

# TEST REPORT

Report number		RAPA15-O-040
Applicant	Name	Corning Optical Communications Wireless Inc.
	Logo	<b>CORNING</b>
	Address	13221 Woodland Park Rd, Suite 400 Herndon, Virginia 20171 USA
Manufacturer	Name	Corning Optical Communications Wireless Inc.
	Address	13221 Woodland Park Rd, Suite 400 Herndon, Virginia 20171 USA
Type of equipment		Optical Repeater
Basic model name		HX-2500-MIMO
Multi model name		N/A
Serial number		N/A
FCC ID		OJFHX-2500-MIMO
Test duration		October 27, 2015 to December 02, 2015
Date of issue		January 26, 2016
Total page		179 pages (including this page)

## SUMMARY

The equipment complies with the regulation; FCC CFR 47 Part 27 Subpart C.

This test report only contains the result of a single test of the sample supplied for the examination. It is not a general valid assessment of the features of the respective products of the mass-production.

January 26, 2016



Tested by Hyun Soo Lee  
Manager

January 26, 2016



Reviewed by Sukil Park  
Executive Managing Director

### Test Report Version History

Version	Date	Revised by	Reason for revision
1.0	December 03, 2015	Hyun Soo Lee	Original Document
2.0	January 18, 2016	Hyun Soo Lee	Test procedure method insertion -935210 D05 v01
3.0	January 26, 2016	Hyun Soo Lee	Test results insertion -Out of band rejection -input versus output signal comparison

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## 1. General description of EUT

### 1.1 Applicant

- Company name : Corning Optical Communications Wireless Inc.
- Address : 13221 Woodland Park Rd, Suite 400 Herndon, Virginia 20171 USA
- Contact person : Habib Riazi / Product Manager
- Phone/Fax : 541-758-2880

### 1.2 Manufacturer

- Company name : Corning Optical Communications Wireless Inc.
- Address : 13221 Woodland Park Rd, Suite 400 Herndon, Virginia 20171 USA
- Phone/Fax : 541-758-2880

### 1.3 Basic description of EUT

- Product name : Optical Repeater
- Basic model name : HX-2500-MIMO
- Alternative model name : N/A
- Output power : Downlink: +33 dBm(2 W)

Max. composite output power based on one carrier per path	+33 dBm (2 W)
MIMO max. composite output power based on one carrier per path	+36 dBm (4 W)

- Frequency Range : 2 496 MHz ~ 2 690 MHz
- Emission Designators : LTE(G7D,W7D)
- Supported Bandwidth : 5 MHz ,10 MHz, 15 MHz, 20 MHz
- FCC Rule Part(s) : FCC CFR47 Part 2 and FCC CFR47 Part 27 Subpart C
- Place of test : Head office  
#101 & B104 Anyang Megavalley, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 431-767, Korea  
  
Open area test site  
103, Anseok-gil, 138beon-gil, Hwaseong-si, Gyeonggi-Do, Korea  
  
(FCC Registration Number: 931589)  
(IC Company address code: 9355B)  
(RRA Designation Number: KR0027)

### 1.4 Alternative type(s)/model(s)

There is no alternative type(s) and/or model(s).

## 1.4 Electrical specification

1.System DL/UL common specifications			
NO	Item	Specification	Comment
General			
1.1	RF Output Port Impedance	50 ohm	
1.2	DL/UL Return loss	16 dB	Design goal 18 dB, all RF ports
1.3	DL to UL System Isolation	Requirement: >32 dB @ all bands (DC to 4 GHz) Conditions: 1. End to end System: includes BTSC, RIU enclosure, OCH, connected to HX2500. 2. Measured with DL & UL Max Gain (44/21 dB). 3. Measured separately for DL & UL operation mode 4. Test Case A: Test the Gain from OCH DL Input to RIU DL Output 5. Test Case B: Test the Gain from RIU UL Input to OCH UL Output 6. Tested with small signal input power (-50 dBm).	To eliminate system oscillation, Required 12 dB for 16 remotes and 20 dB margin, shall be complied even on the DL/UL transient with 16 remotes.
1.4	Delay absolute	Signal Delay <2.0 microseconds(Excluding the Optic link delay)	
1.5	Optical Connector Type	SC/APC	
1.6	Regulatory	FCC certificated, 3GPP 36.812, 3GPP 36.104, RoHS	See regulatory chapter
1.7	PIM at antenna	<-110 dBm for two tones, 33 dBm each. Condition: Insert two tone 33 dBm (WCS 2355 MHz AWS 2137 MHz) at external RF Input, and measured the antenna port equivalent IMD level on 2500 UL (2573 MHz).	Required by customer
1.8	RF Duplex type	TDD (LTE TDD)	
1.9	TDD DL & UL frame	As per 3GPP Standard Matrix	
1.10	MIMO support	2x2	

<b>2. Down Link Specifications (OCH to HX2500-TDD Antenna port on 2500 MHz band) over full operating ambient temperature</b>			
<b>NO</b>	<b>Item</b>	<b>Specification</b>	<b>Comment</b>
2.1	Frequency Range	2496 MHz – 2690 MHz	
2.2	Nominal System Output Power	33 dBm	Linear power
2.3	Gain nominal	53 dB	With OCH in RIU mode, With up to 2 km fiber (3 dBo)
2.4	Gain Max setting	55 dB	To enable 2 dB loss on OCH at 2500 band (margin for OCH loss and manufacturing tolerance compensation)
2.5	Gain variation over temperature	+/- 1 dB max	reference for gain variation is gain @ room temperature
2.6	Output power control Range	19 – 34 dBm min	For commissioning
2.7	Output power control step	1 dBi	
2.8	Pass Band Ripple over 70 MHz	3 dB peak to peak Max 2 dB p-p desired	Tested with OCH
2.9	DL Test Port coupling	-40 dB +/- 1.0 dB relative to DL output	
2.10	OIP3	Not specified (need to meet IMD3 requirement)	
2.11	IMD3	Not specified	
2.12	Spurious emission	Per 3GPP 36 104, 3GPP 36 812	
2.13	LTE spectrum emission mask	Per 3GPP 36 104	
2.14	LTE EVM	3 %, frequency error <math>\pm 0.01</math> ppm	
2.15	Group delay variation	0.250 usec p-p max 0.200 usec p-p desired	
2.16	DL detector type	Two detector type shall be used: 1. Average 2. Peak	
2.17	DL Average detector	Shall use RMS detector and shall represent the average level (the same level measured by spectrum analyzer channel power)	The detector shall represent the average level for LTE signal for Max or Min resource block (equivalent to signal rise/fall time of 50 $\mu$ sec)
2.18	DL Peak detector	Shall use post detection peak detector following the RMS detector, and shall represent the max level (for LTE signal, this is the level equivalent to using maximum resource block allocation).	
2.19	DL detector range	At least -1 to +37 dBm	For CW, For AVG reading, for LTE TDD equivalent to 19-37dBm.

NO	Item	Specification	Comment
2.20	DL detector step	1 dB	
2.21	DL detector calibration accuracy	1 dB With CW 1.5 dB modulated	
2.22		The Engineering GUI shall present levels of both detectors	
2.23		The limiter shall be based on either the Average or Peak detector. The detector to be used for the limiter, shall be selected on the engineering GUI. The default shall be Peak.	The detector implementation method shall be presented and agreed by COCW SE
2.24		The measured level of the selected detector shall be send to the management through the OCH.	
<b>3. Up Link Specifications (HX2500-TDD to OCH on 2500 MHz band) over operating ambient temperature</b>			
3.1	Frequency Range	2496 MHz – 2690 MHz	
3.2	Maximum Gain	41 dB	HX + fiber (1m) + OCH
3.3	Gain setting range	High Gain : 41 dB Normal Gain : 31 dB (default setting) Low Gain : 21 dB	HX + fiber (1m) + OCH
3.4	Gain setting accuracy	±1 dB	
3.5	Gain variation over temperature	+/- 1 dB max	reference for gain variation is gain @ room temperature
3.6	NF	10 dB max at Normal gain 6 dB max at High gain 5 dB max at High gain desired	Tested with OCH (with 1m & 2km fiber)
3.7	Pass Band Ripple	2.5 dB peak to peak Max 2 dB p-p desired	Tested with OCH, over any 70 MHz band
3.8	Limiter threshold	-50 dBm @ High Gain -40 dBm @ Normal Gain -30 dBm @ Low Gain	Above this level limiting starts, in order to prevent high level to BS and at OCH
3.9	High level notification	10 dB above limiter threshold	Notification message shall be sent to OCH
3.10	Max input Power for limiter operation	-5 dBm @ Nominal & Low Gain -15 dBm @ High Gain	@ Nominal & Low Gain
3.11	IIP3	>-10 dBm at nominal gain	For Normal gain and max input level, IMD3 should be below noise floor at BW 1.4 MHz (-103 dBm)
3.12	LTE EVM	3 %	At max UL signal level for each gain setting
3.13	Detector Sensitivity to external RF in signals	No change of detector accuracy for all external services (within 698-2360 MHz) occupied with 33 dBm per service (total power 40 dBm).	Requires high Isolation from external signals at 698 MHz-2360 MHz
3.14	UL EVM Sensitivity to external RF in signals	No change of EVM for all external services (within 698-2360 MHz) occupied with 33 dBm per service (total power 40 dBm).	Requires high Isolation from external signals at 698 MHz-2360 MHz
3.15	Detector range	at least: -5 dB below limiter threshold to -5 dBm	

<b>4. Combiner External 1 RF In Specifications (Wideband)</b>			
<b>NO</b>	<b>Item</b>	<b>Specification</b>	<b>Comment</b>
4.1	Frequency range	698 MHz – 2155 MHz	
4.2	Optional DL bands	728 MHz – 757 MHz 862 MHz – 894 MHz 1930 MHz – 1995 MHz 2110 MHz – 2155 MHz	
4.3	Optional UL bands	698 MHz – 716 MHz & 777 MHz – 787 MHz 817 MHz – 849 MHz 1850 MHz – 1915 MHz 1710 MHz – 1755 MHz	
4.4	Loss to antenna port	0.5 dB max 0.3 dB desired	From External RF In to Antenna port
4.5	Inband ripple	0.1 dB per band	
4.6	Group delay variation	10 nsec	On any band
4.7	Leakage of 2496 – 2690 MHz signal to External 1 & External 2 RF In	-7 dBm max	40 dB isolation from 2500 DL output to External RF In (towards HX4)
4.8	Noise leakage to External 1 RF In	-104 dBm/MHz max @ 698 – 2155 MHz	For any TDD channel in 2496 MHz – 2690 MHz
4.9	Isolation from External RF IN port to Internal UL port @ 2496 – 2690 MHz	>50 dB min	From External RF In (from HX4/HX2300) to 2500 UL input, To avoid PIM/IMD from HX4 to 2500 (WCS DL (2355), AWS DL (2137) => 2500 UL 2573)
<b>5. Combiner External 2 RF In Specifications(WCS)</b>			
5.1	Frequency range	2305 MHz – 2360 MHz	
5.2	Optional DL bands	2350 MHz – 2360 MHz	
5.3	Optional UL bands	2305 MHz – 2315 MHz	
5.4	Loss to antenna port	1.0 dB max 0.5 dB desired	From External RF In to Antenna port
5.5	Inband ripple	0.5 dB per band max	
5.6	Group delay variation	10 nsec	On any band
5.7	Leakage of 2350 – 2360 MHz signal to External 1 RF In	-7 dBm max	40 dB isolation from 2500 DL output to External RF In (towards HX4)
5.8	Noise leakage to External 2 RF In	-104 dBm/MHz max @ 698 – 2360 MHz	For any TDD channel in 2496 MHz – 2690 MHz
5.9	Isolation from External RF IN port to Internal UL port @ 2496 – 2690 MHz	>50 dB min	From External RF In (from HX4/HX2300) to 2500 UL input, To avoid PIM/IMD from HX4 to 2500 (WCS DL (2355), AWS DL (2137) => 2500 UL 2573)



<b>6. DL Extension port specifications</b>			
<b>NO</b>	<b>Item</b>	<b>Specification</b>	<b>Comment</b>
6.1	Connector type	SMA female 50 ohm	
6.2	Return loss	-14 dB max	
6.3	Frequency	300 to 2700 MHz (wide band signal received on the photo diode from the OCH)	
6.4	Gain from photo diode output to Ext. port output	20±1 dB	
6.5	NF of the gain block following the photo diode	3 dB max	In order not to degrade the DL system NF of the external unit
6.6	Ripple	3 dB p-p max from 550 to 2700 MHz 5 dB p-p max from 300 to 2700 MHz	
6.7	OIP3	TBD	
<b>7. UL Extension port specifications</b>			
7.1	Connector type	SMA female 50 ohm	
7.2	Return loss	-14 dB max	
7.3	Frequency	300 to 2700 MHz(wide band signal received on the photo diode from the OCH)	To enable combining of UL narrow band signal at any band
7.4	Gain from Ext. port input to Laser photo diode input	Switchable 15±1 / 20±1 dB	
7.5	NF of the gain block following the photo diode	3 dB max @ Gain 20 dB 5 dB max @ Gain 15 dB	In order not to degrade the UL system NF of the external unit
7.6	IIP3	TBD	
7.7	Ripple	3 dB p-p max from 550 to 2700 MHz 5 dB p-p max from 300 to 2700 MHz	

### 1.5 Mechanical specification

<b>Item</b>	<b>Specifications</b>	<b>Note</b>
Dimensions (L × W × H)	407 mm x 445 mm x 176.5 mm	19 inch(W), 4U(H)
Weight	<25 Kg	55lb
Operating power	34 Vdc ~48 Vdc	DC source 28 Vdc ~ 60 Vdc

### 1.6 Environmental specification

<b>Item</b>	<b>Specifications</b>	<b>Note</b>
Temperature	-20 °C ~ 60 °C	
Relative Humidity	10 % ~ 95 %	

## 2. General information of test

### 2.1 Test standards and results

Applied Standards : FCC CFR47 Part 27			
FCC part	Section	Description of Test	Result
Part 2.1049 Part 27.53	- (m)	Occupied Bandwidth Out of band rejection Input versus output signal comparison	Pass
Part 2.1051 Part 27.53	- (m)(v)	Band Edge	Pass
Part 2.1051 Part 27.53	- (m)	Conducted Spurious Emission	Pass
Part 2.1046 Part 27.50	- (h)	Output Power	Pass
Part 2.1053 Part 27.53	- (m)	Radiated Spurious Emission	Pass
Part 2.1055 Part 27.54	(a)(1),(d) -	Frequency Stability / Temperature Variation	Pass

### 2.2 Description of EUT modification

During the test, there was no mechanical or circuitry modification to improve RF and spurious characteristic, and any RF and spurious suppression device(s) was not added against the device tested.

### 2.3 Test configuration

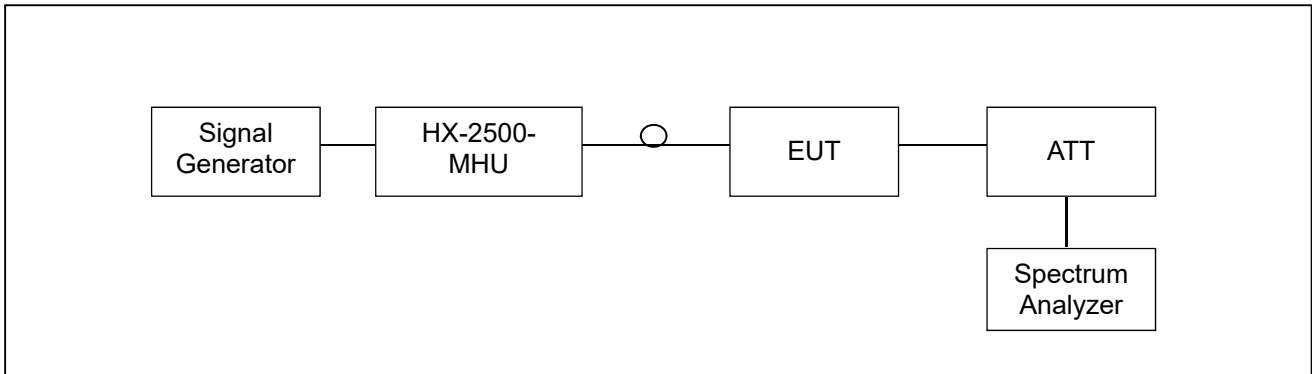
#### • Type of peripheral equipment used

Model	Manufacturer	Description	Connected to
HX-2500-MIMO	Corning Optical Communications Wireless Inc.	EUT	HX-2500-MHU & Spectrum analyzer (thru ATTN)-
HX-2500-MHU	Corning Optical Communications Wireless Inc.	Master Hub Unit	EUT & Signal generator
N5182A	Agilent	Signal Generator	HX-2500-MHU
PE7019-20	Pasternack	Attenuator	EUT
N9020A	Agilent	Spectrum Analyzer	Attenuator

#### • Type of cable used

Device from	Device to	Type of Cable	Length (m)	Shielded
Signal Generator	HX-2500-MHU	SMA-Type	2.0	Y
HX-2500-MHU	EUT	Optical fiber	3.0	-
EUT	Attenuator	N-Type	0.0	Y
Attenuator	Spectrum analyzer	N-Type	3.0	Y

## 2.4 Test setup



## 2.5 Measurement Uncertainty

- Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 ~ 30 MHz

Expanded Uncertainty (95% , K=2) :  $\pm 3.08$  dB

- Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

For open site 30 ~ 1000 MHz

Expanded Uncertainty (95% , K=2) :  $\pm 4.28$  dB

### 3. Measurement data

#### 3.1 Occupied Bandwidth / 26 dB Emission Bandwidth

##### 3.1.1 Specification

- FCC Part 2.1049
- FCC Part 27.53

##### 3.1.2 Test Description

The occupied bandwidth was measured using a spectrum analyzer's 26 dB bandwidth function. The test was performed at three frequencies (low, middle and high channels) at each band using all applicable modulation.

Occupied Bandwidth and 26 dB Emission Bandwidth were measured on port 1 and port 2 under the three types of modulation mode which are QPSK, 16QAM and 64QAM, and resource block was 25~100.

UL/DL Allocation : Configuration 3  
Dw/GP/UP length : Configuration 8

##### 3.1.3 Test Procedure

The method used is as detailed in FCC KDB 935210 D05 v01.

The method used is as detailed in FCC KDB 971168 D01 v02r02.

The EUT was set up to the applicable test frequency with modulation. The EUT antenna terminal was conducted to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable.

For testing, the RBW was set to 1% to 3% of the 26 dB bandwidth and 99% Occupied Bandwidth. The VBW was set to 3 times the RBW and sweep time is coupled.

Occupied bandwidth measured was repeated for each modulation (QPSK, 16QAM and 64QAM)

##### 3.1.4 Test equipment list

Equipment	Model Name	Manufacturer
EUT	HX-2500-MIMO	Corning Optical Communications Wireless Inc.
MHU	HX-2500-MHU	Corning Optical Communications Wireless Inc.
Signal Generator	N5182A	Agilent
Spectrum Analyzer	N9020A	Agilent
Attenuator	PE7019-20	Pasternack
DC Power Supply	6674A	Agilent

##### 3.1.5 Test condition

- Test place: Shield Room
- Test environment: 22.5 °C, 42.5 % R.H.

### 3.1.6 Test results

- Port1

Bandwidth	Modulation	Frequency [MHz]	Occupied Bandwidth [MHz]	26 dB Emission Bandwidth [MHz]
5 MHz	QPSK	2498.5	4.341	4.511
		2593.0	4.498	4.741
		2687.5	4.494	4.742
	16QAM	2498.5	4.283	4.494
		2593.0	4.466	4.874
		2687.5	4.538	4.695
	64QAM	2498.5	4.396	4.502
		2593.0	4.498	4.721
		2687.5	4.457	4.703
10 MHz	QPSK	2501.0	8.982	9.404
		2593.0	9.071	9.573
		2685.0	9.046	9.307
	16QAM	2501.0	8.417	8.680
		2593.0	8.423	8.684
		2685.0	9.032	9.337
	64QAM	2501.0	8.311	8.656
		2593.0	8.311	8.654
		2685.0	8.308	8.651
15 MHz	QPSK	2503.5	13.602	14.24
		2593.0	13.389	14.27
		2682.5	13.575	14.10
	16QAM	2503.5	13.338	14.12
		2593.0	13.510	14.60
		2682.5	13.659	14.21
	64QAM	2503.5	13.582	14.21
		2593.0	13.589	14.22
		2682.5	13.646	14.27
20 MHz	QPSK	2506.0	17.828	19.26
		2593.0	17.844	19.27
		2680.0	17.851	19.28
	16QAM	2506.0	17.864	18.79
		2593.0	17.870	18.80
		2680.0	17.872	18.78
	64QAM	2506.0	17.936	19.28
		2593.0	17.943	19.29
		2680.0	17.943	19.29

## • Port2

Bandwidth	Modulation	Frequency [MHz]	Occupied Bandwidth [MHz]	26 dB Emission Bandwidth [MHz]
5 MHz	QPSK	2498.5	4.341	4.511
		2593.0	4.498	4.742
		2687.5	4.494	4.741
	16QAM	2498.5	4.283	4.494
		2593.0	4.465	4.874
		2687.5	4.538	4.695
	64QAM	2498.5	4.396	4.502
		2593.0	4.499	4.721
		2687.5	4.457	4.703
10 MHz	QPSK	2501.0	8.983	9.404
		2593.0	9.071	9.573
		2685.0	8.986	9.403
	16QAM	2501.0	8.417	8.681
		2593.0	8.424	8.684
		2685.0	8.413	8.681
	64QAM	2501.0	8.311	8.655
		2593.0	8.311	8.654
		2685.0	8.308	8.652
15 MHz	QPSK	2503.5	13.602	14.24
		2593.0	13.390	14.28
		2682.5	13.575	14.10
	16QAM	2503.5	13.388	14.12
		2593.0	13.510	14.60
		2682.5	13.658	14.20
	64QAM	2503.5	13.582	14.21
		2593.0	13.590	14.22
		2682.5	13.485	14.20
20 MHz	QPSK	2506.0	17.828	19.26
		2593.0	17.844	19.27
		2680.0	17.851	19.28
	16QAM	2506.0	17.864	18.79
		2593.0	17.871	18.80
		2680.0	17.872	18.79
	64QAM	2506.0	17.937	19.28
		2593.0	17.943	19.29
		2680.0	17.942	19.28

- Port1 / Out of band rejection

20 dB Frequency	Output power [dBm]	Gain [dB]
2489.3 MHz ~ 2697.2 MHz	44.851	65.851

- Port2 / Out of band rejection

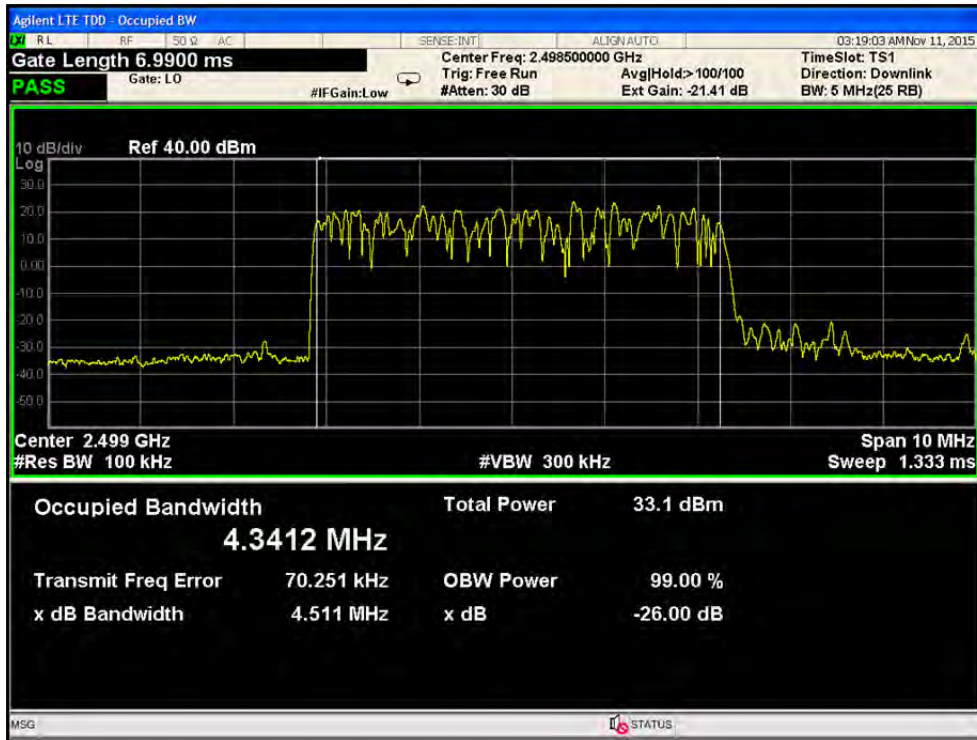
20 dB Frequency	Output power	Gain [dB]
2489.3 MHz ~ 2696.5 MHz	44.851	64.851

- Input signal

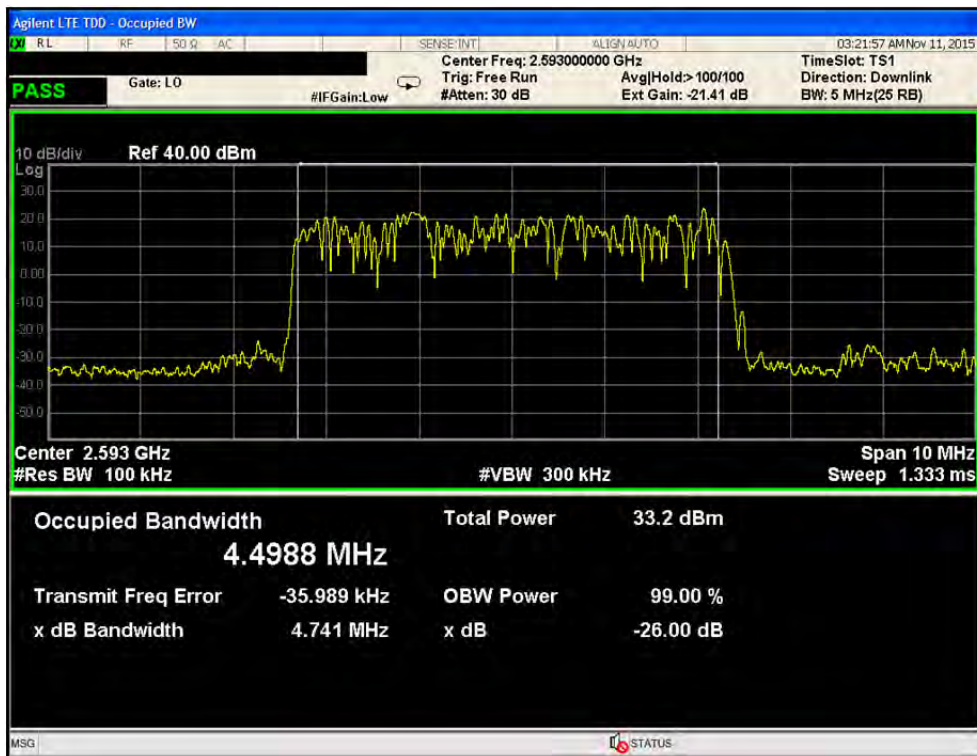
Bandwidth	Modulation	Frequency [MHz]	Occupied Bandwidth [MHz]
5 MHz	QPSK	2593.0	4.510
	16QAM	2593.0	4.512
	64QAM	2593.0	4.519
10 MHz	QPSK	2593.0	9.002
	16QAM	2593.0	9.030
	64QAM	2593.0	9.004
15 MHz	QPSK	2593.0	13.531
	16QAM	2593.0	13.566
	64QAM	2593.0	13.534
20 MHz	QPSK	2593.0	17.995
	16QAM	2593.0	18.024
	64QAM	2593.0	18.015

