

6.7 Emission Mask

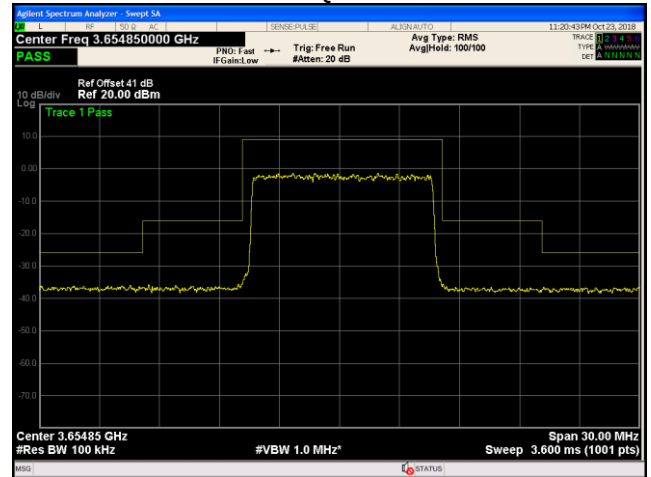
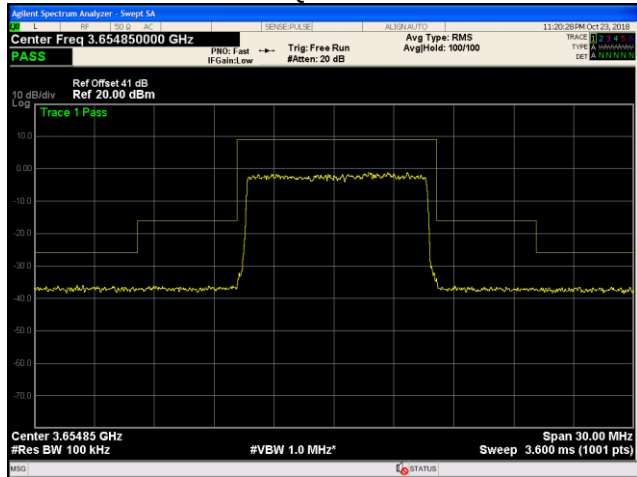
Test Requirement:	FCC part 90.210(b)
Test Method	C63.26-2015
Limit:	Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows: (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB. (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB. (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.
Test Procedure:	1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 RBW=100kHz, VBW=1MHz, Detector mode= RMS, Trace mode: Power averaging over 100 sweeps
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	PASS

Test plots as below:

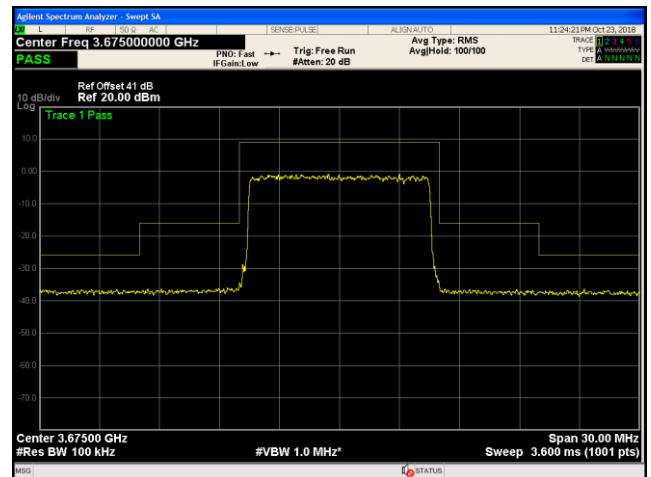
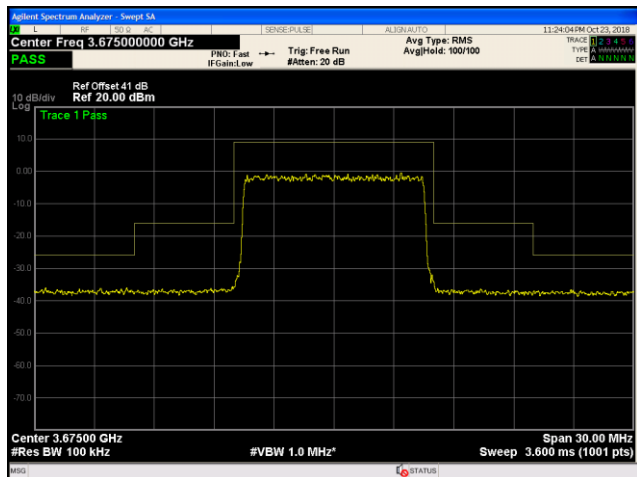
10MHz bandwidth-ANT 1

QPKS

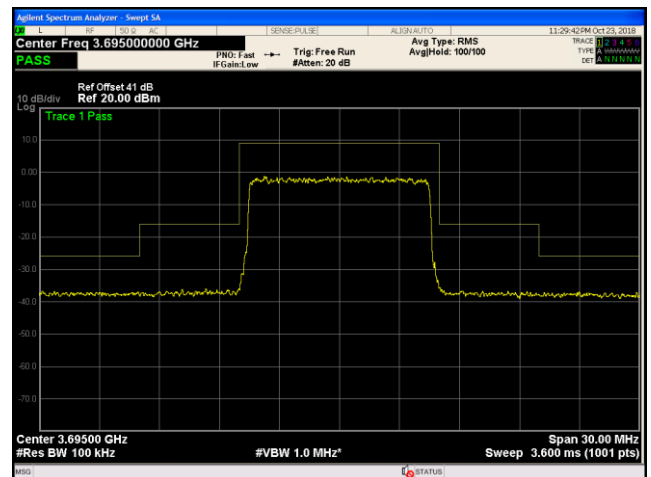
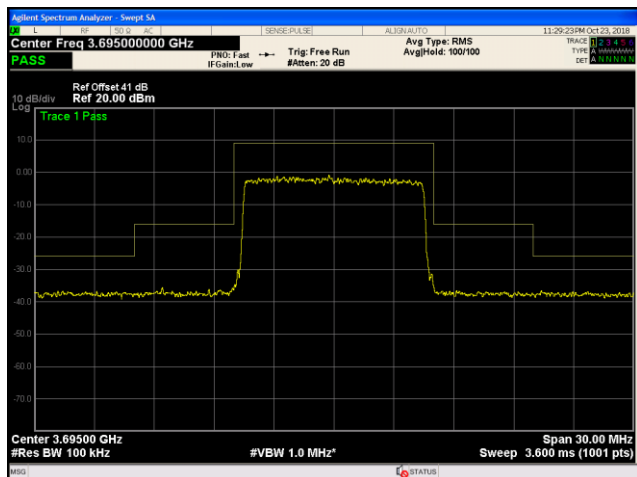
64QAM



Lowest channel



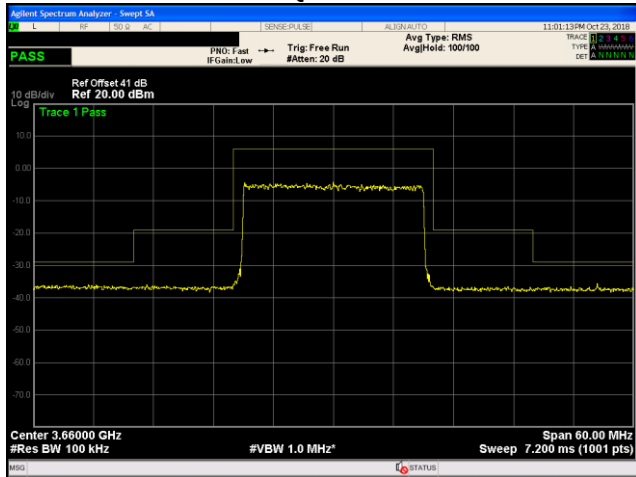
Middle channel



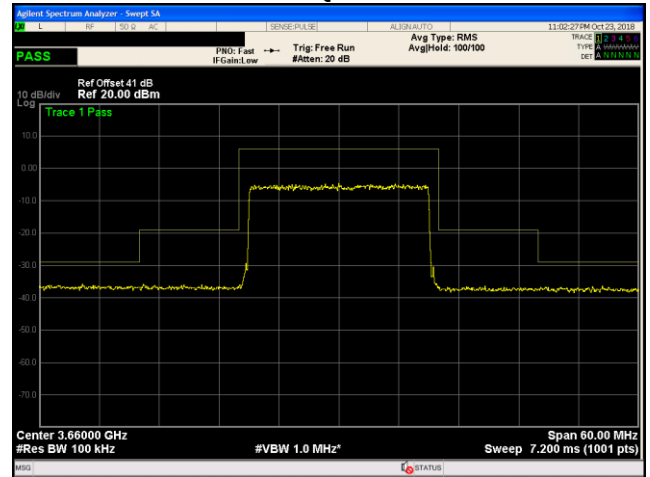
Highest channel

20MHz bandwidth-ANT 1

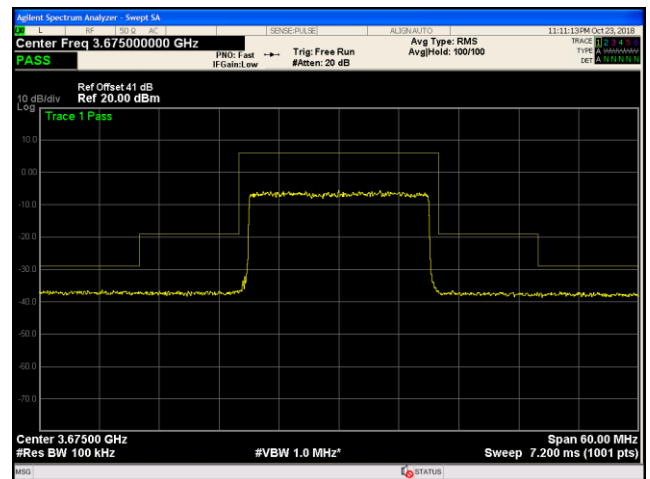
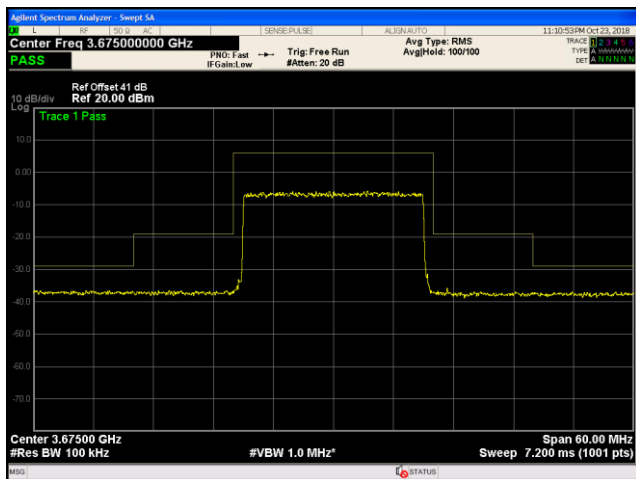
QPKS



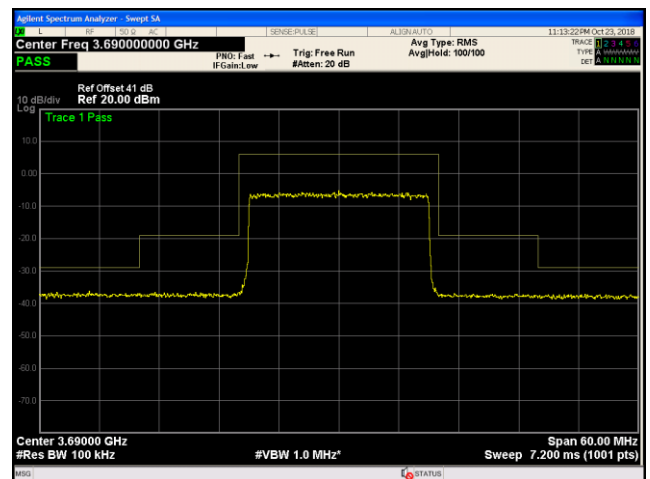
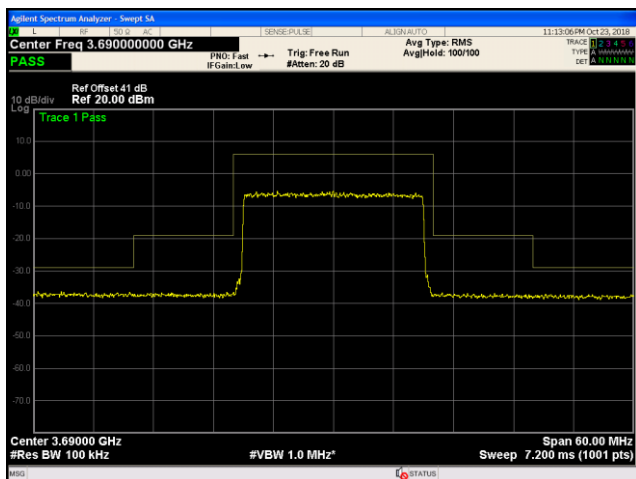
64QAM



