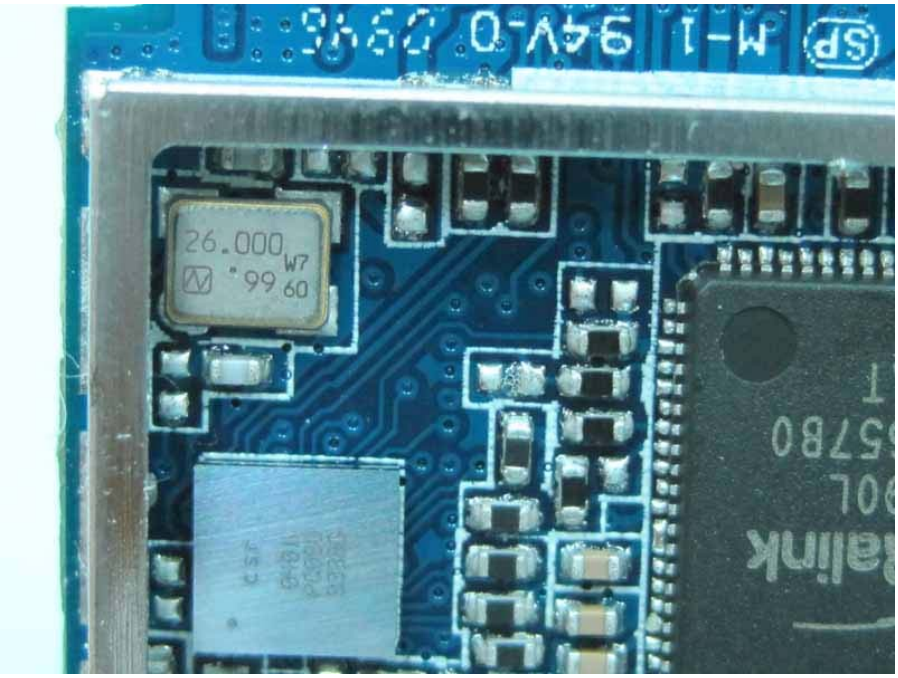


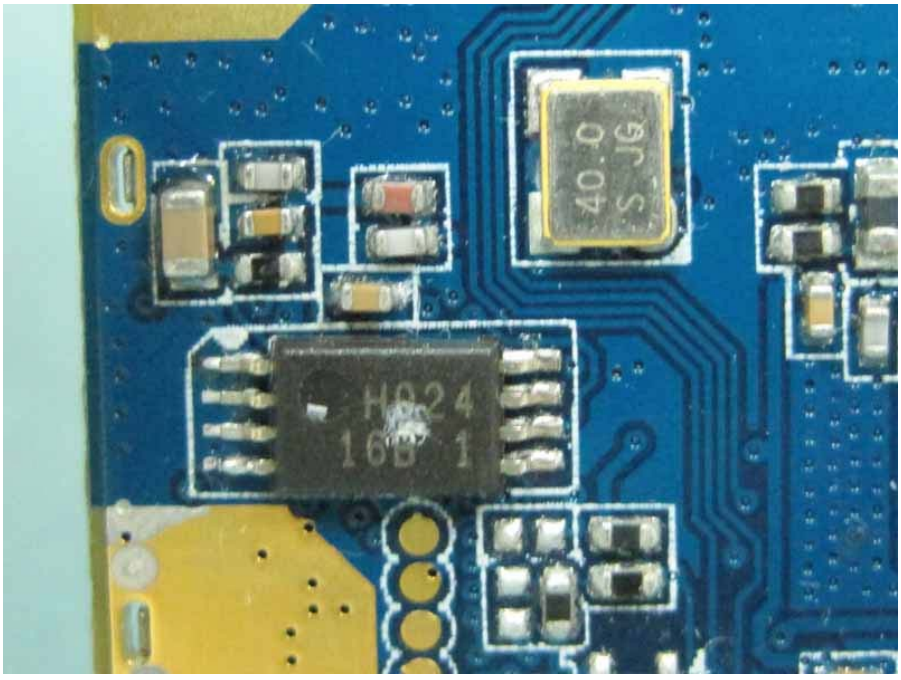
EUT 1.

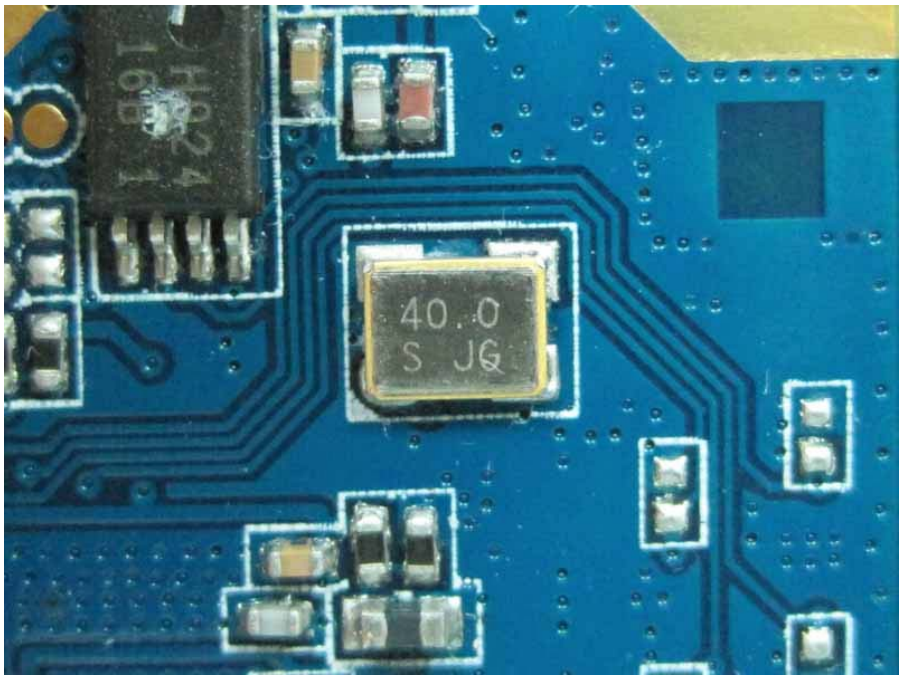
Two antenna connectors with two crystals


2XTL
50 40 30 20 10 mm
10 20 30 40 50 60 70 80


RT3090-V22ST
Ralink
RT3090L
P0M7657B0
0931AT
M-1 94V-0


SP
M-1 94V-0
26.000
W7
99
60

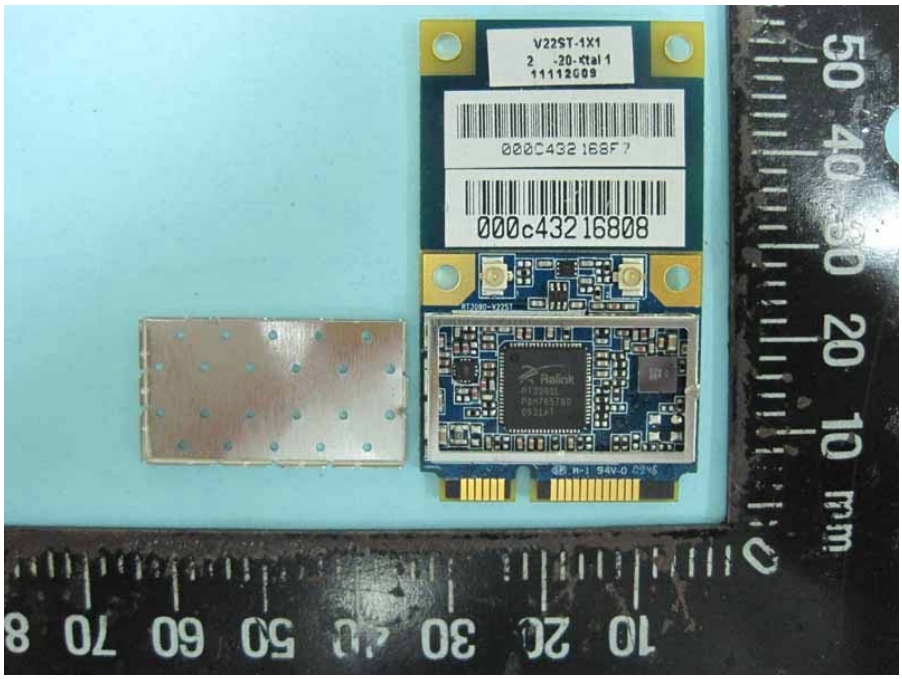

40.0
SJG

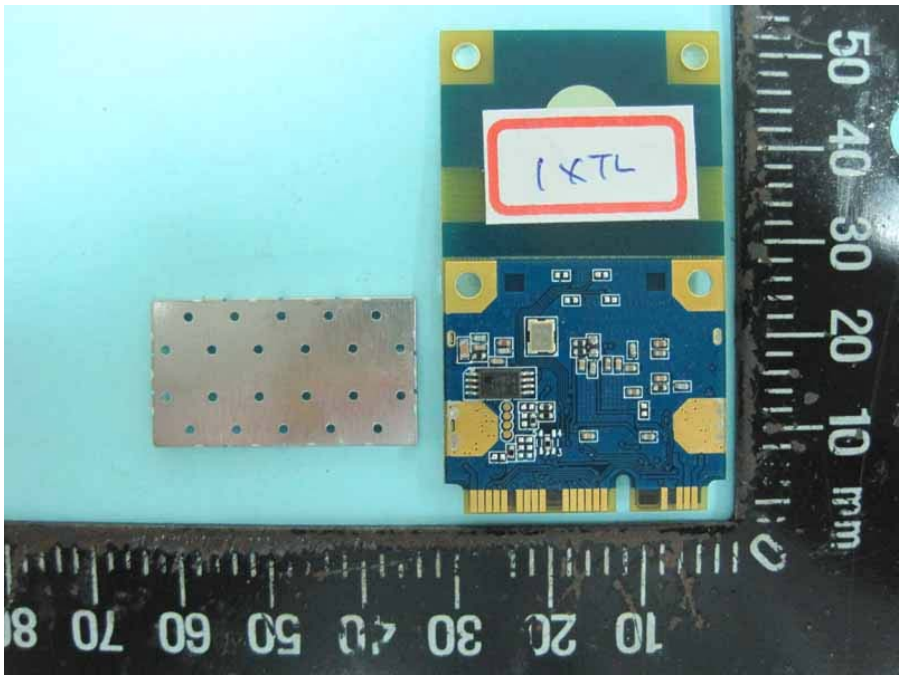

40.0
S JG

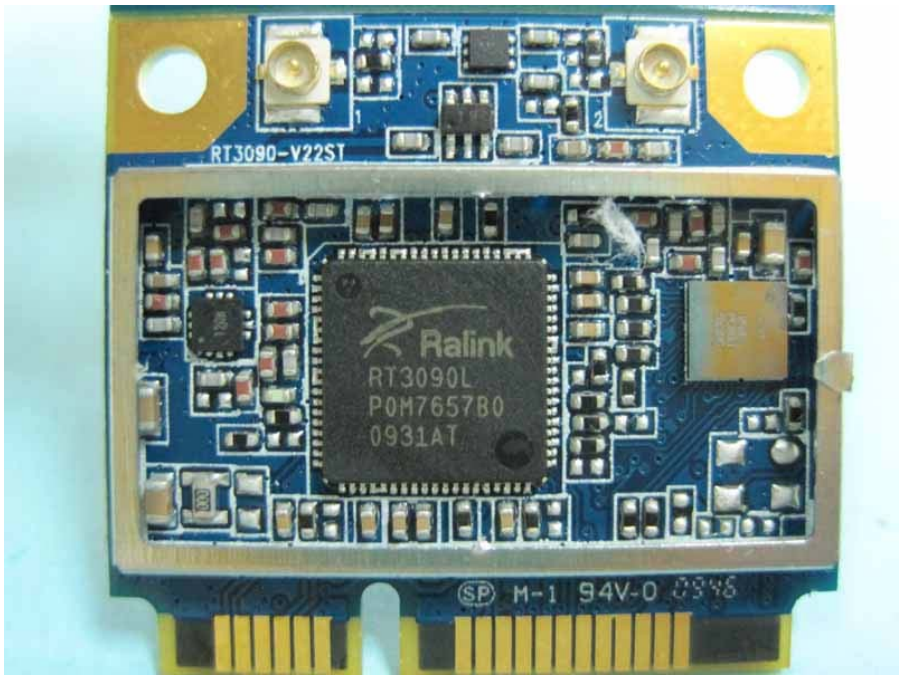

V22ST-1X1
7 -20-Xtal 2
11112009
000C432 169 10
000c43216821

EUT 2.

Two antenna connectors with one crystal



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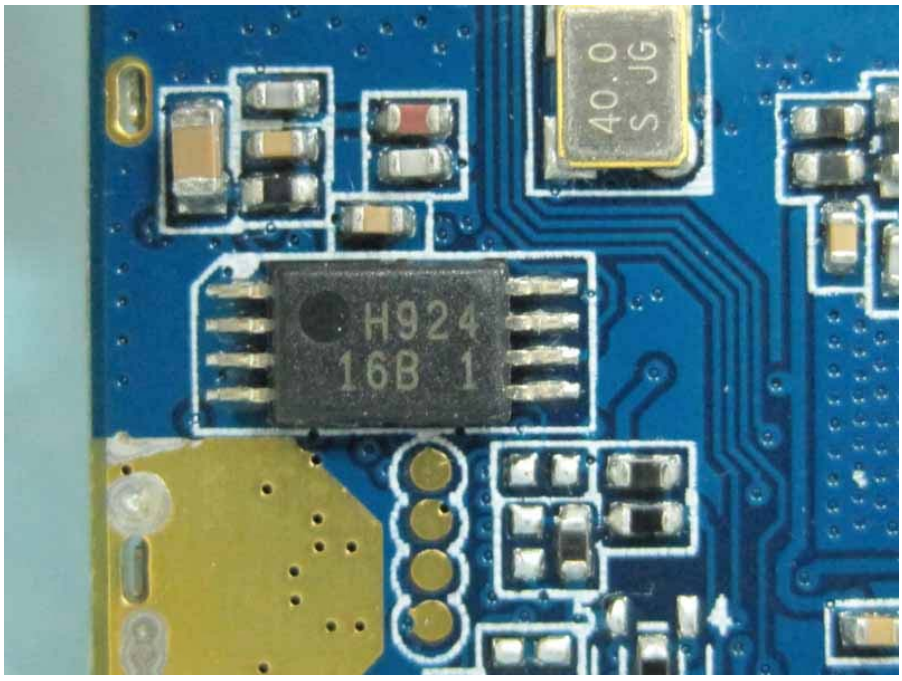
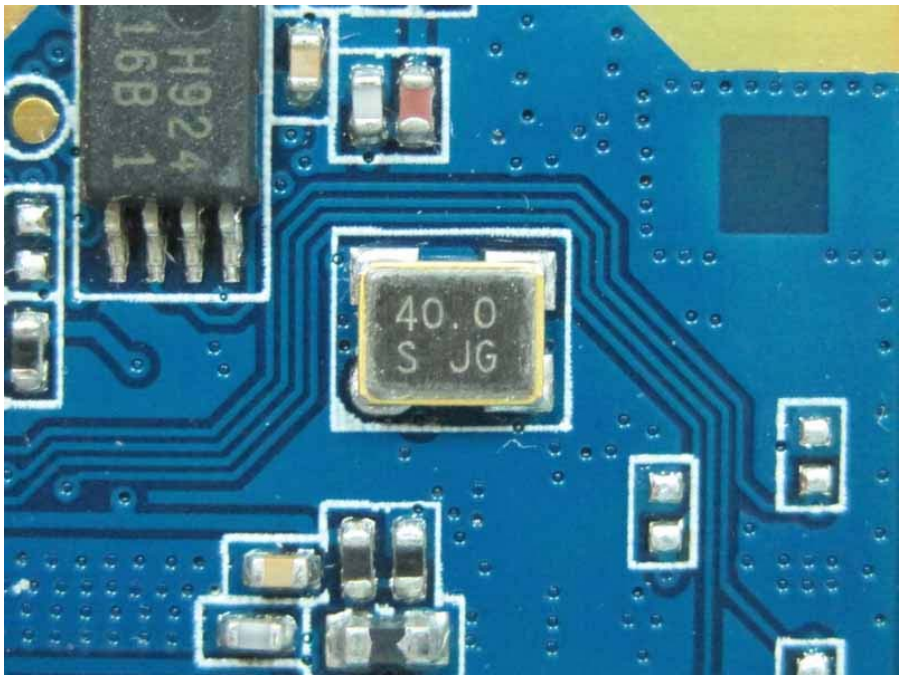
Ralink
RT3090L
P0M7657B0
0931AT
M-1 94V-0

