PCTEST ENGINEERING LABORATORY, INC.
6660-B Dobbin Road, Columbia, MD 21045 USA
Tel. 410.290.6652 / Fax 410.290.6554
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MEASUREMENT REPORT
FCC Part 27 LTE

Applicant Name:
Novatel Wireless Inc.
9645 Scranton Road, Suite 205
San Diego, CA 92121-3030
United States

Date of Testing:
September 14-16, 2011
Test Site/Location:
PCTEST Lab., Columbia, MD, USA
Test Report Serial No.:
0Y1109131635.PKR

FCC ID:	**PKRNVWMIFI4620**
APPLICANT:	**NOVATEL WIRELESS INC.**

Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§2; §27
EUT Type:	Personal Wireless Router
Model(s):	MIFI4620L
Tx Freq. Range:	779.5MHz - 784.5MHz (5MHz BW LTE - Band 13) 782MHz (10MHz BW LTE - Band 13)
Max. Output Power:	0.219 W ERP (5MHz BW - QPSK) (23.4 dBm) 0.2 W ERP (5MHz BW - 16-QAM) (23 dBm) 0.178 W ERP (10MHz BW - QPSK) (22.5 dBm) 0.186 W ERP (10MHz BW - 16-QAM) (22.7 dBm)
Em. Designator(s):	4M47G7D (5MHz BW, QPSK, Low Chan.), 4M48W7D (5MHz BW, 16-QAM Low Chan.), 8M93G7D (10MHz BW, QPSK), 8M94W7D (10MHz BW, 16-QAM)
Test Device S/N:	*identical prototype* [S/N: Primary Unit]

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Grant Conditions: Power output listed is ERP for Part 27.

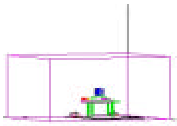
PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

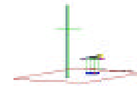
ilac-MRA
ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

REV 1.1LTE
09/13/10

T A B L E   O F   C O N T E N T S



MEASUREMENT REPORT
FCC Part 27

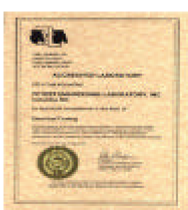


§2.1033 General Information

APPLICANT:	Novatel Wireless Inc.
APPLICANT ADDRESS:	9645 Scranton Road, Suite 205 San Diego, CA 92121-3030
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	6660-B Dobbin Road, Columbia, MD 21045 USA
FCC RULE PART(S):	§2; §27
BASE MODEL:	MIFI4620L
FCC ID:	PKRNVWMIFI4620
FCC CLASSIFICATION:	PCS Licensed Transmitter (PCB)
EMISSION DESIGNATOR(S):	4M47G7D (5MHz BW, QPSK, Low Chan.), 4M48W7D (5MHz BW, 16-QAM Low Chan.), 8M93G7D (10MHz BW, QPSK), 8M94W7D (10MHz BW, 16-QAM)
MODULATIONS:	QPSK, 16-QAM (Uplink)
FREQUENCY TOLERANCE:	Emission must remain in band
Test Device Serial No.:	Primary Unit ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	September 14-16, 2011
TEST REPORT S/N:	0Y1109131635.PKR

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab. located in Columbia, MD 21045, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451A-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451A-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 Testing Facility

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity are, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39^{o} 11'15" N latitude and 76^{o} 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2003 on January 28, 2009.

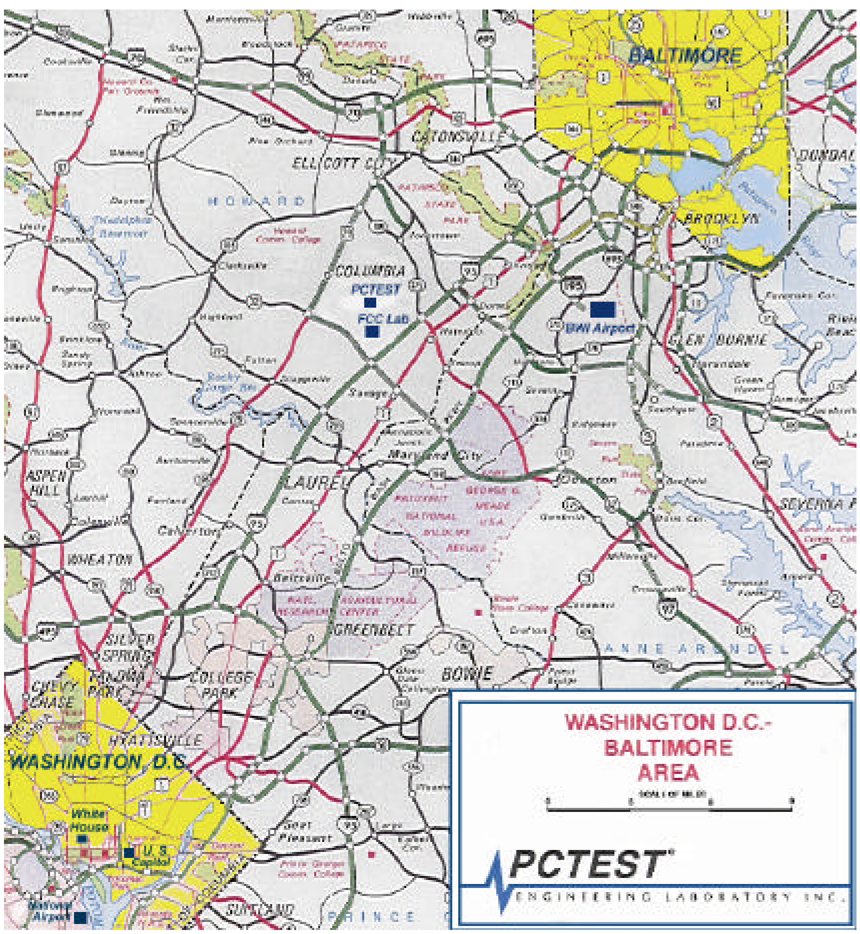


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Novatel Personal Wireless Router FCC ID: PKRNVWMIFI4620**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function. The EUT consisted of the following component(s):

Trade Name / Base Model	FCC ID	Description
Novatel / Model: MIFI4620L	PKRNVWMIFI4620	Personal Wireless Router

Table 2-1. EUT Equipment Description

The EUT was set to transmit at full power in each available channel bandwidth of 5MHz and 10MHz with a CMW500 LTE Base Station Simulator. Each available modulation type (i.e. QPSK, 16-QAM) and resource block size configuration was tested to determine the configuration producing the worst case emissions.

2.2 EUT Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO (BC0, BC1), 850/1900 GSM/GPRS/EDGE, 850/1900 WCDMA/HSPA, Band 13 LTE, 802.11b/g/n WLAN

2.3 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

2.4 Labeling Requirements

Per 2.925

The FCC identifier shall be permanently affixed to the equipment and shall be readily visible to the purchaser at the time of purchase.

Per 15.19; Docket 95-19

In addition to this requirement, a device subject to certification shall be labeled as follows:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(b)(2).

Please see attachment for FCC ID label and label location.

3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The radiated spurious measurements were made outdoors at a 3-meter test range (see Figure 3-1). The equipment under test is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. This power level was recorded using a broadband average power meter. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This level is recorded with the power meter. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

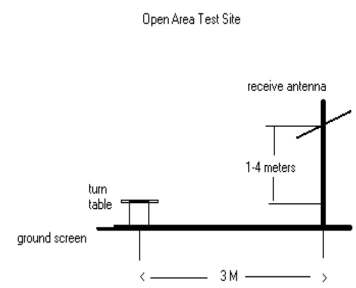


Figure 3-1. Diagram of 3-meter outdoor test range

Deviation from Measurement Procedure............................None

3.2 Occupied Bandwidth Emission Limits

<u>§2.1049, §27.53(l)(6)</u>

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

3.3 Block C Frequency Range

<u>§27.5(b)(3)</u>

Two paired channels of 11 megahertz each are available for assignment in Block C in the 746-757 MHz and 776-787 MHz bands. In the event that no licenses for two channels in this Block C are assigned based on the results of the first auction in which such licenses were offered because the auction results do not satisfy the applicable reserve price, the spectrum in the 746-757 MHz and 776-787 MHz bands will instead be made available for assignment at a subsequent auction as follows: (i) Two paired channels of 6 megahertz each available for assignment in Block C1 in the 746-752 MHz and 776-782 MHz bands. (ii) Two paired channels of 5 megahertz each available for assignment in Block C2 in the 752-757 MHz and 782-787 MHz bands.

3.4 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051, §27.53(c)

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10^{th} harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB. Compliance with these provisions 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. 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 emission are attenuated at least 26 dB below the transmitter power.

3.5 Radiated Power and Radiated Spurious Emissions

§2.1053, §27.53(c)

Spurious and harmonic radiated emissions are measured outdoors at our 3-meter test range. The equipment under test is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. This level is then measured with a broadband average power meter. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10^{th} harmonic. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive average power meter reading. This spurious level is recorded with the power meter. For readings above 1 GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration. This device was tested under all configurations and the worse case radiated power is reported while transmitting with one resource block (RB Offset=24 for 5MHz BW, and RB Offset=49 for 10MHz BW) for each channel bandwidth.

3.6 Frequency Stability / Temperature Variation

§2.1055, §27.54

The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).

2. The equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.

3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A sufficient stabilization period at each temperature shall be used prior to each frequency requirement.

4.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	263-10dB	(DC-18GHz) 10 dB Attenuator	N/A		N/A	N/A
-	No.166	(1000-26500MHz) Microwave RF Cable	N/A		N/A	N/A
-	No.167	(100kHz - 100MHz) RG58 Coax Cable	N/A		N/A	N/A
Agilent	8449B	(1-26.5GHz) Pre-Amplifier	2/8/2011	Annual	2/8/2012	3008A00985
Agilent	85650A	Quasi-Peak Adapter	4/7/2011	Annual	4/7/2012	3303A01872
Agilent	85650A	Quasi-Peak Adapter	4/7/2011	Annual	4/7/2012	2043A00301
Agilent	8566B	(100Hz-22GHz) Spectrum Analyzer	4/7/2011	Annual	4/7/2012	3638A08713
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/13/2010	Annual	10/13/2011	3613A00315
Agilent	E4407B	ESA Spectrum Analyzer	4/5/2011	Annual	4/5/2012	US39210313
Agilent	E4448A	PSA (3Hz-50GHz) Spectrum Analyzer	11/30/2010	Annual	11/30/2011	US42510244
Agilent	E5515C	Wireless Communications Test Set	10/11/2010	Annual	10/11/2011	GB46110872
Agilent	E5515C	Wireless Communications Test Set	10/8/2010	Annual	10/8/2011	GB46310798
Agilent	E5515C	Wireless Communications Test Set	7/6/2011	Annual	7/6/2012	GB41450275
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/8/2011	Annual	4/8/2012	MY45470194
Agilent	E8267C	Vector Signal Generator	10/11/2010	Annual	10/11/2011	US42340152
Agilent	N9020A	MXA Signal Analyzer	10/8/2010	Annual	10/8/2011	US46470561
Agilent	E5515C	Wireless Communications Test Set	2/8/2011	Annual	2/8/2012	GB45360985
Agilent	N9038A	MXE EMI Receiver	8/5/2011	Annual	8/5/2012	MY51210133
Anritsu	ML2495A	Power Meter	10/13/2010	Annual	10/13/2011	941001
Anritsu	MA2411B	Pulse Sensor	N/A		N/A	1027293
Compliance Design	Roberts	Dipole Set	4/7/2010	Biennial	4/7/2012	146
Compliance Design	Roberts	Dipole Set	4/7/2010	Biennial	4/7/2012	147
Emco	3115	Horn Antenna (1-18GHz)	10/14/2009	Biennial	10/14/2011	9704-5182
Emco	3115	Horn Antenna (1-18GHz)	4/8/2010	Biennial	4/8/2012	9205-3874
Espec	ESX-2CA	Environmental Chamber	4/21/2011	Annual	4/21/2012	17620
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/11/2010	Annual	10/11/2011	1833460
Gigatronics	8651A	Universal Power Meter	10/11/2010	Annual	10/11/2011	8650319
K & L	11SH10	Band Pass Filter	N/A		N/A	1300/4000
K & L	11SH10	Band Pass Filter	N/A		N/A	4000/12000
MiniCircuits	VHF-1300+	High Pass Filter	N/A		N/A	30716
MiniCircuits	VHF-3100+	High Pass Filter	N/A		N/A	30721
Pasternack	PE2208-6	Bidirectional Coupler	N/A		N/A	N/A
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	3/11/2011	Annual	3/11/2012	103962
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	8/5/2011	Annual	8/5/2012	112347
Sunol	DRH-118	Horn Antenna (1 - 18GHz)	7/5/2011	Biennial	7/5/2013	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	10/17/2009	Biennial	10/17/2011	A051107
Sunol	DRH-118	Horn Antenna (1-18 GHz)	6/17/2011	Biennial	6/17/2013	A042511

Table 4-1. Test Equipment

5.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/ Digital Info
D = Amplitude/Angle Modulated

16QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Combination (Audio/Data)

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average receive power meter reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the power meter. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

6.0 TEST RESULTS

6.1 Summary

Company Name: Novatel Wireless Inc.

FCC ID: PKRNVWMIFI4620

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (Tx)					
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Sections 7.0, 8.0
2.1051, 27.53(c)(2), 27.53(c)(4)	Band Edge / Conducted Spurious Emissions	< 43 + $10\log_{10}$ (P[Watts]) < 65 + $10\log_{10}$ (P[Watts]) in a 6.25kHz bandwidth for emissions in the 763 – 775MHz and 793 – 805MHz bands		PASS	Sections 7.0, 8.0
2.1046	Transmitter Conducted Output Power Measurements	N/A		N/A	Section 6.2
2.1055, 27.54	Frequency Stability	Fundamental emissions must stay within the allotted band		PASS	Section 6.6
27.50(b)(10)	Effective Radiated Power	< 3 Watts max. ERP	RADIATED	PASS	Section 6.3
2.1053, 27.53(c)(2) 27.53(c)(4)	Undesirable Out-of-Band Emissions	< 43 + $10\log_{10}$ (P[Watts]) for all out-of-band emissions		PASS	Section 6.4
2.1053, 27.53(f)	Undesirable Emissions in the 1559 – 1610MHz band	< -40dBm/MHz EIRP (wideband) < -50dBm EIRP (narrowband)		PASS	Section 6.5

Table 6-1. Summary of Test Results

6.2 Transmitter Conducted Output Power

§2.1046

The **Novatel Personal Wireless Router FCC ID: PKRNVWMIFI4620** was connected to a Rohde and Schwarz LTE Base Station Simulator (Model: CMW500). The EUT was configured through the CMW500 to produce all required combinations of modulations, channel bandwidths, and resource block sizes to determine the configuration producing the worst case emissions.

