



FCC CFR47 PART 27L
CERTIFICATION TEST REPORT
FOR
IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE
MODEL NUMBER: A1430

FCC ID: BCGA1430
IC: 579C-A1430

REPORT NUMBER: 11U14054-2, REVISION A

ISSUE DATE: JANUARY 30, 2012

Prepared for
APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A

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NVLAP LAB CODE 200065-0

Revision History

Issue		Revisions	Revised By
Rev.	Date		
---	01/06/12	Initial Issue	T. Chan
---	01/30/12	Added Peak-to-Average Ratio Plots	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: IPAD WITH 802.11 abgn BT EDR / LE / GSM / WCDMA / LTE

MODEL: A1430

SERIAL NUMBER: PT713734

DATE TESTED: OCTOBER 05-DECEMBER 12, 2011 AND JANUARY 30, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 27L	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:

Tested By:



THU CHAN
ENGINEERING MANAGER
UL CCS



CHIN PANG
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, and FCC CFR 47 FCC Part 27.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) +
Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Apple iPad is a tablet device with iPod functions (music application support and video), 802.11 a/b/g/n radio, Bluetooth radio function, and cellular using GSM 2G/3G/LTE data functions. The rechargeable battery is not user accessible

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average conducted and ERP / EIRP output powers as follows:

Part 27 LTE Band 17 MODE (5.0 MHz BANDWIDTH)					
Frequency range (MHz)	Modulation	Conducted(Average)		ERP(Average)	
		dBm	mW	dBm	mW
706.50	QPSK RB1-0	24.30	269.2	20.00	100.0
710.00		24.30	269.2	20.20	104.7
713.50		24.30	269.2	19.40	87.1
706.50	16QAM, RB1-0	23.50	223.9	18.50	70.8
710.00		23.40	218.8	19.60	91.2
713.50		23.45	221.3	18.50	70.8

Part 27 LTE Band 17 MODE (10.0 MHz BANDWIDTH)					
Frequency range (MHz)	Modulation	Conducted(Average)		ERP(Average)	
		dBm	mW	dBm	mW
709.00	QPSK RB1-0	24.40	275.4	19.68	92.9
710.00		24.43	277.3	19.66	92.5
711.00		24.40	275.4	19.10	81.3
709.00	16QAM RB1-0	23.50	223.9	18.80	75.9
710.00		23.50	223.9	18.70	74.1
711.00		23.50	223.9	18.40	69.2

Part 27 LTE Band 4 MODE (5.0 MHz BANDWIDTH)					
Frequency range (MHz)	Modulation	Conducted(Average)		EIRP(Average)	
		dBm	mW	dBm	mW
1712.5	QPSK RB1-24	23.50	223.9	23.31	214.3
1732.5		23.50	223.9	23.03	200.9
1752.5		23.50	223.9	22.80	190.5
1712.5	16QAM RB1-24	22.50	177.8	22.03	159.6
1732.5		22.50	177.8	22.58	181.1
1752.5		22.50	177.8	22.40	173.8

Part 27 LTE Band 4 MODE (10.0 MHz BANDWIDTH)					
Frequency range (MHz)	Modulation	Conducted(Average)		EIRP(Average)	
		dBm	mW	dBm	mW
1715.0	QPSK RB1-49	23.50	223.9	22.93	196.3
1732.5		23.50	223.9	23.38	217.8
1750.0		23.50	223.9	23.80	239.9
1715.0	16QAM RB1-49	22.33	171.0	21.83	152.4
1732.5		22.31	170.2	22.08	161.4
1750.0		22.50	177.8	22.30	169.8

5.3. SOFTWARE AND FIRMWARE

The test software used during testing was 9B87

The EUT is link to CMW500 during test.

5.4. MAXIMUM ANTENNA GAIN

Please see table below:

	Antenna Gain (dBi)
Band 4, 5MHz Bandwidth	1.41
Band 4, 10MHz Bandwidth	1.20
Band 17, 5MHz Bandwidth	-1.21
Band 17, 10MHz Bandwidth	-1.31

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions below 1GHz tests is channel with highest RF output power.

Based on the investigation results, the highest peak power and enhanced data rate is the worst-case scenario for all measurements.

Worst-case modes:

- LTE Band 4 and band 17

For the fundamental investigation, the EUT is investigated for vertical and horizontal antenna orientations and the worst case was determined to be at Z-position.

5.6. DESCRIPTION OF TEST SETUP

RADIATED TESTS SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Earphone	Apple	NA	NA
AC adapter	Apple	A1344	NA

I/O CABLES (RF Conducted Test)

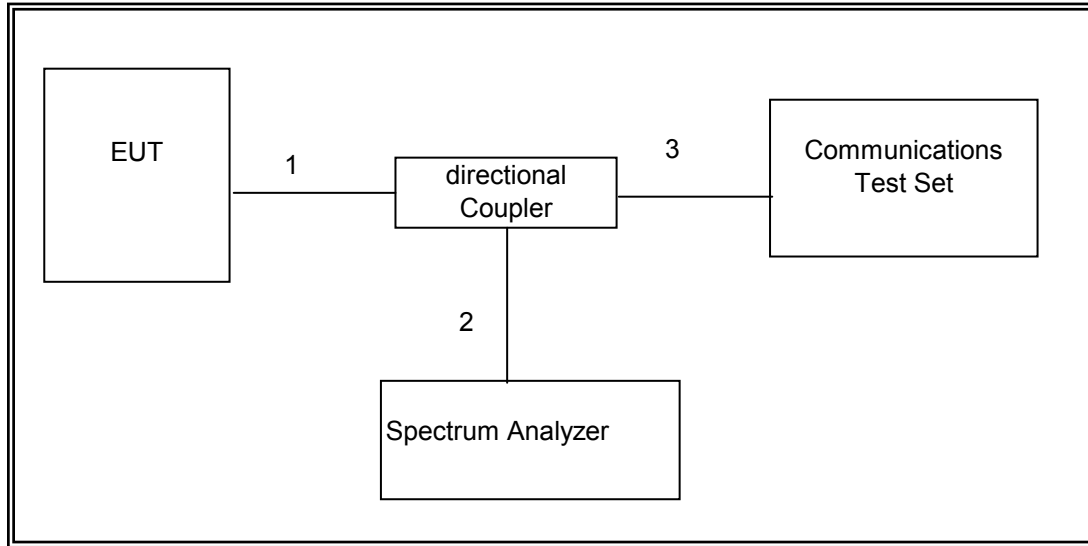
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	RFOut	1	Directional Coupler	Un-shielded	0.1m	NA
2	RF In/Out	1	Spectrum Analyzer	Un-shielded	None	NA
3	RF In/Out	1	Communications Test Set	Un-shielded	1.2m	NA

I/O CABLES (RF Radiated Test)

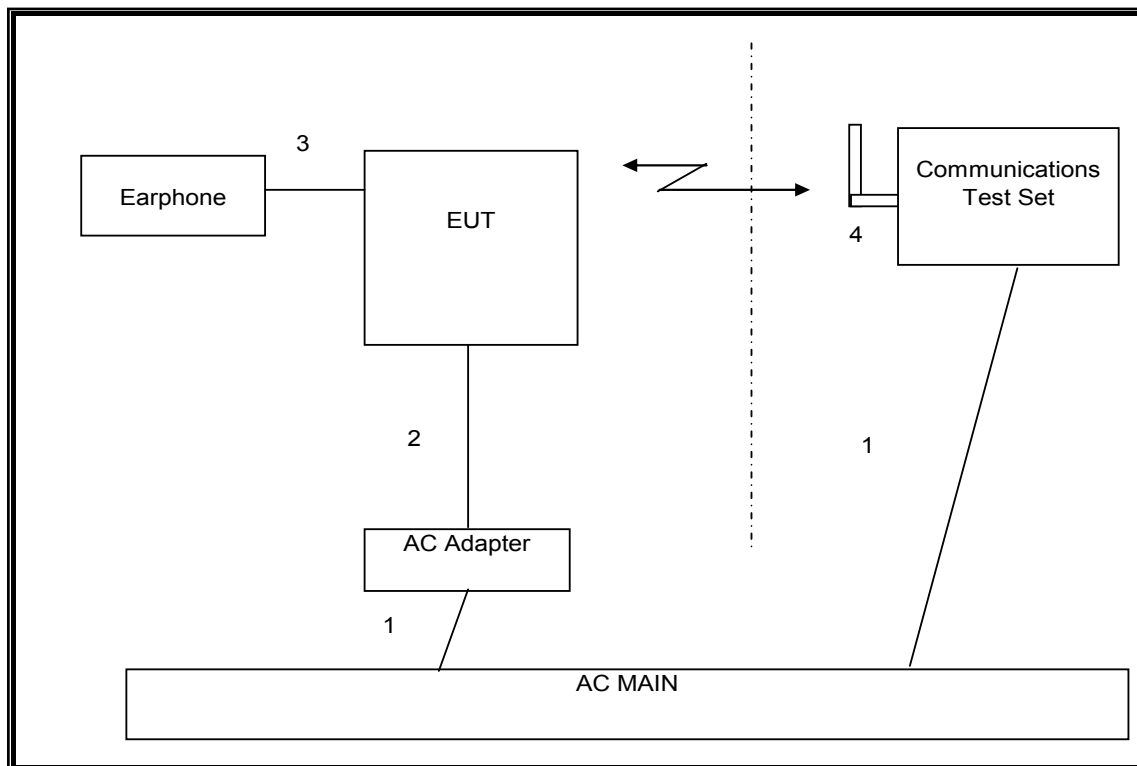
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US 115V	Un-shielded	2m	NA
2	DC	1	US 115V	Un-shielded	1m	NA
3	Jack	1	Earphone	Un-shielded	0.5m	NA
4	RF In/Out	1	Antenna	Un-shielded	none	NA

TEST SETUP

CONDUCTED SETUP DIAGRAM FOR TESTS



RADIATED SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/30/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/12/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/12
Communication Test Set	R & S	CMW500	N/A	05/17/12
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	10/20/12
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689`	CNR
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Directional Coupler	RF-Lambda	RDC5M06G15	None	CNR
Sleeve Dipole 1730~2030 MHz	ETS	3126-1880	C01157	10/01/12
Signal Generator, 20 GHz	Agilent / HP	83732B	C00774	07/14/12
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121C DB4	C00993	07/10/12

7. RF POWER OUTPUT VERIFICATION

7.1. RF OUTPUT POWER FOR LTE BAND 17 (5MHz)

Freq. (MHz)	UL Channel	BW (MHz)	RB Size	RB Offset	Modulation	MPR (dB)	Max Avg Power (dBm)	Max Pk Power (dBm)
706.5	23755	5 (L)	1	0	QPSK	0	24.30	27.65
			1	24		0	24.30	27.50
			12	6		1	23.20	27.80
			25	0		1	23.30	28.40
			1	0	16-QAM	1	23.50	27.70
			1	24		1	23.47	27.50
			12	6		2	22.40	27.70
			25	0		2	22.50	28.30
710.0	23790	5 (M)	1	0	QPSK	0	24.30	27.60
			1	24		0	24.30	27.56
			12	6		1	23.20	27.57
			25	0		1	23.30	28.60
			1	0	16-QAM	1	23.40	27.60
			1	24		1	23.30	27.50
			12	6		2	22.20	27.50
			25	0		2	22.50	28.50
713.5	23825	5 (H)	1	0	QPSK	0	24.30	27.50
			1	24		0	24.30	27.60
			12	6		1	23.20	27.80
			25	0		1	23.30	28.50
			1	0	16-QAM	1	23.45	27.60
			1	24		1	23.40	27.76
			12	6		2	22.20	27.70
			25	0		2	22.50	28.50

7.2. RF OUTPUT POWER FOR LTE BAND 17 (10MHz)

Freq. (MHz)	UL Channel	BW (MHz)	RB Size	RB Offset	Modulation	MPR (dB)	Max Avg Power (dBm)	Max Pk Power (dBm)
709	23780	10 (L)	1	0	QPSK	0	24.40	27.80
			1	49		0	24.30	27.70
			25	12		1	23.30	28.00
			50	0		1	23.30	28.60
			1	0	16-QAM	1	23.50	27.70
			1	49		1	23.50	27.60
			25	12		2	22.48	28.00
			50	0		2	22.45	28.40
710.0	23790	10 (M)	1	0	QPSK	0	24.43	27.85
			1	49		0	24.30	27.80
			25	12		1	23.30	27.80
			50	0		1	23.42	28.74
			1	0	16-QAM	1	23.50	27.70
			1	49		1	23.48	27.50
			25	12		2	22.30	27.80
			50	0		2	22.42	28.60
711	23800	10 (H)	1	0	QPSK	0	24.40	27.80
			1	49		0	24.30	27.70
			25	12		1	23.30	27.70
			50	0		1	23.30	28.60
			1	0	16-QAM	1	23.50	27.60
			1	49		1	23.40	27.55
			25	12		2	22.35	27.80
			50	0		2	22.44	28.56

7.3. RF OUTPUT POWER FOR LTE BAND 4 (5 MHz)

Freq. (MHz)	UL Channel	BW (MHz)	RB Size	RB Offset	Modulation	MPR (dB)	Max Avg Power (dBm)	Max Pk Power (dBm)
1712.5	19975	5 (L)	1	0	QPSK	0	23.45	27.56
			1	24		0	23.50	27.84
			12	6		1	22.50	27.40
			25	0		1	22.40	28.20
			1	0	16-QAM	1	22.5	27.56
			1	24		1	22.5	27.83
			12	6		2	21.41	27.60
			25	0		2	21.40	28.25
1732.5	20175	5 (M)	1	0	QPSK	0	23.45	27.85
			1	24		0	23.50	27.80
			12	6		1	22.40	27.70
			25	0		1	22.45	28.25
			1	0	16-QAM	1	22.40	27.87
			1	24		1	22.50	27.91
			12	6		2	21.38	28.06
			25	0		2	21.48	28.36
1752.5	20375	5 (H)	1	0	QPSK	0	23.40	28.01
			1	24		0	23.50	28.02
			12	6		1	22.45	27.73
			25	0		1	22.50	28.27
			1	0	16-QAM	1	22.47	28.00
			1	24		1	22.50	28.01
			12	6		2	21.50	27.98
			25	0		2	21.40	28.60

7.4. RF OUTPUT POWER FOR LTE BAND 4 (10MHz)

Freq. (MHz)	UL Channel	BW (MHz)	RB Size	RB Offset	Modulation	MPR (dB)	Max Avg Power (dBm)	Max Pk Power (dBm)
1715	20000	10 (L)	1	0	QPSK	0	23.40	27.18
			1	49		0	23.50	27.54
			25	12		1	22.50	27.59
			50	0		1	22.50	28.00
			1	0	16-QAM	1	22.20	27.43
			1	49		1	22.33	27.83
			25	12		2	21.50	27.60
			50	0		2	21.47	28.24
1732.5	20175	10 (M)	1	0	QPSK	0	23.45	27.54
			1	49		0	23.50	27.62
			25	12		1	22.43	28.05
			50	0		1	22.50	28.60
			1	0	16-QAM	1	22.30	27.94
			1	49		1	22.31	27.79
			25	12		2	21.45	28.22
			50	0		2	21.50	28.74
1750	20350	10 (H)	1	0	QPSK	0	23.45	27.80
			1	49		0	23.50	27.75
			25	12		1	22.40	27.95
			50	0		1	22.50	28.50
			1	0	16-QAM	1	22.49	28.02
			1	49		1	22.50	28.00
			25	12		2	21.50	28.03
			50	0		2	21.45	28.78

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

MODES TESTED

- LTE BAND 4 and 17

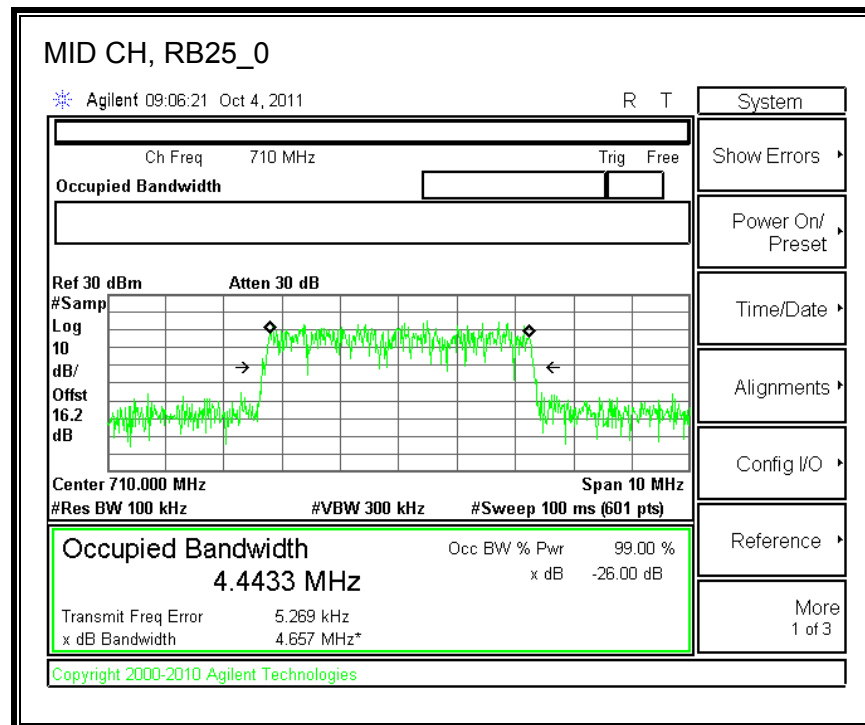
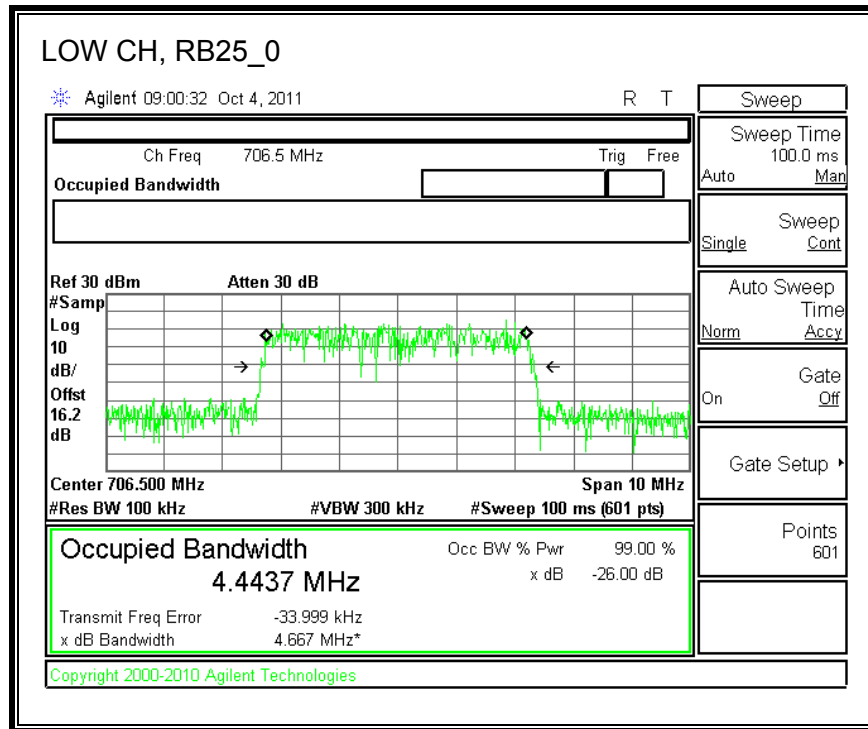
RESULTS

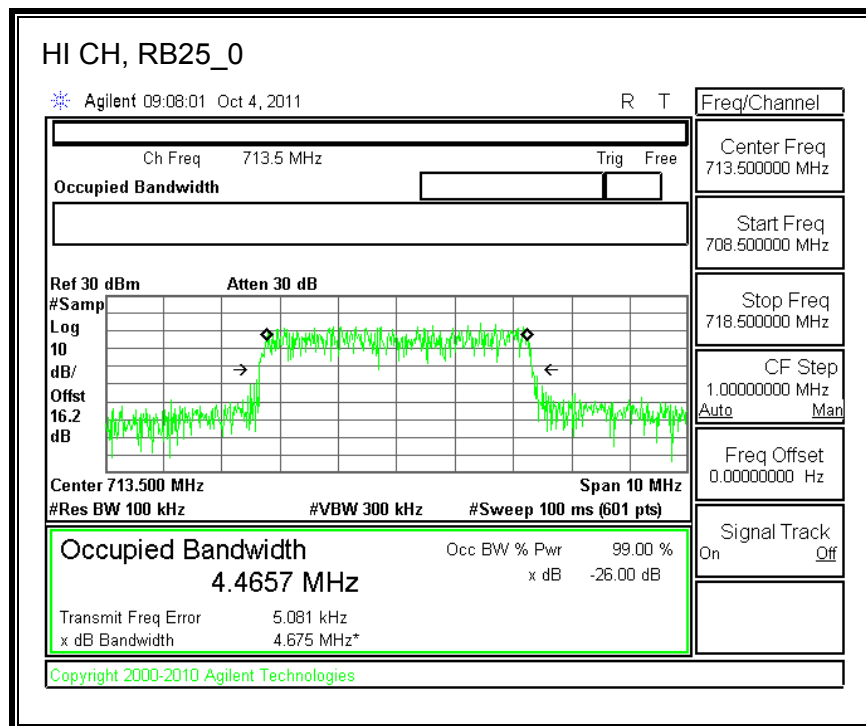
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 17	5.0 MHz BAND QPSK	25/0	706.5	4.4437	4.667
			710.0	4.4433	4.657
			713.5	4.4657	4.675
	5.0 MHz BAND 16QAM		706.5	4.4923	4.701
			710.0	4.4624	4.681
			713.5	4.4893	4.686
	10.0 MHz BAND QPSK	50/0	709.0	8.9640	9.354
			710.5	8.9301	9.343
			711.0	8.9677	9.362
	10.0 MHz BAND 16QAM		709.0	8.9555	9.364
			710.5	8.8327	9.297
			711.0	8.9113	9.368

Band	Mode	RB/RB SIZE	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE BAND 4	5.0 MHz BAND QPSK	25/0	1712.5	4.4435	4.681
			1732.5	4.4455	4.667
			1752.5	4.4573	4.678
	5.0 MHz BAND 16QAM		1712.5	4.4571	4.909
			1732.5	4.4420	4.663
			1752.5	4.4670	4.647
	10.0 MHz BAND QPSK	50/0	1715.0	8.8942	9.289
			1732.5	8.9440	9.333
			1750.0	8.9774	9.647
	10.0 MHz BAND 16QAM		1715.0	8.8815	9.346
			1732.5	8.9466	9.321
			1750.0	8.9280	9.369

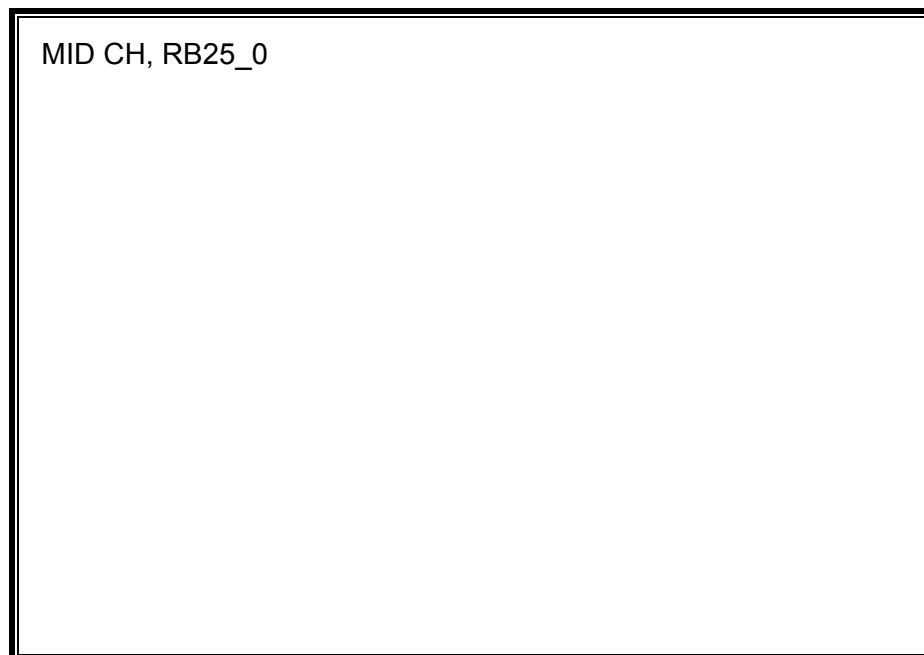
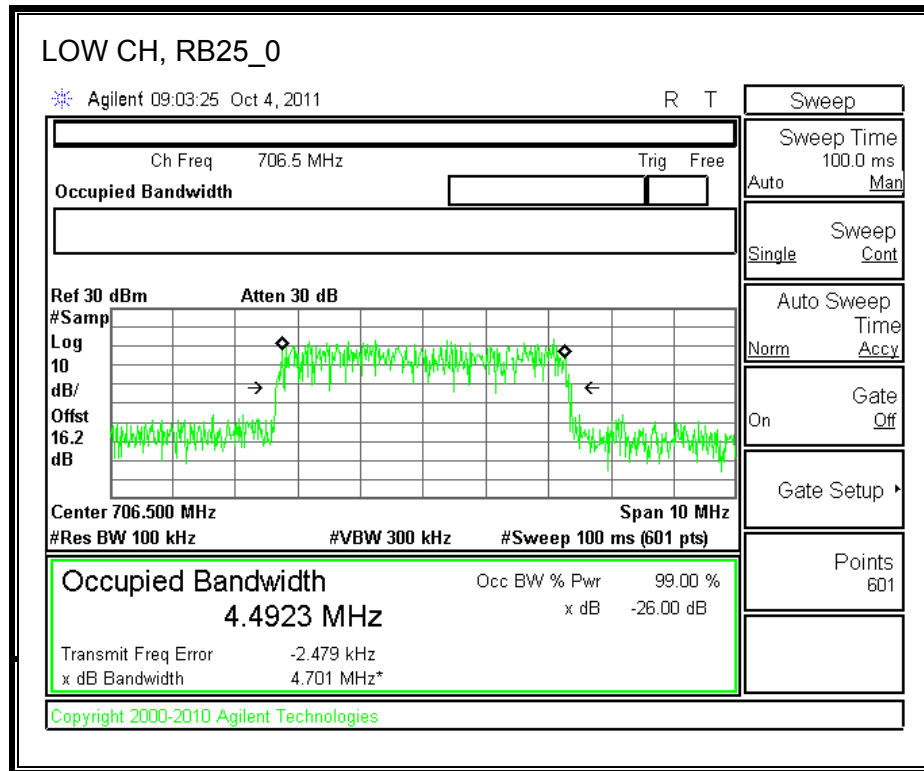
Band 17 (5.0 MHz BAND WIDTH)

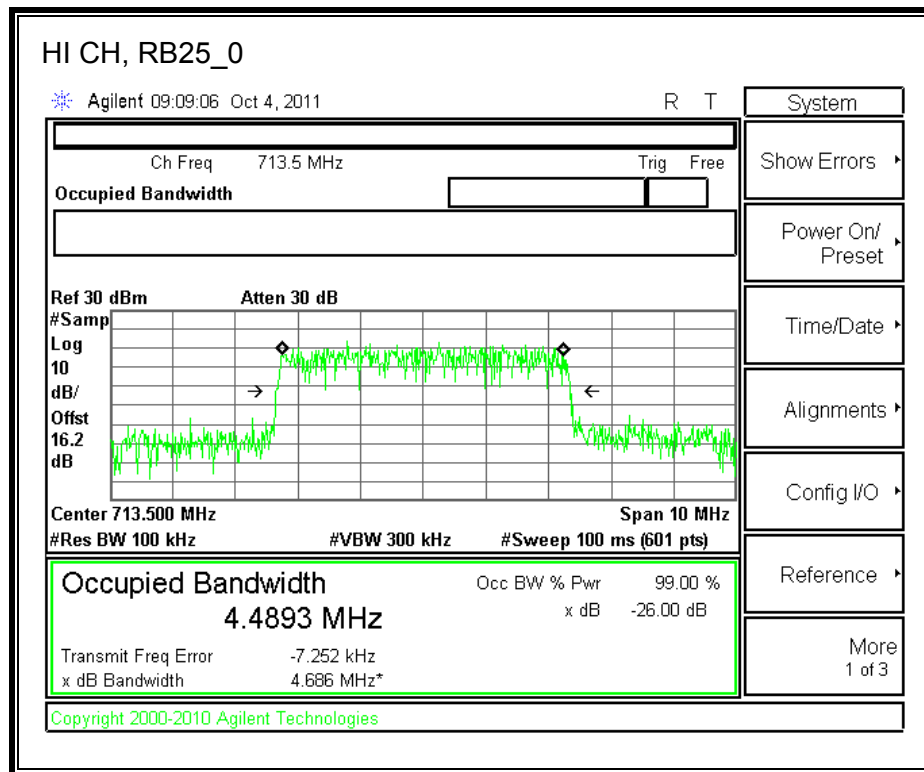
LTE QPSK





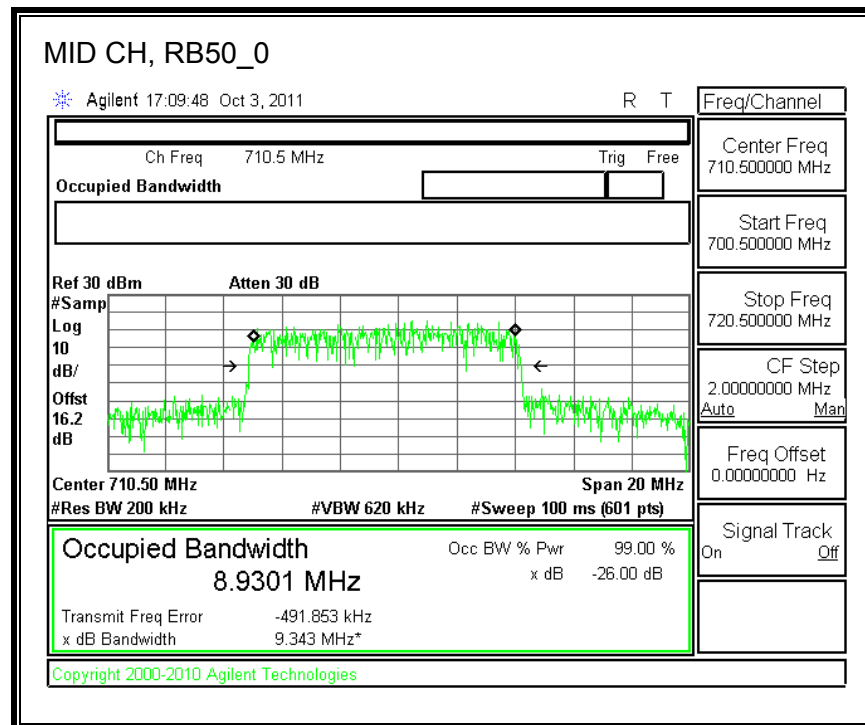
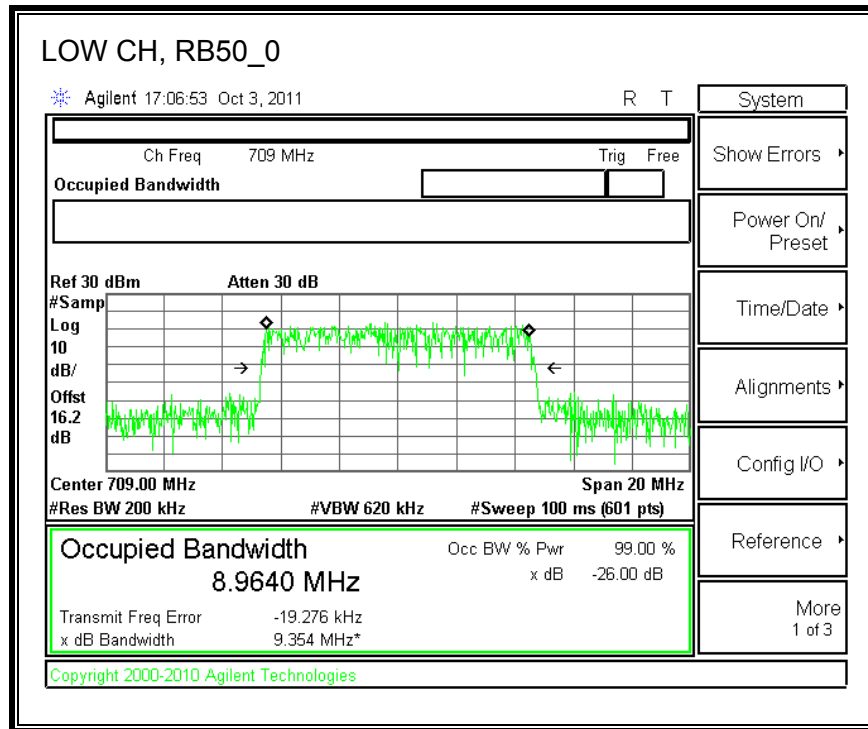
LTE 16QAM

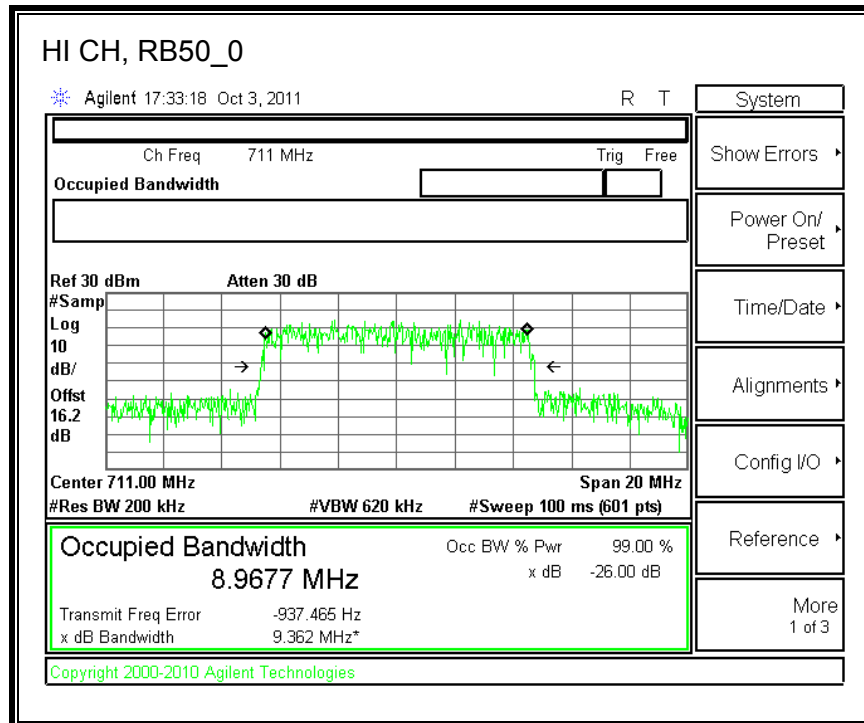




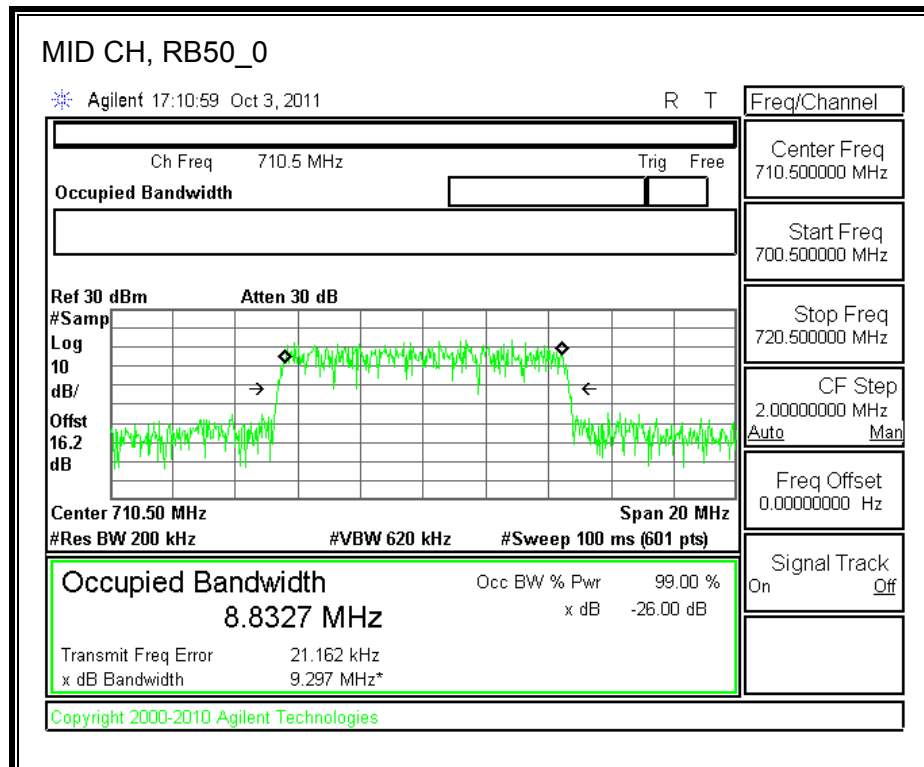
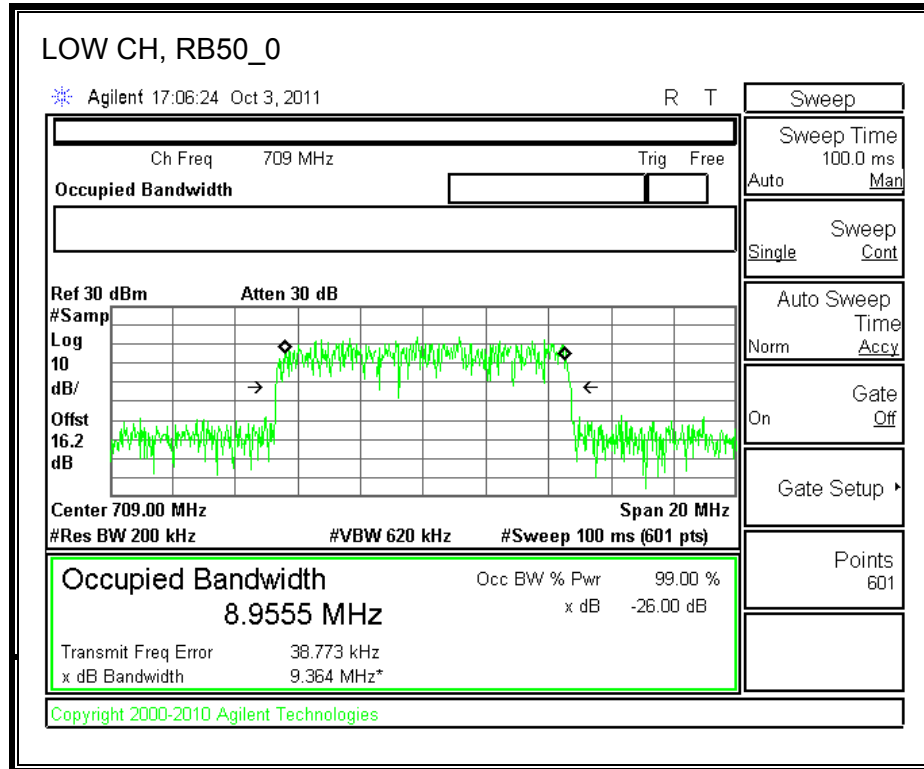
Band 17 (10.0 MHz BAND WIDTH)

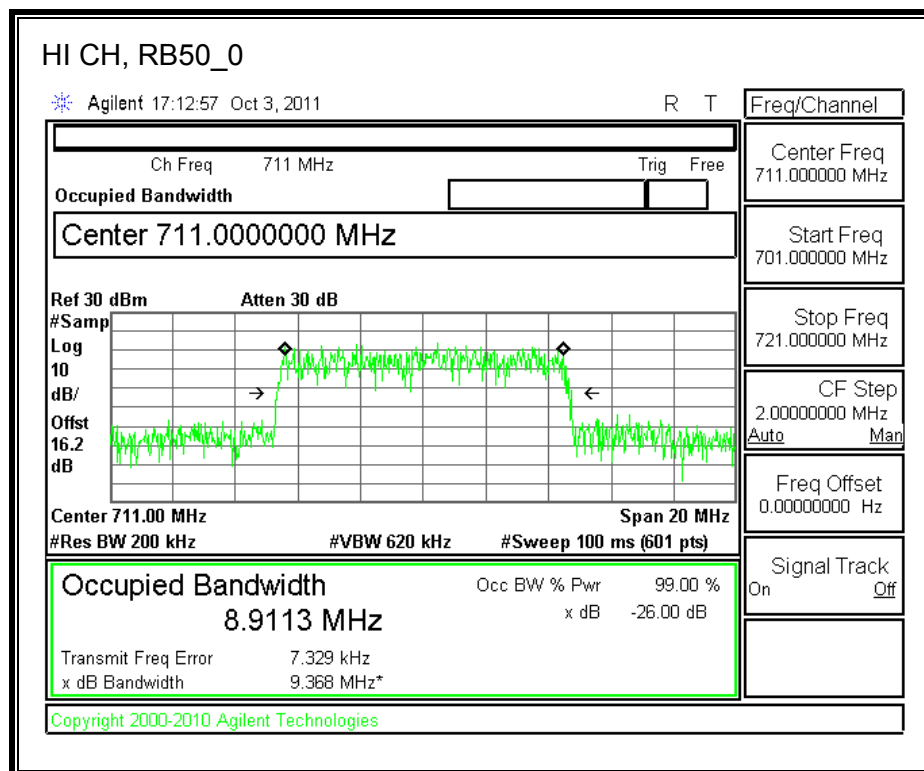
LTE QPSK





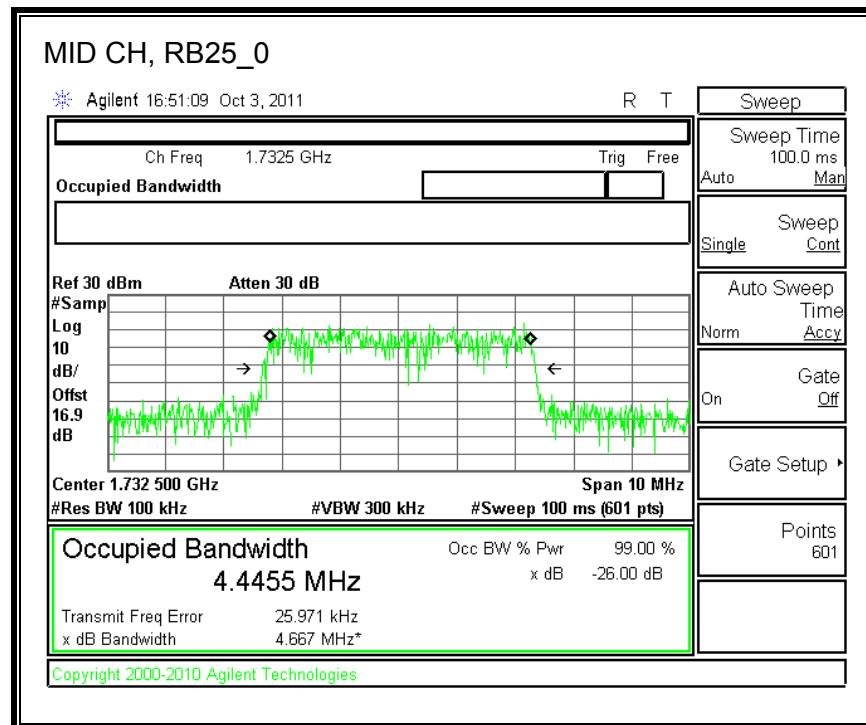
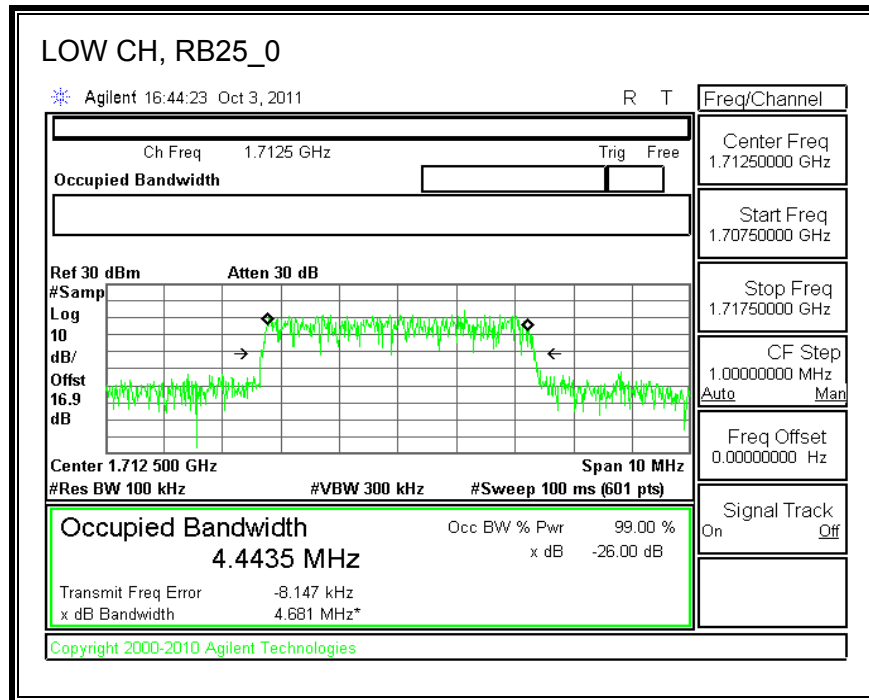
LTE 16QAM

