

FCC Test Report

(Part 27)

Product Name : 4G/LTE Broadband Router with PoE
Model No : MX-210NPV, MX-210V
FCC ID : QI3BIL-MX210NPV

Applicant : Billion Electric Co., Ltd.
Address : 8F., No.192, Sec. 2, Zhongxing Rd., Xindian Dist.,
New Taipei City 231, Taiwan (R.O.C.)

Date of Receipt : 2018/04/27
Issued Date : 2018/06/14
Report No. : 1840351R-HPUSP40V00
Report Version : V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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Test Report

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Applicant : Billion Electric Co., Ltd.
Address : 8F., No.192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei
City 231, Taiwan (R.O.C.)
Manufacturer : Billion Electric Co., Ltd.
Trade Name : BEC, Billion
Model No. : MX-210NPV, MX-210V
EUT Rated Voltage : AC 100-240V/50-60Hz
EUT Test Voltage : AC 120V/60Hz
Measurement Standard : FCC CFR Title 47 Part 2 27
Measurement Reference : TIA/EIA 603-E
Test Result : Complied

Documented By : Anny Chou
(Senior Adm. Specialist / Anny Chou)

Tested By : Vorana Chen
(Senior Engineer / Vorana Chen)

Approved By : Vincent Lin
(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	4G/LTE Broadband Router with PoE
Model No.	MX-210NPV, MX-210V
Trade Name	BEC, Billion
IMEI No.	86832302
FCC ID	QI3BIL-MX210NPV
Modulation	LTE Band 13: QPSK/16-QAM
TX Frequency	LTE Band 13: 777~787MHz
Rx Frequency	LTE Band 13: 746~756MHz
Bandwidth	LTE Band 13: 5MHz/10MHz
HW Version	1.010
SW Version	1.04.1.248
Antenna Type	Dipole

Note: The different description of Model

Model	MX-210NPV	MX-210V
Product Name	4G/LTE Broadband Router with PoE	
Trade Name	BEC, Billion	
LTE antennas(SMA)	Detachable LTE Antenna *2pcs	
SIM slot (2FF)	1	
Ethernet Giga port	2	
802.11b/g/n	Yes	No
Power input from PoE PoE injector	802.3af/at type I (12.95W)	
Power Input: Power adapter	12VDC 1.2A	
External color	Casing: ABS / Dark blue	
Software	without VPN	

1.2. Antenna List

No	Manufacturer	Part No	Antenna Type	Peak Gain
1	Cortec	AN0727-64DP5BSM	Dipole Antenna	0.28 dBi for LTE Band13

1.3. Operational Description

The information contained within this report is intended to show verification of compliance of the 700MHz to the requirements of FCC 47 CFR Part 2 and 27.

The EUT provide all functions described as above. The EUT is tested with maximum rated TX power via the Base Station simulator.

DEKRA has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined

as:

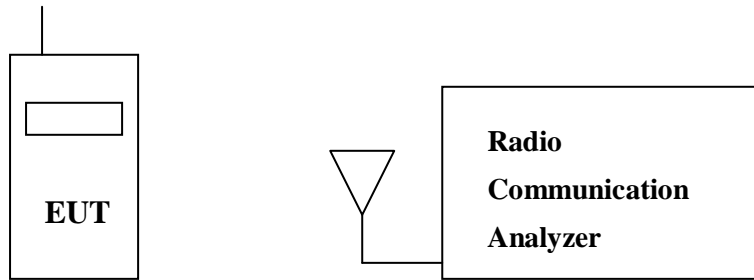
Test Mode:	LTE Band 13 (5M)-QPSK/16QAM
	LTE Band 13 (10M)-QPSK/16QAM

Note :

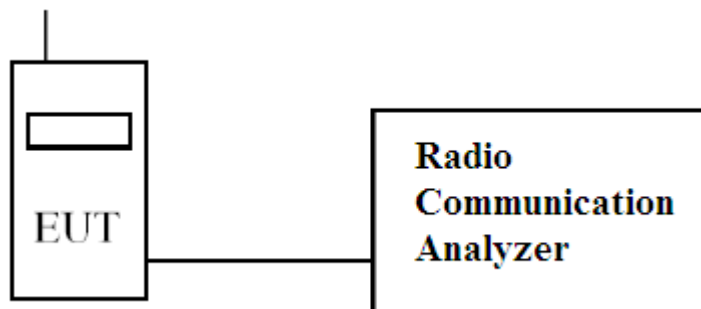
The maximum power levels are chosen in the LTE Band 13, only these modes were used for all tests.

1.4. Configuration of tested System

(a) Configuration of Radiated measurement



(b) Configuration of Conducted measurement



1.5. EUT Setup Procedures

- (1) Setup the EUT and simulators as shown on 1.3
- (2) Turn on the power of all equipments.
- (3) The EUT was set to communicate with MT8820C.
- (4) Repeat the above procedure (3).

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	23
Humidity (%RH)	25-75	51
Barometric pressure (mbar)	860-1060	986

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: File on
Federal Communications Commission
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FCC Accreditation Number: TW3023

1.7. Type of Emission

Band	Bandwidth (MHz)	Modulation	
		QPSK	16QAM
13	5	4M51G7D	4M49W7D
13	10	9M06G7D	9M05W7D

1.8. Voltages and AC currents

LTE Band 13 (5M)	EUT Transmitting (in maximum power) :	AC voltage : 120V , AC current : 0.105A
	EUT Standby	: AC voltage : 120V , AC current : 0.06A
LTE Band 13 (10M)	EUT Transmitting (in maximum power) :	AC voltage : 120V , AC current : 0.105A
	EUT Standby	: AC voltage : 120V , AC current : 0.06A

2. Technical Test

2.1. Summary of test result

FCC Standard	Test Item	Result	Note
2.1046	Conducted Output Power	Pass	
27.5			
2.1049	Occupied Bandwidth	Pass	
27.53 (c)			
2.1051	Spurious Emission at Antenna Terminals	Pass	
27.53 (c)			
2.1051	Conducted Emission	Pass	
27.53 (c)			
2.1053	Field Strength of Spurious Radiation	Pass	
27.53 (c,f)			
2.1055	Frequency Stability for Temperature & Voltage	Pass	
27.54			
27.50	Peak to Average Ratio	Pass	

2.2. List of test Equipment

Conducted /CTR

Instrument	Manufacturer	Type No.	Serial No	Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY54510317	2018/04/13
Directional coupler	Agilent	87300C	MY44300353	2017/11/30
Directional coupler	Agilent	778D-012	50550	2017/11/23
Standard Temperature & Humidity Chamber	WIT	TH-1S-B	EQ-201-00146	2018/02/12
Communication Tester	Agilent	MT8820C	6201465467	2017/07/10

Radiated / Site3

Instrument	Manufacturer	Type No.	Serial No	Cal. Date
Bilog Antenna	Schaffner Chase	CBL6112B	2707	2017/06/29
Horn Antenna	R&S	9120D	556	2018/04/02
Pre-Amplifier	Agilent	87405C	MY55380068	2017/08/08
Spectrum Analyzer	Agilent	N9010A	MY54510317	2018/04/13
Communication Tester	Agilent	MT8820C	6201465467	2017/07/10

2.3. Measurement Uncertainty

Conducted Emission

The measurement uncertainty of confidence of 95% is evaluated as ± 1.52 dB

Radiated Emission (Below 1GHz)

The measurement uncertainty of confidence of 95% is evaluated as ± 3.44 dB .

Radiated Emission (Above 1GHz)

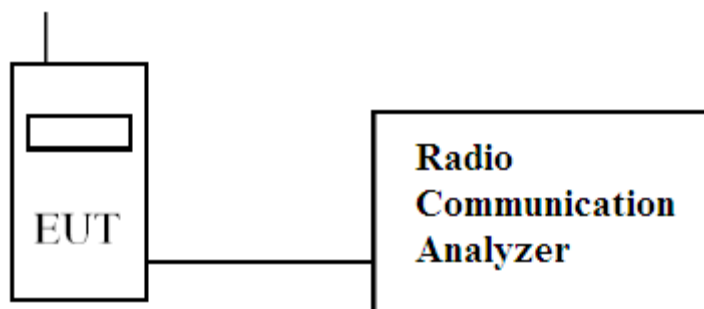
The measurement uncertainty of confidence of 95% is evaluated as ± 4.08 dB

3. Conducted Output Power Measurement

3.1. Test Specification

According to FCC Part 2.1046, 27.50

3.2. Test Setup



3.3. Limits

Band	Limit
LTE Band 13/700	<3W

3.4. Test Procedure

The EUT is tested with maximum rated TX power via the Base Station simulator, and the output power was measured at the antenna terminals of the EUT.

3.5. Test Result of Maximum Power Output

Band	Channel	Modulation	RB No.	RB Offset	MPR	Max Power (Conducted)	Max Power (W)
Band 13 (700MHz)/5MHz	23205 779.5MHz	QPSK	1	#0	0	22.76	0.1888
			1	#Mid	0	23.12	0.2051
			1	#Max	0	22.73	0.1875
			50%	#0	1	22.09	0.1618
			50%	#Mid	1	22.09	0.1618
			50%	#Max	1	22.11	0.1626
			100%	--	1	22.05	0.1603
		16QAM	1	#0	1	21.80	0.1514
			1	#Mid	1	21.75	0.1496
			1	#Max	1	21.77	0.1503
			50%	#0	2	20.82	0.1208
			50%	#Mid	2	20.91	0.1233
			50%	#Max	2	20.94	0.1242
			100%	--	2	20.98	0.1253
	23230 782MHz	QPSK	1	#0	0	22.61	0.1824
			1	#Mid	0	23.28	0.2128
			1	#Max	0	22.85	0.1928
			50%	#0	1	21.96	0.1570
			50%	#Mid	1	22.03	0.1596
			50%	#Max	1	22.04	0.1600
			100%	--	1	22.10	0.1622
		16QAM	1	#0	1	21.76	0.1500
			1	#Mid	1	21.96	0.1570
			1	#Max	1	21.65	0.1462
			50%	#0	2	21.09	0.1285
			50%	#Mid	2	20.94	0.1242
			50%	#Max	2	20.94	0.1242
			100%	--	2	21.01	0.1262
	23255 784.5MHz	QPSK	1	#0	0	22.53	0.1791
			1	#Mid	0	23.10	0.2042
			1	#Max	0	22.68	0.1854
			50%	#0	1	21.87	0.1538
			50%	#Mid	1	22.16	0.1644
			50%	#Max	1	22.03	0.1596
			100%	--	1	22.04	0.1600
		16QAM	1	#0	1	21.54	0.1426
1			#Mid	1	21.68	0.1472	
1			#Max	1	21.71	0.1483	
50%			#0	2	21.00	0.1259	
50%			#Mid	2	21.17	0.1309	
50%			#Max	2	21.12	0.1294	
100%			--	2	20.94	0.1242	

Band	Channel	Modulation	RB No.	RB Offset	MPR	Max Power (Conducted)	Max Power (W)
Band 13 (700MHz)/10MHz	23230 782MHz	QPSK	1	#0	0	22.69	0.1858
			1	#Mid	0	22.99	0.1991
			1	#Max	0	22.92	0.1959
			50%	#0	1	21.99	0.1581
			50%	#Mid	1	22.05	0.1603
			50%	#Max	1	22.08	0.1614
			100%	--	1	22.03	0.1596
		16QAM	1	#0	1	21.65	0.1462
			1	#Mid	1	21.68	0.1472
			1	#Max	1	21.52	0.1419
			50%	#0	2	20.91	0.1233
			50%	#Mid	2	20.93	0.1239
			50%	#Max	2	20.99	0.1256
			100%	--	2	20.96	0.1247

3.6. Maximum Conducted Power and ERP/EIRP Power

According to KDB 412172 D01 Section 1.2 Power Approach

$$\text{EIRP} = P_T + G_T - L_C = \text{ERP} + 2.15 \text{ dB}, \text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

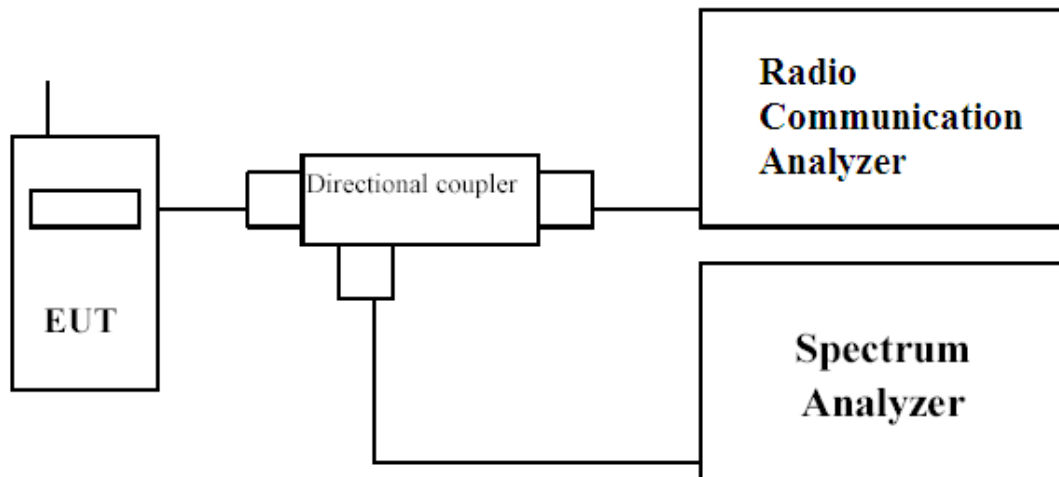
LTE Band	BW	Modulation	Conducted Peak Power (dBm)	Conducted Peak Power (W)	Antenna Gain (dBi)	Maximum ERP (W)	Maximum ERP Limit (W)
13	5M	QPSK	23.28	0.213	0.28	0.138	3
		16QAM	21.96	0.157	0.28	0.102	3
	10M	QPSK	22.99	0.199	0.28	0.129	3
		16QAM	21.68	0.147	0.28	0.096	3

4. Occupied Bandwidth

4.1. Test Secification

According to FCC Part 2.1049, 27.53

4.2. Test Setup



4.3. Test Procedure

The EUT is tested with maximum rated TX power via the Base Station simulator, and the occupied bandwidth was measured at the antenna terminals of the EUT.

