

HCT CO., LTD.

Product Compliance Division

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CERTIFICATE OF COMPLIANCE

FCC Certification

Applicant Name:

Franklin Technology Inc.

Address:

1505 Digital Tower Aston, 505-15 Gasan-dong,
Gumcheon-gu, Seoul, Korea

Date of Issue:

March 25, 2011

Location:

HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon, Icheon-si,
Kyunggi-Do, Korea

Test Report No.: HCTR1103FR05-1

HCT FRN: 0005866421

IC Recognition No.: IC 5944A-2

FCC ID : XHG-U310

APPLICANT : Franklin Technology Inc.

Model(s):

U310

EUT Type:

USB Modem

Tx Frequency:

2 498.5 MHz ~ 2 687.5 MHz (5 MHz Bandwidth)
2 501.0 MHz ~ 2 685.0 MHz (10 MHz Bandwidth)

Rx Frequency:

2 498.5 MHz ~ 2 687.5 MHz (5 MHz Bandwidth)
2 501.0 MHz ~ 2 685.0 MHz (10 MHz Bandwidth)

Max.

RF Output Power:

TX1
0.344 W 5 MHz QPSK (25.37 dBm)/ 0.335 W 5 MHz 16QAM (25.25 dBm)
0.527 W 10 MHz QPSK (27.22 dBm)/ 0.661 W 10 MHz 16QAM (28.20 dBm)
TX2
0.205 W 5 MHz QPSK (23.11 dBm)/ 0.220 W 5 MHz 16QAM (23.43 dBm)
0.317 W 10 MHz QPSK (25.01 dBm)/ 0.308 W 10 MHz 16QAM (24.89 dBm)

Emission

Designator(s):

5 MHz BW : 4M44G7D (QPSK)/ 4M46W7D(16QAM)
10 MHz BW : 9M23G7D (QPSK)/ 9M18W7D(16QAM)

FCC Classification:

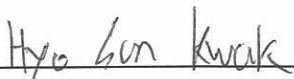
Licensed Non-Broadcast Transmitter (TNB)

FCC Rule Part(s):

§27, §2

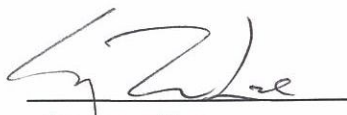
The measurements shown in this report were made in accordance with the procedures specified in §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 853(a)


Report prepared by

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Test engineer of RF Team


Approved by

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Manager of RF Team

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FCC CERTIFICATION REPORT			www.hct.co.kr
Test Report No. HCTR1103FR05-1	Date of Issue: March 25, 2011	EUT Type: USB Modem	FCC ID: XHG-U310

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1103FR05	March 08, 2011	First Approval Report
HCTR1103FR05-1	March 25, 2011	Revise page 1 summary states

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name: Franklin Technology Inc.

Address: 1505 Digital Tower Aston, 505-15 Gasan-dong, Gumcheon-gu, Seoul, Korea

FCC ID: XHG-U310

Application Type: Certification

FCC Classification: Licensed Non-Broadcast Transmitter (TNB)

FCC Rule Part(s): §27, §2

EUT Type: USB Modem

Model(s): U310

Tx Frequency: 2 498.5 MHz ~ 2 687.5 MHz (5 MHz Bandwidth)
2 501.0 MHz ~ 2 685.0 MHz (10 MHz Bandwidth)

Rx Frequency: 2 498.5 MHz ~ 2 687.5 MHz (5 MHz Bandwidth)
2 501.0 MHz ~ 2 685.0 MHz (10 MHz Bandwidth)

Max. Conducted Power: TX1
0.344 W 5 MHz QPSK (25.37 dBm)/ 0.335 W 5 MHz 16QAM (25.25 dBm)
0.527 W 10 MHz QPSK (27.22 dBm)/ 0.661 W 10 MHz 16QAM (28.20 dBm)
TX2
0.205 W 5 MHz QPSK (23.11 dBm)/ 0.220 W 5 MHz 16QAM (23.43 dBm)
0.317 W 10 MHz QPSK (25.01 dBm)/ 0.308 W 10 MHz 16QAM (24.89 dBm)

Emission Designator(s): 5 MHz BW : 4M44G7D (QPSK)/ 4M46W7D(16QAM)
10 MHz BW : 9M23G7D (QPSK)/ 9M18W7D(16QAM)

Date(s) of Tests: March 02, 2011 ~ March 08, 2011

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2. INTRODUCTION

2.1. EUT DESCRIPTION

The Franklin Technology Inc. U310 USB Modem consists of **WIMAX**.

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 105-1, Jangam-ri , Majang-Myeon, Icheon-si, 467-811, KOREA.

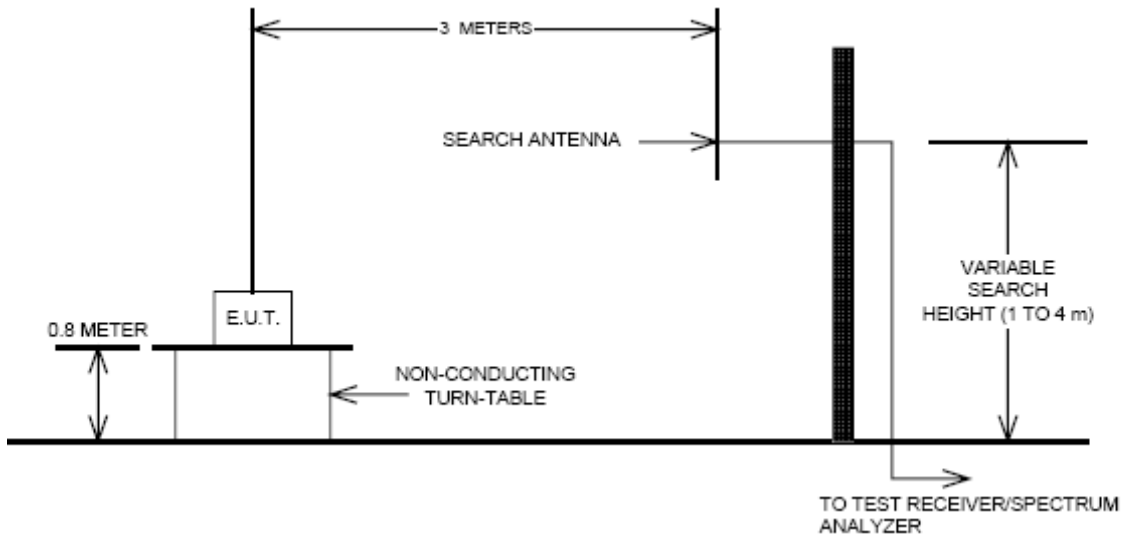
The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated June 10, 2009 (Registration Number: 90661)

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3. DESCRIPTION OF TESTS

3.1 EQUIVALENT ISOTROPIC RADIATED POWER

Test Set-up



Test Procedure

Radiated emission measurements were performed at an SAC(Semi-Anechoic Chamber)

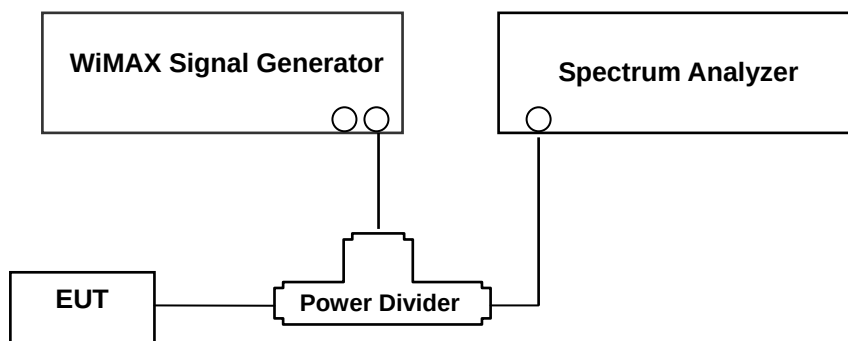
The equipment under test is placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. A styrofoam turntable was rotated 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A half wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the previously recorded signal was duplicated.

The maximum EIRP 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. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

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3.2 OCCUPIED BANDWIDTH.

Test set-up



(Configuration of conducted Emission measurement)
Test Procedure

The EUT was setup to maximum output power at its lowest channel. The occupied bandwidth was measured using a spectrum analyzer. The measurements are repeated for the highest and a middle channel. The EUT's occupied bandwidth is measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Plots of the EUT's occupied bandwidth are shown herein.

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3.3 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL.

Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer.

The EUT was setup to maximum output power at its lowest channel. The Resolution BW of the analyzer is set to 1 % of the emission bandwidth to show compliance with the -13 dBm limit, in the 1 MHz bands immediately outside and adjacent to the edge of the frequency block. The 1 MHz RBW was used to scan from 30 MHz to 26.5 GHz.. A display line was placed at -25 dBm to show compliance. The high, lowest and a middle channel were tested for out of band measurements.

- Band Edge Requirement : When measuring conducted band edge, the ACP feature of the signal analyzer was used. For each segment of the band edge, the allowed integration bandwidth was configured to calculate the channel power that is highest within that band edge segment.

- Occupied Bandwidth Emission Limits

- On any frequency outside but within 5.5 MHz from the band edge of a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10\log(P)$ dB. At frequencies greater than 5.5 MHz from any in-band channel edge, the transmitter power (P) shall be attenuated by at least $55 + 10\log(P)$ dB.

- Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

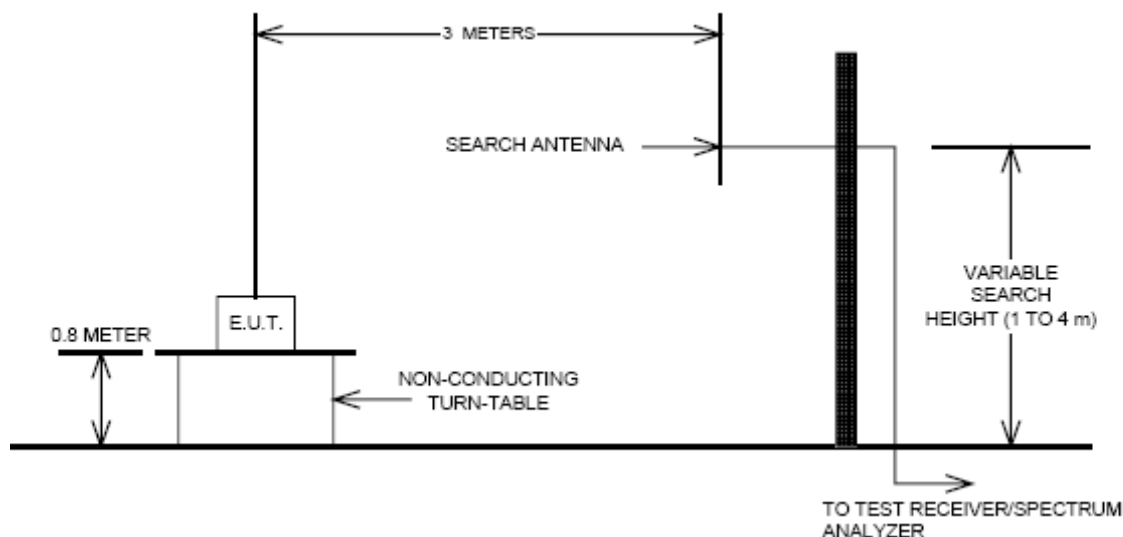
- When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

- The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

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3.4 RADIATED SPURIOUS AND HARMONIC EMISSIONS

Test Set-up



The measurement facilities used for this test have been documented in previous filings with the commission pursuant to section § 2.948. The SAC(Semi-Anechoic Chamber) meets requirements in ANSI C63.4 –2003. A mast capable of lifting the receiving antenna from a height of one to four meters is used together with a rotatable styrofoam platform mounted at three from the antenna mast.

- 1) The unit mounted on a styrofoam turntable 1.5 m × 1.0 m × 0.80 m is 0.8 meter above test site ground level.
- 2) During the emission test, the turntable is rotated and the EUT is manipulated to find the configuration resulting in maximum emission under normal condition of installation and operation.
- 3) The antenna height and polarization are also varied from 1 to 4 meters until the maximum signal is found.
- 4) The spectrum shall be scanned up to the 10th harmonic of the fundamental frequency.

Test Procedure

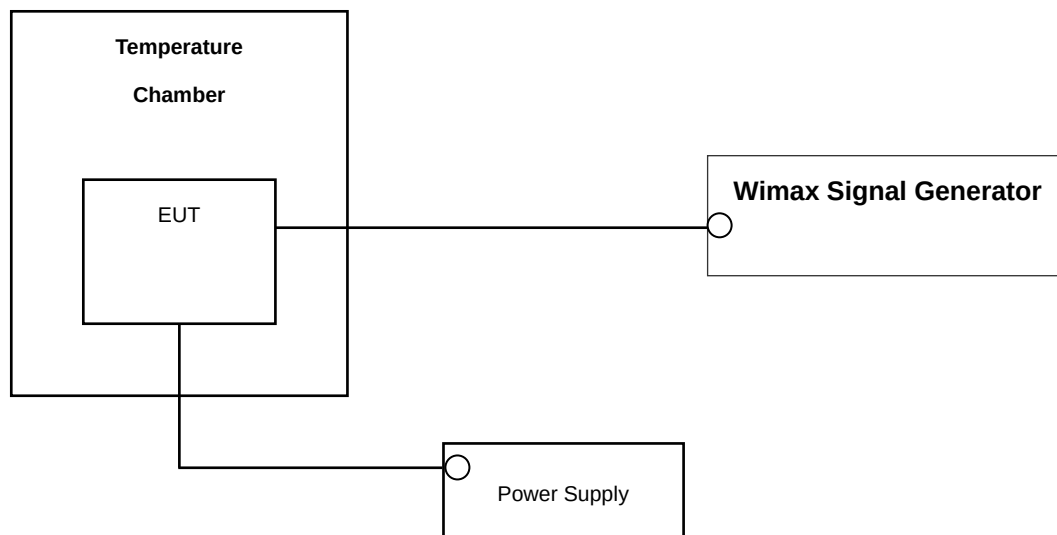
The equipment under test is placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. A styrofoam turntable was rotated 360° and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A half wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the previously recorded signal was duplicated.

The maximum EIRP 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. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

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3.5 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

Test Set-up



* Nominal Operating Voltage

Test Procedure

The frequency stability of the transmitter is measured by:

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

b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification — the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

Time Period and Procedure:

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

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

2. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

NOTE: The EUT is tested down to the battery endpoint.

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4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Interval	Calibration Due
R&S	ESI40/ Spectrum Analyzer	831564/003	Annual	10/29/2011
Agilent	E4416A/ Power Meter	GB41291412	Annual	01/04/2012
Agilent	E9327A/ Power Sensor	MY4442009	Annual	07/23/2011
Agilent	8960 (E5515C)/ Base Station	GB44400269	Annual	02/10/2012
MITEQ	AMF-6D-001180-35-20P/AMP	990893	Annual	05/20/2011
Wainwright	WHK1.2/15G-10EF/H.P.F	2	Annual	06/25/2011
Wainwright	WHK3.3/18G-10EF/H.P.F	1	Annual	06/25/2011
Agilent	775D/ Dual Directional Coupler	12922	Annual	12/29/2011
Agilent	11636B/ Power Divider	11377	Annual	12/29/2011
Digital	EP-3010/ Power Supply	3110117	Annual	01/04/2012
Schwarzbeck	UHAP/ Dipole Antenna	949	Biennial	03/18/2012
Schwarzbeck	UHAP/ Dipole Antenna	950	Biennial	03/18/2012
Korea Engineering	KR-1005L / Chamber	KRAB07063-2CH	Annual	12/28/2011
Schwarzbeck	BBHA 9120D/ Horn Antenna	296	Biennial	09/23/2011
Schwarzbeck	BBHA 9120D/ Horn Antenna	147	Biennial	04/13/2012
Agilent	E4440A/Spectrum Analyzer	US45303008	Annual	06/09/2011

5. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result
2.1049, 27.53(l)(6)	Occupied Bandwidth	N/A	CONDUCTED	PASS
2.1051, 27.53(l)(4)(6)	Band Edge	$< 43 + 10\log_{10}(P[\text{Watts}])$ within 5.5MHz from the band edge		PASS
2.1046	Conducted Output Power	N/A		PASS
2.1051, 27.53(l)(4)(6)	Conducted Spurious Emissions	$< 55 + 10\log_{10}(P[\text{Watts}])$ for all emissions greater than 5.5MHz from the band edge		
2.1055, 27.54	Frequency stability	Fundamental emissions must stay within the allotted band		PASS
27.50(h)(2)	Equivalent Isotropic Radiated Power	< 2 Watts max. EIRP	RADIATED	PASS
2.1053, 27.53(l)(4)	Undesirable Emissions	$< 55 + 10\log_{10}(P[\text{Watts}])$ for all out-of-band emissions		PASS

6. SAMPLE CALCULATION

A. ERP Sample Calculation

Mode	Ch./ Freq.		Measured Level(dBm)	Substitute LEVEL(dBm)	Ant. Gain	C.L	Pol.	ERP	
	channel	Freq.(MHz)						W	dBm
WiMAX	2596.00	-5.16	28.12	10.44	2.34	H	4.19	36.22	

ERP = SubstituteLEVEL(dBm) + Ant. Gain – CL(Cable Loss)

- 1) The EUT mounted on a wooden tripod is 0.8 meter above test site ground level.
- 2) During the test , the turn table is rotated and the antenna height is also varied from 1 to 4 meters until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power (ERP).

B. Emission Designator

Wimax Emission Designator

Emission Designator = 1M27F9W

QPSK Modulation

Emission Designator = 9M11G7D

Wimax BW = 9.11 MHz (Measured at the 99% power bandwidth)

G= Phase Modulation

7 = Quantized/Digital Info

D= Amplitude/Angle Modulated

16QAM / 64QAM Modulation

Emission Designator = 9M12W7D

Wimax BW = 9.12 MHz (Measured at the 99% power bandwidth)

W= Combination (Audio/Data)

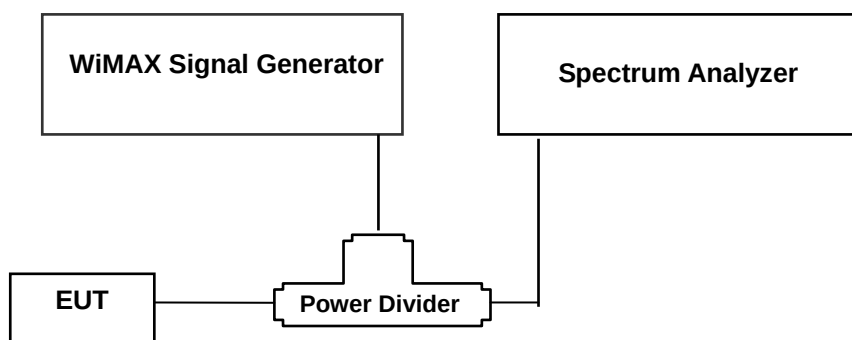
7 = Quantized/Digital Info

D= Amplitude/Angle Modulated

7. TEST DATA

7.1 CONDUCTED OUTPUT POWER

A base station simulator was used to establish communication with the EUT. The base station simulator parameters were set to produce the maximum power from the EUT. This device was tested under all configurations and the highest power is reported. Conducted Output Powers of EUT are reported below.



Test Result

5 MHz channel BW-TX1		
Frequency(MHz)	Modulation	Average Power (dBm)
2498.5	QPSK 1/2	22.76
	QPSK 3/4	22.74
	16QAM 1/2	22.65
	16QAM 3/4	22.76
2593.0	QPSK 1/2	22.70
	QPSK 3/4	22.69
	16QAM 1/2	22.66
	16QAM 3/4	22.73
2687.5	QPSK 1/2	22.86
	QPSK 3/4	22.82
	16QAM 1/2	22.78
	16QAM 3/4	22.81

(WiMAX Conducted Average Output Powers)

10 MHz channel BW-TX1		
Frequency(MHz)	Modulation	Average Power (dBm)
2501.0	QPSK 1/2	23.10
	QPSK 3/4	22.73
	16QAM 1/2	22.78
	16QAM 3/4	22.77
2593.0	QPSK 1/2	22.66
	QPSK 3/4	22.67
	16QAM 1/2	22.69
	16QAM 3/4	22.65
2685.0	QPSK 1/2	22.79
	QPSK 3/4	22.77
	16QAM 1/2	22.83
	16QAM 3/4	22.83

(WiMAX Conducted Average Output Powers)

5 MHz channel BW-TX2		
Frequency(MHz)	Modulation	Average Power (dBm)
2498.5	QPSK 1/2	22.74
	QPSK 3/4	22.55
	16QAM 1/2	22.50
	16QAM 3/4	22.51
2593.0	QPSK 1/2	22.59
	QPSK 3/4	22.64
	16QAM 1/2	22.55
	16QAM 3/4	22.56
2687.5	QPSK 1/2	22.83
	QPSK 3/4	22.85
	16QAM 1/2	22.85
	16QAM 3/4	22.84

(WiMAX Conducted Average Output Powers)

10 MHz channel BW-TX2		
Frequency(MHz)	Modulation	Average Power (dBm)
2501.0	QPSK 1/2	23.04
	QPSK 3/4	22.74
	16QAM 1/2	22.82
	16QAM 3/4	22.79
2593.0	QPSK 1/2	22.71
	QPSK 3/4	22.67
	16QAM 1/2	22.73
	16QAM 3/4	22.74
2685.0	QPSK 1/2	22.88
	QPSK 3/4	23.02
	16QAM 1/2	22.97
	16QAM 3/4	23.02

(WiMAX Conducted Average Output Powers)

Note : Detecting mode is average.

TX1

- 5 MHz: Plots of the EUT's Conducted Output Power are shown Page 42 ~ 47.
- 10 MHz: Plots of the EUT's Conducted Output Power are shown Page 48 ~ 53.

TX2

- 5 MHz: Plots of the EUT's Conducted Output Power are shown Page 54 ~ 59.
- 10 MHz: Plots of the EUT's Conducted Output Power are shown Page 60 ~ 65.

7.2 OCCUPIED BANDWIDTH

5 MHz

Frequency [MHz]	Modulation	Occupied Bandwidth [MHz]
2498.5	QPSK 1/2	4.4218
	QPSK 3/4	4.4395
	16QAM 1/2	4.4358
	16QAM 3/4	4.4592
2593.0	QPSK 1/2	4.4214
	QPSK 3/4	4.4388
	16QAM 1/2	4.4356
	16QAM 3/4	4.4588
2687.5	QPSK 1/2	4.4231
	QPSK 3/4	4.4388
	16QAM 1/2	4.4365
	16QAM 3/4	4.4584

10 MHz

Frequency [MHz]	Modulation	Occupied Bandwidth [MHz]
2501.0	QPSK 1/2	9.0874
	QPSK 3/4	9.2275
	16QAM 1/2	9.1730
	16QAM 3/4	9.1822
2593.0	QPSK 1/2	9.0872
	QPSK 3/4	9.2269
	16QAM 1/2	9.1702
	16QAM 3/4	9.1814
2685.0	QPSK 1/2	9.0898
	QPSK 3/4	9.2273
	16QAM 1/2	9.1682
	16QAM 3/4	9.1824

- 5 MHz: Plots of the EUT's Occupied Bandwidth are shown Page 30 ~ 35.

- 10 MHz: Plots of the EUT's Occupied Bandwidth are shown Page 36 ~ 41.

7.3 CONDUCTED SPURIOUS EMISSIONS

5 MHz

Frequency(MHz)	Modulation	Frequency of Maximum Harmonic (GHz)	Maximum Data (dBm)
2498.5	QPSK 1/2	25.837	-34.480
	QPSK 3/4	26.373	-34.173
	16QAM 1/2	26.398	-34.068
	16QAM 3/4	26.296	-33.218
2593.0	QPSK 1/2	23.109	-34.413
	QPSK 3/4	26.322	-34.568
	16QAM 1/2	25.837	-34.749
	16QAM 3/4	25.761	-33.230
2687.5	QPSK 1/2	26.322	-34.548
	QPSK 3/4	25.863	-34.346
	16QAM 1/2	26.016	-34.482
	16QAM 3/4	25.914	-35.206

10 MHz

Frequency(MHz)	Modulation	Frequency of Maximum Harmonic (GHz)	Maximum Data (dBm)
2501.0	QPSK 1/2	25.684	-34.643
	QPSK 3/4	25.786	-34.353
	16QAM 1/2	26.424	-33.061
	16QAM 3/4	25.684	-34.435
2593.0	QPSK 1/2	26.373	-34.641
	QPSK 3/4	26.347	-33.711
	16QAM 1/2	23.695	-34.727
	16QAM 3/4	26.373	-33.701
2685.0	QPSK 1/2	25.684	-34.383
	QPSK 3/4	25.914	-34.734
	16QAM 1/2	23.415	-34.707
	16QAM 3/4	25.812	-34.523

- 5 MHz: Plots of the EUT's Conducted Spurious Emissions are shown Page 74 ~ 85.

- 10 MHz: Plots of the EUT's Conducted Spurious Emissions are shown Page 86 ~ 97.

7.3.1 CHANNEL EDGE

- 5 MHz: Plots of the EUT's Band Edge are shown Page 66 ~ 69.

- 10 MHz: Plots of the EUT's Band Edge are shown Page 70 ~ 73.

7.4 EQUIVALENT ISOTROPIC RADIATED POWER (WiMAX)

TX1 (5 MHz)

Ch./ Freq.		Measured	Substitute	Ant. Gain	C.L	Pol.	EIRP	
Modulation	Freq.(MHz)	Level(dBm)	LEVEL (dBm)	(dBi)			W	dBm
QPSK	2498.50	-15.93	17.42	10.28	2.33	H	0.344	25.37
	2593.00	-17.00	16.28	10.44	2.34	H	0.274	24.38
	2687.50	-17.44	15.85	10.59	2.52	H	0.247	23.92
16QAM	2498.50	-16.05	17.30	10.28	2.33	H	0.335	25.25
	2593.00	-16.37	16.91	10.44	2.34	H	0.317	25.01
	2687.50	-17.12	16.17	10.59	2.52	H	0.265	24.24

Note: Worst case are QPSK 1/2 and 16QAM 3/4.

TX1 (10 MHz)

Ch./ Freq.		Measured	Substitute	Ant. Gain	C.L	Pol.	EIRP	
Modulation	Freq.(MHz)	Level(dBm)	LEVEL (dBm)	(dBi)			W	dBm
QPSK	2501.00	-13.88	19.15	10.29	2.33	H	0.514	27.11
	2593.00	-14.36	18.92	10.44	2.34	H	0.504	27.02
	2685.00	-14.65	19.15	10.59	2.52	H	0.527	27.22
16QAM	2501.00	-12.79	20.24	10.29	2.33	H	0.661	28.20
	2593.00	-14.49	18.79	10.44	2.34	H	0.489	26.89
	2685.00	-14.77	19.03	10.59	2.52	H	0.513	27.10

Note: Worst case are QPSK 1/2 (2593 MHz = 3/4) and 16QAM 1/2 .

NOTES:

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

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For 5 MHz BW signals, a peak detector is used, with RBW = VBW = 5 MHz. For 10 MHz BW signals, a peak detector is used, with RBW = VBW = 10MHz. A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the Horn antenna is measured. The difference between the gain of the horn and an isotropic antenna is taken into consideration and the EIRP is recorded.

Also, we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna. The worst case of the EUT is in x plane in 5 MHz BW and 10 MHz BW mode. Also worst case of detecting Antenna is in horizontal polarization in 5 MHz BW and 10 MHz BW mode.

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TX2 (5 MHz)

Ch./ Freq.		Measured	Substitute	Ant. Gain	C.L	Pol.	EIRP	
Modulation	Freq.(MHz)	Level(dBm)	LEVEL (dBm)	(dBi)			W	dBm
QPSK	2498.50	-18.19	15.16	10.28	2.33	H	0.205	23.11
	2593.00	-18.45	14.83	10.44	2.34	V	0.196	22.93
	2687.50	-21.88	11.41	10.59	2.52	V	0.089	19.48
16QAM	2498.50	-18.07	15.28	10.28	2.33	V	0.210	23.23
	2593.00	-17.95	15.33	10.44	2.34	V	0.220	23.43
	2687.50	-21.46	11.83	10.59	2.52	V	0.098	19.90

Note: Worst case are QPSK 3/4 (2498.5 MHz = 1/2) and 16QAM 3/4 (2687.5 MHz = 1/2).

TX2 (10 MHz)

Ch./ Freq.		Measured	Substitute	Ant. Gain	C.L	Pol.	EIRP	
Modulation	Freq.(MHz)	Level(dBm)	LEVEL (dBm)	(dBi)			W	dBm
QPSK	2501.00	-16.24	16.79	10.29	2.33	H	0.299	24.75
	2593.00	-16.37	16.91	10.44	2.34	V	0.317	25.01
	2685.00	-19.77	14.03	10.59	2.52	V	0.162	22.10
16QAM	2501.00	-16.12	16.91	10.29	2.33	H	0.307	24.87
	2593.00	-16.49	16.79	10.44	2.34	V	0.308	24.89
	2685.00	-19.02	14.78	10.59	2.52	V	0.193	22.85

Note: Worst case are QPSK 1/2 (2685 MHz = 3/4) and 16QAM 3/4 (2501 MHz = 1/2).

NOTES:

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

The EUT was placed on a non-conductive styrofoam resin table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For 5 MHz BW signals, a peak detector is used, with RBW = VBW = 5 MHz. For 10 MHz BW signals, a peak detector is used, with RBW = VBW = 10MHz. A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the Horn antenna is measured. The difference between the gain of the horn and an isotropic antenna is taken into consideration and the EIRP is recorded.

Also, we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna. The worst case of the EUT is in y plane in 5 MHz BW and 10 MHz BW mode. Also worst case of detecting Antenna is in vertical polarization in 5 MHz BW and 10 MHz BW mode.

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7.4 RADIATED SPURIOUS EMISSIONS

7.4.1 RADIATED SPURIOUS EMISSIONS (TX1: WiMAX 5 MHz-QPSK)

- ☐ MEASURED OUTPUT POWER: 25.37 dBm = 0.344 W
☐ MODULATION SIGNAL: WiMAX 5 MHz
☐ DISTANCE: 3 meters
☐ LIMIT: - (43 + 10 log₁₀ (W)) = - 50.37 dBc

Operating Freq. (MHz)	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBd)	Substitute Level [dBm]	C.L	Pol.	ERP (dBm)	dBc
2498.50	4,997.00	-50.09	12.42	-51.36	3.60	H	-42.54	-67.91
	7,495.50	-44.86	11.36	-37.29	3.88	H	-29.81	-55.18
	9,994.00	-	-	-	-	-	-	-
2593.00	5,186.00	-47.08	12.51	-48.45	3.39	H	-39.33	-64.70
	7,779.00	-46.07	11.26	-38.96	3.72	V	-31.42	-56.79
	10,372.00	-	-	-	-	-	-	-
2687.50	5,375.00	-44.66	12.62	-47.22	3.41	H	-38.01	-63.38
	8,062.50	-43.81	11.21	-34.40	4.07	V	-27.26	-52.63
	10,750.00	-	-	-	-	-	-	-

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5th Harmonic for all channel.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is QPSK 3/4.

7.4.2 RADIATED SPURIOUS EMISSIONS (TX2: WiMAX 5 MHz-QPSK)

■ MEASURED OUTPUT POWER: 23.43 dBm = 0.220 W
 ■ MODULATION SIGNAL: WiMAX 5 MHz
 ■ DISTANCE: 3 meters
 ■ LIMIT: - (43 + 10 log₁₀ (W)) = - 48.43 dBc

Operating Freq. (MHz)	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBd)	Substitute Level [dBm]	C.L	Pol.	ERP (dBm)	dBc
2498.50	4,997.00	-48.10	12.42	-49.37	3.60	H	-40.55	-63.98
	7,495.50	-42.84	11.36	-35.27	3.88	H	-27.79	-51.22
	9,994.00	-	-	-	-	-	-	-
2593.00	5,186.00	-50.79	12.51	-52.16	3.39	H	-43.04	-66.47
	7,779.00	-47.73	11.26	-40.62	3.72	V	-33.08	-56.51
	10,372.00	-	-	-	-	-	-	-
2687.50	5,375.00	-41.40	12.62	-43.96	3.41	H	-34.75	-58.18
	8,062.50	-46.37	11.21	-36.96	4.07	V	-29.82	-53.25
	10,750.00	-	-	-	-	-	-	-

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5th Harmonic for all channel.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is QPSK 3/4.

7.4.3 RADIATED SPURIOUS EMISSIONS (TX1: WiMAX 10 MHz- QPSK)

■ MEASURED OUTPUT POWER: 28.20 dBm = 0.661 W
 ■ MODULATION SIGNAL: WiMAX 10 MHz
 ■ DISTANCE: 3 meters
 ■ LIMIT: - $(43 + 10 \log_{10}(W)) =$ - 53.20 dBc

Operating Freq. (MHz)	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBd)	Substitute Level [dBm]	C.L	Pol.	ERP (dBm)	dBc
2501.00	5,002.00	-51.75	12.41	-53.41	3.60	V	-44.60	-72.80
	7,503.00	-52.47	11.33	-44.97	3.88	H	-37.52	-65.72
	10,004.00	-	-	-	-	-	-	-
2593.00	5,186.00	-49.87	12.51	-51.24	3.39	H	-42.12	-70.32
	7,779.00	-48.53	11.26	-41.42	3.72	V	-33.88	-62.08
	10,372.00	-	-	-	-	-	-	-
2685.00	5,370.00	-47.49	12.62	-50.15	3.41	H	-40.94	-69.14
	8,055.00	-47.06	11.21	-37.45	4.07	V	-30.31	-58.51
	10,740.00	-	-	-	-	-	-	-

- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5th Harmonic for all channel.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is 16QAM 3/4.

