



FCC ID: 2ARCQ-EM7565
Report No.: T180821D09-RP2

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Rev.: 01

FCC 47 CFR PART 27 SUBPART L

TEST REPORT

For

Nodegrid

Model No.: SR

Trade Name: ZPE

Issued to

ZPE Systems, Inc.
46757 Fremont Blvd., Fremont, CA 94538, USA

Issued by

Compliance Certification Services Inc.
Wugu Laboratory
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City 24891, Taiwan. (R.O.C.)
Issued Date: November 29, 2018

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		November 29, 2018		Initial Issue	ALL	Allison Chen
01		December 21, 2018		1. Revised test condition in section 4.2.1.	P.7	Allison Chen



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1 TEST RESULT CERTIFICATION

Applicant: ZPE Systems, Inc.
46757 Fremont Blvd., Fremont, CA 94538, USA

Manufacturer: ZPE Systems, Inc.
46757 Fremont Blvd., Fremont, CA 94538, USA

Equipment Under Test: Nodegrid

Trade Name: ZPE

Model: SR

Date of Test: October 1 ~ 2, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR PART 27 SUBPART L	No non-compliance noted

We hereby certify that:

The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in TIA-603-E and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rule FCC PART 27 Subpart L.

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

Approved by:

Tested by:

Sam Chuang
Manager
Compliance Certification Services Inc.

Jerry Chuang
Engineer
Compliance Certification Services Inc.



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2 EUT DESCRIPTION

Product	Nodegrid
Model No.	SR
Model Discrepancy	N/A
Trade Name	ZPE
Received Date	August 21, 2018
Power Supply	Power from AC adapter or internal Power Supply
Frequency Range	WCDMA Band IV: 1712.4-1752.6 MHz
Transmit Power (EIRP Power)	WCDMA 12.2k RMC Band IV: 26.35dBm
Antenna Gain	External Antenna WCDMA band IV: 2.1 dBi

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. For test mode WCDMA, HSUPA and HSDPA were pretest. The worst case was WCDMA in this test report



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3 TEST SUMMARY

FCC Standard Section	Report Section	Test Item	Result
-	2	Antenna Requirement	Pass
2.1046	-	Average Power	N/A
27.50(d)	8.1	ERP and EIRP Measurement	Pass
2.1049	-	Occupied Bandwidth Measurement	N/A
27.53(h)	-	Conducted Band Edge	N/A
27.53(h)	-	Conducted Spurious Emission	N/A
27.50(a)	-	Peak to Average Ratio	N/A
27.53(h)	8.2	Spurious Radiation Measurement	Pass
2.1055, 27.54	-	Frequency Stability v.s. temperature measurement	N/A

4 TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures document on TIA-603-E and FCC CFR 47, Part 27 Subpart L, KDB 971168 D01 Power Meas License Digital Systems.

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 DESCRIPTION OF TEST MODES

The EUT (model: SR) had been tested under operating condition.

EUT staying in continuous transmitting mode was programmed.

After verification, all tests carried out are with the worst-case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode and receiving radiated spurious emission above 1GHz, which worst case was in CH Mid mode only.

WCDMA Band IV:

Channel Low (CH1312), Channel Mid (CH1413) and Channel High (CH1513) were chosen for full testing.

4.3 THE WORST MODE OF MEASUREMENT

Radiated Emission Measurement	
Test Condition	Emission for Unwanted and Fundamental
Power supply Mode	Mode 1: EUT Power by adapter.
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4
Position	☐ Placed in fixed position. ☒ Placed in fixed position at X-Plane (E2-Plane) ☐ Placed in fixed position at Y-Plane (E1-Plane) ☐ Placed in fixed position at Z-Plane (H-Plane)

Remark:

1. The worst mode was record in this test report.
2. The EUT pre-scanned in three axis ,X,Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case (X-Plane) were recorded in this report.

5 INSTRUMENT CALIBRATION

5.1 MEASURING 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.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Wugu Fully Chamber					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Bilog Antenna	Sunol Sciences	JB1	A052609	03/14/2018	03/13/2019
Cable	HUBER SUHNER	SUCOFLEX 104PEA	23452	06/29/2018	06/28/2019
Cable	HUBER SUHNER	SUCOFLEX 104PEA	33960	06/29/2018	06/28/2019
Digital Radio Communication Tester	R&S	CMU200	116604	07/19/2018	07/18/2019
Digital Thermo-Hygro Meter	WISEWIND	1110	D06	02/08/2018	02/07/2019
Horn Antenna	SCHWARZBECK	BBHA 9120D	779	03/14/2018	03/13/2019
Pre-Amplifier	Anritsu	MH648A	M89145	06/29/2018	06/28/2019
Pre-Amplifier	EMEC	EM01G26G	060570	06/29/2018	06/28/2019
Signal Analyzer	Agilent	N9010A	MY52220817	03/22/2018	03/21/2019
Wideband Radio Communication Tester	R&S	CMW 500	116875	04/20/2018	04/19/2019
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	EZ-EMC (CCS-3A1RE)				



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5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	N/A
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

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



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6 FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan, R.O.C

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."