	Modulation	Channel Bandwidth [MHz]	RB Size	RB Offset	Maximum Avg. Power [dBm]
Low Chan 23205 (779.5 MHz)	QPSK	5	1	0	24.47
	16-QAM	5	1	0	23.52
	QPSK	5	1	24	24.45
	16-QAM	5	1	24	23.33
	QPSK	5	12	6	23.36
	16-QAM	5	12	6	22.32
	QPSK	5	25	0	23.48
	16-QAM	5	25	0	22.79

	Modulation	Channel Bandwidth [MHz]	RB Size	RB Offset	Maximum Avg. Power [dBm]
High Chan 23255 (784.5 MHz)	QPSK	5	1	0	24.48
	16-QAM	5	1	0	23.44
	QPSK	5	1	24	24.49
	16-QAM	5	1	24	23.42
	QPSK	5	12	6	23.55
	16-QAM	5	12	6	22.36
	QPSK	5	25	0	23.55
	16-QAM	5	25	0	22.95

Table 6-2. Maximum Average Conducted Output Power (5MHz Bandwidth)

	Modulation	Channel Bandwidth [MHz]	RB Size	RB Offset	Maximum Avg. Power [dBm]
782MHz	QPSK	10	1	0	24.44
	16-QAM	10	1	0	23.66
	QPSK	10	1	49	24.48
	16-QAM	10	1	49	23.99
	QPSK	10	25	12	23.82
	16-QAM	10	25	12	23.01
	QPSK	10	50	0	23.60
	16-QAM	10	50	0	22.85

Table 6-3. Maximum Average Conducted Output Power (10MHz Bandwidth)

Figure 6-1. Conducted Output Power Test Setup Diagram

6.3 Effective Radiated Power Output Data

§27.50(b)(10)

Frequency [MHz]	Modulation	BW [MHz]	Measured Level [dBm]	Substitute Level [dBm]	Antenna Gain [dBd]	Pol [H/V]	ERP [dBm]	ERP [Watts]	Battery
779.50	QPSK	5	-12.000	22.80	0.00	H	22.80	0.191	Standard
779.50	16-QAM	5	-12.200	22.60	0.00	H	22.60	0.182	Standard
784.50	QPSK	5	-11.400	23.40	0.00	H	23.40	0.219	Standard
784.50	16-QAM	5	-11.800	23.00	0.00	H	23.00	0.200	Standard
782.00	QPSK	10	-12.300	22.50	0.00	H	22.50	0.178	Standard
782.00	16-QAM	10	-12.100	22.70	0.00	H	22.70	0.186	Standard

Table 6-4. Effective Radiated Power Output Data

NOTES:

Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. Final power measurements are made with a broadband average power meter. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. This level is recorded using the power meter. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

This device was tested under all configurations and the worse case radiated power is reported while transmitting with one resource block (RB Offset=24 for 5MHz BW, and RB Offset=49 for 10MHz BW) for each channel bandwidth. EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worse case setup was reported in the horizontally upright position. This unit was tested with its standard battery. Radiated spurious emissions were investigated for QPSK and 16-QAM modulations and the worst case emissions were found with the unit transmitting in QPSK modulation for 5MHz BW, and 16-QAM modulation for 10MHz BW. The data reported in the table above was measured in this test setup.

6.4 LTE Radiated Measurements

§2.1053, §27.53(c)(2)

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY:	779.50	MHz		
BANDWIDTH:	5	MHz		
MEASURED OUTPUT POWER:	23.400	dBm	=	0.219 W
MODULATION SIGNAL:	QPSK			
DISTANCE:	3	meters		
LIMIT:	$43 + 10 \log_{10} (W) =$	36.40	dBc	

FREQUENCY (MHz)	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBi)	SPURIOUS EMISSION LEVEL (dBm)	POL (H/V)	(dBc)
2342.84	-54.94	8.68	-46.26	H	69.7
3122.34	-53.07	8.74	-44.34	H	67.7
3901.84	-89.83	8.92	-80.91	H	104.3
4681.34	-91.29	11.19	-80.10	H	103.5

Table 6-5. Radiated Spurious Data (16-QAM Modulation)

NOTES:

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. Final power measurements are made with a broadband average power meter. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. This spurious level is recorded using the power meter. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This device was tested under all configurations and the worse case radiated power is reported while transmitting with one resource block (RB Offset=24 for 5MHz BW, and RB Offset=49 for 10MHz BW) for each channel bandwidth. EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worse case setup was reported in the horizontally upright position. This unit was tested with its standard battery. Radiated spurious emissions were investigated for QPSK and 16-QAM modulations and the worst case emissions were found with the unit transmitting in QPSK modulation for 5MHz BW, and 16-QAM modulation for 10MHz BW. The data reported in the table above was measured in this test setup.

LTE Radiated Measurements (Cont'd)
§2.1053, §27.53(c)(2)

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY:	784.50	MHz		
BANDWIDTH:	5	MHz		
MEASURED OUTPUT POWER:	23.400	dBm	=	0.219 W
MODULATION SIGNAL:	QPSK			
DISTANCE:	3	meters		
LIMIT:	$43 + 10 \log_{10}$ (W) =	36.40	dBc	

FREQUENCY (MHz)	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBi)	SPURIOUS EMISSION LEVEL (dBm)	POL (H/V)	(dBc)
2349.11	-54.26	8.66	-45.60	H	69.0
3133.61	-51.59	8.72	-42.87	H	66.3
3918.11	-50.99	8.93	-42.06	H	65.5
4702.61	-91.23	11.22	-80.01	H	103.4

Table 6-6. Radiated Spurious Data (16-QAM Modulation)

NOTES:

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. Final power measurements are made with a broadband average power meter. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. This spurious level is recorded using the power meter. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This device was tested under all configurations and the worse case radiated power is reported while transmitting with one resource block (RB Offset=24 for 5MHz BW, and RB Offset=49 for 10MHz BW) for each channel bandwidth. EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worse case setup was reported in the horizontally upright position. This unit was tested with its standard battery. Radiated spurious emissions were investigated for QPSK and 16-QAM modulations and the worst case emissions were found with the unit transmitting in QPSK modulation for 5MHz BW, and 16-QAM modulation for 10MHz BW. The data reported in the table above was measured in this test setup.

LTE Radiated Measurements (Cont'd)

§2.1053, §27.53(c)(2)

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 782.00 MHz
BANDWIDTH: 10 MHz
MEASURED OUTPUT POWER: 22.700 dBm = 0.186 W
MODULATION SIGNAL: 16-QAM
DISTANCE: 3 meters
LIMIT: $43 + 10 \log_{10}$ (W) = 35.70 dBc

FREQUENCY (MHz)	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBi)	SPURIOUS EMISSION LEVEL (dBm)	POL (H/V)	(dBc)
2346.00	-55.20	8.67	-46.53	H	69.2
3128.00	-55.13	8.73	-46.40	H	69.1
3910.00	-53.32	8.92	-44.40	H	67.1
4692.00	-91.26	11.21	-80.06	H	102.8

Table 6-7. Radiated Spurious Data (16-QAM Modulation)

NOTES:

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. Final power measurements are made with a broadband average power meter. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. This spurious level is recorded using the power meter. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This device was tested under all configurations and the worse case radiated power is reported while transmitting with one resource block (RB Offset=24 for 5MHz BW, and RB Offset=49 for 10MHz BW) for each channel bandwidth. EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worse case setup was reported in the horizontally upright position. This unit was tested with its standard battery. Radiated spurious emissions were investigated for QPSK and 16-QAM modulations and the worst case emissions were found with the unit transmitting in QPSK modulation for 5MHz BW, and 16-QAM modulation for 10MHz BW. The data reported in the table above was measured in this test setup.

6.5 LTE Radiated Measurements in 1559 – 1610MHz Band

§2.1053, §27.53(f)

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY:	784.50	MHz	
BANDWIDTH:	5	MHz	
MEASURED OUTPUT POWER:	23.400	dBm	= 0.219 W
DISTANCE:	3	meters	
NARROWBAND EMISSION LIMIT:	-50	dBm	
WIDEBAND EMISSION LIMIT:	-40	dBm/MHz	

FREQUENCY (MHz)	Modulation	EMISSION TYPE	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBi)	SPURIOUS EMISSION LEVEL (dBm)	POL (H/V)	MARGIN (dB)
1573.30	QPSK	WIDEBAND	-53.48	8.43	-45.05	H	-5.05
1573.20	16-QAM	WIDEBAND	-53.98	8.43	-45.55	H	-5.55

Table 6-8. Radiated Spurious Data (5MHz)

OPERATING FREQUENCY:	782.00	MHz	
BANDWIDTH:	10	MHz	
MEASURED OUTPUT POWER:	22.700	dBm	= 0.186 W
DISTANCE:	3	meters	
NARROWBAND EMISSION LIMIT:	-50	dBm	
WIDEBAND EMISSION LIMIT:	-40	dBm/MHz	

FREQUENCY (MHz)	Modulation	EMISSION TYPE	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBi)	SPURIOUS EMISSION LEVEL (dBm)	POL (H/V)	MARGIN (dB)
1572.80	QPSK	WIDEBAND	-51.98	8.43	-43.55	H	-3.55
1572.80	16-QAM	WIDEBAND	-52.48	8.43	-44.05	H	-4.05

Table 6-9. Radiated Spurious Data (10MHz)

NOTES:

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. Final power measurements are made with a broadband average power meter. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. This spurious level is recorded using the power meter. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This device was tested under all configurations and the worse case radiated power is reported while transmitting with one resource block (RB Offset=24 for 5MHz BW, and RB Offset=49 for 10MHz BW) for each channel bandwidth. EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worse case setup was reported in the horizontally upright position. This unit was tested with its standard battery. Radiated spurious emissions were investigated for QPSK and 16-QAM modulations and the worst case emissions were found with the unit transmitting in QPSK modulation for 5MHz BW, and 16-QAM modulation for 10MHz BW. The data reported in the table above was measured in this test setup.

6.6 LTE Frequency Stability Measurements

§2.1055, §27.54

OPERATING FREQUENCY: 782,000,000 Hz

REFERENCE VOLTAGE: 3.7 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.70	+ 20 (Ref)	781,999,991	-9	-0.000001
100 %		- 30	781,999,981	-19	-0.000002
100 %		- 20	782,000,008	8	0.000001
100 %		- 10	781,999,989	-11	-0.000001
100 %		0	782,000,011	11	0.000001
100 %		+ 10	781,999,987	-13	-0.000002
100 %		+ 20	781,999,986	-14	-0.000002
100 %		+ 30	781,999,987	-13	-0.000002
100 %		+ 40	781,999,984	-16	-0.000002
100 %		+ 50	781,999,985	-15	-0.000002
115 %	4.26	+ 20	781,999,981	-19	-0.000002
85 %	3.40	+ 20	781,999,988	-12	-0.000002

Table 6-10. Frequency Stability Data

Note:

The frequency deviation was measured to ensure that the channel emissions remained within the authorized band with varying temperature and voltage.

LTE Frequency Stability Measurements (Cont'd)

§2.1055, §27.54

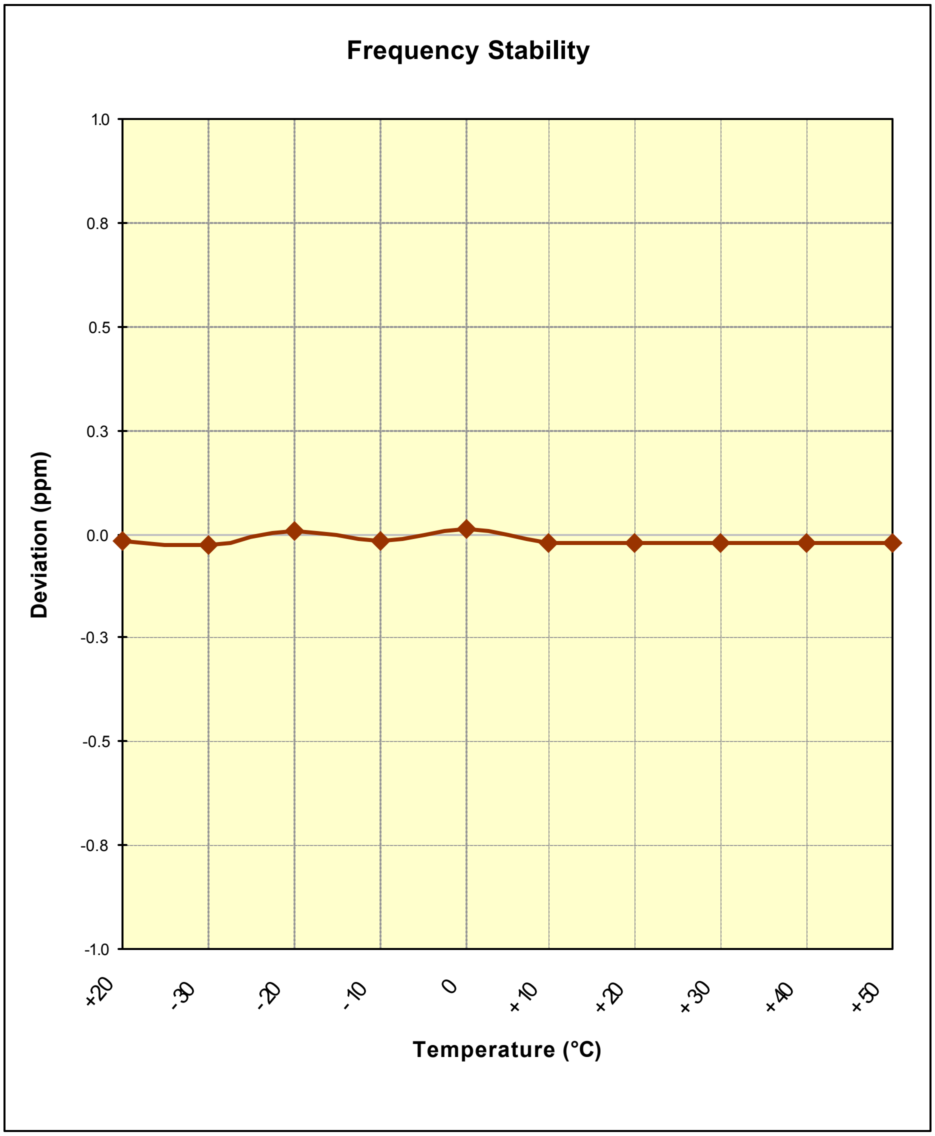


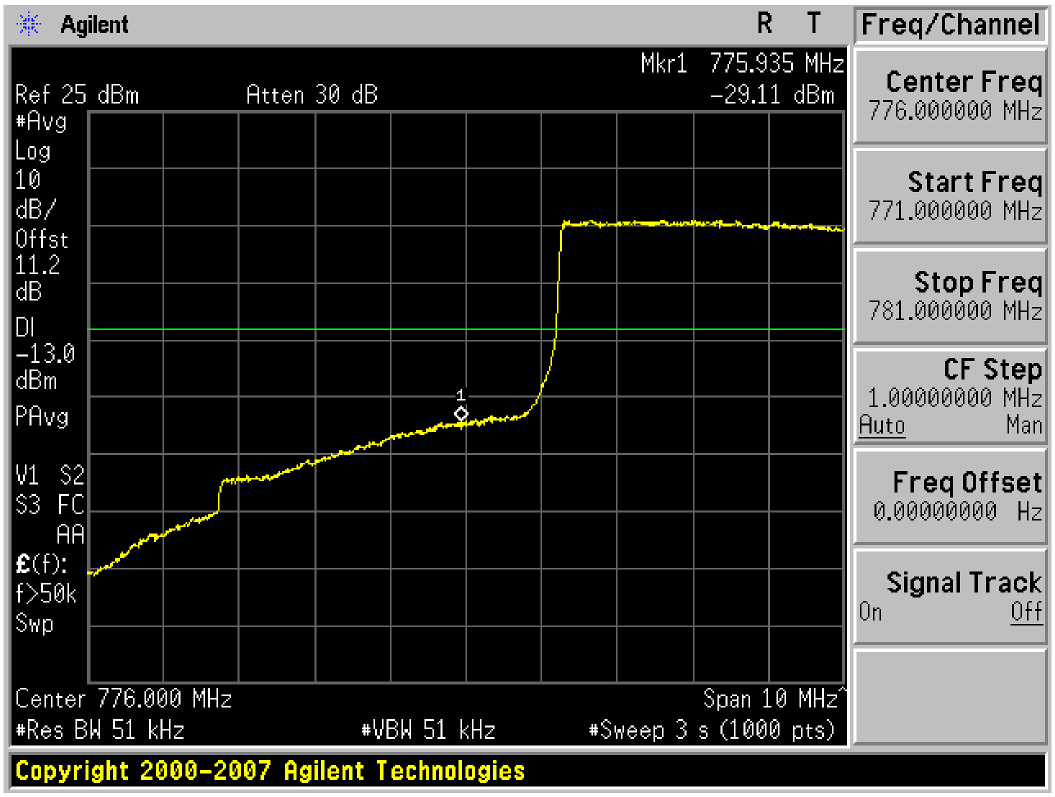
Figure 6-2. Frequency Stability Graph

Note:

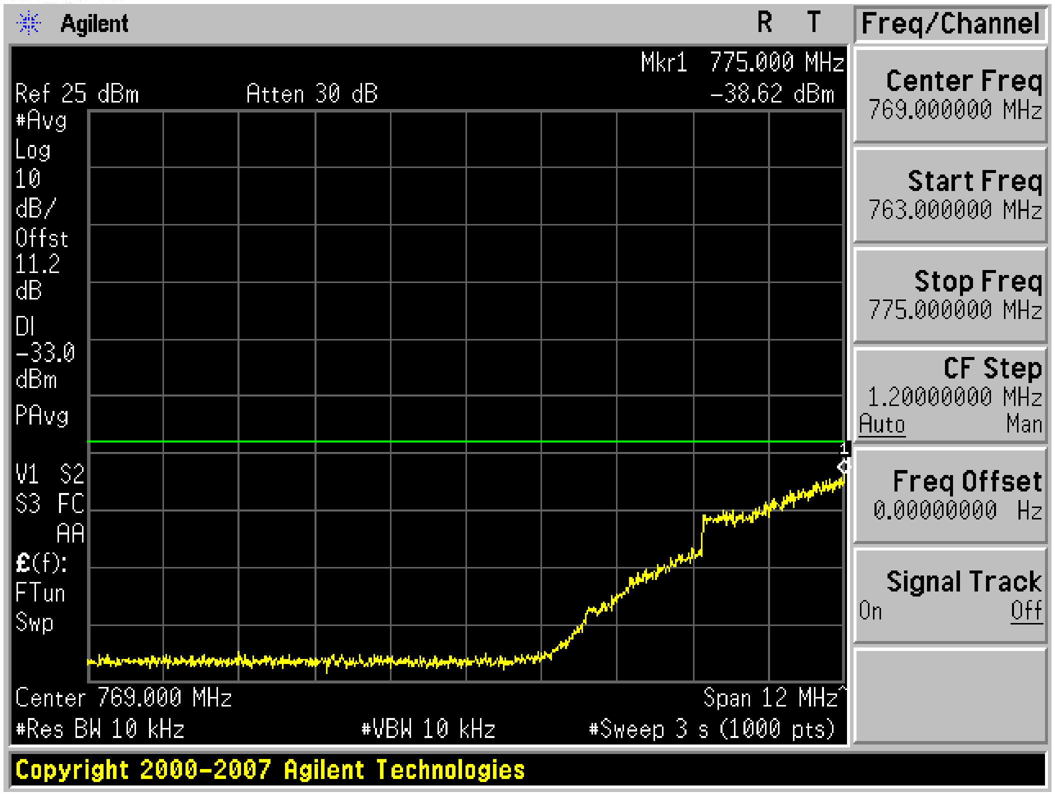
The frequency deviation was measured to ensure that the channel emissions remained within the authorized band with varying temperature and voltage.

7.0 PLOT(S) OF EMISSIONS – 5MHZ BANDWIDTH

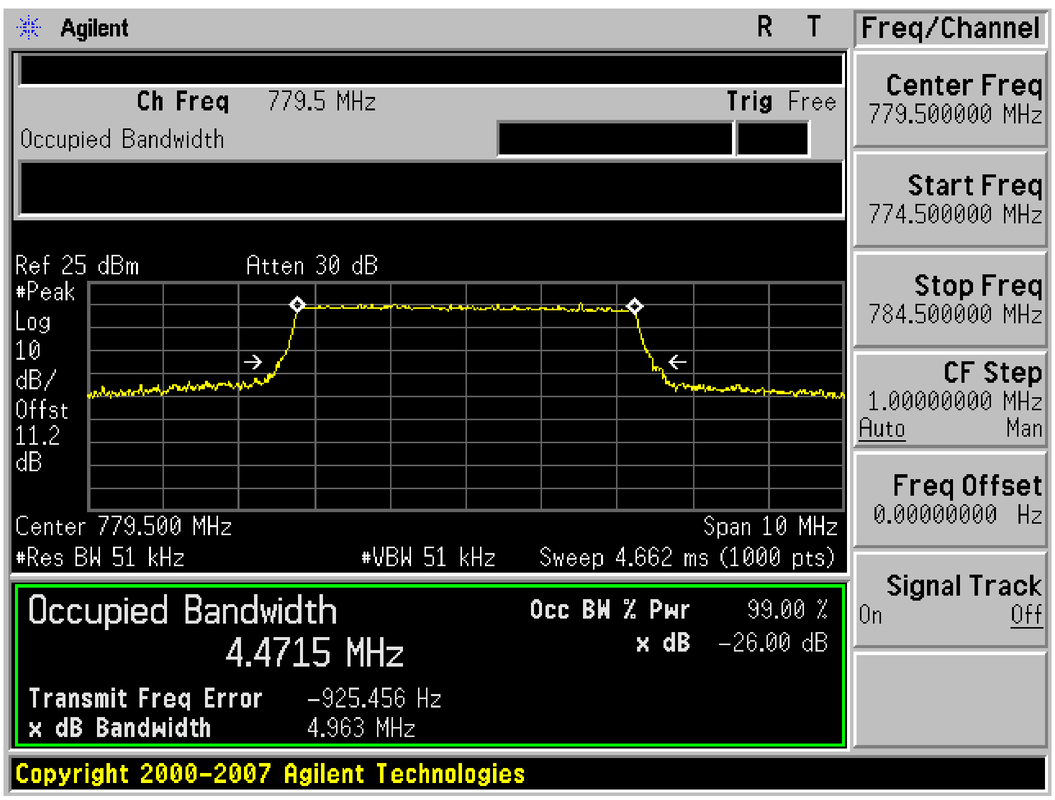
For all plots in Sections 7.0 and 8.0 showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit is 65 + $10\log_{10}(P_{[Watts]})$ = -35dBm in a 6.25kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25kHz with the available equipment, a bandwidth of 10kHz was used instead to show compliance. By using a 10kHz bandwidth, the limit was adjusted by $10\log_{10}$(10kHz/6.25kHz) = 2.04dB. Thus, the limit shown in all plots in the 763 – 775MHz and 793 – 805MHz bands for all available modulation types was -35dBm + 2.04dB = -32.96dBm.



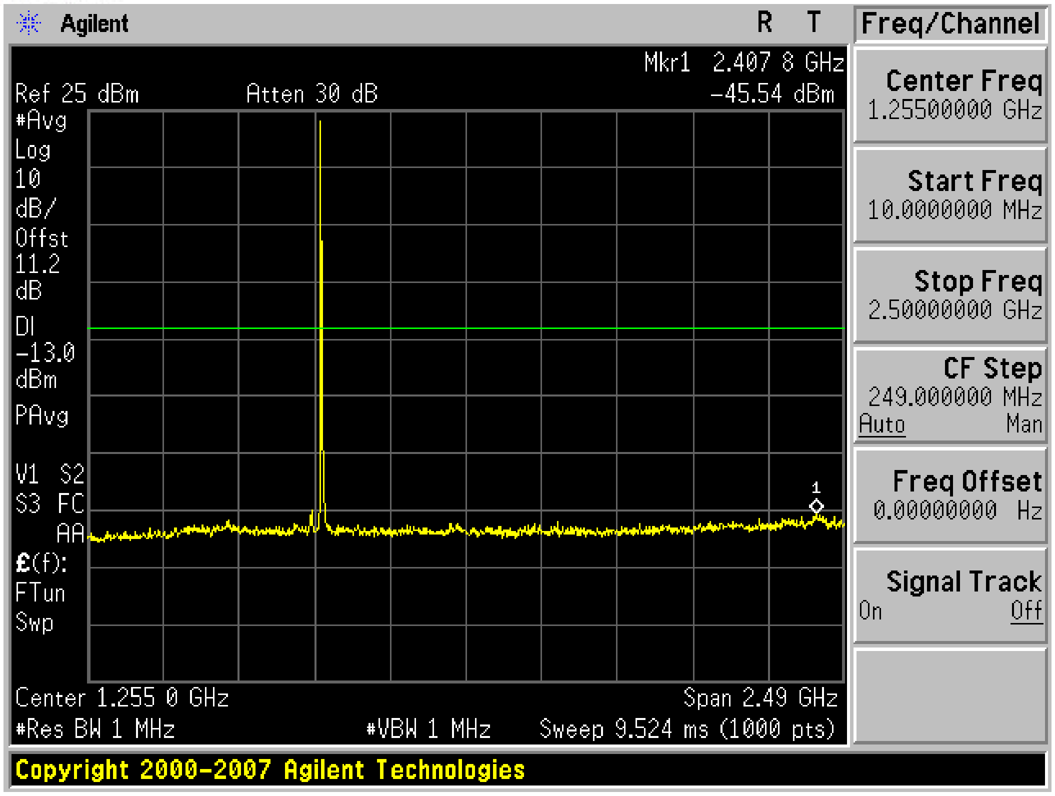
Plot 7-1. Lower Band Edge Plot (QPSK – Low Channel, RB Size 25)



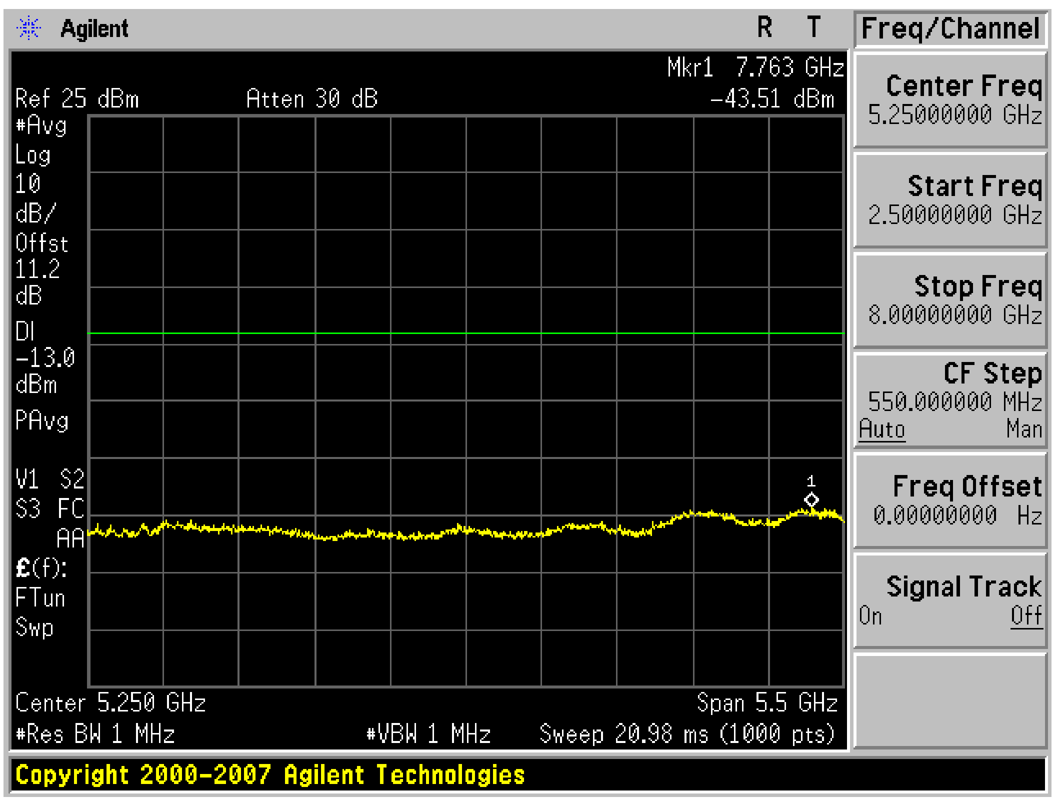
Plot 7-2. Lower Emission Mask (763 – 775MHz) Plot (QPSK – Low Channel, RB Size 25)



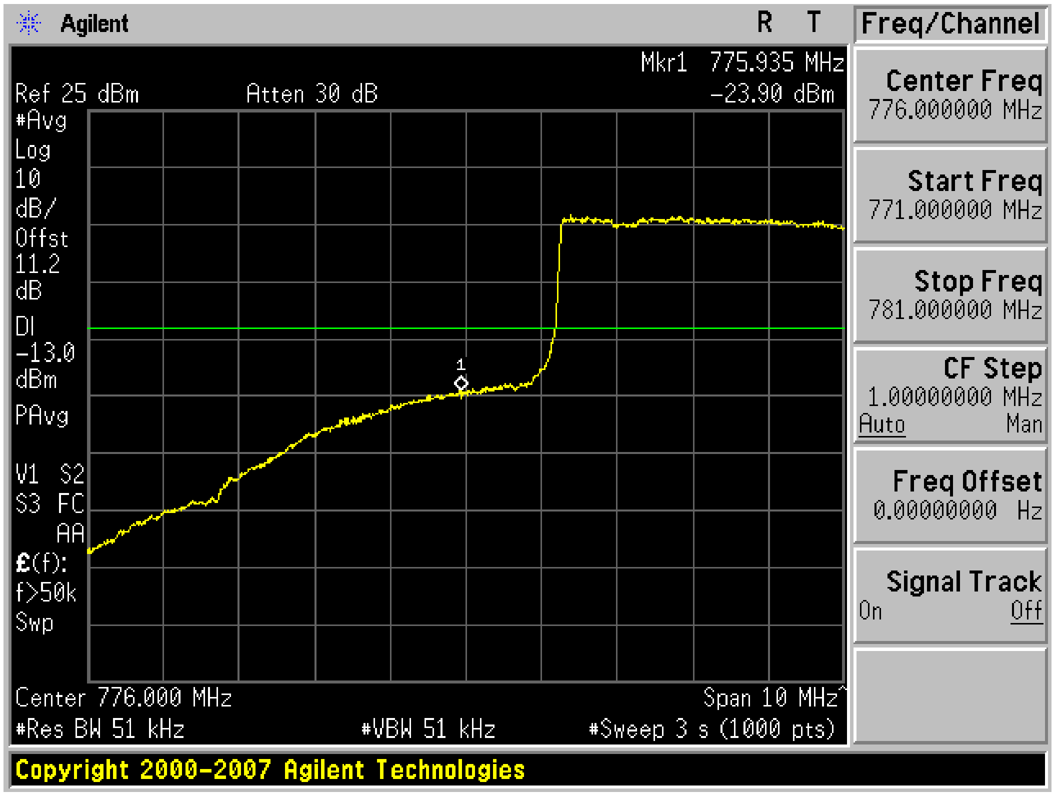
Plot 7-3. Occupied Bandwidth Plot (QPSK – Low Channel, RB Size 25)