7.4.4 RADIATED SPURIOUS EMISSIONS (TX2: WiMAX 10 MHz- QPSK)

- ☐ MEASURED OUTPUT POWER: 25.01 dBm = 0.317 W
☐ MODULATION SIGNAL: WiMAX 10 MHz
☐ DISTANCE: 3 meters
☐ LIMIT: - (43 + 10 log₁₀ (W)) = - 50.01 dBc

Operating Freq. (MHz)	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBd)	Substitute Level [dBm]	C.L	Pol.	ERP (dBm)	dBc
2501.00	5,002.00	-50.57	12.41	-52.23	3.60	H	-43.42	-68.43
	7,503.00	-47.43	11.33	-39.93	3.88	H	-32.48	-57.49
	10,004.00	-	-	-	-	-	-	-
2593.00	5,186.00	-51.71	12.51	-53.08	3.39	H	-43.96	-68.97
	7,779.00	-51.67	11.26	-44.56	3.72	V	-37.02	-62.03
	10,372.00	-	-	-	-	-	-	-
2685.00	5,370.00	-44.54	12.62	-47.20	3.41	H	-37.99	-63.00
	8,055.00	-50.10	11.21	-40.49	4.07	V	-33.35	-58.36
	10,740.00	-	-	-	-	-	-	-

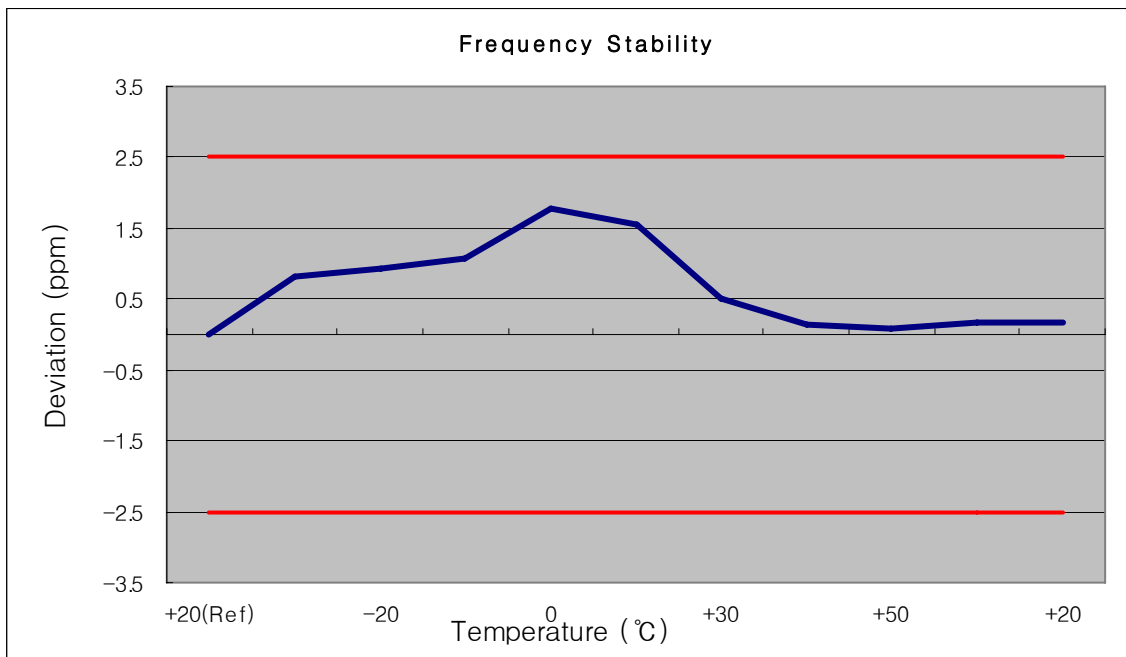
- NOTES:**
1. Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:
 2. The magnitude of spurious emissions attenuated more than 20dB below the limit above 5th Harmonic for all channel.
 3. we have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
 4. Worst case is 16QAM 3/4.

7.5 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

7.5.1 FREQUENCY STABILITY (WiMAX-5 MHz)

OPERATING FREQUENCY: 2593,000,000 Hz
 REFERENCE VOLTAGE: 3.7 VDC
 DEVIATION LIM IT: ± 0.000 25 % or 2.5 ppm

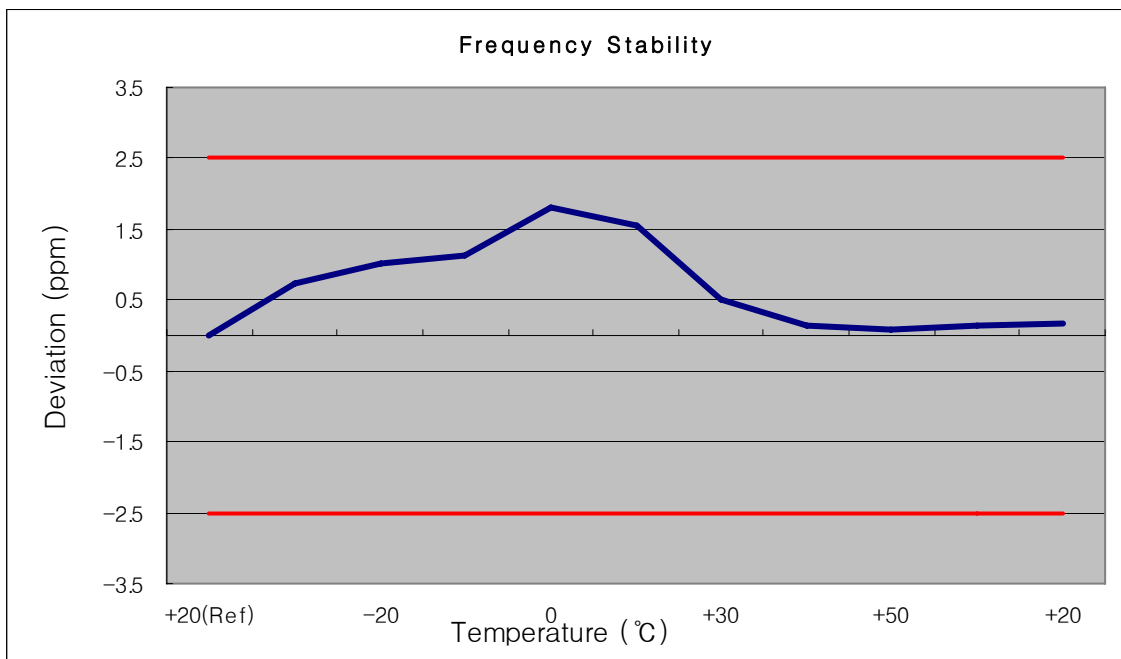
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.700	+20(Ref)	2592 999 520	0.00	0.000 000	0.000
100%		-30	2593 002 100	2100.0	0.000 081	0.810
100%		-20	2593 002 400	2400.0	0.000 093	0.926
100%		-10	2593 002 800	2800.0	0.000 108	1.080
100%		0	2593 004 600	4600.0	0.000 177	1.774
100%		+10	2593 004 000	4000.0	0.000 154	1.543
100%		+30	2593 001 300	1300.0	0.000 050	0.501
100%		+40	2593 000 350	350.0	0.000 013	0.135
100%		+50	2593 000 240	240.0	0.000 009	0.093
115%	4.255	+20	2593 000 410	410.0	0.000 016	0.158
Batt. Endpoint	3.400	+20	2593 000 430	430.0	0.000 017	0.166



7.5.2 FREQUENCY STABILITY (WiMAX-10 MHz)

OPERATING FREQUENCY: 2593,000,000 Hz
 REFERENCE VOLTAGE: 3.7 VDC
 DEVIATION LIM IT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.700	+20(Ref)	2592 999 540	0.00	0.000 000	0.000
100%		-30	2593 001 900	1900.0	0.000 073	0.733
100%		-20	2593 002 600	2600.0	0.000 100	1.003
100%		-10	2593 002 900	2900.0	0.000 112	1.118
100%		0	2593 004 700	4700.0	0.000 181	1.813
100%		+10	2593 004 000	4000.0	0.000 154	1.543
100%		+30	2593 001 300	1300.0	0.000 050	0.501
100%		+40	2593 000 330	330.0	0.000 013	0.127
100%		+50	2593 000 210	210.0	0.000 008	0.081
115%	4.255	+20	2593 000 400	400.0	0.000 015	0.154
Batt. Endpoint	3.400	+20	2593 000 420	420.0	0.000 016	0.162

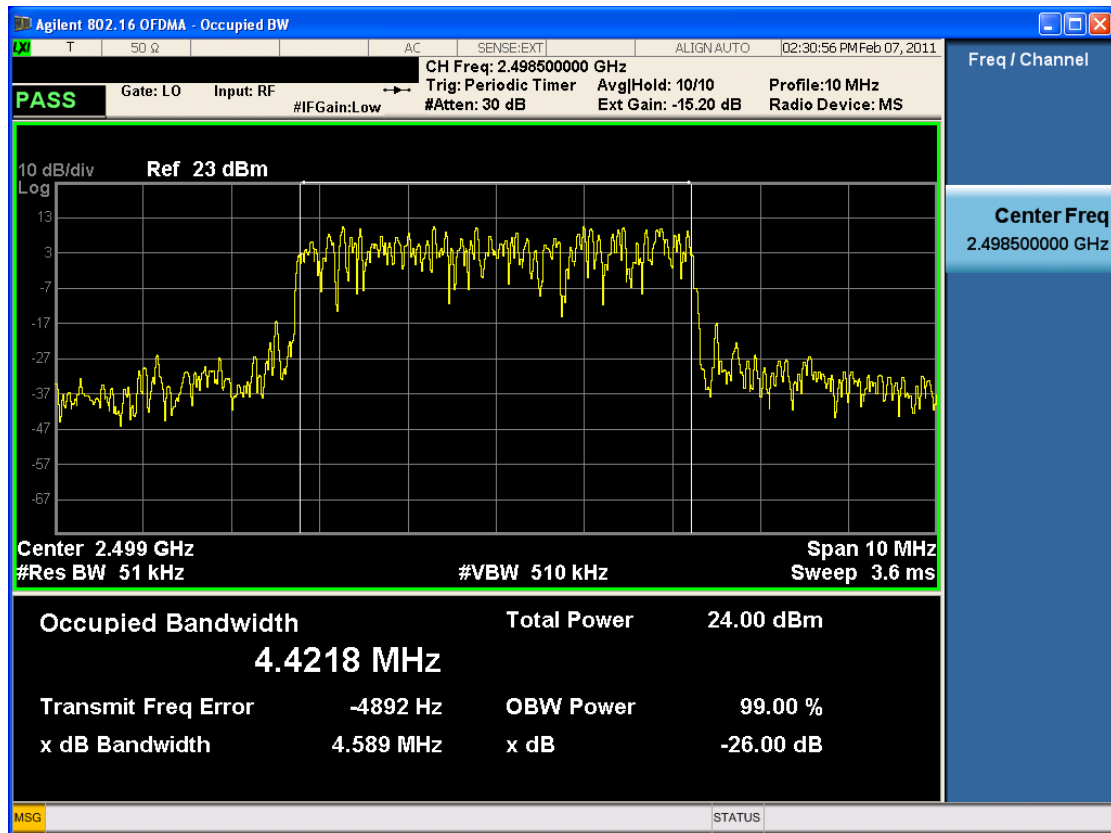


8. TEST PLOTS

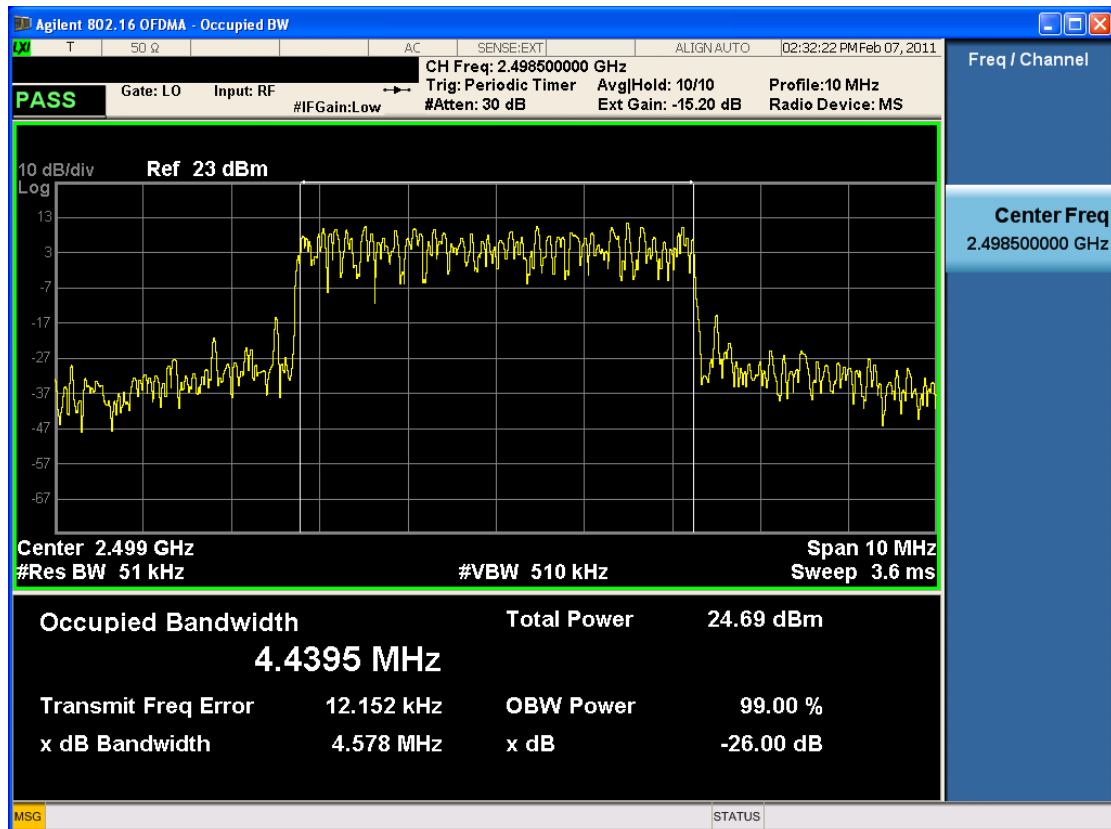
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5 MHz

■ QPSK MODE 1/2 (2498.5 MHz) Occupied Bandwidth

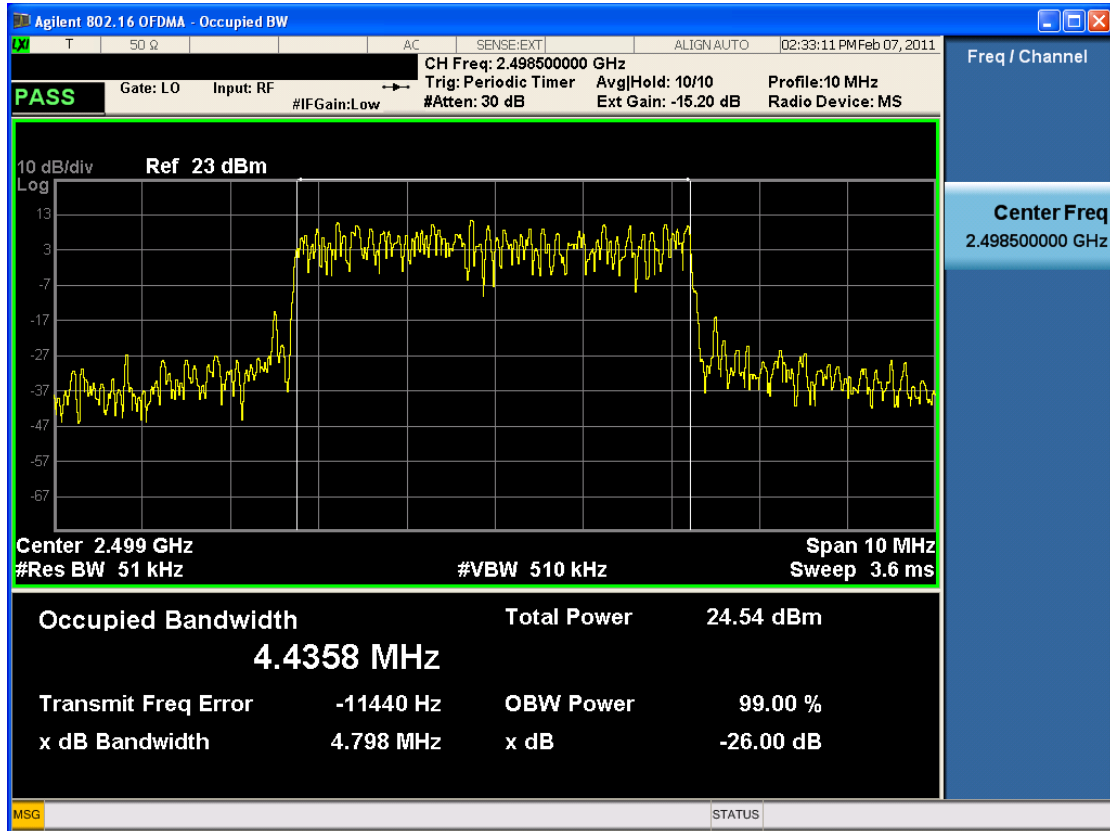


■ QPSK MODE 3/4 (2498.5 MHz) Occupied Bandwidth

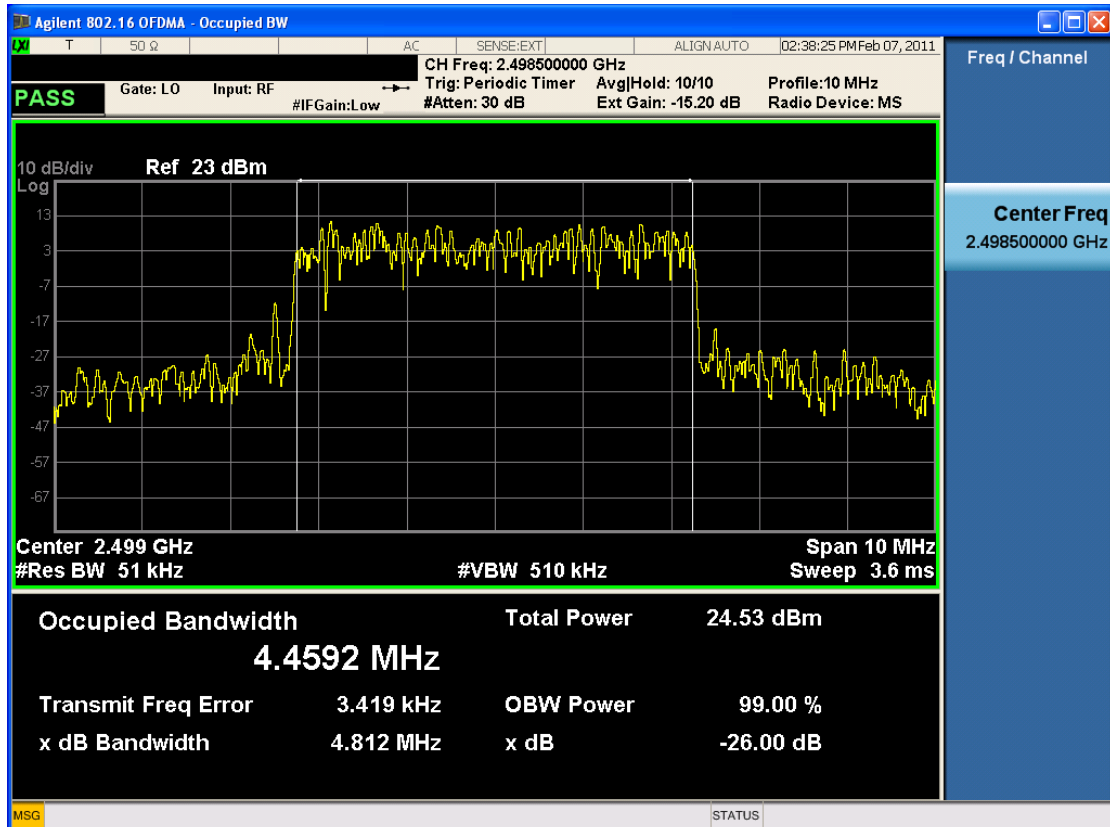


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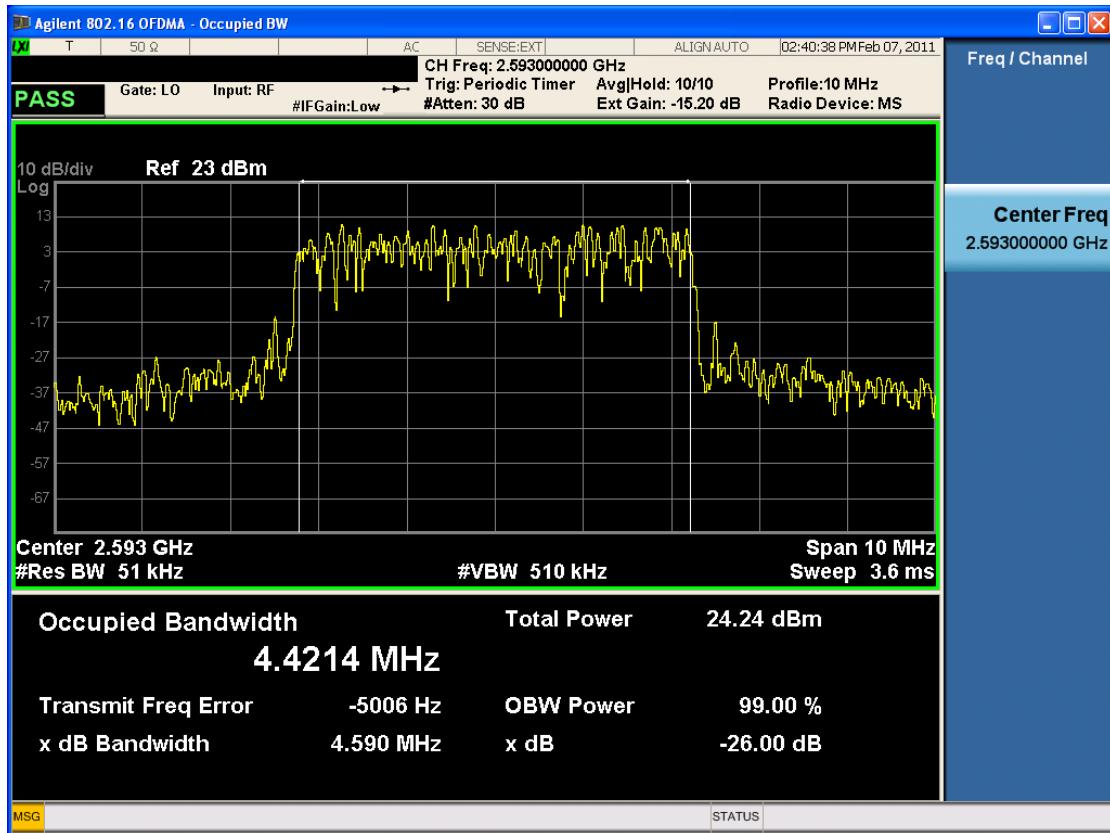
■ 16QAM MODE 1/2 (2498.5 MHz) Occupied Bandwidth



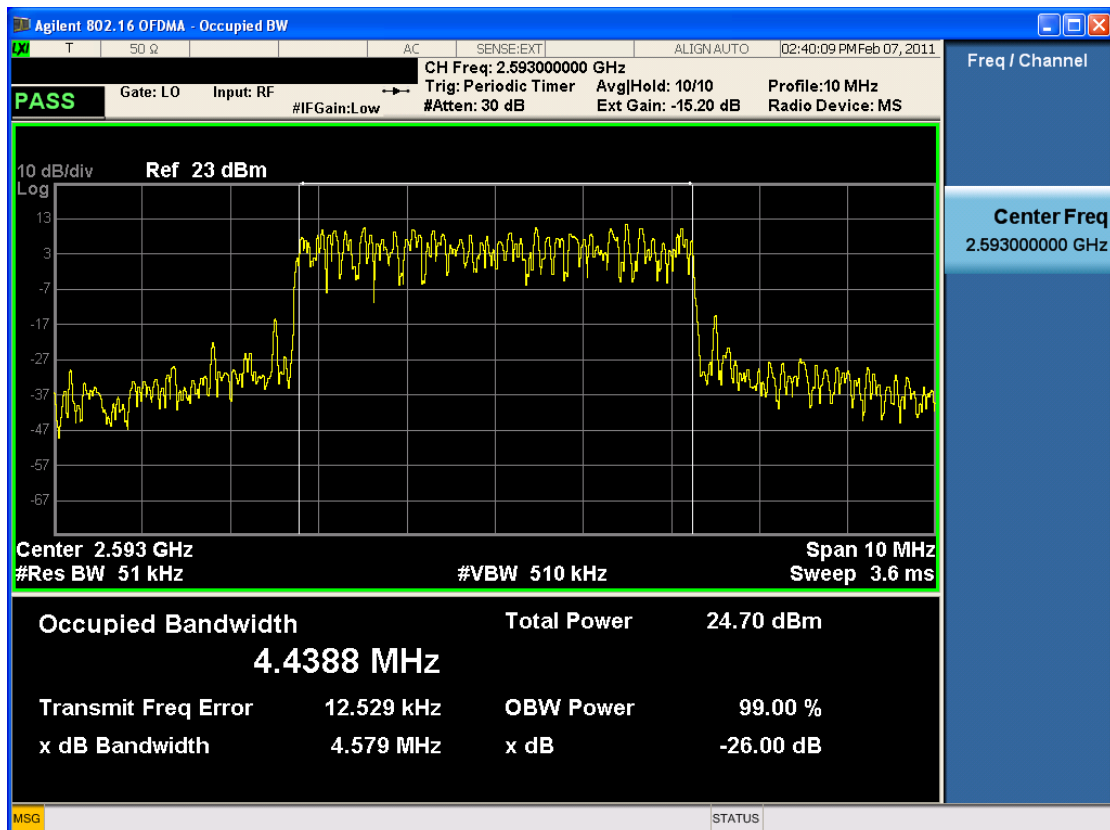
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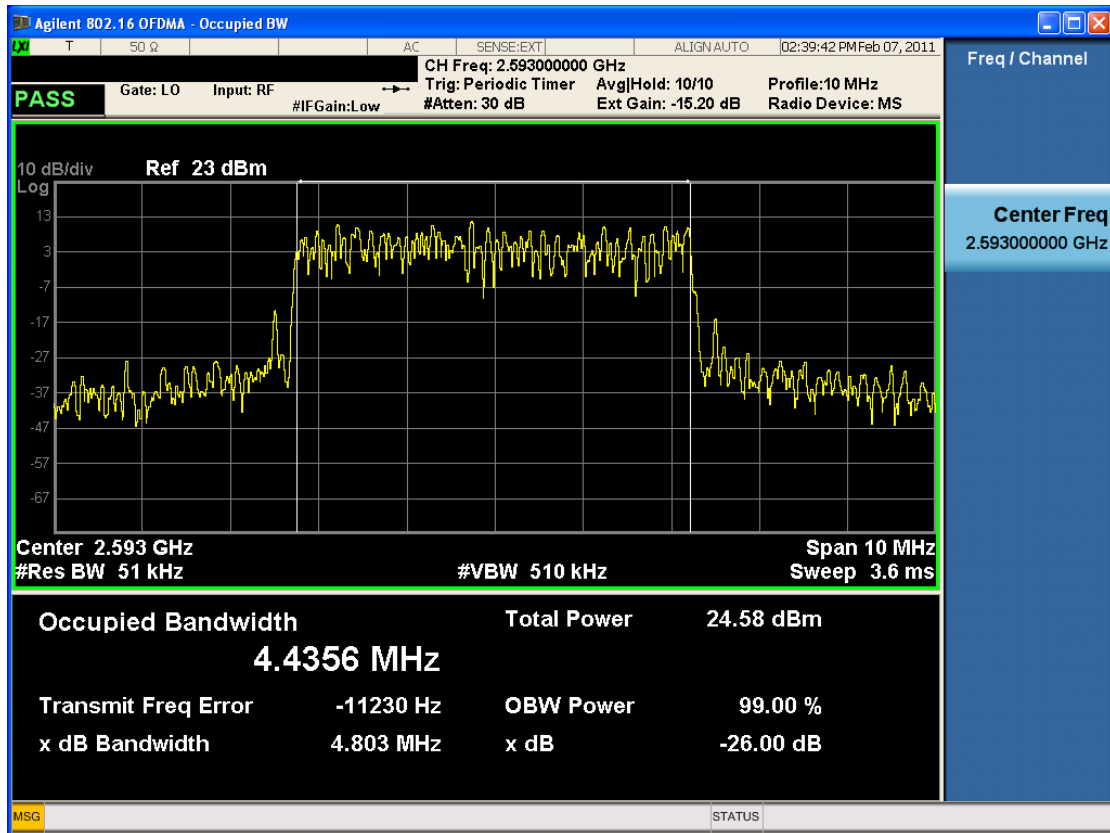
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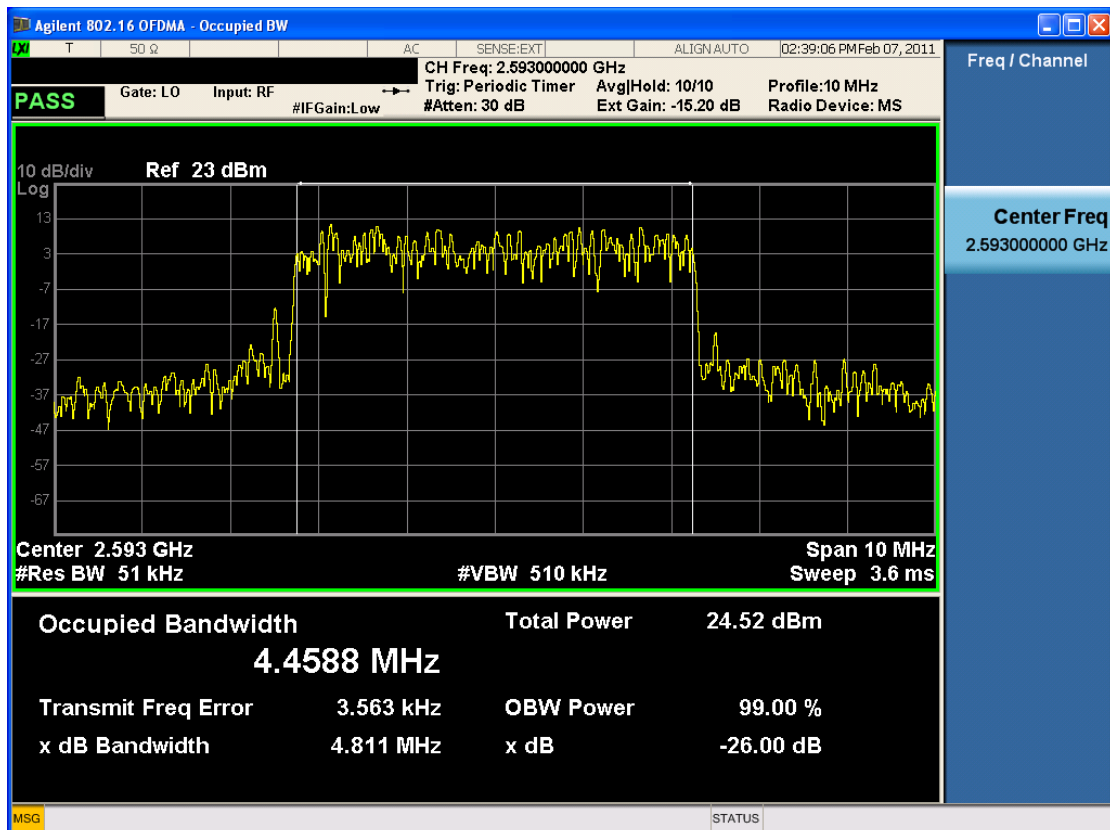
■ QPSK MODE 3/4 (2593.0 MHz) Occupied Bandwidth



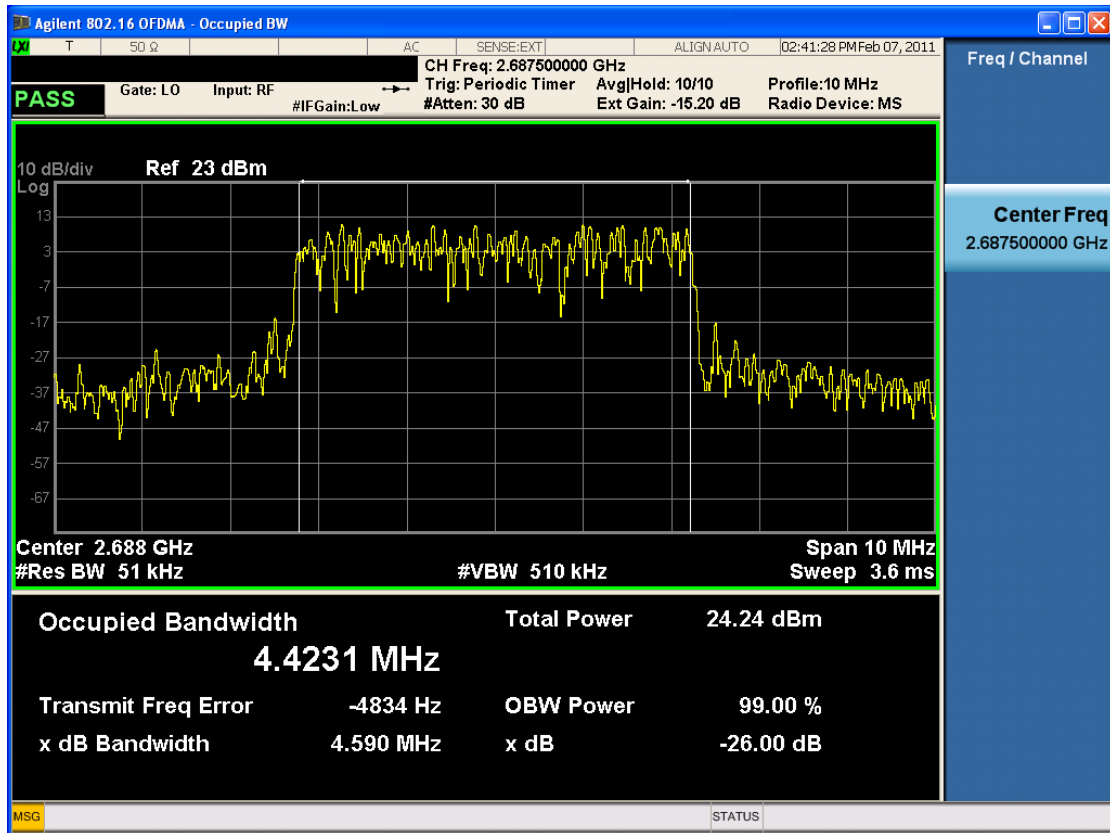
■ 16QAM MODE 1/2 (2593.0 MHz) Occupied Bandwidth