### 3.1.7 Test Plots

•Port1 / LTE 5M / 2498.5 MHz / QPSK

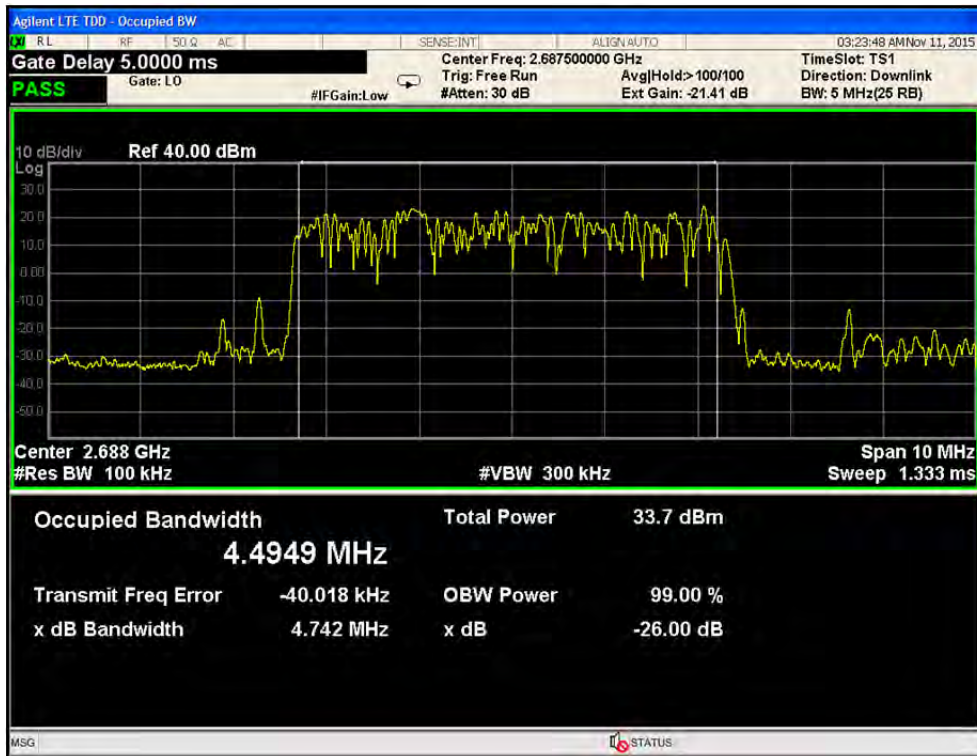


•Port1 / LTE 5M / 2593.0 MHz / QPSK

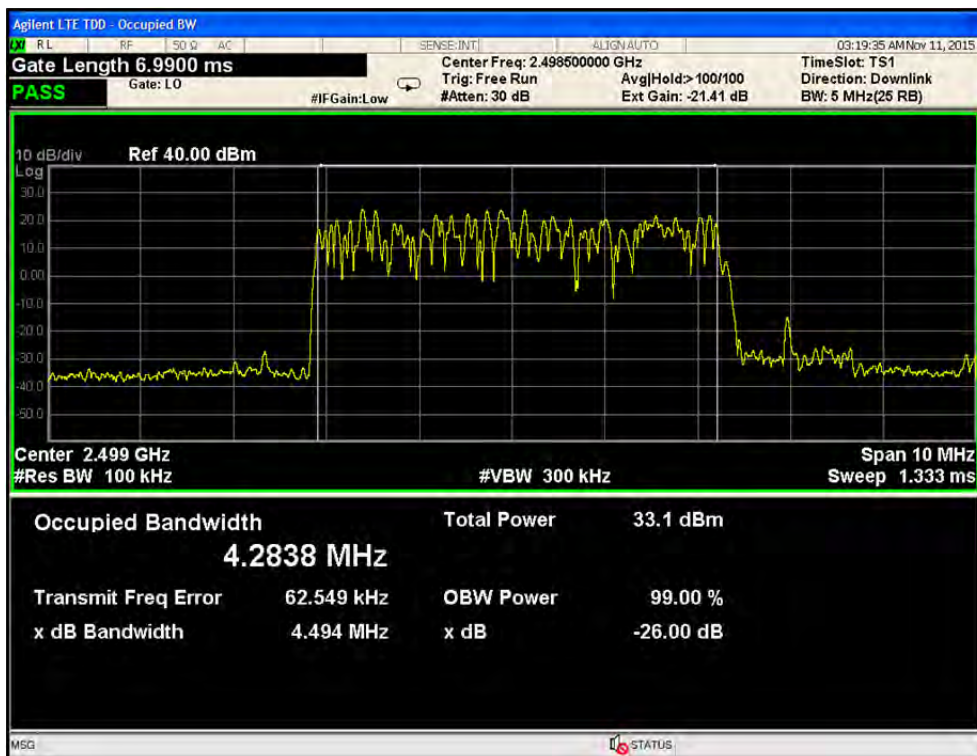




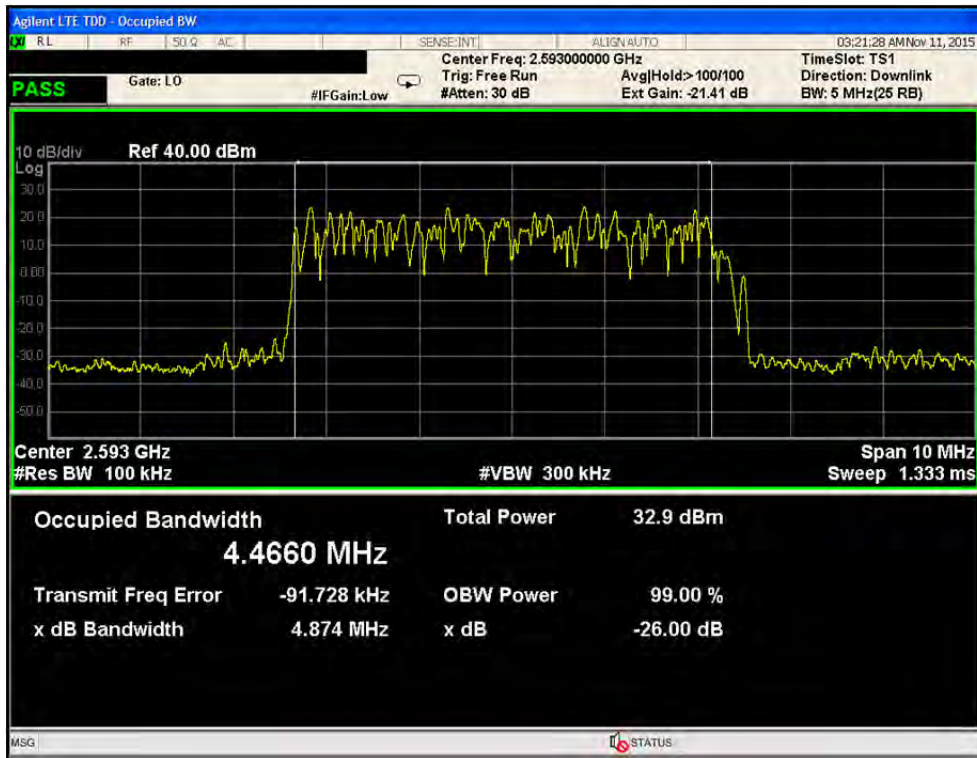
•Port1 / LTE 5M / 2687.5 MHz / QPSK



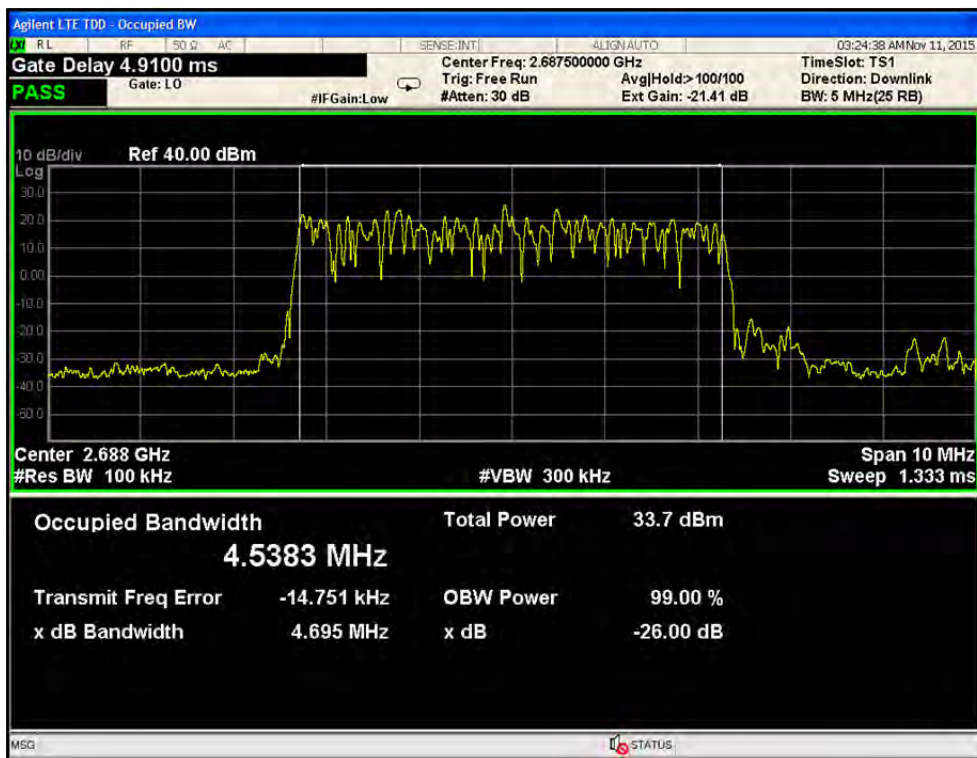
•Port1 / LTE 5M / 2498.5 MHz / 16QAM



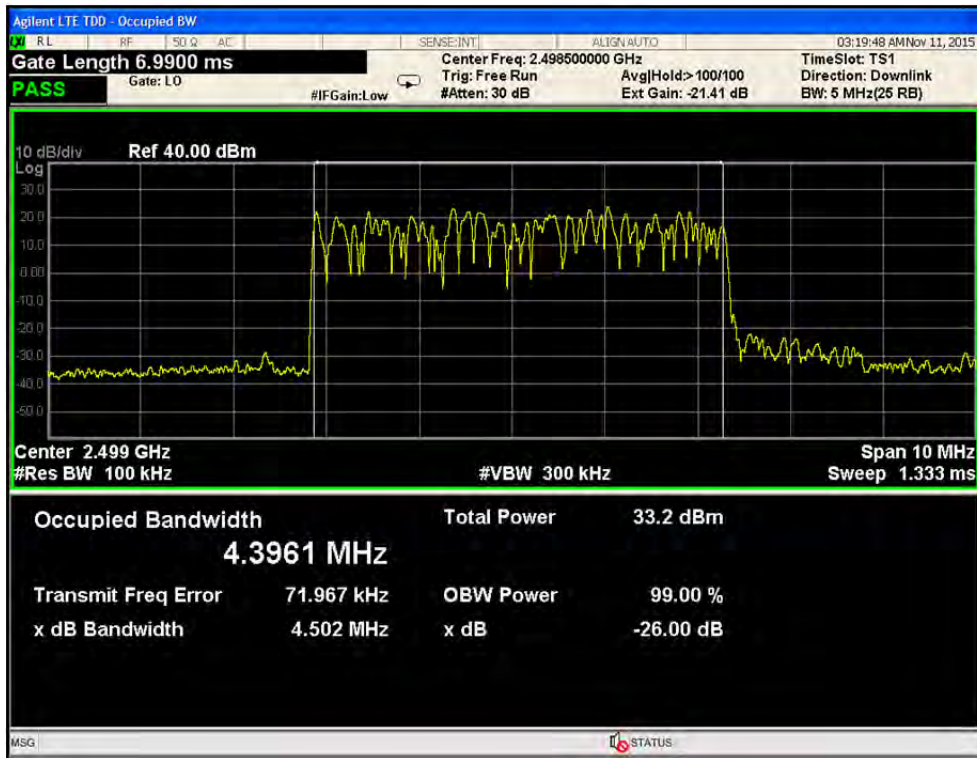
•Port1 / LTE 5M / 2593.0 MHz / 16QAM



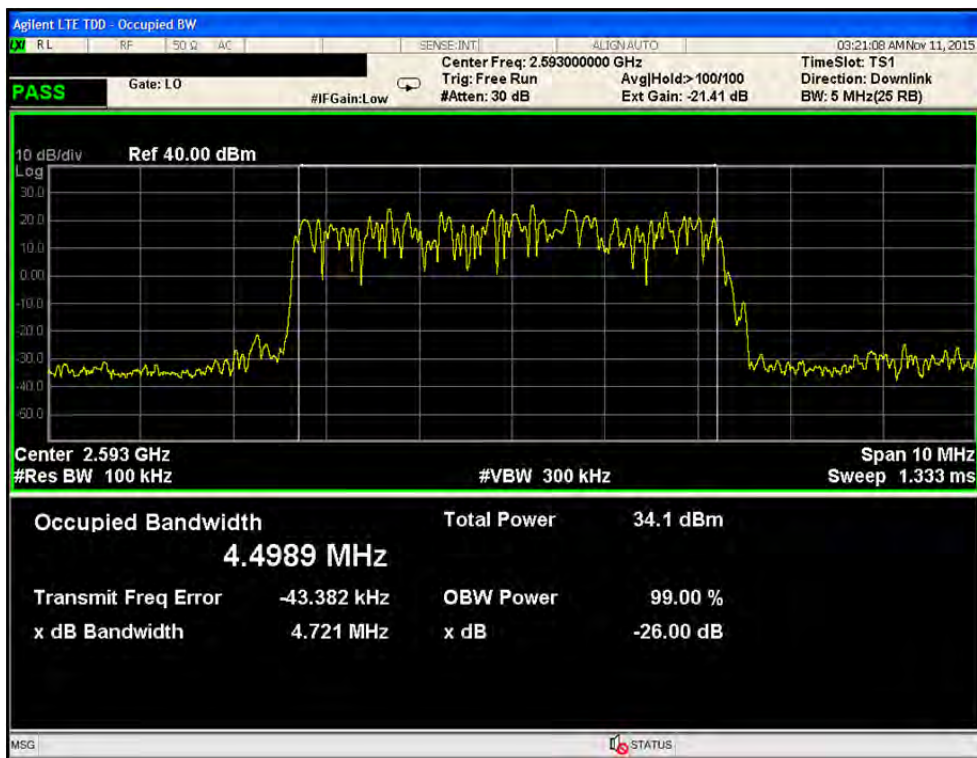
•Port1 / LTE 5M / 2687.5 MHz / 16QAM



•Port1 / LTE 5M / 2498.5 MHz / 64QAM

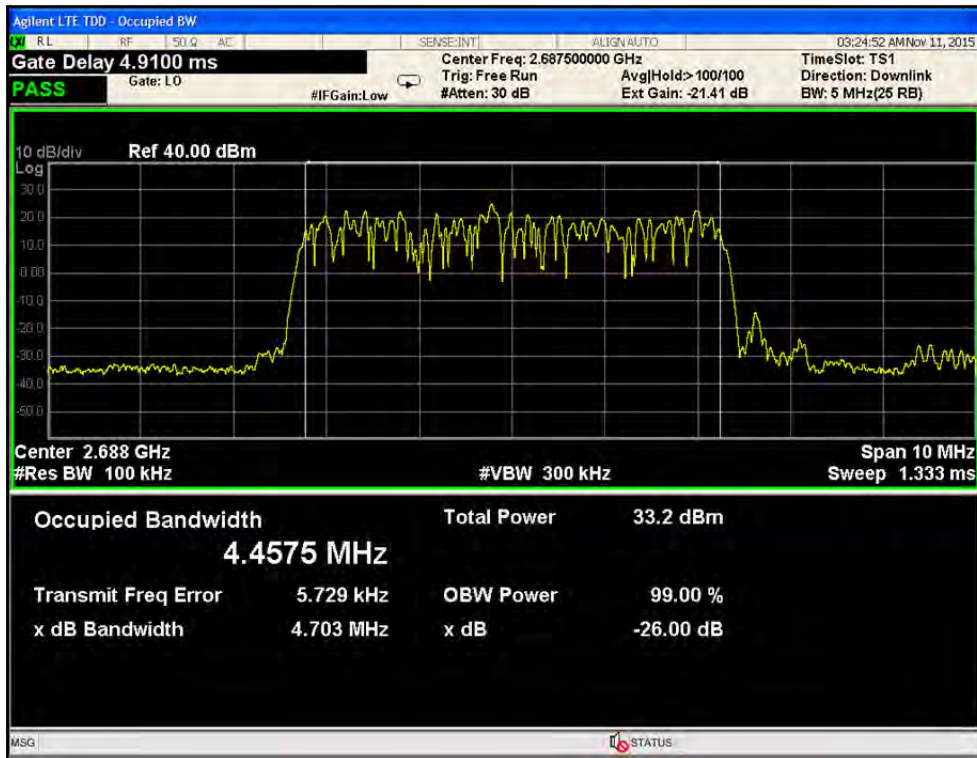


•Port1 / LTE 5M / 2593.0 MHz / 64QAM

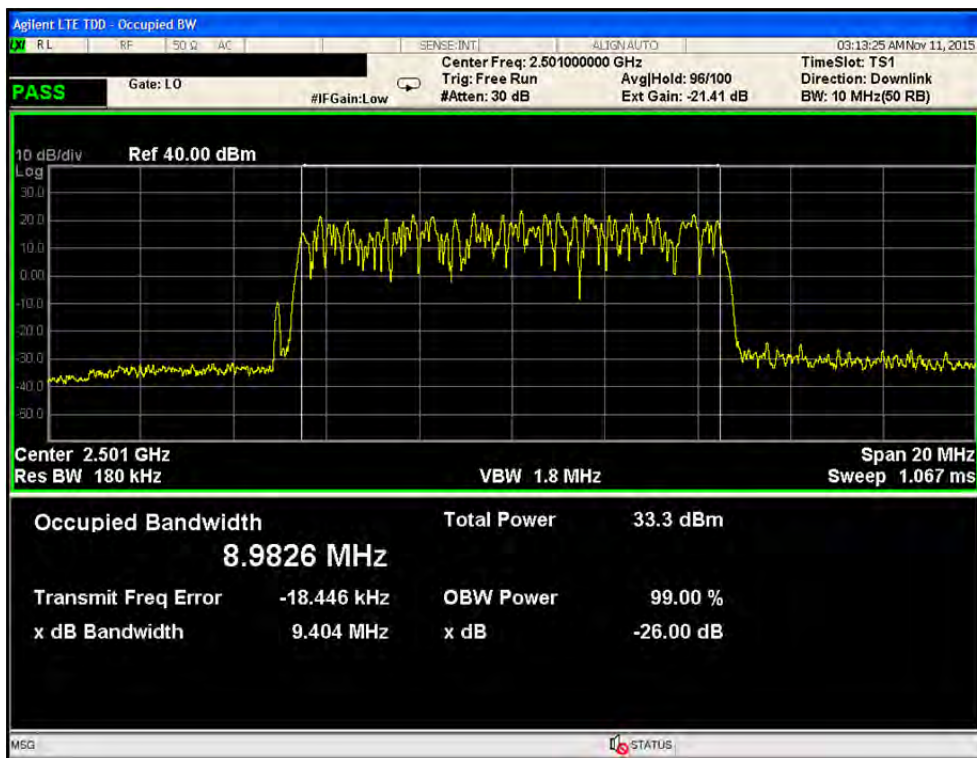




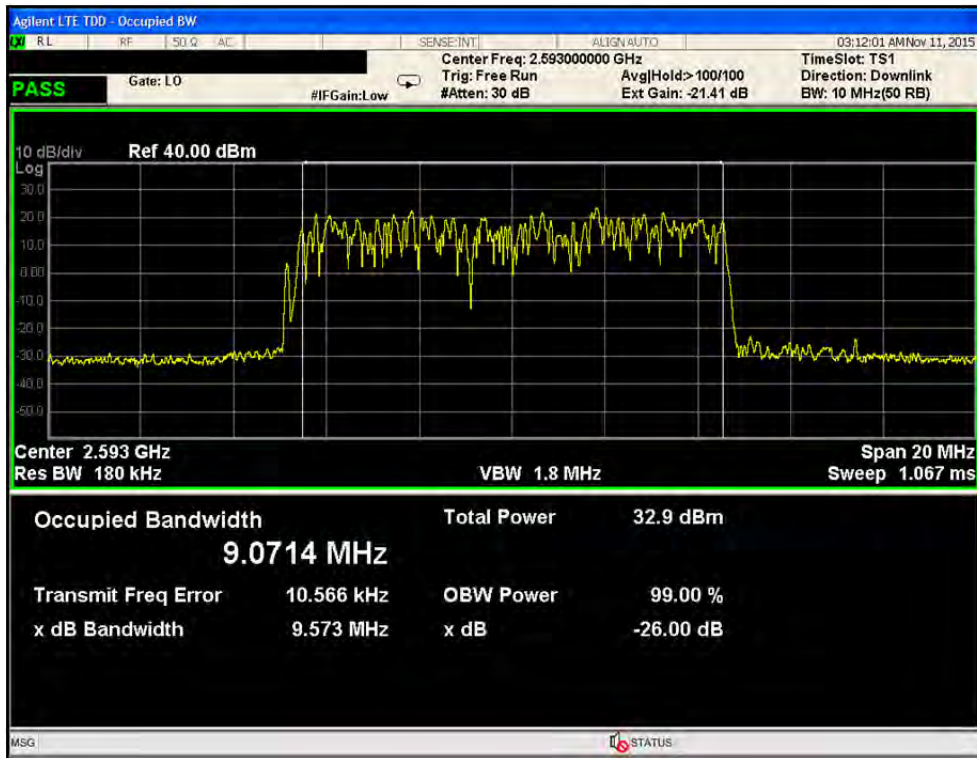
•Port1 / LTE 5M / 2687.5 MHz / 64QAM



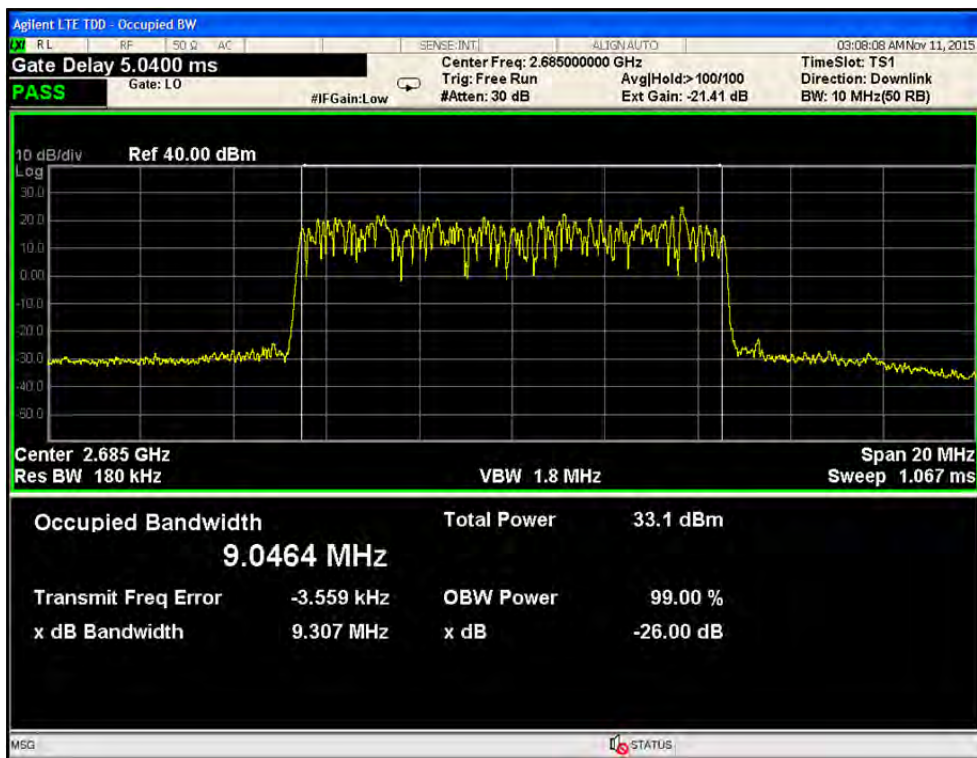
•Port1 / LTE 10M / 2501.0 MHz / QPSK



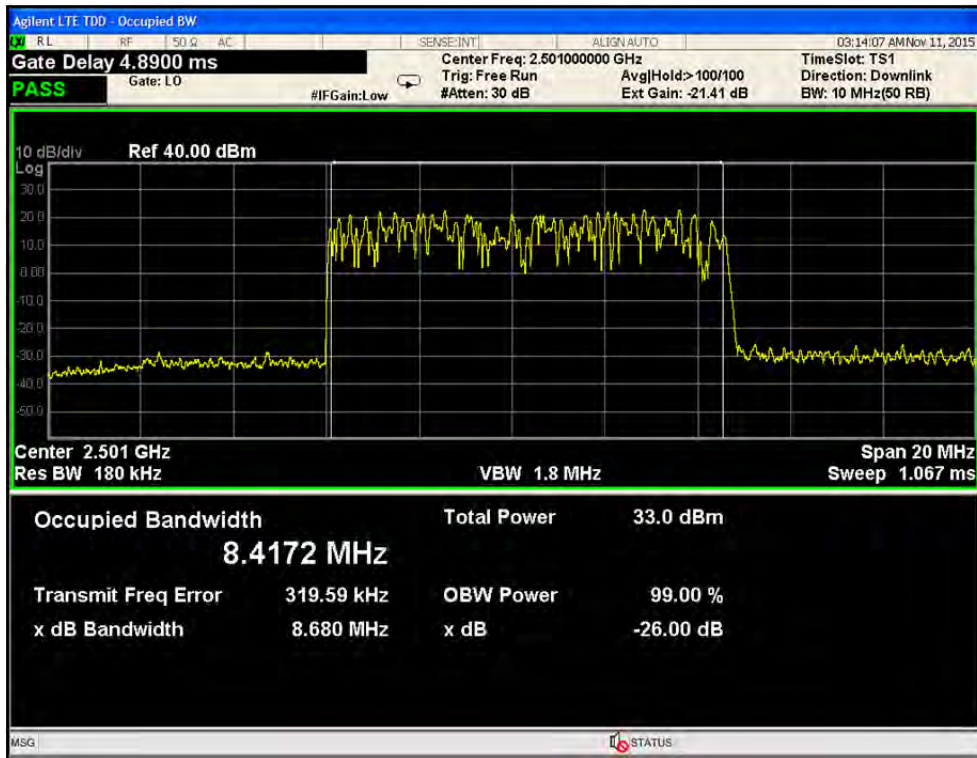
•Port1 / LTE 10M / 2593.0 MHz / QPSK



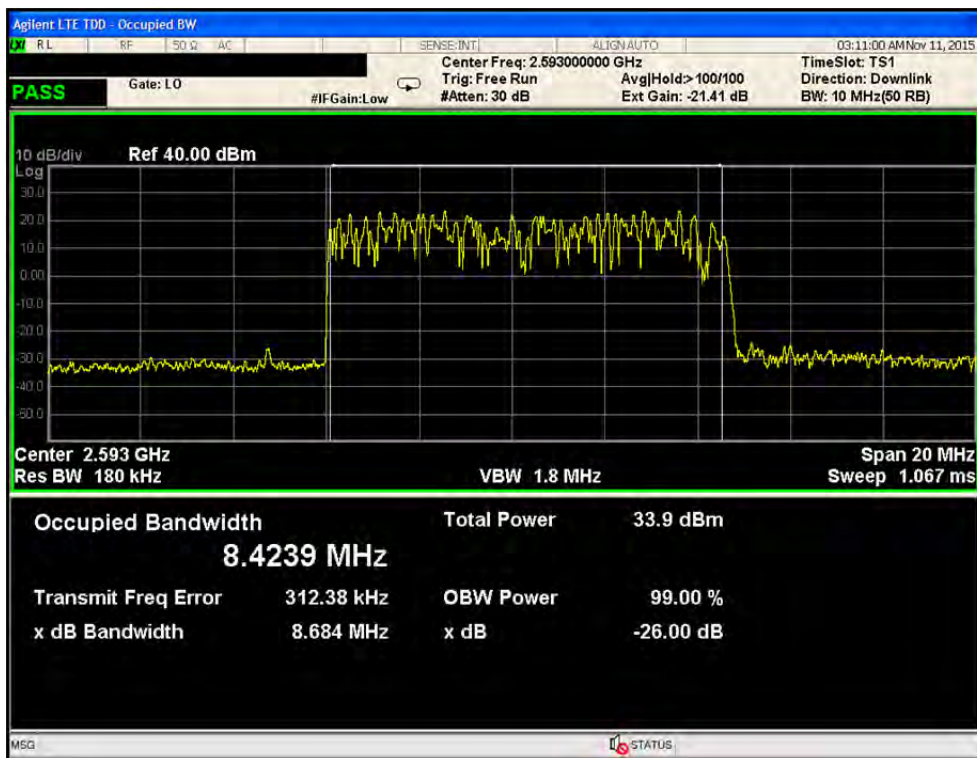
•Port1 / LTE 10M / 2685.0 MHz / QPSK



