HCT CO., LTD.

CERTIFICATION DIVISION
105-1, JANGAM-RI, MAJANG-MYEON, ICHEON-SI, KYUNGGI-DO, KOREA
TEL : +82 31 645 6300 FAX : +82 31 645 6401 www.hct.co.kr

CERTIFICATE OF COMPLIANCE

FCC PART 27 Certification

Applicant Name:

SAMSUNG Electronics Co., Ltd.
416, Maetan-3dong, Yeongtong-gu, Suwon-si,
Gyeonggi-do, Korea

Date of Issue: April 23, 2012
Test Site/Location:
HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon,
Icheon-si, Kyunggi-Do, Korea
Test Report No.: HCTR1204FR23

FCC ID	:	**A3LSLS-BD104Q**
APPLICANT	:	**SAMSUNG Electronics Co., Ltd.**

EUT Type	:	RRH(Remote Radio Head)
Manufacturer	:	SAMSUNG Electronics Co., Ltd.
Model name	:	SLS-BD104Q
Frequency of Operation	:	2 496 MHz ~ 2 690 MHz
TX Output Power	:	30W
FCC Rule Part(s)	:	FCC Part 27 Subpart (c).
Emission Designator	:	9M16G7D(QPSK), 9M13W7D(16QAM/64QAM) 17M8G7D(QPSK), 17M8W7D(16QAM/64QAM)
Test Procedure(s)	:	ANSI/TIA-603C-2004
Application Type	:	Original Equipment
Data of issue	:	April 23, 2012

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of FCC Part 27 of the FCC Rules under normal use and maintenance.

Chang Seok Choi

Report prepared by
: Chang Seok Choi
Test engineer of RF Team

Approved by
: Sang Jun Lee
Manager of RF Team

Revision

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1204FR23	April 23, 2012	First Approval Report

C O N T E N T S

1. GENERAL INFORMATION

1.1. CLIENT INFORMATION

Company	**Samsung Electronics Co., Ltd.**
Contact Point	**416, Maetan-3dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea**
Contact person	**Name: JOON-HO LEE / Senior Research Engineer** **E-mail : joonho@samsung.com** **Tel: +82-31-279-3552** **Fax: +82-31-279-7576**

1.2. PRODUCT INFORMATION

EUT TYPE	RRH(Remote Radio Head)
EMISSION DESIGNATOR	WiMax : 9M16G7D(QPSK), 9M13W7D(16QAM/64QAM) LTE : 17M8G7D(QPSK), 17M8W7D(16QAM/64QAM)
OPERATING FREQUENCY	2 496 MHz ~ 2 690 MHz
TX OUTPUT POWER	10W/Carrier/Path @ TD-LTE 20MHz 5W/Carrier/Path @ WiMAX 10MHz
CHANNEL BANDWIDTH	TD-LTE : 20MHz, WiMAX : 10MHz
MODULATION TYPE	OFDMA (QPSK, 16QAM, 64QAM)
MAXIMUM NUMBER OF CARRIERS/SECTORS	2 Carriers / 3 Sectors
SYSTEM INPUT VOLTAGE	DC - 48 V

1.3. INTRODUCTION OF EUT

The TD-LTE Flexible system is a WiMAX/TD-LTE multi-mode base station. It is controlled by the ACR/EPC for connecting WiMAX/TD-LTE calls to the MS.
The TD-LTE Flexible system interfaces with MSs using WiMAX air channels based on the WiMAX specification (IEEE 802.16) or LTE air channels based on the 3GPP LTE Rel.8/9 specification. It provides high-speed data service and multimedia service in wireless broadband.
To this end, the TD-LTE Flexible system provides the following functions: modulation/demodulation of packet traffic signal, scheduling and radio bandwidth allocation to manage air resources efficiently and ensure Quality of Service (QoS), Automatic Repeat request (ARQ) processing, ranging function, connection control function to transmit the information on the TD-LTE Flexible system and set/hold/disconnect the packet call connection, handover control, control station such as ACR/EPC interface function, power control function and system operation management function.
The TD-LTE Flexible system securely and rapidly transmits and receives various control signals and traffic signals by interfacing with the control station by the method selected by the operator among Fast Ethernet or Gigabit Ethernet.
Physically, the TD-LTE Flexible system consists of a Digital Unit (DU) and a Remote Radio Head (RRH). The RRH is located remotely from the DU. One DU can be connected to up to 3 RRHs.
The TD-LTE Flexible system supports up to 2 Carrier/3Sector service. The RRH is operated as follows.

• RRH-2WB(4Tx/4Rx RF path): Dual Mode
– WiMAX 2Tx/2Rx(2x2 MIMO) + TD-LTE 2Tx/2Rx(2x2 MIMO)
– 5 W + 5 W @ WiMAX 10 MHz channel BW
– 10 W + 10 W @ TD-LTE 20 MHz channel BW

An RRH is a standalone RF unit. It is installed on an outdoor wall, pole or stand.
The main features of the TD-LTE Flexible system are as follows.

Common Platform

The digital boards mounted in the TD-LTE Flexible system share a common DU platform and each DU can accommodate channel cards for operating various communication technologies.
The RRH of the TD-LTE Flexible system can simultaneously provide WiMAX and TD-LTE

- communication technologies operating in the same frequency range.

– Separate DU and RRH Structure
– As the TD-LTE Flexible system consists of a DU and an RRH, it is easy to set up a network
– and it is easy to change the network configuration. For connections between the DU and
– RRH, data traffic signals and OAM information are sent/received through the ‘Digital I/Q
– and C & M’ interface based on the Common Public Radio Interface (CPRI). Physically,
– optic cables are used.
– Each of the DU and RRH receives -48 VDC of power for its operation from different
– rectifier.
– • Easy Installation
– The optic interface component that interfaces with the DU and the RF signal processing
– component is integrated into the RRH, which becomes a very small and very light single
– unit. Therefore, the RRH can be installed on a wall, pole or stand.
– Moreover, as the distance between the RRH and antenna is minimized, the loss of RF
– signals due to the antenna feeder cable can be reduced so that more enhanced RF
– receiving performance than the existing rack-type base station can be provided.
– • Natural Cooling
– Because the RRH is installed outdoors and has an efficient design, it can radiate heat
– efficiently without any additional cooling system. Therefore, no additional maintenance
– cost is needed for cooling the RRH.
– • Loopback Test
– The TD-LTE Flexible system provides the loopback test function to check whether
– communication is normal on the ‘Digital I/Q and C & M’ interface line between the
– DU and RRH.
– • Remote Firmware Downloading
– The operator can upgrade the RRH and its service by replacing its firmware. Without
– visiting the field station, the operator can download firmware to the RRH remotely using
– a simple command from the base station operation server(WSM). In this way, operators
– can minimize the number of visits to the field station, reducing maintenance costs and
– allowing the system to be operated with greater ease.
– • Monitoring Port
– Operators can monitor the information for an RRH using its debug port.
– • Smooth Migration
– The DU of the TD-LTE Flexible system supports migration from Mobile WiMAX to
– TD-LTE by adding channel cards and upgrading the software.
– The RRH, on the other hand, only requires software upgrade for evolving into 4G mobile
– communication in the same frequency range or even simultaneous operation of 3G and
– 4G mobile communications.

2. TEST SUMMARY

2.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance With **FCC Part 27**

SECTION	TEST ITEMS	RESULTS
2.1046, 27.50(h)	Conducted Output Power	Compliant
2.1049, 27.53(m)	Occupied Bandwidth	Compliant
2.1051, 27.53(m)	Spurious Emissions at Antenna Terminals	Compliant
2.1051, 27.53(m)	Band edge	Compliant
2.1053, 27.53(m)	Spurious Radiated Emissions.	Compliant
2.1055(a)(1), 27.54	Frequency Stability over Temperature variation	Compliant
2.1055(d), 27.54	Frequency stability over Voltage variation	Compliant

2.2. MODE OF OPERATION DURING THE TEST

The EUT was operated in a manner representative of the typical usage of the equipment.
During all testing, system components were manipulated within the confines of typical usage to maximize each emission. All Modulation (QPSK, 16QAM, and 64QAM) modes were tested, and the worst case was recorded in this test report.
The device does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports for radiated spurious emission testing.

3. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	**+ 15 ℃ to + 35 ℃**
Relative humidity:	**30 % to 60 %**
Air pressure	**860 mbar to 1060 mbar**

4. TEST EQUIPMENT

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	296	02/20/2014
Schwarzbeck	VULB 9168 / TRILOG Antenna	9168-200	02/19/2013
HD	MA240 / Antenna Position Tower	556	N/A
EMCO	1050 / Turn Table	114	N/A
HD GmbH	HD 100 / Controller	13	N/A
HD GmbH	KMS 560 / SlideBar	12	N/A
MITEQ	AMF-6D-001180-35-20P/AMP	990893	05/02/2012
EMCO	6502/Loop Antenna	9009-2536	01/14/2014
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
Agilent	6674A/ DC Power Supply	3501A00901	05/02/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012

5. CONDUCTED OUTPUT POWER

5.1. Applicable Standard

According to FCC §2.1046 & 27.50(h)

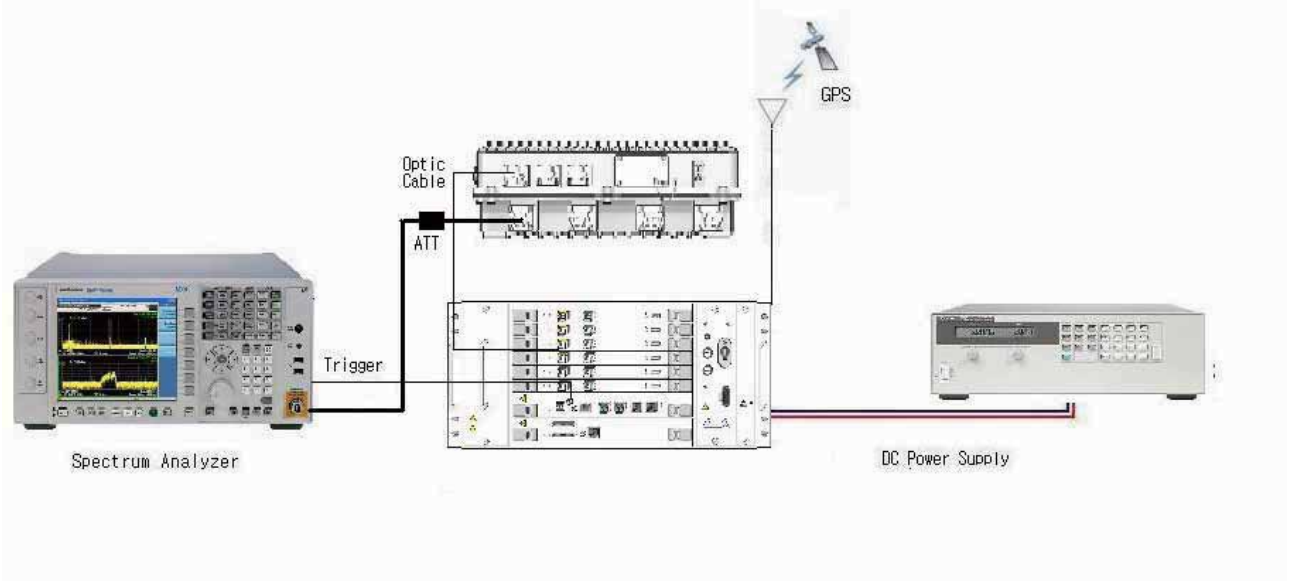
1) *Main, booster and base stations.* (i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

5.2. Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
Agilent	6674A/ DC Power Supply	3501A00901	05/02/2012

5.3. Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.



According to FCC §2.1046 (a), for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

1) The radio frequency load attached to the EUT antenna terminal was 50 Ohm. The lost of the cables the test system is calibrated to correct the reading.
2) The spectrum analyzer was set to RMS Detector function and Average mode.
3) The resolution banswidth of the spectrum analyzer was comparable to the emission bandwidth.

5.4. Test Result

: PASS

5.4.1. Test Data at Output Port 1 (Mobile WiMax)

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	37.18	5.2240
	Middle	2551.5	36.85	4.8417
	High	2683.5	36.71	4.6881
16QAM	Low	2508.5	36.96	4.9659
	Middle	2551.5	36.96	4.9659
	High	2683.5	36.62	4.5920
64QAM	Low	2508.5	36.97	4.9774
	Middle	2551.5	37.00	5.0119
	High	2683.5	36.72	4.6989

5.4.2. Test Data at Output Port 2 (Mobile WiMax)

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	36.21	4.1783
	Middle	2551.5	36.67	4.6452
	High	2683.5	36.82	4.8084
16QAM	Low	2508.5	36.57	4.5394
	Middle	2551.5	36.72	4.6989
	High	2683.5	36.86	4.8529
64QAM	Low	2508.5	36.61	4.5814
	Middle	2551.5	36.73	4.7098
	High	2683.5	36.83	4.8195

5.4.3. Test Data at Output Port 3 (TD-LTE)

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2506	40.07	10.1625
	Middle	2592	40.03	10.0693
	High	2680	39.88	9.7275
16QAM	Low	2506	39.98	9.9541
	Middle	2592	40.05	10.1158
	High	2680	40.00	10.0000
64QAM	Low	2506	40.43	11.0408
	Middle	2592	40.31	10.7399
	High	2680	40.20	10.4713

5.4.4. Test Data at Output Port 4 (TD-LTE)

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2506	40.08	10.1859
	Middle	2592	40.13	10.3039
	High	2680	39.91	9.7949
16QAM	Low	2506	39.95	9.8855
	Middle	2592	39.94	9.8628
	High	2680	39.48	8.8716
64QAM	Low	2506	40.21	10.4954
	Middle	2592	40.22	10.5196
	High	2680	39.74	9.4189

5.4.5. Measure-and-sum data at Output Port 1&2

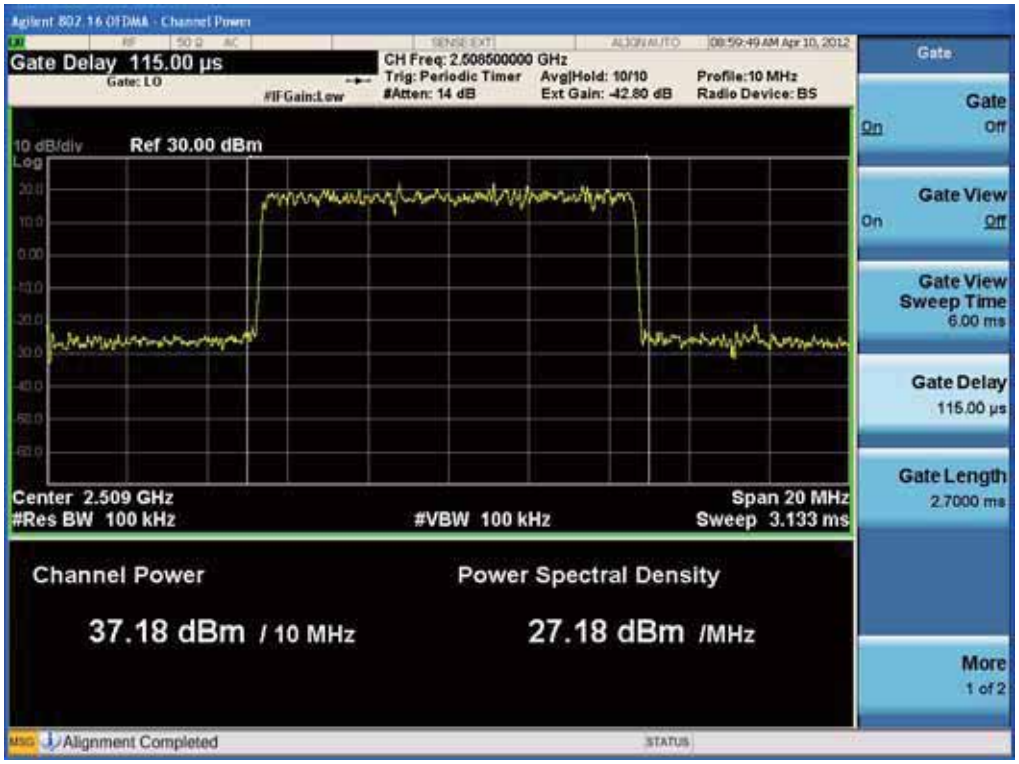
Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	40.19	10.4480
	Middle	2551.5	39.86	9.6834
	High	2683.5	39.72	9.3762
16QAM	Low	2508.5	39.97	9.9318
	Middle	2551.5	39.97	9.9318
	High	2683.5	39.63	9.1840
64QAM	Low	2508.5	39.98	9.9548
	Middle	2551.5	40.01	10.0238
	High	2683.5	39.73	9.3978

5.4.6. Measure-and-sum data at Output Port 3&4

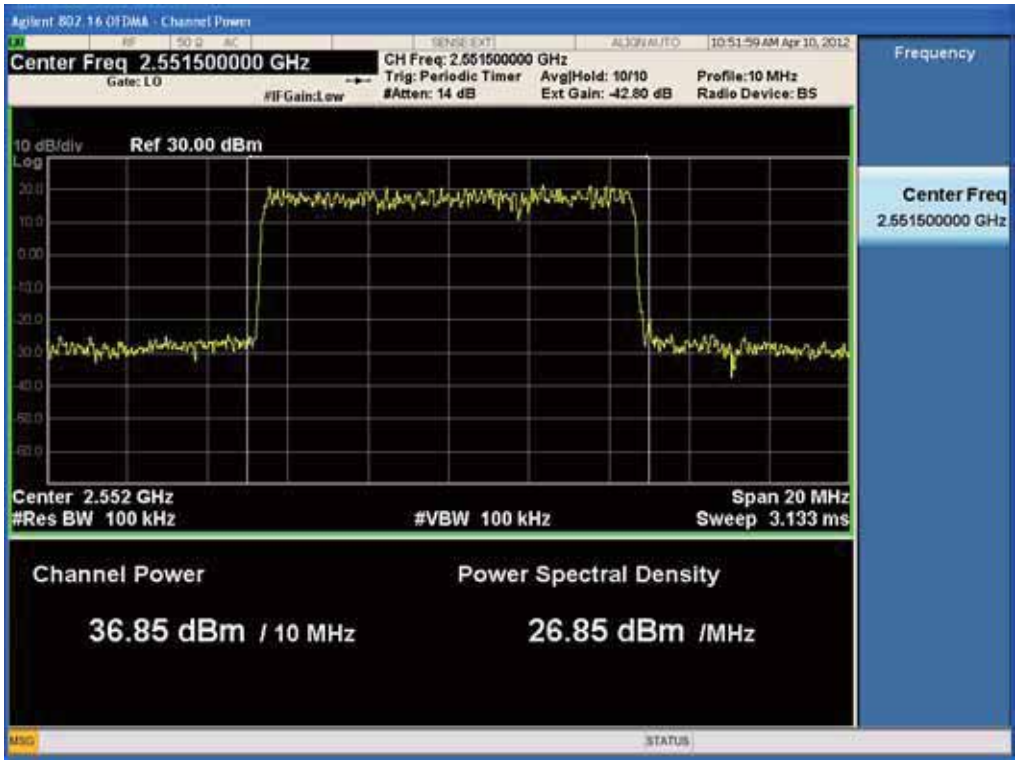
Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2506	43.08	20.3484
	Middle	2592	43.09	20.3732
	High	2680	42.90	19.5224
16QAM	Low	2506	42.97	19.8396
	Middle	2592	43.00	19.9786
	High	2680	42.75	18.8716
64QAM	Low	2506	43.33	21.5362
	Middle	2592	43.27	21.2595
	High	2680	42.98	19.8902

5.4.7. Plot Data for Output Port 1 (Conducted Output Power)

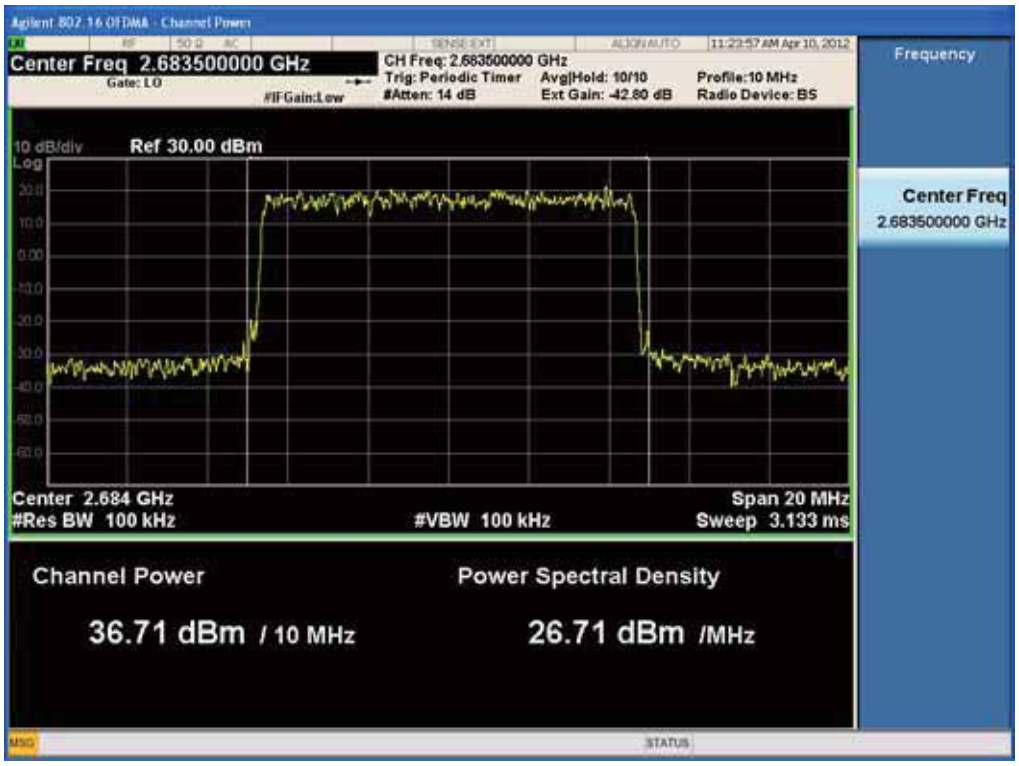
(QPSK Low Channel)



(QPSK Middle Channel)

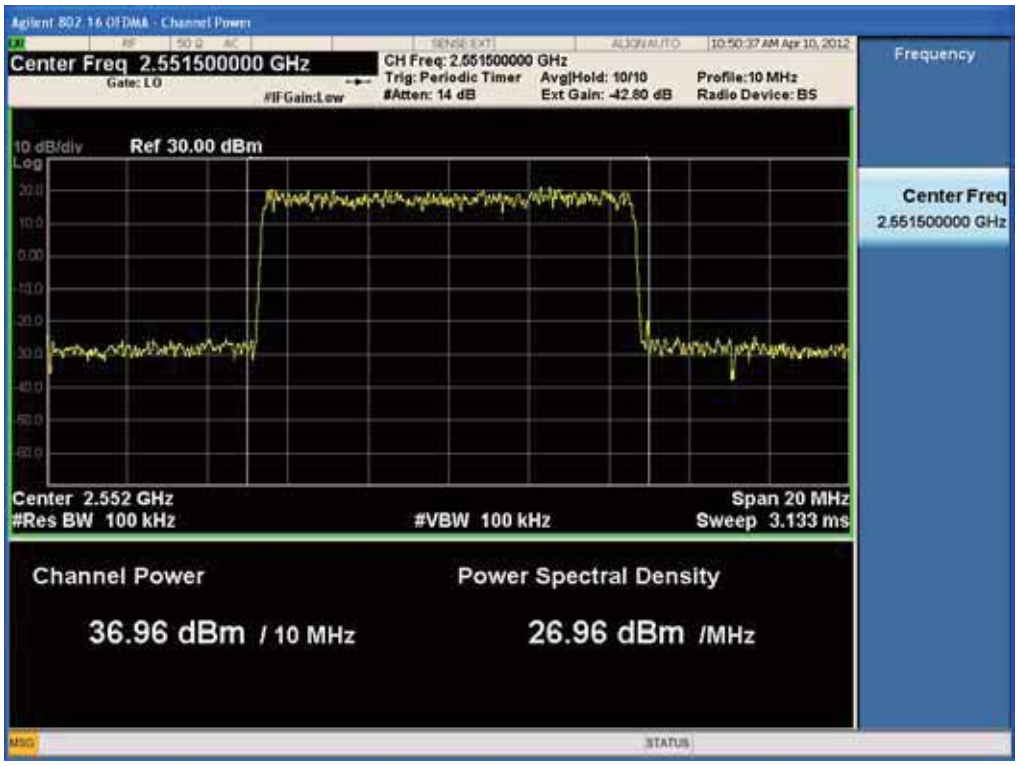


(QPSK High Channel)



(16QAM Low Channel)

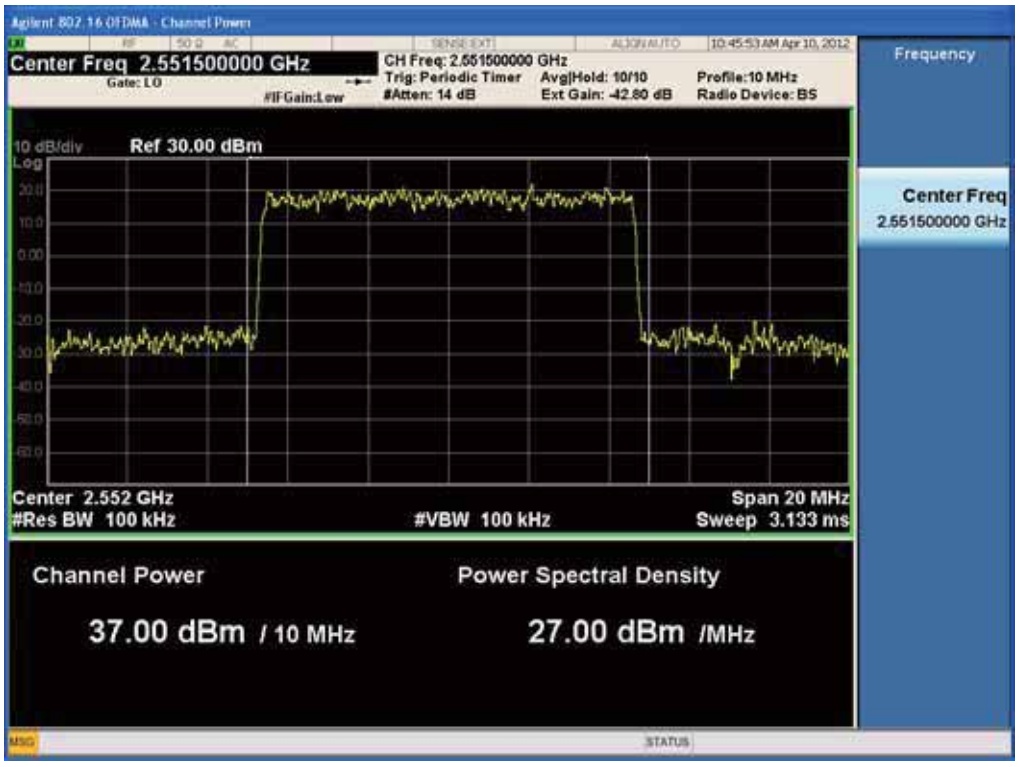
(16QAM Middle Channel)



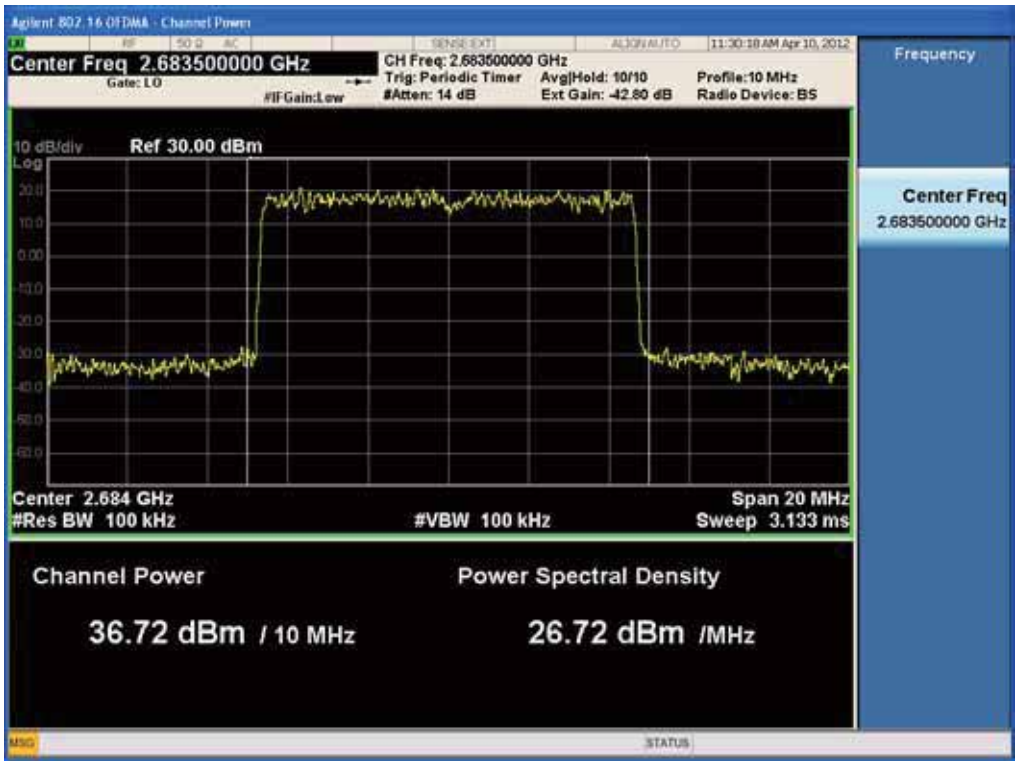
(16QAM High Channel)

(64QAM Low Channel)

(64QAM Middle Channel)

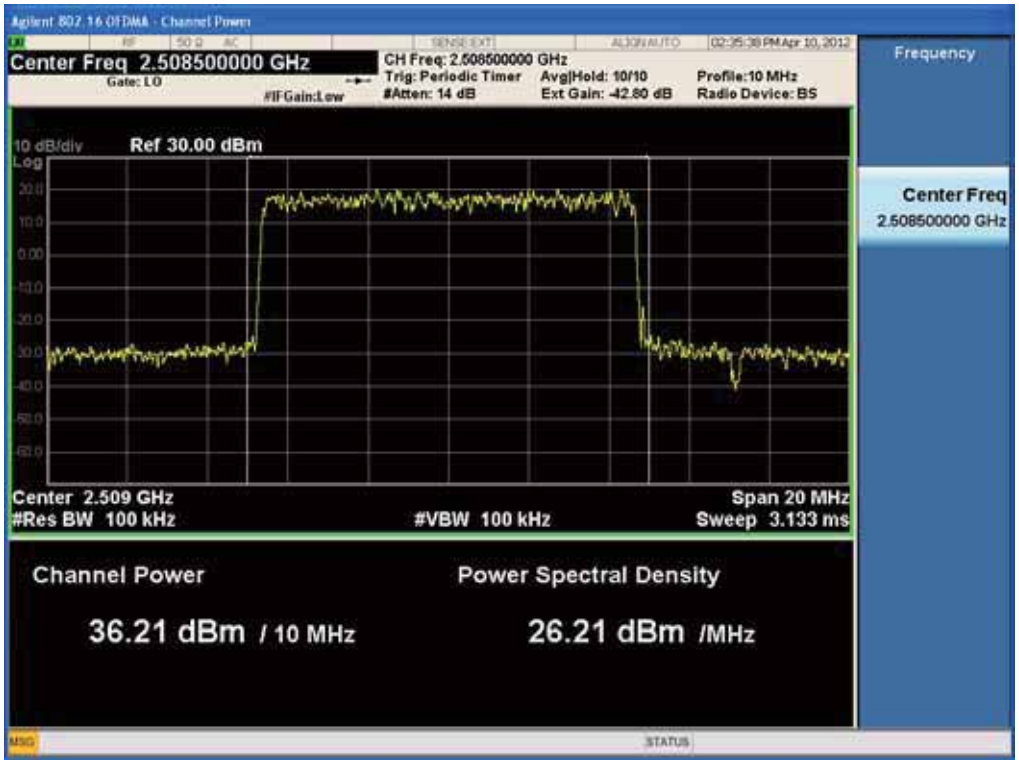


(64QAM High Channel)

