

# **FCC Test Report**

for

## **NFC Reader**

**Model Number : RD-FA6820-01**

**FCC ID : TFJ680PAJ**

**Report Number : RF-U010-1403-043**

**Date of Receipt : March 7, 2014**

**Date of Report : April 8, 2014**

Prepared for

**Uniform Industrial Corp.**

47436 Fremont Blvd., Fremont, CA 94538-6512, USA

Prepared by



**Central Research Technology Co.**

**EMC Test Laboratory**

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NVLAP LAB CODE 200575-0

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## Certification

**Equipment under Test** : NFC Reader  
**Model No.** : RD-FA6820-01  
**FCC ID** : TFJ680PAJ  
**Manufacturer** : Uniform Industrial Corp.  
**Applicant** : Uniform Industrial Corp.  
**Address** : 47436 Fremont Blvd., Fremont, CA 94538-6512, USA  
**Date of Testing** : March 12~24, 2014  
**Applicable Standards** : 47 CFR part 15, Subpart C  
**Deviation** : N/A  
**Condition of Test Sample** : Mass Production



We, **Central Research Technology Co.**, hereby certify that one sample of the designated product was tested in our facility during the period mentioned above. The test records, data evaluation and Equipment Under Test (EUT) configurations shown in the present report are true and accurate representation of the measurements of the sample's RF characteristics under the conditions herein specified.

The test results show that the EUT as described in the present report is in compliance with the requirements set forth in the standards mentioned above and apply to the tested sample identified in the present report only. The test report shall not be reproduced, except in its entirety, without the written approval of Central Research Technology Co.

**PREPARED BY** : Cathy Chen , **DATE** : April 8, 2014  
(Cathy Chen/ Technical Manager)

**APPROVED BY** : T. Y. Shih , **DATE** : Apr. 8, 2014  
(Tsun-Yu Shih/General Manager)

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**Attachment 1 – Photographs of the Test Configurations**

**Attachment 2 – External Photographs of EUT**

**Attachment 3 – Internal Photographs of EUT**

## **1 General Description**

### **1.1 General Description of EUT**

Equipment under Test	: NFC Reader
Model No.	: RD-FA6820-01
Power in	: 5Vdc
Test Voltage	: 120Vac/60Hz to the connected NB/PC
Manufacturer	: Uniform Industrial Corp.
Channel Numbers	: 1
Frequency Range	: 13.56MHz
Function Modulation	: ASK
Function Description	:

The EUT is used to transmit and receive signal both. Please refer to the user's manual for the details.

The EUT was pre-tested on the positioned of each 3 axis. There for only the test data of the worse case- Y axiz was used for Radiated test.

## **1.2 Test Mode**

Normal

## **1.3 Test Methodology**

For this E.U.T., the radiated emissions and conducted emission measurement performed according to the procedures illustrated in ANSI C63.4:2009 and other required were illustrated in separate sections of this test report for detail.

## 1.4 Requirement for Compliance

### (1) Field strength of Fundametal

According to 15.225(a), the field strength of any emissions within the band 13.553 - 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

### (2) Band Edge

According to 15.225(b), Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. According to 15.225(c), Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

### (3) Radiation emission

According to 15.225(d), the field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

### (4) Frequency tolerance

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### (5) Radiated emission limits, general requirements.

According to 15.209, except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
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

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

## (6) 20dB Bandwidth

According to 15.215(c) requires the device must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates.

## (7) Restricted Band

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
<sup>2</sup> 1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(2)
13.36 - 13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

## (8) Conduction Emission Requirement

For intentional device, according to §15.207(a) line conduction emission limit is as below table.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

\* Decreases with the logarithm of the frequency.

**1.5 The Support Units****Conducted Emission Test**

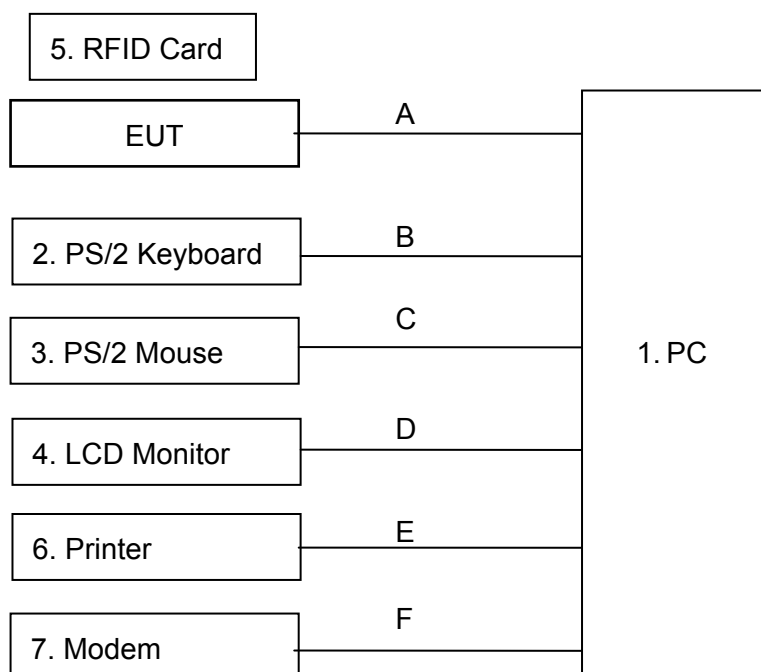
<b>No.</b>	<b>Unit</b>	<b>Model No.</b>	<b>FCC ID</b>	<b>Trade Name</b>	<b>Power Cord</b>	<b>Supported by lab.</b>
1	PC	LATITUDE D620	DoC	DELL	0.9m	✓
2	PS/2 Keyboard	N12ROU	DoC	ACER	1.8	✓
3	PS/2 Mouse	MO71KC	N/A	DELL	1.8m	✓
4	LCD Monitor	U2410	DoC	DELL	1.8m	✓
5	RF ID Card	N/A	N/A	N/A	N/A	
6	Printer	LQ-300+II	N/A	EPSON	1.8m	✓
7	Modem	DM-1414	IFAXDM14 14	ACEEX	1.8m	✓

**Radiated Emission Test**

<b>No.</b>	<b>Unit</b>	<b>Model No.</b>	<b>FCC ID</b>	<b>Trade Name</b>	<b>Power Cord</b>	<b>Supported by lab.</b>
1	Notebook	LATITUDE D620	DoC	DELL	0.9m	✓
2	USB Mouse	N12ROU	DoC	ACER	N/A	✓
3	RFID Card	N/A	N/A	N/A	N/A	

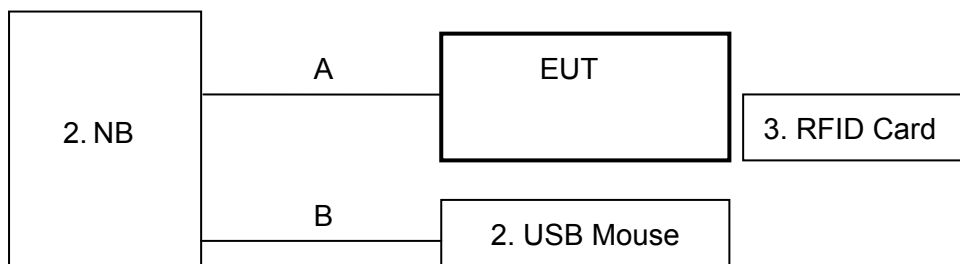
## 1.6 Layout of Setup

### Conducted Emission Test



No.	Cable	Length	Shielded	Core	Shielded Backshell	Supported by lab.	Note
A	5pin wildcat to USB Cable	0.9m	✓				
B	PS/2 Keyboard Cable	1.8m	✓			✓	
C	PS/2 Mouse Cable	1.8m	✓			✓	
D	D-SUB Cable	1.8m	✓	✓		✓	
E	Printer Cable	1.8m	✓	✓		✓	
F	Series Cable	1.8m	✓			✓	

## Radiated Emission Test



No.	Cable	Length	Shielded	Core	Shielded Backshell	Supported by lab.	Note
A	5pin wildcat to USB Cable	0.9m	✓				
B	USB Mouse Cable	1.8m	✓			✓	

## 1.7 Test Capability

### Test Facility

The test facility used for evaluating the conformance of the EUT with each standard in the present report meets what required in CISPR16-1-4, CISPR16-2-3 and ANSI C63.4:2009.

Test Room	Type of Test Room	Descriptions
TR1	10m semi-anechoic chamber (23m×14m×9m)	Complying with the NSA requirements in documents CISPR 22 and ANSI C63.4:2009. For the radiated emission measurement.
TR11	3m semi-anechoic chamber (9m × 6m × 6m)	
TR300	3m fully-anechoic chamber (8m × 5m × 5m)	
TR13	Test site	For the RF conducted emission measurement.
TR5	Shielding Room (8m×5m×4m)	For the conducted emission measurement.

### Test Laboratory Competence Information

Central Research Technology Co. has been accredited/registered/authorized by the agencies listed in the following table.

Certificate	Nation	Agency	Code	Mark
Accreditation Certificate	USA	NVLAP	200575-0	ISO/IEC 17025
	R.O.C. (Taiwan)	TAF	0905	ISO/IEC 17025
	R.O.C. (Taiwan)	BSMI	SL2-IN-E-0033, SL2-IS-E-0033, SL2-R1/R2-E-0033, SL2-A1-E-0033 SL2-L1-E-0033	ISO/IEC 17025
Site Filing Document	USA	FCC	474046, TW1053	Test facility list & NSA Data
	Canada	IC	4699A-1,-3	Test facility list & NSA Data
	Japan	VCCI	R-1527,C-1609,T-1441, G-10, C-4400, G-614, T-1334	Test facility list & NSA Data
Authorization Certificate	Germany	TUV	10021687	ISO/IEC 17025
	Norway	Nemko	ELA212	ISO/IEC 17025

The copy of each certificate can be downloaded from our web site: [www.crc-lab.com](http://www.crc-lab.com)

### 1.8 Measurement Uncertainty

The assessed measurement uncertainty with a suitable coverage factor K to ensure 95% confidence level for the normal distribution are shown as below, the values are less than  $U_{cispr}$  in table 1 of CISPR 16-4-2

Test Item	Measurement Uncertainty
Radiated Emission (30MHz~200MHz)	Horizontal 3.3dB ; Vertical 4.1dB
Radiated Emission (200~1000MHz)	Horizontal 3.8dB ; Vertical 5.1dB

## 2 Conducted Emission Measurement

Test Data: Pass

### 2.1 Limits for Emission Measurement

For intentional device, according to §15.207(a) line conduction emission limit is as below table.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

\* Decreases with the logarithm of the frequency.

