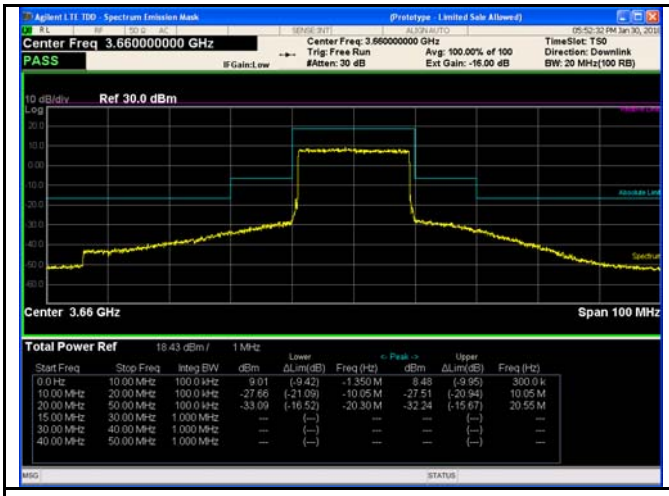
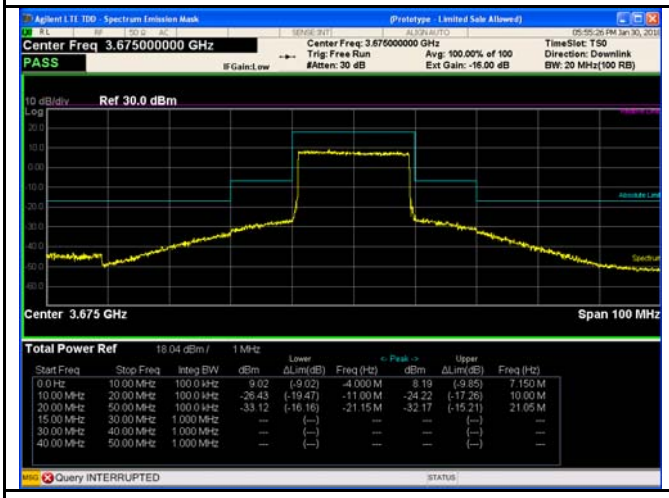


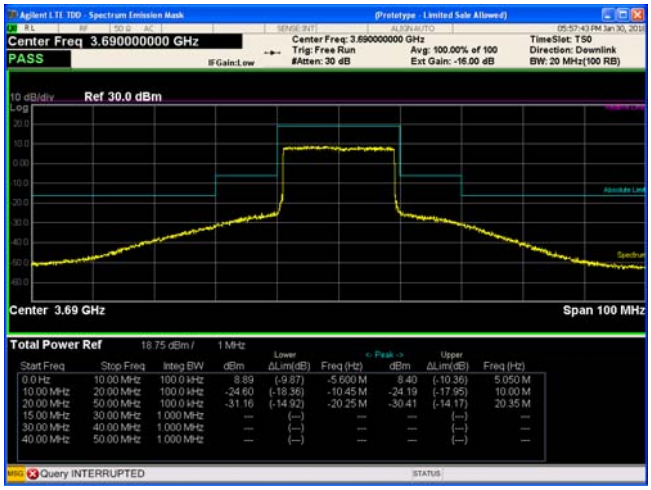
20MHz - Low CH QPSK

20MHz - Low CH 64QAM

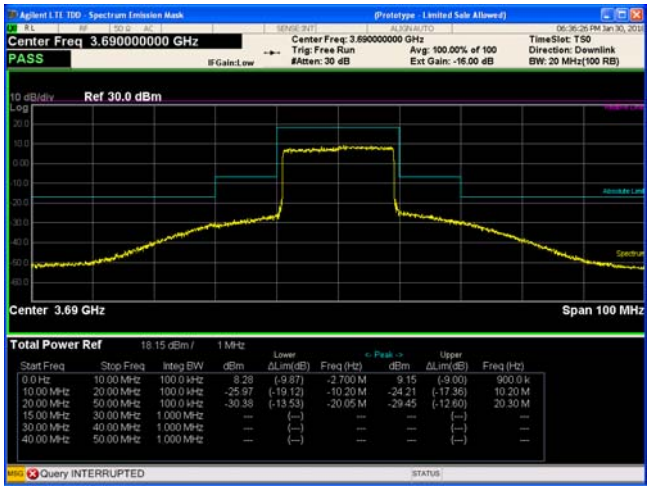


20MHz - Middle CH QPSK

20MHz - Middle CH 64QAM

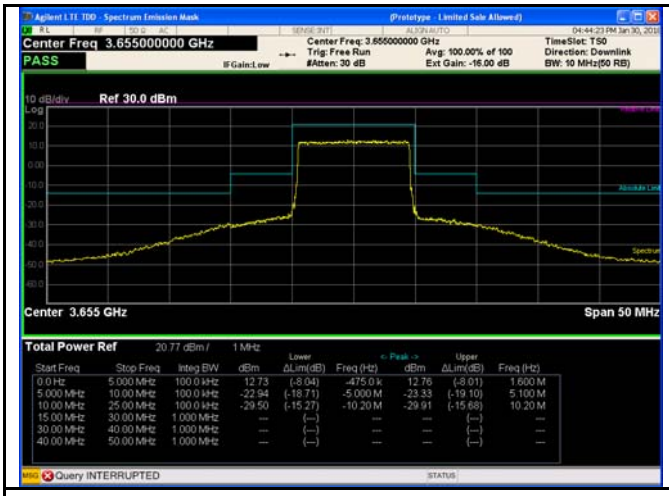
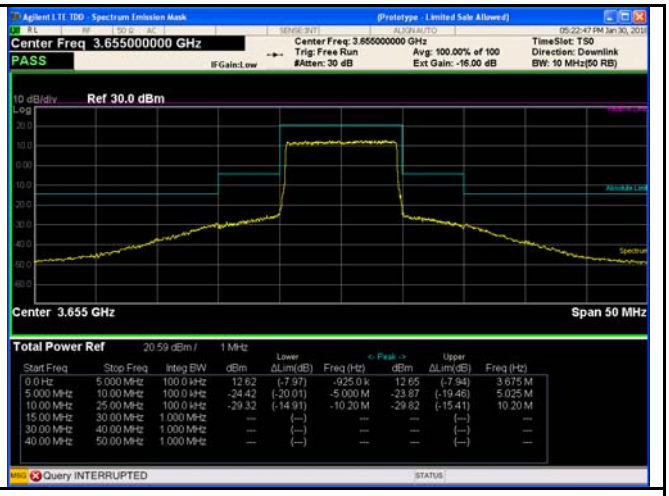
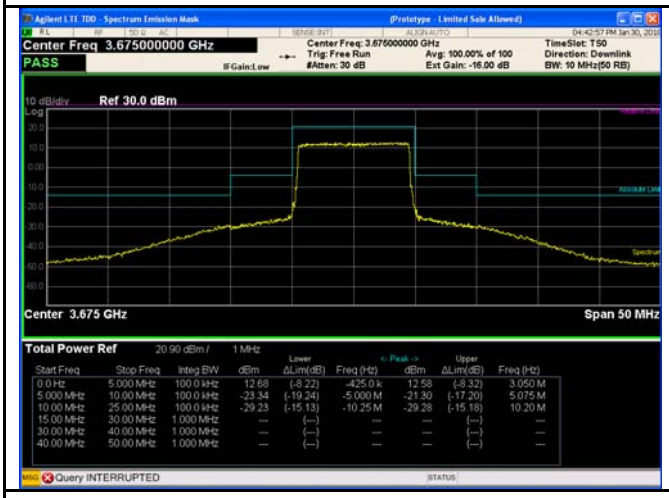
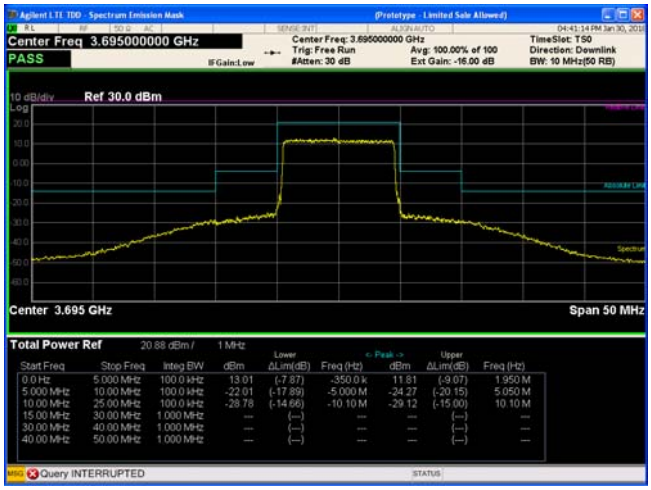
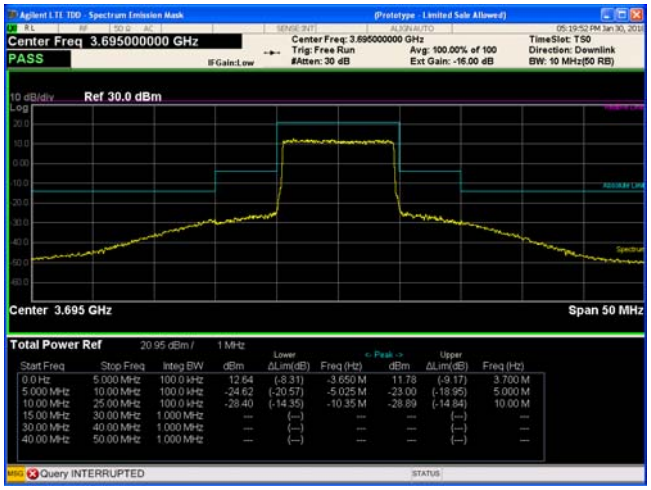