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7 SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

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

7.2 SUPPORT EQUIPMENT

No	Equipment	Brand	Model	Series No.	FCC ID	Data Cable
	N/A					

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8 FCC PART 27 REQUIREMENTS

8.1 EIRP MEASUREMENT

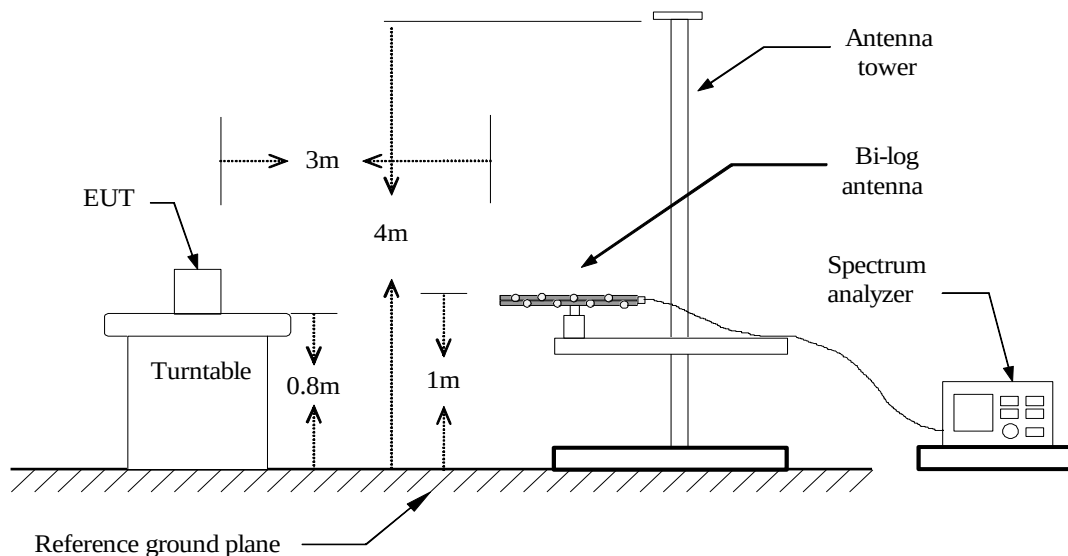
LIMIT

FCC Part 27.50(d)(4)

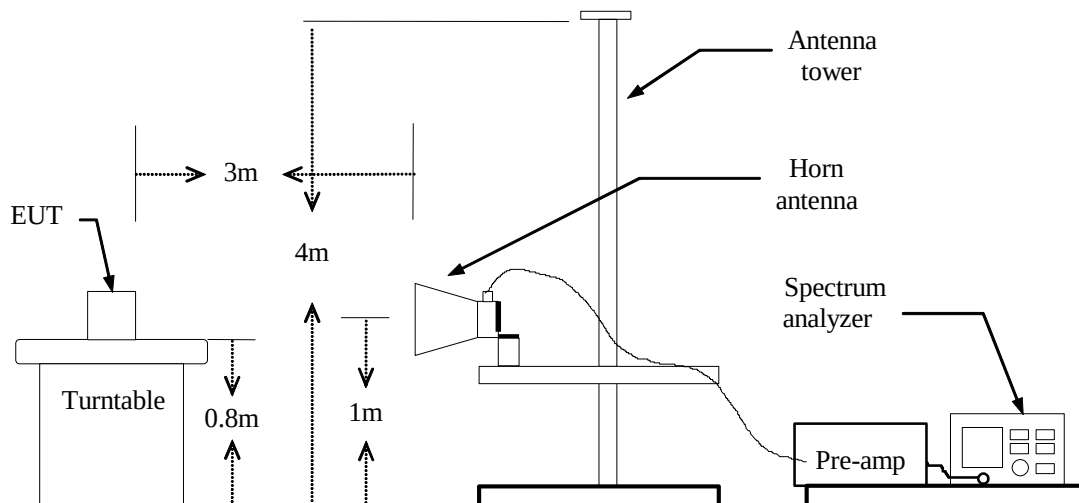
Fixed, mobile, and portable (handheld) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Test Configuration

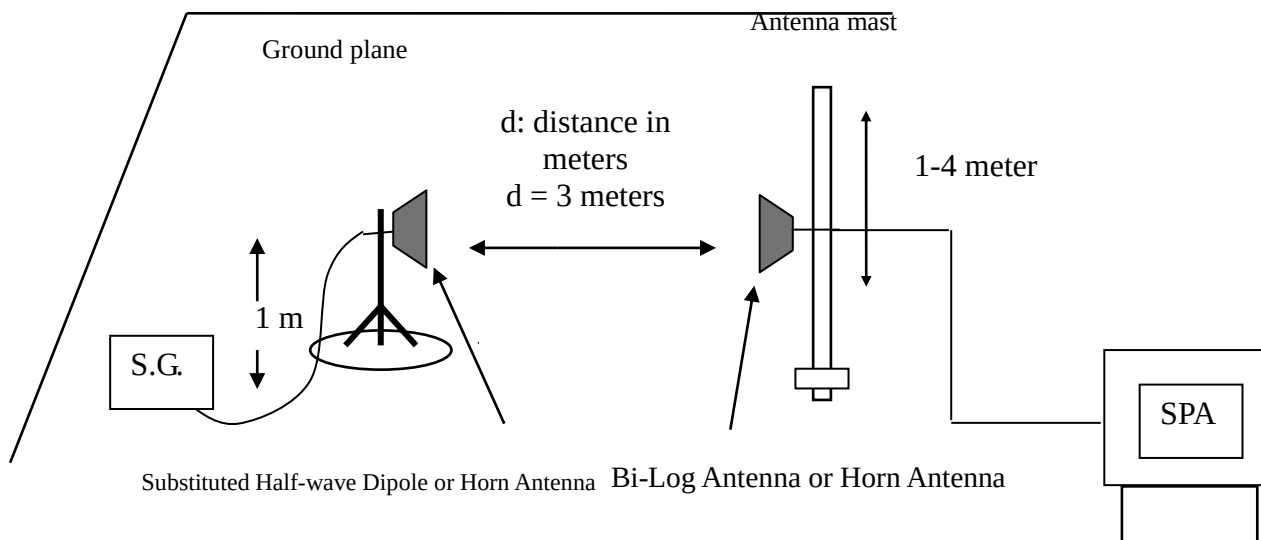
Below 1 GHz



Above 1 GHz



For Substituted Method Test Set-UP



TEST PROCEDURE

1. The EUT was placed on a non-conductive rotating platform (0.8m for below 1G and above 1G) in a semi-chamber. The radiated emission at the fundamental frequency was measured at 3m and SA with RMS detector per section 5, KDB 971168 D01 Power Meas License Digital Systems.
2. During the measurement, the call box parameters were set to get the maximum output power of the EUT. The maximum emission was recorded from spectrum analyzer power level (LVL) from 360 degrees rotation of turntable and the test antenna raised and lowered over a range from 1m to 4m in both horizontally and vertically polarized orientations.
3. EIRP was measured method according to TIA/EIA-603-E. The EUT was replaced by the substitution antenna at same location, and then record the maximum Analyzer reading through raised and lowered the test antenna.

