



**FCC 47 CFR PART 22H, 24E AND 27L  
CERTIFICATION TEST REPORT**

**FOR**

**LTE PHONE BLUETOOTH, WLAN (2.4GHZ & 5GHZ) AND NFC**

**MODEL NUMBER: LG-D500, LGD500, D500, LGMS500, LG-MS500, MS500**

**FCC ID: ZNFD500**

**REPORT NUMBER: 13U14980-3**

**ISSUE DATE: APRIL 16, 2013**

*Prepared for*  
**LG ELECTRONICS MOBILECOMM U.S.A., INC.  
1000 SYLVAN AVE.  
ENGLEWOODS CLIFFS, NJ 07632**

*Prepared by*  
**UL VERIFICATION SERVICES INC.  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	04/16/13	Initial Issue	P. Kim

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>6</b>
<b>2. TEST METHODOLOGY .....</b>	<b>7</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>7</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>7</b>
4.1. MEASURING INSTRUMENT CALIBRATION .....	7
4.2. SAMPLE CALCULATION .....	7
4.3. MEASUREMENT UNCERTAINTY.....	7
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>8</b>
5.1. DESCRIPTION OF EUT .....	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. SOFTWARE AND FIRMWARE.....	10
5.4. DESCRIPTION OF AVAILABLE ANTENNAS .....	10
5.5. WORST-CASE CONFIGURATION AND MODE.....	10
5.6. DESCRIPTION OF TEST SETUP.....	11
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>13</b>
<b>7. RF POWER OUTPUT VERIFICATION .....</b>	<b>14</b>
7.1. GSM MODES .....	14
7.1.1. GSM/GPRS/EGPRS.....	14
7.2. UMTS MODES .....	17
7.2.1. UMTS-REL 99 .....	17
7.2.2. UMTS-HSDPA.....	19
7.2.3. UMTS-HSUPA.....	21
7.3. LTE BANDS.....	25
7.3.1. LTE BAND 2-5MHz BANDWIDTH .....	25
7.3.2. LTE BAND 2-10MHz BANDWIDTH .....	26
7.3.3. LTE BAND 4-5MHz BANDWIDTH .....	27
7.3.4. LTE BAND 4-10MHz BANDWIDTH .....	28
7.3.5. LTE BAND 4-15MHz BANDWIDTH .....	29
7.3.6. LTE BAND 4-20MHz BANDWIDTH .....	30
7.3.7. LTE BAND 17-5MHz BANDWIDTH .....	31
7.3.8. LTE BAND 17-10MHz BANDWIDTH .....	32
<b>8. CONDUCTED TEST RESULTS .....</b>	<b>33</b>
8.1. OCCUPIED BANDWIDTH .....	33
8.1.1. GSM-GPRS .....	38
8.1.2. GSM-EGPRS.....	41
8.1.3. UMTS-REL 99 .....	45
8.1.4. UMTS-HSDPA.....	51
8.1.5. LTE BAND 2-5MHz BANDWIDTH .....	57

8.1.6.	LTE BAND 2-10MHz BANDWIDTH .....	63
8.1.7.	LTE BAND 4-5MHz BANDWIDTH .....	69
8.1.8.	LTE BAND 4-10MHz BANDWIDTH .....	75
8.1.9.	LTE BAND 4-15MHz BANDWIDTH .....	81
8.1.10.	LTE BAND 4-20MHz BANDWIDTH.....	87
8.1.11.	LTE BAND 17-5MHz BANDWIDTH.....	93
8.1.12.	LTE BAND 17-10MHz BANDWIDTH.....	99
<b>8.2.</b>	<b>BAND EDGE.....</b>	<b>105</b>
8.2.1.	GSM-GPRS .....	106
8.2.2.	GSM-EGPRS.....	108
8.2.3.	UMTS-REL 99 .....	110
8.2.4.	UMTS-HSDPA.....	113
8.2.5.	LTE BAND 2-5MHz BANDWIDTH .....	116
8.2.6.	LTE BAND 2-10MHz BANDWIDTH .....	124
8.2.7.	LTE BAND 4-5MHz BANDWIDTH.....	132
8.2.8.	LTE BAND 4-10MHz BANDWIDTH.....	140
8.2.9.	LTE BAND 4-15MHz BANDWIDTH.....	148
8.2.10.	LTE BAND 4-20MHz BANDWIDTH .....	156
8.2.11.	LTE BAND 17-5MHz BANDWIDTH.....	164
8.2.12.	LTE BAND 17-10MHz BANDWIDTH.....	172
<b>8.3.</b>	<b>OUT OF BAND EMISSIONS.....</b>	<b>180</b>
8.3.1.	GSM-GPRS .....	181
8.3.2.	GSM-EGPRS.....	184
8.3.3.	UMTS-REL 99 .....	187
8.3.4.	UMTS-HSDPA.....	192
8.3.5.	LTE BAND 2-5MHz BANDWIDTH .....	197
8.3.6.	LTE BAND 2-10MHz BANDWIDTH .....	200
8.3.7.	LTE BAND 2-5MHz BANDWIDTH .....	203
8.3.8.	LTE BAND 2-10MHz BANDWIDTH .....	206
8.3.9.	LTE BAND 2-15MHz BANDWIDTH .....	209
8.3.10.	LTE BAND 2-20MHz BANDWIDTH.....	212
8.3.11.	LTE BAND 17-5MHz BANDWIDTH.....	215
8.3.12.	LTE BAND 17-10MHz BANDWIDTH.....	218
<b>9.</b>	<b>FREQUENCY STABILITY .....</b>	<b>221</b>
<b>10.</b>	<b>RADIATED TEST RESULTS .....</b>	<b>226</b>
10.1.	RADIATED POWER (ERP & EIRP).....	226
10.1.1.	GSM-GPRS.....	230
10.1.2.	GSM-EGPRS .....	232
10.1.3.	UMTS-REL 99.....	234
10.1.4.	UMTS-HSDPA .....	237
10.1.5.	LTE BAND 2-5MHz BANDWIDTH.....	240
10.1.7.	LTE BAND 4-5MHz BANDWIDTH.....	245
10.1.8.	LTE BAND 4-10MHz BANDWIDTH.....	247
10.1.9.	LTE BAND 4-15MHz BANDWIDTH.....	249
10.1.10.	LTE BAND 4-20MHz BANDWIDTH.....	251
10.1.11.	LTE BAND 17-5MHz BANDWIDTH.....	253
10.1.12.	LTE BAND 17-10MHz BANDWIDTH.....	255
10.2.	FIELD STRENGTH OF SPURIOUS RADIATION.....	257
10.2.1.	GSM-GPRS.....	258

---

10.2.2.	GSM-EGPRS .....	260
10.2.3.	UMTS-REL 99 .....	262
10.2.4.	UMTS-HSDPA .....	265
10.2.5.	LTE BAND 2-5MHz BANDWIDTH .....	268
10.2.6.	LTE BAND 2-10MHz BANDWIDTH .....	270
10.2.7.	LTE BAND 4-5MHz BANDWIDTH .....	272
10.2.8.	LTE BAND 4-10MHz BANDWIDTH .....	274
10.2.9.	LTE BAND 4-15MHz BANDWIDTH .....	276
10.2.10.	LTE BAND 4-20MHz BANDWIDTH .....	278
10.2.11.	LTE BAND 17-5MHz BANDWIDTH .....	280
10.2.12.	LTE BAND 17-10MHz BANDWIDTH .....	282
<b>11.</b>	<b>SETUP PHOTOS .....</b>	<b>284</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** LG ELECTRONICS MOBILECOMM U.S.A., INC.  
1000 SYLVAN AVE.  
ENGLEWOODS CLIFFS, NJ 07632

**EUT DESCRIPTION:** LTE PHONE BLUETOOTH, WLAN (2.4GHZ & 5GHZ) AND NFC

**MODEL:** LG-D500, LGD500, D500, LGMS500, LG-MS500, MS500

**SERIAL NUMBER:** 303KPYR337170 (GSM & UMTS) AND 303KPUH337167 (LTE)

**DATE TESTED:** APRIL 15 TO MAY19, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 22H, 24E AND 27L	Pass

UL Verification Services Inc. 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 Verification Services Inc. By:

Tested By:



PHILIP KIM  
WiSE PROGRAM MANAGER  
UL Verification Services Inc.

MONA HUA  
WiSE ENGINEER  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 2, FCC CFR 47 Part 22, FCC CFR Part 24, FCC Part 27, RSS-132 Issue 2, RSS-133 Issue 4 and RSS-139 Issue 2.

## 3. FACILITIES AND ACCREDITATION

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

UL Verification Services Inc. 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 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 EUT is a LTE Phone with Bluetooth, WLAN(2.4GHz & 5GHz) and NFC capabilities.

### 5.2. MAXIMUM OUTPUT POWER

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

Part 22 Cellular Band					
Frequency range (MHz)	Modulation	Conducted		ERP	
		dBm	mW	dBm	mW
824.2 - 848.8	GPRS	34.00	2511.9	28.82	762.1
824.2 - 848.8	EGPRS	30.70	1174.9	25.44	349.9

Part 24 PCS Band					
Frequency range (MHz)	Modulation	Conducted		EIRP	
		dBm	mW	dBm	mW
1850.2 - 1909.8	GPRS	31.59	1442.1	29.35	861.0
1850.2 - 1909.8	EGPRS	31.69	1475.7	27.06	508.2

Part 22/24 Band					
Frequency range (MHz)	Modulation	Conducted		ERP/EIRP	
		dBm	mW	dBm	mW
826.4 - 846	REL 99	27.70	588.8	22.53	179.1
1852.4 - 1907.6		27.48	559.8	25.87	386.4

Part 22/24 Band					
Frequency range (MHz)	Modulation	Conducted		ERP/EIRP	
		dBm	mW	dBm	mW
826.4 - 846	HSDPA	28.00	631.0	23.72	235.5
1852.4 - 1907.6		27.82	605.3	26.72	469.9

Part 27 Band					
Frequency range (MHz)	Modulation	Conducted		EIRP	
		dBm	mW	dBm	mW
1712.4-1752.6	AWS Rel 99	27.37	545.8	26.55	451.9
	AWS HSDPA	27.54	567.5	27.36	544.5

Part 24 LTE Band 2 MODE (5.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
1852.5-1907.5	QPSK	25/0	28.30	676.1	28.07	641.2
	16QAM		28.26	669.9	27.17	521.2

Part 24 LTE Band 2 MODE (10.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
1855.0-1905	QPSK	50/0	28.31	677.6	29.07	807.2
	16QAM		28.01	632.4	28.67	736.2

Part 27 LTE Band 4 MODE (5.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
1712.5-1752.5	QPSK	25/0	28.28	673.0	27.61	576.8
	16QAM		27.48	559.8	26.91	490.9

Part 27 LTE Band 4 MODE (10.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
1715.0-1750.0	QPSK	50/0	27.95	623.7	28.01	632.4
	16QAM		27.73	592.9	27.01	502.3

Part 27 LTE Band 4 MODE (15.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
1717.5-1747.5	QPSK	75/0	28.08	642.7	28.65	732.8
	16QAM		28.34	682.3	27.85	609.5

Part 27 LTE Band 4 MODE (20.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
1720.0-1745.0	QPSK	100/0	28.04	636.8	27.61	576.8
	16QAM		28.38	688.7	27.11	514.0

Part 27 LTE Band 17 MODE (5.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
706.5-713.5	QPSK	25/0	28.70	741.3	20.36	108.6
	16QAM		27.97	626.6	19.07	80.7

Part 27 LTE Band 17 MODE (10.0 MHz BANDWIDTH)						
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted		EIRP	
			dBm	mW	dBm	mW
709.0-711.0	QPSK	50/0	28.48	704.7	21.02	126.5
	16QAM		27.89	615.2	20.10	102.3

### 5.3. SOFTWARE AND FIRMWARE

The EUT is linked with Agilent 8960 and CMW500 Communication Test Sets.

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral antenna with a maximum peak gain as follow:

BAND	Gain (dBi)
GSM850/WCDMA B5( 824-894MHz)	-4.7
PCS/WCDMA B2 (1850-1990MHz)	0.35
WCDMA B4/LTE B4(1710-2155MHz)	1.1
LTE band 17 (704-746MHz)	-3.2

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case is EUT on the highest power. Based on Peak Power measurement investigations, the following modes should be considered as worst-case scenario for all other measurements.

Worst-case modes:

- GSM: GPRS and EGPRS
- UMTS: WCDMA and HSDPA
- LTE: Band 2, 4, and 17

For the fundamental investigation, since the EUT is a portable device that has three orientations; an X, Y and Z orientations and the worst among X, Y, and Z with AC/DC adapter and headset have been investigated. After the investigation the worst case was found to be X-Position with an AC Adapter for Cell bands and Z-position with an AC Adapter and headset for PCS bands respectively

## 5.6. DESCRIPTION OF TEST SETUP

### RADIATED TESTS SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
AC Adapter	LG	MCS-01WR	RB320071516
Headset	LG	NA	NA

### I/O CABLES (RF Conducted Test)

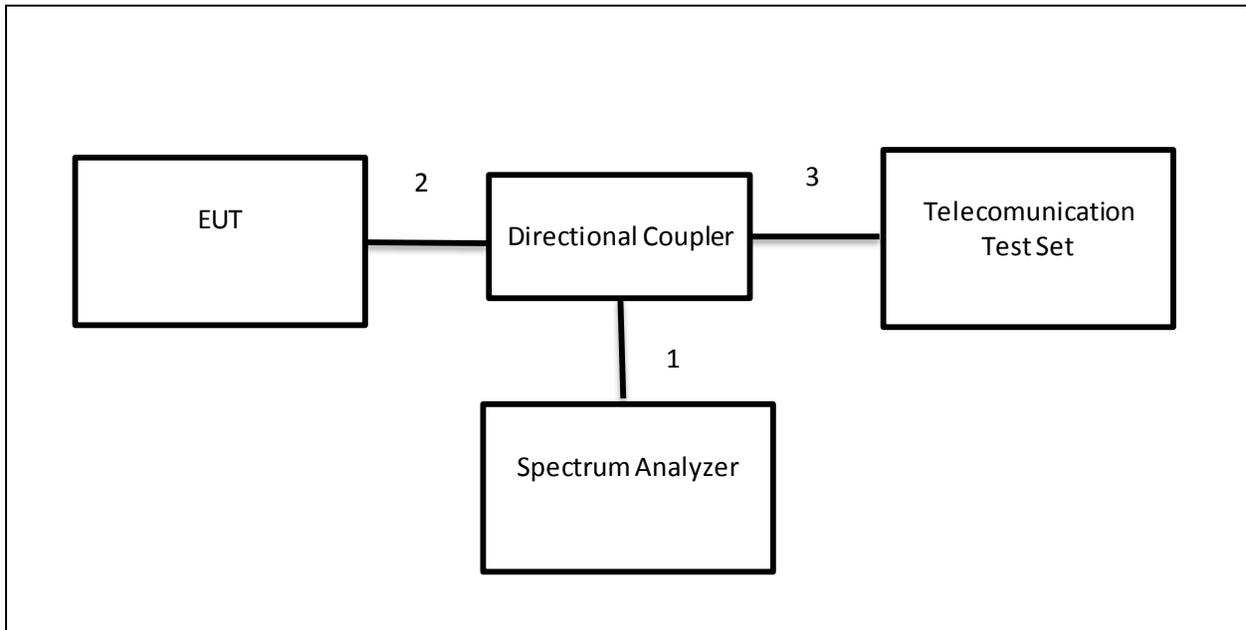
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	RF In/Out	1	Spectrum Analyzer	UN-SHELDED	None	N/A
2	RF out	1	Directional Coupler	UN-SHELDED	0.1m	N/A
3	RF In/Out	1	Communication Call box	UN-SHELDED	0.5m	N/A

### I/O CABLES (RF Radiated Test)

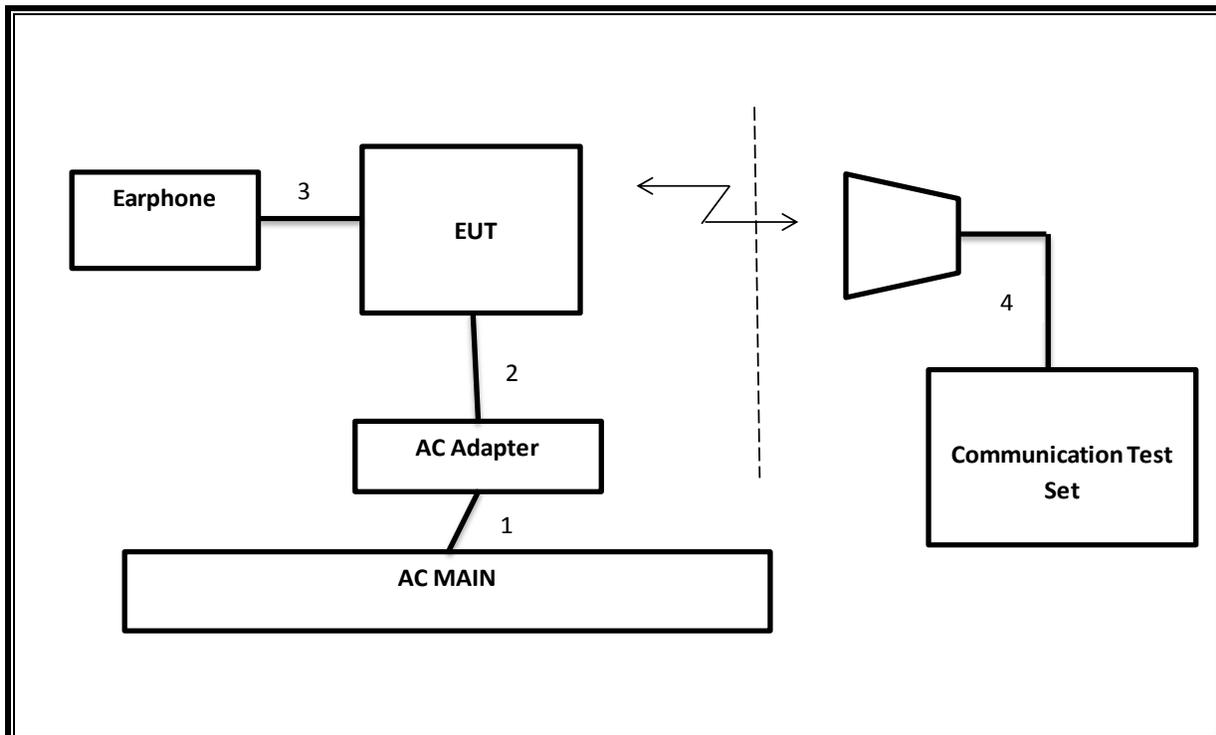
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	115VAC	UN-SHELDED	1.0m	N/A
2	DC	1	DC	UN-SHELDED	1.0m	Volume control on
3	Audio	1	Earphone	UN-SHELDED	1.0m	NA
4	RF In/Out	1	Horn	UN-SHELDED	5m	NA

### TEST SETUP

**CONDUCTED SETUP**



**RADIATED SETUP**



## 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	C01179	02/26/14
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/13
Antenna, Horn, 18 GHz	EMCO	3115	C00783	10/25/13
Antenna, Horn, 18 GHz	EMCO	3115	C00945	12/11/13
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	03/28/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	10/22/13
Communication Test Set	Agilent / HP	E5515C	C01086	11/10/13
Communication Test Set	R & S	CMW500	None	06/28/13
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	01/09/14
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02689	CNR
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Directional Coupler, 4.2 GHz, 40 dB	A-R	DC7144A	C00983	CNR
Vector Signal Generator	Agilent / HP	E4438C	None	07/06/13
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121C DB4	C00993	02/01/14

## 7. RF POWER OUTPUT VERIFICATION

### 7.1. GSM MODES

#### 7.1.1. GSM/GPRS/EGPRS

##### TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with  $VBW \geq RBW \geq 26dB$  BW, typically 3MHz.
- Set a marker to point the corresponding peak value.

## **TEST PROCEDURE**

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900  
Press Connection control to choose the different menus  
Press RESET > choose all to reset all settings  
Connection Press Signal Off to turn off the signal and change settings  
Network Support > GSM+GPRS or GSM+EGPRS  
Main Service > Packet Data  
Service selection > Test Mode A – Auto Slot Config. off  
MS Signal Press Slot Config bottom on the right twice to select and change the number of time slots and power setting  
    > Slot configuration > Uplink/Gamma  
    > 33 dBm for GPRS 850/900  
    > 27 dBm for EGPRS 850/900  
    > 30 dBm for GPRS1800/1900  
    > 26 dBm for EGPRS1800/1900  
BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel  
Frequency Offset > + 0 Hz  
Mode > BCCH and TCH  
BCCH Level > -85 dBm (May need to adjust if link is not stable)  
BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]  
Channel Type > Off  
P0> 4 dB  
Slot Config > Unchanged (if already set under MS Signal)  
TCH > choose desired test channel  
  
Hopping > Off  
Main Timeslot > 3 (Default)  
Network Coding Scheme > CS1 (GPRS) and MCS5 (EGPRS)  
Bit Stream > 2E9-1PSR Bit Pattern  
AF/RF Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input  
Connection Press Signal On to turn on the signal and change settings

## **RESULTS**

**CELL BAND**

Mode	Ch.	f (MHz)	1 time slots	
			Peak	Avg
GSM	128	824.2	32.9	32.9
	190	836.6	32.9	32.9
	251	848.8	32.9	32.8

Mode	Ch.	f (MHz)	1 time slots		2 time slots		3 time slots		4 time slots	
			Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
GPRS	128	824.2	34.00	33.62	31.82	31.75	30.38	30.31	29.82	29.6
	190	836.6	33.98	33.6	31.76	31.53	30.49	30.15	29.8	29.49
	251	848.8	33.96	33.2	31.6	31.45	30.43	30.07	29.75	29.51

Mode	Ch.	f (MHz)	1 time slots		2 time slots		3 time slots		4 time slots	
			Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
EGPRS	128	824.2	30.6	27.4	29.9	26.7	28.9	25.7	28.0	24.8
	190	836.6	30.7	27.5	30.0	26.8	28.9	25.7	28.1	24.9
	251	848.8	30.6	27.4	29.9	26.7	28.7	25.5	28.0	24.8

**PCS BAND**

Mode	Ch.	f (MHz)	1 time slots	
			Peak	Avg
GSM	512	1850.2	30.0	29.9
	661	1880.0	30.1	30.0
	810	1909.8	30.0	29.8

Mode	Ch.	f (MHz)	1 time slots		2 time slots		3 time slots		4 time slots	
			Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
GPRS	512	1850.2	31.59	31.50	28.76	28.11	27.59	27.01	26.66	25.86
	661	1880.0	31.34	31.25	28.75	28.13	27.53	27.00	26.51	25.80
	810	1909.8	31.58	31.25	28.82	28.08	27.66	27.13	26.58	25.84

Mode	Ch.	f (MHz)	1 time slots		2 time slots		3 time slots		4 time slots	
			Peak	Avg	Peak	Avg	Peak	Avg	Peak	Avg
EGPRS	512	1850.2	31.69	26.23	29.55	25.55	29.46	25.35	28.75	24.86
	661	1880.0	31.48	26.19	29.46	25.53	29.34	25.41	28.68	24.83
	810	1909.8	31.45	25.71	29.44	25.5	29.37	25.43	28.7	24.84

## 7.2. UMTS MODES

### 7.2.1. UMTS-REL 99

#### TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW  $\geq$  RBW  $\geq$  26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

#### TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	$\beta_c$	Not Applicable
	$\beta_d$	Not Applicable
	$\beta_{ec}$	Not Applicable
	$\beta_c/\beta_d$	8/15
	$\beta_{hs}$	Not Applicable
	$\beta_{ed}$	Not Applicable

## RESULTS

Band	UL Ch	DL Ch	Frequency	Peak Conducted Output Power (dBm)	Average Conducted Output Power (dBm)
UMTS 850	4132	4357	826.4	27.70	24.19
	4180	4405	836.0	27.48	24.20
	4230	4455	846.0	27.60	24.17

Band	UL Ch	DL Ch	Frequency	Peak Conducted Output Power (dBm)	Average Conducted Output Power (dBm)
UMTS 1900	9262	9662	1852.4	27.10	24.00
	9400	9800	1880.0	27.48	24.10
	9538	9938	1907.6	27.44	24.13

Band	UL Ch	DL Ch	Frequency	Peak Conducted Output Power (dBm)	Average Conducted Output Power (dBm)
UMTS 1700	1312	1537	1712.4	27.37	23.98
	1413	1638	1732.6	27.31	24.10
	1513	1738	1752.6	26.89	23.85

## 7.2.2. UMTS-HSDPA

### TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	HSUPA Test	Not Applicable			
	Power Control Algorithm	Algorithm 2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	$\beta_{ec}$	-	-	-	-
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
	$\beta_{hs}$	4/15	24/15	30/15	30/15
	$\beta_{ed}$	Not Applicable			
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	$A_{hs} = \beta_{hs}/\beta_c$	30/15			

**RESULTS**

Band	Subtest	UL Ch	DL Ch	Frequency	Peak power (dBm)	Average Power dBm
UMTS850 (Band V)	1	4132	4357	826.4	28.00	23.80
		4180	4405	836.0	27.90	23.6
		4230	4455	846.0	27.86	23.59
	2	4132	4357	826.4	27.95	23.72
		4180	4405	836.0	27.90	23.56
		4230	4455	846.0	27.95	23.73
	3	4132	4357	826.4	27.98	23.73
		4180	4405	836.0	27.97	23.53
		4230	4455	846.0	27.80	23.65
	4	4132	4357	826.4	27.85	23.71
		4180	4405	836.0	27.72	23.54
		4230	4455	846.0	27.62	23.67
UMTS1900 (Band II)	1	9262	9662	1852.4	27.10	23.51
		9400	9800	1880.0	27.06	23.48
		9538	9938	1907.6	27.15	23.50
	2	9262	9662	1852.4	27.00	23.54
		9400	9800	1880.0	27.10	23.58
		9538	9938	1907.6	27.82	23.57
	3	9262	9662	1852.4	27.20	23.55
		9400	9800	1880.0	27.35	23.40
		9538	9938	1907.6	27.54	23.50
	4	9262	9662	1852.4	27.12	23.51
		9400	9800	1880.0	27.65	23.56
		9538	9938	1907.6	27.33	23.60

Note 1: Maximum output power levels that are possible for all subtests reported.

Band	Subtest	UL Ch	DL Ch	Frequency	Peak power (dBm)	Average Power dBm
UMTS 1700 (Band IV)	1	1312	1537	1712.4	27.43	23.91
		1413	1638	1732.6	27.50	24.10
		1513	1738	1752.6	27.00	23.98
	2	1312	1537	1712.4	27.47	23.86
		1413	1638	1732.6	27.46	24.07
		1513	1738	1752.6	27.02	23.89
	3	1312	1537	1712.4	27.37	23.90
		1413	1638	1732.6	27.54	23.97
		1513	1738	1752.6	27.26	23.86
	4	1312	1537	1712.4	27.42	23.95
		1413	1638	1732.6	27.35	24.02
		1513	1738	1752.6	27.32	23.81

### 7.2.3. UMTS-HSUPA

#### TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	$\beta_c$	11/15	6/15	15/15	2/15	15/15
	$\beta_d$	15/15	15/15	9/15	15/15	0
	$\beta_{ec}$	209/225	12/15	30/15	2/15	5/15
	$\beta_c/\beta_d$	11/15	6/15	15/9	2/15	-
	$\beta_{hs}$	22/15	12/15	30/15	4/15	5/15
HSDPA Specific Settings	$\beta_{ed}$	1309/225	94/75	47/15 47/15	56/75	47/15
	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
$A_{hs} = \beta_{hs}/\beta_c$	30/15					
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	12
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18		E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27

**RESULTS**

Band	Subtest	UL Ch	DL Ch	Frequency	Peak power (dBm)	Average power (dBm)
UMTS850 (Band V)	1	4132	4357	826.4	27.9	23.2
		4180	4405	836.0	27.8	23.5
		4230	4455	846.0	27.7	23.2
	2	4132	4357	826.4	27.7	22.3
		4180	4405	836.0	27.7	22.5
		4230	4455	846.0	27.6	22.4
	3	4132	4357	826.4	27.6	22.5
		4180	4405	836.0	27.8	22.9
		4230	4455	846.0	27.5	22.5
	4	4132	4357	826.4	27.9	22.3
		4180	4405	836.0	27.7	22.8
		4230	4455	846.0	27.7	22.8
	5	4132	4357	826.4	28.0	23.4
		4180	4405	836.0	27.5	23.5
		4230	4455	846.0	27.4	23.2
UMTS1900 (Band II)	1	9262	9662	1852.4	27.1	23.4
		9400	9800	1880.0	27.7	23.7
		9538	9938	1907.6	27.8	23.6
	2	9262	9662	1852.4	27.1	22.3
		9400	9800	1880.0	27.6	22.4
		9538	9938	1907.6	27.4	22.1
	3	9262	9662	1852.4	27.1	22.5
		9400	9800	1880.0	27.6	22.6
		9538	9938	1907.6	27.7	22.7
	4	9262	9662	1852.4	27.0	22.4
		9400	9800	1880.0	27.8	22.5
		9538	9938	1907.6	27.6	22.7
	5	9262	9662	1852.4	27.2	23.5
		9400	9800	1880.0	27.7	23.8
		9538	9938	1907.6	27.6	23.6

Note 1: Maximum output power levels that are possible for all subtests reported.

Band	Subtest	UL Ch	DL Ch	Frequency	Peak power (dBm)	Average power (dBm)
UMTS 1700 (Band IV)	1	1312	1537	1712.4	27.8	23.4
		1413	1638	1732.6	27.2	23.6
		1513	1738	1752.6	27.7	22.9
	2	1312	1537	1712.4	27.0	21.9
		1413	1638	1732.6	27.0	21.8
		1513	1738	1752.6	27.8	22.2
	3	1312	1537	1712.4	27.7	22.5
		1413	1638	1732.6	27.6	22.5
		1513	1738	1752.6	26.9	21.9
	4	1312	1537	1712.4	27.7	21.9
		1413	1638	1732.6	27.2	22.0
		1513	1738	1752.6	26.6	22.0
	5	1312	1537	1712.4	28.0	23.4
		1413	1638	1732.6	27.6	23.7
		1513	1738	1752.6	27.4	23.5

### 7.2.4. DC-HSDPA

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

**Table E.5.0: Levels for HSDPA connection setup**

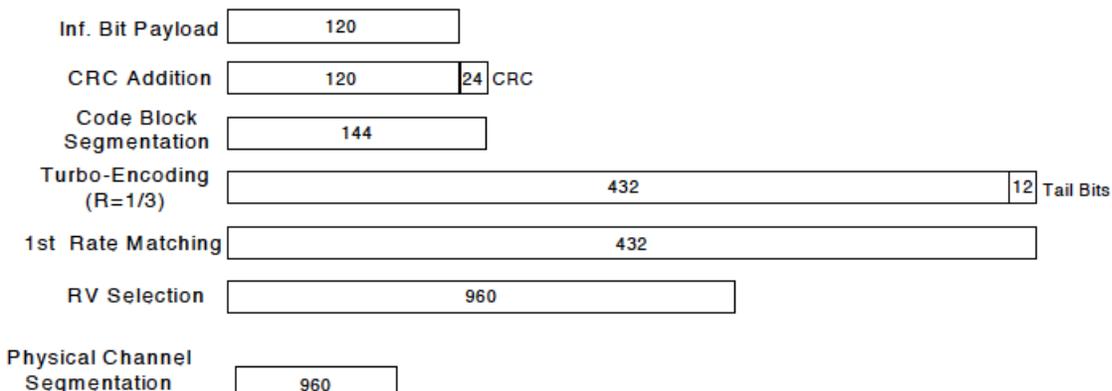
Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload ( $N_{INF}$ )	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		



**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**

The following 4 Sub-tests for HSDPA were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	$\beta_d$ (SF)	64			
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
	$\beta_{hs}$	4/15	24/15	30/15	30/15
	MPR	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	$A_{hs} = \beta_{hs} / \beta_c$	30/15			

Up commands are set continuously to set the UE to Max power.

**Results**

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band II	Subtest 1	9262	1852.4	23.9
		9400	1880.0	24.0
		9538	1907.6	24.0
	Subtest 2	9262	1852.4	23.6
		9400	1880.0	23.6
		9538	1907.6	23.5
	Subtest 3	9262	1852.4	23.4
		9400	1880.0	23.5
		9538	1907.6	23.4
	Subtest 4	9262	1852.4	23.5
		9400	1880.0	23.6
		9538	1907.6	23.4

**HSPA+**

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, the RF conducted power is not measured.

### 7.3. LTE BANDS

#### 7.3.1. LTE BAND 2-5MHz BANDWIDTH

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
5	18625	1852.5	QPSK	1	0	23.52	26.84
				1	12	23.54	26.61
				1	24	23.50	26.56
				12	0	22.60	26.39
				12	6	22.62	26.11
				12	11	22.67	26.31
				25	0	22.43	27.15
			16QAM	1	0	22.50	26.22
				1	12	22.37	26.09
				1	24	22.33	26.06
				12	0	21.55	26.45
				12	6	21.46	26.12
				12	11	21.54	26.31
				25	0	21.59	27.01
	18900	1880.0	QPSK	1	0	23.59	27.97
				1	12	23.68	27.78
				1	24	23.64	27.69
				12	0	22.66	27.28
				12	6	22.68	27.15
				12	11	22.61	27.24
				25	0	22.55	28.02
			16QAM	1	0	22.50	27.14
				1	12	22.47	27.11
				1	24	22.47	27.02
				12	0	21.60	27.32
				12	6	21.54	27.20
				12	11	21.60	27.26
25				0	21.66	28.01	
19175	1907.5	QPSK	1	0	23.54	28.18	
			1	12	23.51	28.04	
			1	24	23.55	28.10	
			12	0	22.67	27.87	
			12	6	22.68	27.71	
			12	11	22.58	27.74	
			25	0	22.72	28.30	
		16QAM	1	0	22.52	27.77	
			1	12	22.58	27.65	
			1	24	22.24	27.42	
			12	0	21.60	28.07	
			12	6	21.60	27.93	
			12	11	21.54	28.00	
			25	0	21.70	28.26	

**7.3.2. LTE BAND 2-10MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
10	18650	1855.0	QPSK	1	0	23.43	26.86
				1	24	23.53	26.58
				1	49	23.57	26.86
				25	0	22.60	26.54
				25	12	22.59	26.16
				25	24	22.53	26.38
				50	0	22.48	27.13
			16QAM	1	0	22.42	26.25
				1	24	22.25	26.11
				1	49	22.35	26.14
				25	0	21.62	26.51
				25	12	21.63	26.18
				25	24	21.60	26.34
				50	0	21.70	27.27
	18900	1880.0	QPSK	1	0	23.50	28.23
				1	24	23.64	27.90
				1	49	23.61	27.70
				25	0	22.67	27.28
				25	12	22.70	27.29
				25	24	22.60	27.31
				50	0	22.70	27.91
			16QAM	1	0	22.37	27.06
				1	24	22.38	27.09
				1	49	22.26	26.95
				25	0	21.72	27.51
				25	12	21.71	27.30
				25	24	21.60	27.31
50				0	21.57	28.00	
19150	1905.0	QPSK	1	0	23.56	28.65	
			1	24	23.60	28.29	
			1	49	23.54	27.90	
			25	0	22.62	28.03	
			25	12	22.73	28.00	
			25	24	22.58	27.84	
			50	0	22.58	28.31	
		16QAM	1	0	21.71	27.50	
			1	24	22.13	27.76	
			1	49	21.96	27.50	
			25	0	21.72	27.39	
			25	12	21.82	27.23	
			25	24	21.80	27.40	
			50	0	21.70	28.01	

**7.3.3. LTE BAND 4-5MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
5	19975	1712.5	QPSK	1	0	23.66	27.81
				1	12	23.65	27.79
				1	24	23.60	27.78
				12	0	22.52	27.56
				12	6	22.49	27.60
				12	11	22.52	27.61
				25	0	22.42	28.21
			16QAM	1	0	22.36	27.38
				1	12	22.35	27.48
				1	24	22.44	27.61
				12	0	21.42	27.10
				12	6	21.46	27.03
				12	11	21.47	27.12
				25	0	21.53	28.03
	20175	1732.5	QPSK	1	0	23.66	27.31
				1	12	23.51	27.24
				1	24	23.35	27.22
				12	0	22.51	27.11
				12	6	22.43	26.91
				12	11	22.39	27.00
				25	0	22.53	28.28
			16QAM	1	0	22.30	27.02
				1	12	22.31	26.95
				1	24	22.23	26.81
				12	0	21.34	26.61
				12	6	21.30	26.22
				12	11	21.23	26.36
				25	0	21.35	27.48
	20375	1752.5	QPSK	1	0	23.25	26.93
				1	12	23.16	26.73
1				24	23.20	26.78	
12				0	22.42	27.03	
12				6	22.36	26.95	
12				11	22.33	27.04	
25				0	22.10	27.37	
16QAM			1	0	22.01	26.86	
			1	12	22.09	26.89	
			1	24	22.00	26.90	
			12	0	21.26	26.51	
			12	6	21.25	26.30	
			12	11	21.32	26.45	
			25	0	21.48	27.43	

**7.3.4. LTE BAND 4-10MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
10	20000	1715.0	QPSK	1	0	23.60	27.91
				1	24	23.51	27.77
				1	49	23.66	27.68
				25	0	22.53	27.35
				25	12	22.56	27.21
				25	24	22.58	27.15
				50	0	22.53	27.92
			16QAM	1	0	22.00	26.70
				1	24	22.04	27.73
				1	49	22.11	27.59
				25	0	21.63	27.24
				25	12	21.65	27.09
				25	24	21.69	27.35
				50	0	21.67	27.41
	20175	1732.5	QPSK	1	0	23.70	27.36
				1	24	23.56	27.30
				1	49	23.41	27.36
				25	0	22.58	27.30
				25	12	22.37	27.21
				25	24	22.41	27.22
				50	0	22.52	27.95
			16QAM	1	0	22.14	26.45
				1	24	22.01	27.15
				1	49	22.14	27.12
				25	0	21.39	26.73
				25	12	21.38	26.34
				25	24	21.31	26.41
				50	0	21.39	27.34
	20350	1750.0	QPSK	1	0	23.29	27.00
				1	24	23.20	26.92
1				49	23.20	26.83	
25				0	22.34	27.60	
25				12	22.32	27.44	
25				24	22.29	27.45	
50				0	22.12	27.16	
16QAM			1	0	21.88	27.05	
			1	24	21.98	27.10	
			1	49	21.90	26.18	
			25	0	21.35	26.50	
			25	12	21.44	26.21	
			25	24	21.34	26.46	
			50	0	21.48	27.23	

**7.3.5. LTE BAND 4-15MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
15	20025	1717.5	QPSK	1	0	23.53	27.91
				1	37	23.61	27.64
				1	74	23.64	27.42
				36	0	22.54	28.00
				36	16	22.64	27.85
				36	35	22.63	27.82
				75	0	22.64	28.08
			16QAM	1	0	22.24	27.51
				1	37	22.20	27.56
				1	74	22.13	27.16
				36	0	21.70	28.15
				36	16	21.72	28.01
				36	35	21.51	27.95
				75	0	21.52	28.34
	20175	1732.5	QPSK	1	0	23.65	27.39
				1	37	23.42	27.29
				1	74	23.42	27.31
				36	0	22.46	27.37
				36	16	22.42	27.04
				36	35	22.33	27.01
				75	0	22.51	27.91
			16QAM	1	0	22.43	27.27
				1	37	22.35	26.90
				1	74	22.18	26.66
				36	0	21.51	26.85
				36	16	21.43	26.35
				36	35	21.34	26.30
75				0	21.50	27.78	
20325	1747.5	QPSK	1	0	23.46	27.41	
			1	37	23.31	27.08	
			1	74	23.22	26.87	
			36	0	22.32	27.25	
			36	16	22.36	27.07	
			36	35	22.31	27.25	
			75	0	22.23	27.53	
		16QAM	1	0	22.22	26.78	
			1	37	22.09	26.81	
			1	74	21.98	26.91	
			36	0	21.47	26.53	
			36	16	21.44	26.21	
			36	35	21.42	26.45	
			75	0	21.31	27.20	

**7.3.6. LTE BAND 4-20MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
20	20050	1720.0	QPSK	1	0	23.60	27.93
				1	49	23.68	27.59
				1	99	23.70	27.36
				50	0	22.68	28.04
				50	24	22.55	27.88
				50	49	22.51	27.70
				100	0	22.61	28.00
			16QAM	1	0	22.51	27.80
				1	49	22.52	27.86
				1	99	22.34	27.50
				50	0	21.71	28.12
				50	24	21.59	27.73
				50	49	21.46	27.61
				100	0	21.71	28.38
	20175	1732.5	QPSK	1	0	23.70	27.46
				1	49	23.54	27.31
				1	99	23.45	27.35
				50	0	22.47	27.50
				50	24	22.51	27.22
				50	49	22.38	27.11
				100	0	22.45	27.79
			16QAM	1	0	22.29	27.71
				1	49	22.20	27.10
				1	99	22.17	26.96
				50	0	21.42	26.77
				50	24	21.44	26.22
				50	49	21.35	26.34
				100	0	21.65	27.89
	20300	1745.0	QPSK	1	0	23.36	27.31
				1	49	23.29	27.09
1				99	23.24	26.92	
50				0	22.34	27.30	
50				24	22.38	27.04	
50				49	22.34	27.39	
100				0	22.32	27.45	
16QAM			1	0	22.36	27.07	
			1	49	22.34	27.05	
			1	99	22.22	27.13	
			50	0	21.35	26.51	
			50	24	21.36	26.16	
			50	49	21.23	26.52	
			100	0	21.44	28.03	

**7.3.7. LTE BAND 17-5MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
5	23755	706.5	QPSK	1	0	23.54	27.61
				1	12	23.60	27.67
				1	24	23.50	27.61
				12	0	22.68	27.09
				12	6	22.66	26.98
				12	11	22.64	27.17
				25	0	22.56	28.03
			16QAM	1	0	22.42	26.88
				1	12	22.42	27.01
				1	24	22.32	26.63
				12	0	21.70	26.77
				12	6	21.73	26.44
				12	11	21.63	26.74
				25	0	21.75	27.40
	23790	710.0	QPSK	1	0	23.50	27.73
				1	12	23.63	27.75
				1	24	23.49	27.83
				12	0	22.73	27.50
				12	6	22.69	27.50
				12	11	22.58	27.58
				25	0	22.50	28.02
			16QAM	1	0	22.40	27.10
				1	12	22.65	27.68
				1	24	22.37	27.53
				12	0	21.74	27.23
				12	6	21.76	27.17
				12	11	21.66	27.38
25				0	21.73	27.91	
23825	713.5	QPSK	1	0	23.50	27.87	
			1	12	23.63	28.23	
			1	24	23.45	28.24	
			12	0	22.59	27.54	
			12	6	22.73	27.32	
			12	11	22.76	27.30	
			25	0	22.48	28.70	
		16QAM	1	0	22.44	27.59	
			1	12	22.71	27.45	
			1	24	22.24	27.27	
			12	0	21.66	27.41	
			12	6	21.78	27.01	
			12	11	21.83	27.64	
			25	0	21.81	27.97	

**7.3.8. LTE BAND 17-10MHz BANDWIDTH**

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Avg Pwr (dBm)	Peak Pwr (dBm)
10	23780	709.0	QPSK	1	0	23.49	27.79
				1	24	23.61	27.74
				1	49	23.61	28.48
				25	0	22.58	27.41
				25	12	22.62	27.32
				25	24	22.62	27.57
			16QAM	50	0	22.44	27.70
				1	0	22.41	26.88
				1	24	22.48	27.35
				1	49	22.42	27.37
				25	0	21.81	26.92
				25	12	21.78	27.01
				25	24	21.81	27.44
				50	0	21.75	27.77
	23790	710.0	QPSK	1	0	23.65	27.91
				1	24	23.63	27.85
				1	49	23.66	28.28
				25	0	22.58	27.58
				25	12	22.57	27.66
				25	24	22.60	27.50
			16QAM	50	0	22.60	27.76
				1	0	22.48	26.95
				1	24	22.43	27.58
				1	49	22.51	27.15
				25	0	21.81	27.24
				25	12	21.76	27.10
				25	24	21.73	27.41
				50	0	21.74	27.70
	23800	711.0	QPSK	1	0	23.46	27.83
				1	24	23.52	27.95
1				49	23.44	28.39	
25				0	22.65	27.85	
25				12	22.49	27.41	
25				24	22.63	27.70	
16QAM			50	0	22.49	27.75	
			1	0	22.20	27.00	
			1	24	21.93	26.92	
			1	49	21.94	26.77	
			25	0	21.76	27.11	
			25	12	21.70	27.15	
			25	24	21.80	27.19	
			50	0	21.72	27.89	

## 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

- GSM: GPRS and EGPRS
- UMTS: WCDMA and HSDPA
- LTE: Band 2, 4, and 17

#### RESULTS

Mode	Band	Channel	f (MHz)	99% BW (kHz)	-26dB BW (kHz)
GPRS	CELL	128	824.2	255.4292	259.520
		190	836.4	254.5846	259.173
		251	848.8	252.1207	258.396
	PCS	512	1850.2	239.6740	244.043
		661	1880.0	238.6739	243.931
		810	1909.8	239.9574	244.028

Mode	Band	Channel	f (MHz)	99% BW (kHz)	-26dB BW (kHz)
EGPRS	CELL	128	824.2	249.9780	306.679
		190	836.4	250.7451	255.379
		251	848.8	254.0657	259.244
	PCS	512	1850.2	238.9544	285.587
		661	1880.0	236.9225	290.822
		810	1909.8	240.5797	244.654

Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
UMTS, WCDMA	CELL	4357	826.4	4.2784	4.628
		4405	836.0	4.2230	4.610
		4455	846.0	4.1691	4.565
	PCS	9662	1852.4	4.2362	4.620
		9800	1880.0	4.1526	4.573
		9938	1907.6	4.1143	4.499
	AWS	1312	1712.4	4.0690	4.573
		1413	1732.6	4.2420	4.560
		1513	1752.6	4.2494	4.479

Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
UMTS, HSDPA	CELL	4357	826.4	4.0582	4.575
		4405	836.0	4.1681	4.584
		4455	846.0	4.1698	4.539
	PCS	9662	1852.4	4.0744	4.599
		9800	1880.0	3.9316	4.540
		9938	1907.6	4.2254	4.566
	AWS	1312	1712.4	4.0706	4.479
		1413	1732.6	4.1315	4.606
		1513	1752.6	4.1456	4.519

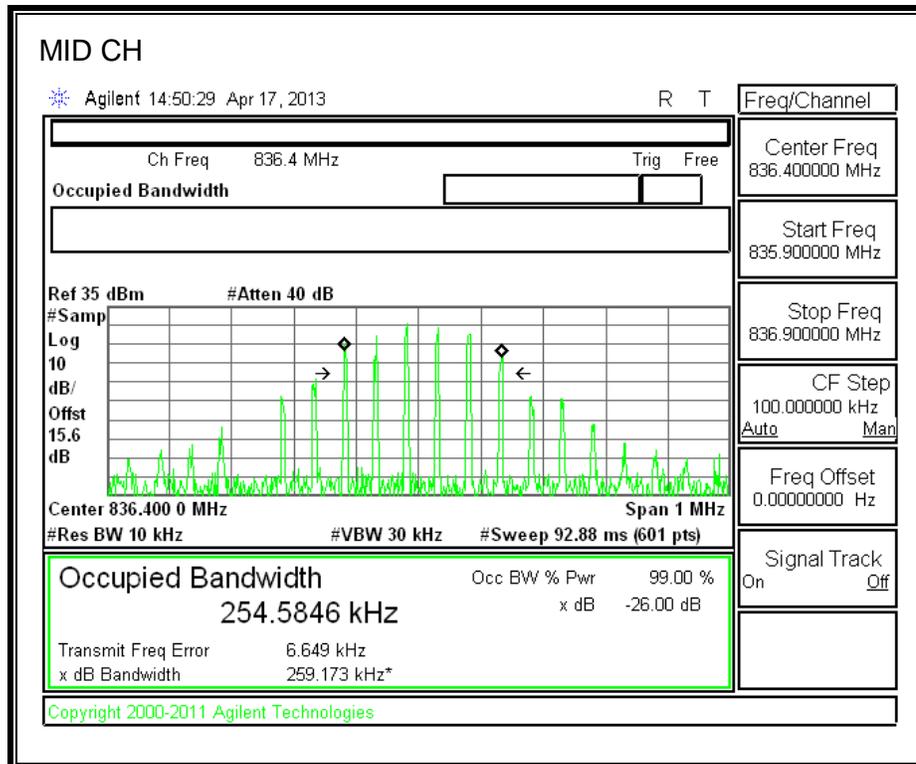
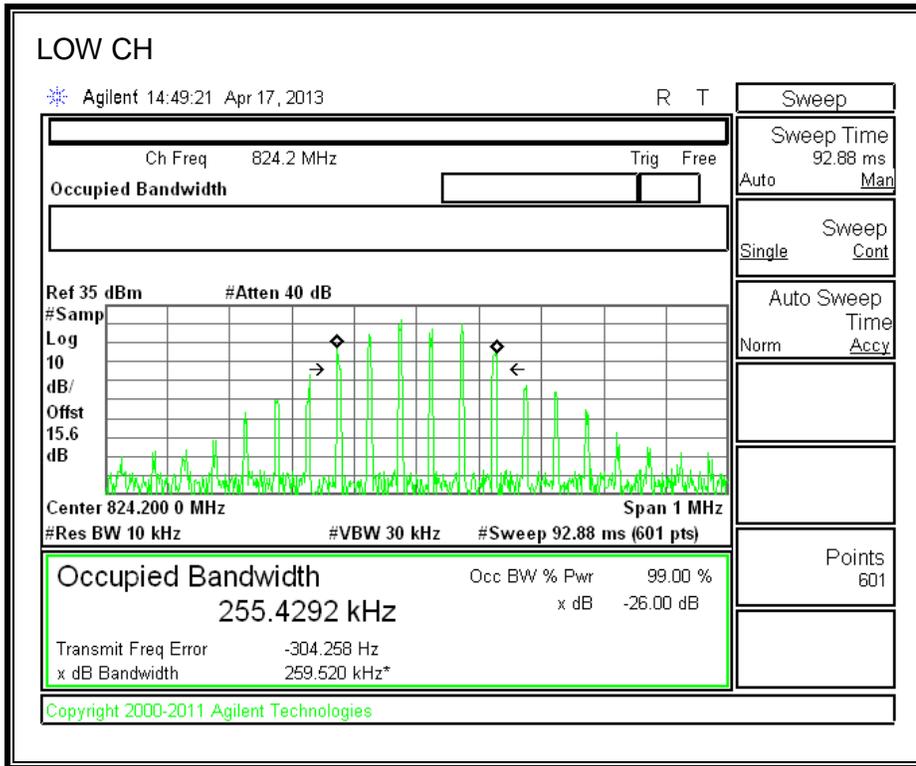
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE Band 2	5.0 MHz BAND QPSK	12/6	1852.5	2.1804	2.403
		25/0		4.5029	4.679
	5.0 MHz BAND 16QAM	12/6		2.1606	2.274
		25/0		4.4703	5.970
	5.0 MHz BAND QPSK	12/6	1880.0	2.1578	2.386
		25/0		4.4539	4.853
	5.0 MHz BAND 16QAM	12/6		2.1413	2.760
		25/0		4.4915	4.774
	5.0 MHz BAND QPSK	12/6	1907.5	2.1667	2.506
		25/0		4.4392	4.668
	5.0 MHz BAND 16QAM	12/6		2.1686	2.754
		25/0		4.4702	4.776
	10 MHz BAND QPSK	25/12	1855	4.4529	4.765
		50/0		8.8040	9.380
	10 MHz BAND 16QAM	25/12		4.4632	4.677
		50/0		8.8789	9.542
	10 MHz BAND QPSK	25/12	1880	4.4780	4.946
		50/0		8.9119	9.378
10 MHz BAND 16QAM	25/12	4.4678		4.730	
	50/0	8.9073		9.290	
10 MHz BAND QPSK	25/12	1905	4.4933	5.262	
	50/0		9.0008	9.373	
10 MHz BAND 16QAM	25/12		4.5142	5.072	
	50/0		9.0030	9.364	

Band	Mode	RB/RB SIZE	f (MHz)	99% BW (kHz)	-26dB BW (kHz)
LTE Band 4	5.0 MHz BAND QPSK	12/6	1712.5	2.1269	2.632
		25/0		4.5089	4.816
	5.0 MHz BAND 16QAM	12/6		2.1581	2.615
		25/0		4.4726	4.777
	5.0 MHz BAND QPSK	12/6	1732.5	2.1515	2.379
		25/0		4.4598	4.824
	5.0 MHz BAND 16QAM	12/6		2.1449	2.486
		25/0		4.4589	4.817
	5.0 MHz BAND QPSK	12/6	1752.5	2.1601	2.521
		25/0		4.4656	4.668
	5.0 MHz BAND 16QAM	12/6		2.1893	2.651
		25/0		4.4656	4.684
	10 MHz BAND QPSK	25/12	1715.0	4.4963	5.761
		50/0		8.8977	9.387
	10 MHz BAND 16QAM	25/12		4.4770	5.102
		50/0		8.9554	9.350
	10 MHz BAND QPSK	25/12	1732.5	4.4705	4.712
		50/0		8.9328	9.532
	10 MHz BAND 16QAM	25/12		4.4522	5.011
		50/0		8.9530	9.286
	10 MHz BAND QPSK	25/12	1750.0	4.4631	5.721
		50/0		8.8333	9.347
	10 MHz BAND 16QAM	25/12		4.4649	5.268
		50/0		8.9797	9.370
	15 MHz BAND QPSK	36/18	1717.5	6.4630	7.905
		75/0		13.4178	14.157
	15 MHz BAND 16QAM	36/18		6.4561	7.150
		75/0		13.2925	14.093
	15 MHz BAND QPSK	36/18	1732.5	6.4142	7.239
		75/0		13.4451	14.038
	15 MHz BAND 16QAM	36/18		6.4440	6.826
		75/0		13.3068	14.070
15 MHz BAND QPSK	36/18	1747.5	6.4064	6.747	
	75/0		13.4758	14.007	
15 MHz BAND 16QAM	36/18		6.4402	7.149	
	75/0		13.2222	14.053	
20 MHz BAND QPSK	100/0	1720.0	8.8467	9.349	
	50/19		18.0325	18.782	
20 MHz BAND 16QAM	100/0		8.9236	9.401	
	50/19		17.7471	18.474	
20 MHz BAND QPSK	100/0	1732.5	8.8301	10.067	
	50/19		17.8209	18.609	
20 MHz BAND 16QAM	100/0		8.9730	9.616	
	50/19		17.8651	18.672	
20 MHz BAND QPSK	100/0	1745.0	8.8977	9.495	
	50/19		18.0289	18.624	
20 MHz BAND 16QAM	50/19		8.8356	9.507	
	100/0		17.7960	18.624	

Band	Mode	RB/RB SIZE	f (MHz)	99% BW (kHz)	-26dB BW (kHz)
LTE Band 17	5.0 MHz BAND QPSK	12/6	706.5	2.1297	2.769
		25/0		4.4732	4.726
	5.0 MHz BAND 16QAM	12/6		2.1787	2.756
		25/0		4.4707	4.645
	5.0 MHz BAND QPSK	12/6	710.0	2.1597	2.634
		25/0		4.4538	4.850
	5.0 MHz BAND 16QAM	12/6		2.1675	2.617
		25/0		4.4788	4.698
	5.0 MHz BAND QPSK	12/6	713.5	2.1579	2.427
		25/0		4.4652	4.826
	5.0 MHz BAND 16QAM	12/6		2.1777	2.877
		25/0		4.4977	4.752
	10 MHz BAND QPSK	25/12	709.0	4.5161	5.542
		50/0		8.8630	9.298
	10 MHz BAND 16QAM	25/12		4.4210	5.037
		50/0		8.8886	9.312
	10 MHz BAND QPSK	25/12	710.0	4.4508	5.010
		50/0		8.9543	9.365
10 MHz BAND 16QAM	25/12	4.4342		5.052	
	50/0	8.8620		9.404	
10 MHz BAND QPSK	25/12	711.0	4.4719	5.070	
	50/0		8.9914	9.545	
10 MHz BAND 16QAM	25/12		4.4867	4.861	
	50/0		8.8459	9.326	

