



## FCC 47 CFR PART 15 SUBPART C

for

**Keyboards**

**Model: TK1002**

**Brand: TYPO**

**Test Report Number:**

**C140714Z03-RP1**

Issued for

**ICHIA TECHNOLOGIES INC**

**268, HwaYa 2nd Road, Hwa-Ya Tech. Park, Gueishan, Taoyuan 333 Taiwan**

Issued by:

**COMPLIANCE CERTIFICATION SERVICES (SHENZHEN) INC.**

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**Issued Date: July 28, 2014**



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Revision History

Rev.	Issue Date.	Revisions	Effect Page	Revised By
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TABLE OF CONTENTS

<b>1 TEST CERTIFICATION .....</b>	<b>4</b>
<b>2 EUT DESCRIPTION .....</b>	<b>5</b>
<b>3 TEST METHODOLOGY .....</b>	<b>6</b>
3.1. DESCRIPTION OF TEST MODES.....	6
<b>4 TEST METHODOLOGY .....</b>	<b>7</b>
4.1. EUT EXERCISE .....	7
4.2. FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS.....	7
<b>5 INSTRUMENT CALIBRATION .....</b>	<b>8</b>
<b>6 SETUP OF EQUIPMENT UNDER TEST .....</b>	<b>8</b>
6.1. DESCRIPTION OF SUPPORT UNITS .....	8
6.2. CONFIGURATION OF SYSTEM UNDER TEST .....	8
<b>7 FACILITIES AND ACCREDITATIONS.....</b>	<b>9</b>
7.1. FACILITIES .....	9
7.2. ACCREDITATIONS.....	9
7.3. MEASUREMENT UNCERTAINTY .....	9
<b>8 FCC PART 15.249 REQUIREMENTS .....</b>	<b>10</b>
8.1. BAND EDGES MEASUREMENT .....	10
8.2. POWER LINE CONDUCTED EMISSIONS MEASUREMENT .....	20
8.3. SPURIOUS EMISSIONS MEASUREMENT .....	24



## 1 TEST CERTIFICATION

<b>Product</b>	Keyboards
<b>Model</b>	TK1002
<b>Brand</b>	TYPO
<b>Tested</b>	July 14~25, 2014
<b>Applicant</b>	<b>ICHIA TECHNOLOGIES INC</b> 268, HwaYa 2nd Road, Hwa-Ya Tech. Park, Gueishan, Taoyuan 333 Taiwan
<b>Manufacturer</b>	<b>ICHIA TECHNOLOGIES INC</b> 268, HwaYa 2nd Road, Hwa-Ya Tech. Park, Gueishan, Taoyuan 333 Taiwan

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted
DEVIATION FROM APPLICABLE STANDARD	
None	

### We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.249.

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

**Approved by:**

**Sunday Hu**  
Supervisor of EMC Dept.  
Compliance Certification Service Inc.

**Reviewed by:**

**Ruby Zhang**  
Supervisor of Report Dept.  
Compliance Certification Service Inc.



## 2 EUT DESCRIPTION

<b>Product</b>	Keyboards
<b>Model</b>	TK1002
<b>Brand</b>	TYPO
<b>Model Discrepancy</b>	N/A
<b>Identify Number</b>	C140714Z03-RP1
<b>Power Supply</b>	DC5V supplied by the notebook
<b>Frequency Range</b>	2402-2480 MHz
<b>Transmit Power</b>	Peak: 67.25dBuV/m (Max.) Average: 66.61dBuV/m (Max.)
<b>Modulation Technique</b>	FHSS(GFSK for 1Mbps)
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	PCB Antenna with 0dBi gain(Max)
<b>Temperature Range</b>	-20°C ~ +55°C
<b>Hardware Version</b>	TYPO-H-TK1002
<b>Software Version</b>	TYPO-S-TK1002

**Note:** 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2. This submittal(s) (test report) is intended for FCC ID: 2AA83-TK1002 filing to comply with Section 15.207, 15.209 and 15.249 of the FCC Part 15, Subpart C Rules.



### 3 TEST METHODOLOGY

#### 3.1. DESCRIPTION OF TEST MODES

The EUT had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

The following test mode(s) were scanned during the preliminary test below 1G:

Test Item	Test mode	Worse mode
Conducted Emission	Mode 1: Normal	<input checked="" type="checkbox"/>
Radiated Emission	Mode 1: TX	<input checked="" type="checkbox"/>

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

Channel Low (2402MHz), Channel Mid (2441MHz) and Channel High (2480MHz) were chosen for the final testing.

The field strength of spurious radiation emission was measured in the following position: EUT stand-up position (Y mode) and lie-down position (X, Z mode) The following data show only the worst case setup.

The worst case (X axis) was reported.



## 4 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4:2009 and FCC CFR 15.209 and 15.249.

### 4.1. EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.209,15.249 under the FCC Rules Part 15 Subpart C.

### 4.2. FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	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
2.1735 - 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

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

<sup>2</sup> Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



## 5 INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

## 6 SETUP OF EQUIPMENT UNDER TEST

### 6.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model No.	Serial No.	FCC ID	Brand	Data Cable	Power Cord
1	Notebook	B475	WB04861612	N/A	LENOVO	Shielded 1.00m	Unshielded 2.50m

**Note:**

- 1) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

### 6.2. CONFIGURATION OF SYSTEM UNDER TEST

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.



## 7 FACILITIES AND ACCREDITATIONS

### 7.1. FACILITIES

All measurement facilities used to collect the measurement data are located at **No.10-1, Mingkeda Logistics Park, No.18, Huanguan South Rd., Guan Lan Town, Baoan District, Shenzhen, China**

The sites are constructed in conformance with the requirements of ANSI C63.4:2009, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 7.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

<b>USA</b>	<b>A2LA</b>
<b>China</b>	<b>CNAS</b>

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

<b>USA</b>	<b>FCC</b>
<b>Japan</b>	<b>VCCI(C-3478, R-3135, T-652, G-624)</b>
<b>Canada</b>	<b>INDUSTRY CANADA</b>
<b>Taiwan</b>	<b>BSMI</b>

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>

### 7.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

<b>Parameter</b>	<b>Uncertainty</b>
Radiated Emission, 30 to 200 MHz Test Site : 966(2)	+/-3.6880dB
Radiated Emission, 200 to 1000 MHz Test Site : 966(2)	+/-3.6695dB
Radiated Emission, 1 to 8 GHz	+/-5.1782dB
Radiated Emission, 8 to 18 GHz	+/-5.2173dB
Conducted Emissions	+/-3.6836dB
Band Width	178kHz
Peak Output Power MU	+/-1.906dB
Band Edge MU	+/-0.182dB
Channel Separation MU	416.178Hz
Duty Cycle MU	0.054ms
Frequency Stability MU	226Hz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



## 8 FCC PART 15.249 REQUIREMENTS

### 8.1. BAND EDGES MEASUREMENT

#### LIMIT

1. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength ( $\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

2. As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.
3. As shown in Section 15.249(d) 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 Section 15.209, whichever is the lesser attenuation.

