HCT CO., LTD.

CERTIFICATION DIVISION
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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: JULY, 15, 2010
Test Site/Location:
HCT, San 136-1 Ami-ri, Bubal-eup, Icheon-si,
Kyungki-do, Korea
Test Report No.: HCTR1007FR03-1

FCC ID : A3LSPI-2C21012500

APPLICANT : SAMSUNG Electronics Co., Ltd.

EUT Type	:	Mobile WiMAX Indoor RAS
Manufacturer	:	SAMSUNG Electronics Co., Ltd.
Model name	:	SPI-2C21012500
Frequency of Operation	:	2496 MHz ~ 2690 MHz
FCC Rule Part(s)	:	FCC Part 27 Subpart (m).
Emission Designator	:	9M12G7D(QPSK), 9M13W7D(16QAM/64QAM)
Test Procedure(s)	:	ANSI/TIA-603C-C-2004
Application Type	:	Original Equipment
Data of issue	:	JULY 7, 2010

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
HCTR1007FR03	July 7,2010	First Approval Report
HCTR1007FR03-1	July 15, 2010	The figure of W consists with dBm, added Combine equipment list.

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1. GENERAL INFORMATION

1.1. CLIENT INFORMATION

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1.2. PRODUCT INFORMATION

EUT TYPE	Mobile WiMAX Indoor RAS
EMISSION DESIGNATOR	9M12G7D (QPSK), 9M13W7D(16QAM/64QAM)
OPERATING FREQUENCY	2496MHz ~ 2690MHz
TX OUTPUT POWER	100 mW (20 dBm) / Carrier / Path 400 mW (26 dBm) / Carrier / 4 Path
CHANNEL BANDWIDTH	10 MHz
MODULATION TYPE	OFDMA(QPSK, 16QAM, 64QAM)
MAXIMUM NUMBER OF CARRIERS/SECTORS	1 Carrier / Omni
SYSTEM INPUT VOLTAGE	POE (DC 48 V) or DC 12 V

1.3. OPERATING DESCRIPTION OF EUT

The SPI-2C21supports 10 MHz bandwidth per carrier and has a large packet service in high speed.
As the SPI-2C21 consists of a DU and an RRH, it is easy to set up a network and it is easy to change the network configuration**.**
The SPI-2C21 provides the MIMO function as follows according to Mobile WiMAX Wave 2 Profile:

- Downlink

  Matrix A (STC)

  Transmission ratio of the Matrix A or STC is 1 and equal to that of Single Input Single Output (SISO). However The Matrix A or the STC reduces the error of the signal received from the MS by raising the stability of the signal received from the MS by means of the Tx diversity. This technology is, also, effective in low Signal to Noise Ratio (SNR) and provides excellent performance even when the MS moves in high speed.

  Matrix B (SM, vertical encoding)

  Matrix B or SM method raises the effectiveness of the frequency by raising the transmission ratio in proportion to the number of antenna in comparison with SISO. This technology is effective when the reception SNR is high.

- Uplink

  Collaborative SM

  Collaborative SM is the technology that doubles the frequency efficiency in view of the SPI-2C21 as two MSs with each individual antenna send data simultaneously by using the same channel.

The SPI-2C21 provides the adaptive MIMO switching function which selects the SM or STC method dynamically for the downlink MIMO function. The SPI-2C21 performs switching based on a value calculated by reflecting the Carrier to Interference and Noise Ratio (CINR) and transmission success rate sent by an MS.

4T4R with CDD

The SPI-2C21 provides the 4T4R with CDD for which the frequency diversity is applied to downlink by adapting the RRH-2WB that provides the 4Tx/4Rx RF path. The 4T4R with CDD is that the CDD function is added to the MIMO function, it is divided into the following two modes according to the MIMO mode.

- Matrix A (STC) + CDD
- Matrix B (SM) + CDD

The SPI-2C21 switches dynamically to the two 4T4R with CDD modes given above depending to the CINR and transmission success rate reported by an MS. At this time, the Collaborative SM (CSM) is applied to the uplink.

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(l)	Occupied Bandwidth	Compliant
2.1051, 27.53(l)	Spurious Emissions at Antenna Terminals	Compliant
2.1051, 27.53(l)	Band edge	Compliant
2.1053, 27.53(l)	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 and different input sources ware tested, and the worst case (POE) 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	09/23/2010
Schwarzbeck	BBHA 9120D / Double Ridged Horn Antenna	147	04/13/2011
Schwarzbeck	VULB 9168 / TRILOG Antenna	9168-200	01/06/2011
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	AFS44-00102650-42-10P44-PS	1532439	04/05/2011
EMCO	6502/Loop Antenna	9009-2536	01/13/2012
R&S	ESI40 / EMI TEST Receiver	831564/003	10/30/2010
Wainwright Instrument	WHF6.0/26.5G-6SS / High Pass Filter	1	05/12/2011
Agilent	6674A / DC Power Supply	3501A00901	05/14/2011
Agilent	8498A / Attenuator	51161	01/06/2011
Agilent	8498A / Attenuator	51162	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BU5347	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BR0530	01/14/2011
Agilent	N9020A / MXA Signal Analyzer	US46220219	03/03/2011
Agilent	11636B / Power Divider	11377	12/24/2010
Cernex	CDPU5260404K/ Power Divider-4WAY	14695	02/08/2011

5. CONDUCTED OUTPUT POWER

5.1. Applicable Standard

According to FCC §2.1046 & 27.5(h)

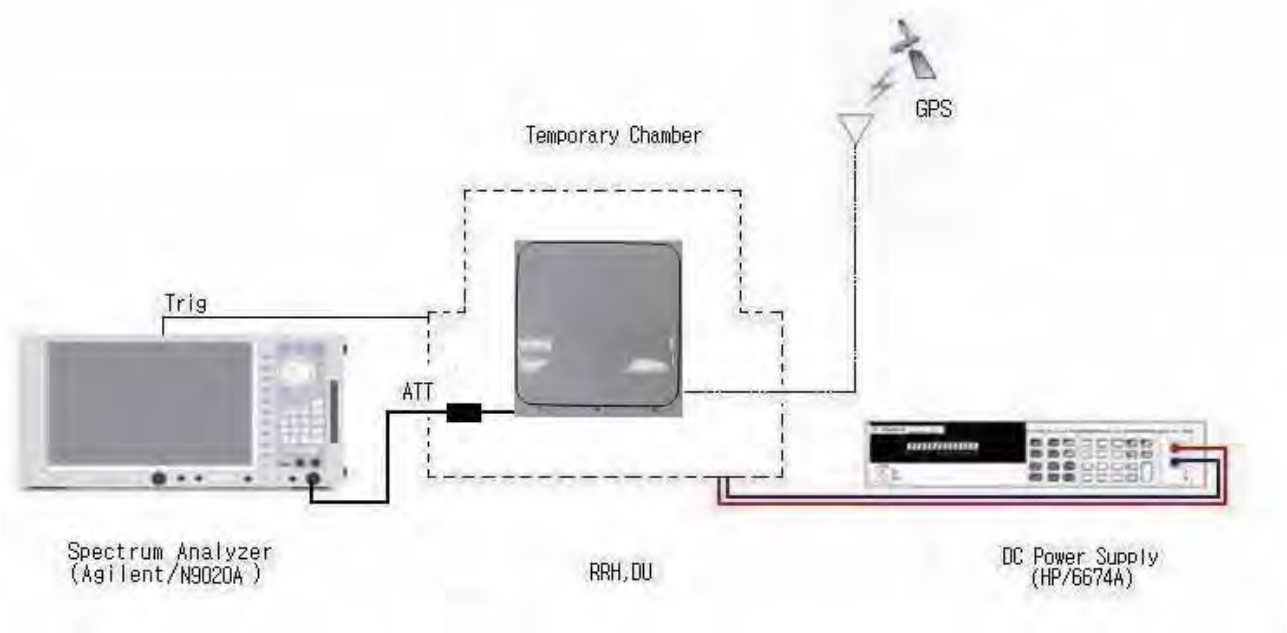
1) *Main, booster and base stations.* (i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is 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	6674A / DC Power Supply	3501A00901	05/14/2011
Agilent	8498A / Attenuator	51161	01/06/2011
Agilent	8498A / Attenuator	51162	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BU5347	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BR0530	01/14/2011
WEINSCHEL	AF117A-69-43 / STEP ATTENUATOR	20623	01/14/2011
WEINSCHEL	AF117A-69-43 / STEP ATTENUATOR	21207	01/06/2011
Agilent	N9020A / MXA Signal Analyzer	US46220219	03/03/2011
Agilent	11636B / Power Divider	11377	12/24/2010
Cernex	CDPU5260404K/ Power Divider-4WAY	14695	02/08/2011

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 Maximum hold mode.
3) The resolution banswidth of the spectrum analyzer was comparable to the emission bandwidth.
4) PAR is measured by using CCDF function of Spectrum Analyzer. Info BW is equal to EUT's emission bandwidth.

5.3.1. Environmental Conditions:

Temperature:	27 °C
Relative Humidity:	67 %

5.4. Test Result

: PASS

5.4.1. Test Data at Output Port 0

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	20.30	0.1072
	Middle	2602.0	20.06	0.1014
	High	2683.5	19.65	0.0923
16QAM	Low	2508.5	20.55	0.1136
	Middle	2602.0	20.06	0.1014
	High	2683.5	19.64	0.0921
64QAM	Low	2508.5	20.53	0.1130
	Middle	2602.0	20.00	0.1000
	High	2683.5	19.63	0.0919

5.4.2. Test Data at Output Port 1

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	19.32	0.0856
	Middle	2602.0	19.27	0.0846
	High	2683.5	19.54	0.0900
16QAM	Low	2508.5	19.24	0.0840
	Middle	2602.0	19.28	0.0848
	High	2683.5	19.48	0.0888
64QAM	Low	2508.5	19.24	0.0840
	Middle	2602.0	19.28	0.0848
	High	2683.5	19.52	0.0896

5.4.3. Test Data at Output Port 2

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	19.86	0.0969
	Middle	2602.0	19.84	0.0964
	High	2683.5	19.63	0.0918
16QAM	Low	2508.5	19.84	0.0964
	Middle	2602.0	19.86	0.0969
	High	2683.5	19.63	0.0919
64QAM	Low	2508.5	19.85	0.0967
	Middle	2602.0	19.85	0.0967
	High	2683.5	19.62	0.0917

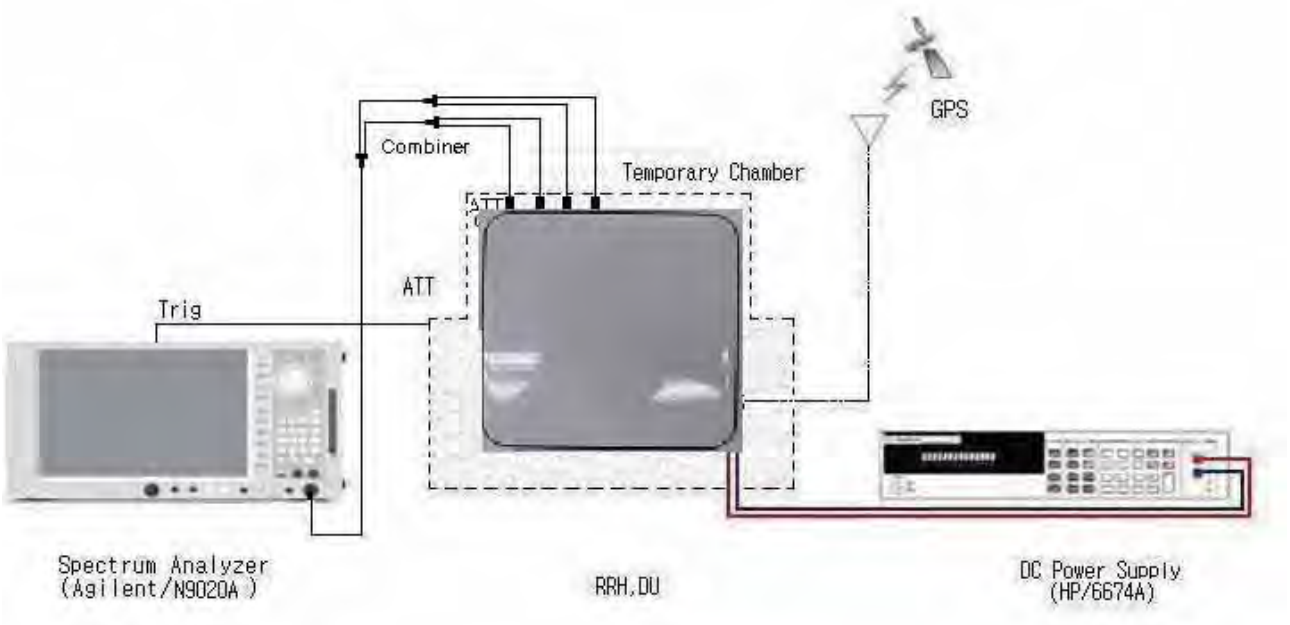
5.4.4. Test Data at Output Port 3

Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	19.19	0.0830
	Middle	2602.0	19.26	0.0844
	High	2683.5	19.44	0.0880
16QAM	Low	2508.5	19.17	0.0827
	Middle	2602.0	19.17	0.0827
	High	2683.5	19.41	0.0873
64QAM	Low	2508.5	19.18	0.0828
	Middle	2602.0	19.20	0.0832
	High	2683.5	19.39	0.0869

5.4.5. Combined Test Data at Output Port

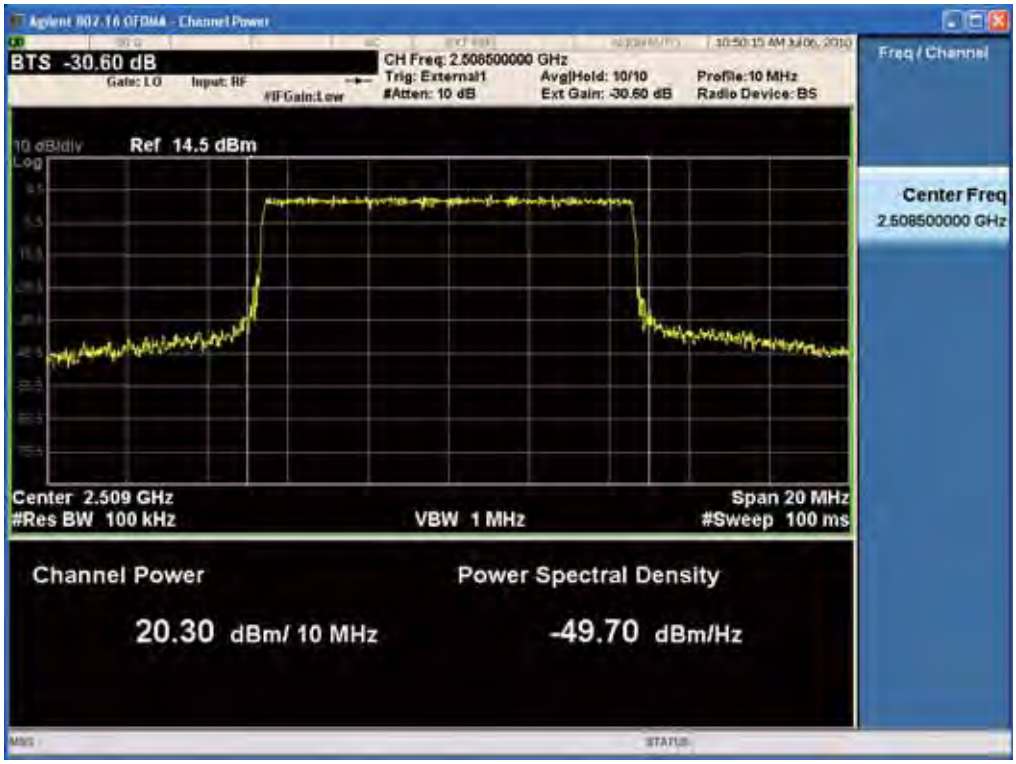
Modulation	Channel	Frequency	Measured Output Power	
			dBm	W
QPSK	Low	2508.5	25.73	0.3742
	Middle	2602.0	25.89	0.3882
	High	2683.5	25.61	0.3640
16QAM	Low	2508.5	25.71	0.3724
	Middle	2602.0	25.88	0.3873
	High	2683.5	25.75	0.3759
64QAM	Low	2508.5	25.69	0.3707
	Middle	2602.0	25.87	0.3864
	High	2683.5	25.71	0.3724

[Combine test diagram]

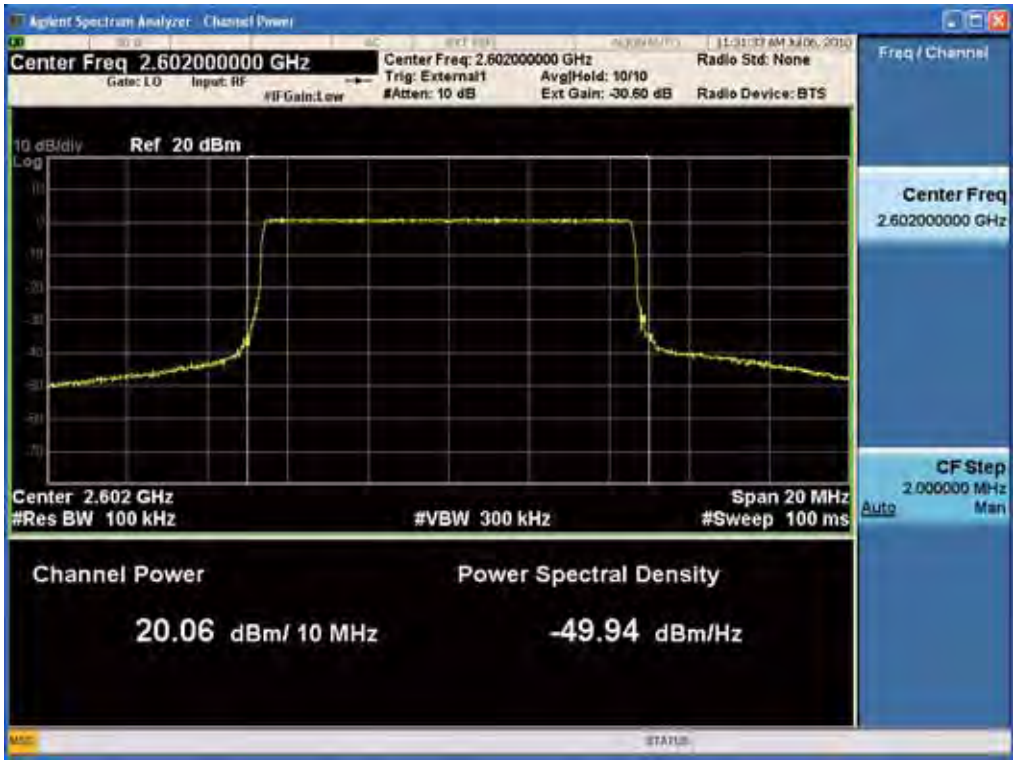


5.4.6. Plot Data for Output 0 (Conducted Output Power)

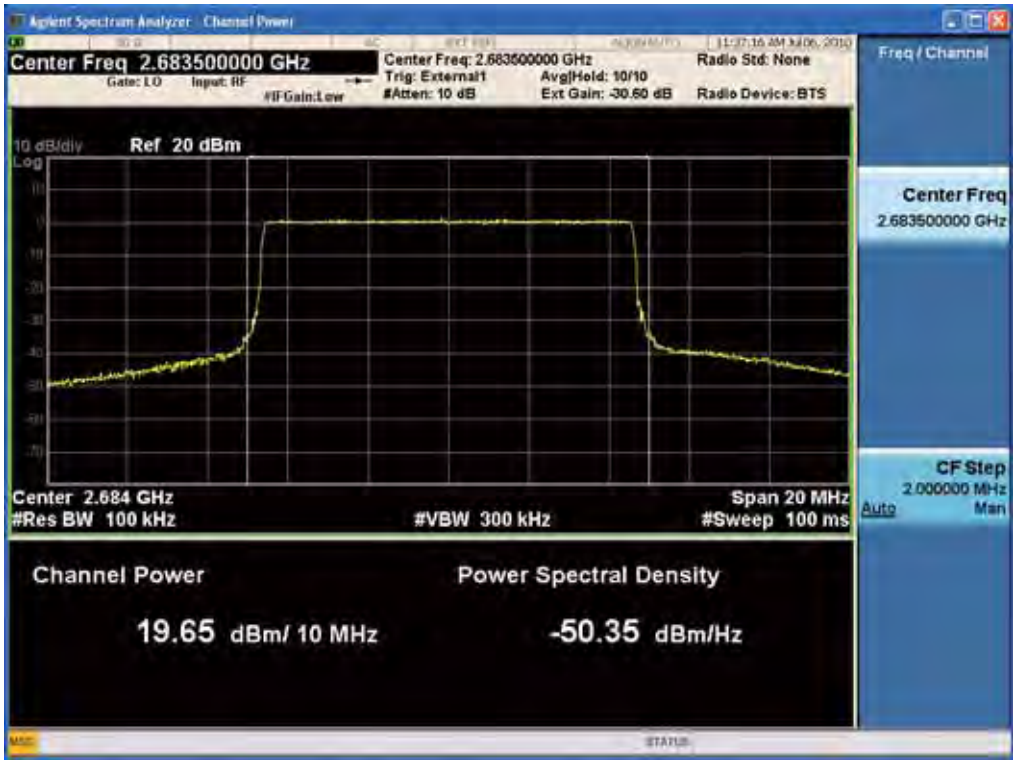
(QPSK Low Channel)



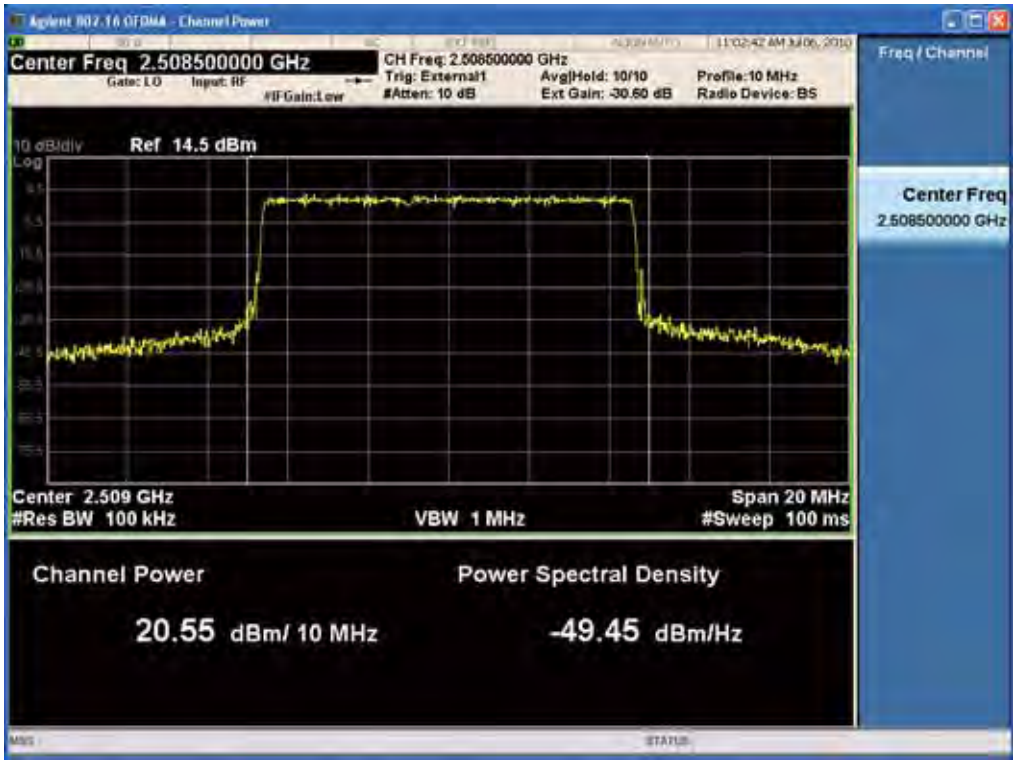
(QPSK Middle Channel)



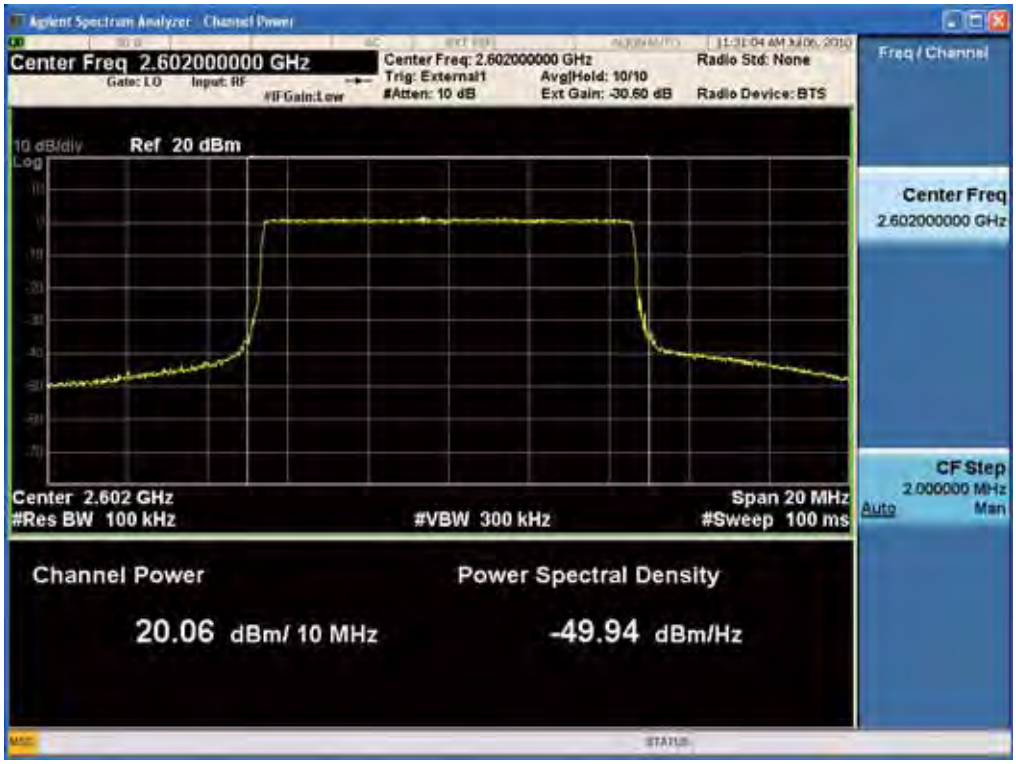
(QPSK High Channel)



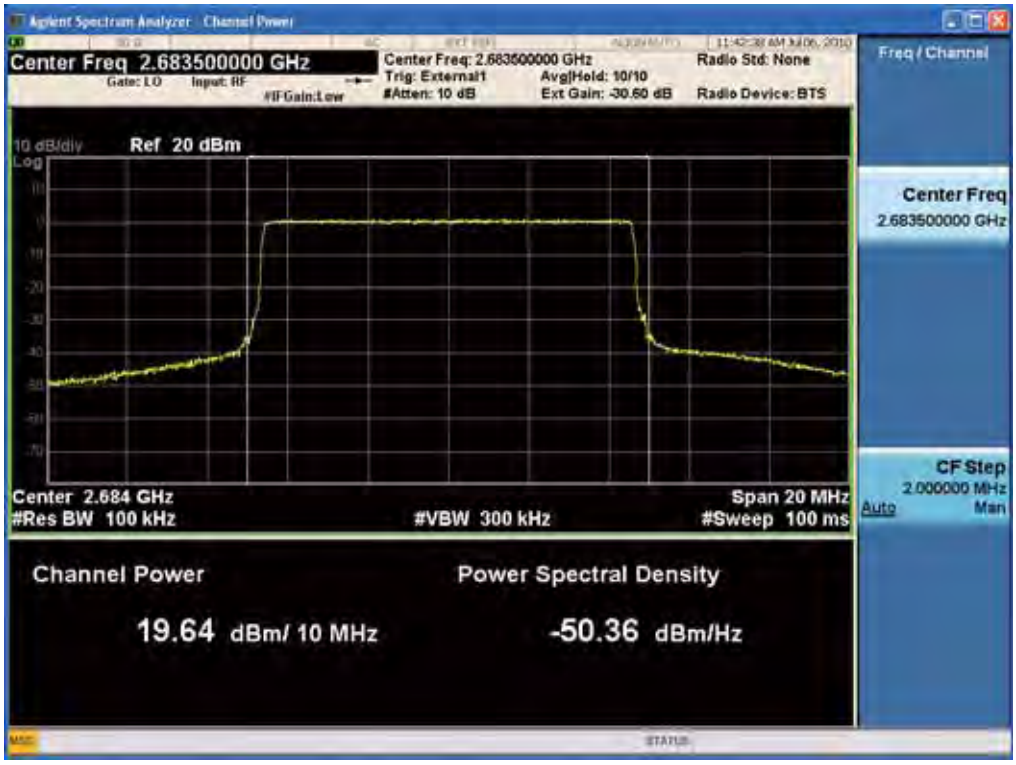
(16QAM Low Channel)



(16QAM Middle Channel)



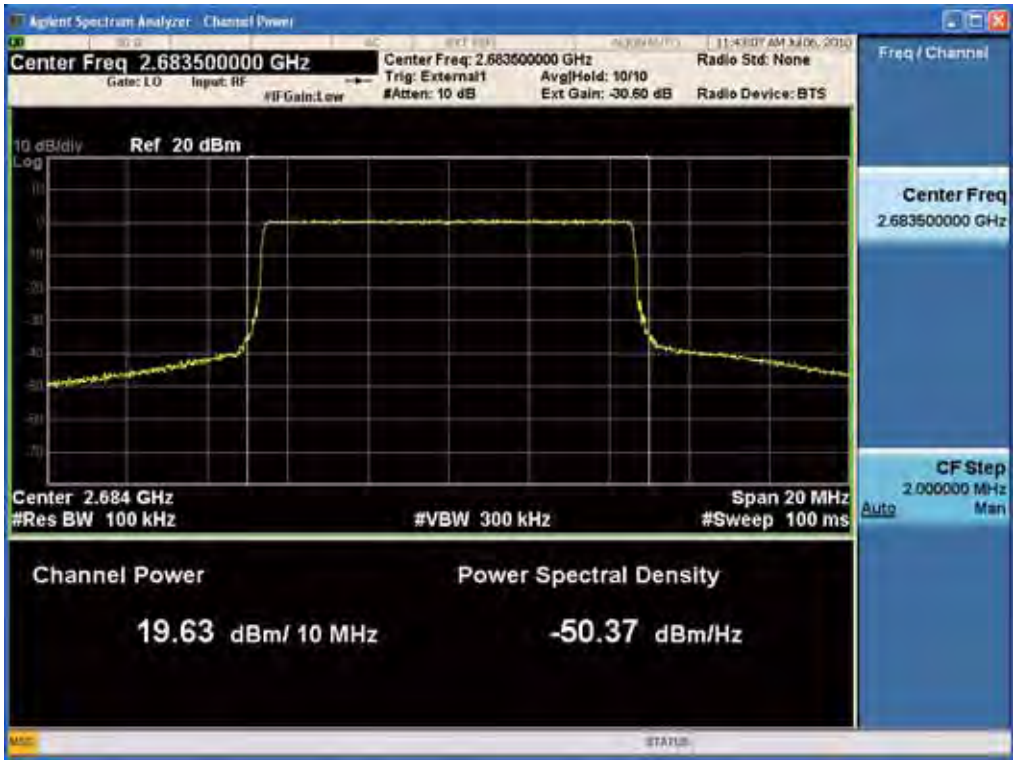
(16QAM High Channel)



(64QAM Low Channel)

(64QAM Middle Channel)

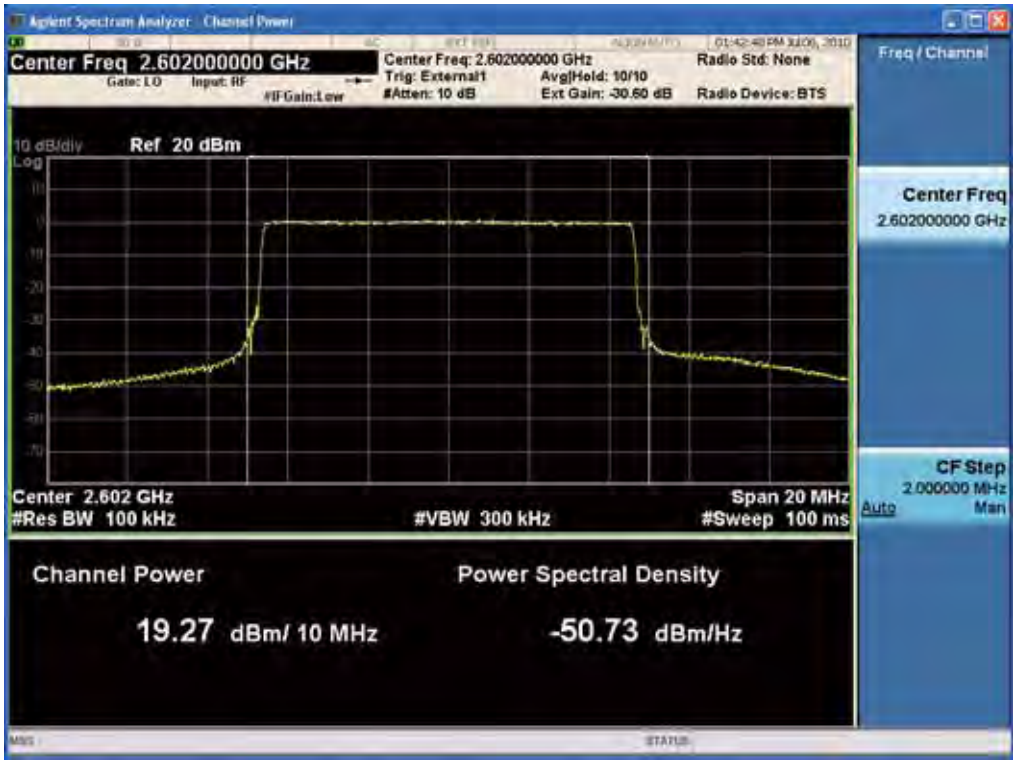
(64QAM High Channel)



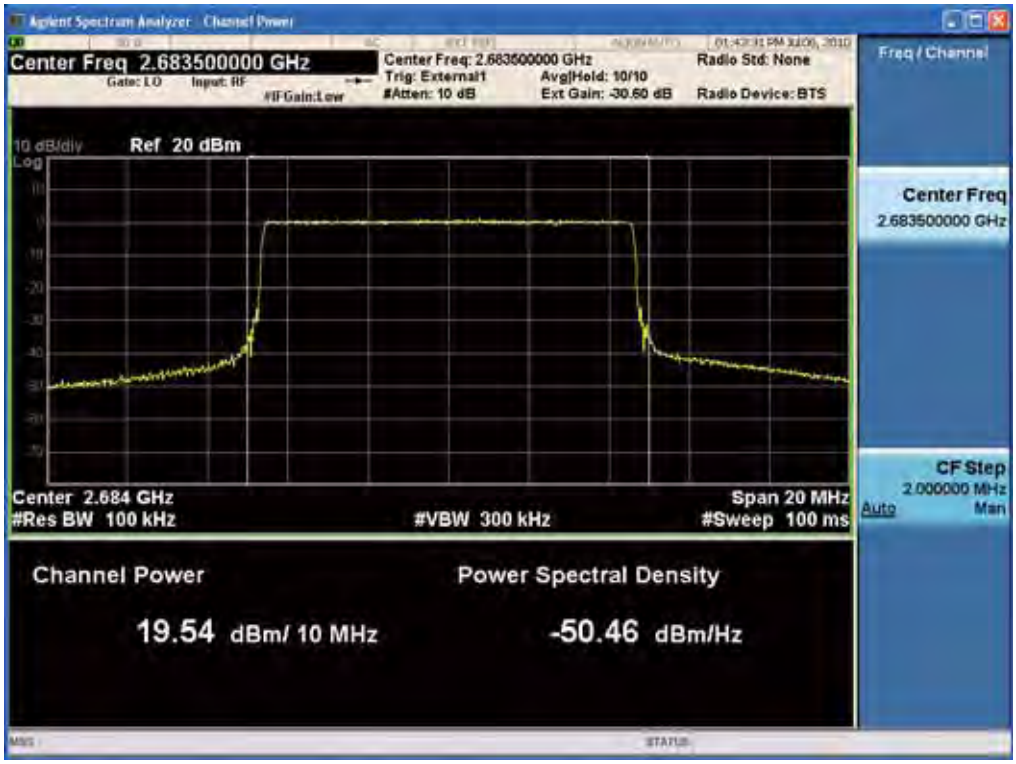
5.4.7. Plot Data for Output 1 (Conducted Output Power)

(QPSK Low Channel)

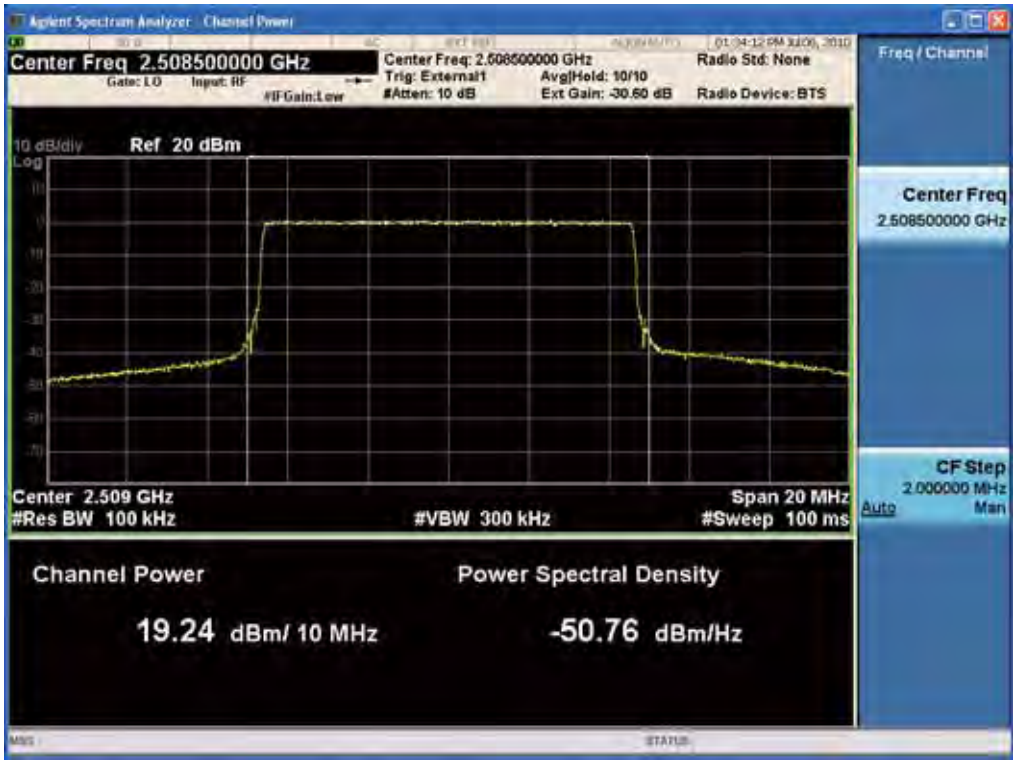
(QPSK Middle Channel)



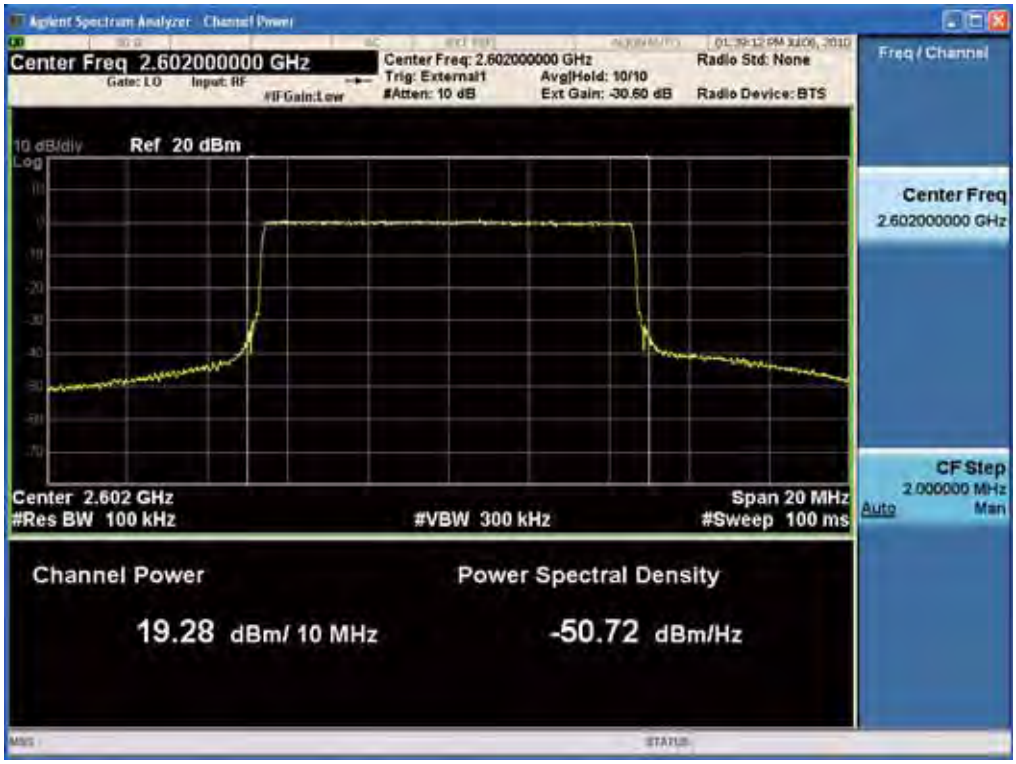
(QPSK High Channel)



(16QAM Low Channel)

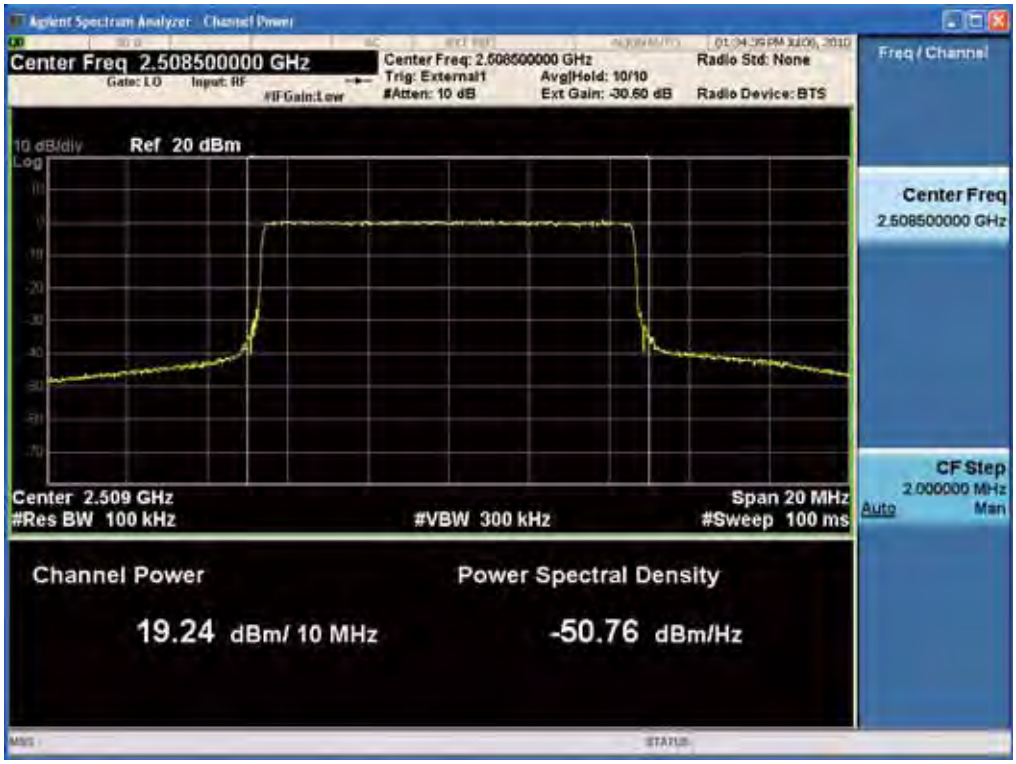


(16QAM Middle Channel)



(16QAM High Channel)

(64QAM Low Channel)

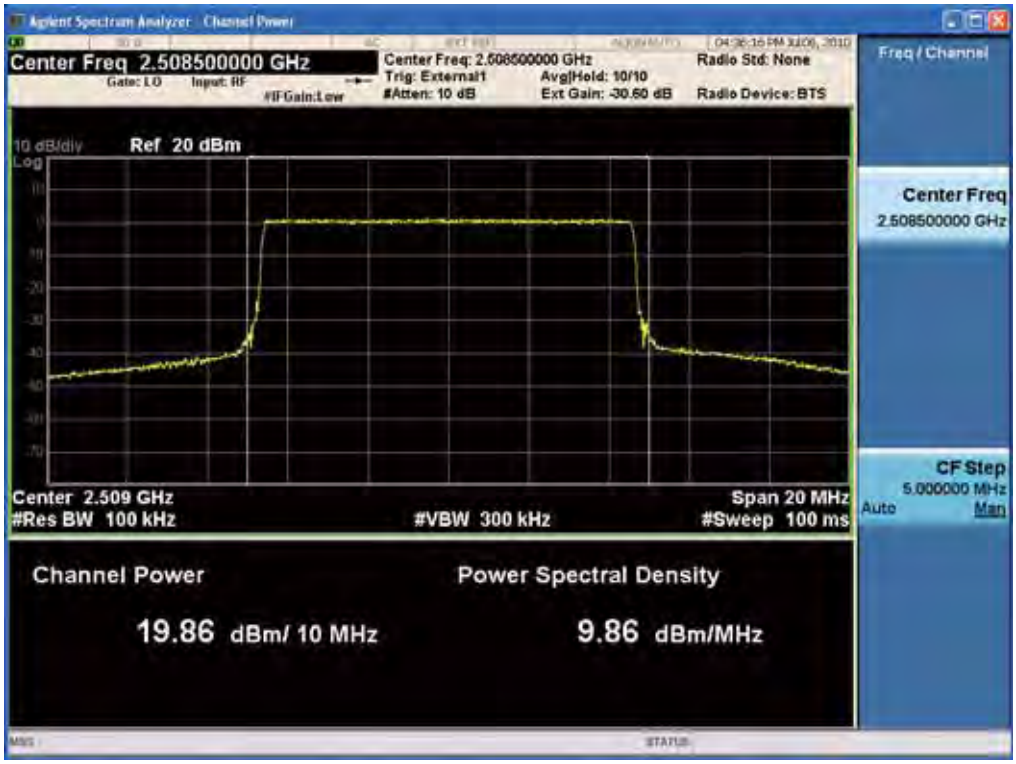


(64QAM Middle Channel)