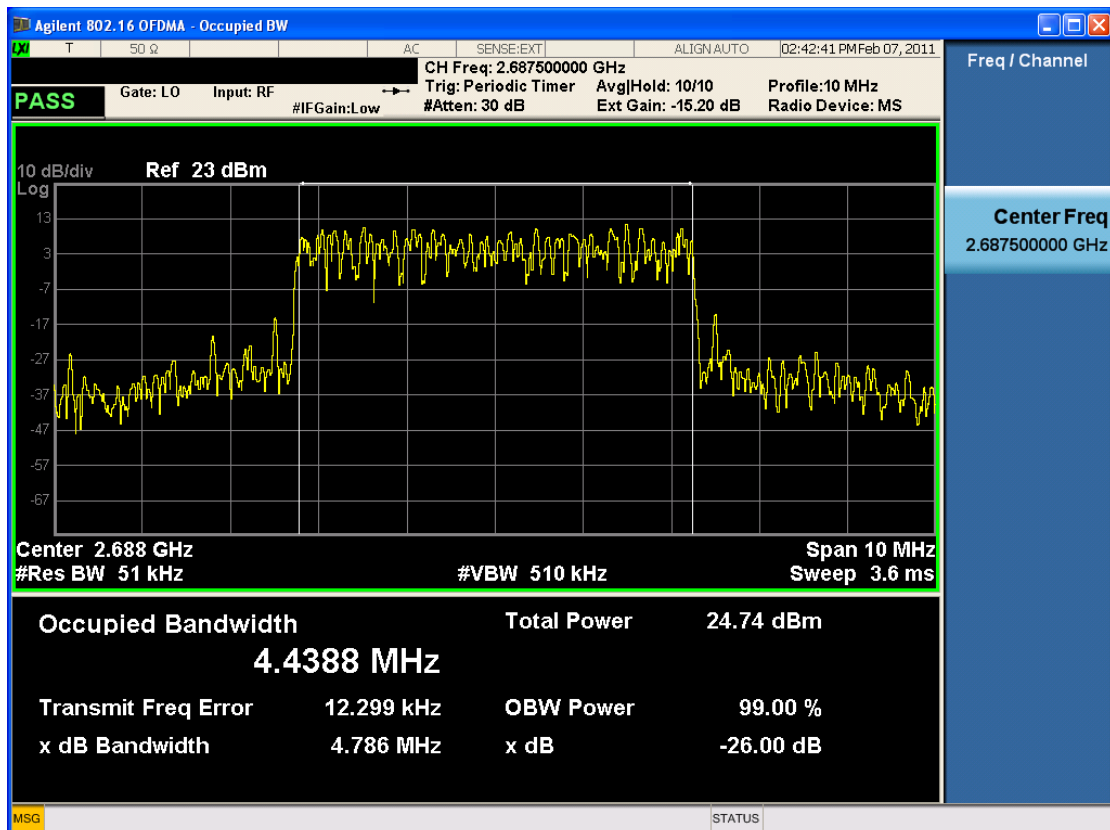
■ 16QAM MODE 3/4 (2593.0 MHz) Occupied Bandwidth



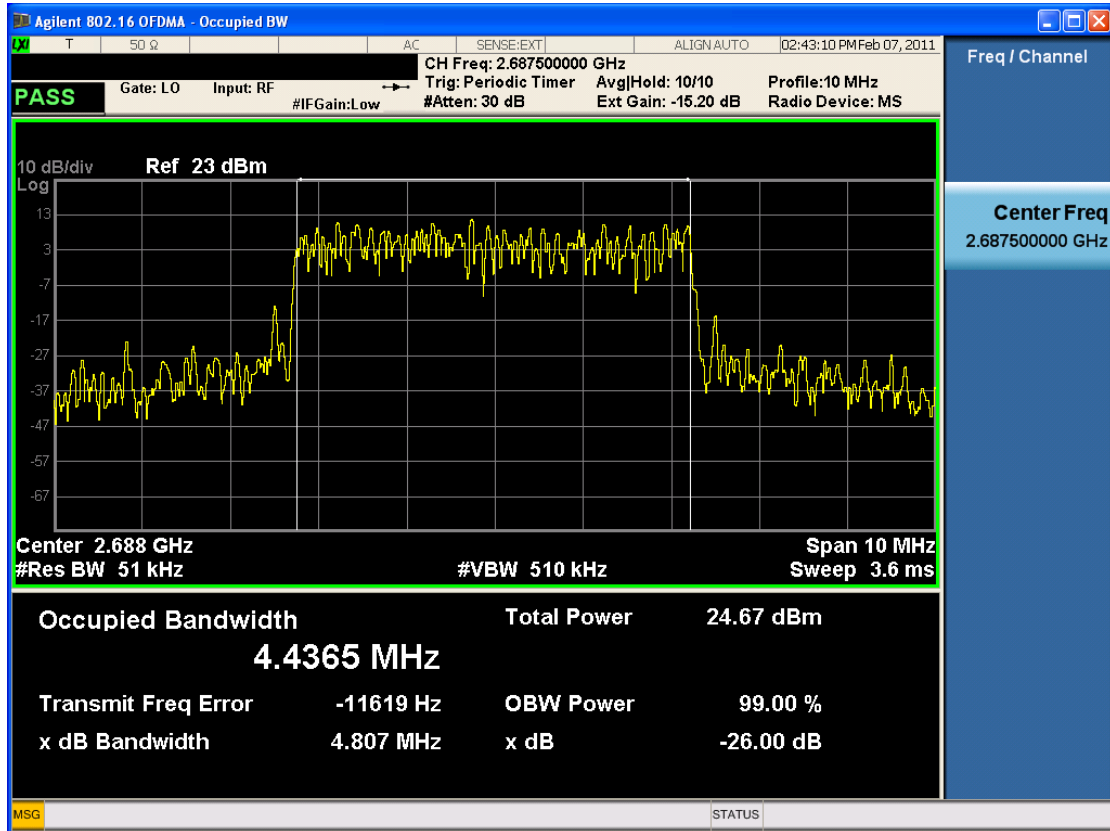
■ QPSK MODE 1/2 (2687.5 MHz) Occupied Bandwidth



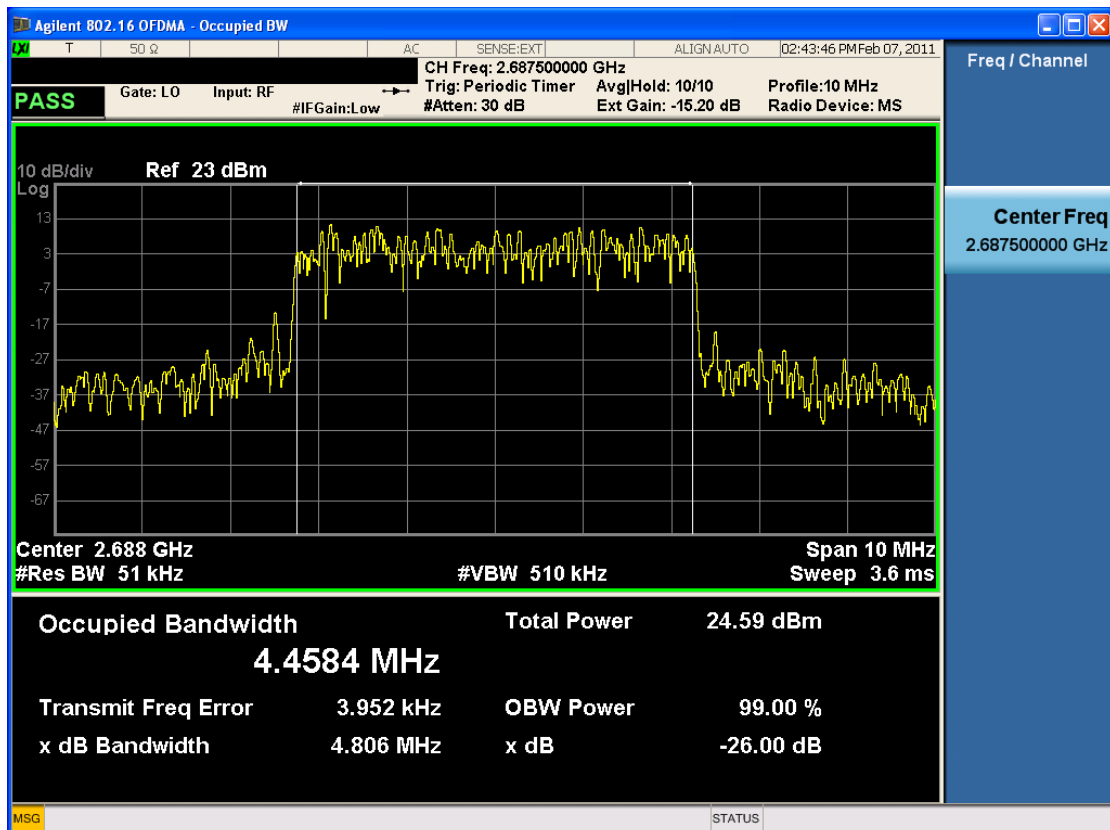
■ QPSK MODE 3/4 (2687.5 MHz) Occupied Bandwidth



■ 16QAM MODE 1/2 (2687.5 MHz) Occupied Bandwidth

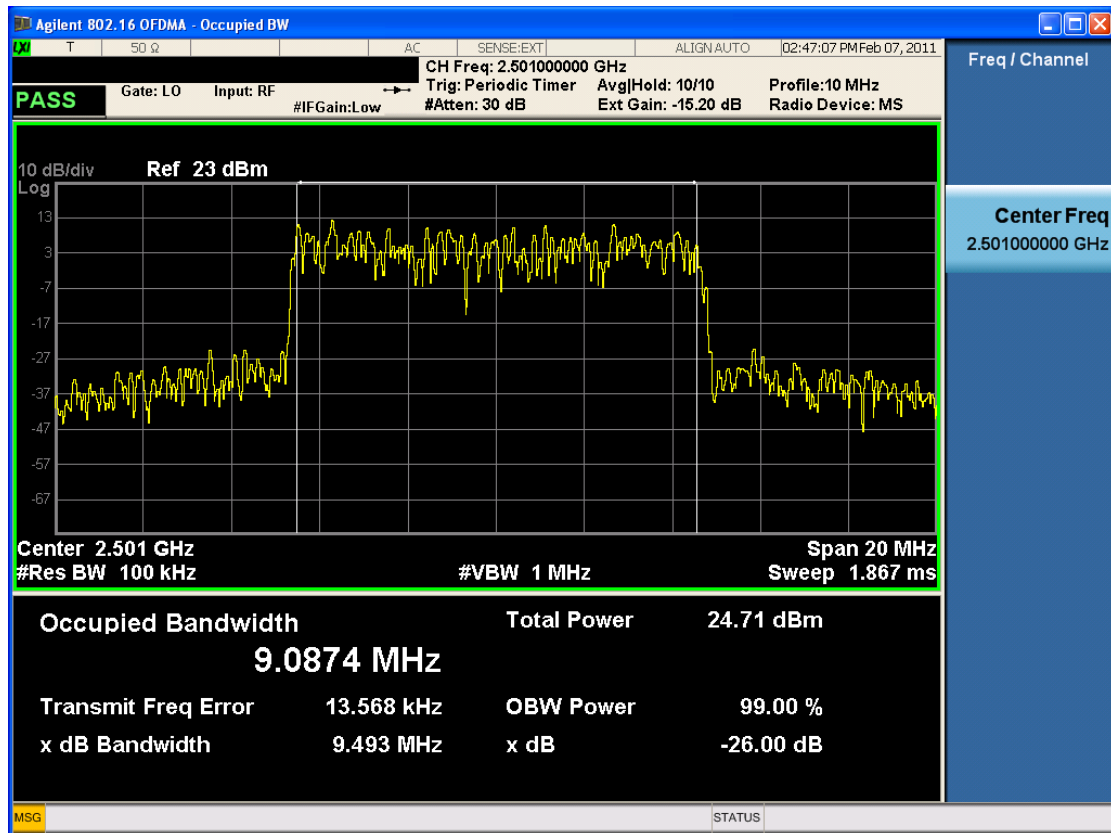


■ 16QAM MODE 3/4 (2687.5 MHz) Occupied Bandwidth

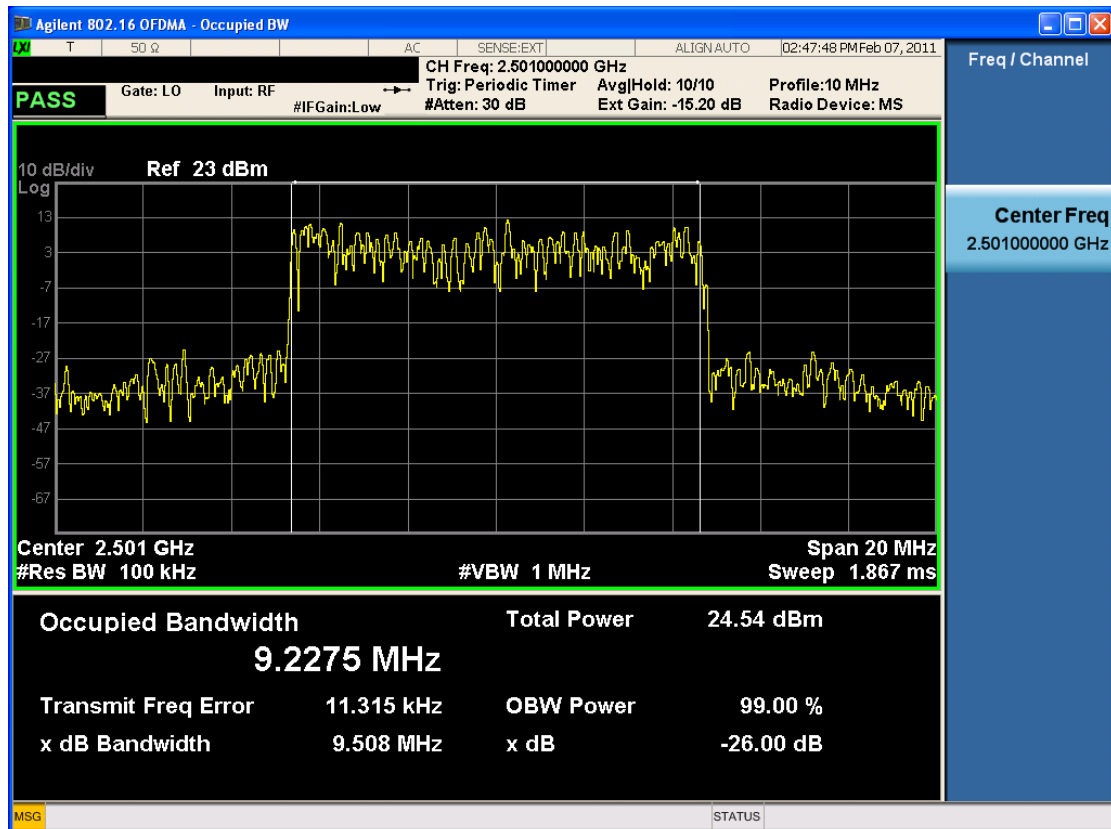


10 MHz

■ QPSK MODE 1/2 (2501.0 MHz) Occupied Bandwidth

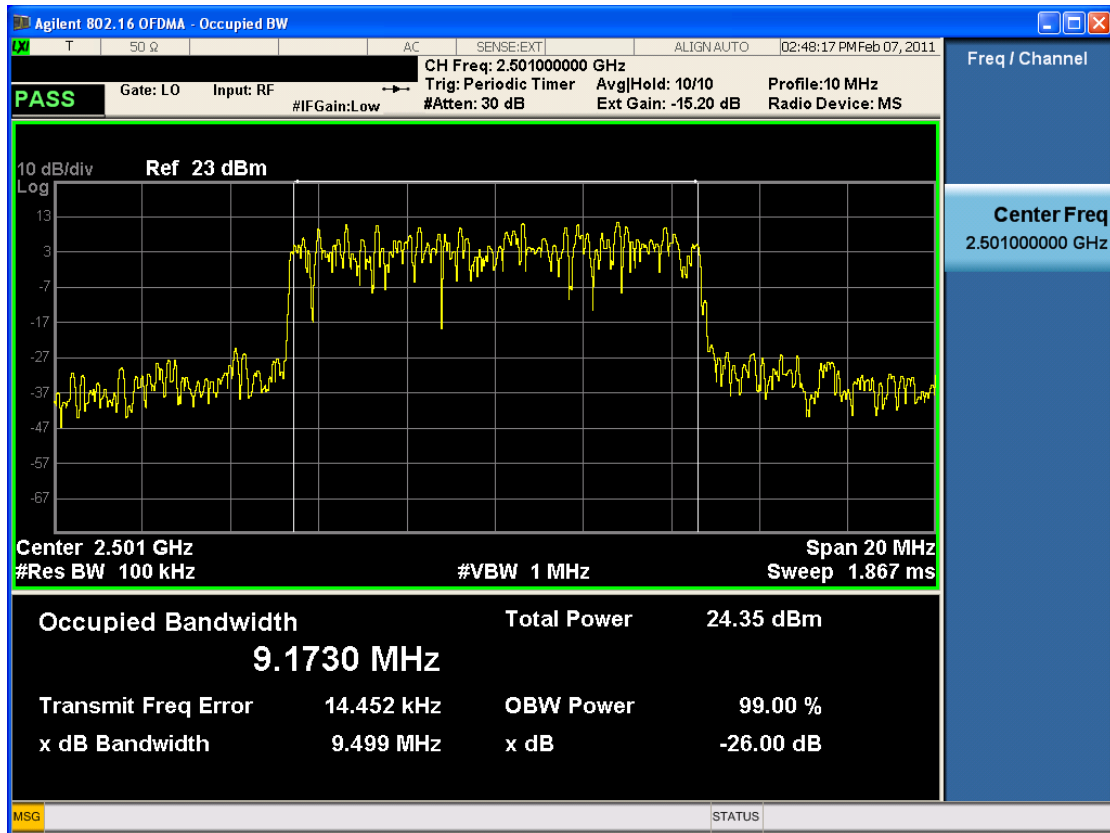


■ QPSK MODE 3/4 (2501.0 MHz) Occupied Bandwidth

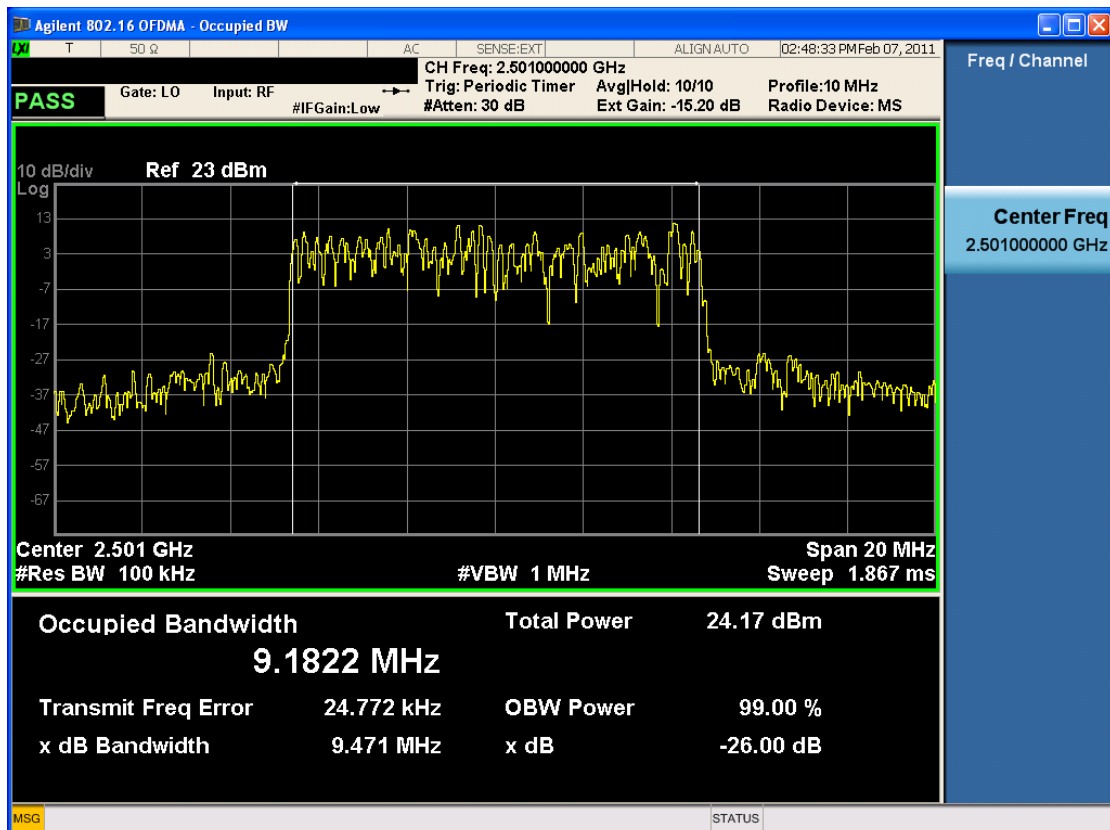


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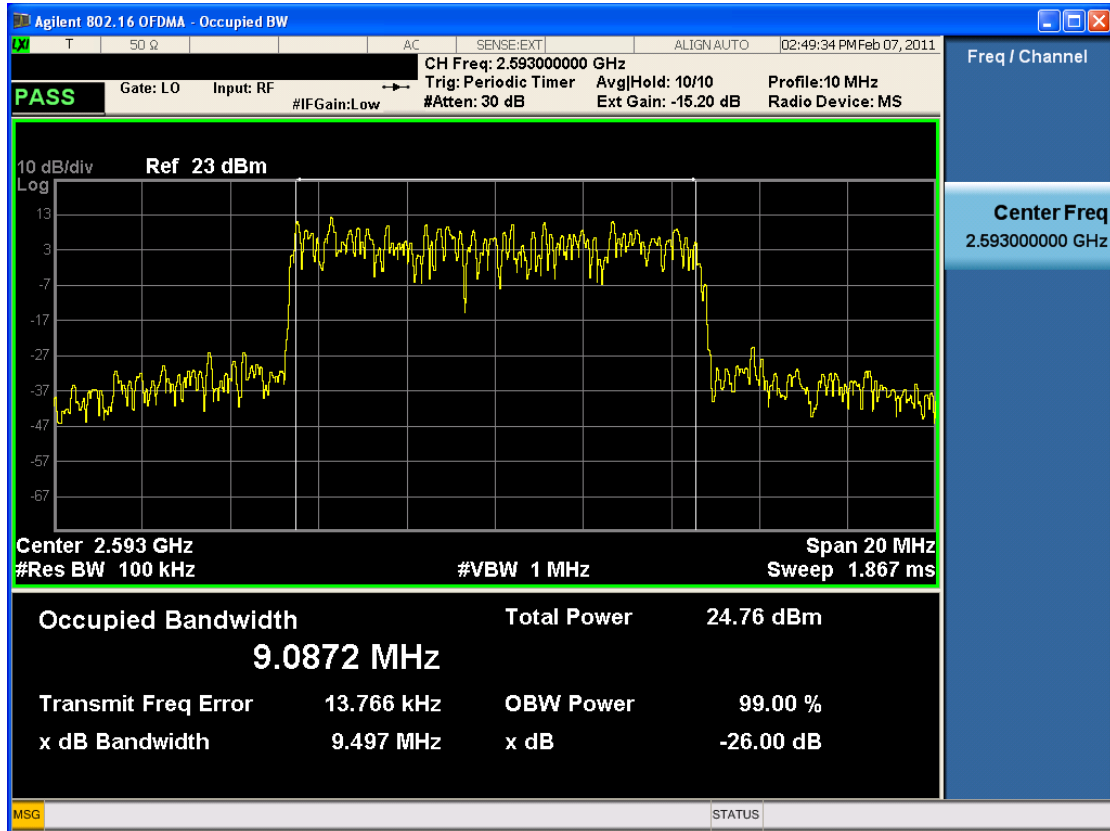
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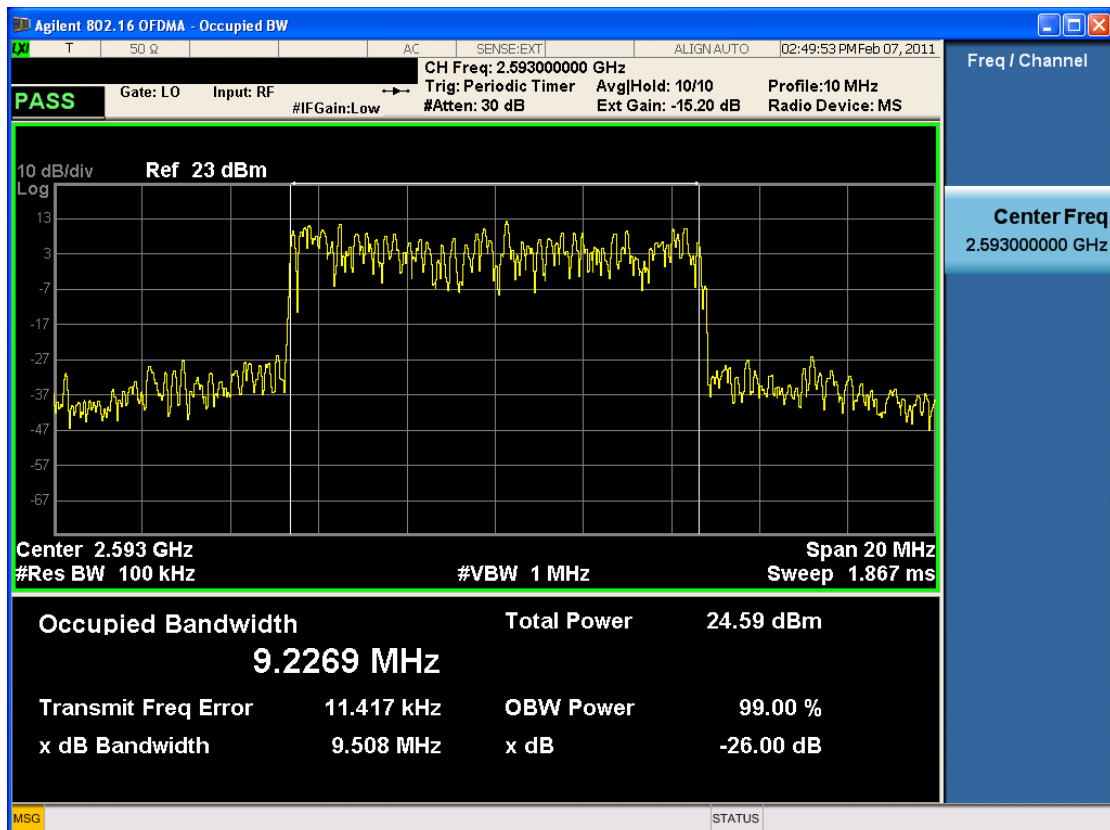
■ 16QAM MODE 3/4 (2501.0 MHz) Occupied Bandwidth



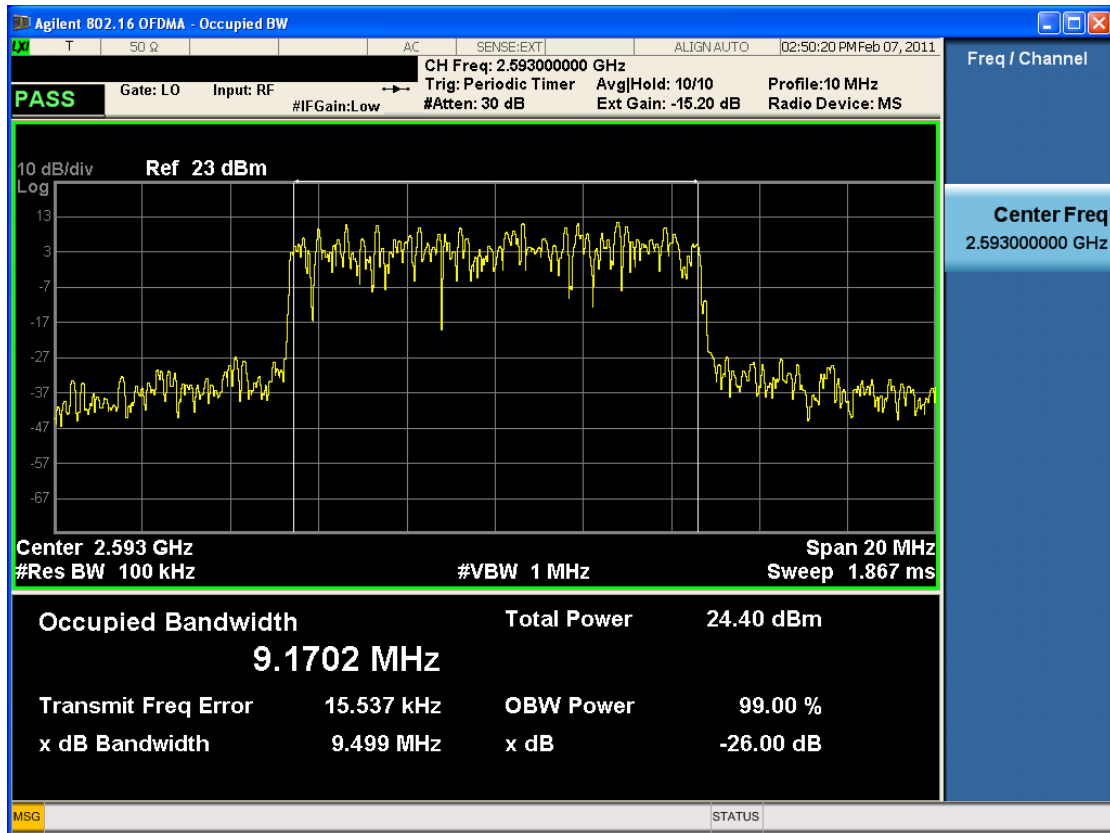
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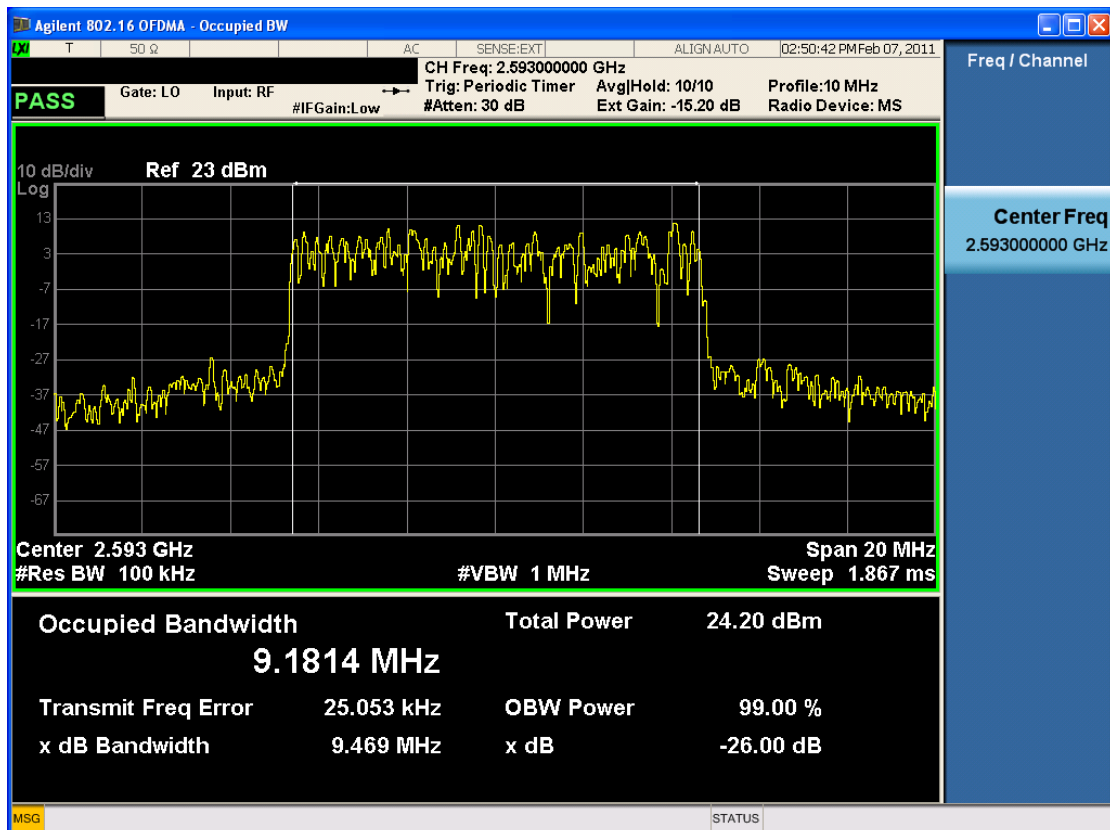
■ QPSK MODE 3/4 (2593.0 MHz) Occupied Bandwidth