Note:

For a device with a permanent antenna operating at or below 30 MHz, the FCC will accept measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions: (1) perform the AC line conducted tests with the permanent antenna to determine compliance with the Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the permanent antenna to determine compliance with the Section 15.207 limits within the transmitter's fundamental emission band.

## 2.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
Test Receiver	R&S	ESCS 30/ 836858/021	Jan. 15, 2014	Jan. 15, 2015
LISN	R&S	ESH2-Z5/ 880669/039	March 15, 2014	March 15, 2015
2 <sup>nd</sup> LISN	R&S	ENV4200/ 833209/010	March 29, 2013	March 29, 2014
50Ω terminator	N/A	N/A/ 001	Aug. 19, 2013	Aug. 19, 2014
RF Switch	N/A	RSU28/ 338965/002	Aug. 19, 2013	Aug. 19, 2014
RF Cable	N/A	N/A/ C0052 ~ 56	Aug. 19, 2013	Aug. 19, 2014
Dummy Load	N/A	50Ω 1/4W Resistance	NCR	NCR
Test Software	Audix	e3/ Ver. 5.2004-2-19k	NCR	NCR
TR5 shielded room	ETS LINDGREN	TR5/ 15353-F	NCR	NCR

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR : No Calibration Required.

## Instrument Setting

IF BW	Measurement Time	Detector	Trace	Comment
9kHz	1 second	Quasi-Peak / Average	Maxhold	

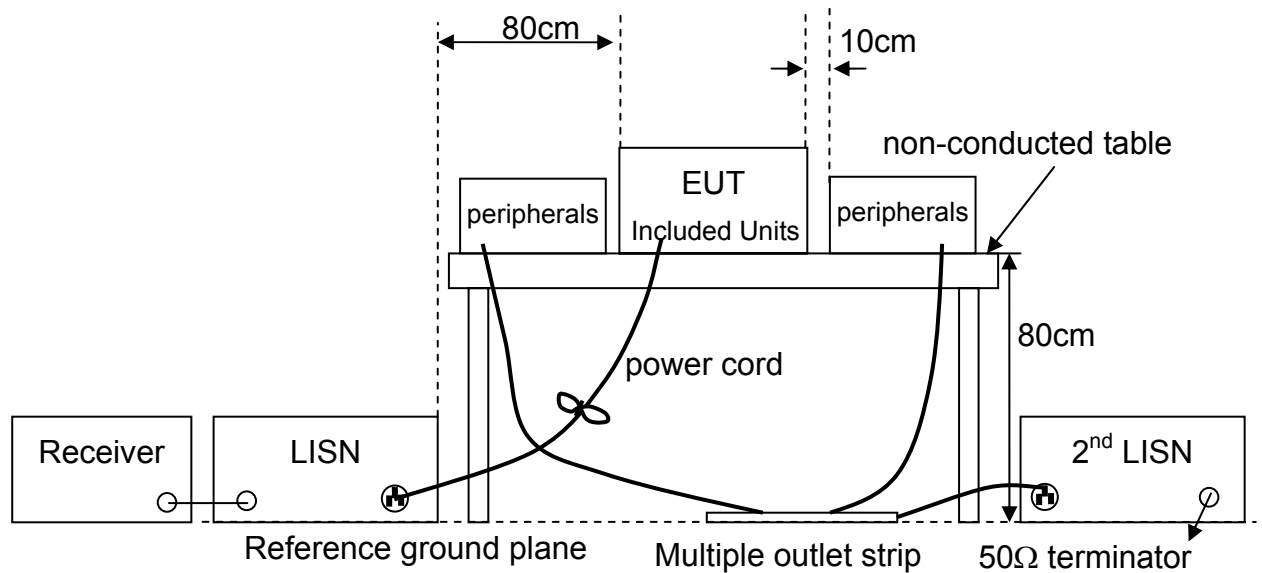
## Climatic Condition

Ambient Temperature : 24°C;      Relative Humidity : 60%

## **2.3 Test Procedures**

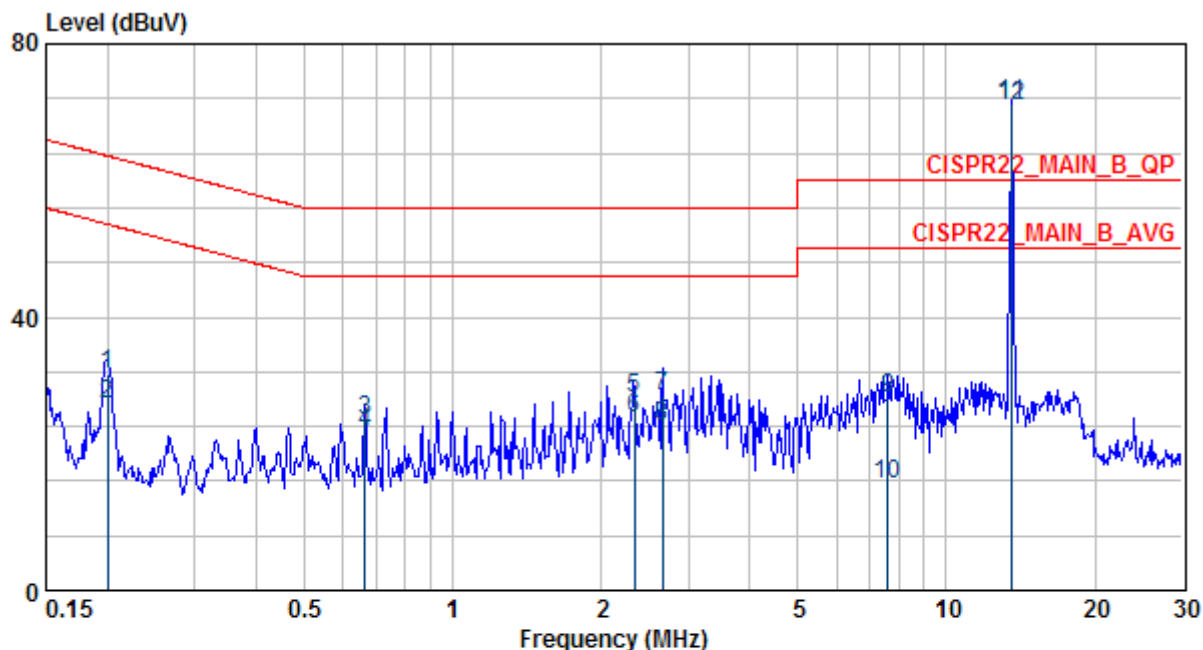
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a non-conducted table with a height of 0.8 meters above the reference ground plane and 0.4 meters from the conducting wall of the shielded room. Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 12 millimeters above the reference ground plane.
- c. Connect the EUT's power source to the appropriate power mains through the LISN.
- d. All the other peripherals are connected to the 2<sup>nd</sup> LISN, if any.
- e. The LISN was placed 0.8 meters from the EUT and at least 0.8 meters from other units and other metal planes.
- f. Measure the conducted emissions on each power line (Neutral Line and Line 1 – Hot side) of the EUT's power source by using the test receiver connected to the coupling RF output port of LISN.
- g. Rapidly scan the signal from 150kHz to 30MHz by using the receiver through the Maximum-Peak detector to determine those frequencies associated with higher emission levels for each measured line.
- h. Then measure the maximum level of conducted disturbance for each frequency found from step g. by using the receiver through the Quasi-Peak and Average detectors per CISPR 16-1.
- i. Record the level for each frequency and compare with the required limit.

## 2.4 Test Configurations



## 2.5 Test Data

Test Mode : Continuous Transmitting, with antenna  
 Tester : Kent Frequency Range : 150kHz~30MHz  
 Phase : Line

