



FCC 47 CFR PART 15 SUBPART C TEST REPORT

for

Modular IoT Gateway

Model: VT-GTWY-6UL01-M4

Brand: VT-GTWY-6UL01-M4

Test Report Number:
C170223Z01-RP1-4

Issued for

VOLANSYS TECHNOLOGIES PVT LTD

**Block A-7th Floor, Safal Profitaire, Corporate Road,
Praladnagar, Ahmedabad-380 015, Gujarat. India**

Issued by:

Compliance Certification Services (Shenzhen) Inc.

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Issued Date: April 10, 2017



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TESTING CERT #2861.01

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 10, 2017	Initial Issue	ALL	Sabrina Wang



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1 TEST CERTIFICATION

Product	Modular IoT Gateway
Model	VT-GTWY-6UL01-M4
Brand	VT-GTWY-6UL01-M4
Tested	February 23~April 10, 2017
Applicant	VOLANSYS TECHNOLOGIES PVT LTD Block A-7th Floor, Safal Profitaire, Corporate Road, Prahaladnagar, Ahmedabad-380 015, Gujarat. India
Manufacturer	VOLANSYS TECHNOLOGIES PVT LTD Block A-7th Floor, Safal Profitaire, Corporate Road, Prahaladnagar, Ahmedabad-380 015, Gujarat. India

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 Service(Shenzhen) 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 C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.225.

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(Shenzhen)
Inc.

Reviewed by:

Ruby Zhang
Supervisor of Report Dept.
Compliance Certification Service(Shenzhen)
Inc.



2 EUT DESCRIPTION

Product	Modular IoT Gateway
Model Number	VT-GTWY-6UL01-M4
Brand	VT-GTWY-6UL01-M4
Model Discrepancy	N/A
Identify Number	C170223Z01-RP1-4
Received Date	February 23, 2017
Power Supply	DC5V Supply by the adapter
Adapter Manufacturer / Model No.	KUANTEN / KT241050300US Input: 100-240V~50/60Hz 0.8A Output: DC5V 3A DC Output Cable: Unshielded 1.50m
Frequency Range	13.56 MHz
Transmit Power	54.22dBuV/m(measured at 3m)
Modulation Technique	ASK
Number of Channels	1Channel
Antenna Specification	Not mentioned
Temperature Range	0°C ~ +50°C
Hardware Version	version – 01
Software Version	version – 01

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: 2AKNO-GW6UL01M4** filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.



3 TEST METHODOLOGY

3.1. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

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

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.



4 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 15.207, 15.209 and 15.225.

4.1. EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2. 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 15.207, 15.209, 15.225 under the FCC Rules Part 15 Subpart C.

4.3. GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10: 2013. Conducted emissions from the EUT

measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10: 2013.



4.4. 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
¹ 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	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² 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	DoC	THINK PAD	Unshielded, 1.50m	Unshielded, 1.60m (AC Cable) Unshielded, 1.80m (DC Cable)

Note: 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

☒ **No10-1, 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, 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.

USA	A2LA
China	CNAS

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

Canada	Industry Canada
Japan	VCCI(C-4815, R-4320, T-2317, G-10624)
USA	FCC

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

Parameter	Uncertainty
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 15.225 REQUIREMENTS

8.1. TIMING OF THE TRANSMITTER

LIMIT

FCC	
Timing of the transmitter	
(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.	

MEASUREMENT

Measurement parameter	
Detector :	Positive peak
Sweep time:	100ms
Resolution bandwidth:	100kHz
Video bandwidth:	300kHz
Span:	Zero span
Trace-Mode:	Single sweep

Duty cycle of the EUT: 100%

RESULT: passed



8.2. 99 % EMISSION BANDWIDTH

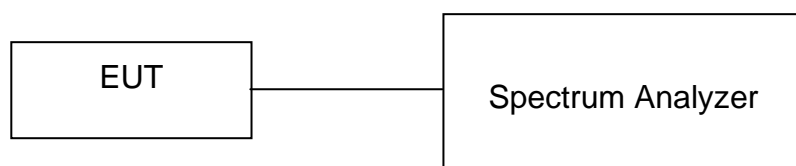
LIMIT

None; for reporting purposes only.

MEASUREMENT EQUIPMENT USED

Radiated Emission Test Site 966(2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	02/21/2017	02/20/2018
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/21/2017	02/20/2018
Amplifier	EMEC	EM330	060661	03/18/2017	03/17/2018
High Noise Amplifier	Agilent	8449B	3008A01838	02/21/2017	02/20/2018
Loop Antenna	COM-POWER	AL-130	121044	09/25/2016	09/24/2017
Bilog Antenna	SCHAFFNER	CBL6143	5082	02/21/2017	02/20/2018
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2017	02/27/2018
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	02/28/2017	02/27/2018
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Antenna Tower	SUNOL	TLT2	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	02/21/2017	02/20/2018
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW= 1kHz, VBW = 3kHz, Span = 10kHz, Sweep = auto.
4. Mark the peak frequency and 26dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