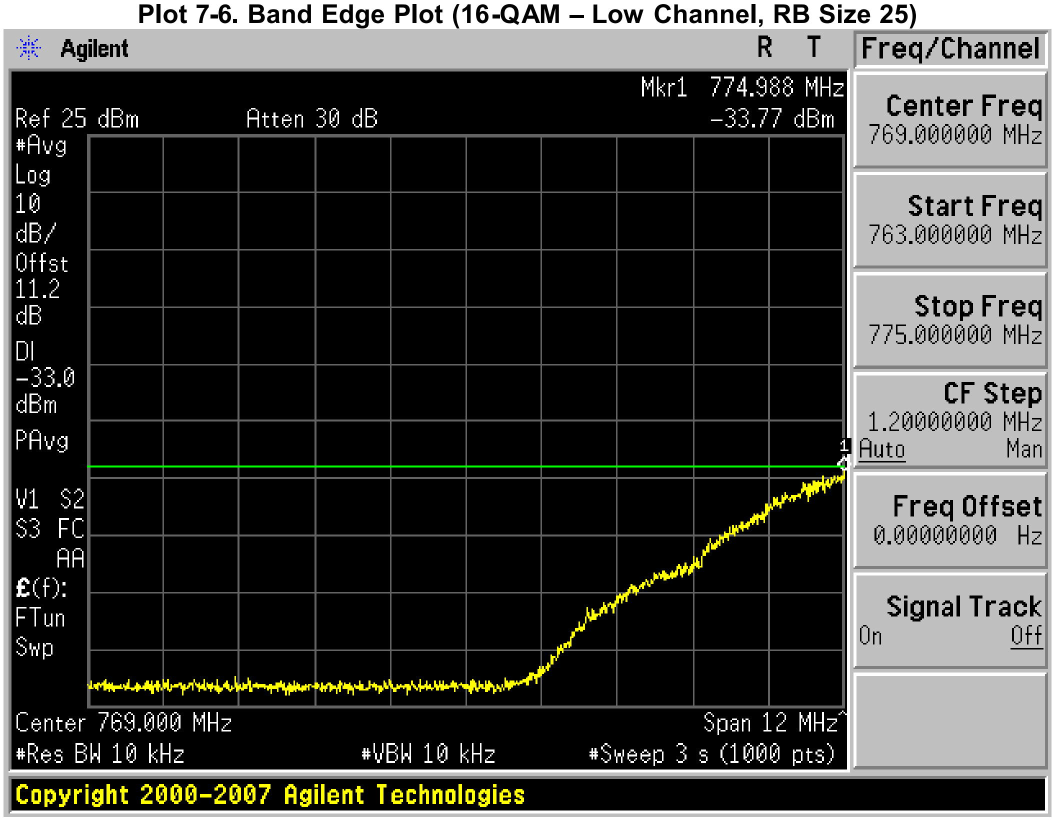
Plot 7-4. Conducted Spurious Plot (QPSK – Low Channel, RB Size 25)



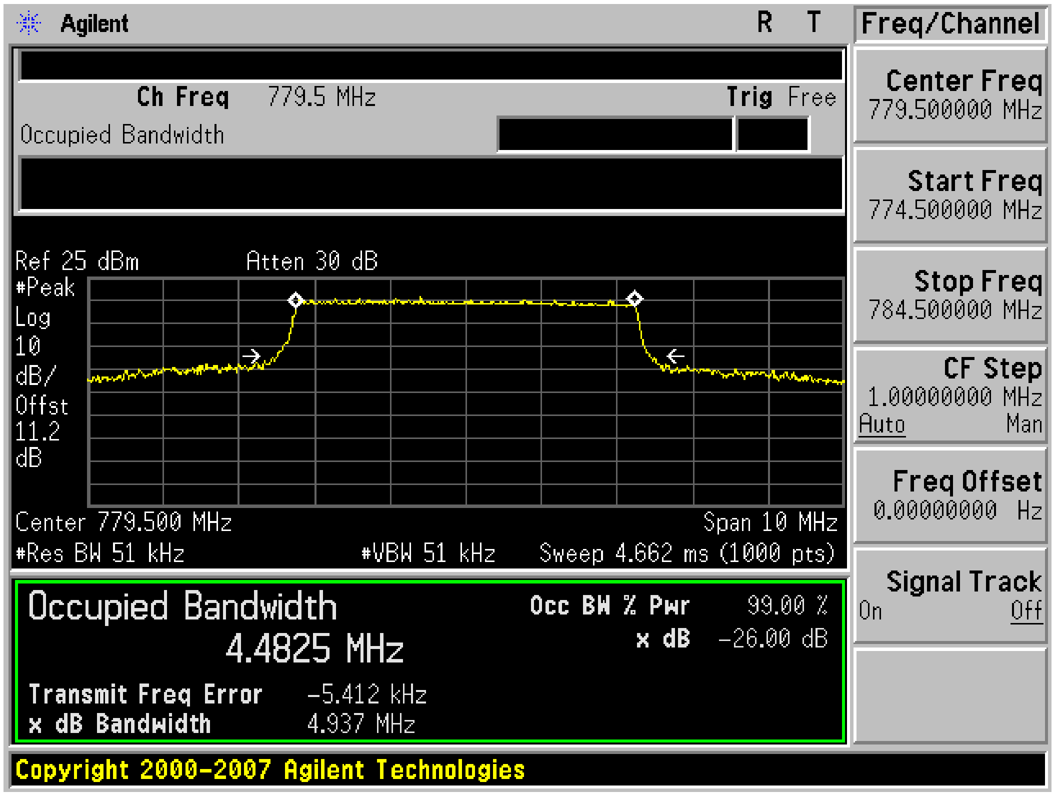
Plot 7-5. Conducted Spurious Plot (QPSK – Low Channel, RB Size 25)



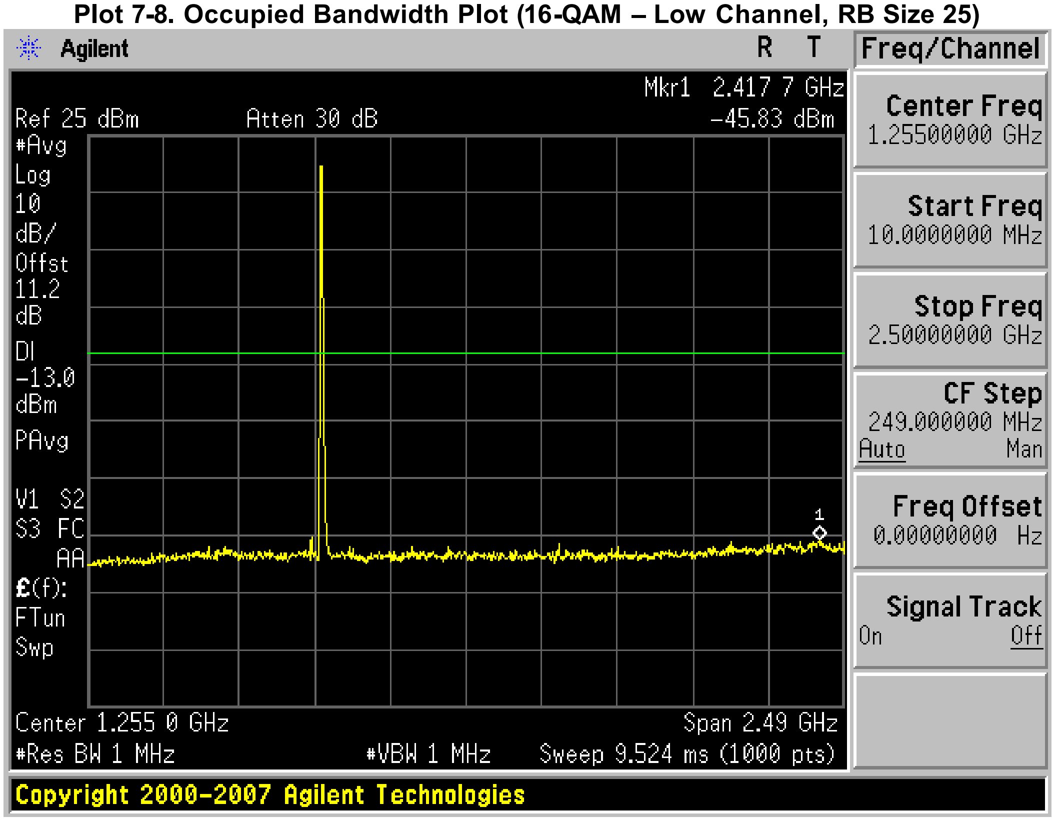
Plot 7-6. Band Edge Plot (16-QAM – Low Channel, RB Size 25)



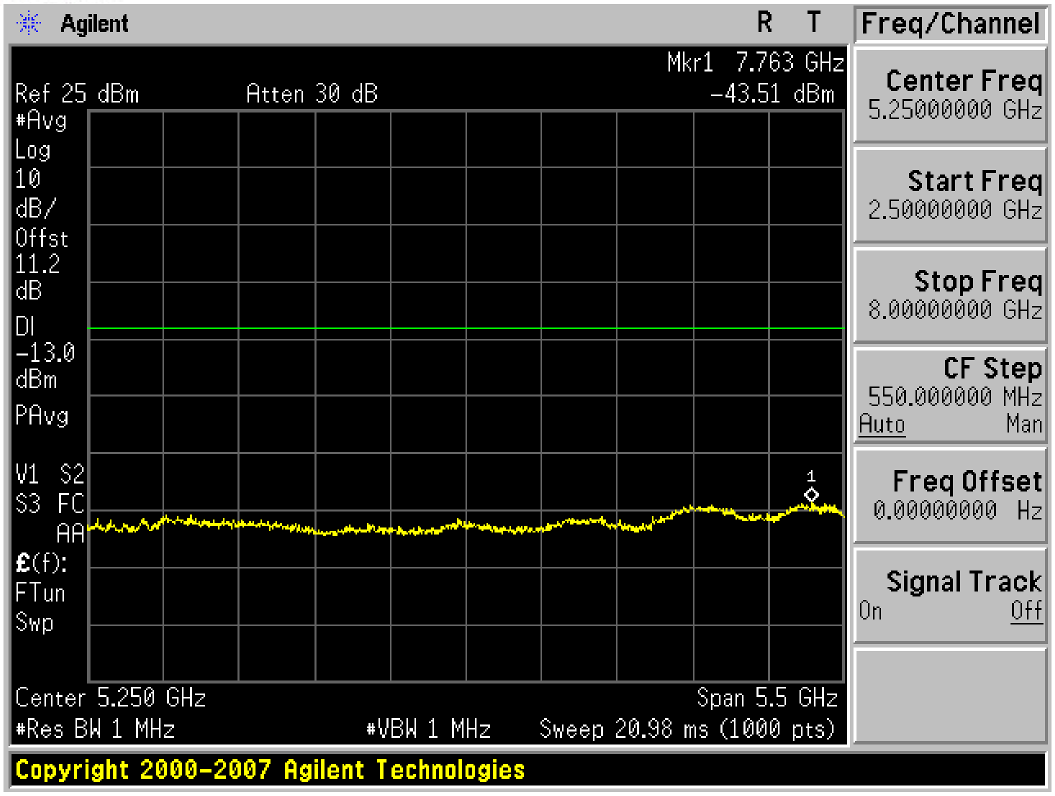
Plot 7-7. Lower Emission Mask (763 – 775MHz) Plot (16-QAM – Low Channel, RB Size 25)



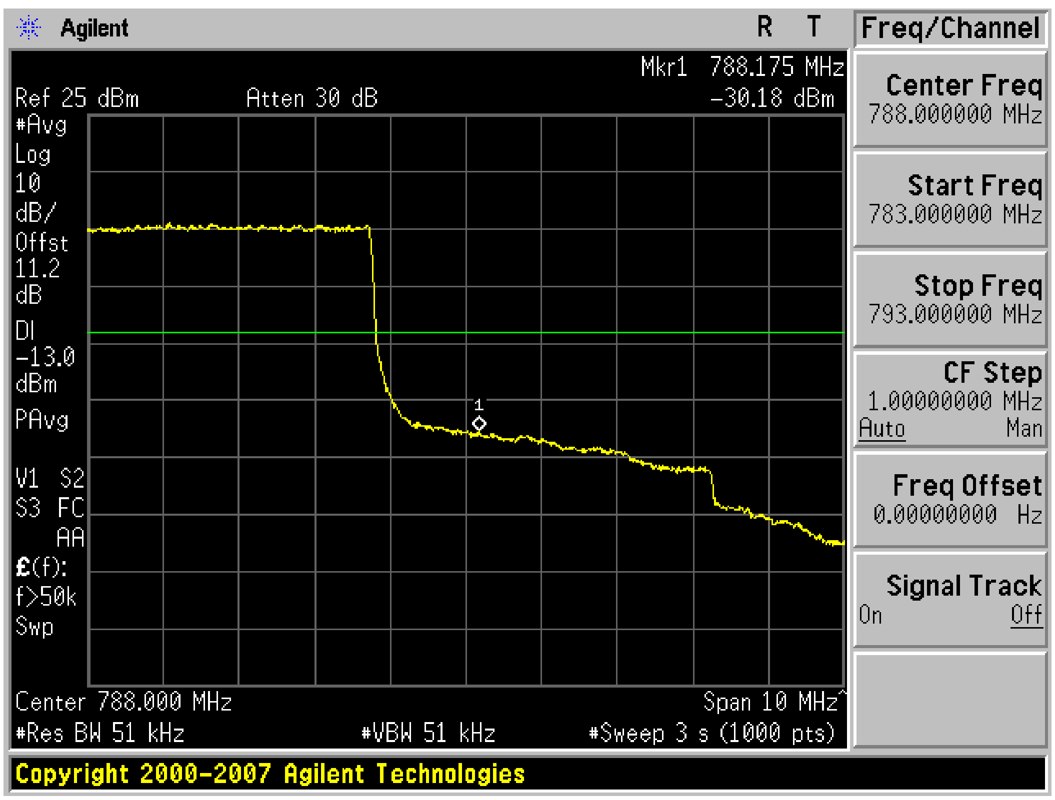
Plot 7-8. Occupied Bandwidth Plot (16-QAM – Low Channel, RB Size 25)



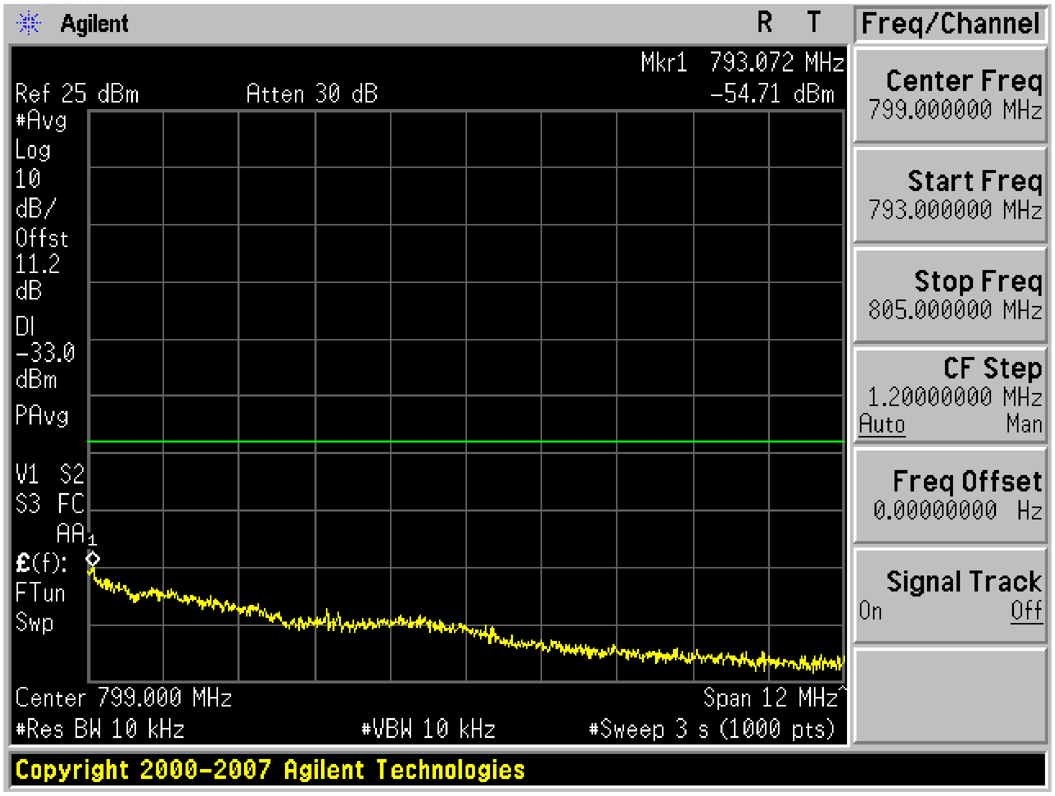
Plot 7-9. Conducted Spurious Plot (16-QAM – Low Channel, RB Size 25)