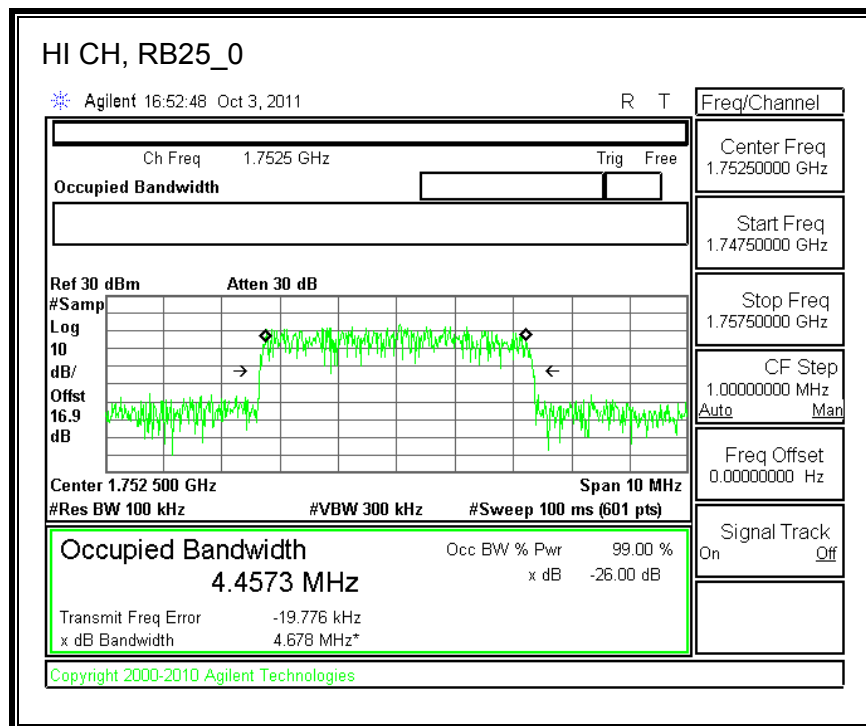




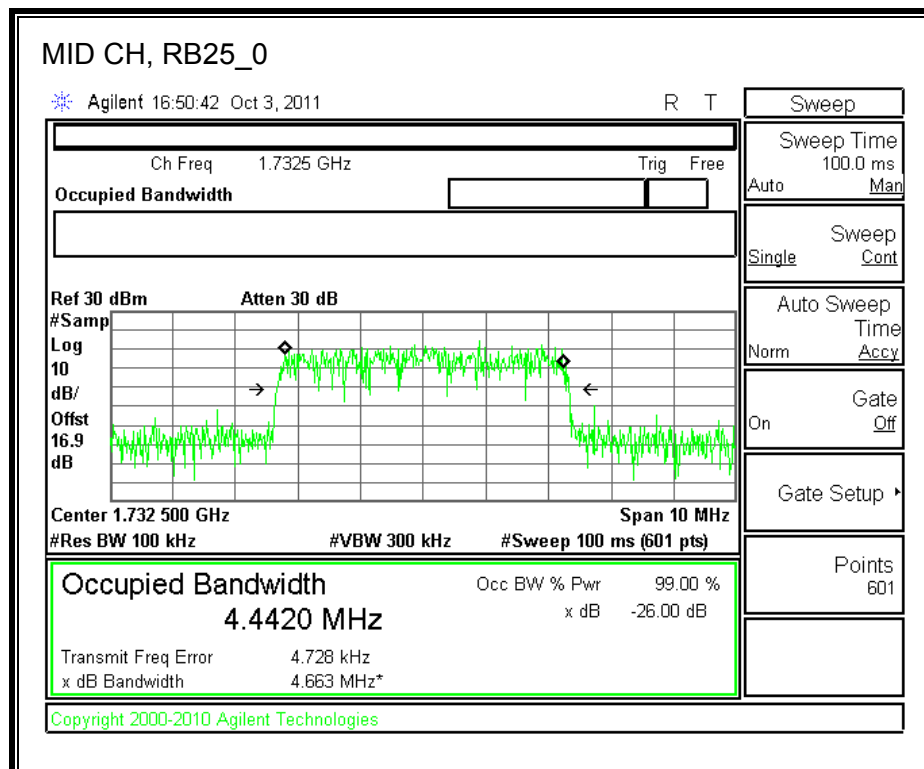
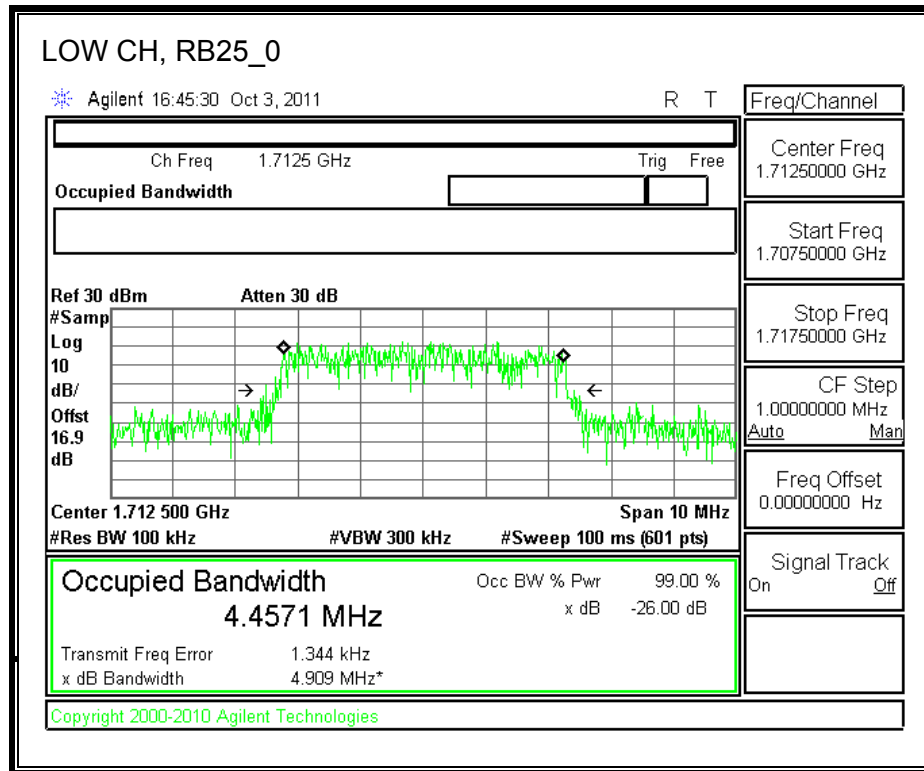
Band 4 (5.0 MHz BAND WIDTH)

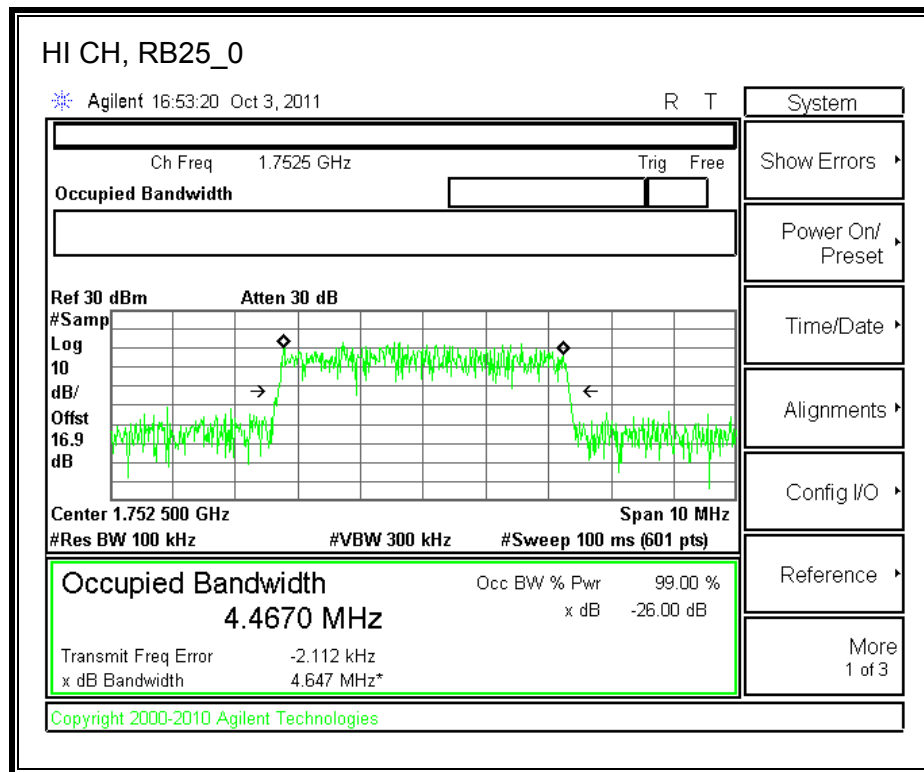
LTE QPSK





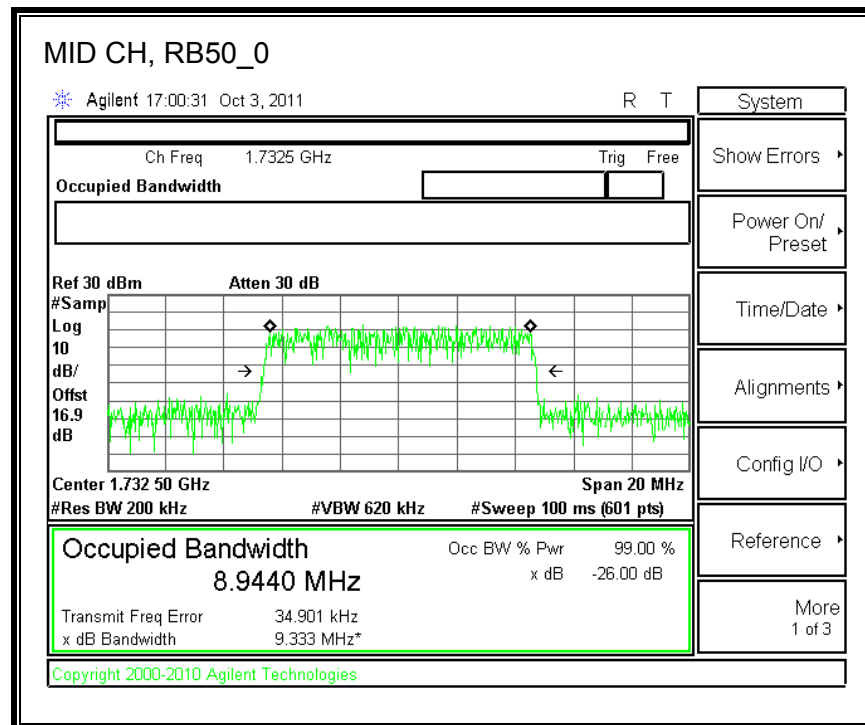
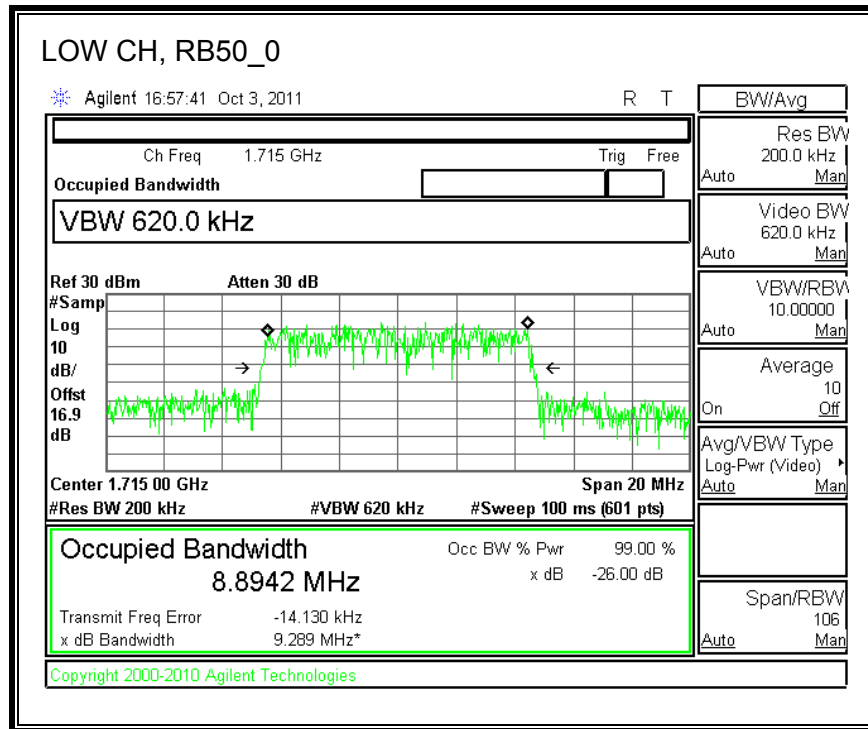
LTE 16QAM

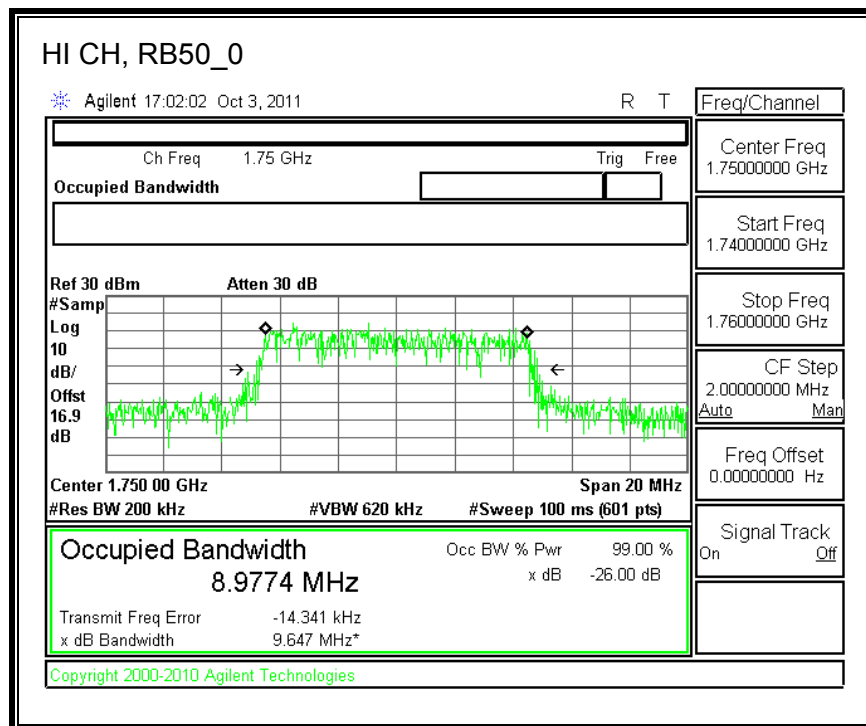




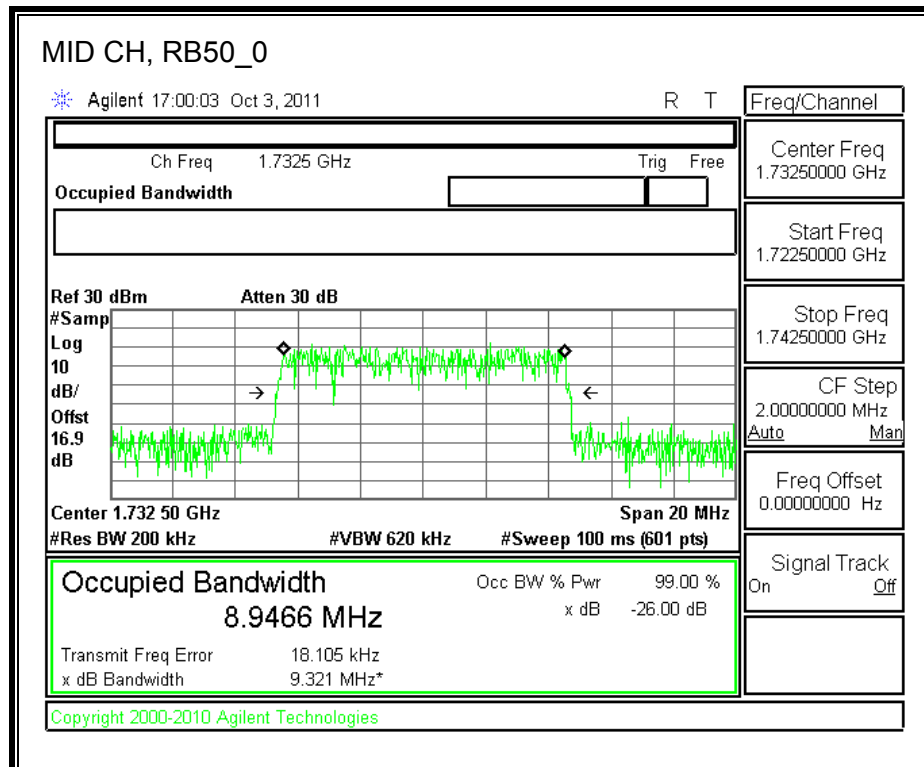
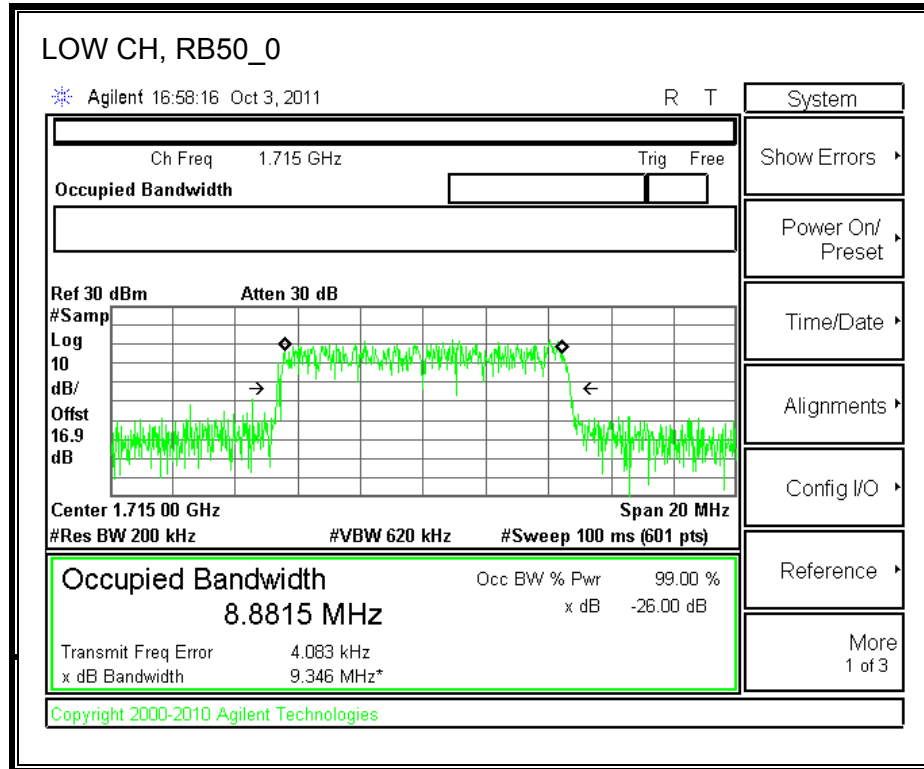
Band 4 (10.0 MHz BAND WIDTH)

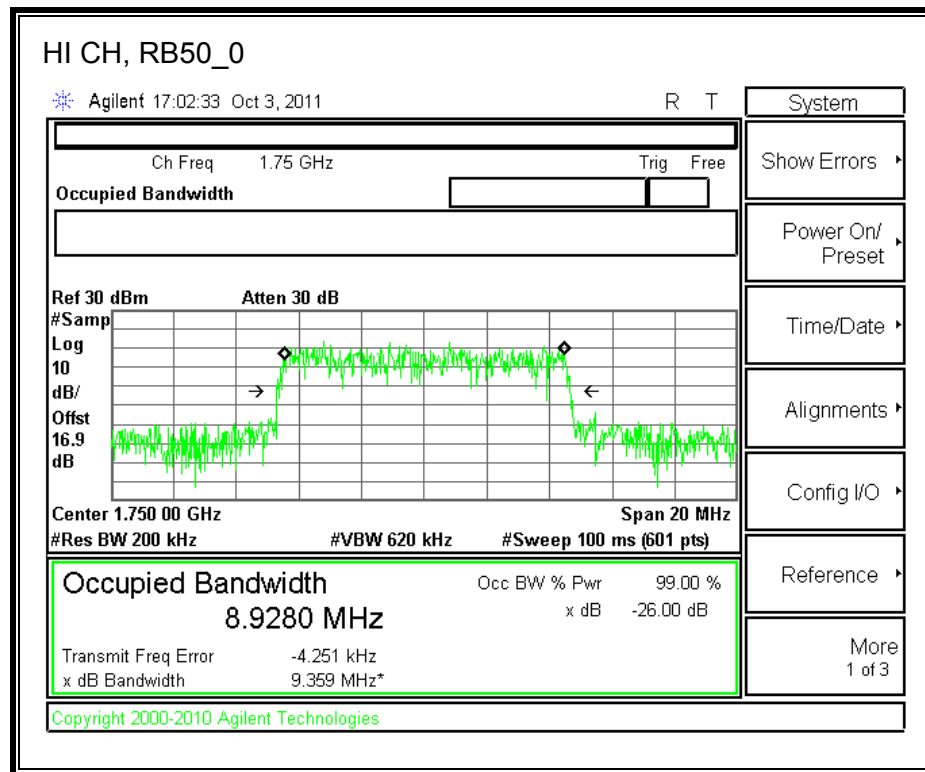
LTE QPSK





LTE 16QAM





8.2. BAND EDGE

RULE PART(S)

FCC: 27.53

LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

TEST PROCEDURE

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

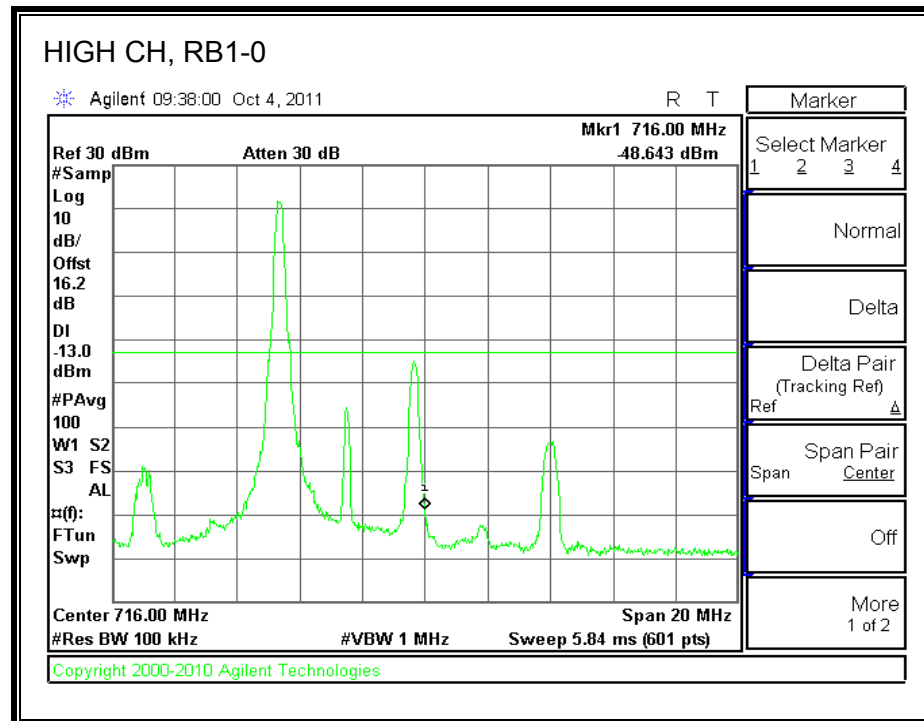
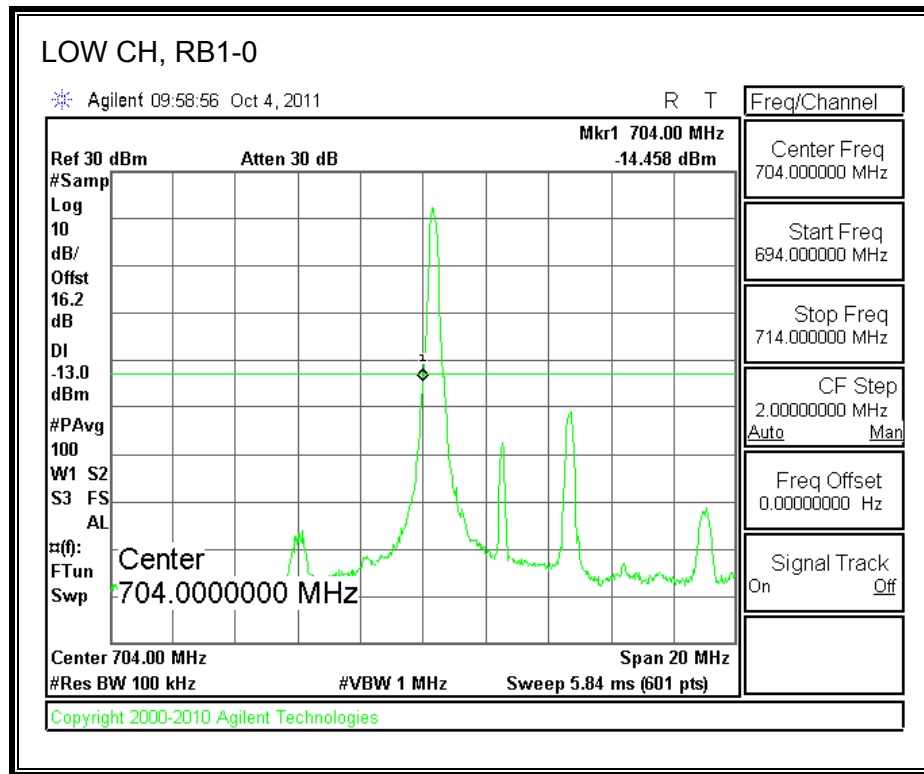
- Set the spectrum analyzer span to include the block edge frequency (704, 716, 1710 and 1755 MHz)
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

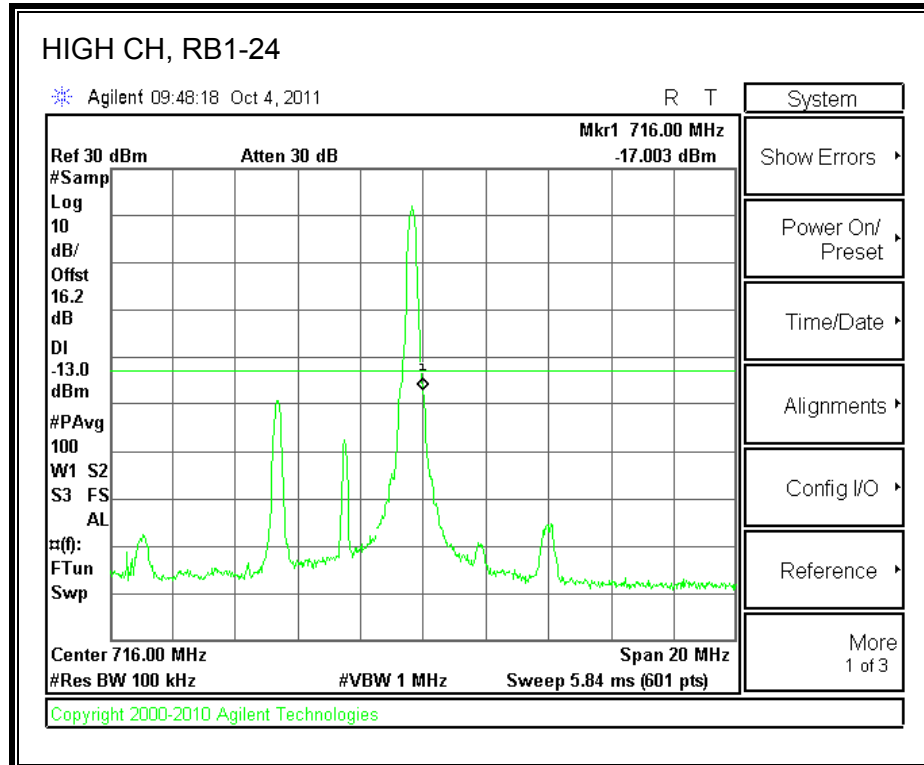
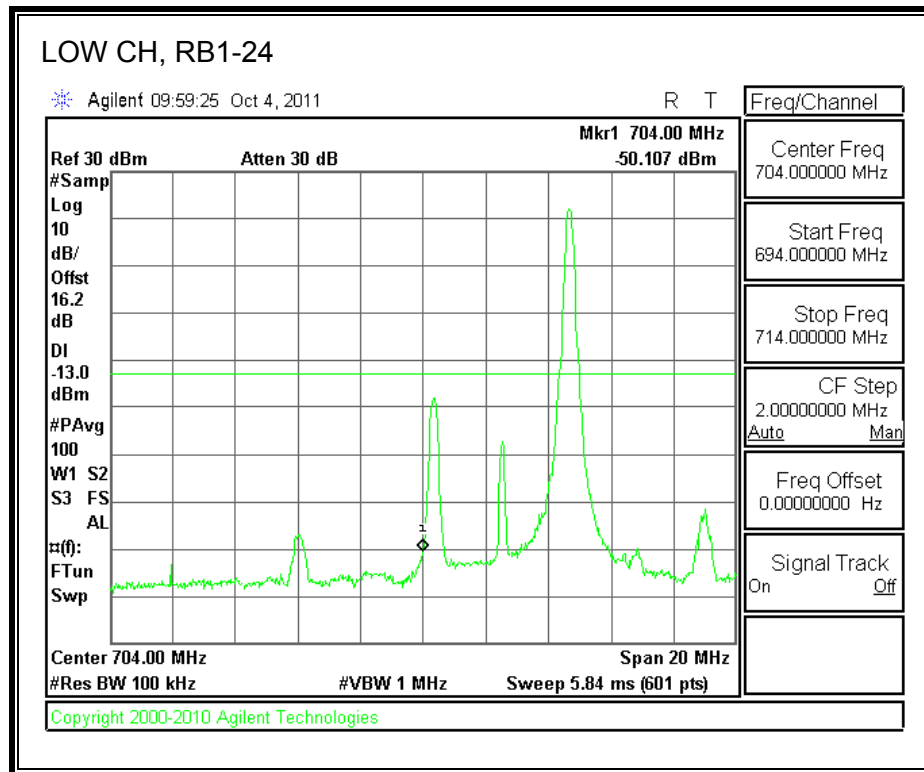
MODES TESTED

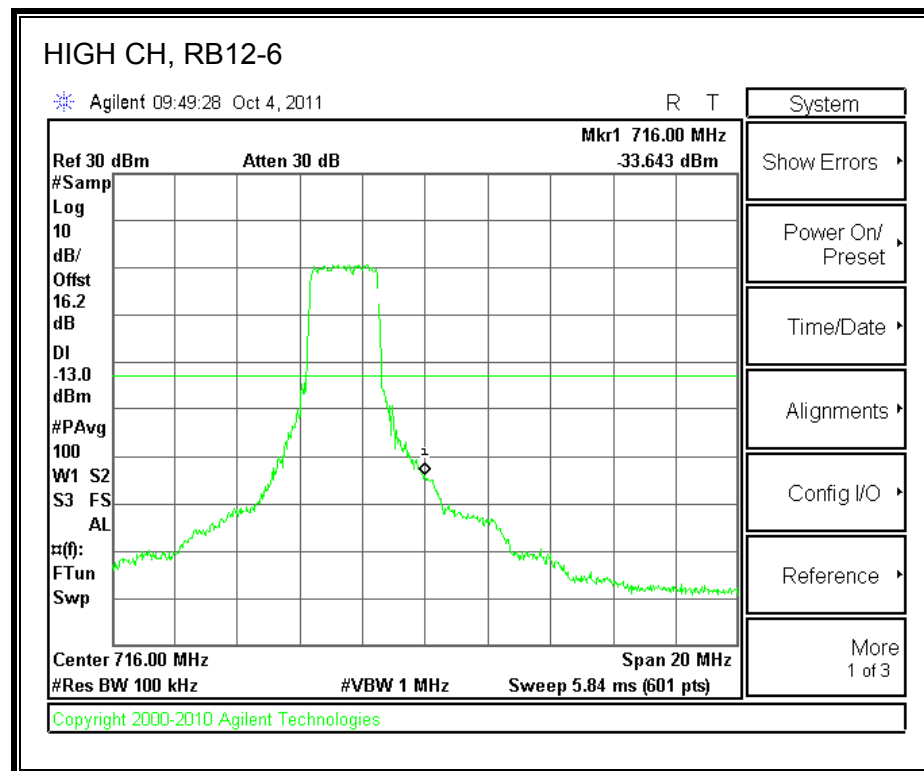
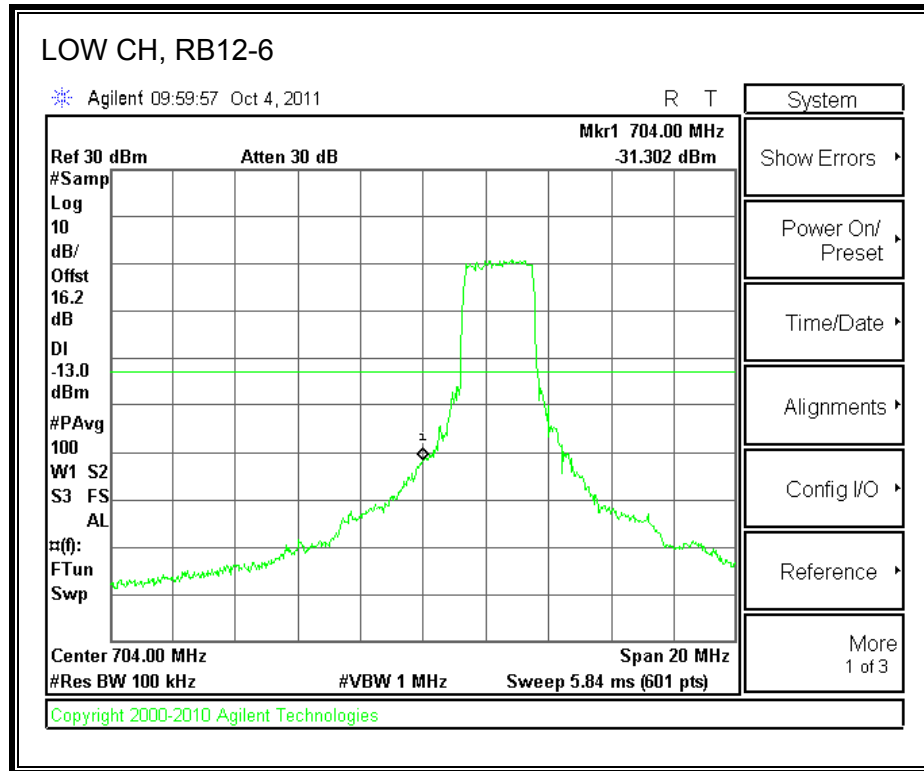
- LTE BAND 4 and BAND 17

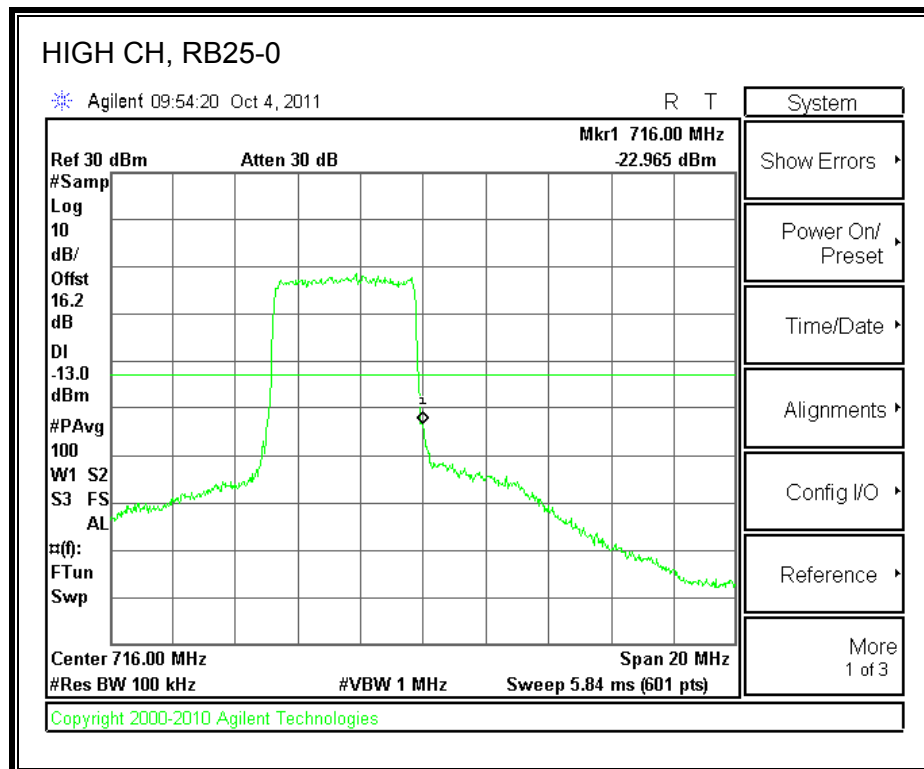
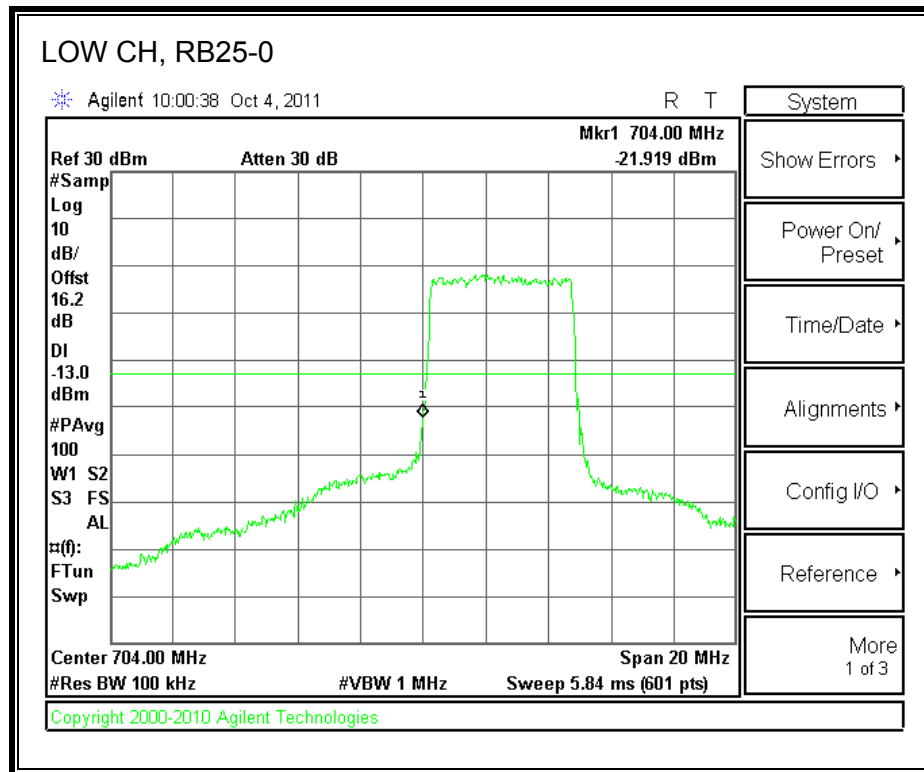
RESULTS

LTE QPSK Band 17 (5.0 MHz BAND WIDTH)

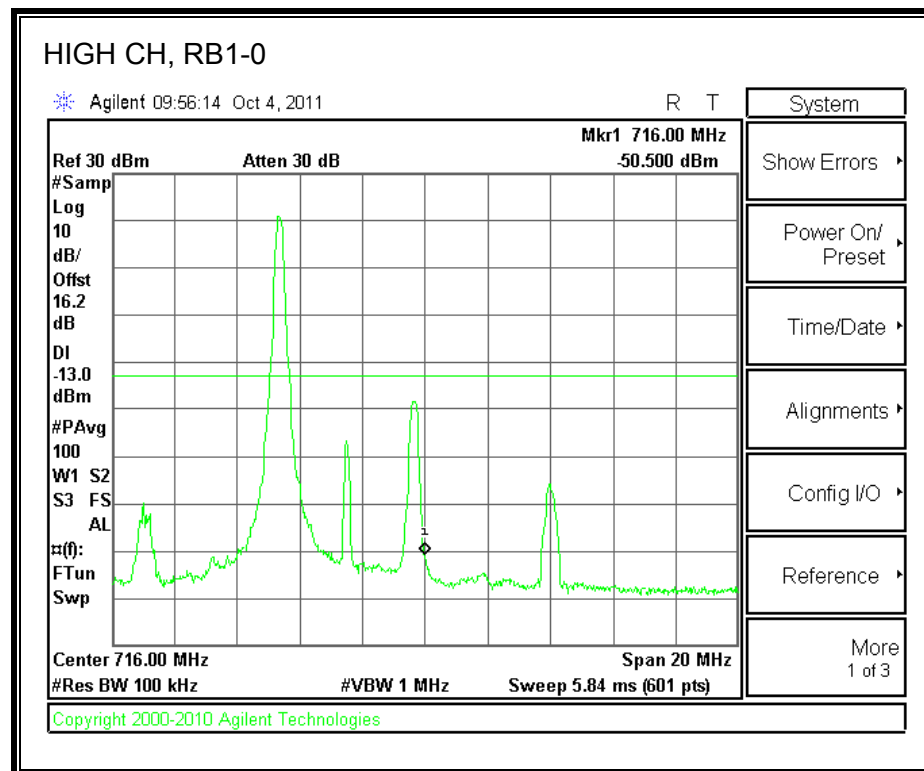
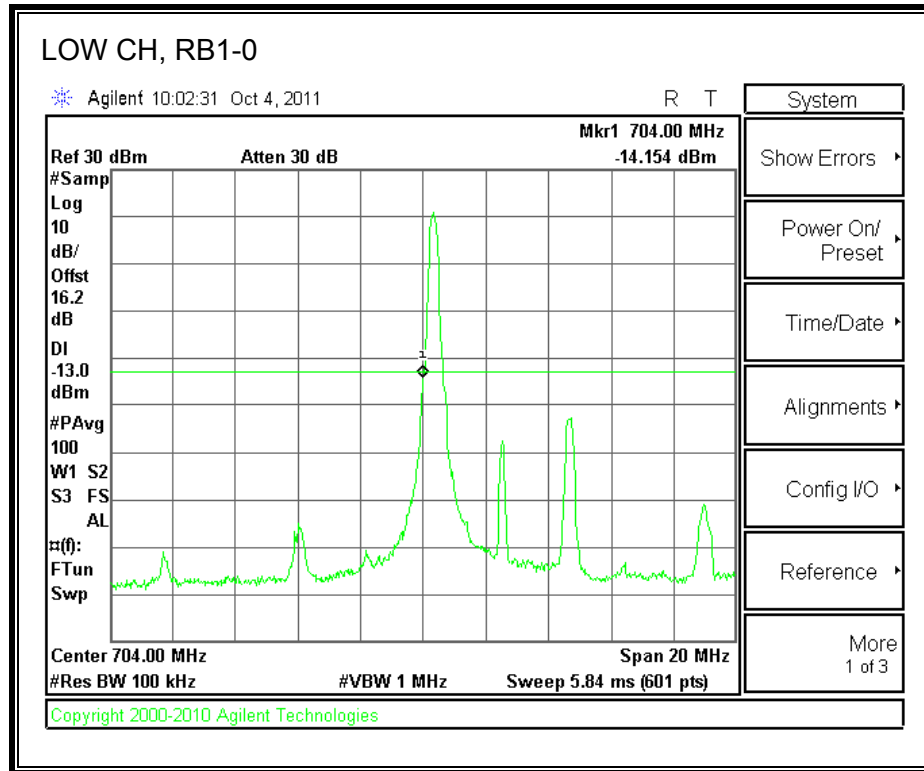


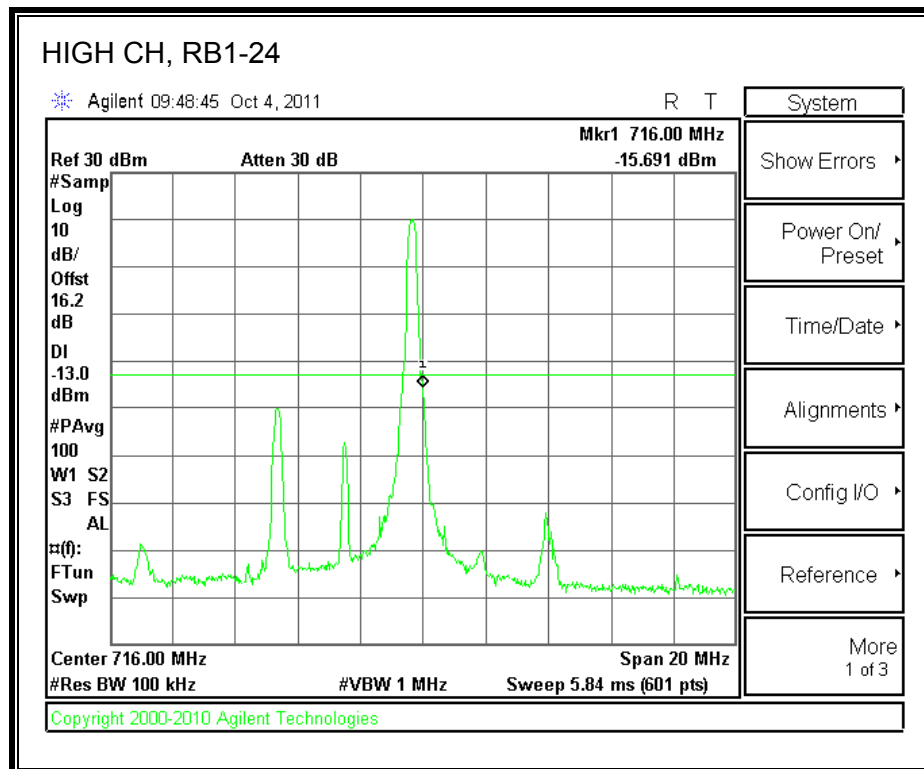
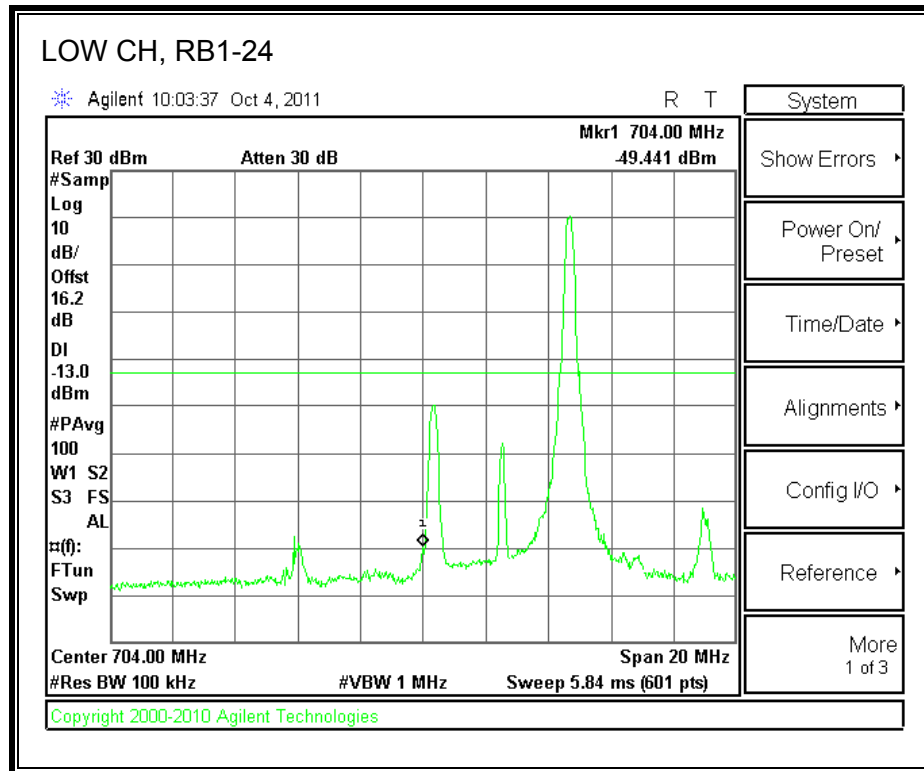