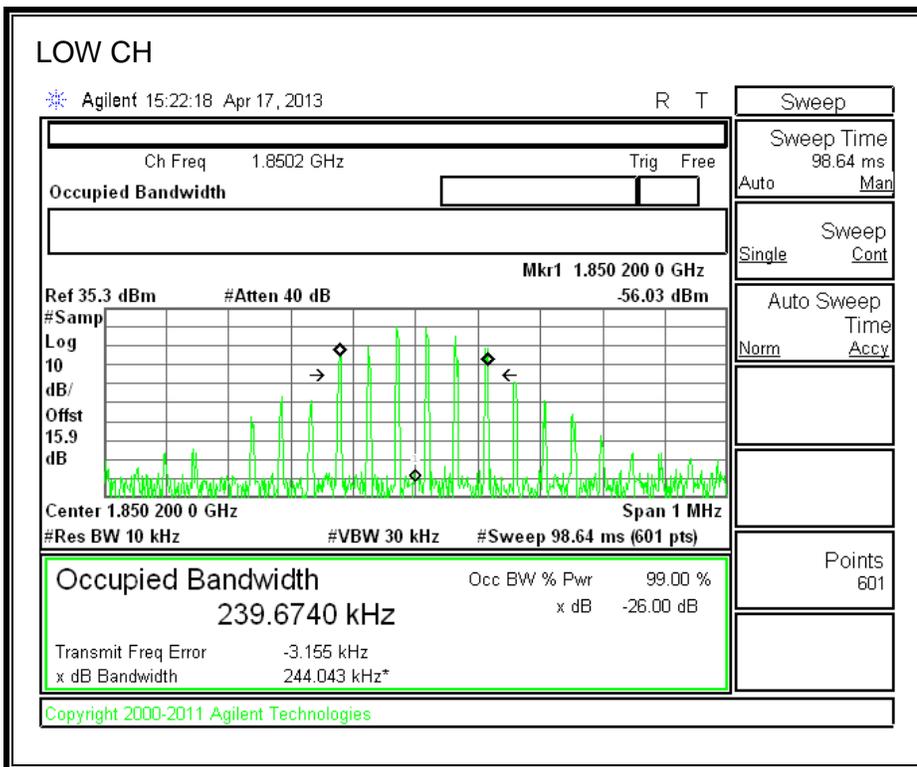
**8.1.1. GSM-GPRS**

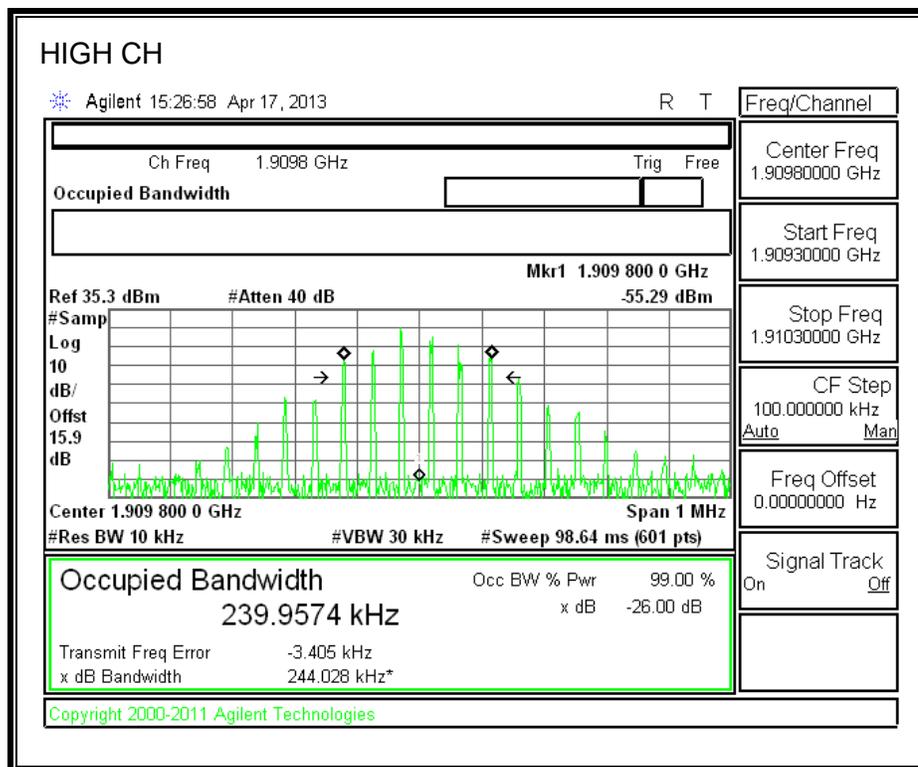
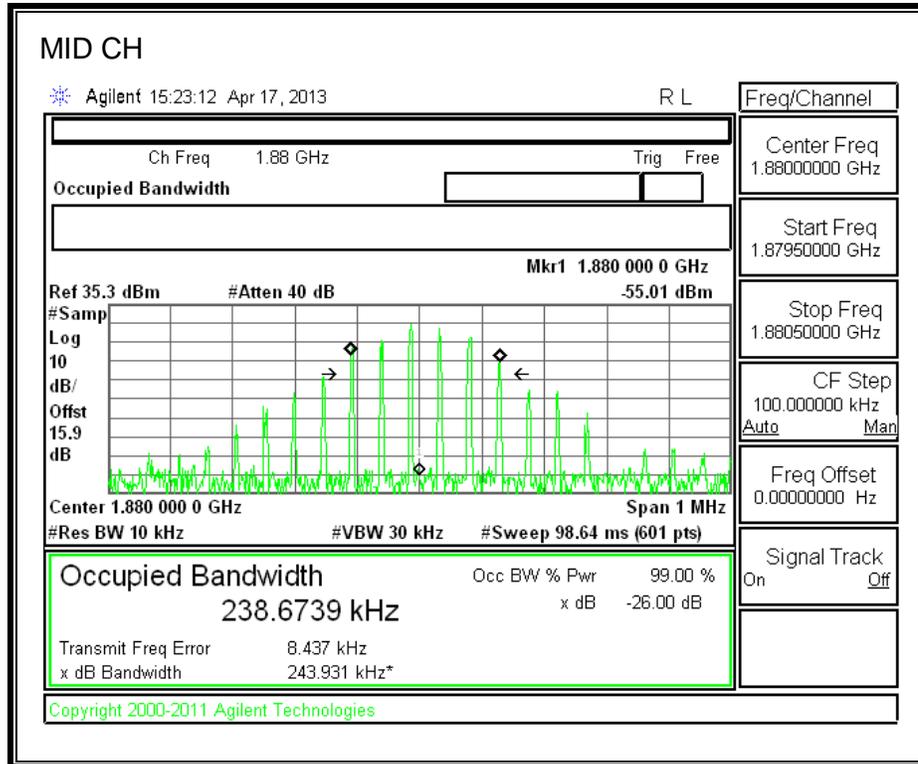
**CELL BAND**





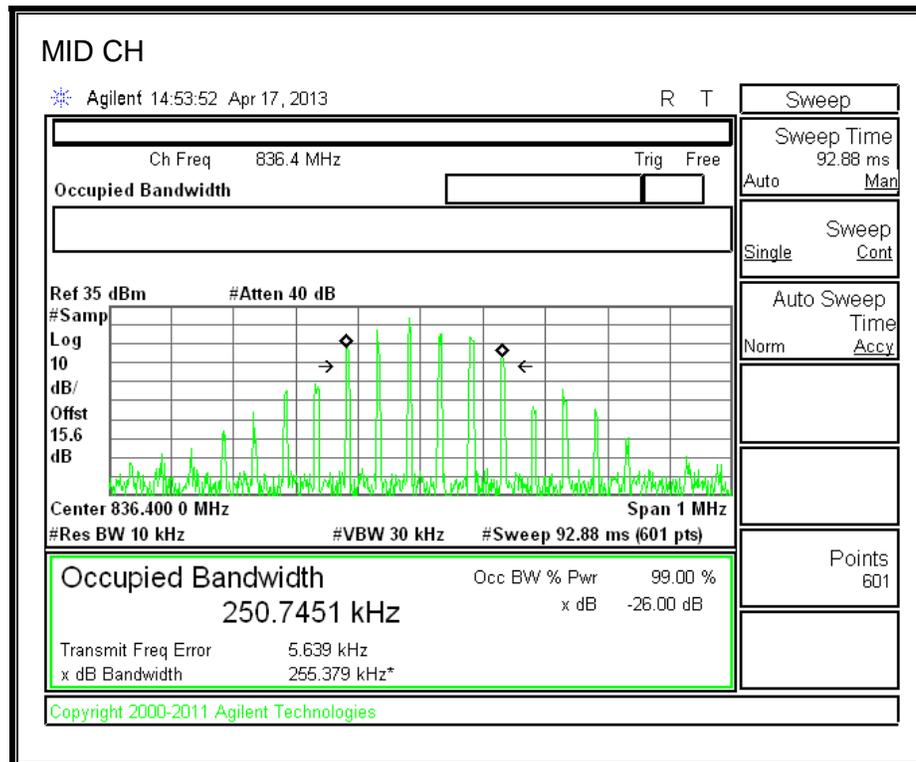
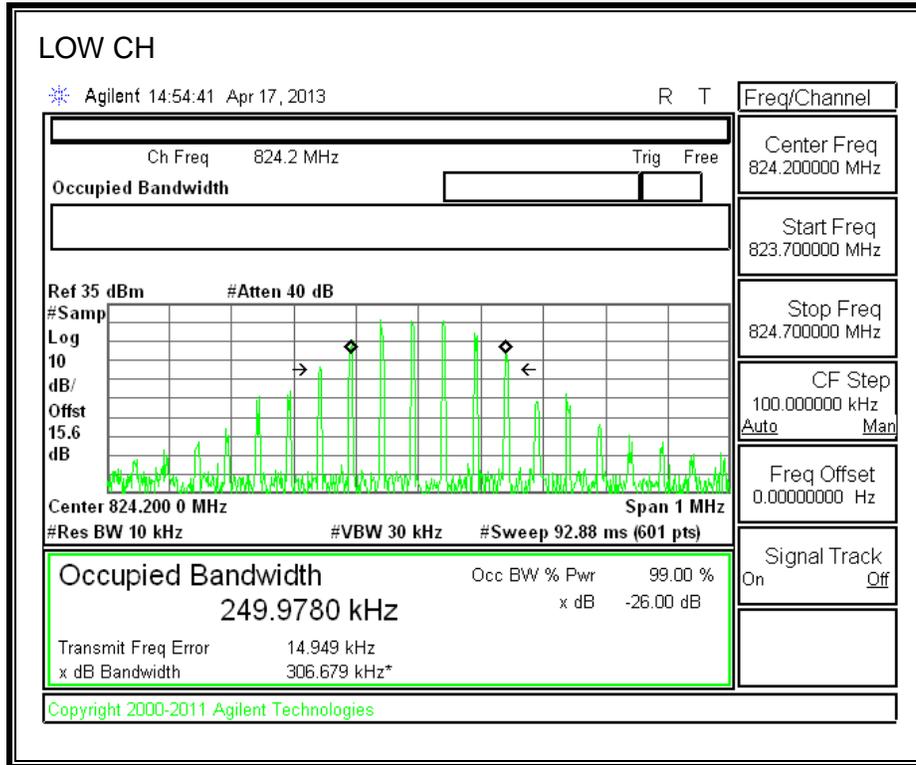
**PCS BAND**

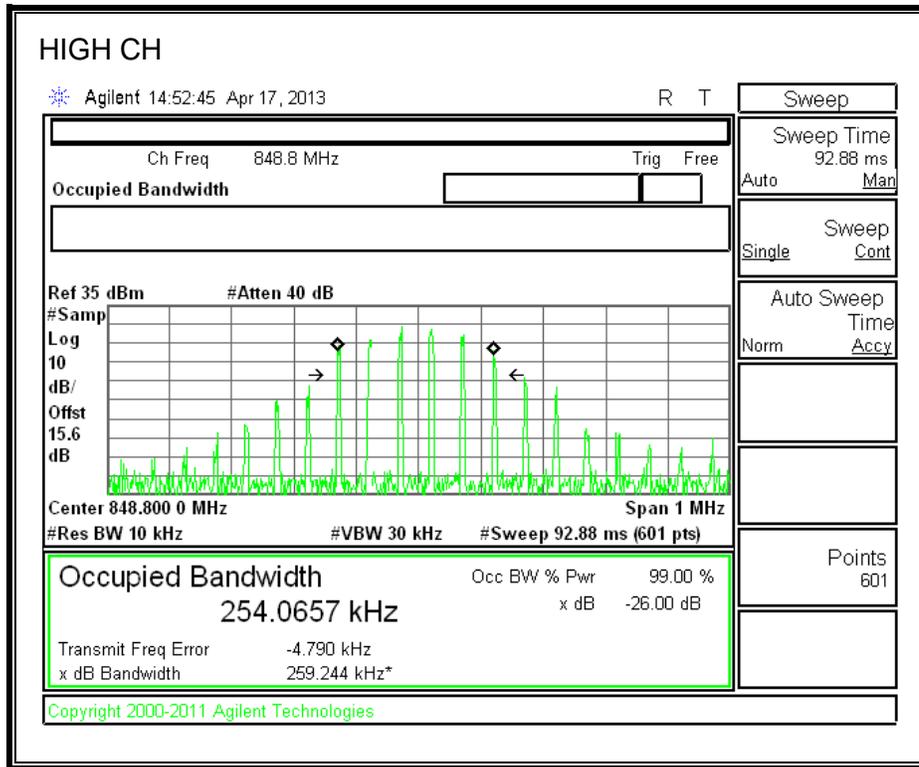




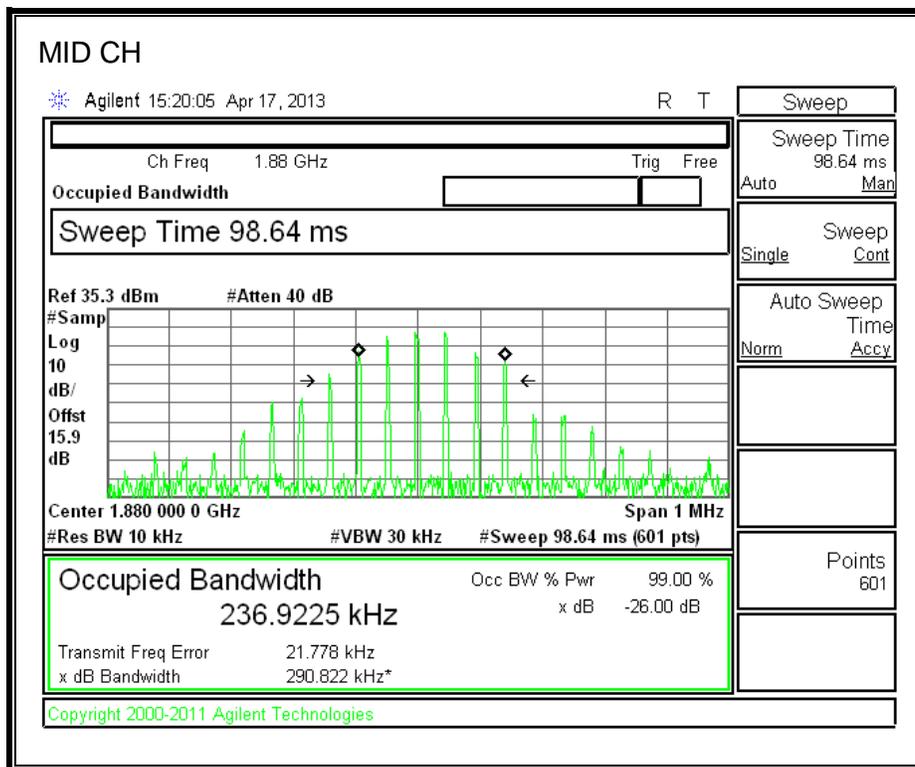
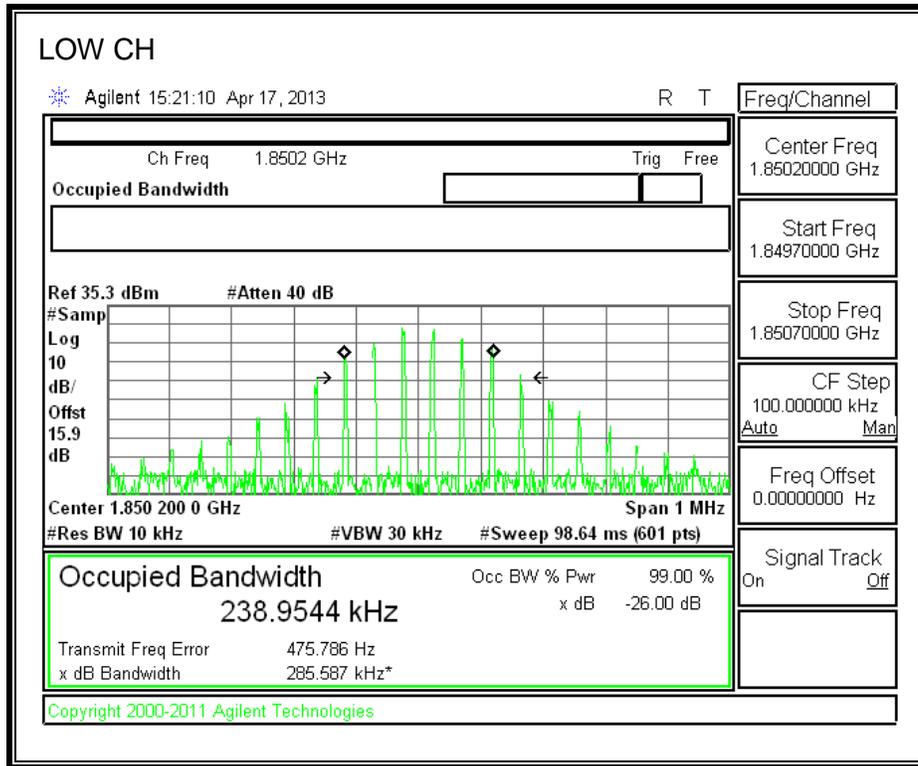
### 8.1.2. GSM-EGPRS

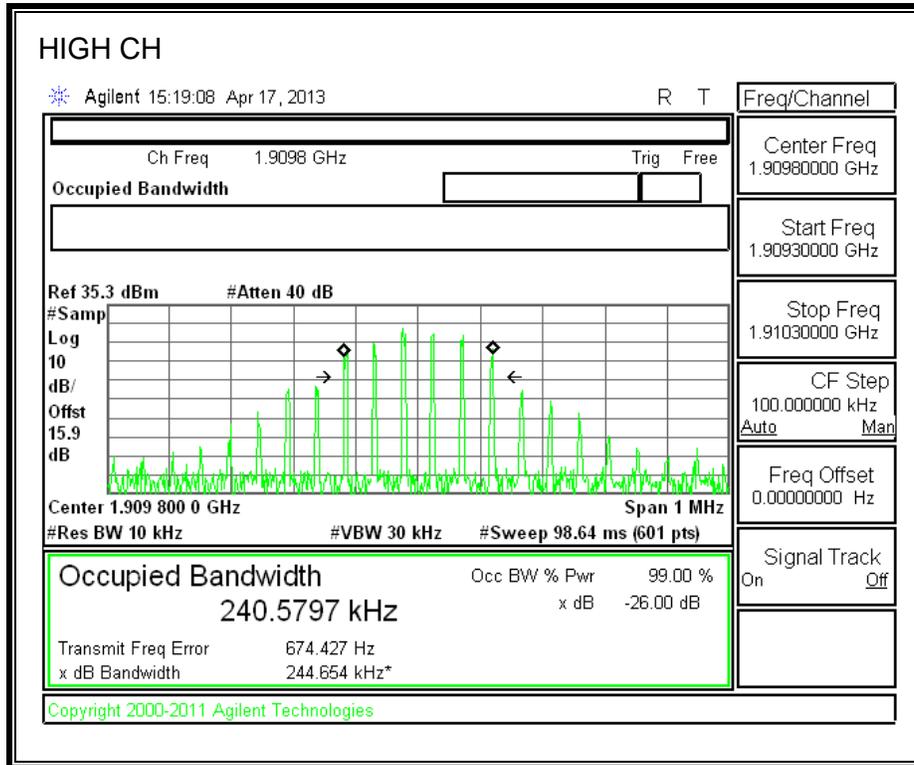
#### CELL BAND





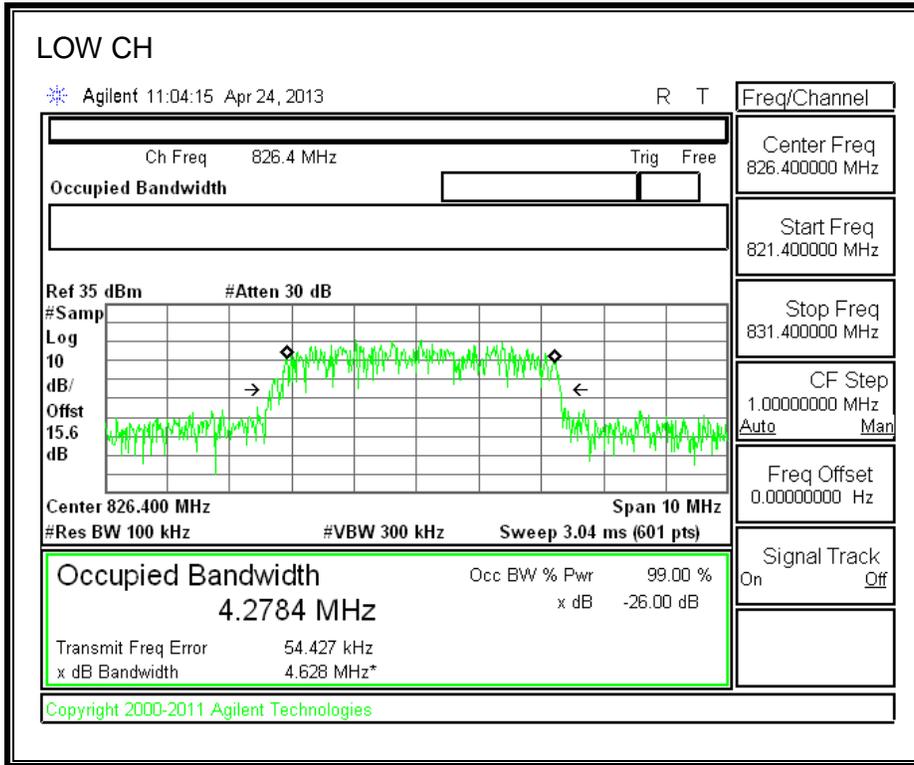
**PCS BAND**

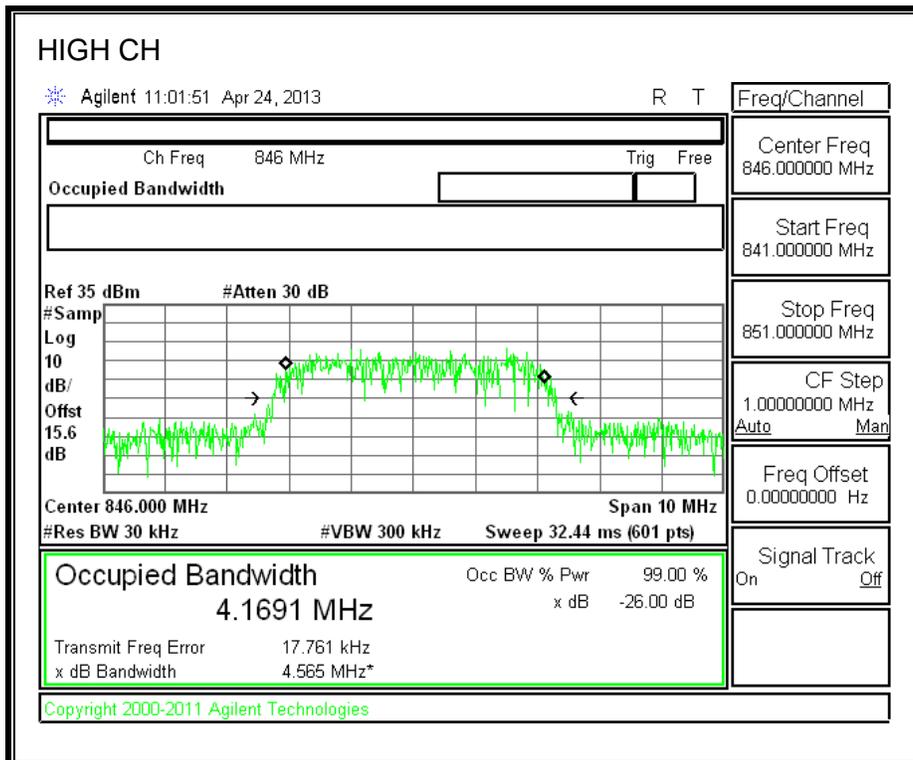
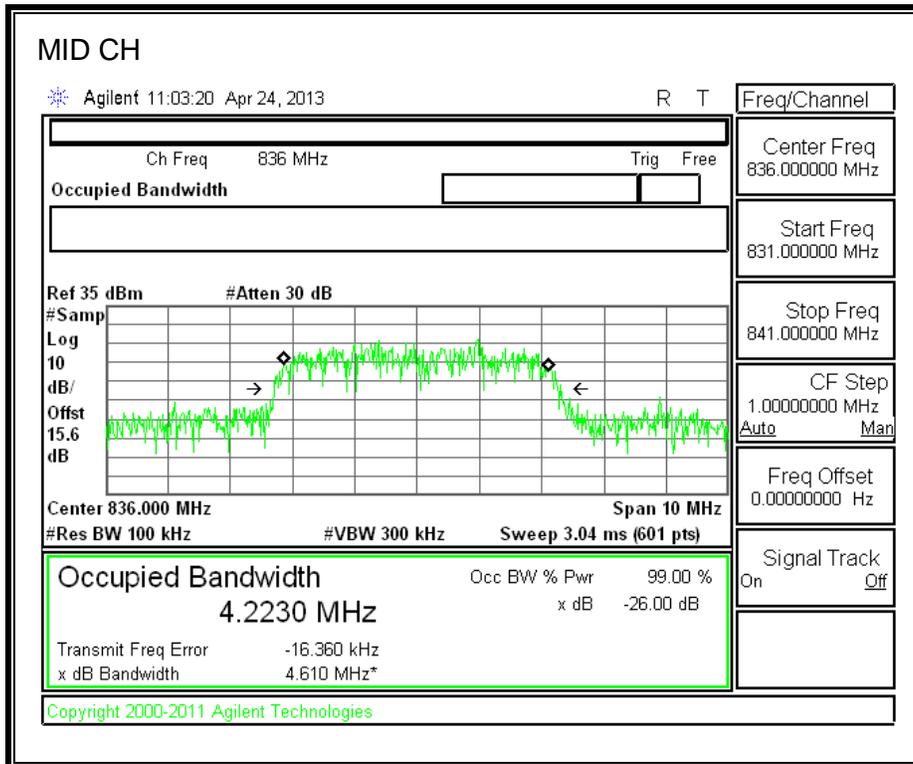




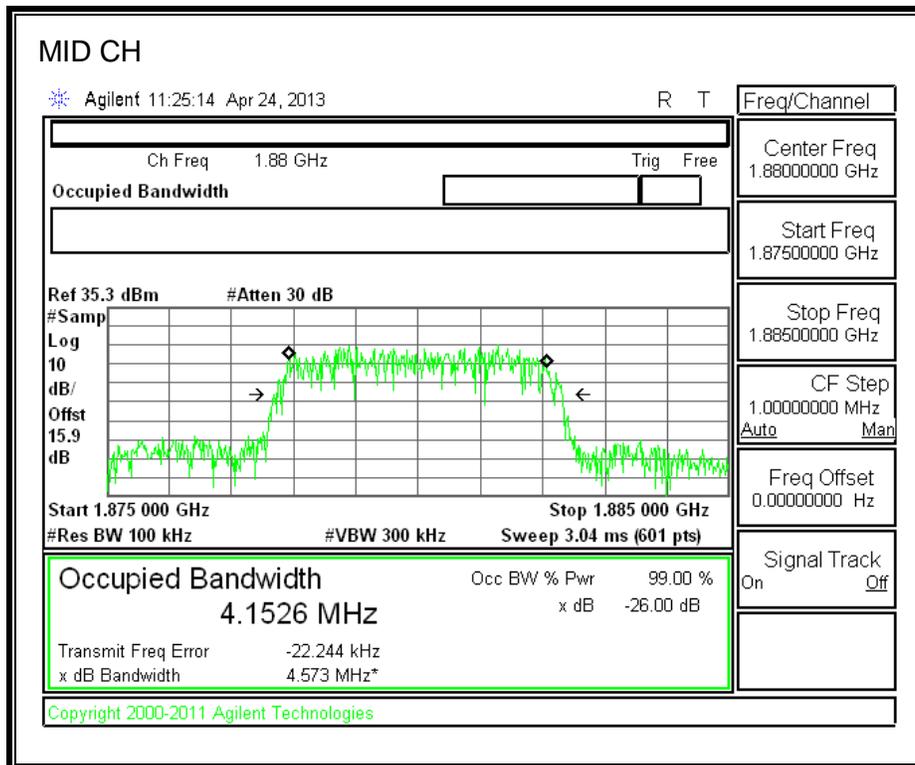
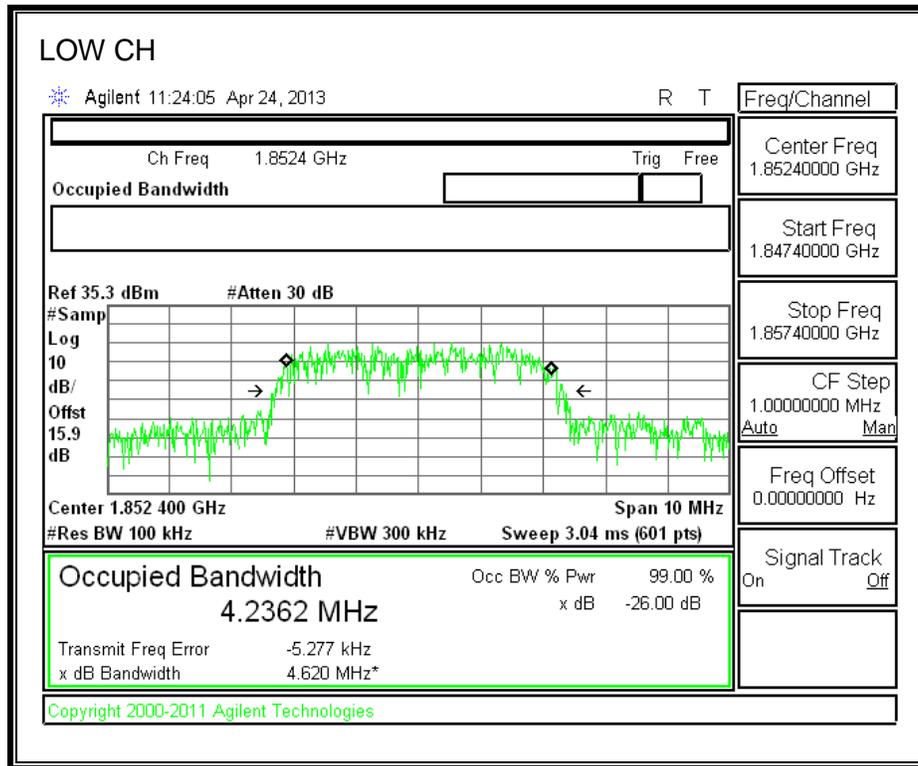
### 8.1.3. UMTS-REL 99

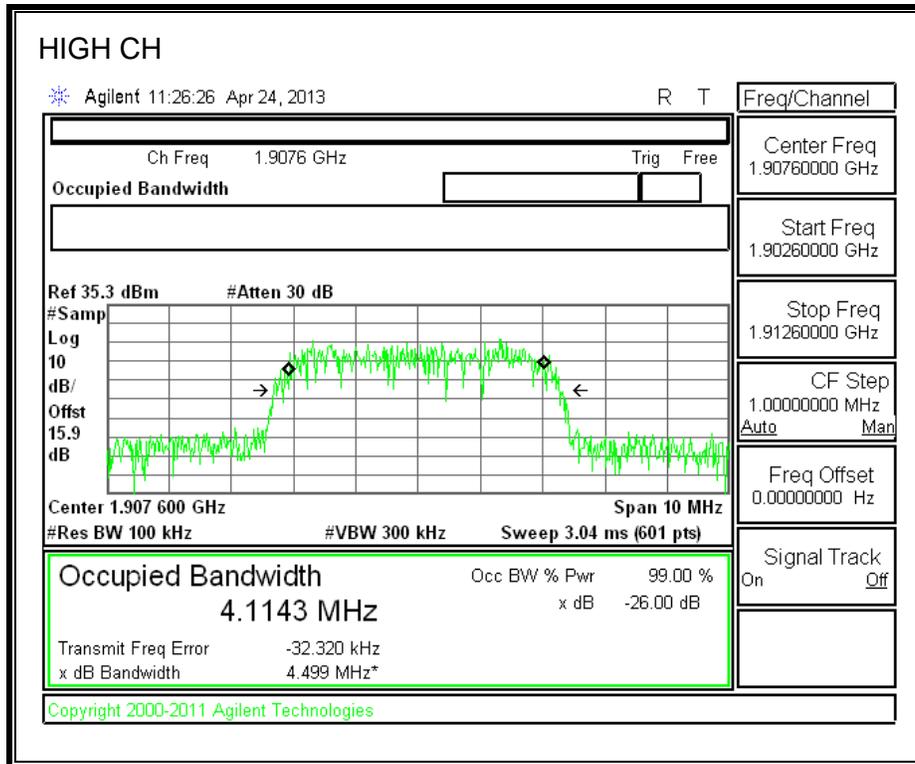
#### CELL BAND



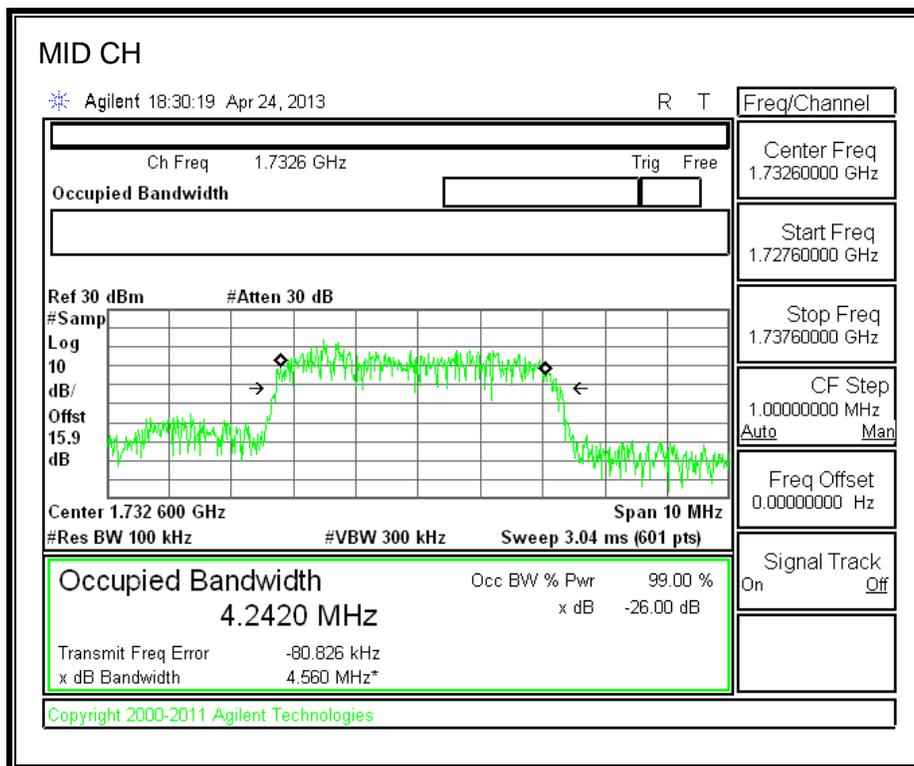
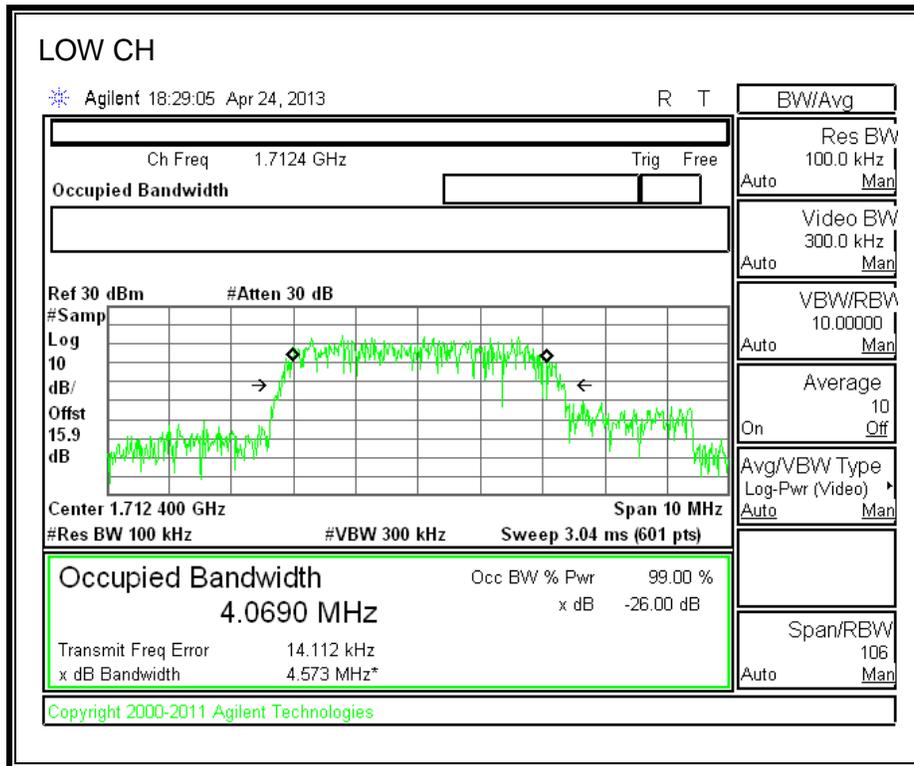


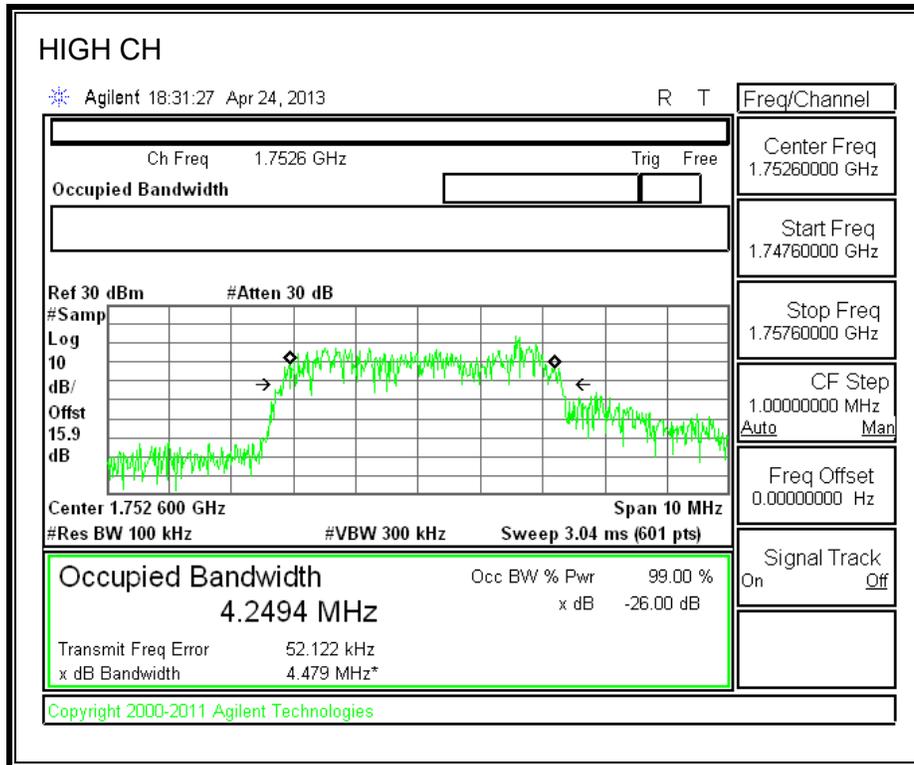
**PCS BAND**





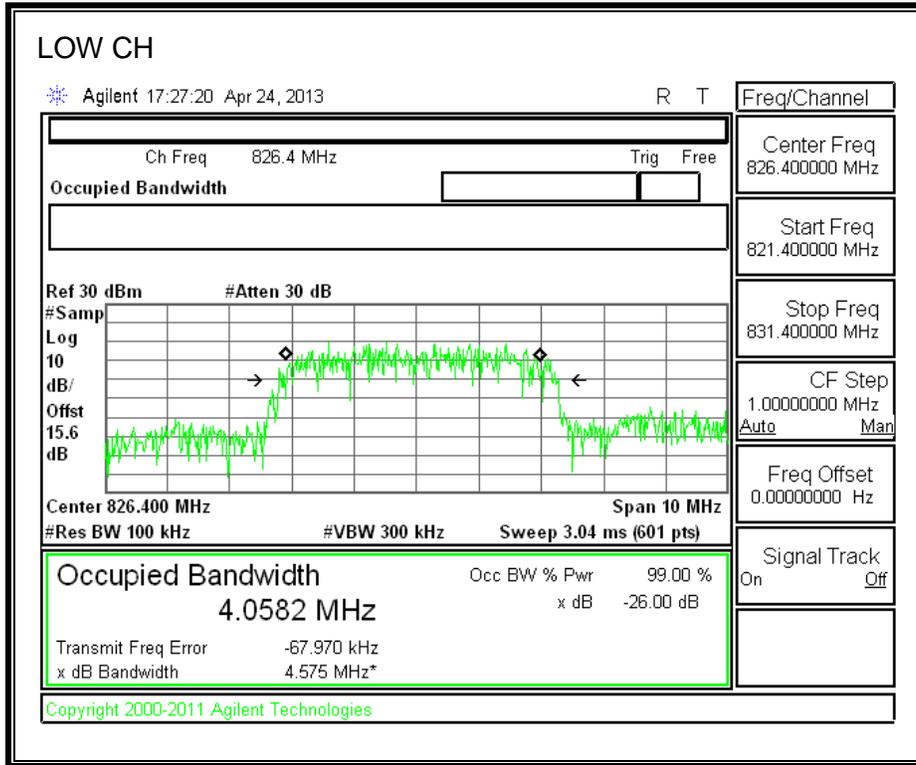
**AWS BAND**

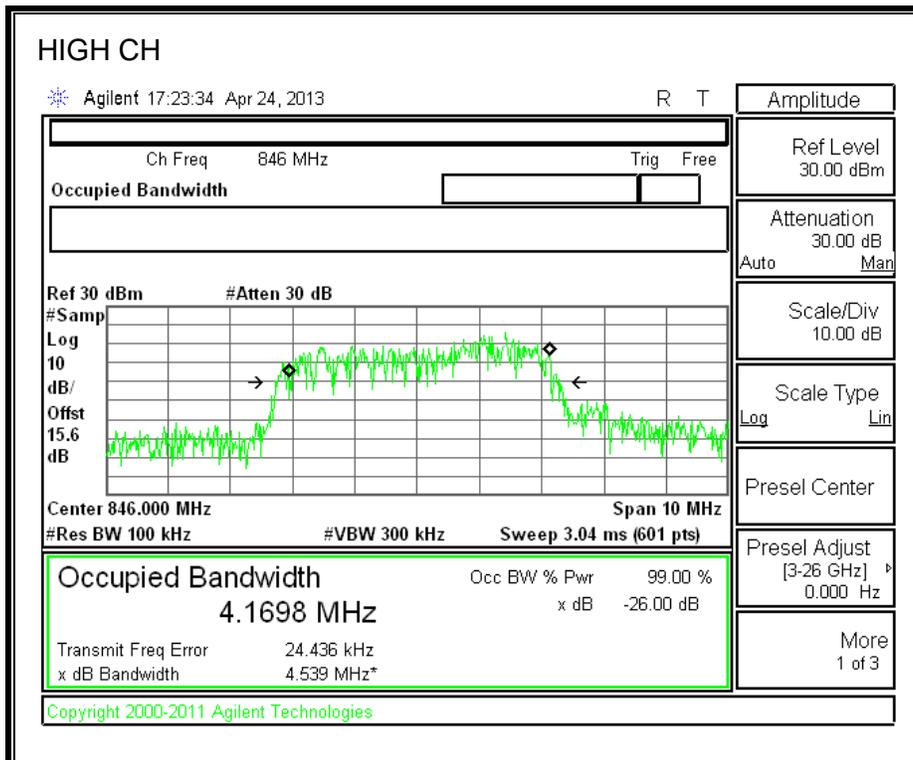
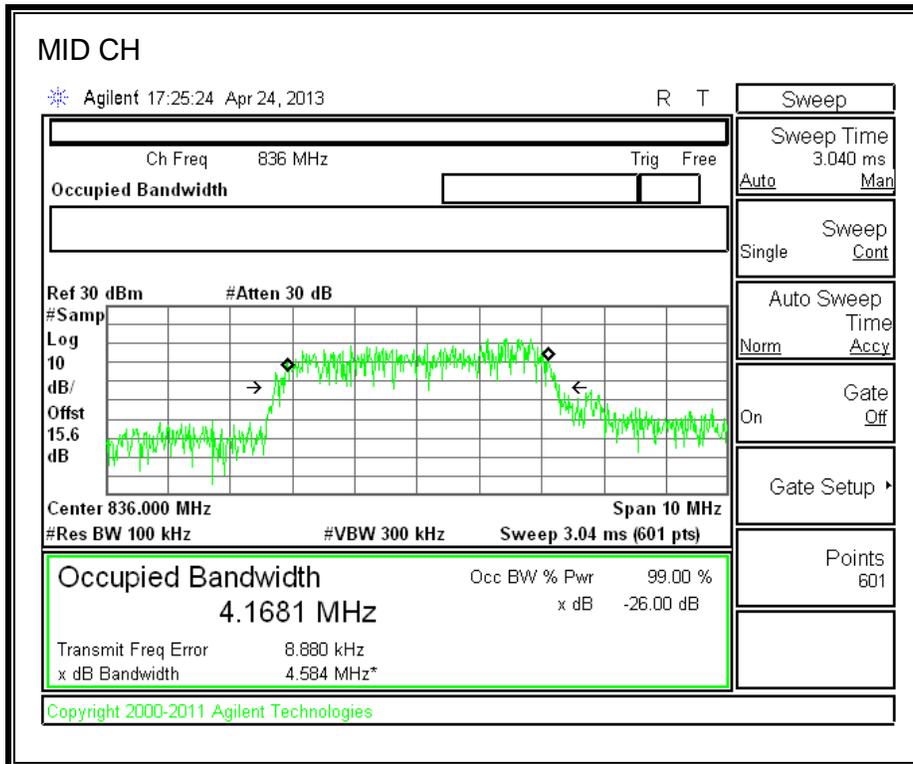




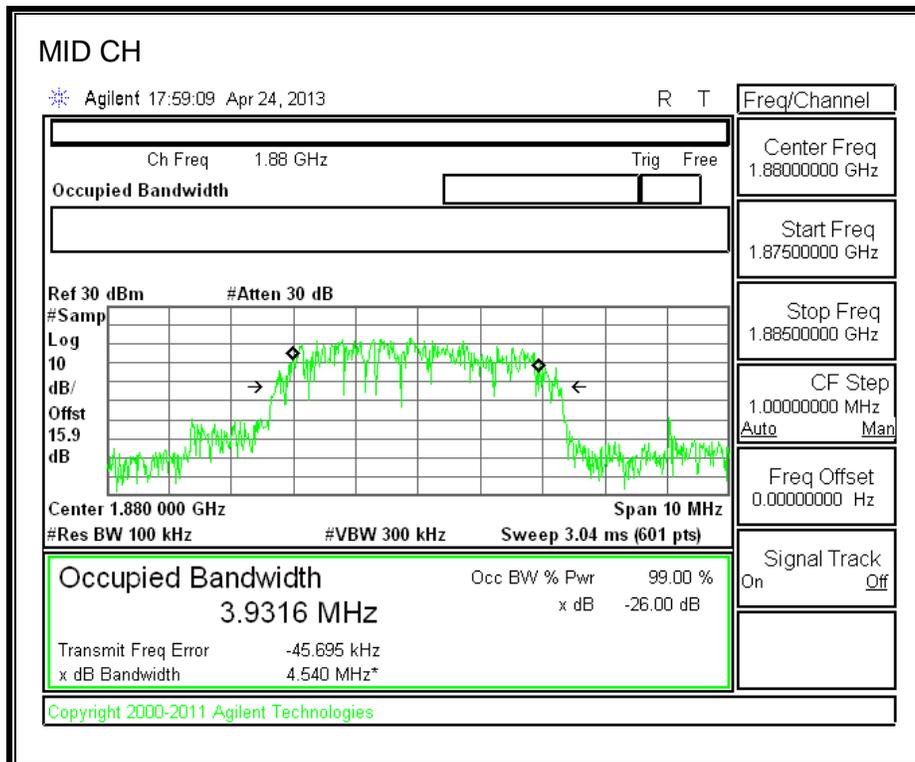
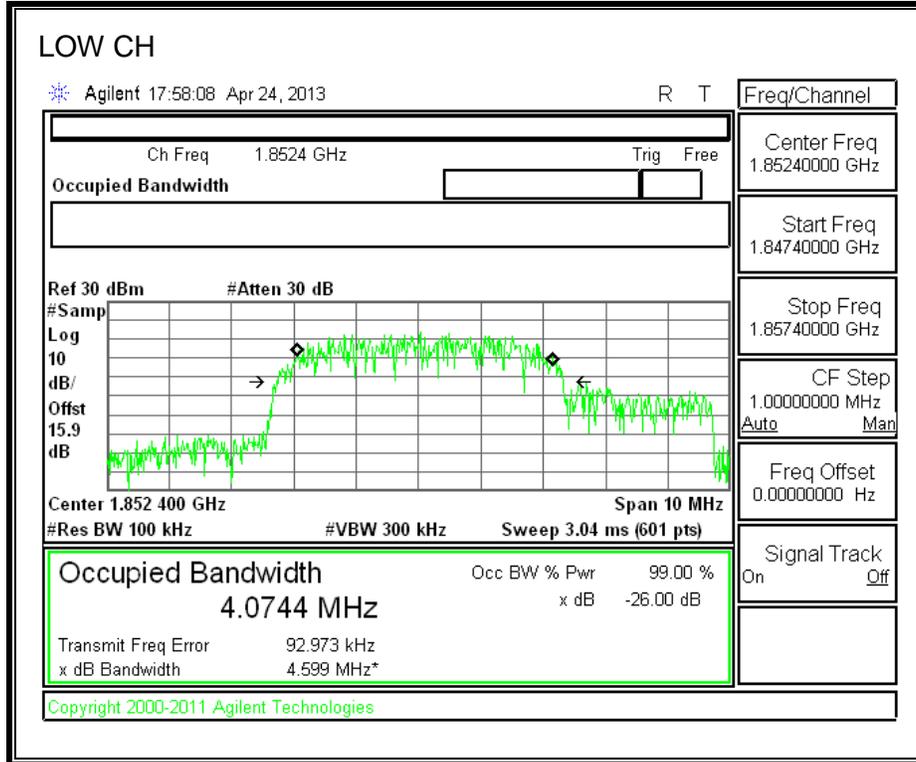
### 8.1.4. UMTS-HSDPA

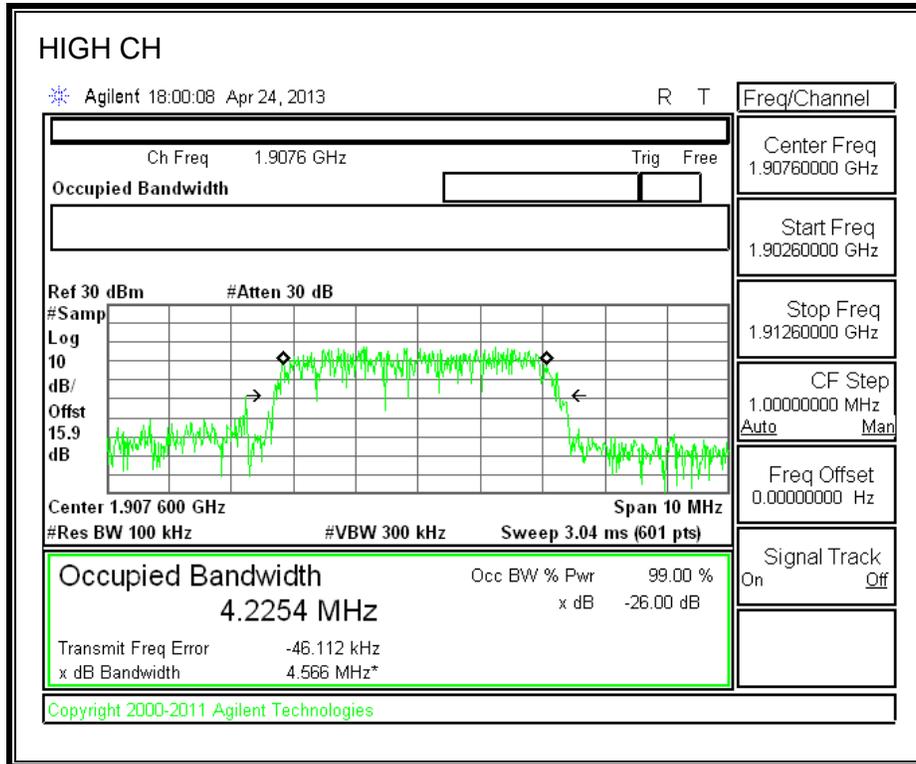
#### CELL BAND



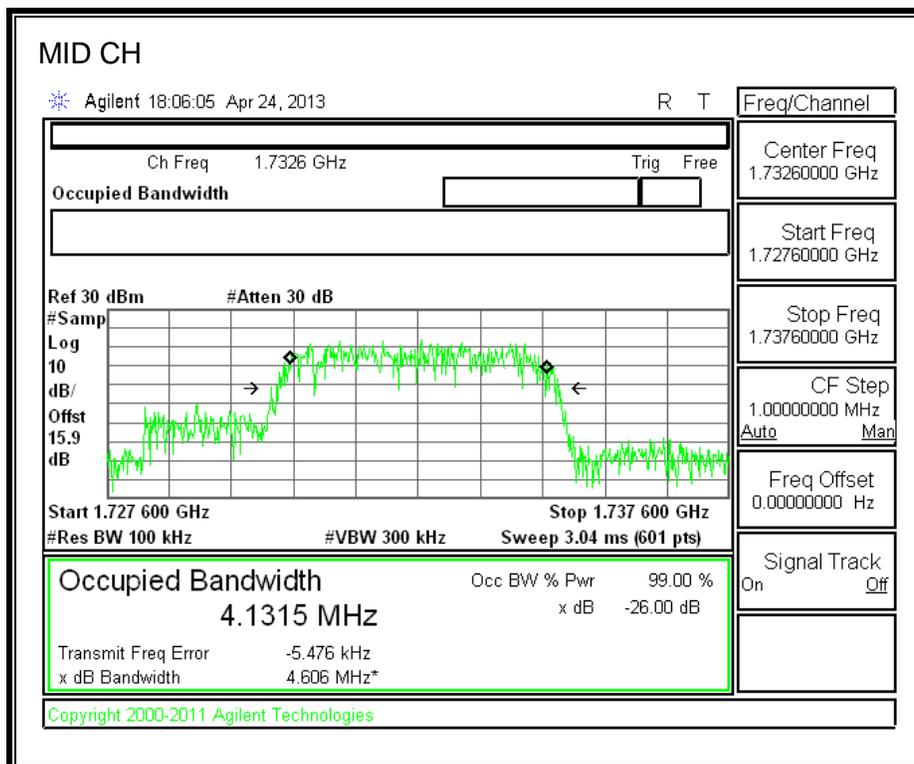
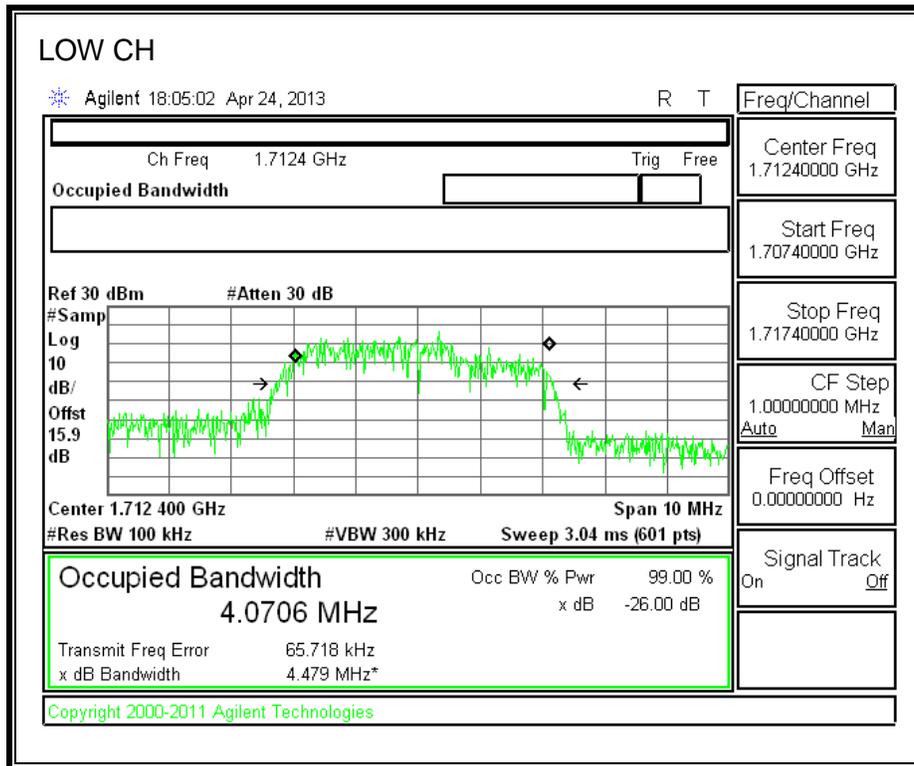


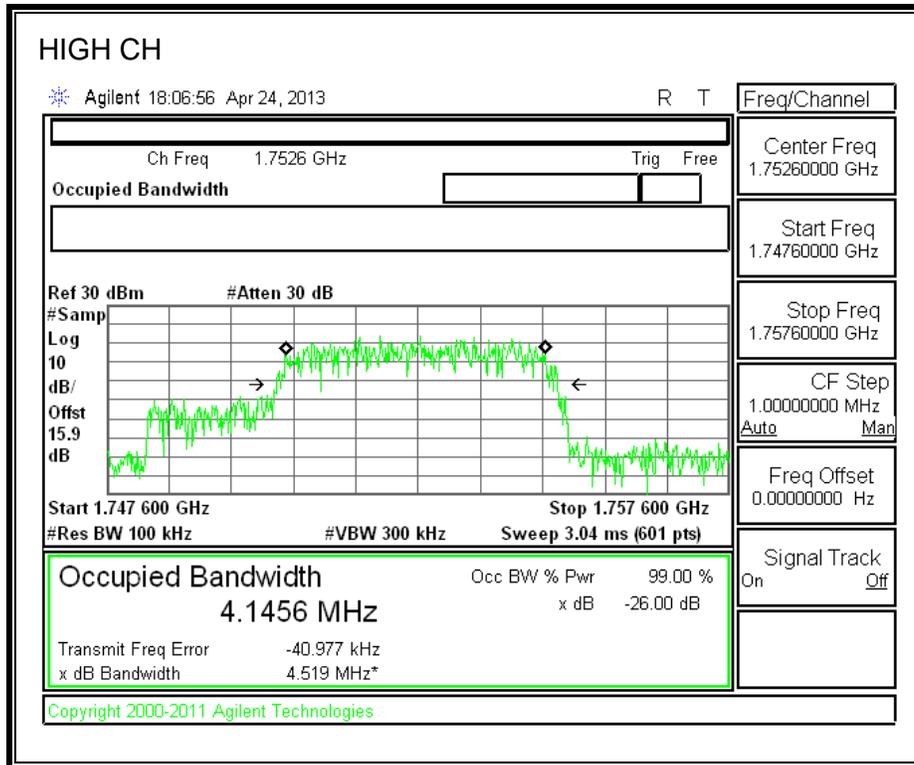
**PCS BAND**





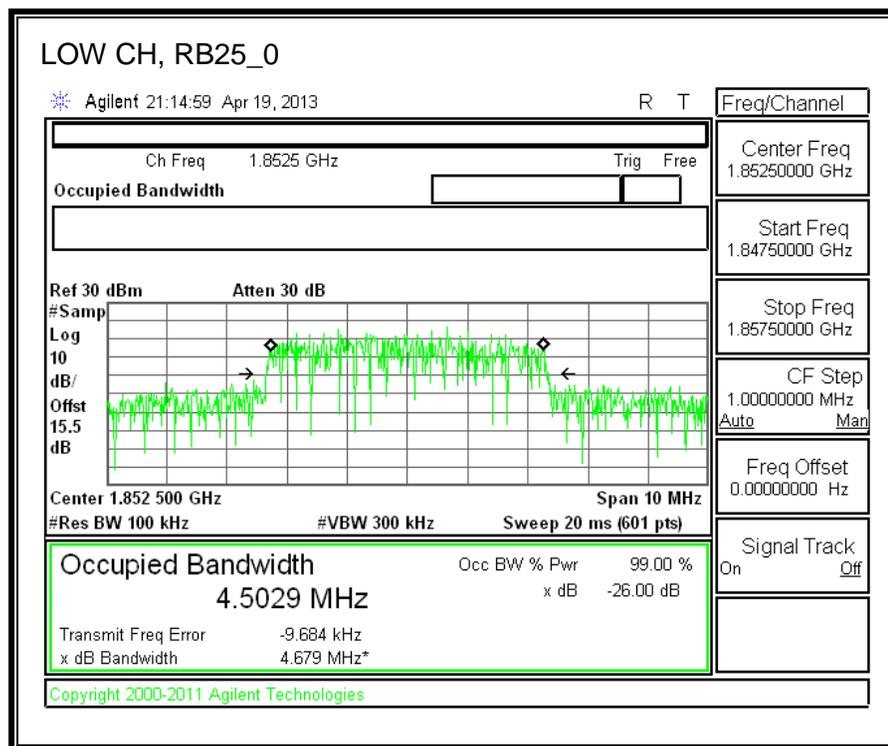
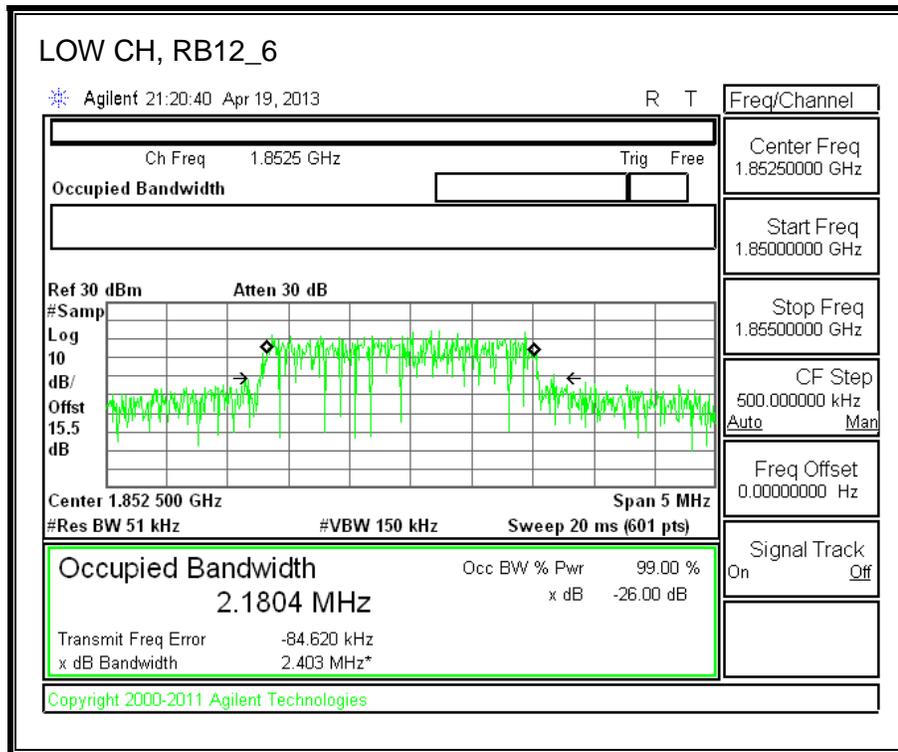
**AWS BAND**