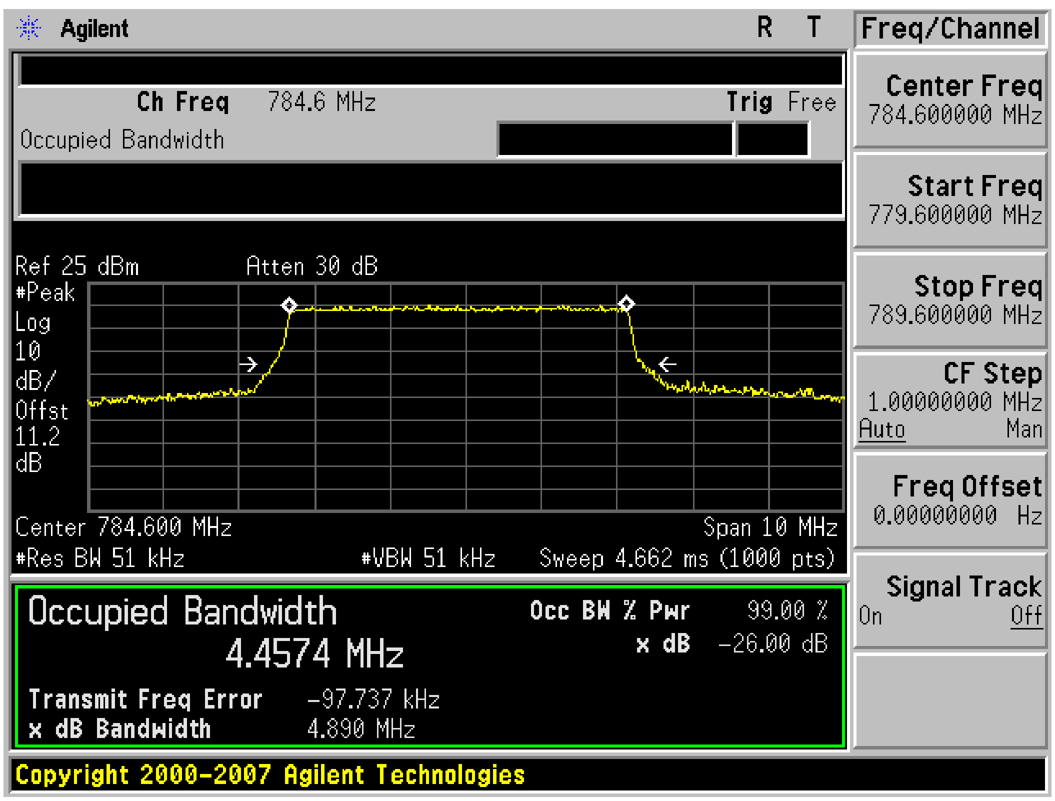
Plot 7-10. Conducted Spurious Plot (16-QAM – Low Channel, RB Size 25)



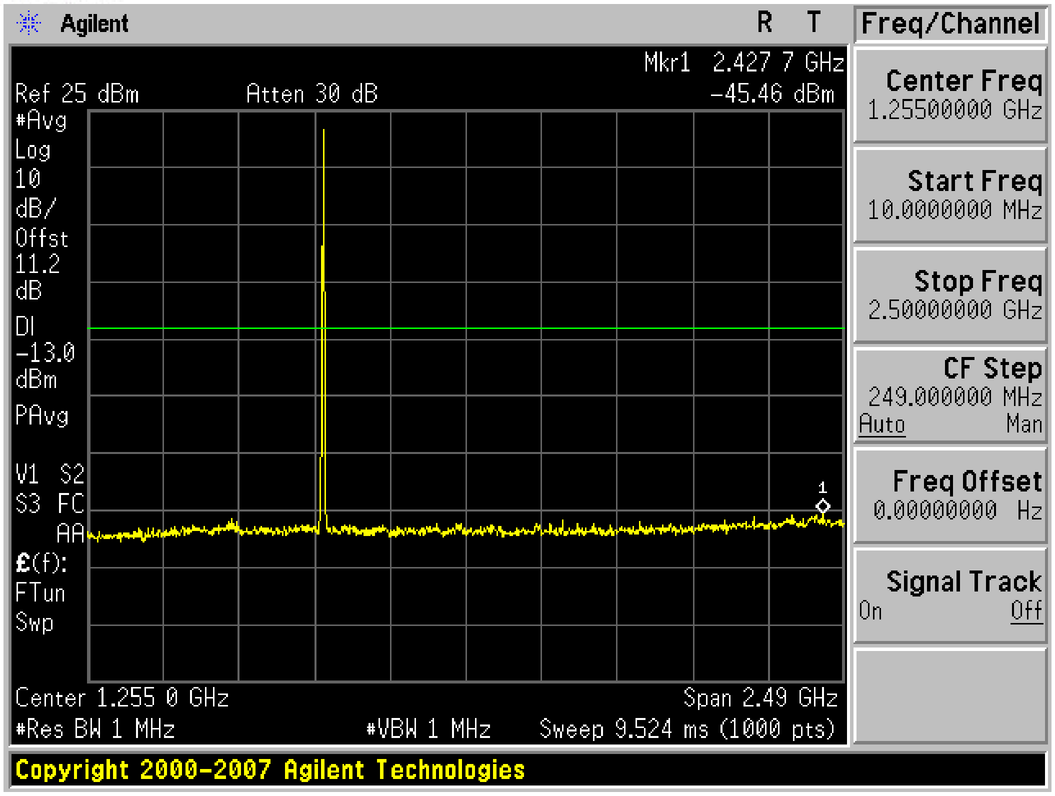
Plot 7-11. Upper Band Edge Plot (QPSK – High Channel, RB Size 25)



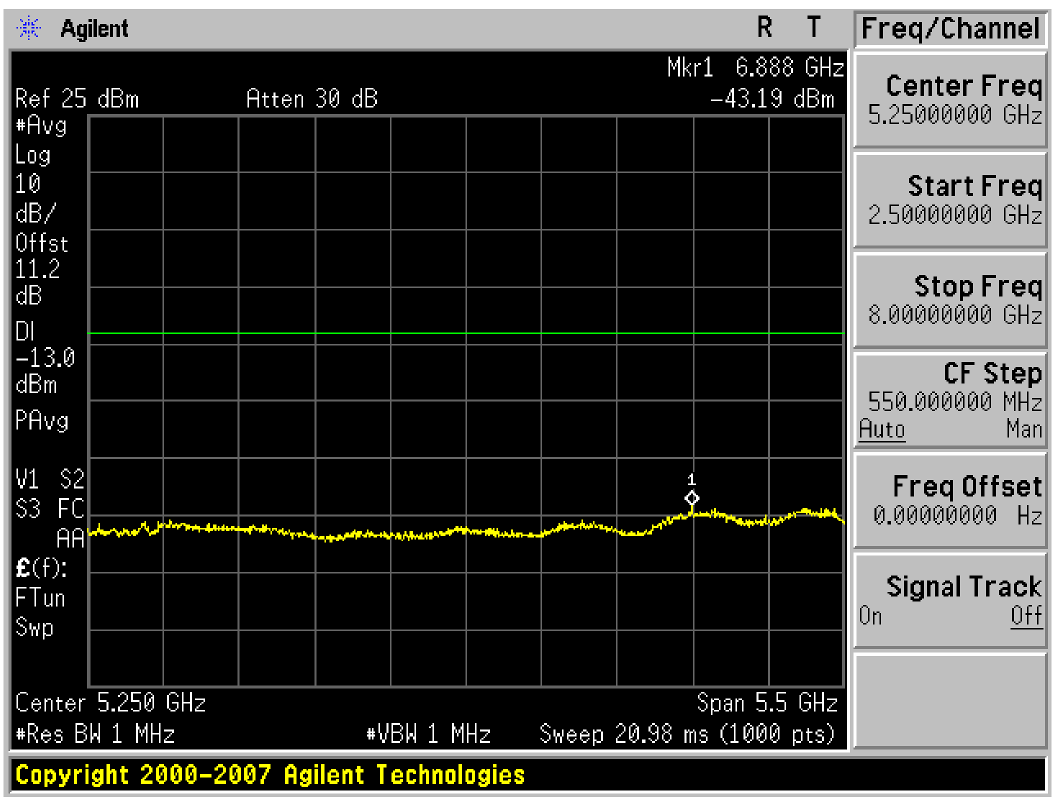
Plot 7-12. Upper Emission Mask (793 – 805MHz) Plot (QPSK – High Channel, RB Size 25)



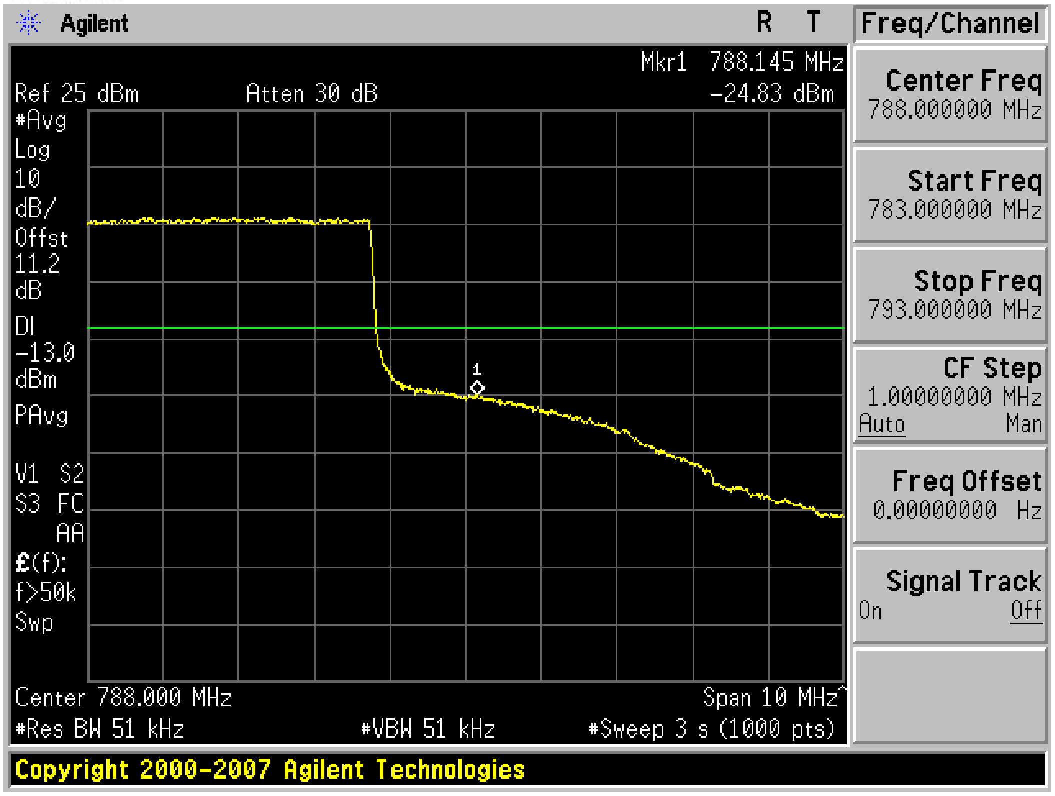
Plot 7-13. Occupied Bandwidth Plot (QPSK – High Channel, RB Size 25)



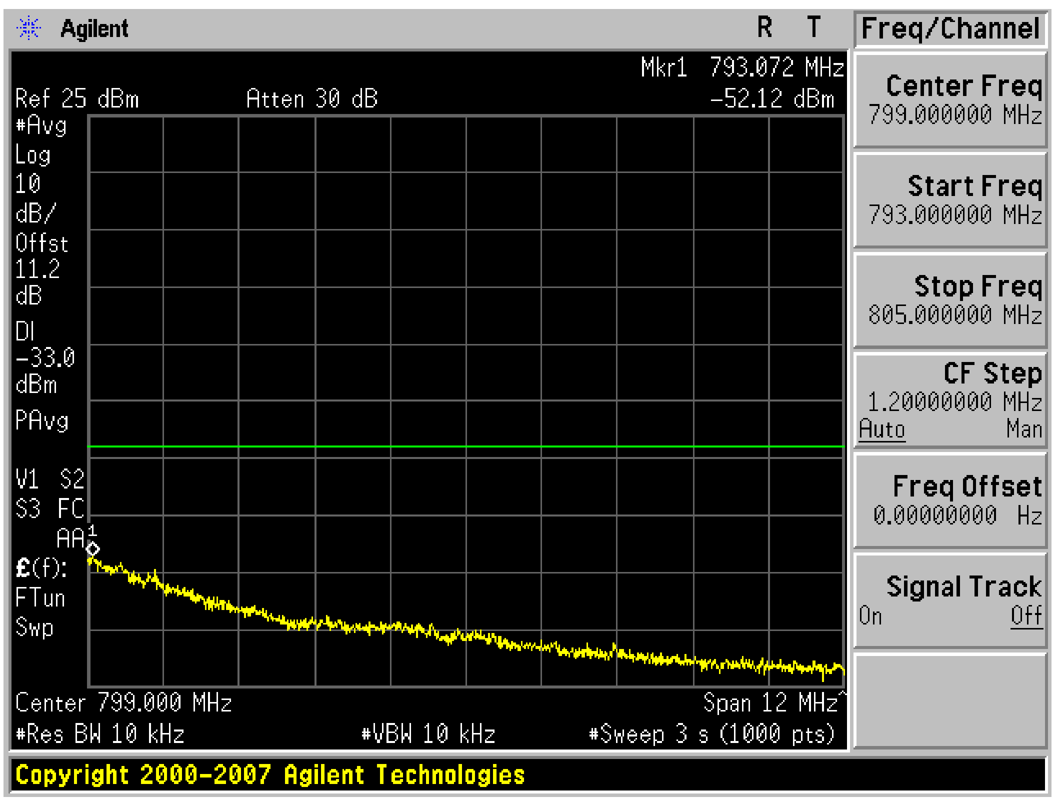
Plot 7-14. Conducted Spurious Plot (QPSK – High Channel, RB Size 25)