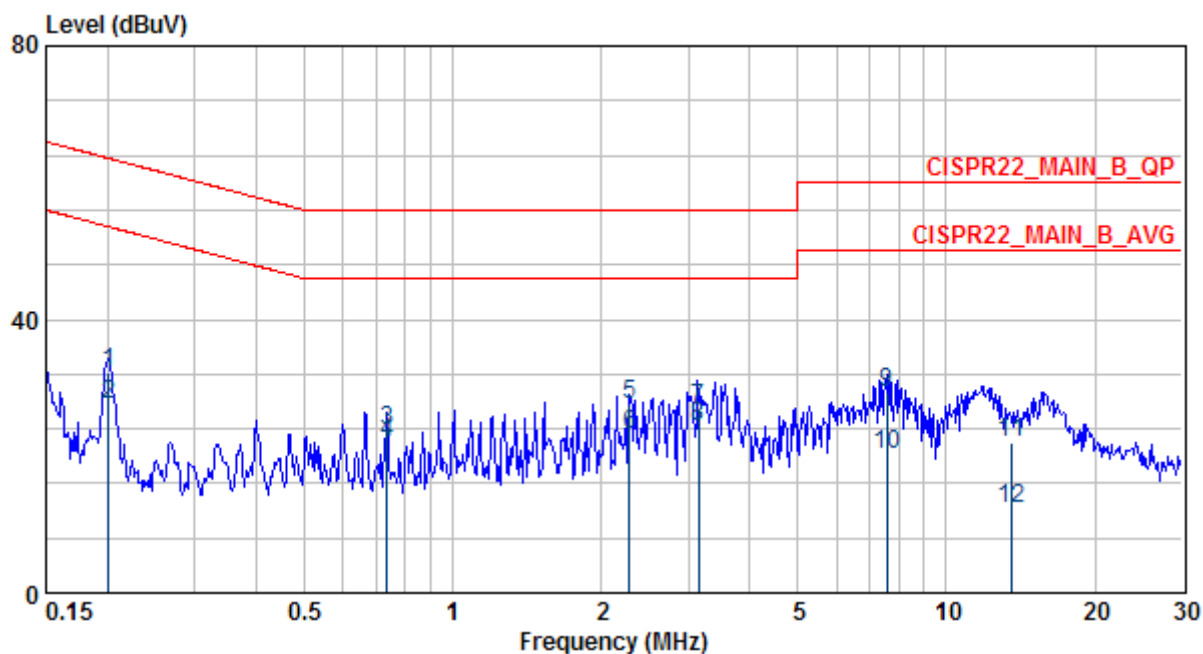


	Freq	Level	Factor	Read Level	Limit Line	Over Limit	Ant Pos	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	cm		
1	0.200	31.76	0.16	31.60	63.62	-31.86	---	LINE	QP
2	0.200	27.11	0.16	26.95	53.62	-26.51	---	LINE	AVERAGE
3	0.665	24.80	0.19	24.61	56.00	-31.20	---	LINE	QP
4	0.665	23.07	0.19	22.88	46.00	-22.93	---	LINE	AVERAGE
5	2.329	28.21	0.28	27.93	56.00	-27.79	---	LINE	QP
6 @	2.329	25.19	0.28	24.91	46.00	-20.81	---	LINE	AVERAGE
7	2.664	28.40	0.29	28.11	56.00	-27.60	---	LINE	QP
8	2.664	24.16	0.29	23.87	46.00	-21.84	---	LINE	AVERAGE
9	7.606	28.13	0.47	27.66	60.00	-31.87	---	LINE	QP
10	7.606	15.42	0.47	14.95	50.00	-34.58	---	LINE	AVERAGE
11 @	13.560	71.22	0.68	70.54	60.00	11.22	---	LINE	QP
12 @	13.560	70.91	0.68	70.23	50.00	20.91	---	LINE	AVERAGE

## Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. Tx Fundamental(marked 11, 12), for reference only. Please refer to next page.

**Test Mode** : Continuous Transmitting, with dummy load  
**Tester** : Kent **Frequency Range** : 150kHz~30MHz  
**Phase** : Line

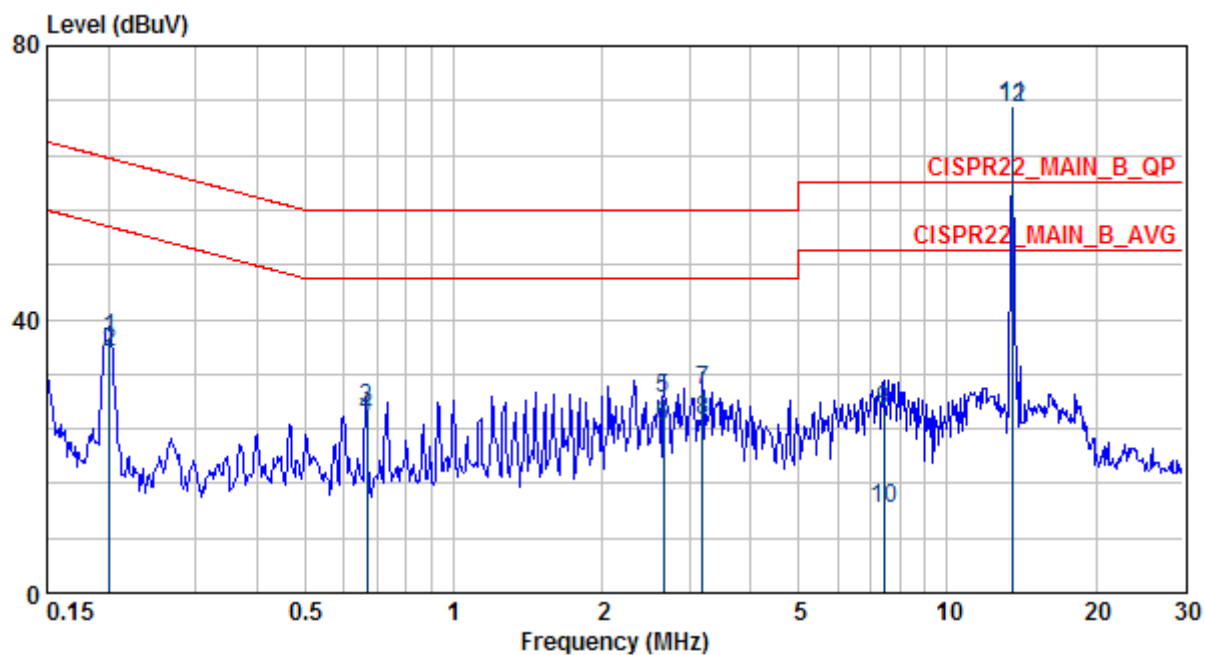


	Freq	Level	Factor	Read Level	Limit Line	Over Limit	Ant Pos	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	cm		
1	0.201	32.23	0.16	32.07	63.58	-31.35	---	LINE	QP
2	0.201	27.49	0.16	27.33	53.58	-26.09	---	LINE	AVERAGE
3	0.735	23.76	0.20	23.56	56.00	-32.24	---	LINE	QP
4	0.735	22.11	0.20	21.91	46.00	-23.89	---	LINE	AVERAGE
5	2.277	27.41	0.28	27.13	56.00	-28.59	---	LINE	QP
6	2.277	23.16	0.28	22.88	46.00	-22.84	---	LINE	AVERAGE
7	3.148	26.82	0.30	26.52	56.00	-29.18	---	LINE	QP
8	3.148	24.18	0.30	23.88	46.00	-21.82	---	LINE	AVERAGE
9	7.566	29.30	0.47	28.83	60.00	-30.70	---	LINE	QP
10	7.566	20.23	0.47	19.76	50.00	-29.77	---	LINE	AVERAGE
11	13.560	21.98	0.68	21.30	60.00	-38.02	---	LINE	QP
12	13.560	12.18	0.68	11.50	50.00	-37.82	---	LINE	AVERAGE

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.

**Test Mode** : Continuous Transmitting, with antenna  
**Tester** : Kent **Frequency Range** : 150kHz~30MHz  
**Phase** : Neutral

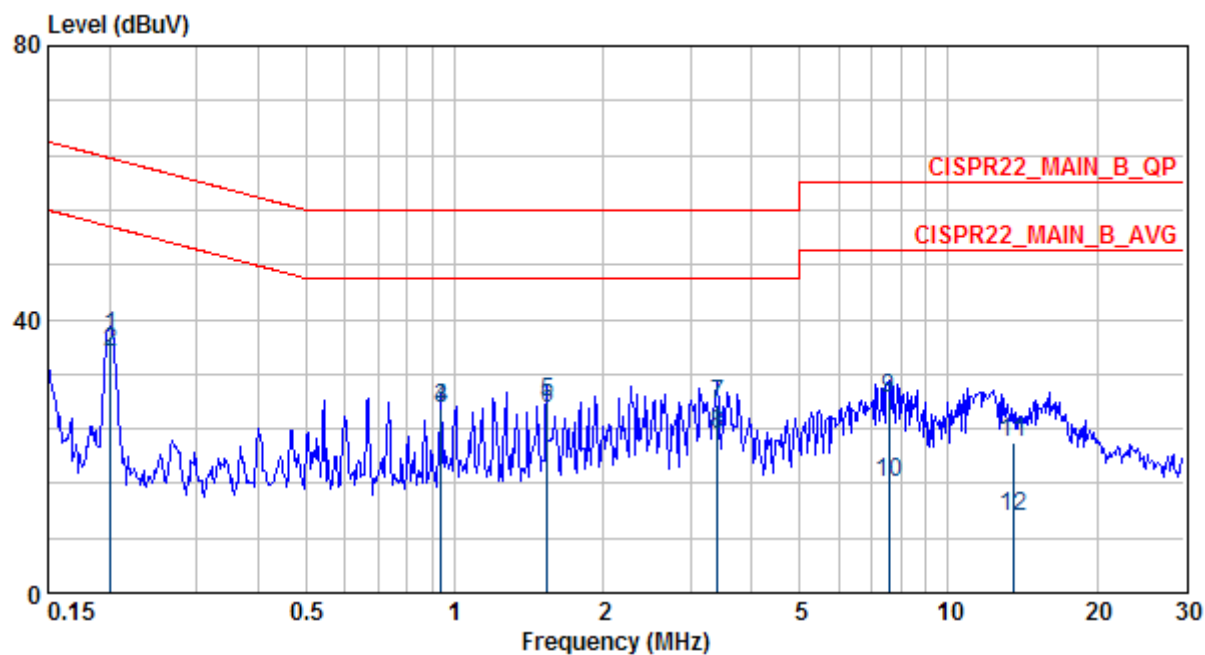


	Freq	Level	Factor	Read Level	Limit Line	Over Limit	Ant Pos	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	cm		
1	0.201	37.34	0.18	37.16	63.58	-26.24	---	NEUTRAL	QP
2 @	0.201	35.31	0.18	35.13	53.58	-18.27	---	NEUTRAL	AVERAGE
3	0.667	26.91	0.20	26.71	56.00	-29.09	---	NEUTRAL	QP
4 @	0.667	25.80	0.20	25.60	46.00	-20.20	---	NEUTRAL	AVERAGE
5	2.665	28.38	0.30	28.08	56.00	-27.62	---	NEUTRAL	QP
6 @	2.665	24.43	0.30	24.13	46.00	-21.57	---	NEUTRAL	AVERAGE
7	3.198	29.47	0.31	29.16	56.00	-26.53	---	NEUTRAL	QP
8 @	3.198	25.07	0.31	24.76	46.00	-20.93	---	NEUTRAL	AVERAGE
9	7.446	26.66	0.49	26.17	60.00	-33.34	---	NEUTRAL	QP
10	7.446	12.29	0.49	11.80	50.00	-37.71	---	NEUTRAL	AVERAGE
11 @	13.560	71.13	0.71	70.42	60.00	11.13	---	NEUTRAL	QP
12 @	13.560	70.86	0.71	70.15	50.00	20.86	---	NEUTRAL	AVERAGE

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. Tx Fundamental(marked 11, 12), for reference only. Please refer to next page.