•Port1 / LTE 10M / 2501.0 MHz / 16QAM

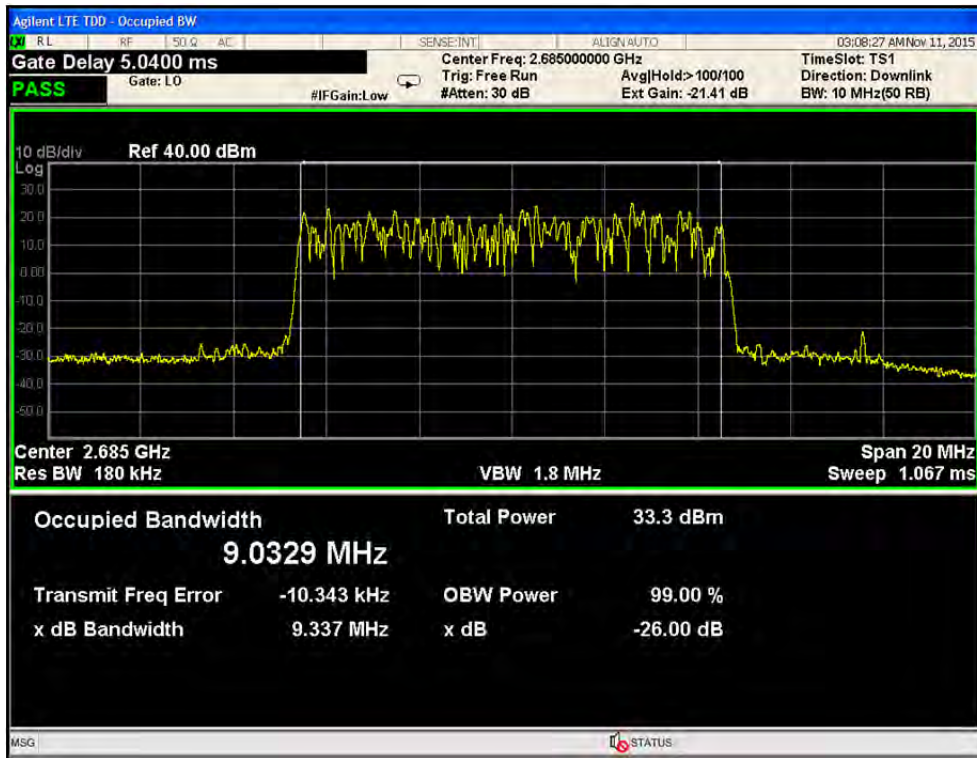


•Port1 / LTE 10M / 2593.0 MHz / 16QAM

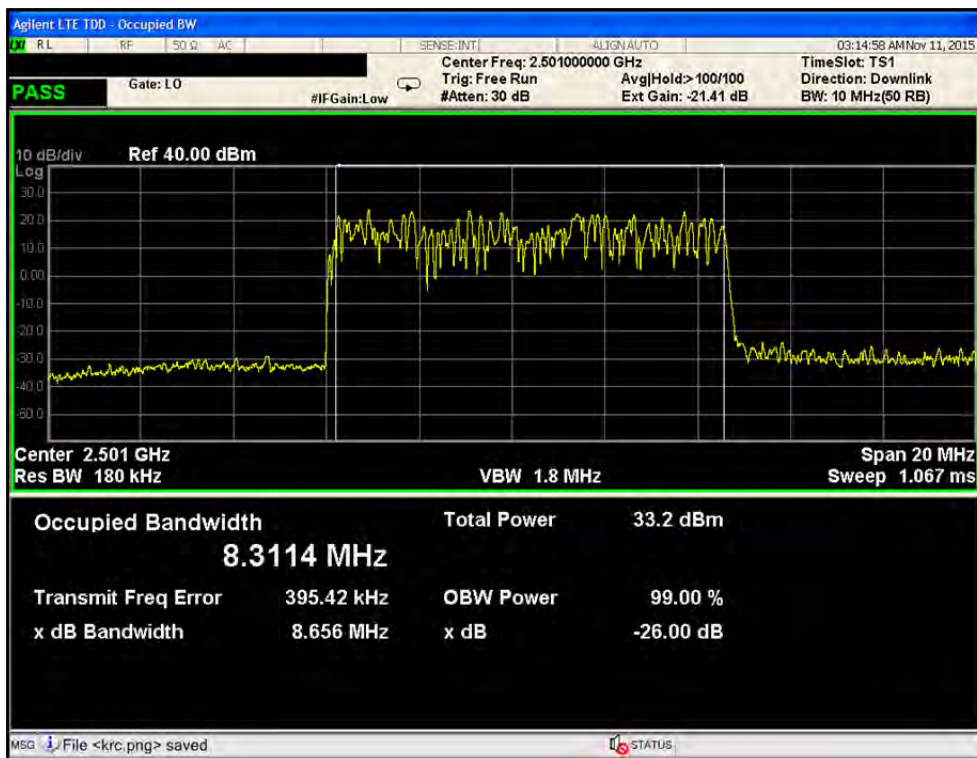




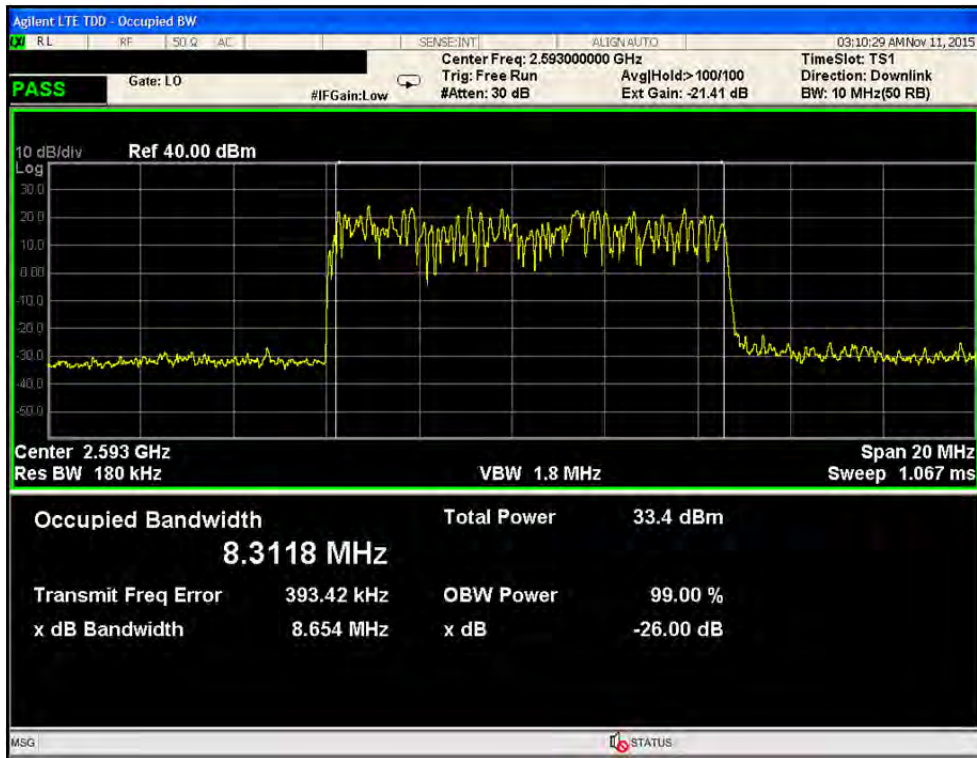
•Port1 / LTE 10M / 2685.0 MHz / 16QAM



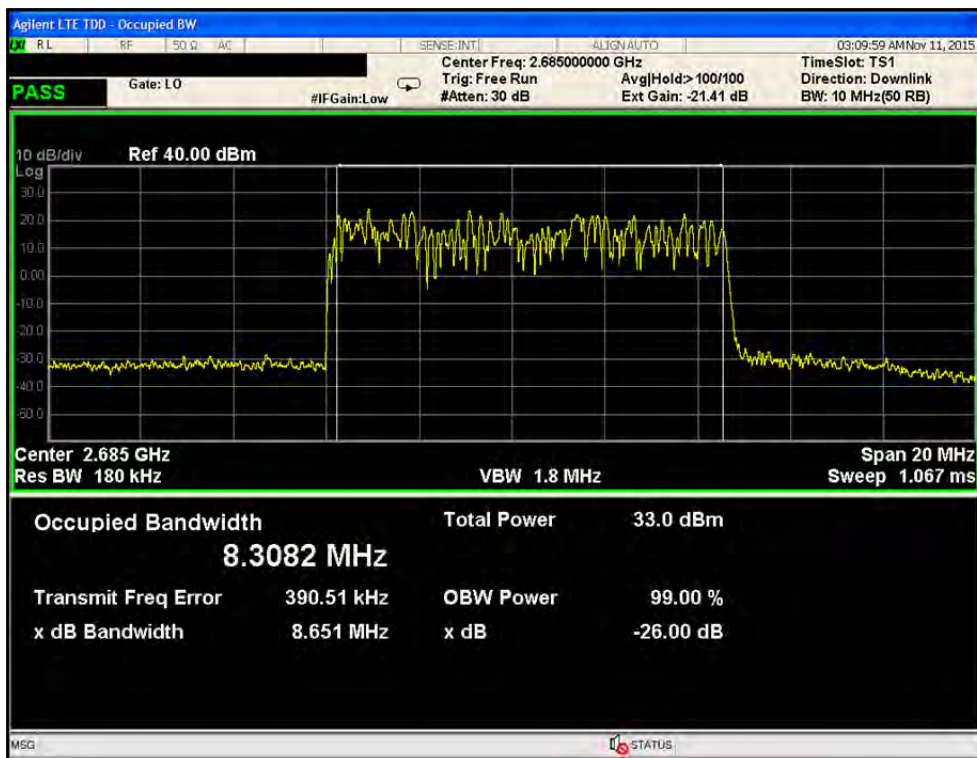
•Port1 / LTE 10M / 2501.0 MHz / 64QAM



•Port1 / LTE 10M / 2593.0 MHz / 64QAM

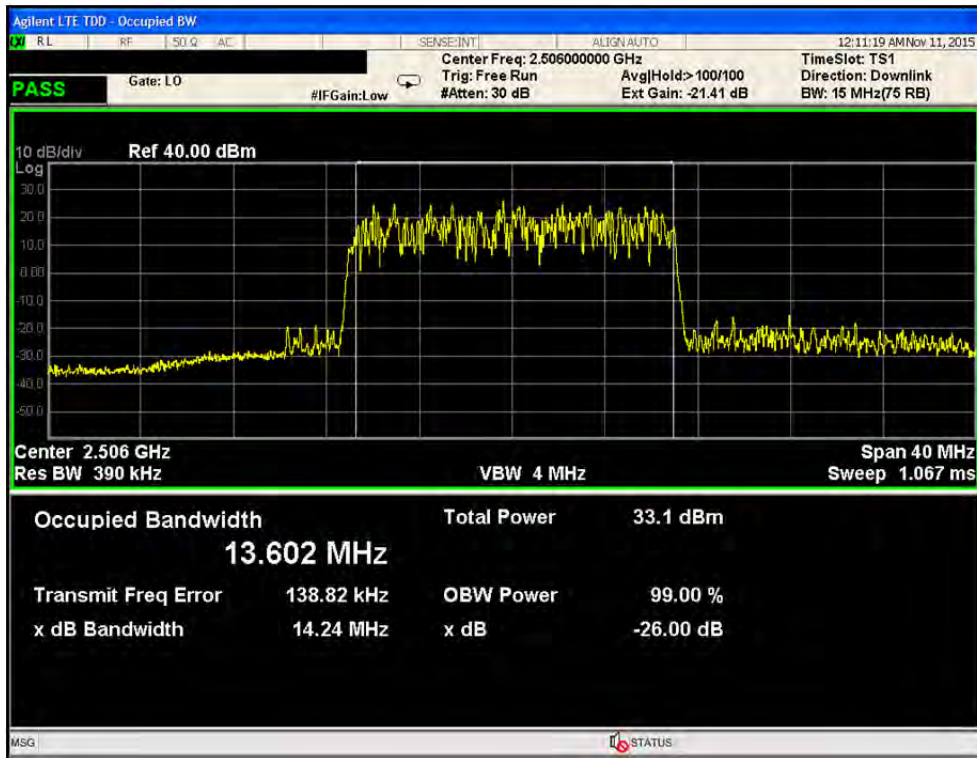


•Port1 / LTE 10M / 2685.0 MHz / 64QAM

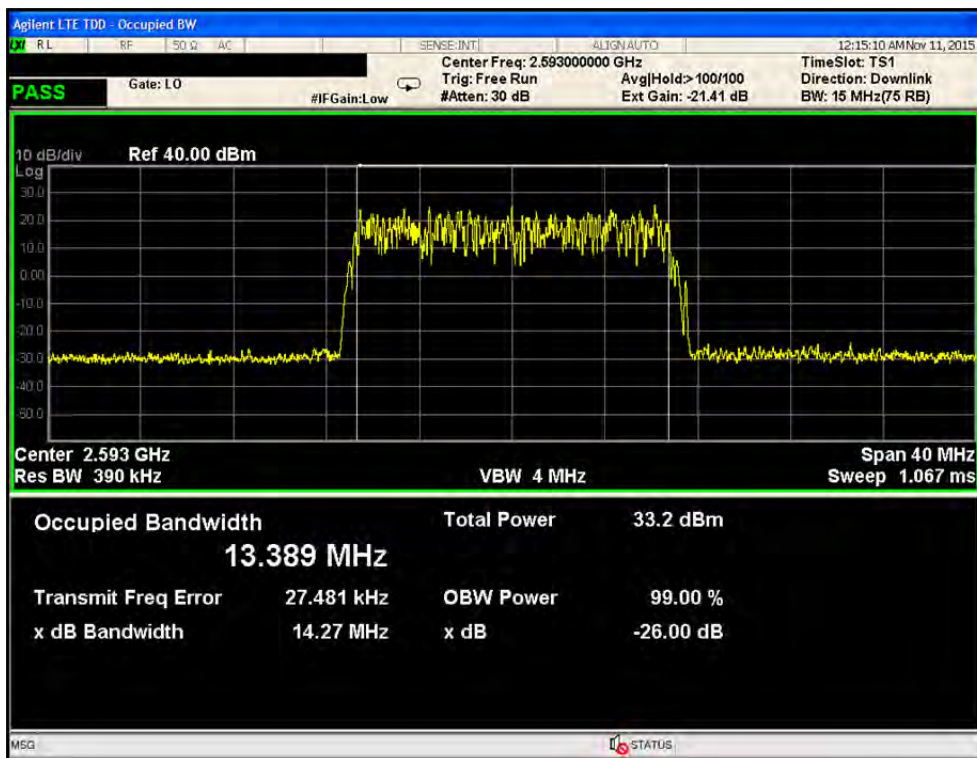




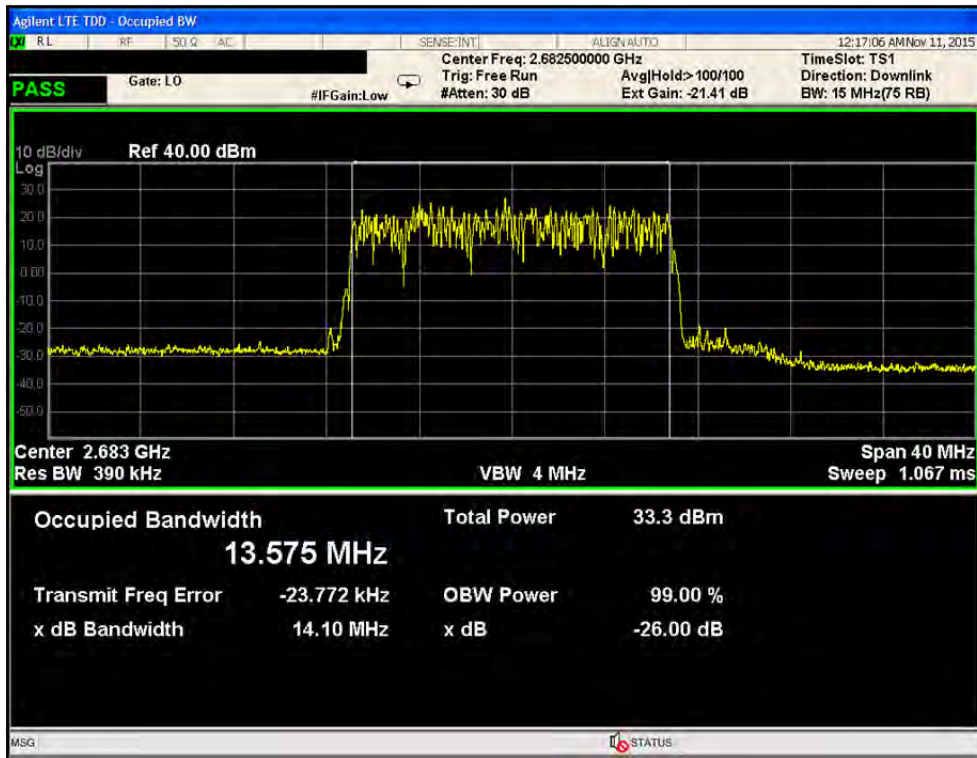
•Port1 / LTE 15M / 2503.5 MHz / QPSK



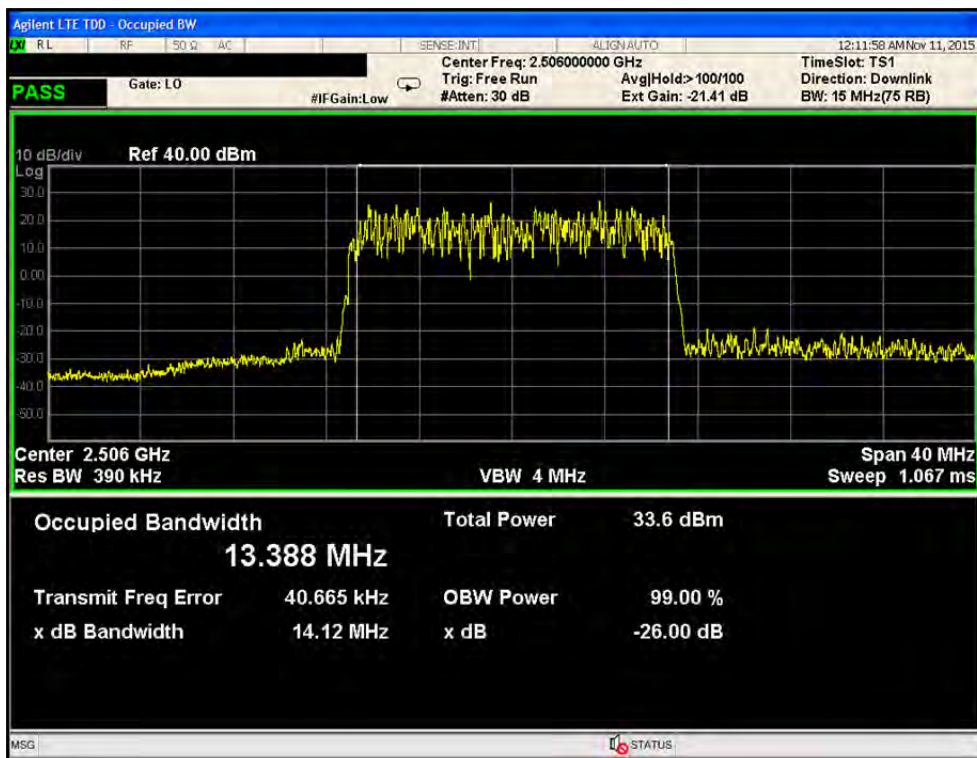
•Port1 / LTE 15M / 2593.0 MHz / QPSK



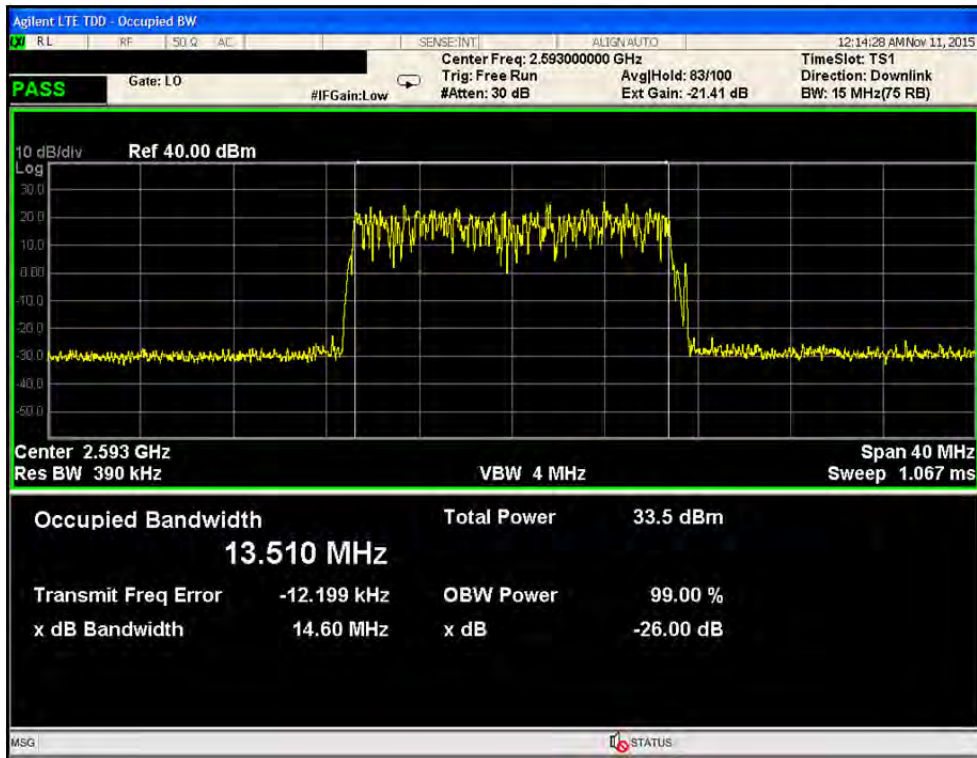
•Port1 / LTE 15M / 2682.5 MHz / QPSK



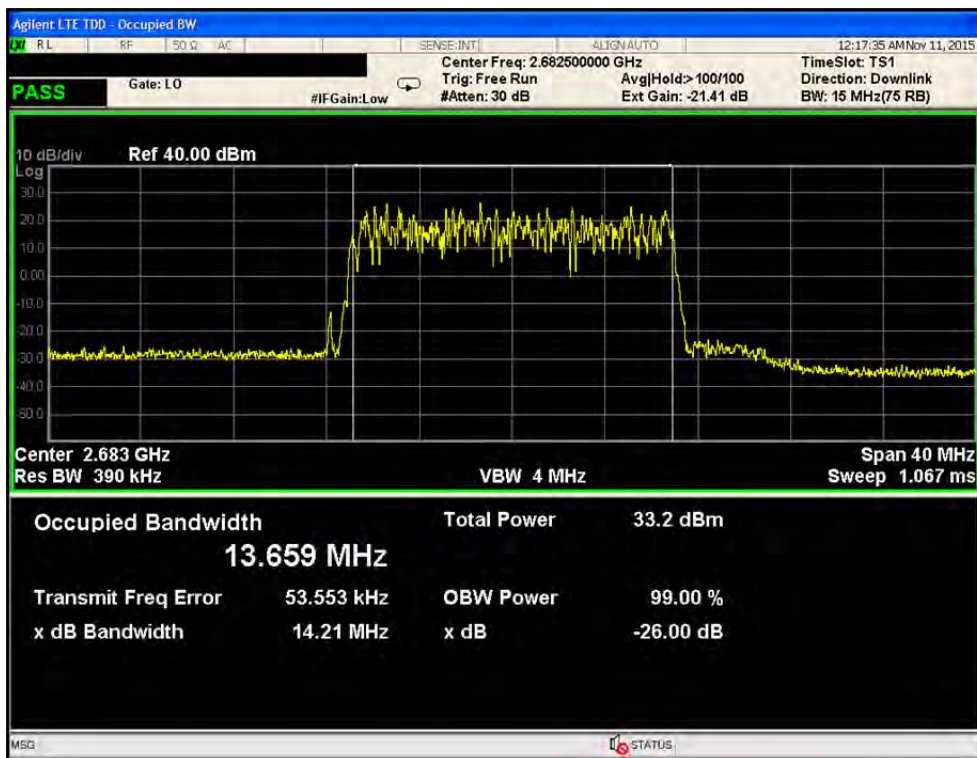
•Port1 / LTE 15M / 2503.5 MHz / 16QAM



•Port1 / LTE 15M / 2593.0 MHz / 16QAM

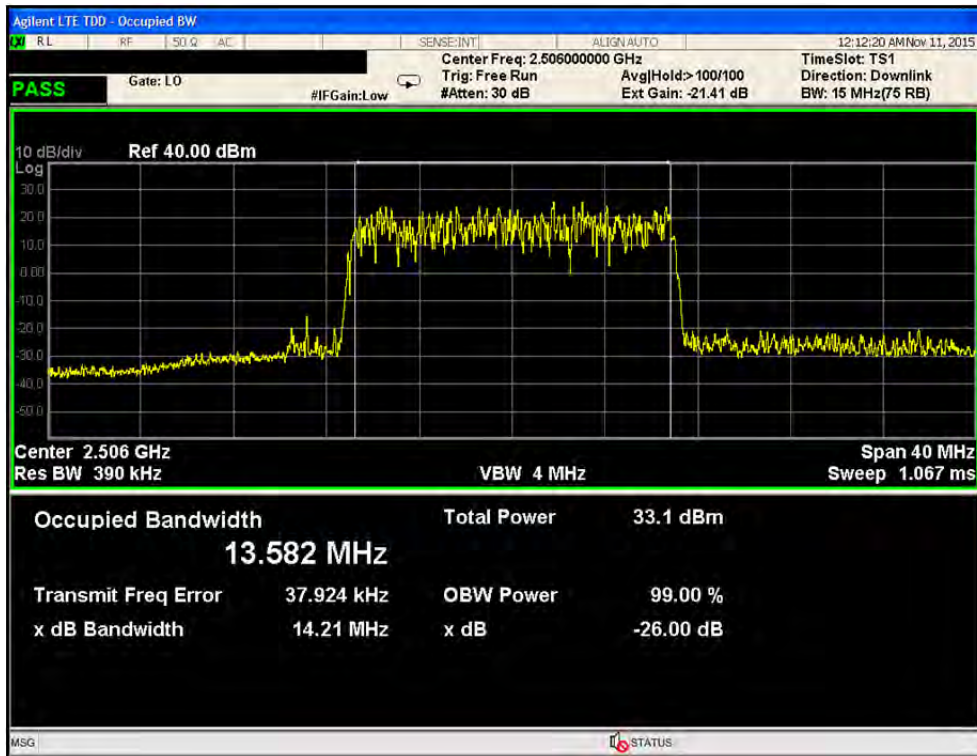


•Port1 / LTE 15M / 2682.5 MHz / 16QAM

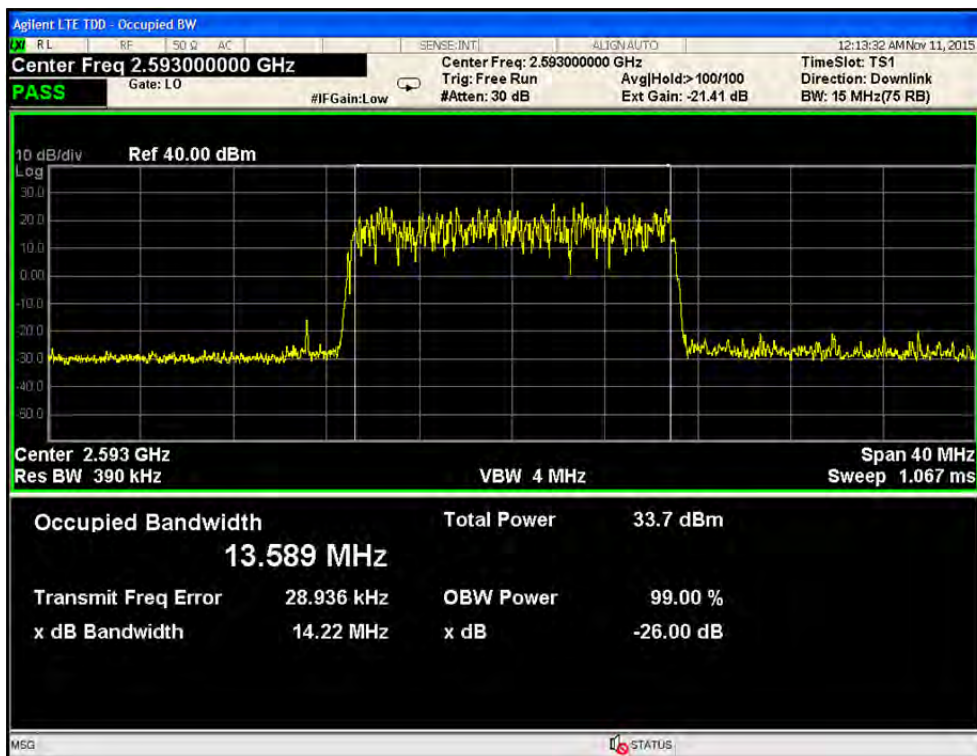




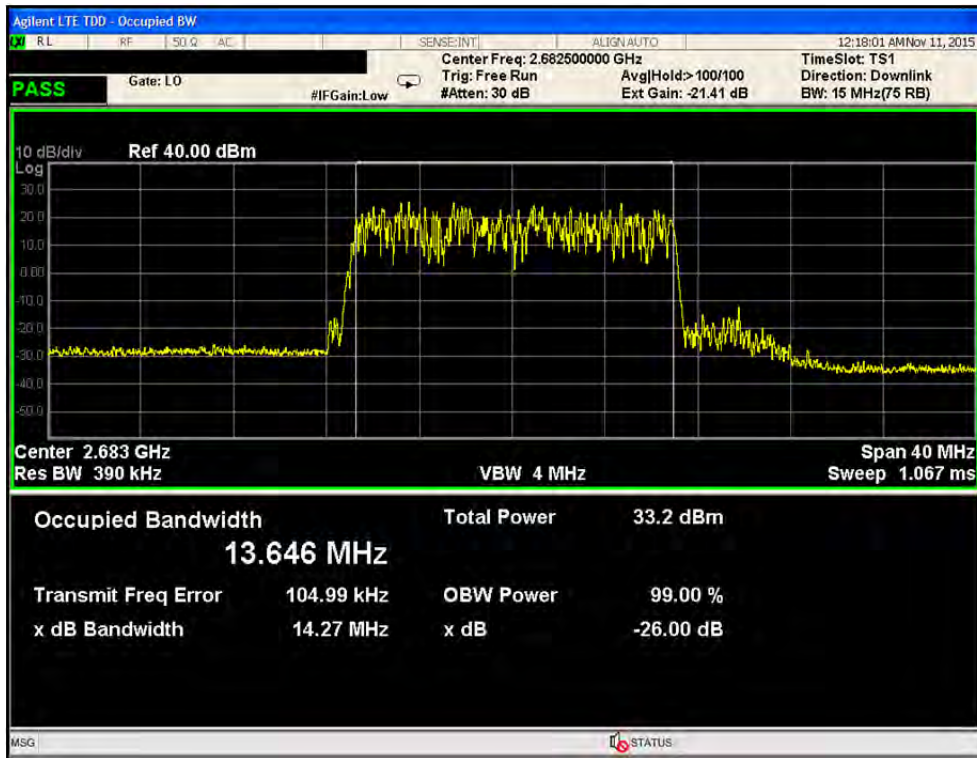