The Resolution BW of the analyzer is set to 1 %~5% of the emission bandwidth. The EUT's occupied bandwidth is measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The plots below show the resultant display from the Spectrum Analyser.

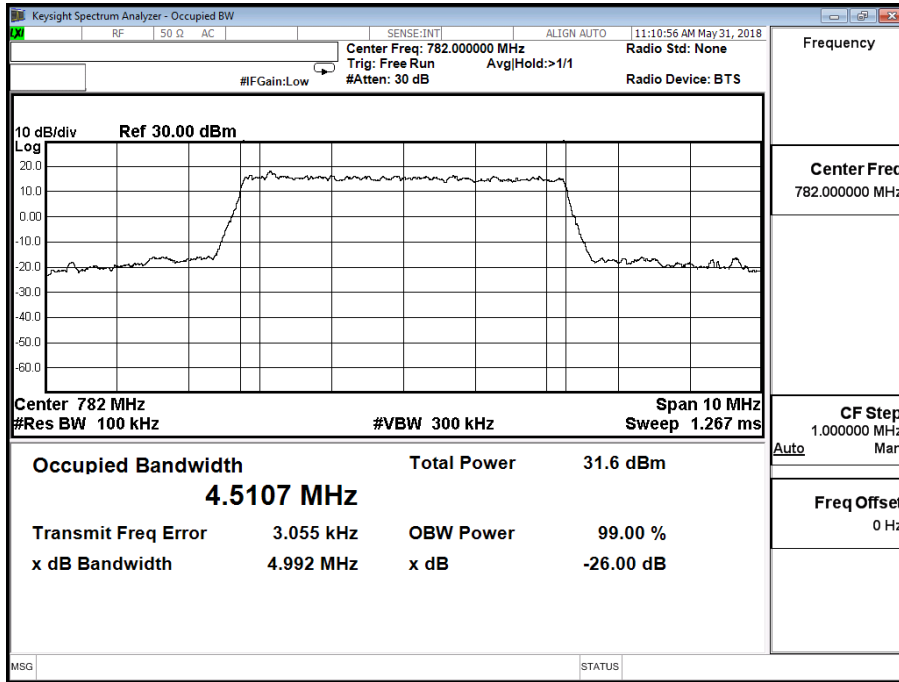
4.4. Test Result of Occupied Bandwidth

Product	4G/LTE Broadband Router with PoE
Test Mode	Occupied Bandwidth
Test Site	CTR

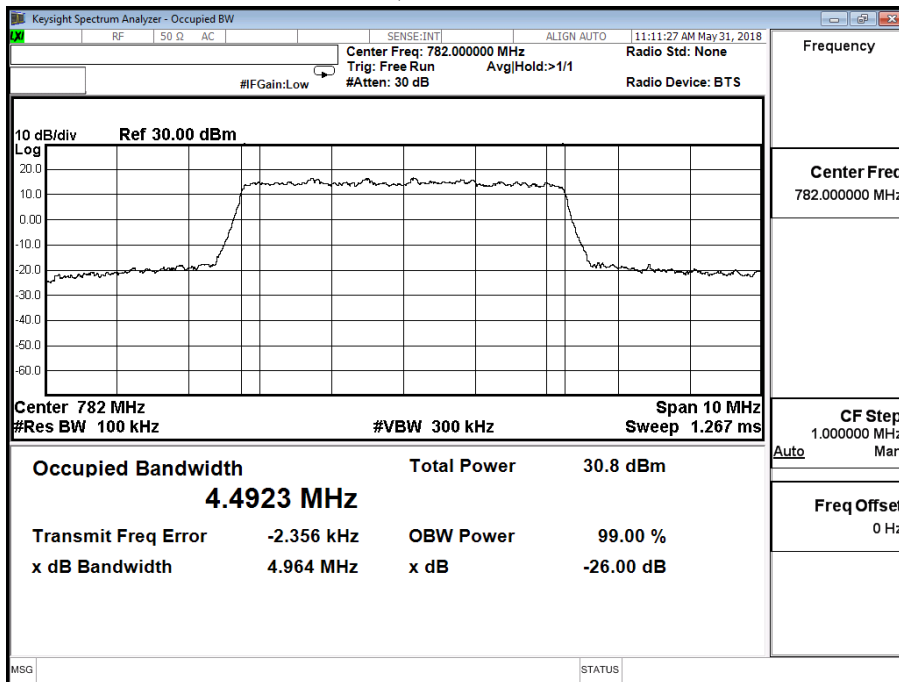
Test Mode	Channel	TX Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB bandwidth (MHz)	Result
Band 13 5M QPSK	23230	782	4.5107	4.992	Pass
Band 13 5M 16QAM	23230	782	4.4923	4.964	Pass
Band 13 10M QPSK	23230	782	9.0573	10.070	Pass
Band 13 10M 16QAM	23230	782	9.0497	10.050	Pass

Product	4G/LTE Broadband Router with PoE		
Test Mode	Occupied Bandwidth		
Date of Test	2018/05/31	Test Site	CTR
Test Condition	Band 13 5M		

Band 13 5M QPSK - LTE Mode CH 23230

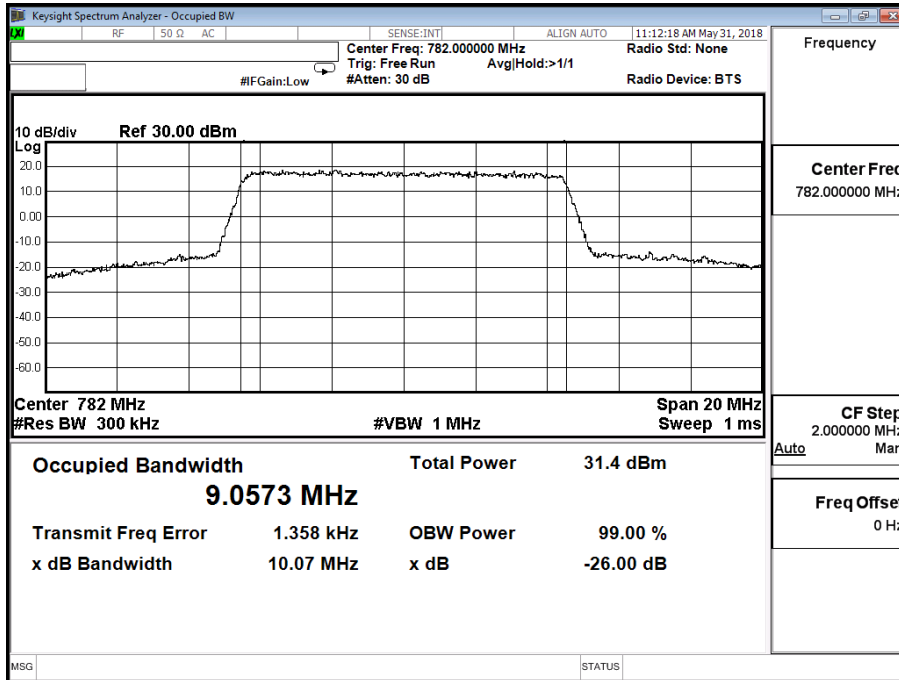


Band 13 5M 16QAM - LTE Mode CH23230

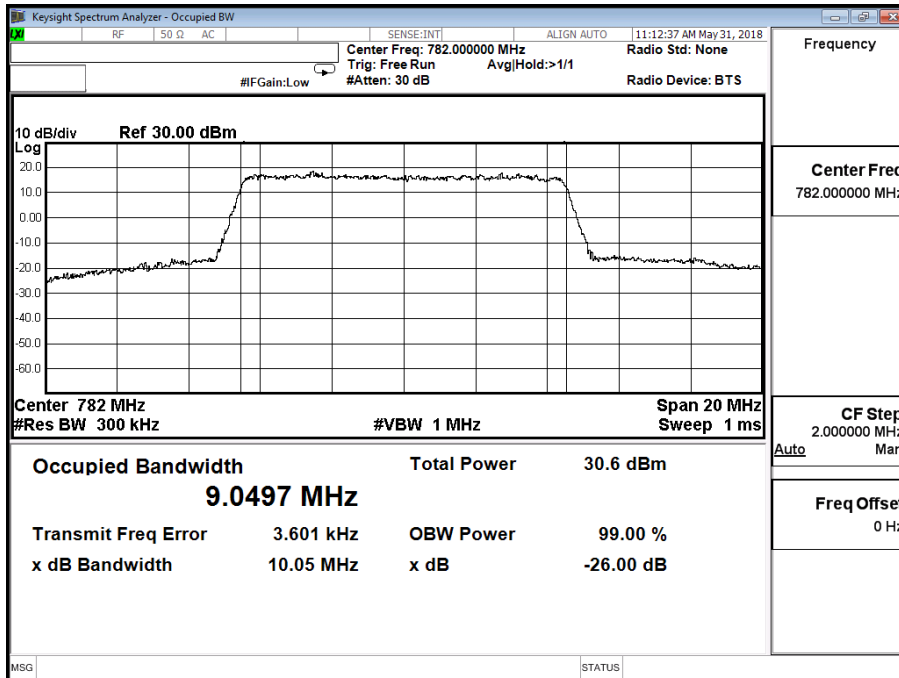


Product	4G/LTE Broadband Router with PoE		
Test Mode	Occupied Bandwidth		
Date of Test	2018/05/31	Test Site	CTR
Test Condition	Band 13 10M		

Band 13 10M QPSK - LTE Mode CH 23230



Band 13 10M 16QAM - LTE Mode CH23230

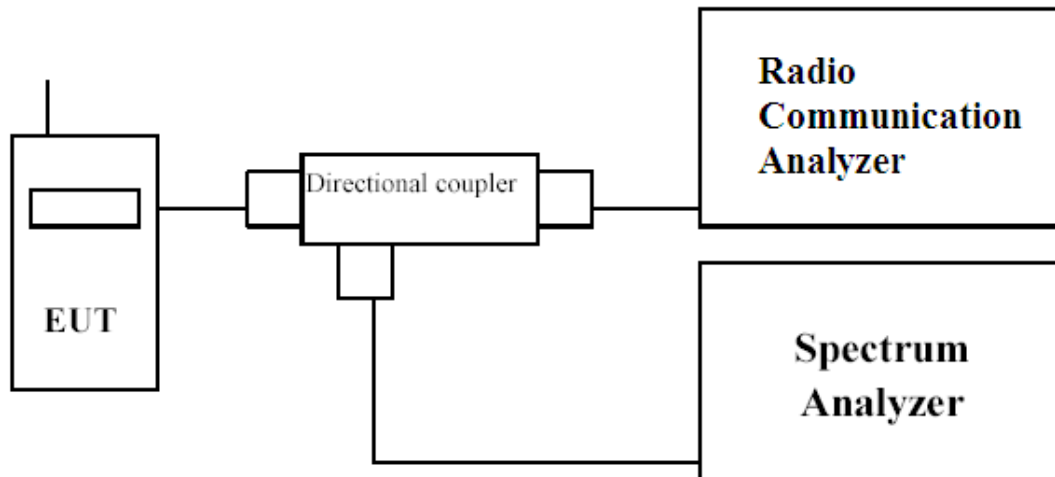


5. Spurious Emission At Antenna Terminals (+/-1MHz)

5.1. Test Specification

According to Part 2.1051, 27.53

5.2. Setup



5.3. Limits

The spurious (unwanted) emission limits specified in the individual FCC rule parts applicable to licensed digital transmitters (typically referred to under the heading 'emission limits') normally apply to any and all emissions that are present outside of the authorized frequency band/block and apply to emissions in both the out-of-band and spurious domains. unwanted emissions are required by the licensed rule parts to be attenuated below the transmitter power by a factor of at least $43 + 10\log(P)$ dB, where P represents the transmitter power expressed in watts

5.4. Test Procedure

In accordance with Part 27.53 at least 1% of the emission bandwidth was used for the resolution and video bandwidths up to 1MHz away from the Block Edge. At greater than 1MHz, the resolution and video bandwidth were increased to 1MHz/3MHz.

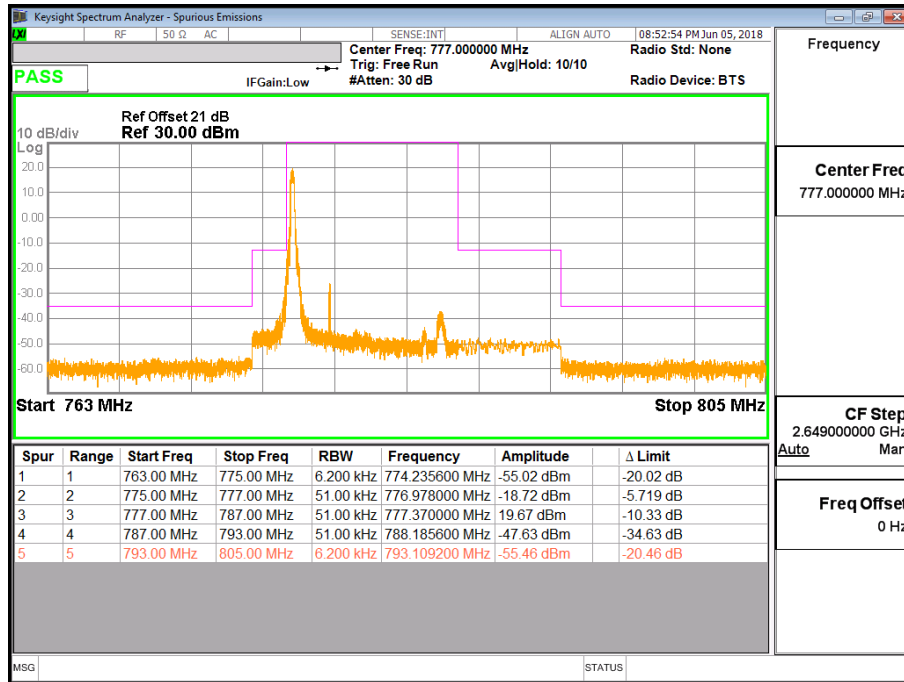
The reference power and path losses of all channels used for testing in each frequency block were measured.