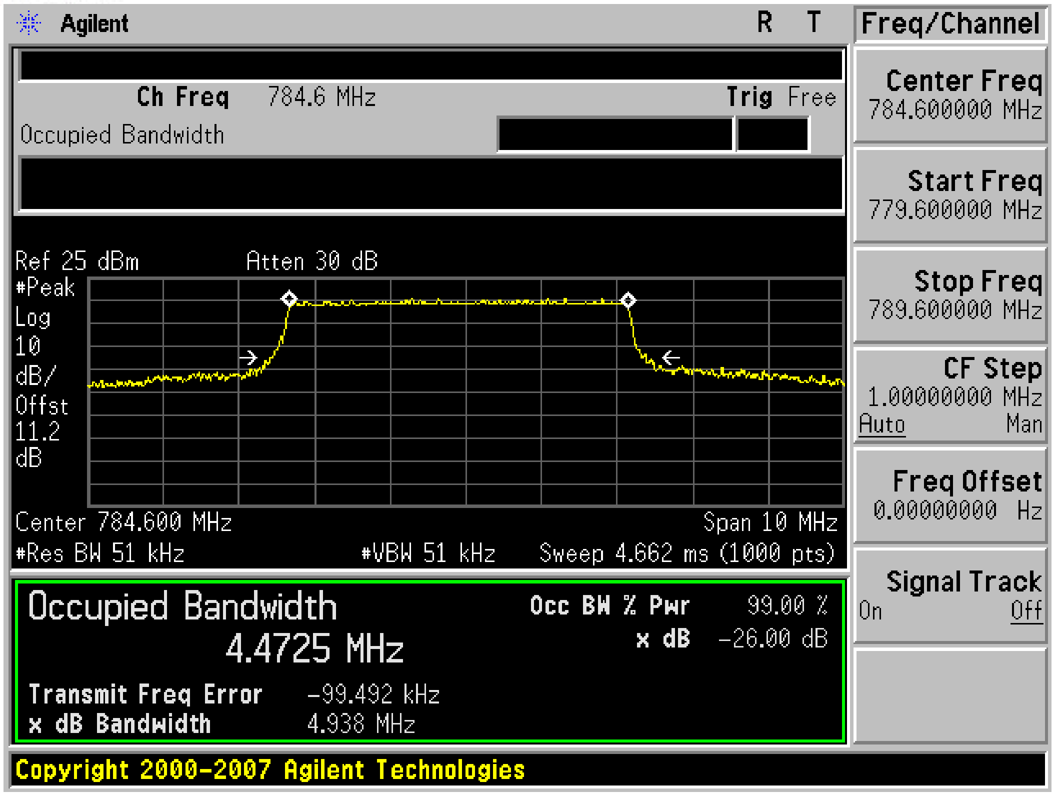
Plot 7-15. Conducted Spurious Plot (QPSK – High Channel, RB Size 25)



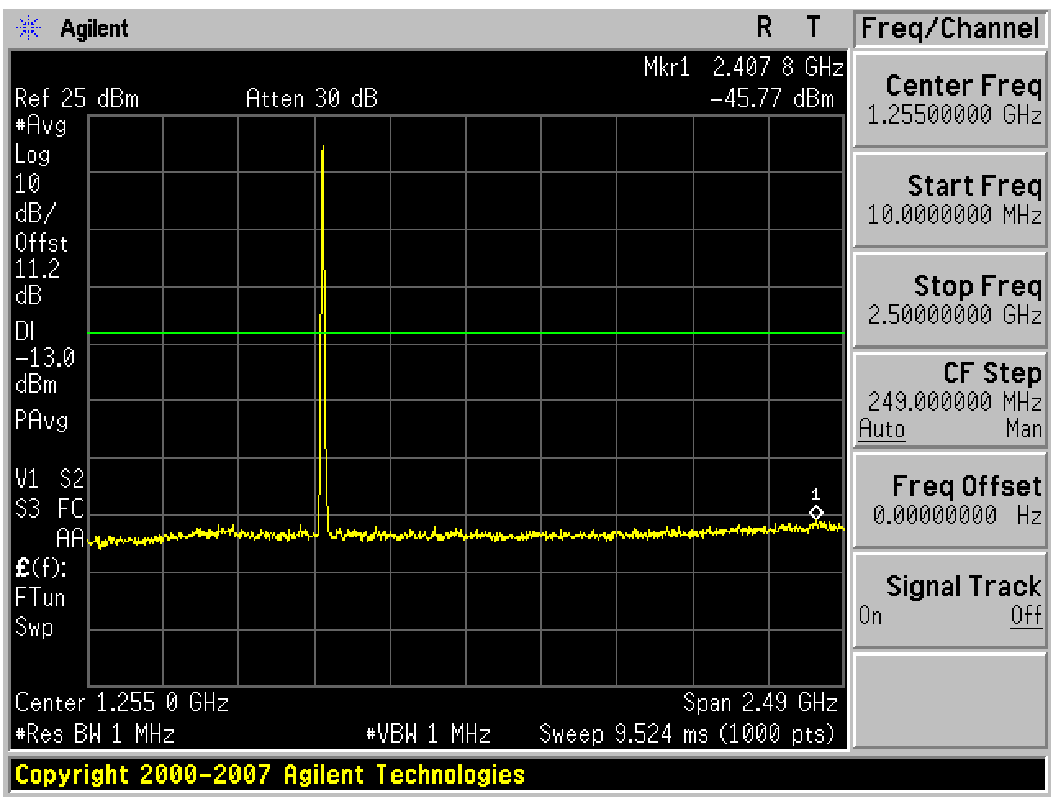
Plot 7-16. Upper Band Edge Plot (16-QAM – High Channel, RB Size 25)



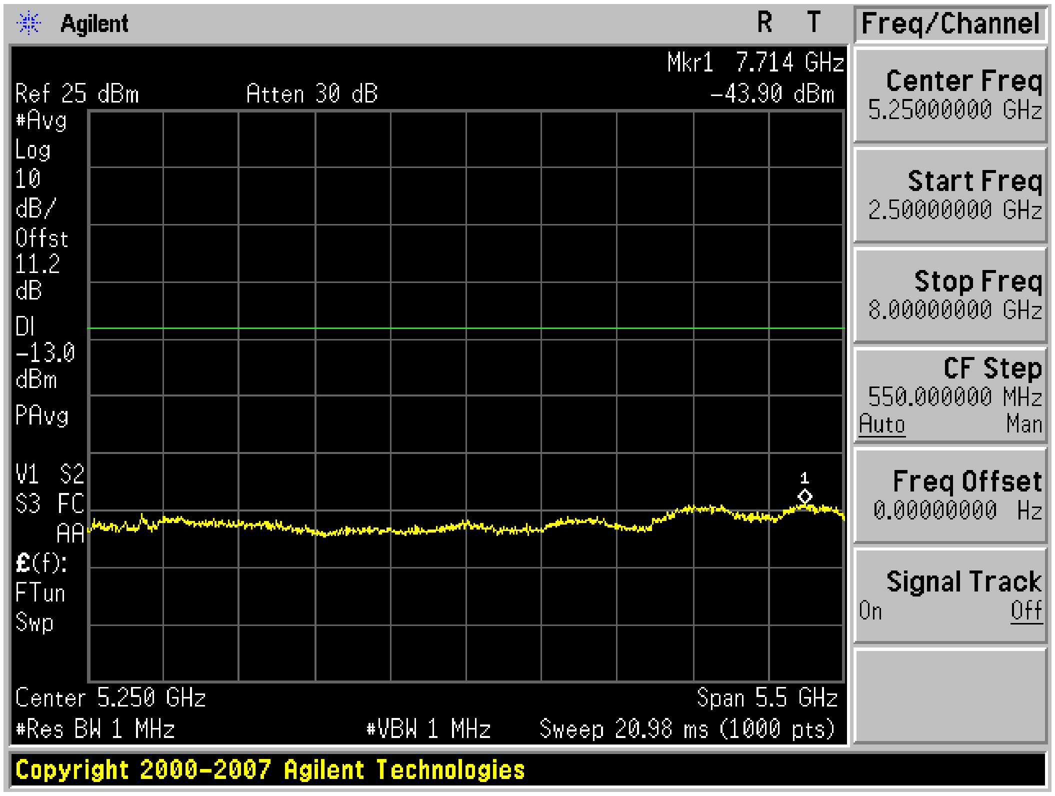
Plot 7-17. Upper Emission Mask (793 – 805MHz) Plot (16-QAM – High Channel, RB Size 25)



Plot 7-18. Occupied Bandwidth Plot (16-QAM – High Channel, RB Size 25)

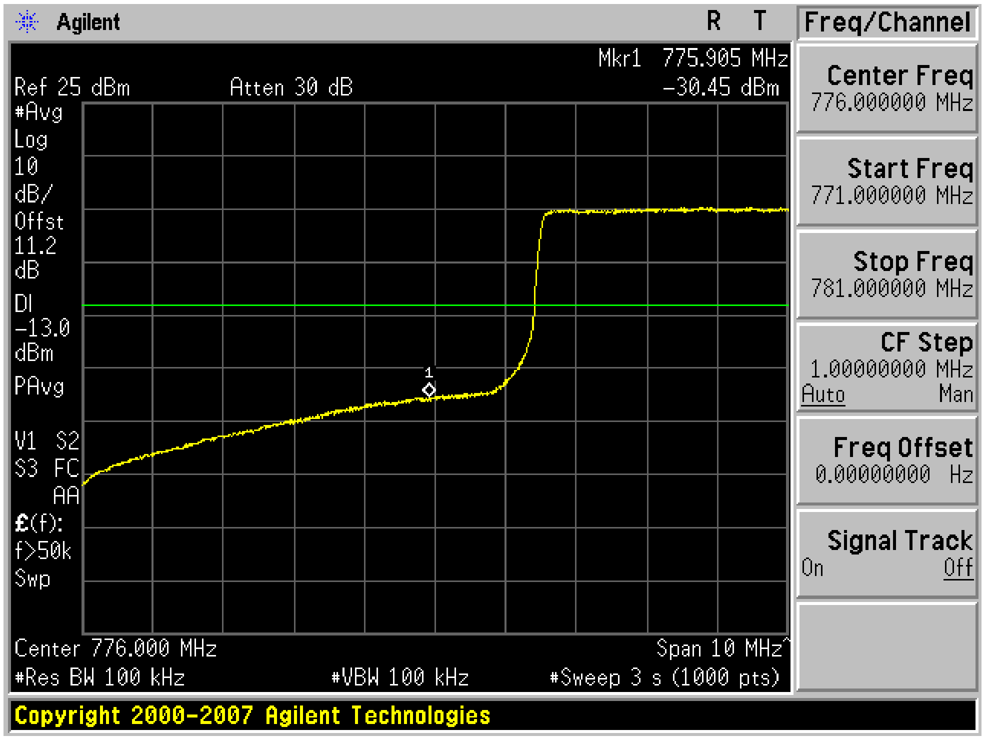


Plot 7-19. Conducted Spurious Plot (16-QAM – High Channel, RB Size 25)

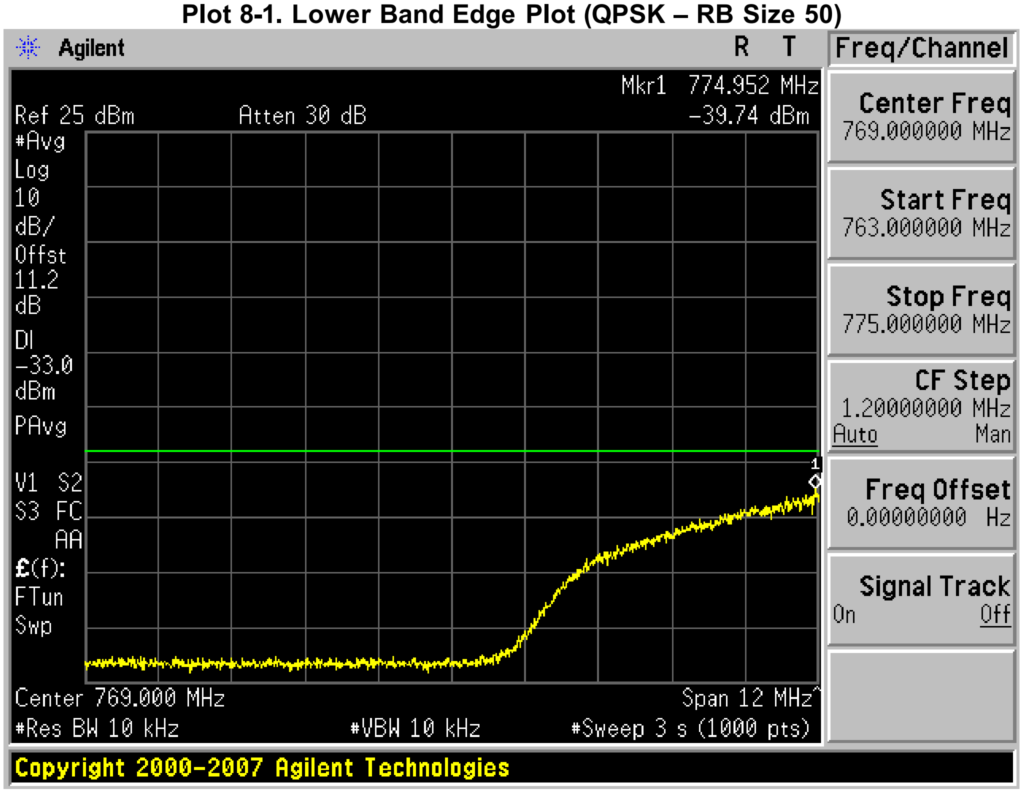


Plot 7-20. Conducted Spurious Plot (16-QAM – High Channel, RB Size 25)

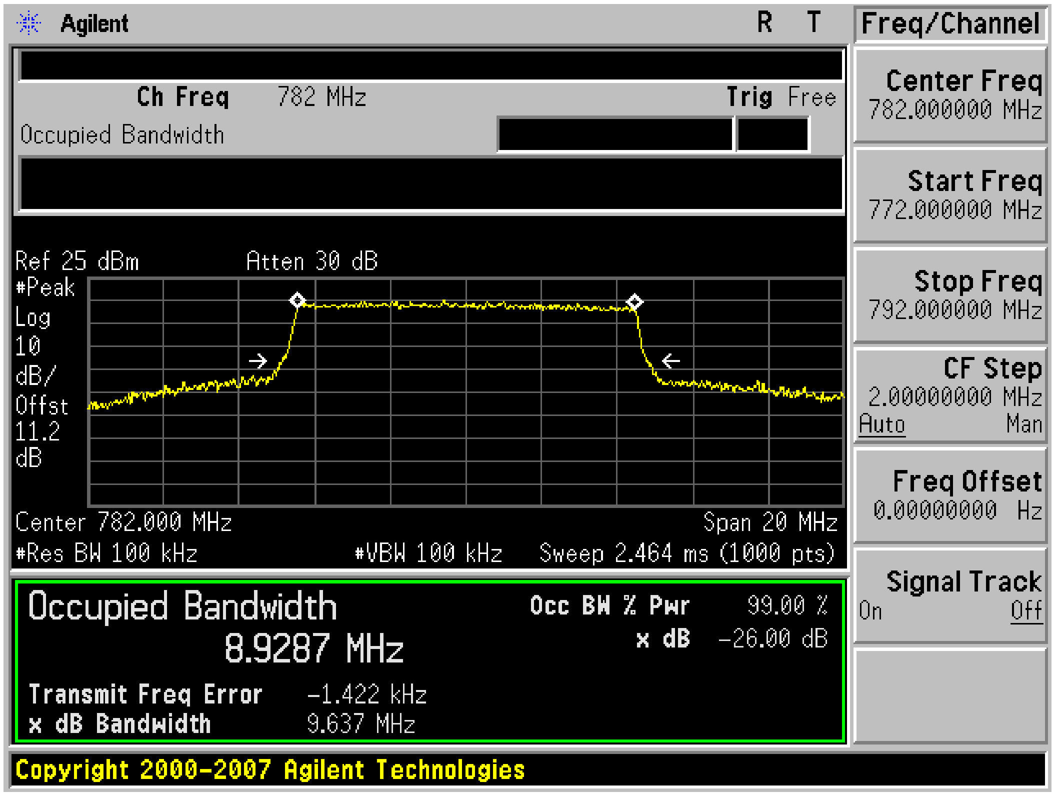
8.0 PLOT(S) OF EMISSIONS – 10MHZ BANDWIDTH