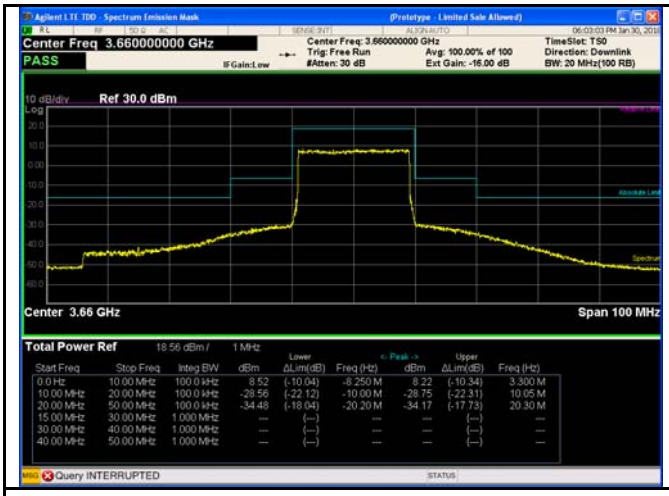
20MHz - High CH QPSK



20MHz - High CH 64QAM

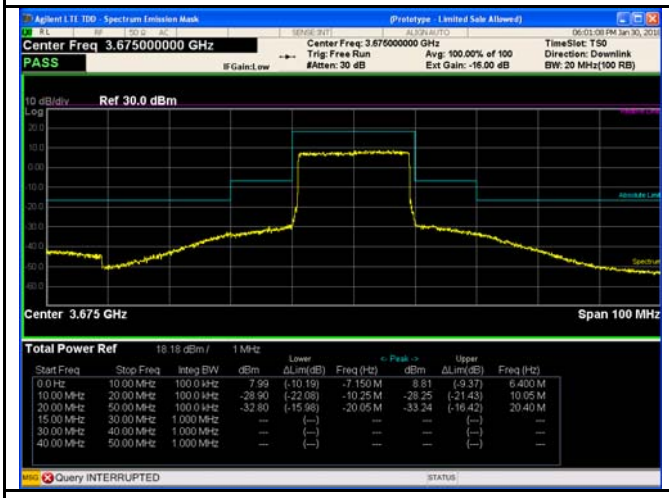
Master-Chain 3

	
10MHz - Low CH QPSK	10MHz - Low CH 64QAM
	
10MHz - Middle CH QPSK	10MHz - Middle CH 64QAM
	
10MHz - High CH QPSK	10MHz - High CH 64QAM



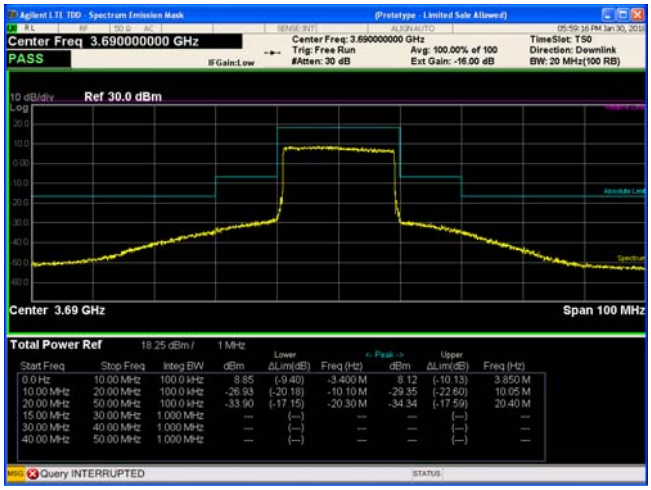
20MHz - Low CH QPSK

20MHz - Low CH 64QAM

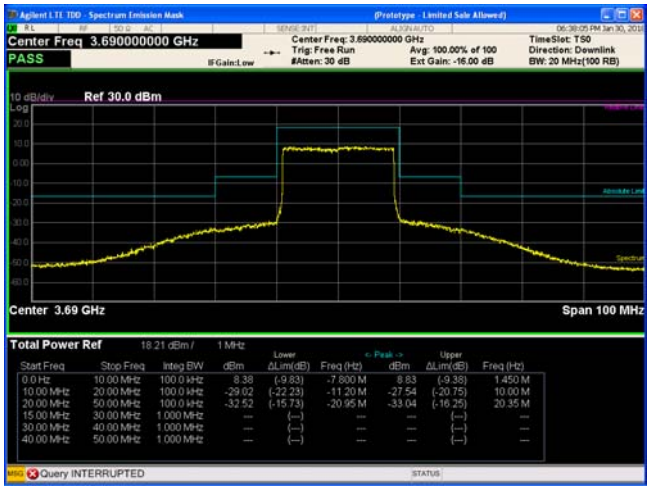


20MHz - Middle CH QPSK

20MHz - Middle CH 64QAM

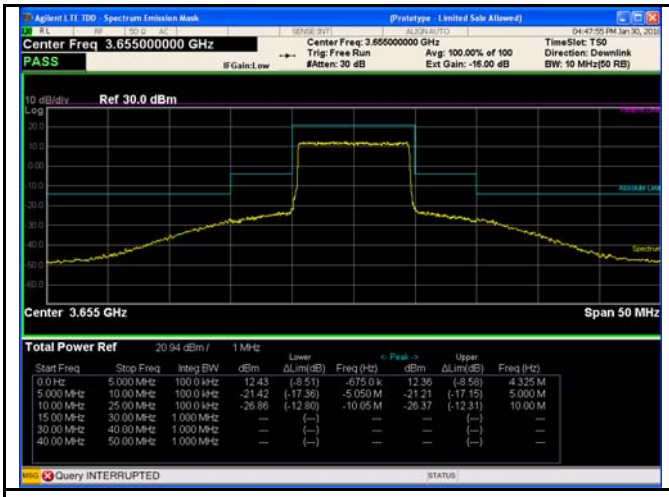
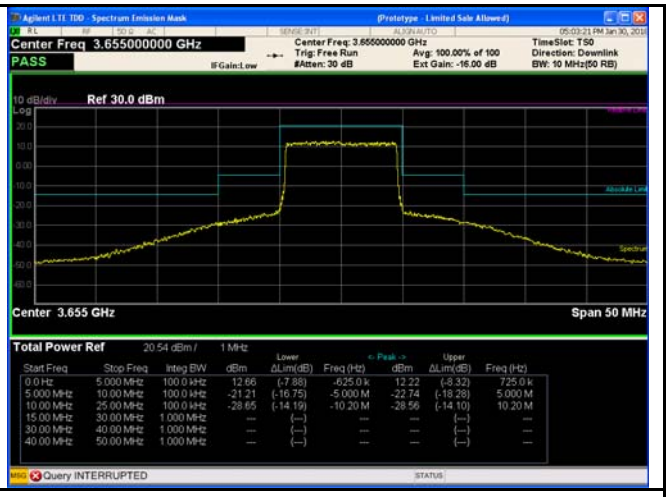
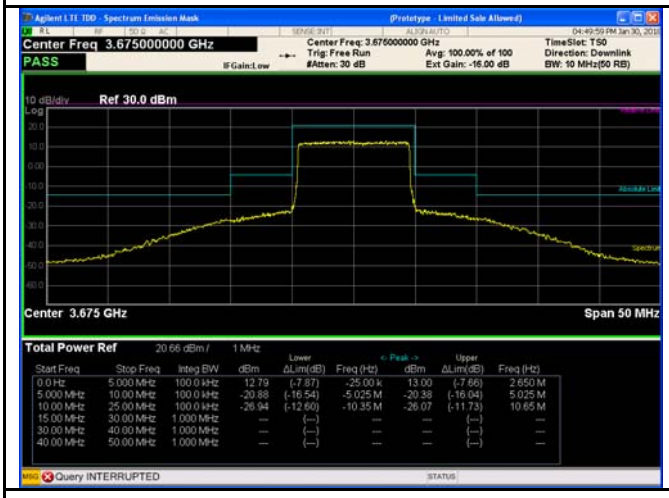
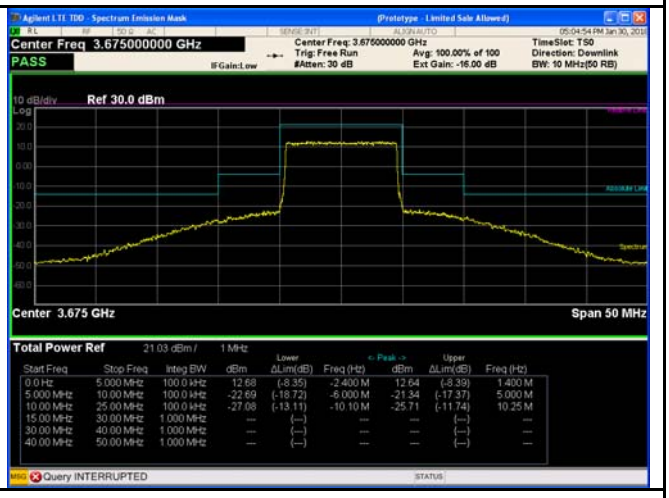
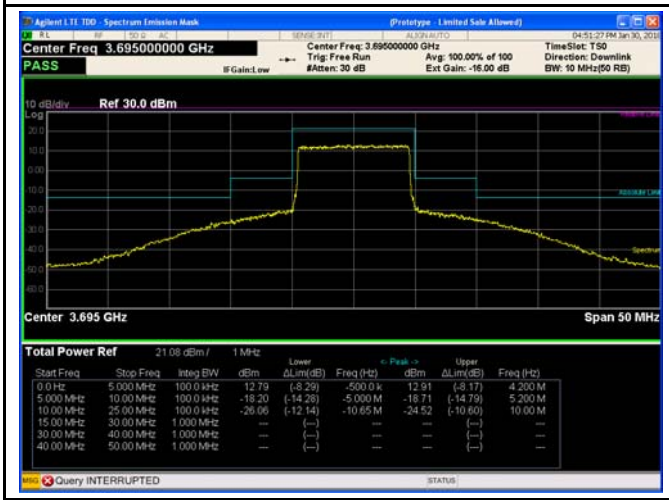
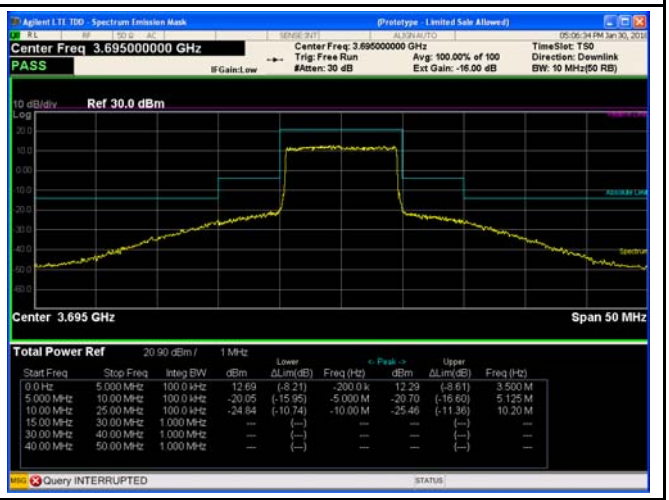