On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10\log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations

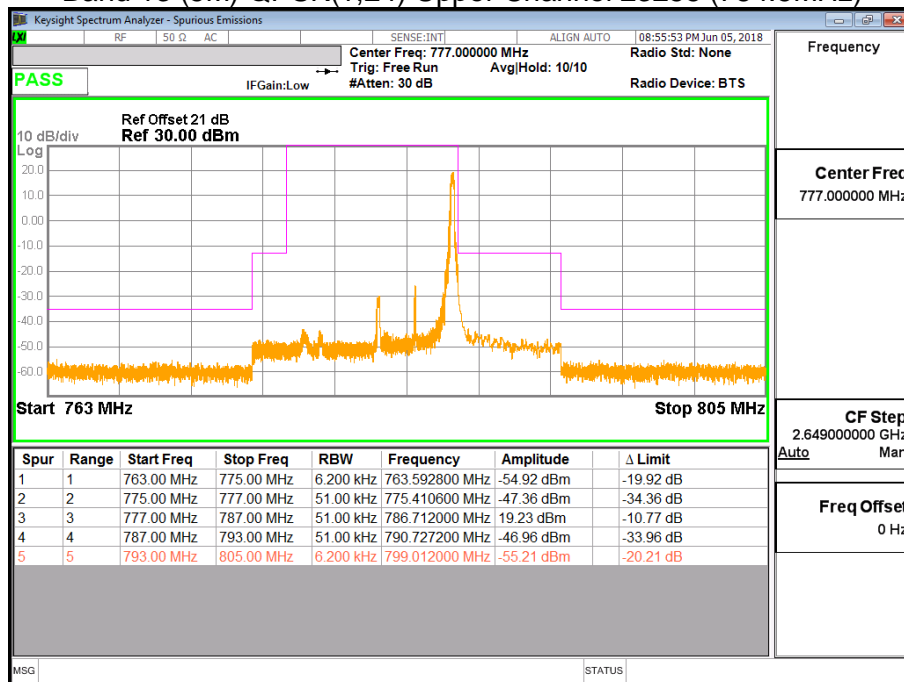
5.5. Test Result of Spurious Emission At Antenna Terminals (+/-1MHz)

Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission At Antenna Terminals (+/-1MHz)		
Date of Test	2018/06/05	Test Site	CTR
Test Condition	Block Edge Test (Band 13 (5M))		

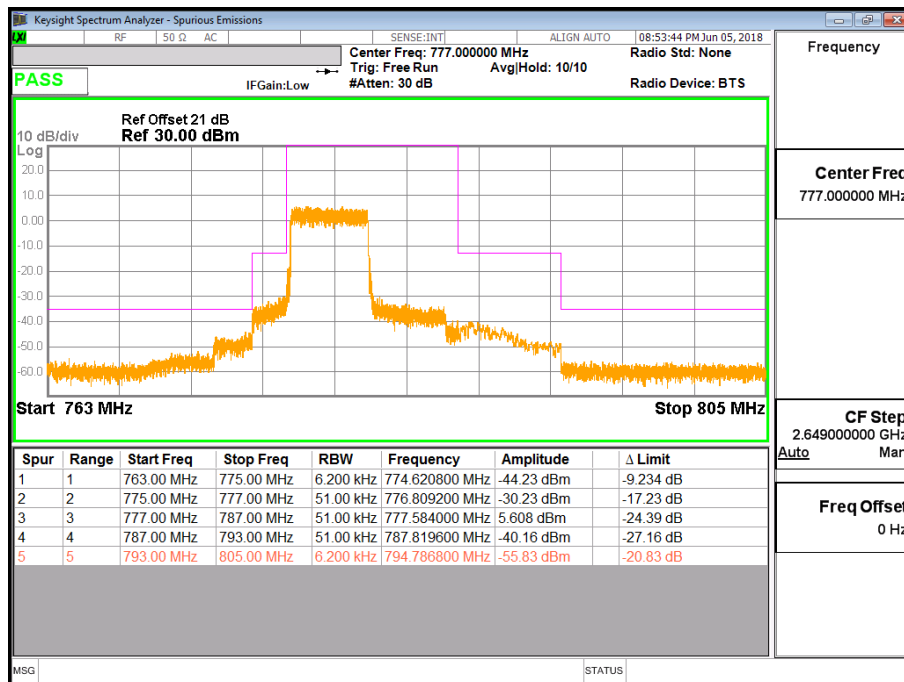
Band 13 (5M) QPSK(1,0) Lower Channel 23205 (779.5MHz)



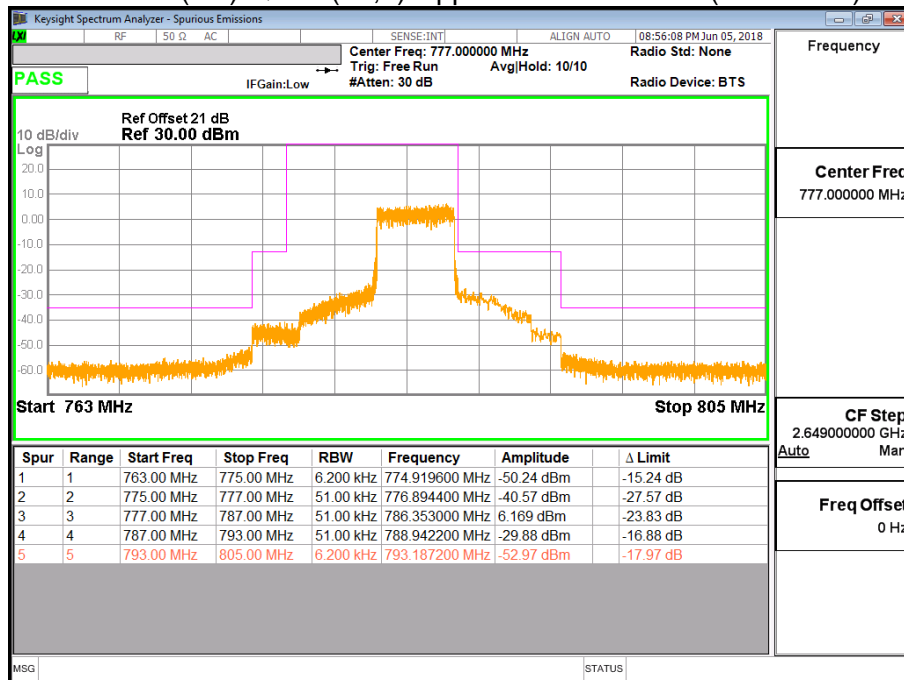
Band 13 (5M) QPSK(1,24) Upper Channel 23255 (784.5MHz)



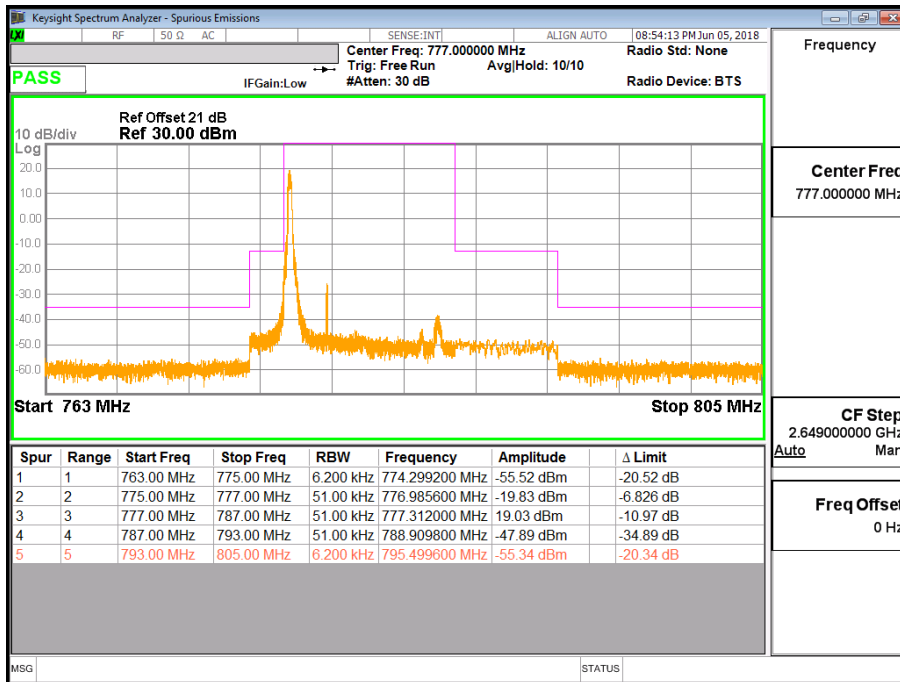
Band 13 (5M) QPSK(25,0) Lower Channel 23205 (779.5MHz)



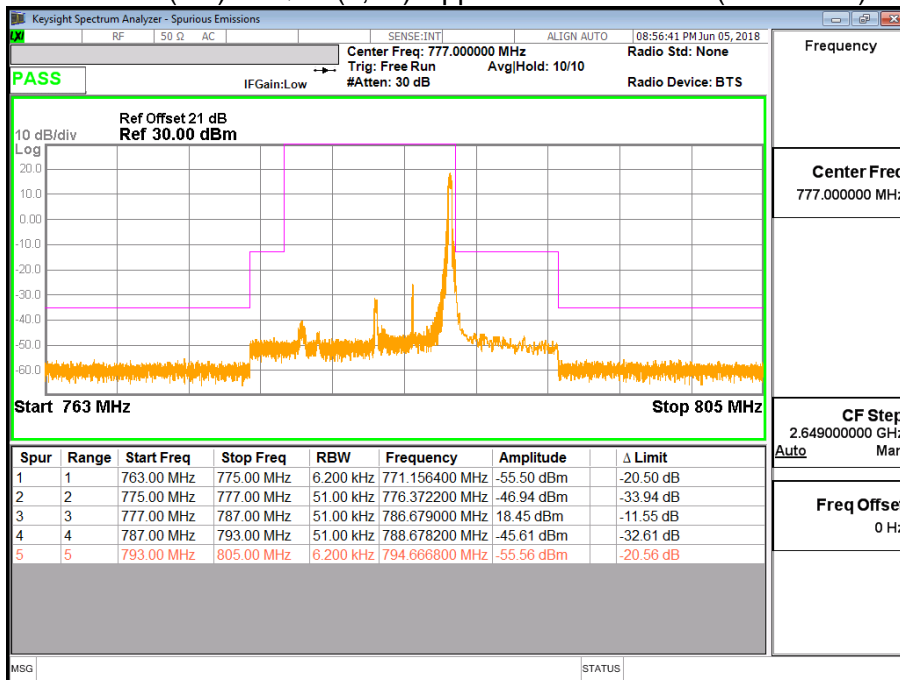
Band 13 (5M) QPSK(25,0) Upper Channel 23255 (784.5MHz)



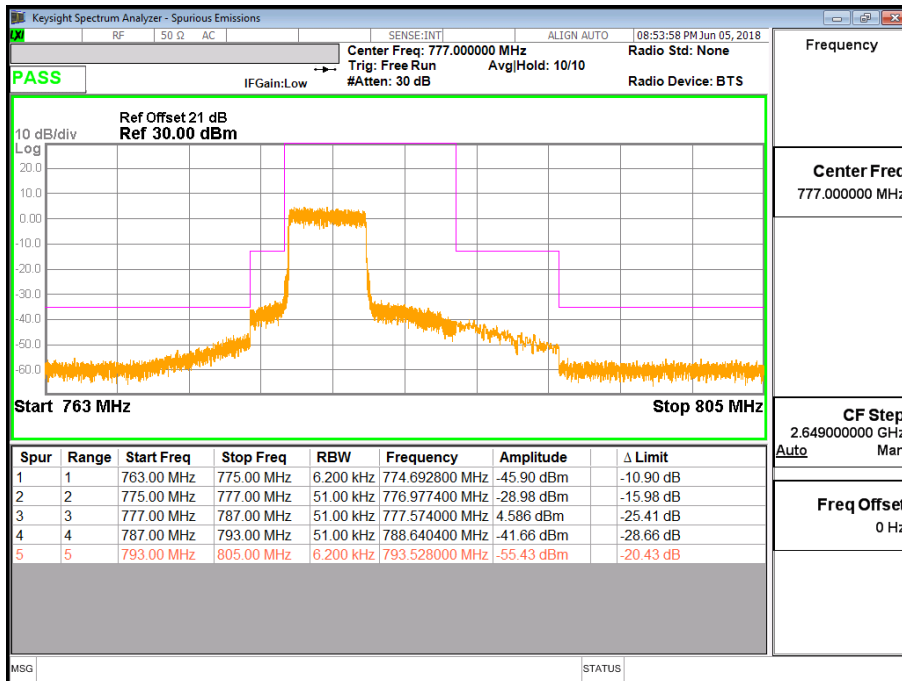
Band 13 (5M) 16QAM(1,0) Lower Channel 23205 (779.5MHz)