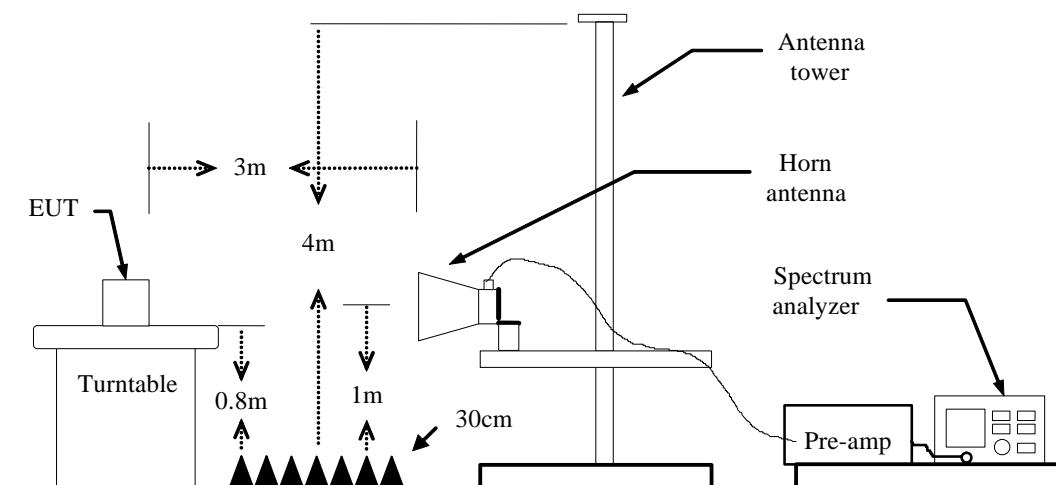
**MEASUREMENT EQUIPMENT USED**

<b>Radiated Emission Test Site 966 (2)</b>					
<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model Number</b>	<b>Serial Number</b>	<b>Last Calibration</b>	<b>Due Calibration</b>
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/01/2014	03/01/2015
Spectrum Analyzer	Agilent	N9010A	MY52221469	10/25/2013	10/24/2014
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	03/09/2014	03/08/2015
Amplifier	MITEQ	AM-1604-3000	1123808	03/18/2015	03/18/2015
High Noise Amplifier	Agilent	8449B	3008A01838	03/18/2015	03/18/2015
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	07/10/2014	07/09/2015
Bilog Antenna	SCHAFFNER	CBL6143	5082	03/01/2014	03/01/2015
Horn Antenna	SCHWARZBECK	BBHA9120	D286	03/01/2014	03/01/2015
Loop Antenna	COM-POWER	AL-130	121044	09/27/2013	09/26/2014
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/28/2014	02/28/2015
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

*Remark: Each piece of equipment is scheduled for calibration once a year.*



## **Test Configuration**



## **TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz / VBW=2.2kHz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