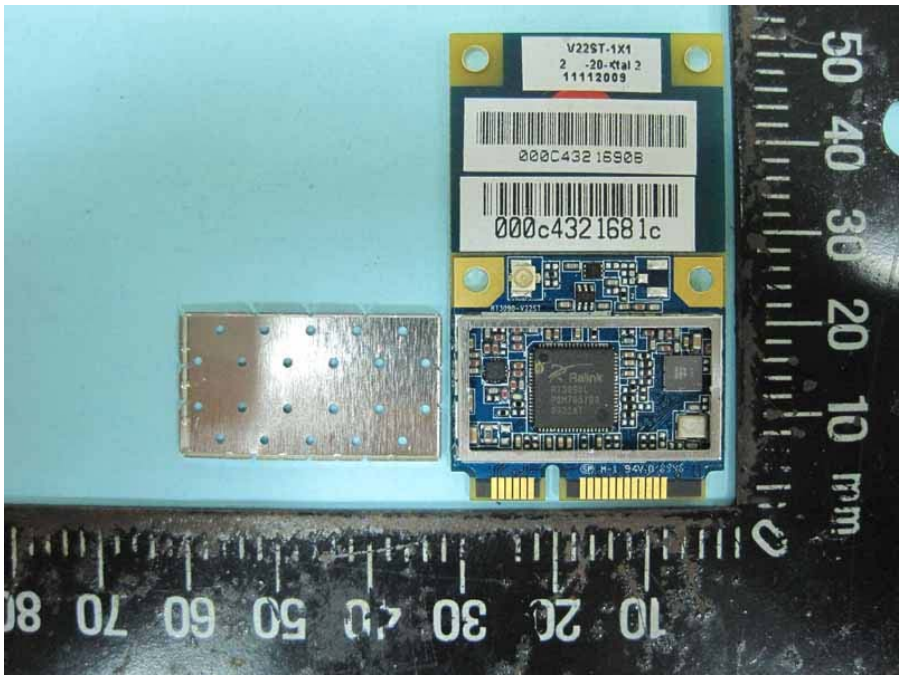

40.0
S JG
H924
16B 1

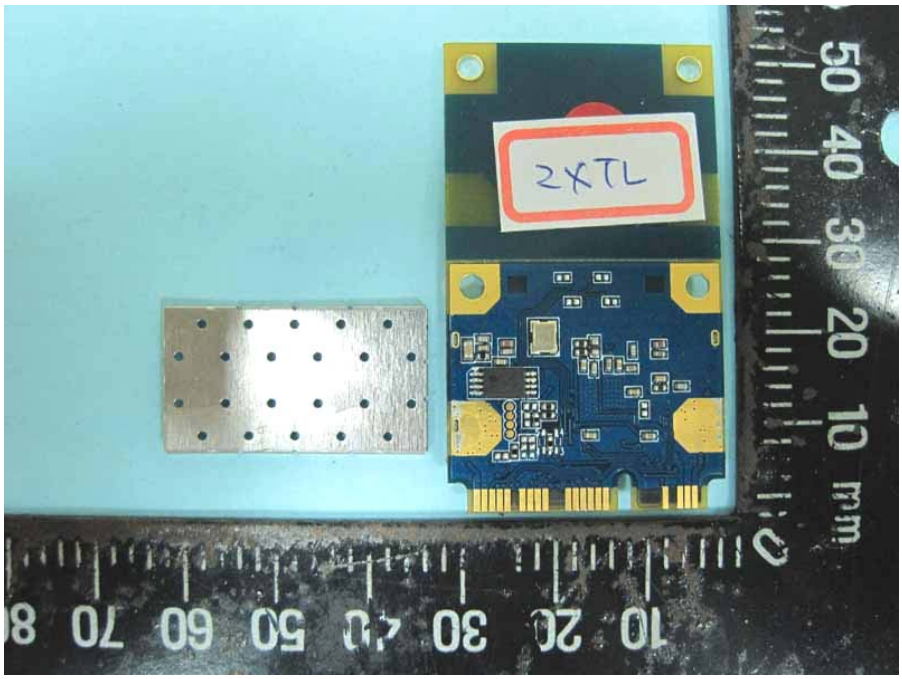

40.0
S JG

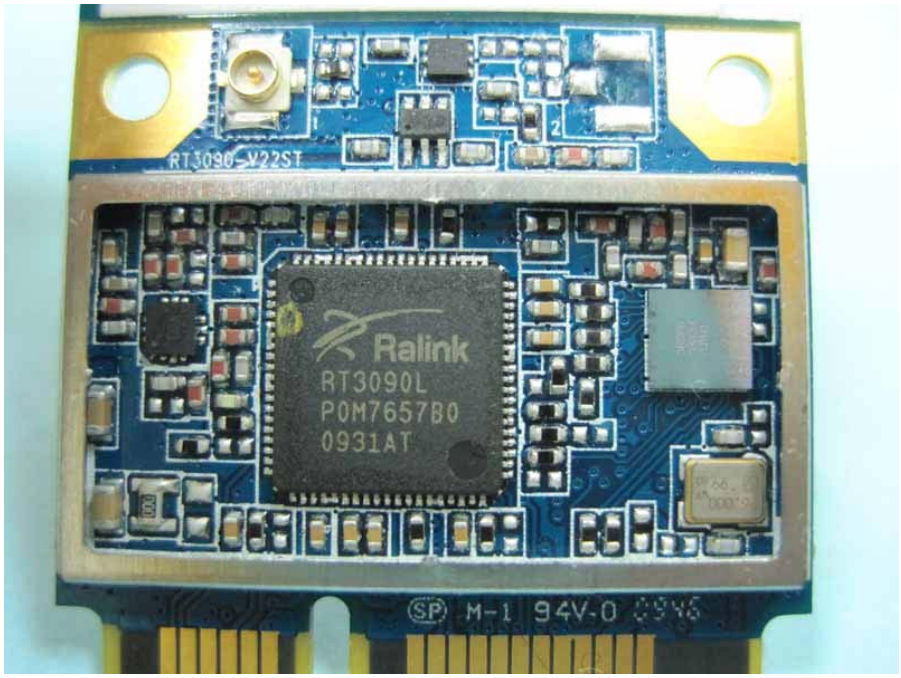

V22ST-1X1
11112009
000C432168F7
000c43216808

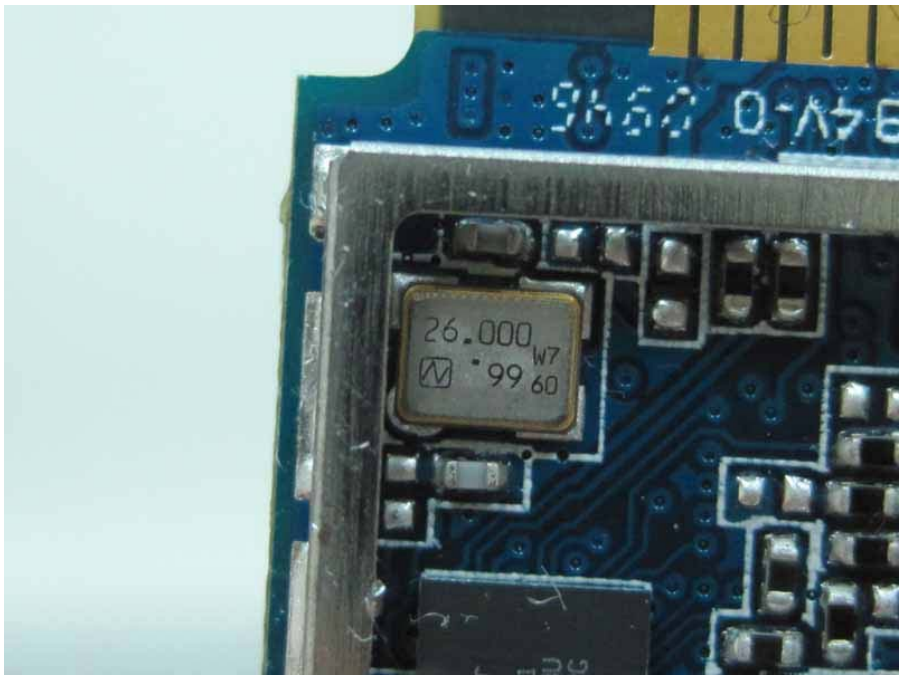
EUT 3.