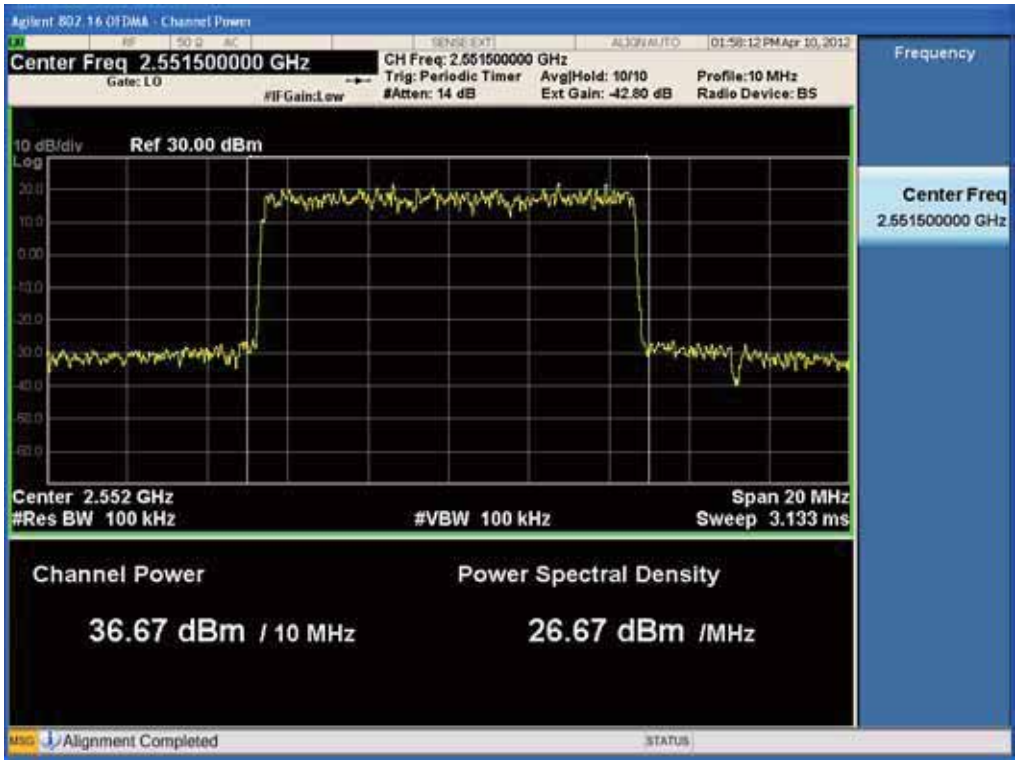


5.4.8. Plot Data for Output Port 2 (Conducted Output Power)

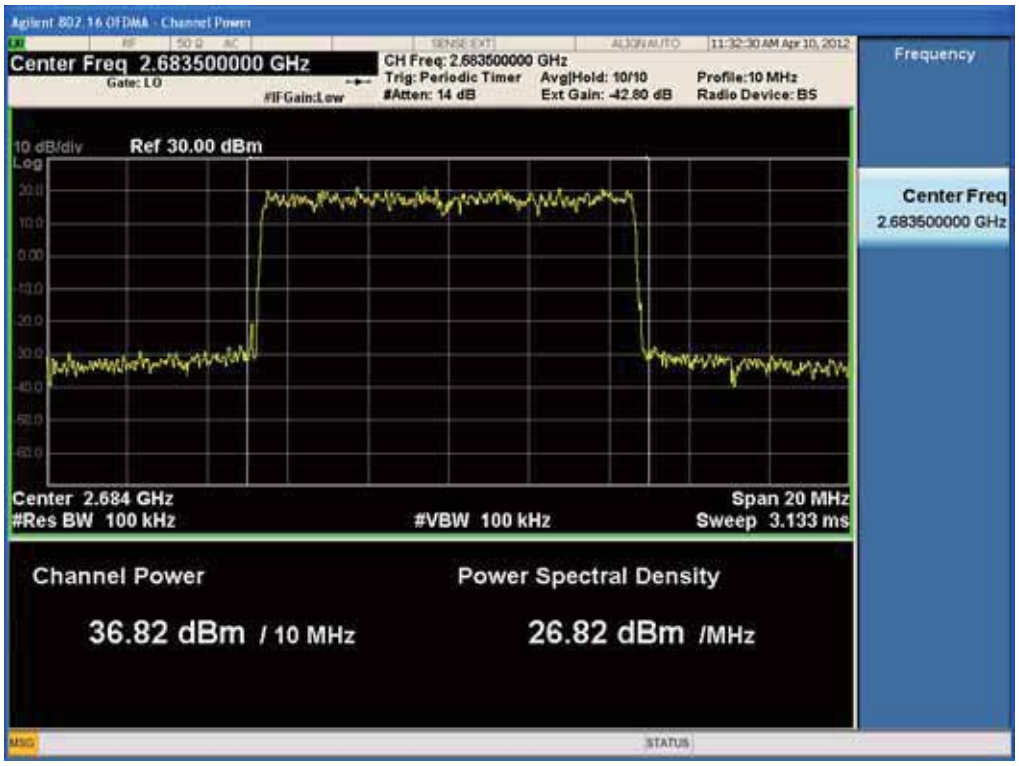
(QPSK Low Channel)



(QPSK Middle Channel)

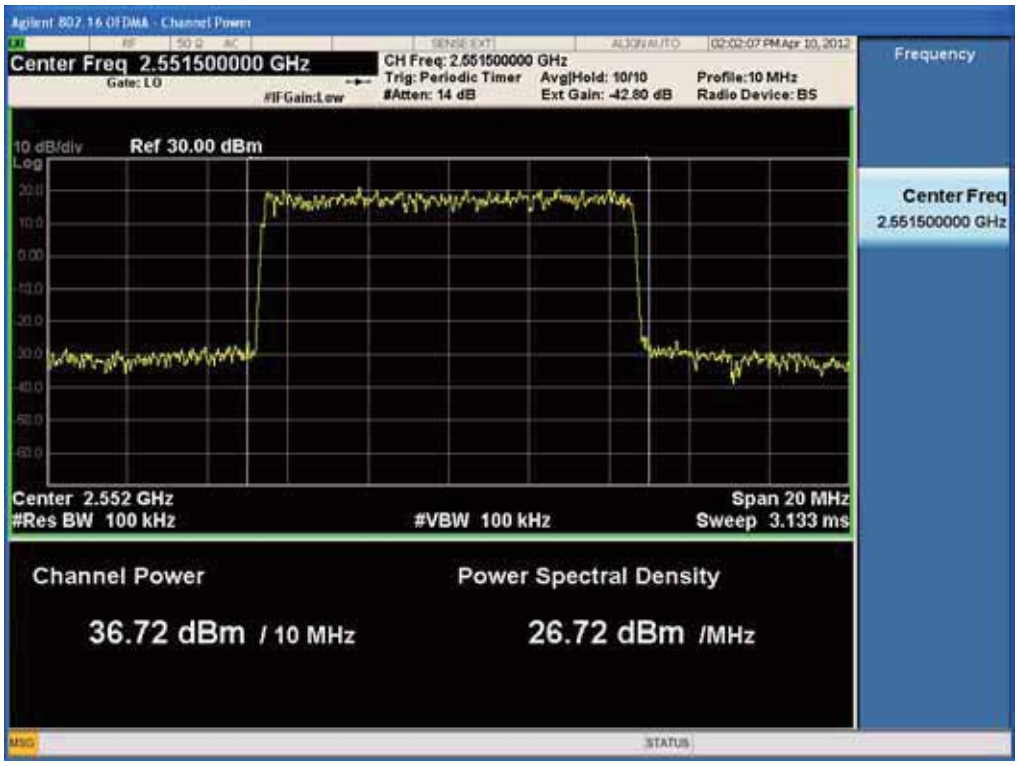


(QPSK High Channel)



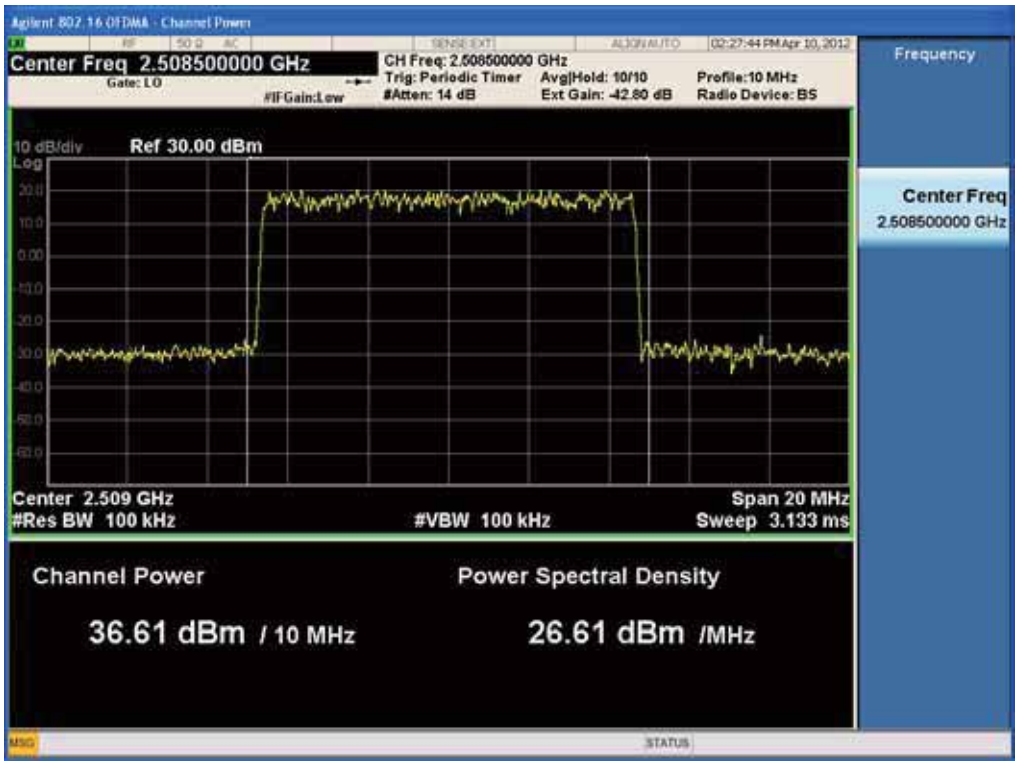
(16QAM Low Channel)

(16QAM Middle Channel)



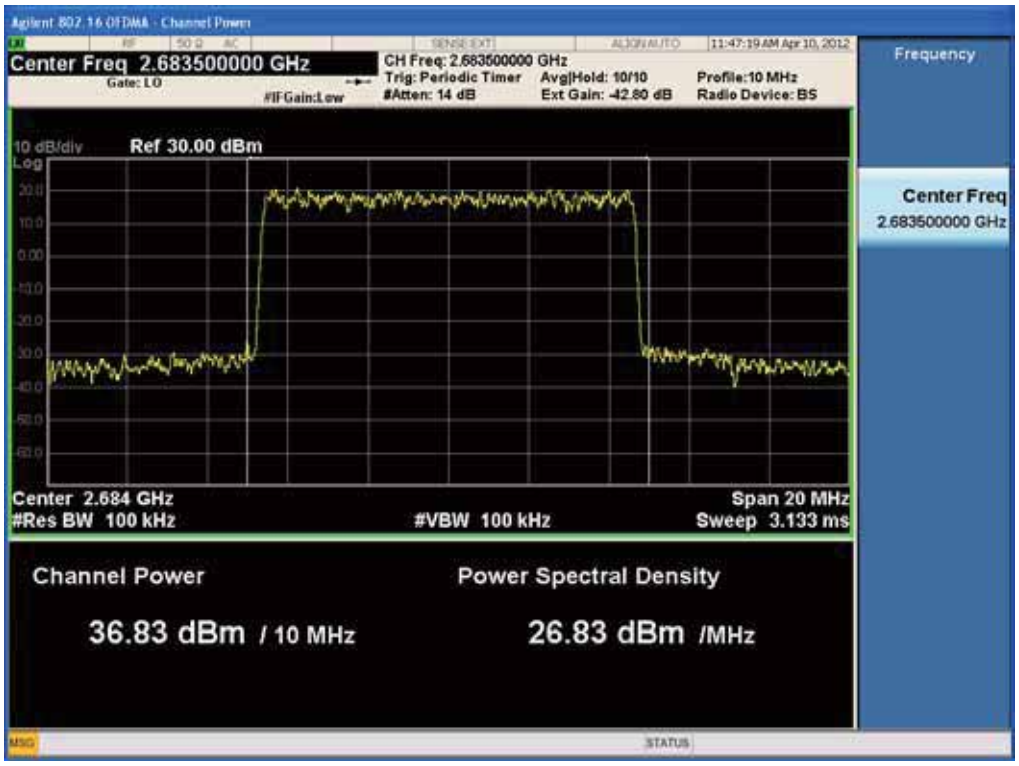
(16QAM High Channel)

(64QAM Low Channel)



(64QAM Middle Channel)

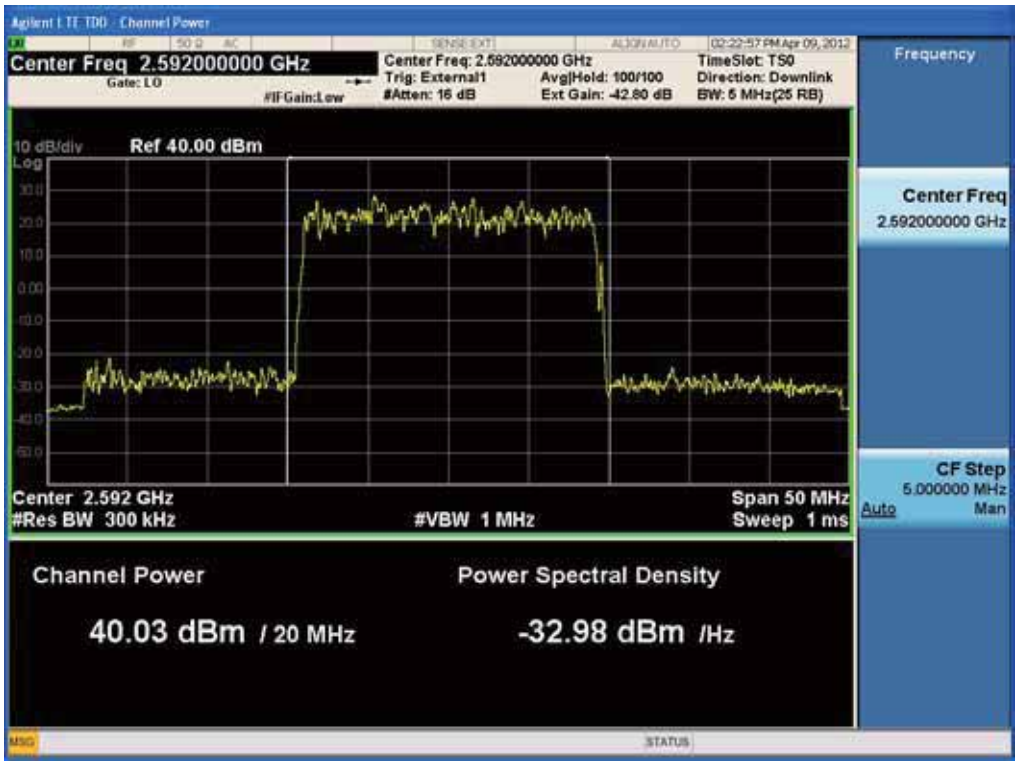
(64QAM High Channel)



5.4.9. Plot Data for Output Port 3 (Conducted Output Power)

(QPSK Low Channel)

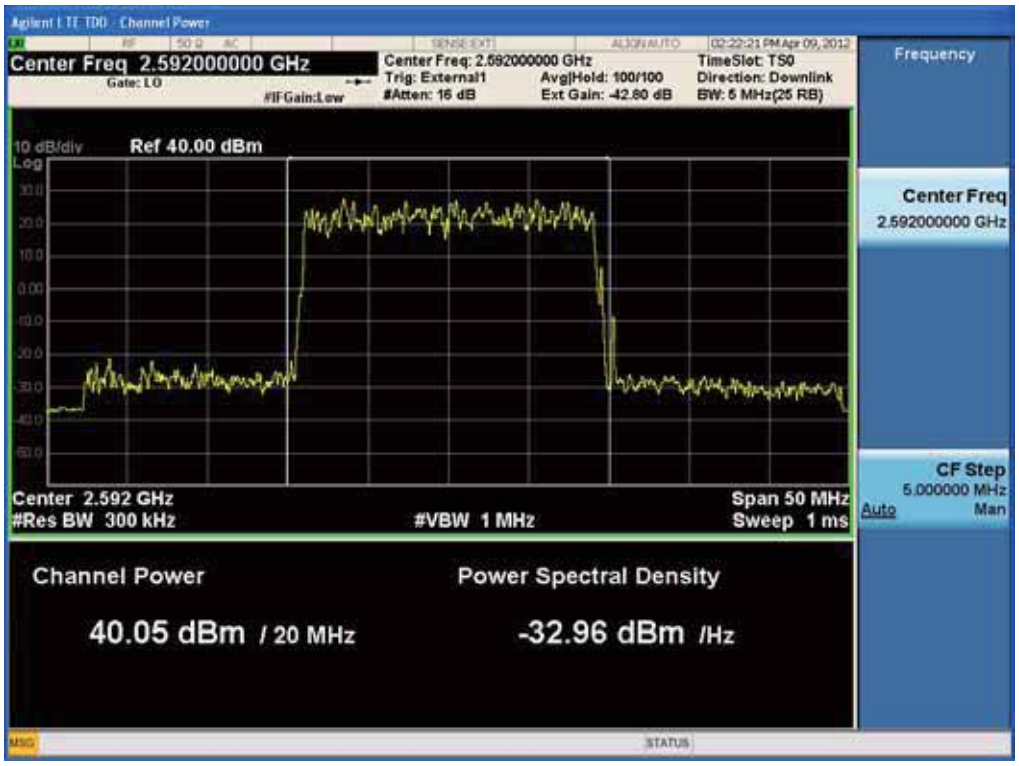
(QPSK Middle Channel)



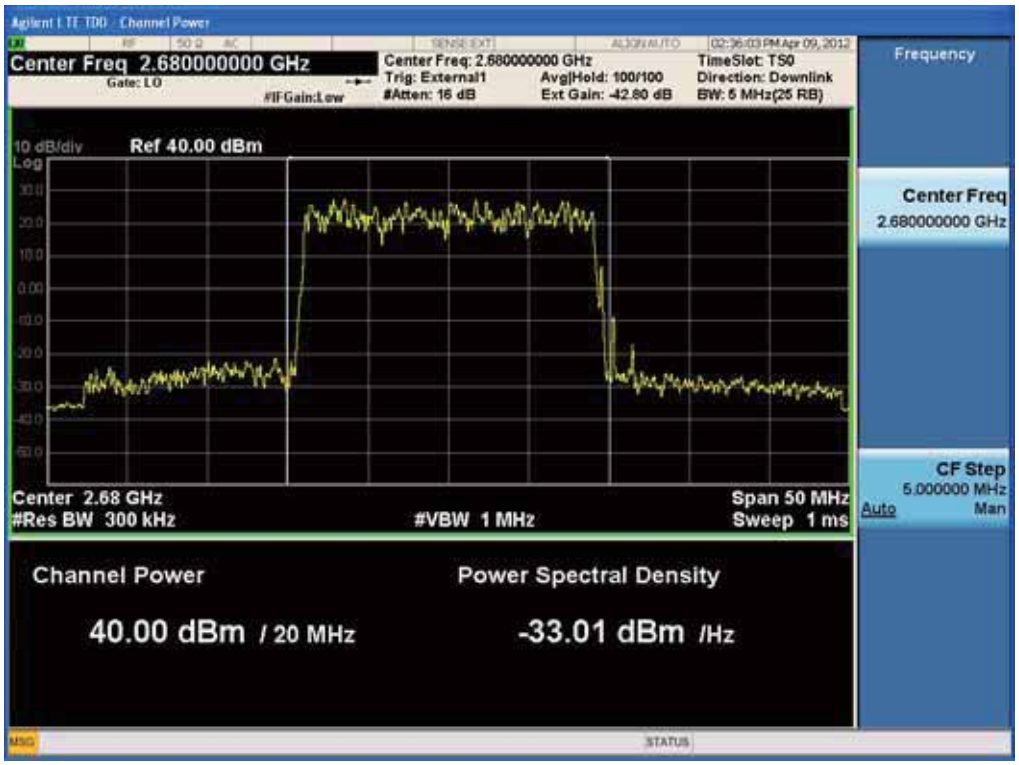
(QPSK High Channel)

(16QAM Low Channel)

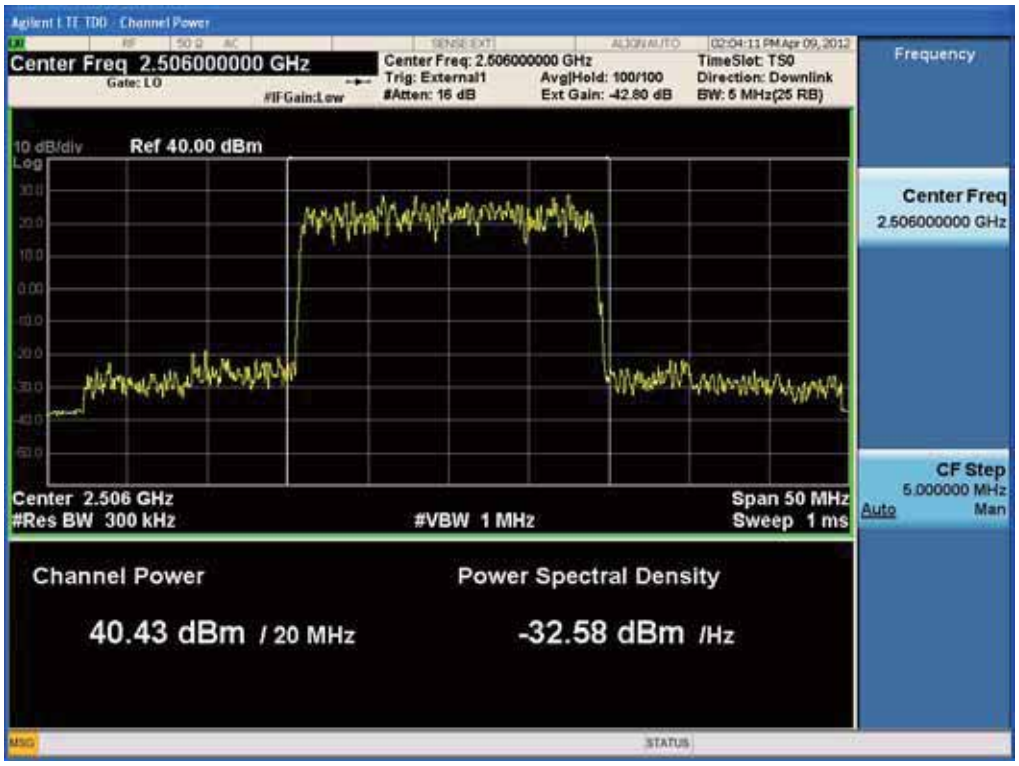
(16QAM Middle Channel)



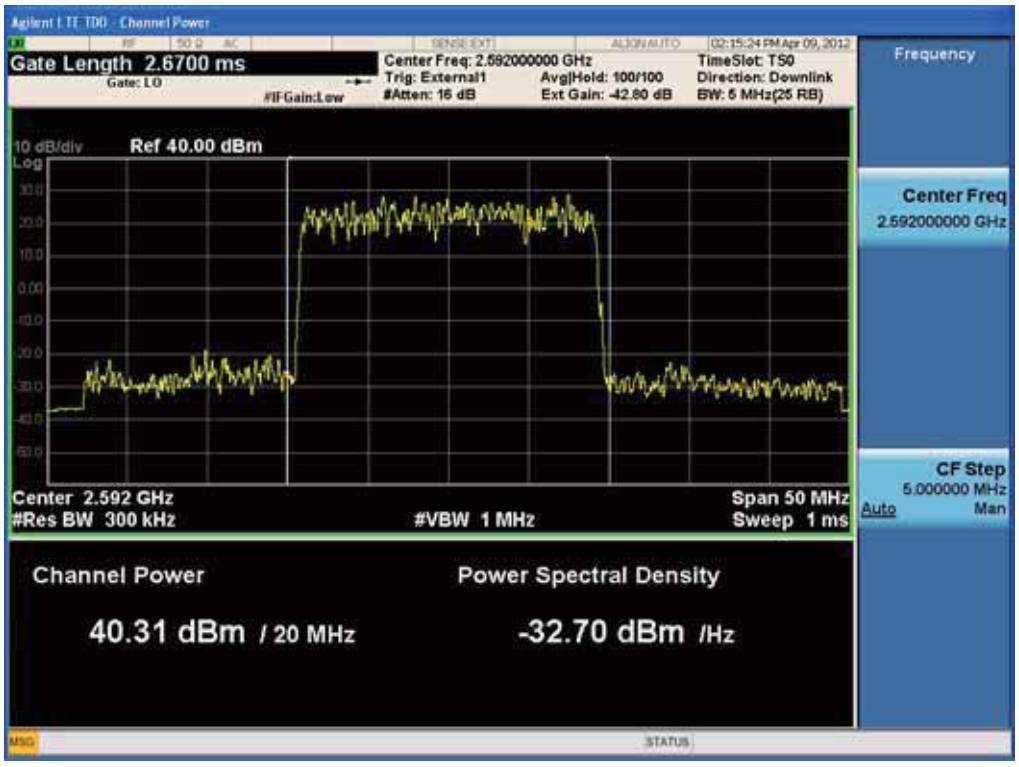
(16QAM High Channel)



(64QAM Low Channel)



(64QAM Middle Channel)

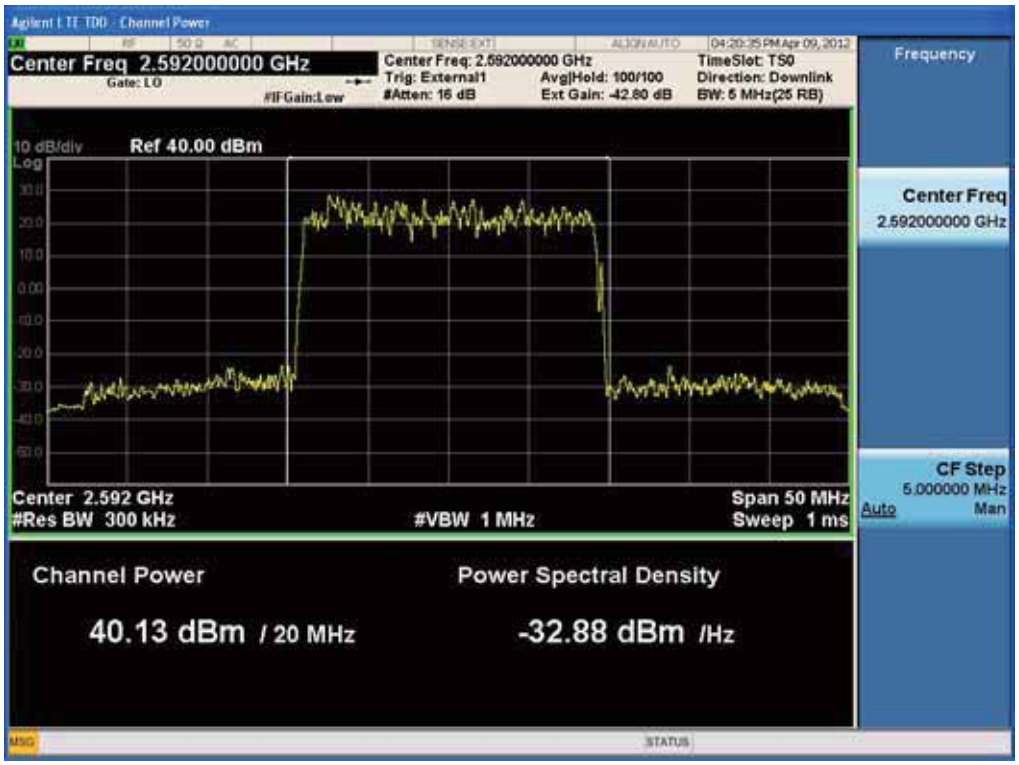


(64QAM High Channel)

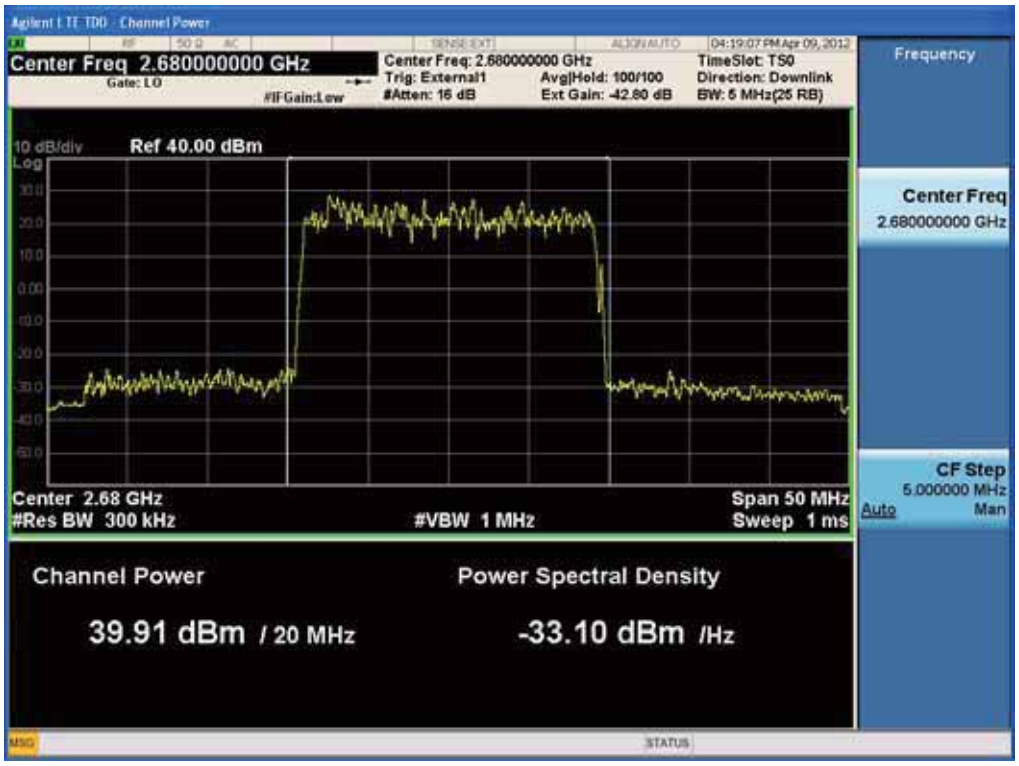
5.4.10. Plot Data for Output Port 4 (Conducted Output Power)

(QPSK Low Channel)

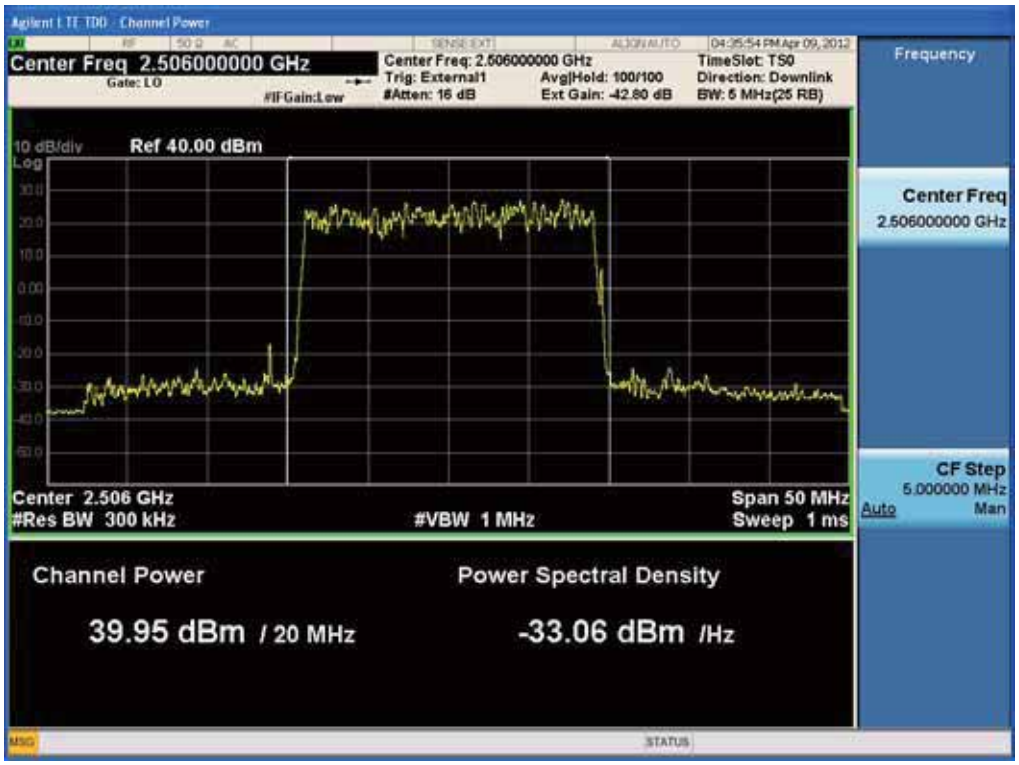
(QPSK Middle Channel)



