



FCC ID: 2ARCQ-EM7565
Report No.: T180821D09-RP3

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FCC 47 CFR PART 22 SUBPART H AND PART 24 SUBPART E

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 description of test modes in section 4.3. 2. Revised test condition in section 4.4.	P.8-9	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: September 28 ~ October 2, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR PART 22 SUBPART H AND PART 24 SUBPART E	No non-compliance noted

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 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 22 Subpart H, PART 24 Subpart E.

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	
Trade Name	ZPE	
Model	SR	
Model Discrepancy	N/A	
Received Date	August 21, 2018	
Power Supply	Power from AC adapter or internal Power Supply	
Frequency Range	LTE Band 2 Channel Bandwidth: 1.4MHz	1850.7 MHz ~ 1909.2 MHz
	LTE Band 2 Channel Bandwidth: 3MHz	1851.5 MHz ~ 1908.4 MHz
	LTE Band 2 Channel Bandwidth: 5MHz	1852.5 MHz ~ 1907.5 MHz
	LTE Band 2 Channel Bandwidth: 10MHz	1855.0 MHz ~1905.0 MHz
	LTE Band 2 Channel Bandwidth: 15MHz	1857.5 MHz ~ 1902.5 MHz
	LTE Band 2 Channel Bandwidth: 20MHz	1860.0 MHz ~1900.0 MHz
	LTE Band 5 Channel Bandwidth: 1.4MHz	824.7 MHz ~ 848.2MHz
	LTE Band 5 Channel Bandwidth: 3MHz	825.5 MHz ~ 847.4 MHz
	LTE Band 5 Channel Bandwidth: 5MHz	826.5 MHz ~846.5 MHz
	LTE Band 5 Channel Bandwidth: 10MHz	829 MHz ~844 MHz
Modulation Technique	LTE Band 2	QPSK, 16QAM
	LTE Band 5	QPSK, 16QAM
Antenna Specification	External Antenna LTE Band 2: 3 dBi LTE Band 5: 1.8 dBi	

Transmit Power (ERP & EIRP Power)	LTE Band 2 Channel Bandwidth: 1.4MHz	QPSK: 31.66 dBm 16QAM: 32.39 dBm
	LTE Band 2 Channel Bandwidth: 3MHz	QPSK: 31.59 dBm 16QAM: 32.13 dBm
	LTE Band 2 Channel Bandwidth: 5MHz	QPSK: 31.59 dBm 16QAM: 32.18 dBm
	LTE Band 2 Channel Bandwidth: 10MHz	QPSK: 31.67 dBm 16QAM: 32.59 dBm
	LTE Band 2 Channel Bandwidth: 15MHz	QPSK: 31.85 dBm 16QAM: 32.59 dBm
	LTE Band 2 Channel Bandwidth: 20MHz	QPSK: 31.68 dBm 16QAM: 32.42 dBm
	LTE Band 5 Channel Bandwidth: 1.4MHz	QPSK: 29.44 dBm 16QAM: 29.69 dBm
	LTE Band 5 Channel Bandwidth: 3MHz	QPSK: 29.17 dBm 16QAM: 29.58 dBm
	LTE Band 5 Channel Bandwidth: 5MHz	QPSK: 28.74 dBm 16QAM: 29.67 dBm
	LTE Band 5 Channel Bandwidth: 10MHz	QPSK: 28.90 dBm 16QAM: 29.35 dBm

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



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3. TEST SUMMARY

FCC Standard Section	Report Section	Test Item	Result
-	2	Antenna Requirement	Pass
2.1046	-	Output Power measurement	N/A
22.913(a), 24.232(c)	8.1	ERP Measurement	Pass
2.1055, 22.355, 24.235	-	Frequency Stability v.s. temperature measurement	N/A
2.1049	-	Occupied Bandwidth Measurement	N/A
22.917(a), 24.238(a)	-	Conducted Band Edge	N/A
22.913(d), 24.232(d)	-	Peak to Average Ratio	N/A
22.917(a), 24.238(a)	-	Conducted Spurious Emission	N/A
22.917(a), 24.238(a)	8.2	Spurious Radiation Measurement	Pass

4. TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures document on chapter 13 of TIA-603-E and FCC CFR 47, Part 2 and Part 22 Subpart H & Part 24 Subpart E, 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 EUT EXERCISE

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

4.3 DESCRIPTION OF TEST MODES

The EUT had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

LTE Band 2: 1850 MHz ~ 1915MHz

Three channels had been tested for each channel bandwidth.

Channel Bandwidth	1.4MHz		3MHz		5MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low channel (L)	18607	1850.7	18615	1851.5	18625	1852.5
Middle channel (M)	18900	1880	18900	1880.0	18900	1880
High channel (H)	19192	1909.2	19184	1908.4	19175	1907.5
Channel Bandwidth	10MHz		15MHz		20MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low channel (L)	18650	1855	18675	1857.5	18700	1860
Middle channel (M)	18900	1880	18900	1880.0	18900	1880
High channel (H)	19150	1905	19125	1902.5	19100	1900

LTE Band 5: 824 MHz ~ 849

Three channels had been tested for each channel bandwidth.

Channel Bandwidth	1.4MHz		3MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low channel (L)	20407	824.7	20415	825.5
Middle channel (M)	20525	836.5	20525	836.5
High channel (H)	20642	848.2	20634	847.4
Channel Bandwidth	5MHz		10MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low channel (L)	20425	826.5	20450	829
Middle channel (M)	20525	836.5	20525	836.5
High channel (H)	20625	846.5	20600	844

For test mode:

The conducted power be measured in 1, 50% and 100% RB allocation, offset to upper edge, centered and lower edge of the channel bandwidth of each required channel.

	QPSK	Worst Mode	16QAM	Worst Mode
Band2	1.4M	1 RB ALLOCATED AT THE LOWER EDGE	1.4M	1 RB ALLOCATED AT THE LOWER EDGE
	3M	1 RB ALLOCATED AT THE LOWER EDGE	3M	1 RB ALLOCATED AT THE LOWER EDGE
	5M	1 RB ALLOCATED AT THE LOWER EDGE	5M	1 RB ALLOCATED AT THE LOWER EDGE
	10M	1 RB ALLOCATED AT THE LOWER EDGE	10M	1 RB ALLOCATED AT THE LOWER EDGE
	15M	1 RB ALLOCATED AT THE LOWER EDGE	15M	1 RB ALLOCATED AT THE LOWER EDGE
	20M	1 RB ALLOCATED AT THE LOWER EDGE	20M	1 RB ALLOCATED AT THE LOWER EDGE
Band5	1.4M	1 RB ALLOCATED AT THE LOWER EDGE	1.4M	1 RB ALLOCATED AT THE LOWER EDGE
	3M	1 RB ALLOCATED AT THE LOWER EDGE	3M	1 RB ALLOCATED AT THE LOWER EDGE
	5M	1 RB ALLOCATED AT THE LOWER EDGE	5M	1 RB ALLOCATED AT THE LOWER EDGE
	10M	1 RB ALLOCATED AT THE LOWER EDGE	10M	1 RB ALLOCATED AT THE LOWER EDGE

4.4 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 $k=2$.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

- ☐ 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

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

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 A 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 22 & 24 REQUIREMENTS

8.1 ERP & EIRP MEASUREMENT

LIMIT

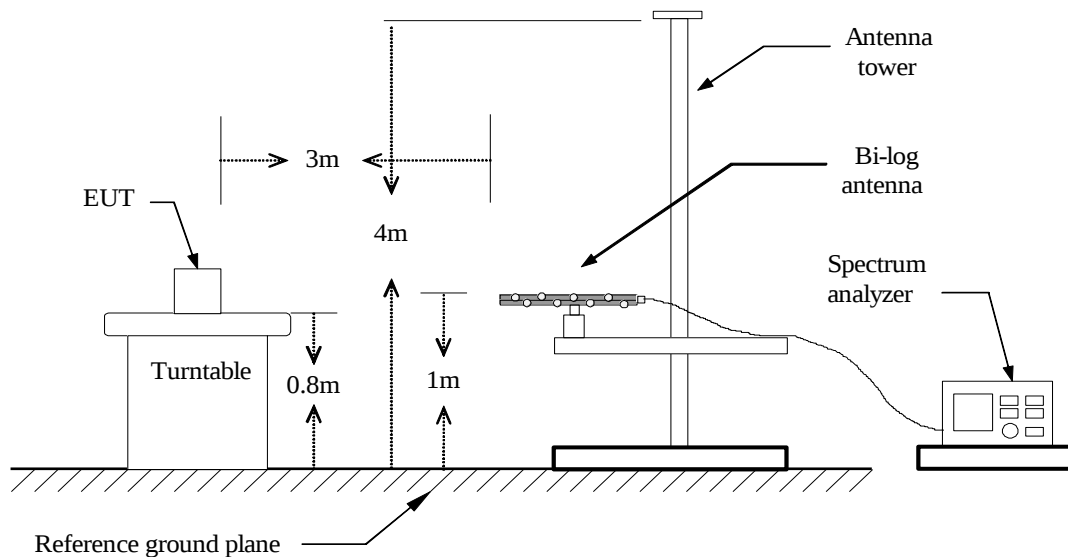
According to FCC §2.1046

FCC 22.913(a): The Effective Radiated Power (ERP) of mobile transmitters must not exceed 7 Watts.

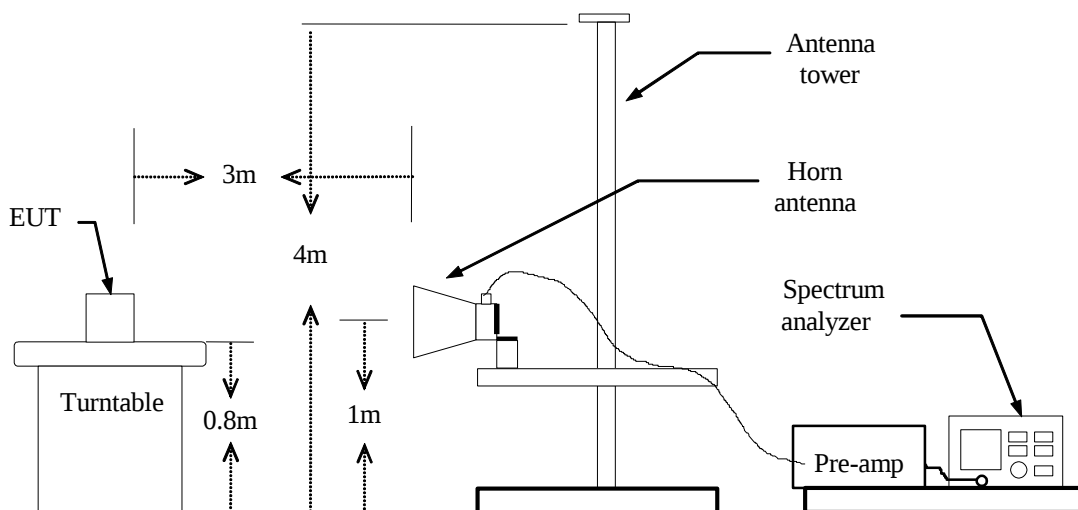
FCC 24.232(c): The equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

TEST CONFIGURATION

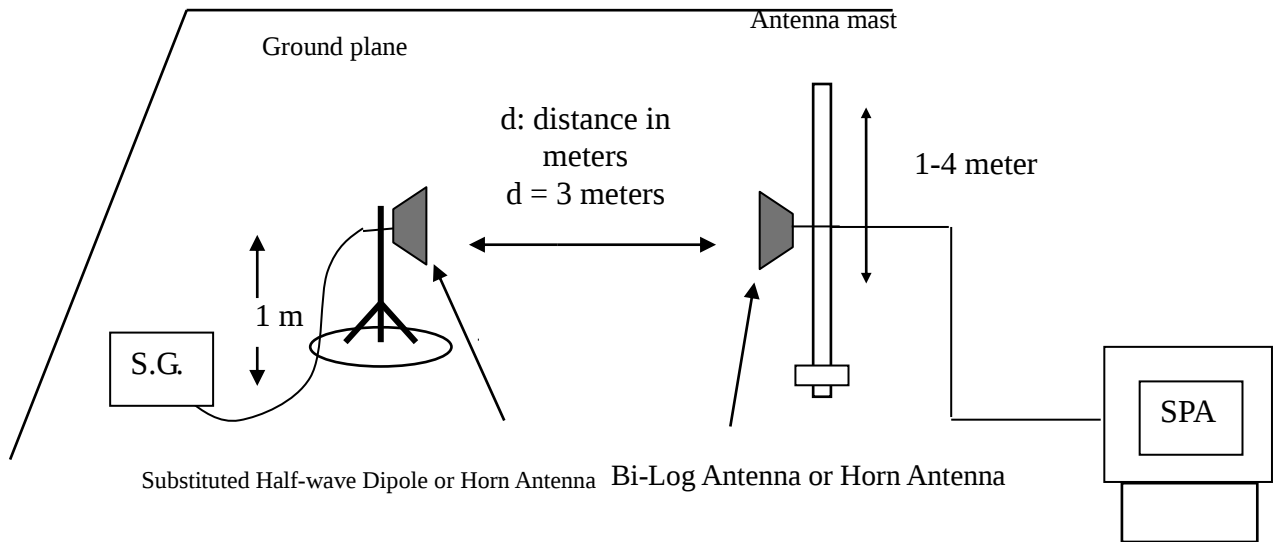
Below 1 GHz



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.

