



**FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E
CERTIFICATION TEST REPORT**

FOR

**GSM/WCDMA/LTE Phone + Bluetooth &
WLAN (2.4GHz & 5GHz) and NFC BAR PHONE**

MODEL NUMBER: SM-C105S

FCC ID: A3LSMC105S

REPORT NUMBER: 13U15830-1 REVISION A

ISSUE DATE: SEP 6, 2013

Prepared for

**SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY, GYEONGGI-DO 443-742, SOUTH KOREA**

Prepared by

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



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	8/30/13	Initial	P. Kim
A	9/6/13	Updated statement of ERP/ERIP measurement	P.Kim

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	6
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. SAMPLE CALCULATION	7
4.3. MEASUREMENT UNCERTAINTY.....	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. SOFTWARE AND FIRMWARE.....	9
5.4. DESCRIPTION OF AVAILABLE ANTENNAS	9
5.5. WORST-CASE CONFIGURATION AND MODE.....	10
5.6. DESCRIPTION OF TEST SETUP.....	10
6. TEST AND MEASUREMENT EQUIPMENT	12
7. RF POWER OUTPUT VERIFICATION	13
7.1. GSM/GPRS	13
7.1.1. GSM OUTPUT POWER RESULT.....	14
7.2. UMTS REL 99.....	15
7.2.1. UMTS REL 99 OUTPUT POWER RESULT	15
7.3. UMTS HSDPA	16
7.3.1. UMTS HSDPA OUTPUT POWER RESULT.....	17
7.3.2. UMTS HSUPA	18
7.3.3. UMTS HSUPA OUTPUT POWER RESULT.....	20
7.4. LTE OUTPUT VERIFICATION.....	21
7.4.1. LTE OUTPUT RESULT	21
8. PEAK TO AVERAGE POWER RATIO	23
8.1. GPRS	23
8.1. WCDMA REL 99.....	24
8.1. WCDMA HSUPA	25
8.2. LTE BAND 5.....	26
8.2.1. 5 MHz	26

8.2.2.	10 MHz	28
9.	CONDUCTED TEST RESULTS	30
10.	OCCUPIED BANDWIDTH.....	30
10.1.1.	UMTS REL 99 MODE	35
10.1.2.	WCDMA HSUPA.....	37
10.2.	<i>LTE Band 5</i>	<i>39</i>
10.2.1.	LTE BAND 5-5MHz BANDWIDTH.....	39
10.2.2.	LTE BAND 5-10MHz BANDWIDTH.....	47
11.	BAND EDGE.....	54
11.1.1.	GPRS MODE	55
11.1.2.	UMTS REL 99 MODE	56
11.1.3.	UMTS HSUPA MODE	57
11.2.	<i>LTE BAND 5.....</i>	<i>58</i>
11.2.1.	LTE BAND 5-5MHZ BANDWIDTH	58
11.2.2.	LTE BAND 5-10MHZ BANDWIDTH	63
12.	OUT OF BAND EMISSIONS.....	69
12.1.1.	GPRS PCS BAND.....	70
12.1.2.	UMTS REL 99 MODE	72
12.1.3.	UMTS HSUPA MODE	75
12.2.	<i>LTE BAND 5.....</i>	<i>77</i>
12.2.1.	LTE BAND 4-5MHz BANDWIDTH.....	77
12.2.2.	LTE BAND 4-10MHz BANDWIDTH.....	81
13.	FREQUENCY STABILITY.....	85
13.1.	<i>GPRS MODULATION – MID CHANNEL</i>	<i>86</i>
13.1.1.	PCS.....	86
13.2.	<i>WCDMA – MID CHANNEL</i>	<i>87</i>
13.2.1.	Band 2.....	87
13.3.	<i>LTE – MID CHANNEL</i>	<i>88</i>
13.3.1.	Band 5.....	88
14.	RADIATED TEST RESULTS	89
14.1.	<i>RADIATED POWER (ERP & EIRP).....</i>	<i>89</i>
14.1.1.	GPRS 1900 (Cellular Band)	92
14.1.1.	WCDMA REL 99	93
14.1.1.	WCDMA HSUPA.....	94

14.1.1.	LTE BAND 5.....	95
14.2.	<i>FIELD STRENGTH OF SPURIOUS RADIATION</i>	99
14.2.1.	GPRS 1900 (Cellular Band)	100
14.2.1.	WCDMA REL 99	101
14.2.1.	WCDMA HSUPA.....	102
14.2.1.	LTE BAND 5.....	103
15.	SETUP PHOTOS	107

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY, GYEONGGI-DO 443-742, SOUTH KOREA

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + Bluetooth &
WLAN (2.4GHz & 5GHz) and NFC

MODEL: SM-C105S

SERIAL NUMBER: 1693679-VS

DATE TESTED: Aug 6-28, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H, 24E and 27F	PASS

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

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

Approved & Released For UL CCS By:



PHILIP KIM
WiSE OPERATIONS MANAGER
UL Verification Services

Tested By:



CHARLES VERGONIO
WiSE LAB TECHNICIAN
UL Verification Services

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, and FCC CFR Part 24.

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a bar-style cell phone featuring 802.11 A/B/G/N 1X1 HT20, HT40 + BT4.0 (LE)+ GSM1900/WCDMA1900MHz/LTE AND NFC BAR PHONE

5.2. MAXIMUM OUTPUT POWER

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

Part 22/24 Band					
Frequency range (MHz)	Modulation	Conducted		ERP	
		dBm	mW	dBm	mW
1850.2-1909.8	GPRS	29.92	981.7	25.90	389.0

Part 24 PCS Band					
Frequency range (MHz)	Modulation	Conducted		EIRP	
		dBm	mW	dBm	mW
1852.4 – 1907.6	REL 99	23.80	239.9	21.88	154.2
1852.4 – 1907.6	HSUPA	23.80	239.9	21.64	145.9

Part 22 LTE Band 5 MODE (5 MHz BANDWIDTH)				
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted	
			dBm	mW
826.5-846.5	QPSK	1/0	23.94	247.7
	16QAM		23.11	204.6

Part 22 LTE Band 5 MODE (10.0- MHz BANDWIDTH)				
Frequency range (MHz)	Modulation	Start RB and RB offset	Conducted	
			dBm	mW
829-844	QPSK	1/0	23.92	246.6
	16QAM		23.83	241.5

5.3. SOFTWARE AND FIRMWARE

Software version was E470S.001

The firmware used was Android 4.2.2.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Gain (dBi)
850MHz	-2.75dBi
1900MHz	-0.65dBi

5.5. WORST-CASE CONFIGURATION AND MODE

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

Worst-case modes: GPRS, UMTS WCDMA and UMTS HSDPA Sub-test 1.

Since the EUT is a portable device, to determine the worst/highest emissions, the X, Y, and Z orientations of the EUT with respect to the turntable and the worst among them with headset and an AC adapter were investigated. After the investigations, Y-Orientation without AC adapter and headset was the worst case for CELL bands, and X-Orientation for PCS bands.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung Electronics	N/A	N/A	DoC
Headset	Samsung Electronics	N/A	N/A	DoC

I/O CABLES (CONDUCTED SETUP)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	RF	1	Antenna Port	Un-Shielded	0.2m	NA
2	RF In/Out	1	Call Box	Un-Shielded	0.5m	NA
3	RF Out	1	Spectrum Analyzer	None	None	NA

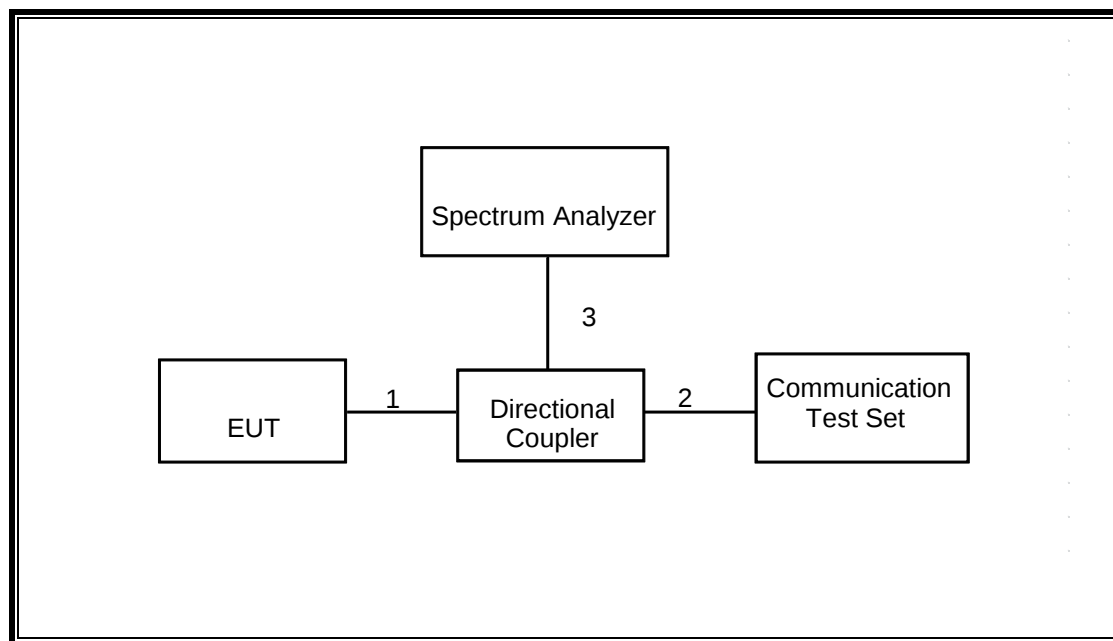
I/O CABLES (RADIATED SETUP)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	DC	Un-shielded	1m	NA
2	Jack	1	Earphone	Un-shielded	1.2m	NA

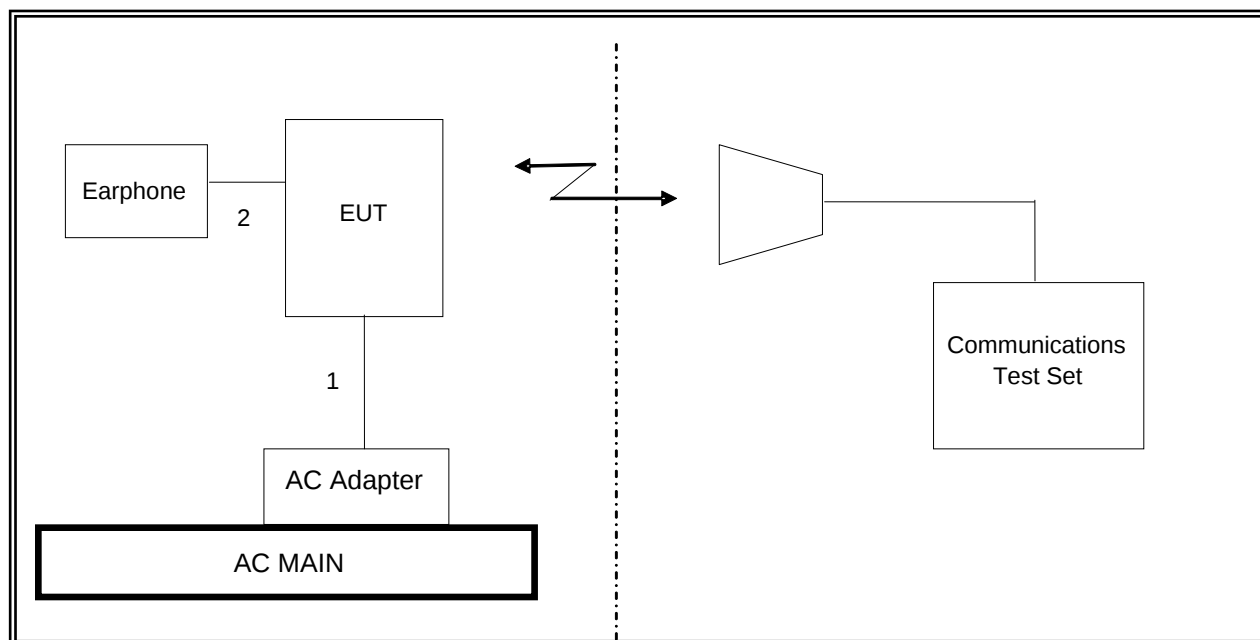
TEST SETUP

The EUT is a stand-alone device. A link is established between the EUT and the communications test set.

SETUP DIAGRAM FOR RF CONDUCTED TESTS



SETUP DIAGRAM FOR RF RADIATED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Horn, 18 GHz	EMCO	3115	C00872	10/25/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/11/13
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01179	02/26/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	10/22/13
Communication Test Set	Agilent / HP	E5515C	C01086	06/20/14
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
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	C01016	08/14/14
Vector signal generator, 6 GHz	Agilent / HP	E4438C	None	07/06/14
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121C DB4	C00993	02/14/14

7. RF POWER OUTPUT VERIFICATION

7.1. GSM/GPRS

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 $VBW \geq RBW \geq 26\text{dB BW}$, typically 3MHz.
- Set a marker to point the corresponding peak value.

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

> 30 dBm for GPRS1800/1900

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 > CS4 (GPRS) and MCS9 (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

7.1.1. GSM OUTPUT POWER RESULT

RESULTS

GSM

PCS

GSM (GMSK) - Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
1900	512	1850.2	29.74
	661	1880.0	29.82
	810	1909.8	29.85

GPRS

GPRS (GMSK) - Coding Scheme: CS1

PCS

Band	Ch No.	Freq. (MHz)	Avg Pwr (dBm)	
			1 time slot	2 time slot
1900	512	1850.2	29.78	27.33
	661	1880.0	29.88	27.40
	810	1909.8	29.92	27.35

7.2. UMTS REL 99

TEST PROCEDURE

The following summary of these settings are illustrated below:

WCDMA General Settings	Mode	Rel99
	Subtest	-
	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	β_c	Not Applicable
	β_d	Not Applicable
	β_{ec}	Not Applicable
	β_c/β_d	8/15
	β_{hs}	Not Applicable
	β_{ed}	Not Applicable

7.2.1. UMTS REL 99 OUTPUT POWER RESULT

Band	Mode	Ch.	f(MHz)	Conducted Power
				Avg (dBm)
Band II	REL 99	9275	1852.4	23.50
		9400	1880	23.80
		9525	1907.6	23.30

7.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel5 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	Algorithm 2			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	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			

7.3.1. UMTS HSDPA OUTPUT POWER RESULT

Band	Mode	Subset	Ch.	f(MHz)	Conducted Power (dBm)
					Avg (dBm)
Band II	HSDPA	1	9662	1852.4	22.5
			9400	1880	22.8
			9525	1907.6	22.1
		2	9275	1852.4	21.5
			9400	1880	21.8
			9525	1907.6	21.3
		3	9275	1852.4	20.6
			9400	1880	20.8
			9525	1907.6	20.2
		4	9275	1852.4	20.6
			9400	1880	20.8
			9525	1907.6	20.3

7.3.2. UMTS HSUPA

TEST PROCEDURE

The following summary of these settings are illustrated below: (ETSI TS 134.121-1 Table C.11.1)

	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				
	P-CPICH (dB)	-10				
	P-CCPCH (dB)	-12				
	SCH (dB)	-12				
	PICH(dB)	-15				
	DPCH (dB)	-9				
	HS-SCCH_1 (dB)	-8				
	HS-PDSCH (dB)	-3				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	Bc	11/15	6/15	15/15	2/15	15/15
	Bd	15/15	15/15	9/15	15/15	15/15
	Bec	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/15
	Bhs	22/15	12/15	30/15	4/15	30/15
	β_{ed} (note1)	1309/225	94/75	47/15 47/15	56/75	134/15
	MPR	0	2	1	2	0
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				
	Ahs = β_{hs}/β_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	21
	Reference E-TFCIs	5	5	2	5	5
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9

	Mode	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA
	Subtest	1	2	3	4	5
	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

Note1: β ed cannot be set directly, it is set by Absolute Grant Value.

7.3.3. UMTS HSUPA OUTPUT POWER RESULT

Band	Mode	Subset	Ch.	f(MHz)	Conducted Power
					Avg (dBm)
Band II	HSUPA	1	9275	1852.4	23.6
			9400	1880	23.8
			9525	1907.6	23.3
		2	9275	1852.4	21.6
			9400	1880	21.8
			9525	1907.6	21.4
		3	9275	1852.4	23.5
			9400	1880	23.7
			9525	1907.6	23.2
		4	9275	1852.4	21.6
			9400	1880	21.9
			9525	1907.6	21.3
		5	9275	1852.4	23.6
			9400	1880	23.7
			9525	1907.6	23.6

7.4. LTE OUTPUT VERIFICATION

7.4.1. LTE OUTPUT RESULT

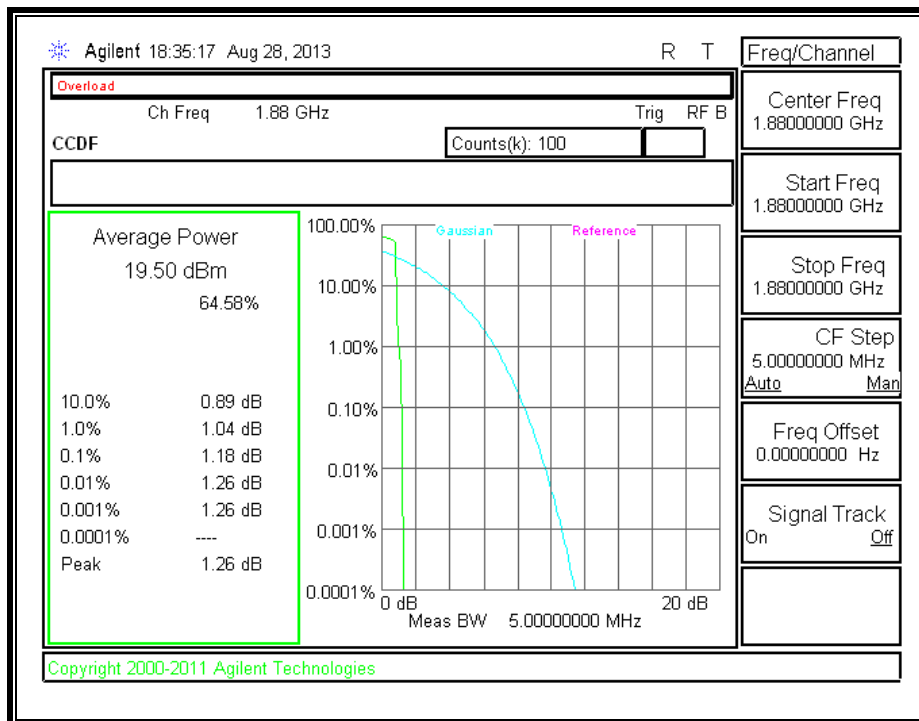
Band	Frequency	Modulation	BW (MHz)	RB Size	RB Offset	Average
LTE5	829	QPSK	10	1	0	23.46
				1	24	23.38
				1	49	23.05
				25	0	22.36
				25	11	22.34
				25	24	22.22
				50	0	22.35
	829	16QAM		1	0	22.68
				1	24	22.66
				1	49	22.42
				25	0	21.17
				25	11	21.28
				25	24	21.09
				50	0	21.19
	836.5	QPSK		1	0	23.94
				1	24	23.73
				1	49	23.30
				25	0	22.24
				25	11	22.26
				25	24	22.28
				50	0	22.33
	836.5	16QAM		1	0	22.21
				1	24	22.08
				1	49	22.30
				25	0	20.96
				25	11	21.04
				25	24	20.91
				50	0	21.16
	844	QPSK		1	0	23.71
				1	24	23.69
				1	49	23.25
				25	0	22.20
				25	11	22.19
				25	24	22.06
				50	0	22.20
	844	16QAM		1	0	22.81
				1	24	22.40
				1	49	22.65
				25	0	21.14
				25	11	21.08
				25	24	20.92
				50	0	21.08

Band	Frequency	Modulation	BW (MHz)	RB Size	RB Offset	Average
LTE5	826.5	QPSK	5	1	0	23.69
				1	11	23.16
				1	24	23.39
				12	0	22.37
				12	5	22.42
				12	11	22.39
				25	0	22.36
	826.5	16QAM		1	0	22.23
				1	11	22.22
				1	24	22.29
				12	0	20.70
				12	5	20.73
				12	11	20.75
				25	0	21.02
	836.5	QPSK		1	0	23.92
				1	11	23.87
				1	24	23.58
				12	0	22.23
				12	5	22.16
				12	11	22.10
				25	0	22.23
	836.5	16QAM		1	0	22.27
				1	11	22.30
				1	24	22.24
				12	0	20.95
				12	5	20.90
				12	11	20.82
				25	0	21.03
	846.5	QPSK		1	0	23.82
				1	11	23.62
				1	24	23.31
				12	0	22.30
				12	5	22.23
				12	11	22.11
				25	0	22.20
	846.5	16QAM		1	0	22.82
				1	11	22.67
				1	24	22.41
				12	0	20.92
				12	5	20.86
				12	11	20.81
				25	0	21.10