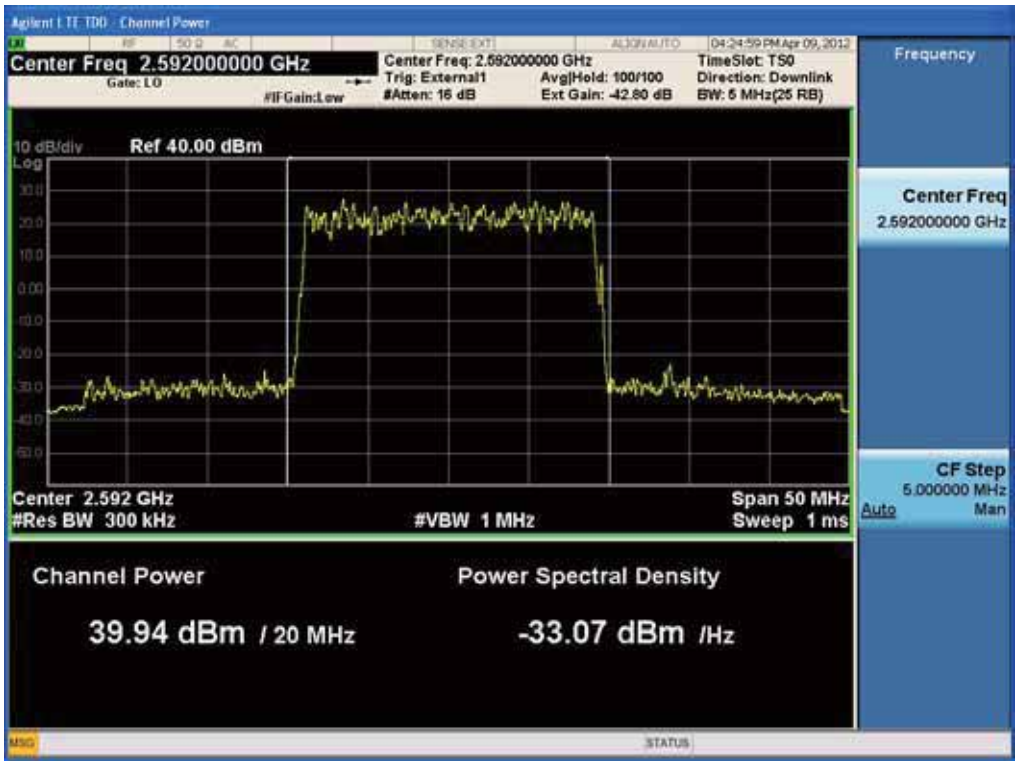
(QPSK High Channel)



(16QAM Low Channel)



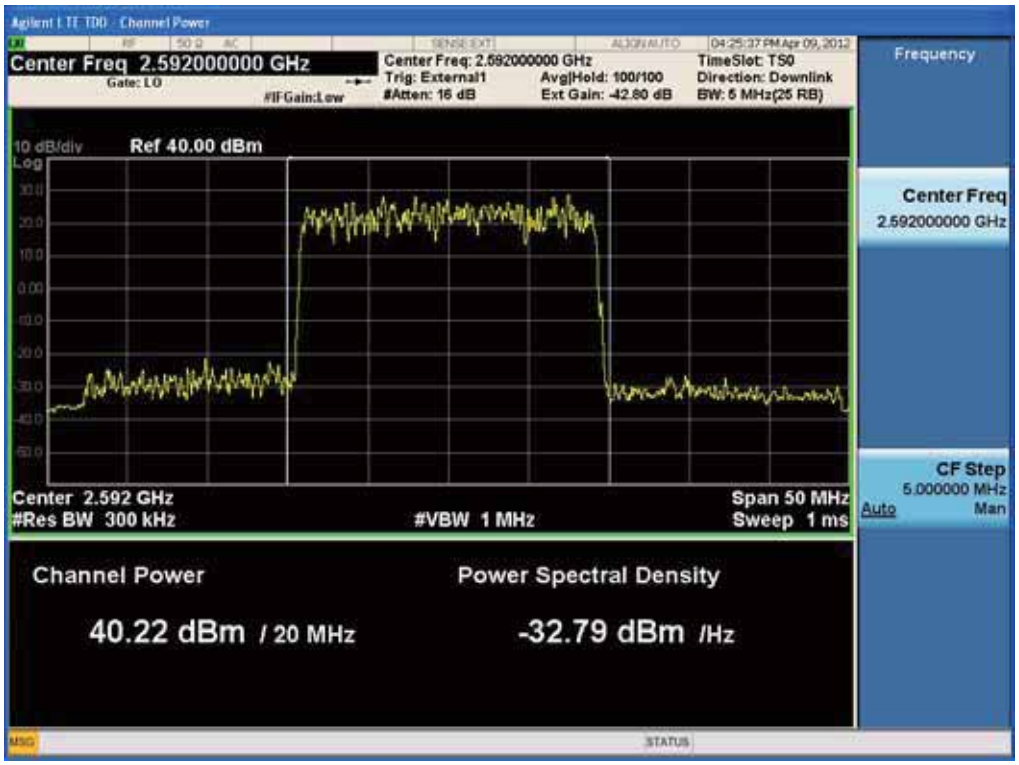
(16QAM Middle Channel)



(16QAM High Channel)

(64QAM Low Channel)

(64QAM Middle Channel)



(64QAM High Channel)

6. OCCUPIED BANDWIDTH

6.1. Applicable Standard

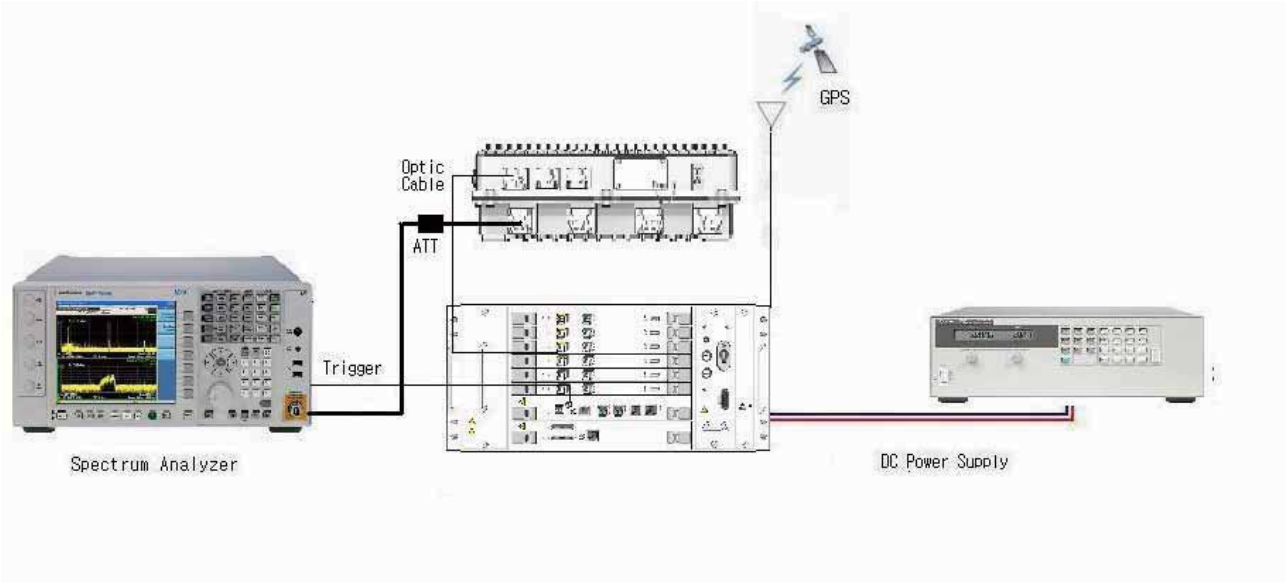
Requirements: CFR 47, Section 27.53(m)(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth 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. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

6.2.Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
Agilent	6674A/ DC Power Supply	3501A00901	05/02/2012

6.3. Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.



The EUT was connected to a spectrum analyzer enabled with an occupied bandwidth function via its antenna port. Measurements were performed to determine the occupied bandwidth in accordance with FCC Part 2.1049. The occupied bandwidth was measured from the fundamental emission at the bottom, middle and top channels. The occupied bandwidth was measured using the built in occupied bandwidth function of the spectrum analyzer. It was set to measure the bandwidth where 99% of the signal power was contained. The analyzer automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.

6.4. Test Result

: PASS

6.4.1. Test Data at Output Port 1

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.0968	9.431
	Middle	2551.5	9.1251	9.416
	High	2683.5	9.1421	9.444
16QAM	Low	2508.5	9.1110	9.436
	Middle	2551.5	9.1337	9.430
	High	2683.5	9.1219	9.426
64QAM	Low	2508.5	9.1021	9.435
	Middle	2551.5	9.0997	9.429
	High	2683.5	9.1090	9.425

6.4.2. Test Data at Output Port 2

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.1284	9.601
	Middle	2551.5	9.1026	9.432
	High	2683.5	9.1665	9.426
16QAM	Low	2508.5	9.0990	9.785
	Middle	2551.5	9.0974	9.616
	High	2683.5	9.0837	9.431
64QAM	Low	2508.5	9.1226	9.622
	Middle	2551.5	9.0966	9.599
	High	2683.5	9.1262	9.432

6.4.3. Test Data at Output Port 3

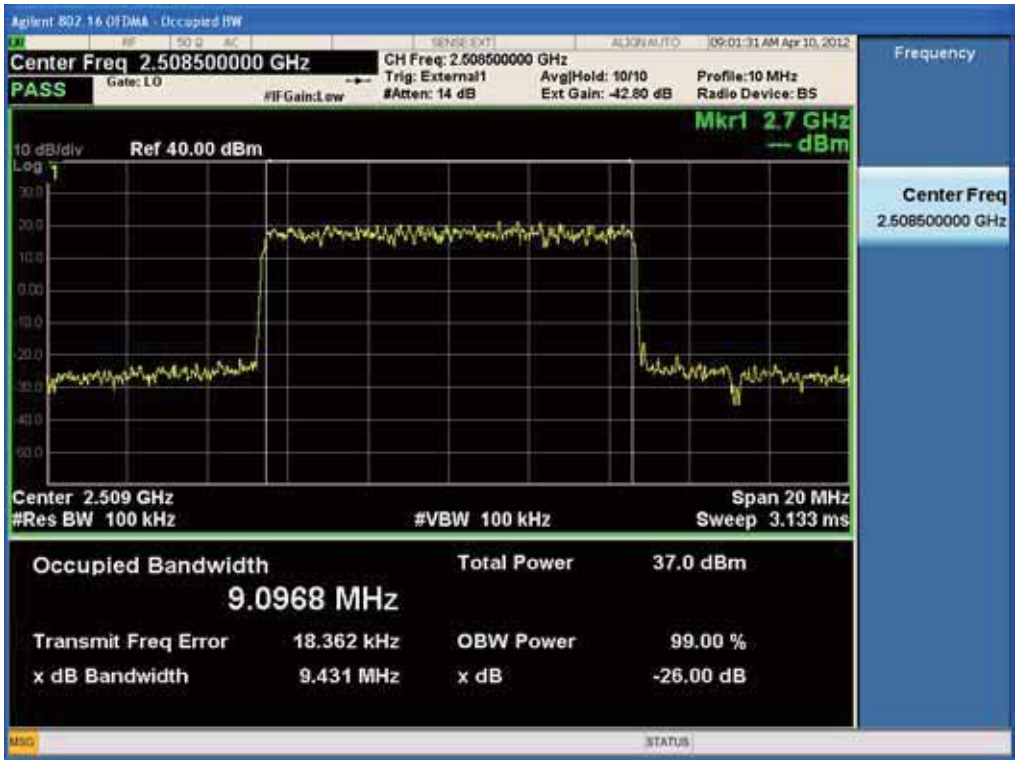
Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2506	17.661	18.810
	Middle	2592	17.811	18.790
	High	2680	17.816	18.800
16QAM	Low	2506	17.771	18.730
	Middle	2592	17.814	18.690
	High	2680	17.802	18.720
64QAM	Low	2506	17.874	18.630
	Middle	2592	17.883	18.630
	High	2680	17.890	18.630

6.4.4. Test Data at Output Port 4

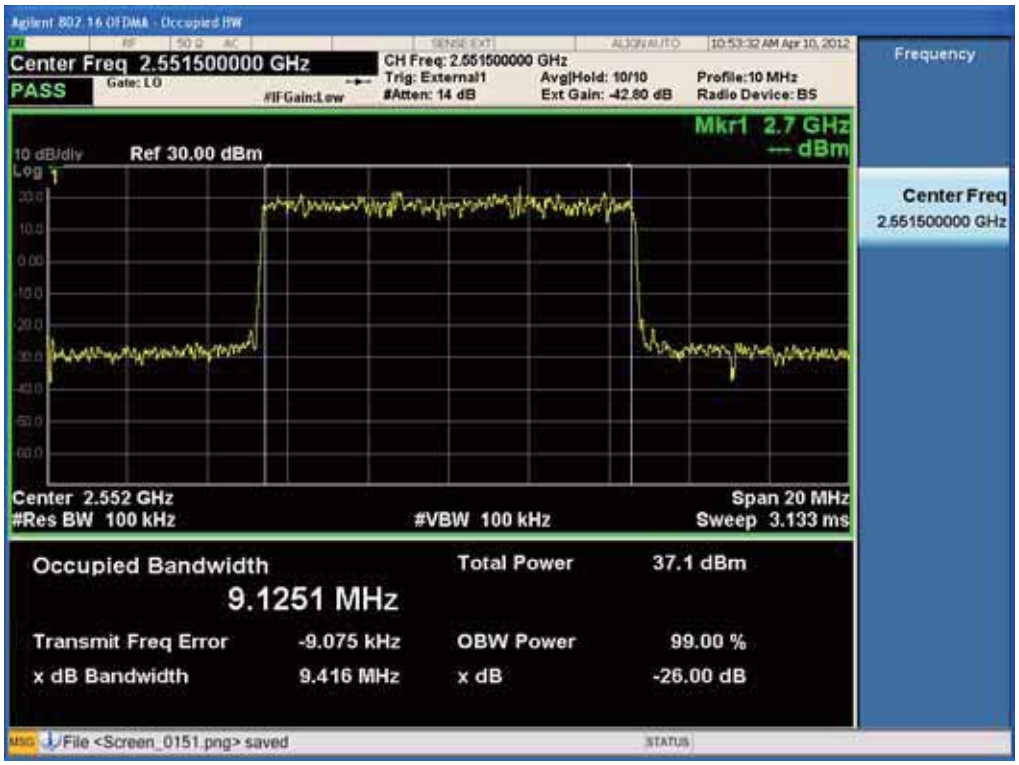
Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2506	17.873	18.630
	Middle	2592	17.819	18.810
	High	2680	17.818	18.800
16QAM	Low	2506	17.812	18.780
	Middle	2592	17.802	18.710
	High	2680	17.817	18.690
64QAM	Low	2506	17.875	18.630
	Middle	2592	17.875	18.630
	High	2680	17.881	18.630

6.4.5. Test Plot at Output Port 1

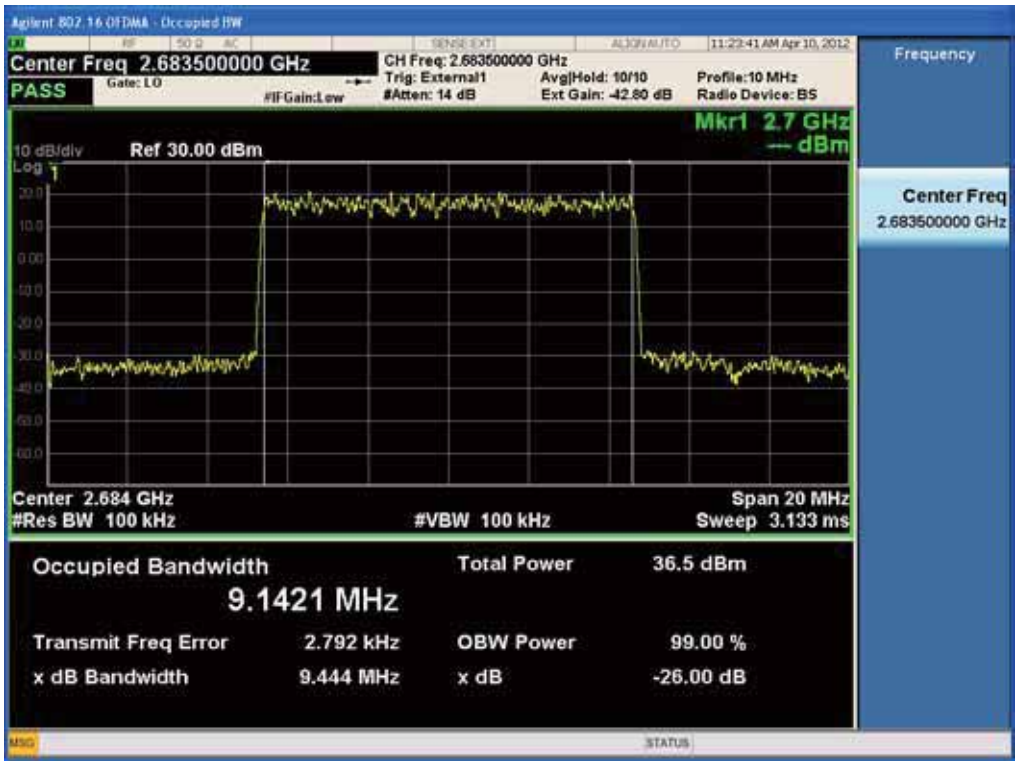
(QPSK Low Channel)



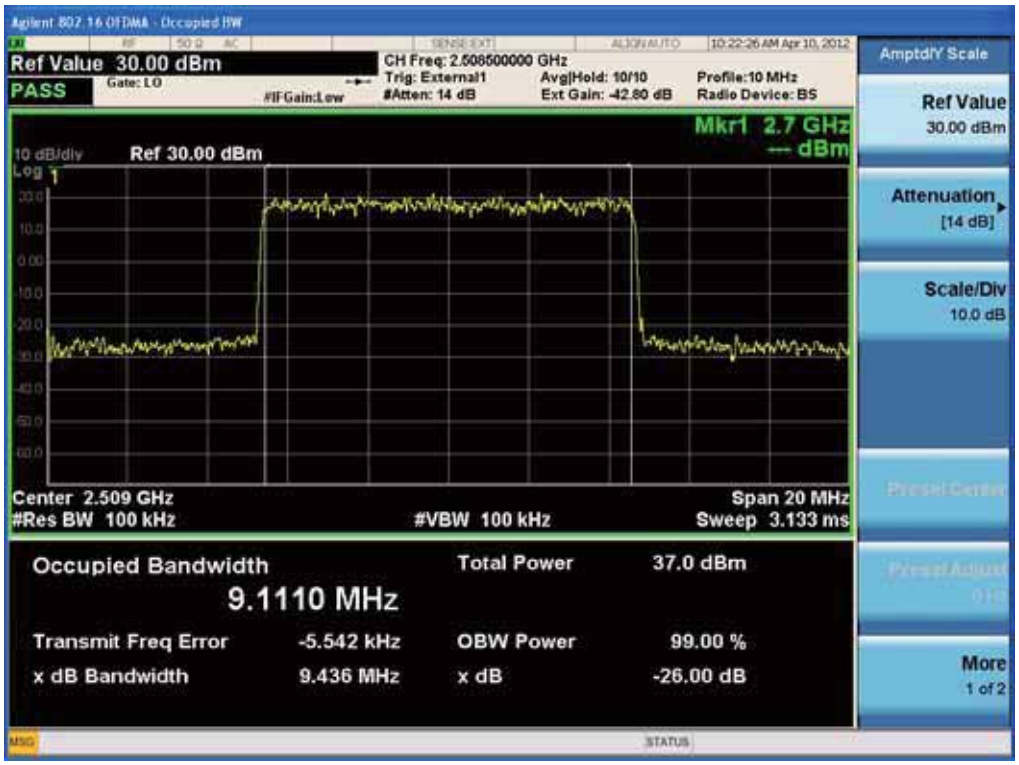
(QPSK Middle Channel)



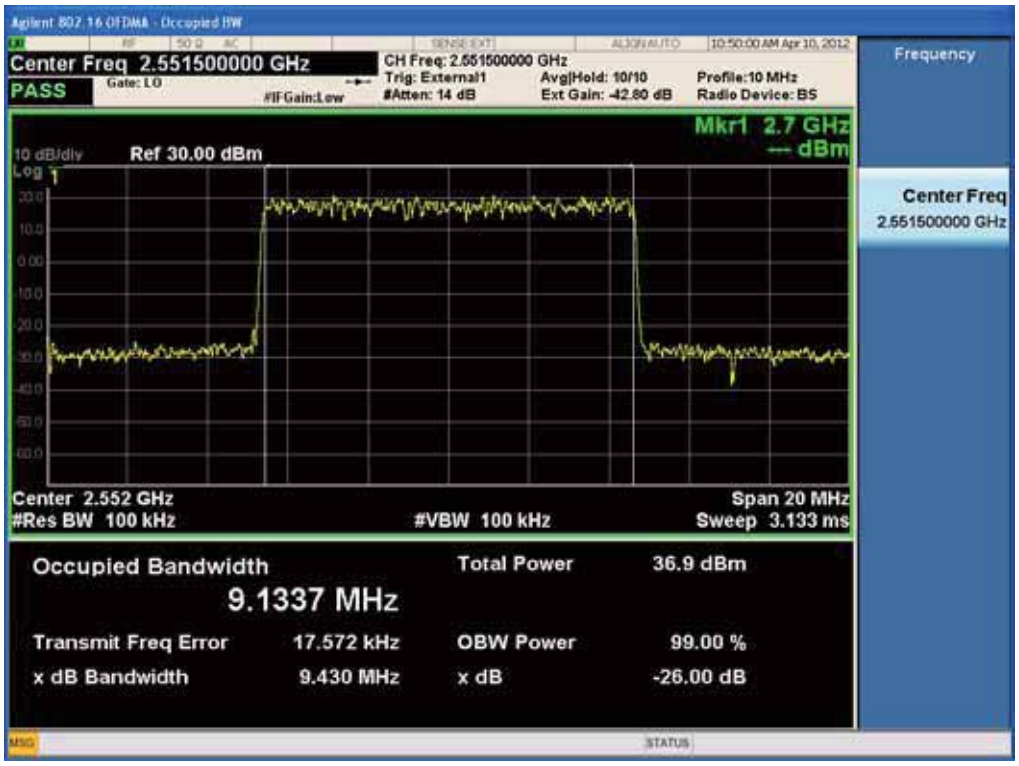
(QPSK High Channel)



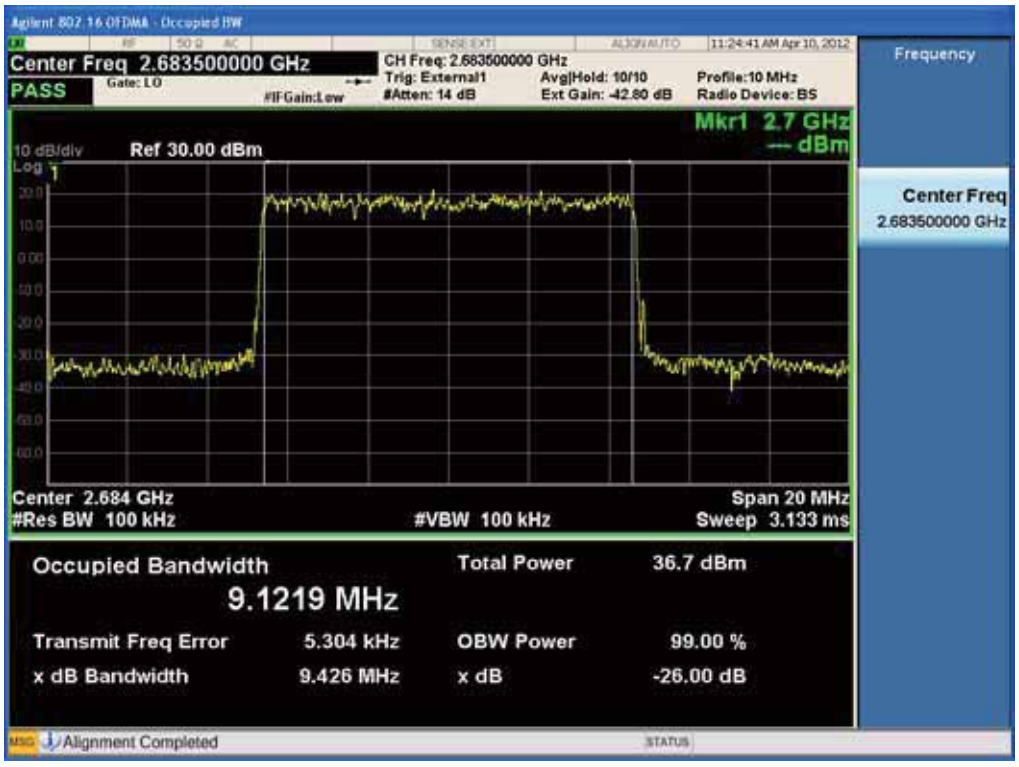
(16QAM Low Channel)



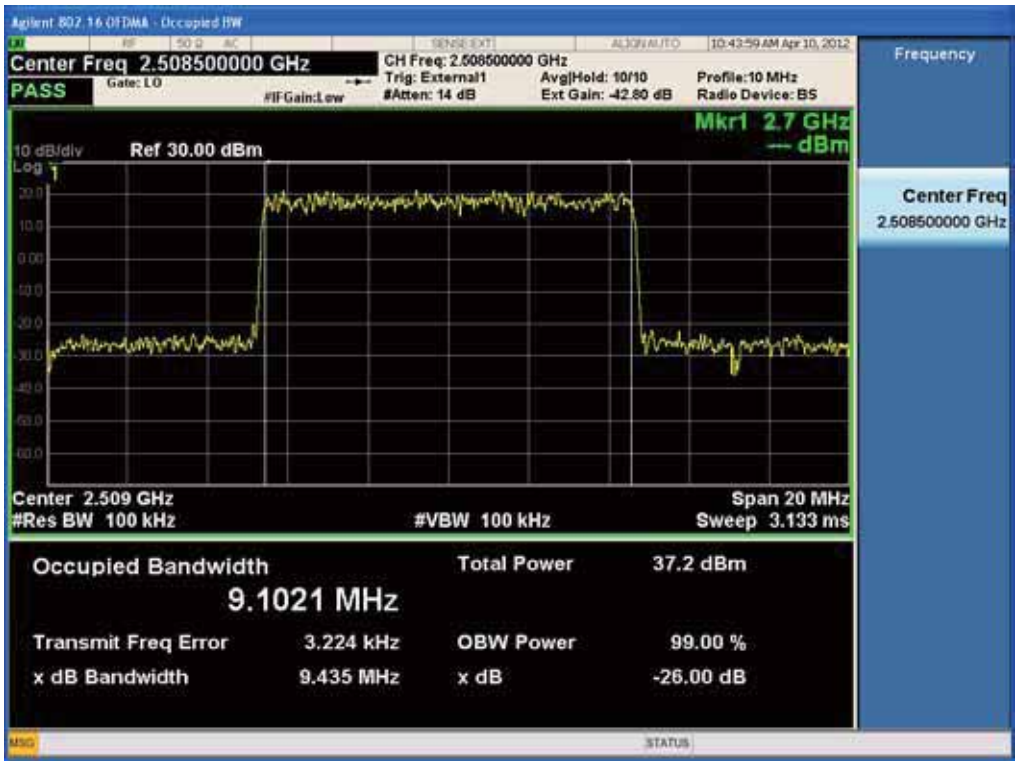
(16QAM Middle Channel)



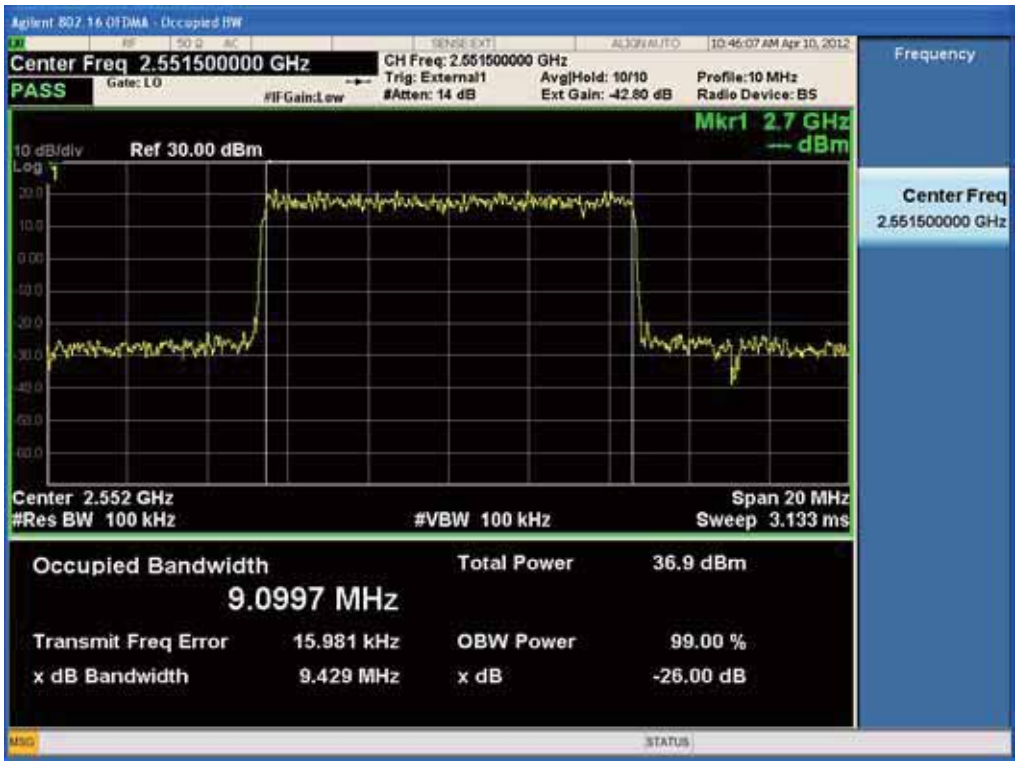
(16QAM High Channel)



