



**FCC CFR47 PART 27 SUBPART C
CERTIFICATION TEST REPORT**

FOR

IPAD WITH 802.11 ABGN BT EDR / LE / GSM / CDMA / WCDMA / LTE

MODEL NUMBER: A1403

FCC ID: BCGA1403

REPORT NUMBER: 11U13938-6, Revision B

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Prepared for

APPLE

1 INFINITE LOOP

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NVLAP LAB CODE 200065-0

Revision History

Issue		Revisions	Revised By
Rev.	Date		
---	11/28/11	Initial Issue	T. Chan
A	02/02/12	Revised report	T. Chan
B	02/11/12	Full Test on 5MHz Bandwidth On LTE Band 13	C. Pang

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: The Apple iPad, Model A1403 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the CDMA/GSM 2G/3G/LTE data radio functions.

MODEL: A1403

SERIAL NUMBER: PT654922

DATE TESTED: SEPTEMBER 13 - NOVEMBER 18, 2011 and FEBRUARY 7-11, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 27 C	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 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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

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, Model A1403 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the CDMA/GSM 2G/3G/LTE data radio functions.

5.2. MAXIMUM OUTPUT POWER

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

5MHz BANDWIDTH

Part 27 LTE Band 13

Frequency range (MHz)	QPSK	ERP (Average)	
		dBm	mW
779.5	RB1-0	23.62	230.1
	RB1-24	23.22	209.9
	RB12-6	22.52	178.6
	RB25-0	22.72	187.1
782	RB1-0	23.72	235.5
	RB1-24	23.17	207.5
	RB12-6	22.42	174.6
	RB25-0	22.92	195.9
784.5	RB1-0	23.64	231.2
	RB1-24	23.42	219.8
	RB12-6	22.62	182.8
	RB25-0	22.72	187.1

Frequency range (MHz)	16QAM	ERP (Average)	
		dBm	mW
779.5	RB1-0	22.52	178.6
	RB1-24	21.82	152.1
	RB12-6	21.32	135.5
	RB25-0	21.92	155.6
782	RB1-0	22.62	182.8
	RB1-24	21.92	155.6
	RB12-6	21.42	138.7
	RB25-0	21.77	150.3
784.5	RB1-0	22.67	184.9
	RB1-24	21.82	152.1
	RB12-6	21.52	141.9
	RB25-0	21.92	155.6

10MHz BANDWIDTH

Part 27 LTE Band 13

Frequency range (MHz)	QPSK	ERP (Average)	
		dBm	mW
782	RB1-0	23.97	249.5
	RB1-49	23.17	207.5
	RB25-12	22.75	188.4
	RB50-0	23.34	215.8

10MHz BANDWIDTH

Part 27 LTE Band 13

Frequency range (MHz)	16QAM	ERP(Average)	
		dBm	mW
782	RB1-0	22.82	191.4
	RB1-49	22.72	187.1
	RB25-12	21.72	148.6
	RB50-0	21.82	152.1

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dipole antenna for the 700MHz with a maximum peak gain of -0.28dBi for band 13.

5.4. SOFTWARE AND FIRMWARE

The test software used during testing was 9B87

The EUT is linked with CMW500 Test Set.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel for RF radiated emissions below 1GHz and AC conducted emissions are determined as the channel with the AC Power Adapter Source

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 13, QPSK and 16QAM

The EUT is a portable device, to determine the worst case, X Y and Z position and EUT with AC Adapter and earphone has been investigated for the maximum power and worst-case orientation and Z position without AC Adapter is determined to be the worst case.

5.6. DESCRIPTION OF TEST SETUP**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)

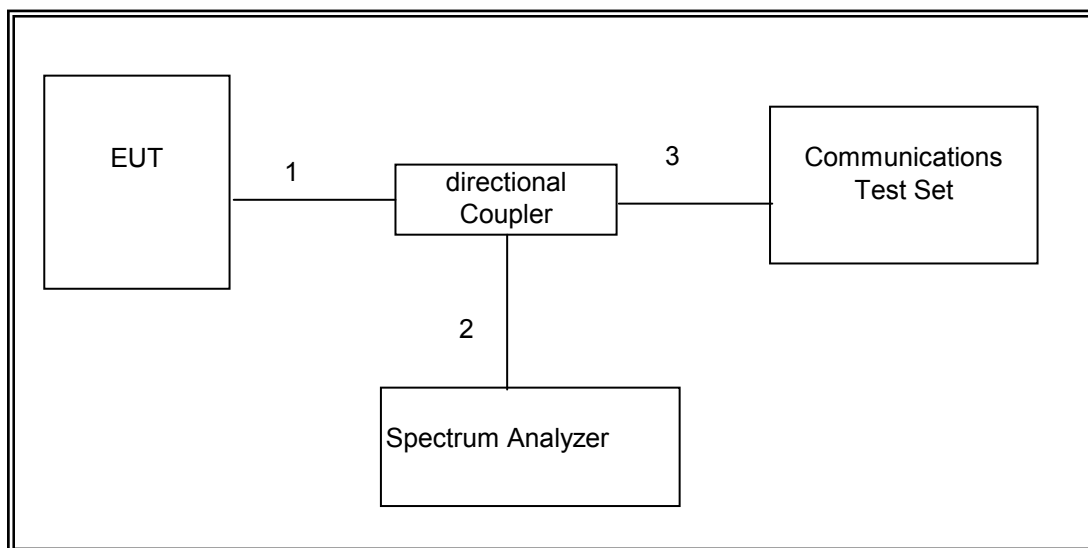
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US 115V	Un-shielded	2m	NA
2	DC	1	US 115V	Un-shielded	1m	NA
3	Jack	1	Earphone	Un-shielded	0.5m	NA
4	RF In/Out	1	Antenna	Un-shielded	none	NA

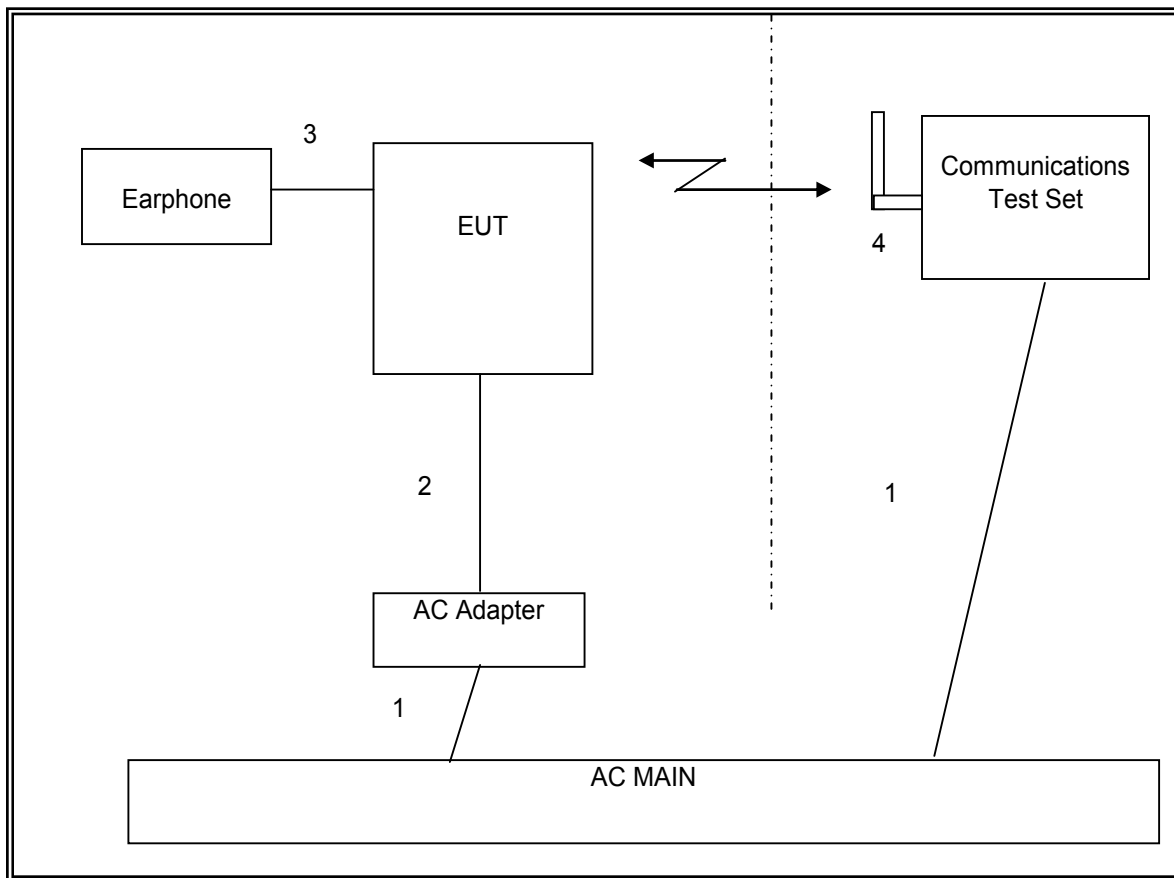
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Earphone	Apple	NA	NA
AC Adaptor	Apple	A1344	N/A

TEST SETUP

The EUT is a stand-alone device. The Wireless Communication test set exercised the EUT.

SETUP DIAGRAM FOR RF CONDUCTED TESTS

SETUP DIAGRAM FOR RADIATED 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	C00872	06/29/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/12/12
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/12
Wideband Communication Test Set	R & S	CMW 500	None	01/25/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/12
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	10/20/12
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689	CNR
Directional Coupler	RF-Lambda	RFDC5M06G15	NA	CNR
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 POWER OUTPUT FOR LTE BAND 13

5MHz Bandwidth

Band	BW	Freq. (MHz)	Mode	UL RB Allocation	Average	
					dBm	mW
13	5	779.5	QPSK	RB 1-0	24.30	281.8
				RB 1-24	24.30	281.8
				RB 12-6	23.40	223.9
				RB 25-0	23.30	223.9
			16QAM	RB 1-0	23.50	221.8
				RB 1-24	23.40	217.8
				RB 12-6	22.30	177.8
				RB 25-0	22.40	171.8
13	5	782.0	QPSK	RB 1-0	24.30	269.2
				RB 1-24	24.30	269.2
				RB 12-6	23.30	213.8
				RB 25-0	23.30	213.8
			16QAM	RB 1-0	23.30	213.8
				RB 1-24	23.20	208.9
				RB 12-6	22.20	166.0
				RB 25-0	22.50	177.8
		784.5	QPSK	RB 1-0	24.40	281.8
				RB 1-24	24.20	278.6
				RB 12-6	23.20	223.9
				RB 25-0	23.40	223.9
			16QAM	RB 1-0	23.40	221.8
				RB 1-24	23.30	221.3
				RB 12-6	22.30	175.8
				RB 25-0	22.40	177.8

10MHz Bandwidth

Part 27 LTE Band 13				
Frequency range (MHz)	MODE	Start RB Offset	Average	
			dBm	mW
782	QPSK	RB1-0	24.30	269.2
		RB1-49	24.29	268.5
		RB25-12	23.40	218.8
		RB50-0	23.30	213.8
782	16QAM	RB1-0	23.50	223.9
		RB1-49	23.45	221.3
		RB25-12	22.40	173.8
		RB50-0	22.50	177.8

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.

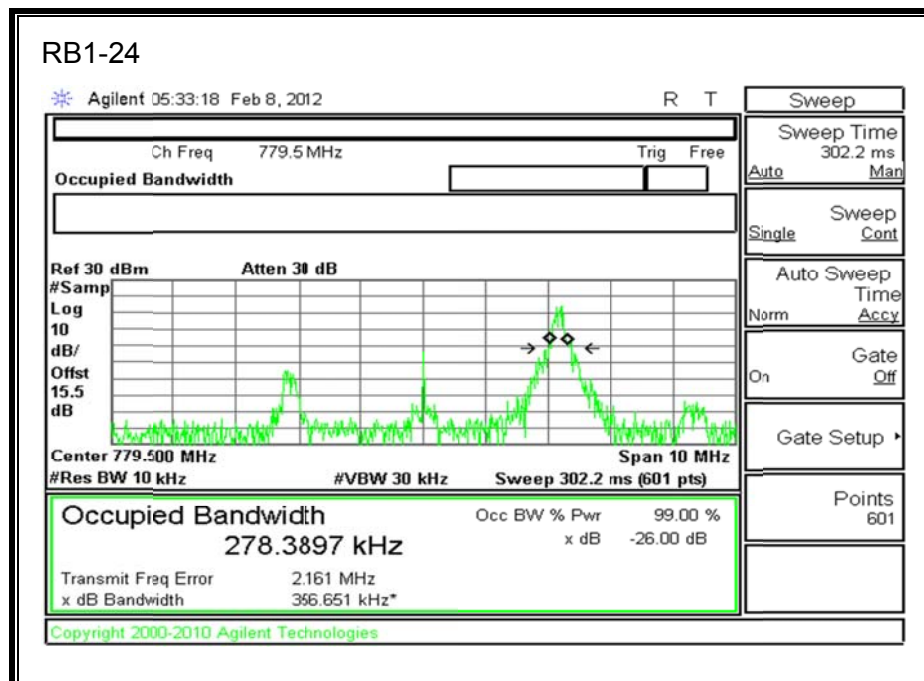
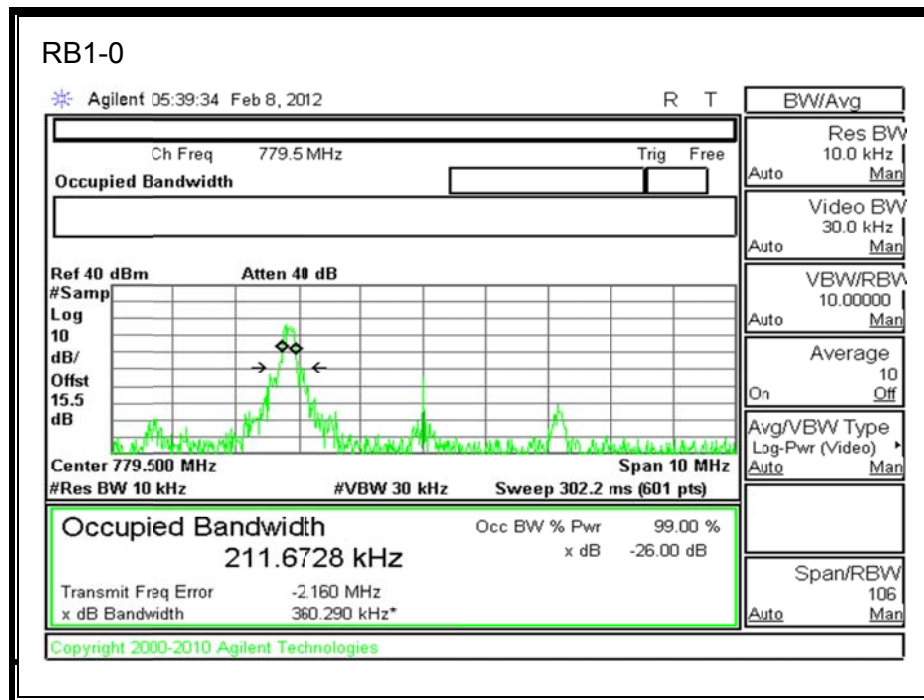
MODES TESTED: LTE Band

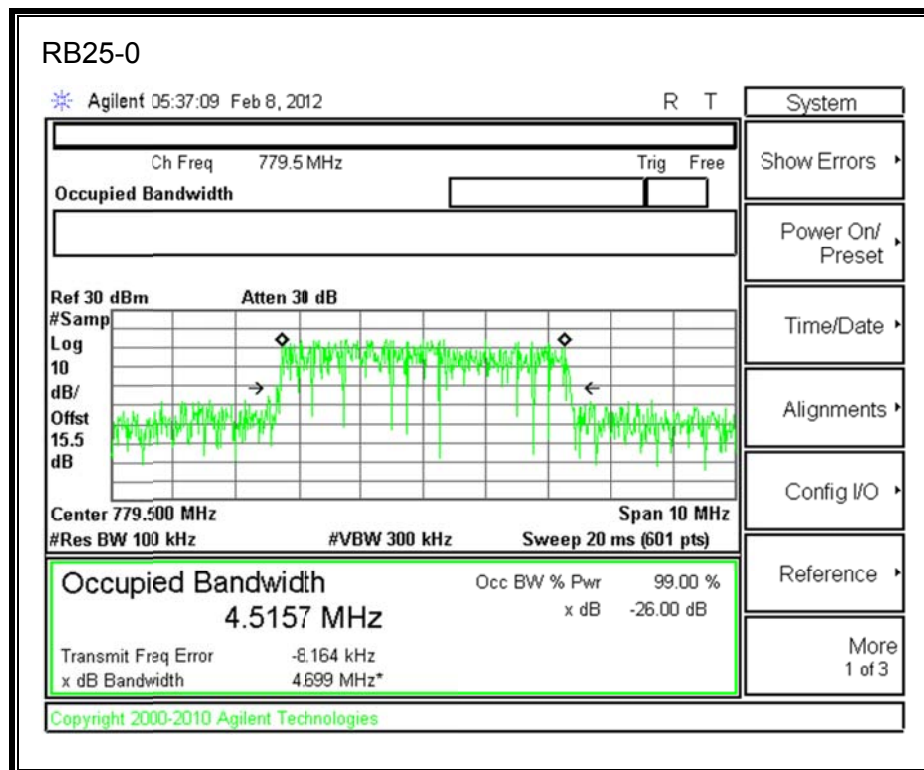
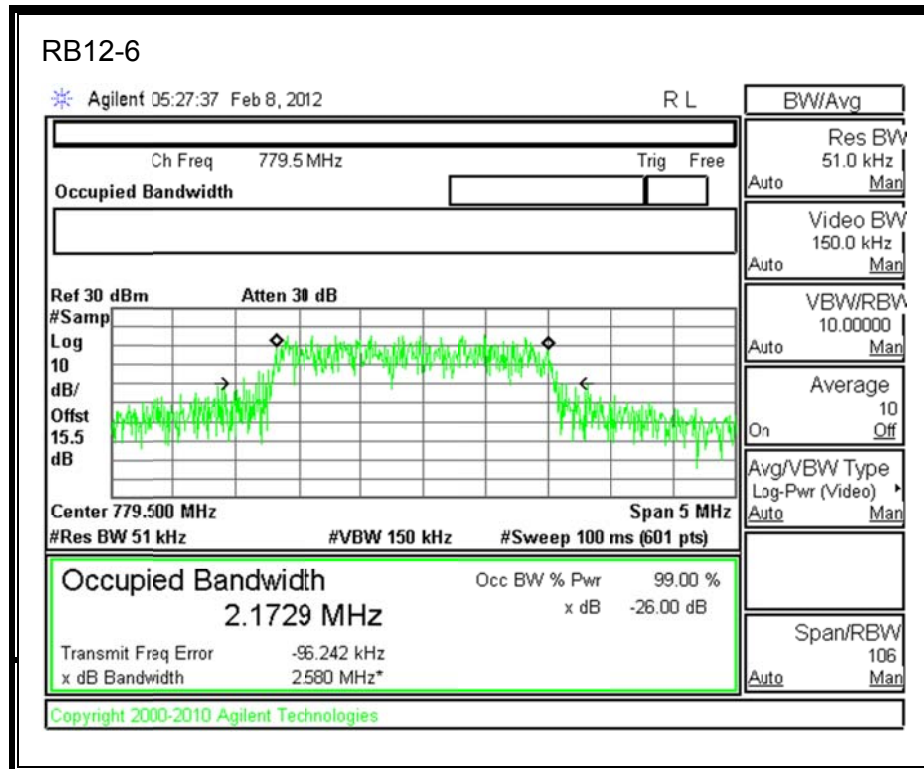
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (kHz)	-26dB BW (KHz)
LTE	5 MHz BAND QPSK	1/0	779.5	211.6728	360.290
		1/24		278.3897	356.651
		12/6		2172.90	2580.00
		25/0		4515.70	4699.00
	5 MHz BAND 16QAM	1/0		232.9749	385.982
		1/24		259.1365	337.582
		12/6		2138.60	2225.00
		25/0		4495.20	4746.00

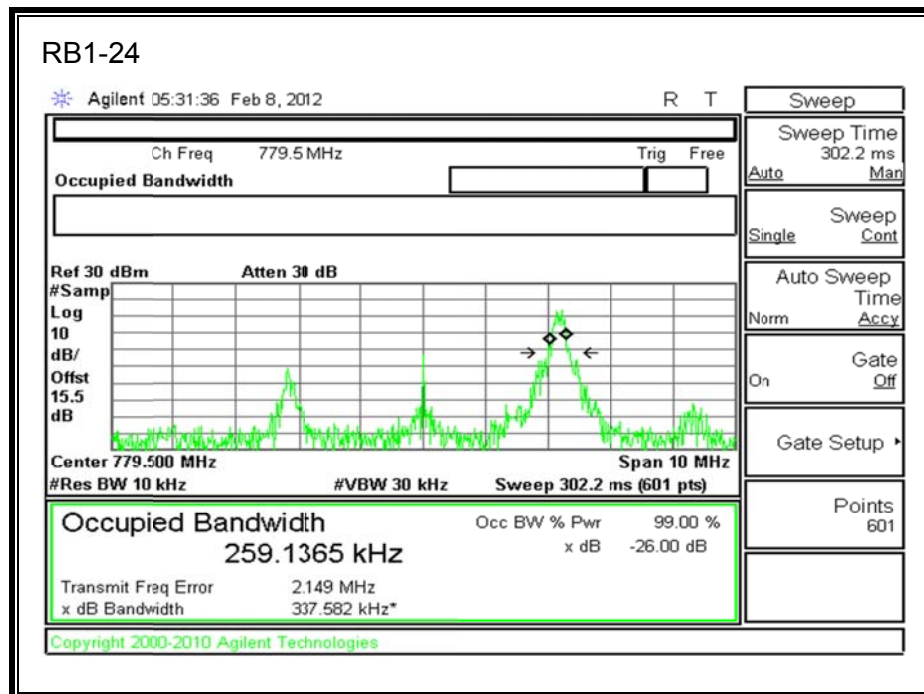
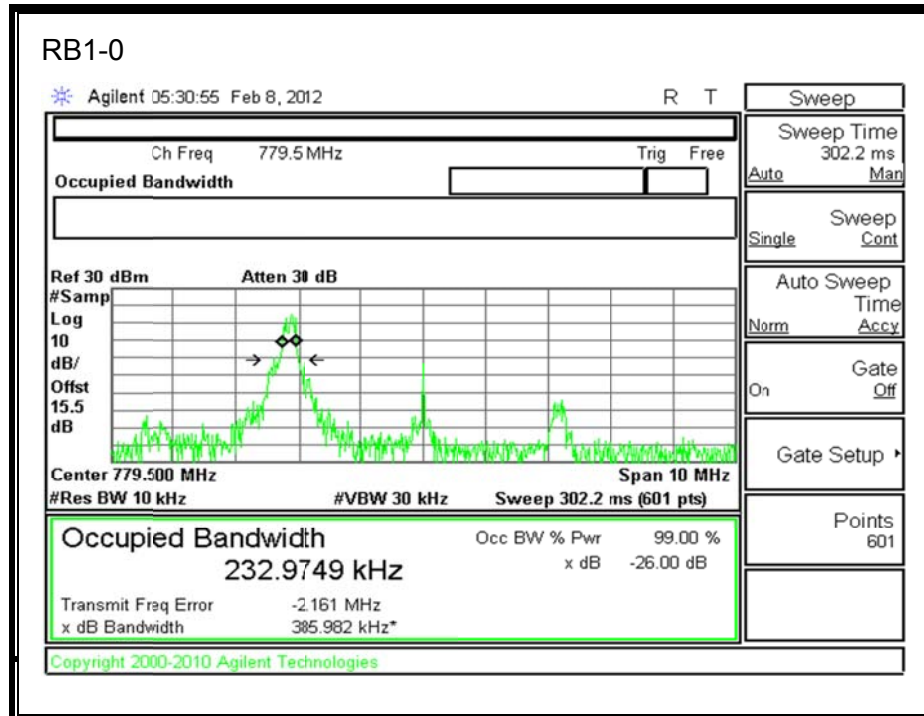
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (kHz)	-26dB BW (KHz)
LTE	5 MHz BAND QPSK	1/0	782	292.5298	383.486
		1/24		336.8320	483.658
		12/6		2151.10	2508.00
		25/0		4515.30	4798.00
	5 MHz BAND 16QAM	1/0		238.5785	390.632
		1/24		272.1100	429.258
		12/6		2157.30	2630.00
		25/0		4457.80	4656.00

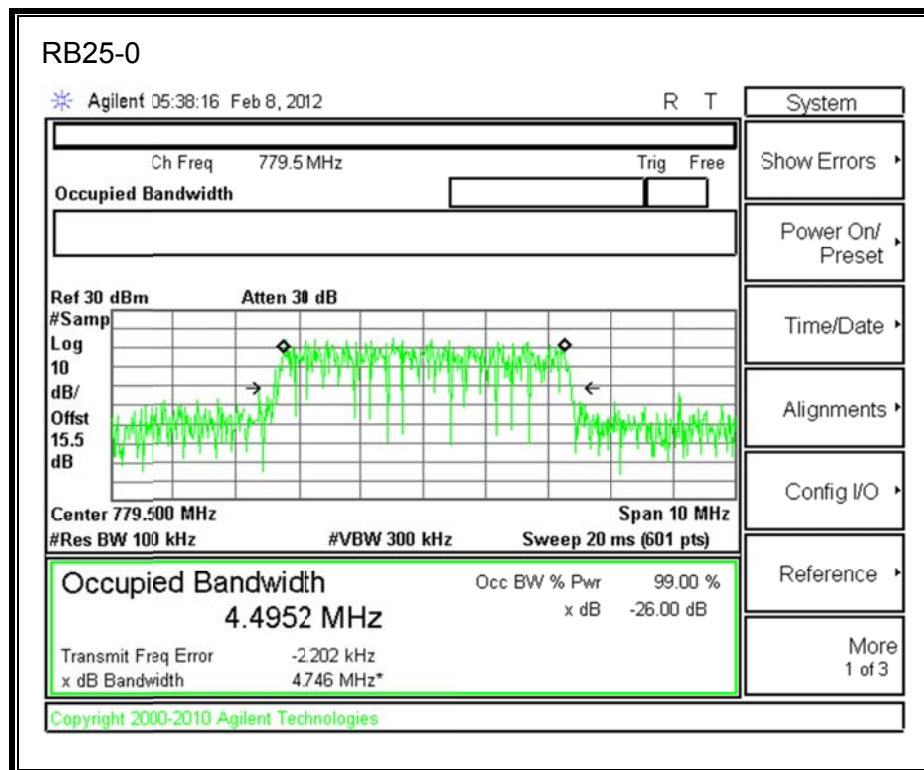
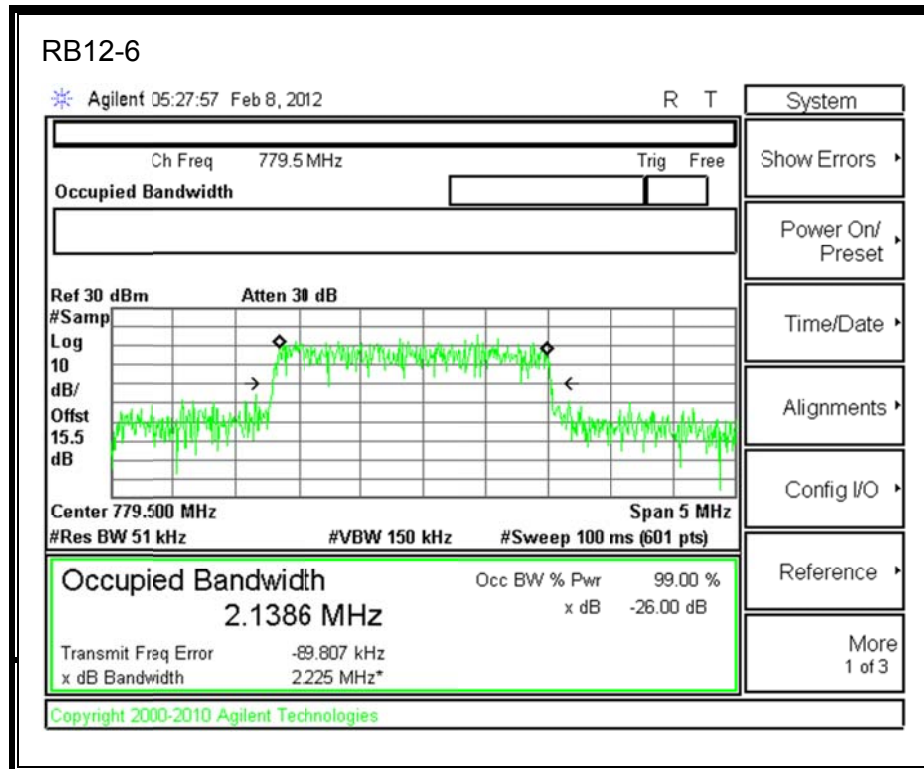
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (kHz)	-26dB BW (MHz)
LTE	10 MHz BAND QPSK	1/0	784.5	233.5355	295.713
		1/24		245.6675	357.772
		12/6		2141.20	2522.00
		25/0		4490.80	4806.00
	10 MHz BAND 16QAM	1/0		225.5086	344.410
		1/24		232.5782	297.216
		12/6		2160.60	2507.00
		25/0		4447.50	4847.00