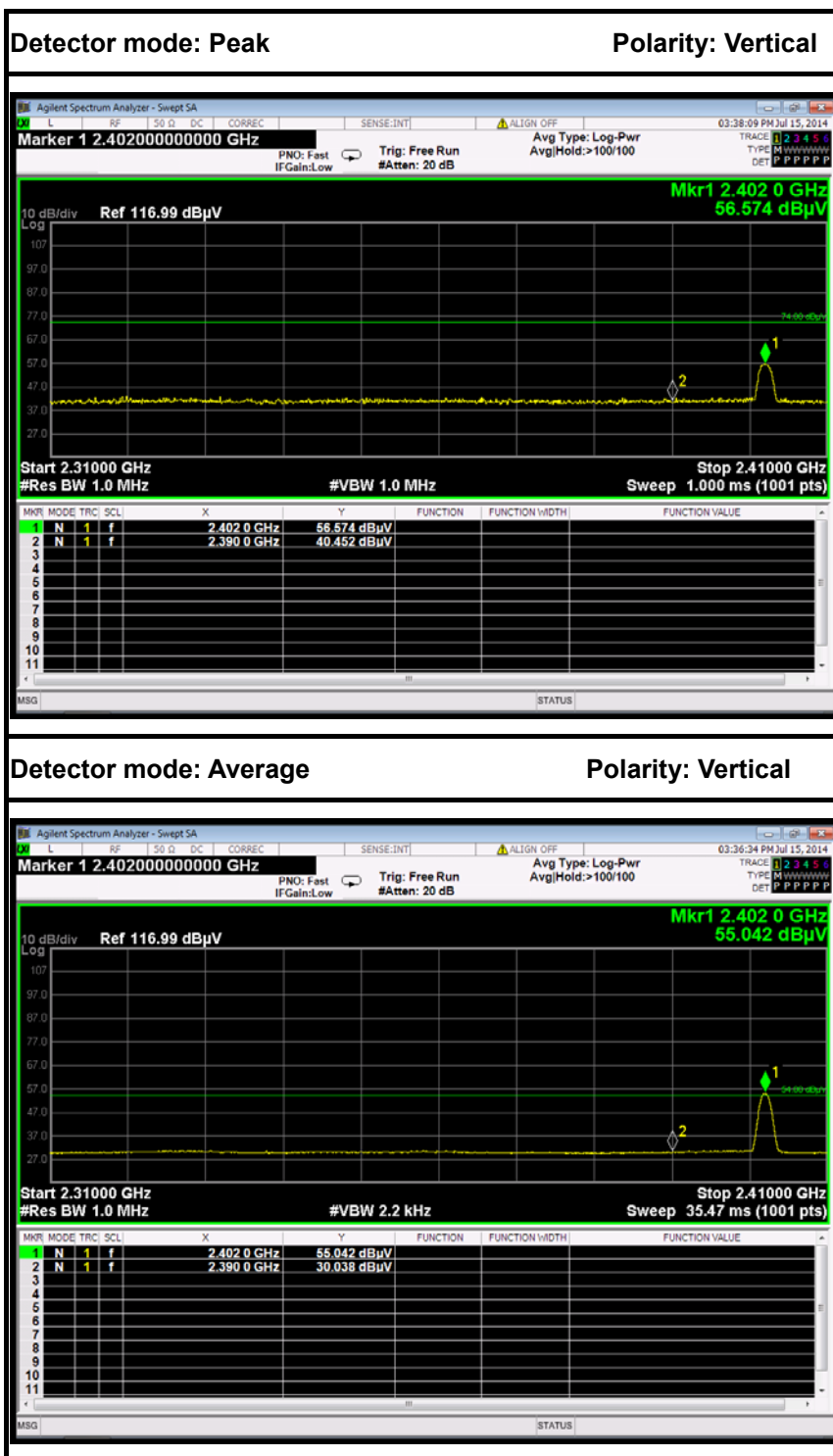
## **TEST RESULTS**

*Refer to attach spectrum analyzer data chart.*



## Test Data

### Band Edges (CH-Low)

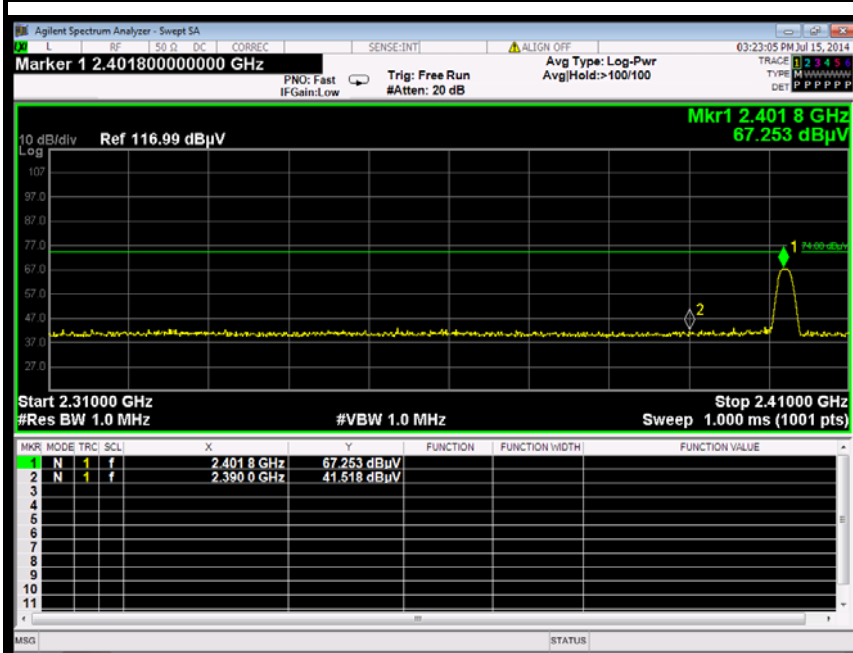


No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	33.85	-6.60	40.45	74.00	-33.55	Peak	Vertical
2	2390.0000	23.44	-6.60	30.04	54.00	-23.96	Average	Vertical



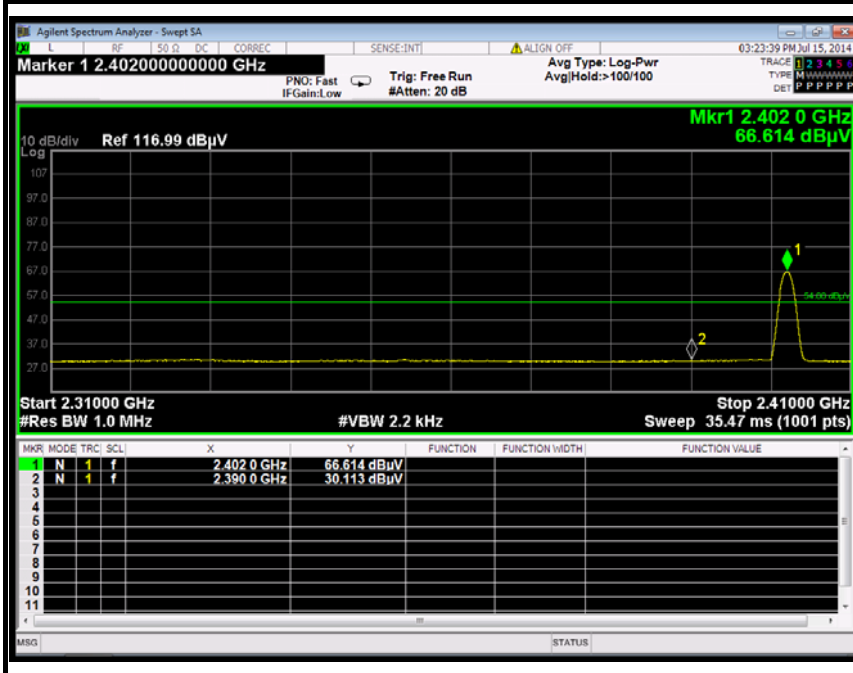
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

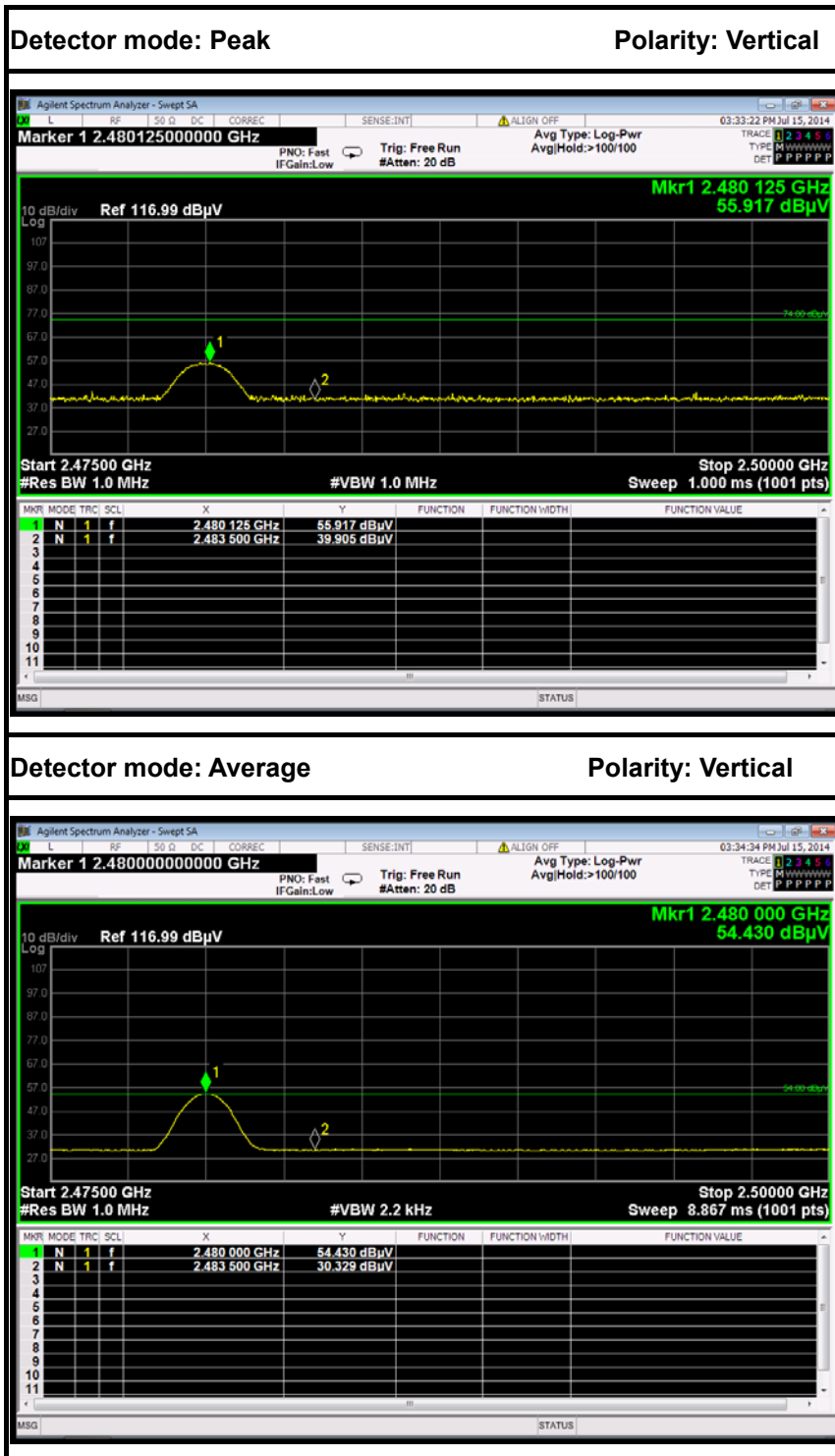
Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	34.92	-6.60	41.52	74.00	-32.48	Peak	Horizontal
2	2390.0000	23.51	-6.60	30.11	54.00	-23.89	Average	Horizontal