**Test Mode** : Continuous Transmitting, with dummy load  
**Tester** : Kent **Frequency Range** : 150kHz~30MHz  
**Phase** : Neutral



	Freq	Level	Factor	Read Level	Limit Line	Over Limit	Ant Pos	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	cm		
1	0.201	37.57	0.18	37.39	63.58	-26.01	---	NEUTRAL	QP
2 @	0.201	35.19	0.18	35.01	53.58	-18.39	---	NEUTRAL	AVERAGE
3	0.937	26.93	0.22	26.71	56.00	-29.07	---	NEUTRAL	QP
4 @	0.937	26.89	0.22	26.67	46.00	-19.11	---	NEUTRAL	AVERAGE
5	1.538	27.96	0.26	27.70	56.00	-28.04	---	NEUTRAL	QP
6 @	1.538	26.89	0.26	26.63	46.00	-19.11	---	NEUTRAL	AVERAGE
7	3.413	27.57	0.32	27.25	56.00	-28.43	---	NEUTRAL	QP
8	3.413	23.13	0.32	22.81	46.00	-22.87	---	NEUTRAL	AVERAGE
9	7.563	28.31	0.49	27.82	60.00	-31.69	---	NEUTRAL	QP
10	7.563	16.04	0.49	15.55	50.00	-33.96	---	NEUTRAL	AVERAGE
11	13.560	22.09	0.71	21.38	60.00	-37.91	---	NEUTRAL	QP
12	13.560	11.13	0.71	10.42	50.00	-38.87	---	NEUTRAL	AVERAGE

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.

### **3 Field Strength of fundamental**

**Result: Pass**

#### **3.1 Applied Standard**

According to 15.225(a), The field strength of any emissions within the band 13.553 - 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

According to 15.225(b), Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

According to 15.225(c), Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

### 3.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESCI/ 100019	June 7, 2013	June 7, 2014
Loop Antenna	EMCO	6502/ 20558	Aug. 29, 2013	Aug. 29, 2014
RF Cable	N/A	N/A/ C0080	Feb. 10, 2014	Aug. 10, 2014
Test Software	Audix	e3/ ARD-SPR-000282	NCR	NCR
TR11 Semi – anechoic Chamber	ETS. LINDGREN	TR11/ 906-A	May 11, 2013	May 11, 2014

Note:

1. The calibrations are traceable to NML/ROC.
2. The calibration date of the semi-anechoic chamber listed above is the date of NSA measurement.

### Instrument Setting

RBW	VBW	Detector	Trace	Comment
9kHz	N/A	Quasi-Peak	Maxhold	

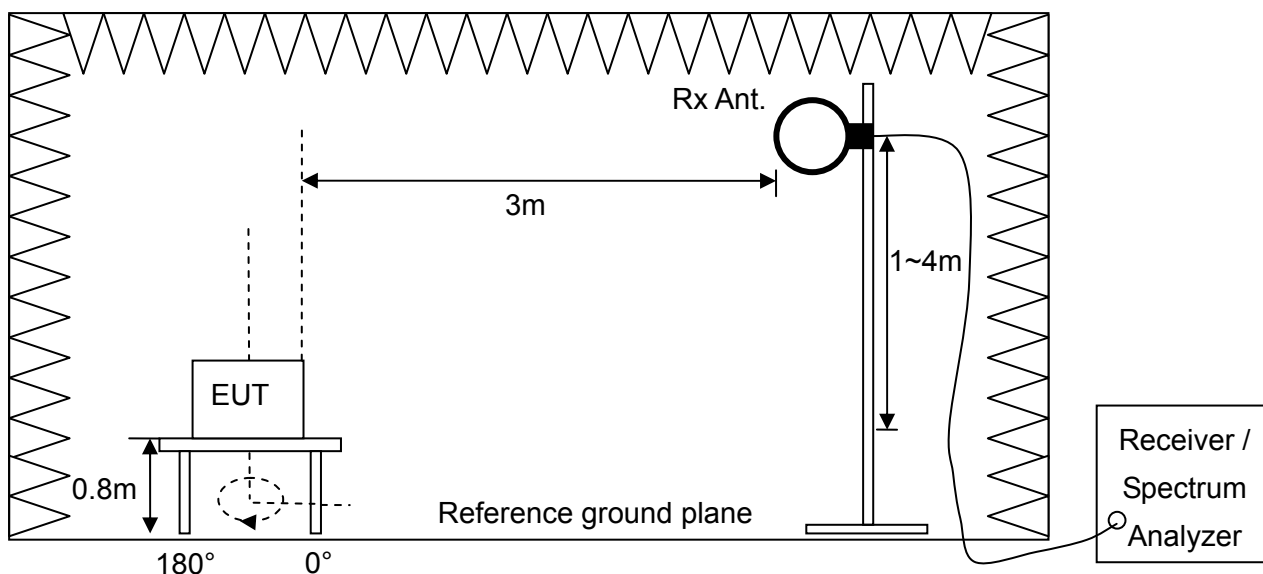
### Climatic Condition

Ambient Temperature : 20°C; Relative Humidity : 60%

### 3.3 Measurement Procedure

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it should be placed on a wooden table with a height of 0.8 meters above the reference ground plane in the semi-anechoic chamber. If the EUT is floor-standing equipment, it should be placed on a non-conducted support with a height of 12 millimeters above the reference ground plane in the semi-anechoic chamber.
- c. The EUT is set at 3m away from the receiving antenna.
- d. Rapidly sweep the signal in the test frequency range by using the spectrum through the Maximum-peak detector.
- e. Rotate the EUT from 0° to 360° and position the receiving loop antenna at 1~4 meters above the reference ground plane to determine the fundamental frequency and record them.
- f. Finely turn the turntable and the antenna is be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response and recorded position of fundamental frequency found from step e.
- g. Record and compare the maximum level with the required limit.
- h. Change the receiving antenna to another polarization to measure Field Strength of fundamental by following step e. to g. again.

### 3.4 Test Configuration



**3.5 Test Data****Field strength of fundamental****Test Mode : Mode 1, Continuous Transmitting****Tester : Liu**

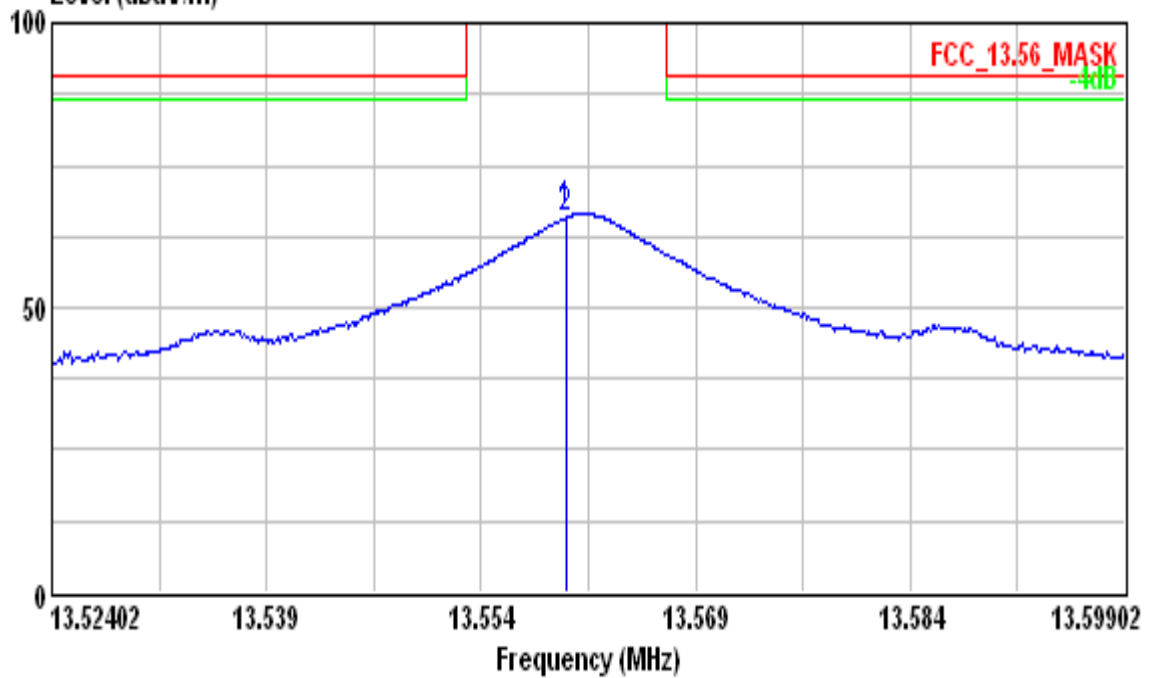
<b>Freq. (MHz)</b>	<b>Polarization</b>	<b>Reading Data (dBuV)</b>	<b>Correction Factor (dB/m)</b>	<b>Emission Level (dBuV/m)</b>	<b>Limit (dBuV/m)</b>	<b>Margin (dB)</b>
13.56	H	51.24	14.36	65.60	124	58.40
13.56	V	47.45	14.36	61.81	124	62.19

Note :

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor
2. Output Field Strength (dBuV/m) = Reading Data + Correction Factor
3. The limit is 15848 (uV/m)=84dBuV/m @ 30 m , for main frequency < 30MHz, the formula transfers the limit at 30 m to 3m is  $L_{30}(\text{dBuV/m}) + 40 = 124 \text{ dBuV/m}$
4. Margin (dB) = Limit – Output Field Strength