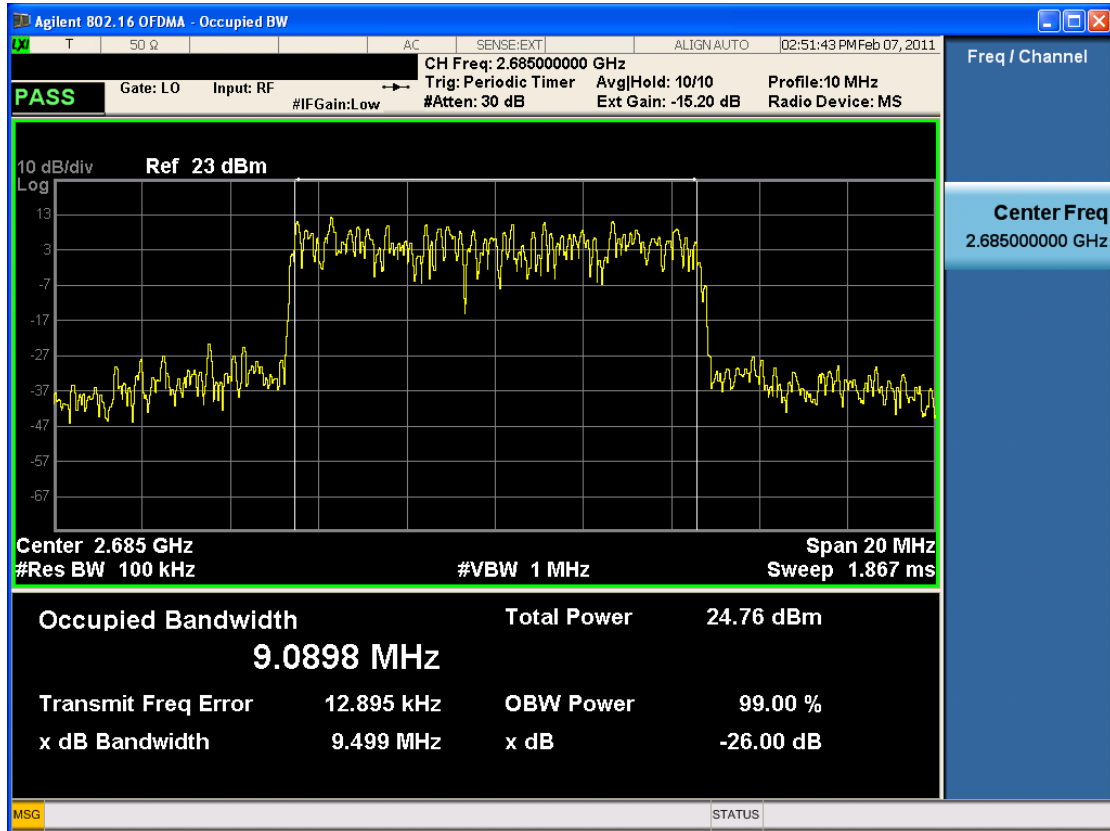
■ 16QAM MODE 1/2 (2593.0 MHz) Occupied Bandwidth



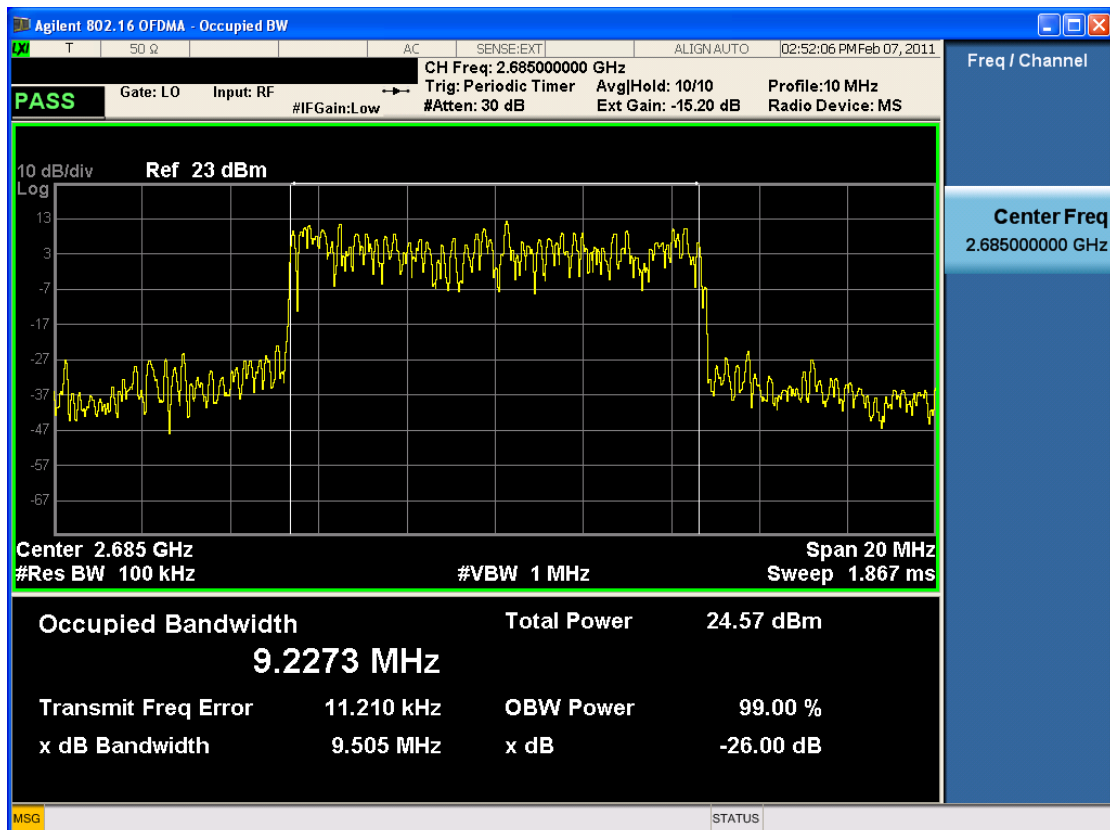
■ 16QAM MODE 3/4 (2593.0 MHz) Occupied Bandwidth



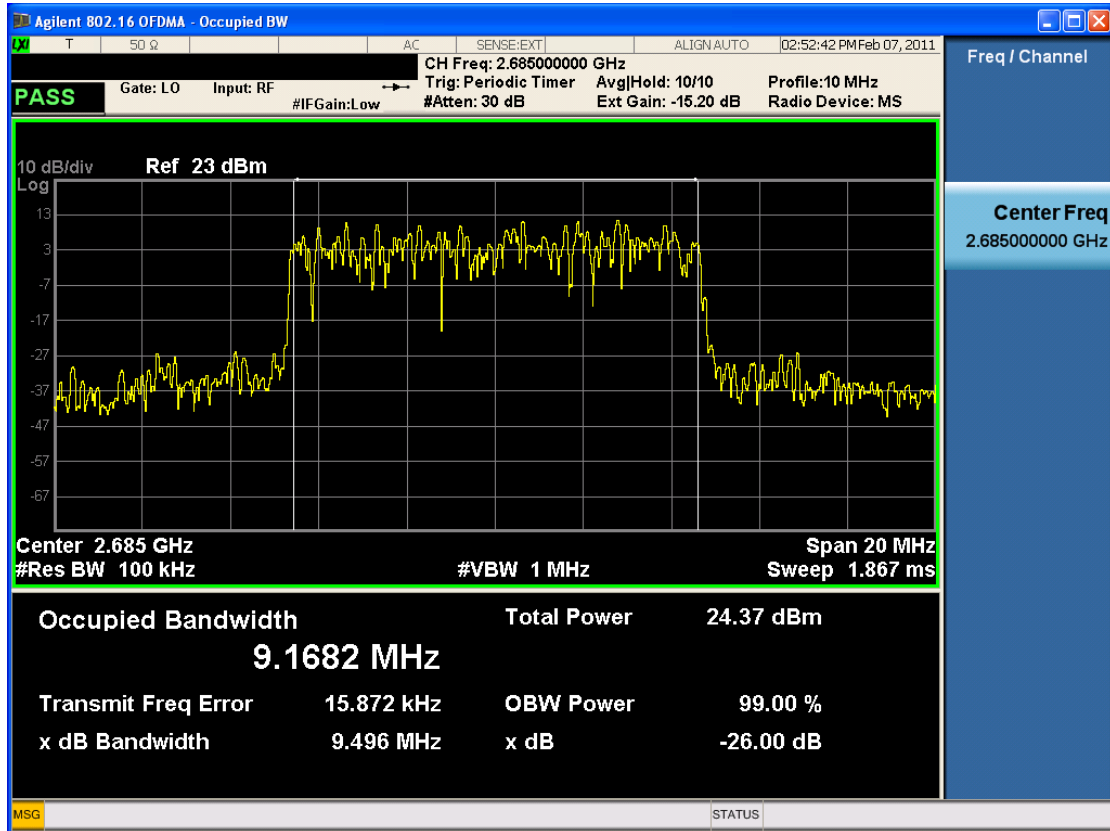
■ QPSK MODE 1/2 (2685.0 MHz) Occupied Bandwidth



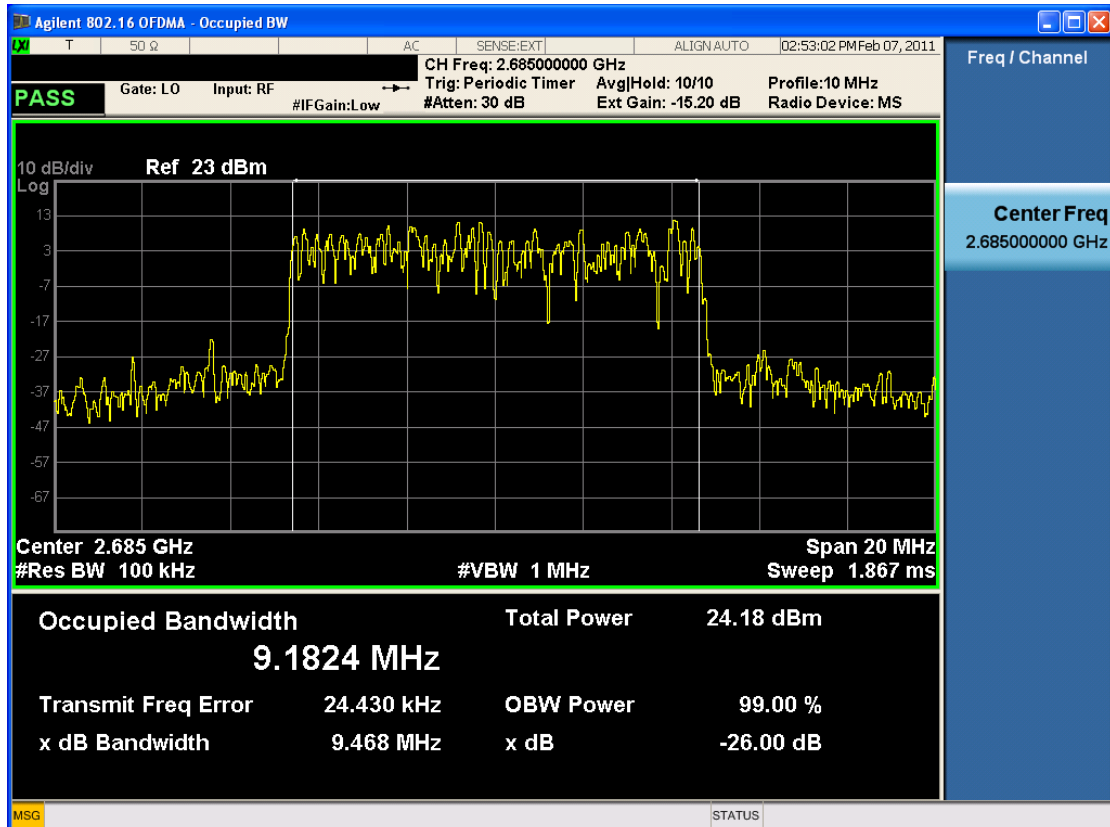
■ QPSK MODE 3/4 (2685.0 MHz) Occupied Bandwidth



■ 16QAM MODE 1/2 (2685.0 MHz) Occupied Bandwidth

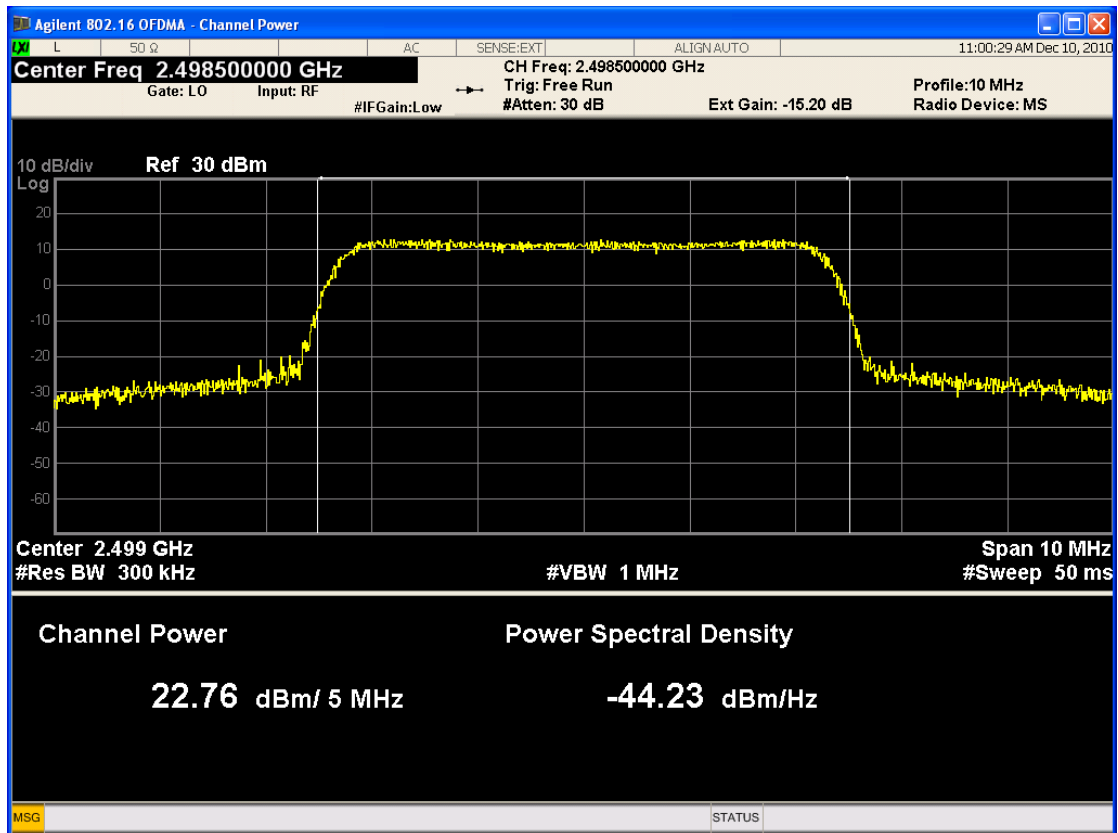


■ 16QAM MODE 3/4 (2685.0 MHz) Occupied Bandwidth

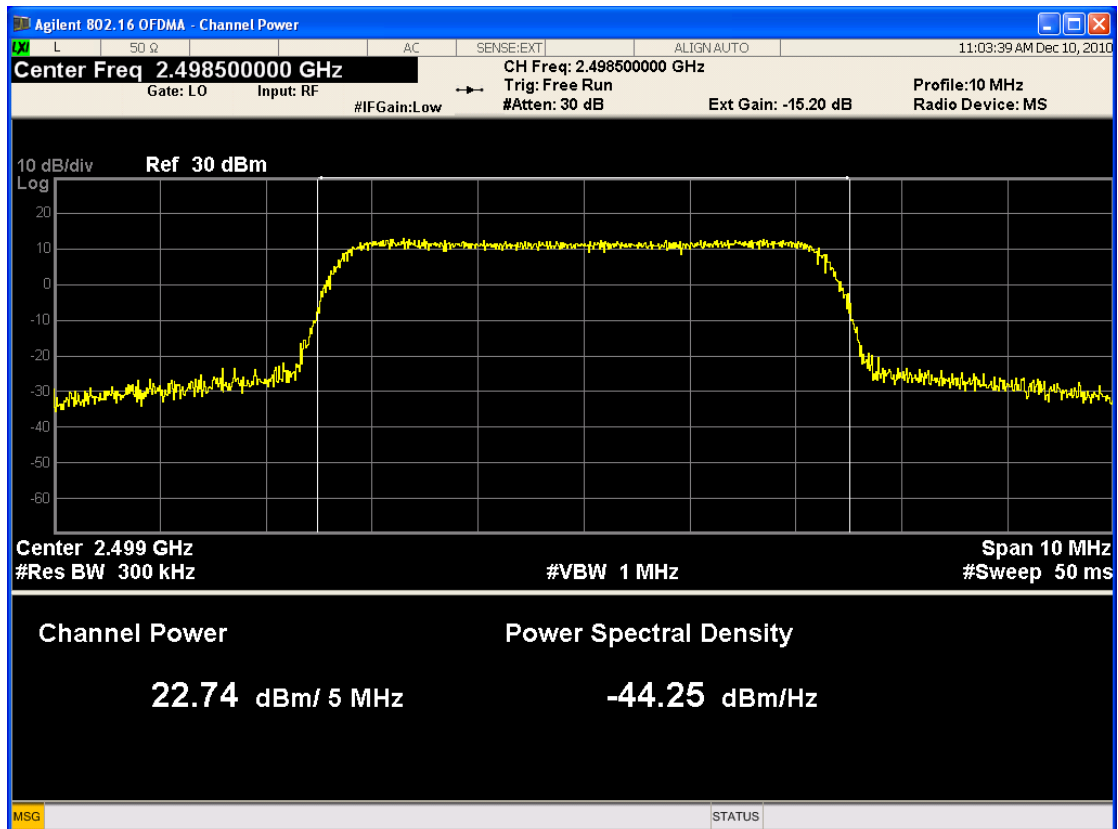


TX-1 (5 MHz)

■ QPSK MODE 1/2 (2498.5 MHz) Conducted Output Power

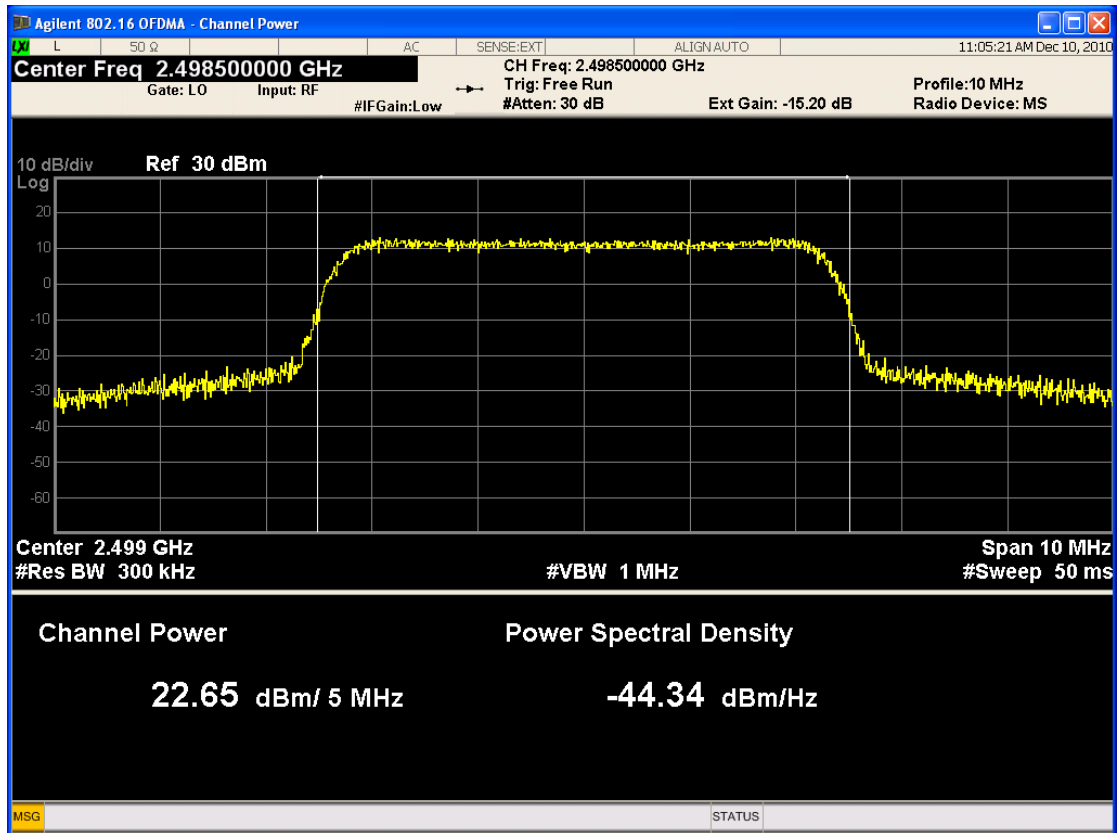


■ QPSK MODE 3/4 (2498.5 MHz) Conducted Output Power

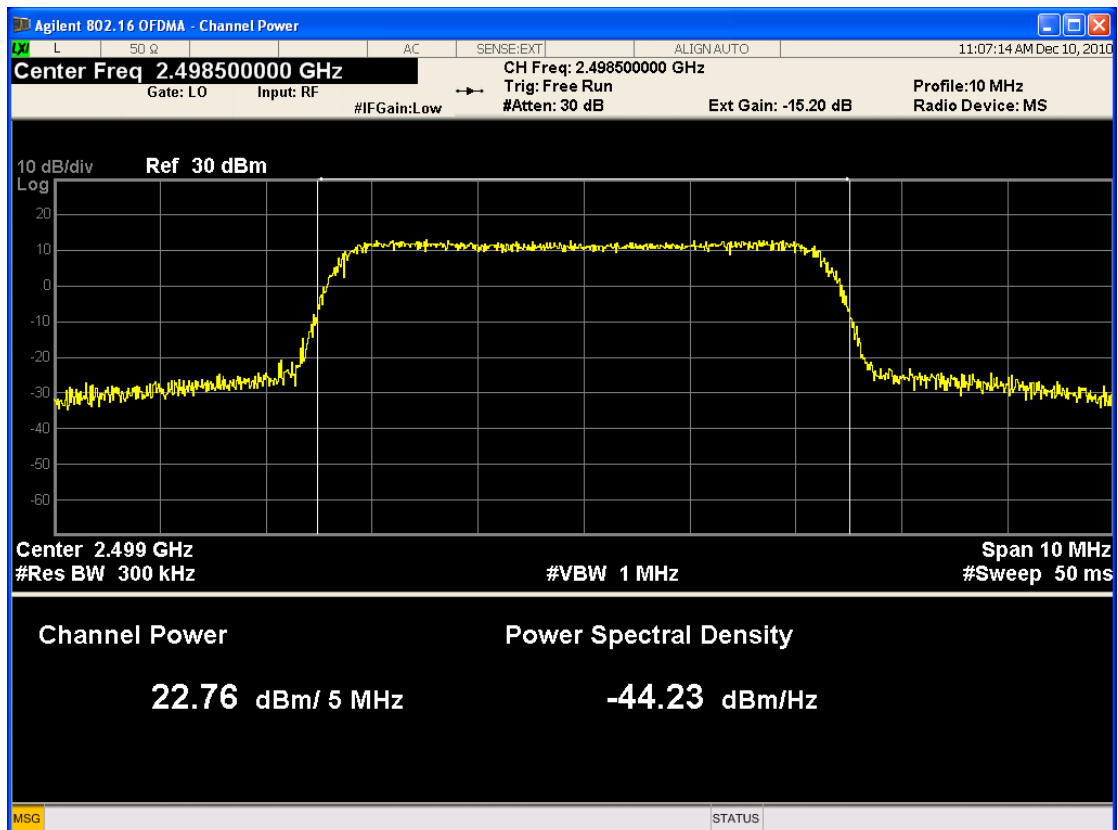


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■ 16QAM MODE 1/2 (2498.5 MHz) Conducted Output Power

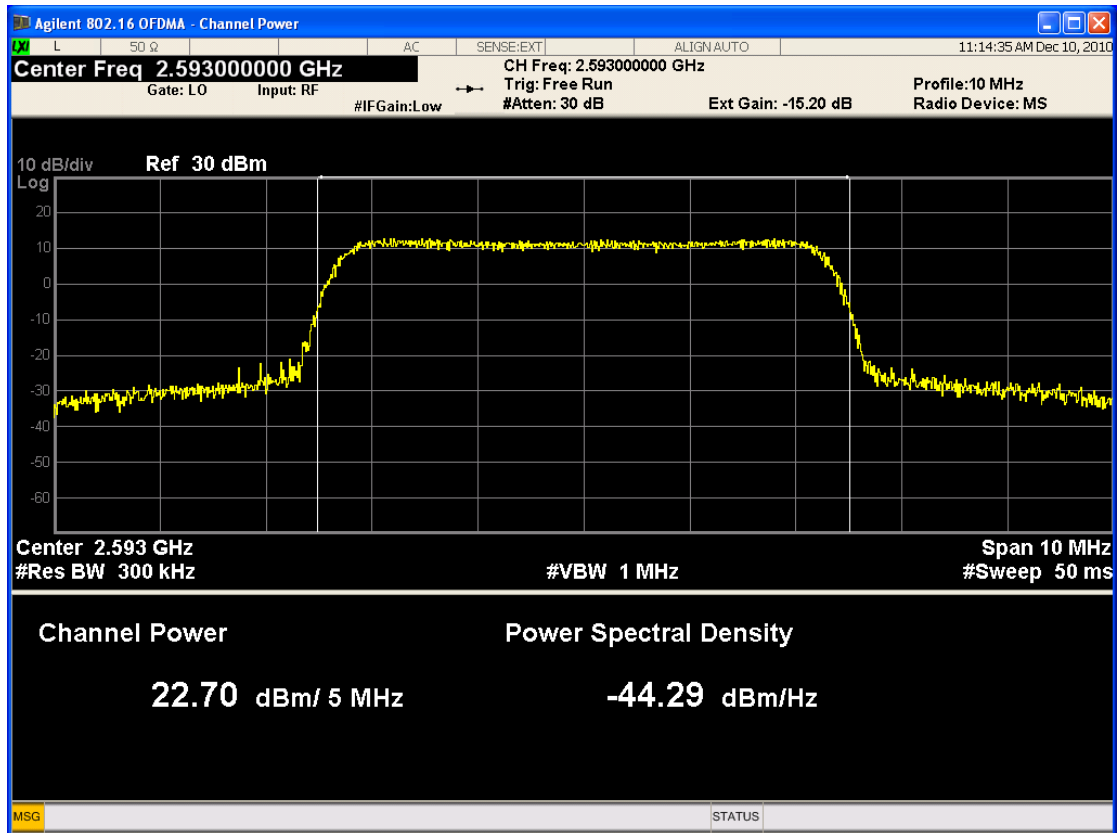


■ 16QAM MODE 3/4 (2498.5 MHz) Conducted Output Power

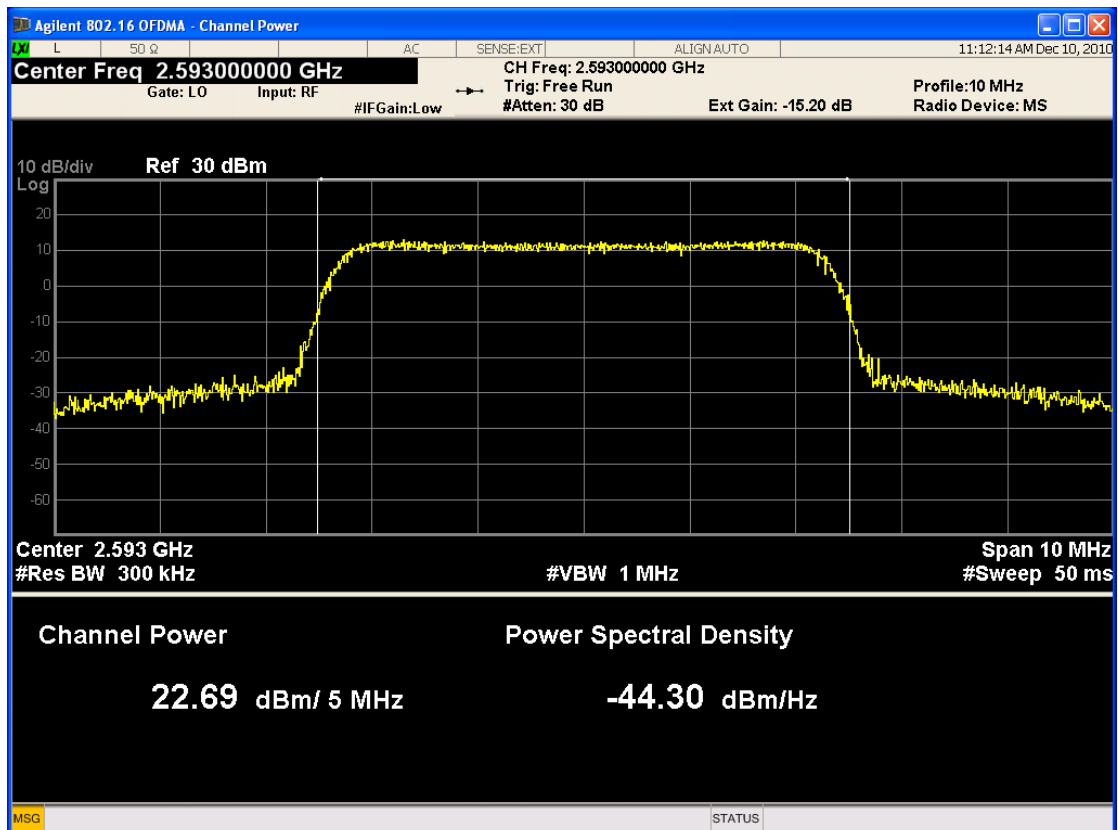


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■ QPSK MODE 1/2 (2593.0 MHz) Conducted Output Power