8. PEAK TO AVERAGE POWER RATIO

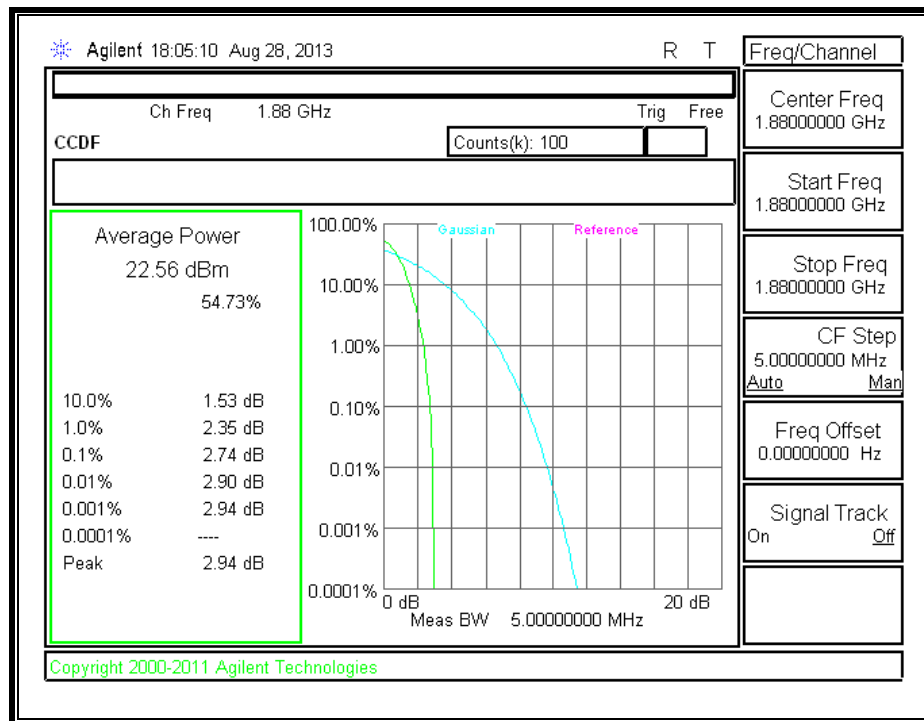
8.1. GPRS

PCS



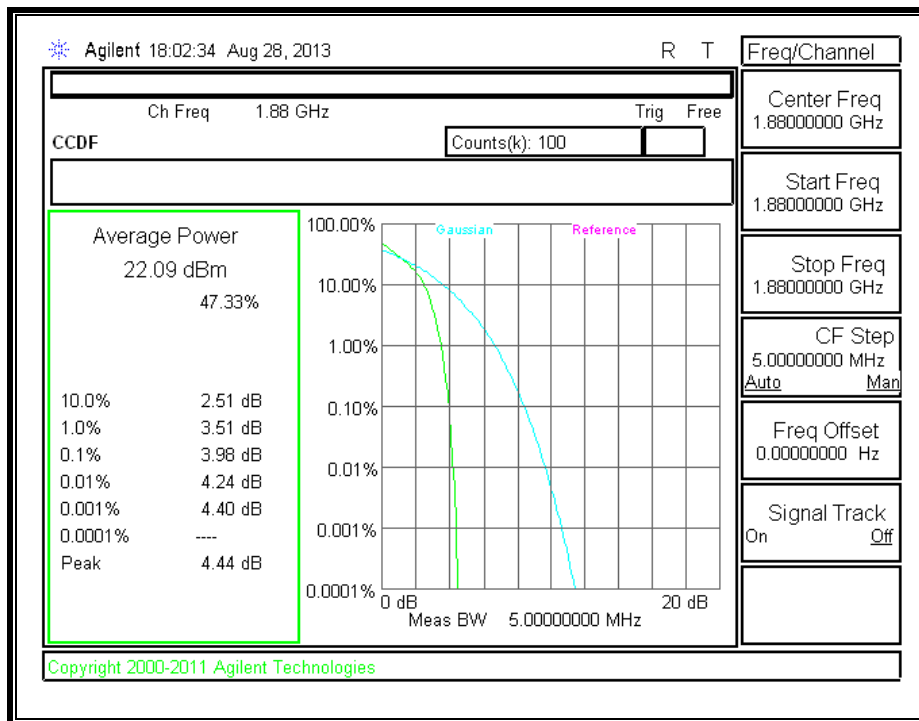
8.1. WCDMA REL 99

BAND 2



8.1. WCDMA HSUPA

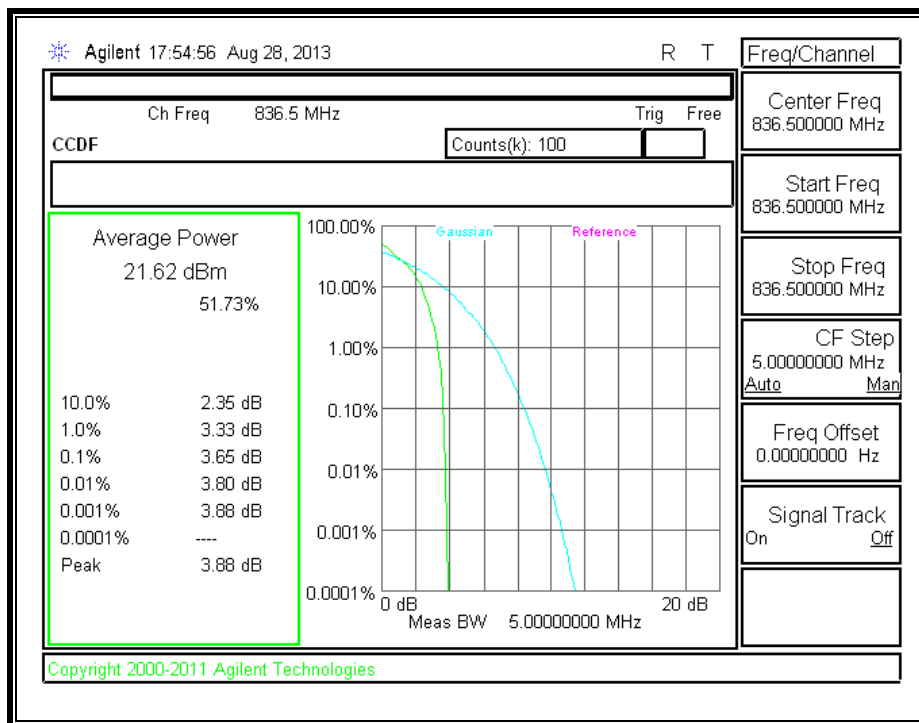
BAND 2



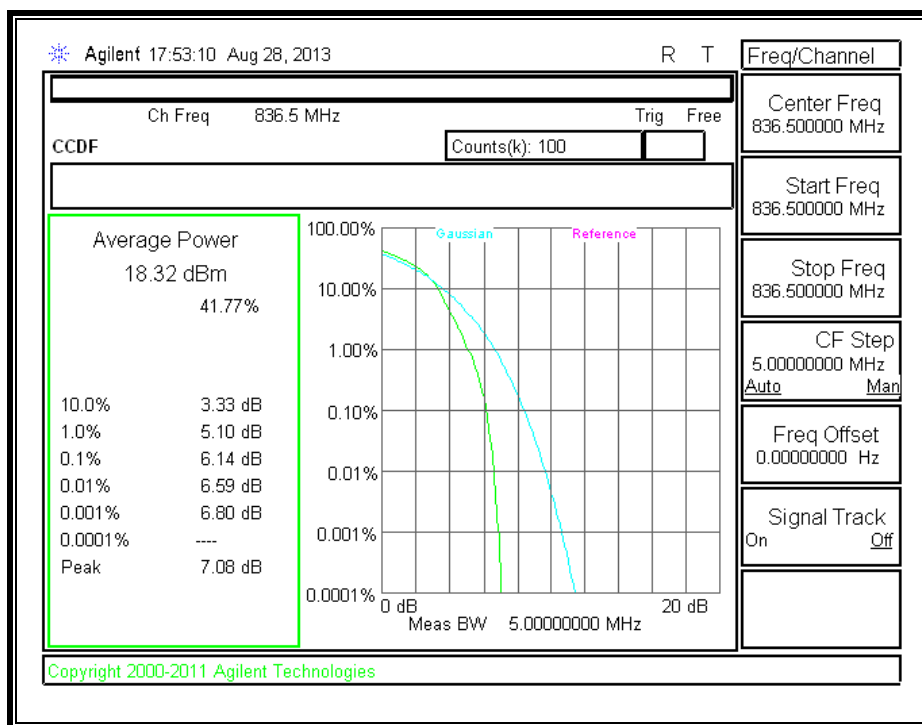
8.2. LTE BAND 5

8.2.1. 5 MHz

QPSK

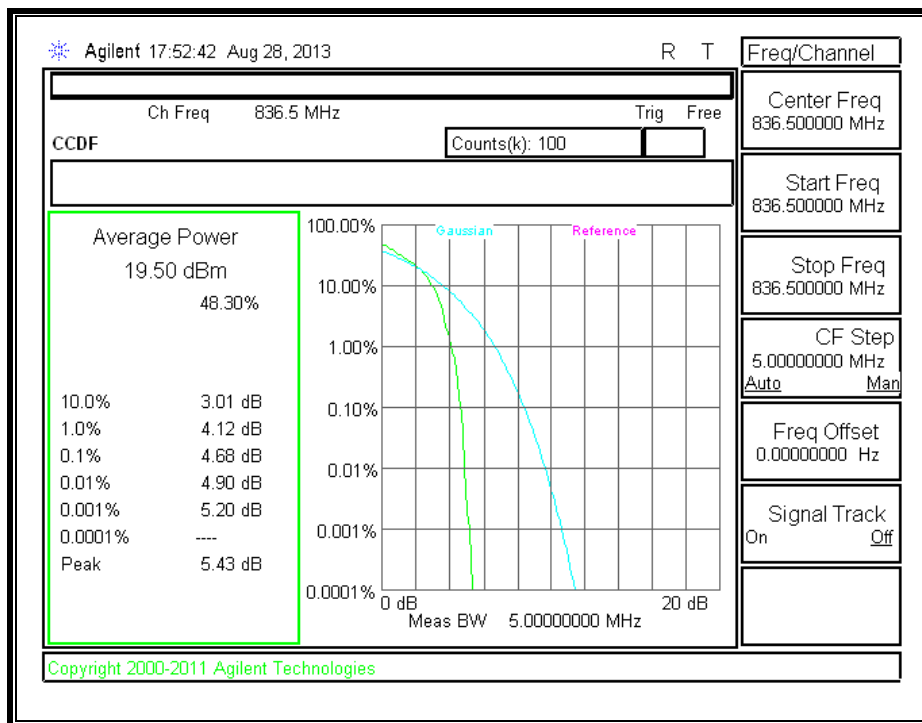


16QAM

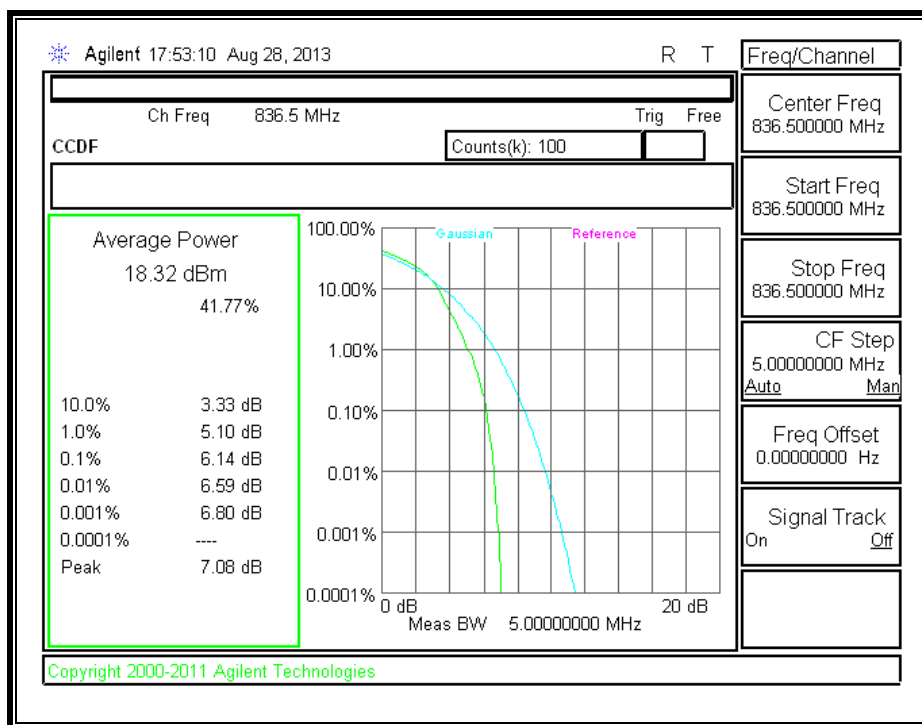


8.2.2. 10 MHz

QPSK



16QAM



9. CONDUCTED TEST RESULTS

10. 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

- GPRS
- UMTS REL 99, and HSUPA
- LTE BAND 5

RESULTS

GPRS

Band	Channel	f (MHz)	99% BW (kHz)	-26dB BW (kHz)
PCS	512	1850.2	250.2790	316.088
	661	1880.0	241.8306	317.866
	810	1909.8	245.4879	295.661

REL 99

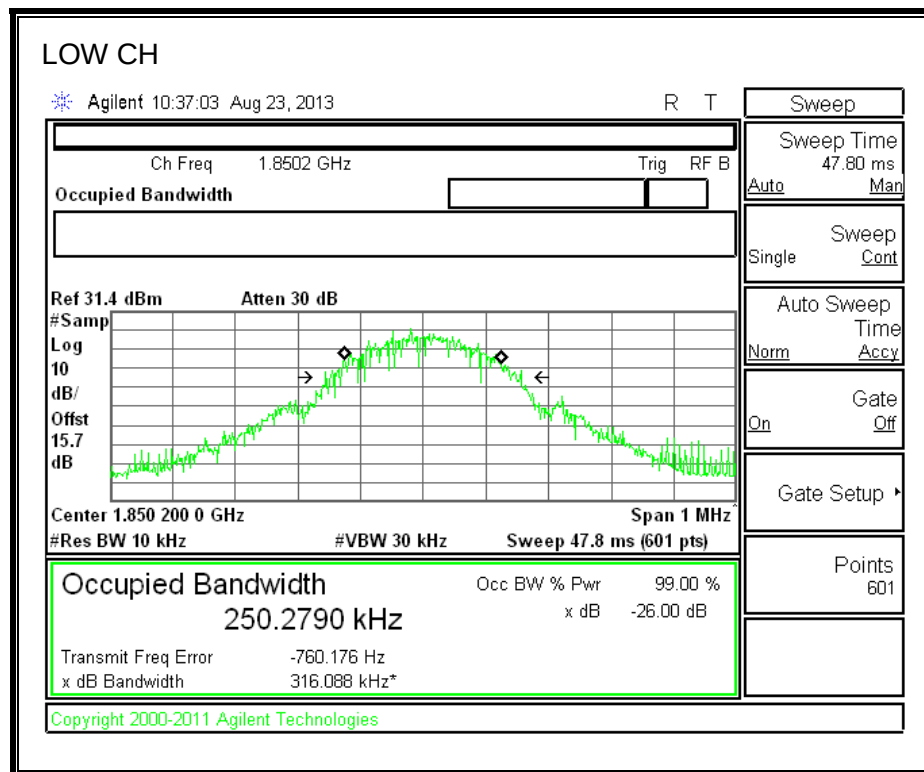
Band	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 2	9662	1852.4	4.2342	4.924
	9800	1880	4.2539	4.940
	9938	1907.6	4.2956	4.959

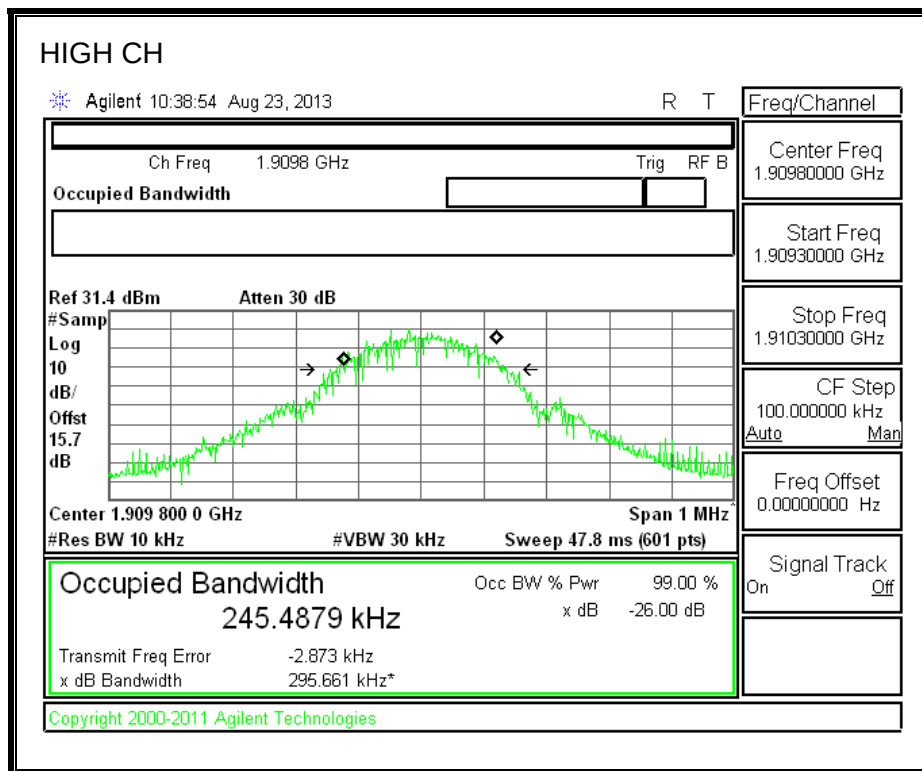
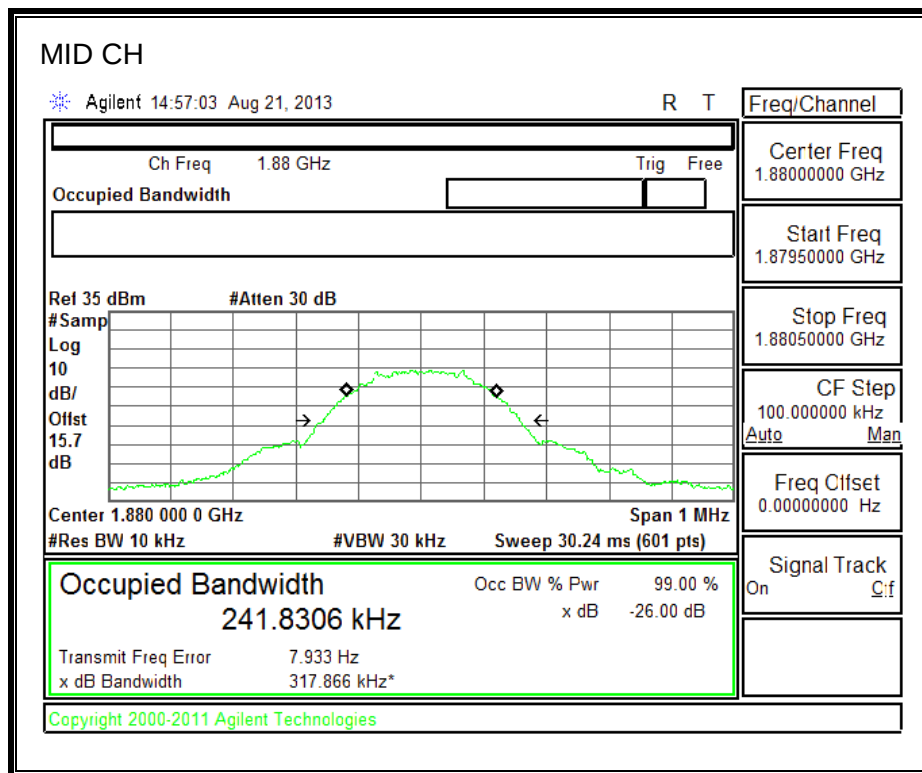
HSUPA

Band	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 2	9662	1852.4	4.2542	4.946
	9800	1880	4.3013	5.050
	9938	1907.6	4.272	5.024

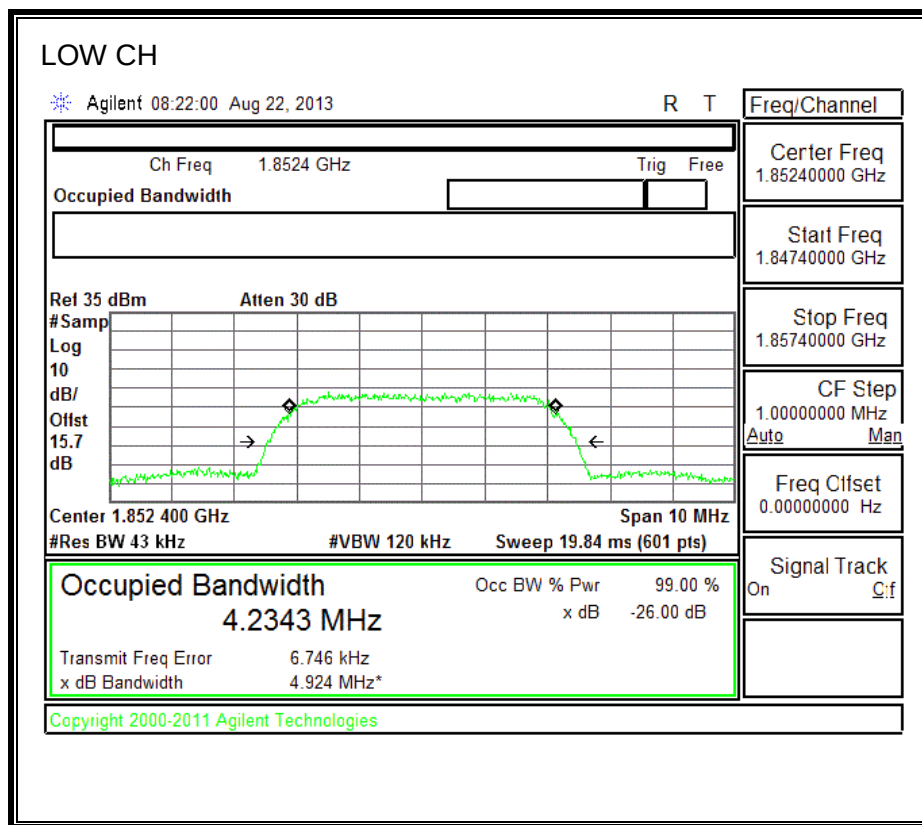
LTE Band 5

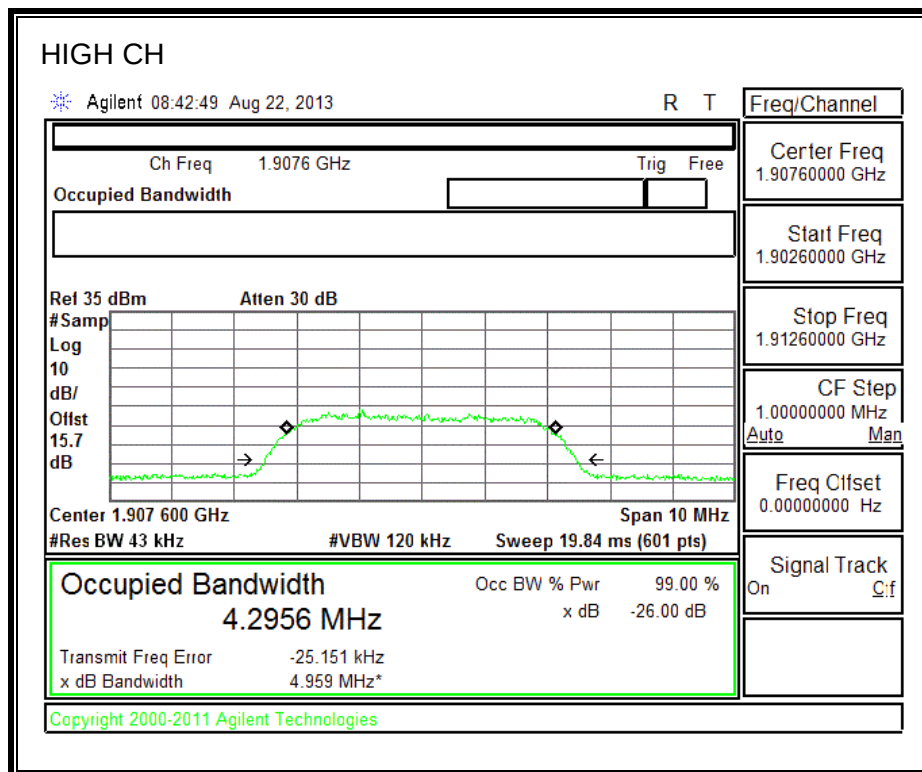
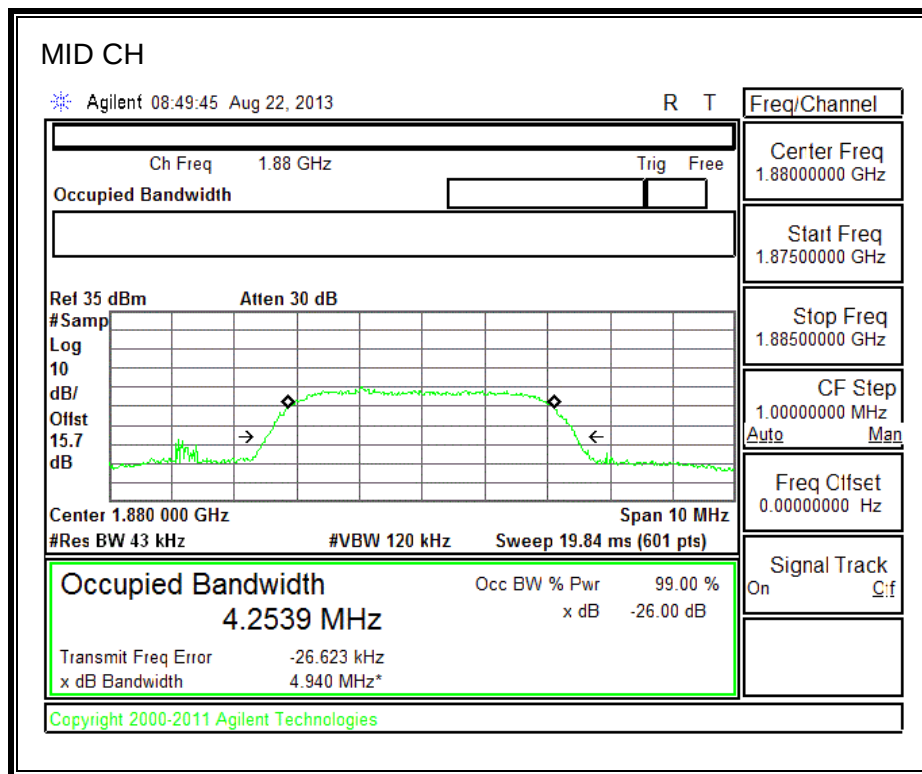
Band	Mode	RB/RB SIZE	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE Band 5	5.0 MHz BAND	12/5	826.5	2.2505	3.464
	QPSK	25/0		4.5208	4.942
	5.0 MHz BAND	12/5		2.2530	3.263
	16QAM	25/0		4.5177	4.993
	5.0 MHz BAND	12/5	836.5	2.2415	3.188
	QPSK	25/0		4.5215	5.010
	5.0 MHz BAND	12/5		2.2400	3.354
	16QAM	25/0		4.5238	5.000
	5.0 MHz BAND	12/5	846.5	2.2350	3.358
	QPSK	25/0		4.5386	4.974
	5.0 MHz BAND	12/5		2.2143	3.083
	16QAM	25/0		4.5470	5.012
	10 MHz BAND	25/11	829	4.4748	5.282
	QPSK	50/0		8.9753	9.830
	10 MHz BAND	25/11		4.5839	5.798
	16QAM	50/0		8.9685	9.954
	10 MHz BAND	25/11	836.5	4.6116	5.992
	QPSK	50/0		8.9930	9.780
	10 MHz BAND	25/11		4.5746	5.881
	16QAM	50/0		8.9688	9.836
	10 MHz BAND	25/11	844	4.7767	6.517
	QPSK	50/0		9.0039	9.936
	10 MHz BAND	25/11		4.7548	6.450
	16QAM	50/0		8.9939	9.740

PCS BAND

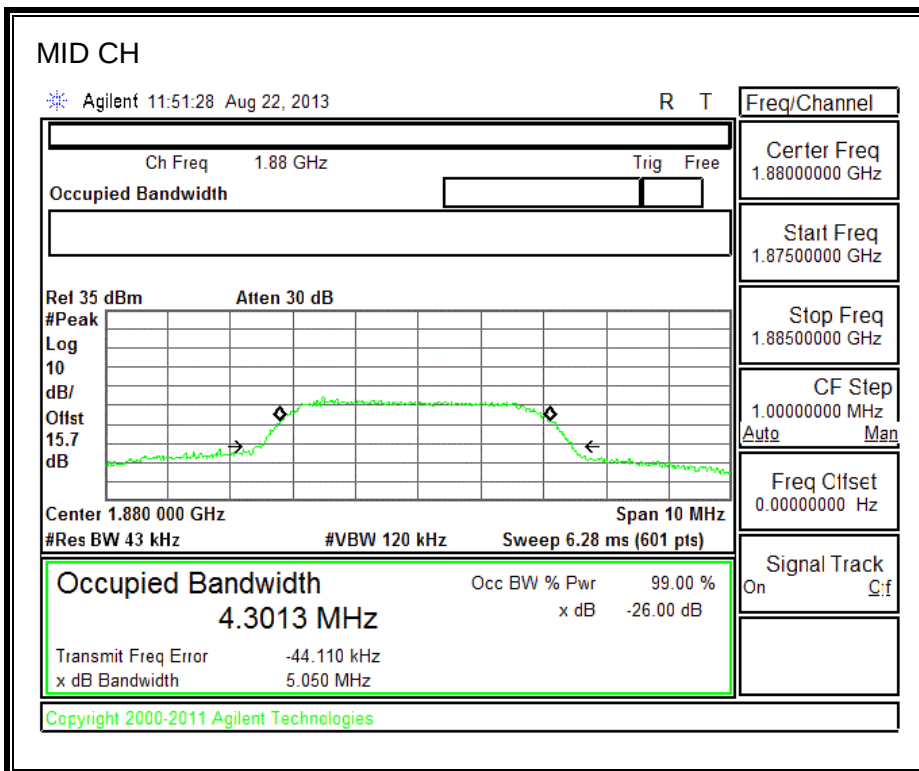
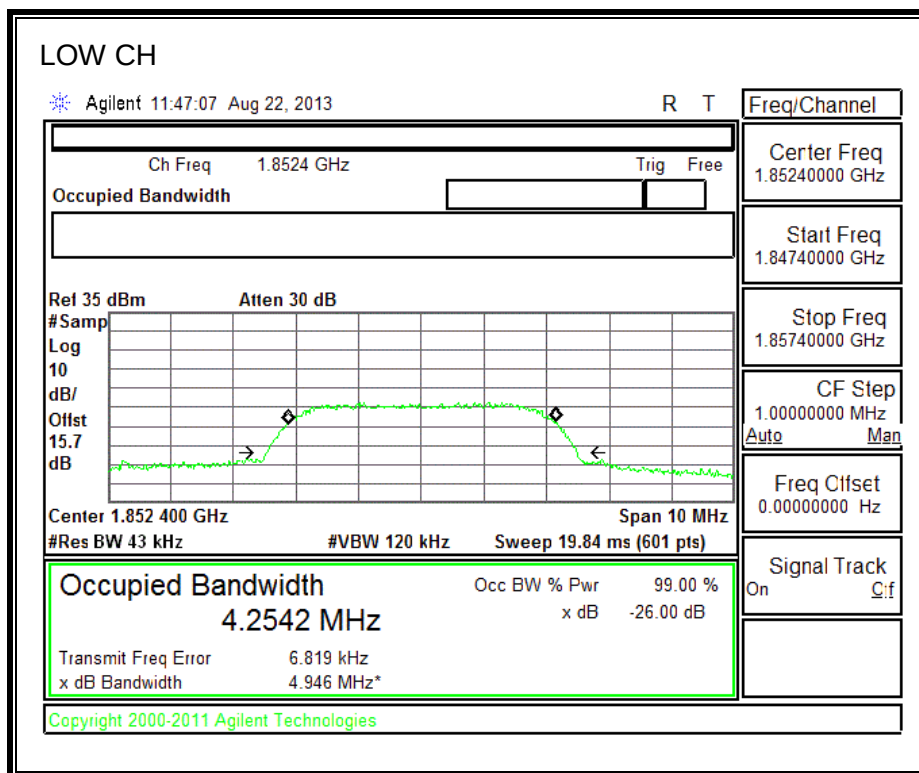