LTE Band 2

BW: 1.4MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						EIRP (dBm)	EIRP (W)	EIRP (dBm)	EIRP (W)
2	1.4	Lowest	QPSK	1	0	13.52	0.0225	29.84	0.9638
		Middle		1	0	11.16	0.0131	30.98	1.2531
		Highest		1	0	8.76	0.0075	31.66	1.4655
		Lowest	16 QAM	1	0	14.10	0.0257	30.20	1.0471
		Middle		1	0	12.53	0.0179	32.39	1.7338
		Highest		1	0	9.23	0.0084	32.09	1.6181

BW: 3MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						EIRP (dBm)	EIRP (W)	EIRP (dBm)	EIRP (W)
2	3	Lowest	QPSK	1	0	13.33	0.0215	29.51	0.8933
		Middle		1	0	11.56	0.0143	31.22	1.3243
		Highest		1	0	8.79	0.0076	31.59	1.4421
		Lowest	16 QAM	1	0	13.82	0.0241	30.25	1.0593
		Middle		1	0	12.32	0.0171	32.13	1.6331
		Highest		1	0	9.26	0.0084	32.03	1.5959

BW: 5MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						EIRP (dBm)	EIRP (W)	EIRP (dBm)	EIRP (W)
2	5	Lowest	QPSK	1	0	13.25	0.0211	29.56	0.9036
		Middle		1	0	11.36	0.0137	31.14	1.3002
		Highest		1	0	8.97	0.0079	31.59	1.4421
		Lowest	16 QAM	1	0	13.93	0.0247	30.31	1.0740
		Middle		1	0	12.18	0.0165	32.18	1.6520
		Highest		1	0	9.52	0.0090	32.13	1.6331

BW: 10MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						EIRP (dBm)	EIRP (W)	EIRP (dBm)	EIRP (W)
2	10	Lowest	QPSK	1	0	13.32	0.0215	29.69	0.9311
		Middle		1	0	11.34	0.0136	31.31	1.3521
		Highest		1	0	9.25	0.0084	31.67	1.4689
		Lowest	16 QAM	1	0	14.13	0.0259	30.45	1.1092
		Middle		1	0	12.27	0.0169	32.30	1.6982
		Highest		1	0	10.10	0.0102	32.59	1.8155

BW: 15MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						EIRP (dBm)	EIRP (W)	EIRP (dBm)	EIRP (W)
2	15	Lowest	QPSK	1	0	13.25	0.0211	29.71	0.9354
		Middle		1	0	11.40	0.0138	31.05	1.2735
		Highest		1	0	9.93	0.0098	31.85	1.5311
		Lowest	16 QAM	1	0	13.97	0.0249	30.42	1.1015
		Middle		1	0	12.34	0.0171	32.01	1.5885
		Highest		1	0	10.98	0.0125	32.59	1.8155

BW: 20MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						EIRP (dBm)	EIRP (W)	EIRP (dBm)	EIRP (W)
2	20	Lowest	QPSK	1	0	13.27	0.0212	29.82	0.9594
		Middle		1	0	11.77	0.0150	31.13	1.2972
		Highest		1	0	10.46	0.0111	31.68	1.4723
		Lowest	16 QAM	1	0	14.16	0.0261	30.62	1.1535
		Middle		1	0	12.69	0.0186	32.14	1.6368
		Highest		1	0	11.41	0.0138	32.42	1.7458

LTE Band 5

BW: 1.4MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						ERP (dBm)	ERP (W)	ERP (dBm)	ERP (W)
5	1.4	Lowest	QPSK	1	0	13.20	0.0209	28.94	0.7834
		Middle		1	0	14.27	0.0267	29.44	0.8790
		Highest		1	0	14.82	0.0303	29.05	0.8035
		Lowest	16 QAM	1	0	14.09	0.0256	29.69	0.9311
		Middle		1	0	15.09	0.0323	29.57	0.9057
		Highest		1	0	15.45	0.0351	29.23	0.8375

BW: 3MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						ERP (dBm)	ERP (W)	ERP (dBm)	ERP (W)
5	3	Lowest	QPSK	1	0	13.59	0.0229	29.17	0.8260
		Middle		1	0	14.30	0.0269	28.89	0.7745
		Highest		1	0	14.54	0.0284	28.27	0.6714
		Lowest	16 QAM	1	0	14.32	0.0270	29.58	0.9078
		Middle		1	0	15.02	0.0318	29.45	0.8810
		Highest		1	0	15.07	0.0321	28.33	0.6808

BW: 5MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						ERP (dBm)	ERP (W)	ERP (dBm)	ERP (W)
5	5	Lowest	QPSK	1	0	13.27	0.0212	28.74	0.7482
		Middle		1	0	14.23	0.0265	28.48	0.7047
		Highest		1	0	14.68	0.0294	27.97	0.6266
		Lowest	16 QAM	1	0	13.95	0.0248	29.67	0.9268
		Middle		1	0	14.67	0.0293	29.60	0.9120
		Highest		1	0	15.07	0.0321	28.29	0.6745



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BW: 10MHz / RB=1, RB Offset=0

Band	BW (MHz)	Channel	Mode	UL RB Allocation	UL RB offset	Vertical		Horizontal	
						ERP (dBm)	ERP (W)	ERP (dBm)	ERP (W)
5	10	Lowest	QPSK	1	0	13.53	0.0225	28.76	0.7516
		Middle		1	0	14.17	0.0261	28.56	0.7178
		Highest		1	0	14.40	0.0275	28.90	0.7762
		Lowest	16 QAM	1	0	14.15	0.0260	29.35	0.8610
		Middle		1	0	14.18	0.0262	29.26	0.8433
		Highest		1	0	16.25	0.0422	29.26	0.8433

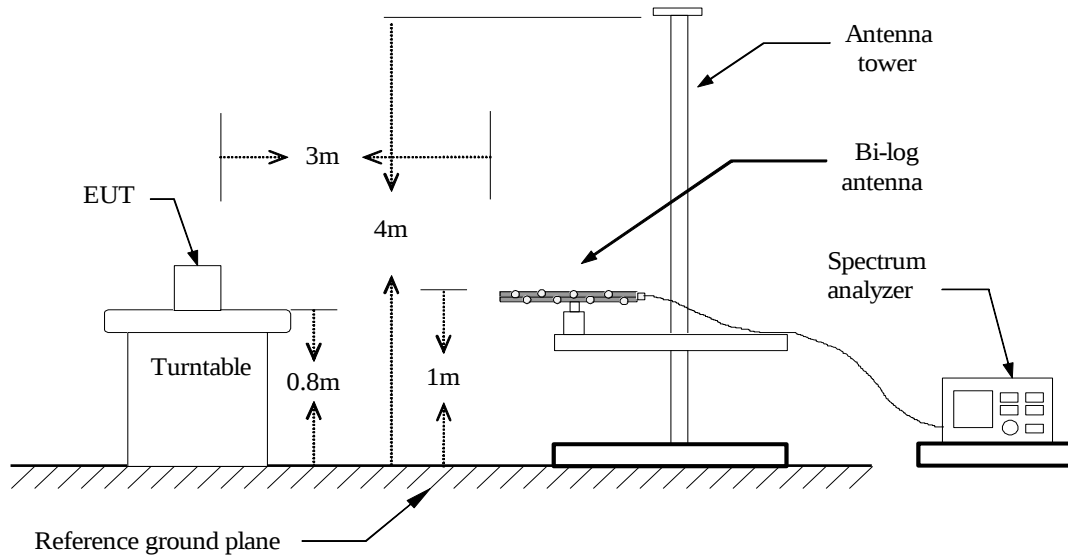
8.2 FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT

LIMIT

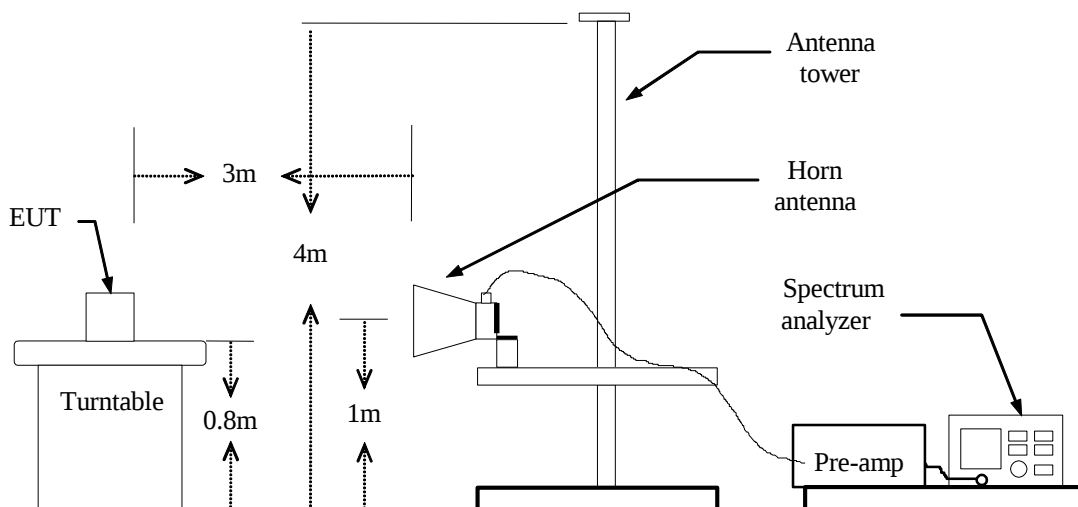
The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB. The limit of emission equal to -13dBm

Test Configuration

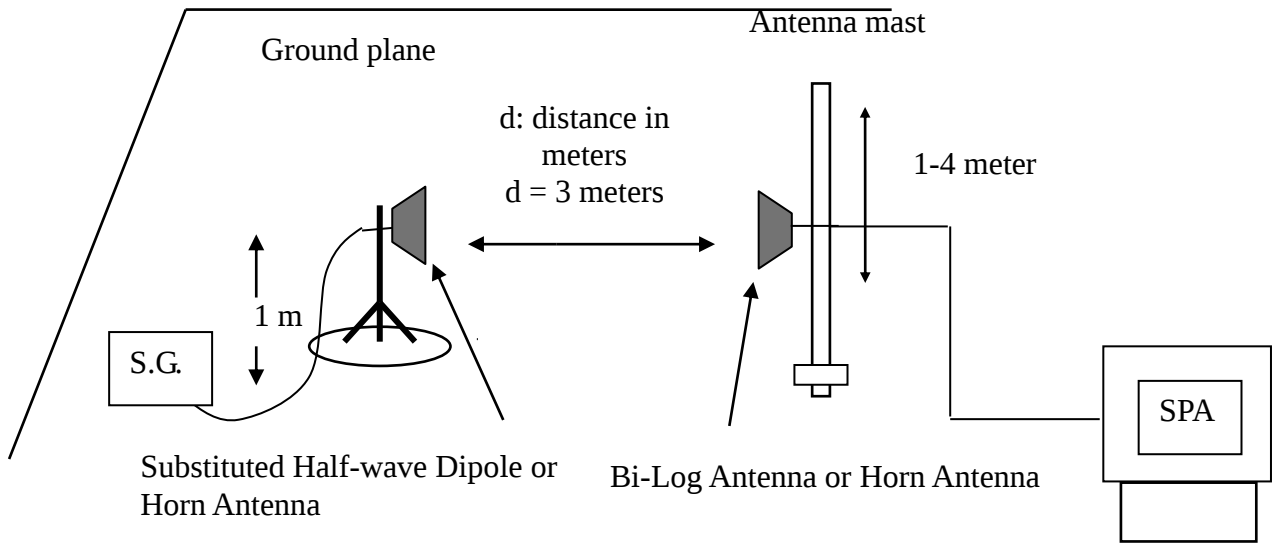
Below 1 GHz



Above 1 GHz



Substituted Method Test Set-up



TEST PROCEDURE

1. According to KDB 971168 D01 Power Meas License Digital Systems 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

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

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

TEST RESULTS

Refer to the attached tabular data sheets.



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Test Results

Below 1GHz

LTE Band 2 / BW: 20MHz / QPSK / RB =1, RB Offset = 0

Operation Mode: Tx / Mid CH

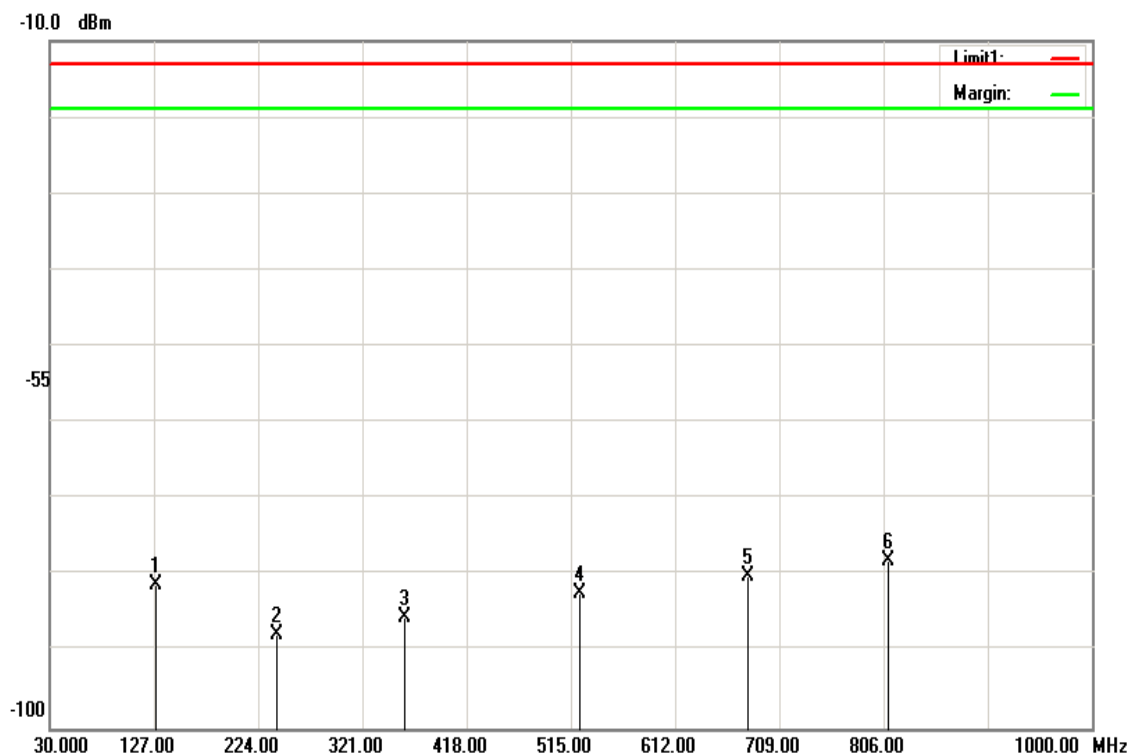
Test Date: October 2, 2018

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)
128.9400	-80.03	1.13	-81.16	-13.00	-68.16	V
241.9450	-86.21	1.54	-87.75	-13.00	-74.75	V
359.8000	-83.52	1.9	-85.42	-13.00	-72.42	V
523.7300	-79.94	2.3	-82.24	-13.00	-69.24	V
680.3850	-77.54	2.64	-80.18	-13.00	-67.18	V
810.3650	-75.17	2.89	-78.06	-13.00	-65.06	V

Note: We selected worst case to performed test, The results can be meet other mode.

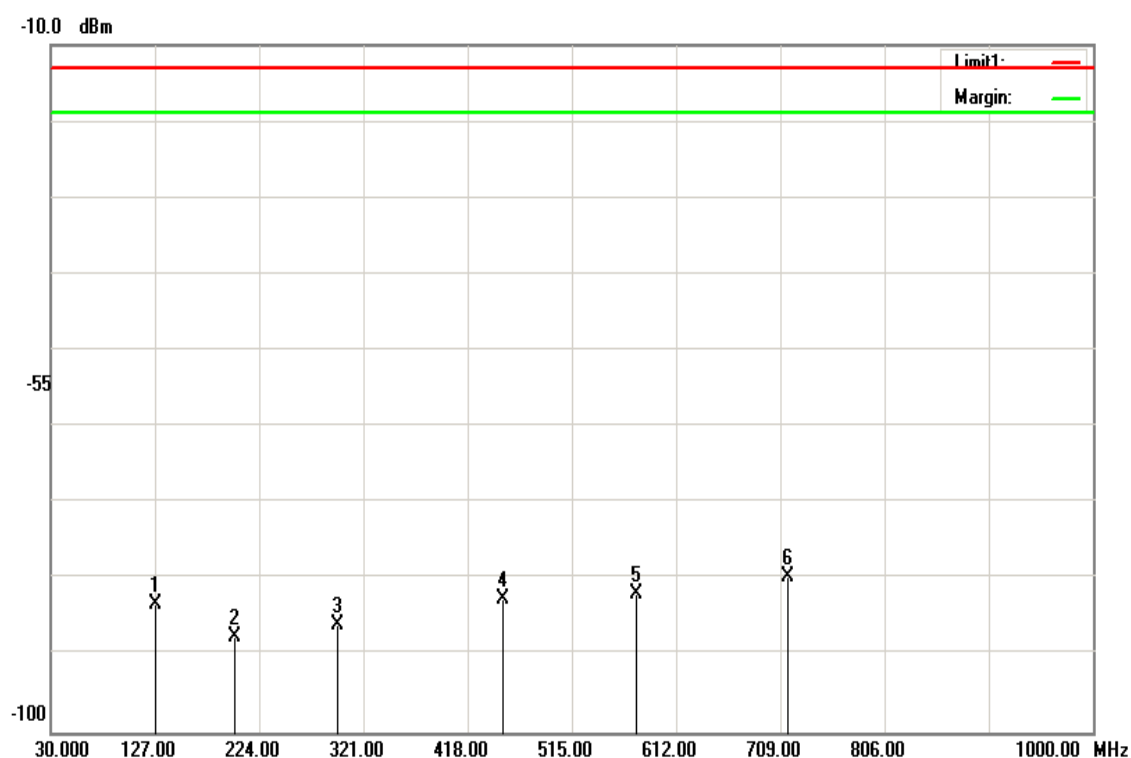
Operation Mode: Tx / Mid CH

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)
127.9700	-82.11	1.12	-83.23	-13.00	-70.23	H
201.6900	-85.99	1.41	-87.40	-13.00	-74.40	H
296.7500	-84.33	1.72	-86.05	-13.00	-73.05	H
451.4650	-80.43	2.13	-82.56	-13.00	-69.56	H
575.6250	-79.57	2.42	-81.99	-13.00	-68.99	H
715.7900	-76.85	2.71	-79.56	-13.00	-66.56	H

Note: We selected worst case to performed test, The results can be meet other mode.

