

FCC Part 15C

Measurement And Test Report For

Senstech Sdn. Bhd.

Suite 10-01, Level 10, Menara Atlan, 161B Jalan Ampang,
50450 Kuala Lumpur, Malaysia

FCC ID: Z9I-MD-S01

Nov 28, 2011

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: MM chip dedicated reader writer module
Report Number:	MTI111102003RF
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Test Date:	Nov 4 - 25, 2011
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior written consent of MTI Technology Laboratory Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Senstech Sdn. Bhd.
Address of applicant:	Suite 10-01, Level 10, Menara Atlan, 161B Jalan Ampang, 50450 Kuala Lumpur, Malaysia
Manufacturer:	FEC Inc
Address of manufacturer:	1414 Higashi, Utsugi machi, Kanazawa shi, Ishikawa, 920-0377, Japan
Equipment Under Test:	MM chip dedicated reader writer module
Tested Model No.:	MMRW-MD-S01
Trade Name:	/
Supplementary Models No:	/
	Remark: supplementary models are only different in exterior with tested Model and with the same circuit construction
Type of Modulation:	ASK
Antenna Type:	Integral Antenna
Frequency Band:	2408.875-2478.875 MHz
Channel No.:	15
Channel Spacing:	5 MHz
Rated Power:	<10mW
Power Supply:	DC 5V

Remark: * The test data gathered are from the production sample provided by the manufacturer.

1.2 Related Submittal(s) / Grant (s)

This submittal(s) is a test report based on the Electromagnetic Interference (EMI) tests performed on the EUT. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4 - 2003.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.209, and 15.249 rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 - 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

All measurement required was performed at laboratory of NTEK Testing Technology Co., Ltd., at 1/F, Building E, Fenda Science Park Sanwei Community, Xixiang Street, Baoan District , Shenzhen,Guangdong

The test facility is recognized, certified, or accredited by the following organizations:

FCC – Registration No.: 238937

NTEK Testing Technology 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 238937.

2. SYSTEM TEST CONFIGURATION

The tests documented in this report were performed in accordance with ANSI C63.4-2003 and FCC CFR 47 Part 15 Subpart C.

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 that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

2.3 General Test Procedures

Conducted Emissions The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 7.1 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions The EUT is placed on a turntable, which is 0.8 m above ground plane. The turntable 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4-2003.

2.4 List of Measuring Equipments Used

Items	Equipment	Manufacturer	Model No.	Serial No.	Last Cal	Calibration Period
1	EMI Test Receiver	ROHDE & SCHWARZ	ESI 26	100079	2011/11	1 year
2	Horn Antenna	R/S	CH14-H052	1091698	2011/11	1 year
3	3m Semi- Anechoic Chamber	ETS	N/A	N/A	2011/11	1 year
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100038	2011/11	1 year
2	EMI Test Receiver	ROHDE & SCHWARZ	ESI 26	100009	2011/11	1 year
3	Receiver/ Spectrum Analyzer	ROHDE & SCHWARZ	ESCI	100106	2011/11	1 year
4	Spectrum Analyzer	Agilent	E7405A	US41160415	2011/11	1 year
5	Artificial Mains	ROHDE & SCHWARZ	ESH2-Z5	100028	2011/11	1 year
6	Pulse Limiter	ROHDE & SCHWARZ	ESHSZ2	100044	2011/11	1 year
7	LISN	COM Power	LI-200	12212	2011/11	1 year
8	LISN	COM Power	LI-200	12019	2011/11	1 year
9	3m/5m Semi- Anechoic Chamber	ETS	N/A	N/A	2011/11	1 year
10	Ultra-Broadband Antenna	R/S	HL562	100015	2011/11	1 year
11	Horn Antenna	R/S	HF906	100039	2011/11	1 year
12	RF Test Panel	R/S	TS / RSP	335015/ 0017	N/A	N/A
13	Turntable	ETS	2088	2149	N/A	N/A
14	Antenna Mast	ETS	2075	2346	N/A	N/A
15	Loop Antenna	SCHWARZBECK	HFRA 5150	9453	2011/11	1 year

3. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
15.203	Antenna Requirement	Pass
15.205	Restricted Band of Operation	Pass
15.207	Conducted Emission	N/A
15.209	Radiated Emission	Pass
15.249(a)	Field Strength	Pass
15.249(d)	Out of Band Emission	Pass

4. ANTENNA REQUIREMENT

4.1 Standard Applicable

Section 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

4.2 Antenna Connected Construction

This product has a permanent antenna, fulfill the requirement of this section.