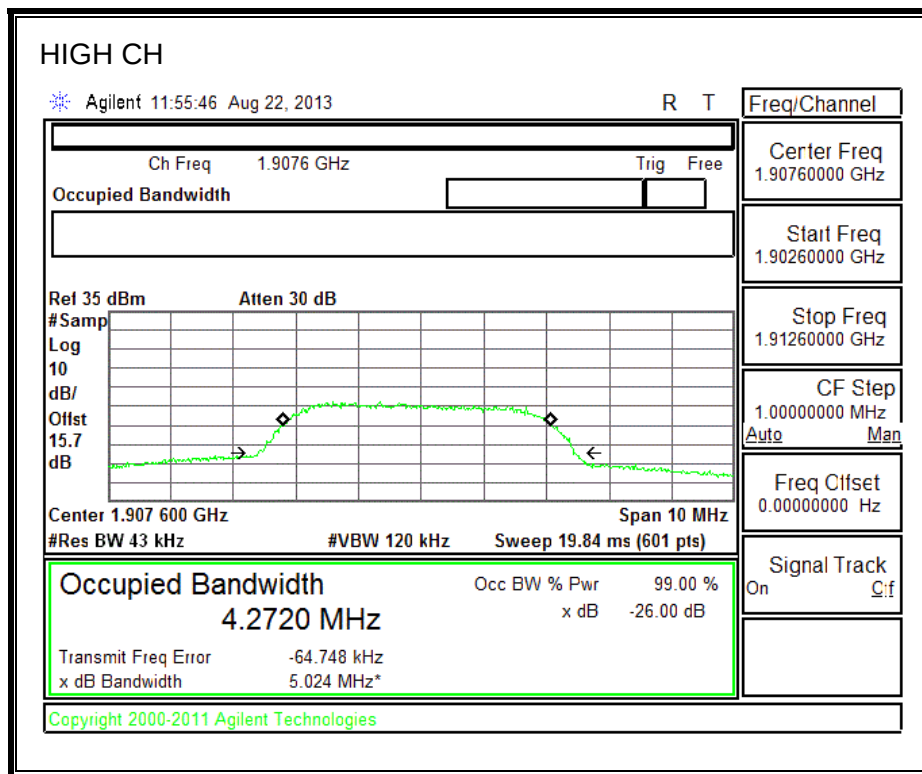
10.1.1. UMTS REL 99 MODE





10.1.2. WCDMA HSUPA

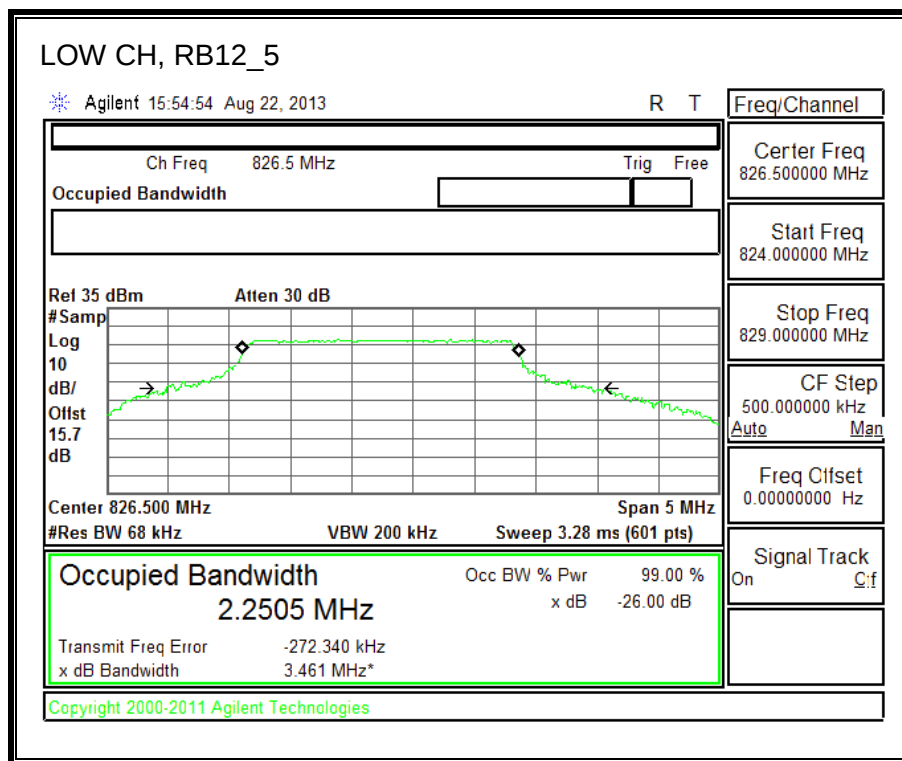


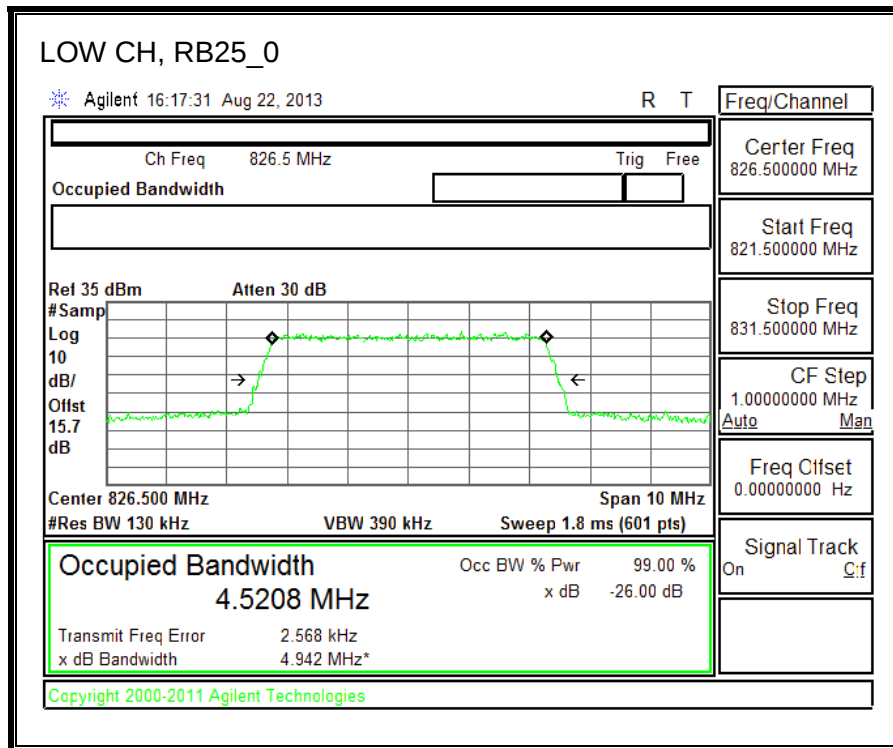


10.2. LTE Band 5

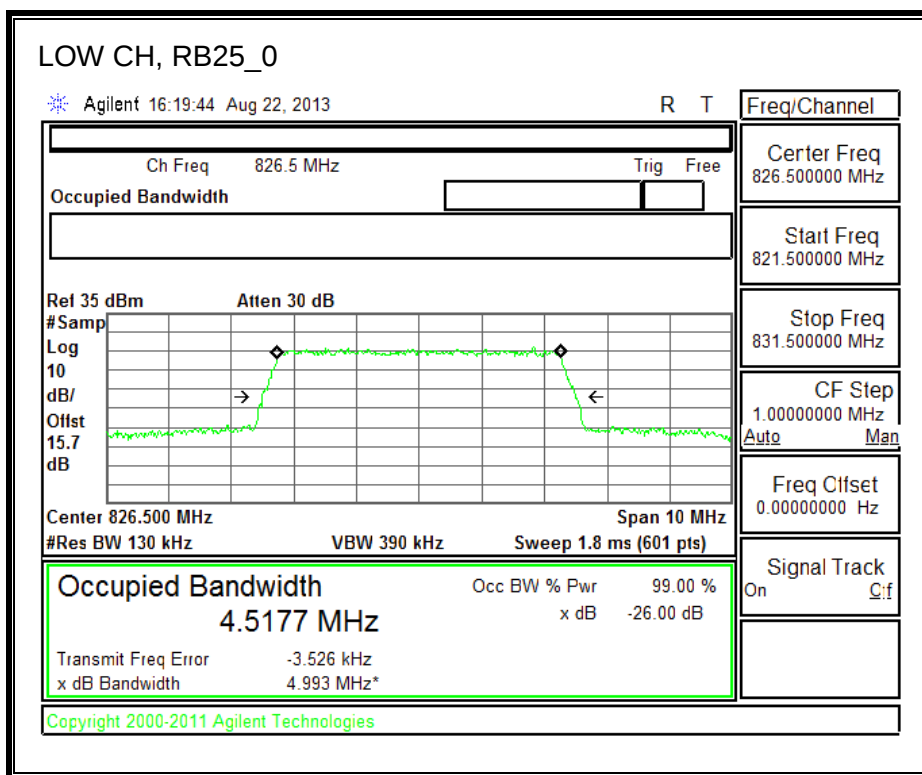
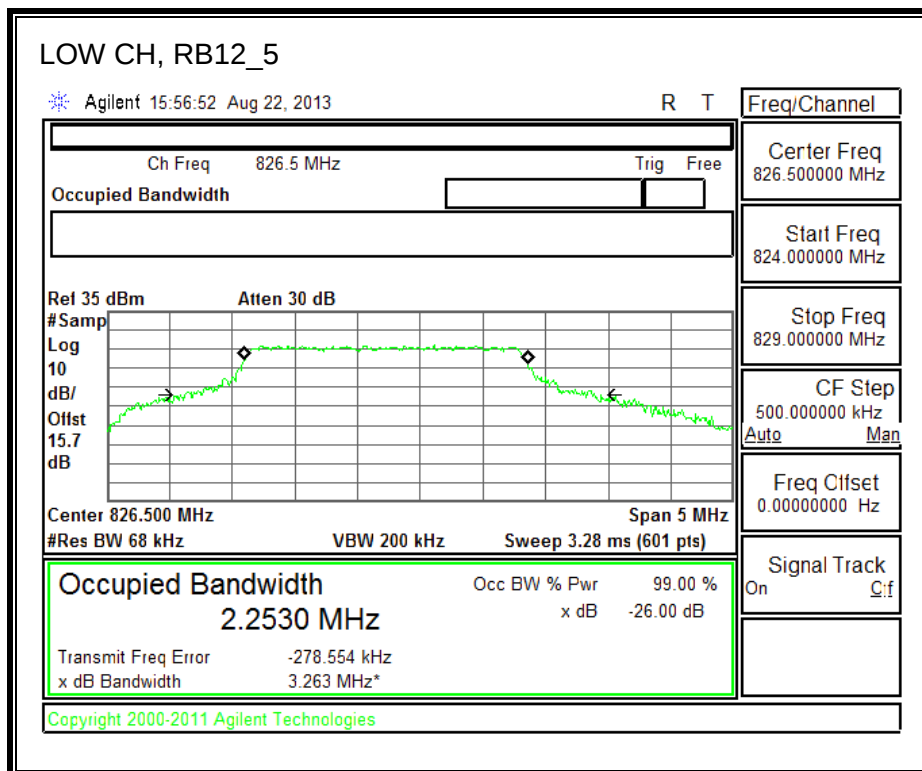
10.2.1. LTE BAND 5-5MHz BANDWIDTH

LOW-QPSK

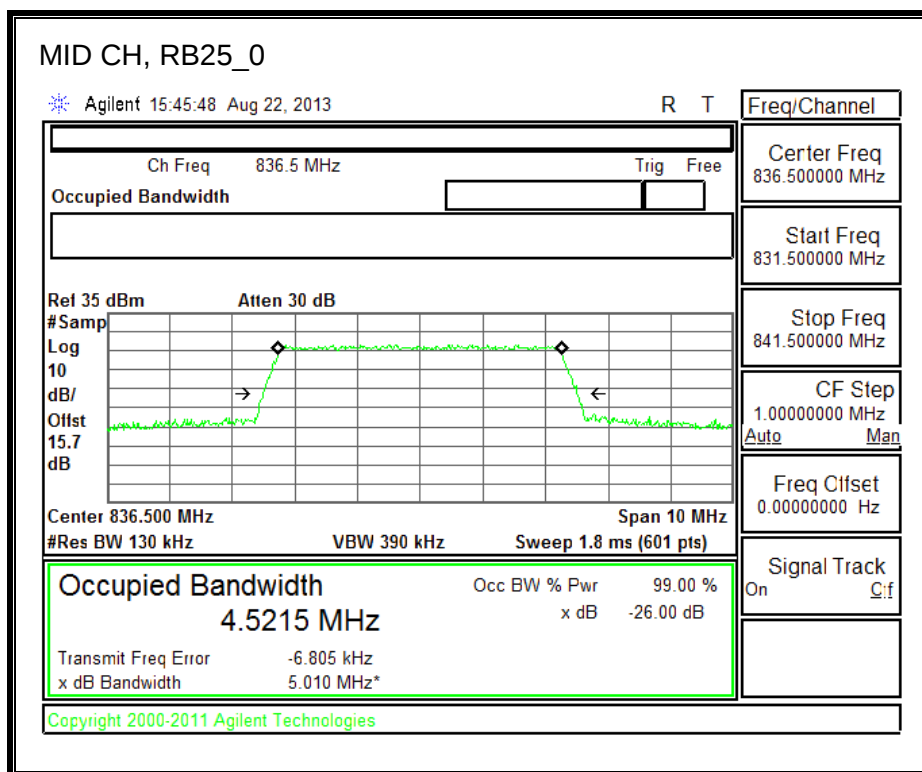
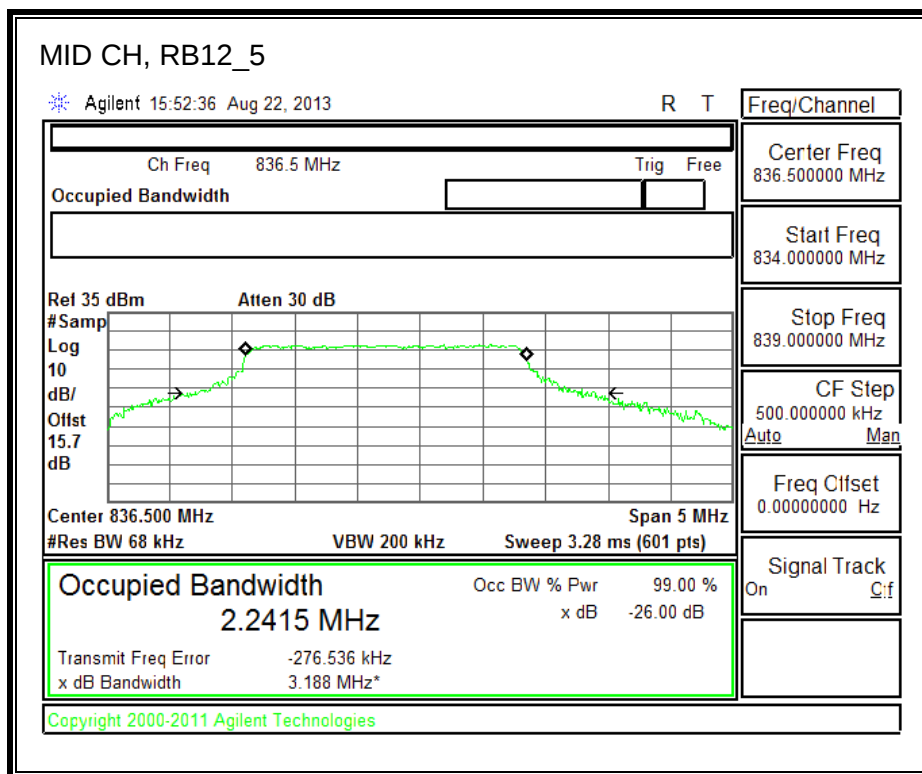




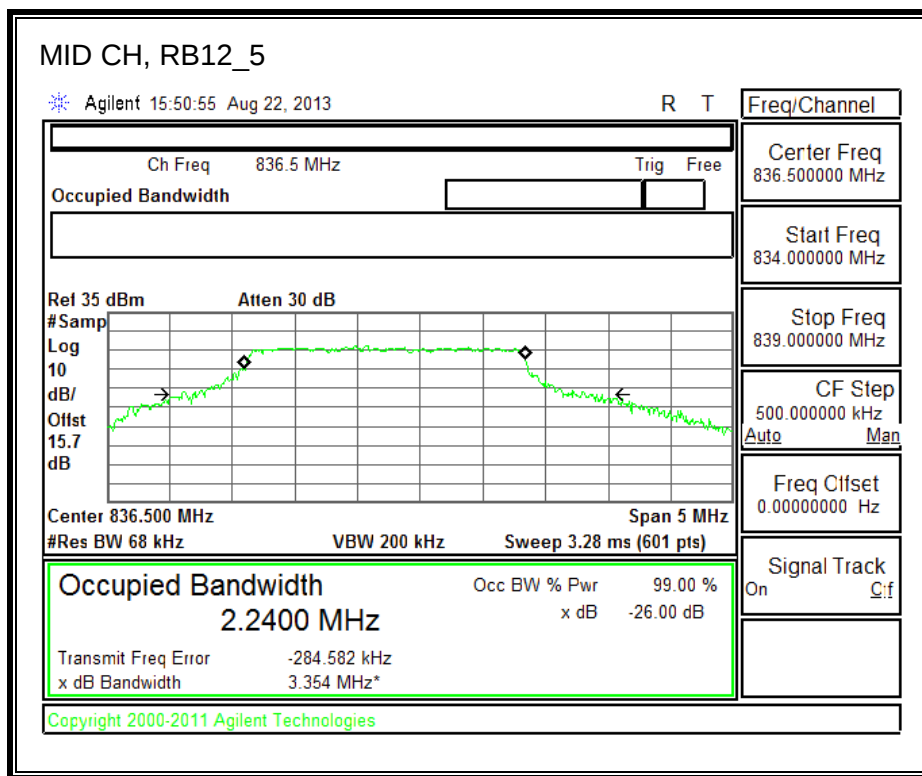
LOW-16QAM

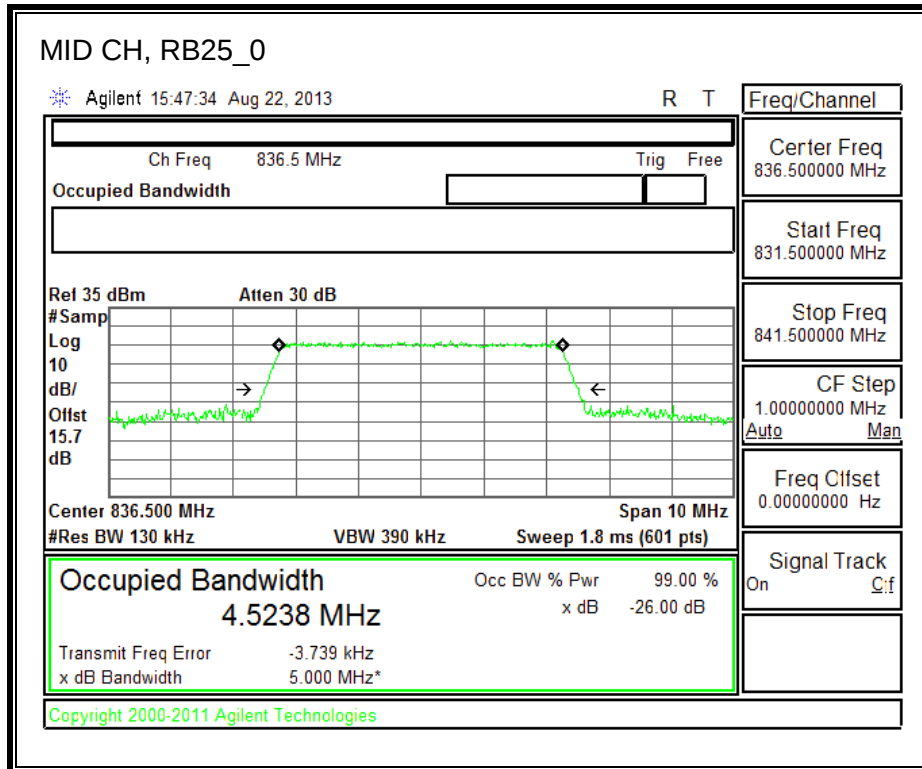


MID-QPSK

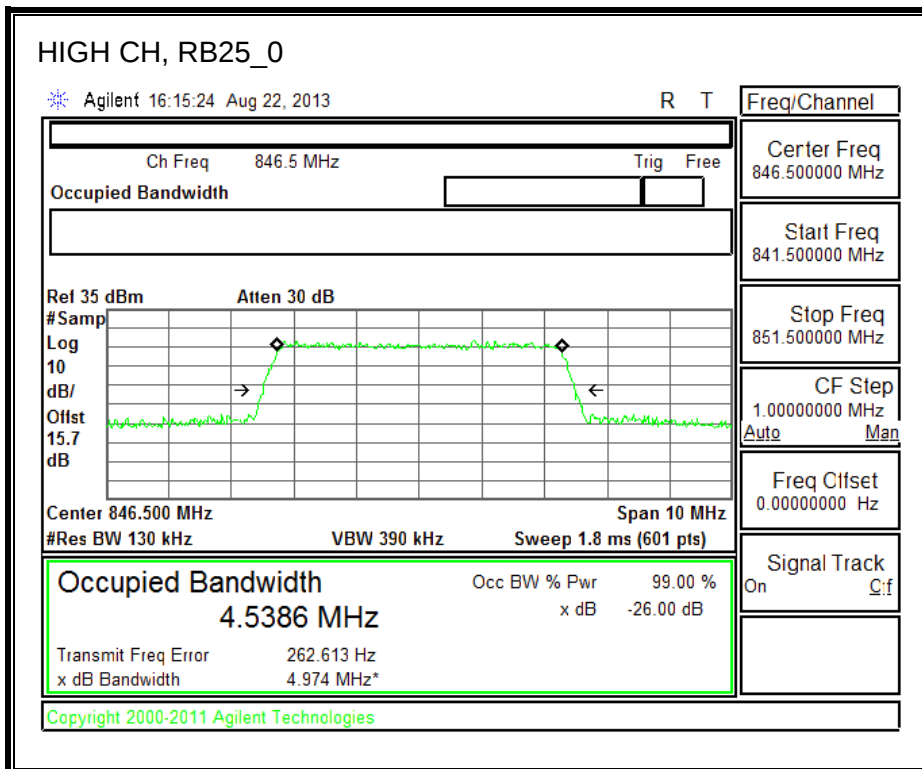
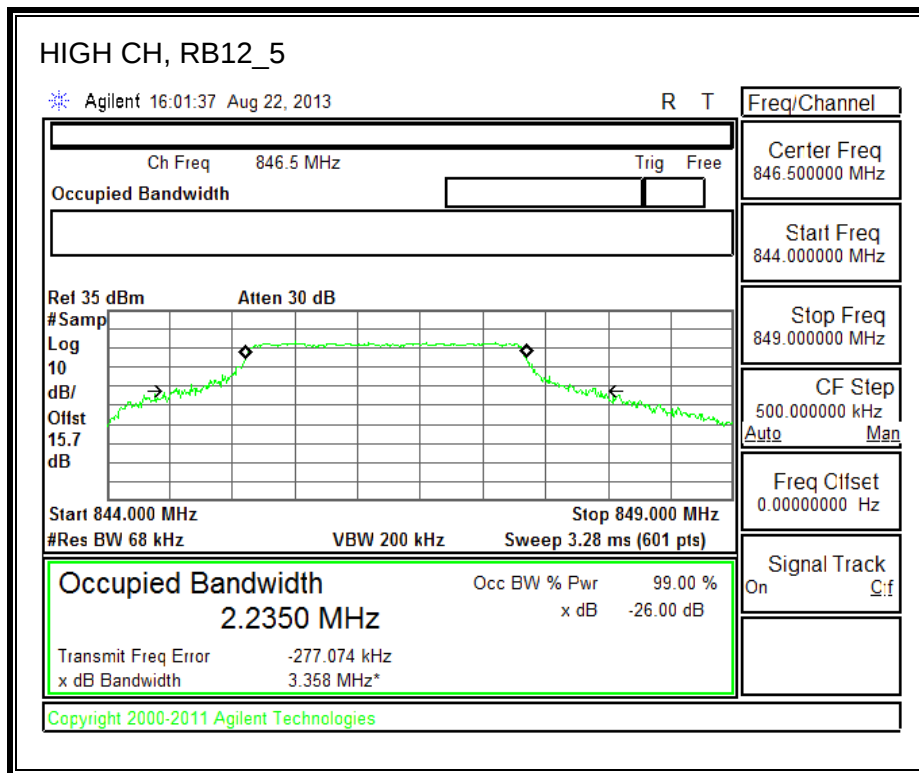


MID-16QAM

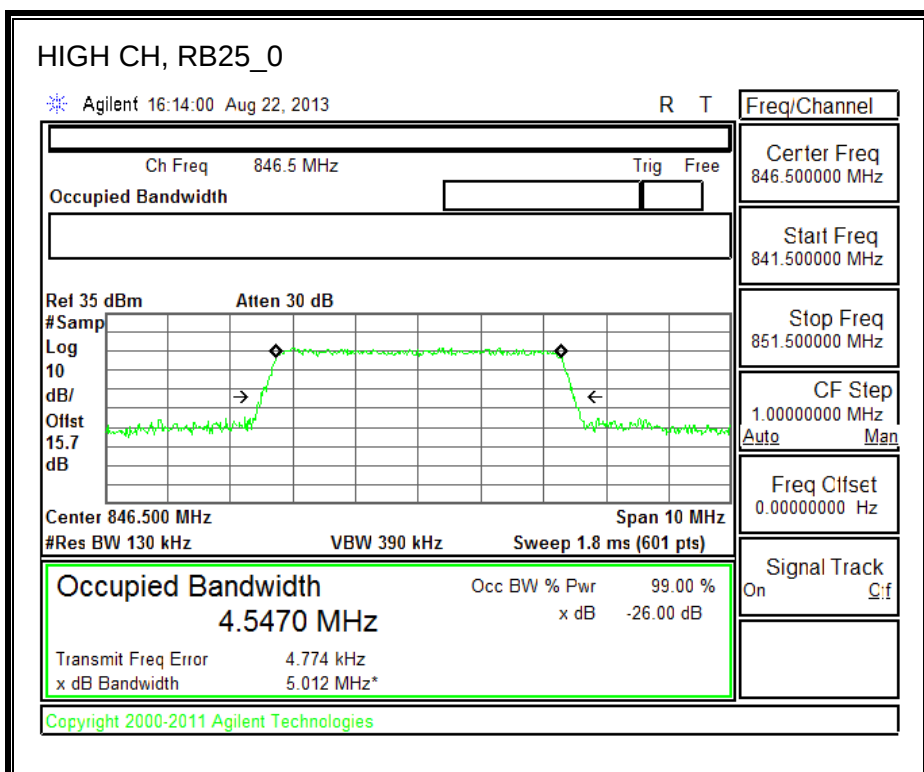
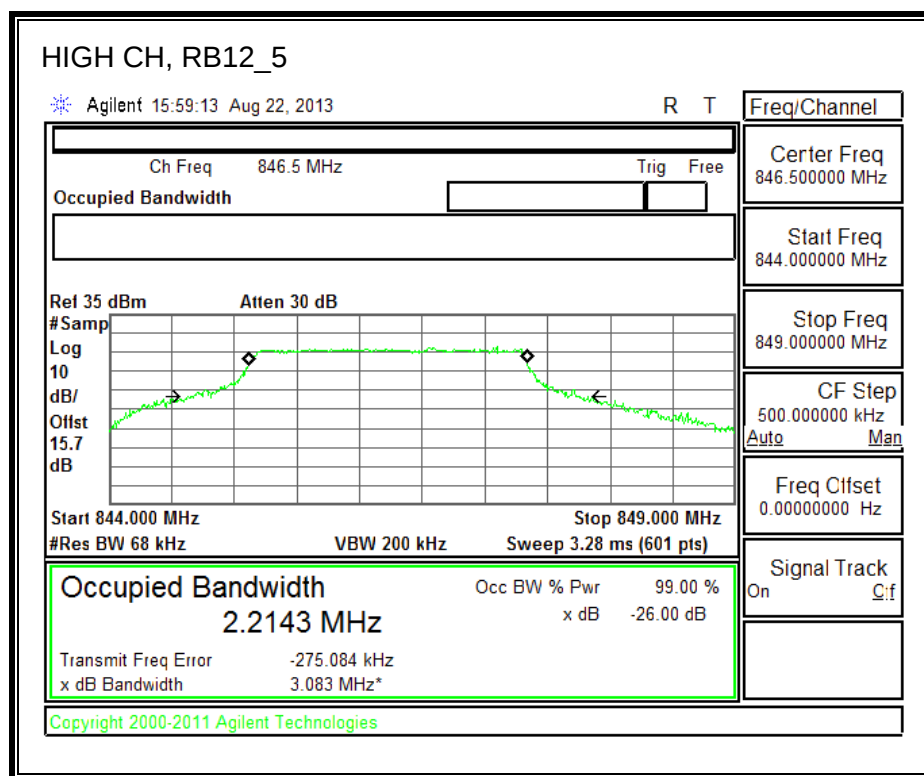




HIGH-QPSK

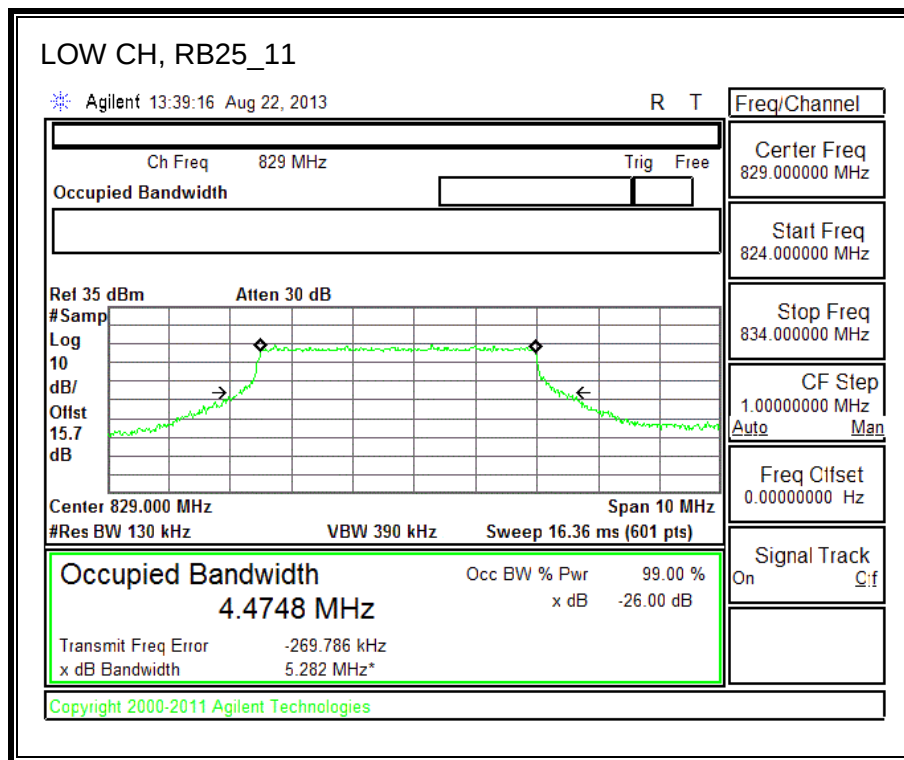


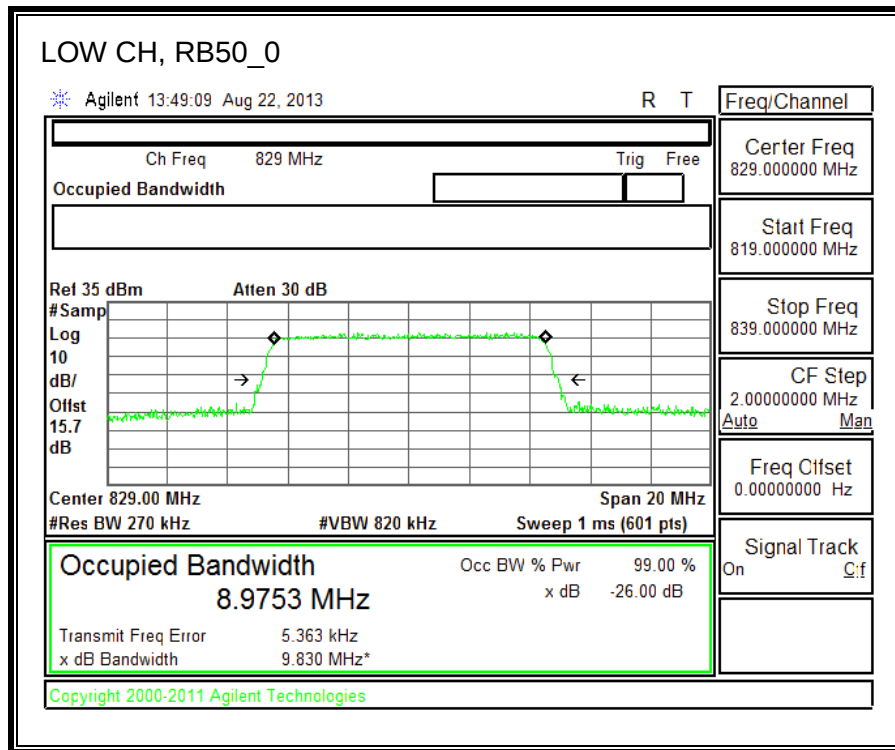
HIGH-16QAM



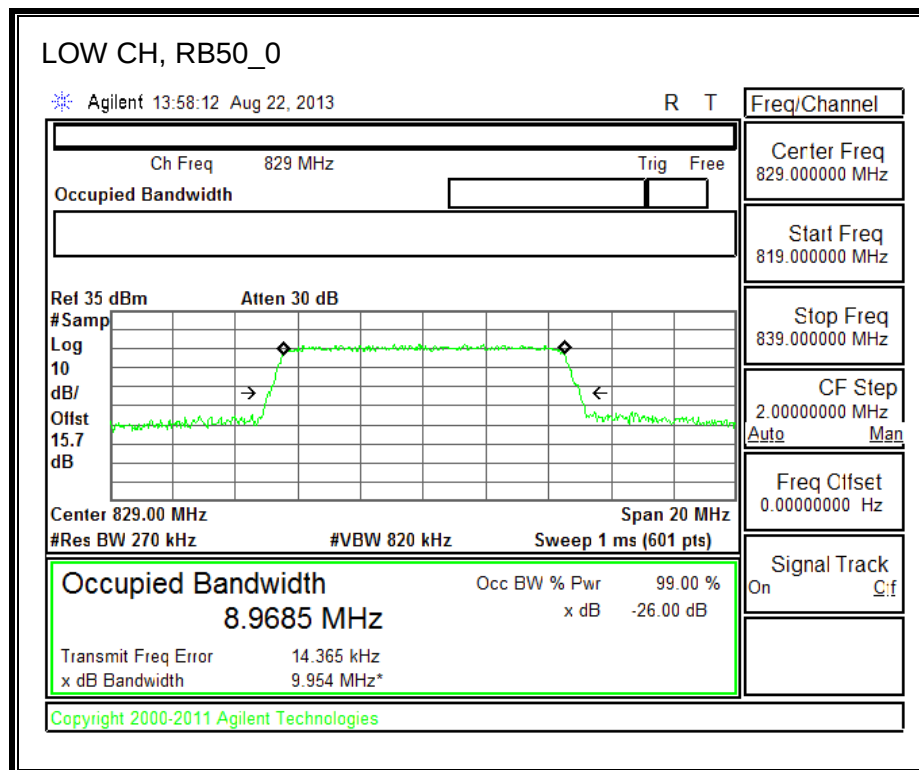
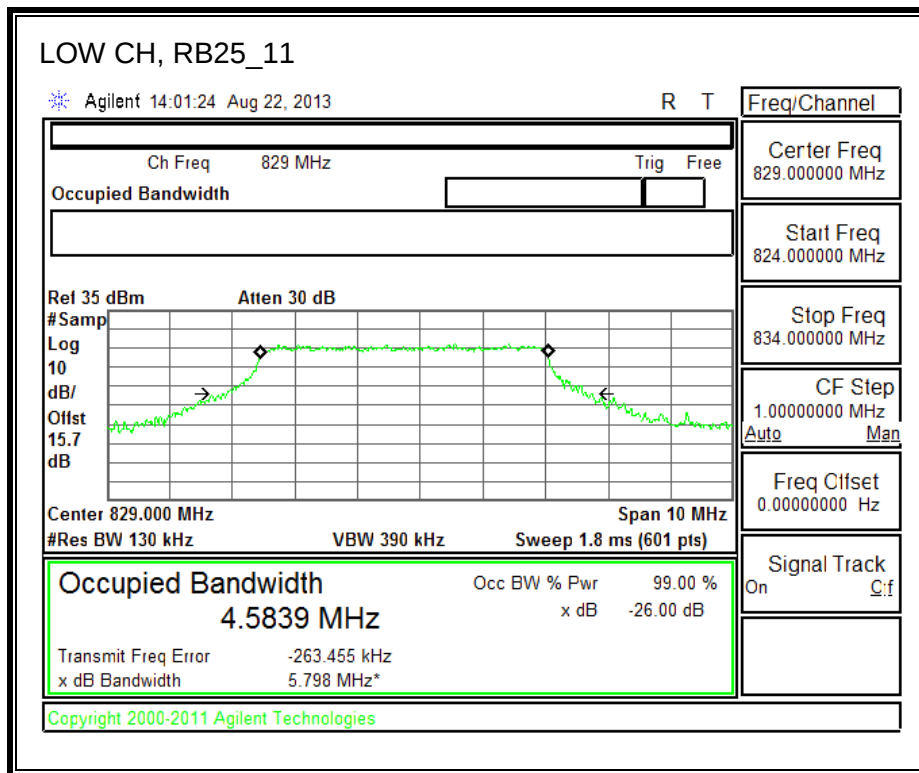
10.2.2. LTE BAND 5-10MHz BANDWIDTH