•Port1 / LTE 15M / 2503.5 MHz / 64QAM



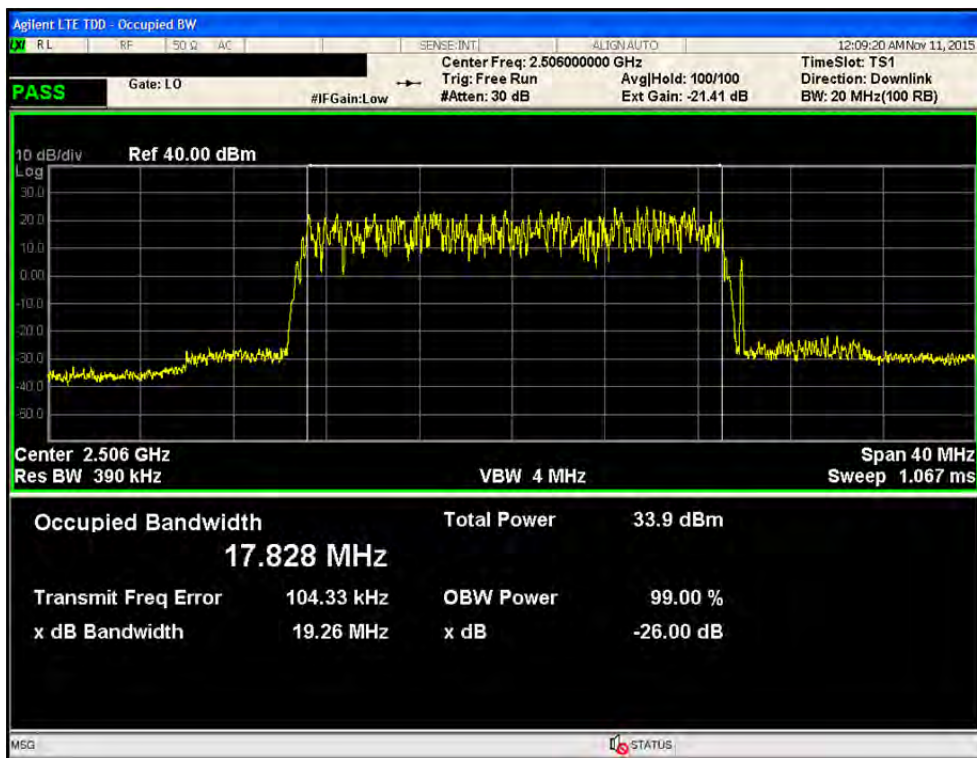
•Port1 / LTE 15M / 2593.0 MHz / 64QAM



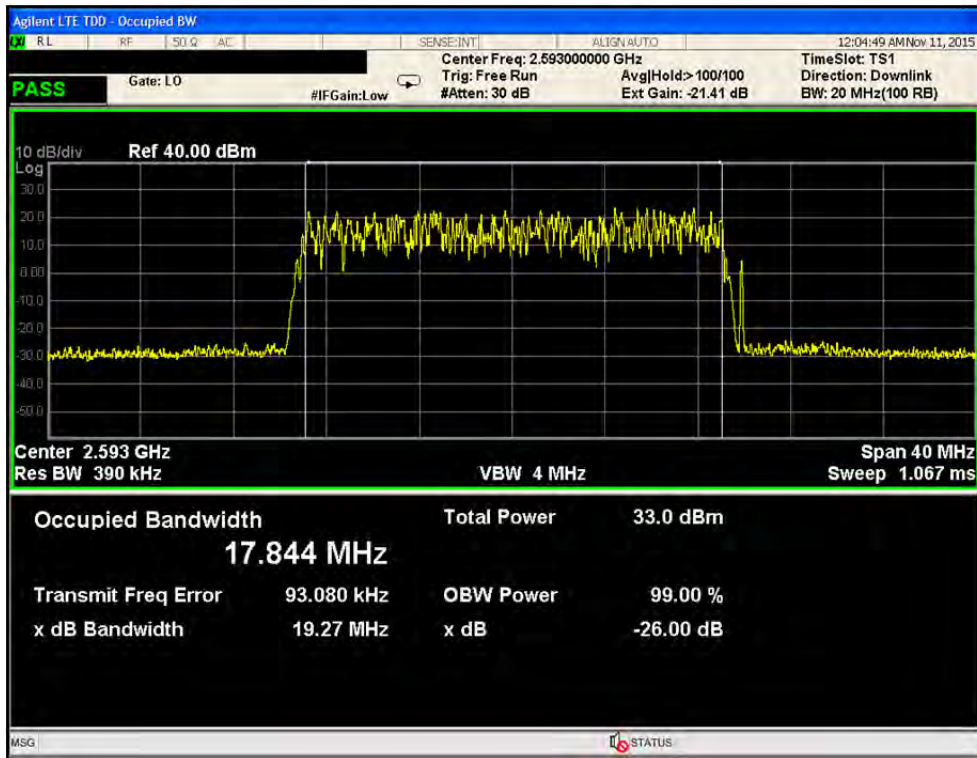
•Port1 / LTE 15M / 2682.5 MHz / 64QAM



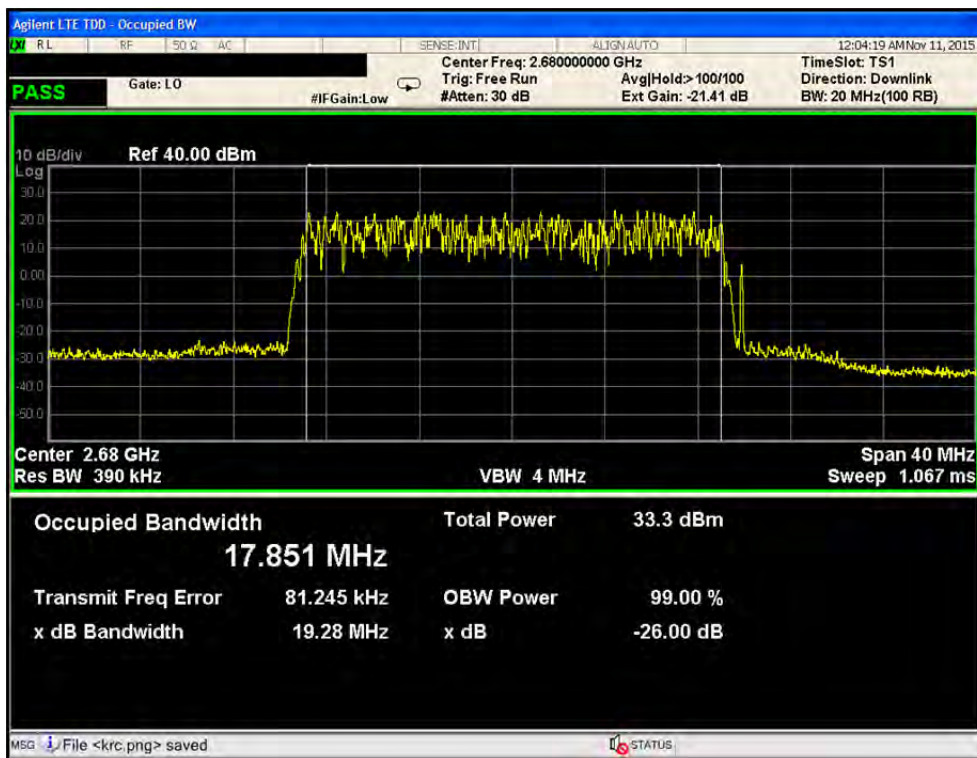
•Port1 / LTE 20M / 2506.0 MHz / QPSK



•Port1 / LTE 20M / 2593.0 MHz / QPSK

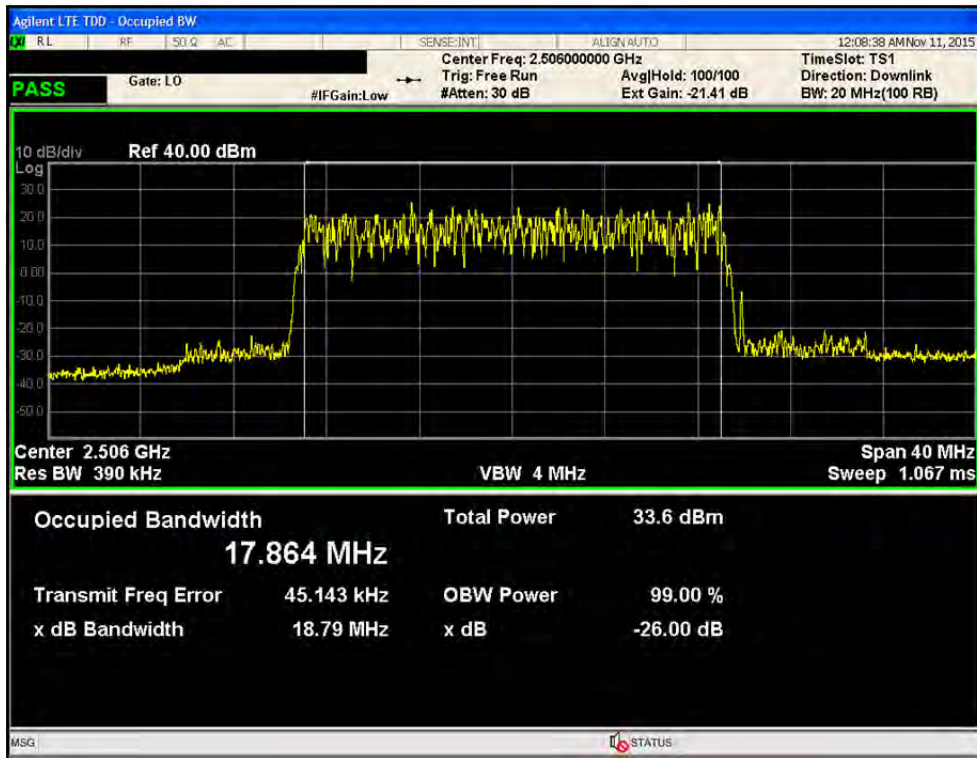


•Port1 / LTE 20M / 2680.0 MHz / QPSK

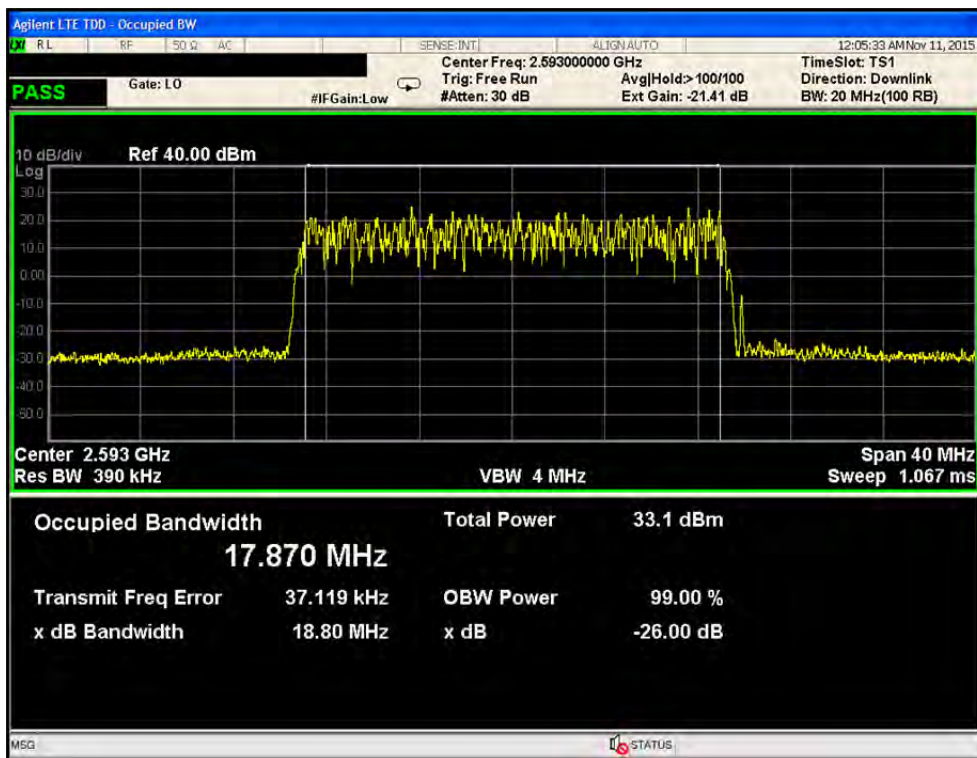




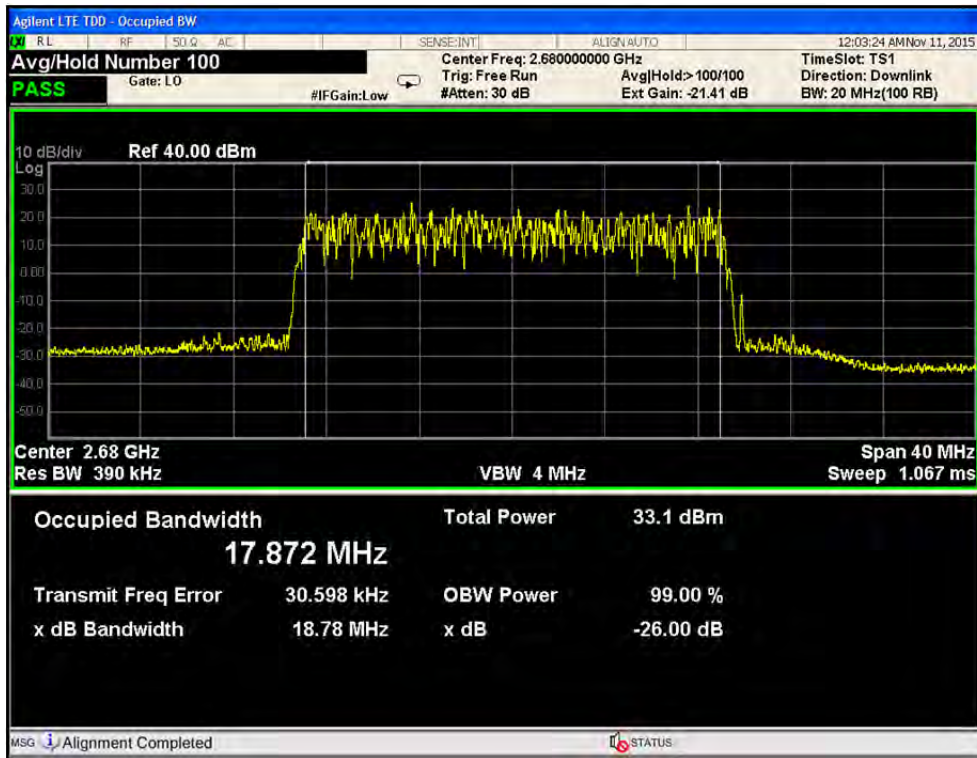
•Port1 / LTE 20M / 2506.0 MHz / 16QAM



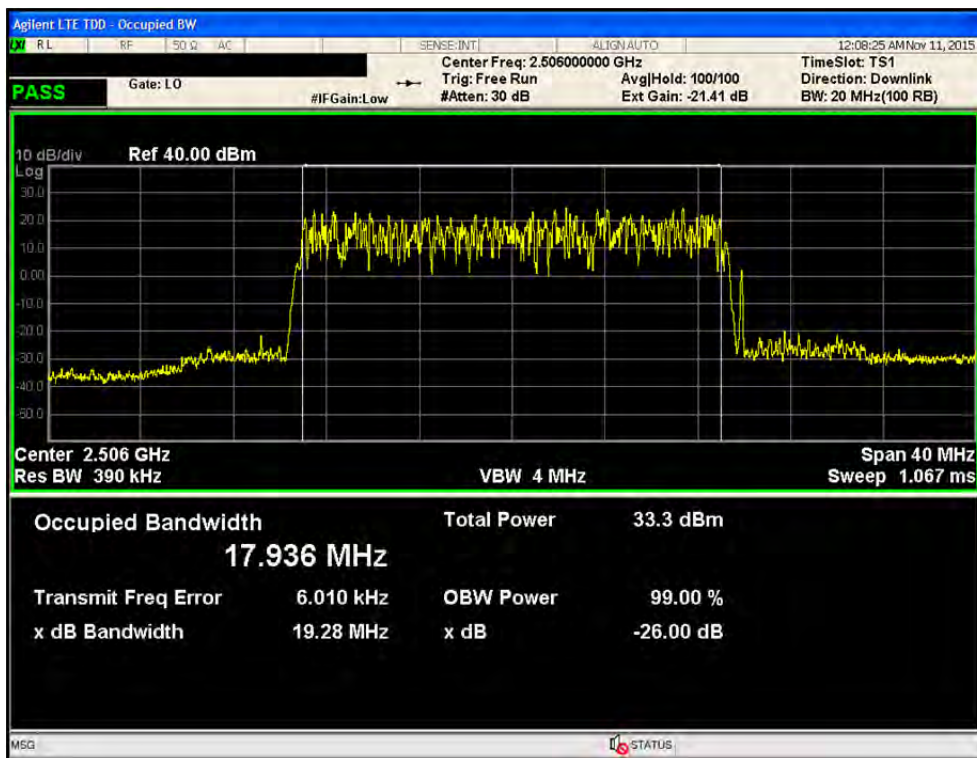
•Port1 / LTE 20M / 2593.0 MHz / 16QAM



•Port1 / LTE 20M / 2680.0 MHz / 16QAM

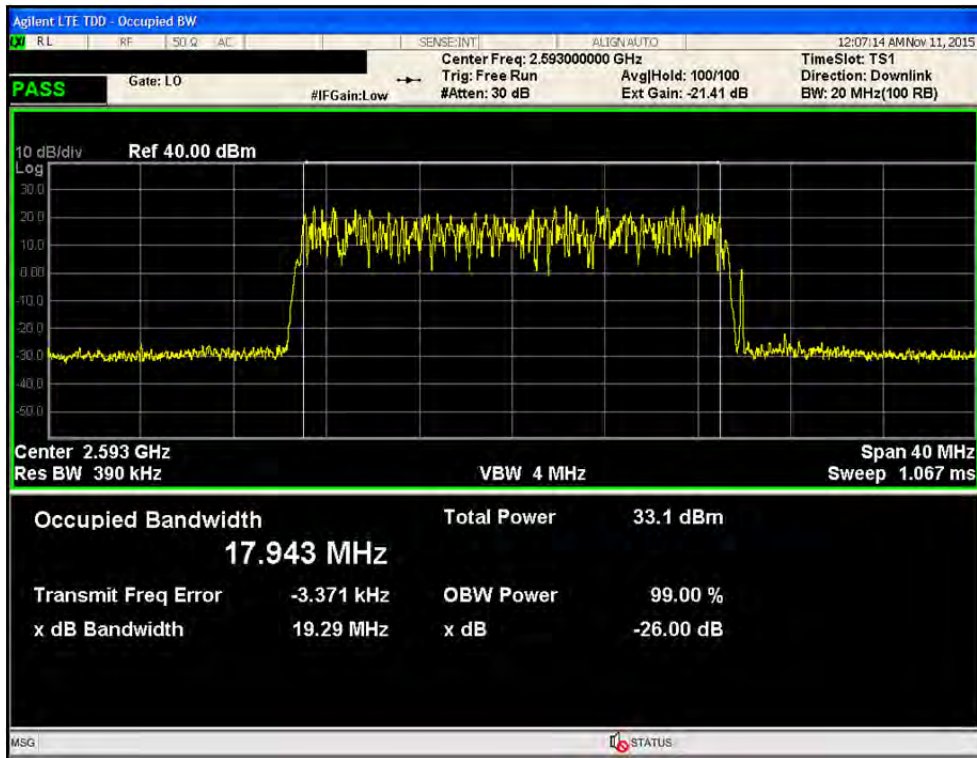


•Port1 / LTE 20M / 2506.0 MHz / 64QAM

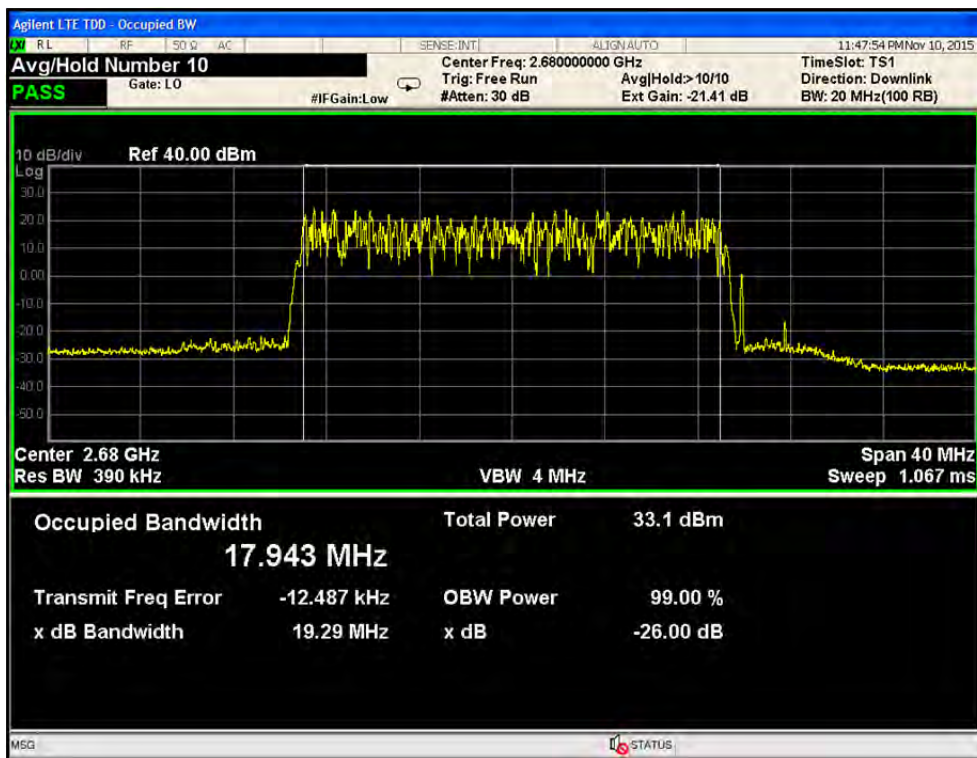




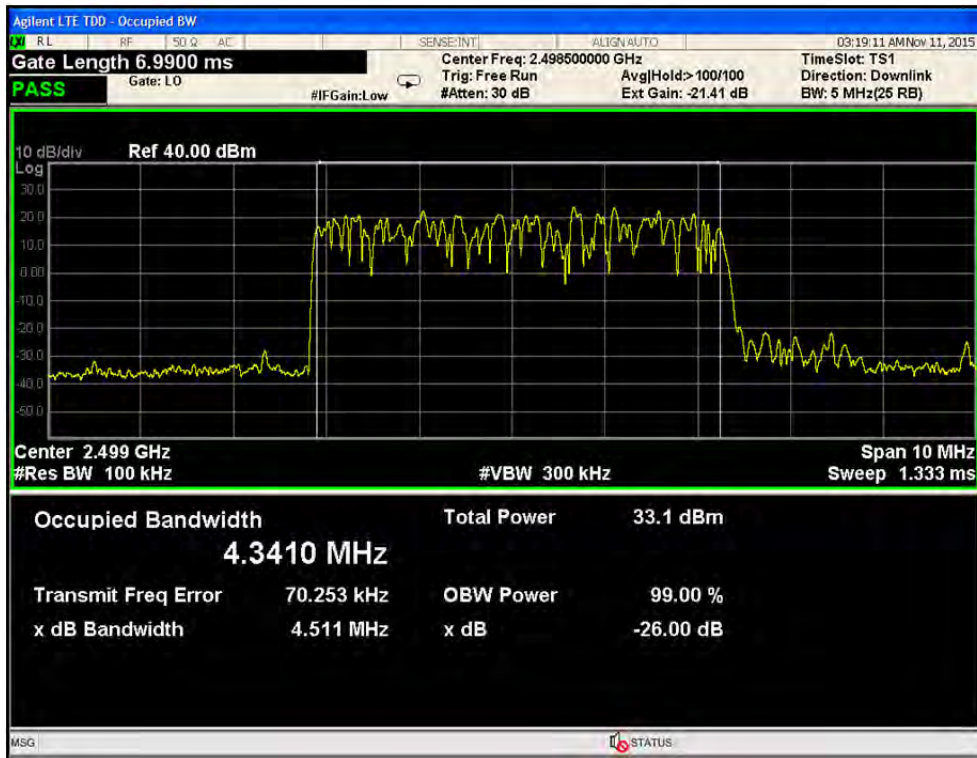
•Port1 / LTE 20M / 2593.0 MHz / 64QAM



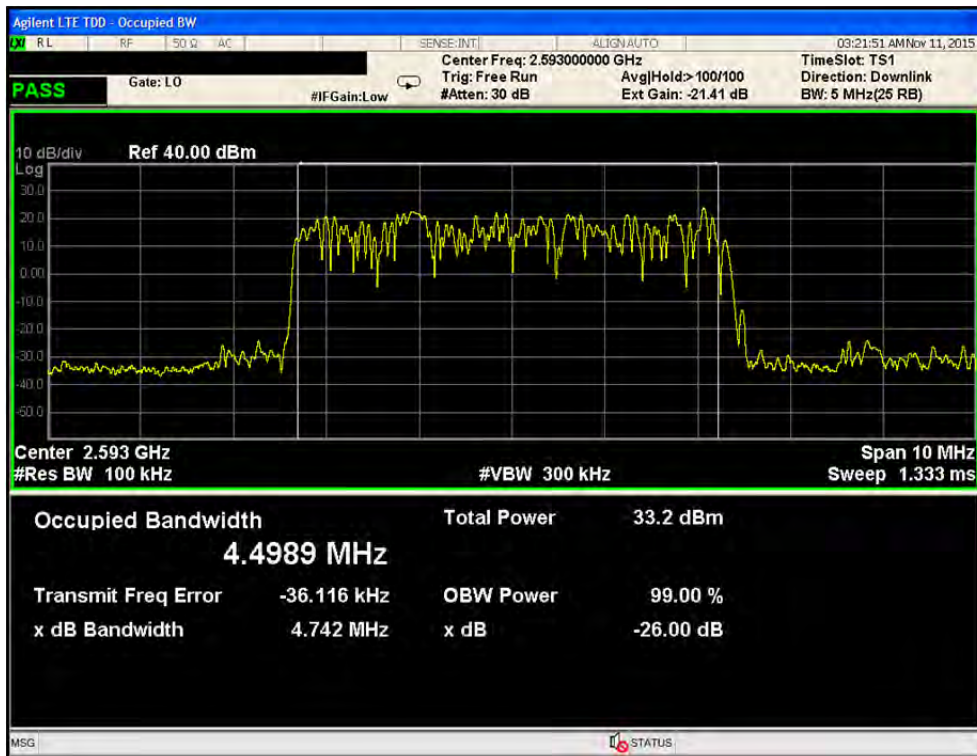
•Port1 / LTE 20M / 2680.0 MHz / 64QAM



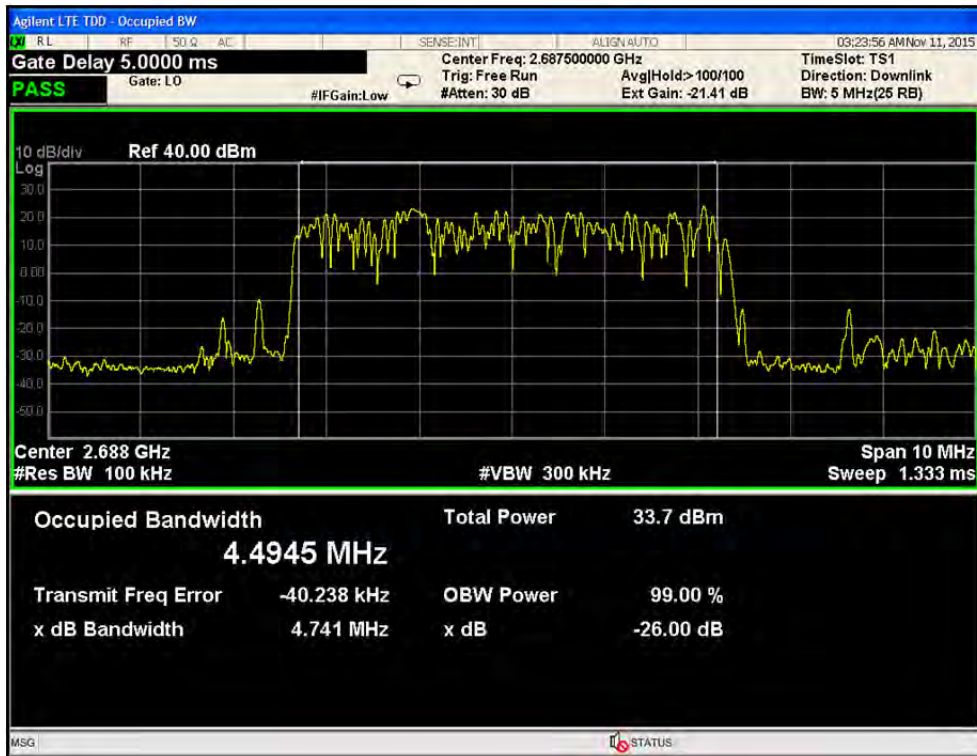