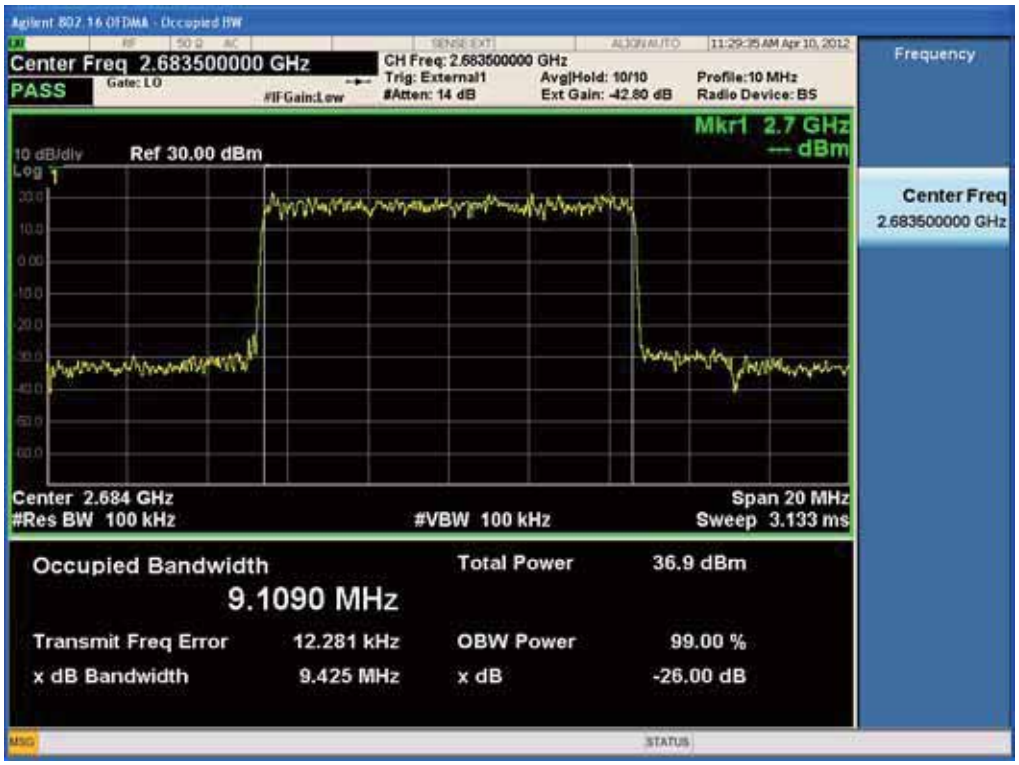
(64QAM Low Channel)



(64QAM Middle Channel)

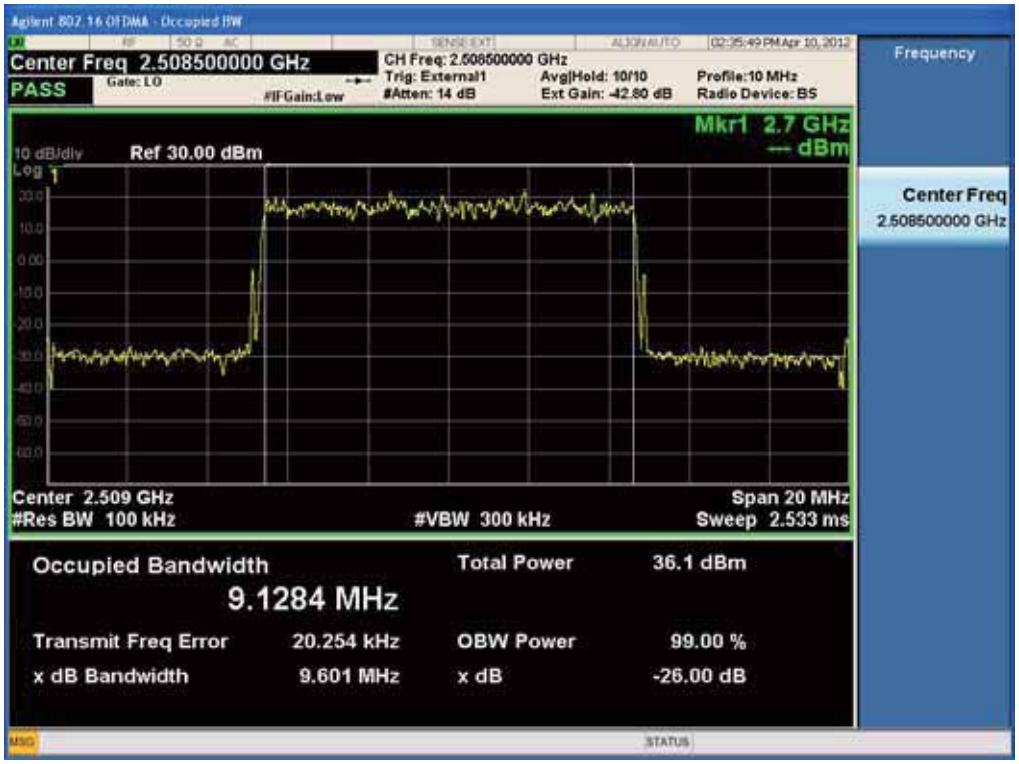


(64QAM High Channel)

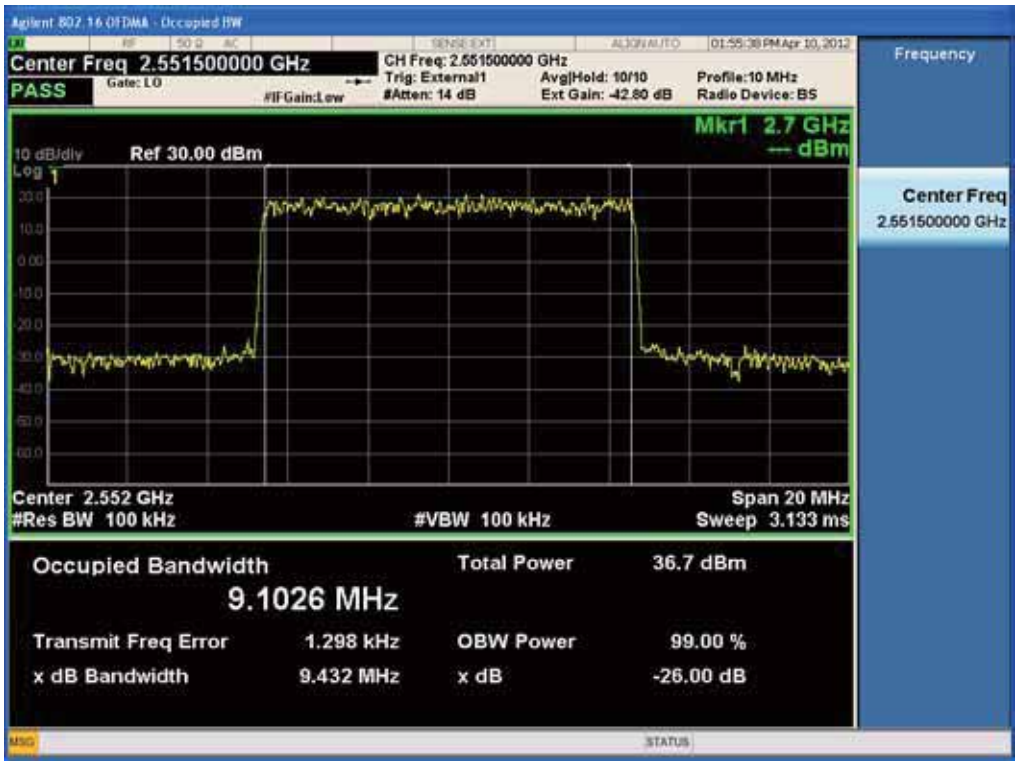


6.4.6. Test Plot at Output Port 2

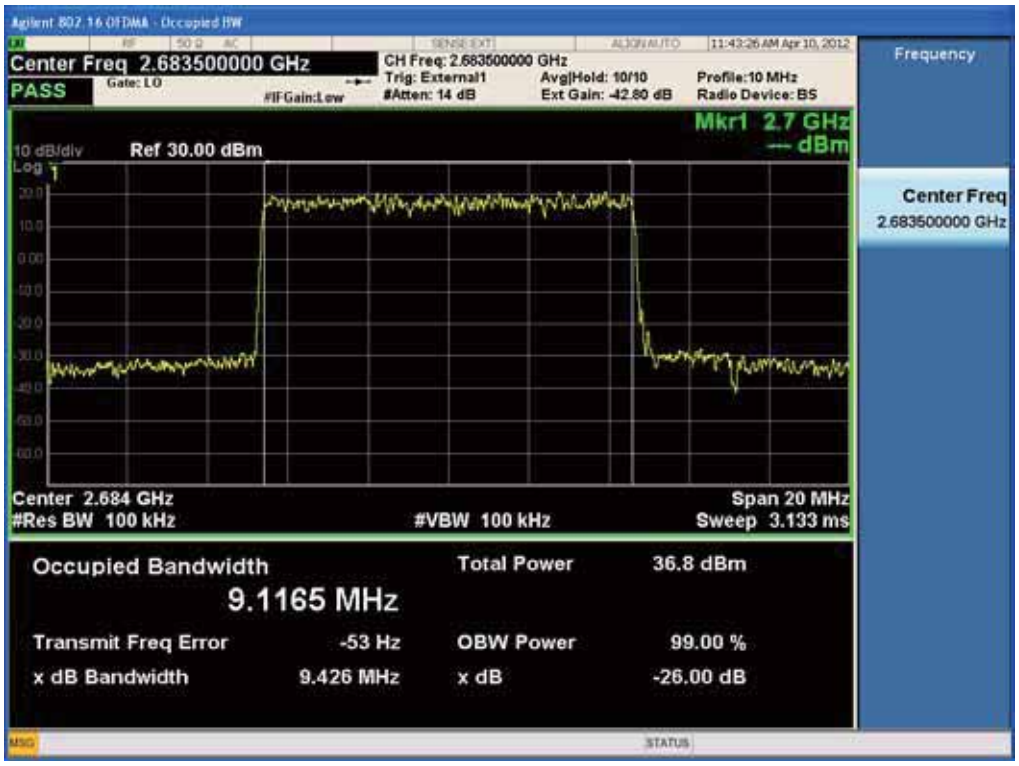
(QPSK Low Channel)



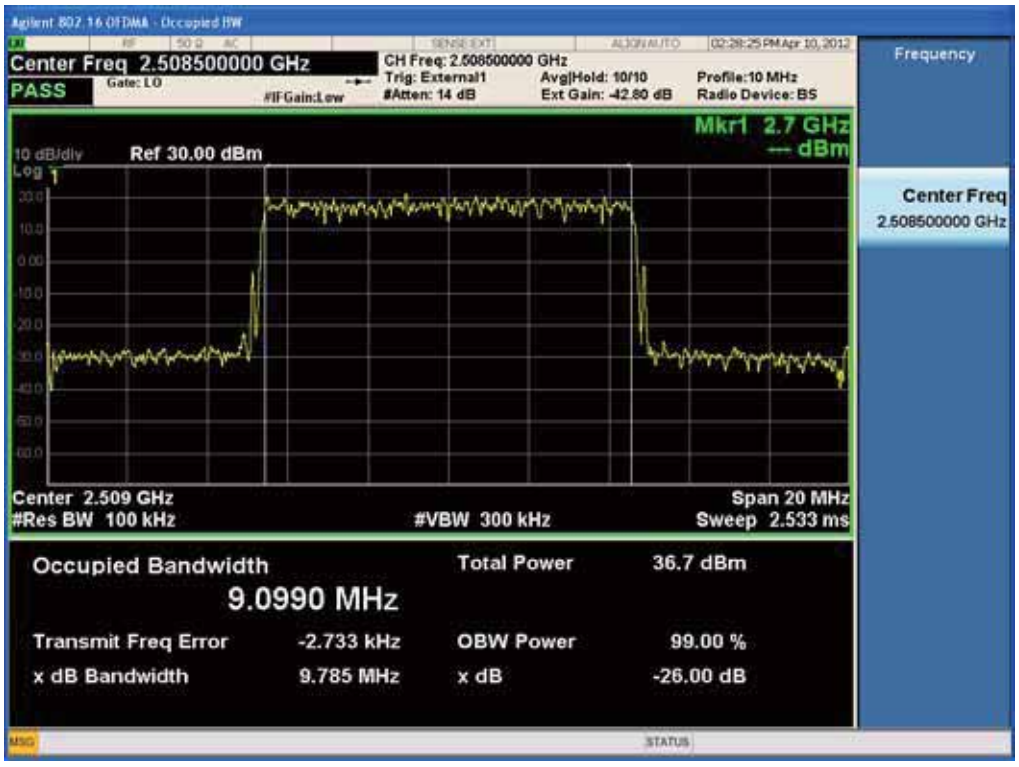
(QPSK Middle Channel)



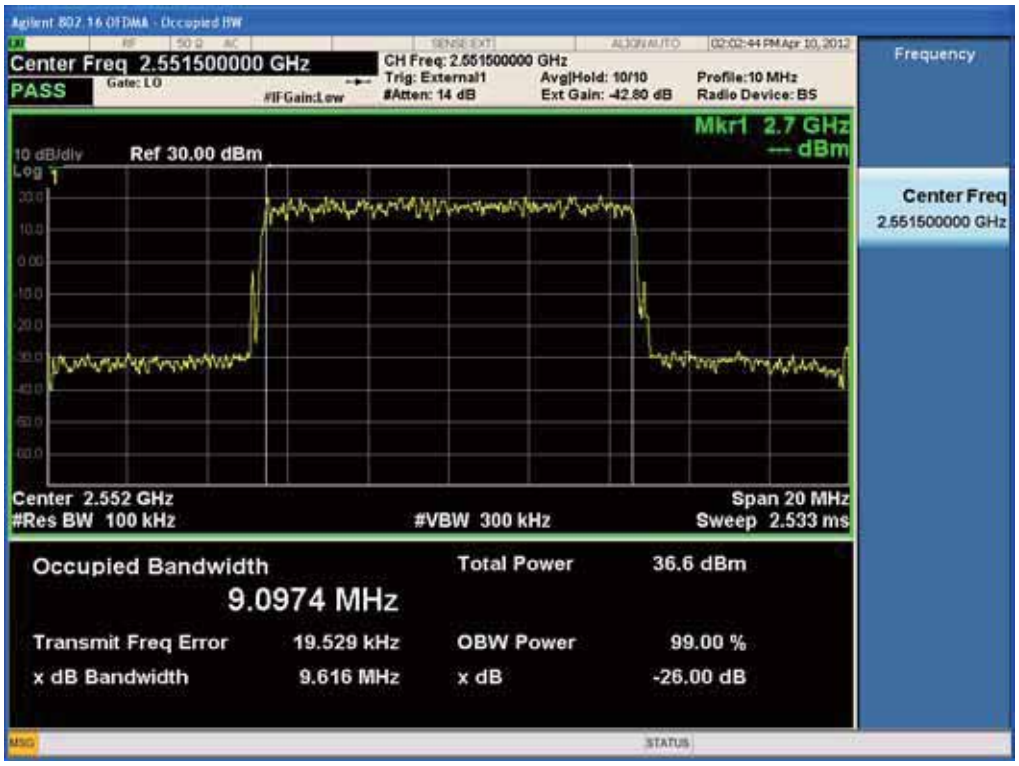
(QPSK High Channel)



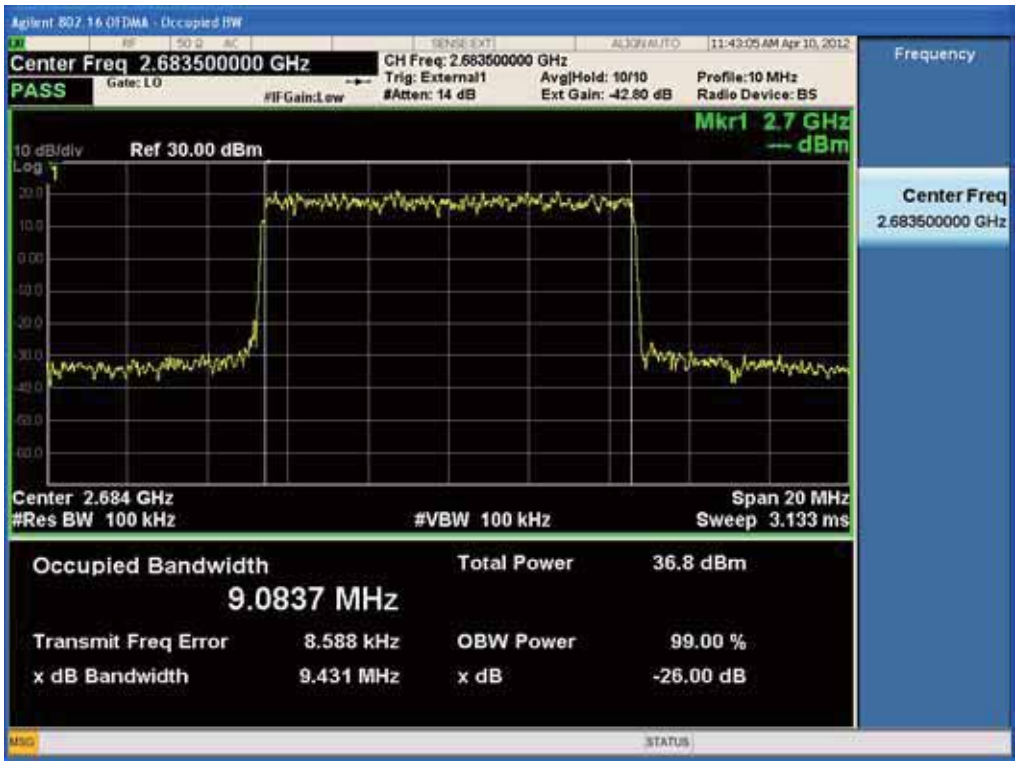
(16QAM Low Channel)



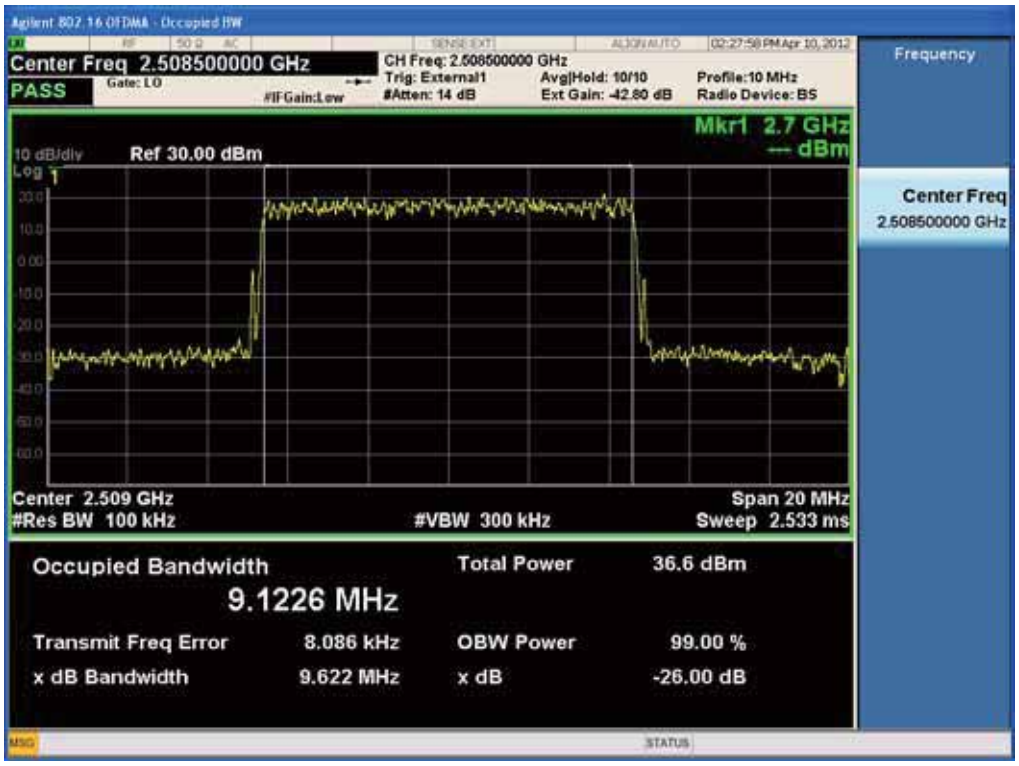
(16QAM Middle Channel)



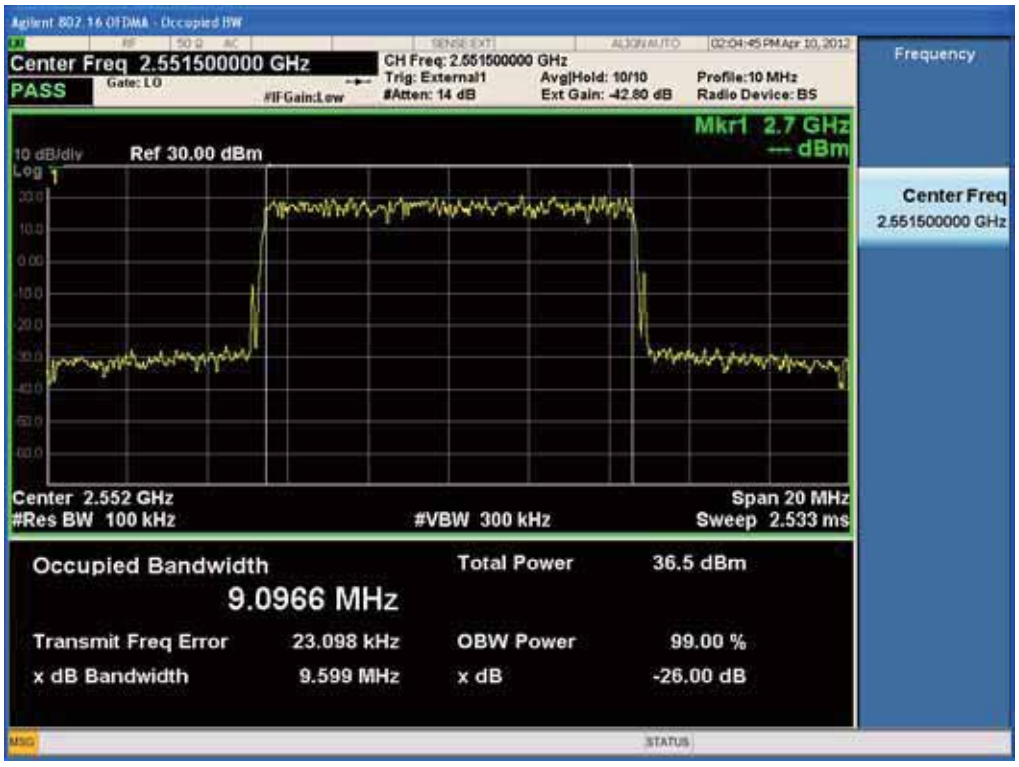
(16QAM High Channel)



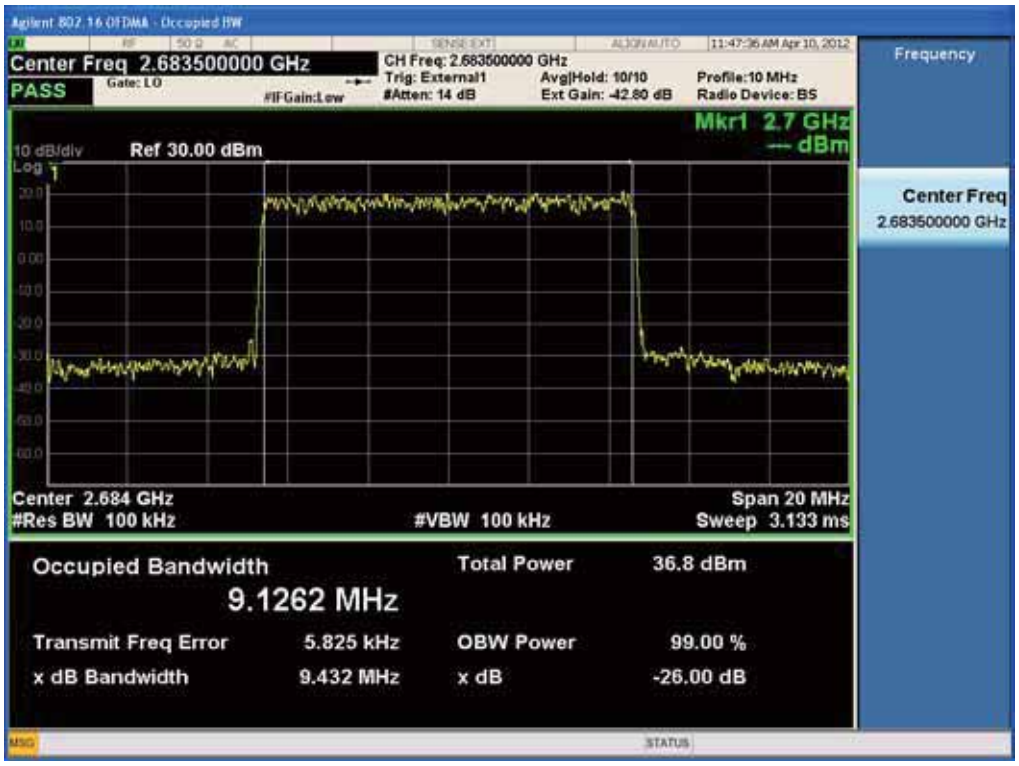
(64QAM Low Channel)



(64QAM Middle Channel)

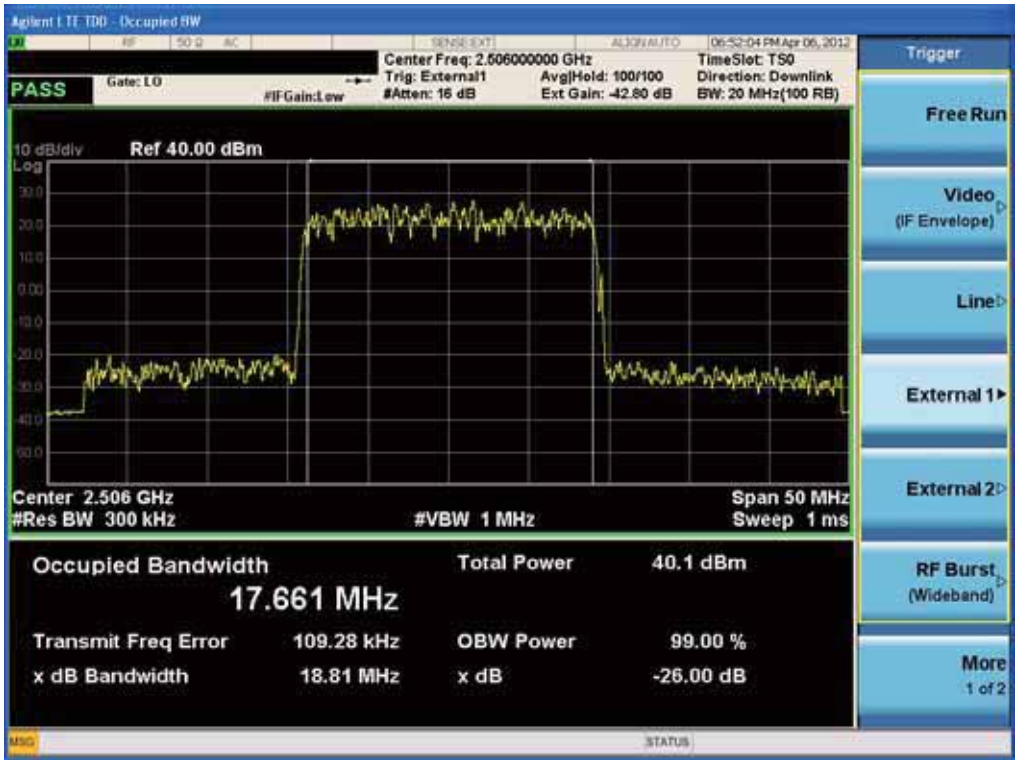


(64QAM High Channel)

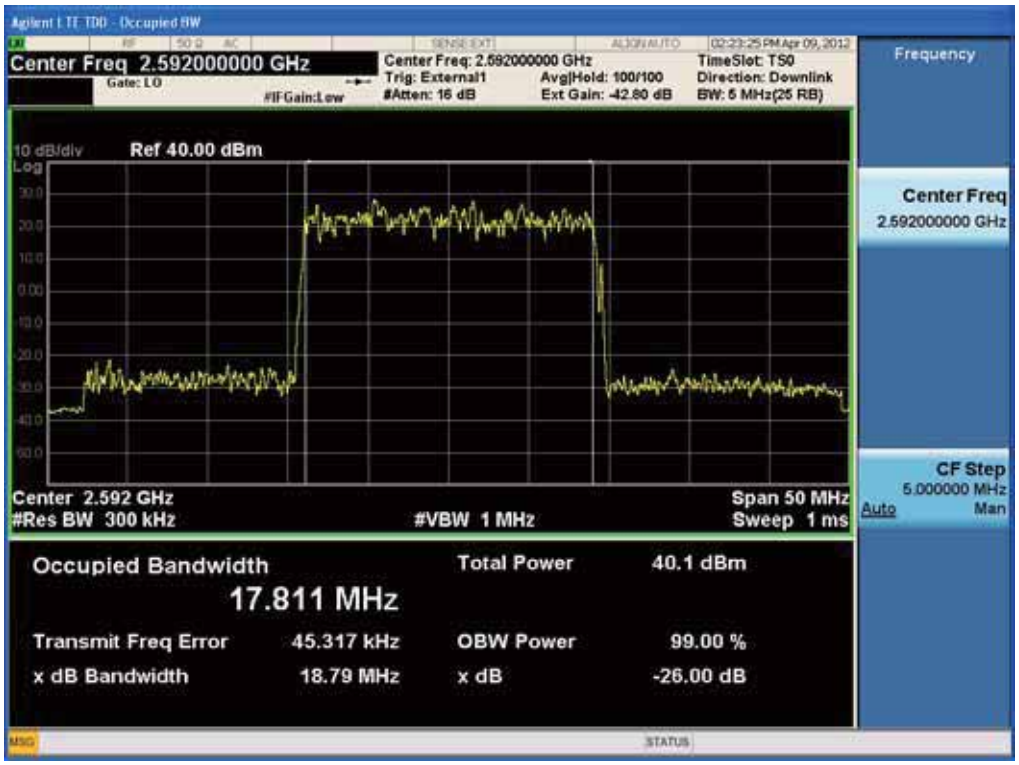


6.4.7. Test Plot at Output Port 3

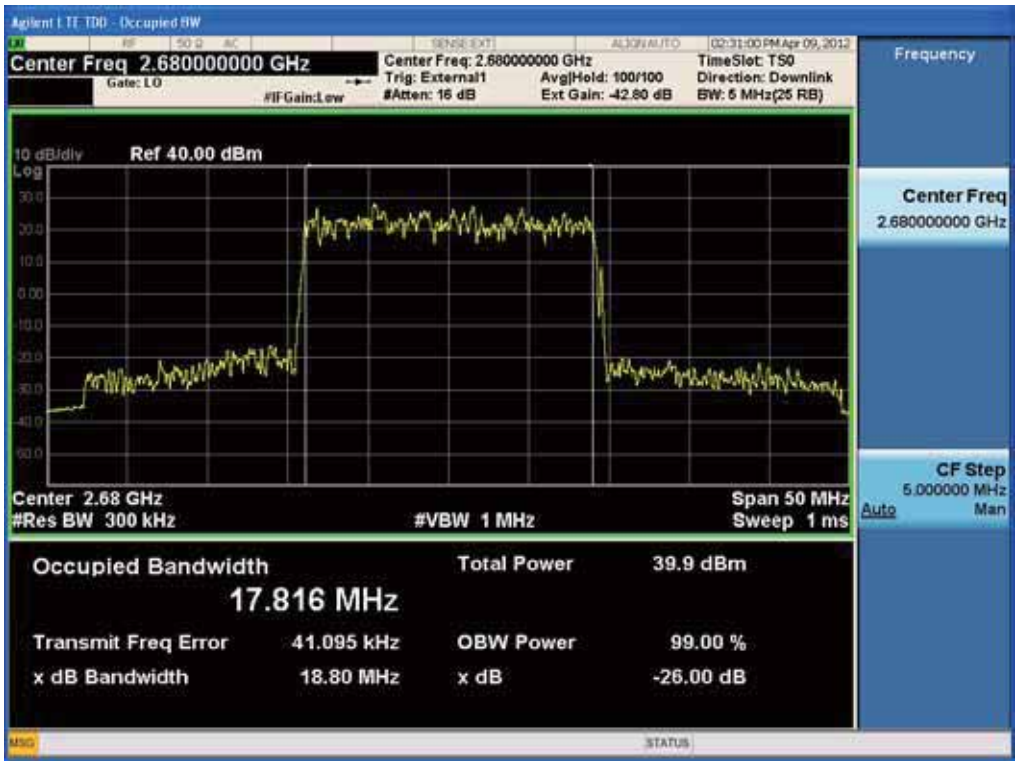
(QPSK Low Channel)