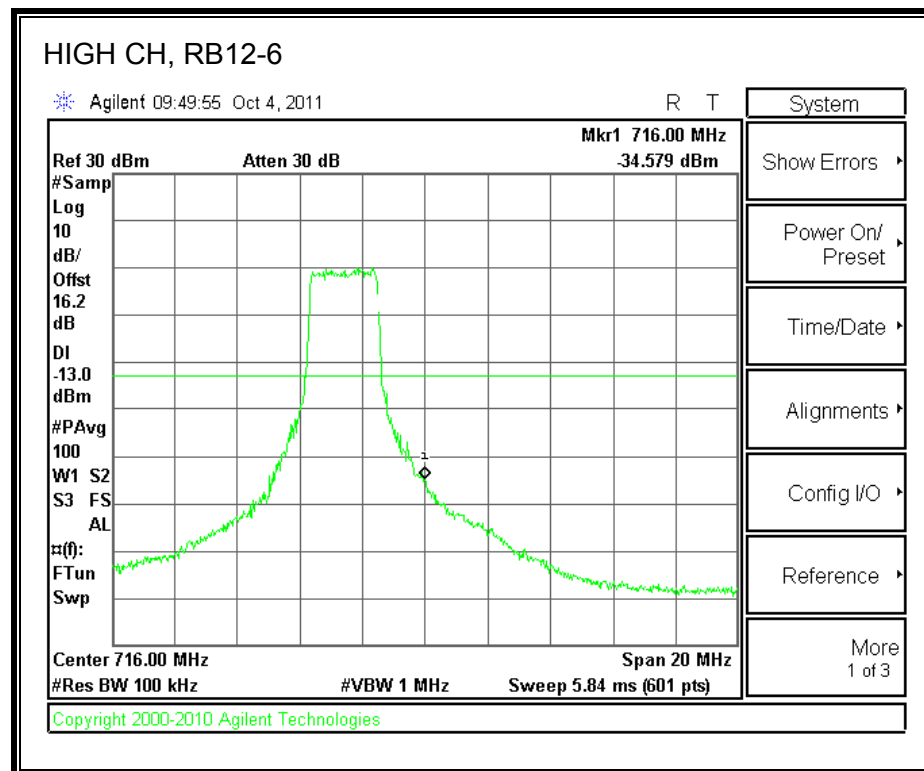
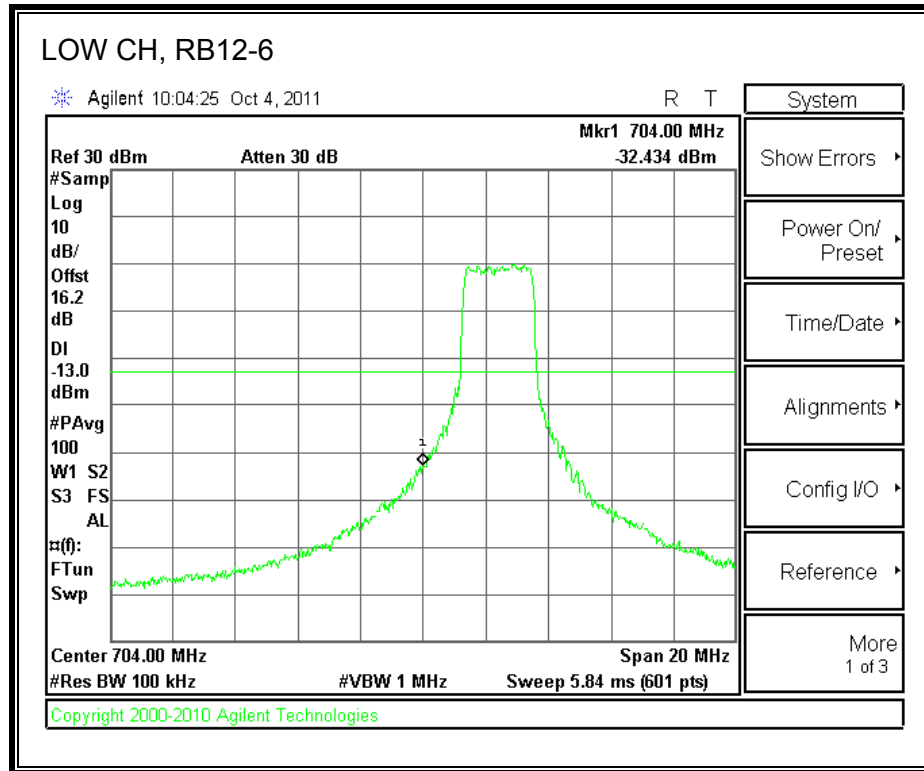


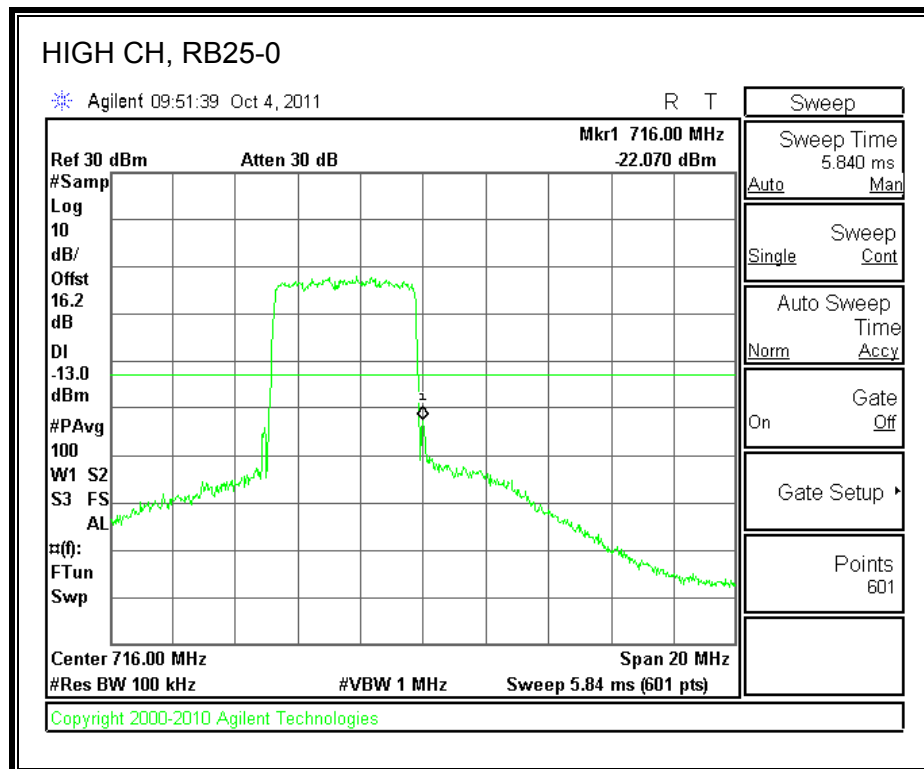
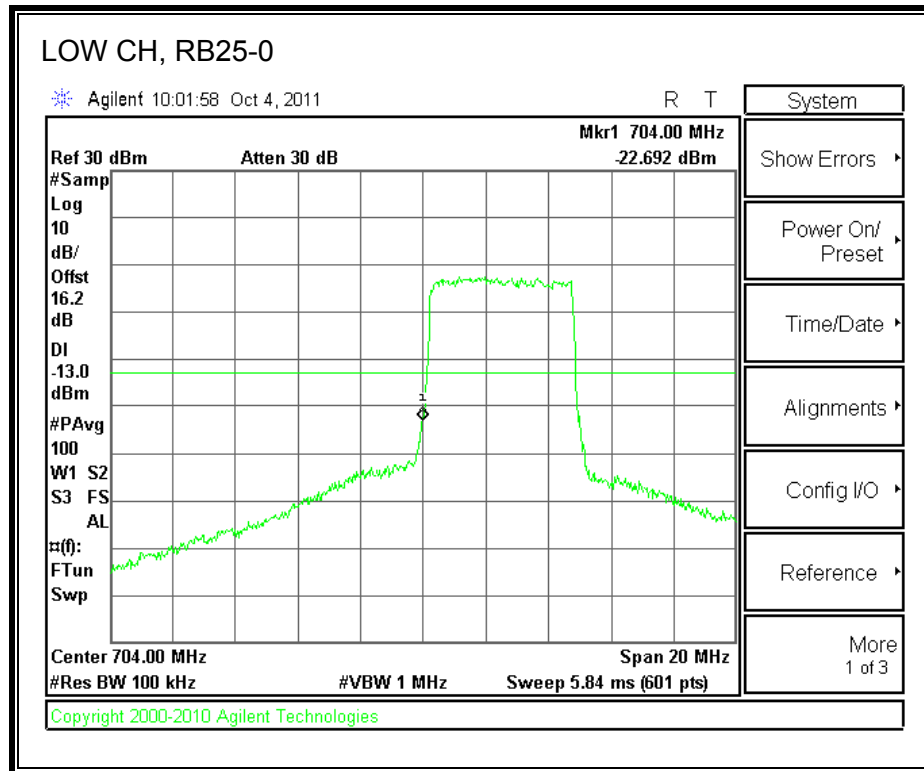


LTE 16QAM Band 17 (5.0 MHz BAND WIDTH)

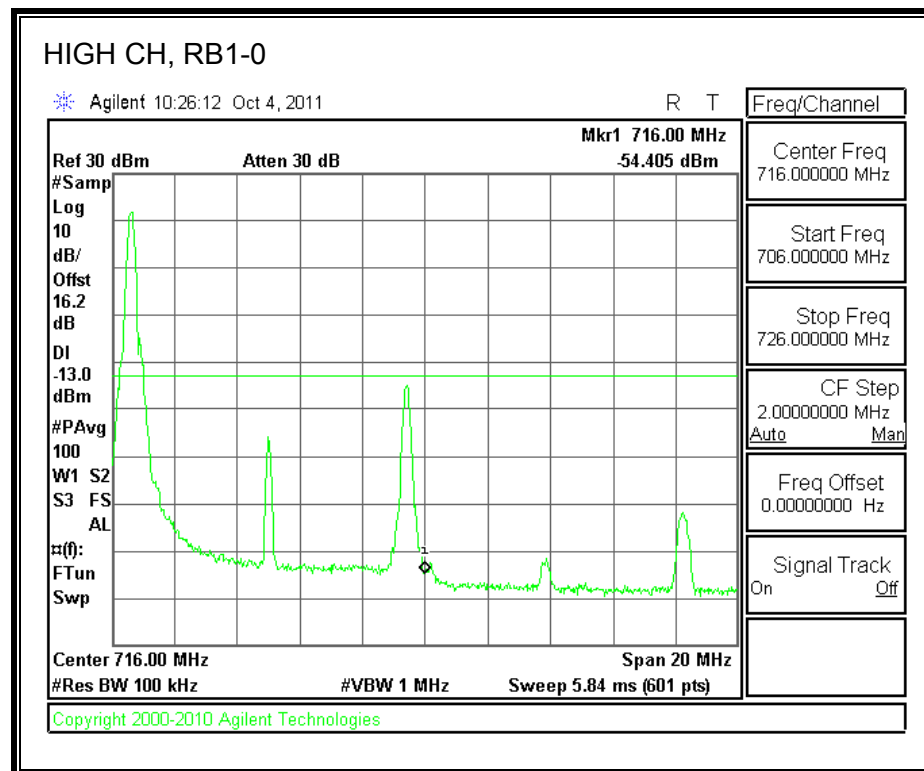
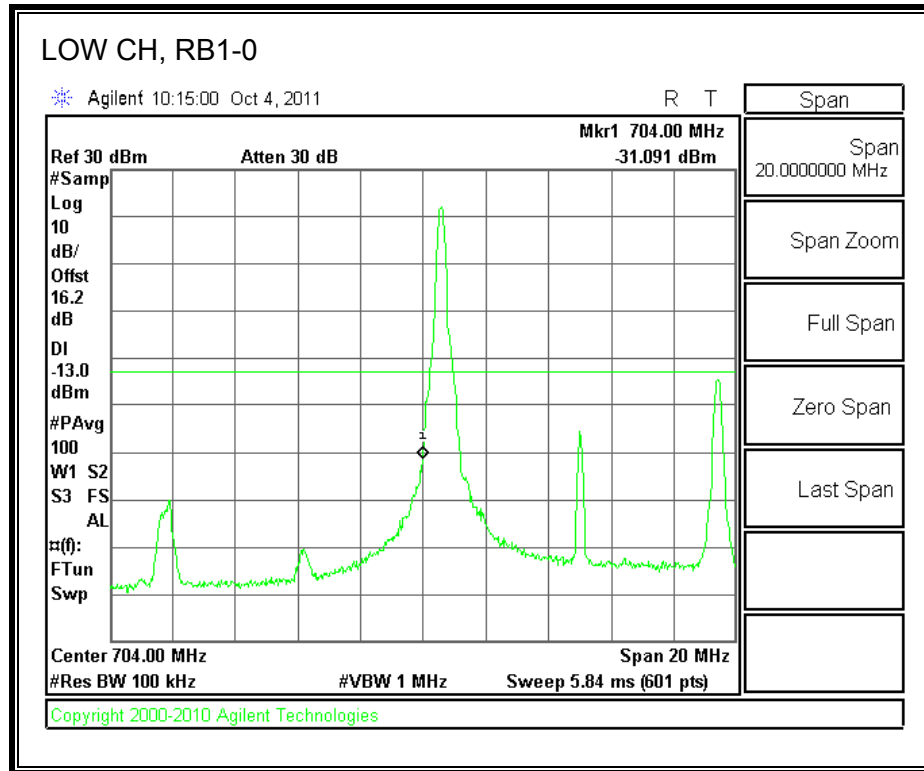


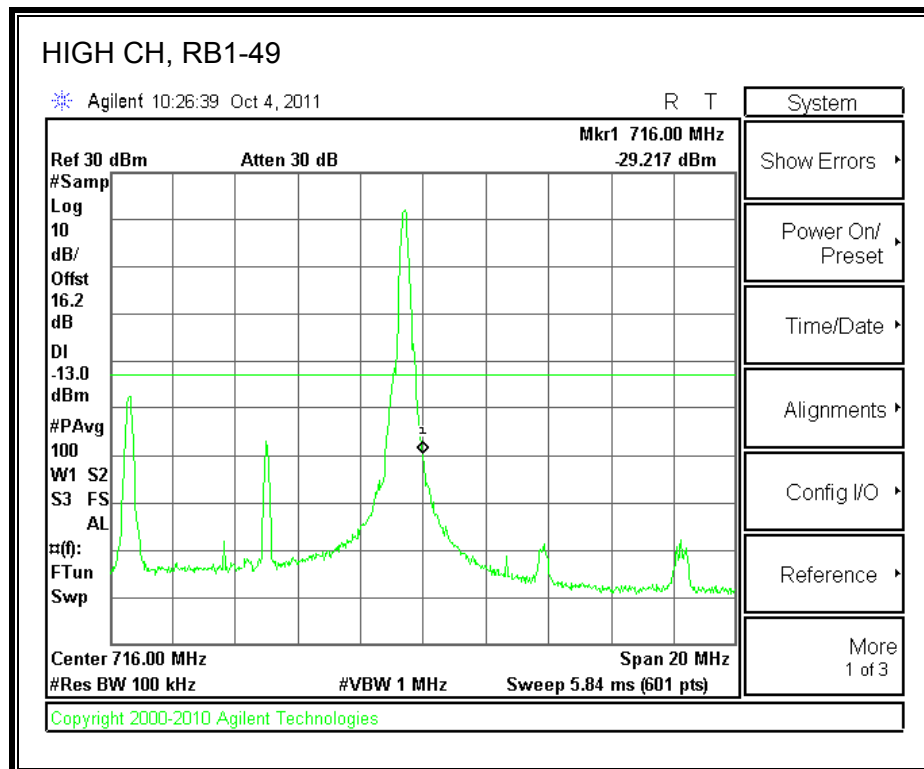
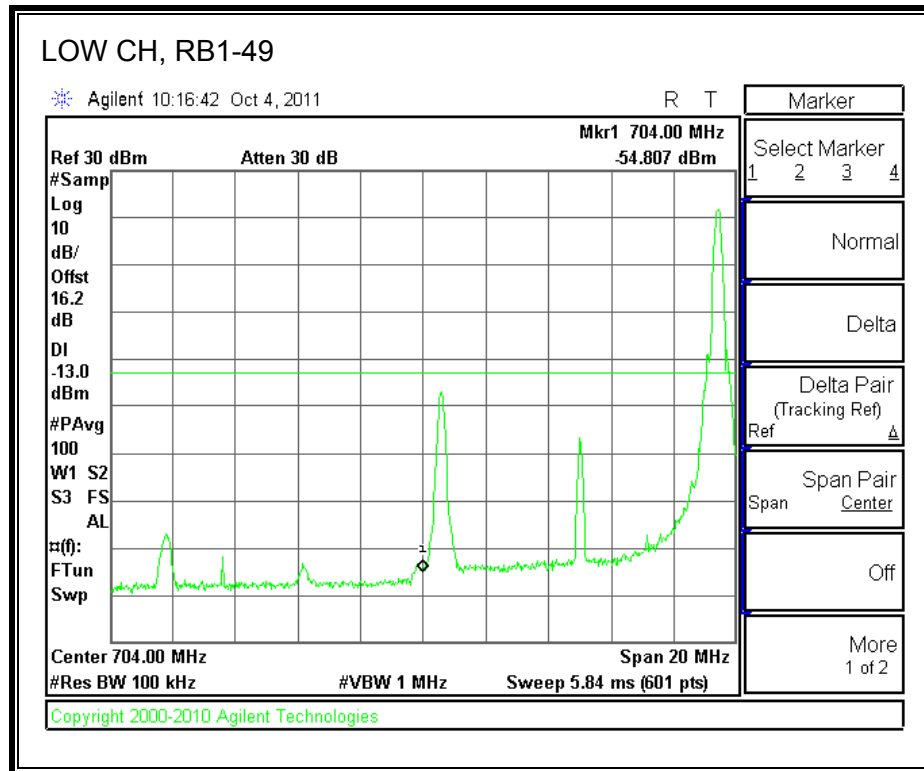


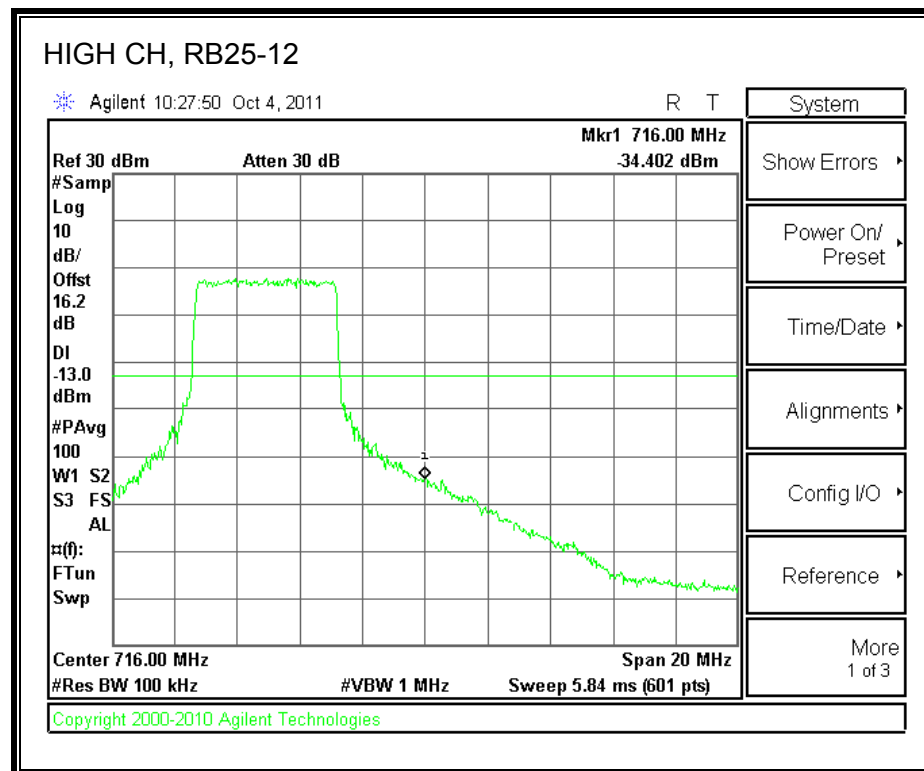
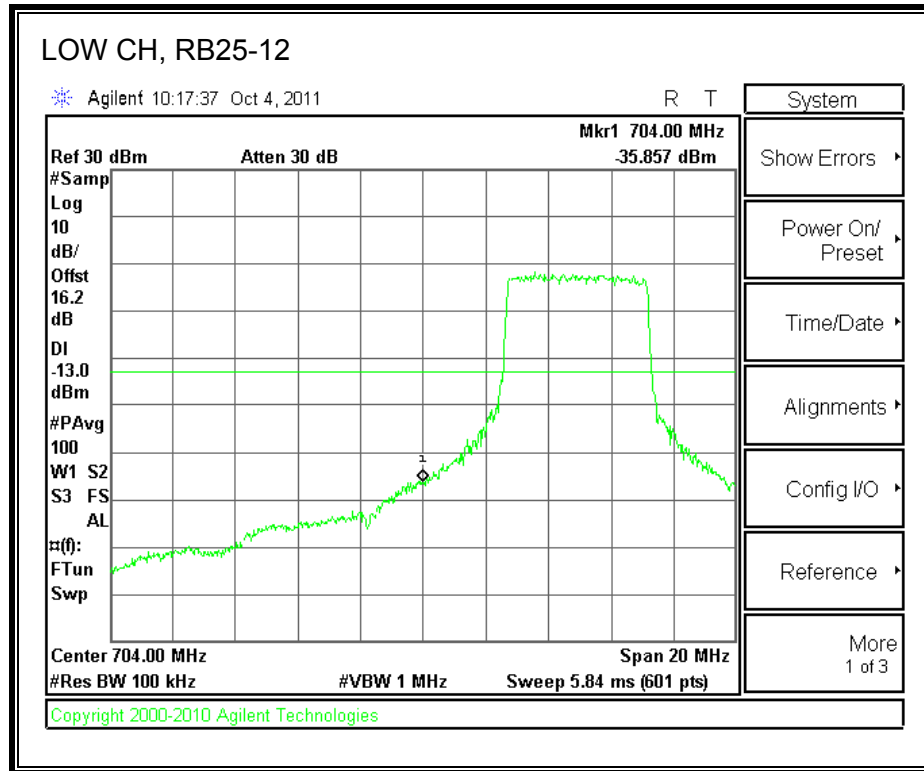


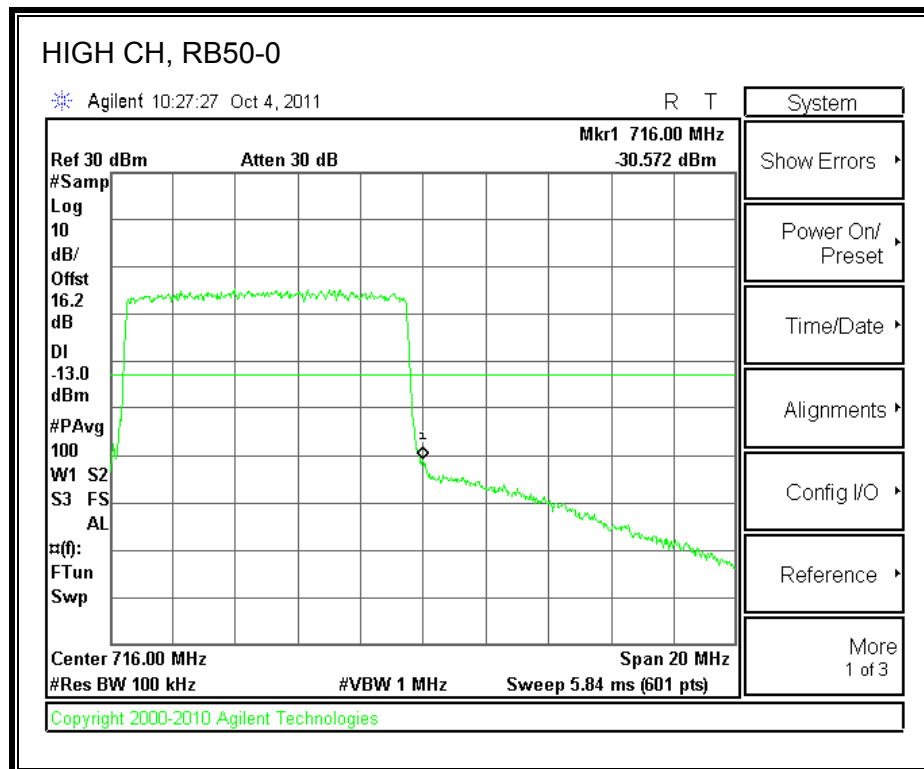
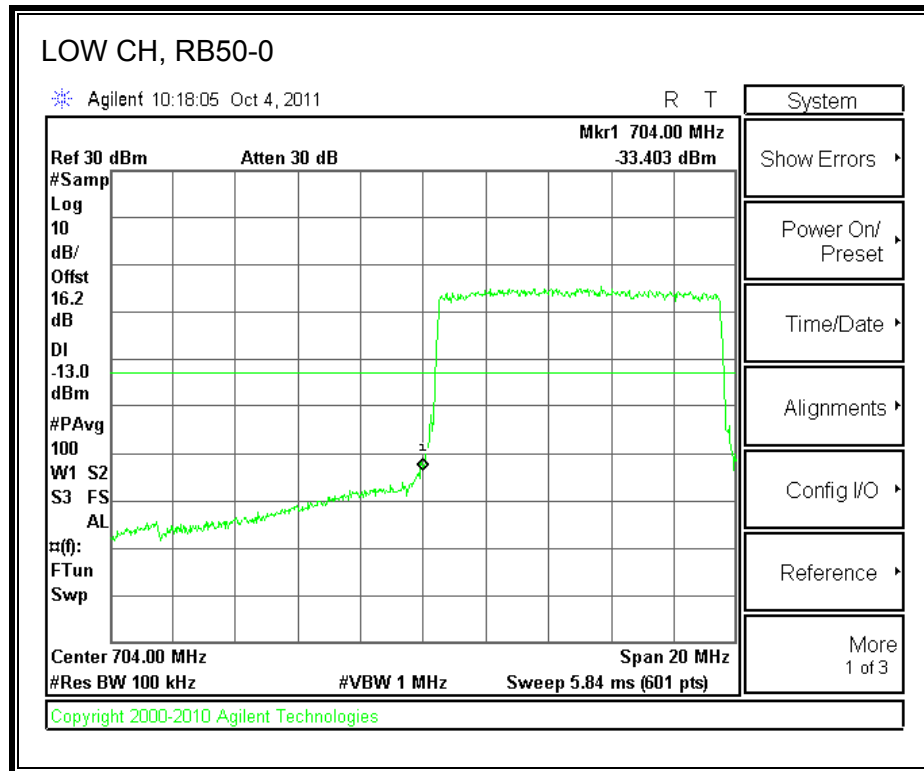


LTE QPSK Band 17 (10.0 MHz BAND WIDTH)

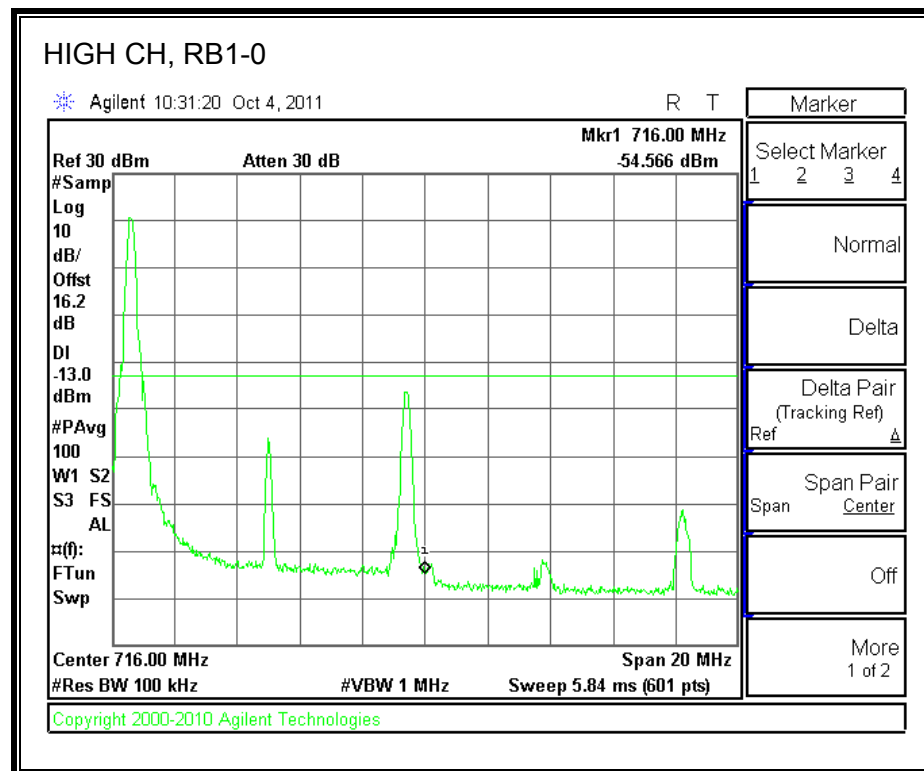
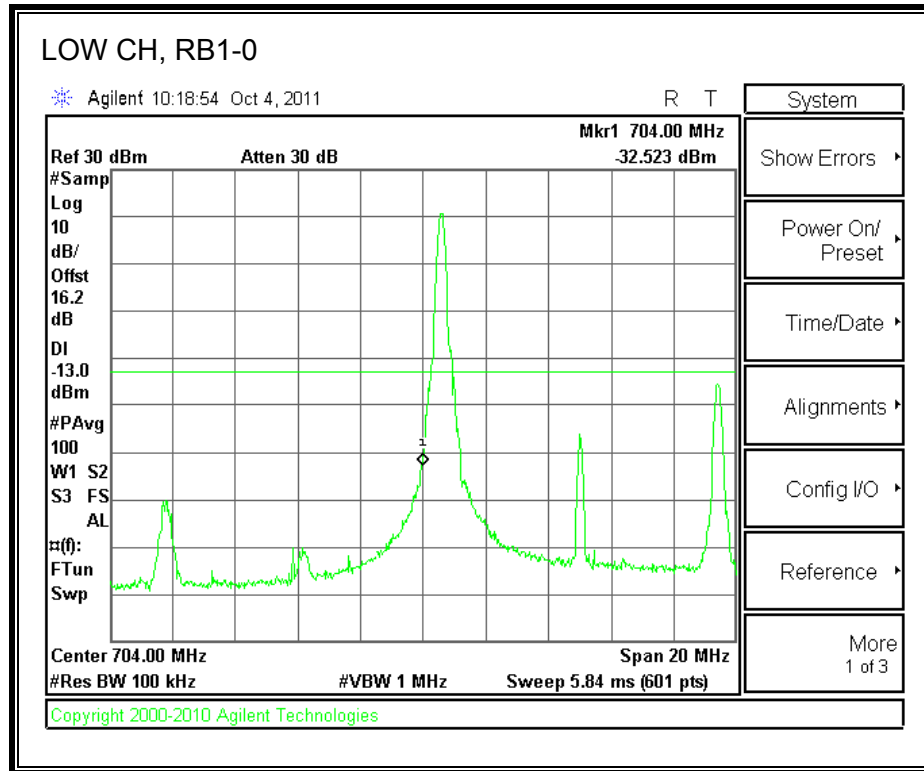


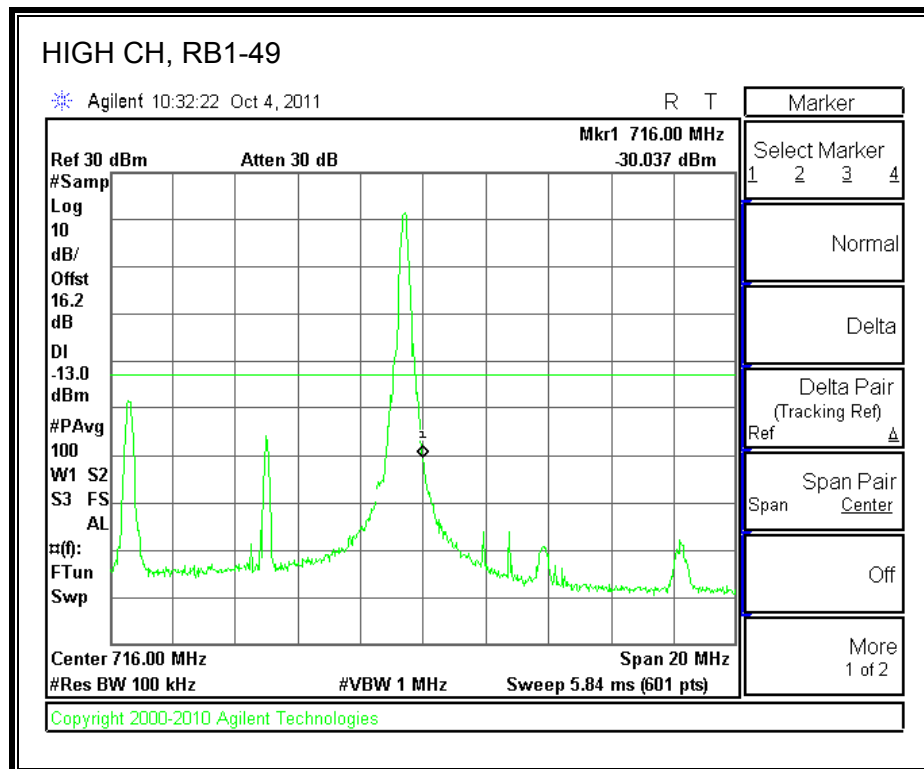
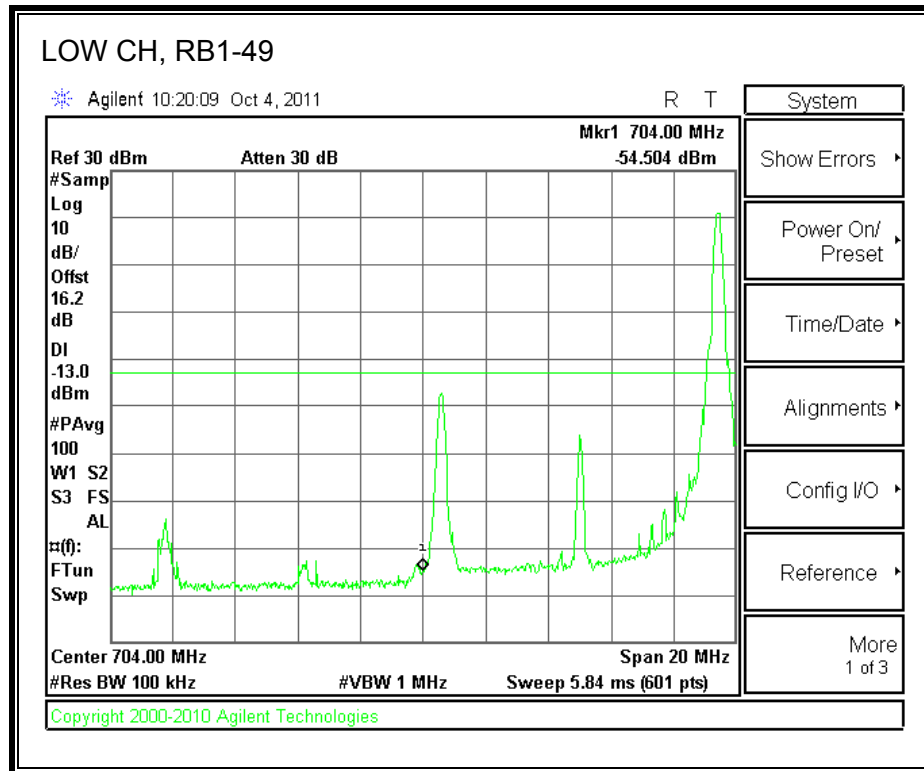


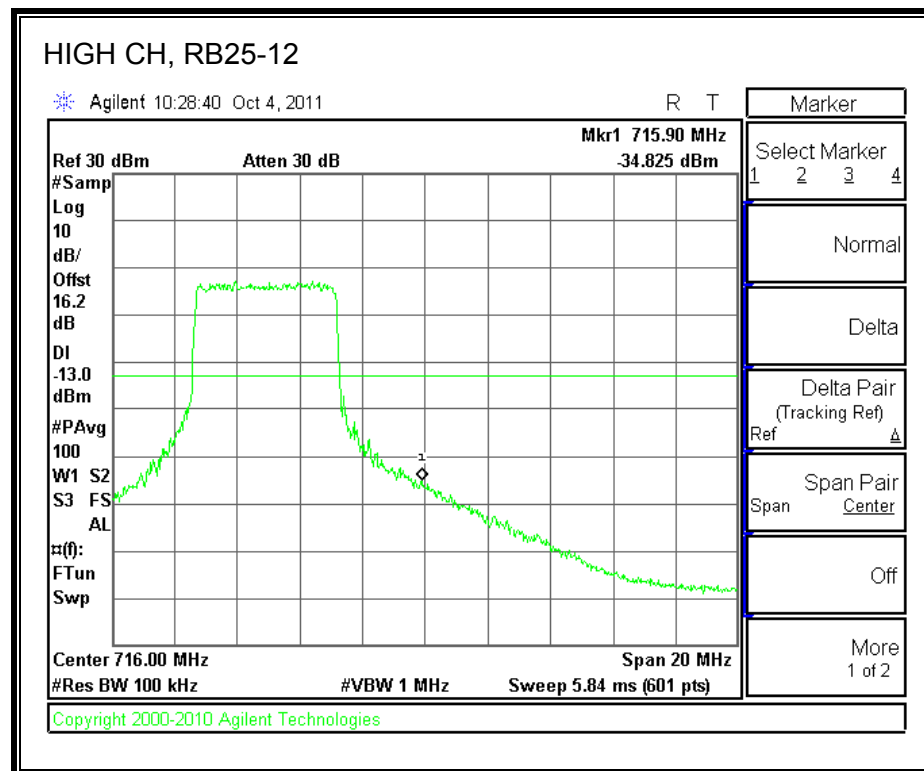
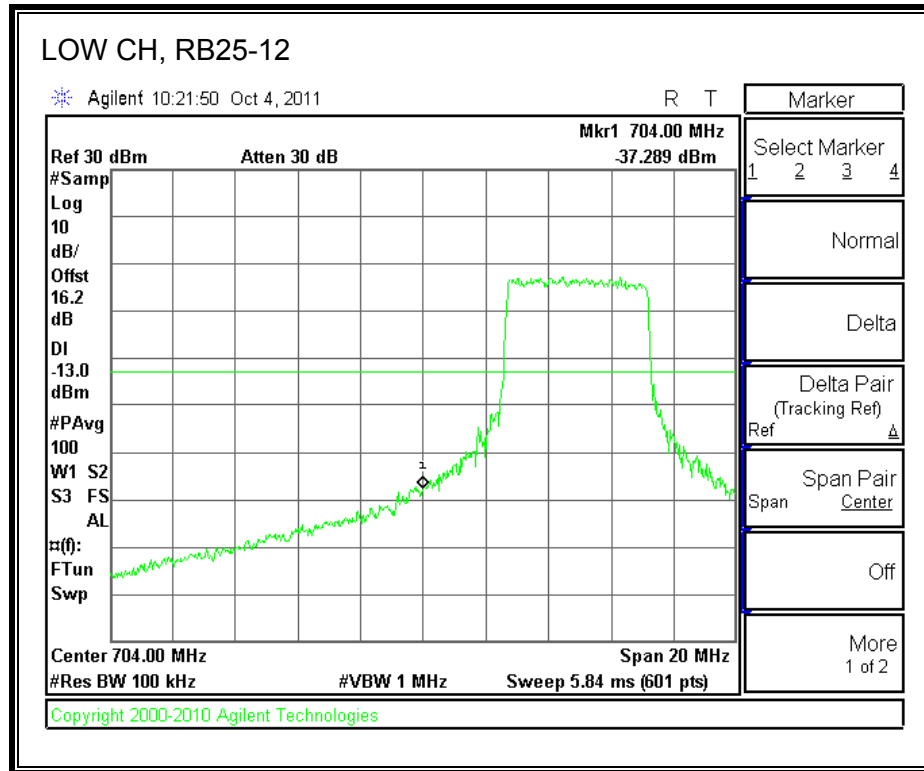


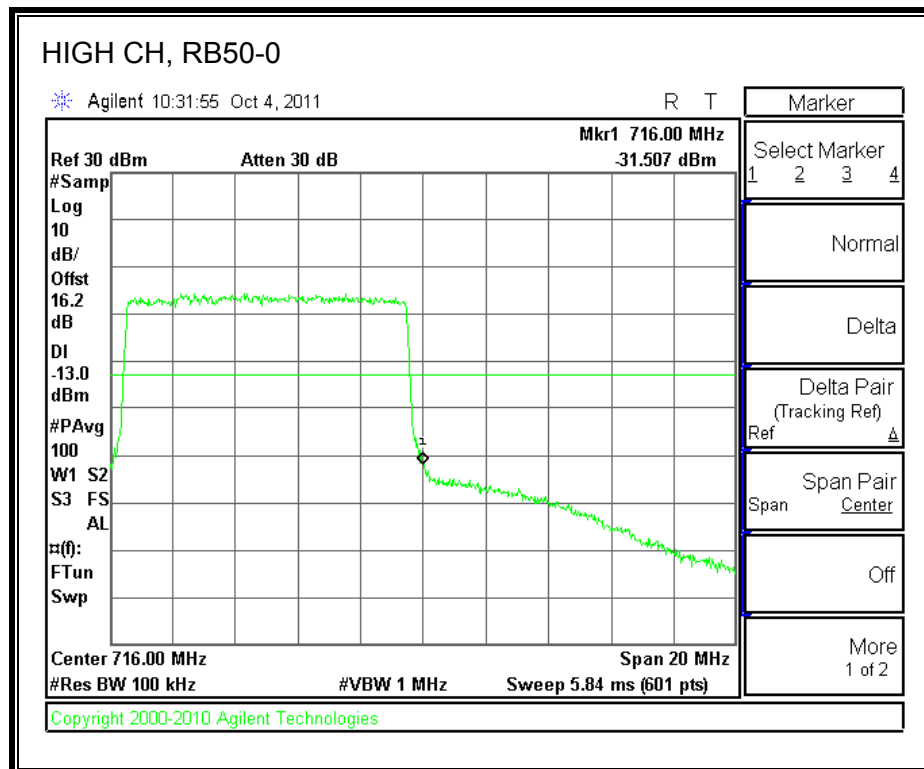
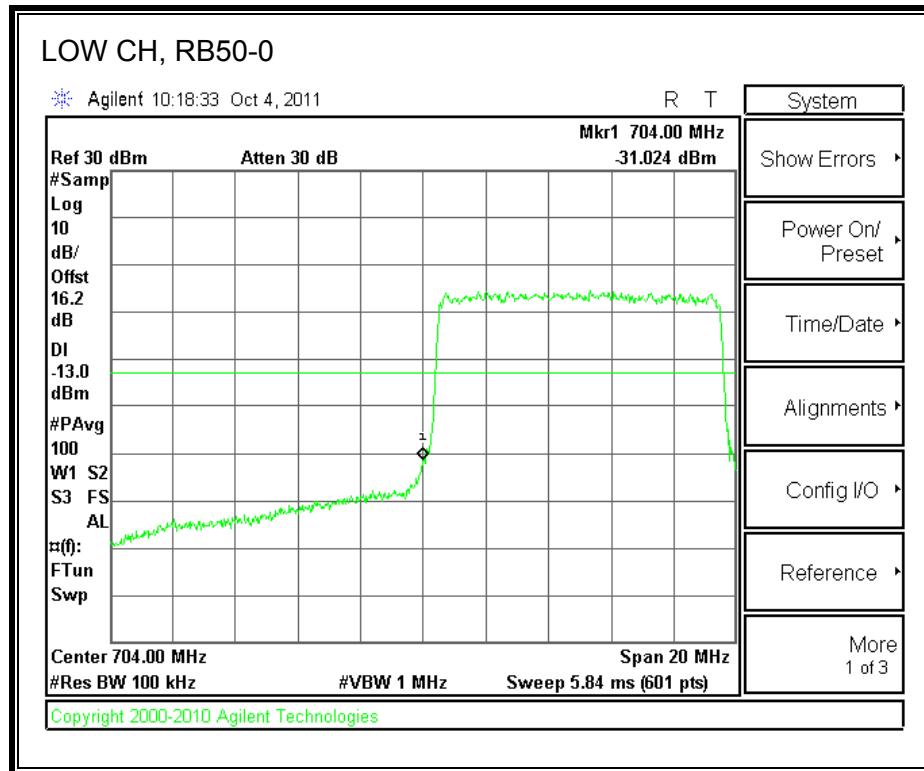


LTE 16QAM Band 17 (10.0 MHz BAND WIDTH)