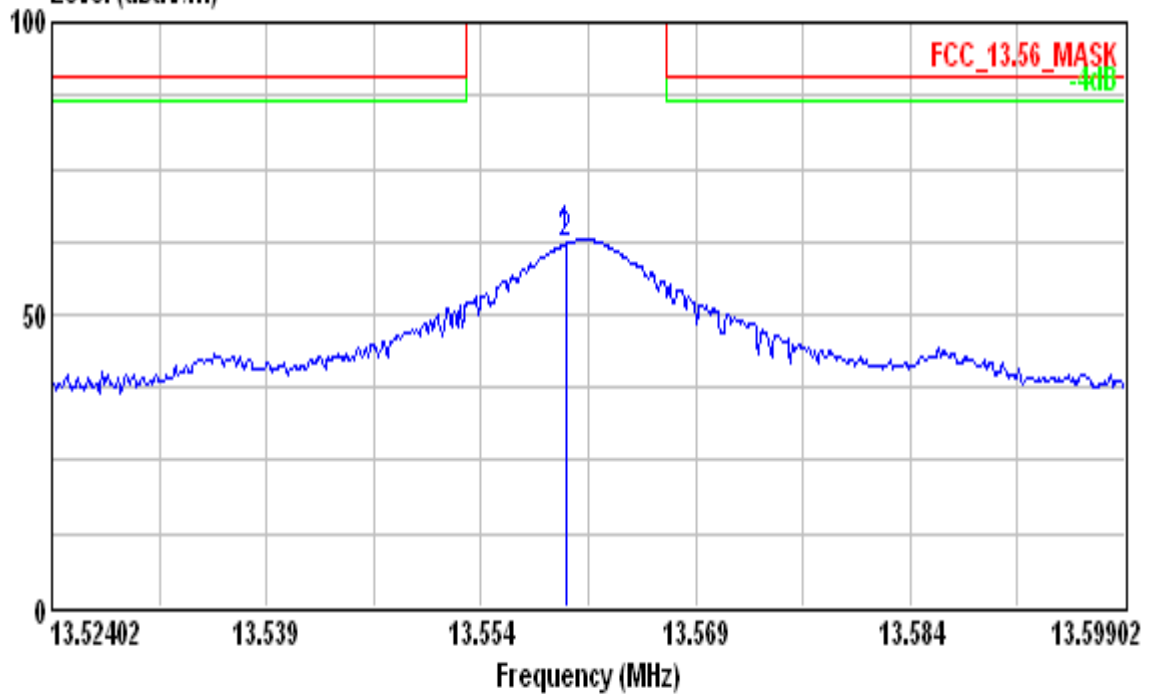
## H Polarization

Level (dBuV/m)



## V Polarization

Level (dBuV/m)



## Band Edge

Test Mode : Mode 1, Continuous Transmitting

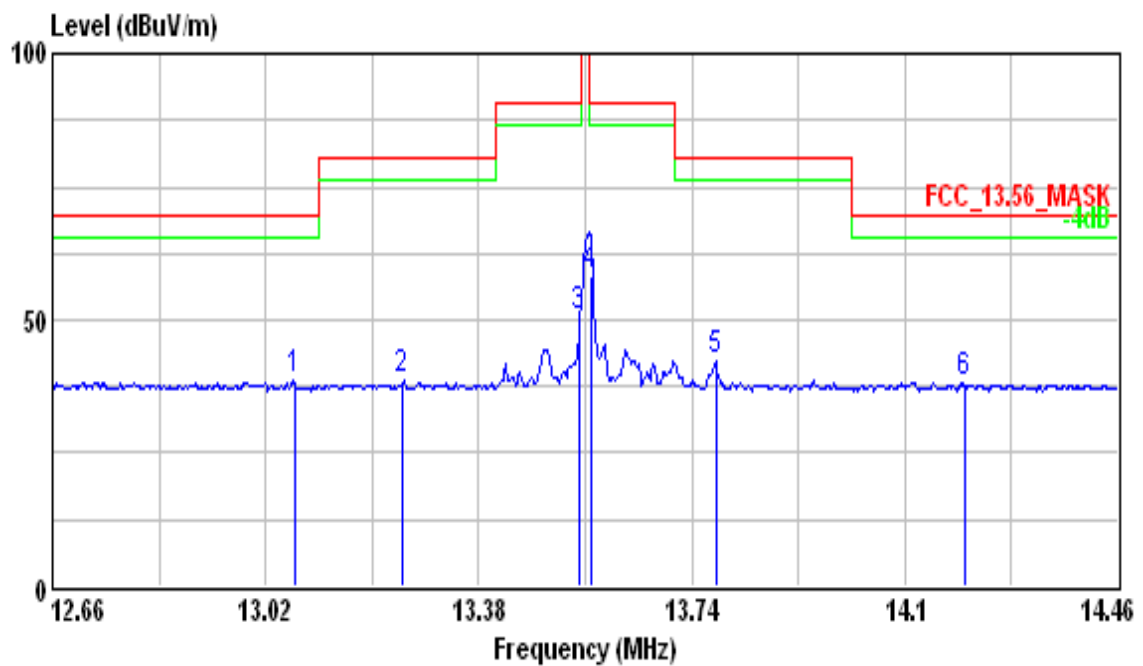
Tester : Liu

Emission Freq. (MHz)	Polarizortal	Reading Data (dBuV)	Correction Factor (dB/m)	Maximum Emission within the band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.16	H	24.35	14.39	38.74	80.51	41.77
13.16	V	24.35	14.4	38.75	80.51	41.76
13.55	H	35.9	14.36	50.26	90.47	40.21
13.55	V	30.17	14.36	44.53	90.47	45.94
13.57	H	44.08	14.36	58.44	90.47	32.03
13.57	V	39.44	14.36	53.8	90.47	36.67
13.78	H	27.85	14.34	42.19	80.51	38.32
13.78	V	27.19	14.34	41.53	80.51	38.98

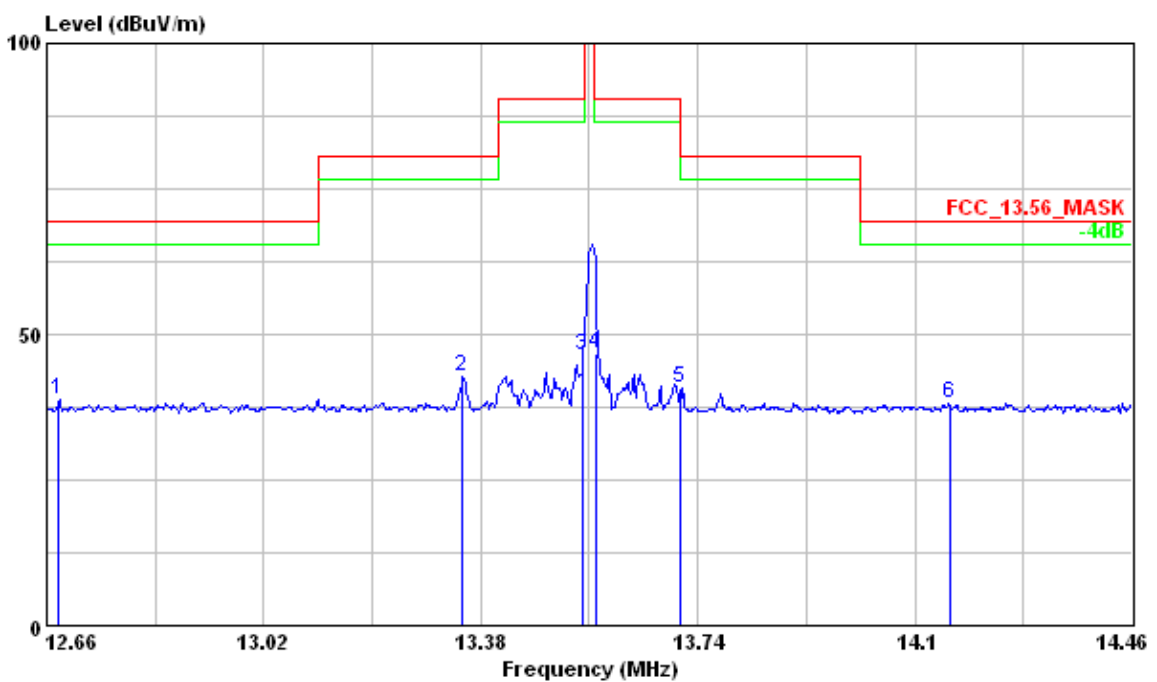
Note :

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor
2. Output Field Strength (dBuV/m) = Reading Data + Correction Factor
3. For main frequency < 30MHz, the formula transfers the limit at 30 m to 3m is  $L_{30}(\text{dBuV/m}) + 40$
4. Margin (dB) = Limit – Maximum Emission within the band

## H Polarization



## V Polarization



## 4 Radiated Emission

Result: Pass

### 4.1 Applied Standard

According to 15.225(d), The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
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

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

## 4.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESCI/ 100019	June 7, 2013	June 7, 2014
Spectrum Analyzer	Agilent	E4407B/ MY45106795	May 29, 2013	May 29, 2014
Loop Antenna	EMCO	6502/ 20558	Aug. 29, 2013	Aug. 29, 2014
Bi-Log Antenna	EMCO	3142C/ 52088	May 27, 2013	May 27, 2014
Pre-Amplifier	Mini-circuit	ZKL-2/ 004	Feb. 10, 2014	Aug. 10, 2014
RF Cable	N/A	N/A/ C0080	Feb. 10, 2014	Aug. 10, 2014
Test Software	Audix	e3/ ARD-SPR-0002 82	NCR	NCR
TR11 Semi - anechoic Chamber	ETS. LINDGREN	TR11/ 906-A	May 11, 2013	May 11, 2014

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR:No Calibration Required.

