

FCC C2PC Test Report

FCC ID : TLZ-NM230NF
Equipment : IEEE 802.11 b/g/n Wireless LAN and Bluetooth
combo M.2 1216 module
Model No. : AW-NM230NF-H
Brand Name : AzureWave
Applicant : AzureWave Technologies, Inc.
Address : 8F, No. 94, Baozhong Rd., Xindian Dist., New
Taipei City, Taiwan 231
Standard : 47 CFR FCC Part 15.247
Received Date : Jul. 21, 2017
Tested Date : Jul. 31 ~ Aug. 09, 2017

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:



Along Chen / Assistant Manager

Approved by:



Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR550703-05AE	Rev. 01	Initial issue	Aug. 18, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	[dBuV]: 0.469MHz 39.88 (Margin -16.66dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 4880.00MHz 49.14 (Margin -4.86dB) - AV	Pass

1 General Description

1.1 Information

This report is prepared for FCC class II change.

This report is issued as a supplementary report to original ICC report no. FR550703AE. The modification is concerned with additional Monopole antennas. In this report, conducted emission and radiated emission tests had been re-tested and only its data was presented in the following sections.

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Freq. (MHz)	Channel Number	Data Rate
2400-2483.5	V4.1 LE	2402-2480	0-39 [40]	1 Mbps
Note 1: Bluetooth LE (Low energy) uses GFSK modulation.				

1.1.2 Antenna Details (New set of antenna was marked in boldface)

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	Walsin	RFMTA340715IMLB301	PIFA	I-PEX	3
2	JOYMAX	IHX-323XRSXX-999	Monopole	I-Pex	2.36

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
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1.1.4 Accessories

N/A

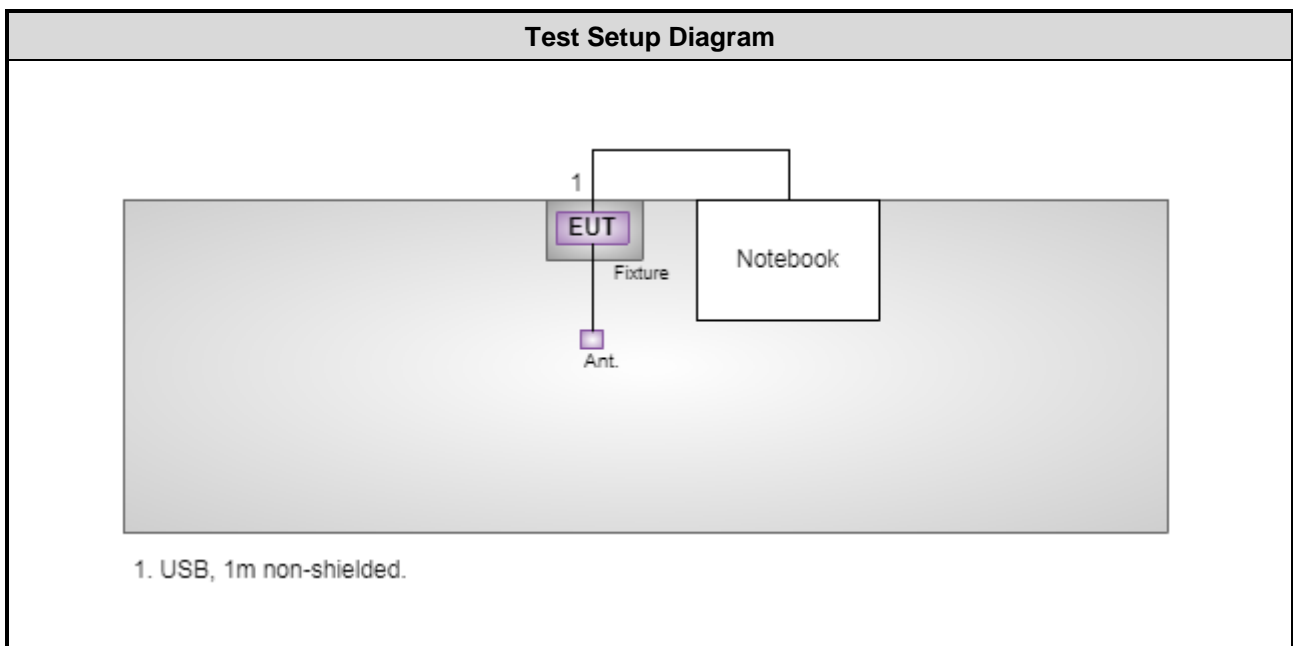
1.1.5 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	Latitude E5420	DoC	USB, 1m non-shielded.