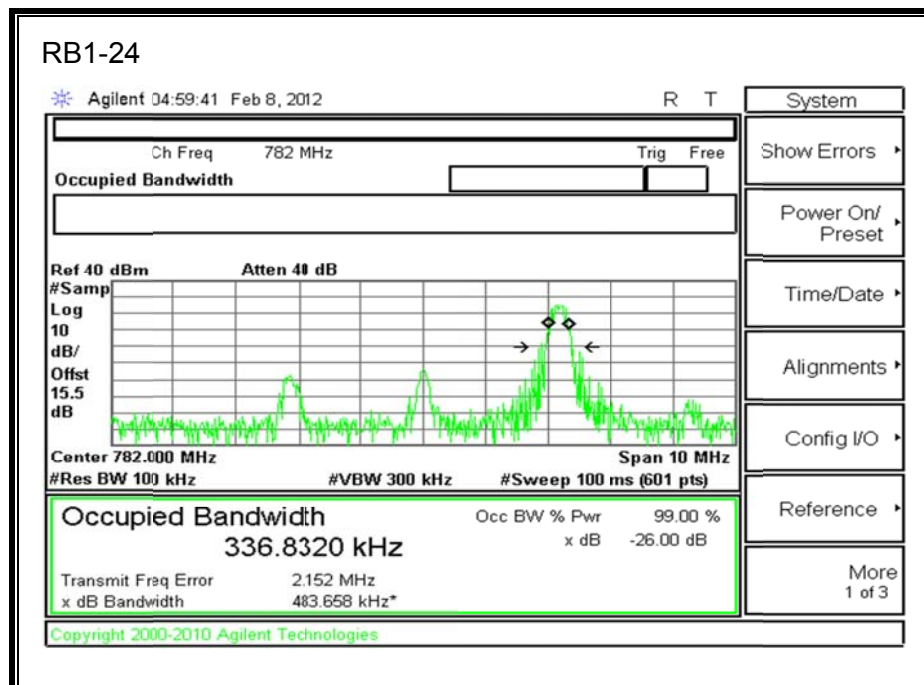
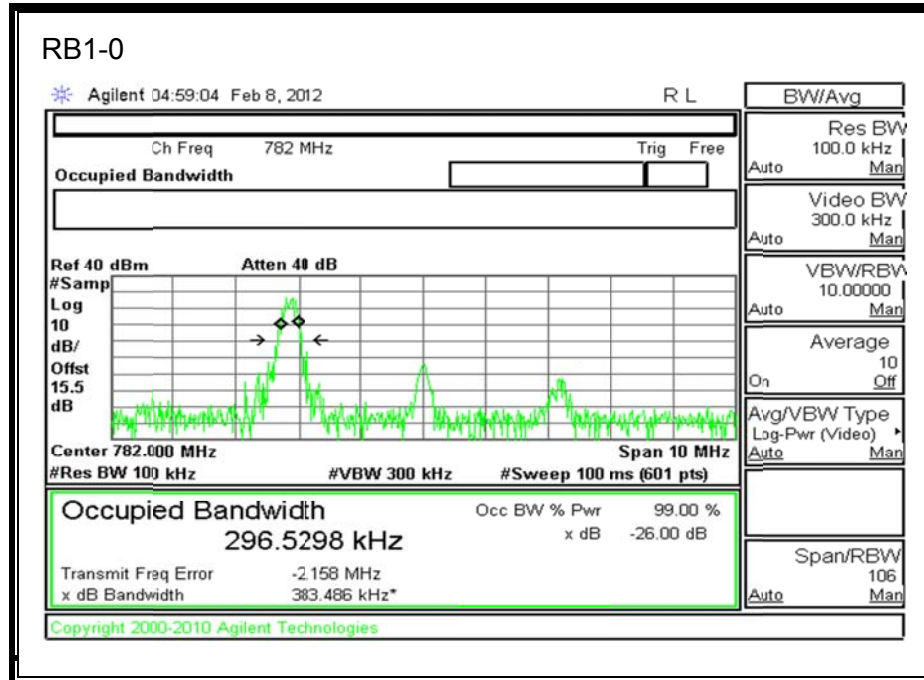
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (kHz)	-26dB BW (MHz)
LTE	10 MHz BAND QPSK	1/0	782	327.5481	4.659
		1/49		297.9415	4.603
		25/12		4532.30	4.901
		50/0		8892.80	9.358
	10 MHz BAND 16QAM	1/0		294.0165	4.566
		1/49		281.8627	4.602
		25/12		4544.40	4.855
		50/0		9022.30	9.465

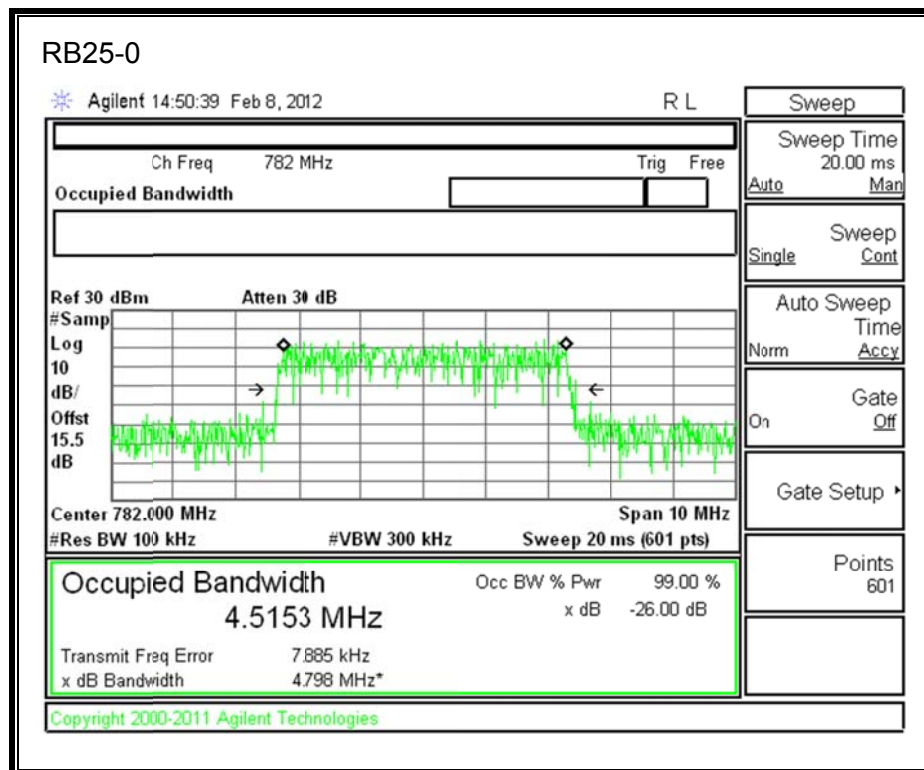
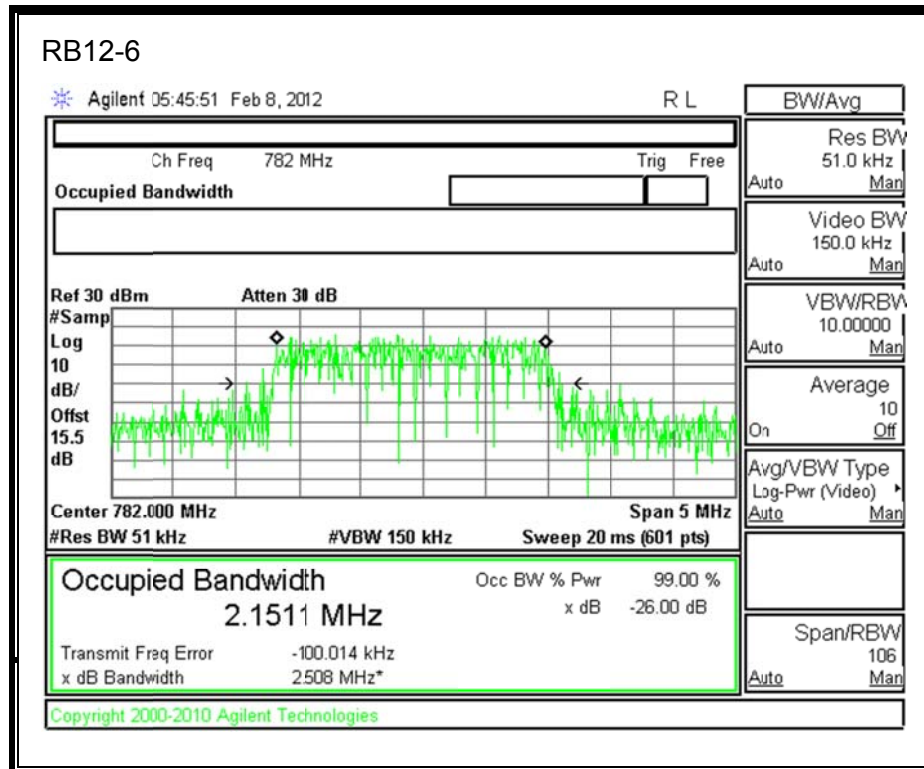
LTE Band 13**Band 13 QPSK (5MHz Bandwidth)****779.5MHz**

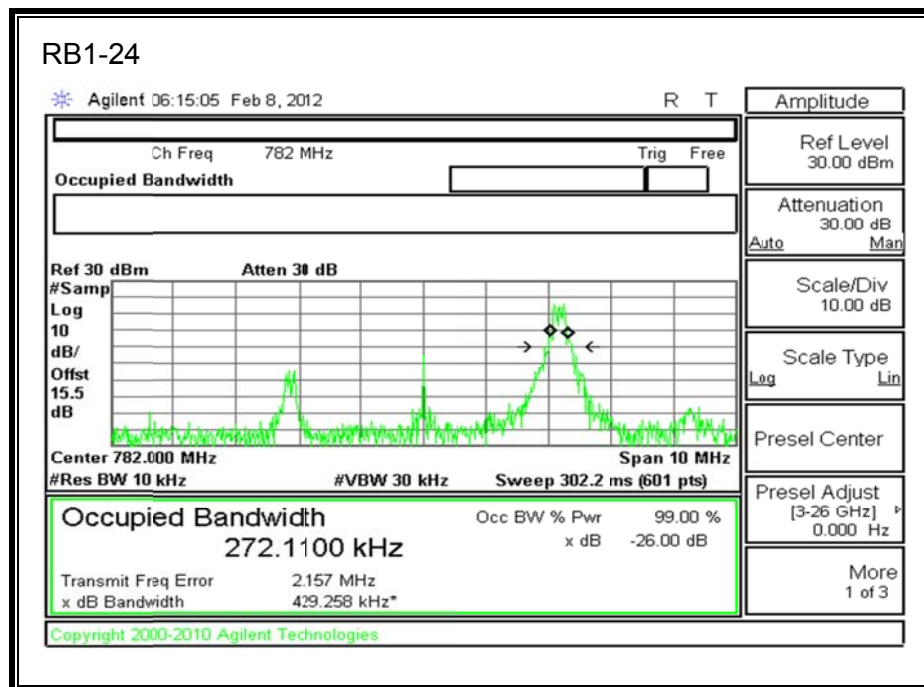
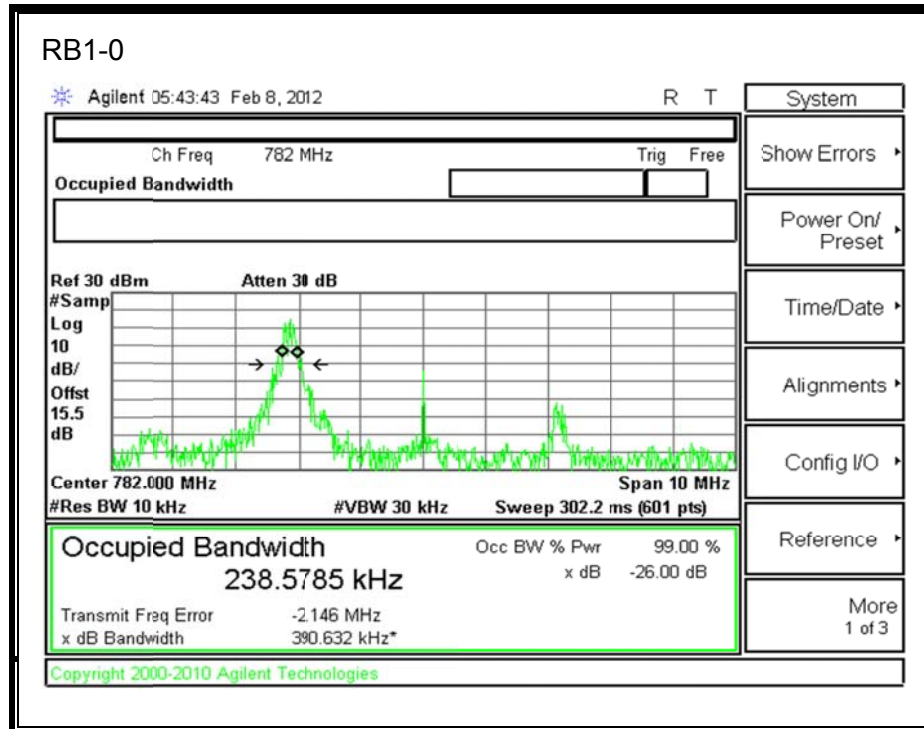


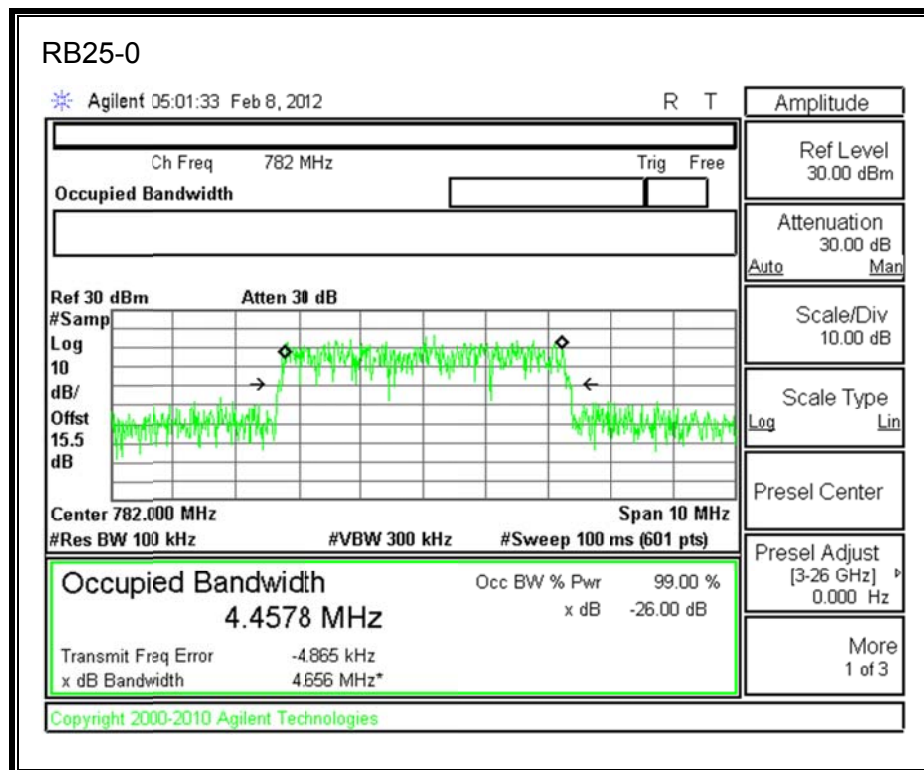
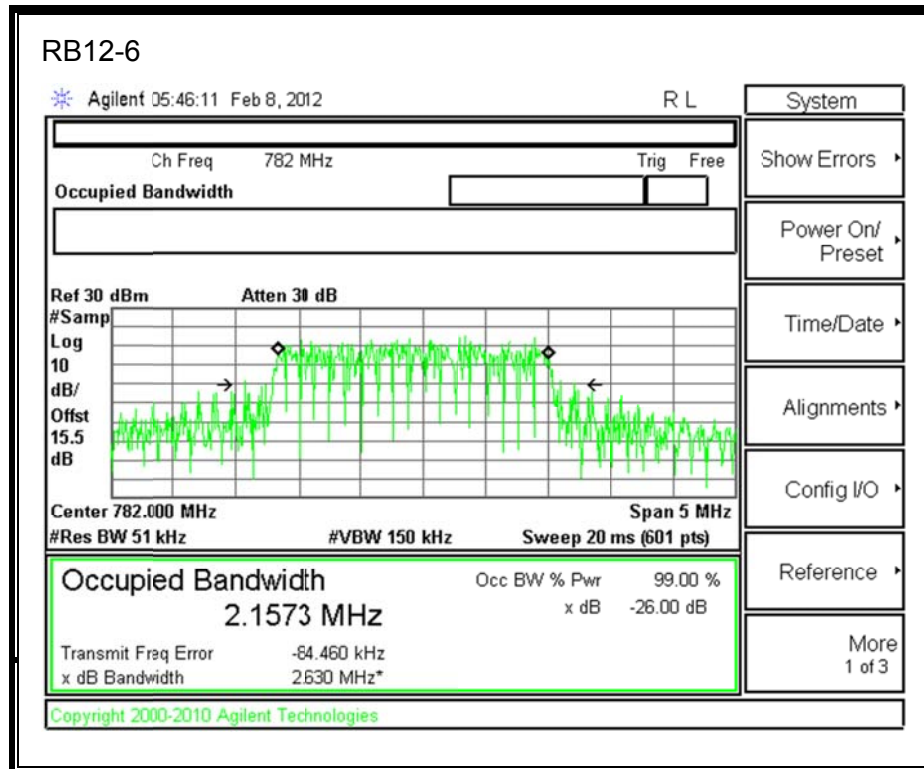
Band 13 16QAM (5MHz Bandwidth)**779.5.MHz**

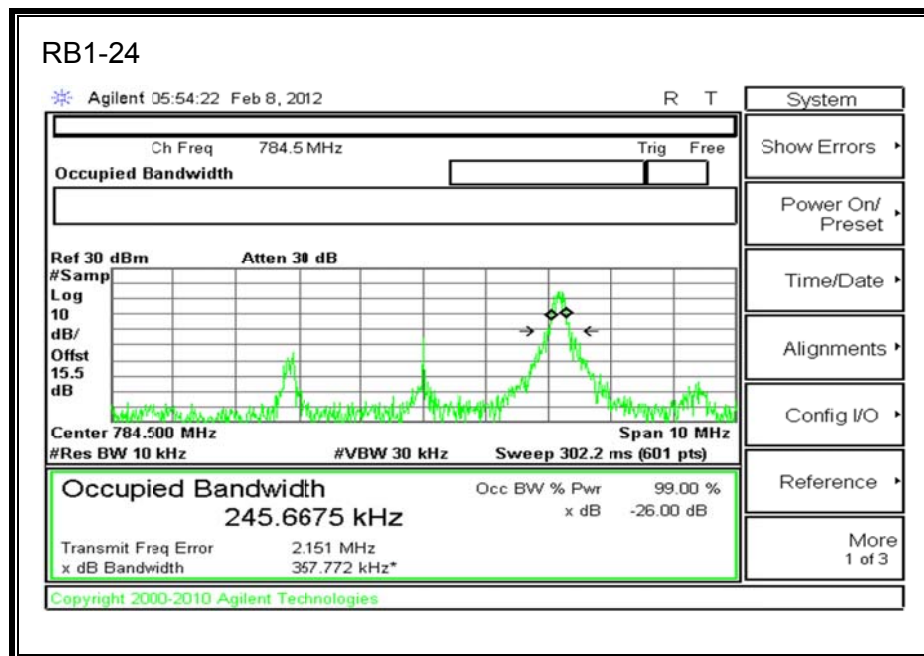
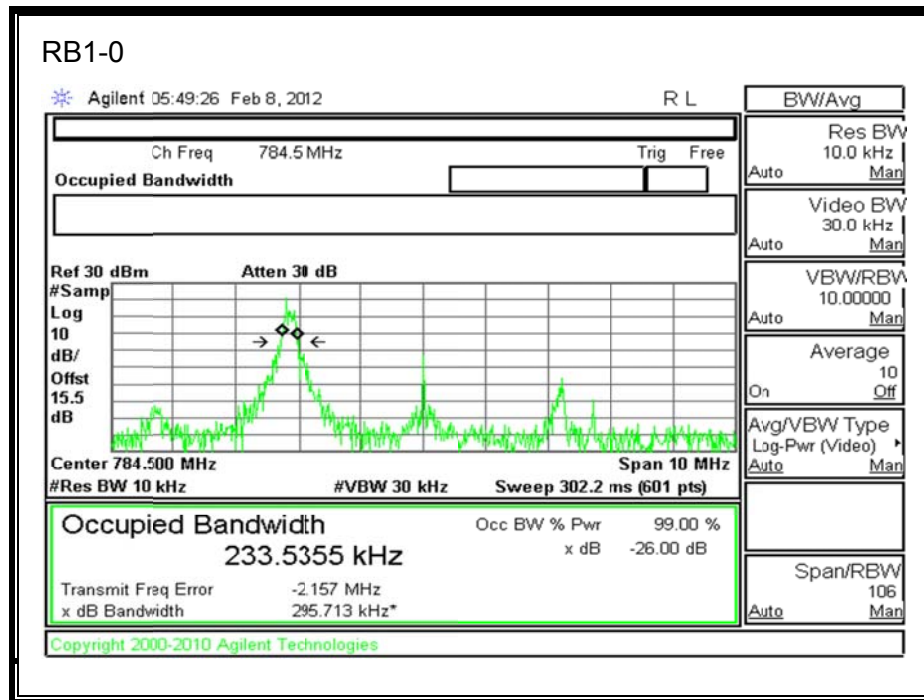


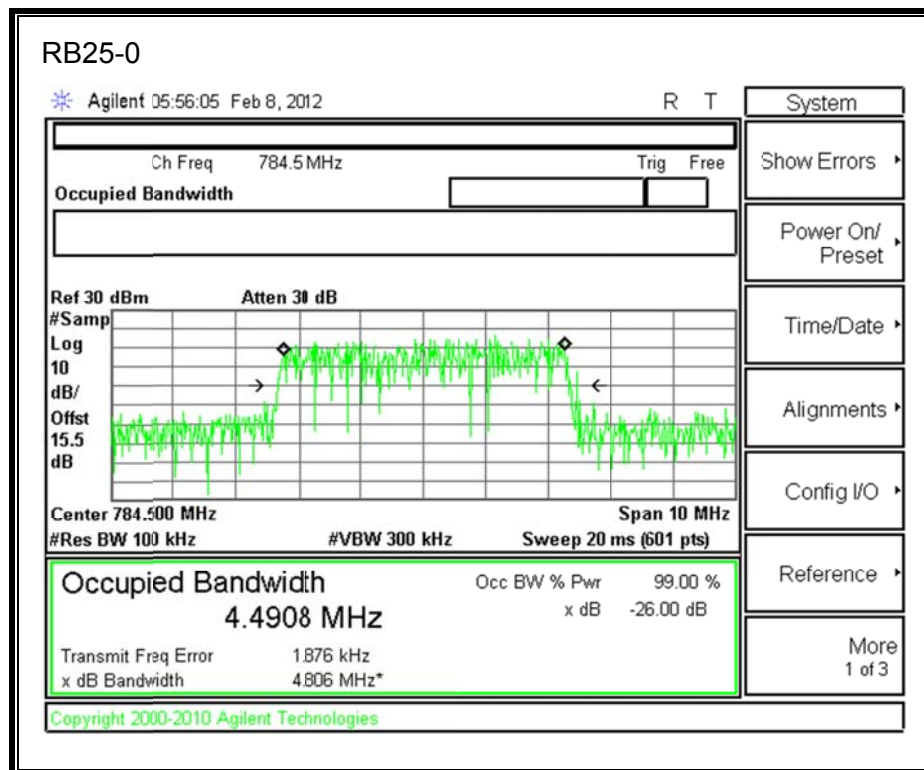
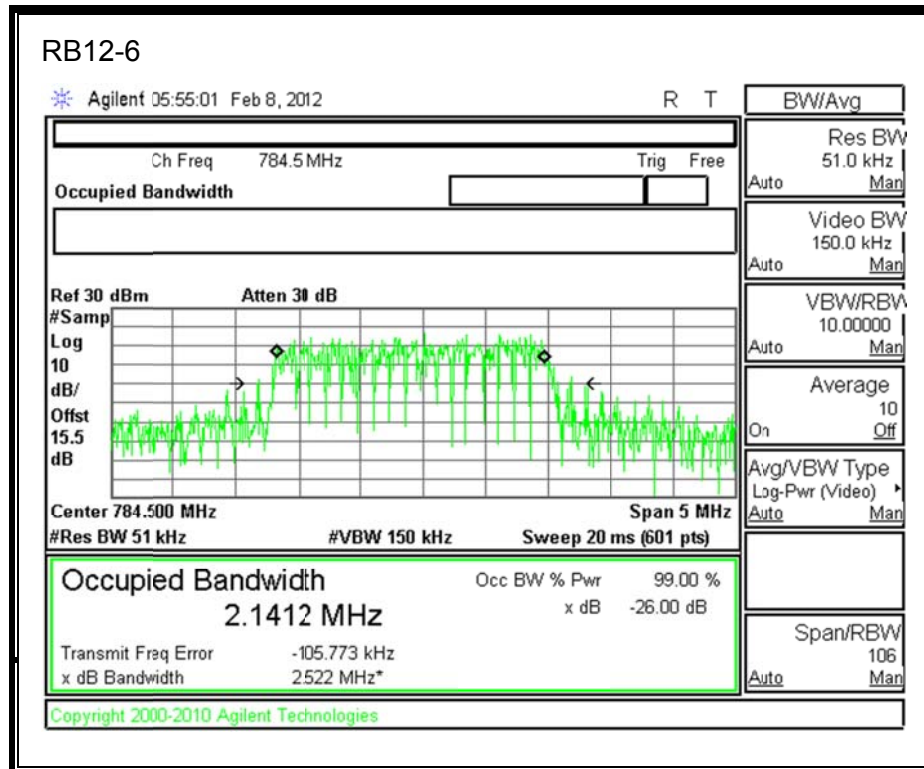
LTE Band 13**Band 13 QPSK (5MHz Bandwidth)****782MHz**

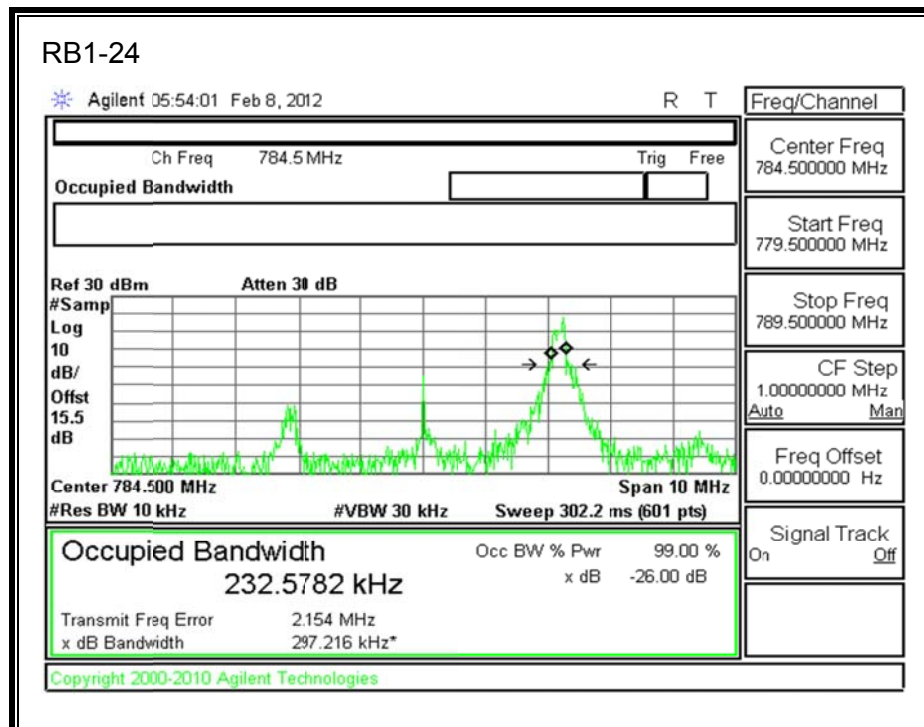
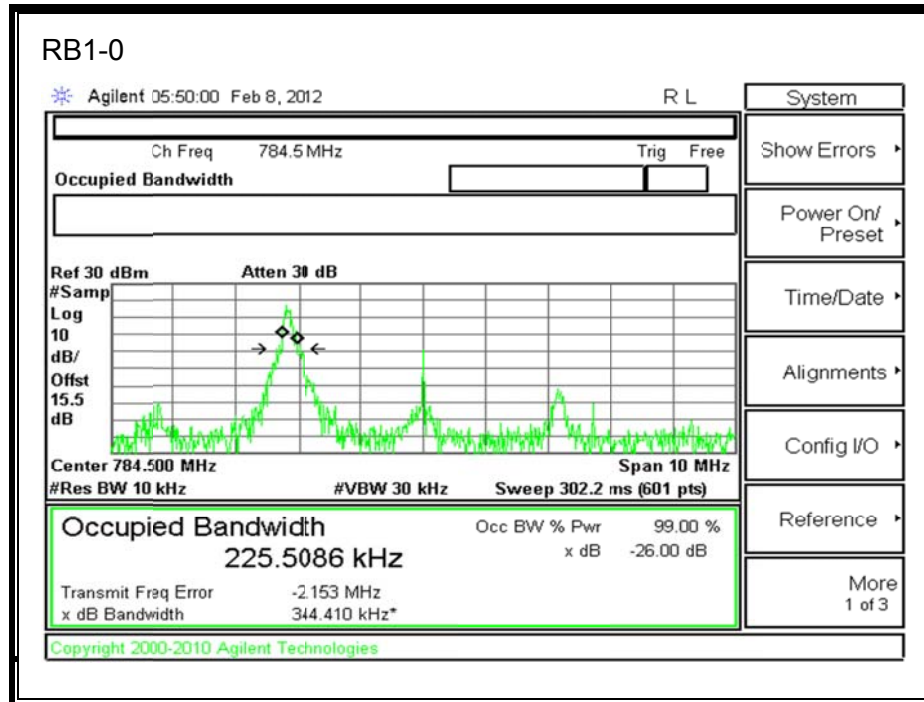