$$\text{ERP} = \text{S.G. output (dBm)} + \text{Antenna Gain (dBi)} - \text{Cable (dB)} - 2.15$$

$$\text{EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain (dBi)} - \text{Cable (dB)}$$

TEST RESULTS

No non-compliance noted.

TEST DATA

WCDMA 12.2K RMC

Test Mode	Channel	Vertical		Horizontal	
		EIRP(dBm)	EIRP(W)	EIRP(dBm)	EIRP(W)
WCDMA 12.2K RMC (Band IV)	Lowest	7.48	0.0056	26.35	0.4315
	Middle	6.79	0.0048	26.22	0.4188
	Highest	7.51	0.0056	26.23	0.4198

8.2 FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT

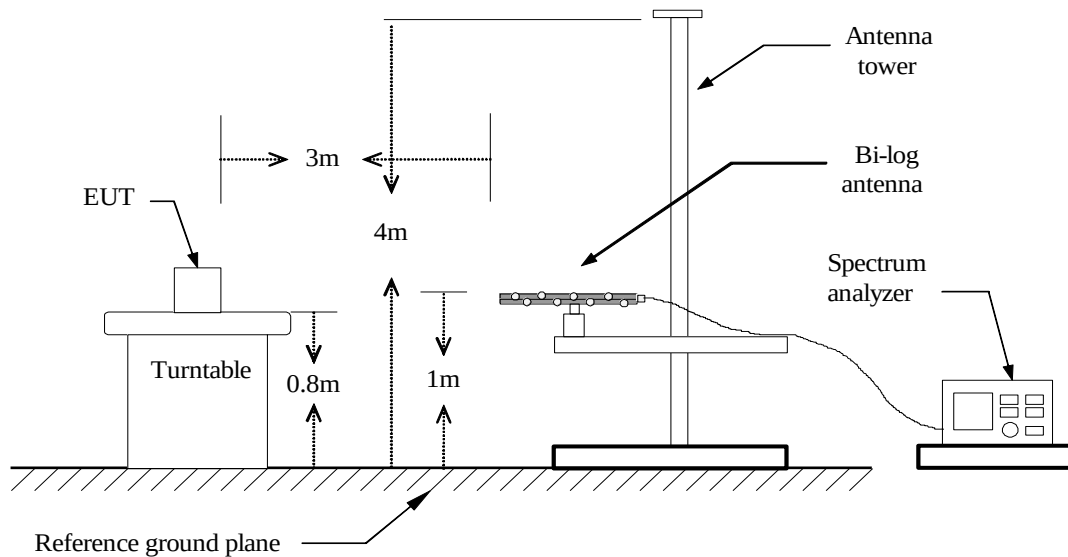
LIMIT

FCC §27.53 (h)

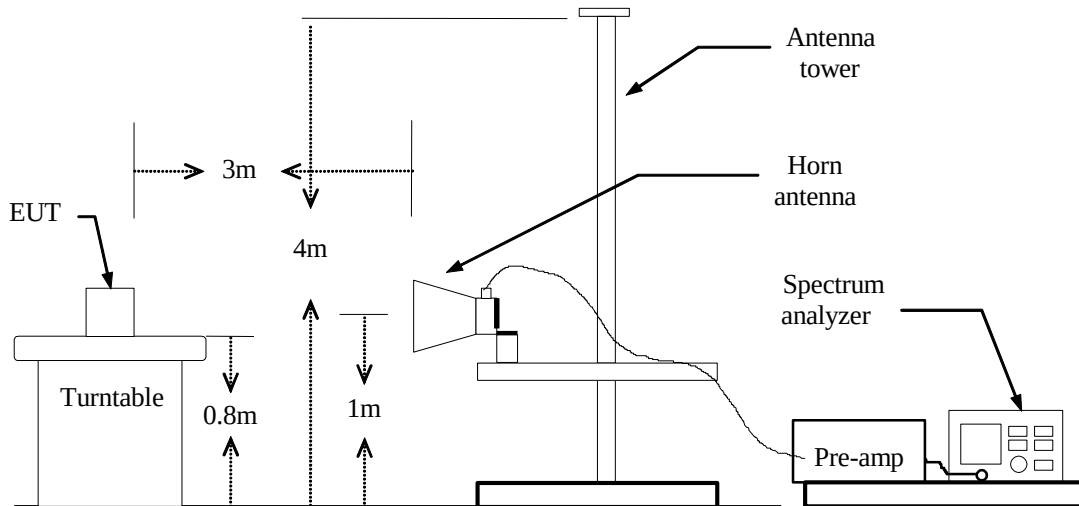
The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