1.3 Test Setup Chart



1.4 Test Equipment List and Calibration Data

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Dec. 21, 2016	Dec. 20, 2017
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 08, 2016	Nov. 07, 2017
RF Cable-CON	EMC	EMCCFD300-BM-B M-6000	50821	Dec. 20, 2016	Dec. 19, 2017
Measurement Software	AUDIX	e3	6.120210k	NA	NA

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

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Nov. 25, 2016	Nov. 24, 2017
Receiver	R&S	ESR3	101658	Nov. 24, 2016	Nov. 23, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 25, 2017	Jul. 24, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 21, 2016	Dec. 20, 2017
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 25, 2016	Oct. 24, 2017
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017
Preamplifier	EMC	EMC02325	980225	Jul. 28, 2017	Jul. 27, 2018
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2016	Oct. 05, 2017
Preamplifier	EMC	EMC184045B	980192	Aug. 24, 2016	Aug. 23, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 09, 2016	Dec. 08, 2017
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 09, 2016	Dec. 08, 2017
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	16052	Dec. 09, 2016	Dec. 08, 2017
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 09, 2016	Dec. 08, 2017
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 09, 2016	Dec. 08, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA

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

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247

ANSI C63.10-2013

FCC KDB 558074 D01 DTS Meas Guidance v04

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$))

Measurement Uncertainty	
Parameters	Uncertainty
AC conducted emission	± 2.90 dB
Radiated emission ≤ 1 GHz	± 3.66 dB
Radiated emission > 1 GHz	± 5.63 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	20°C / 57%	Alex Tsai
Radiated Emissions	03CH01-WS	23-24°C / 62-64%	Vincent Yeh

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Test Configuration
AC Power Line Conducted Emissions Radiated Emissions ≤ 1GHz	BT LE	2402	1Mbps	---
Radiated Emissions > 1GHz	BT LE	2402, 2440, 2480	1Mbps	---

NOTE:

- The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Y-plane** results were found as the worst case and were shown in this report.

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

3.1.2 Test Procedures

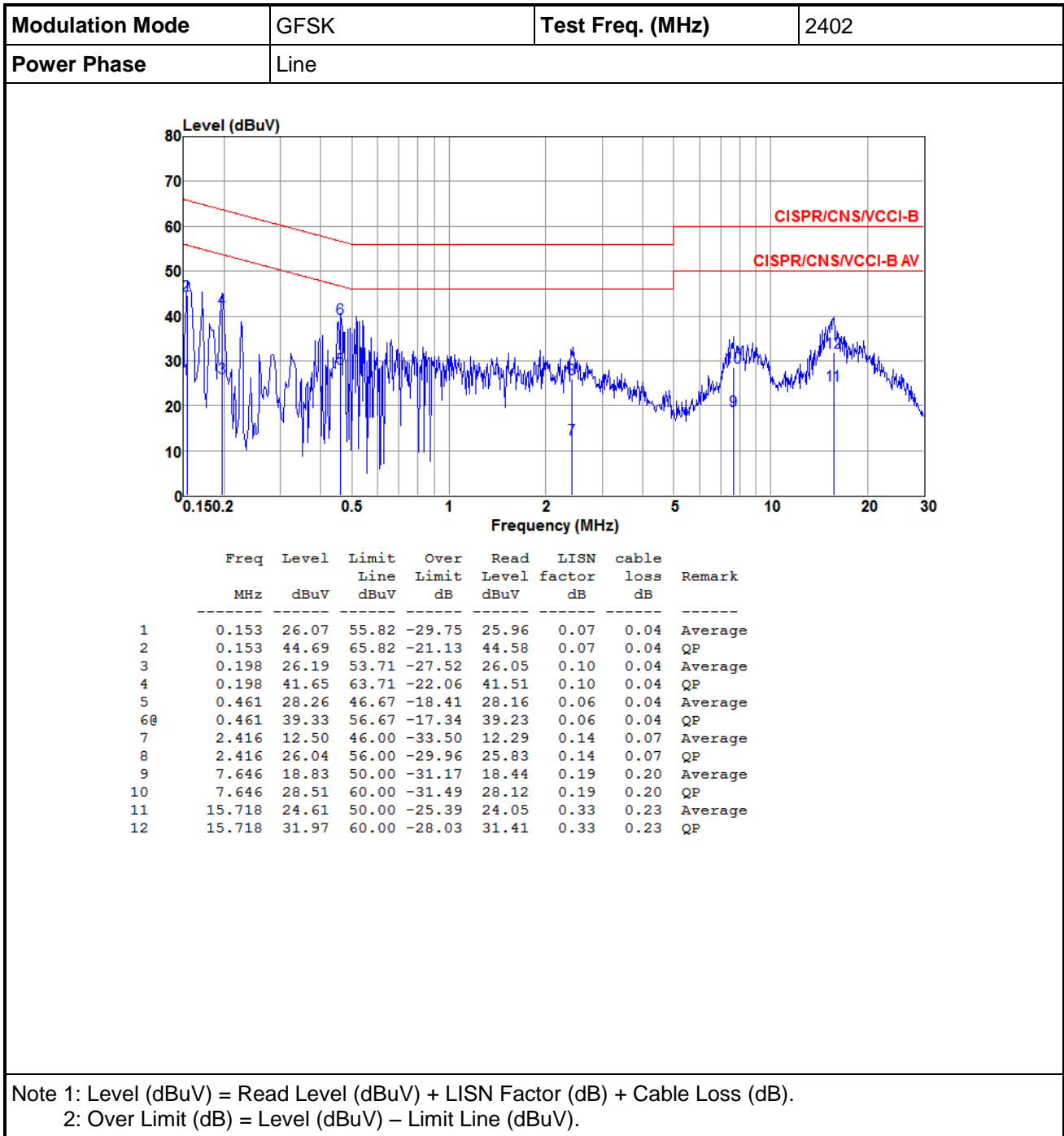
1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V/60Hz