LOW-QPSK

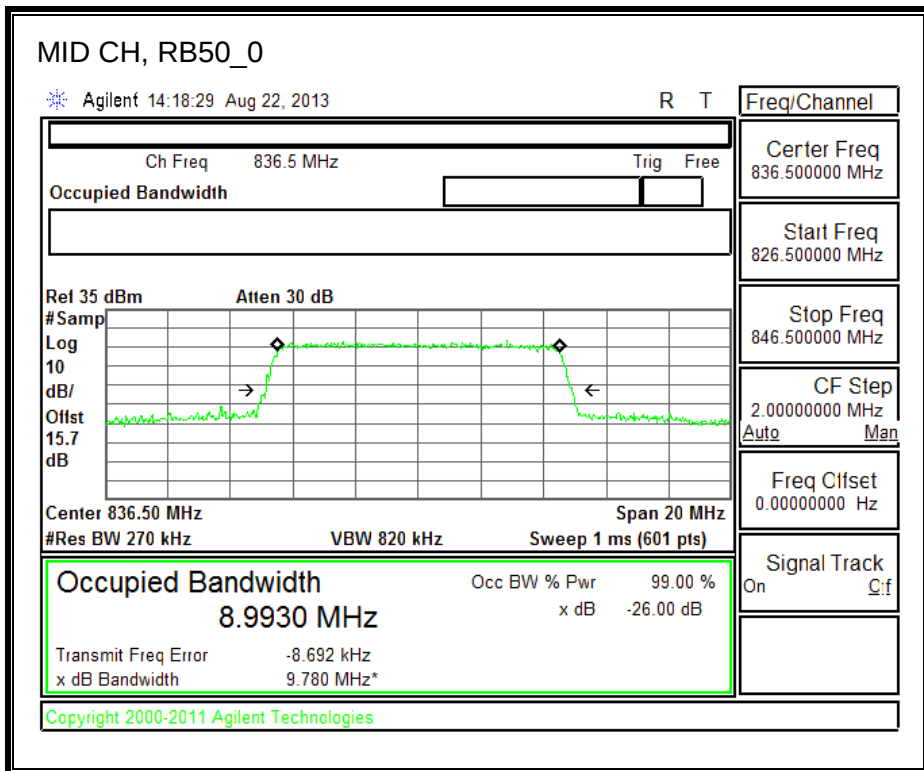
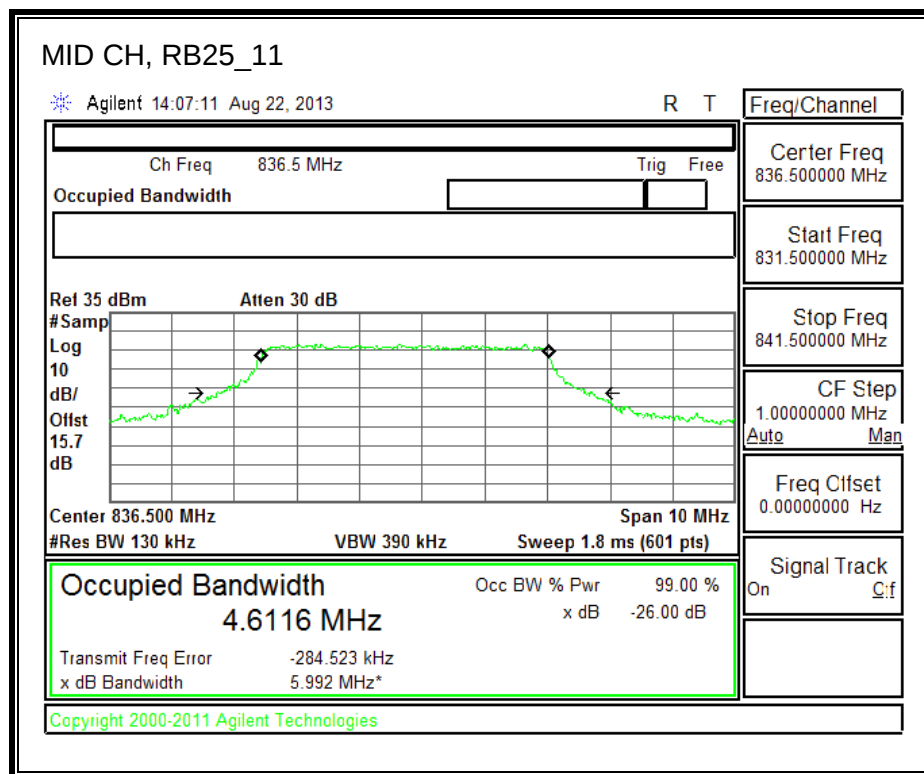




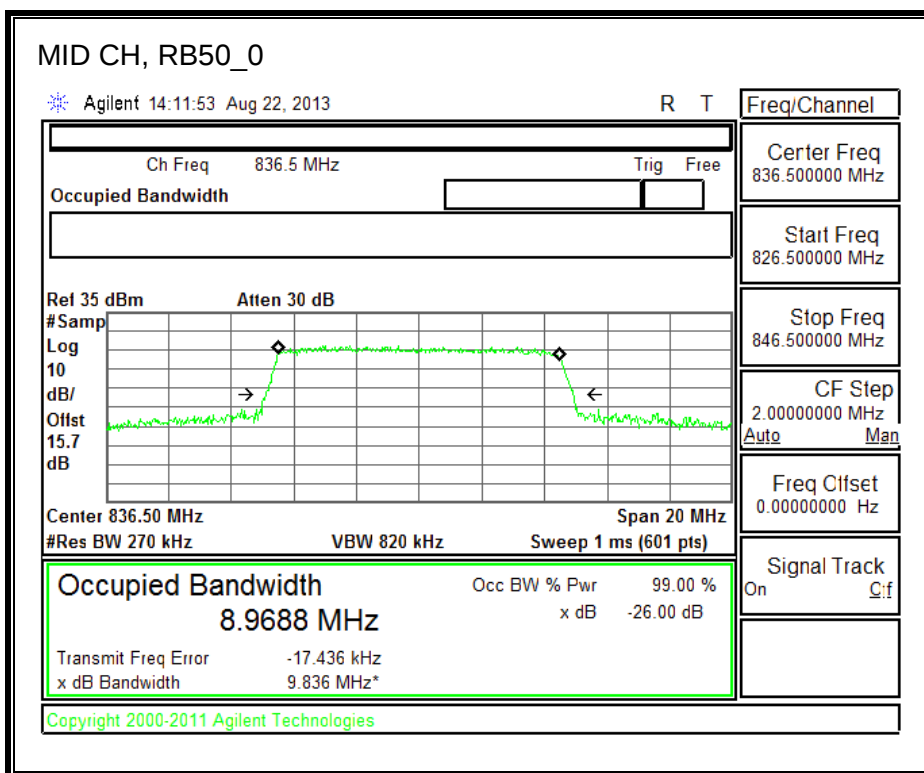
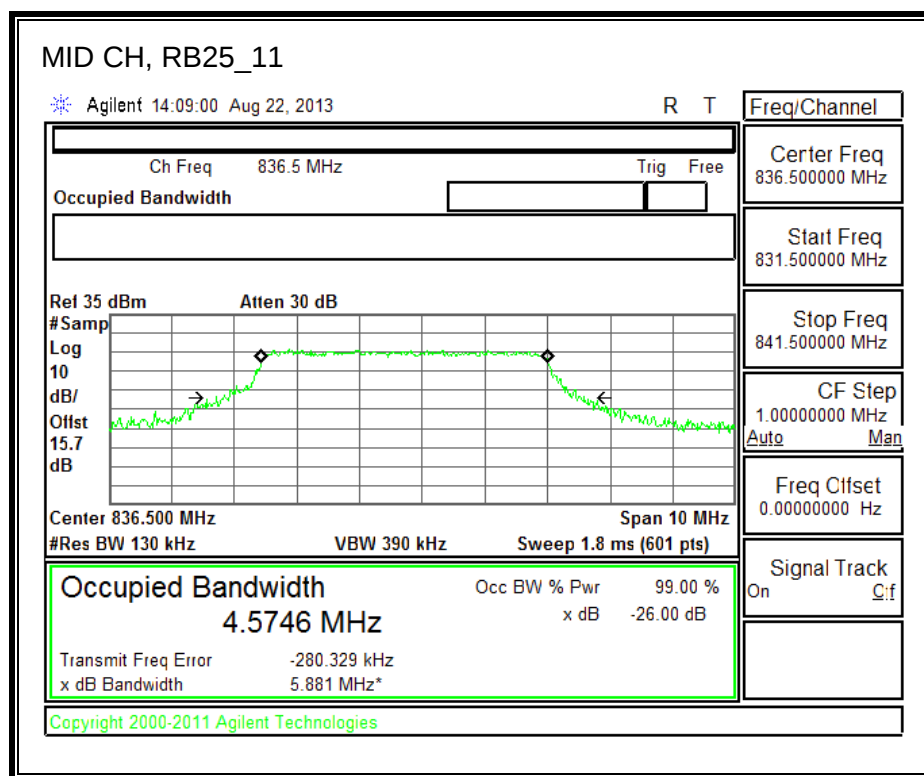
LOW-16QAM



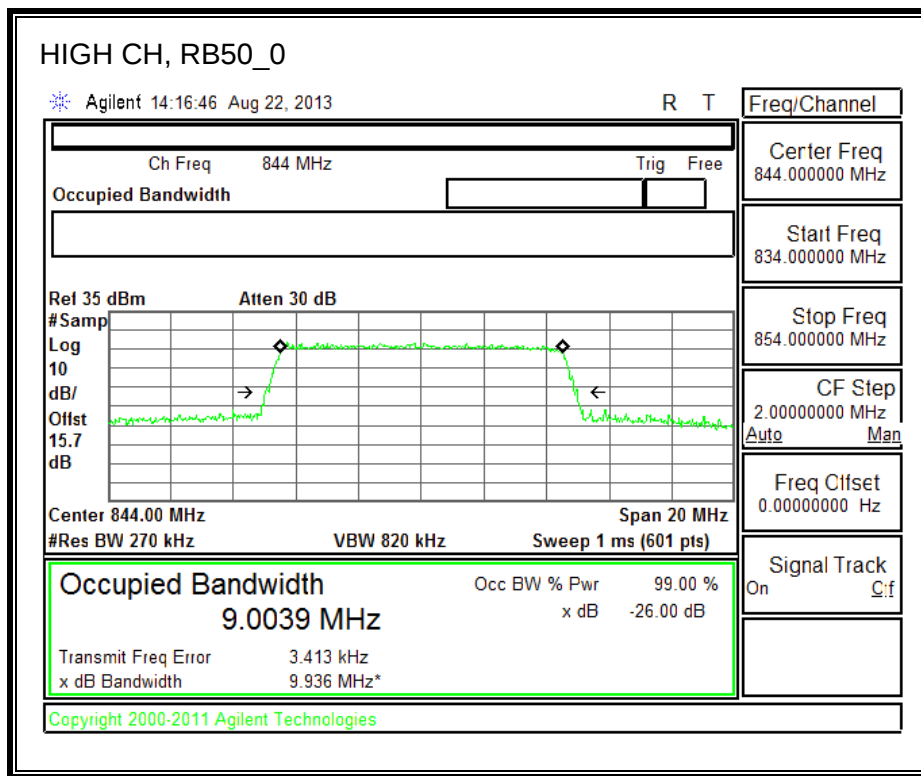
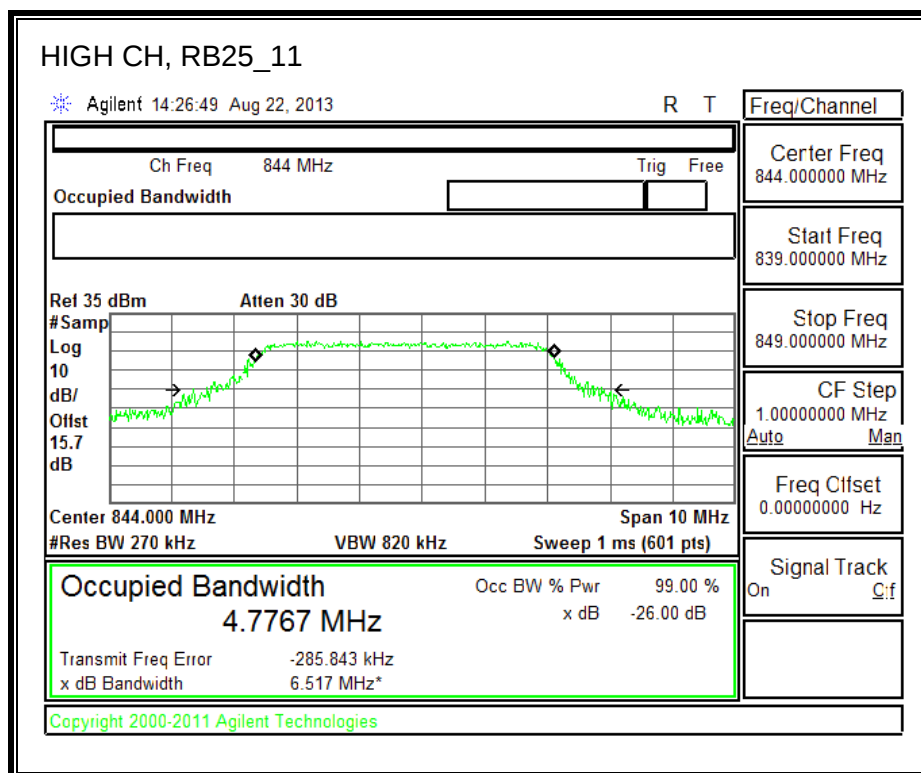
MID-QPSK



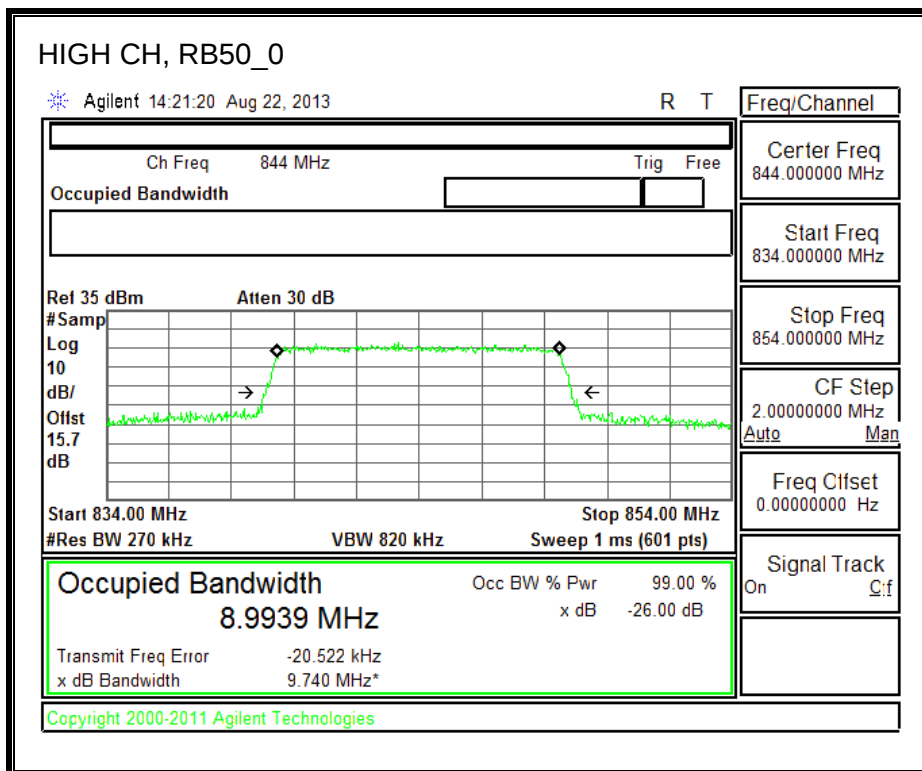
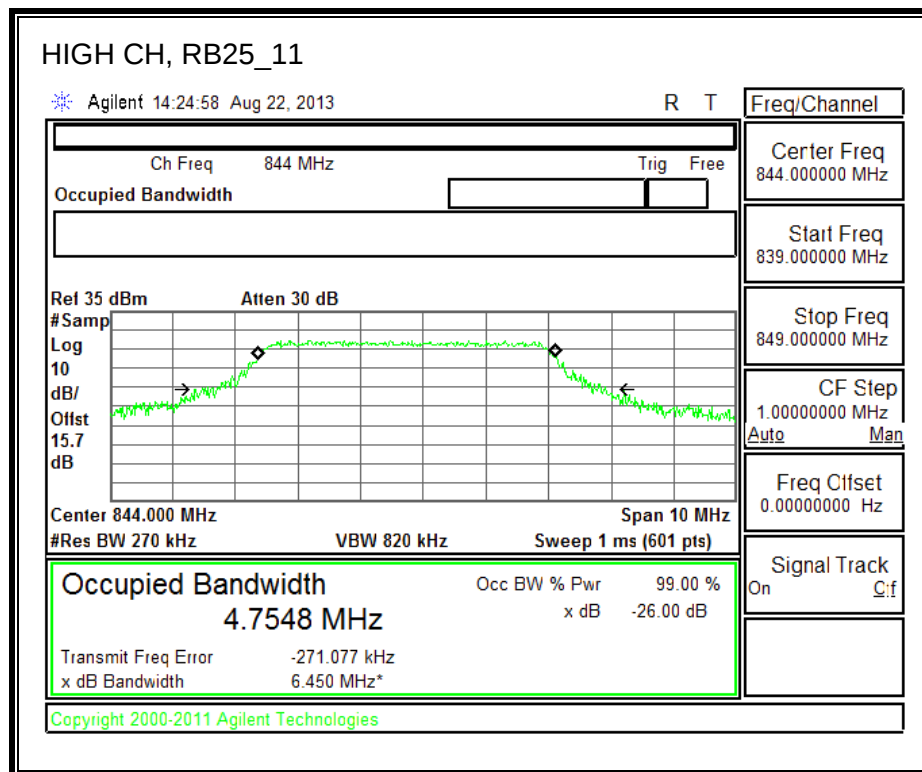
MID-16QAM



HIGH-QPSK



HIGH-16QAM



11. BAND EDGE

RULE PART(S)

FCC: §22.359, 24.238

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, 848, 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.

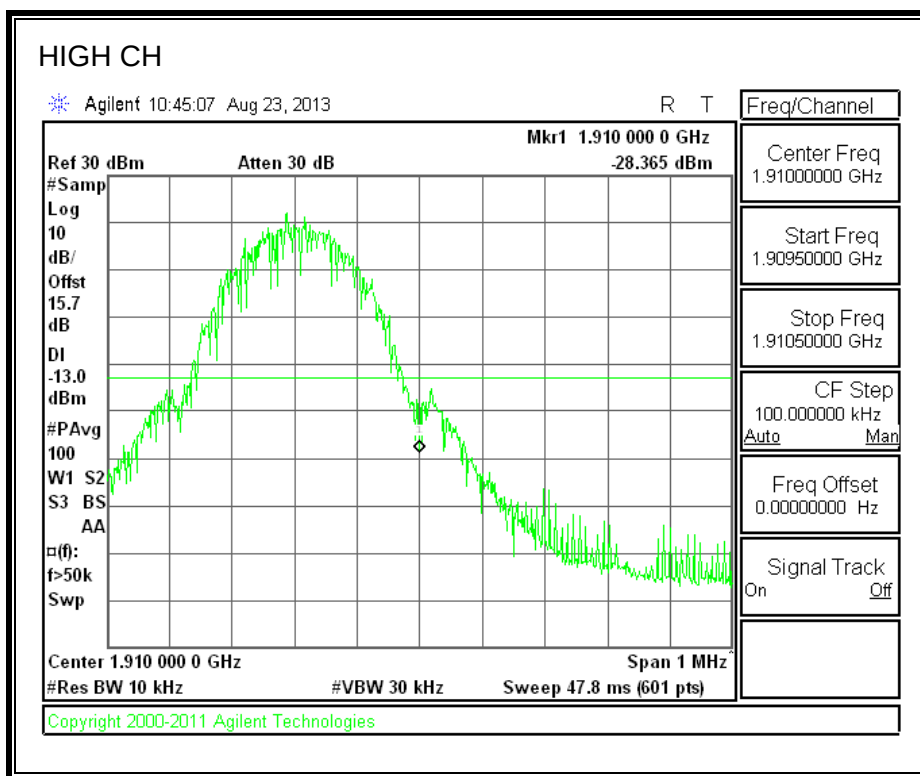
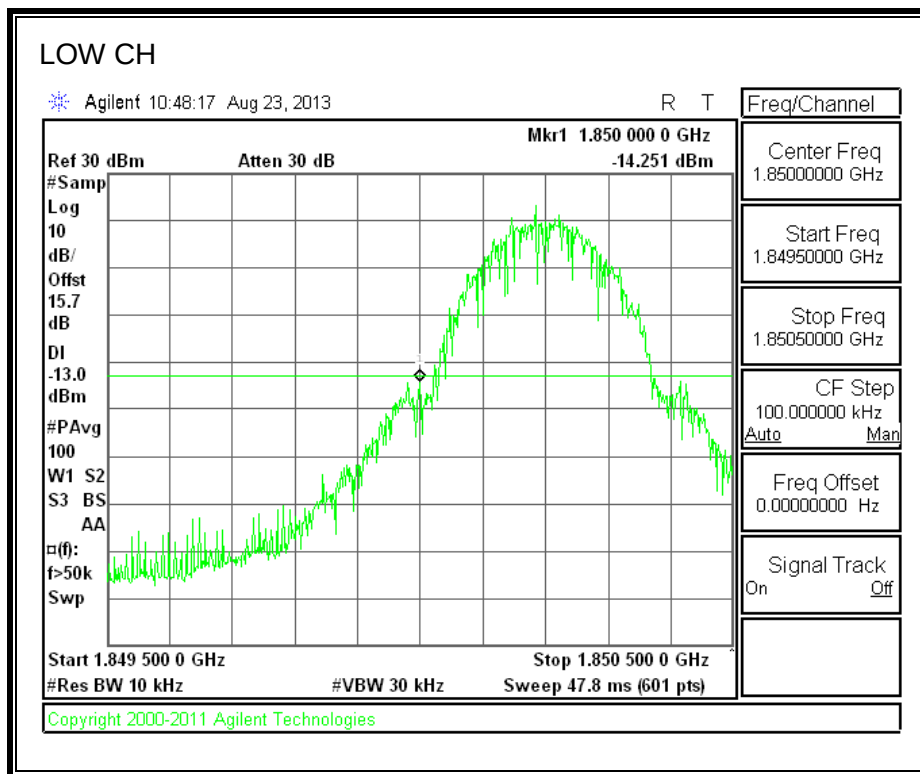
MODES TESTED

- GPRS
- UMTS REL 99, and HSUPA
- LTE band5

RESULTS

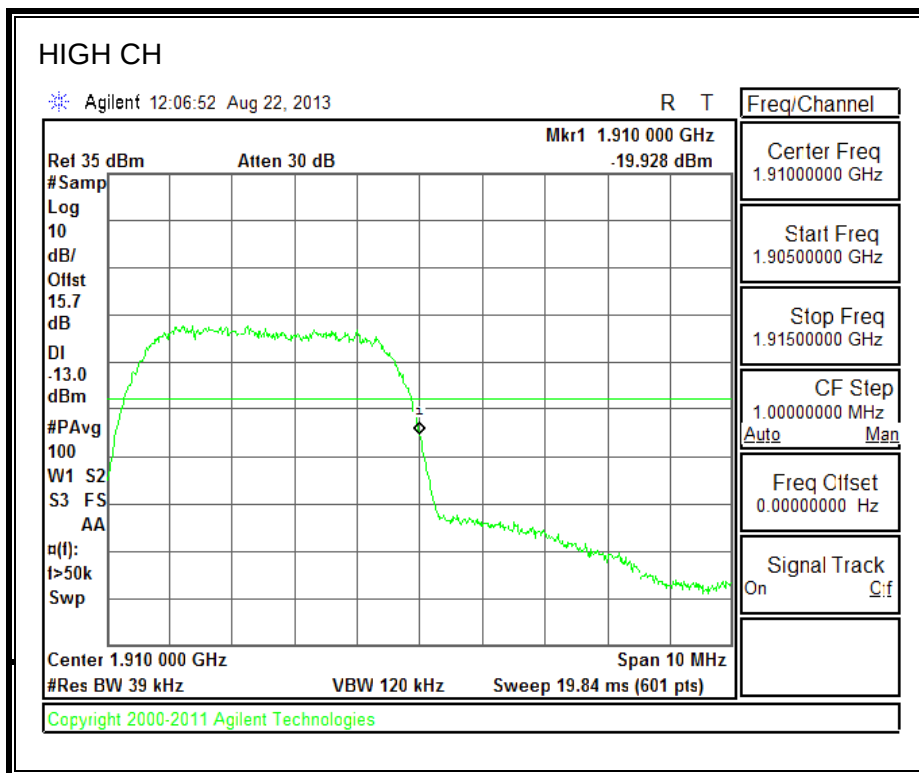
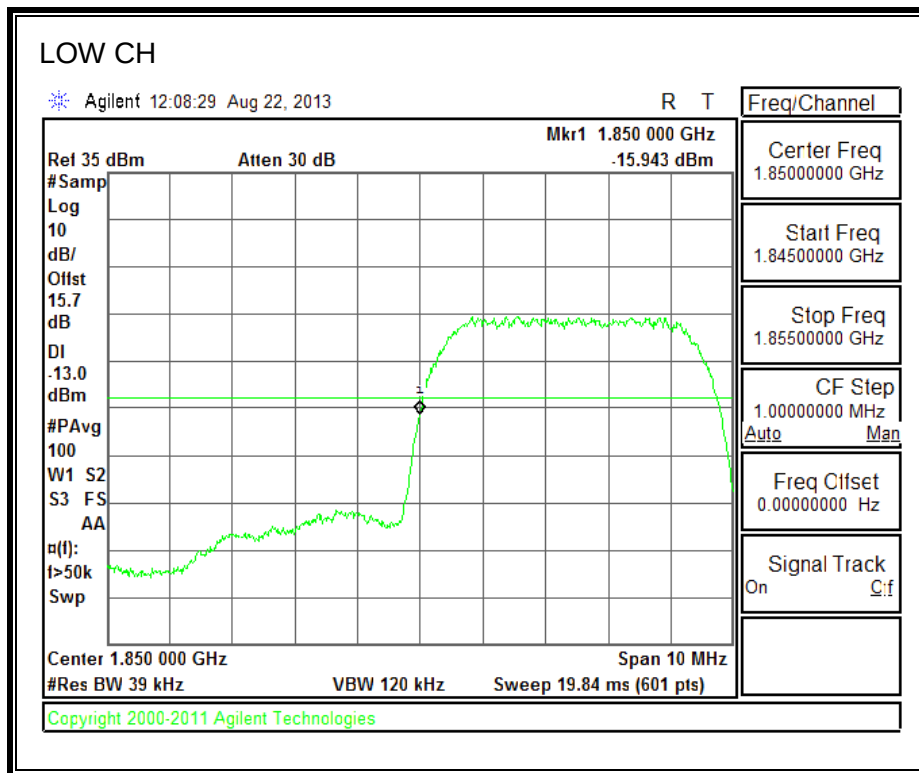
11.1.1. GPRS MODE