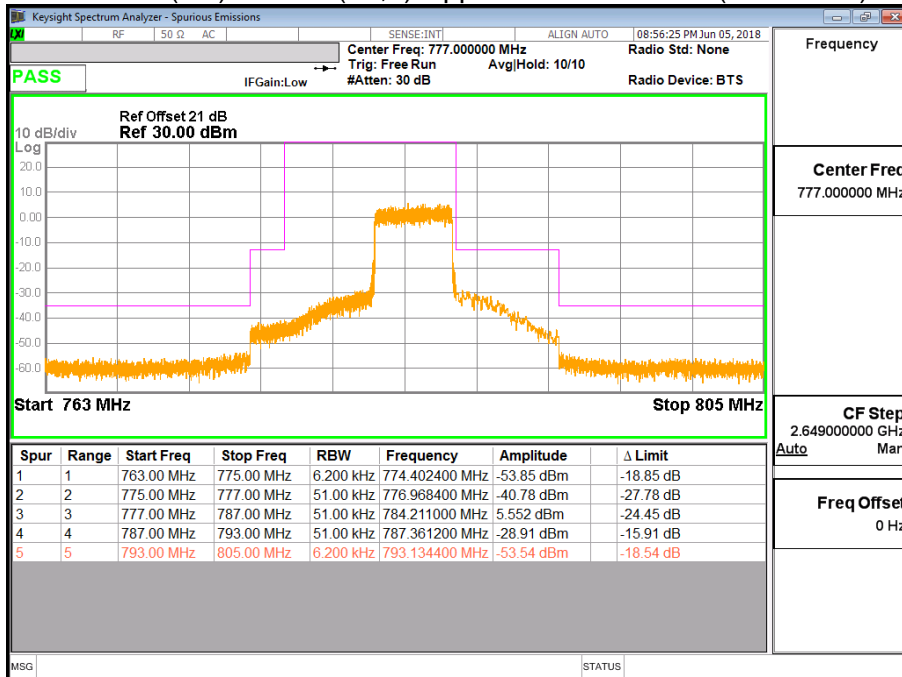
Band 13 (5M) 16QAM(1,24) Upper Channel 23255 (784.5MHz)



Band 13 (5M) 16QAM(25,0) Lower Channel 23205 (779.5MHz)

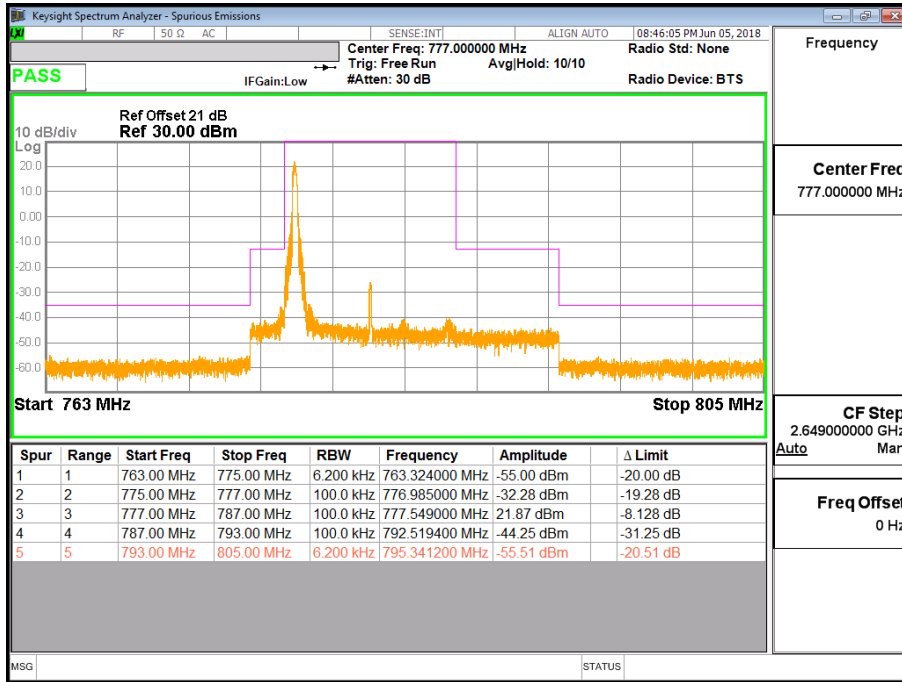


Band 13 (5M) 16QAM(25,0) Upper Channel 23255 (784.5MHz)

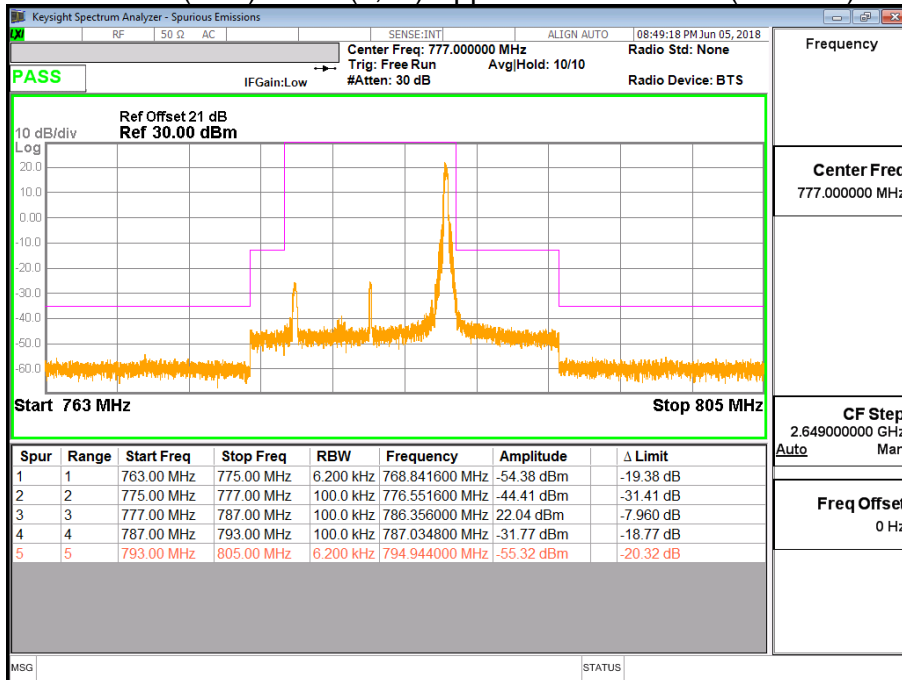


Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission At Antenna Terminals (+/-1MHz)		
Date of Test	2018/06/05	Test Site	CTR
Test Condition	Block Edge Test (Band 13 (10M))		

Band 13 (10M) QPSK(1,0) Lower Channel 23230 (782MHz)



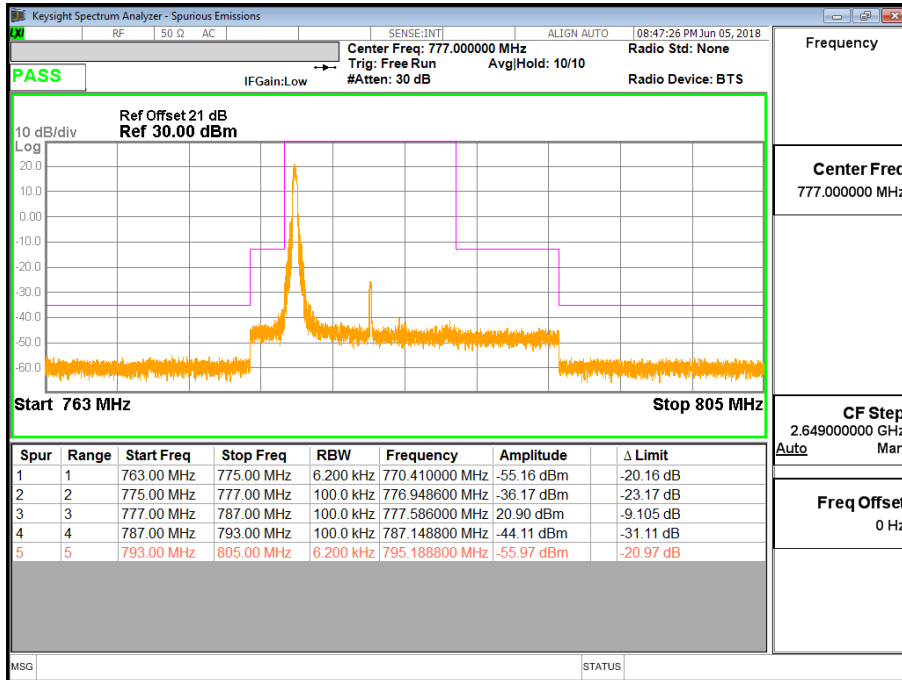
Band 13 (10M) QPSK(1,49) Upper Channel 23230 (782MHz)



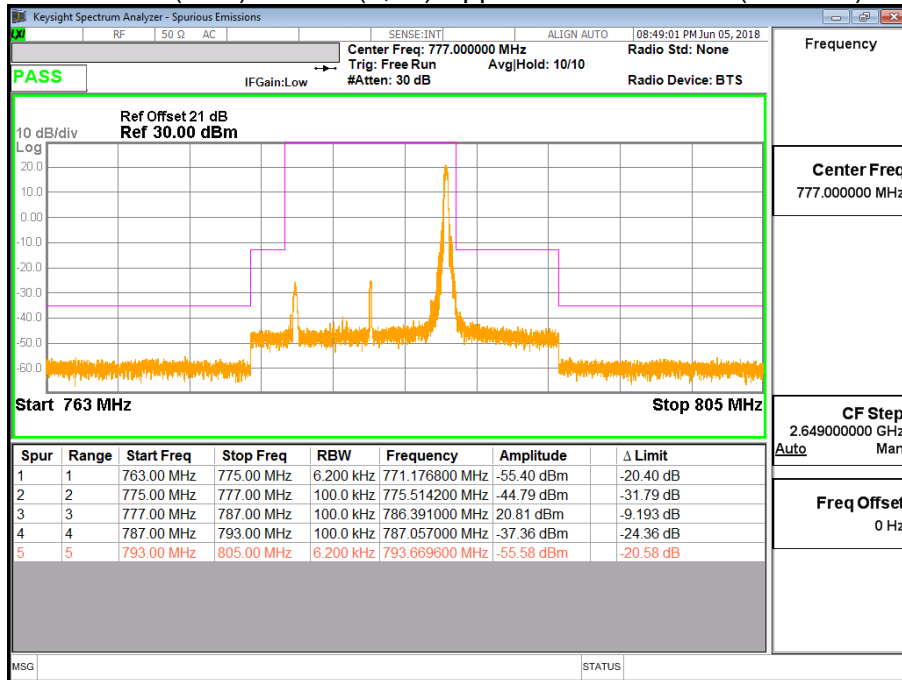
Band 13 (10M) QPSK(50,0) Channel 23230 (782MHz)



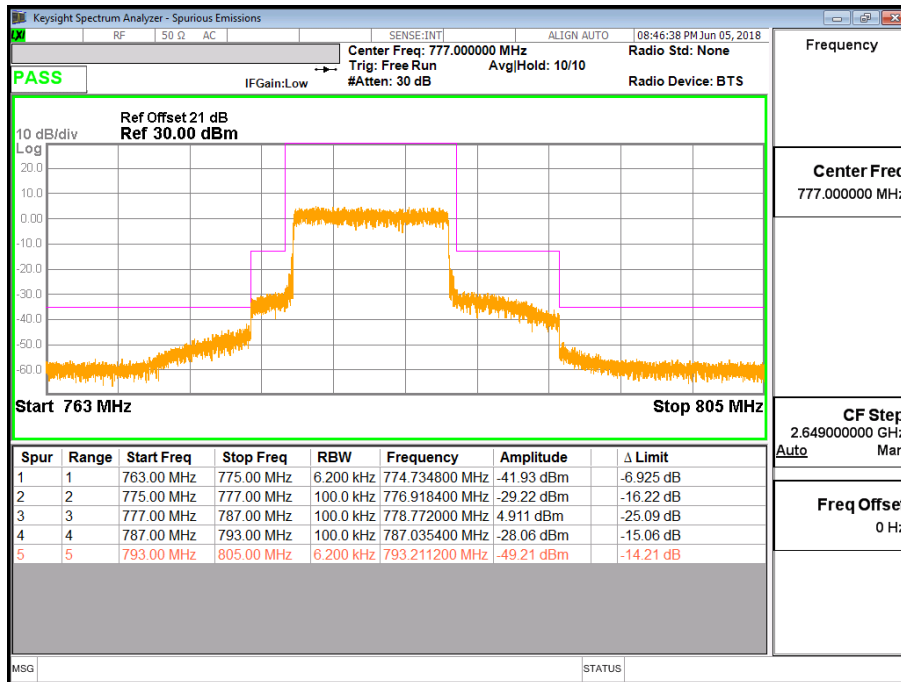
Band 13 (10M) 16QAM(1,0) Lower Channel 23230 (782MHz)



Band 13 (10M) 16QAM(1,49) Upper Channel 23230 (782MHz)



Band 13 (10M) 16QAM(50,0) Channel 23230 (782MHz)