3.1.3 Test Setup

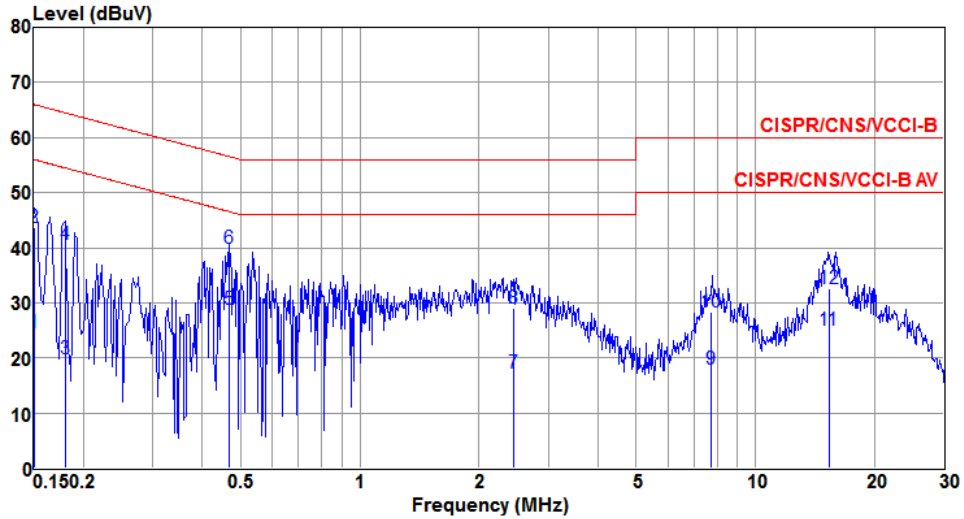


- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions



Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Neutral		



	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.150	24.66	56.00	-31.34	24.52	0.10	0.04	Average
2	0.150	43.60	66.00	-22.40	43.46	0.10	0.04	QP
3	0.180	19.94	54.50	-34.56	19.81	0.09	0.04	Average
4	0.180	40.59	64.50	-23.91	40.46	0.09	0.04	QP
5	0.469	28.71	46.54	-17.83	28.55	0.12	0.04	Average
6	0.469	39.88	56.54	-16.66	39.72	0.12	0.04	QP
7	2.452	17.30	46.00	-28.70	17.08	0.15	0.07	Average
8	2.452	28.98	56.00	-27.02	28.76	0.15	0.07	QP
9	7.748	17.96	50.00	-32.04	17.50	0.26	0.20	Average
10	7.748	28.44	60.00	-31.56	27.98	0.26	0.20	QP
11	15.373	24.97	50.00	-25.03	24.37	0.37	0.23	Average
12	15.373	32.66	60.00	-27.34	32.06	0.37	0.23	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).
 Note 2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).