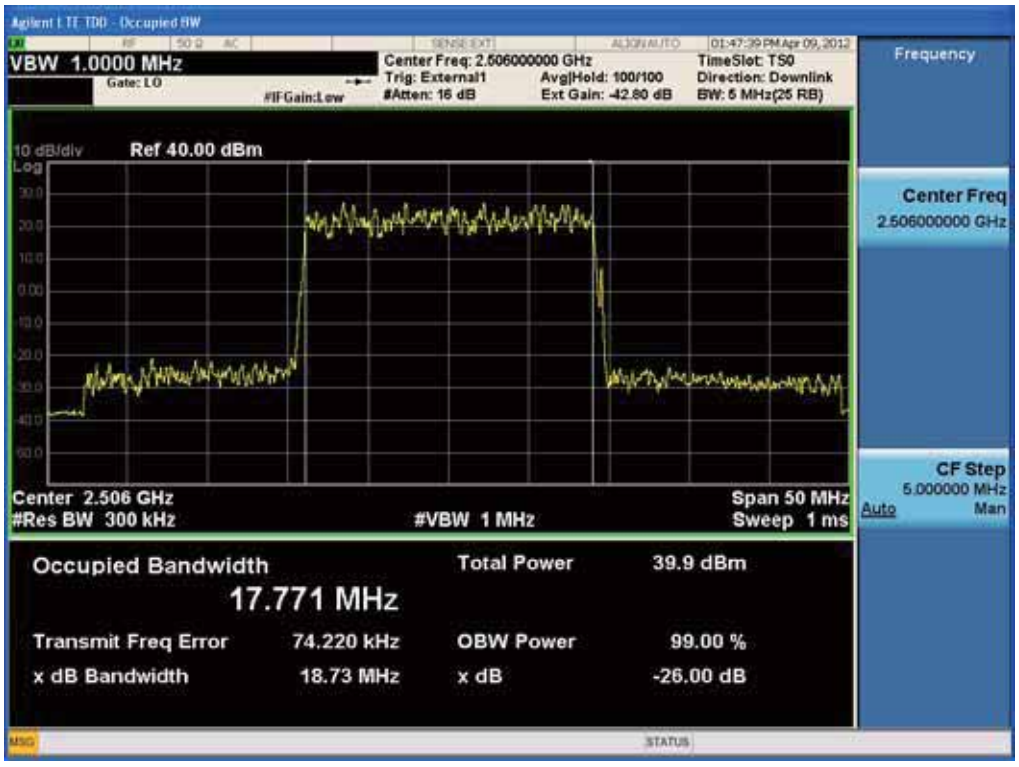
(QPSK Middle Channel)



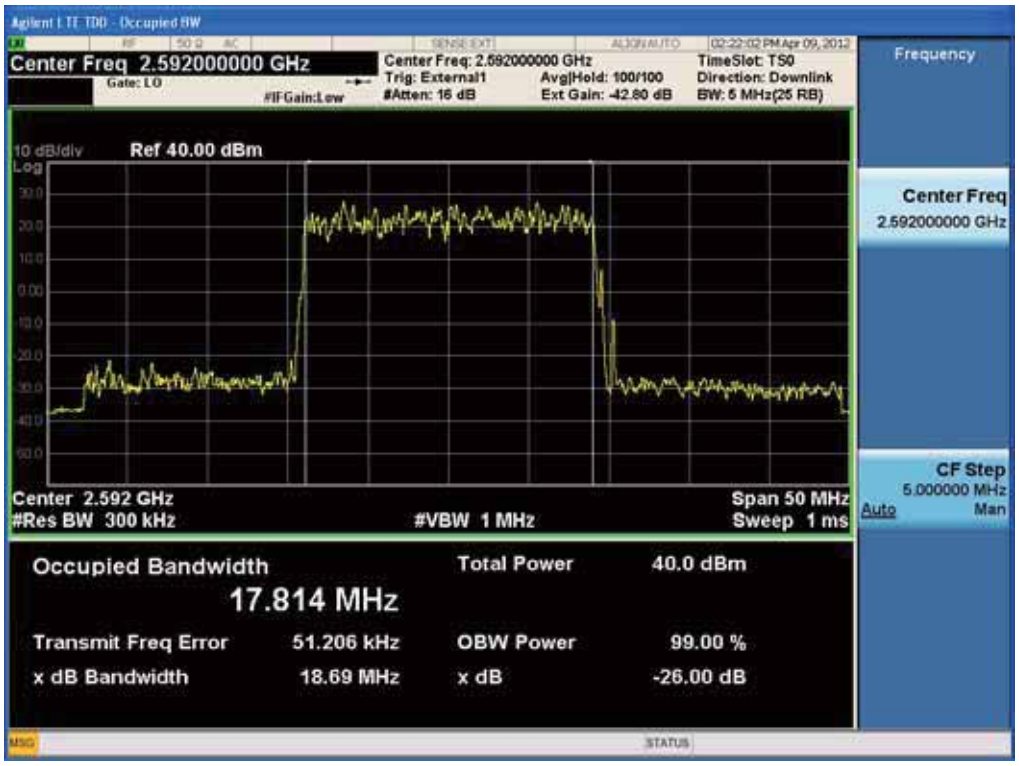
(QPSK High Channel)



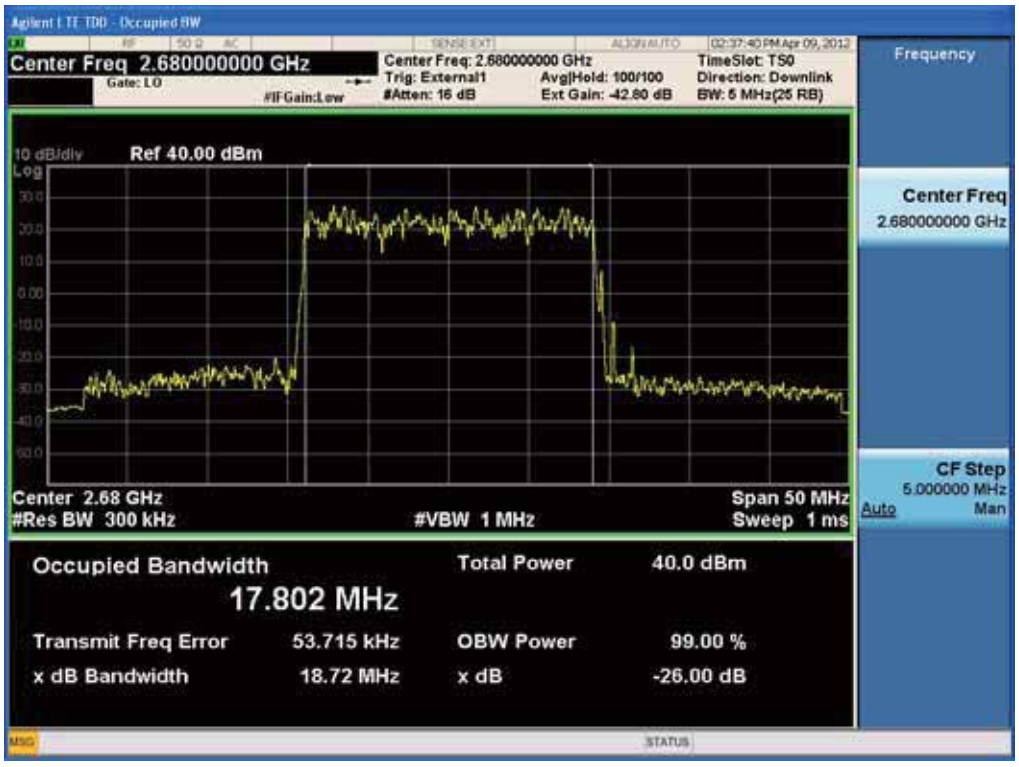
(16QAM Low Channel)



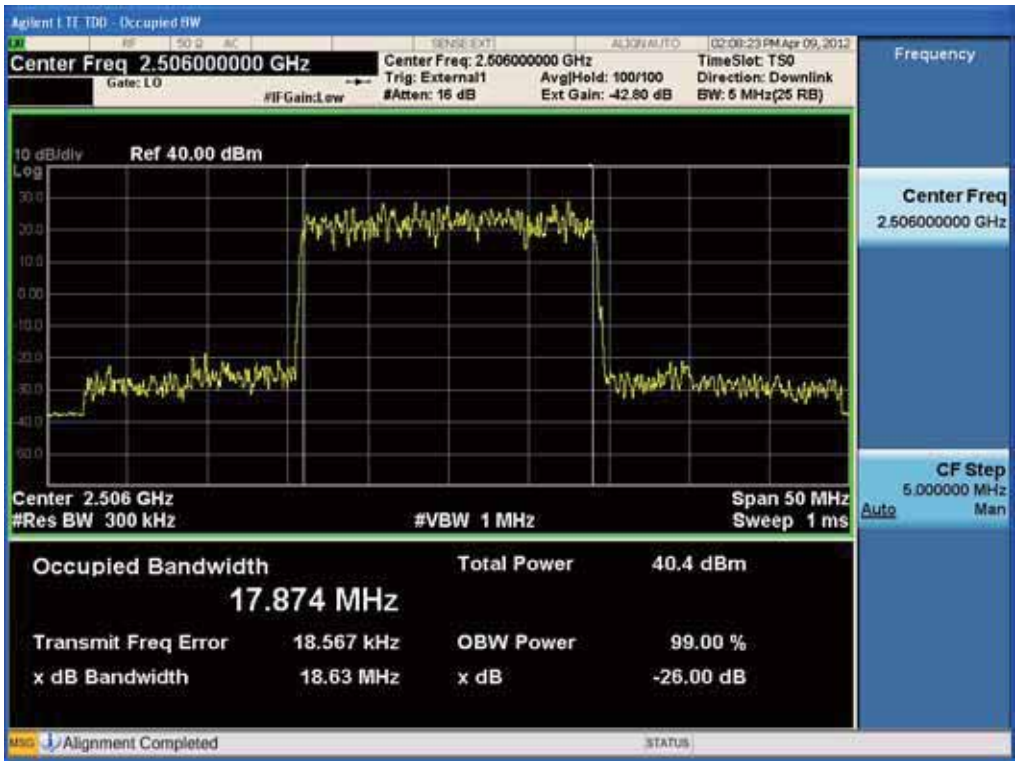
(16QAM Middle Channel)



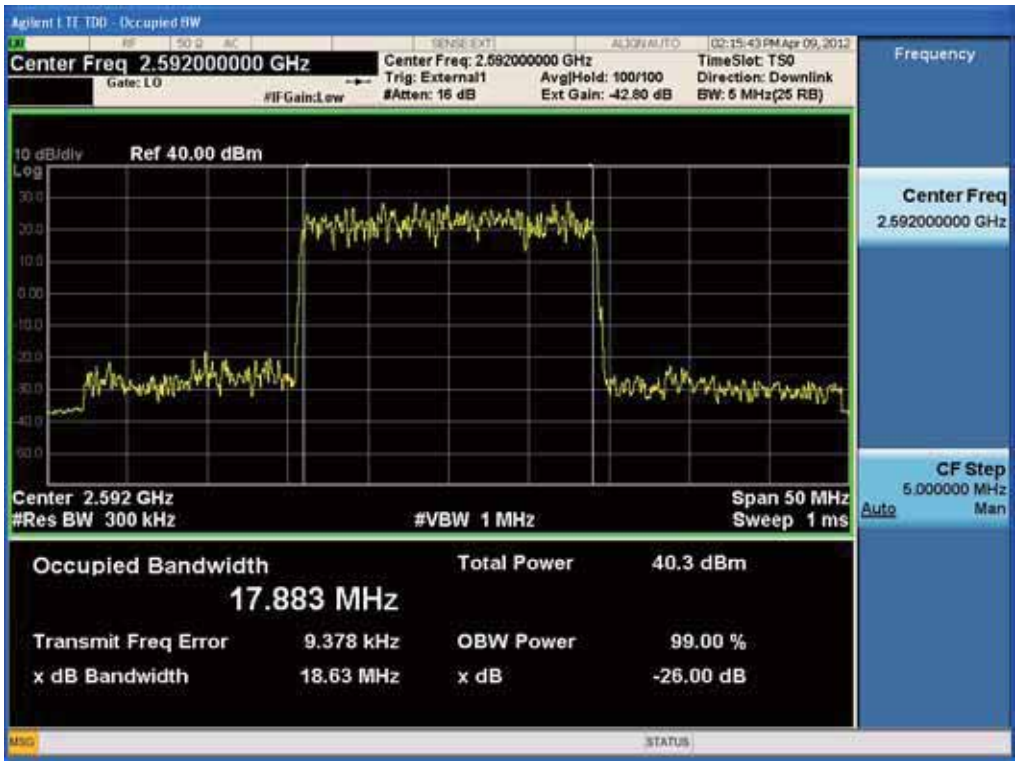
(16QAM High Channel)



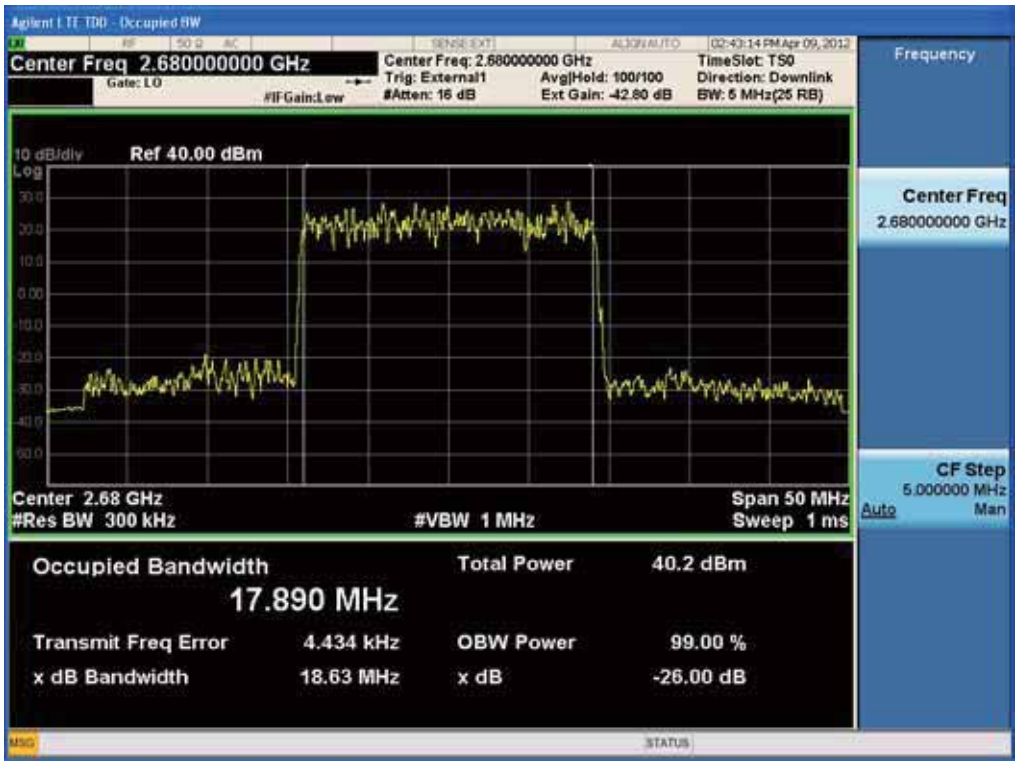
(64QAM Low Channel)



(64QAM Middle Channel)

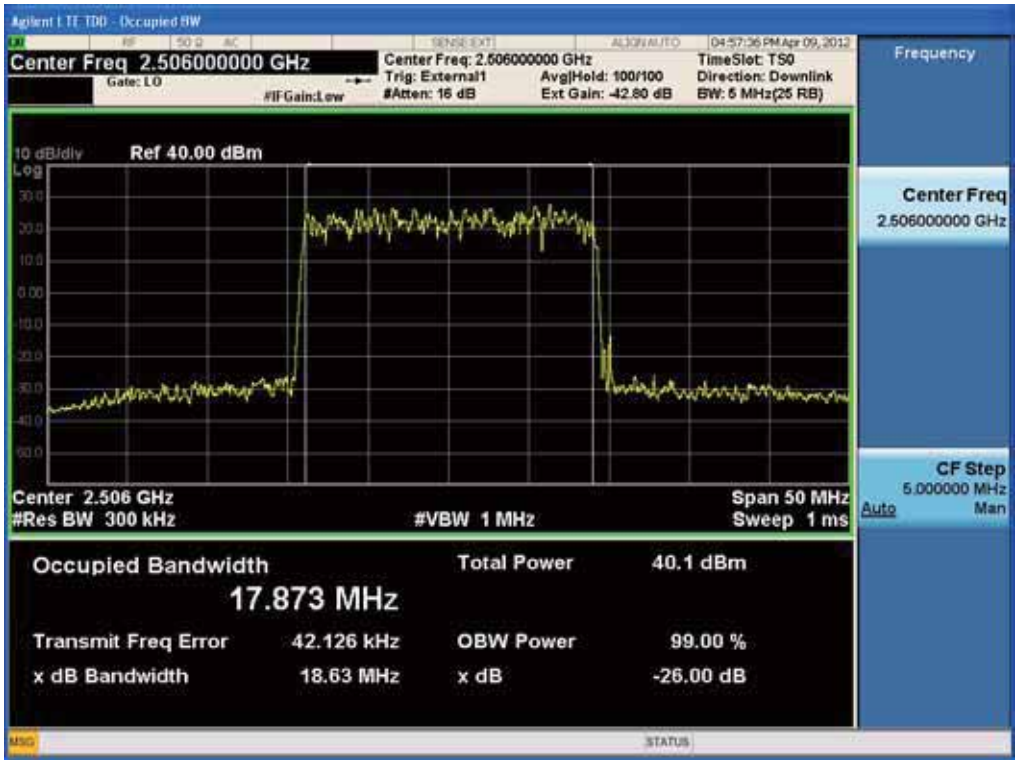


(64QAM High Channel)

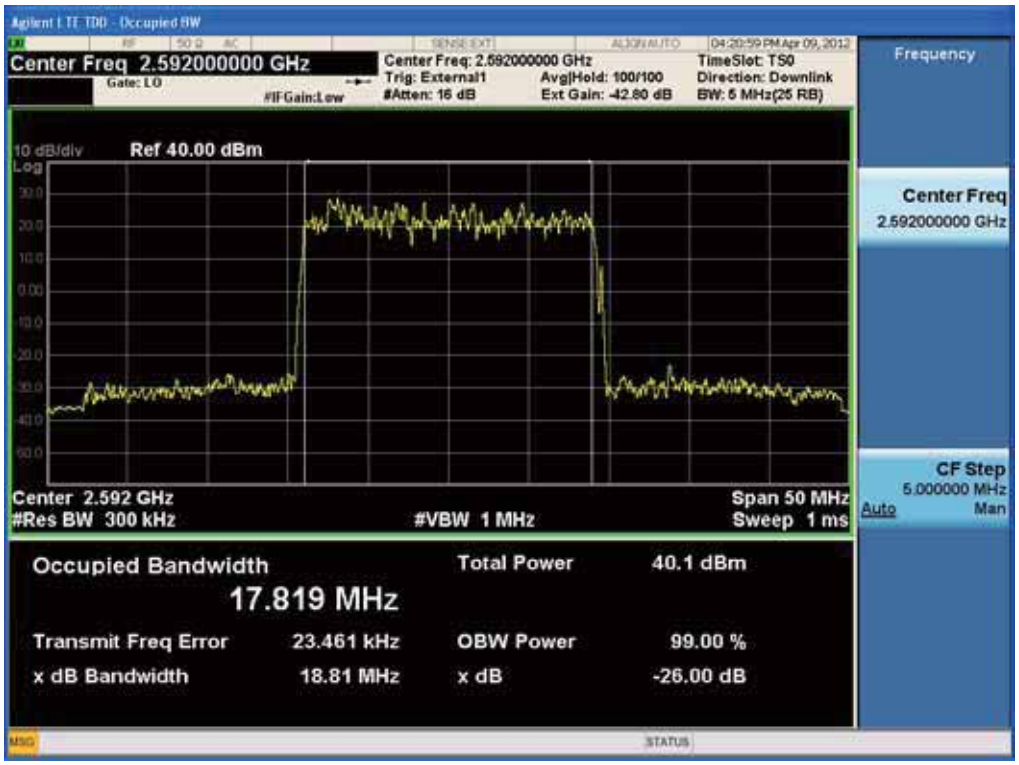


6.4.8. Test Plot at Output Port 4

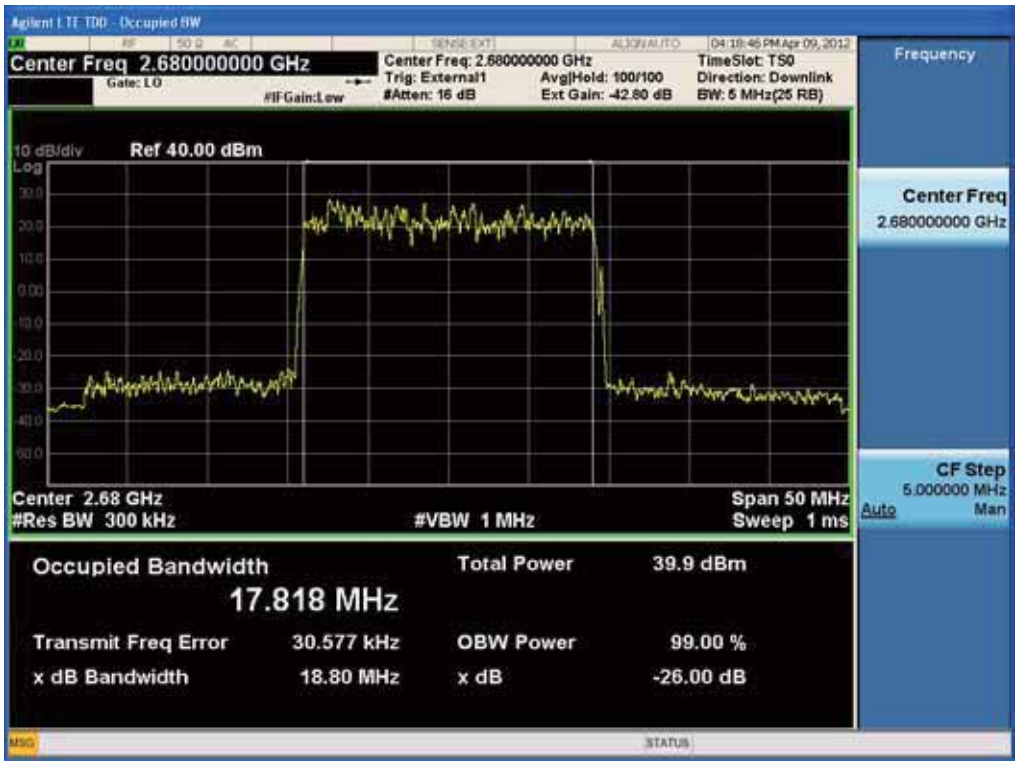
(QPSK Low Channel)



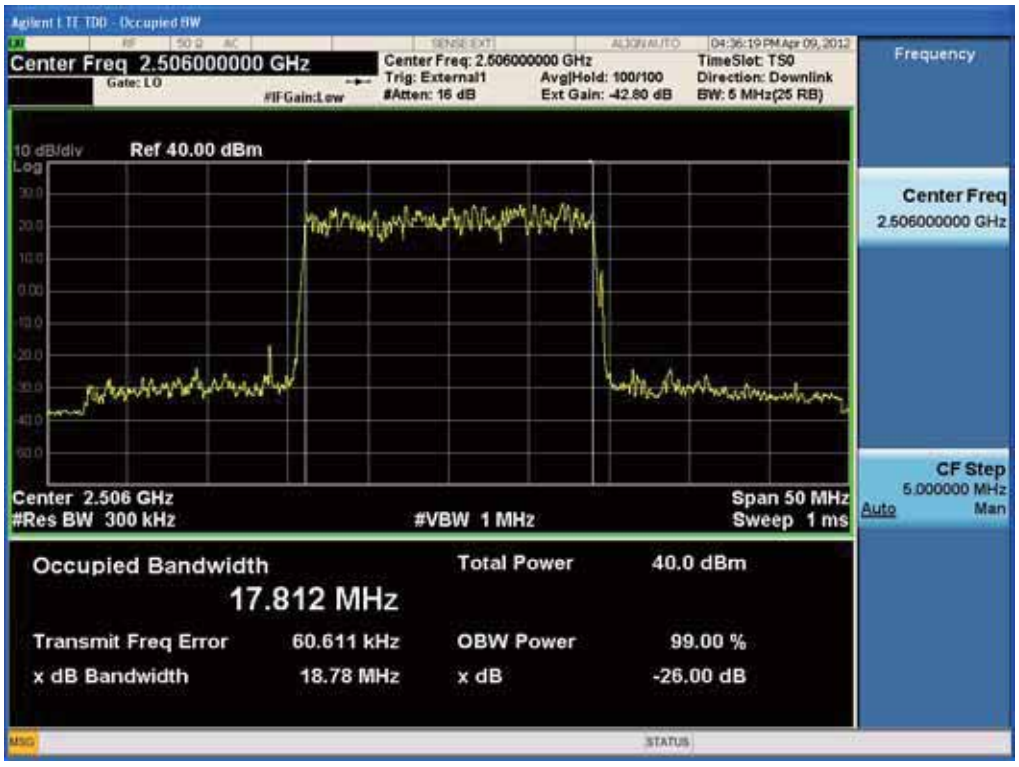
(QPSK Middle Channel)



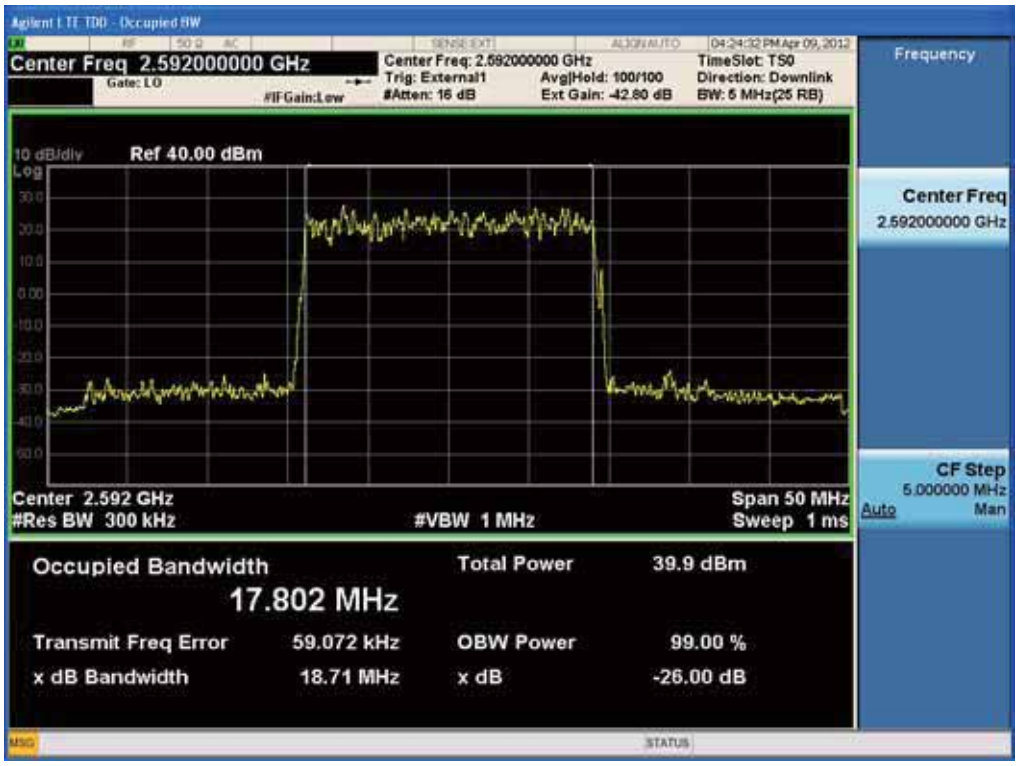
(QPSK High Channel)



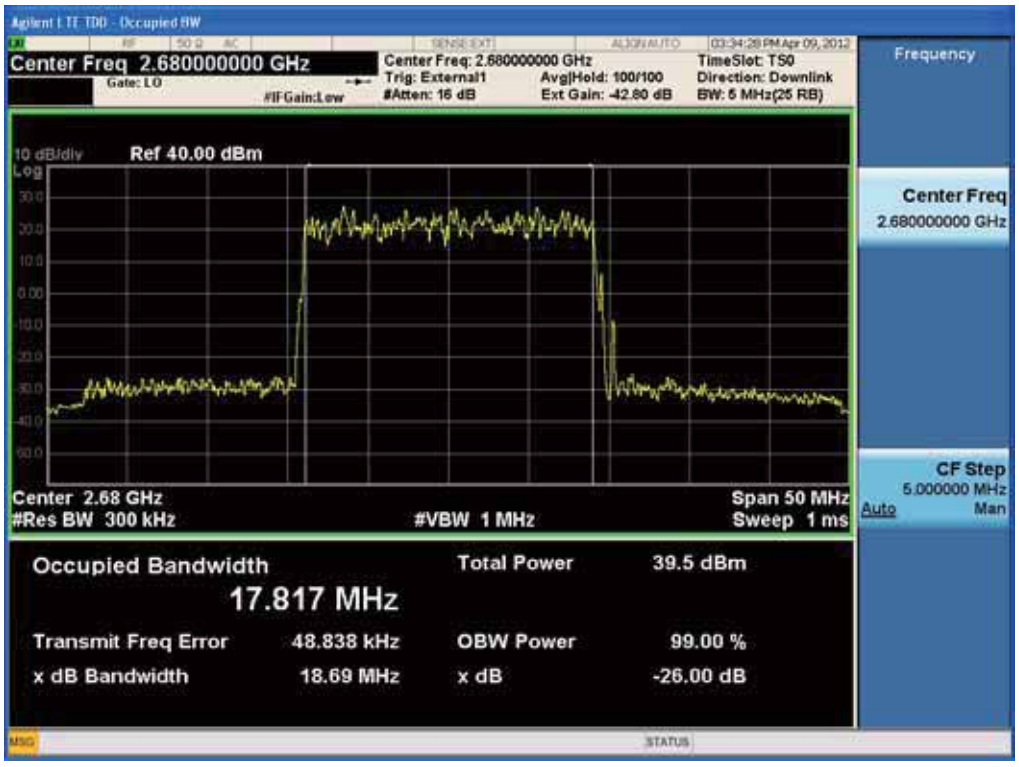
(16QAM Low Channel)



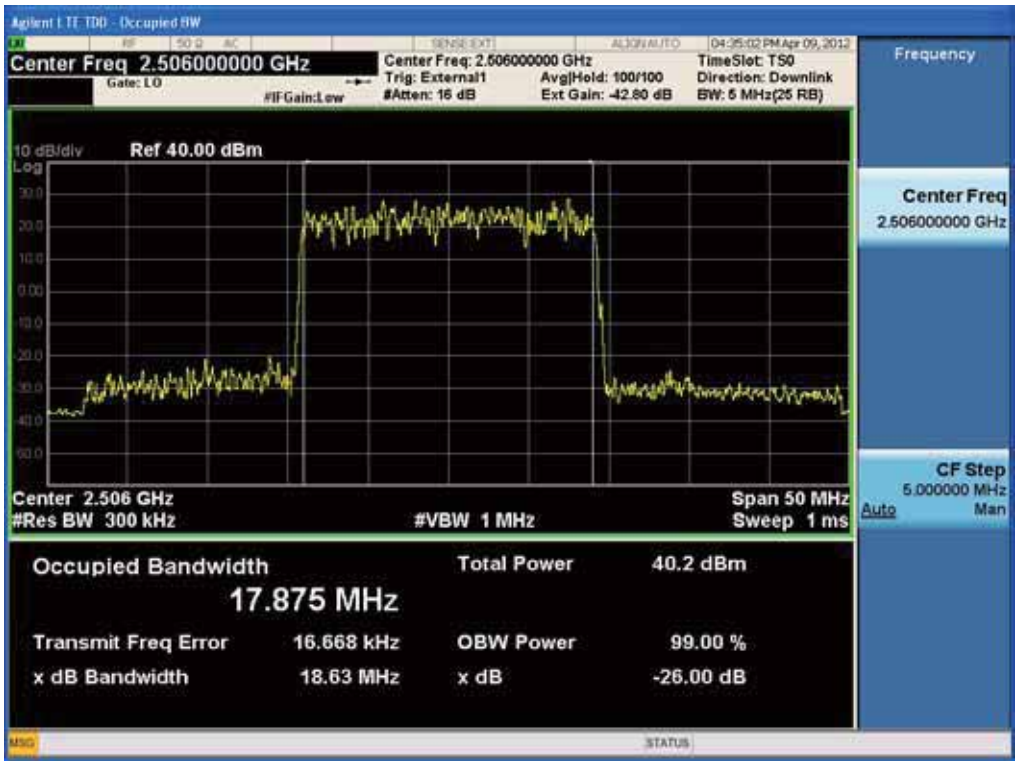
(16QAM Middle Channel)