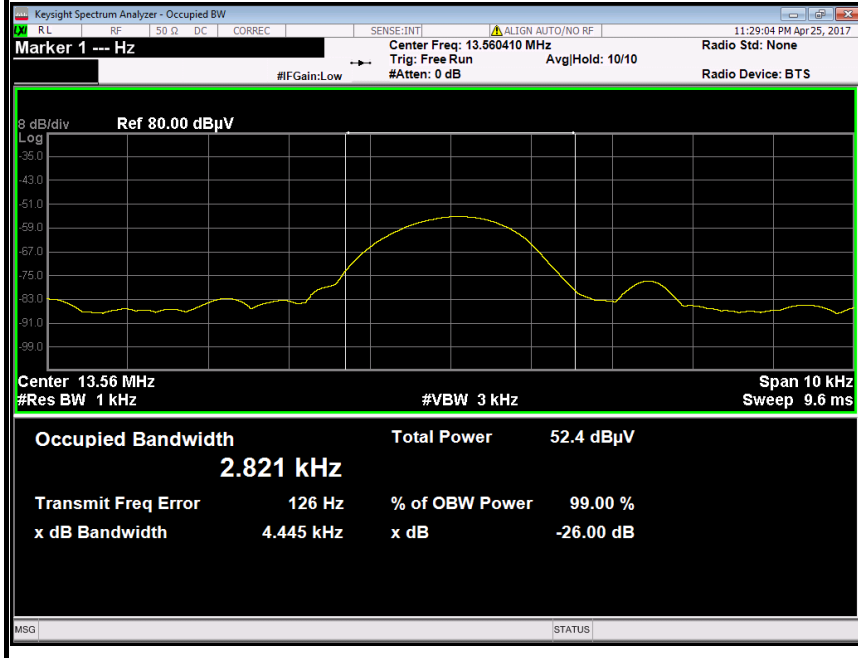
TEST RESULTS

No non-compliance noted.



Test Plot

Bandwidth (TX / CH 13.56MHz)





8.3. POWER LINE CONDUCTED EMISSIONS MEASUREMENT

8.3.1. 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 μ 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 μ 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.

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	02/11/2017	02/10/2018
LISN(EUT)	ROHDE&SCHWARZ	ENV216	101543-WX	02/11/2017	02/10/2018
LISN	EMCO	3825/2	8901-1459	02/12/2017	02/11/2018
Temp. / Humidity Meter	VICTOR	HTC-1	N/A	02/15/2017	02/14/2018
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.

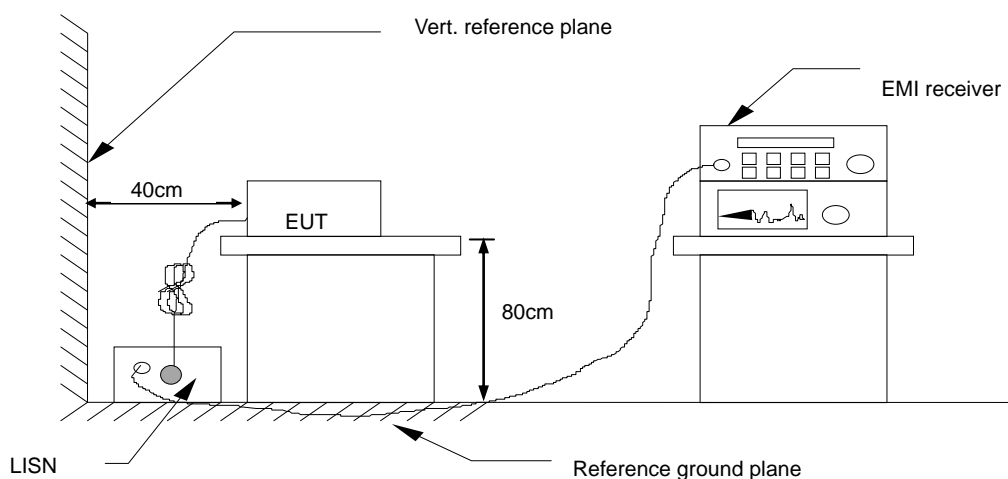


8.3.2. TEST PROCEDURES (please refer to measurement standard)

- 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.



8.3.3. TEST SETUP



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

8.3.4. DATA SAMPLE

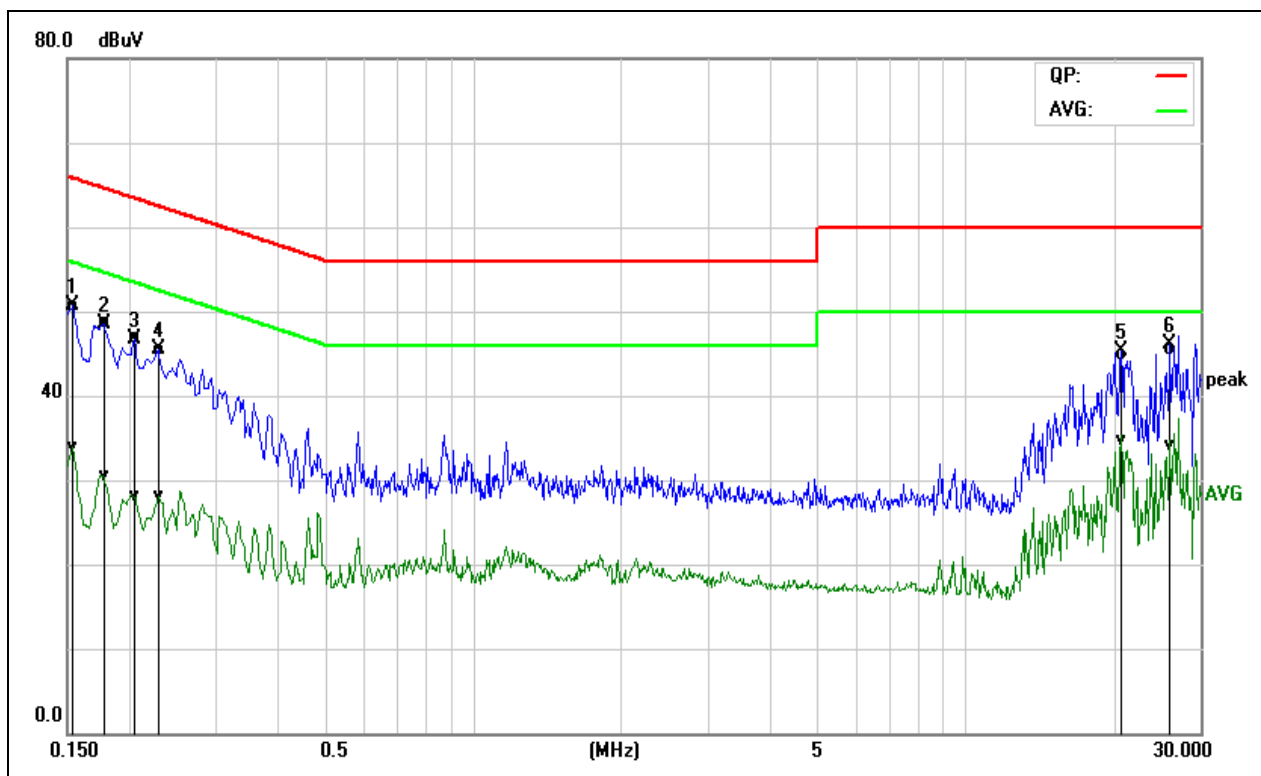
Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Line (L1/L2)
X.XXXX	32.69	25.65	11.52	44.21	37.17	65.78	55.79	-21.57	-18.62	L1

