FCC 47 CFR PART 27

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

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 wording described to “LTE Band 30”. 2. Revised test condition in section 4.2. 3. Revised the limit line in section 8.2.	P.7-8, 14, 18-29.	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; December 14, 2018

APPLICABLE STANDARDS	
Standard	**TEST RESULT**
FCC Part 27, FCC Part 2	No non-compliance noted

The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Sam Chuang
Manager
Compliance Certification Services Inc.

Tested by:

Jerry Chuang
Engineer
Compliance Certification Services Inc.

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	
Modulation Technology	LTE Band 30	QPSK, 16QAM
Frequency Range	LTE Band 30 Channel Bandwidth: 5MHz	2307.5MHz ~ 2312.5MHz
	LTE Band 30 Channel Bandwidth: 10MHz	2310MHz
Maximum EIRP Power	LTE Band 30 Channel Bandwidth: 5MHz	QPSK: 23.12 dBm 16QAM: 22.35 dBm
	LTE Band 30 Channel Bandwidth: 10MHz	QPSK: 23.08 dBm 16QAM: 22.64 dBm
Antenna Specification	External Antenna LTE Band 30: 3.8 dBi	

Note: *1. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.*

3. TEST SUMMARY

FCC Standard Section	Report Section	Test Item	Result
-	2	Antenna Requirement	Pass
2.1046	-	Output Power measurement	N/A
27.50(a)	8.1	EIRP Power Density	Pass
2.1055, 27.54	-	Frequency Stability v.s. temperature measurement	N/A
2.1049	-	Occupied Bandwidth Measurement	N/A
2.1051 27.53(a)(4)	-	Conducted Band Edge	N/A
2.1051 27.53(a)(4)	-	Conducted Spurious Emission	N/A
2.1053 27.53(a)(4)	8.2	Spurious Radiation Measurement	Pass

4. TEST METHODOLOGY

4.1 DESCRIPTION OF TEST TYPE

The EUT had been tested under operating condition.
TIA-603-E and KDB 971168 D01 Power Meas License Digital Systems
Software used to control the EUT for staying in continuous transmitting mode was programmed.

LTE Band 30: 2305 MHz ~ 2315 MHz

Three channels had been tested for each channel bandwidth.

Channel Bandwidth	5MHz		10MHz	
	Channel	Frequency(MHz)	Channel	Frequency(MHz)
Low CH	27685	2307.5	-	-
Middle CH	27710	2310	27710	2310
High CH	27735	2312.5	-	-

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
Band30	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

4.2 THE WORST MODE OF 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)				

Conducted					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Coaxial Cable	Woken	WC12	CC001	06/29/2018	06/28/2019
Coaxial Cable	Woken	WC12	CC003	06/29/2018	06/28/2019
Power Divider	Solvang Technology	STI08-0015	008	07/27/2018	07/26/2019
Signal Analyzer	R&S	FSV 40	101073	09/27/2018	09/26/2019
Wideband Radio Communication Tester	R&S	CMW 500	116875	04/20/2018	04/19/2019

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

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.”

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix I 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. TEST PROCEDURE AND RESULT

8.1 EIRP POWER DENSITY

LIMIT

According to FCC §2.1046
FCC 27.50 (a) (3):
For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth. For mobile and portable stations using time division duplexing (TDD) technology, the duty cycle must not exceed 38 percent in the 2305-2315 MHz and 2350-2360 MHz bands. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305-2315 MHz band. Power averaging shall not include intervals in which the transmitter is off.

TEST PROCEDURE

1. The testing follows FCC KDB 971168 and ANSI C63.26 Section 5.2.4.1
2. Set instrument center frequency to OBW center frequency.
3. Set span to at least 1.5 times the OBW.
4. Set the RBW to the specified reference bandwidth (5MHz).
5. Set VBW ≥ 3 × RBW.
6. Detector = RMS (power averaging).
7. Ensure that the number of measurement points in the sweep ≥ 2 × span/RBW.
8. Sweep time = auto couple.
9. Employ trace averaging (RMS) mode over a minimum of 100 traces.
10. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

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

TEST RESULTS

No non-compliance noted.

EIRP POWER DENSITY

LTE Band 30

Power Density				
Mode	Conducted Power Density (dBm/5MHz)			
BW	5MHz		10MHz	
Mod.	QPSK	16QAM	QPSK	16QAM
Lowest Ch	20.92	20.27	--	--
Middle Ch	20.95	20.10	21.08	20.64
Highest Ch	21.12	20.35	--	--

EIRP Power Density				
Mode	EIRP Power Density (dBm/5MHz)			
Antenna Gain (dBi)	2			
BW	5MHz		10MHz	
Mod.	QPSK	16QAM	QPSK	16QAM
Lowest Ch	22.92	22.27	--	--
Middle Ch	22.95	22.10	23.08	22.64
Highest Ch	23.12	22.35	--	--
Limit	250mW / 5MHz = 24dBm / 5MHz			
Result	Pass			