Test Configuration

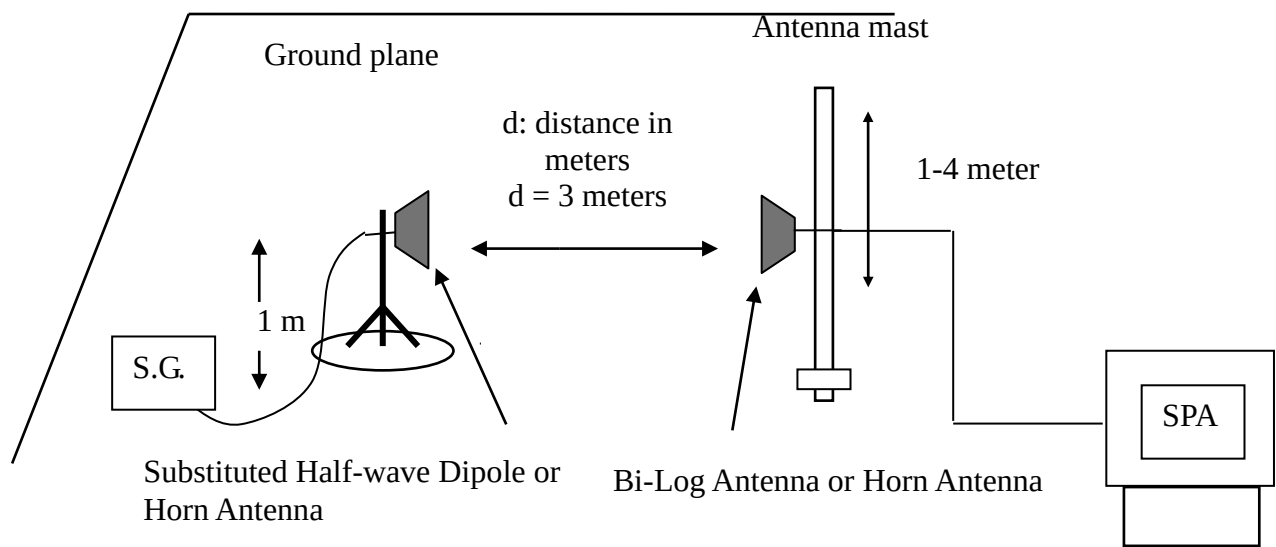
Below 1 GHz



Above 1 GHz



Substituted Method Test Set-up





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TEST PROCEDURE

1. According to KDB 971168 D01 Power Meas License Digital System and TIA-603-E Section 2.2.12.
2. The EUT was placed on a turntable
 - (1) Below 1G : 0.8m
 - (2) Above 1G : 0.8m
 - (3) EUT set 3m from the receiving antenna
 - (4) The table was rotated 360 degrees of the highest spurious emission to determine the position.
3. Set the spectrum analyzer , RBW=1MHz, VBW=3MHz.
4. A horn antenna was driven by a signal generator.
5. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission

ERP = S.G. output (dBm) + Antenna Gain (dBi) – Cable (dB) - 2.15

EIRP = S.G. output (dBm) + Antenna Gain (dBi) – Cable (dB)

TEST RESULTS

Refer to the attached tabular data sheets.

Below 1GHz

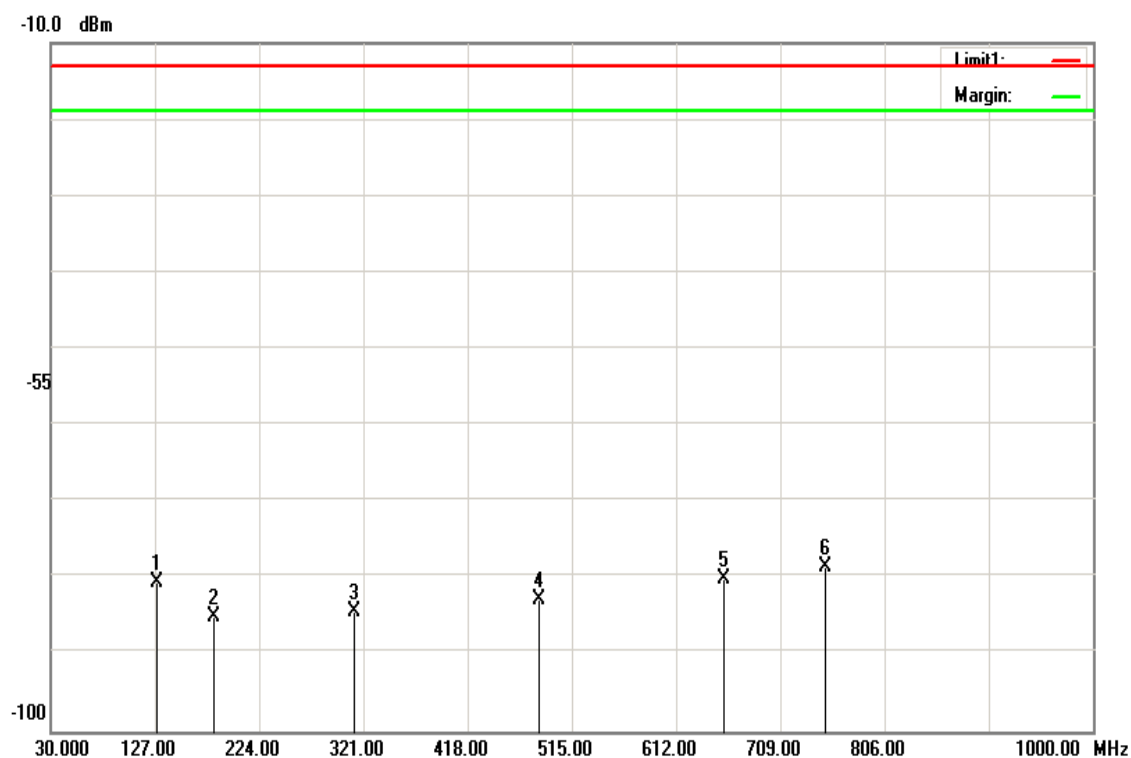
Operation Mode: WCDMA 12.2k RMC Band IV / TX /Mid CH

Test Date: October 1, 2018

Temperature: 23°C

Tested by: Jerry Chuang

Humidity: 41 %RH

Polarity: Ver.