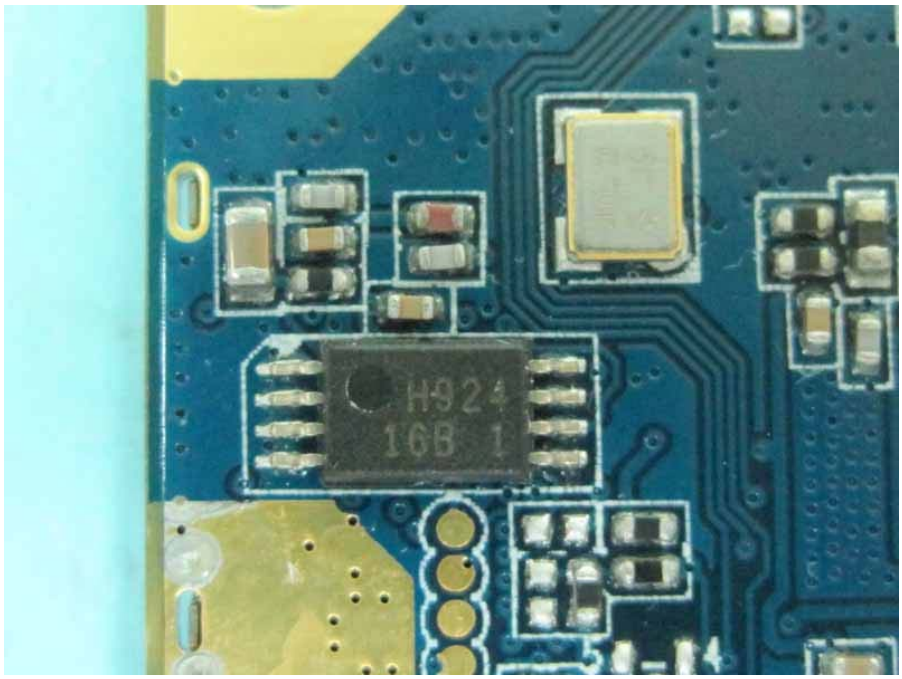
One antenna connector with two crystals

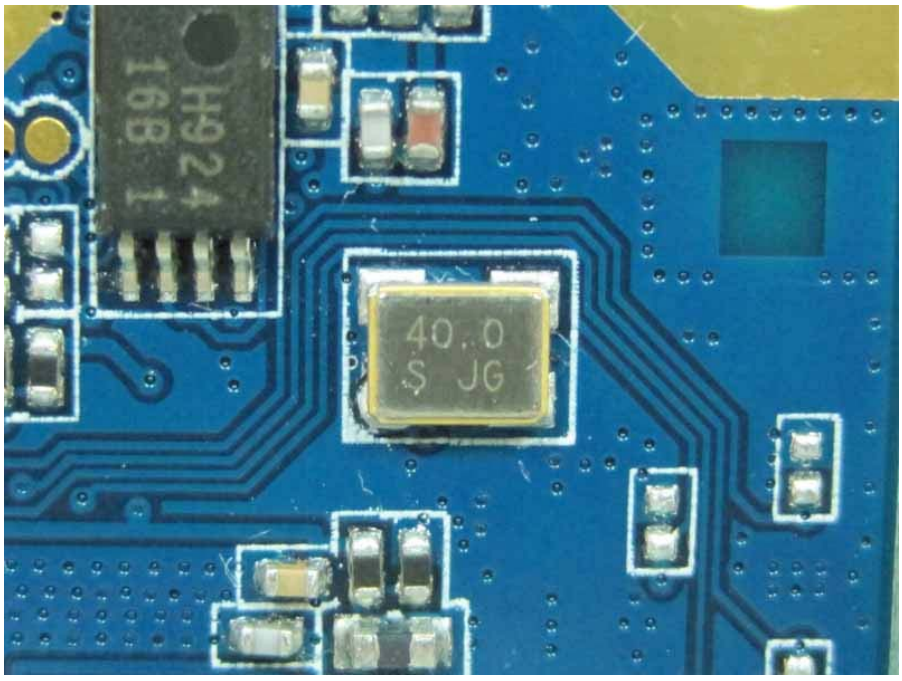





RT3090-V22ST
Ralink
RT3090L
P0M7657B0
0931AT
M-1 94V-0


26.000
W7
99 60

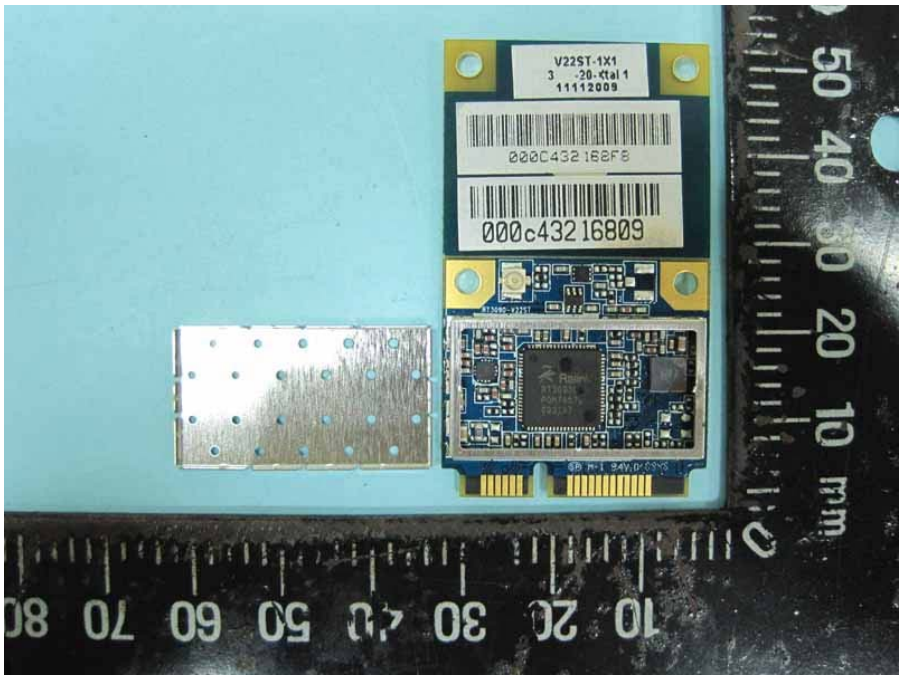


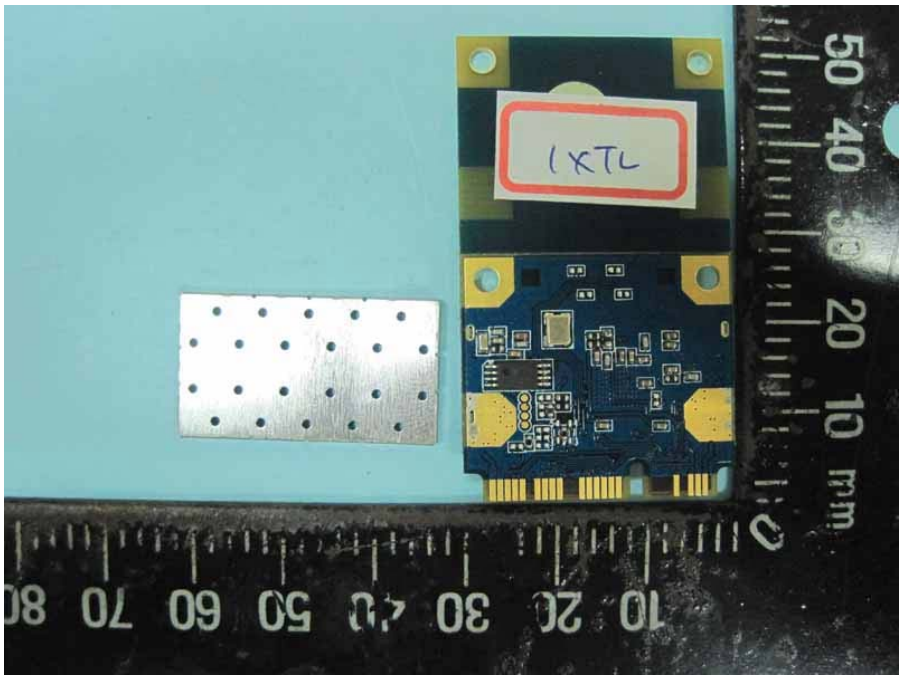


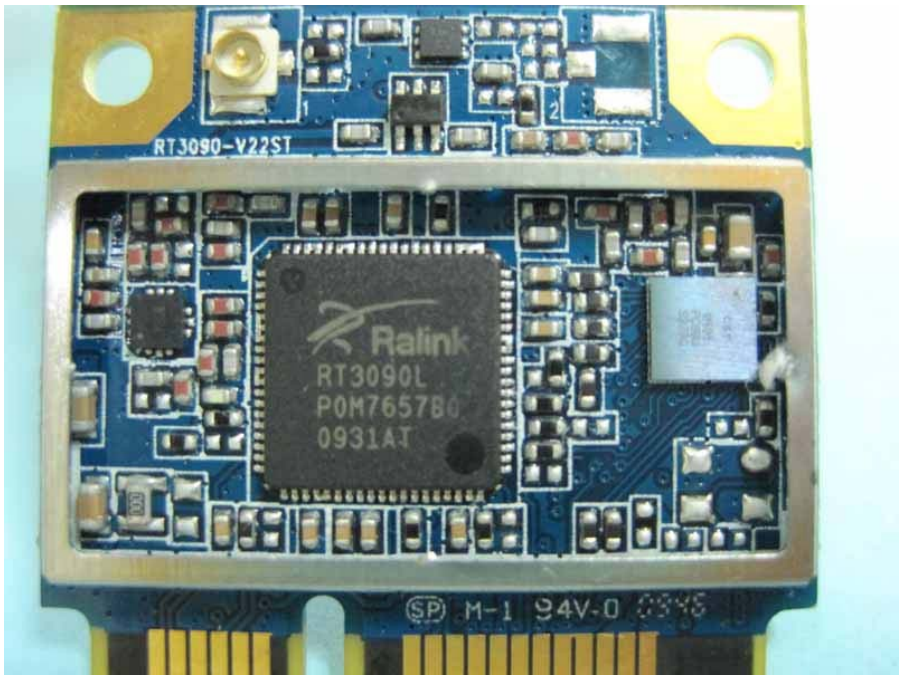
SPORTON International Inc.
TEL : 886-2-2696-2468
FAX : 886-2-2696-2255

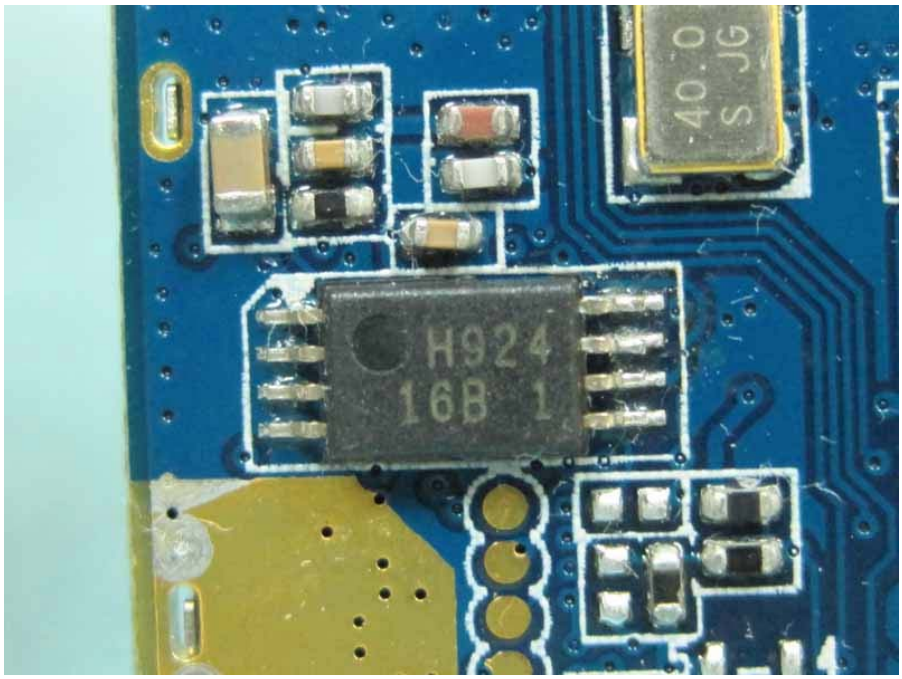
EUT 4.

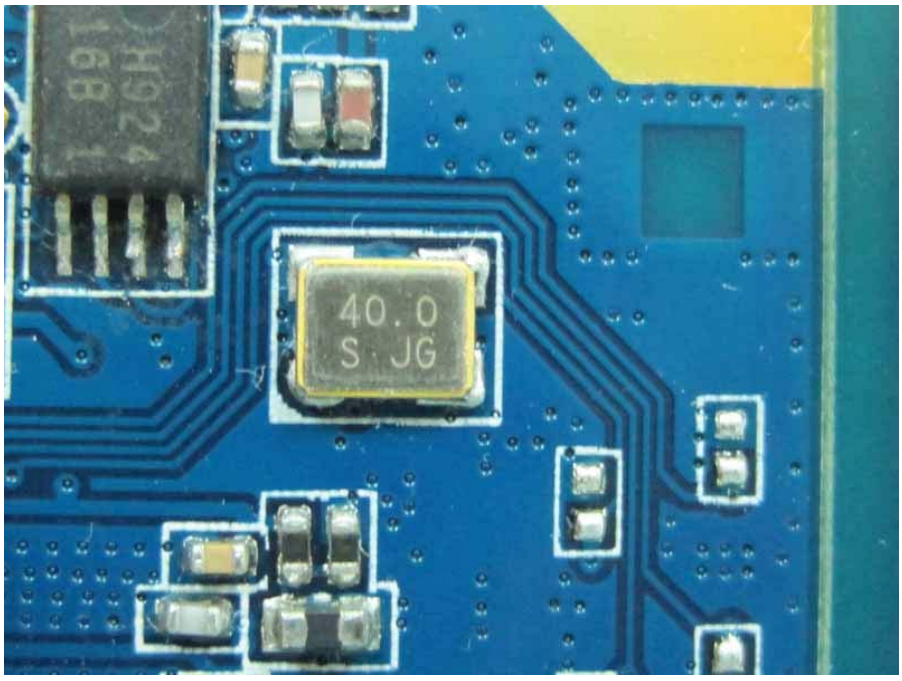
One antenna connector with one crystal




IXTL
50
40
30
20
10
mm
10
20
30
40
50
60
70
80


RT3090-V22ST
Ralink
RT3090L
P0M765780
0931AT
M-1 94V-0





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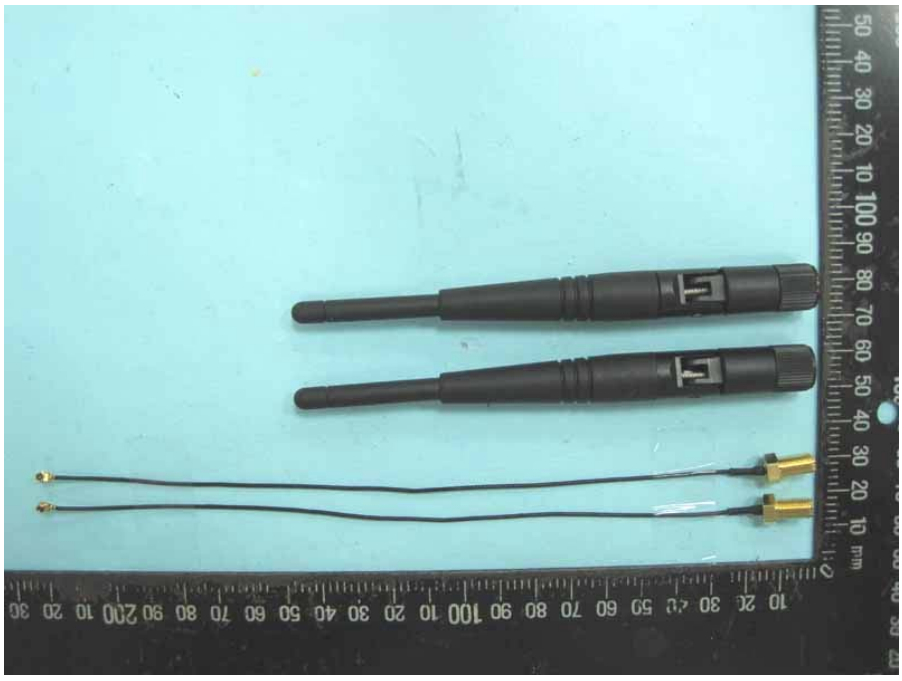
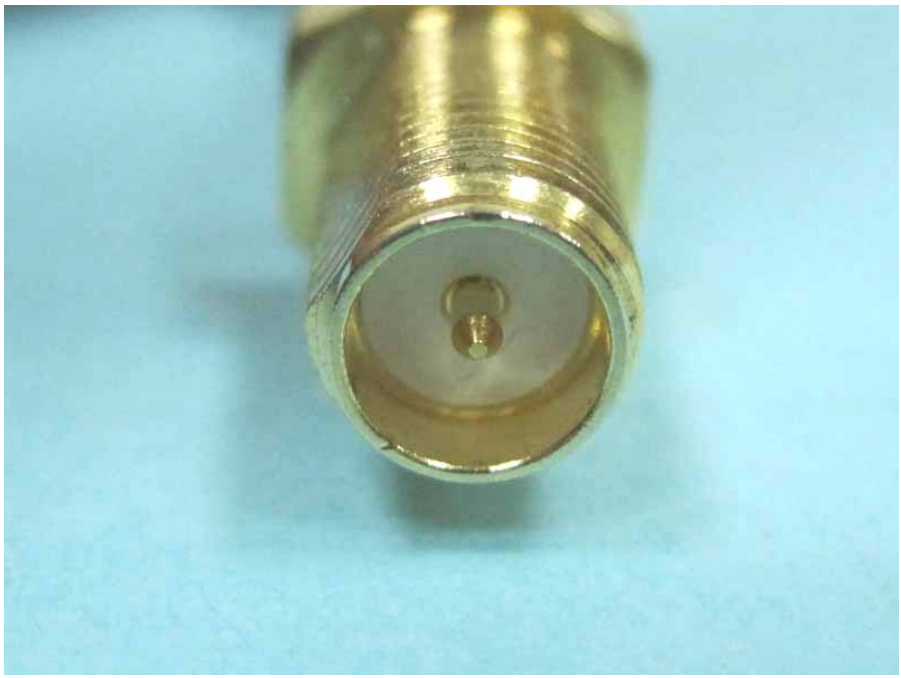
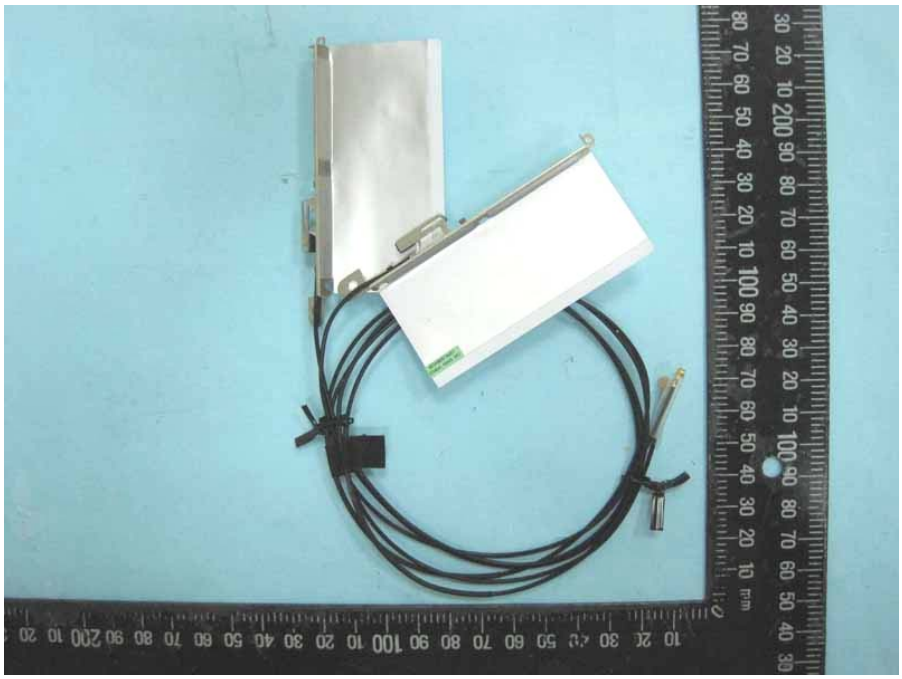
TEL : 886-2-2696-2468
FAX : 886-2-2696-2255