PCS BAND



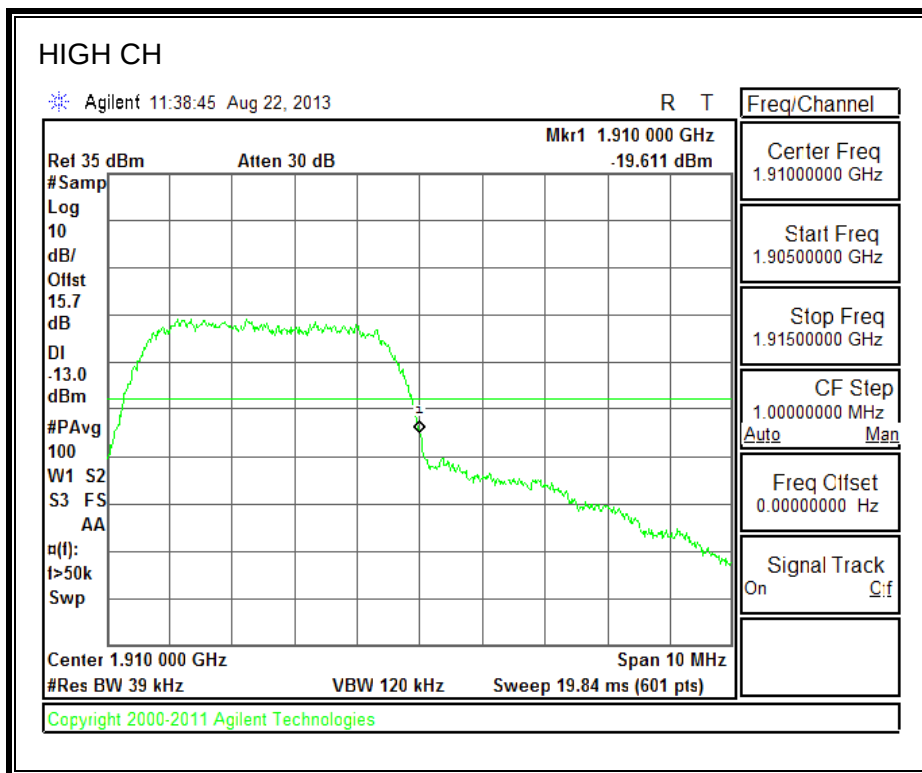
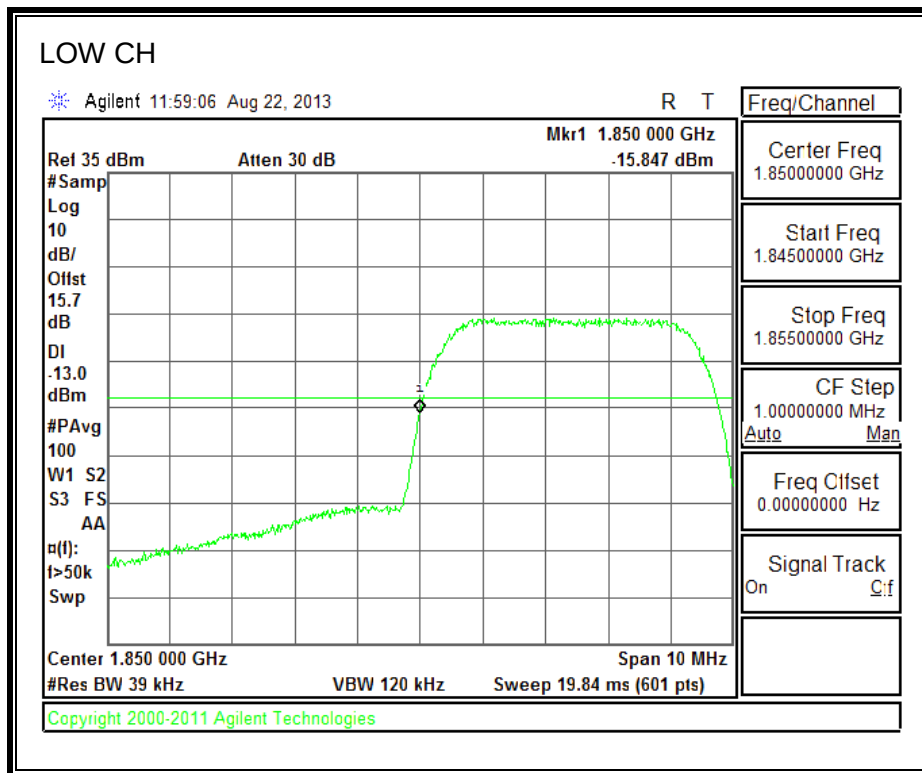
11.1.2. UMTS REL 99 MODE

BAND 2



11.1.3. UMTS HSUPA MODE

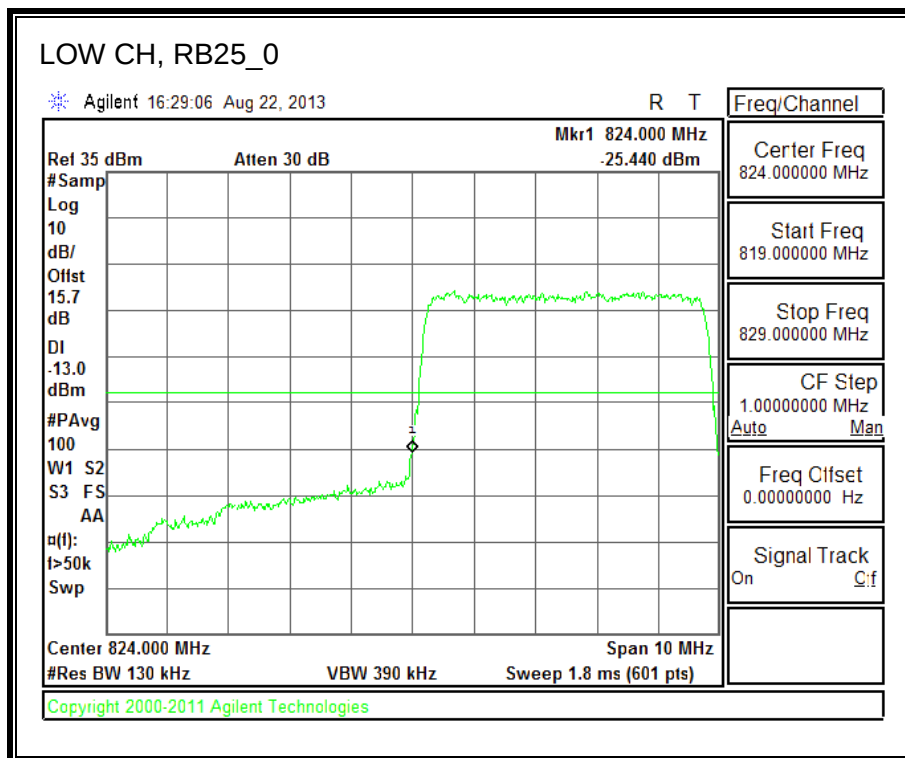
BAND 2

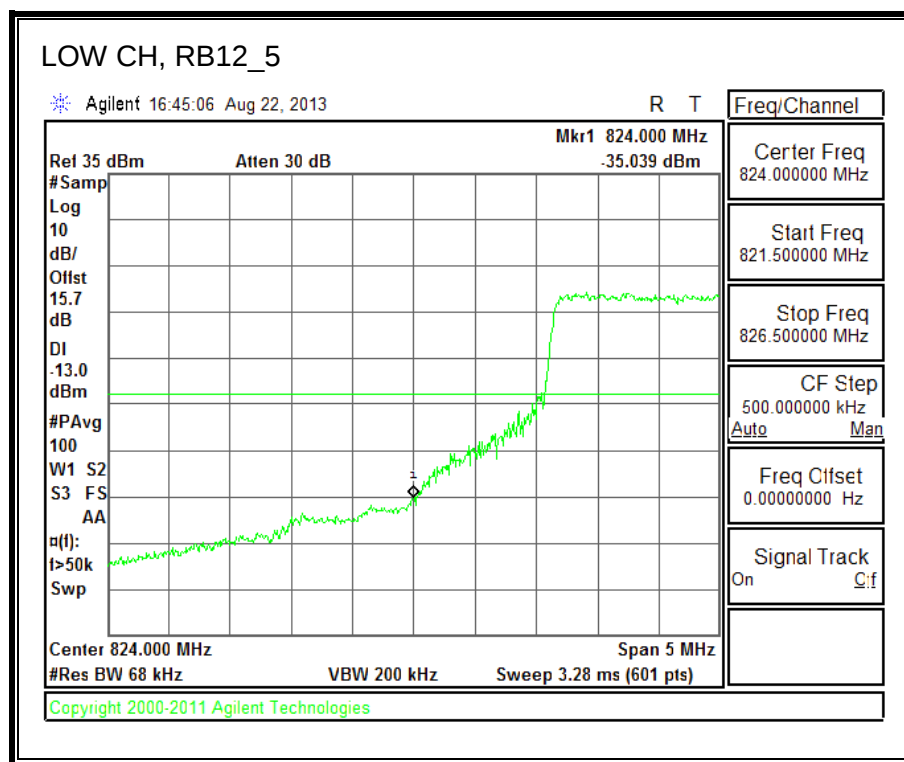


11.2. LTE BAND 5

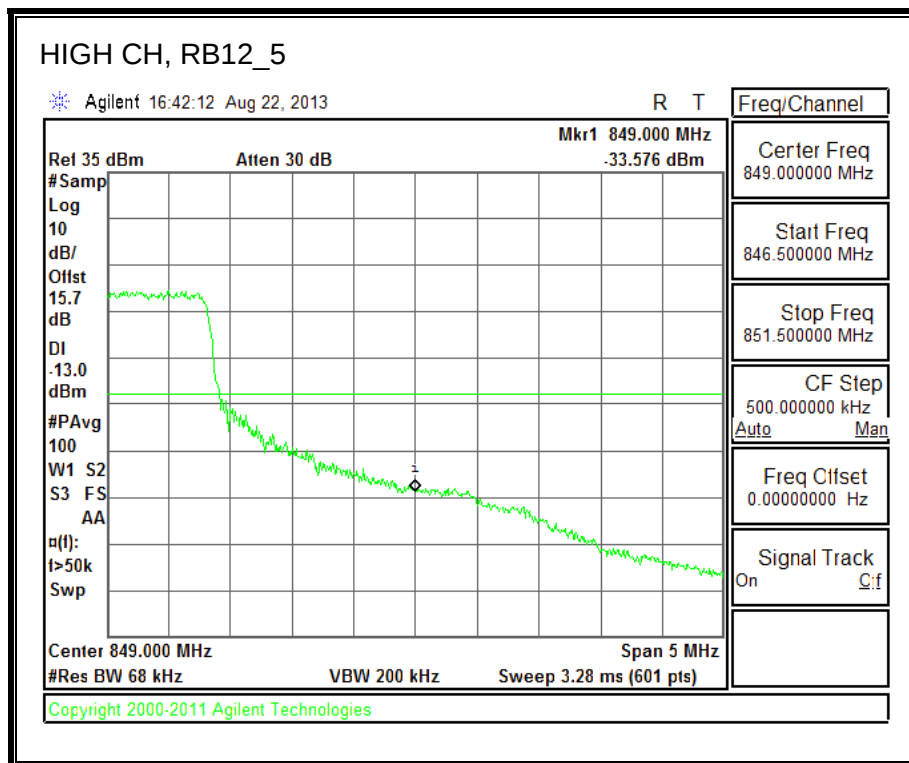
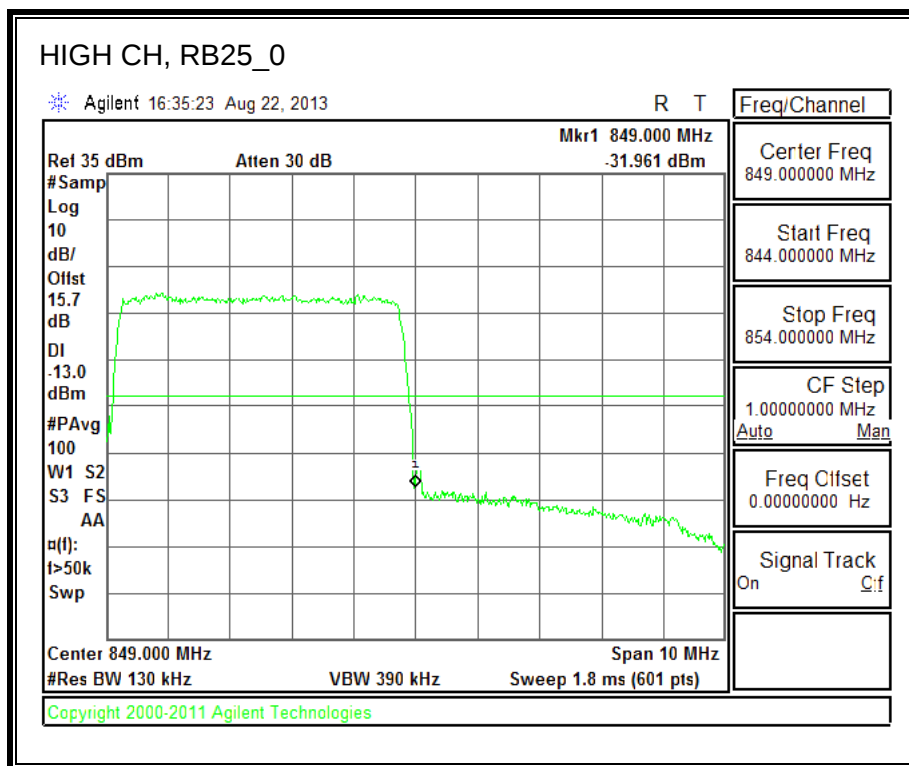
11.2.1. LTE BAND 5-5MHZ BANDWIDTH

LOW-QPSK

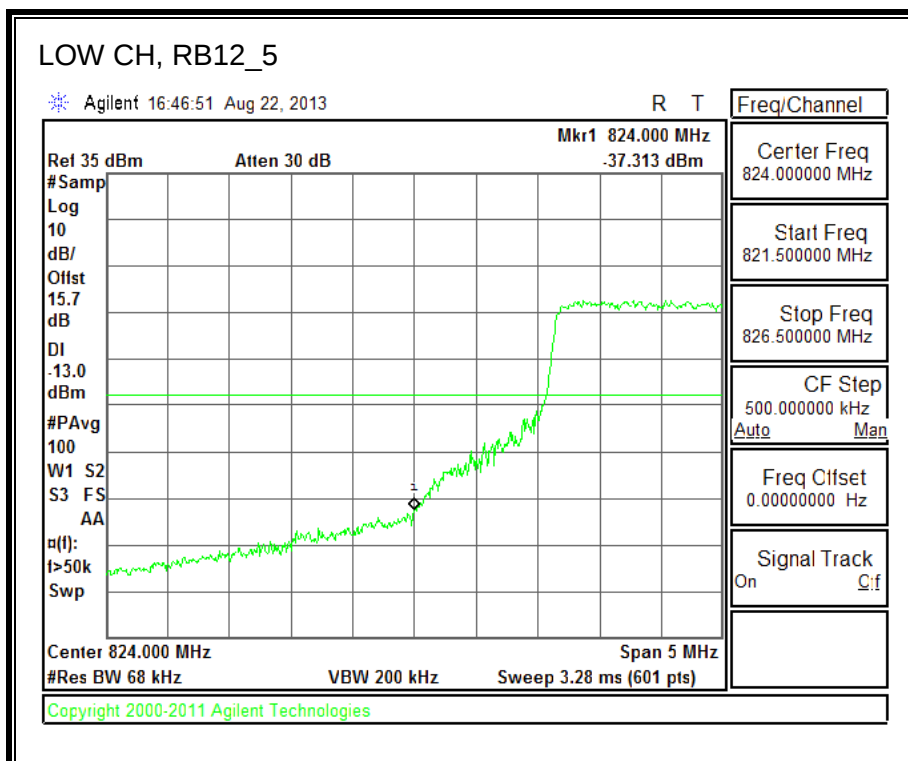
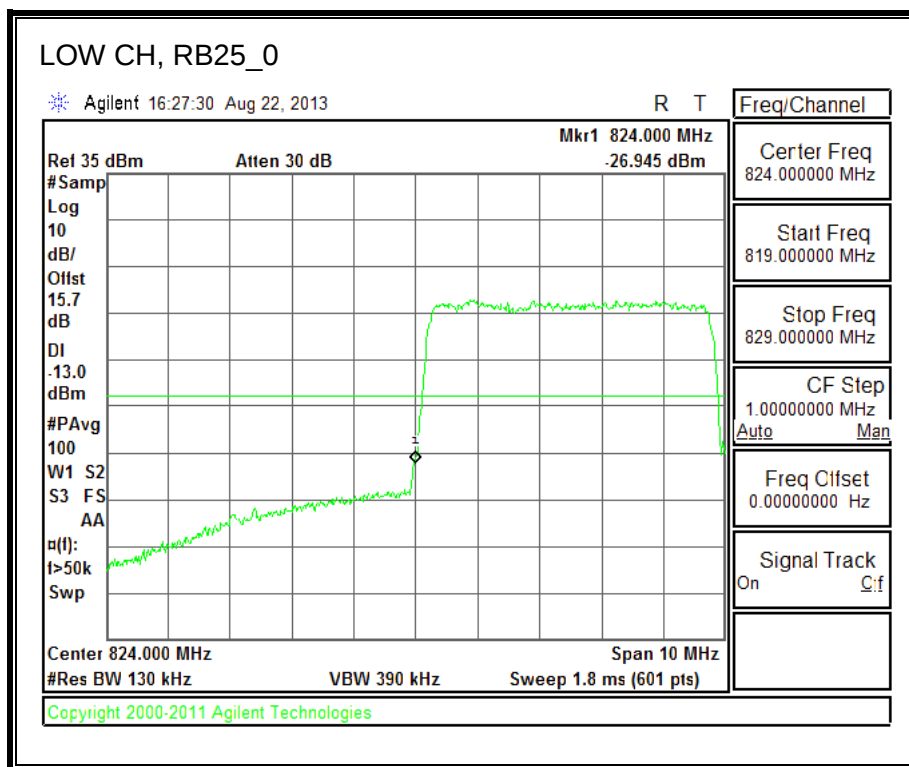




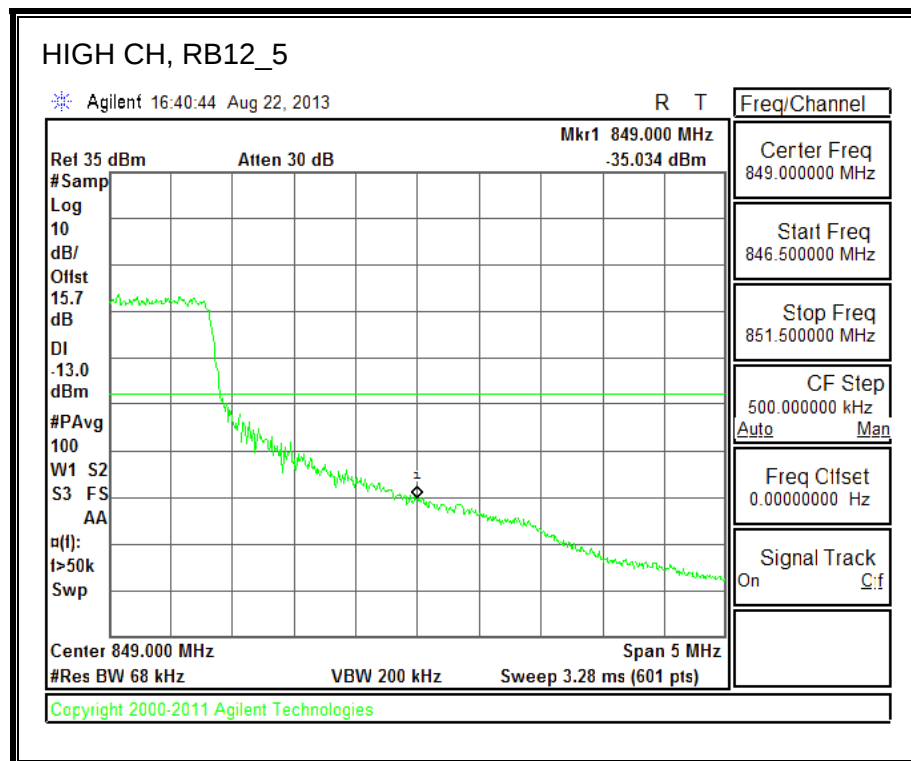
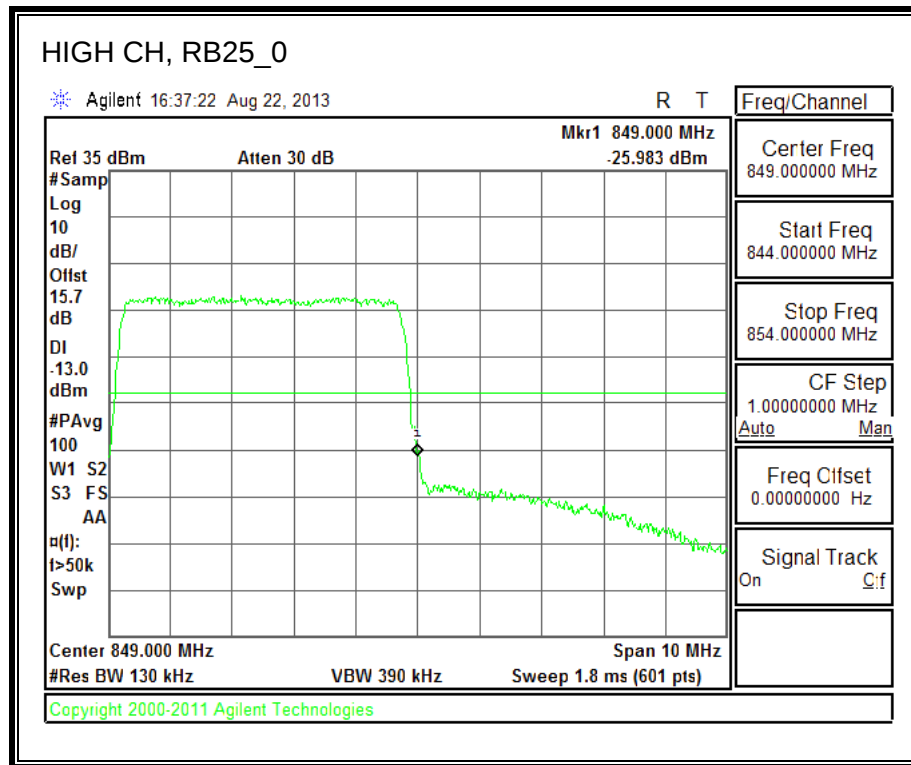
HIGH-QPSK



LOW-16QAM

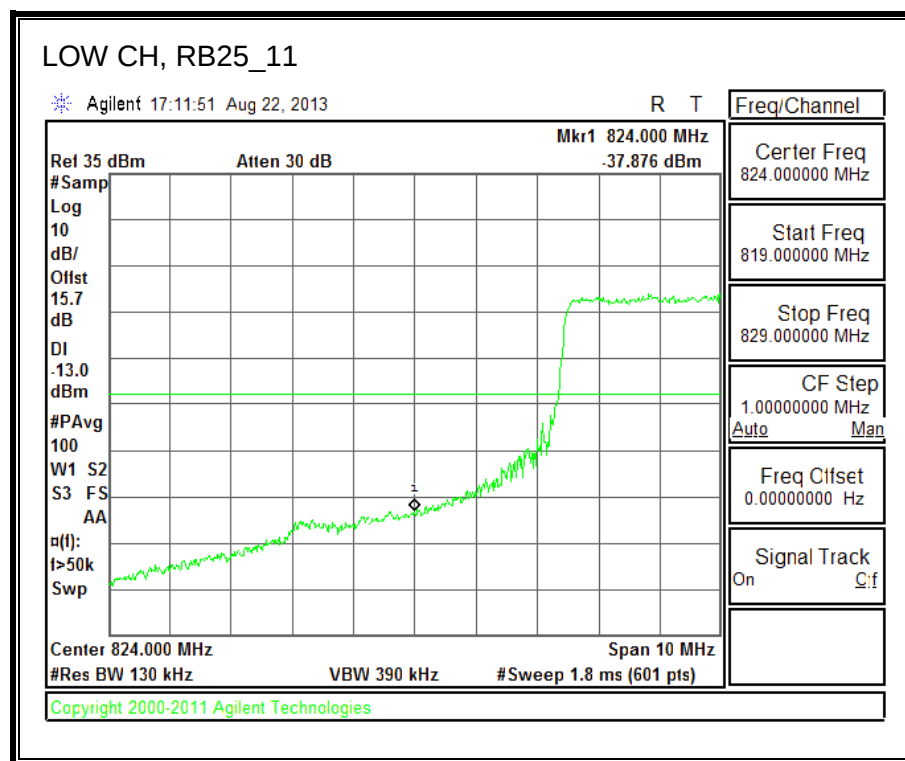
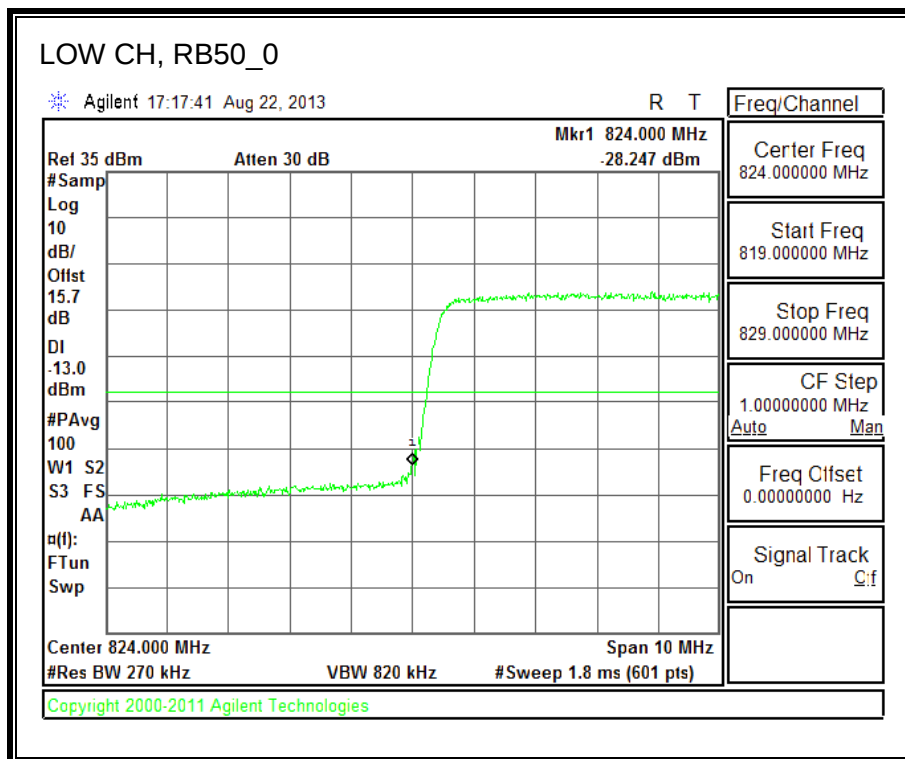