Lowest channel



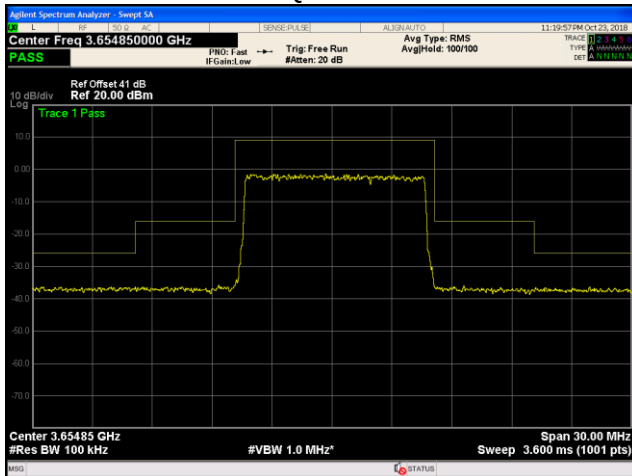
Middle channel



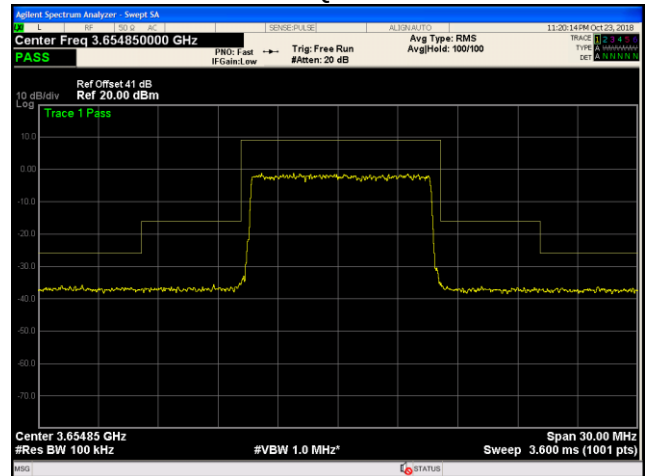
Highest channel

10MHz bandwidth-ANT 2

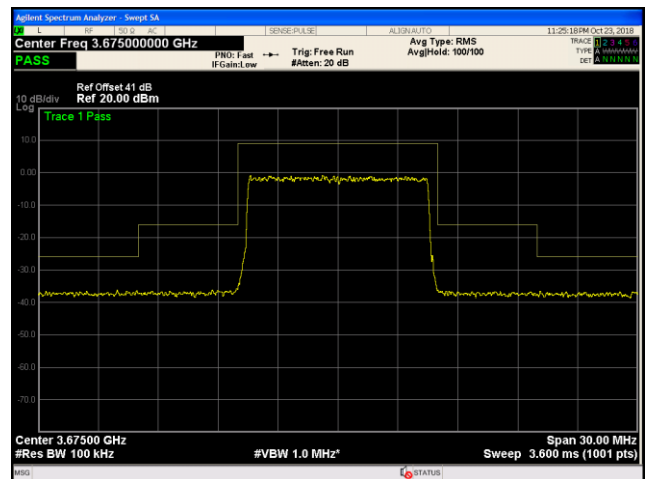
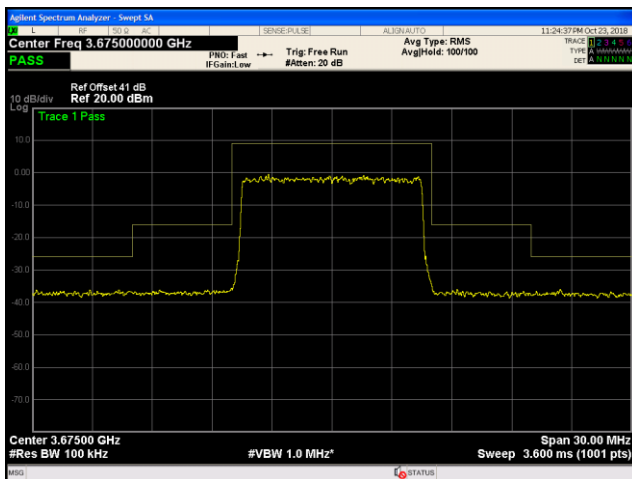
QPKS



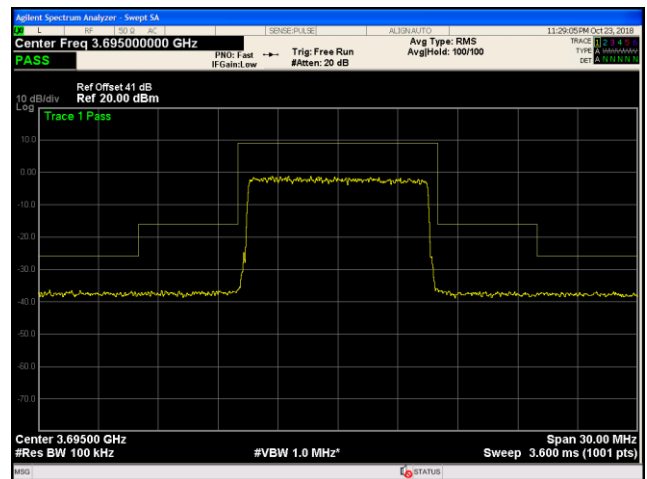
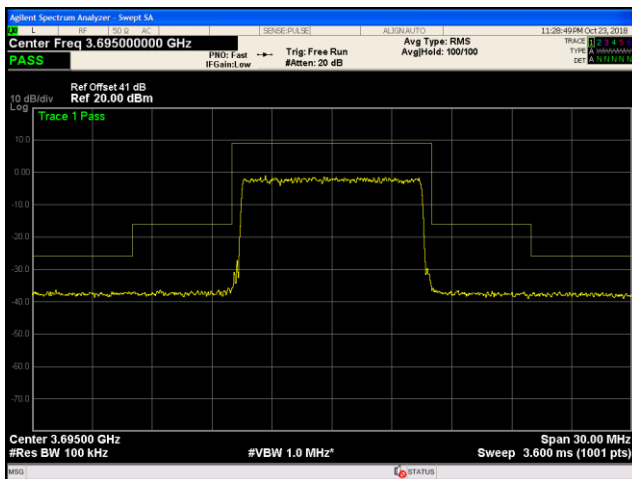
64QAM



Lowest channel



Middle channel

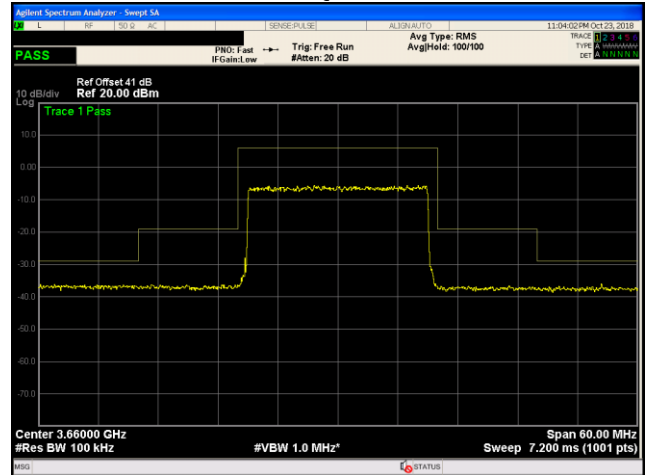
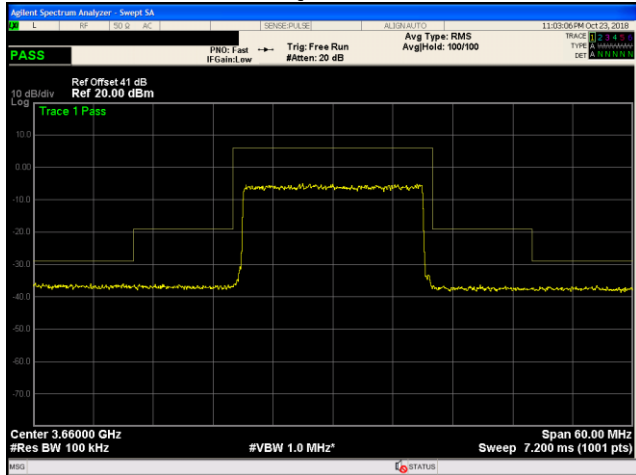


Highest channel

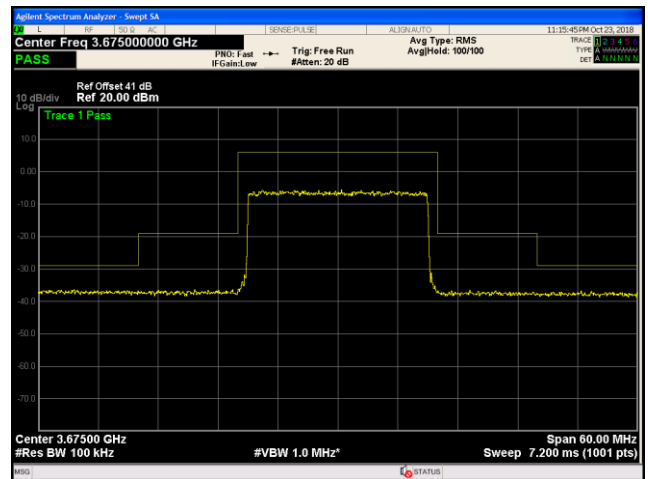
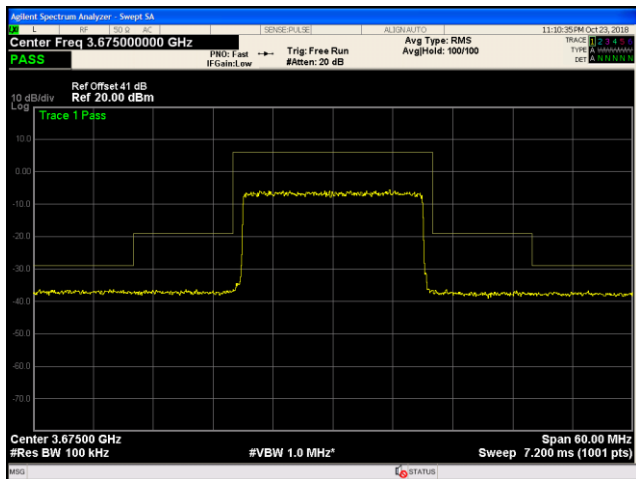
20MHz bandwidth-ANT 2

QPKS

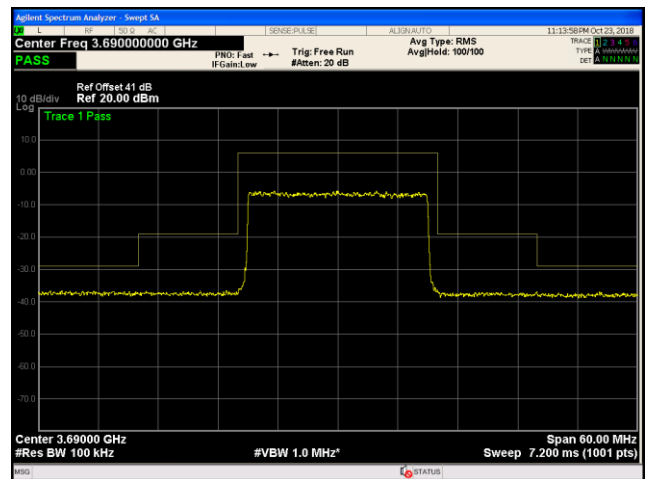
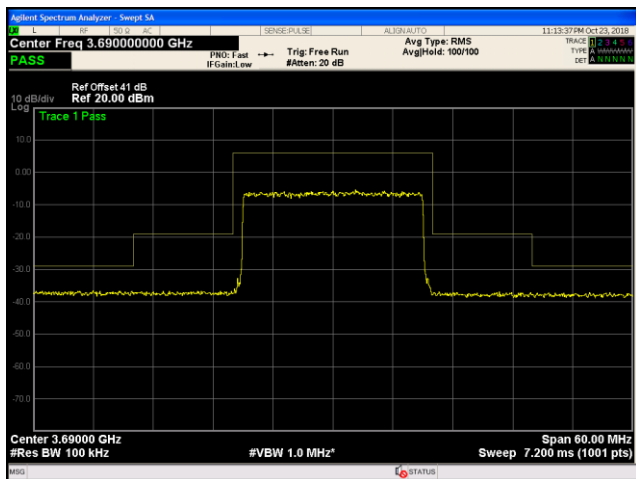
64QAM