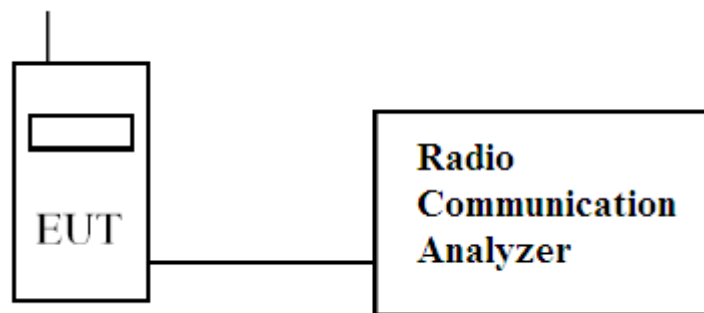
6. Spurious Emission

6.1. Test Specification

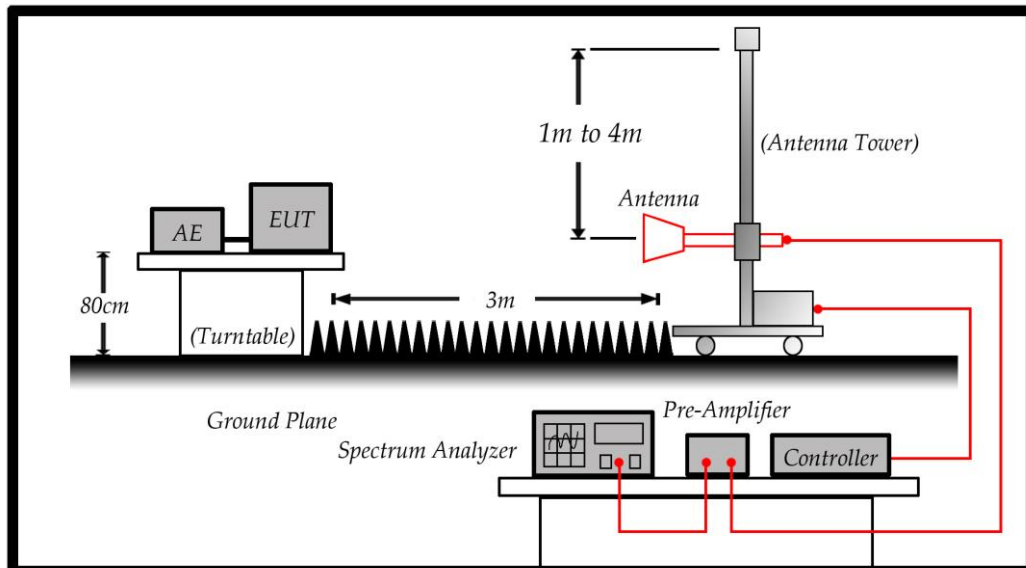
According to Part 2.1051, 2.1053, 27.53

6.2. Test Setup

6.2.1 Spurious emissions at antenna terminals.



6.2.2 Field strength of spurious radiation.



6.3. Limits

Limit	<-13dBm
--------------	-------------------

43 + 10Log(P) down on the carrier where P is the power in Watts.

6.4. Test Procedure

In accordance with Part 2.1051, 2.1053, 27.53, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 30MHz to 20GHz. The EUT was set to transmit on full power. The EUT was tested on Low, middle and High channels for both power levels. The resolution and video bandwidth was set to 1MHz/3MHz in accordance with Part 2.1051, 2.1053, 27.53. The spectrum analyzer detector was set to Max Hold. In addition, measurements were made up to the 10th harmonic of the fundamental. The device was then replaced with a substitution antenna, which input signal was adjusted until the received level matched that of the previously detected emission.

- (1) The EUT is tested with maximum rated TX power via the Base Station simulator.
- (2) The EUT is tested in three orthogonal planes, The worst case was showing in this report.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to TIA/EIA 603-E on radiated measurement.

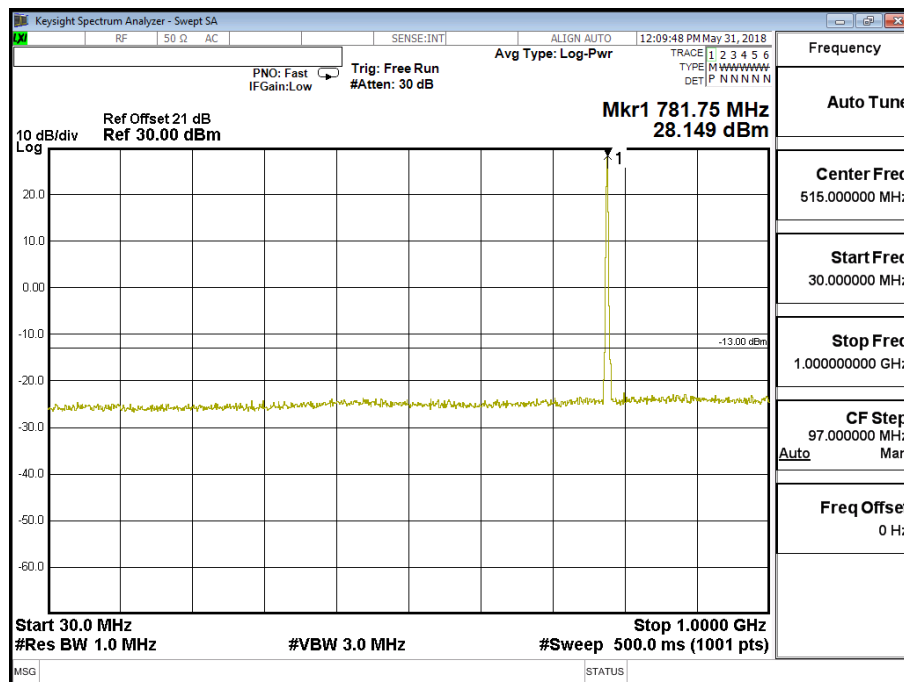
For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

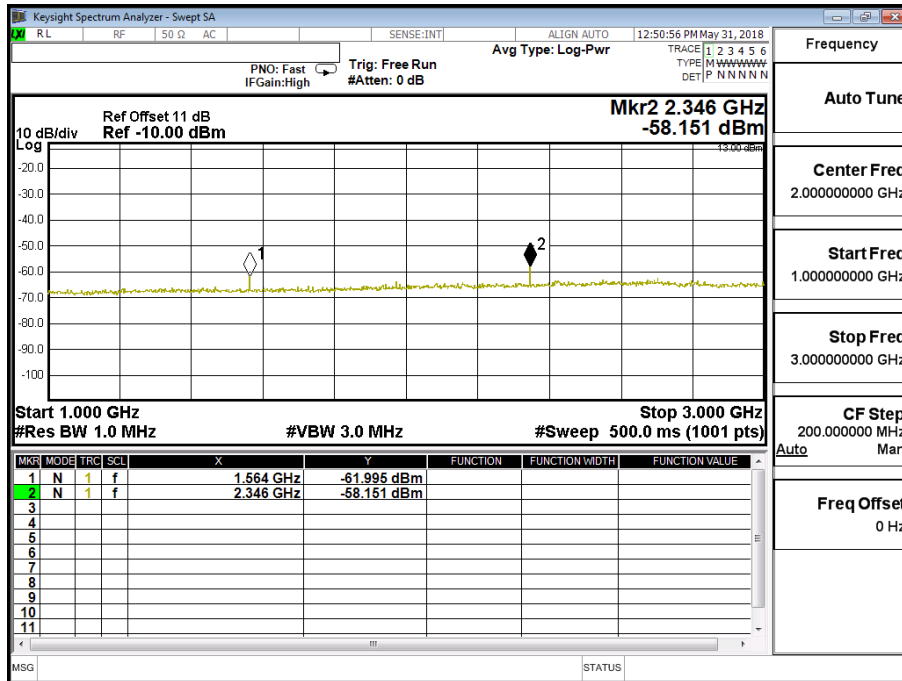
6.5. Test Result of Spurious Emission

Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2018/05/31	Test Site	CTR
Test Condition	LTE-Band 13 (5M)	Test Range	30MHz~10GHz

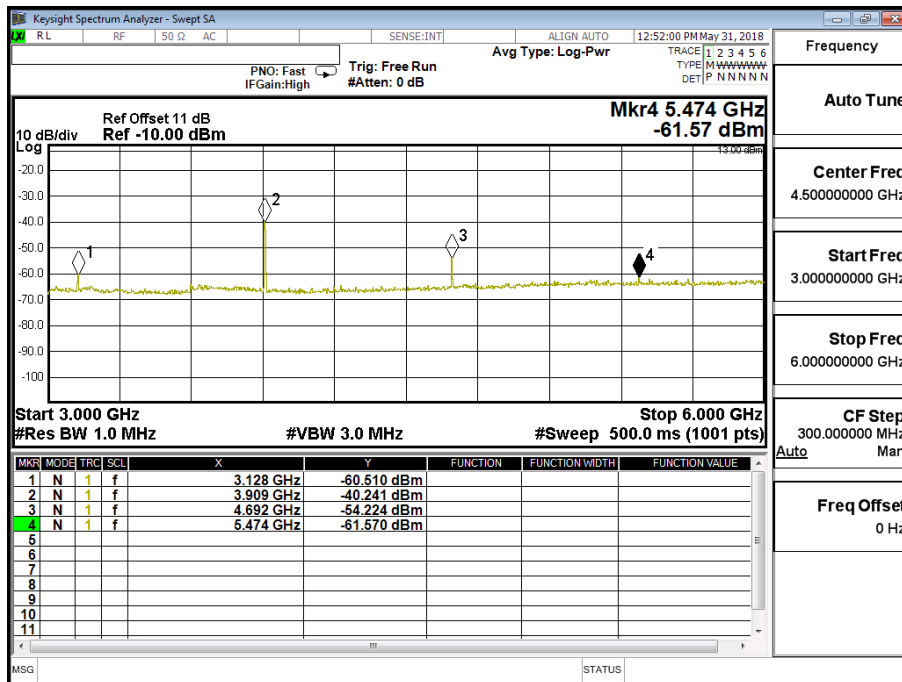
LTE-Band 13 (5M) QPSK(1,12) CH23230

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
1564	-61.995	0.58	-61.415	-13
2346	-58.151	0.70	-57.451	-13
3128	-60.510	1.01	-59.500	-13
3909	-40.241	1.18	-39.061	-13
4692	-54.224	1.23	-52.994	-13
5474	-61.570	1.45	-60.120	-13
6256	-63.493	1.56	-61.933	-13
7032	-63.610	1.59	-62.020	-13
7820	-66.216	1.82	-64.396	-13

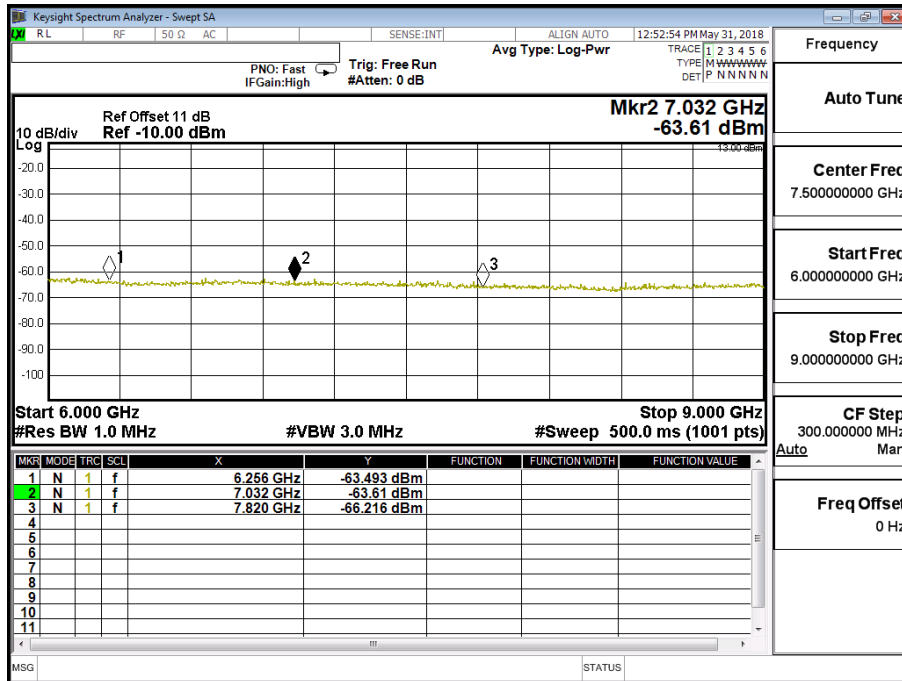




Frequency	Auto Tune
Center Freq	2.000000000 GHz
Start Freq	1.000000000 GHz
Stop Freq	3.000000000 GHz
CF Step	200.000000 MHz
Freq Offset	0 Hz



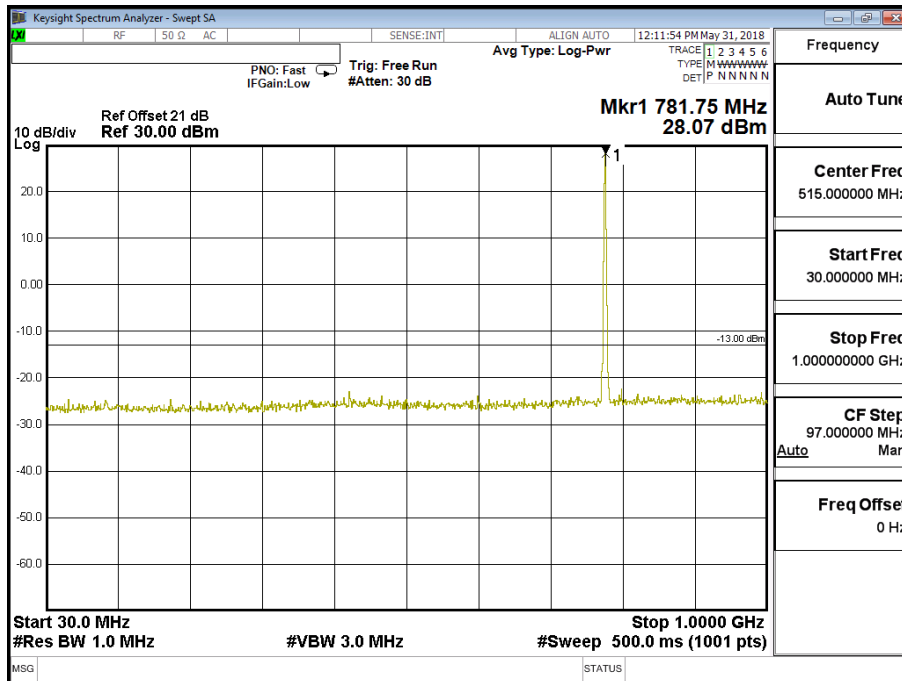
Frequency	Auto Tune
Center Freq	4.500000000 GHz
Start Freq	3.000000000 GHz
Stop Freq	6.000000000 GHz
CF Step	300.000000 MHz
Freq Offset	0 Hz