HIGH-16QAM

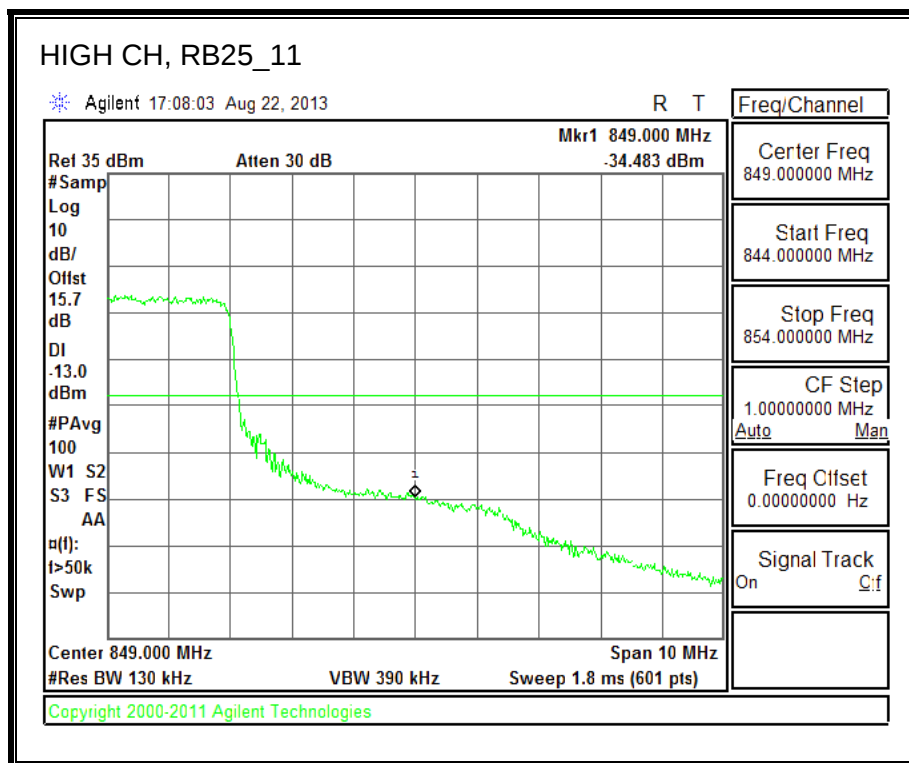
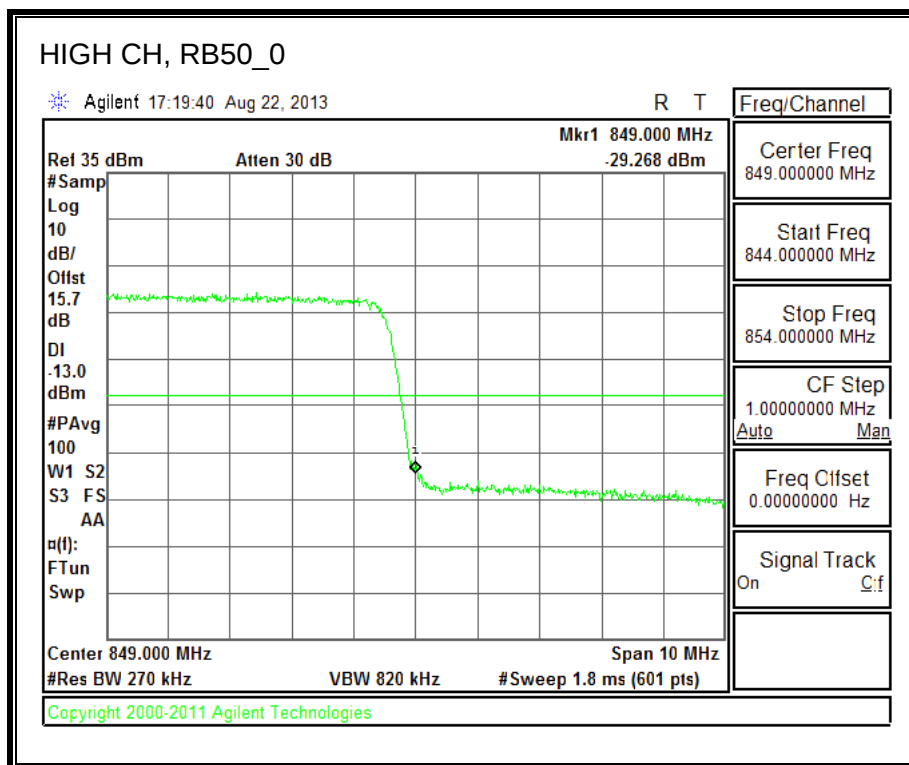


11.2.2. LTE BAND 5-10MHZ BANDWIDTH

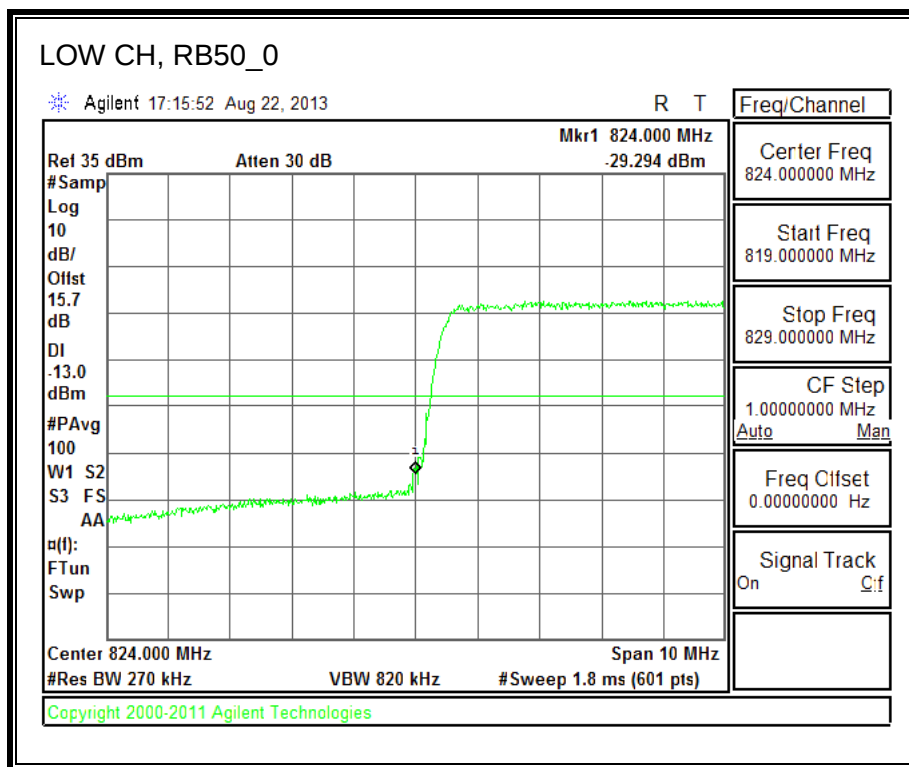
LOW-QPSK

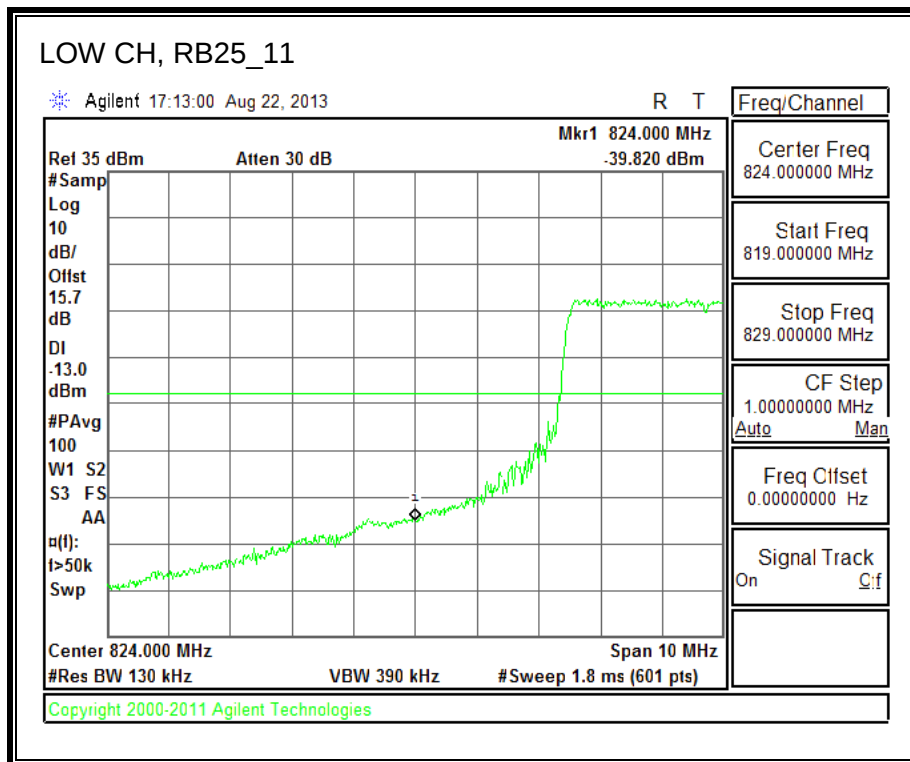


HIGH-QPSK

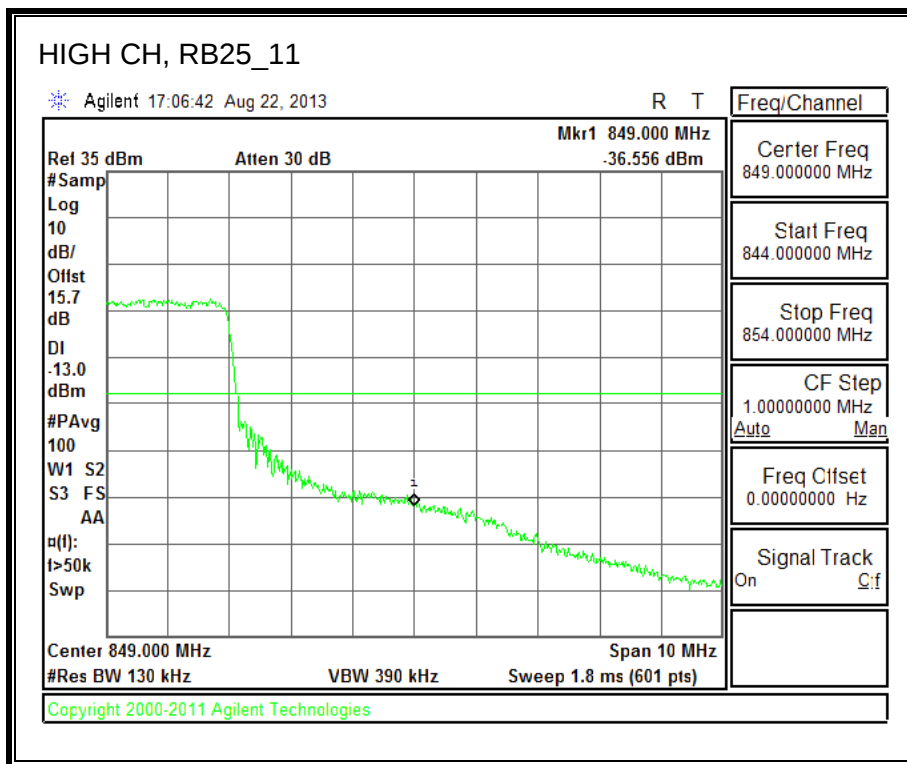


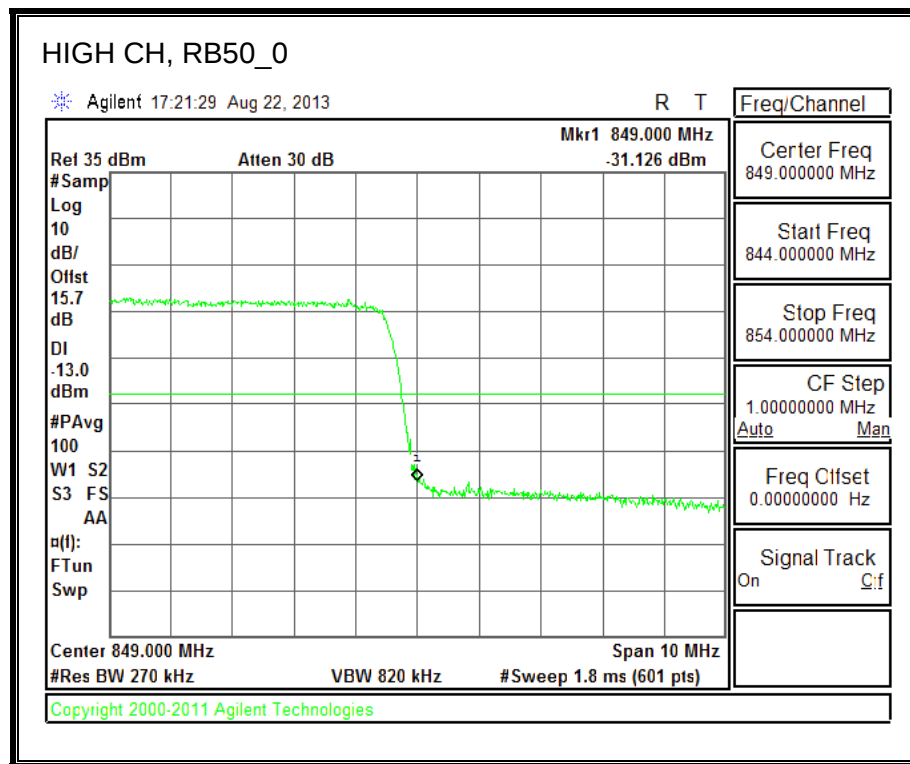
LOW-16QAM





HIGH-16QAM





12. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238

LIMITS

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

TEST PROCEDURE

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

For each out of band emissions measurement:

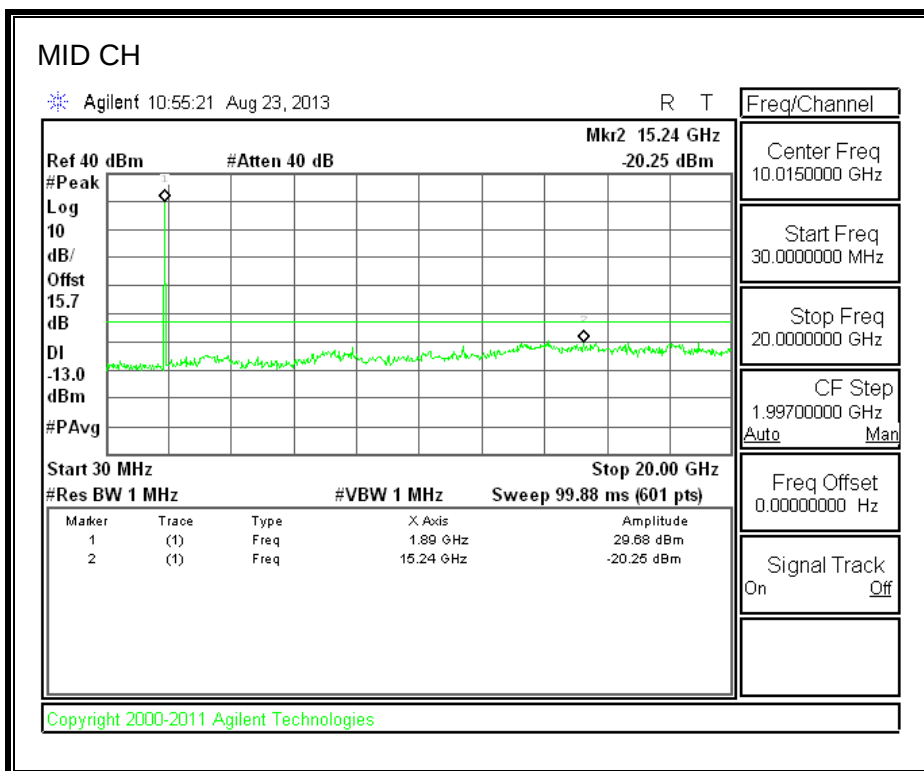
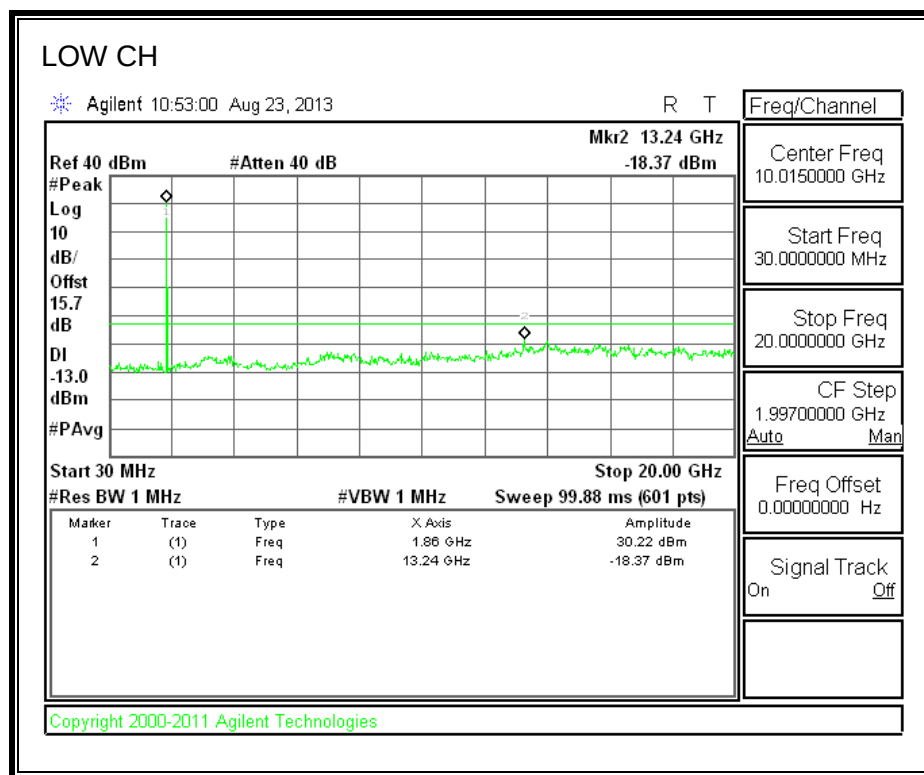
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

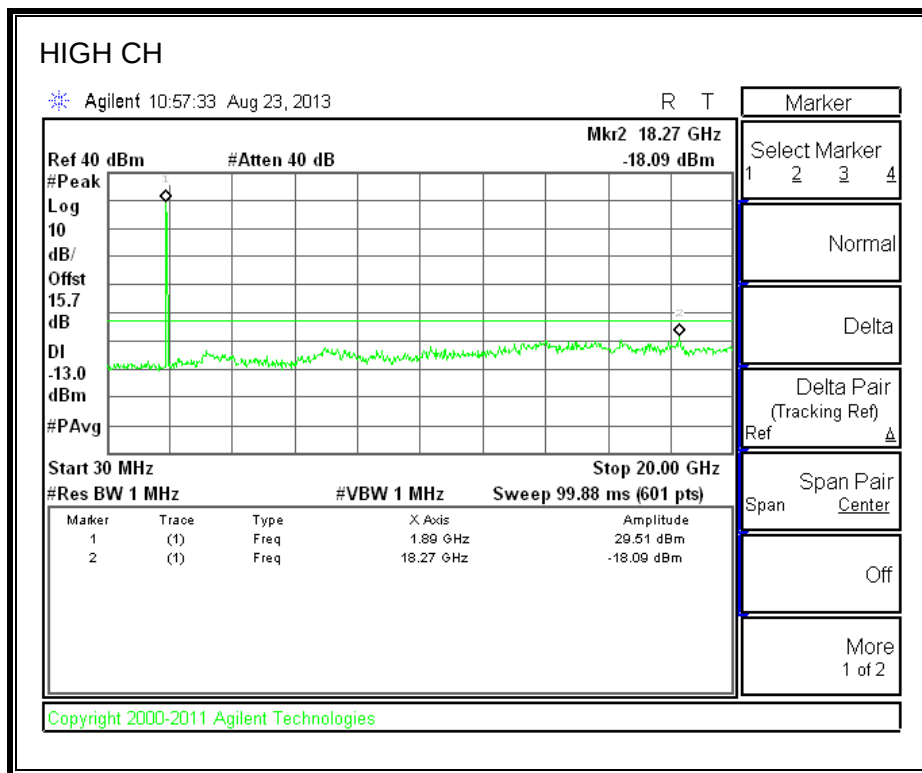
MODES TESTED

- GPRS
- UMTS REL 99, and HSUPA
- LTE band 5

RESULTS

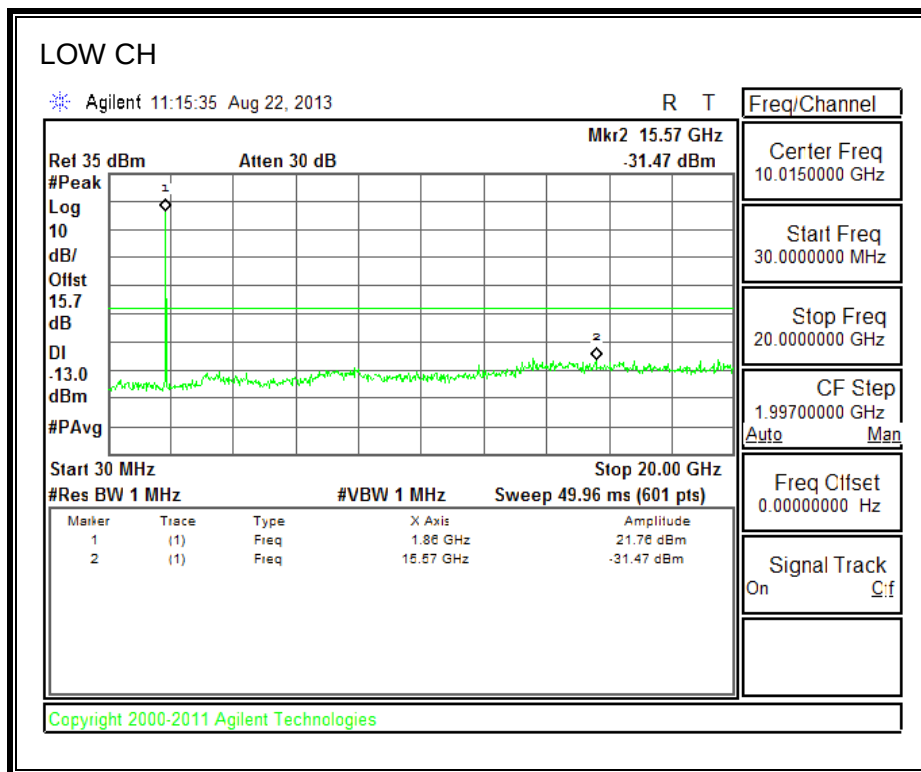
12.1.1. GPRS PCS BAND

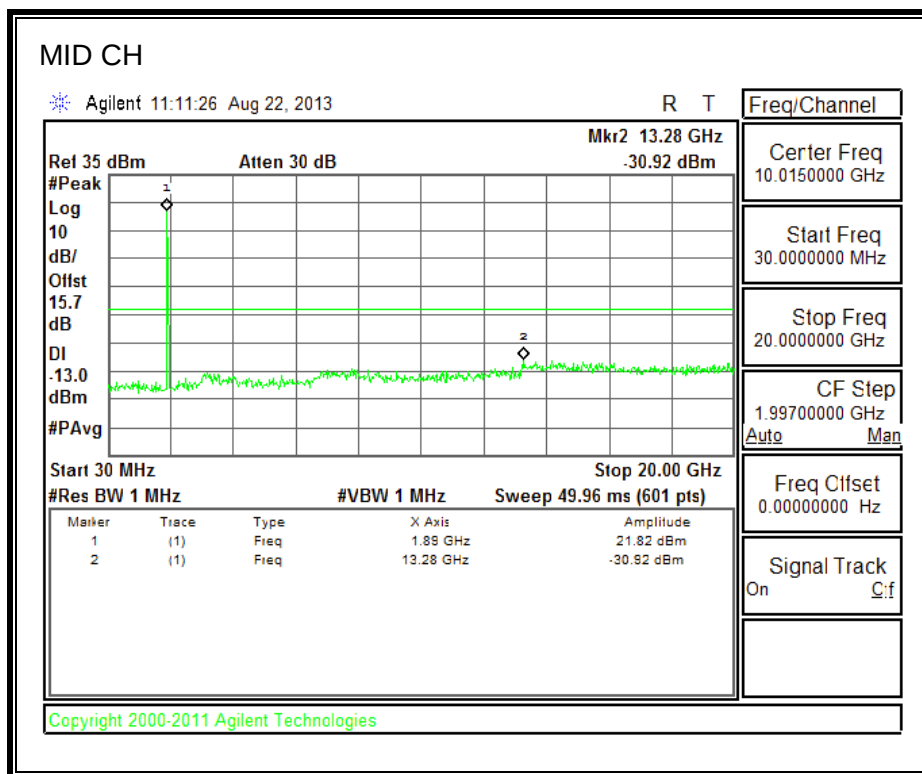


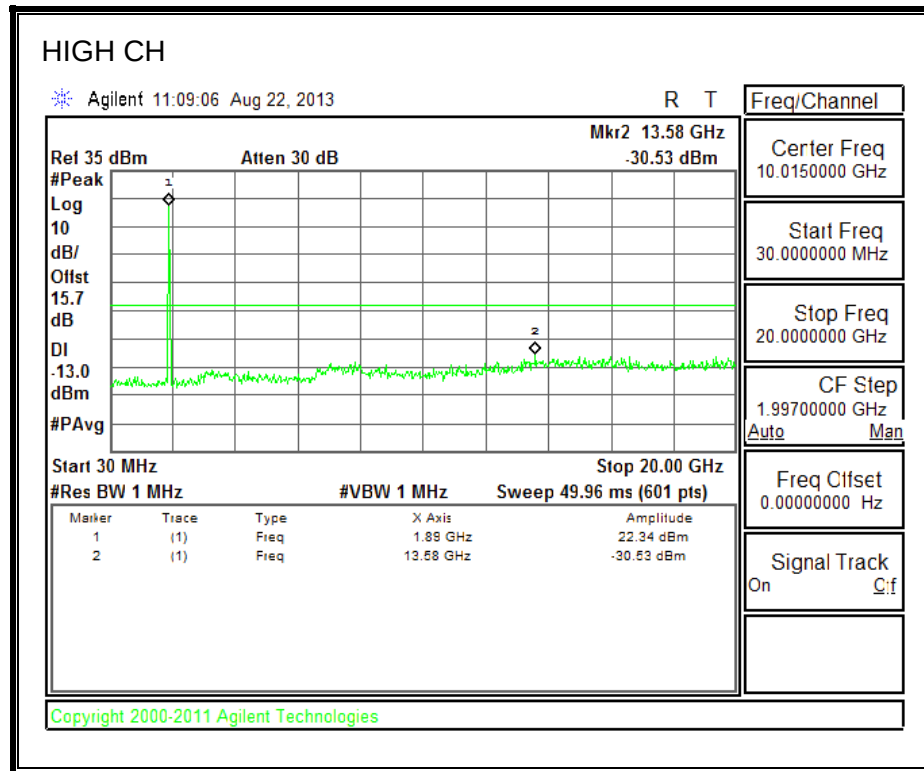


12.1.2. UMTS REL 99 MODE

BAND 2

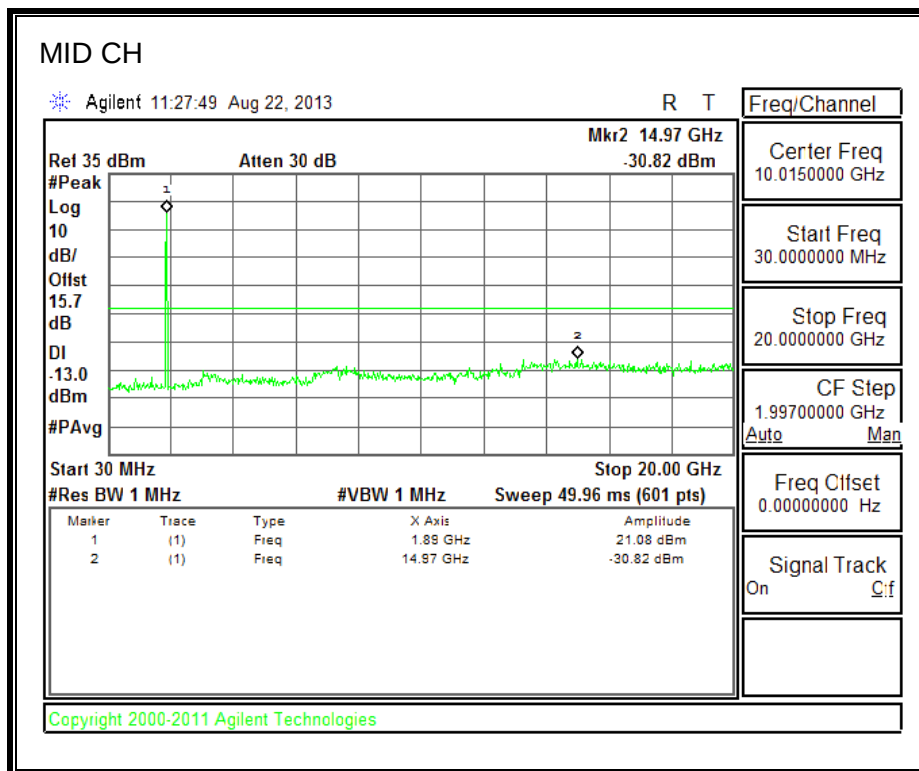
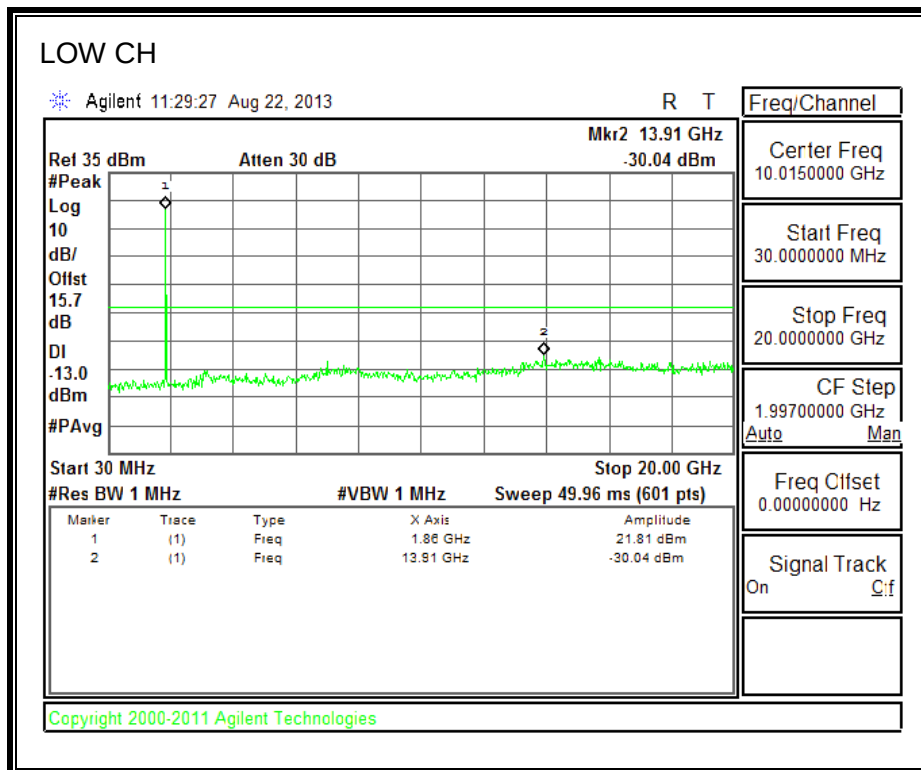