Lowest channel



Middle channel



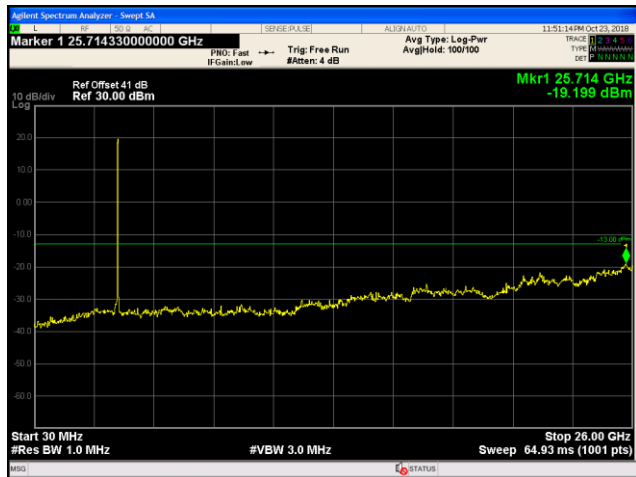
Highest channel

6.8 Out of band emission at antenna terminals

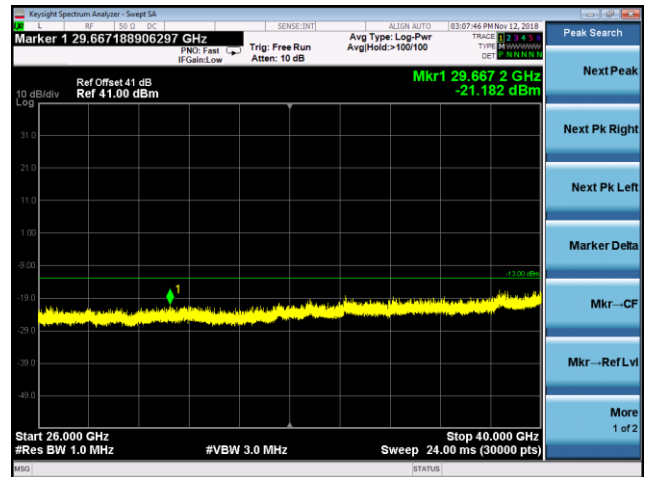
Test Requirement:	FCC part90.1323
Test Method:	FCC part2.1051 and C63.26-2015
Limit:	-13dBm
Test Procedure:	1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 The resolution bandwidth of the spectrum analyzer was set at 100 kHz when below 1GHz, 1MHz when above 1 GHz; sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic. 3 For the out of band: RBW =1 MHz, VBW=3 MHz, Start=30MHz, Stop= 10th harmonic. 4 Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	1. During the test, pre-scan the QPSK, 64QAM modulation, and found the QPSK modulation(10MHz/20MHz middle channel) is the worst case. 2. The emission evaluation for MIMO mode is exempted because all the emissions on SISO mode are lower (at least) by 3.0dB than the limit masks.