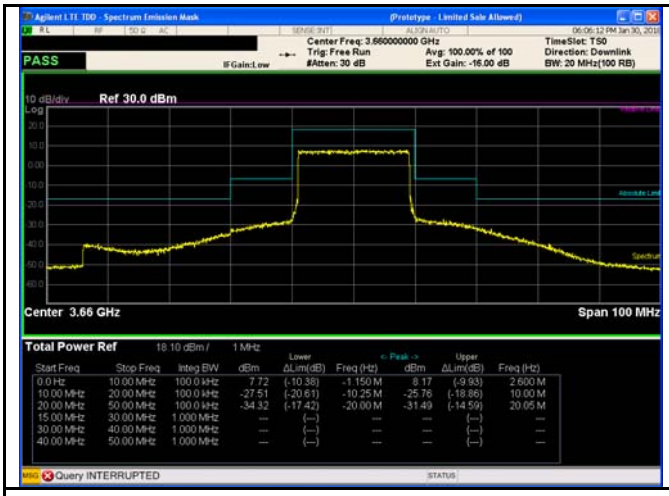
20MHz - High CH QPSK



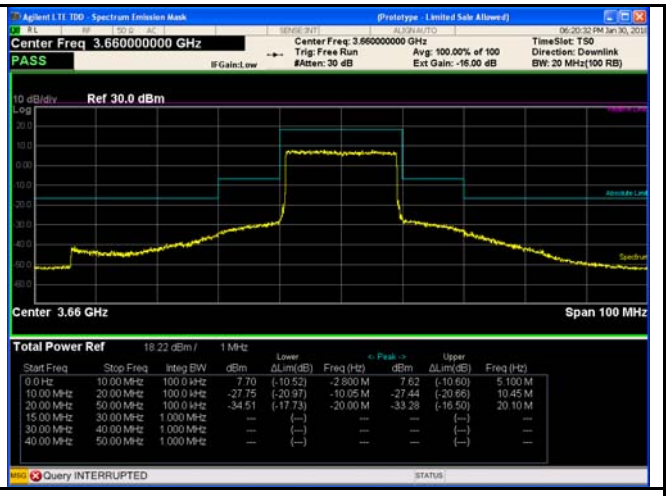
20MHz - High CH 64QAM

Slave-Chain 0

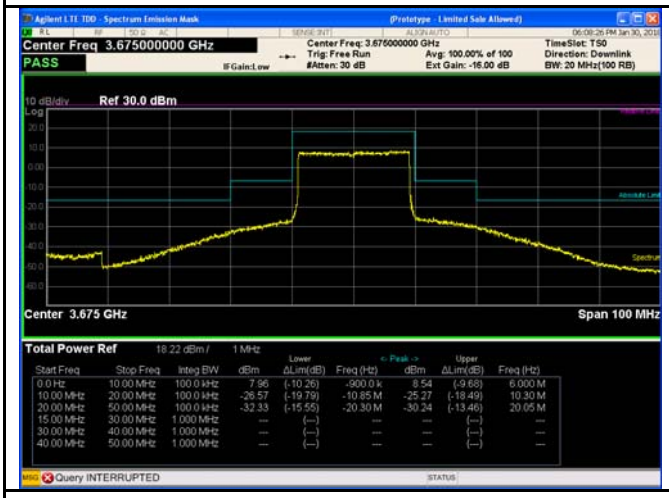
	
10MHz - Low CH QPSK	10MHz - Low CH 64QAM
	
10MHz - Middle CH QPSK	10MHz - Middle CH 64QAM
	
10MHz - High CH QPSK	10MHz - High CH 64QAM



20MHz - Low CH QPSK

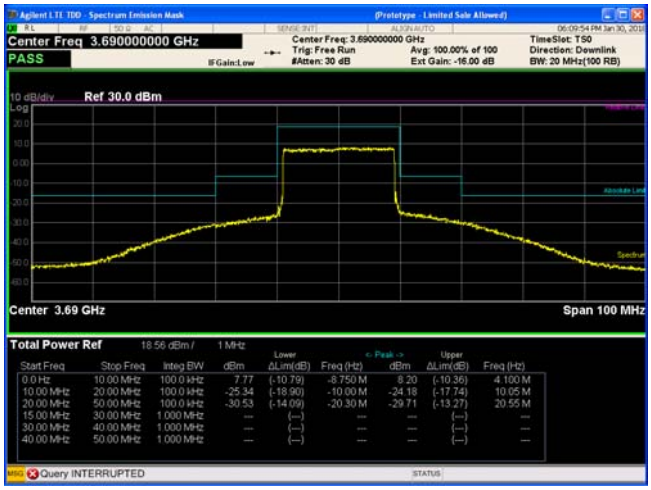


20MHz - Low CH 64QAM

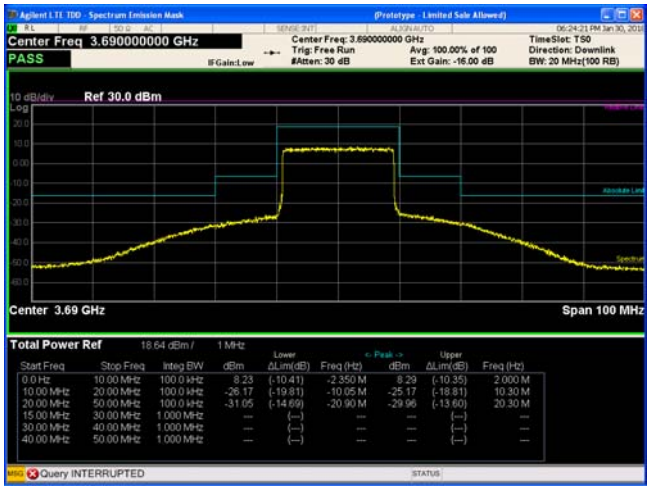


20MHz - Middle CH QPSK

20MHz - Middle CH 64QAM

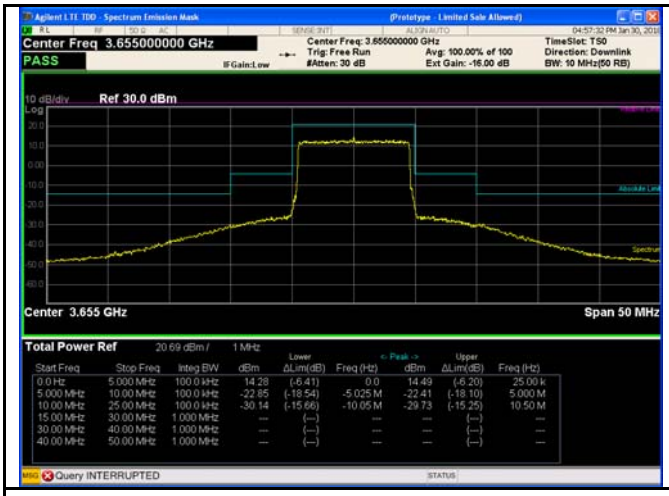
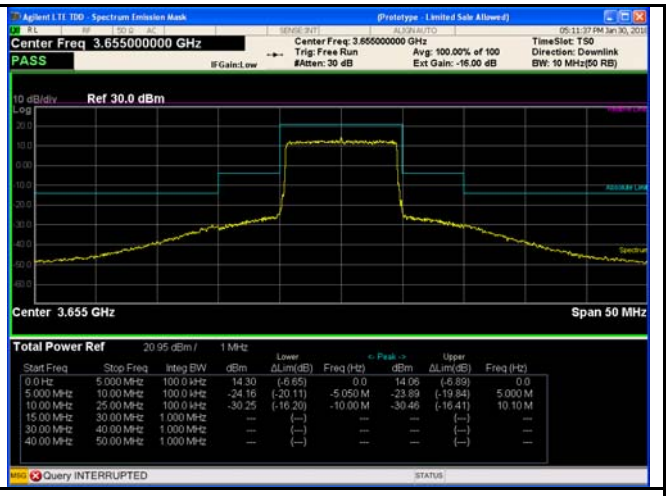
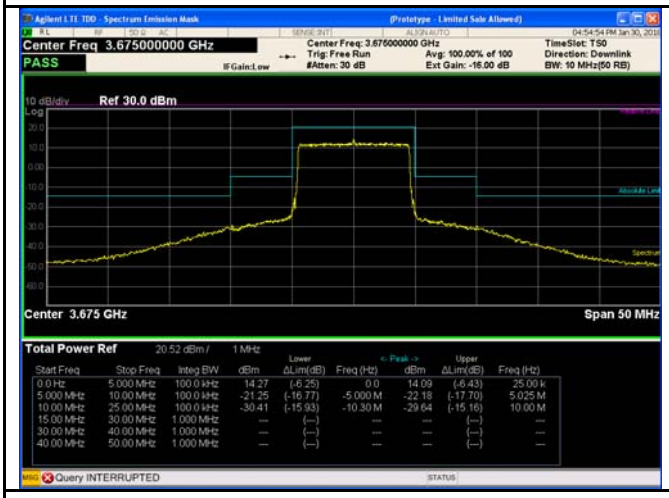
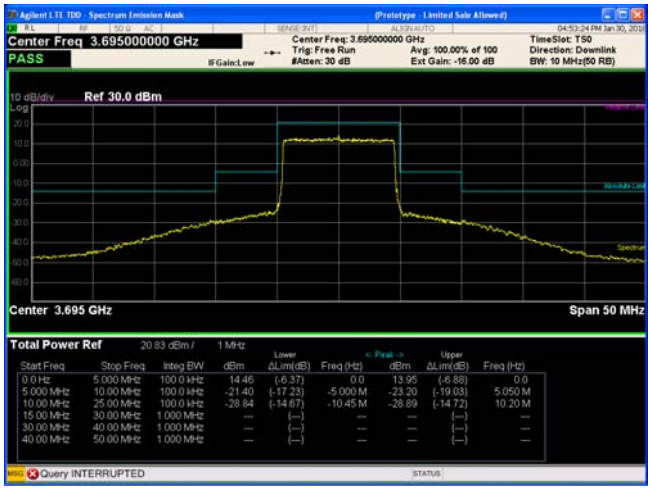
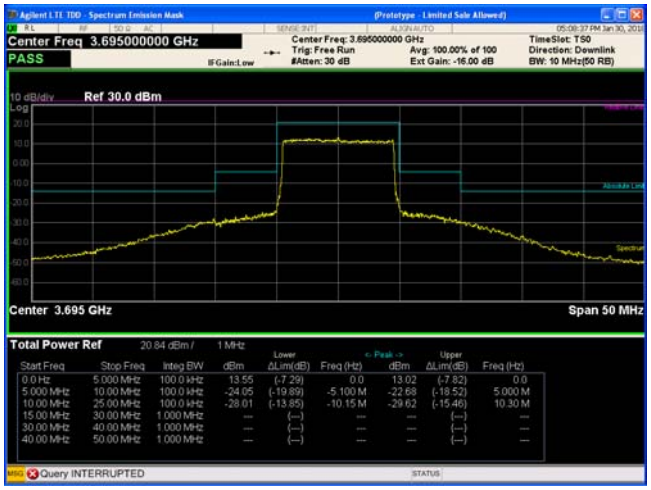


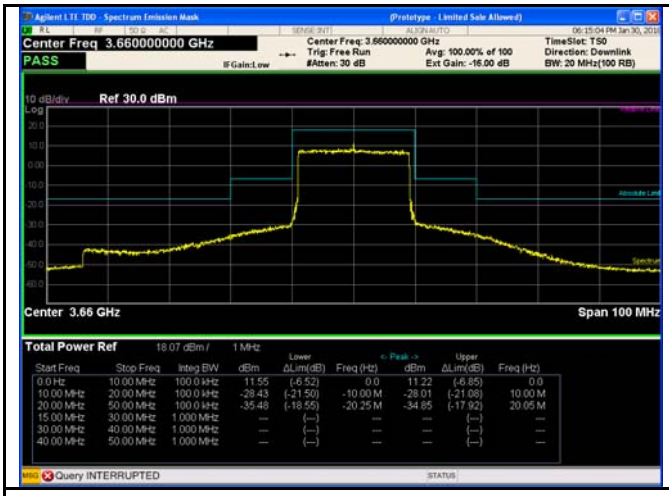
20MHz - High CH QPSK



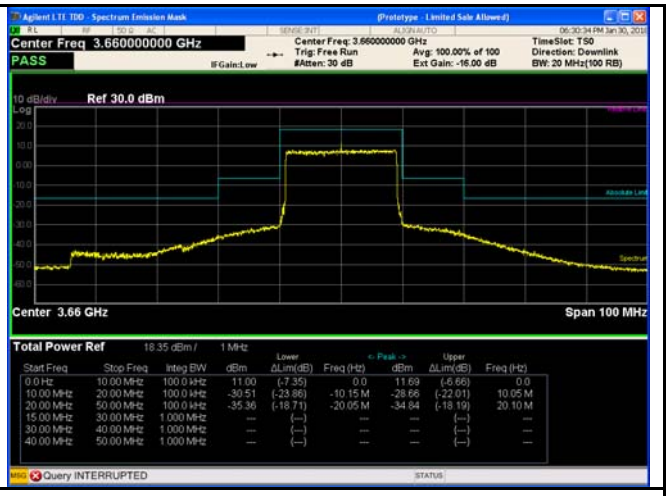
20MHz - High CH 64QAM

Slave-Chain 1

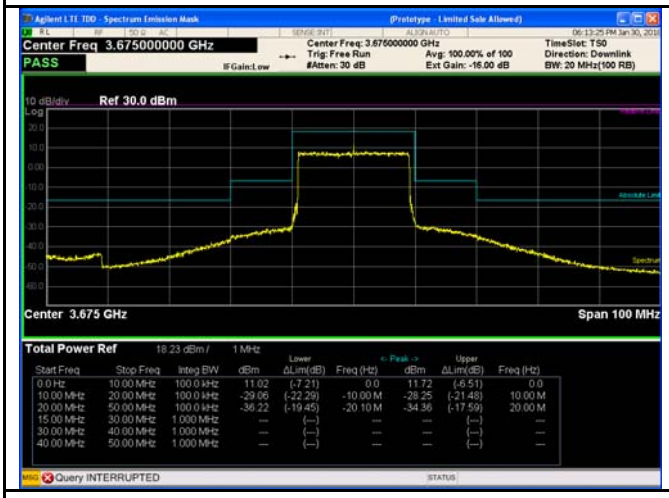
	
10MHz - Low CH QPSK	10MHz - Low CH 64QAM
	
10MHz - Middle CH QPSK	10MHz - Middle CH 64QAM
	
10MHz - High CH QPSK	10MHz - High CH 64QAM



20MHz - Low CH QPSK

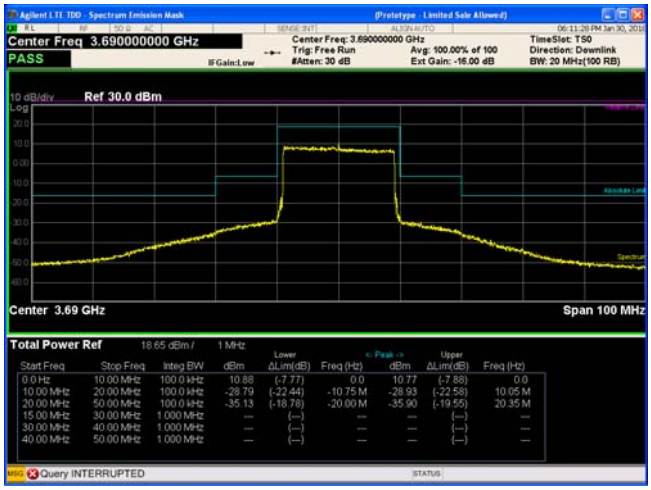


20MHz - Low CH 64QAM

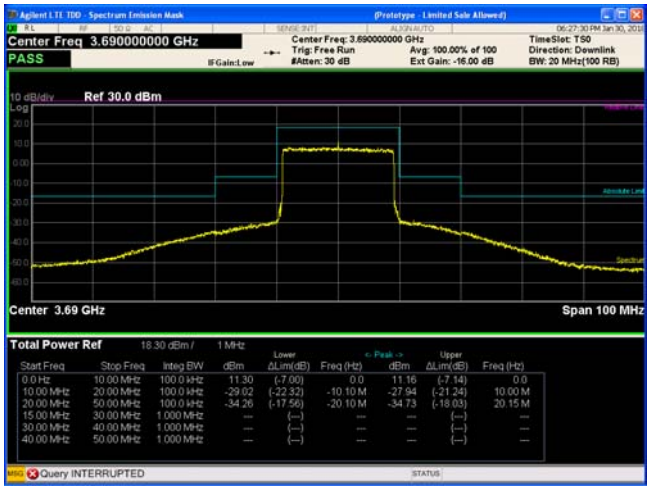


20MHz - Middle CH QPSK

20MHz - Middle CH 64QAM



20MHz - High CH QPSK



20MHz - High CH 64QAM

11 Out of band emission at antenna terminals

Test Requirement:	FCC part90.1323
Test Method:	FCC part2.1051
	ANSI C63.26-2015
Test Mode:	Data communicating mode
Limit:	-13dBm

11.1 EUT Operation

Operating Environment :

Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.3kPa

11.2 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: Set the RBW=100 kHz, VBW=300 kHz when below 1 GHz, RBW =1 MHz, VBW=3 MHz when above 1 GHz, 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.

11.3 Test Result

Remark: During the test, pre-scan the QPSK, 64QAM modulation, and found the QPSK modulation(10MHz/20MHz middle channel) is the worst case.
The permit frequency range of Part 90Z is from 3650-3700MHz. according the frequency table of the device on page 7. Notes as below:

1. The frequency star and stop for band edge test instruction as below:

bandwidth	Left > 1MHz	Left 1MHz immediately	Low channel	Middle Channel	High channel	Right 1MHz immediately	Right > 1MHz
10MHz	3644-3649	3649-3650	3655	3675	3695	3700-3701	3701-3706
20MHz	3639-3649	3649-3650	3660	3675	3690	3700-3701	3701-3711

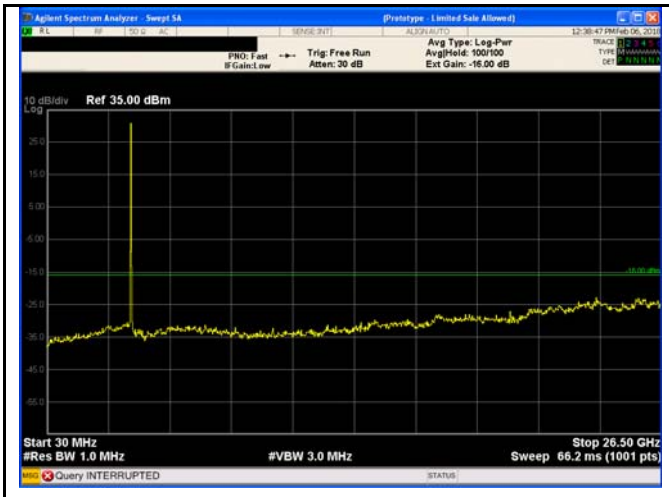
Note 1:
For **low** channel, we test left 1 MHz immediately and more than 1MHz away (5 MHz for 10 MHz bandwidth & 10MHz for 20MHz bandwidth) from the permit left band 3650 MHz; the emission above right of 3700MHz has no intentional.

For **high** channel, we test right 1 MHz immediately and more than 1MHz away (5 MHz for 10 MHz bandwidth & 10MHz for 20MHz bandwidth) from the permit right band 3700 MHz; the emission below left of 3650MHz has no intentional.
For **middle** channel, we both test left and right 1 MHz immediately and more than 1MHz away (5 MHz for 10 MHz bandwidth & 10MHz for 20MHz bandwidth) from the permit band 3650 MHz to 3700 MHz; see above table.