3.2 Emissions in Restricted Frequency Bands

3.2.1 Limit of Emissions in Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.2.2 Test Procedures

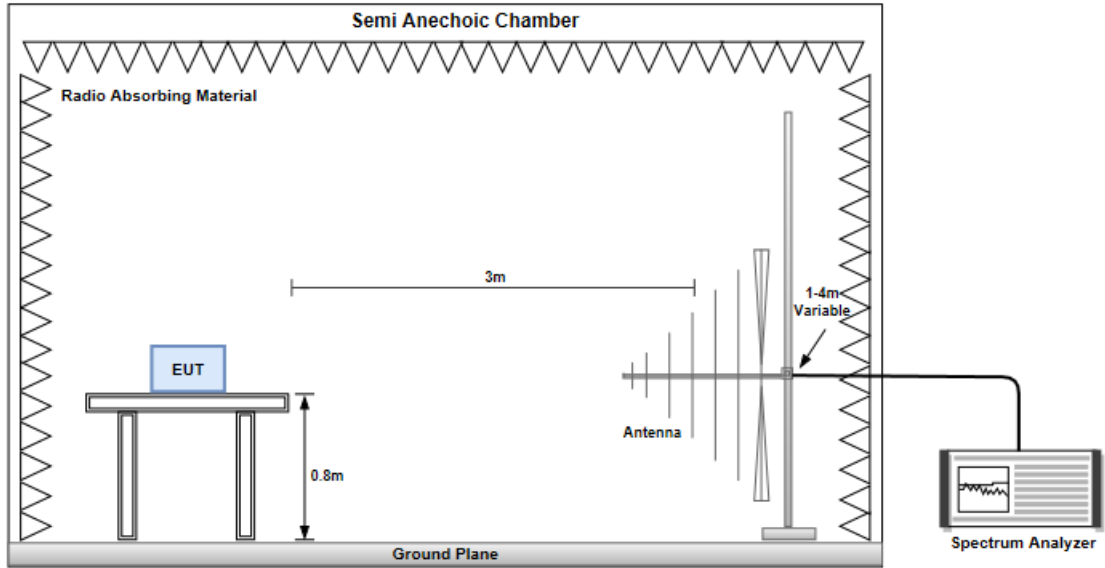
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

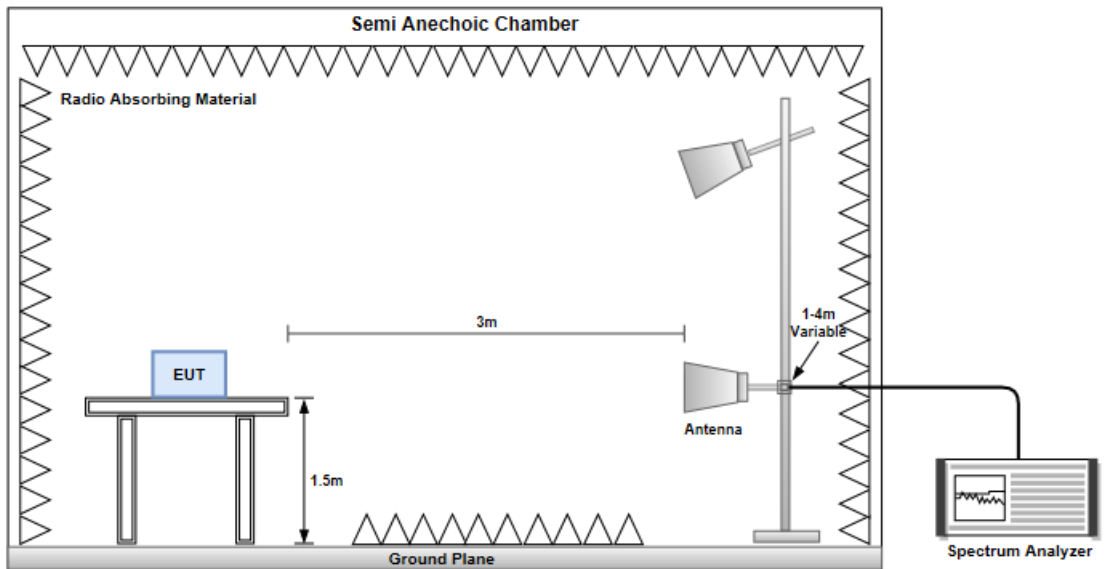
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