Factor = Insertion loss of LISN + Cable Loss
Result = Quasi-peak Reading/ Average Reading + Factor
Limit = Limit stated in standard
Margin = Result (dBuV) – Limit (dBuV)
L1 = Hot side
L2 = Neutral side



8.3.5. TEST RESULTS

Model No.	VT-GTWY-6UL01-M4	RBW,VBW	9 kHz
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested by	Luja Huang	Line	L1
Test Date	March 9, 2017	Test Voltage	AC 120V/60Hz

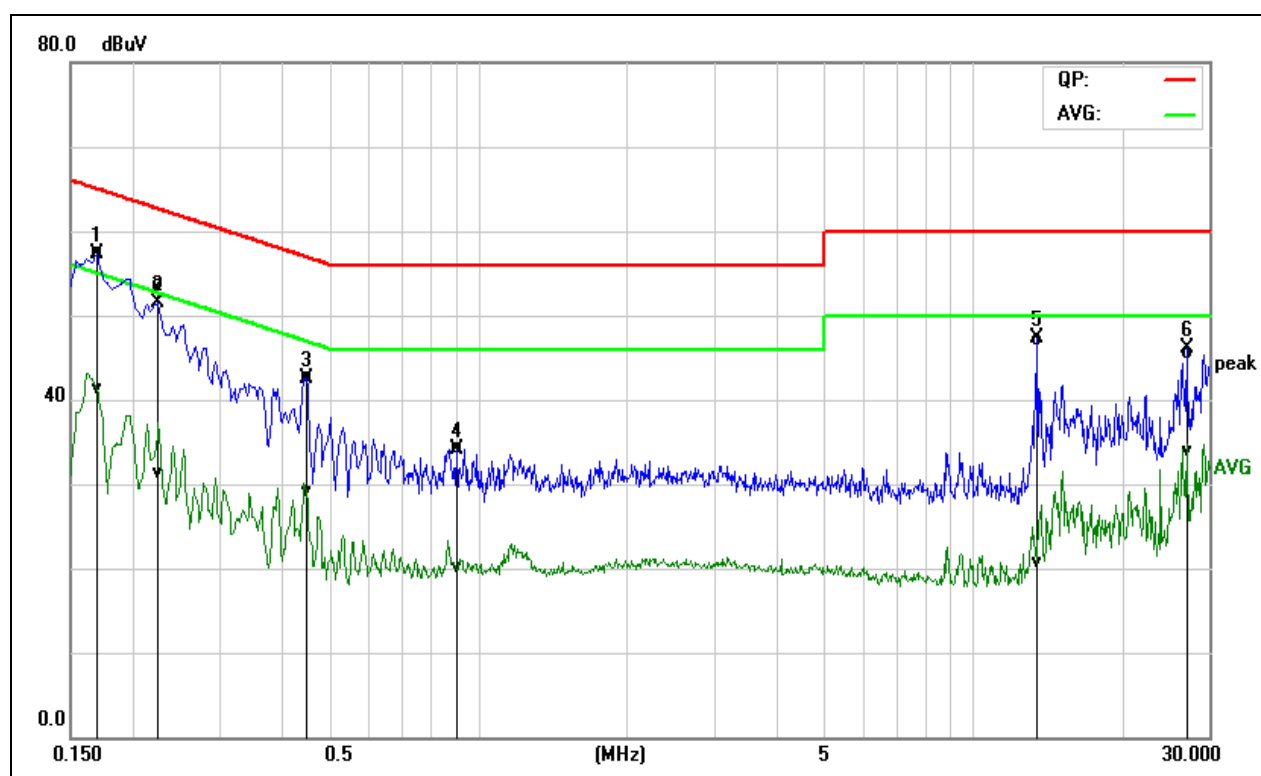


Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
0.1539	31.13	14.31	19.62	50.75	33.93	65.78	55.79	-15.03	-21.86	Pass
0.1780	29.07	10.82	19.63	48.70	30.45	64.57	54.58	-15.87	-24.13	Pass
0.2060	27.18	8.45	19.64	46.82	28.09	63.36	53.37	-16.54	-25.28	Pass
0.2300	25.97	8.55	19.63	45.60	28.18	62.45	52.45	-16.85	-24.27	Pass
20.7979	24.50	14.44	20.34	44.84	34.78	60.00	50.00	-15.16	-15.22	Pass
26.0020	24.98	13.59	20.45	45.43	34.04	60.00	50.00	-14.57	-15.96	Pass

REMARKS: L1 = Line One (Live Line)



Model No.	VT-GTWY-6UL01-M4	RBW,VBW	9 kHz
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested by	Luja Huang	Line	L2
Test Date	March 9, 2017	Test Voltage	AC 120V/60Hz