**Band Edges (CH-High)**

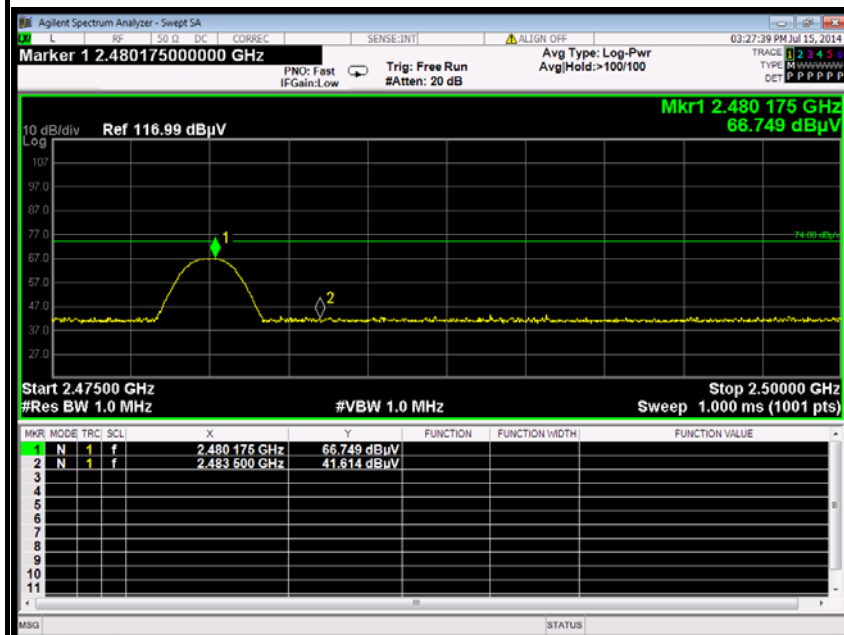


No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	33.31	-6.60	39.91	74.00	-34.10	Peak	Vertical
2	2483.5000	23.73	-6.60	30.33	54.00	-23.67	Average	Vertical



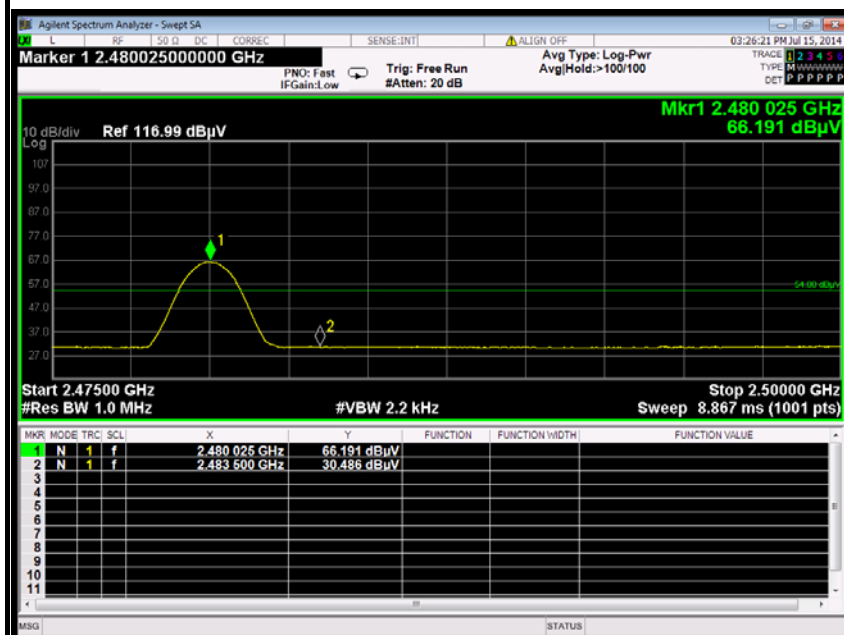
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal



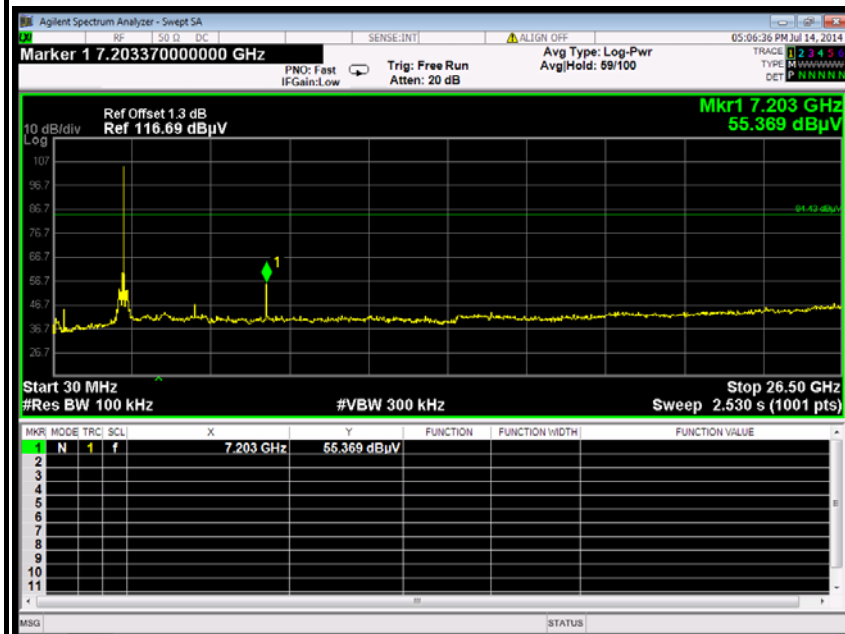
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	35.01	-6.60	41.61	74.00	-32.39	Peak	Horizontal
2	2483.5000	23.89	-6.60	30.49	54.00	-23.51	Average	Horizontal