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
128.9400	-79.48	1.13	-80.61	-13.00	-67.61	V
181.8050	-83.64	1.34	-84.98	-13.00	-71.98	V
312.2700	-82.59	1.76	-84.35	-13.00	-71.35	V
483.9600	-80.62	2.21	-82.83	-13.00	-69.83	V
656.6200	-77.54	2.58	-80.12	-13.00	-67.12	V
750.7100	-75.72	2.78	-78.50	-13.00	-65.50	V



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Operation Mode: WCDMA 12.2k RMC Band IV / TX /Mid CH

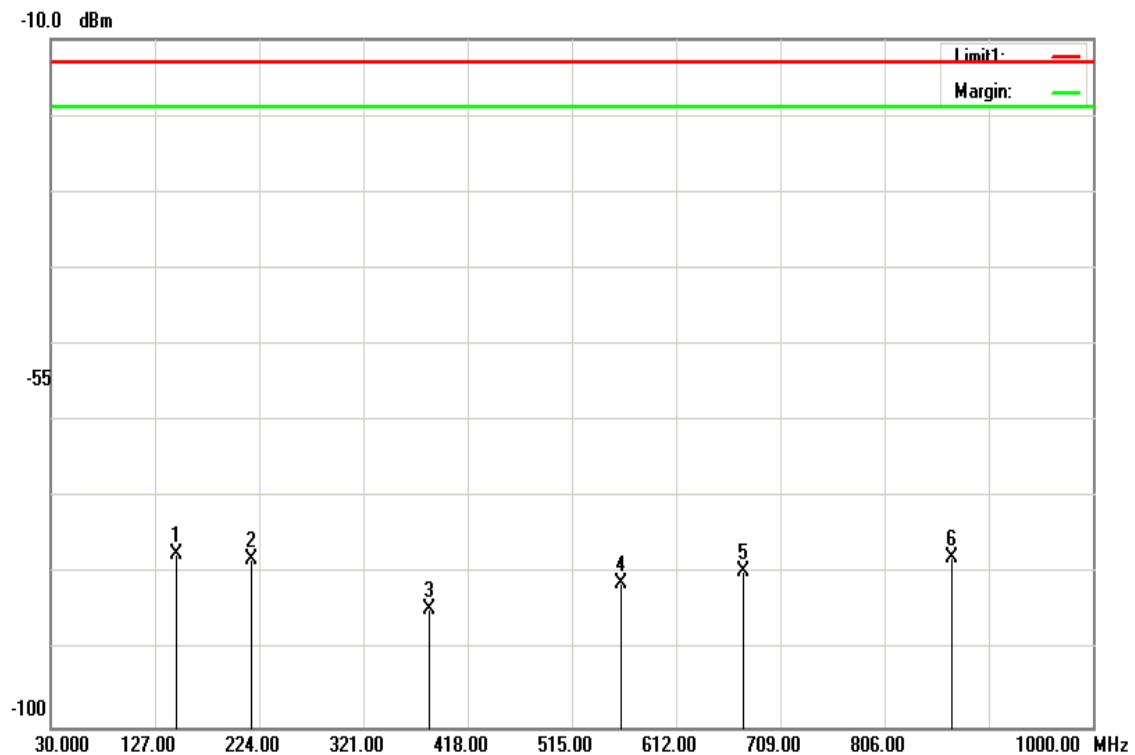
Test Date: October 1, 2018

Temperature: 23°C

Tested by: Jerry Chuang

Humidity: 41 %RH

Polarity: Hor.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
147.3700	-76.11	1.2	-77.31	-13.00	-64.31	H
216.7250	-76.62	1.46	-78.08	-13.00	-65.08	H
382.5950	-82.67	1.96	-84.63	-13.00	-71.63	H
561.0750	-78.77	2.38	-81.15	-13.00	-68.15	H
675.0500	-77	2.63	-79.63	-13.00	-66.63	H
868.5650	-74.78	3	-77.78	-13.00	-64.78	H

Above 1GHz

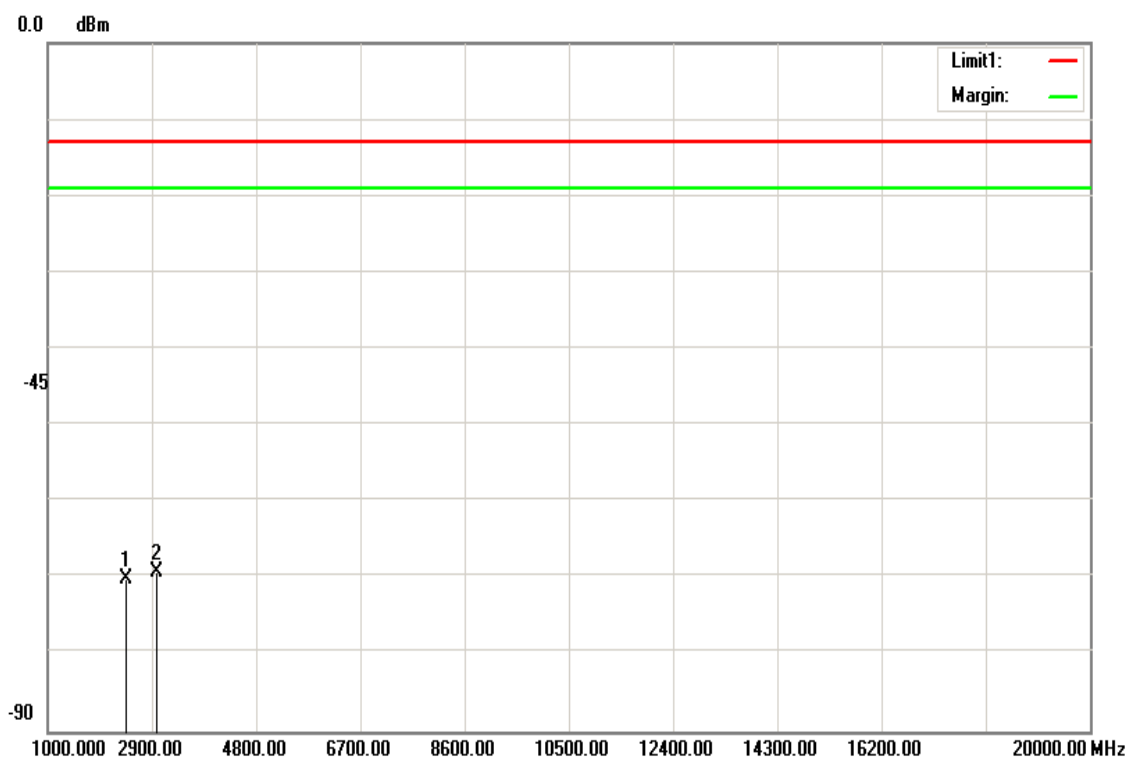
Operation Mode: WCDMA 12.2k RMC Band IV / TX /Low CH **Test Date:** October 2, 2018