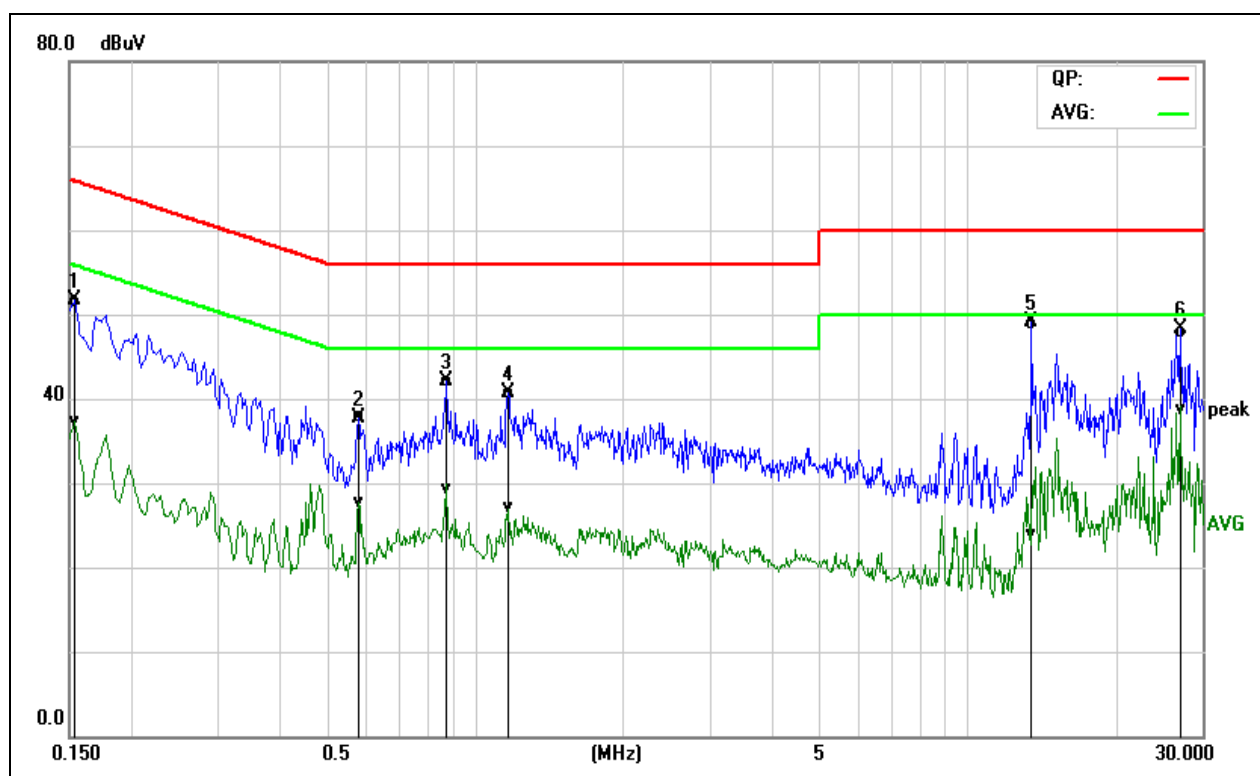


Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
0.1700	37.97	21.82	19.53	57.50	41.35	64.96	54.96	-7.46	-13.61	Pass
0.2280	34.25	11.67	19.54	53.79	31.21	62.52	52.52	-8.73	-21.31	Pass
0.4500	23.08	9.59	19.53	42.61	29.12	56.87	46.88	-14.26	-17.76	Pass
0.9060	14.71	0.53	19.57	34.28	20.10	56.00	46.00	-21.72	-25.90	Pass
13.5020	27.07	0.57	20.05	47.12	20.62	60.00	50.00	-12.88	-29.38	Pass
27.0980	24.86	13.28	20.63	45.49	33.91	60.00	50.00	-14.51	-16.09	Pass

REMARKS: L2 = Line Two (Neutral Line)



Model No.	VT-GTWY-6UL01-M4	RBW,VBW	9 kHz
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested by	Luja Huang	Line	L1
Test Date	March 9, 2017	Test Voltage	AC 240V/50Hz