5. §15.205, §15.209, §15.249 (a)- RADIATED EMISSION

5.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

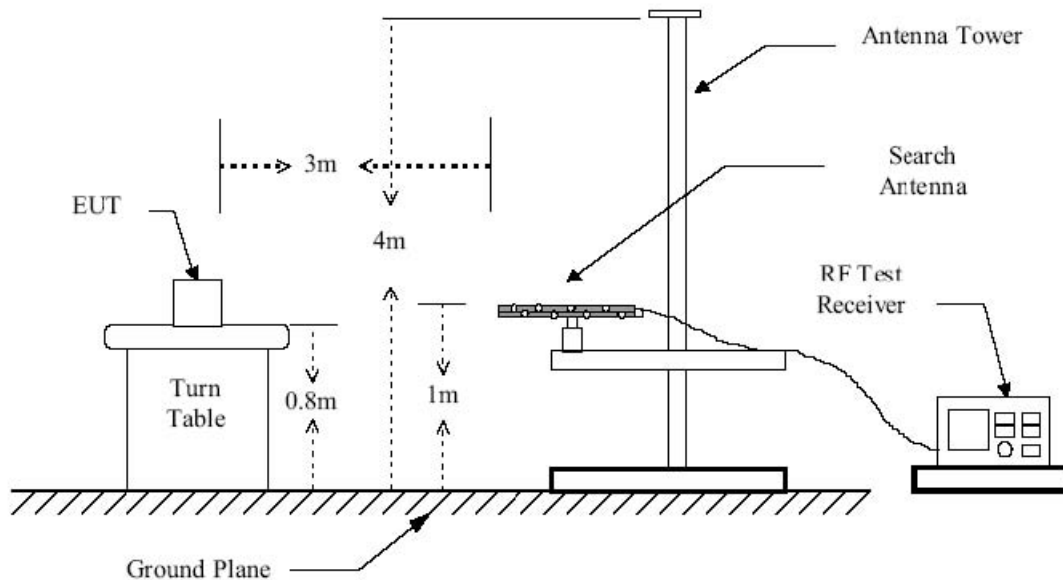
Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of fundamental (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

EMISSIONS RADIATED OUTSIDE OF THE SPECIFIED FREQUENCY BANDS, EXCEPT FOR HARMONICS, SHALL BE ATTENUATED BY AT LEAST 20 dB BELOW THE LEVEL OF THE FUNDAMENTAL OR TO THE GENERAL RADIATED EMISSION LIMITS IN 15.209, WHICHEVER IS THE LESSER ATTENUATION.

Emissions that fall in the restricted bands (15.205) must be less than 54dBuV/m otherwise the spurious and harmonics must be attenuated by at least 20dB.

5.2 EUT Setup



5.3 Test Equipment List and Details

See section 2.4.

5.4 Test Procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using the quasi-peak method or average method as specified and then reported in Data sheet peak mode and QP mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.