Test plots as follows (worst case):
Spurious emission

LTE band 43(10 MHz 64QAM)- ANT 1 Lowest channel

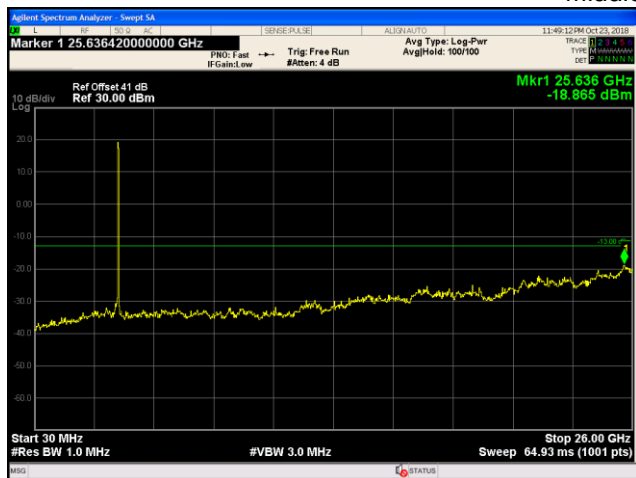


30MHz~26GHz



26GHz~40GHz

Middle channel

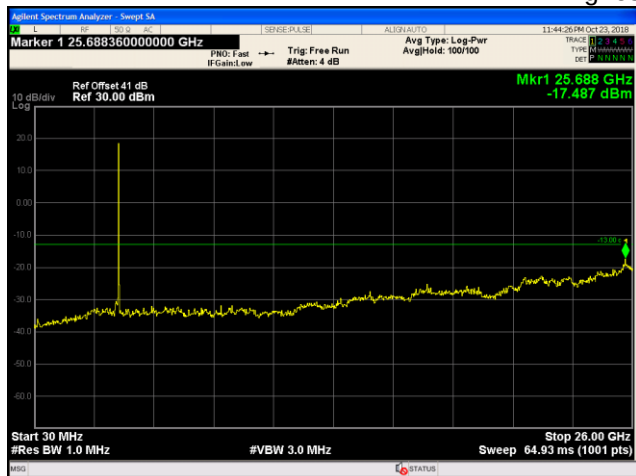


30MHz~26GHz

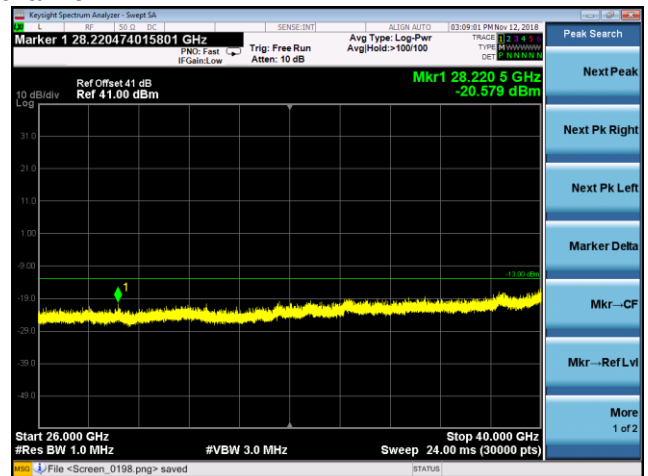


26GHz~40GHz

Highest channel

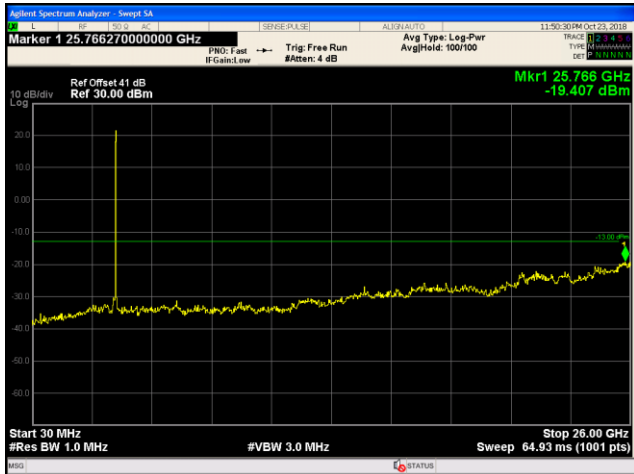


30MHz~26GHz

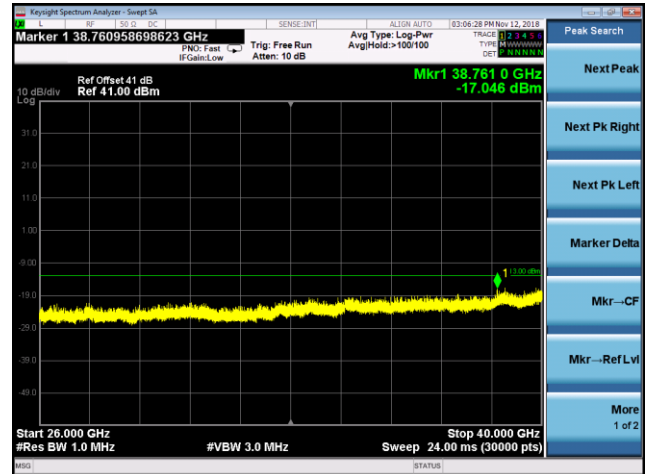


26GHz~40GHz

LTE band 43(10 MHz QPSK)-ANT 1 Lowest channel

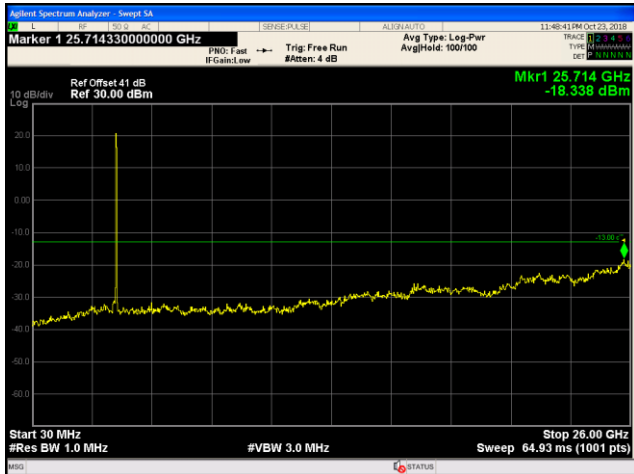


30MHz~26GHz

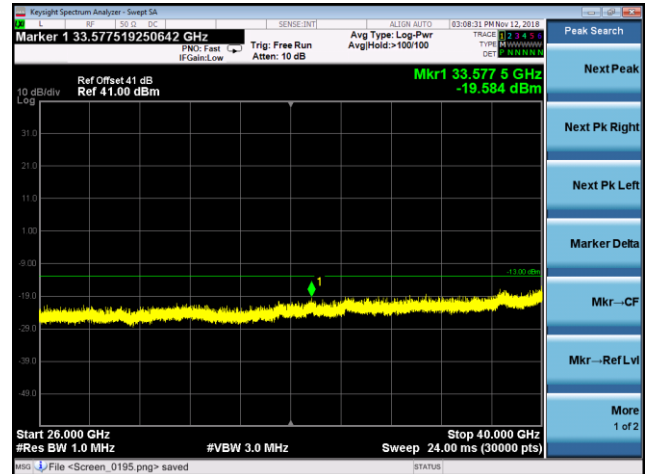


26GHz~40GHz

Middle channel

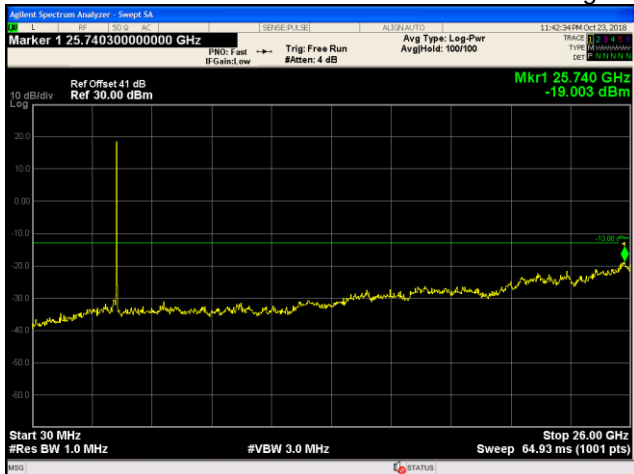


30MHz~26GHz

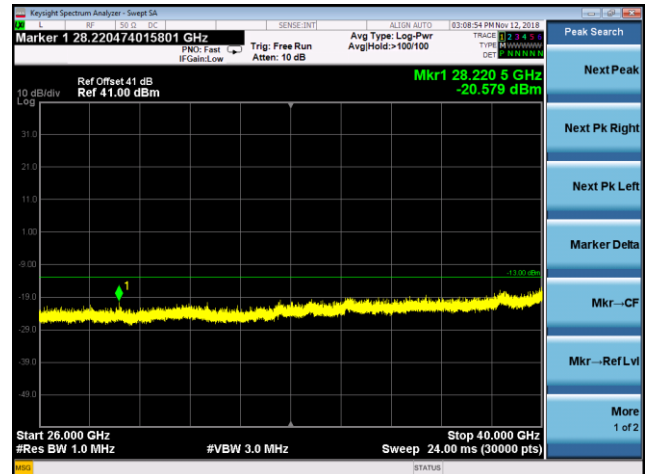


26GHz~40GHz

Highest channel

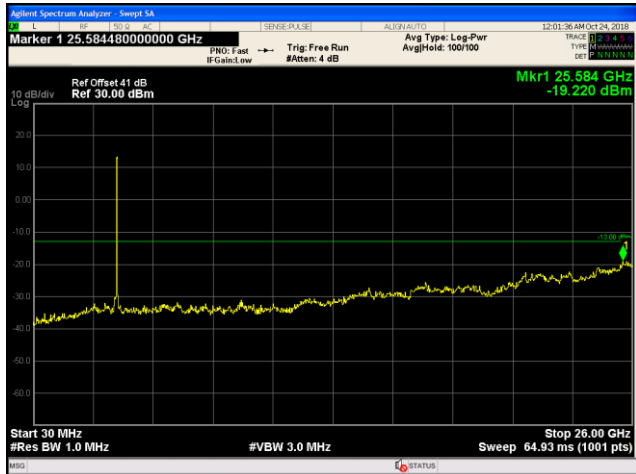


30MHz~26GHz

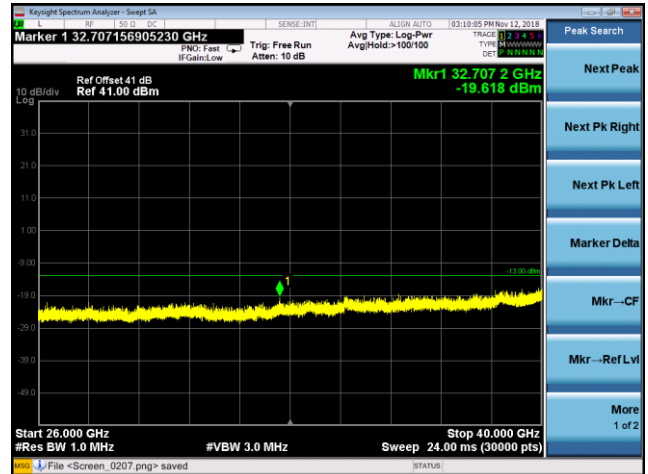


26GHz~40GHz

LTE band 43(20 MHz 64QAM)-ANT 1 Lowest channel

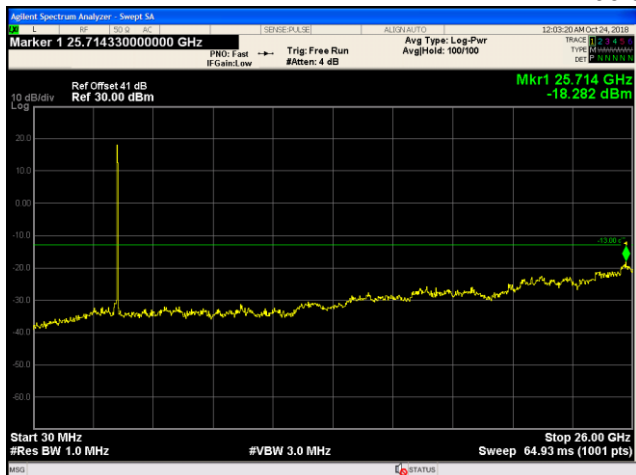


30MHz~26GHz

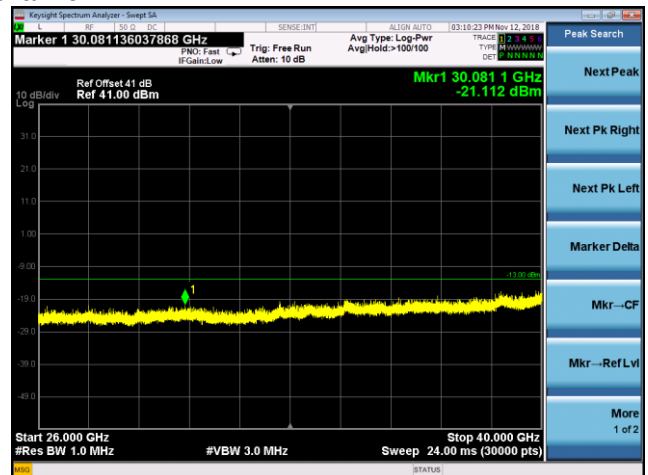


26GHz~40GHz

Middle channel

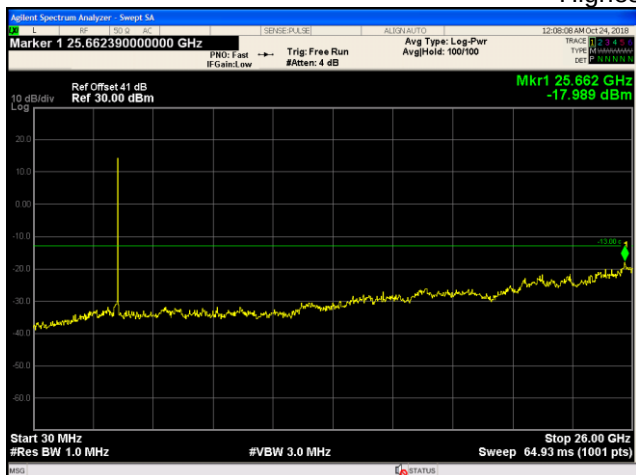


30MHz~26GHz

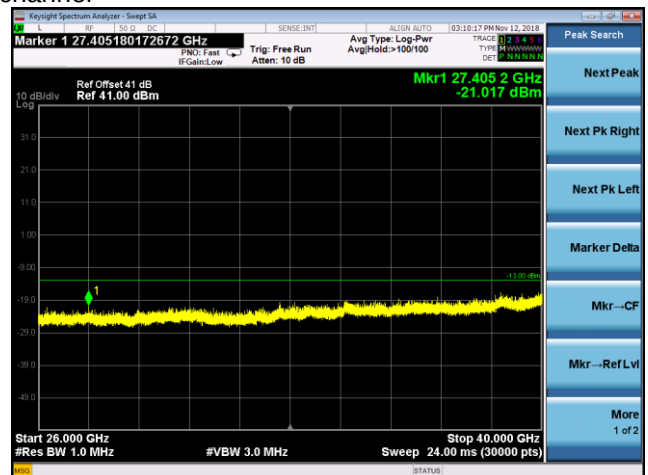