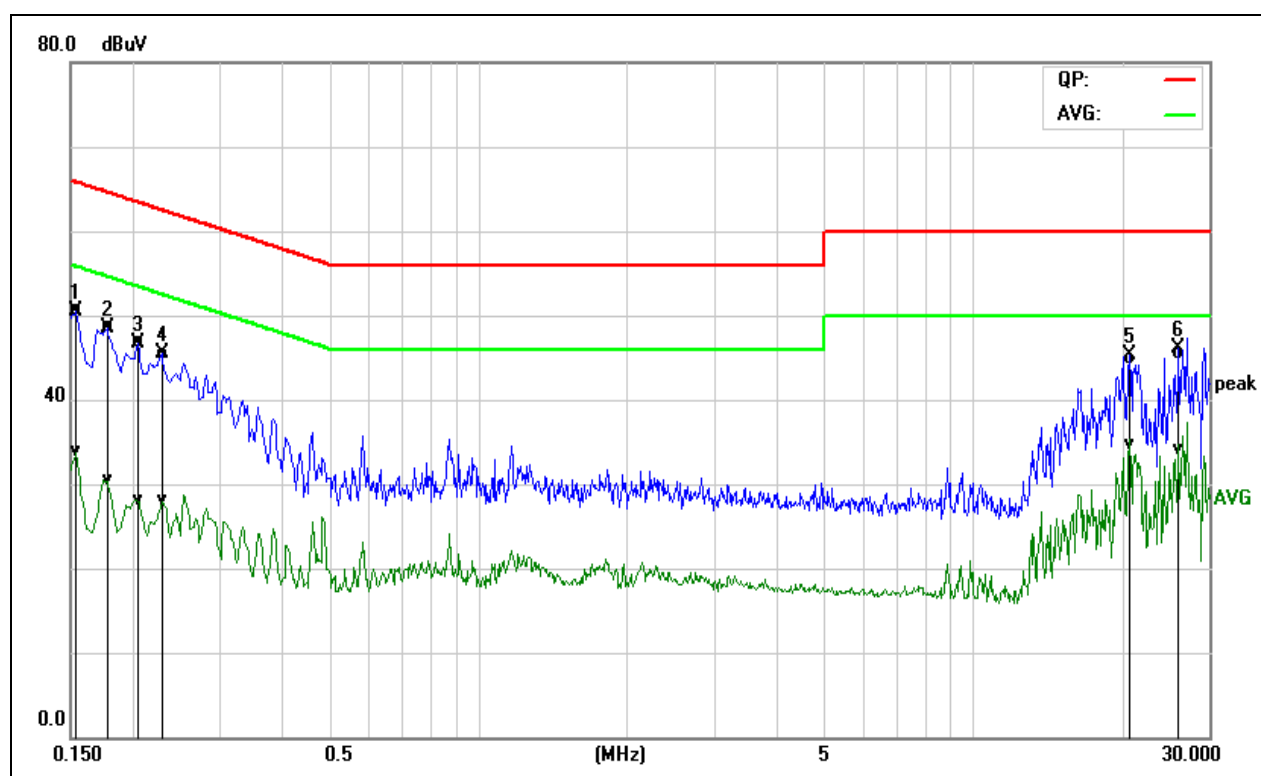


Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
0.1539	31.98	17.61	19.62	51.60	37.23	65.78	55.79	-14.18	-18.56	Pass
0.5820	18.32	8.22	19.56	37.88	27.78	56.00	46.00	-18.12	-18.22	Pass
0.8780	22.63	9.82	19.57	42.20	29.39	56.00	46.00	-13.80	-16.61	Pass
1.1660	21.21	7.49	19.58	40.79	27.07	56.00	46.00	-15.21	-18.93	Pass
13.5020	28.93	3.93	20.05	48.98	23.98	60.00	50.00	-11.02	-26.02	Pass
27.1020	27.42	18.14	20.47	47.89	38.61	60.00	50.00	-12.11	-11.39	Pass

REMARKS: L1 = Line One (Live Line)



Model No.	VT-GTWY-6UL01-M4	RBW,VBW	9 kHz
Environmental Conditions	22°C, 45% RH	Test Mode	Mode 1
Tested by	Luja Huang	Line	L2
Test Date	March 9, 2017	Test Voltage	AC 240V/50Hz



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)
0.1539	31.23	14.41	19.52	50.75	33.93	65.78	55.79	-15.03	-21.86	Pass
0.1780	29.17	10.92	19.53	48.70	30.45	64.57	54.58	-15.87	-24.13	Pass
0.2060	27.28	8.55	19.54	46.82	28.09	63.36	53.37	-16.54	-25.28	Pass
0.2300	26.06	8.64	19.54	45.60	28.18	62.45	52.45	-16.85	-24.27	Pass
20.7979	24.56	14.50	20.28	44.84	34.78	60.00	50.00	-15.16	-15.22	Pass
26.0020	24.80	13.41	20.63	45.43	34.04	60.00	50.00	-14.57	-15.96	Pass

REMARKS: L2 = Line Two (Neutral Line)



8.4. SPURIOUS EMISSIONS MEASUREMENT

8.4.1. LIMITS OF RADIATED EMISSIONS MEASUREMENT

LIMIT

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.
 - (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.
 - (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.
 - (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz and shall not exceed the general radiated emission limits in §15.209.
1. 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.



8.4.2. TEST INSTRUMENTS

Radiated Emission Test Site 966(2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	02/21/2017	02/20/2018
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	02/21/2017	02/20/2018
Amplifier	EMEC	EM330	060661	03/18/2017	03/17/2018
High Noise Amplifier	Agilent	8449B	3008A01838	02/21/2017	02/20/2018
Loop Antenna	COM-POWER	AL-130	121044	09/25/2016	09/24/2017
Bilog Antenna	SCHAFFNER	CBL6143	5082	02/21/2017	02/20/2018
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2017	02/27/2018
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	02/28/2017	02/27/2018
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Antenna Tower	SUNOL	TLT2	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	02/21/2017	02/20/2018
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. N.C.R = No Calibration Required.

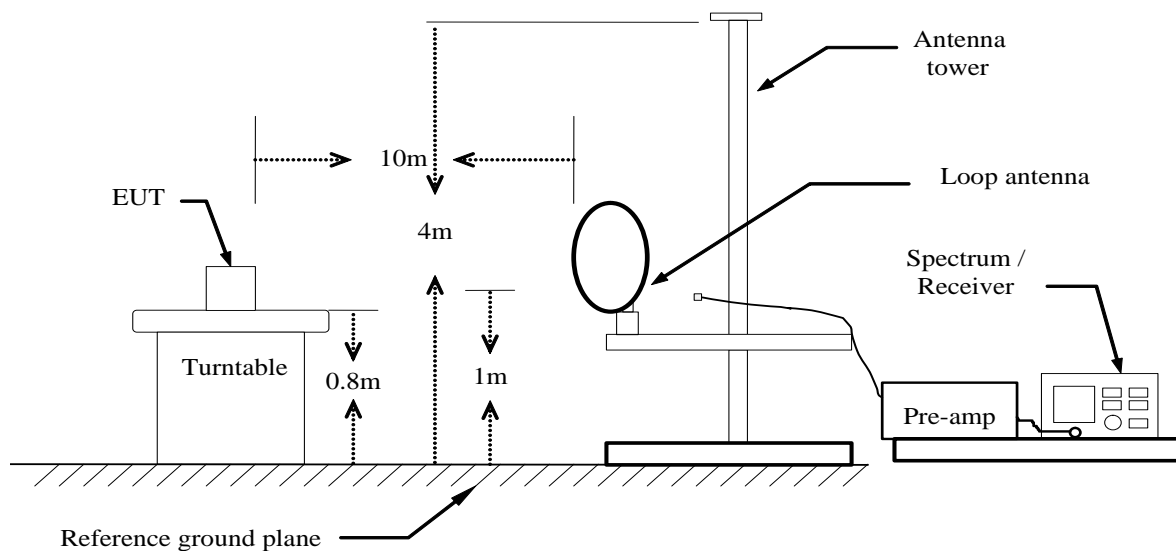
8.3.3 TEST PROCEDURE (please refer to measurement standard)