•Port2 / LTE 5M / 2498.5 MHz / QPSK



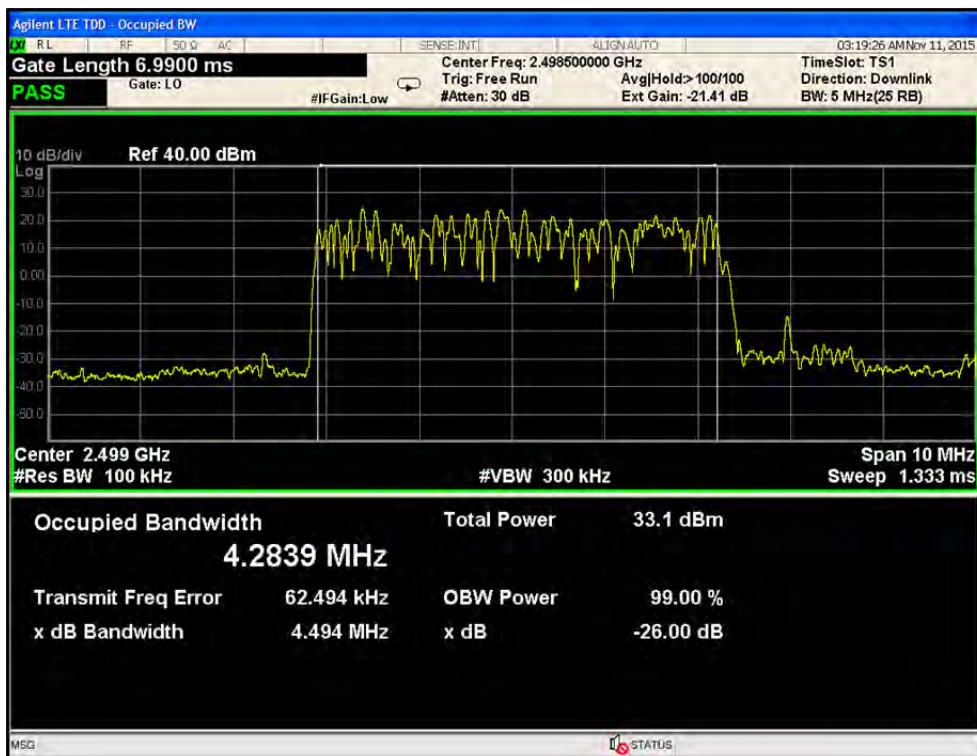
•Port2 / LTE 5M / 2593.0 MHz / QPSK



•Port2 / LTE 5M / 2687.5 MHz / QPSK

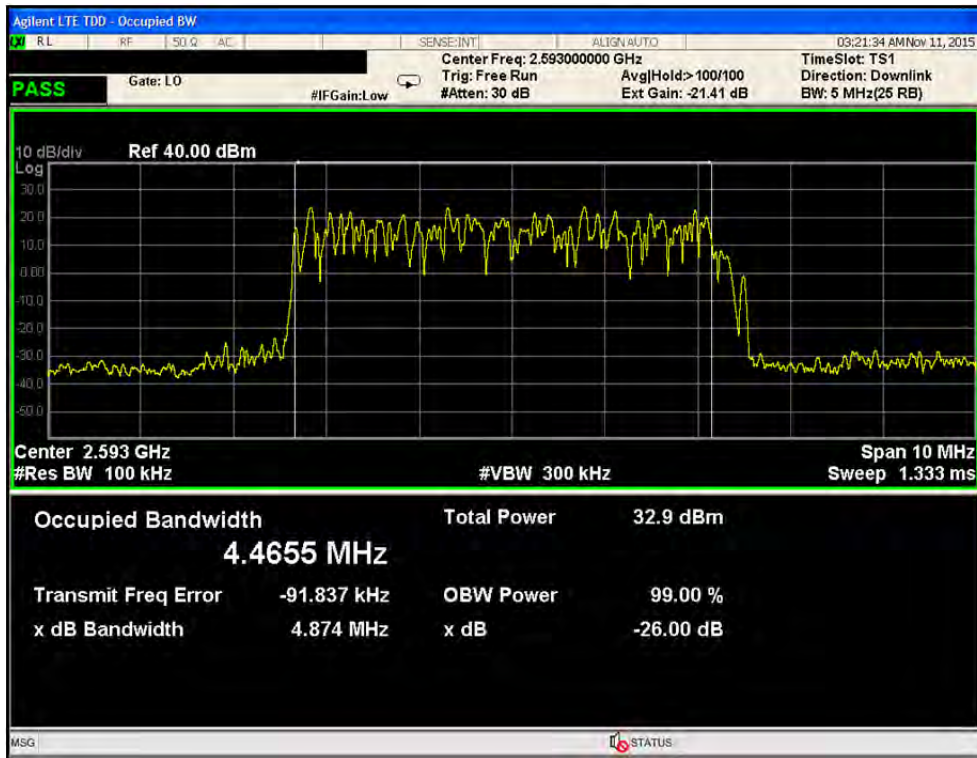


•Port2 / LTE 5M / 2498.5 MHz / 16QAM

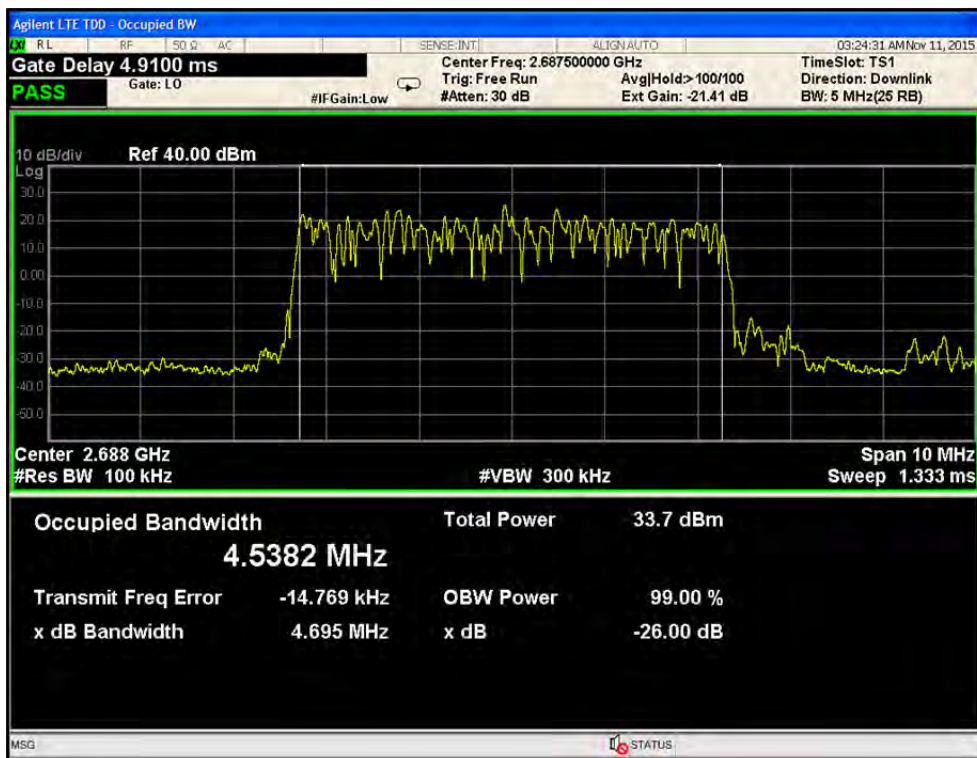




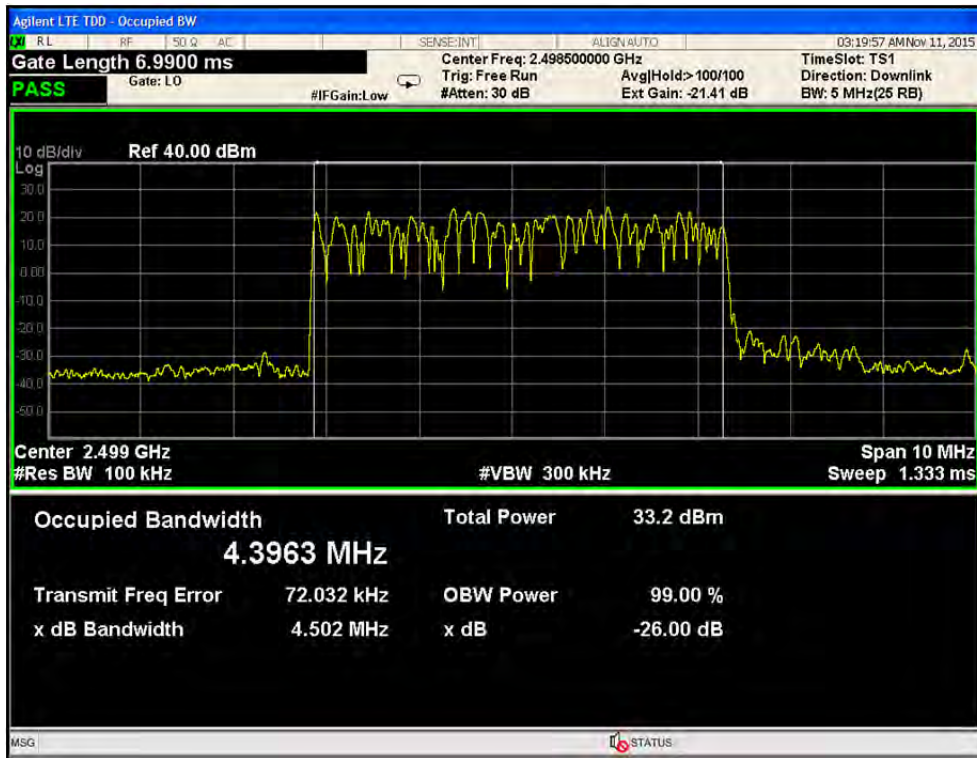
•Port2 / LTE 5M / 2593.0 MHz / 16QAM



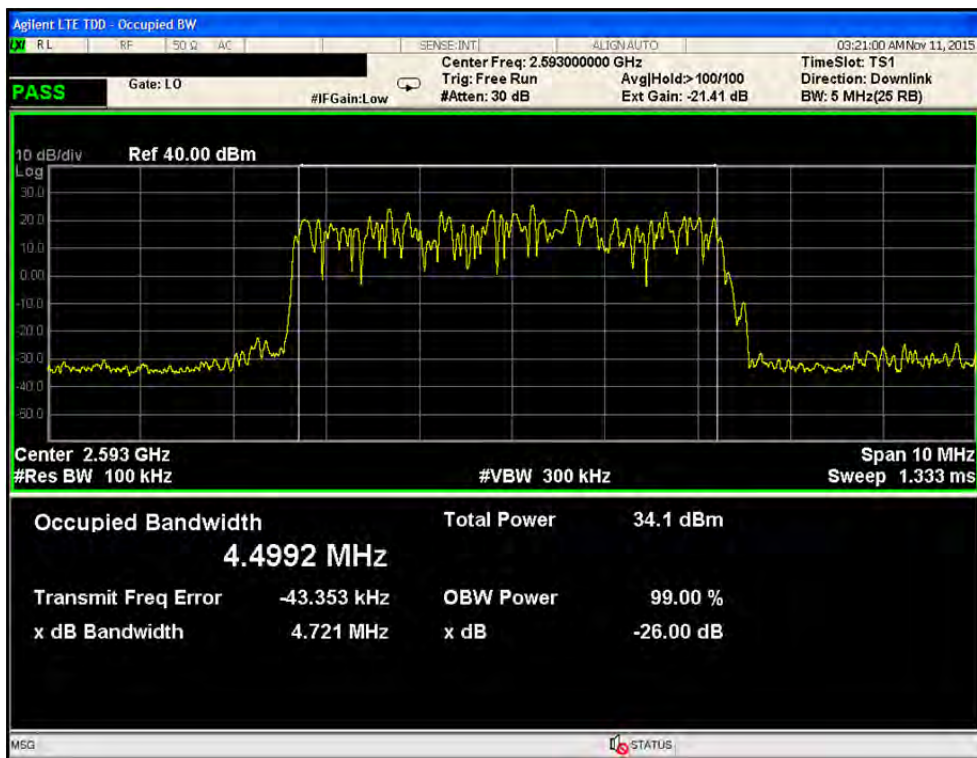
•Port2 / LTE 5M / 2687.5 MHz / 16QAM



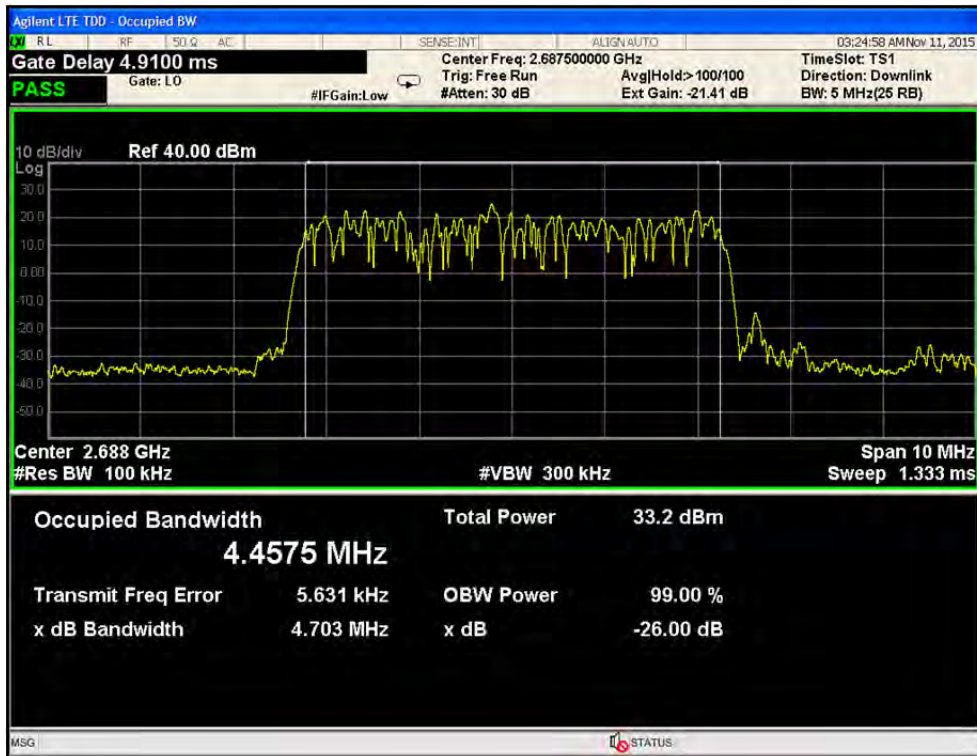
•Port2 / LTE 5M / 2498.5 MHz / 64QAM



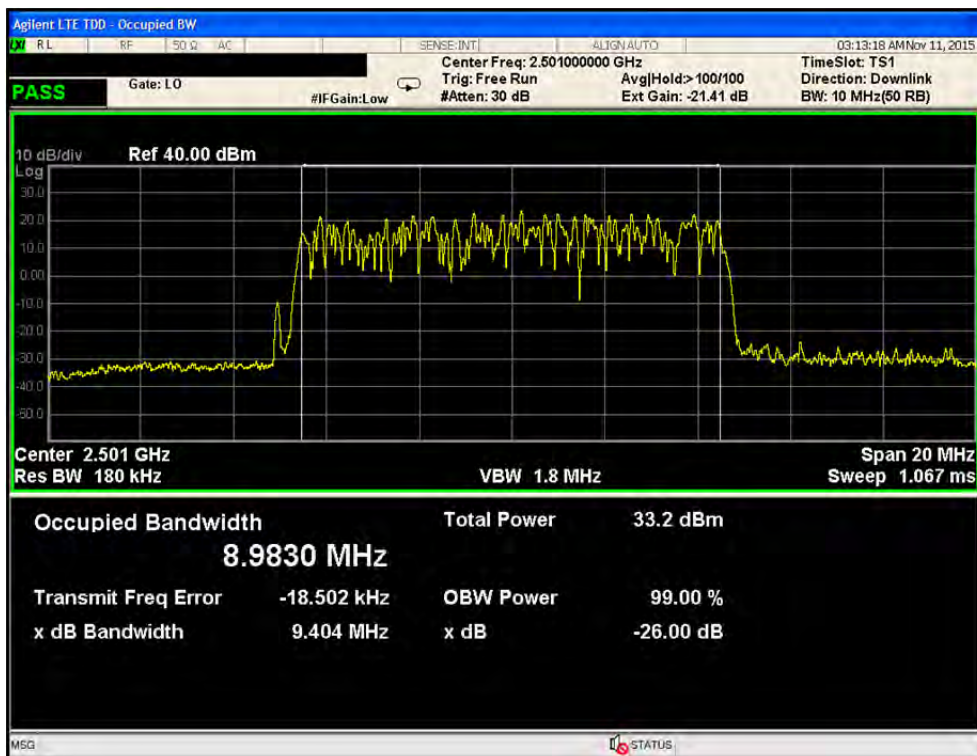
•Port2 / LTE 5M / 2593.0 MHz / 64QAM



•Port2 / LTE 5M / 2687.5 MHz / 64QAM

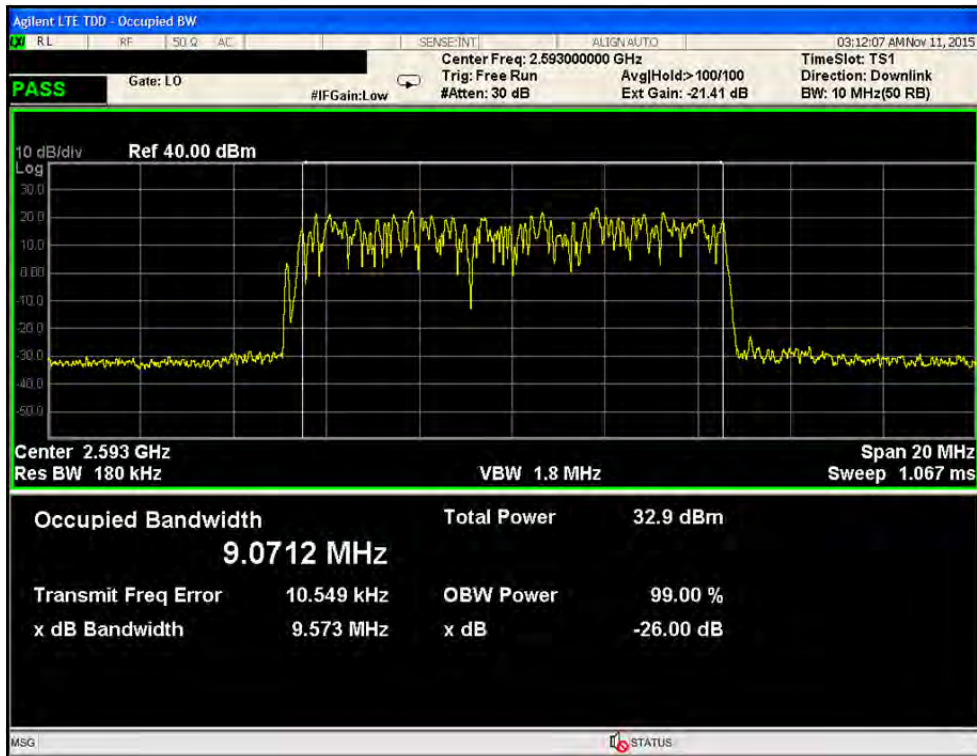


•Port2 / LTE 10M / 2501.0 MHz / QPSK

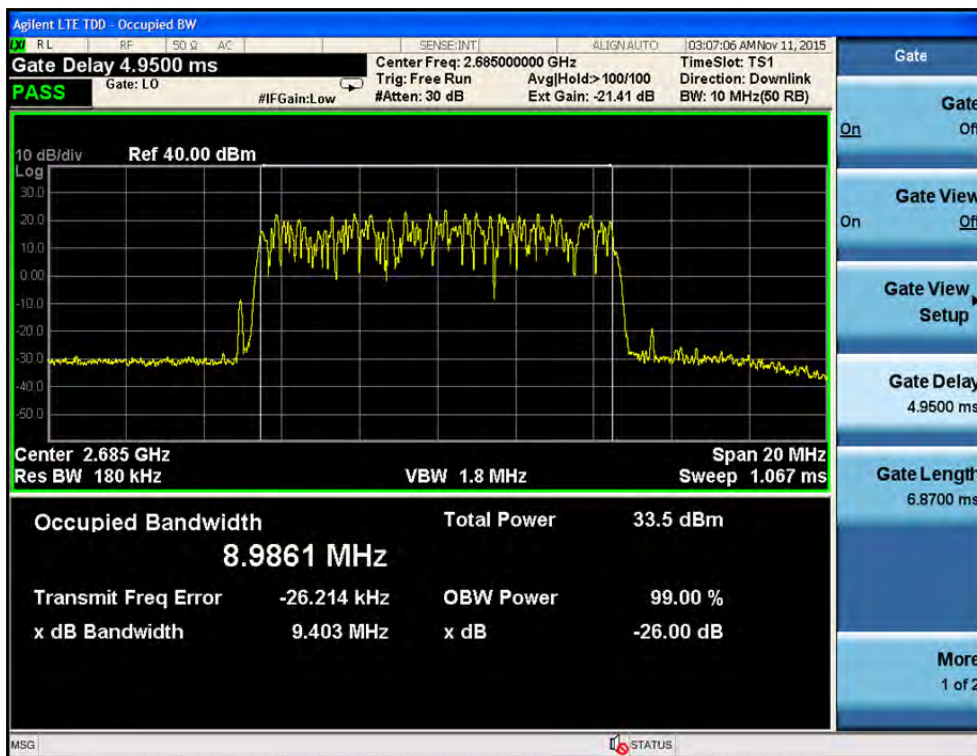




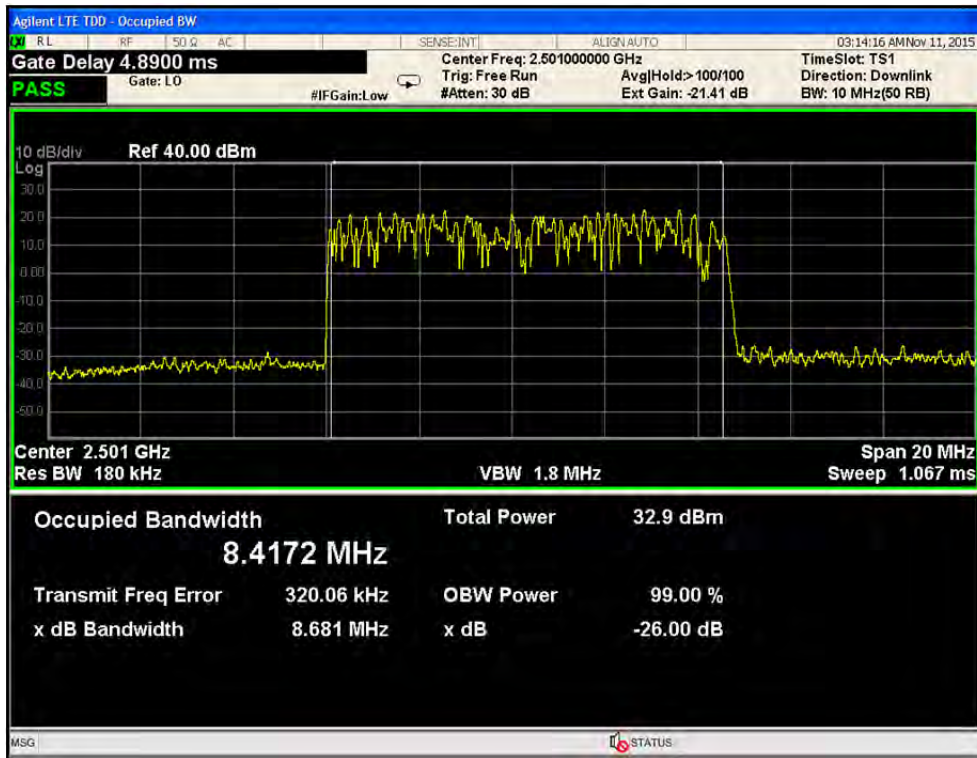
•Port2 / LTE 10M / 2593.0 MHz / QPSK



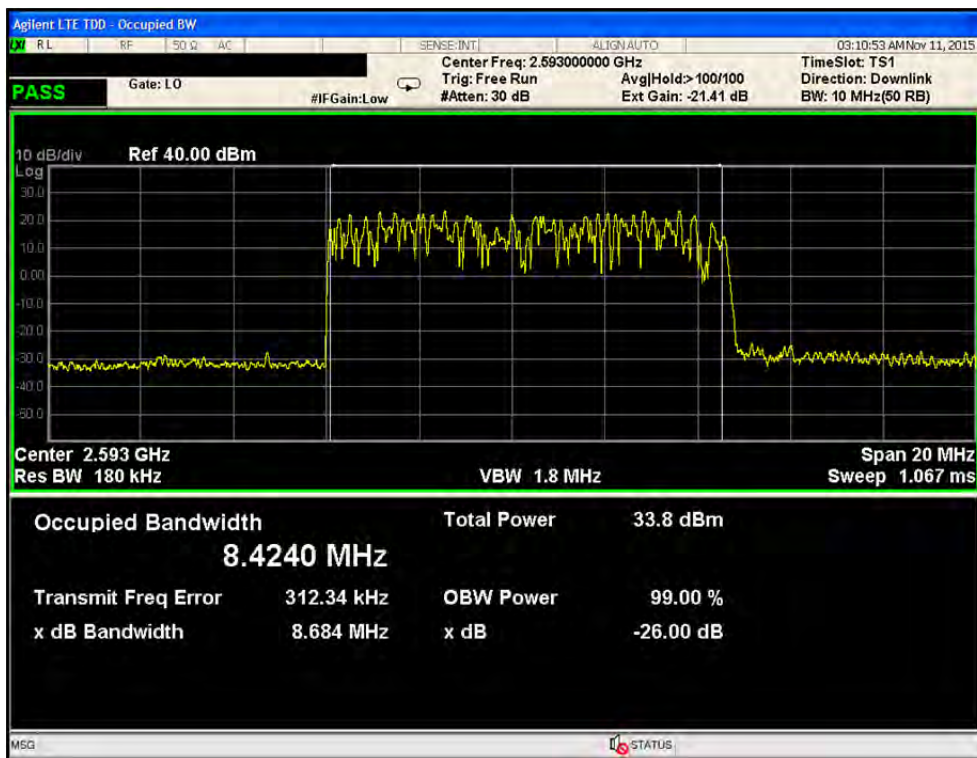
•Port2 / LTE 10M / 2685.0 MHz / QPSK



•Port2 / LTE 10M / 2501.0 MHz / 16QAM

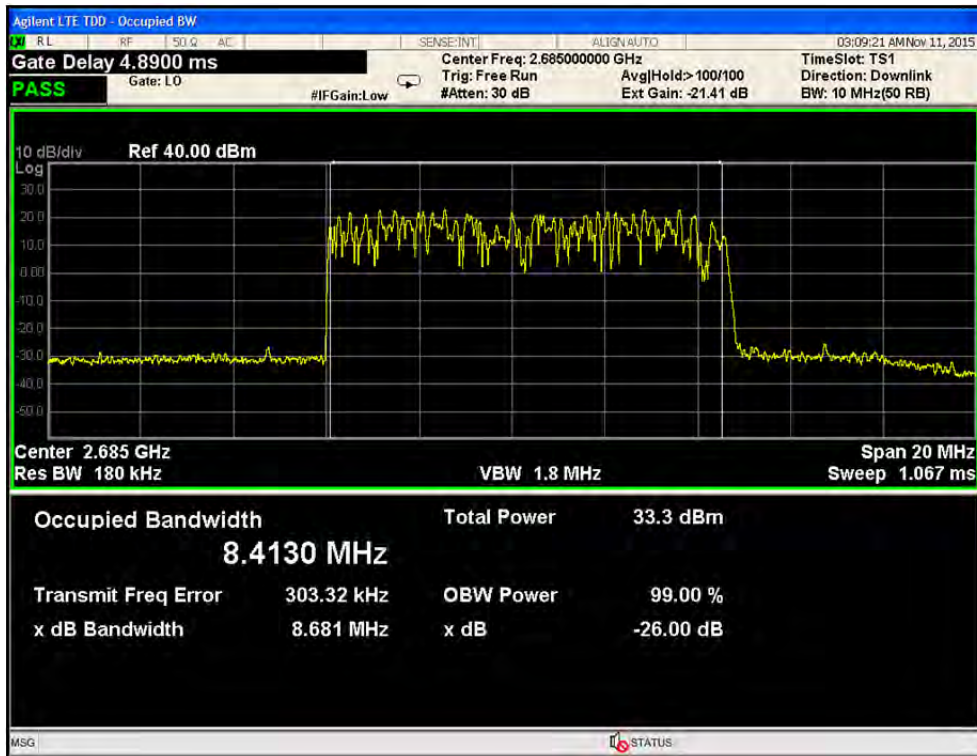