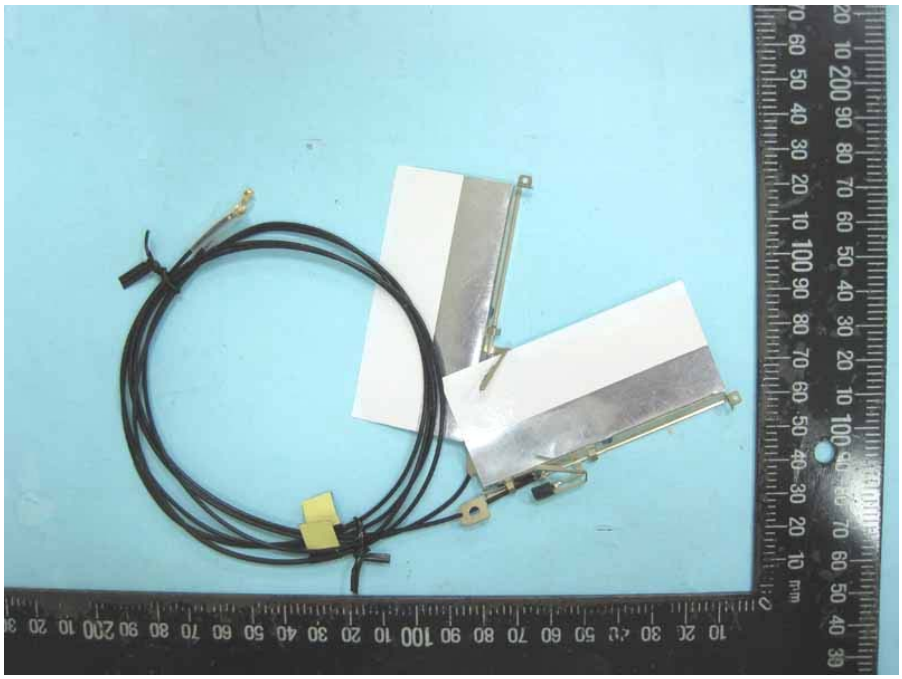
Antenna A



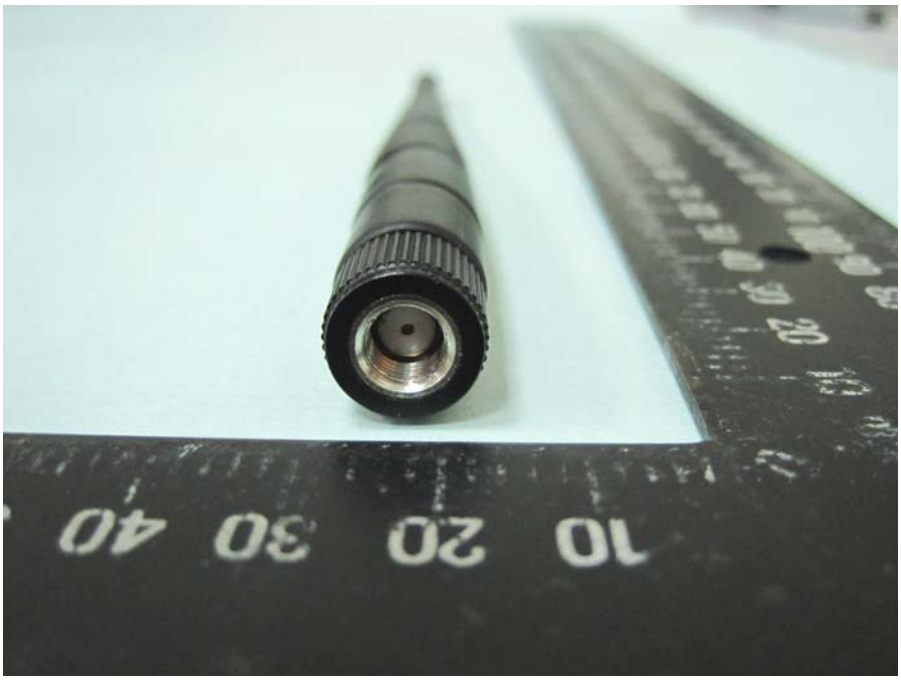


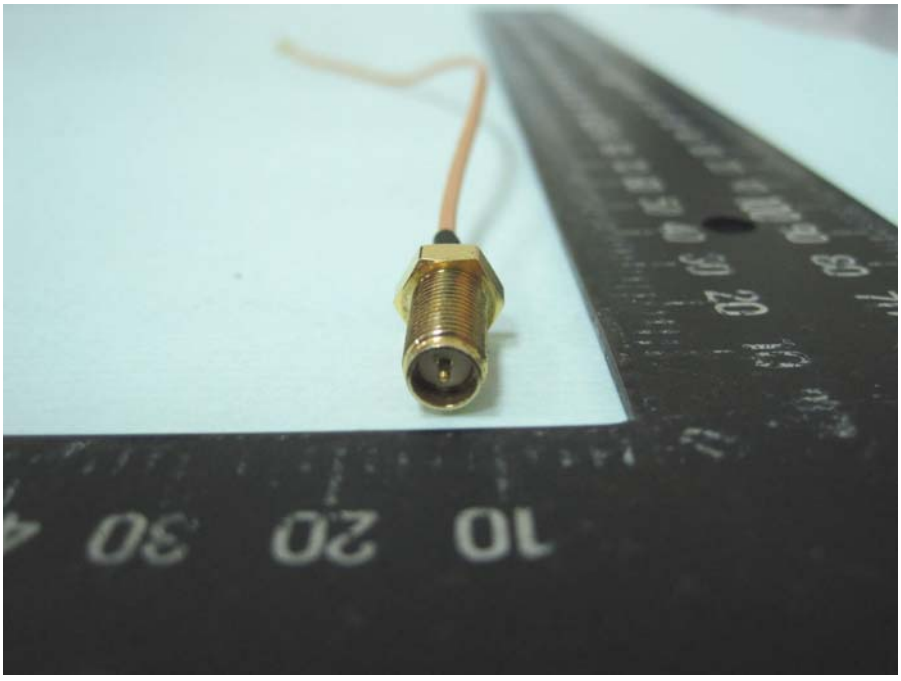
Antenna B



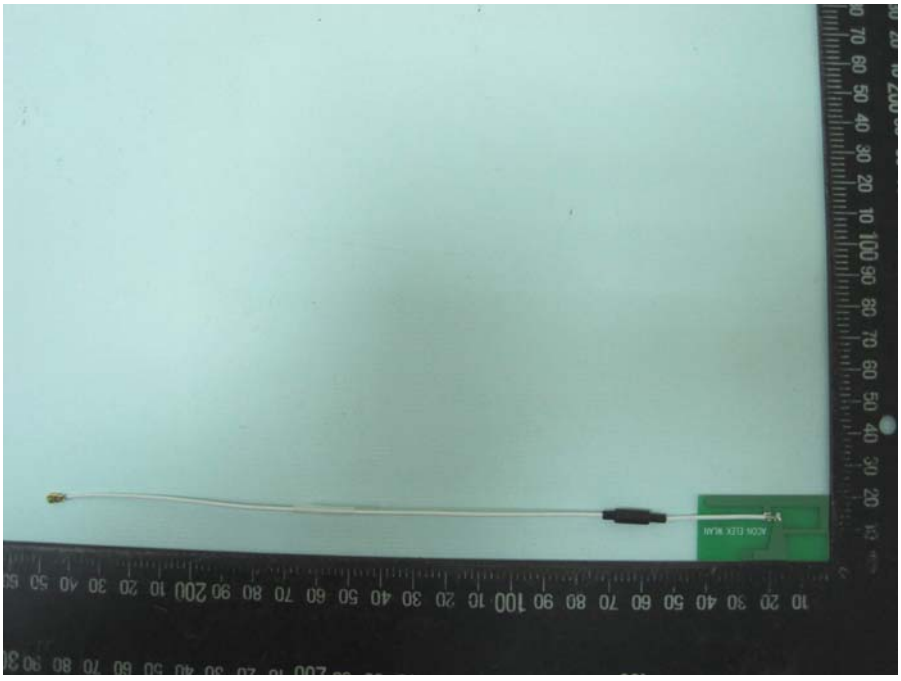


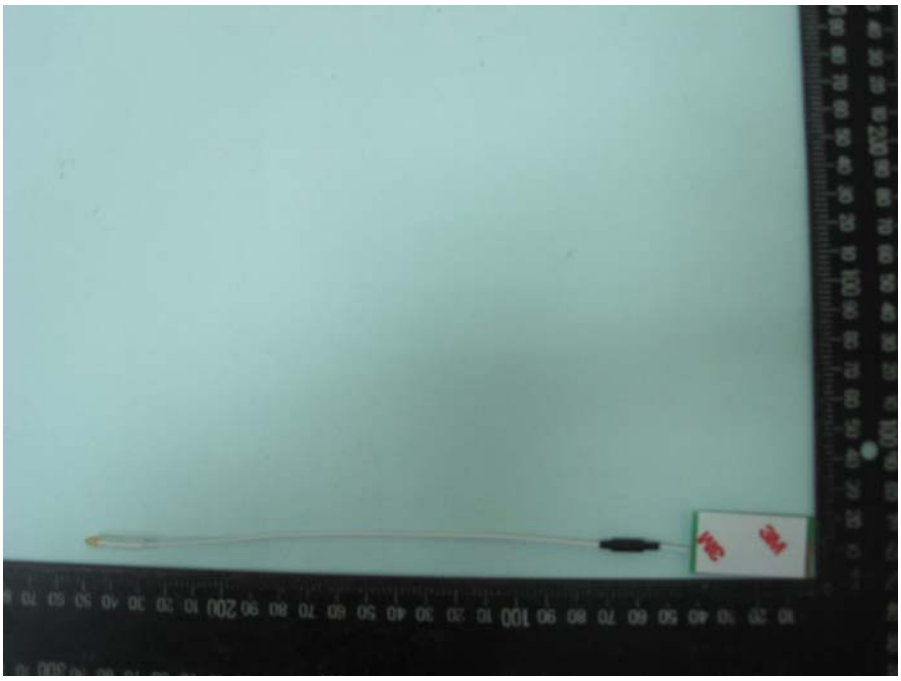
Antenna C


10 20 30 40


10 20 30

Antenna D





Appendix B. Test Photos

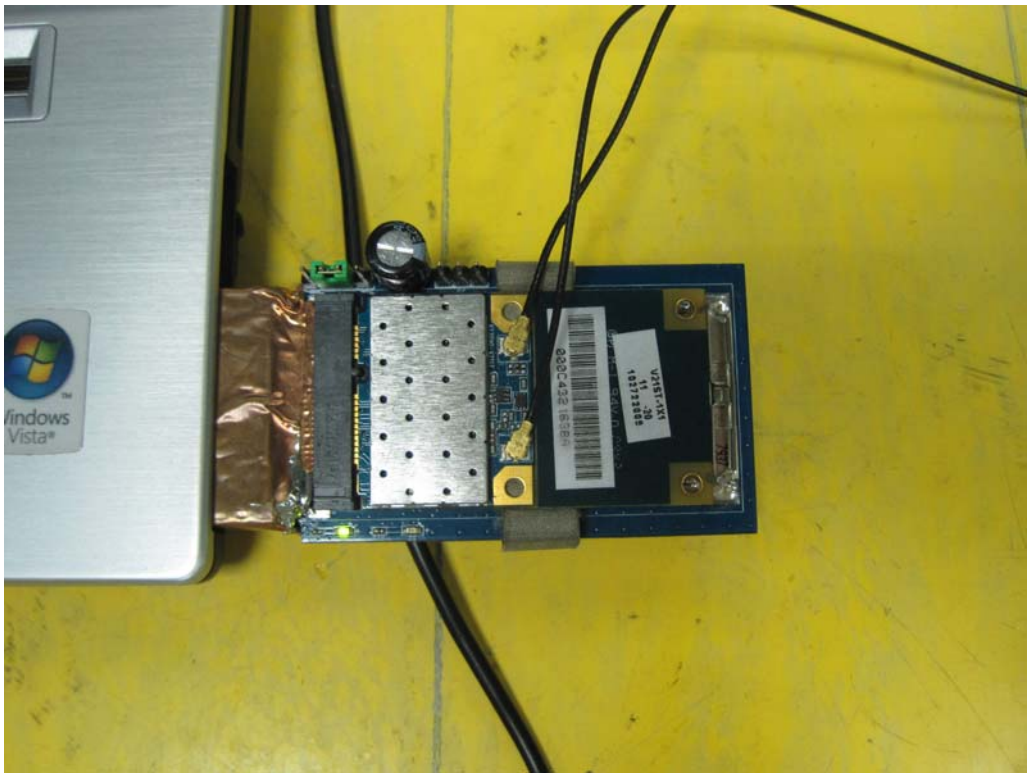
1. Photographs of Conducted Emissions Test Configuration

Test Mode: Mode 1

FRONT VIEW

REAR VIEW

SIDE VIEW



Test Mode: Mode 2

FRONT VIEW

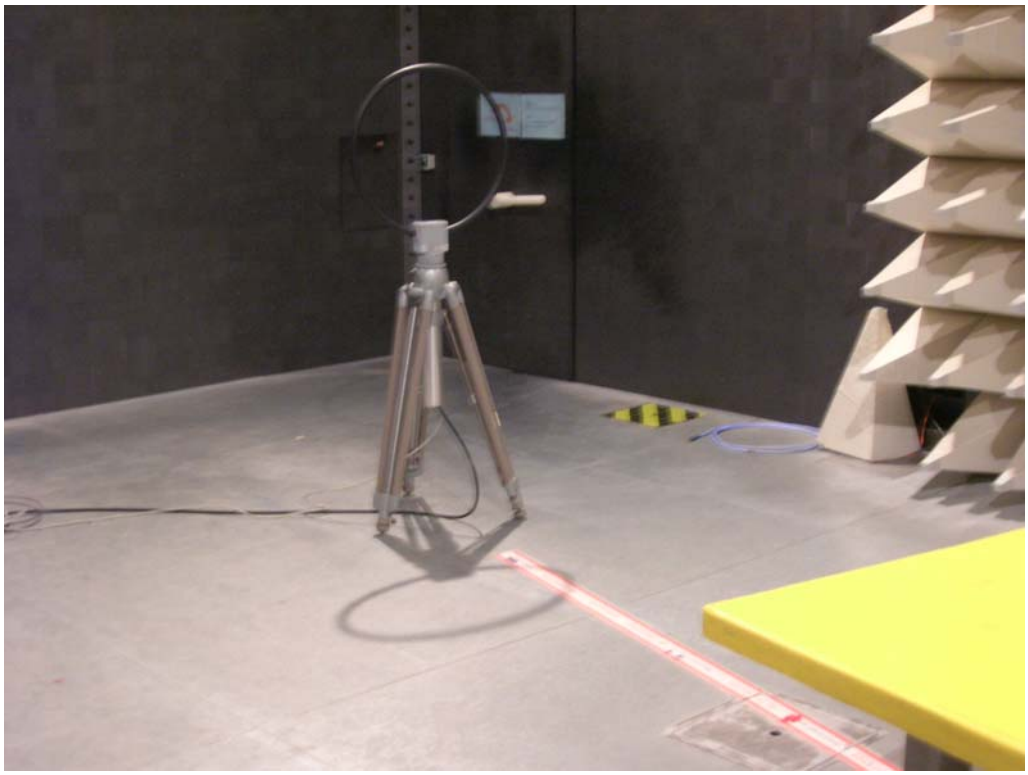
REAR VIEW

SIDE VIEW

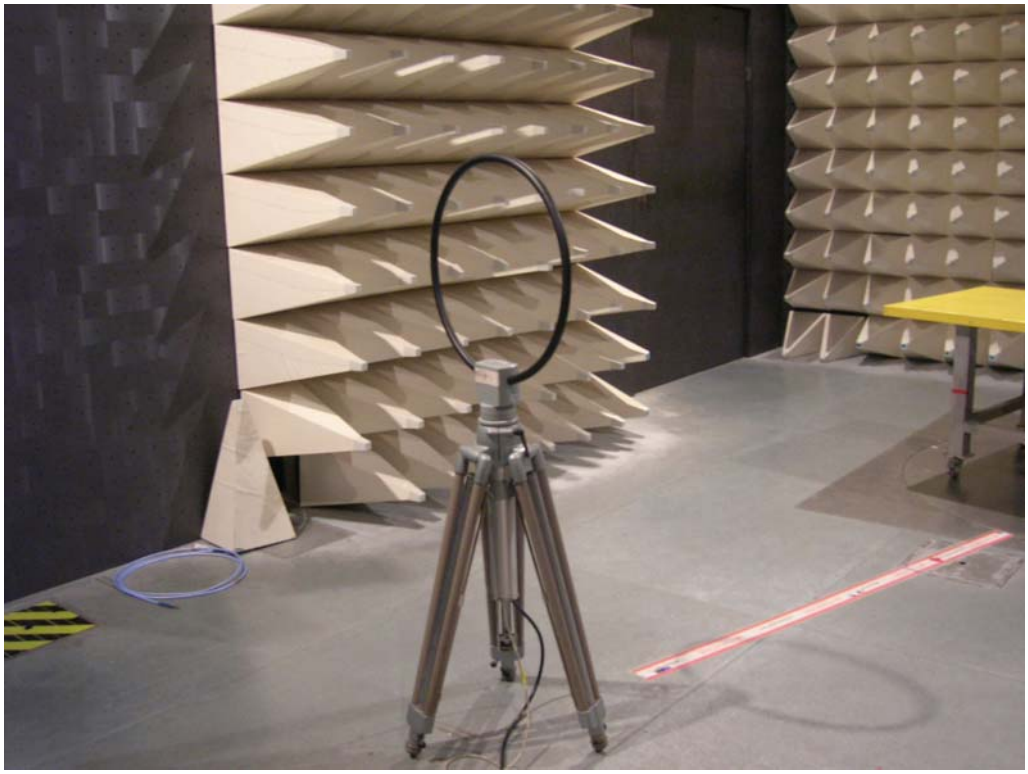
2. Photographs of Radiated Emissions Test Configuration