3.2.3 Test Setup

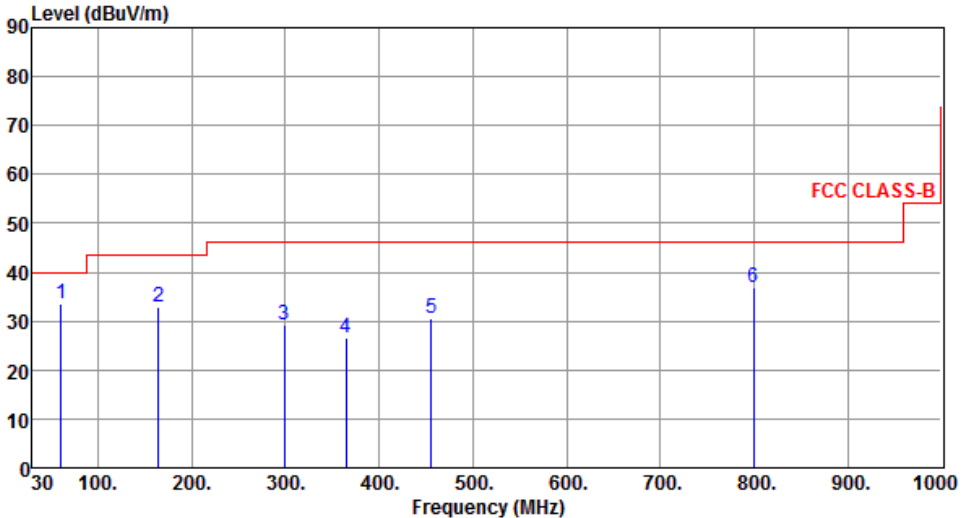
Radiated Emissions below 1 GHz



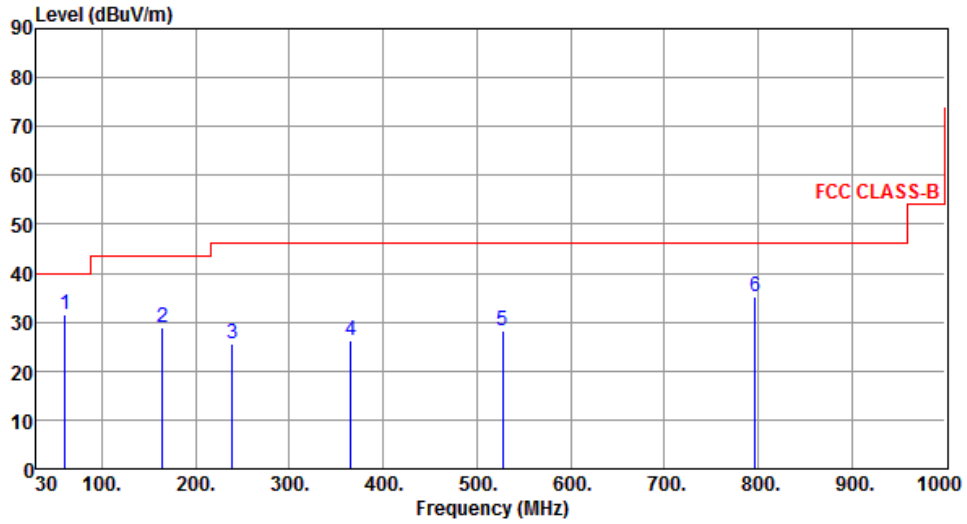
Radiated Emissions above 1 GHz



3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402						
Polarization	Horizontal								
									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	61.04	33.70	40.00	-6.30	42.59	-8.89	Peak	---	---
2	164.83	33.02	43.50	-10.48	41.31	-8.29	Peak	---	---
3	298.69	29.33	46.00	-16.67	37.05	-7.72	Peak	---	---
4	364.65	26.42	46.00	-19.58	32.54	-6.12	Peak	---	---
5	455.83	30.66	46.00	-15.34	34.42	-3.76	Peak	---	---
6	799.21	36.83	46.00	-9.17	34.67	2.16	Peak	---	---
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m). Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.</p>									

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	61.04	31.54	40.00	-8.46	40.43	-8.89	Peak	---	---
2	164.83	28.80	43.50	-14.70	37.09	-8.29	Peak	---	---
3	239.52	25.60	46.00	-20.40	35.12	-9.52	Peak	---	---
4	365.62	26.29	46.00	-19.71	32.38	-6.09	Peak	---	---
5	527.61	28.23	46.00	-17.77	30.85	-2.62	Peak	---	---
6	797.27	35.37	46.00	-10.63	33.24	2.13	Peak	---	---