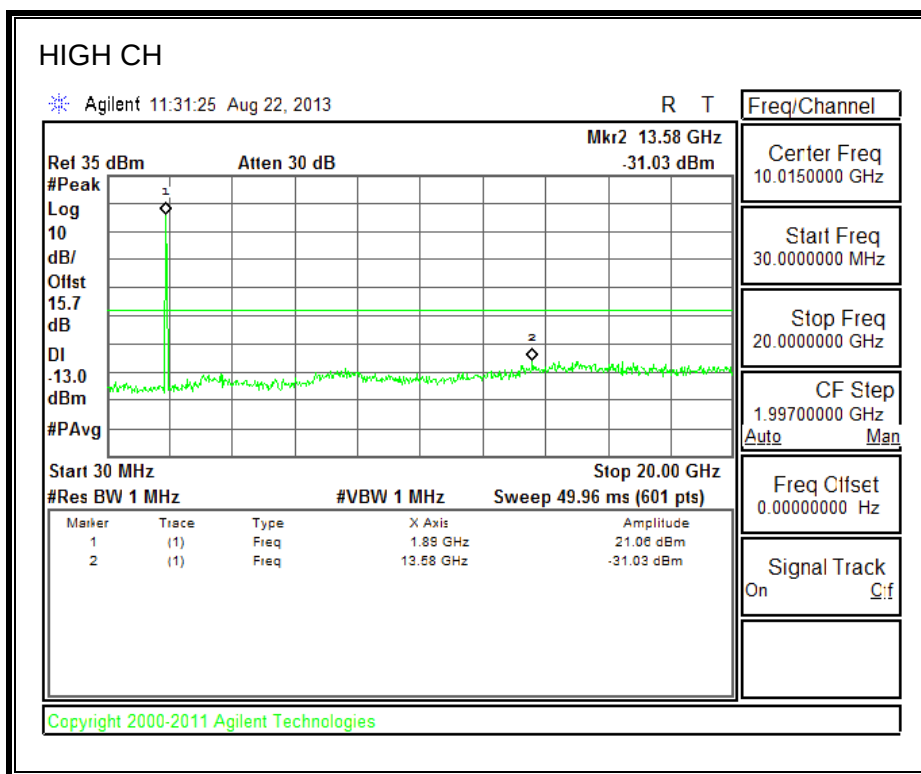




12.1.3. UMTS HSUPA MODE

BAND 2

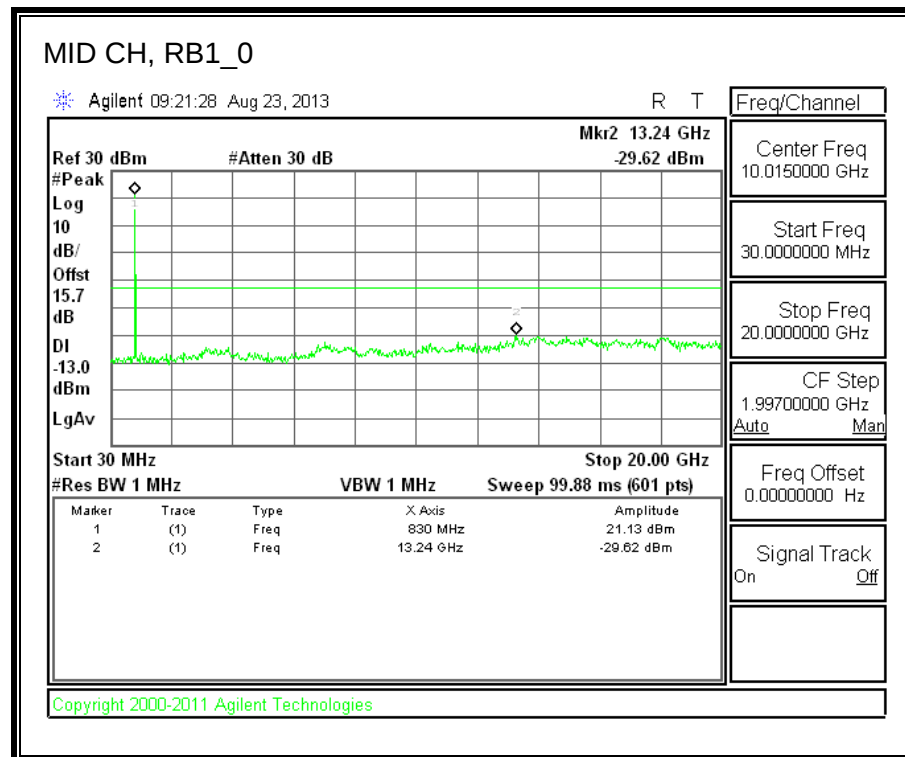
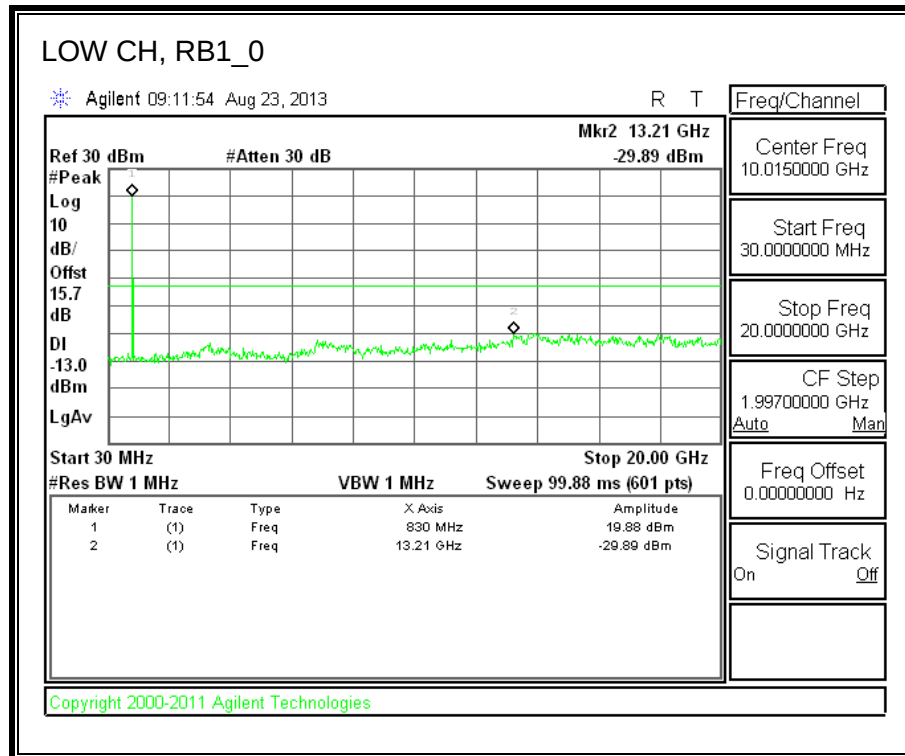


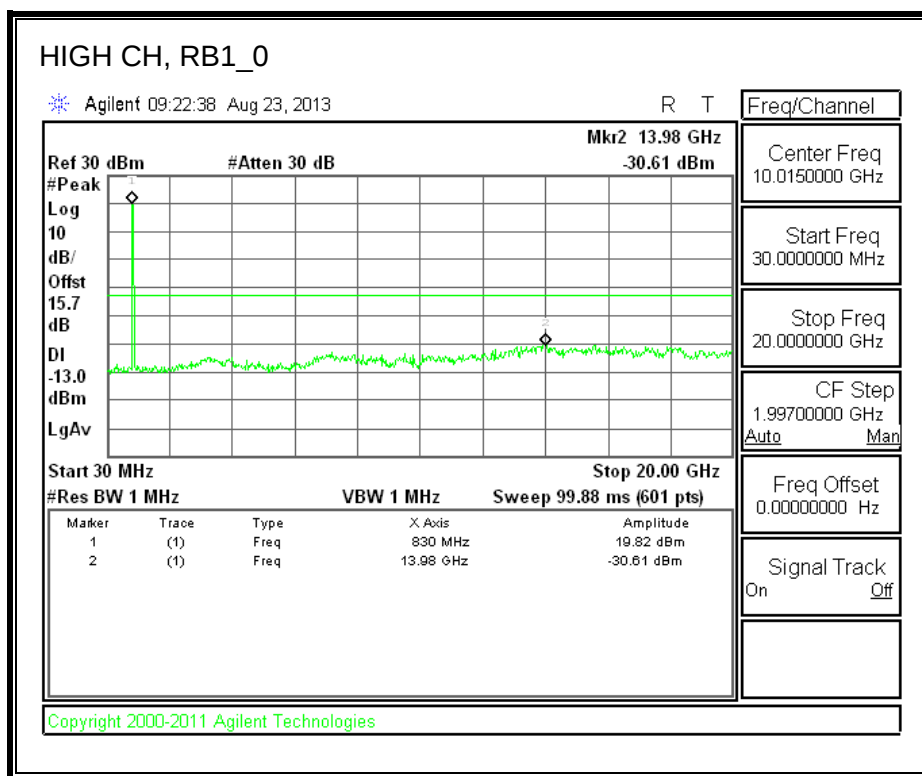


12.2. LTE BAND 5

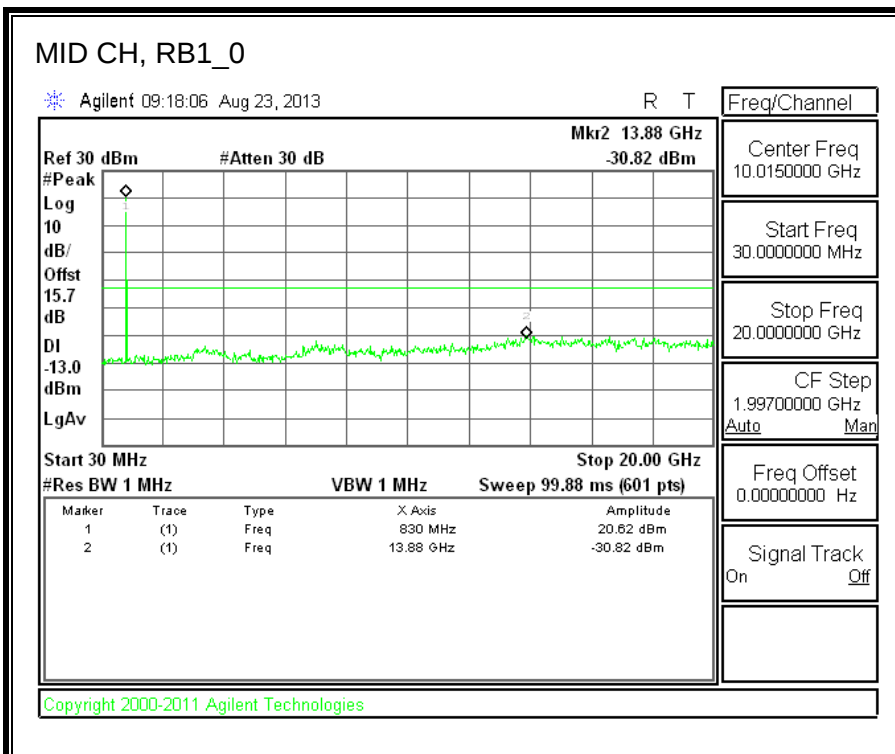
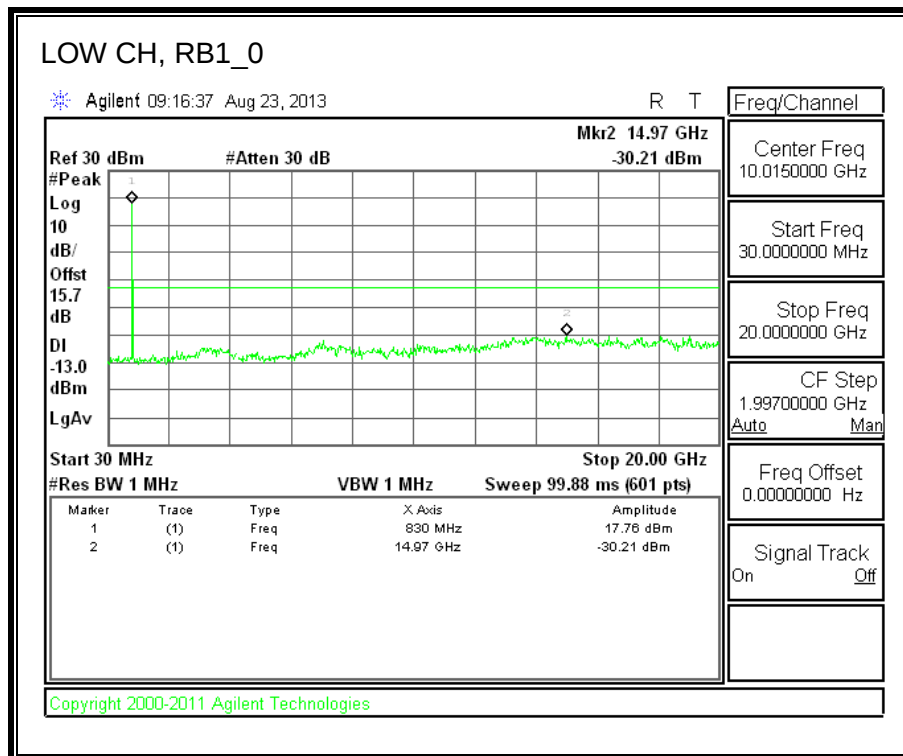
12.2.1. LTE BAND 4-5MHz BANDWIDTH

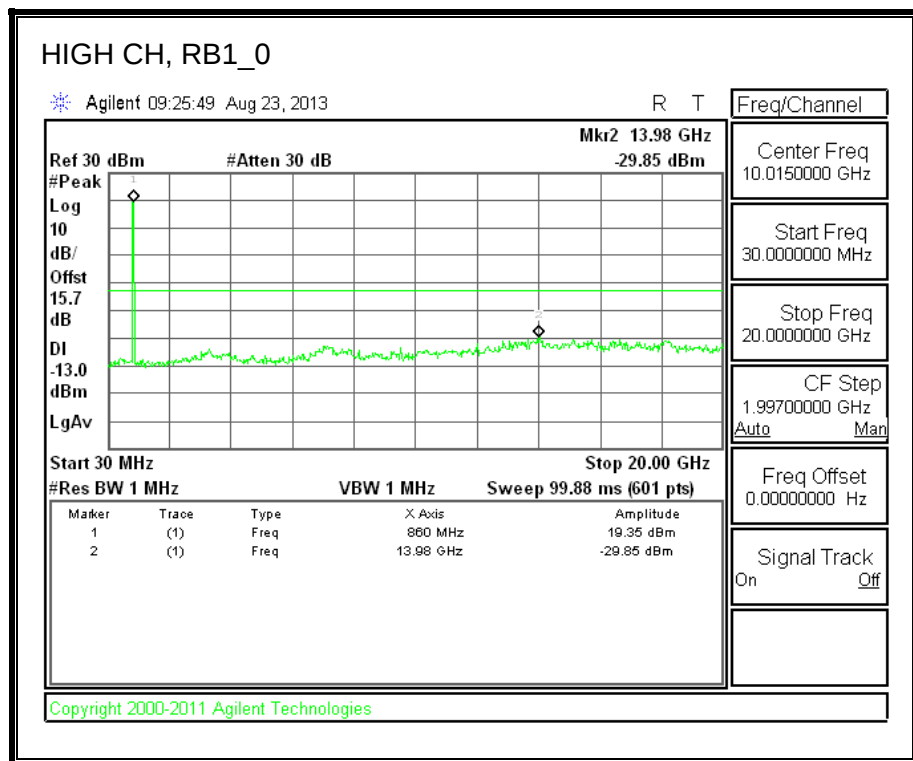
QPSK





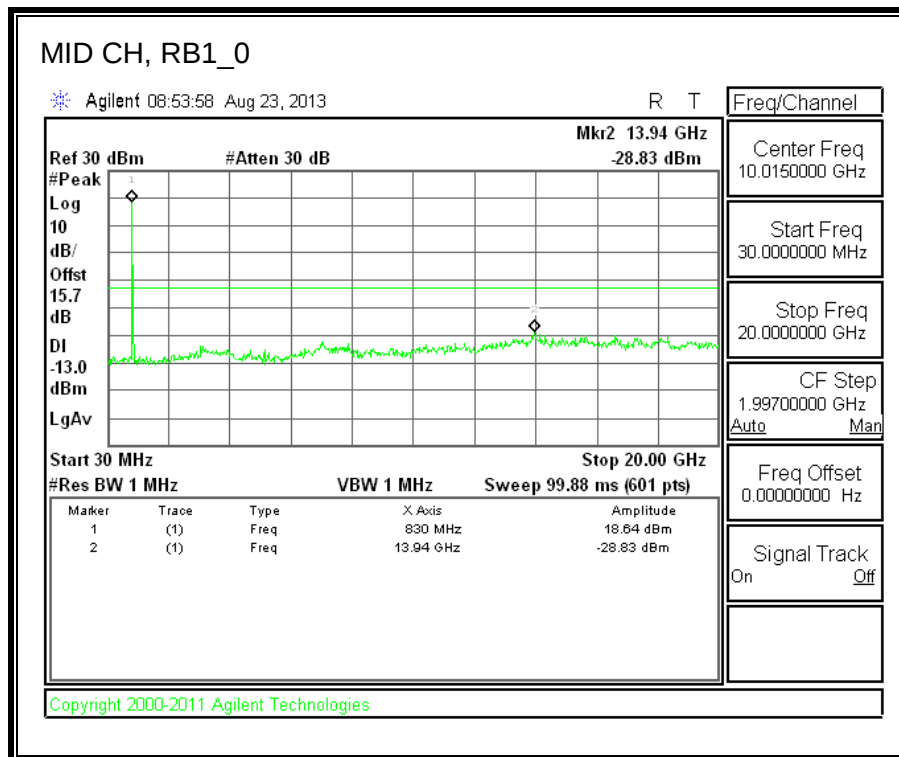
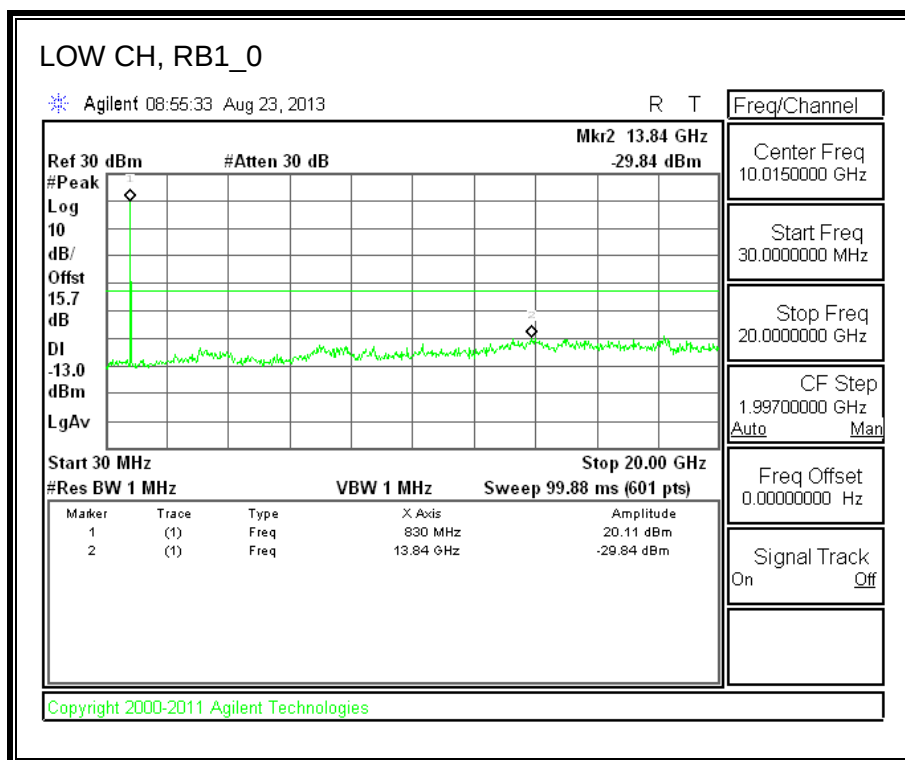
16QAM

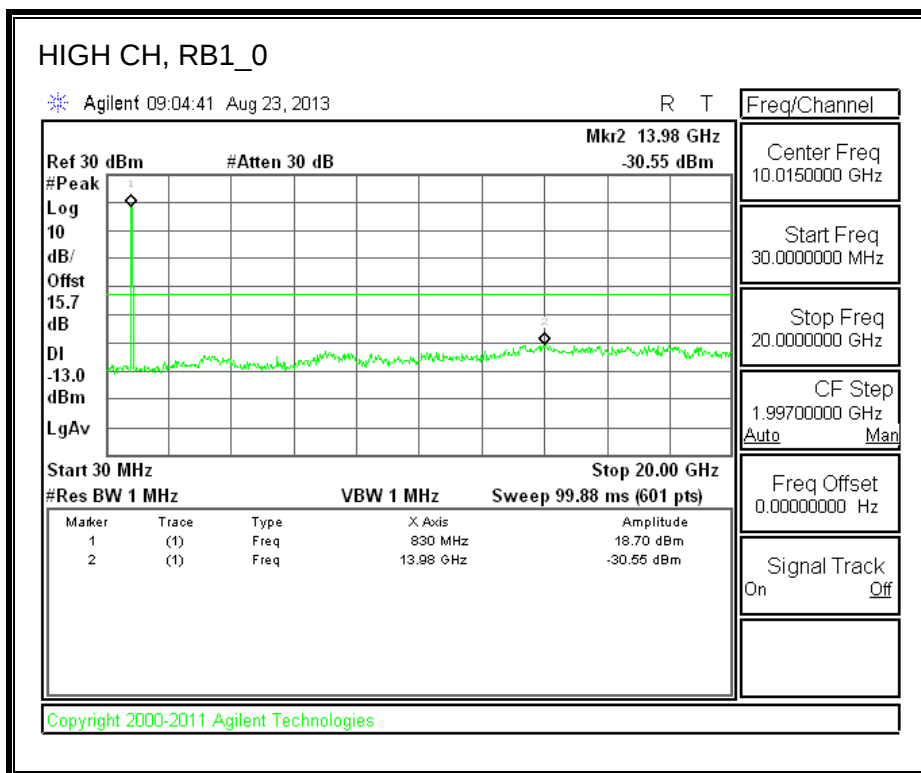




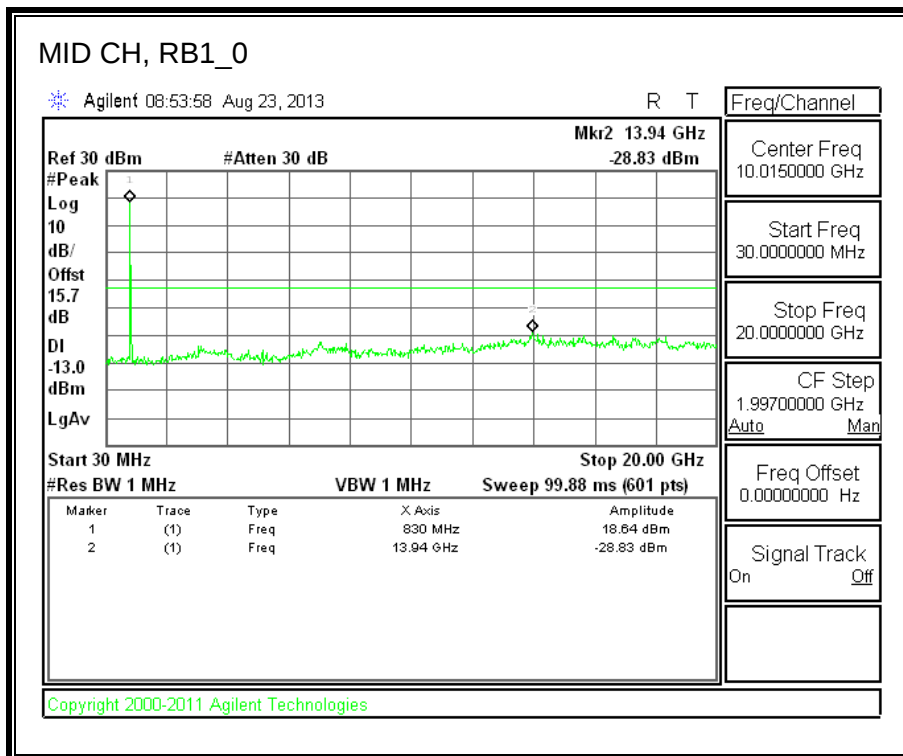
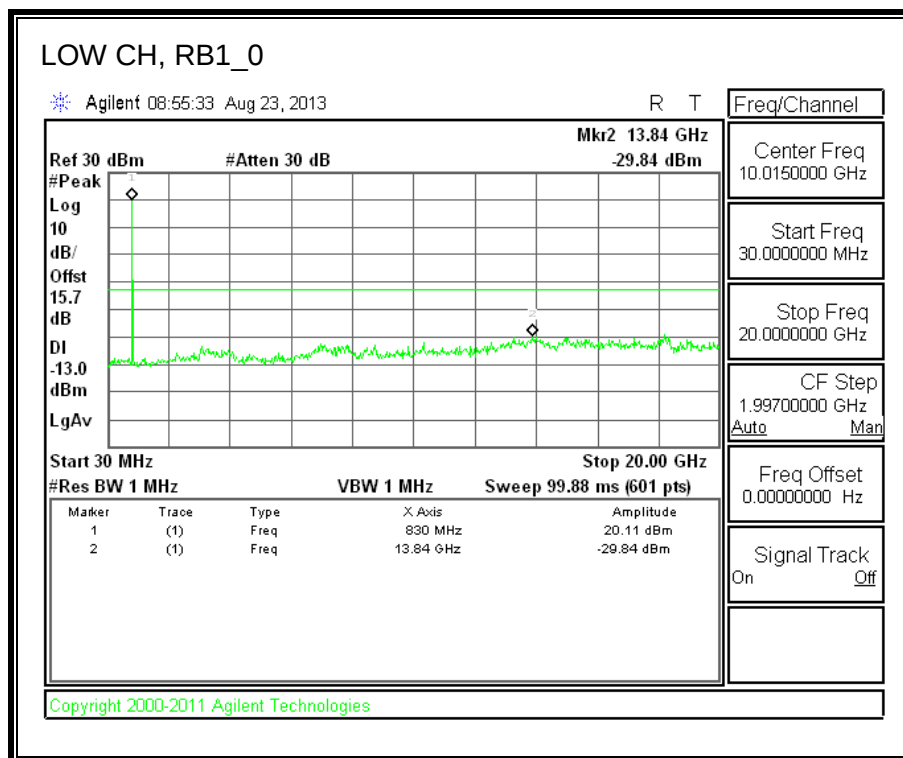
12.2.2. LTE BAND 4-10MHz BANDWIDTH

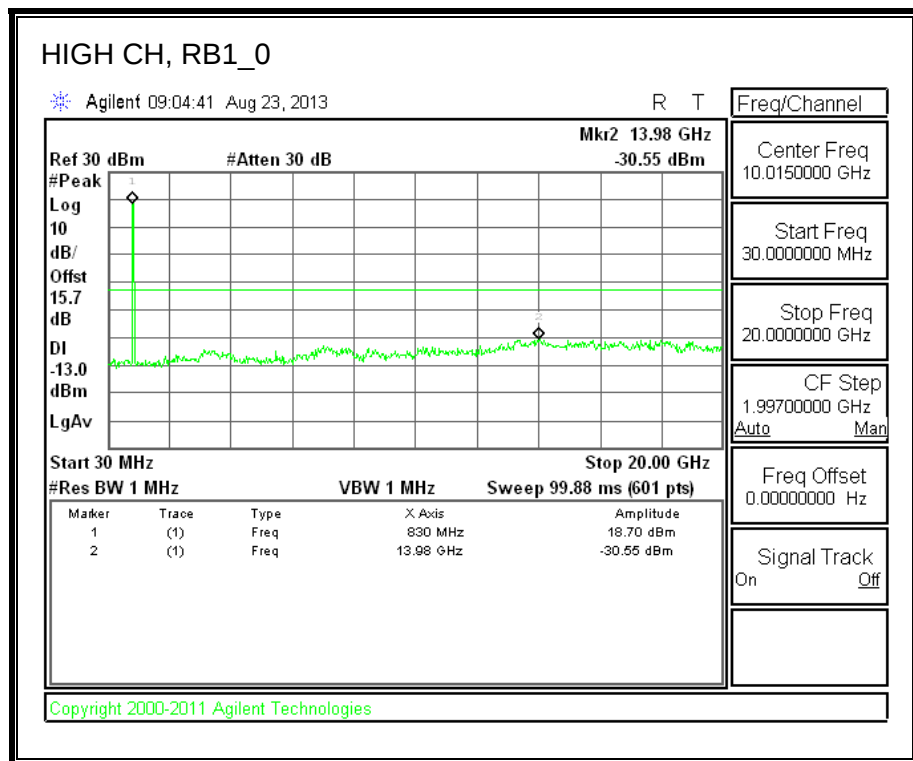
QPSK





16QAM





13. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235

LIMITS

- §22.355 - The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.
- §24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST PROCEDURE

Use Agilent 8960 with Frequency Error measurement capability.