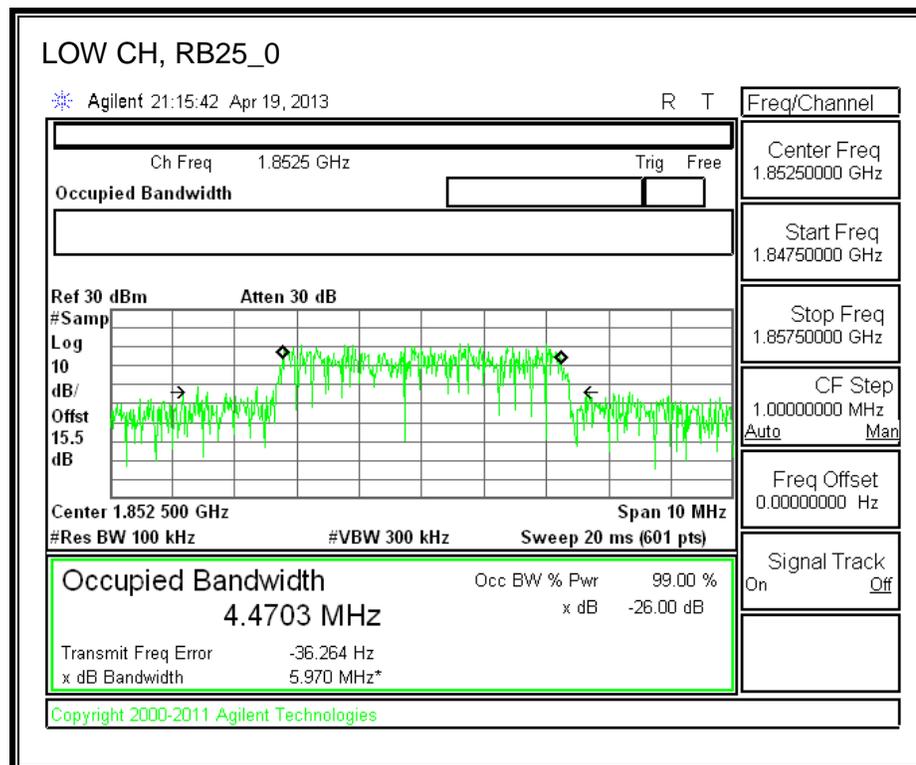
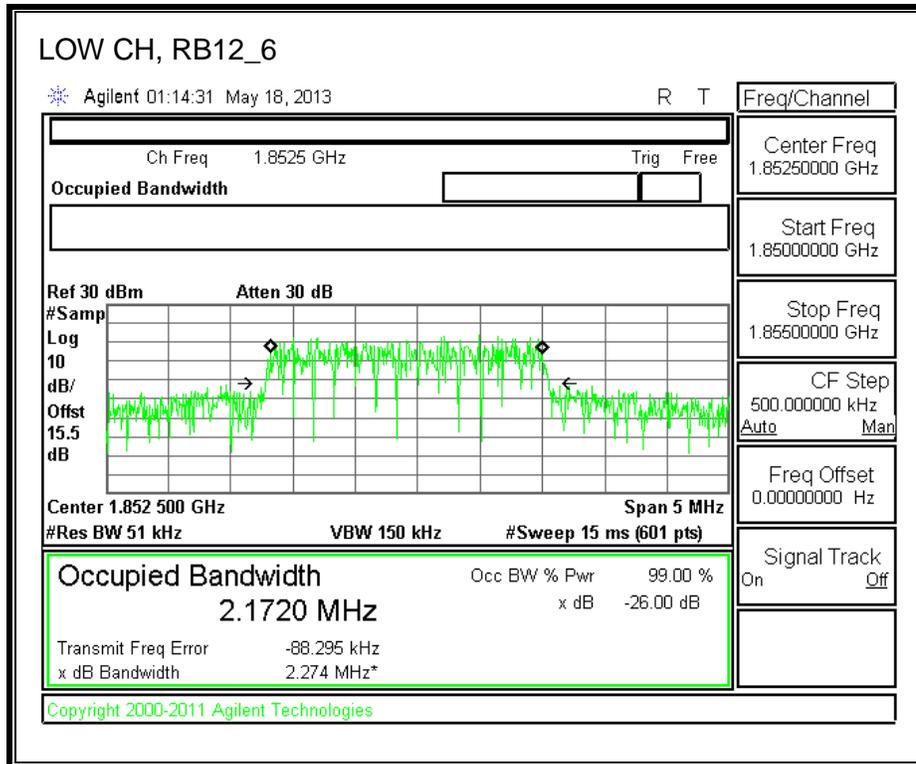


### 8.1.5. LTE BAND 2-5MHz BNADWIDTH

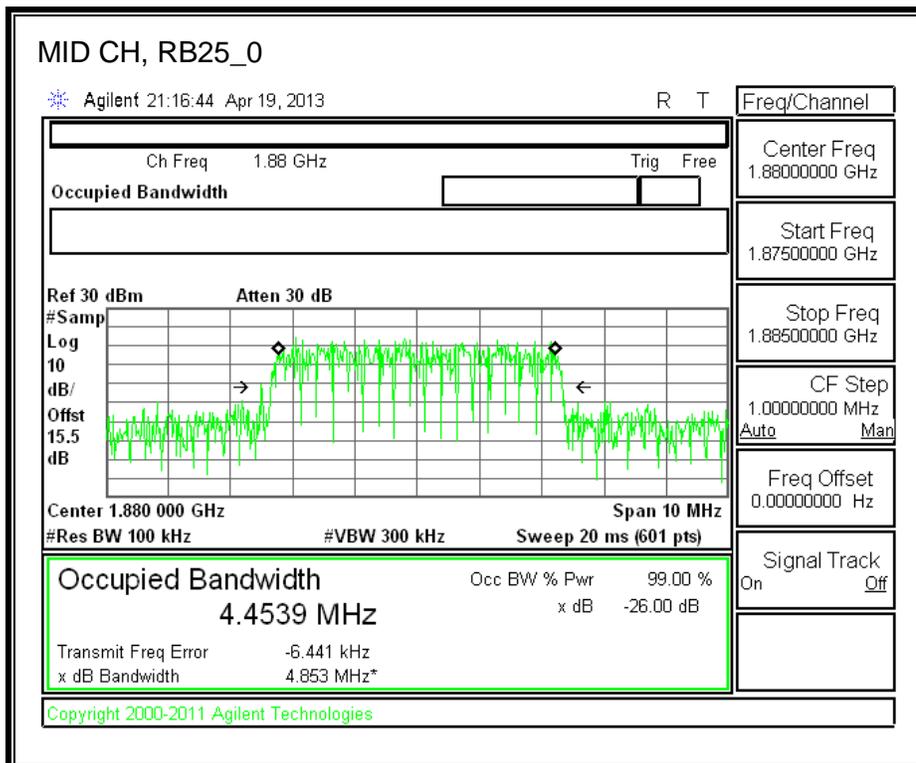
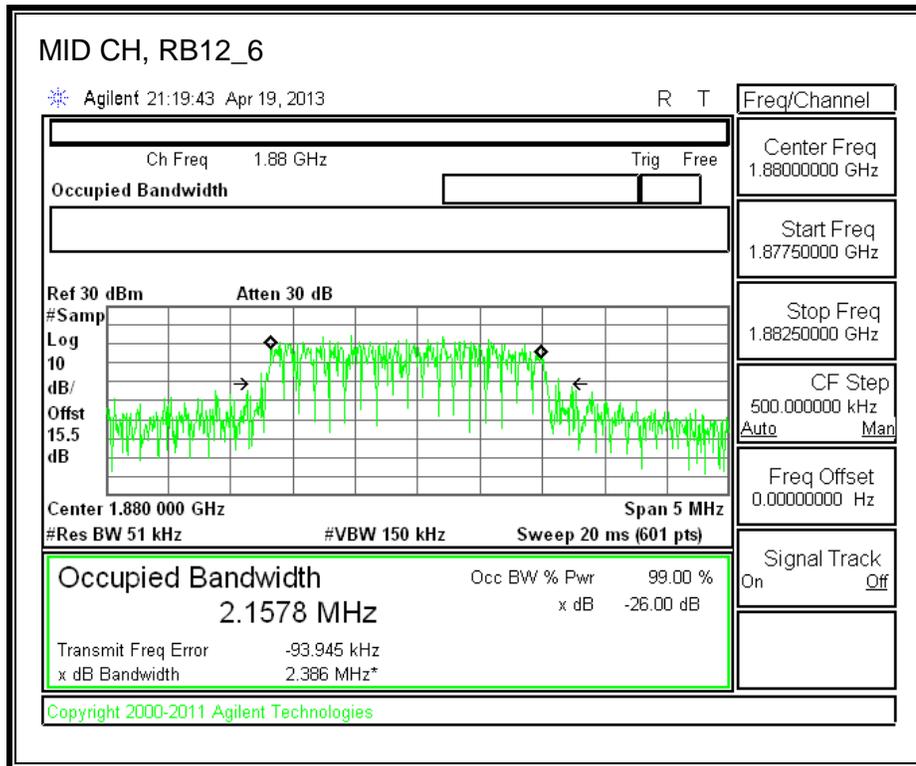
#### LOW-QPSK



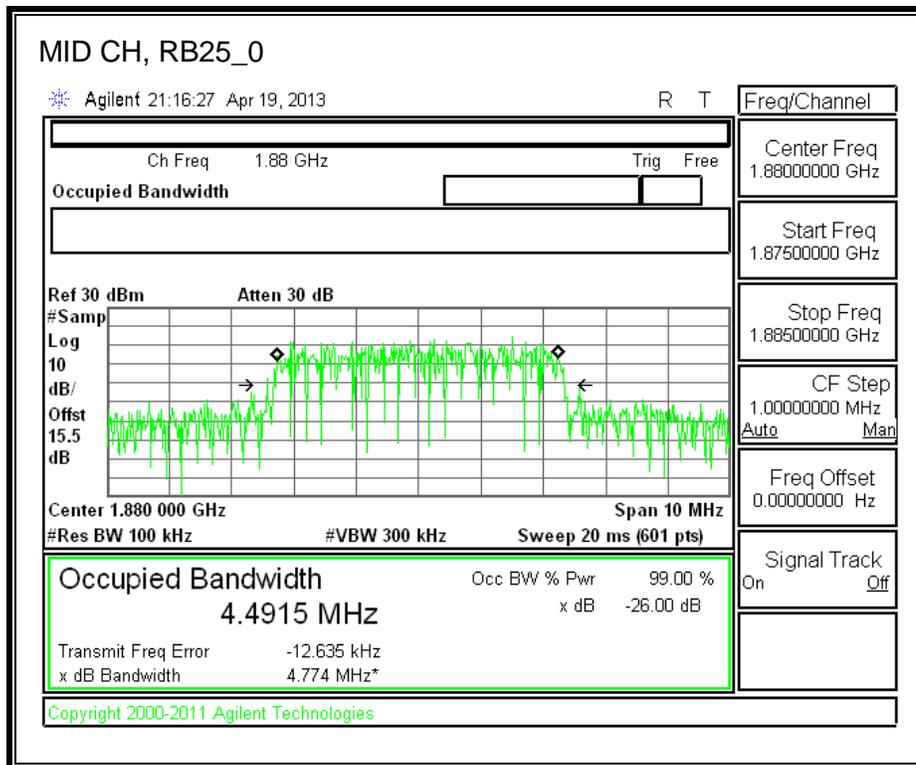
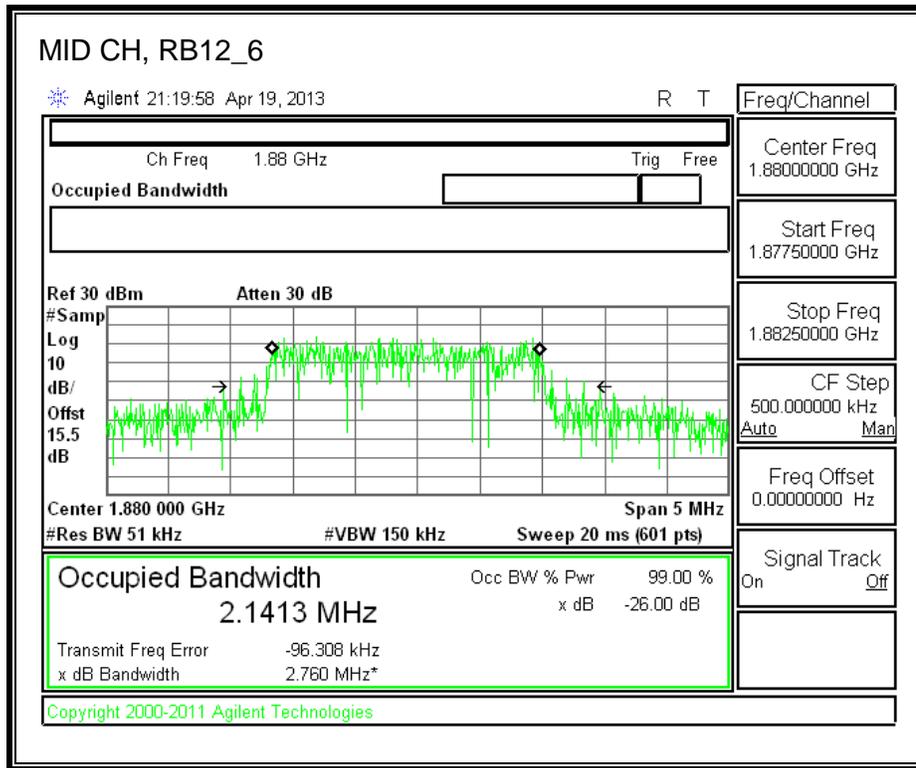
**LOW-16QAM**



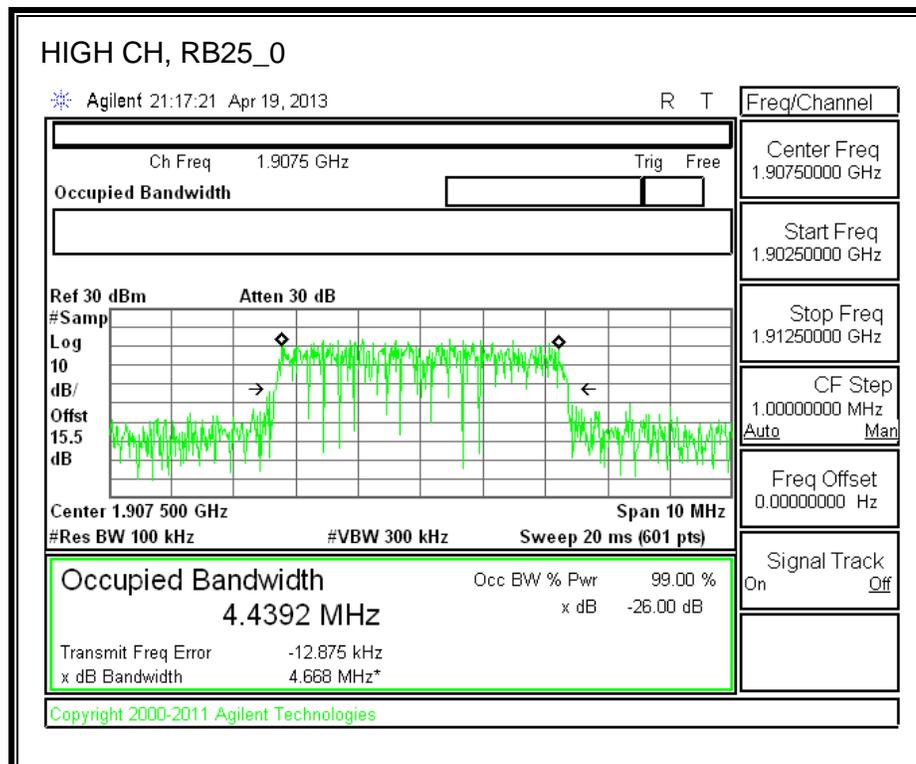
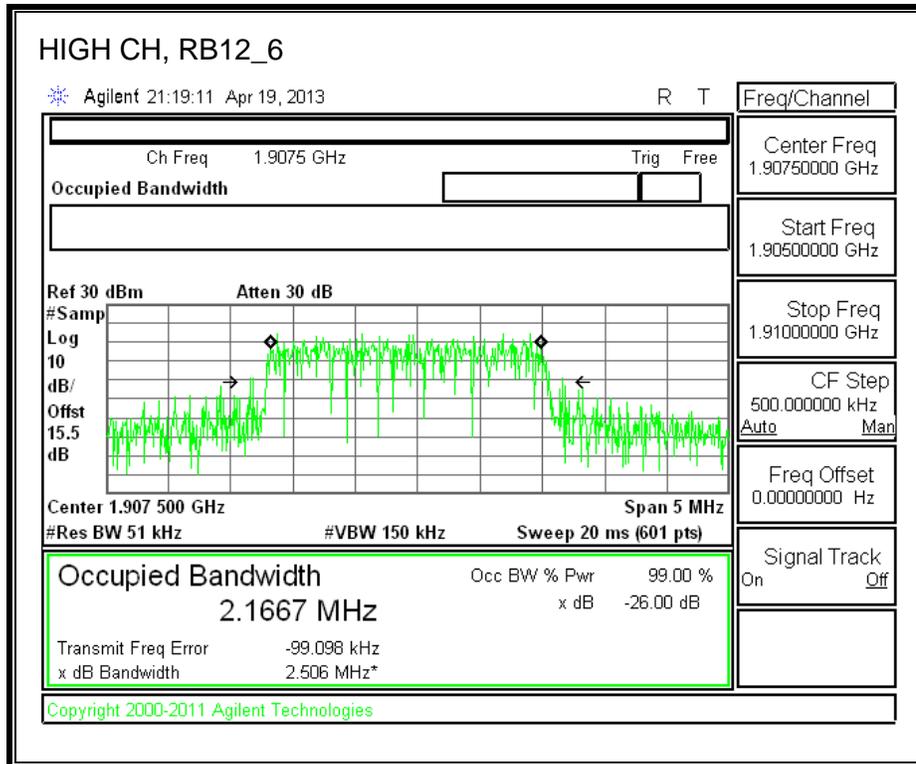
**MID-QPSK**



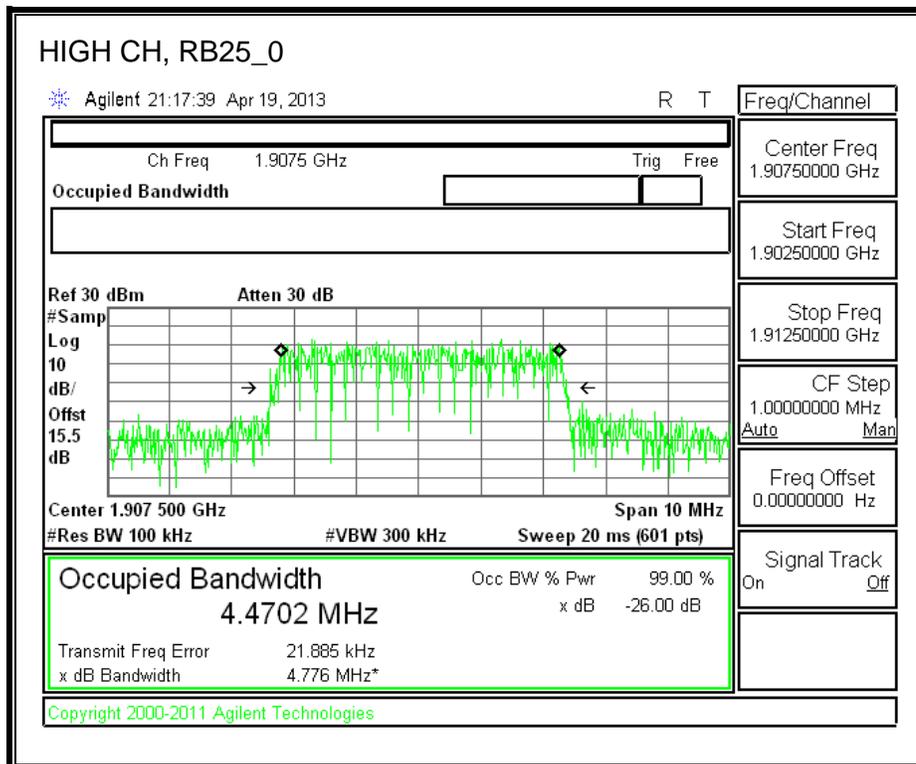
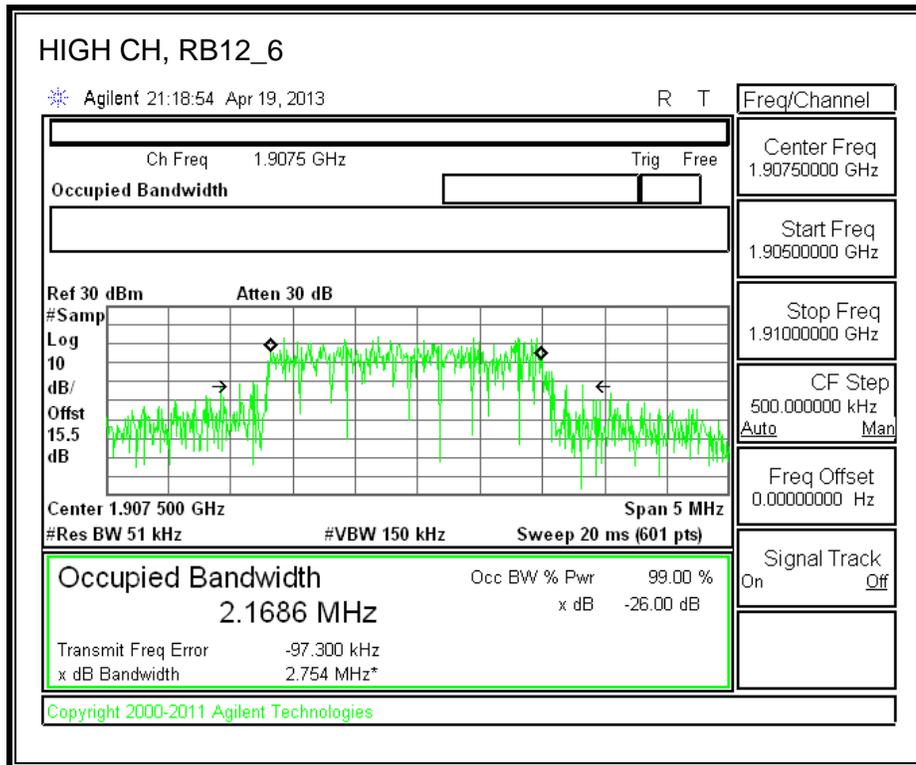
**MID-16QAM**



**HIGH-QPSK**

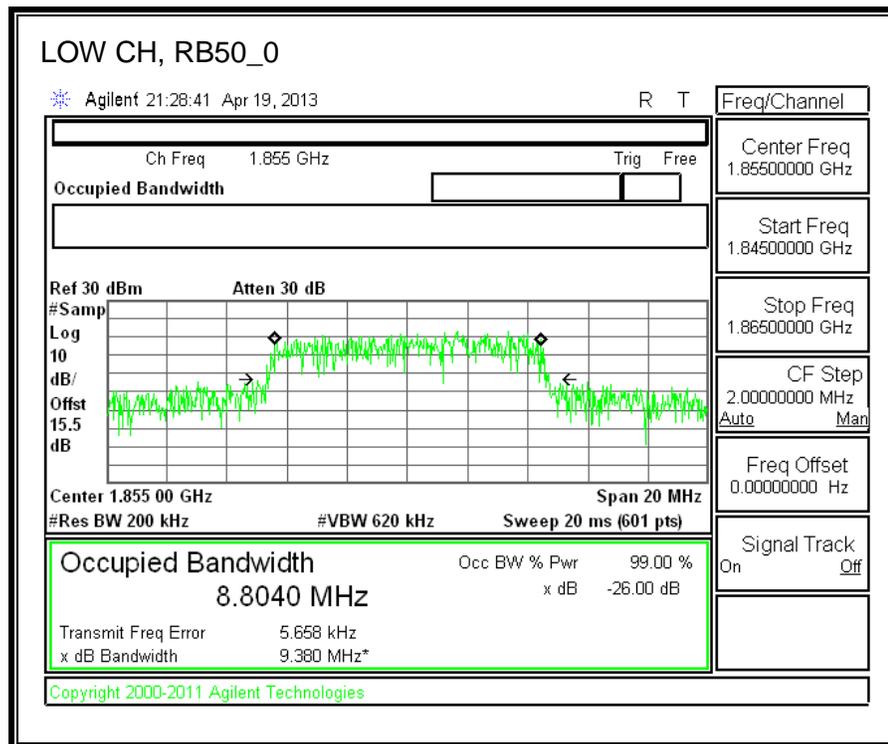
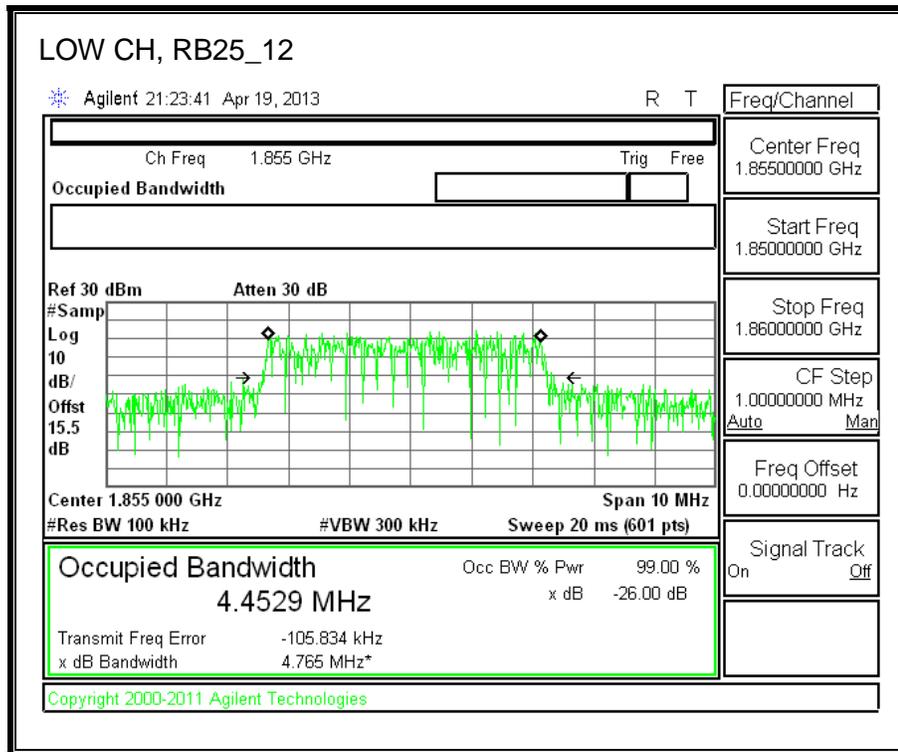


**HIGH-16QAM**

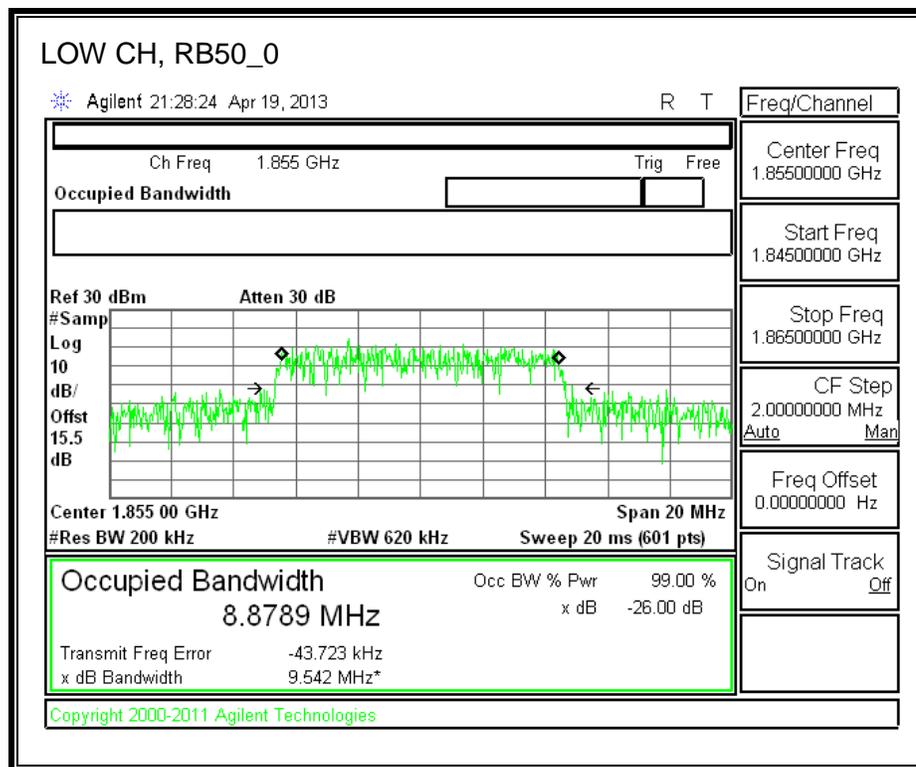
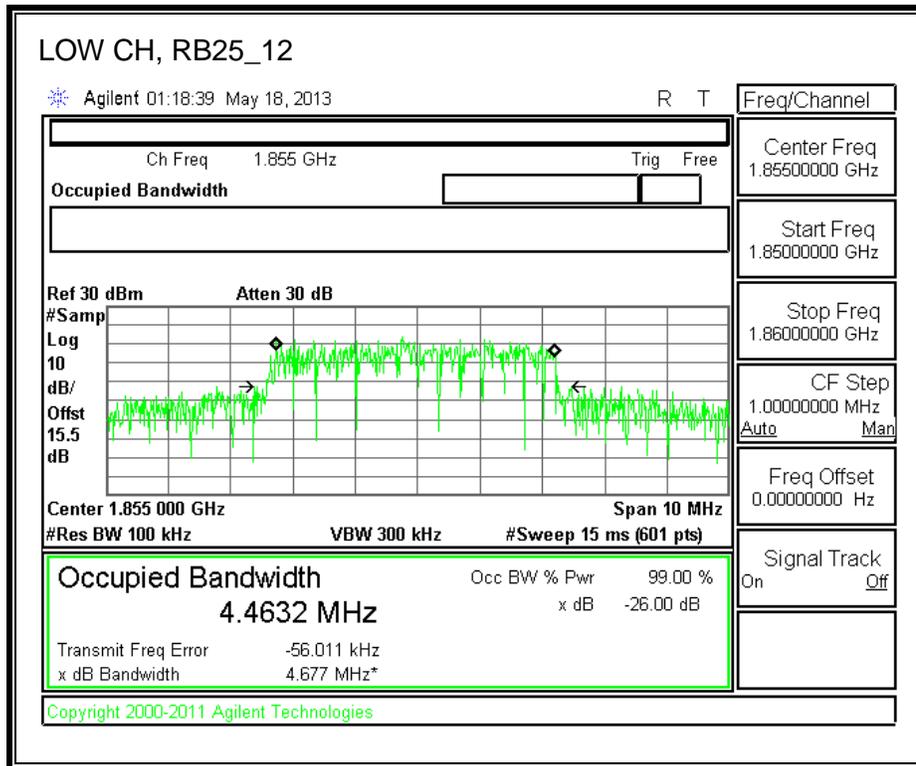


### 8.1.6. LTE BAND 2-10MHz BANDWIDTH

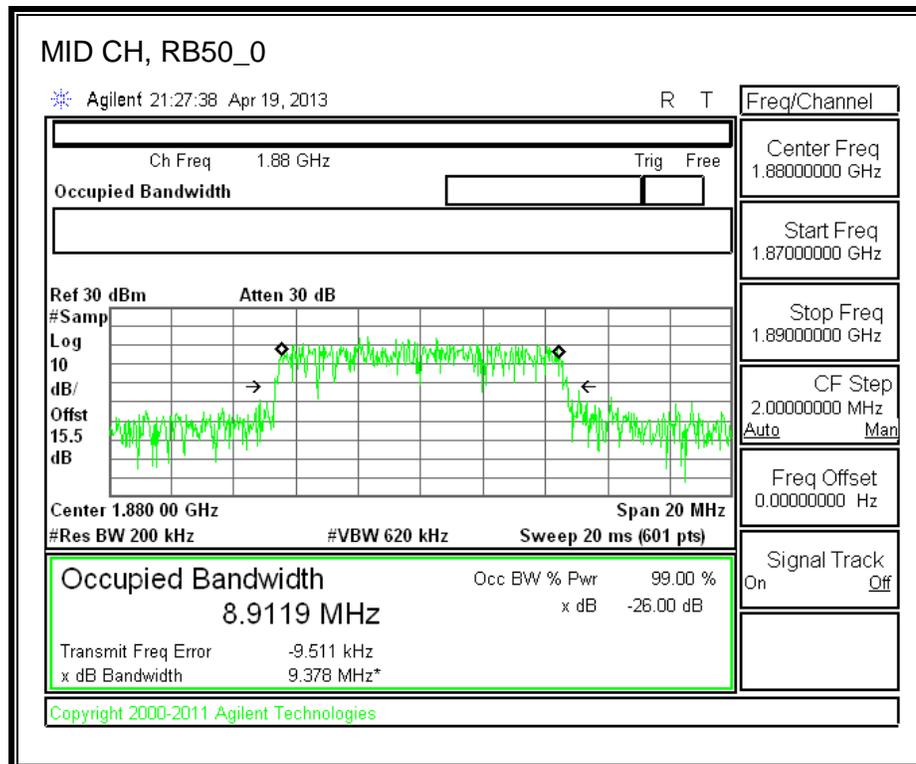
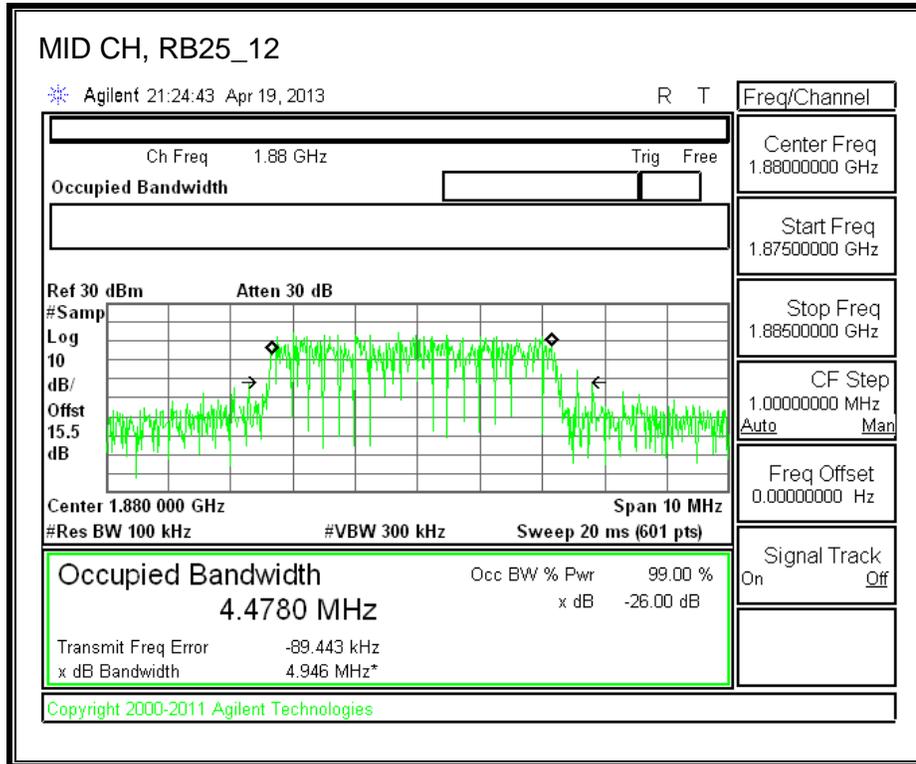
#### LOW-QPSK



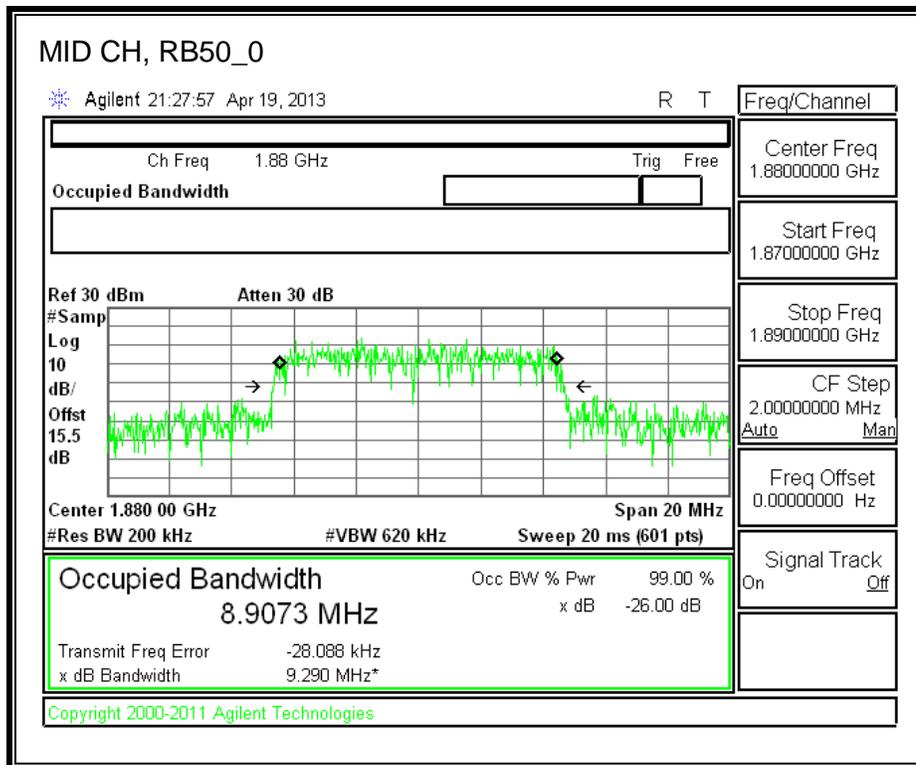
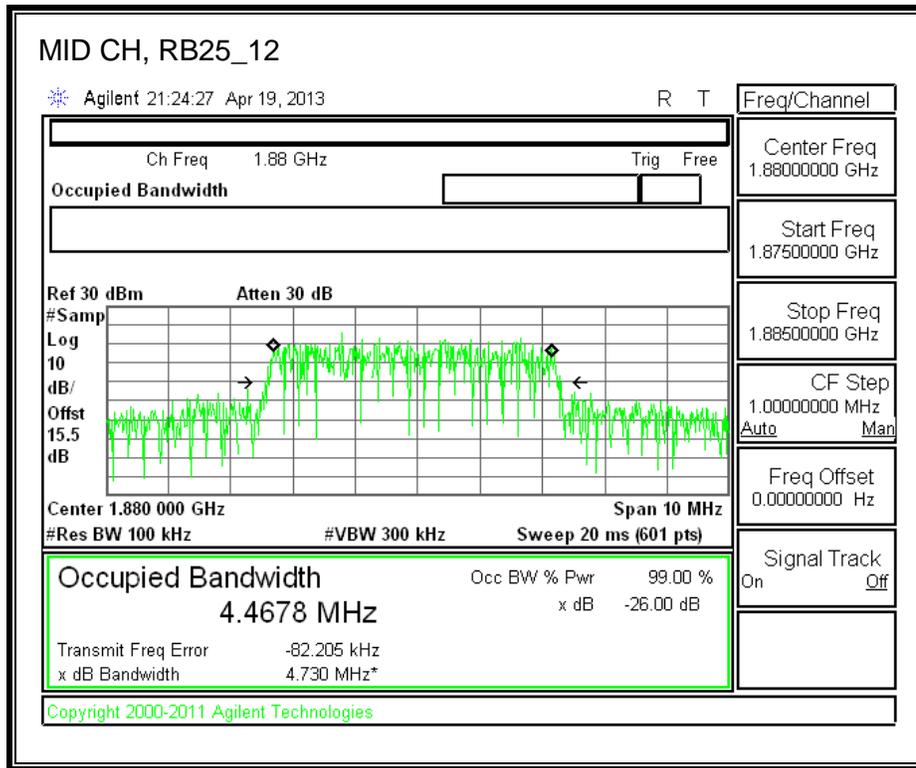
**LOW-16QAM**



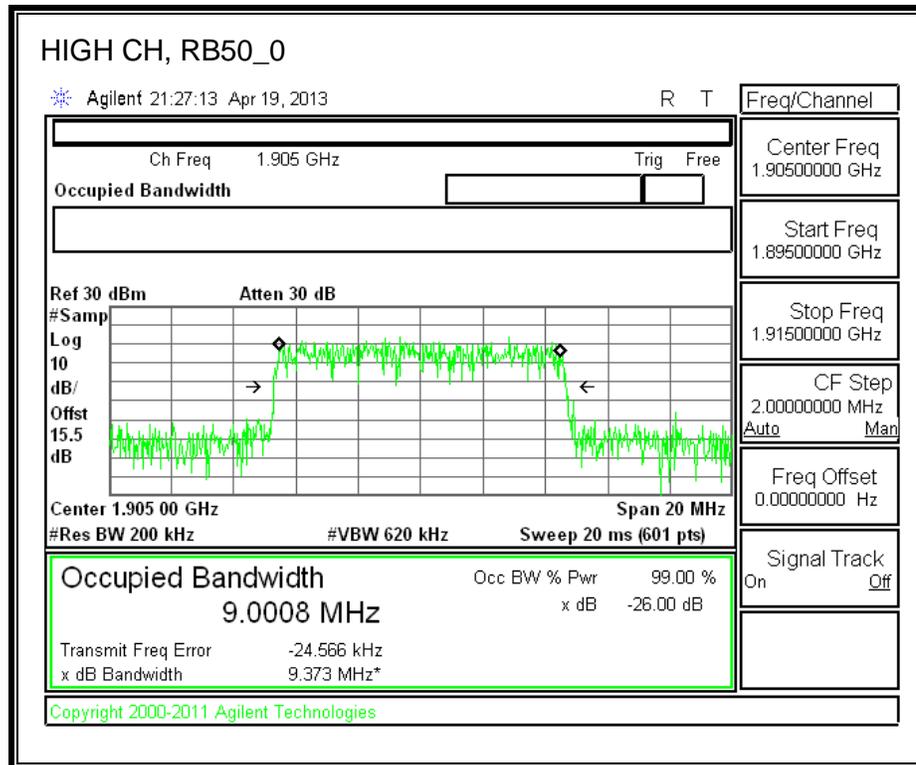
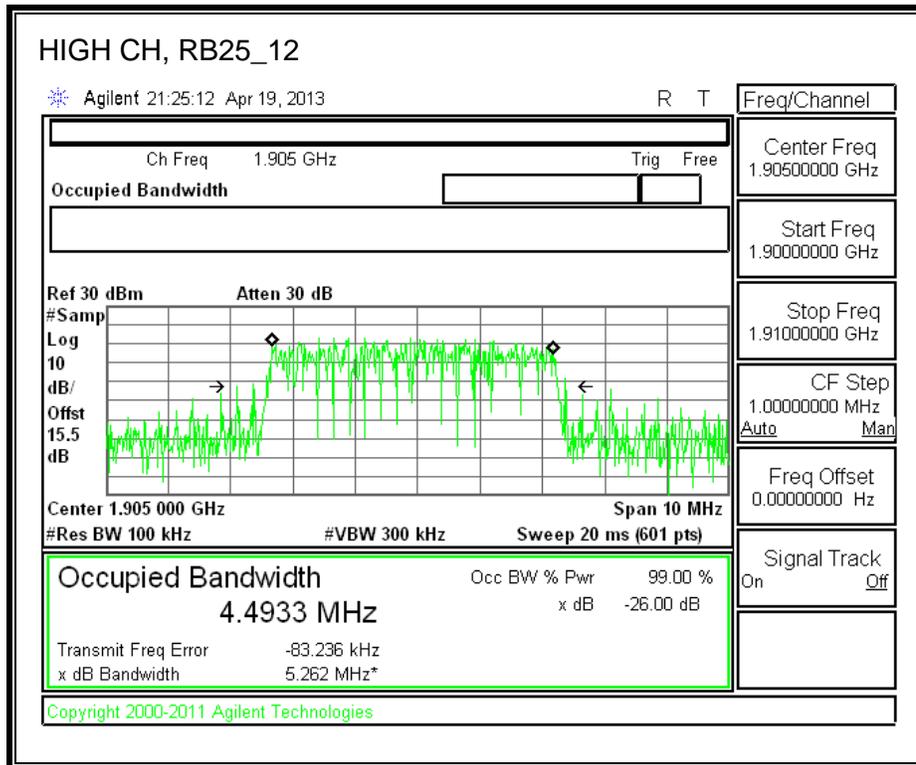
**MID-QPSK**



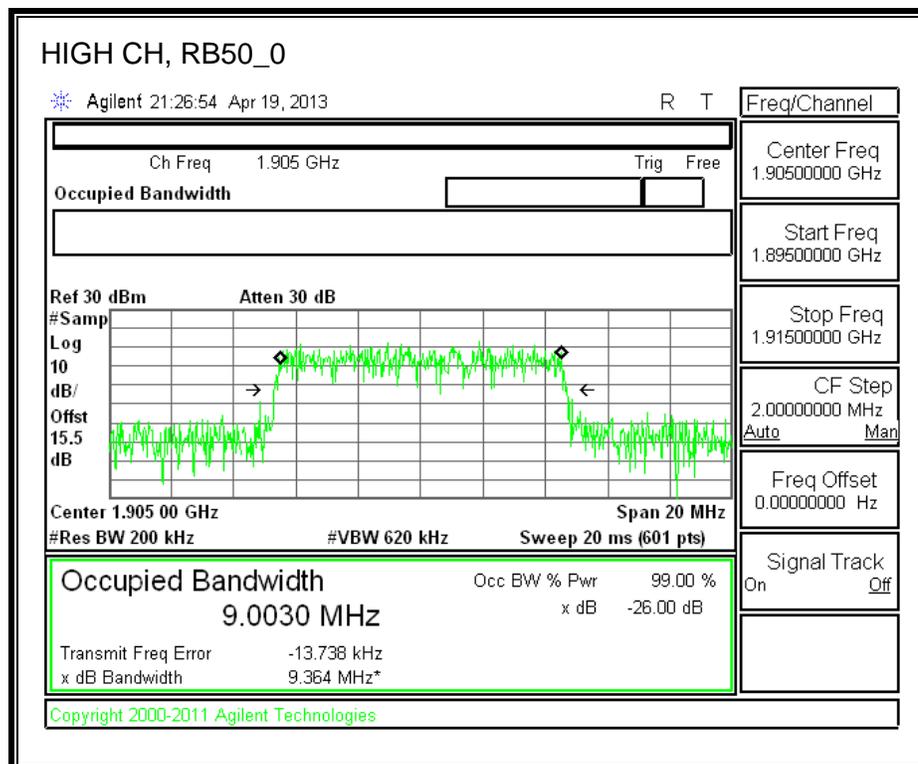
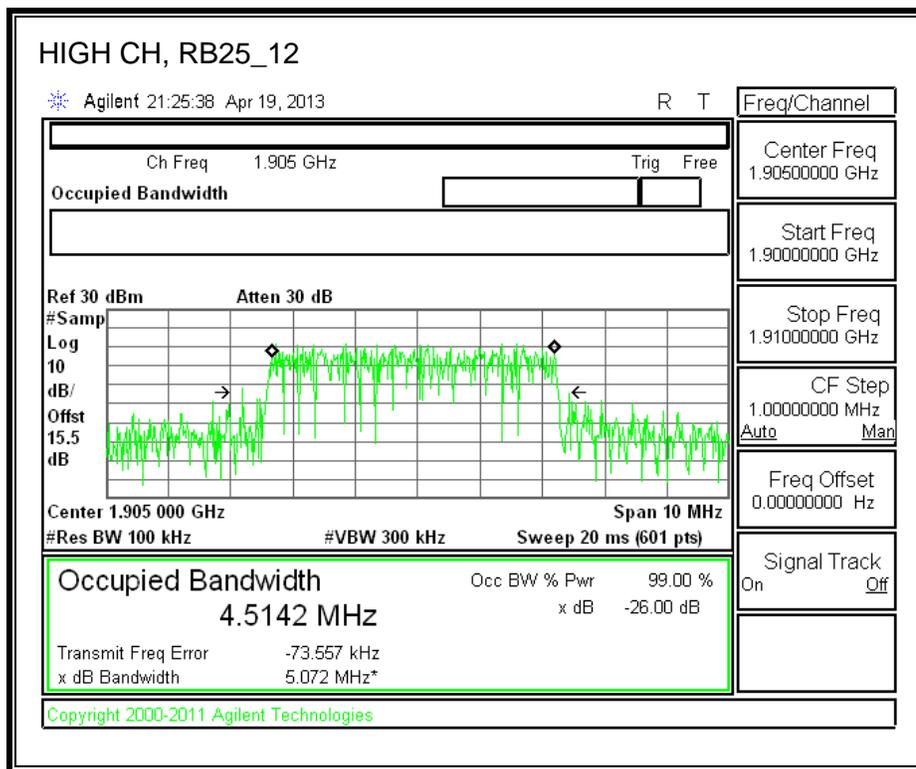
**MID-16QAM**



**HIGH-QPSK**

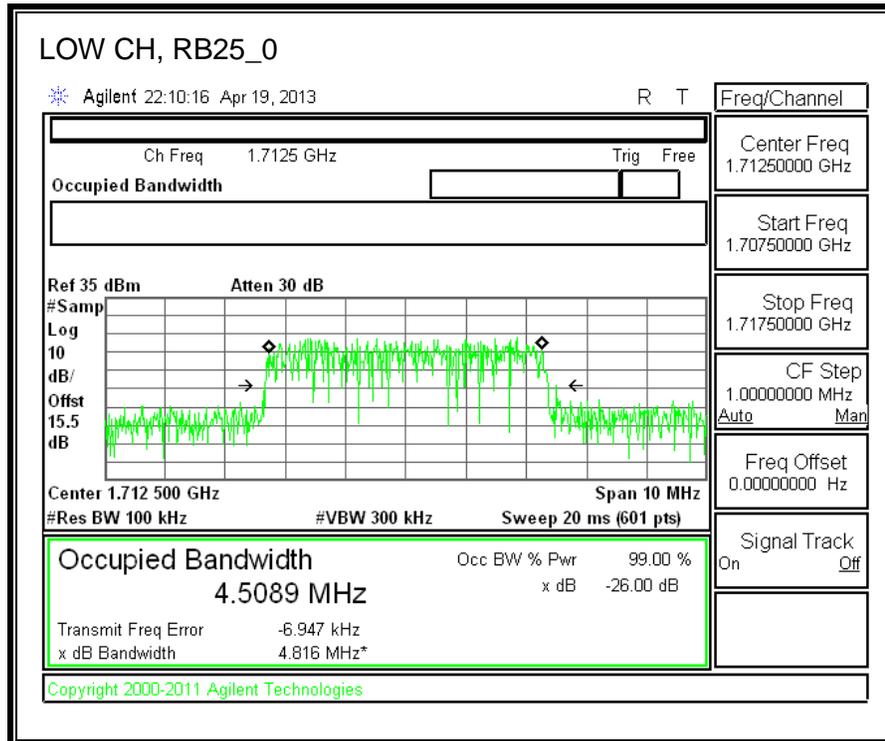
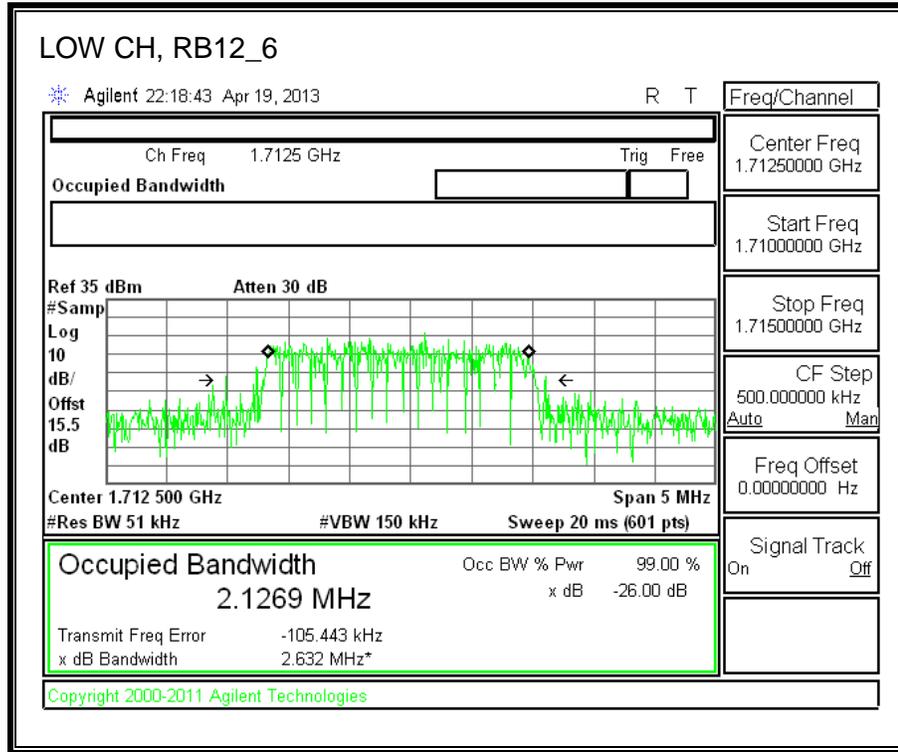


**HIGH-16QAM**



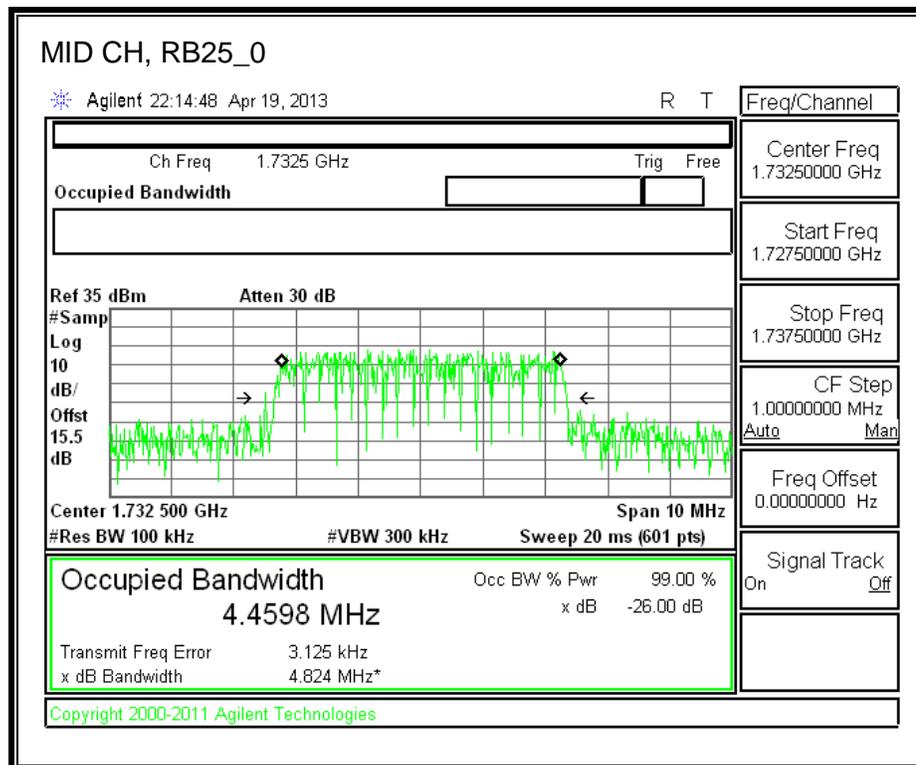
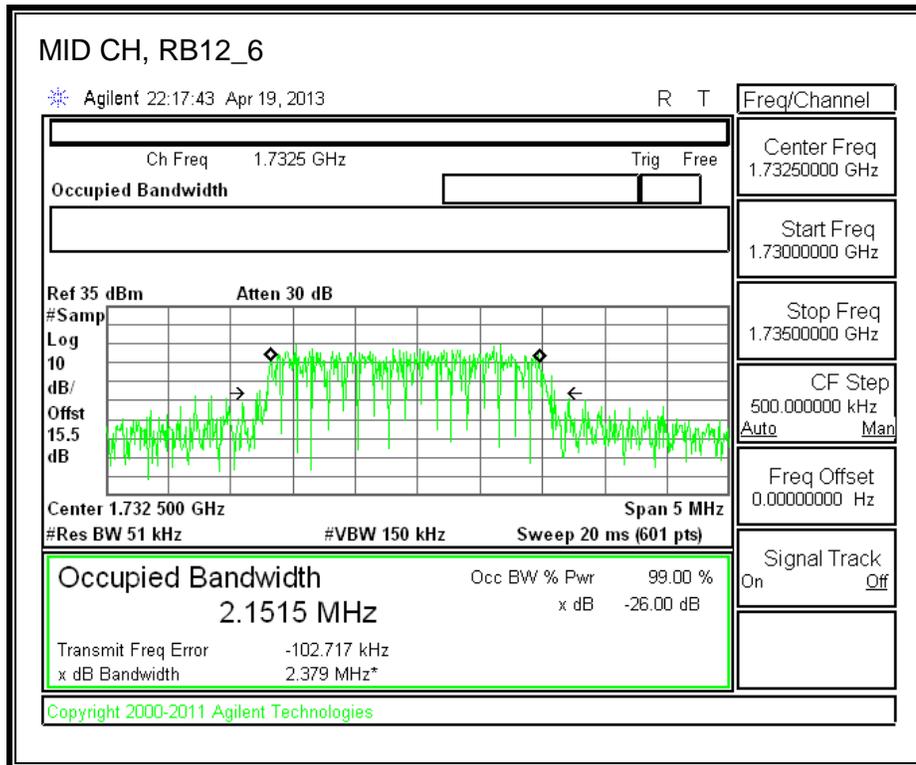
### 8.1.7. LTE BAND 4-5MHz BANDWIDTH