5.5 Corrected Amplitude & Margin Calculation

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

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

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

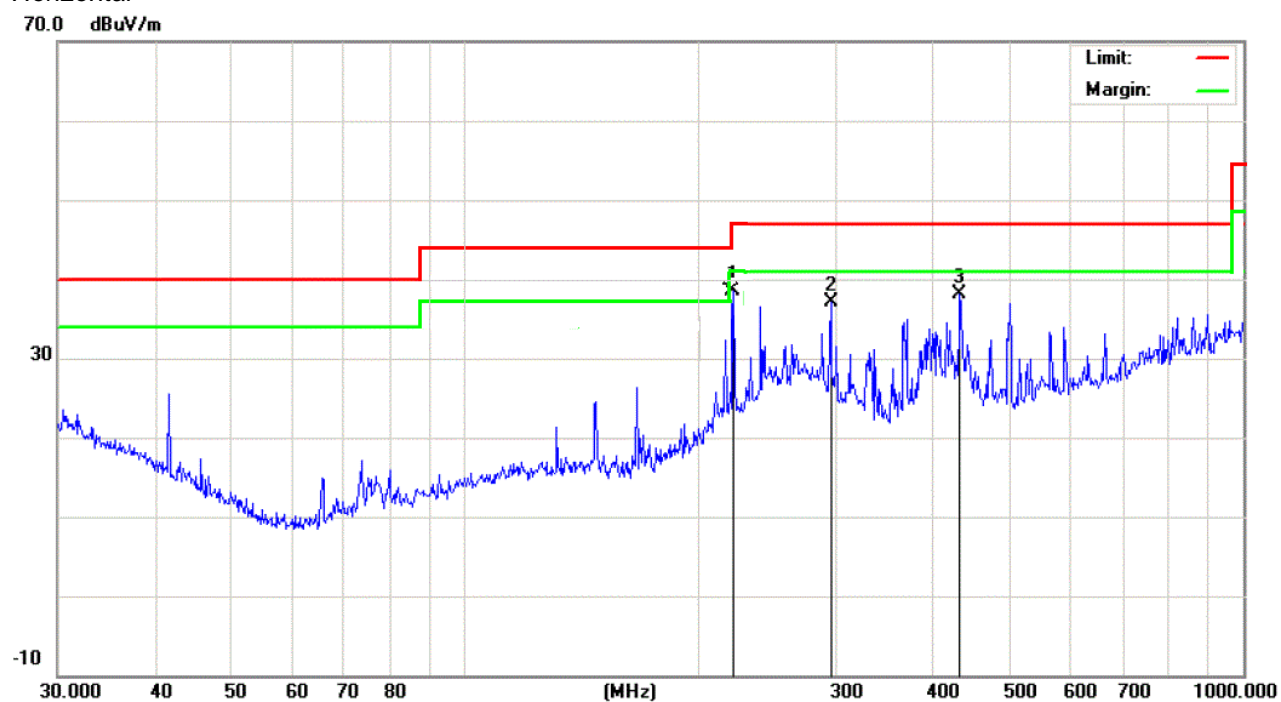
5.6 Test Result

According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst margin of:

-1.20 dB μ V at 4817.750 MHz in the Vertical polarization, 9 kHz to 25 GHz, 3Meters

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

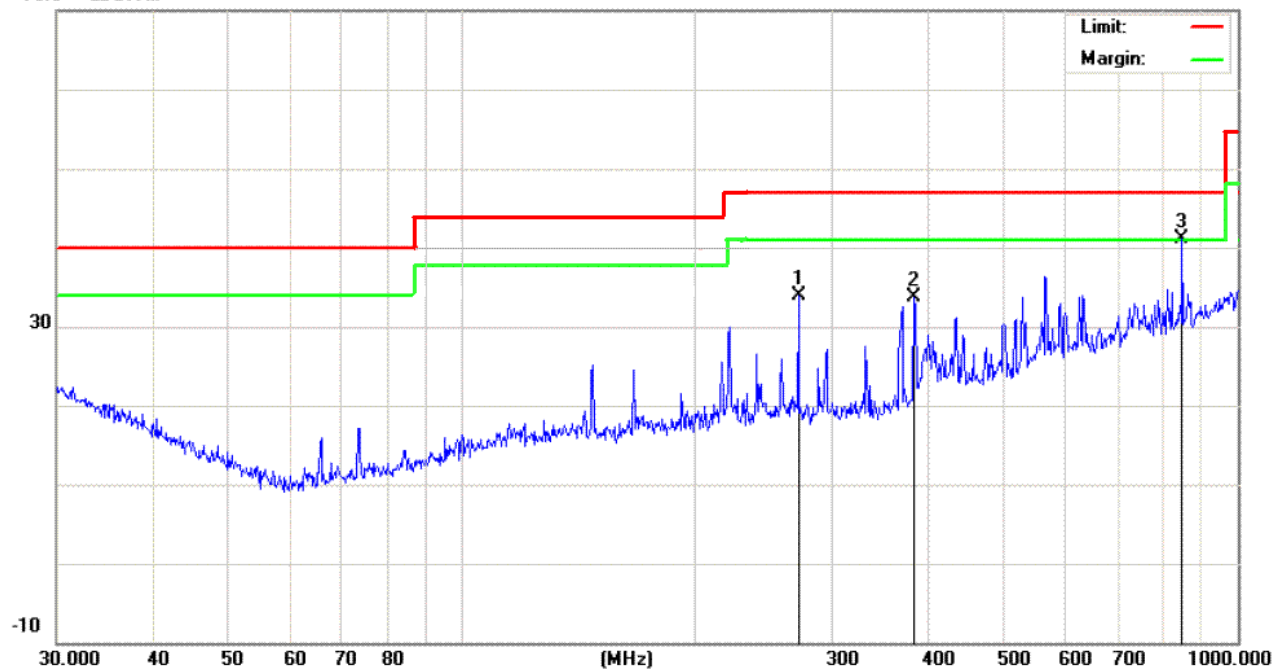
Plot of Radiation Emissions Test
Transmitting below 1GHz- Low CH
Horizontal



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	221.3921	28.57	9.98	38.55	46.00	-7.45	QP
2		295.1469	22.75	14.37	37.12	46.00	-8.88	QP
3		432.5457	20.44	17.75	38.19	46.00	-7.81	QP