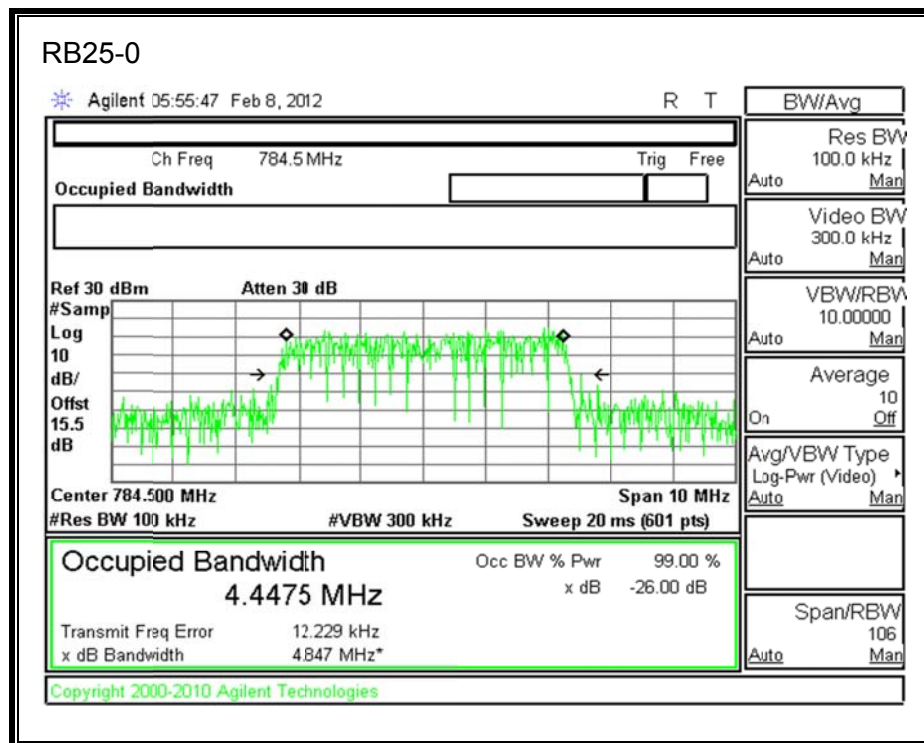
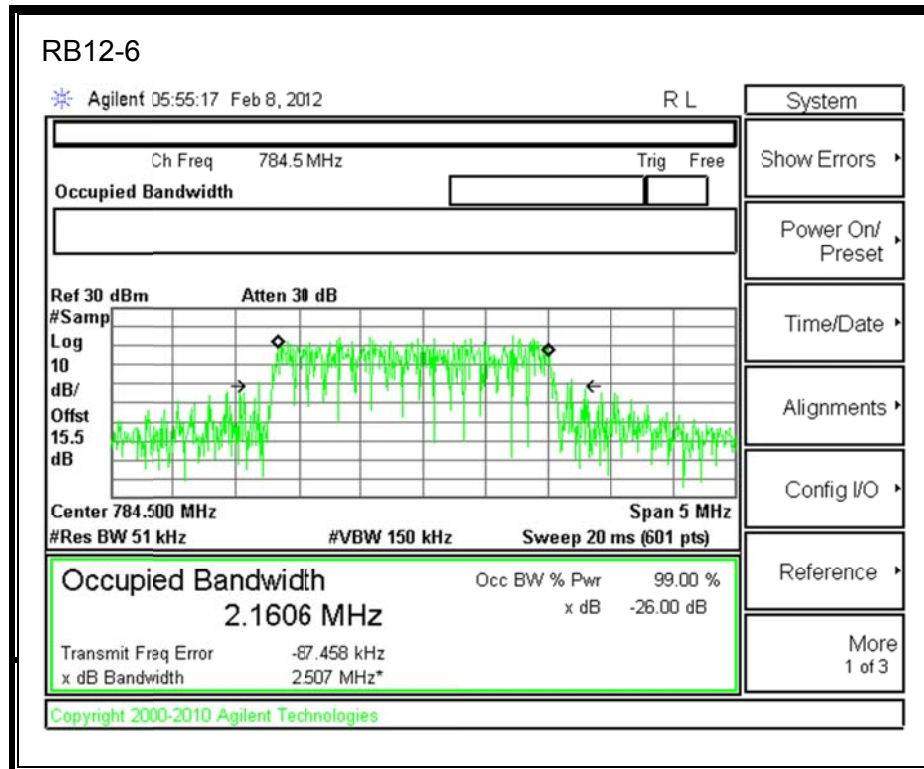
Band 13 16QAM (5MHz Bandwidth)**782.MHz**

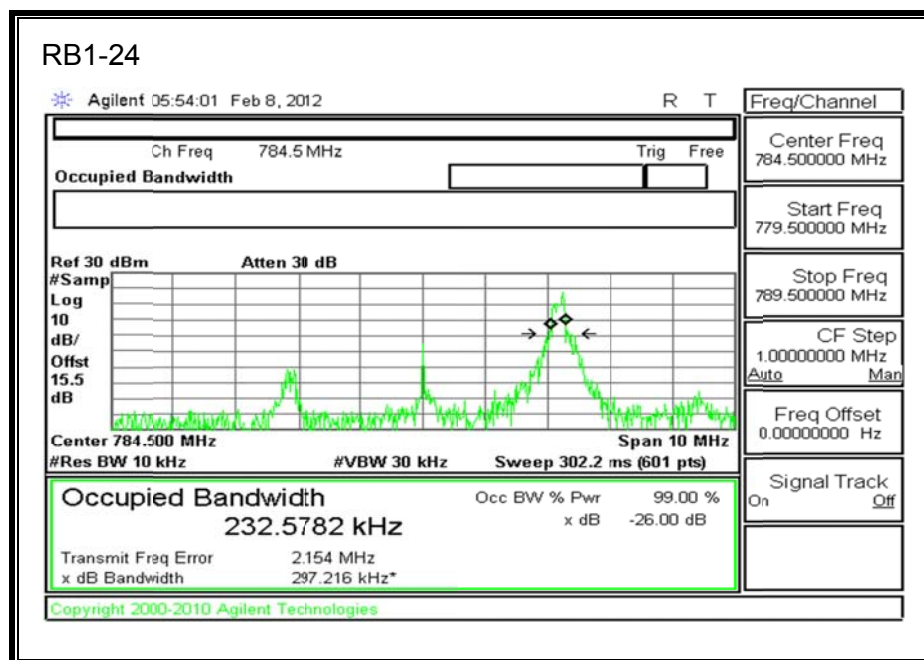
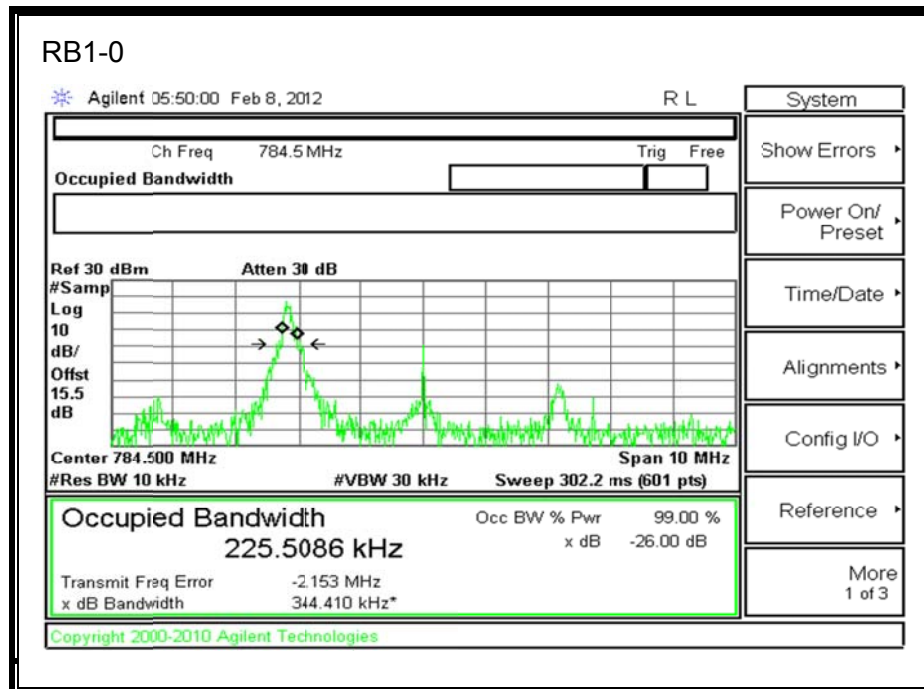


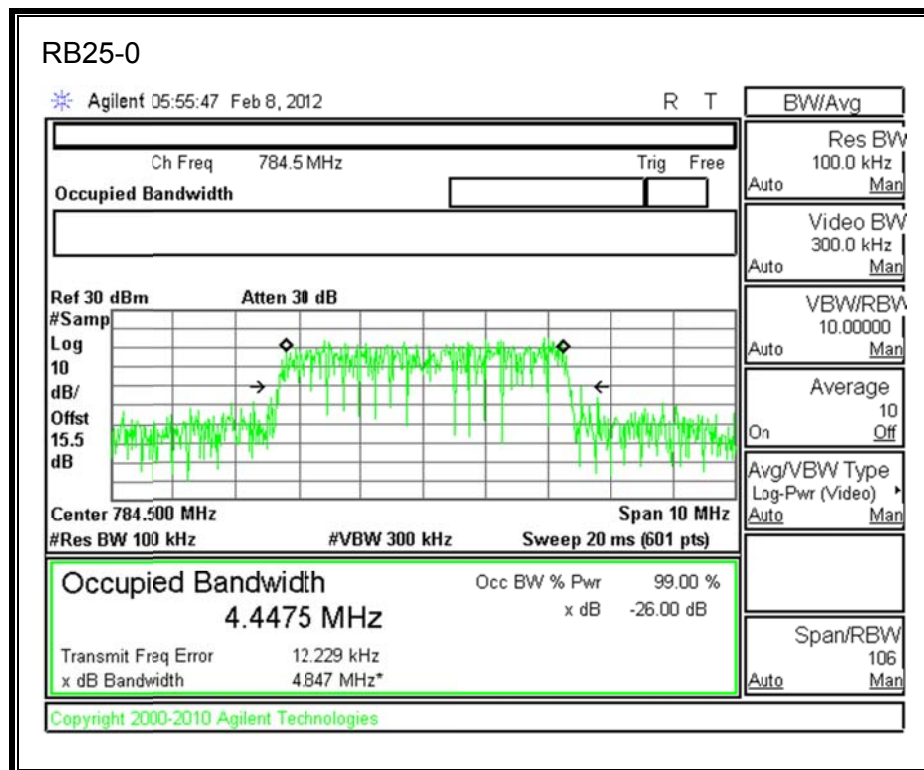
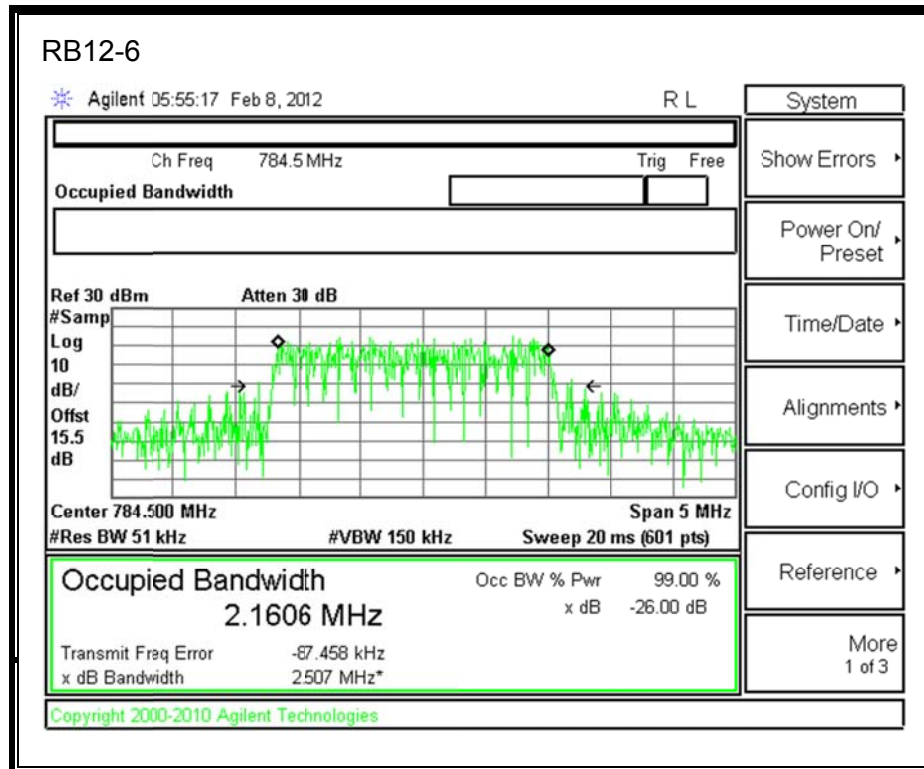
LTE Band 13**Band 13 QPSK (5MHz Bandwidth)****784.5MHzMHz**

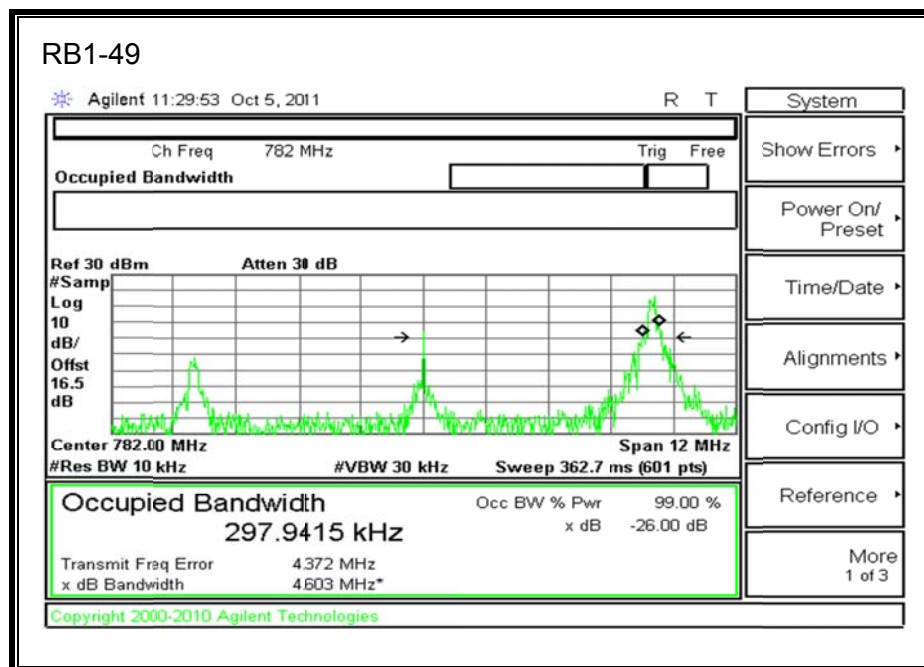
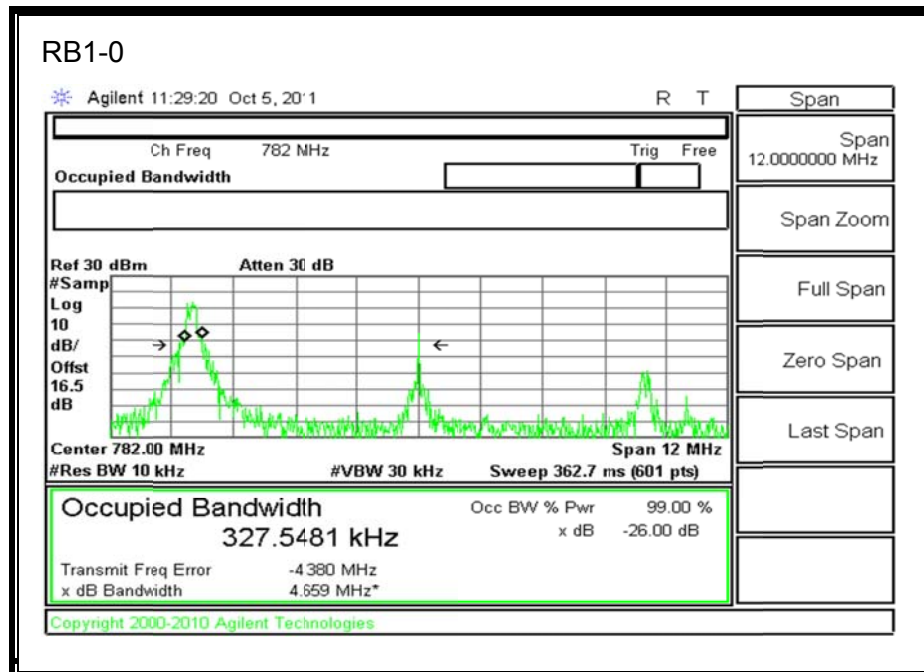


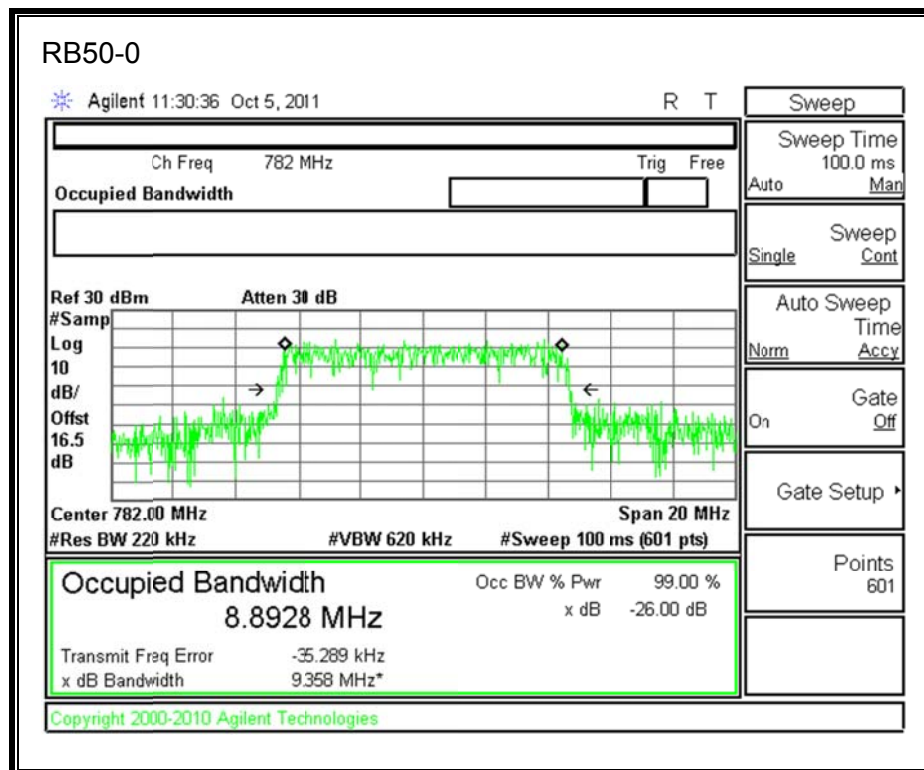
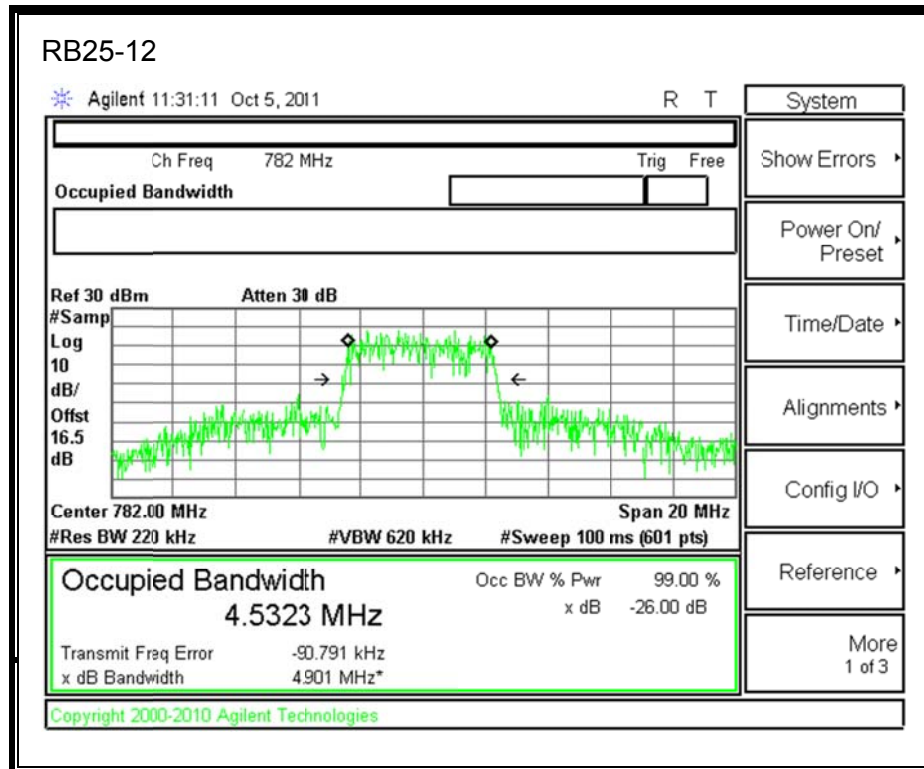
Band 13 16QAM (5MHz Bandwidth)**784.5.MHz**

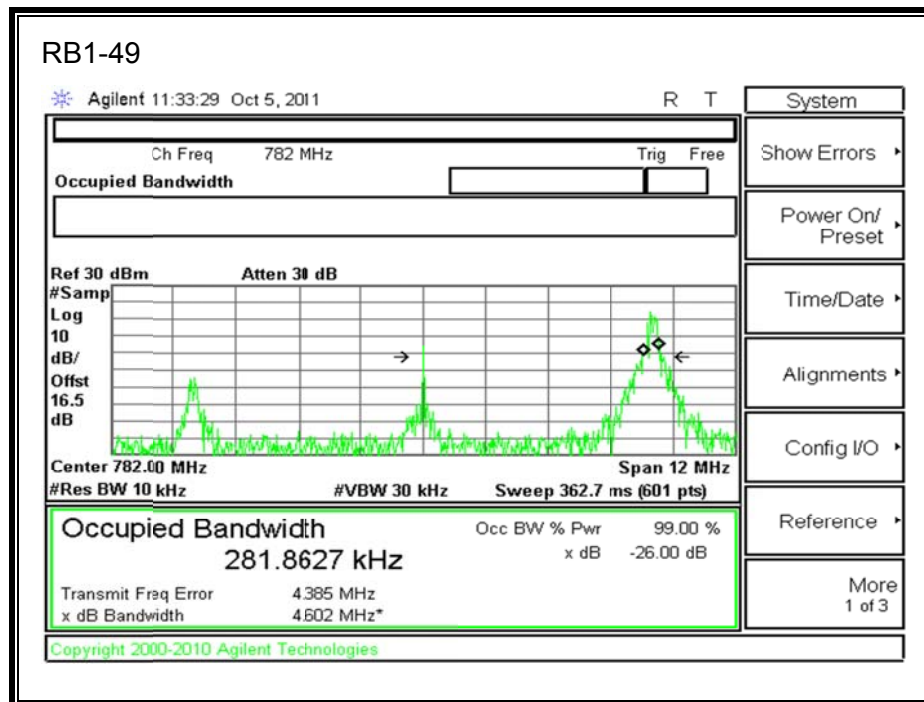
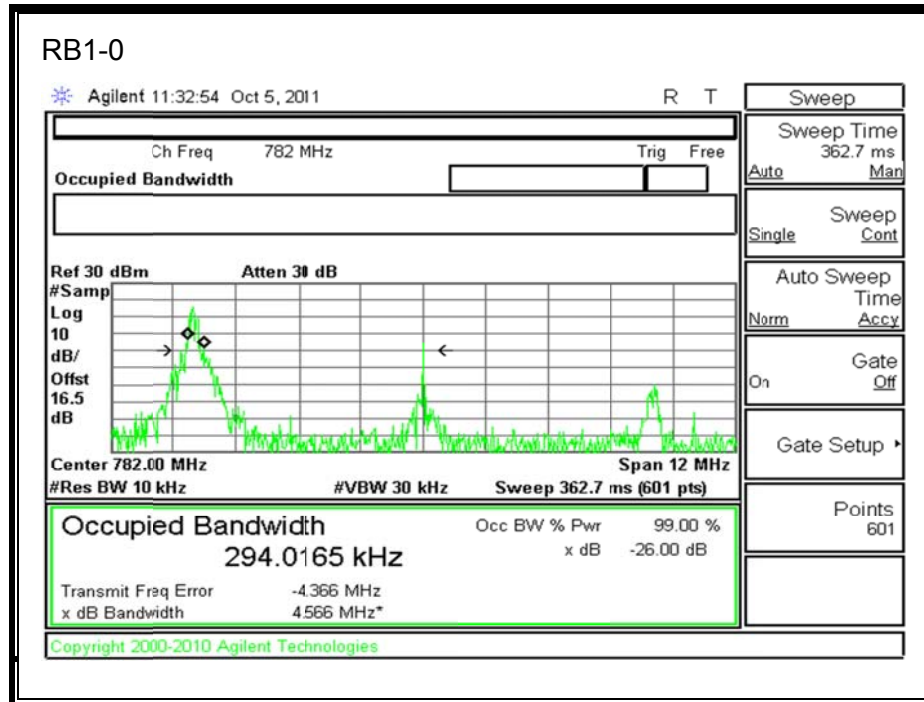


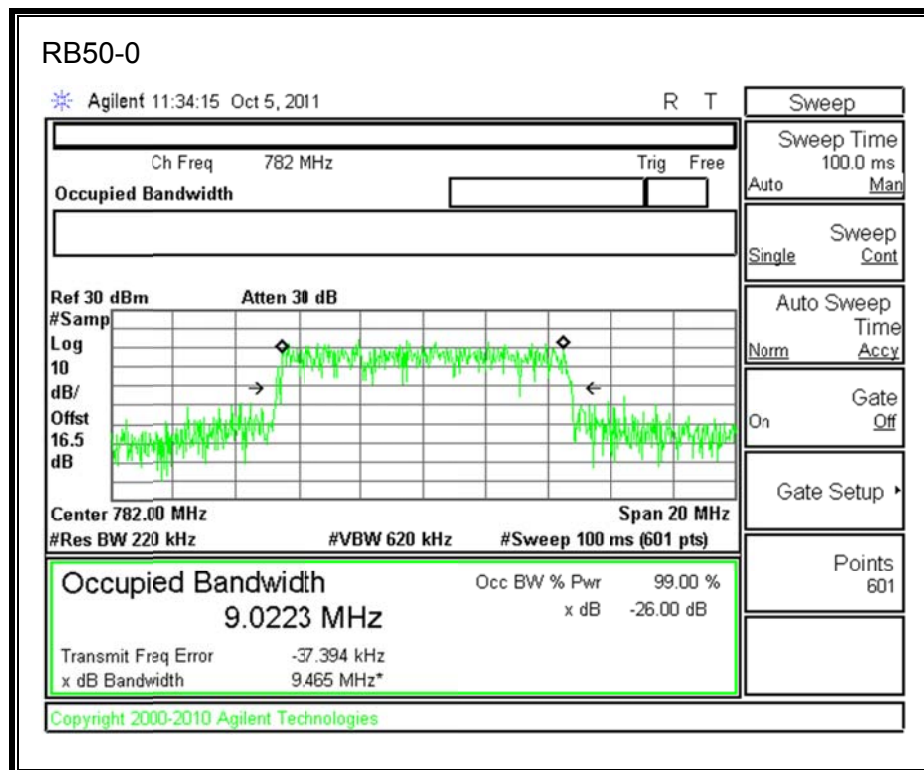
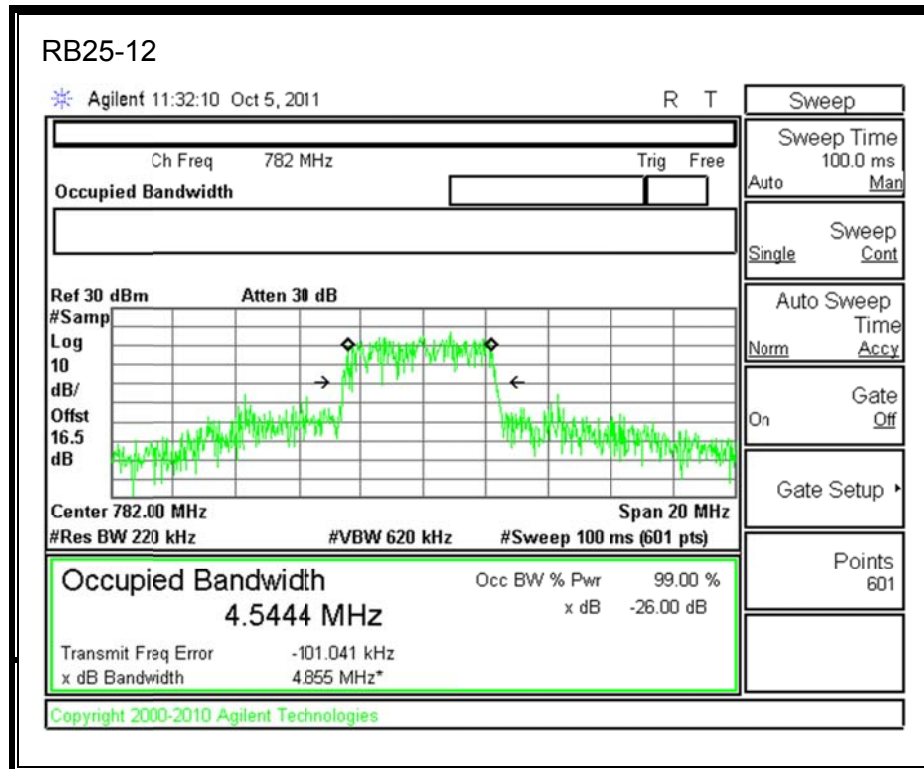
LTE Band 13**Band 13 16QAM (5MHz Bandwidth)****784.5MHz**