#### LOW-QPSK

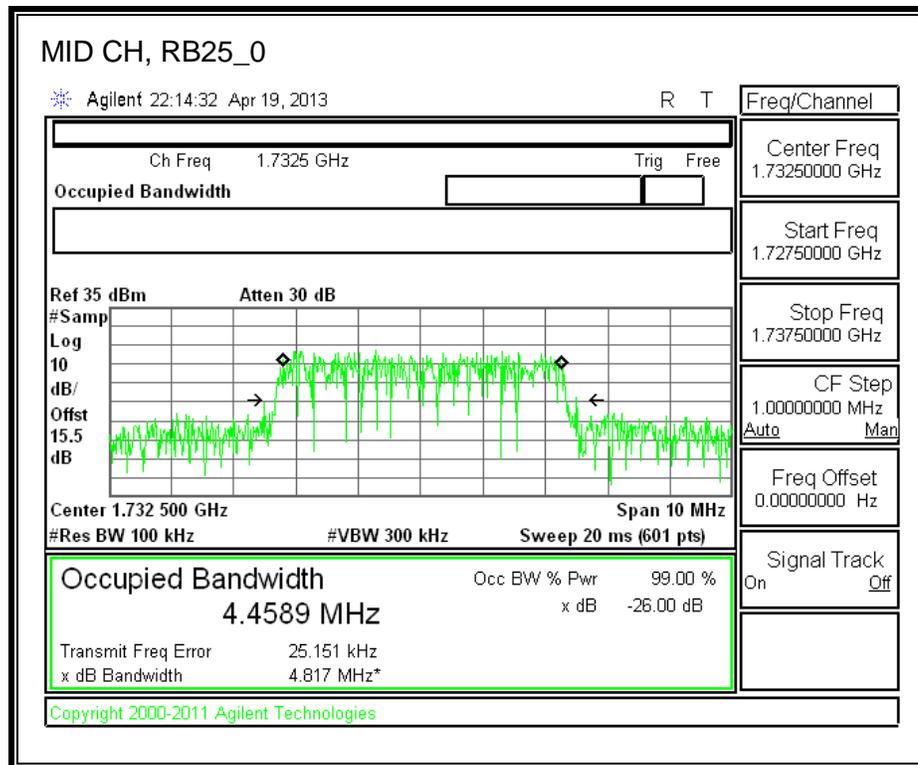
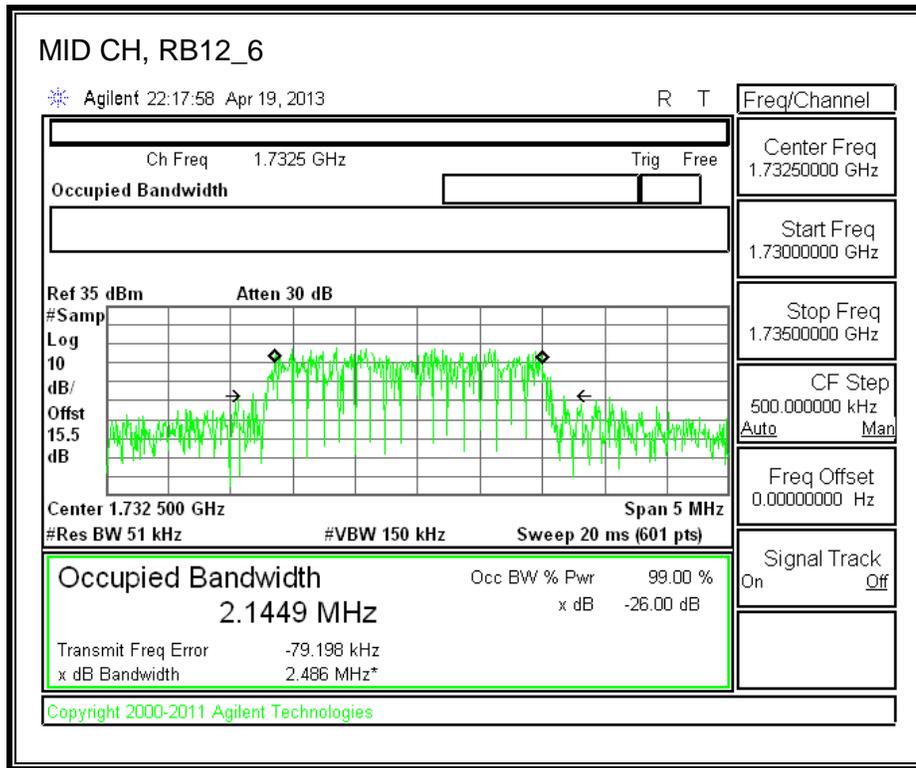




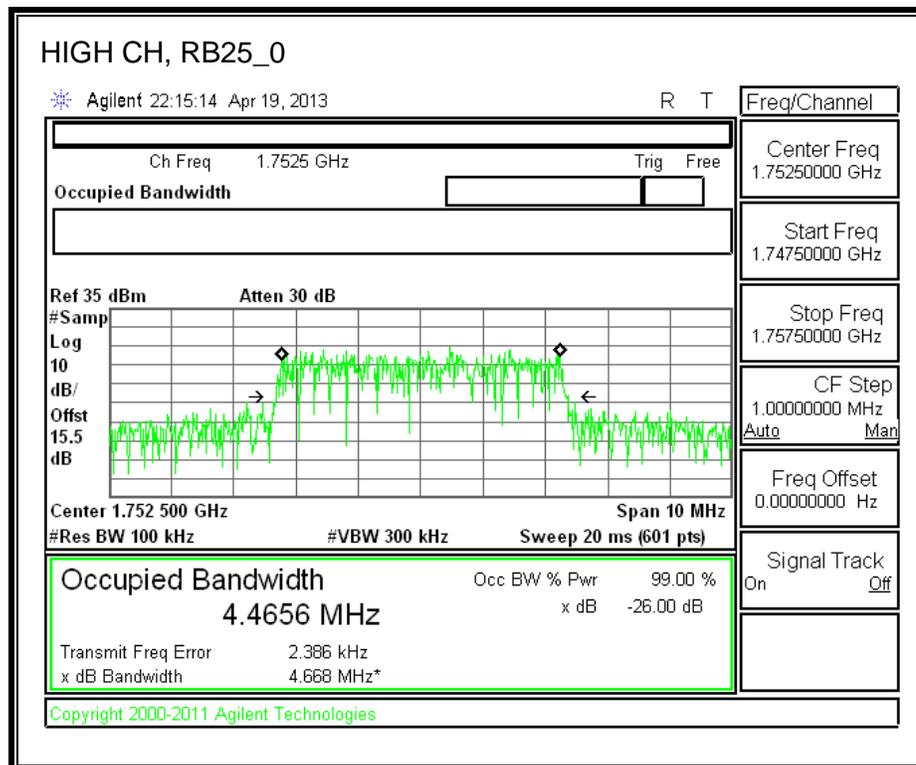
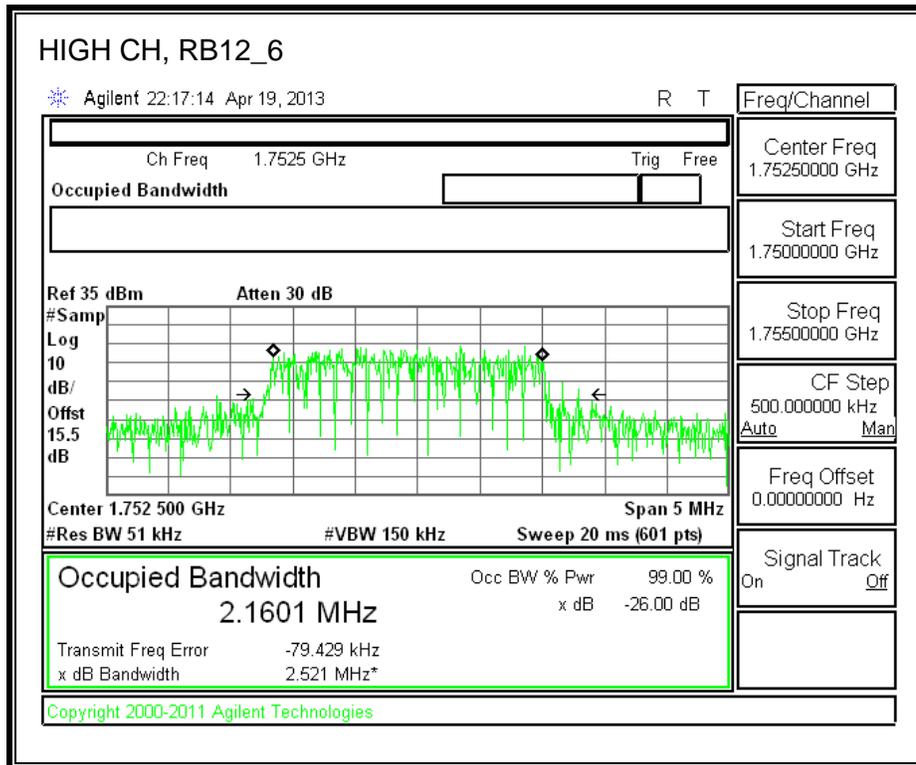
**MID-QPSK**



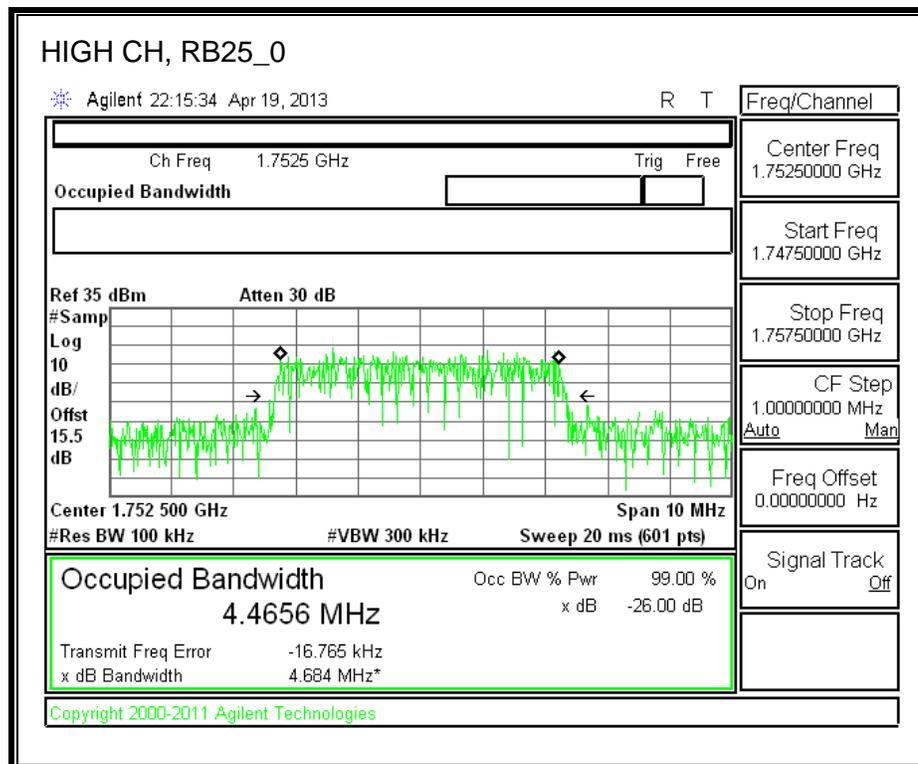
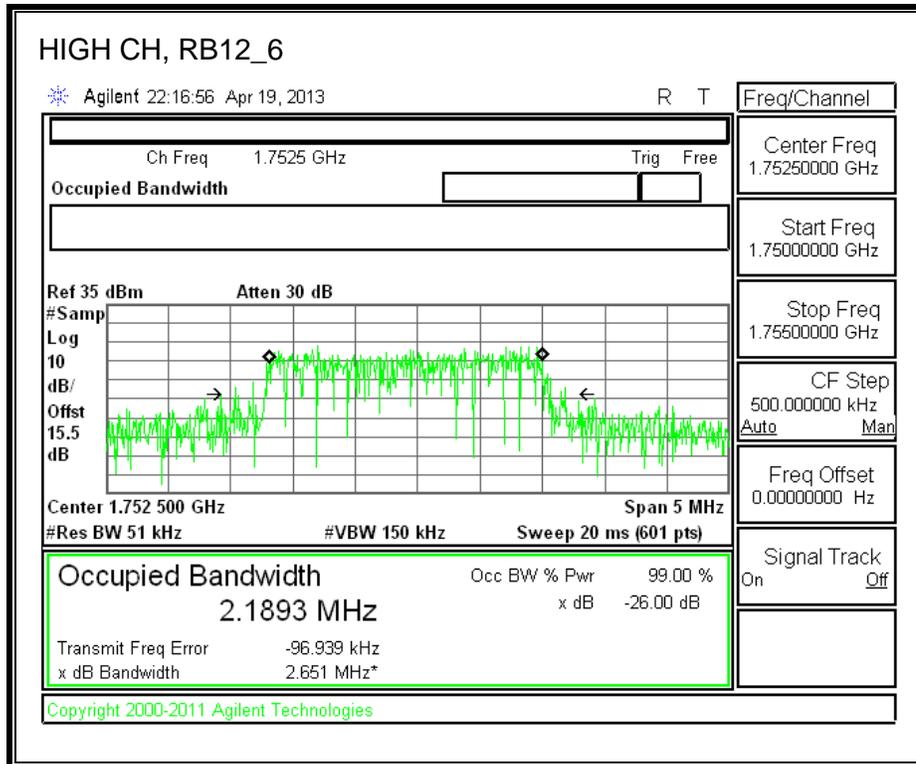
**MID-16QAM**



**HIGH-QPSK**

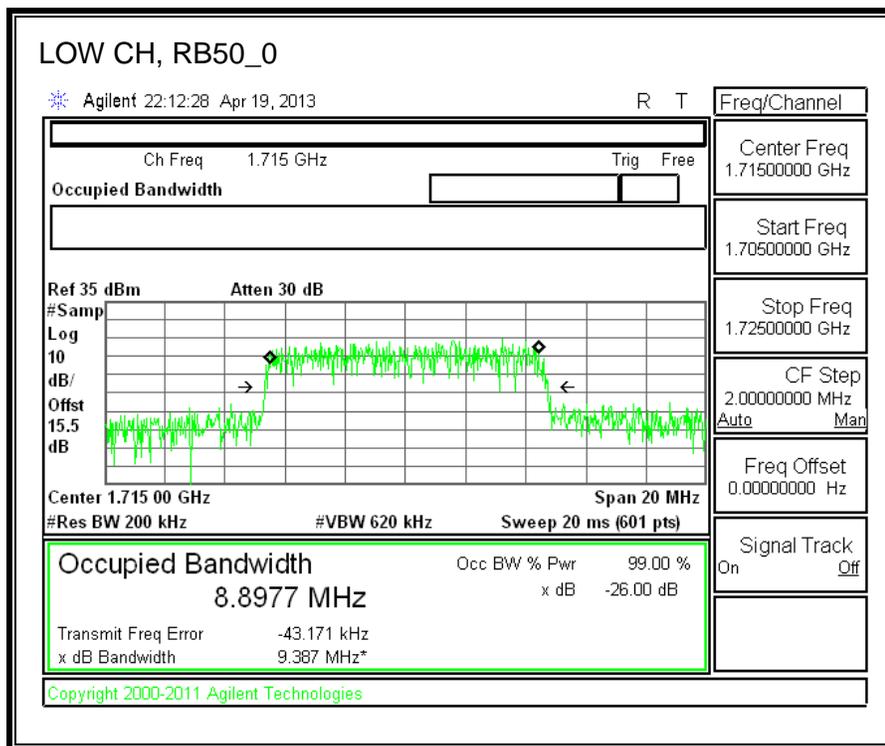
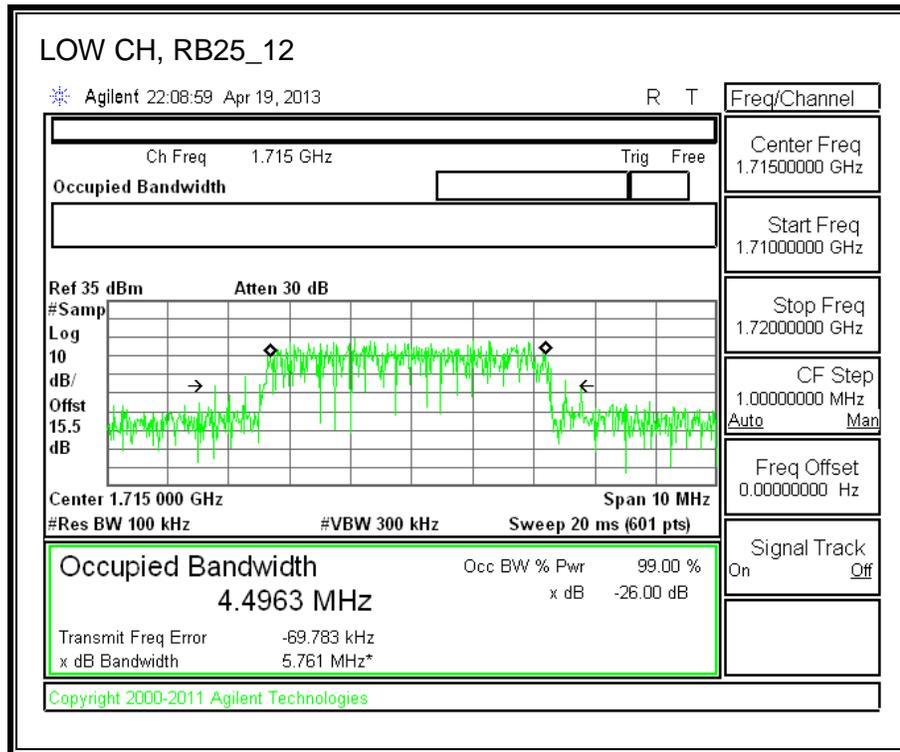


**HIGH-16QAM**

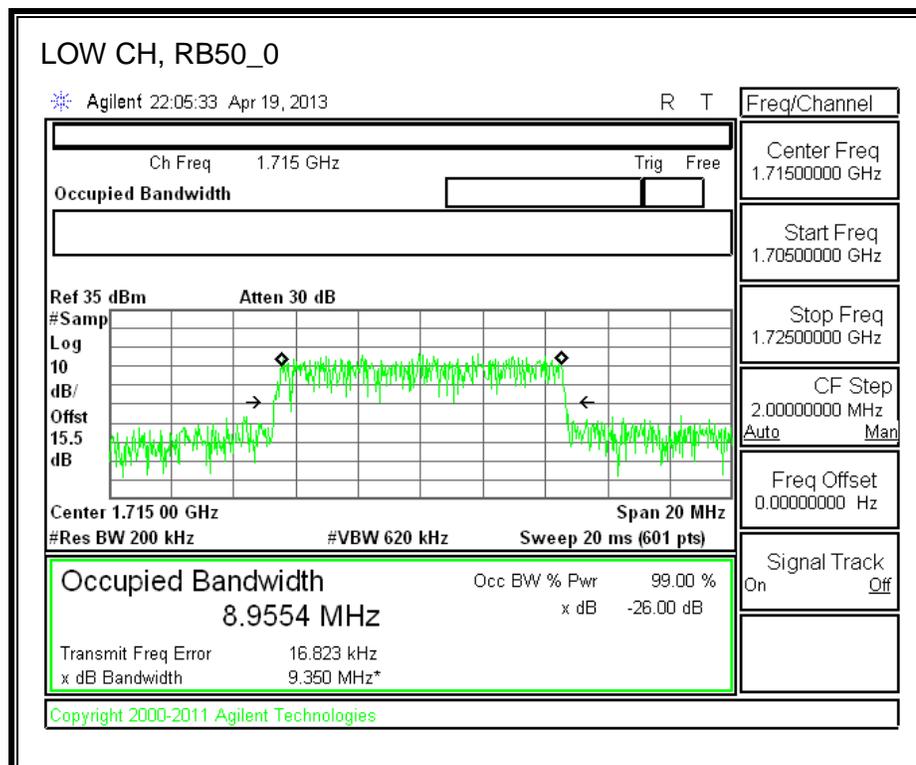
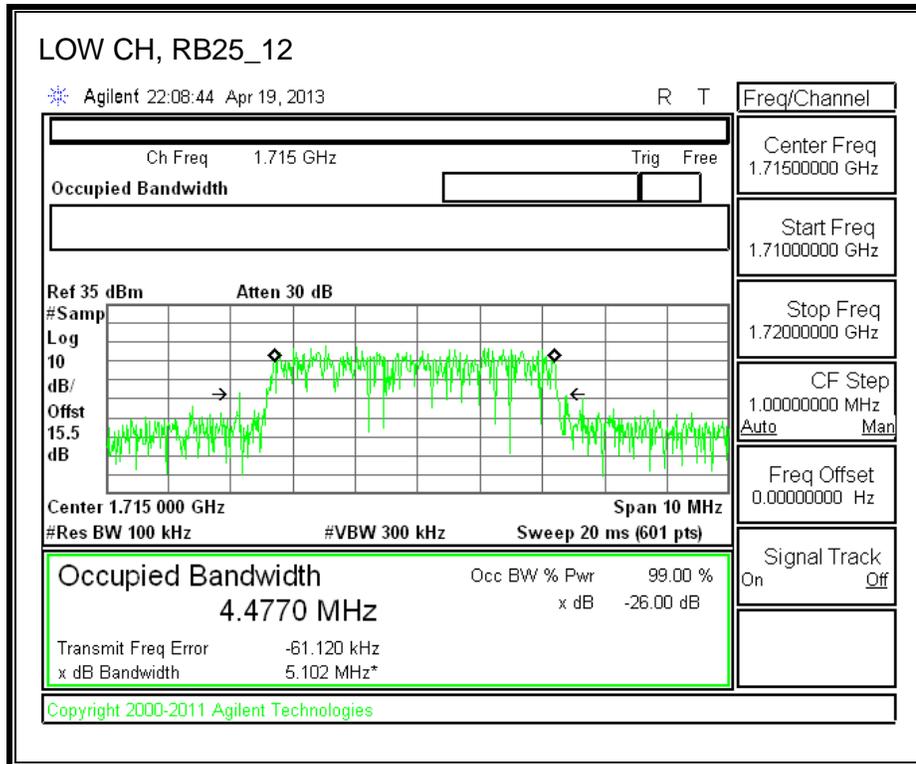


### 8.1.8. LTE BAND 4-10MHz BANDWIDTH

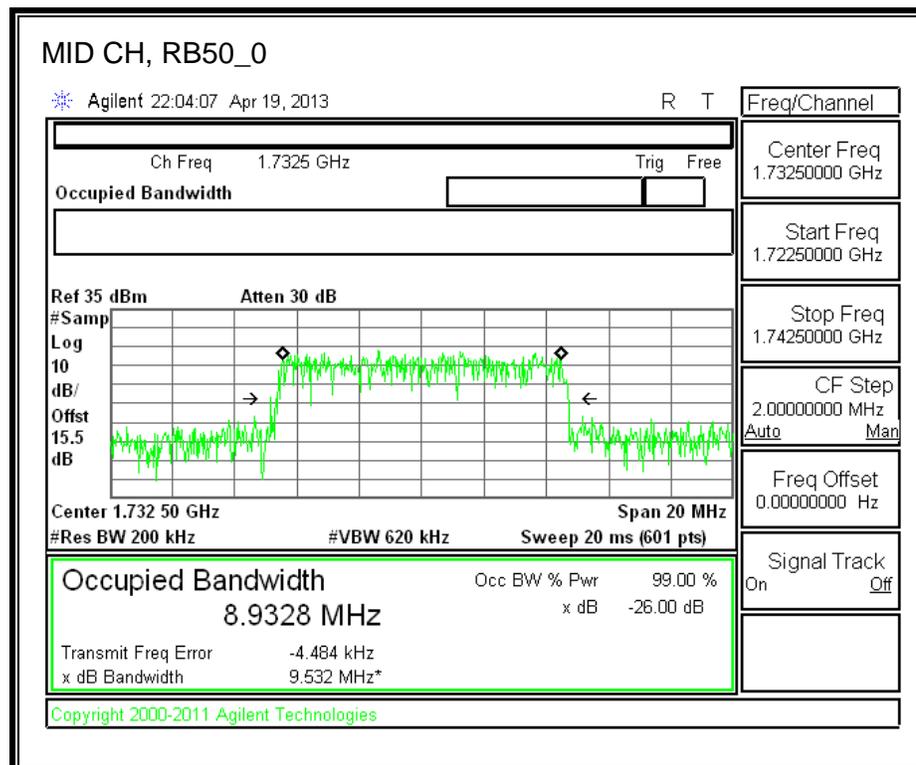
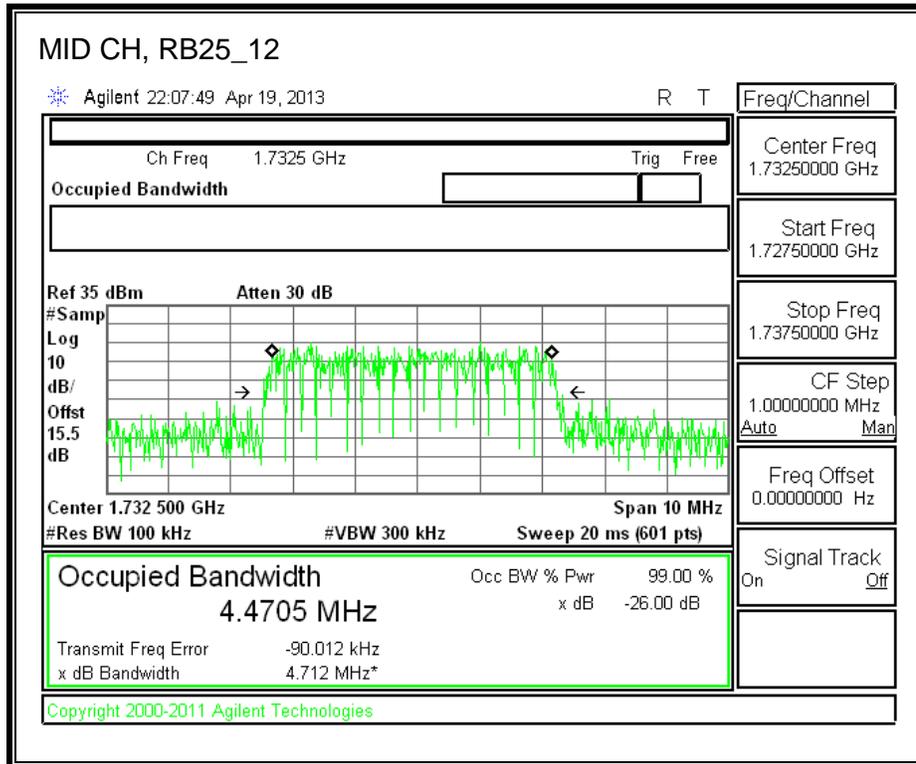
#### LOW-QPSK



**LOW-16QAM**

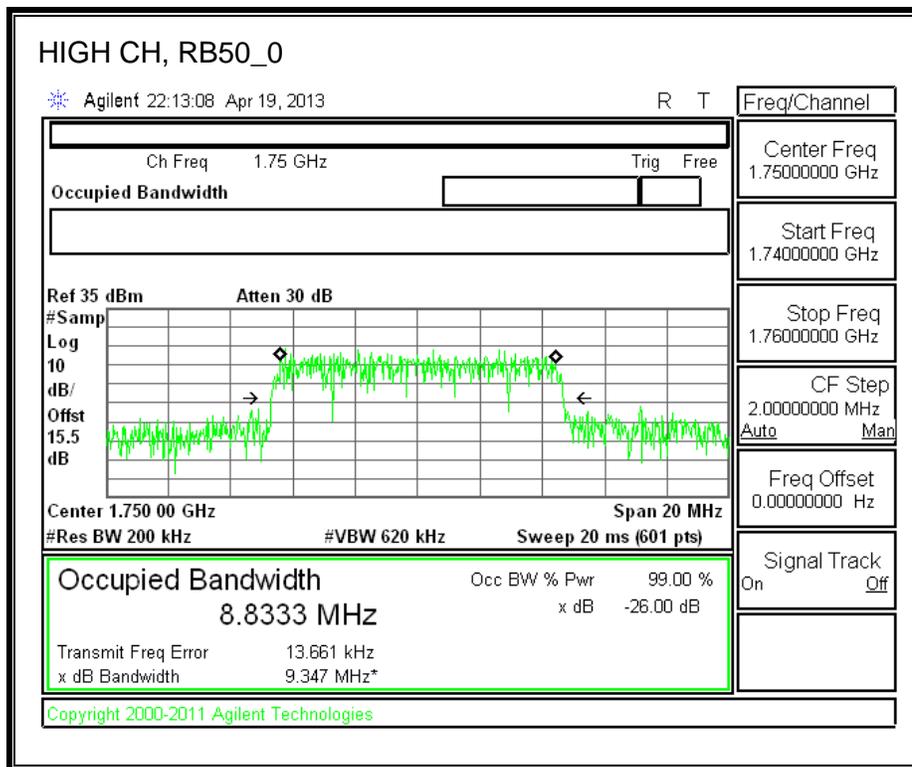
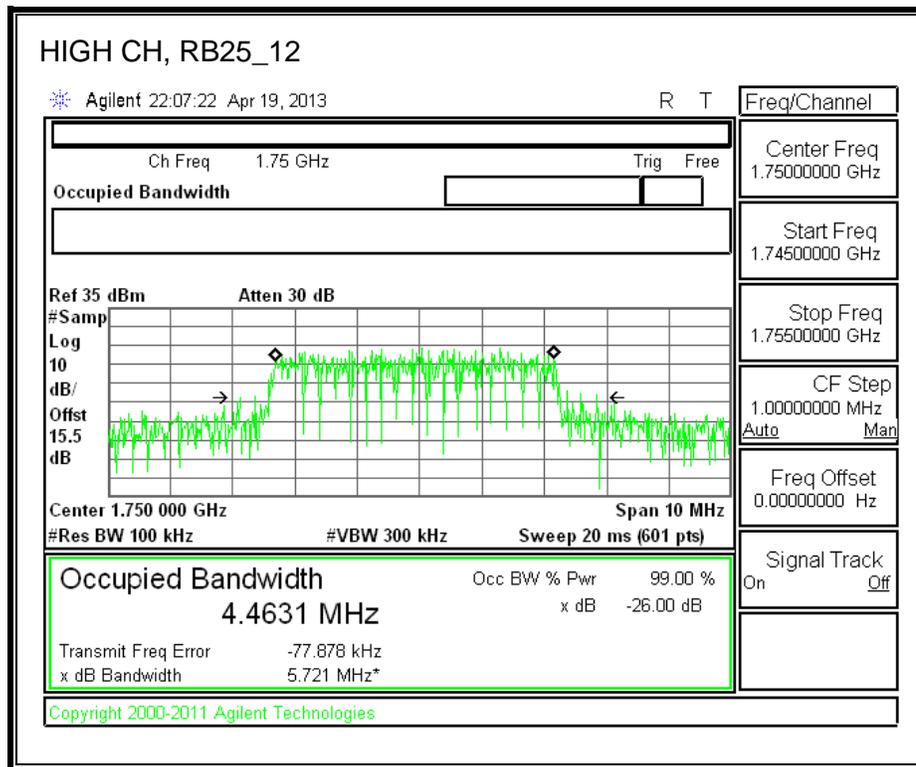


**MID-QPSK**

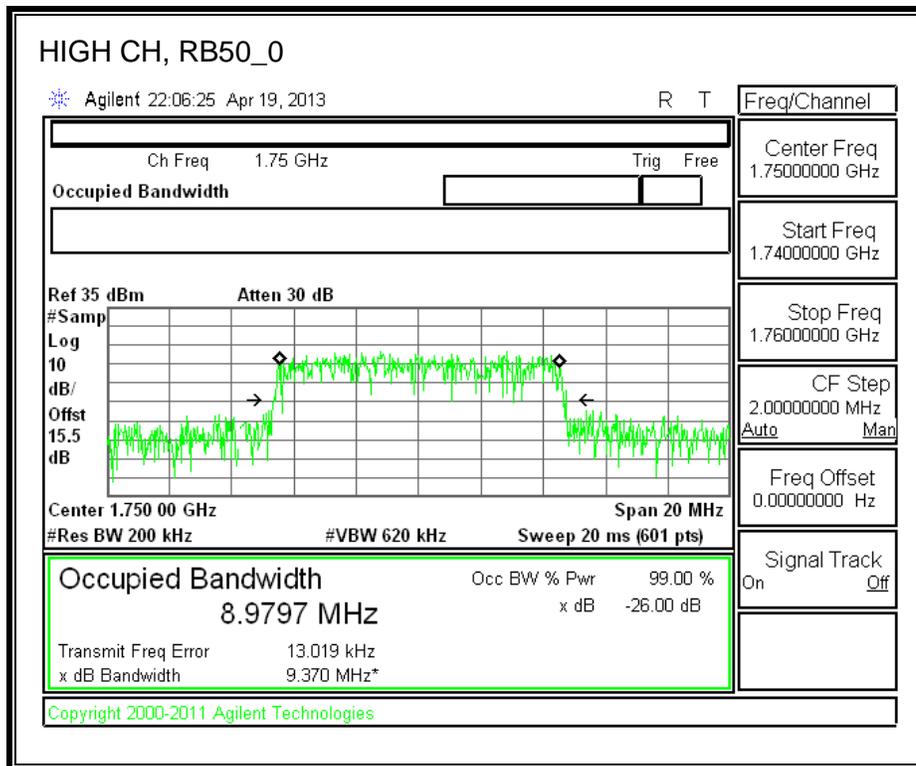
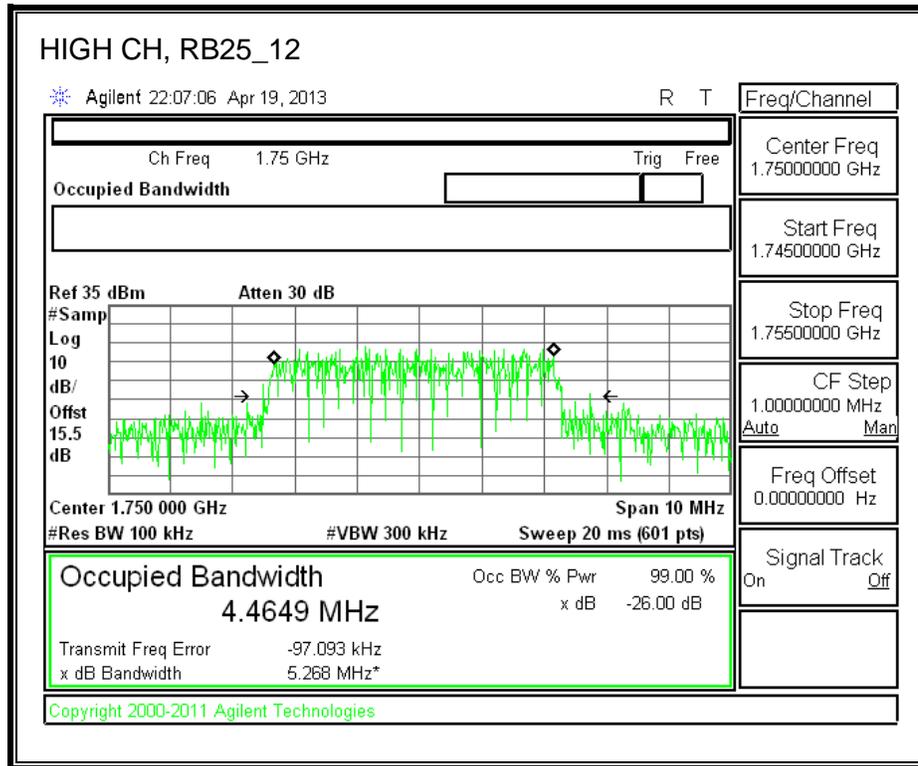




**HIGH-QPSK**

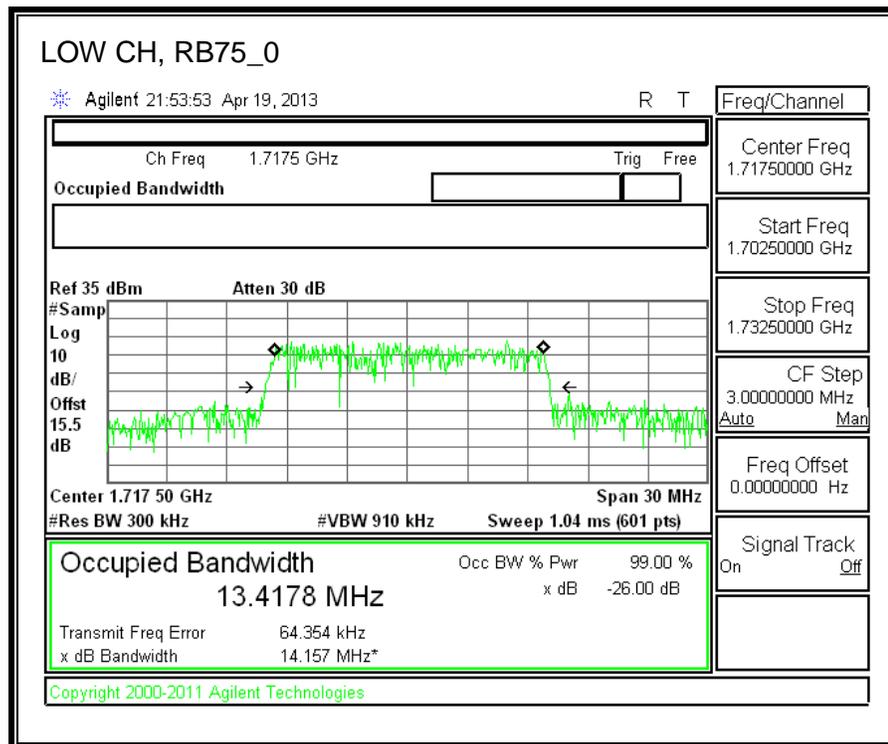
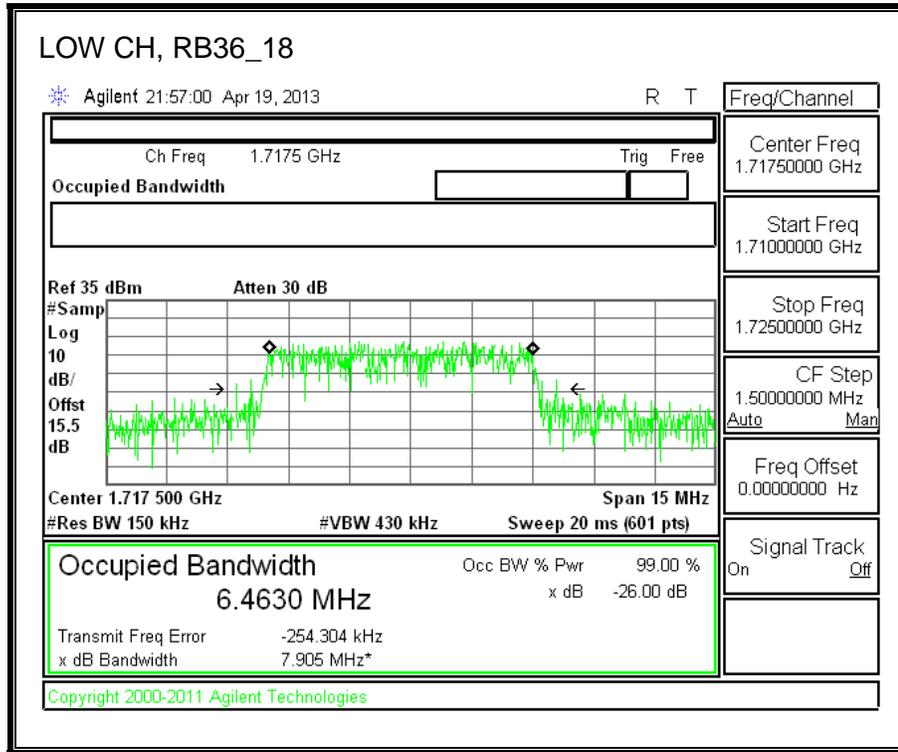


**HIGH-16QAM**

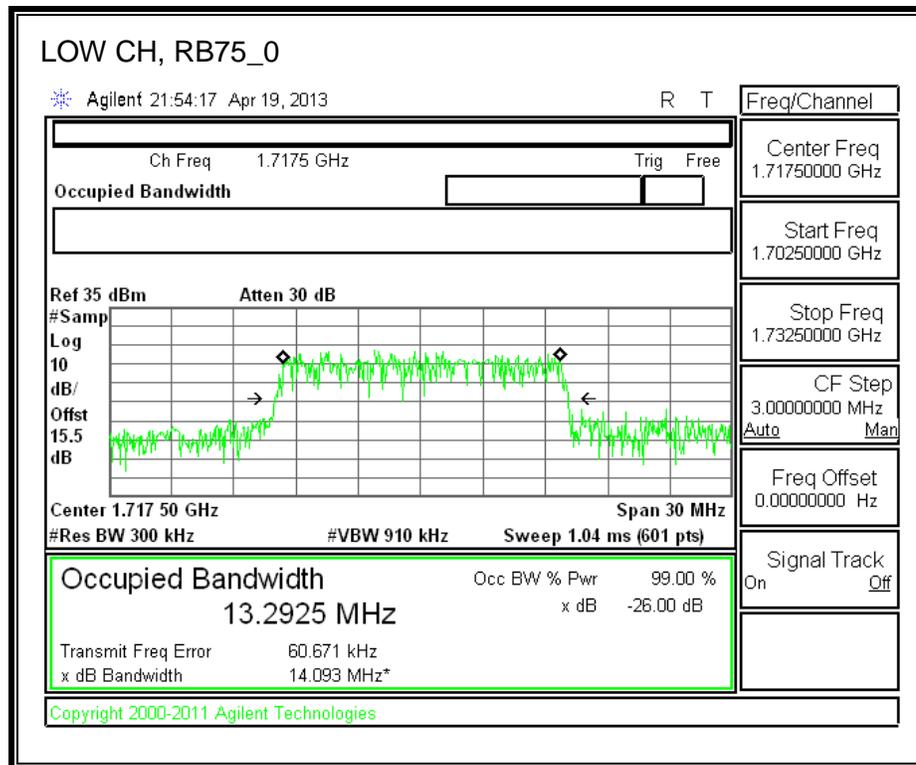
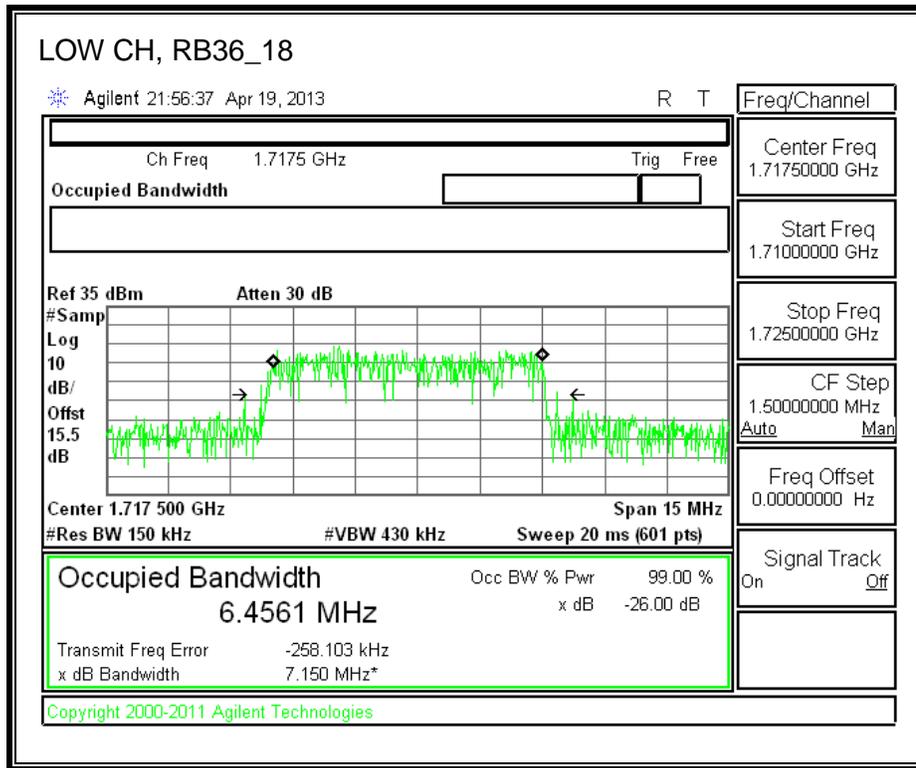


### 8.1.9. LTE BAND 4-15MHz BANDWIDTH

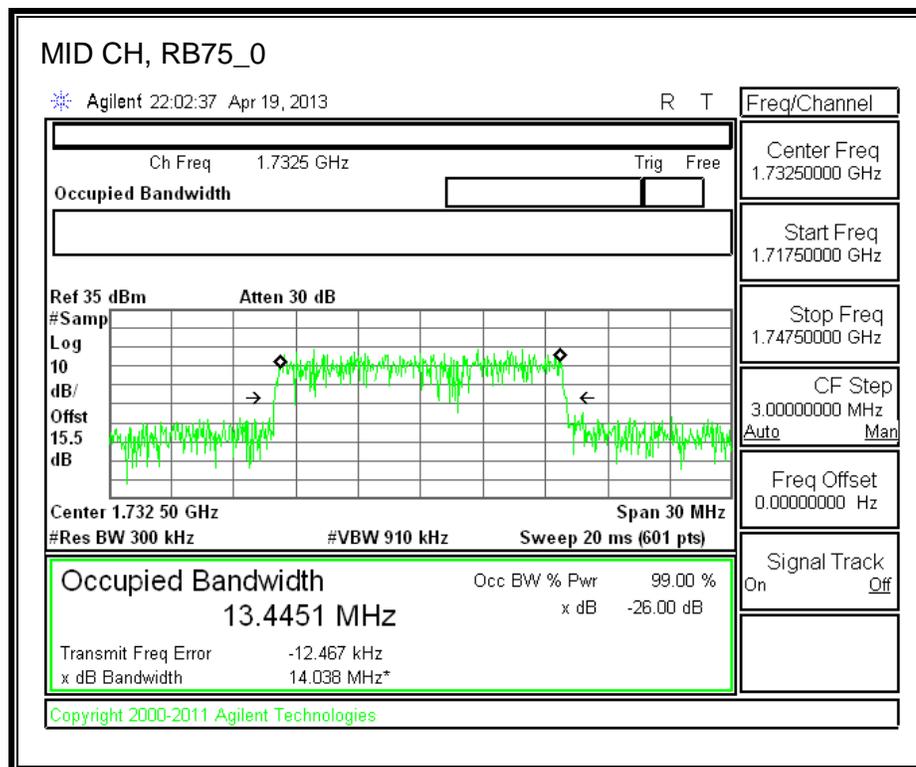
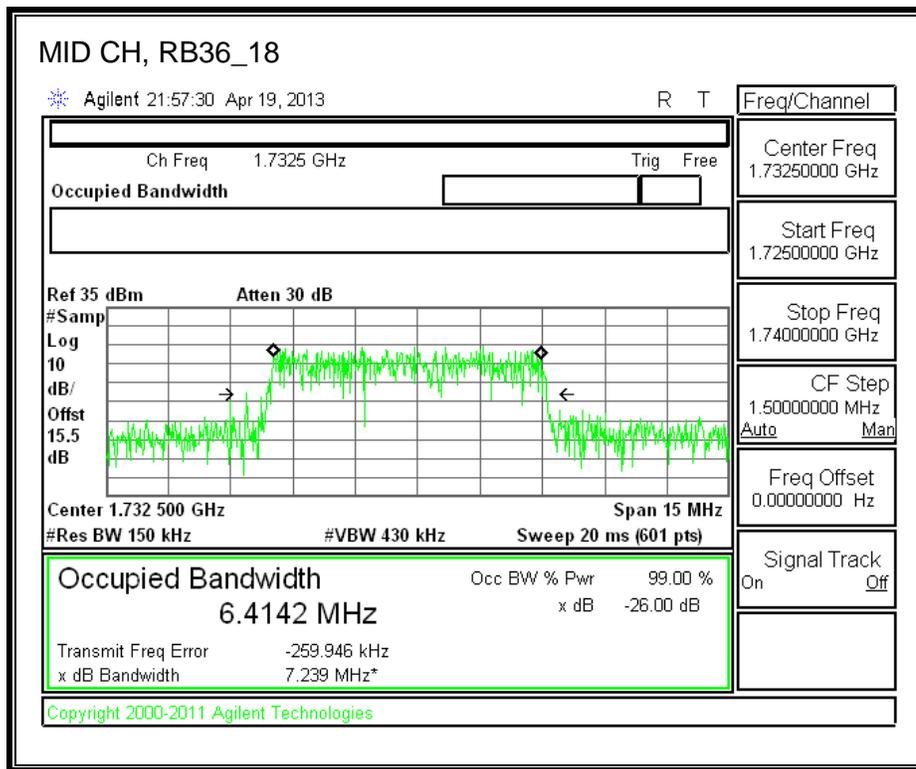
#### LOW-QPSK



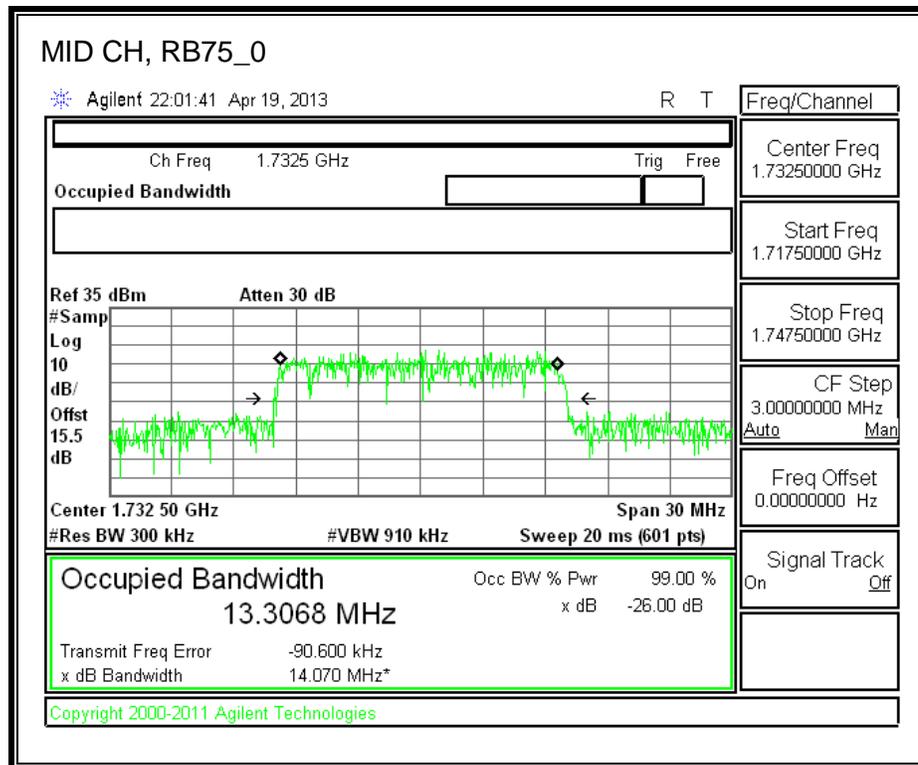
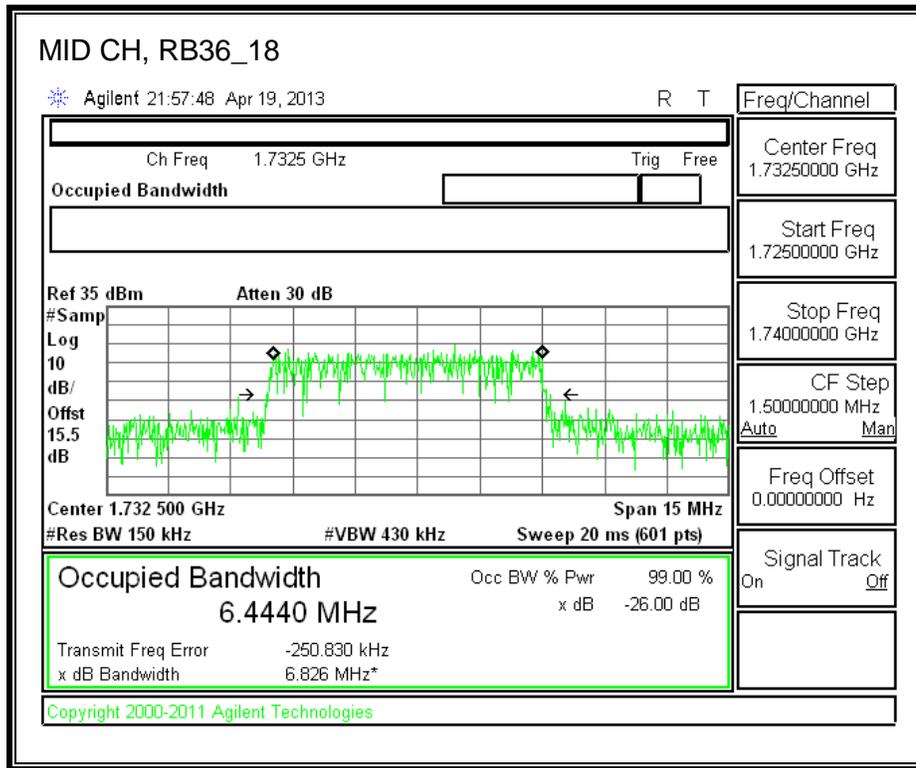
**LOW-16QAM**



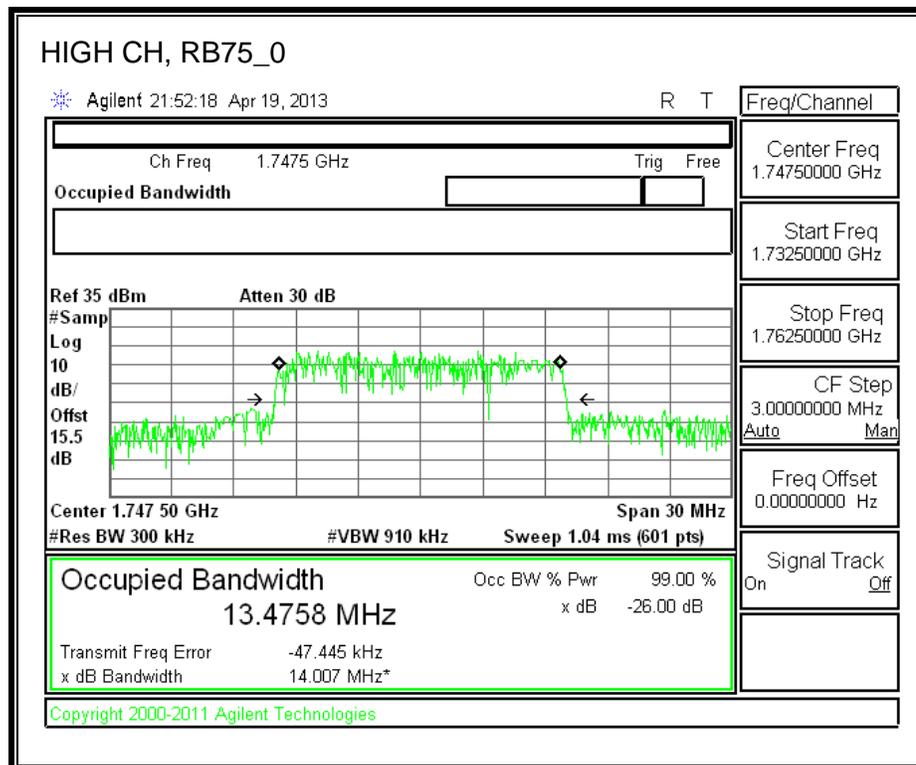
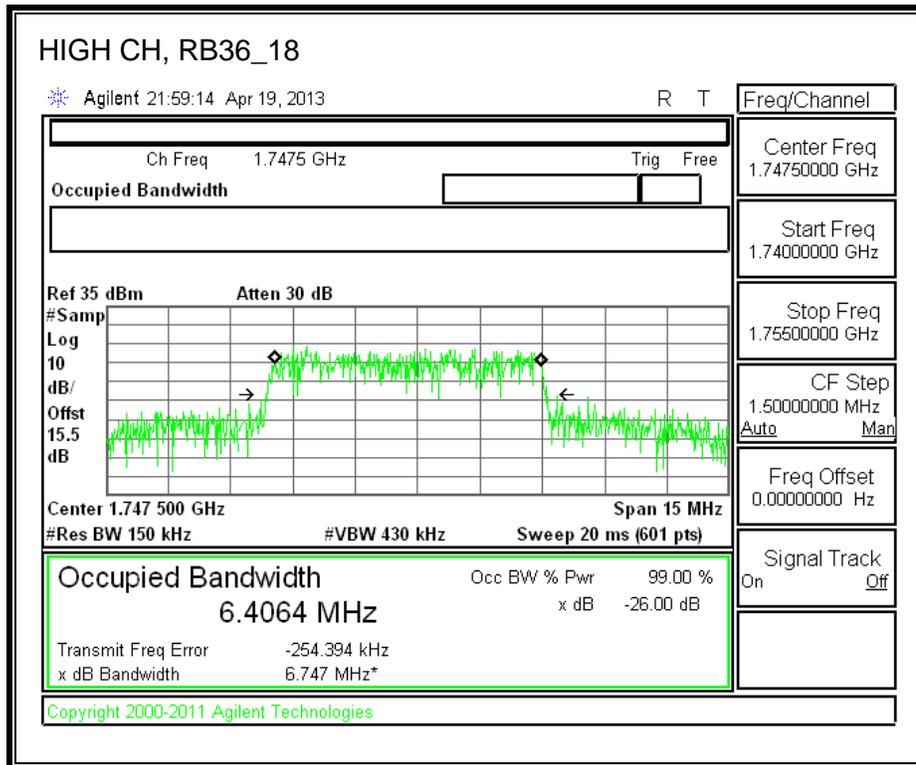
**MID-QPSK**