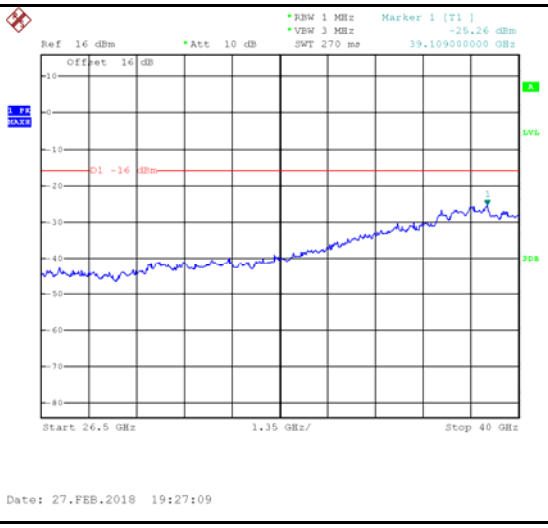
2. The RBW and the limit instruction as below: (The general limit = -13dBm)

1. For 2x2 MIMO, the limit=-13dBm -10 log 2=-16dBm.
2. For RBW=100kHz, the limit = -16dBm – 10log(1MHz/100kHz)= -26dBm
3. For RBW=50kHz, the limit= -16dBm – 10log(1MHz/50kHz)= -29dBm
   (The spectrum of N9020A only display the RBW=51kHz, and RBW=50kHz limit is lower than RBW=51kHz.)
4. For RBW=200kHz, the limit= -16dBm - 10log(1MHz/200kHz)= -23dBm