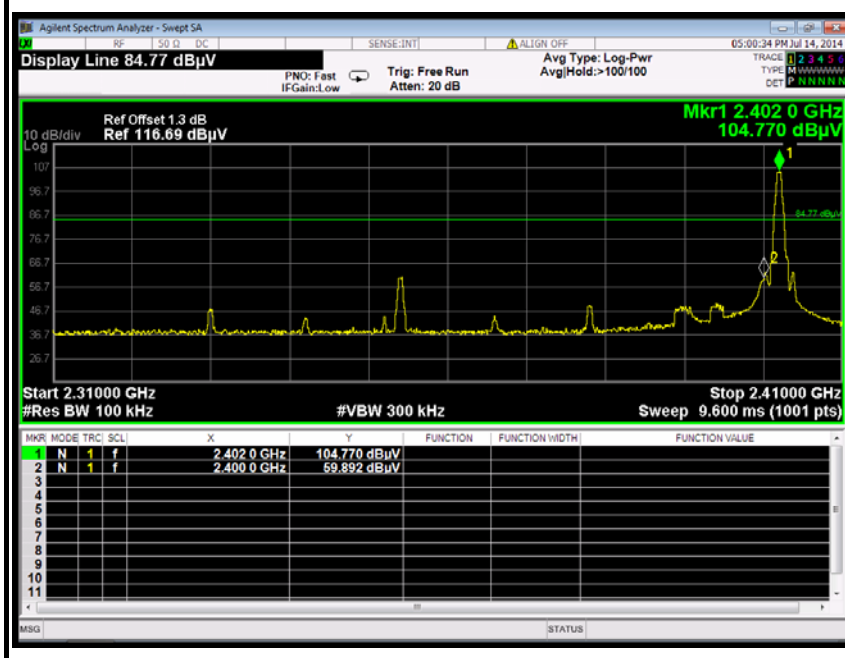
## Test Plot

## Conducted Measurement

### CH Low (30MHz ~26.5GHz )

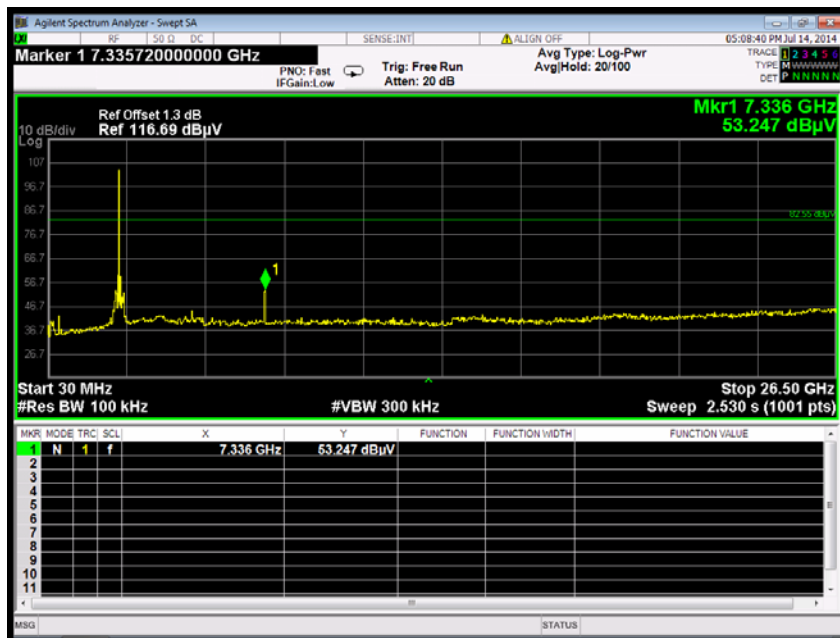


### CH Low (2.31GHz ~2.41GHz )

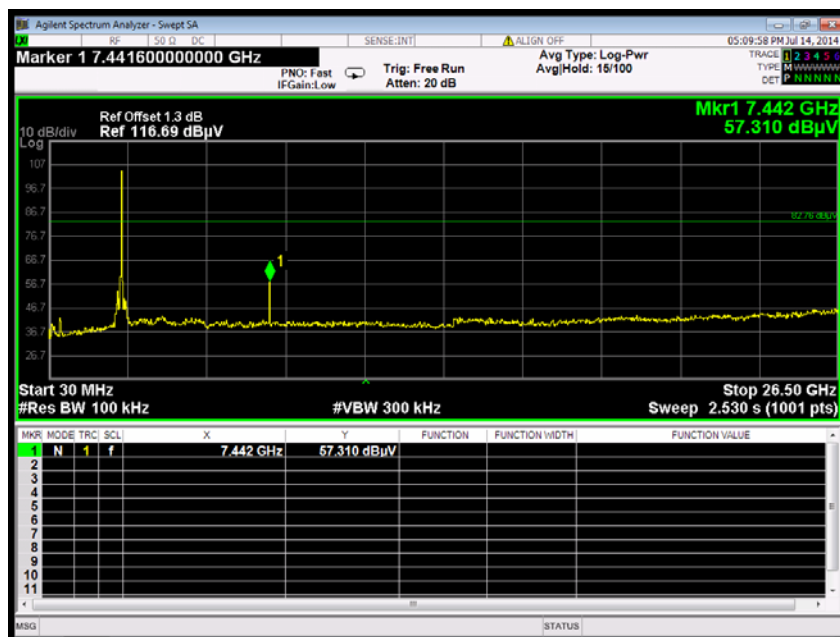




CH Mid (30MHz ~ 26.5GHz)

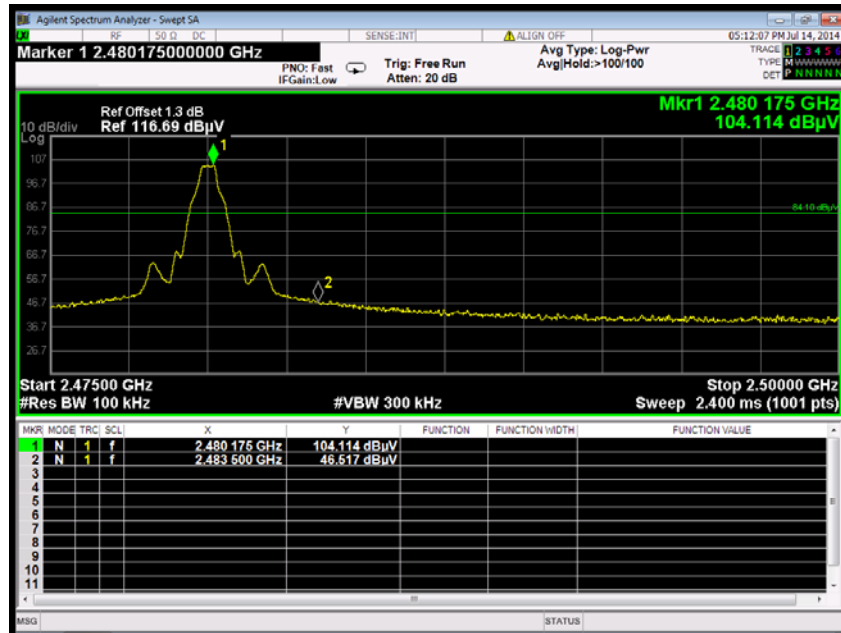


CH High (30MHz ~ 26.5GHz)