LTE Band 13Band 13 QPSK (10MHz Bandwidth)782MHz



Band 13 16QAM (10MHz Bandwidth)**782MHz**



8.2. BAND EDGE

RULE PART(S)

FCC part 27.53(c)

LIMITS

On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

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

Compliance with the provisions of paragraphs above of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

TEST PROCEDURE

The transmitter output was connected to an 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.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

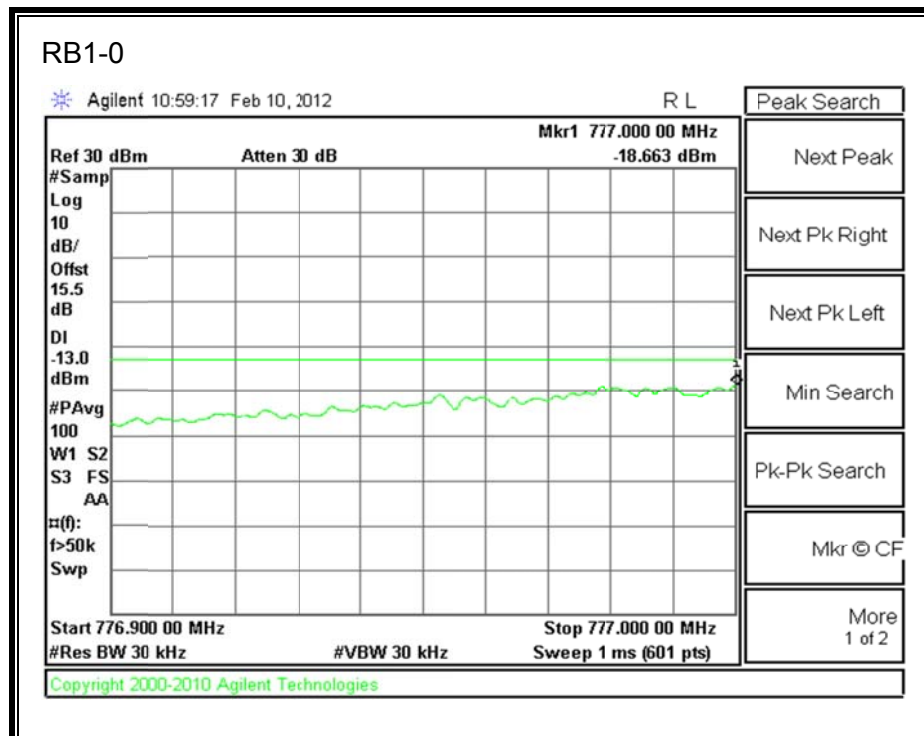
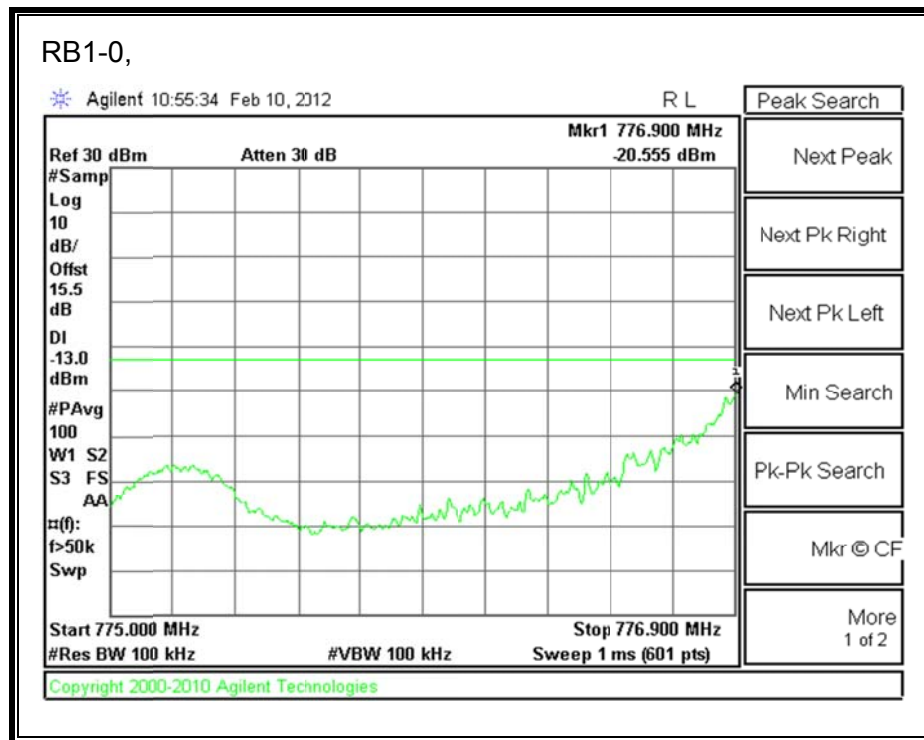
NOTE:

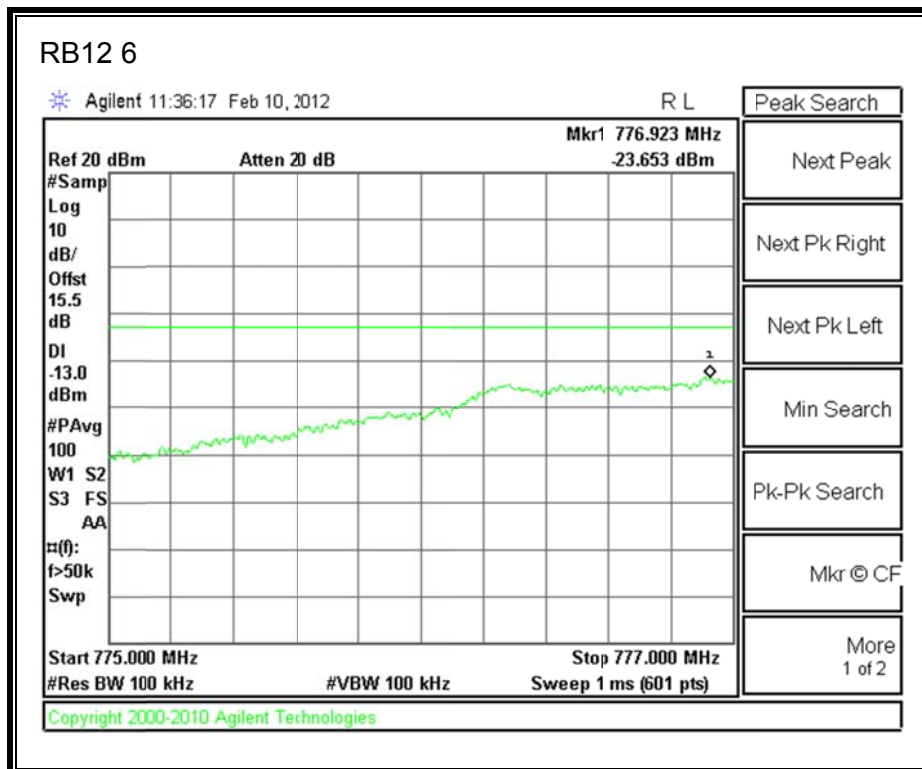
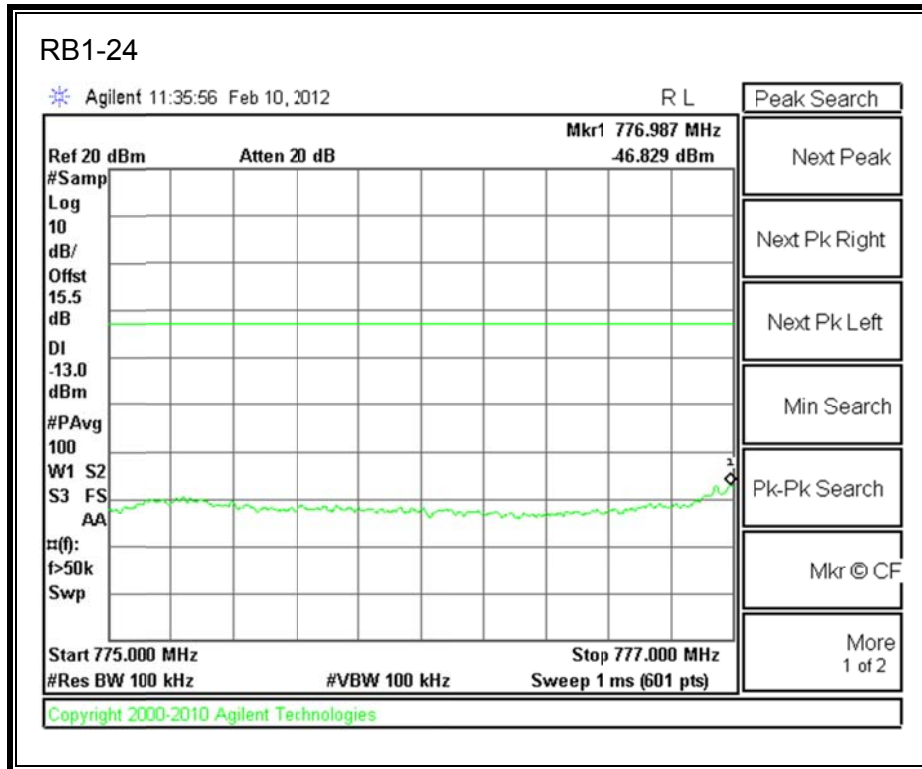
For emissions between 763–775 MHz and 793–805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment. By using a 10 kHz bandwidth resolution, the limit was adjusted by $10 \cdot \log (10 \text{ kHz} / 6.25 \text{ kHz}) = 2.04 \text{ dB}$. Thus, the limit shown in the 763-775MHz and 793-805MHz band for all available modulation types was $-35 \text{ dBm} + 2.04 \text{ dB} = -32.96 \text{ dBm}$.

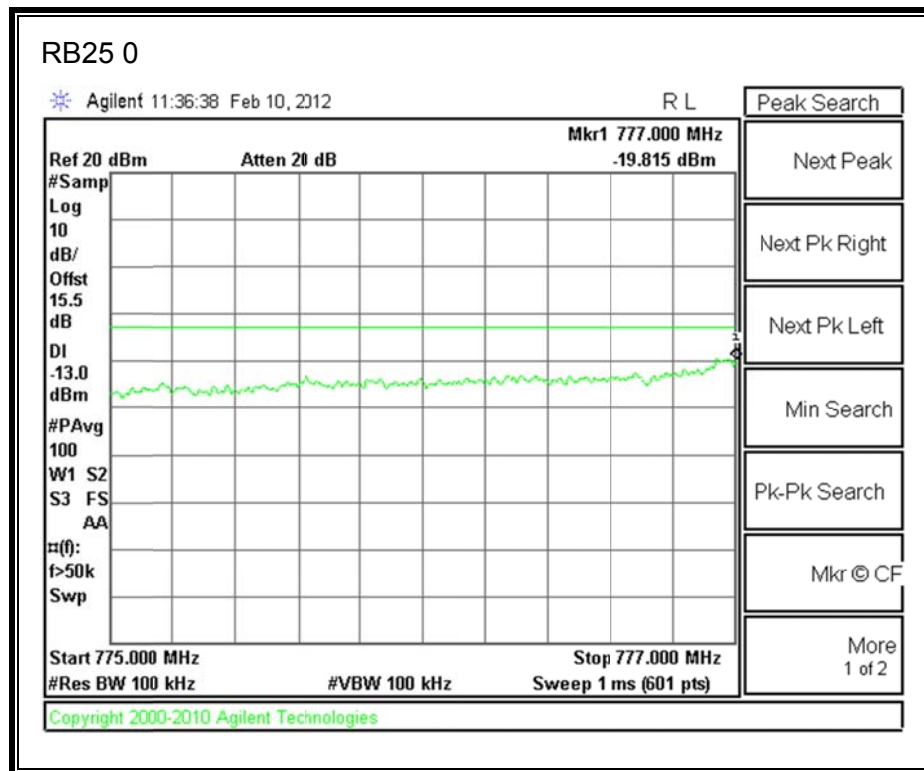
MODES TESTED

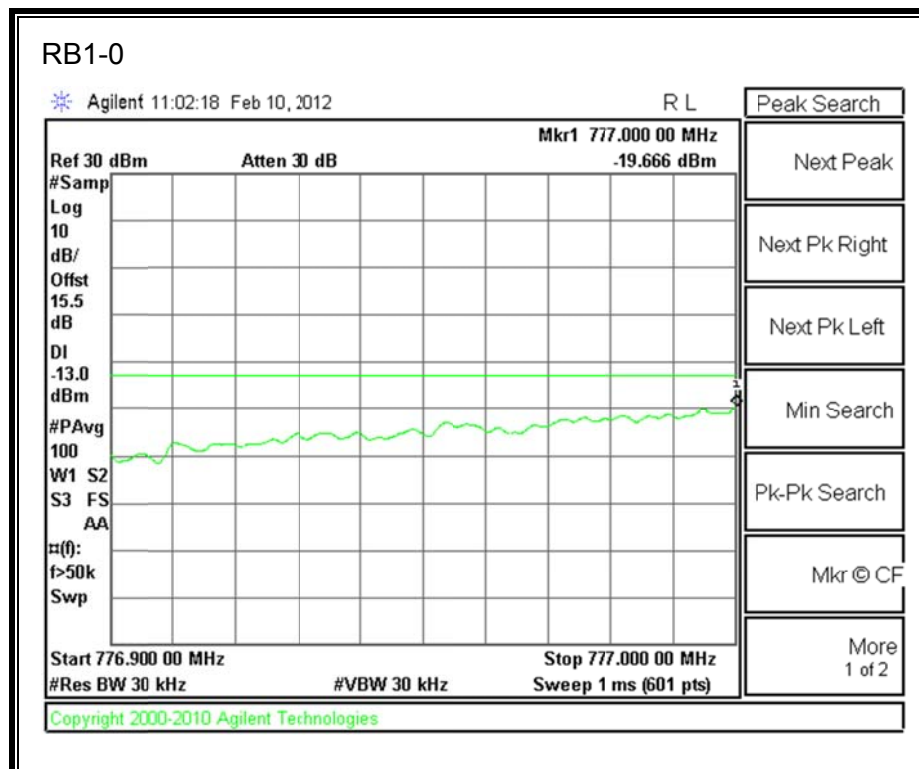
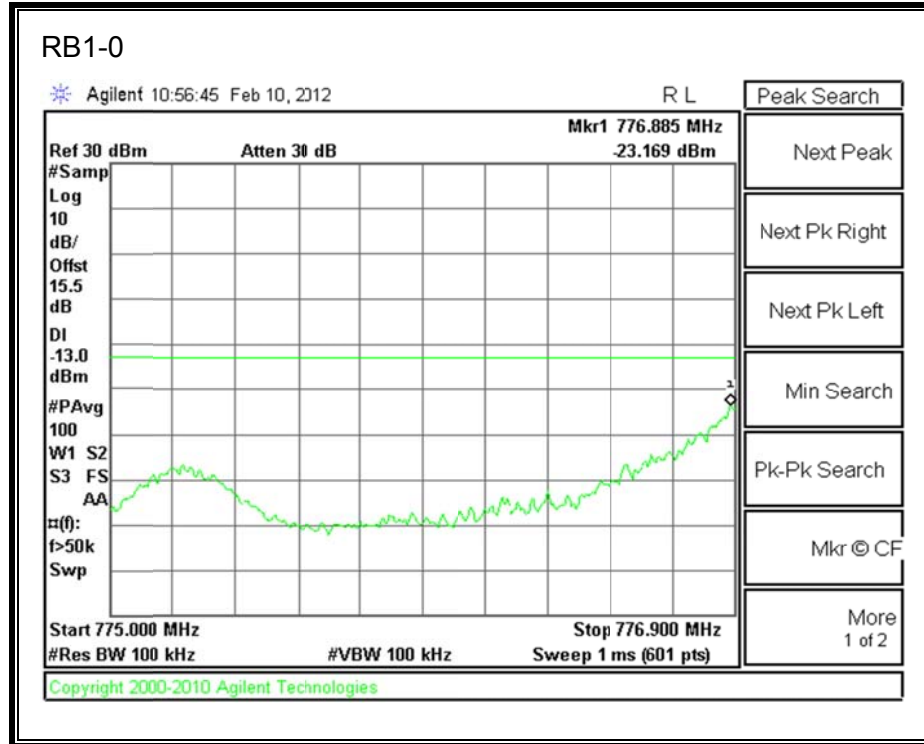
LTE BAND 13

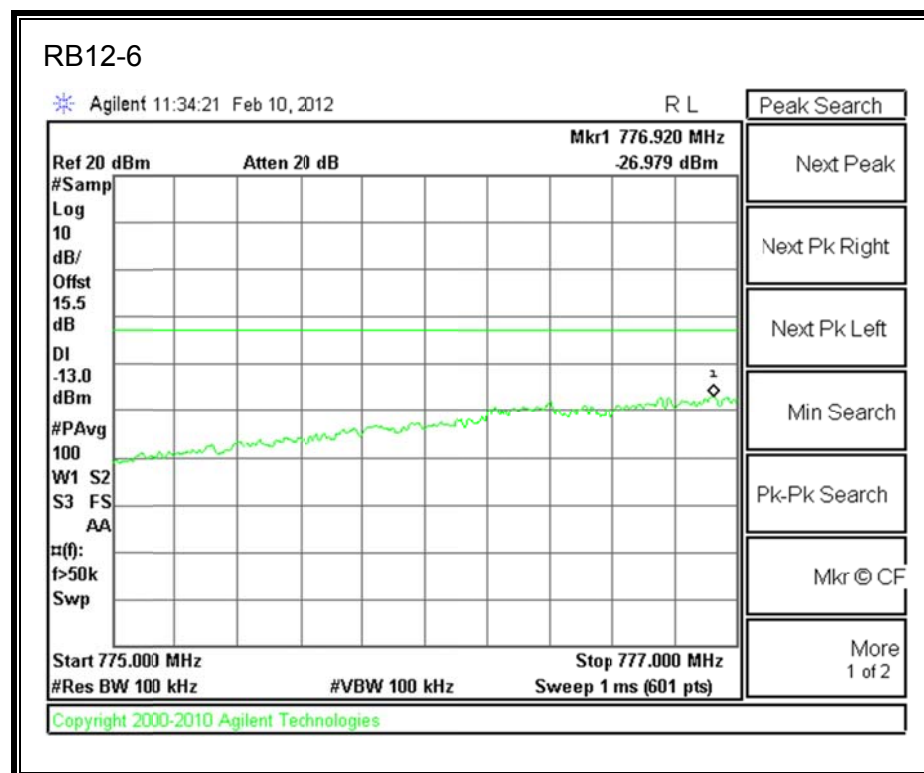
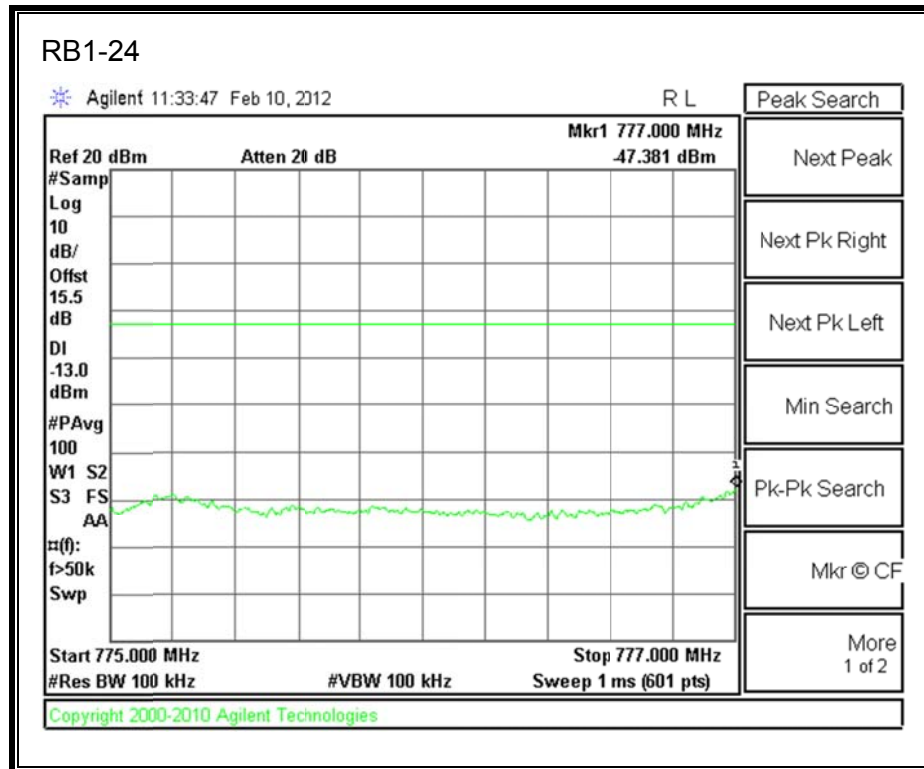
RESULTS

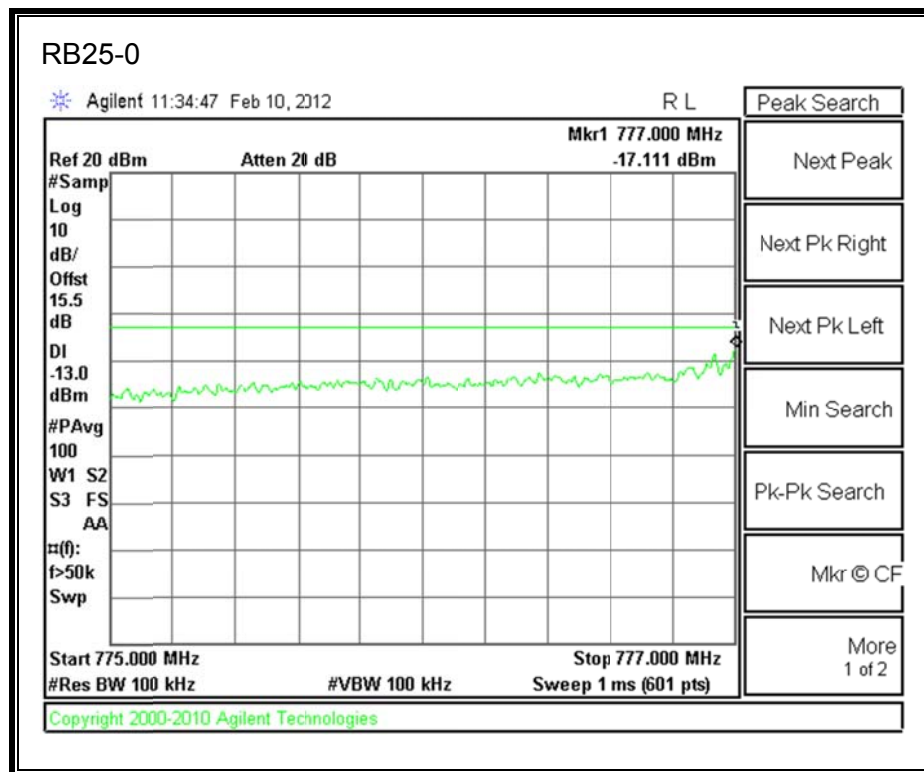
LTE QPSK 779.5 MHz Band 13, 775 – 777MHz (5MHz Bandwidth)

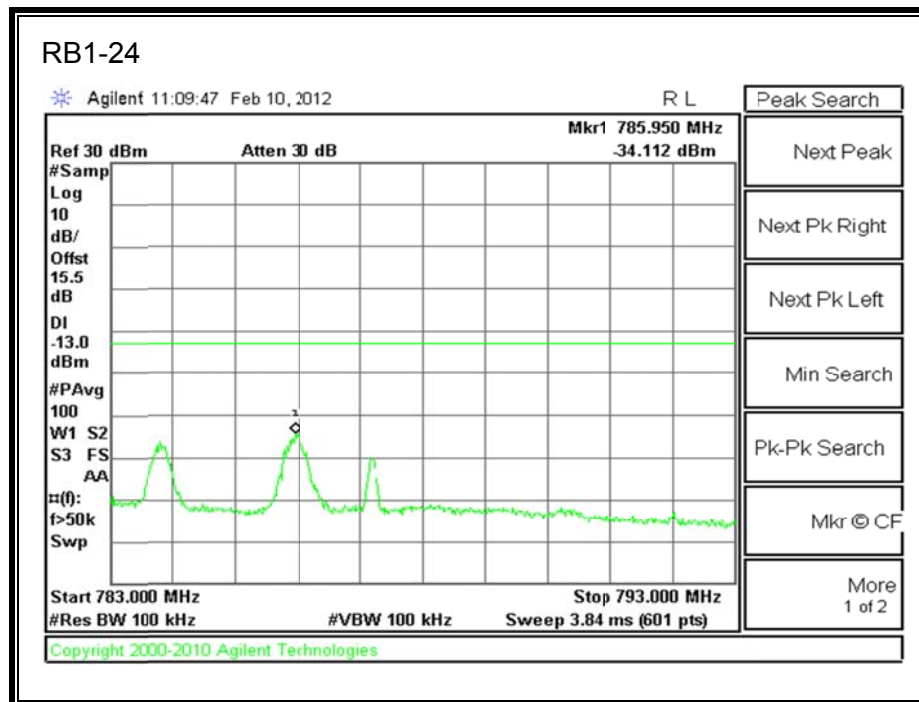
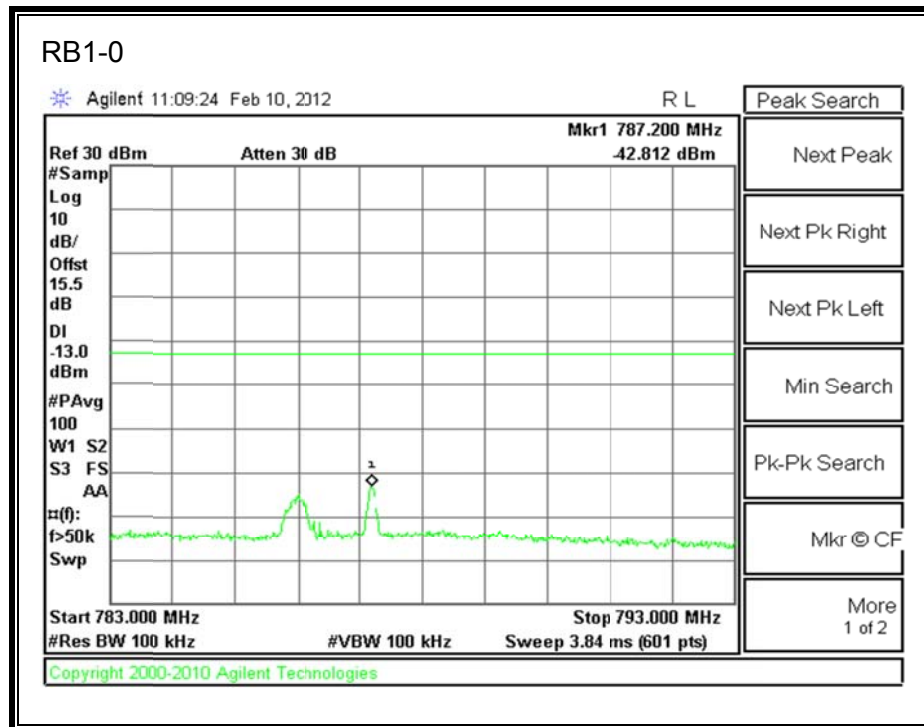