8.2 RADIATED EMISSION MEASUREMENT

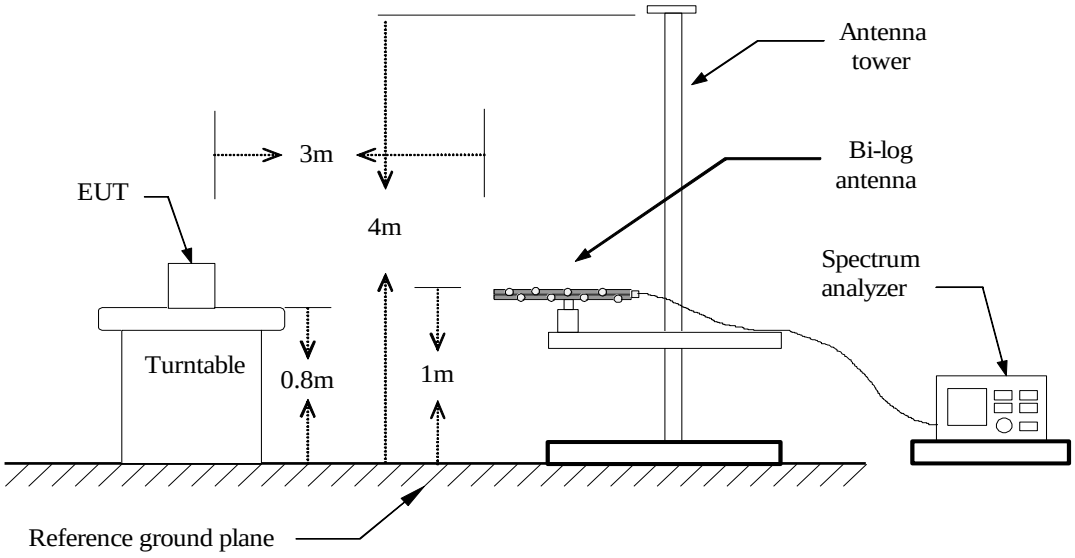
LIMITS

27.53(a)(4), Band 30

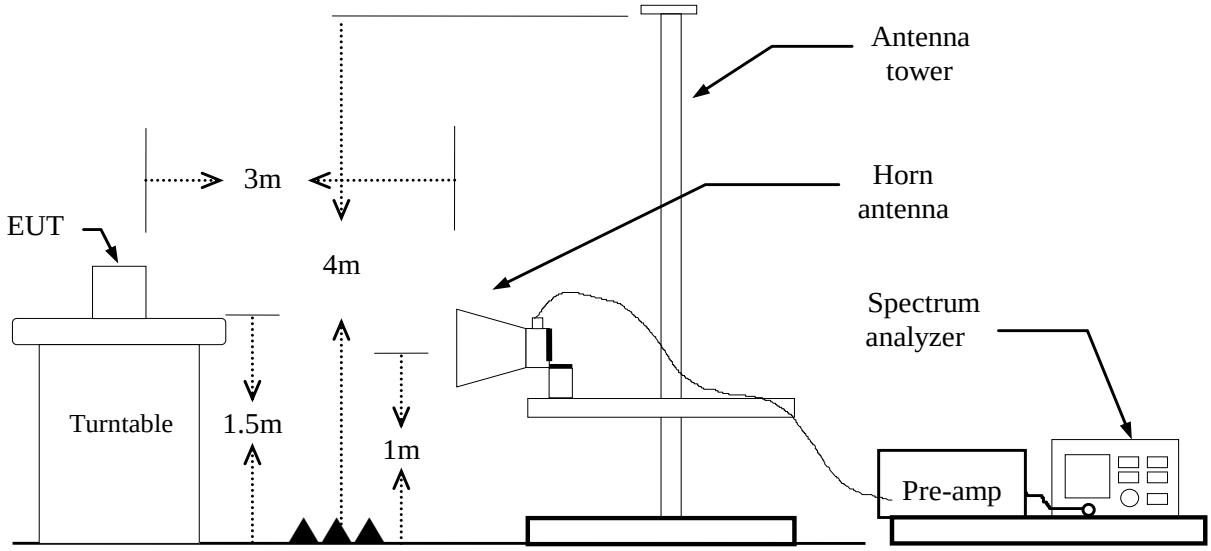
The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 70 + 10 log (P) dB.
It is measured by means of a calibrated spectrum analyzer and scanned from 9 kHz up to a frequency including its 10th harmonic.