CH High (2.475GHz ~ 2.5GHz)





## 8.2. POWER LINE CONDUCTED EMISSIONS MEASUREMENT

### 8.2.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

**NOTE:**

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 8.2.2. TEST INSTRUMENTS

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	03/09/2014	03/08/2015
LISN(EUT)	ROHDE&SCHWARZ	ENV216	101543-WX	04/20/2014	04/19/2015
LISN	EMCO	3825/2	8901-1459	03/09/2014	03/08/2015
Temp. / Humidity Meter	VICTOR	HTC-1	N/A	03/17/2014	03/17/2015
Test S/W	FARAD	EZ-EMC/ CCS-3A1-CE			

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. N.C.R = No Calibration Request.

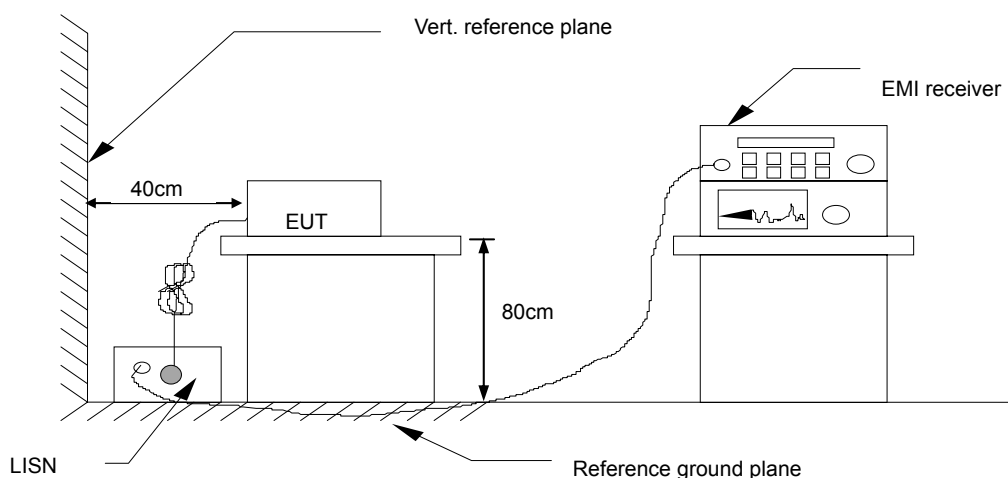


**8.2.3. TEST PROCEDURES** (please refer to measurement standard)

- The EUT and Support equipment, if needed, was placed on a non-conducted table, which is 0.8m above the ground plane and 0.4m away from the conducted wall.
- The test equipment EUT installed received AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane. All support equipment power received from a second LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The frequency range from 150 kHz to 30 MHz was searched. The test data of the worst-case condition(s) was recorded. Emission levels under limit 20dB were not recorded.



## 8.2.4. TEST SETUP



- For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

## 8.2.5. DATA SAMPLE

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XXXX	32.69	25.65	11.52	44.21	37.17	65.78	55.79	-21.57	-18.62	Pass

Factor = Insertion loss of LISN + Cable Loss  
Result = Quasi-peak Reading/ Average Reading + Factor  
Limit = Limit stated in standard  
Margin = Result (dBuV) – Limit (dBuV)

**8.2.6. TEST RESULTS****Test Data****Operation Mode:** Normal**Test Date:** July 22, 2014**Temperature:** 26°C**Humidity:** 60% RH**Tested by:** Steady Han

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Line (L1/L2)
0.2100	25.85	19.56	9.69	35.54	29.25	63.20	53.21	-27.66	-23.96	L1
0.4020	18.44	12.22	9.68	28.12	21.90	57.81	47.81	-29.69	-25.91	L1
1.2700	23.12	19.05	9.72	32.84	28.77	56.00	46.00	-23.16	-17.23	L1
2.5380	24.23	16.24	9.72	33.95	25.96	56.00	46.00	-22.05	-20.04	L1
10.0140	38.84	8.38	9.87	48.71	18.25	60.00	50.00	-11.29	-31.75	L1
22.2099	25.52	13.20	9.86	35.38	23.06	60.00	50.00	-24.62	-26.94	L1
0.2140	23.46	16.57	9.79	33.25	26.36	63.04	53.05	-29.79	-26.69	L2
0.4940	22.32	19.13	9.68	32.00	28.81	56.10	46.10	-24.10	-17.29	L2
1.0580	22.90	19.65	9.80	32.70	29.45	56.00	46.00	-23.30	-16.55	L2
1.6940	25.42	18.21	9.75	35.17	27.96	56.00	46.00	-20.83	-18.04	L2
10.0219	34.54	6.76	9.87	44.41	16.63	60.00	50.00	-15.59	-33.37	L2
12.3100	26.76	9.03	9.80	36.56	18.83	60.00	50.00	-23.44	-31.17	L2

**Note:**

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Peak detector, Quasi-peak detector and average detector.
3. "---" denotes the emission level was or more than 2dB below the Average limit.
4. The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;
5. L1= Line One (Live Line)/ L2= Line Two (Neutral Line)



## 8.3. SPURIOUS EMISSIONS MEASUREMENT

### 8.3.1. LIMITS OF RADIATED EMISSIONS MEASUREMENT

1. In the section 15.249(a):

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental Field Strength (mV/m)	Field Strength of Harmonics (μV/m)
902-928 MHz	50	500
2400 - 2483.5 MHz	50	500
5725 - 5875 MHz	50	500
24.0 - 24.25 GHz	250	2500

2. 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 (μV/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

**Remark:** 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.

3. In the above emission table, the tighter limit applies at the band edges.

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

**8.3.2. TEST INSTRUMENTS**

<b>Radiated Emission Test Site 966 (2)</b>					
<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model Number</b>	<b>Serial Number</b>	<b>Last Calibration</b>	<b>Due Calibration</b>
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/01/2014	03/01/2015
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	03/09/2014	03/08/2015
Amplifier	MITEQ	AM-1604-3000	1123808	03/18/2015	03/18/2015
High Noise Amplifier	Agilent	8449B	3008A01838	03/18/2015	03/18/2015
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	07/10/2014	07/09/2015
Bilog Antenna	SCHAFFNER	CBL6143	5082	03/01/2014	03/01/2015
Horn Antenna	SCHWARZBECK	BBHA9120	D286	03/01/2014	03/01/2015
Loop Antenna	COM-POWER	AL-130	121044	09/27/2013	09/26/2014
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/28/2014	02/28/2015
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. The FCC Site Registration number is 101879.  
3. N.C.R = No Calibration Required.