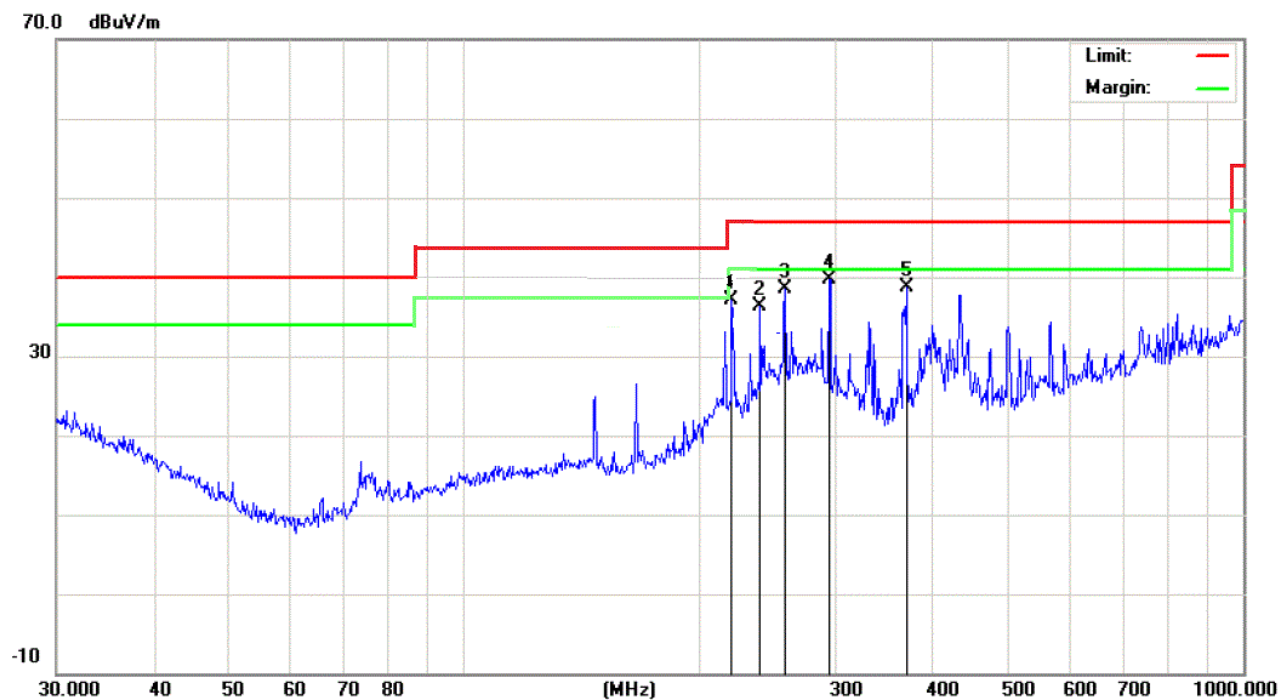
Vertical

70.0 dBuV/m



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		271.3246	20.40	13.43	33.83	46.00	-12.17	QP
2		382.5879	17.20	16.54	33.74	46.00	-12.26	QP
3	*	848.0563	15.60	25.44	41.04	46.00	-4.96	QP

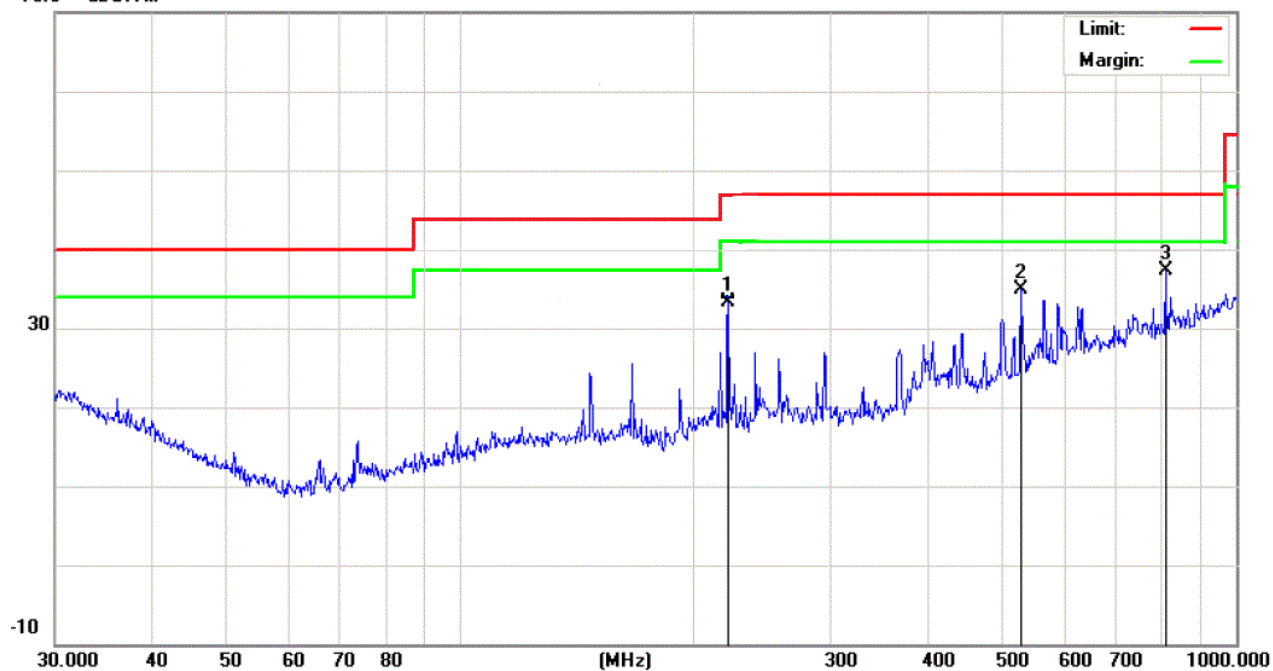
Transmitting below 1GHz- Middle CH
Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1	*	220.6171	27.18	9.91	37.09	46.00	-8.91	QP
2		239.9874	24.99	11.36	36.35	46.00	-9.65	QP
3		258.3264	24.32	14.13	38.45	46.00	-6.55	QP
4		294.1137	25.37	14.30	39.67	46.00	-7.33	QP
5		369.4047	22.78	15.87	38.65	46.00	-7.35	QP