•Port2 / LTE 10M / 2593.0 MHz / 16QAM

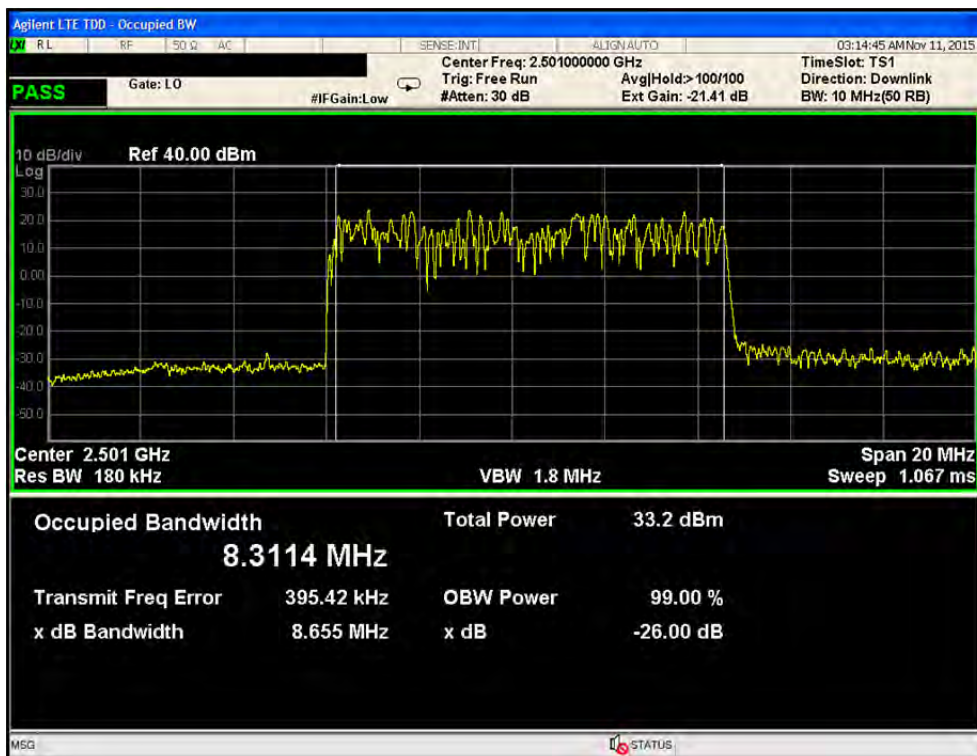




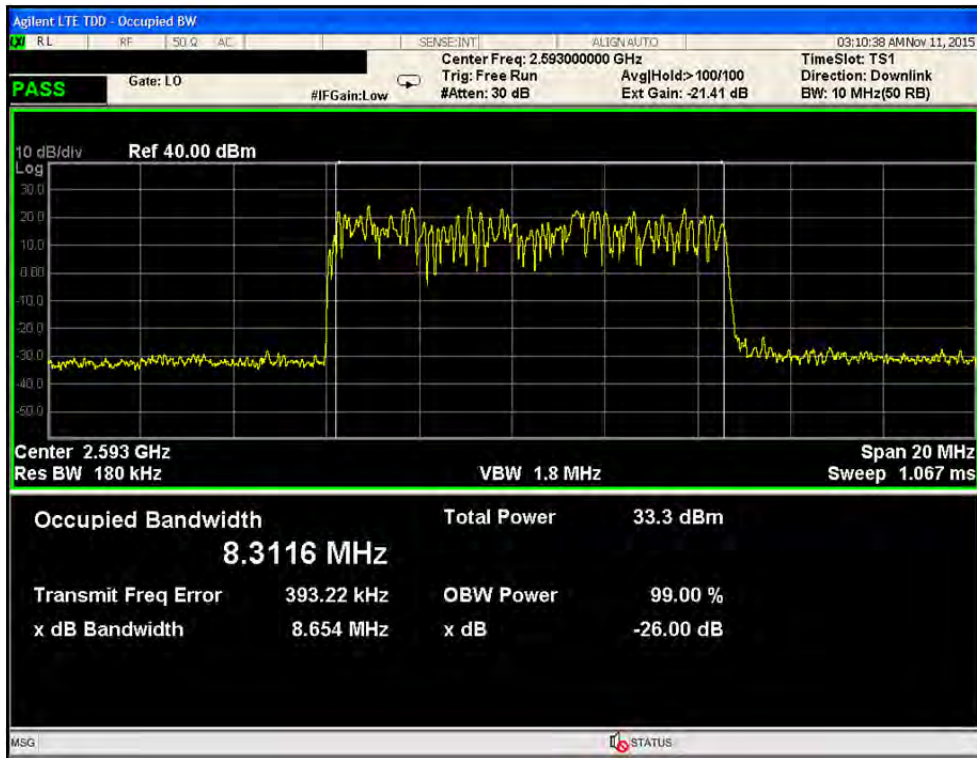
•Port2 / LTE 10M / 2685.0 MHz / 16QAM



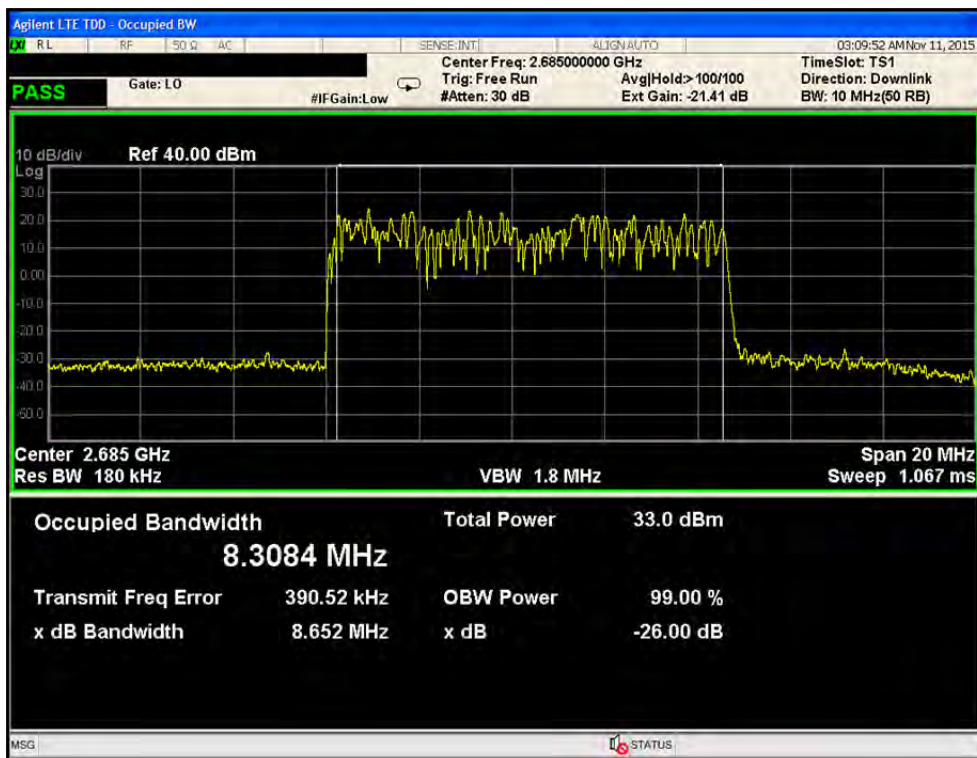
•Port2 / LTE 10M / 2501.0 MHz / 64QAM



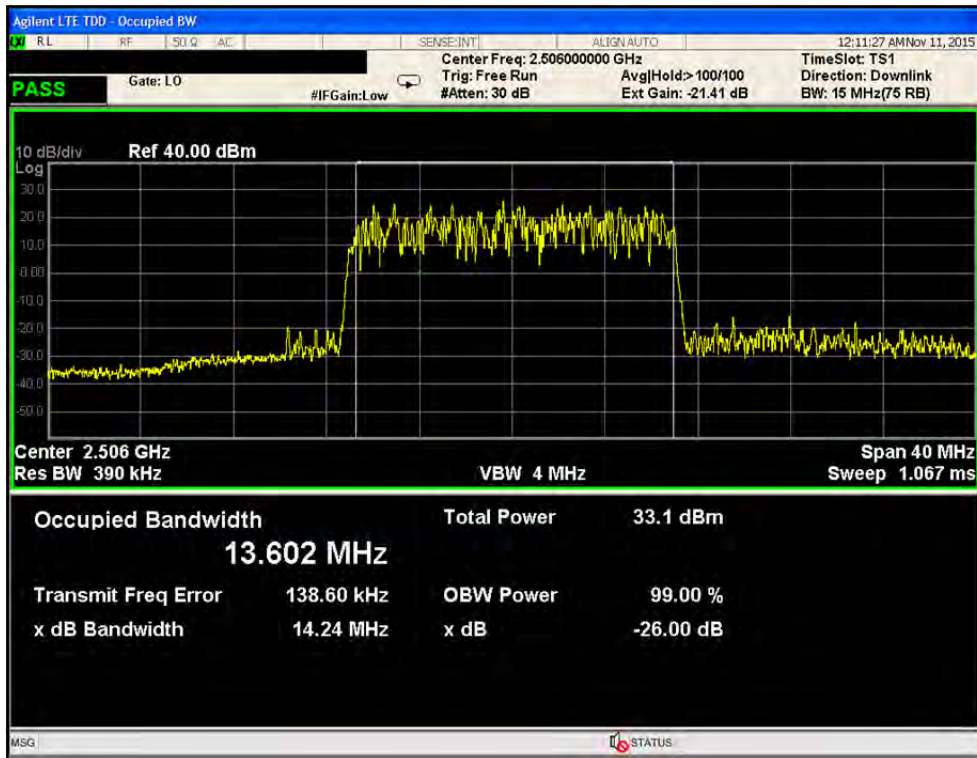
•Port2 / LTE 10M / 2593.0 MHz / 64QAM



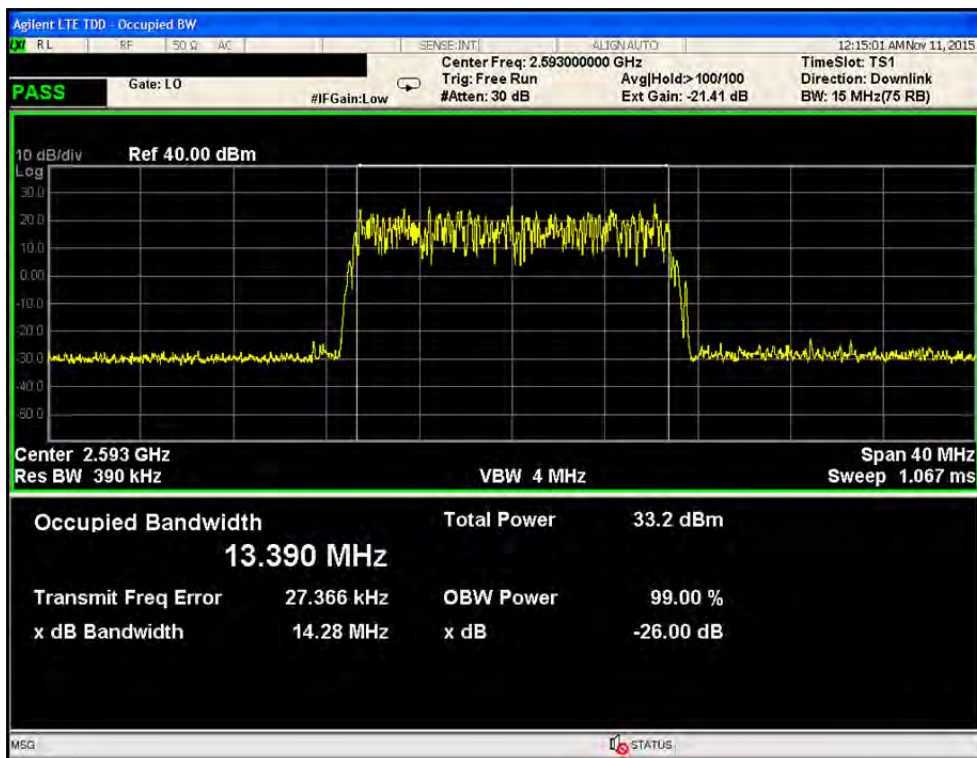
•Port2 / LTE 10M / 2685.0 MHz / 64QAM



•Port2 / LTE 15M / 2503.5 MHz / QPSK

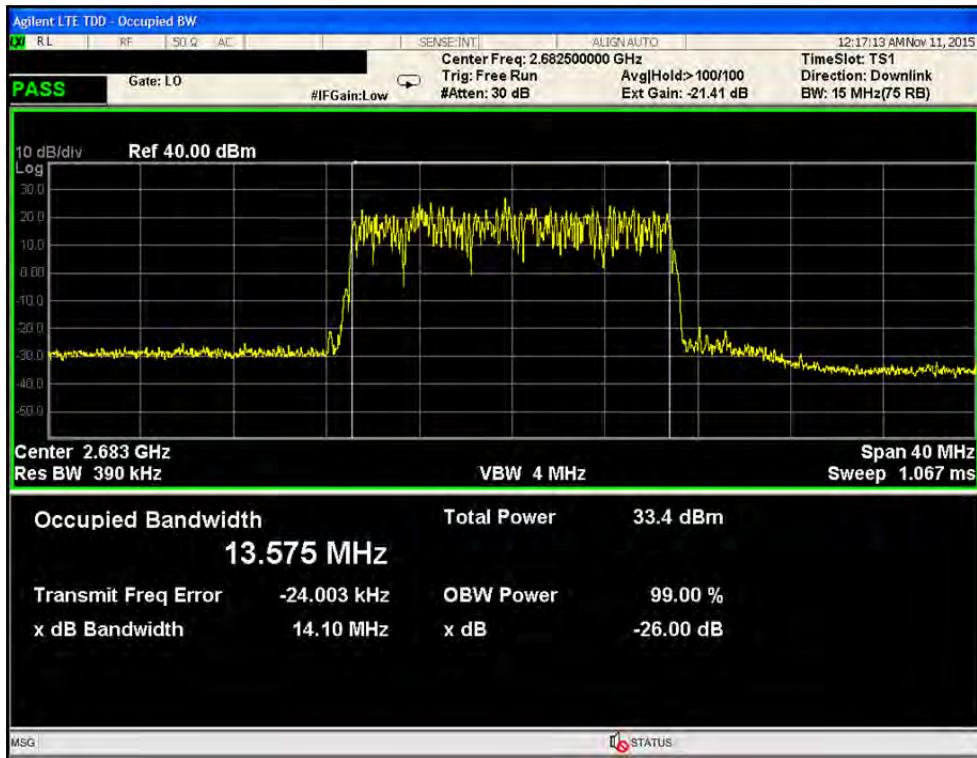


•Port2 / LTE 15M / 2593.0 MHz / QPSK

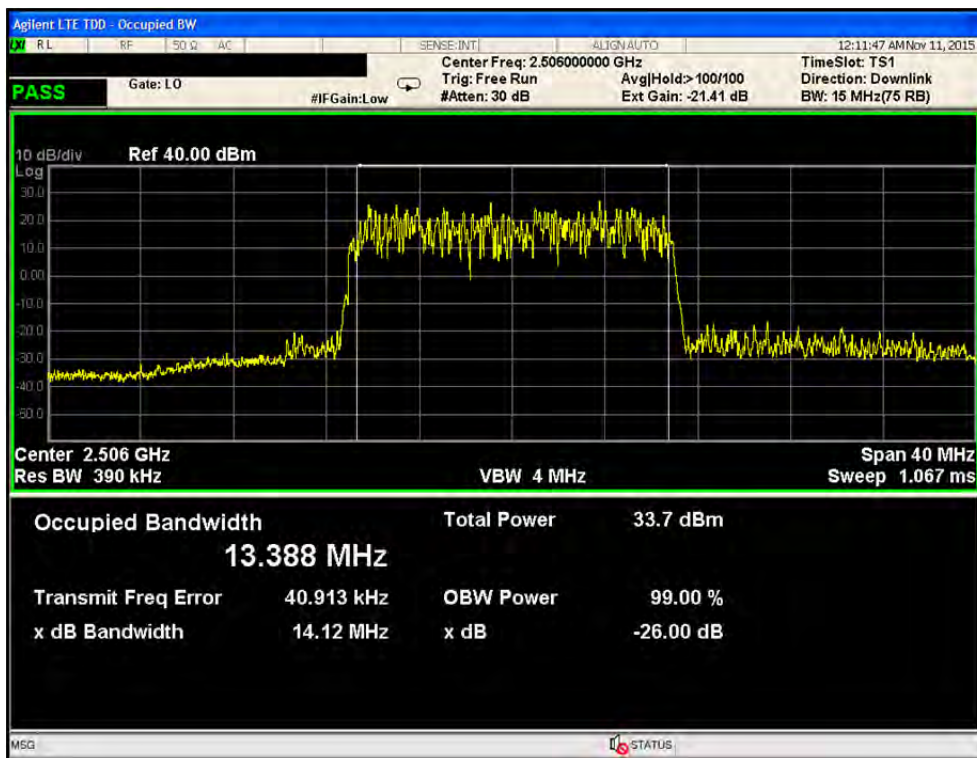




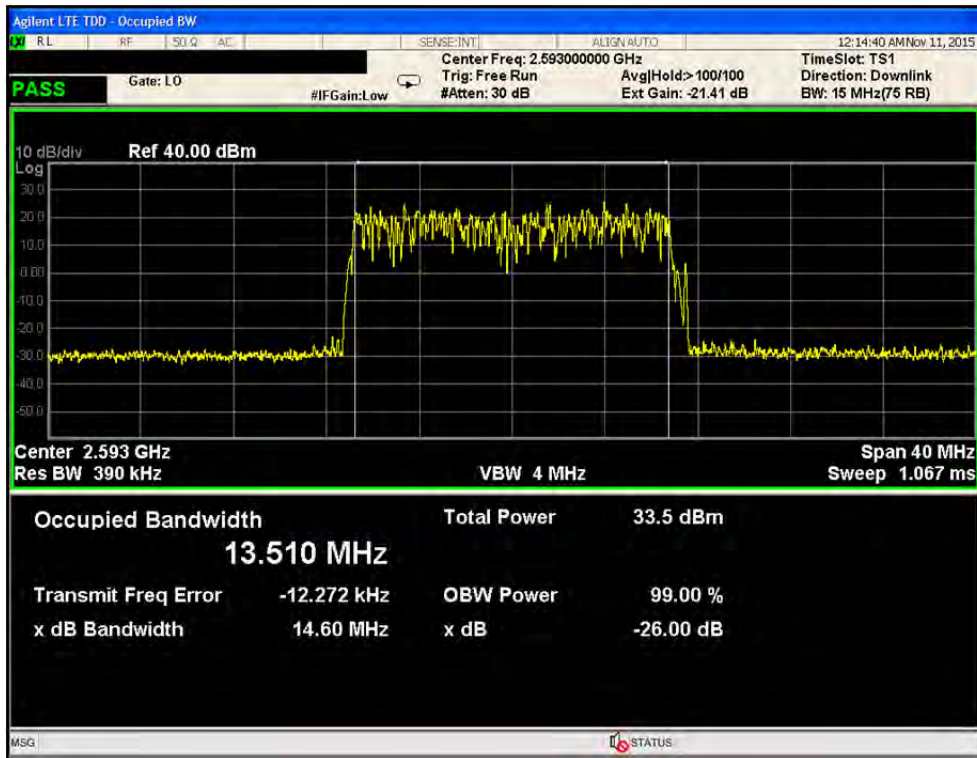
•Port2 / LTE 15M / 2682.5 MHz / QPSK



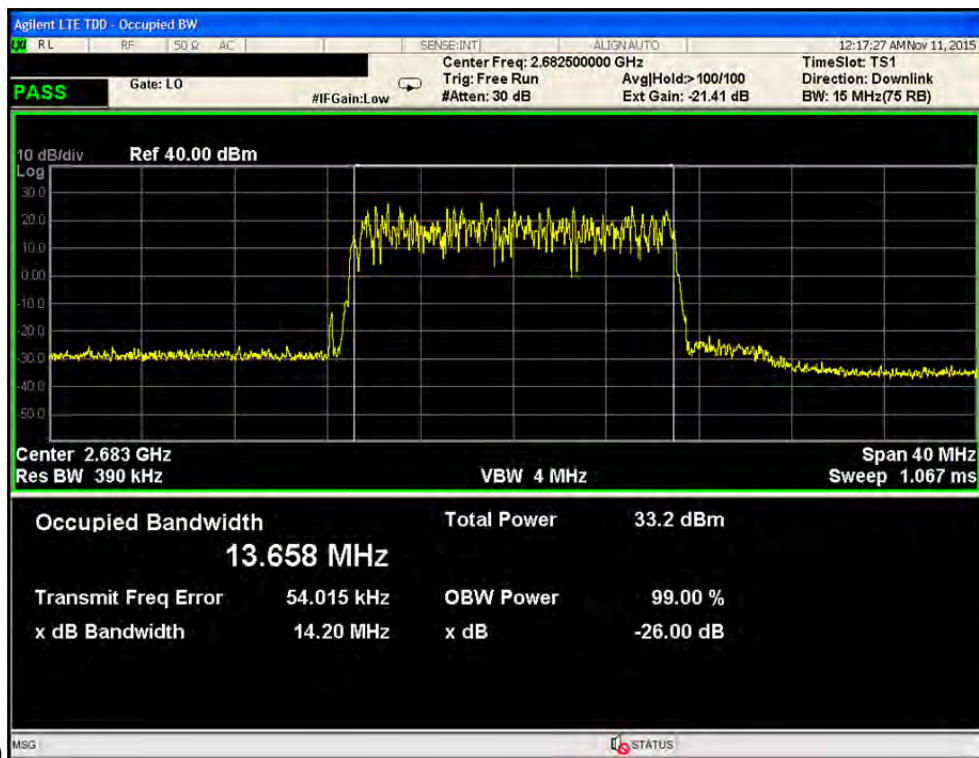
•Port2 / LTE 15M / 2503.5 MHz / 16QAM



•Port2 / LTE 15M / 2593.0 MHz / 16QAM

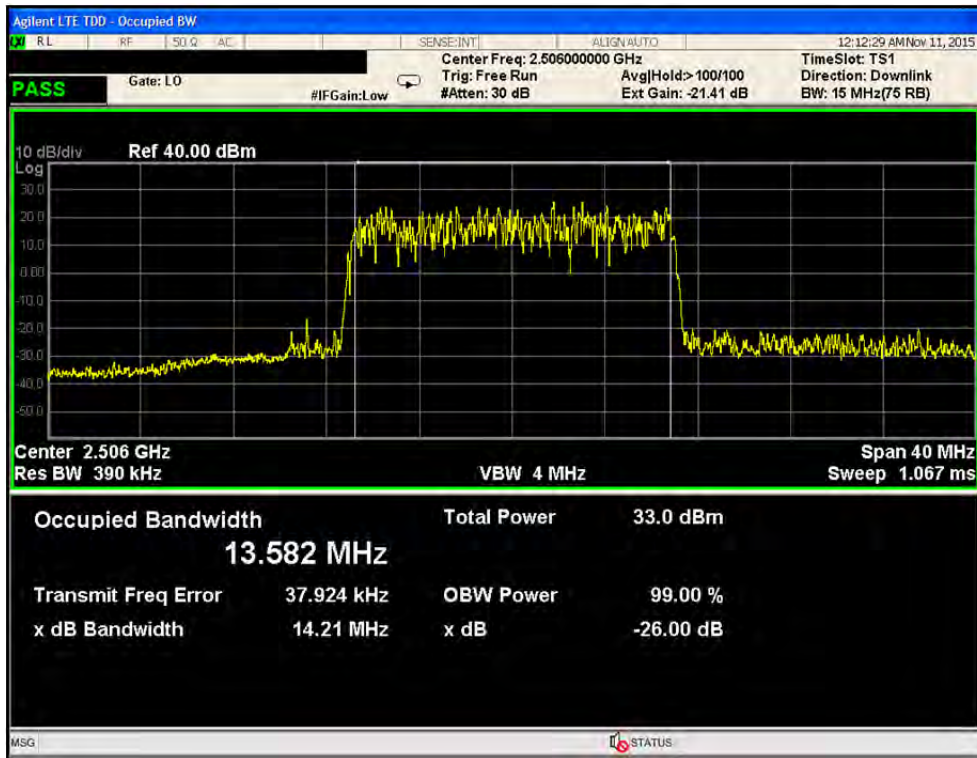


•Port2 / LTE 15M / 2682.5 MHz / 16QAM

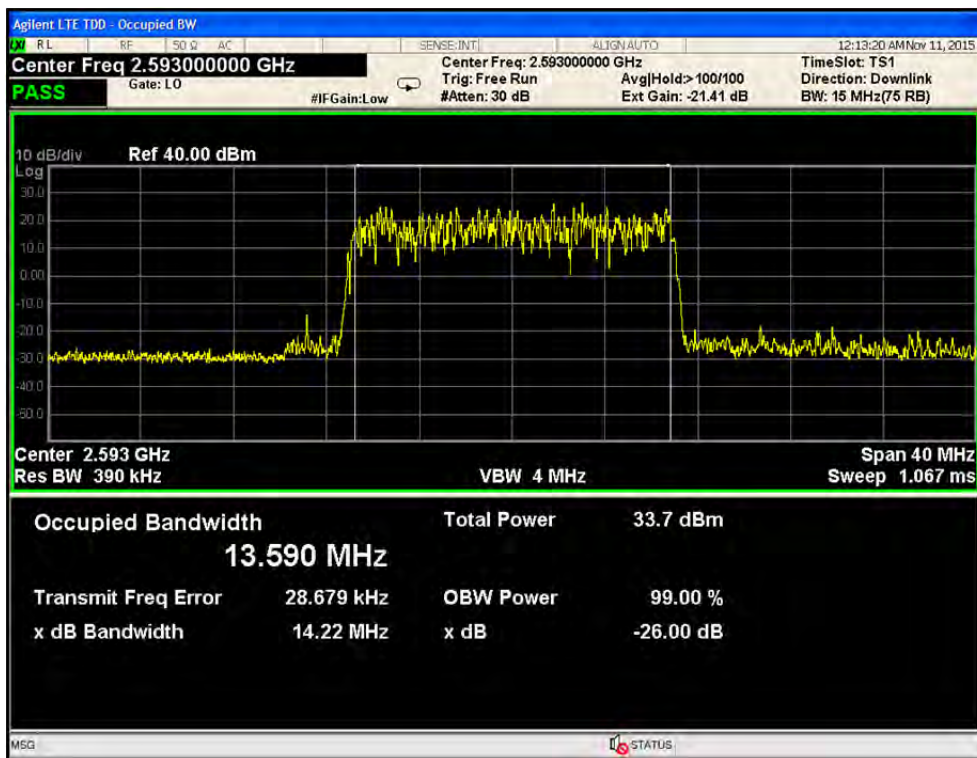


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•Port2 / LTE 15M / 2503.5 MHz / 64QAM