LTE Band 2 / BW: 20MHz / 16QAM / RB =1, RB Offset = 0

Operation Mode: Tx / Mid CH

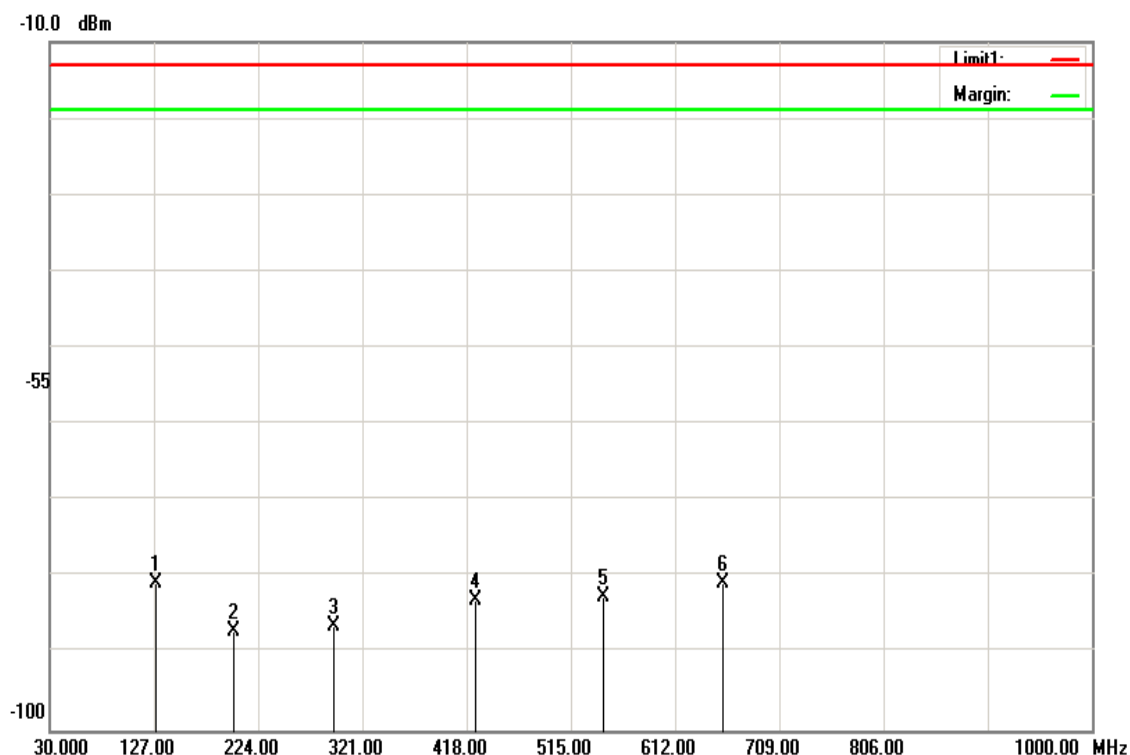
Test Date: October 2, 2018

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)
128.9400	-79.62	1.13	-80.75	-13.00	-67.75	V
201.2050	-85.74	1.4	-87.14	-13.00	-74.14	V
294.3250	-84.77	1.71	-86.48	-13.00	-73.48	V
425.7600	-80.9	2.07	-82.97	-13.00	-69.97	V
545.0700	-80.18	2.35	-82.53	-13.00	-69.53	V
656.6200	-78.11	2.58	-80.69	-13.00	-67.69	V

Note: We selected worst case to performed test, The results can be meet other mode.

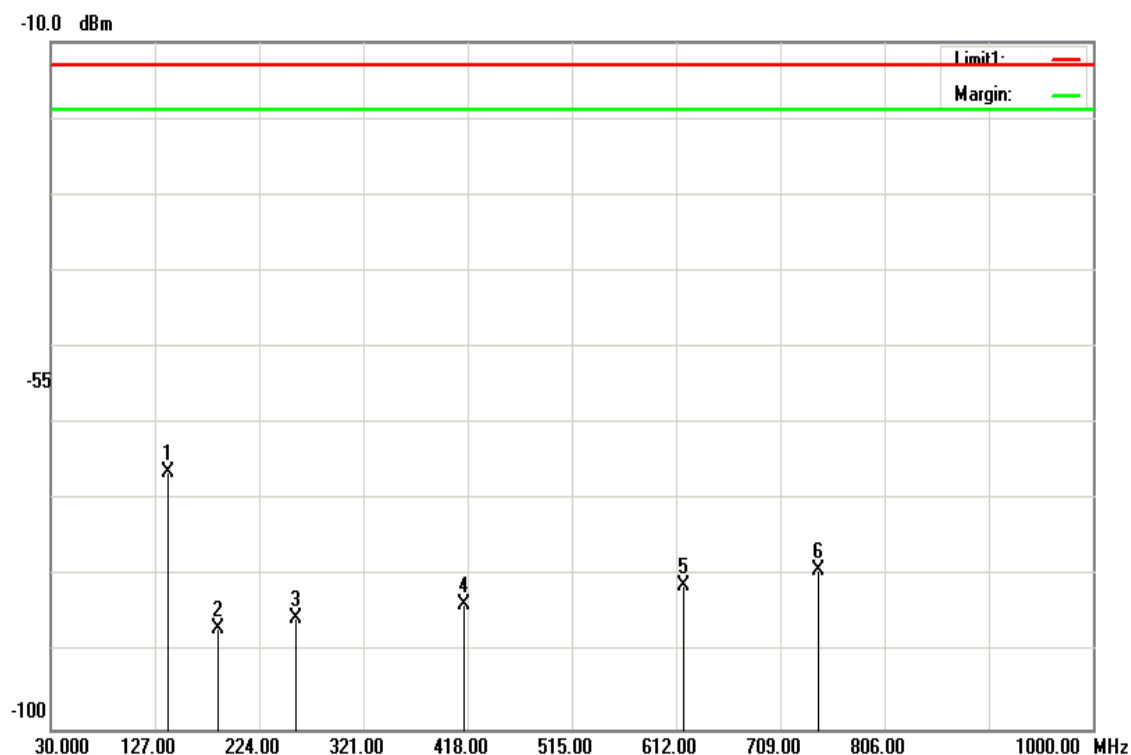
Operation Mode: Tx / Mid CH

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)
139.6100	-65.16	1.17	-66.33	-13.00	-53.33	H
186.6550	-85.48	1.35	-86.83	-13.00	-73.83	H
258.4350	-83.83	1.6	-85.43	-13.00	-72.43	H
415.0900	-81.65	2.05	-83.70	-13.00	-70.70	H
619.2750	-78.66	2.51	-81.17	-13.00	-68.17	H
743.9200	-76.48	2.77	-79.25	-13.00	-66.25	H

Note: We selected worst case to performed test, The results can be meet other mode.



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Above 1GHz

LTE Band 2 / BW: 20MHz / QPSK RB =1, RB Offset = 0

Operation Mode: Tx / Low CH

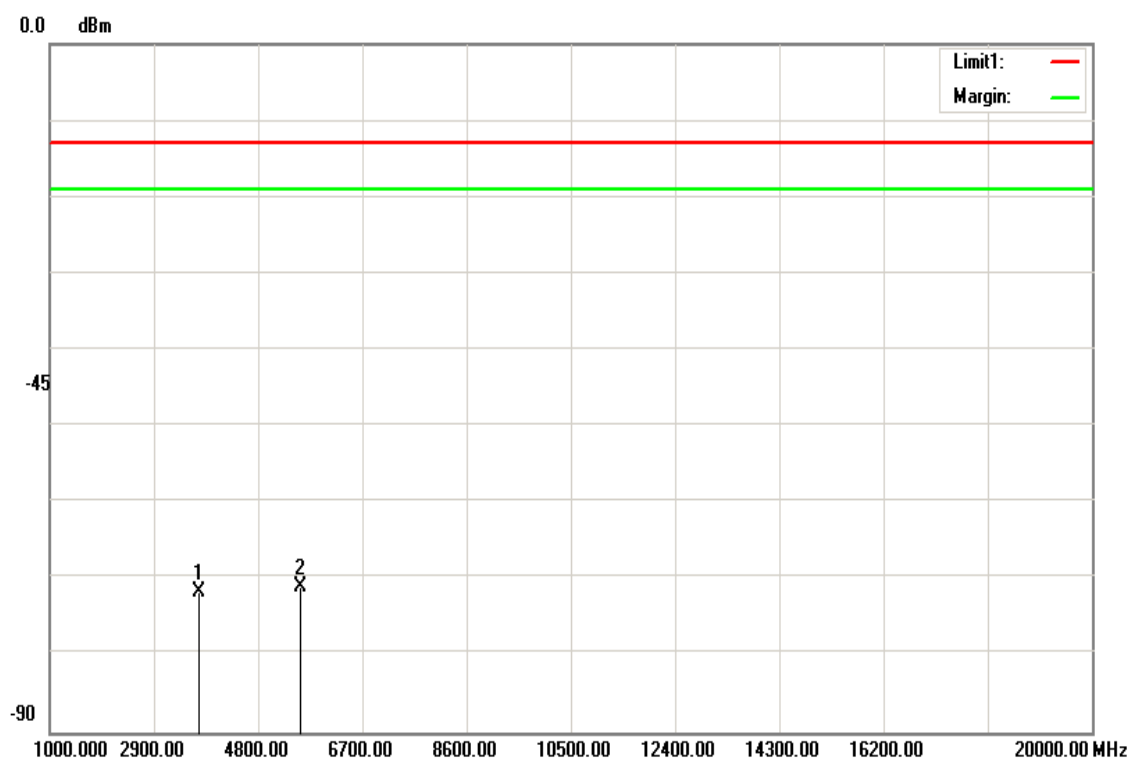
Test Date: October 2, 2018

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)
3720.000	-65.12	6.65	-71.77	-13.00	-58.77	V
5580.000	-62.71	8.31	-71.02	-13.00	-58.02	V
N/A						

Remark:

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

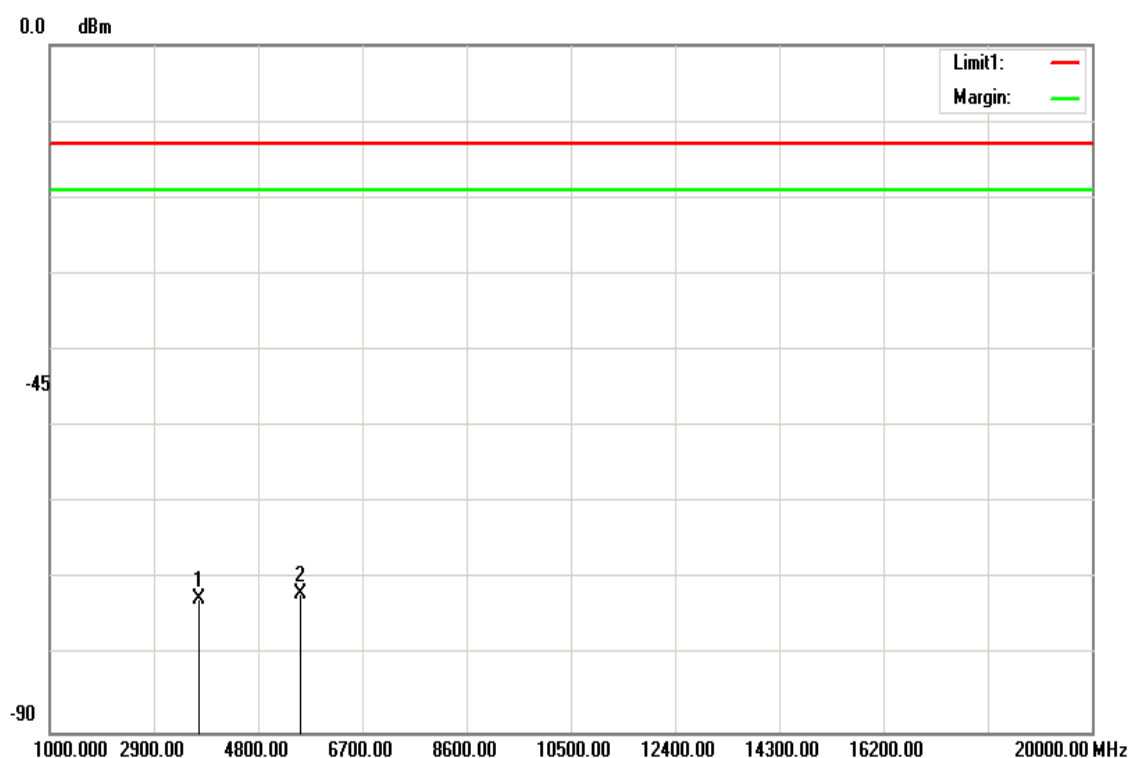


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Operation Mode: Tx / Low CH
Temperature: 22°C
Humidity: 40 %RH

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)
3720.000	-65.81	6.65	-72.46	-13.00	-59.46	H
5580.000	-63.56	8.31	-71.87	-13.00	-58.87	H
N/A						

Remark:

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

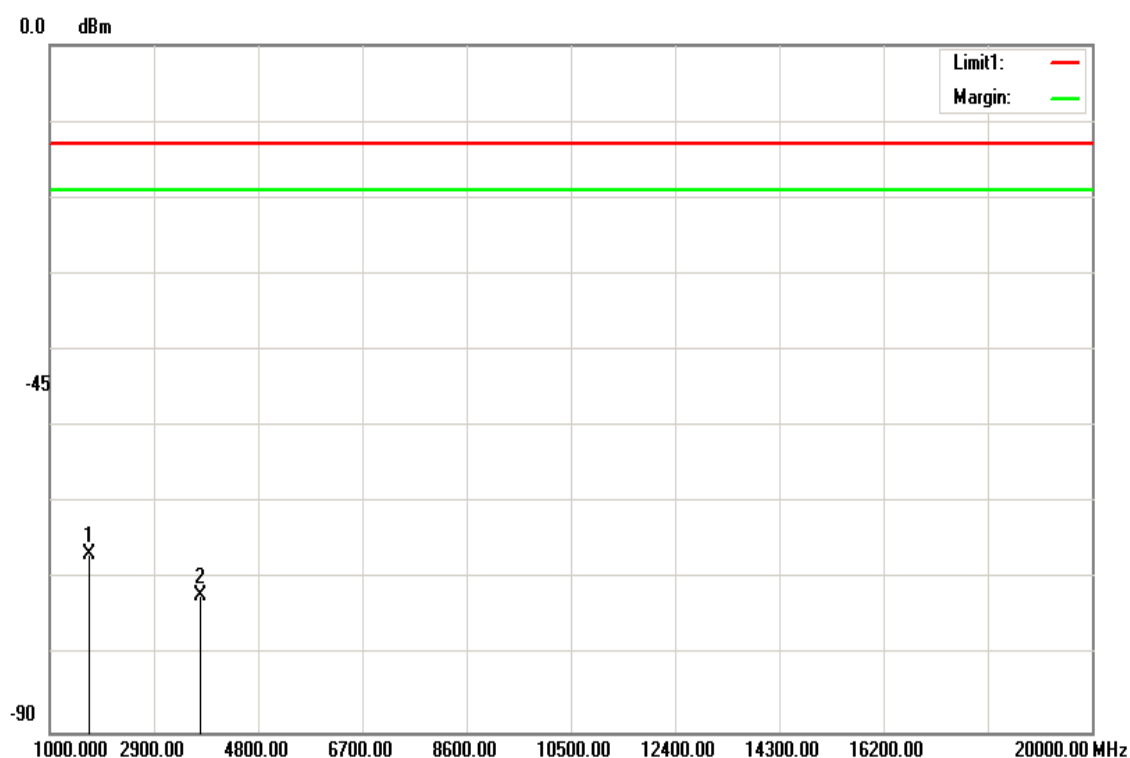


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
1717.500	-62.45	4.29	-66.74	-13.00	-53.74	V
3760.000	-65.47	6.68	-72.15	-13.00	-59.15	V
N/A						