Test Configuration

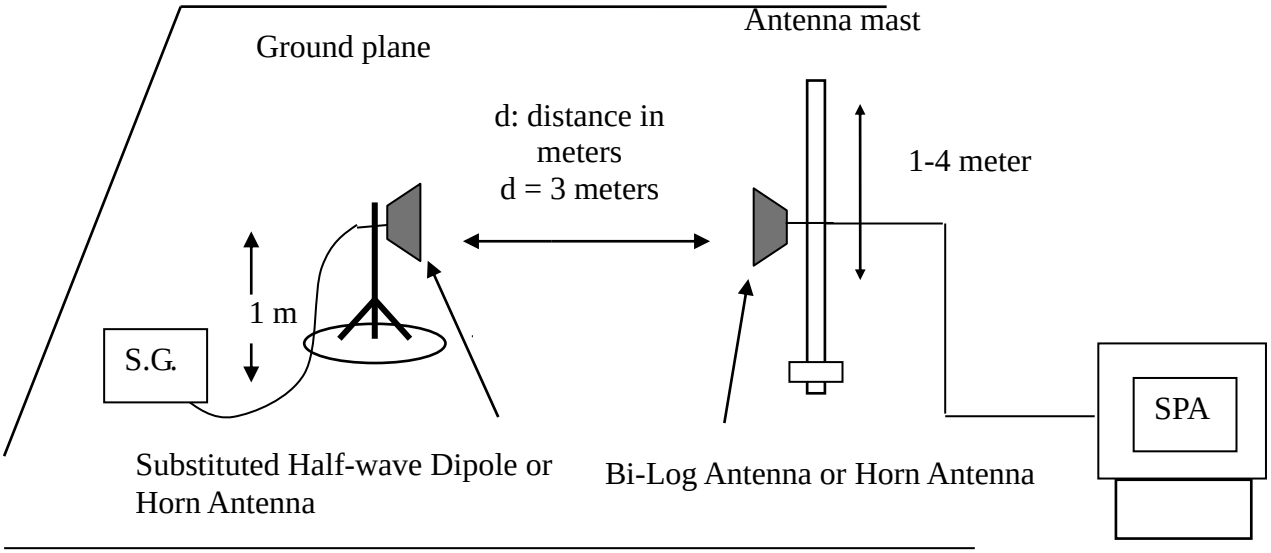
Below 1 GHz



Above 1 GHz



Substituted Method Test Set-up



TEST PROCEDURES

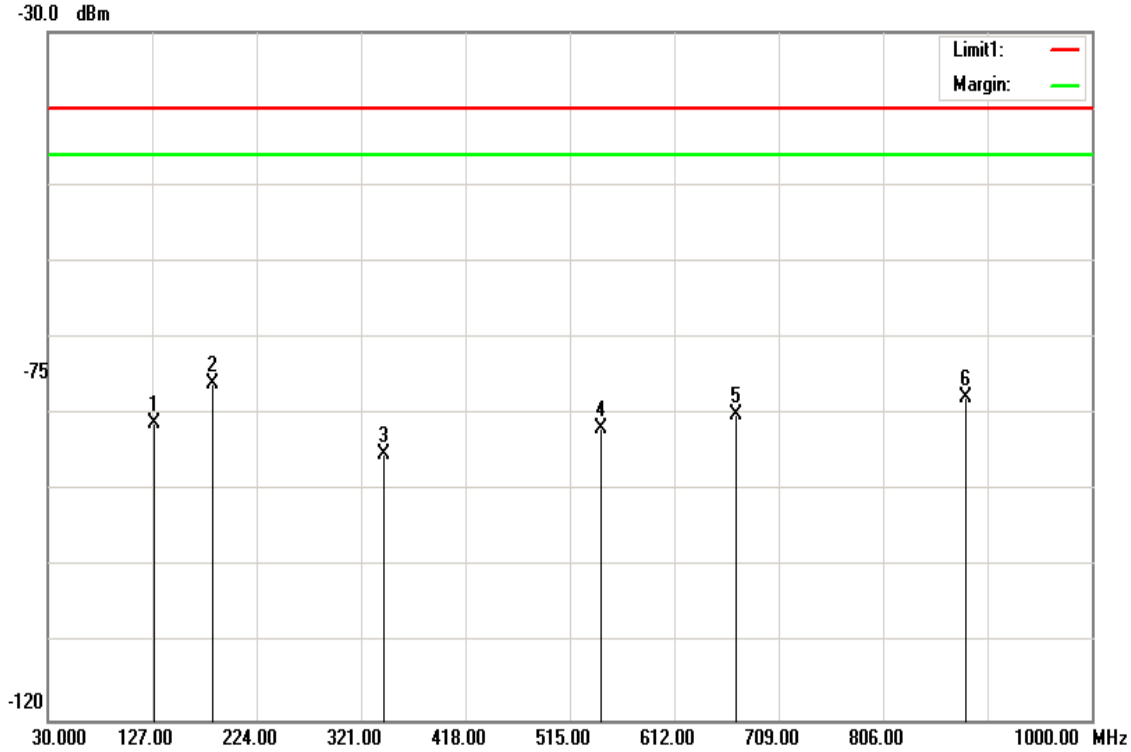
1. According to KDB 971168 D01 Power Meas License Digital Systems and TIA-603-E.
2. The EUT was placed on a turntable
   (1) Below 1G : 0.8m
   (2) Above 1G : 0.8m
   (3) EUT set 3m from the receiving antenna
   (4) The table was rotated 360 degrees of the highest spurious emission to determine the position.
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)

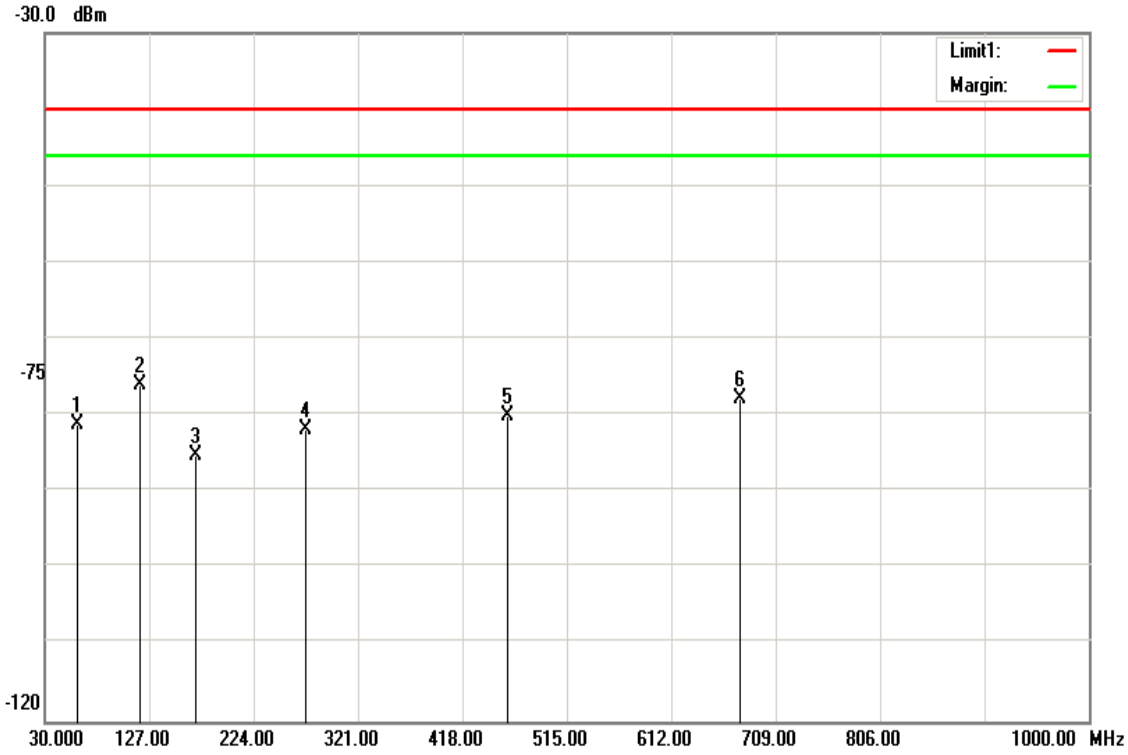
Test Results
Below 1GHz
LTE Band 30 / BW: 10MHz / QPSK / RB =1, RB Offset = 0

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	22℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Ver.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
128.9400	-80.05	1.13	-81.18	-40.00	-41.18	V
182.7750	-74.67	1.34	-76.01	-40.00	-36.01	V
342.3400	-83.3	1.85	-85.15	-40.00	-45.15	V
543.6150	-79.62	2.35	-81.97	-40.00	-41.97	V
669.7150	-77.38	2.61	-79.99	-40.00	-39.99	V
882.6300	-74.67	3.03	-77.70	-40.00	-37.70	V