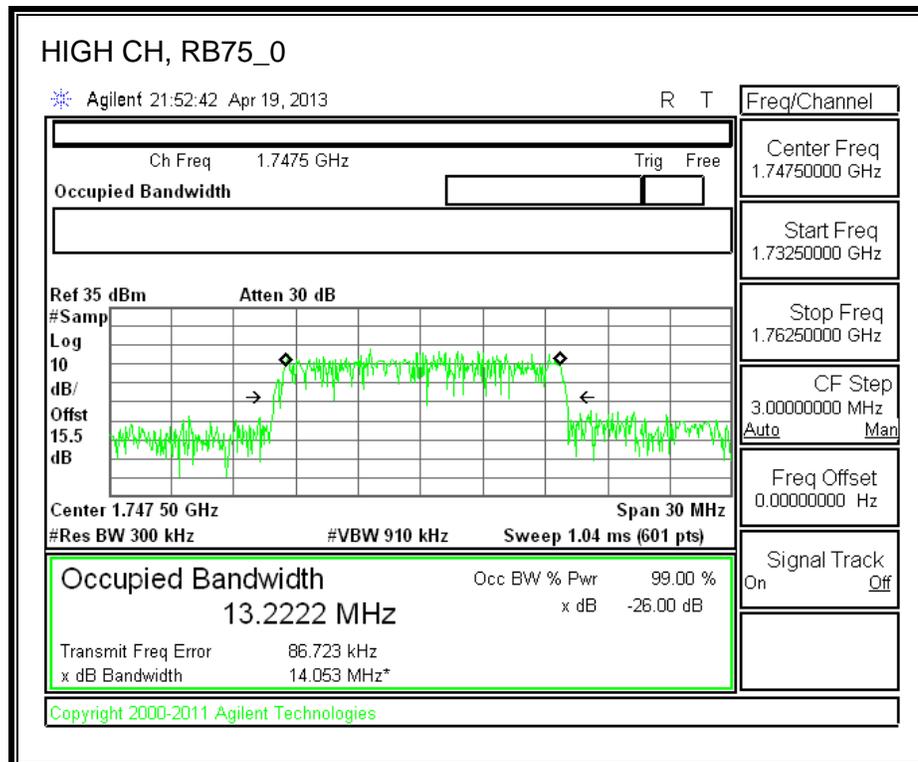
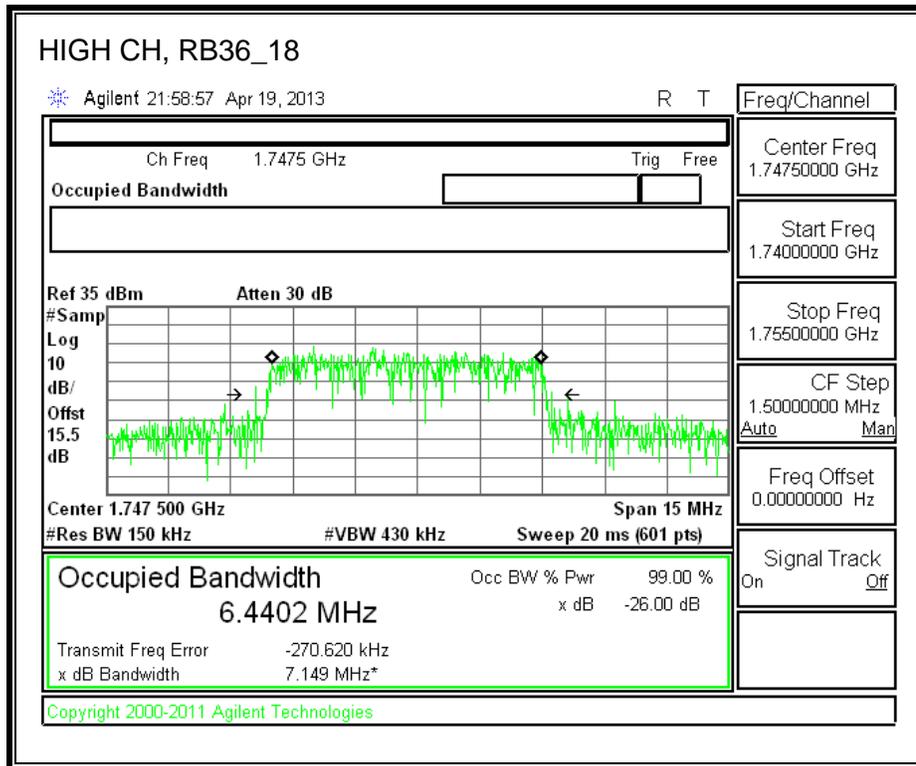
**MID-16QAM**



**HIGH-QPSK**

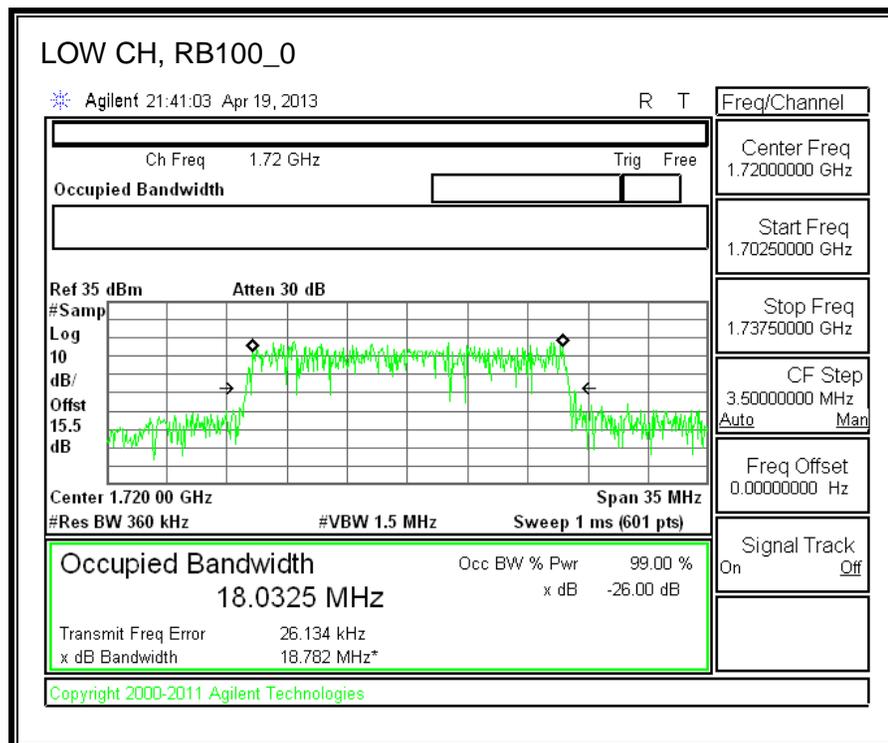
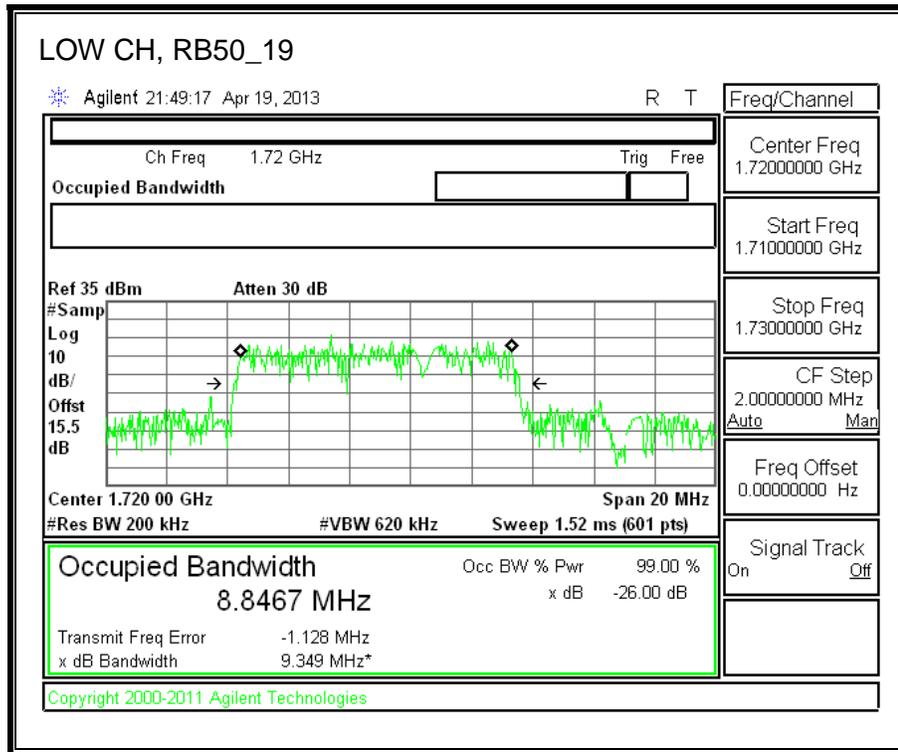


**HIGH-16QAM**

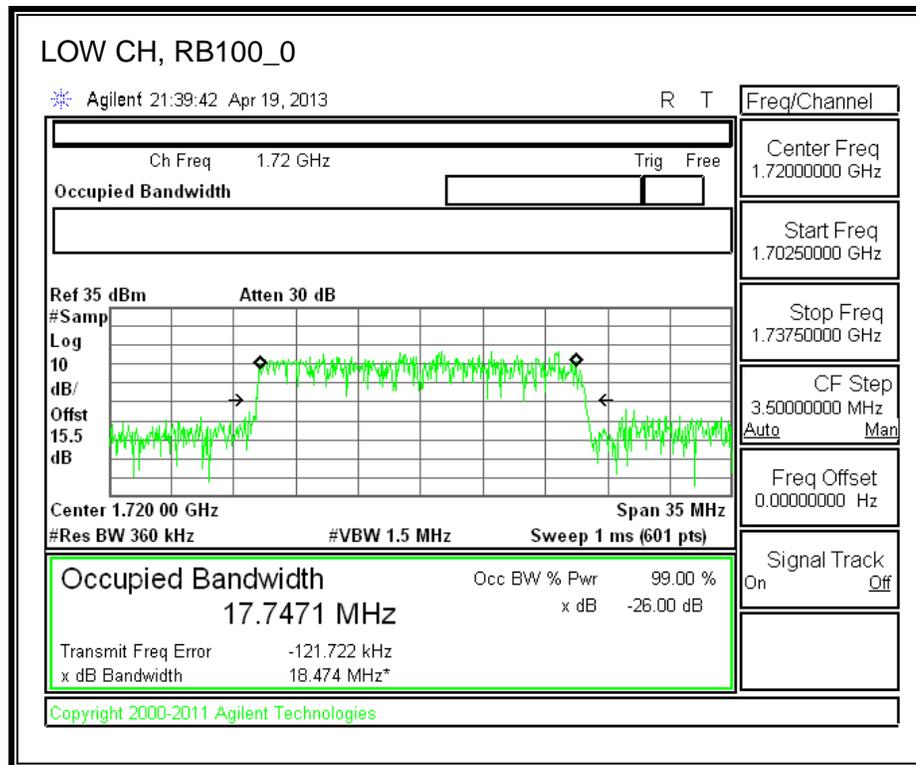
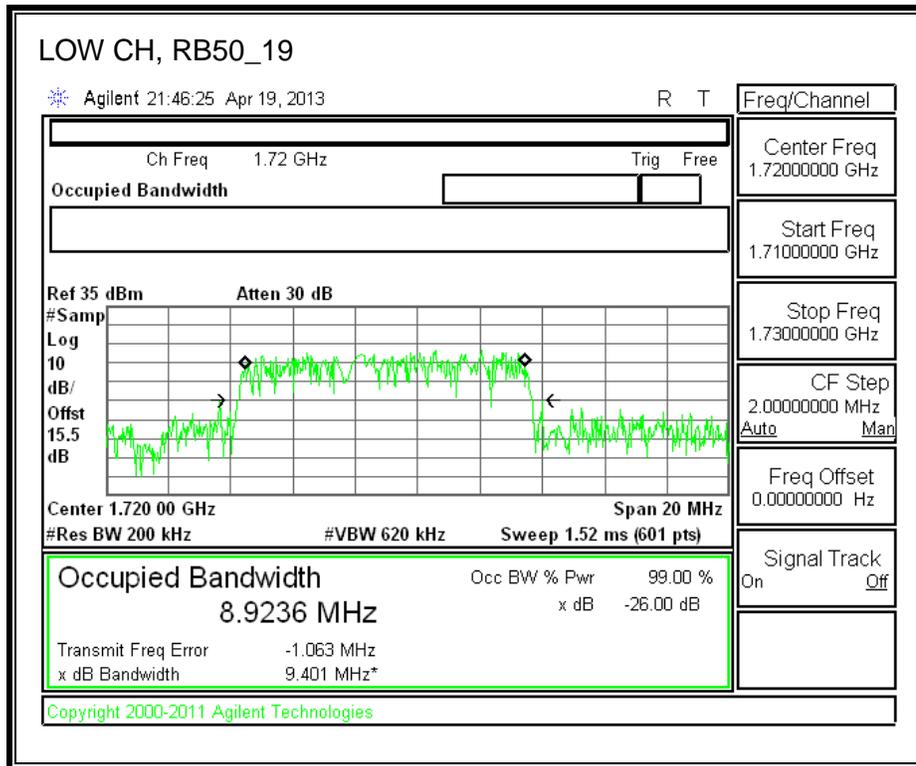


### 8.1.10. LTE BAND 4-20MHz BANDWIDTH

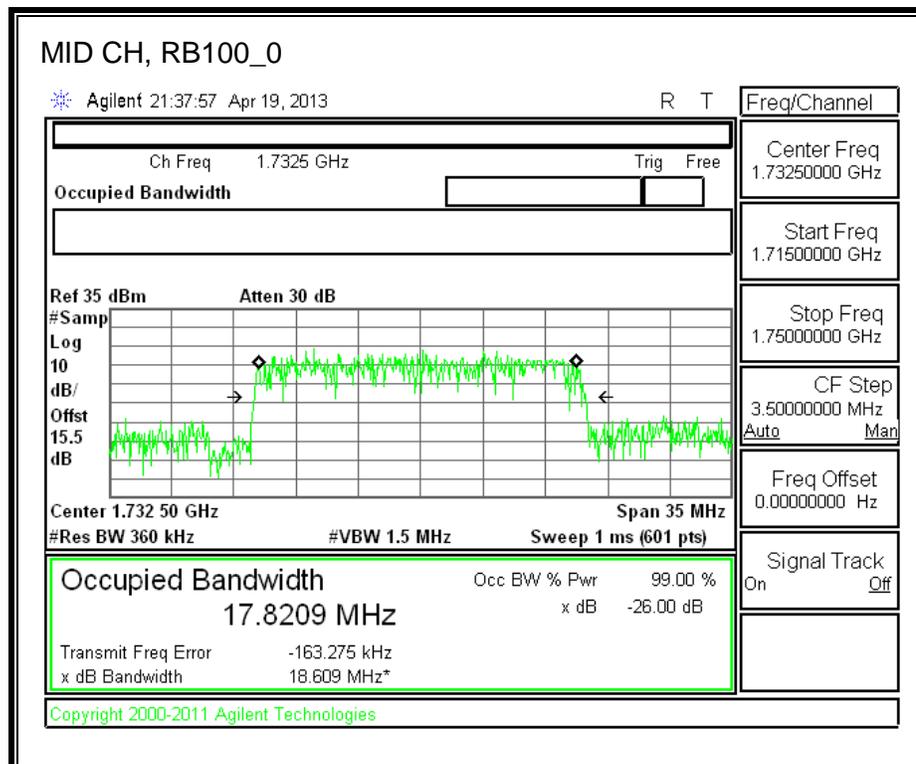
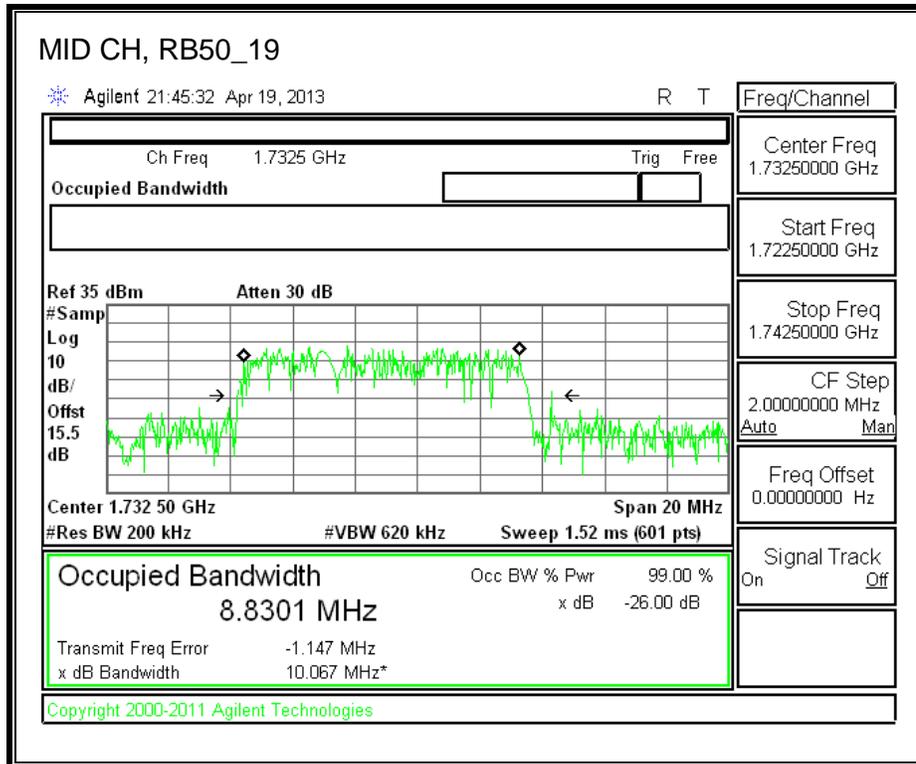
#### LOW-QPSK



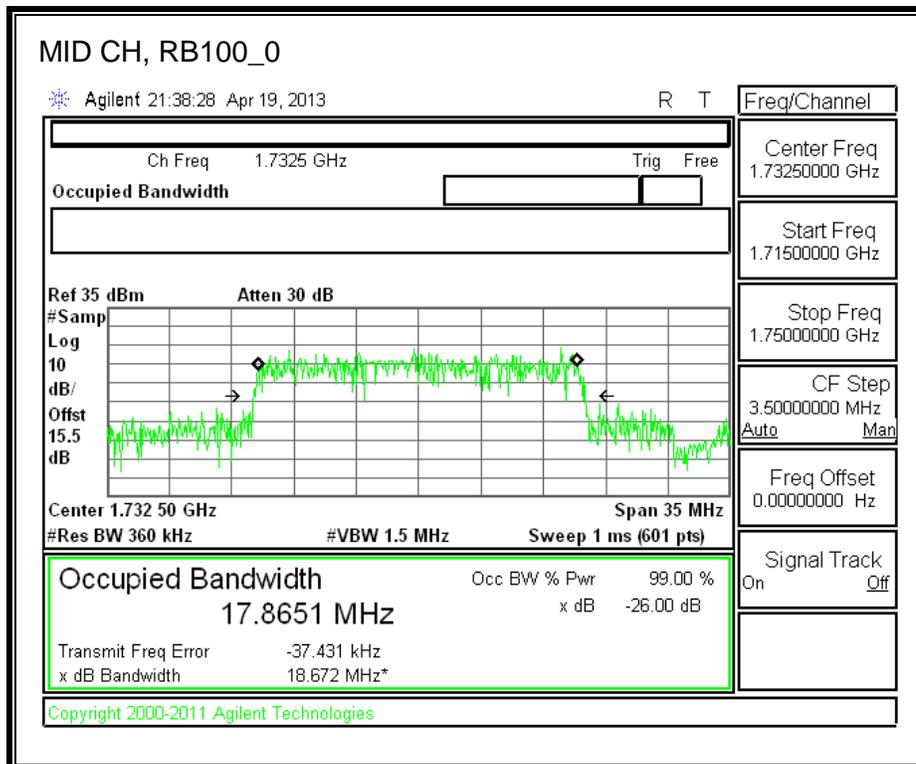
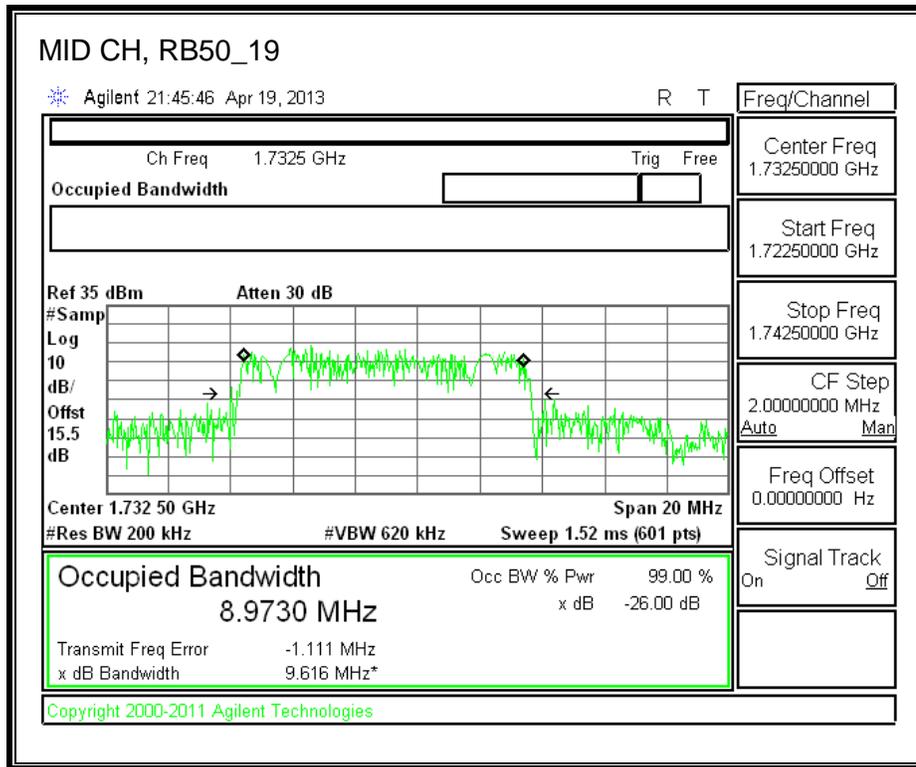
**LOW-16QAM**



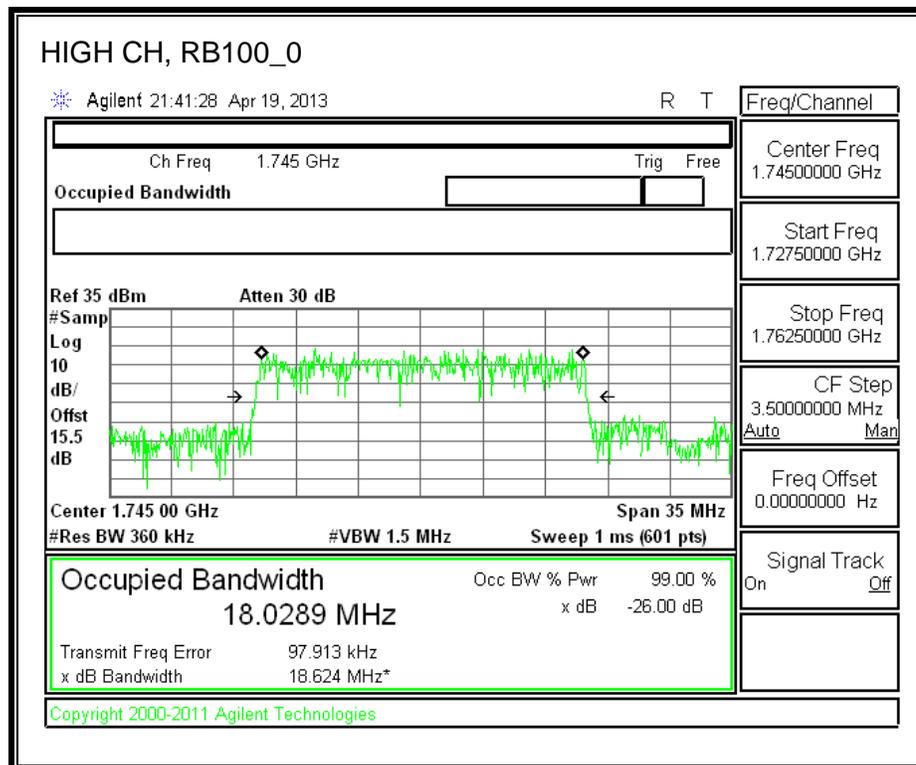
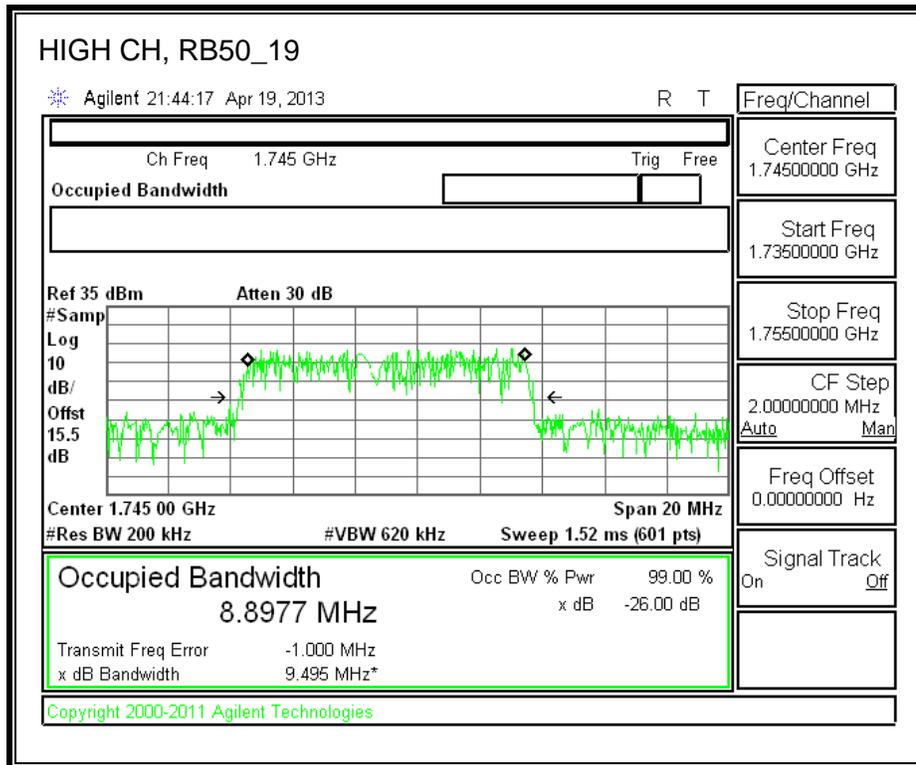
**MID-QPSK**



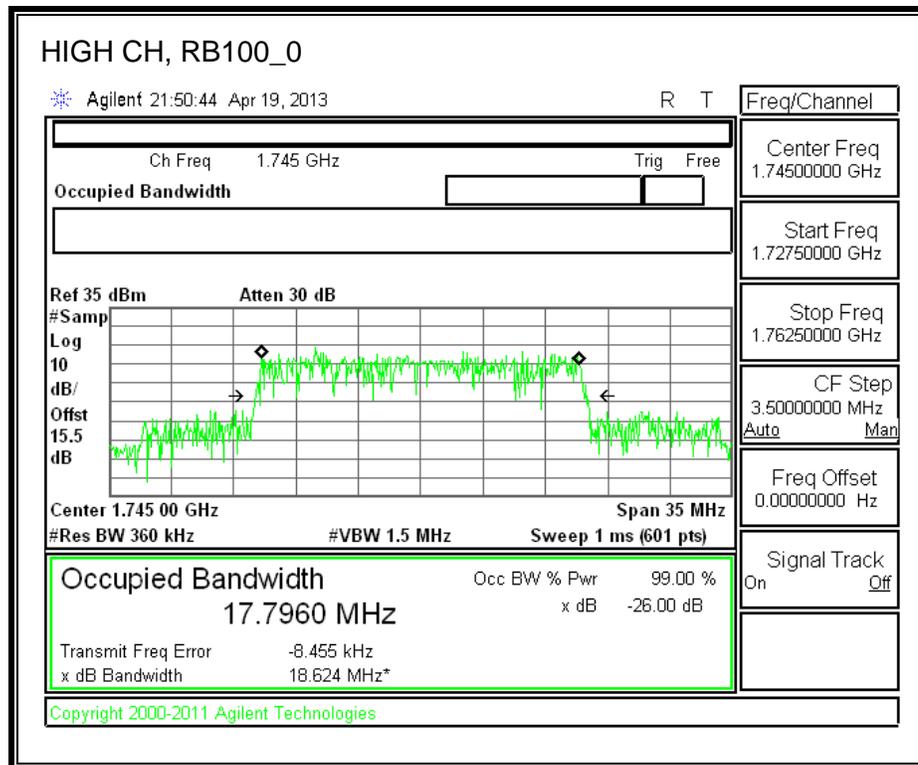
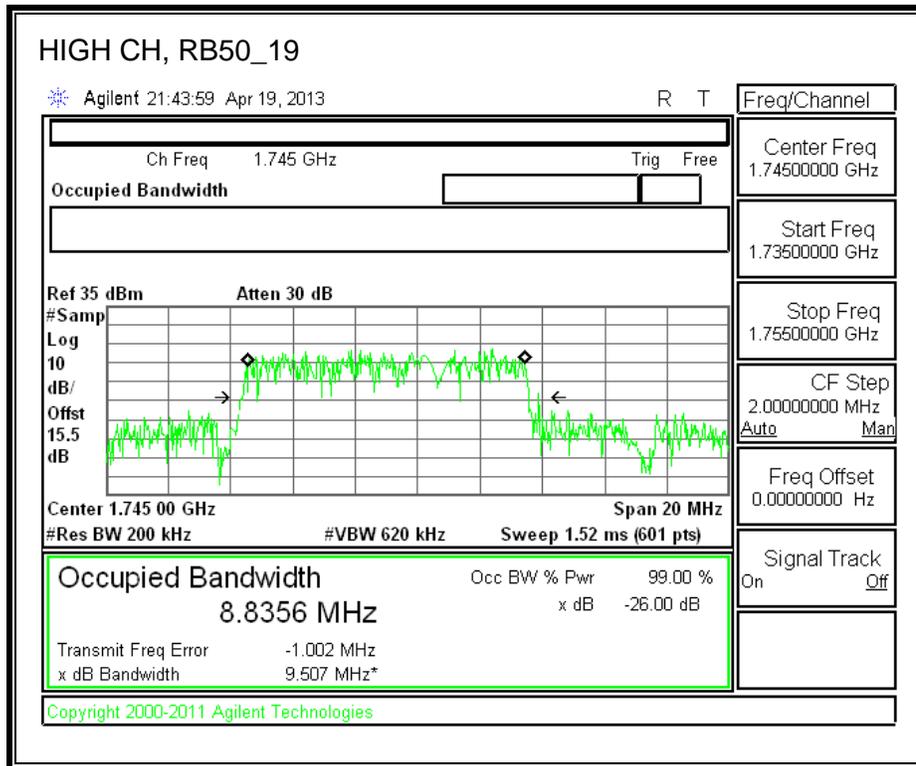
**MID-16QAM**



**HIGH-QPSK**

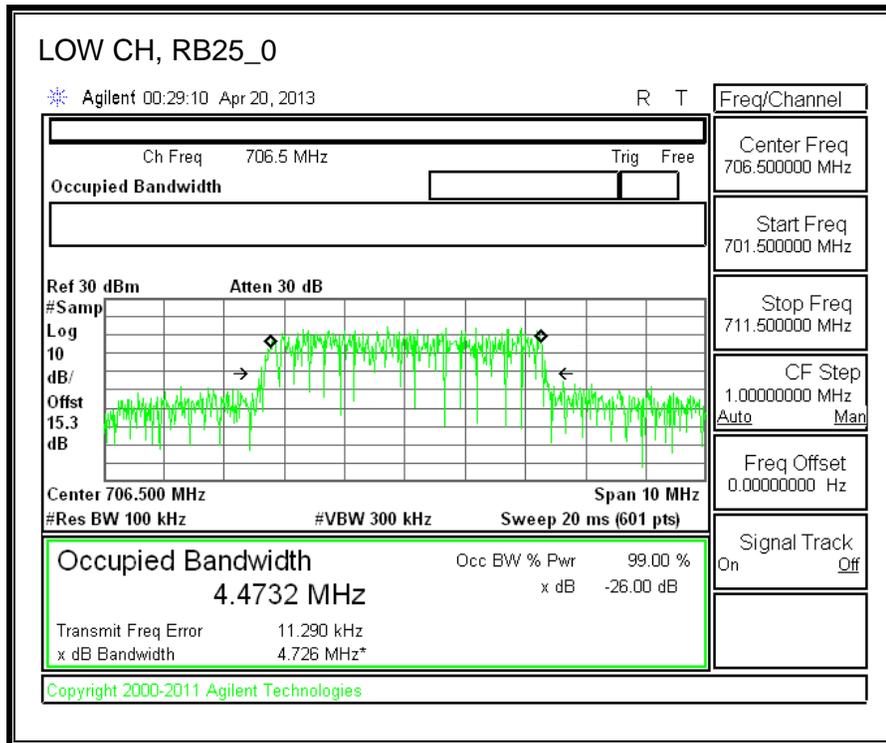
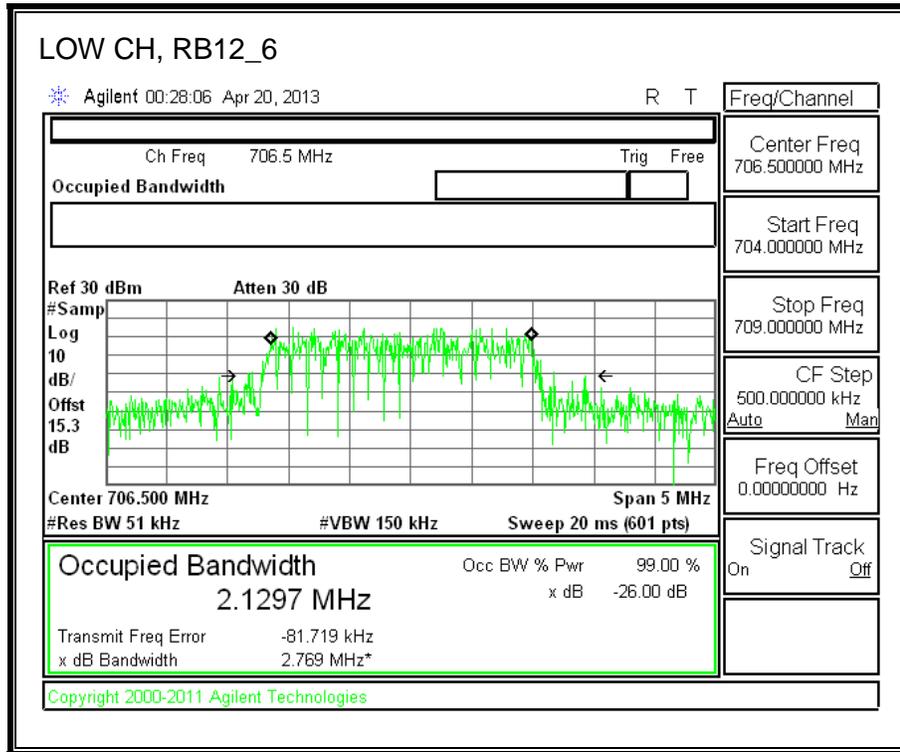


**HIGH-16QAM**

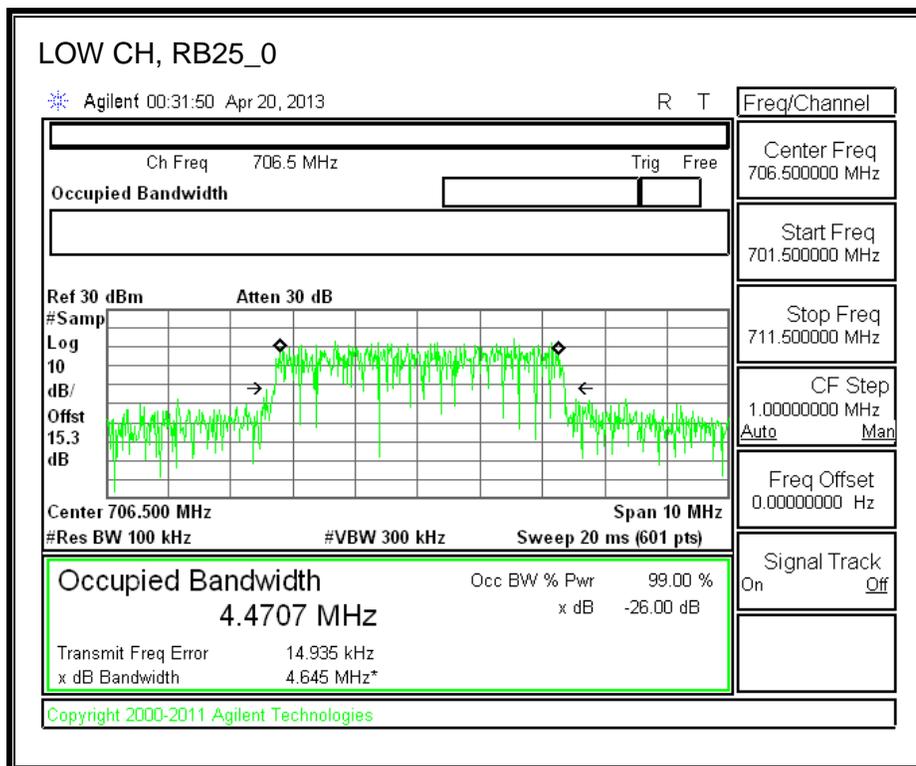
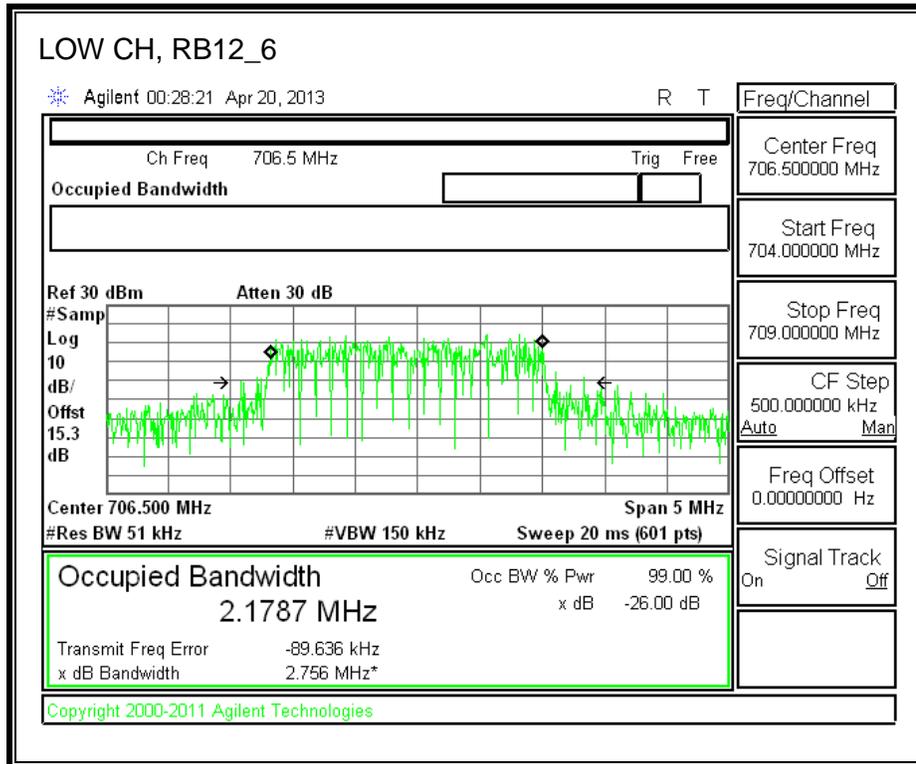


### 8.1.11. LTE BAND 17-5MHz BANDWIDTH

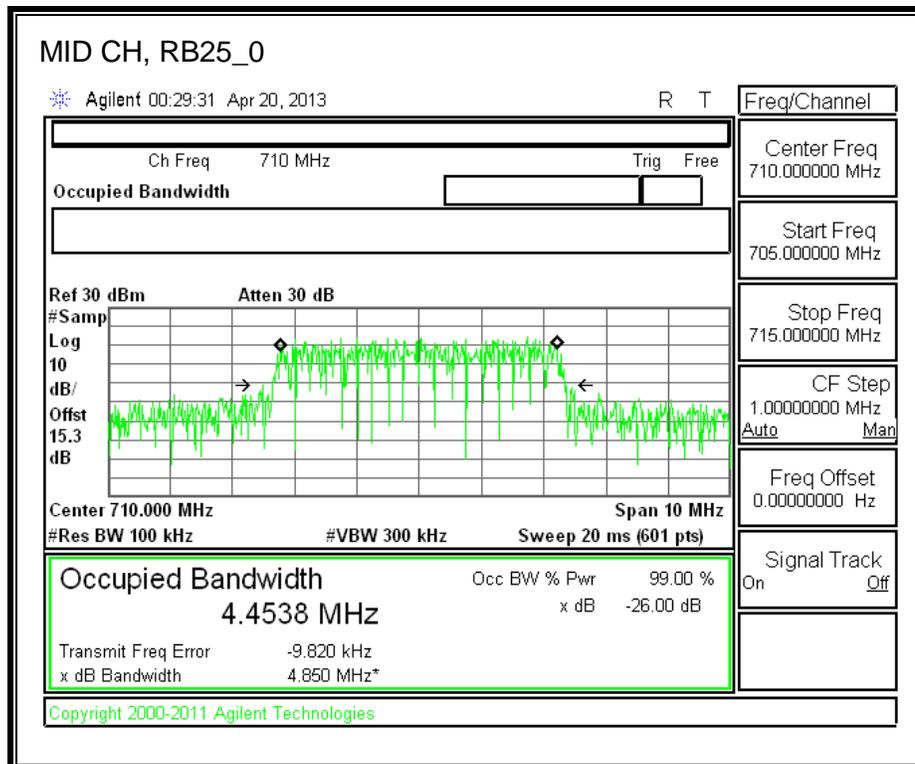
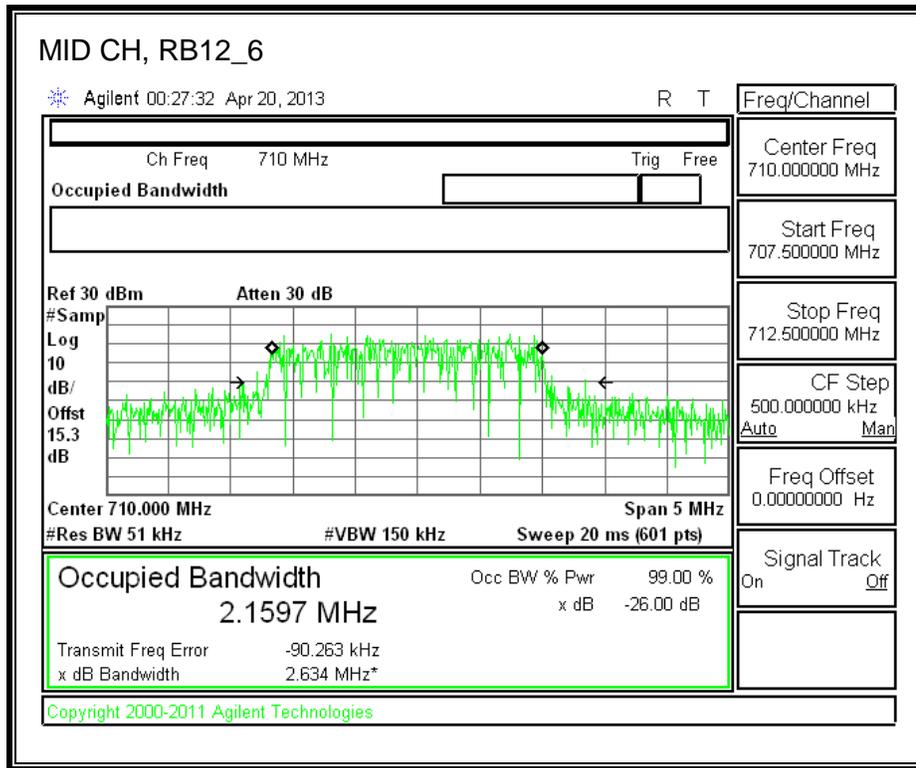
#### LOW-QPSK



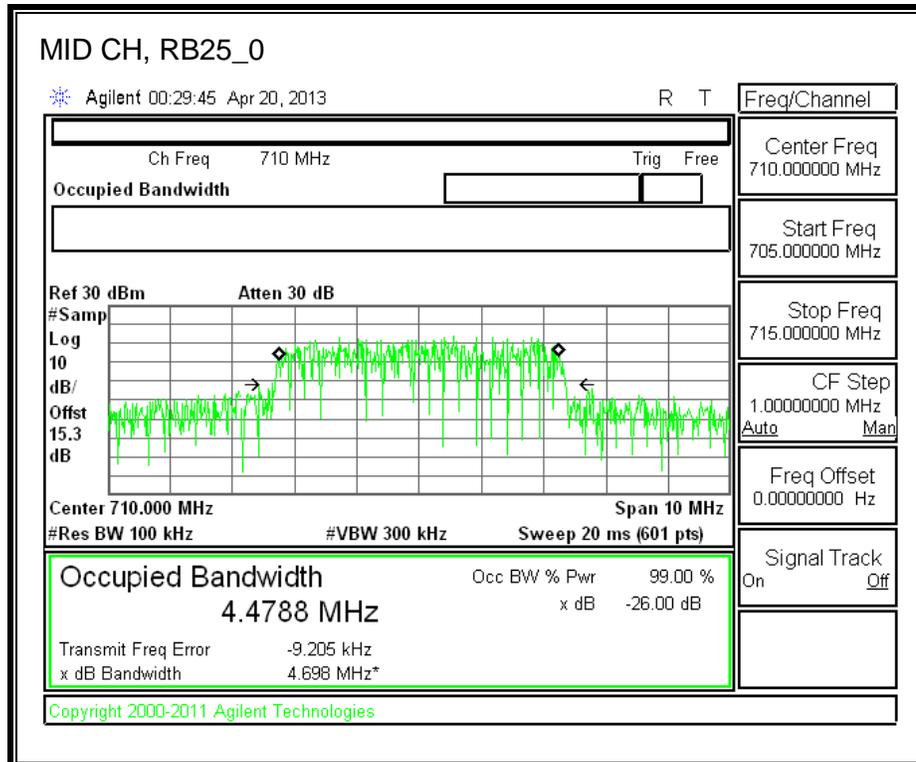
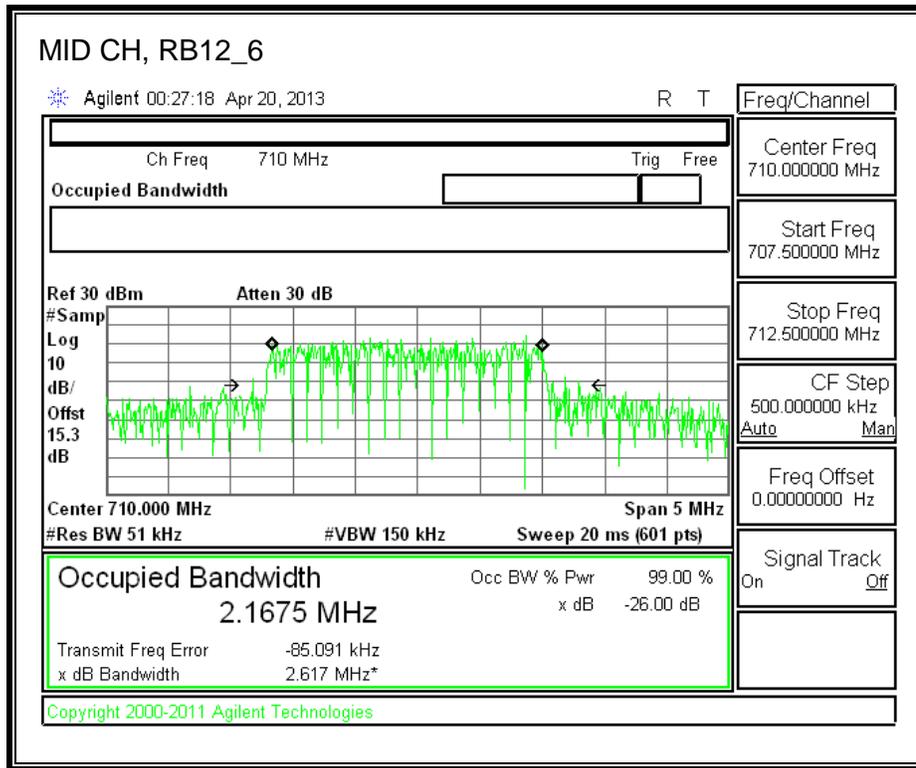
**LOW-16QAM**



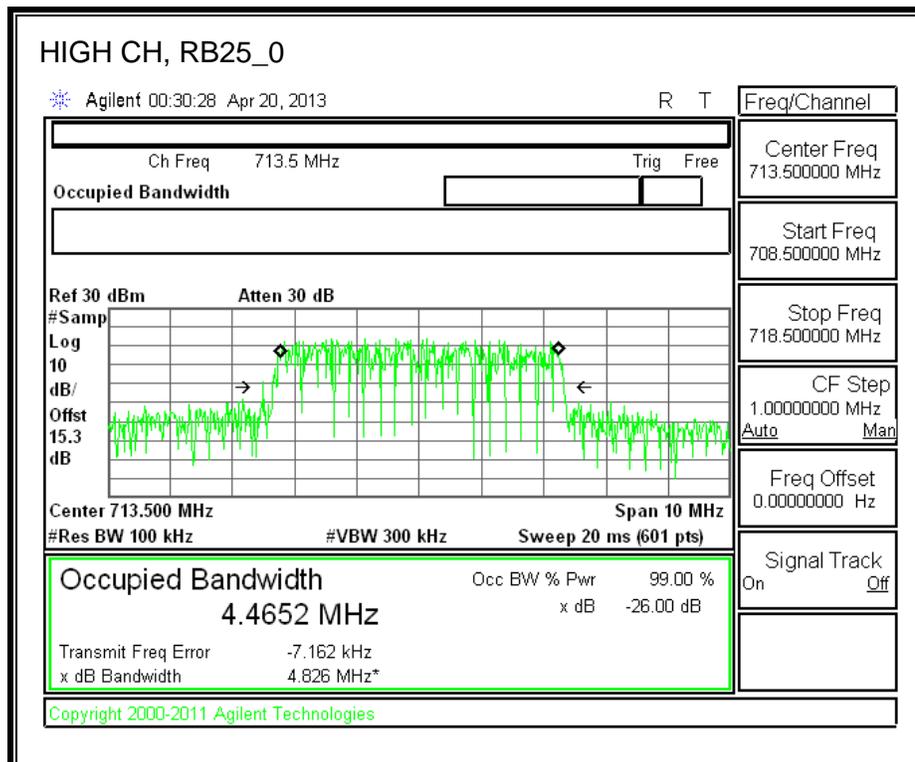
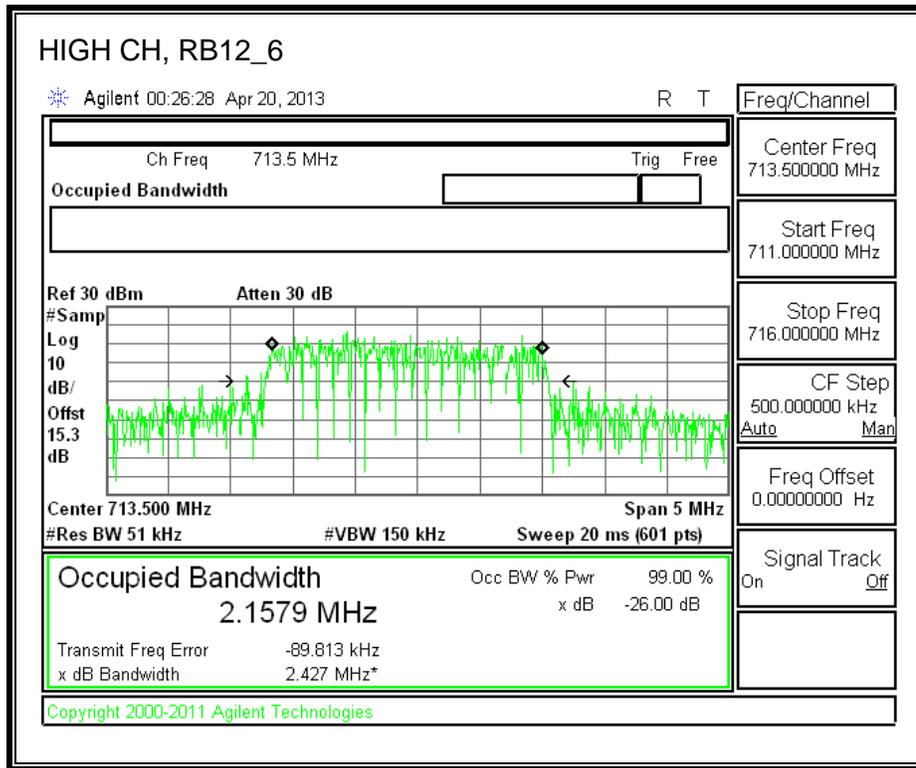
**MID-QPSK**



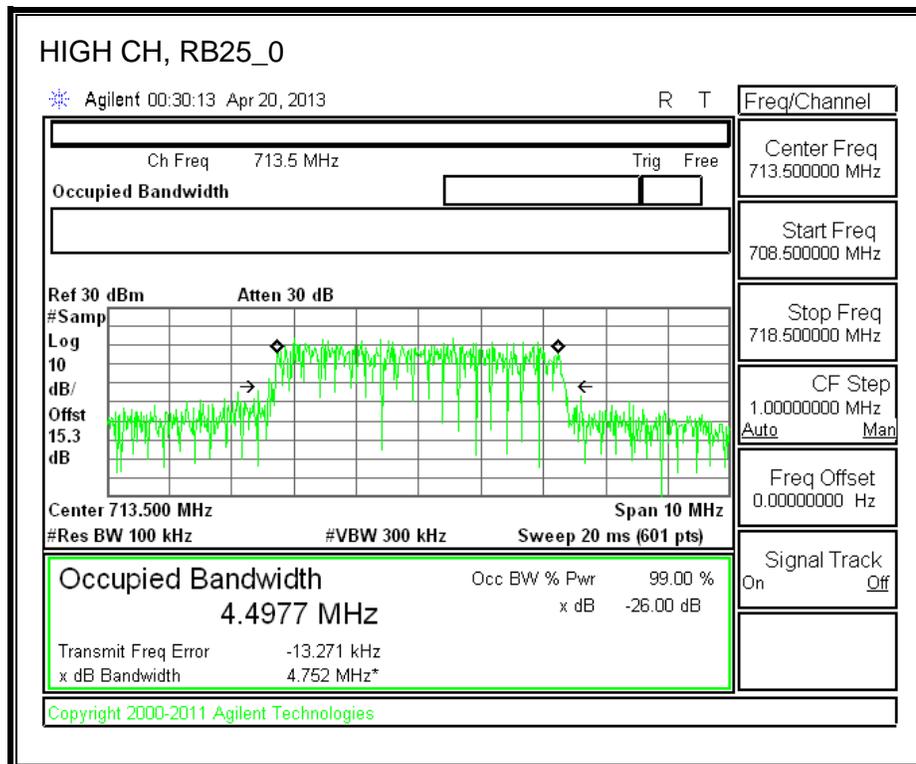
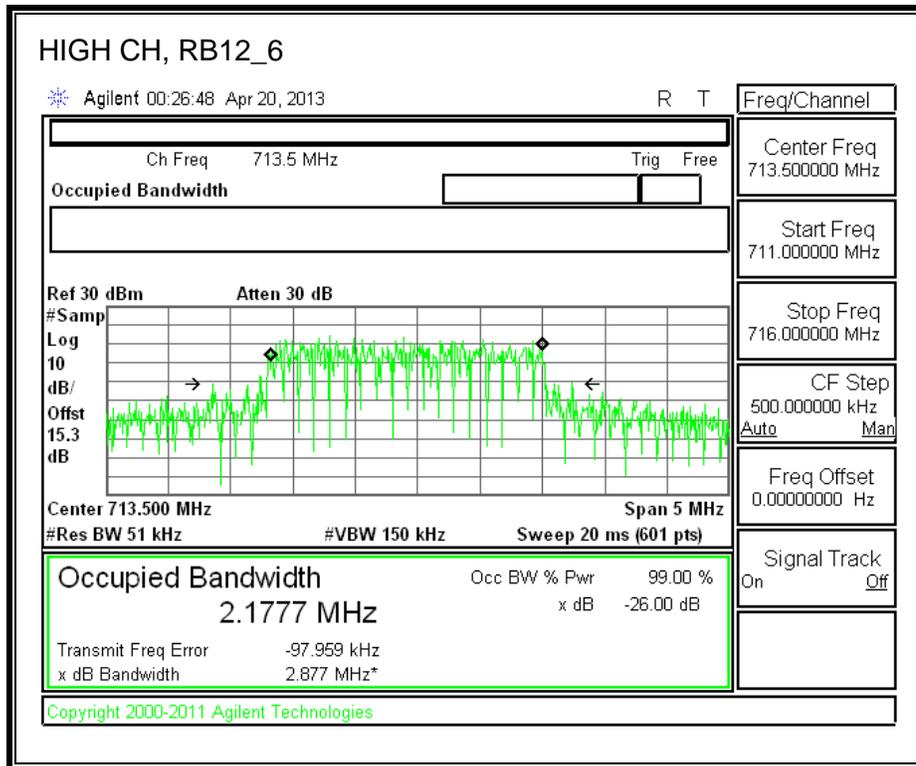
**MID-16QAM**