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 30MHz:
9kHz~150kHz: RBW=200Hz / VBW=600Hz / Sweep=AUTO
150kHz~30MHz: RBW=9kHz / VBW=27kHz / Sweep=AUTO
Above 30MHz:
RBW=100kHz / VBW=300kHz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

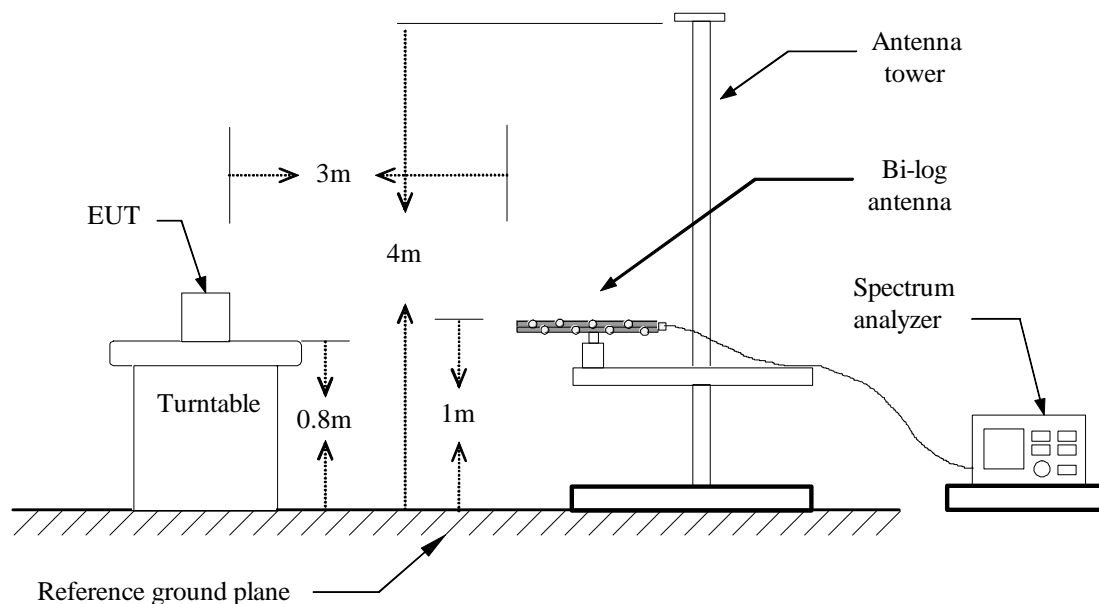


8.4.2.1. TEST SETUP

Below 30MHz



Below 1 GHz



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

**8.4.2.2. 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	Peak

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



8.4.2.3. TEST RESULTS

Below 1GHz

Operation Mode: TX / CH 1 (13.56)

Test Date: March 25, 2017

Temperature: 24°C

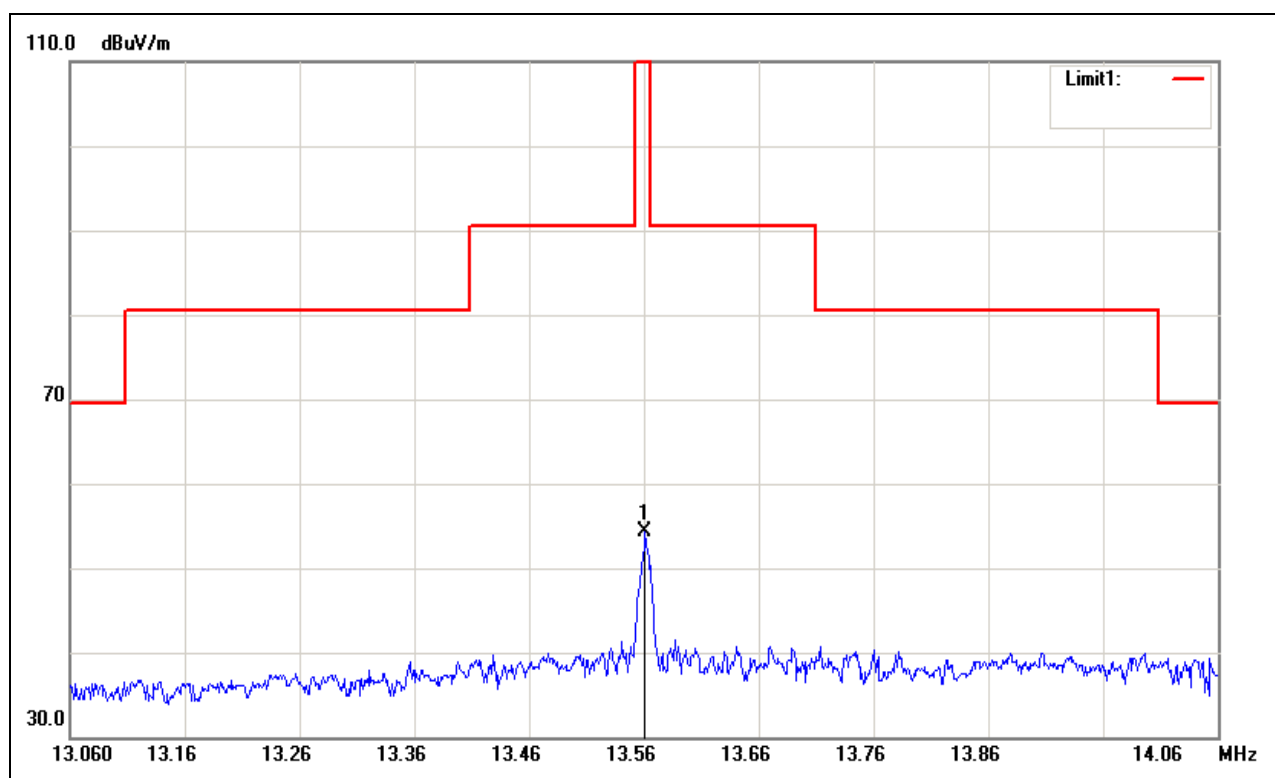
Tested by: Darry Wu

Humidity: 52 % RH

Polarity: Ver. / Hor.