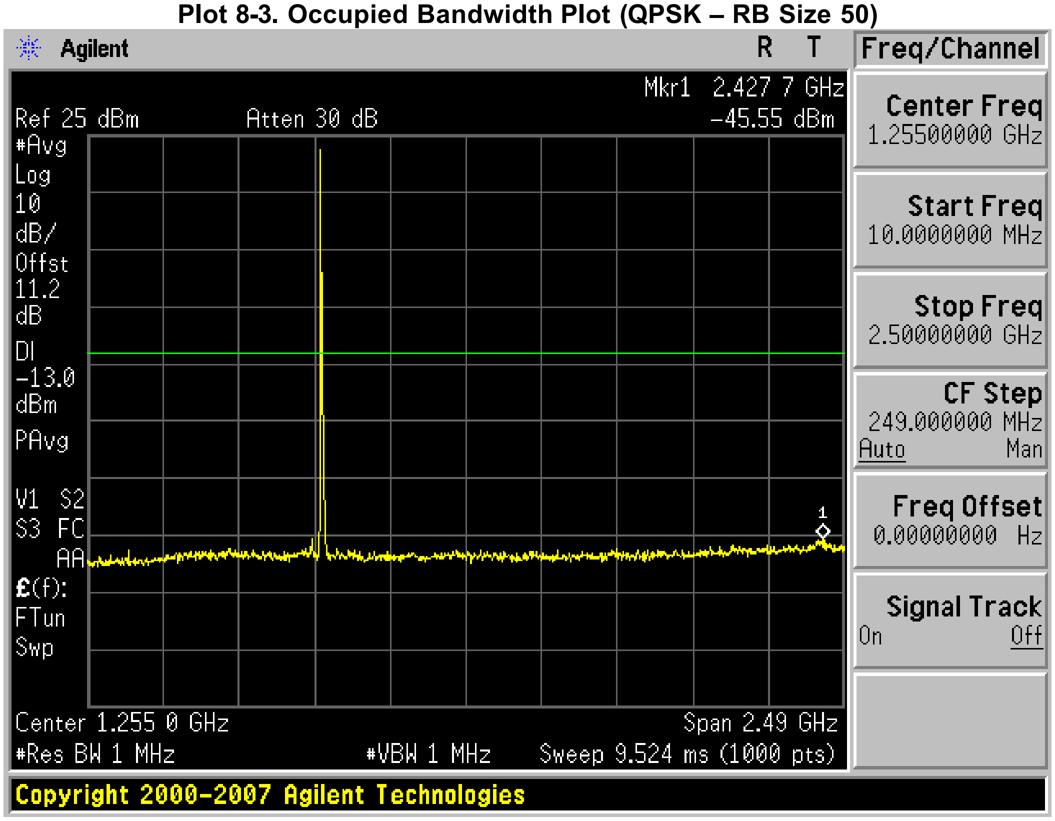
Plot 8-1. Lower Band Edge Plot (QPSK – RB Size 50)



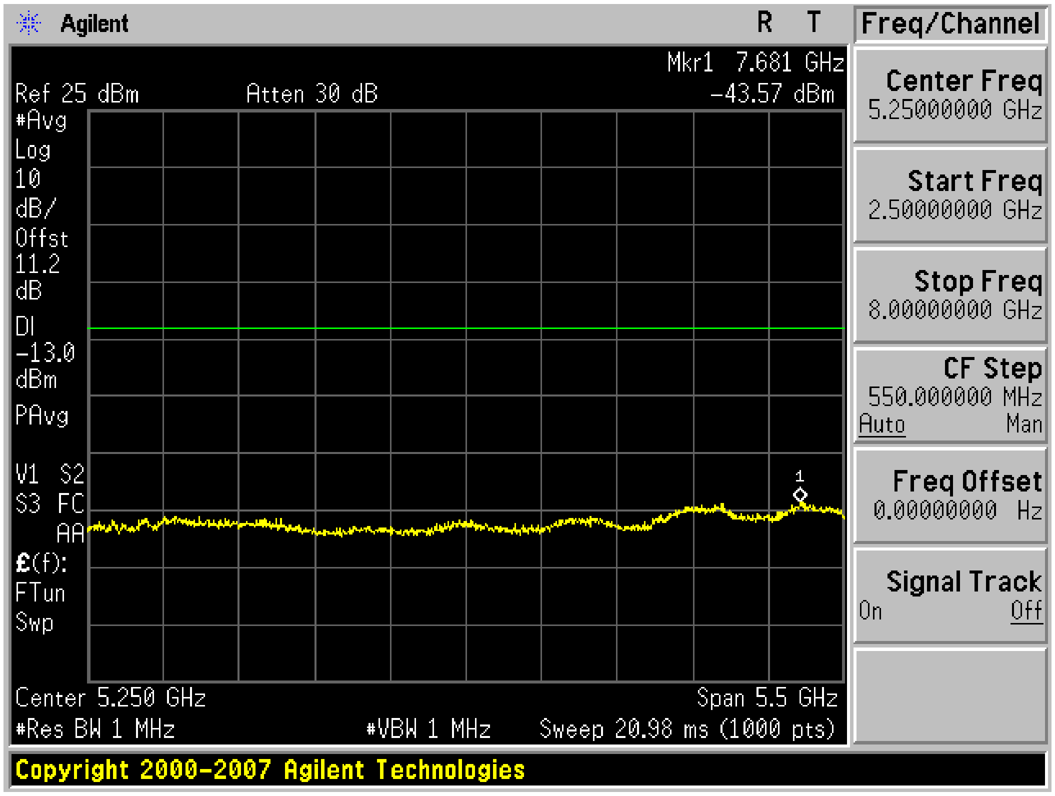
Plot 8-2. Lower Emission Mask (763 – 775MHz) Plot (QPSK – RB Size 50)



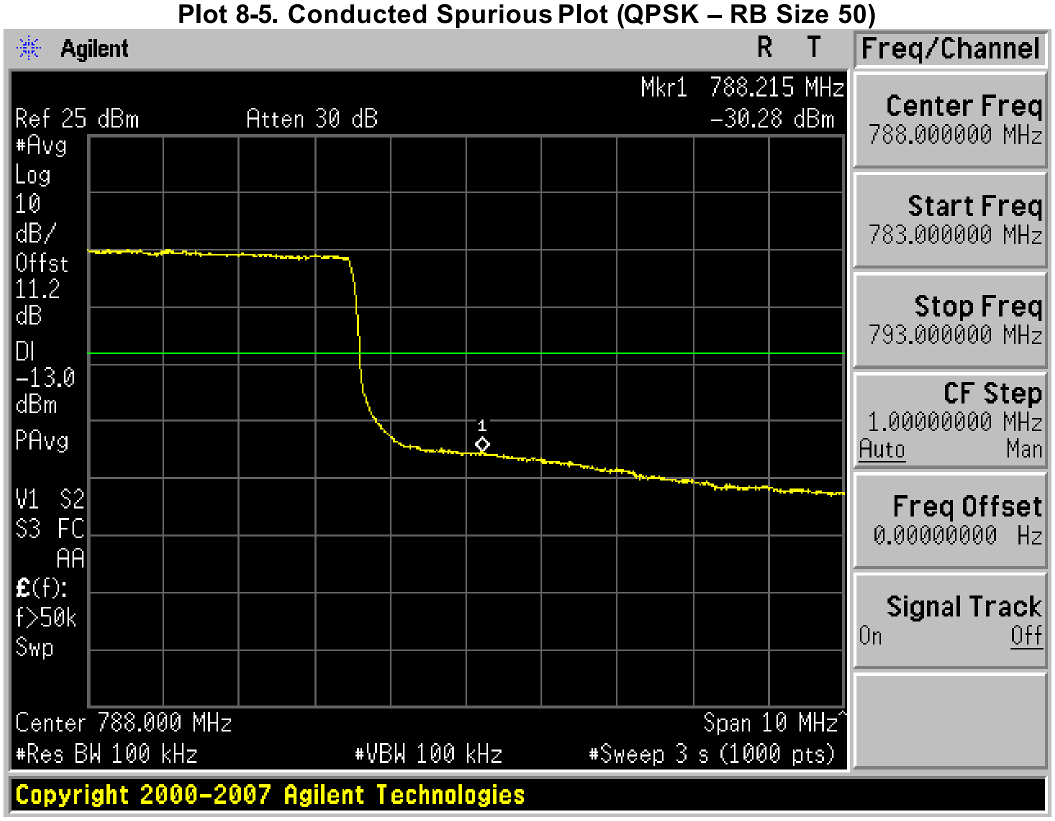
Plot 8-3. Occupied Bandwidth Plot (QPSK – RB Size 50)



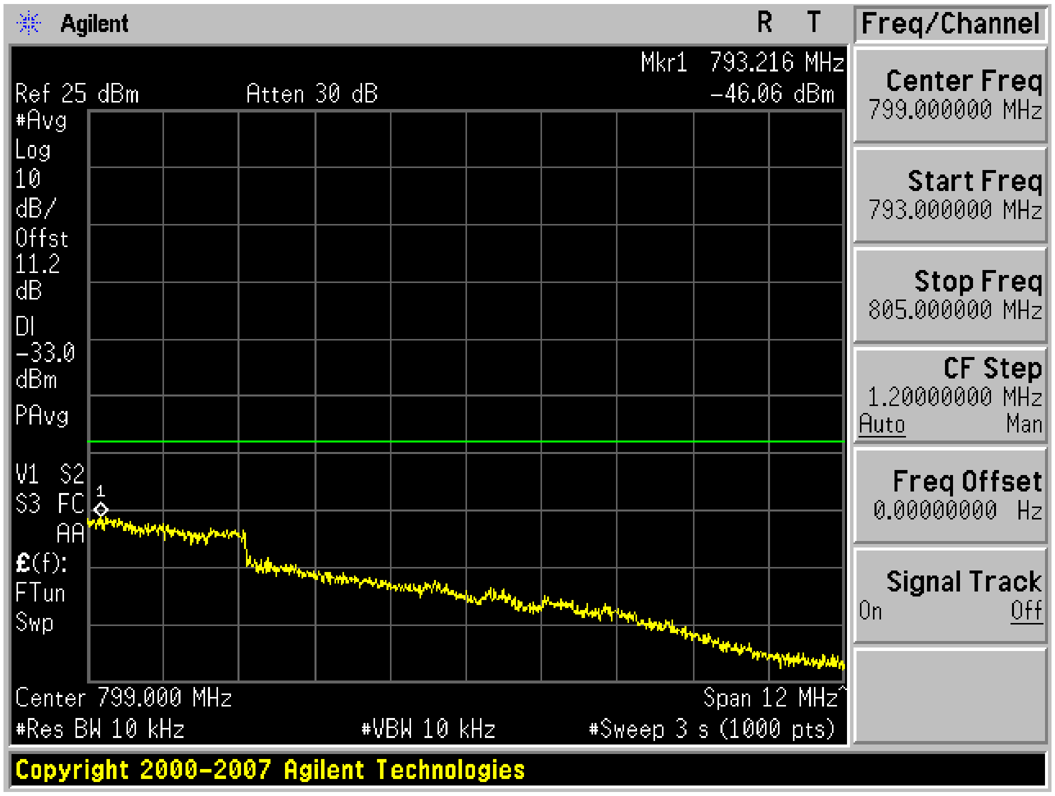
Plot 8-4. Conducted Spurious Plot (QPSK – RB Size 50)



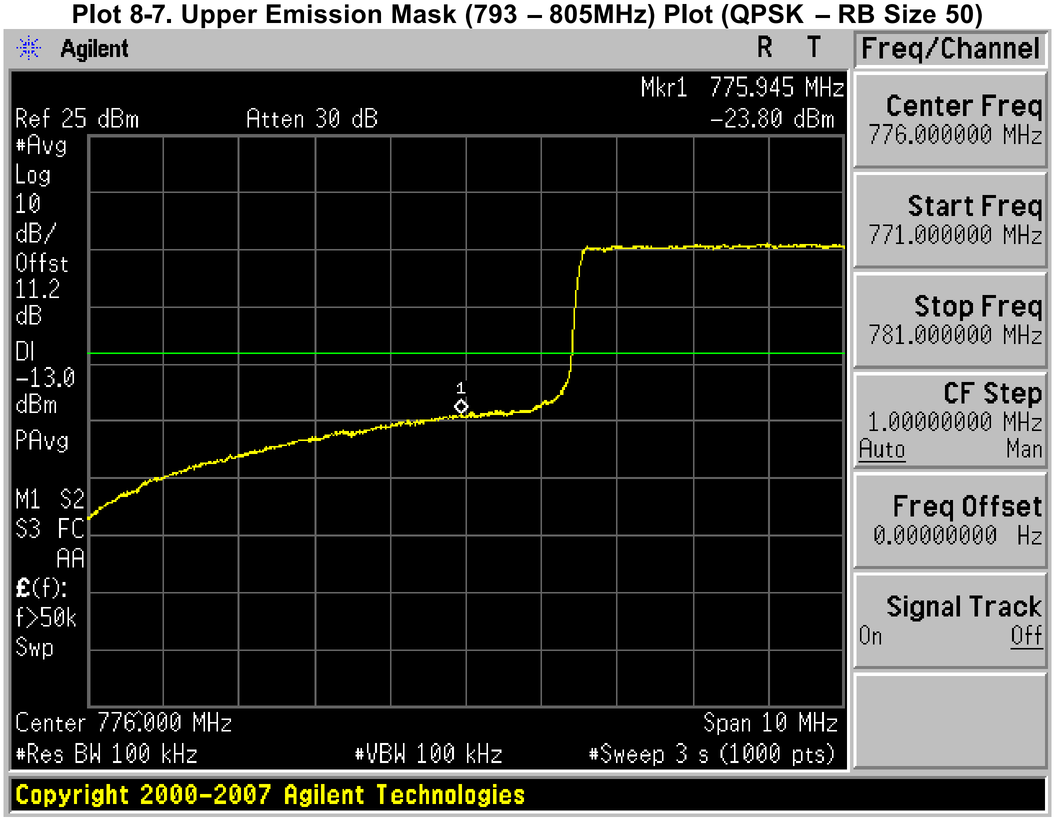
Plot 8-5. Conducted Spurious Plot (QPSK – RB Size 50)



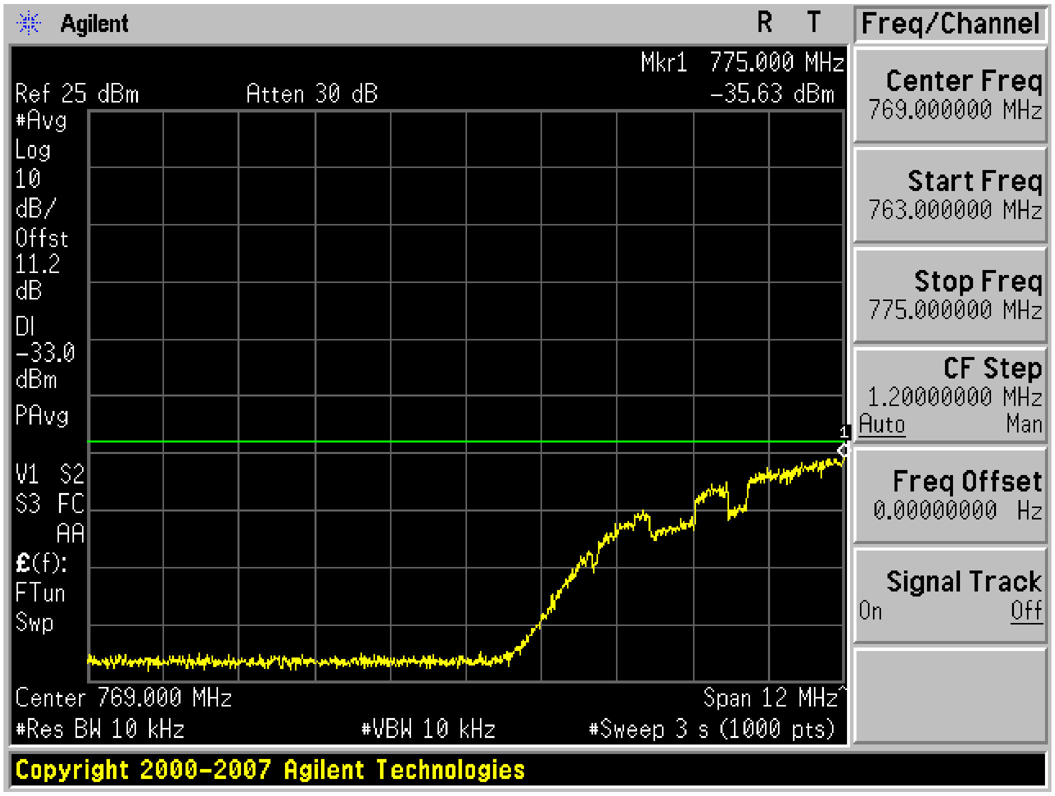
Plot 8-6. Upper Band Edge Plot (QPSK – RB Size 50)