Temperature: 22°C

Tested by: Jerry Chuang

Humidity: 40 %RH

Polarity: Ver.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
2438.500	-64.75	5.25	-70.00	-13.00	-57.00	V
2998.500	-63.33	5.91	-69.24	-13.00	-56.24	V
N/A						

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

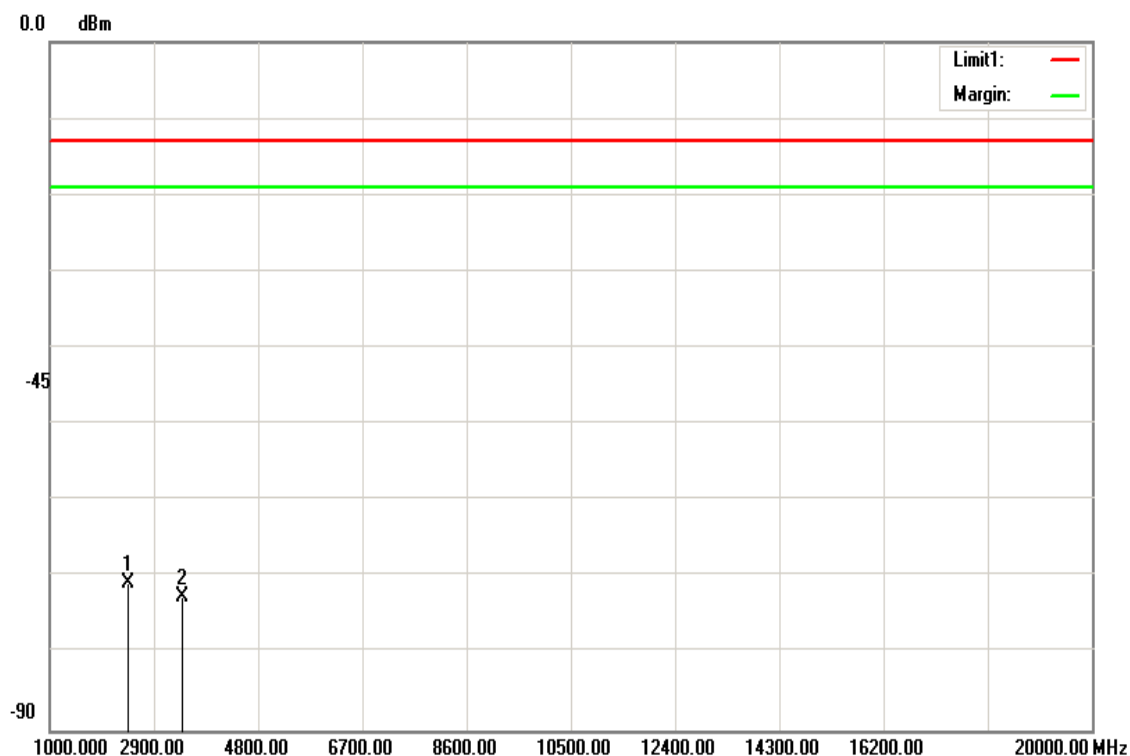


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Operation Mode: WCDMA 12.2k RMC Band IV / TX /Low CH
Temperature: 22°C
Humidity: 40 %RH

Test Date: October 2, 2018
Tested by: Jerry Chuang
Polarity: Hor.