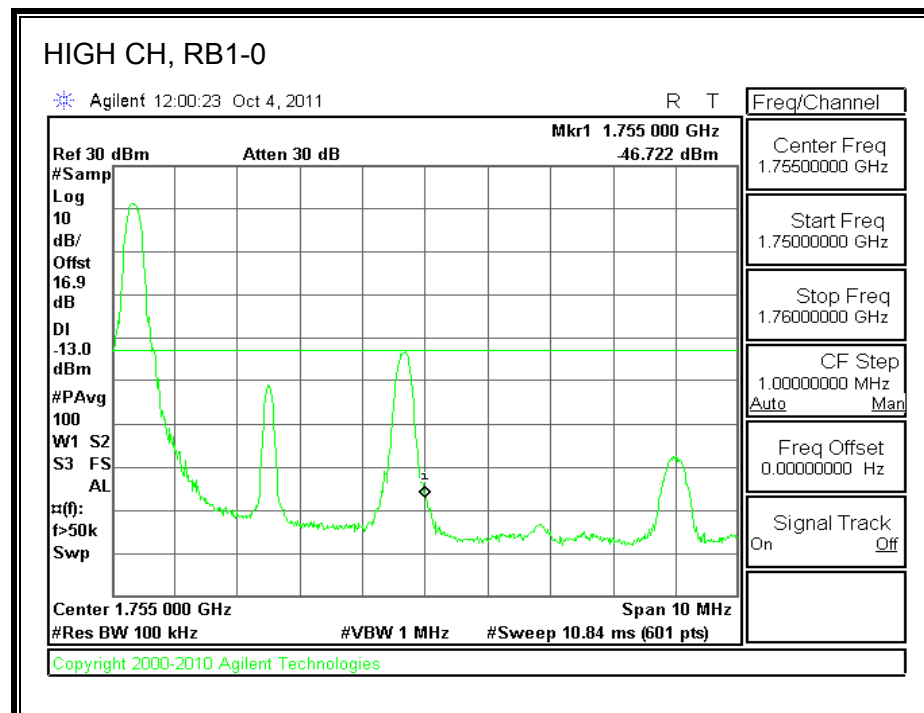
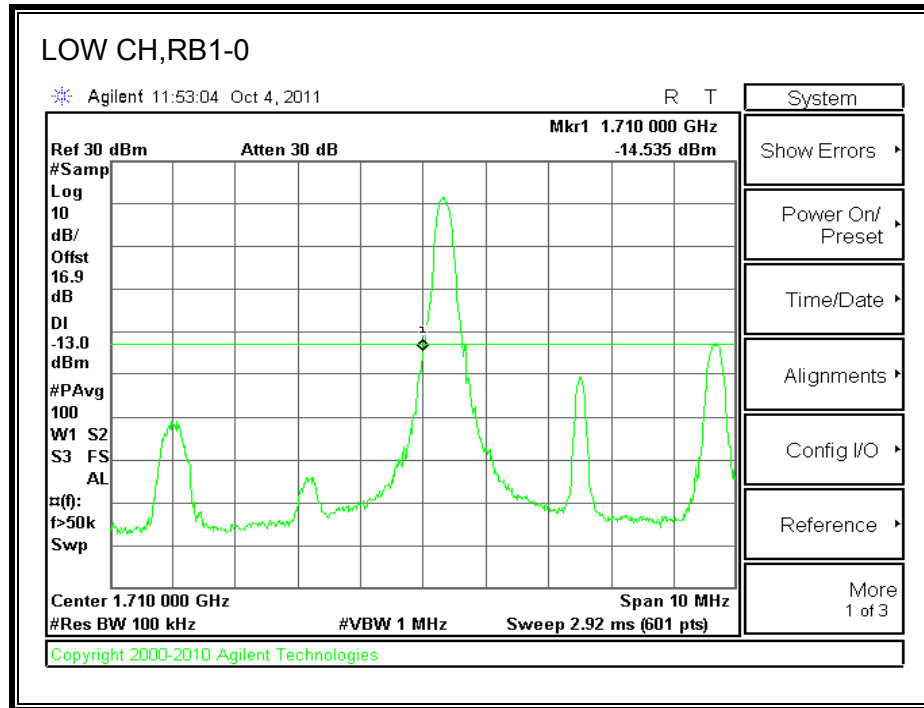


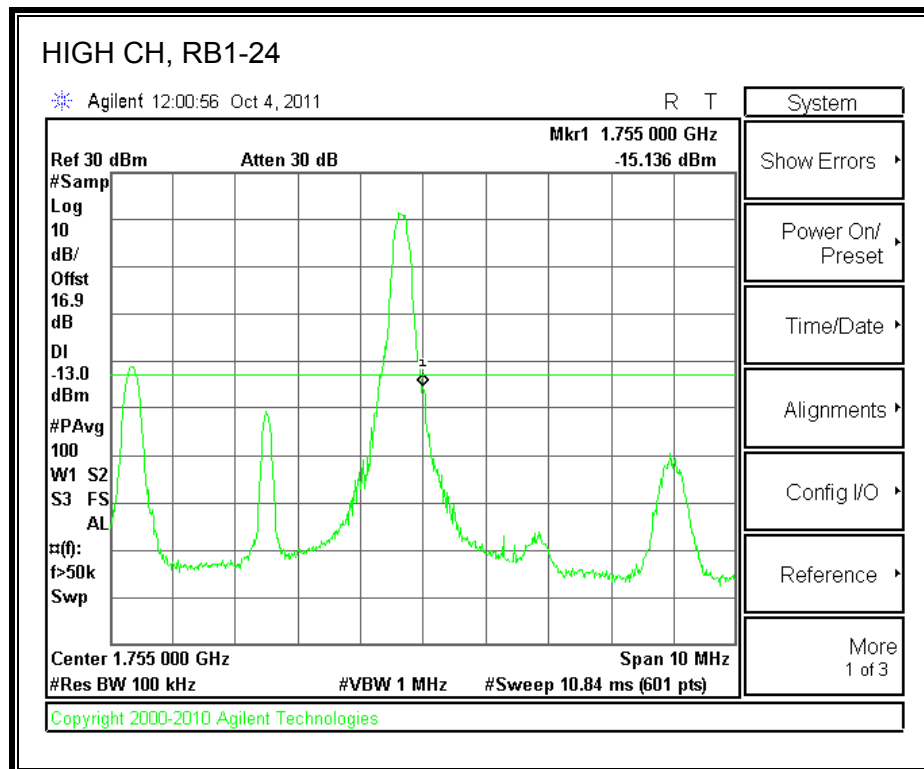
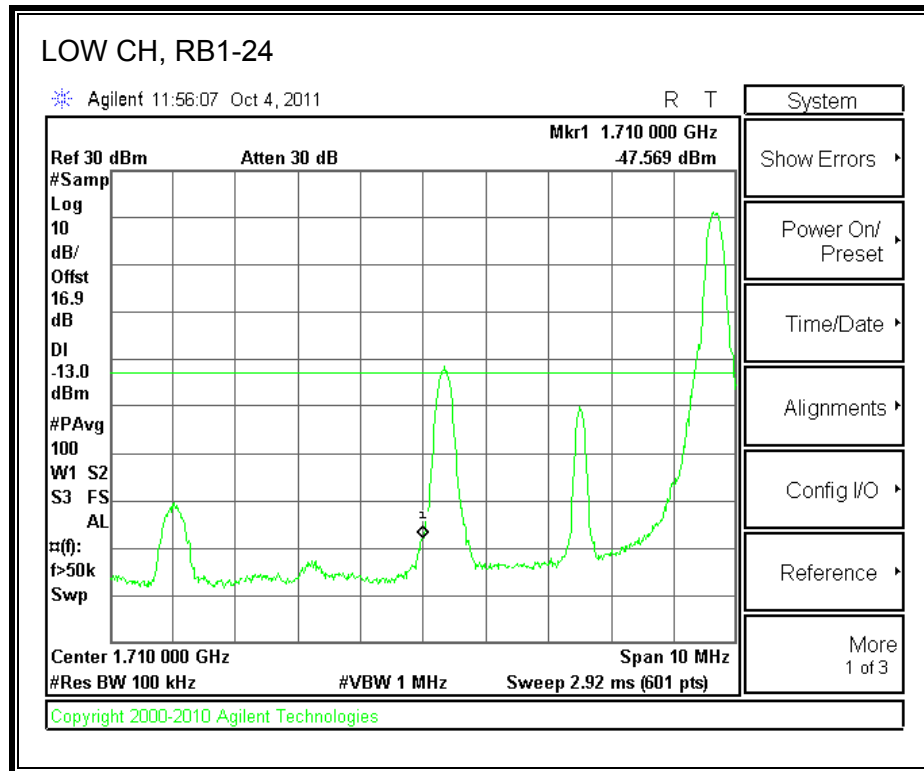


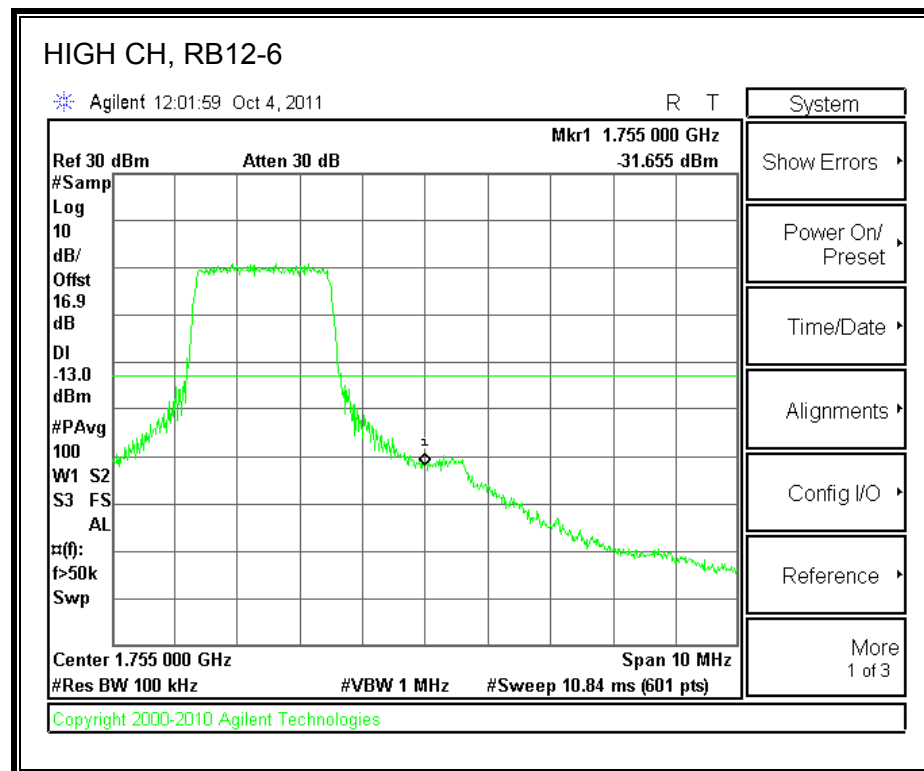
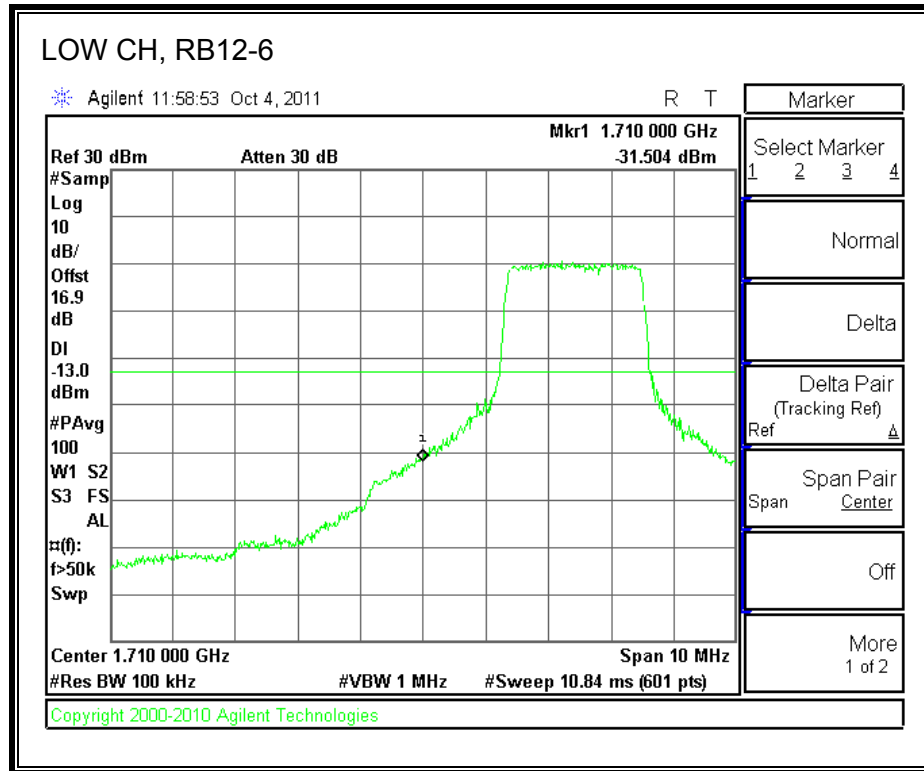


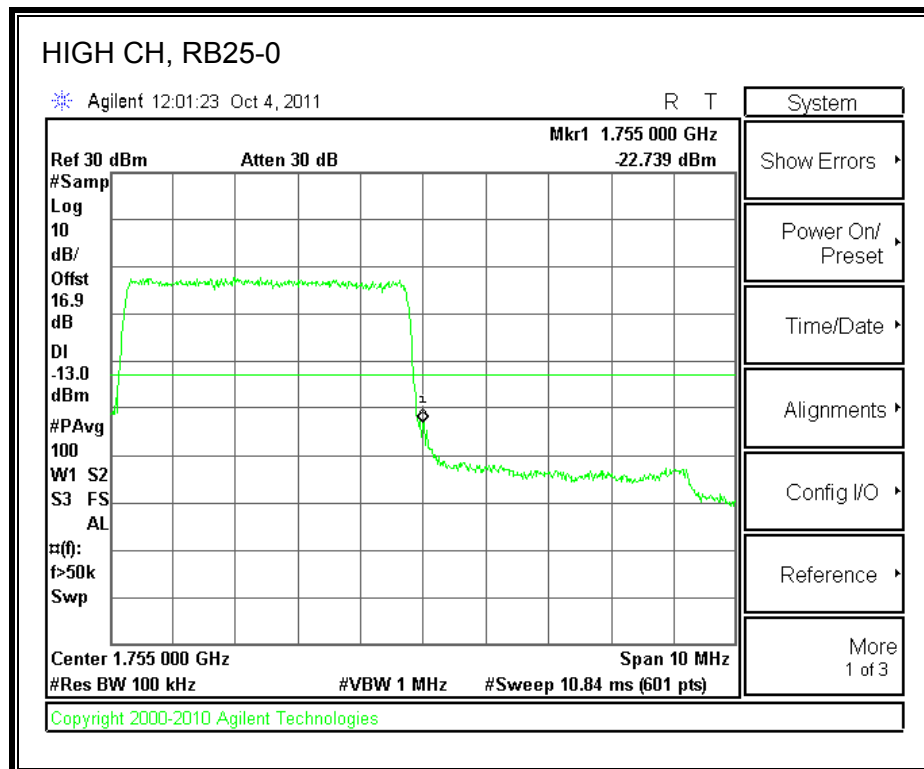
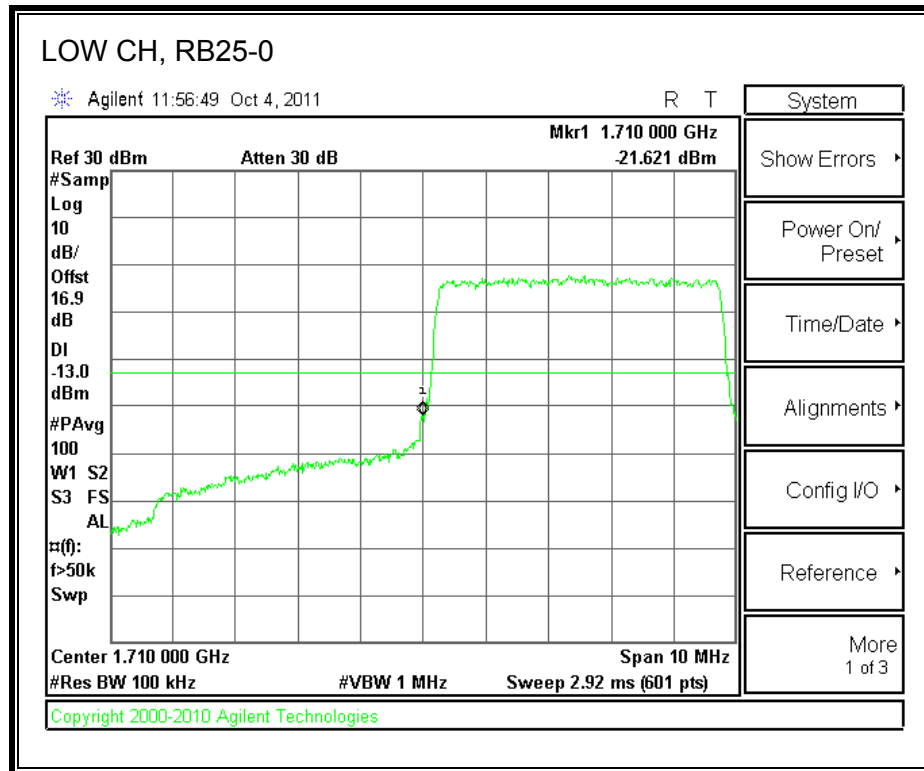


LTE QPSK Band 4 (5.0 MHz BAND WIDTH)

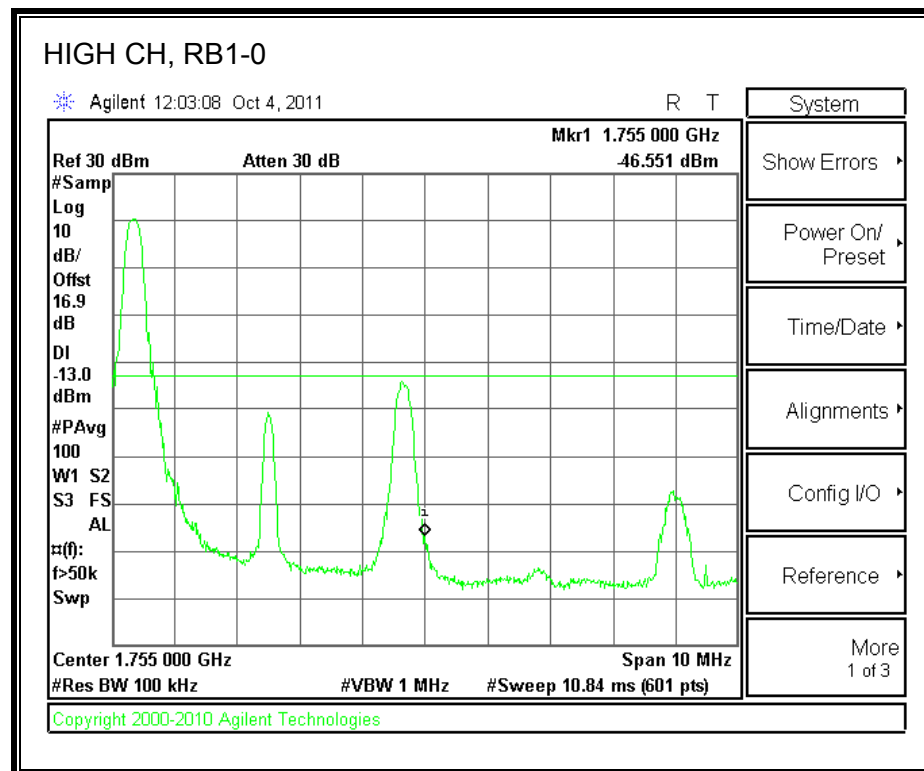
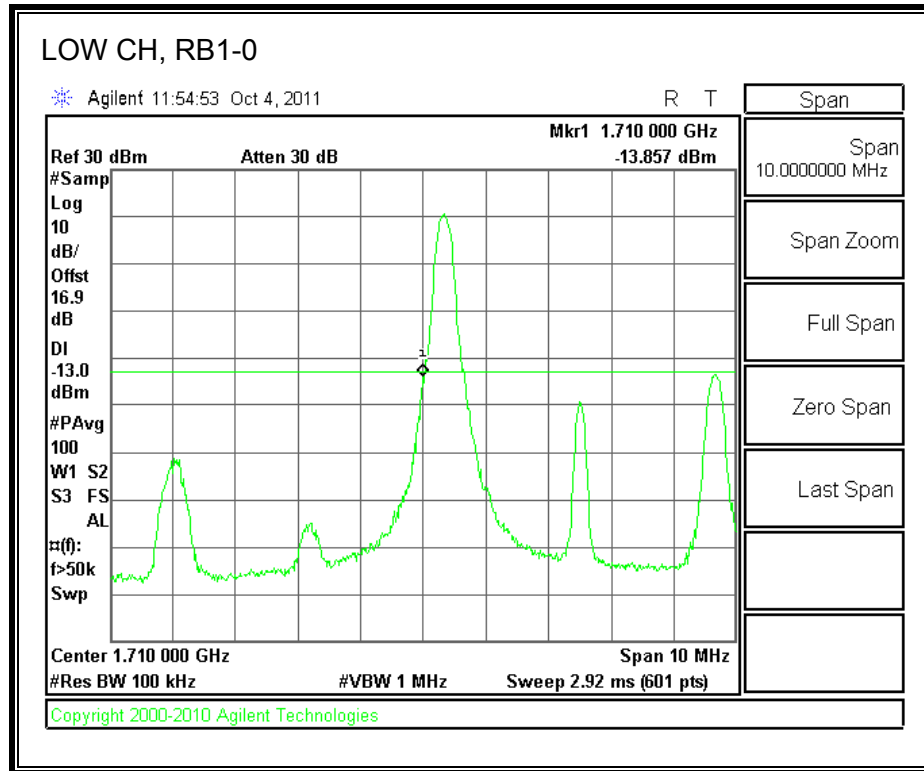


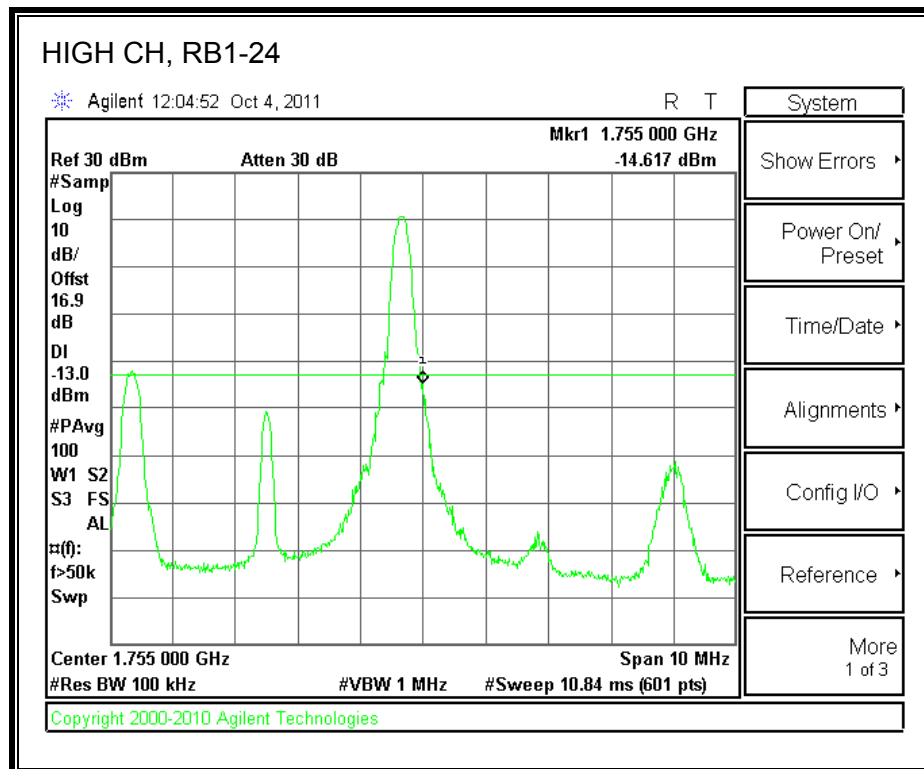
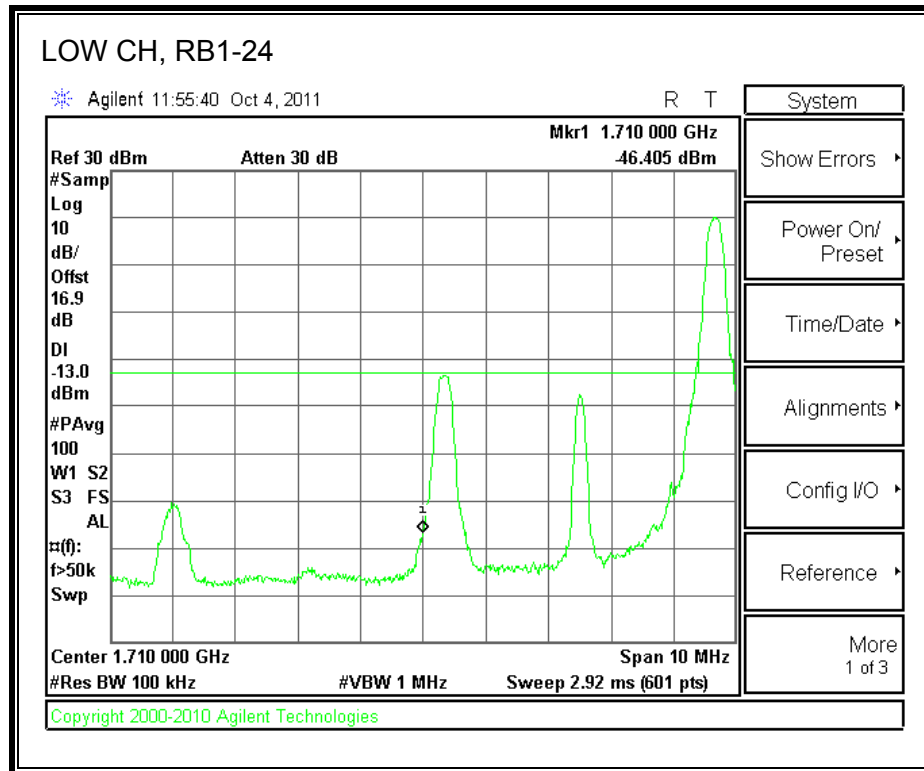


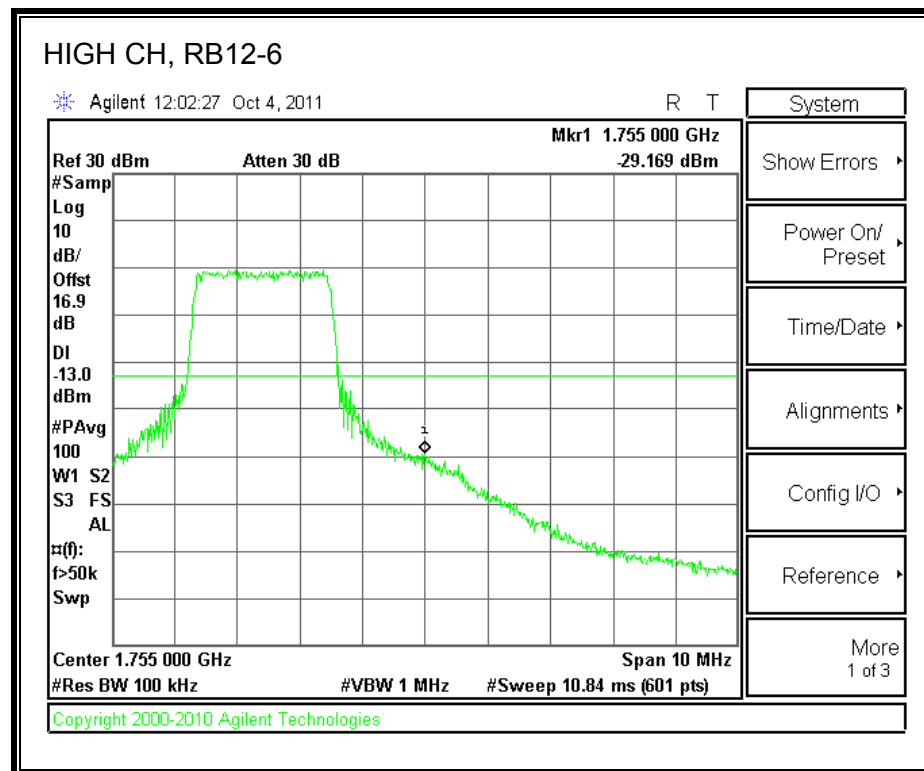
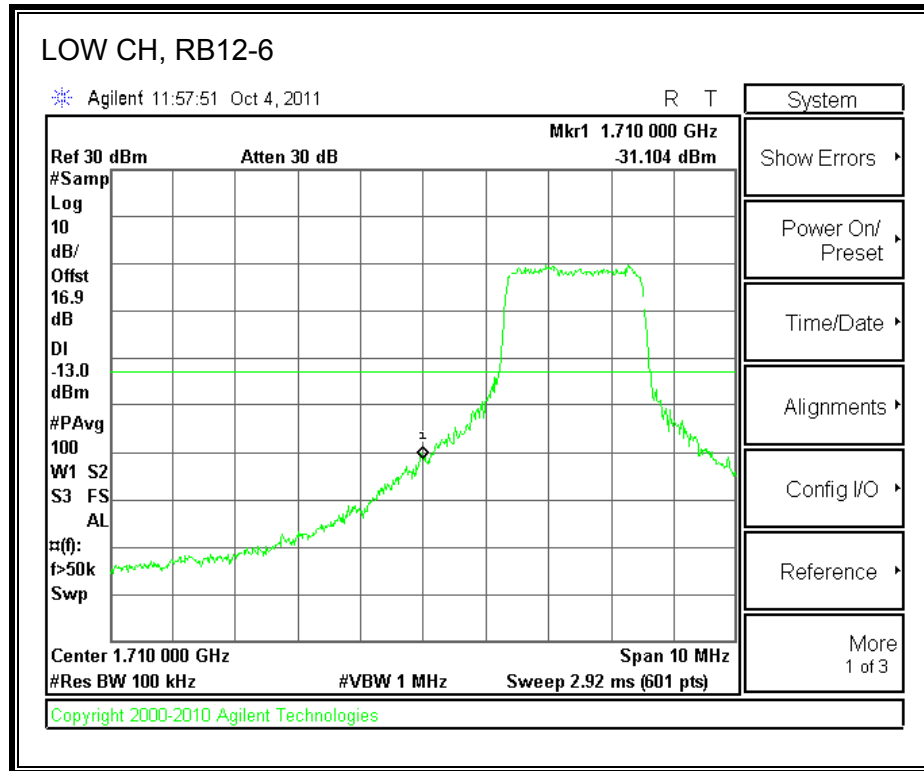


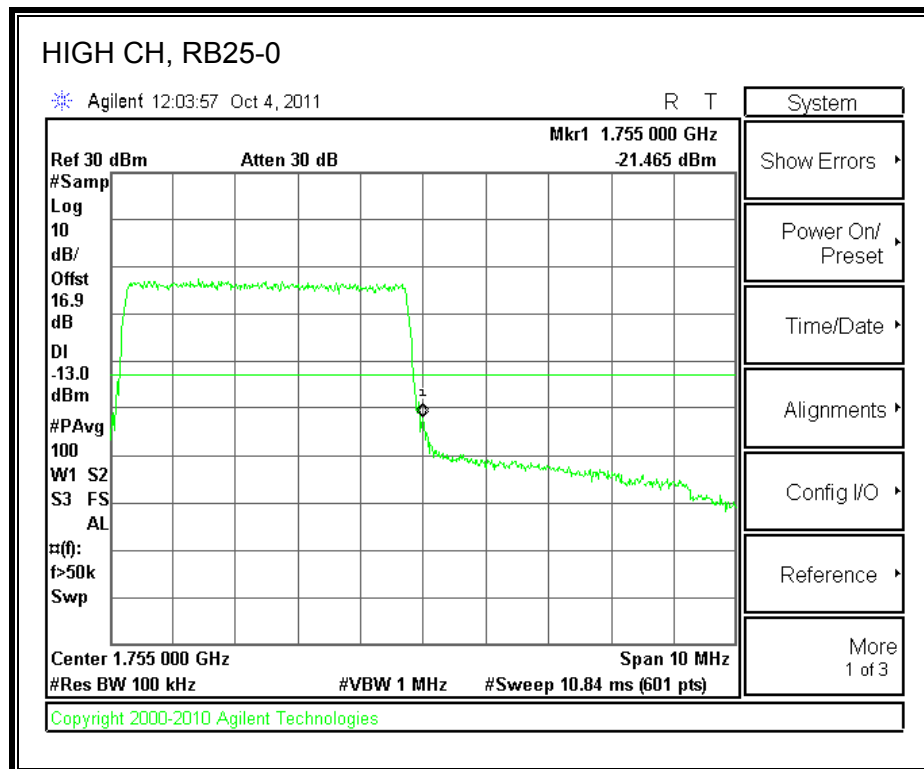
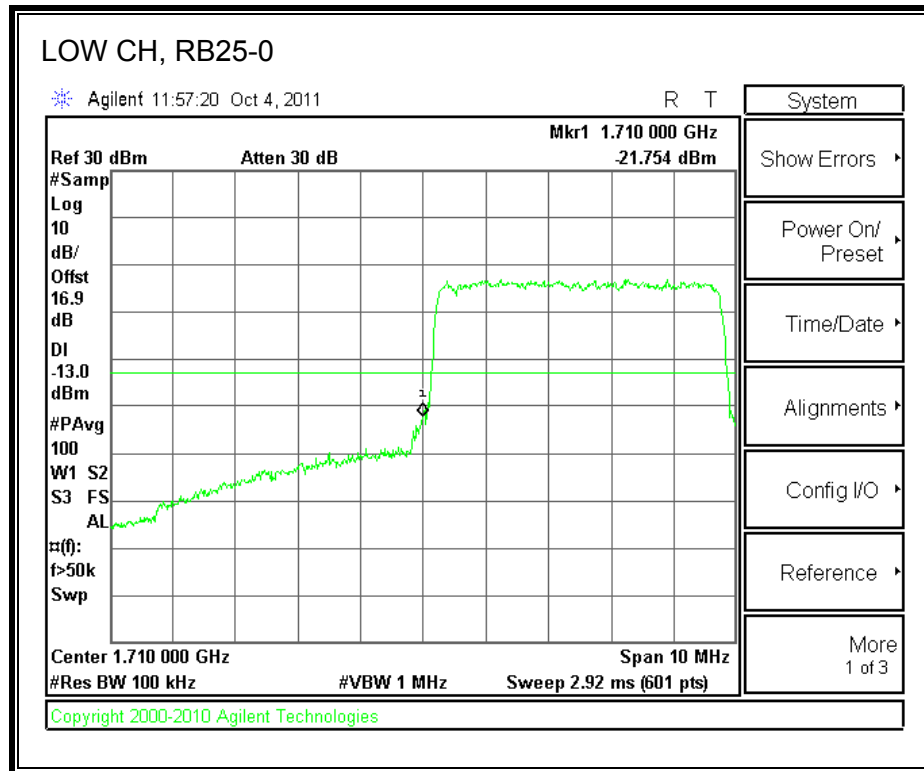


LTE 16QAM Band 4 (5.0 MHz BAND WIDTH)

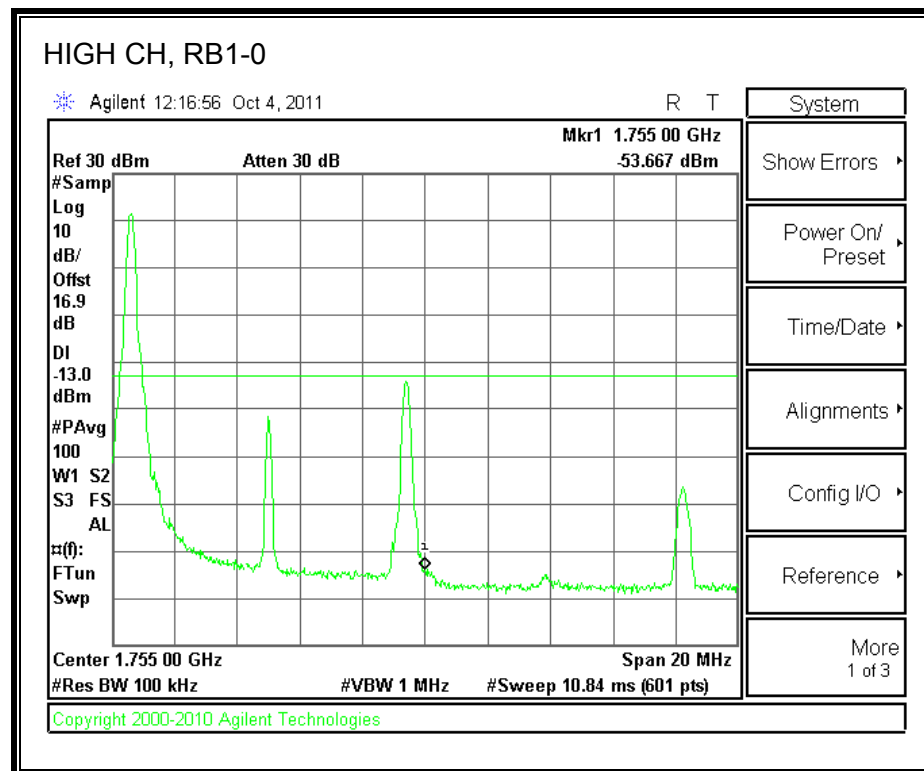
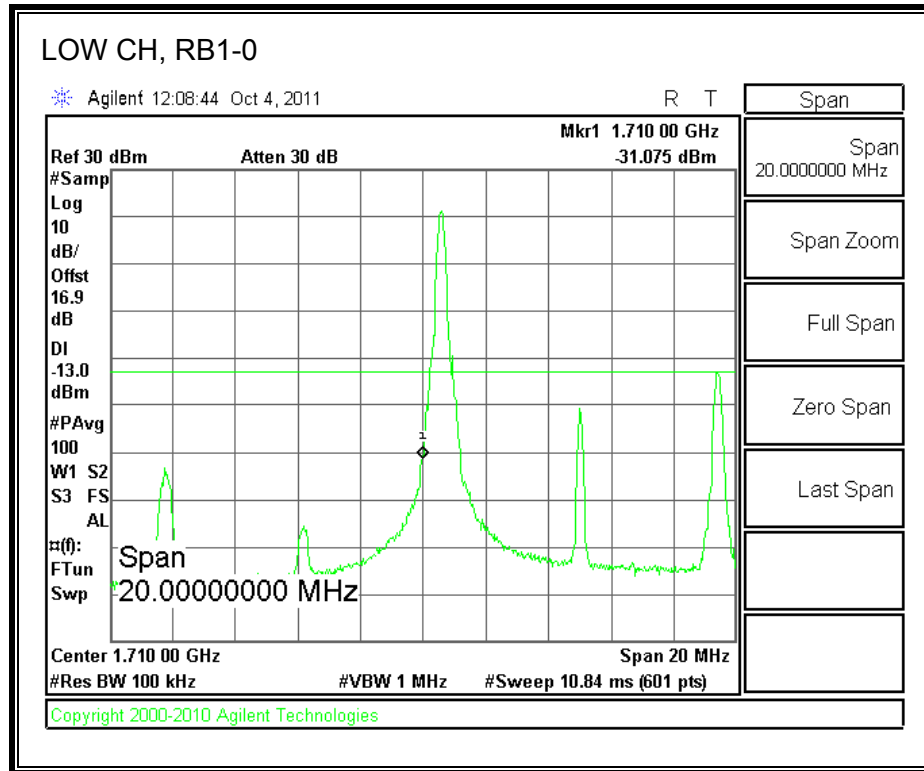


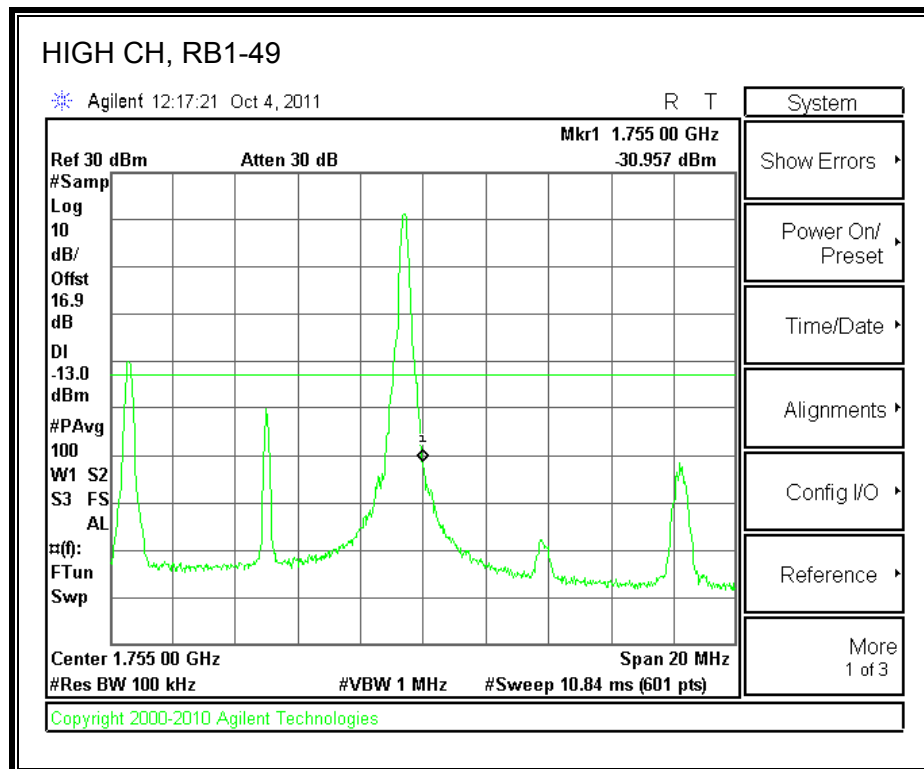
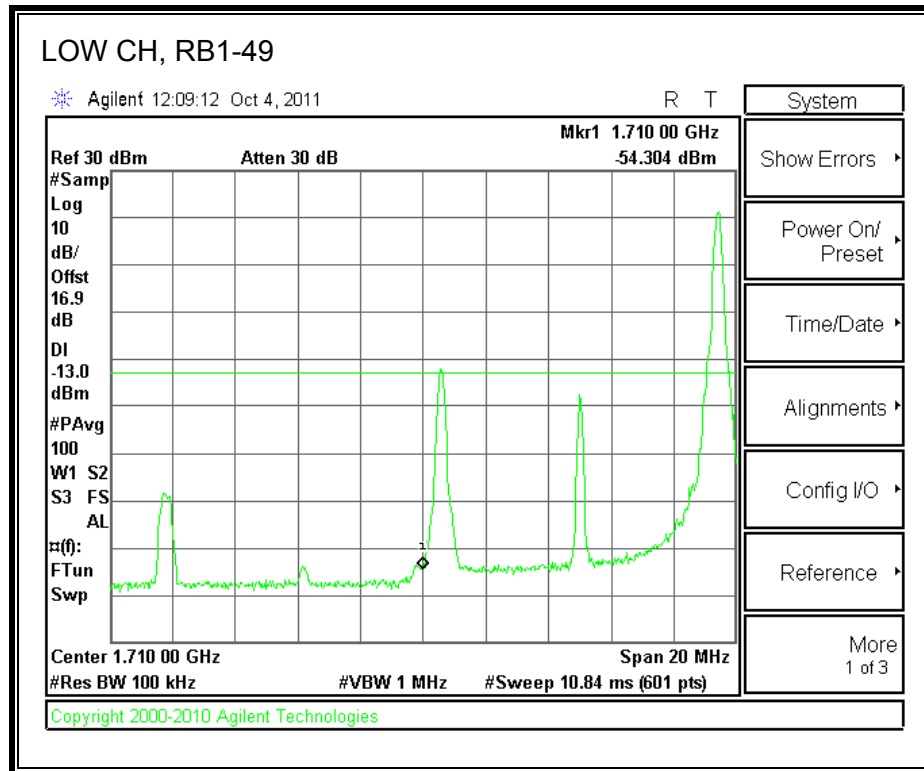


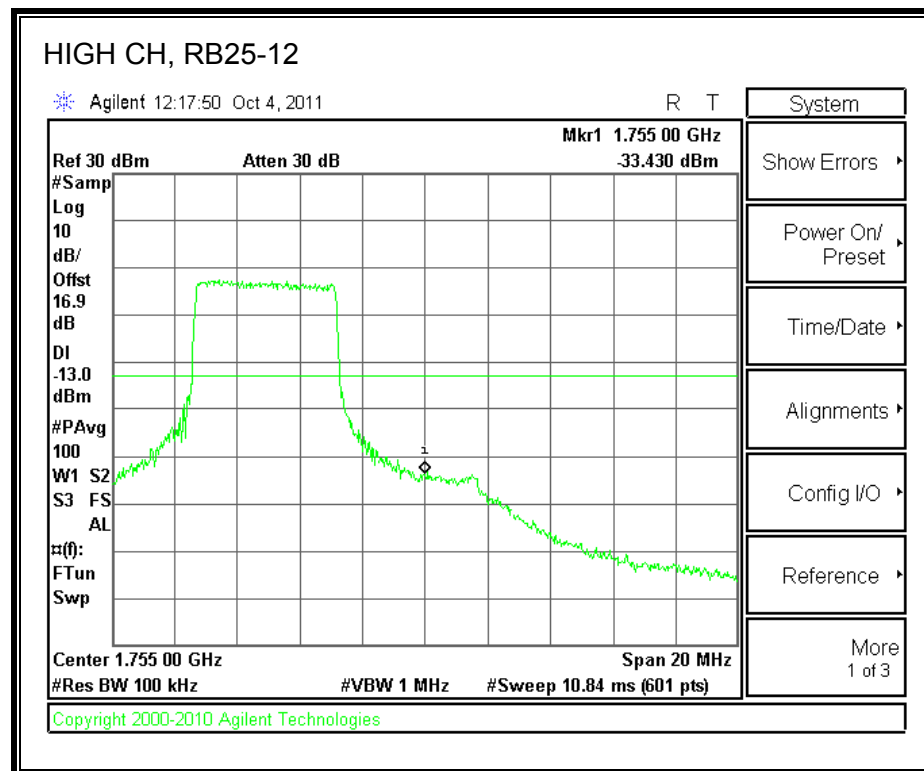
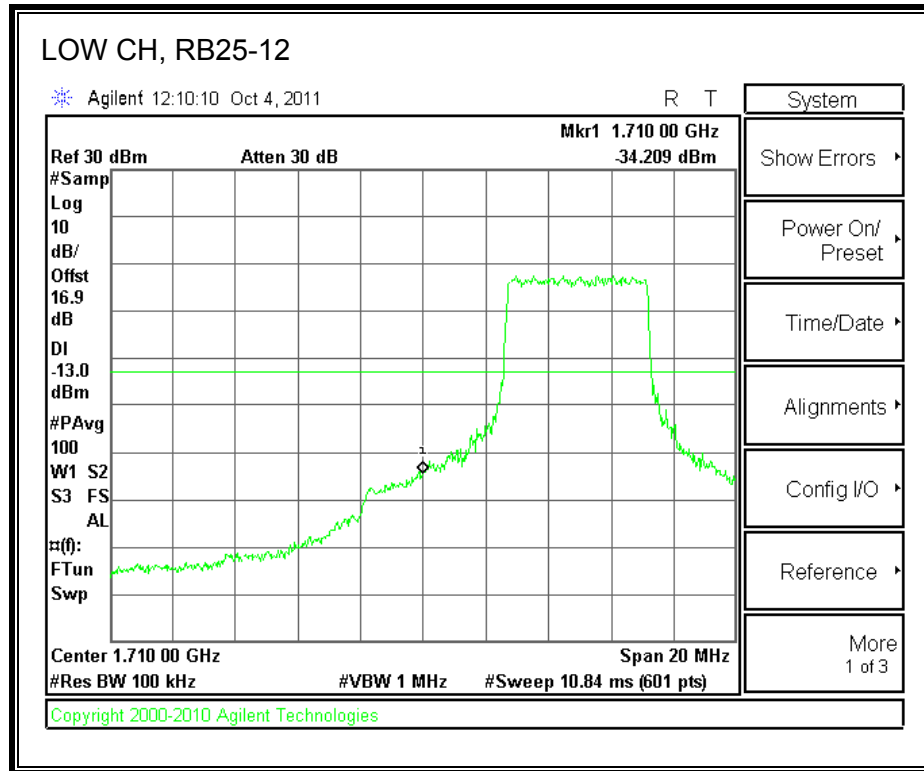