**8.3.3 TEST PROCEDURE** (please refer to measurement standard)

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

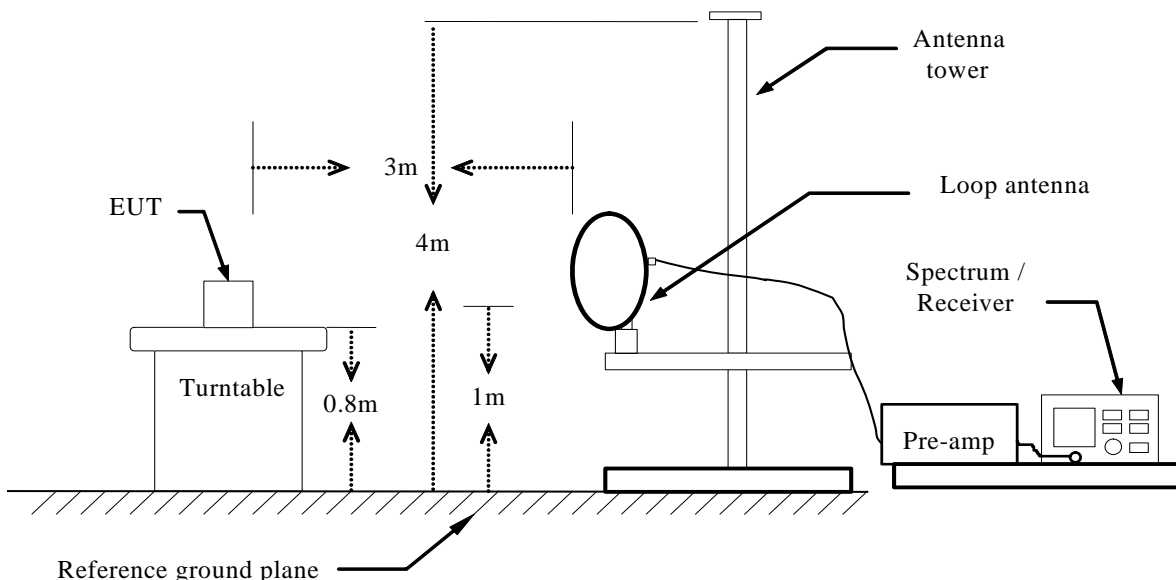
(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.

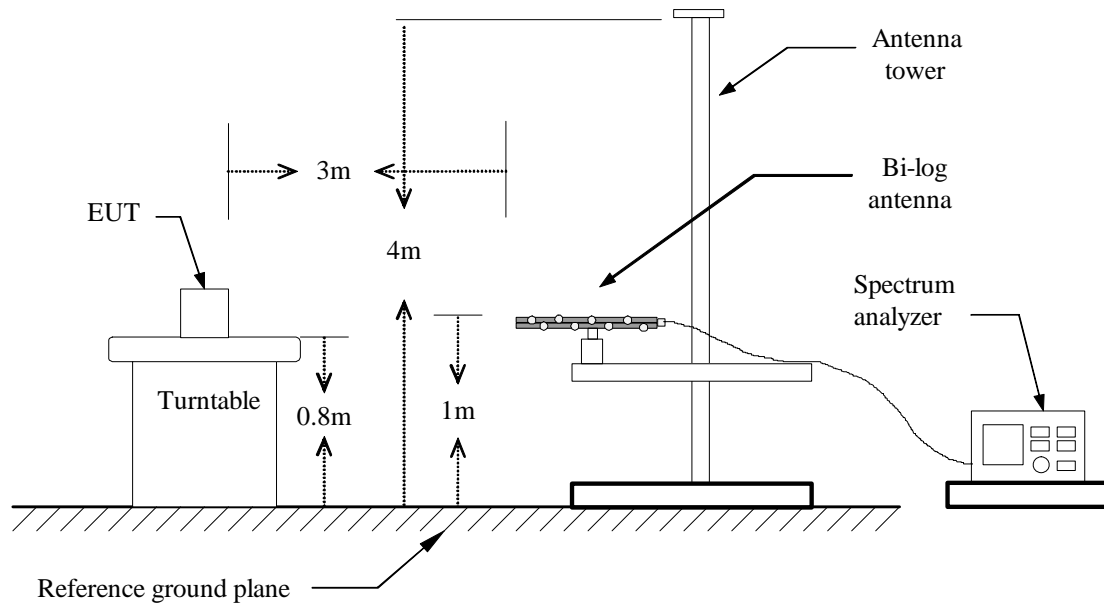
**8.3.2.1. TEST SETUP**

**Below 30MHz**

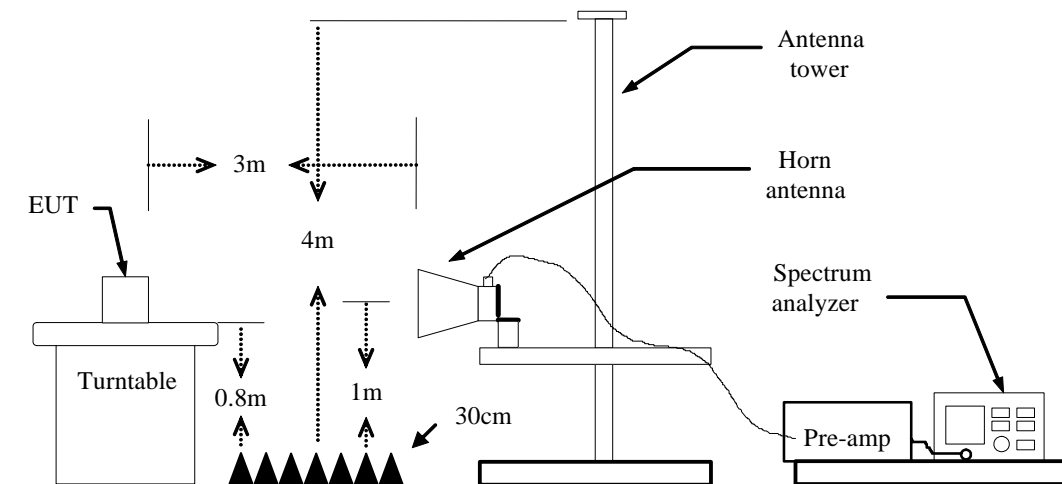




**Below 1 GHz**



**Above 1 GHz**



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

**8.3.2.2. DATA SAMPLE****Below 1GHz**

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
XXX.XXXX	37.47	-16.41	21.06	40.00	-18.94	V	QP