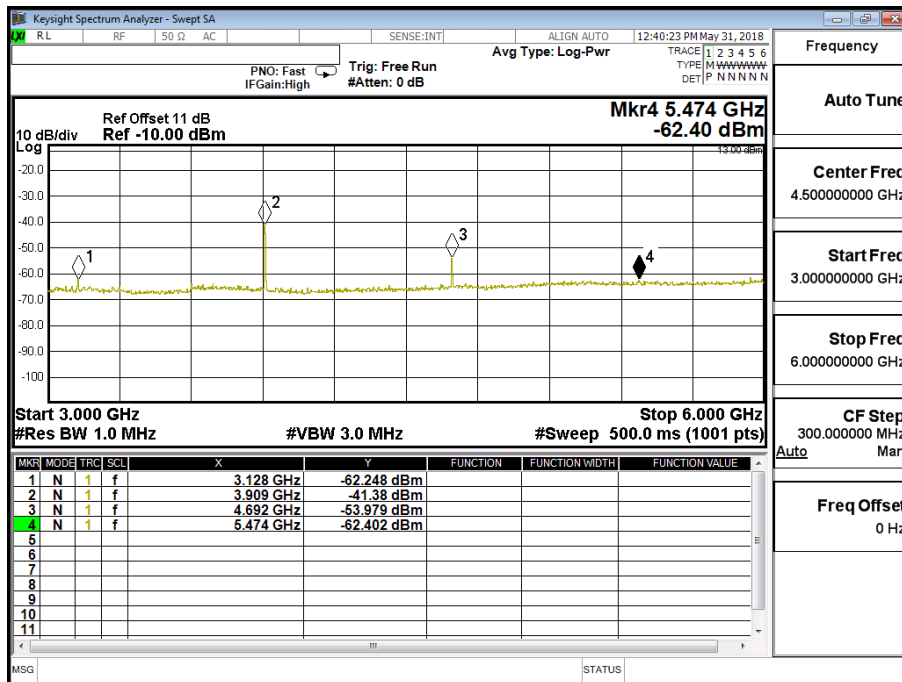
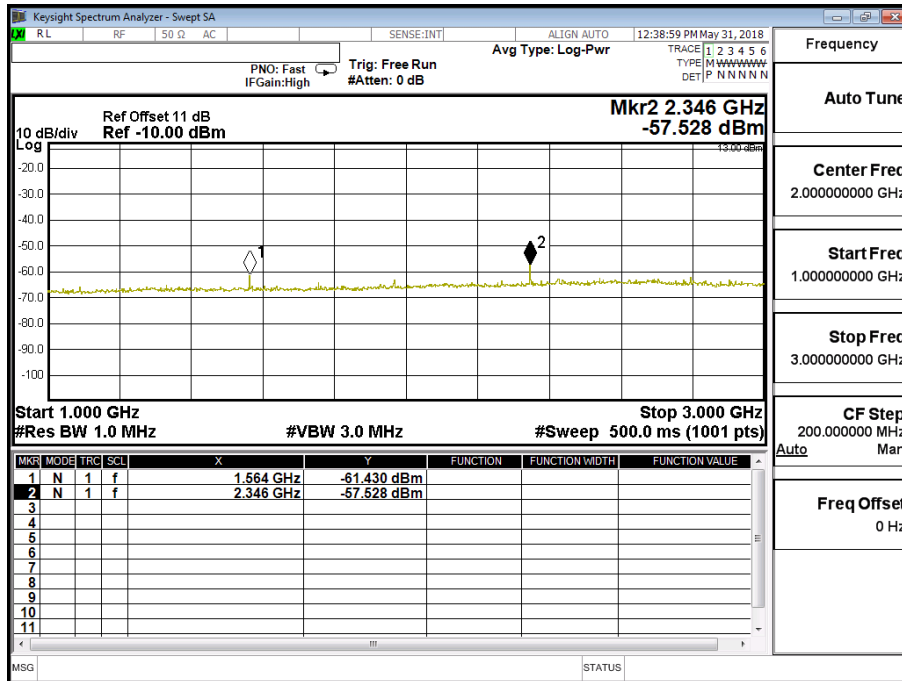


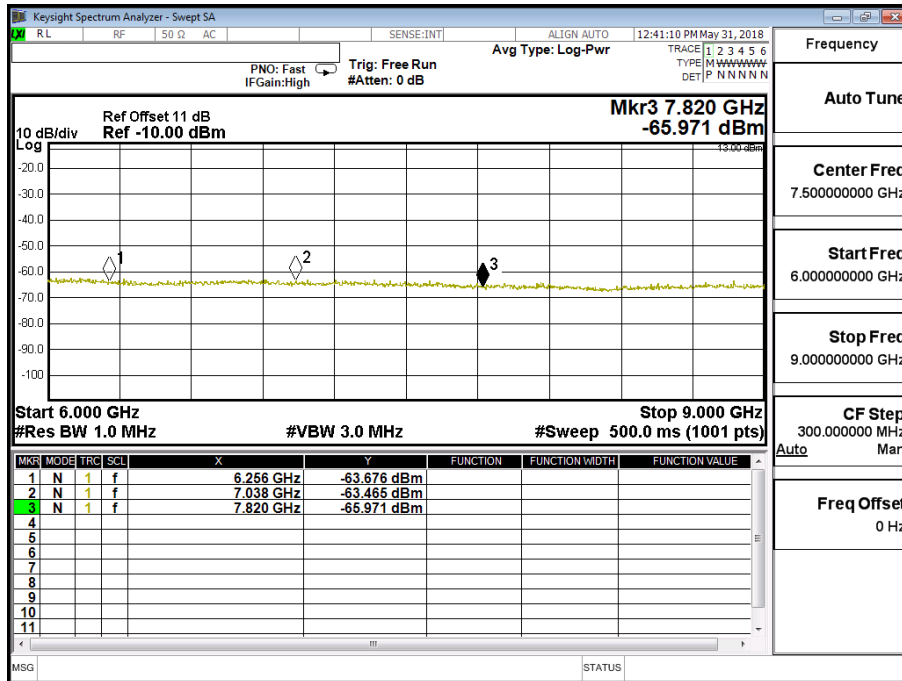
Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2018/05/31	Test Site	CTR
Test Condition	LTE-Band 13 (5M)	Test Range	30MHz~10GHz

LTE-Band 13 (5M) 16QAM(1,12) CH23230

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
1564	-61.430	0.58	-60.850	-13
2346	-57.528	0.70	-56.828	-13
3128	-62.248	1.01	-61.238	-13
3909	-41.380	1.18	-40.200	-13
4692	-53.979	1.23	-52.749	-13
5474	-62.402	1.45	-60.952	-13
6256	-63.676	1.56	-62.116	-13
7038	-63.465	1.59	-61.875	-13
7820	-65.971	1.82	-64.151	-13



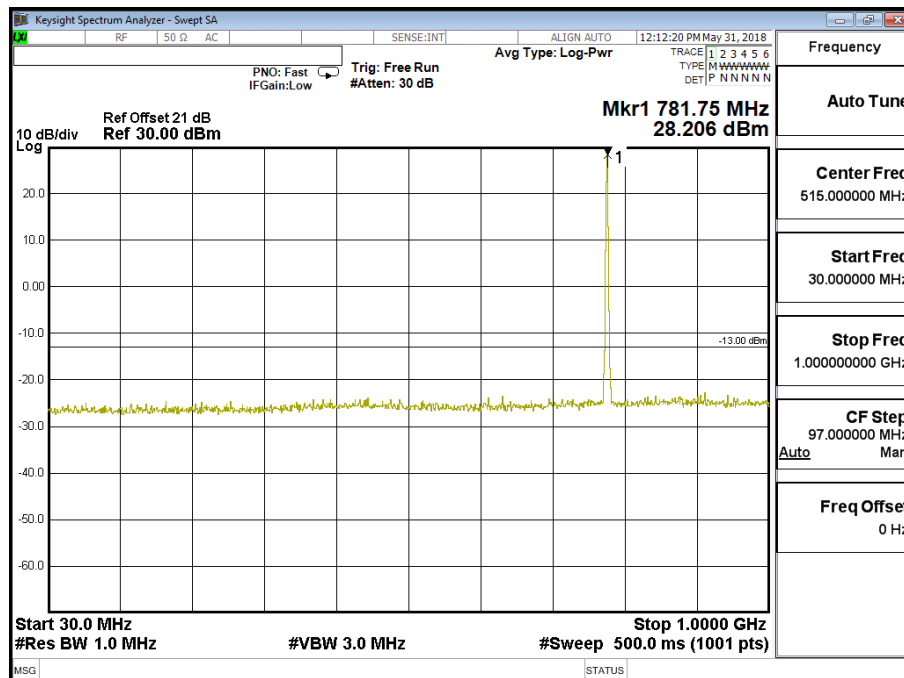


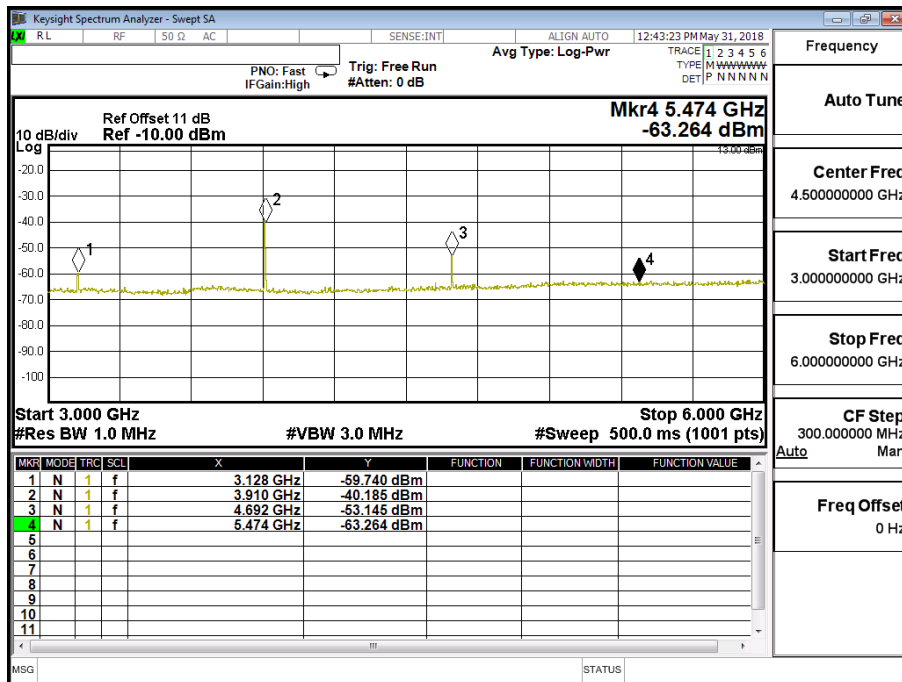
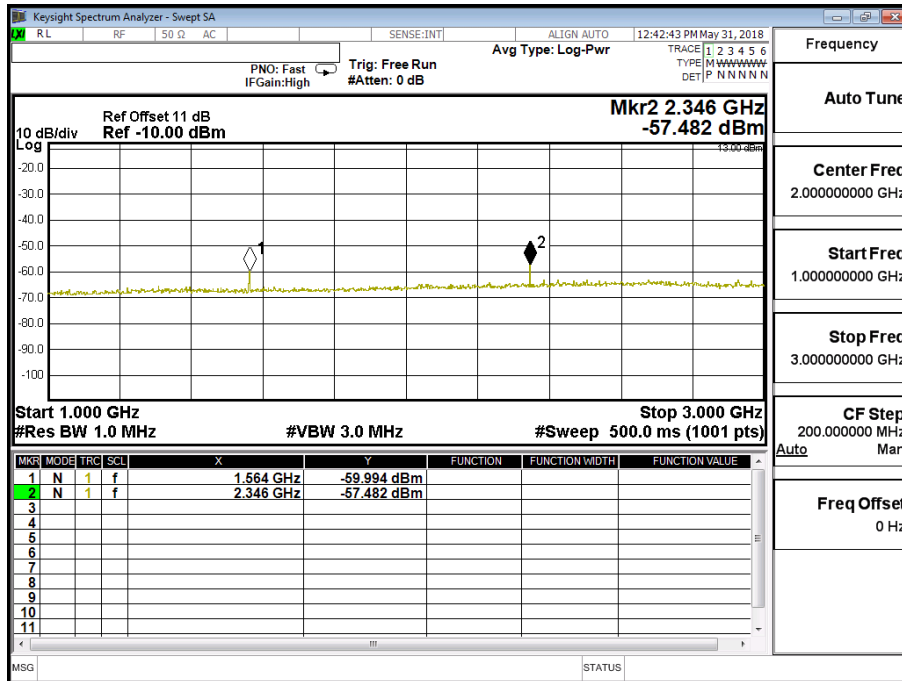