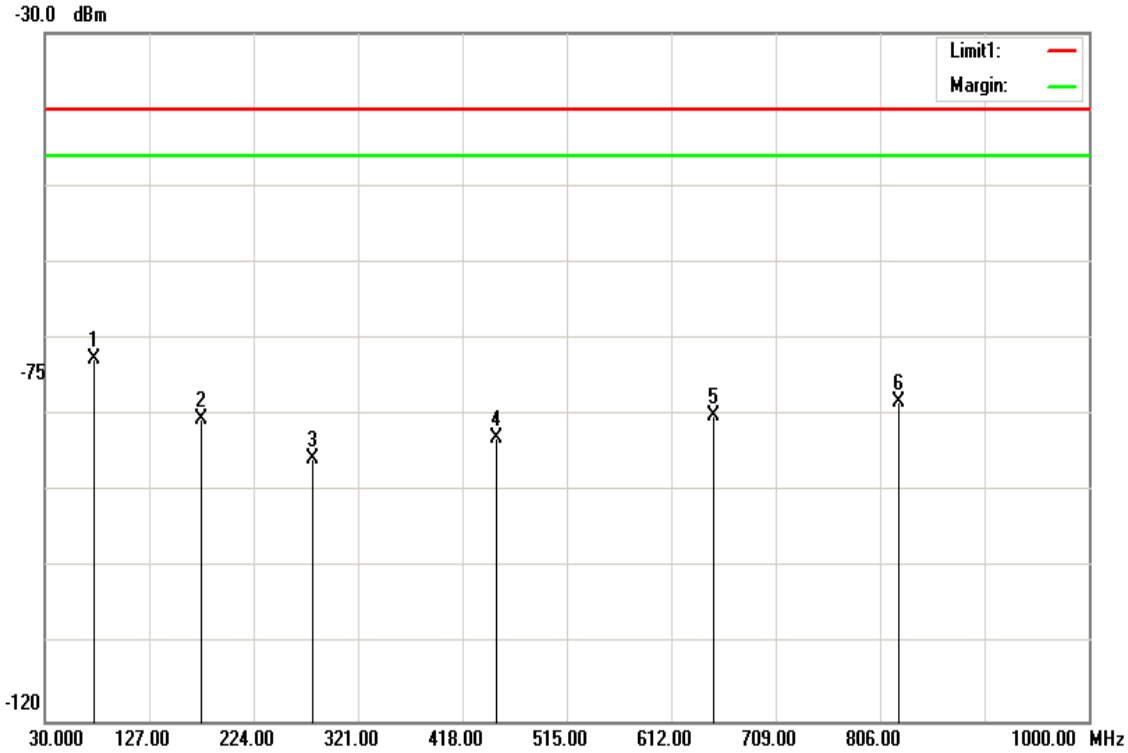
Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
60.0700	-80.41	0.77	-81.18	-40.00	-41.18	H
118.7550	-74.93	1.08	-76.01	-40.00	-36.01	H
169.6800	-83.86	1.29	-85.15	-40.00	-45.15	H
272.5000	-80.33	1.64	-81.97	-40.00	-41.97	H
460.1950	-77.84	2.15	-79.99	-40.00	-39.99	H
676.0200	-75.07	2.63	-77.70	-40.00	-37.70	H

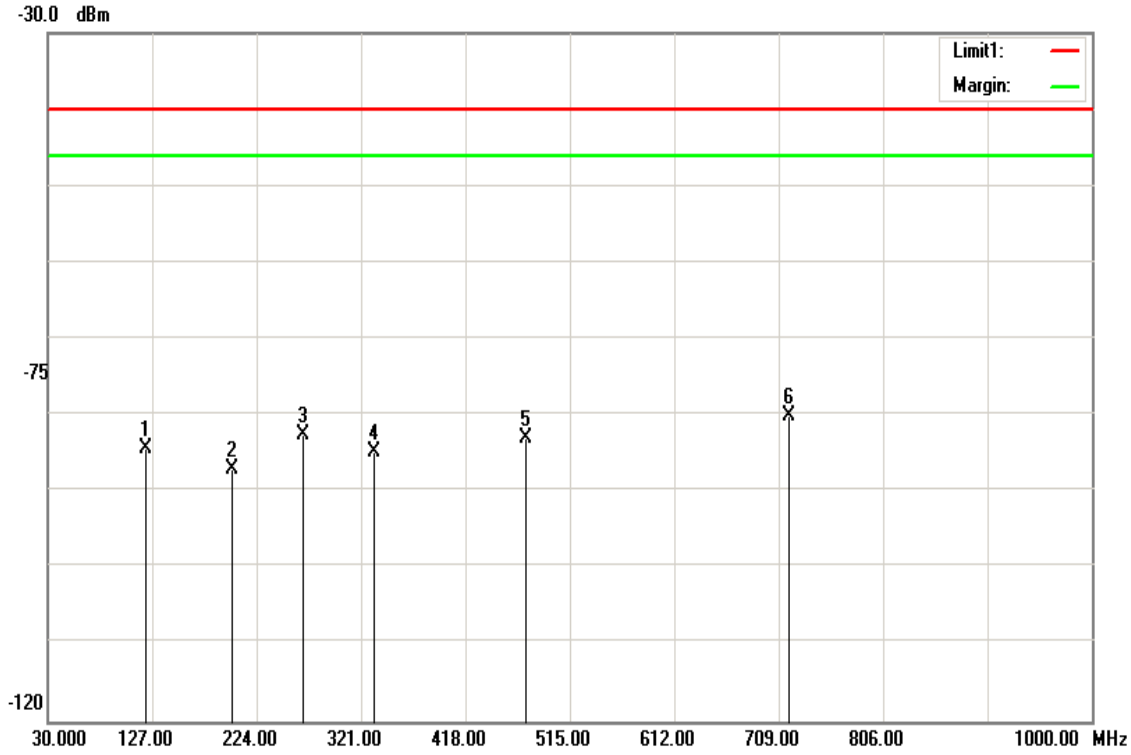
LTE Band 30 / BW: 10MHz / 16QAM / RB =1, RB Offset = 0

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Ver.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
76.0750	-71.76	0.86	-72.62	-40.00	-32.62	V
175.9850	-79.13	1.31	-80.44	-40.00	-40.44	V
278.8050	-83.97	1.66	-85.63	-40.00	-45.63	V
449.5250	-80.93	2.13	-83.06	-40.00	-43.06	V
651.7700	-77.5	2.57	-80.07	-40.00	-40.07	V
823.4600	-75.26	2.92	-78.18	-40.00	-38.18	V

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.