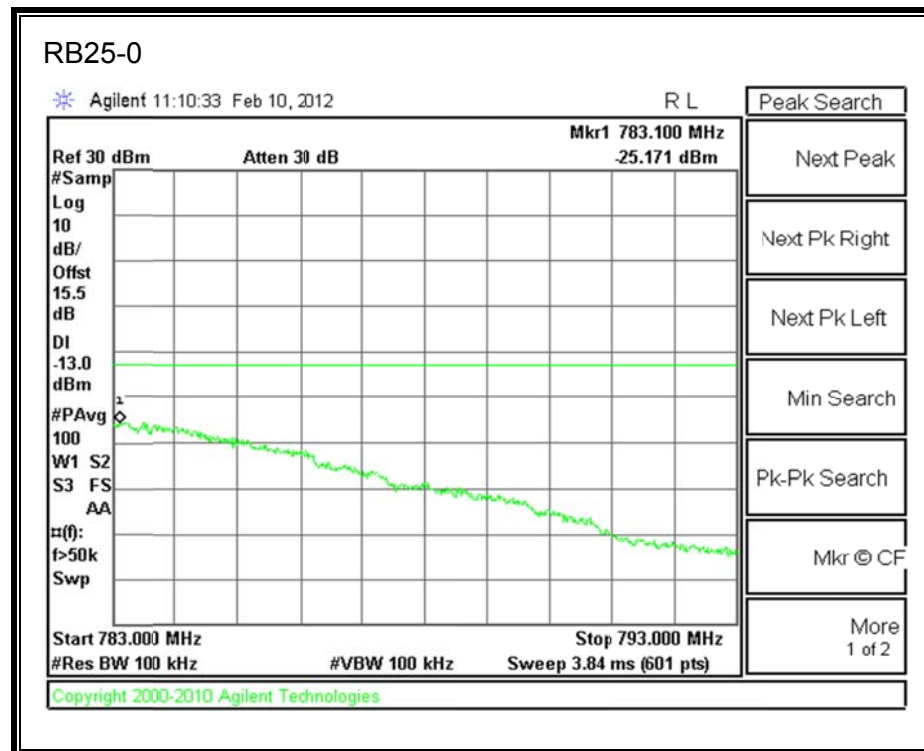
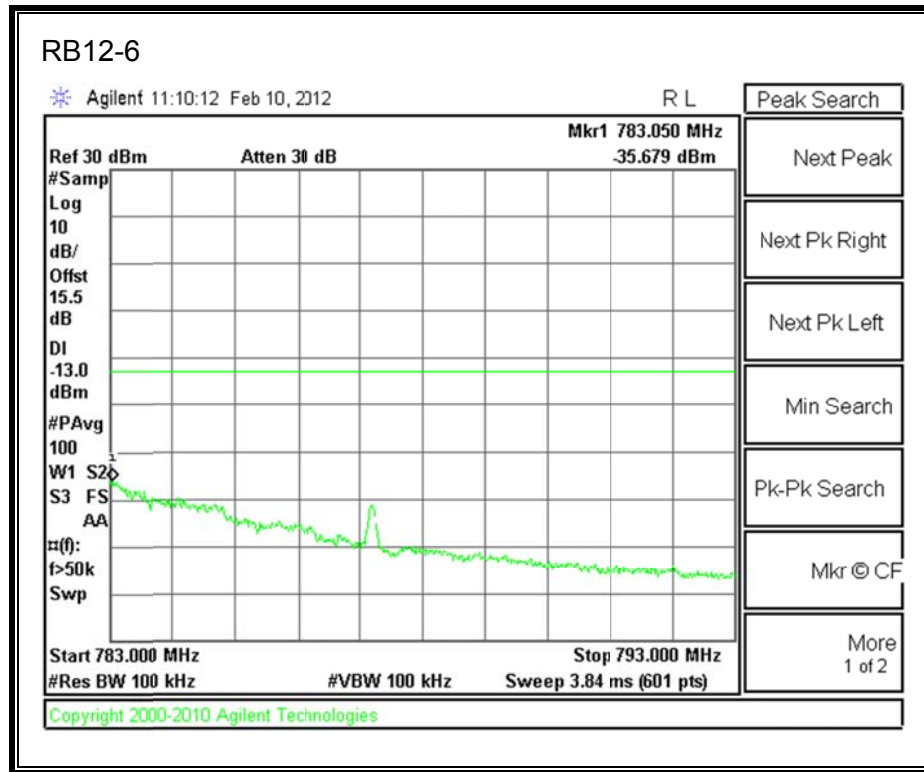


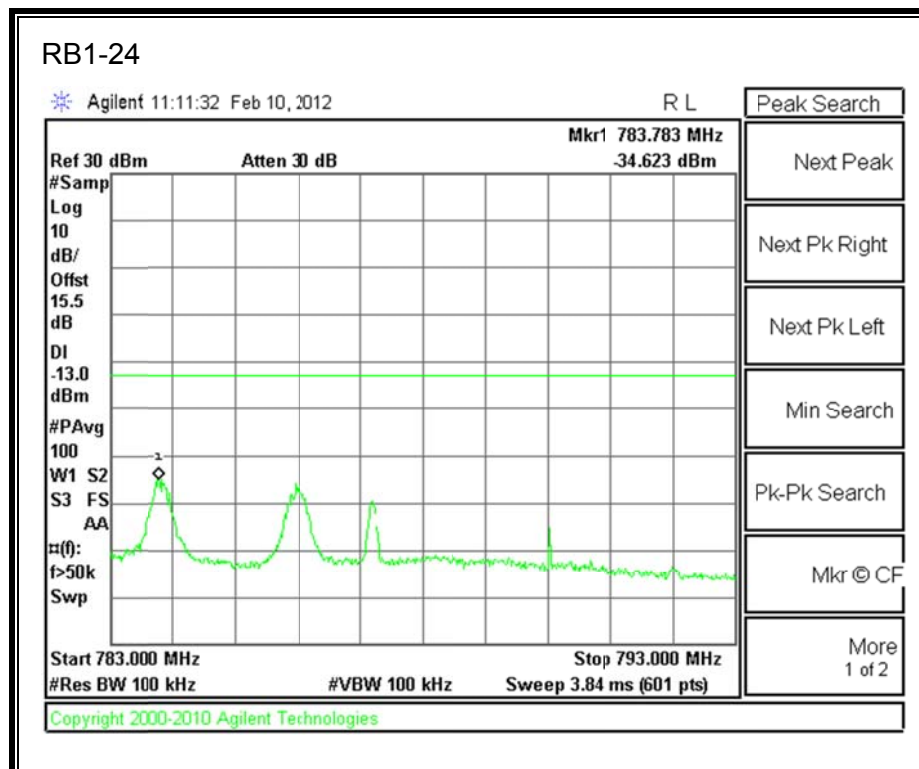
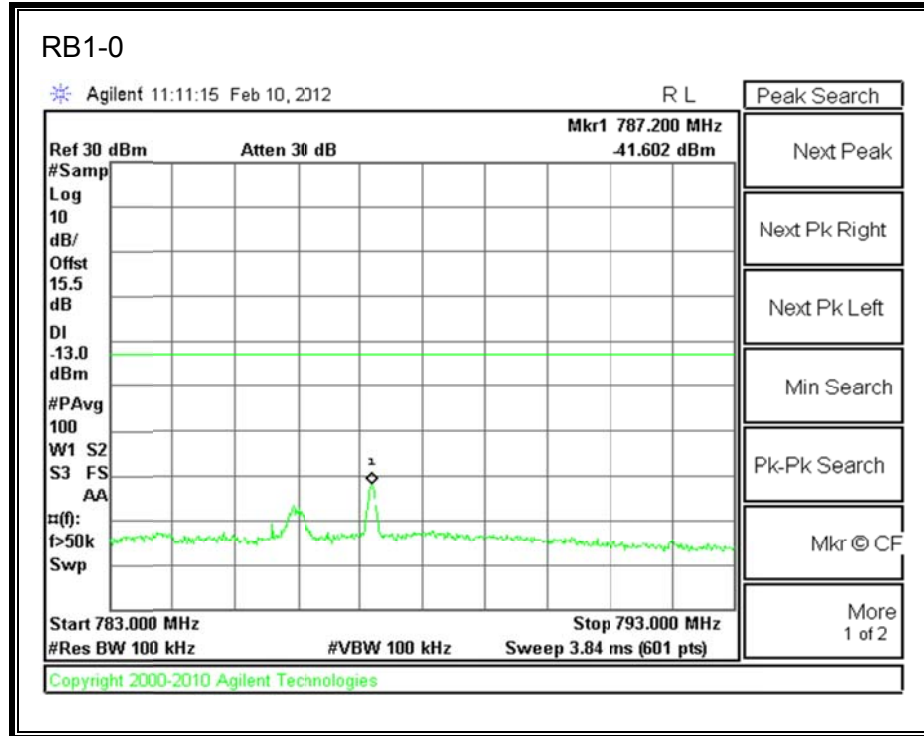
LTE 16QAM 779.5MHz Band 13, 775 - 777MHz (5MHz Bandwidth)

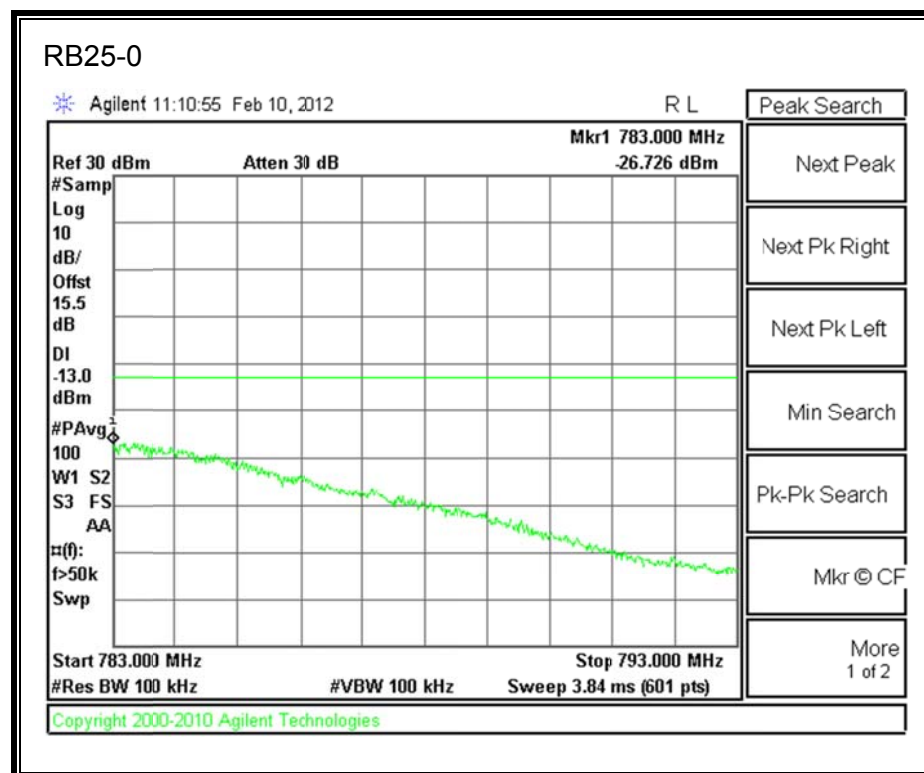
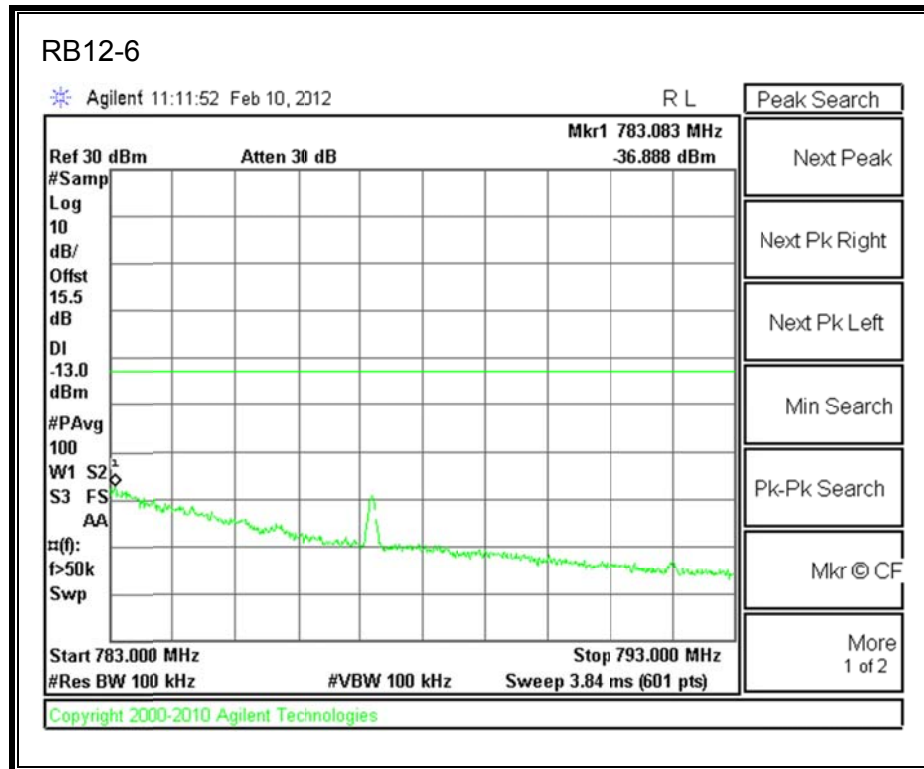


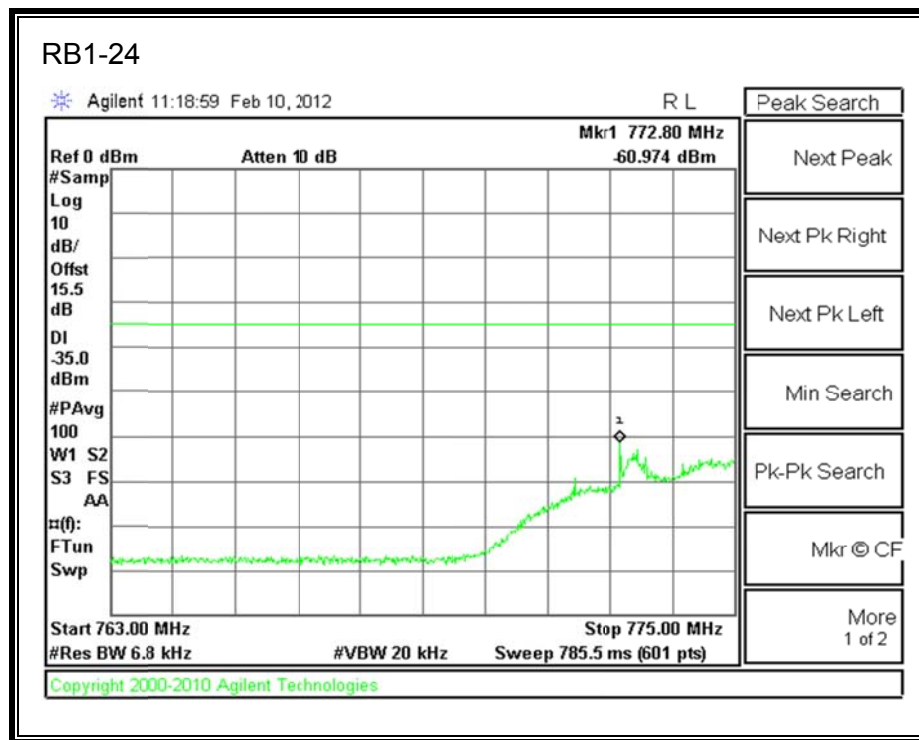
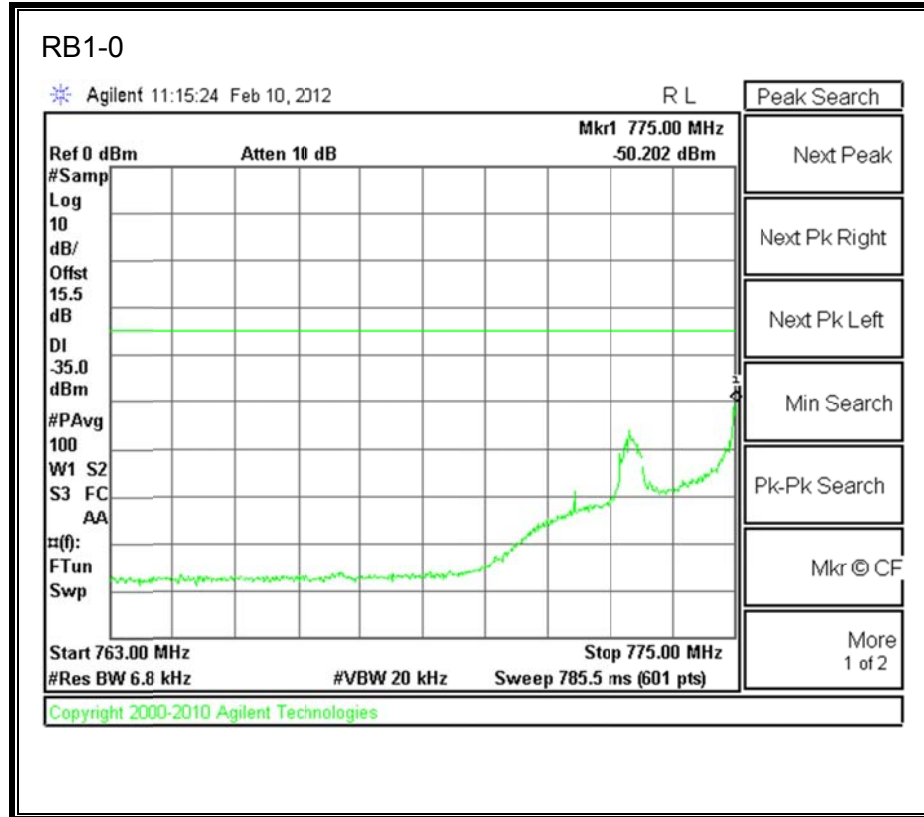


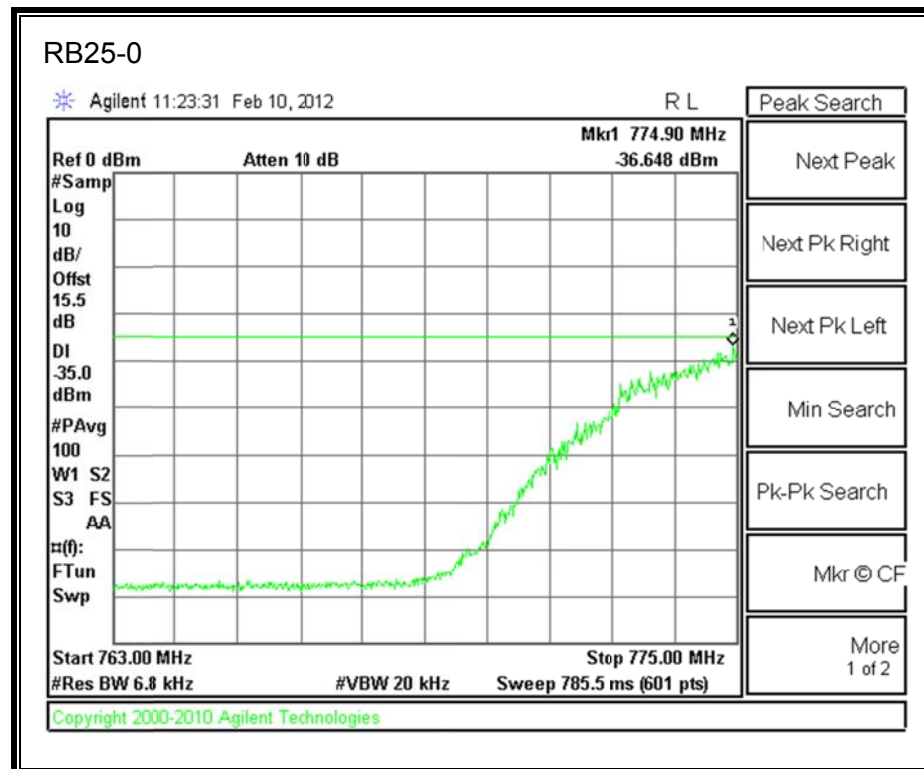
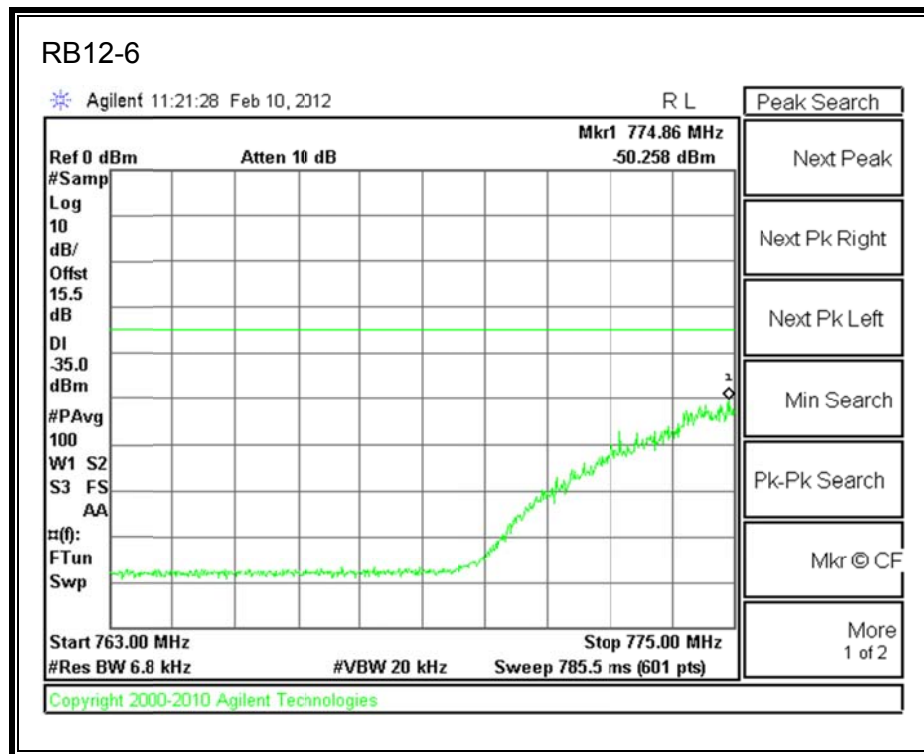
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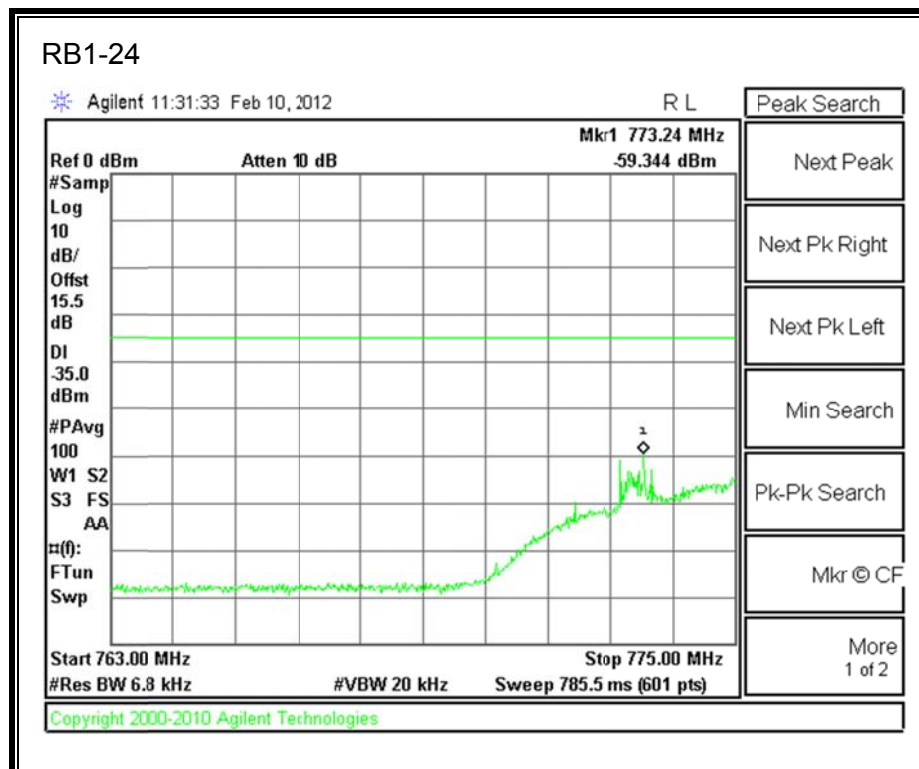
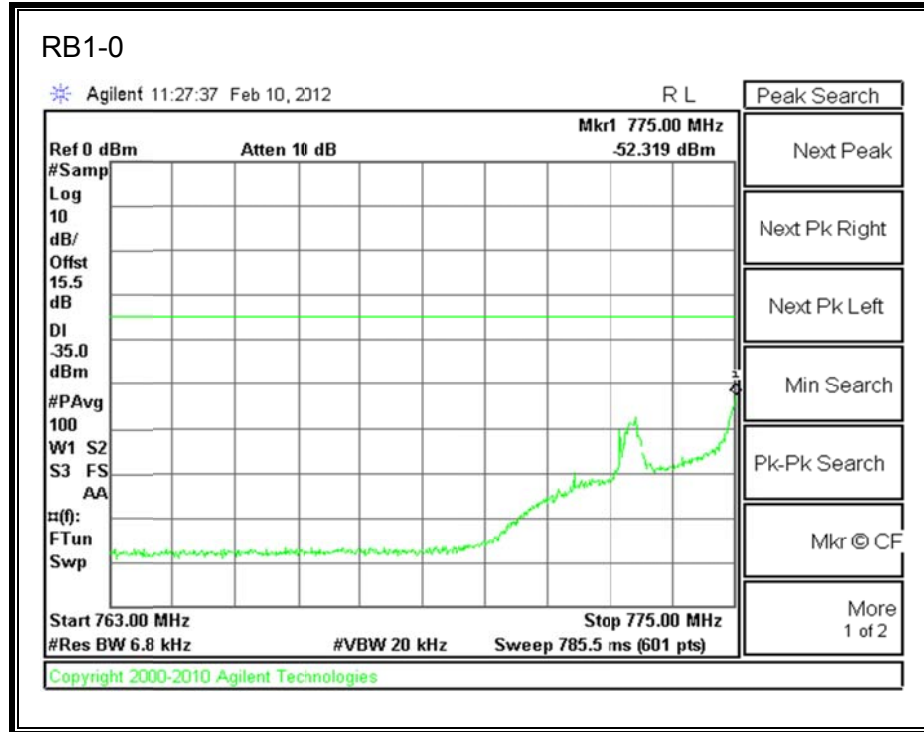


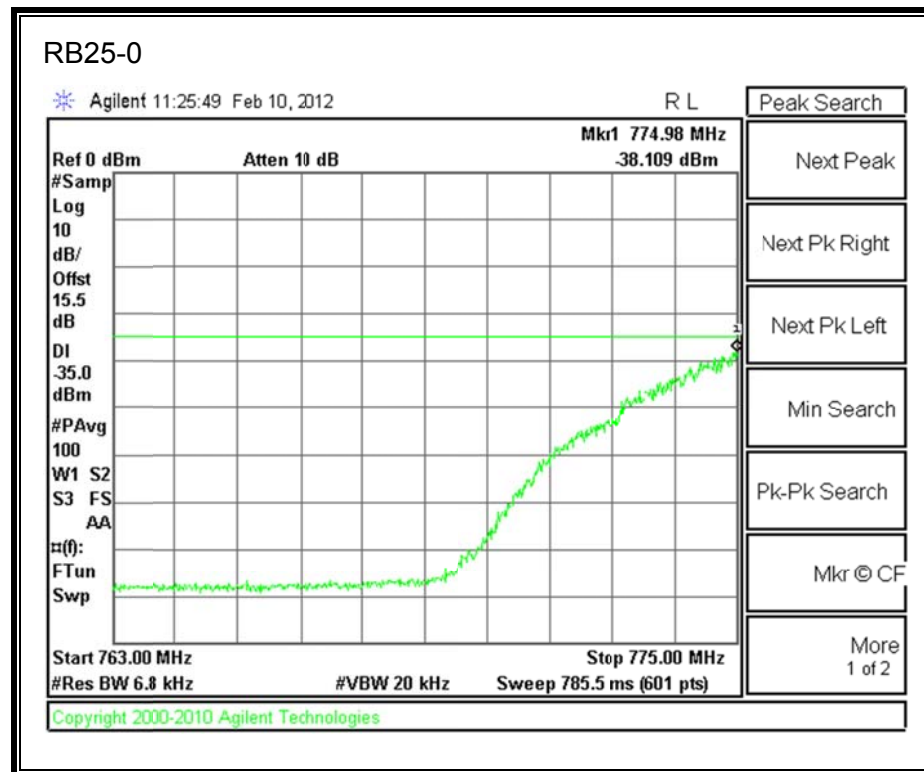
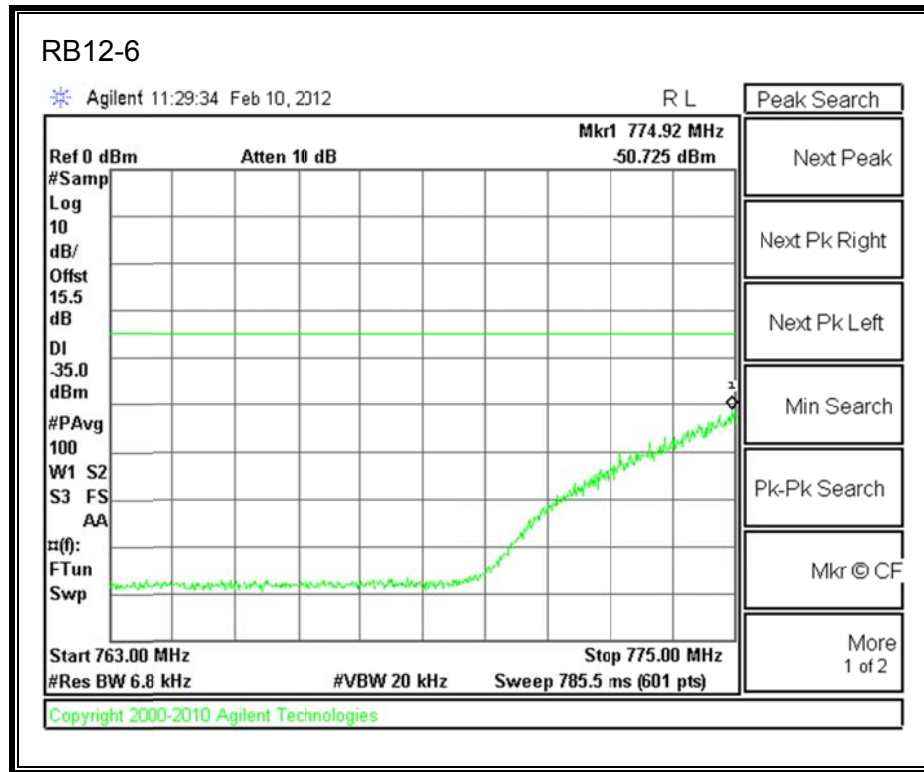
LTE 16QAM 779.5MHz Band 13, 783 - 793MHz (5MHz Bandwidth)