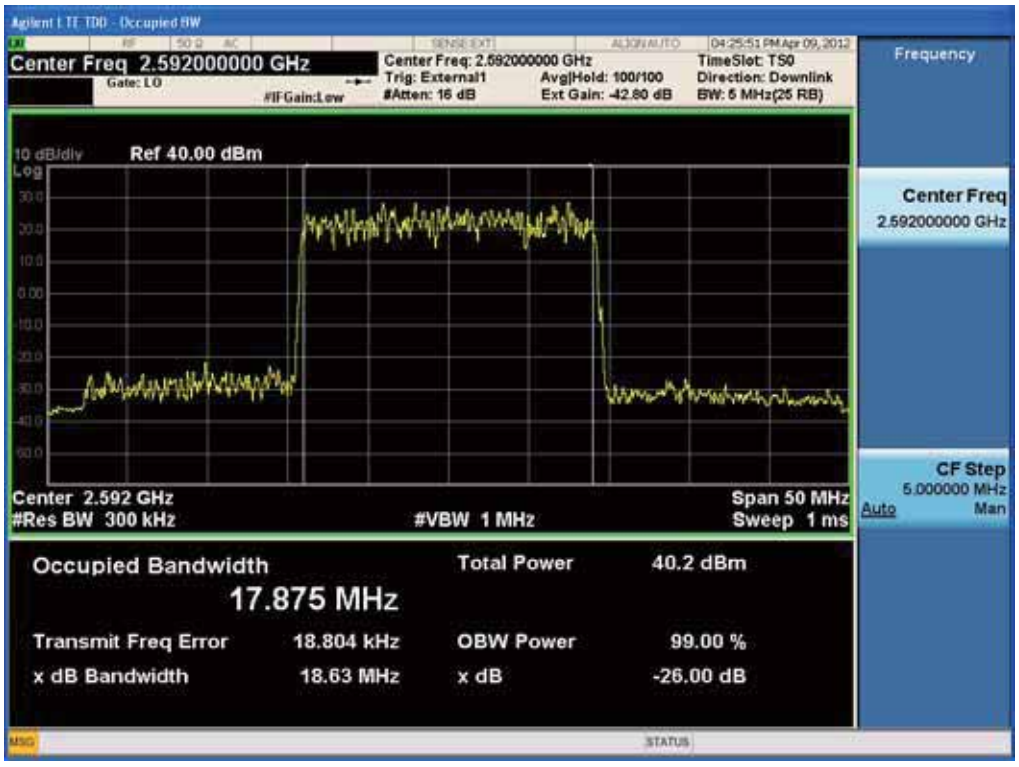
(16QAM High Channel)



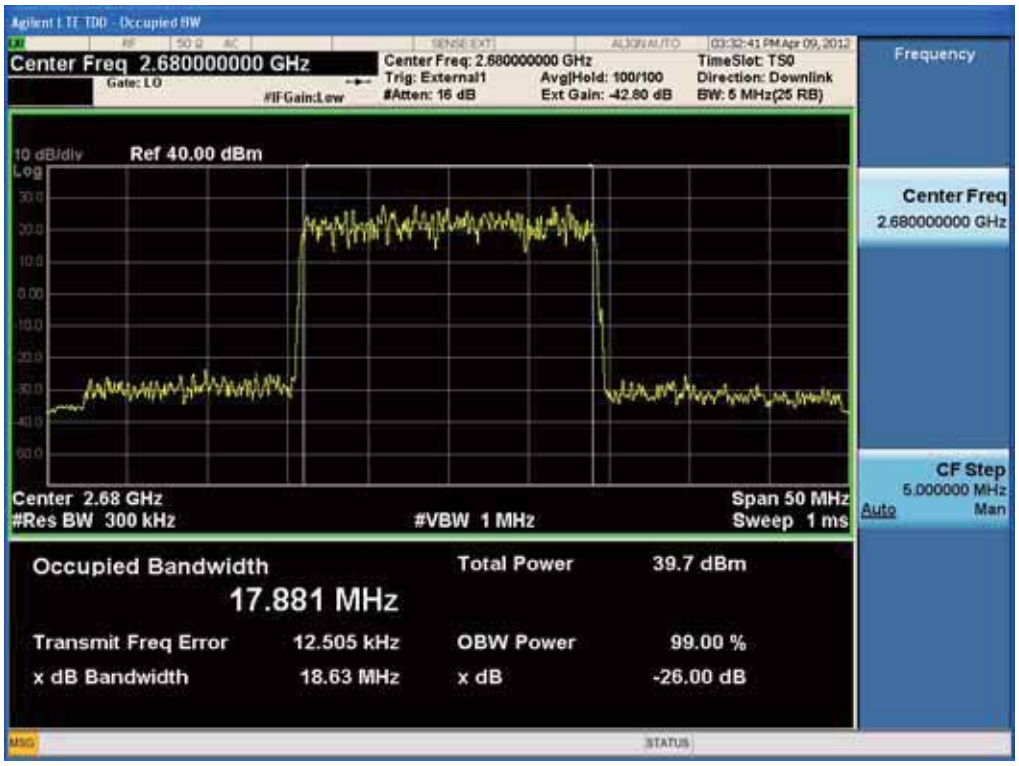
(64QAM Low Channel)



(64QAM Middle Channel)



(64QAM High Channel)



7. SPURIOUS EMISSION AT ANTENNA TERMINAL

7.1. Applicable Standard

CFR 47§2.1051, §27.53

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1051

§27.53(m) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS No. 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. Provided that a documented interference complaint cannot be mutually resolved between the parties prior to the applicable deadline, then the following additional attenuation requirements shall apply:

7.2. Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
Agilent	6674A/ DC Power Supply	3501A00901	05/02/2012

7.3. Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.4. Test Result

: Pass

Port 1 & Port 2 (WiMax)		Measure-and-sum Data (dBm)		
		QPSK	16QAM	64QAM
Band Edge	2508.5 MHz	-17.861	-18.275	-17.645
	2551.5 MHz	-	-	-
	2683.5 MHz	-20.407	-20.387	-19.346

Port 1 & Port 2 (WiMax)		Measure-and-sum Data (dBm)		
		QPSK	16QAM	64QAM
Spurious Emission (30 MHz ~ 1 GHz)	2508.5 MHz	-39.077	-38.965	-39.055
	2551.5 MHz	-38.851	-38.961	-38.961
	2683.5 MHz	-38.851	-38.934	-38.846

Port 1 & Port 2 (WiMax)		Measure-and-sum Data (dBm)		
		QPSK	16QAM	64QAM
1 GHz ~ 26.5 GHz	2508.5 MHz	-18.152	-18.081	-17.997
	2551.5 MHz	-18.133	-18.008	-18.384
	2683.5 MHz	-18.104	-17.938	-18.214

※ Test Data for Port1 & Port2 is calculated by measure-and-sum method.

(N=2, so Calculated Data = Measured Data + 10log2 (=3 dB))

Port 3 & Port 4 (LTE)		Measure-and-sum Data (dBm)		
		QPSK	16QAM	64QAM
Band Edge	2506 MHz	-17.805	-16.798	-16.834
	2592 MHz	-	-	-
	2680 MHz	-17.325	-18.223	-16.907

Port 3 & Port 4 (LTE)		Measure-and-sum Data (dBm)		
		QPSK	16QAM	64QAM
Spurious Emission (30 MHz ~ 1 GHz)	2506 MHz	-38.996	-38.876	-39.026
	2592 MHz	-38.955	-38.867	-39.097
	2680 MHz	-38.9	-38.961	-39.080

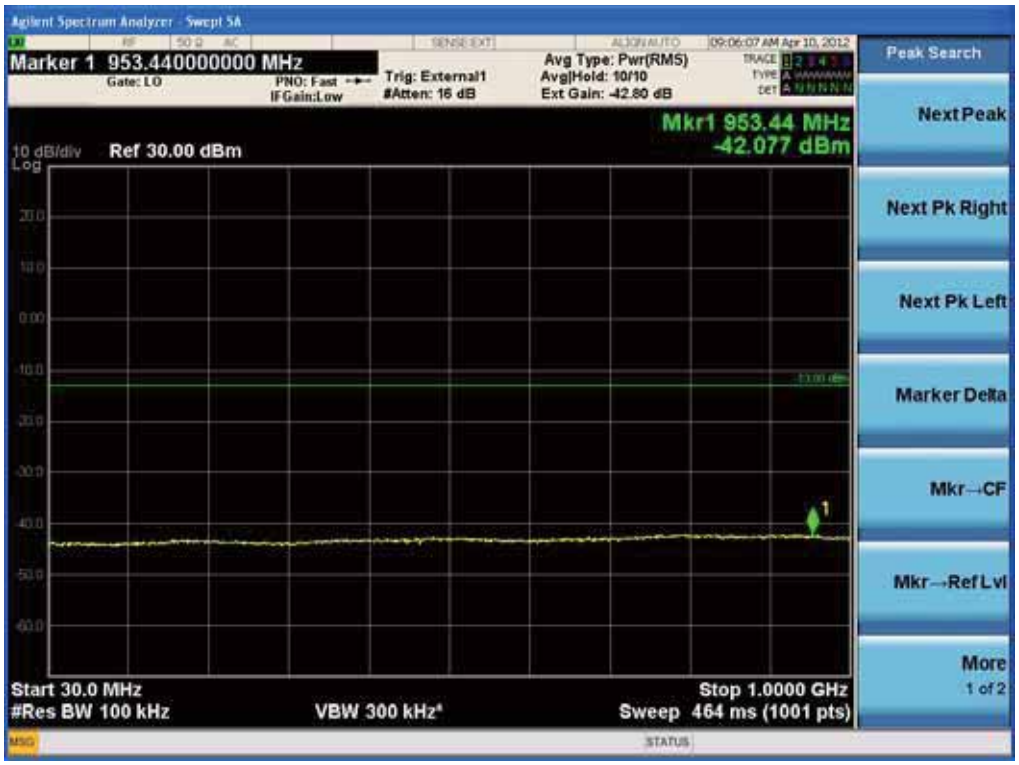
Port 3 & Port 4 (LTE)		Measure-and-sum Data (dBm)		
		QPSK	16QAM	64QAM
1 GHz ~ 26.5 GHz	2506 MHz	-17.727	-17.904	-17.937
	2592 MHz	-17.904	-18.053	-17.831
	2680 MHz	-17.937	-18.080	-18.312

※ Test Data for Port1 & Port2 is calculated by measure-and-sum method.

(N=2, so Calculated Data = Measured Data + 10log2 (=3 dB))

7.4.1. Plot Data at Output Port 1

(QPSK Low Channel)

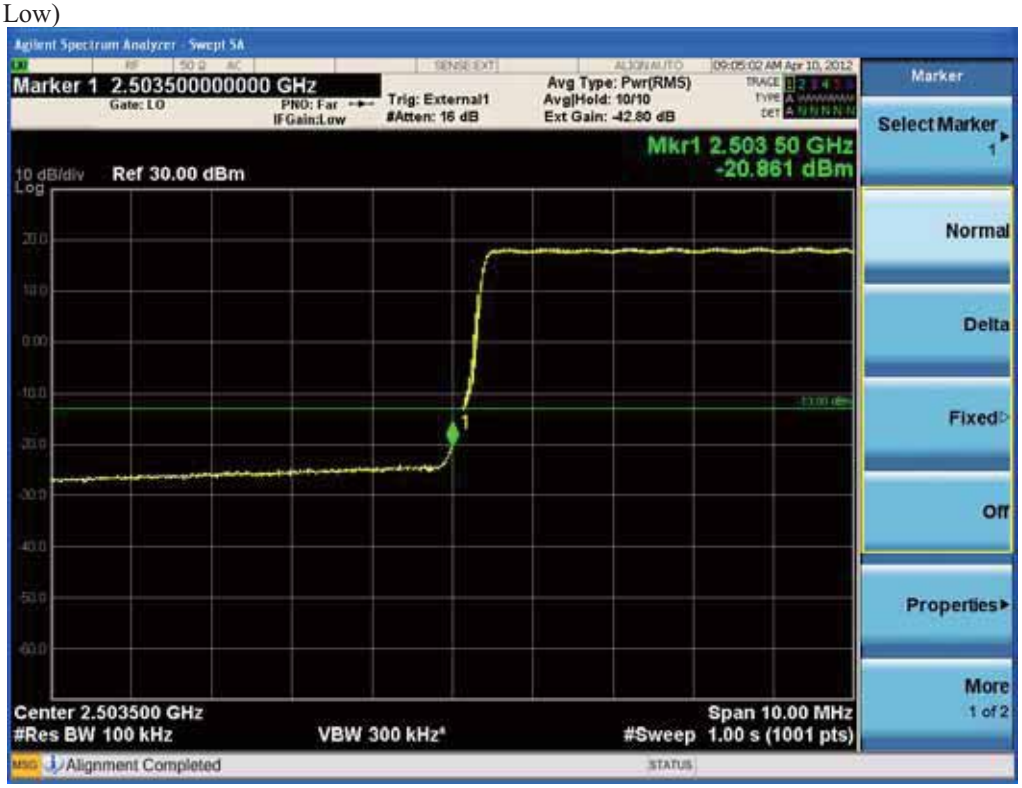


(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



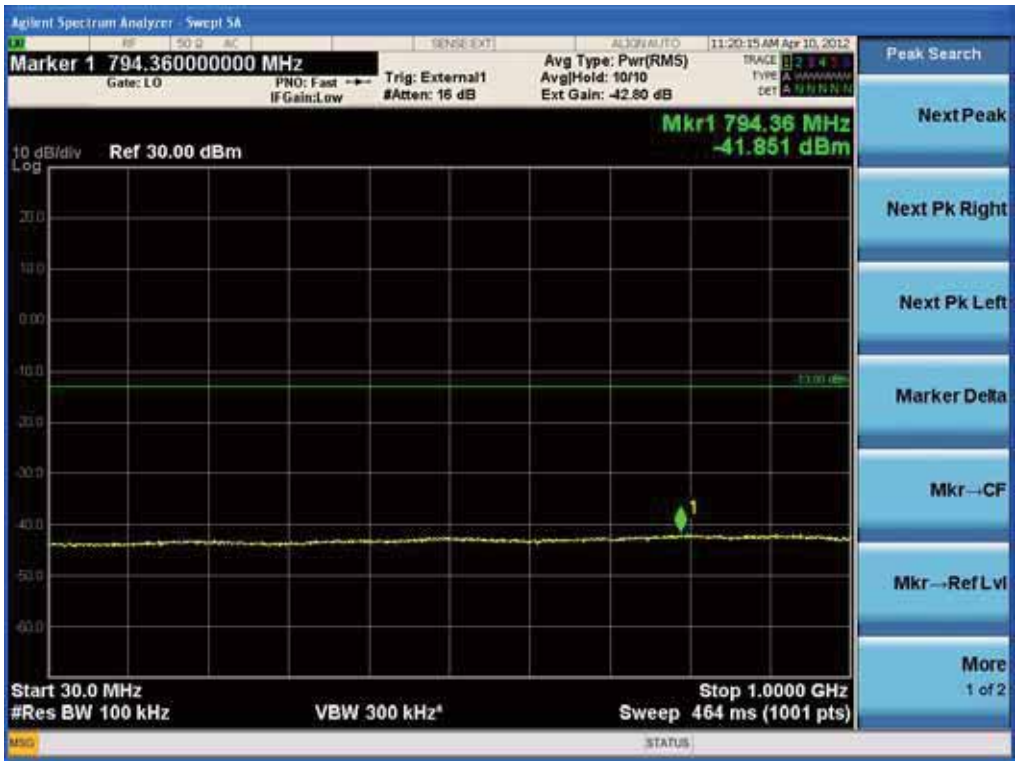
(QPSK Middle Channel)

(30 MHz ~ 1 GHz)

(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

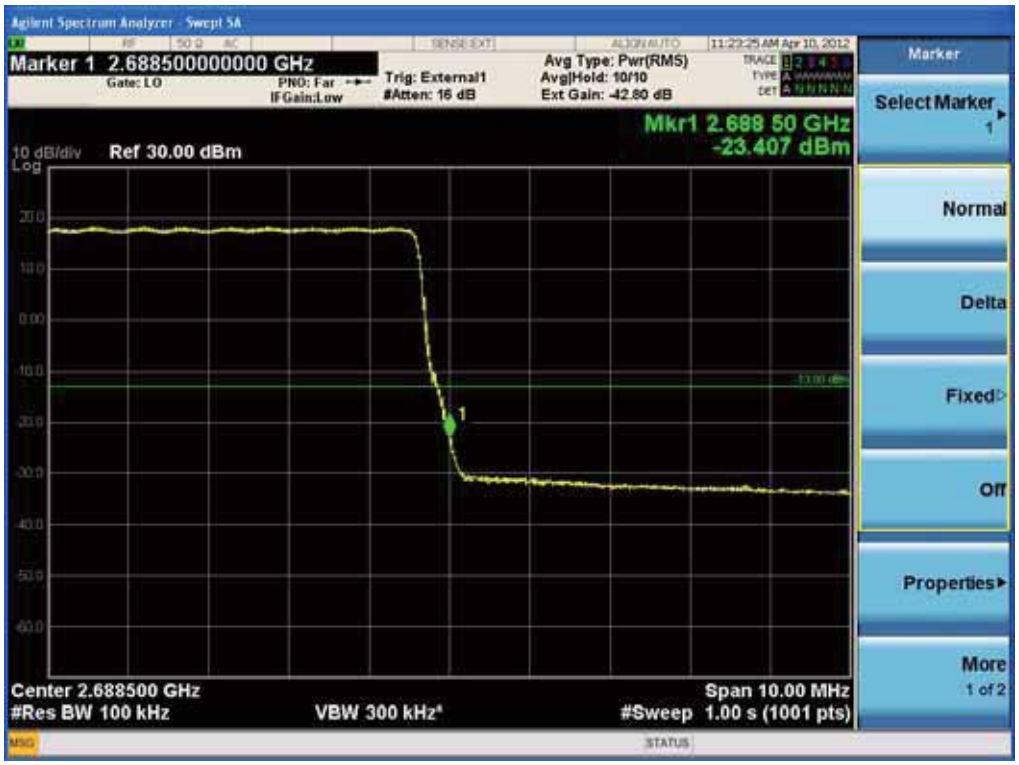


(30 MHz ~ 1 GHz)

(QPSK High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)



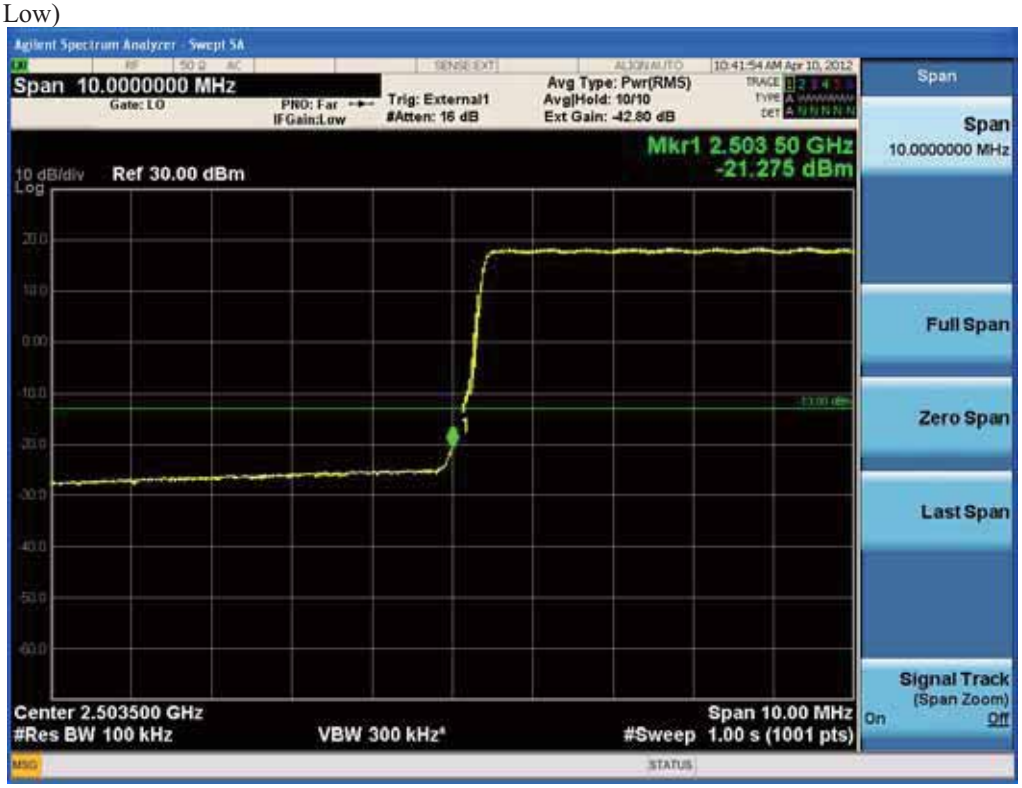
(16QAM Low Channel)

(30 MHz ~ 1 GHz)

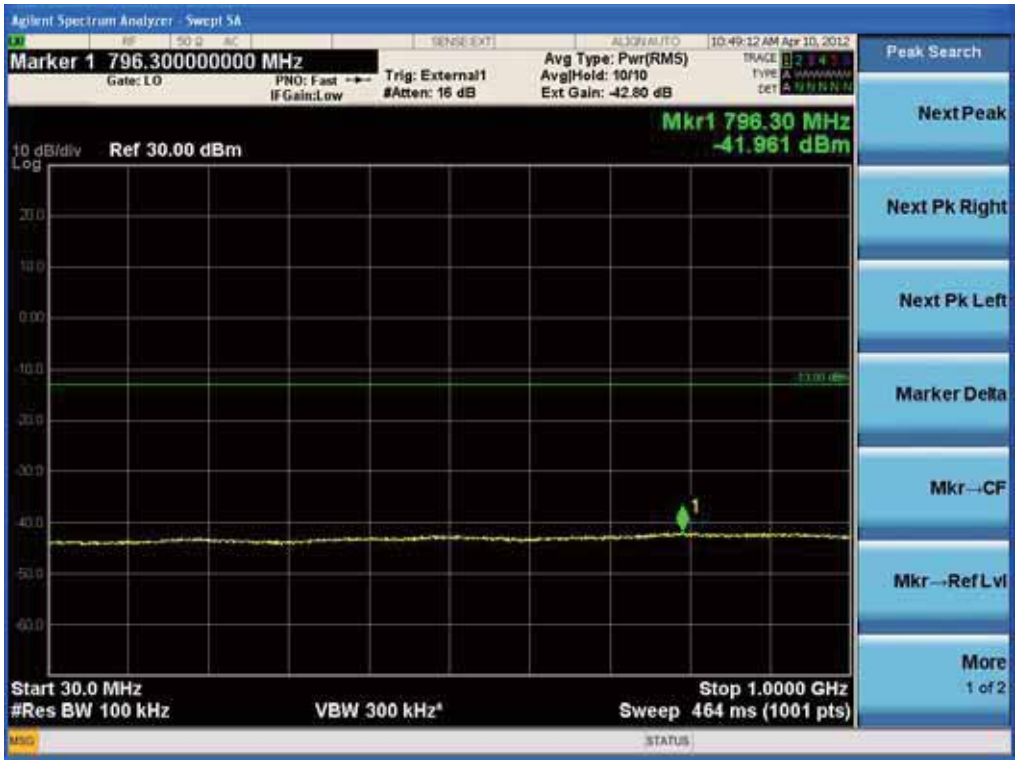
(16QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

(30 MHz ~ 1 GHz)

(16QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

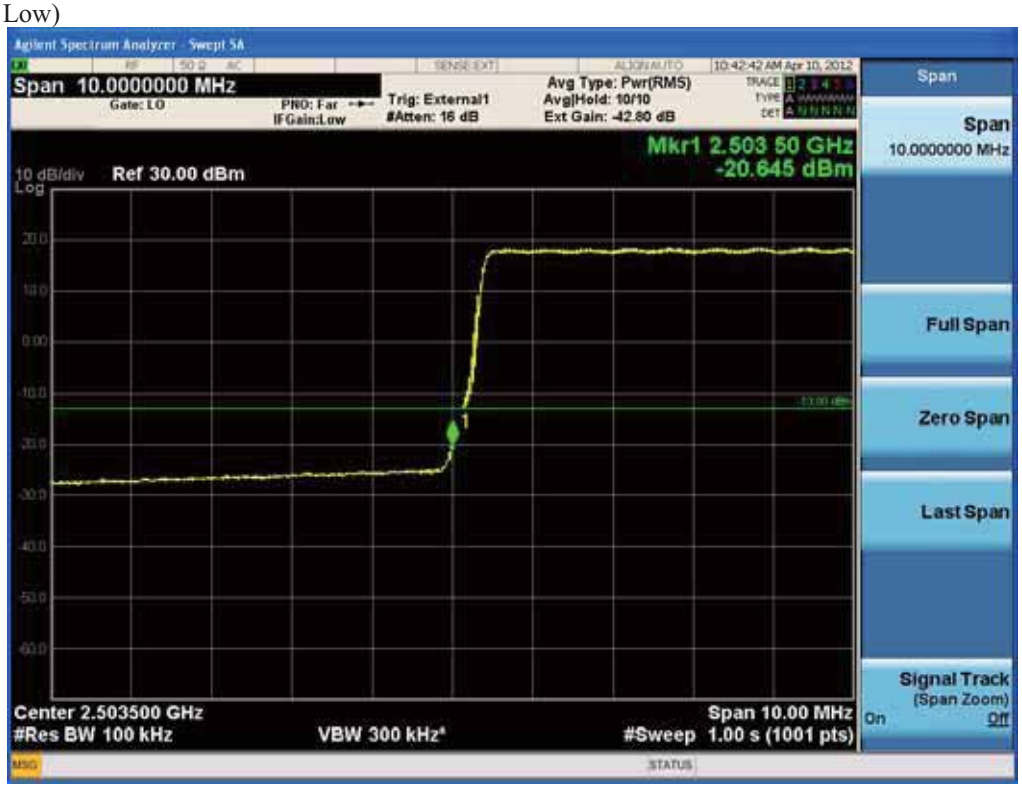
(64QAM Low Channel)

(30 MHz ~ 1 GHz)

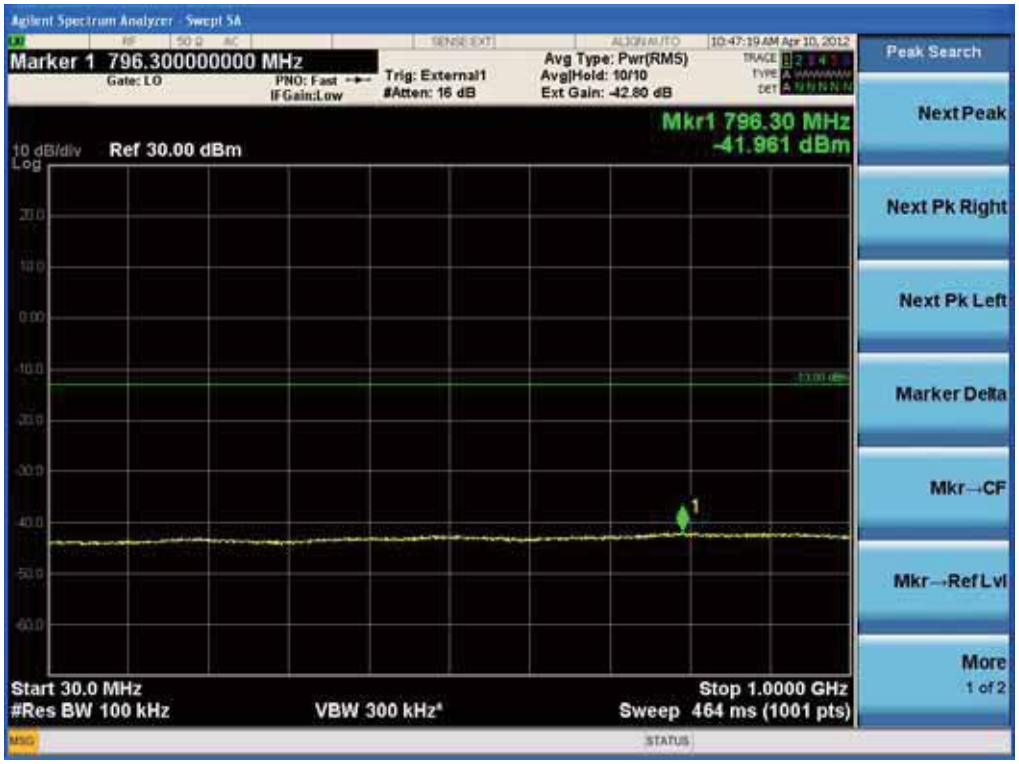
(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



(64QAM Middle Channel)

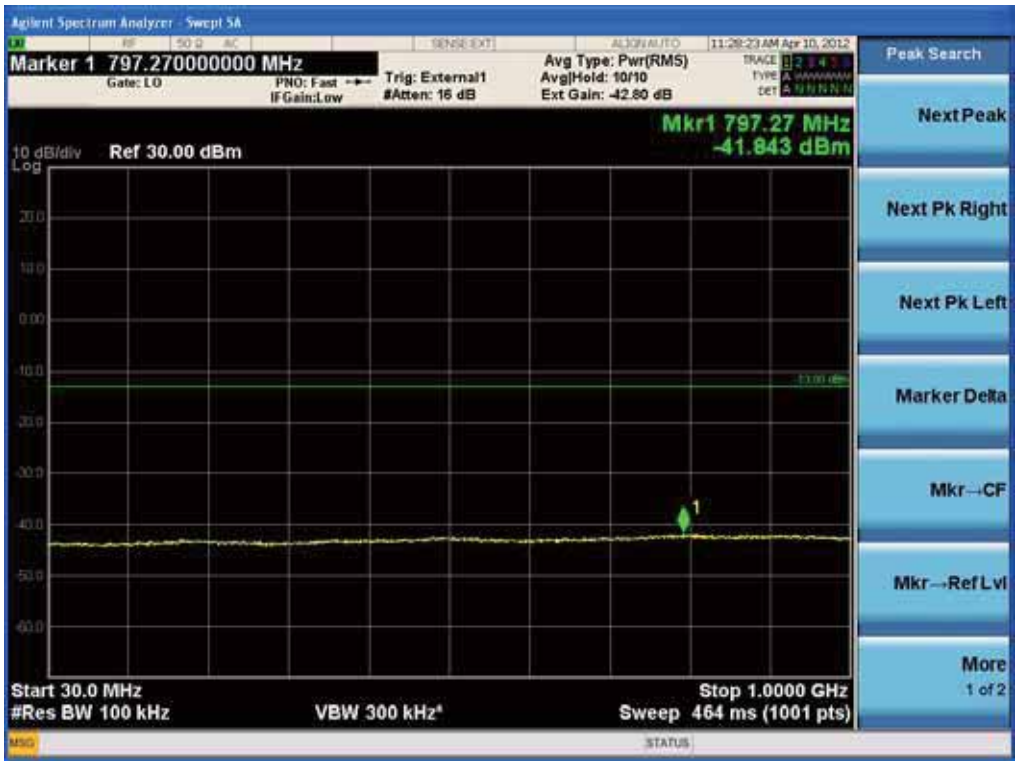


(30 MHz ~ 1 GHz)