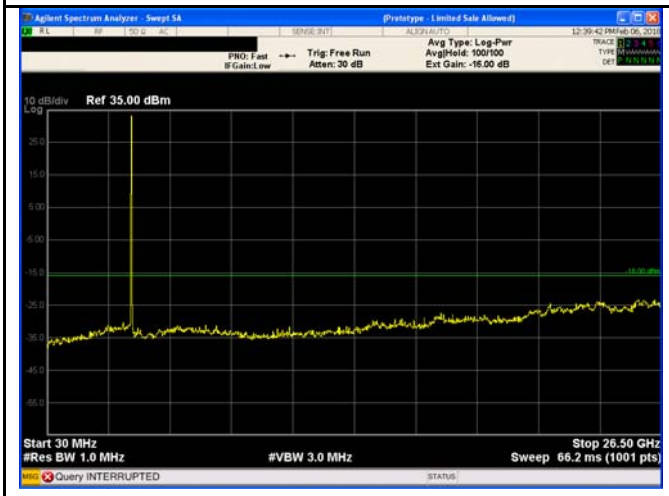
Test Plots Spurious emission
Master



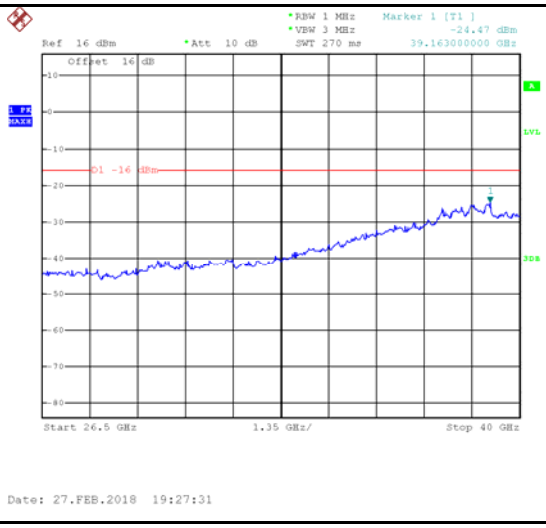
10MHz - Low CH 30MHz~26.5GHz



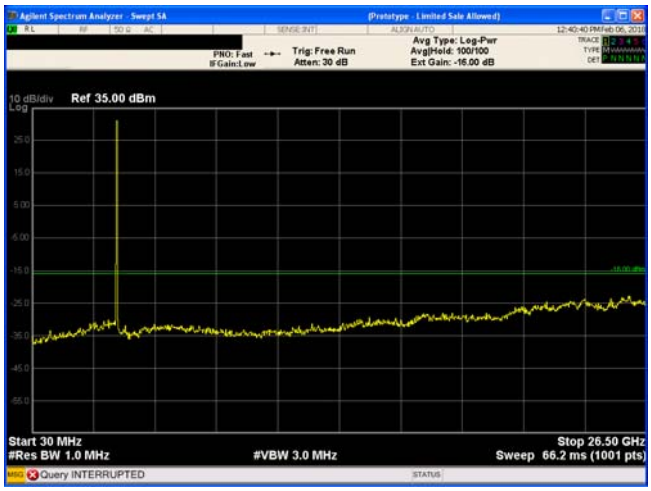
10MHz - Low CH 26.5GHz~40GHz



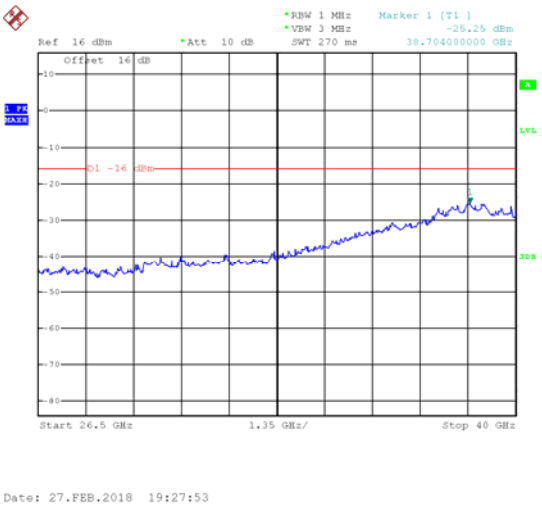
10MHz - Middle CH 30MHz~26.5GHz



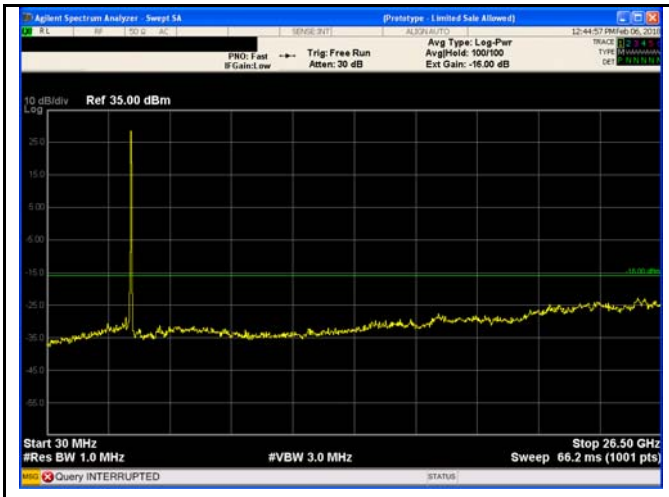
10MHz - Middle CH 26.5GHz~40GHz



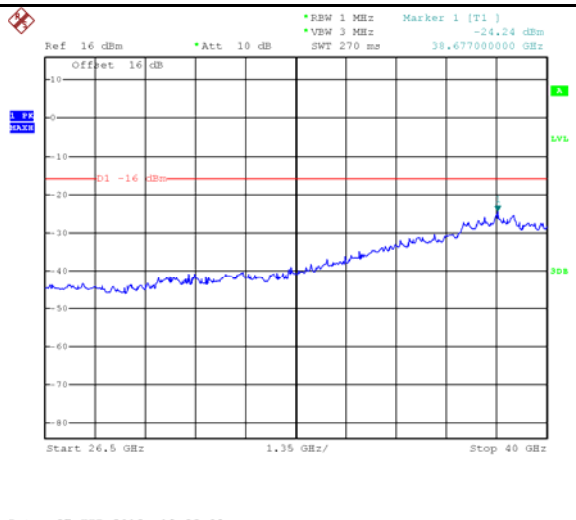
10MHz - High CH 30MHz~26.5GHz



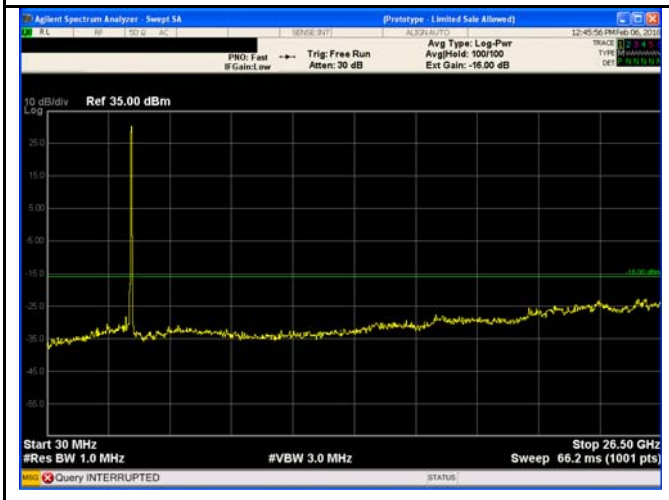
10MHz - High CH 26.5GHz~40GHz



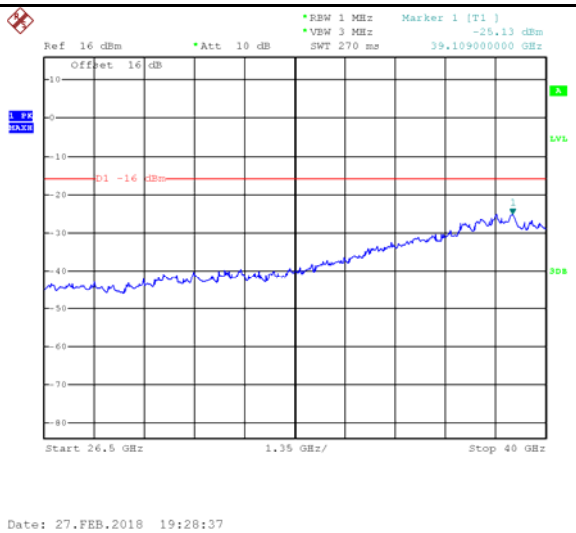
20MHz - Low CH 30MHz~26.5GHz



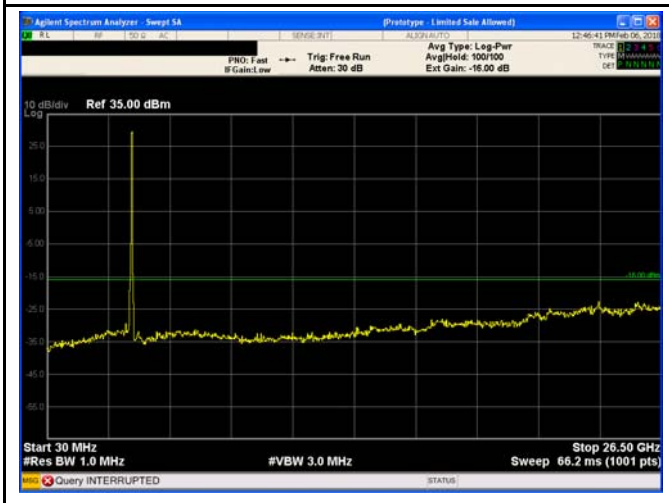
20MHz - Low CH 26.5GHz~40GHz



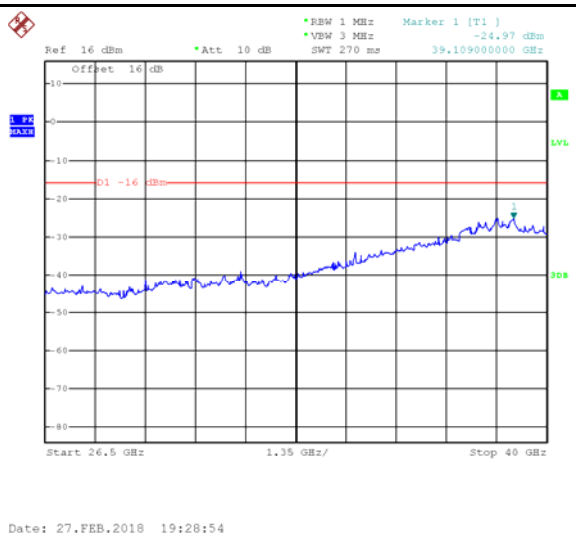
20MHz - Middle CH 30MHz~26.5GHz



20MHz - Middle CH 26.5GHz~40GHz

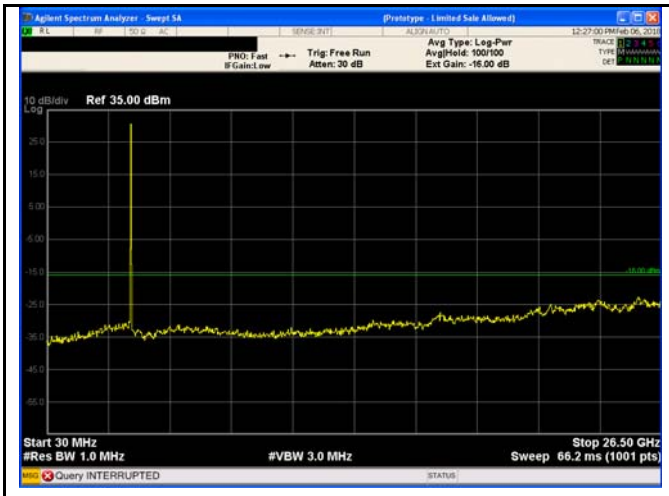
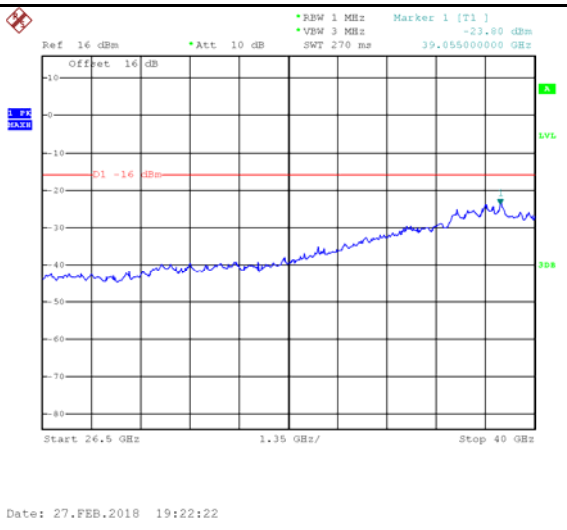
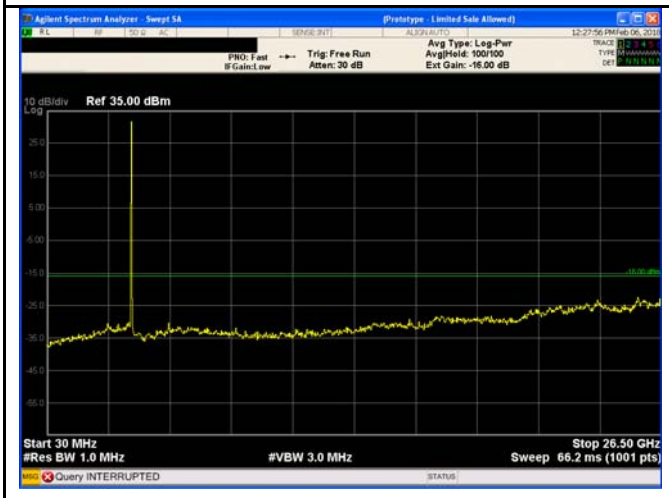
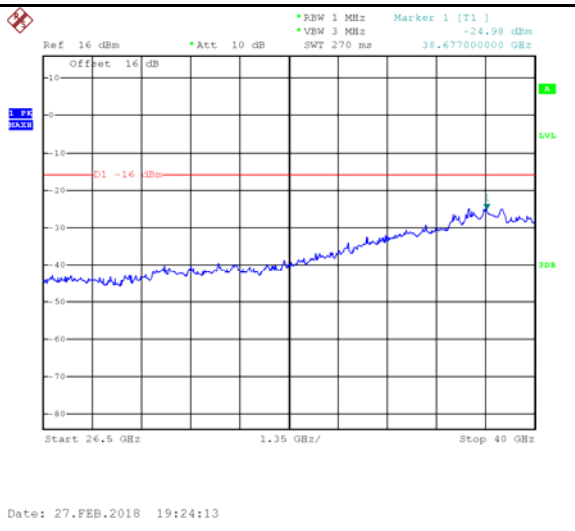
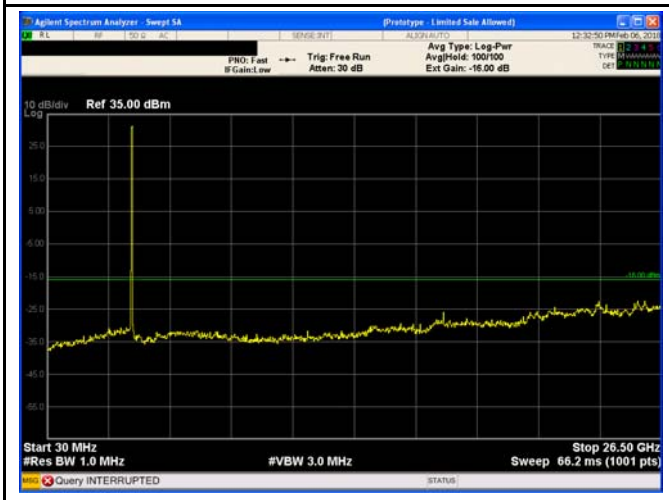
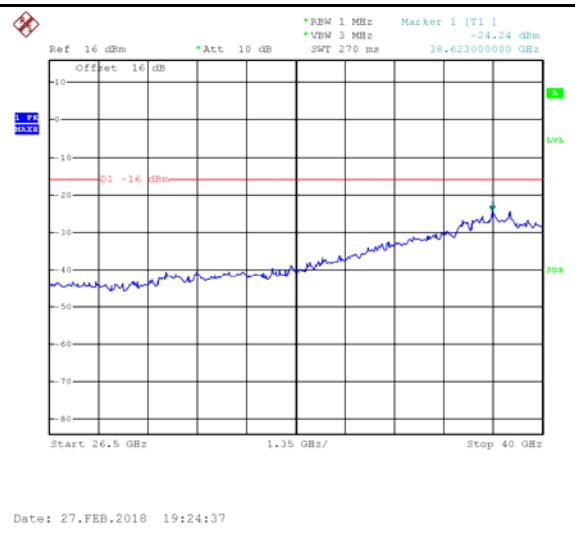


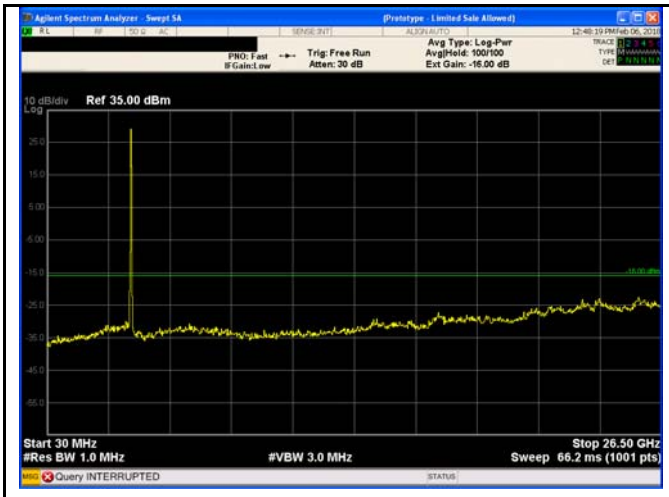
20MHz - High CH 30MHz~26.5GHz

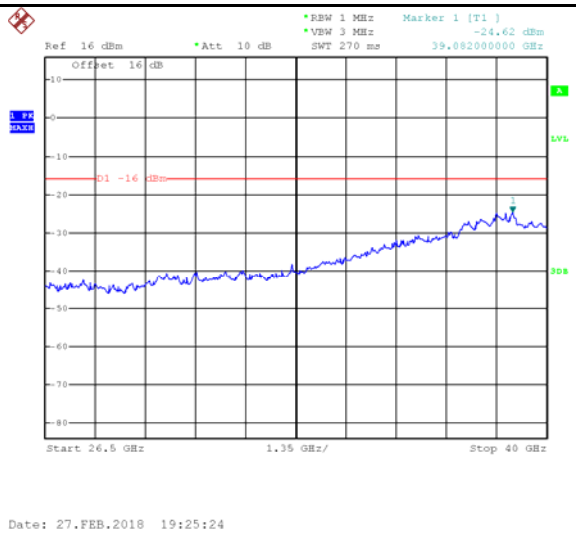


20MHz - High CH 26.5GHz~40GHz

Slave

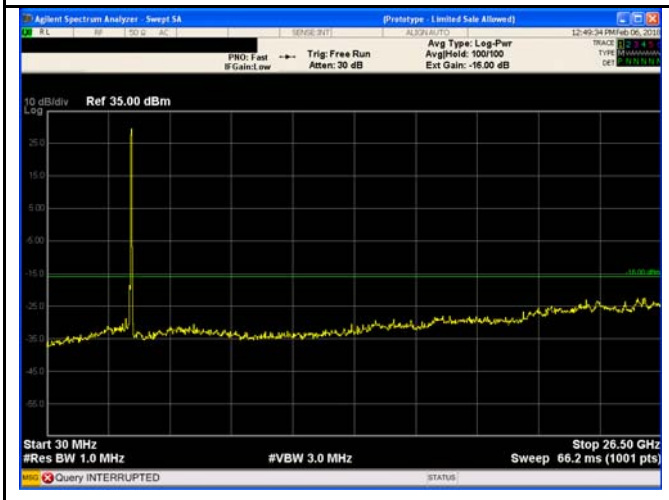
	
10MHz - Low CH 30MHz~26.5GHz	10MHz - Low CH 26.5GHz~40GHz
	
10MHz - Middle CH 30MHz~26.5GHz	10MHz - Middle CH 26.5GHz~40GHz
	
10MHz - High CH 30MHz~26.5GHz	10MHz - High CH 26.5GHz~40GHz

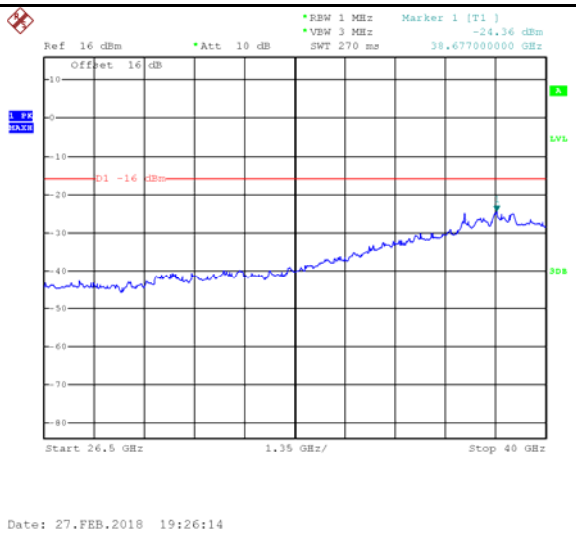




20MHz - Low CH 30MHz~26.5GHz

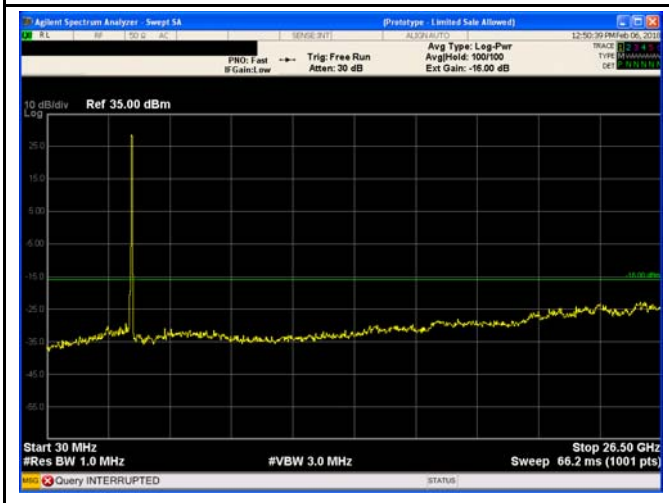
20MHz - Low CH 26.5GHz~40GHz

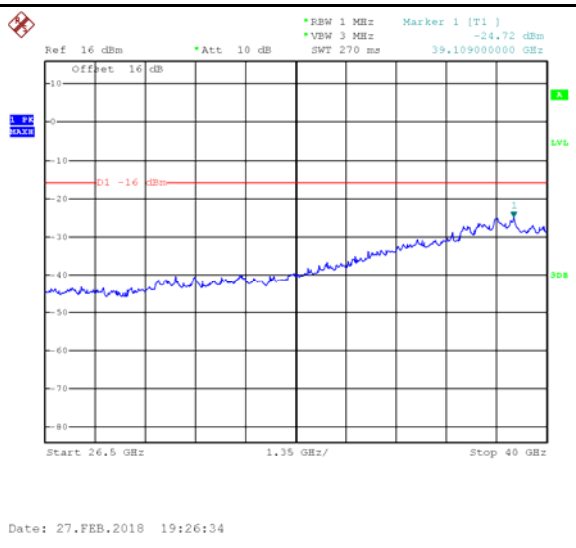




20MHz - Middle CH 30MHz~26.5GHz

20MHz - Middle CH 26.5GHz~40GHz

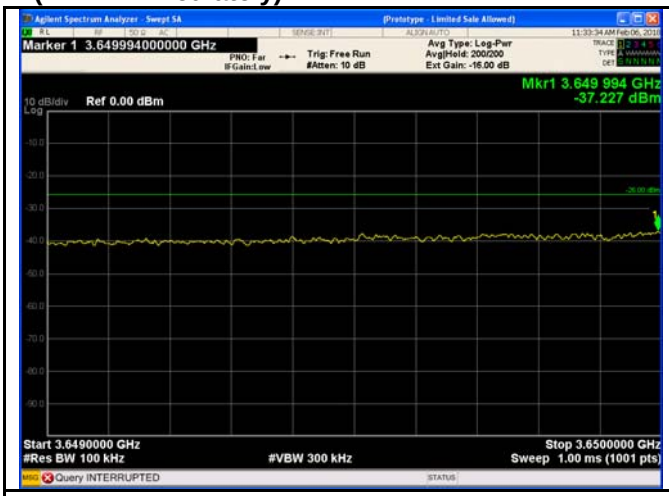




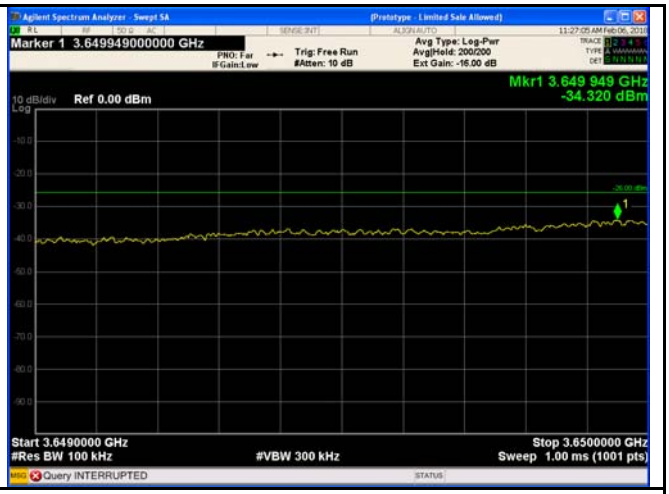
20MHz - High CH 30MHz~26.5GHz

20MHz - High CH 26.5GHz~40GHz

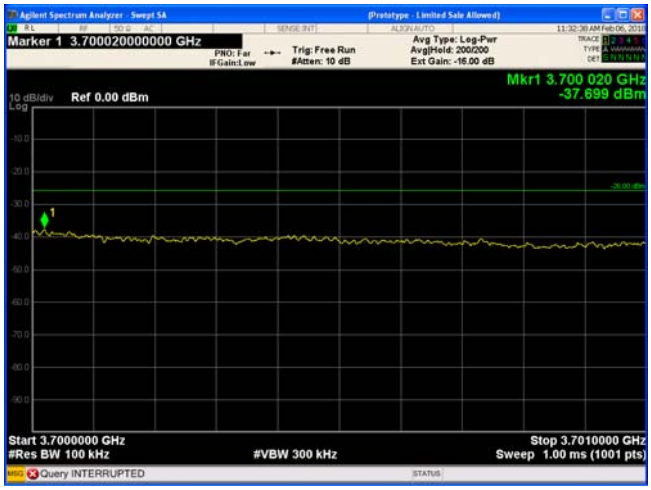
Band edge emission
Master
(1MHz immediately)