26GHz~40GHz

Highest channel

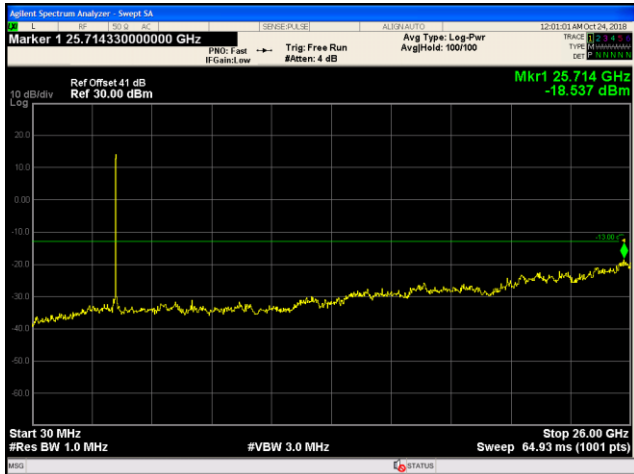


30MHz~26GHz

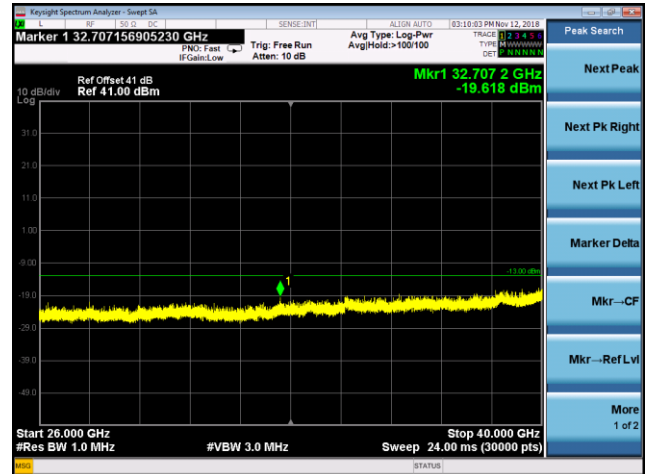


26GHz~40GHz

LTE band 43(20 MHz QPSK)-ANT 1 Lowest channel

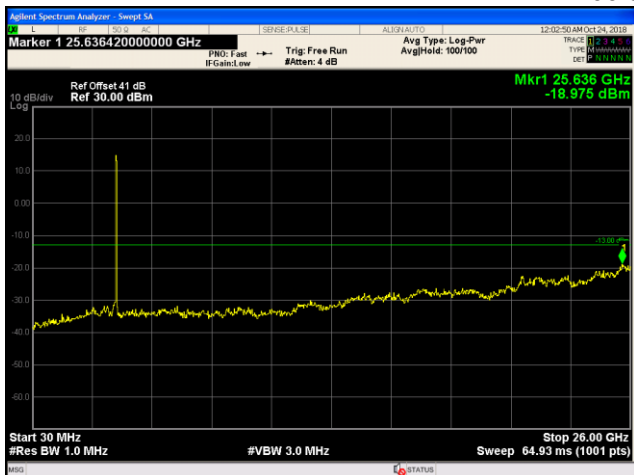


30MHz~26GHz

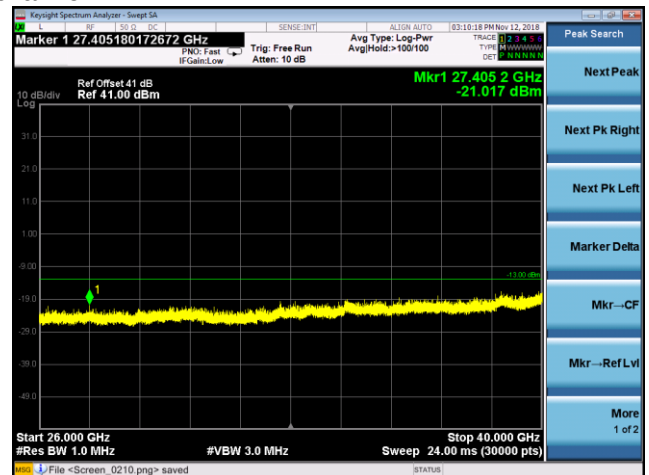


26GHz~40GHz

Middle channel

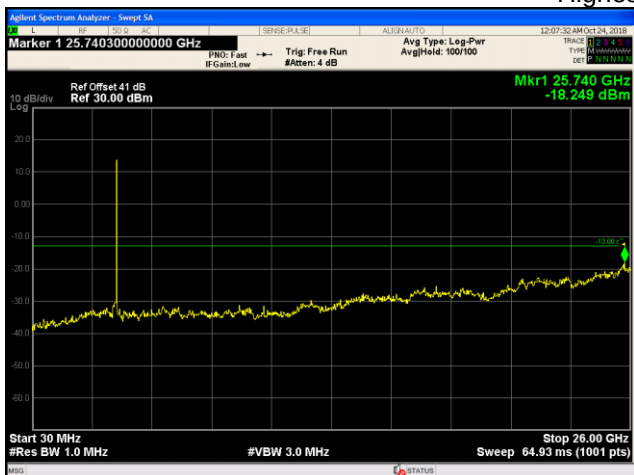


30MHz~26GHz

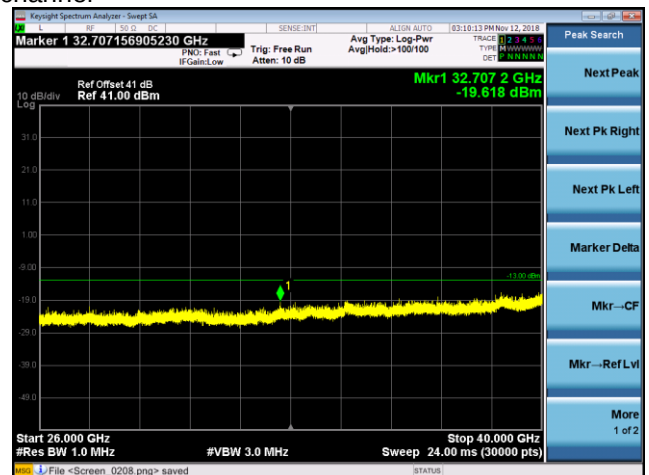


26GHz~40GHz

Highest channel

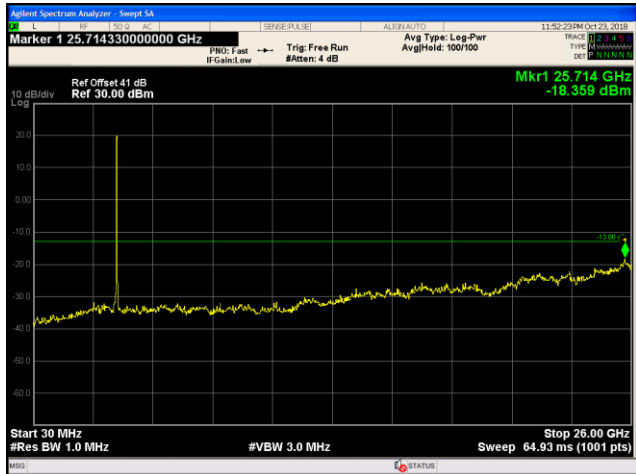


30MHz~26GHz

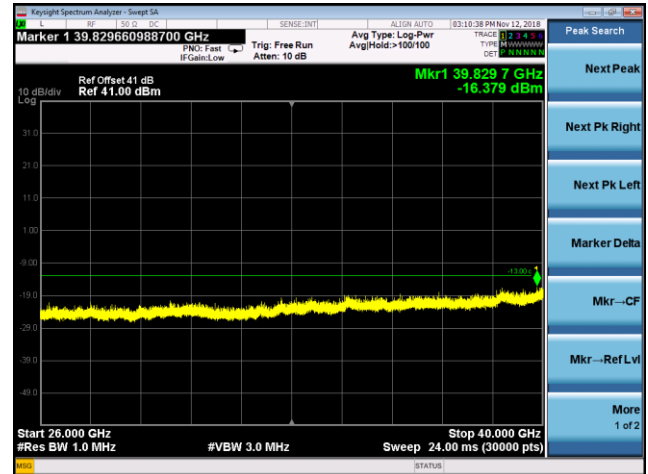


26GHz~40GHz

LTE band 43(10 MHz 64QAM)-ANT 2 Lowest channel

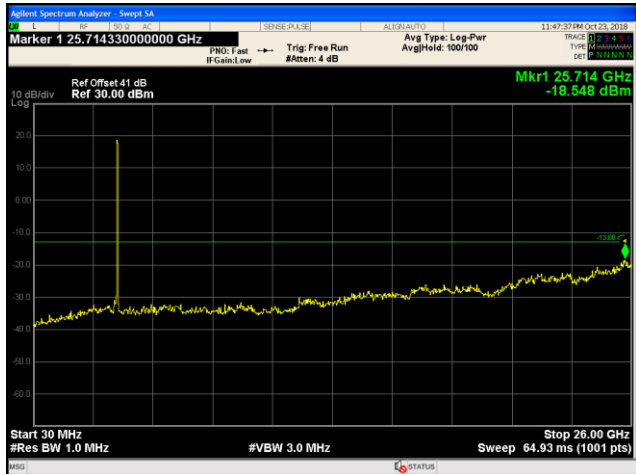


30MHz~26GHz

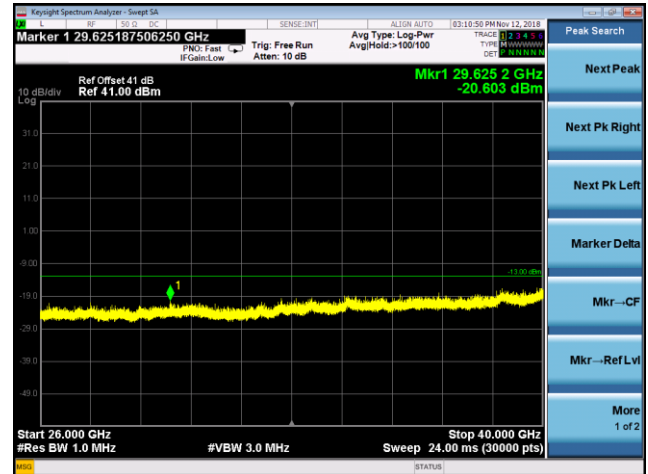


26GHz~40GHz

Middle channel

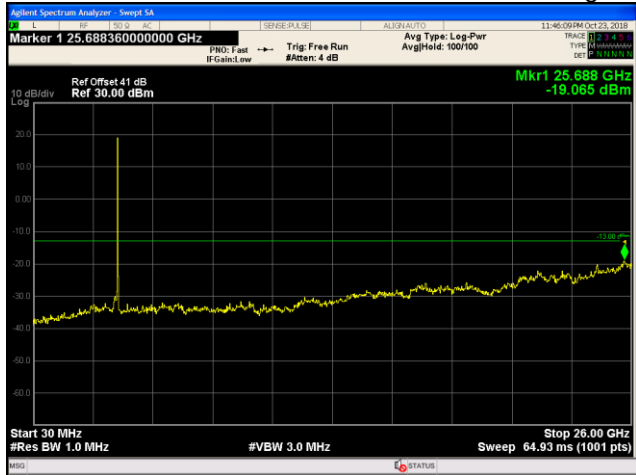


30MHz~26GHz

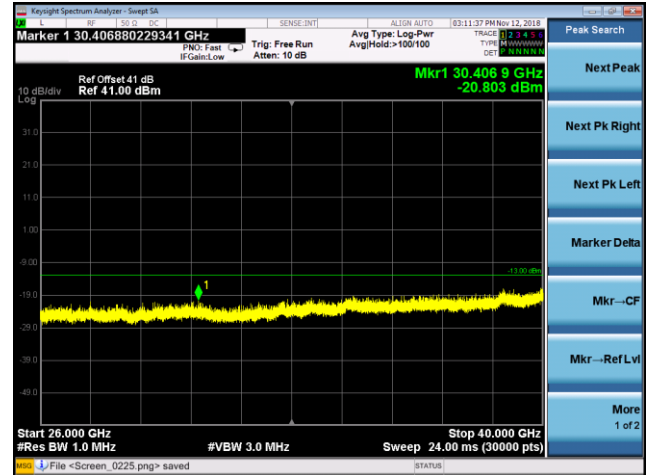


26GHz~40GHz

Highest channel

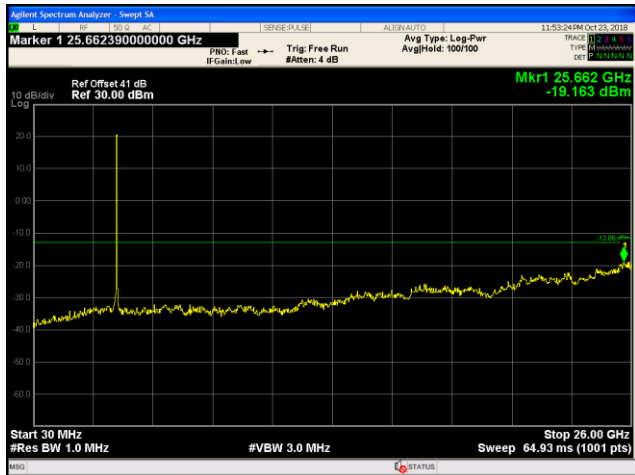


30MHz~26GHz

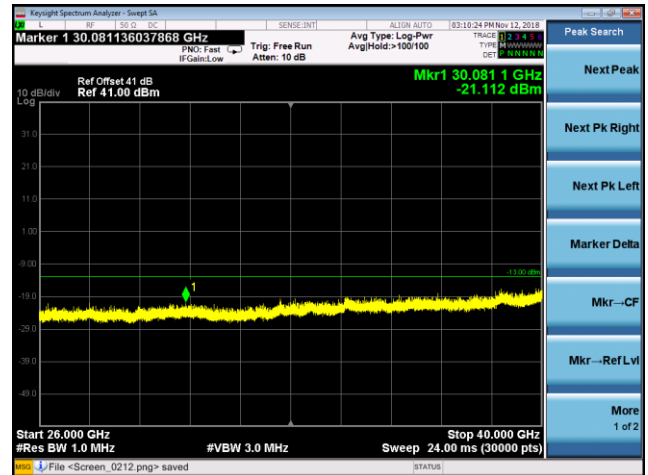


26GHz~40GHz

LTE band 43(10 MHz QPSK)-ANT 2 Lowest channel

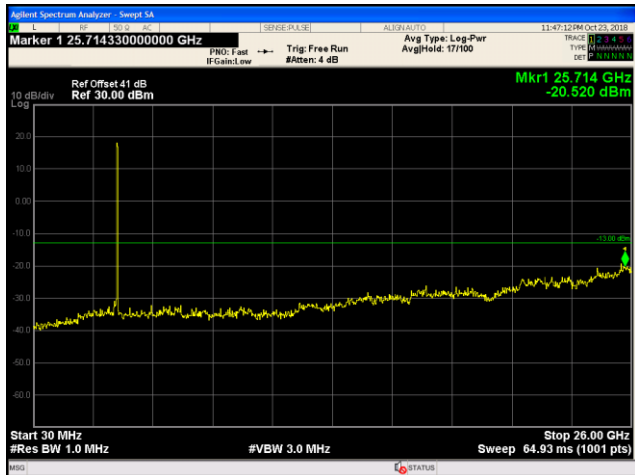


30MHz~26GHz