(64QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

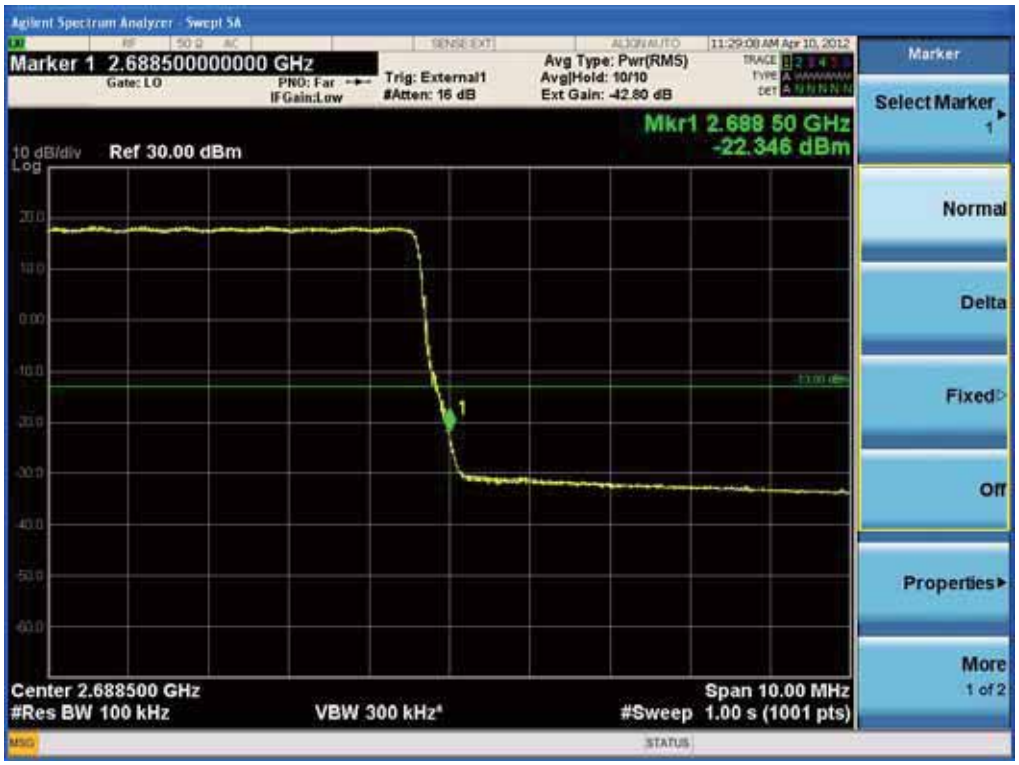


(30 MHz ~ 1 GHz)

(64QAM High Channel)

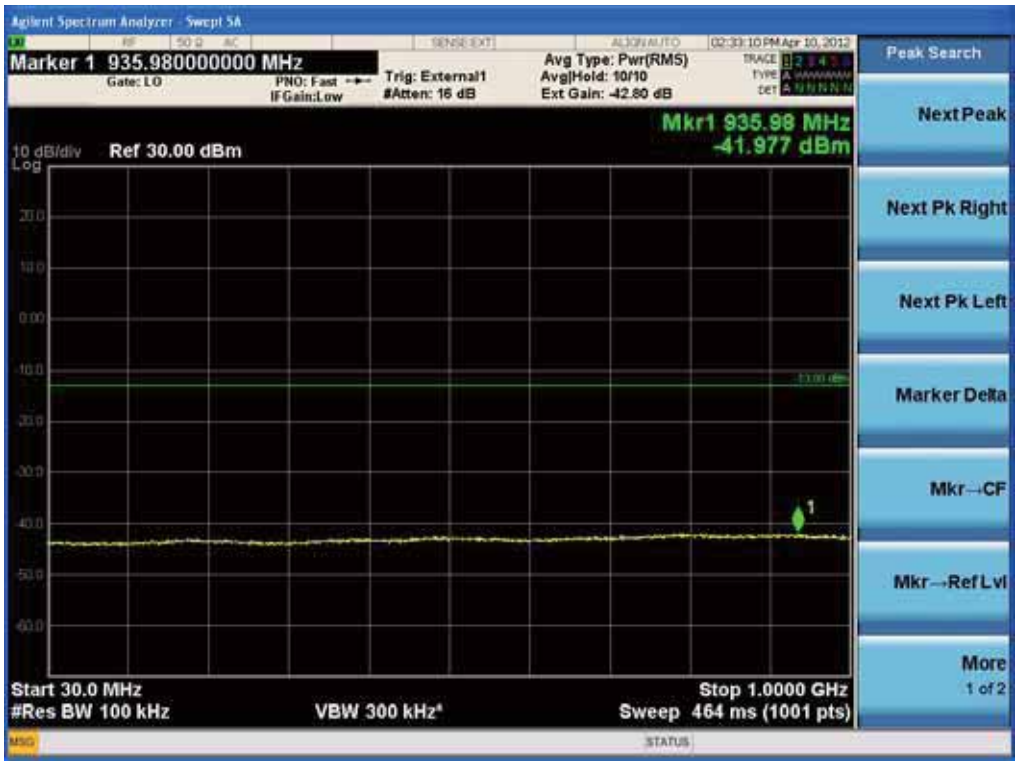
(1 GHz ~ 26.5 GHz)

(Band Edge High)



7.4.2. Plot Data at Output Port 2

(QPSK Low Channel)

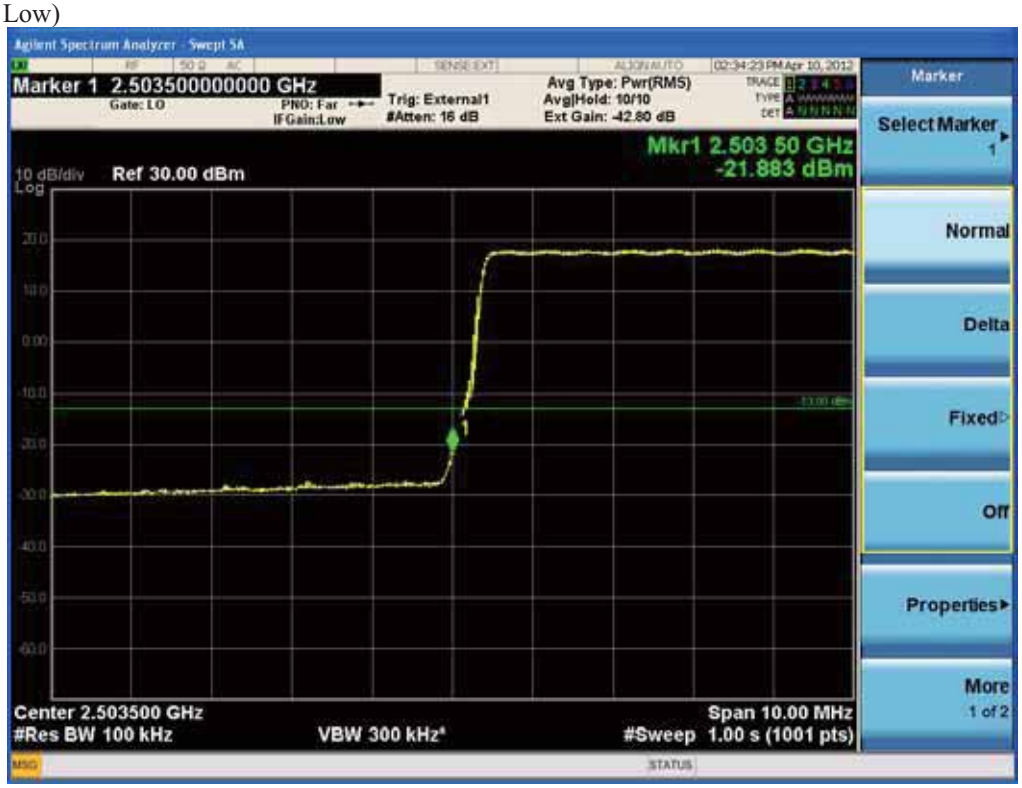


(30 MHz ~ 1 GHz)

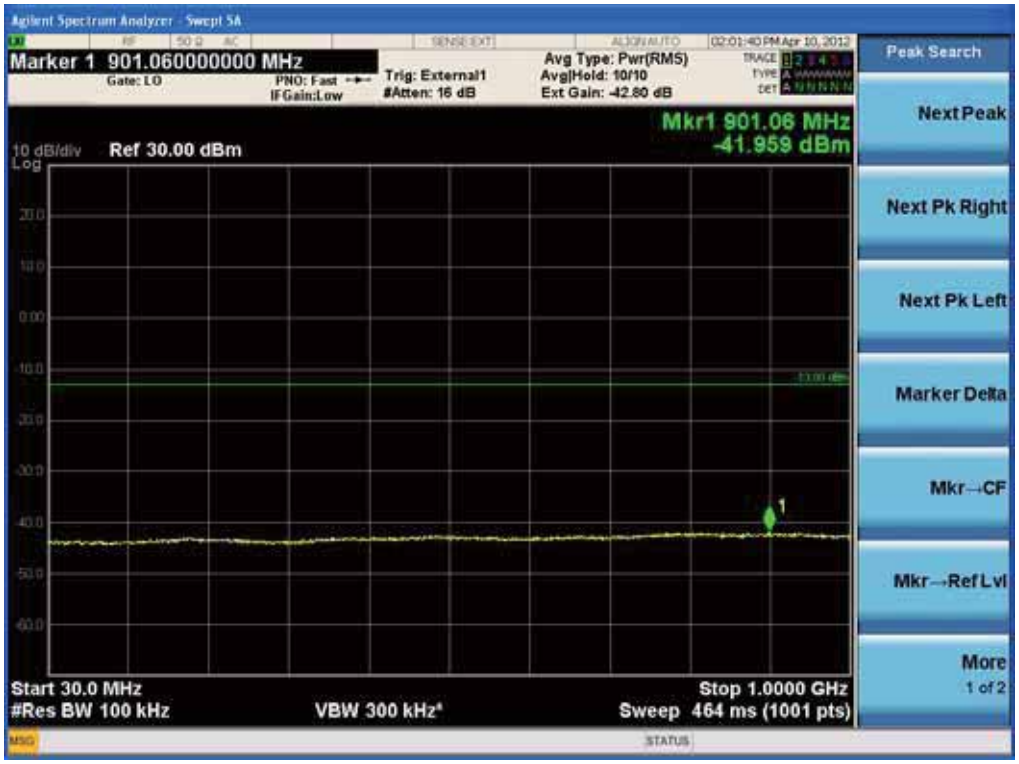
(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

(30 MHz ~ 1 GHz)

(QPSK High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

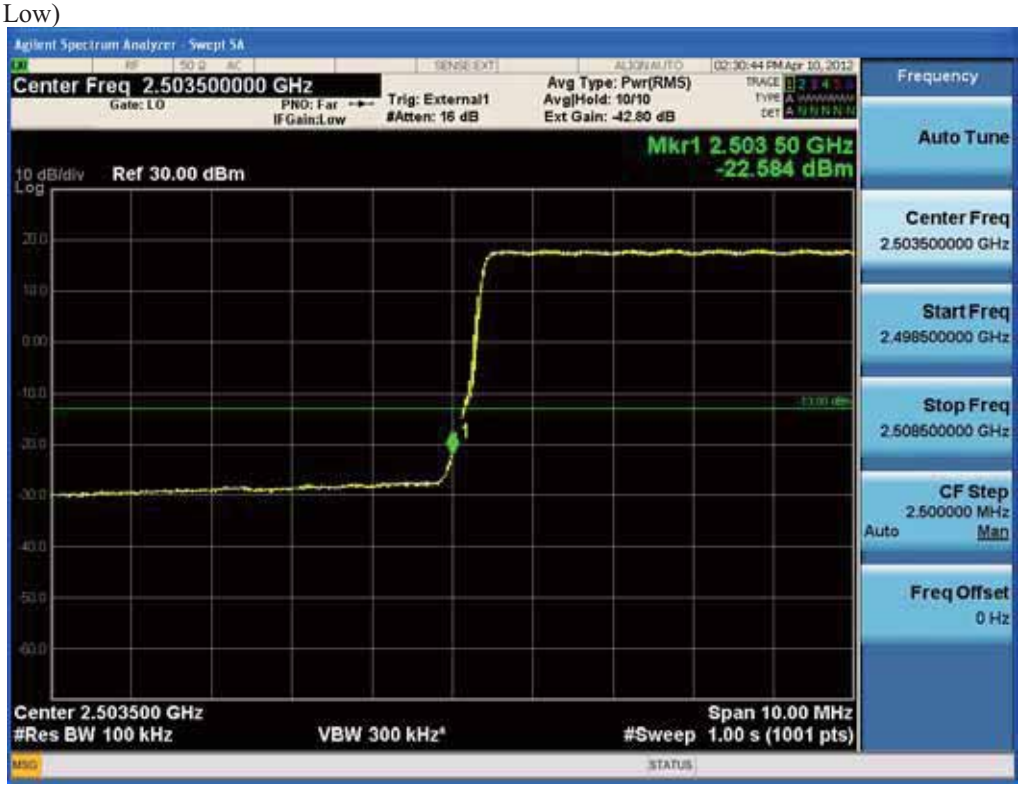
(16QAM Low Channel)

(30 MHz ~ 1 GHz)

(16QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



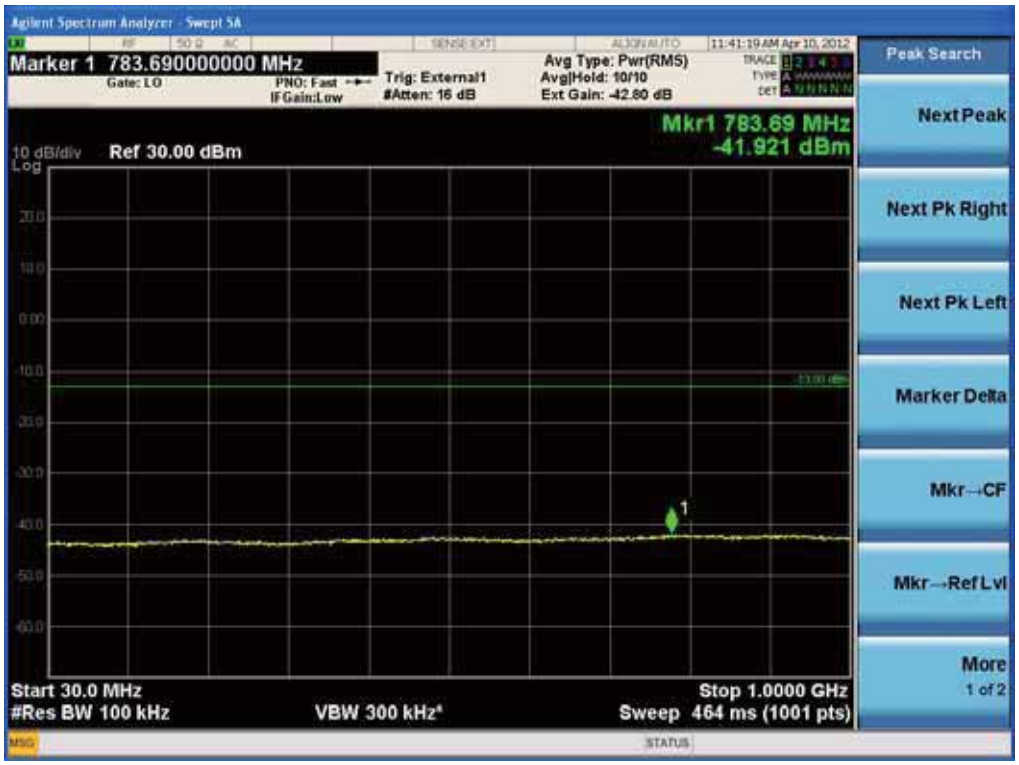
(16QAM Middle Channel)

(30 MHz ~ 1 GHz)

(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)



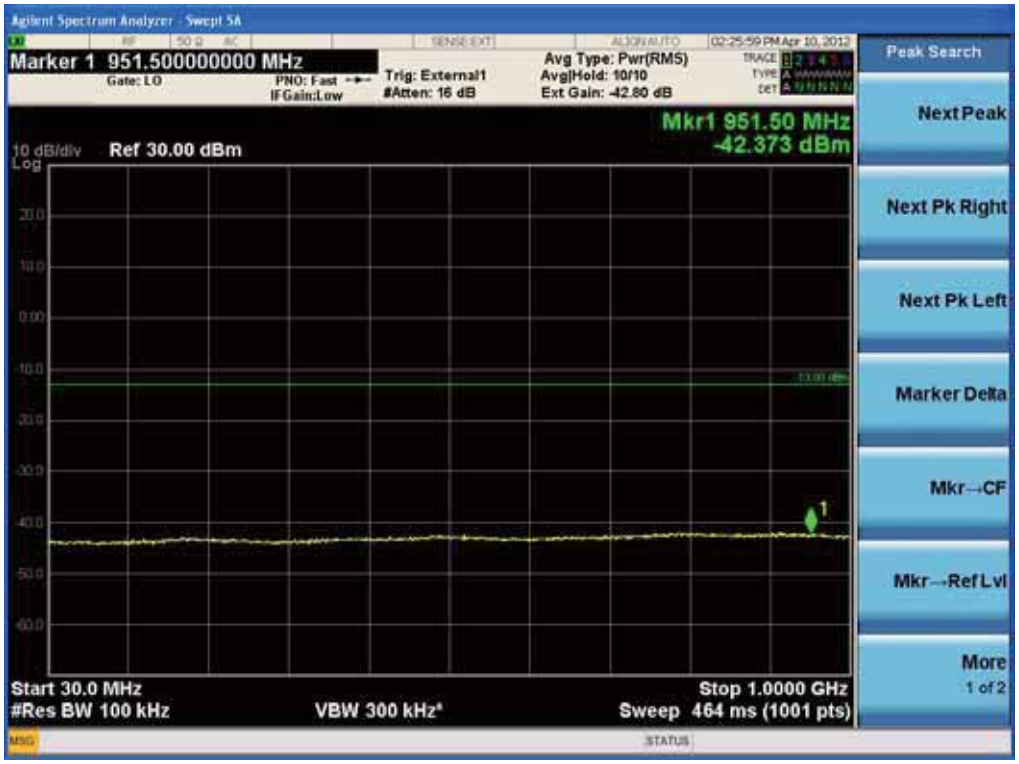
(30 MHz ~ 1 GHz)

(16QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

(64QAM Low Channel)

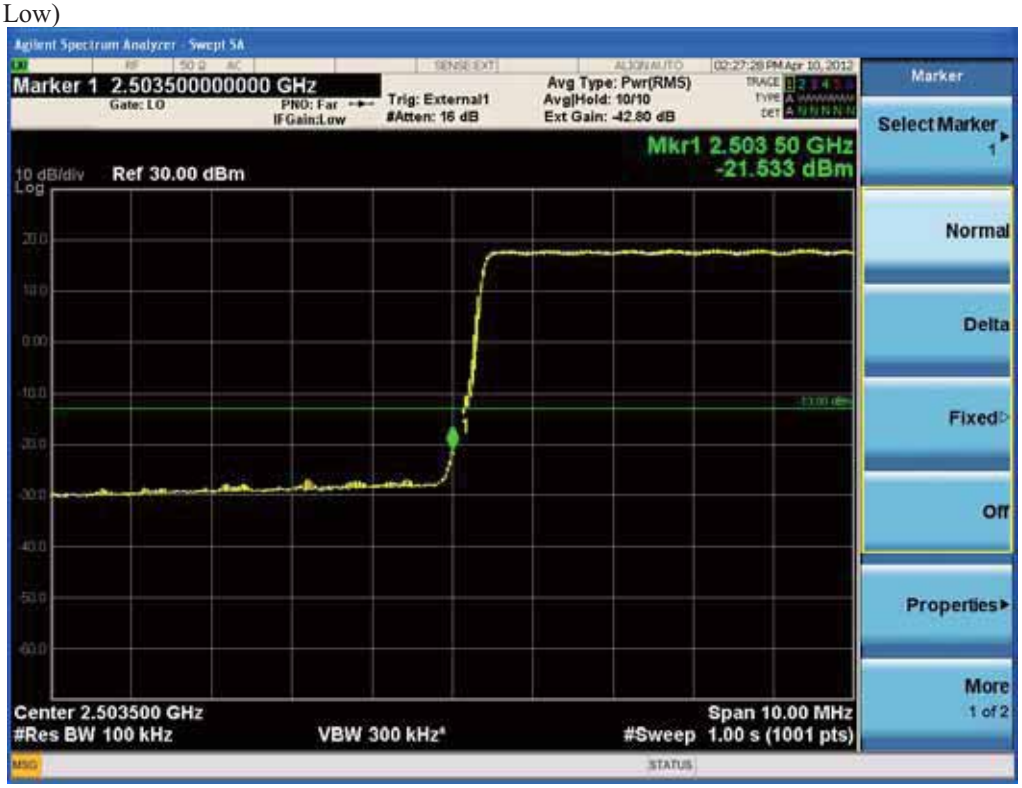


(30 MHz ~ 1 GHz)

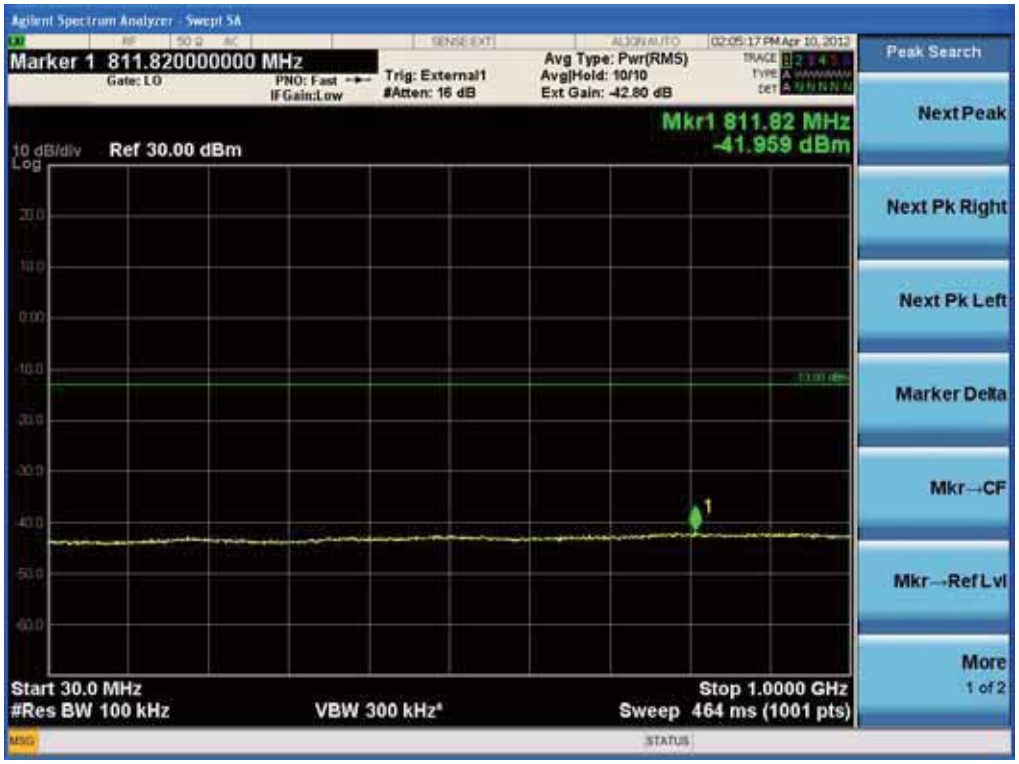
(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

(64QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

(30 MHz ~ 1 GHz)

(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

7.4.3. Plot Data at Output Port 3

(QPSK Low Channel)

(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)

(QPSK Middle Channel)

(30 MHz ~ 1 GHz)

(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

(30 MHz ~ 1 GHz)

(QPSK High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

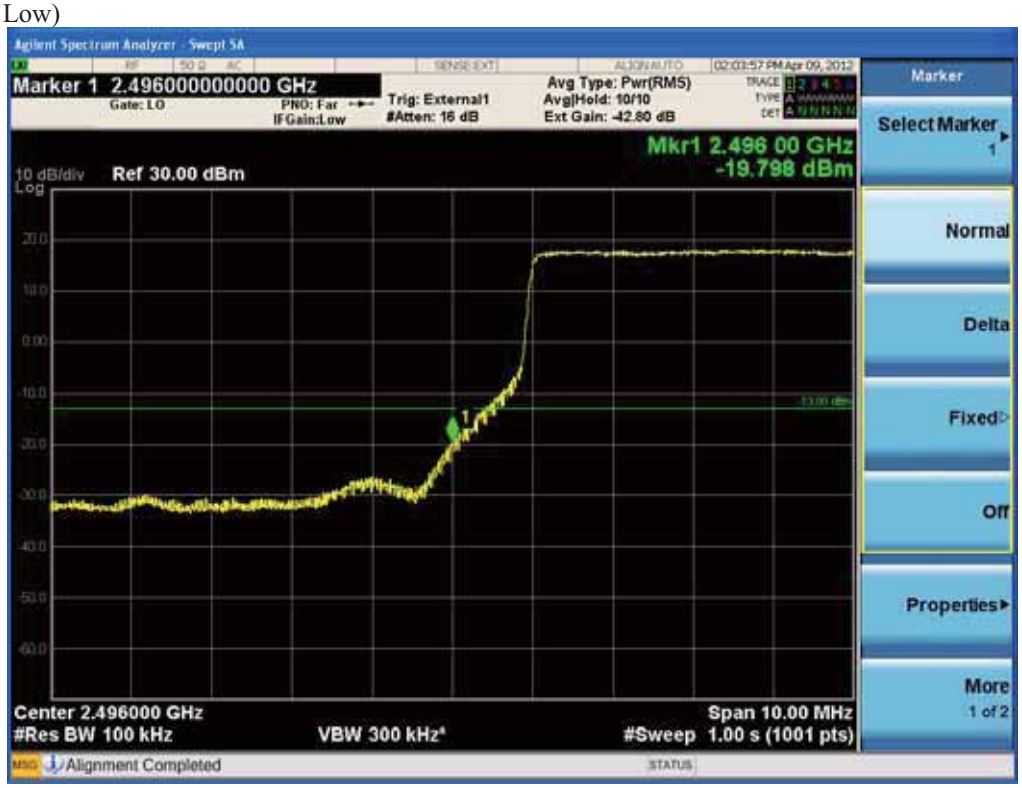
(16QAM Low Channel)

(30 MHz ~ 1 GHz)

(16QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



(16QAM Middle Channel)

(30 MHz ~ 1 GHz)

(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

(30 MHz ~ 1 GHz)

(16QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

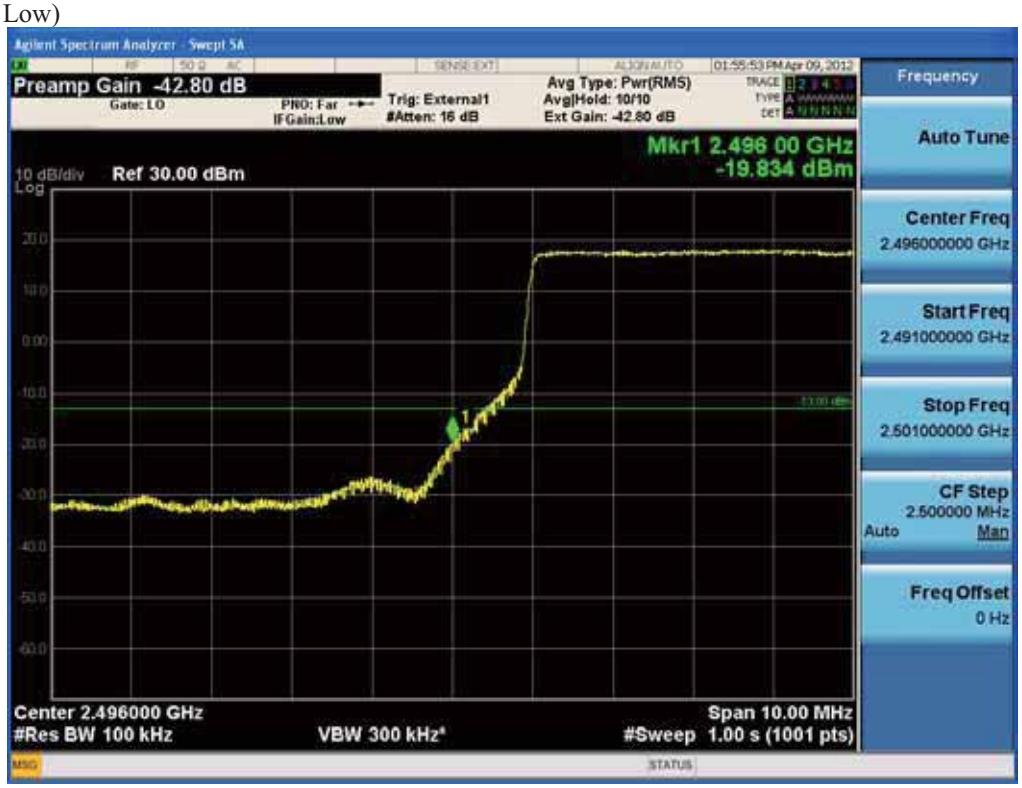
(64QAM Low Channel)

(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



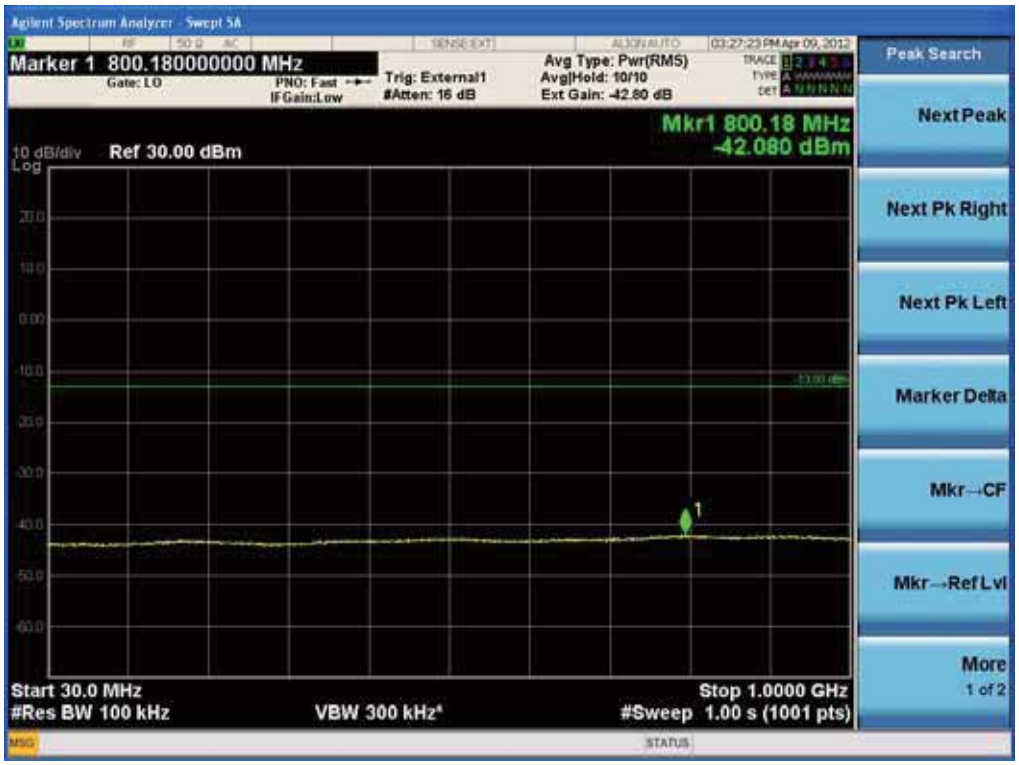
(64QAM Middle Channel)

(30 MHz ~ 1 GHz)

(64QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(64QAM High Channel)



(30 MHz ~ 1 GHz)