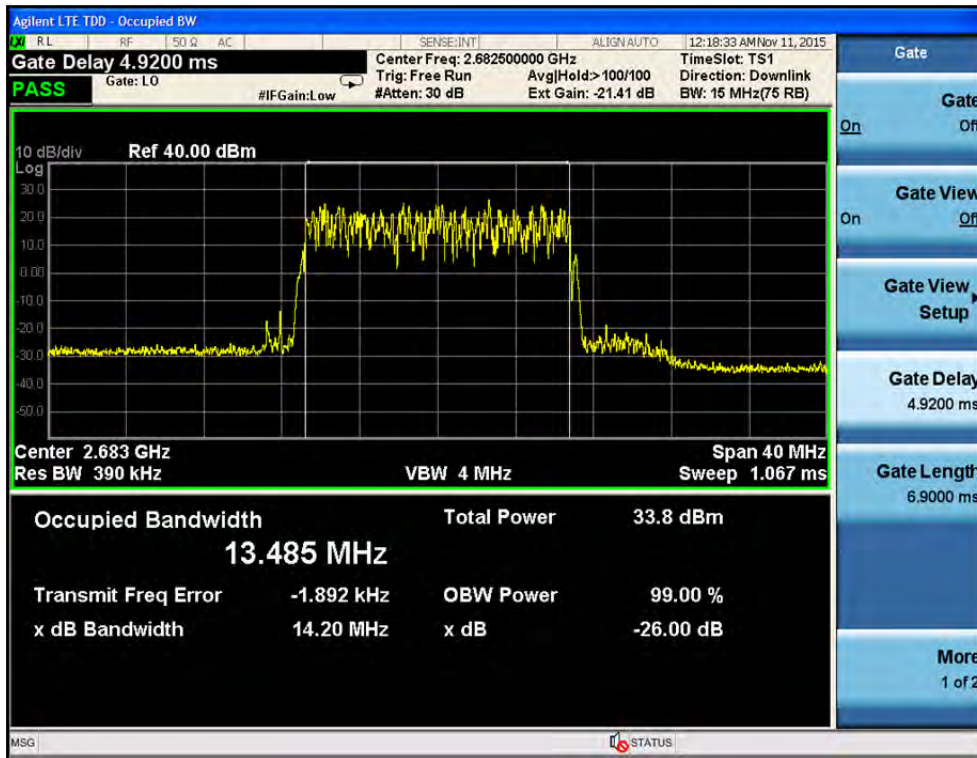


•Port2 / LTE 15M / 2593.0 MHz / 64QAM

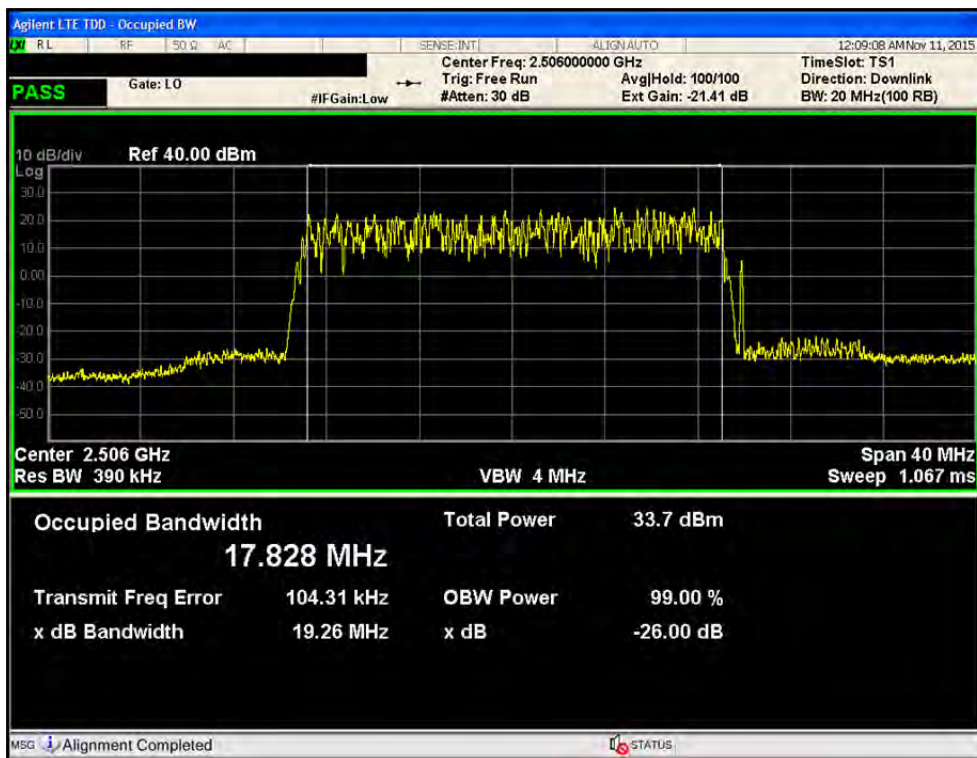




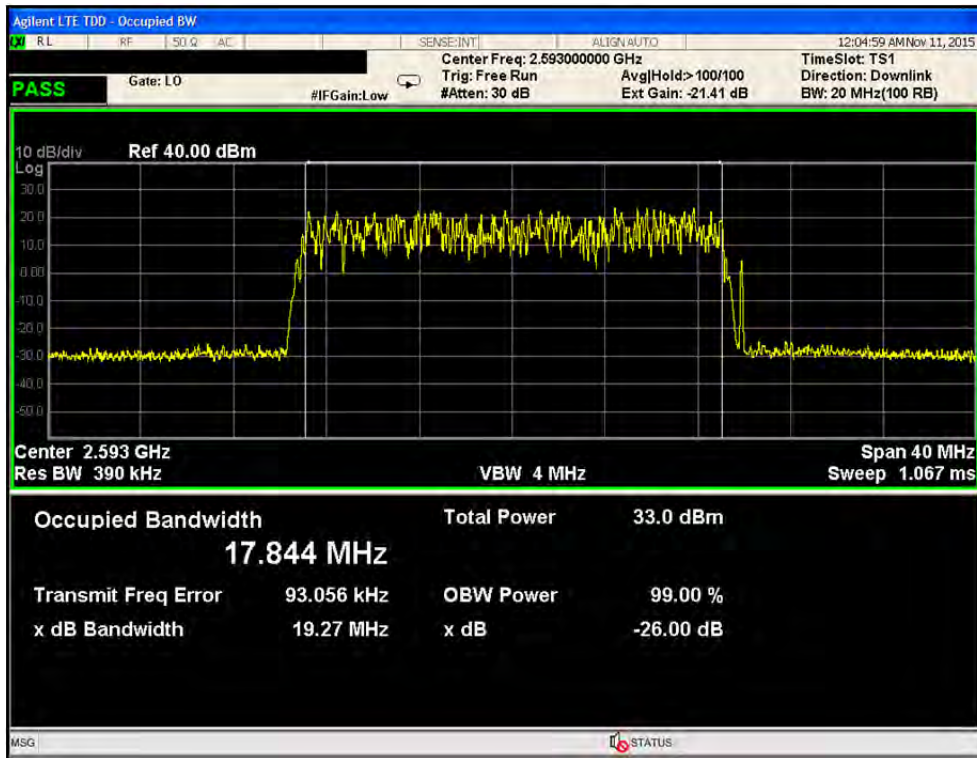
•Port2 / LTE 15M / 2682.5 MHz / 64QAM



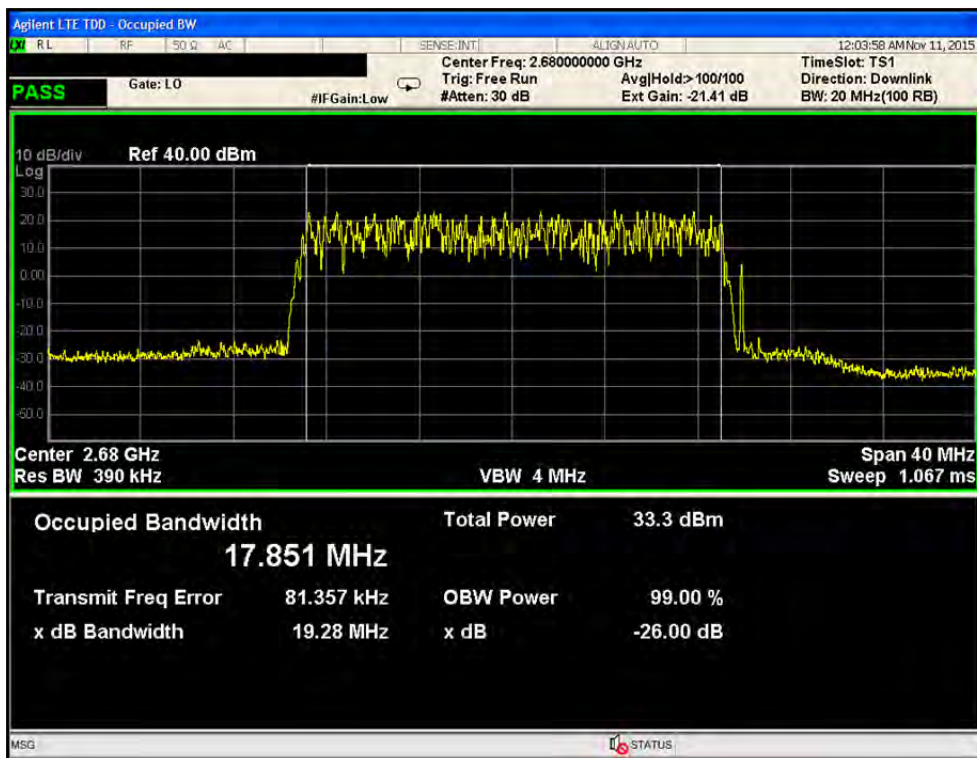
•Port2 / LTE 20M / 2506.0 MHz / QPSK



•Port2 / LTE 20M / 2593.0 MHz / QPSK

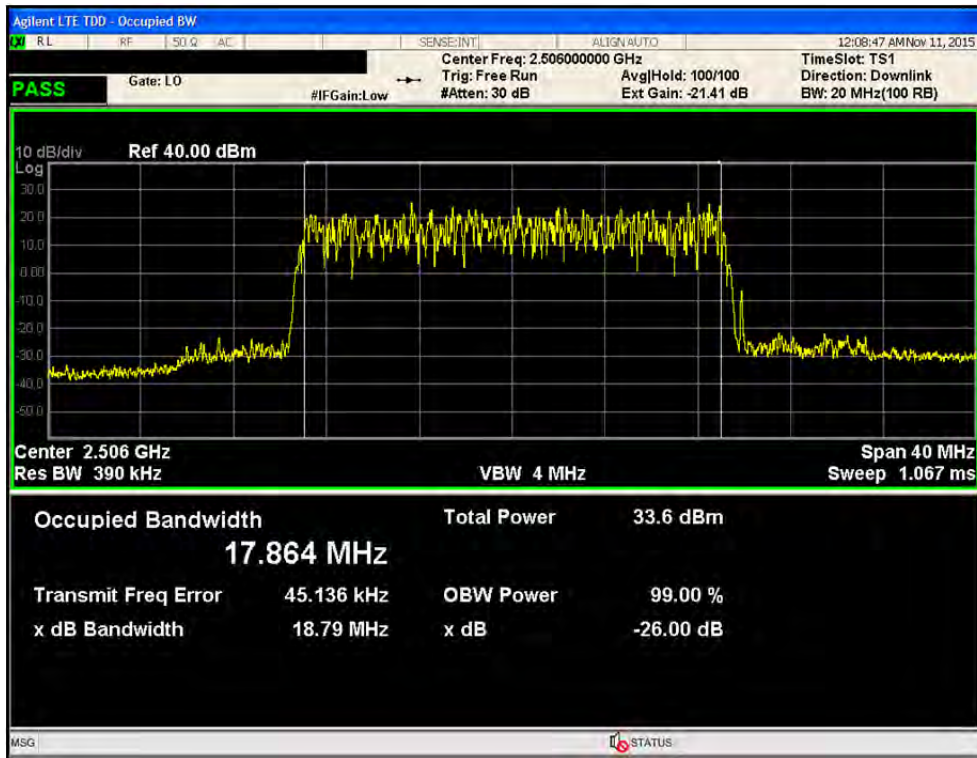


•Port2 / LTE 20M / 2680.0 MHz / QPSK

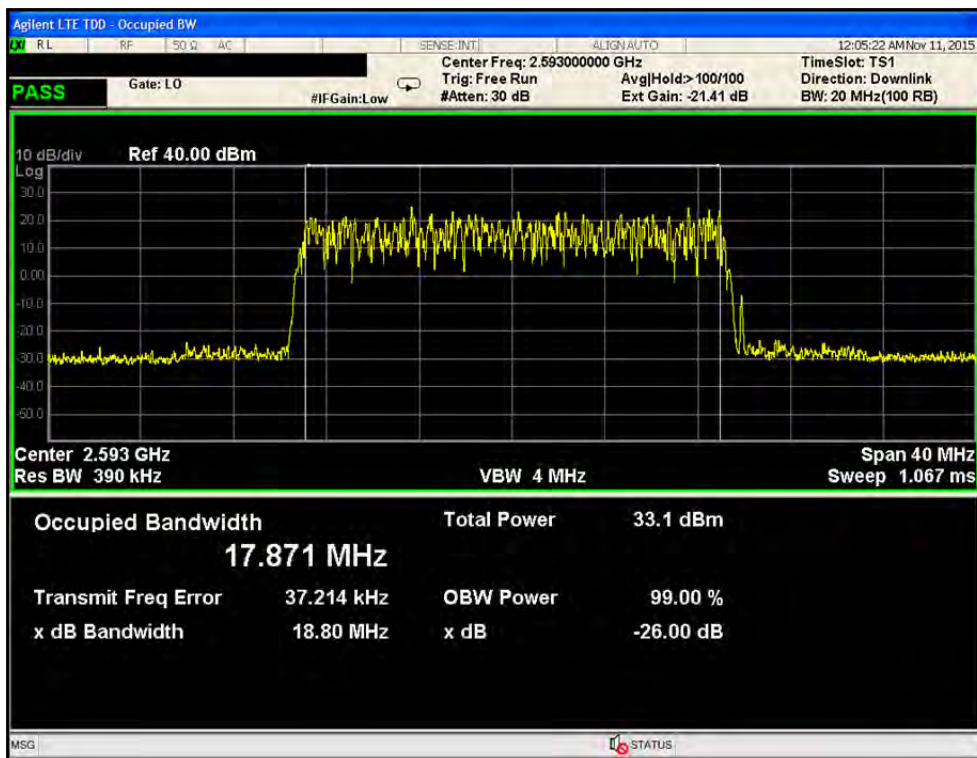




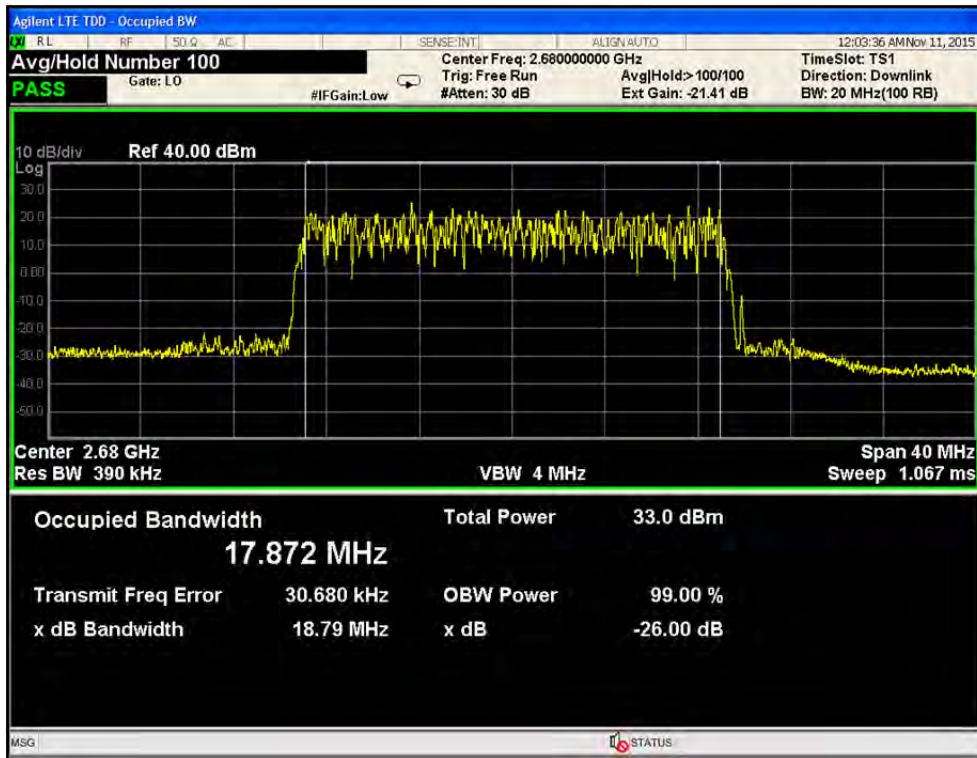
•Port2 / LTE 20M / 2506.0 MHz / 16QAM



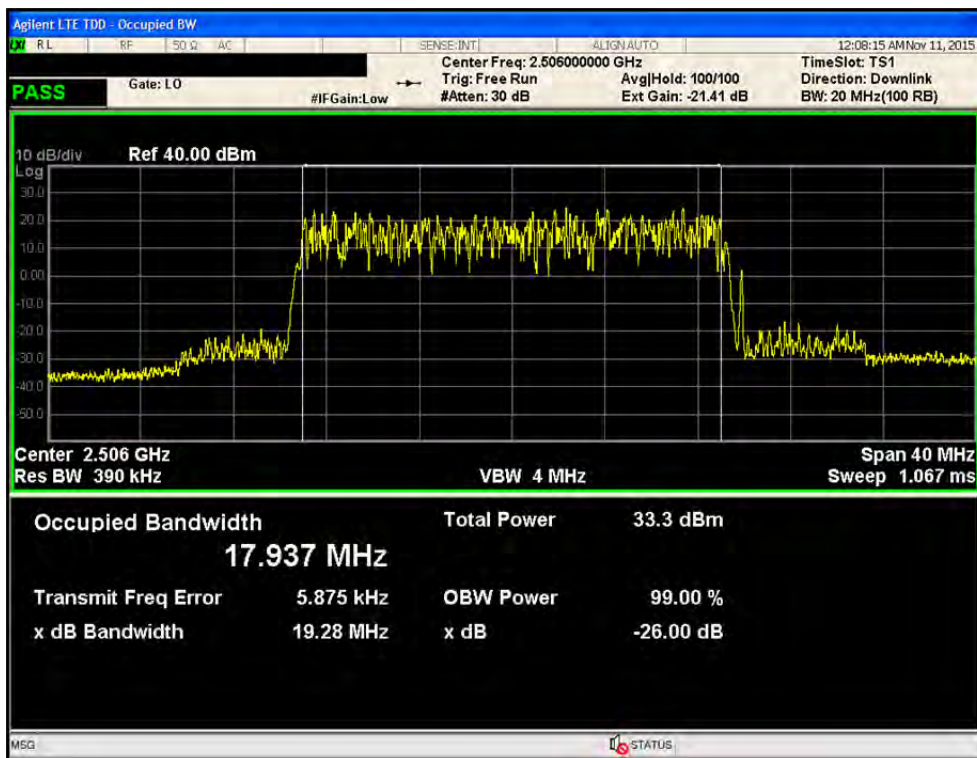
•Port2 / LTE 20M / 2593.0 MHz / 16QAM



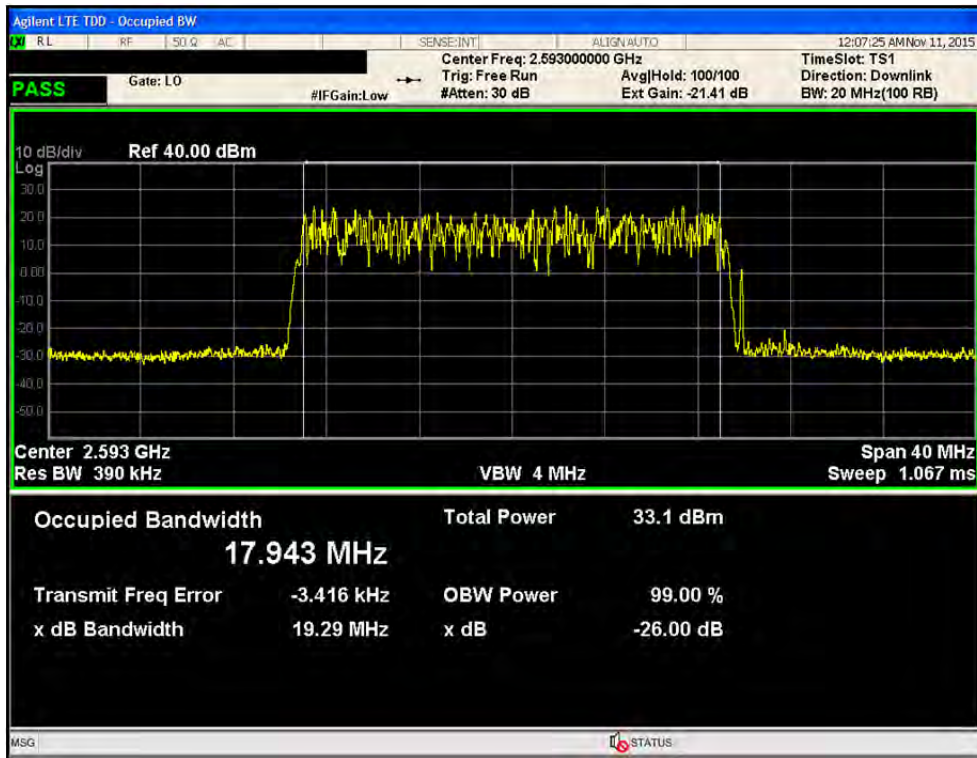
•Port2 / LTE 20M / 2680.0 MHz / 16QAM