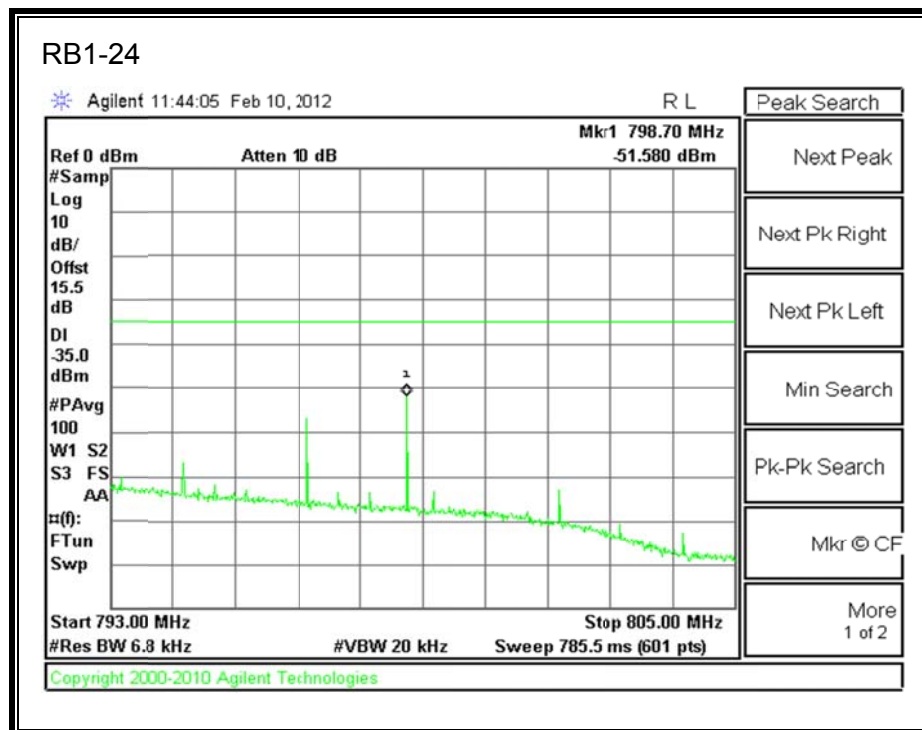
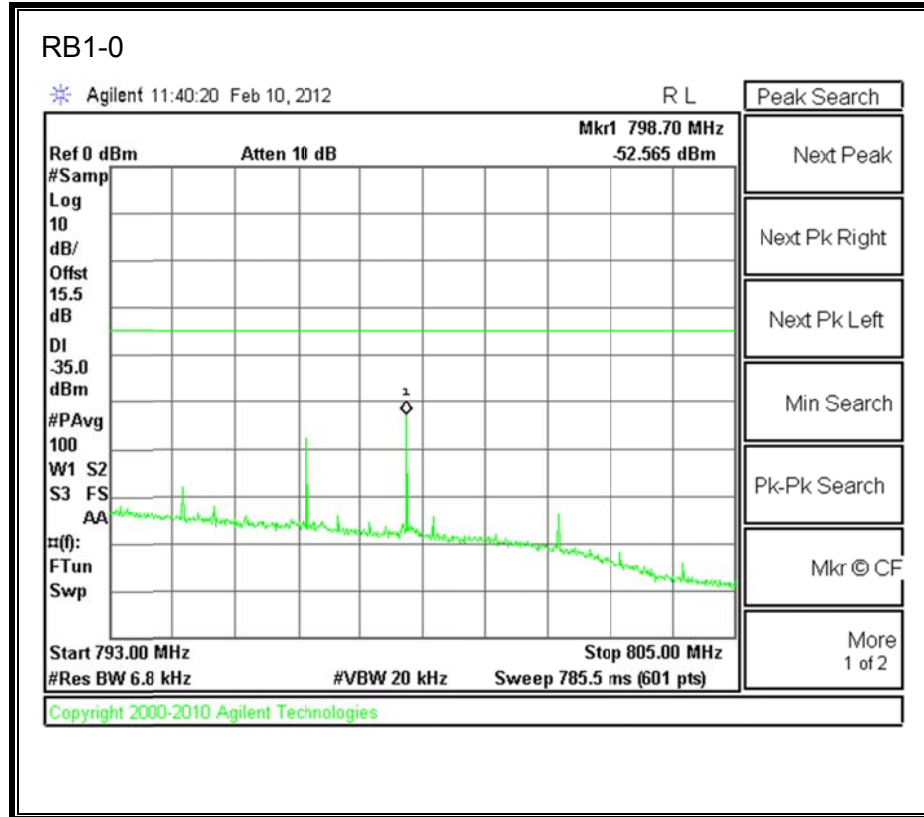


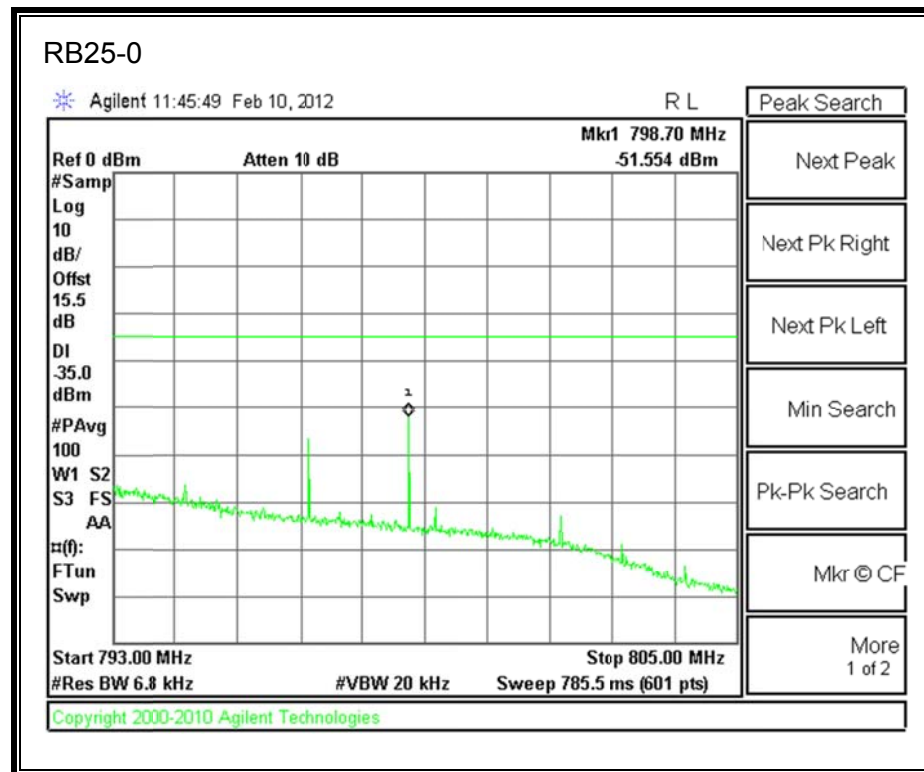
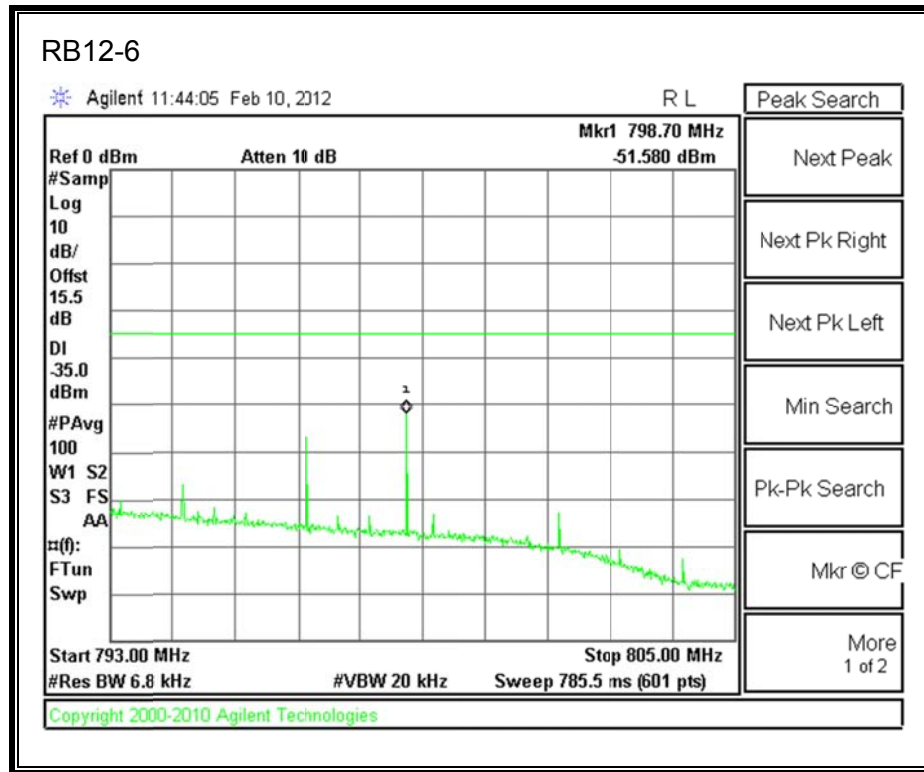
LTE QPSK 779.5MHz Band 13, 763 - 775MHz (5MHz Bandwidth)

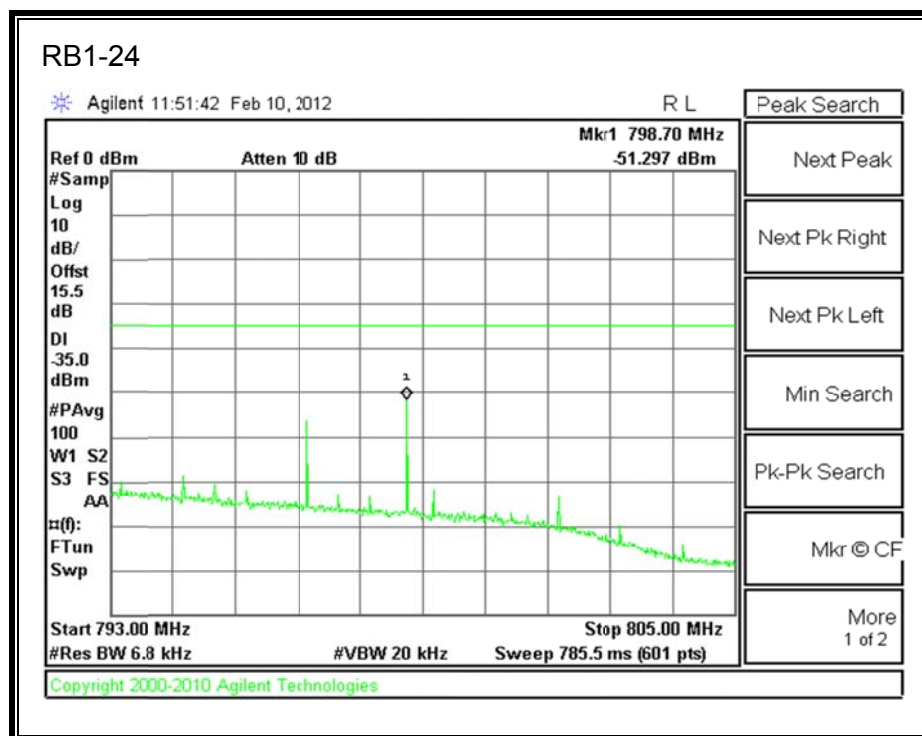
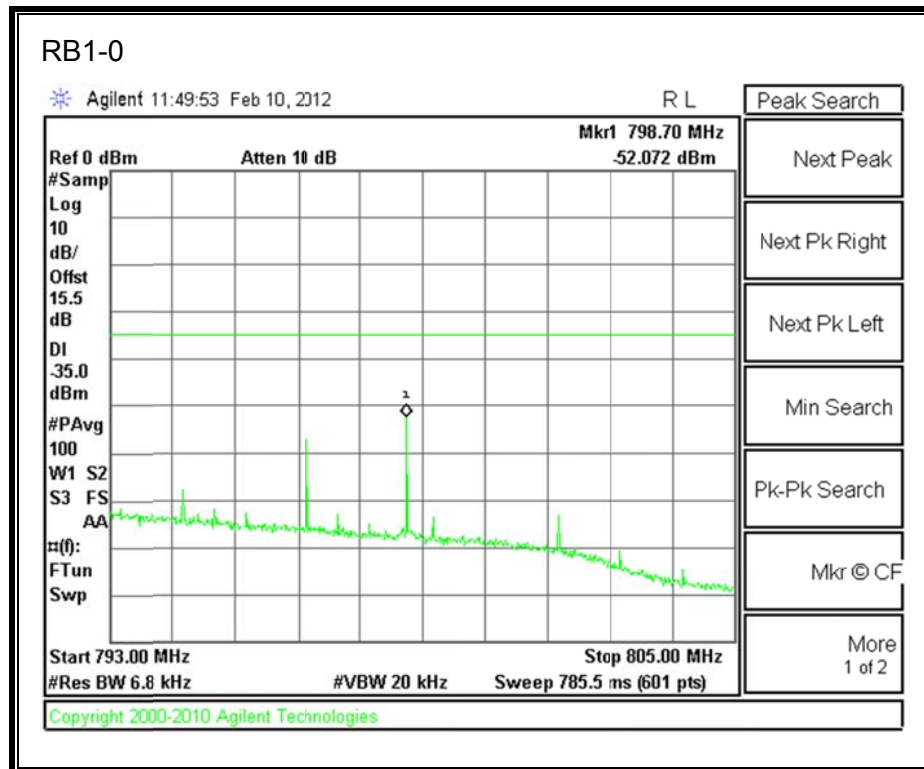


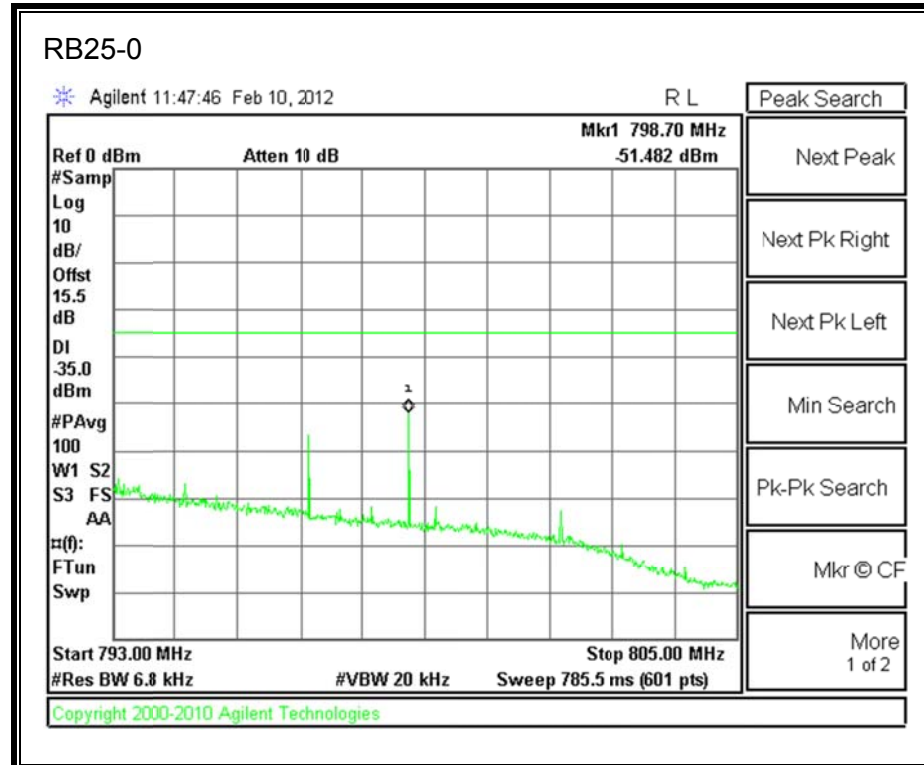
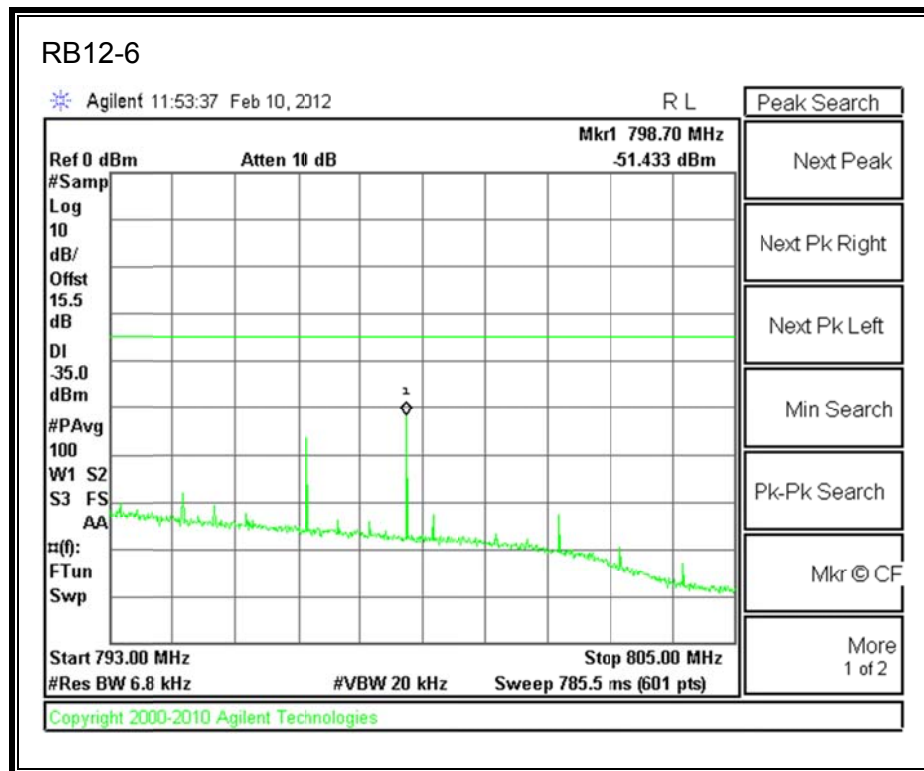
LTE 16QAM 779.5MHz Band 13, 763-775MHz (5MHz Bandwidth)

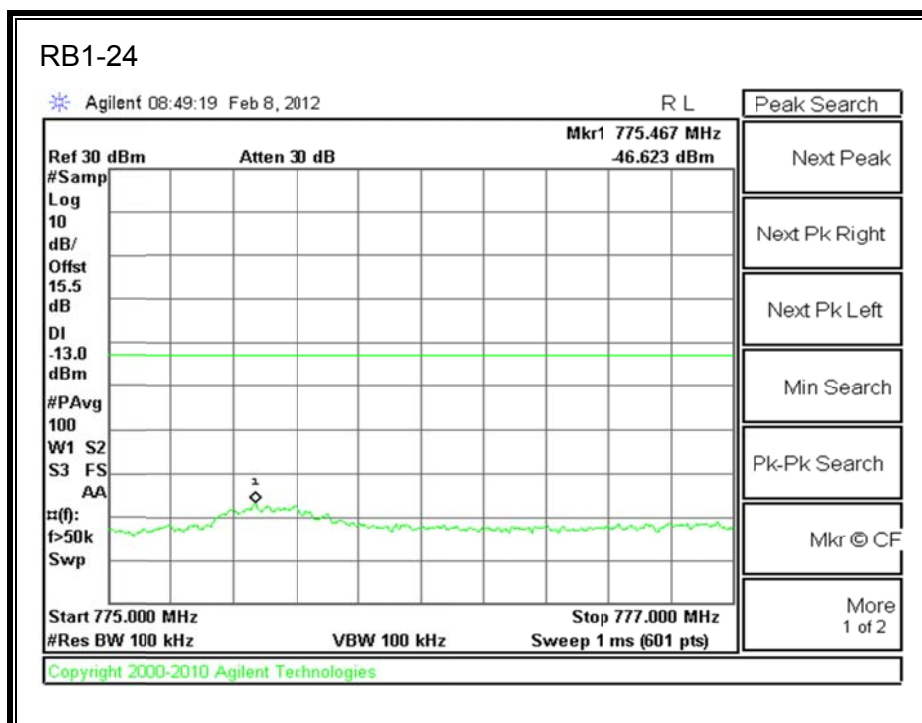
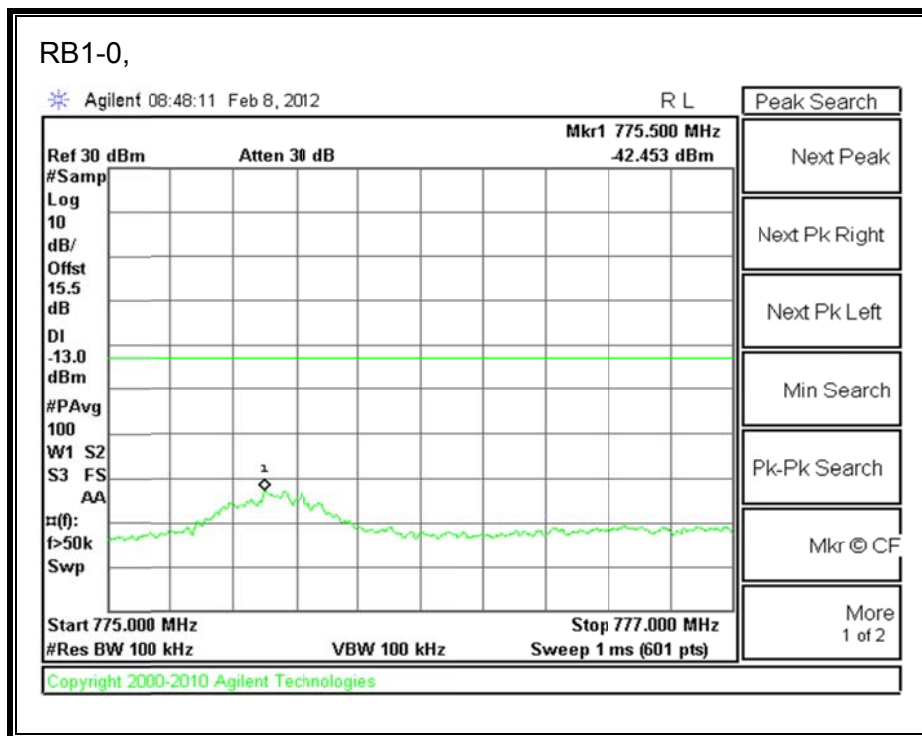


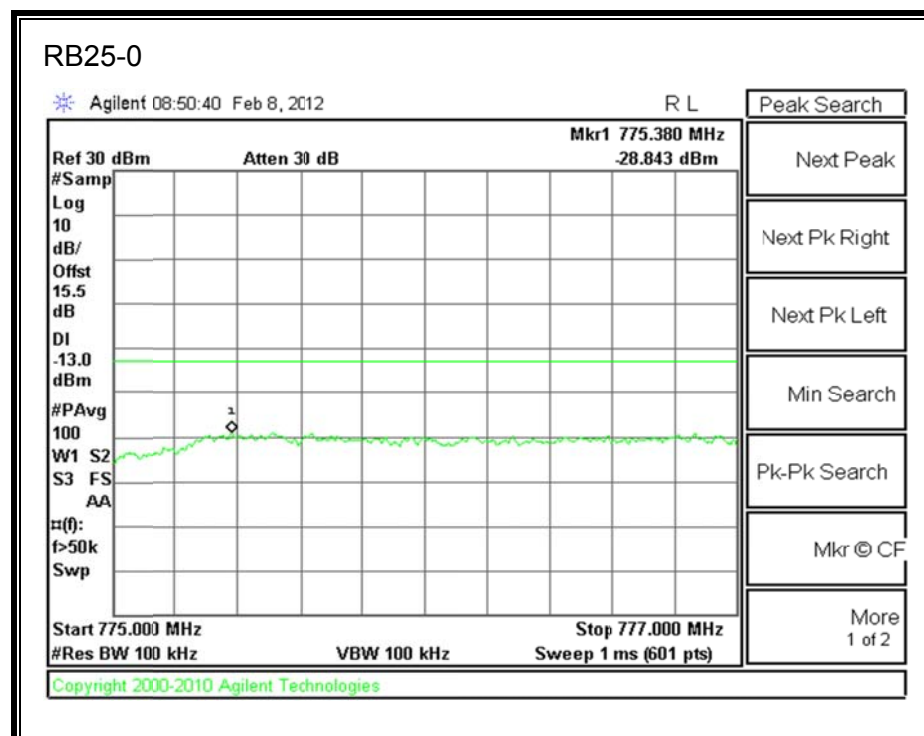
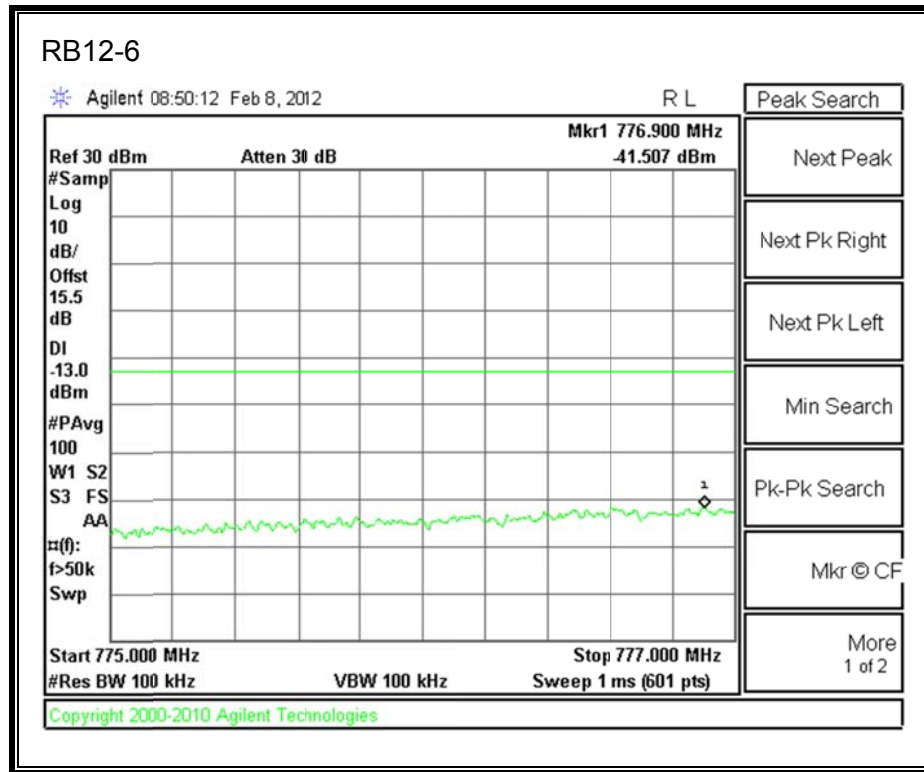
LTE QPSK 779.5MHz Band 13, 793 - 805MHz (5MHz Bandwidth)

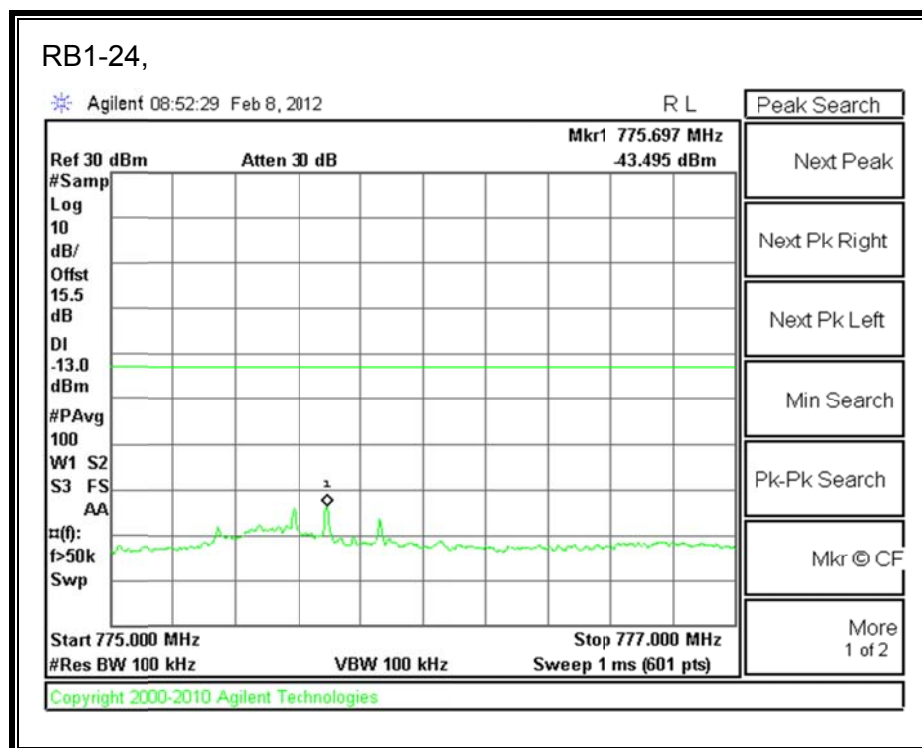
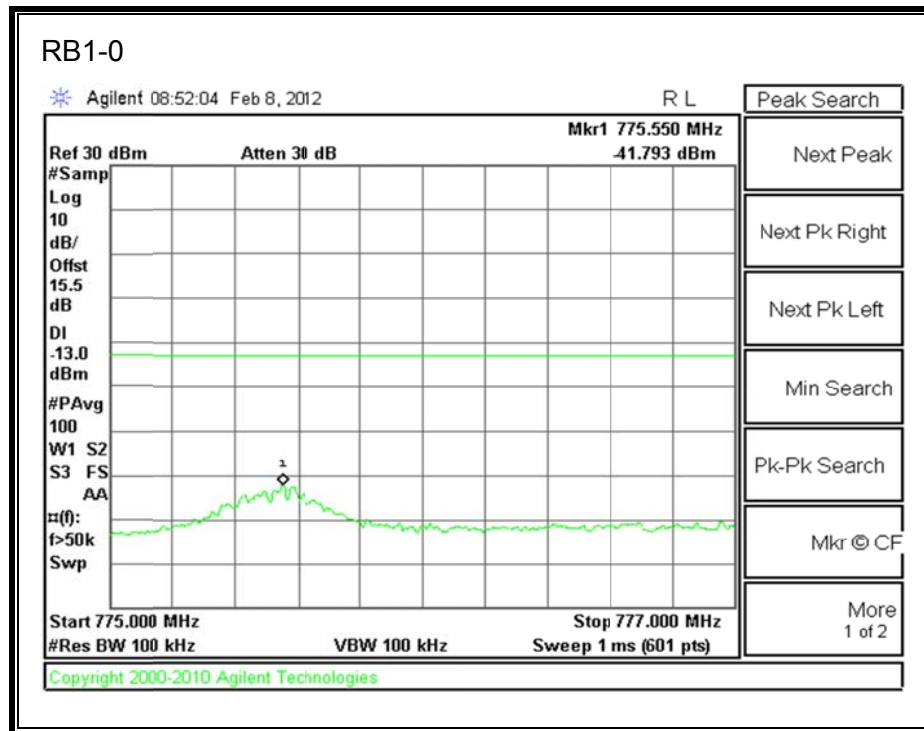