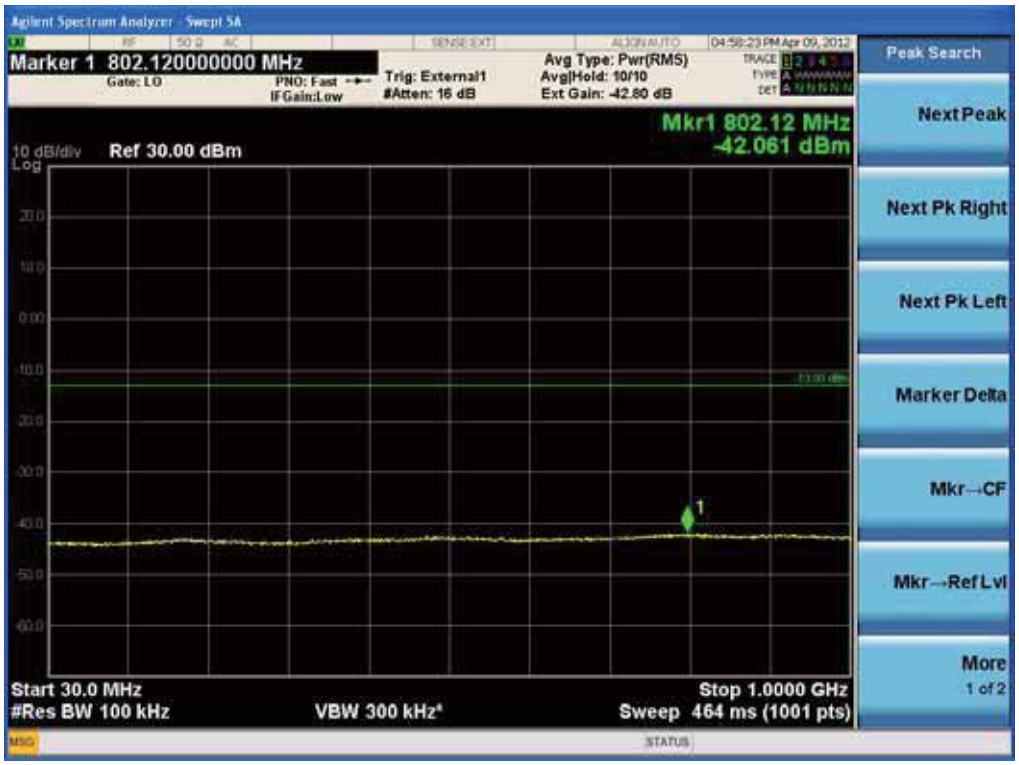
(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

7.4.4. Plot Data at Output Port 4

(QPSK Low Channel)

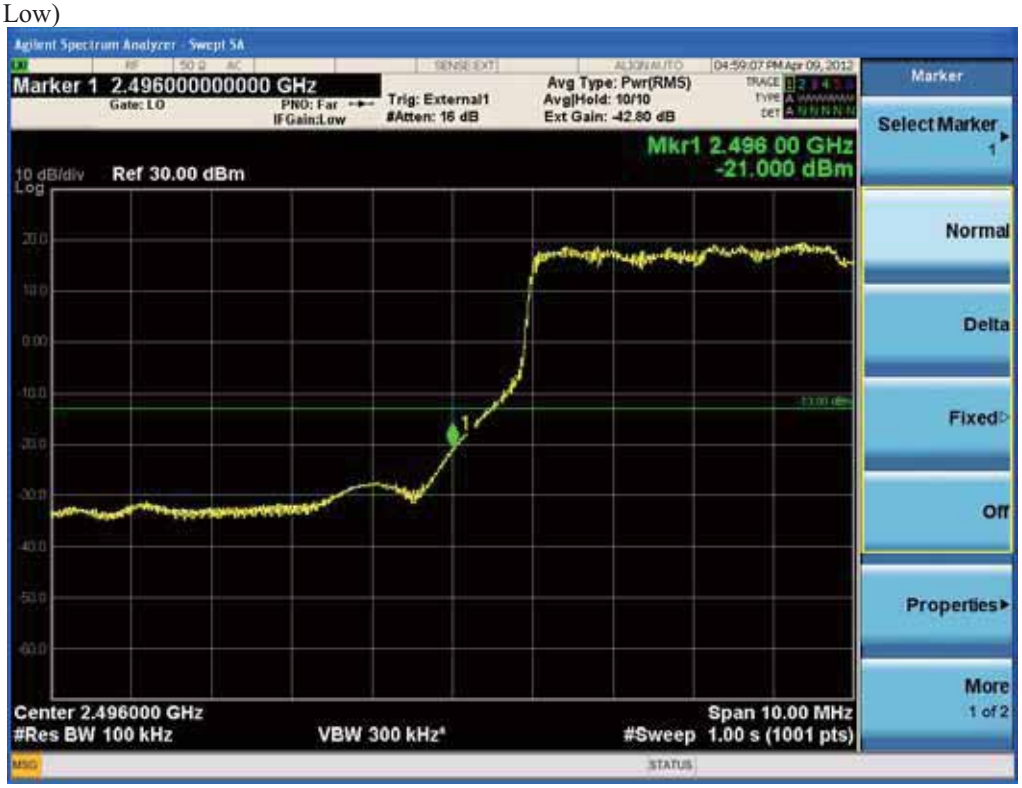


(30 MHz ~ 1 GHz)

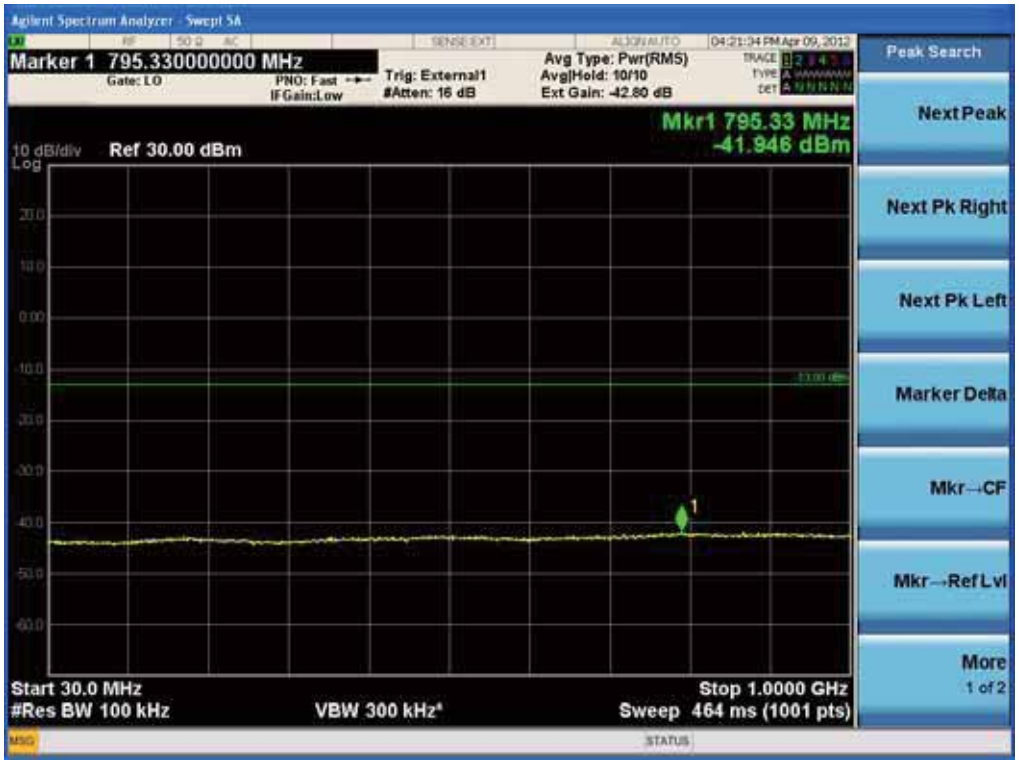
(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



(QPSK Middle Channel)

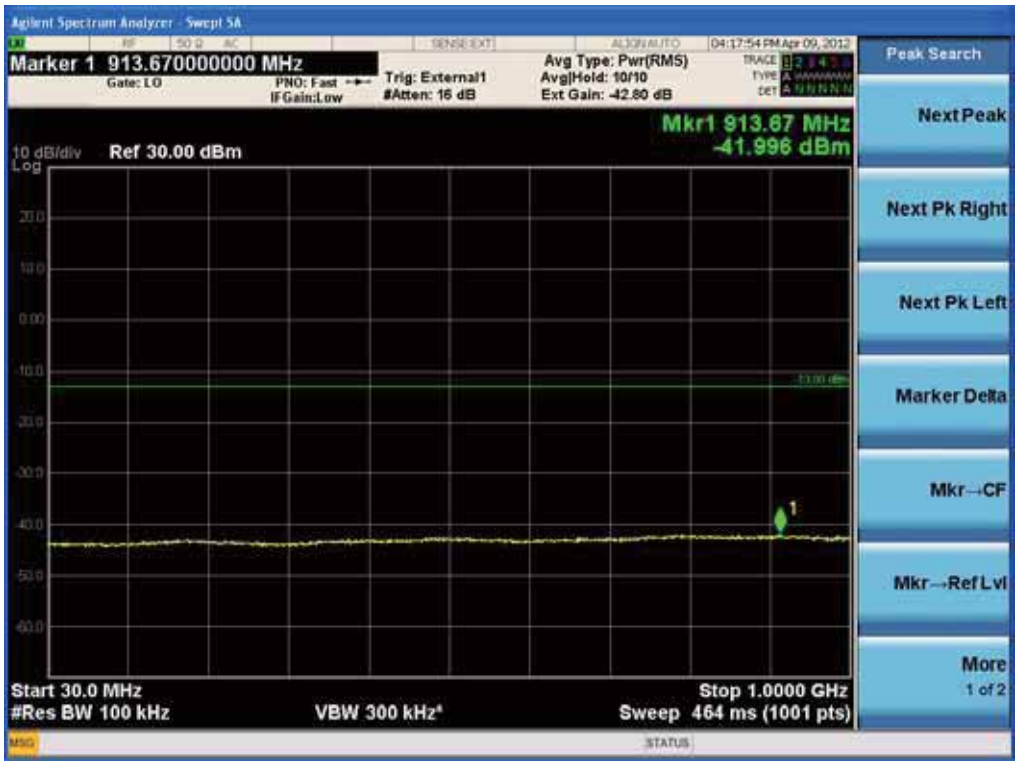


(30 MHz ~ 1 GHz)

(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)



(30 MHz ~ 1 GHz)

(QPSK High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

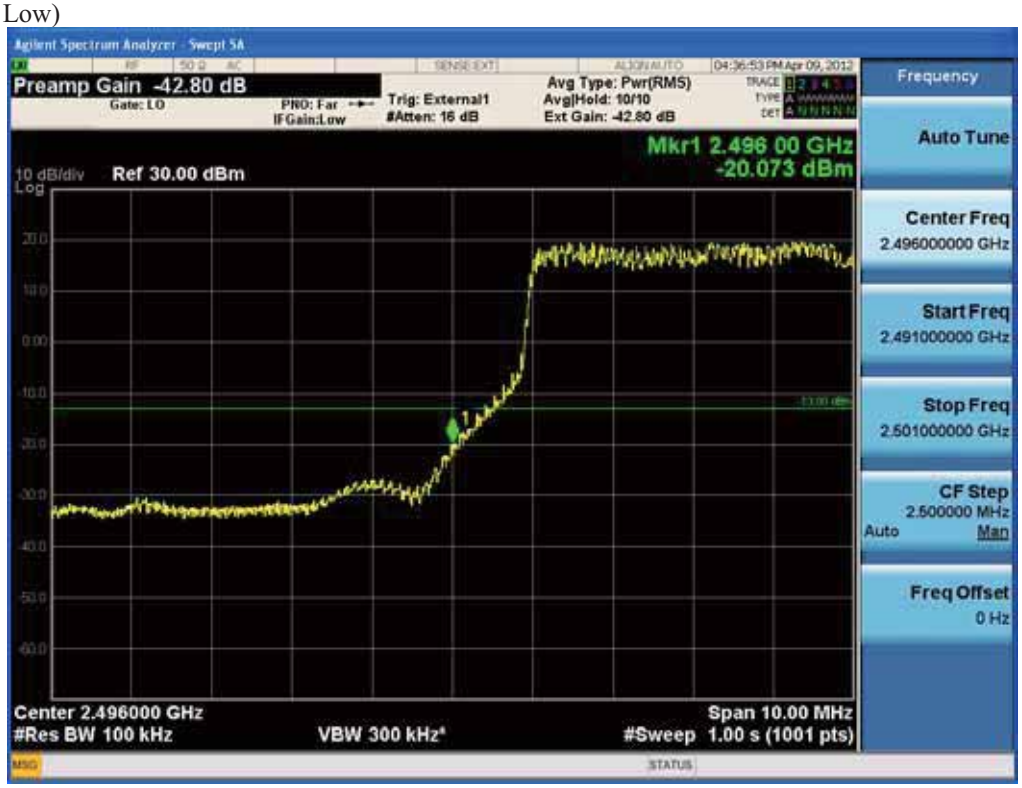
(16QAM Low Channel)

(30 MHz ~ 1 GHz)

(16QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



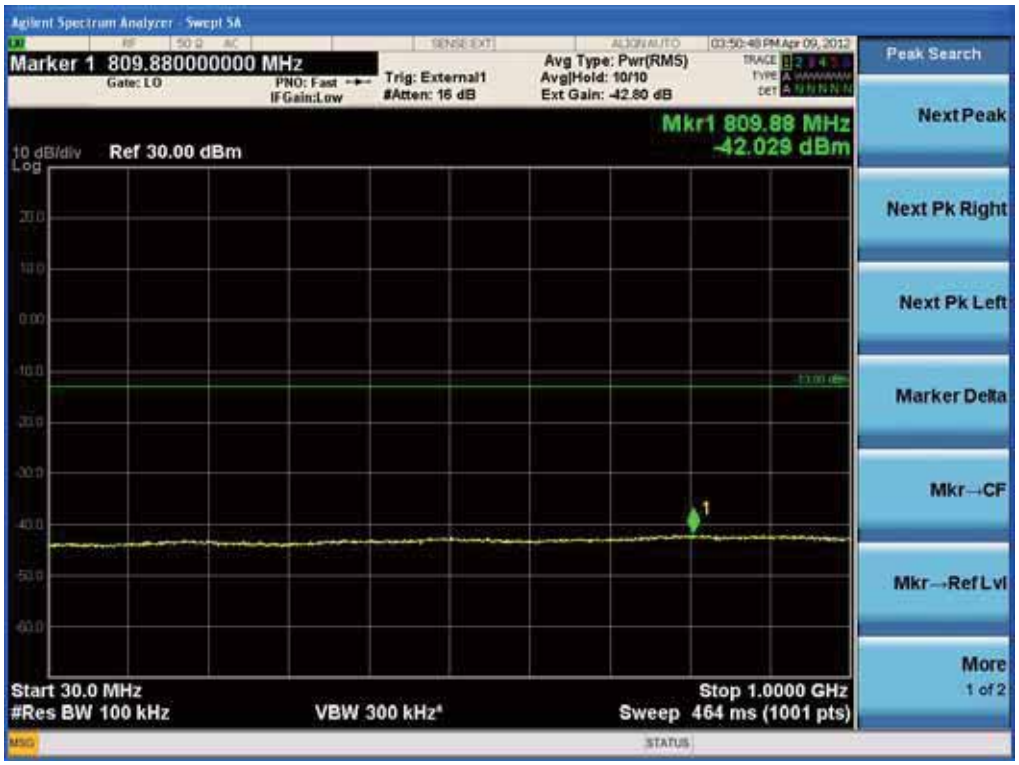
(16QAM Middle Channel)

(30 MHz ~ 1 GHz)

(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)



(30 MHz ~ 1 GHz)

(16QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)

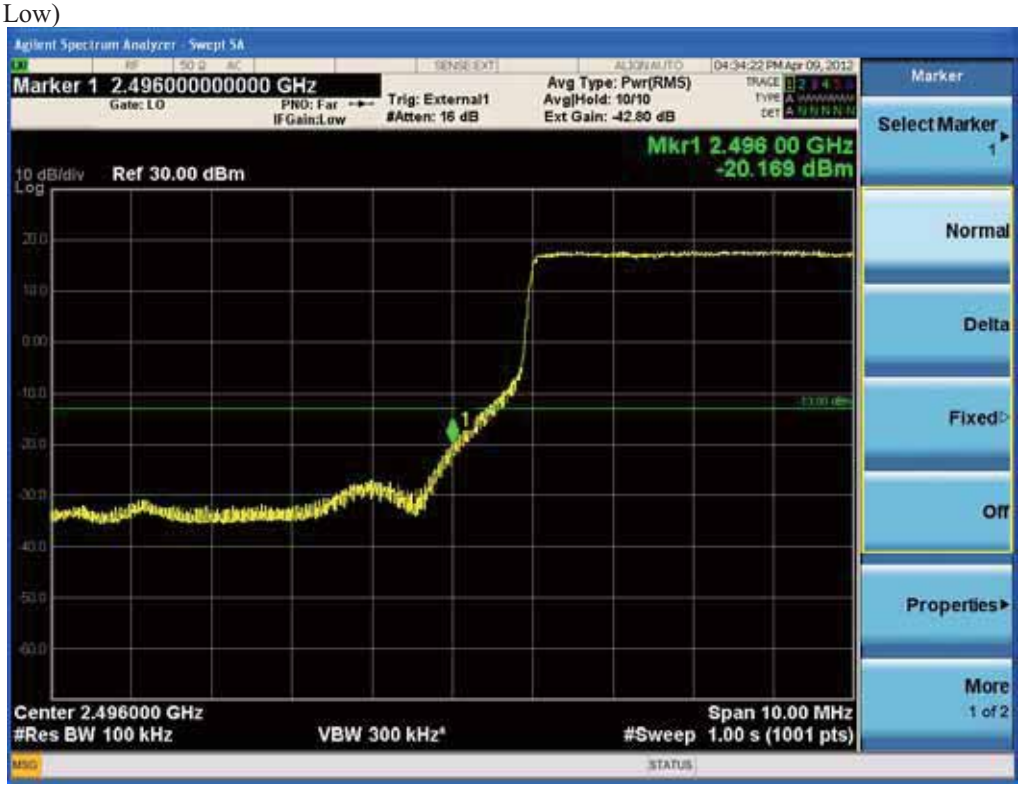
(64QAM Low Channel)

(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge Low)



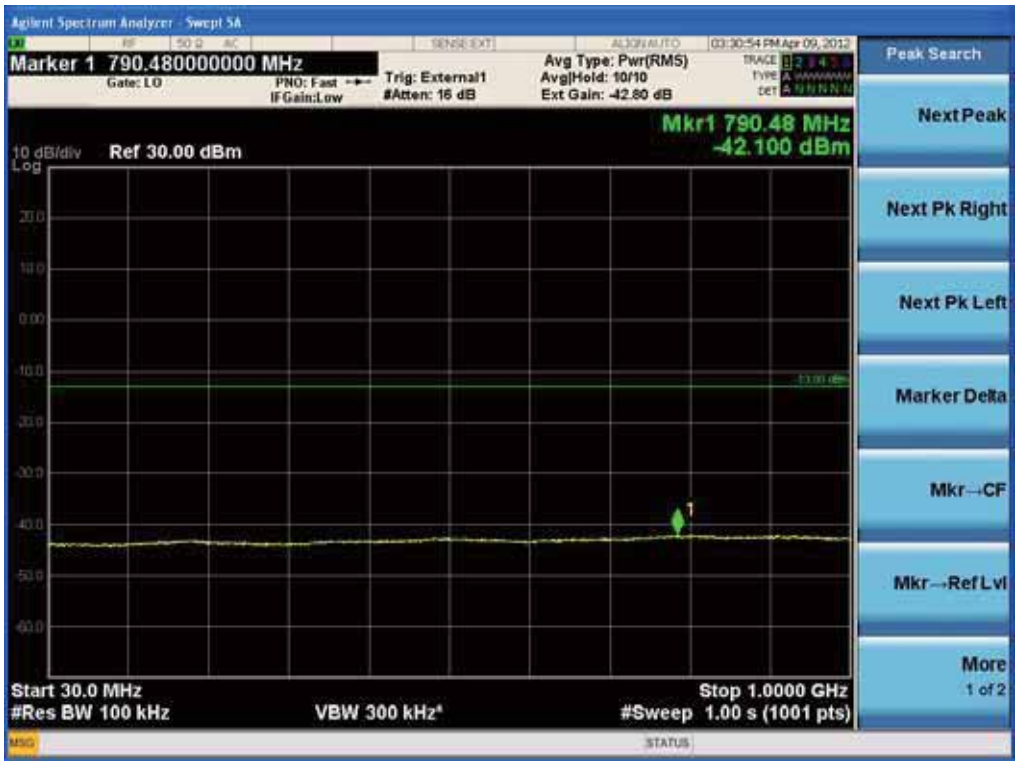
(64QAM Middle Channel)

(30 MHz ~ 1 GHz)

(64QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

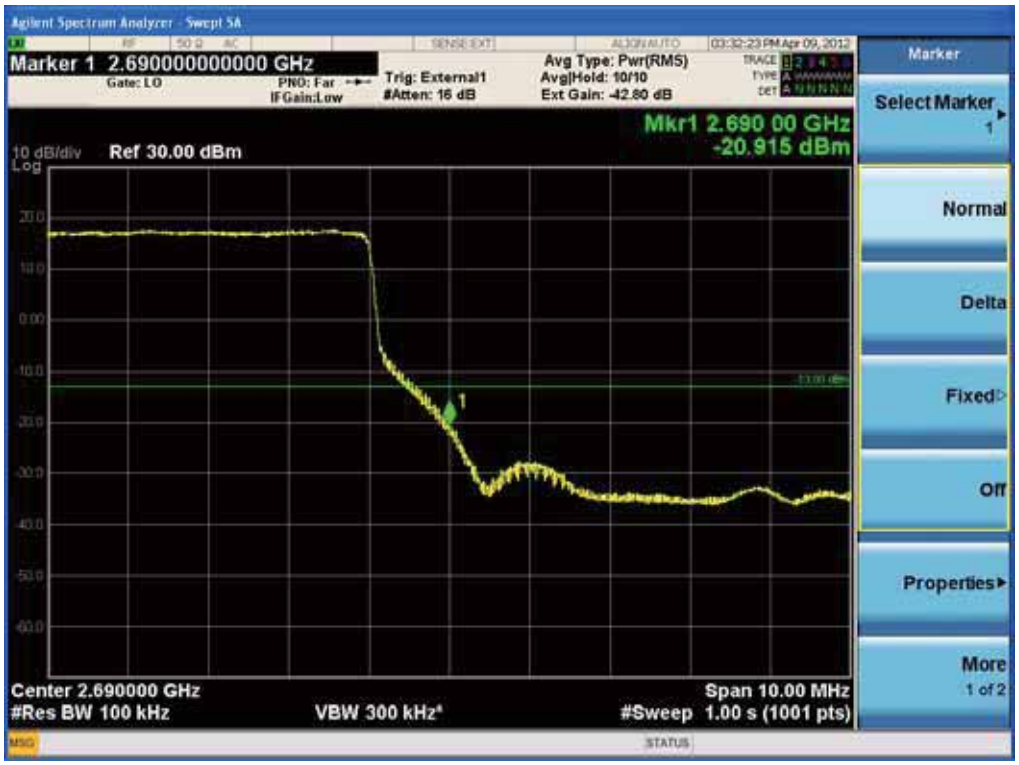


(30 MHz ~ 1 GHz)

(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

(Band Edge High)



8. RADIATED SPURIOUS EMISSION

8.1 Applicable Standard

(l) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts. (2) For fixed and temporary fixed digital stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee. Provided that the complaint cannot be mutually resolved between the parties, both licensees of existing and new systems shall reduce their out-of-band emissions by at least 67 + 10 log (P) dB measured at 3 MHz from their channel's edges for distances between stations exceeding 1.5 km.

8.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	296	02/20/2014
Schwarzbeck	VULB 9168 / TRILOG Antenna	9168-200	02/19/2013
HD	MA240 / Antenna Position Tower	556	N/A
EMCO	1050 / Turn Table	114	N/A
HD GmbH	HD 100 / Controller	13	N/A
HD GmbH	KMS 560 / SlideBar	12	N/A
MITEQ	AMF-6D-001180-35-20P/AMP	990893	05/02/2012
EMCO	6502/Loop Antenna	9009-2536	01/14/2014
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	67-30-33 / Attenuator	BR0530	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	11787	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
DaeYoung	DFSS60/ Frequency Converter	1003030-1	05/03/2012

8.3 Test Procedure

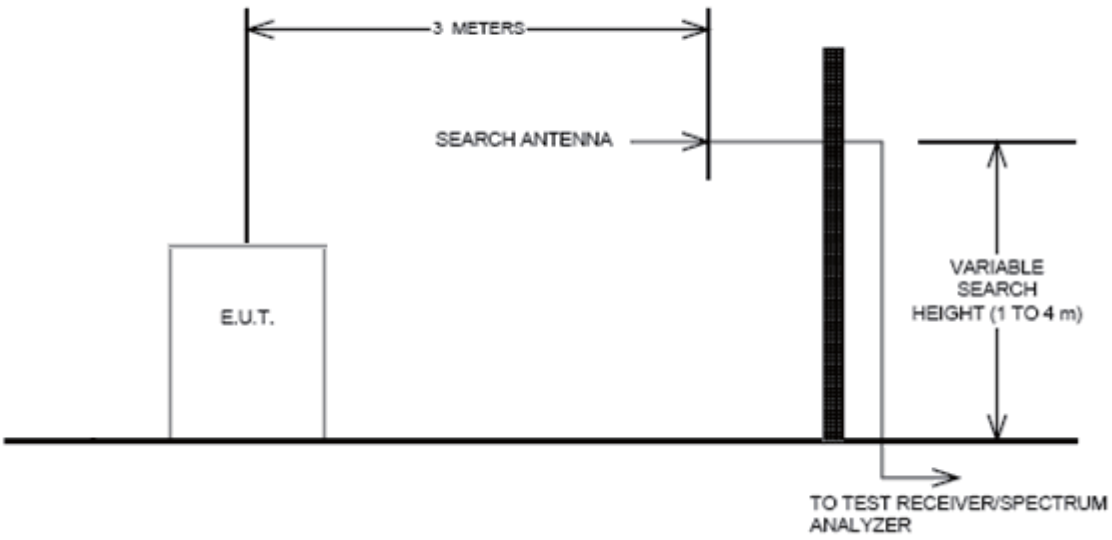
Radiated emission measurements were performed at an semi-anechoic chamber.

The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission.

A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated.

The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

8.3.1 Radiated Spurious Emissions Test Setup



8.4 Test Result

: PASS (There were no emissions detected above the noise floor which was at least 20 dB below the limit.)

Mode	Frequency	Freq.(MHz)	Substitute Level [dBm]	Ant. Gain (dBd)	C.L	Pol.	ERP (dBm)	Margin (dB)
WiMax	2508.5	5017.00	-49.98	10.32	9.57	V	-49.23	-36.23
		7525.50	-53.30	8.84	12.24	V	-56.70	-43.70
LTE	2506	5012.00	-48.65	10.31	9.57	V	-47.91	-34.91
		7518.00	-52.39	8.84	12.23	V	-55.78	-42.78
	2592	5184.00	-49.14	10.51	9.72	V	-48.35	-35.35
		7776.00	-51.88	8.99	12.36	V	-55.25	-42.25

9. FREQUECNY STABILITY

9.1 Applicable Standard

Requirements: FCC § 2.1055 (a), Part27.54 following: The frequency stability shall be sufficient to ensure that the fundamental emissions stay

9.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	N9020A /Signal Analyzer	US46220219	06/10/2012
WEINSCHEL	67-30-33 / Attenuator	BU5347	11/07/2012
WEINSCHEL	AF9003-69-31 / Attenuator	5701	11/07/2012
Agilent	6674A/ DC Power Supply	3501A00901	05/02/2012

9.3 Test Procedure

Frequency Stability over Temperature variation:

The equipment under test was connected to an external DC power supply and the RF output was connected to a Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 30 minutes, the frequency output was recorded from the VSA8960 S/W via MXA Signal Analyzer.

Frequency stability over Voltage variation: An external variable DC power supply Source. The voltage was set to 85% and 115% of the nominal value. The output frequency was recorded for each voltage.

9.4. Test Result

: Pass

9.4.1. Frequency Stability over Temperature and Voltage variation

Modulation: QPSK

Reference: - 48 Vdc at 20°c **Freq.** = 2551,500,000 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2551 499 999	-0.7	0.0	0.0000
	-30	2551 499 998	-1.7	-1.0	-0.0004
	-20	2551 499 999	-1.1	-0.4	-0.0002
	-10	2551 499 999	-0.6	0.1	0.0000
	0	2551 499 999	-1.2	-0.5	-0.0002
	+10	2551 499 999	-1.5	-0.8	-0.0003
	+30	2551 499 999	-0.9	-0.2	-0.0001
	+40	2551 499 999	-1.1	-0.4	-0.0002
	+50	2551 500 000	-0.4	0.3	0.0001
115%	+20	2551 499 999	-0.9	-0.2	-0.0001
85%	+20	2551 499 999	-1.2	-0.5	-0.0002

(Output Port 1)

Modulation: 64QAM

Reference: - 48 Vdc at 20°c **Freq.** = 2551,500,000 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2551 499 999	-1.5	0.0	0.0000
	-30	2551 499 999	-1.2	0.3	0.0001
	-20	2551 499 999	-1.3	0.2	0.0001
	-10	2551 499 999	-0.8	0.7	0.0003
	0	2551 499 999	-1.2	0.3	0.0001
	+10	2551 499 999	-1.5	0.0	0.0000
	+30	2551 499 999	-0.6	0.9	0.0004
	+40	2551 499 999	-0.9	0.6	0.0002
	+50	2551 499 999	-1.2	0.3	0.0001
115%	+20	2551 499 999	-1.4	0.1	0.0000
85%	+20	2551 499 999	-1.3	0.2	0.0001

(Output Port 2)

Modulation: QPSK

Reference: - 48 Vdc at 20°c **Freq.** = 2592,000,000 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2591 999 998	-2.4	0.0	0.0000
	-30	2591 999 999	-1.5	0.9	0.0003
	-20	2591 999 997	-2.9	-0.5	-0.0002
	-10	2591 999 997	-3.3	-0.9	-0.0003
	0	2591 999 996	-3.8	-1.4	-0.0005
	+10	2591 999 995	-4.9	-2.5	-0.0010
	+30	2591 999 999	-1.2	1.2	0.0005
	+40	2592 000 001	0.6	3.0	0.0012
	+50	2591 999 999	-1.2	1.2	0.0005
115%	+20	2591 999 999	-1.5	0.9	0.0003
85%	+20	2591 999 997	-3.2	-0.8	-0.0003

(Output Port 3)

Modulation: 64QAM

Reference: - 48 Vdc at 20°c **Freq.** = 2592,000,000 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2591 999 997	-3.2	0.0	0.0000
	-30	2591 999 998	-2.1	1.1	0.0004
	-20	2591 999 998	-1.8	1.4	0.0005
	-10	2591 999 998	-2.3	0.9	0.0003
	0	2591 999 998	-2.2	1.0	0.0004
	+10	2591 999 998	-1.9	1.3	0.0005
	+30	2591 999 999	-1.3	1.9	0.0007
	+40	2591 999 999	-0.8	2.4	0.0009
	+50	2591 999 999	-1.2	2.0	0.0008
115%	+20	2591 999 998	-2.5	0.7	0.0003
85%	+20	2591 999 998	-1.9	1.3	0.0005

(Output Port 4)

10. RF EXPOSURE STATEMENT

1. LIMITS

According to §1.1310 and §2.1091 RF exposure is calculated.

(B) Limits for General Population/Uncontrolled Exposures

Frequency range (MHz)	Electric field Strength (V/m)	Magnetic field Strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*(180/ f^2)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	.....	.....	f/1500	30
1500 - 100.000	.....	.....	1.0	30

F = frequency in MHz

* = Plane-wave equivalent power density

2. MAXIMUM PERMISSIBLE EXPOSURE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

S = Power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

[Mobile WiMax]

Max Peak output Power at antenna input terminal	40.19000	dBm
Max Peak output Power at antenna input terminal	10447.20219	mW
Prediction distance	300.00000	cm
Prediction frequency	2508.50000	MHz
Antenna Gain(typical)	17.00000	dBi
Antenna Gain(numeric)	50.11872	-
Power density at prediction frequency (S)	0.46296	mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm^2

[LTE]

Max Peak output Power at antenna input terminal	43.33000	dBm
Max Peak output Power at antenna input terminal	21527.81735	mW
Prediction distance	300.00000	cm
Prediction frequency	2506.00000	MHz
Antenna Gain(typical)	17.00000	dBi
Antenna Gain(numeric)	50.11872	-
Power density at prediction frequency (S)	0.95400	mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm^2

3. RESULTS

The power density level at 300 cm is 0.46296 mW/cm², which is below the uncontrolled exposure limit of 1.0 mW/cm² at Mobile WiMax BAND

The power density level at 300 cm is 0.954 mW/cm², which is below the uncontrolled exposure limit of 1.0 mW/cm² at LTE BAND