## Instrument Setting

RBW	VBW	Detector	Trace	Comment
9kHz	N/A	Quasi-Peak	Maxhold	Below 30MHz
120kHz	N/A	Quasi-Peak	Maxhold	Below 1GHz

## Climatic Condition

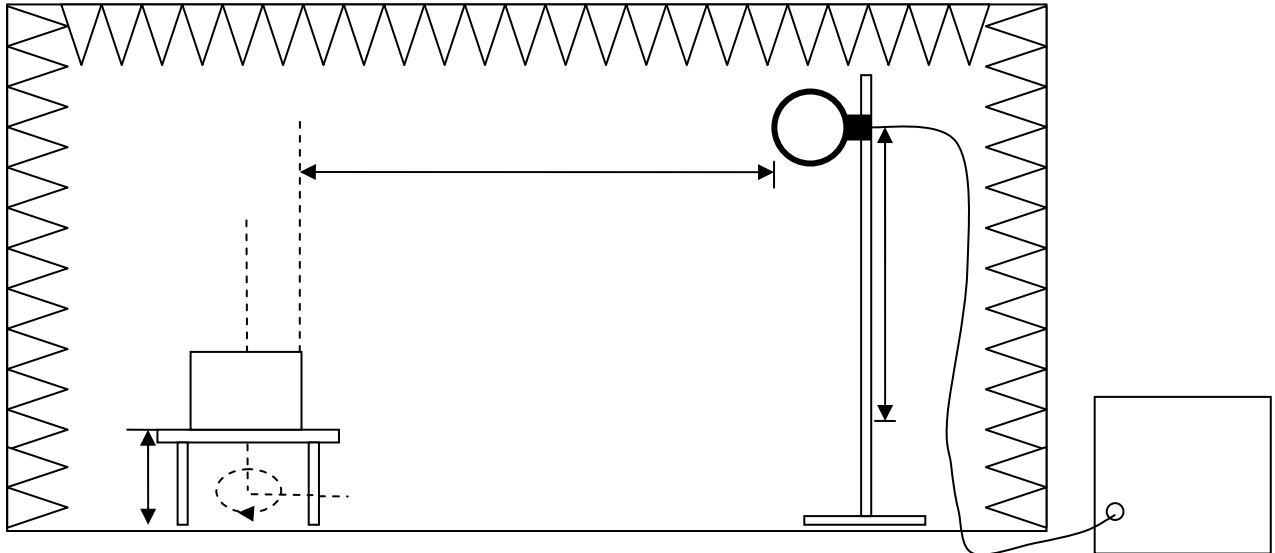
Ambient Temperature : 20°C; Relative Humidity : 60 %

### **4.3 Measurement Procedure**

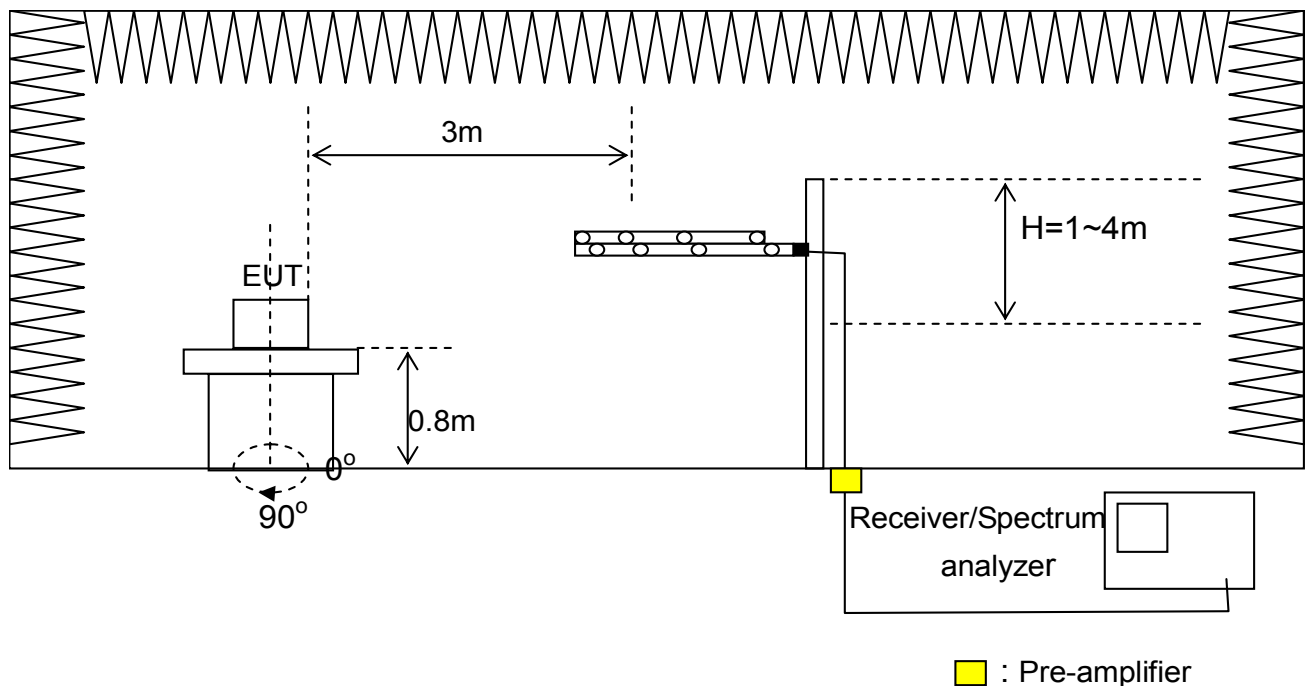
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. A software provided by client enabled the EUT to transmit and receive data at specified channel frequencies individually.
- c. If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 meters above the reference ground plane in the semi-anechoic chamber. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 12 millimeters above the reference ground plane in the semi-anechoic chamber.
- d. The EUT was set 3m away from the interference receiving antenna.
- e. Rapidly sweep the signal in the test frequency range by using the spectrum through the Maximum-peak detector.
- f. Rotate the EUT from 0° to 360° and position the receiving antenna at heights from 1 to 4 meters above the reference ground plane continuously to determine at least six frequencies associated with higher emission levels and record them.
- g. Then measure each frequency found from step f. by using the spectrum with rotating the EUT and positioning the receiving antenna height to determine the maximum level.
- h. Record frequency, azimuth angle of the turntable, height, and polarization of the receiving antenna and compare the maximum level with the required limit.
- i. Change the receiving antenna to another polarization to measure radiated emission by following step e. to h. again.
- j. If the peak emission level measured from step f. is 4dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. value will be measured and presented.

#### 4.4 Test Configuration

##### Below 30MHz

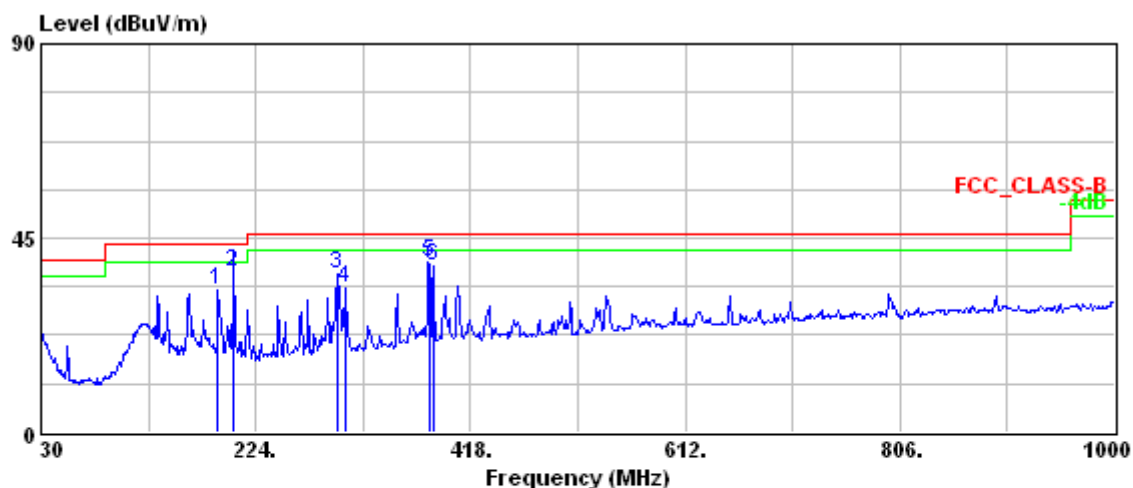


##### Above 30MHz



## 4.5 Test Data

Test Mode : Continuous Transmitting  
 Tester : Liu Frequency Range : 9kHz~1GHz  
 Polarization : Horizontal



	Freq	Level	Read	Limit	Over	Ant	Table		
	MHz	dBuV/m	Level	Factor	Line	Limit	Pos	Pos	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg	Remark
1	190.110	32.79	48.66	-15.87	43.50	-10.71	---	---	HORIZONTAL Peak
2	204.010	36.93	52.49	-15.56	43.50	-6.57	181	50	HORIZONTAL QP
3	297.840	36.62	48.54	-11.92	46.00	-9.38	---	---	HORIZONTAL Peak
4	304.900	33.44	45.02	-11.58	46.00	-12.56	---	---	HORIZONTAL Peak
5	380.500	39.31	48.68	-9.37	46.00	-6.69	---	---	HORIZONTAL Peak
6	384.000	38.61	47.87	-9.26	46.00	-7.39	---	---	HORIZONTAL Peak

Note :

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier
2. Emission Level (dBuV/m) = Reading Data + Correction Factor

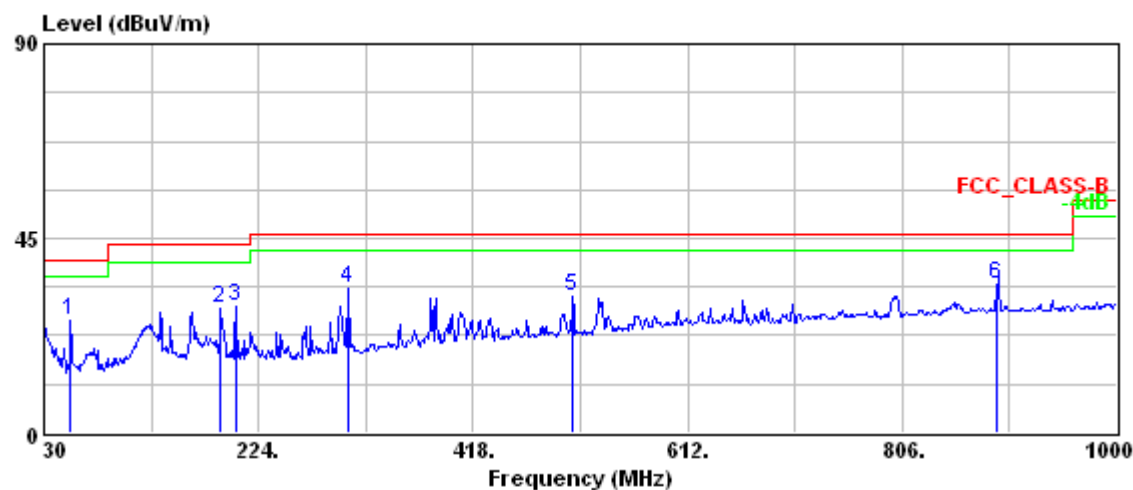
No signal can be detected from 9kHz to 30MHz, so the graphs are omitted below 30MHz.