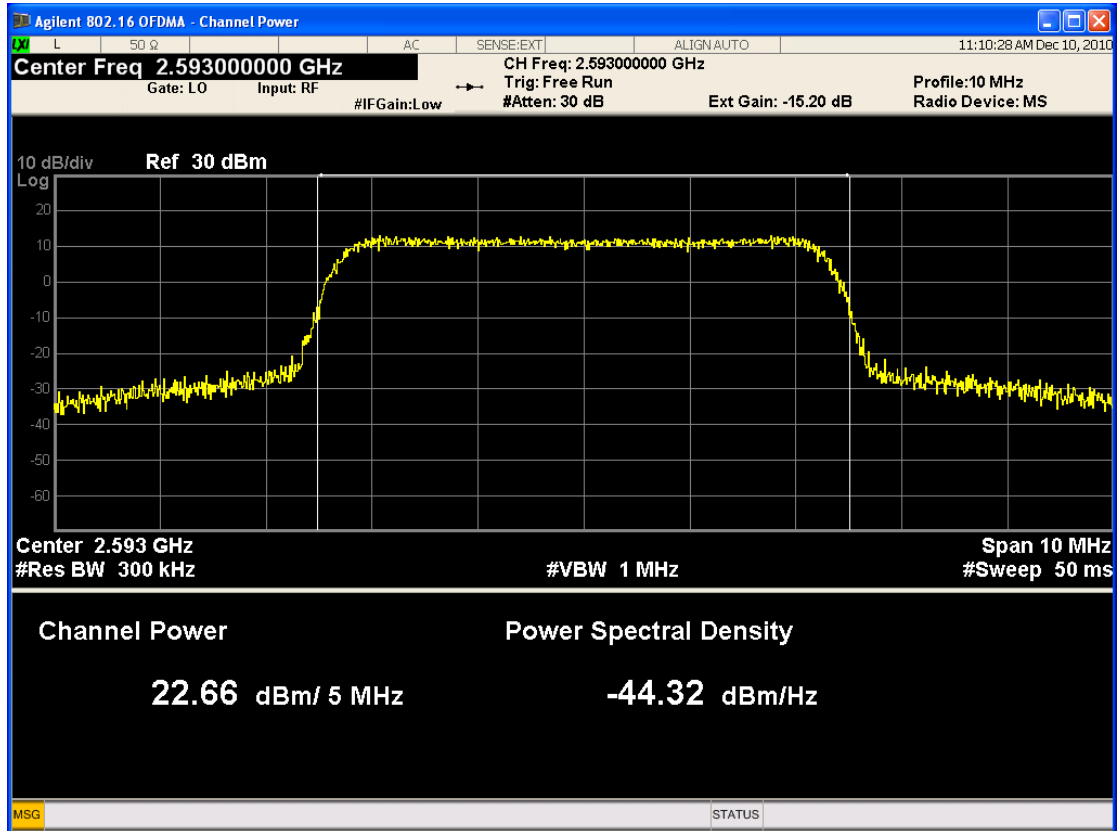


■ QPSK MODE 3/4 (2593.0 MHz) Conducted Output Power

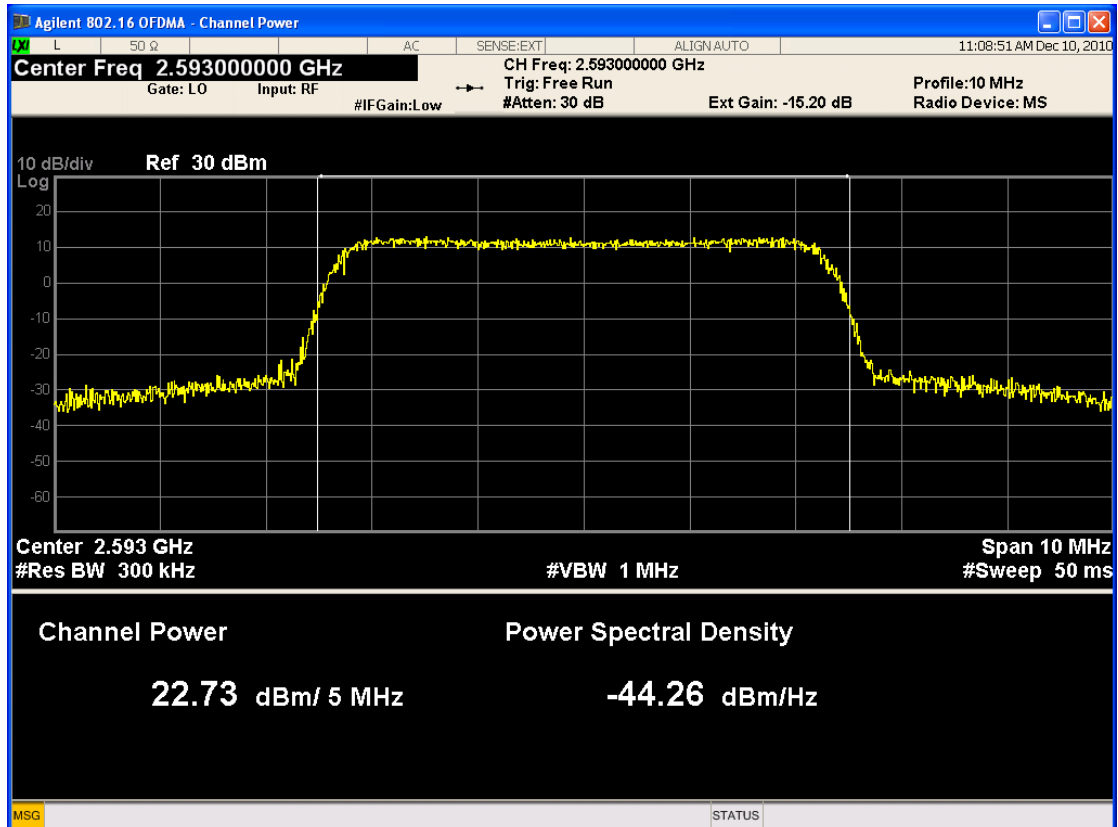


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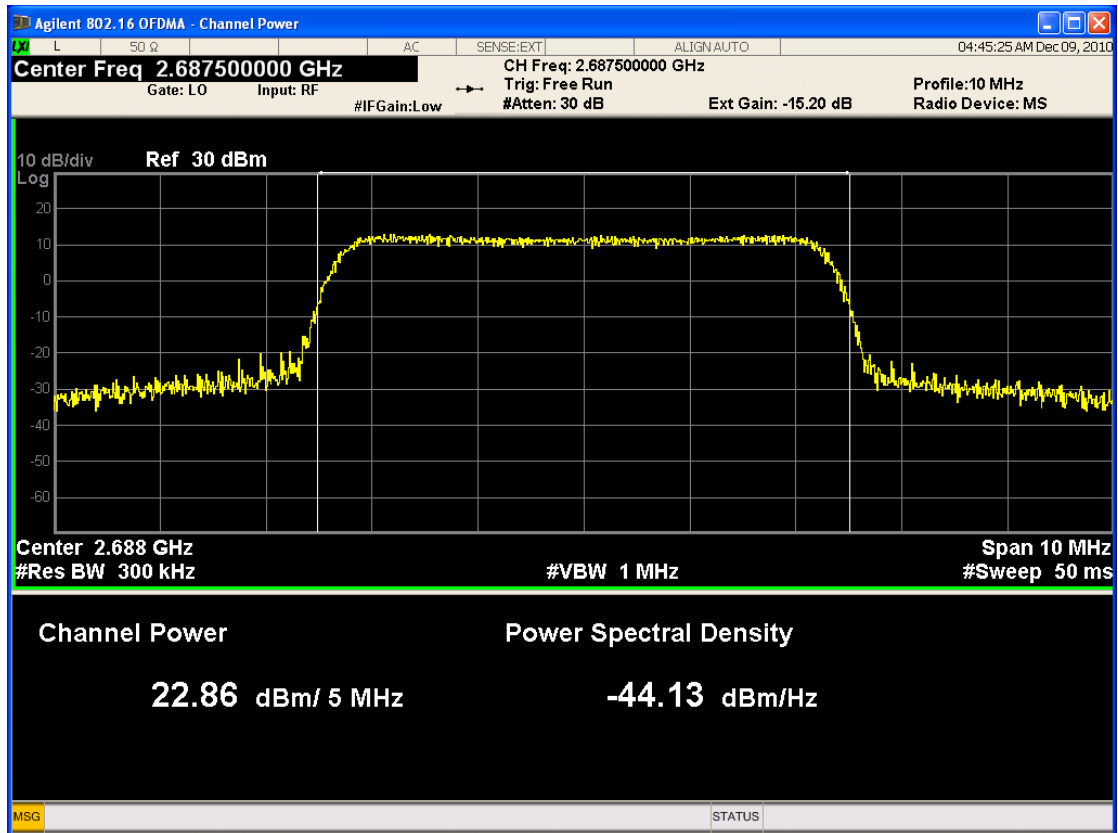
■ 16QAM MODE 1/2 (2593.0 MHz) Conducted Output Power



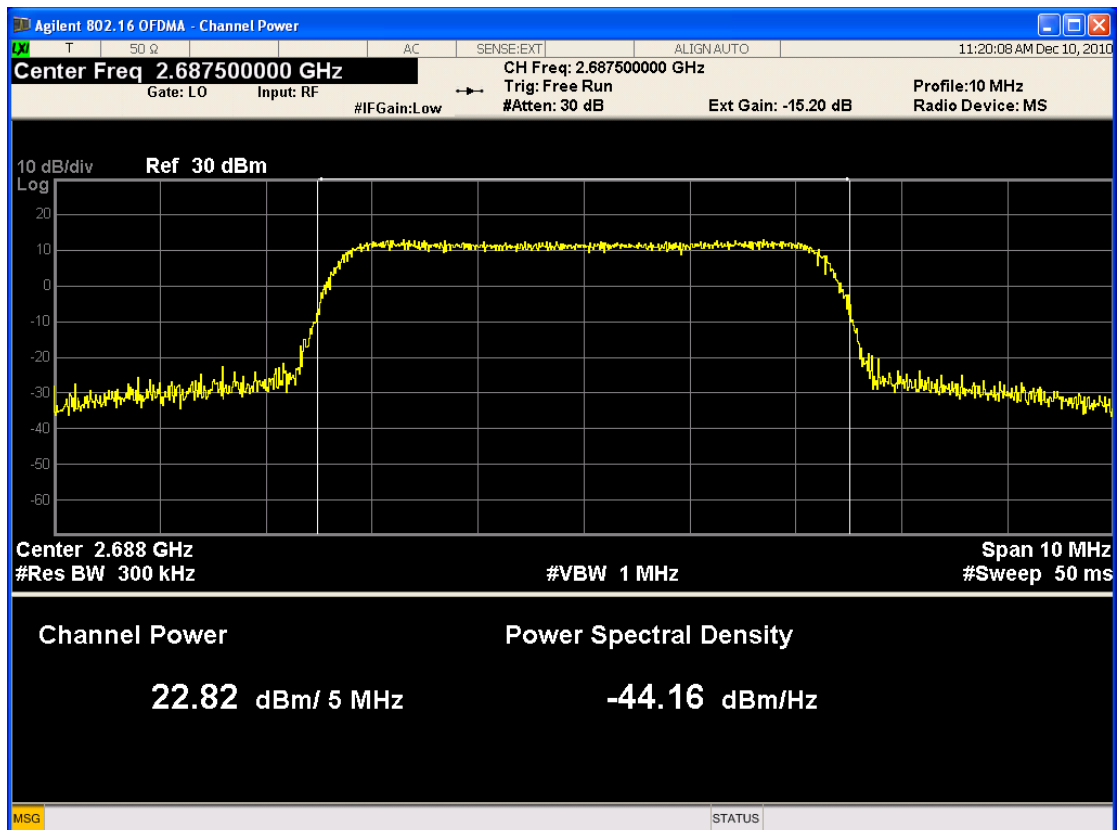
■ 16QAM MODE 3/4 (2593.0 MHz) Conducted Output Power



■ QPSK MODE 1/2 (2687.5 MHz) Conducted Output Power

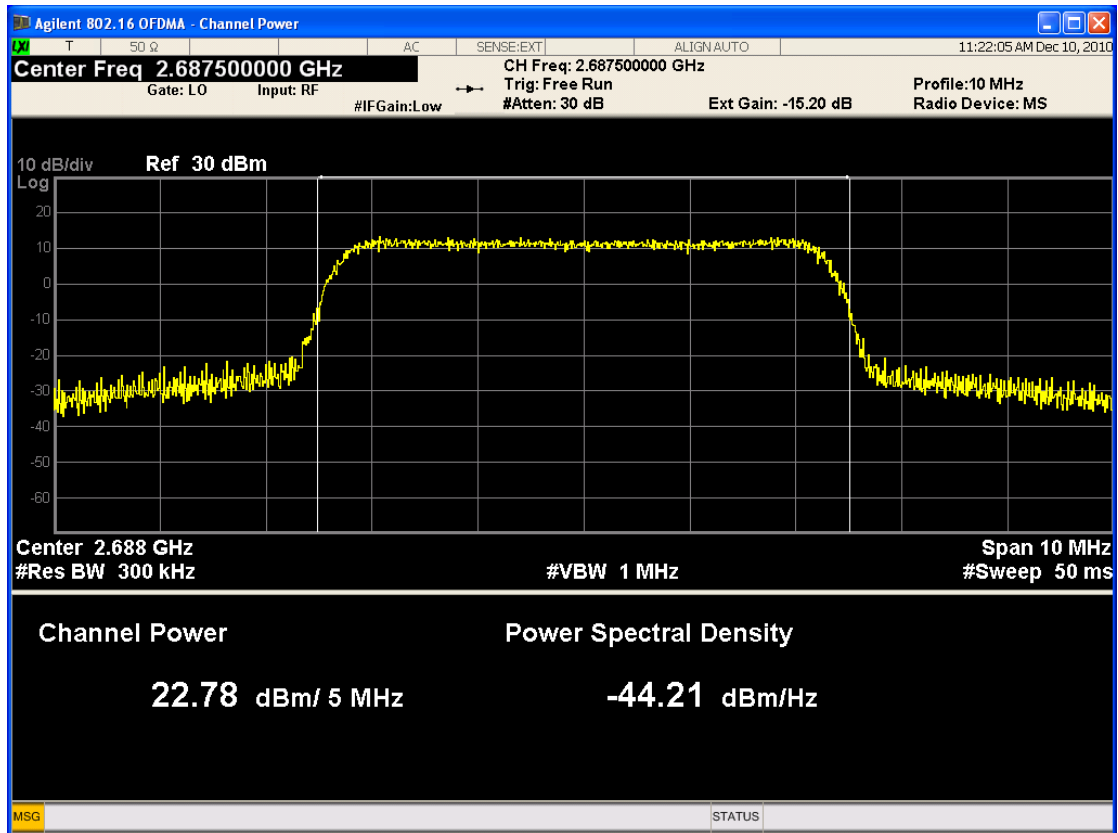


■ QPSK MODE 3/4 (2687.5 MHz) Conducted Output Power

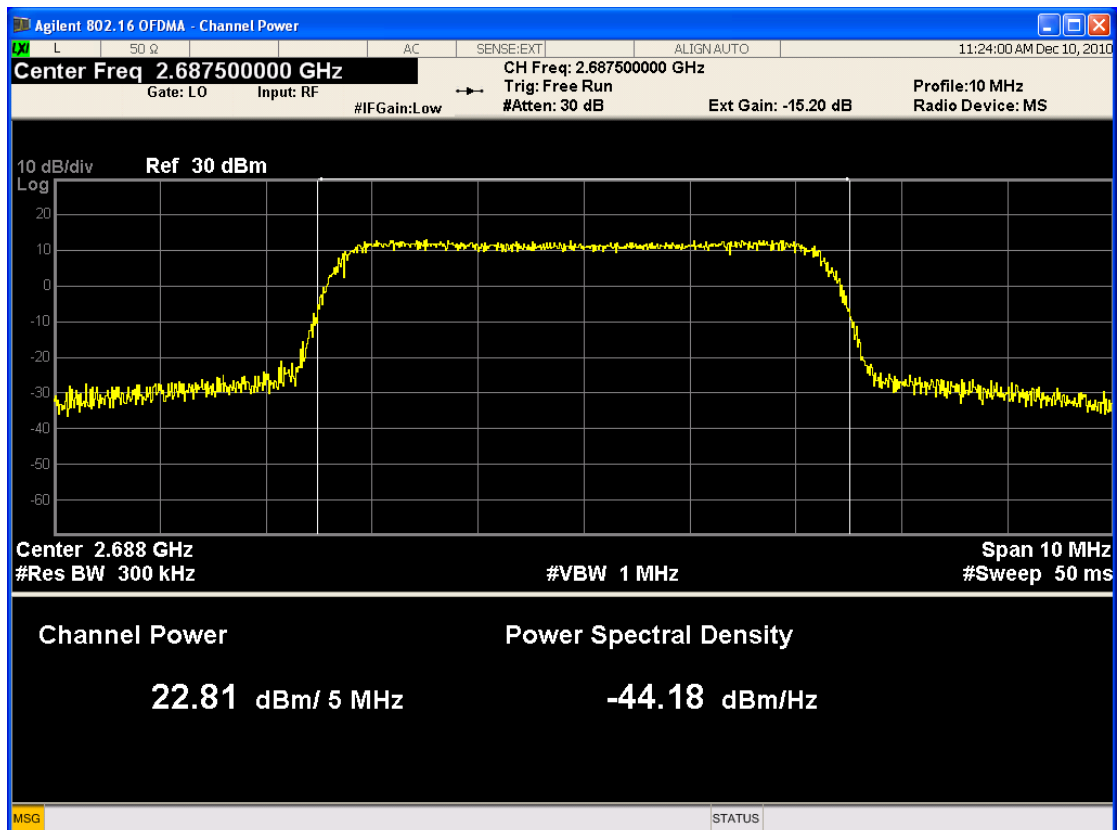


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■ 16QAM MODE 1/2 (2687.5 MHz) Conducted Output Power



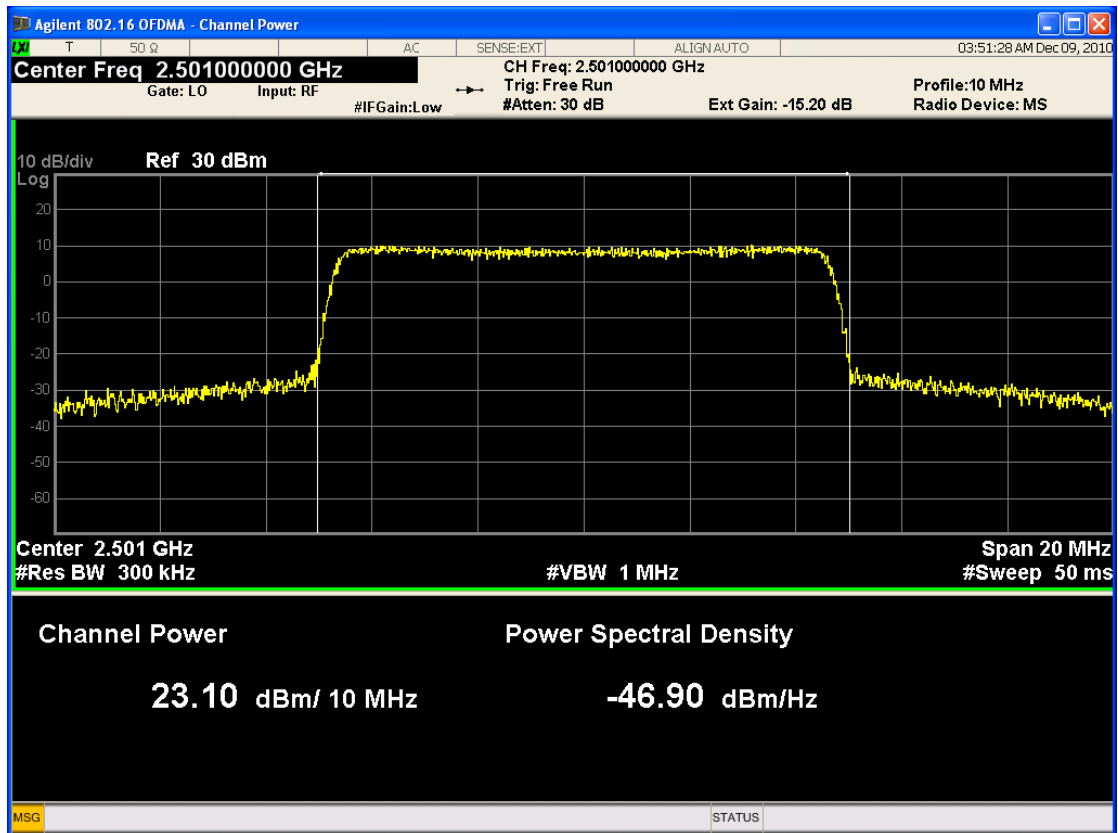
■ 16QAM MODE 3/4 (2687.5 MHz) Conducted Output Power



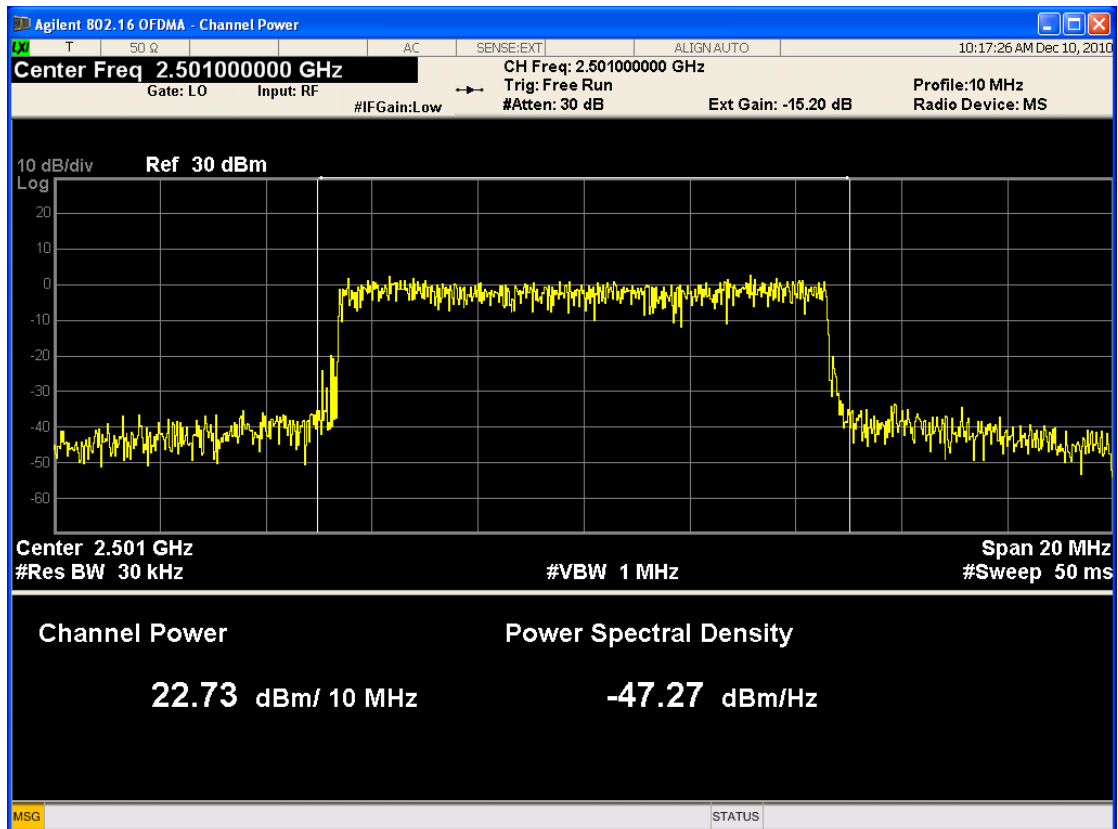
FCC CERTIFICATION REPORT			www.hct.co.kr
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TX-1 (10 MHz)

■ QPSK MODE 1/2 (2501.0 MHz) Conducted Output Power

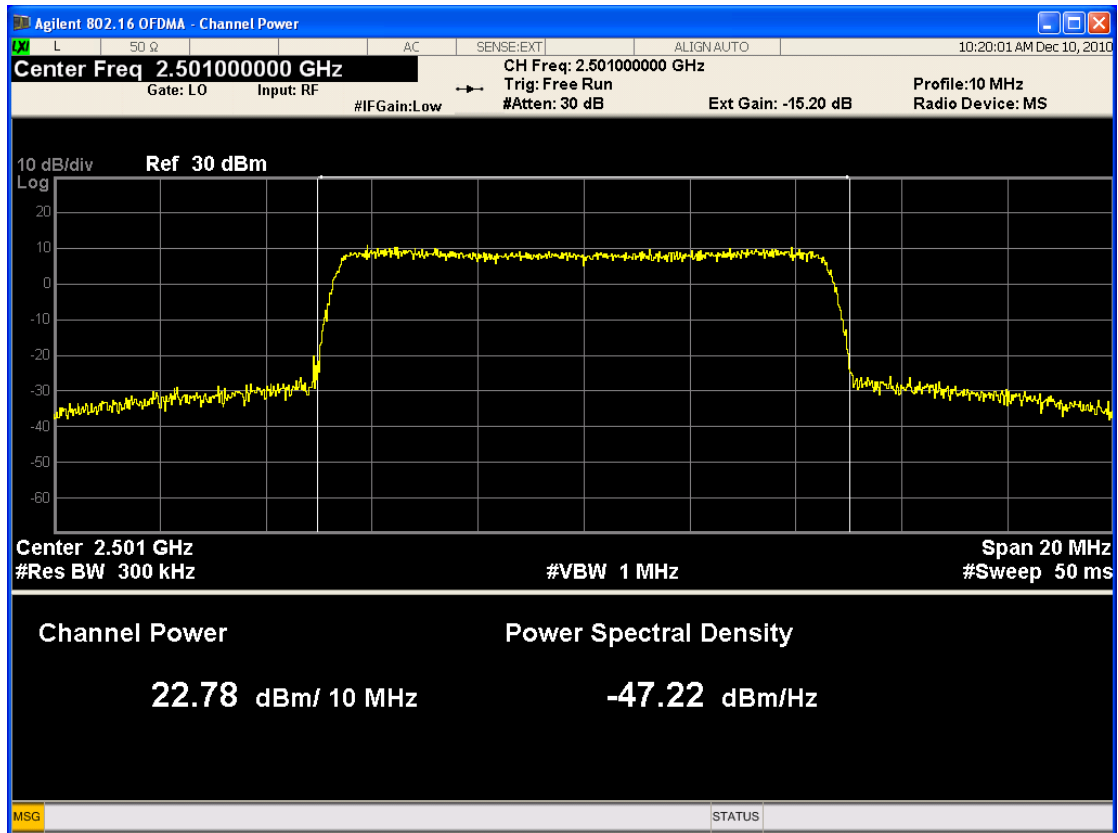


■ QPSK MODE 3/4 (2501.0 MHz) Conducted Output Power

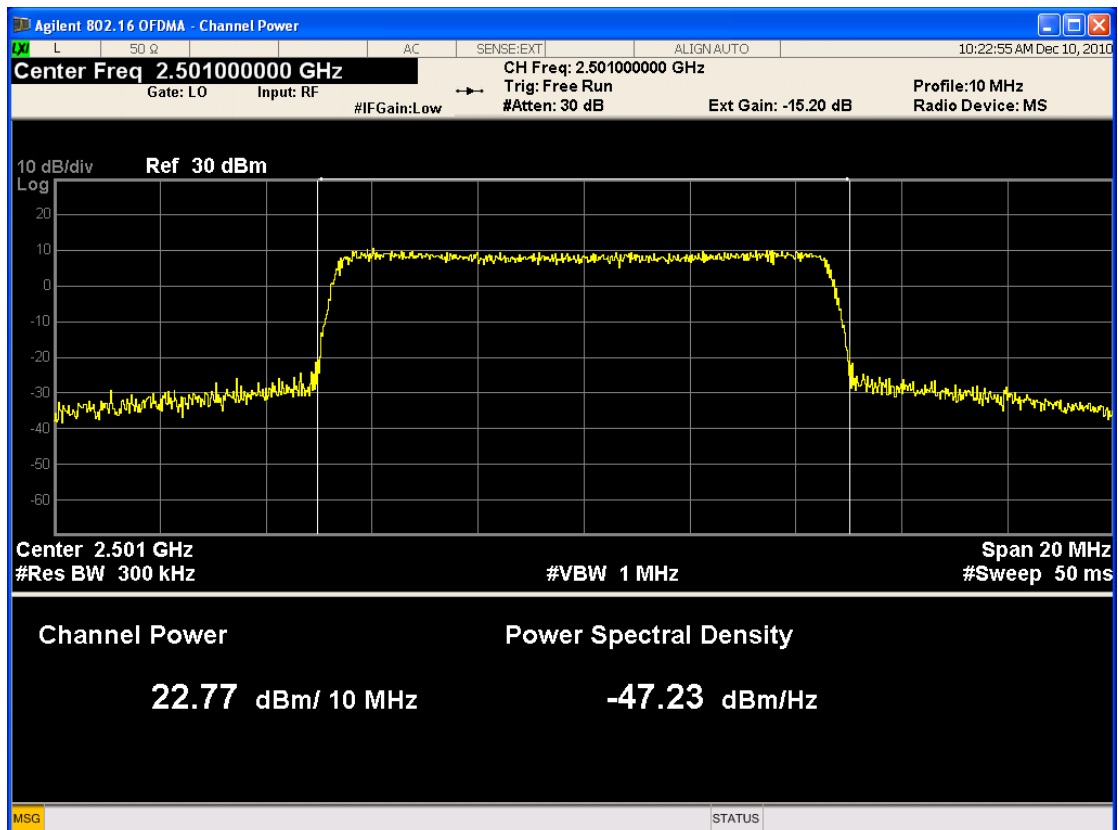


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■ 16QAM MODE 1/2 (2501.0 MHz) Conducted Output Power

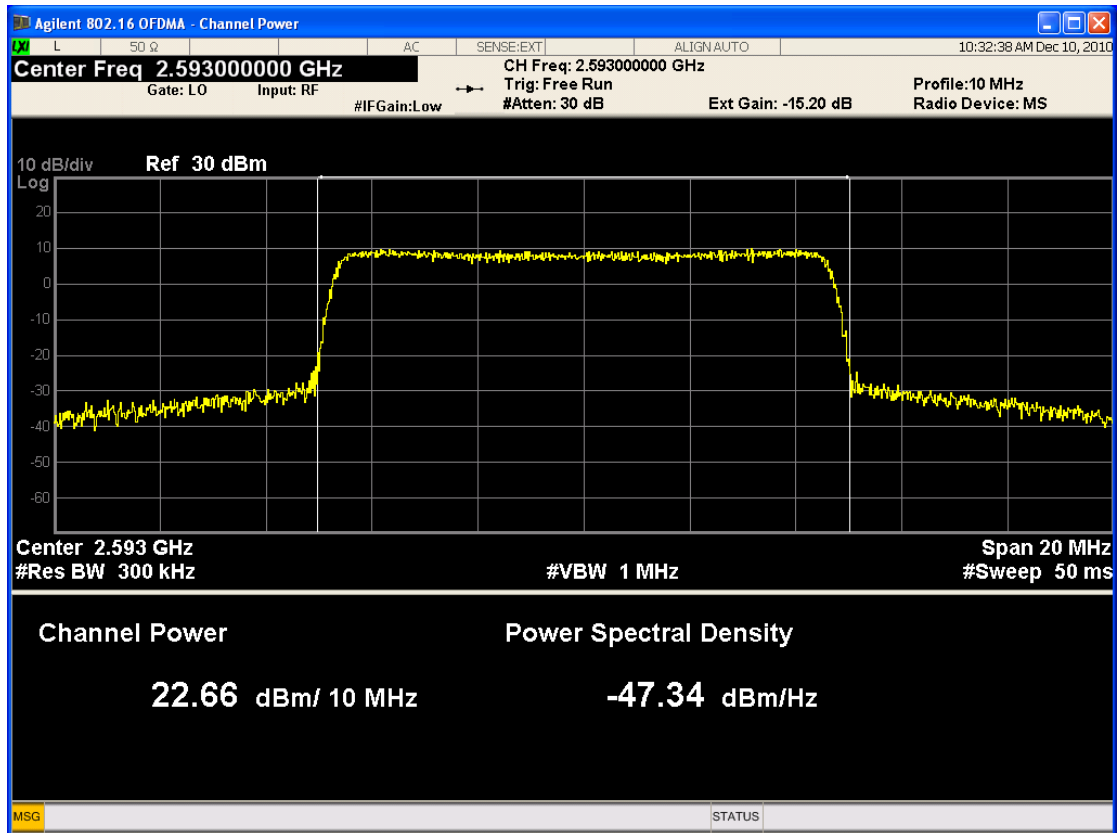


■ 16QAM MODE 3/4 (2501.0 MHz) Conducted Output Power

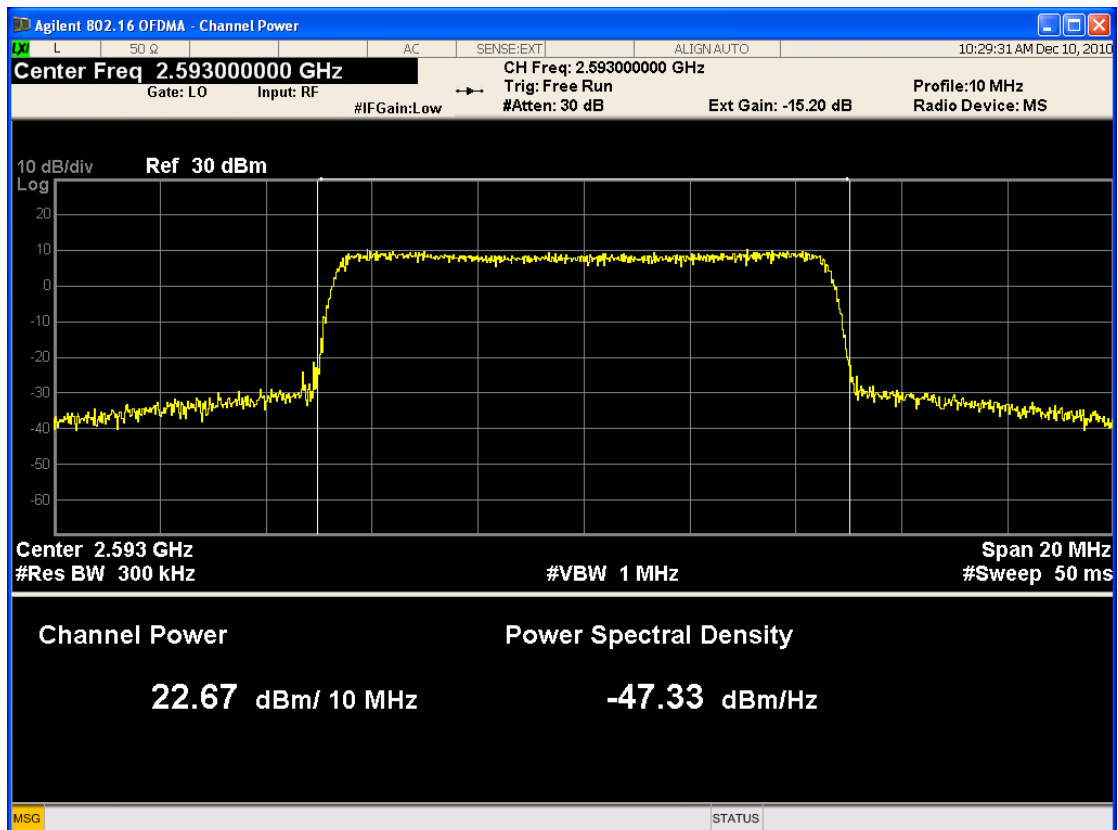


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■ QPSK MODE 1/2 (2593.0 MHz) Conducted Output Power