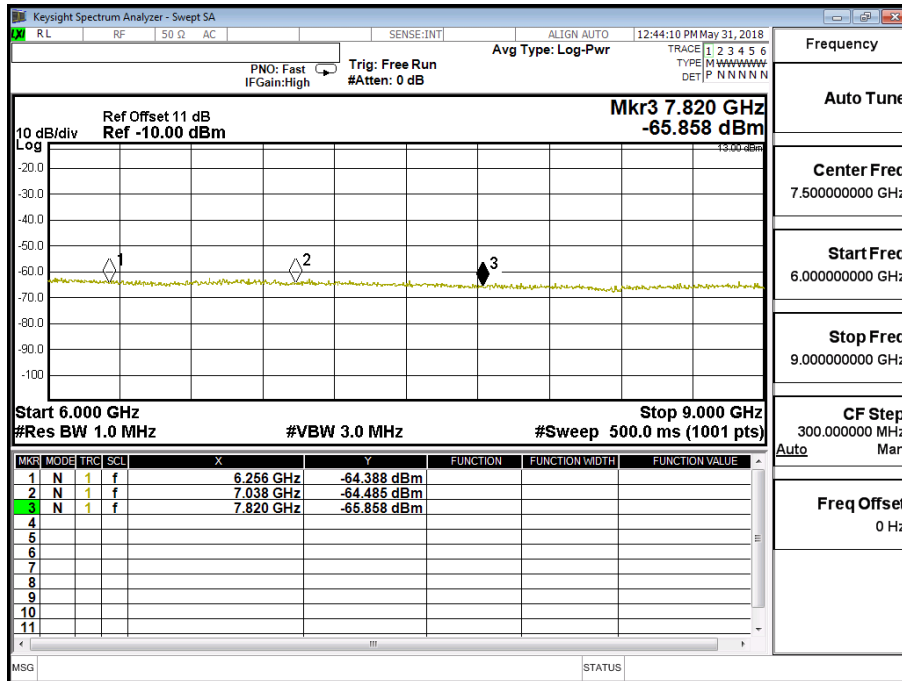
Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2018/05/31	Test Site	CTR
Test Condition	LTE-Band 13 (10M)	Test Range	30MHz~10GHz

LTE-Band 13 (10M) QPSK(1,24) CH23230

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
1564	-59.994	0.58	-59.414	-13
2346	-57.482	0.70	-56.782	-13
3128	-59.740	1.01	-58.730	-13
3910	-40.185	1.18	-39.005	-13
4692	-53.145	1.23	-51.915	-13
5474	-63.264	1.45	-61.814	-13
6256	-64.388	1.56	-62.828	-13
7038	-64.485	1.59	-62.895	-13
7820	-65.858	1.82	-64.038	-13



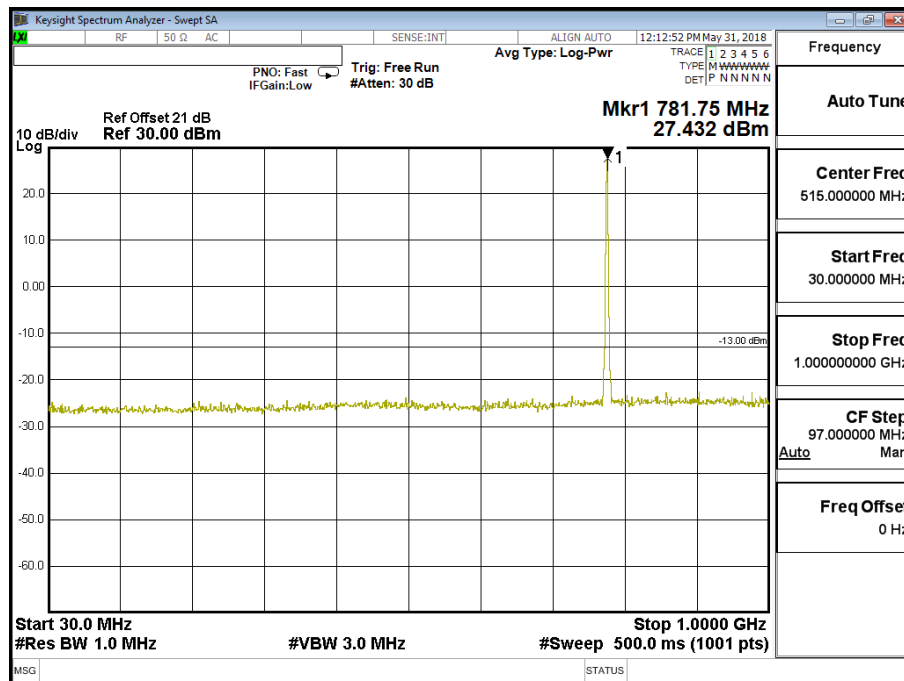


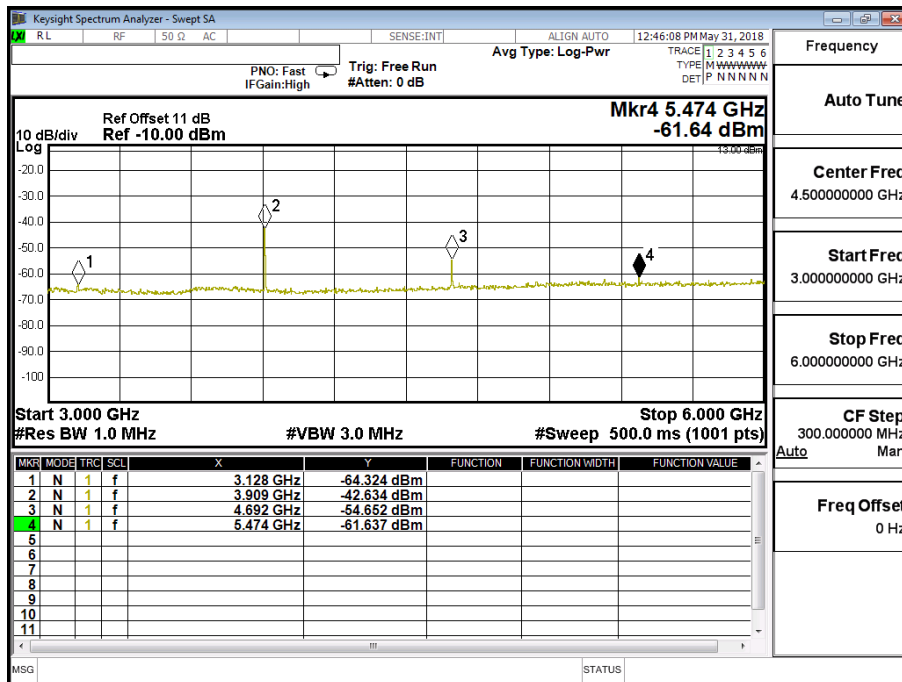
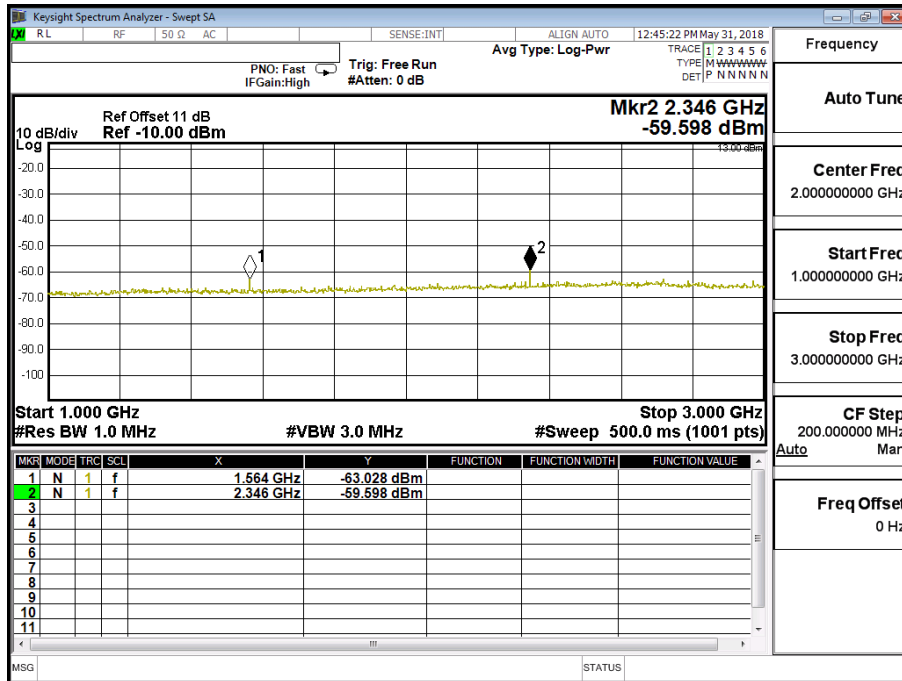


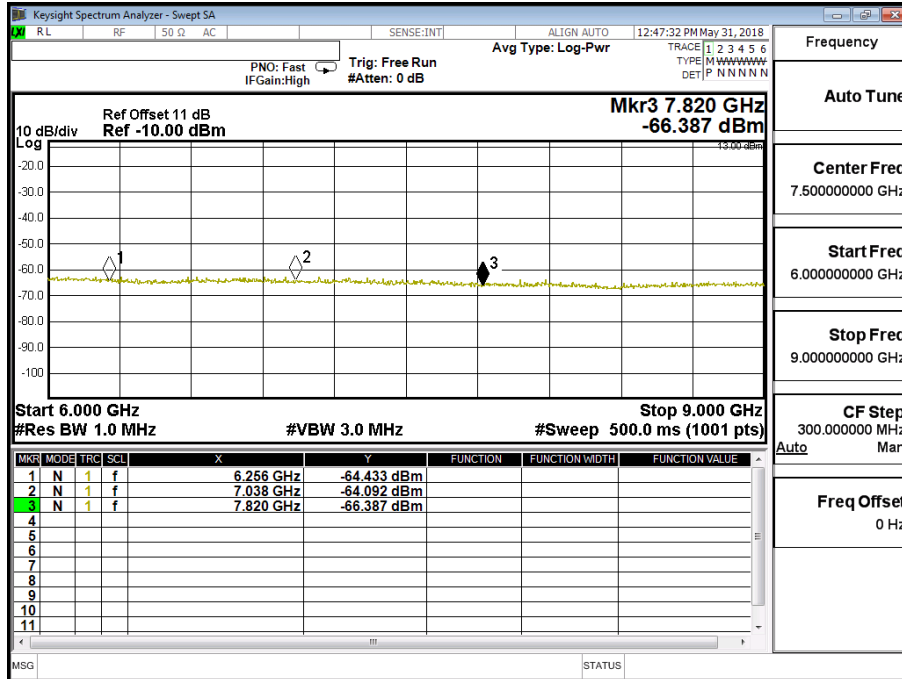
Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2018/05/31	Test Site	CTR
Test Condition	LTE-Band 13 (10M)	Test Range	30MHz~10GHz

LTE-Band 13 (10M) 16QAM(1,24) CH23230

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
1564	-63.028	0.58	-62.448	-13
2346	-59.598	0.70	-58.898	-13
3128	-64.324	1.01	-63.314	-13
3909	-42.634	1.18	-41.454	-13
4692	-54.652	1.23	-53.422	-13
5474	-61.637	1.45	-60.187	-13
6256	-64.433	1.56	-62.873	-13
7038	-64.092	1.59	-62.502	-13
7820	-66.387	1.82	-64.567	-13







Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission (Radiated)		
Date of Test	2018/05/30	Test Site	Site3
Test Condition	Band 13 (5M) QPSK(1,12)	Test Range	9KHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 13 (5M) QPSK(1,12)

1564	-58.089	-62.553	1.630	9.800	-54.383	-40
2346	-61.334	-61.540	2.100	10.600	-53.040	-13
3128	-59.860	-60.924	2.350	12.300	-50.974	-13
3910	-47.186	-47.254	2.700	12.600	-37.354	-13
4692	-63.030	-59.687	2.830	12.700	-49.817	-13
5474	-63.344	-59.194	3.200	13.000	-49.394	-13

Vertical Emissions Band 13 (5M) QPSK(1,12)

1564	-56.904	-60.651	1.630	9.800	-52.481	-40
2346	-64.261	-63.870	2.100	10.600	-55.370	-13
3128	-59.653	-59.729	2.350	12.300	-49.779	-13
3910	-56.580	-54.674	2.700	12.600	-44.774	-13
4692	-62.747	-58.688	2.830	12.700	-48.818	-13
5474	-63.823	-59.298	3.200	13.000	-49.498	-13

Note:

1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 6 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

Product	4G/LTE Broadband Router with PoE		
Test Mode	Spurious Emission (Radiated)		
Date of Test	2018/05/30	Test Site	Site3
Test Condition	Band 13 (10M) QPSK(1,24)	Test Range	9KHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 13 (10M) QPSK(1,24)

1564	-58.351	-62.771	1.630	9.800	-54.601	-40
2346	-61.379	-61.585	2.100	10.600	-53.085	-13
3128	-60.027	-61.091	2.350	12.300	-51.141	-13
3910	-47.107	-47.257	2.700	12.600	-37.357	-13
4692	-63.131	-59.789	2.830	12.700	-49.919	-13
5474	-63.277	-59.127	3.200	13.000	-49.327	-13

Vertical Emissions Band 13 (10M) QPSK(1,24)

1564	-58.153	-61.900	1.630	9.800	-53.730	-40
2346	-63.068	-62.677	2.100	10.600	-54.177	-13
3128	-59.665	-59.741	2.350	12.300	-49.791	-13
3910	-57.410	-55.526	2.700	12.600	-45.626	-13
4692	-63.377	-59.318	2.830	12.700	-49.448	-13
5474	-63.423	-58.898	3.200	13.000	-49.098	-13