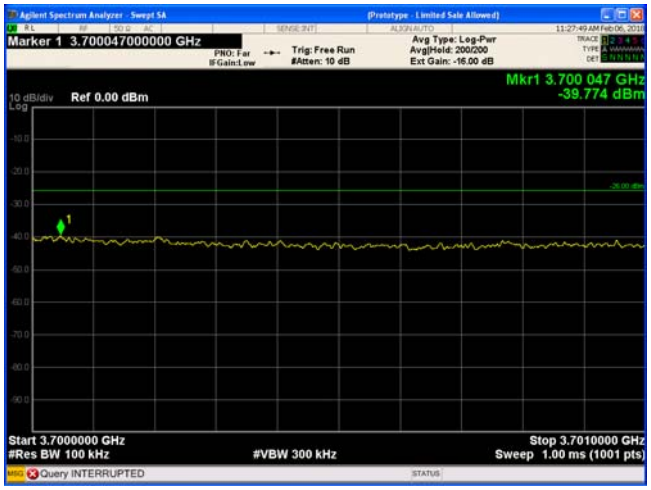
10MHz – 3649MHz-3650MHz Low CH QPSK



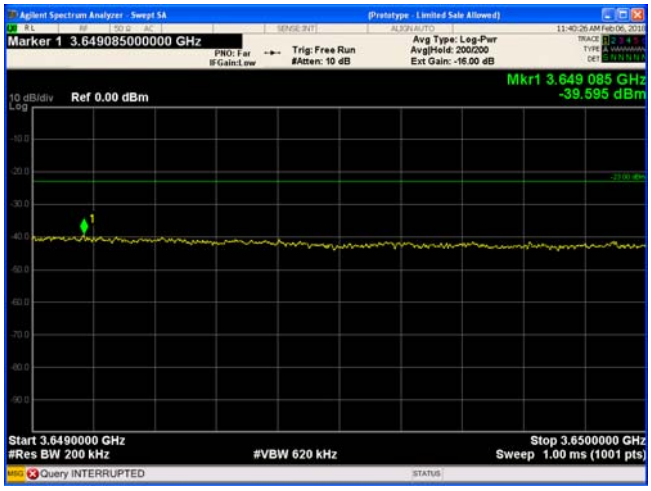
10MHz –3649MHz-3650MHz Low CH 64QAM



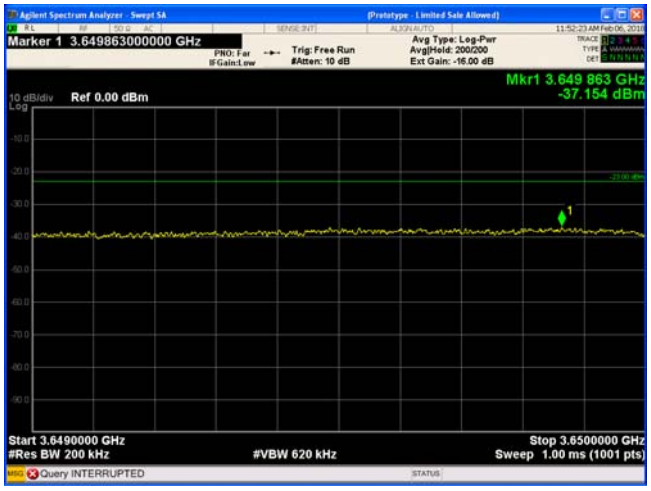
10MHz - 3700MHz -3701MHz High CH QPSK



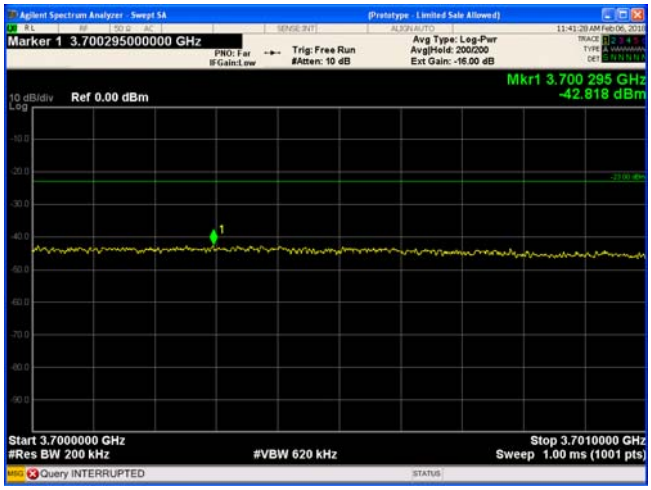
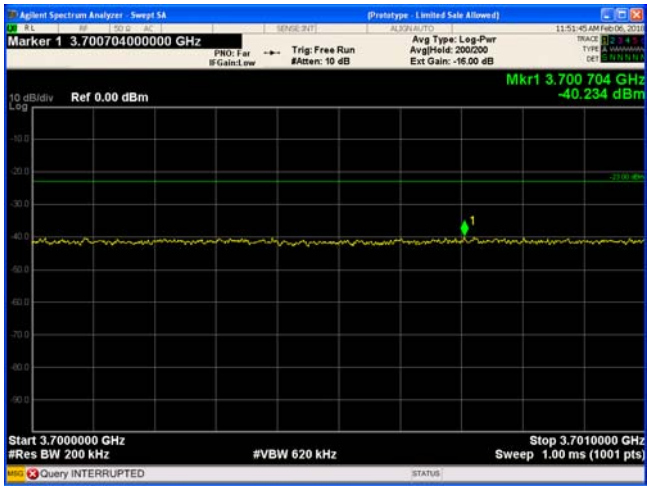
10MHz - 3700MHz -3701MHz High CH 64QAM



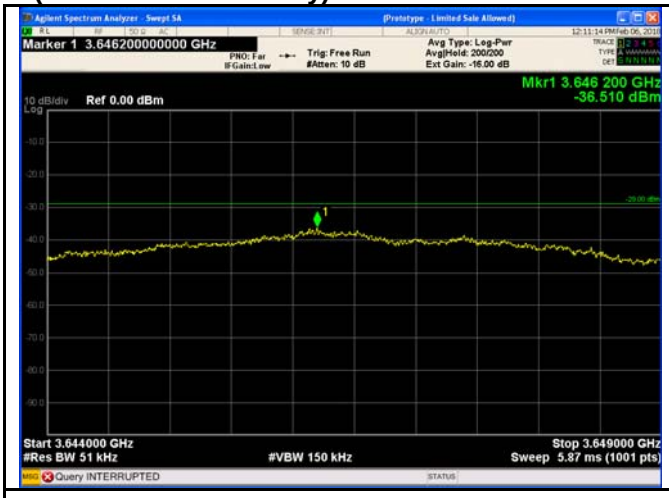
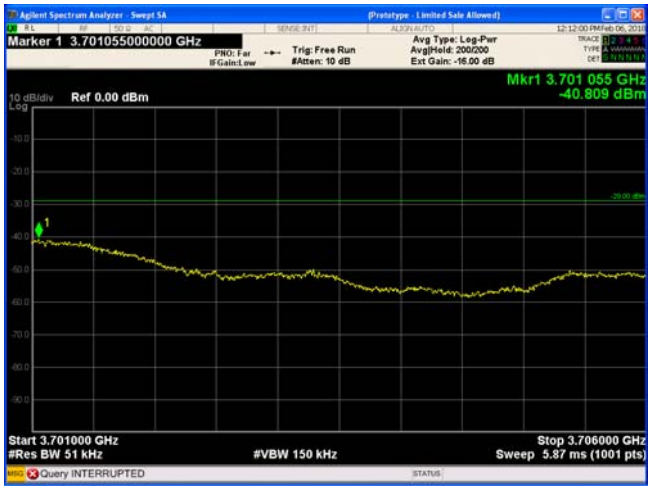
20MHz – 3649MHz-3650MHz Low CH QPSK

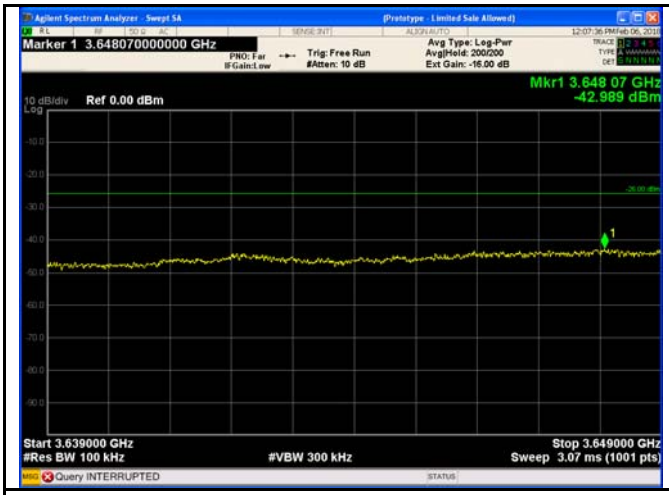


20MHz – 3649MHz-3650MHz Low CH 64QAM

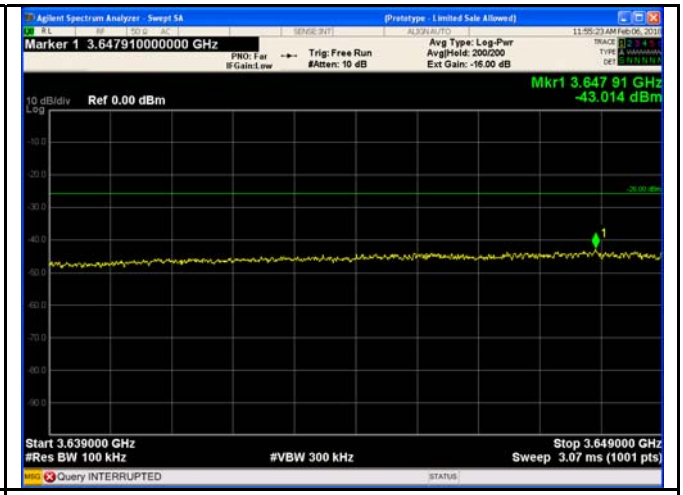
	
20MHz - 3700MHz -3701MHz High CH QPSK	20MHz - 3700MHz -3701MHz High CH 64QAM

Master
(more than 1MHz away)