Remark:

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

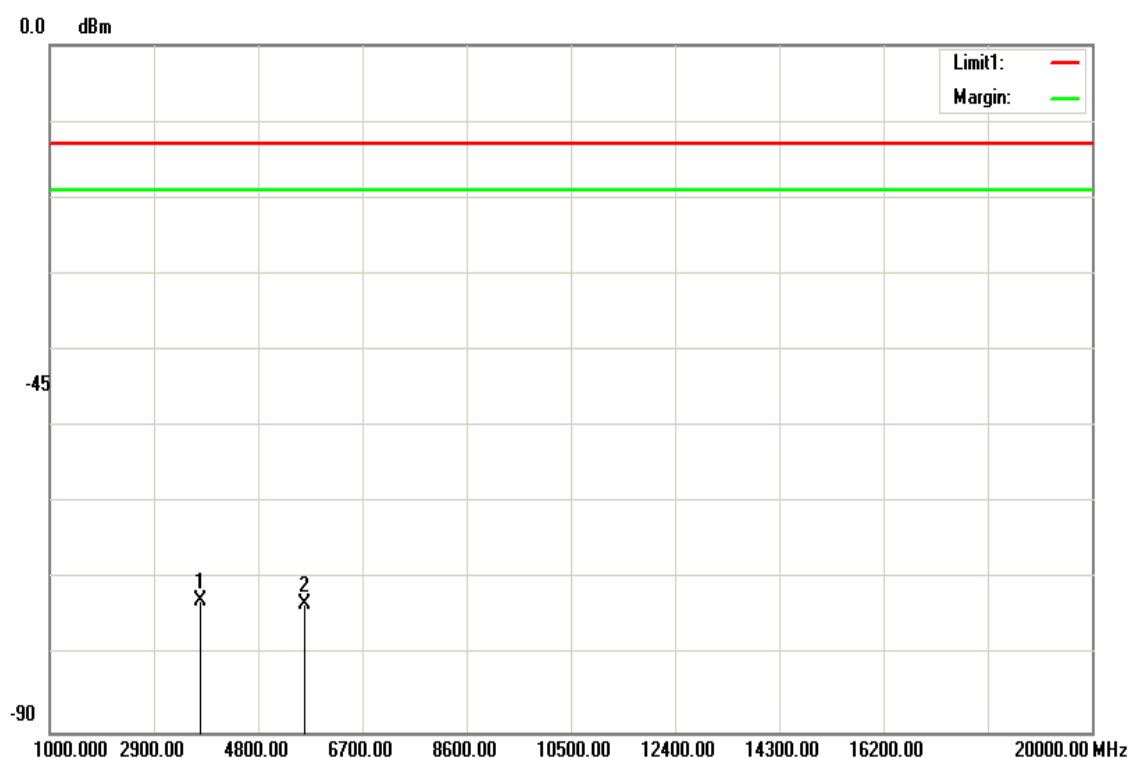


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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)
3760.000	-66.13	6.68	-72.81	-13.00	-59.81	H
5640.000	-64.9	8.37	-73.27	-13.00	-60.27	H
N/A						

Remark:

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

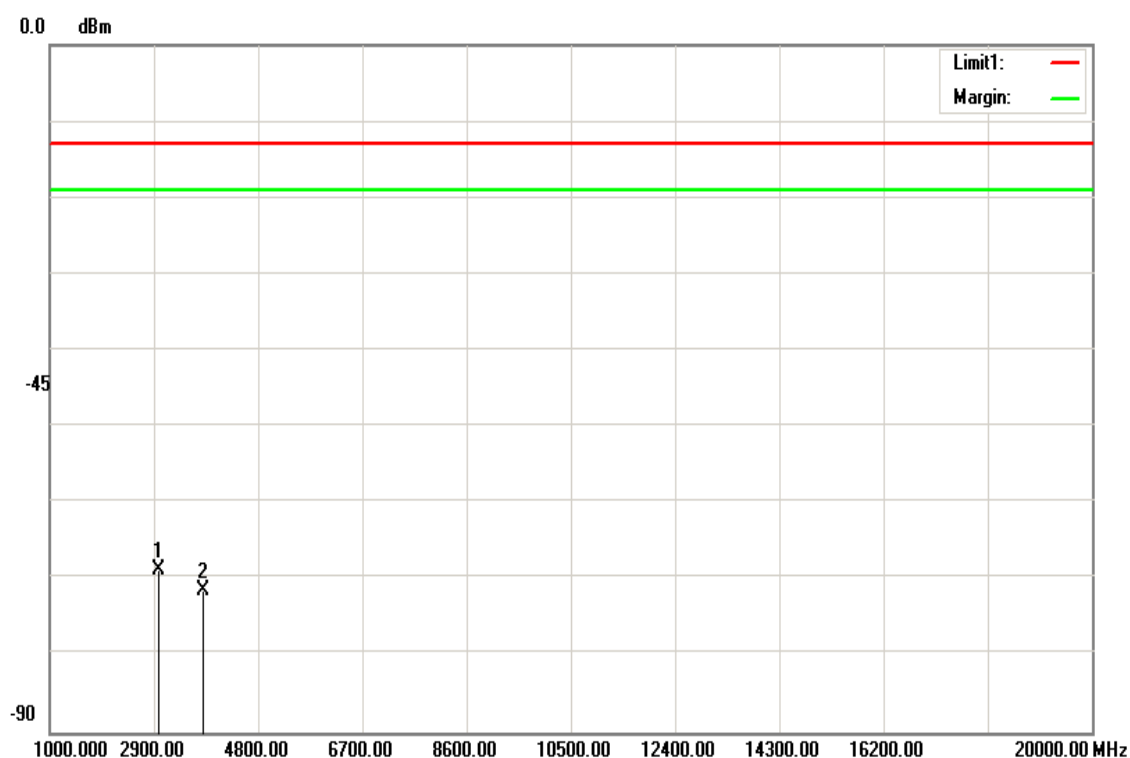


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Operation Mode: Tx / High CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
2998.500	-62.85	5.91	-68.76	-13.00	-55.76	V
3800.000	-64.65	6.72	-71.37	-13.00	-58.37	V
N/A						

Remark:

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

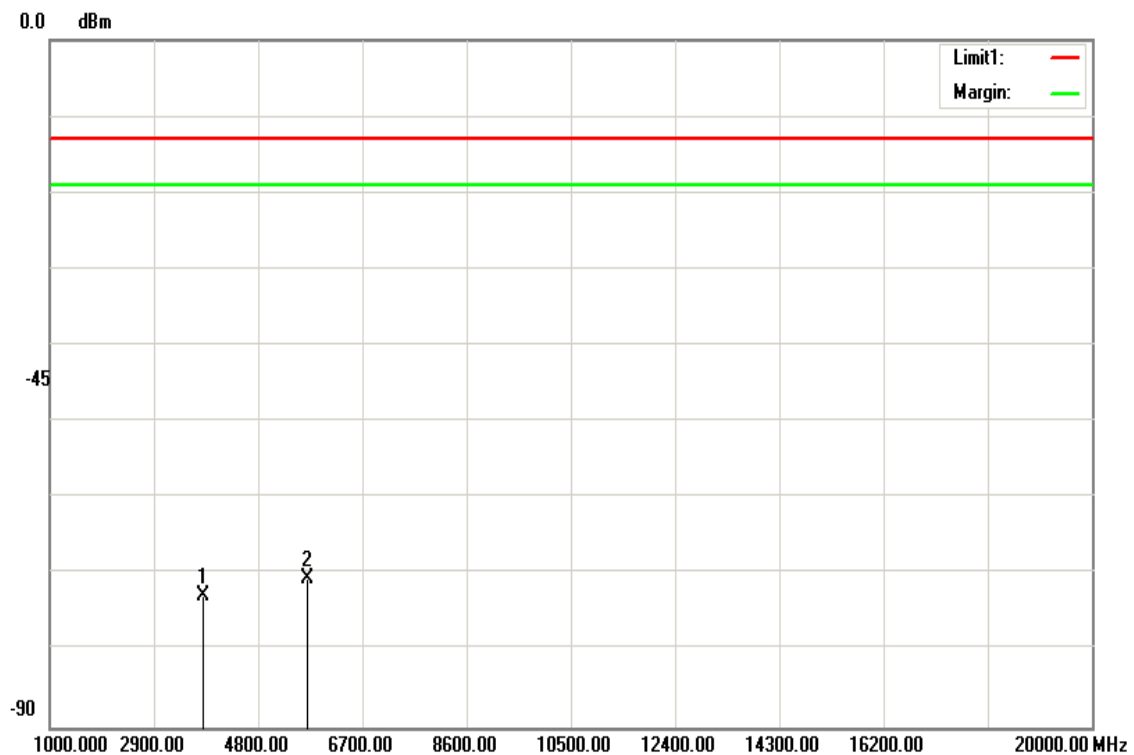
Operation Mode: Tx / High CH

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)
3800.000	-66.13	6.72	-72.85	-13.00	-59.85	H
5700.000	-62.09	8.42	-70.51	-13.00	-57.51	H
N/A						

Remark:

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

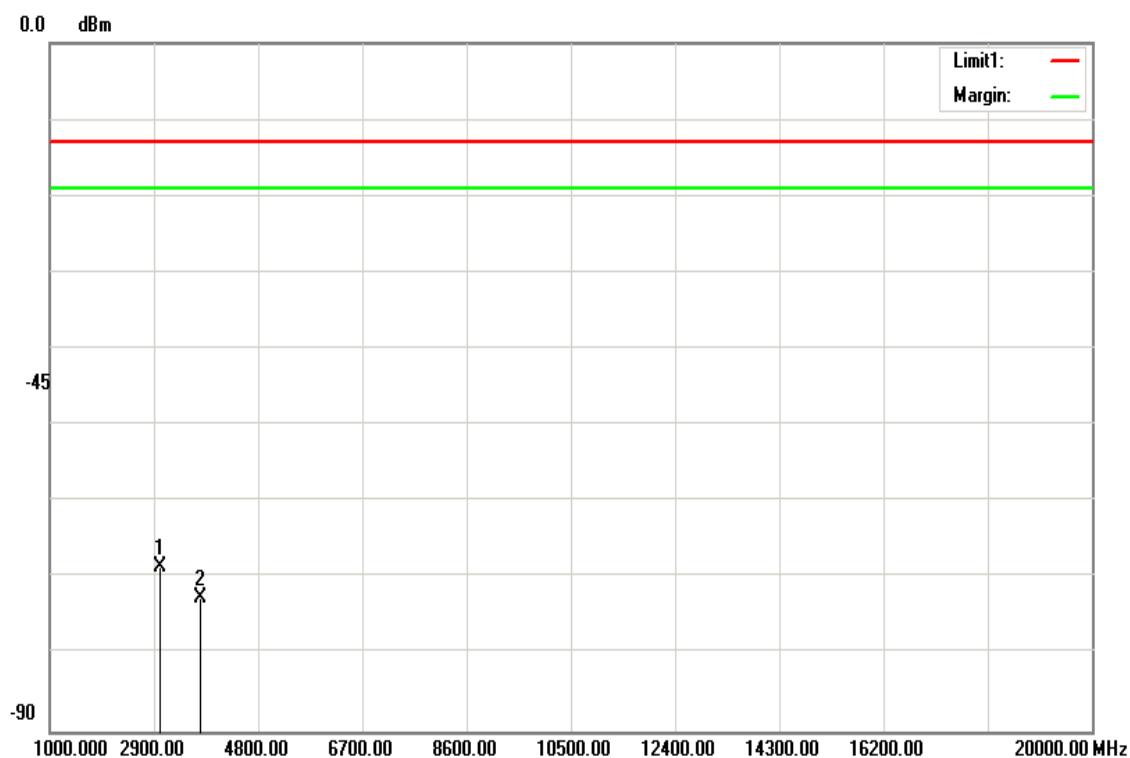
LTE Band 2 / BW: 20MHz / 16QAM / RB =1, RB Offset = 0
Operation Mode: Tx / Low CH

Test Date: October 2, 2018

Temperature: 22°C

Tested by: Jerry Chuang

Humidity: 40 %RH

Polarity: Ver.