**HIGH-QPSK**

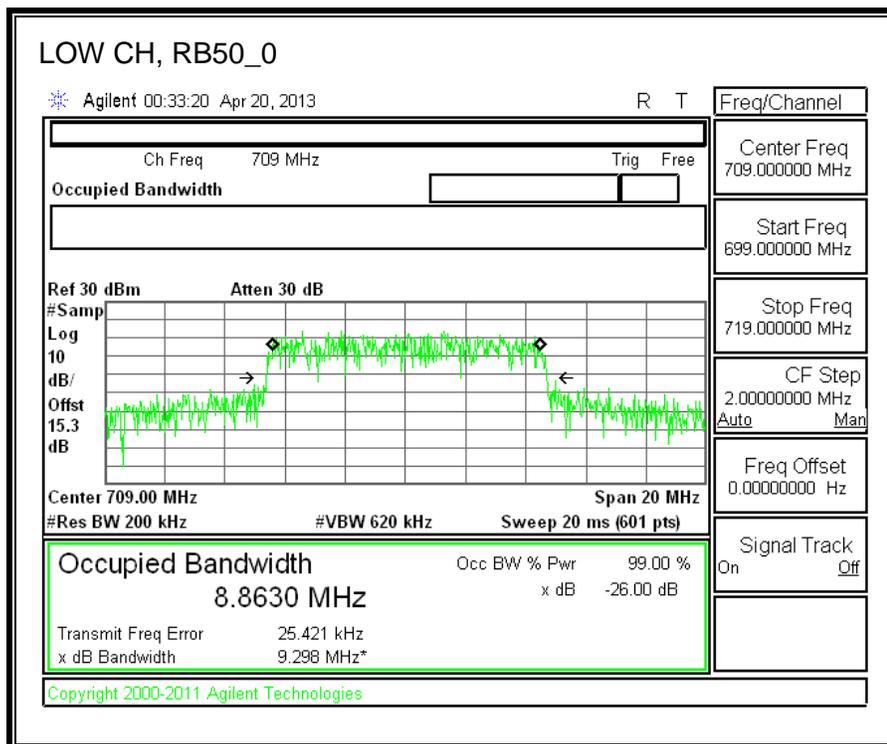
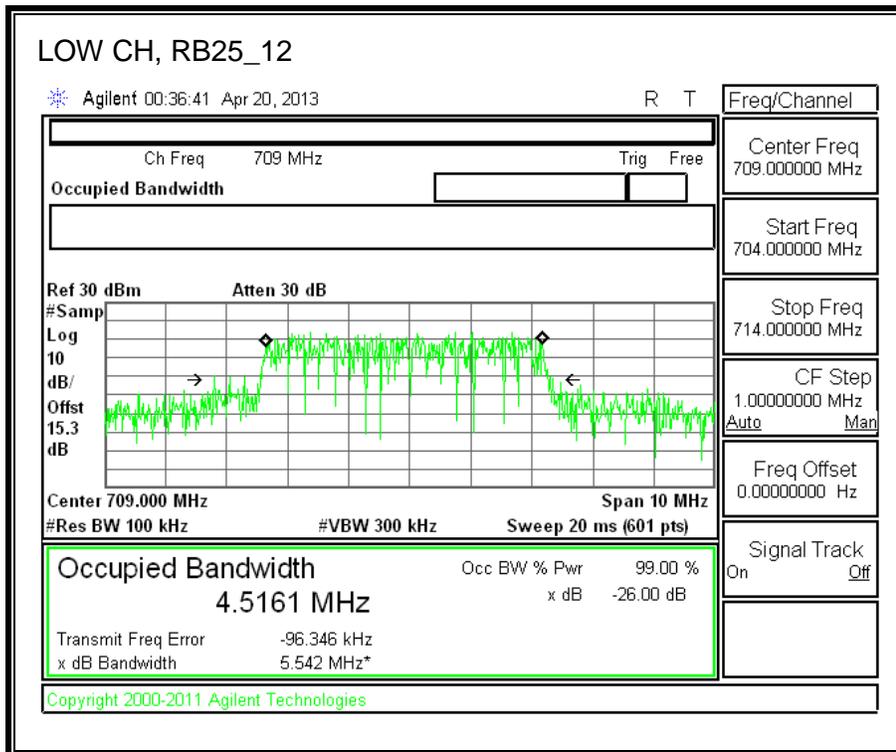


**HIGH-16QAM**

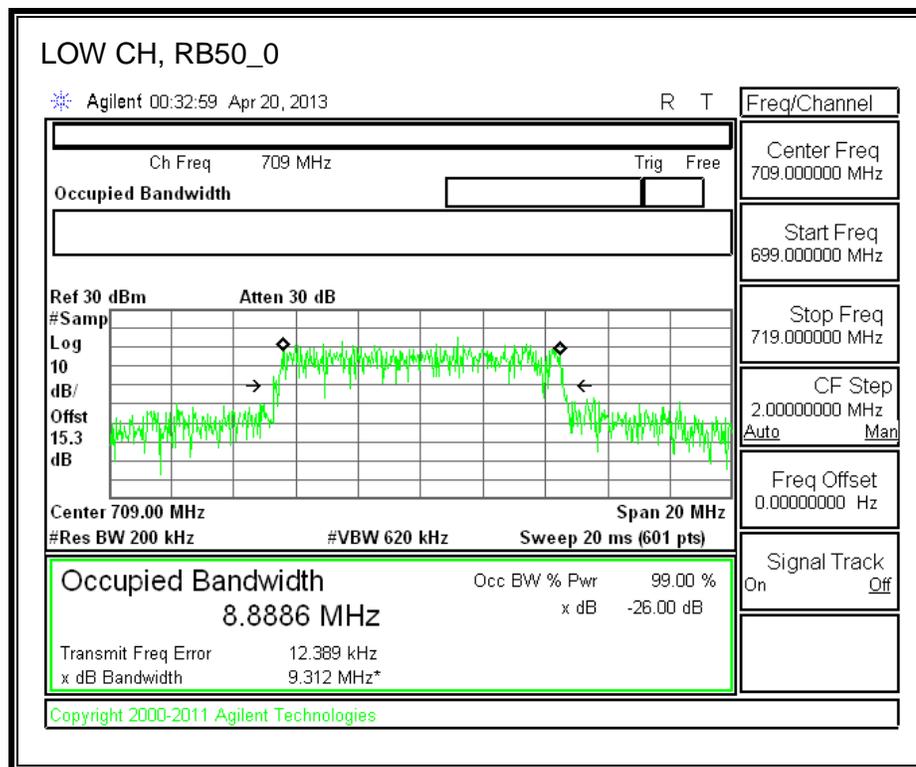
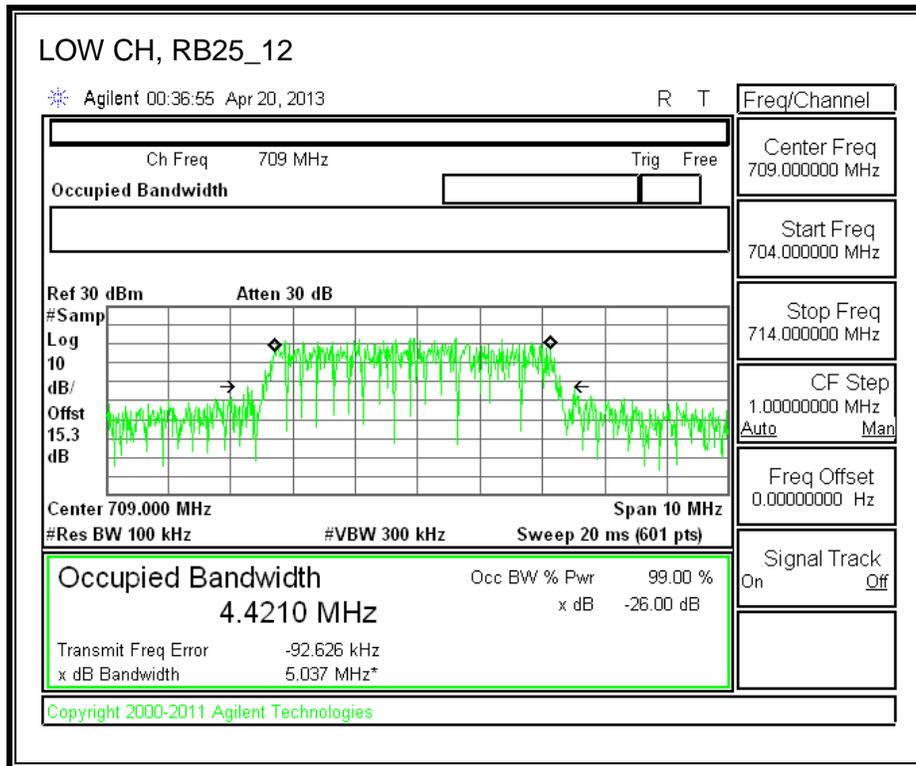


### 8.1.12. LTE BAND 17-10MHz BANDWIDTH

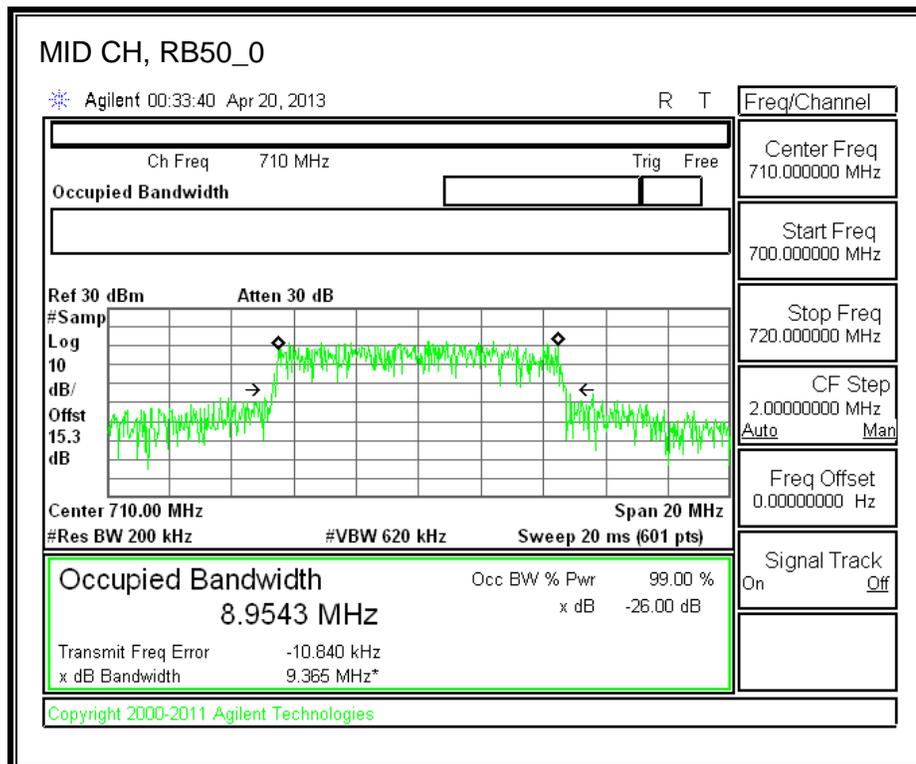
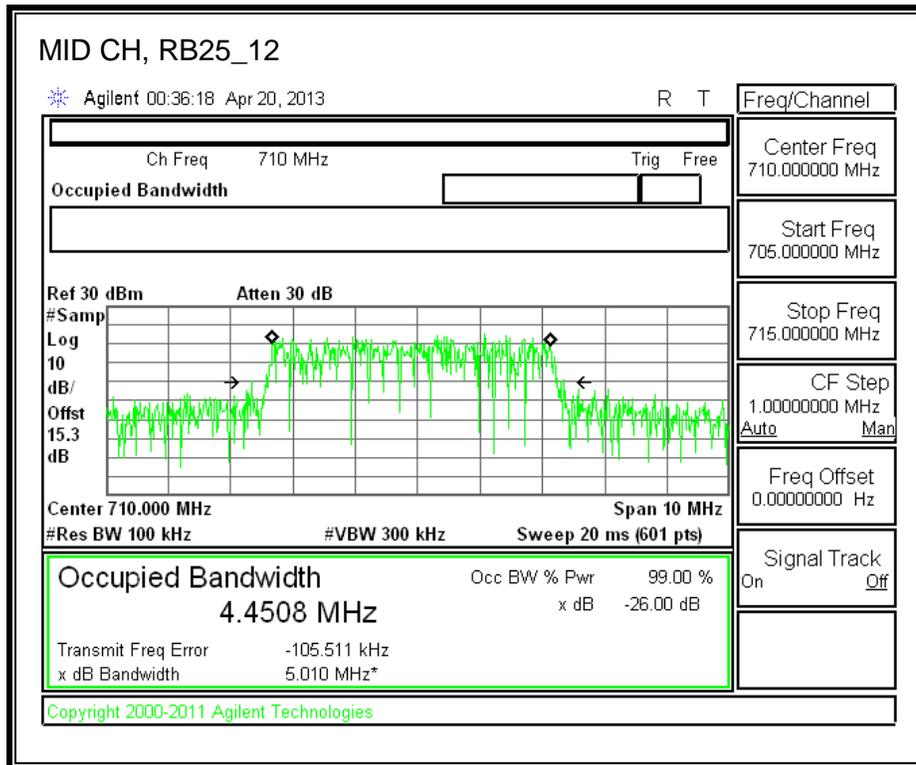
#### LOW-QPSK



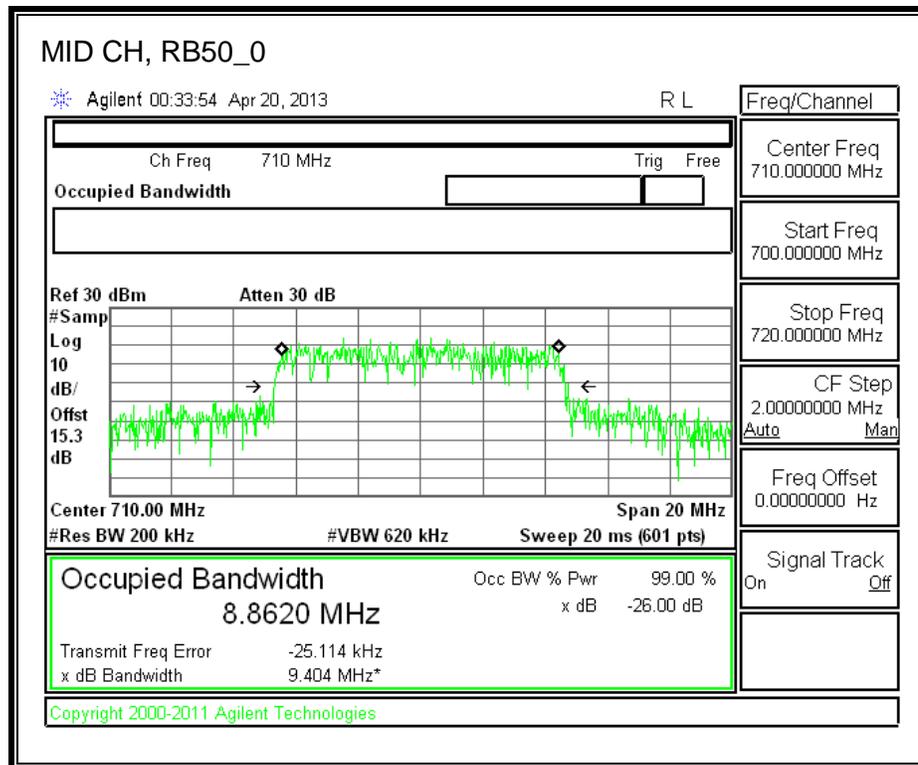
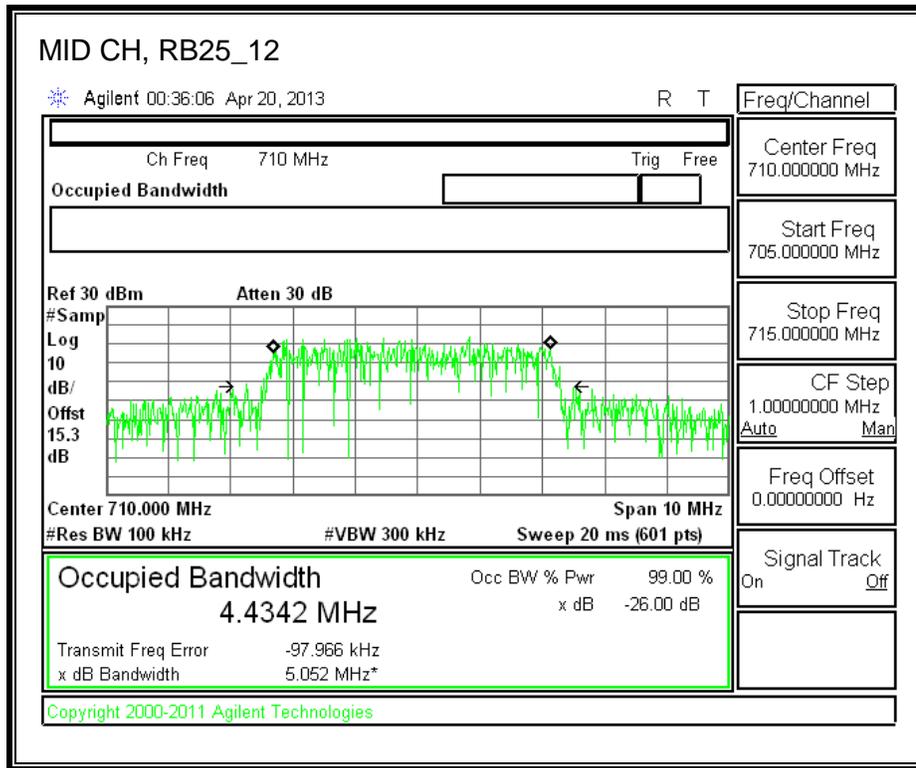
**LOW-16QAM**



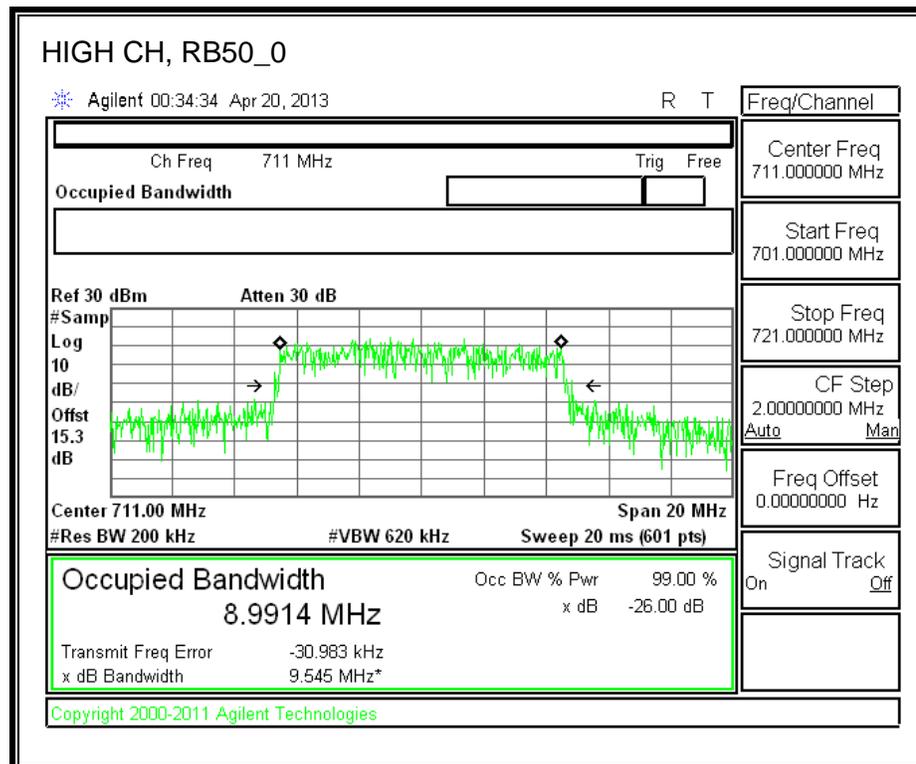
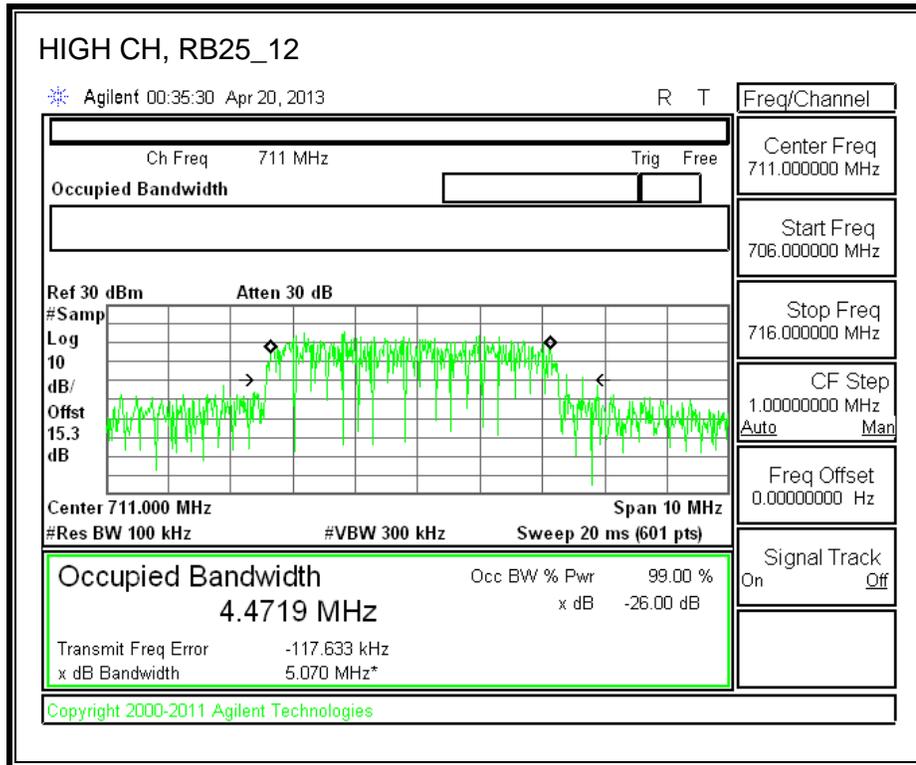
**MID-QPSK**



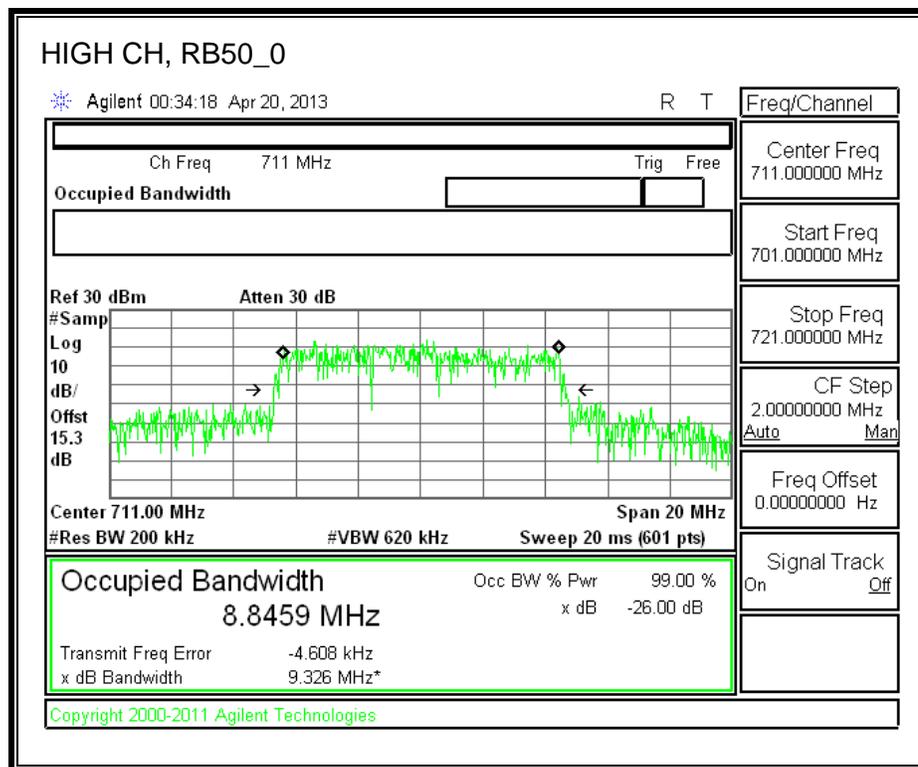
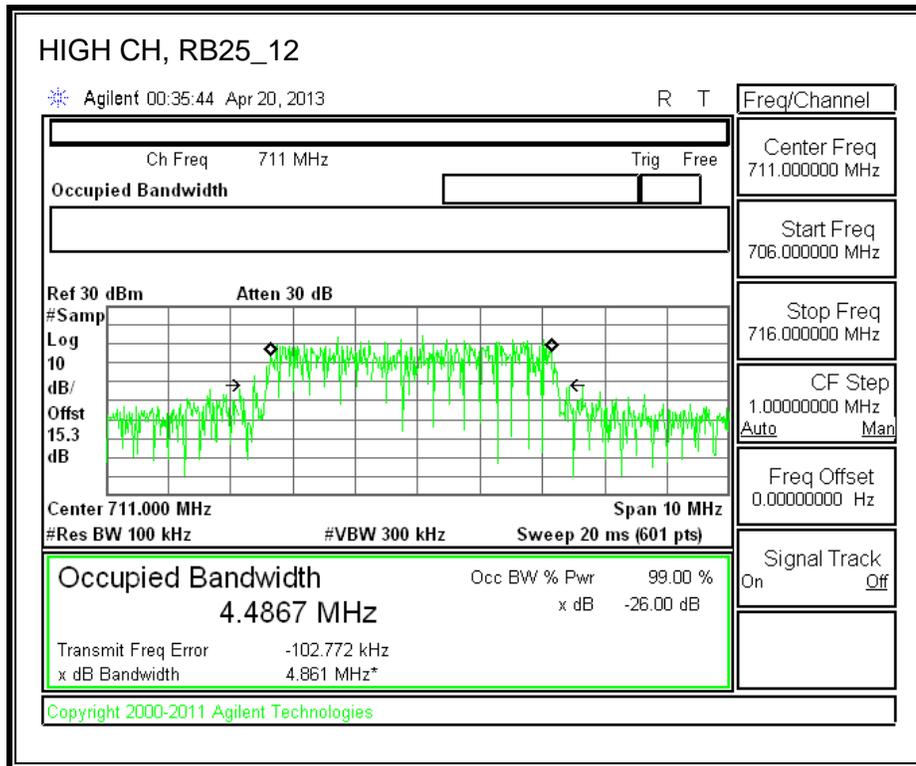
**MID-16QAM**



**HIGH-QPSK**



**HIGH-16QAM**



## **8.2. BAND EDGE**

### **RULE PART(S)**

FCC: §22.359, 24.238, and 27.

### **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 Agilent 8960 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 (824, 849, 1850, 1910MHz)
- 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.

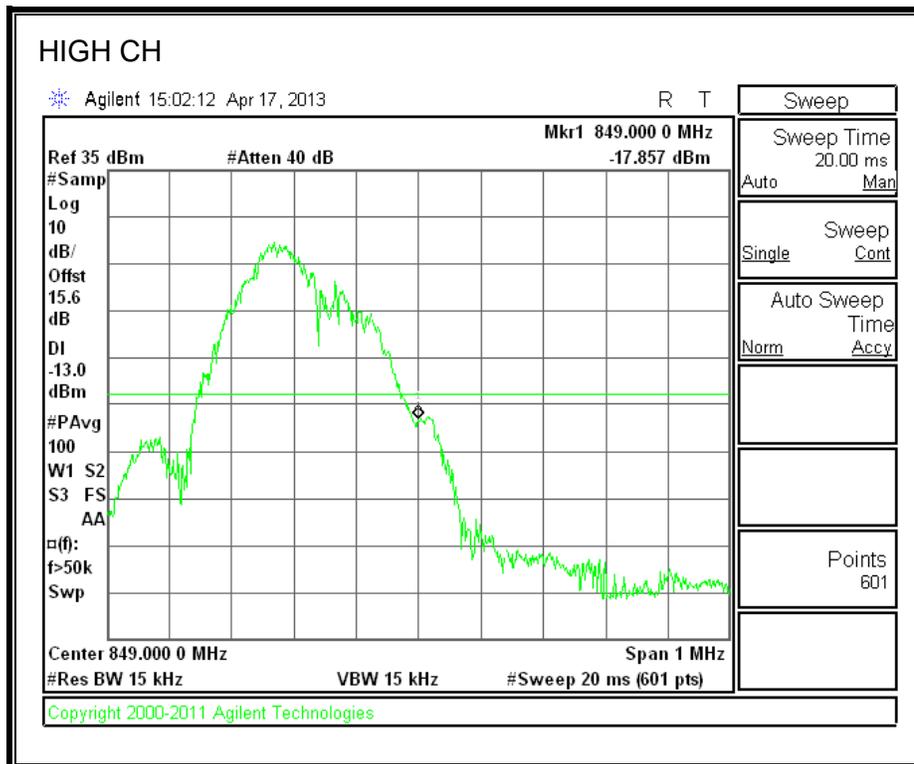
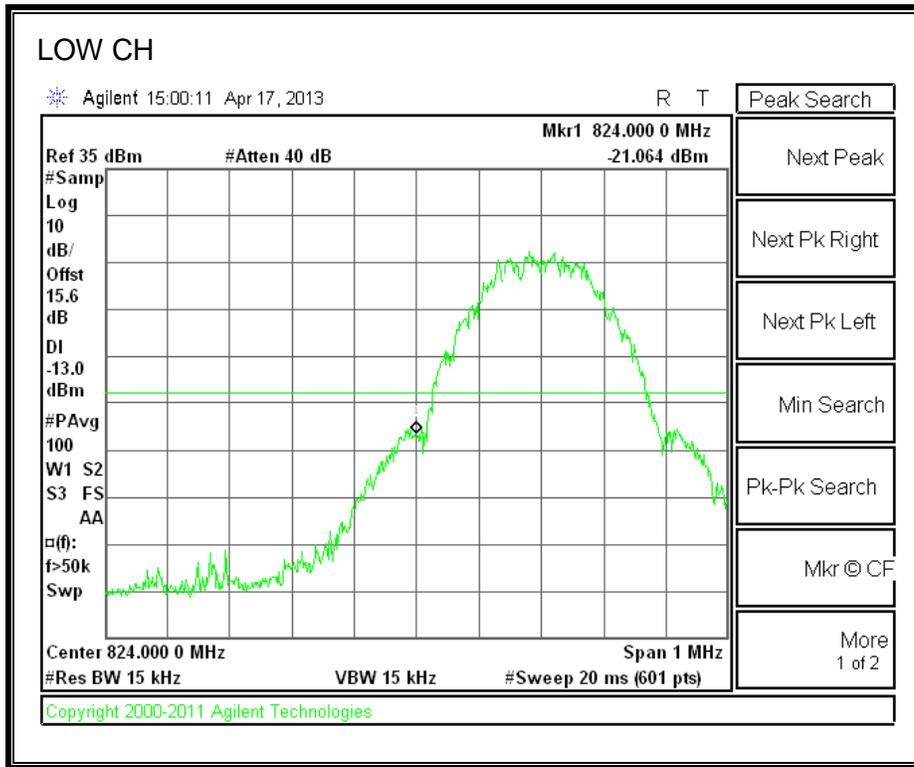
### **MODES TESTED**

- GSM: GPRS and EGPRS
- UMTS: WCDMA and HSDPA
- LTE: Band 2, 4, and 17

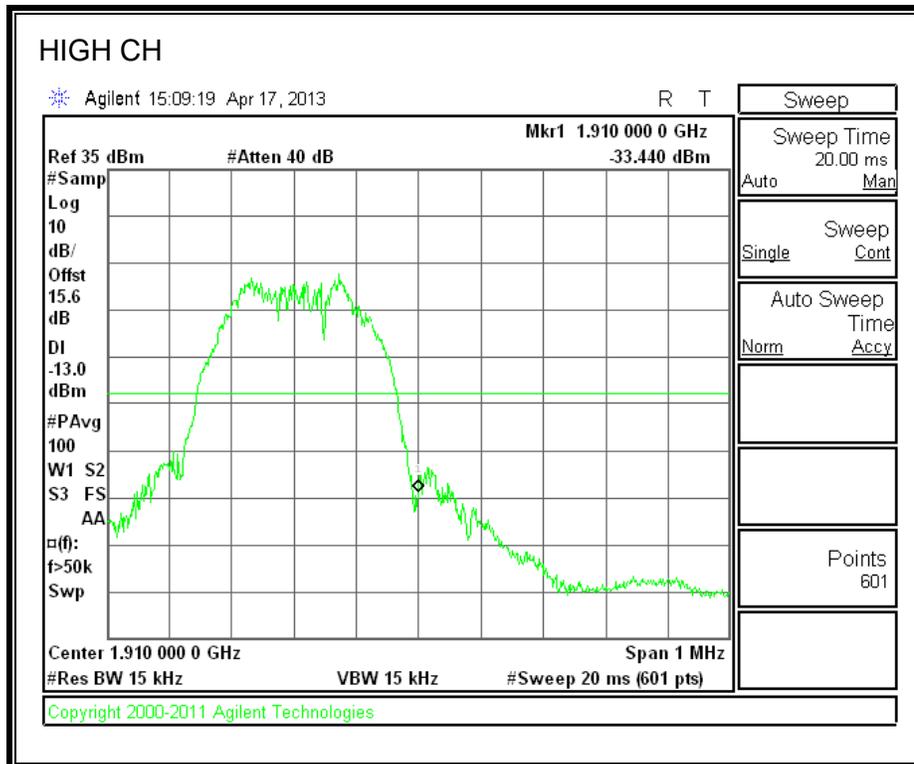
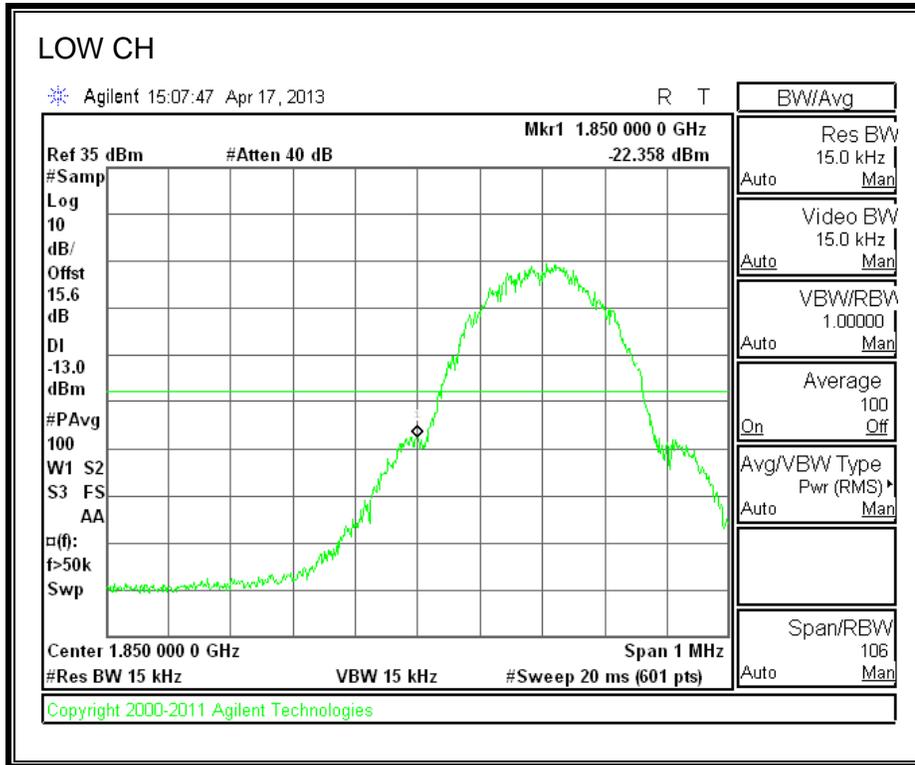
### **RESULTS**

### 8.2.1. GSM-GPRS

#### CELL BAND

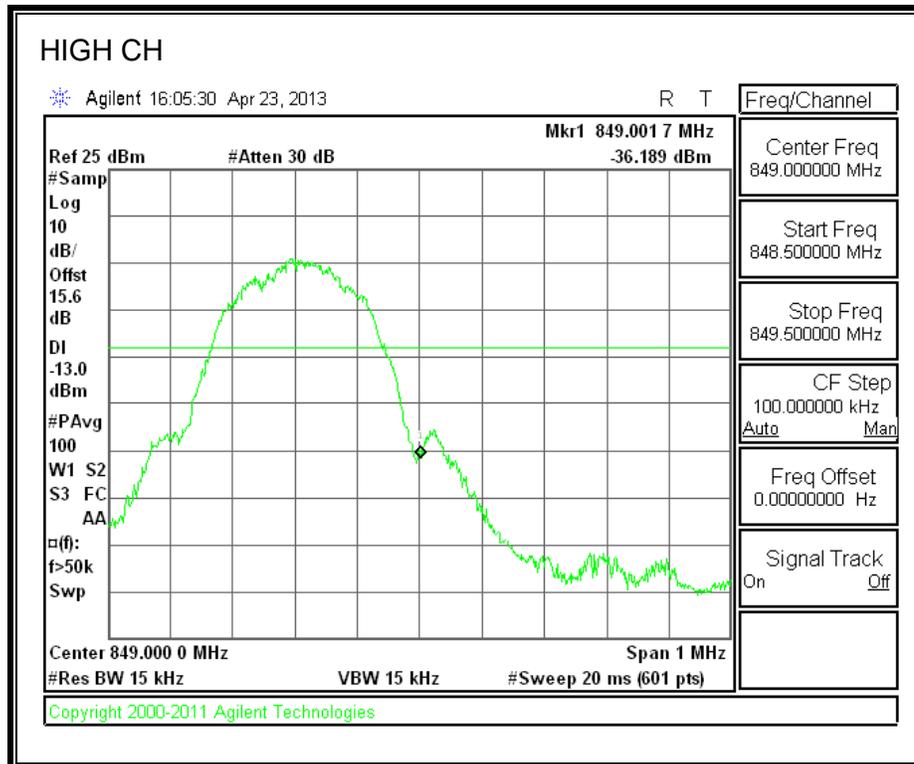
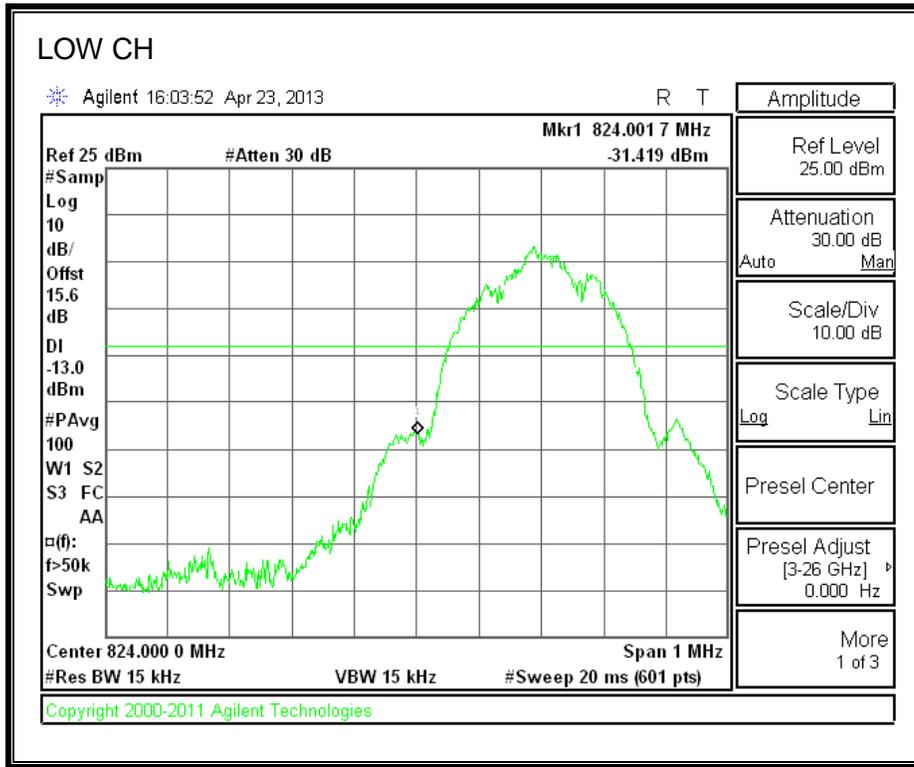


**PCS BAND**

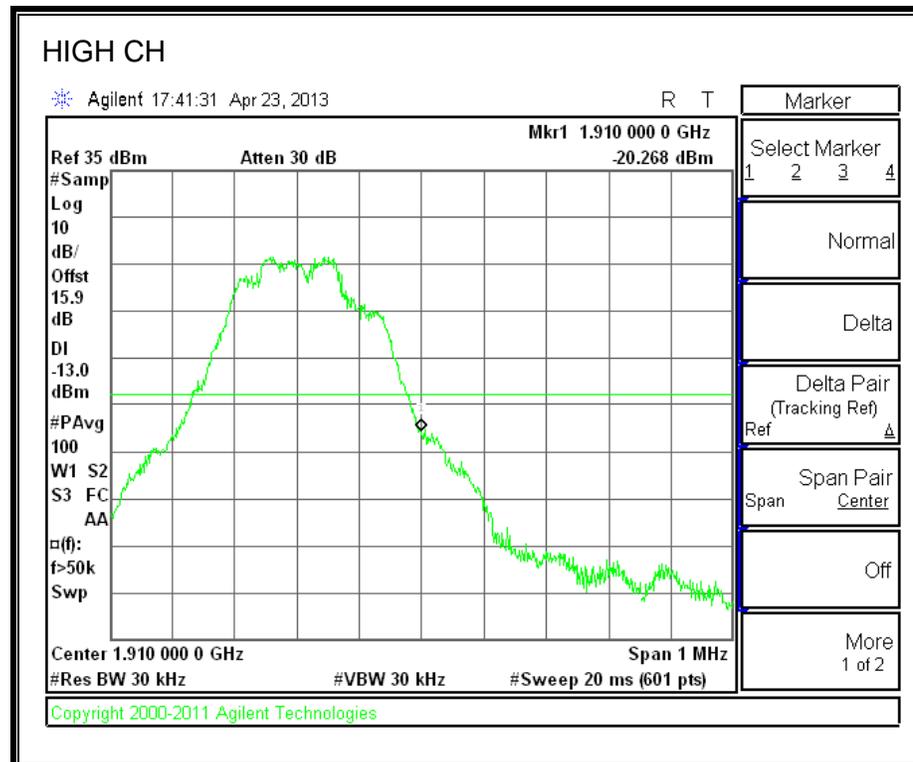
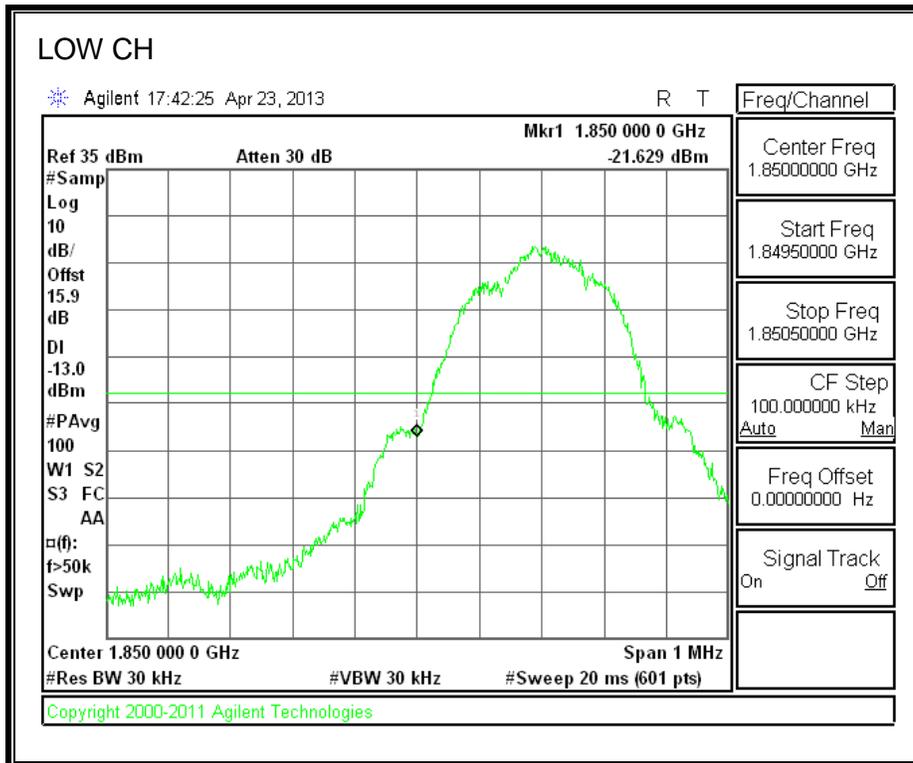


**8.2.2. GSM-EGPRS**

**CELL BAND**

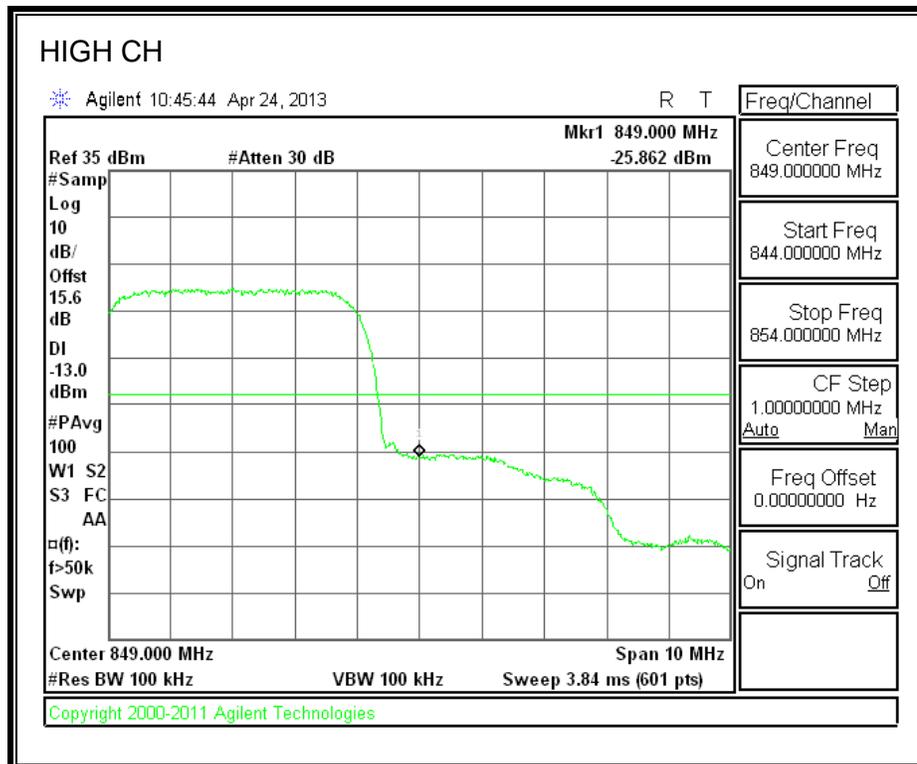
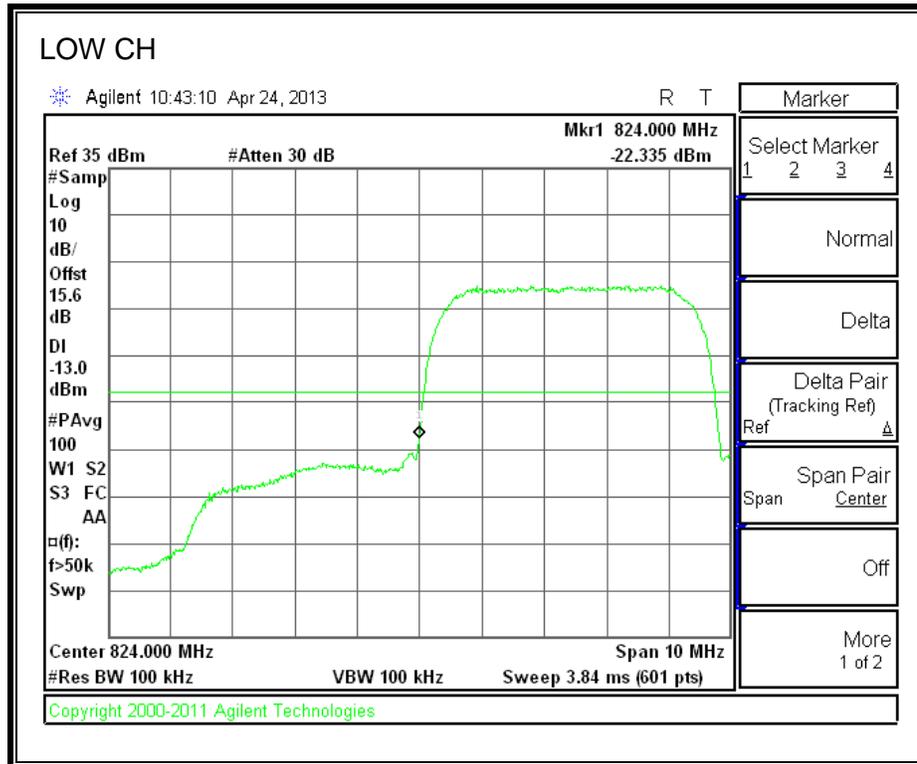


**PCS BAND**

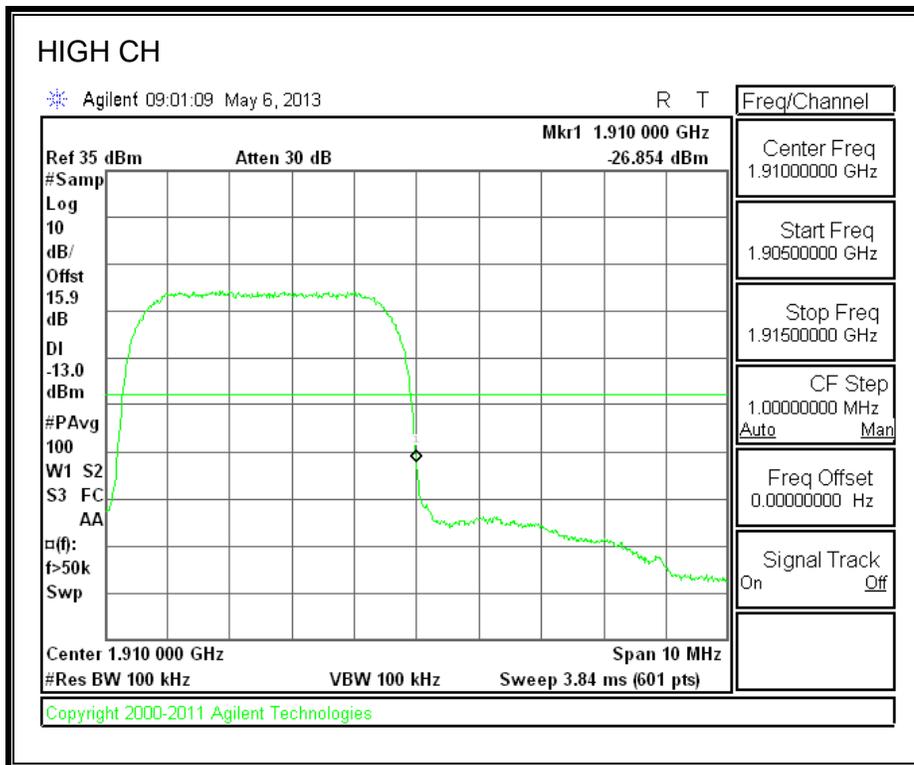
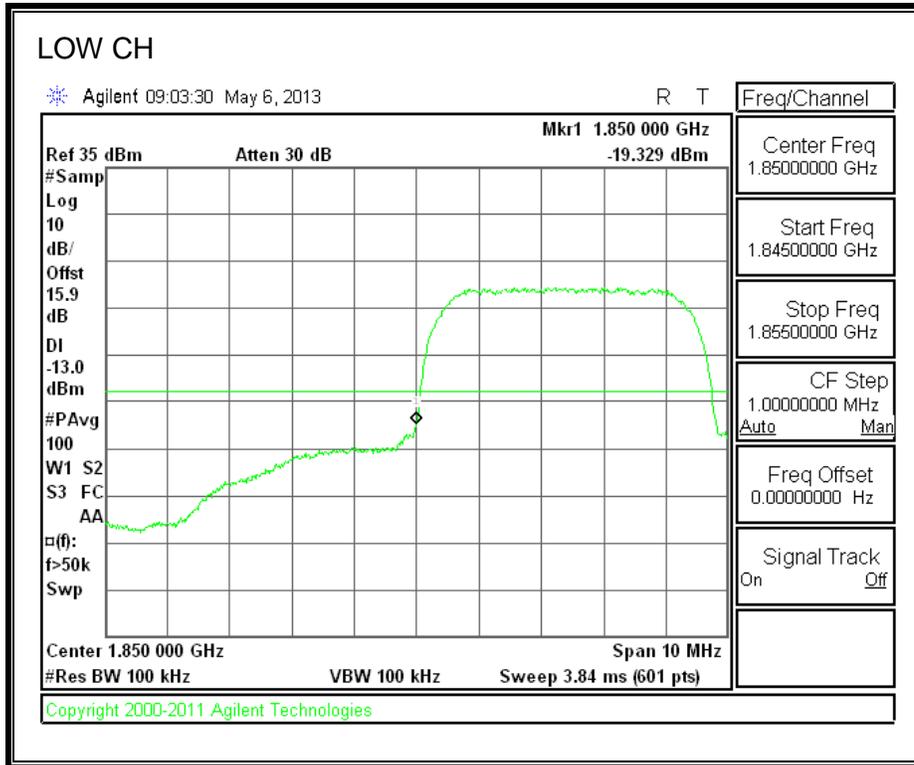


**8.2.3. UMTS-REL 99**

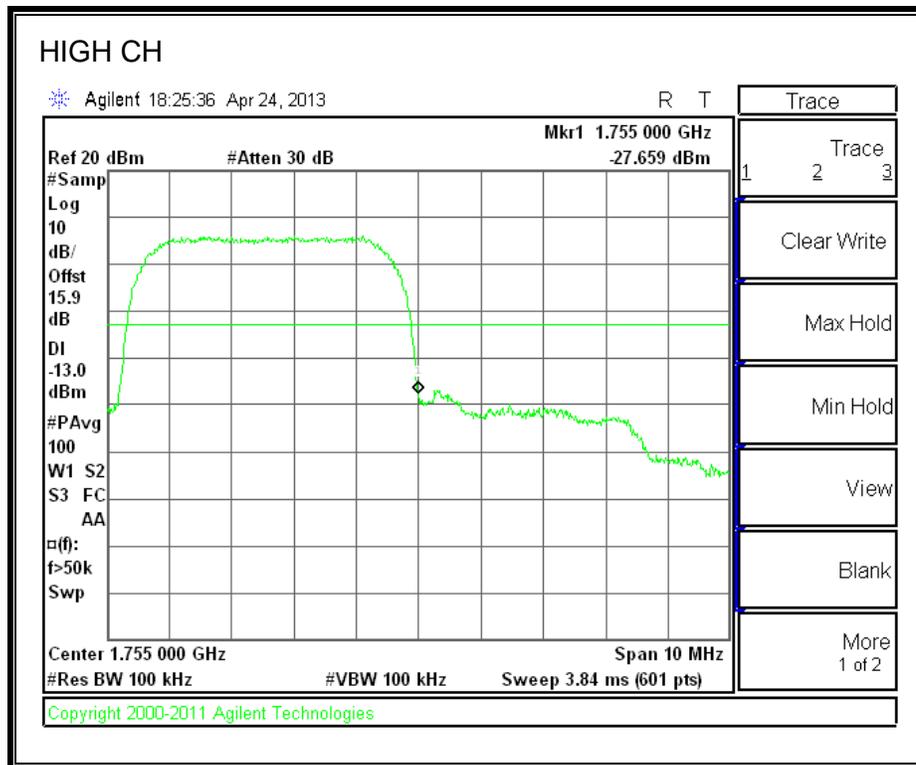
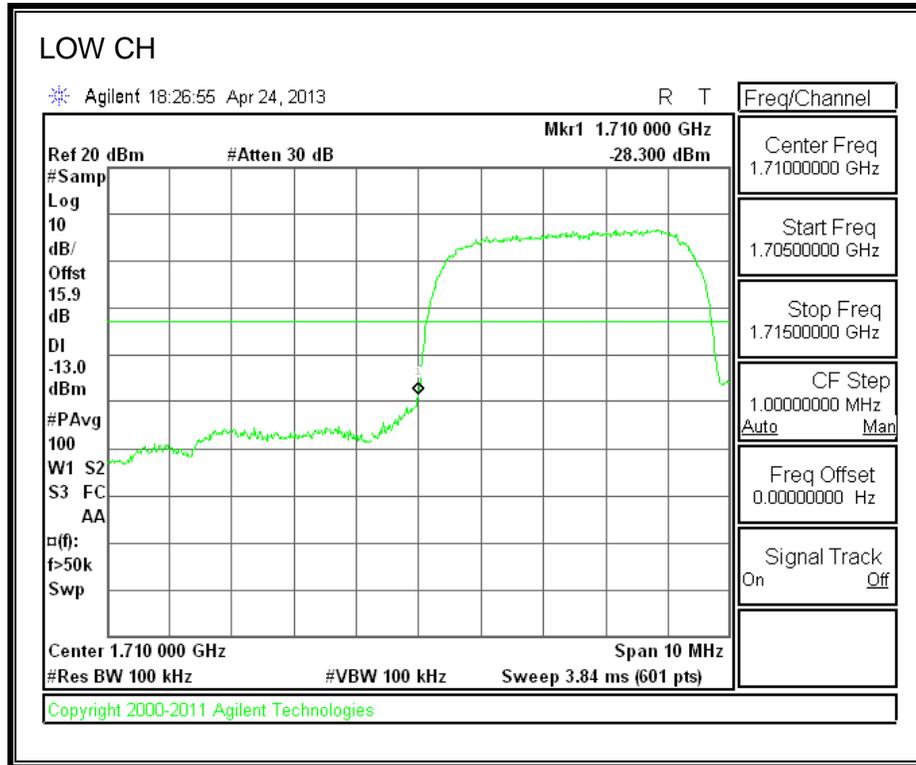
**CELL BAND**