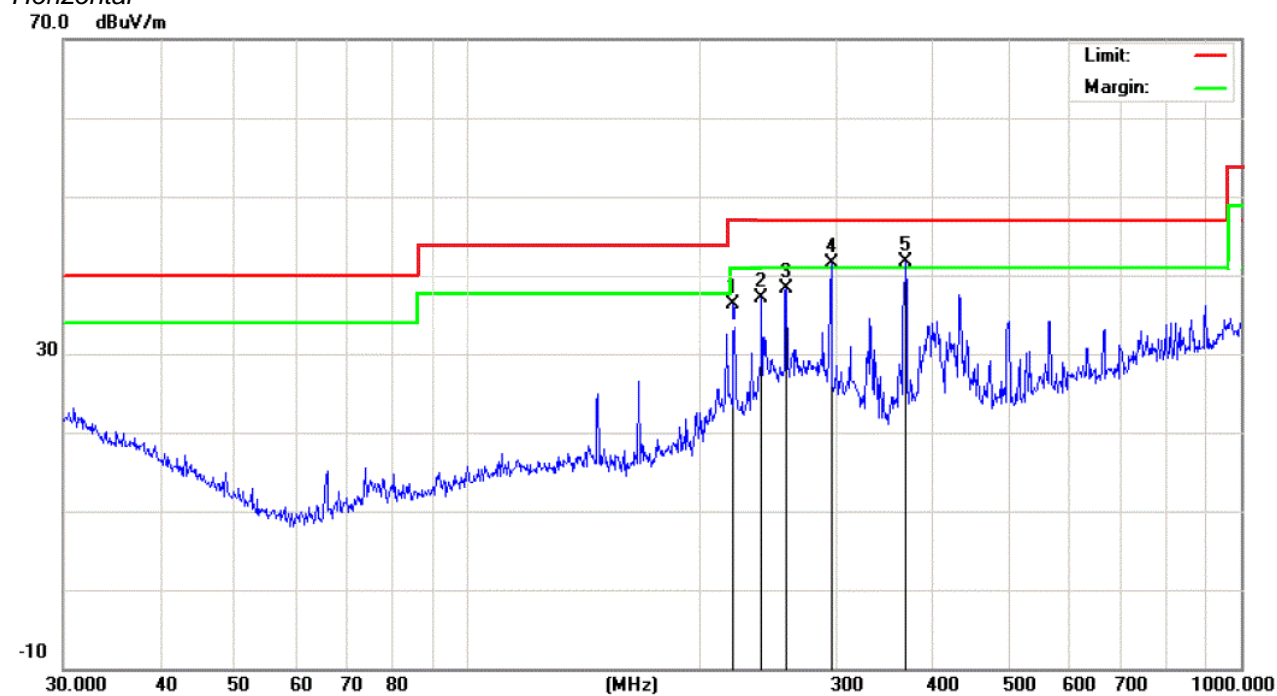
Vertical

70.0 dBuV/m



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			Detector
			dBuV	dB	dBuV/m	dBuV/m	dB	
1	*	221.3921	23.26	9.98	33.24	46.00	-12.76	QP
2		528.2458	15.32	19.56	34.88	46.00	-11.12	QP
3		810.2654	13.24	24.14	37.38	46.00	-8.62	QP