- Temp. = -30° to $+50^{\circ}\text{C}$
- Voltage = 85% - 115%

Frequency Stability vs Temperature:

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

Frequency Stability vs Voltage:

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

MODES TESTED

- GPRS 1900
- UMTS 1900
- LTE band 5

RESULTS

See the following pages

13.1. GPRS MODULATION – MID CHANNEL

13.1.1. PCS

Reference Frequency: PCS Mid Channel 1880MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.70	50	1879.999963	0.005	2.5
3.70	40	1879.999965	0.004	2.5
3.70	30	1879.999961	0.006	2.5
3.70	20	1879.999973	0	2.5
3.70	10	1879.999964	0.005	2.5
3.70	0	1879.999979	-0.003	2.5
3.70	-10	1879.999984	-0.006	2.5
3.70	-20	1879.999969	0.002	2.5
3.70	-30	1879.999994	-0.011	2.5

Reference Frequency: PCS Mid Channel 1880 MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.70	20	1879.999973	0	2.5
4.20	20	1879.999988	-0.008	2.5
3.30	20	1879.999969	0.002	2.5

13.2. WCDMA – MID CHANNEL

13.2.1. Band 2

Reference Frequency: PC S Mid Channel 1880MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.70	50	1879.999979	0.003	2.5
3.70	40	1879.999981	0.002	2.5
3.70	30	1879.999977	0.004	2.5
3.70	20	1879.999985	0	2.5
3.70	10	1879.999976	0.005	2.5
3.70	0	1879.999983	0.001	2.5
3.70	-10	1879.99998	0.003	2.5
3.70	-20	1879.999982	0.002	2.5
3.70	-30	1879.999988	-0.002	2.5

Reference Frequency: PCS Mid Channel 1880 MHz @ 20°C Limit: to stay +/- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.70	20	1879.999985	0	2.5
4.20	20	1879.999989	-0.002	2.5
3.30	20	1879.999986	-0.001	2.5

13.3. LTE – MID CHANNEL

13.3.1. Band 5

Reference Frequency: Cell Mid Channel 836.5 MHz @ 20°C Limit: +/- 2.5 ppm = 2091.250 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.70	50	836.500010	-0.002	2.5
3.70	40	836.500009	-0.001	2.5
3.70	30	836.500009	-0.001	2.5
3.70	20	836.500008	0	2.5
3.70	10	836.500009	-0.001	2.5
3.70	0	836.500008	0.000	2.5
3.70	-10	836.500010	-0.002	2.5
3.70	-20	836.500010	-0.002	2.5
3.70	-30	836.500012	-0.005	2.5

Reference Frequency: PCS Mid Channel 1880 MHz @ 20°C Limit: +/- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
			Delta (ppm)	Limit (ppm)
3.70	20	836.500008	0.00000	2.5
4.20	20	836.500010	-0.00106	2.5
3.30	20	836.500008	0.00000	2.5

14. RADIATED TEST RESULTS

14.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, §24.232

LIMITS

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17

The ERP/EIRP power was measured with the spectrum analyzer which attached with receiver antenna via calibrated cable. The measurements have been taken 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 for GSM and 5MHz for WCDMA modes respectively.
- Set a marker to point the corresponding peak value.

Please refer to the fundamental measurement template on completing the radiated power measurement: (Please refer to the figure 5A)

1. Tuning the table to find the worst angle and raising the antenna to maximize the reading. Once peak position has been achieved and has been entered under "SA Reading (dBm)"
2. Perform Substitute measurement by following the setup described below:
 - a. For Low Band (below 1GHz):
 - i. Obtain the calibrated dipole antenna
 - ii. Set the output power of the signal generator to 0dBm
 - iii. Find the peak position again.
 - iv. Increase SG output power until SG value equals that of current "SA reading (dBm)" column.
 - v. Enter the SG output power under "SG reading (dBm)" and template will calculate the proper ERP value.
 - b. For High Band (above 1GHz):
 - i. Obtain the calibrated Horn antenna.
 - ii. Set the output power of the signal generator to 0dBm
 - iii. Find the peak position again.

- iv. Increase SG output power until SG value equals that of current “SA reading (dBm)” column.
- v. Enter the SG output power under “SG reading (dBm)” and template will calculate the proper EIRP value.

Formula: ERP value = SG reading - cable loss (connect SG and dipole)

EIRP value = SG reading - cable loss (connect SG and Horn) + Substitution Horn antenna gain

MODES TESTED

- GPRS
- WCDMA REL 99, and HSUPA
- LTE Band 5

RESULTS

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
GPRS	512	1850.20	25.90	389.05
	661	1880.00	25.33	341.19
	810	1909.80	25.19	330.37

Band 2

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
REL 99	9662	1852.40	21.20	131.83
	9800	1880.00	21.88	154.17
	9938	1907.60	21.12	129.42

Mode	Channel	f (MHz)	EIRP	
			dBm	mW
HSUPA	9662	1852.40	20.17	103.99
	9800	1880.00	21.64	145.88
	9938	1907.60	20.79	119.95

LTE band 5

Mode	RB/RB Offset	f (MHz)	ERP	
			dBm	mW
5.0 MHZ BAND QPSK	25/0	826.50	17.80	60.26
		836.50	21.79	151.01
		846.50	19.60	91.20
5.0 MHZ BAND 16QAM		826.50	18.66	73.45
		836.50	20.80	120.23
		846.50	19.63	91.83
10.0 MHZ BAND QPSK	50/0	829.00	19.52	89.54
		836.50	21.12	129.42
		844.00	19.91	97.95
10.0 MHZ BAND 16QAM		829.00	17.73	59.29
		836.50	22.68	185.35
		844.00	20.13	103.04

14.1.1. GPRS 1900 (Cellular Band)

High Frequency Fundamental Measurement Compliance Certification Services Chamber D								
Company:		Samsung						
Project #:		13U15830						
Date:		08/22/13						
Test Engineer:		Kiya Kedida						
Configuration:		EUT with charger						
Mode:		GPRS 1900MHz						
Test Equipment:								
Receiving: T344, and Chamber D SMA Cables								
Substitution: Horn T60 Substitution, 4ft SMA Cable (244639001) Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.850	14.6	V	0.85	7.94	21.67	33.0	-11.3	
1.850	17.9	H	0.85	8.80	25.90	33.0	-7.1	
Mid Ch								
1.880	14.0	V	0.85	7.95	21.07	33.0	-11.9	
1.880	17.5	H	0.85	8.68	25.33	33.0	-7.7	
High Ch								
1.910	13.8	V	0.85	7.97	20.88	33.0	-12.1	
1.910	17.5	H	0.85	8.57	25.19	33.0	-7.8	
Rev. 3.17.11								

14.1.1. WCDMA REL 99

REL99 BAND 2

High Frequency Fundamental Measurement Compliance Certification Services Chamber D								
Company:		Samsung						
Project #:		13U15830						
Date:		08/22/13						
Test Engineer:		Kiya Kedida						
Configuration:		EUT with charger						
Mode:		Rel 99, PCS, Average						
Test Equipment:								
Receiving: T344, and Chamber D SMA Cables								
Substitution: Horn T60 Substitution, 8ft SMA Cable Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.852	9.6	V	1.50	7.94	16.04	33.0	-17.0	
1.852	13.9	H	1.50	8.80	21.20	33.0	-11.8	
Mid Ch								
1.880	11.1	V	1.50	7.95	17.56	33.0	-15.4	
1.880	14.7	H	1.50	8.68	21.88	33.0	-11.1	
High Ch								
1.908	10.0	V	1.50	7.97	16.52	33.0	-16.5	
1.908	14.1	H	1.50	8.57	21.12	33.0	-11.9	
Rev. 3.17.11								

14.1.1. WCDMA HSUPA

HSUPA BAND 2

High Frequency Fundamental Measurement Compliance Certification Services Chamber D								
Company:		Samsung						
Project #:		13U15830						
Date:		08/22/13						
Test Engineer:		Kiya Kedida						
Configuration:		EUT with charger						
Mode:		HSUPA, PCS, Average						
Test Equipment:								
Receiving: T344, and Chamber D SMA Cables								
Substitution: Horn T60 Substitution, 8ft SMA Cable Warehouse								
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1.852	8.6	V	1.50	7.94	15.04	33.0	-18.0	
1.852	12.9	H	1.50	8.80	20.17	33.0	-12.8	
Mid Ch								
1.880	10.8	V	1.50	7.95	17.29	33.0	-15.7	
1.880	14.5	H	1.50	8.68	21.64	33.0	-11.4	
High Ch								
1.908	9.9	V	1.50	7.97	16.42	33.0	-16.6	
1.908	13.7	H	1.50	8.57	20.79	33.0	-12.2	
Rev. 3.17.11								

14.1.1. LTE BAND 5

5 MHz

QPSK

High Frequency Substitution Measurement Compliance Certification Services Chamber C								
Company:		SAMSUNG						
Project #:		13U15830						
Date:		08/28/13						
Test Engineer:		CHARLES VERGONIO						
Configuration:		EUT with AC Adapter						
Mode:		LTE Band 5 - 5MHz BW QPSK, Average						
Test Equipment:								
Receiving: Sunol T185, and 3m Chamber N-type Cable (Setup this one for testing EUT)								
Substitution: Dipole S/N: 00022117, 4ft SMA Cable (SN # 245200 001) Warehouse.								
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
826.50	15.66	V	0.5	0.0	15.16	38.5	-23.3	
826.50	18.30	H	0.5	0.0	17.80	38.5	-20.6	
Mid Ch								
836.50	21.29	V	0.5	0.0	20.79	38.5	-17.7	
836.50	22.29	H	0.5	0.0	21.79	38.5	-16.7	
High Ch								
846.50	16.02	V	0.5	0.0	15.52	38.5	-22.9	
846.50	20.10	H	0.5	0.0	19.60	38.5	-18.8	
Rev. 3.17.11								

16QAM

High Frequency Substitution Measurement Compliance Certification Services Chamber C

Company: SAMSUNG
Project #: 13U15830
Date: 08/28/13
Test Engineer: CHARLES VERGONIO
Configuration: EUT with AC Adapter
Mode: LTE Band 5 - 5MHz BW 16QAM, Average

Test Equipment:

Receiving: Sunol T185, and 3m Chamber N-type Cable (Setup this one for testing EUT)
Substitution: Dipole S/N: 00022117, 4ft SMA Cable (SN # 245200 001) Warehouse.

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
826.50	16.65	V	0.5	0.0	16.15	38.5	-22.3	
826.50	19.16	H	0.5	0.0	18.66	38.5	-19.8	
Mid Ch								
836.50	18.91	V	0.5	0.0	18.41	38.5	-20.0	
836.50	21.30	H	0.5	0.0	20.80	38.5	-17.6	
High Ch								
846.50	15.78	V	0.5	0.0	15.28	38.5	-23.2	
846.50	20.13	H	0.5	0.0	19.63	38.5	-18.8	

Rev. 3.17.11

10 MHz

QPSK

High Frequency Substitution Measurement Compliance Certification Services Chamber C								
Company:		SAMSUNG						
Project #:		13U15830						
Date:		08/28/13						
Test Engineer:		CHARLES VERGONIO						
Configuration:		EUT with AC Adapter						
Mode:		LTE Band 5 - 10MHz BW QPSK, Average						
Test Equipment:								
Receiving: Sunol T185, and 3m Chamber N-type Cable (Setup this one for testing EUT)								
Substitution: Dipole S/N: 00022117, 4ft SMA Cable (SN # 245200 001) Warehouse.								
f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
829.00	17.68	V	0.5	0.0	17.18	38.5	-21.3	
829.00	20.02	H	0.5	0.0	19.52	38.5	-18.9	
Mid Ch								
836.50	19.47	V	0.5	0.0	18.97	38.5	-19.5	
836.50	21.62	H	0.5	0.0	21.12	38.5	-17.3	
High Ch								
844.00	14.76	V	0.5	0.0	14.26	38.5	-24.2	
844.00	20.41	H	0.5	0.0	19.91	38.5	-18.5	
Rev. 3.17.11								

16QAM

High Frequency Substitution Measurement Compliance Certification Services Chamber C

Company: SAMSUNG
Project #: 13U15830
Date: 08/28/13
Test Engineer: CHARLES VERGONIO
Configuration: EUT with AC Adapter
Mode: LTE Band 5 - 10MHz BW 16QAM, Average

Test Equipment:

Receiving: Sunol T185, and 3m Chamber N-type Cable (Setup this one for testing EUT)
Substitution: Dipole S/N: 00022117, 4ft SMA Cable (SN # 245200 001) Warehouse.

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
829.00	16.08	V	0.5	0.0	15.58	38.5	-22.9	
829.00	18.23	H	0.5	0.0	17.73	38.5	-20.7	
Mid Ch								
836.50	23.13	V	0.5	0.0	22.63	38.5	-15.8	
836.50	23.18	H	0.5	0.0	22.68	38.5	-15.8	
High Ch								
844.00	13.50	V	0.5	0.0	13.00	38.5	-25.4	
844.00	20.63	H	0.5	0.0	20.13	38.5	-18.3	

Rev. 3.17.11

14.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238

LIMIT

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

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

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

MODES TESTED

- GPRS
- UMTS REL 99, and HSUPA
- LTE Band 5

RESULTS

14.2.1. GPRS 1900 (Cellular Band)

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Samsung							
Project #:		13U15830							
Date:		08/20/13							
Test Engineer:		TRINA NOOR							
Configuration:		Y Position-AC Adapter							
Mode:		GPRS 1900							
Chamber		Pre-amplifier		Filter		Limit			
3m Chamber		T343 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1850MHz									
3.700	-10.1	V	3.0	35.4	1.0	-44.5	-13.0	-31.5	
5.550	-2.8	V	3.0	34.7	1.0	-36.6	-13.0	-23.6	
7.400	-14.8	V	3.0	34.9	1.0	-48.7	-13.0	-35.7	
3.700	-11.4	H	3.0	35.4	1.0	-45.8	-13.0	-32.8	
5.550	-6.4	H	3.0	34.7	1.0	-40.1	-13.0	-27.1	
7.400	-14.9	H	3.0	34.9	1.0	-48.8	-13.0	-35.8	
Mid Ch, 1880.0MHz									
3.760	-9.0	V	3.0	35.3	1.0	-43.3	-13.0	-30.3	
5.640	-1.9	V	3.0	34.7	1.0	-35.7	-13.0	-22.7	
7.520	-14.7	V	3.0	34.9	1.0	-48.7	-13.0	-35.7	
3.760	-11.1	H	3.0	35.3	1.0	-45.5	-13.0	-32.5	
5.640	-6.7	H	3.0	34.7	1.0	-40.4	-13.0	-27.4	
7.520	-11.3	H	3.0	34.9	1.0	-45.2	-13.0	-32.2	
High Ch, 1907.6MHz									
3.820	-9.9	V	3.0	35.3	1.0	-44.2	-13.0	-31.2	
5.729	-5.8	V	3.0	34.7	1.0	-39.6	-13.0	-26.6	
7.640	-13.7	V	3.0	35.0	1.0	-47.6	-13.0	-34.6	
3.820	-8.2	H	3.0	35.3	1.0	-42.5	-13.0	-29.5	
5.729	-7.1	H	3.0	34.7	1.0	-40.8	-13.0	-27.8	
7.640	-10.6	H	3.0	35.0	1.0	-44.5	-13.0	-31.5	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

14.2.1. WCDMA REL 99

REL99 BAND 2

Compliance Certification Services									
Above 1GHz High Frequency Substitution Measurement									
Company:		Samsung							
Project #:		13U15830							
Date:		08/20/13							
Test Engineer:		TRINA NOOR							
Configuration:		Y Position-AC Adapter							
Mode:		TX, UMTS 1900, REL 99							
Chamber		Pre-amplifier		Filter		Limit			
3m Chamber		T343 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1852.4MHz									
3.704	-19.7	V	3.0	35.4	1.0	-54.1	-13.0	-41.1	
5.557	-9.4	V	3.0	34.7	1.0	-43.1	-13.0	-30.1	
7.409	-17.0	V	3.0	34.9	1.0	-50.9	-13.0	-37.9	
3.704	-22.6	H	3.0	35.4	1.0	-57.0	-13.0	-44.0	
5.557	-8.9	H	3.0	34.7	1.0	-42.6	-13.0	-29.6	
7.409	-17.9	H	3.0	34.9	1.0	-51.8	-13.0	-38.8	
Mid Ch, 1880.0MHz									
3.760	-19.7	V	3.0	35.3	1.0	-54.0	-13.0	-41.0	
5.640	-11.2	V	3.0	34.7	1.0	-45.0	-13.0	-32.0	
7.520	-17.1	V	3.0	34.9	1.0	-51.0	-13.0	-38.0	
3.760	-21.4	H	3.0	35.3	1.0	-55.7	-13.0	-42.7	
5.640	-12.8	H	3.0	34.7	1.0	-46.5	-13.0	-33.5	
7.520	-17.1	H	3.0	34.9	1.0	-51.1	-13.0	-38.1	
High Ch, 1907.6MHz									
3.815	-20.2	V	3.0	35.3	1.0	-54.4	-13.0	-41.4	
5.772	-9.6	V	3.0	34.7	1.0	-43.4	-13.0	-30.4	
7.630	-15.9	V	3.0	34.9	1.0	-49.9	-13.0	-36.9	
3.815	-21.3	H	3.0	35.3	1.0	-55.6	-13.0	-42.6	
5.772	-13.8	H	3.0	34.7	1.0	-47.6	-13.0	-34.6	
7.630	-17.0	H	3.0	34.9	1.0	-51.0	-13.0	-38.0	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

14.2.1. WCDMA HSUPA

HSUPA BAND 2

Compliance Certification Services									
Above 1GHz High Frequency Substitution Measurement									
Company:		Samsung							
Project #:		13U15830							
Date:		08/20/13							
Test Engineer:		TRINA NOOR							
Configuration:		Y Position-AC Adapter							
Mode:		TX, UMTS 1900, HSUPA							
Chamber		Pre-amplifier		Filter		Limit			
3m Chamber		T343 8449B		Filter 1		Part 24			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1852.4MHz									
3.704	-22.5	V	3.0	35.4	1.0	-56.9	-13.0	-43.9	
5.557	-14.1	V	3.0	34.7	1.0	-47.9	-13.0	-34.9	
7.409	-18.6	V	3.0	34.9	1.0	-52.5	-13.0	-39.5	
3.704	-22.5	H	3.0	35.4	1.0	-56.9	-13.0	-43.9	
5.557	-11.0	H	3.0	34.7	1.0	-44.7	-13.0	-31.7	
7.409	-18.2	H	3.0	34.9	1.0	-52.1	-13.0	-39.1	
Mid Ch, 1880.0MHz									
3.760	-19.4	V	3.0	35.3	1.0	-53.8	-13.0	-40.8	
5.640	-11.3	V	3.0	34.7	1.0	-45.1	-13.0	-32.1	
7.520	-16.6	V	3.0	34.9	1.0	-50.5	-13.0	-37.5	
3.760	-22.3	H	3.0	35.3	1.0	-56.6	-13.0	-43.6	
5.640	-14.1	H	3.0	34.7	1.0	-47.9	-13.0	-34.9	
7.520	-17.3	H	3.0	34.9	1.0	-51.2	-13.0	-38.2	
High Ch, 1907.6MHz									
3.815	-20.2	V	3.0	35.3	1.0	-54.5	-13.0	-41.5	
5.772	-10.1	V	3.0	34.7	1.0	-43.9	-13.0	-30.9	
7.630	-16.6	V	3.0	34.9	1.0	-50.6	-13.0	-37.6	
3.815	-21.8	H	3.0	35.3	1.0	-56.1	-13.0	-43.1	
5.772	-15.0	H	3.0	34.7	1.0	-48.7	-13.0	-35.7	
7.630	-17.8	H	3.0	34.9	1.0	-51.8	-13.0	-38.8	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

14.2.1. LTE BAND 5

5 MHz

QPSK

UL Verification Services Above 1GHz High Frequency Substitution Measurement									
Company: Samsung									
Project #: 13U15830									
Date: 08/19/13									
Test Engineer: TRINA NOOR									
Configuration: EUT.W CHAGER -X Position									
Mode: TX, LTE BAND 5, 5MHz BW,QPSK									
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		FCC Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Channel (826.5MHz)									
1.653	-26.9	V	3.0	35.5	1.0	-61.4	-13.0	-48.4	
2.479	-24.5	V	3.0	35.4	1.0	-58.9	-13.0	-45.9	
3.306	-22.2	V	3.0	35.5	1.0	-56.7	-13.0	-43.7	
1.653	-27.2	H	3.0	35.5	1.0	-61.8	-13.0	-48.8	
2.479	-25.0	H	3.0	35.4	1.0	-59.4	-13.0	-46.4	
3.306	-22.0	H	3.0	35.5	1.0	-56.6	-13.0	-43.6	
Mid Channel (836.5MHz)									
1.673	-27.5	V	3.0	35.5	1.0	-62.0	-13.0	-49.0	
2.509	-23.9	V	3.0	35.4	1.0	-58.3	-13.0	-45.3	
3.346	-21.9	V	3.0	35.5	1.0	-56.4	-13.0	-43.4	
1.673	-27.3	H	3.0	35.5	1.0	-61.8	-13.0	-48.8	
2.509	-26.0	H	3.0	35.4	1.0	-60.4	-13.0	-47.4	
3.346	-21.0	H	3.0	35.5	1.0	-55.5	-13.0	-42.5	
High Channel (846.5MHz)									
1.693	-27.1	V	3.0	35.5	1.0	-61.7	-13.0	-48.7	
2.539	-23.3	V	3.0	35.4	1.0	-57.7	-13.0	-44.7	
3.386	-22.8	V	3.0	35.5	1.0	-57.3	-13.0	-44.3	
1.693	-27.0	H	3.0	35.5	1.0	-61.6	-13.0	-48.6	
2.539	-25.4	H	3.0	35.4	1.0	-59.8	-13.0	-46.8	
3.386	-21.1	H	3.0	35.5	1.0	-55.6	-13.0	-42.6	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

16QAM

UL Verification Services Above 1GHz High Frequency Substitution Measurement									
Company: Samsung									
Project #: 13U15830									
Date: 08/19/13									
Test Engineer: TRINA NOOR									
Configuration: EUT.W CHAGER -X Position									
Mode: TX, LTE BAND 5, 5MHz BW, 16QAM									
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		FCC Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Channel (826.5MHz)									
1.653	-27.6	V	3.0	35.5	1.0	-62.2	-13.0	-49.2	
2.479	-23.4	V	3.0	35.4	1.0	-57.8	-13.0	-44.8	
3.306	-20.6	V	3.0	35.5	1.0	-55.2	-13.0	-42.2	
1.653	-27.7	H	3.0	35.5	1.0	-62.2	-13.0	-49.2	
2.479	-25.3	H	3.0	35.4	1.0	-59.8	-13.0	-46.8	
3.306	-21.1	H	3.0	35.5	1.0	-55.6	-13.0	-42.6	
Mid Channel (836.5MHz)									
1.673	-27.0	V	3.0	35.5	1.0	-61.5	-13.0	-48.5	
2.509	-23.1	V	3.0	35.4	1.0	-57.5	-13.0	-44.5	
3.346	-21.2	V	3.0	35.5	1.0	-55.7	-13.0	-42.7	
1.673	-27.0	H	3.0	35.5	1.0	-61.5	-13.0	-48.5	
2.509	-25.4	H	3.0	35.4	1.0	-59.8	-13.0	-46.8	
3.346	-20.9	H	3.0	35.5	1.0	-55.4	-13.0	-42.4	
High Channel (846.5MHz)									
1.693	-27.3	V	3.0	35.5	1.0	-61.8	-13.0	-48.8	
2.539	-23.8	V	3.0	35.4	1.0	-58.2	-13.0	-45.2	
3.389	-21.5	V	3.0	35.5	1.0	-56.0	-13.0	-43.0	
1.693	-27.1	H	3.0	35.5	1.0	-61.6	-13.0	-48.6	
2.539	-25.4	H	3.0	35.4	1.0	-59.9	-13.0	-46.9	
3.389	-21.0	H	3.0	35.5	1.0	-55.5	-13.0	-42.5	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

10 MHz

QPSK

UL Verification Services Above 1GHz High Frequency Substitution Measurement									
Company: Samsung									
Project #: 13U15830									
Date: 08/19/13									
Test Engineer: TRINA NOOR									
Configuration: EUT.W CHAGER -X Position									
Mode: TX, LTE BAND 5, 10MHz BW,QPSK									
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		FCC Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Channel (829MHz)									
1.658	-27.9	V	3.0	35.5	1.0	-62.5	-13.0	-49.5	
2.487	-23.7	V	3.0	35.4	1.0	-58.1	-13.0	-45.1	
3.316	-21.5	V	3.0	35.5	1.0	-56.0	-13.0	-43.0	
1.658	-27.8	H	3.0	35.5	1.0	-62.3	-13.0	-49.3	
2.487	-24.5	H	3.0	35.4	1.0	-58.9	-13.0	-45.9	
3.316	-20.2	H	3.0	35.5	1.0	-54.8	-13.0	-41.8	
Mid Channel (836.5MHz)									
1.673	-27.6	V	3.0	35.5	1.0	-62.1	-13.0	-49.1	
2.509	-23.7	V	3.0	35.4	1.0	-58.1	-13.0	-45.1	
3.346	-20.8	V	3.0	35.5	1.0	-55.3	-13.0	-42.3	
1.673	-26.7	H	3.0	35.5	1.0	-61.3	-13.0	-48.3	
2.509	-25.0	H	3.0	35.4	1.0	-59.4	-13.0	-46.4	
3.346	-21.4	H	3.0	35.5	1.0	-55.9	-13.0	-42.9	
High Channel (844MHz)									
1.688	-27.4	V	3.0	35.5	1.0	-61.9	-13.0	-48.9	
2.532	-23.2	V	3.0	35.4	1.0	-57.6	-13.0	-44.6	
3.376	-20.6	V	3.0	35.5	1.0	-55.1	-13.0	-42.1	
1.688	-27.0	H	3.0	35.5	1.0	-61.5	-13.0	-48.5	
2.532	-25.6	H	3.0	35.4	1.0	-60.0	-13.0	-47.0	
3.376	-20.4	H	3.0	35.5	1.0	-54.9	-13.0	-41.9	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									

16QAM

UL Verification Services Above 1GHz High Frequency Substitution Measurement									
Company:		Samsung							
Project #:		13U15830							
Date:		08/19/13							
Test Engineer:		TRINA NOOR							
Configuration:		EUT.W CHAGER -X Position							
Mode:		TX, LTE BAND 5, 10MHz BW,16QAM							
Chamber		Pre-amplifier		Filter		Limit			
5m Chamber B		T145 8449B		Filter 1		FCC Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Channel (829MHz)									
1.658	-27.4	V	3.0	35.5	1.0	-61.9	-13.0	-48.9	
2.487	-20.5	V	3.0	35.4	1.0	-54.9	-13.0	-41.9	
3.316	-21.6	V	3.0	35.5	1.0	-56.1	-13.0	-43.1	
1.658	-26.8	H	3.0	35.5	1.0	-61.3	-13.0	-48.3	
2.487	-25.8	H	3.0	35.4	1.0	-60.2	-13.0	-47.2	
3.316	-21.6	H	3.0	35.5	1.0	-56.2	-13.0	-43.2	
Mid Channel (836.5MHz)									
1.673	-27.0	V	3.0	35.5	1.0	-61.5	-13.0	-48.5	
2.509	-24.0	V	3.0	35.4	1.0	-58.4	-13.0	-45.4	
3.346	-21.2	V	3.0	35.5	1.0	-55.7	-13.0	-42.7	
1.673	-27.1	H	3.0	35.5	1.0	-61.7	-13.0	-48.7	
2.509	-25.8	H	3.0	35.4	1.0	-60.2	-13.0	-47.2	
3.346	-21.5	H	3.0	35.5	1.0	-56.0	-13.0	-43.0	
High Channel (844MHz)									
1.688	-27.4	V	3.0	35.5	1.0	-62.0	-13.0	-49.0	
2.532	-23.2	V	3.0	35.4	1.0	-57.7	-13.0	-44.7	
3.376	-20.1	V	3.0	35.5	1.0	-54.6	-13.0	-41.6	
1.688	-27.2	H	3.0	35.5	1.0	-61.8	-13.0	-48.8	
2.532	-26.2	H	3.0	35.4	1.0	-60.6	-13.0	-47.6	
3.376	-20.7	H	3.0	35.5	1.0	-55.2	-13.0	-42.2	
Rev. 03.03.09									
Note: No other emissions were detected above the system noise floor.									