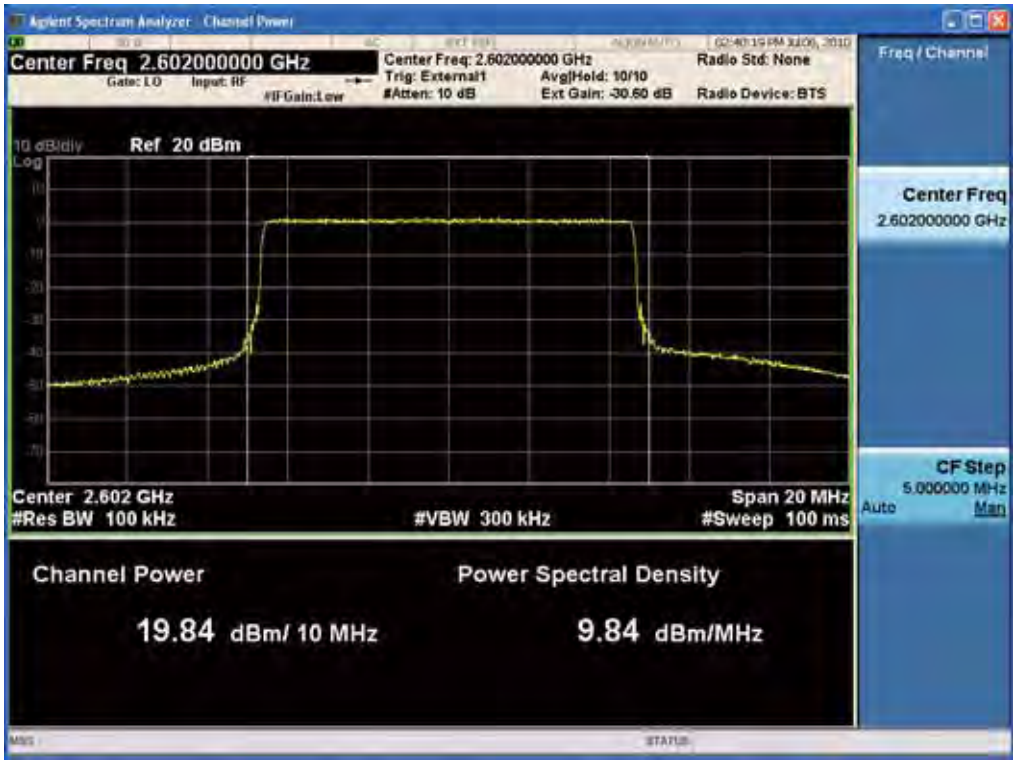
(64QAM High Channel)

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

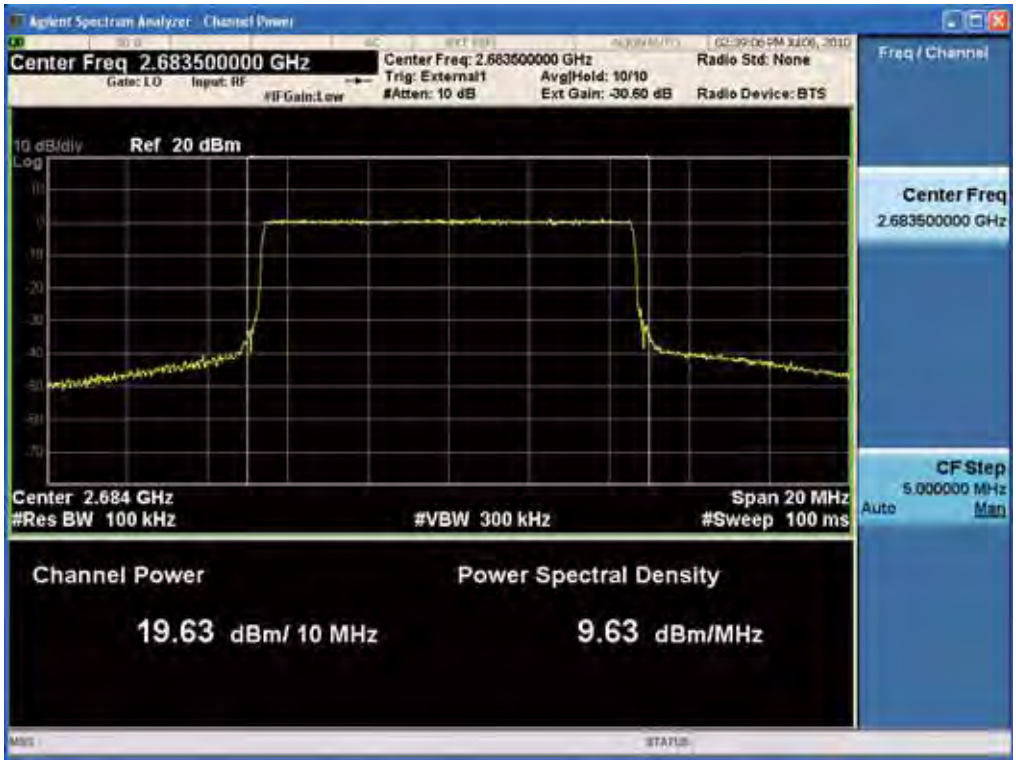
(QPSK Low Channel)



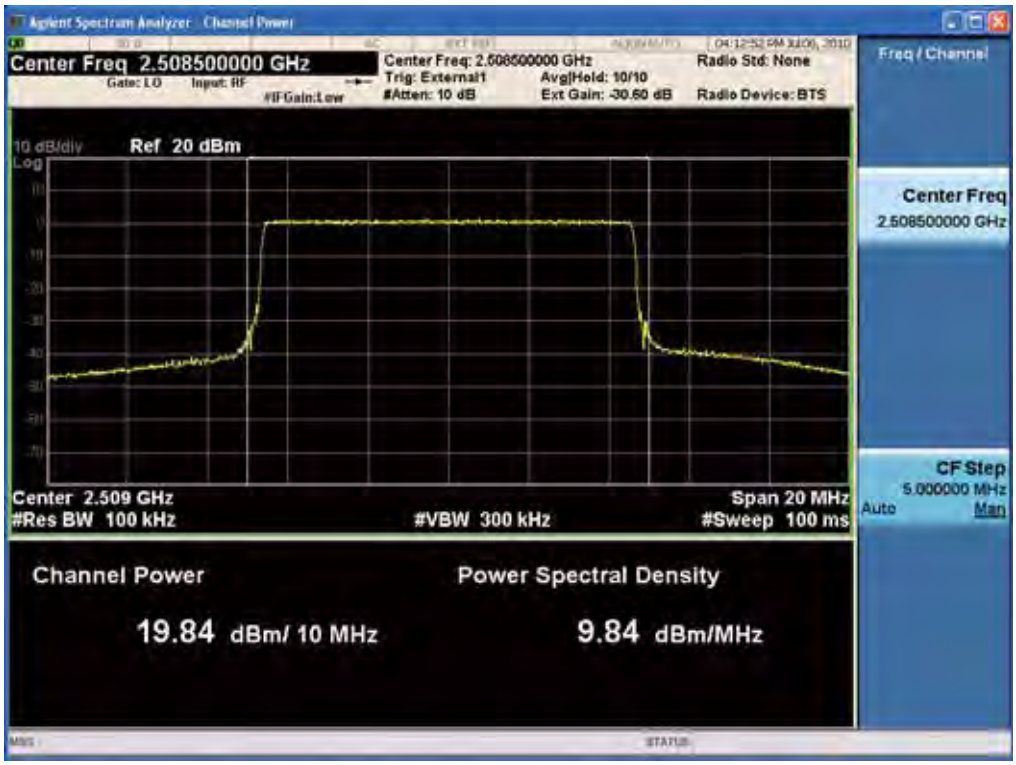
(QPSK Middle Channel)



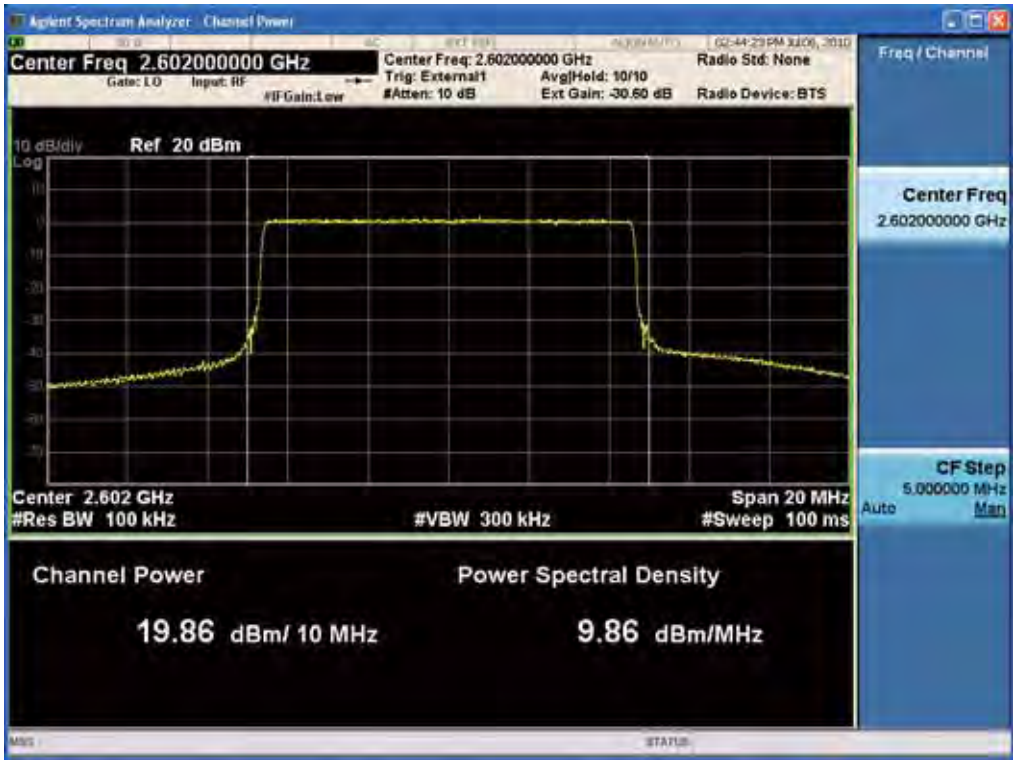
(QPSK High Channel)



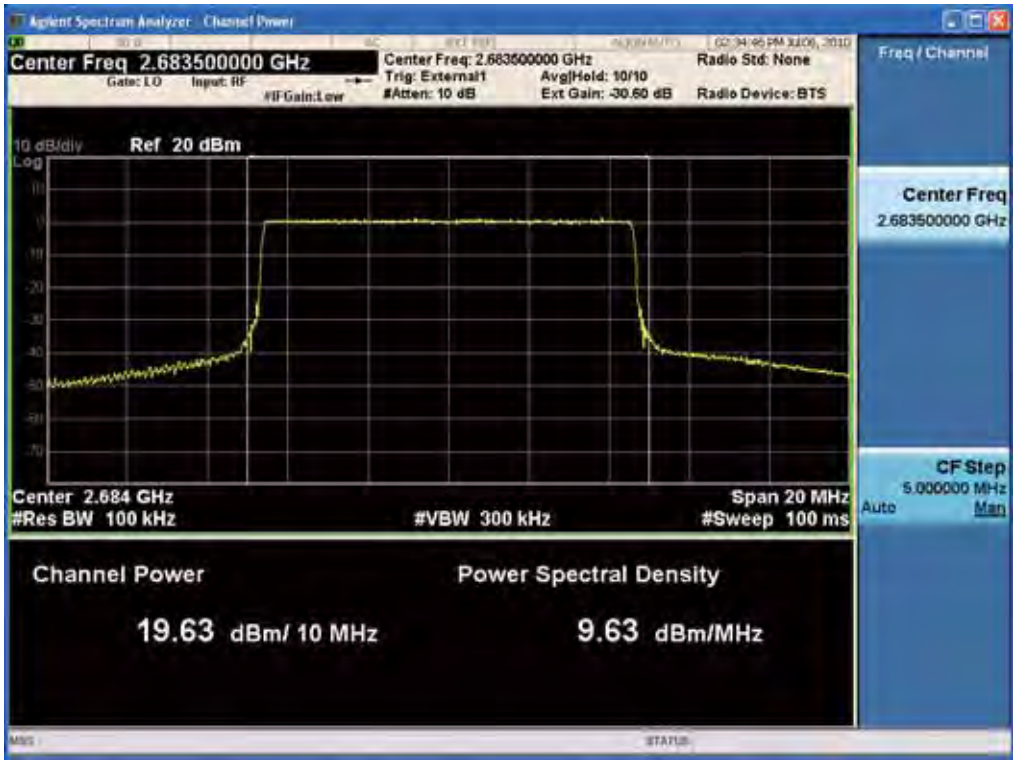
(16QAM Low Channel)



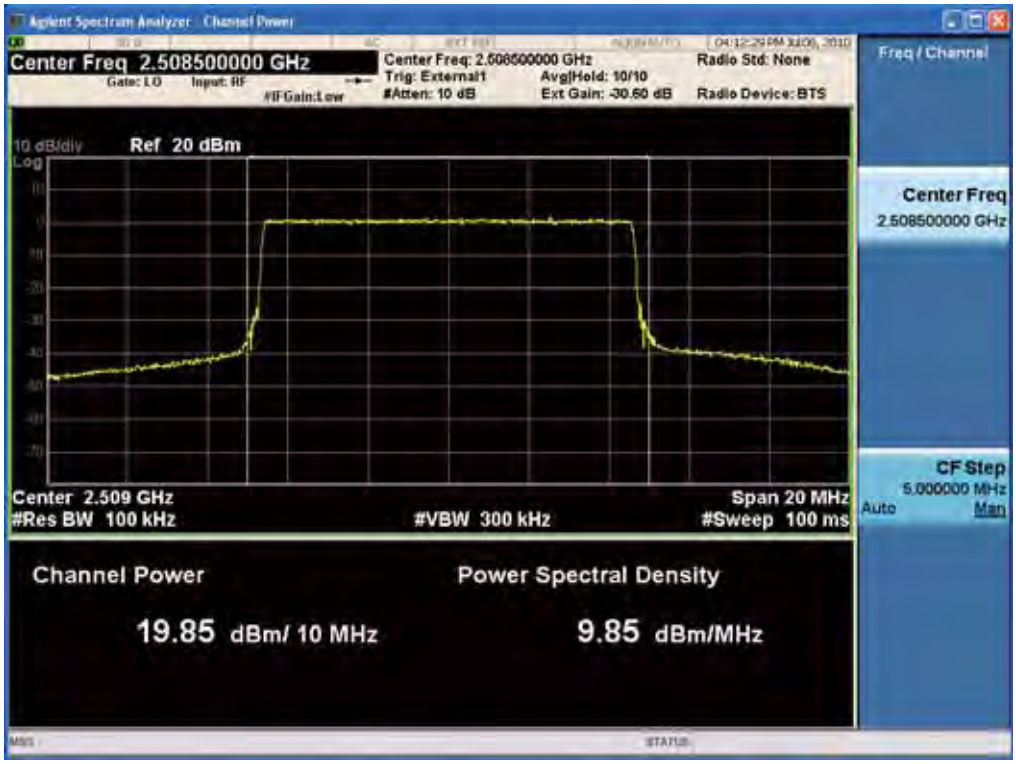
(16QAM Middle Channel)



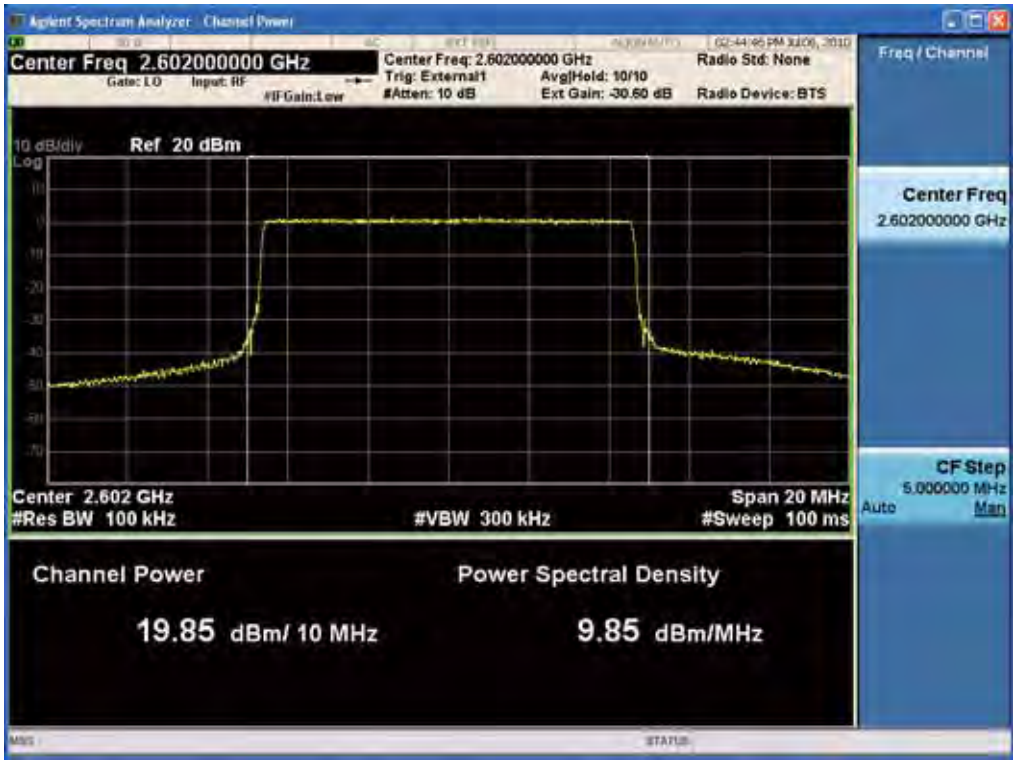
(16QAM High Channel)



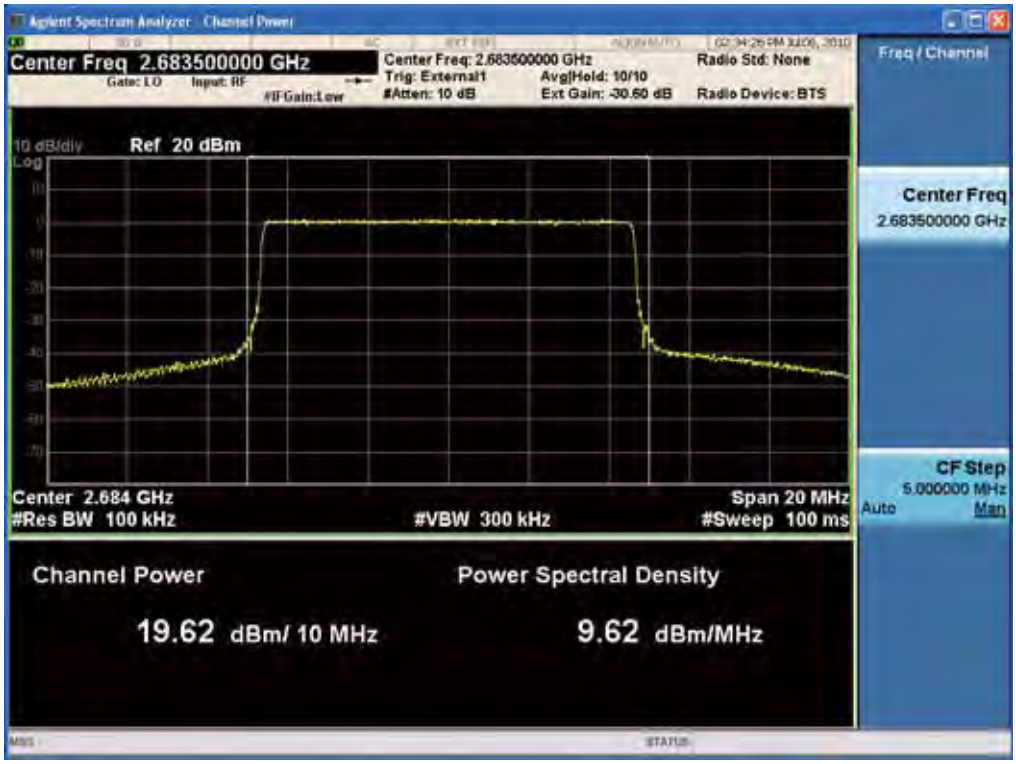
(64QAM Low Channel)



(64QAM Middle Channel)

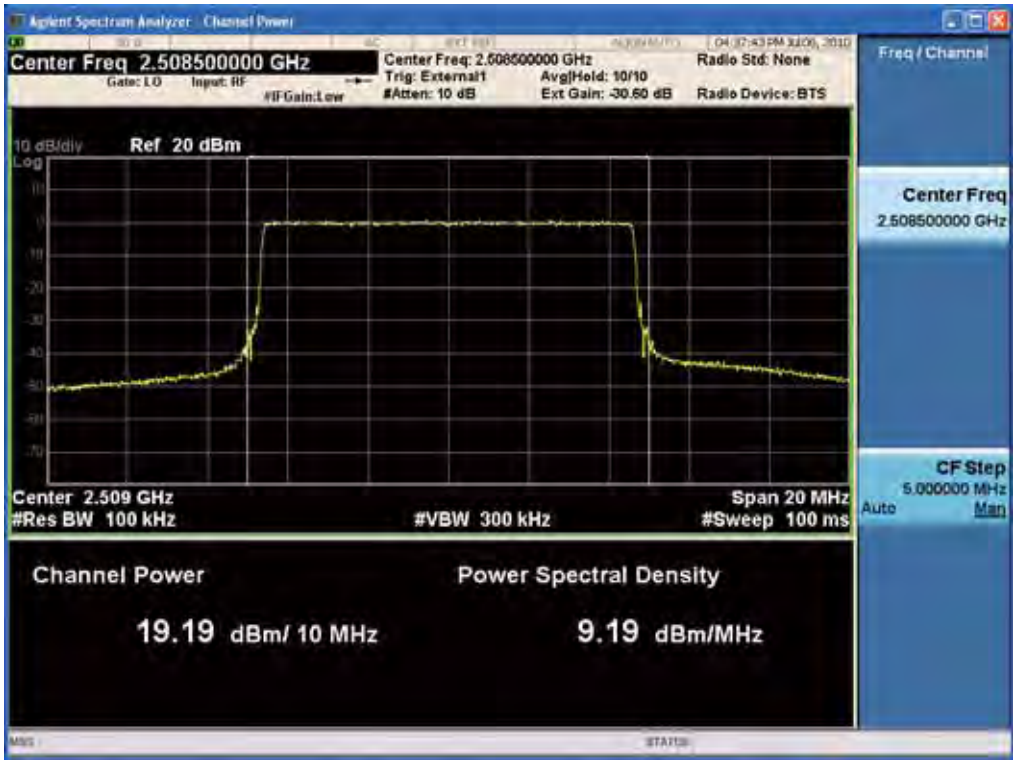


(64QAM High Channel)

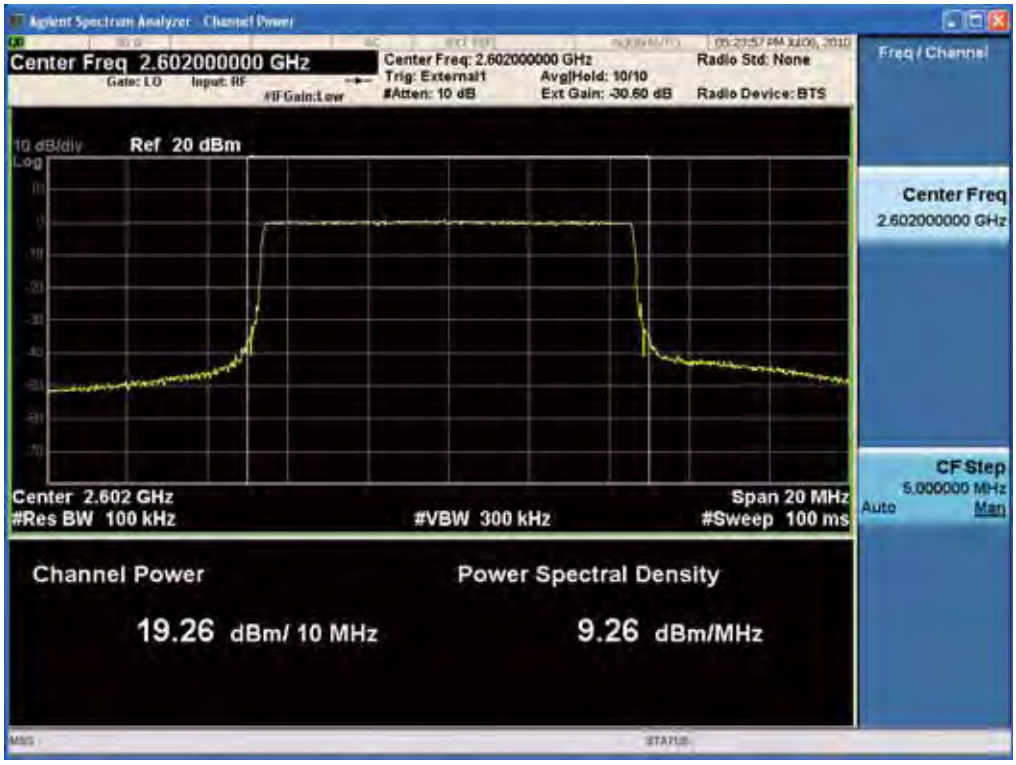


5.4.9. Plot Data for Output 3 (Conducted Output Power)

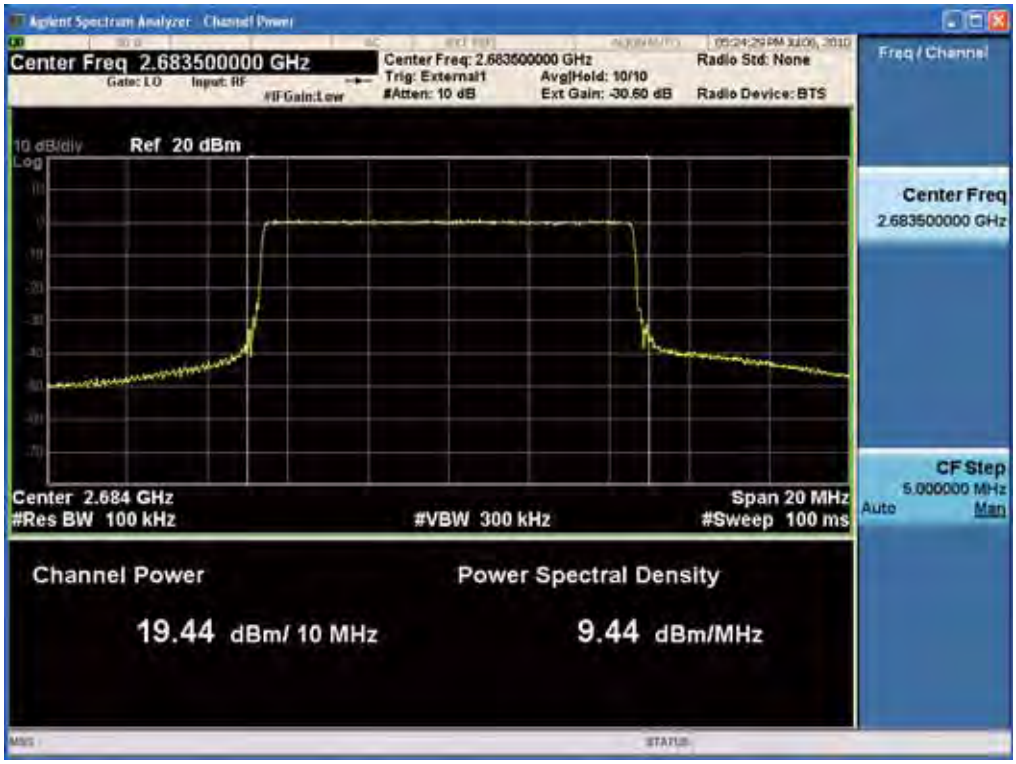
(QPSK Low Channel)



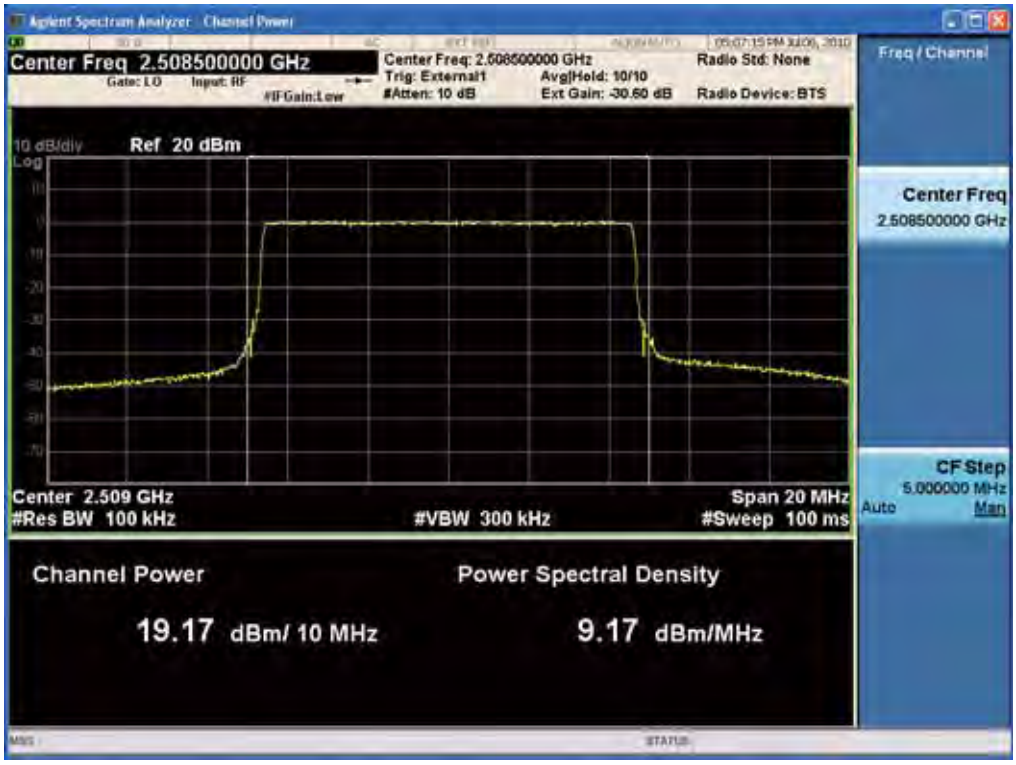
(QPSK Middle Channel)



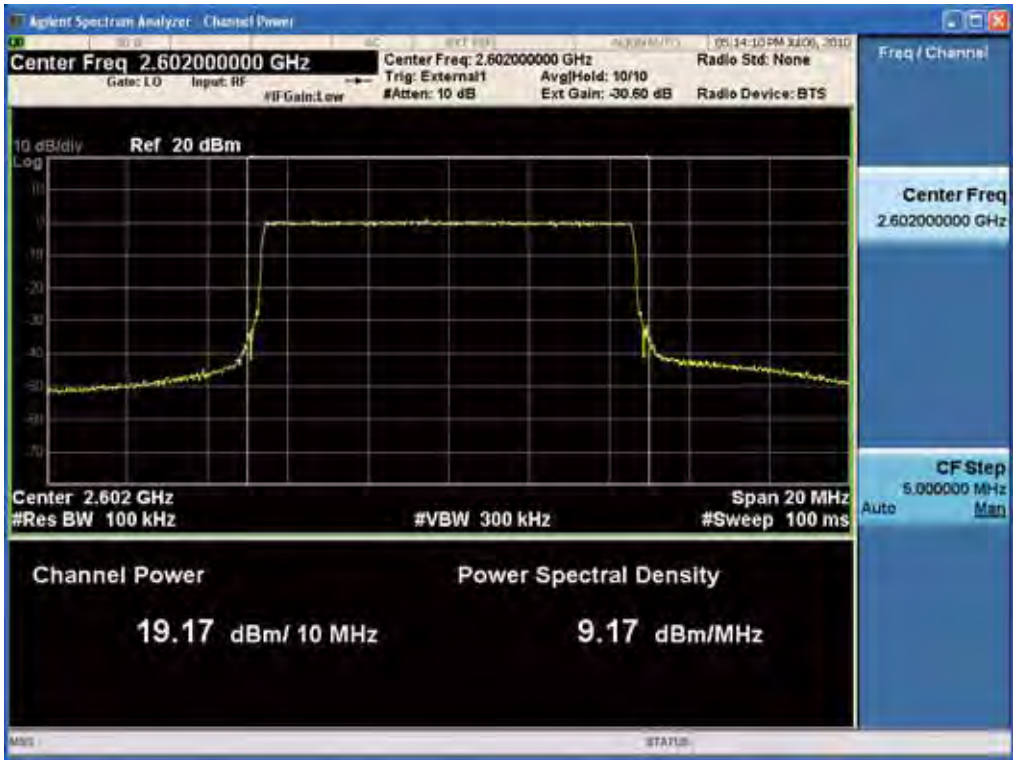
(QPSK High Channel)



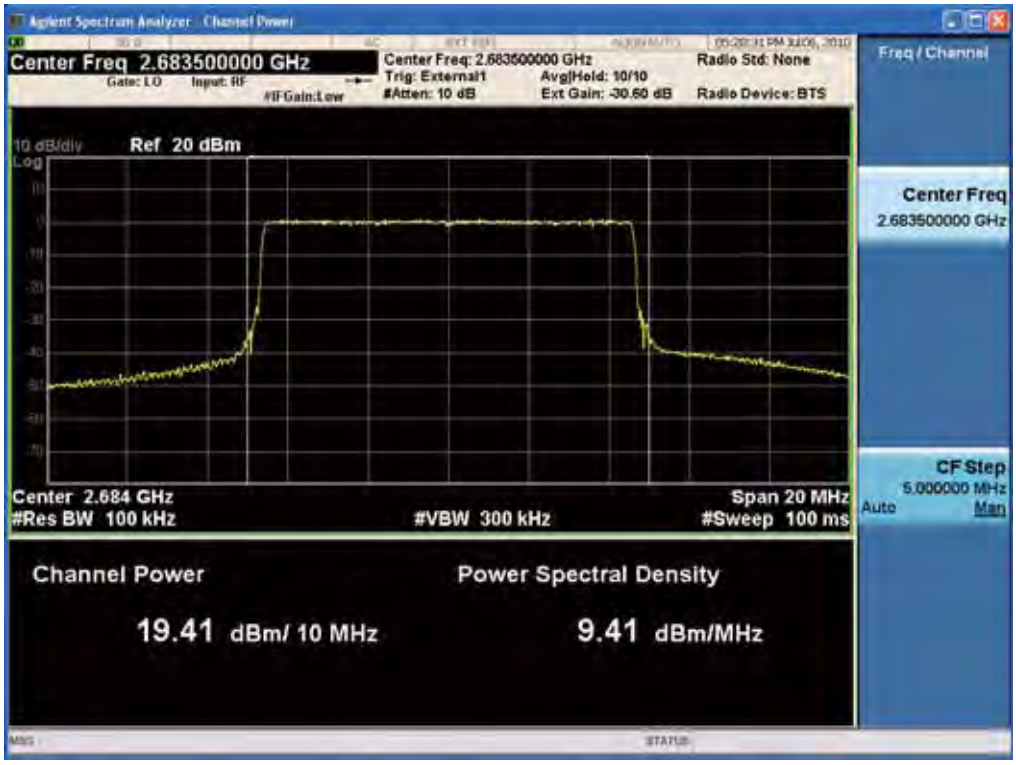
(16QAM Low Channel)



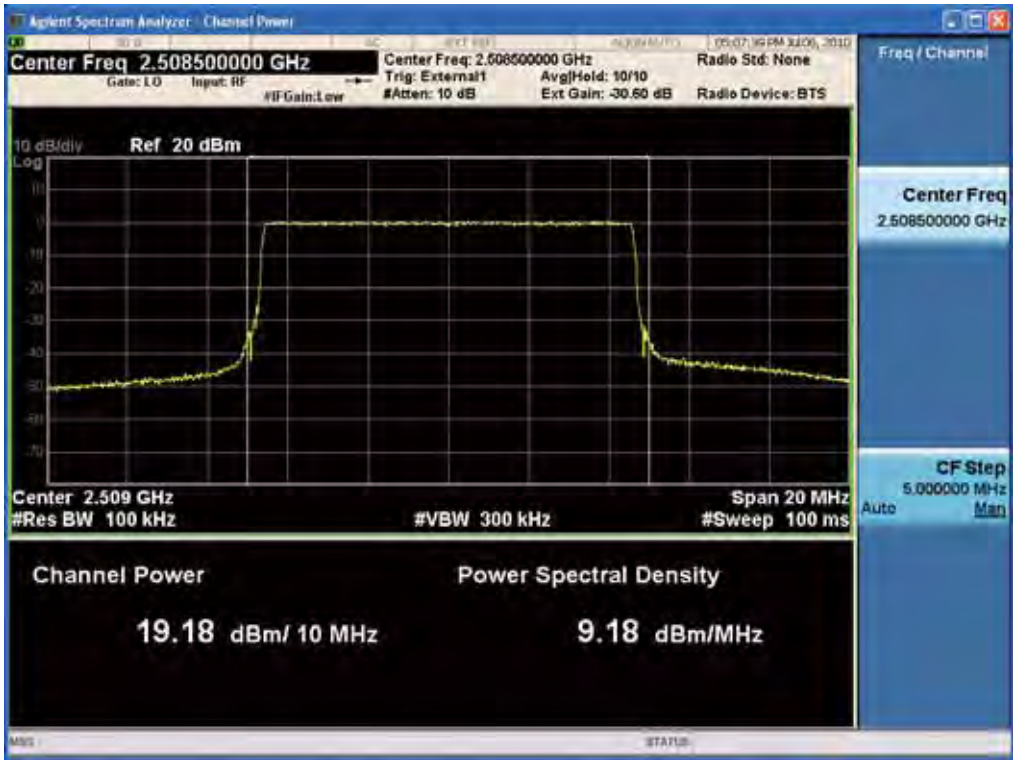
(16QAM Middle Channel)



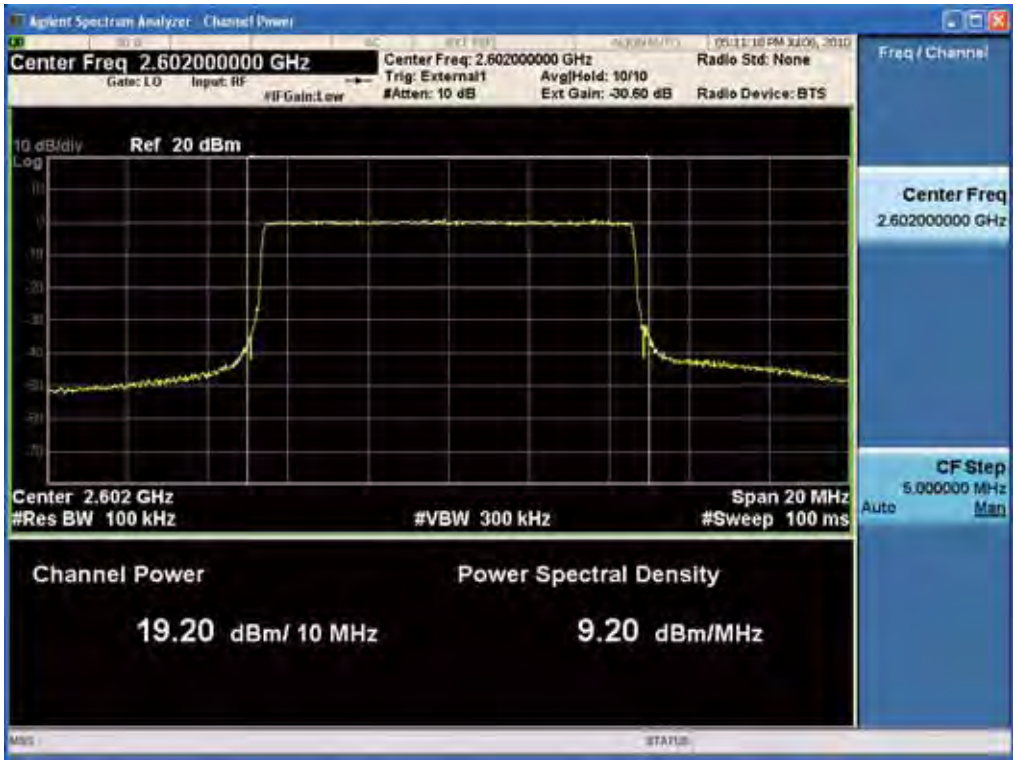
(16QAM High Channel)



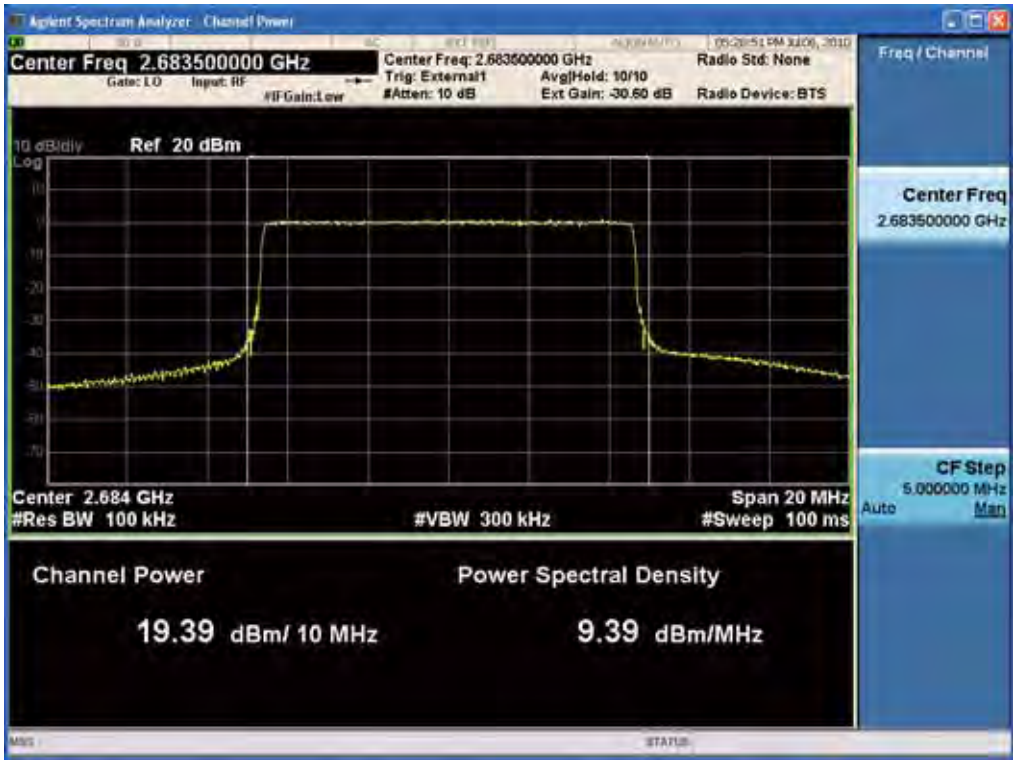
(64QAM Low Channel)



(64QAM Middle Channel)

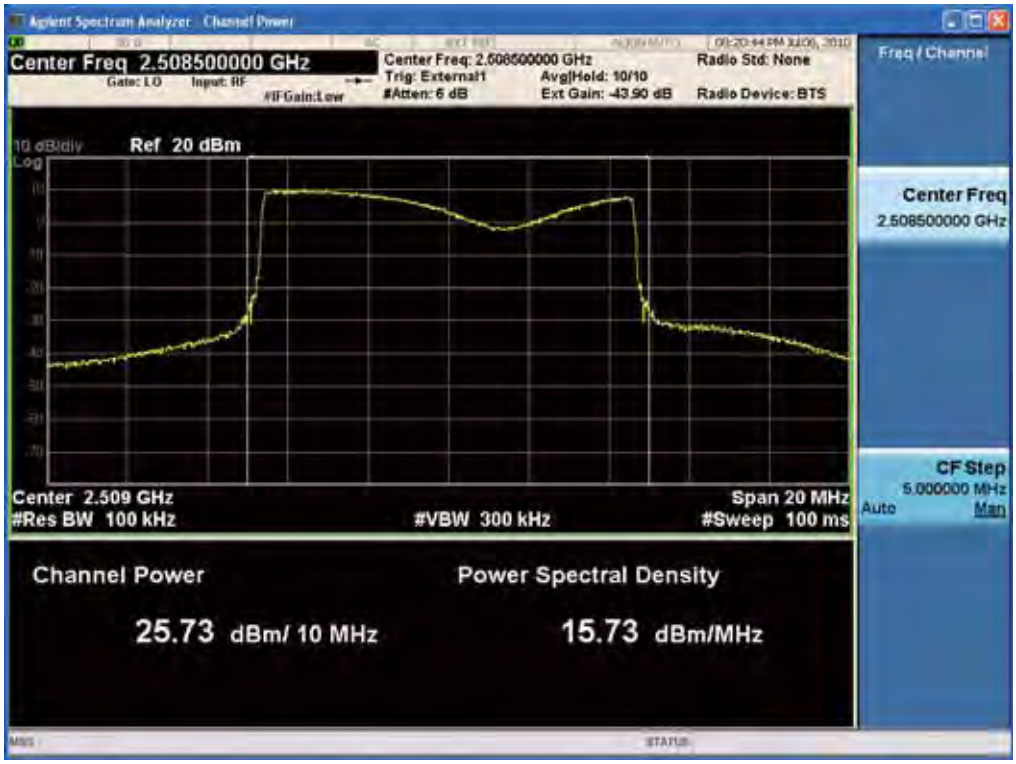


(64QAM High Channel)



5.4.10. Combined Plot Data for Output (Conducted Output Power)

(QPSK Low Channel)

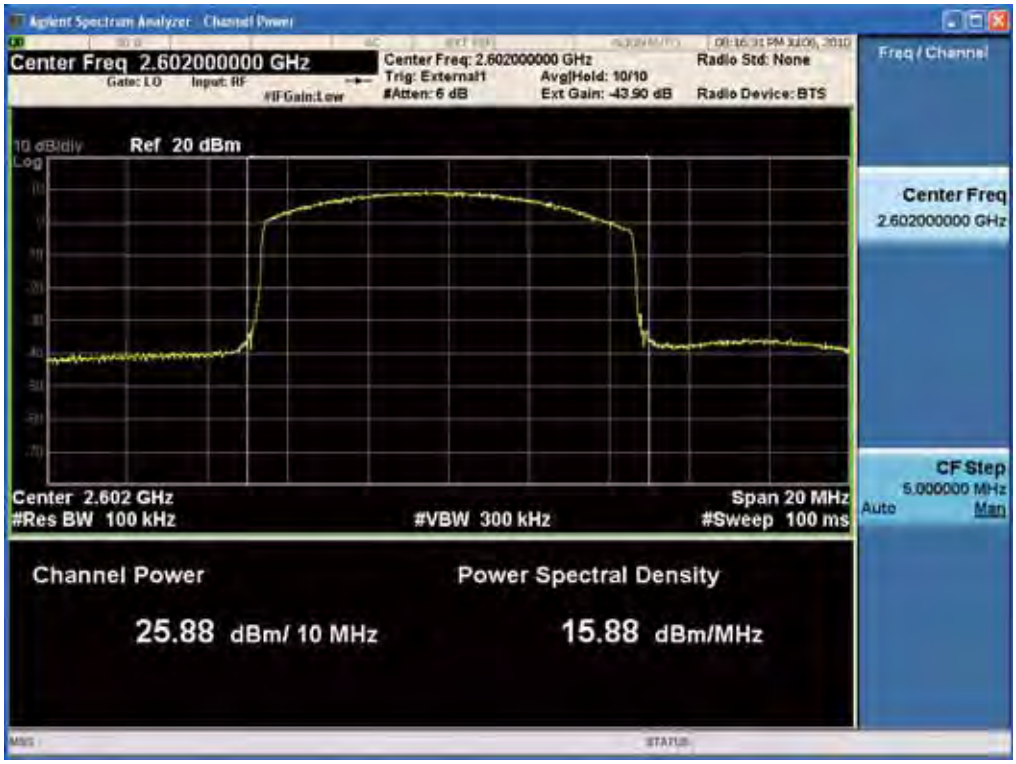


(QPSK Middle Channel)