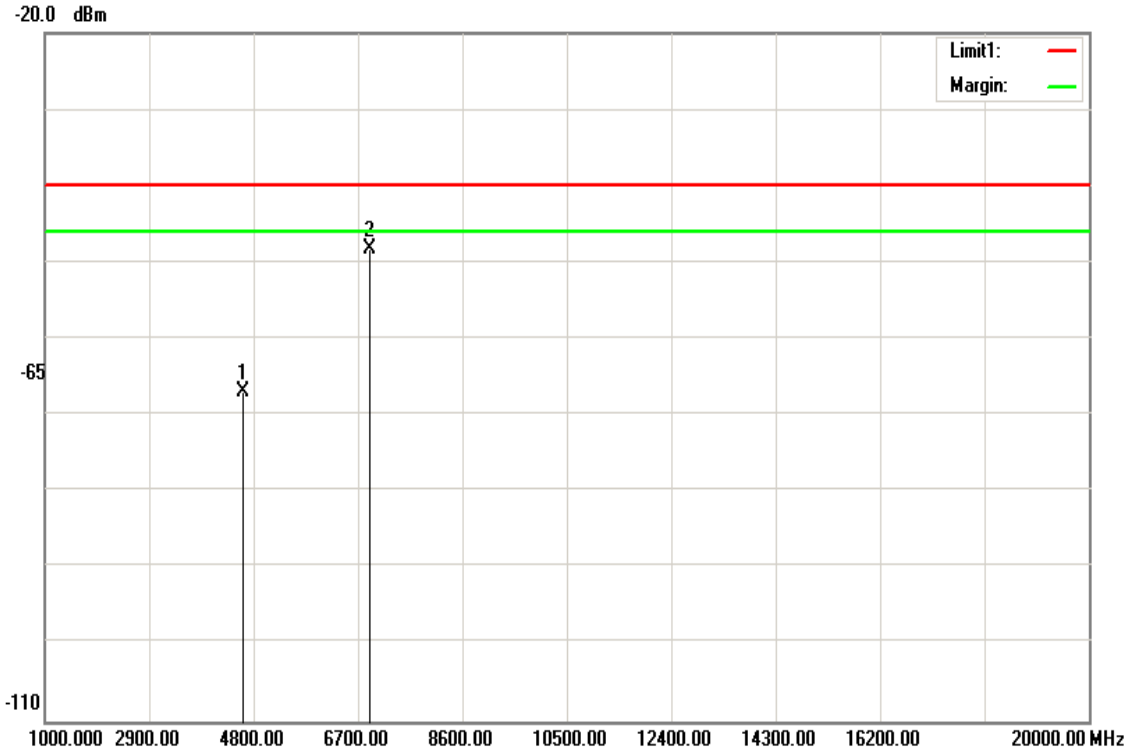


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
120.6950	-83.18	1.09	-84.27	-40.00	-44.27	H
200.7200	-85.71	1.4	-87.11	-40.00	-47.11	H
267.1650	-81.01	1.63	-82.64	-40.00	-42.64	H
333.6100	-82.88	1.82	-84.70	-40.00	-44.70	H
473.7750	-80.71	2.19	-82.90	-40.00	-42.90	H
719.1850	-77.27	2.72	-79.99	-40.00	-39.99	H

Above 1GHz

LTE Band 30 / BW: 5MHz / QPSK RB =1, RB Offset = 0

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Ver.

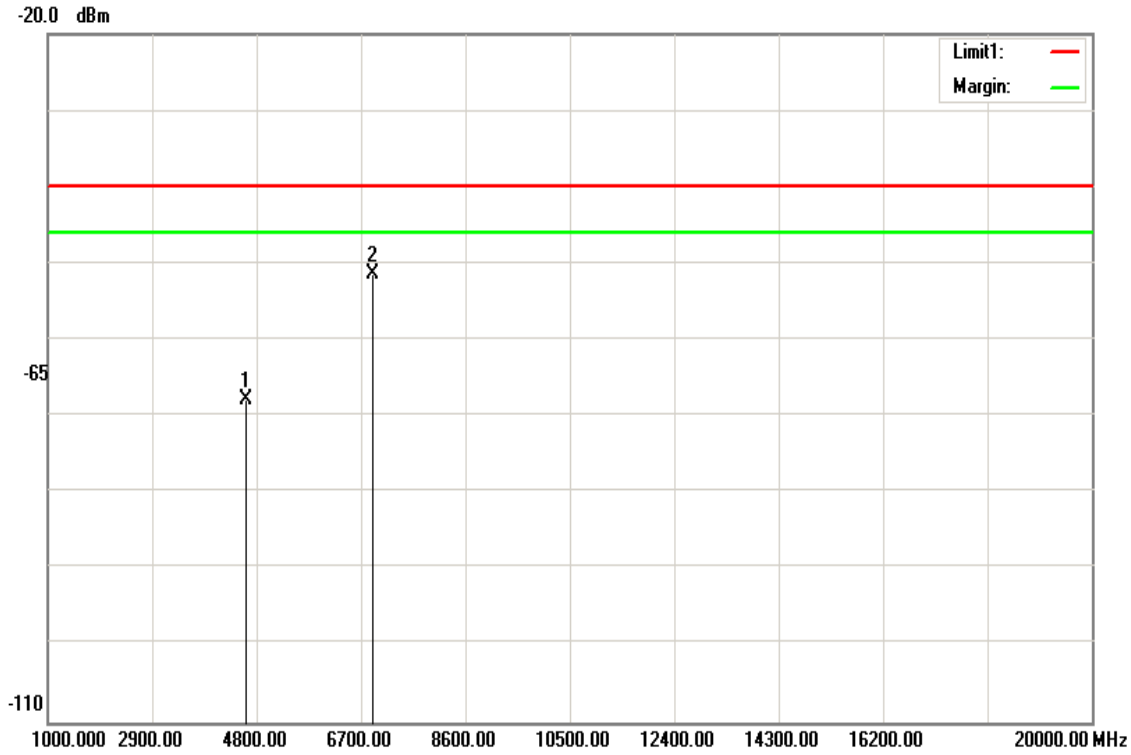


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4615.500	-59.41	7.46	-66.87	-40.00	-26.87	V
6922.000	-38.81	9.39	-48.20	-40.00	-8.20	V
N/A						

Remark:

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

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.