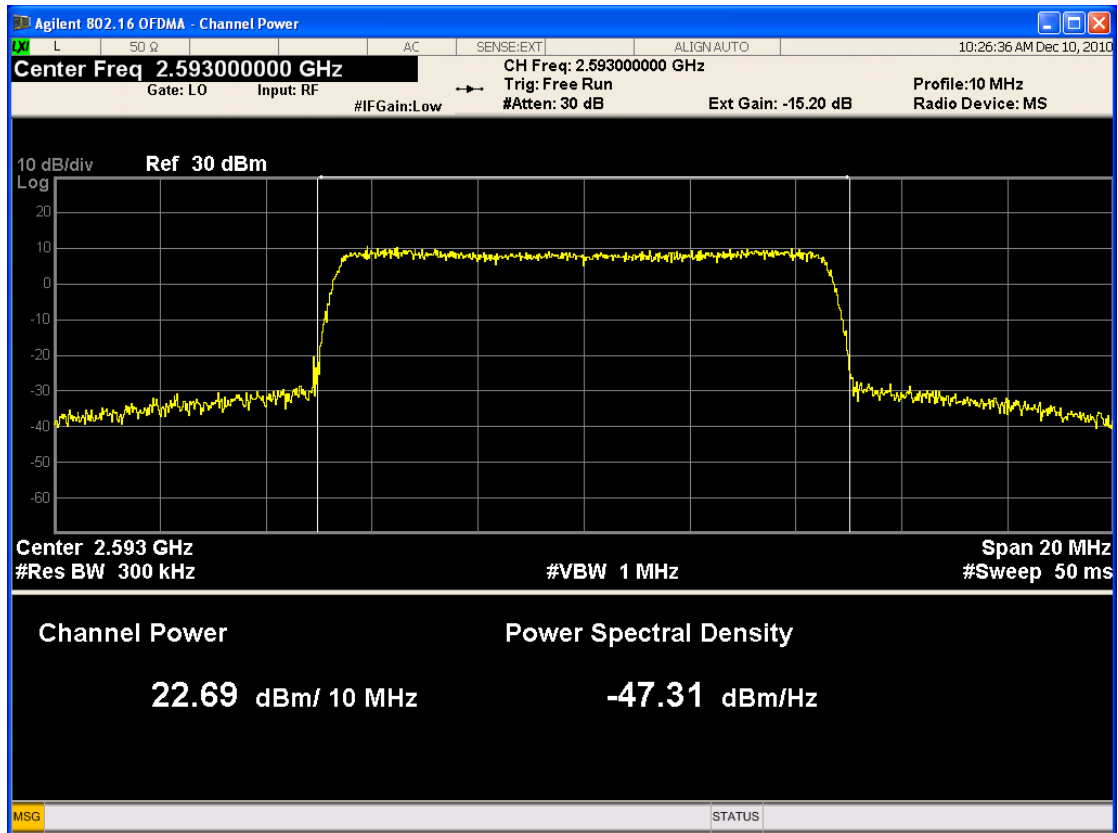


■ QPSK MODE 3/4 (2593.0 MHz) Conducted Output Power

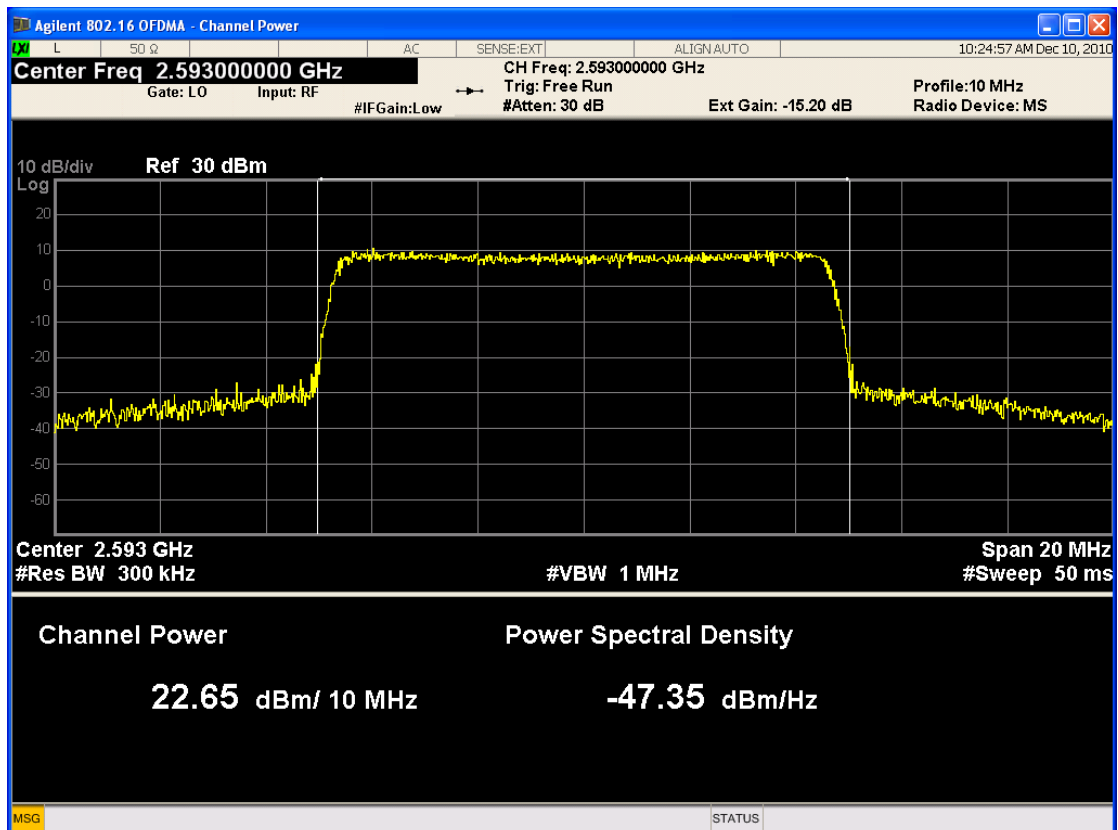


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■ 16QAM MODE 1/2 (2593.0 MHz) Conducted Output Power

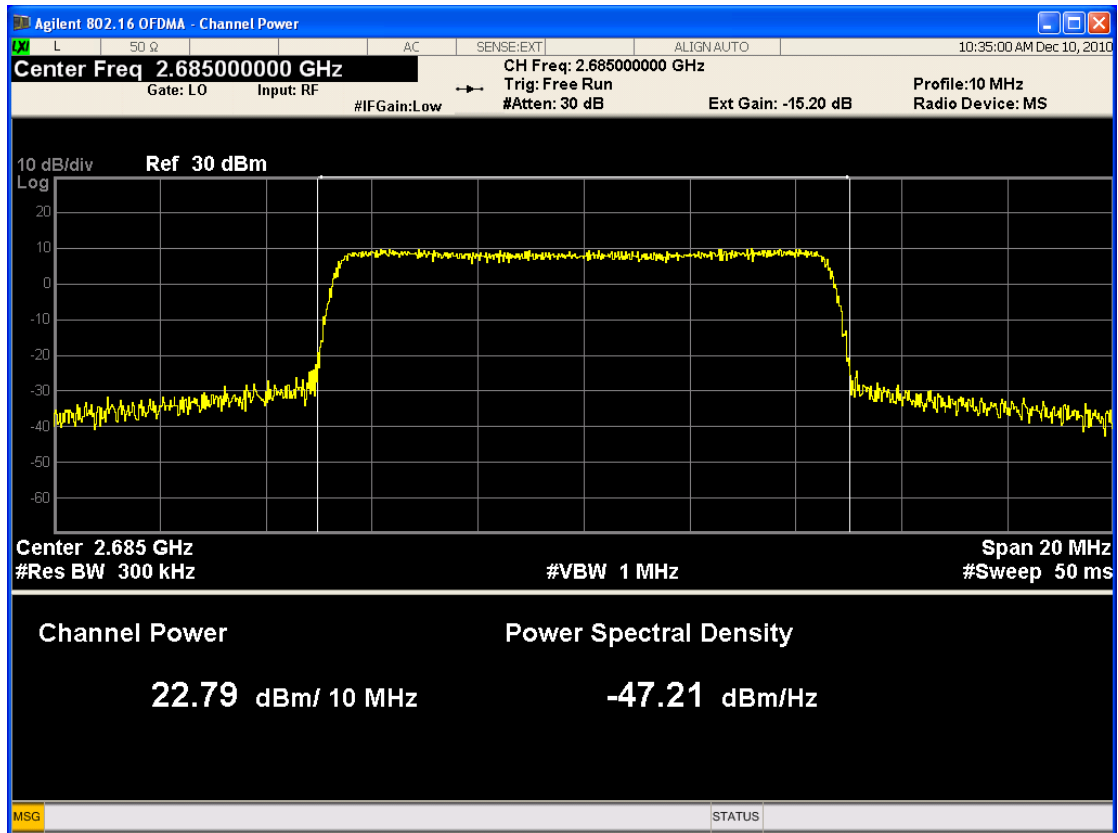


■ 16QAM MODE 3/4 (2593.0 MHz) Conducted Output Power

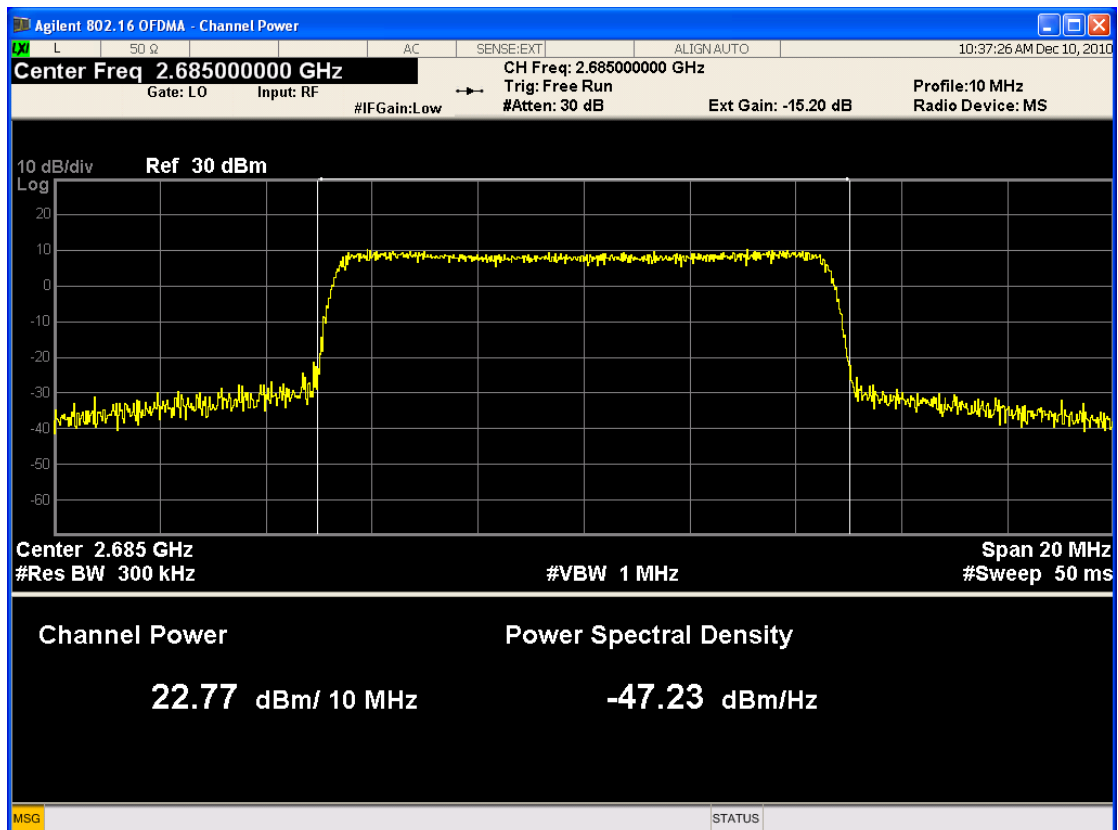


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■ QPSK MODE 1/2 (2685.0 MHz) Conducted Output Power

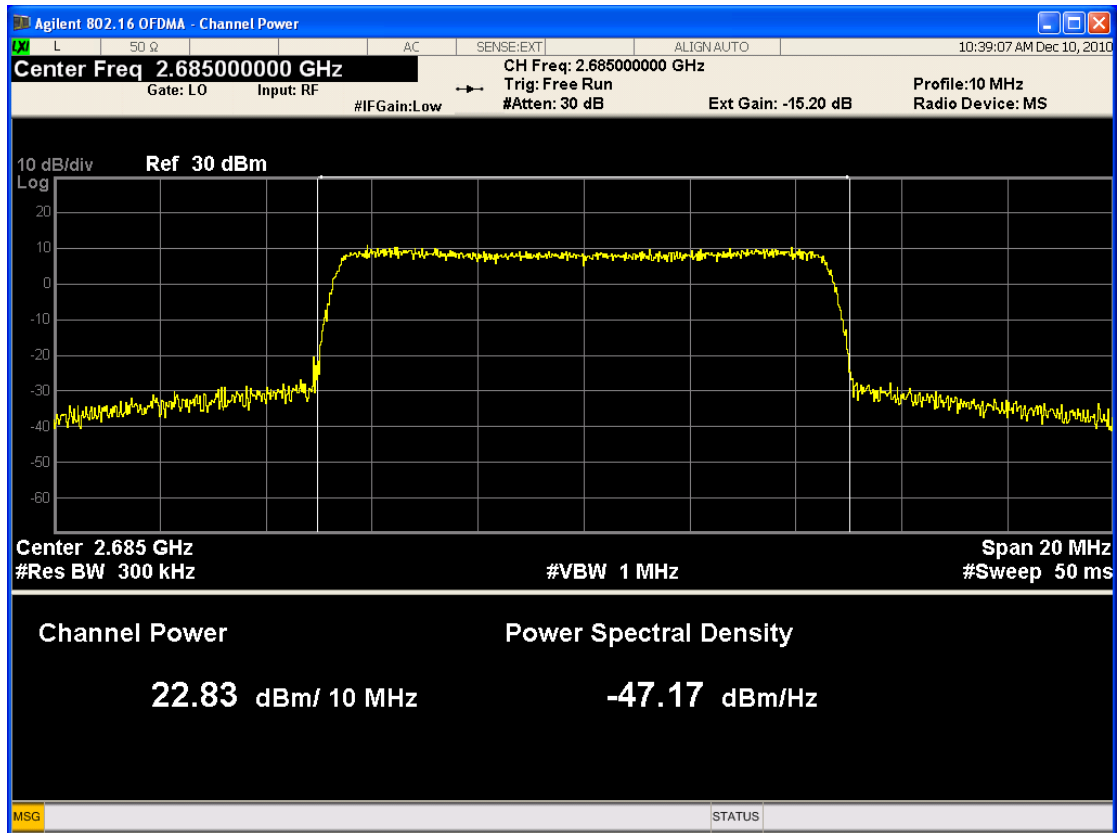


■ QPSK MODE 3/4 (2685.0 MHz) Conducted Output Power

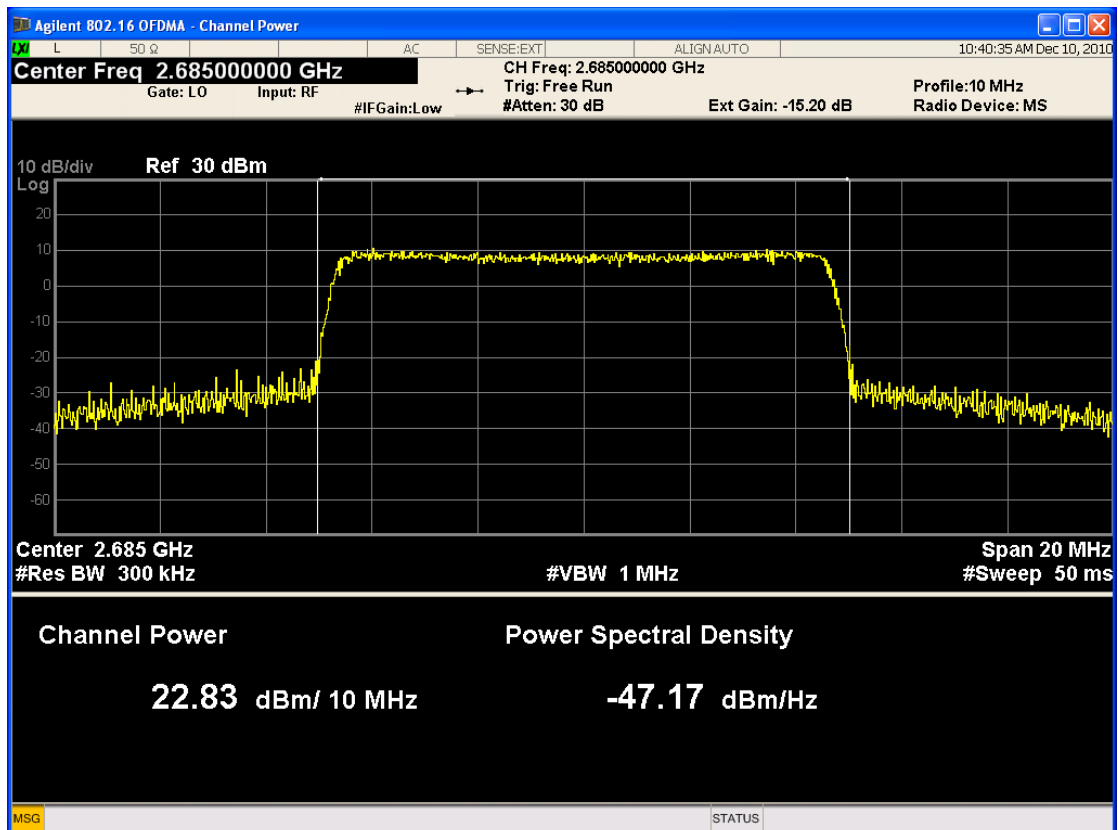


FCC CERTIFICATION REPORT			www.hct.co.kr
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■ 16QAM MODE 1/2 (2685.0 MHz) Conducted Output Power



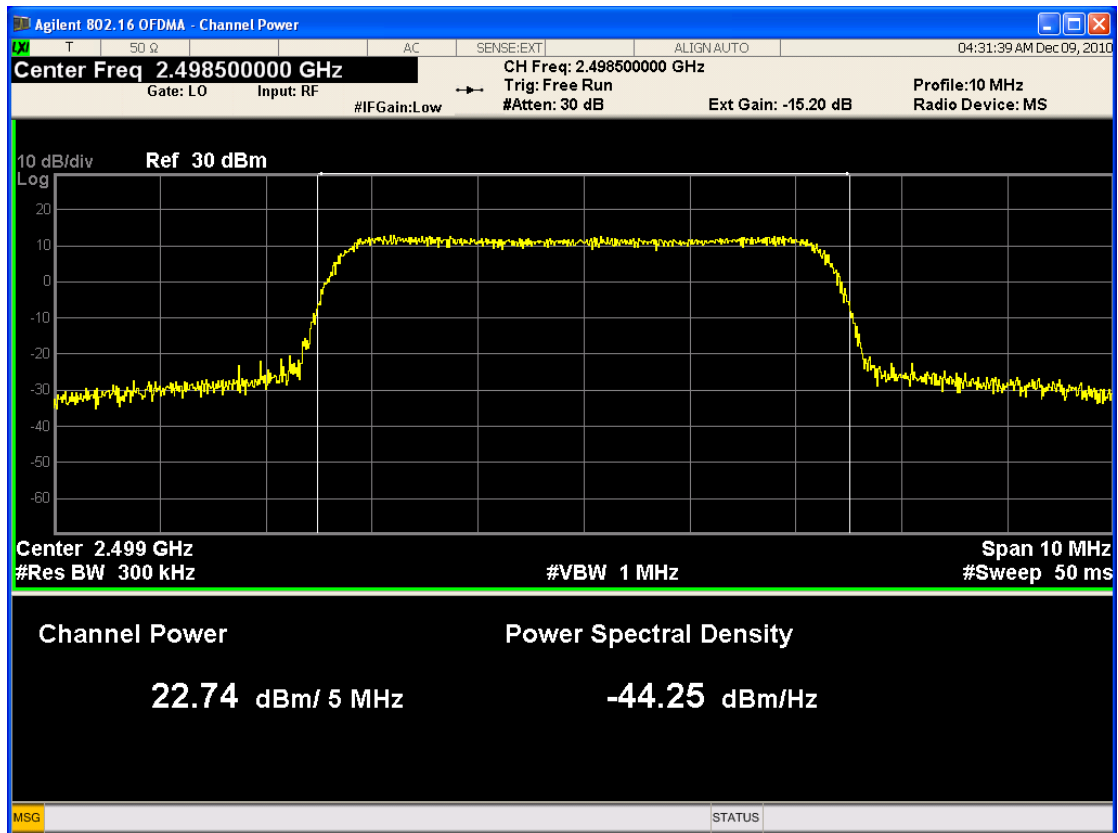
■ 16QAM MODE 3/4 (2685.0 MHz) Conducted Output Power



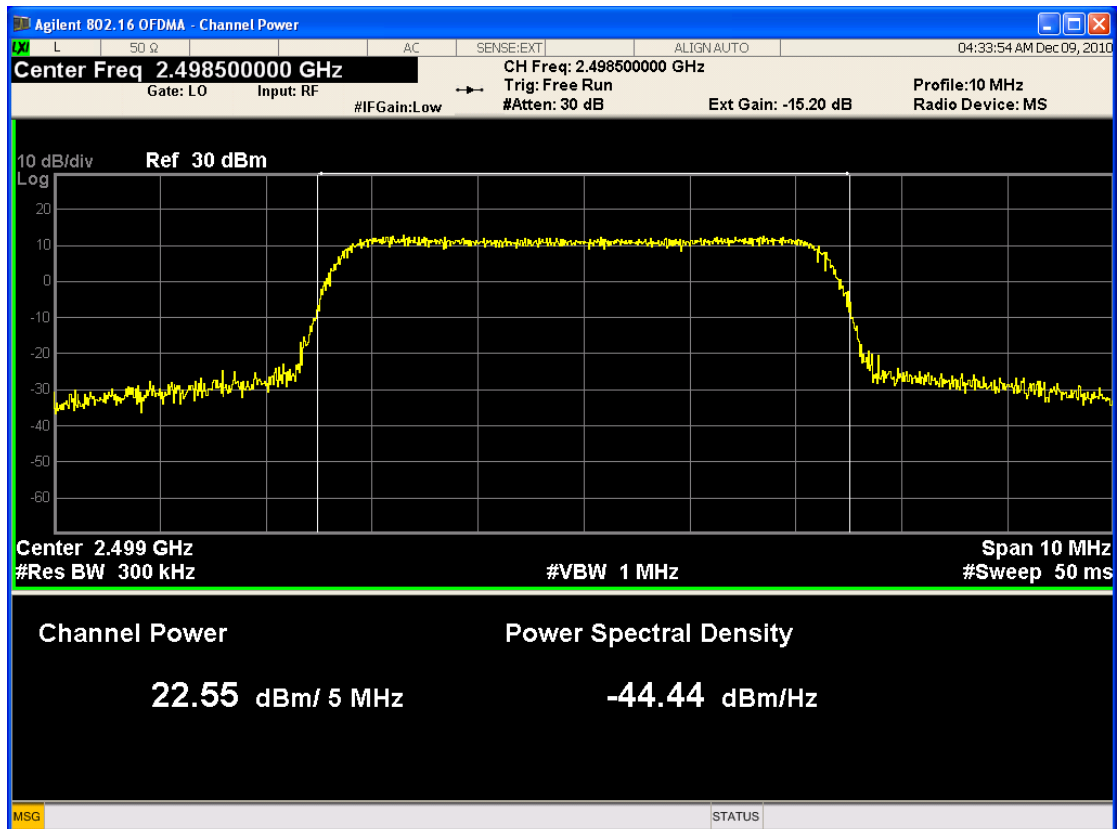
FCC CERTIFICATION REPORT			www.hct.co.kr
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TX-2 (5 MHz)

■ QPSK MODE 1/2 (2498.5 MHz) Conducted Output Power

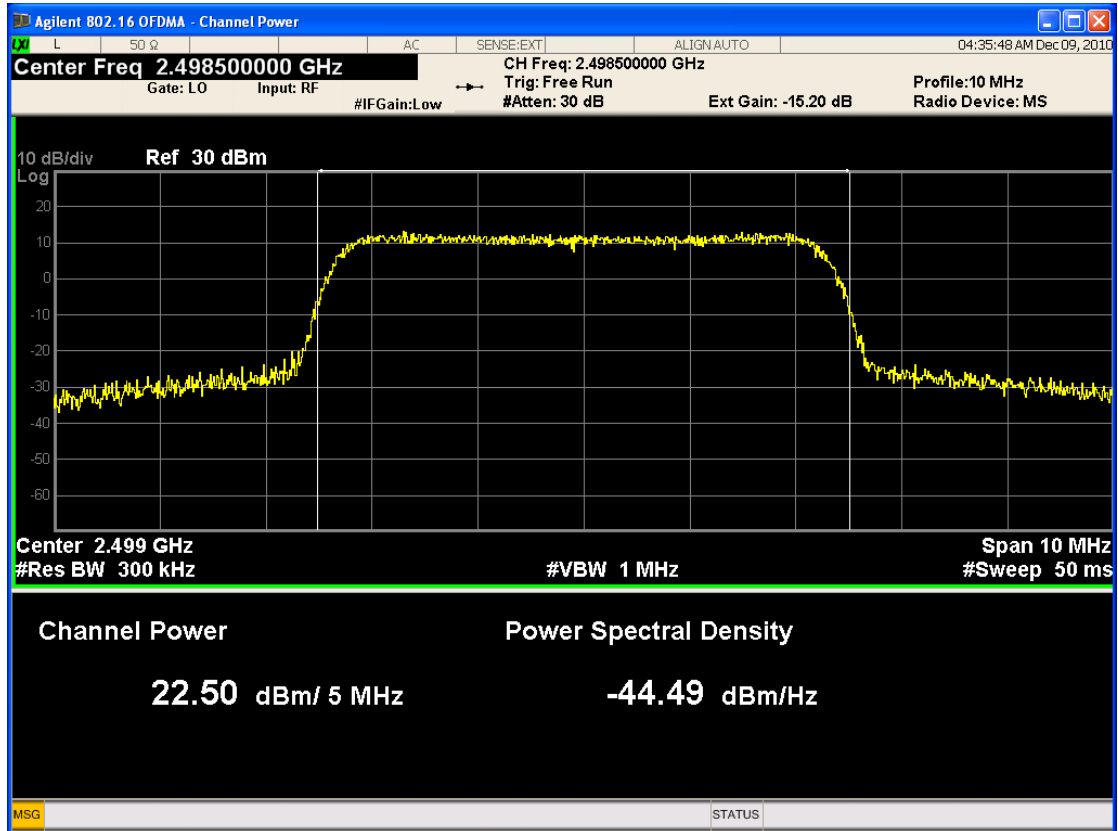


■ QPSK MODE 3/4 (2498.5 MHz) Conducted Output Power

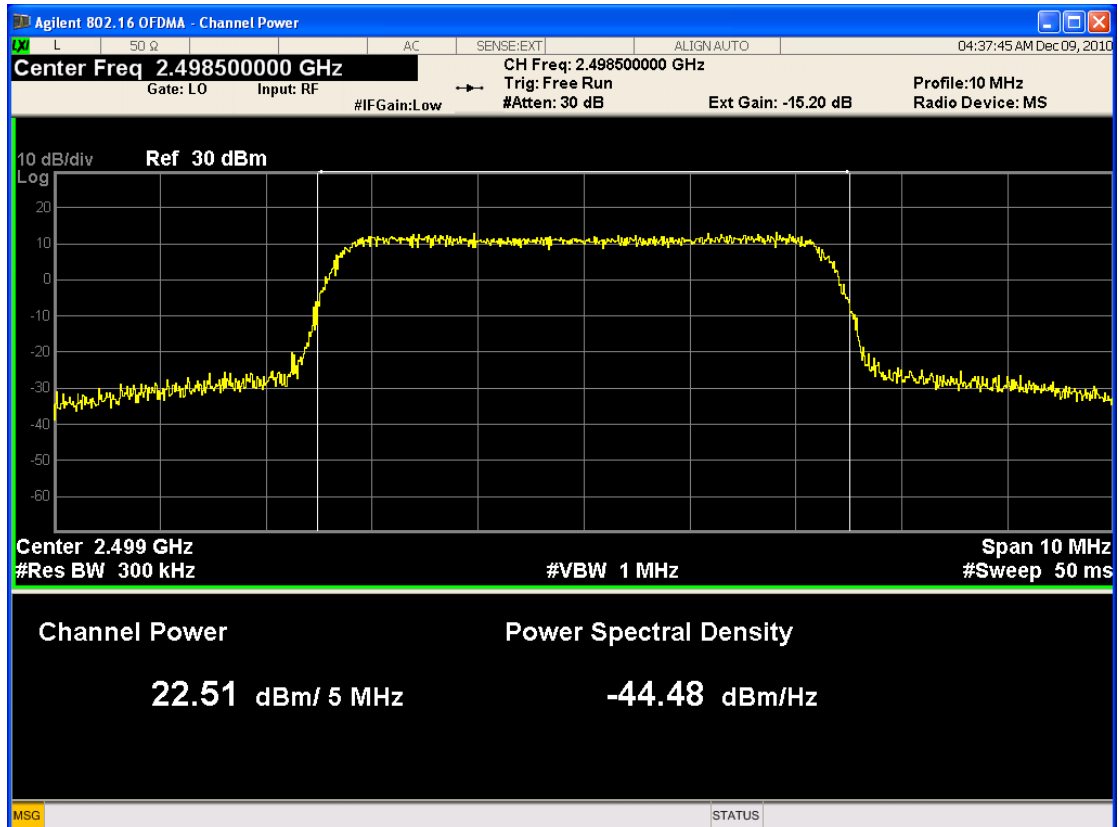


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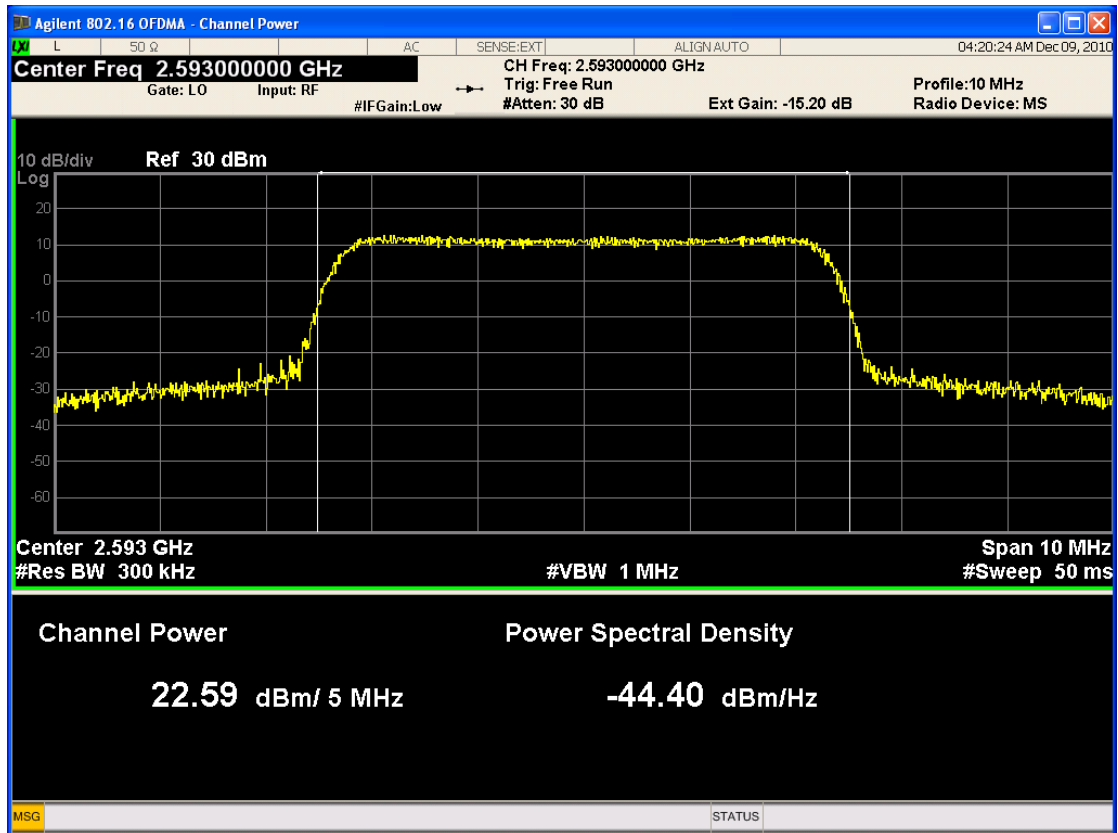
■ 16QAM MODE 1/2 (2498.5 MHz) Conducted Output Power



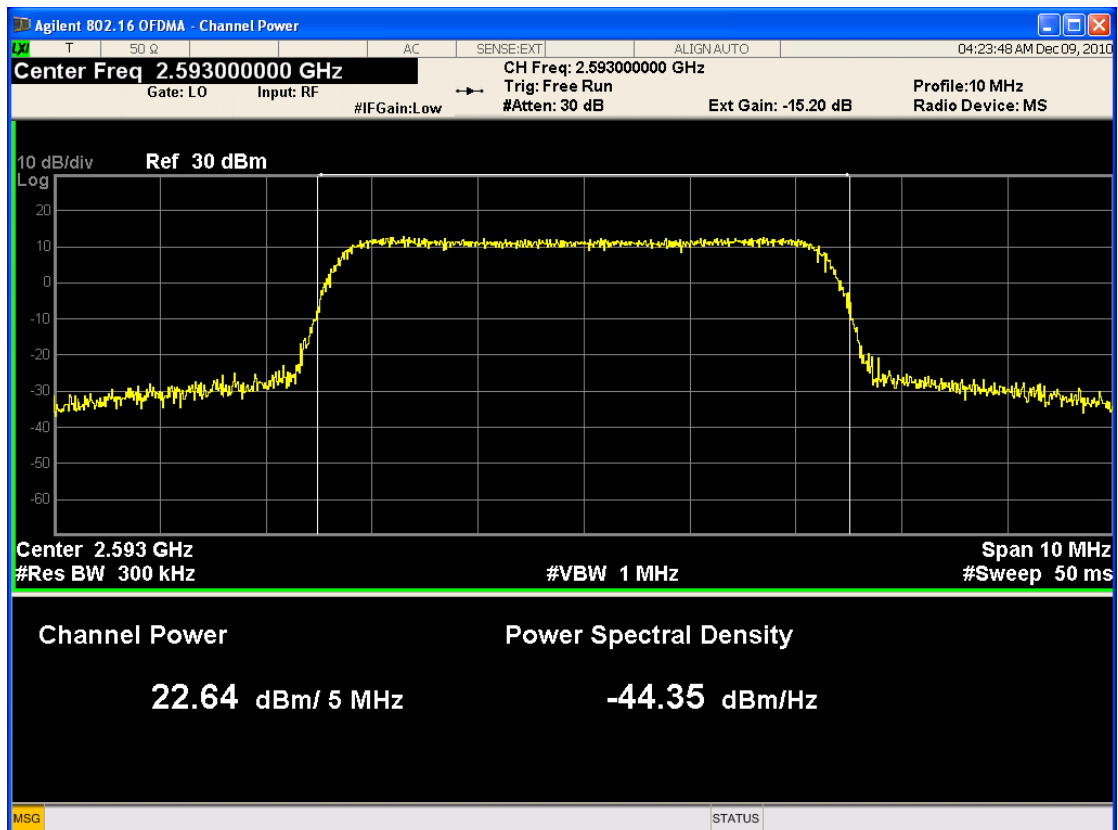
■ 16QAM MODE 3/4 (2498.5 MHz) Conducted Output Power