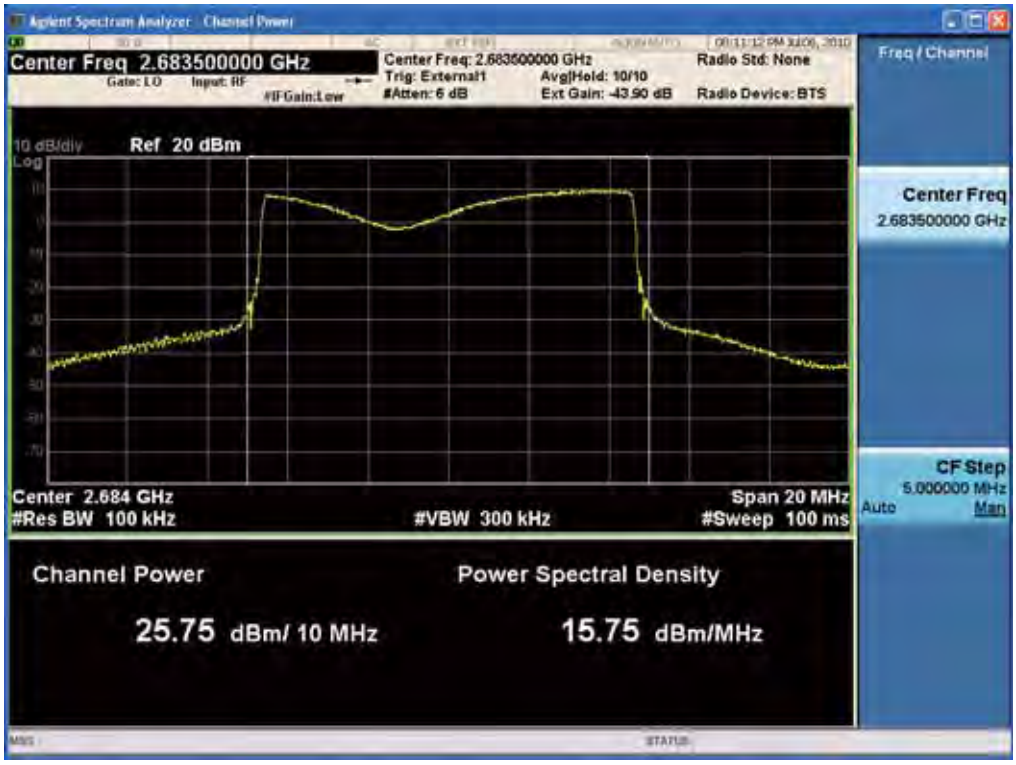
(QPSK High Channel)

(16QAM Low Channel)

(16QAM Middle Channel)



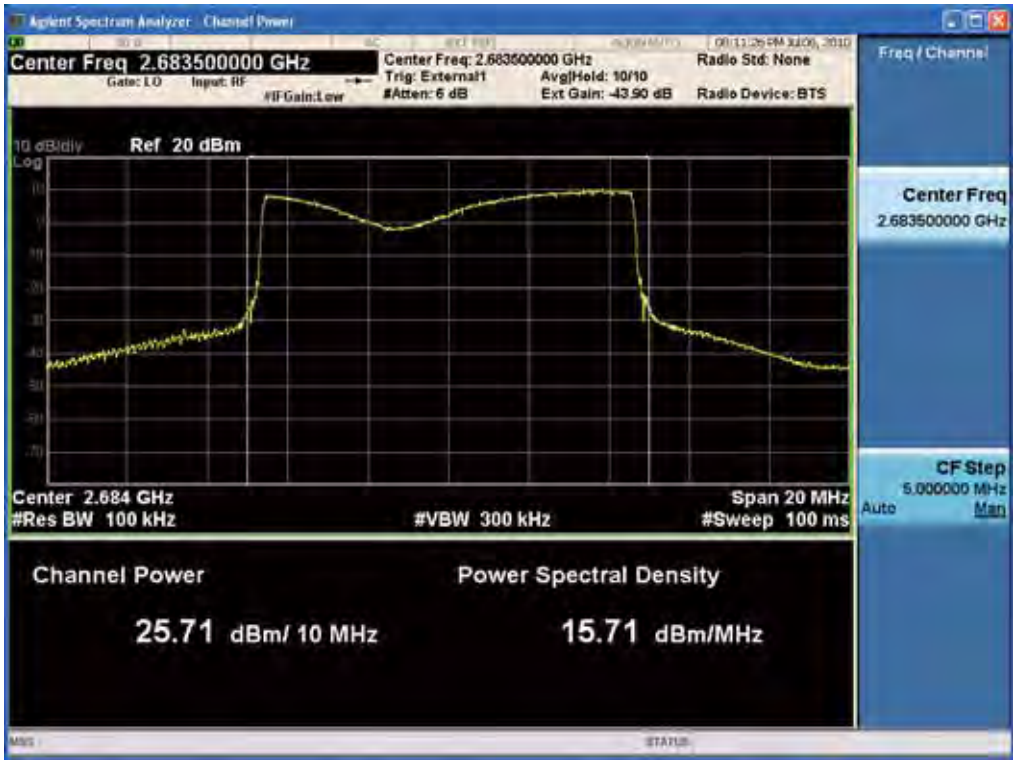
(16QAM High Channel)



(64QAM Low Channel)

(64QAM Middle Channel)

(64QAM High Channel)



6. OCCUPIED BANDWIDTH

6.1. Applicable Standard

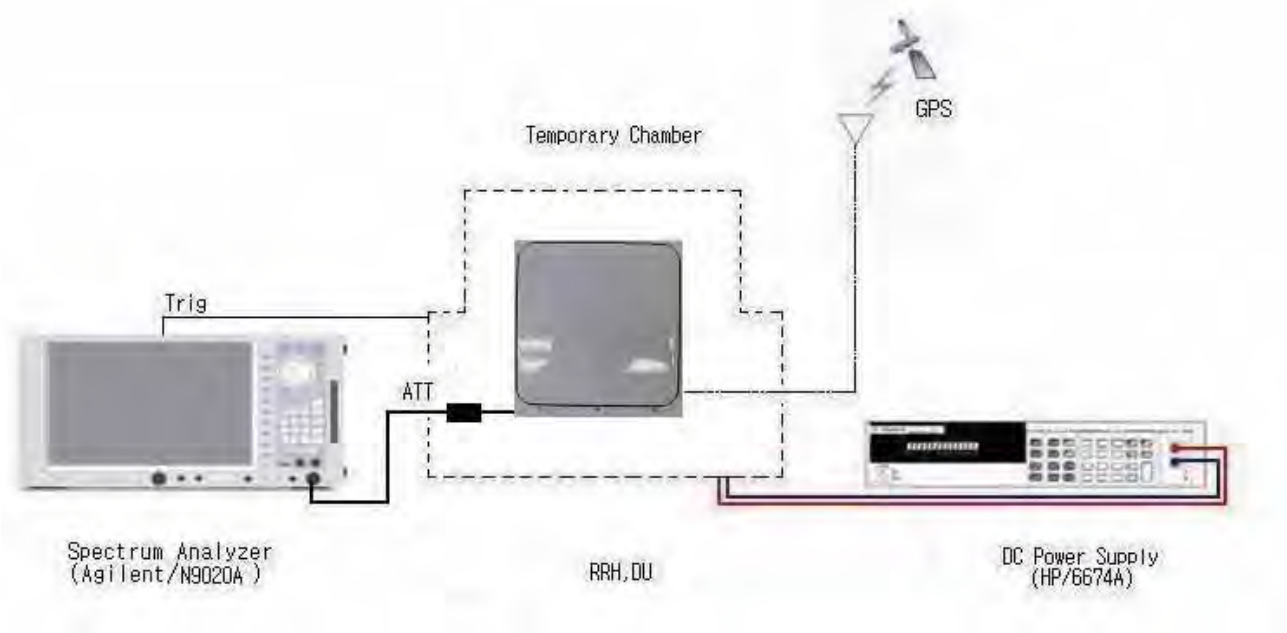
Requirements: CFR 47, Section 27.53(m)(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth 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	6674A / DC Power Supply	3501A00901	05/14/2011
Agilent	8498A / Attenuator	51161	01/06/2011
Agilent	8498A / Attenuator	51162	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BU5347	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BR0530	01/14/2011
Agilent	N9020A / MXA Signal Analyzer	US46220219	03/03/2011
Agilent	11636B / Power Divider	11377	12/24/2010
Cernex	CDPU5260404K/ Power Divider-4WAY	14695	02/08/2011

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 analyser 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 analyser. It was set to measure the bandwidth where 99% of the signal power was contained. The analyser automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.

6.3.1. Environmental Conditions:

Temperature:	25 ℃
Relative Humidity:	59 %

6.4. Test Result

: PASS

6.4.1. Test Data at Output Port 0

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.1126	9.469
	Middle	2602.0	9.1113	9.463
	High	2683.5	9.1111	9.468
16QAM	Low	2508.5	9.1135	9.515
	Middle	2602.0	9.1152	9.499
	High	2683.5	9.1114	9.503
64QAM	Low	2508.5	9.1105	9.520
	Middle	2602.0	9.1067	9.475
	High	2683.5	9.1124	9.508

6.4.2. Test Data at Output Port 1

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.1096	9.446
	Middle	2602.0	9.1091	9.456
	High	2683.5	9.1107	9.451
16QAM	Low	2508.5	9.1099	9.452
	Middle	2602.0	9.1100	9.449
	High	2683.5	9.1100	9.448
64QAM	Low	2508.5	9.1087	9.444
	Middle	2602.0	9.1117	9.448
	High	2683.5	9.1098	9.445

6.4.3. Test Data at Output Port 2

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.1072	9.461
	Middle	2602.0	9.1067	9.449
	High	2683.5	9.1053	9.469
16QAM	Low	2508.5	9.1091	9.464
	Middle	2602.0	9.1056	9.458
	High	2683.5	9.1095	9.437
64QAM	Low	2508.5	9.1084	9.457
	Middle	2602.0	9.1096	9.475
	High	2683.5	9.1069	9.458

6.4.4. Test Data at Output Port 3

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.1098	9.454
	Middle	2602.0	9.1068	9.469
	High	2683.5	9.1101	9.453
16QAM	Low	2508.5	9.1053	9.454
	Middle	2602.0	9.1041	9.458
	High	2683.5	9.1110	9.472
64QAM	Low	2508.5	9.1073	9.488
	Middle	2602.0	9.1101	9.461
	High	2683.5	9.1130	9.471

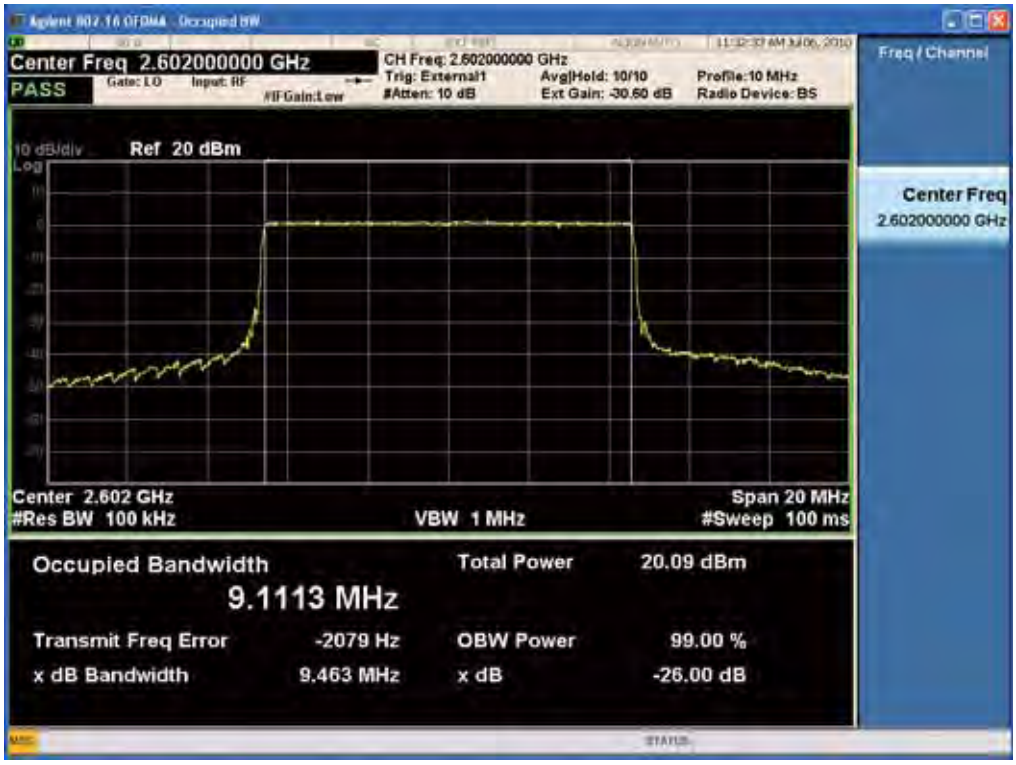
6.4.5. Combined Test Data at Output Port

Modulation	Channel	Frequency	Measured Bandwidth	
			99 %	26 dB
QPSK	Low	2508.5	9.1606	9.459
	Middle	2602.0	8.6946	9.371
	High	2683.5	9.1691	9.475
16QAM	Low	2508.5	9.1616	9.447
	Middle	2602.0	8.6961	9.366
	High	2683.5	9.1680	9.450
64QAM	Low	2508.5	9.1591	9.450
	Middle	2602.0	8.6951	9.373
	High	2683.5	9.1721	9.476

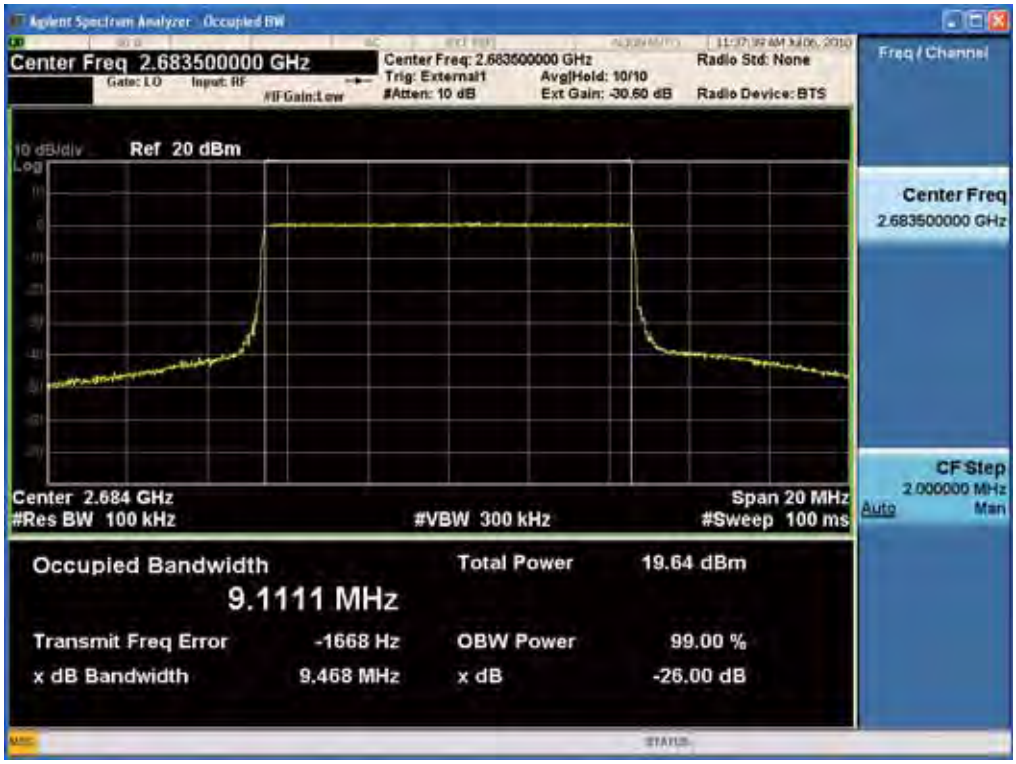
6.4.6. Test Plot at Output Port 0

(QPSK Low Channel)

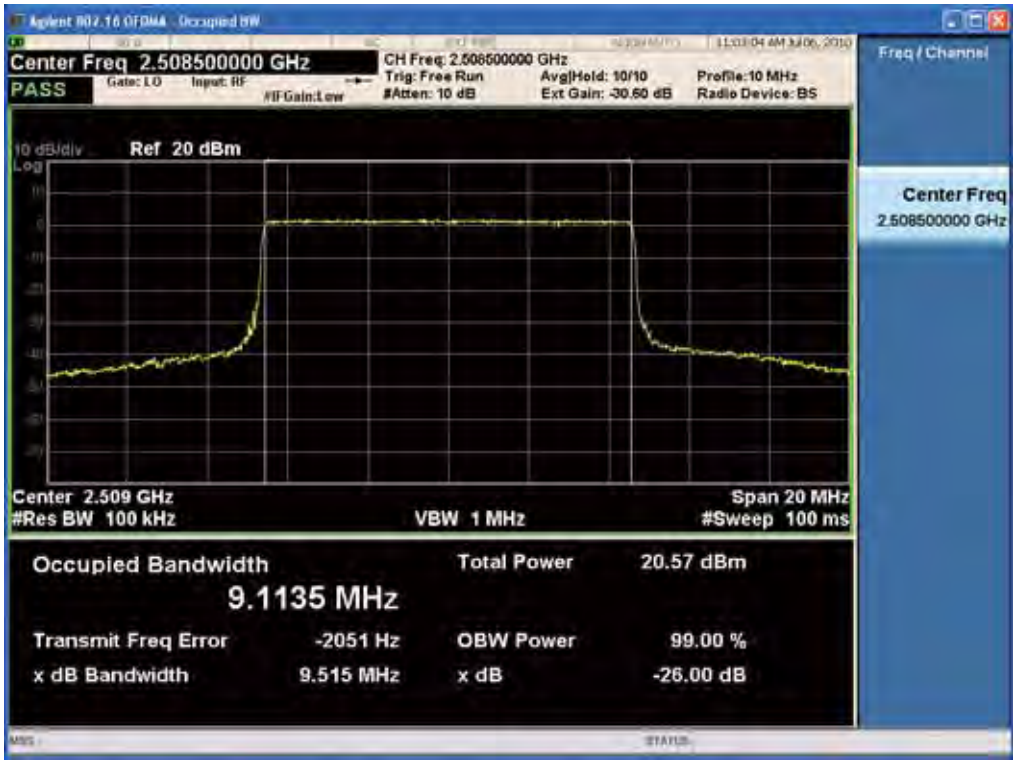
(QPSK Middle Channel)



(QPSK High Channel)

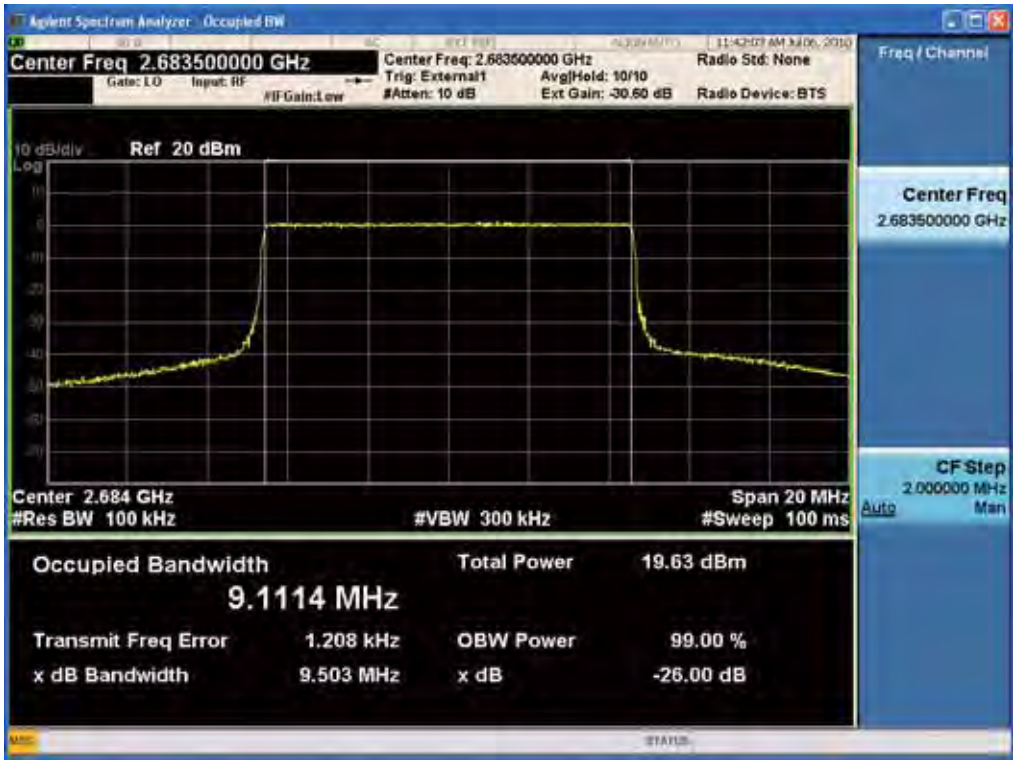


(16QAM Low Channel)

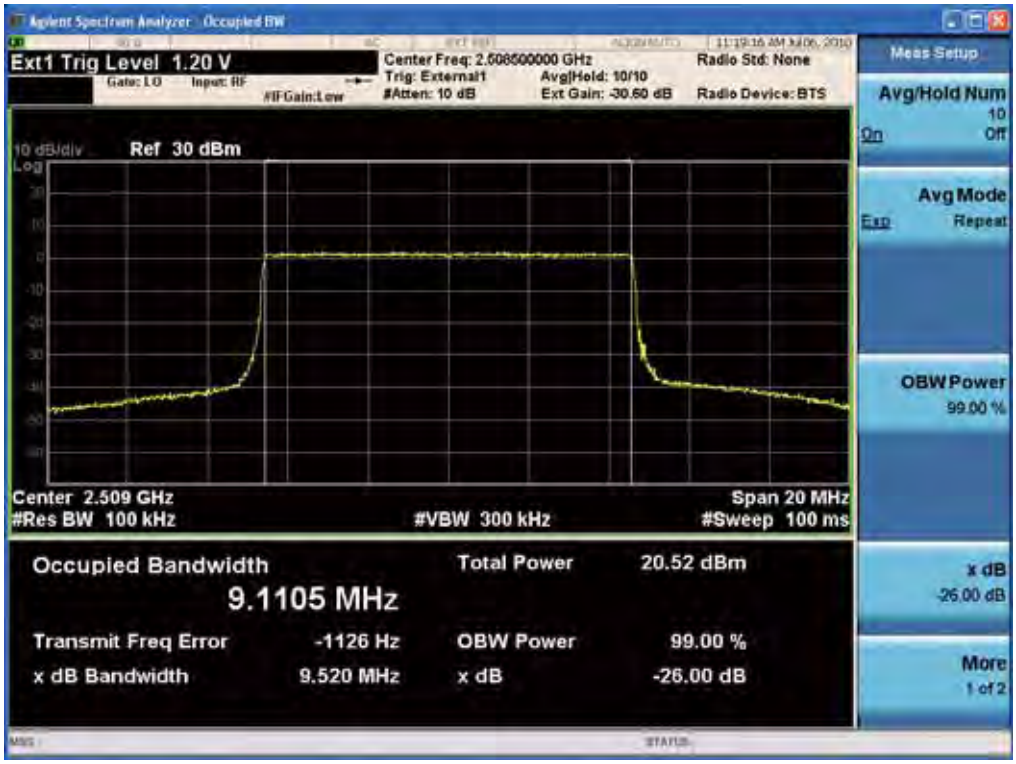


(16QAM Middle Channel)

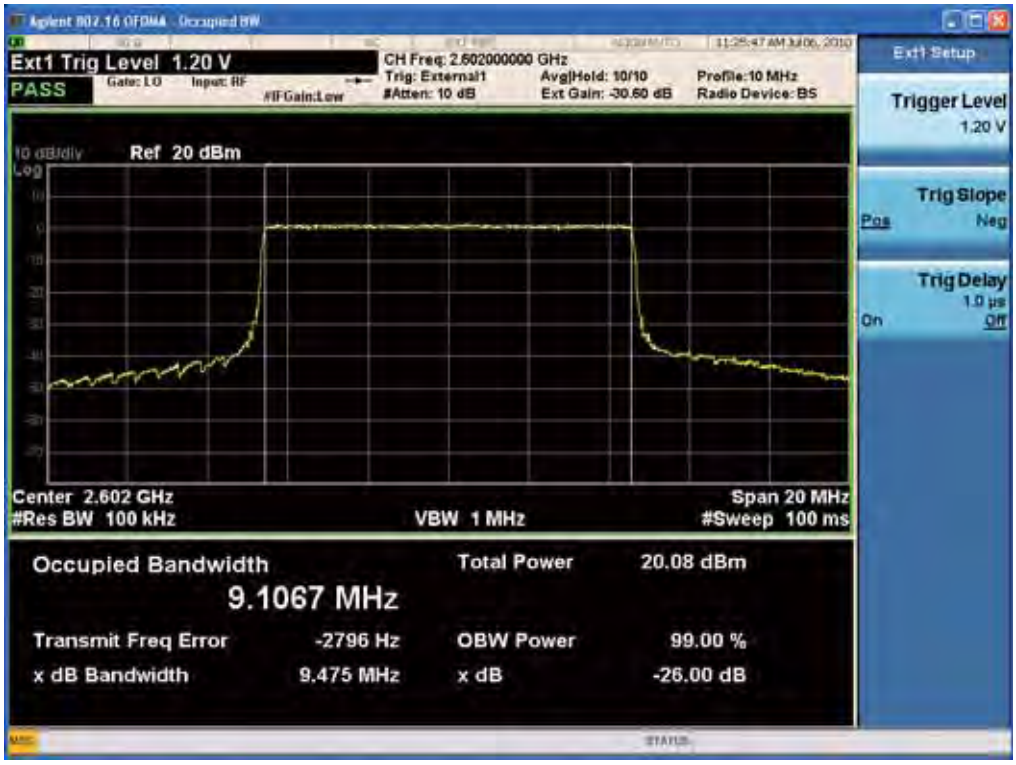
(16QAM High Channel)



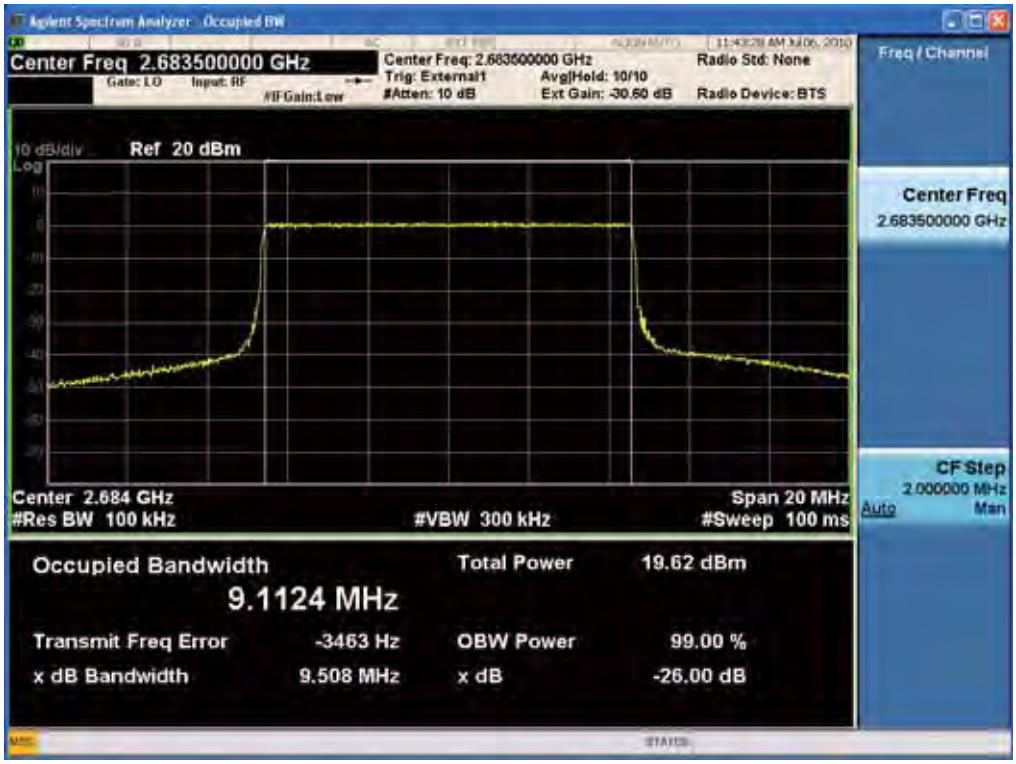
(64QAM Low Channel)



(64QAM Middle Channel)



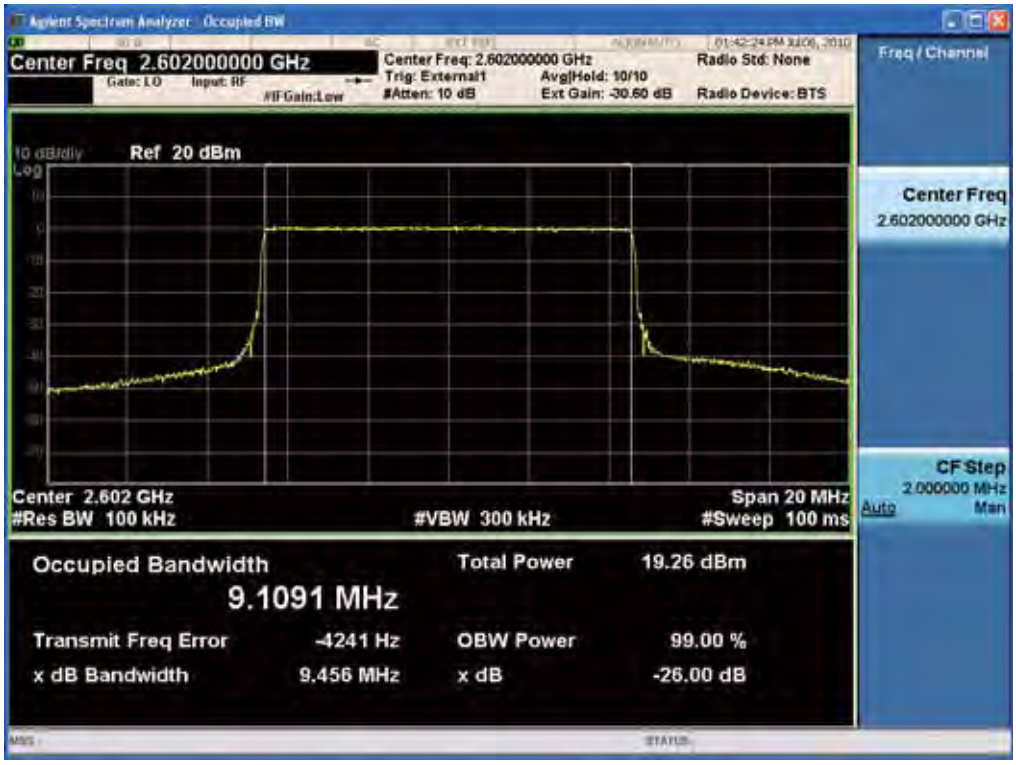
(64QAM High Channel)



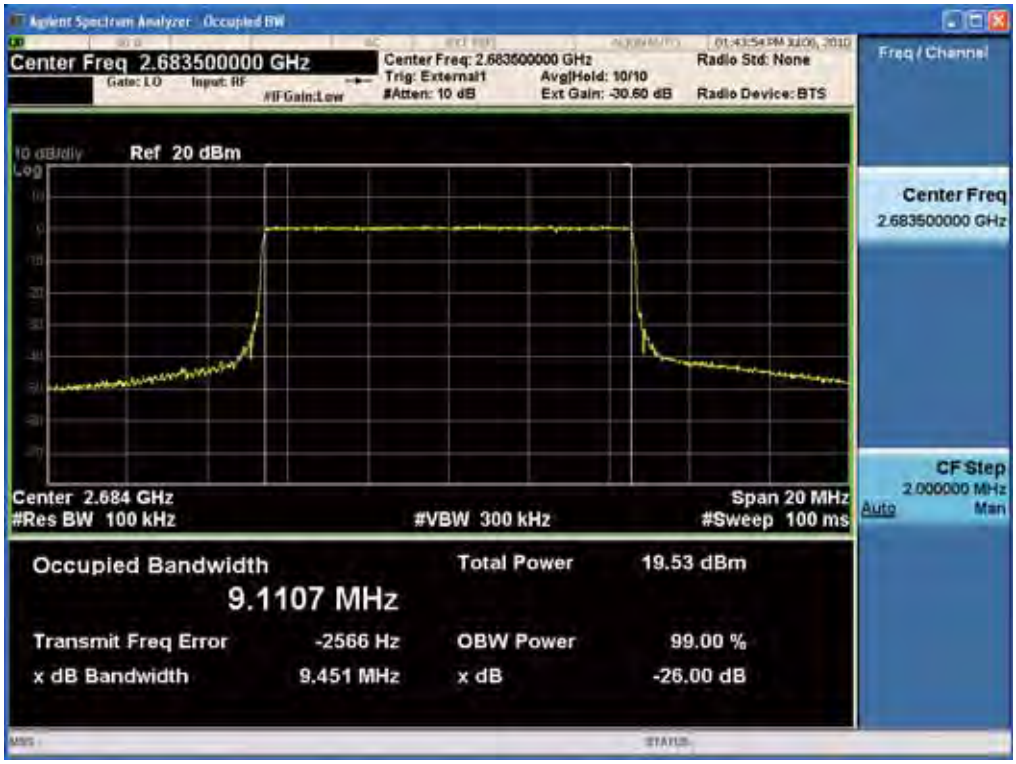
6.4.7. Test Plot at Output Port 1

(QPSK Low Channel)

(QPSK Middle Channel)

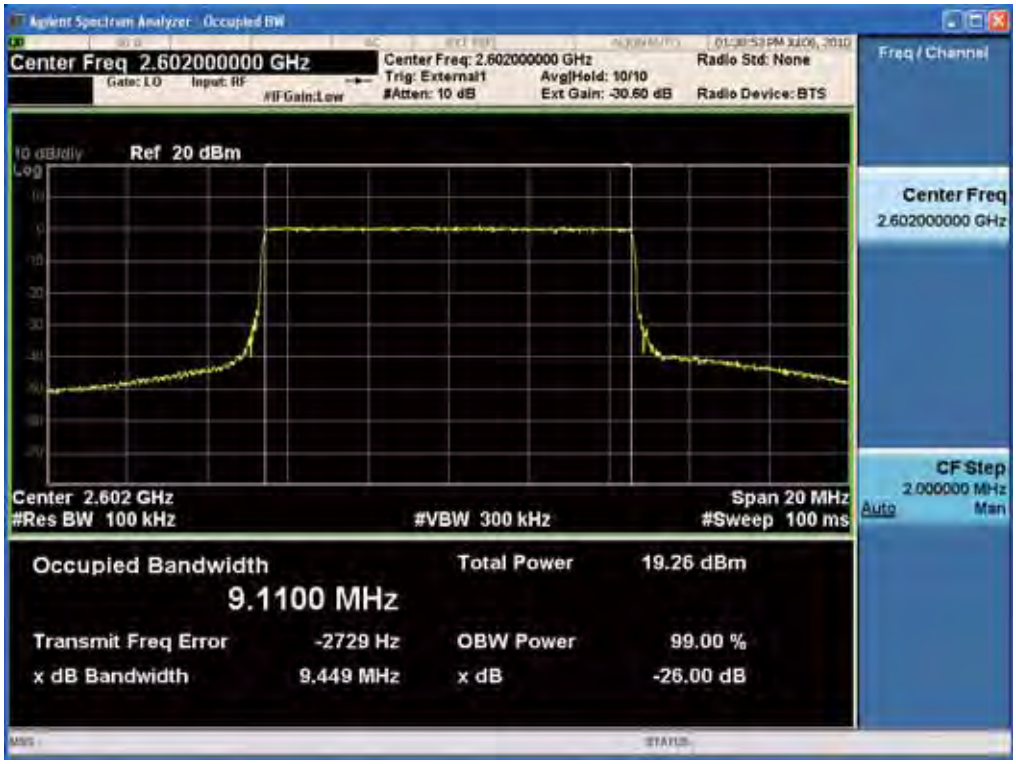


(QPSK High Channel)

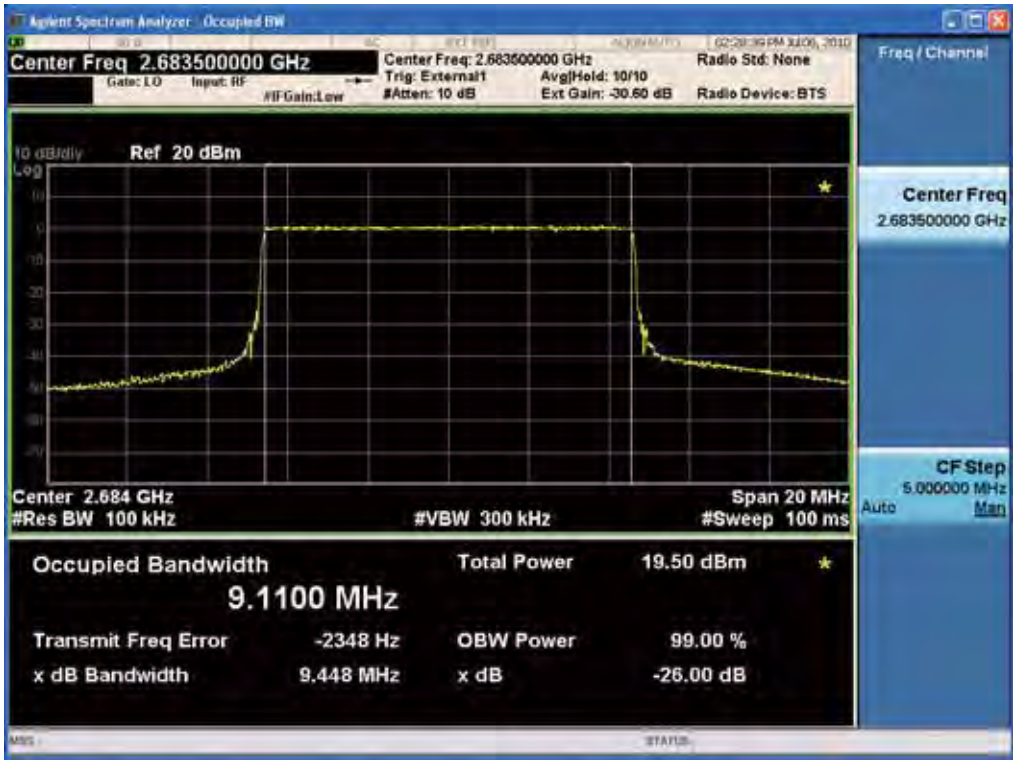


(16QAM Low Channel)

(16QAM Middle Channel)

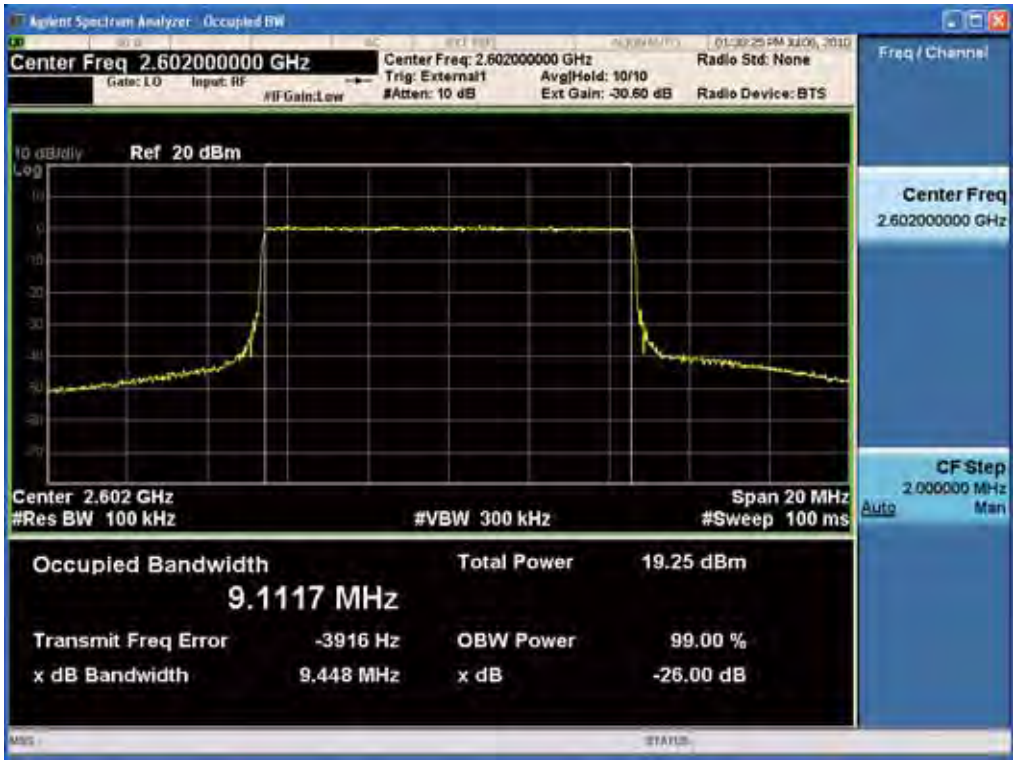


(16QAM High Channel)

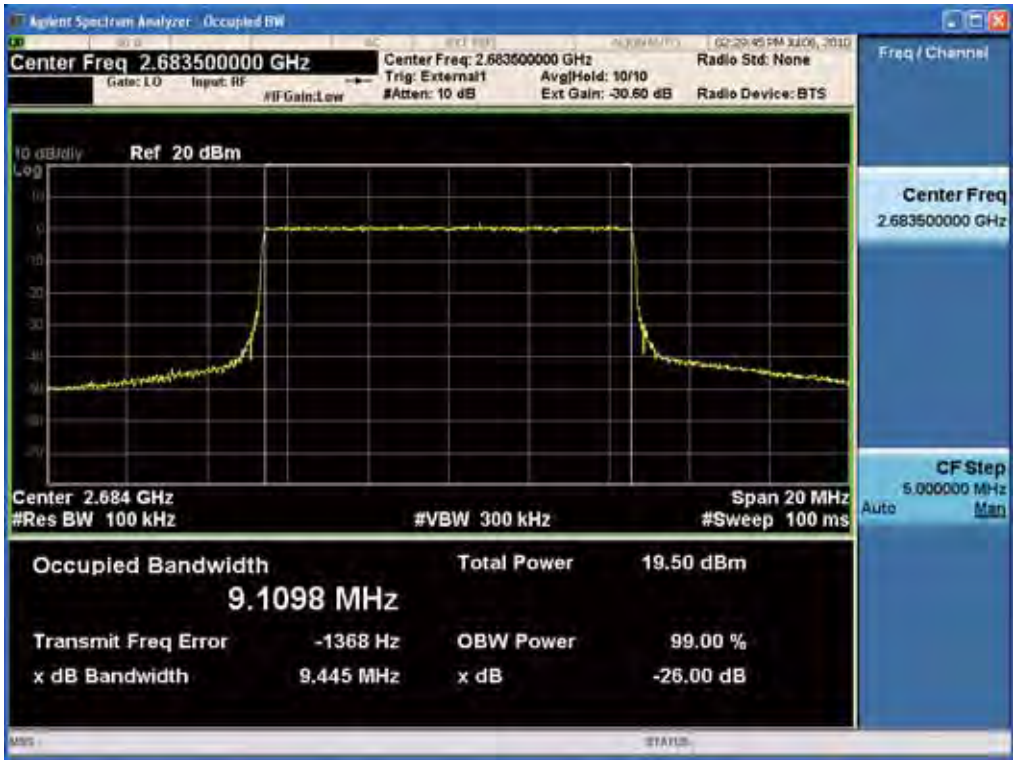


(64QAM Low Channel)

(64QAM Middle Channel)

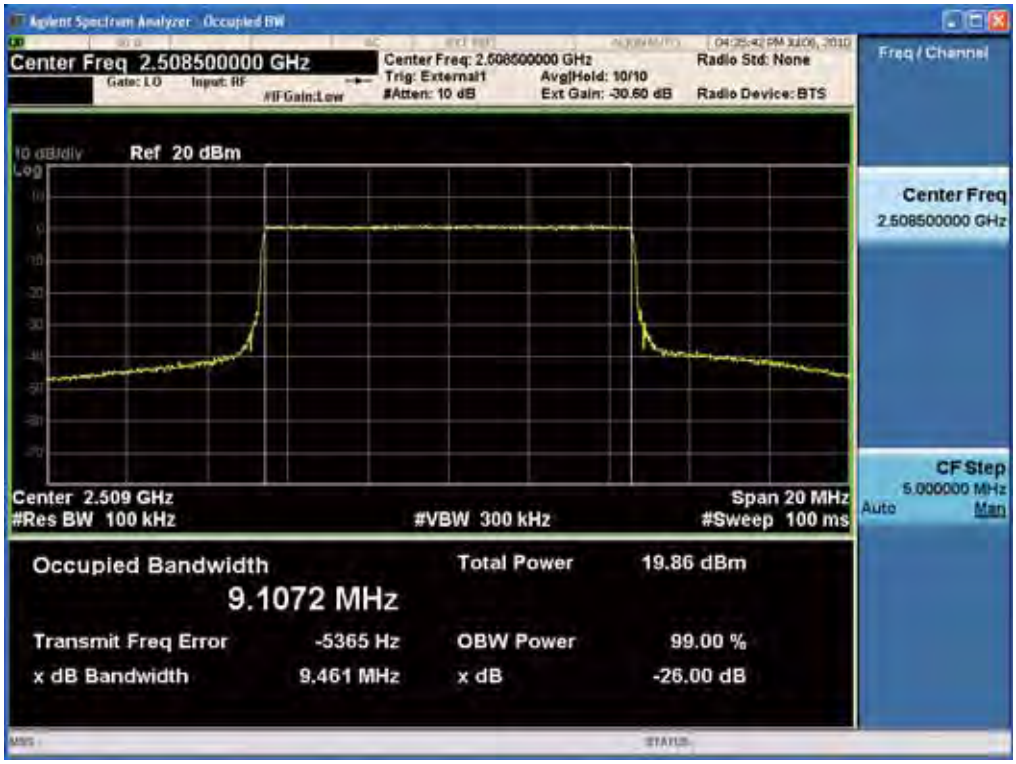


(64QAM High Channel)