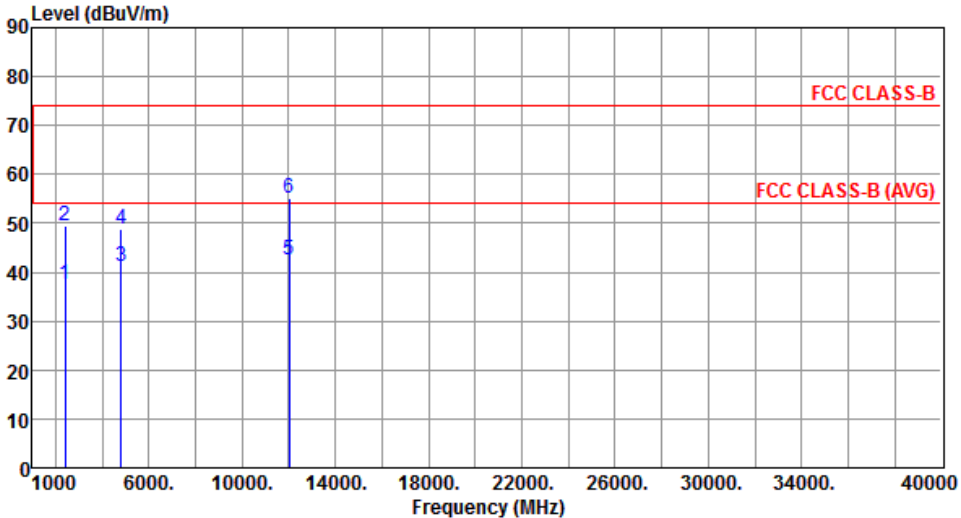
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

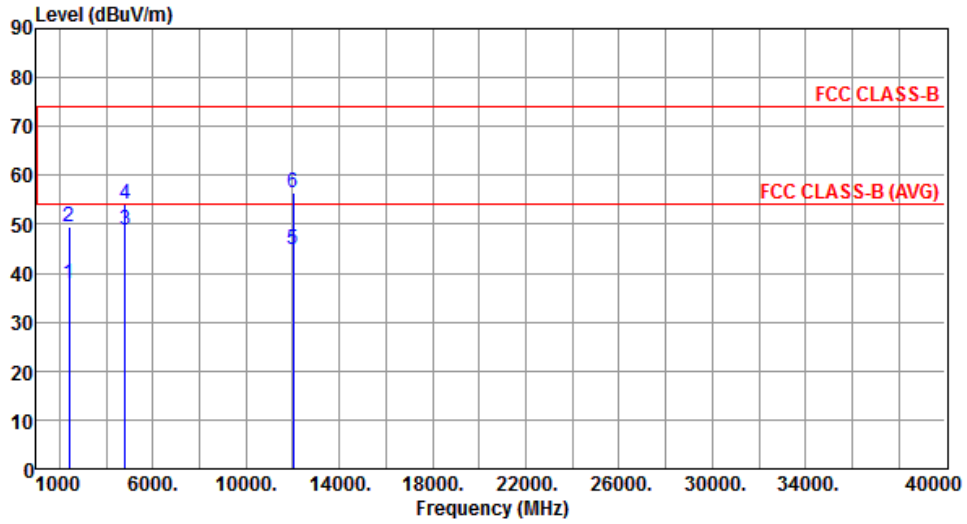
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.2.5 Transmitter Radiated Unwanted Emissions (Above 1GHz) for GFSK

Modulation	GFSK	Test Freq. (MHz)	2402						
Polarization	Horizontal								
									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	2390.00	37.50	54.00	-16.50	40.68	-3.18	Average	100	128
2	2390.00	49.59	74.00	-24.41	52.77	-3.18	Peak	100	128
3	4804.00	41.16	54.00	-12.84	37.42	3.74	Average	117	42
4	4804.00	48.96	74.00	-25.04	45.22	3.74	Peak	117	42
5	12010.00	42.38	54.00	-11.62	28.83	13.55	Average	100	146
6	12010.00	55.11	74.00	-18.89	41.56	13.55	Peak	100	146
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>									