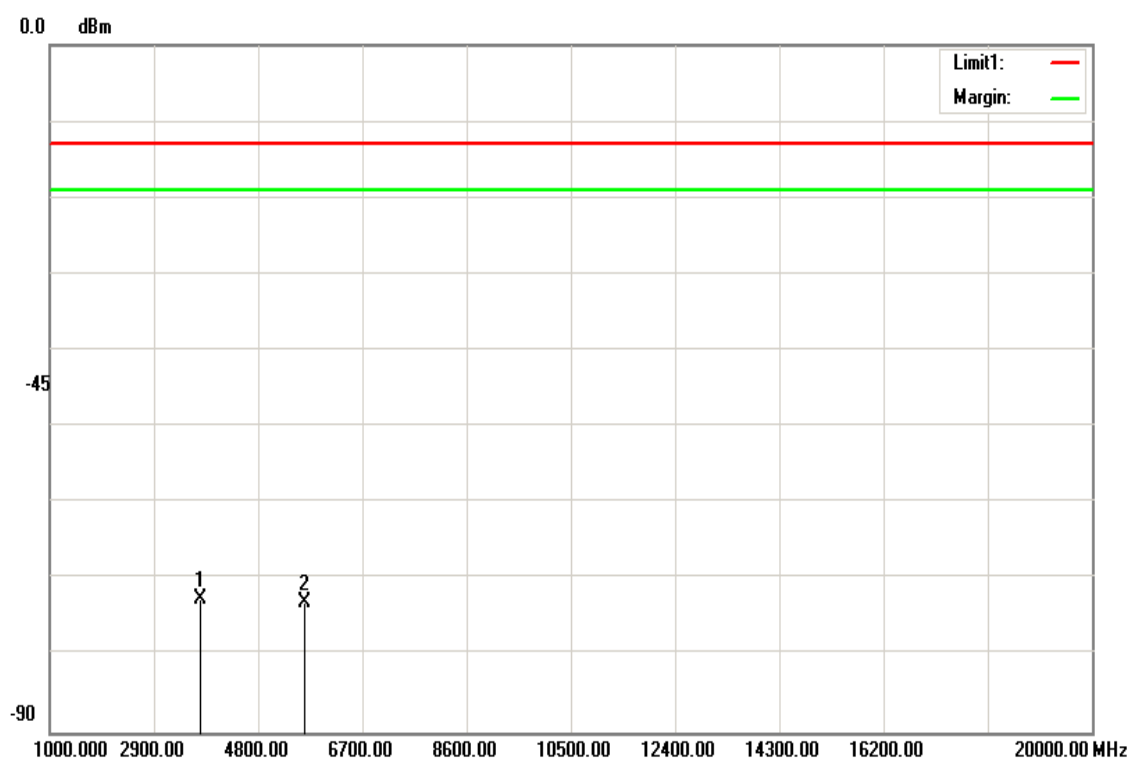
Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
3002.000	-62.58	5.91	-68.49	-13.00	-55.49	V
3760.000	-65.99	6.68	-72.67	-13.00	-59.67	V
N/A						

Remark:

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

Operation Mode: Tx / Low CH
Temperature: 22°C
Humidity: 40 %RH

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



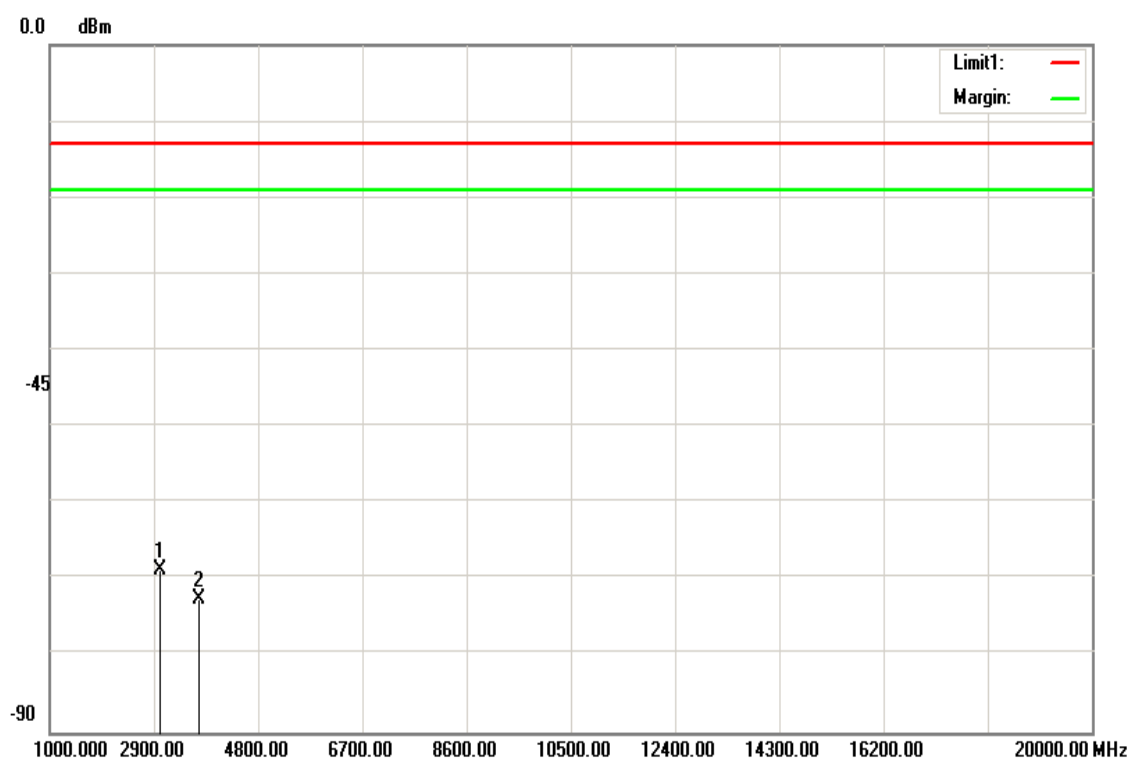
Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
3760.000	-65.95	6.68	-72.63	-13.00	-59.63	H
5640.000	-64.55	8.37	-72.92	-13.00	-59.92	H
N/A						

Remark:

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

Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
3002.000	-62.77	5.91	-68.68	-13.00	-55.68	V
3720.000	-65.89	6.65	-72.54	-13.00	-59.54	V
N/A						

Remark:

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

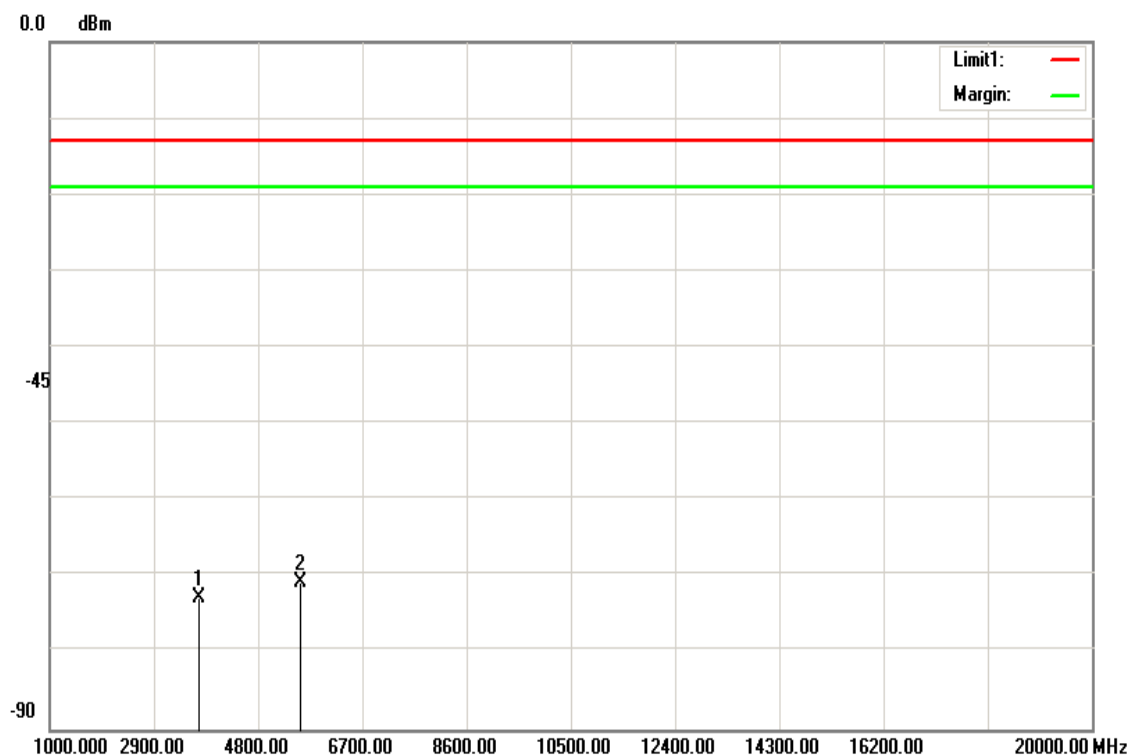


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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)
3720.000	-66.07	6.65	-72.72	-13.00	-59.72	H
5580.000	-62.44	8.31	-70.75	-13.00	-57.75	H
N/A						

Remark:

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

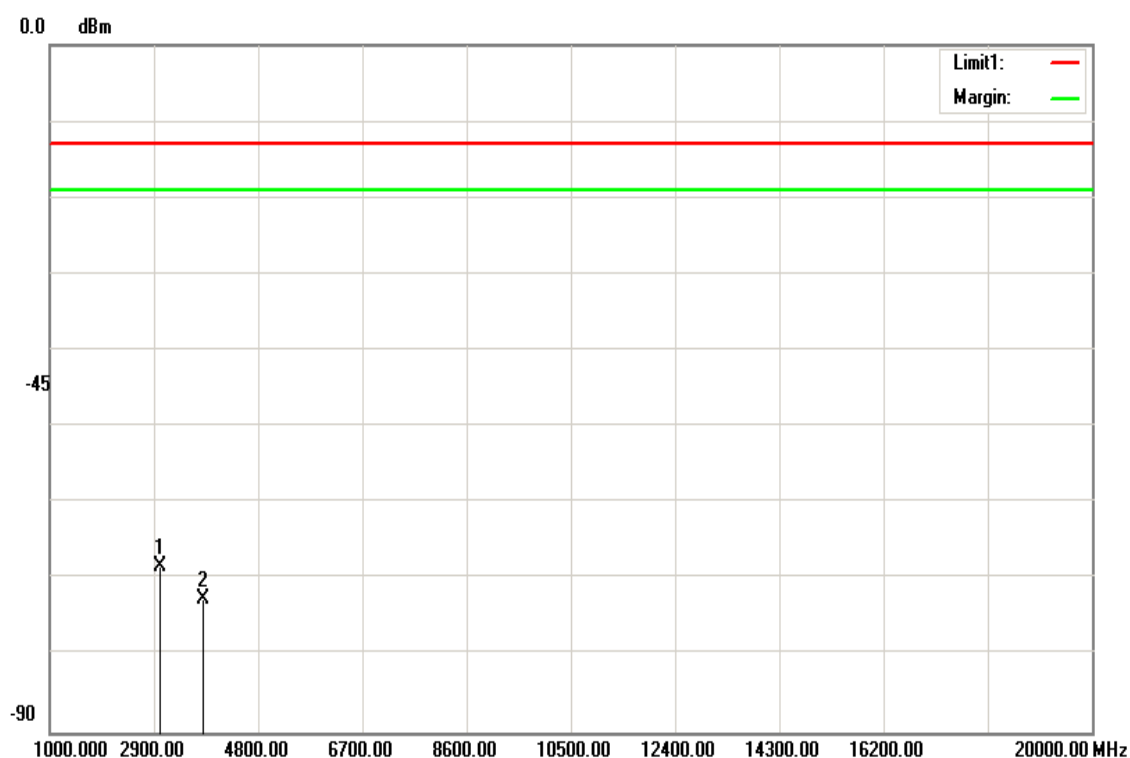


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Operation Mode: Tx / High CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
3002.000	-62.34	5.91	-68.25	-13.00	-55.25	V
3800.000	-65.93	6.72	-72.65	-13.00	-59.65	V
N/A						

Remark:

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

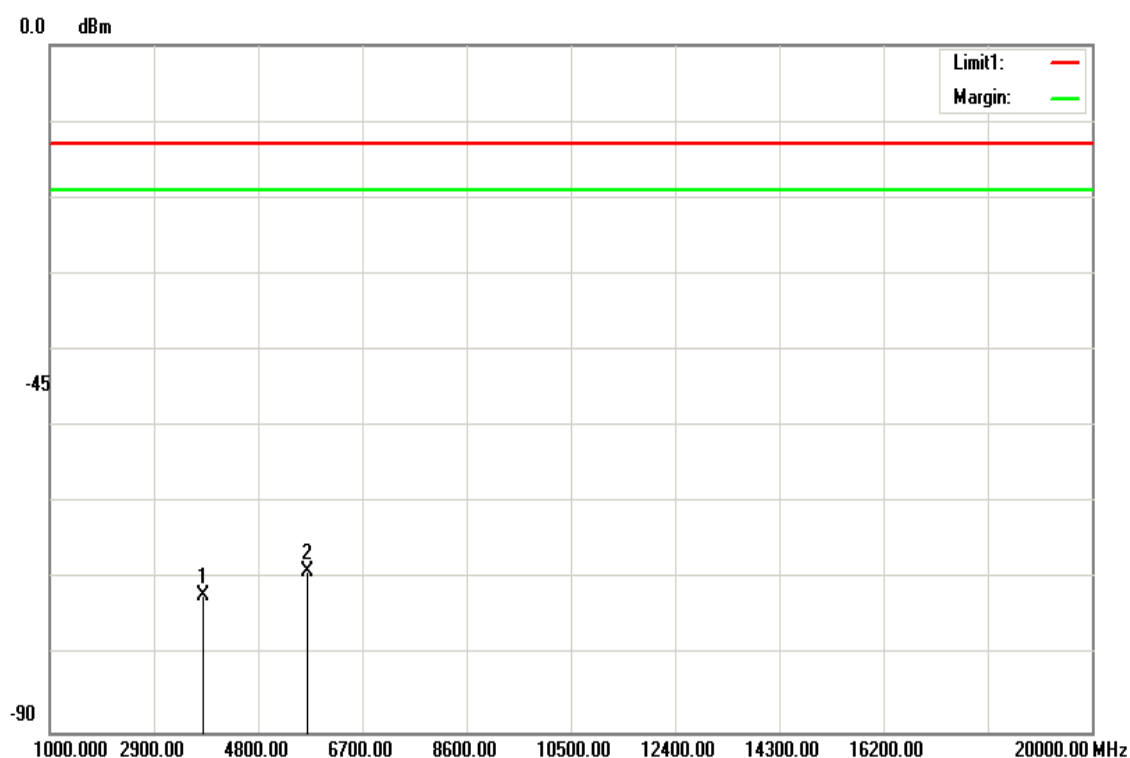
Operation Mode: Tx / High CH

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)
3800.000	-65.42	6.72	-72.14	-13.00	-59.14	H
5700.000	-60.5	8.42	-68.92	-13.00	-55.92	H
N/A						

Remark:

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



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Test Results

Below 1GHz

LTE Band 5 / BW: 10MHz / QPSK / RB =1, RB Offset = 0

Operation Mode: Tx / Mid CH

Test Date:

September 28, 2018

Temperature: 23°C

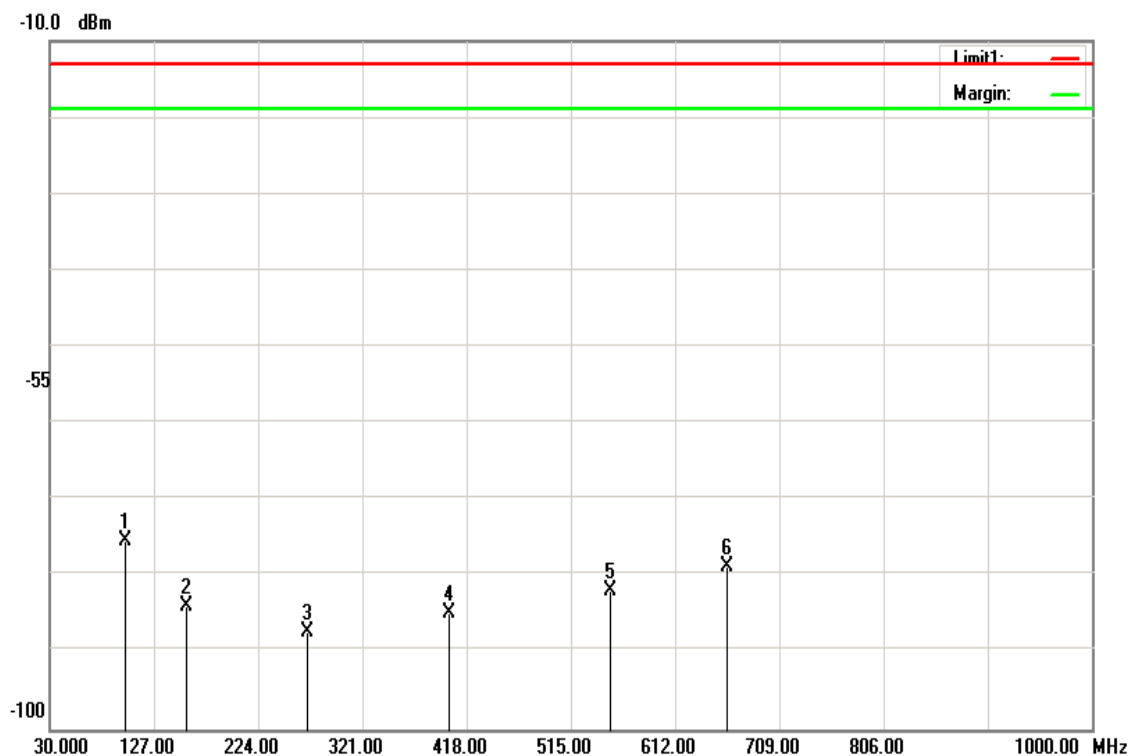
Tested by:

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)
100.8100	-74.37	0.99	-75.36	-13.00	-62.36	V
157.5550	-82.78	1.24	-84.02	-13.00	-71.02	V
270.0750	-85.75	1.64	-87.39	-13.00	-74.39	V
401.9950	-82.87	2.01	-84.88	-13.00	-71.88	V
551.8600	-79.54	2.36	-81.90	-13.00	-68.90	V
660.9850	-76.09	2.59	-78.68	-13.00	-65.68	V

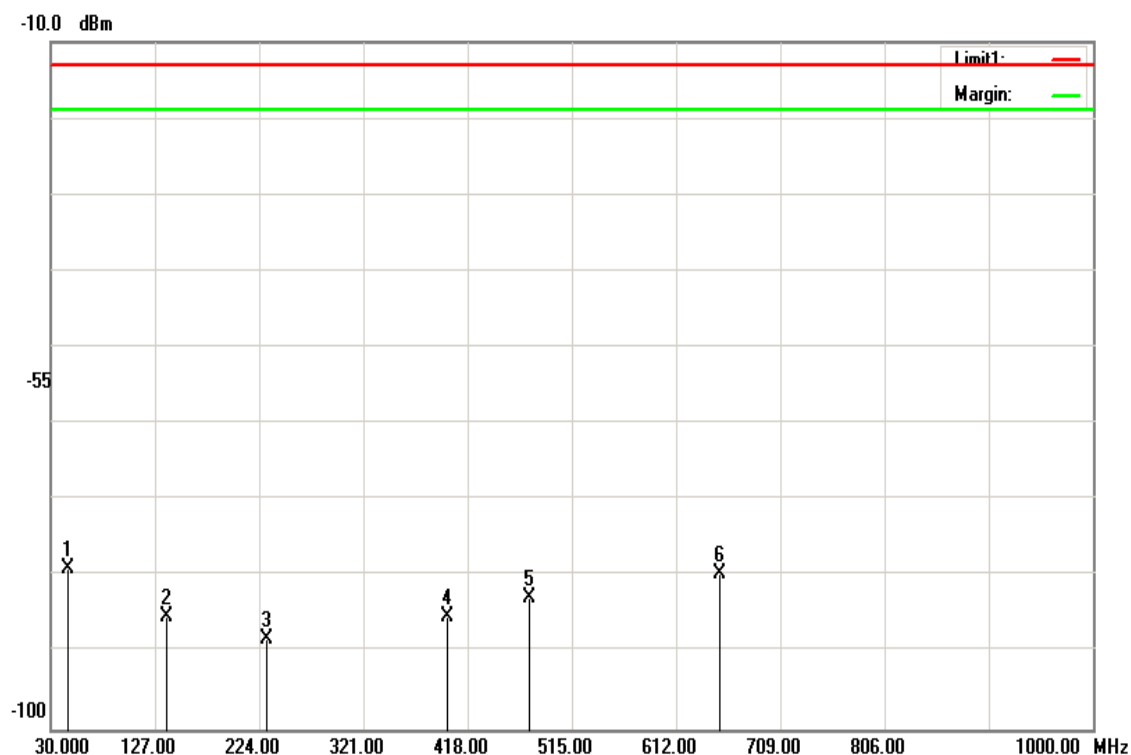
Operation Mode: Tx / Mid CH

Test Date: September 28, 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)
46.9750	-78.26	0.68	-78.94	-13.00	-65.94	H
138.1550	-84.21	1.16	-85.37	-13.00	-72.37	H
231.2750	-86.76	1.5	-88.26	-13.00	-75.26	H
400.0550	-83.22	2.01	-85.23	-13.00	-72.23	H
475.7150	-80.54	2.19	-82.73	-13.00	-69.73	H
653.2250	-76.97	2.58	-79.55	-13.00	-66.55	H

LTE Band 5 / BW: 10MHz / 16QAM / RB =1, RB Offset = 0

Operation Mode: Tx / Mid CH

Test Date:

September 28, 2018

Temperature: 23°C

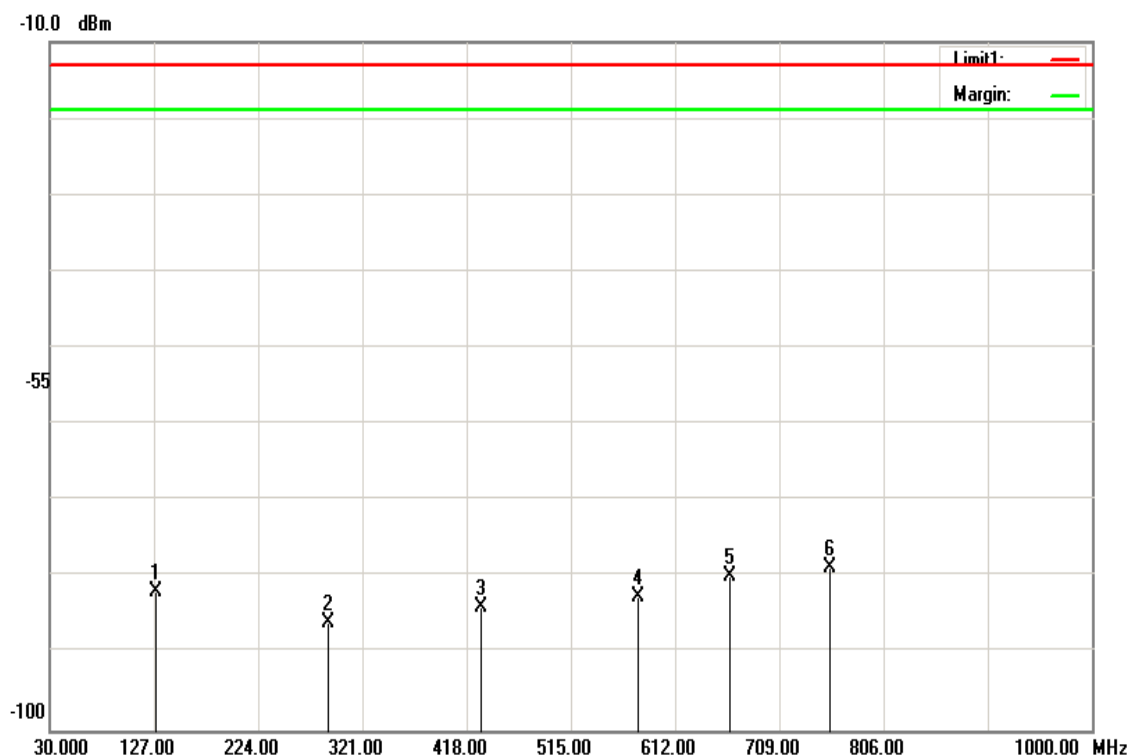
Tested by:

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	-80.81	1.13	-81.94	-13.00	-68.94	V
289.4750	-84.26	1.69	-85.95	-13.00	-72.95	V
431.5800	-81.72	2.09	-83.81	-13.00	-70.81	V
577.0800	-80.1	2.42	-82.52	-13.00	-69.52	V
662.9250	-77.23	2.6	-79.83	-13.00	-66.83	V
757.0150	-76.05	2.79	-78.84	-13.00	-65.84	V

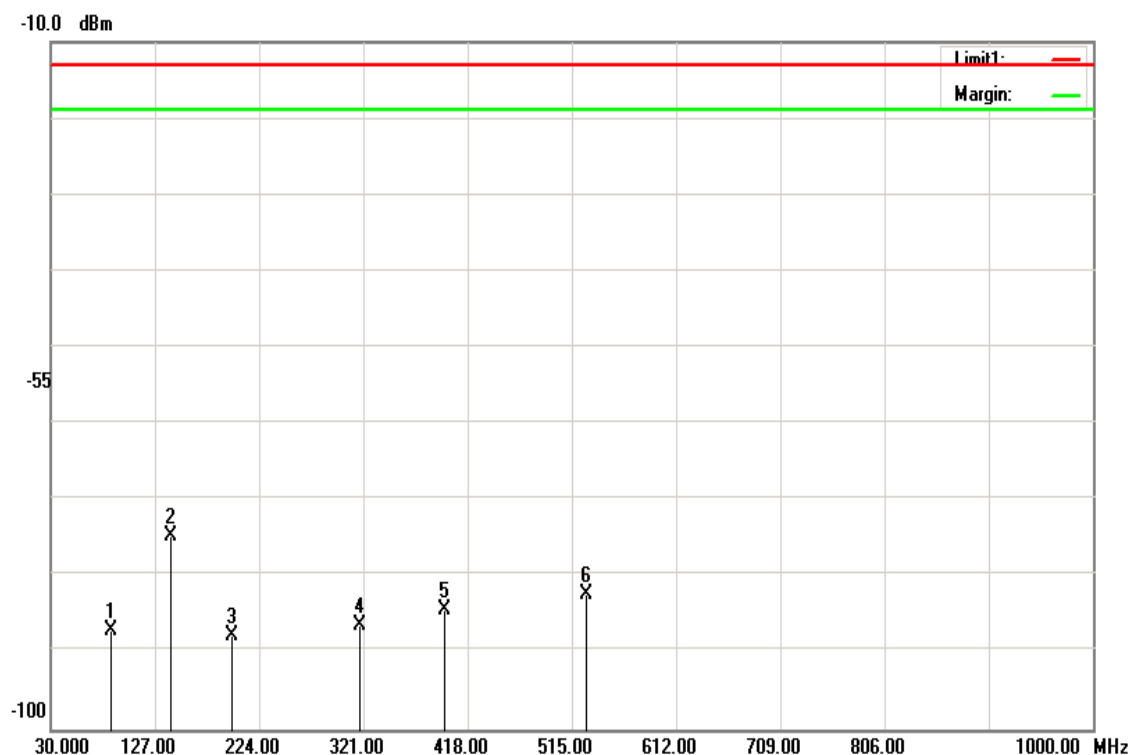
Operation Mode: Tx / Mid CH I

Test Date: September 28, 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)
86.7450	-86.22	0.91	-87.13	-13.00	-74.13	H
142.0350	-73.52	1.18	-74.70	-13.00	-61.70	H
198.7800	-86.37	1.4	-87.77	-13.00	-74.77	H
318.0900	-84.53	1.78	-86.31	-13.00	-73.31	H
397.1450	-82.3	2	-84.30	-13.00	-71.30	H
528.5800	-80.01	2.31	-82.32	-13.00	-69.32	H



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Above 1GHz

LTE Band 5 / BW: 10 MHz / QPSK / RB =1, RB Offset = 0

Operation Mode: Tx / Low CH

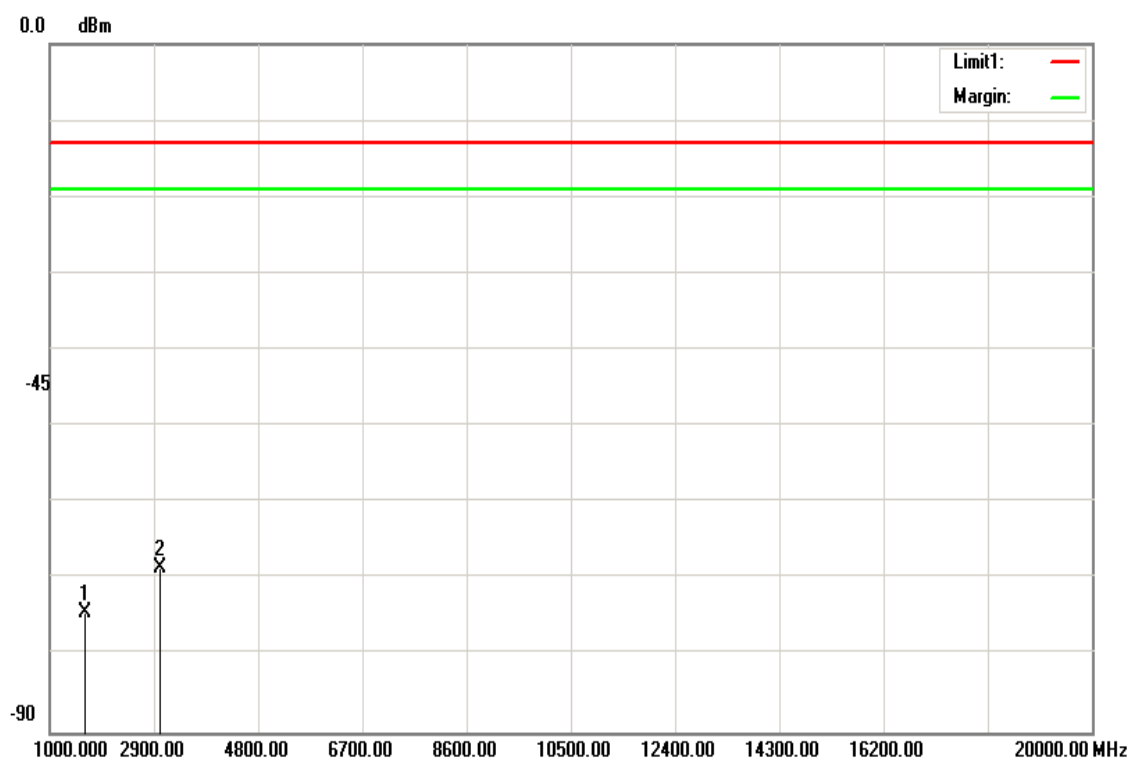
Test Date: October 2, 2018

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)
1658.000	-70.07	4.21	-74.28	-13.00	-61.28	V
3002.000	-62.63	5.91	-68.54	-13.00	-55.54	V
N/A						

Remark:

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

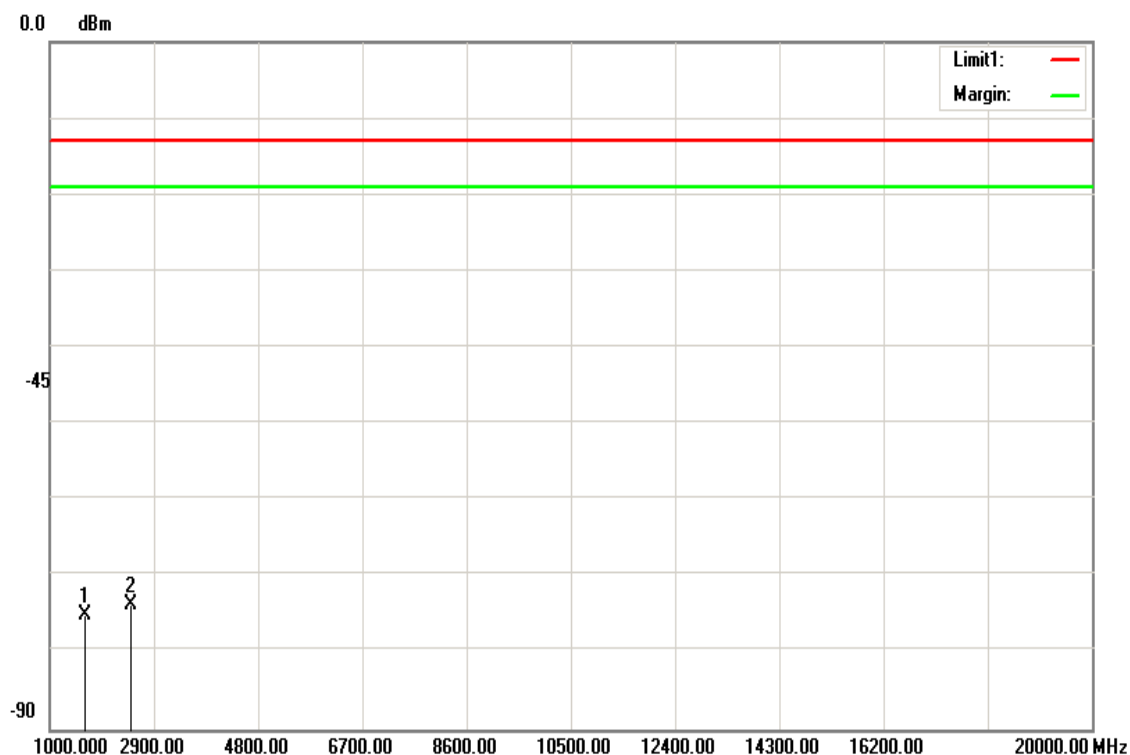


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Operation Mode: Tx / Low CH
Temperature: 22°C
Humidity: 40 %RH