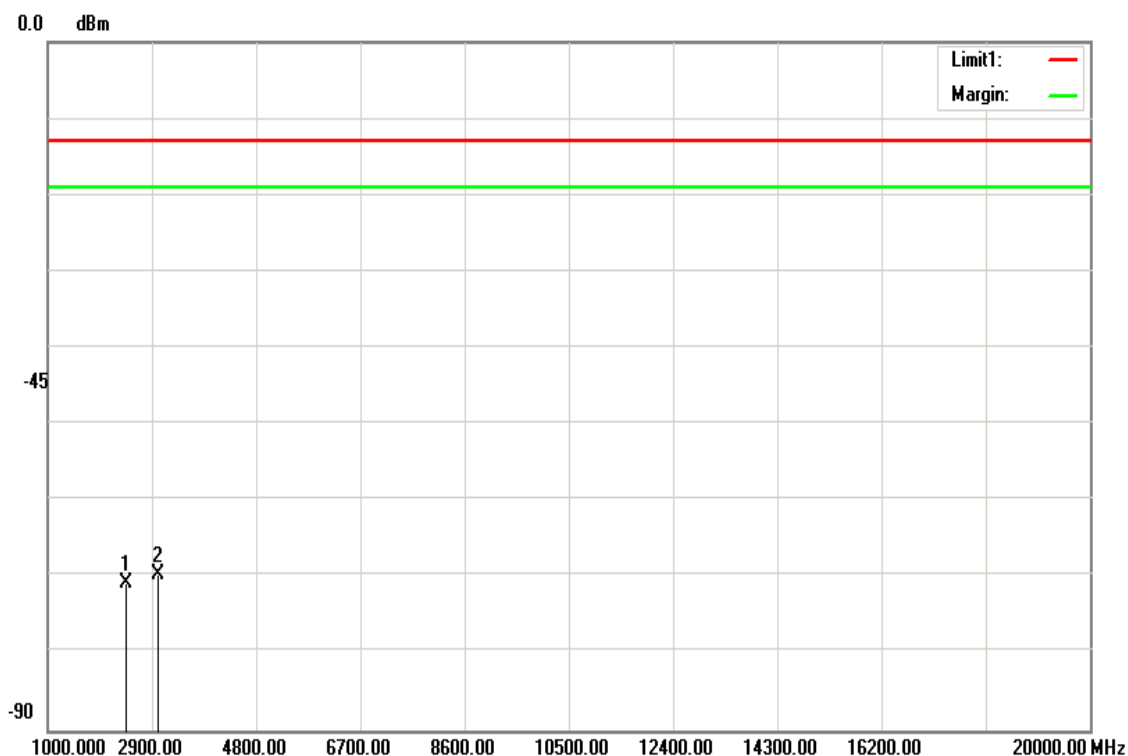


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
2435.000	-65.57	5.25	-70.82	-13.00	-57.82	H
3424.800	-66.21	6.35	-72.56	-13.00	-59.56	H
N/A						

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

Operation Mode: WCDMA 12.2k RMC Band IV / TX/Mid CH **Test Date:** October 2, 2018
Temperature: 22°C **Tested by:** Jerry Chuang
Humidity: 40 %RH **Polarity:** Ver.

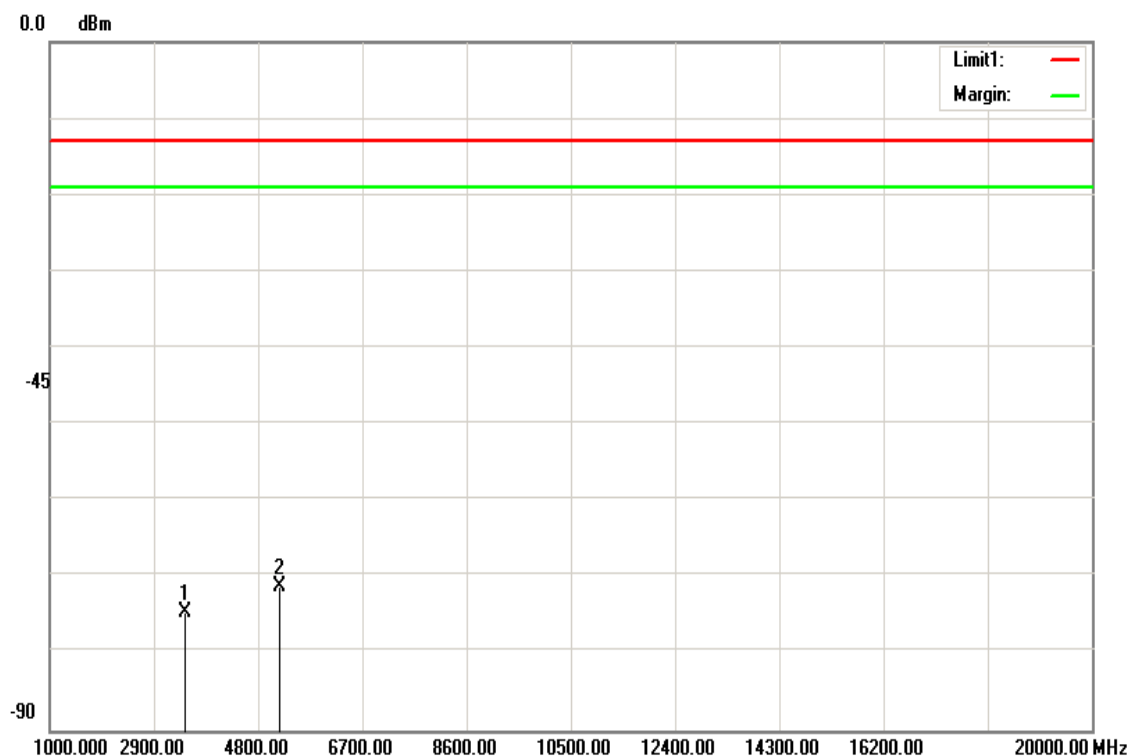


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
2438.500	-65.48	5.25	-70.73	-13.00	-57.73	V
3002.000	-63.69	5.91	-69.60	-13.00	-56.60	V
N/A						

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

Operation Mode: WCDMA 12.2k RMC Band IV / TX/Mid CH **Test Date:** October 2, 2018
Temperature: 22°C **Tested by:** Jerry Chuang
Humidity: 40 %RH **Polarity:** Hor.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
3465.200	-68.23	6.39	-74.62	-13.00	-61.62	H
5197.800	-63.14	7.98	-71.12	-13.00	-58.12	H
N/A						

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.