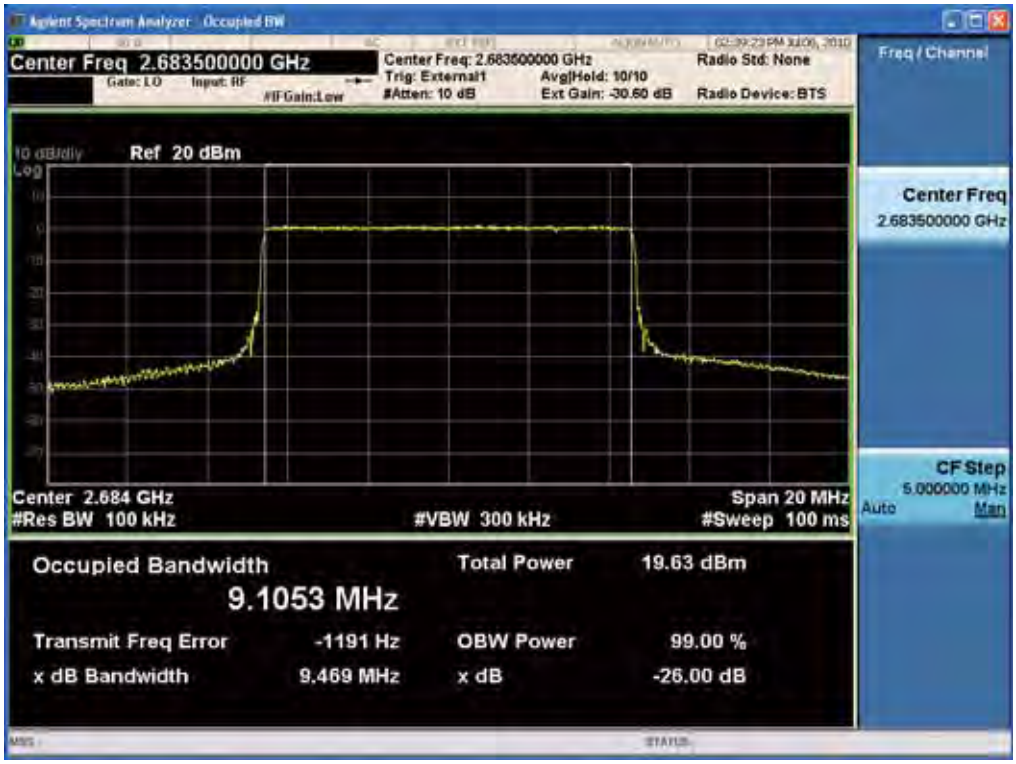
6.4.8. Test Plot at Output Port 2

(QPSK Low Channel)



(QPSK Middle Channel)

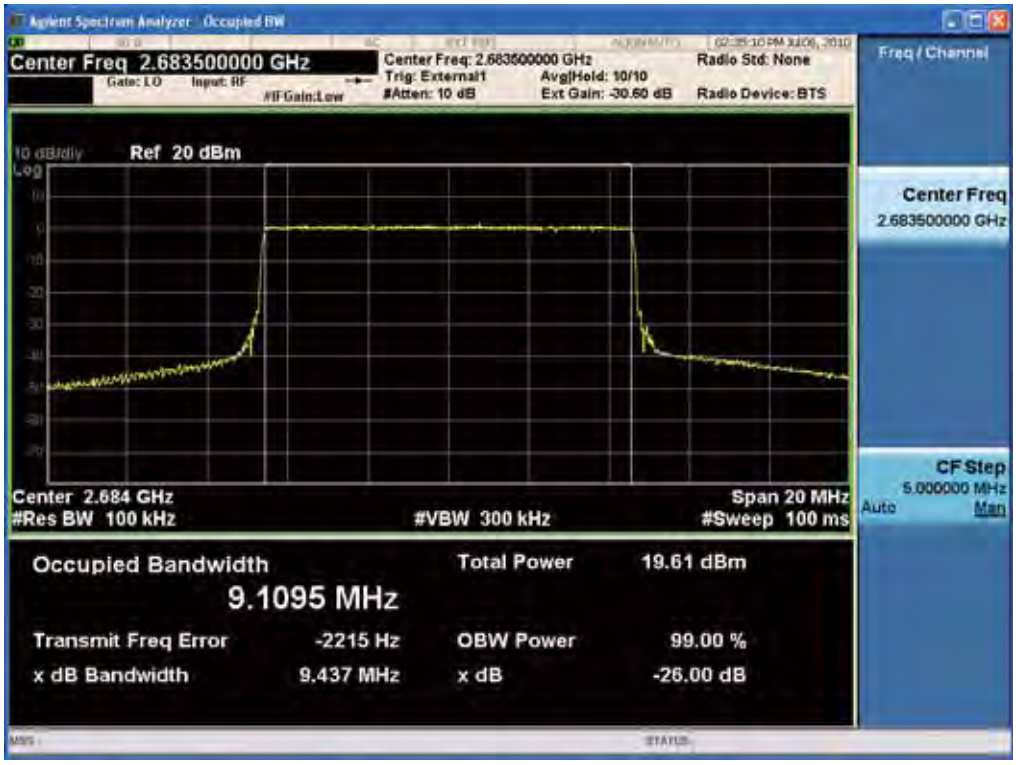
(QPSK High Channel)



(16QAM Low Channel)

(16QAM Middle Channel)

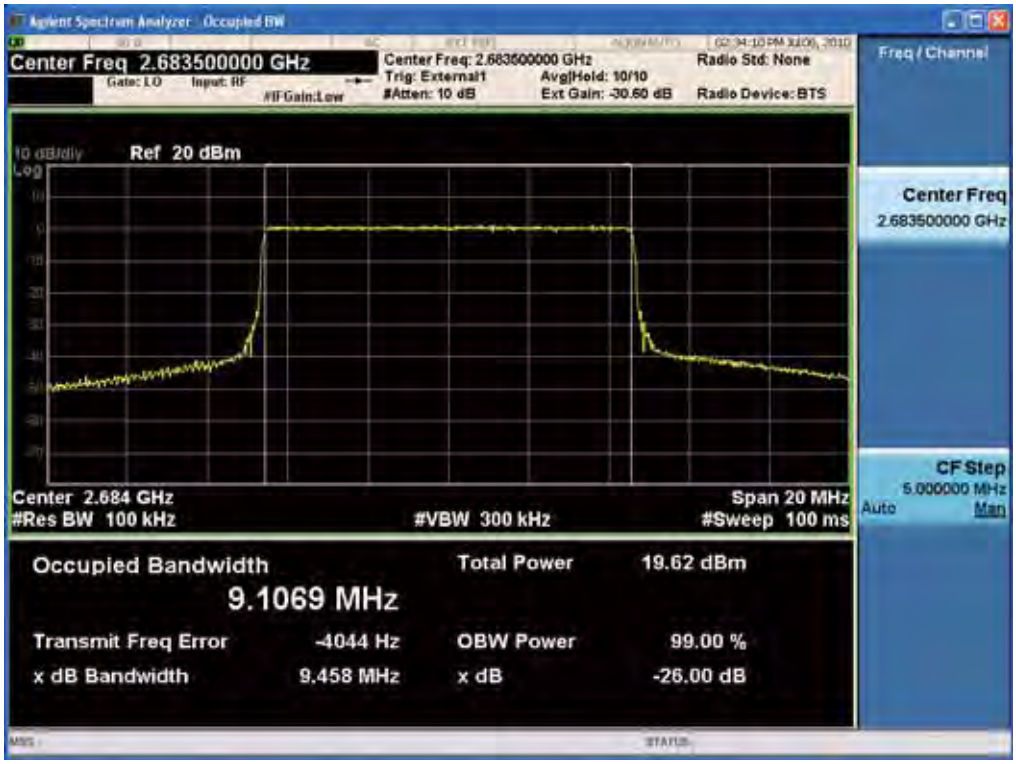
(16QAM High Channel)



(64QAM Low Channel)

(64QAM Middle Channel)

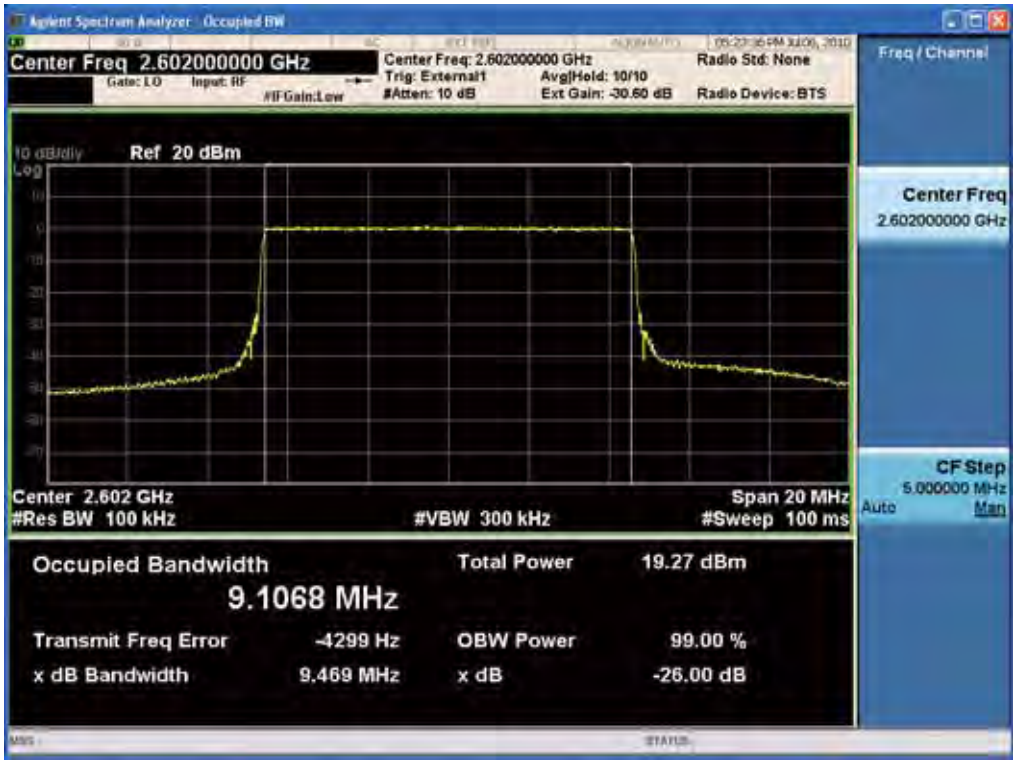
(64QAM High Channel)



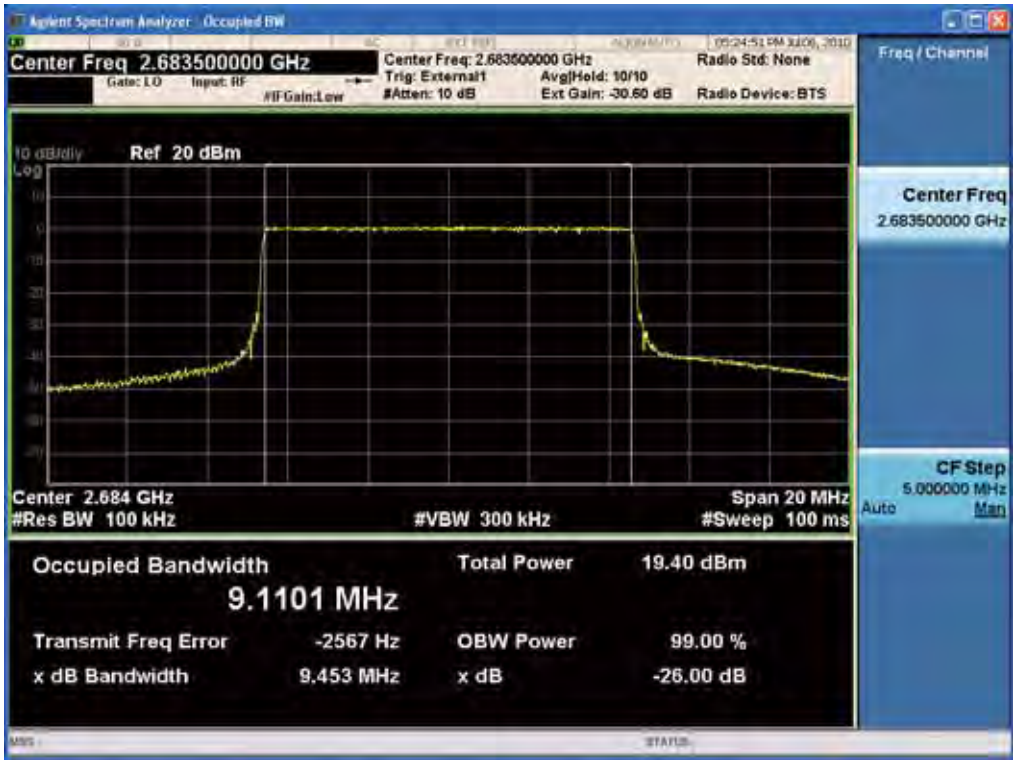
6.4.9. Test Plot at Output Port 3

(QPSK Low Channel)

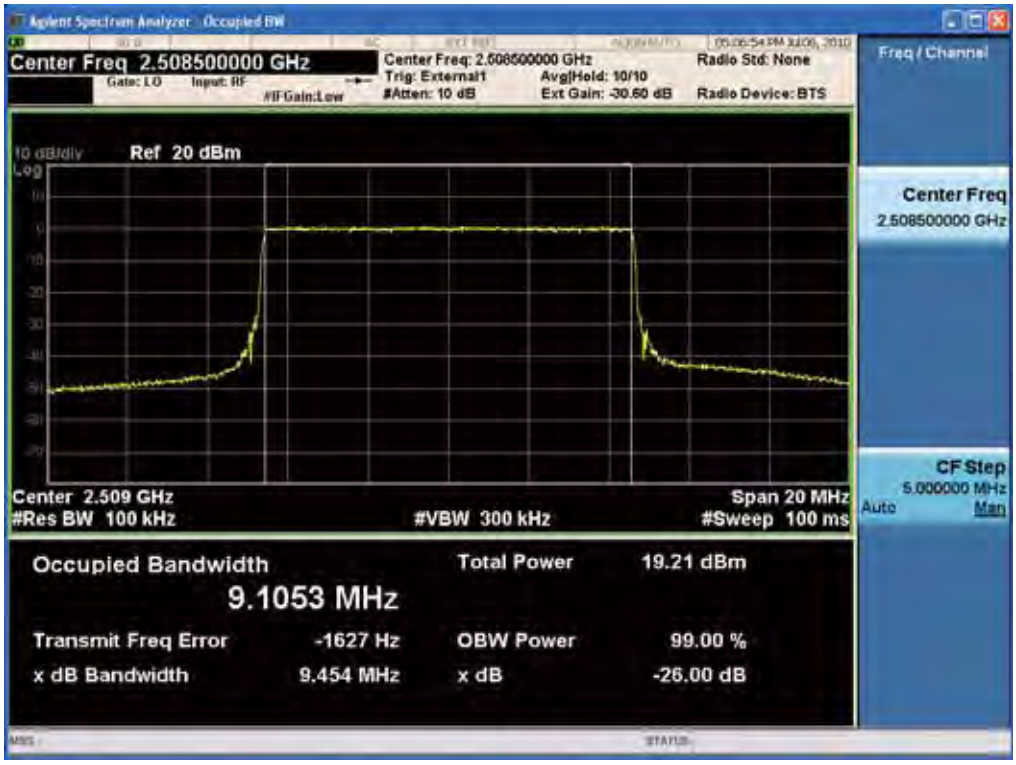
(QPSK Middle Channel)



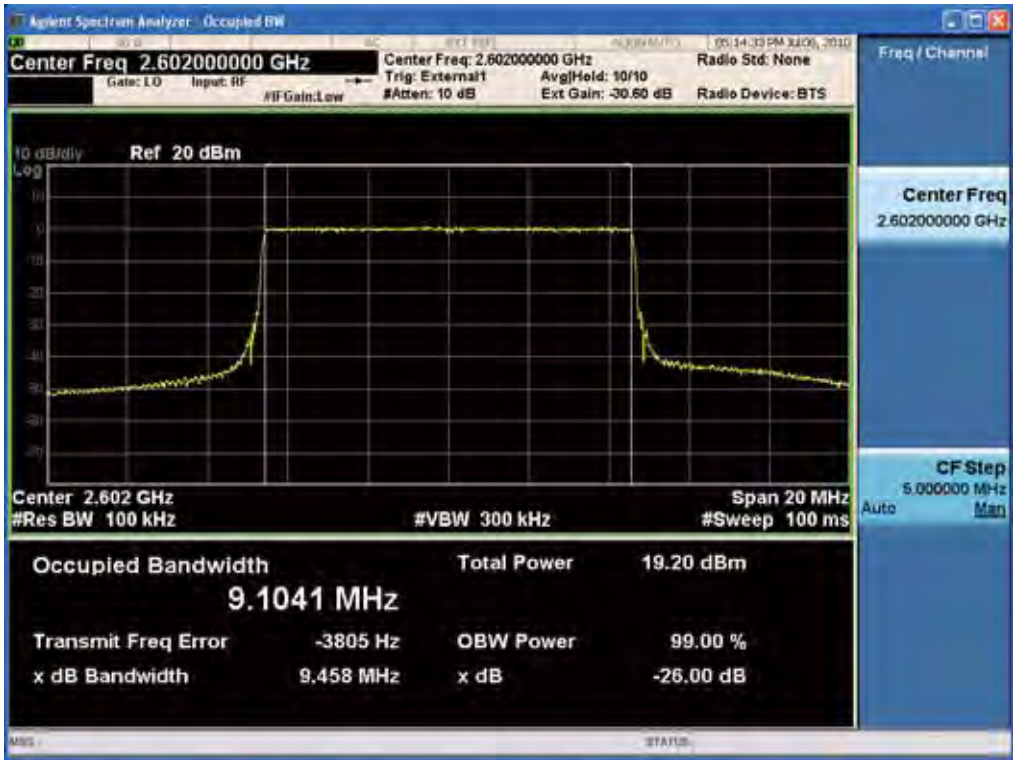
(QPSK High Channel)



(16QAM Low Channel)

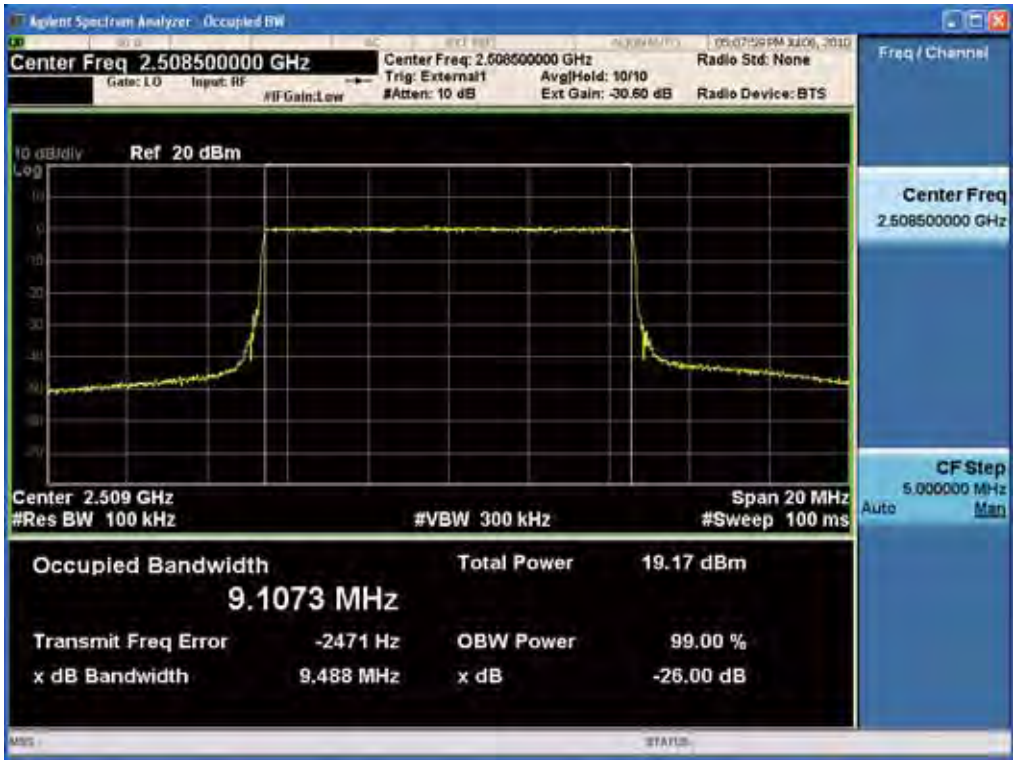


(16QAM Middle Channel)

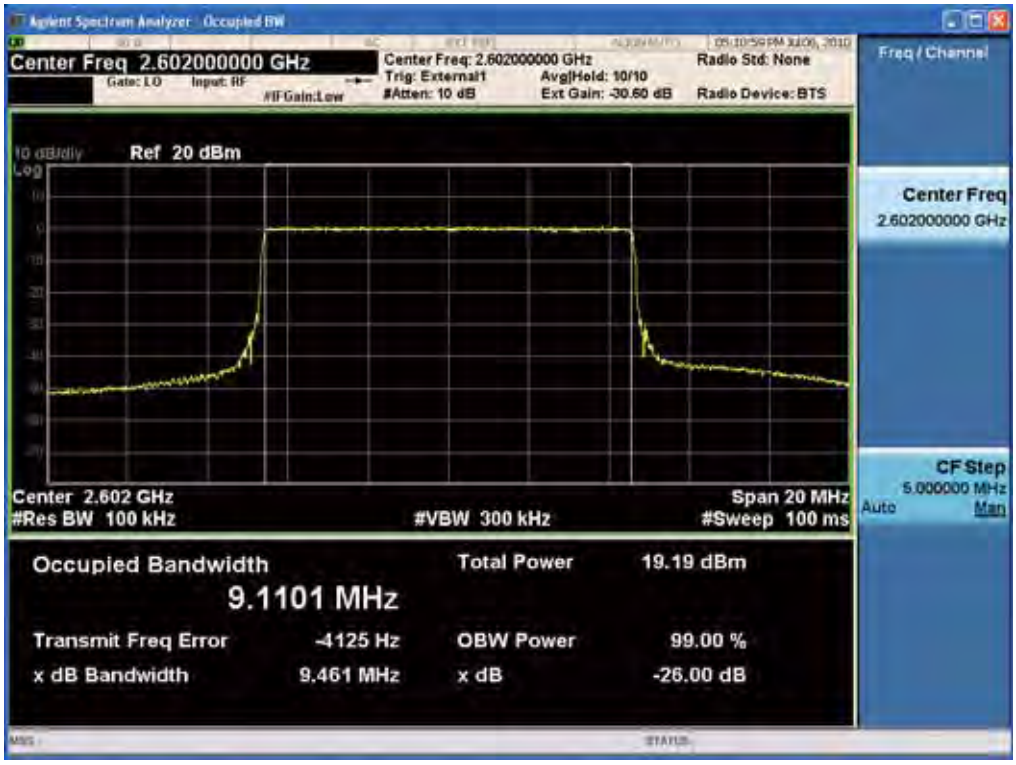


(16QAM High Channel)

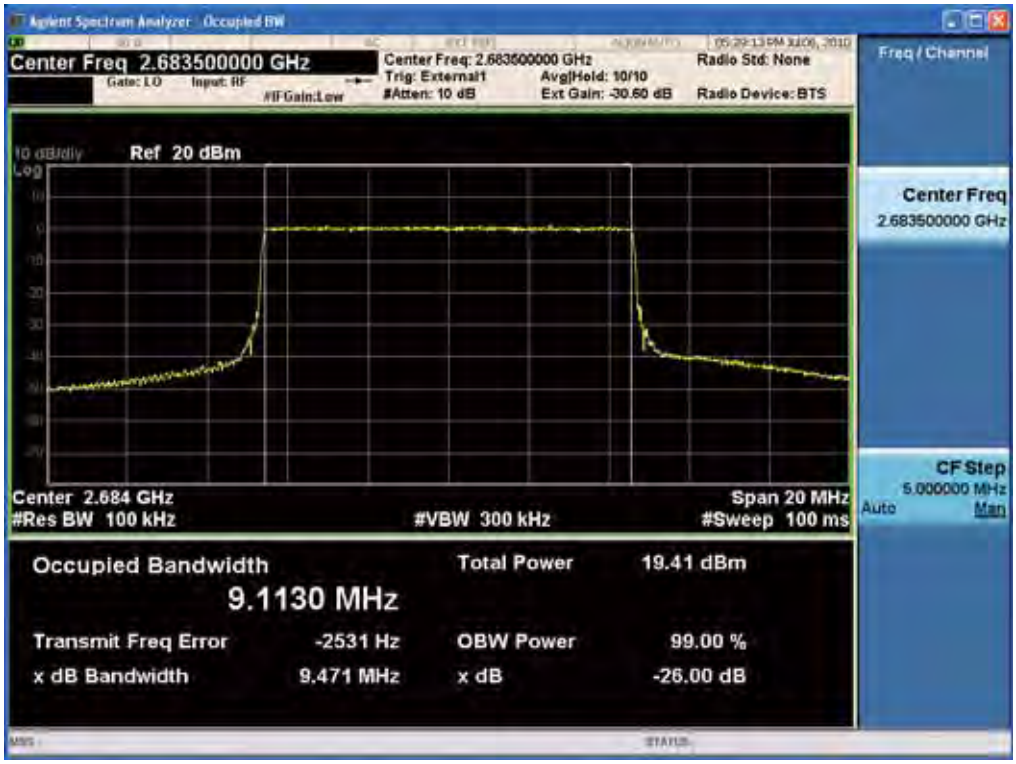
(64QAM Low Channel)



(64QAM Middle Channel)



(64QAM High Channel)

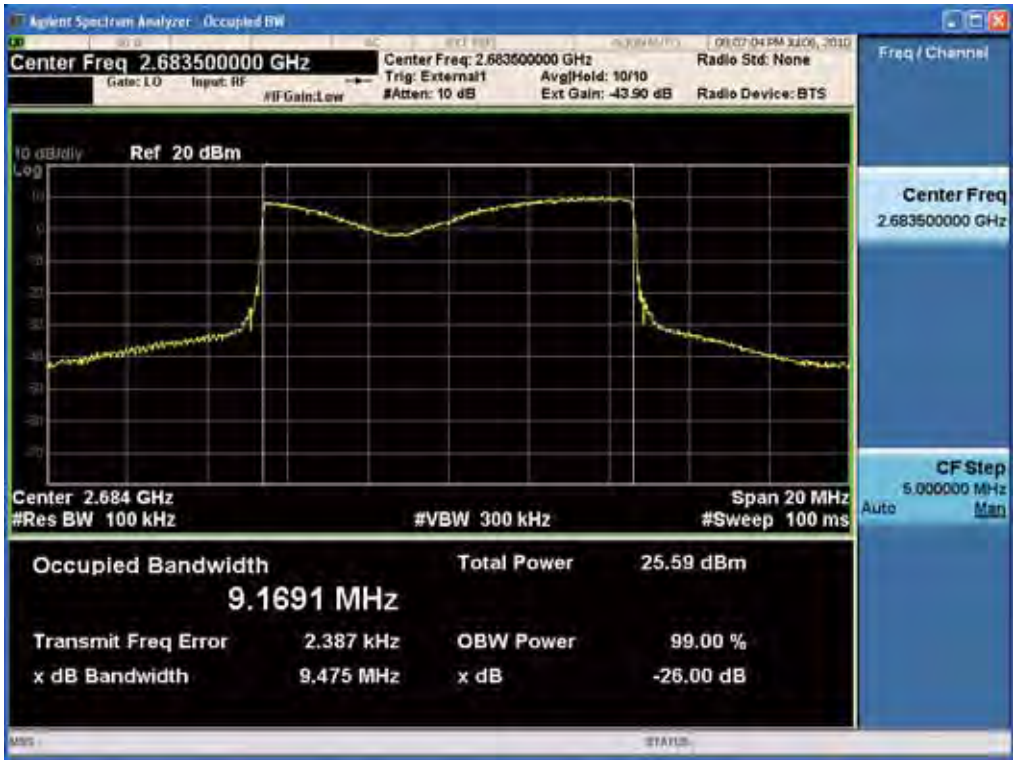


6.4.10. Combined Test Plot at Output Port

(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. BAND EDGES

7.1. Applicable Standard

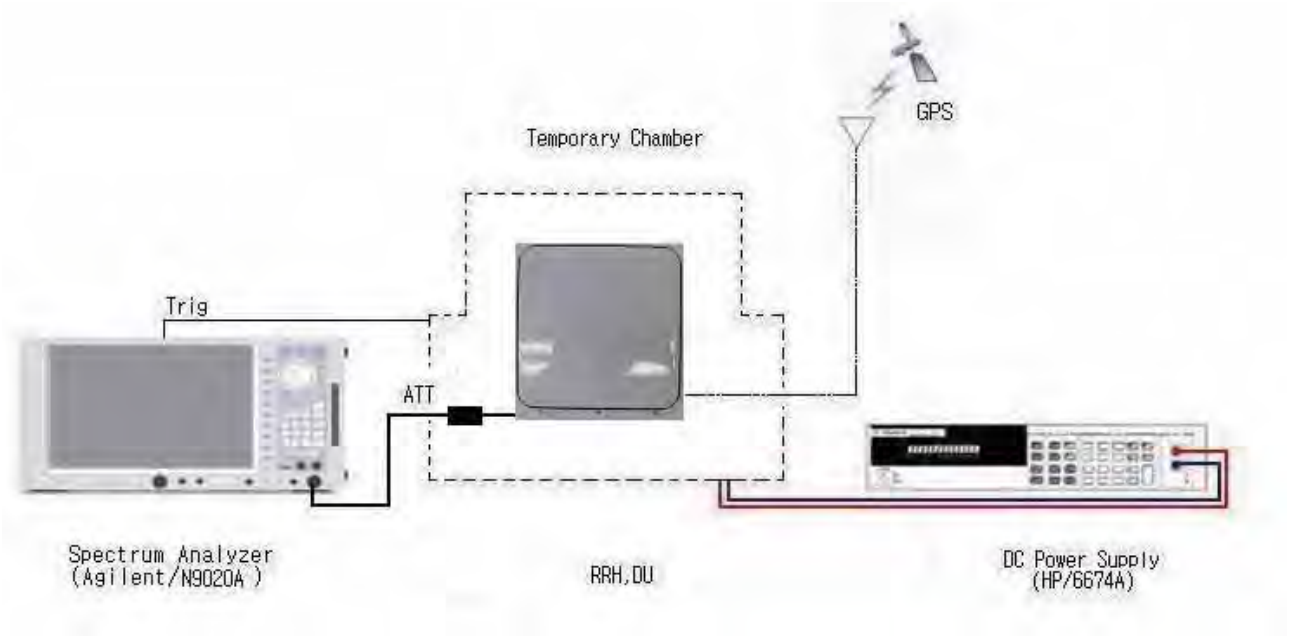
According to §27.53(m), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (p) by a factor of at least 43 + 10 log (p) dB.

7.2. Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	6674A / DC Power Supply	3501A00901	05/14/2011
Agilent	8498A / Attenuator	51161	01/06/2011
Agilent	8498A / Attenuator	51162	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BU5347	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BR0530	01/14/2011
Agilent	N9020A / MXA Signal Analyzer	US46220219	03/03/2011
Agilent	11636B / Power Divider	11377	12/24/2010
Cernex	CDPU5260404K/ Power Divider-4WAY	14695	02/08/2011

7.3. Test Procedure

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



The center of the spectrum analyzer was set to block edge frequency.

The EUT provides the MIMO function which is able to transmit on the same channel with same data simultaneously therefore a combiner is used to sum the individual transmitter output power.

The test data is shown as a combined output in the report.

7.3.1. Environmental Conditions

Temperature:	25 °C
Relative Humidity:	56 %

7.4. Test Result

: PASS

7.4.1. Test data at Output 0

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)
QPSK	Low	2508.5	-40.059	-13.0
	High	2683.5	-38.164	
16QAM	Low	2508.5	-42.966	
	High	2683.5	-41.624	
64QAM	Low	2508.5	-34.243	
	High	2683.5	-34.518	

7.4.2. Test data at Output 1

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)
QPSK	Low	2508.5	-22.926	-13.0
	High	2683.5	-31.869	
16QAM	Low	2508.5	-28.766	
	High	2683.5	-24.999	
64QAM	Low	2508.5	-31.084	
	High	2683.5	-35.391	

7.4.3. Test data at Output 2

Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)
QPSK	Low	2508.5	-34.788	-13.0
	High	2683.5	-33.000	
16QAM	Low	2508.5	-28.183	
	High	2683.5	-21.735	
64QAM	Low	2508.5	-24.708	
	High	2683.5	-33.665	

7.4.4. Test data at Output 3

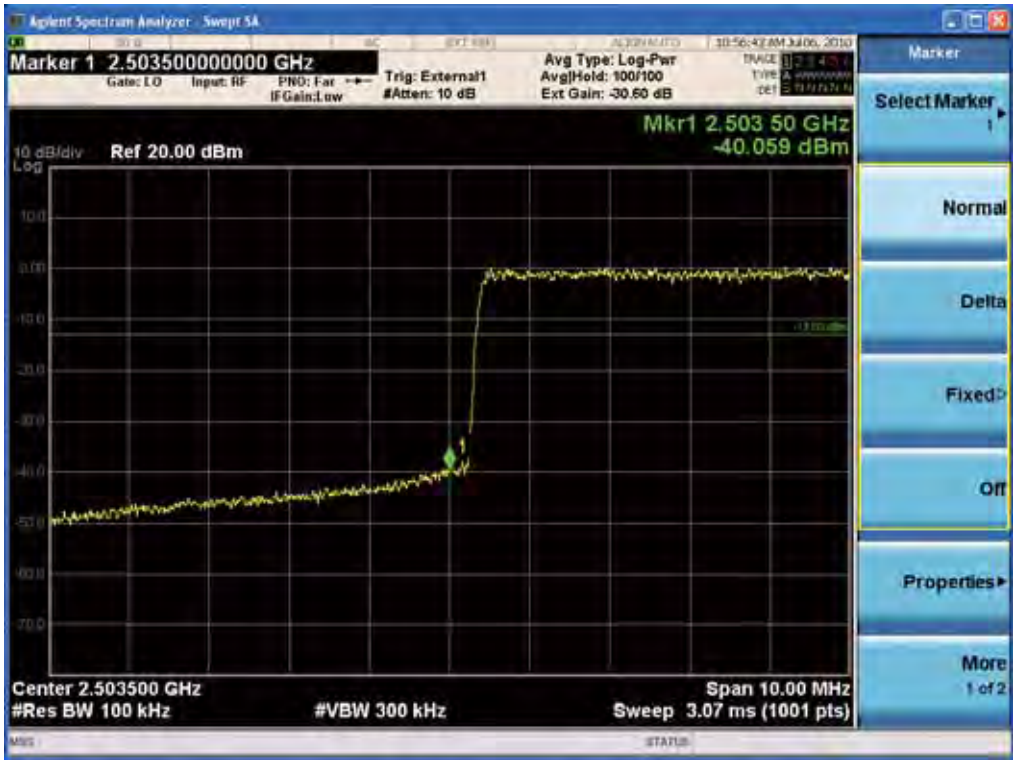
Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)
QPSK	Low	2508.5	-28.185	-13.0
	High	2683.5	-25.824	
16QAM	Low	2508.5	-34.229	
	High	2683.5	-20.486	
64QAM	Low	2508.5	-38.860	
	High	2683.5	-32.909	

7.4.5. Combined Test data at Output

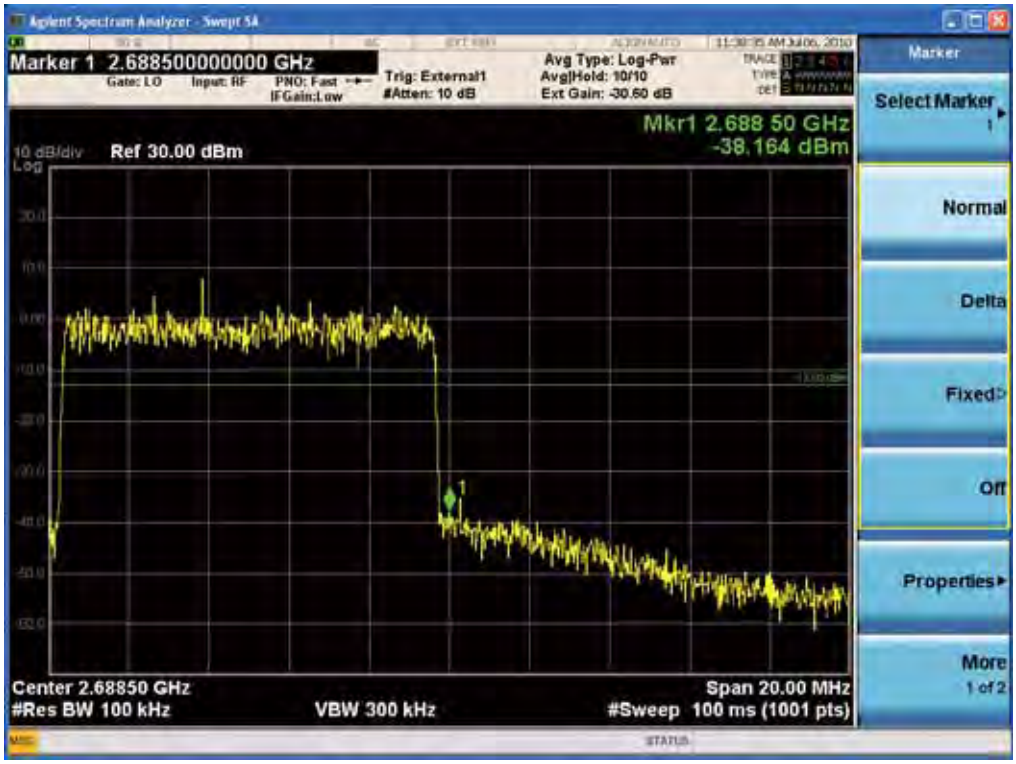
Modulation	Channel	Measured Frequency (MHz)	Max. Measured Value (dBm)	Limit (dBm)
QPSK	Low	2508.5	-25.444	-13.0
	High	2683.5	-22.732	
16QAM	Low	2508.5	-23.602	
	High	2683.5	-26.099	
64QAM	Low	2508.5	-20.192	
	High	2683.5	-23.897	

7.4.6. Plot Data at Output 0

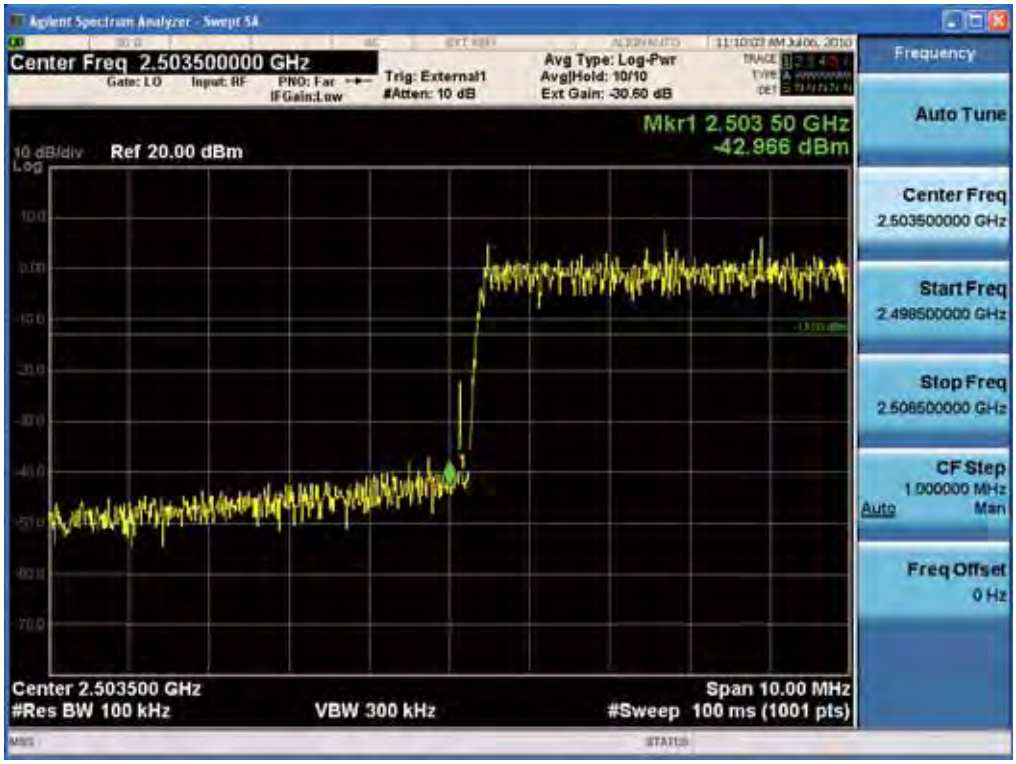
(QPSK Low Channel)



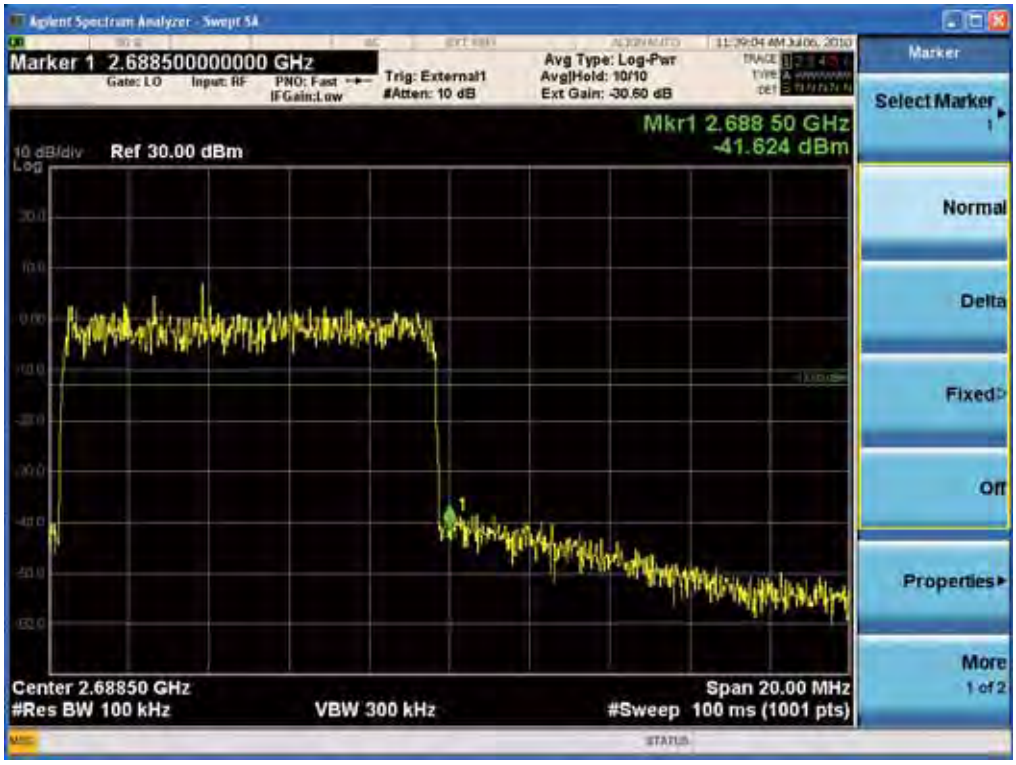
(QPSK High Channel)



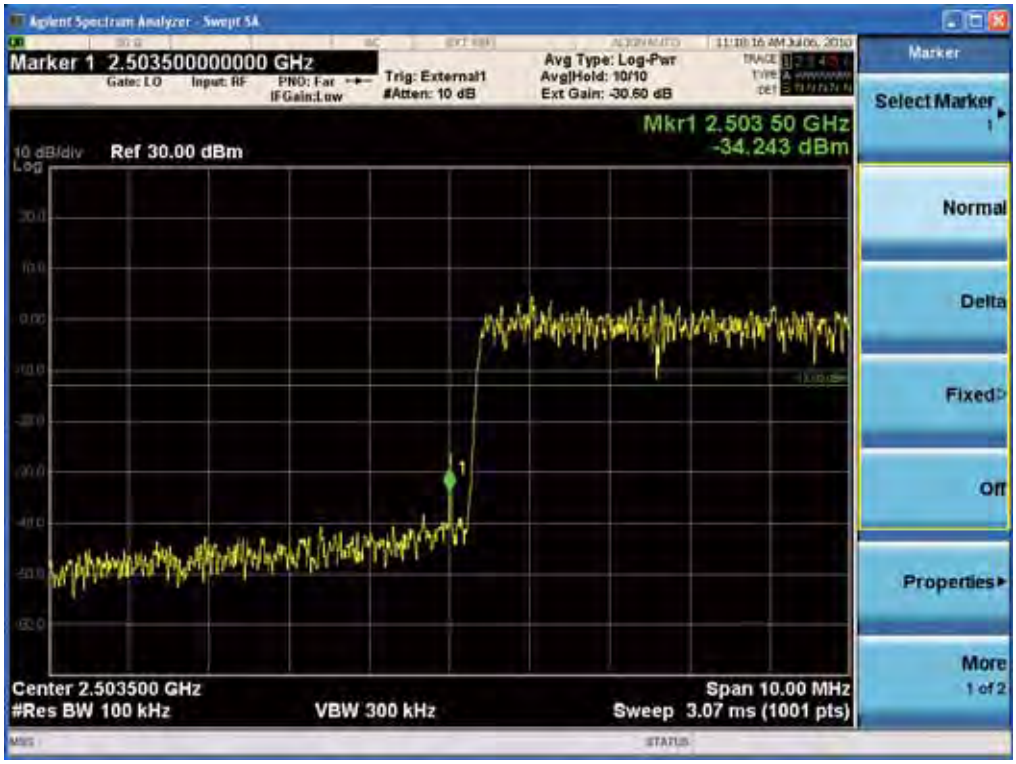
(16QAM Low Channel)



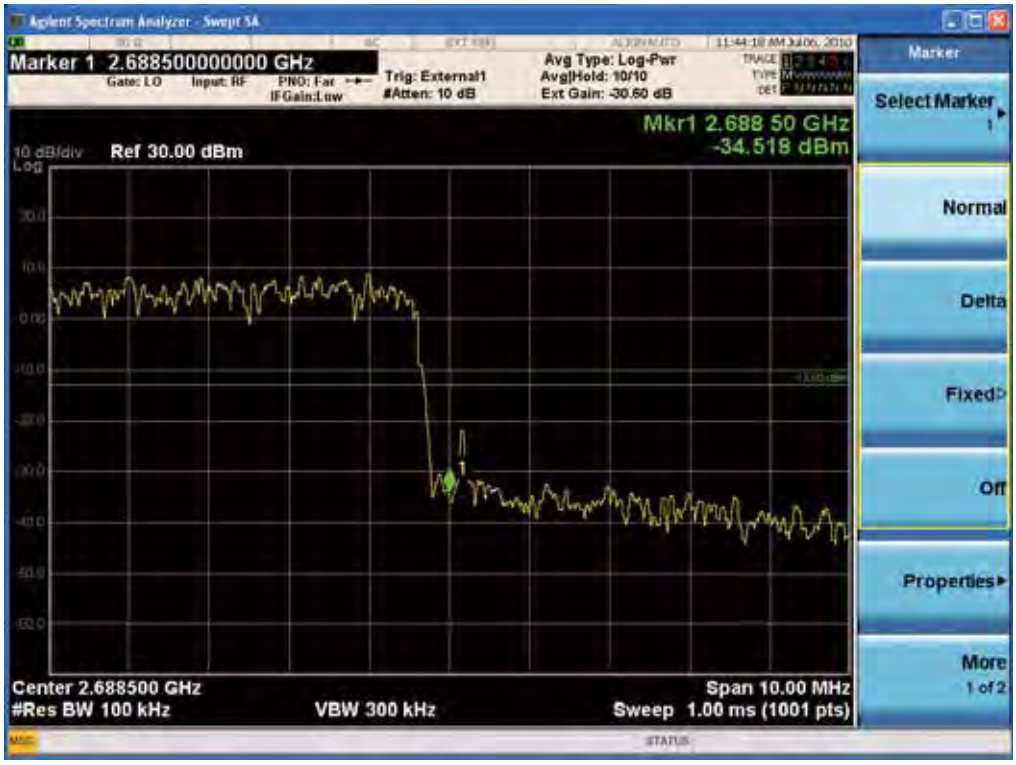
(16QAM High Channel)



(64QAM Low Channel)