9kHz ~30MHz

FRONT VIEW



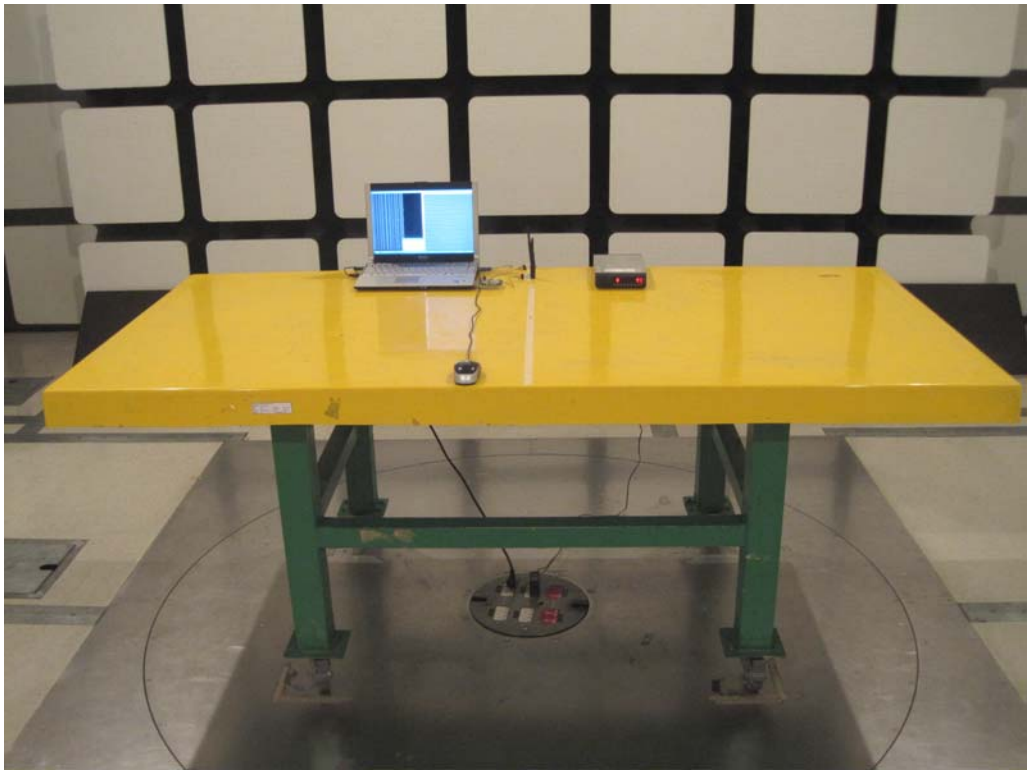
REAR VIEW



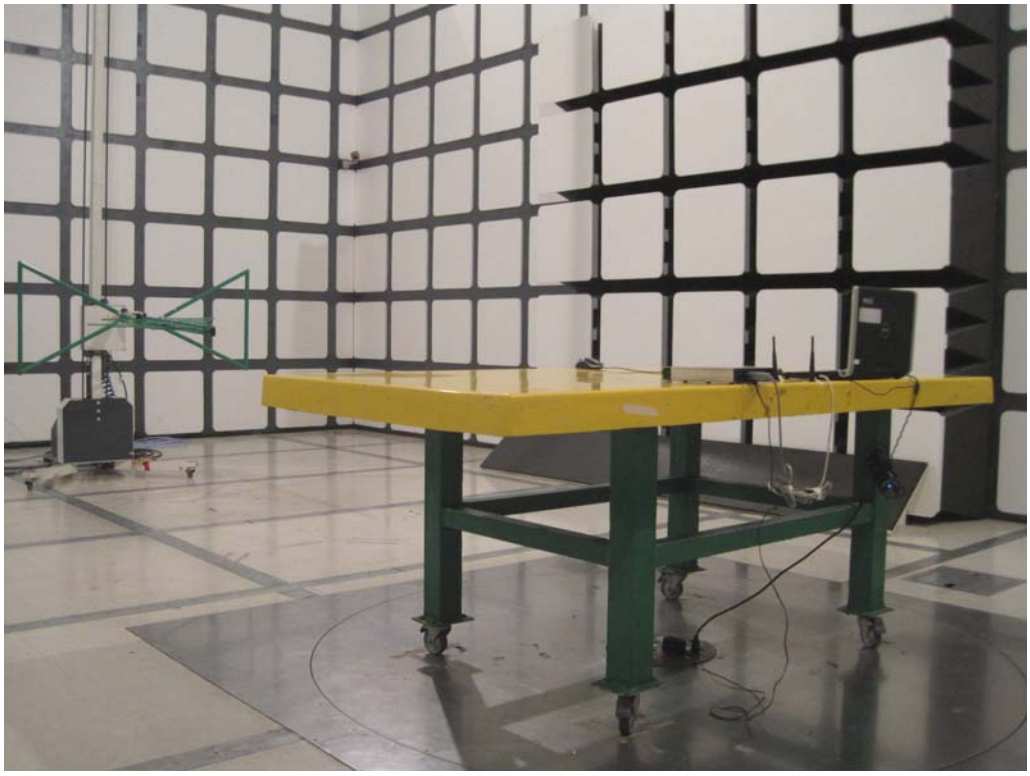
30MHz~1GHz

Test Mode: Mode 1

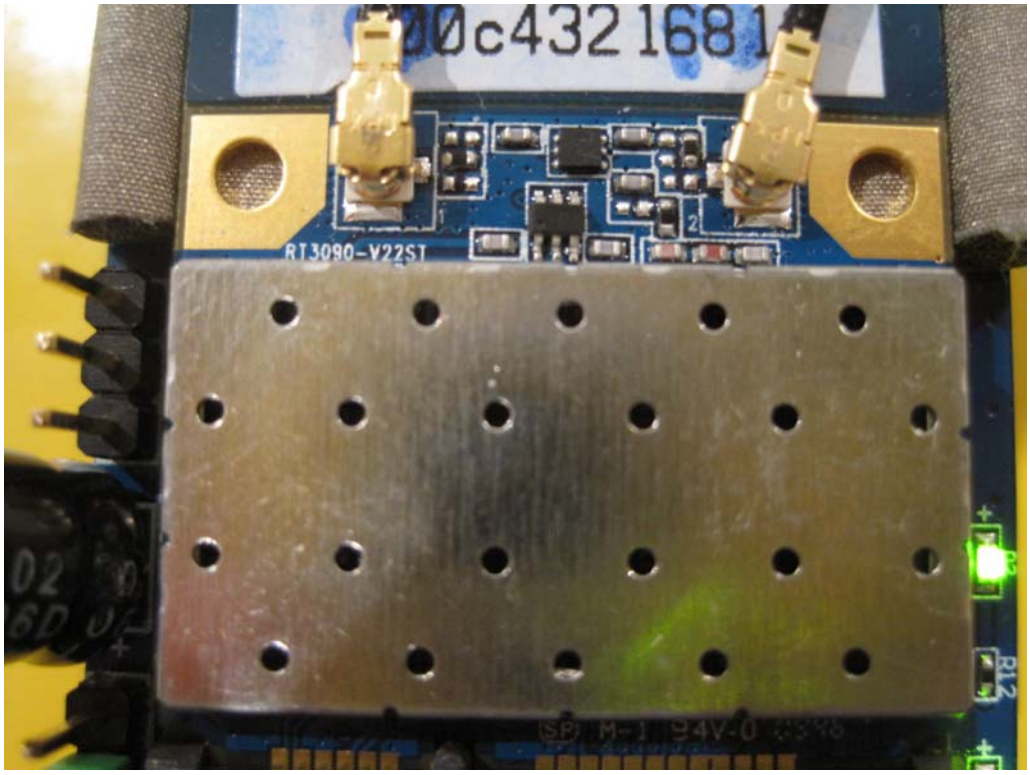
FRONT VIEW



REAR VIEW

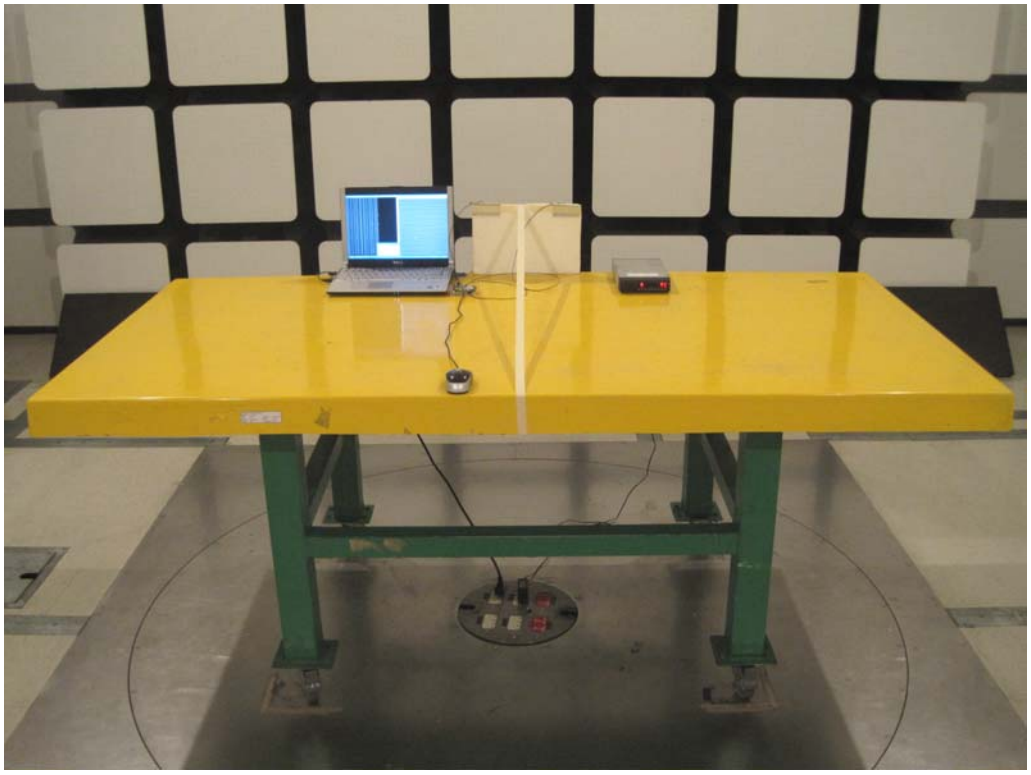


SIDE VIEW

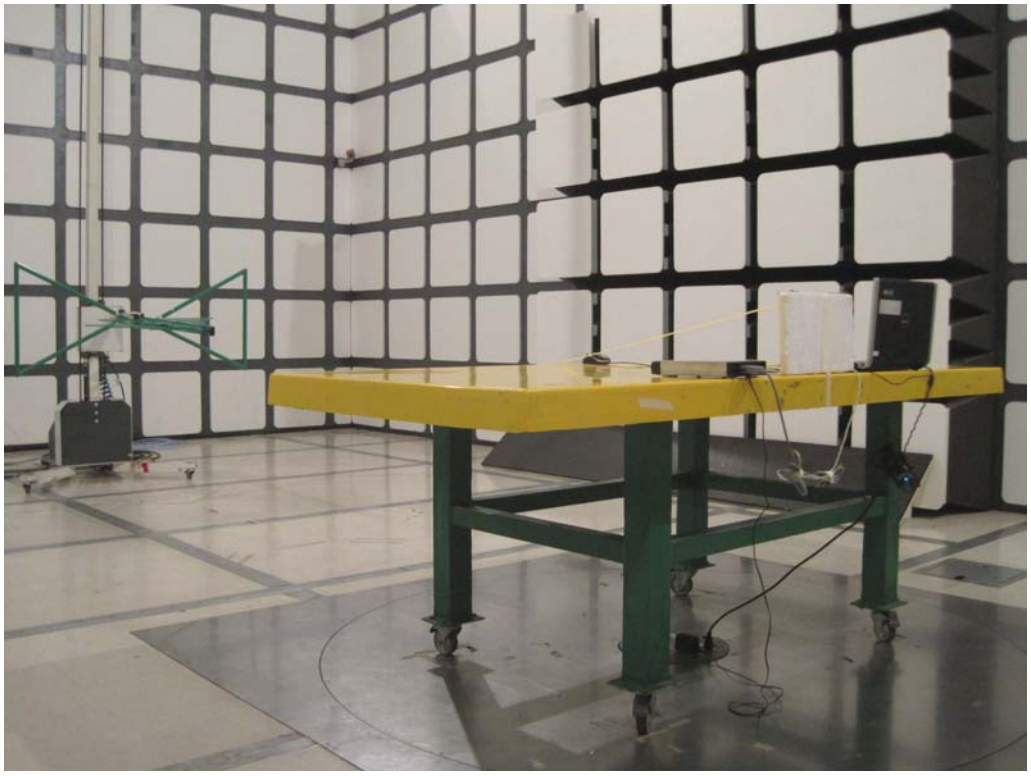


Test Mode: Mode 2

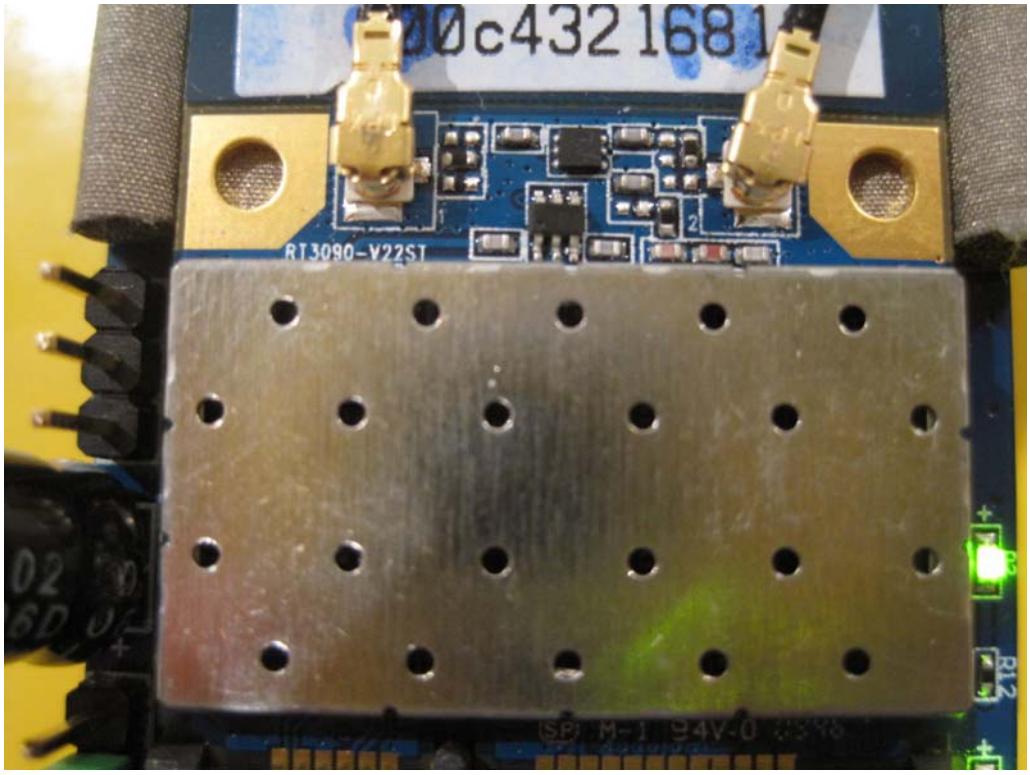
FRONT VIEW



REAR VIEW



SIDE VIEW

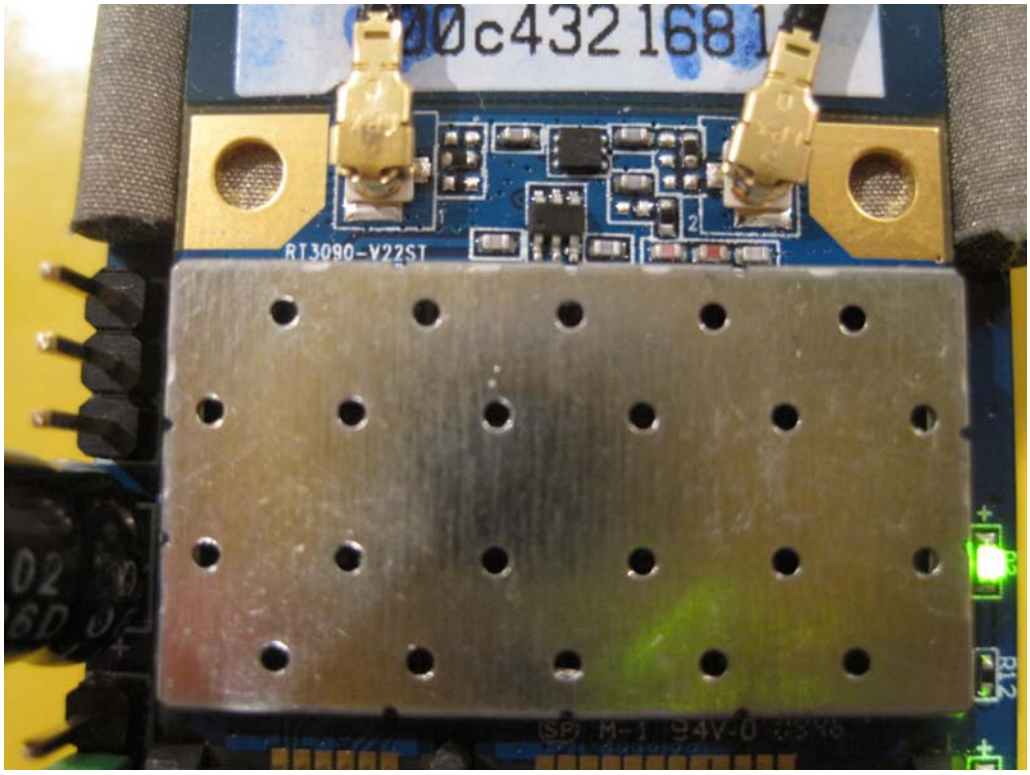


Test Mode: Mode 3

FRONT VIEW

REAR VIEW

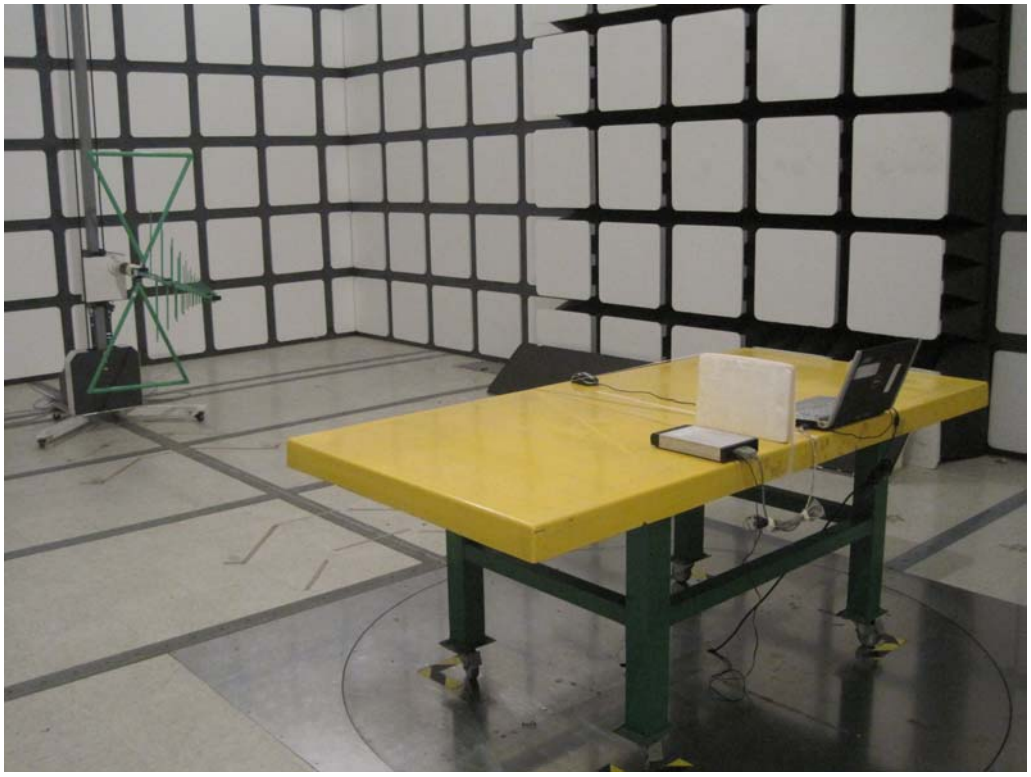
SIDE VIEW



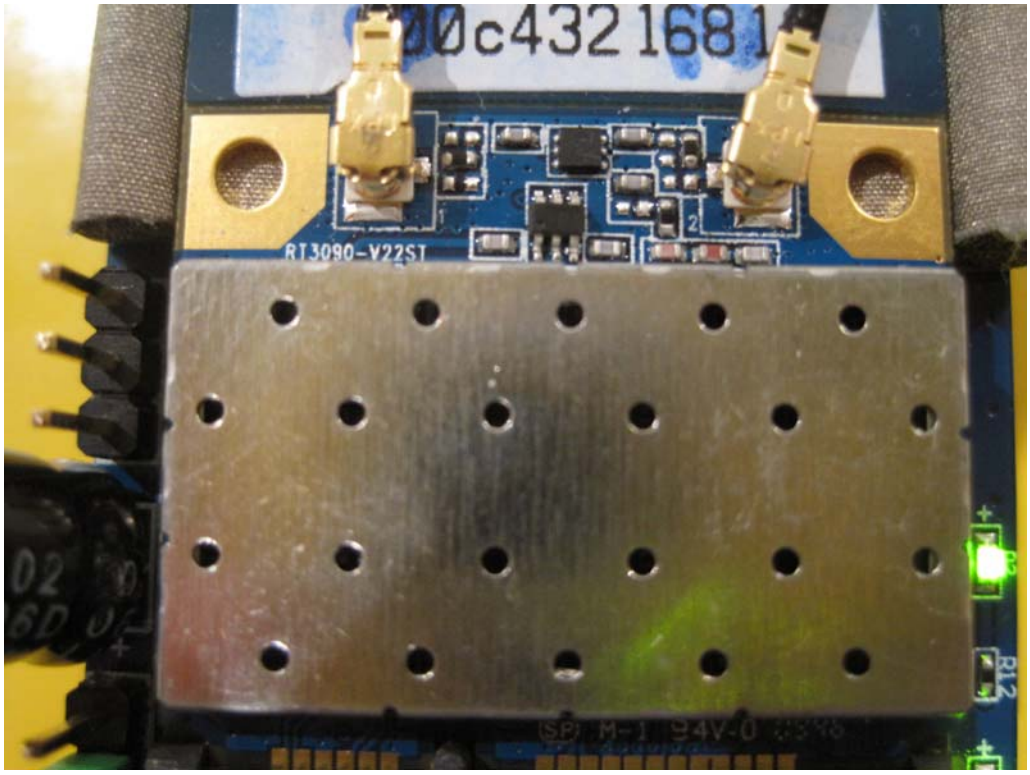