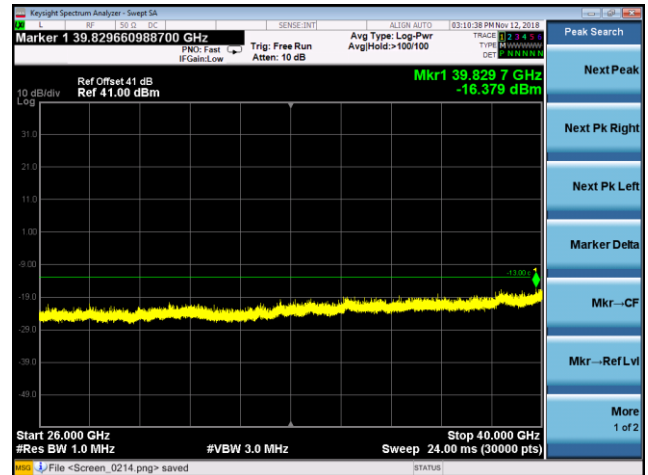


26GHz~40GHz

Middle channel

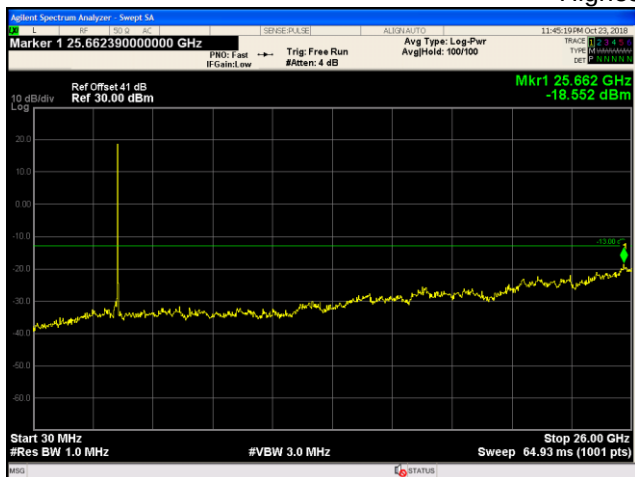


30MHz~26GHz

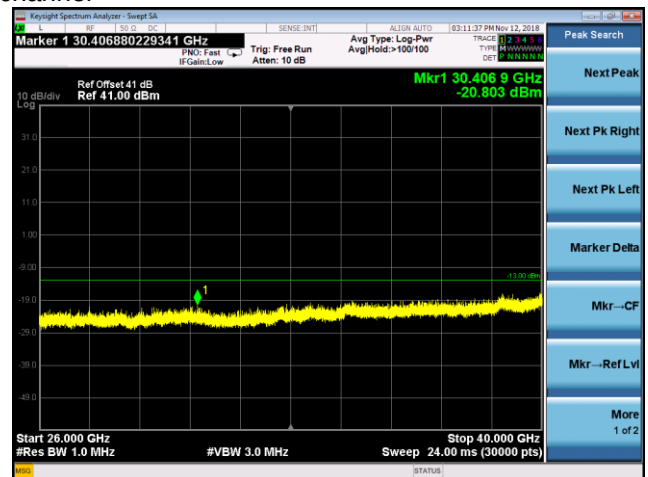


26GHz~40GHz

Highest channel

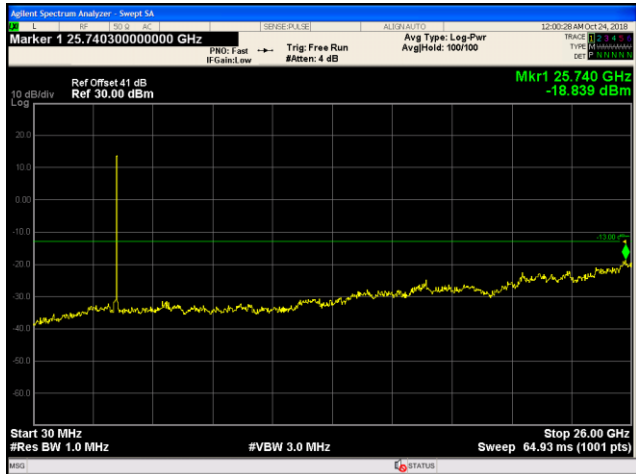


30MHz~26GHz

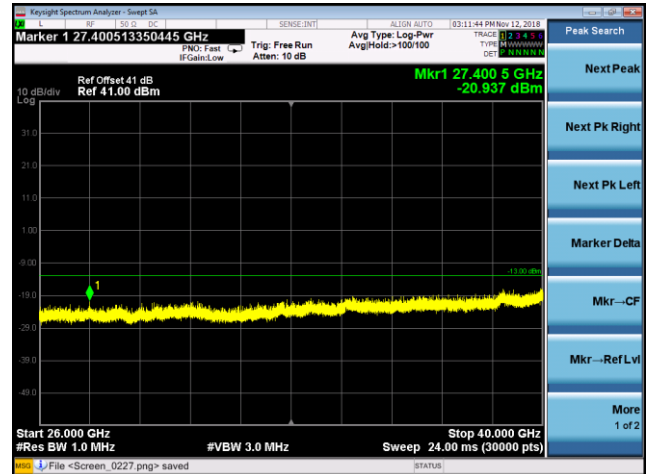


26GHz~40GHz

LTE band 43(20 MHz 64QAM)-ANT 2 Lowest channel

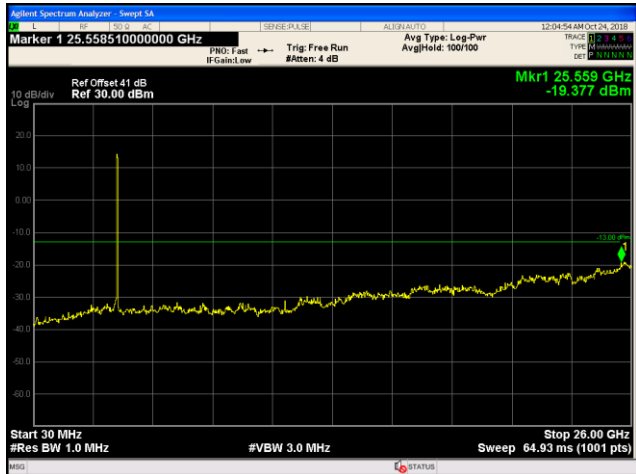


30MHz~26GHz

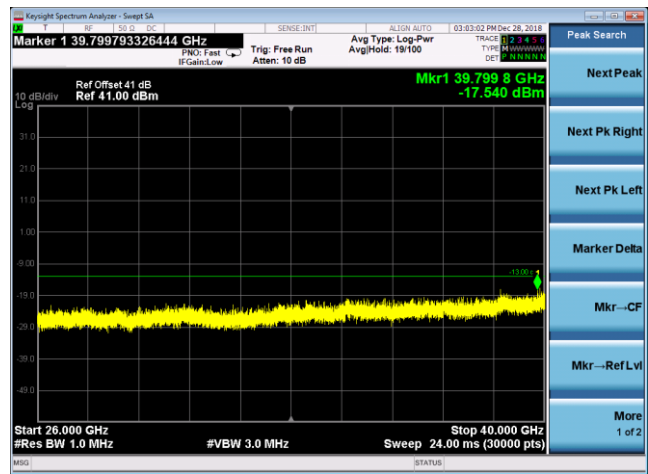


26GHz~40GHz

Middle channel

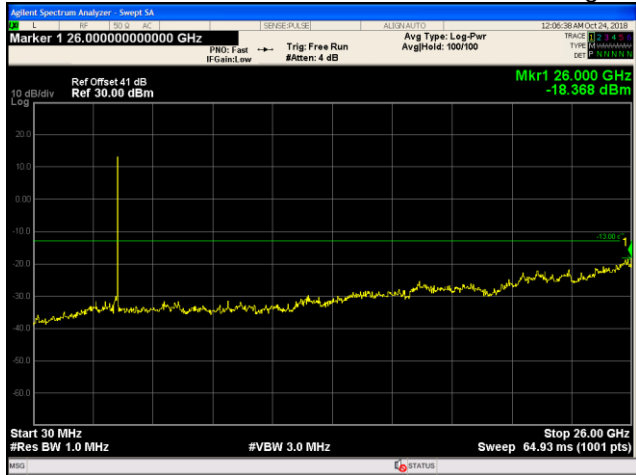


30MHz~26GHz

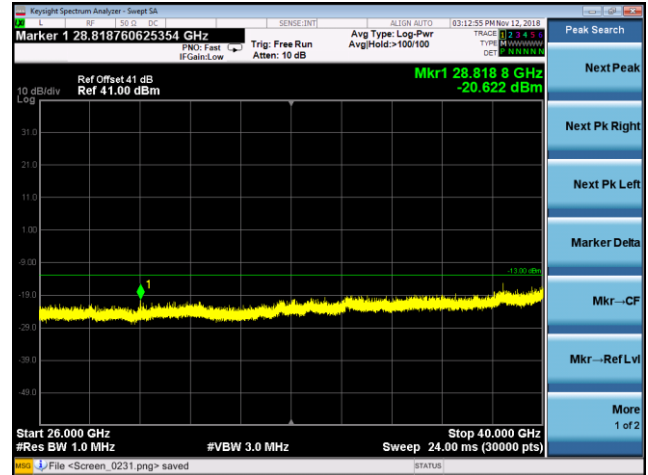


26GHz~40GHz

Highest channel

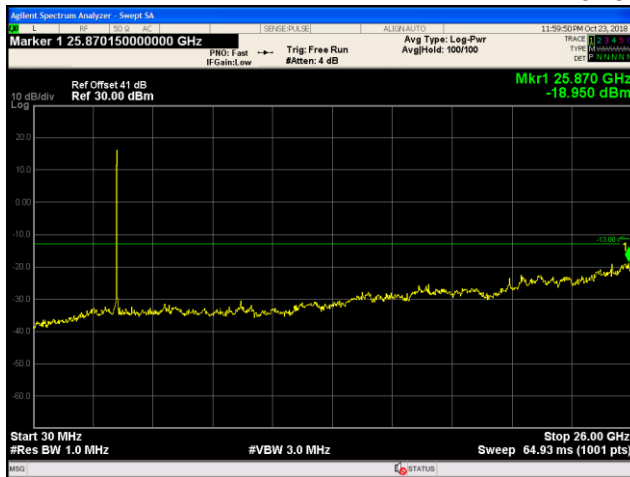


30MHz~26GHz

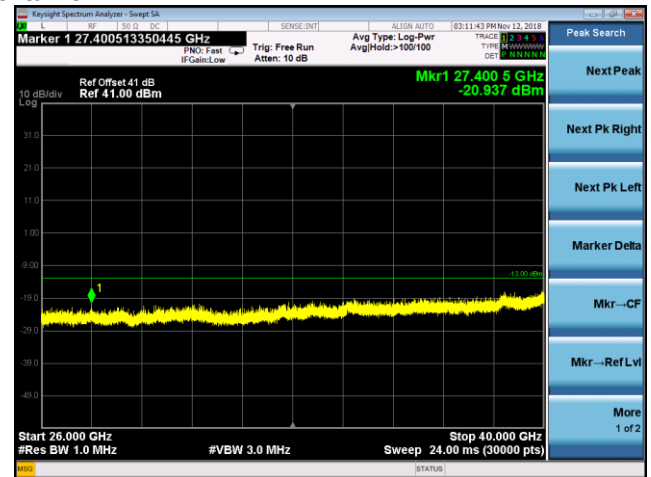


26GHz~40GHz

LTE band 43(20 MHz QPSK)-ANT 2 Lowest channel

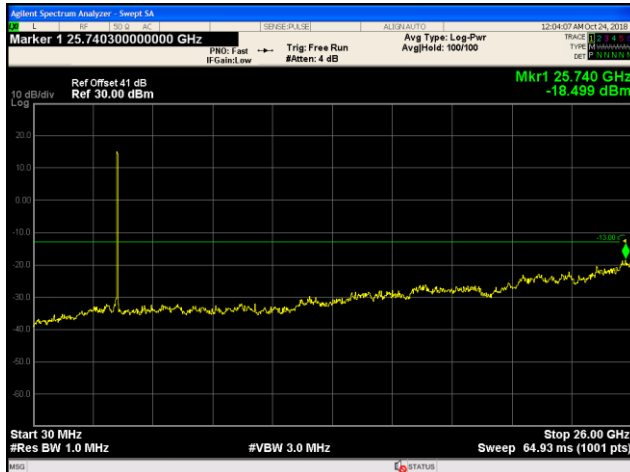


30MHz~26GHz

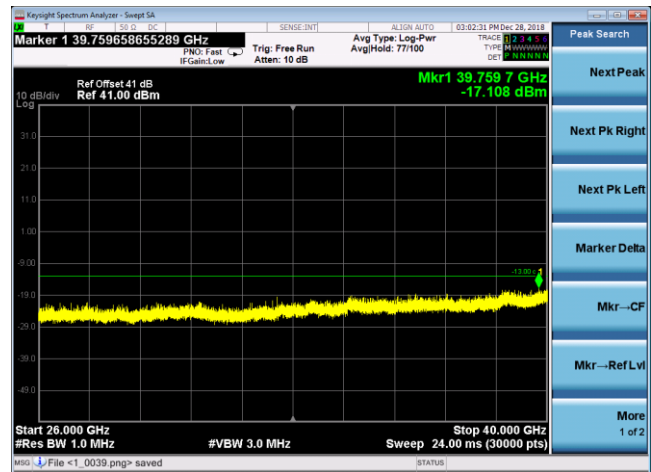


26GHz~40GHz

Middle channel

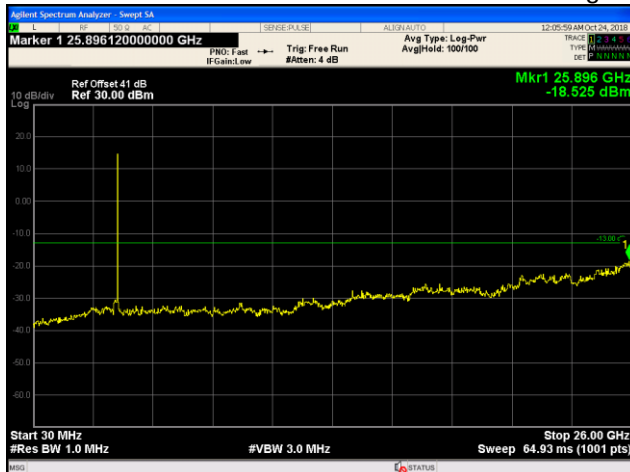


30MHz~26GHz

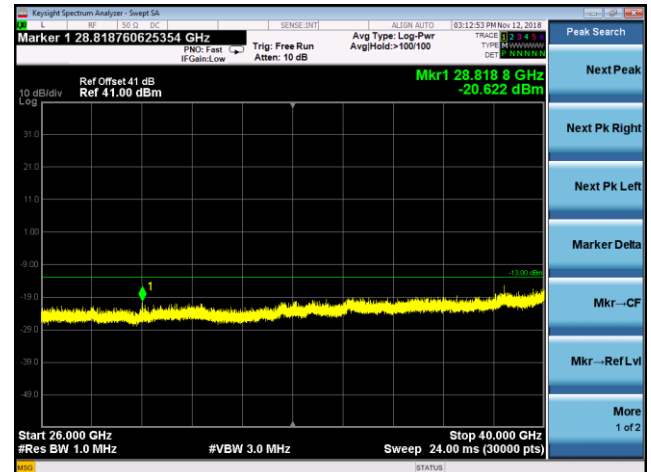


26GHz~40GHz

Highest channel



30MHz~26GHz

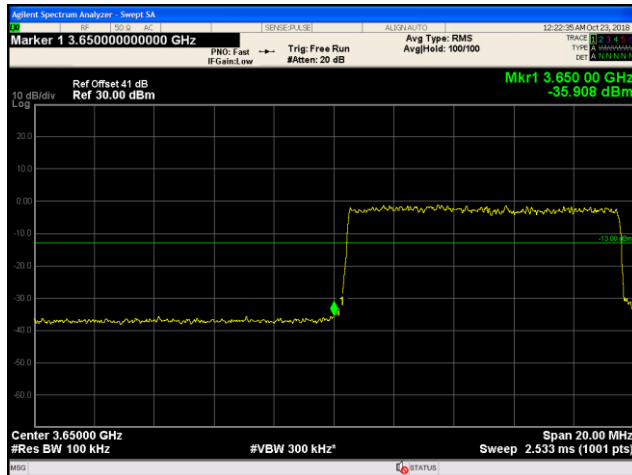


26GHz~40GHz

Band edge emission:

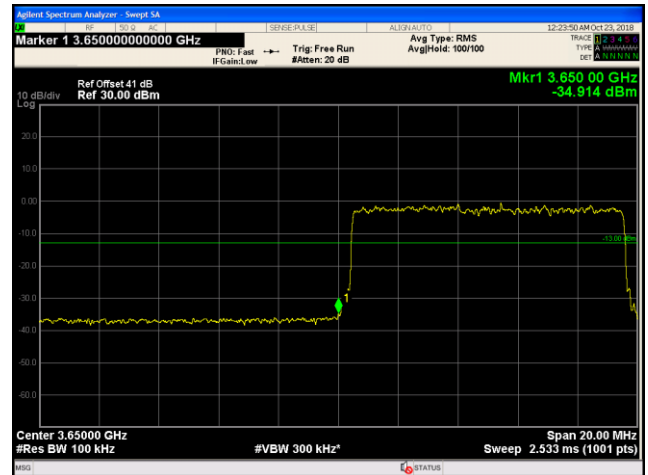
LTE Band 43: Bandwidth=10MHz –QPSK

ANT 1



Lowest channel

ANT 2



Lowest channel



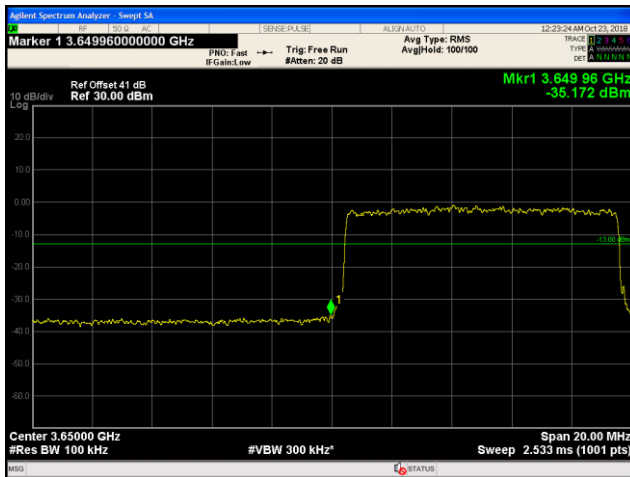
Highest channel



Highest channel

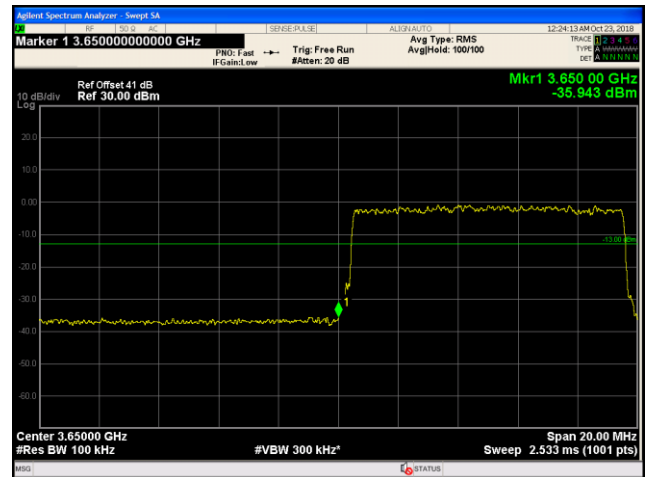
LTE Band 43: Bandwidth=10MHz – 64QAM

ANT 1

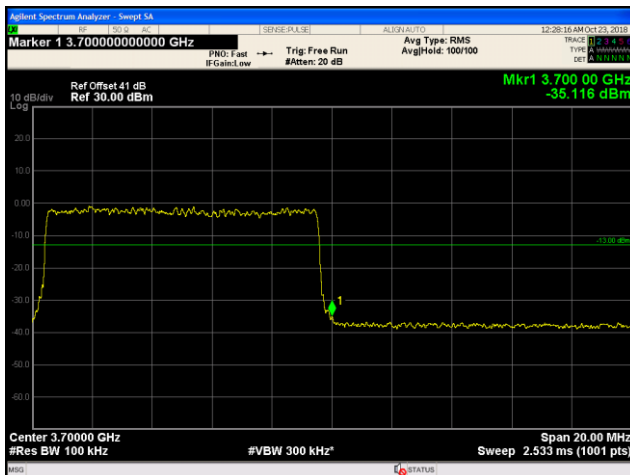


Lowest channel

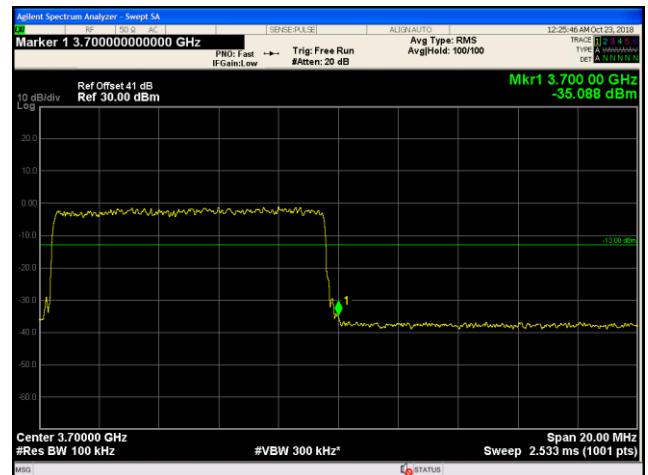
ANT 2



Lowest channel



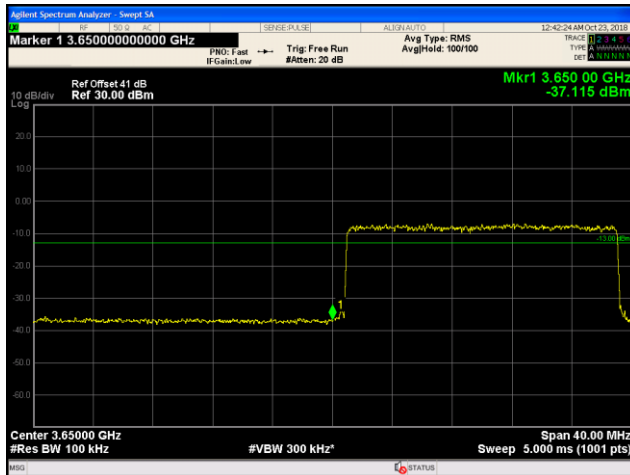
Highest channel



Highest channel

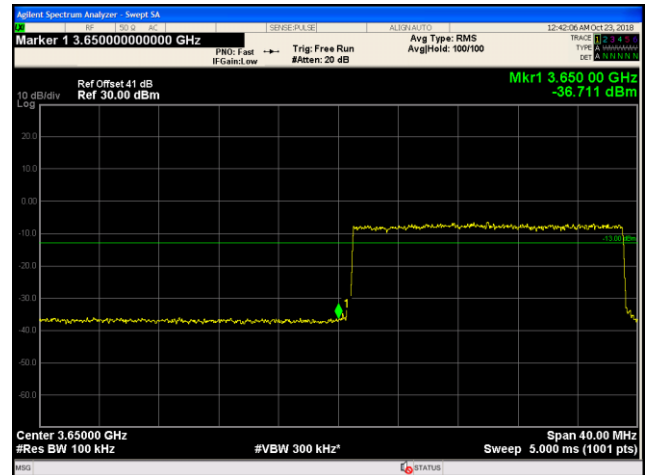
LTE Band 43: Bandwidth=20MHz –QPSK

ANT 1

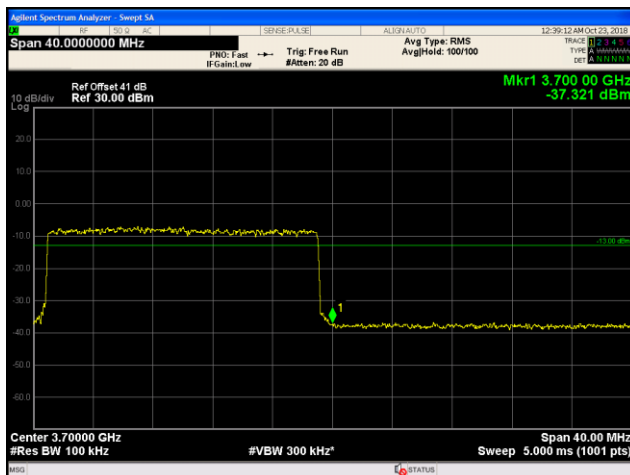


Lowest channel

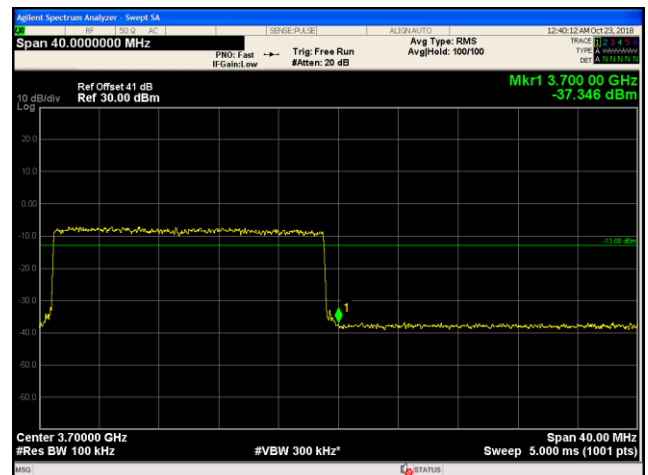
ANT 2



Lowest channel



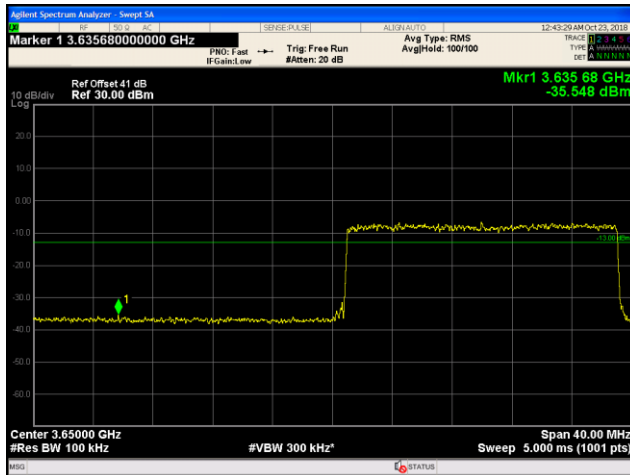
Highest channel



Highest channel

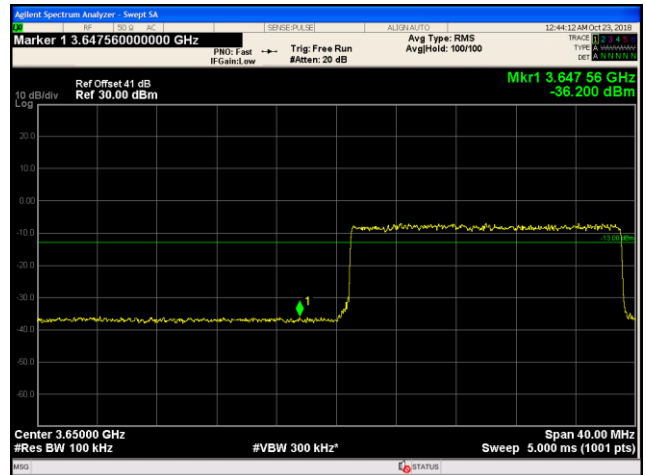
LTE Band 43: Bandwidth=20MHz-64QAM

ANT 1

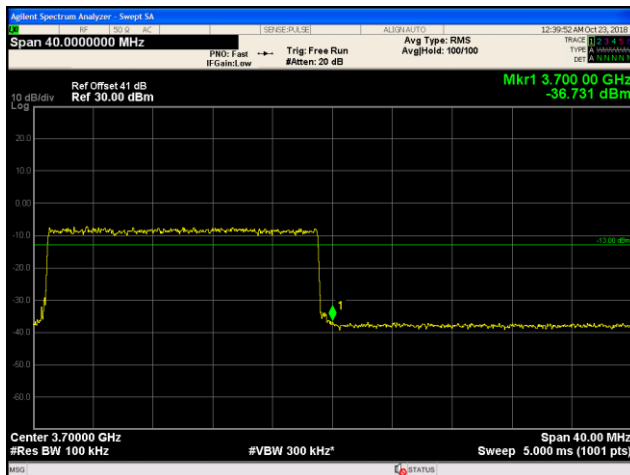


Lowest channel

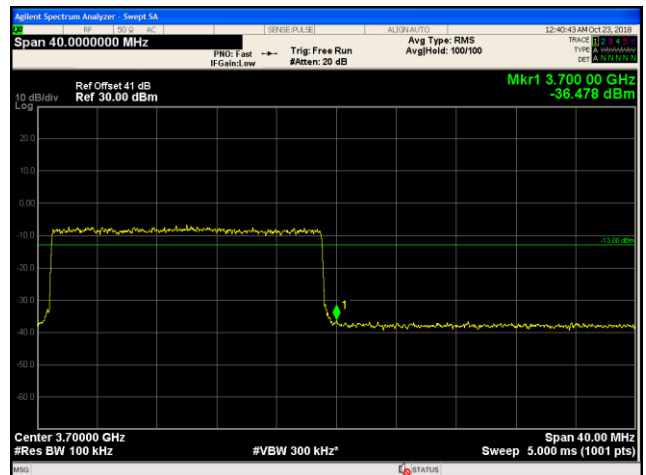
ANT 2



Lowest channel

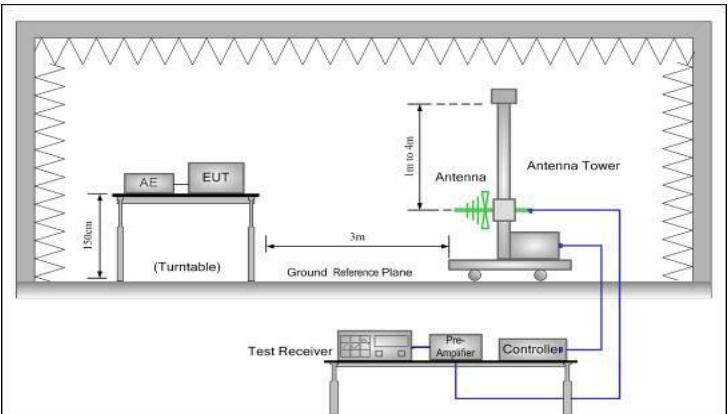
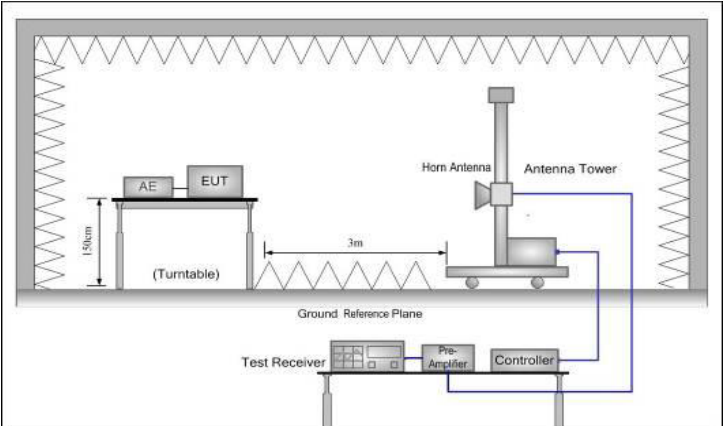
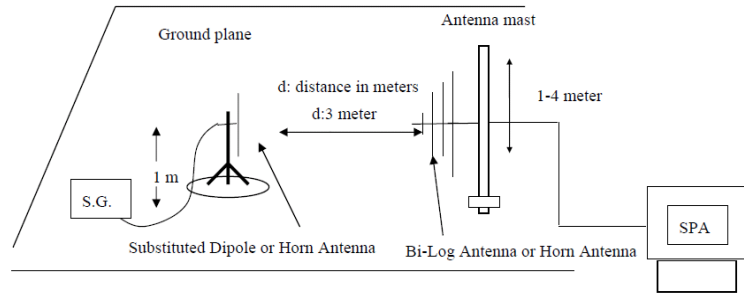


Highest channel



Highest channel

6.9 Field strength of spurious radiation measurement

Test Requirement:	Part 90.1323
Test Method:	FCC part 2.1053 and C63.26-2015
Limit:	-13dBm
Test setup:	Below 1GHz  Above 1GHz  Substituted method: 
Test Procedure:	1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations. 3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission

	was determined using the substitution method. 4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency. $\text{ERP / EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain(dB/dBi)} - \text{Cable Loss (dB)}$
Test Uncertainty:	± 4.88 dB
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details.
Test results:	Passed
Remark:	During the test, pre-scan the QPSK, 64QAM modulation, and found the QPSK modulation is the worst case.