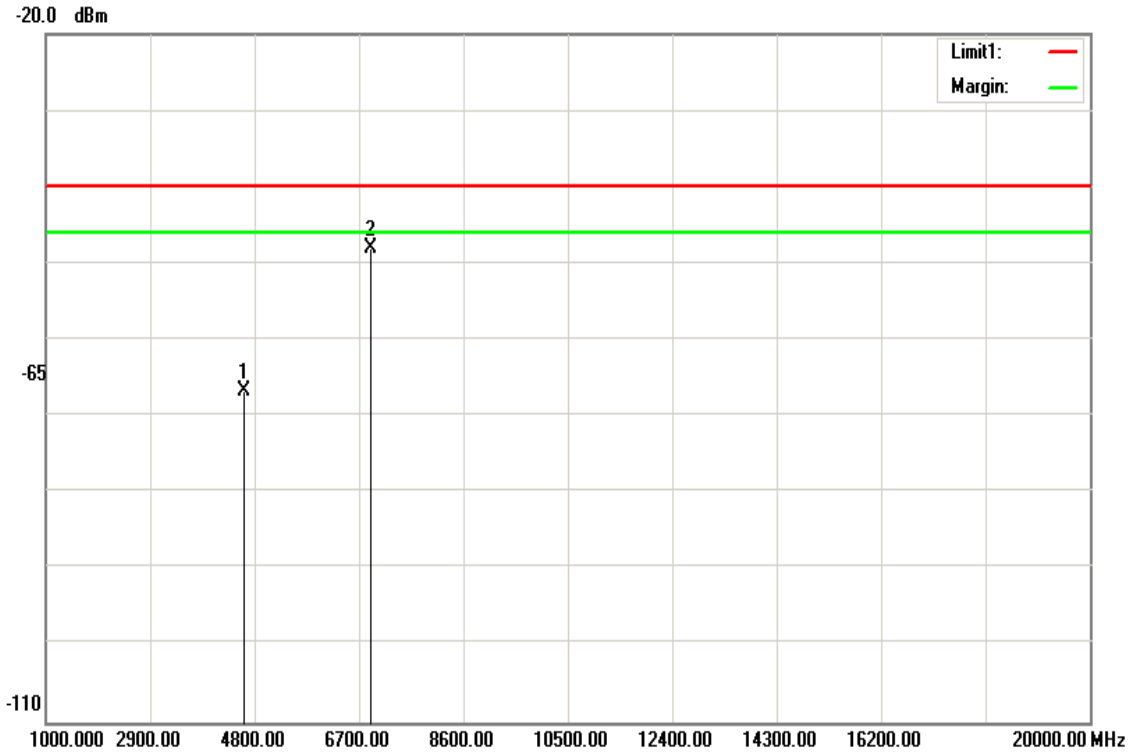
Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4615.500	-60.24	7.46	-67.70	-40.00	-27.70	H
6922.000	-41.9	9.39	-51.29	-40.00	-11.29	H
N/A						

Remark:

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

LTE Band 30 / BW: 10MHz / QPSK RB =1, RB Offset = 0

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.

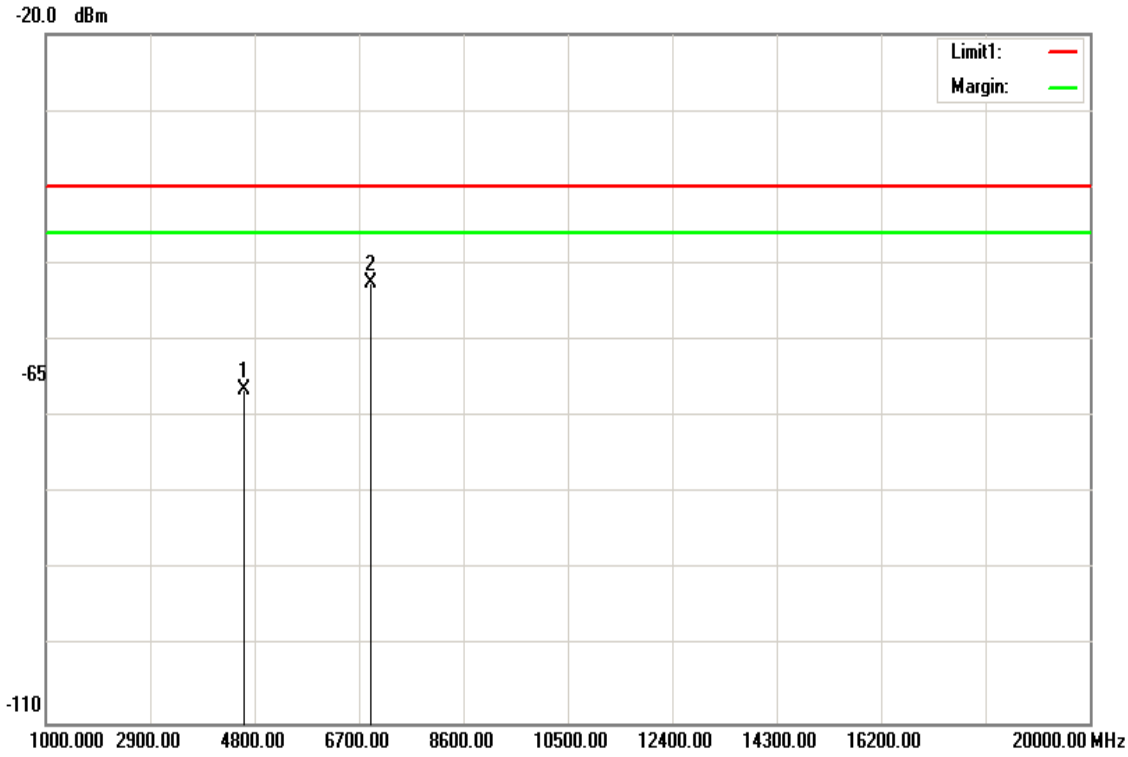


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4612.000	-59.29	7.46	-66.75	-40.00	-26.75	V
6918.500	-38.56	9.39	-47.95	-40.00	-7.95	V
N/A						

Remark:

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

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.