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Operation Mode: WCDMA 12.2k RMC Band IV / TX /High CH

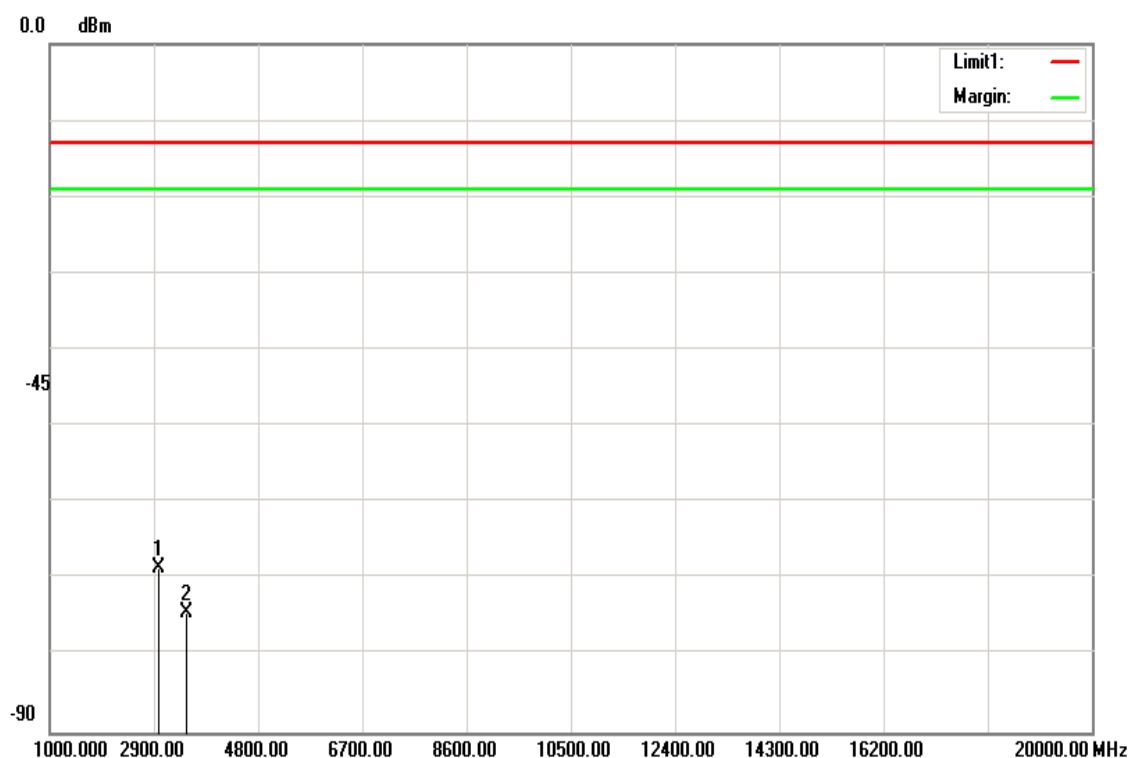
Test Date: October 2, 2018

Temperature: 22°C

Tested by: Jerry Chuang

Humidity: 40 %RH

Polarity: Ver.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
2998.500	-62.62	5.91	-68.53	-13.00	-55.53	V
3505.200	-67.88	6.44	-74.32	-13.00	-61.32	V
N/A						

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.



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Operation Mode: WCDMA 12.2k RMC Band IV / TX /High CH

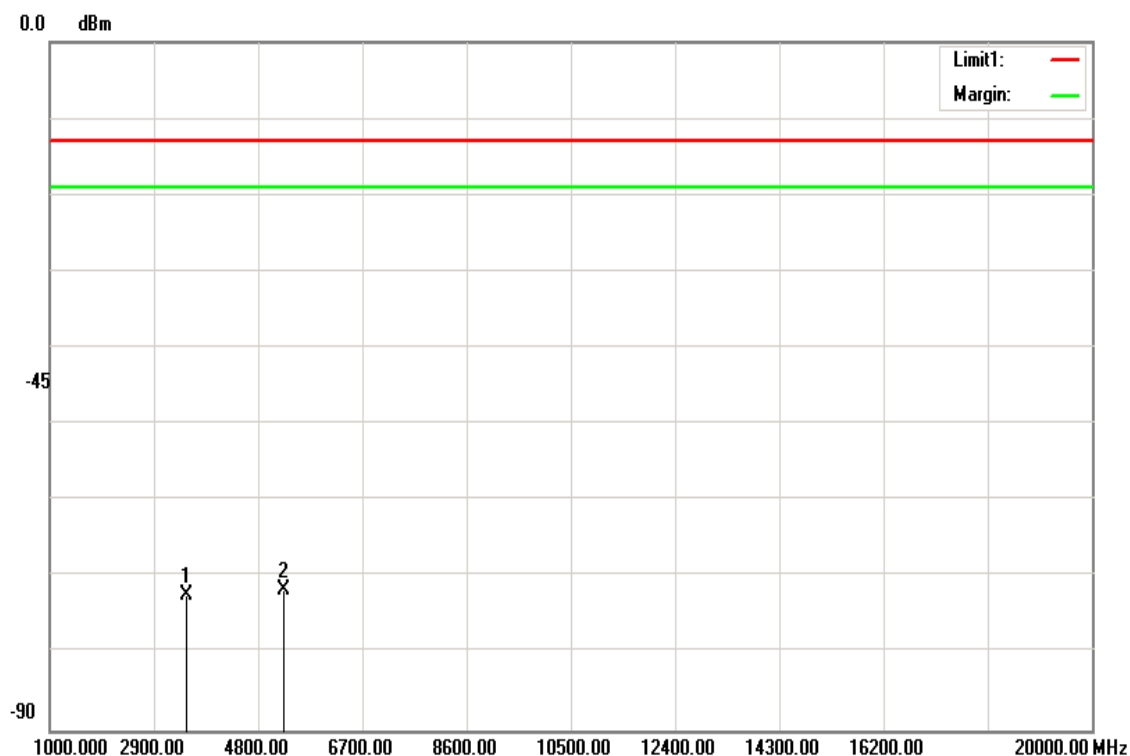
Test Date: October 2, 2018

Temperature: 22°C

Tested by: Jerry Chuang

Humidity: 40 %RH

Polarity: Hor.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
3505.200	-65.96	6.44	-72.40	-13.00	-59.40	H
5257.800	-63.53	8.03	-71.56	-13.00	-58.56	H
N/A						

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

- End of Test Report -