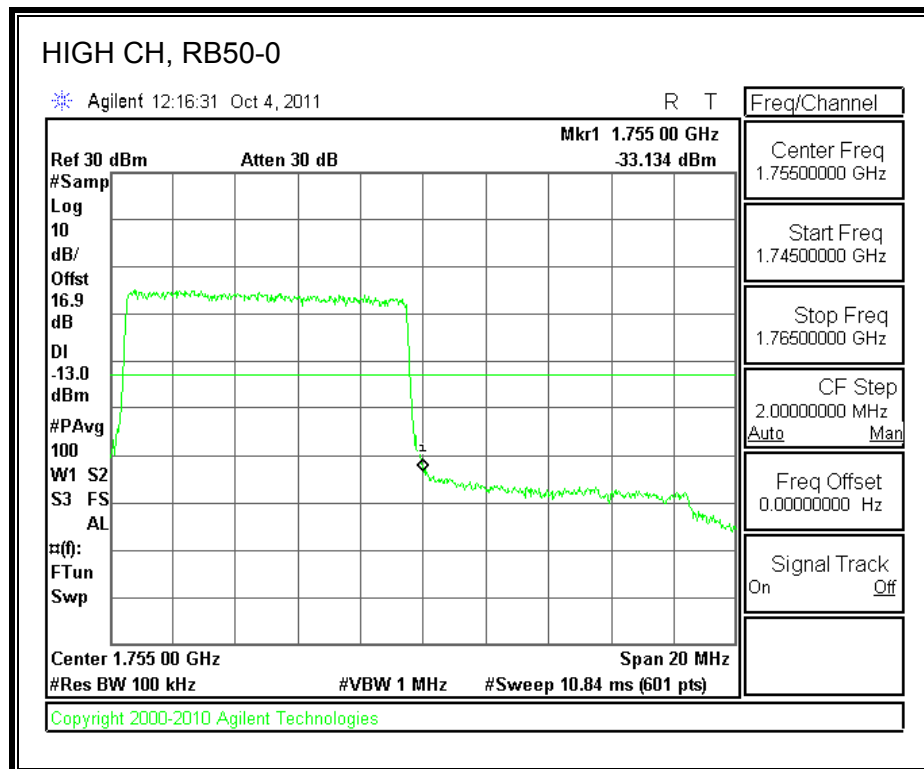
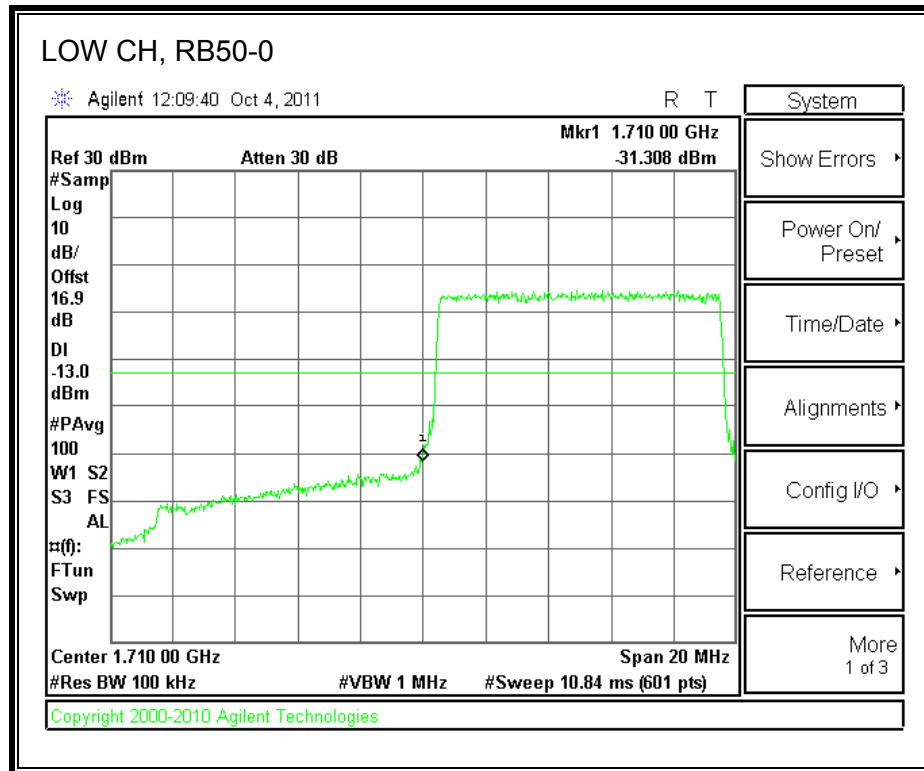


LTE QPSK Band 4 (10.0 MHz BAND WIDTH)

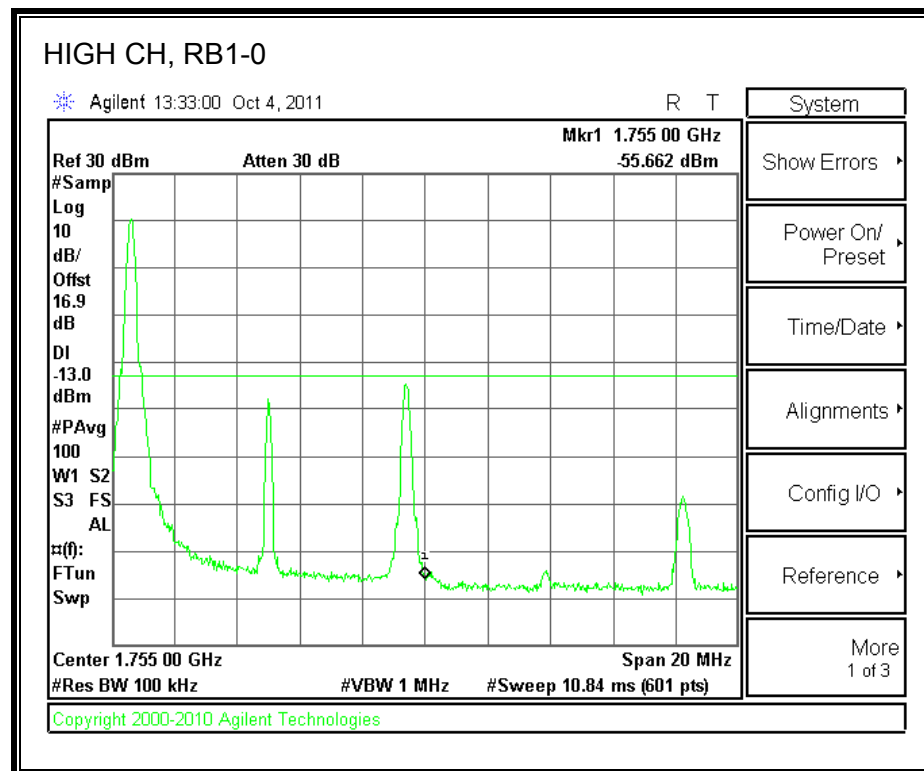
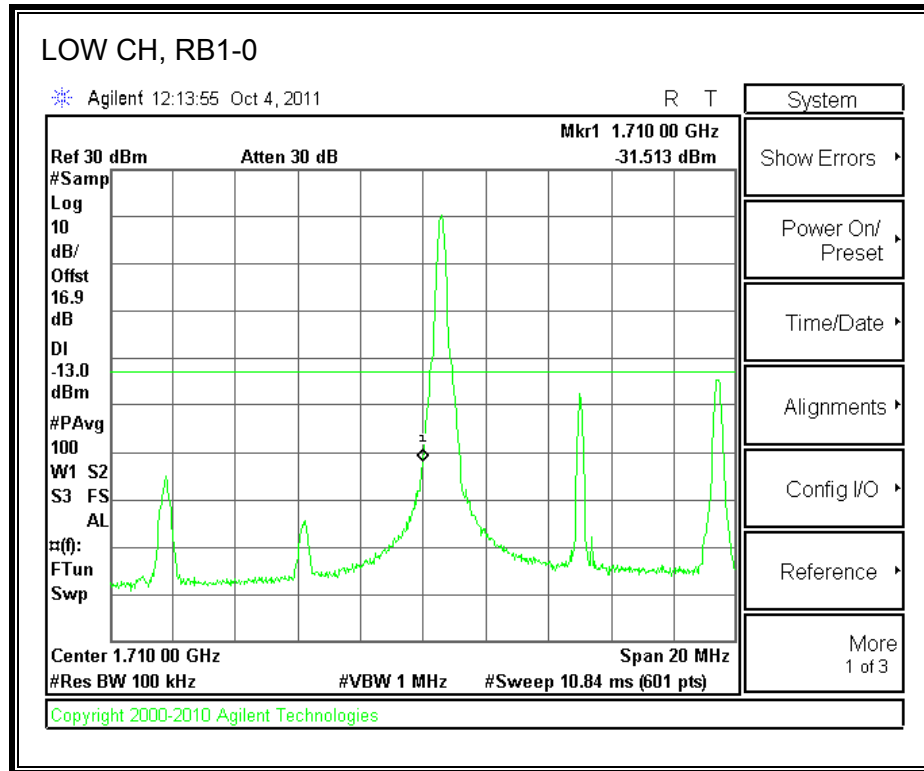


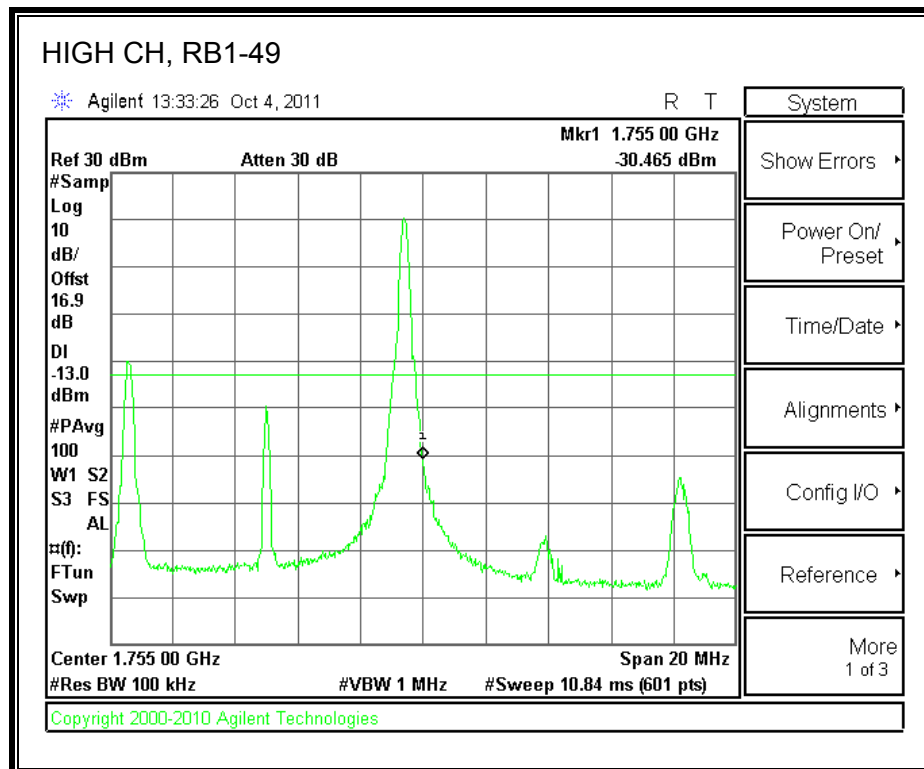
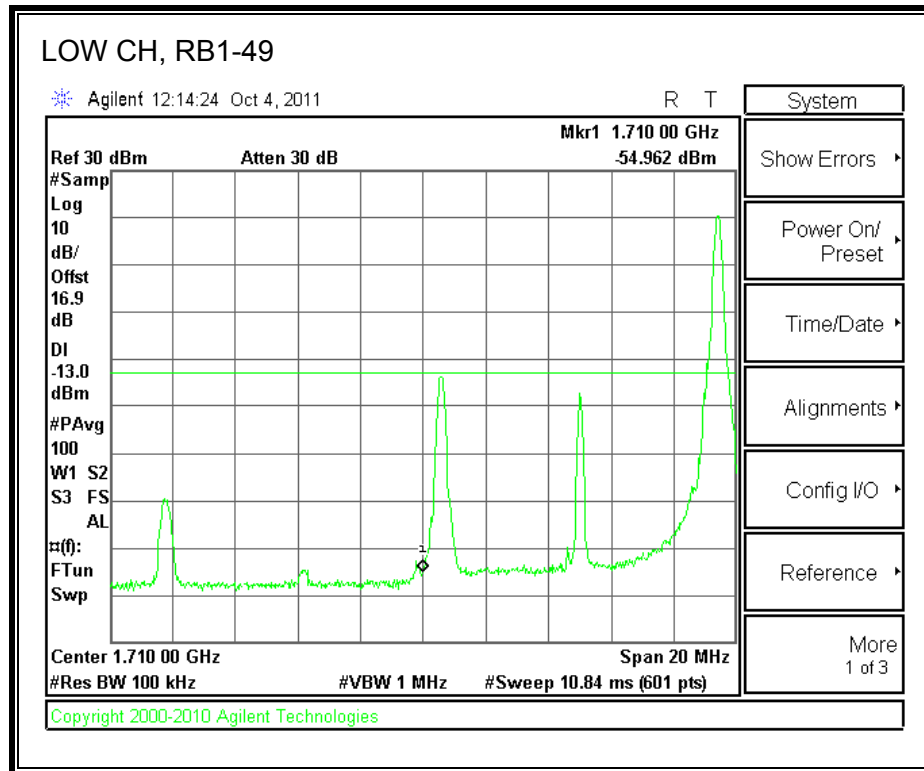


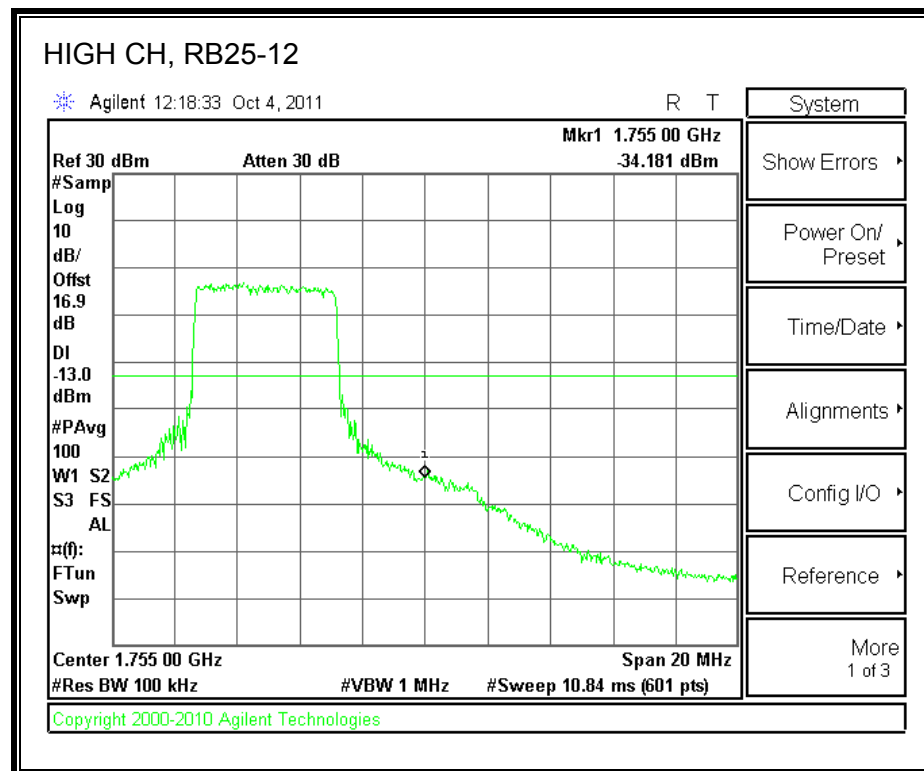
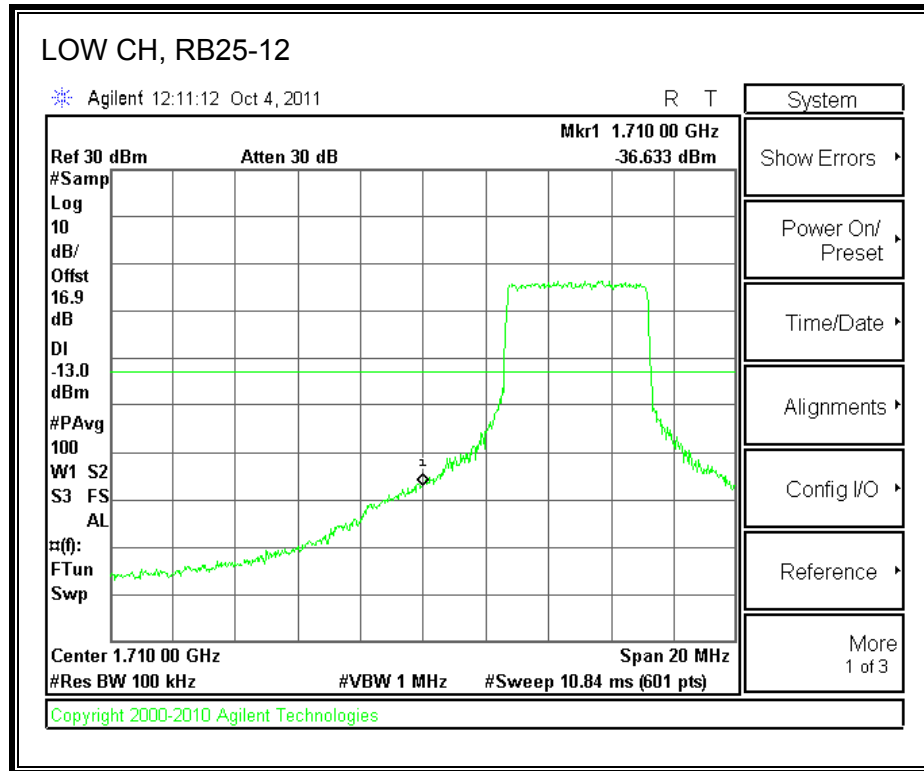


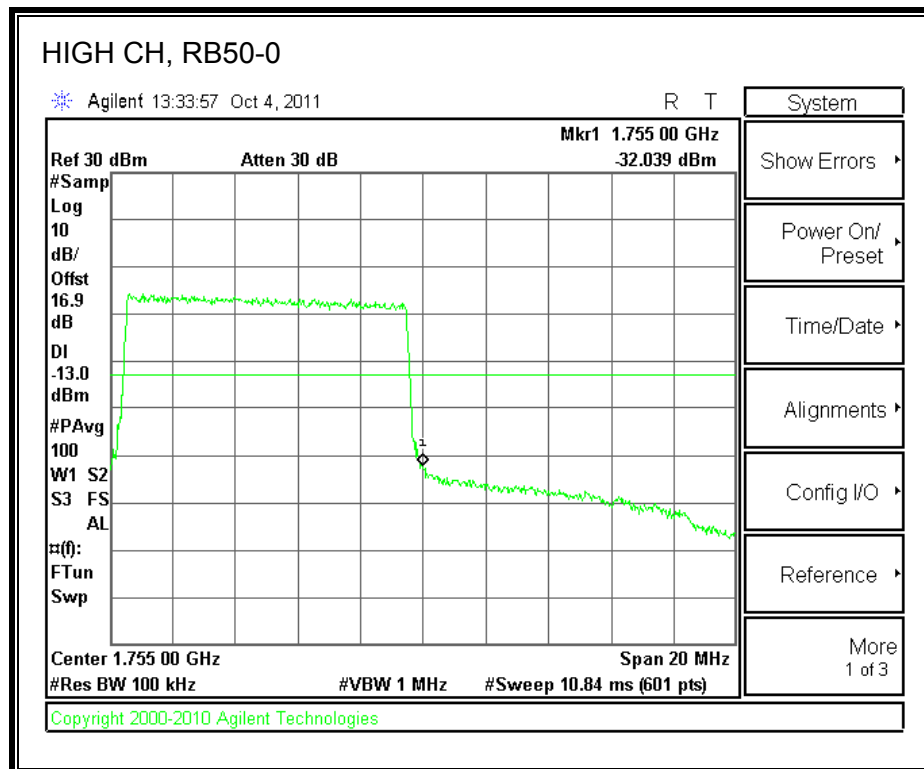
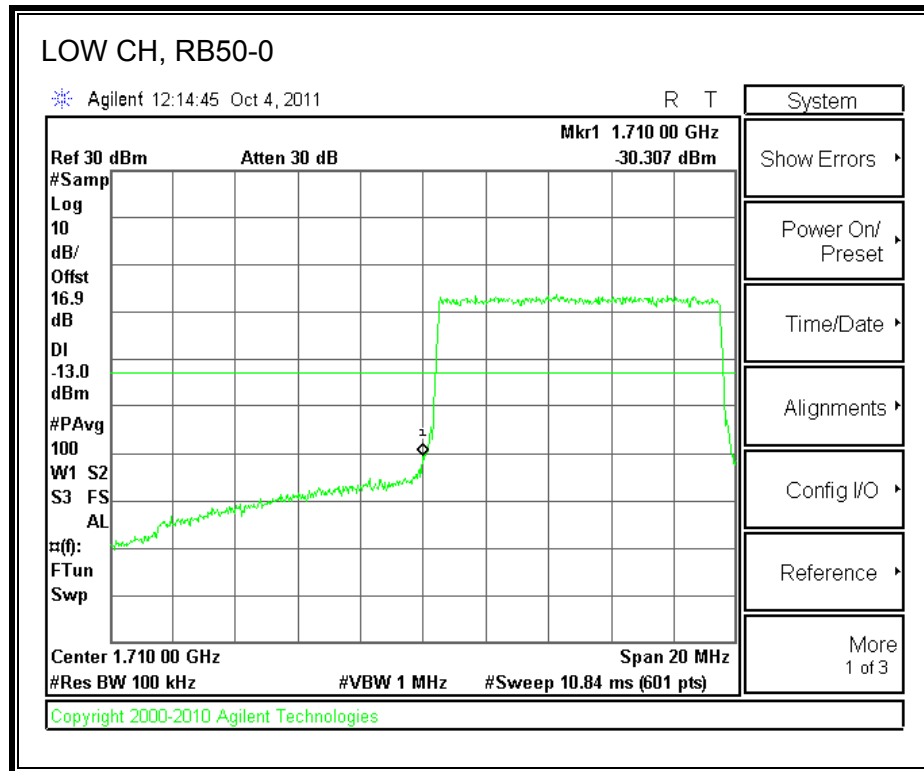


LTE 16QAM Band 4 (10.0 MHz BAND WIDTH)









8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §27.53

LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

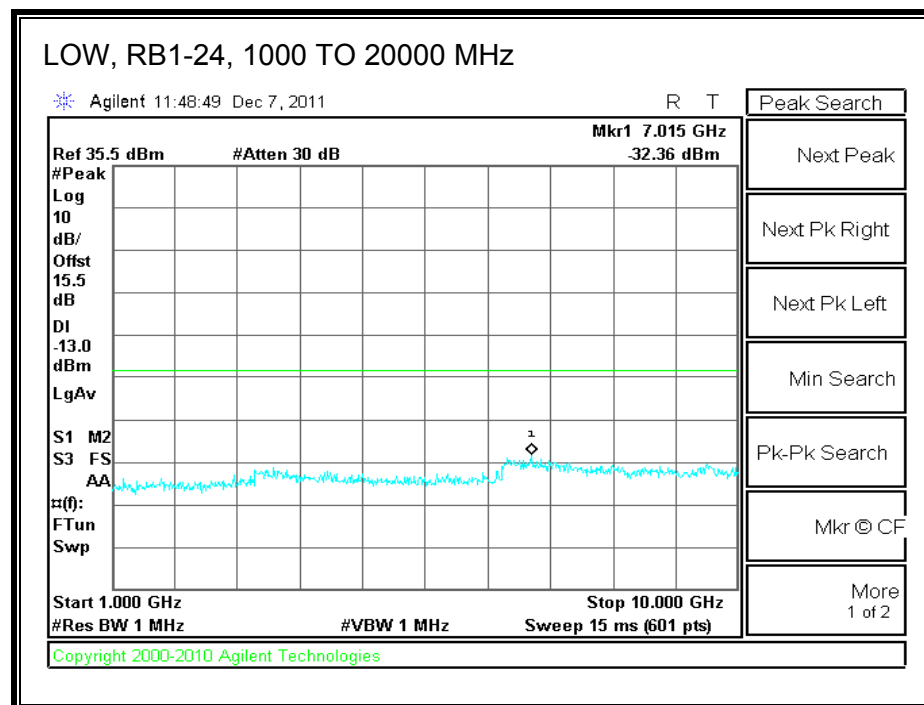
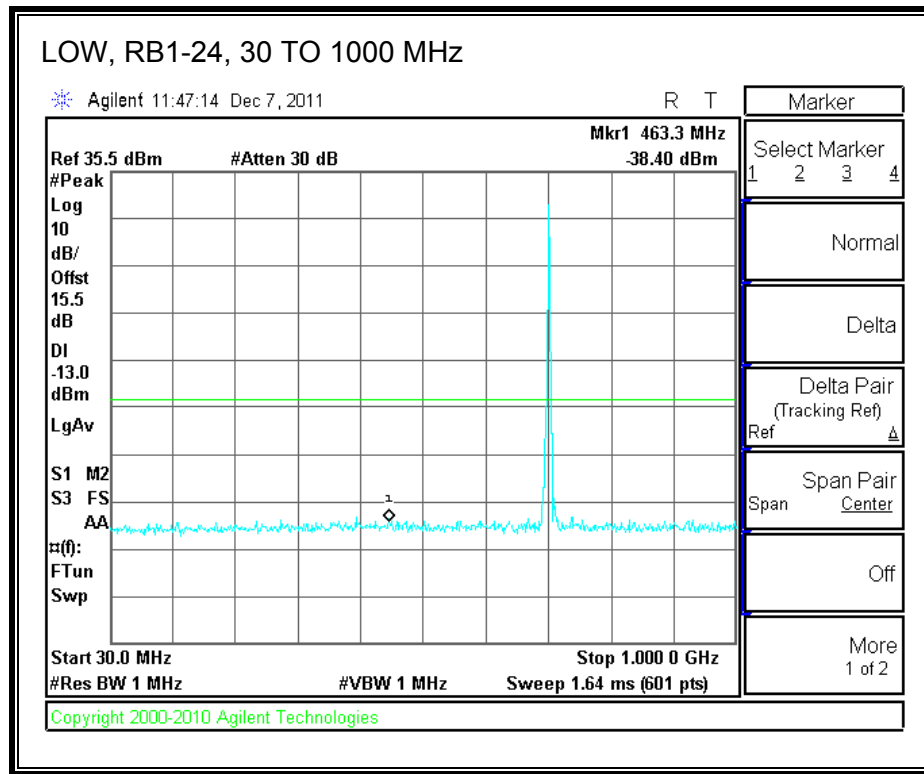
MODES TESTED

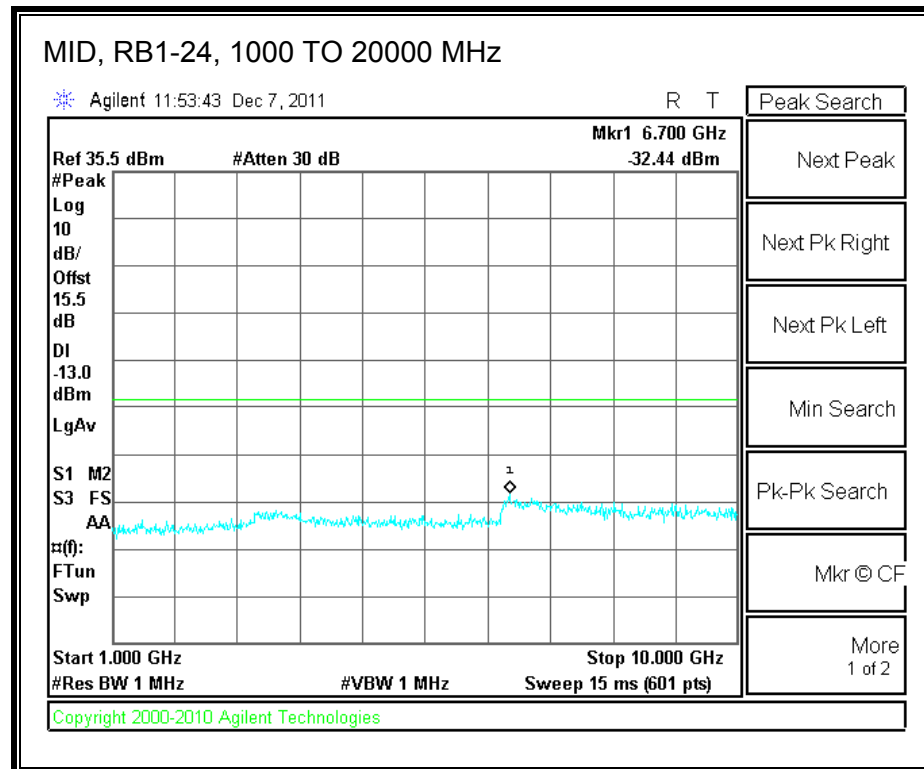
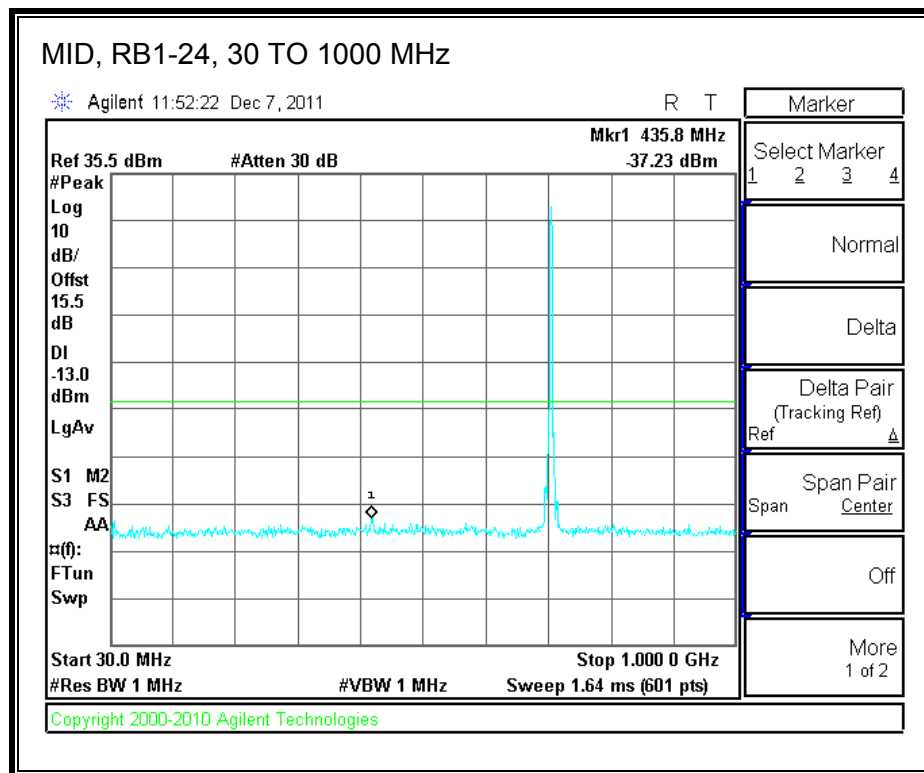
- LTE BAND 4 and BAND 17

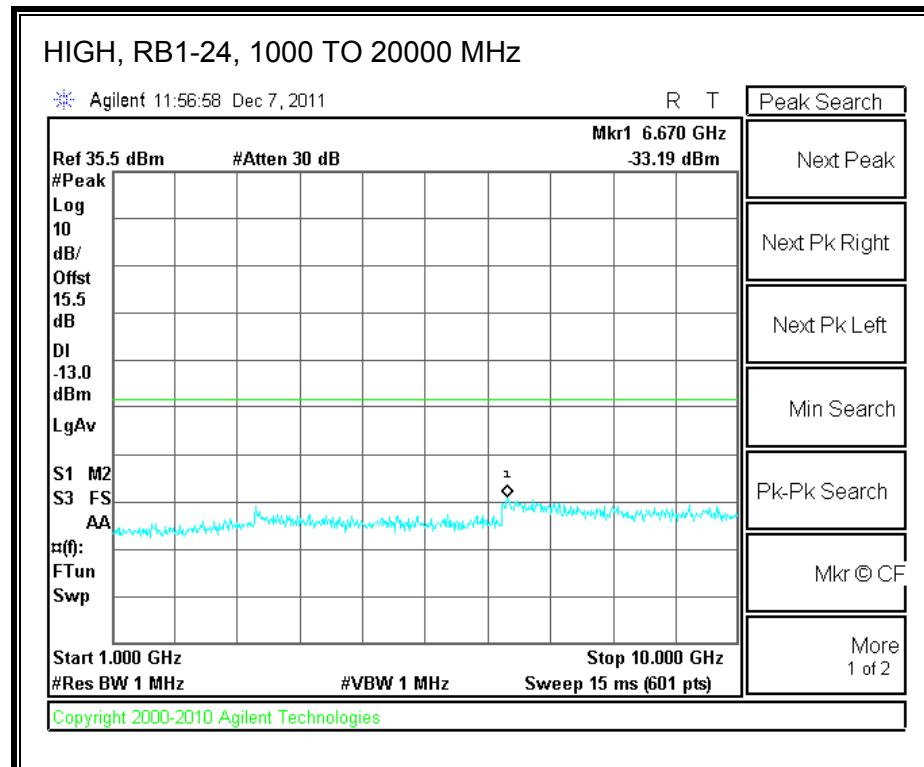
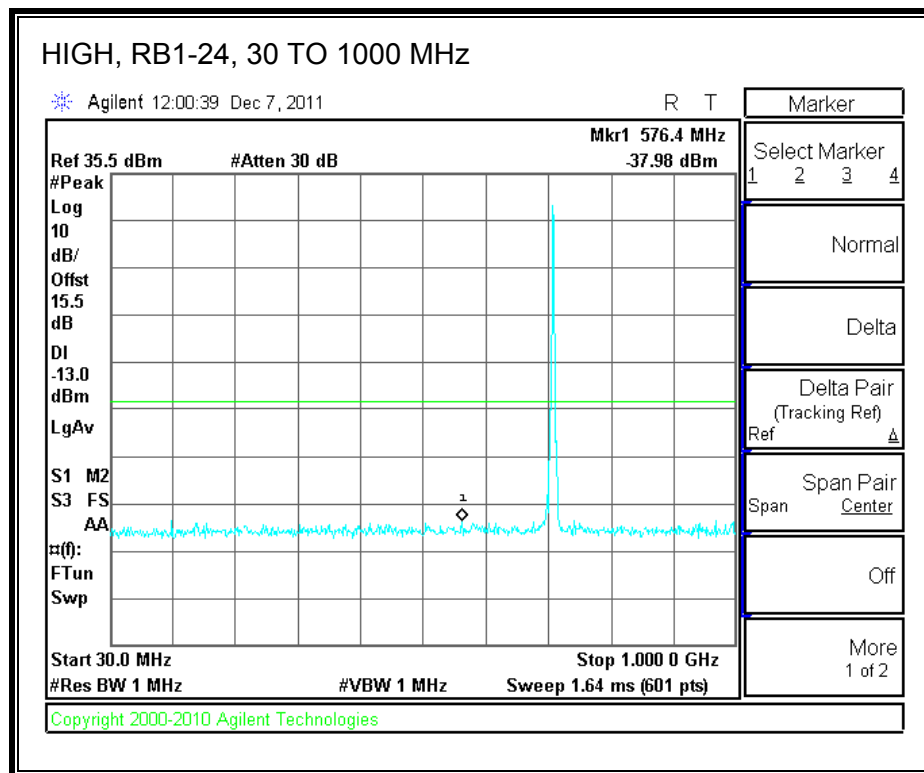
RESULTS

Band 17 (5.0 MHz BAND WIDTH)

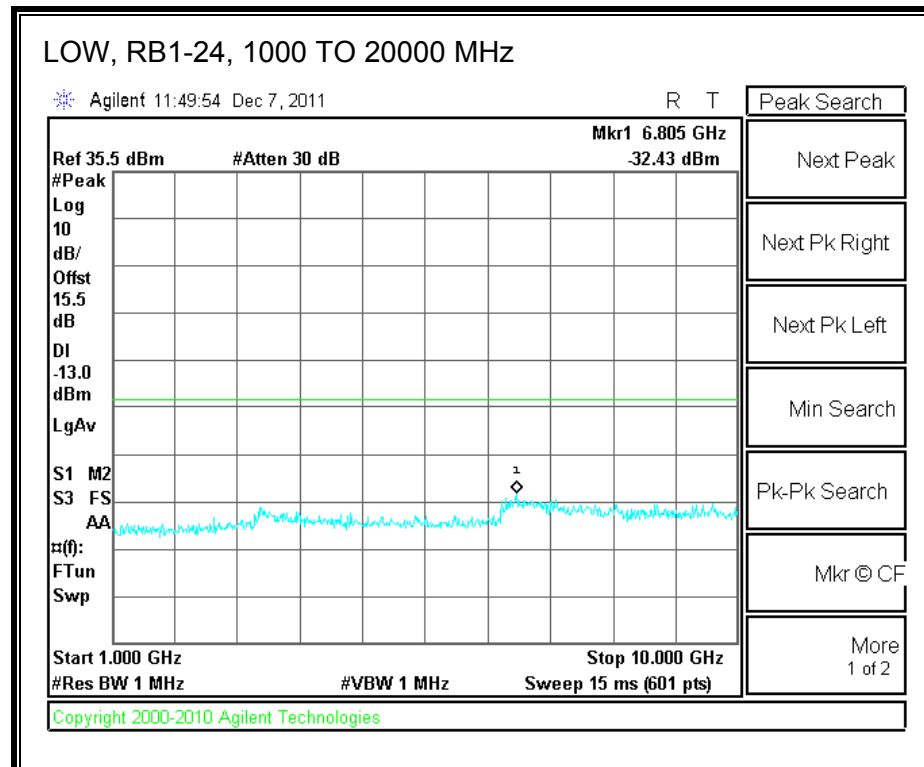
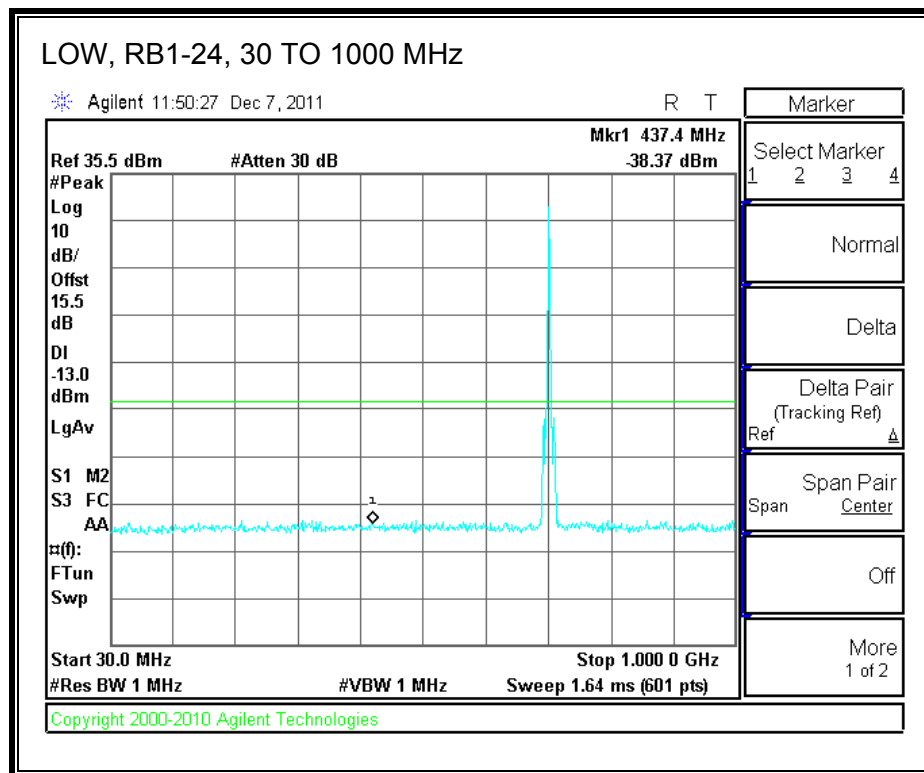
LTE QPSK

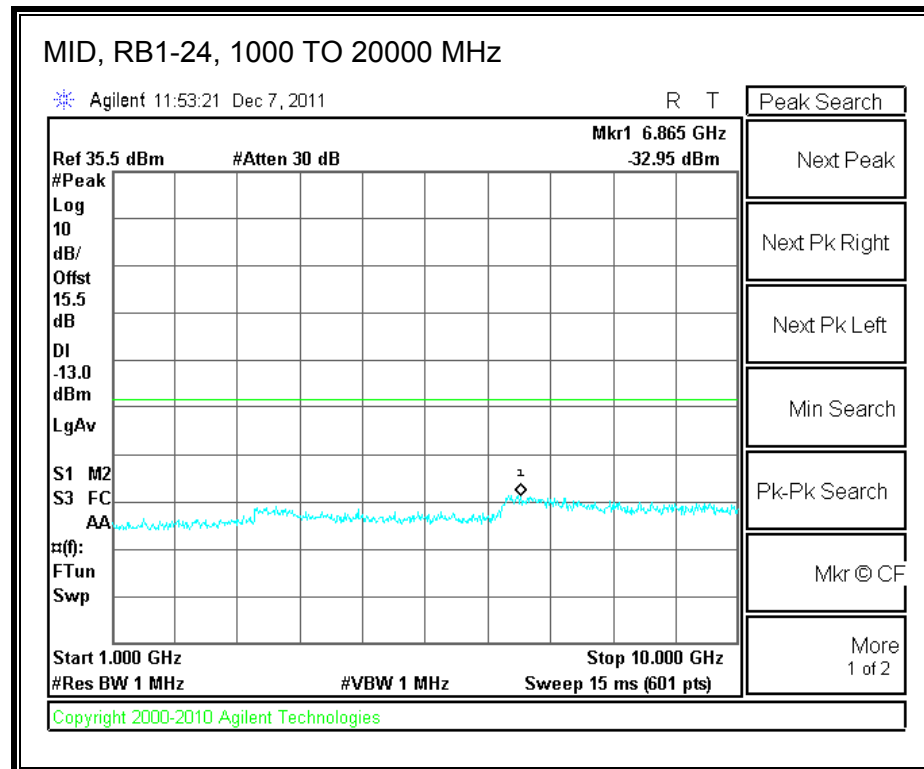
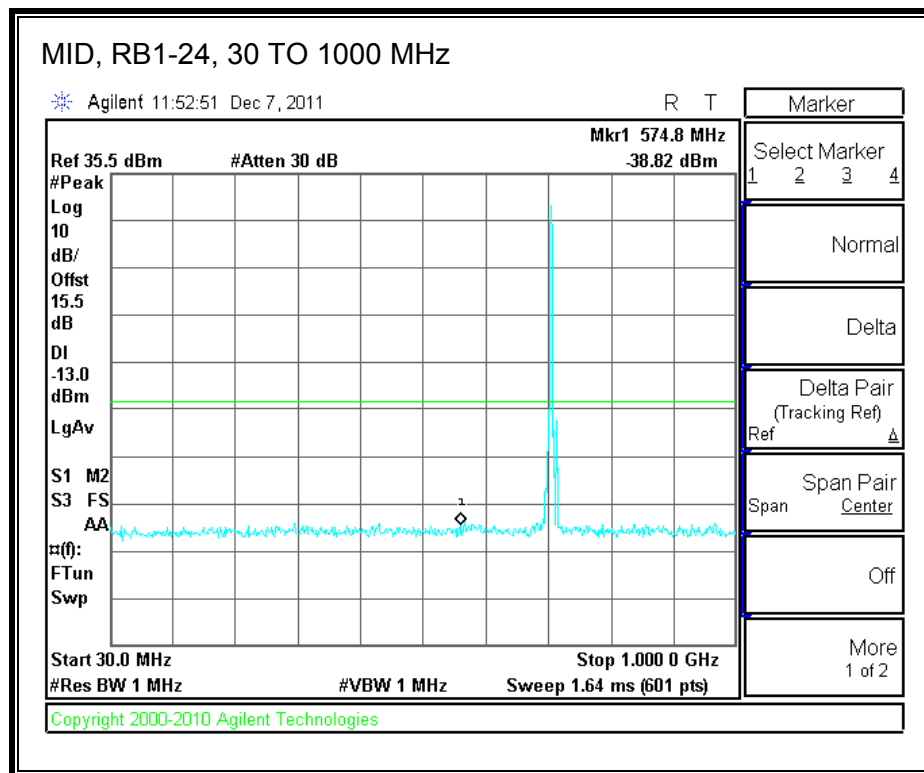