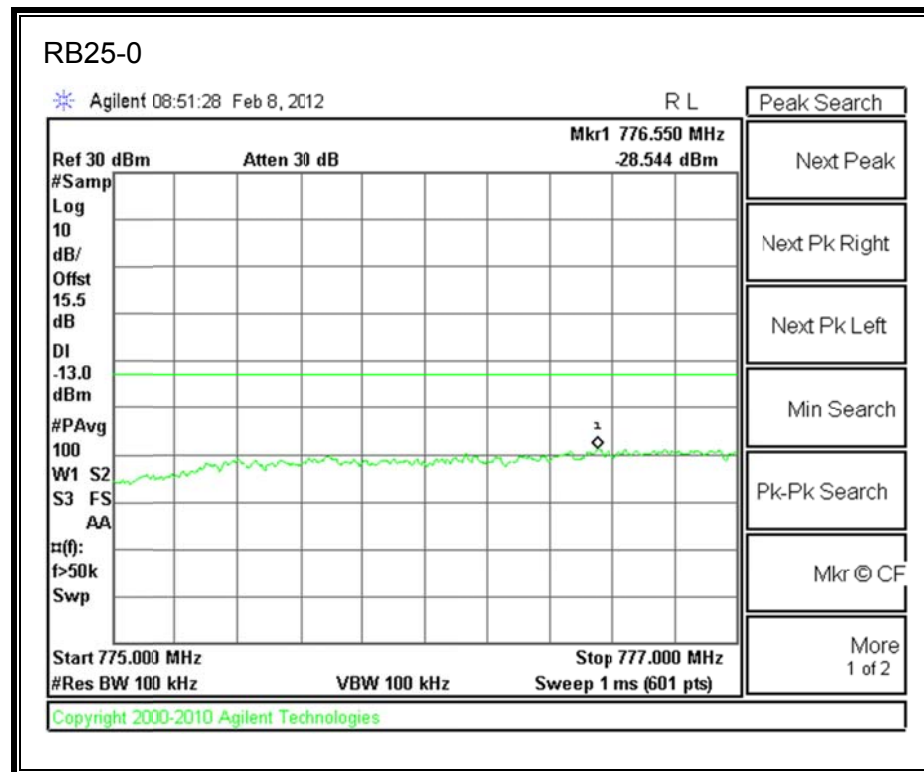
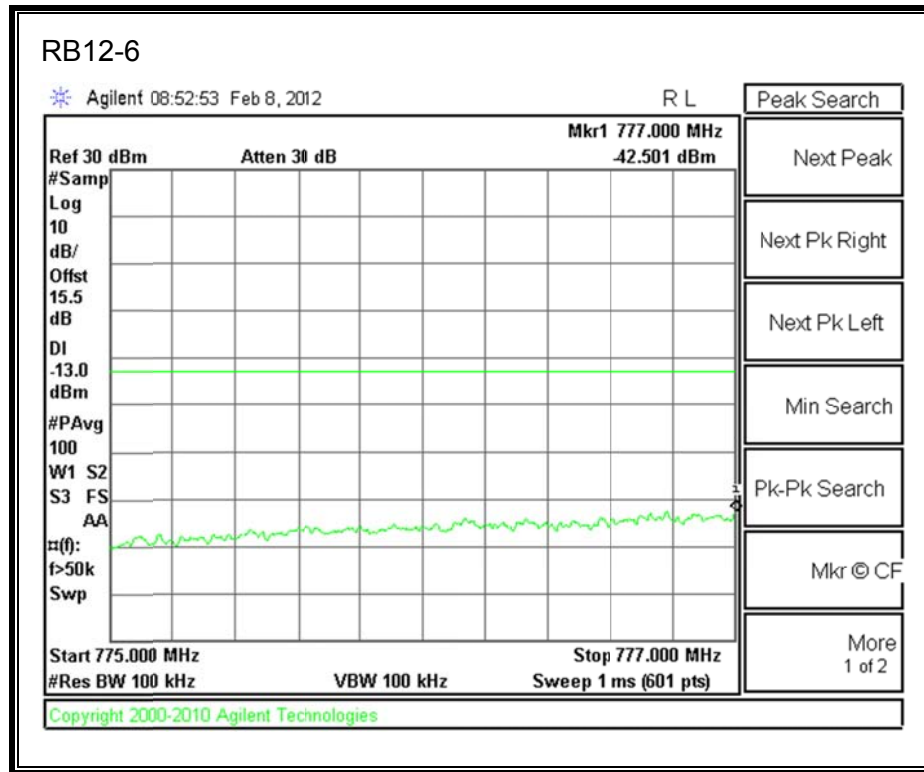
LTE 16QAM 779.5MHz Band 13, 793 - 805MHz (5MHz Bandwidth)

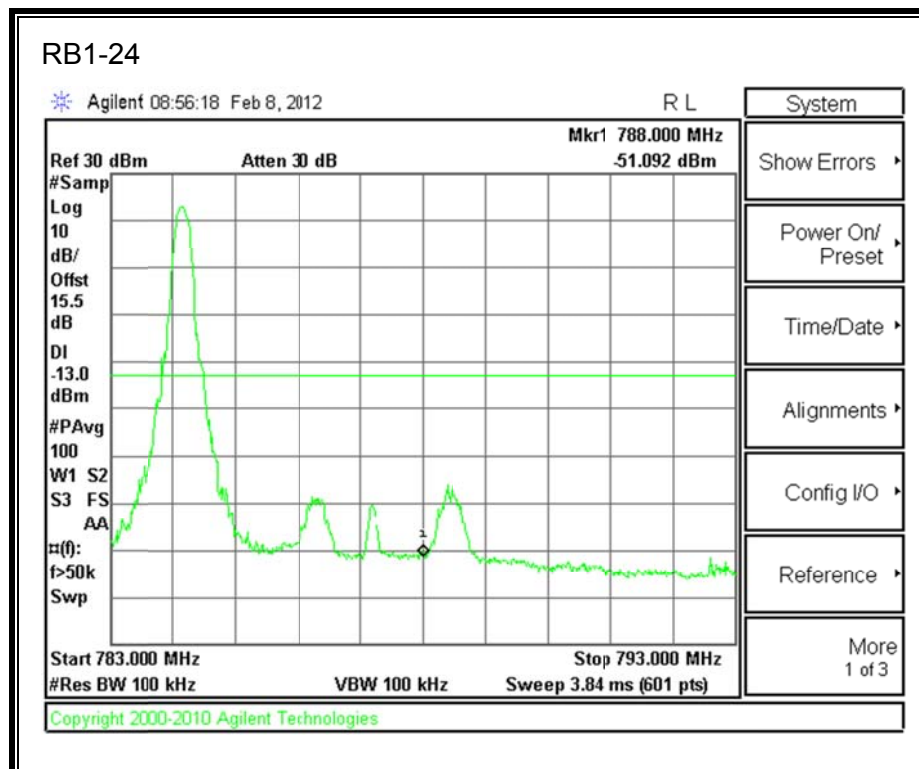
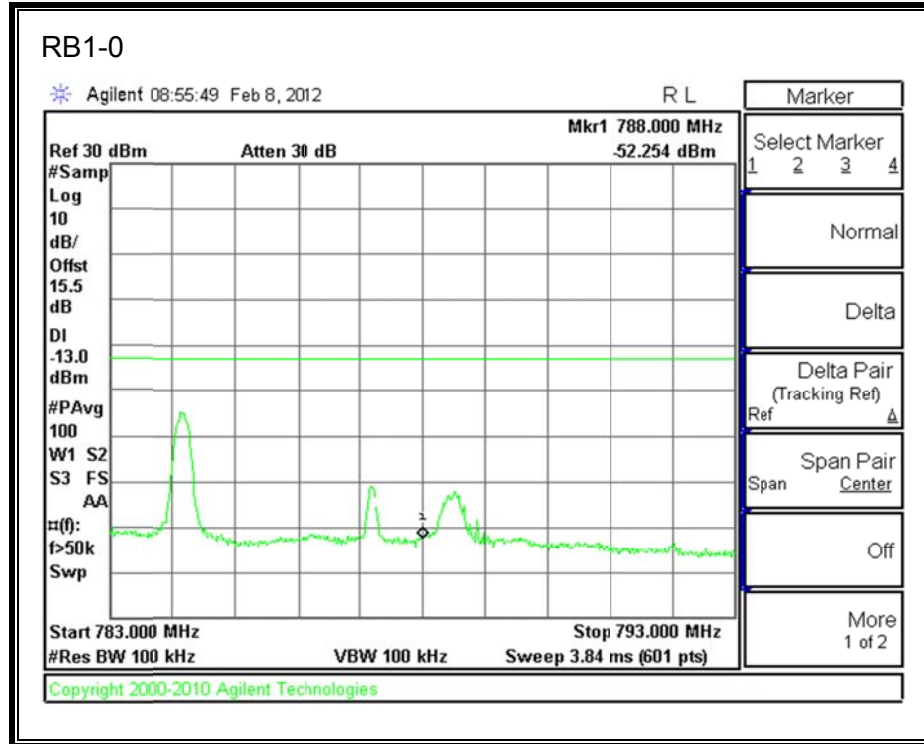


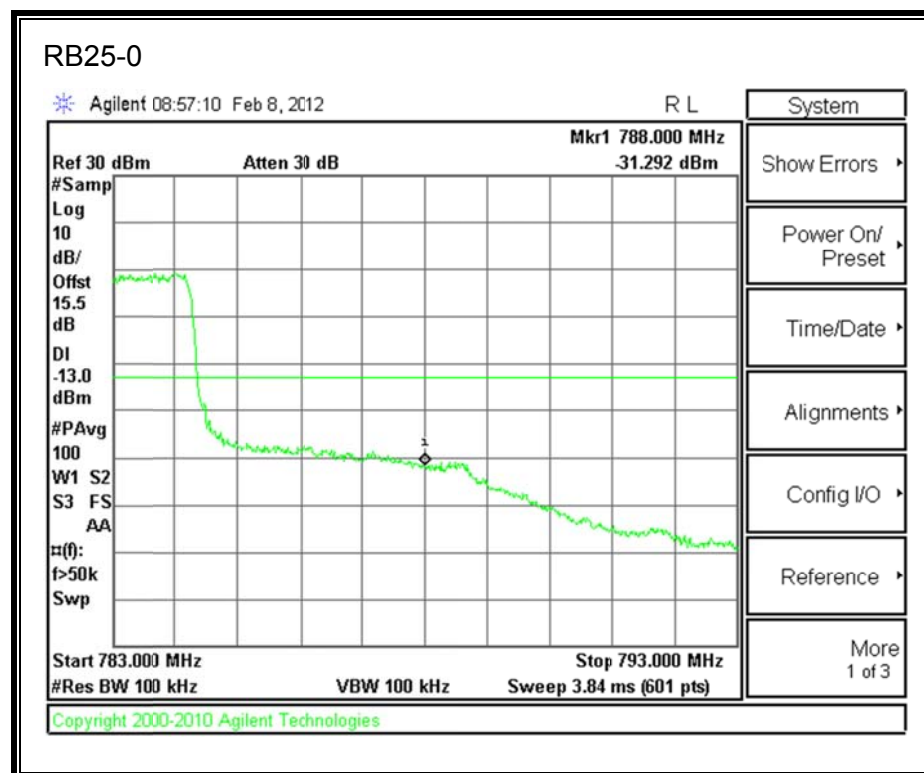
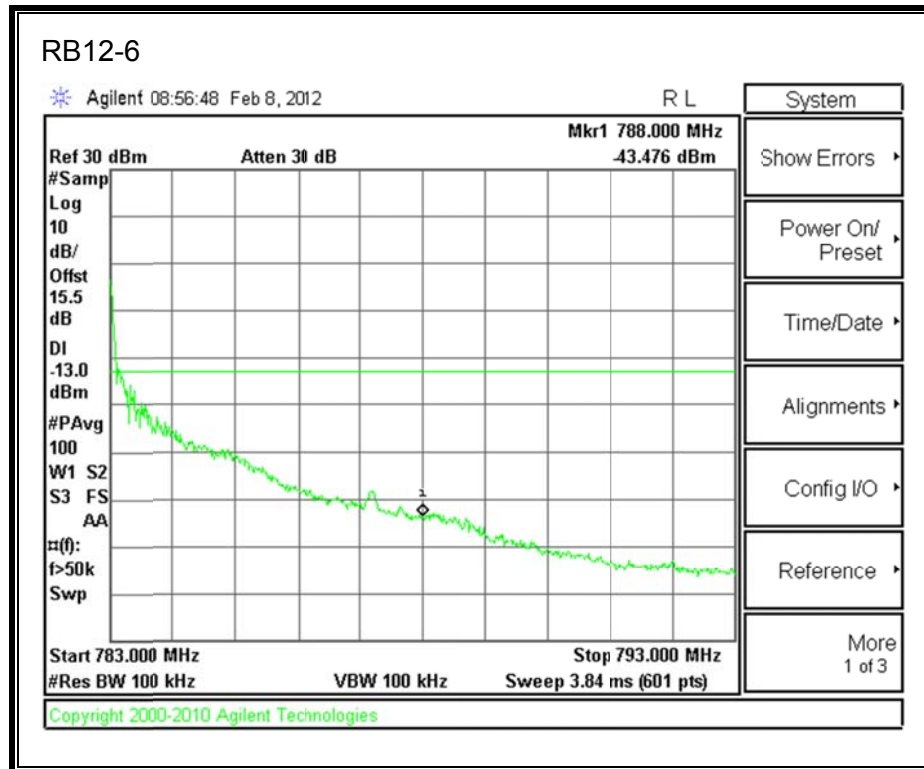
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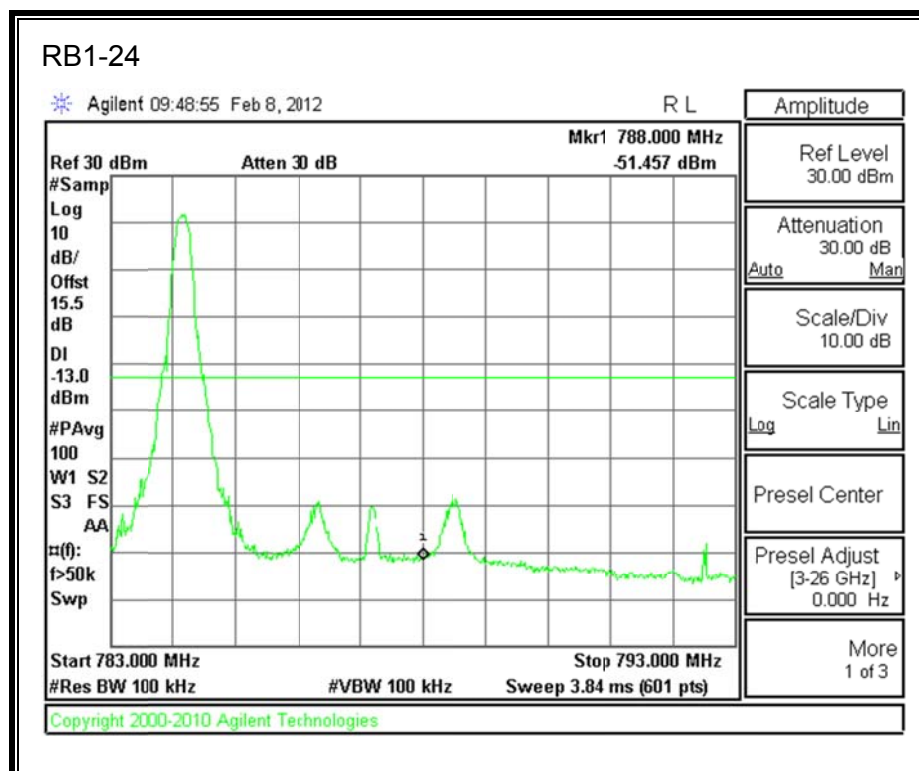
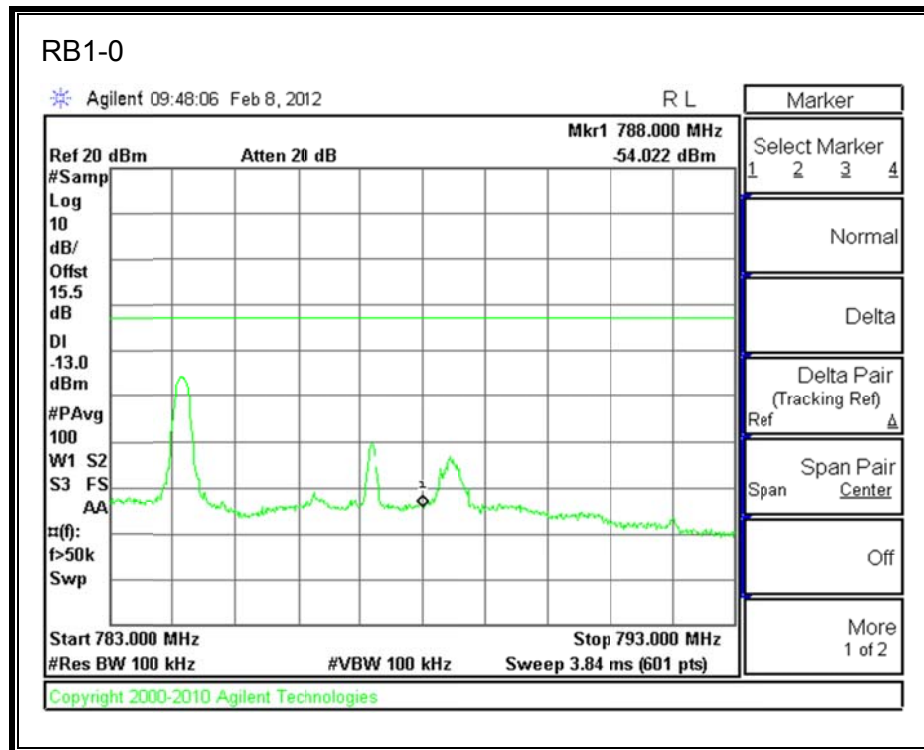


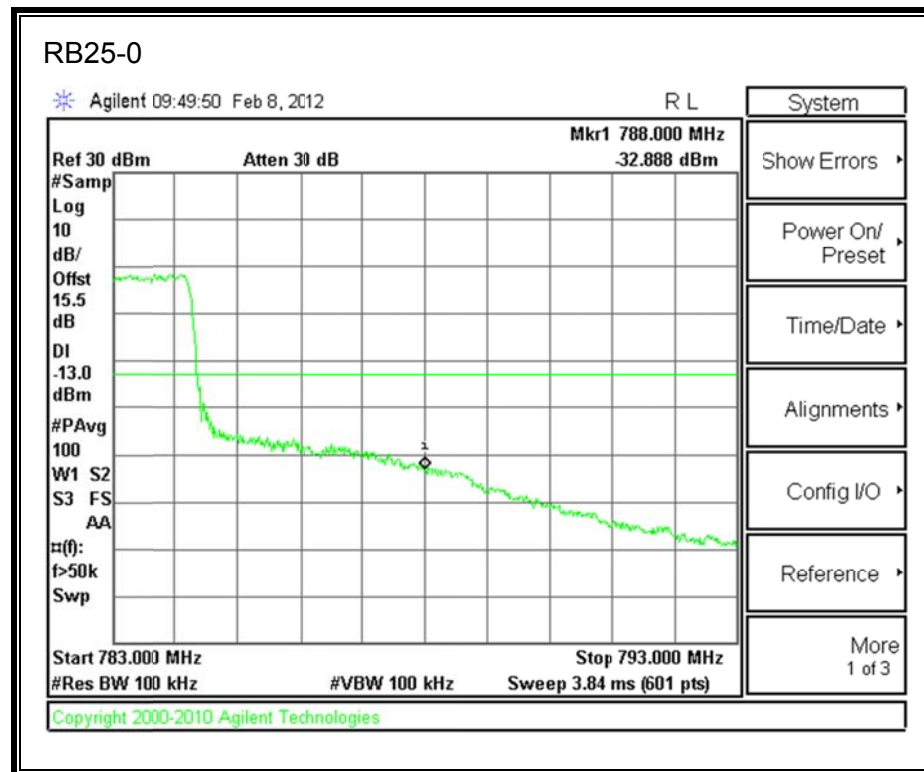
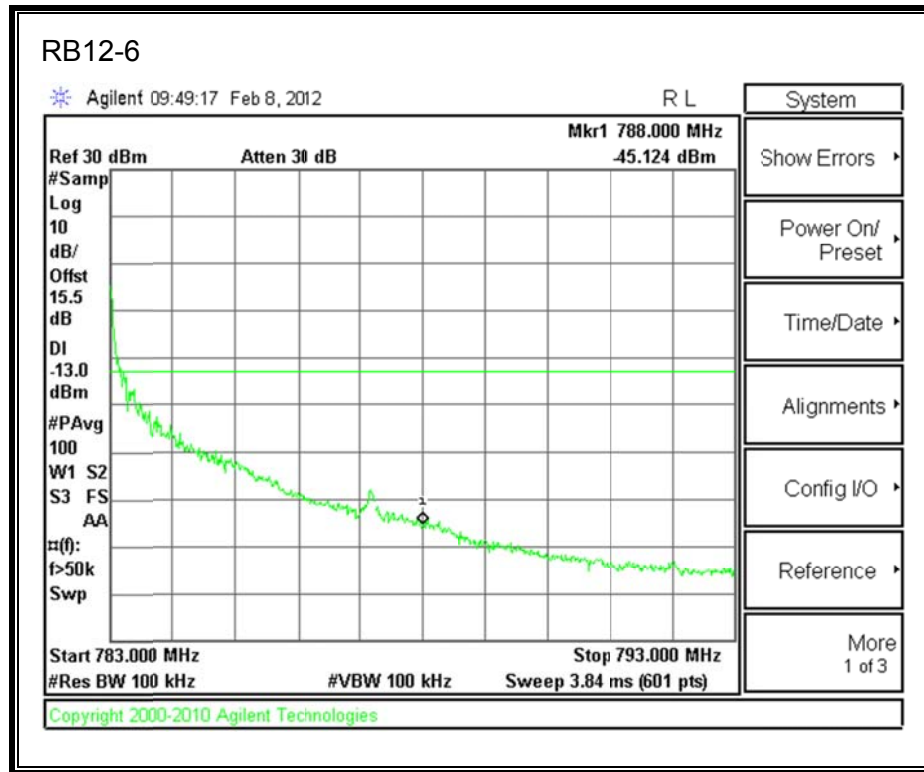
LTE 16QAM 782MHz Band 13, 775 - 777MHz (5MHz Bandwidth)

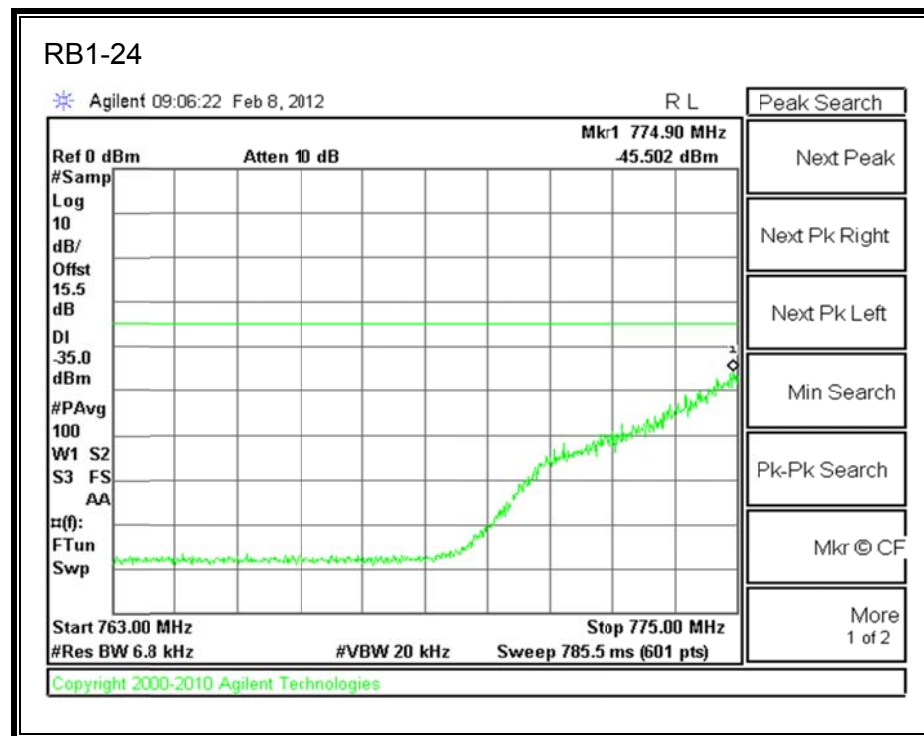
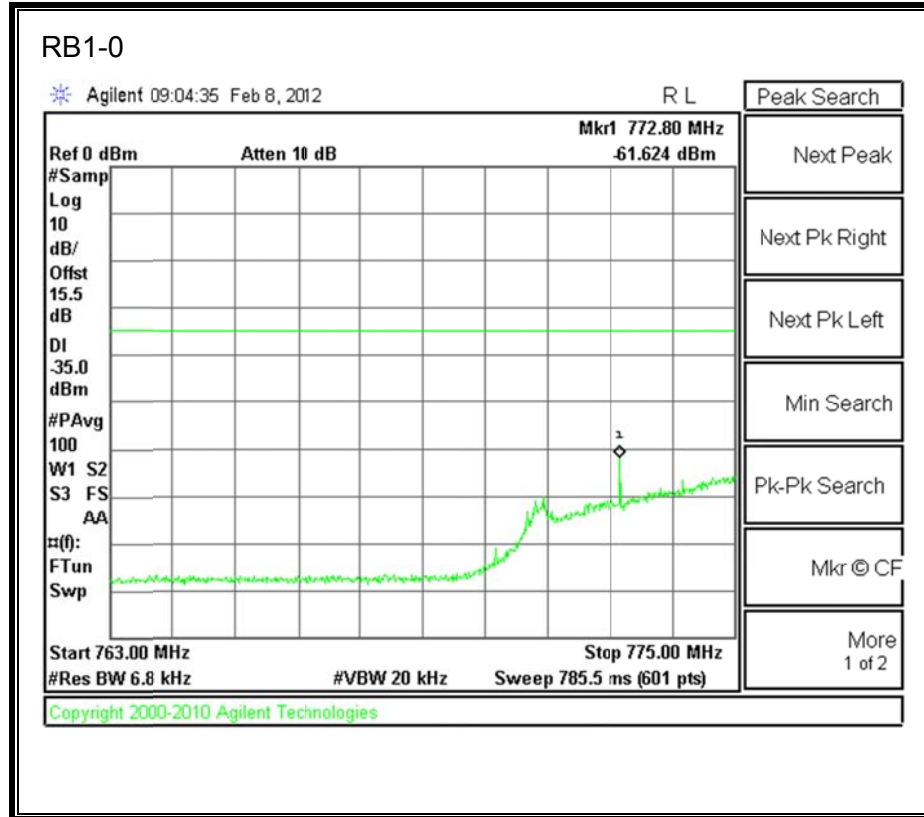