Test Mode: Mode 4

FRONT VIEW

REAR VIEW



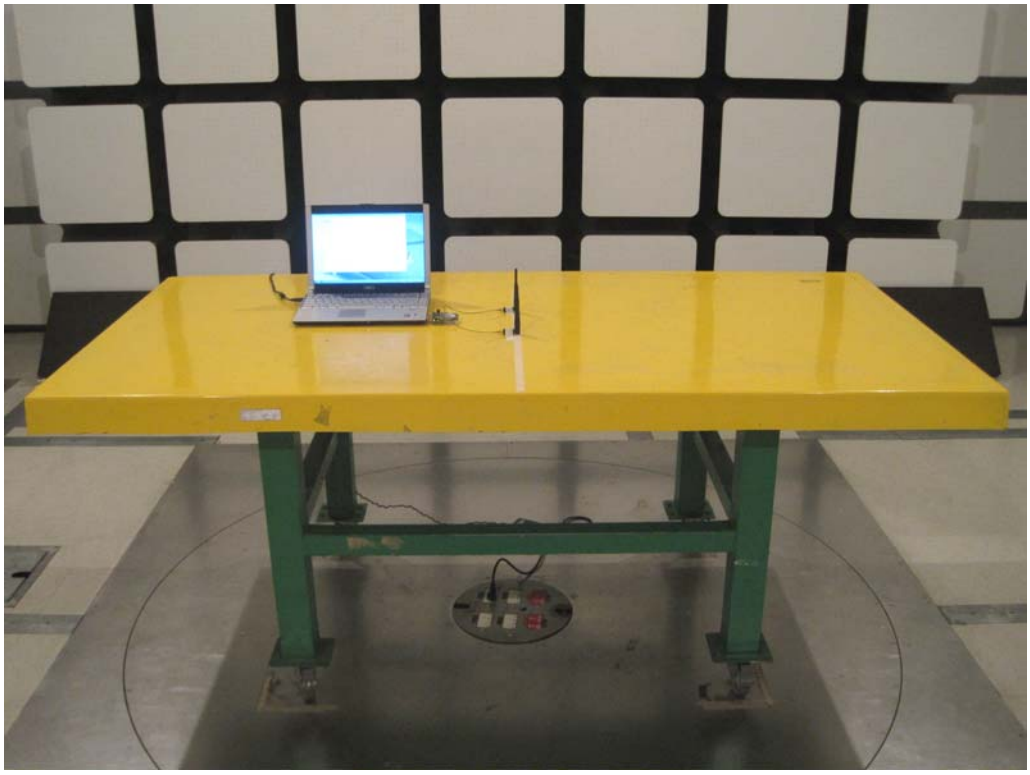
SIDE VIEW



Above 1GHz

Test Mode: Mode 1

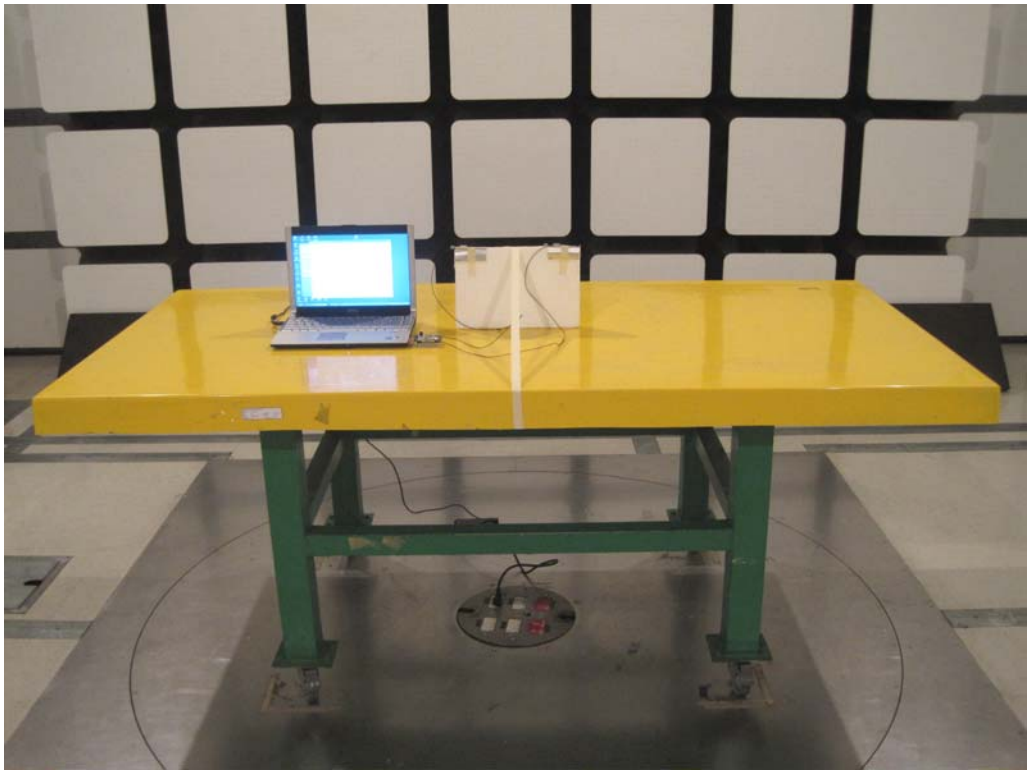
FRONT VIEW



REAR VIEW

Test Mode: Mode 2

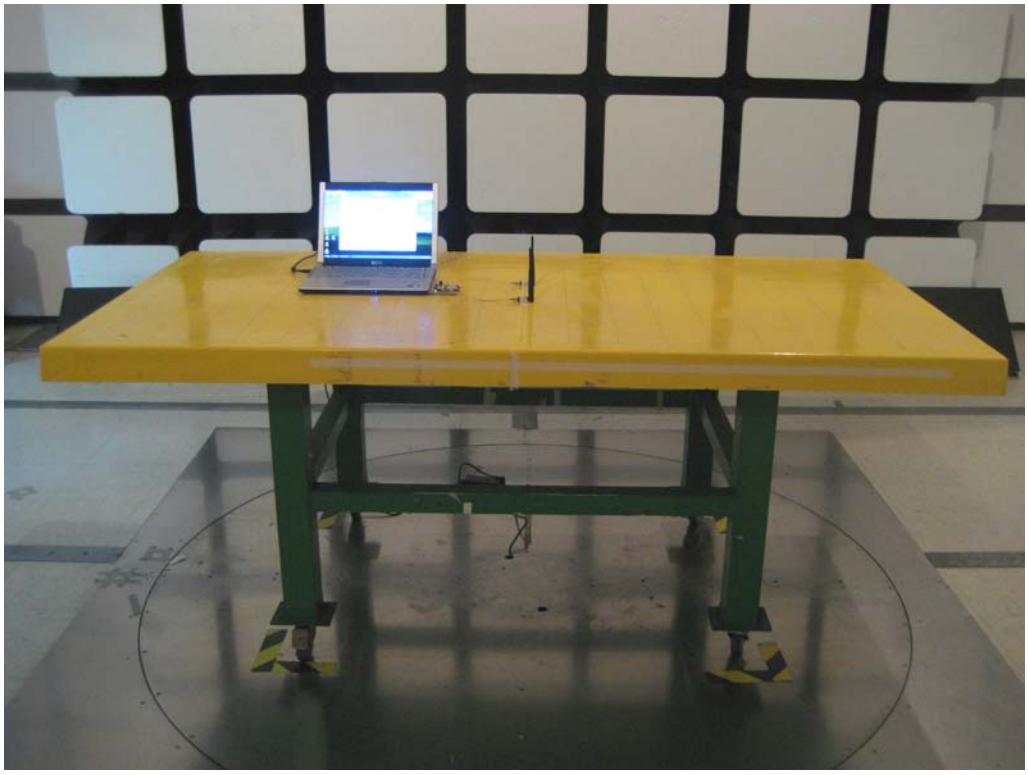
FRONT VIEW



REAR VIEW

Test Mode: Mode 3

FRONT VIEW



REAR VIEW

Test Mode: Mode 4

FRONT VIEW

REAR VIEW

Appendix C. Maximum Permissible Exposure

1. Maximum Permissible Exposure

1.1. Applicable Standard

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 0.25 m normally can be maintained between the user and the device.