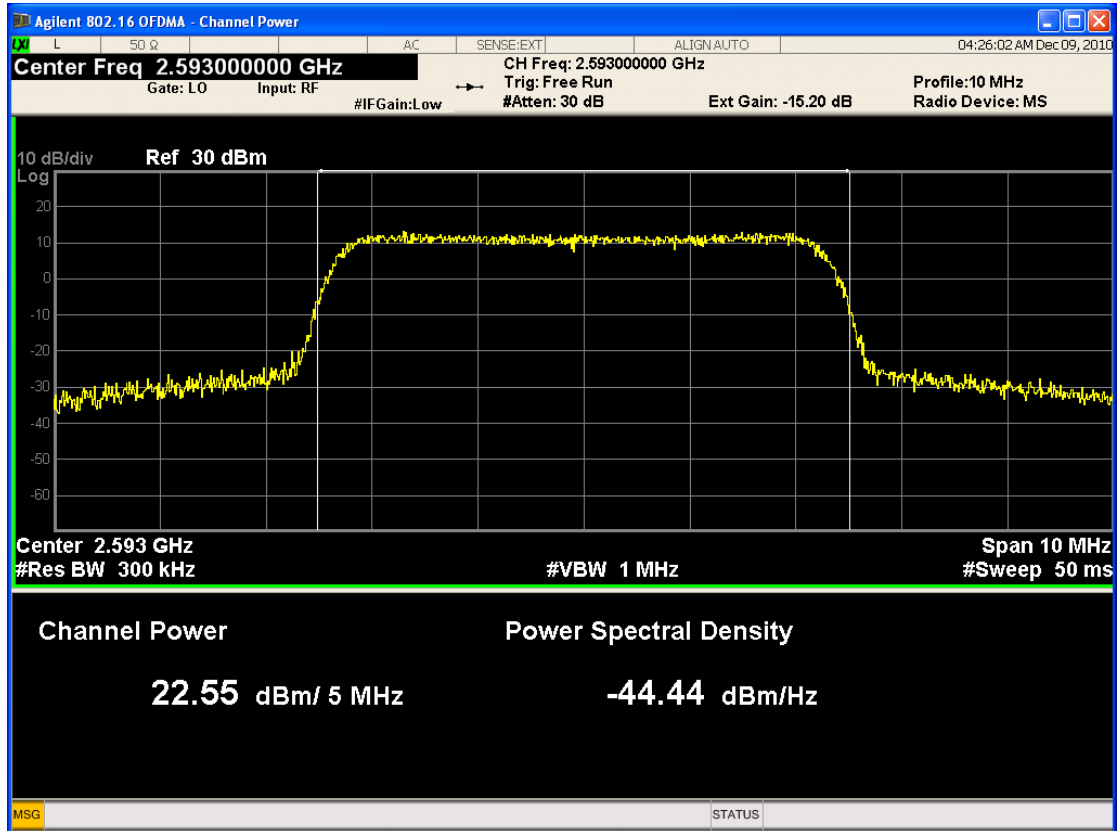
■ QPSK MODE 1/2 (2593.0 MHz) Conducted Output Power



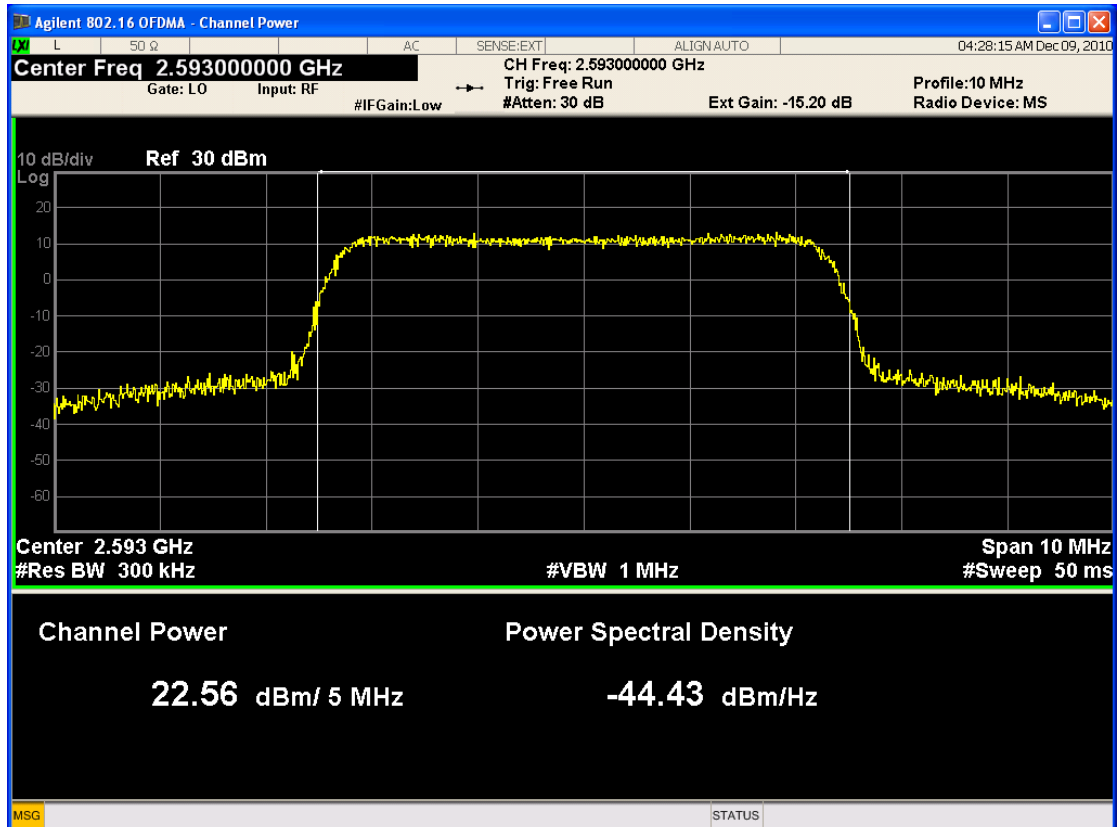
■ QPSK MODE 3/4 (2593.0 MHz) Conducted Output Power



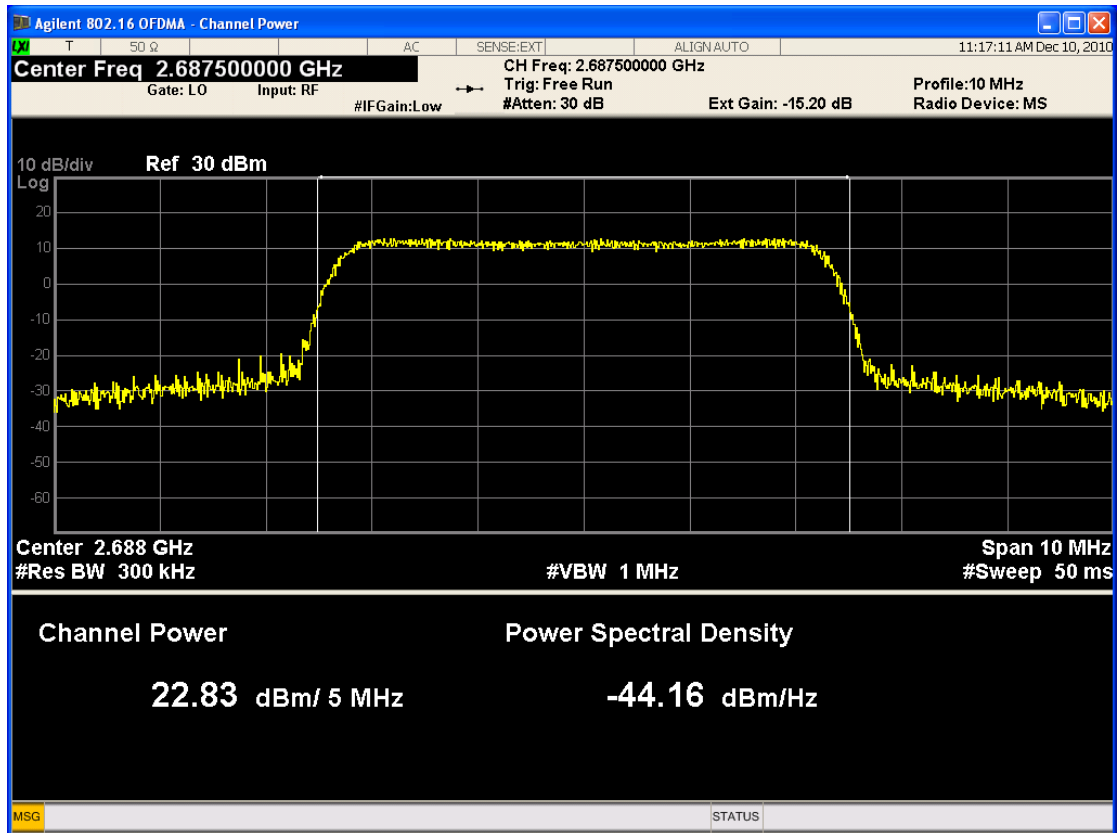
■ 16QAM MODE 1/2 (2593.0 MHz) Conducted Output Power



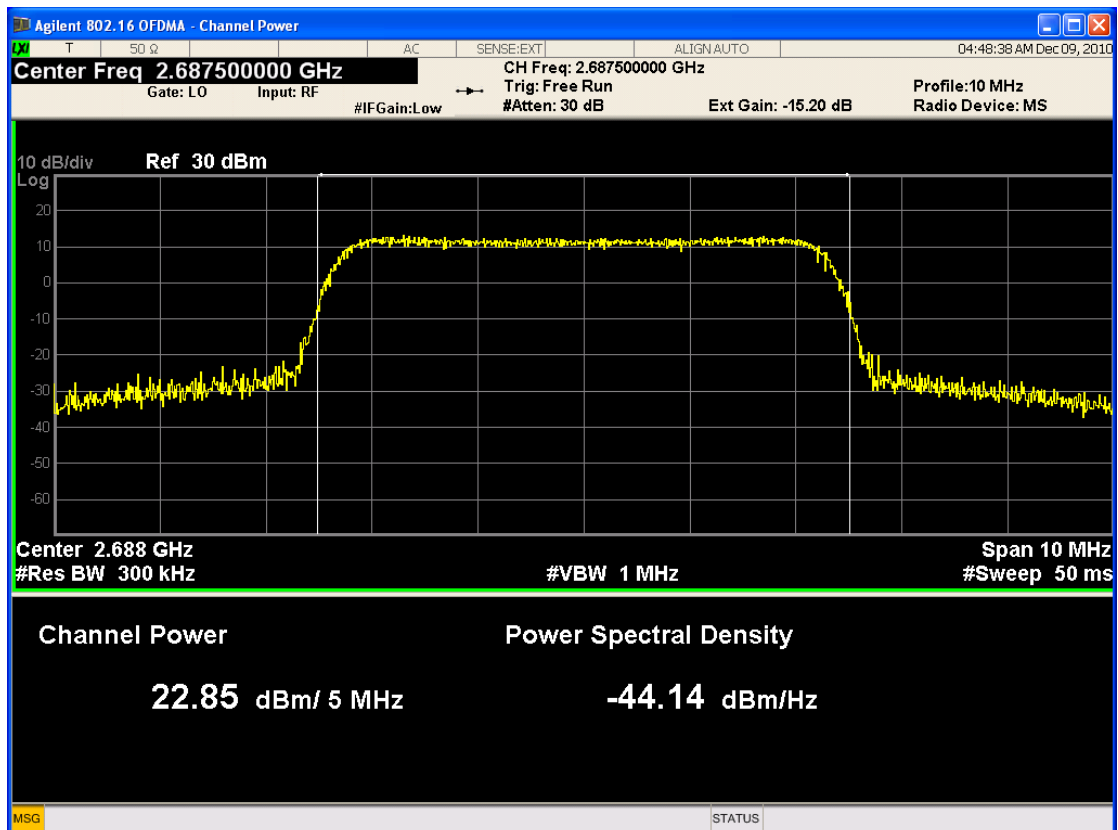
■ 16QAM MODE 3/4 (2593.0 MHz) Conducted Output Power



■ QPSK MODE 1/2 (2687.5 MHz) Conducted Output Power

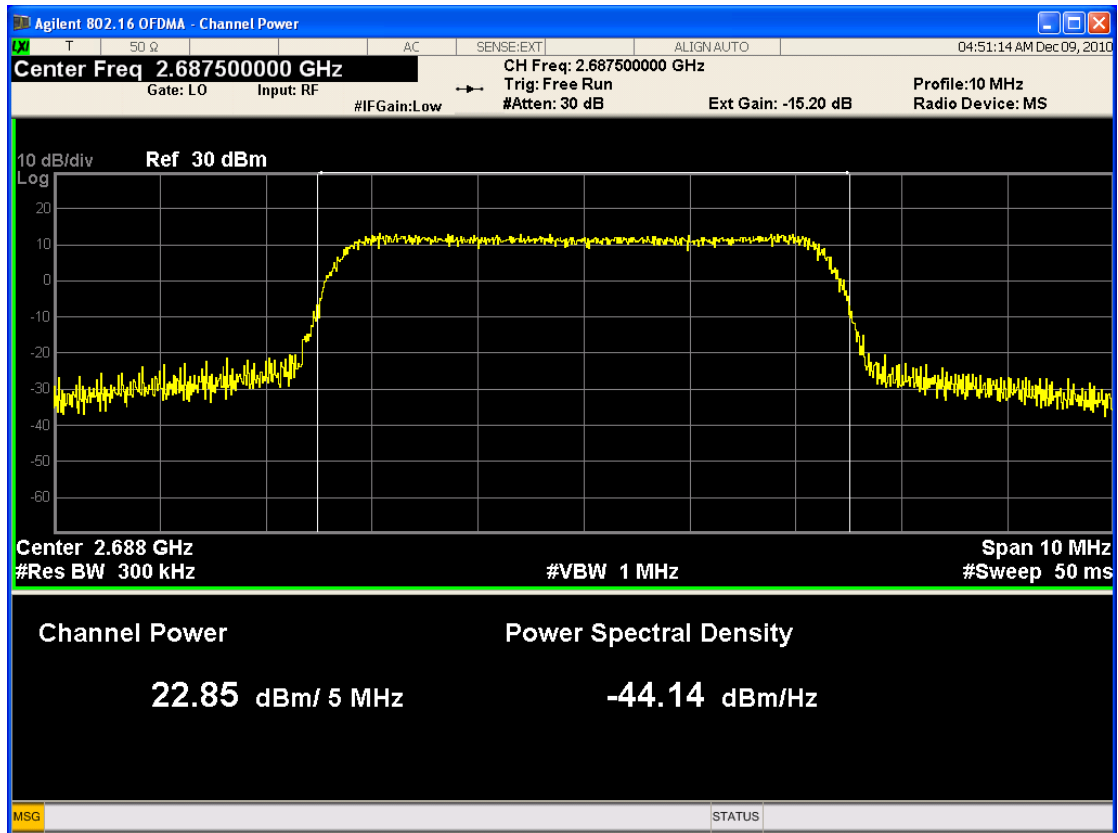


■ QPSK MODE 3/4 (2687.5 MHz) Conducted Output Power

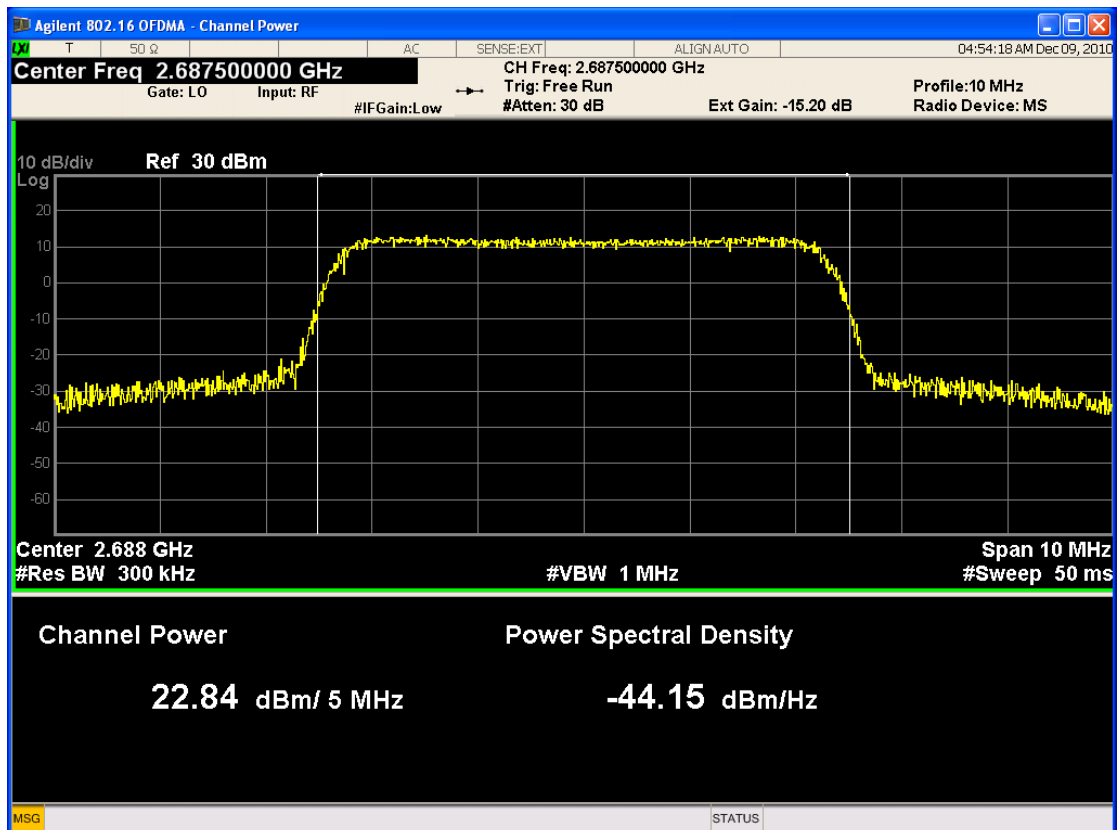


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■ 16QAM MODE 1/2 (2687.5 MHz) Conducted Output Power

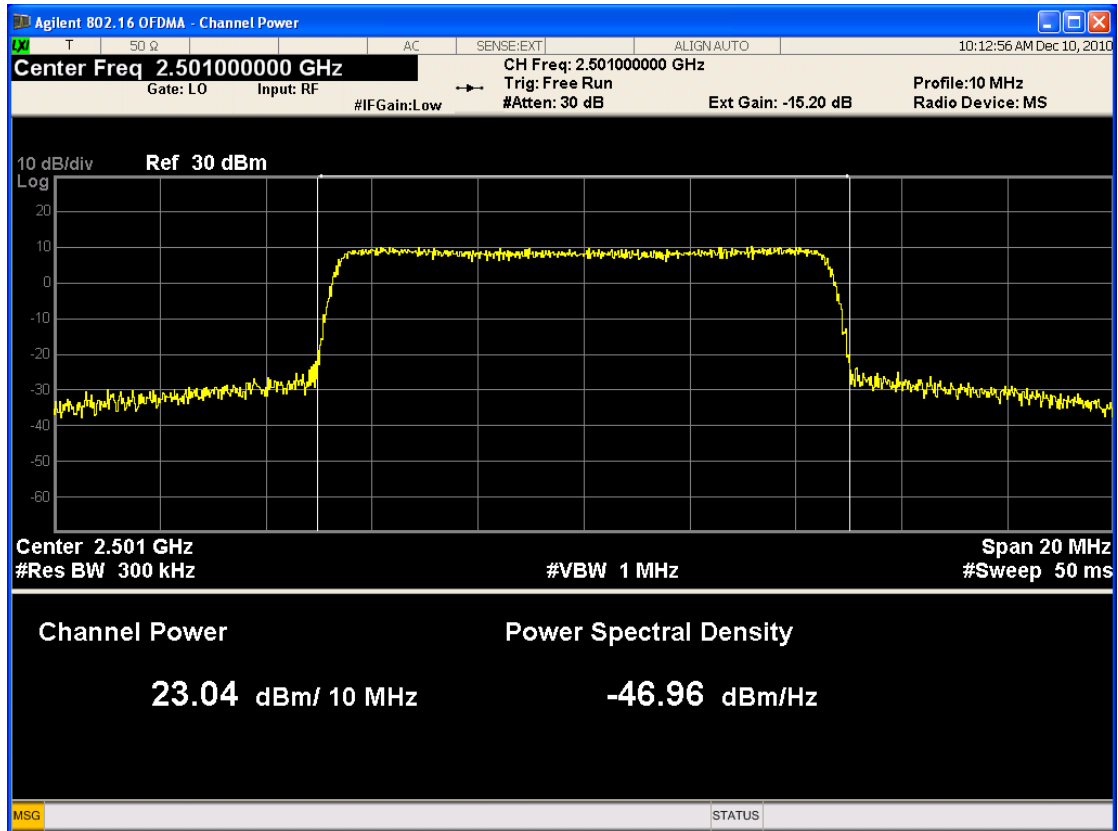


■ 16QAM MODE 3/4 (2687.5 MHz) Conducted Output Power

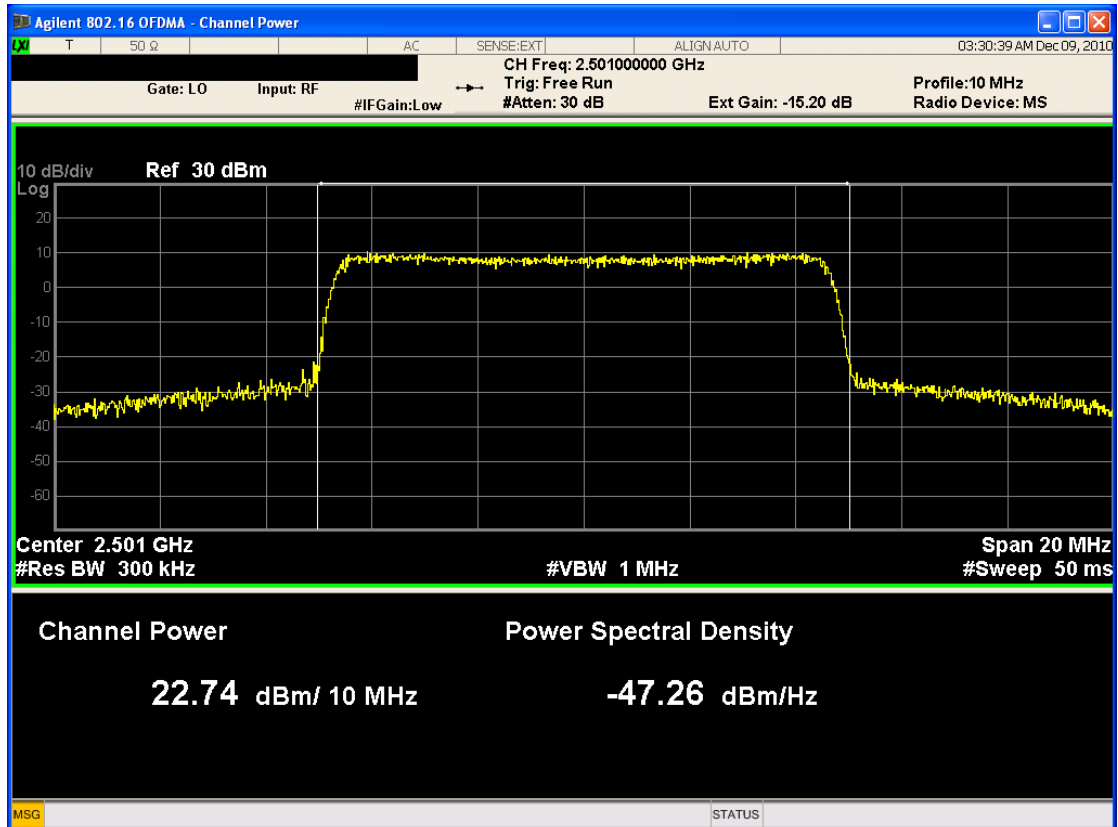


TX-2 (10 MHz)

■ QPSK MODE 1/2 (2501.0 MHz) Conducted Output Power

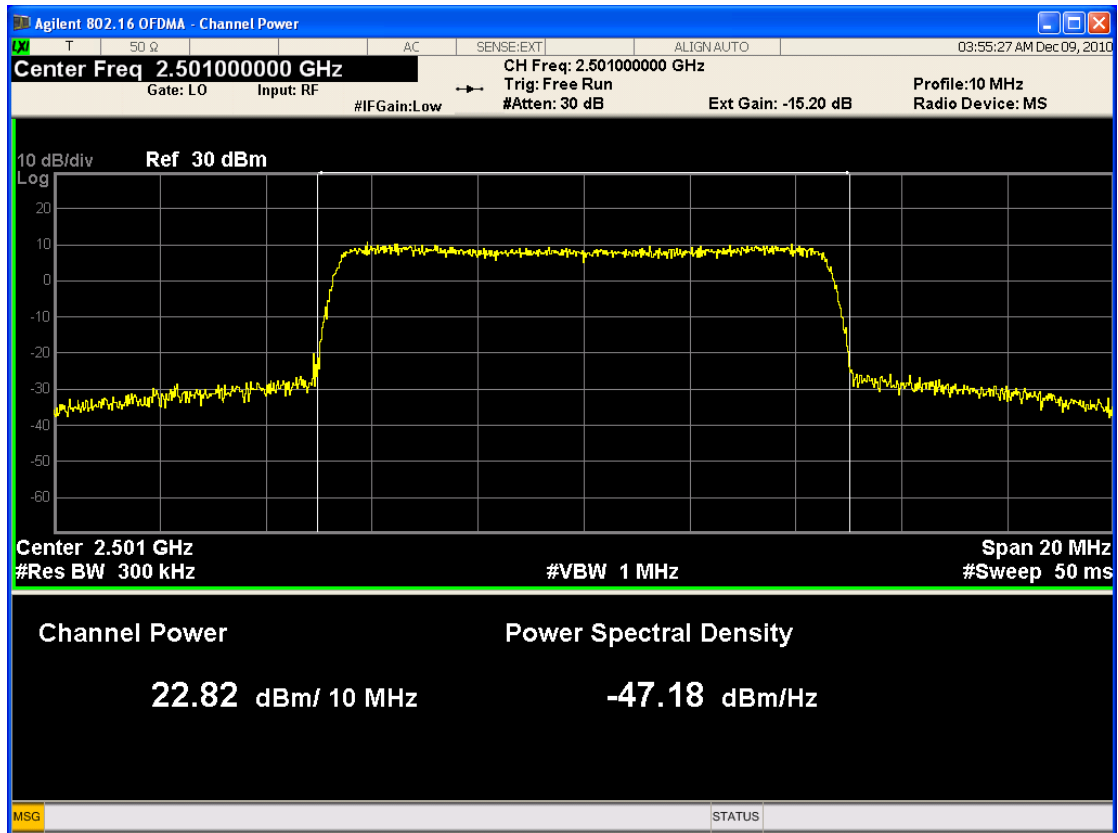


■ QPSK MODE 3/4 (2501.0 MHz) Conducted Output Power

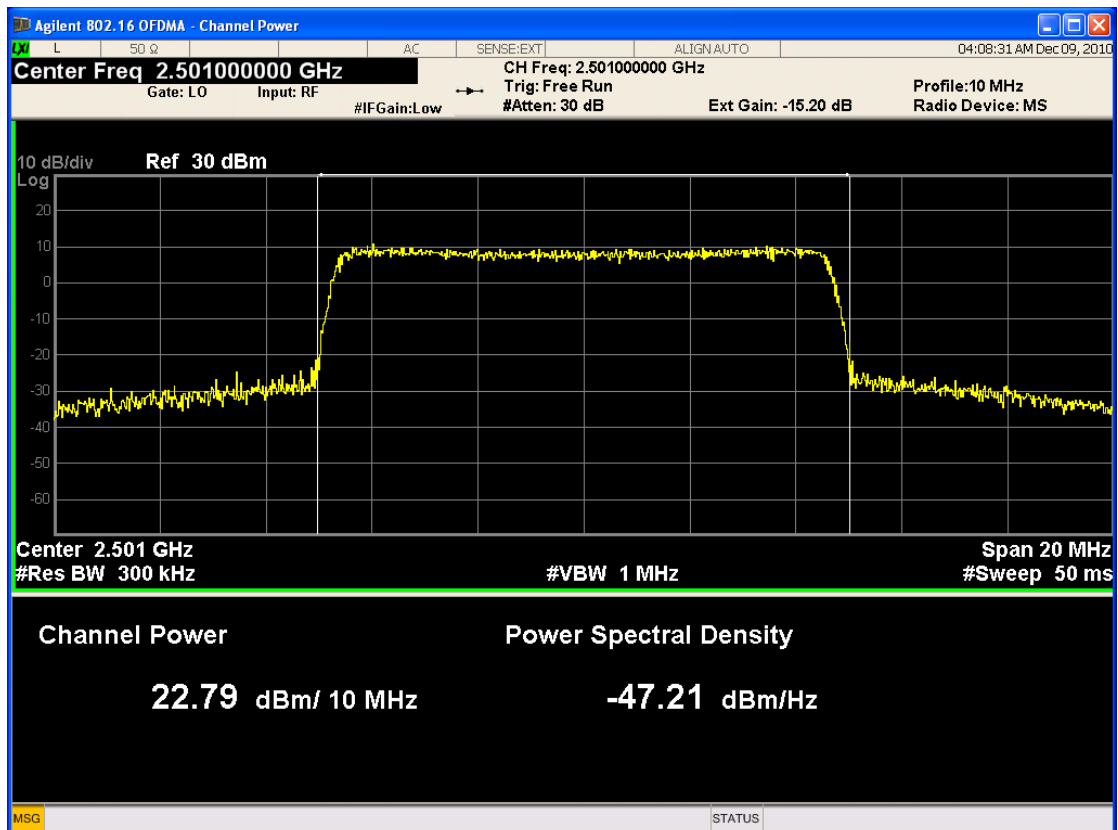


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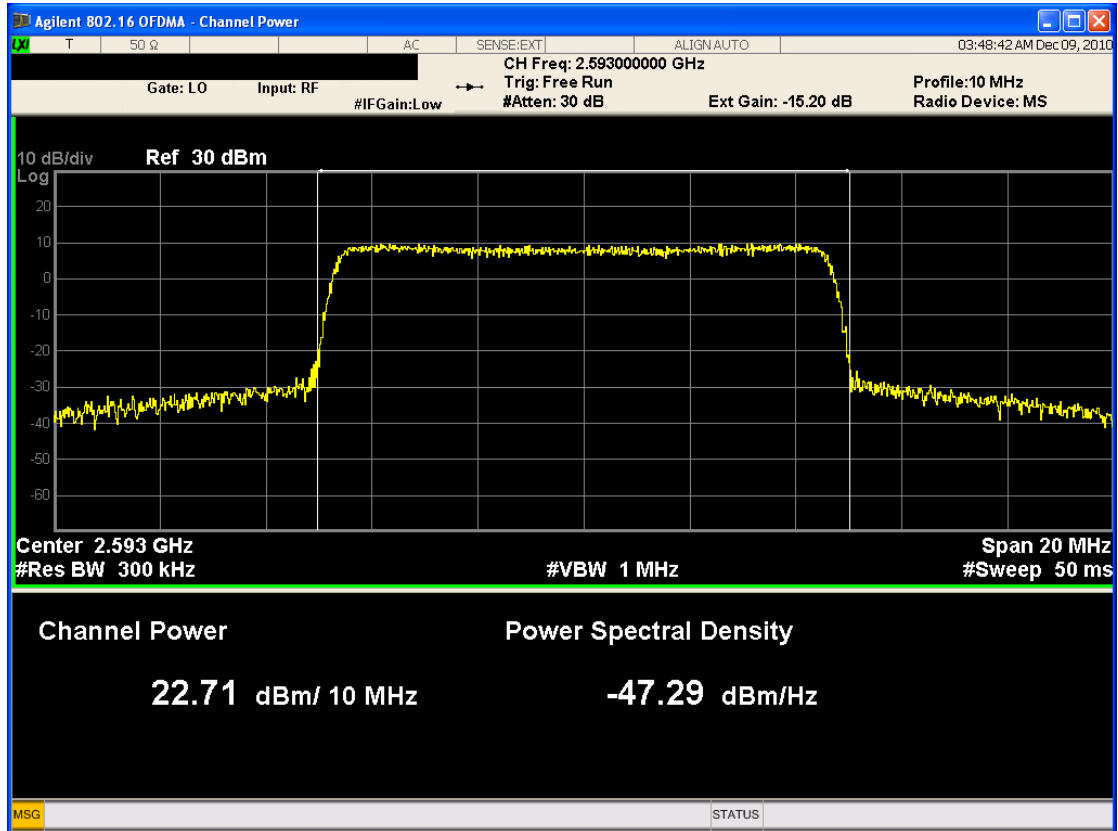
■ 16QAM MODE 1/2 (2501.0 MHz) Conducted Output Power