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



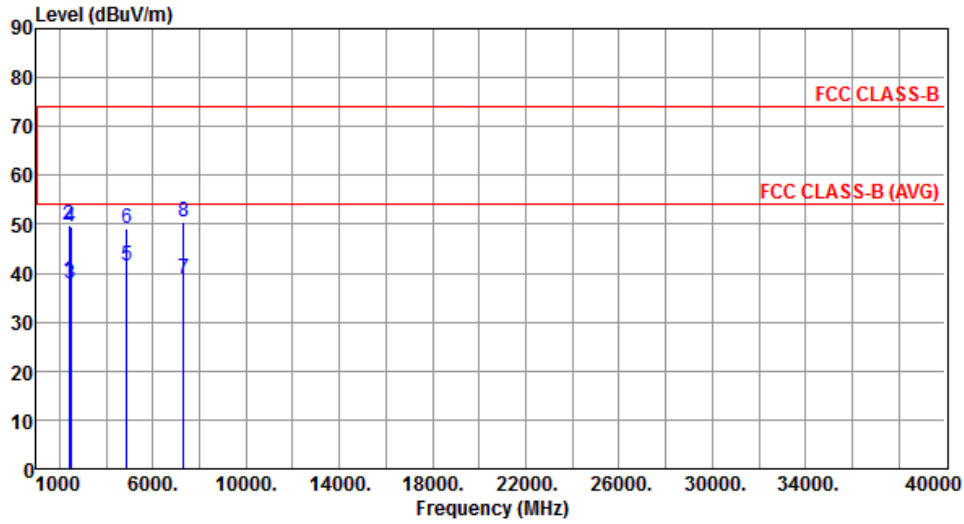
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	37.90	54.00	-16.10	41.08	-3.18	Average	100	358
2	2390.00	49.33	74.00	-24.67	52.51	-3.18	Peak	100	358
3	4804.00	48.83	54.00	-5.17	45.09	3.74	Average	386	79
4	4804.00	54.26	74.00	-19.74	50.52	3.74	Peak	386	79
5	12010.00	44.82	54.00	-9.18	31.27	13.55	Average	100	213
6	12010.00	56.43	74.00	-17.57	42.88	13.55	Peak	100	213

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	2440
Polarization	Horizontal		



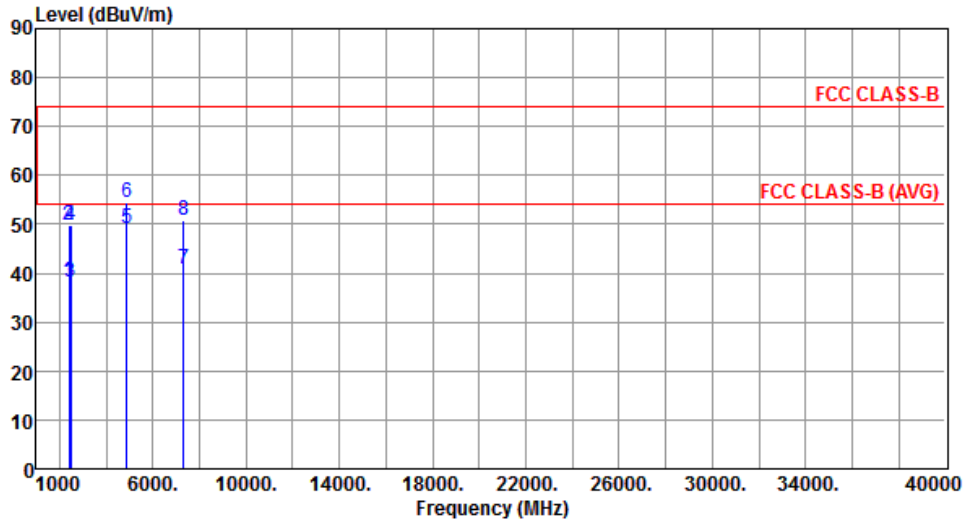
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	38.38	54.00	-15.62	41.56	-3.18	Average	100	140
2	2390.00	49.85	74.00	-24.15	53.03	-3.18	Peak	100	140
3	2483.50	37.93	54.00	-16.07	40.73	-2.80	Average	100	140
4	2483.50	49.57	74.00	-24.43	52.37	-2.80	Peak	100	140
5	4880.00	41.46	54.00	-12.54	37.50	3.96	Average	120	38
6	4880.00	49.22	74.00	-24.78	45.26	3.96	Peak	120	38
7	7320.00	38.79	54.00	-15.21	30.38	8.41	Average	100	282
8	7320.00	50.40	74.00	-23.60	41.99	8.41	Peak	100	282