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)
1658.000	-70.73	4.21	-74.94	-13.00	-61.94	H
2487.000	-68.49	5.31	-73.80	-13.00	-60.80	H
N/A						

Remark:

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

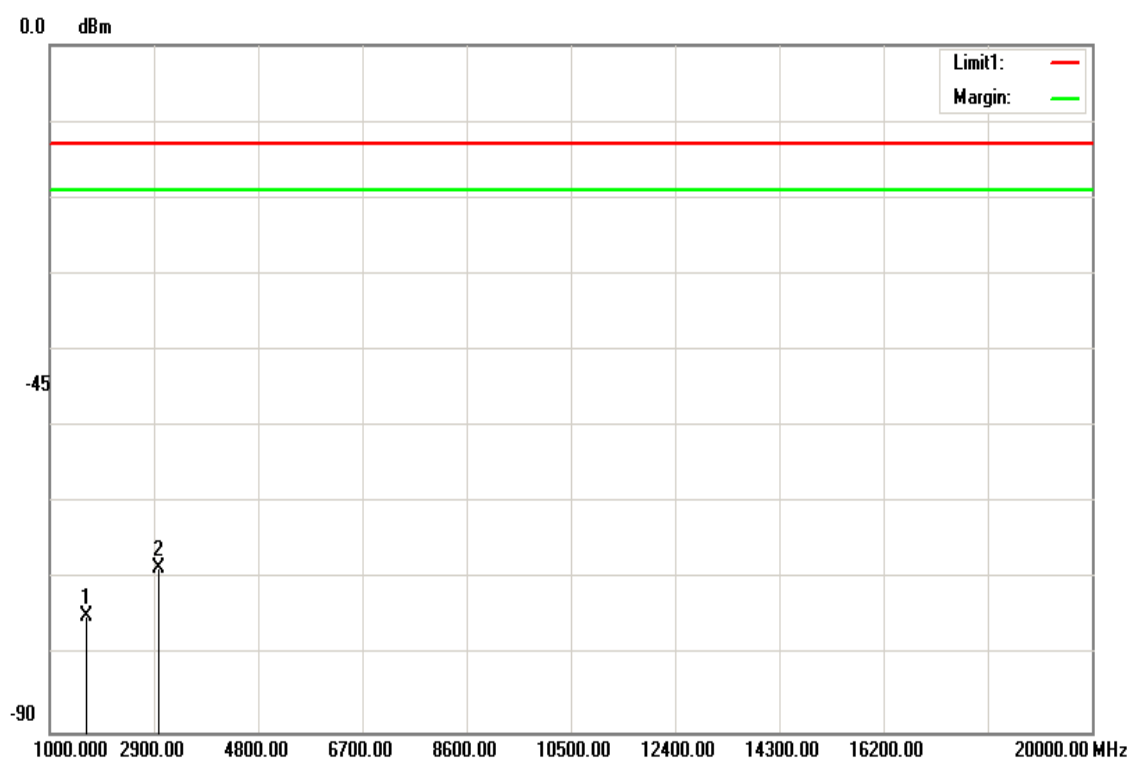


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
1673.000	-70.66	4.23	-74.89	-13.00	-61.89	V
2998.500	-62.63	5.91	-68.54	-13.00	-55.54	V
N/A						

Remark:

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

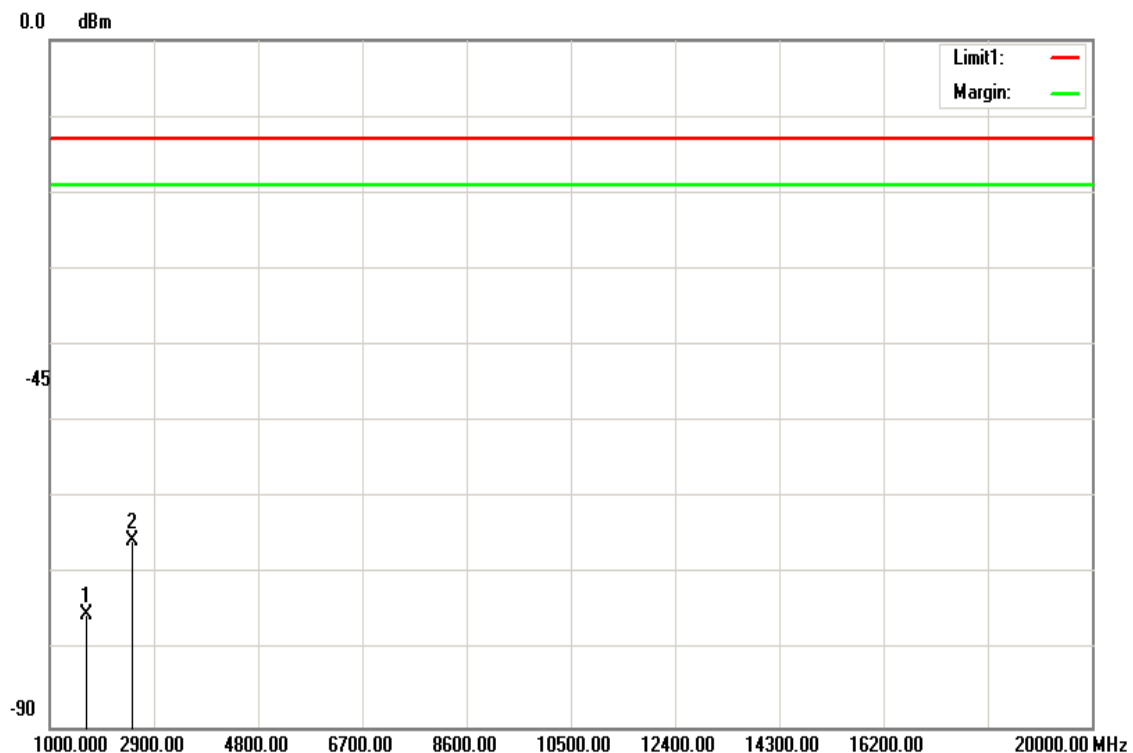


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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)
1673.000	-70.94	4.23	-75.17	-13.00	-62.17	H
2498.000	-60.21	5.33	-65.54	-13.00	-52.54	H
N/A						

Remark:

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

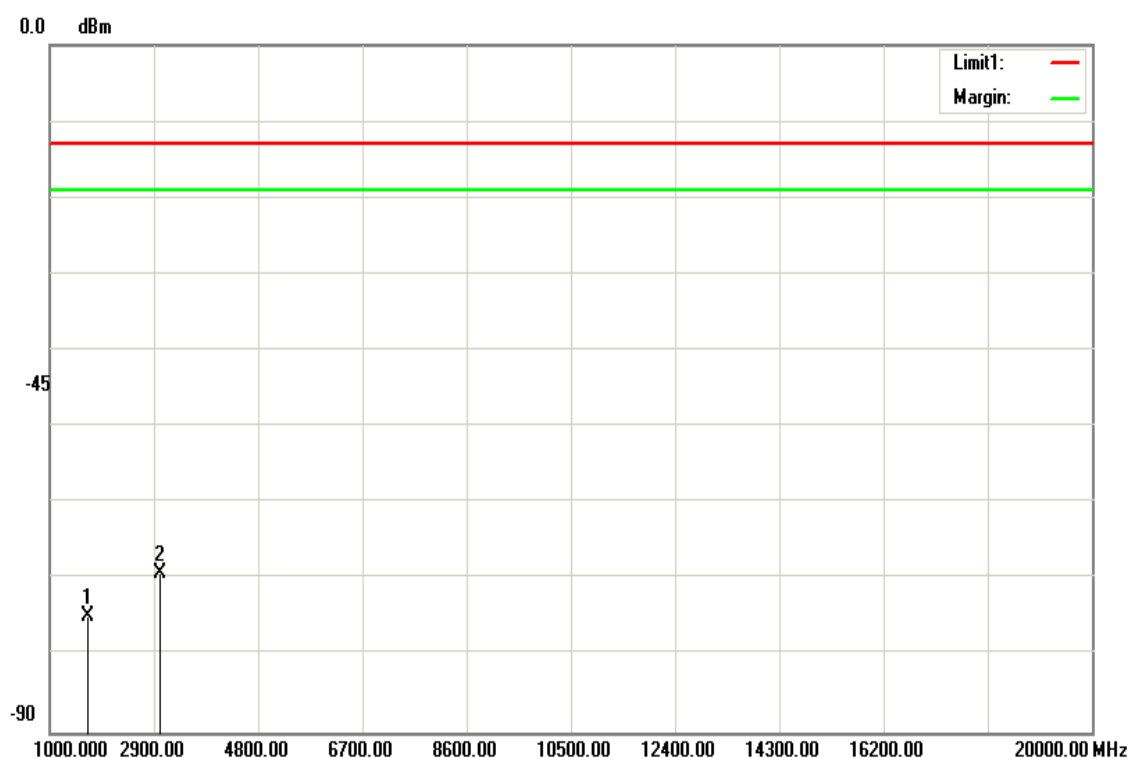


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Operation Mode: Tx / High CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
1688.000	-70.61	4.25	-74.86	-13.00	-61.86	V
3002.000	-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: Tx / High CH

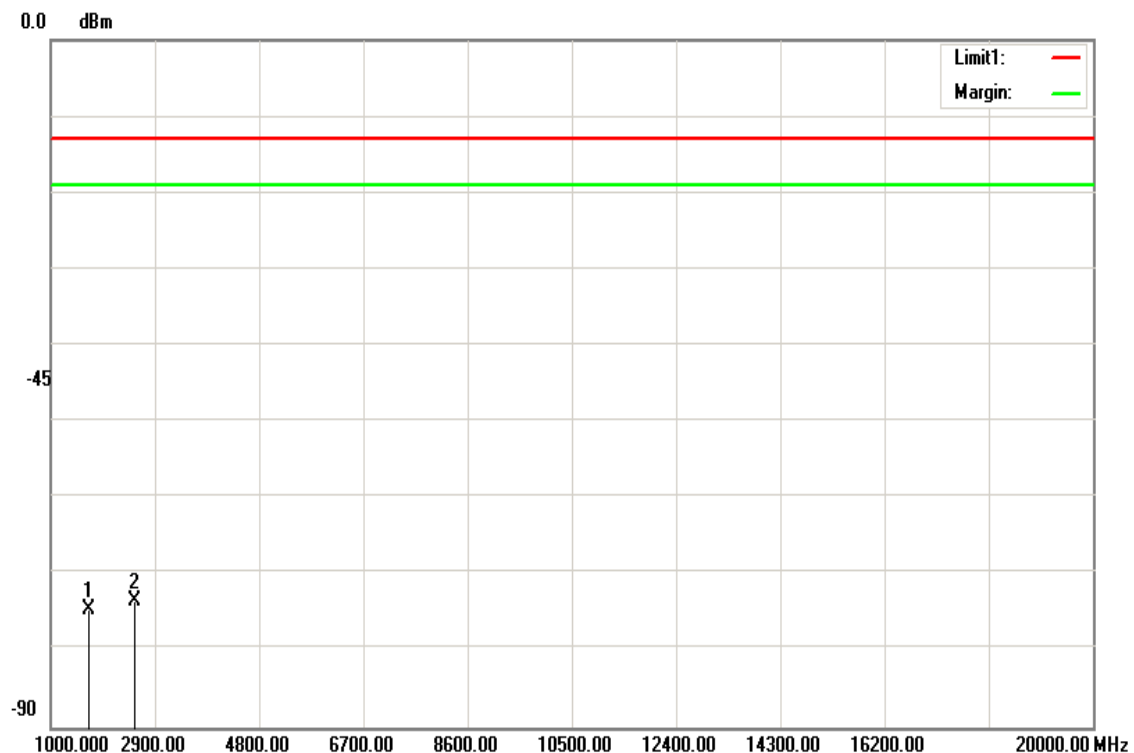
Test Date: October 2, 2018

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)
1688.000	-70.39	4.25	-74.64	-13.00	-61.64	H
2532.000	-67.99	5.37	-73.36	-13.00	-60.36	H
N/A						

Remark:

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

LTE Band 5 / BW: 10MHz / 16QAM / RB =1, RB Offset = 0

Operation Mode: Tx / Low CH

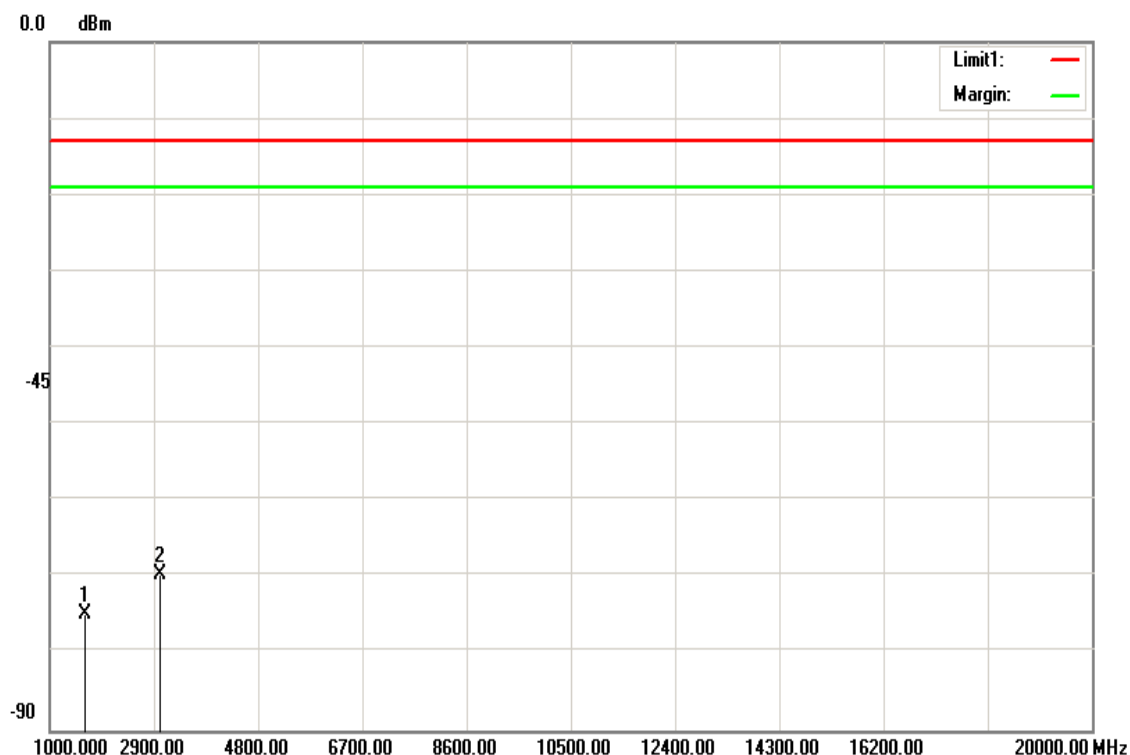
Test Date: October 2, 2018

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)
1658.000	-70.49	4.21	-74.70	-13.00	-61.70	V
3002.000	-63.65	5.91	-69.56	-13.00	-56.56	V
N/A						