**PCS BAND**

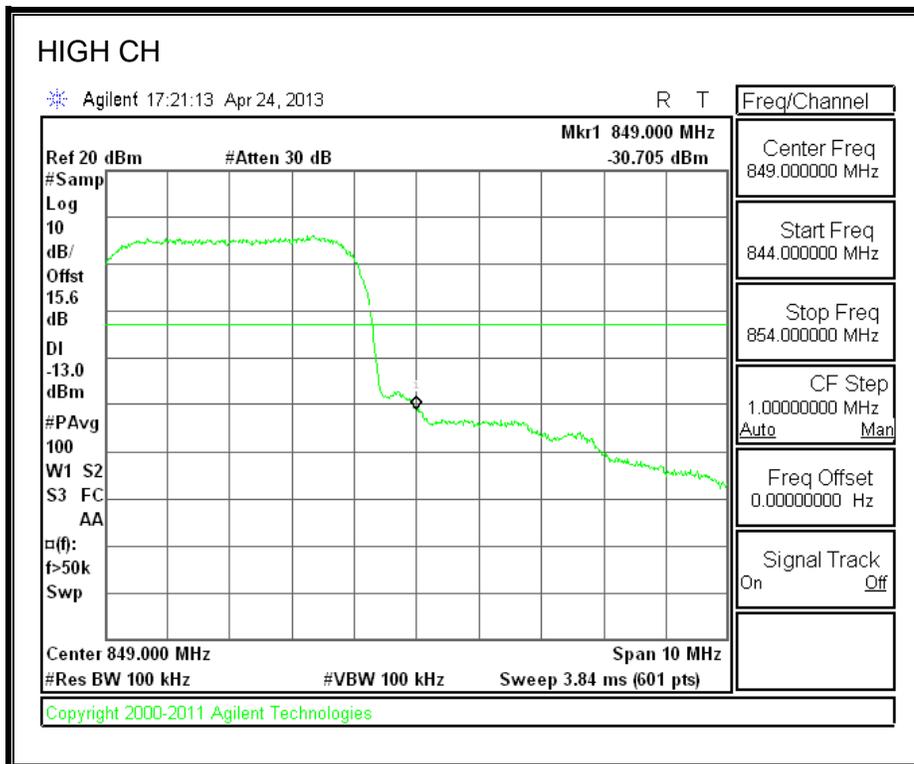
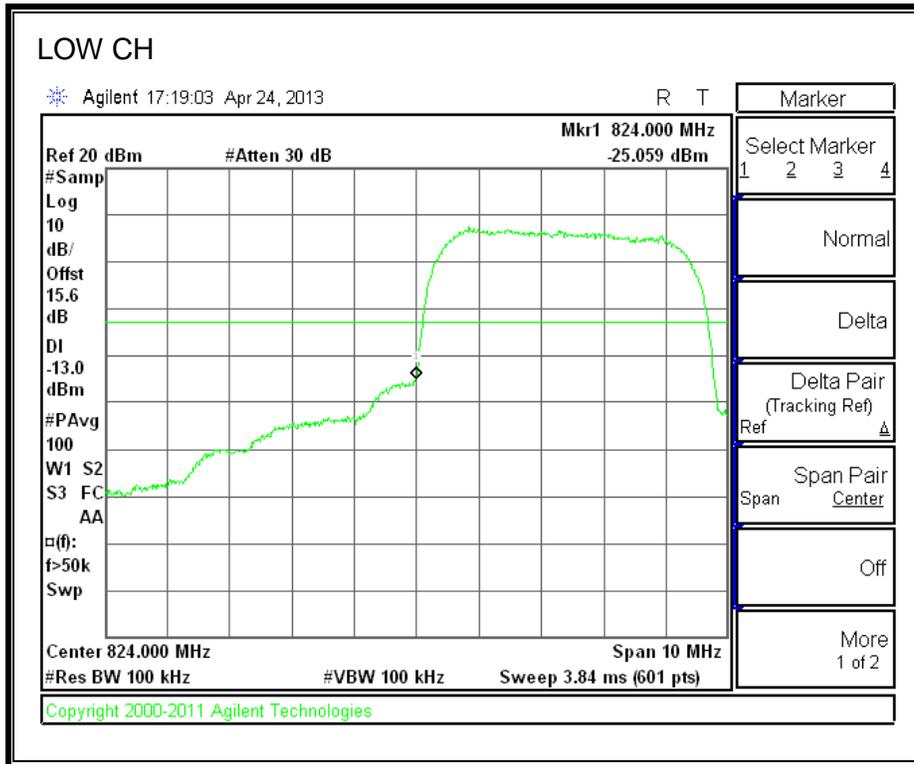


**AWS BAND**

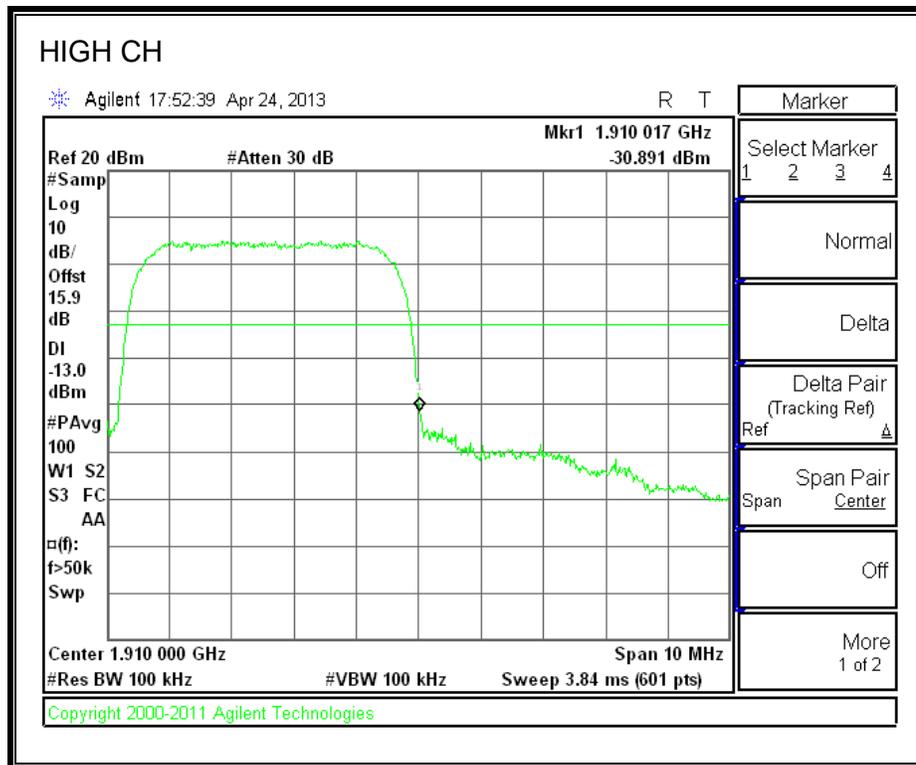
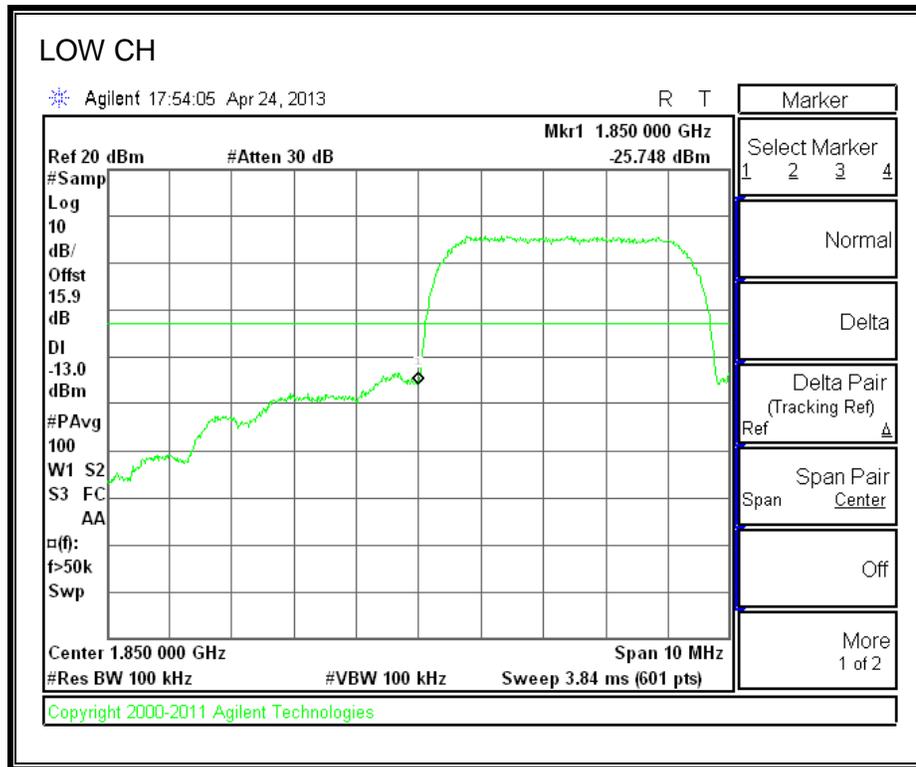


**8.2.4. UMTS-HSDPA**

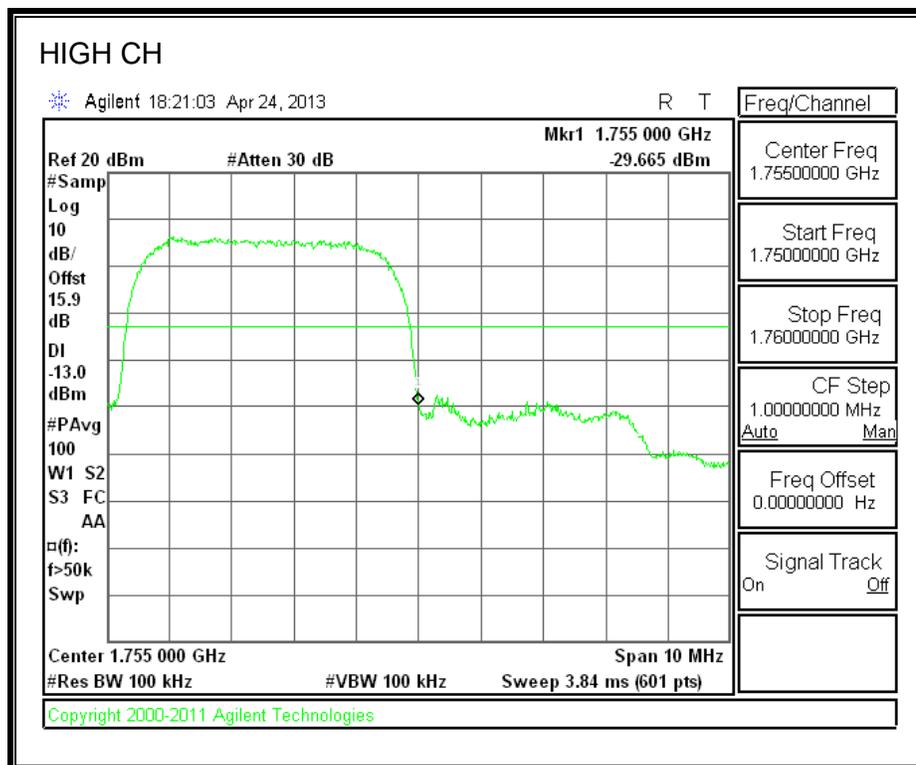
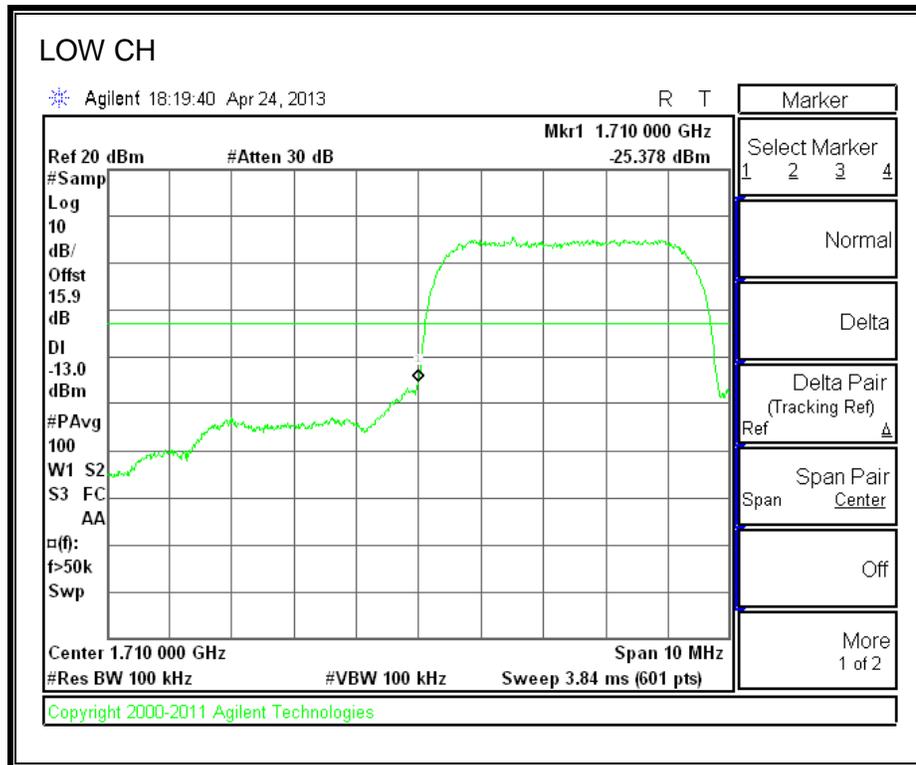
**CELL BAND**



**PCS BAND**

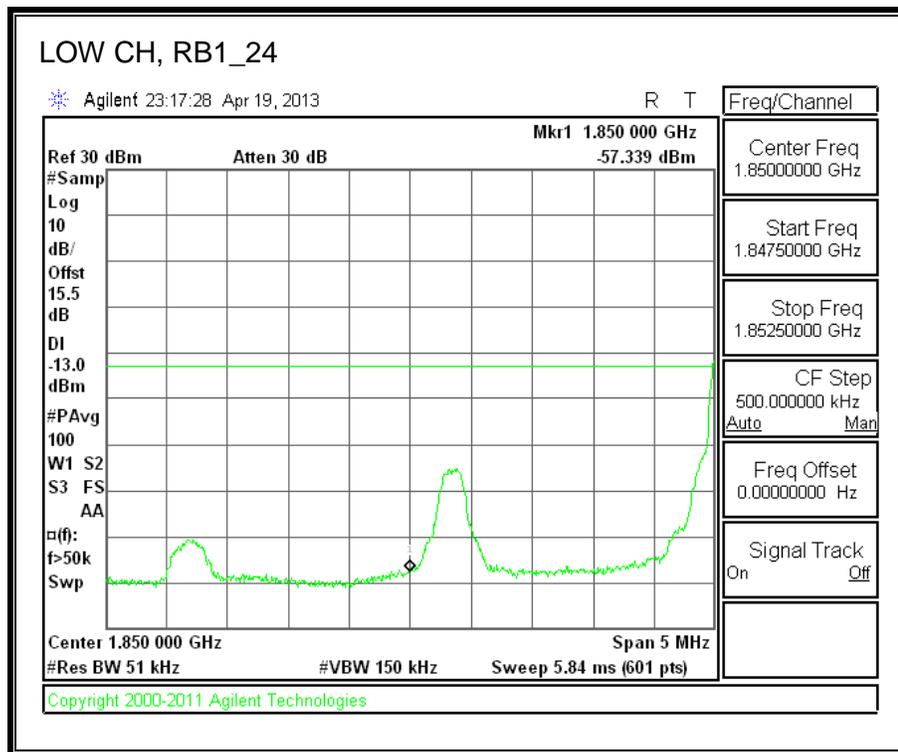
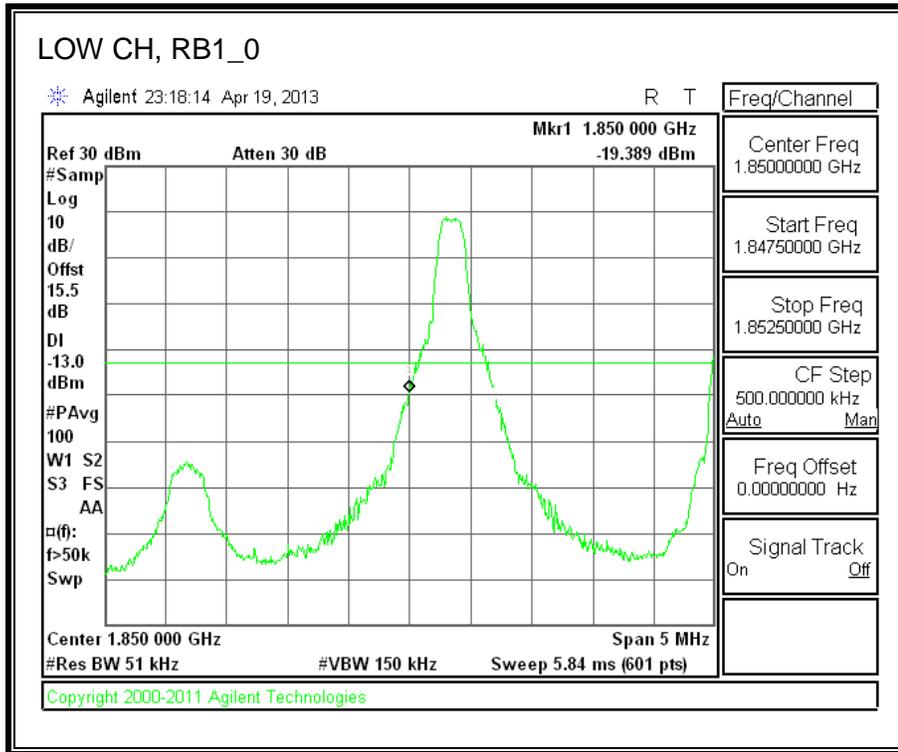


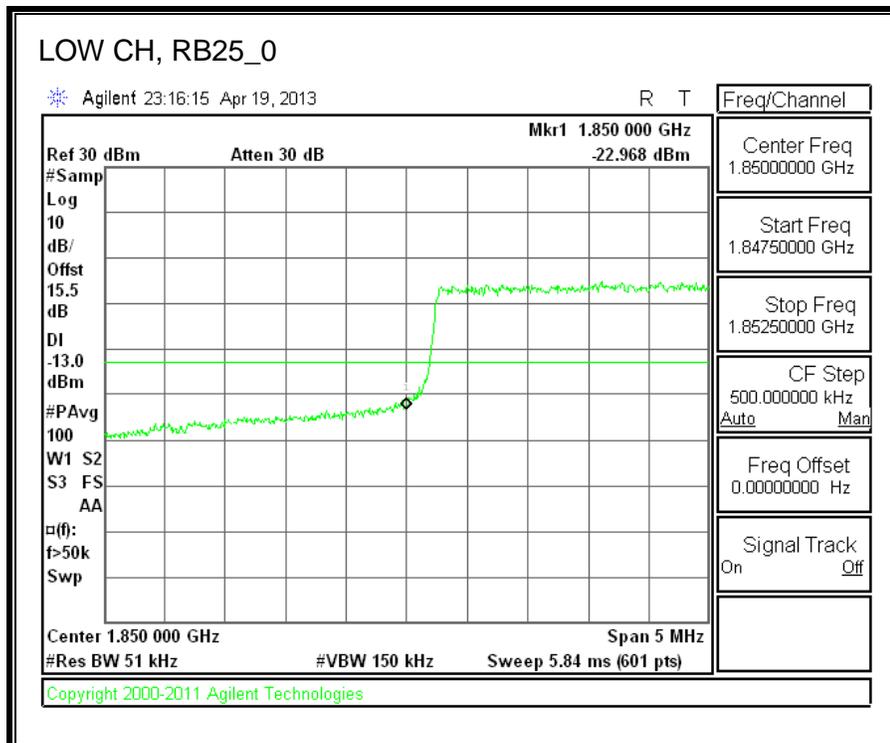
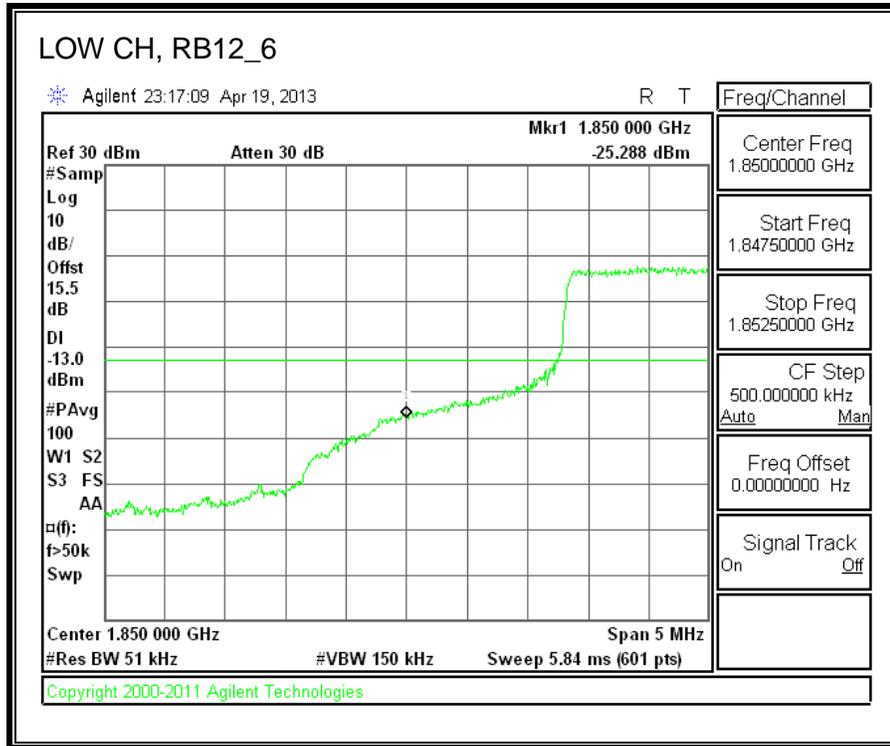
**AWS BAND**



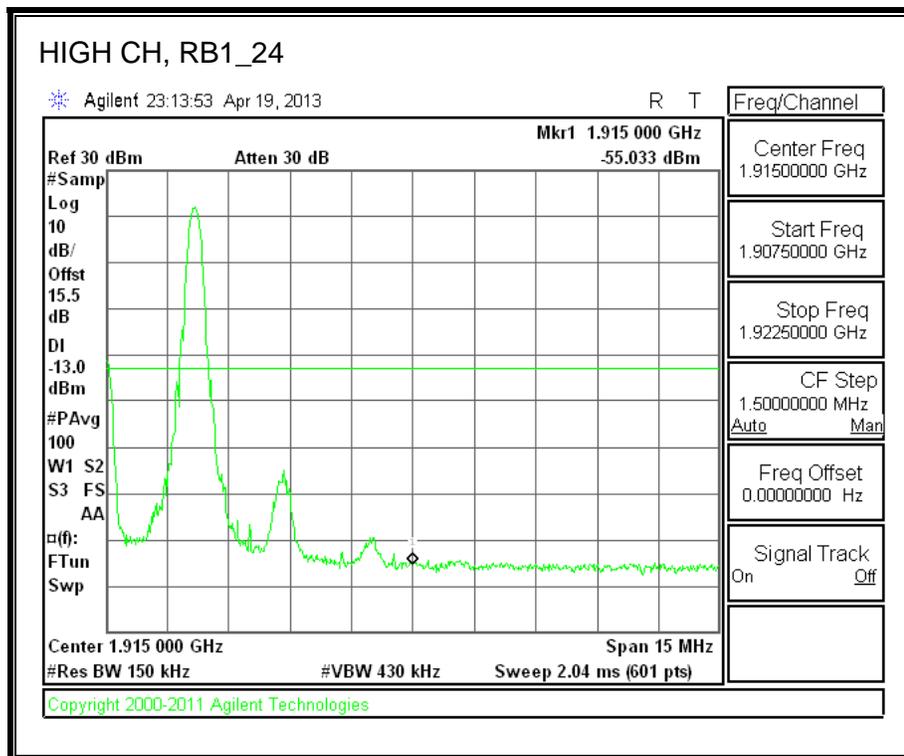
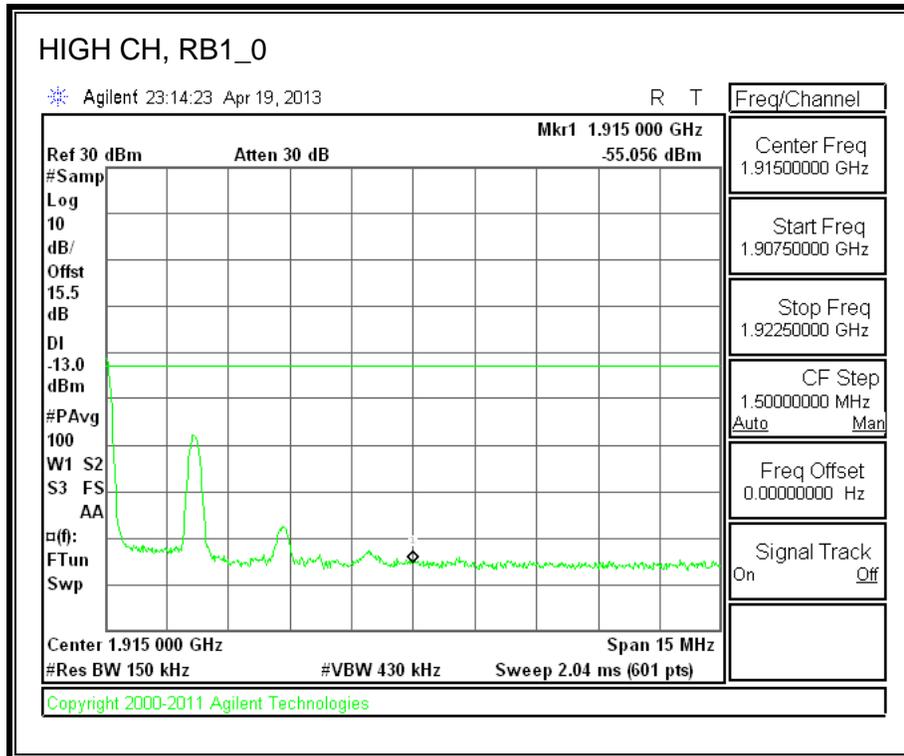
### 8.2.5. LTE BAND 2-5MHz BANDWIDTH

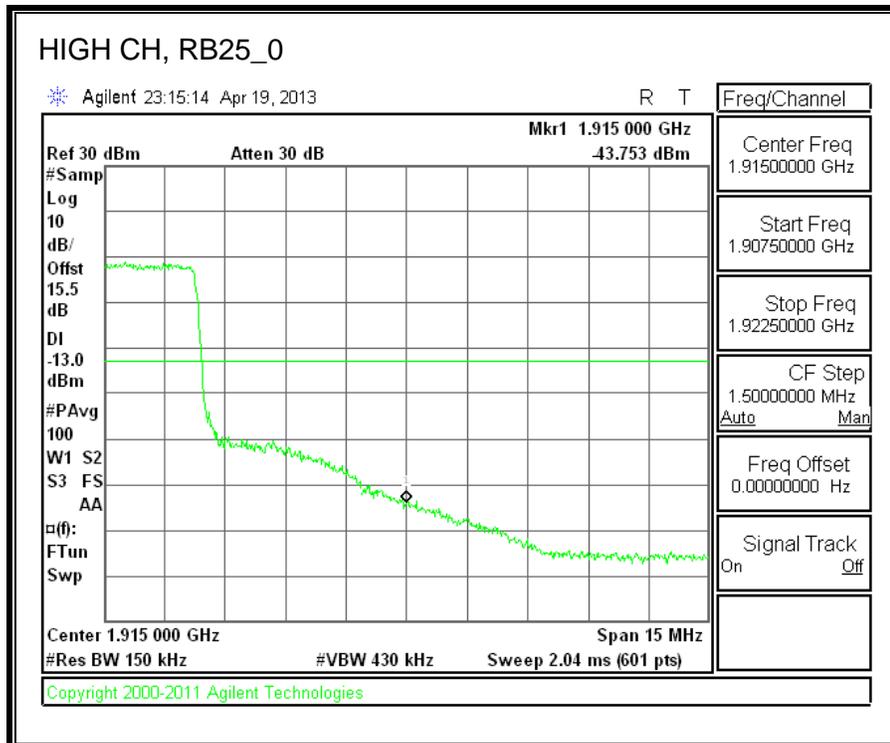
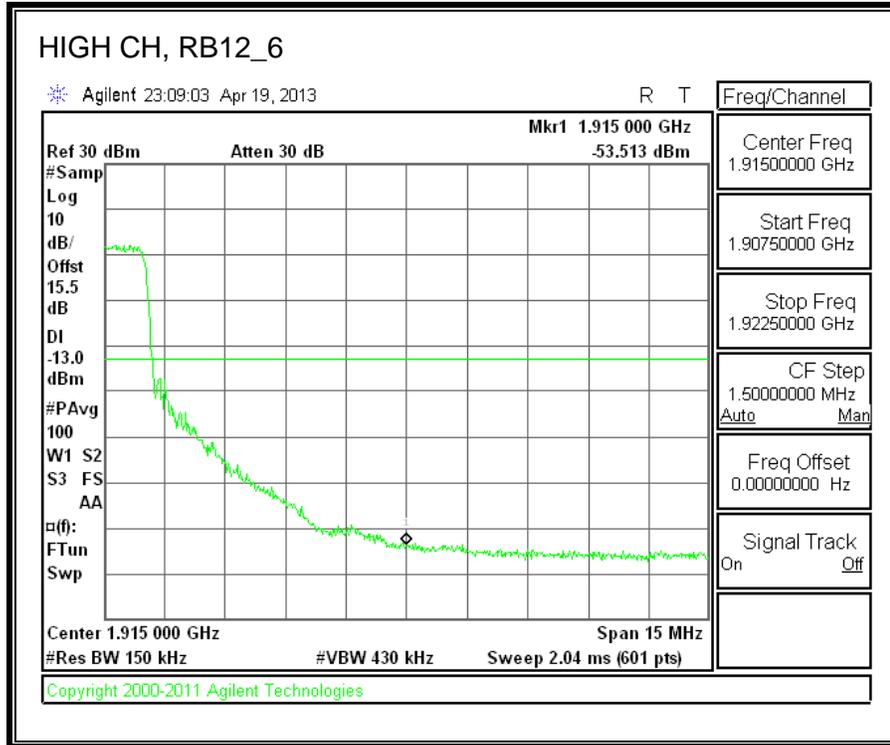
#### LOW-QPSK



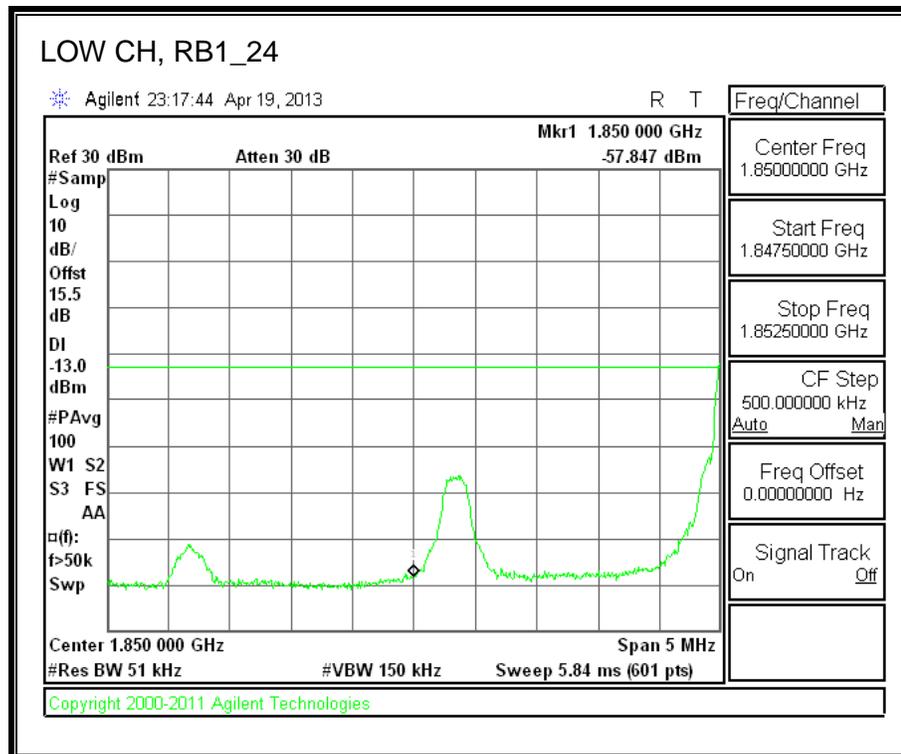
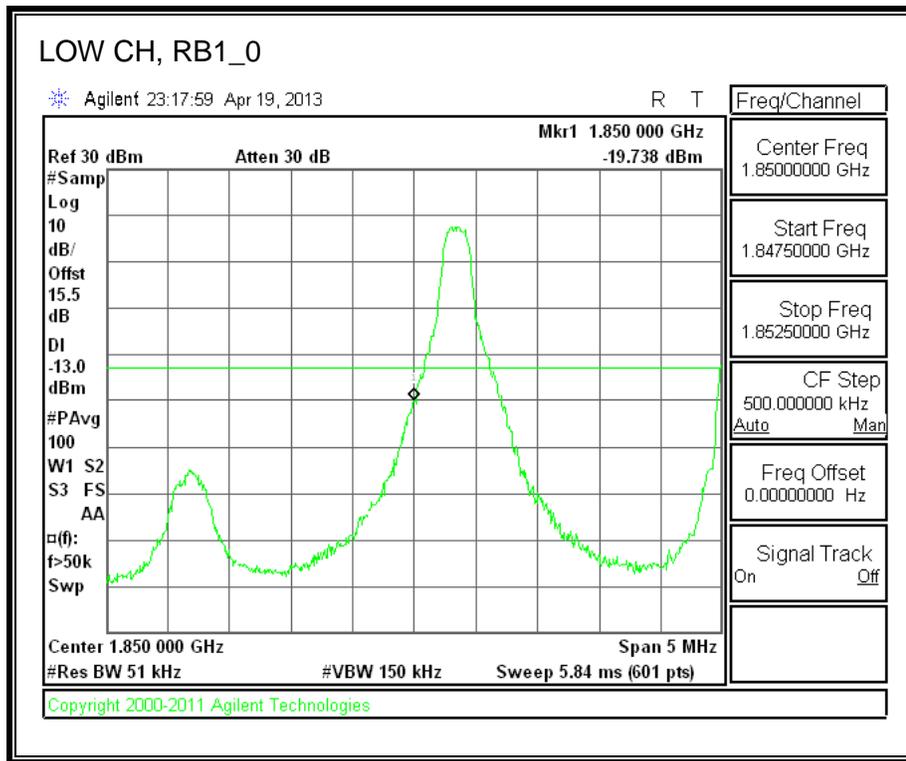


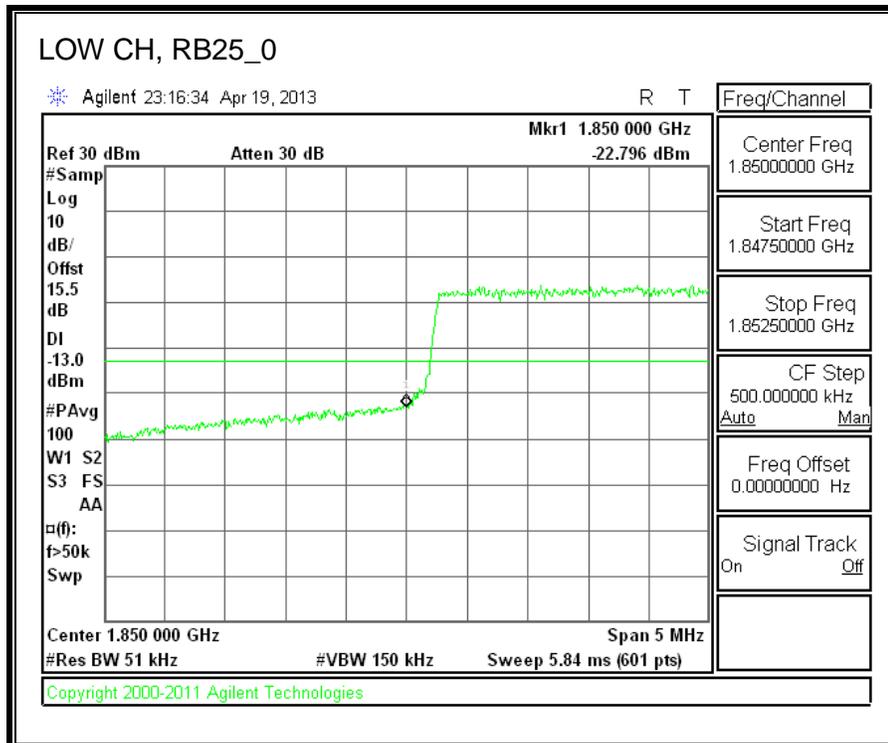
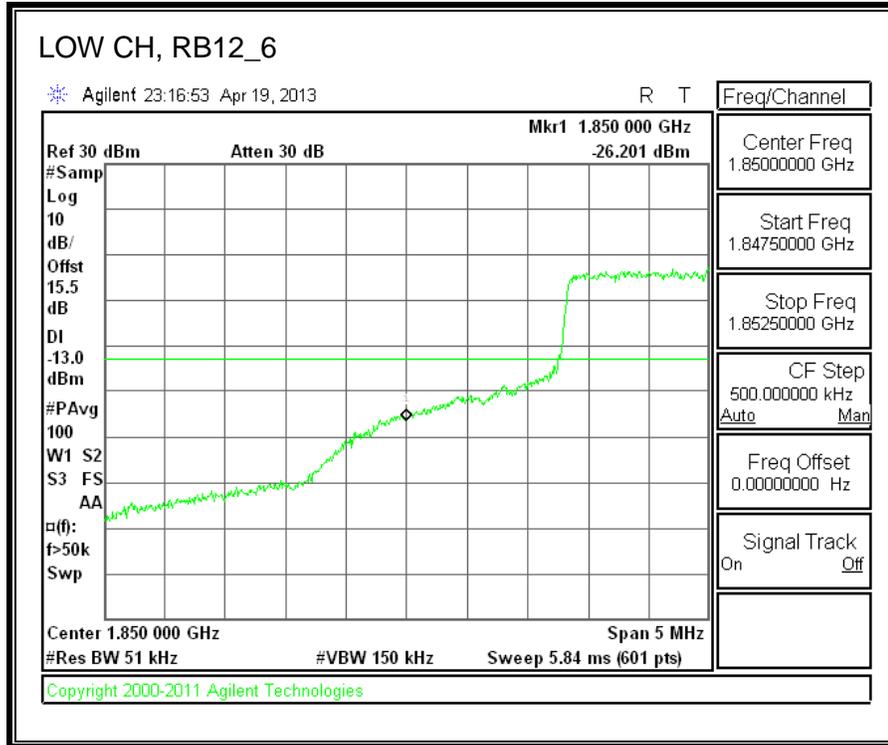
**HIGH-QPSK**



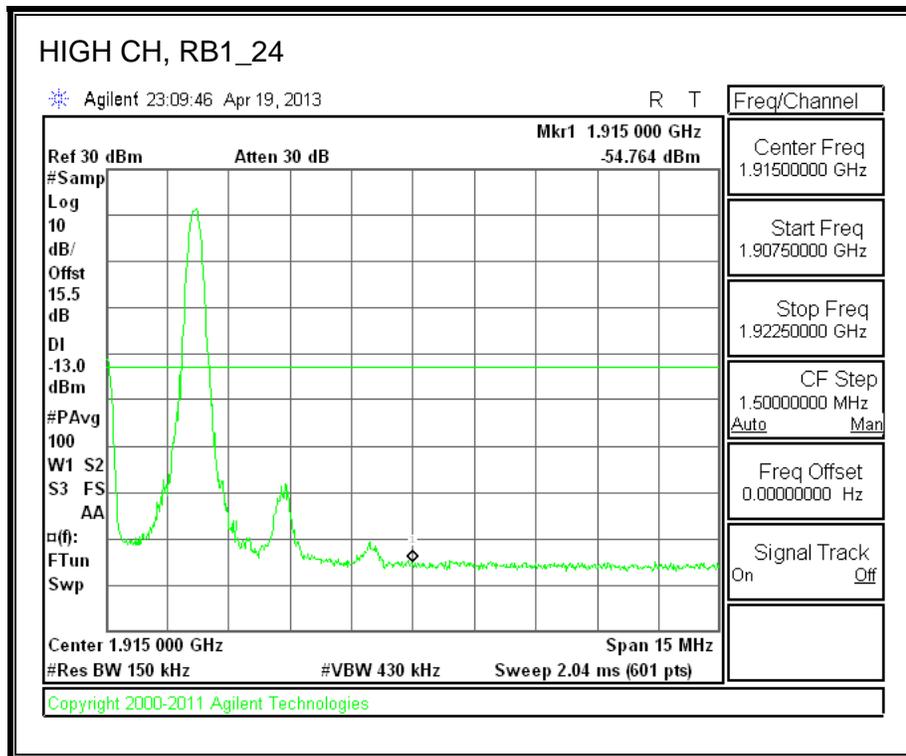
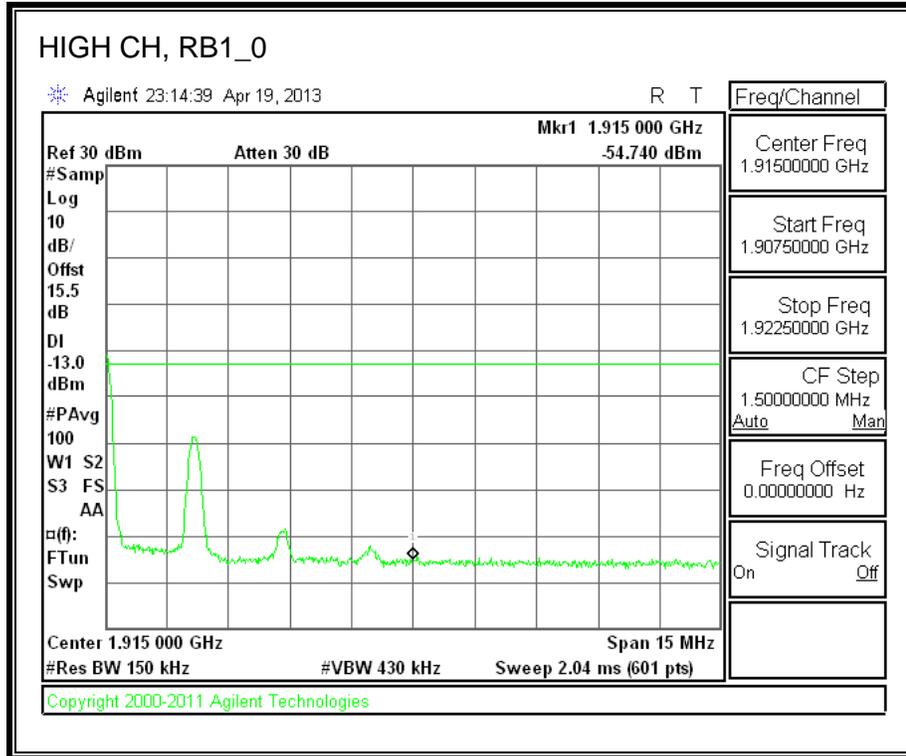


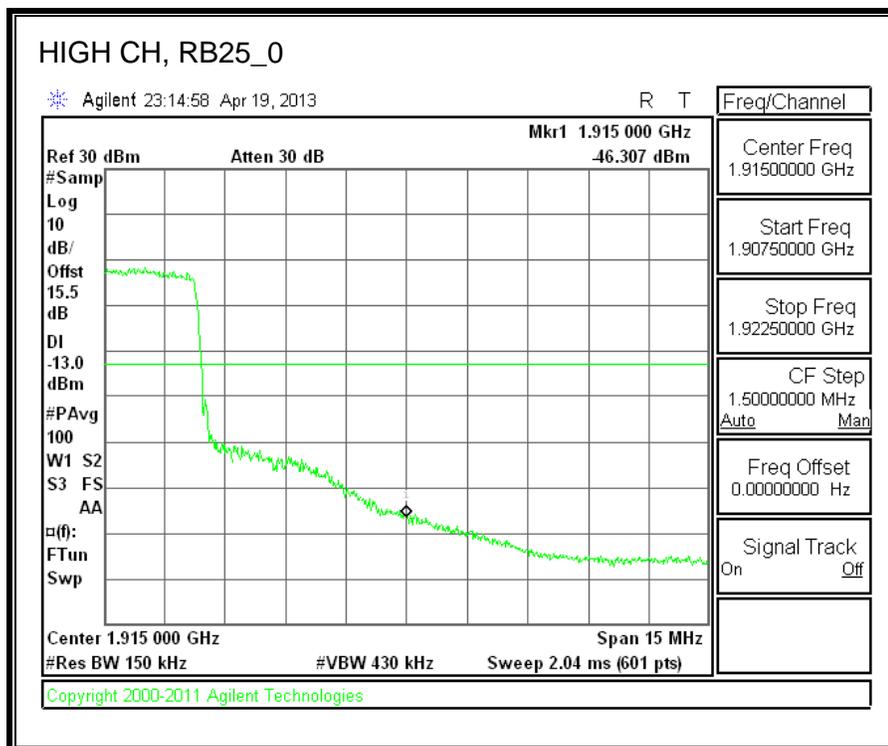
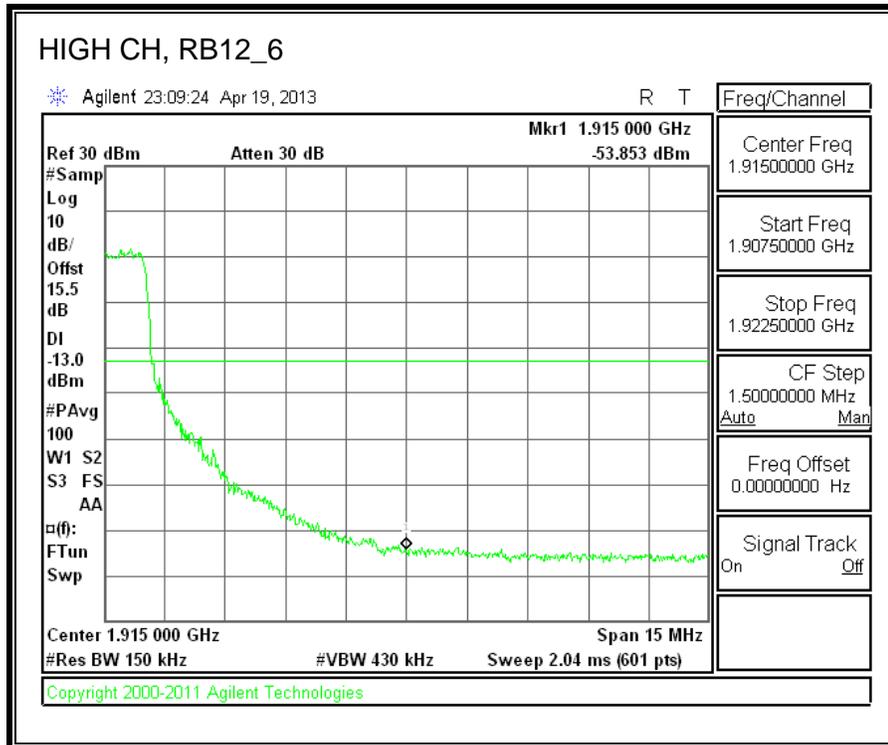
**LOW-16QAM**





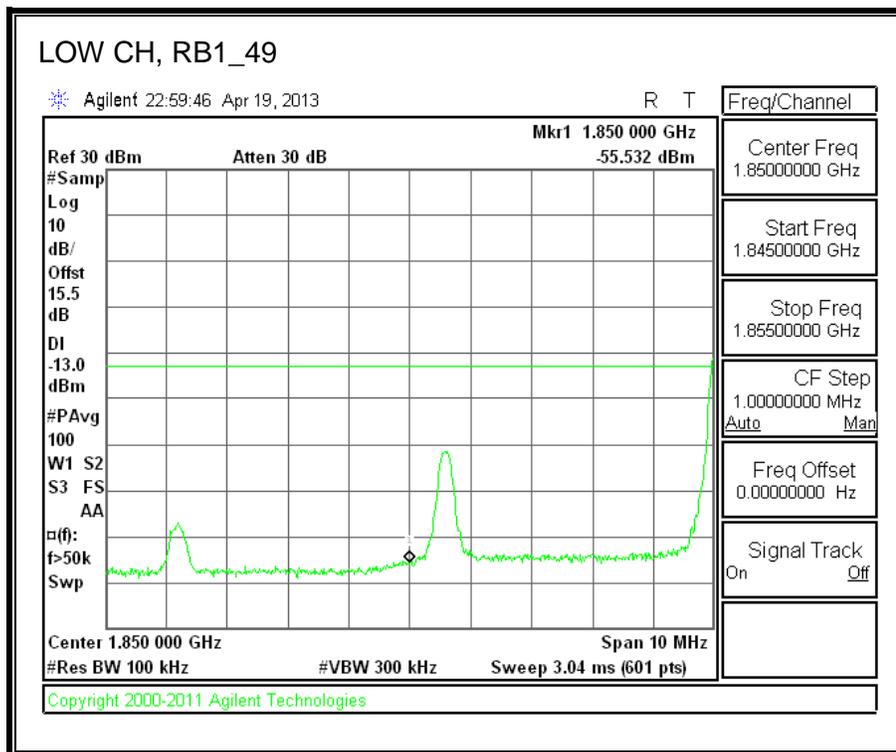
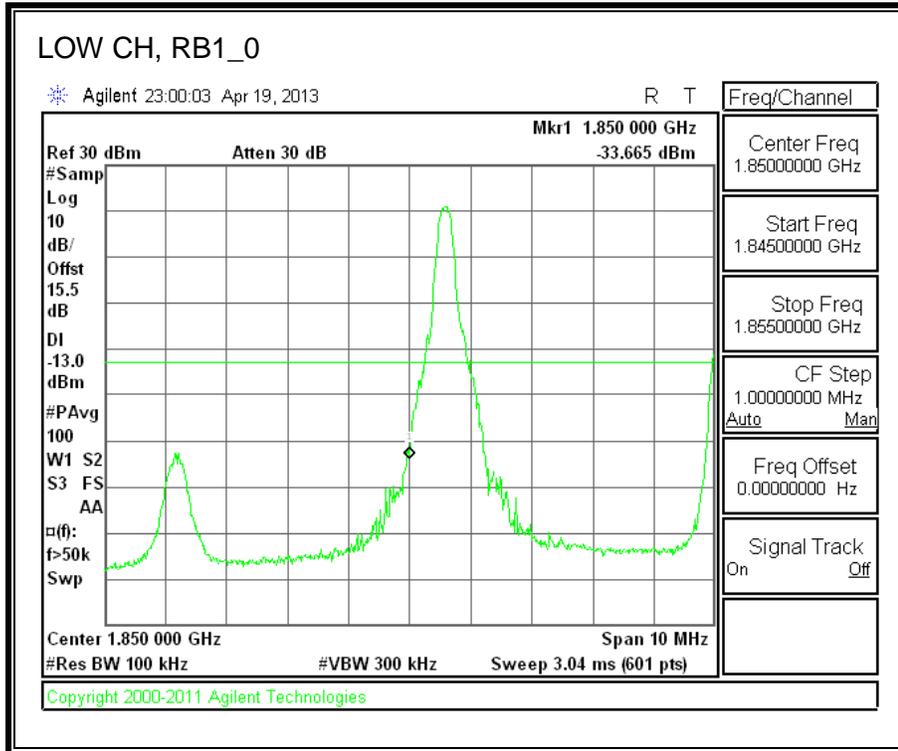
**HIGH-16QAM**

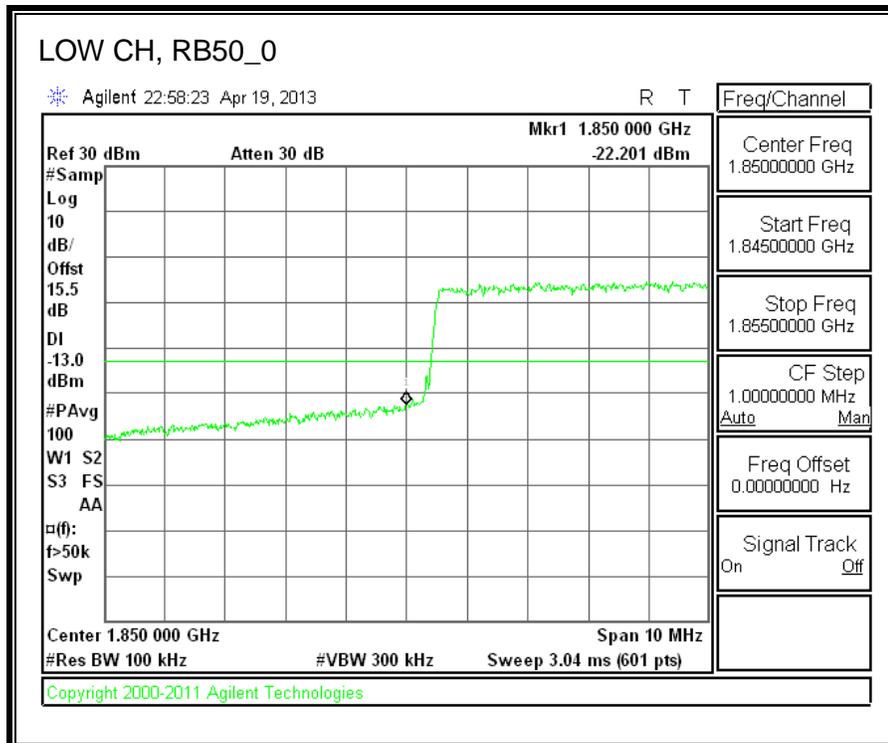
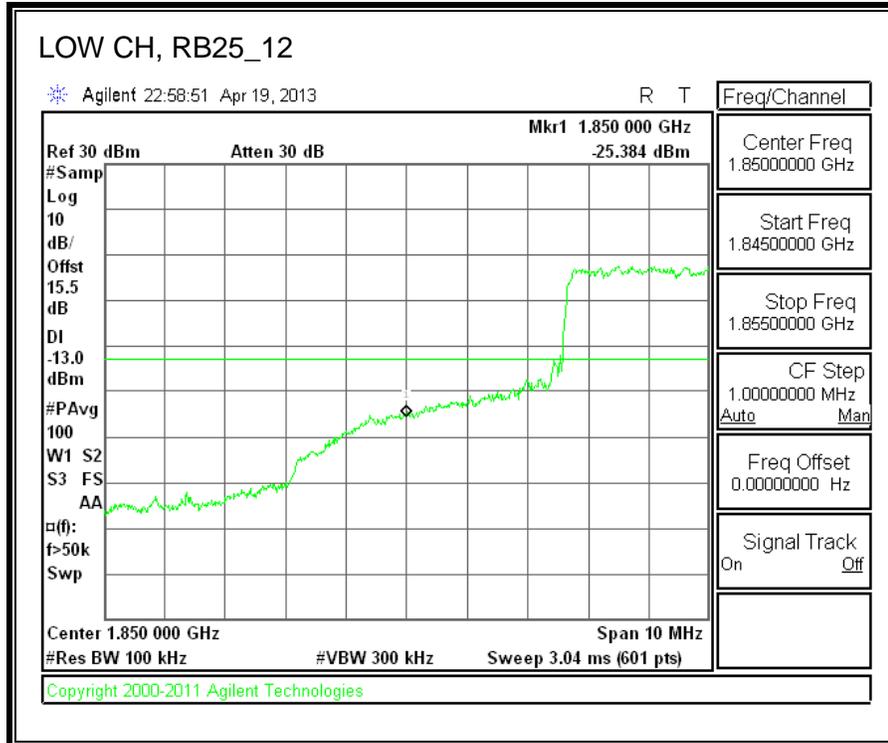




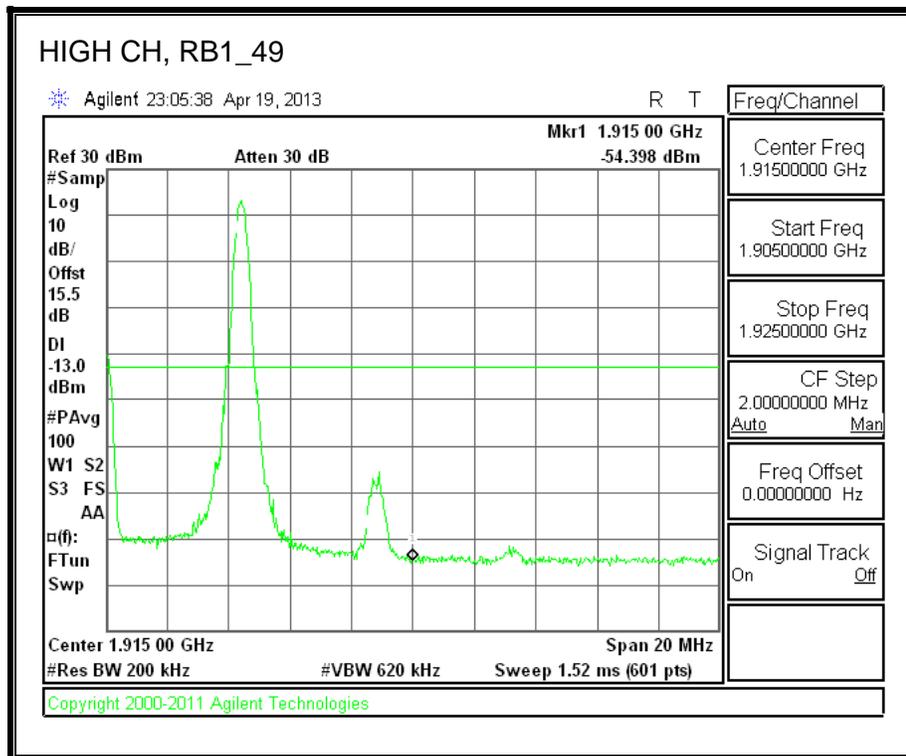
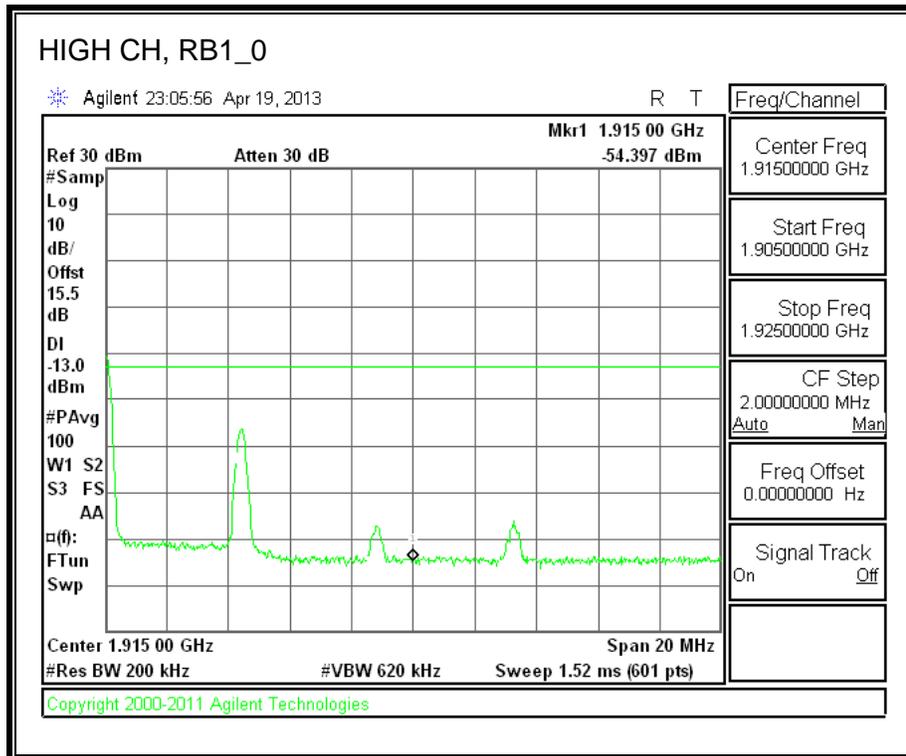
### 8.2.6. LTE BAND 2-10MHz BANDWIDTH