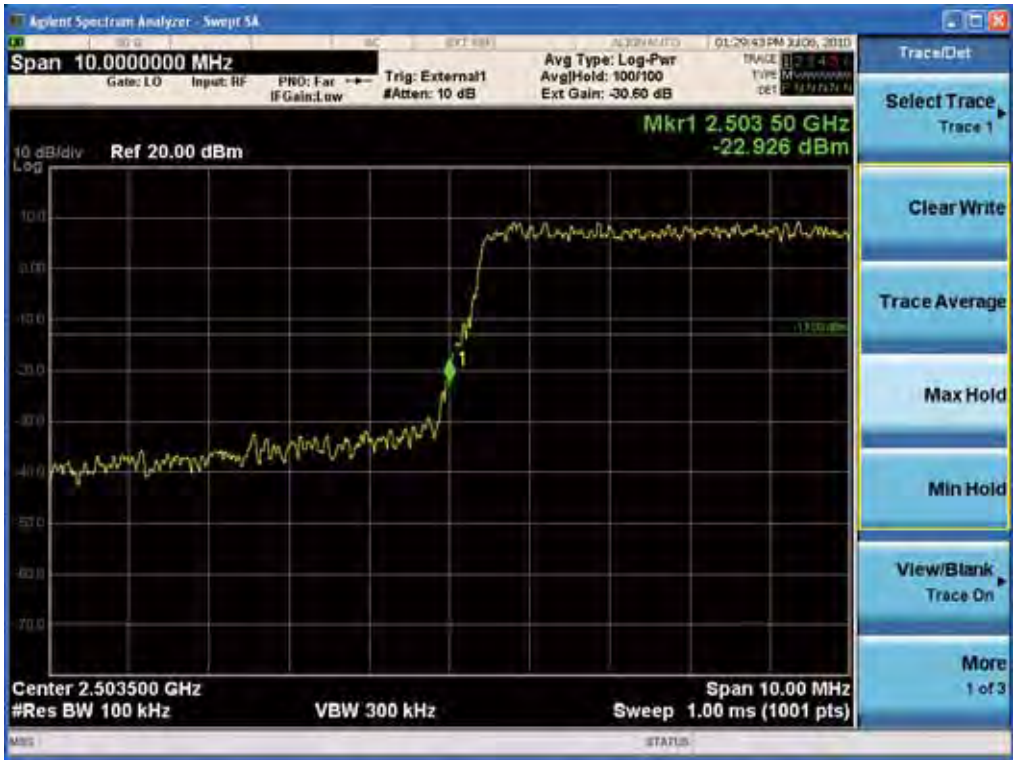


(64QAM High Channel)

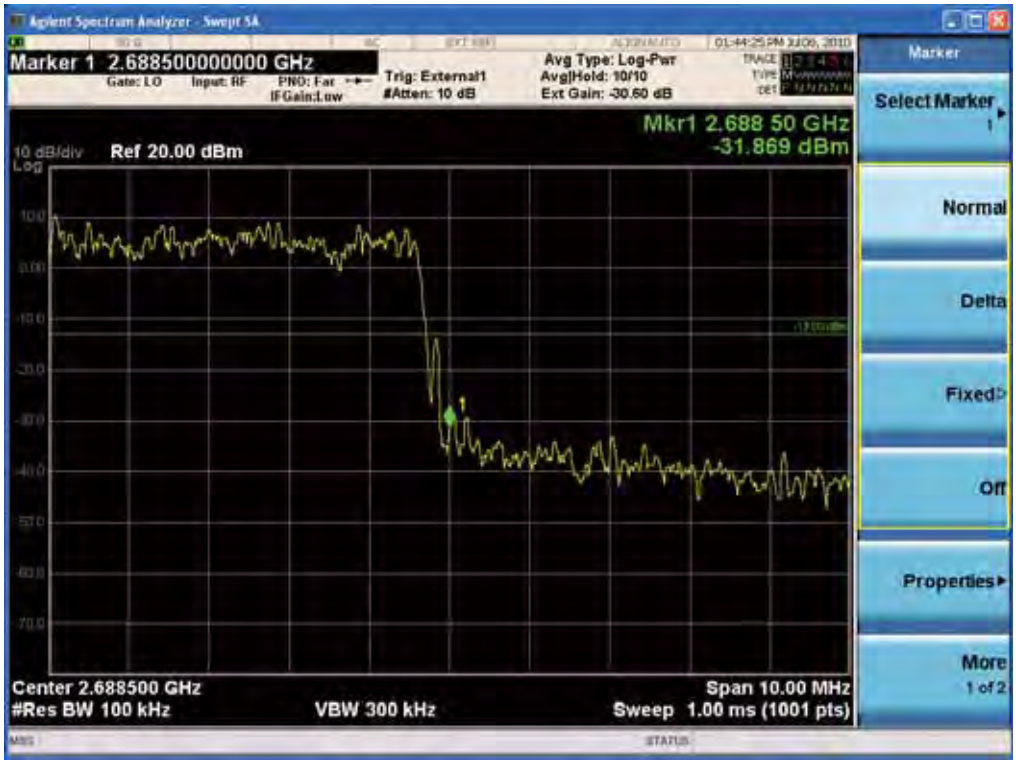


7.4.7. Plot Data at Output 1

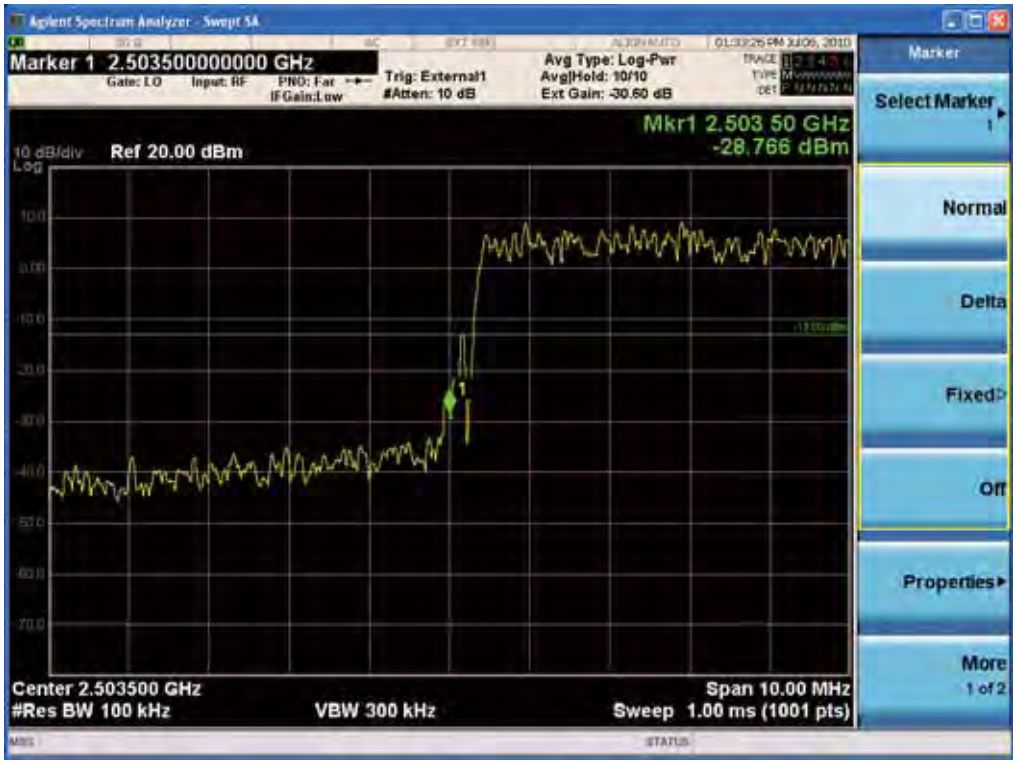
(QPSK Low Channel)



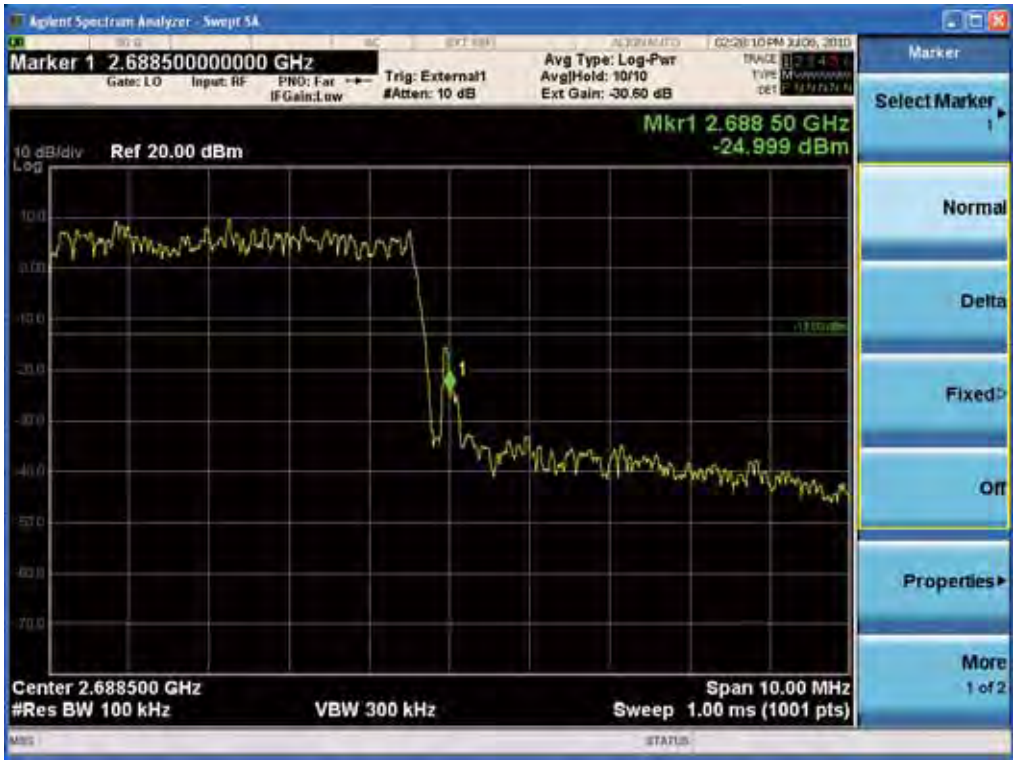
(QPSK High Channel)



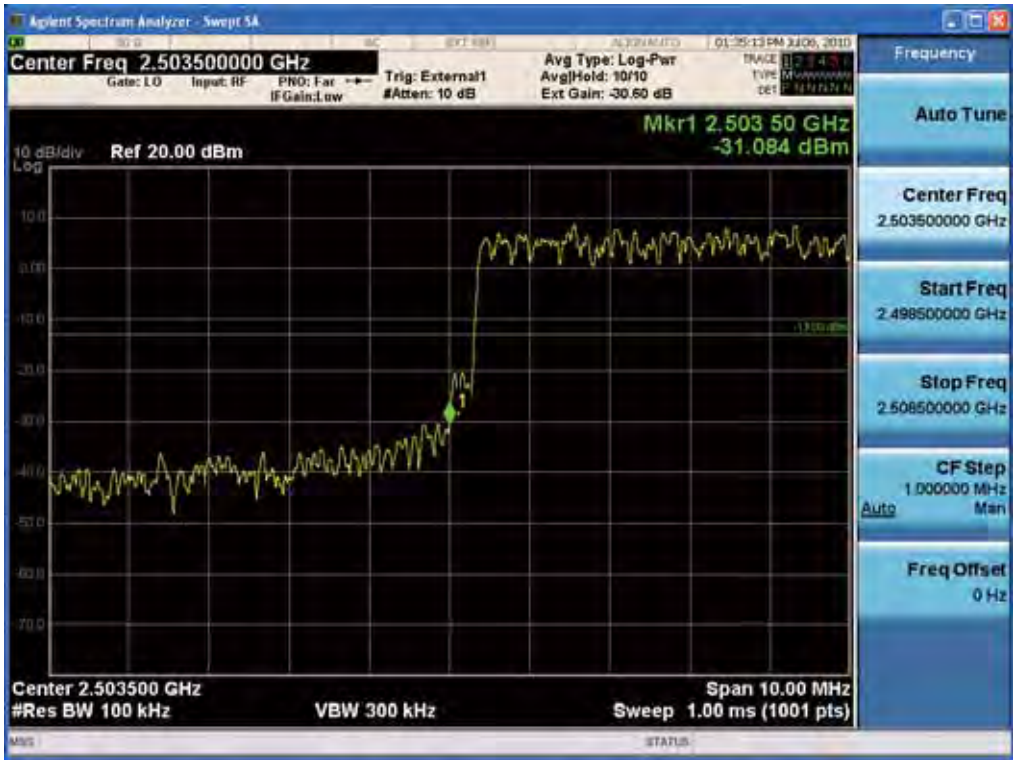
(16QAM Low Channel)



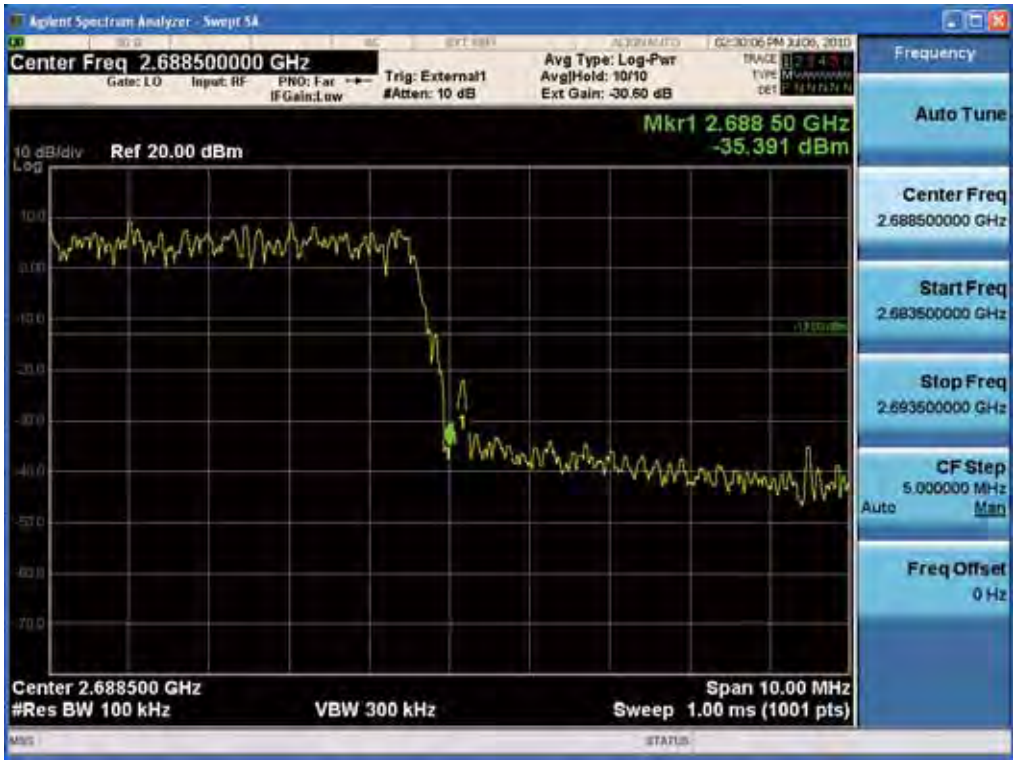
(16QAM High Channel)



(64QAM Low Channel)

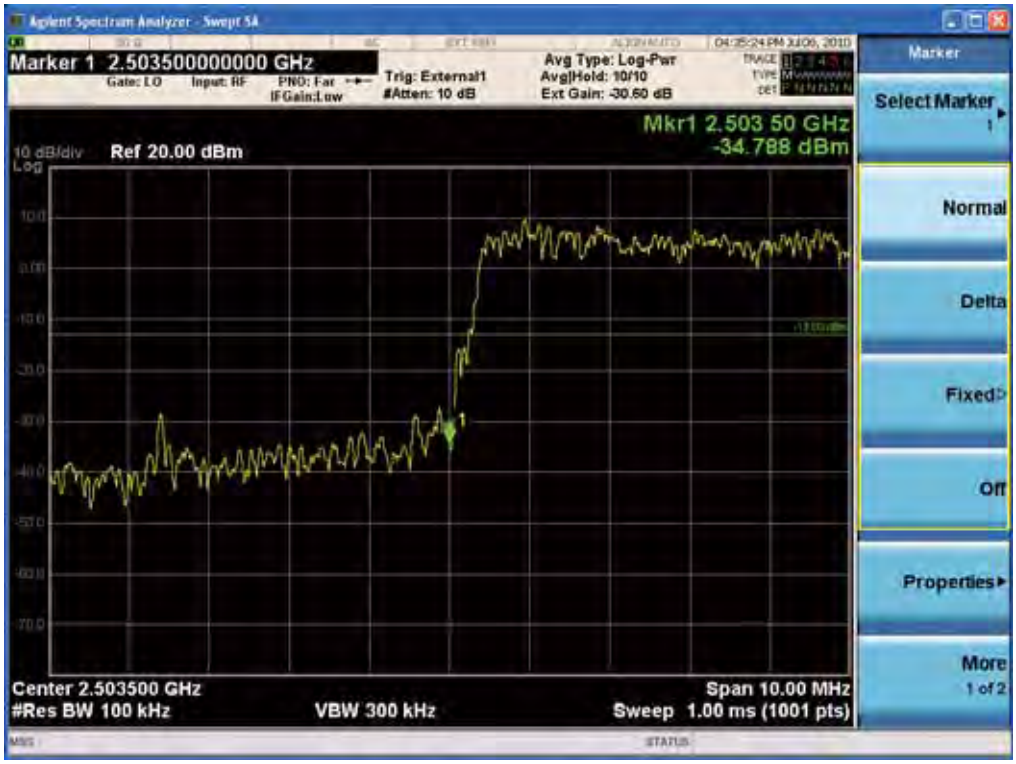


(64QAM High Channel)

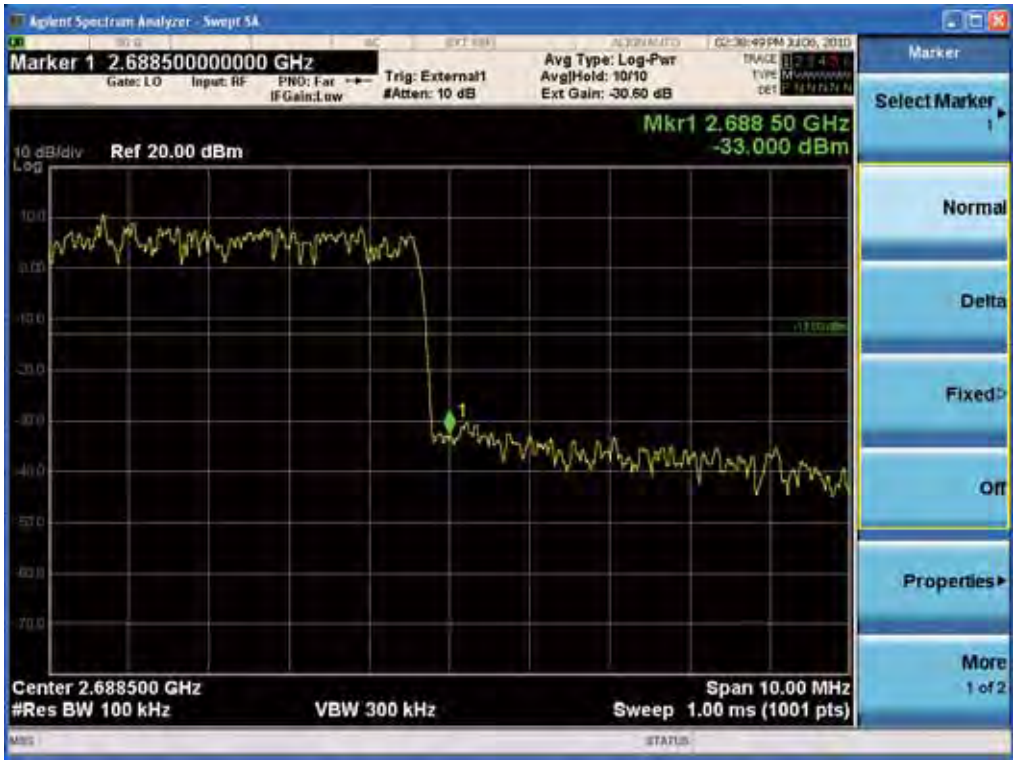


7.4.8. Plot Data at Output 2

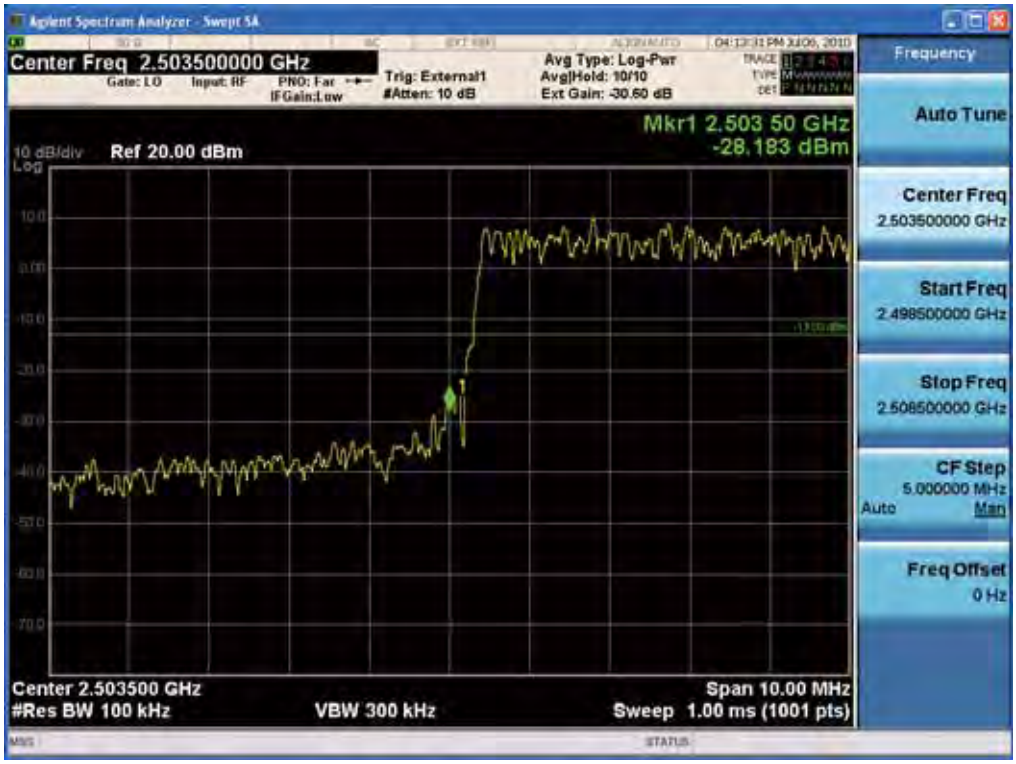
(QPSK Low Channel)



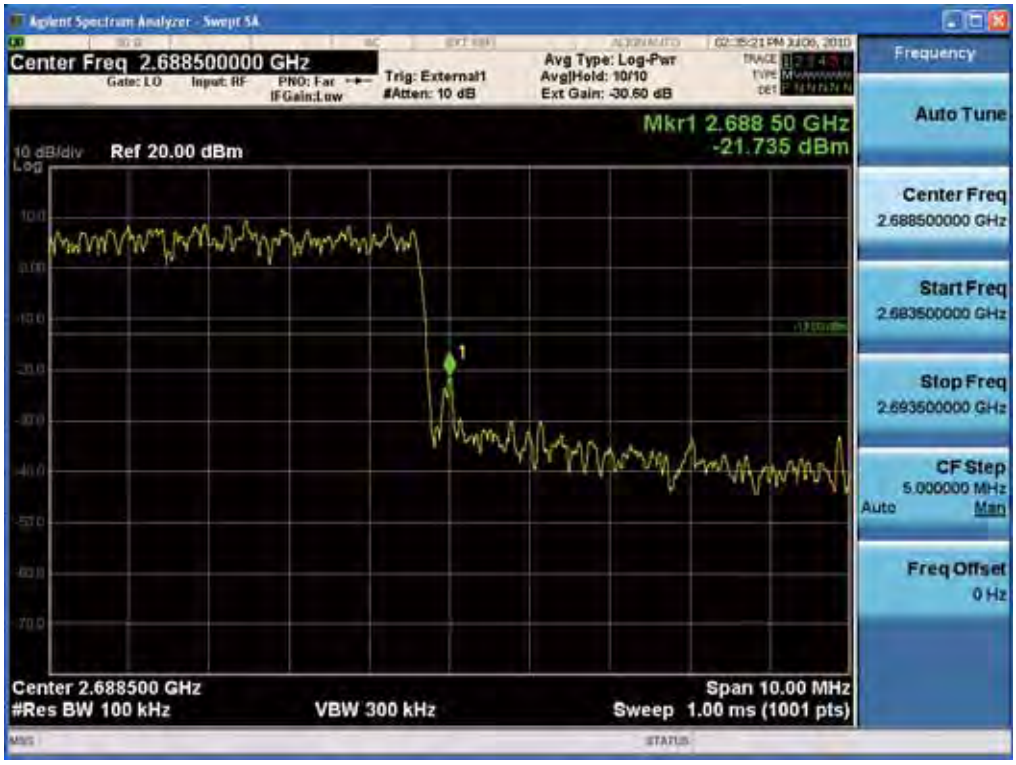
(QPSK High Channel)



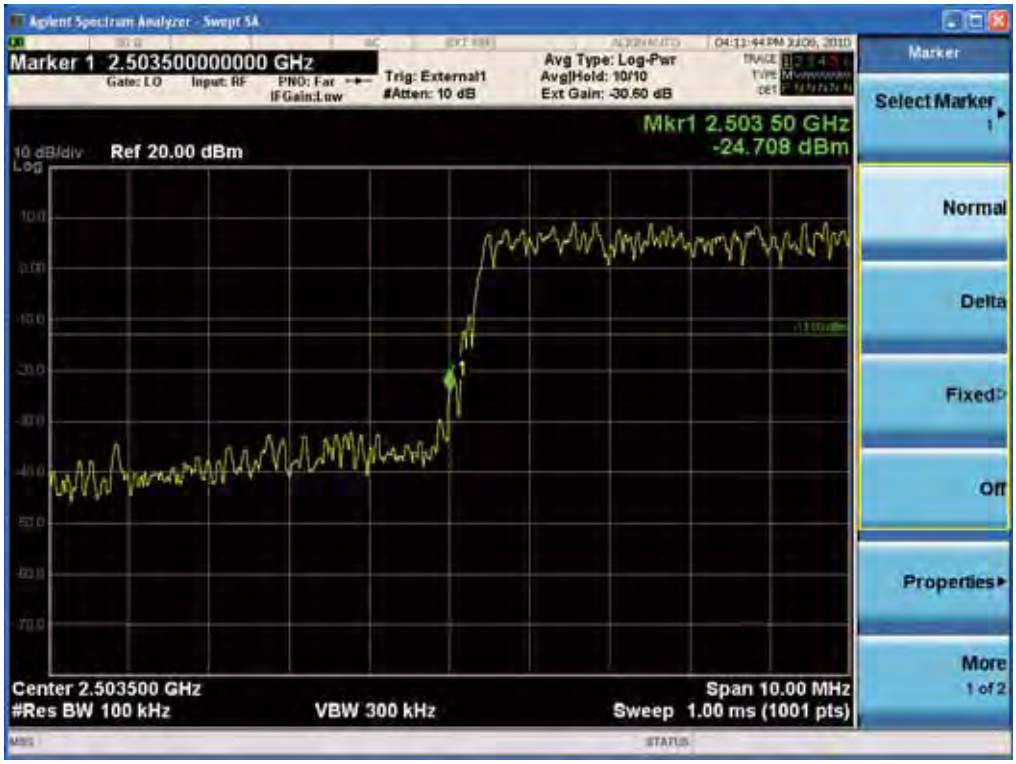
(16QAM Low Channel)



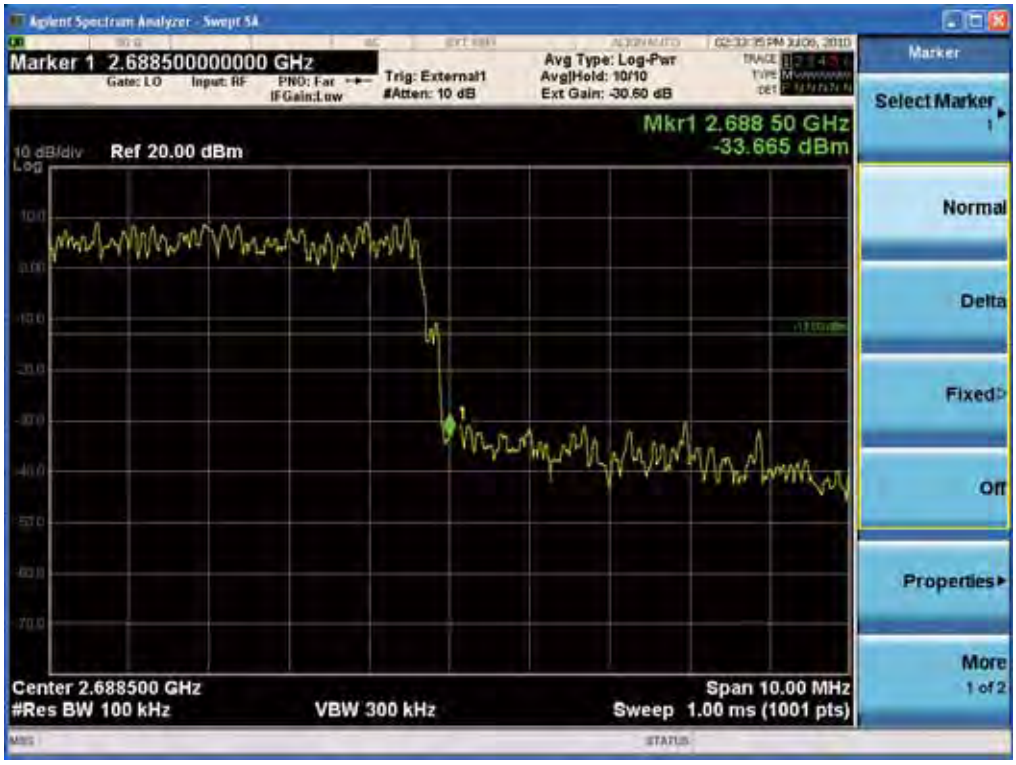
(16QAM High Channel)



(64QAM Low Channel)

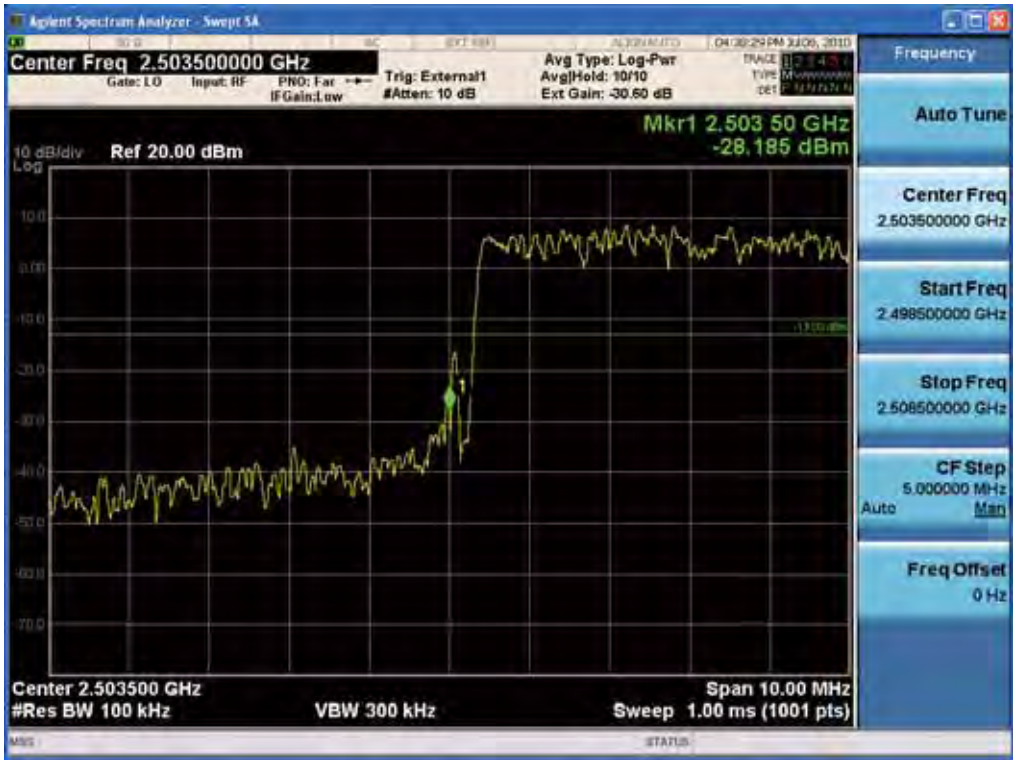


(64QAM High Channel)

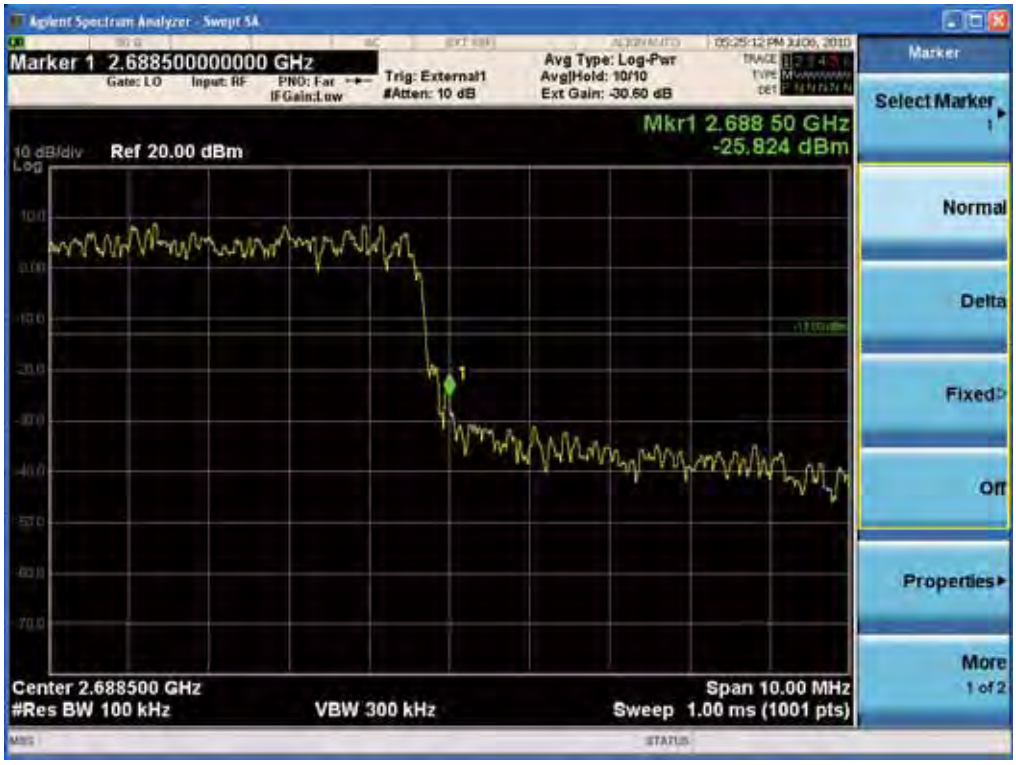


7.4.9. Plot Data at Output 3

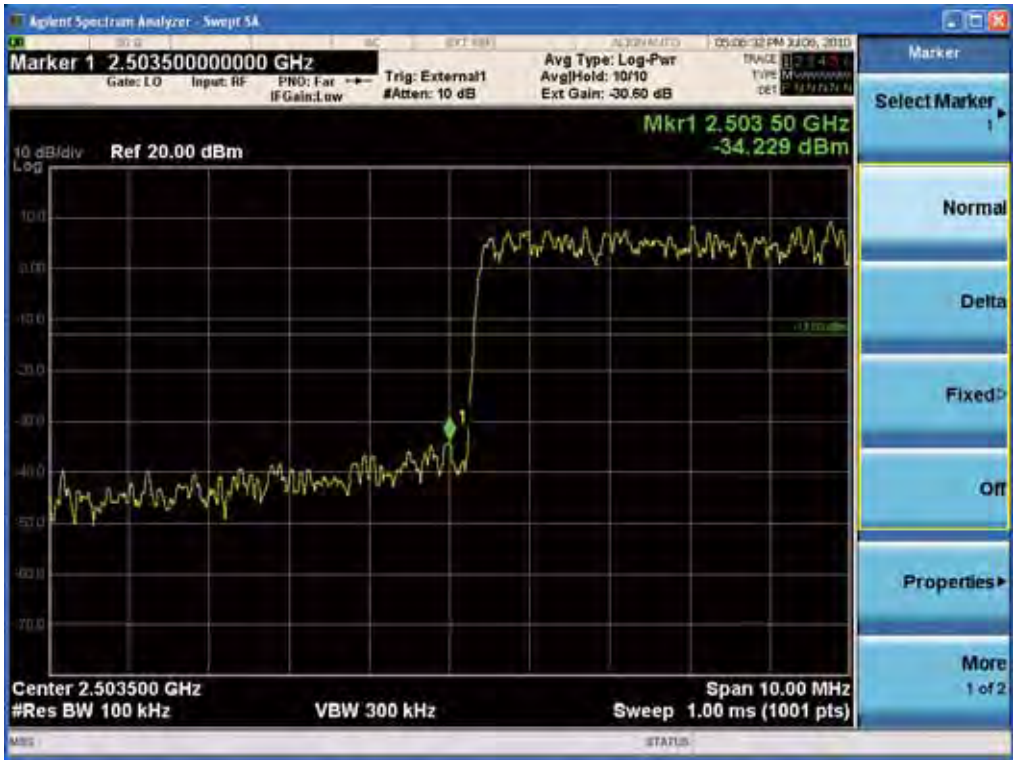
(QPSK Low Channel)



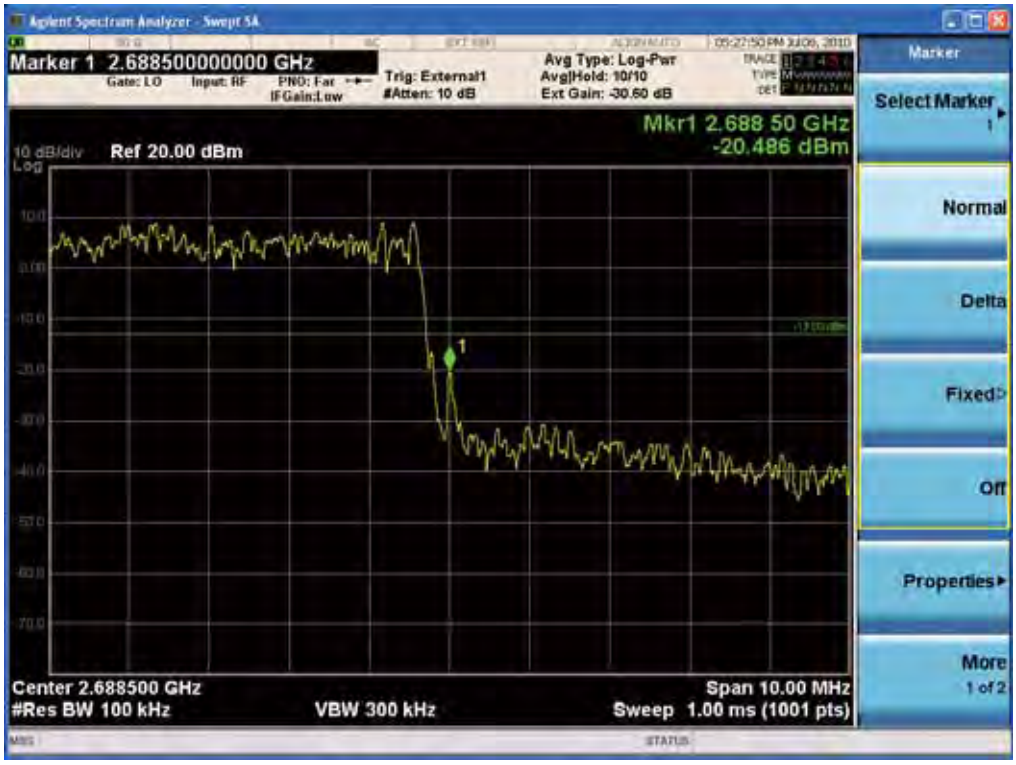
(QPSK High Channel)



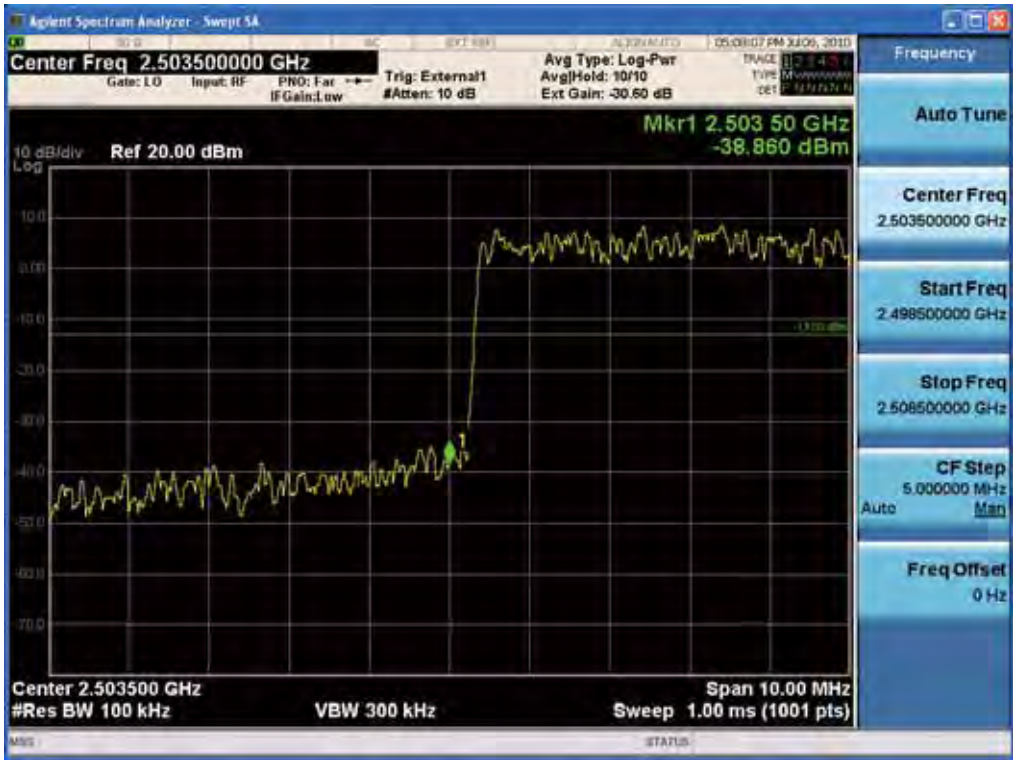
(16QAM Low Channel)



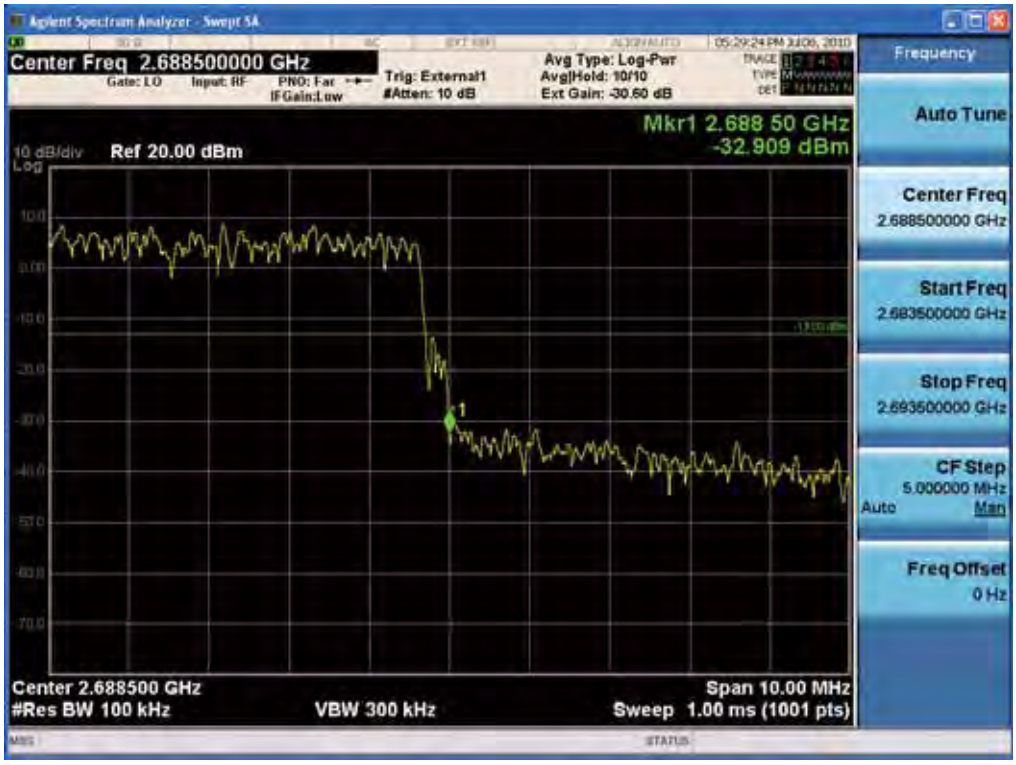
(16QAM High Channel)



(64QAM Low Channel)

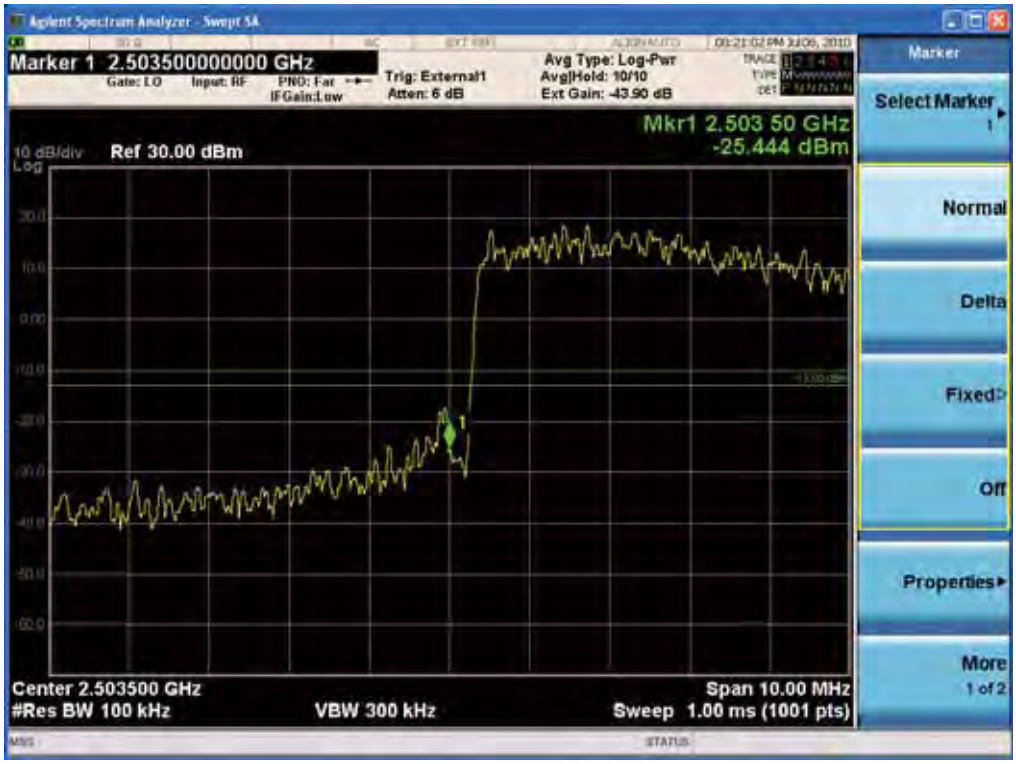


(64QAM High Channel)