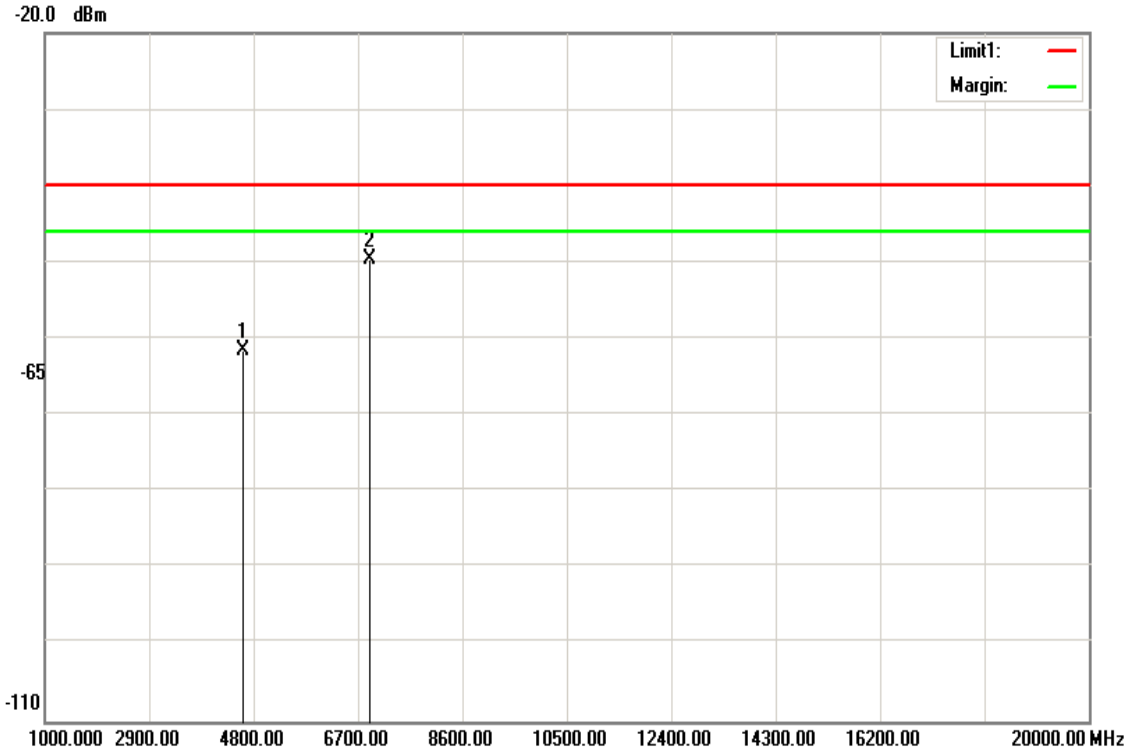
Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4612.000	-59.04	7.46	-66.50	-40.00	-26.50	H
6915.000	-43.21	9.39	-52.60	-40.00	-12.60	H
N/A						

Remark:

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

LTE Band 30 / BW: 5MHz / 16QAM RB =1, RB Offset = 0

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Ver.

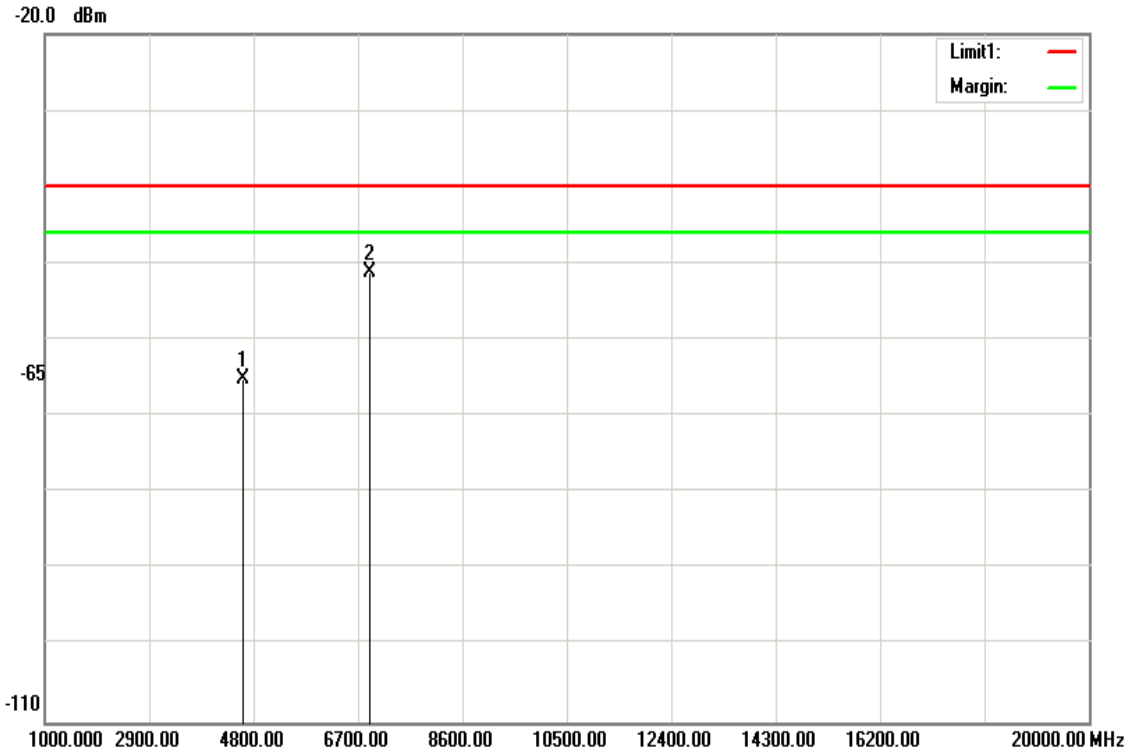


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4615.500	-54.12	7.46	-61.58	-40.00	-21.58	V
6922.000	-40.17	9.39	-49.56	-40.00	-9.56	V
N/A						

Remark:

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

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.