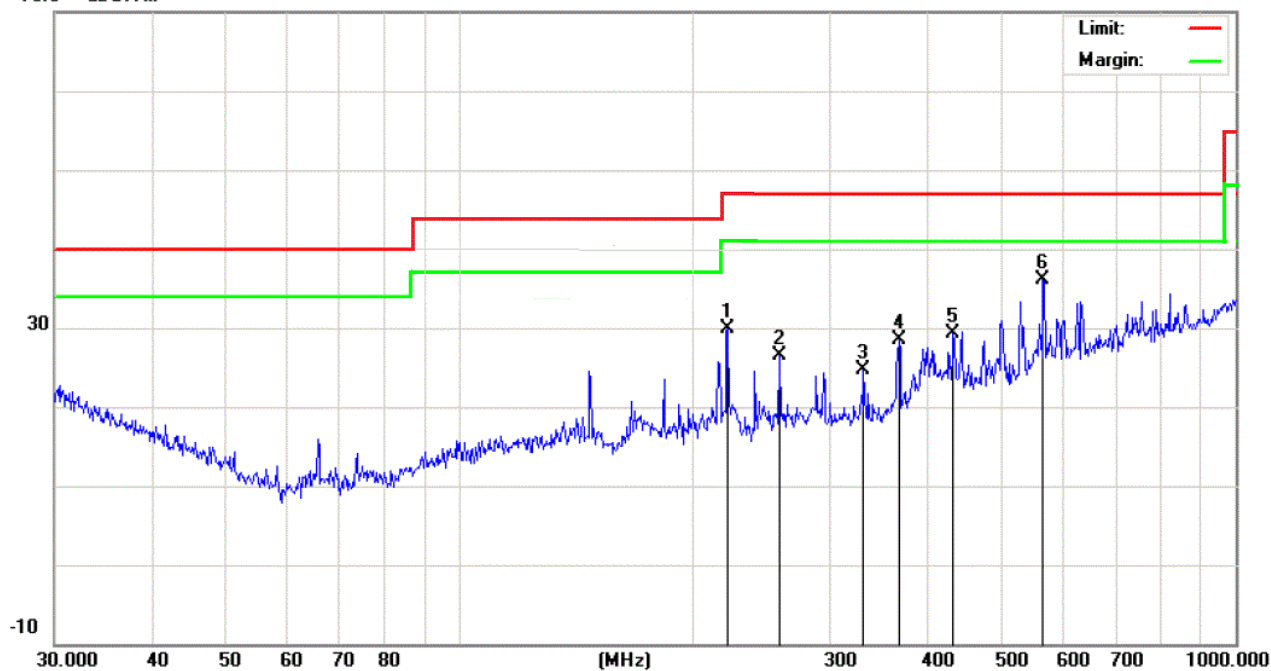
Transmitting below 1GHz- High CH
Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1	*	220.6171	26.32	9.91	36.23	46.00	-9.77	peak
2		239.9874	25.74	11.36	37.10	46.00	-8.90	peak
3		258.3264	24.19	14.13	38.32	46.00	-7.68	peak
4	!	295.1469	27.07	14.37	41.44	46.00	-4.56	peak
5	!	368.1116	25.89	15.82	41.71	46.00	-4.29	peak

Vertical

70.0 dBuV/m



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	221.3921	19.95	9.98	29.93	46.00	-16.07	peak
2		258.3264	12.34	14.13	26.47	46.00	-19.53	peak
3		331.3546	9.67	14.97	24.64	46.00	-21.36	peak
4		368.1116	12.78	15.82	28.60	46.00	-17.40	peak
5		432.5457	11.50	17.75	29.25	46.00	-16.75	peak
6		564.6389	14.89	21.13	36.02	46.00	-9.98	peak