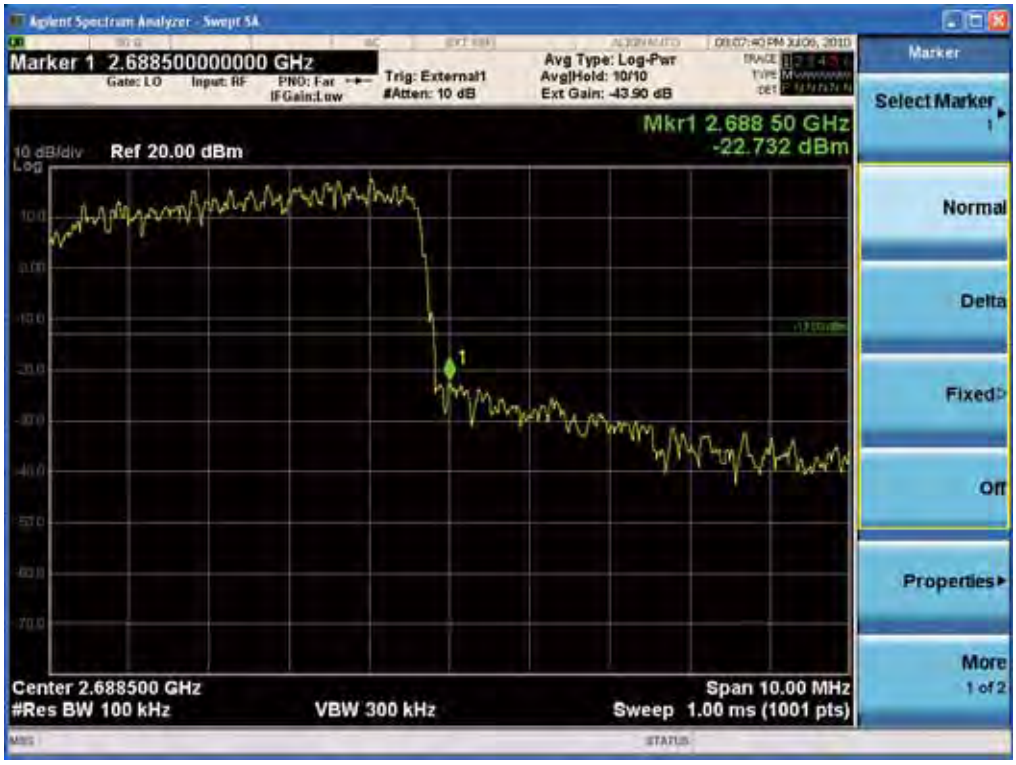


7.4.10. Combined Plot Data at Output

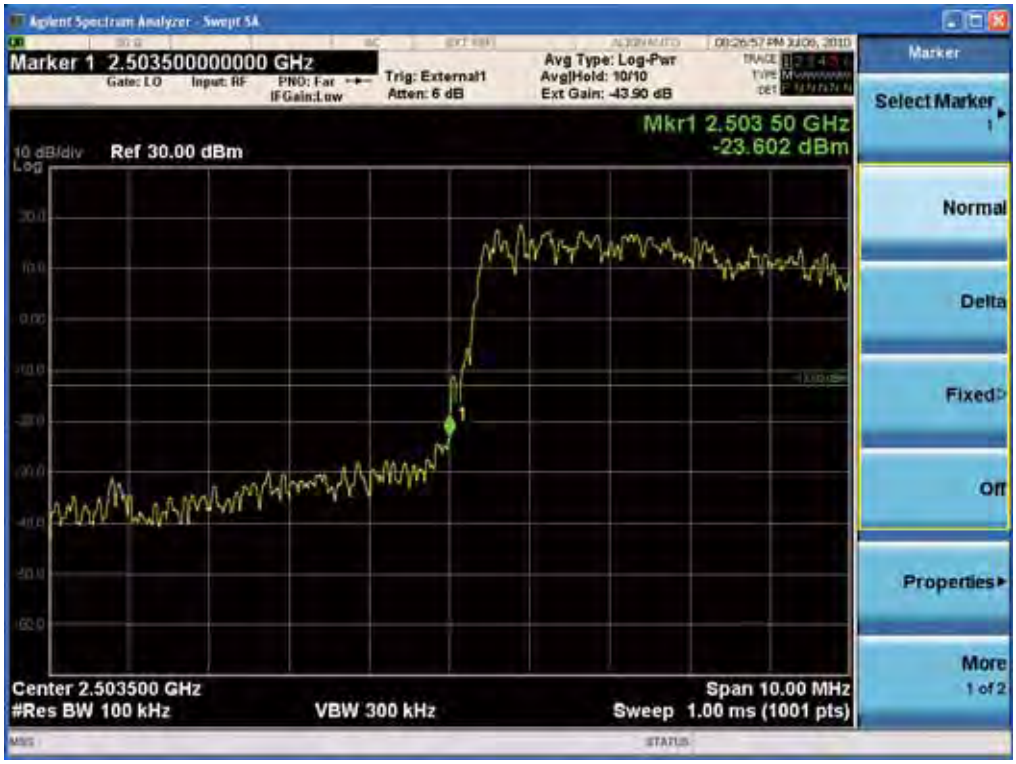
(QPSK Low Channel)



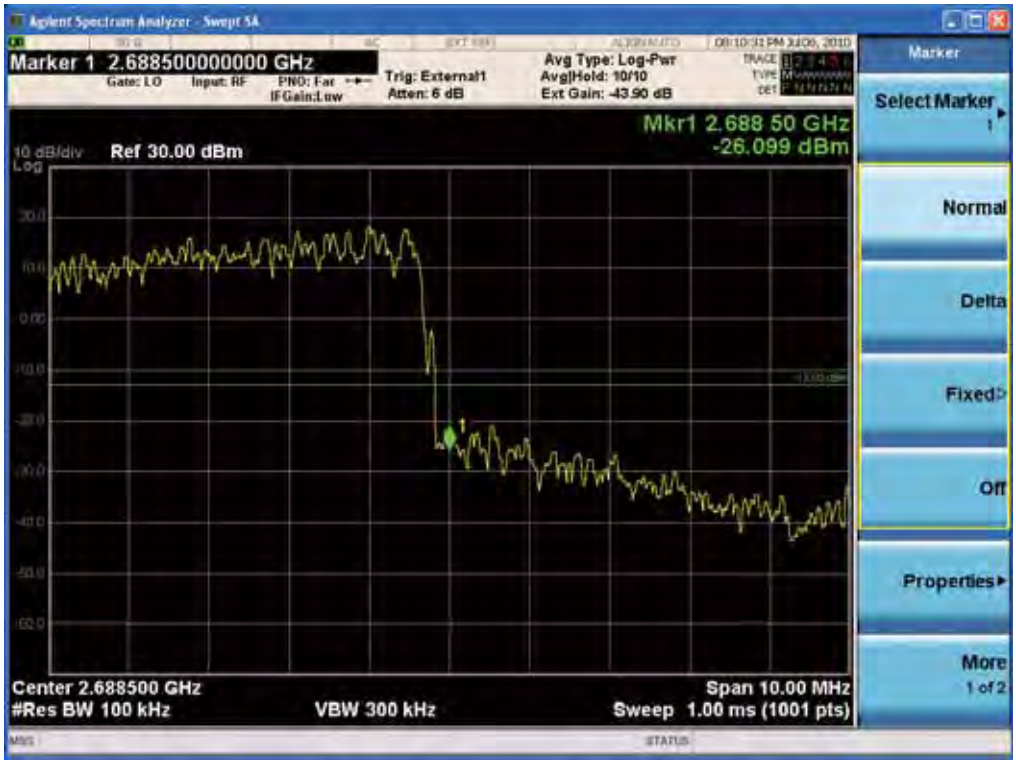
(QPSK High Channel)



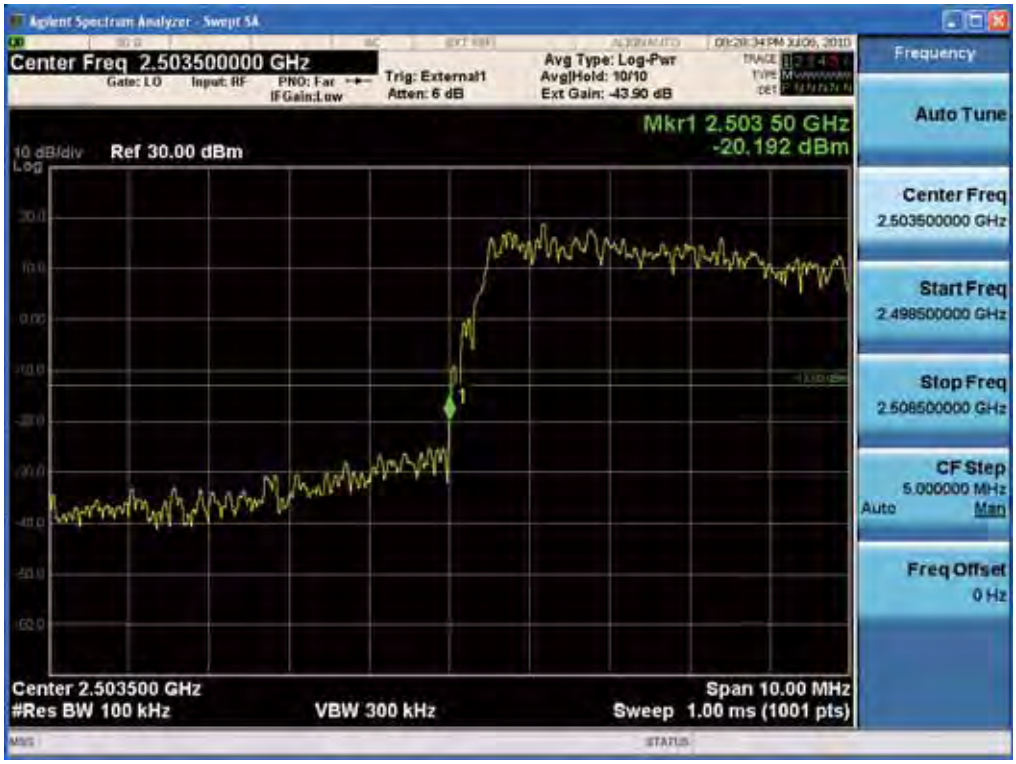
(16QAM Low Channel)



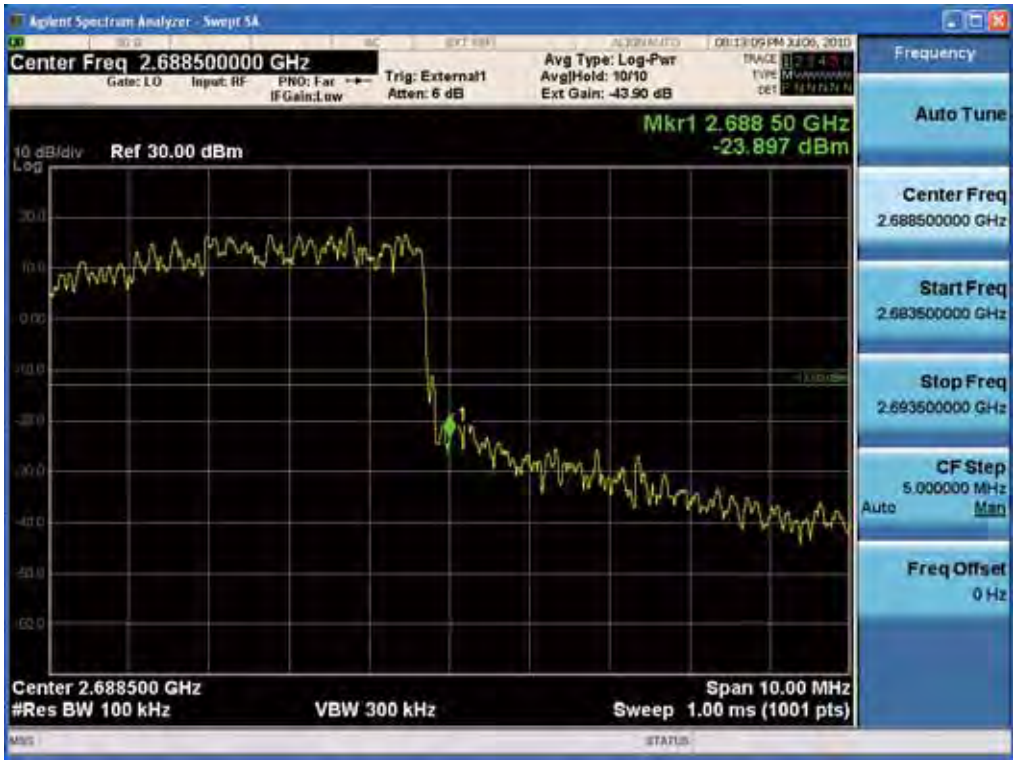
(16QAM High Channel)



(64QAM Low Channel)



(64QAM High Channel)



8. SPURIOUS EMISSION AT ANTENNA TERMINAL

8.1. 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

8.2. Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	6674A / DC Power Supply	3501A00901	05/14/2011
Agilent	8498A / Attenuator	51161	01/06/2011
Agilent	8498A / Attenuator	51162	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BU5347	01/06/2011
WEINSCHEL	67-30-33 / Attenuator	BR0530	01/14/2011
Agilent	N9020A / MXA Signal Analyzer	US46220219	03/03/2011
Agilent	11636B / Power Divider	11377	12/24/2010
Cernex	CDPU5260404K/ Power Divider-4WAY	14695	02/08/2011

8.3. 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.

The EUT provides the MIMO function which is able to transmit on the same channel with same data simultaneously therefore a combiner is used to sum the individual transmitter output power.

The test data is shown as a combined output in the report.

8.3.1 Environmental Conditions:

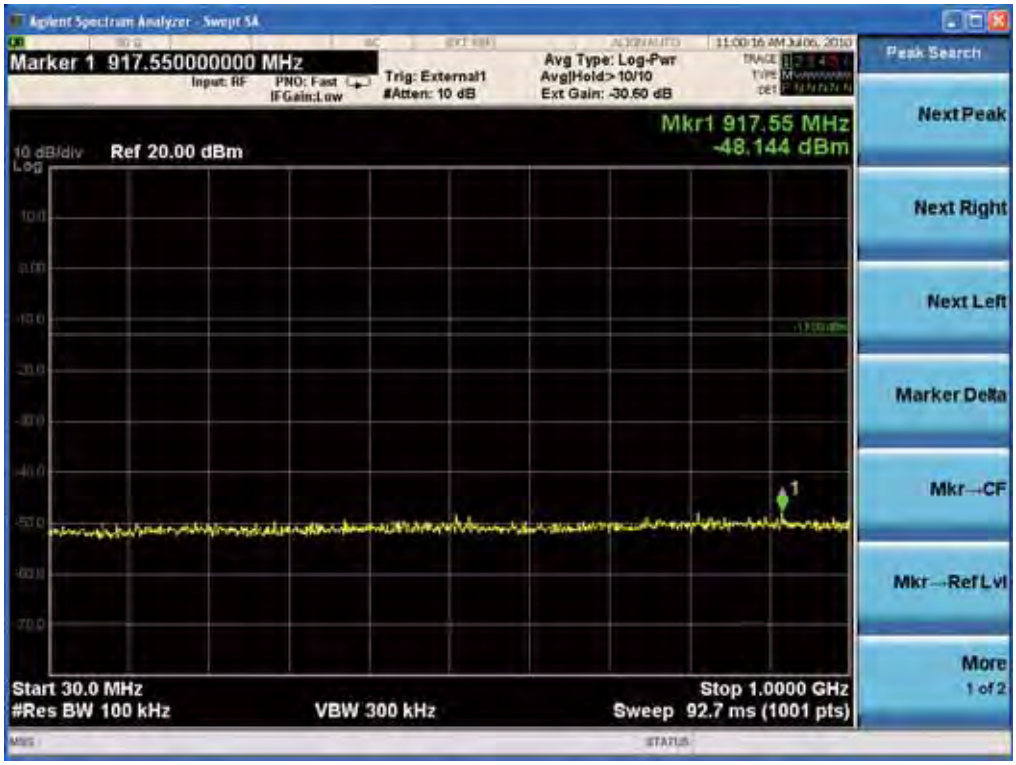
Temperature:	25 °C
Relative Humidity:	66 %

8.4. Test Result

: Pass

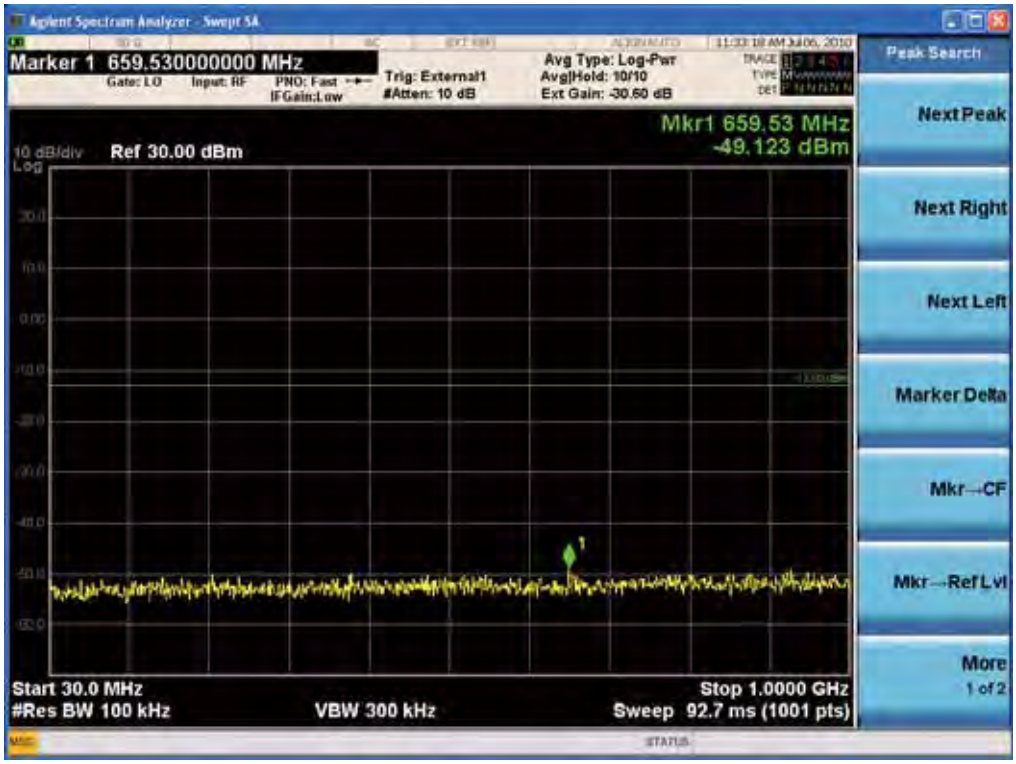
8.4.1. Plot Data at Output 0

(QPSK Low Channel)



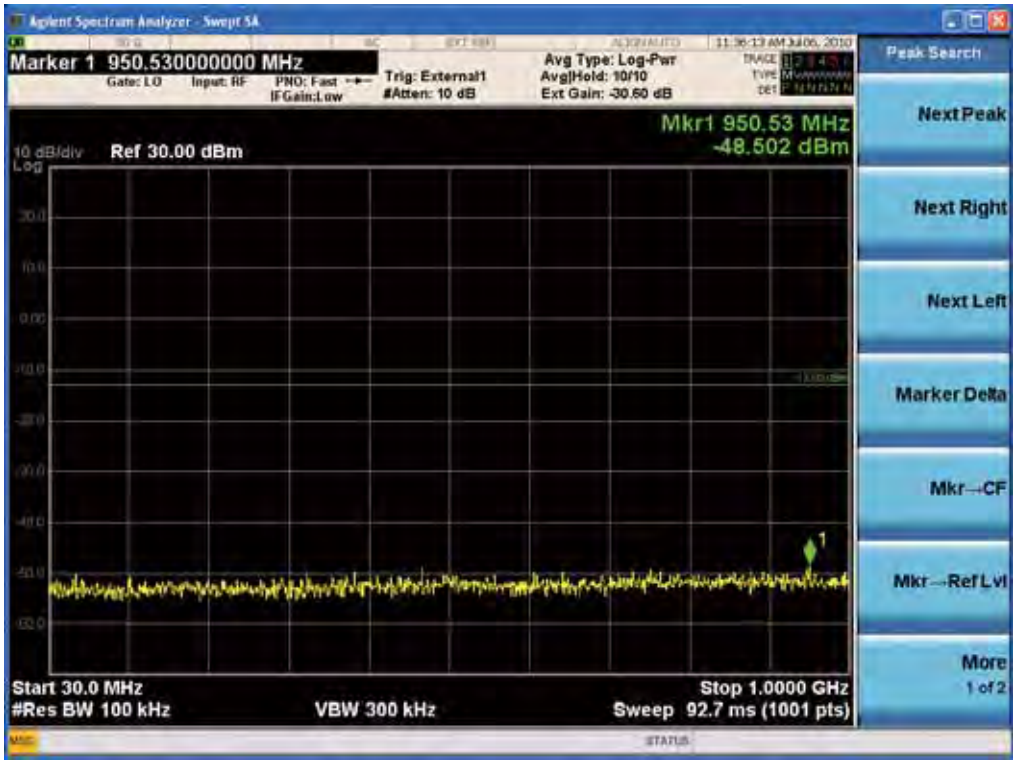
(30 MHz ~ 1 GHz)

(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

(QPSK High Channel)



(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

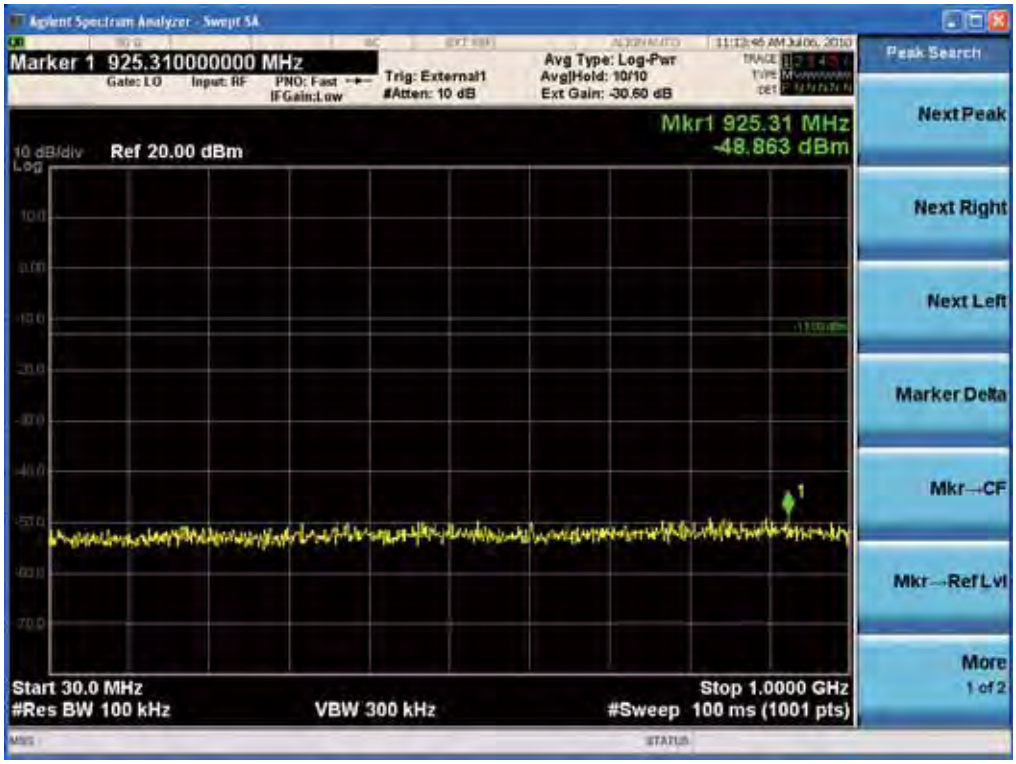
(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

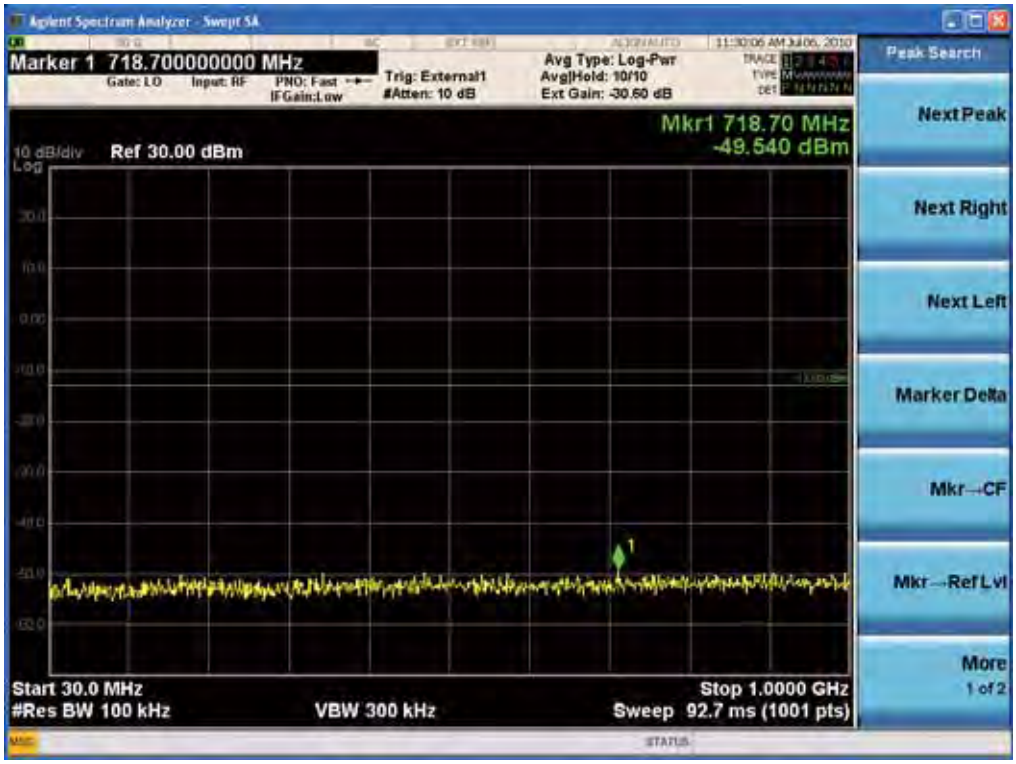
(1 GHz ~ 26.5 GHz)

(16QAM LOW Channel)



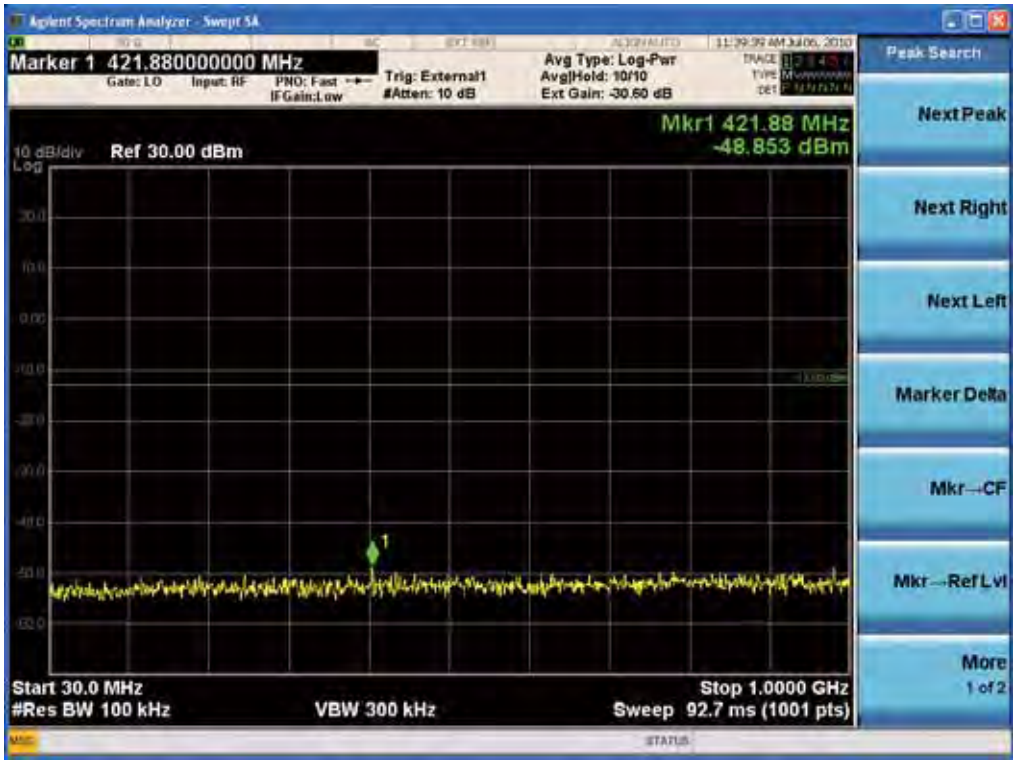
(30 MHz ~ 1 GHz)

(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

(16QAM High Channel)



(30 MHz ~ 1 GHz)

(16QAM LOW Channel)

(1 GHz ~ 26.5 GHz)

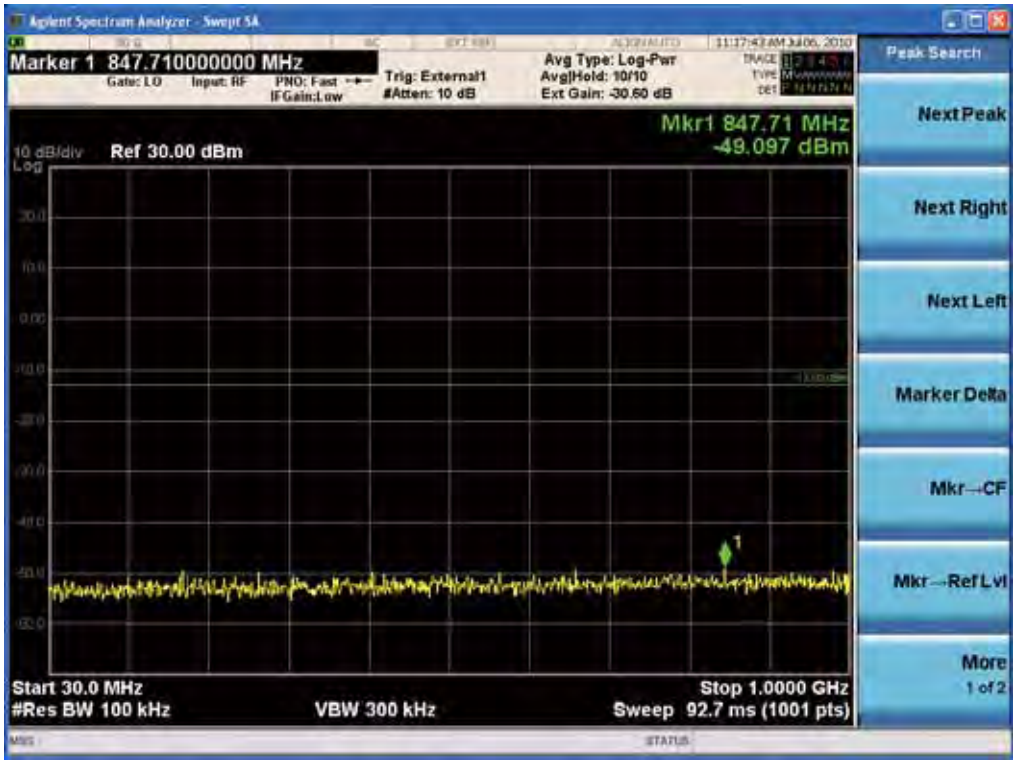
(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

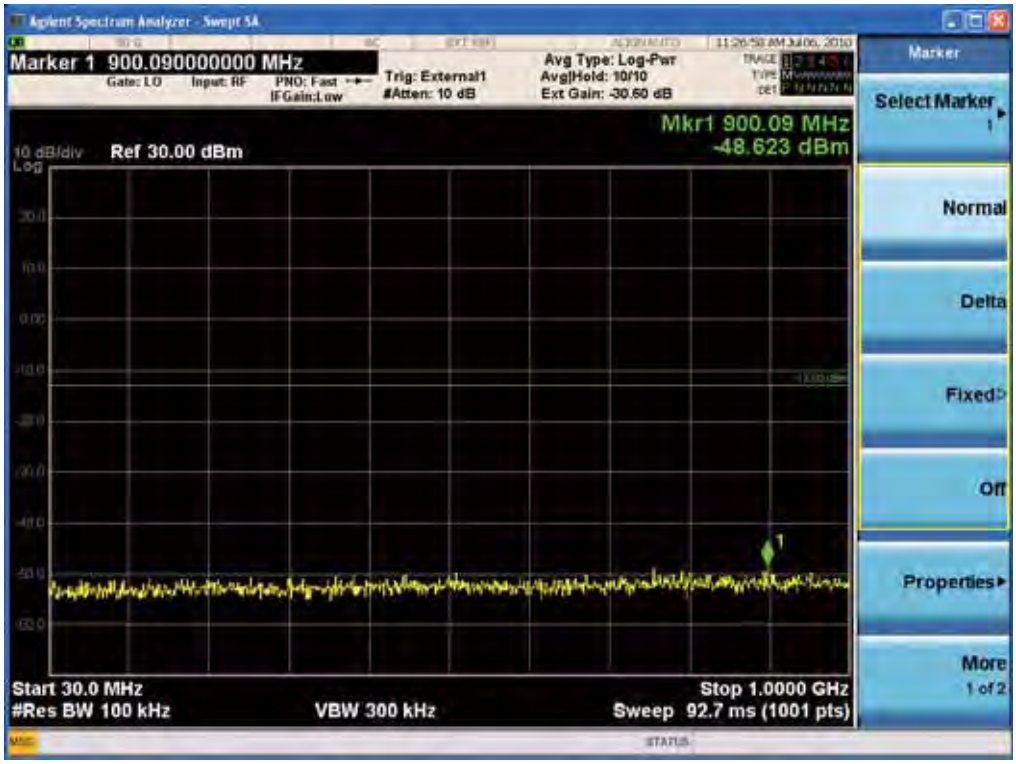
(1 GHz ~ 26.5 GHz)

(64QAM Low Channel)



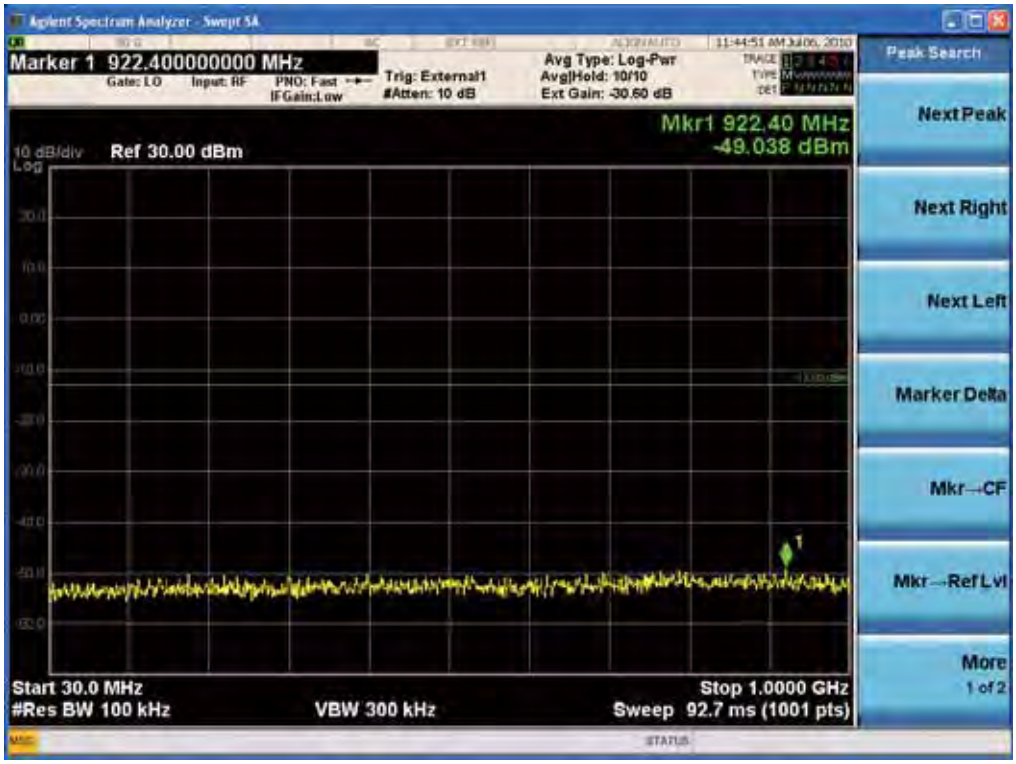
(30 MHz ~ 1 GHz)

(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

(64QAM High Channel)



(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(64QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

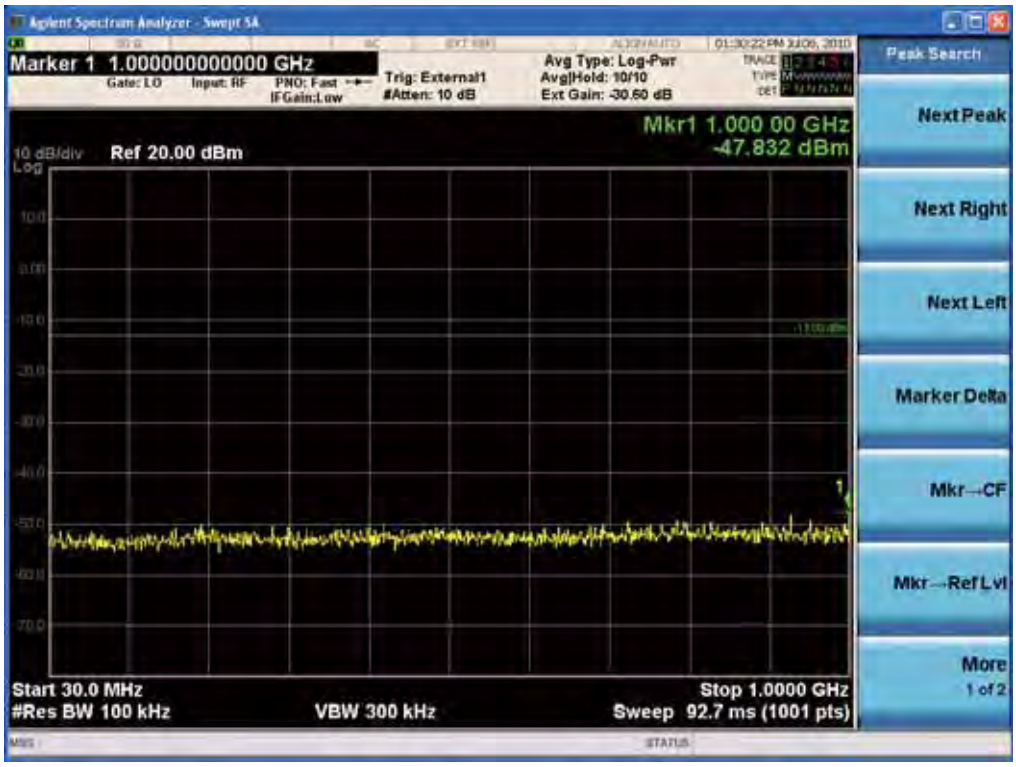
(64QAM High Channel)


Agilent Spectrum Analyzer - Swept SA
Marker 1 25.515500000000 GHz
Gate: LO
Input: RF
PNO: Fast
IFGain:Low
Trig: External1
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
Ext Gain: -30.60 dB
Mkr1 25.516 GHz
-26.706 dBm
10 dB/div
Log
Ref 30.00 dBm
Start 1.00 GHz
#Res BW 1.0 MHz
VBW 3.0 MHz
Stop 26.50 GHz
Sweep 510 ms (1001 pts)
Marker
Mkr→CF
Mkr→CF Step
Mkr→Start
Mkr→Stop
Mkr→Ref Lvl

(1 GHz ~ 26.5 GHz)

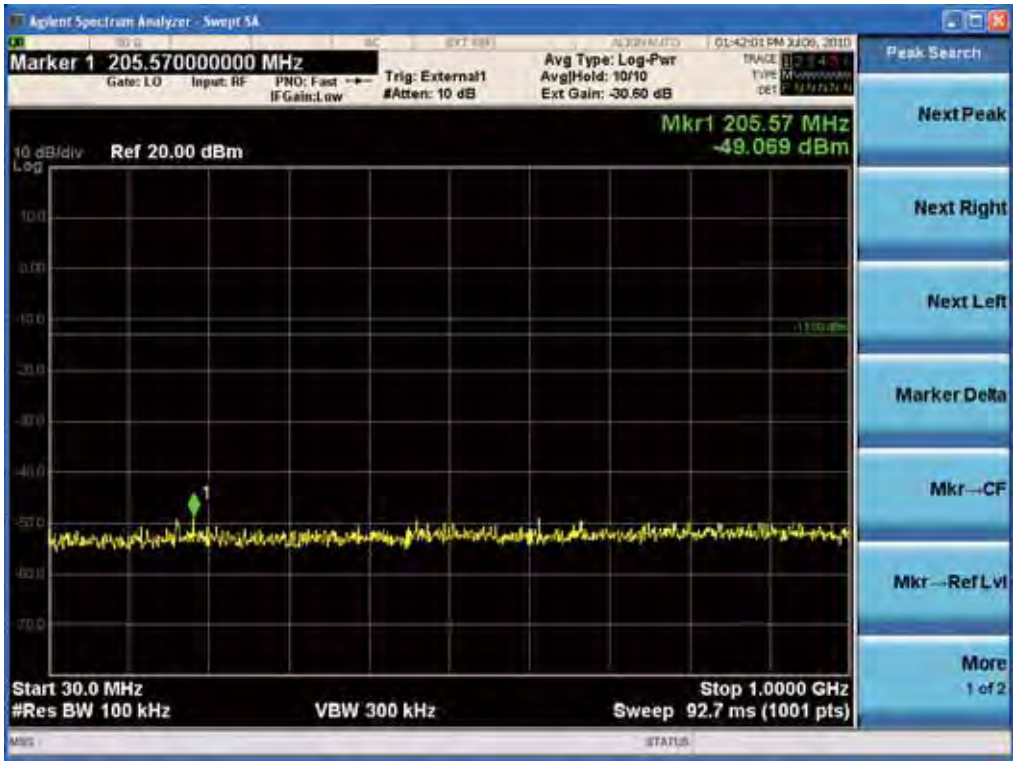
8.4.2. Plot Data at Output 1

(QPSK Low Channel)



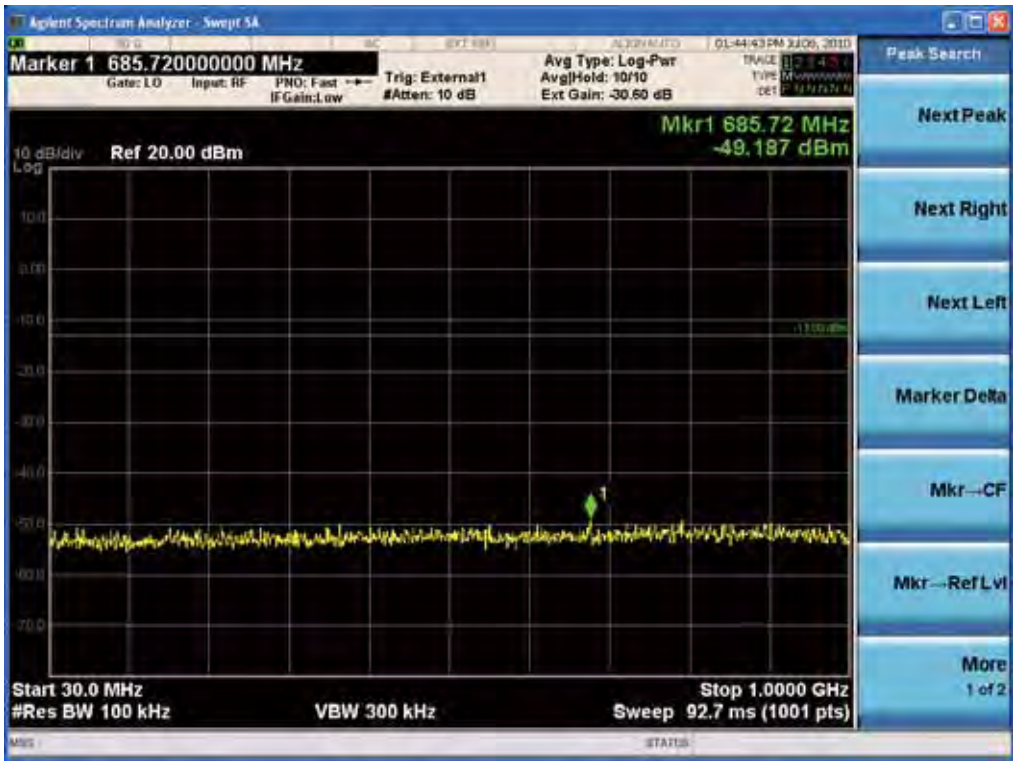
(30 MHz ~ 1 GHz)

(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

(QPSK High Channel)



(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

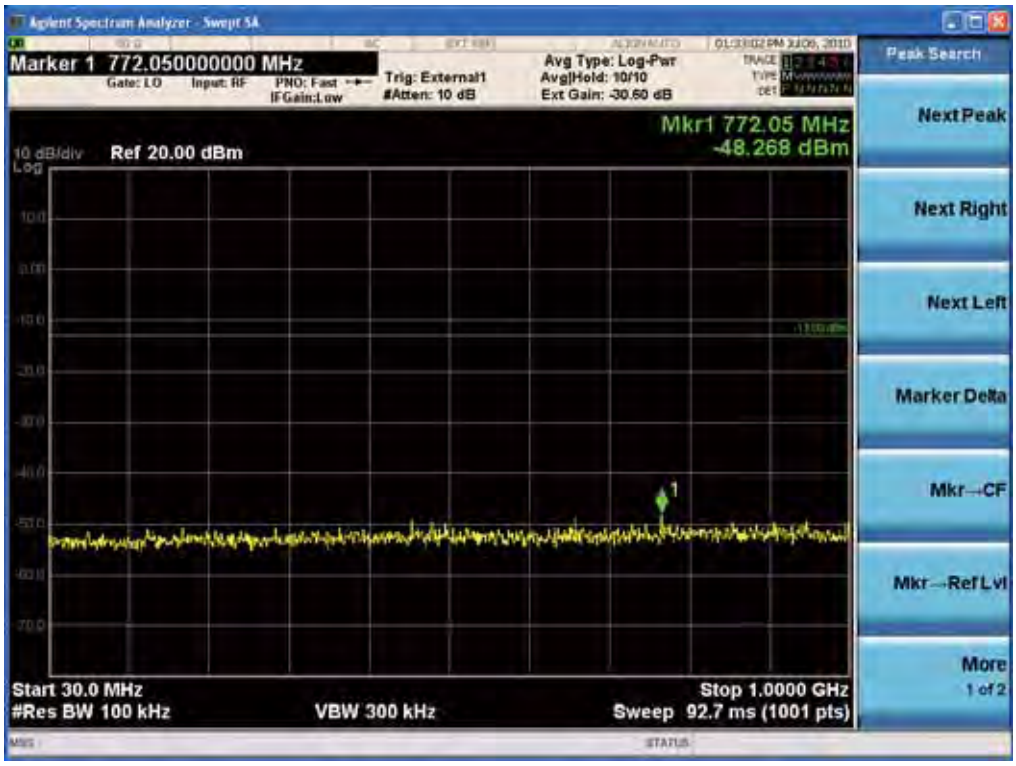
(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