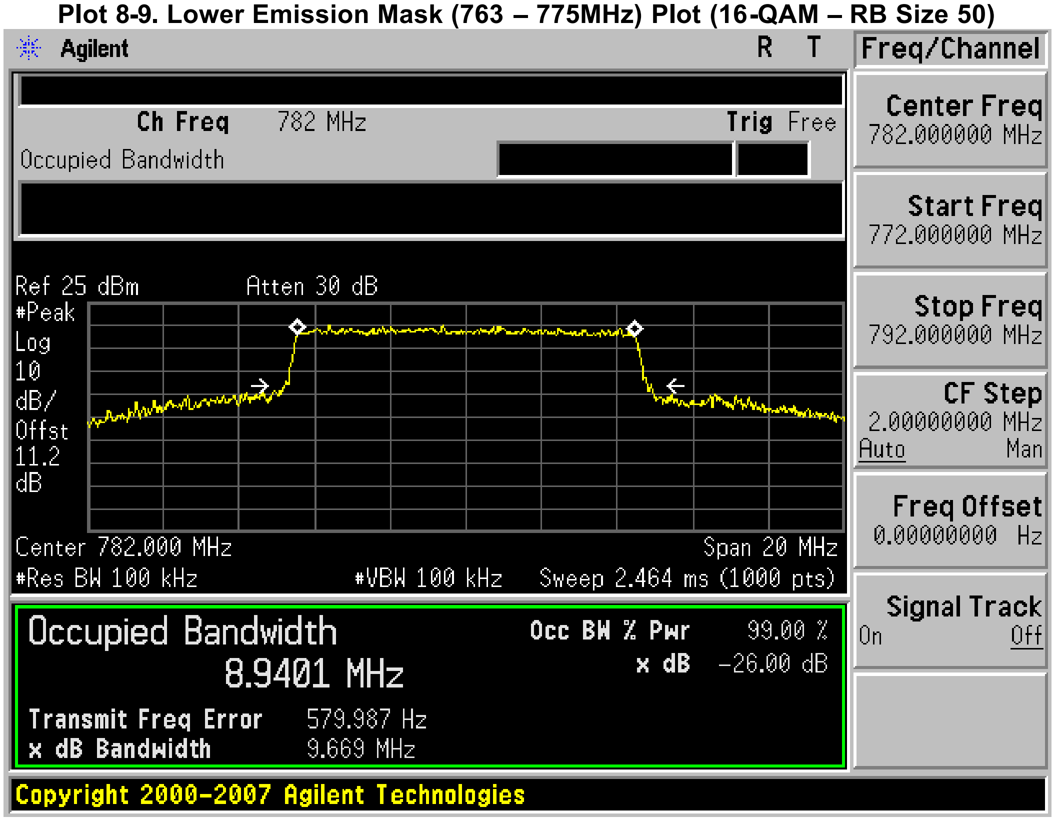
Plot 8-7. Upper Emission Mask (793 – 805MHz) Plot (QPSK – RB Size 50)



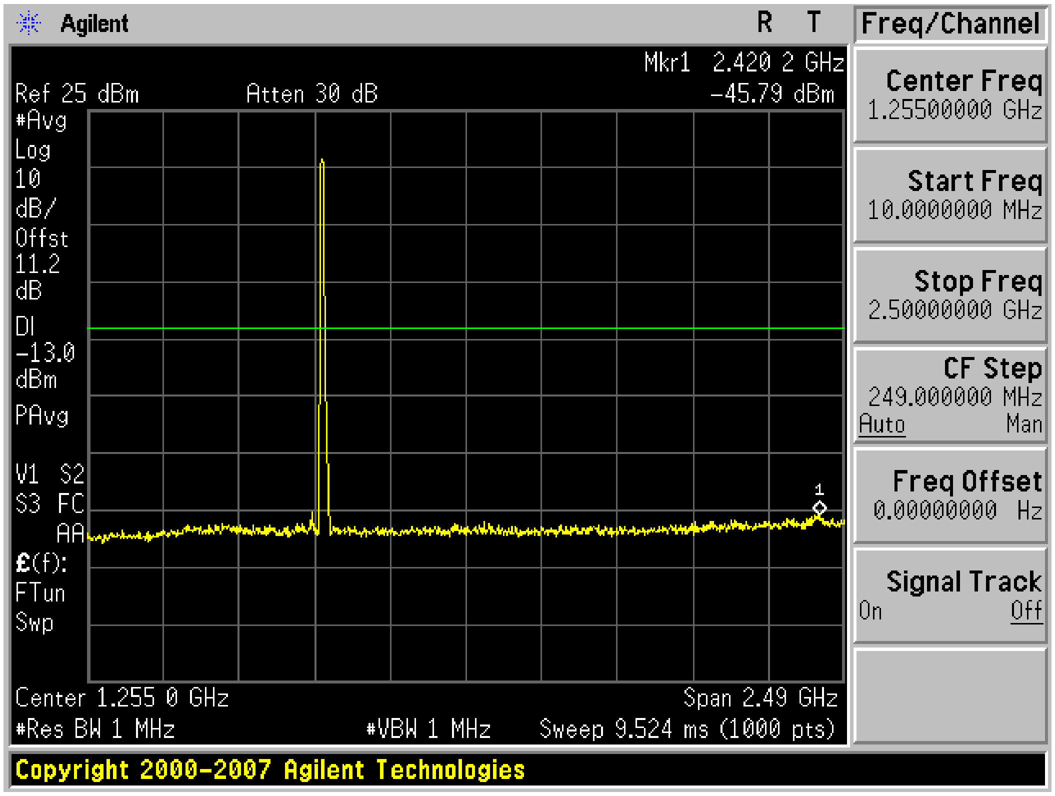
Plot 8-8. Lower Band Edge Plot (16-QAM – RB Size 50)



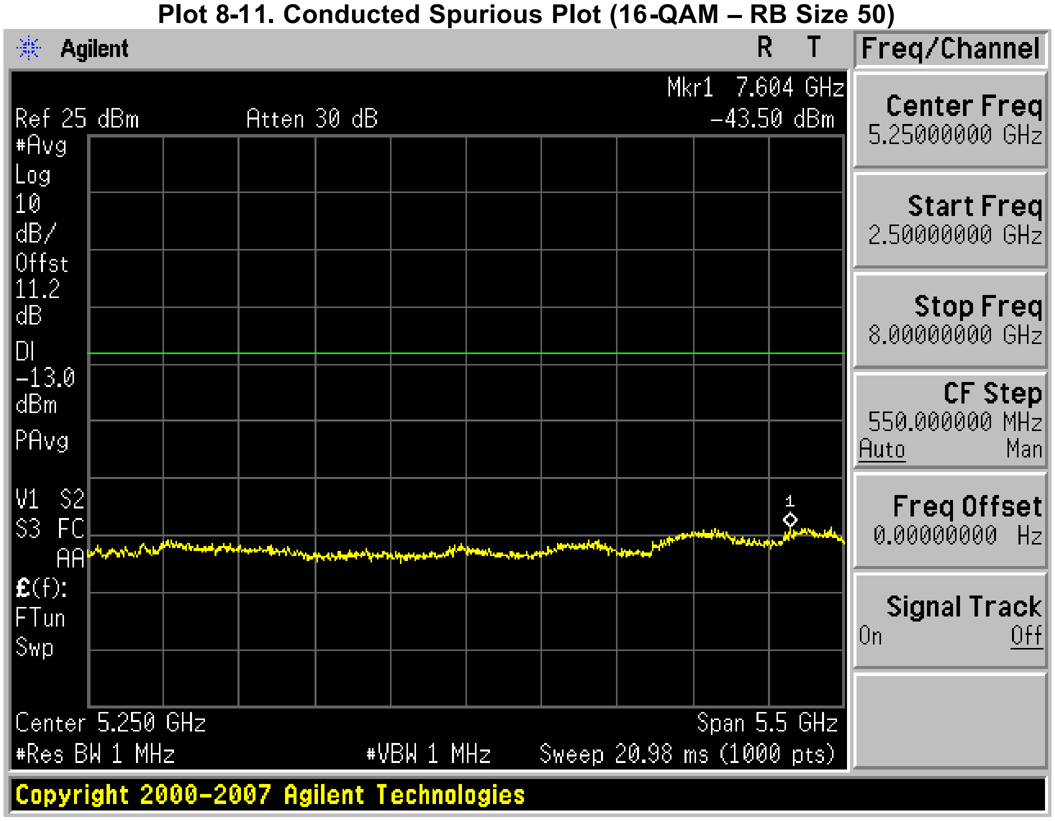
Plot 8-9. Lower Emission Mask (763 – 775MHz) Plot (16-QAM – RB Size 50)



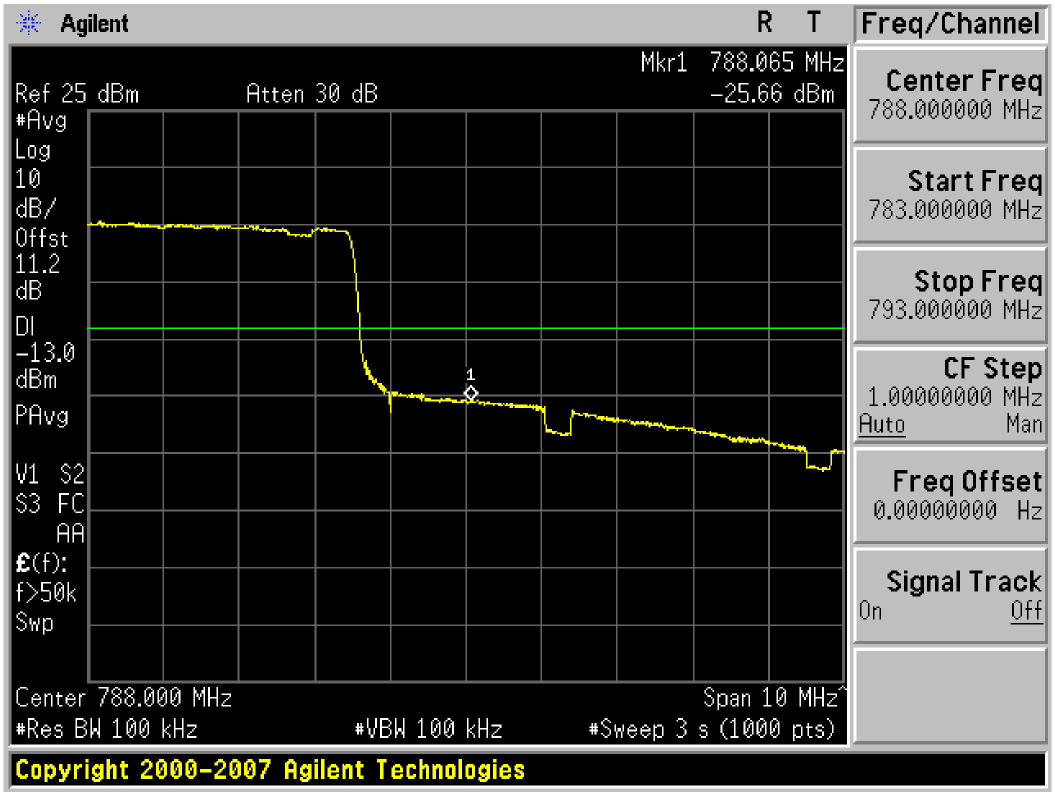
Plot 8-10. Occupied Bandwidth Plot (16-QAM – RB Size 50)



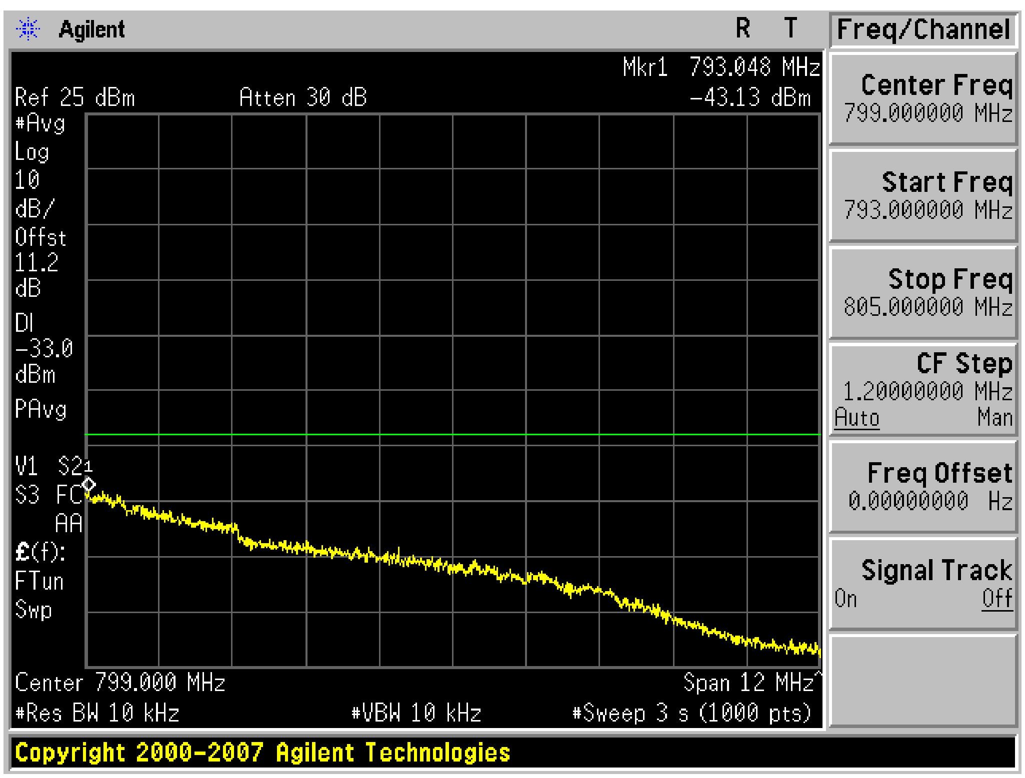
Plot 8-11. Conducted Spurious Plot (16-QAM – RB Size 50)



Plot 8-12. Conducted Spurious Plot (16-QAM – RB Size 50)



Plot 8-13. Upper Band Edge Plot (16-QAM – RB Size 50)



Plot 8-14. Upper Emission Mask (793 – 805MHz) Plot (16-QAM – RB Size 50)

9.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Novatel Personal Wireless Router FCC ID: PKRNVWMIFI4620** complies with all the requirements of Parts 2 and 27 of the FCC rules.