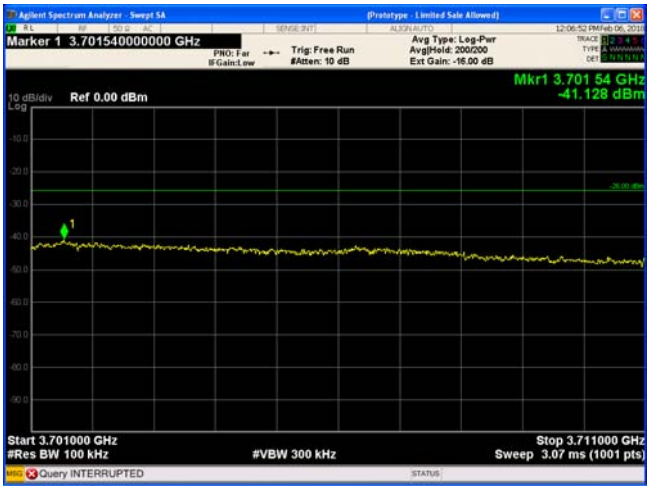
	
10MHz – 3644M-3649M Low CH QPSK	10MHz – 3644M-3649M Low CH 64QAM
	
10MHz - 3701M-3706M High CH QPSK	10MHz - 3701M-3706M High CH 64QAM



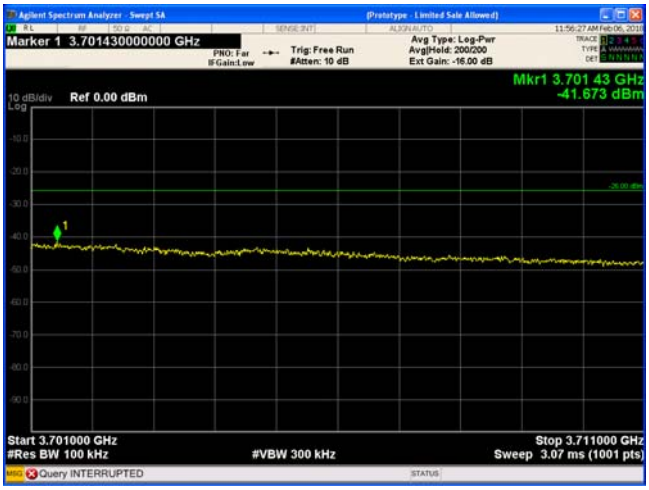
20MHz –3639M-3649M Low CH QPSK



20MHz –3639M-3649M Low CH 64QAM

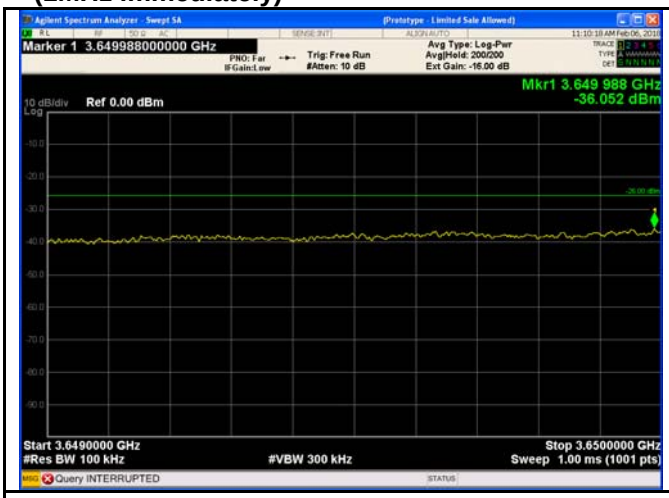


20MHz - 3701M-3711M High CH QPSK

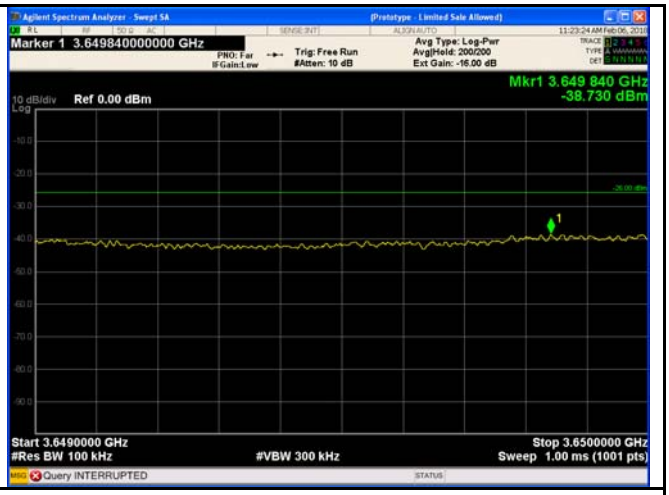


20MHz - 3701M-3711M High CH 64QAM

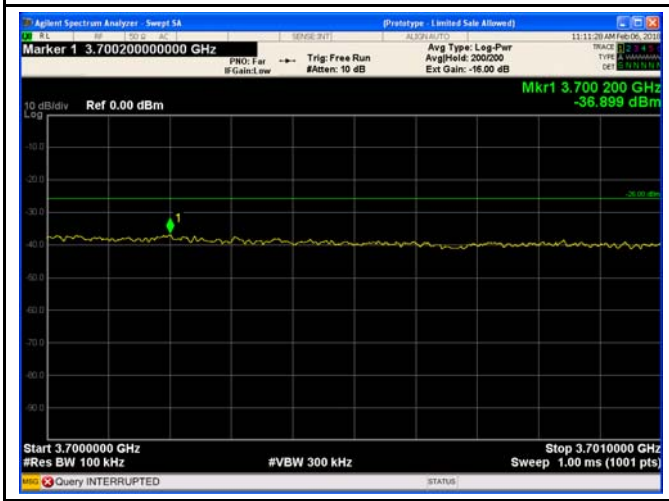
Slave
(1MHz immediately)



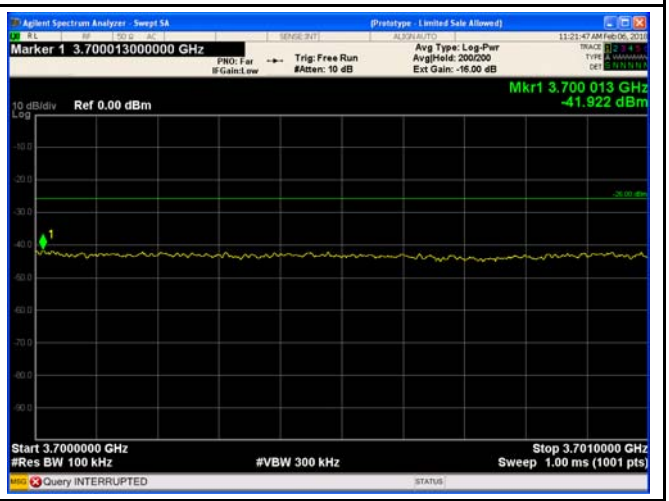
10MHz – 3649MHz-3650MHz Low CH QPSK



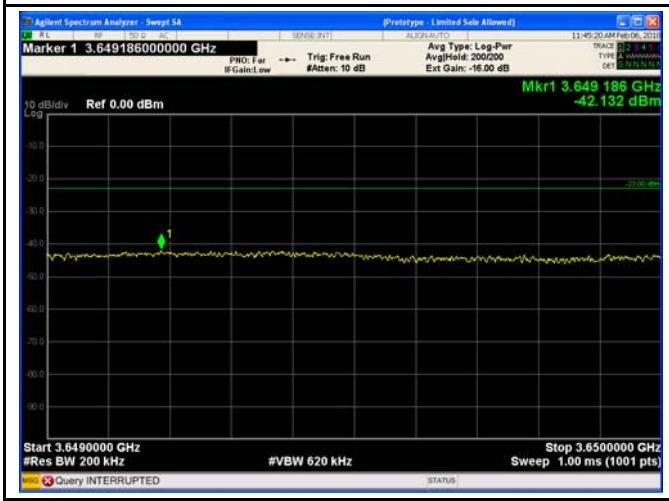
10MHz –3649MHz-3650MHz Low CH 64QAM



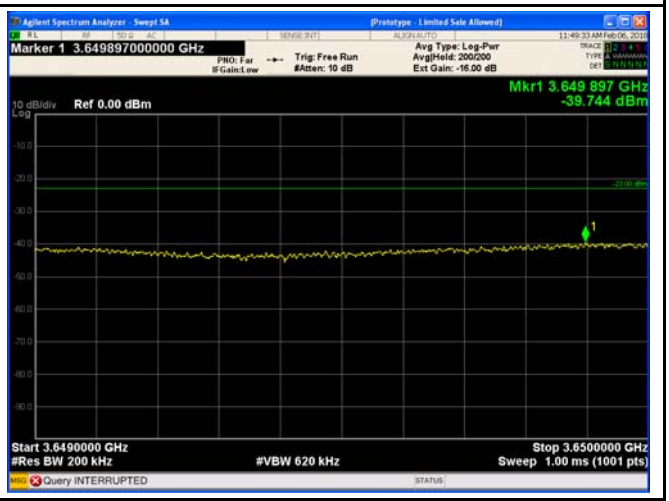
10MHz - 3700MHz -3701MHz High CH QPSK



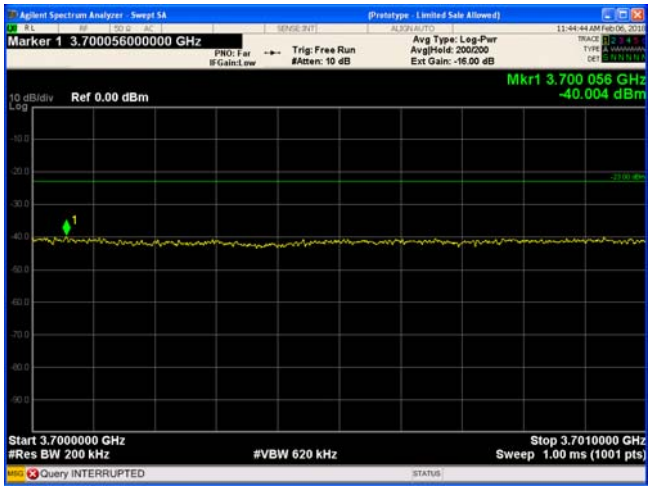
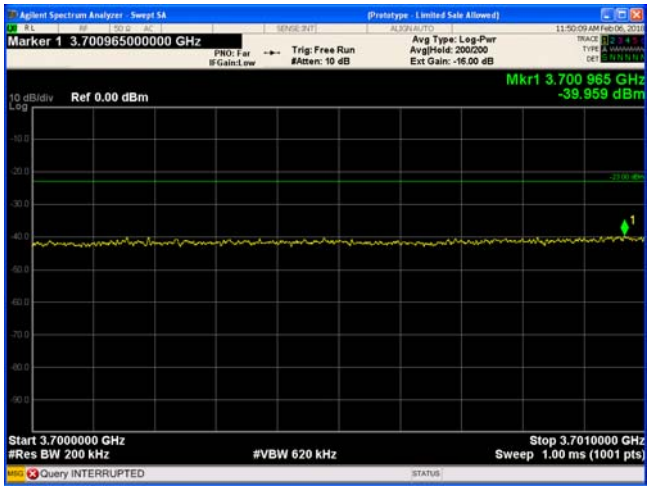
10MHz - 3700MHz -3701MHz High CH 64QAM



20MHz – 3649MHz-3650MHz Low CH QPSK

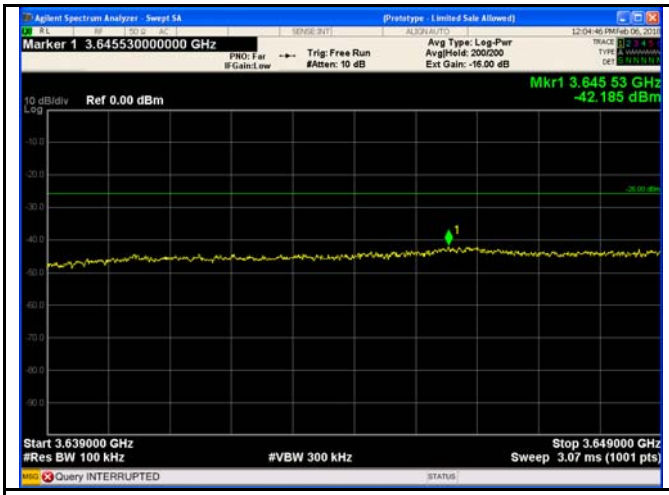


20MHz – 3649MHz-3650MHz Low CH 64QAM

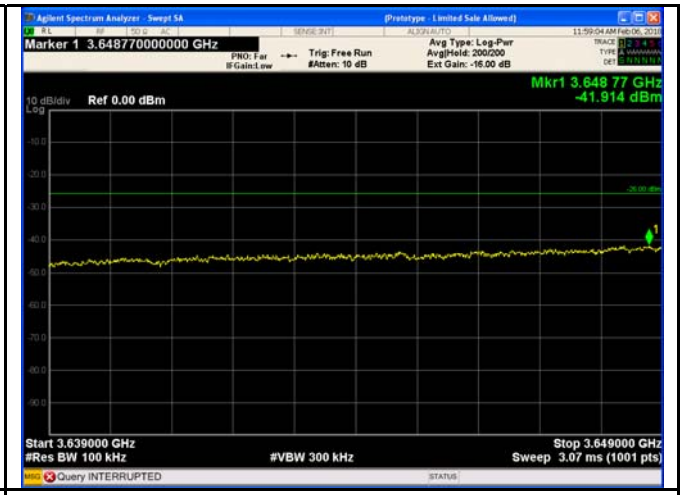
	
20MHz - 3700MHz -3701MHz High CH QPSK	20MHz - 3700MHz -3701MHz High CH 64QAM

Slave
(more than 1MHz away)

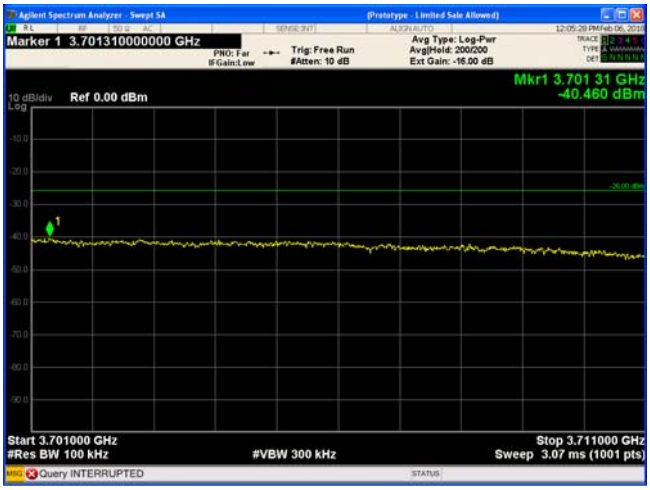
	
10MHz – 3644M-3649M Low CH QPSK	10MHz – 3644M-3649M Low CH 64QAM
	
10MHz - 3701M-3706M High CH QPSK	10MHz - 3701M-3706M High CH 64QAM



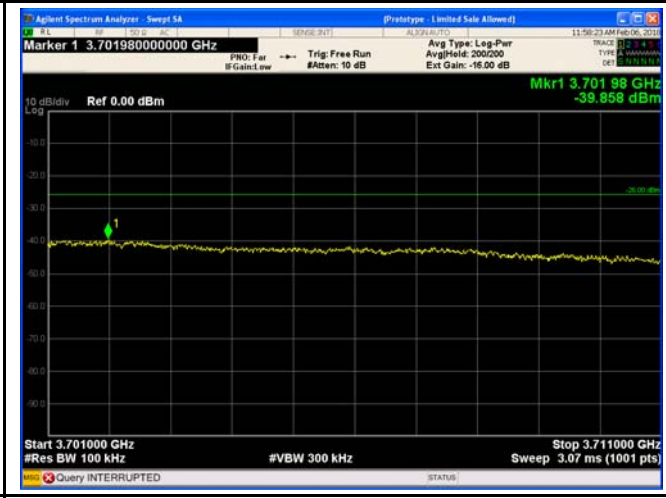
20MHz –3639M-3649M Low CH QPSK



20MHz –3639M-3649M Low CH 64QAM



20MHz - 3701M-3711M High CH QPSK



20MHz - 3701M-3711M High CH 64QAM

12 Field strength of spurious radiation measurement

Test Requirement:	FCC part90.1323
Test Method:	FCC part2.1051
	ANSI C63.26-2015
Test Mode:	Data communicating mode
Limit:	-13dBm