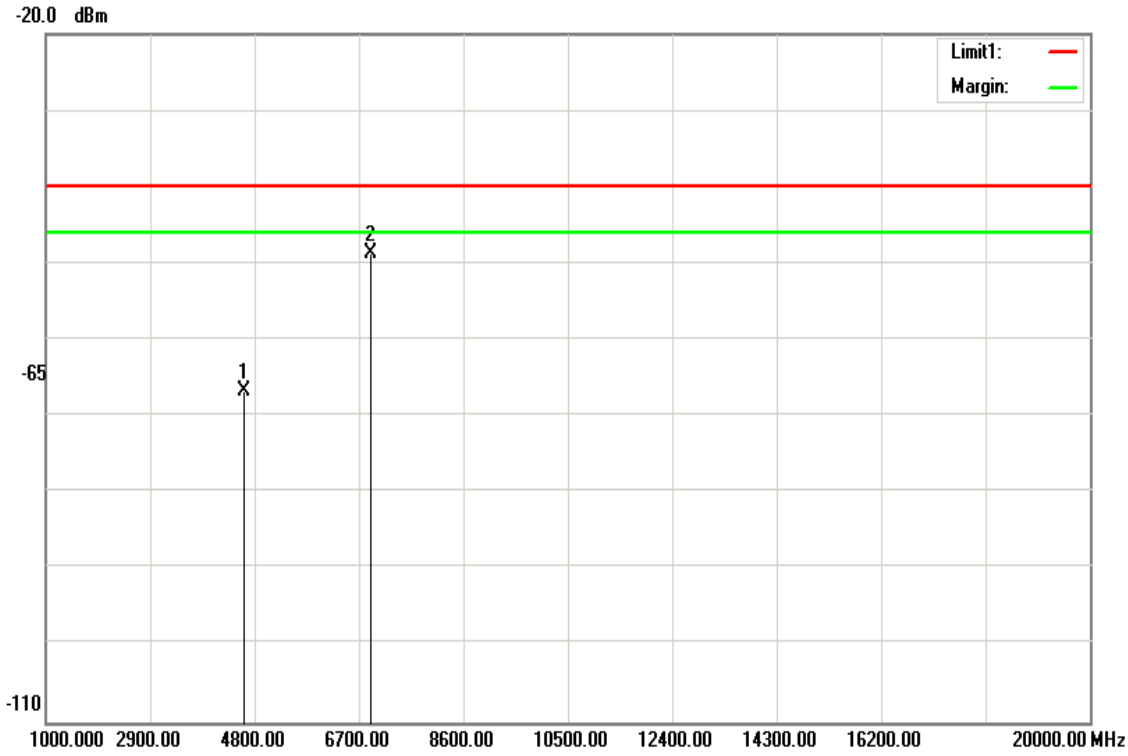
Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4615.500	-57.76	7.46	-65.22	-40.00	-25.22	H
6922.000	-41.75	9.39	-51.14	-40.00	-11.14	H
N/A						

Remark:

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

LTE Band 30 / BW: 10MHz / 16QAM RB =1, RB Offset = 0

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.

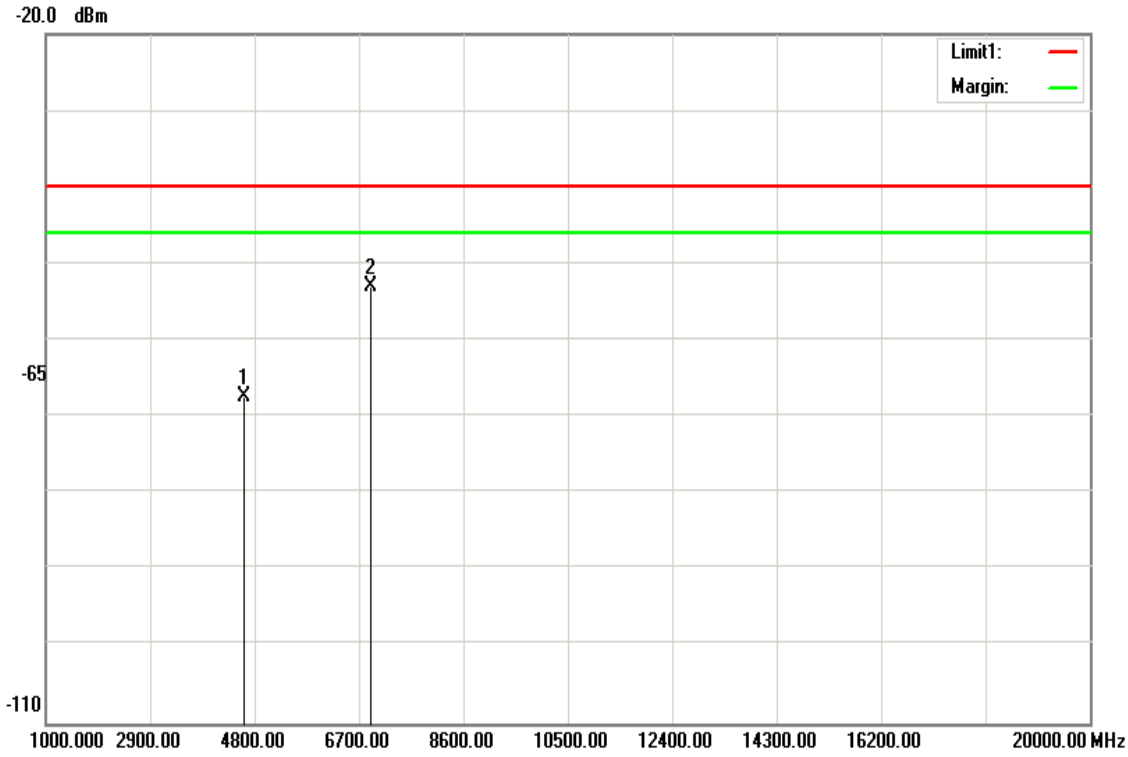


Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4612.000	-59.18	7.46	-66.64	-40.00	-26.64	V
6918.500	-39.23	9.39	-48.62	-40.00	-8.62	V
N/A						

Remark:

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

Operation Mode:	Tx / Mid CH	**Test Date:**	December 14, 2018
Temperature:	23℃	**Tested by:**	Jerry Chuang
Humidity:	46 %RH	**Polarity:**	Hor.



Frequency (MHz)	S.G. (dBm)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)	Antenna Polarization (V/H)
4612.000	-59.88	7.46	-67.34	-40.00	-27.34	H
6915.000	-43.48	9.39	-52.87	-40.00	-12.87	H
N/A						

Remark:

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

-- End of Test Report --