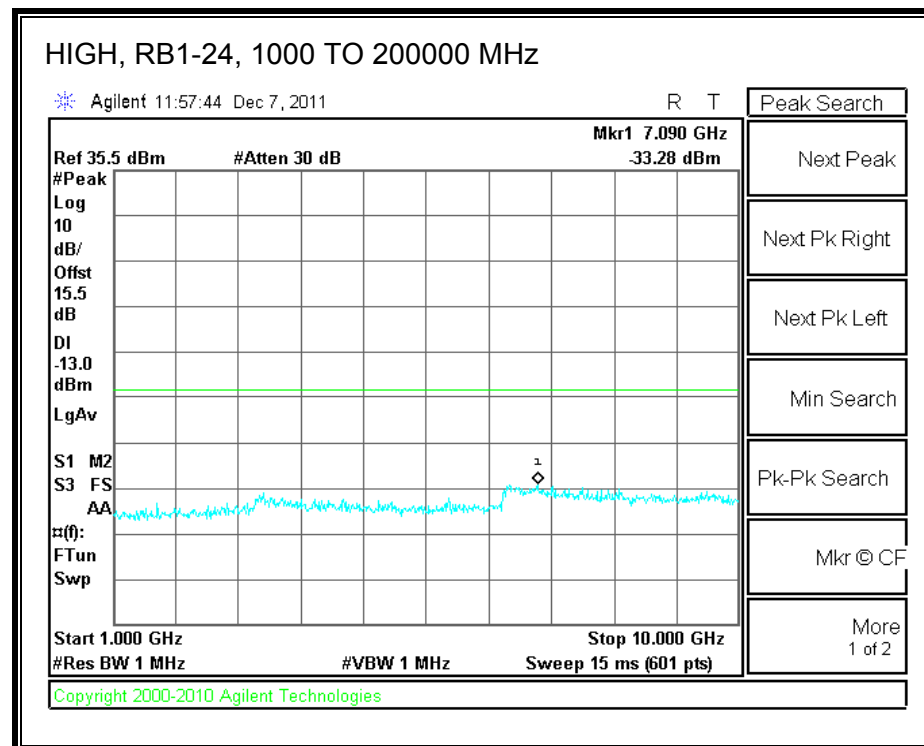
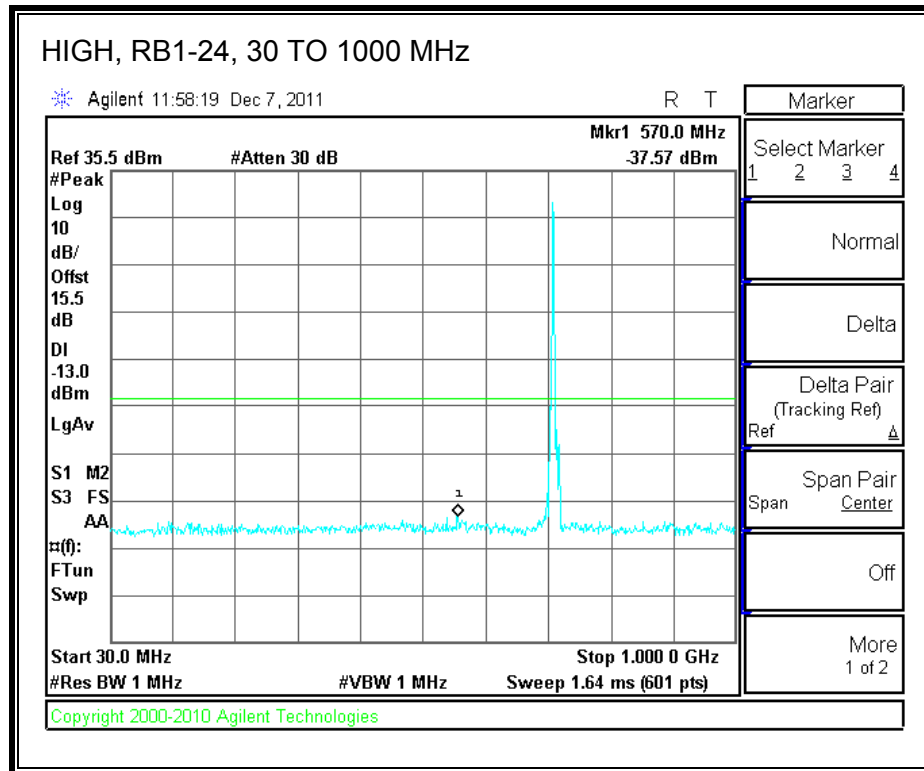




LTE 16QAM

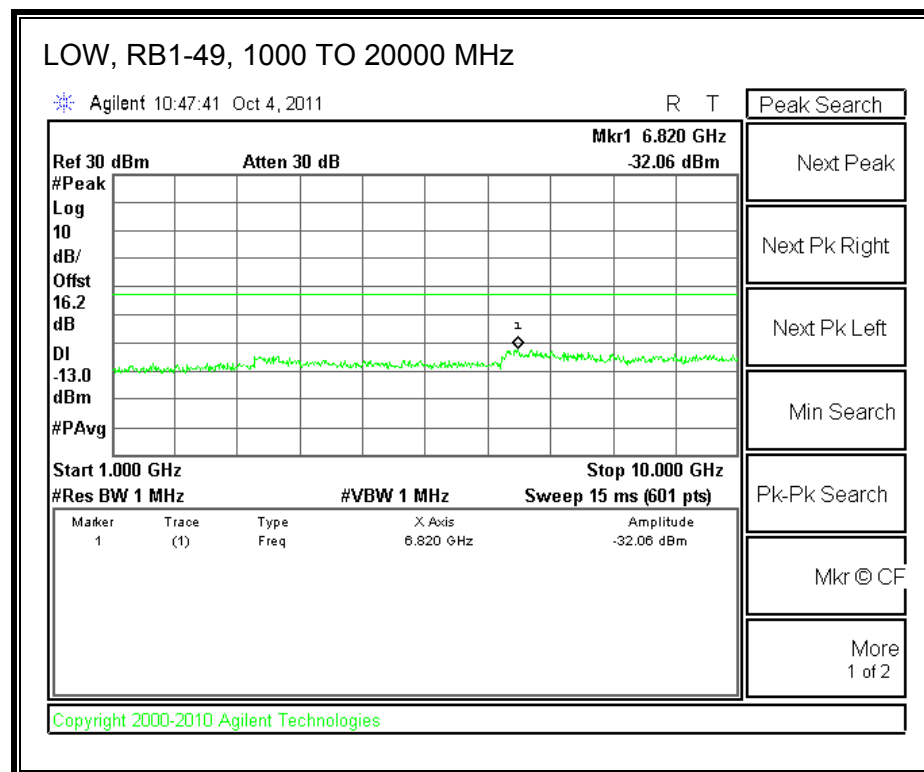
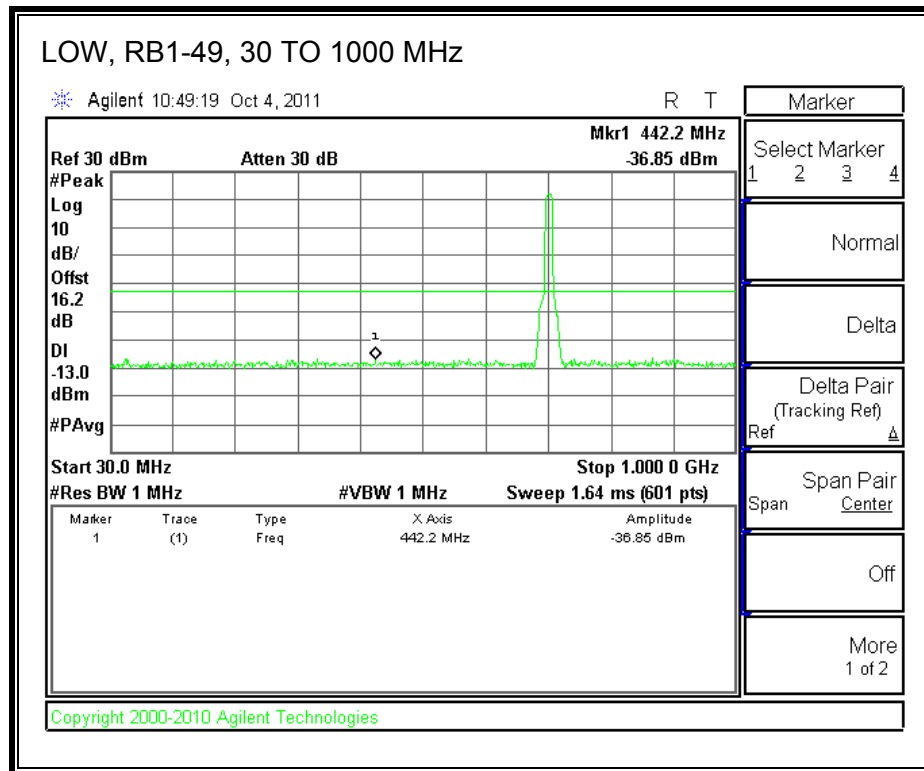


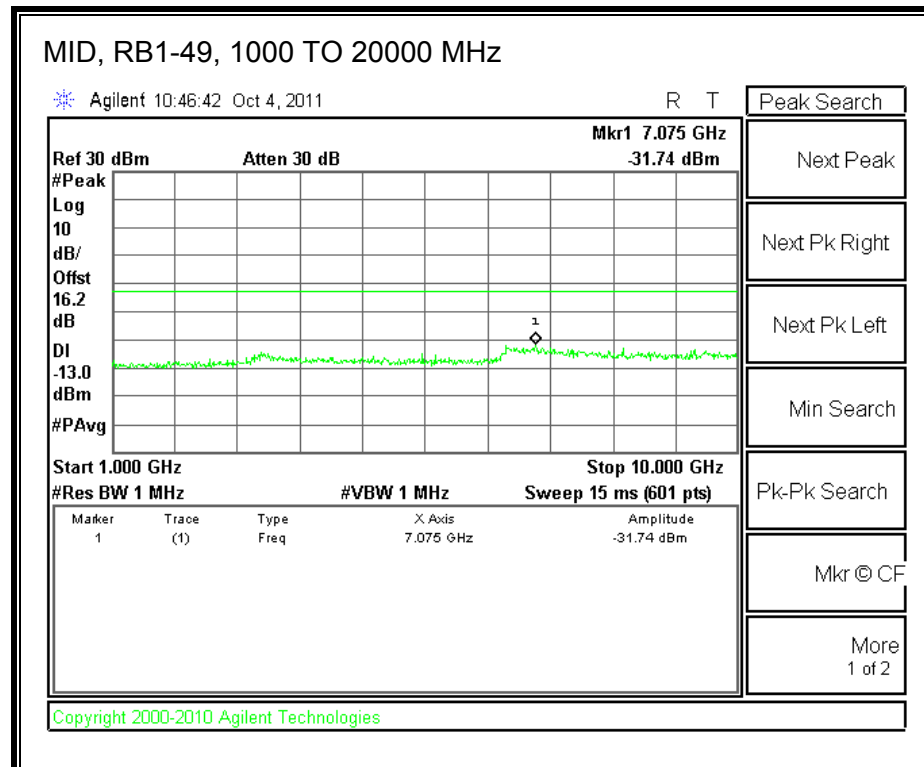
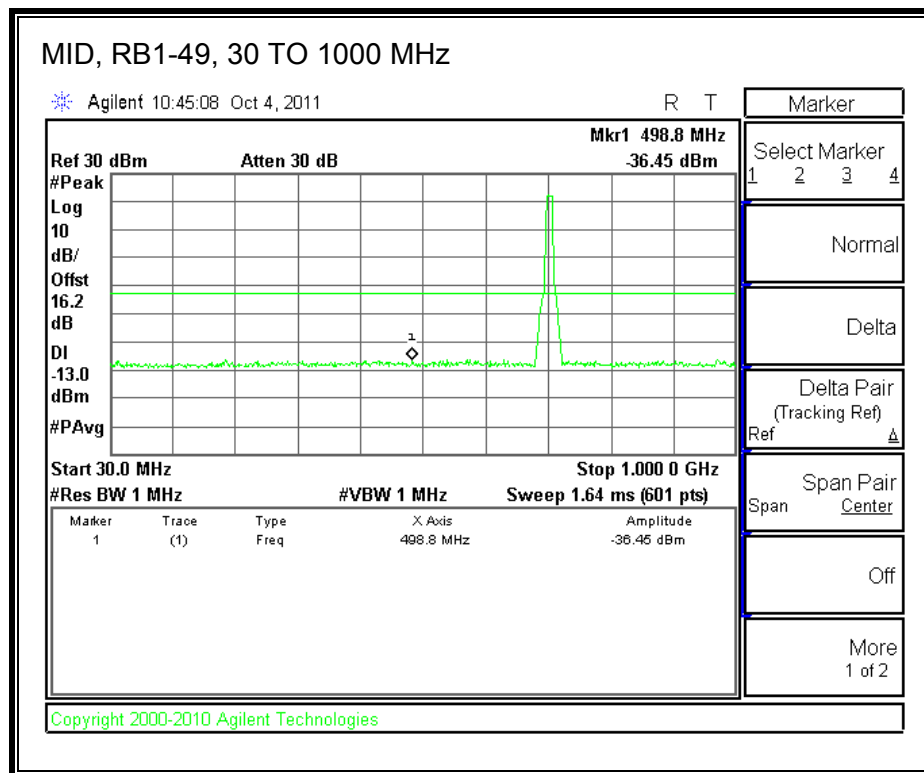


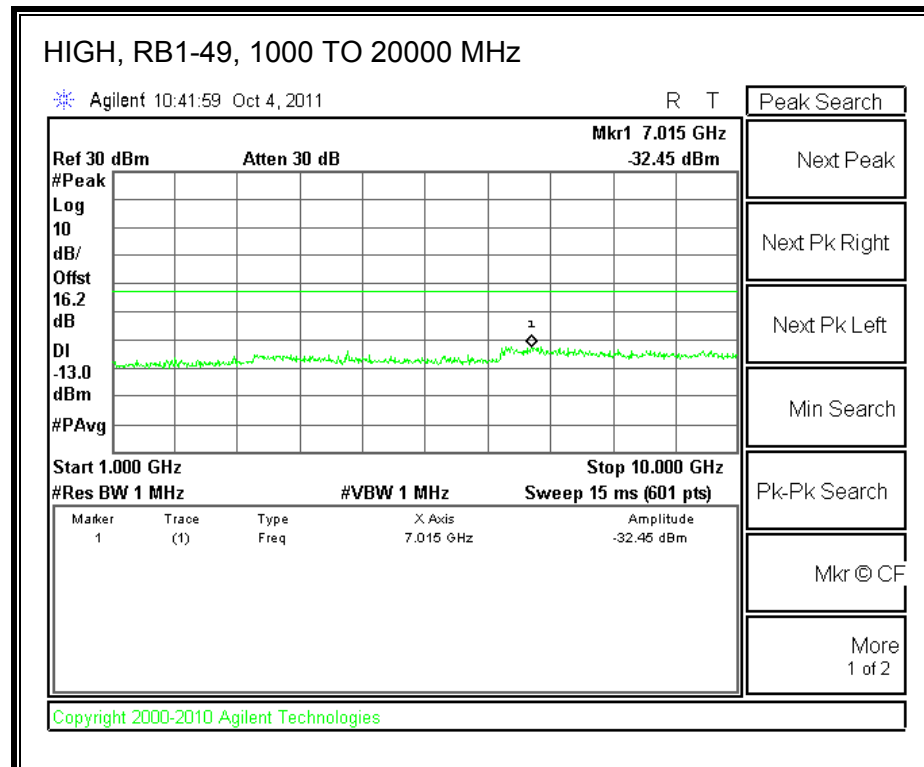
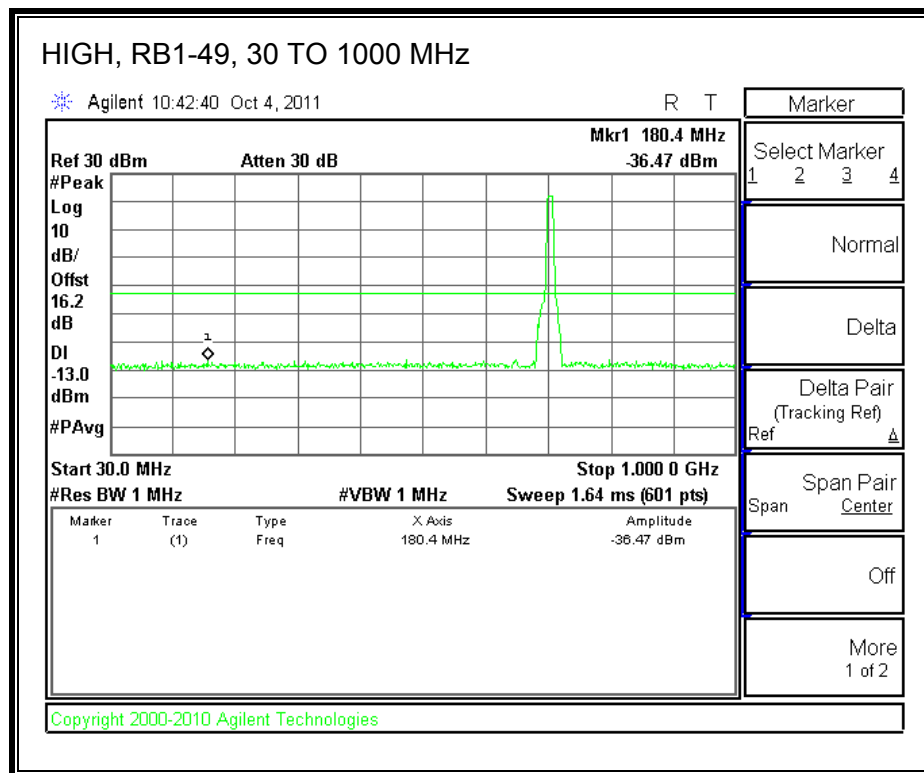


Band 17 (10.0 MHz BAND WIDTH)

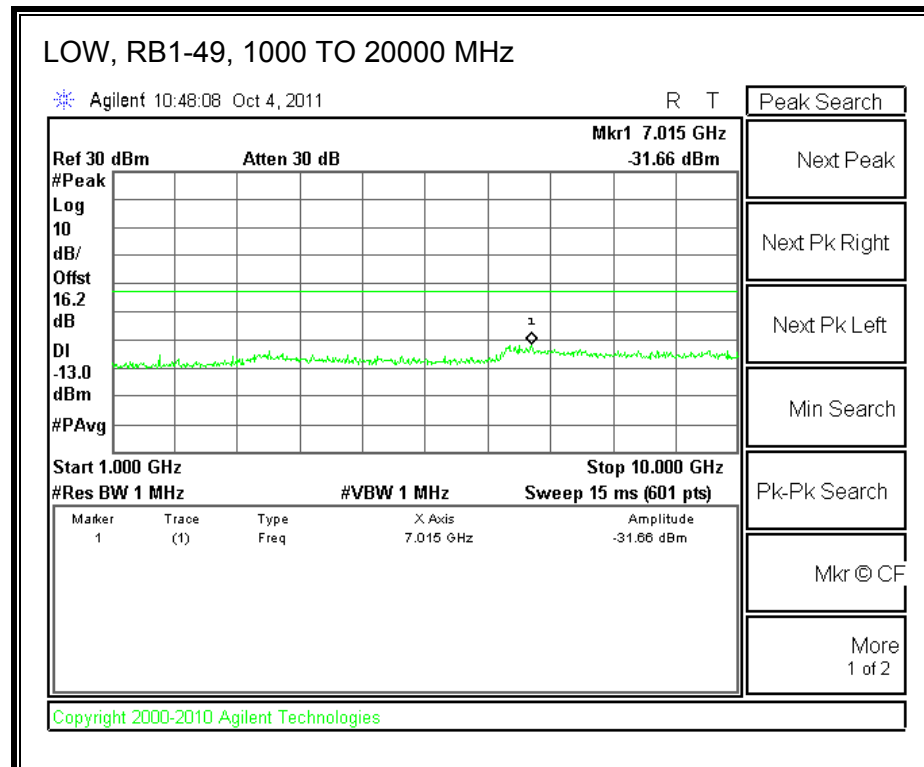
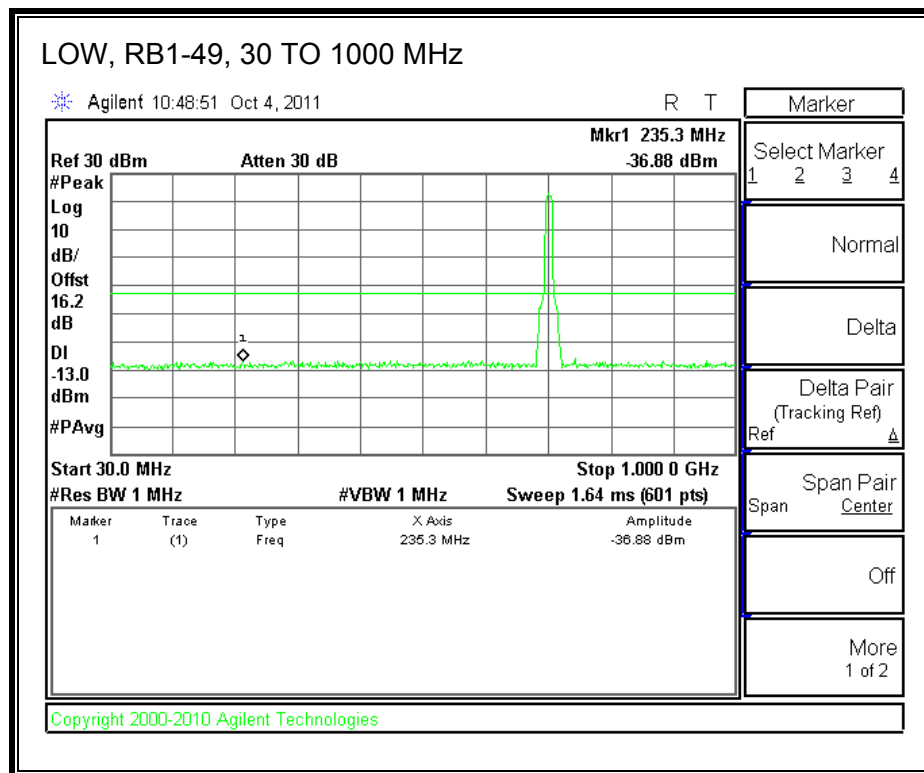
LTE QPSK

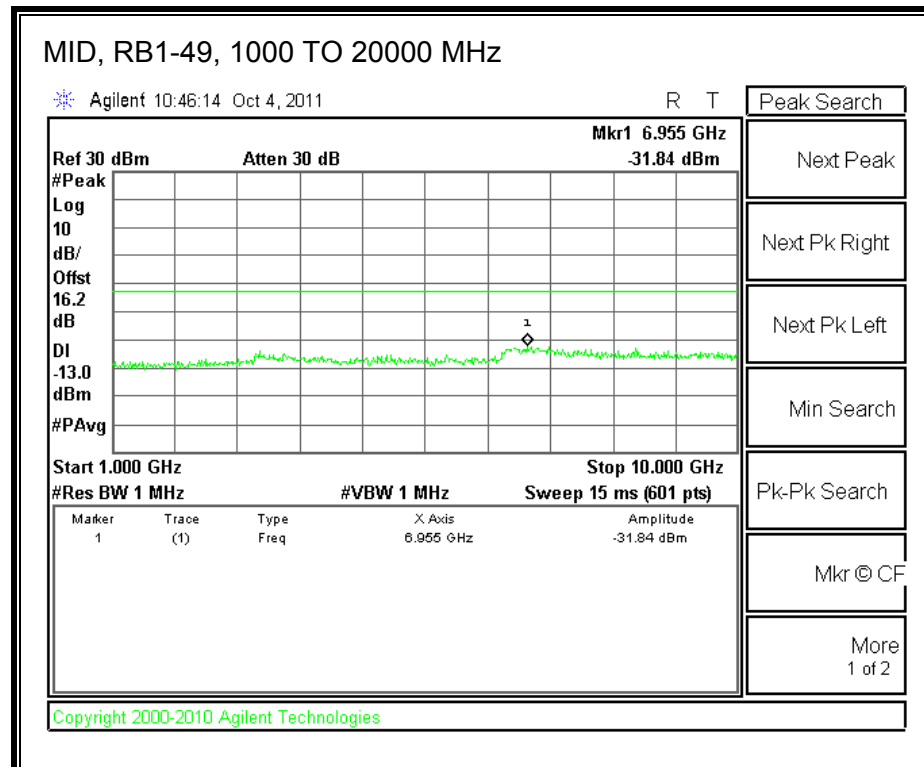
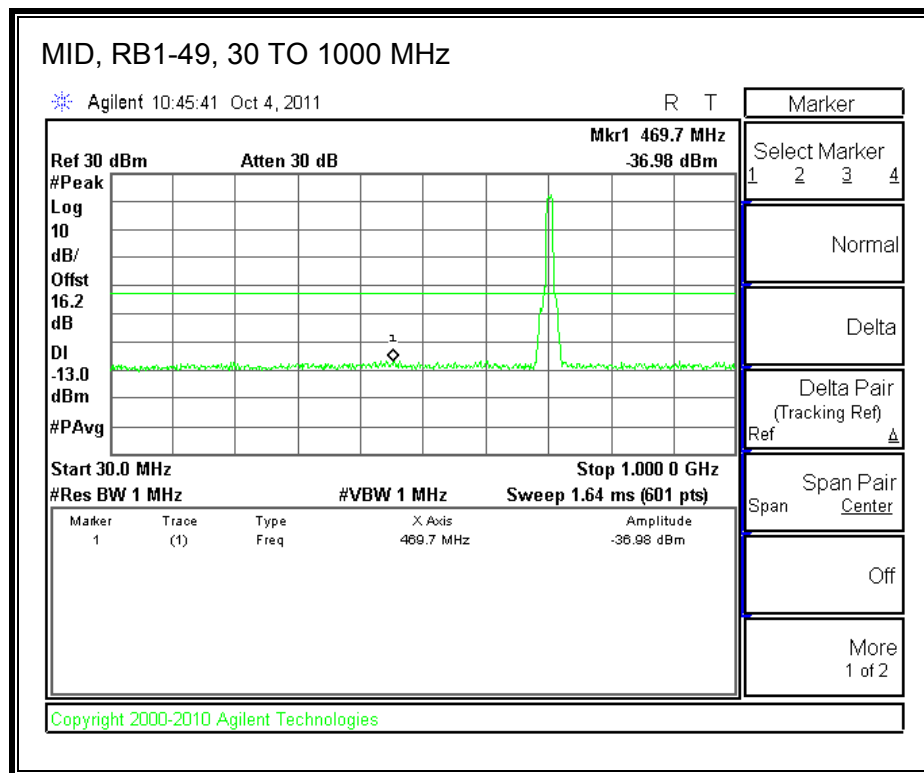


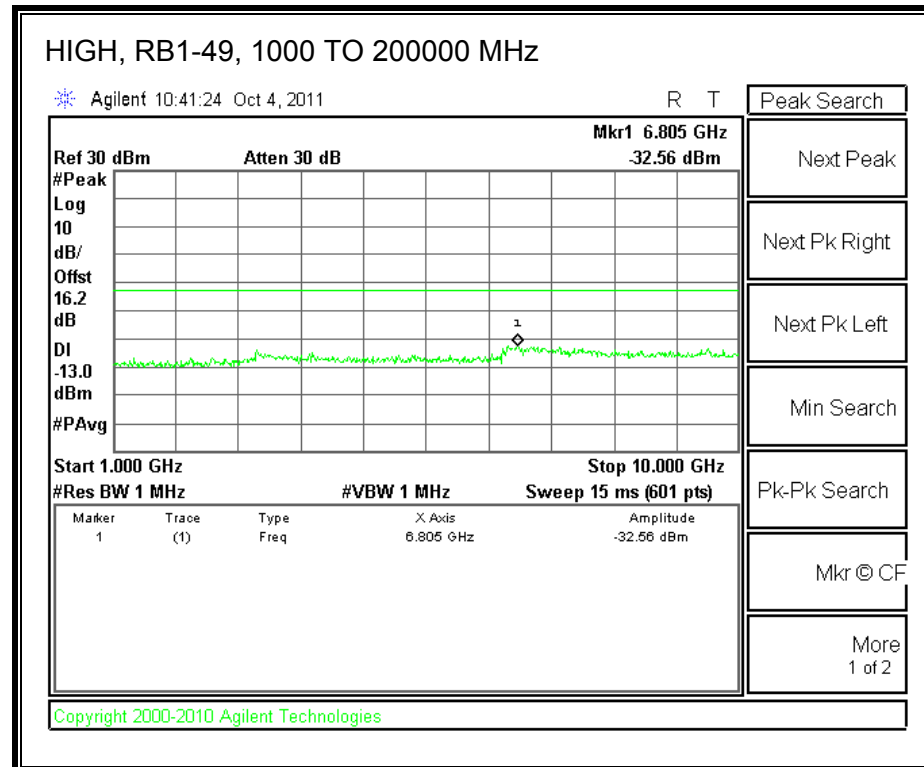
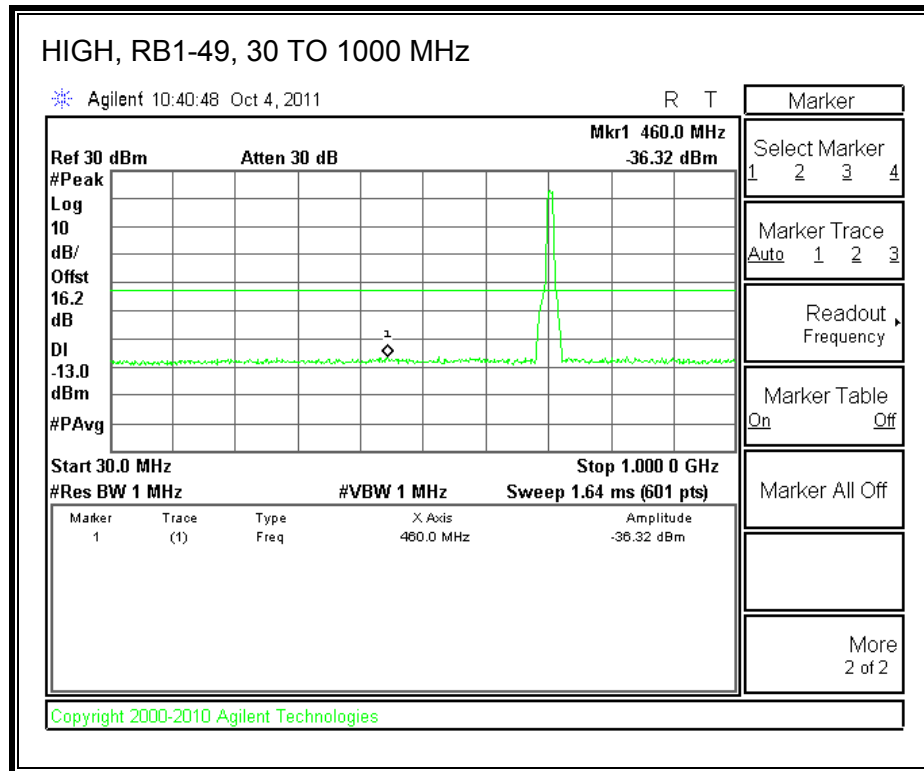




LTE 16QAM

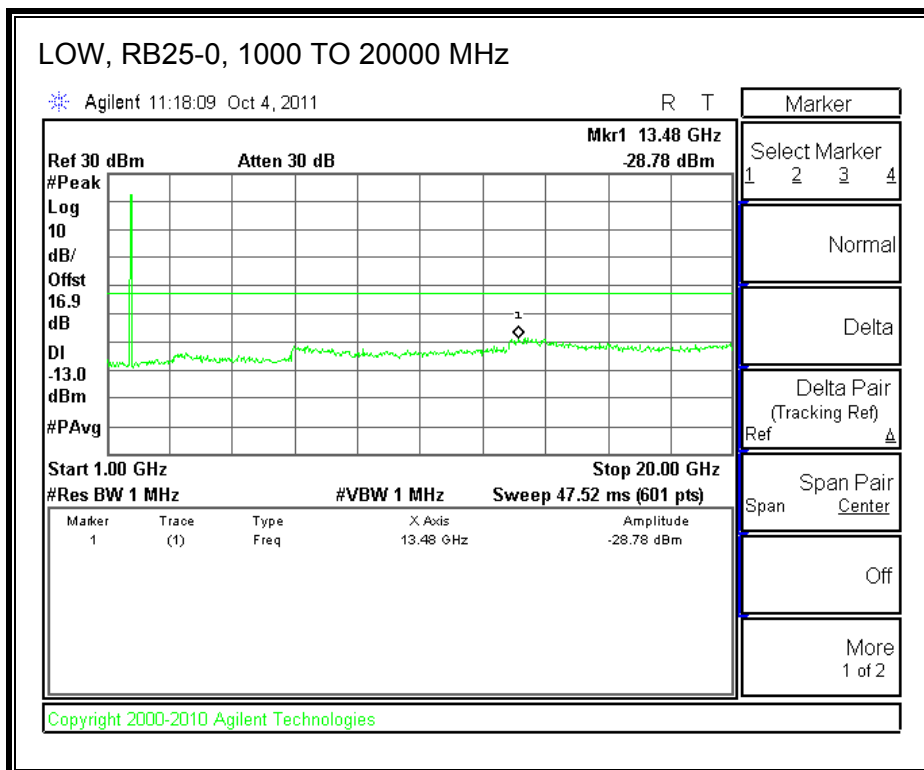
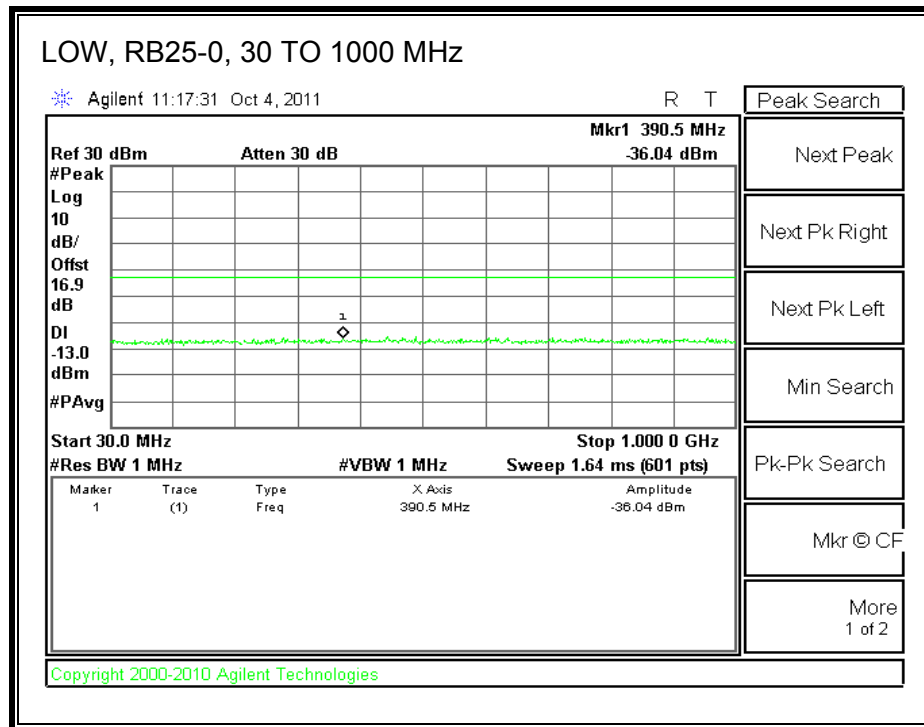


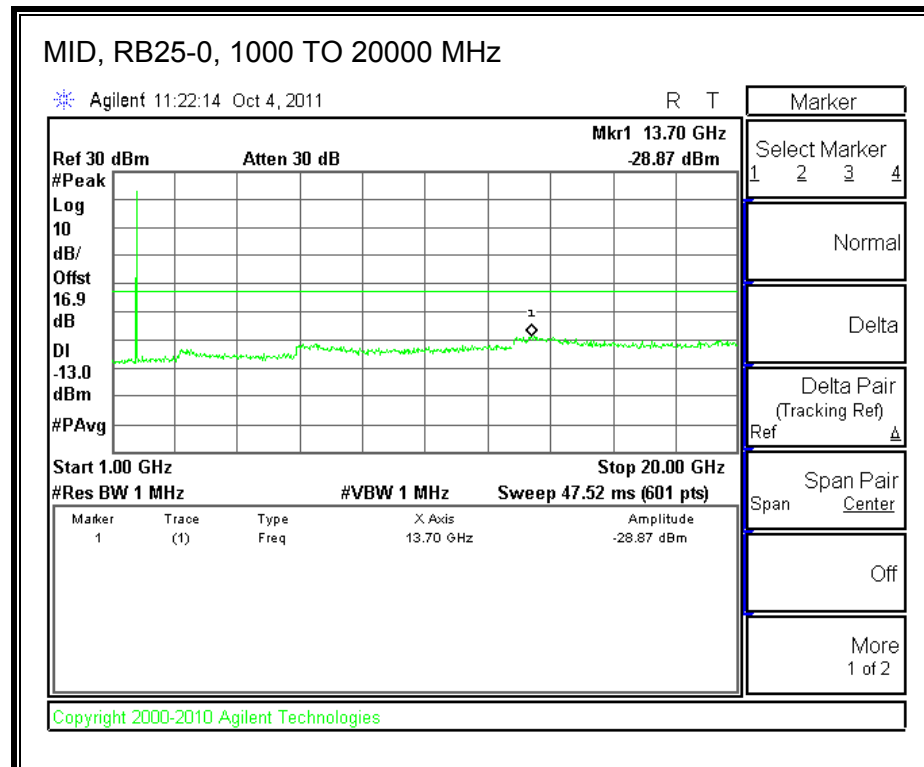
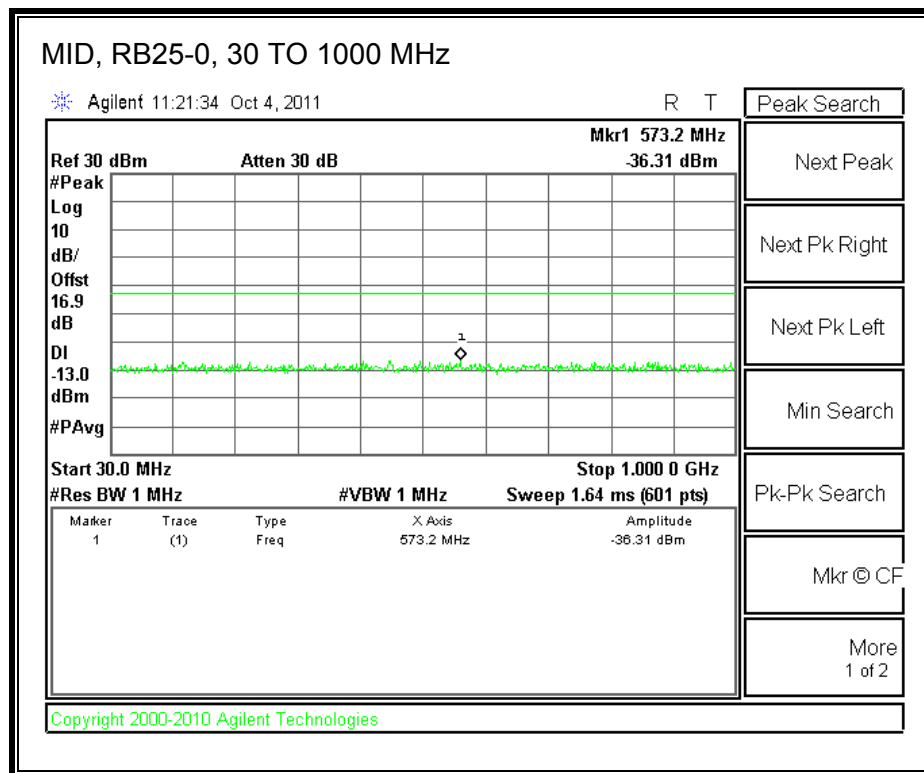


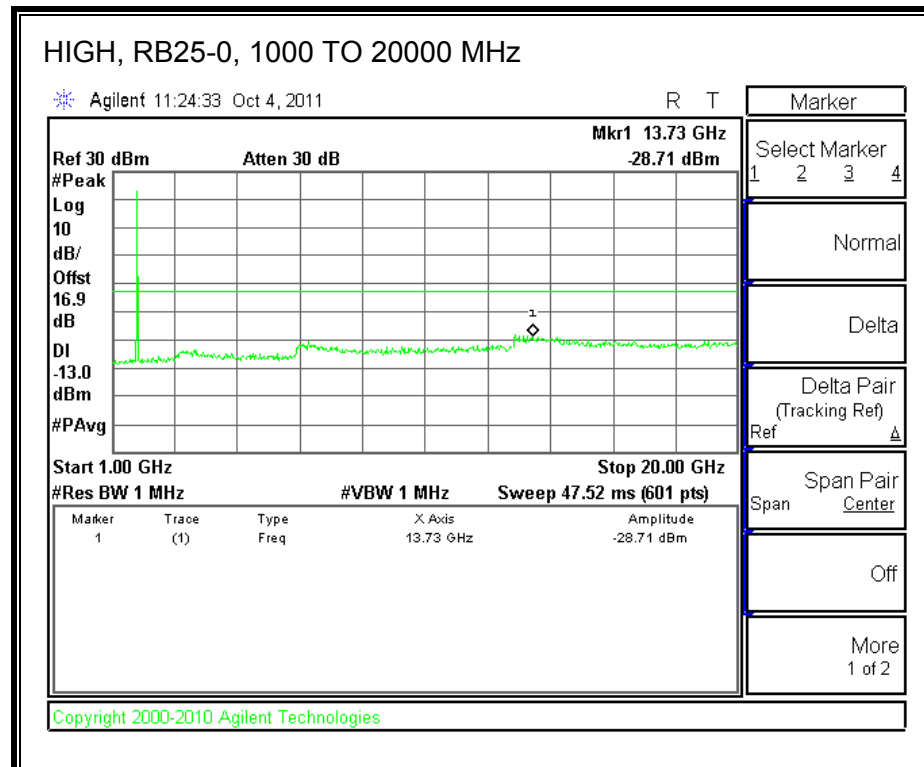
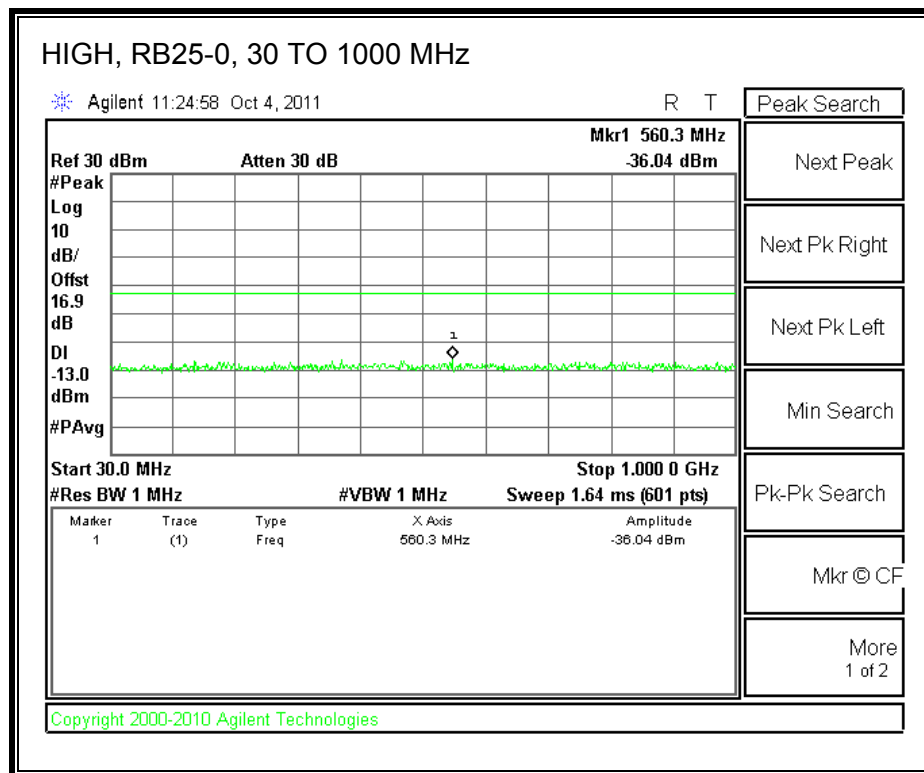


Band 4 (5.0 MHz BAND WIDTH)

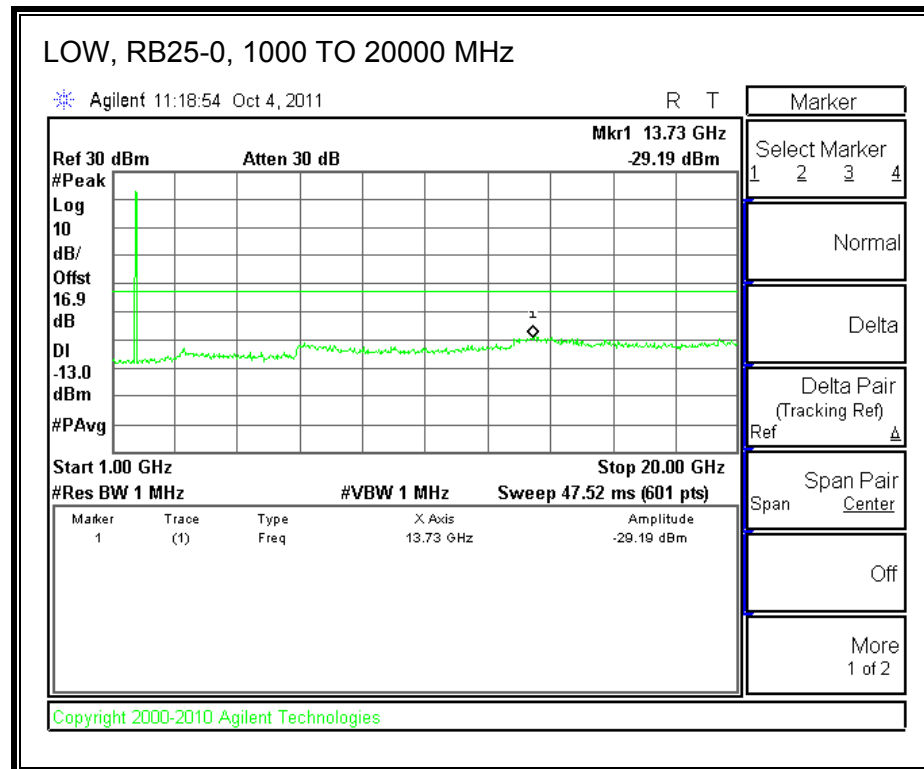
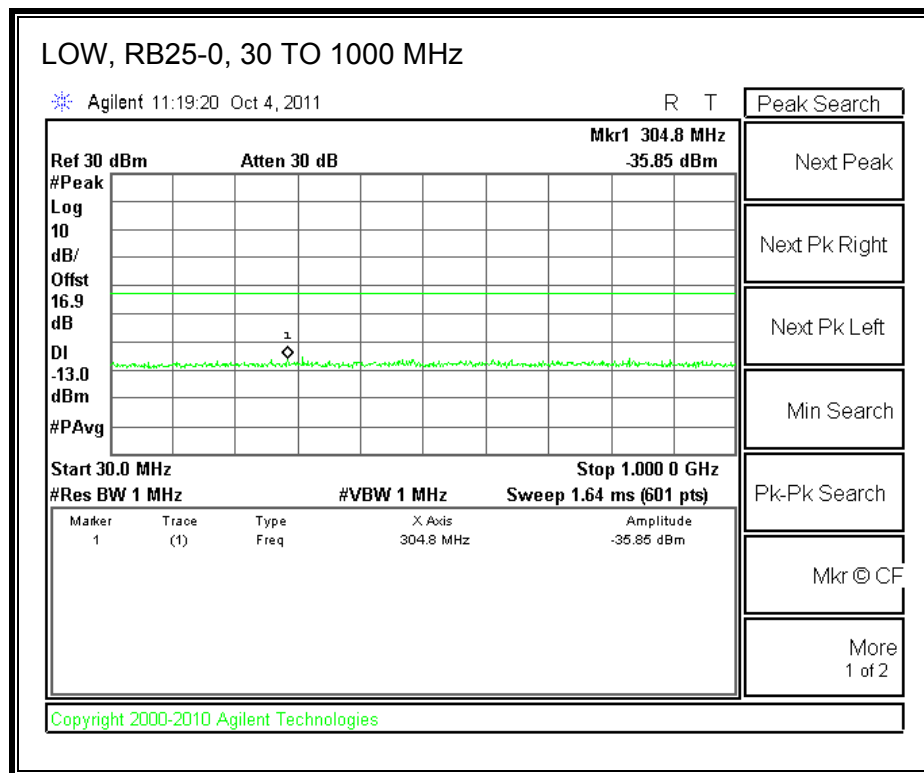
LTE QPSK