Note:

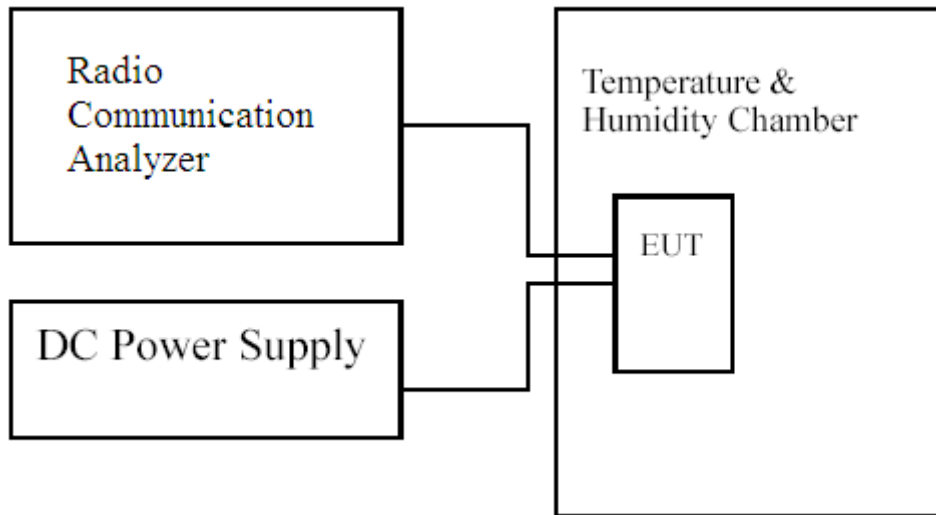
1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 6 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

7. Frequency Stability Under Temperature & Voltage Variations

7.1. Test Specification

According to Part 2.1055, 27.54

7.2. Test Setup



7.3. Limits

Limit	<±2.5ppm
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7.4. Test Procedure

The frequency stability of transmitter is measured by:

- (a) Temperature: The temperature is varied from -30 °C to 50 °C in 10 °C increment using a standard temperature & Humidity chamber.
- (b) Primary Supply Voltage: The primary supply voltage is varied 85% to 115% of the nominal value for non hand-carried equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating endpoint which shall be specified by the manufacturer.

The EUT was connected via the base station simulator. Universal Radio Communication Tester, (MT8820C), was used to measure The Frequency Error. The maximum result of measurements was recorded.

7.5. Test Result of Frequency Stability Under Temperature Variations

Product	4G/LTE Broadband Router with PoE		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2018/06/01	Test Site	CTR
Test Condition	Band 13 (5M) CH23230(782MHz)-QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	0.782	0.0084	±1.96
-20	0.782	0.0038	±1.96
-10	0.782	-0.0048	±1.96
0	0.782	-0.0044	±1.96
10	0.782	-0.0044	±1.96
20	0.782	0.0046	±1.96
30	0.782	-0.0045	±1.96
40	0.782	-0.0039	±1.96
50	0.782	-0.0048	±1.96

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	0.782	0.0063	±1.96
120	0.782	0.0046	±1.96
102	0.782	0.0042	±1.96

Product	4G/LTE Broadband Router with PoE		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2018/06/01	Test Site	CTR
Test Condition	Band 13 (5M) CH23230(782MHz)-16QAM	Test Range	-30°C~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	0.782	0.0063	±1.96
-20	0.782	0.0045	±1.96
-10	0.782	-0.0061	±1.96
0	0.782	0.0039	±1.96
10	0.782	-0.0068	±1.96
20	0.782	0.0031	±1.96
30	0.782	-0.0036	±1.96
40	0.782	-0.0035	±1.96
50	0.782	-0.0049	±1.96

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	0.782	0.0035	±1.96
120	0.782	0.0031	±1.96
102	0.782	-0.0037	±1.96

Product	4G/LTE Broadband Router with PoE		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2018/06/01	Test Site	CTR
Test Condition	Band 13 (10M) CH23230(782MHz)-QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	0.782	0.0051	±1.96
-20	0.782	0.0060	±1.96
-10	0.782	0.0037	±1.96
0	0.782	-0.0037	±1.96
10	0.782	-0.0041	±1.96
20	0.782	-0.0047	±1.96
30	0.782	-0.0037	±1.96
40	0.782	-0.0034	±1.96
50	0.782	-0.0032	±1.96

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	0.782	0.0033	±1.96
120	0.782	-0.0047	±1.96
102	0.782	-0.0039	±1.96

Product	4G/LTE Broadband Router with PoE		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2018/06/01	Test Site	CTR
Test Condition	Band 13 (10M) CH23230(782MHz)-16QAM	Test Range	-30°C~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	0.782	0.0046	±1.96
-20	0.782	0.0059	±1.96
-10	0.782	-0.0039	±1.96
0	0.782	-0.0041	±1.96
10	0.782	-0.0032	±1.96
20	0.782	-0.0037	±1.96
30	0.782	-0.0047	±1.96
40	0.782	-0.0040	±1.96
50	0.782	-0.0039	±1.96

Voltage Variations

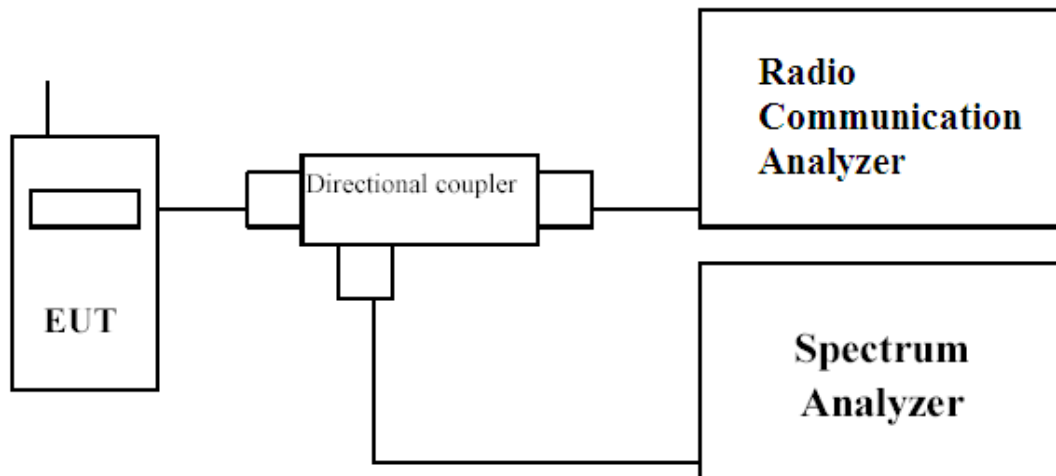
AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	0.782	0.0053	±1.96
120	0.782	-0.0037	±1.96
102	0.782	-0.0043	±1.96

8. Peak to Average Ratio

8.1 Test Specification

According to Part 27.50(a)

8.2 Test Setup



8.3 Limits

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure.

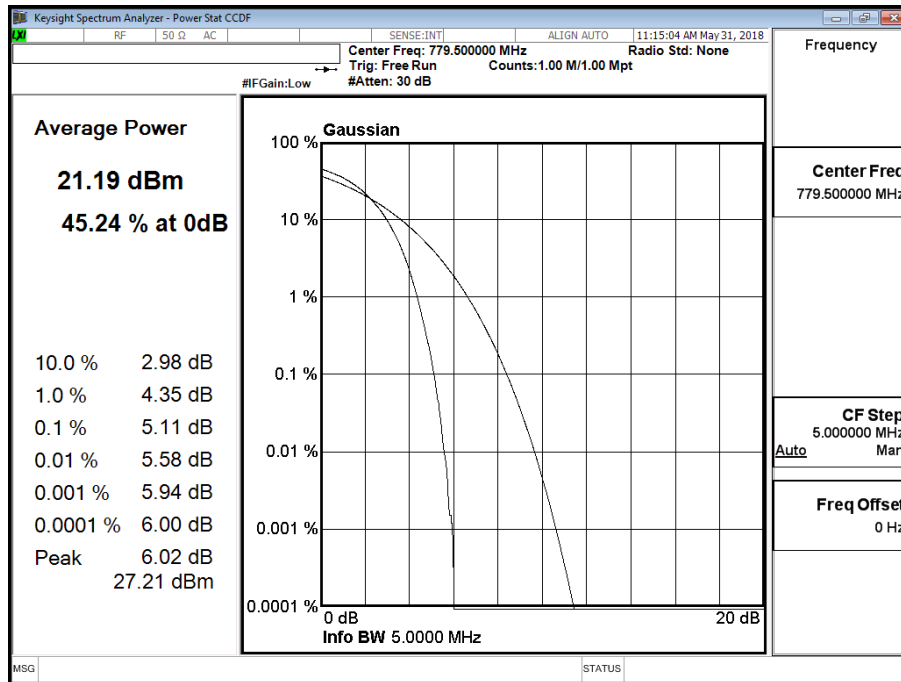
8.4 Test Procedure

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Set the measurement interval as follows:
 - 1) for continuous transmissions, set to 1 ms,
 - 2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
- e) Record the maximum PAPR level associated with a probability of 0.1%.

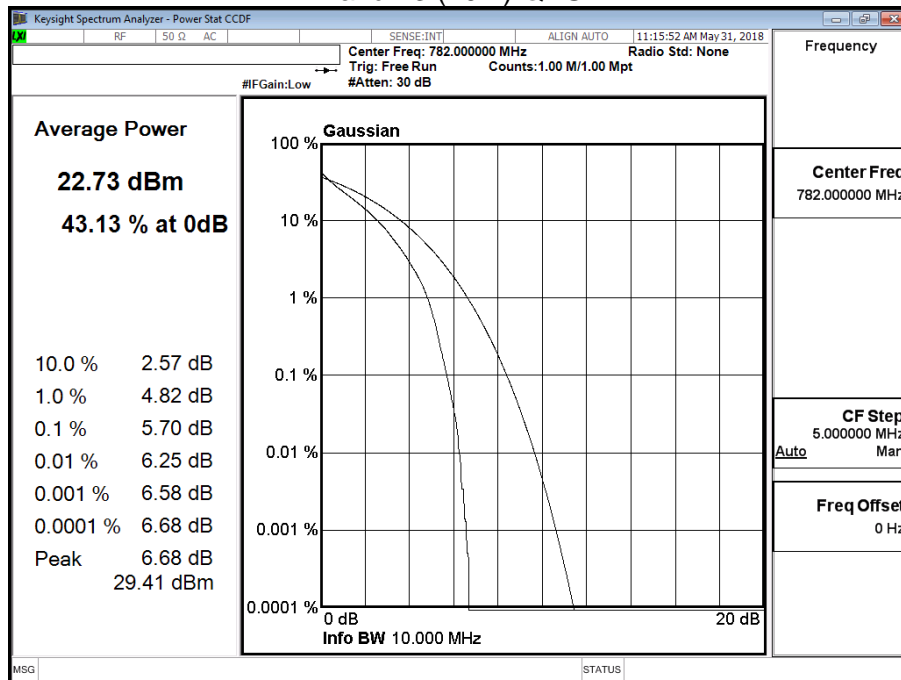
8.5 Test Result of Spurious Emission

Product	4G/LTE Broadband Router with PoE		
Test Mode	Peak to Average Ratio		
Date of Test	2018/06/01	Test Site	CTR
Test Condition	LTE-Band 13		

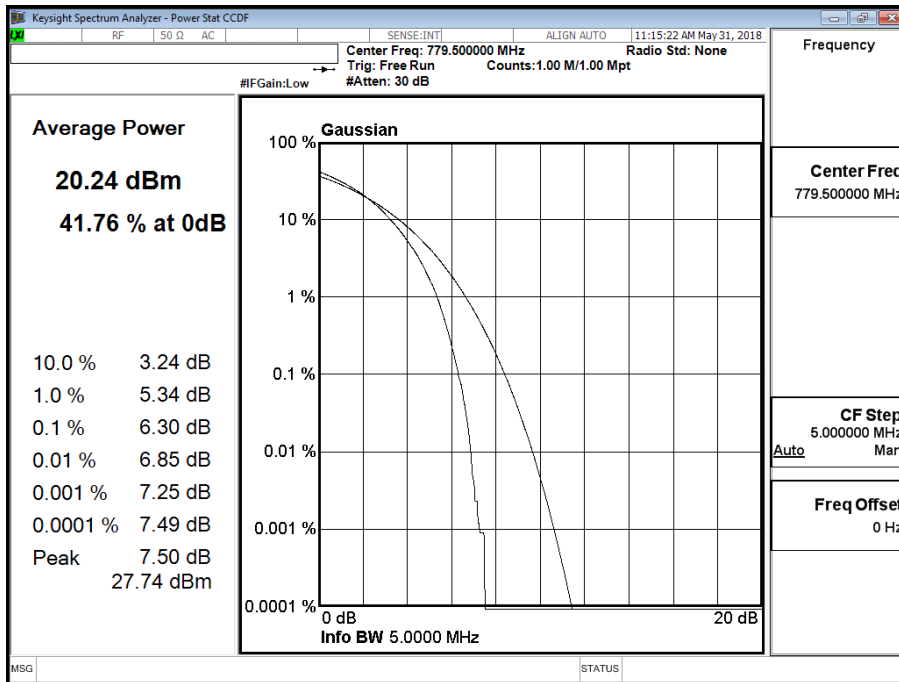
Band 13 (5M) QPSK



Band 13 (10M) QPSK



Band 13 (5M) 16QAM



Band 13 (10M) 16QAM