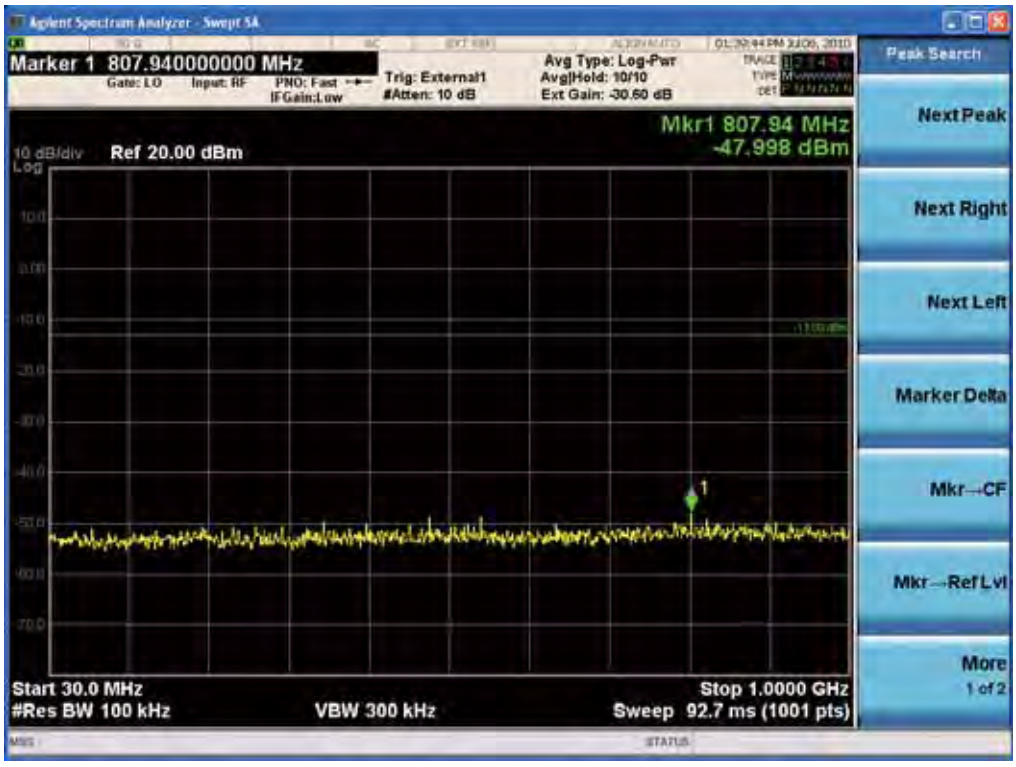
(1 GHz ~ 26.5 GHz)

(16QAM LOW Channel)



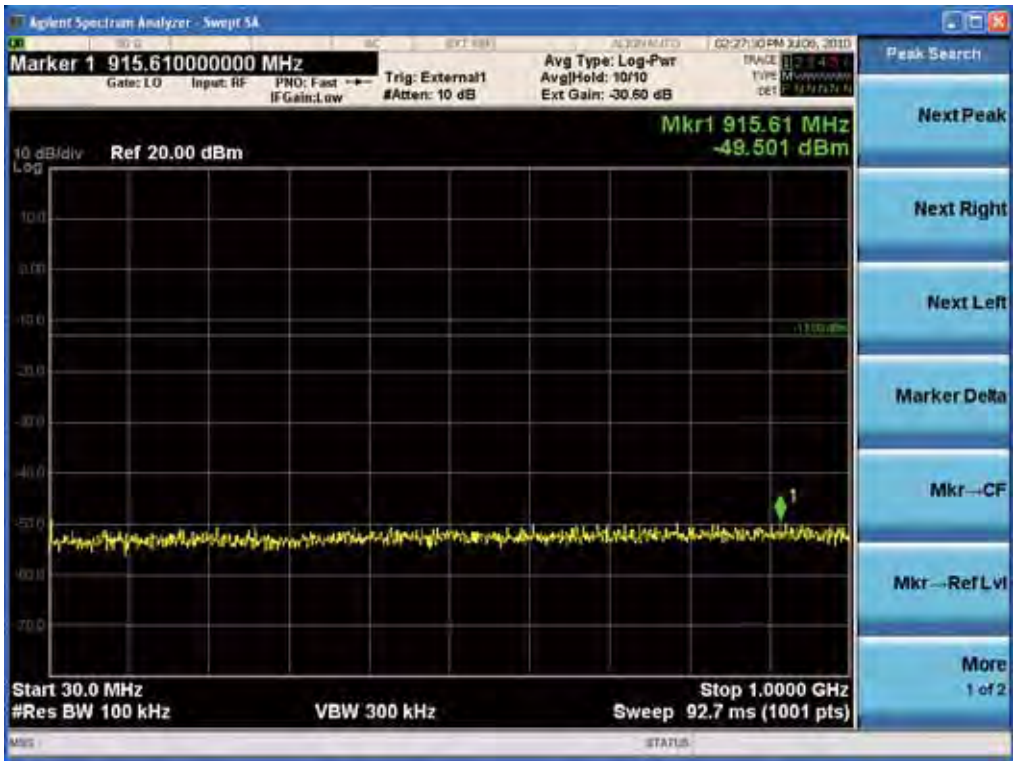
(30 MHz ~ 1 GHz)

(16QAM Middle Channel)



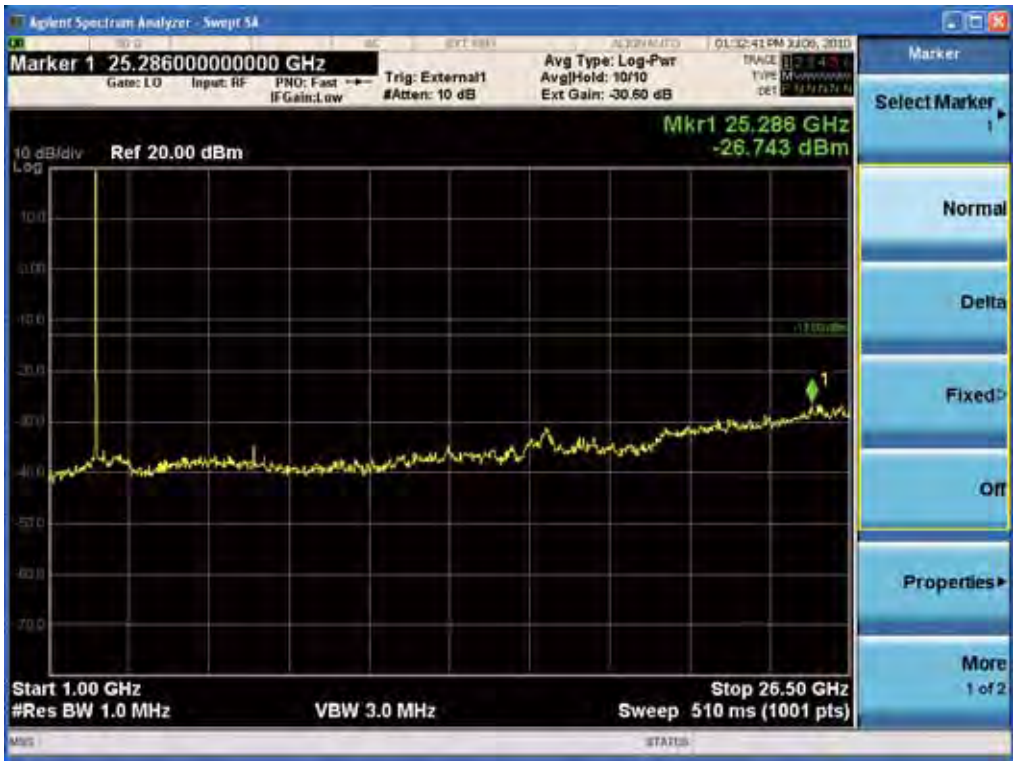
(30 MHz ~ 1 GHz)

(16QAM High Channel)



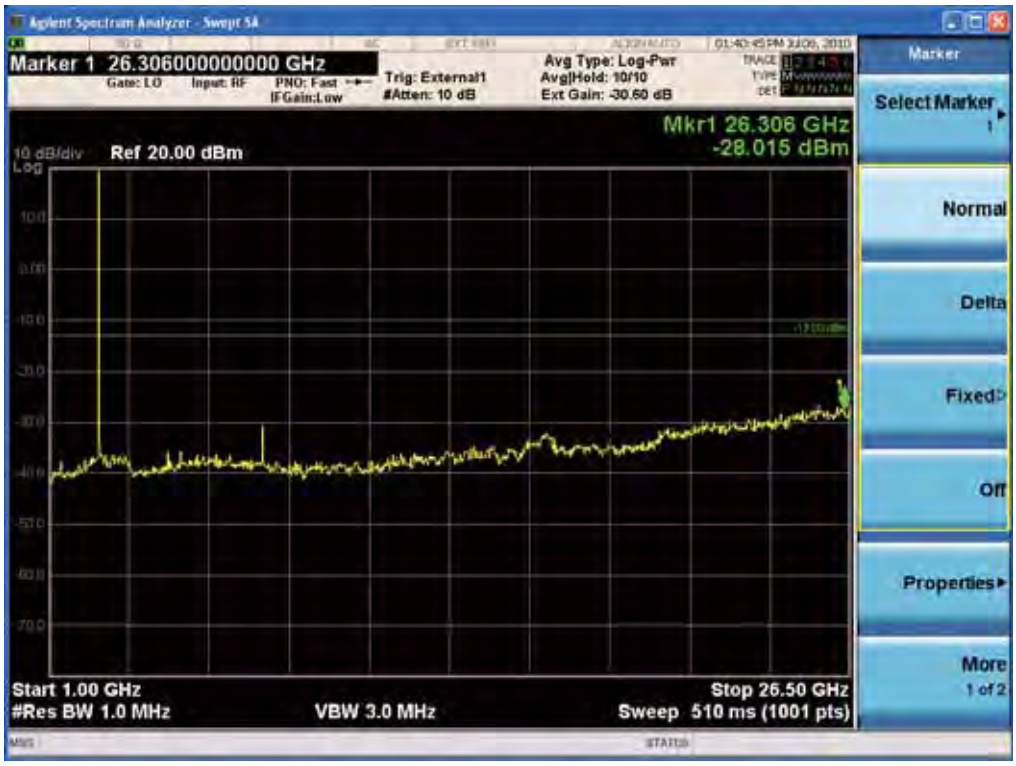
(30 MHz ~ 1 GHz)

(16QAM LOW Channel)



(1 GHz ~ 26.5 GHz)

(16QAM Middle Channel)

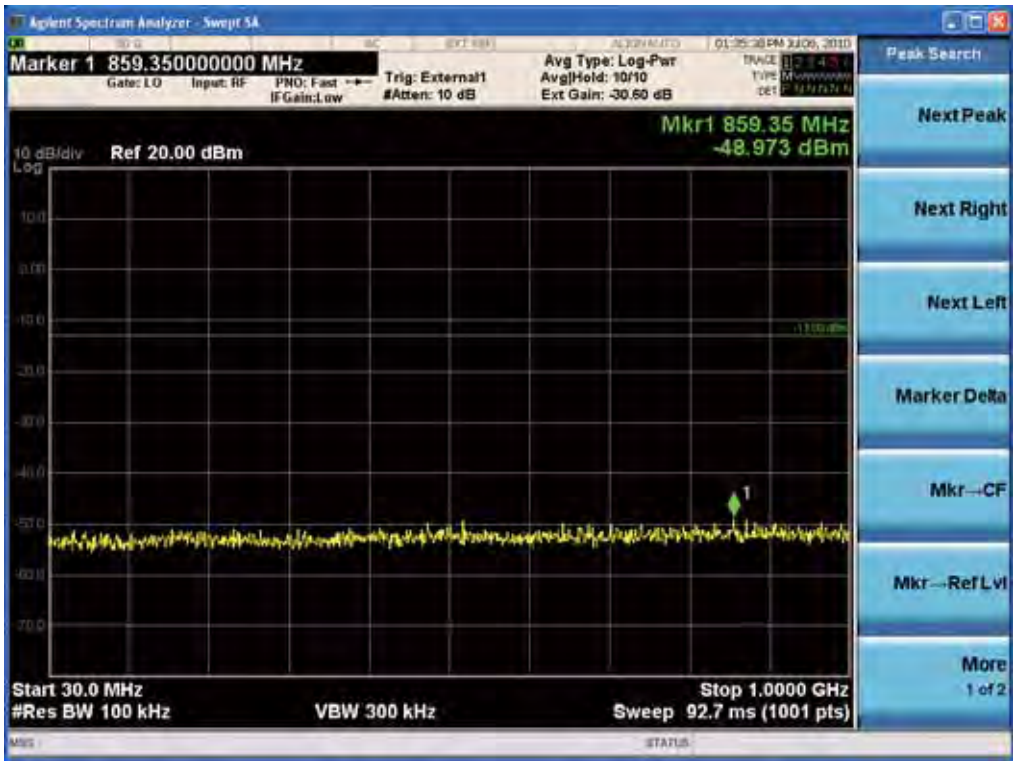


(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

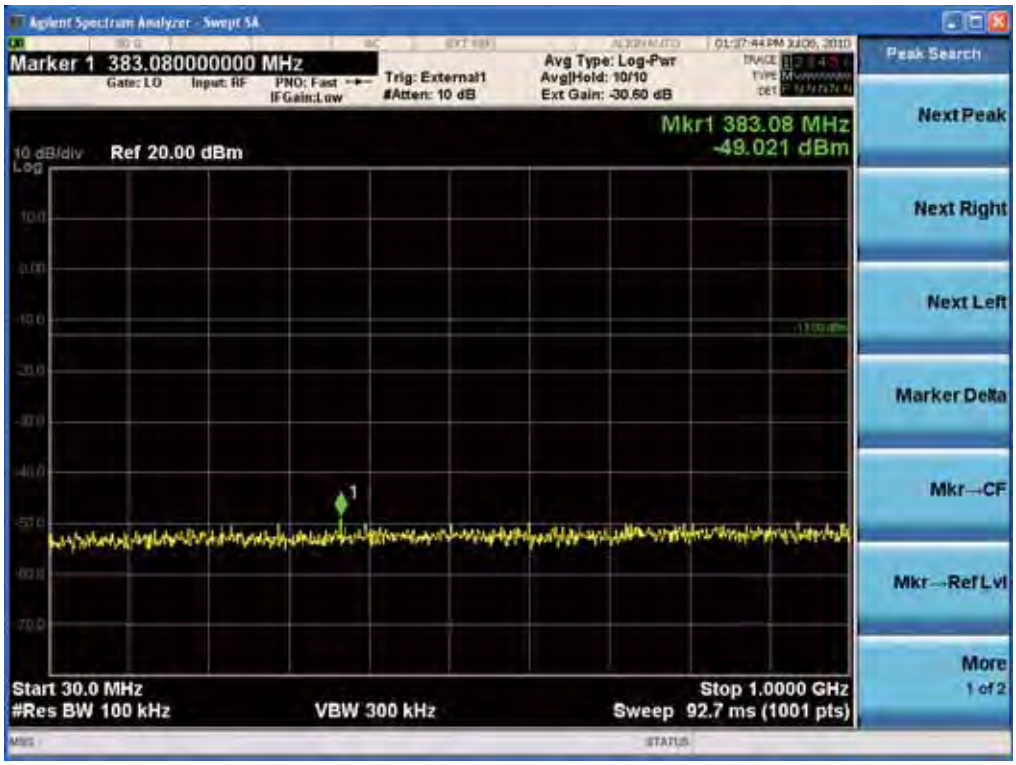
(1 GHz ~ 26.5 GHz)

(64QAM Low Channel)



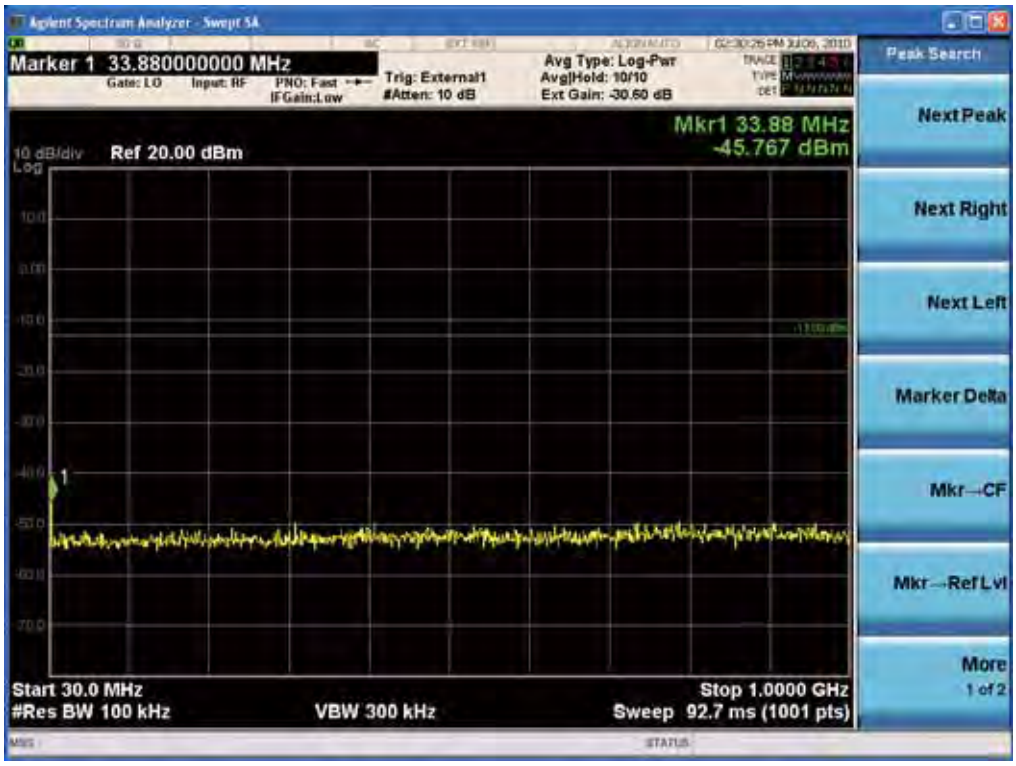
(30 MHz ~ 1 GHz)

(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

(64QAM High Channel)



(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(64QAM Middle Channel)

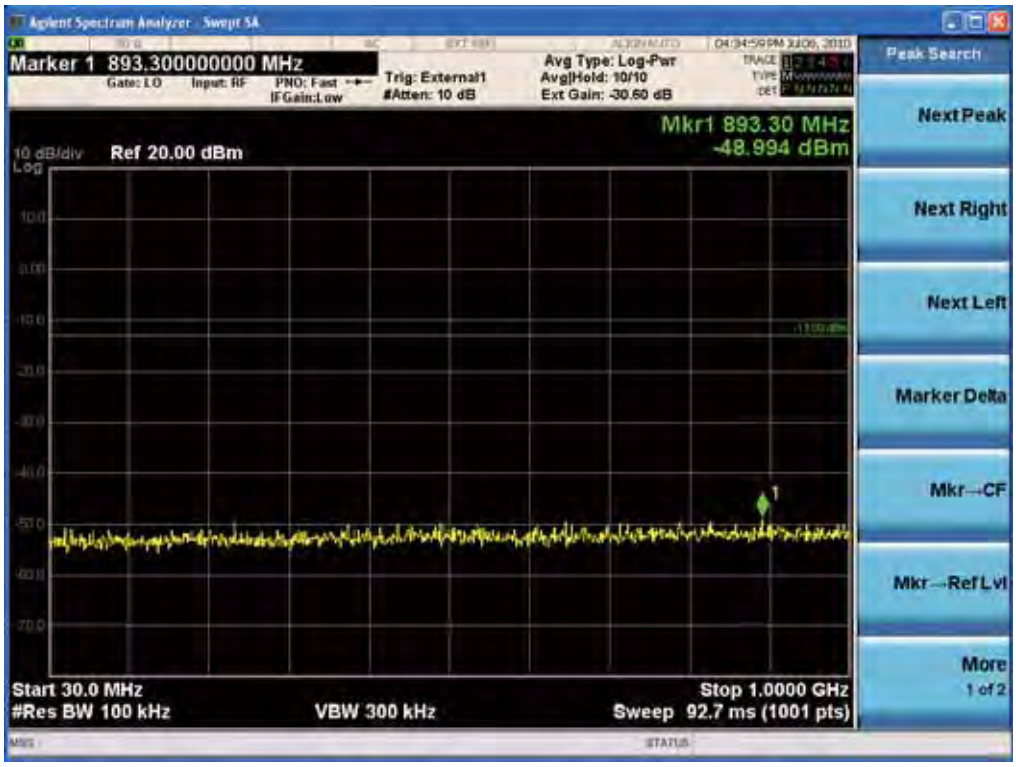
(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

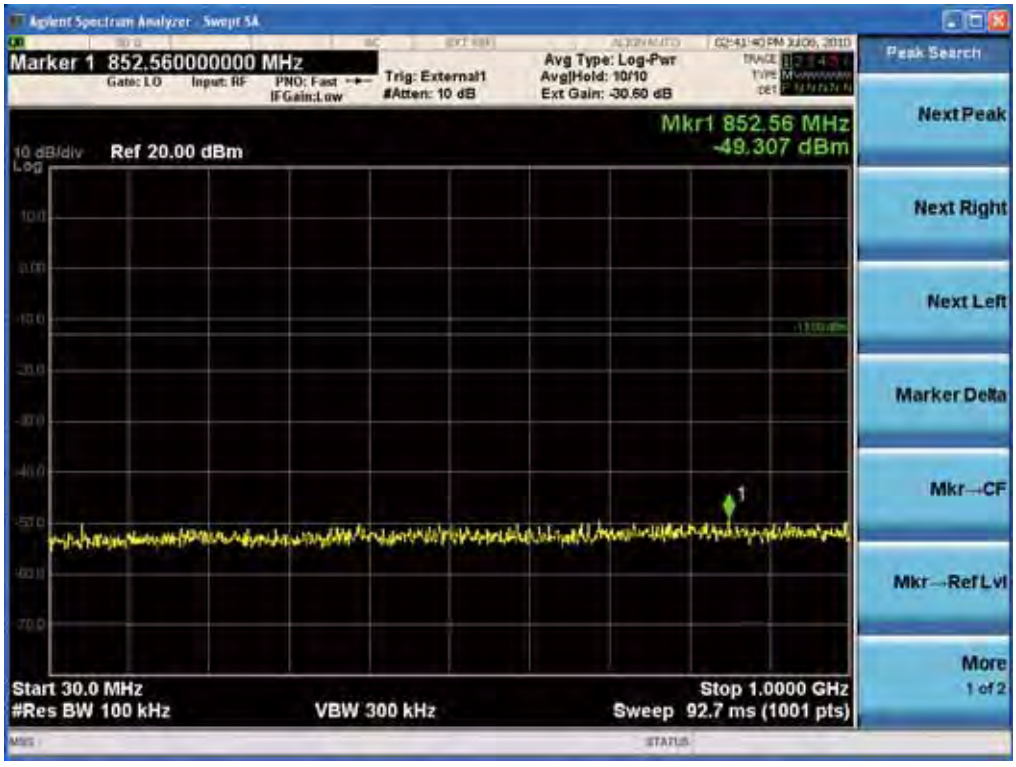
8.4.3. Plot Data at Output 2

(QPSK Low Channel)



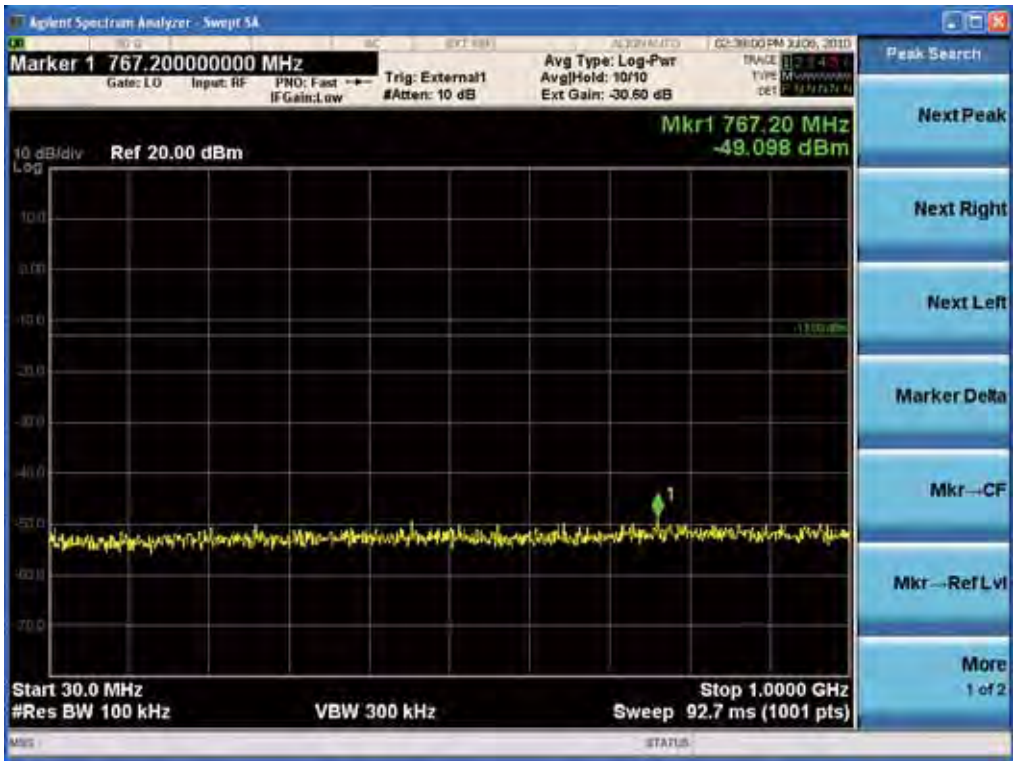
(30 MHz ~ 1 GHz)

(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

(QPSK High Channel)



(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

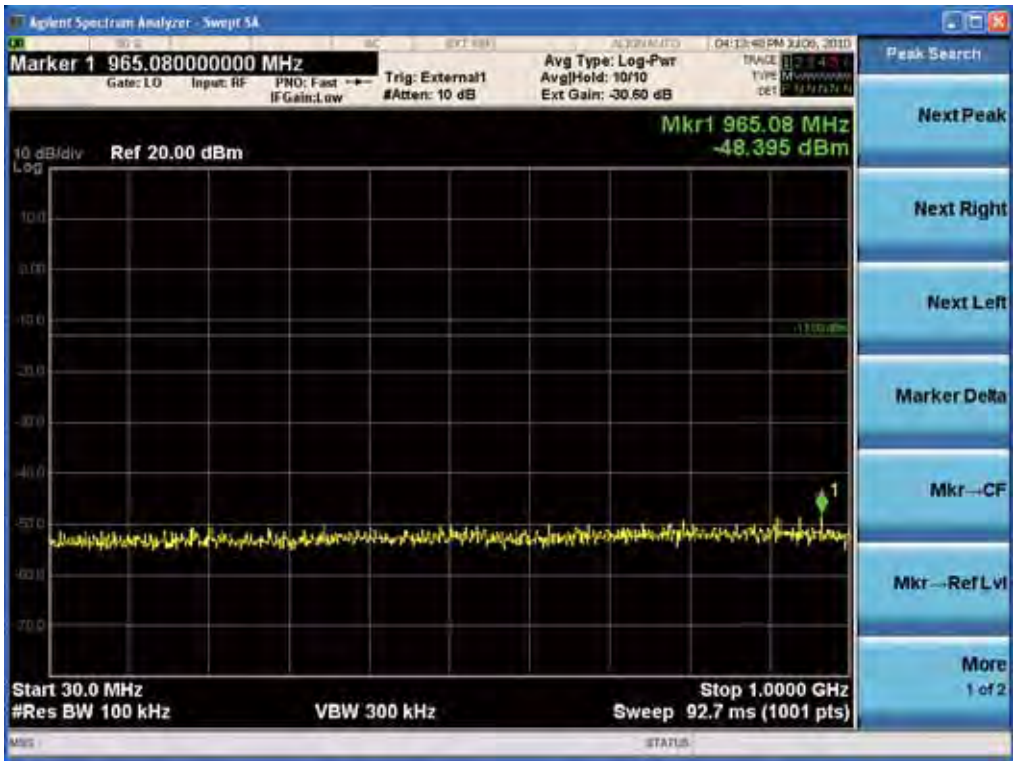
(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

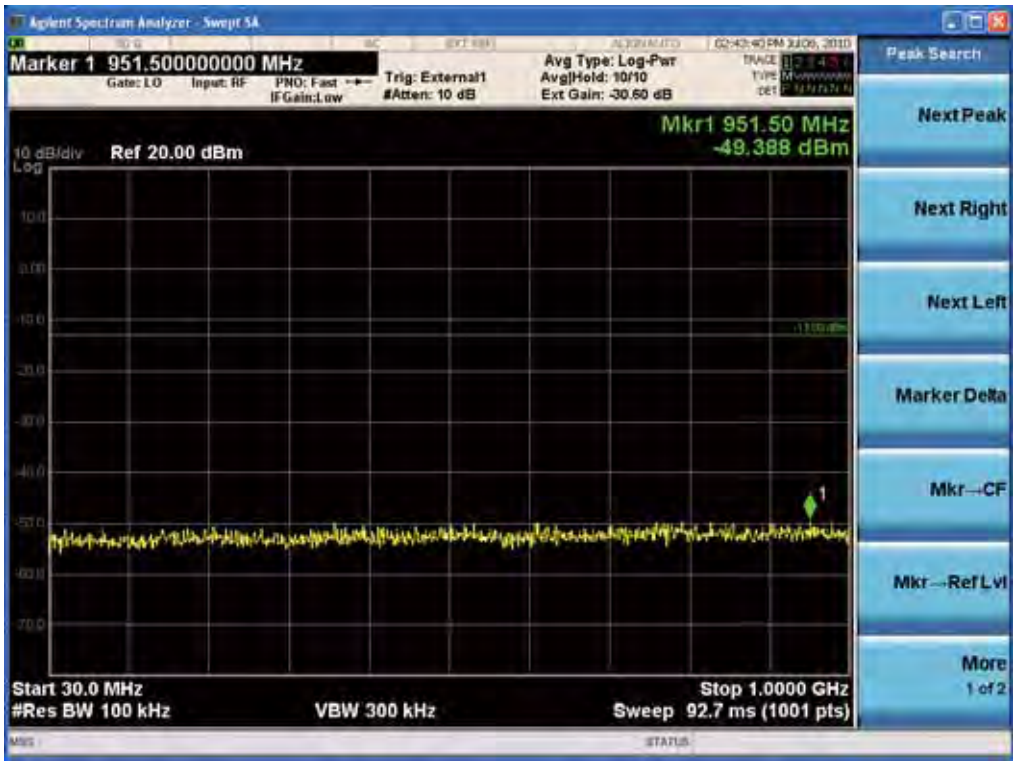
(1 GHz ~ 26.5 GHz)

(16QAM LOW Channel)



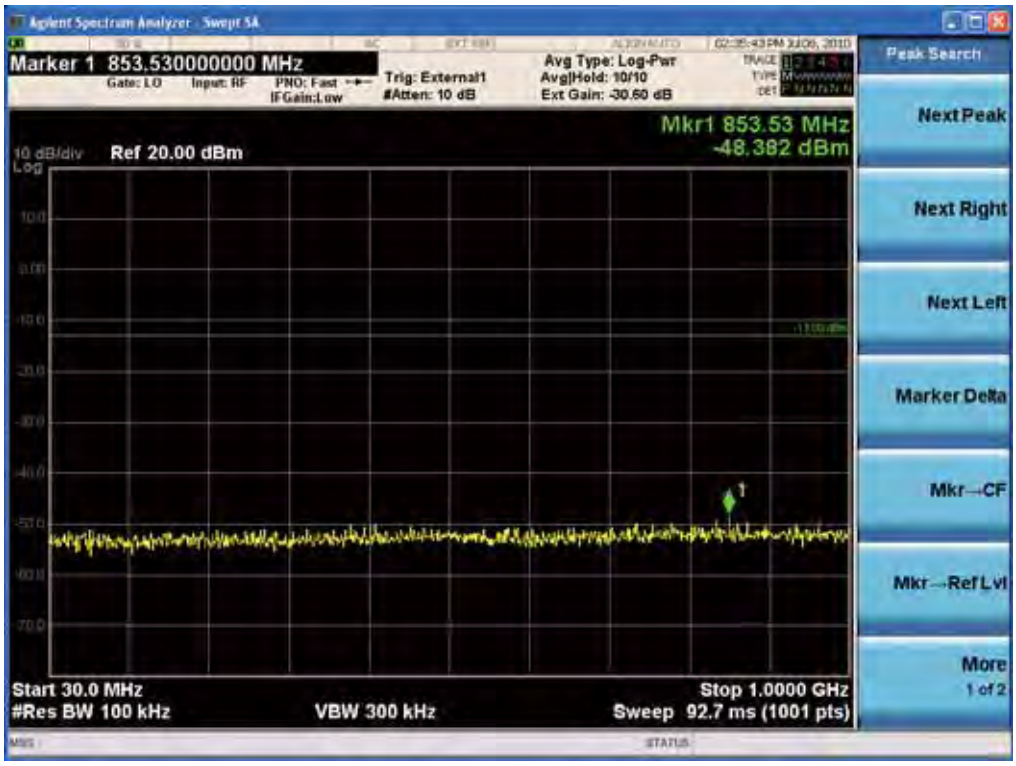
(30 MHz ~ 1 GHz)

(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

(16QAM High Channel)



(30 MHz ~ 1 GHz)

(16QAM LOW Channel)

(1 GHz ~ 26.5 GHz)

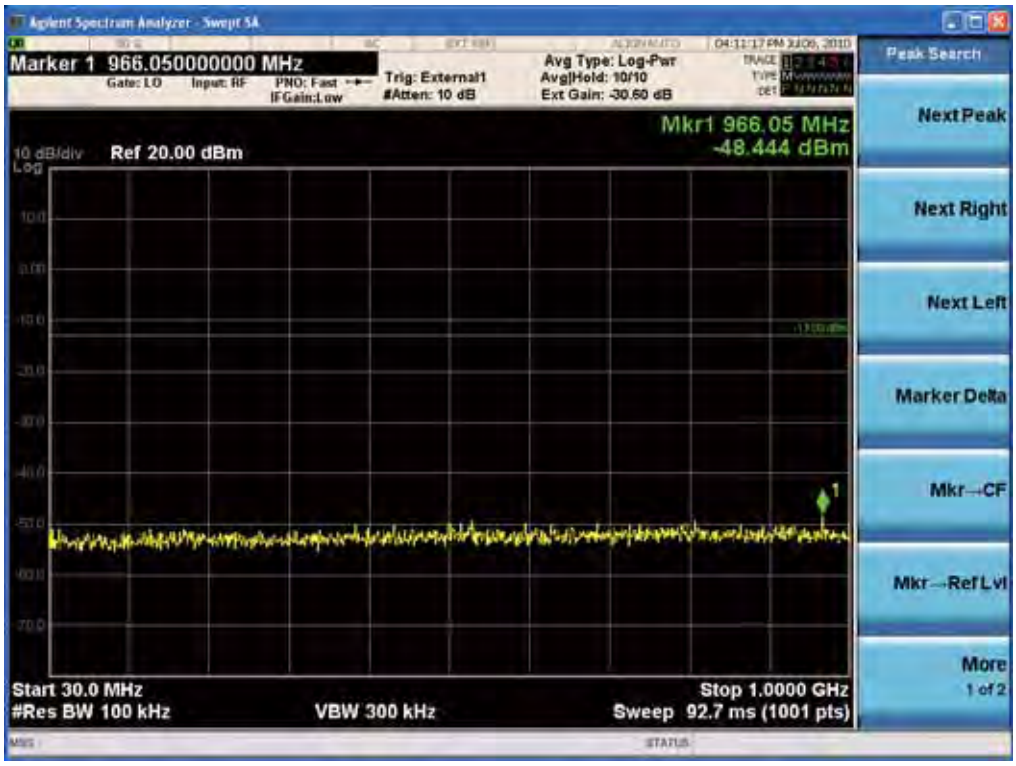
(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

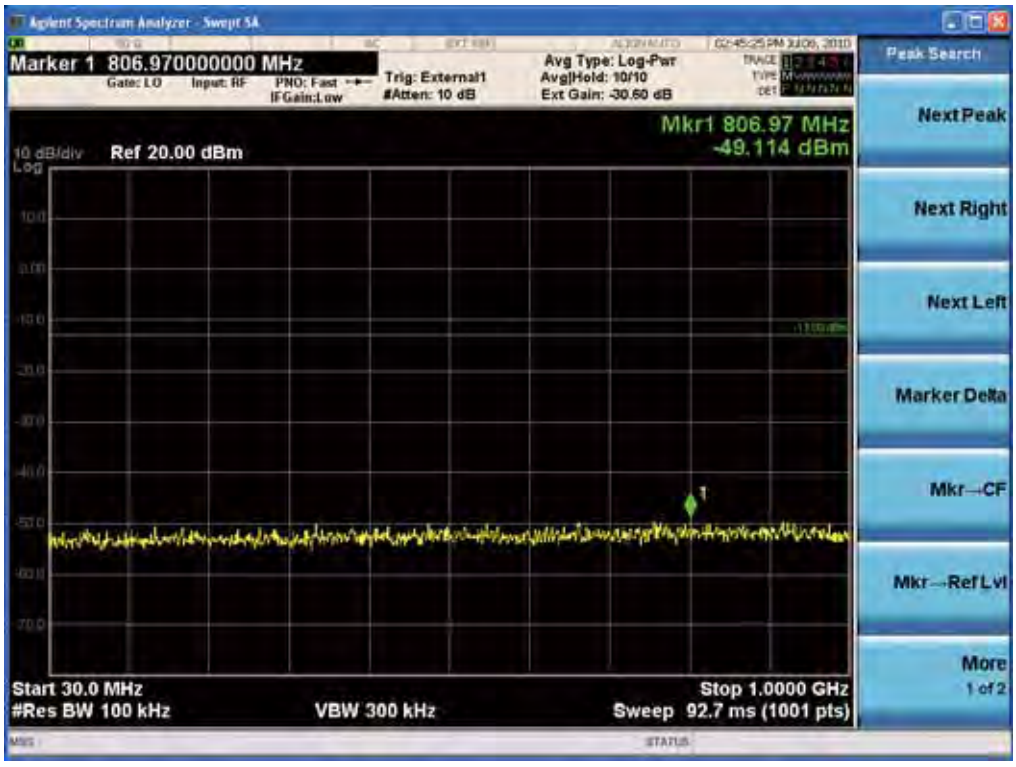
(1 GHz ~ 26.5 GHz)

(64QAM Low Channel)



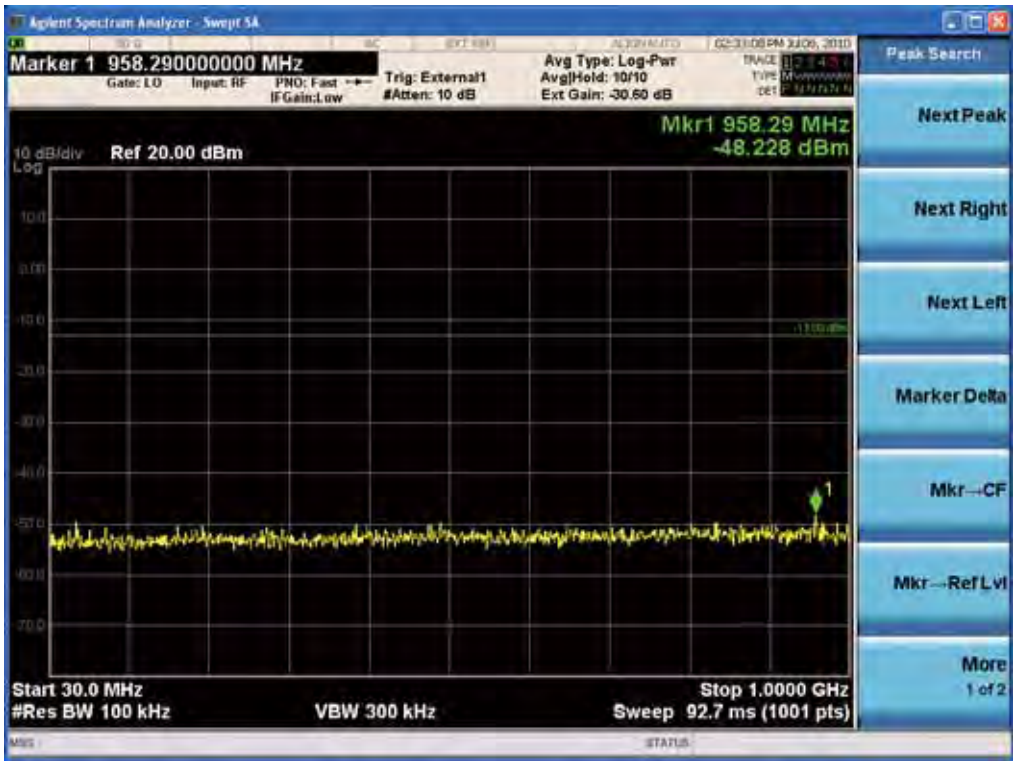
(30 MHz ~ 1 GHz)

(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

(64QAM High Channel)



(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(64QAM Middle Channel)

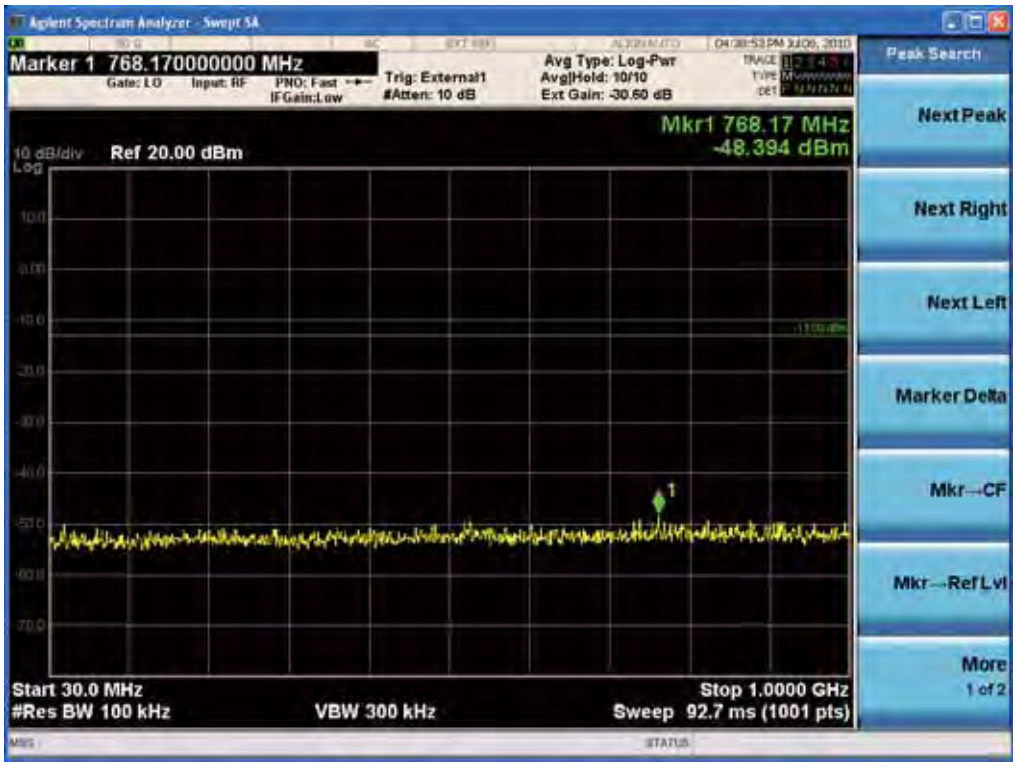
(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

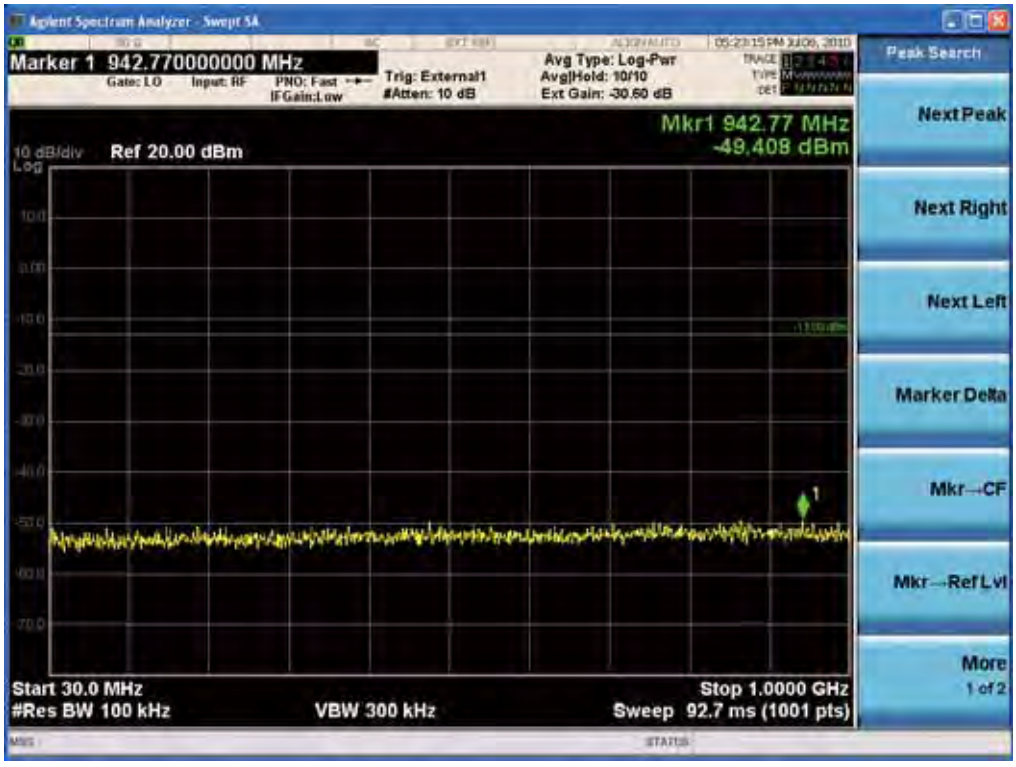
8.4.4. Plot Data at Output 3

(QPSK Low Channel)