(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/ cm²)	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/ cm²)	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

1.2. MPE Calculation Method

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

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.

1.3. Calculated Result and Limit

<For Antenna A>:

For Bluetooth Function

Max Peak Output Power: 4.52 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
2.93	1.9634	4.5200	2.8314	0.001106	1	Complies

For WLAN Function:

Max Peak Output Power: 21.68 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
2.93	1.9634	21.6800	147.2313	0.057537	1	Complies

CONCULSION:

Both of the WLAN and Bluetooth can transmit simultaneously, the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.001106 / 1 + 0.057537 / 1 = 0.058643, which isless than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

<For Antenna B>:

For Bluetooth Function

Max Peak Output Power: 4.52 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
2.95	1.9724	4.5200	2.8314	0.001112	1	Complies

For WLAN Function:

Max Peak Output Power: 21.93 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
2.95	1.9724	21.9300	155.9553	0.061228	1	Complies

CONCULSION:

Both of the WLAN and Bluetooth can transmit simultaneously, the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.001112 / 1 + 0.061228 / 1 = 0.06234, which isless than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

<For Antenna C>:

For Bluetooth Function

Max Peak Output Power: 4.52 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
3.7	2.3442	4.5200	2.8314	0.001321	1	Complies

For WLAN Function:

Max Peak Output Power: 21.68 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
3.7	2.3442	21.6800	147.2313	0.068699	1	Complies

CONCULSION:

Both of the WLAN and Bluetooth can transmit simultaneously, the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.001321 / 1 + 0.068699 / 1 = 0.07002, which isless than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

<For Antenna D>:

For Bluetooth Function

Max Peak Output Power: 4.52 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
3.5	2.2387	4.5200	2.8314	0.001262	1	Complies

For WLAN Function:

Max Peak Output Power: 21.93 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
3.5	2.2387	21.9300	155.9553	0.069494	1	Complies

CONCULSION:

Both of the WLAN and Bluetooth can transmit simultaneously, the formula of calculatedthe MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.001262 / 1 + 0.069494 / 1 = 0.070756, which isless than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

Appendix D. Antenna List

Table for Filed Antenna

Item	Note		Antenna		
			Brand	P/N	Gain with cable loss (Peak)
1	Dipole	Main and Aux.(cable loss 0.5dB)	Micon	71306	2.93
2	PIFA	Main and Aux. for 2 connector	MICHIGAN	Main Antenna: 6036B0014401 Aux Antenna: 6036B0016901	Main: 2.95 Aux.: 2.95
3	PIFA	TX and RX	FAVORTRON	TX: W870CU K05007009701 RX: W870CU K05007009801	TX: 1.66 RX: 0.53
4	PIFA	TX1 and RX 2	FAVORTRON	W860CU N01001146001	TX1: 1.23 RX 2: 2.08
5	PIFA	TX1 and RX 2	Well Green	W830T SK840WMPB01+B	TX1: 1.39 RX2: 1.88
6	PIFA	TX1 and RX 2	FAVORTRON	TX1: W760TUN N01001136001 RX2: W760TUN N01001137001	TX1: 2.70 RX2: 2.48
7	PIFA	TX1 and RX 2	Well Green	R130T SKR13WMPB01+A	TX1: 0.92 RX2: 0.41
8	PIFA	Main and Aux.	Well Green	C4800_WM-1	2.6
9	PIFA	Main and Aux.	Well Green	C4500 WM-1	2.46
10	PIFA	Main and Aux.	Well Green	C4500 WM-2	2.91
11	PIFA	TX1 and RX 2	VSO	C4500 821 103 01211150	TX1: 1.22 RX2: -0.23
12	PIFA	Main and Aux.	Well Green	6-23-7M815-011	0.78
13	Dipole	Main and Aux.(cable loss 0.3dB)	Joymax	IWX-145XRSXX-999	3.7
14	PIFA	Main and Aux.	ACON	APP6P-700119	3.5

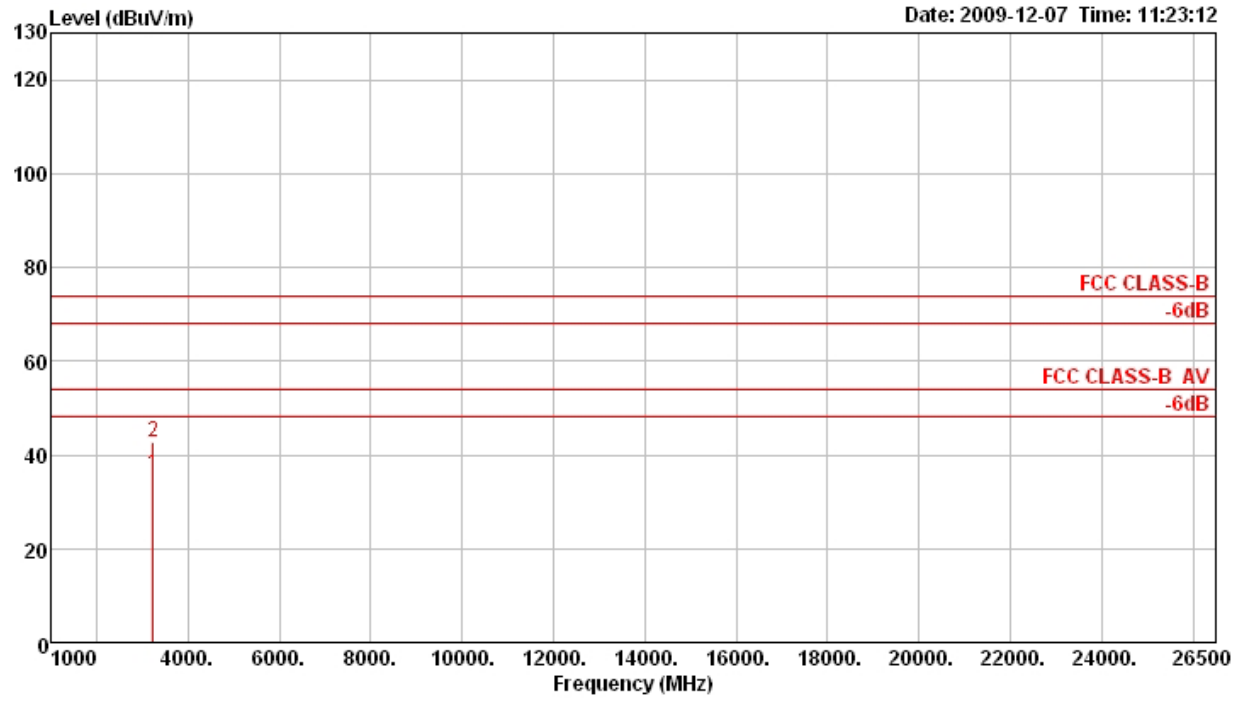
Appendix E. Co-location

1. Results of Radiated Emissions for Co-located

<For Antenna A>

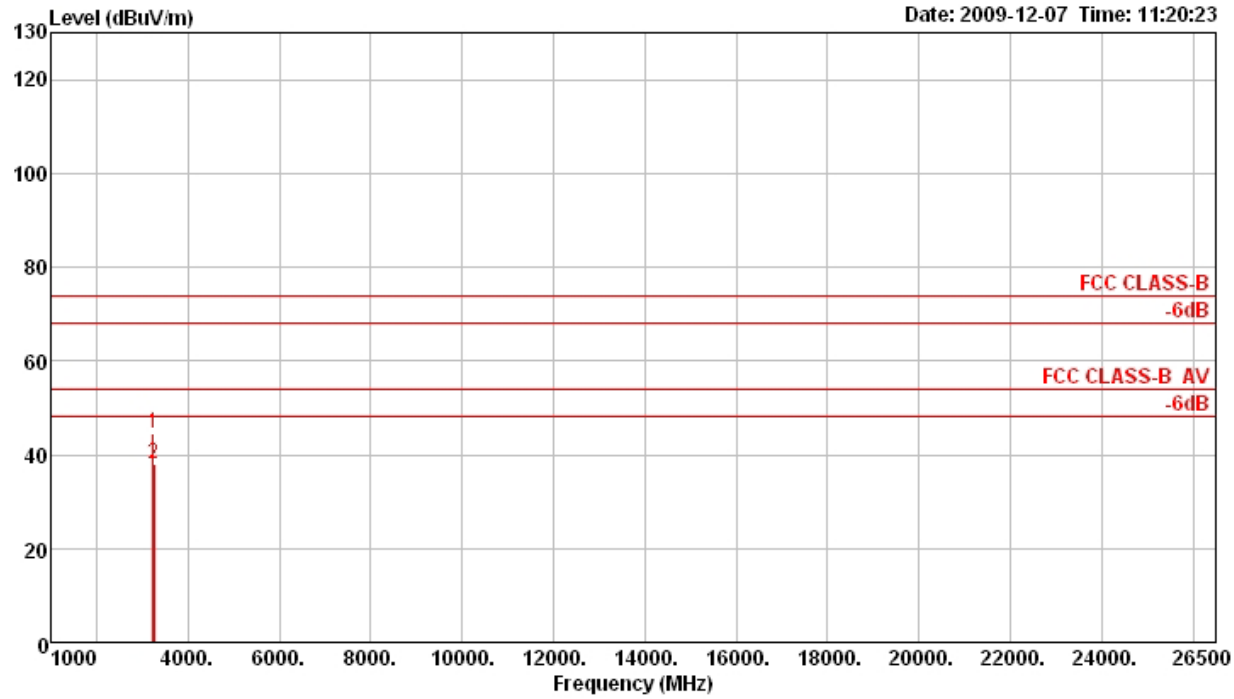
Temperature	23°C	Humidity	56%
Test Engineer	Alan Huang	Configurations	2.4GHz Bluetooth + 2.4GHz WLAN

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 a	3247.22	35.74	54.00	-18.26	38.22	2.69	34.95	29.78	243	100	Average	HORIZONTAL
2 p	3248.46	42.67	74.00	-31.33	45.15	2.69	34.95	29.78	243	100	Peak	HORIZONTAL

Vertial

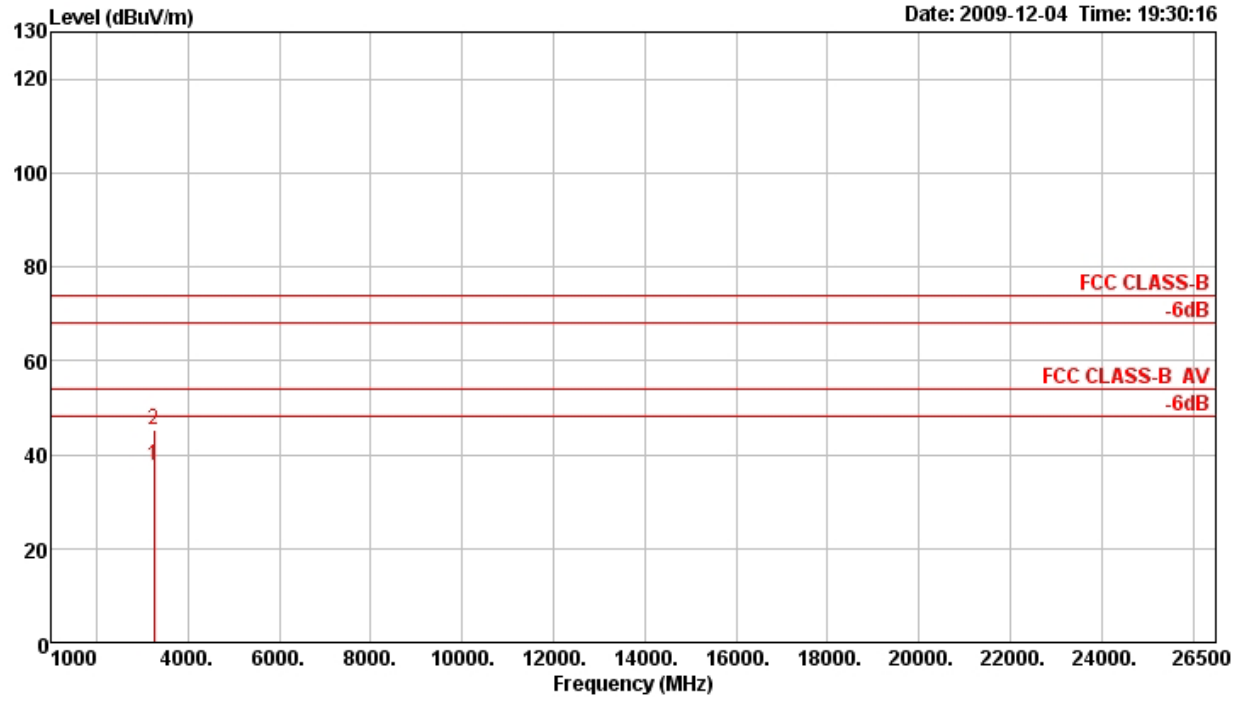


	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 p	3248.21	44.65	74.00	-29.35	47.13	2.69	34.95	29.78	85	121	Peak	VERTICAL
2 a	3249.20	37.88	54.00	-16.12	40.36	2.69	34.95	29.78	85	121	Average	VERTICAL