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	2440
Polarization	Vertical		



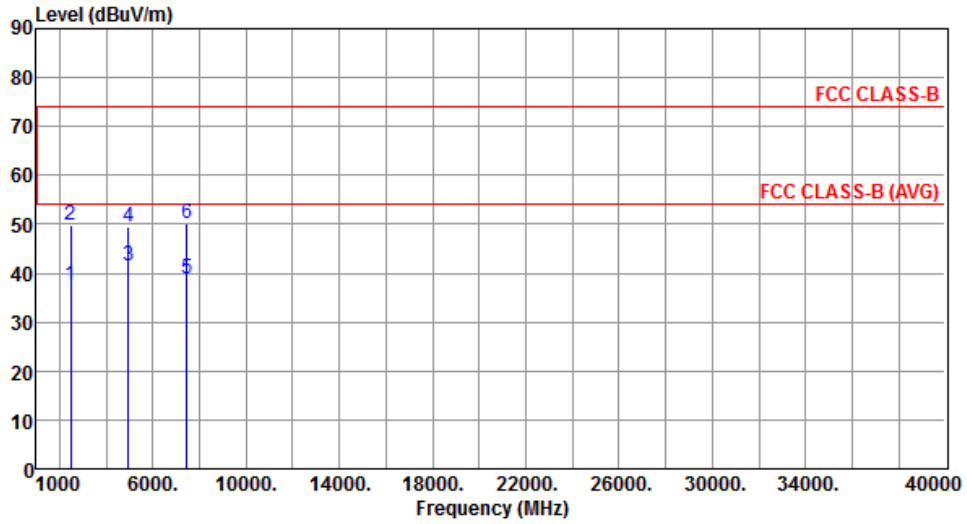
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	38.15	54.00	-15.85	41.33	-3.18	Average	107	321
2	2390.00	49.71	74.00	-24.29	52.89	-3.18	Peak	107	321
3	2483.50	38.22	54.00	-15.78	41.02	-2.80	Average	107	321
4	2483.50	49.75	74.00	-24.25	52.55	-2.80	Peak	107	321
5	4880.00	49.14	54.00	-4.86	45.18	3.96	Average	390	82
6	4880.00	54.52	74.00	-19.48	50.56	3.96	Peak	390	82
7	7320.00	40.97	54.00	-13.03	32.56	8.41	Average	315	42
8	7320.00	50.77	74.00	-23.23	42.36	8.41	Peak	315	42

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



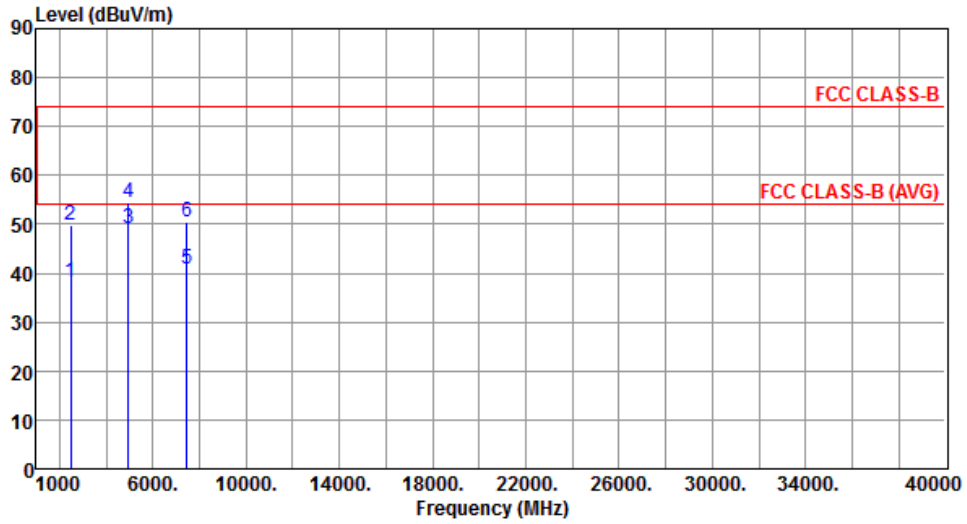
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	37.66	54.00	-16.34	40.46	-2.80	Average	100	141
2	2483.50	49.78	74.00	-24.22	52.58	-2.80	Peak	100	141
3	4960.00	41.52	54.00	-12.48	37.31	4.21	Average	116	38
4	4960.00	49.36	74.00	-24.64	45.15	4.21	Peak	116	38
5	7440.00	38.72	54.00	-15.28	30.19	8.53	Average	288	188
6	7440.00	50.29	74.00	-23.71	41.76	8.53	Peak	288	188

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	38.23	54.00	-15.77	41.03	-2.80	Average	100	321
2	2483.50	49.92	74.00	-24.08	52.72	-2.80	Peak	100	321
3	4960.00	49.11	54.00	-4.89	44.90	4.21	Average	387	86
4	4960.00	54.41	74.00	-19.59	50.20	4.21	Peak	387	86
5	7440.00	40.86	54.00	-13.14	32.33	8.53	Average	321	41
6	7440.00	50.62	74.00	-23.38	42.09	8.53	Peak	321	41

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin
Kou District, New Taipei City,
Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd St.,
Kwei Shan District, Tao Yuan City
333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

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