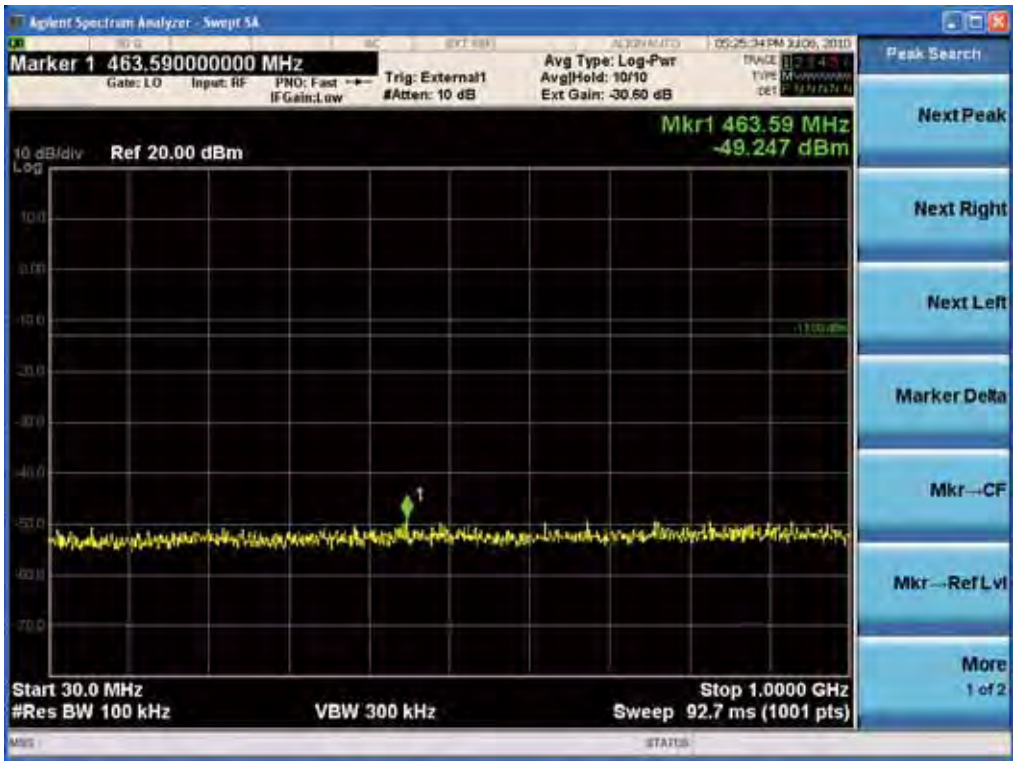
(30 MHz ~ 1 GHz)

(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

(QPSK High Channel)



(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

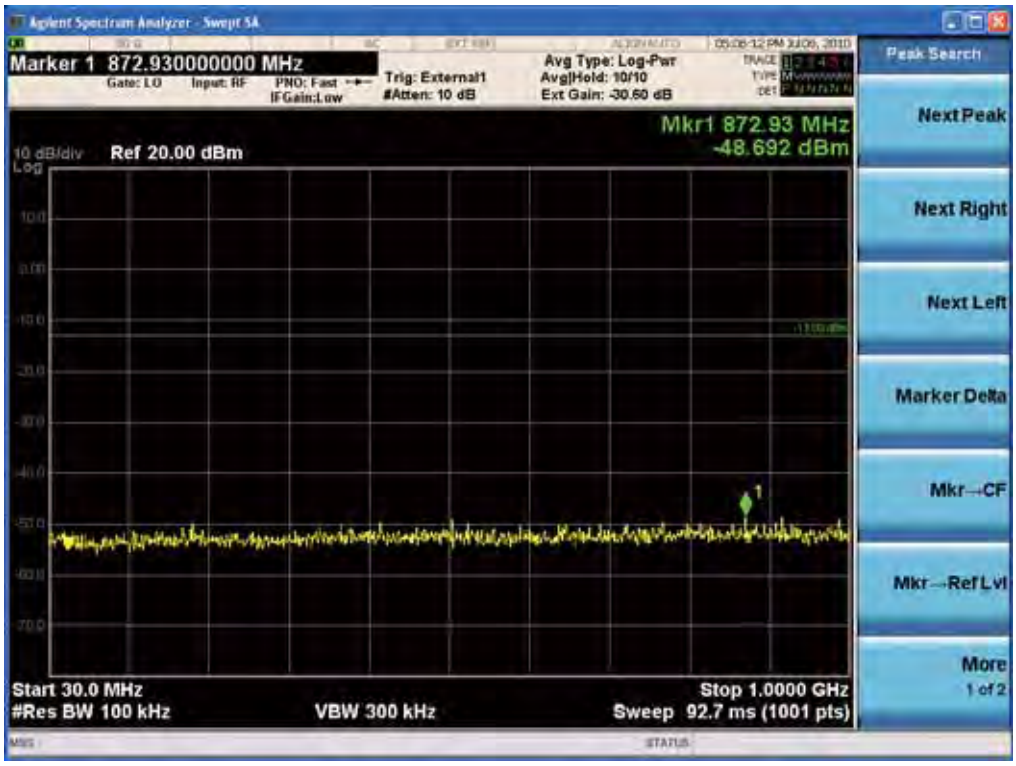
(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

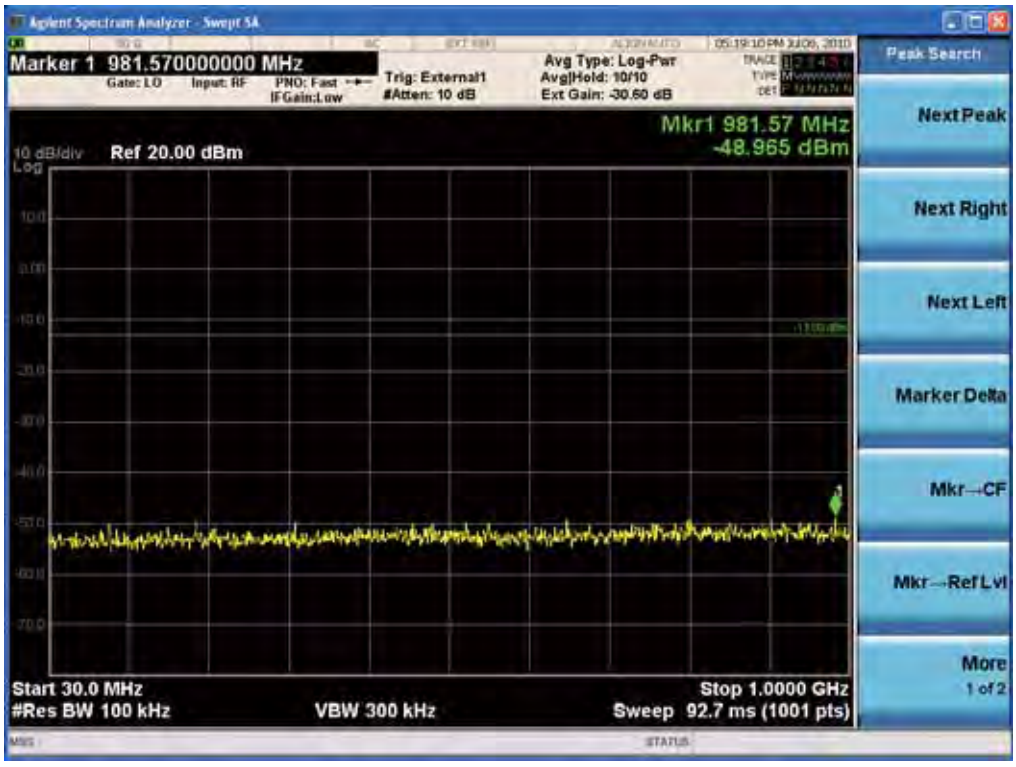
(1 GHz ~ 26.5 GHz)

(16QAM LOW Channel)



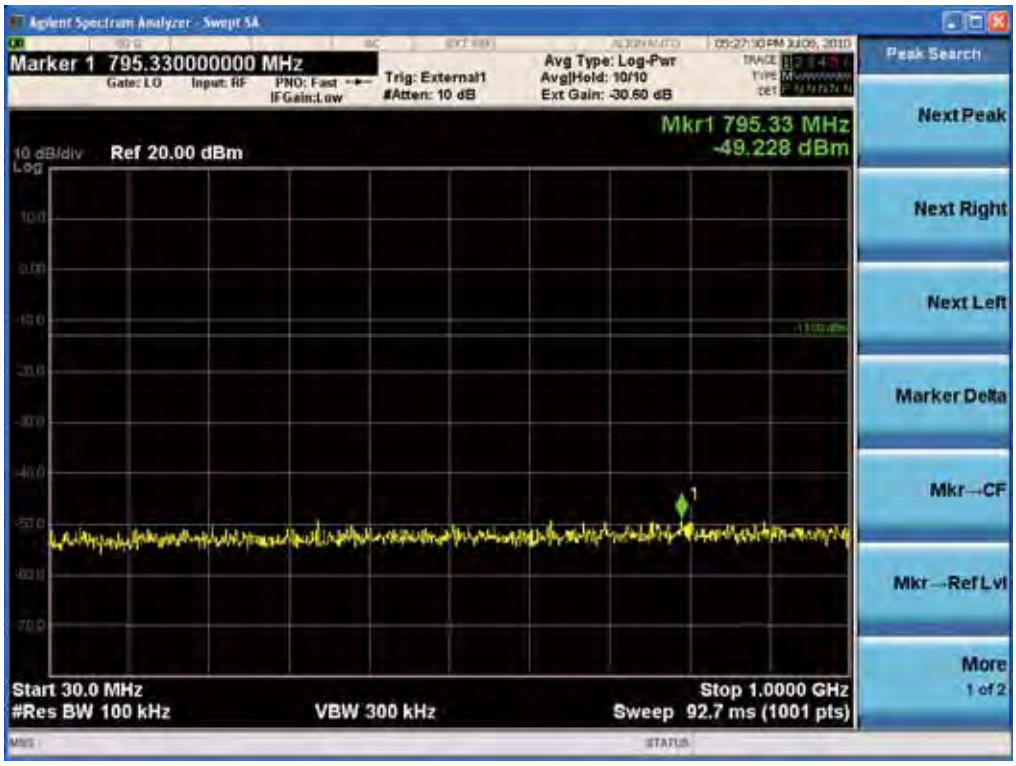
(30 MHz ~ 1 GHz)

(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

(16QAM High Channel)



(30 MHz ~ 1 GHz)

(16QAM LOW Channel)

(1 GHz ~ 26.5 GHz)

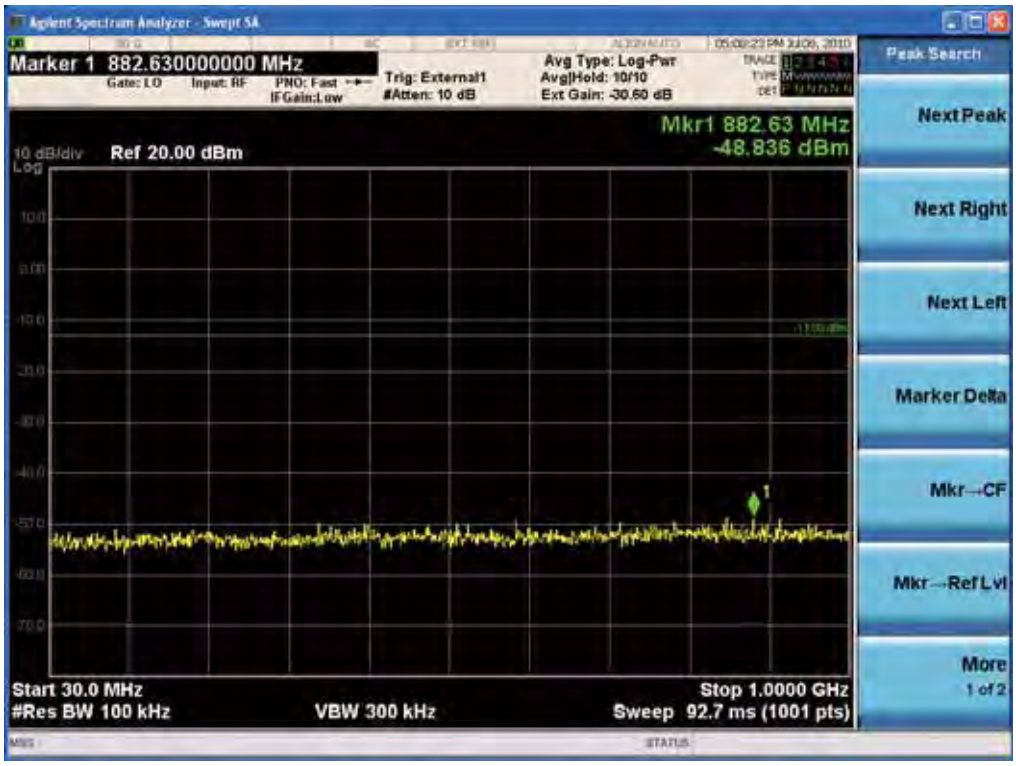
(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

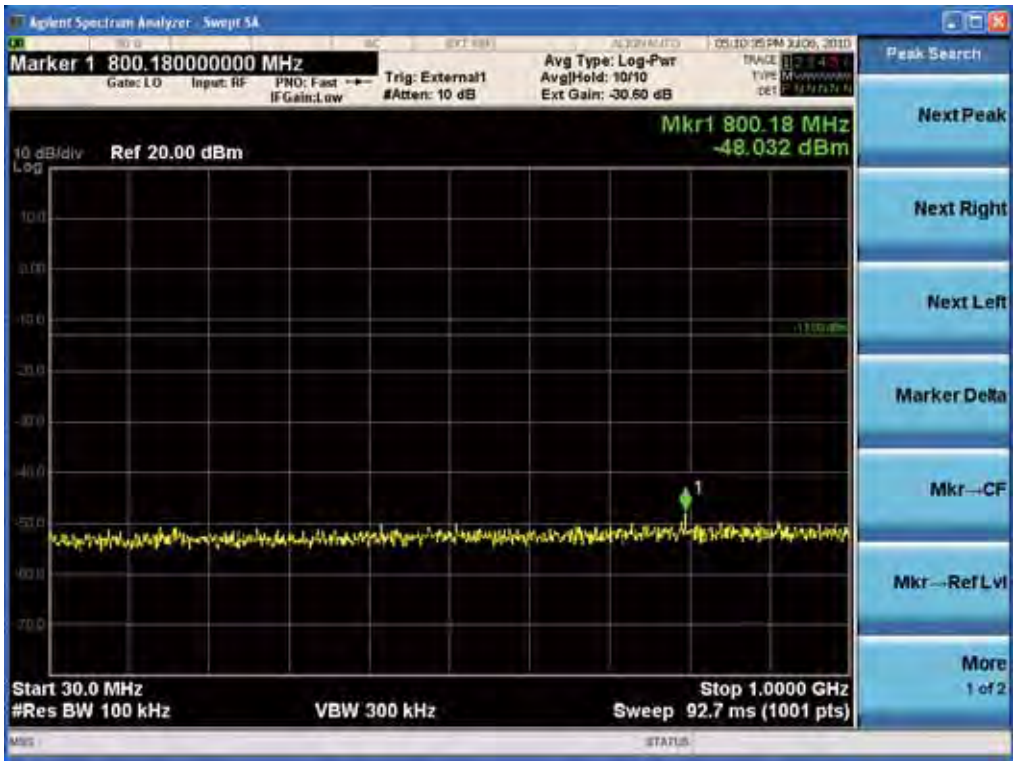
(1 GHz ~ 26.5 GHz)

(64QAM Low Channel)



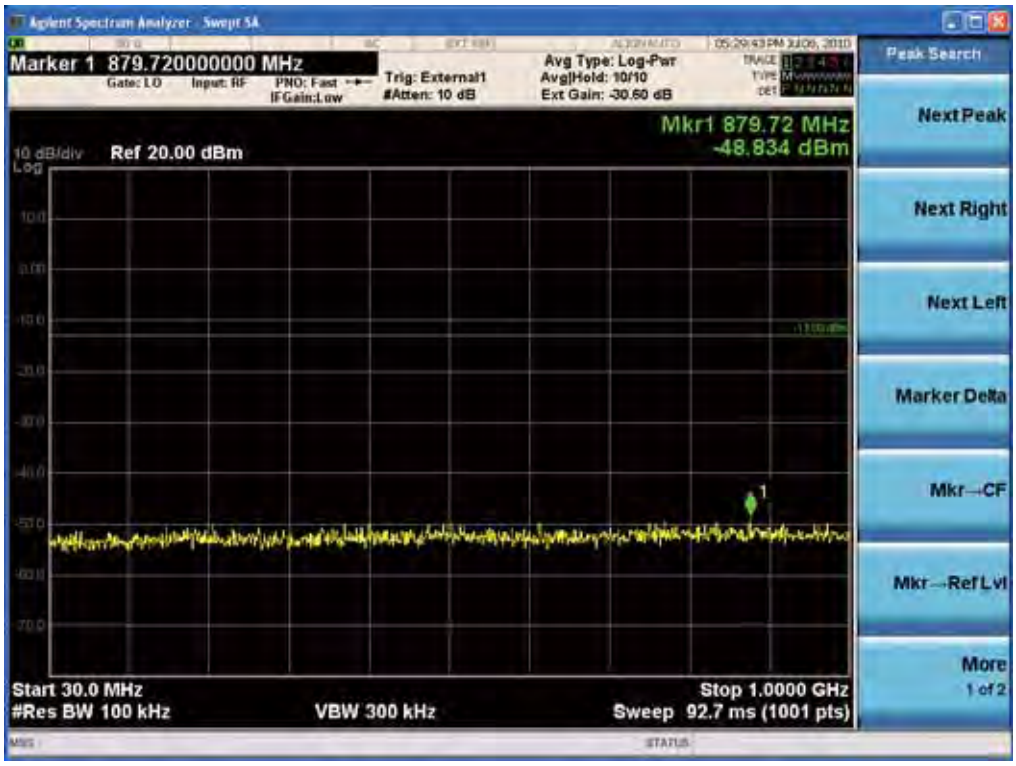
(30 MHz ~ 1 GHz)

(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

(64QAM High Channel)



(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(64QAM Middle Channel)

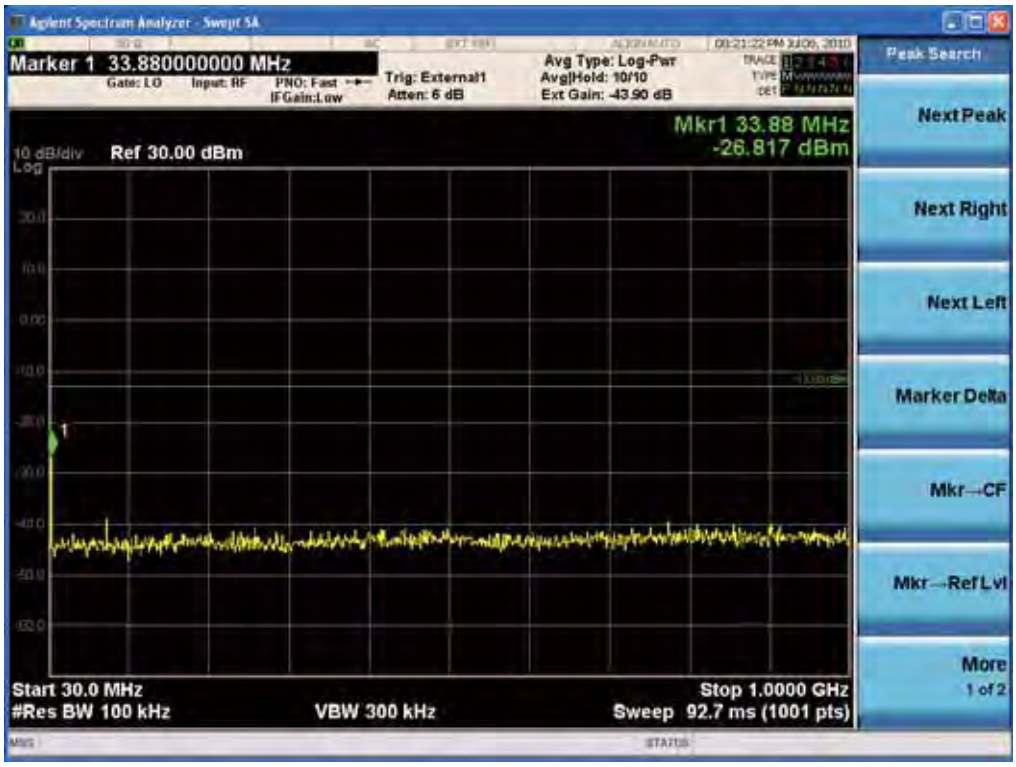
(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

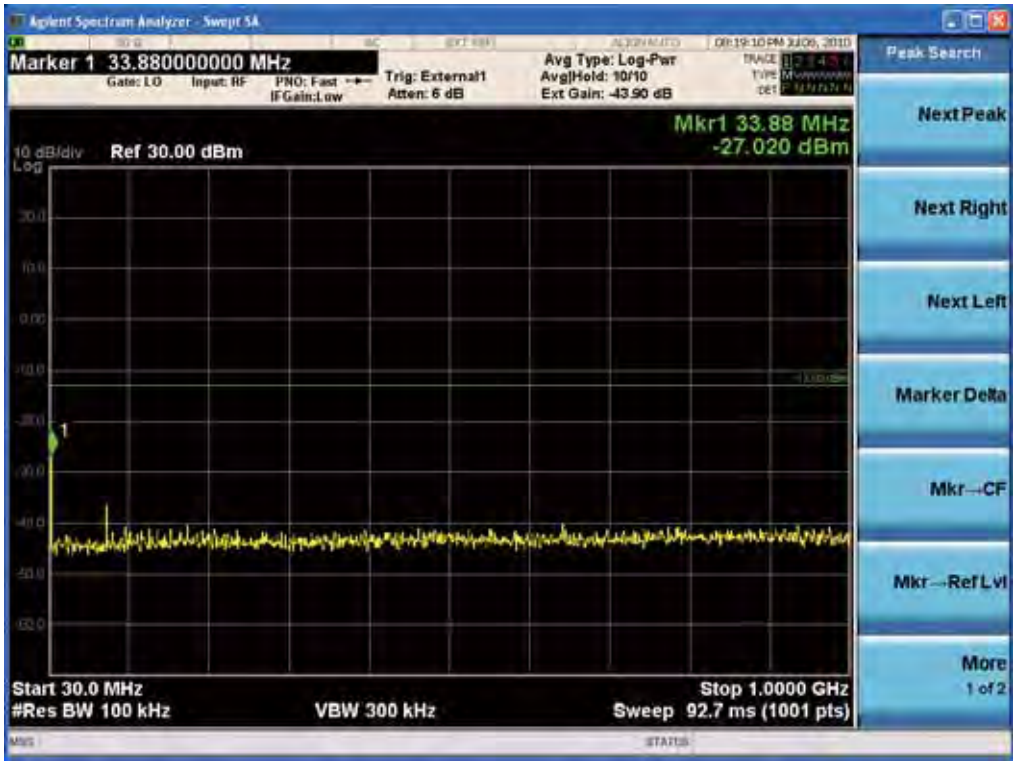
8.4.5. Combined Plot Data at Output

(QPSK Low Channel)



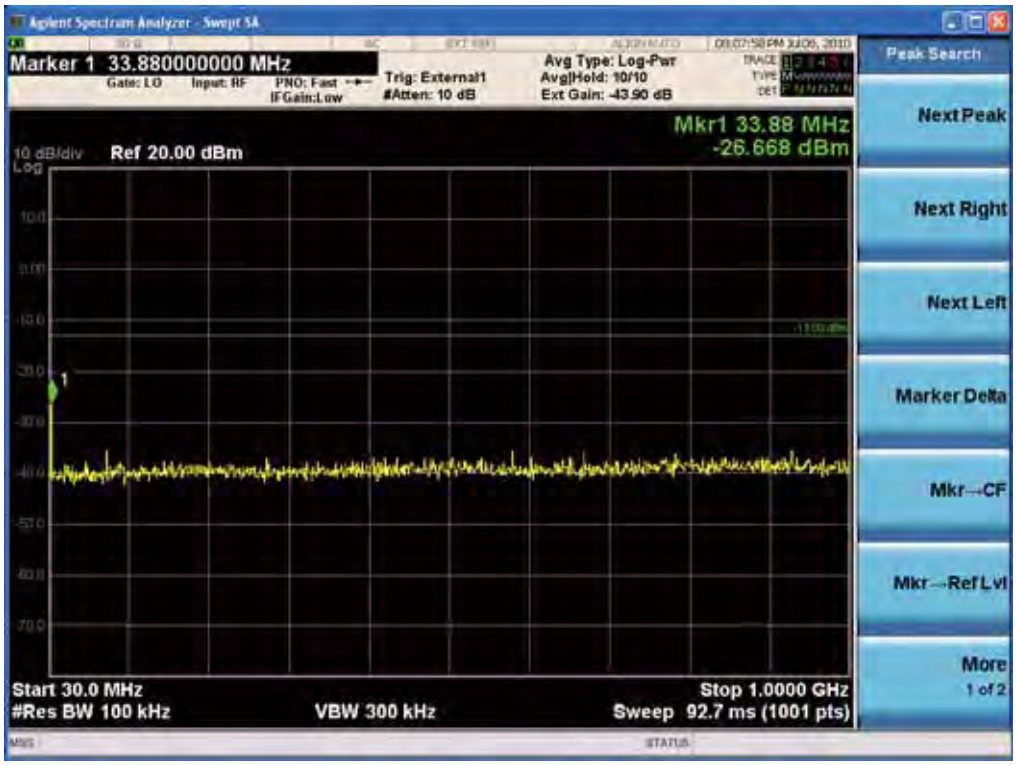
(30 MHz ~ 1 GHz)

(QPSK Middle Channel)



(30 MHz ~ 1 GHz)

(QPSK High Channel)



(30 MHz ~ 1 GHz)

(QPSK Low Channel)

(1 GHz ~ 26.5 GHz)

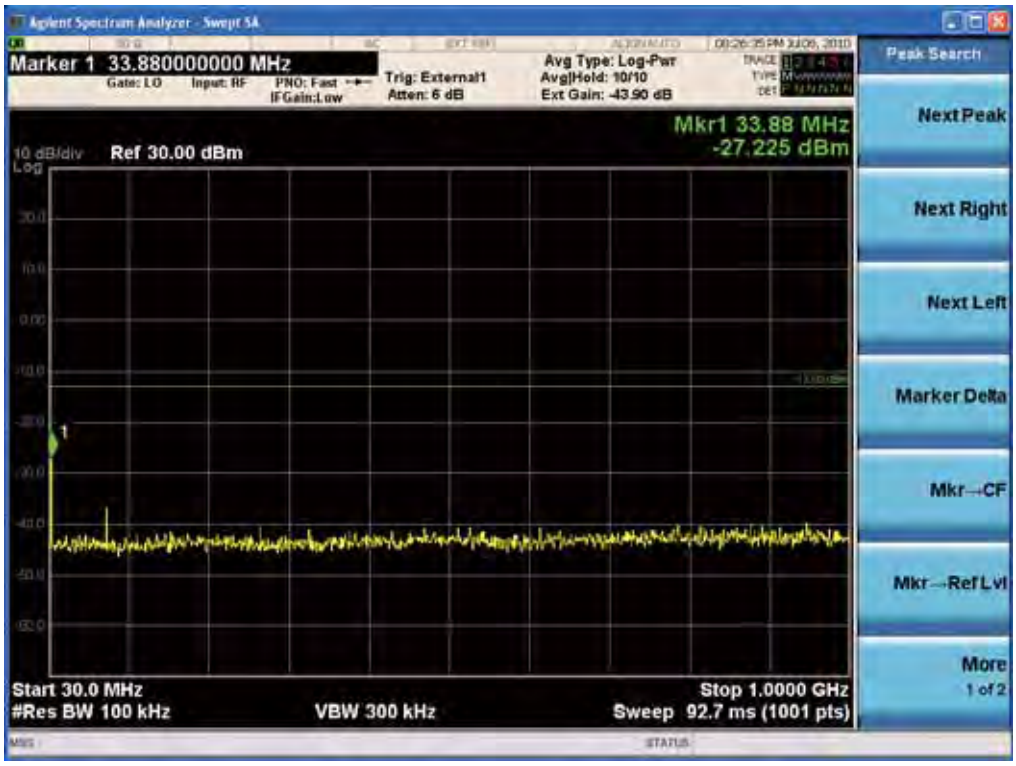
(QPSK Middle Channel)

(1 GHz ~ 26.5 GHz)

(QPSK High Channel)

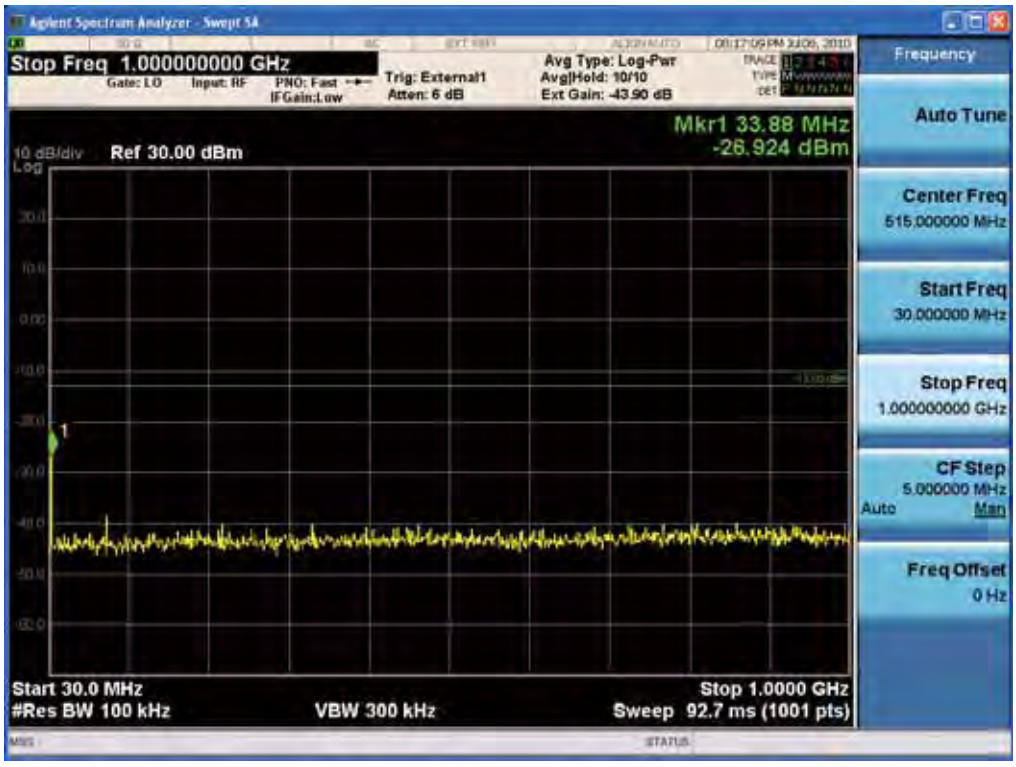
(1 GHz ~ 26.5 GHz)

(16QAM LOW Channel)



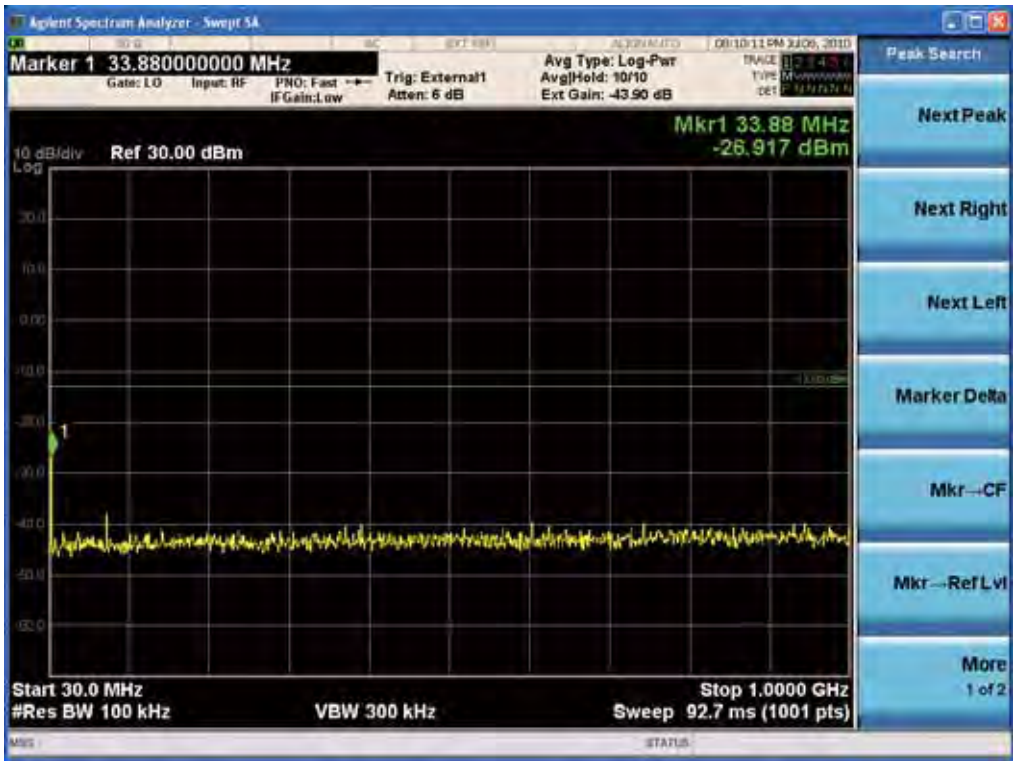
(30 MHz ~ 1 GHz)

(16QAM Middle Channel)



(30 MHz ~ 1 GHz)

(16QAM High Channel)



(30 MHz ~ 1 GHz)

(16QAM LOW Channel)

(1 GHz ~ 26.5 GHz)

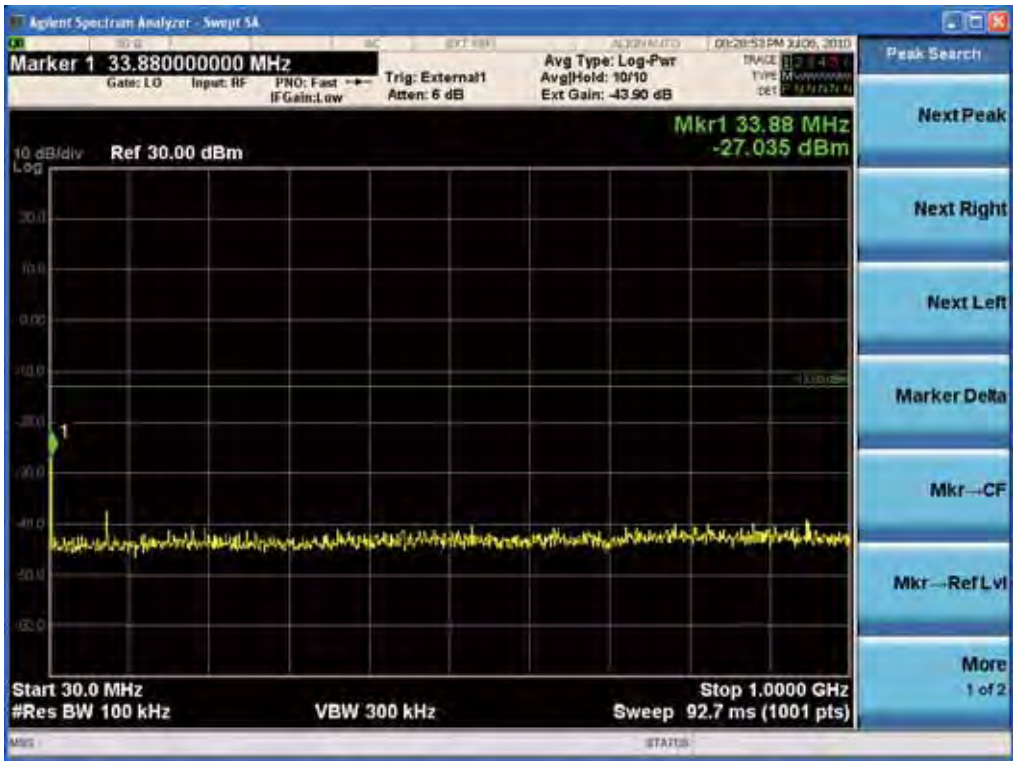
(16QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(16QAM High Channel)

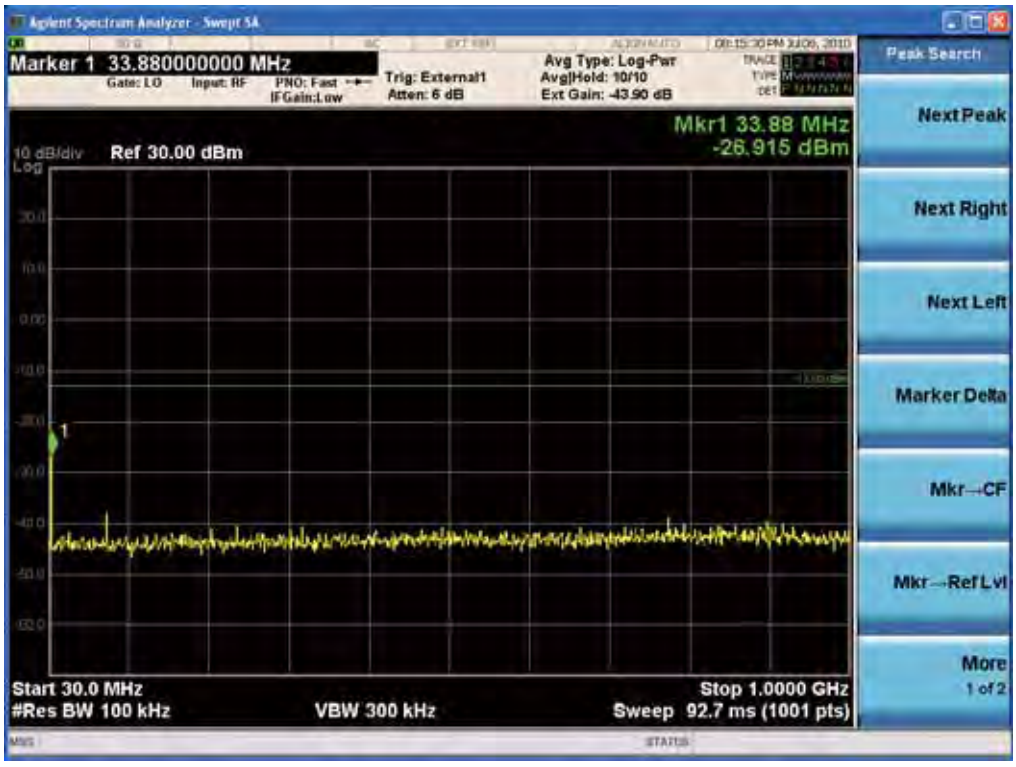
(1 GHz ~ 26.5 GHz)

(64QAM Low Channel)



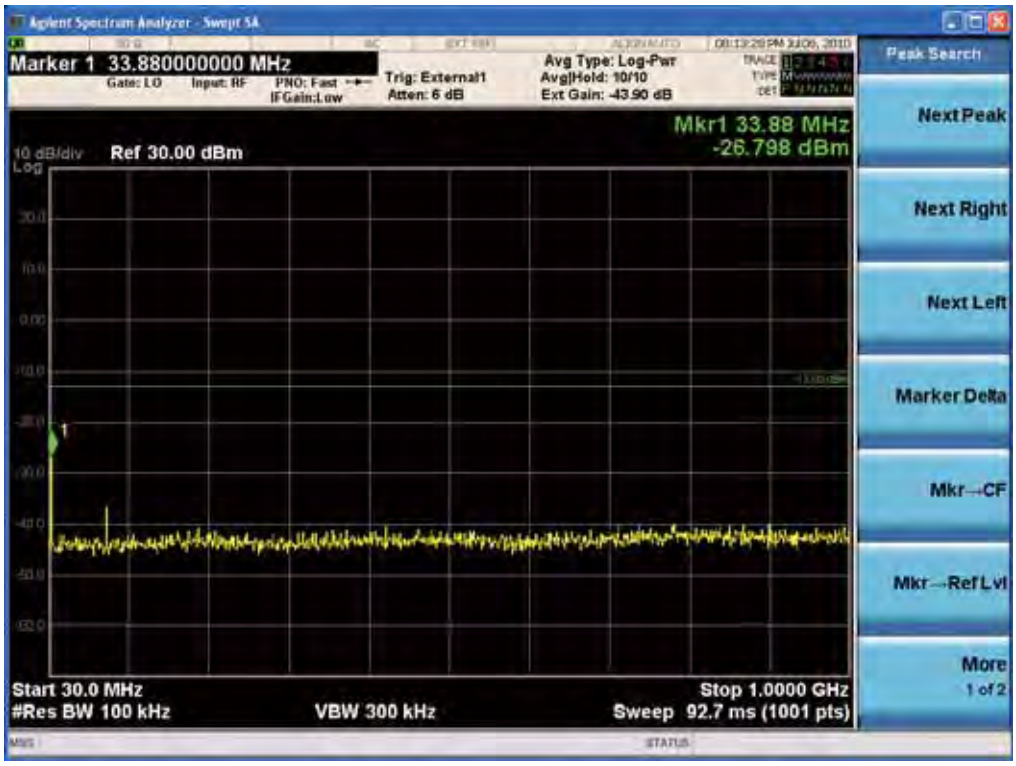
(30 MHz ~ 1 GHz)

(64QAM Middle Channel)



(30 MHz ~ 1 GHz)

(64QAM High Channel)



(30 MHz ~ 1 GHz)

(64QAM Low Channel)

(1 GHz ~ 26.5 GHz)

(64QAM Middle Channel)

(1 GHz ~ 26.5 GHz)

(64QAM High Channel)

(1 GHz ~ 26.5 GHz)

9. RADIATED SPURIOUS EMISSION

9.1 Applicable Standard

Requirements: CFR 47, §2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

9.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Schwarzbeck	BBHA 9120D /Double Ridged Horn Antenna	296	09/23/2010
Schwarzbeck	BBHA 9120D /Double Ridged Horn Antenna	147	04/13/2011
Schwarzbeck	VULB 9168/ TRILOG Antenna	9168-200	01/06/2011
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	AFS44-00102650-42-10P44-PS	1532439	04/05/2011
EMCO	6502/Loop Antenna	9009-2536	01/13/2012
R&S	ESI40 / EMI TEST Receiver	831564/003	10/30/2010
Agilent	11636B / Power Divider	11377	12/24/2010
Cernex	CDPU5260404K/ Power Divider-4WAY	14695	02/08/2011

9.3 Test Procedure

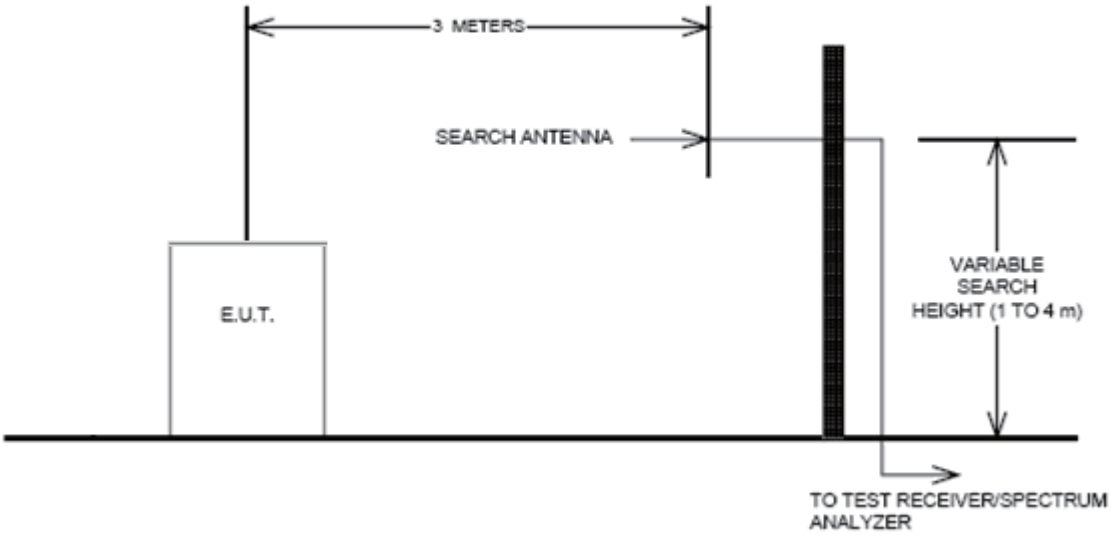
Radiated emission measurements were performed at an open Site.

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.

9.3.1 Radiated Spurious Emissions Test Setup



9.3.2 Environmental Conditions:

Temperature:	26 °C
Relative Humidity:	60 %

9.4 Test Result

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

10. FREQUECNY STABILITY

10.1 Applicable Standard

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

10.2 Test Equipment List and Details

Manufacturer	Model / Equipment	Serial No.	Calibration Due
Agilent	6674A / DC Power Supply	3501A00901	05/14/2011
WEINSCHEL	67-30-33 / Attenuator	BR0530	01/14/2011
Agilent	N9020A / MXA Signal Analyzer	US46220219	03/03/2011

10.3 Test Procedure

Frequency Stability over Temperature variation:
The equipment under test was connected to an external AC-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 AC-DC power supply Source. The voltage was set to 85% and 115% of the nominal value. The output frequency was recorded for each voltage.

10.3.1. Environmental conditions

Temperature:	24 ° C
Relative Humidity:	58 %

10.4. Test Result

: Pass

10.4.1. Frequency Stability over Temperature and Voltage variation

Modulation: QPSK

Reference: - 48 Vdc at 20°C **Freq.** = 2608,000,000 MHz

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,607,999,935	0.02056
40	2,607,999,936	0.02017
30	2,607,999,937	0.01979
20	**Reference**	
10	2,607,999,936	0.02017
0	2,607,999,938	0.0194
-10	2,607,999,937	0.01979
-20	2,607,999,938	0.0194
-30	2,607,999,935	0.02056

Reference: - 48 Vdc at 20°C **Freq.** = 2608,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,607,999,937	0.01979
55.2	2,607,999,936	0.02017

(Output Port0 Middle CH)

Modulation: 16QAM

Reference: - 48 Vdc at 20°C **Freq.** = 2608,000,000 MHz

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,607,999,937	0.01979
40	2,607,999,936	0.02017
30	2,607,999,935	0.02056
20	**Reference**	
10	2,607,999,937	0.01979
0	2,607,999,938	0.0194
-10	2,607,999,935	0.02056
-20	2,607,999,938	0.0194
-30	2,607,999,936	0.02017

Reference: - 48 Vdc at 20°C **Freq.** = 2608,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,607,999,938	0.0194
55.2	2,607,999,937	0.01979

(Output Port1 Middle CH)

Modulation: 64QAM

Reference: - 48 Vdc at 20°c **Freq.** = 2608,000,000 MHz

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,607,999,935	0.02056
40	2,607,999,936	0.02017
30	2,607,999,938	0.0194
20	**Reference**	
10	2,607,999,936	0.02017
0	2,607,999,938	0.0194
-10	2,607,999,935	0.02056
-20	2,607,999,938	0.0194
-30	2,607,999,936	0.02017

Reference: - 48 Vdc at 20°c **Freq.** = 2608,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,607,999,936	0.02017
55.2	2,607,999,938	0.0194

(Output Port2 Middle CH)

Reference: - 48 Vdc at 20°c **Freq.** = 2608,000,000 MHz

Temperature (Celsius)	Measured Freq (MHz)	Drift (ppm)
50	2,607,999,936	0.02017
40	2,607,999,938	0.0194
30	2,607,999,937	0.01979
20	**Reference**	
10	2,607,999,936	0.02017
0	2,607,999,938	0.0194
-10	2,607,999,935	0.02056
-20	2,607,999,938	0.0194
-30	2,607,999,936	0.02017

Reference: - 48 Vdc at 20°c **Freq.** = 2608,000,000 MHz

Voltage(dc) +/-15% Ref	Measured Freq (MHz)	Drift (ppm)
40.8	2,607,999,938	0.0194
55.2	2,607,999,936	0.02017

(Output Port3 Middle CH)

11. 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

Max Peak output Power at antenna input terminal	25.89	dBm
Max Peak output Power at antenna input terminal	388.15037	mW
Prediction distance	25.00000	cm
Prediction frequency	2602.00	MHz
Antenna Gain(typical)	12.02000	dBi
Antenna Gain(numeric)	15.92209	-
Power density at prediction frequency (S)	0.78688	mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency	1.00000	mW/cm^2

3. RESULTS

The power density level at 25 cm is 0.78688 mW/cm², which is below the uncontrolled exposure limit of 1.0 mW/cm² at 2602 MHz.