<For Antenna B>

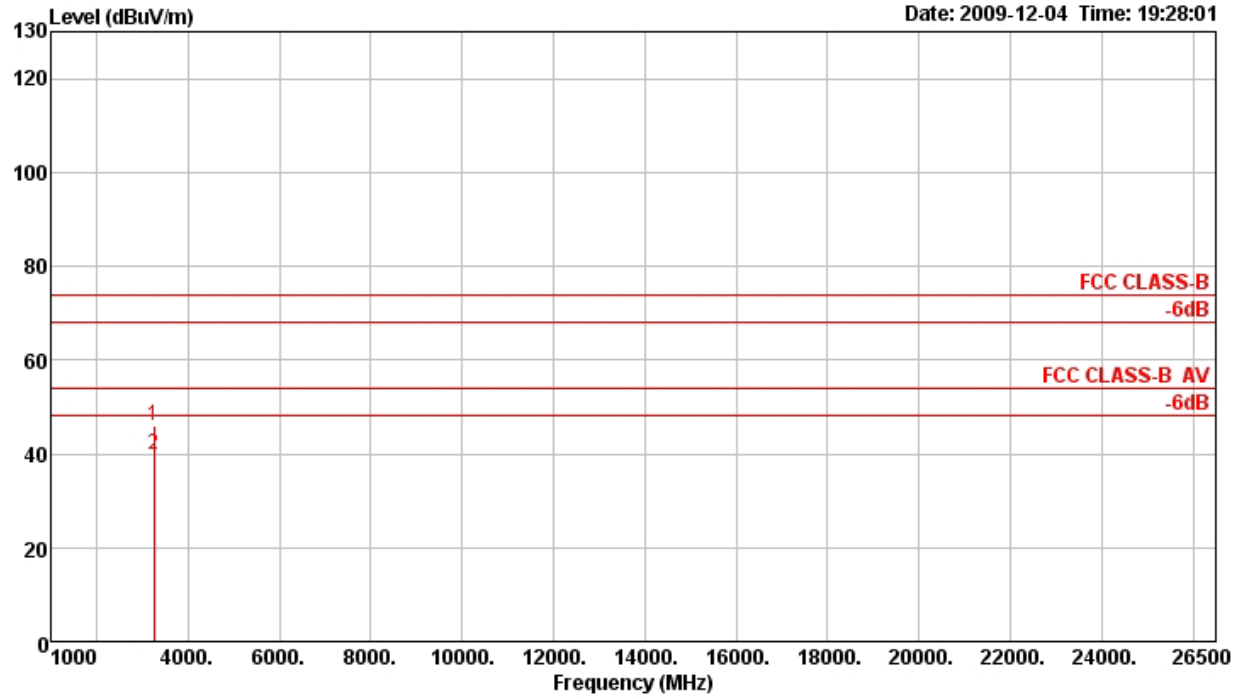
Temperature	23°C	Humidity	56%
Test Engineer	Alan Huang	Configurations	2.4GHz Bluetooth + 2.4GHz WLAN

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 a	3249.35	37.56	54.00	-16.44	40.04	2.69	34.95	29.78	352	100	Average	HORIZONTAL
2 p	3249.53	45.20	74.00	-28.80	47.68	2.69	34.95	29.78	352	100	Peak	HORIZONTAL

Vertial

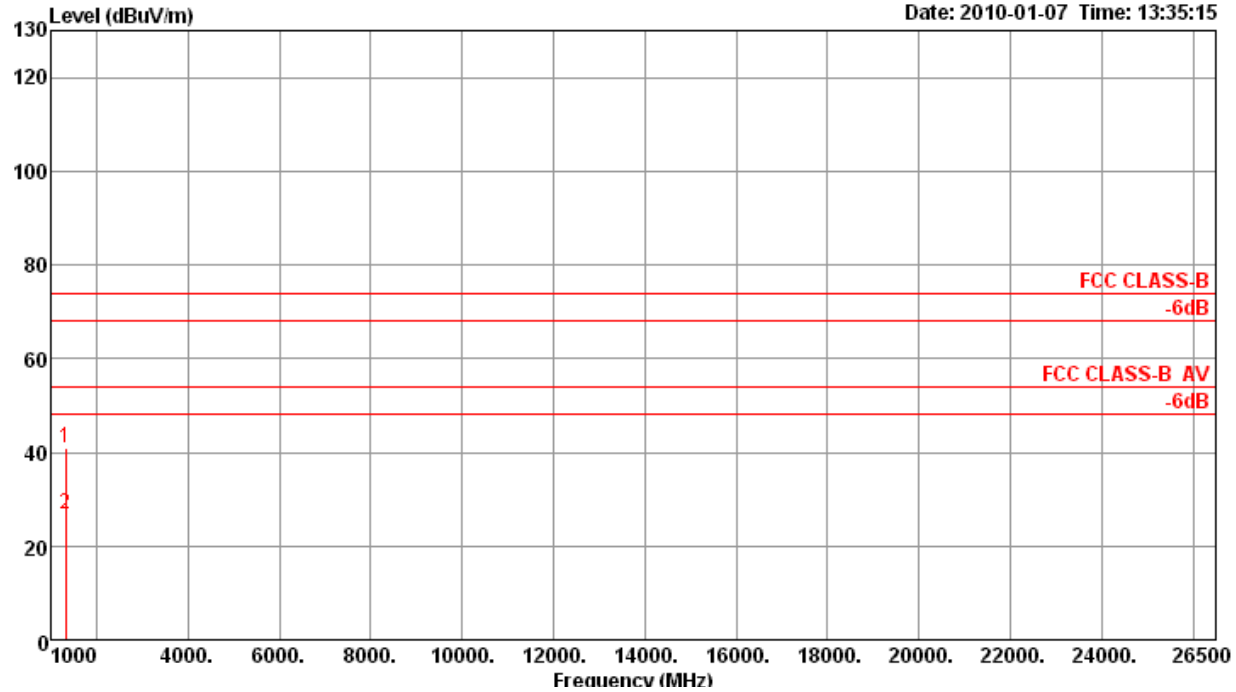


	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 p	3249.29	46.12	74.00	-27.88	48.60	2.69	34.95	29.78	85	121	Peak	VERTICAL
2 a	3249.33	39.84	54.00	-14.16	42.32	2.69	34.95	29.78	85	121	Average	VERTICAL

<For Antenna C>

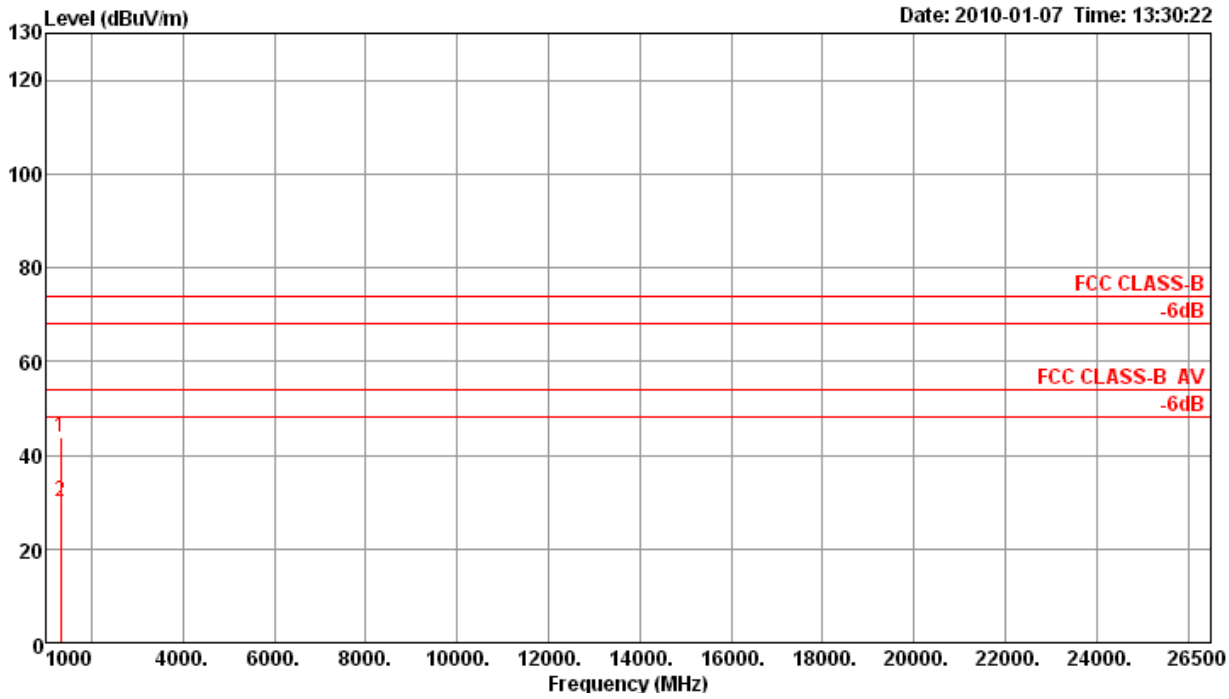
Temperature	23°C	Humidity	56%
Test Engineer	Johnson Chang	Configurations	2.4GHz Bluetooth + 2.4GHz WLAN

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 p	1330.48	41.02	74.00	-32.98	47.67	2.99	34.71	25.07	255	100	Peak	HORIZONTAL
2 a	1331.78	26.71	54.00	-27.29	33.36	2.99	34.71	25.07	255	100	Average	HORIZONTAL

Vertial

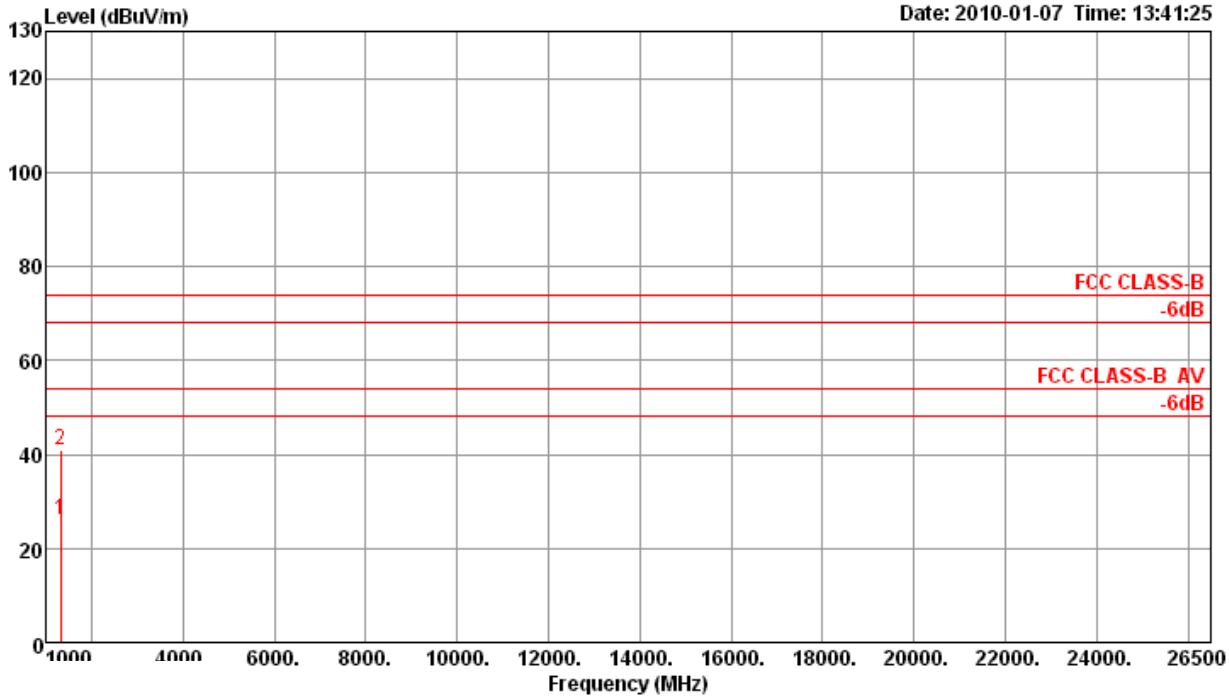


	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 p	1328.34	43.94	74.00	-30.06	50.56	2.99	34.68	25.07	193	100	Peak	VERTICAL
2 a	1330.80	29.90	54.00	-24.10	36.55	2.99	34.71	25.07	193	100	Average	VERTICAL

<For Antenna D>

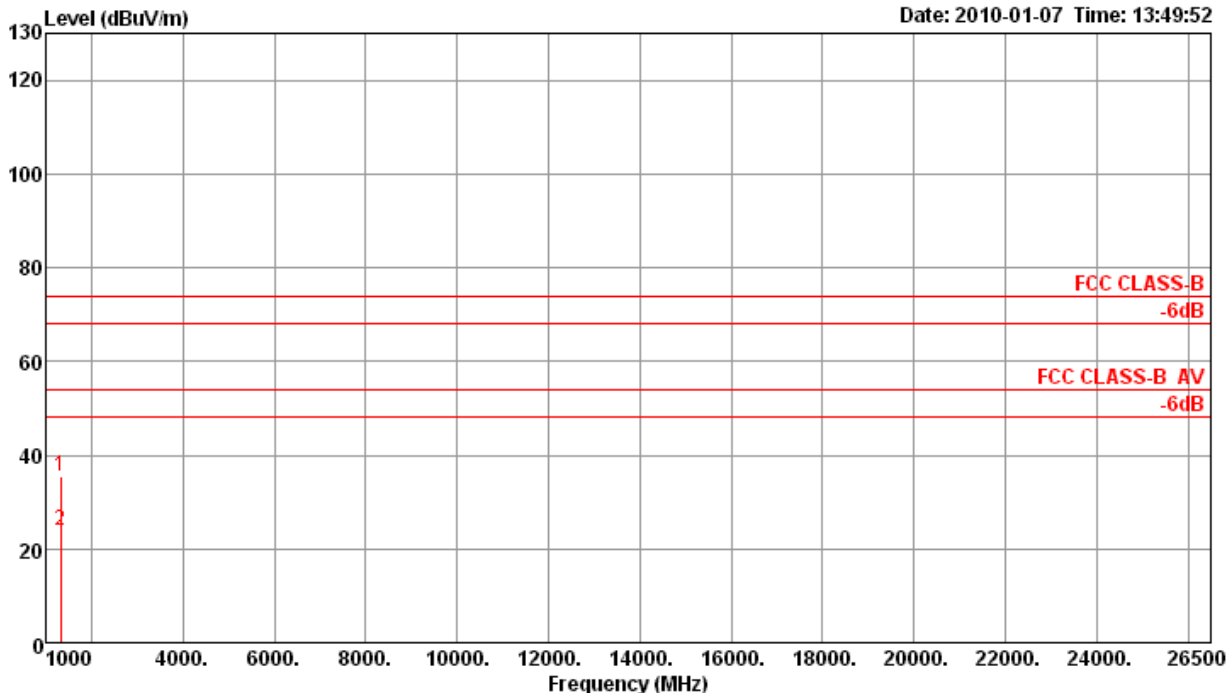
Temperature	23°C	Humidity	56%
Test Engineer	Johnson Chang	Configurations	2.4GHz Bluetooth + 2.4GHz WLAN

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 a	1331.60	26.05	54.00	-27.95	32.70	2.99	34.71	25.07	267	100	Average	HORIZONTAL
2 p	1331.62	41.01	74.00	-32.99	47.66	2.99	34.71	25.07	267	100	Peak	HORIZONTAL

Vertial



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m	deg	cm		
1 p	1327.08	35.49	74.00	-38.51	42.11	2.99	34.68	25.07	277	100	Peak	VERTICAL
2 a	1329.76	23.94	54.00	-30.06	30.56	2.99	34.68	25.07	277	100	Average	VERTICAL