Remark:

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

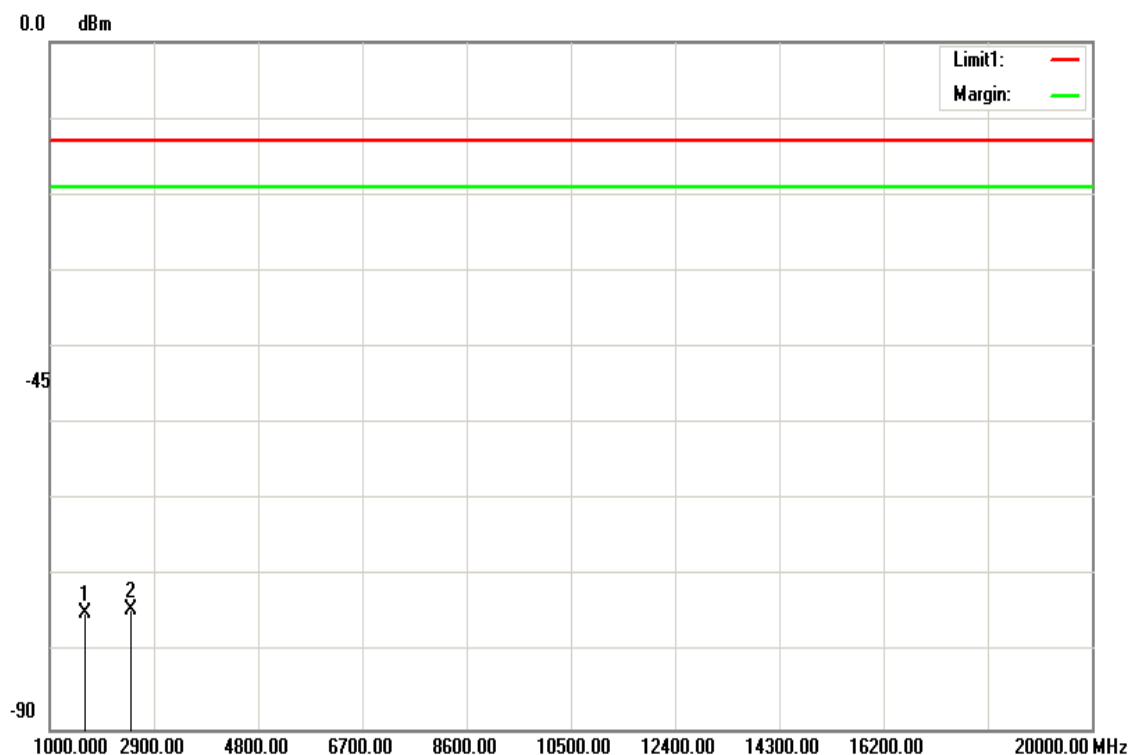


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Operation Mode: Tx / Low CH
Temperature: 22°C
Humidity: 40 %RH

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)
1658.000	-70.52	4.21	-74.73	-13.00	-61.73	H
2487.000	-69.01	5.31	-74.32	-13.00	-61.32	H
N/A						

Remark:

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

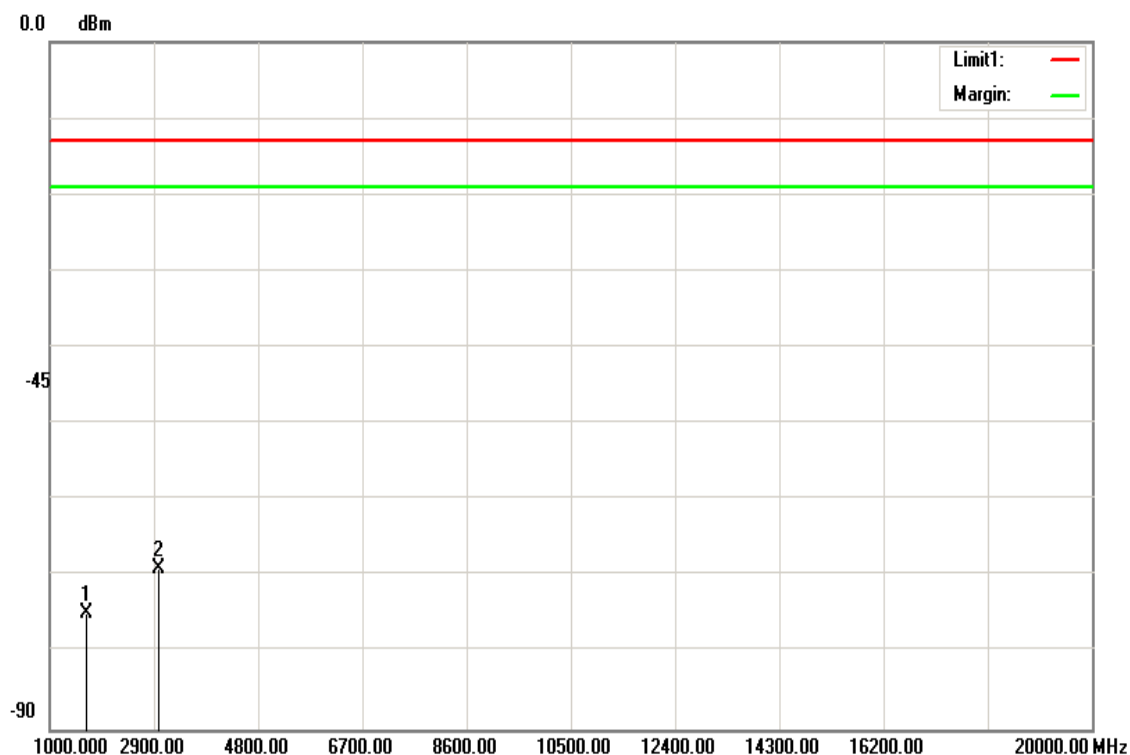


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
1673.000	-70.47	4.23	-74.70	-13.00	-61.70	V
2998.500	-63.12	5.91	-69.03	-13.00	-56.03	V
N/A						

Remark:

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

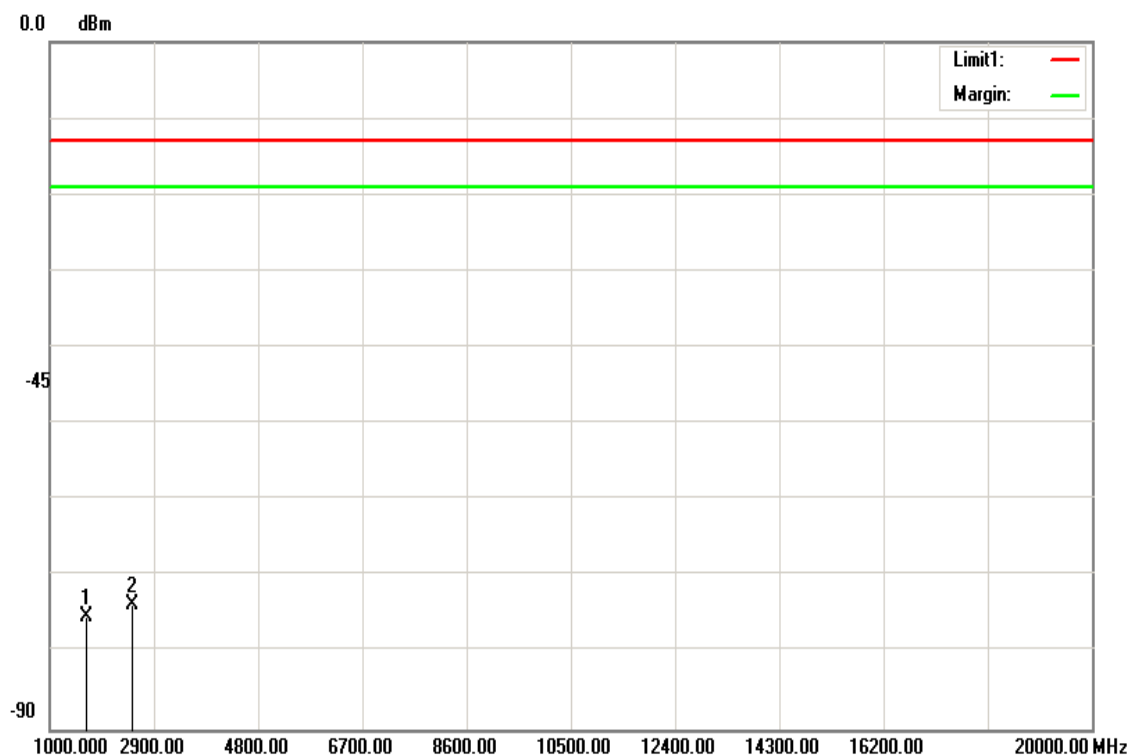


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Operation Mode: Tx / Mid CH
Temperature: 22°C
Humidity: 40 %RH

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)
1673.000	-71.02	4.23	-75.25	-13.00	-62.25	H
2509.000	-68.25	5.34	-73.59	-13.00	-60.59	H
N/A						

Remark:

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

Operation Mode: Tx / High CH

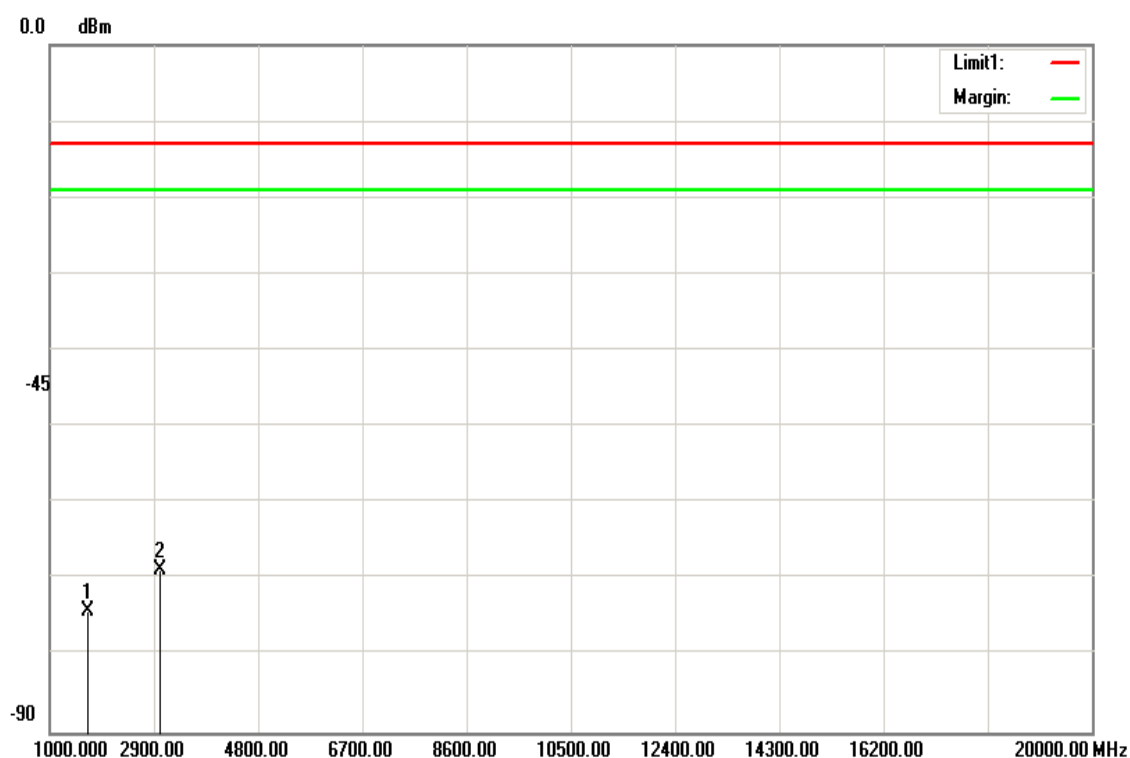
Test Date: October 2, 2018

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)
1688.000	-69.81	4.25	-74.06	-13.00	-61.06	V
3002.000	-62.82	5.91	-68.73	-13.00	-55.73	V
N/A						

Remark:

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

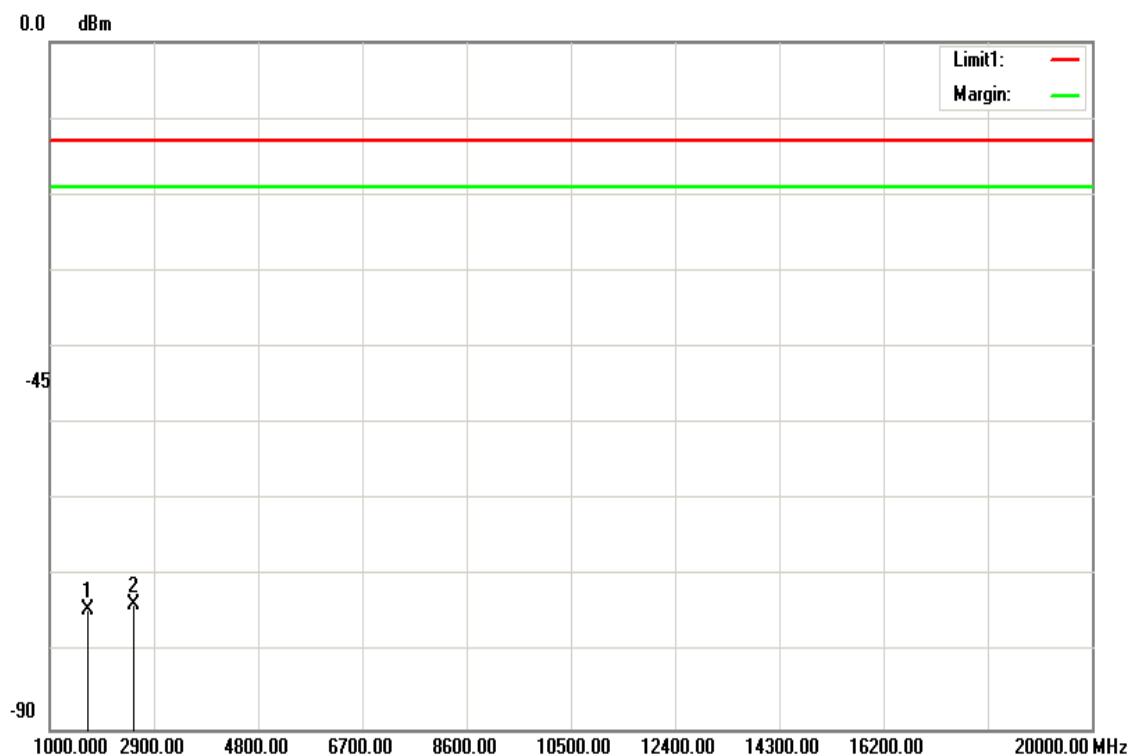


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Operation Mode: Tx / High CH
Temperature: 22°C
Humidity: 40 %RH

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)
1688.000	-70.16	4.25	-74.41	-13.00	-61.41	H
2532.000	-68.28	5.37	-73.65	-13.00	-60.65	H
N/A						

Remark:

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

- End of Test Report -