#### LOW-QPSK



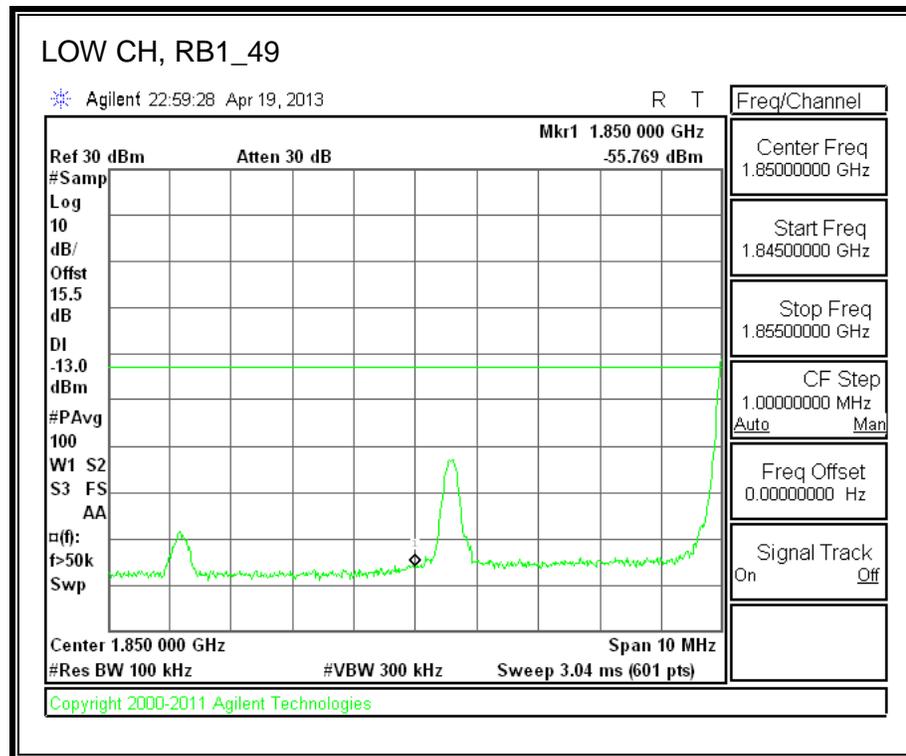
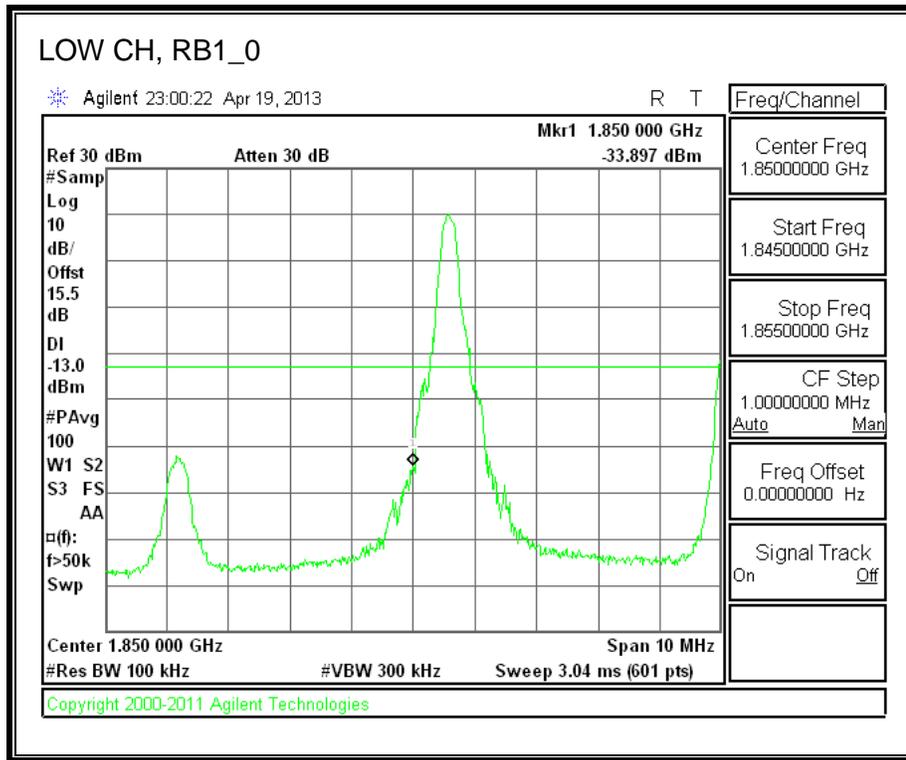


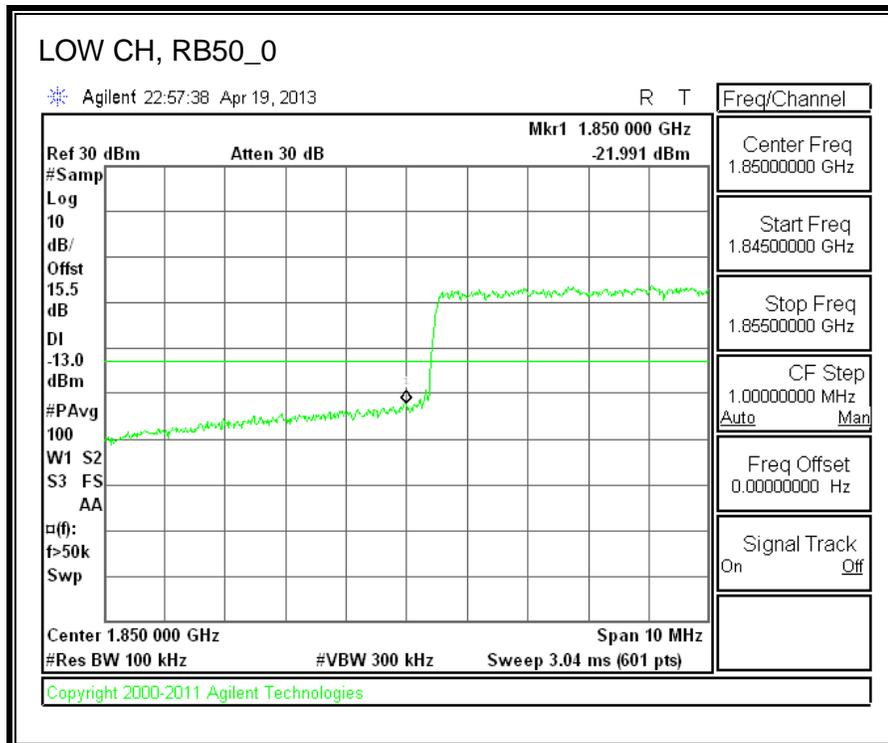
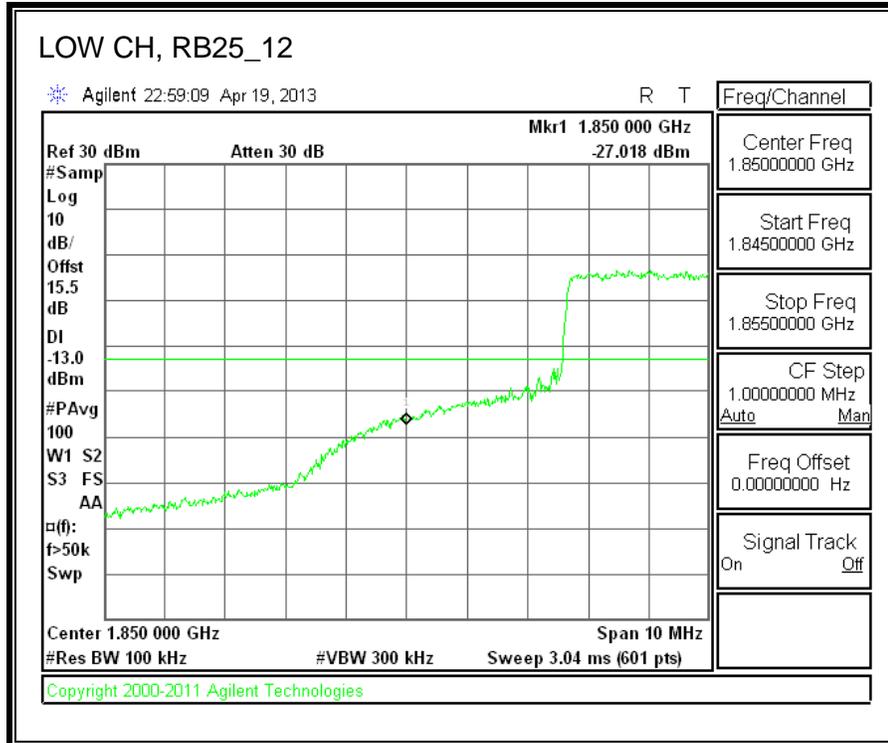
**HIGH-QPSK**



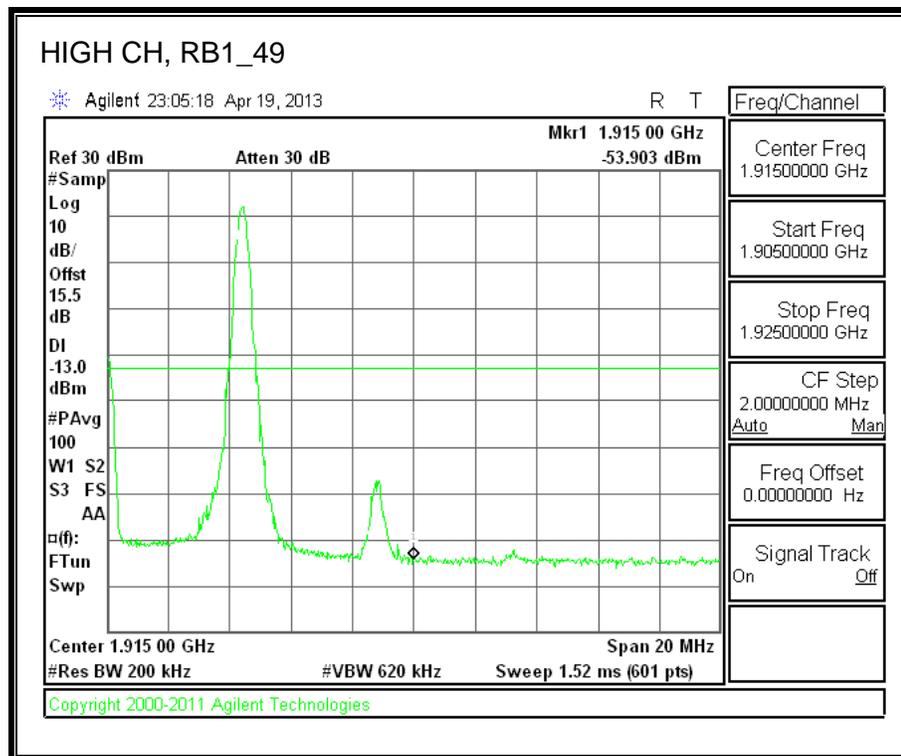
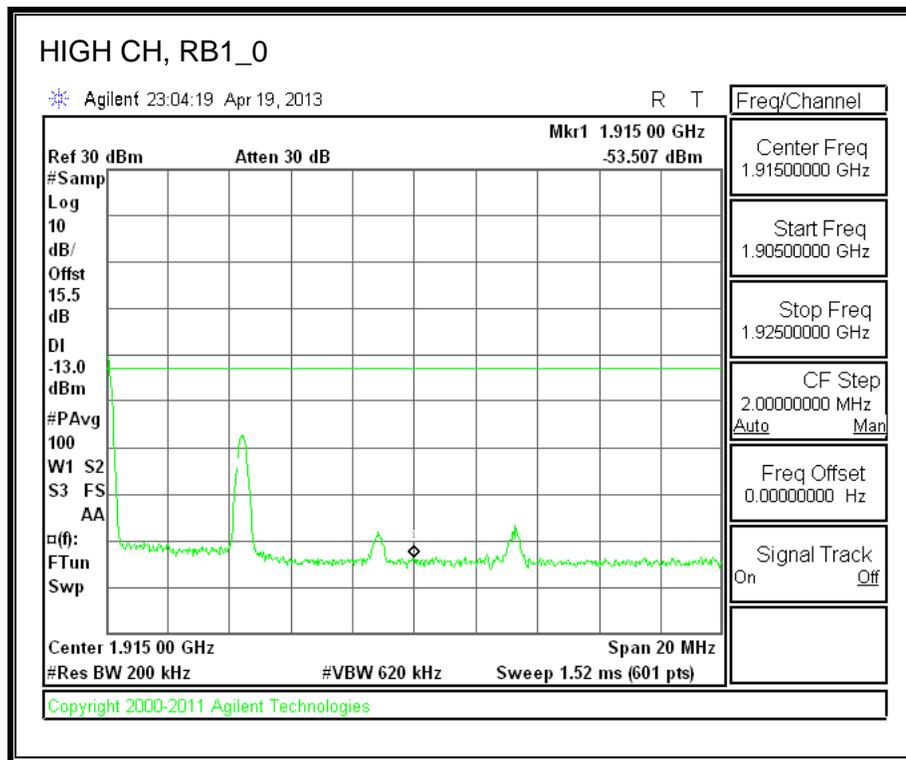


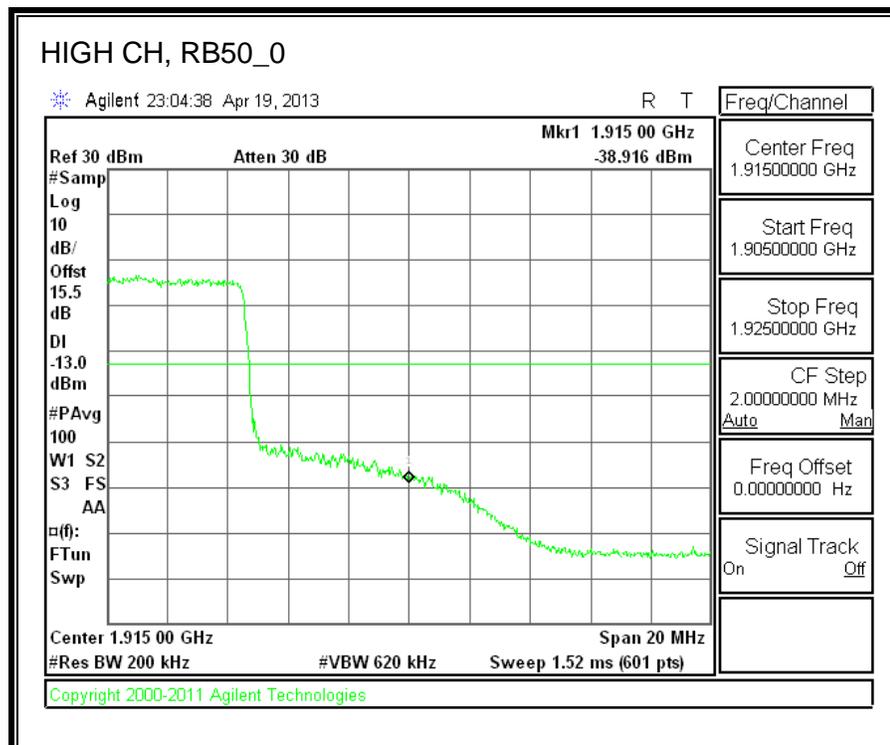
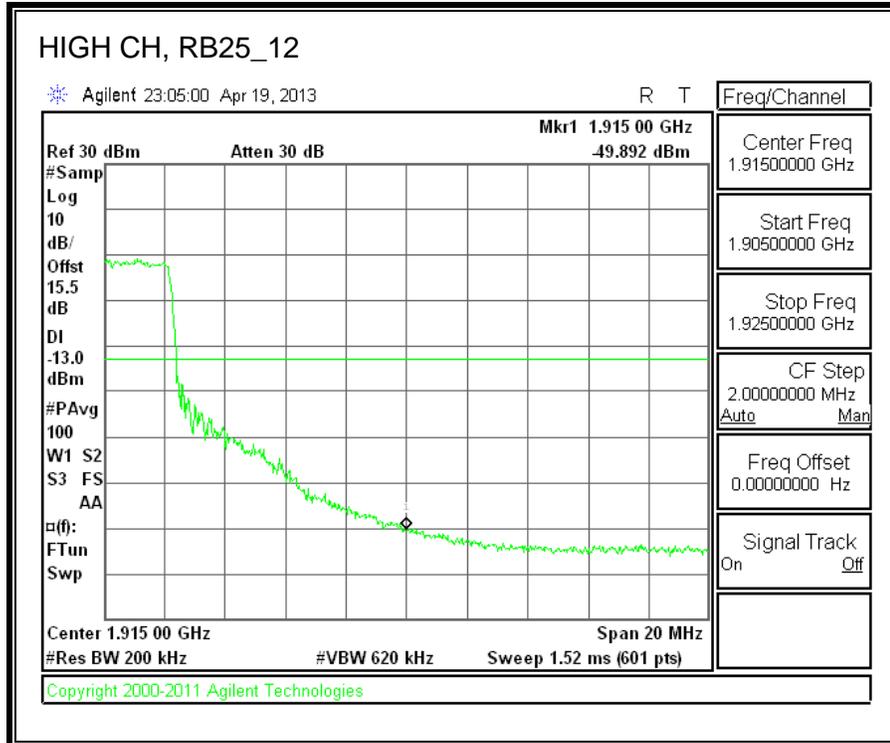
**LOW-16QAM**





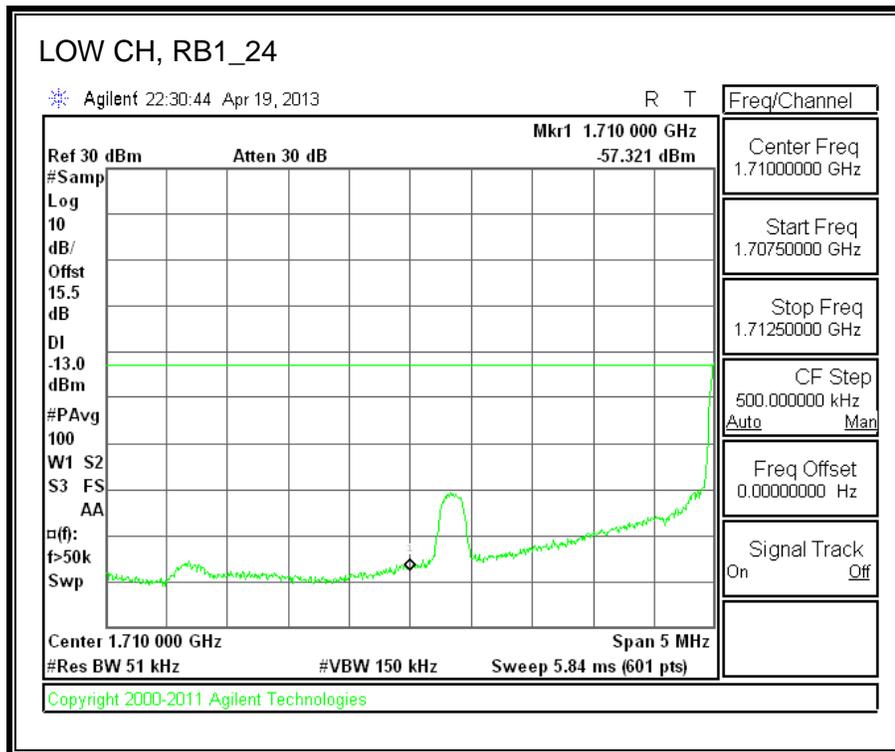
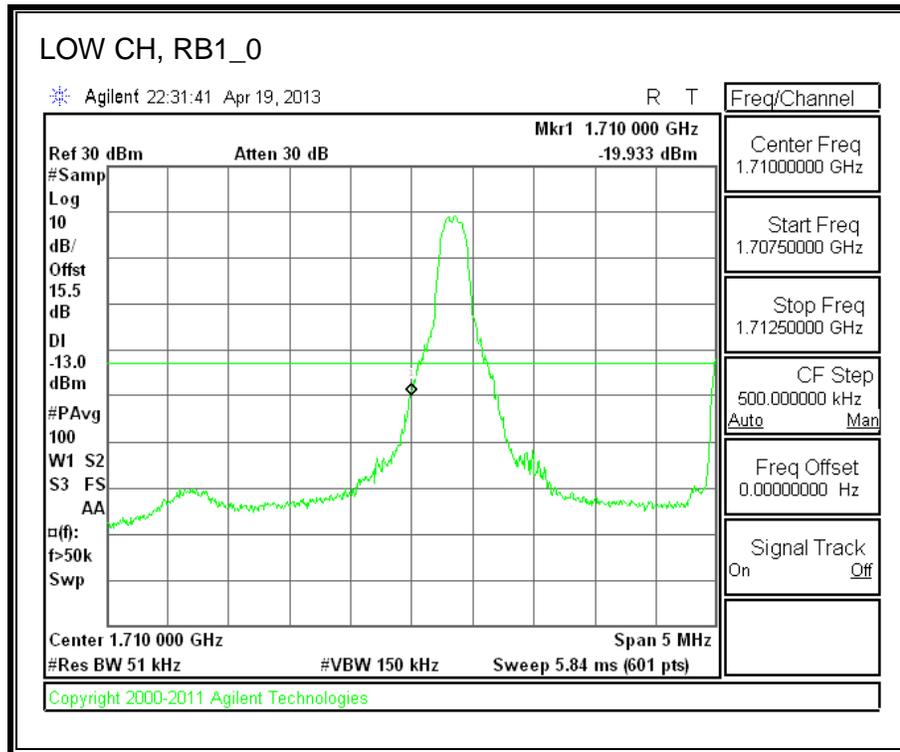
**HIGH-16QAM**

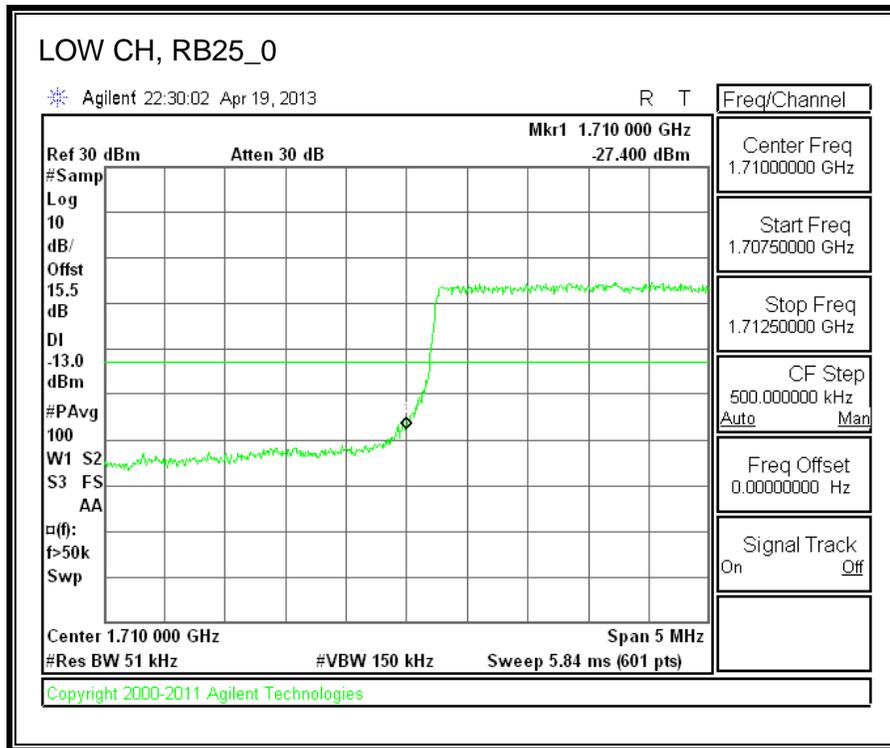
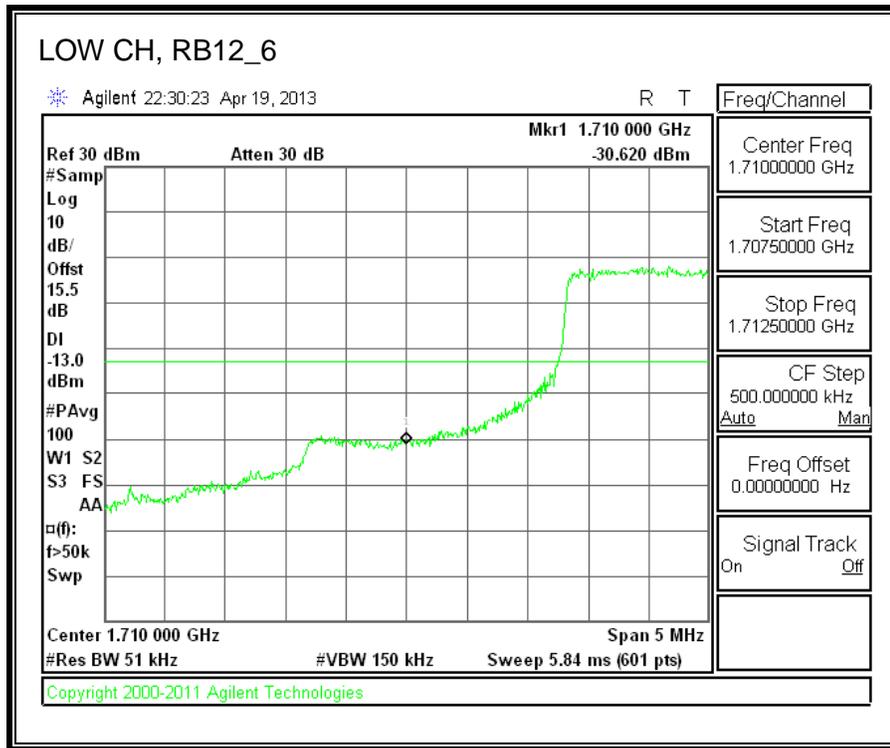




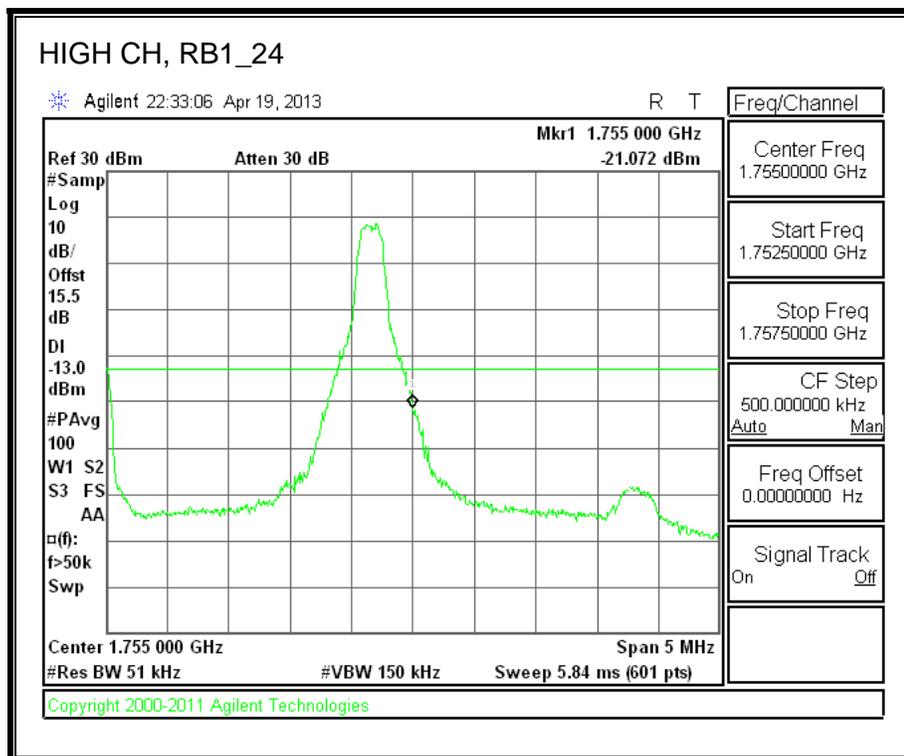
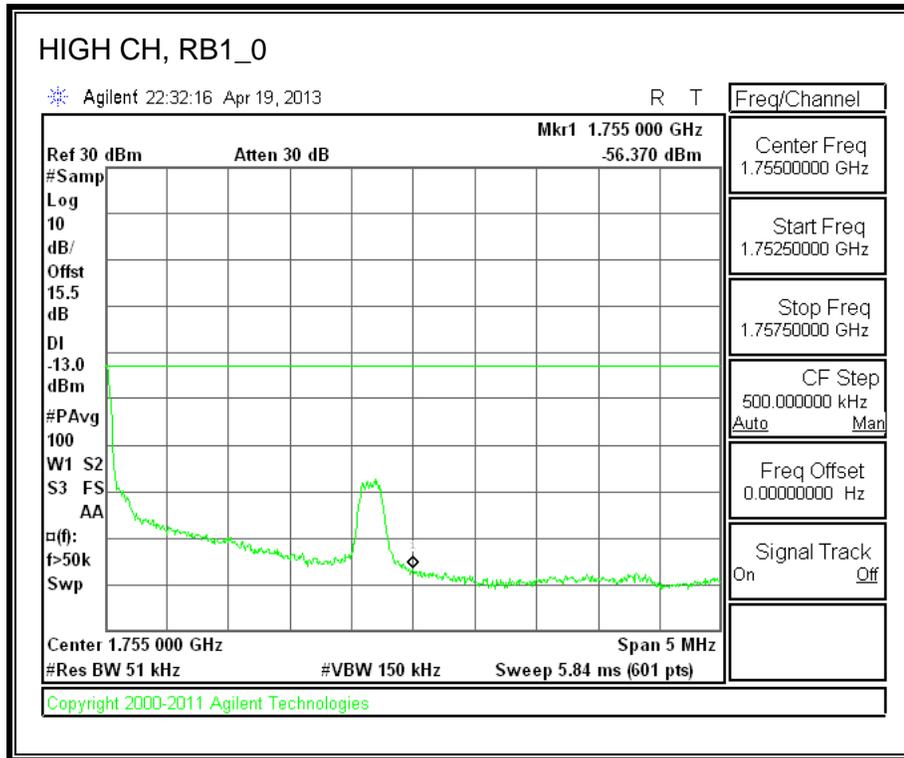
### 8.2.7. LTE BAND 4-5MHZ BANDWIDTH

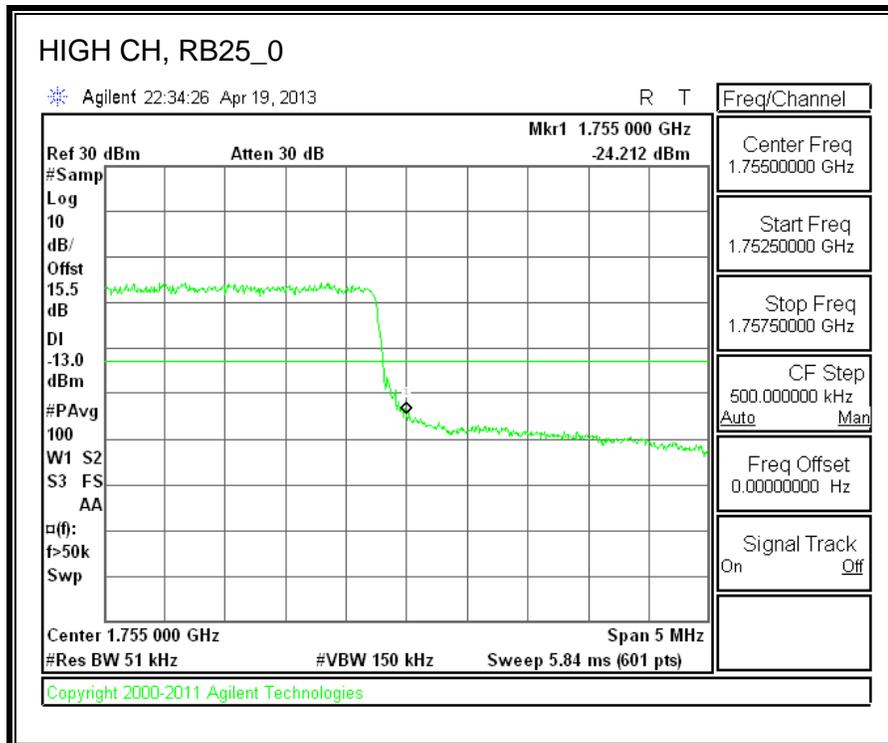
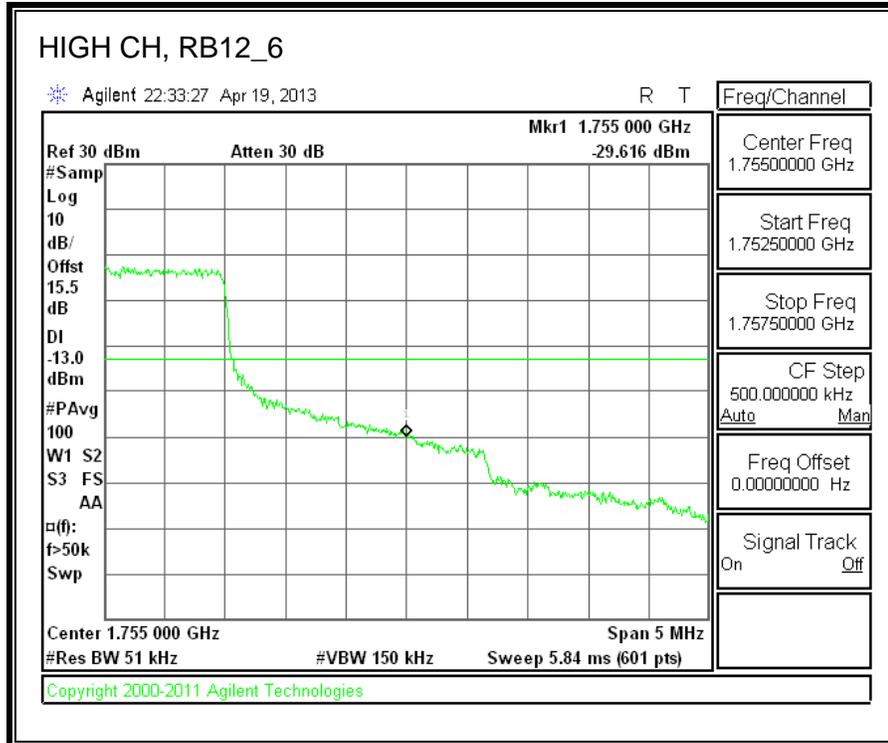
#### LOW-QPSK



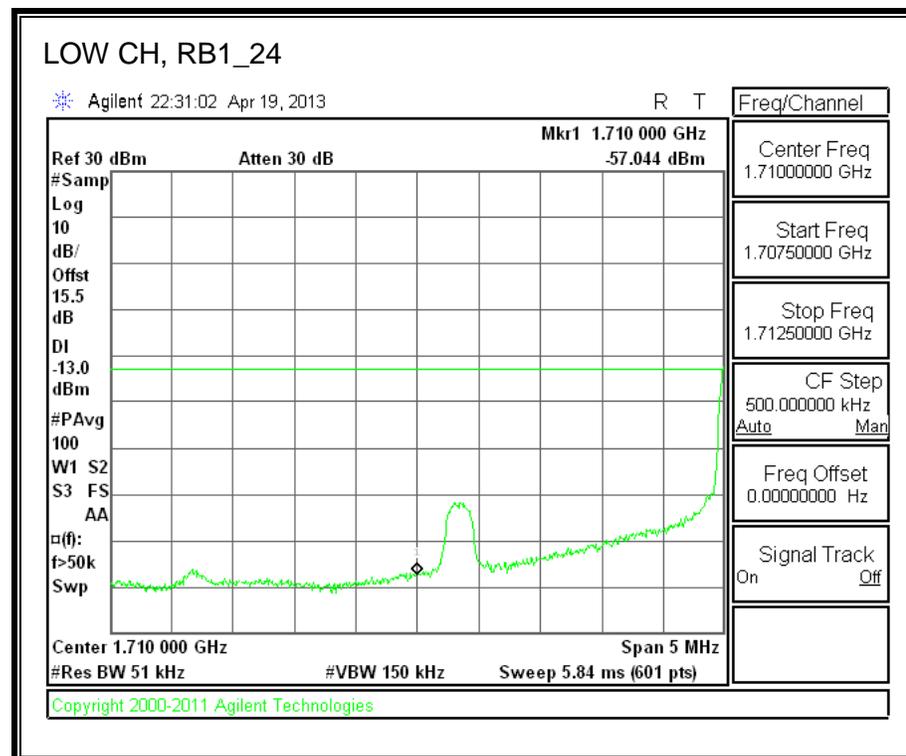
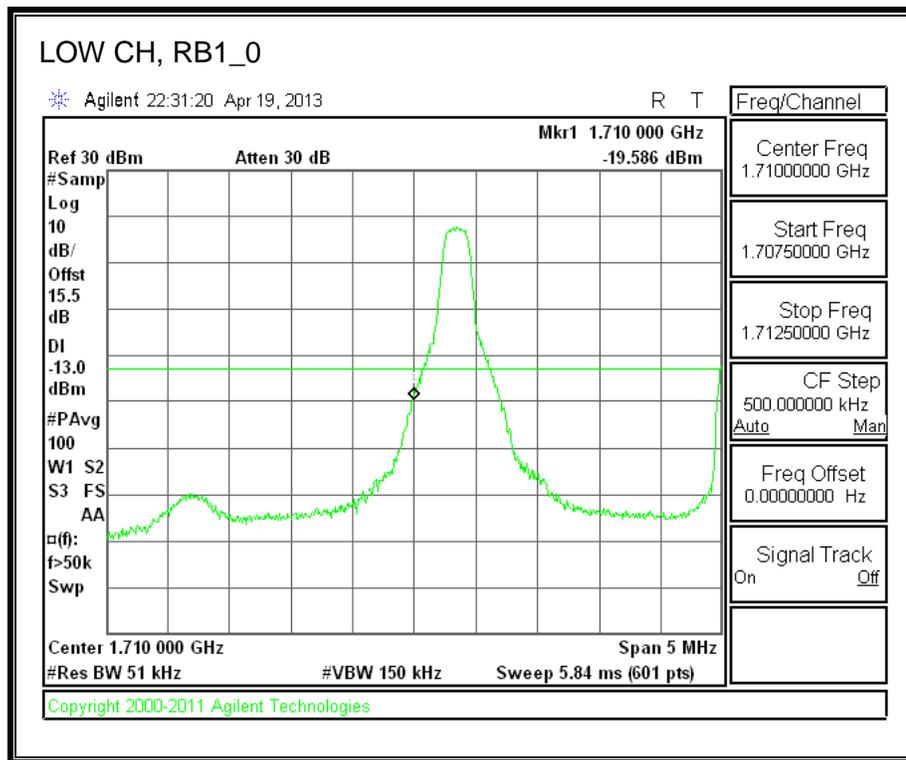


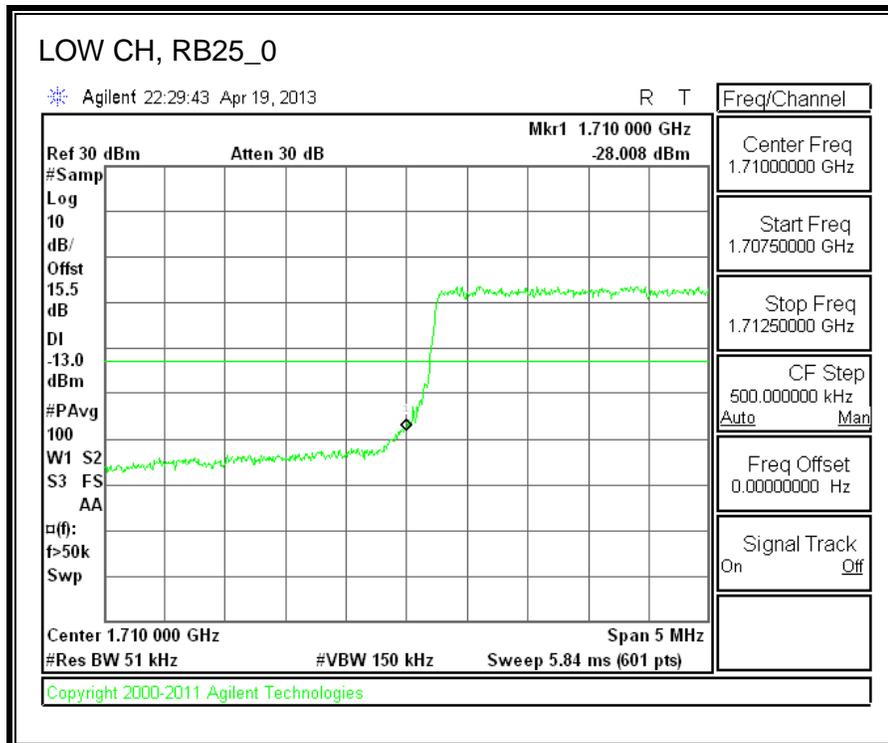
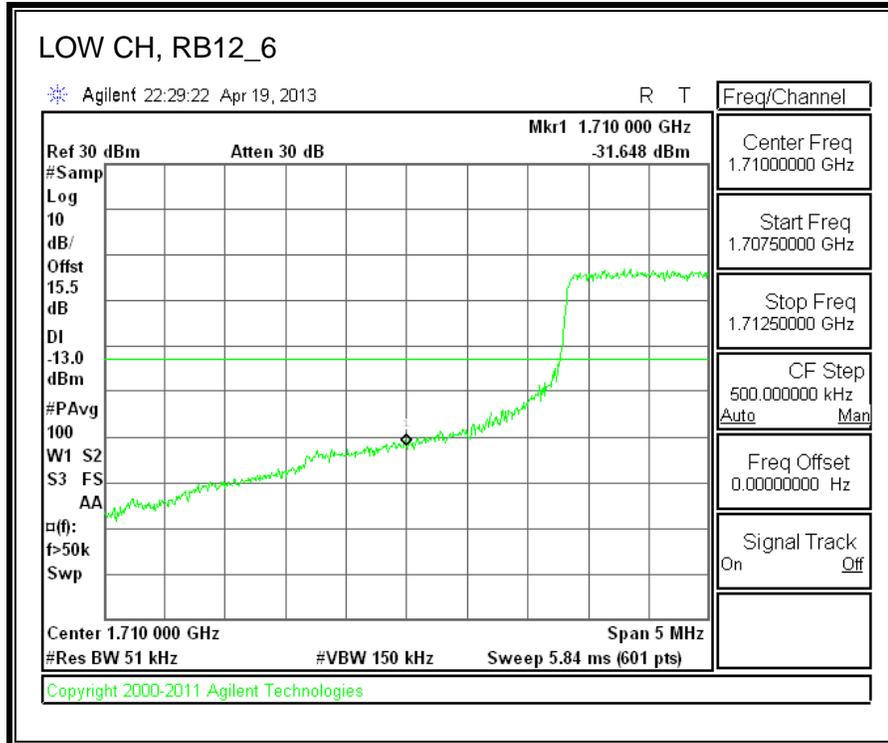
**HIGH-QPSK**



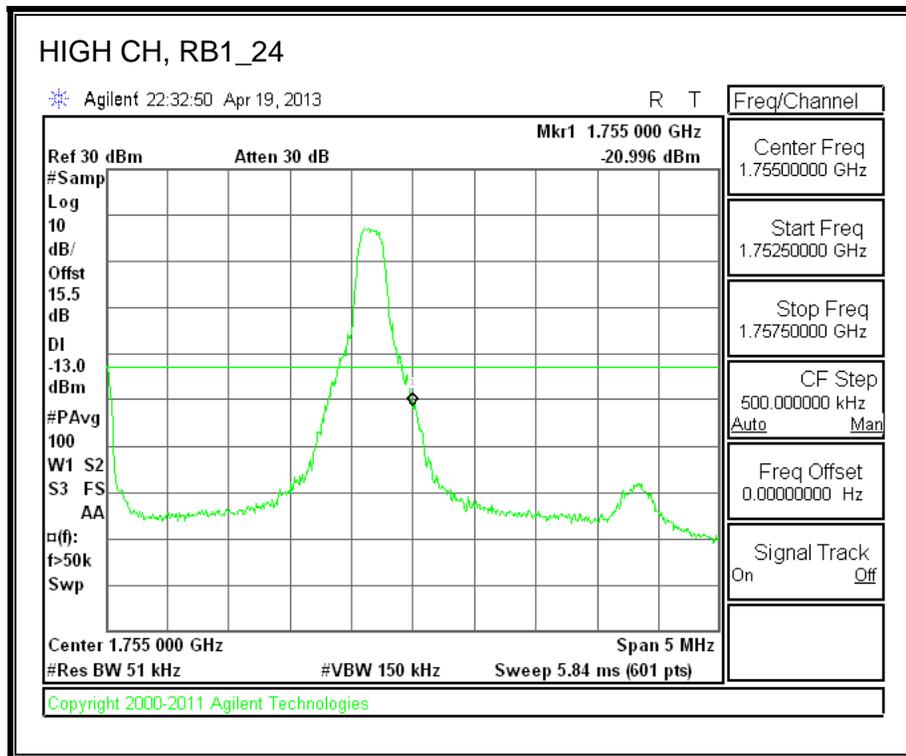
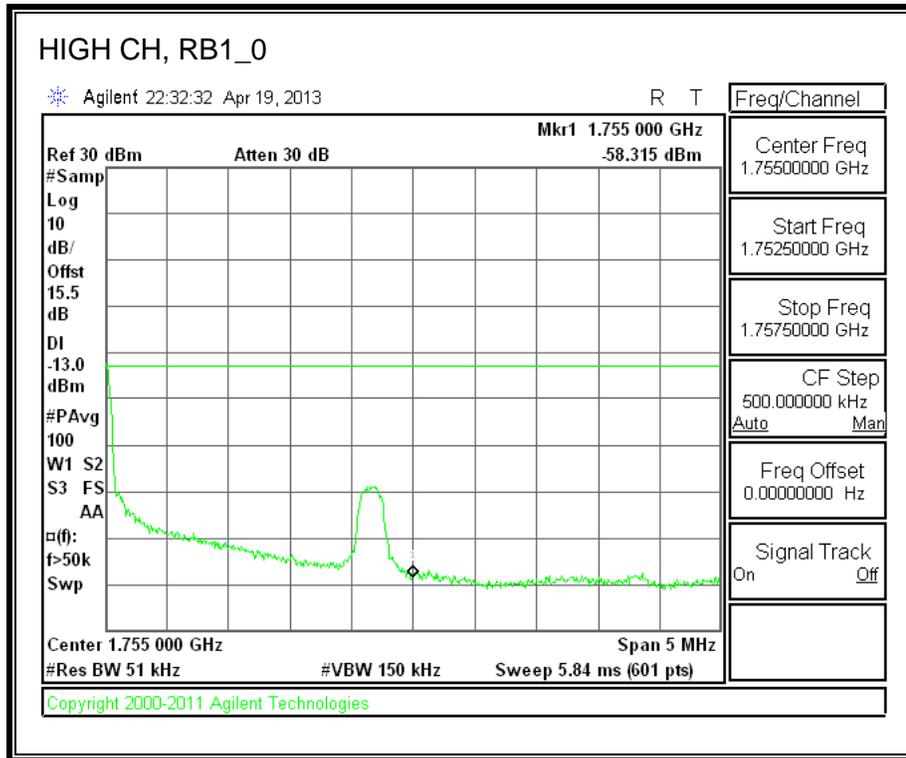


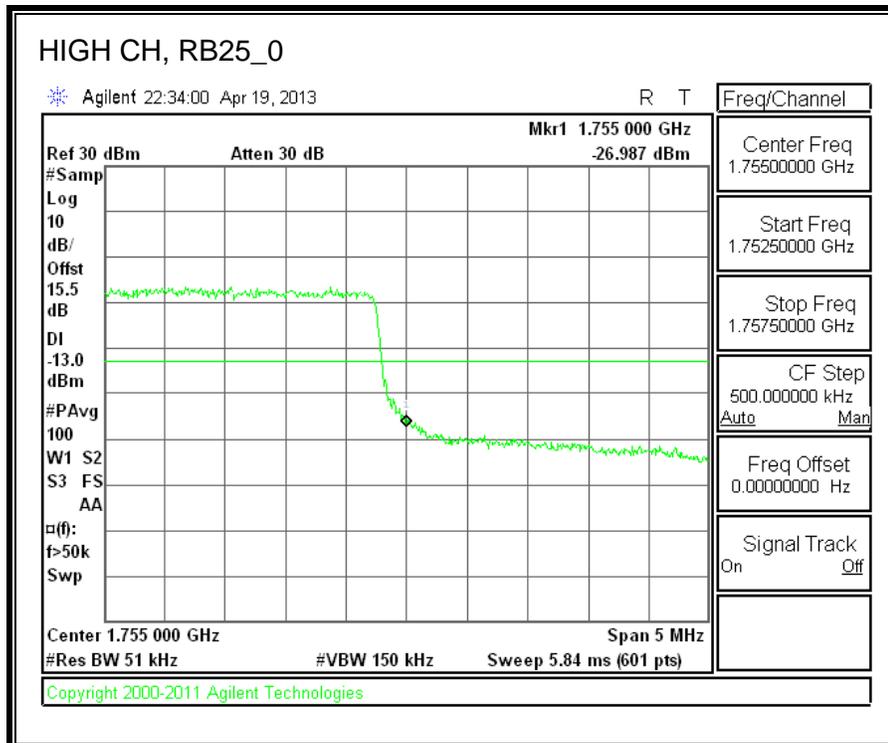
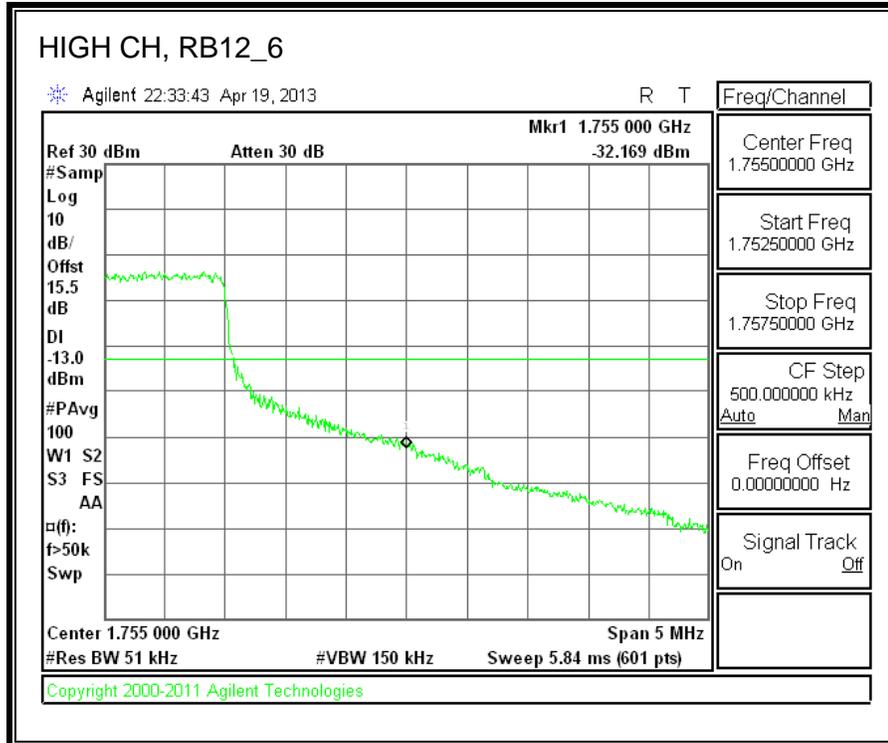
**LOW-16QAM**





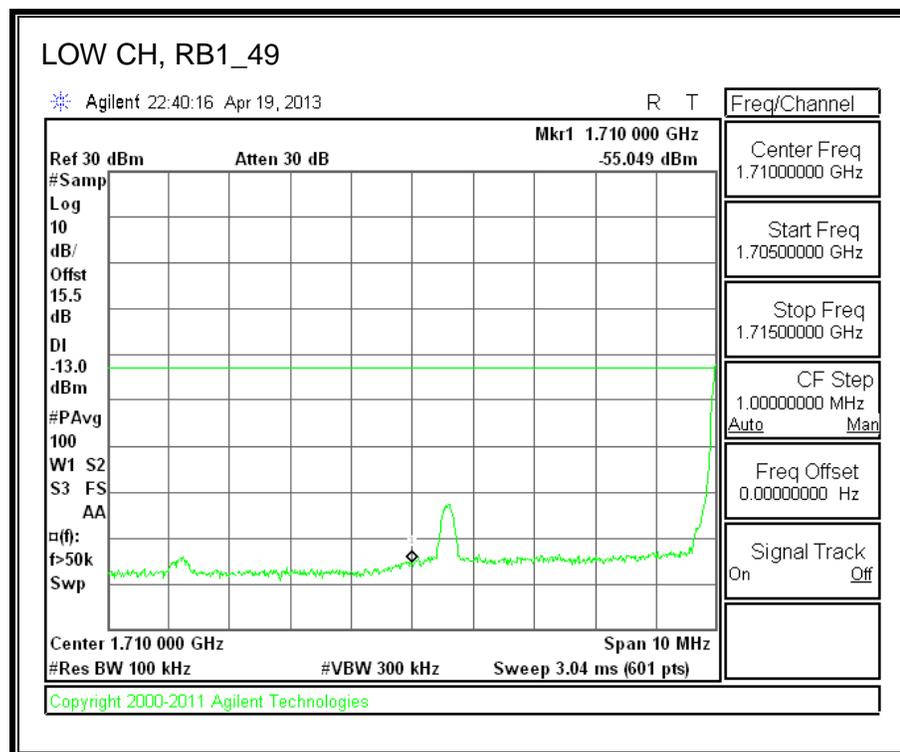
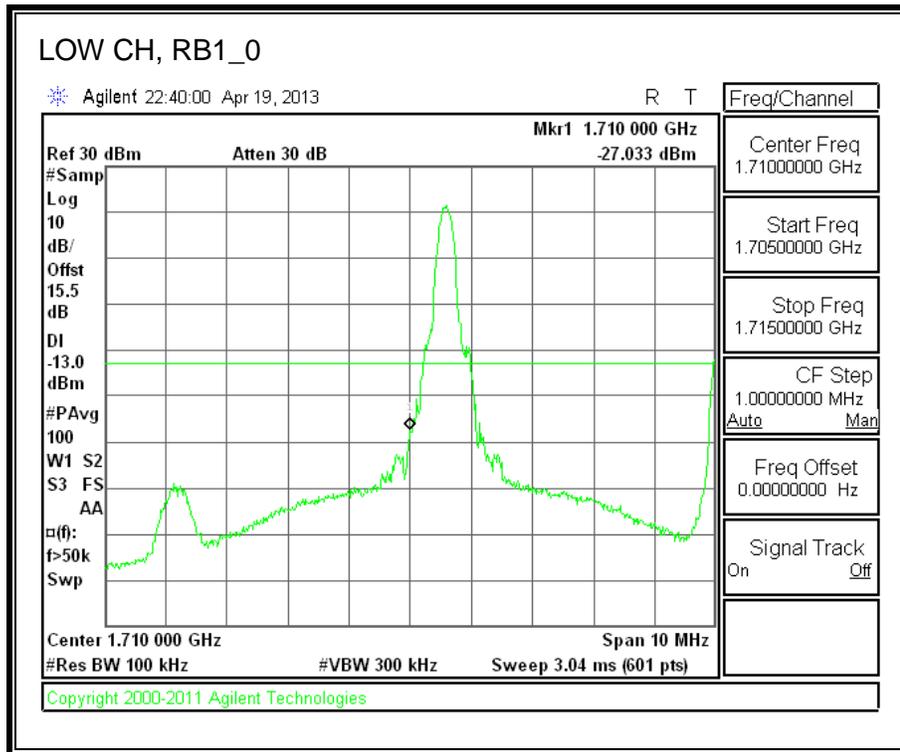
**HIGH-16QAM**

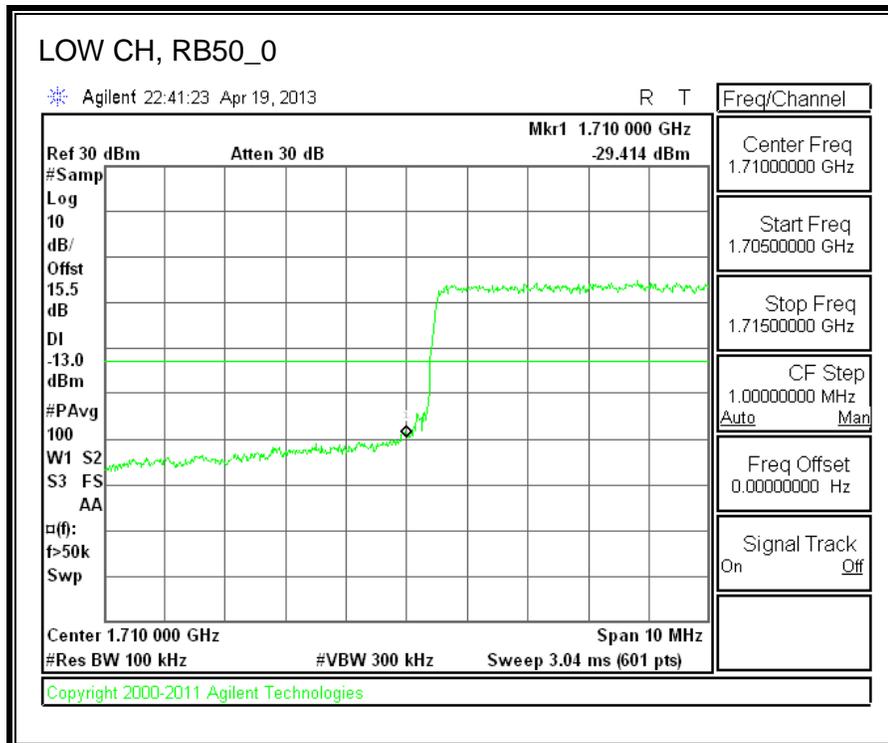
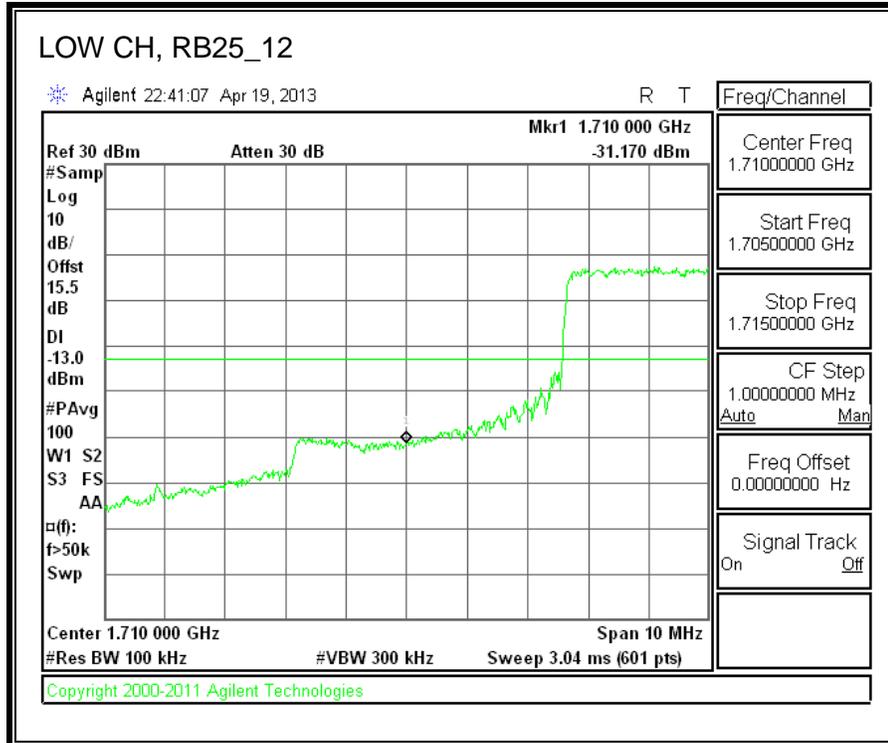




### 8.2.8. LTE BAND 4-10MHZ BANDWIDTH

#### LOW-QPSK





**HIGH-QPSK**