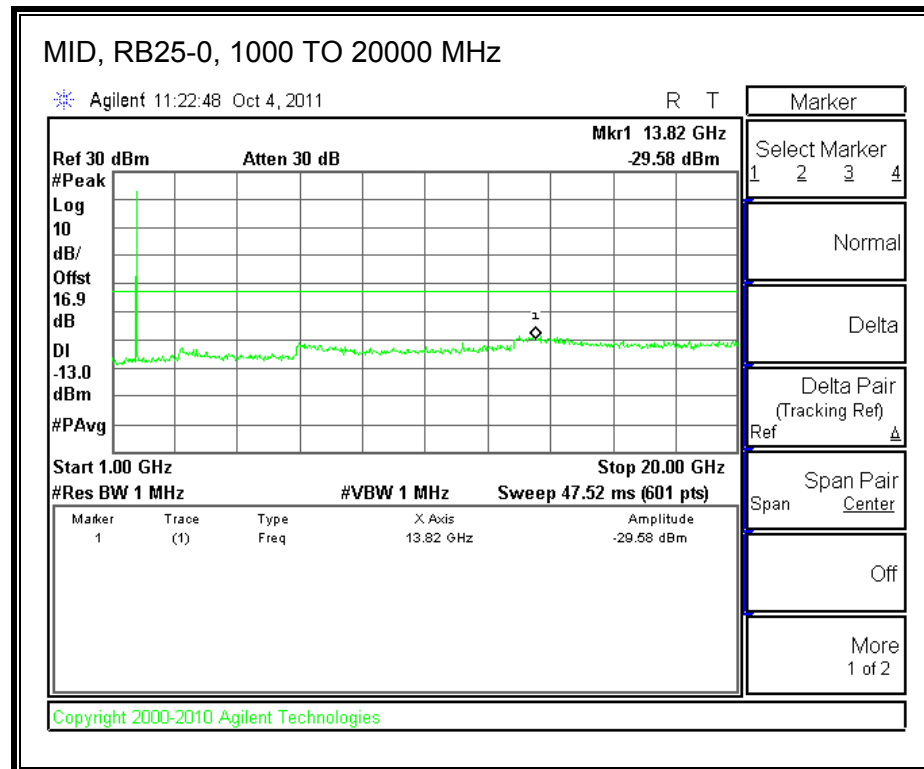
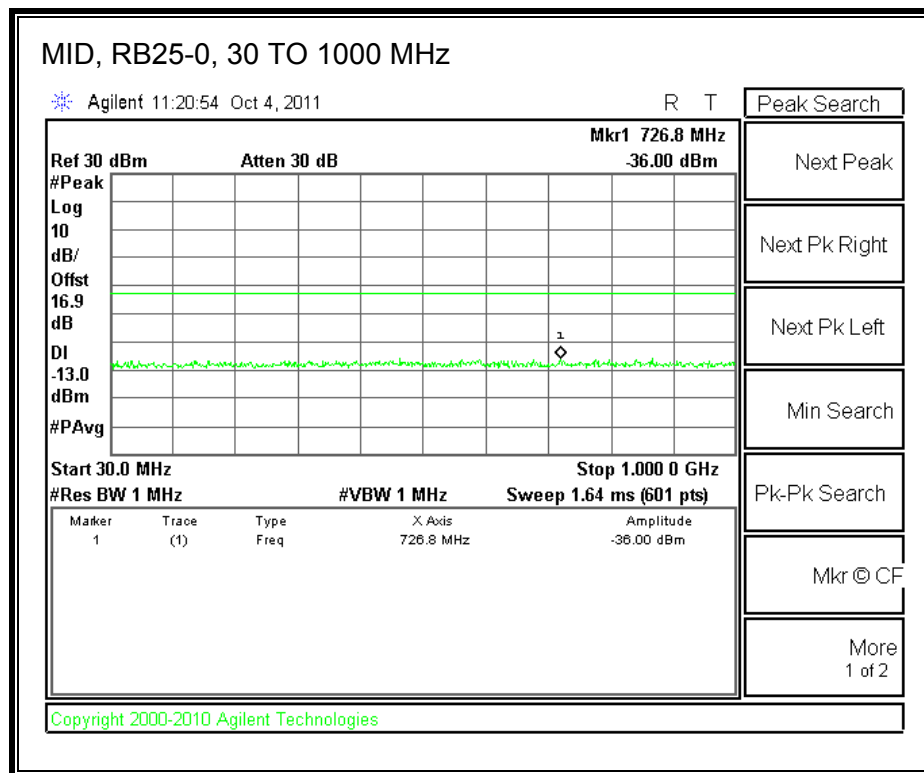


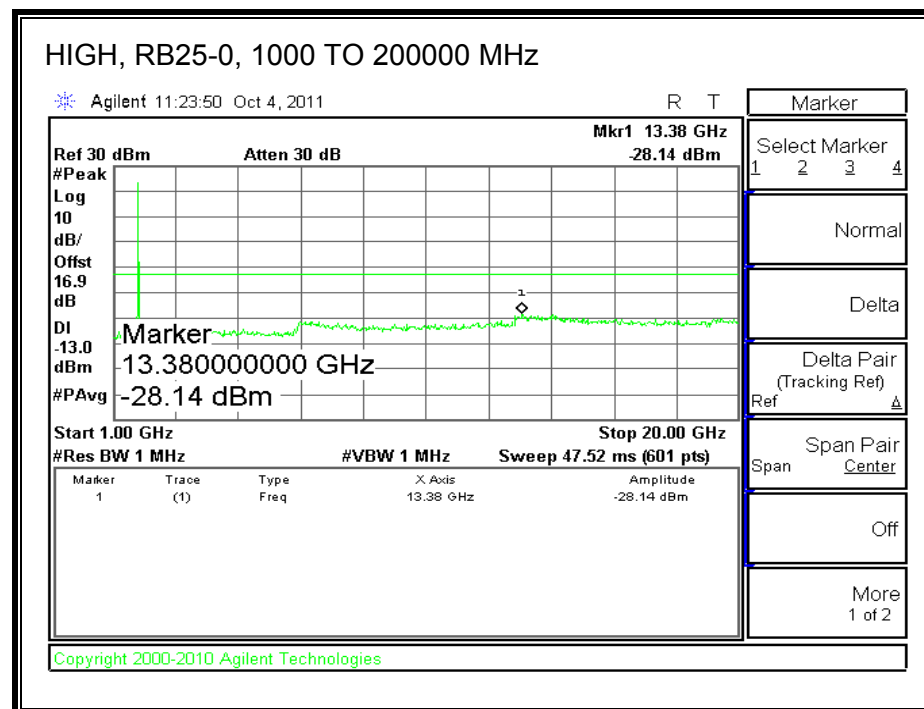
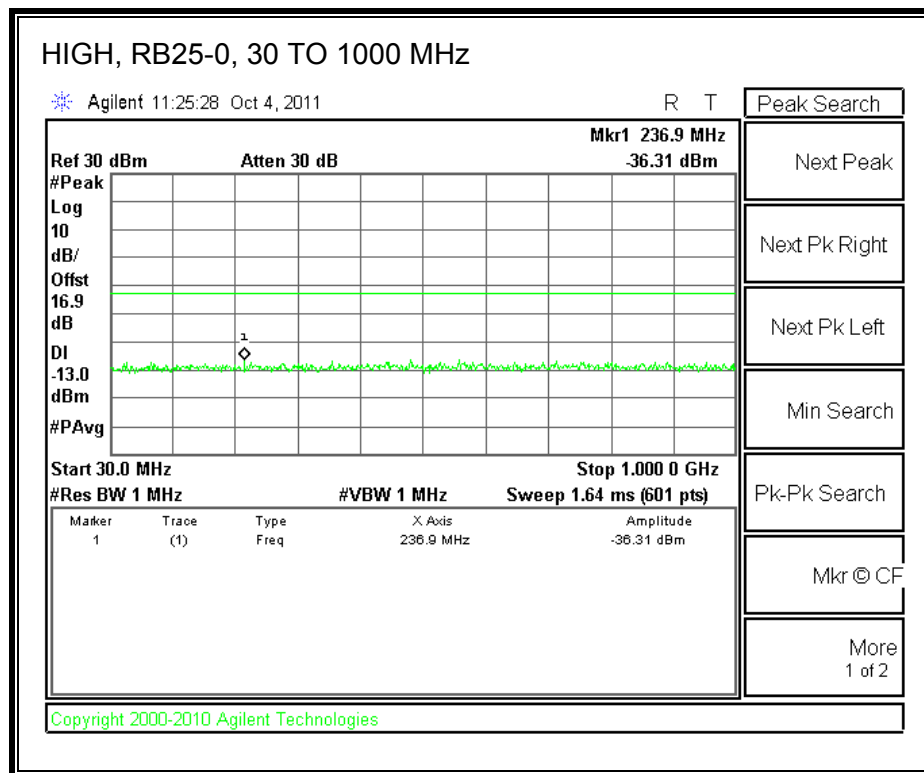




LTE 16QAM

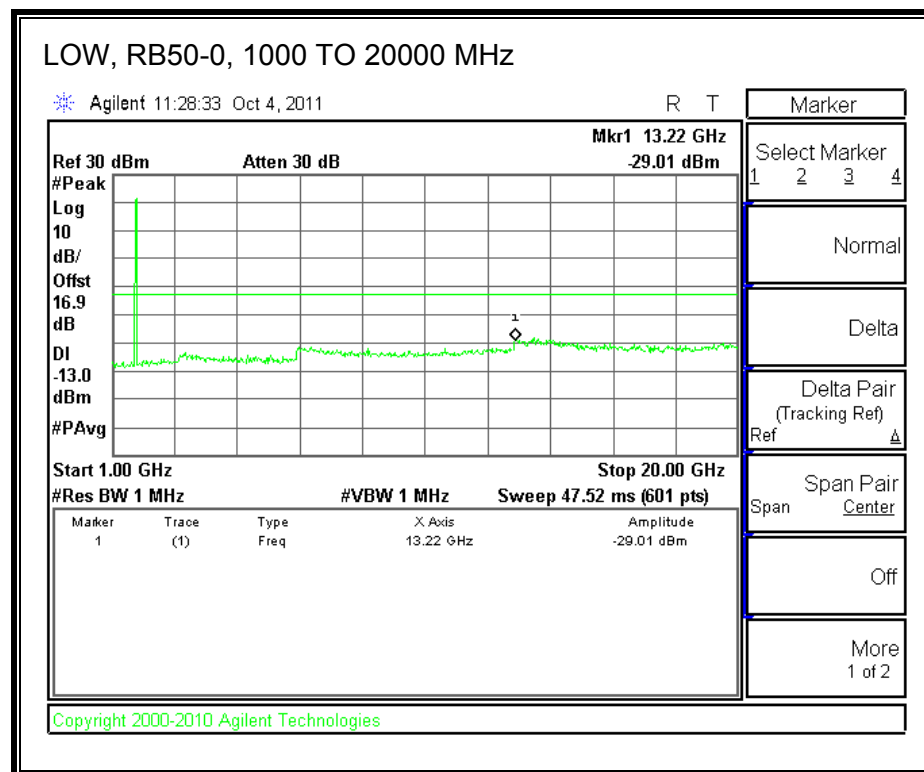
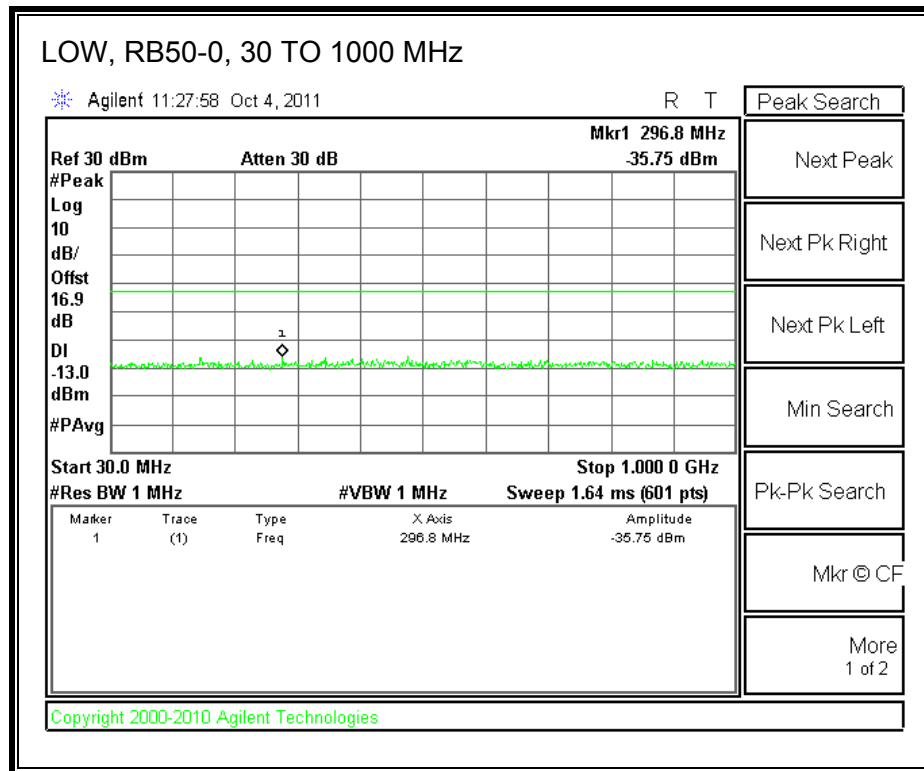


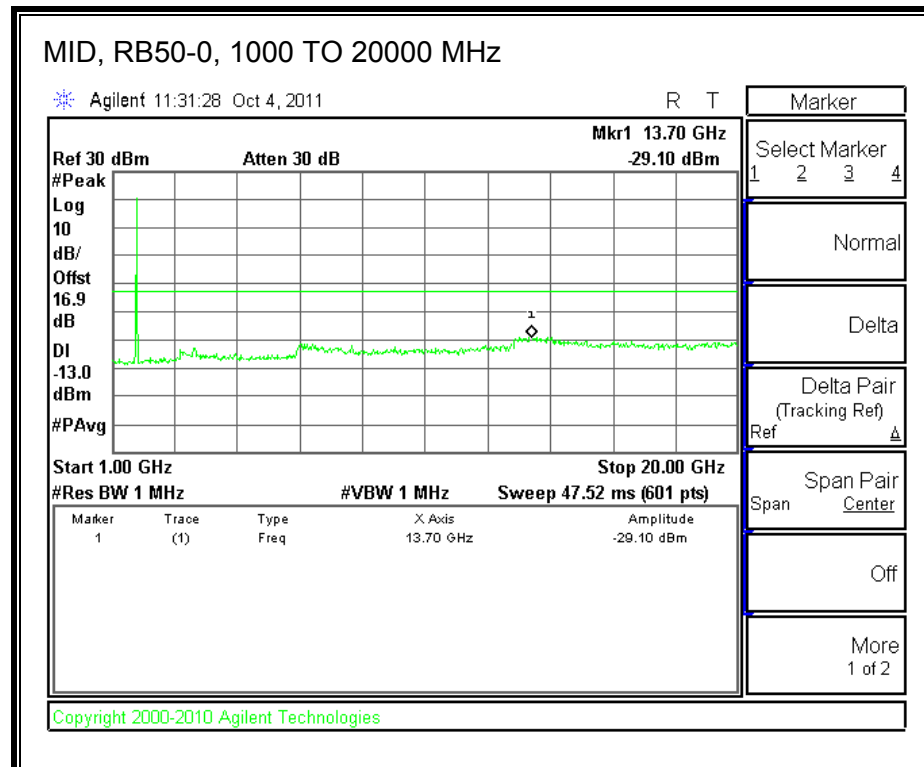
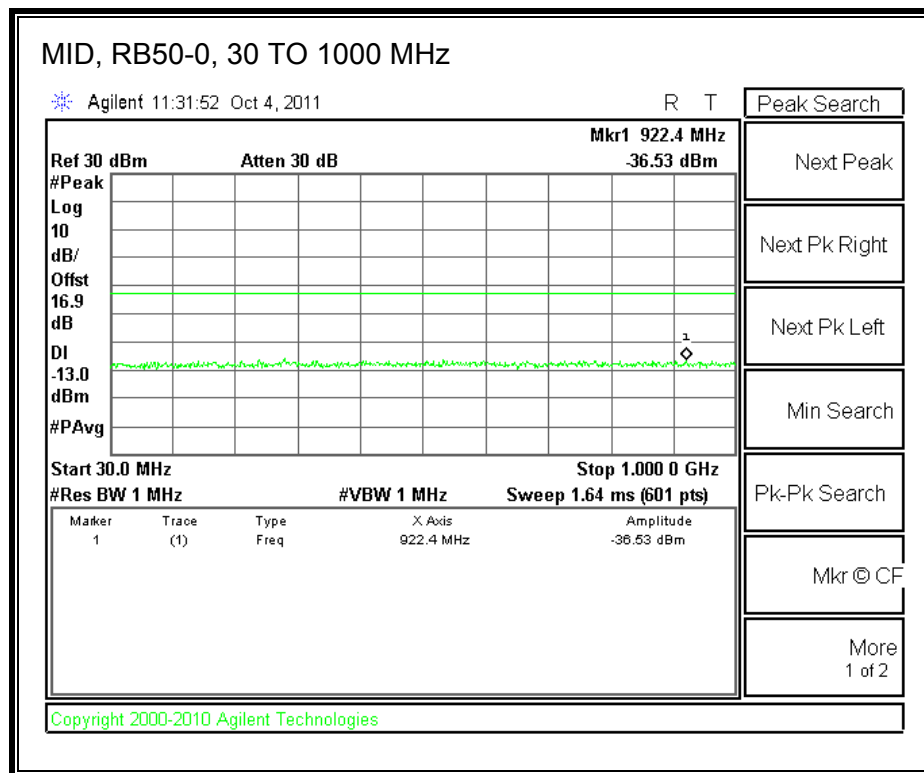


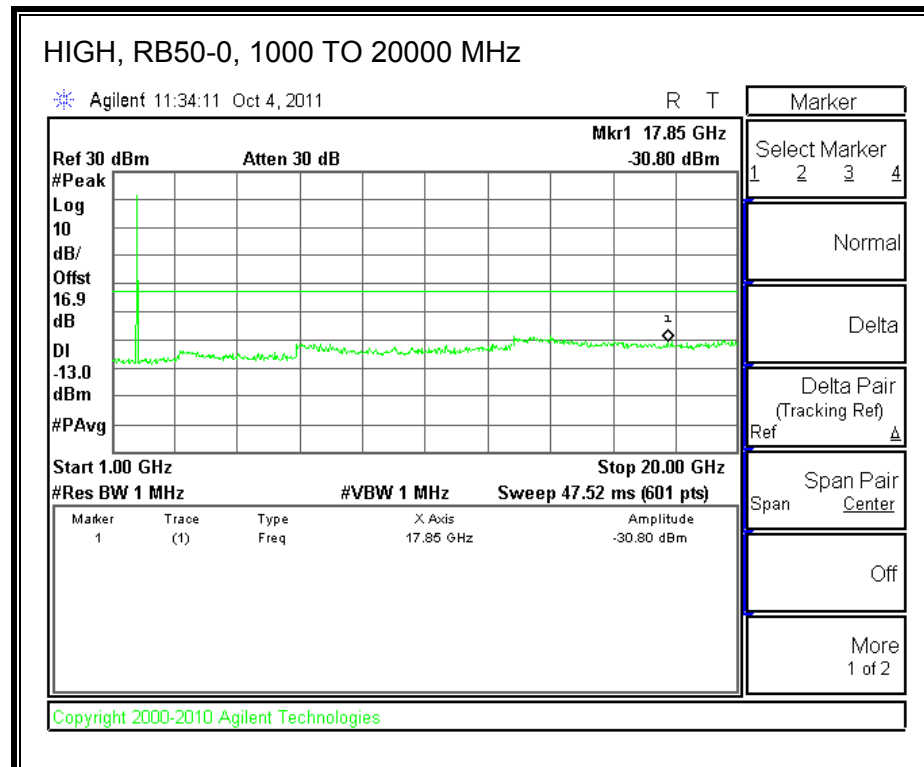
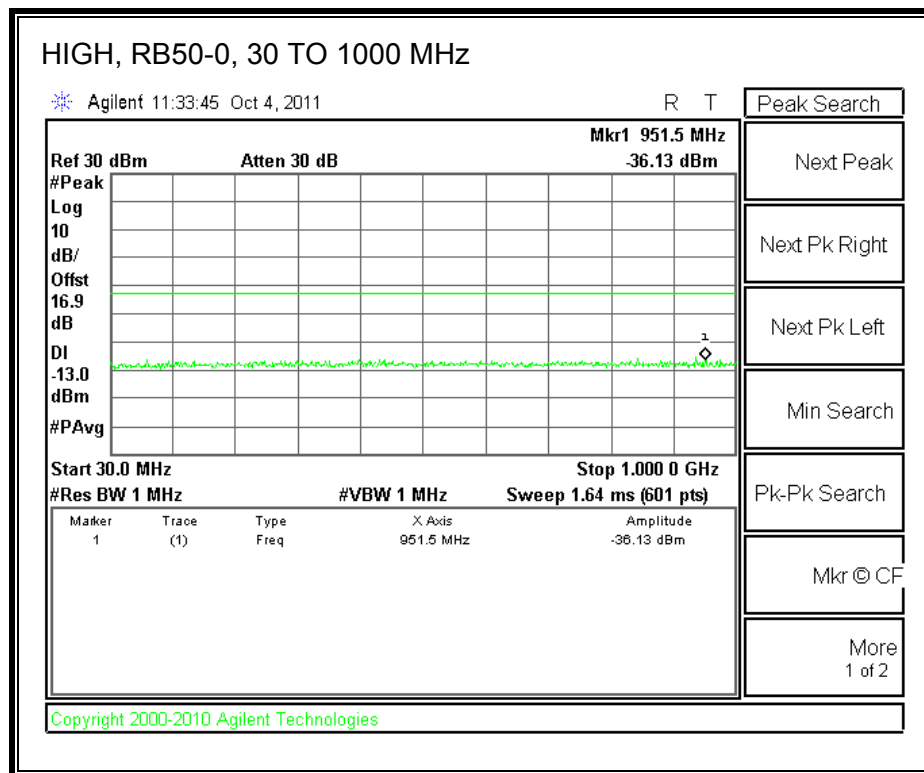


Band 4 (10.0 MHz BAND WIDTH)

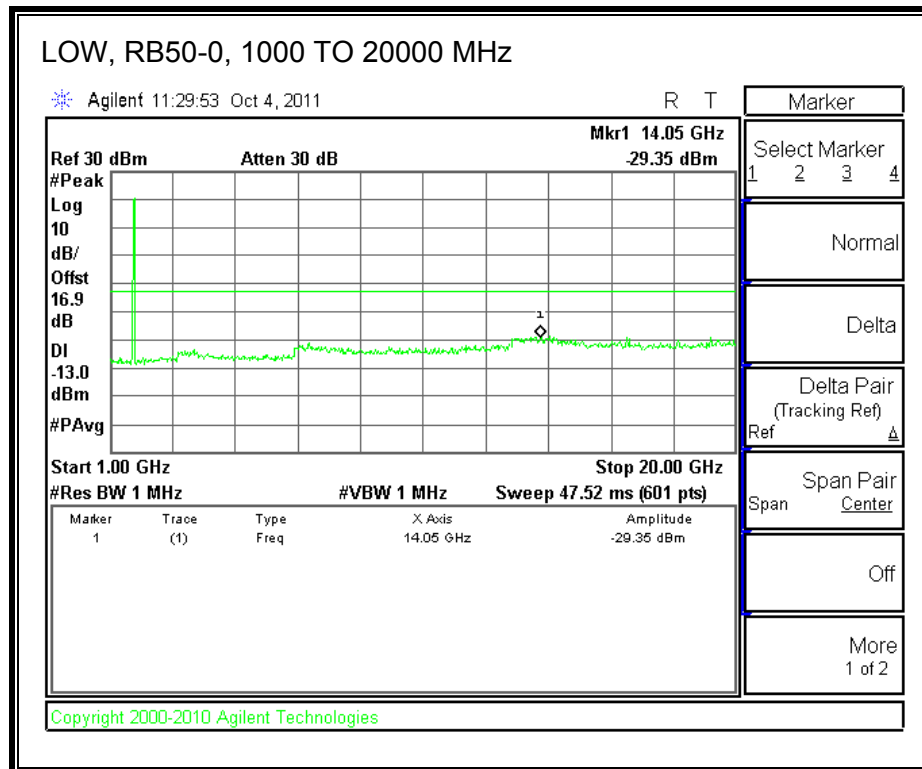
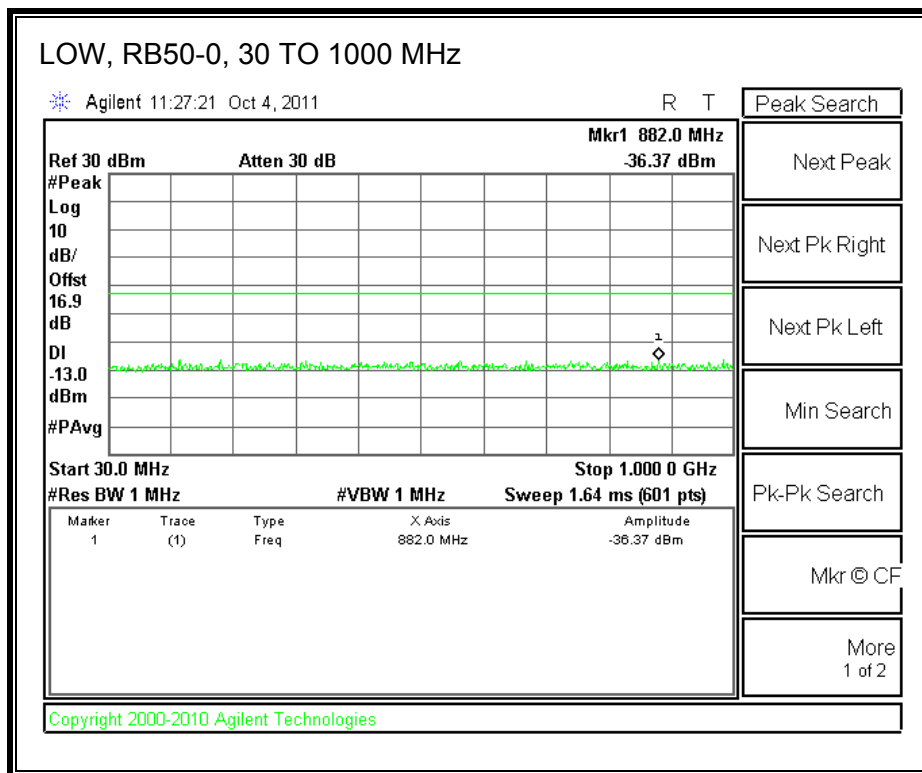
LTE QPSK

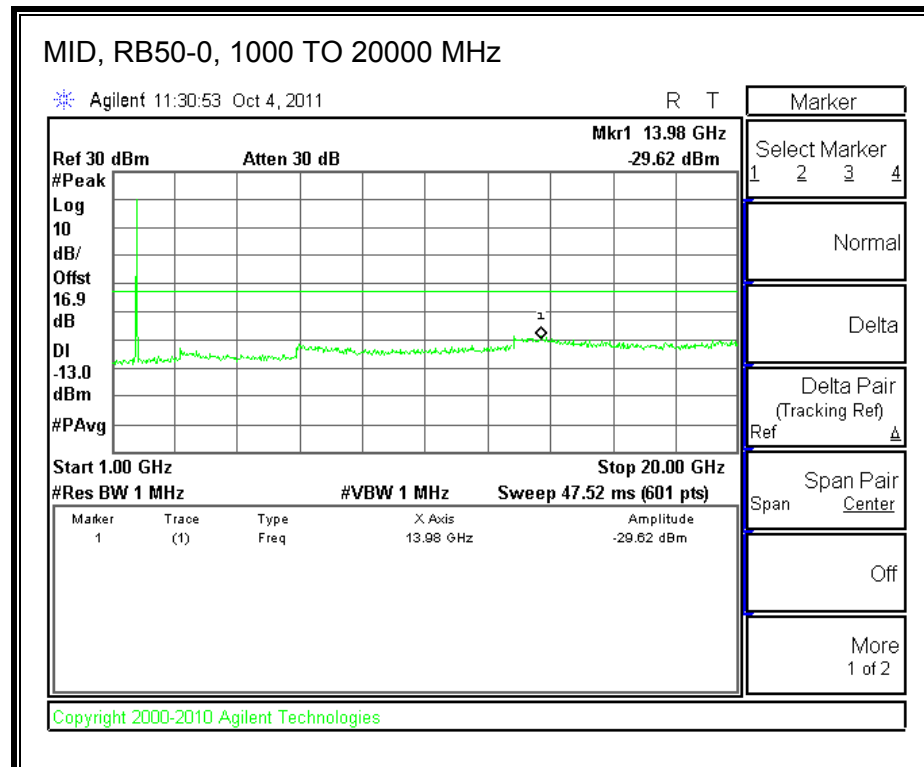
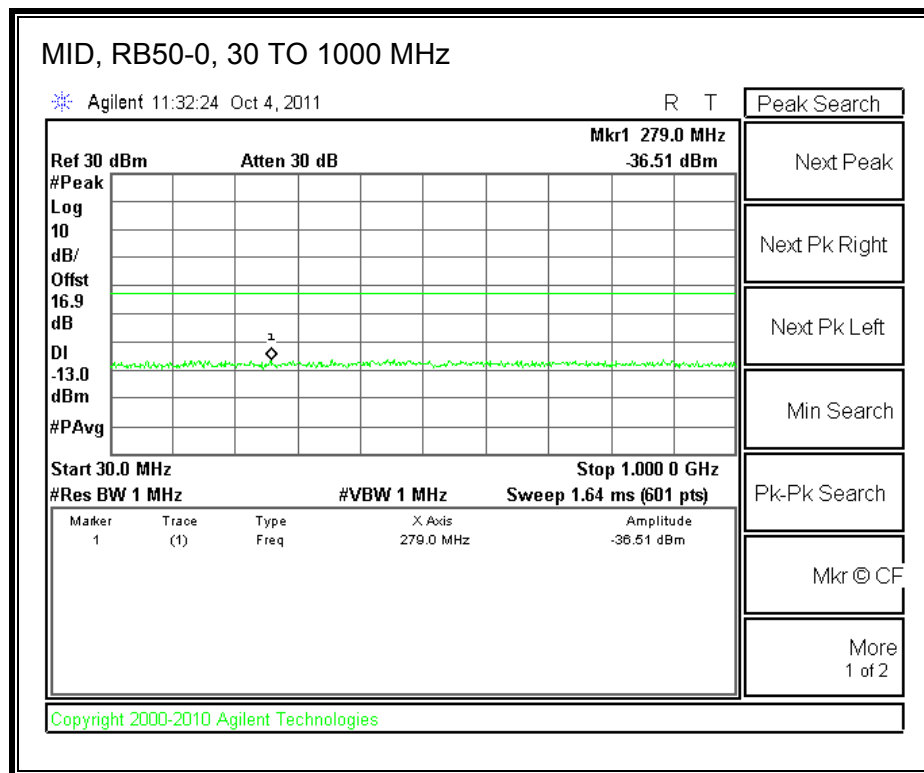


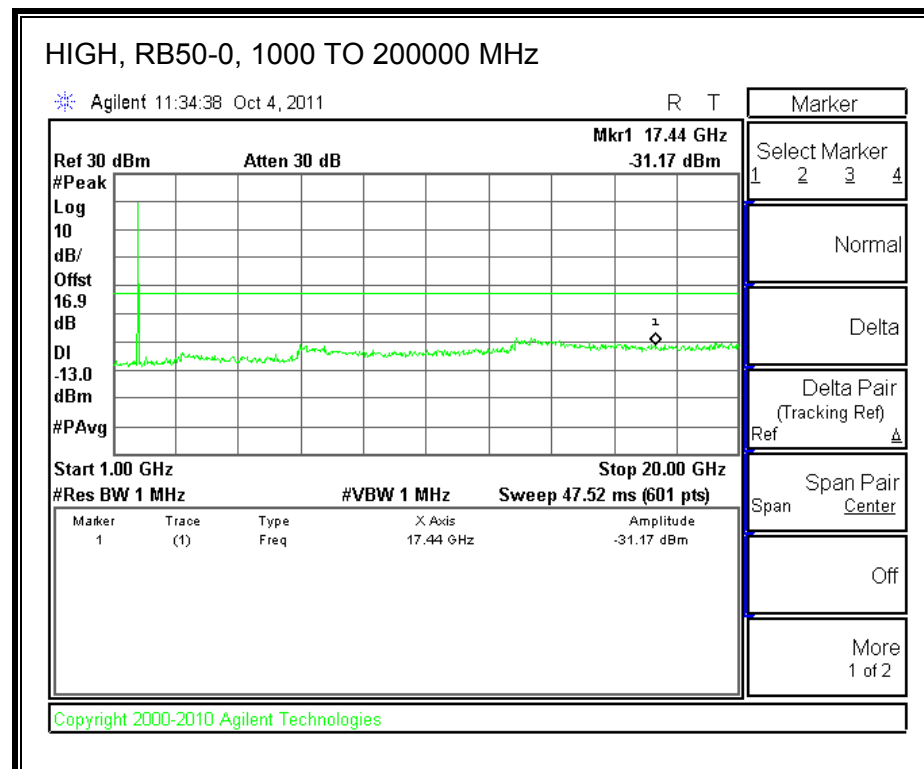
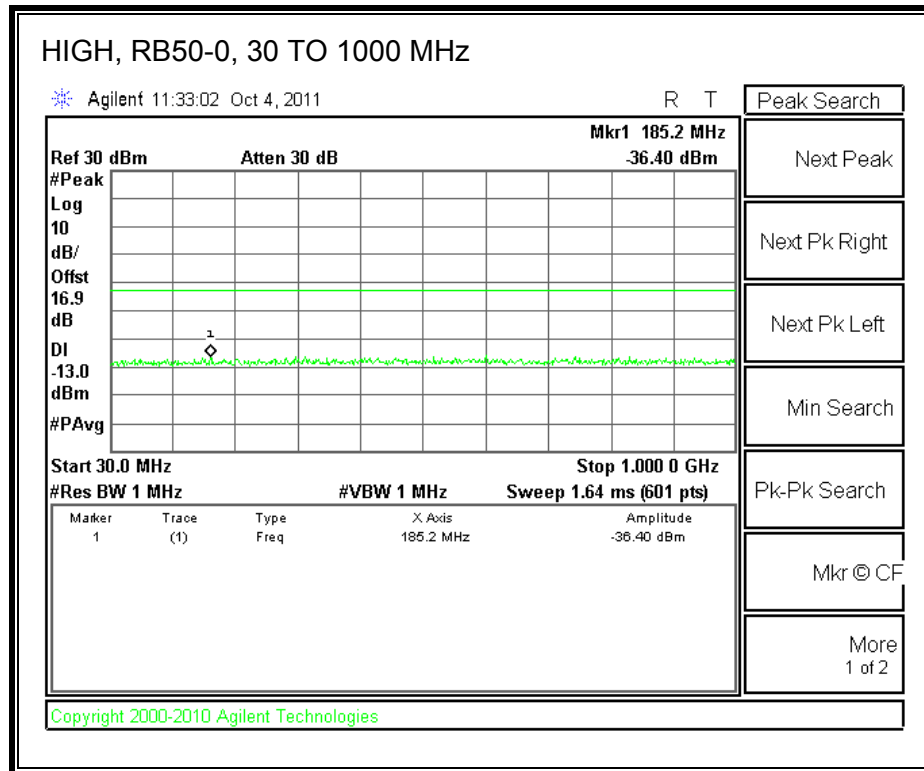




LTE 16QAM



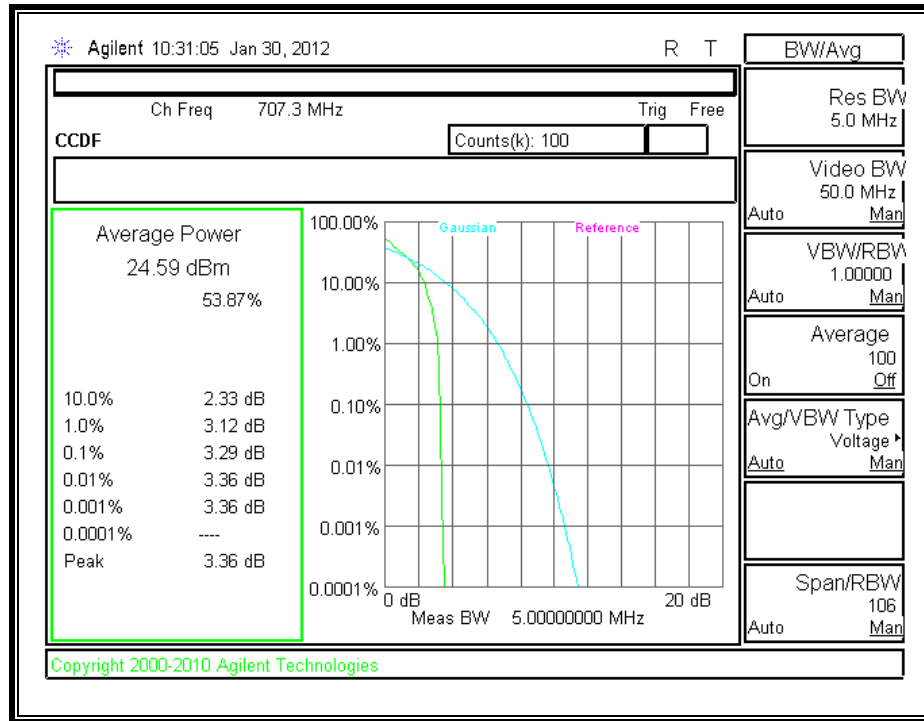




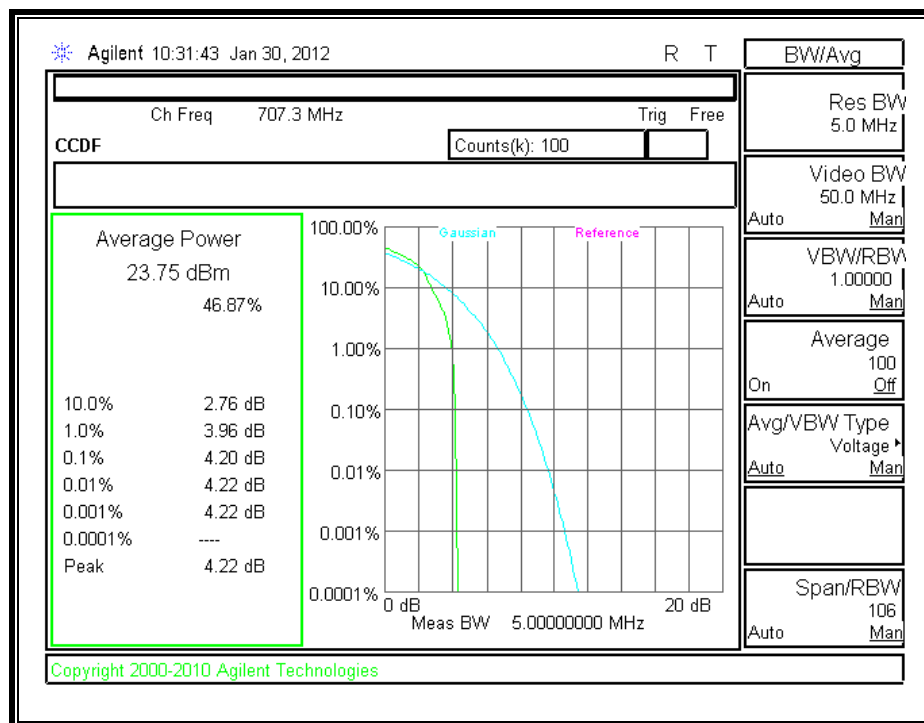
BAND 17, Peak-To-Average Ratio:

Mode	Channel Band-width (MHZ)	Modulation	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
				*Peak	Average	
QPSK	5	RB1 0	710	27.95	24.59	3.36
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio
				*Peak	Average	
16QAM	5	RB1 0	710	27.97	23.75	4.22
*Peak Reading = Average Reading + Peak-to-Average Ratio						

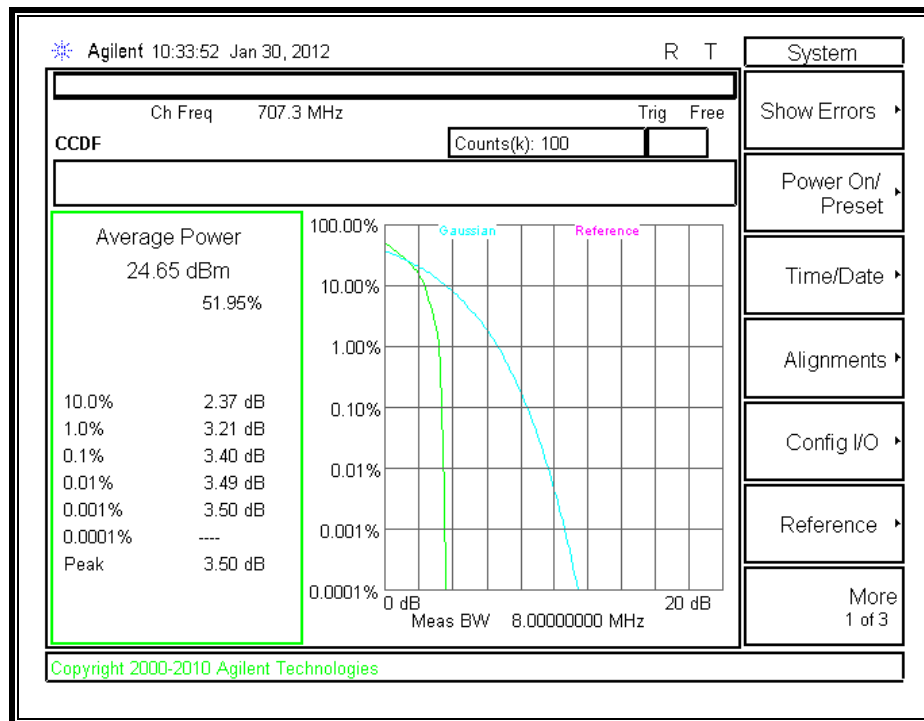
Mode	Channel Band-width (MHZ)	Modulation	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
				*Peak	Average	
QPSK	10	RB1 49	710	28.15	24.65	3.5
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio
				*Peak	Average	
16QAM	10	RB1 49	710	28.2	23.4	4.8
*Peak Reading = Average Reading + Peak-to-Average Ratio						