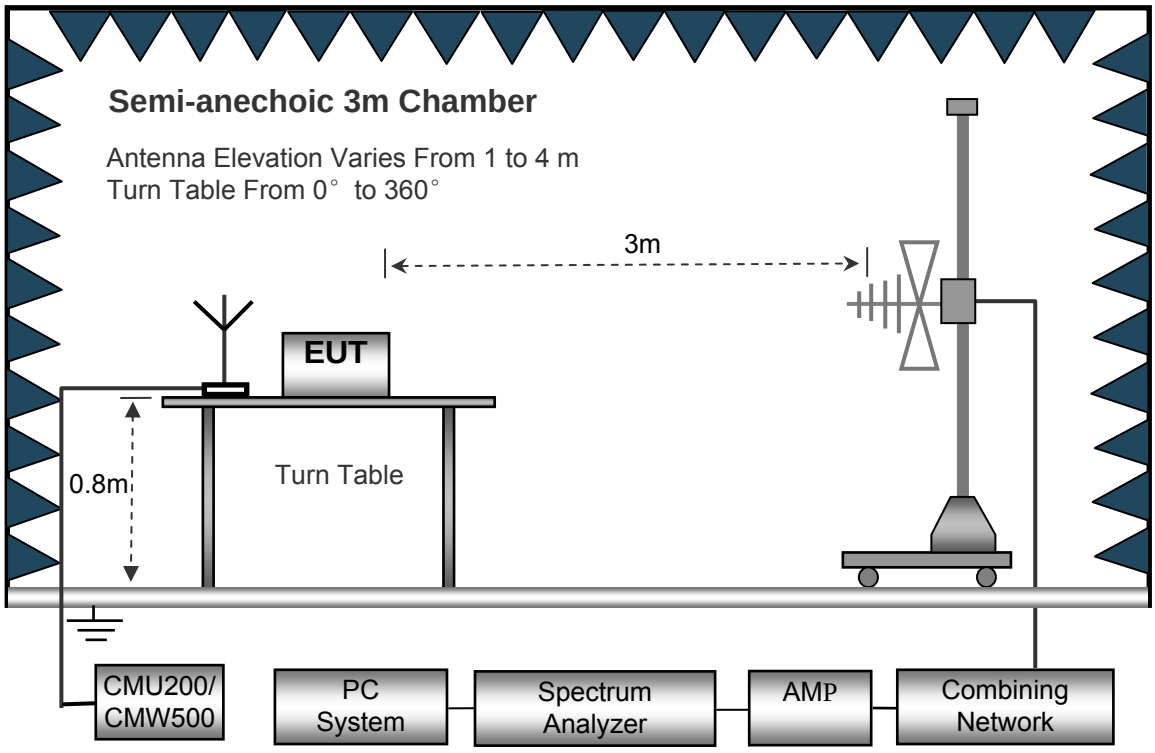
12.1 EUT Operation

Operating Environment :

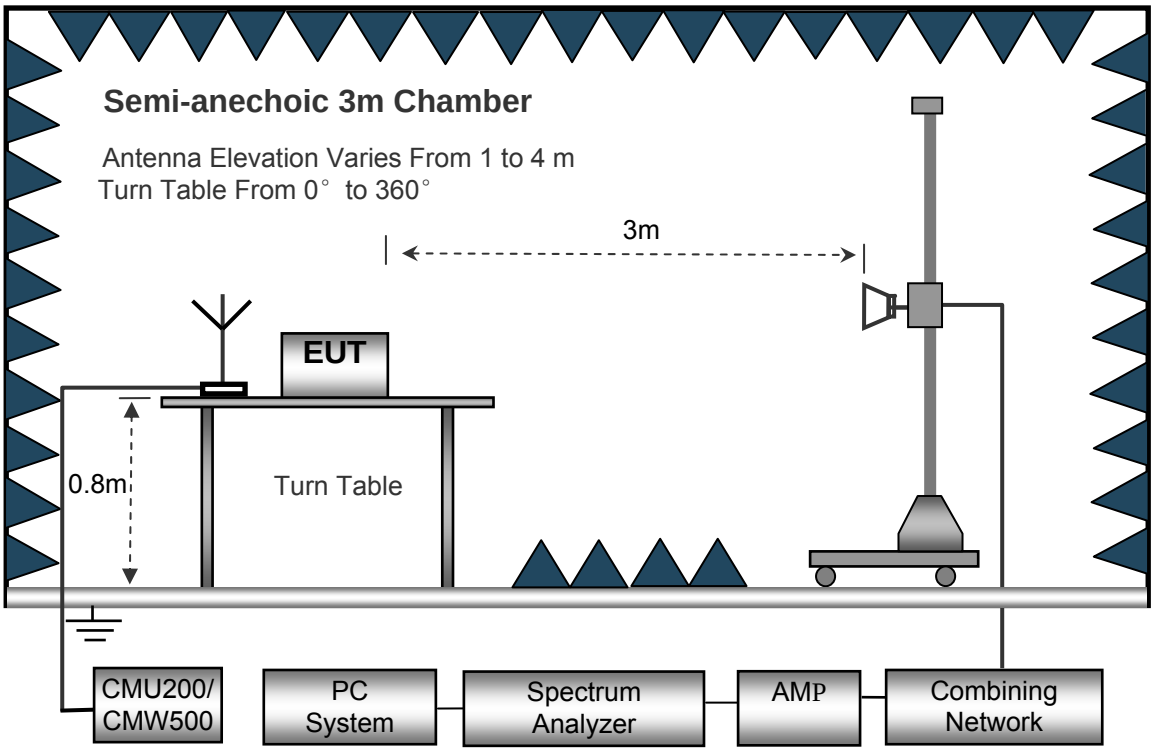
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

12.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site.
The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



12.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

12.4 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.
   ERP / EIRP = S.G. output (dBm) + Antenna Gain(dB/dBi) – Cable Loss (dB)

12.5 Test Result

30MHz-18GHz

Remark: During the test, pre-scan the QPSK, 64QAM modulation, and found the QPSK modulation and 10MHz bandwitch is the worst case.

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
Low channel										
198.63	41.48	316	1.3	H	-69.03	0.15	0.00	-69.18	-13.00	-56.18
198.63	28.69	314	1.1	V	-78.90	0.15	0.00	-79.05	-13.00	-66.05
1649.40	65.95	89	1.1	H	-47.10	2.34	12.40	-37.04	-13.00	-24.04
1649.40	59.98	274	2.1	V	-51.17	2.34	12.40	-41.11	-13.00	-28.11
2474.10	53.58	207	1.5	H	-55.83	2.79	12.70	-45.92	-13.00	-32.92
2474.10	44.73	71	1.3	V	-64.04	2.79	12.70	-54.13	-13.00	-41.13
Middle channel										
198.63	41.23	177	2.2	H	-69.28	0.15	0.00	-69.43	-13.00	-56.43
198.63	27.77	5	1.0	V	-79.82	0.15	0.00	-79.97	-13.00	-66.97
1673.00	59.00	356	1.4	H	-54.05	2.37	12.50	-43.92	-13.00	-30.92
1673.00	53.62	1	2.0	V	-57.53	2.37	12.50	-47.40	-13.00	-34.40
2509.50	46.54	130	1.0	H	-62.87	2.79	12.70	-52.96	-13.00	-39.96
2509.50	36.91	320	2.2	V	-71.86	2.79	12.70	-61.95	-13.00	-48.95
High channel										
198.63	41.21	353	1.0	H	-69.30	0.15	0.00	-69.45	-13.00	-56.45
198.63	28.26	50	1.5	V	-79.33	0.15	0.00	-79.48	-13.00	-66.48
1696.60	51.19	6	1.9	H	-61.45	2.37	12.50	-51.32	-13.00	-38.32
1696.60	47.46	252	2.2	V	-63.27	2.37	12.50	-53.14	-13.00	-40.14
2544.90	39.83	182	1.1	H	-69.75	2.81	12.80	-59.76	-13.00	-46.76
2544.90	29.08	16	1.6	V	-79.72	2.81	12.80	-69.73	-13.00	-56.73

Remark:

Test Frequency: 18GHz~40GHz

The measurements were more than 20 dB below the limit and not recorded.

13 Frequency stability V.S. Temperature measurement

Test Requirement: FCC Part90.213(a)

Test Method: FCC Part2.1055(a)(1)(b)

ANSI C63.26-2015

Test Mode: Data communicating mode

Limit: FCC:

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
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			

13.1 EUT Operation

Operating Environment :

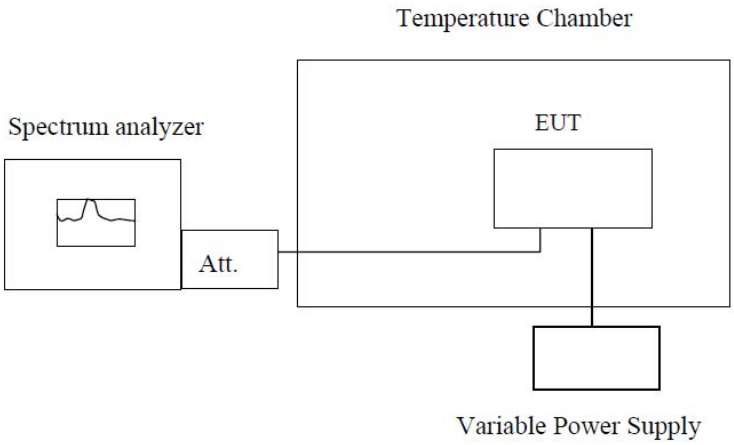
Temperature: 23.5 °C

Humidity: 52.3 % RH

Atmospheric Pressure: 101.3kPa

13.2 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℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to –30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.



Note : Measurement setup for testing on Antenna connector

13.3 Test Result

Remark: All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Master-Chain 2

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	107	0.0293
-25		113	0.0309
-10		103	0.0282
0		108	0.0295
10		107	0.0293
20		109	0.0298
30		109	0.0298
40		115	0.0315
55		113	0.0309

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	113	0.0309
-25		112	0.0306
-10		121	0.0331
0		114	0.0311
10		120	0.0328
20		121	0.0331
30		115	0.0314
40		109	0.0298
55		118	0.0322

Master-Chain 3

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	106	0.0290
-25		107	0.0293
-10		112	0.0306
0		110	0.0301
10		116	0.0317
20		103	0.0282
30		117	0.0320
40		118	0.0323
55		116	0.0317

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	118	0.0322
-25		108	0.0295
-10		123	0.0336
0		116	0.0317
10		110	0.0301
20		124	0.0339
30		115	0.0314
40		115	0.0314
55		116	0.0317

Slave-Chain 0

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	104	0.0285
-25		110	0.0301
-10		100	0.0274
0		103	0.0282
10		103	0.0282
20		107	0.0293
30		95	0.0260
40		97	0.0265
55		95	0.0260

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	114	0.0311
-25		109	0.0298
-10		106	0.0290
0		112	0.0306
10		109	0.0298
20		111	0.0303
30		121	0.0331
40		109	0.0298
55		119	0.0325

Slave-Chain 1

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	104	0.0285
-25		108	0.0295
-10		93	0.0254
0		101	0.0276
10		100	0.0274
20		105	0.0287
30		100	0.0274
40		102	0.0279
55		103	0.0282

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	48	110	0.0301
-25		106	0.0290
-10		112	0.0306
0		109	0.0298
10		106	0.0290
20		115	0.0314
30		105	0.0287
40		115	0.0314
55		116	0.0317

14 Frequency stability V.S. Voltage measurement

Test Requirement: FCC Part90.213(a)

Test Method: FCC Part2.1055(a)(1)(b)

ANSI C63.26-2015

Test Mode: Data communicating mode

Limit: FCC:

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
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			

14.1 EUT Operation

Operating Environment :

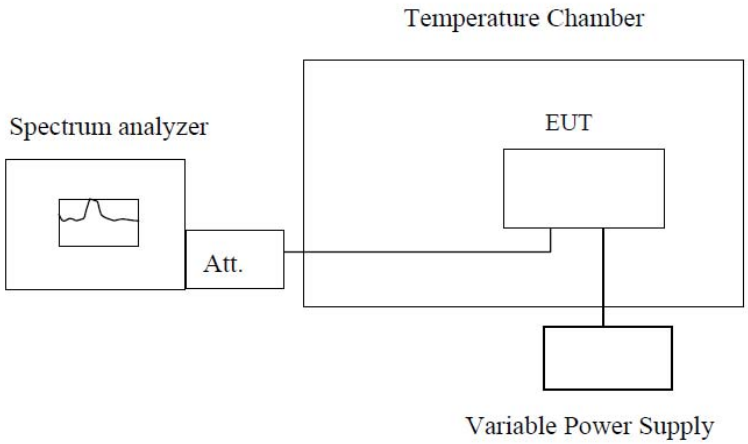
Temperature: 22.9 °C

Humidity: 52.0 % RH

Atmospheric Pressure: 101.3kPa

14.2 Test Procedure

1. Set chamber temperature to 25℃. 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.



Note : Measurement setup for testing on Antenna connector

14.3 Test Result

Remark: All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Master-Chain 2

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	105	0.0287
	48	90	0.0246
	55	106	0.0290

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	103	0.0281
	48	100	0.0273
	55	109	0.0298

Master-Chain 3

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	94	0.0257
	48	107	0.0293
	55	99	0.0271

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	98	0.0268
	48	106	0.0290
	55	99	0.0270

Slave-Chain 0

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	92	0.0252
	48	105	0.0287
	55	102	0.0279

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	105	0.0287
	48	98	0.0268
	55	109	0.0298

Slave-Chain 1

Test Frequency: 3655MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	94	0.0257
	48	98	0.0268
	55	103	0.0282

Test Frequency: 3660MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	42	105	0.1255
	48	102	0.1219
	55	110	0.1315

15 Photographs of test setup and EUT.

Note: Please refer to appendix: WTS18S0199015W_Photo.

====== End of Report ======