Test Mode : Continuous Transmitting

Tester : Liu

Frequency Range : 9kHz~1GHz

Polarization : Vertical



	Freq	Level	Read	Limit	Over	Ant	Table		
	MHz	dBuV/m	Level	Factor	Line	Limit	Pos	Pos	Pol/Phase
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg	Remark
1	54.030	25.98	44.64	-18.66	40.00	-14.02	---	---	VERTICAL
2	190.110	28.68	44.55	-15.87	43.50	-14.82	---	---	VERTICAL
3	203.070	29.22	44.80	-15.58	43.50	-14.28	---	---	VERTICAL
4	304.900	33.62	45.20	-11.58	46.00	-12.38	---	---	VERTICAL
5	507.900	31.61	38.15	-6.54	46.00	-14.39	---	---	VERTICAL
6 @	890.980	34.41	35.36	-0.95	46.00	-11.59	101	5	VERTICAL

Note :

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier
2. Emission Level (dBuV/m) = Reading Data + Correction Factor

No signal can be detected from 9kHz to 30MHz, so the graphs are omitted below 30MHz.

## **5 Frequency Tolerance**

**Result: Pass**

### **5.1 Applied Standard**

According to 15.225(e), the frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

**5.2 Test Instruments**

<b>Test Site and Equipment</b>	<b>Manufacturer</b>	<b>Model No./ Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
Spectrum Analyzer	Agilent	E4405B/ MY45106706	April 9, 2013	April 9, 2014
Temperature Chamber	Terchy	MHG-800LF/ 920224	Aug. 16, 2013	Aug. 16, 2014
Adjustable AC Power Supply	EXTECH	6110/ 1102108	NCR	NCR
Test Site	N.A.	TR13	NCR	NCR

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR:No Calibration Required.

**Instrument Setting**

<b>RBW</b>	<b>VBW</b>	<b>Detector</b>	<b>Trace</b>	<b>Comment</b>
300Hz	1kHz	Peak	Maxhold	

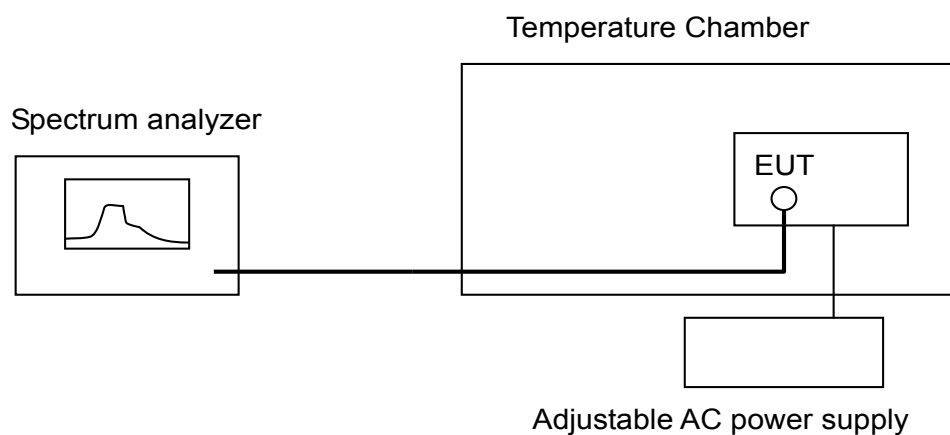
**Climatic Condition**

Ambient Temperature : 21°C;      Relative Humidity : 55%

### 5.3 Measurement Procedure

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage described in the user's manual supported by the manufacturer in test site TR13.
- b. Measure the frequency tolerance by using the spectrum analyzer and following the test conditions described in FCC 15.225(e) to perform the normal and extreme conditions test.
- c. Record the value and compare with the required limit.

### 5.4 Test Configuration



## 5.5 Test Data

Test Mode : Continuous Transmitting

Tester : Jun

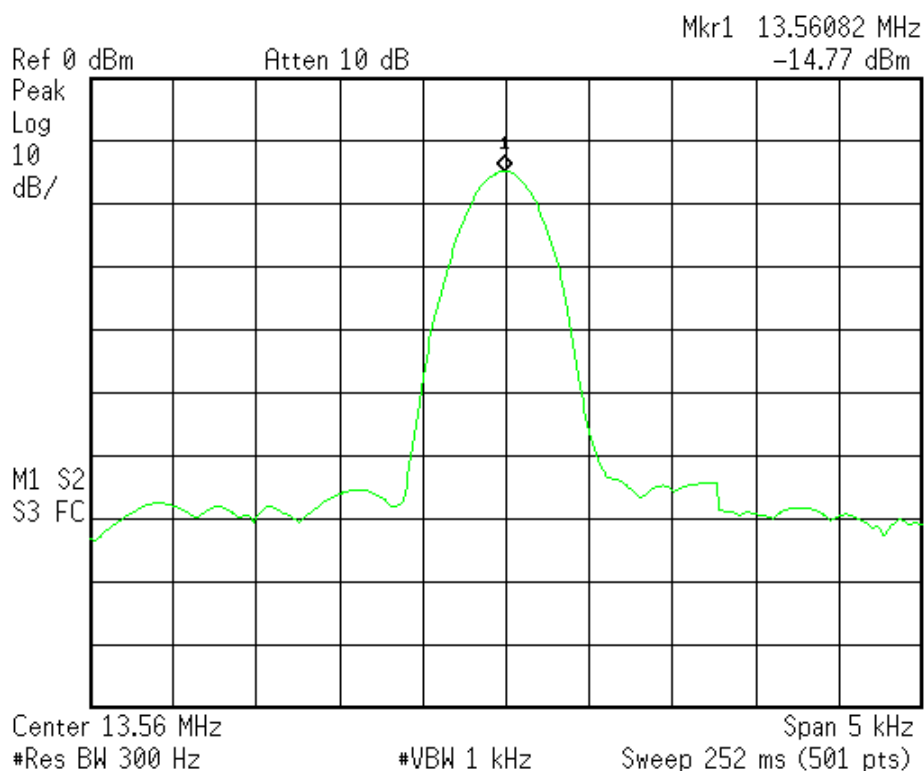
Temperature (°C)	DC Voltage (Volt)	Meas. Frequency (MHz)	Deviation (kHz)	Limit (kHz)	Margin (kHz)
20°C	5	13.56082	NA	1.356	NA
	5.75	13.56080	0.02	1.356	1.336
	4.25	13.56080	0.02	1.356	1.336
-20°C	5	13.56086	0.04	1.356	1.316
50°C	5	13.56078	0.04	1.356	1.316

Note:

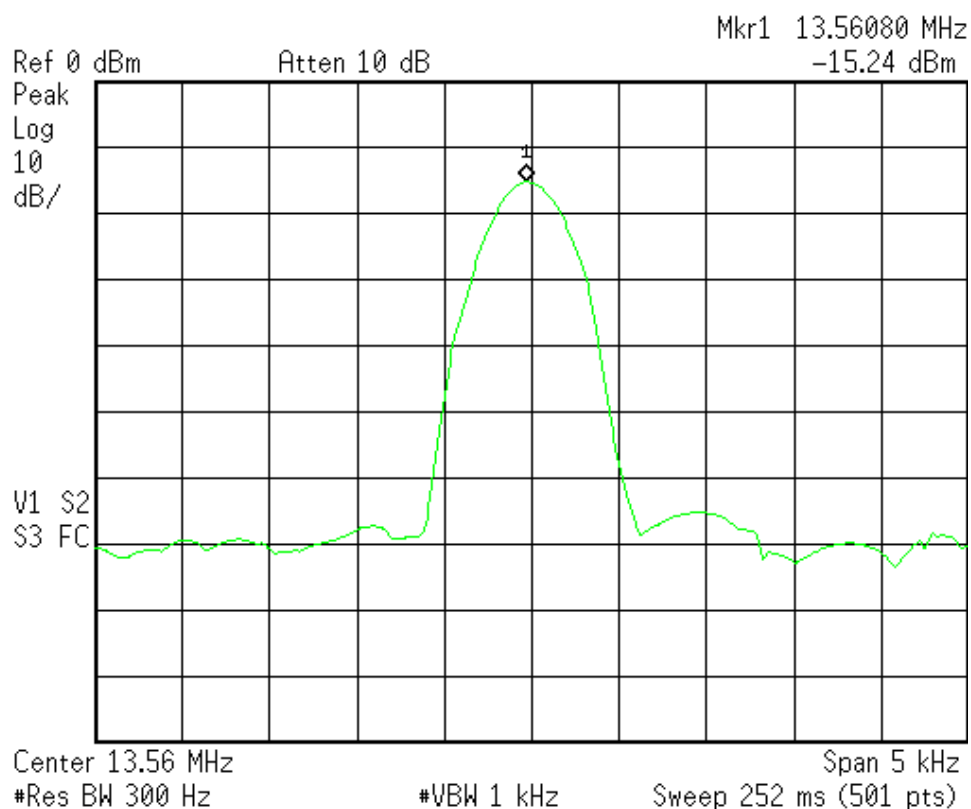
1. Deviation(kHz) = | Meas. Frequency – Meas. Frequency @20°C/5Vdc |