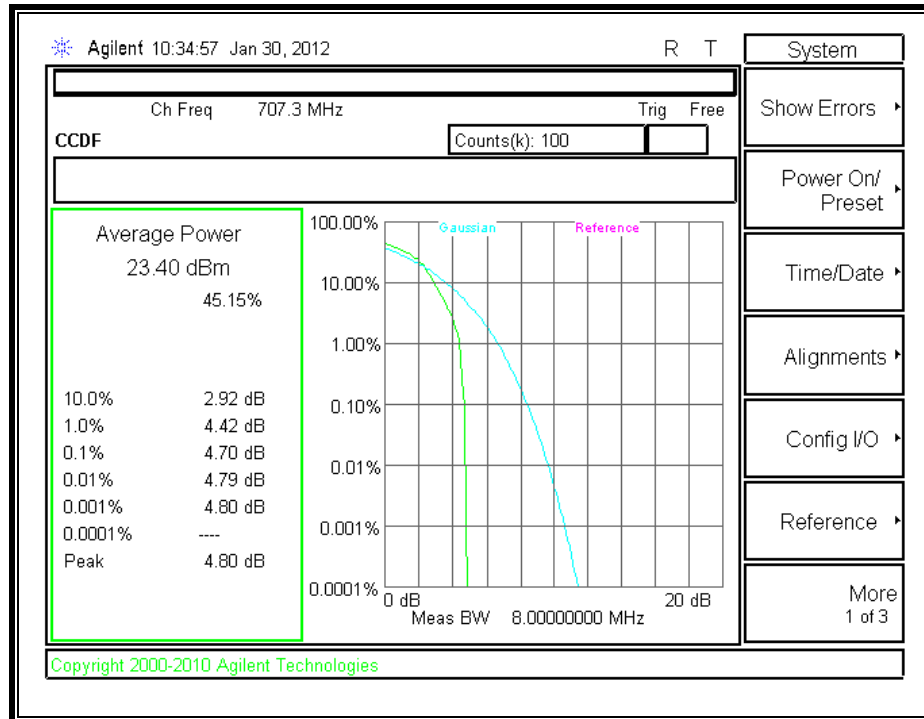
710MHz, 5MHz 16QAM



710MHz, 10MHz_QPSK



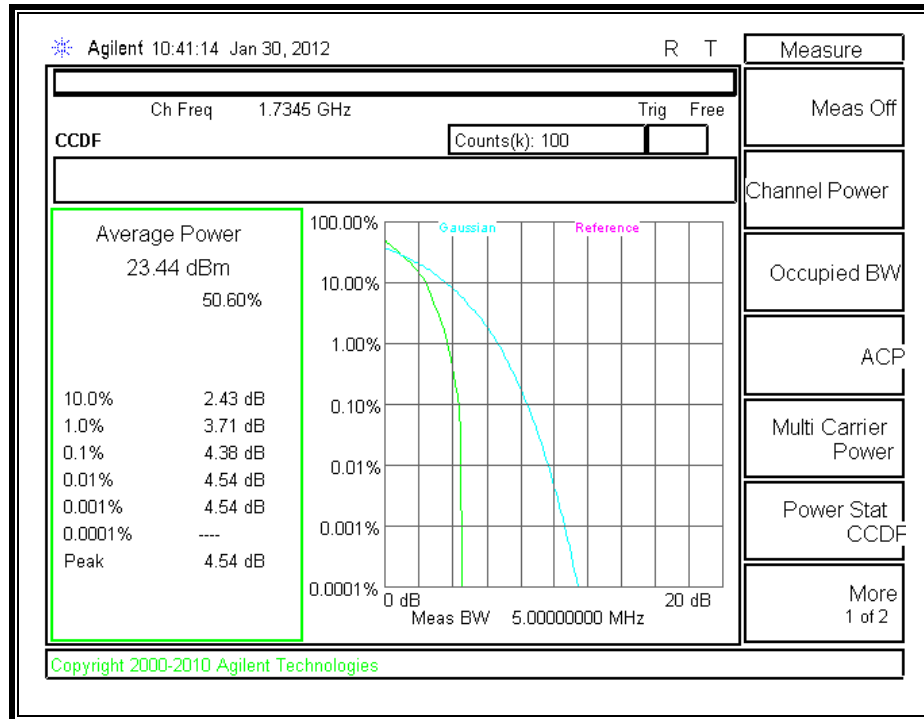
710MHz, 10MHz_16QAM



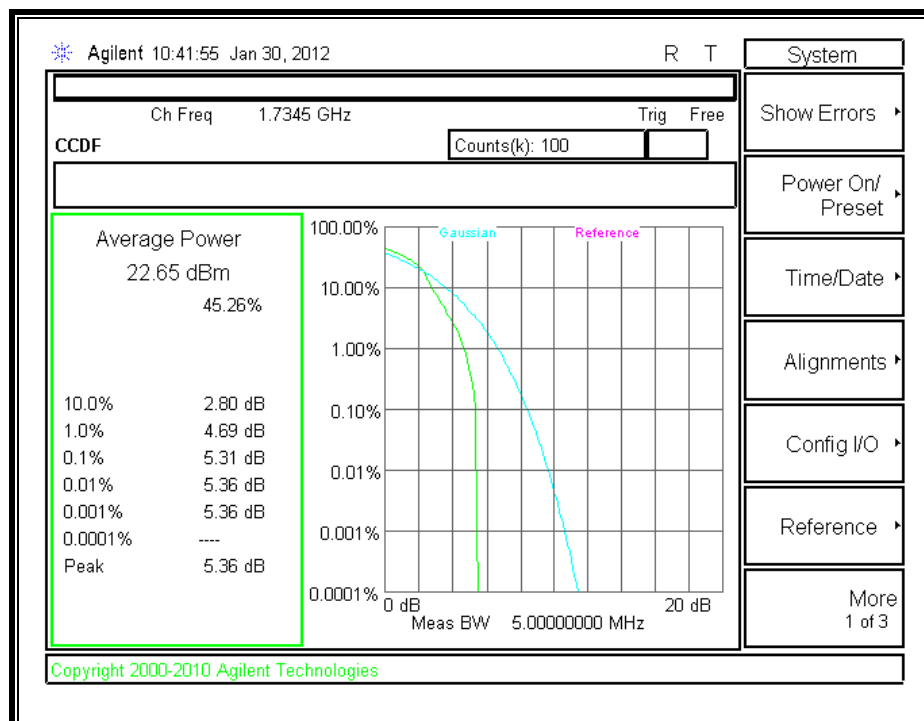
BAND 4, Peak-To-Average Ratio:

Mode	Channel Band-width (MHZ)	Modulation	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
				*Peak	Average	
QPSK	5	RB1 24	1732.5	27.98	23.44	4.54
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio
				*Peak	Average	
16QAM	5	RB1 24	1732.5	28.01	22.65	5.36
*Peak Reading = Average Reading + Peak-to-Average Ratio						

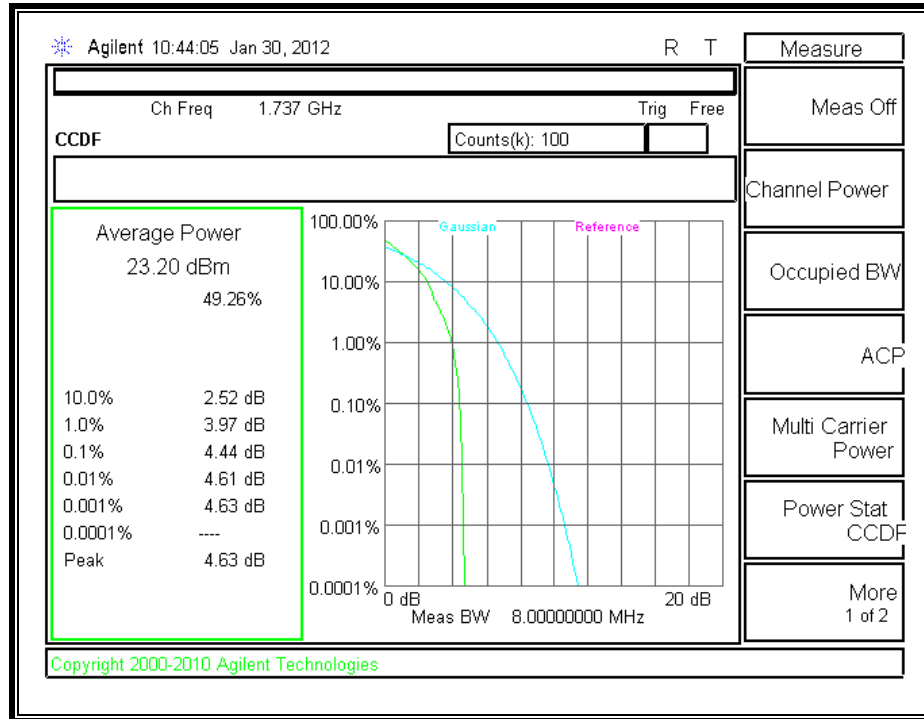
Mode	Channel Band-width (MHZ)	Modulation	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio (PAR)
				*Peak	Average	
QPSK	10	RB1 49	1732.5	27.83	23.2	4.63
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average Ratio
				*Peak	Average	
16QAM	10	RB1 49	1732.5	28.09	21.94	6.15
*Peak Reading = Average Reading + Peak-to-Average Ratio						



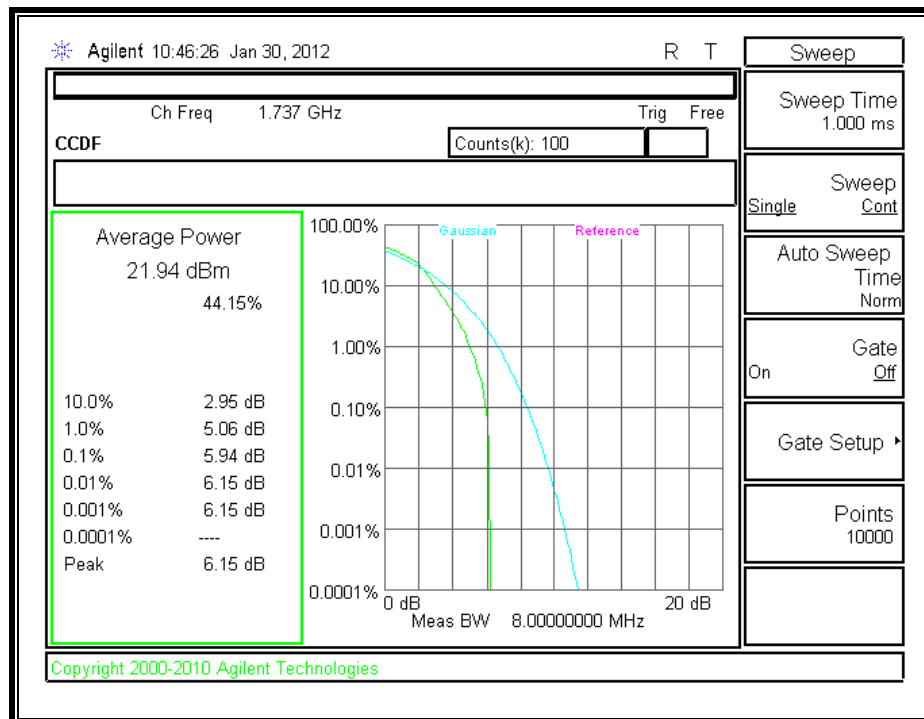
1732MHz, 5MHz_16QAM



1732MHz, 10MHz QPSK



1732MHz, 10MHz 16QAM



8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §27.54

LIMITS

- § 27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = -30° to +50°C
- Voltage = 3.8 Vdc (85% - 115%)

Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50°C is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

MODES TESTED

- LTE BAND 4 & BAND 17

RESULTS

See the following pages.

LTE BAND 17 – 710 MHz, 5MHz

Reference Frequency: LTE Band 17_Mid Channe 710.000002MHz @ 20°C Limit: to stay +/- 2.5 ppm = 1775.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	710.000009	-0.009	2.5
3.80	40	710.000000	0.002	2.5
3.80	30	710.000004	-0.003	2.5
3.80	20	710.000002	0	2.5
3.80	10	710.000004	-0.002	2.5
3.80	0	709.999999	0.005	2.5
3.80	-10	710.000004	-0.003	2.5
3.80	-20	710.000000	0.003	2.5
3.80	-30	709.999998	0.006	2.5

Reference Frequency: LTE Band 17_Mid channel 710.000002MHz @ 20°C Limit: to stay +/- 2.5 ppm = 1775.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	710.000002	0	2.5
3.40	20	710.000019	-0.024	2.5
4.20	20	710.000019	-0.024	2.5
End Voltage(3.0)	20	709.999995	0.010	2.5

LTE BAND 17 – 710 MHz, 10MHz

Reference Frequency: LTE Band 17_Mid Channel 710.999998MHz @ 20°C Limit: to stay +/- 2.5 ppm = 1777.500 Hz				
Power Supply (Vac)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	711.000002	-0.006	2.5
3.80	40	711.000002	-0.005	2.5
3.80	30	711.000000	-0.002	2.5
3.80	20	710.999998	0	2.5
3.80	10	711.000001	-0.005	2.5
3.80	0	710.999996	0.003	2.5
3.80	-10	710.999996	0.003	2.5
3.80	-20	710.999995	0.004	2.5
3.80	-30	710.999995	0.005	2.5

Reference Frequency: LTE Band 17_Mid Channel 710.999998MHz @ 20°C Limit: to stay +/- 2.5 ppm = 1777.500 Hz				
Power Supply (Vac)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	710.999998	0.000	2.5
3.40	20	711.000010	-0.017	2.5
4.20	20	711.000010	-0.017	2.5
End Voltage(3.0)	20	710.999991	0.009	2.5

LTE BAND 4 (5MHz) – 1732.5 MHz

Reference Frequency: LTE Band 4_Mid Channle 1732.499995MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1732.499991	0.0023	2.5
3.80	40	1732.499992	0.0017	2.5
3.80	30	1732.499994	0.0006	2.5
3.80	20	1732.499995	0.0000	2.5
3.80	10	1732.499993	0.0012	2.5
3.80	0	1732.499989	0.0035	2.5
3.80	-10	1732.499993	0.0012	2.5
3.80	-20	1732.499990	0.0029	2.5
3.80	-30	1732.500010	-0.0087	2.5

Reference Frequency: LTE Band 4_Mid Channle 1732.499995MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	1732.499995	0.0000	2.5
3.40	20	1732.499998	-0.0017	2.5
4.20	20	1732.500004	-0.0052	2.5
End Voltage(3.0)	20	1732.500006	-0.0063	2.5

LTE BAND 4 (10MHz) – 1732.5 MHz,

Reference Frequency: LTE Band 4_Mid Channel 1732.499995MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1732.499994	0.0006	2.5
3.80	40	1732.500003	-0.0046	2.5
3.80	30	1732.500004	-0.0052	2.5
3.80	20	1732.499995	0.0000	2.5
3.80	10	1732.500008	-0.0075	2.5
3.80	0	1732.499996	-0.0006	2.5
3.80	-10	1732.499993	0.0012	2.5
3.80	-20	1732.500002	-0.0040	2.5
3.80	-30	1732.500005	-0.0058	2.5

Reference Frequency: LTE Band 4_Mid Channel 1732.499995MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4331.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	20	1732.499995	0.0000	2.5
3.40	20	1732.500002	-0.0040	2.5
4.20	20	1732.499989	0.0038	2.5
End voltage (3.0)	20	1732.500005	-0.0058	2.5

9. RADIATED TEST RESULTS

9.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §27.50(d) (2)

LIMITS:

27.50 (c)(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.

27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

TEST PROCEDURE

ANSI / TIA / EIA 603C Clause 2.2.17

MODES TESTED

- LTE BAND 4 & BAND 17

RESULTS

ERP LTE Band 17 (5.0 MHz BAND WIDTH)

Mode	RB/RB SIZE	f (MHz)	ERP	
			dBm	mW
5MHz Band QASK	1/0	706.5	20.00	100.00
		710.0	20.20	104.71
		713.5	19.40	87.10
5MHz Band 16QAM	1/0	706.5	18.50	70.79
		710.0	19.60	91.20
		713.5	18.50	70.79

ERP LTE Band 17 (10.0 MHz BAND WIDTH)

Mode	RB/RB SIZE	f (MHz)	ERP	
			dBm	mW
10.0 MHZ BAND QPSK	1/49	709.0	19.68	92.90
		710.0	19.66	92.47
		711.0	19.10	81.28
10.0 MHZ BAND 16QAM	1/49	709.0	18.80	75.86
		710.0	18.70	74.13
		711.0	18.40	69.18

EIRP LTE Band 4 (5.0 MHz BAND WIDTH)

Mode	RB/RB SIZE	f (MHz)	ERP(AVERAGE)	
			dBm	mW
5.0 MHZ BAND QPSK	1/24	1712.5	23.31	214.29
		1732.5	23.03	200.91
		1752.5	22.80	190.55
5.0 MHZ BAND 16QAM	1/24	1712.5	22.03	159.59
		1732.5	22.58	181.13
		1752.5	22.40	173.78

EIRP LTE Band 4 (10.0 MHz BAND WIDTH)

Mode	RB/RB SIZE	f (MHz)	EIRP(AVERAGE)	
			dBm	mW
10.0 MHZ BAND QPSK	1/49	1715.0	22.93	196.34
		1732.5	23.38	217.77
		1750.0	23.80	239.88
10.0 MHZ BAND 16QAM	1/49	1715.0	21.83	152.41
		1732.5	22.08	161.44
		1750.0	22.30	169.82

ERP LTE QPSK Band 17 (5.0 MHz BAND WIDTH)

RB1-0

High Frequency Substitution Measurement Compliance Certification Services Chamber B								
Company:		Apple						
Project #:		11U14054						
Date:		12/06/11						
Test Engineer:		Chin Pang						
Configuration:		EUT only						
Mode:		TX, LTE BAND 17 5MHz BW						
Test Equipment:								
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)								
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.								
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
RB=1 & SRB=0, QPSK								
706.50	20.50	V	0.5	0.0	20.00	34.8	-14.8	
706.50	14.70	H	0.5	0.0	14.20	34.8	-20.6	
RB=1 & SRB=0, QPSK								
710.00	20.70	V	0.5	0.0	20.20	34.8	-14.6	
710.00	15.30	H	0.5	0.0	14.80	34.8	-20.0	
RB=1 & SRB=0, QPSK								
713.50	19.90	V	0.5	0.0	19.40	34.8	-15.4	
713.50	15.30	H	0.5	0.0	14.80	34.8	-20.0	
Rev. 3.17.11								

ERP LTE 16QAM Band 17 (5.0 MHz BAND WIDTH)

RB1-0

High Frequency Substitution Measurement Compliance Certification Services Chamber B								
Company:		Apple						
Project #:		11U14054						
Date:		12/6/2011						
Test Engineer:		Chin Pang						
Configuration:		EUT only						
Mode:		TX, LTE BAND 17 5MHz BW						
Test Equipment:								
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)								
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.								
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
RB=1 & SRB=0, 16QAM								
706.50	19.00	V	0.5	0.0	18.50	34.8	-16.3	
706.50	14.30	H	0.5	0.0	13.80	34.8	-21.0	
RB=1 & SRB=0, 16QAM								
710.00	20.10	V	0.5	0.0	19.60	34.8	-15.2	
710.00	14.30	H	0.5	0.0	13.80	34.8	-21.0	
RB=1 & SRB=0, 16QAM								
713.50	19.00	V	0.5	0.0	18.50	34.8	-16.3	
713.50	14.80	H	0.5	0.0	14.30	34.8	-20.5	
Rev. 3.17.11								

ERP LTE QPSK Band 17 (10.0 MHz BAND WIDTH)

RB1-49

High Frequency Substitution Measurement Compliance Certification Services Chamber B								
Company:	Apple							
Project #:	11U14054							
Date:	12/01/11							
Test Engineer:	Chin Pang							
Configuration:	EUT only							
Mode:	TX, LTE BAND 17 , 10MHz BW							
	Average							
Test Equipment:								
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)								
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.								
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
RB=1 & SRB=49, QPSK								
709.00	20.18	V	0.5	0.0	19.68	34.8	-15.1	
709.00	17.20	H	0.5	0.0	16.70	34.8	-18.1	
RB=1 & SRB=49, QPSK								
710.00	20.16	V	0.5	0.0	19.66	34.8	-15.1	
710.00	15.10	H	0.5	0.0	14.60	34.8	-20.2	
RB=1 & SRB=0, QPSK								
711.00	19.60	V	0.5	0.0	19.10	34.8	-15.7	
711.00	15.00	H	0.5	0.0	14.50	34.8	-20.3	
Rev. 3.17.11								

ERP LTE 16QAM Band 17 (10.0 MHz BAND WIDTH)

RB1-49

High Frequency Substitution Measurement Compliance Certification Services Chamber B								
Company:	Apple							
Project #:	11U14054							
Date:	11/18/11							
Test Engineer:	Chin Pang							
Configuration:	EUT only							
Mode:	TX, LTE BAND 17 , 10MHz BW							
	Average							
Test Equipment:								
Receiving: Sunol T130, and 3m Chamber N-type Cable (Setup this one for testing EUT)								
Substitution: Dipole S/N: 00022117, 6ft SMA Cable (SN # 208947003) Warehouse.								
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
RB=1 & SRB=49, 16QAM								
709.00	19.30	V	0.5	0.0	18.80	34.5	-15.7	
709.00	14.00	H	0.5	0.0	13.50	34.5	-21.0	
RB=1 & SRB=49, 16QAM								
710.00	19.20	V	0.5	0.0	18.70	34.5	-15.8	
710.00	14.30	H	0.5	0.0	13.80	34.5	-20.7	
RB=1 & SRB=0, 16QAM								
711.00	18.90	V	0.5	0.0	18.40	34.5	-16.1	
711.00	14.00	H	0.5	0.0	13.50	34.5	-21.0	
Rev. 3.17.11								

EIRP LTE QPSK Band 4 (5.0 MHz BAND WIDTH)

RB1-24

High Frequency Fundamental Measurement Compliance Certification Services Chamber B								
Company:		Apple						
Project #:		11U14054						
Date:		12/06/11						
Test Engineer:		Chin Pang						
Configuration:		EUT ALONE						
Mode:		TX, LTE BAND 4_5.0 MHz BW						
		Average						
Test Equipment:								
Receiving: Horn T59, and Camber B SMA Cables								
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 24, QPSK								
1.713	15.6	V	0.67	8.40	23.31	30.0	-6.7	
1.713	9.3	H	0.67	8.50	17.13	30.0	-12.9	
RB1 24, QPSK								
1.733	15.3	V	0.67	8.45	23.03	30.0	-7.0	
1.733	11.3	H	0.67	8.54	19.17	30.0	-10.8	
RB1 24, QPSK								
1.753	15.0	V	0.67	8.47	22.80	30.0	-7.2	
1.753	11.0	H	0.67	8.50	18.83	30.0	-11.2	
Rev. 1.24.7								

EIRP LTE 16QAM Band 4 (5.0 MHz BAND WIDTH)

RB1-24

High Frequency Fundamental Measurement Compliance Certification Services Chamber B								
Company:		Apple						
Project #:		11U14054						
Date:		12/06/11						
Test Engineer:		Chin Pang						
Configuration:		EUT ALONE						
Mode:		TX, LTE BAND 4_5.0 MHz BW Average						
Test Equipment:								
Receiving: Horn T59, and Camber B SMA Cables								
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 24, 16QAM								
1.713	14.3	V	0.67	8.40	22.03	30.0	-8.0	
1.713	8.4	H	0.67	8.50	16.23	30.0	-13.8	
RB1 24, 16QAM								
1.733	14.8	V	0.67	8.45	22.58	30.0	-7.4	
1.733	9.7	H	0.67	8.54	17.57	30.0	-12.4	
RB1 24, 16QAM								
1.753	14.6	V	0.67	8.47	22.40	30.0	-7.6	
1.753	9.7	H	0.67	8.50	17.53	30.0	-12.5	
Rev. 1.24.7								

EIRP LTE QPSK Band 4 (10MHz BANDWIDTH)

RB1-49

High Frequency Fundamental Measurement Compliance Certification Services Chamber B								
Company:		Apple						
Project #:		11U14054						
Date:		12/01/11						
Test Engineer:		Chin Pang						
Configuration:		EUT ALONE						
Mode:		TX, LTE BAND 4_10.0 MHz BW						
		Average						
Test Equipment:								
Receiving: Horn T59, and Camber B SMA Cables								
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 49, QPSK								
1.715	15.2	V	0.67	8.40	22.93	30.0	-7.1	
1.715	7.9	H	0.67	8.50	15.73	30.0	-14.3	
RB1 49, QPSK								
1.733	15.6	V	0.67	8.45	23.38	30.0	-6.6	
1.733	5.3	H	0.67	8.54	13.17	30.0	-16.8	
RB1 49, QPSK								
1.750	16.0	V	0.67	8.47	23.80	30.0	-6.2	
1.750	10.7	H	0.67	8.50	18.53	30.0	-11.5	
Rev. 1.24.7								

EIRP LTE 16QAM Band 4 (10MHz BAND WIDTH)

RB1-49

High Frequency Fundamental Measurement Compliance Certification Services Chamber B								
Company:		Apple						
Project #:		11U14054						
Date:		12/01/11						
Test Engineer:		Chin Pang						
Configuration:		EUT ALONE						
Mode:		TX, LTE BAND 4_10.0 MHz BW						
		Average						
Test Equipment:								
Receiving: Horn T59, and Camber B SMA Cables								
Substitution: Horn T60 Substitution, 6ft SMA Cable (244640002) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
RB1 49, 16QAM								
1.715	14.1	V	0.67	8.40	21.83	30.0	-8.2	
1.715	7.3	H	0.67	8.50	15.13	30.0	-14.9	
RB1 49, 16QAM								
1.733	14.3	V	0.67	8.45	22.08	30.0	-7.9	
1.733	4.8	H	0.67	8.54	12.67	30.0	-17.3	
RB1 49, 16QAM								
1.750	14.5	V	0.67	8.47	22.30	30.0	-7.7	
1.750	9.8	H	0.67	8.50	17.63	30.0	-12.4	
Rev. 1.24.7								

9.1. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §27.53.

LIMIT

§27.53 (g) For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB.

§27.53 (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

MODES TESTED

- LTE BAND 4 & 17

RESULTS

ERP LTE QPSK Band 17 (5.0 MHz BANDWIDTH)

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12-06-11							
Test Engineer:		Chin pang							
Configuration:		EUT only							
Mode:		LTE Band 17_5MHz BW_QPSK Worst Case							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch (706.5 MHz) QPSK									
1.418	-20.9	V	3.0	35.7	1.0	-55.6	-13.0	-42.6	
2.126	-18.5	V	3.0	35.4	1.0	-52.9	-13.0	-39.9	
1.418	-23.8	H	3.0	35.7	1.0	-58.6	-13.0	-45.6	
2.126	-20.6	H	3.0	35.4	1.0	-55.0	-13.0	-42.0	
Mid Ch (710.0 MHz), QPSK									
1.424	-19.0	V	3.0	35.7	1.0	-53.8	-13.0	-40.8	
2.136	-17.5	V	3.0	35.4	1.0	-51.9	-13.0	-38.9	
1.424	-22.8	H	3.0	35.7	1.0	-57.5	-13.0	-44.5	
2.136	-20.2	H	3.0	35.4	1.0	-54.5	-13.0	-41.5	
Hi Ch (713.5 MHz) QPSK									
1.431	-21.8	V	3.0	35.7	1.0	-56.5	-13.0	-43.5	
2.146	-15.1	V	3.0	35.4	1.0	-49.4	-13.0	-36.4	
1.431	-22.7	H	3.0	35.7	1.0	-57.5	-13.0	-44.5	
2.146	-16.7	H	3.0	35.4	1.0	-51.1	-13.0	-38.1	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

ERP LTE 16QAM Band 17 (5.0 MHz BANDWIDTH)

Compliance Certification Services									
Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12-06-11							
Test Engineer:		Chin pang							
Configuration:		EUT only							
Mode:		LTE Band 17_5MHz BW_16QAM							
		Worst Case							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch (706.5 MHz), 16QAM									
1.418	-21.9	V	3.0	35.7	1.0	-56.6	-13.0	-43.6	
2.126	-19.7	V	3.0	35.4	1.0	-54.1	-13.0	-41.1	
1.418	-24.8	H	3.0	35.7	1.0	-59.6	-13.0	-46.6	
2.126	-21.6	H	3.0	35.4	1.0	-56.0	-13.0	-43.0	
Mid Ch (710.0 MHz), 16QAM									
1.420	-17.9	V	3.0	35.7	1.0	-52.6	-13.0	-39.6	
2.130	-16.5	V	3.0	35.4	1.0	-50.9	-13.0	-37.9	
1.420	-24.8	H	3.0	35.7	1.0	-59.6	-13.0	-46.6	
2.130	-16.8	H	3.0	35.4	1.0	-51.2	-13.0	-38.2	
Hi Ch (713.5 MHz) 16QAM									
1.427	-22.0	V	3.0	35.7	1.0	-56.7	-13.0	-43.7	
2.141	-13.6	V	3.0	35.4	1.0	-47.9	-13.0	-34.9	
1.427	-22.9	H	3.0	35.7	1.0	-57.6	-13.0	-44.6	
2.141	-16.7	H	3.0	35.4	1.0	-51.0	-13.0	-38.0	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

ERP LTE QPSK Band 17 (10.0 MHz BANDWIDTH)

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12-06-11							
Test Engineer:		Chin pang							
Configuration:		EUT only							
Mode:		LTE Band 17_10MHz BW_QPSK Worst Case							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch (709 MHz) QPSK									
1.418	-17.9	V	3.0	35.7	1.0	-52.6	-13.0	-39.6	
2.141	-18.6	V	3.0	35.4	1.0	-52.9	-13.0	-39.9	
1.418	-21.8	H	3.0	35.7	1.0	-56.6	-13.0	-43.6	
2.141	-18.7	H	3.0	35.4	1.0	-53.0	-13.0	-40.0	
Mid Ch (710.0 MHz) QPSK									
1.429	-19.8	V	3.0	35.7	1.0	-54.5	-13.0	-41.5	
2.144	-17.6	V	3.0	35.4	1.0	-51.9	-13.0	-38.9	
1.429	-23.3	H	3.0	35.7	1.0	-58.1	-13.0	-45.1	
2.144	-18.7	H	3.0	35.4	1.0	-53.1	-13.0	-40.1	
Hi Ch (711 MHz) QPSK									
1.431	-22.8	V	3.0	35.7	1.0	-57.5	-13.0	-44.5	
2.146	-15.2	V	3.0	35.4	1.0	-49.5	-13.0	-36.5	
1.431	-23.0	H	3.0	35.7	1.0	-57.8	-13.0	-44.8	
2.146	-18.7	H	3.0	35.4	1.0	-53.1	-13.0	-40.1	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

ERP LTE 16QAM Band 17 (10.0 MHz BANDWIDTH)

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12-06-11							
Test Engineer:		Chin pang							
Configuration:		EUT only							
Mode:		LTE Band 17_10MHz BW_16QAM Worst Case							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch (709 MHz), 16QAM									
1.418	-17.5	V	3.0	35.7	1.0	-52.2	-13.0	-39.2	
2.141	-18.4	V	3.0	35.4	1.0	-52.7	-13.0	-39.7	
1.418	-21.8	H	3.0	35.7	1.0	-56.6	-13.0	-43.6	
2.141	-17.8	H	3.0	35.4	1.0	-52.1	-13.0	-39.1	
Mid Ch (710.0 MHz), 16QAM									
1.429	-19.4	V	3.0	35.7	1.0	-54.1	-13.0	-41.1	
2.144	-16.8	V	3.0	35.4	1.0	-51.1	-13.0	-38.1	
1.429	-21.7	H	3.0	35.7	1.0	-56.5	-13.0	-43.5	
2.144	-18.3	H	3.0	35.4	1.0	-52.7	-13.0	-39.7	
High Ch (711 MHz), 16QAM									
1.427	-22.6	V	3.0	35.7	1.0	-57.3	-13.0	-44.3	
2.141	-14.2	V	3.0	35.4	1.0	-48.5	-13.0	-35.5	
1.427	-23.8	H	3.0	35.7	1.0	-58.5	-13.0	-45.5	
2.141	-17.7	H	3.0	35.4	1.0	-52.0	-13.0	-39.0	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

EIRP LTE QPSK Band 4 (5.0 MHz BANDWIDTH)

Compliance Certification Services									
Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12/07/11							
Test Engineer:		Chin Pang							
Configuration:		EUT ALONE							
Mode:		TX, QPSK_5 MHz_RB#1_24 MODE							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1712.5MHz									
3.429	-0.5	V	3.0	35.5	1.0	-35.0	-13.0	-22.0	
10.288	-7.2	V	3.0	35.3	1.0	-41.5	-13.0	-28.5	
12.003	-3.0	V	3.0	34.2	1.0	-36.2	-13.0	-23.2	
3.429	2.6	H	3.0	35.5	1.0	-37.1	-13.0	-24.1	
10.288	6.4	H	3.0	35.3	1.0	-27.9	-13.0	-14.9	
12.003	1.1	H	3.0	34.2	1.0	-32.1	-13.0	-19.1	
13.718	-0.3	H	3.0	33.8	1.0	-33.2	-13.0	-20.2	
Mid Ch, 1732.5MHz									
3.469	-6.4	V	3.0	35.5	1.0	-40.9	-13.0	-27.9	
10.408	-3.0	V	3.0	35.3	1.0	-37.3	-13.0	-24.3	
3.469	-9.5	H	3.0	35.5	1.0	-43.9	-13.0	-30.9	
10.408	10.0	H	3.0	35.3	1.0	-24.3	-13.0	-11.3	
High Ch, 1752.5MHz									
3.469	-18.0	V	3.0	35.5	1.0	-52.5	-13.0	-39.5	
5.184	-12.9	V	3.0	35.3	1.0	-47.2	-13.0	-34.2	
3.469	-17.5	H	3.0	35.5	1.0	-51.9	-13.0	-38.9	
5.184	-10.6	H	3.0	35.3	1.0	-45.0	-13.0	-32.0	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

EIRP LTE 16QAM Band 4 (5.0 MHz BANDWIDTH)

Compliance Certification Services									
Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12/07/11							
Test Engineer:		Chin Pang							
Configuration:		EUT ALONE							
Mode:		TX, 16QAM_5 MHz_RB#1_24 MODE							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1712.5MHz									
3.429	-1.0	V	3.0	35.5	1.0	-35.5	-13.0	-22.5	
10.288	-9.2	V	3.0	35.3	1.0	-43.5	-13.0	-30.5	
12.003	-4.0	V	3.0	34.2	1.0	-37.2	-13.0	-24.2	
3.429	-3.6	H	3.0	35.5	1.0	-38.1	-13.0	-25.1	
10.288	6.9	H	3.0	35.3	1.0	-27.4	-13.0	-14.4	
12.003	3.1	H	3.0	34.2	1.0	-30.1	-13.0	-17.1	
13.718	0.5	H	3.0	33.8	1.0	-32.4	-13.0	-19.4	
Mid Ch, 1732.5MHz									
3.469	-8.4	V	3.0	35.5	1.0	-42.9	-13.0	-29.9	
10.408	-3.6	V	3.0	35.3	1.0	-37.9	-13.0	-24.9	
3.469	-10.5	H	3.0	35.5	1.0	-44.9	-13.0	-31.9	
10.408	10.4	H	3.0	35.3	1.0	-23.9	-13.0	-10.9	
High Ch, 1752.5MHz									
3.469	-18.4	V	3.0	35.5	1.0	-52.9	-13.0	-39.9	
5.184	-13.3	V	3.0	35.3	1.0	-47.6	-13.0	-34.6	
3.469	-19.0	H	3.0	35.5	1.0	-53.4	-13.0	-40.4	
5.184	-14.6	H	3.0	35.3	1.0	-49.0	-13.0	-36.0	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

EIRP LTE QPSK Band 4 (10.0 MHz BANDWIDTH)

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12/07/11							
Test Engineer:		Chin Pang							
Configuration:		EUT ALONE							
Mode:		TX, QPSK_10 MHz_RB#1_49 MODE							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1715MHz									
3.439	-5.0	V	3.0	35.5	1.0	-39.5	-13.0	-26.5	
5.519	-13.9	V	3.0	35.4	1.0	-48.3	-13.0	-35.3	
3.439	-6.6	H	3.0	35.5	1.0	-41.0	-13.0	-28.0	
10.318	4.9	H	3.0	35.3	1.0	-29.4	-13.0	-16.4	
12.304	1.6	H	3.0	34.2	1.0	-31.6	-13.0	-18.6	
Mid Ch, 1732.5MHz									
3.473	-8.4	V	3.0	35.5	1.0	-42.9	-13.0	-29.9	
10.421	5.0	V	3.0	35.2	1.0	-39.2	-13.0	-26.2	
3.473	-8.5	H	3.0	35.5	1.0	-42.9	-13.0	-29.9	
10.421	7.0	H	3.0	35.2	1.0	-27.3	-13.0	-14.3	
12.156	-0.6	H	3.0	34.2	1.0	-33.8	-13.0	-20.8	
High Ch, 1750MHz									
3.509	-18.3	V	3.0	35.4	1.0	-52.8	-13.0	-39.8	
10.528	-3.9	V	3.0	35.2	1.0	-38.0	-13.0	-25.0	
3.509	-16.3	H	3.0	35.4	1.0	-50.8	-13.0	-37.8	
5.184	-11.6	H	3.0	35.3	1.0	-46.0	-13.0	-33.0	
10.528	11.0	H	3.0	35.2	1.0	-23.2	-13.0	-10.2	
12.283	-6.4	H	3.0	34.2	1.0	-39.6	-13.0	-26.6	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

EIRP LTE 16QAM Band 4 (10.0 MHz BANDWIDTH)

Compliance Certification Services									
Above 1GHz High Frequency Substitution Measurement									
Company:		Apple							
Project #:		11U14054							
Date:		12/07/11							
Test Engineer:		Chin Pang							
Configuration:		EUT ALONE							
Mode:		TX, 16QAM_10 MHz_RB#1_49 MODE							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		Part 27			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1715MHz									
3.439	-5.5	V	3.0	35.5	1.0	-40.0	-13.0	-27.0	
5.519	-13.5	V	3.0	35.4	1.0	-47.9	-13.0	-34.9	
3.439	-7.1	H	3.0	35.5	1.0	-41.5	-13.0	-28.5	
10.318	3.9	H	3.0	35.3	1.0	-30.4	-13.0	-17.4	
12.304	-0.4	H	3.0	34.2	1.0	-33.6	-13.0	-20.6	
Mid Ch, 1732.5MHz									
3.473	-7.4	V	3.0	35.5	1.0	-41.9	-13.0	-28.9	
10.421	-5.0	V	3.0	35.2	1.0	-39.2	-13.0	-26.2	
3.473	-8.7	H	3.0	35.5	1.0	-43.1	-13.0	-30.1	
10.421	8.0	H	3.0	35.2	1.0	-26.3	-13.0	-13.3	
12.156	-1.6	H	3.0	34.2	1.0	-34.8	-13.0	-21.8	
High Ch, 1750MHz									
3.509	-18.1	V	3.0	35.4	1.0	-52.6	-13.0	-39.6	
10.528	-4.9	V	3.0	35.2	1.0	-39.0	-13.0	-26.0	
3.509	-16.8	H	3.0	35.4	1.0	-51.3	-13.0	-38.3	
5.184	-12.3	H	3.0	35.3	1.0	-46.7	-13.0	-33.7	
10.528	12.0	H	3.0	35.2	1.0	-22.2	-13.0	-9.2	
12.283	-6.4	H	3.0	34.2	1.0	-39.6	-13.0	-26.6	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

9.2. RECEIVER SPURIOUS EMISSIONS

RULE PART(S)

FCC: N/A

LIMIT

Spurious Emission Limits for Receivers:

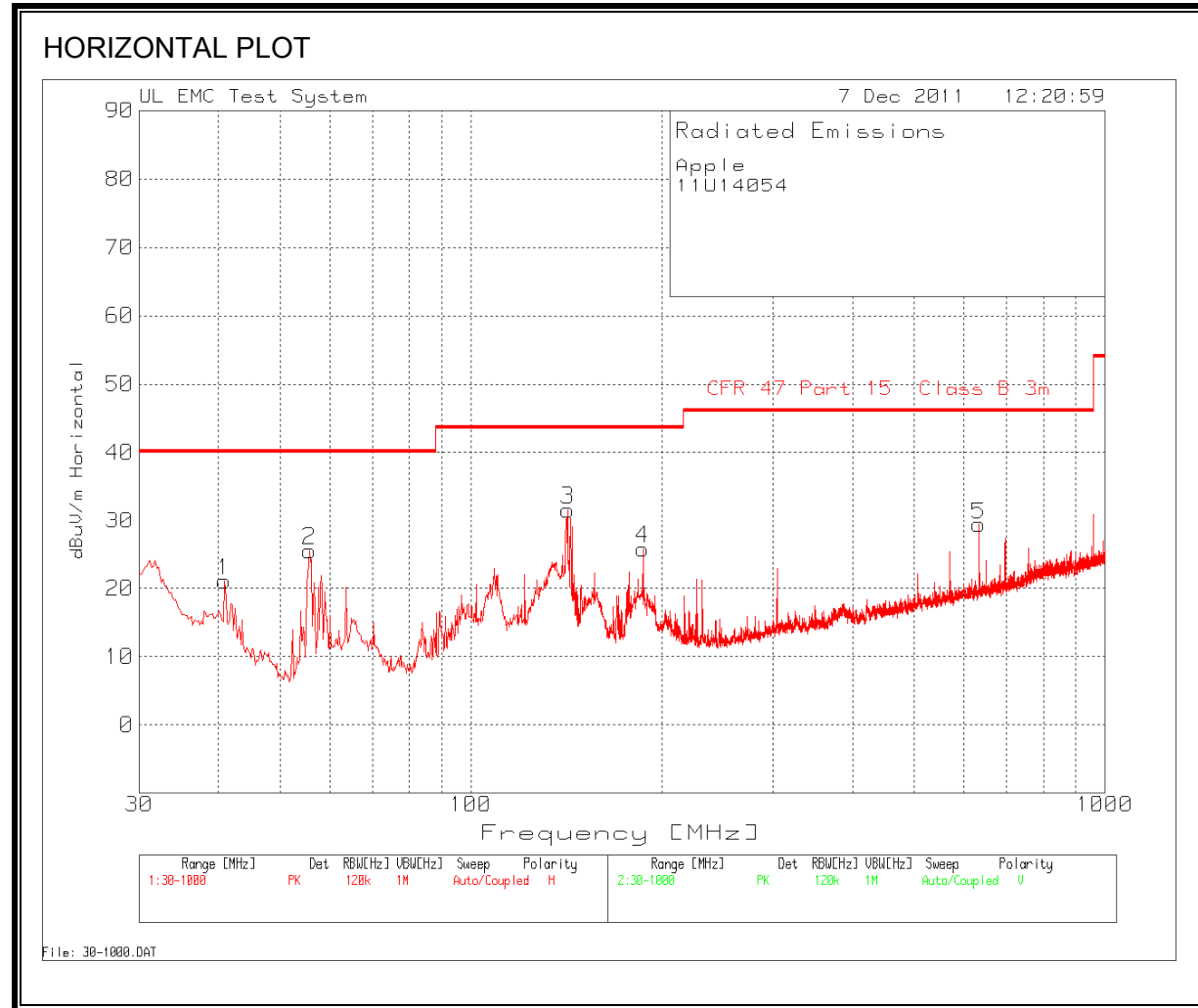
Spurious Frequency (MHz)	Field Strength (microvolts/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

TEST PROCEDURE

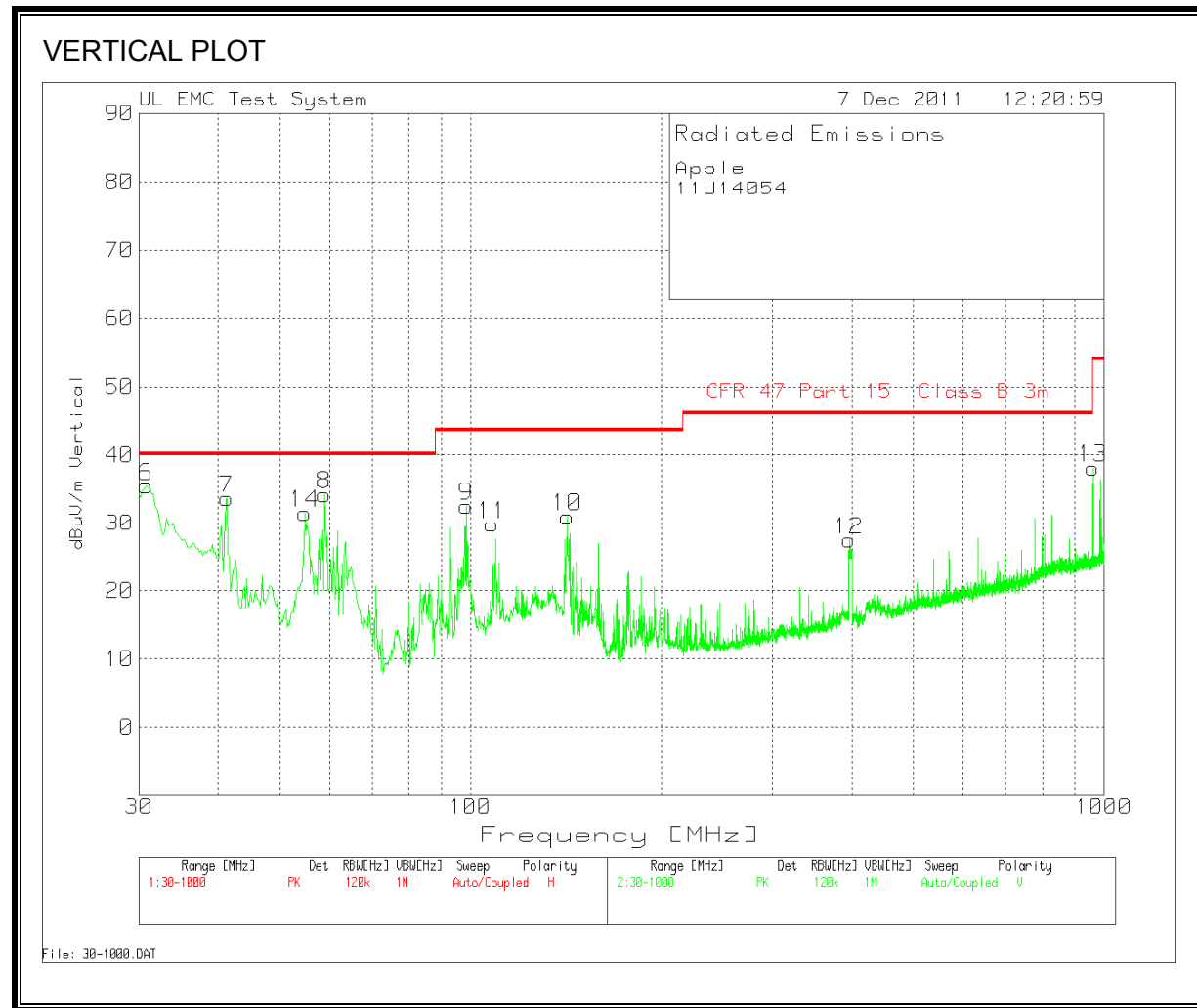
The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (local oscillator frequency, intermediate frequency or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable and local oscillator frequencies.

RESULTS

RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, HORIZONTAL



RECEIVER SPURIOUS EMISSIONS FOR 30 TO 1000 MHz, VERTICAL



HORIZONTAL AND VERTICAL DATA

Apple									
11U14054									
Engineer: Chin Pang									
Date: Dec 7, 2011									
Range 1 30 - 1000MHz									
Frequency	Reading	Detector	ChmbrB Amp [dB]	Ant Factors.[dB]	dBuV/m	Part 15 B	Margin	Polarity	
40.8553	36.63	PK	-29.2	13.6	21.03	40	-18.97	Horz	
55.5875	46.58	PK	-29	7.9	25.48	40	-14.52	Horz	
142.2362	46.65	PK	-28.1	13.1	31.65	43.5	-11.85	Horz	
186.8205	42.38	PK	-27.7	11.1	25.78	43.5	-17.72	Horz	
633.0516	37.26	PK	-26.5	18.6	29.36	46	-16.64	Horz	
Range 2 30 - 1000MHz									
Frequency	Reading	Detector	ChmbrB Amp [dB]	Ant Factors.[dB]	dBuV/m	Part 15 B	Margin	Polarity	
30.7754	44.75	PK	-29.3	20	35.45	40	-4.55	Vert	
41.243	49.54	PK	-29.2	13.3	33.64	40	-6.36	Vert	
58.8829	55.37	PK	-29	7.9	34.27	40	-5.73	Vert	
98.6211	51.47	PK	-28.6	9.7	32.57	43.5	-10.93	Vert	
142.2362	45.93	PK	-28.1	13.1	30.93	43.5	-12.57	Vert	
108.3133	46.75	PK	-28.5	11.6	29.85	43.5	-13.65	Vert	
395.9792	39.38	PK	-26.9	15	27.48	46	-18.52	Vert	
961.0372	40.27	PK	-24.3	22.2	38.17	54	-15.83	Vert	
54.8122	52.56	PK	-29	7.9	31.46	40	-8.54	Vert	

RECEIVER SPURIOUS EMISSIONS ABOVE 1000 MHz

Note: No emissions were detected above the system noise floor.