Fundamental

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
13.5600	39.93	14.29	54.22	124.00	-69.78	Peak





Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
38.7300	42.59	-11.27	31.32	40.00	-8.68	V	Peak
99.8400	38.64	-14.13	24.51	43.50	-18.99	V	Peak
199.7500	38.38	-12.20	26.18	43.50	-17.32	V	Peak
600.3600	37.79	-5.84	31.95	46.00	-14.05	V	Peak
666.3200	45.58	-4.87	40.71	46.00	-5.29	V	Peak
900.0900	32.91	-2.33	30.58	46.00	-15.42	V	Peak
39.7000	39.07	-11.25	27.82	40.00	-12.18	H	Peak
232.7300	42.12	-10.85	31.27	46.00	-14.73	H	Peak
299.6600	40.48	-10.01	30.47	46.00	-15.53	H	Peak
600.3600	37.45	-5.84	31.61	46.00	-14.39	H	Peak
666.3200	40.40	-4.87	35.53	46.00	-10.47	H	Peak
834.1300	36.57	-3.07	33.50	46.00	-12.50	H	Peak

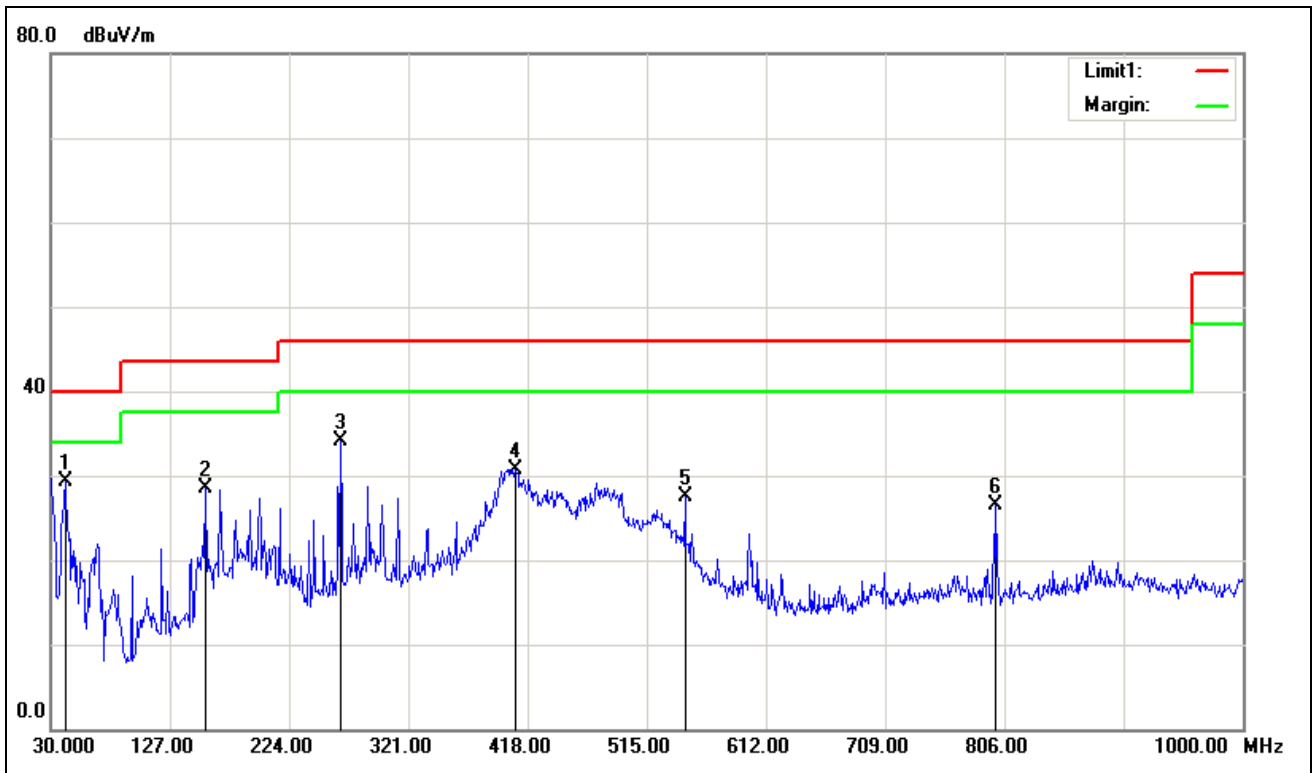
****Note:** The emission found is too lower to record between lowest internal used/generated frequency to 30 MHz.

REMARKS:

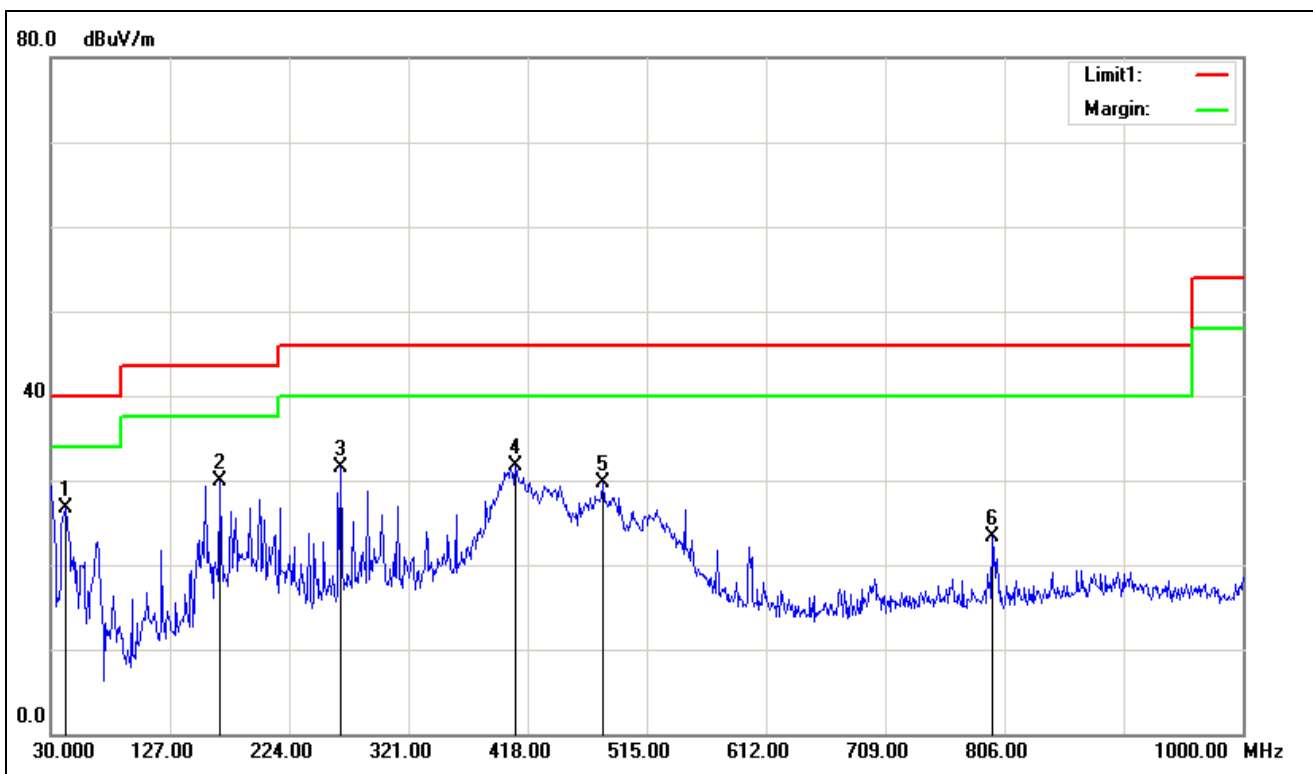
1. Radiated emissions measured in frequency range from 9kHz to 1GHz were made with an instrument using peak/quasi-peak detector mode.
2. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
3. Measurements above show only up to 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.
4. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m)



Vertical



Horizontal





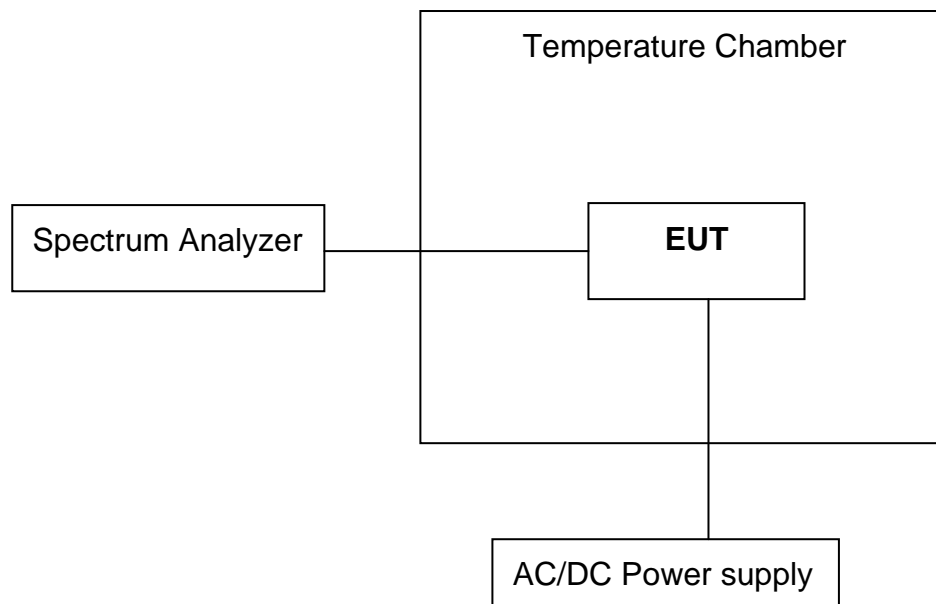
8.5. FREQUENCY STABILITY

LIMIT

According to §15.225(e), the frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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.

Test Configuration

Temperature and Voltage Measurement (under normal and extreme test conditions)



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the environment into appropriate environment.
4. Set the spectrum analyzer as RBW=1kHz, VBW = RBW, Span = 200kHz, Sweep = auto.
5. Mark the peak frequency and measure the frequency tolerance using frequency counter function.
6. Repeat until all the results are investigated.



TEST RESULTS

No non-compliance noted.

Temperature Variations

Temp. (°C)	Voltage (VAC)	Measured Frequency (MHz)	Delta Frequency (Hz)	Tolerance (%)	Limit (±%)	Margin (%)	Result (Pass/Fail)
-20	7.5	13.56005	10	0.00007	0.01	-0.00993	Pass
-10		13.56004	30	0.00022	0.01	-0.00978	Pass
0		13.56002	10	0.00007	0.01	-0.00993	Pass
10		13.56013	170	0.00125	0.01	-0.00875	Pass
20		13.56006	10	0.00007	0.01	-0.00993	Pass
30		13.56004	80	0.00059	0.01	-0.00941	Pass
40		13.55997	20	0.00015	0.01	-0.00985	Pass
50		13.5603	100	0.00074	0.01	-0.00926	Pass

Voltage Variations

Temp. (°C)	Voltage (VAC)	Measured Frequency (MHz)	Delta Frequency (Hz)	Tolerance (%)	Limit (±%)	Margin (%)	Result (Pass/Fail)
20	6.75	13.56014	150	0.00111	0.01	-1.00889	Pass
	7.50	13.56007	10	0.00003	0.01	-2.00997	Pass
	8.25	13.56003	40	0.00003	0.01	-3.00977	Pass