**Above 1GHz**

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
XXXX.XXXX	55.54	4.56	60.10	74.00	-13.90	V	Peak
XXXX.XXXX	29.66	4.56	34.22	54.00	-19.78	V	AVG

Frequency (MHz) = Emission frequency in MHz  
Reading (dBuV) = Uncorrected Analyzer / Receiver reading  
Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain  
Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)  
Limit (dBuV/m) = Limit stated in standard  
Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)  
Q.P. = Quasi-peak Reading  
Peak = Peak Reading  
AVG = Average Reading

**8.3.2.3. TEST RESULTS****Below 1 GHz****Operation Mode:** TX**Test Date:** July 14, 2014**Temperature:** 24°C**Tested by:** Steady Han**Humidity:** 52% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBμV)	Correction Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
60.0700	48.38	-13.48	34.90	40.00	-5.10	V	QP
98.8700	50.12	-14.32	35.80	43.50	-7.70	V	QP
107.6000	53.49	-13.69	39.80	43.50	-3.70	V	QP
170.6500	47.22	-12.82	34.40	43.50	-9.10	V	QP
263.7700	44.18	-10.51	33.67	46.00	-12.33	V	QP
600.3600	39.39	-5.83	33.56	46.00	-12.44	V	QP
60.0700	52.88	-13.48	39.40	40.00	-0.60	H	QP
107.6000	53.29	-13.69	39.60	43.50	-3.90	H	QP
167.7400	54.13	-12.53	41.60	43.50	-1.90	H	QP
216.2400	51.25	-11.05	40.20	46.00	-5.80	H	QP
312.2700	51.13	-9.93	41.20	46.00	-4.80	H	QP
372.4100	50.14	-8.64	41.50	46.00	-4.50	H	QP

**Remark:** No emission found between lowest internal used/generated frequency to 30MHz.**Notes:**

1. Measuring frequencies from 9kHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30MHz to 1GHz were made with an instrument using Peak/Quasi-peak detector mode.
3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.



## Above 1 GHz

**Operation Mode:** TX / CH Low

**Test Date:** July 14, 2014

**Temperature:** 24°C

**Tested by:** Steady Han

**Humidity:** 52% RH

**Polarity:** Ver. / Hor.

### Fundamental

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
2402.0000	66.29	-9.72	56.57	114.00	-57.43	V	Peak
2402.0000	64.76	-9.72	55.04	94.00	-38.96	V	AVG
2402.0000	76.97	-9.72	67.25	114.00	-46.75	H	Peak
2402.0000	76.33	-9.72	66.61	94.00	-27.39	H	AVG

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1036.000	47.91	-9.65	38.26	74.00	-35.74	V	peak
1504.000	48.33	-11.05	37.28	74.00	-36.72	V	peak
1801.000	46.41	-8.61	37.80	74.00	-36.20	V	peak
1990.000	51.56	-8.32	43.24	74.00	-30.76	V	peak
3322.000	44.13	-3.21	40.92	74.00	-33.08	V	peak
4978.000	41.56	2.42	43.98	74.00	-30.02	V	peak
1882.000	46.24	-8.49	37.75	74.00	-36.25	H	peak
1999.000	47.78	-8.31	39.47	74.00	-34.53	H	peak
3421.000	43.25	-3.03	40.22	74.00	-33.78	H	peak
3988.000	43.43	-1.08	42.35	74.00	-31.65	H	peak
4384.000	42.50	0.09	42.59	74.00	-31.41	H	peak
5797.000	41.25	3.05	44.30	74.00	-29.70	H	peak

### REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** TX / CH Mid**Test Date:** July 14, 2014**Temperature:** 24°C**Tested by:** Steady Han**Humidity:** 52% RH**Polarity:** Ver. / Hor.**Fundamental**

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
2441.0000	66.02	-9.77	56.25	114.00	-57.76	V	Peak
2441.0000	64.50	-9.77	54.73	94.00	-39.27	V	AVG
2441.0000	76.77	-9.77	67.00	114.00	-47.00	H	Peak
2441.0000	76.17	-9.77	66.40	94.00	-27.60	H	AVG

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1729.000	49.79	-9.22	40.57	74.00	-33.43	V	peak
1999.000	51.62	-8.31	43.31	74.00	-30.69	V	peak
3358.000	43.51	-3.15	40.36	74.00	-33.64	V	peak
4321.000	41.91	-0.10	41.81	74.00	-32.19	V	peak
5176.000	41.23	2.52	43.75	74.00	-30.25	V	peak
5608.000	41.56	2.73	44.29	74.00	-29.71	V	peak
1999.000	48.90	-8.31	40.59	74.00	-33.41	H	peak
3421.000	42.97	-3.03	39.94	74.00	-34.06	H	peak
4339.000	41.64	-0.04	41.60	74.00	-32.40	H	peak
5176.000	41.17	2.52	43.69	74.00	-30.31	H	peak
6310.000	40.89	4.73	45.62	74.00	-28.38	H	peak
7003.000	40.14	7.71	47.85	74.00	-26.15	H	peak

**REMARKS:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



**Operation Mode:** TX / CH High

**Test Date:** July 14, 2014

**Temperature:** 24°C

**Tested by:** Steady Han

**Humidity:** 52% RH

**Polarity:** Ver. / Hor.

## Fundamental

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
2480.0000	65.70	-9.78	55.92	114.00	-58.08	V	Peak
2480.0000	64.21	-9.78	54.43	94.00	-39.57	V	AVG
2480.0000	76.53	-9.78	66.75	114.00	-47.25	H	Peak
2480.0000	75.97	-9.78	66.19	94.00	-27.81	H	AVG

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1729.000	54.50	-9.22	45.28	74.00	-28.72	V	peak
1999.000	53.72	-8.31	45.41	74.00	-28.59	V	peak
2971.000	44.84	-3.94	40.90	74.00	-33.10	V	peak
4285.000	42.10	-0.20	41.90	74.00	-32.10	V	peak
4699.000	42.01	1.26	43.27	74.00	-30.73	V	peak
4870.000	41.52	1.97	43.49	74.00	-30.51	V	peak
1729.000	49.05	-9.22	39.83	74.00	-34.17	H	peak
1990.000	49.17	-8.32	40.85	74.00	-33.15	H	peak
3745.000	42.50	-1.98	40.52	74.00	-33.48	H	peak
4051.000	42.67	-0.89	41.78	74.00	-32.22	H	peak
4735.000	42.31	1.41	43.72	74.00	-30.28	H	peak
5149.000	40.90	2.52	43.42	74.00	-30.58	H	peak

## REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).