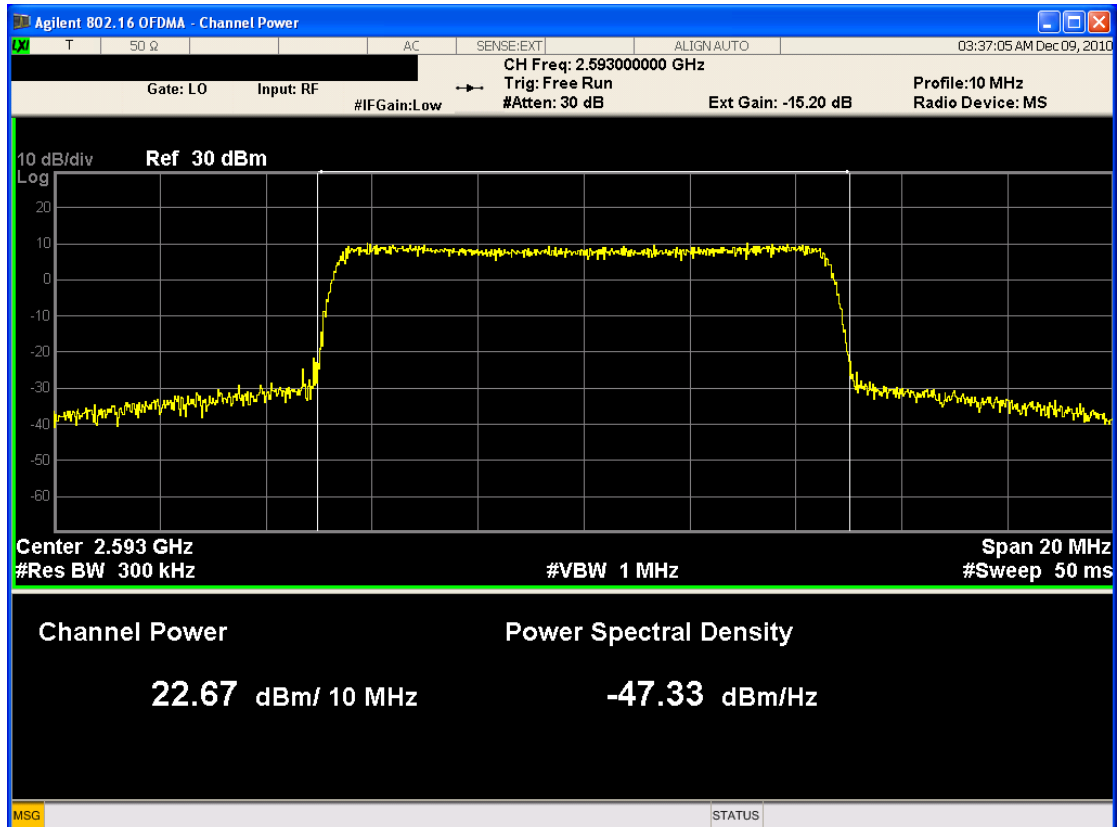
■ 16QAM MODE 3/4 (2501.0 MHz) Conducted Output Power



■ QPSK MODE 1/2 (2593.0 MHz) Conducted Output Power

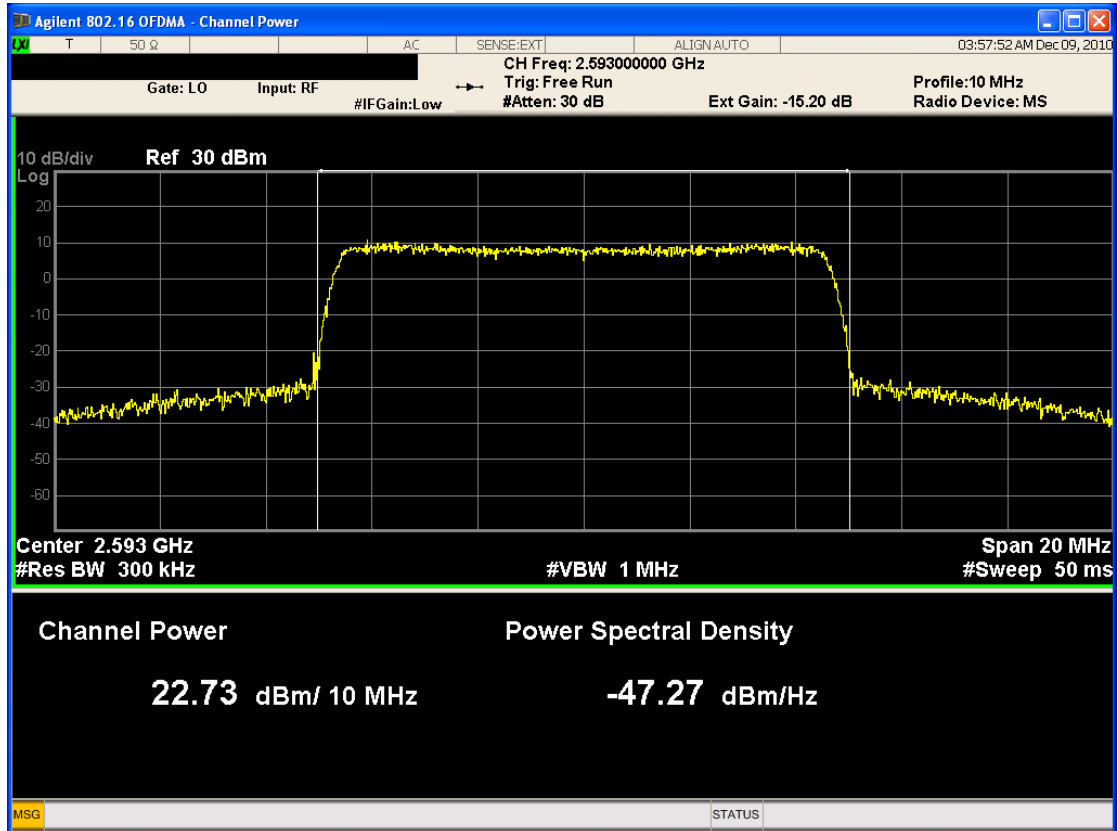


■ QPSK MODE 3/4 (2593.0 MHz) Conducted Output Power

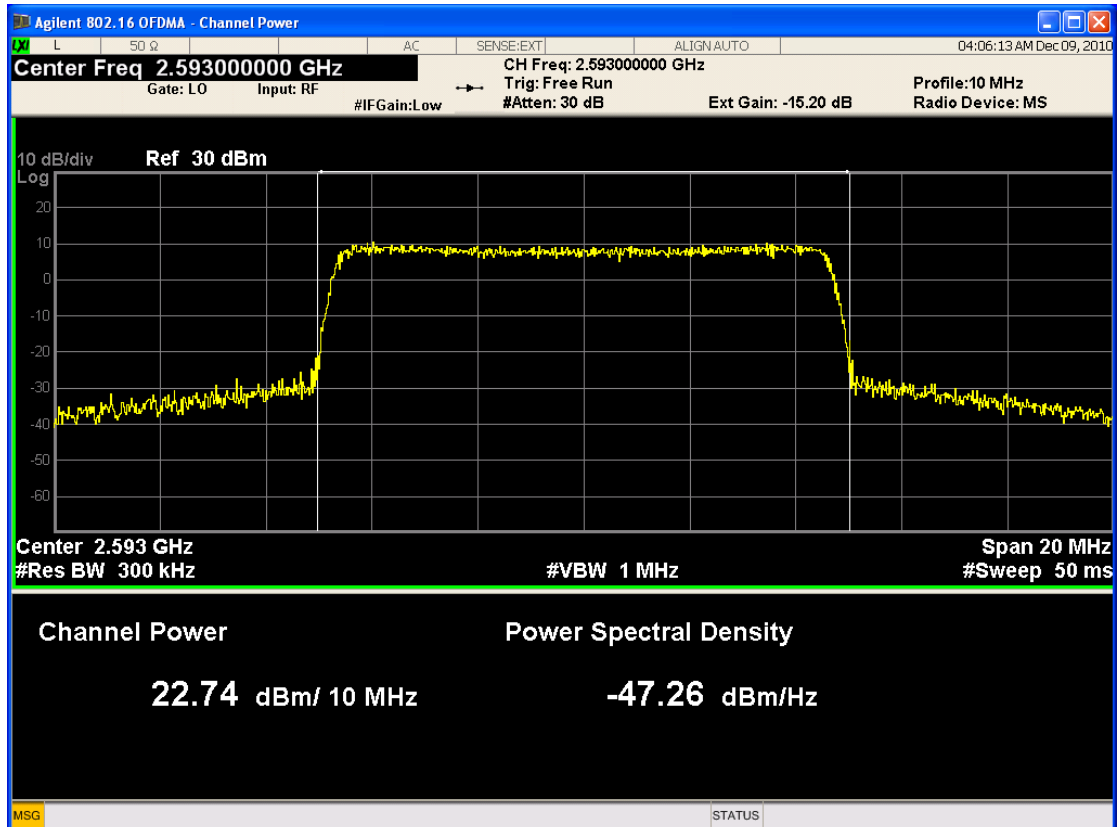


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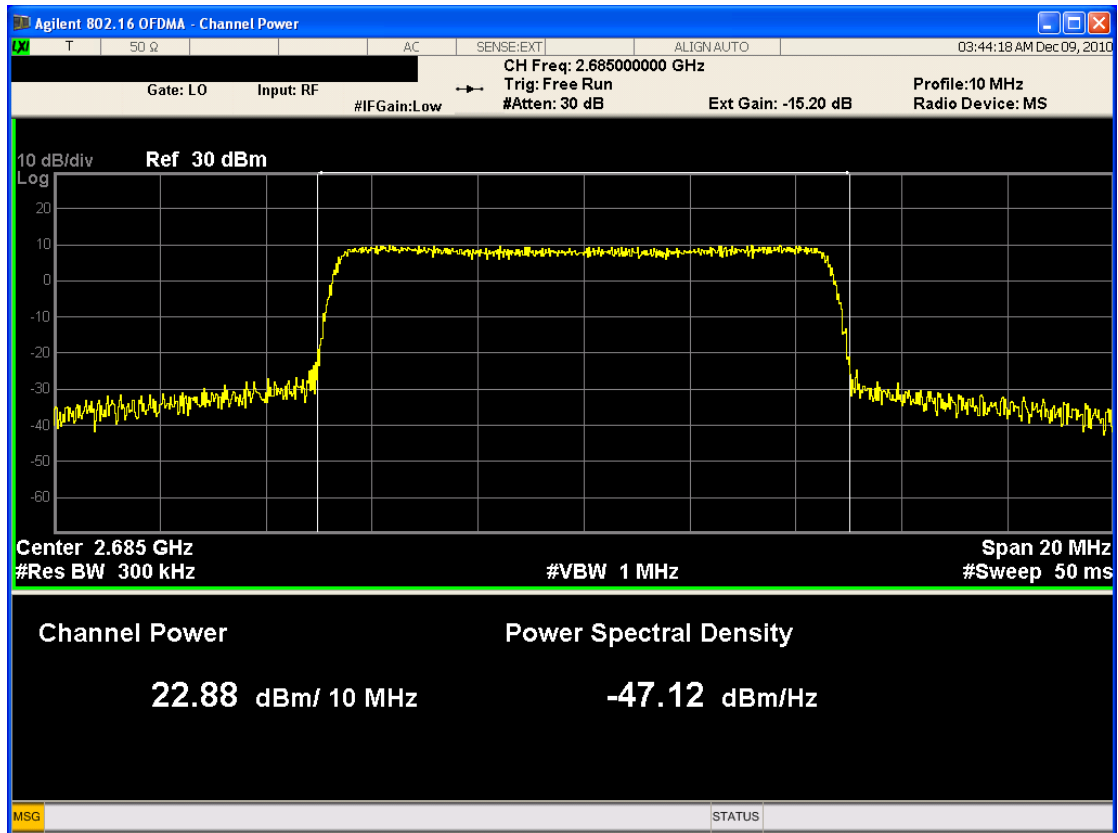
■ 16QAM MODE 1/2 (2593.0 MHz) Conducted Output Power



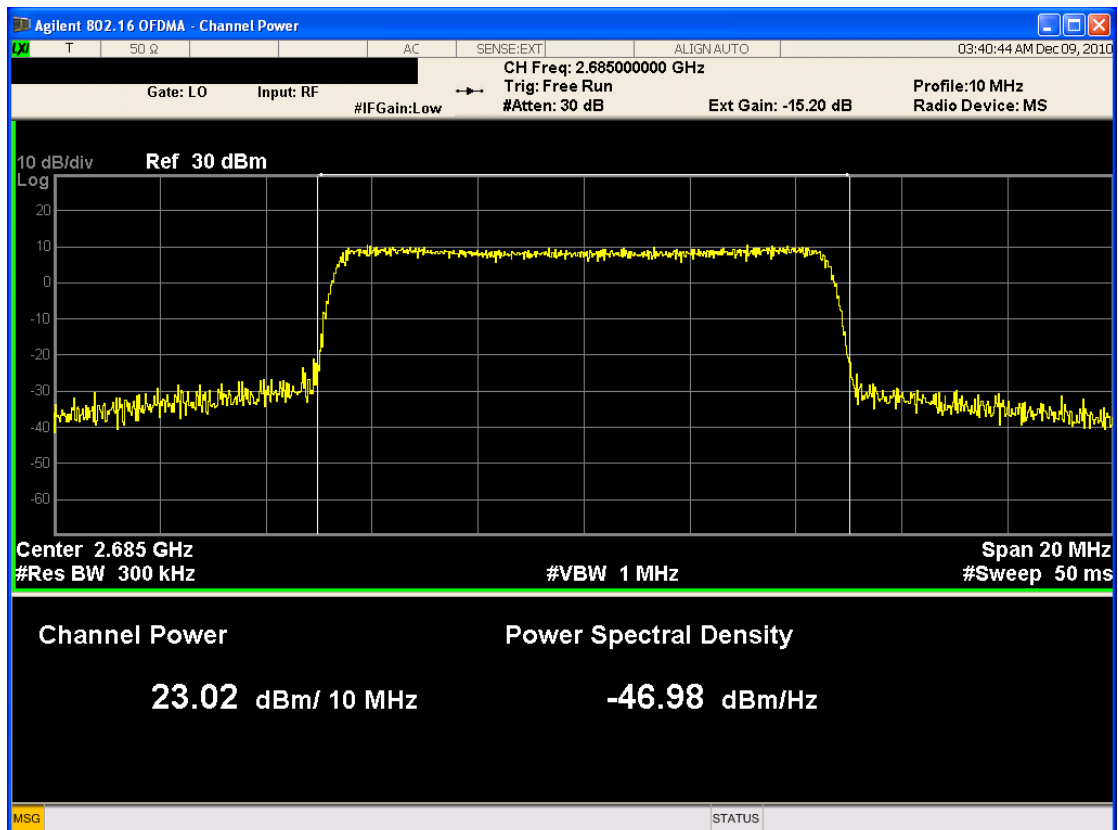
■ 16QAM MODE 3/4 (2593.0 MHz) Conducted Output Power



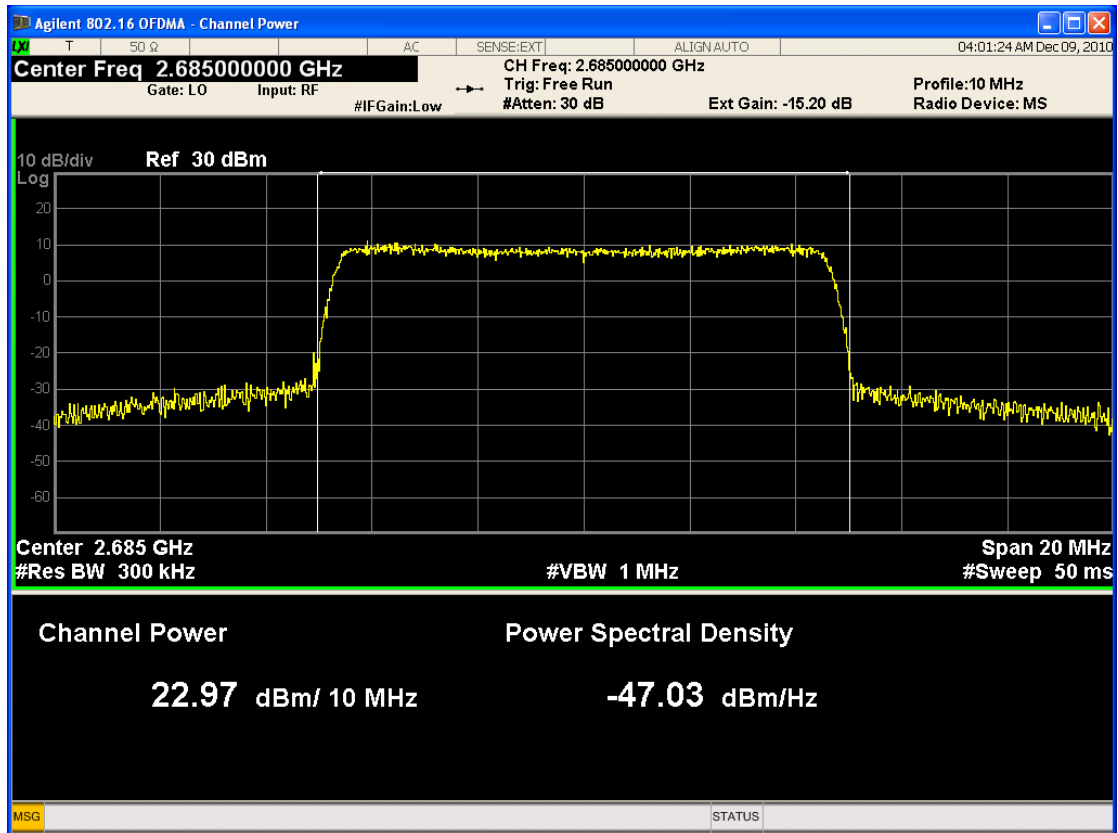
■ QPSK MODE 1/2 (2685.0 MHz) Conducted Output Power



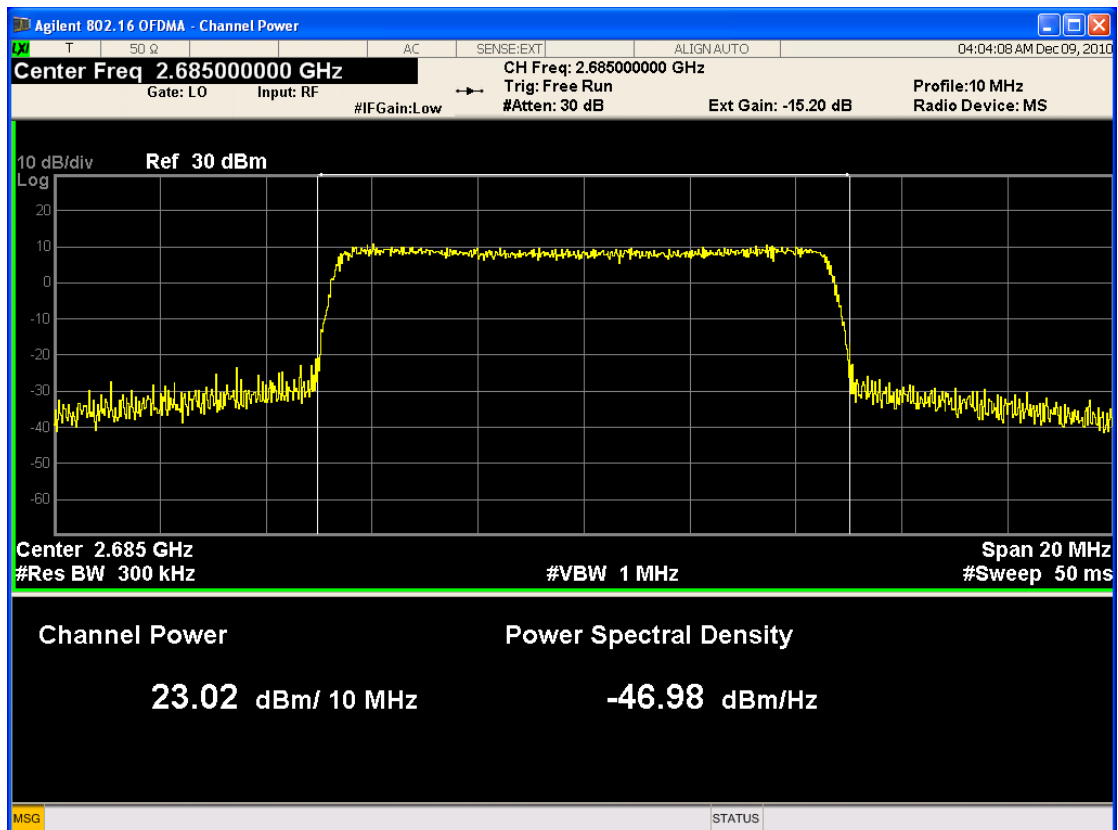
■ QPSK MODE 3/4 (2685.0 MHz) Conducted Output Power



■ 16QAM MODE 1/2 (2685.0 MHz) Conducted Output Power

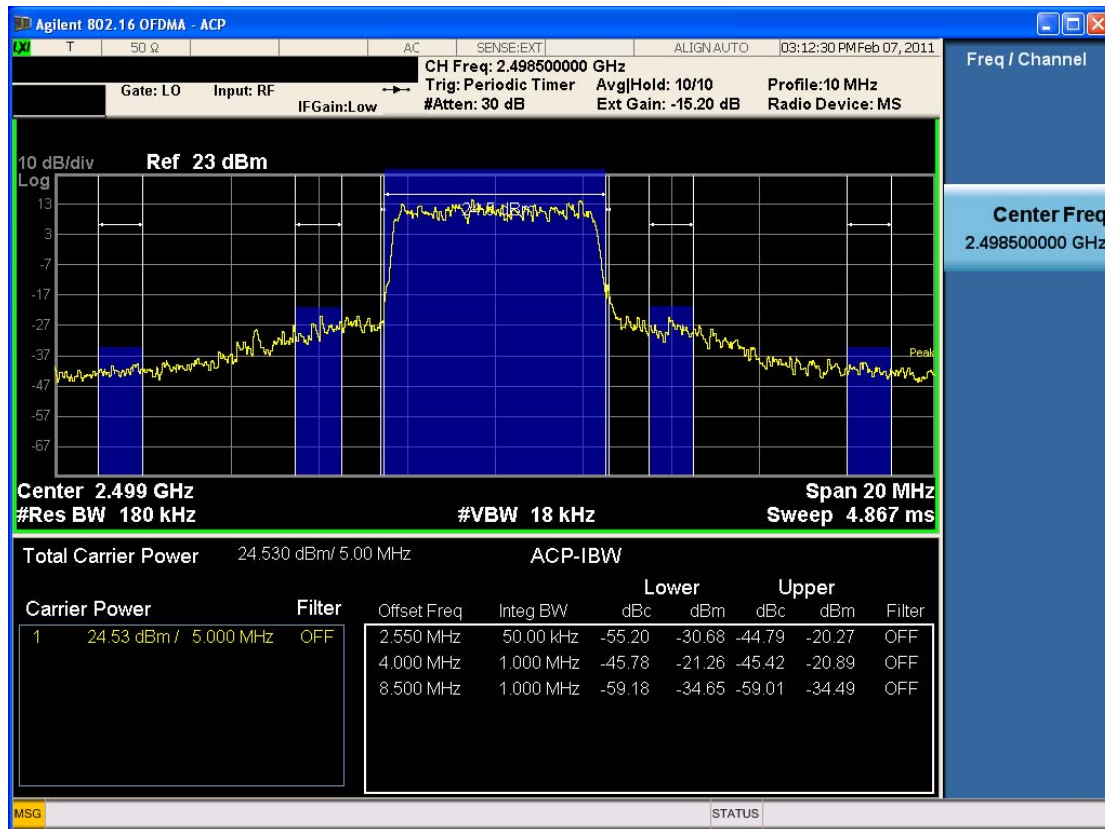


■ 16QAM MODE 3/4 (2685.0 MHz) Conducted Output Power



5 MHz

■ QPSK MODE 1/2 (2498.5 MHz) Channel Edge



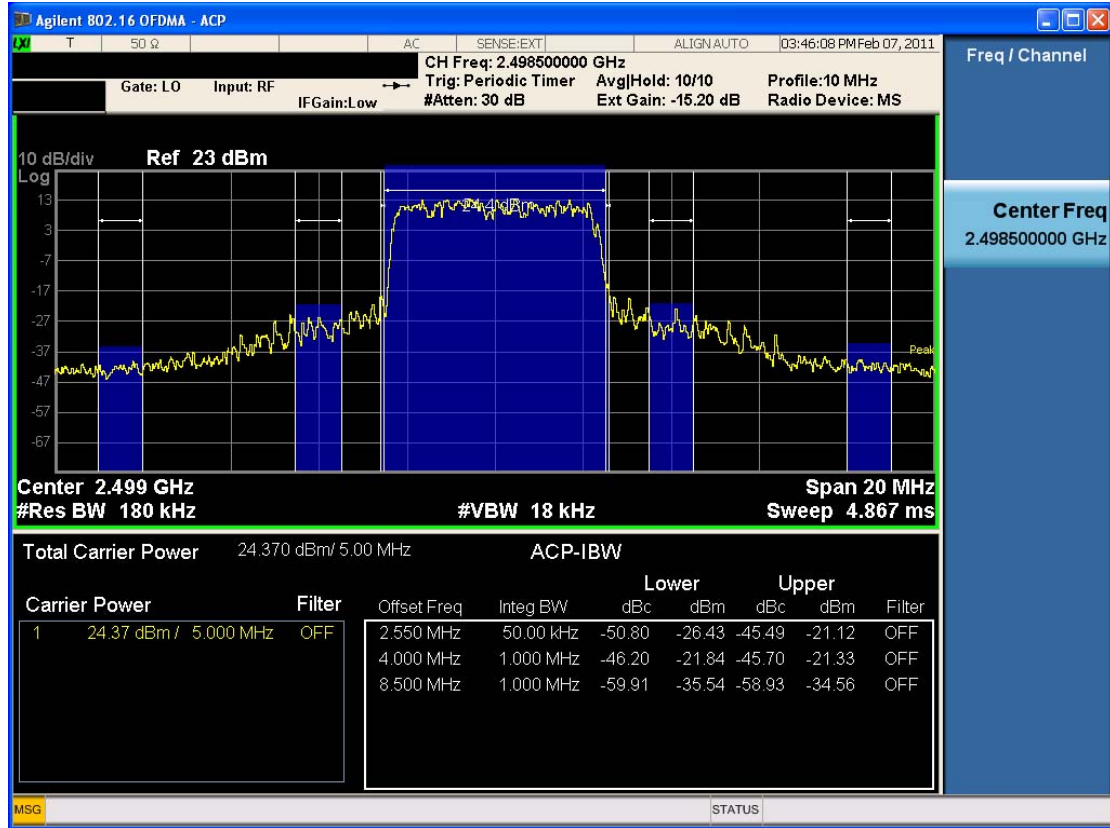
■ QPSK MODE 3/4 (2498.5 MHz) Channel Edge



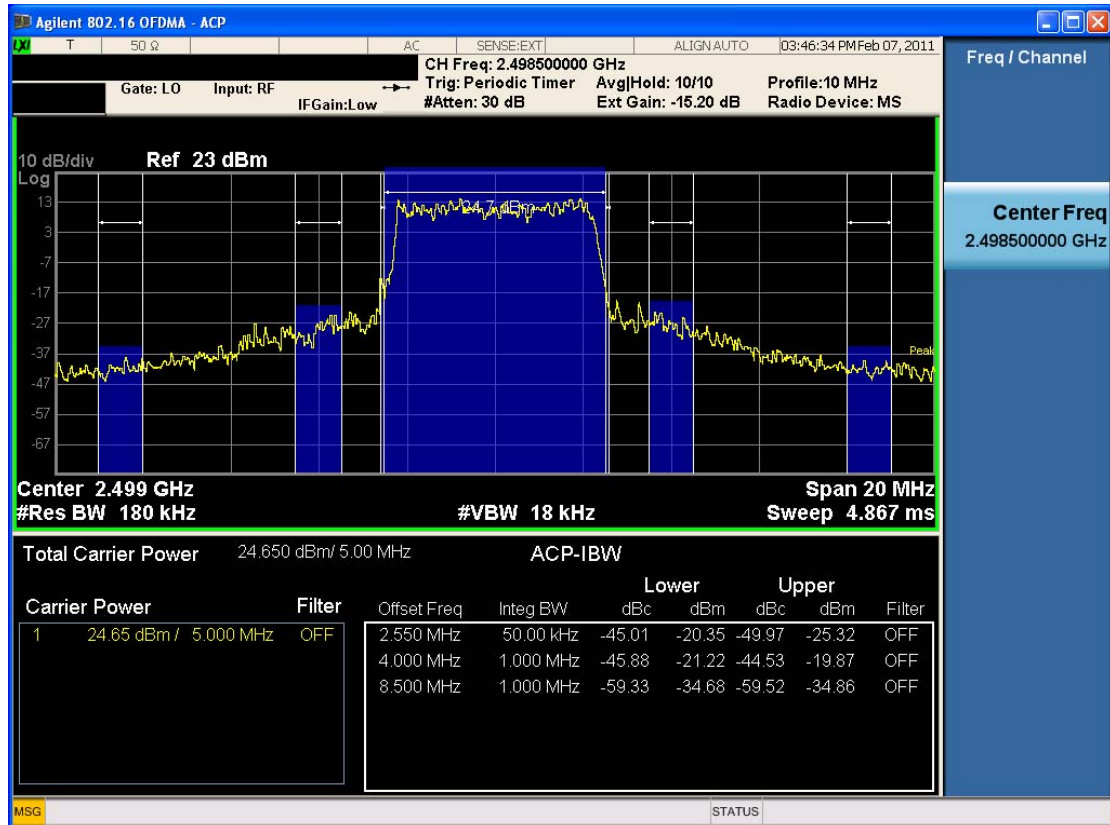
FCC CERTIFICATION REPORT

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■ 16QAM MODE 1/2 (2498.5 MHz) Channel Edge



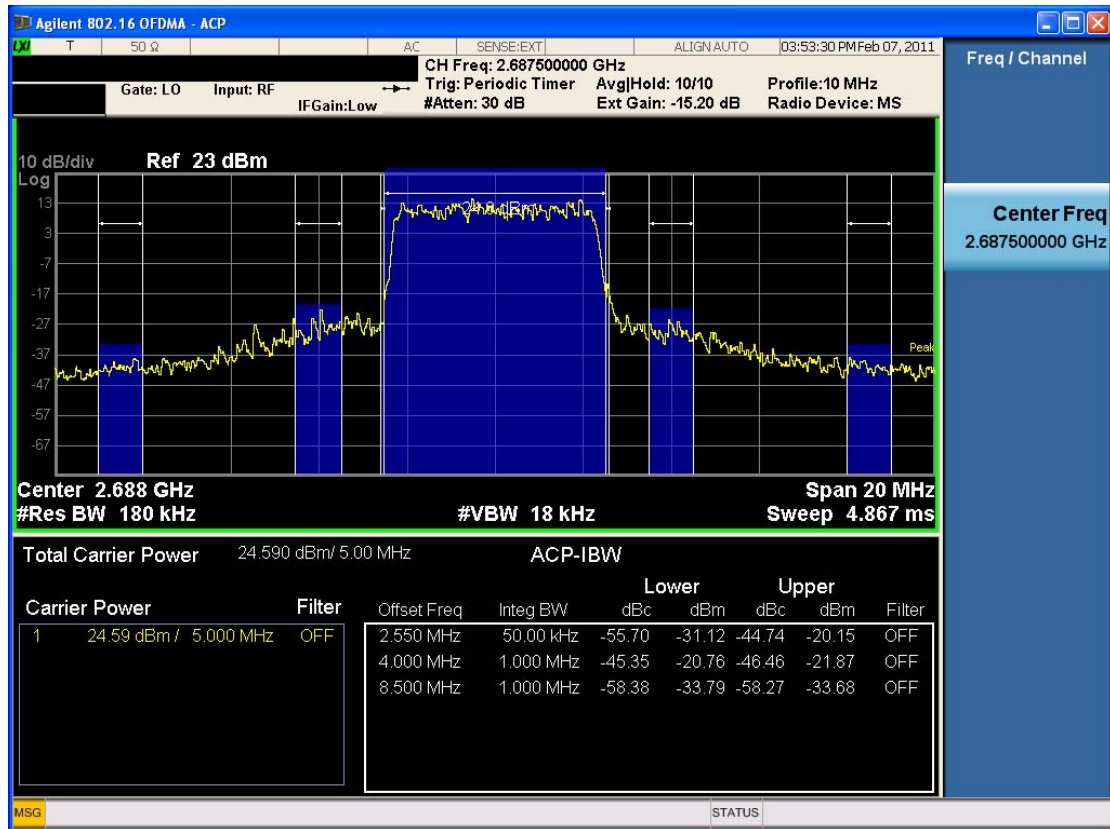
■ 16QAM MODE 3/4 (2498.5 MHz) Channel Edge



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■ QPSK MODE 1/2 (2687.5 MHz) Channel Edge



■ QPSK MODE 3/4 (2687.5 MHz) Channel Edge