Spurious Emission Above 1GHz

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Low CH										
4817.750	AV	42.3	289	H	34.1	5.2	33.0	48.6	54	-5.4
4817.750	AV	46.5	60	V	34.1	5.2	33.0	52.8	54	-1.2
4817.750	PK	50.6	56	H	37.4	6.1	33.5	60.6	74	-13.4
4817.750	PK	53.3	185	V	37.4	6.1	33.5	63.3	74	-10.7
7226.625	AV	47.7	90	H	29.1	3.7	34.0	46.5	54	-7.5
7226.625	AV	47.7	147	V	29.1	3.7	34.0	46.5	54	-7.5
7226.625	PK	43.7	289	H	37.4	6.1	33.5	53.7	74	-20.3
7226.625	PK	61.6	60	V	34.1	5.2	33.0	67.9	74	-6.1
2408.875	AV	76.9	56	H	34.1	5.2	33.0	83.2	94	-10.8
2408.875	AV	76.1	185	V	37.4	6.1	33.5	86.1	94	-7.9
2408.875	PK	88.8	90	H	29.1	3.7	34.0	87.6	114	-26.4
2408.875	PK	90.5	147	V	29.1	3.7	34.0	89.3	114	-24.7
Middle CH										
4887.750	AV	43.9	333	H	34.1	5.2	33.0	50.2	54	-3.8
4887.750	AV	45.2	43	V	34.1	5.2	33.0	51.5	54	-2.5
4887.750	PK	55.3	99	H	37.4	6.1	33.5	65.3	74	-8.7
4887.750	PK	53.5	79	V	37.4	6.1	33.5	63.5	74	-10.5
7331.625	AV	43.5	45	H	29.1	3.7	34.0	42.3	54	-11.7
7331.625	AV	46.2	44	V	29.1	3.7	34.0	45.0	54	-9.0
7331.625	PK	45.4	333	H	37.4	6.1	33.5	55.4	74	-18.6
7331.625	PK	46.7	43	V	37.4	6.1	33.5	56.7	74	-17.3
2443.875	AV	74.2	99	H	34.1	5.2	33.0	80.5	94	-13.5
2443.875	AV	76.1	79	V	34.1	5.2	33.0	82.4	94	-11.6
2443.875	PK	86.7	45	H	29.1	3.7	34.0	85.5	114	-28.5
2443.875	PK	88.4	44	V	29.1	3.7	34.0	87.2	114	-26.8
High CH										
4957.750	AV	38.2	270	H	37.4	6.1	33.5	48.2	54	-5.8
4957.750	AV	36.1	45	V	37.4	6.1	33.5	46.1	54	-7.9
4957.750	PK	55.6	95	H	34.1	5.2	33.0	61.9	74	-12.1
4957.750	PK	52.2	359	V	34.1	5.2	33.0	58.5	74	-15.5
7436.625	AV	45.9	0	H	29.1	3.7	34.0	44.7	54	-9.3
7436.625	AV	47.8	63	V	29.1	3.7	34.0	46.6	54	-7.4
7436.625	PK	50.1	270	H	34.1	5.2	33.0	56.4	74	-17.6
7436.625	PK	52.0	45	V	34.1	5.2	33.0	58.3	74	-15.7
2478.875	AV	69.6	95	H	37.4	6.1	33.5	79.6	94	-14.4
2478.875	AV	68.8	359	V	37.4	6.1	33.5	78.8	94	-15.2
2478.875	PK	81.8	0	H	29.1	3.7	34.0	80.6	114	-33.4
2478.875	PK	83.0	63	V	29.1	3.7	34.0	81.8	114	-32.2

Note: Testing is carried out with frequency rang 9 kHz to the tenth harmonics, which above 4th Harmonics is close to the noise base even antenna close up to 1meter distance according the measurement of ANSI C63.4. Emissions 20dB lower than the limit are not reported.

6. §15.249(b) OUT OF BAND EMISSIONS

6.1 Limits of bandedge Measurement

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

6.2 Test Equipment List and Details

See section 2.4.

6.3 Test Procedure

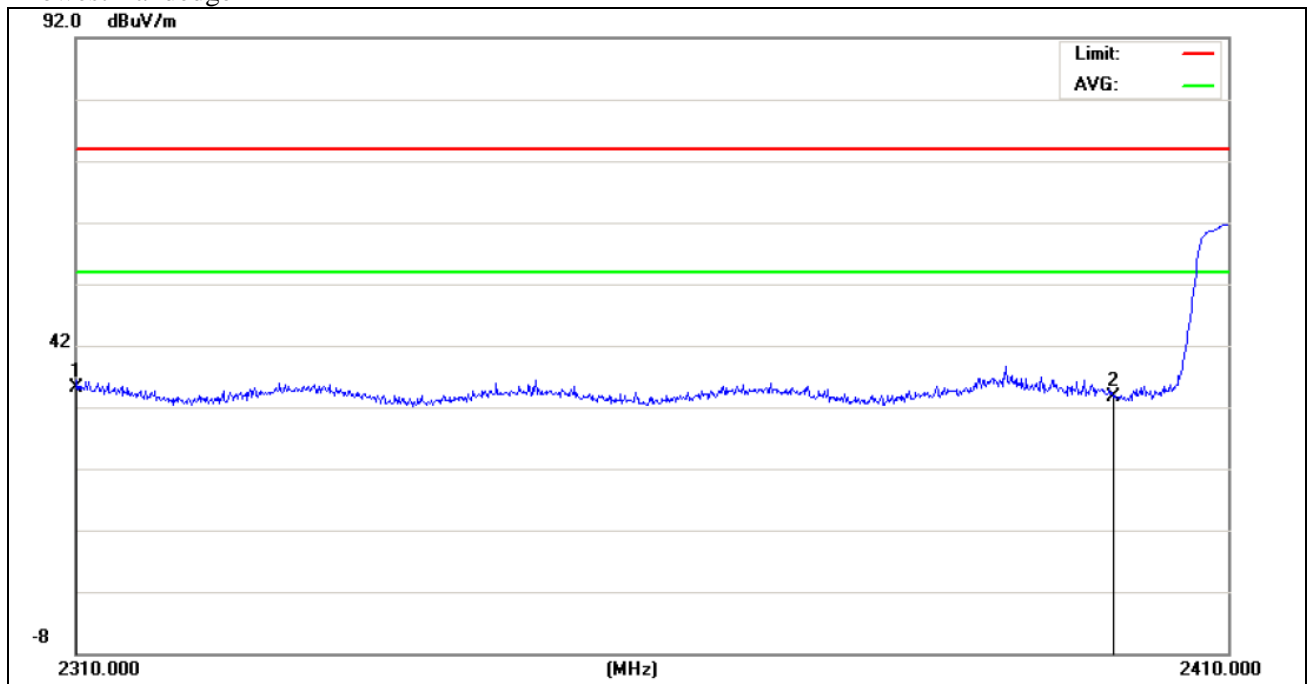
As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