Measurement Data (worst case):

Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
10MHz for QPSK				
Lowest Channel				
7310.00	Vertical	-38.62	-13	Pass
10985.00	V	-33.44		
7310.00	Horizontal	-38.62		
10985.00	H	-33.10		
Middle Channel				
7350.00	Vertical	-37.67	-13	Pass
11025.00	V	-34.39		
7350.00	Horizontal	-37.95		
11025.00	H	-33.98		
Highest				
7390.00	Vertical	-37.31	-13	Pass
11065.00	V	-33.42		
7390.00	Horizontal	-38.67		
11065.00	H	-33.62		
20MHz for QPSK				
Lowest Channel				
7320.00	Vertical	-38.73	-13	Pass
10995.00	V	-33.11		
7320.00	Horizontal	-38.33		
10995.00	H	-33.67		
Middle Channel				
7350.00	Vertical	-37.85	-13	Pass
11025.00	V	-34.42		
7350.00	Horizontal	-37.12		
11025.00	H	-33.99		
Highest Channel				
7380.00	Vertical	-37.85	-13	Pass
11055.00	V	-33.22		
7380.00	Horizontal	-38.85		
11055.00	H	-33.25		
Remark:				
1. The emission levels of below 1 GHz are very lower than the limit and not show in test report.				

6.10 Frequency stability V.S. Temperature measurement

Test Requirement:	FCC Part 90.213(a)																																																																										
Test Method:	FCC Part 2.1055(a)(1)(b) and C63.26-2015																																																																										
Limit:	FCC: <table><thead><tr><th rowspan="2">Frequency range (MHz)</th><th rowspan="2">Fixed and base stations (±ppm)</th><th colspan="2">Mobile stations (±ppm)</th></tr><tr><th>Over 2 watts output power</th><th>2 watts or less output power</th></tr></thead><tbody><tr><td>Below 25</td><td>100</td><td>100</td><td>200</td></tr><tr><td>25–50</td><td>20</td><td>20</td><td>50</td></tr><tr><td>72–76</td><td>5</td><td></td><td>50</td></tr><tr><td>150–174</td><td>5</td><td>5</td><td>50</td></tr><tr><td>216–220</td><td>1.0</td><td></td><td>1.0</td></tr><tr><td>220–222</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>421–512</td><td>2.5</td><td>5</td><td>5</td></tr><tr><td>806–809</td><td>1.0</td><td>1.5</td><td>1.5</td></tr><tr><td>809–824</td><td>1.5</td><td>2.5</td><td>2.5</td></tr><tr><td>851–854</td><td>1.0</td><td>1.5</td><td>1.5</td></tr><tr><td>854–869</td><td>1.5</td><td>2.5</td><td>2.5</td></tr><tr><td>896–901</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>902–928</td><td>2.5</td><td>2.5</td><td>2.5</td></tr><tr><td>929–930</td><td>1.5</td><td>2.5</td><td>2.5</td></tr><tr><td>935–940</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>1427–1435</td><td>300</td><td>300</td><td>300</td></tr><tr><td>Above 2450</td><td></td><td></td><td></td></tr></tbody></table>	Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)		Over 2 watts output power	2 watts or less output power	Below 25	100	100	200	25–50	20	20	50	72–76	5		50	150–174	5	5	50	216–220	1.0		1.0	220–222	0.1	1.5	1.5	421–512	2.5	5	5	806–809	1.0	1.5	1.5	809–824	1.5	2.5	2.5	851–854	1.0	1.5	1.5	854–869	1.5	2.5	2.5	896–901	0.1	1.5	1.5	902–928	2.5	2.5	2.5	929–930	1.5	2.5	2.5	935–940	0.1	1.5	1.5	1427–1435	300	300	300	Above 2450			
Frequency range (MHz)	Fixed and base stations (±ppm)			Mobile stations (±ppm)																																																																							
		Over 2 watts output power	2 watts or less output power																																																																								
Below 25	100	100	200																																																																								
25–50	20	20	50																																																																								
72–76	5		50																																																																								
150–174	5	5	50																																																																								
216–220	1.0		1.0																																																																								
220–222	0.1	1.5	1.5																																																																								
421–512	2.5	5	5																																																																								
806–809	1.0	1.5	1.5																																																																								
809–824	1.5	2.5	2.5																																																																								
851–854	1.0	1.5	1.5																																																																								
854–869	1.5	2.5	2.5																																																																								
896–901	0.1	1.5	1.5																																																																								
902–928	2.5	2.5	2.5																																																																								
929–930	1.5	2.5	2.5																																																																								
935–940	0.1	1.5	1.5																																																																								
1427–1435	300	300	300																																																																								
Above 2450																																																																											
Test setup:	Spectrum analyzer Att. Temperature Chamber EUT Variable Power Supply Note : Measurement setup for testing on Antenna connector																																																																										
Test procedure:	1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to −30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached																																																																										
Test Instruments:	Refer to section 5.8 for details																																																																										
Test mode:	Refer to section 5.3 for details																																																																										
Test results:	Passed																																																																										
Remark:	All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.																																																																										

Measurement Data (the worst channel):

Band43

Reference Frequency: Lowest channel=3655.0MHz(10MHz for QPSK)			
Power supplied (Vdc)	Temperature (°C)	Frequency error	
		Hz	ppm
48.00	-40	187	0.051163
	-20	176	0.048153
	-10	180	0.049248
	0	144	0.039398
	10	150	0.041040
	20	132	0.036115
	30	126	0.034473
	40	120	0.032832
	55	113	0.030917

Reference Frequency: Lowest channel=3660.0MHz(20MHz for QPSK)			
Power supplied (Vdc)	Temperature (°C)	Frequency error	
		Hz	ppm
48.00	-40	187	0.051093
	-20	165	0.045082
	-10	174	0.047541
	0	123	0.033607
	10	160	0.043716
	20	144	0.039344
	30	150	0.040984
	40	108	0.029508
	55	133	0.036339

Reference Frequency: Lowest channel=3655.0MHz(10MHz for 64QAM)			
Power supplied (Vdc)	Temperature (°C)	Frequency error	
		Hz	ppm
48.00	-40	199	0.054446
	-20	181	0.049521
	-10	165	0.045144
	0	171	0.046785
	10	123	0.033653
	20	132	0.036115
	30	136	0.037209
	40	128	0.035021
	55	144	0.039398

Reference Frequency: Lowest channel=3660.0MHz(20MHz for 64QAM)			
Power supplied (Vdc)	Temperature (°C)	Frequency error	
		Hz	ppm
48.00	-40	198	0.054098
	-20	180	0.049180
	-10	156	0.042623
	0	132	0.036066
	10	144	0.039344
	20	171	0.046721
	30	105	0.028689
	40	116	0.031694
	55	128	0.034973

6.11 Frequency stability V.S. Voltage measurement

Test Requirement:	FCC Part 90.213(a)																																																																										
Test Method:	FCC Part 2.1055(a)(1)(b) and C63.26-2015																																																																										
Limit:	FCC: <table><thead><tr><th rowspan="2">Frequency range (MHz)</th><th rowspan="2">Fixed and base stations (±ppm)</th><th colspan="2">Mobile stations (±ppm)</th></tr><tr><th>Over 2 watts output power</th><th>2 watts or less output power</th></tr></thead><tbody><tr><td>Below 25</td><td>100</td><td>100</td><td>200</td></tr><tr><td>25-50</td><td>20</td><td>20</td><td>50</td></tr><tr><td>72-76</td><td>5</td><td></td><td>50</td></tr><tr><td>150-174</td><td>5</td><td>5</td><td>50</td></tr><tr><td>216-220</td><td>1.0</td><td></td><td>1.0</td></tr><tr><td>220-222</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>421-512</td><td>2.5</td><td>5</td><td>5</td></tr><tr><td>806-809</td><td>1.0</td><td>1.5</td><td>1.5</td></tr><tr><td>809-824</td><td>1.5</td><td>2.5</td><td>2.5</td></tr><tr><td>851-854</td><td>1.0</td><td>1.5</td><td>1.5</td></tr><tr><td>854-869</td><td>1.5</td><td>2.5</td><td>2.5</td></tr><tr><td>896-901</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>902-928</td><td>2.5</td><td>2.5</td><td>2.5</td></tr><tr><td>929-930</td><td>1.5</td><td></td><td></td></tr><tr><td>935-940</td><td>0.1</td><td>1.5</td><td>1.5</td></tr><tr><td>1427-1435</td><td>300</td><td>300</td><td>300</td></tr><tr><td>Above 2450</td><td></td><td></td><td></td></tr></tbody></table>	Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)		Over 2 watts output power	2 watts or less output power	Below 25	100	100	200	25-50	20	20	50	72-76	5		50	150-174	5	5	50	216-220	1.0		1.0	220-222	0.1	1.5	1.5	421-512	2.5	5	5	806-809	1.0	1.5	1.5	809-824	1.5	2.5	2.5	851-854	1.0	1.5	1.5	854-869	1.5	2.5	2.5	896-901	0.1	1.5	1.5	902-928	2.5	2.5	2.5	929-930	1.5			935-940	0.1	1.5	1.5	1427-1435	300	300	300	Above 2450			
Frequency range (MHz)	Fixed and base stations (±ppm)			Mobile stations (±ppm)																																																																							
		Over 2 watts output power	2 watts or less output power																																																																								
Below 25	100	100	200																																																																								
25-50	20	20	50																																																																								
72-76	5		50																																																																								
150-174	5	5	50																																																																								
216-220	1.0		1.0																																																																								
220-222	0.1	1.5	1.5																																																																								
421-512	2.5	5	5																																																																								
806-809	1.0	1.5	1.5																																																																								
809-824	1.5	2.5	2.5																																																																								
851-854	1.0	1.5	1.5																																																																								
854-869	1.5	2.5	2.5																																																																								
896-901	0.1	1.5	1.5																																																																								
902-928	2.5	2.5	2.5																																																																								
929-930	1.5																																																																										
935-940	0.1	1.5	1.5																																																																								
1427-1435	300	300	300																																																																								
Above 2450																																																																											
Test setup:	Spectrum analyzer  Att. Temperature Chamber EUT Variable Power Supply Note : Measurement setup for testing on Antenna connector																																																																										
Test procedure:	1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. 3. Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.																																																																										
Test Instruments:	Refer to section 5.8 for details																																																																										
Test mode:	Refer to section 5.3 for details, and all channels have been tested, only shows the worst channel data in this report.																																																																										
Test results:	Passed																																																																										
Remark:	All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.																																																																										

Measurement Data (the worst channel):

Band43

Reference Frequency: Lowest channel=3655.0MHz(10MHz for QPSK)			
Temperature (°C)	Power supplied (Vdc)	Frequency error	
		Hz	ppm
25	42.0	89	0.024350
	48.0	78	0.021341
	55.0	90	0.024624
Reference Frequency: Lowest channel=3660.0MHz(20MHz for QPSK)			
Temperature (°C)	Power supplied (Vdc)	Frequency error	
		Hz	ppm
25	42.0	99	0.027049
	48.0	71	0.019399
	55.0	80	0.021858

Reference Frequency: Lowest channel=3655.0MHz(10MHz for 64QAM)			
Temperature (°C)	Power supplied (Vdc)	Frequency error	
		Hz	ppm
25	42.0	84	0.022982
	48.0	96	0.026265
	55.0	73	0.019973
Reference Frequency: Lowest channel=3660.0MHz(20MHz for 64QAM)			
Temperature (°C)	Power supplied (Vdc)	Frequency error	
		Hz	ppm
25	42.0	98	0.026776
	48.0	85	0.023224
	55.0	60	0.016393