2. Margin (kHz)= Limit – Deviation

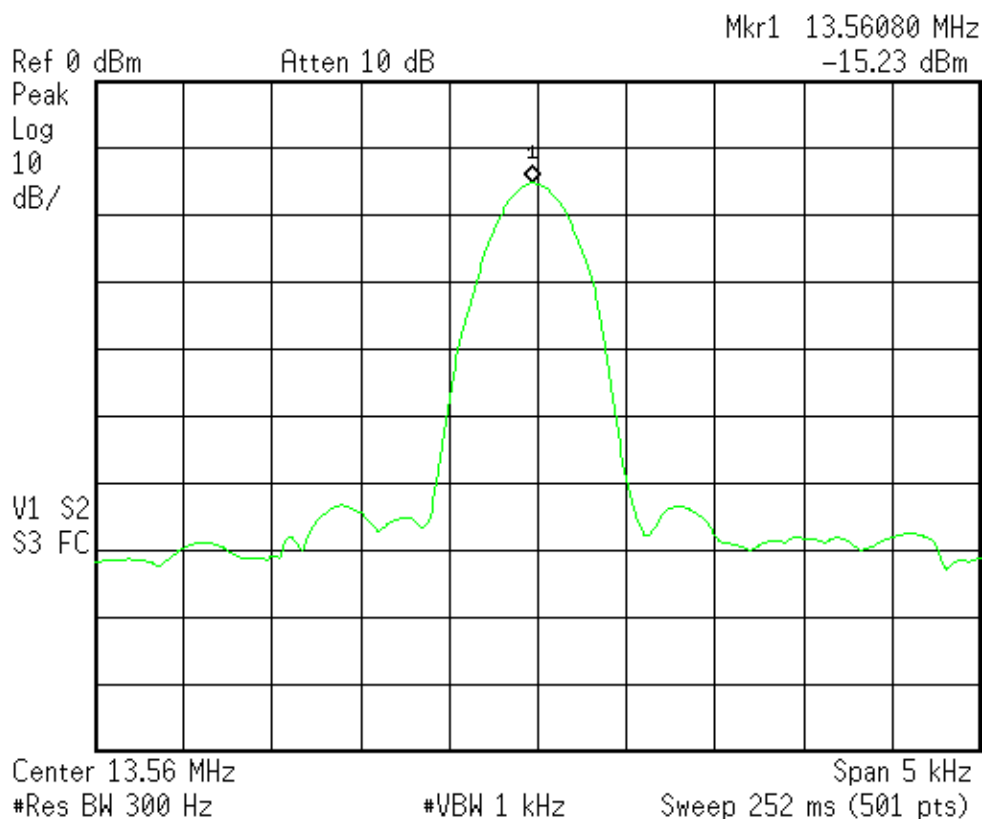
20°C, 5Vdc

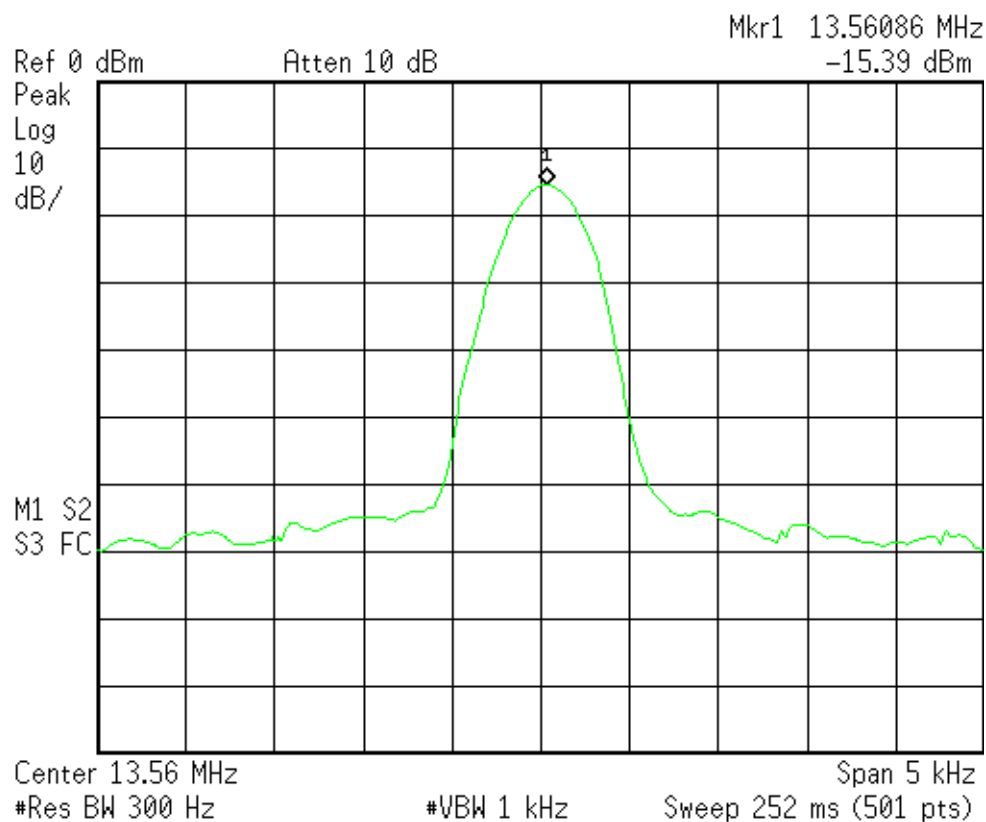
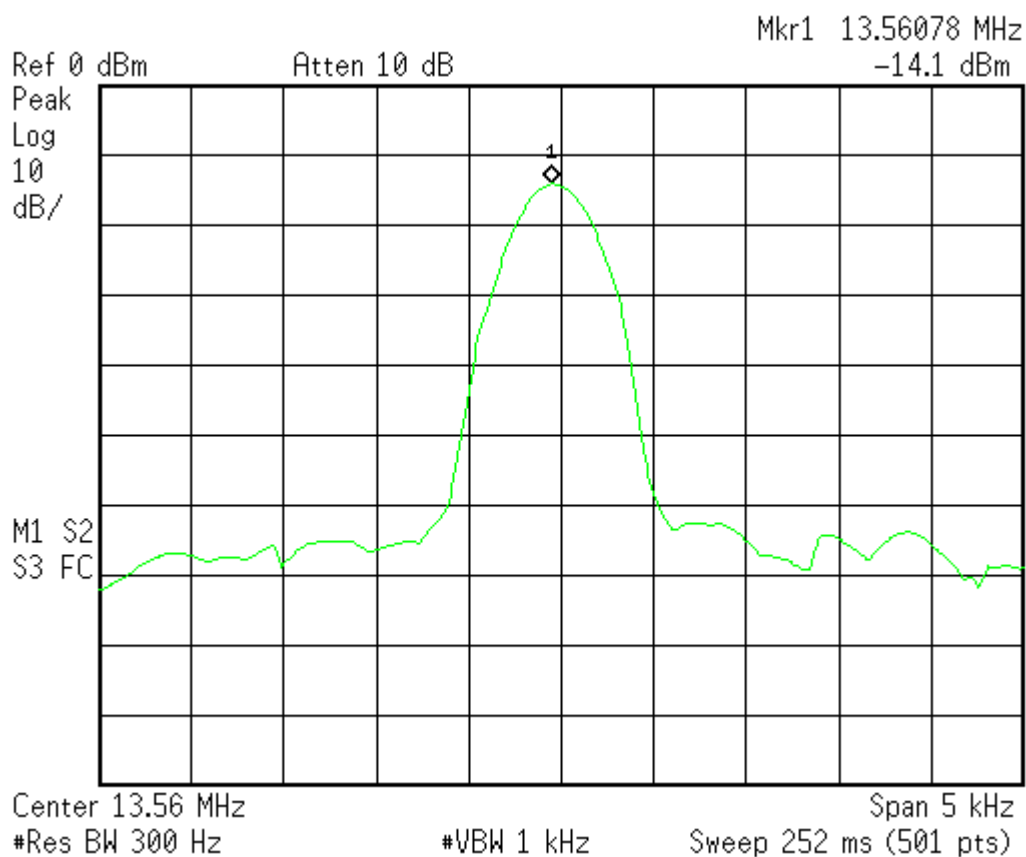


20°C, 5.75Vdc



20°C, 4.25Vdc



**-20°C, 5Vdc****50°C, 5Vdc**

## **6 20dB Bandwidth**

**Result:** Pass

### **6.1 Applied Standard**

According to 15.215(c) requires the device must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates.

According to 15.225, Operation should within the band 13.110 – 14.010 MHz.

**6.2 Test Instruments**

<b>Test Site and Equipment</b>	<b>Manufacturer</b>	<b>Model No./ Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
Spectrum Analyzer	Agilent	E4405B/ MY45106706	April 9, 2013	April 9, 2014
Test Site	N.A.	TR13	NCR	NCR

Note:

- 1.The calibrations are traceable to NML/ROC.
- 2.NCR : No Calibration Required.

**Instrument Setting**

<b>RBW</b>	<b>VBW</b>	<b>Detector</b>	<b>Trace</b>	<b>Comment</b>
300Hz	1kHz	Peak	Maxhold	

**Climatic Condition**

Ambient Temperature : 21°C;      Relative Humidity : 55%

### 6.3 Measurement Procedure

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage described in the user's manual supported by the manufacturer in test site TR13.
- b. Measure the 20dB bandwidth by using the spectrum analyzer and following the test conditions described in FCC 15.215.
- c. Record the frequency and compare with the required limit.

### 6.4 Test Configuration



## 6.5 Test Data

Test Mode : Continuous Transmitting

Tester : Jun

Operating Frequency (MHz)	The lowest frequency (MHz)	The highest frequency (MHz)	Limit (MHz)
13.56	13.56042	13.5612	13.110~14.01