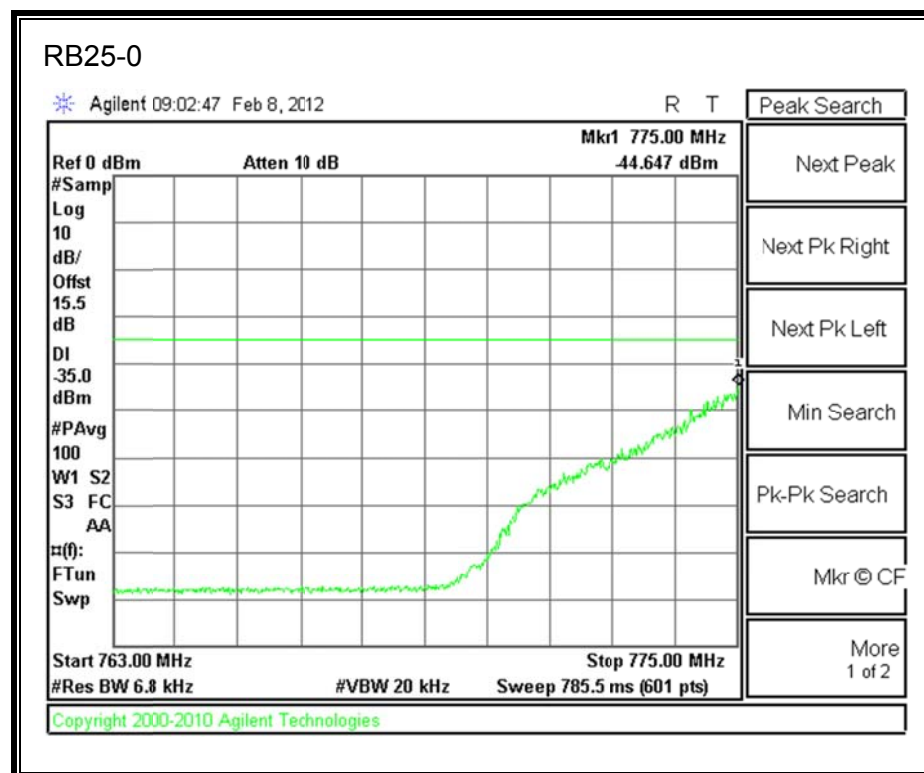
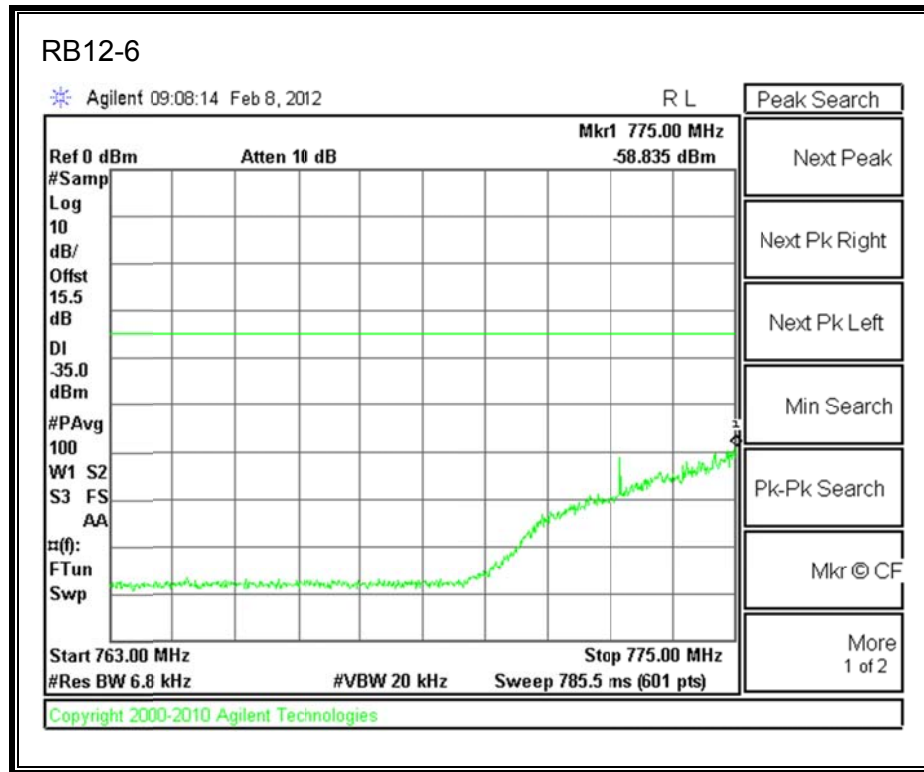
LTE QPSK 782MHz Band 13, 783 - 793MHz (5MHz Bandwidth)

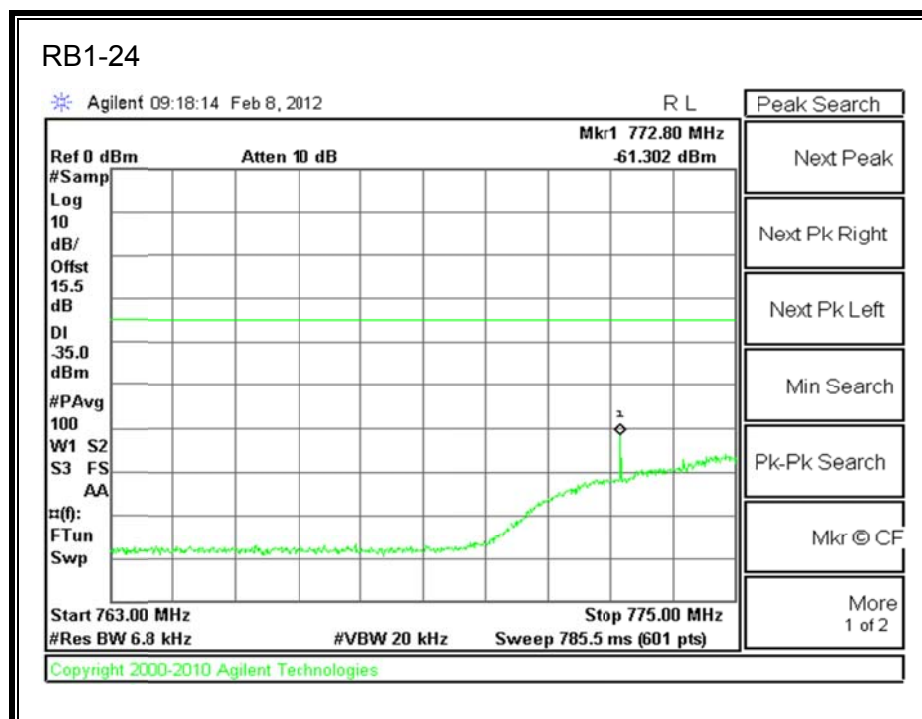
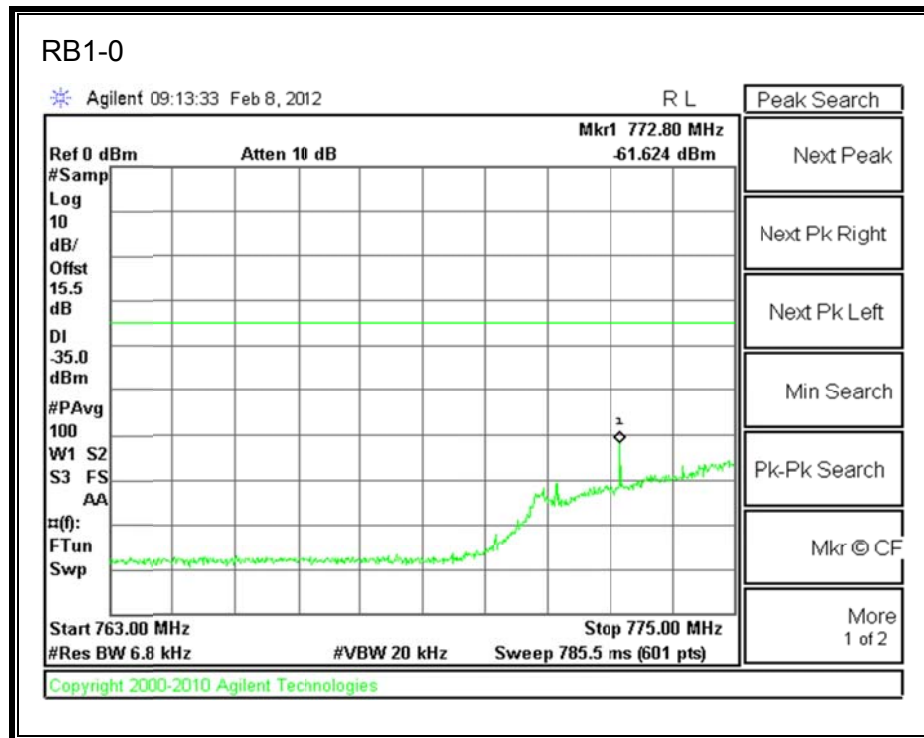


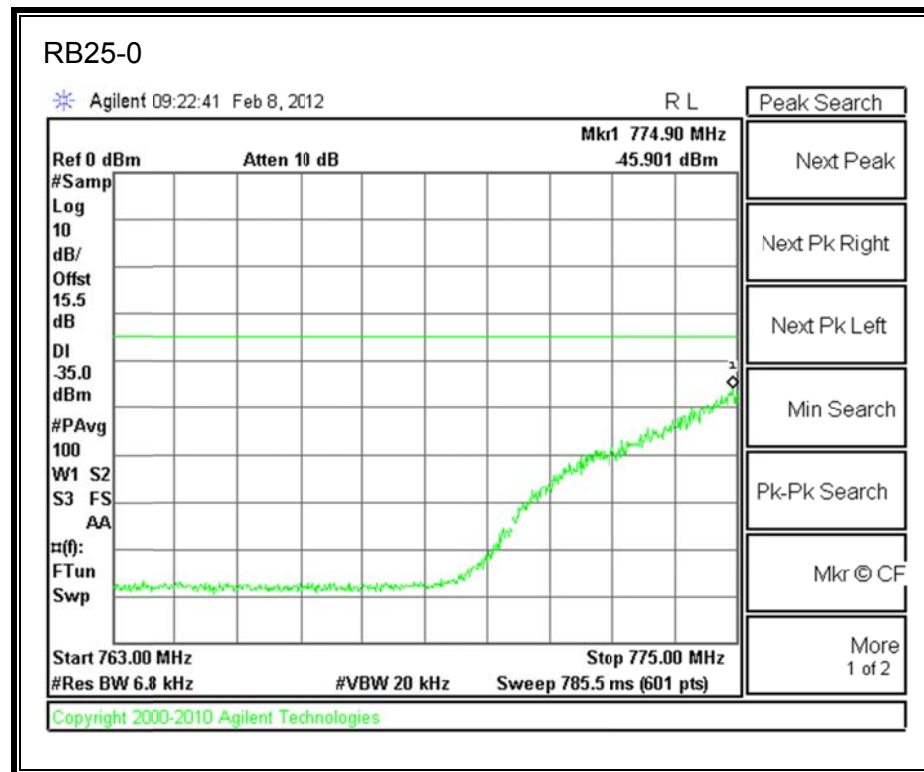
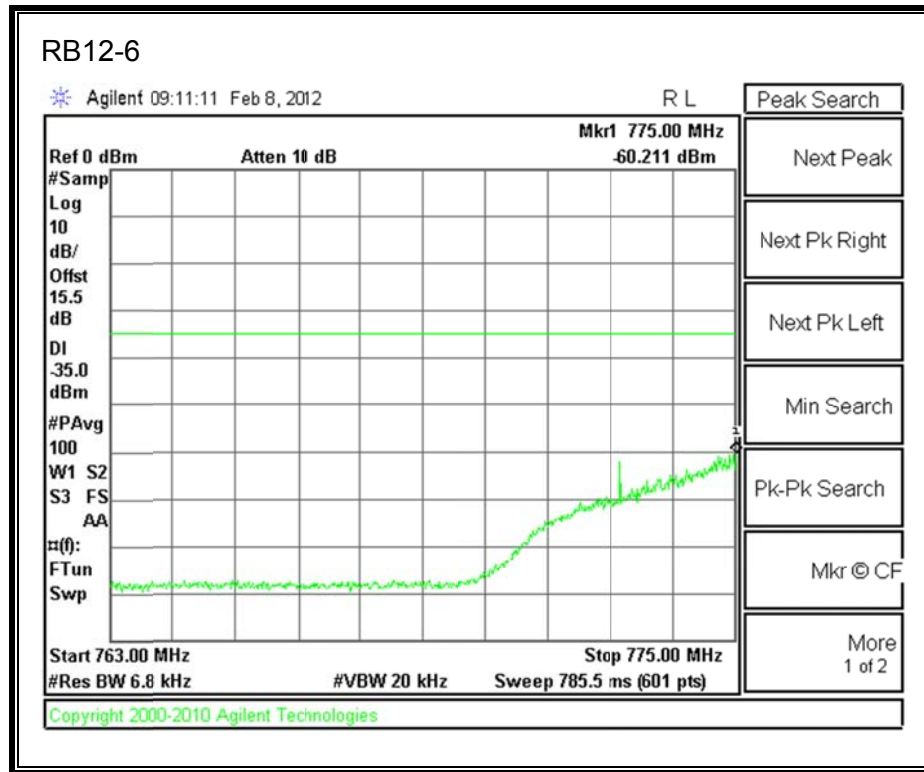
LTE 16QAM 782MHz Band 13, 783 - 793MHz (5MHz Bandwidth)

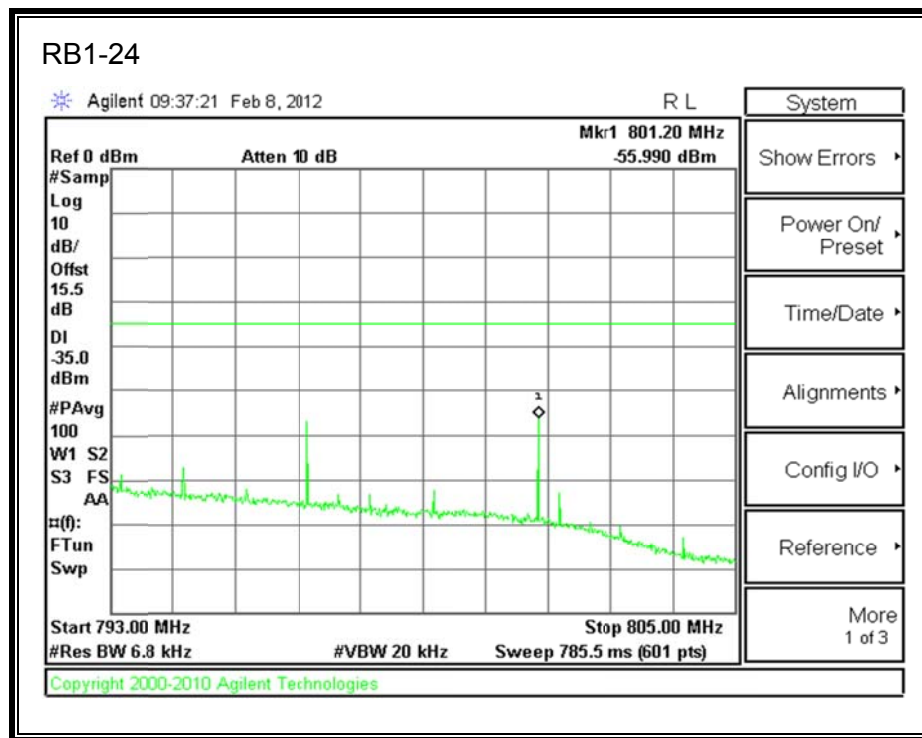
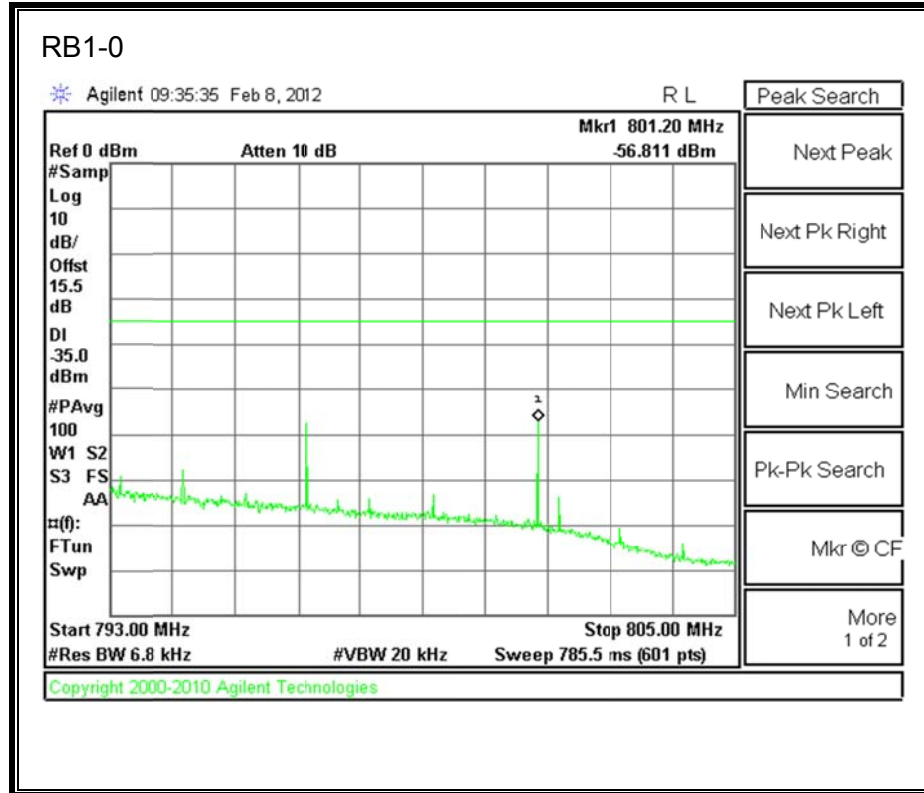


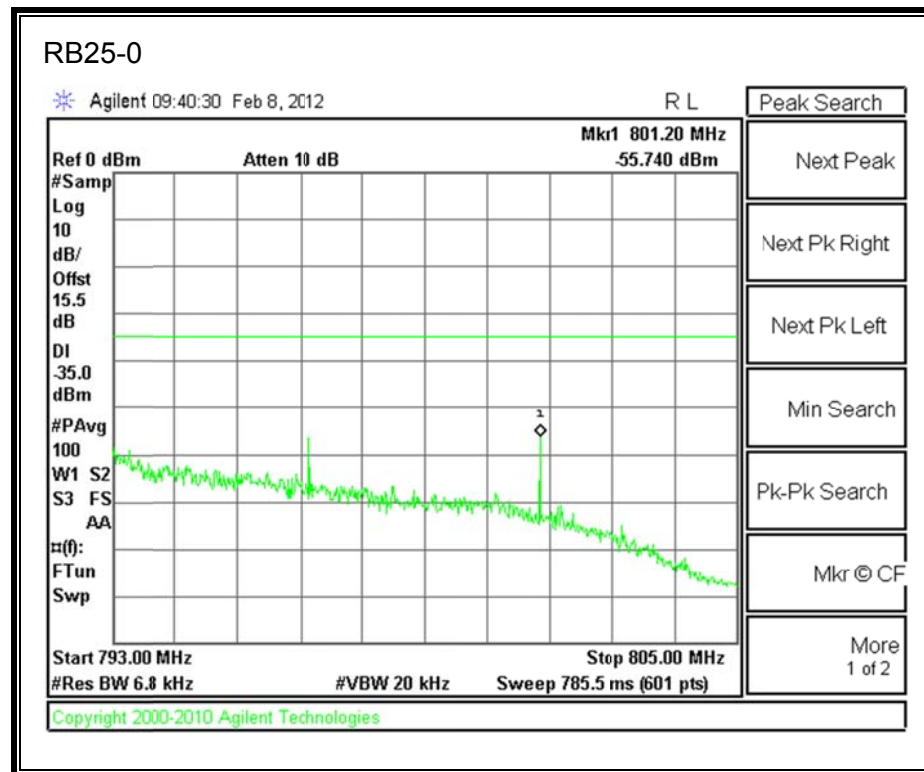
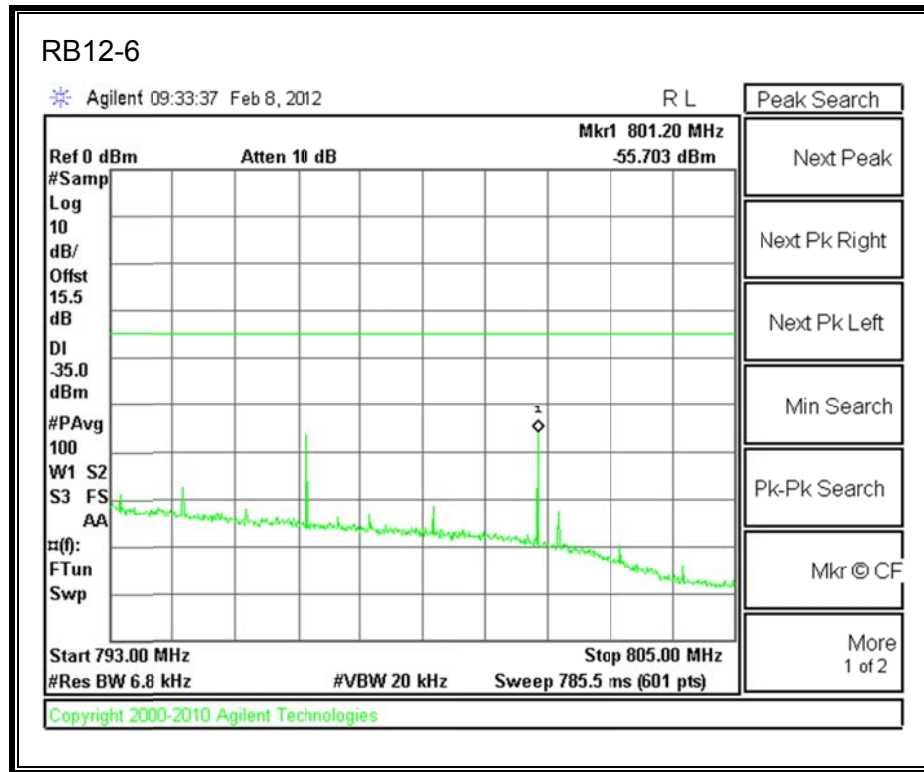
LTE QPSK 782MHz Band 13, 763 - 775MHz (5MHz Bandwidth)

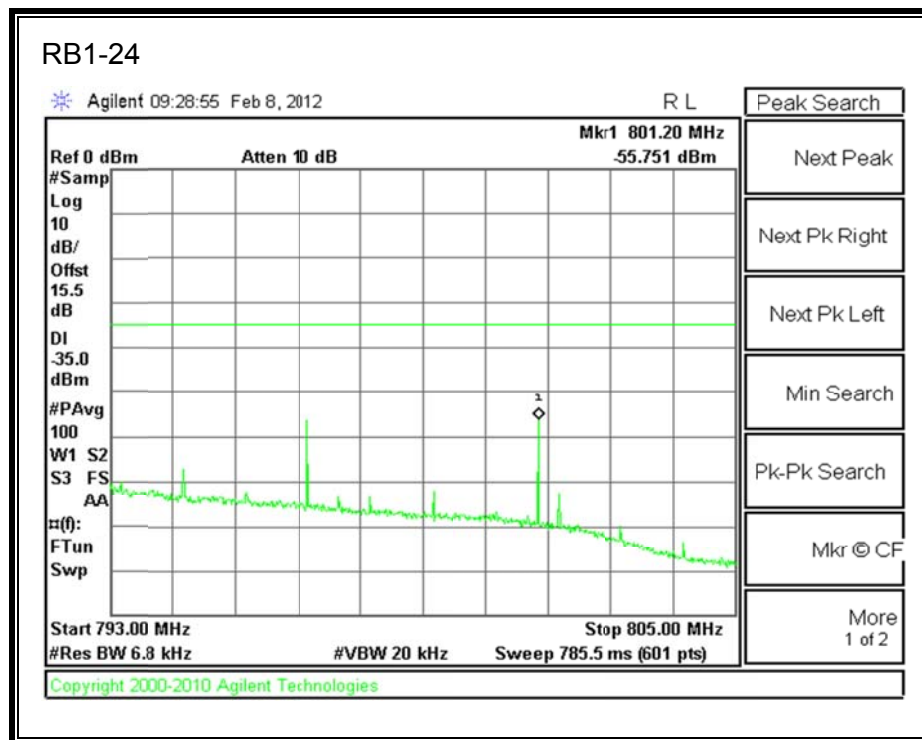
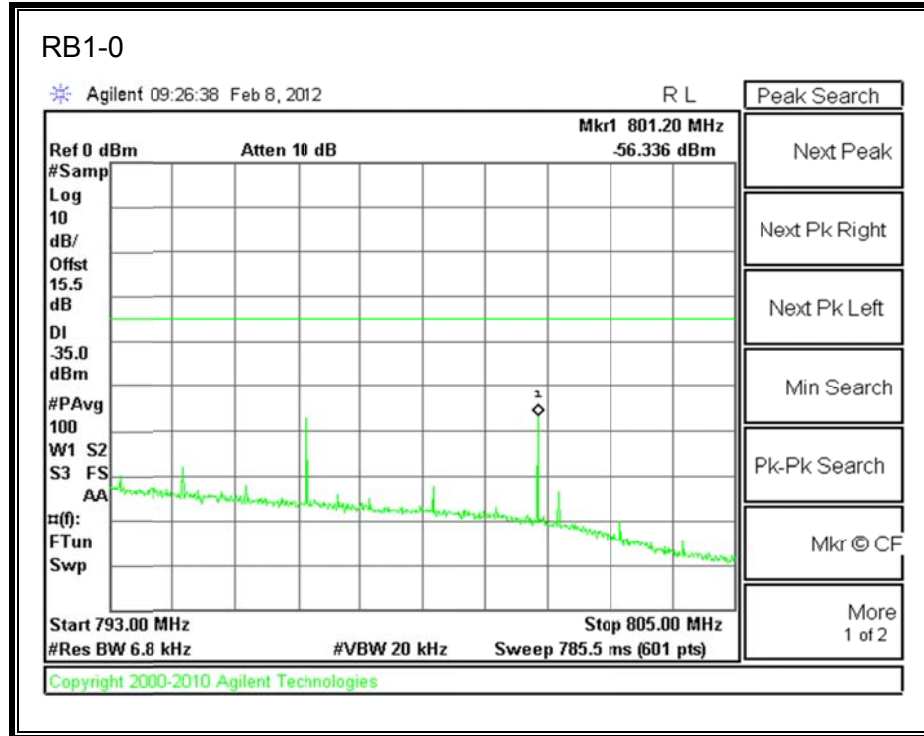


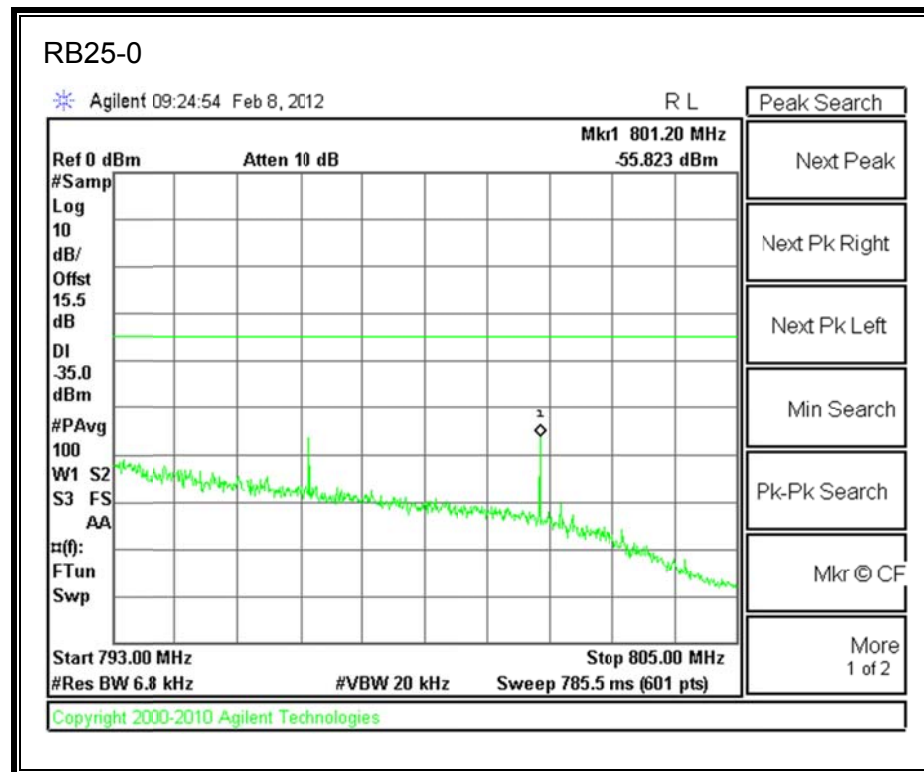
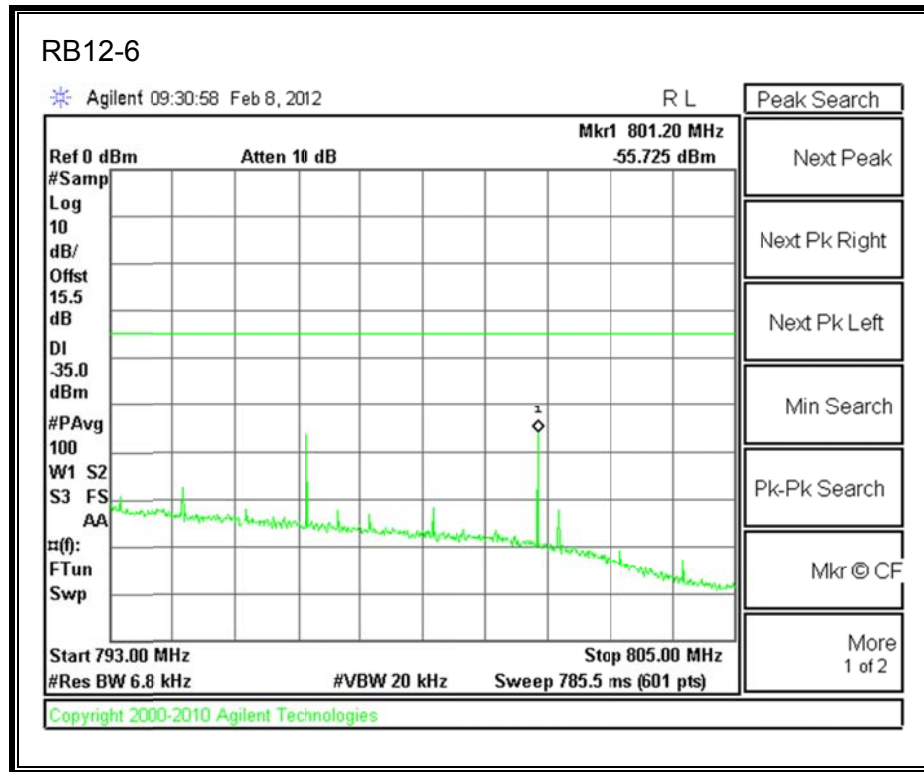
LTE 16QAM 782MHz Band 13, 763-775MHz (5MHz Bandwidth)



LTE QPSK 782MHz Band 13, 793 - 805MHz (5MHz Bandwidth)



LTE 16QAM 7825MHz Band 13, 793 - 805MHz (5MHz Bandwidth)



LTE QPSK 784.5 MHz Band 13, 775 - 777MHz (5MHz Bandwidth)