6.4 Test Result /Plots

Frequency MHz	Limit dBuv	Result
Low Edge	<54	Pass
High Edge	<54	Pass

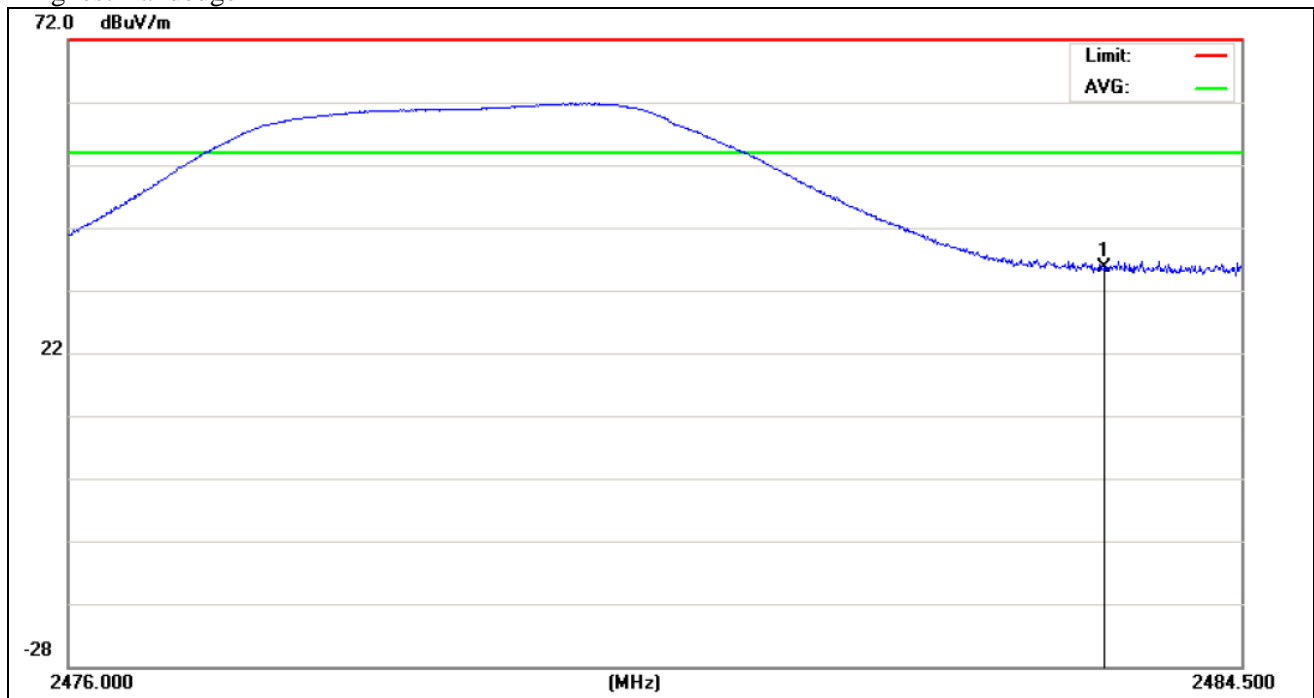
The edge emissions are below the FCC 15.209 Limits. Please refer to the test plots below.

Lowest Bandedge



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	52.41	-17.26	35.15	54.00	-18.85	AVE
	2310.000	58.83	-17.26	41.57	74.00	-32.43	peak
2	2390.000	50.90	-17.46	33.44	54.00	-20.56	AVE
	2390.000	59.25	-17.46	41.79	74.00	-32.21	peak

Highest Bandedge



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	53.51	-17.35	36.16	54.00	-17.84	AVE
	2483.500	58.71	-17.35	41.36	74.00	-32.64	peak