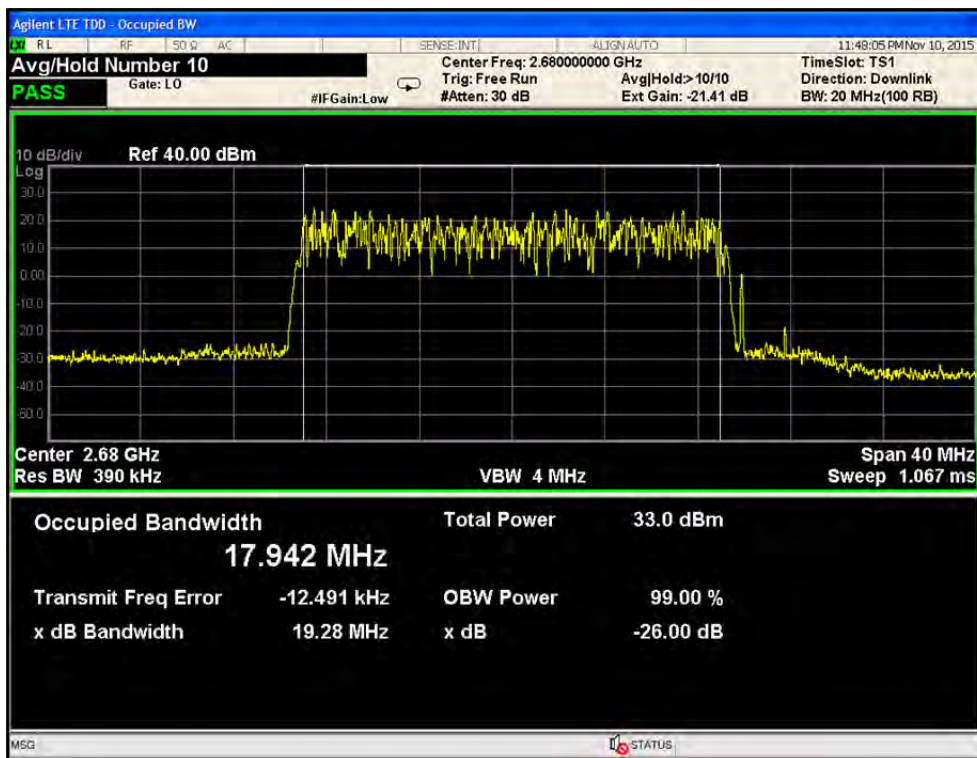
•Port2 / LTE 20M / 2506.0 MHz / 64QAM



•Port2 / LTE 20M / 2593.0 MHz / 64QAM



•Port2 / LTE 20M / 2680.0 MHz / 64QAM

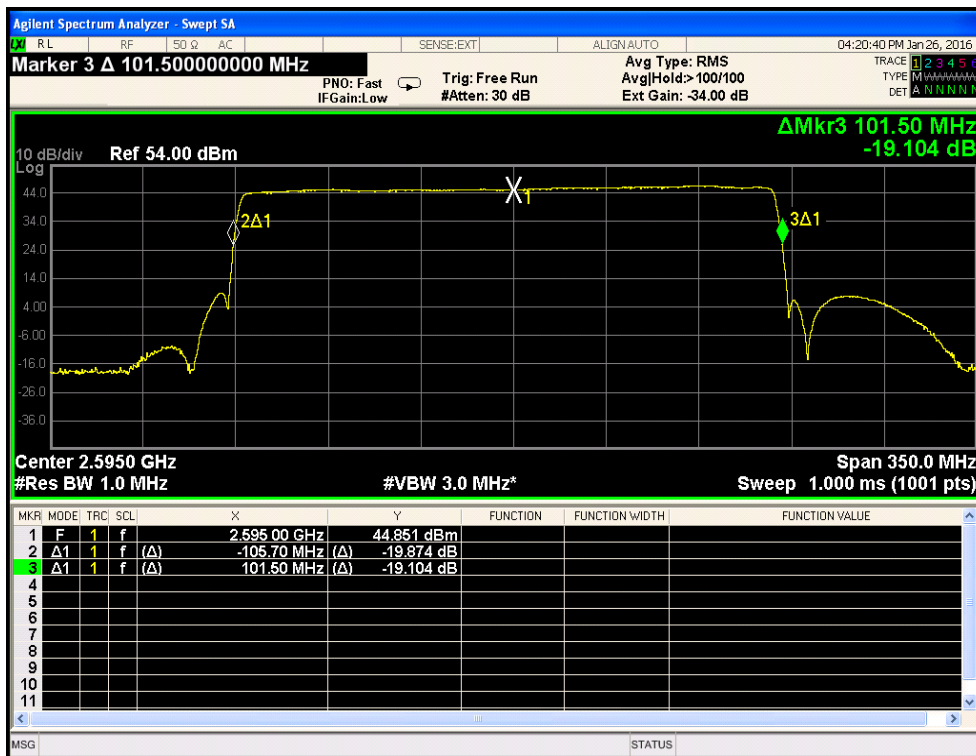




•Port1 / Out of band rejection

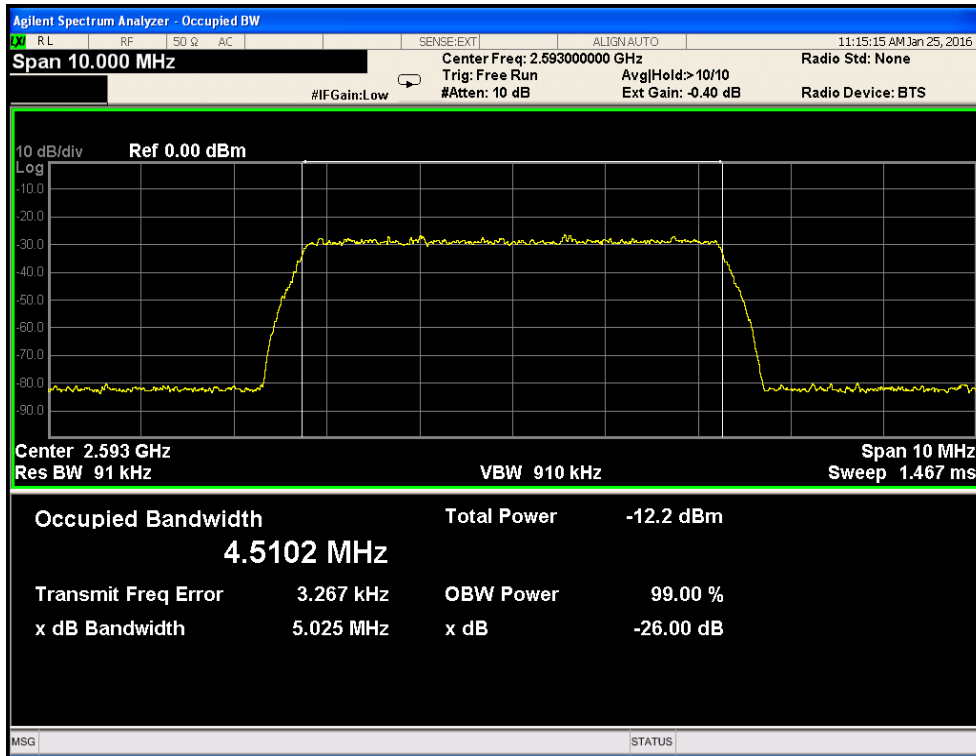


•Port2 / Out of band rejection

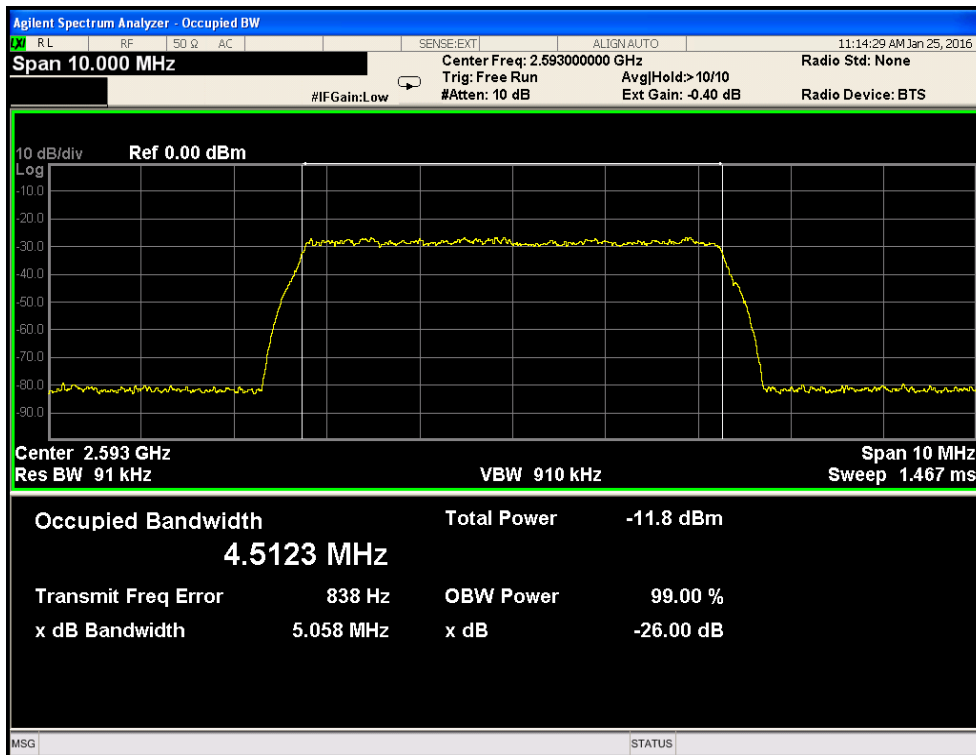




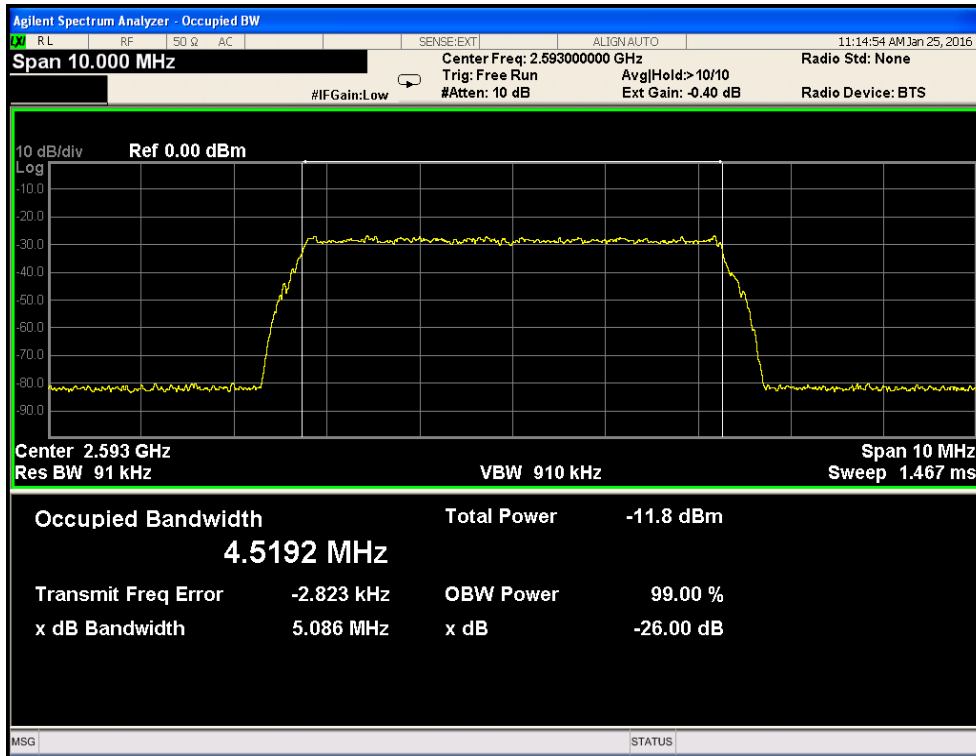
• Input signal bandwidth / 5MHz / QPSK



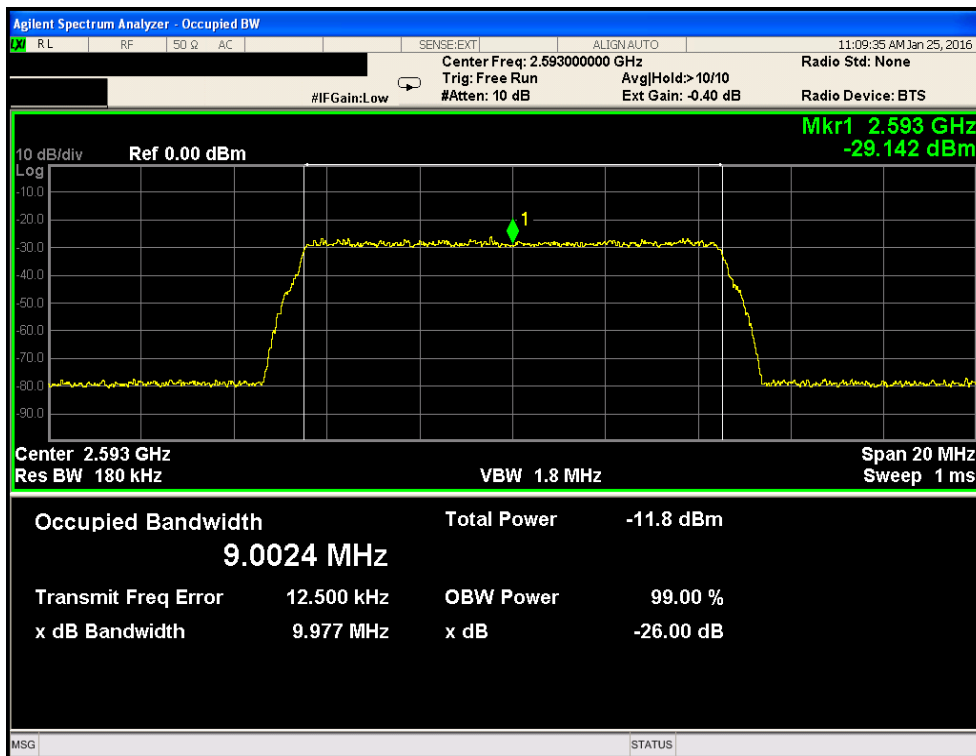
• Input signal bandwidth / 5MHz / 16QAM



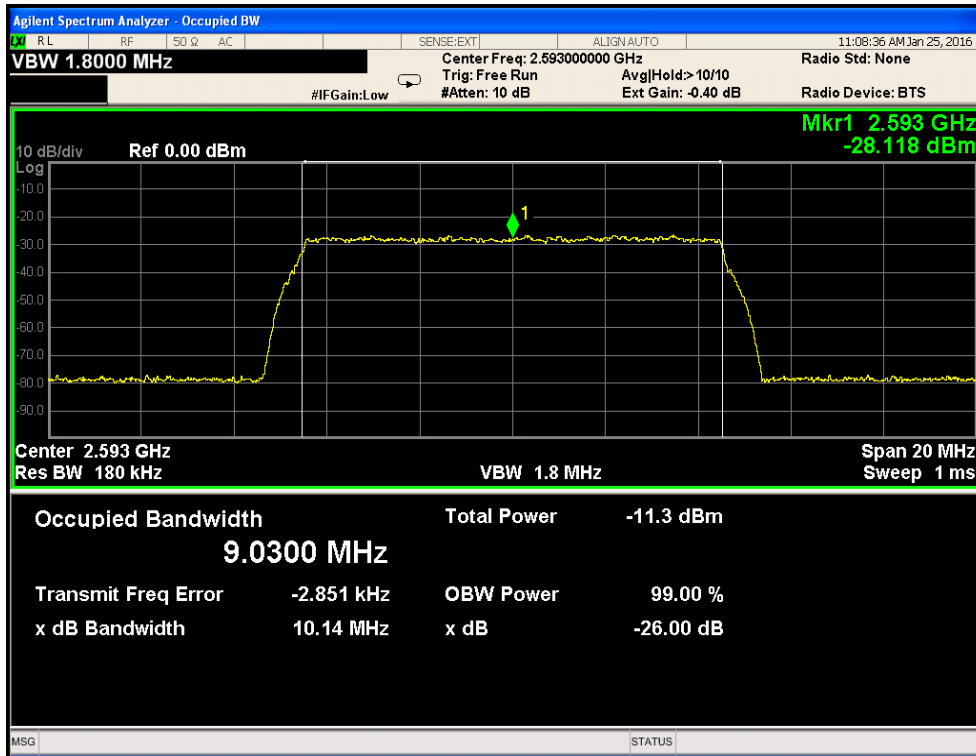
• Input signal bandwidth / 5MHz / 64QAM



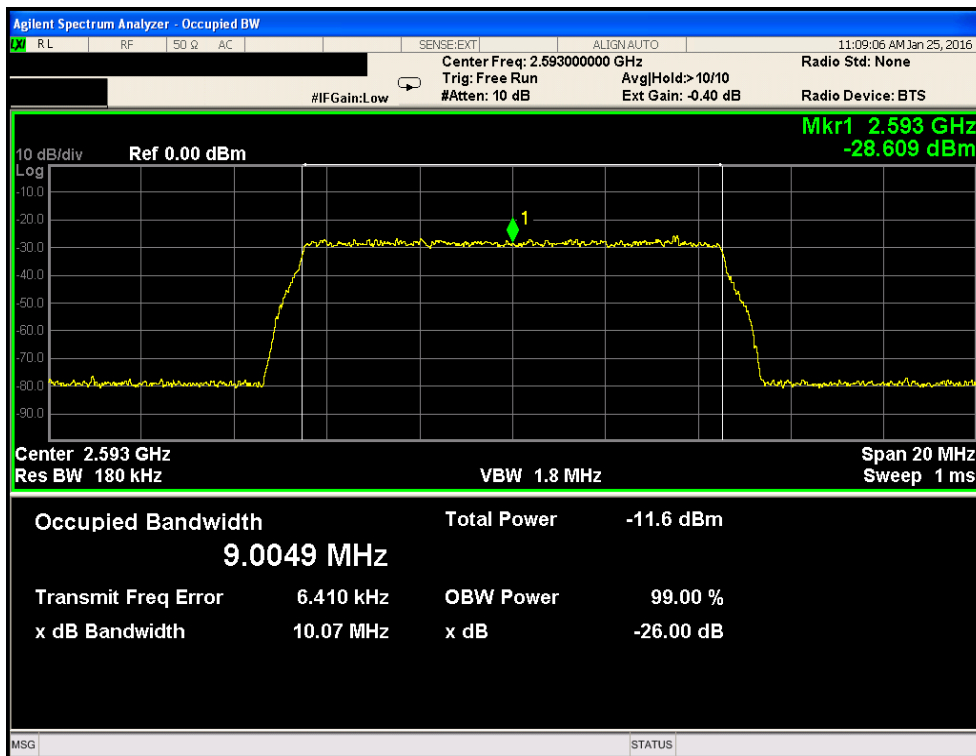
• Input signal bandwidth / 10MHz / QPSK



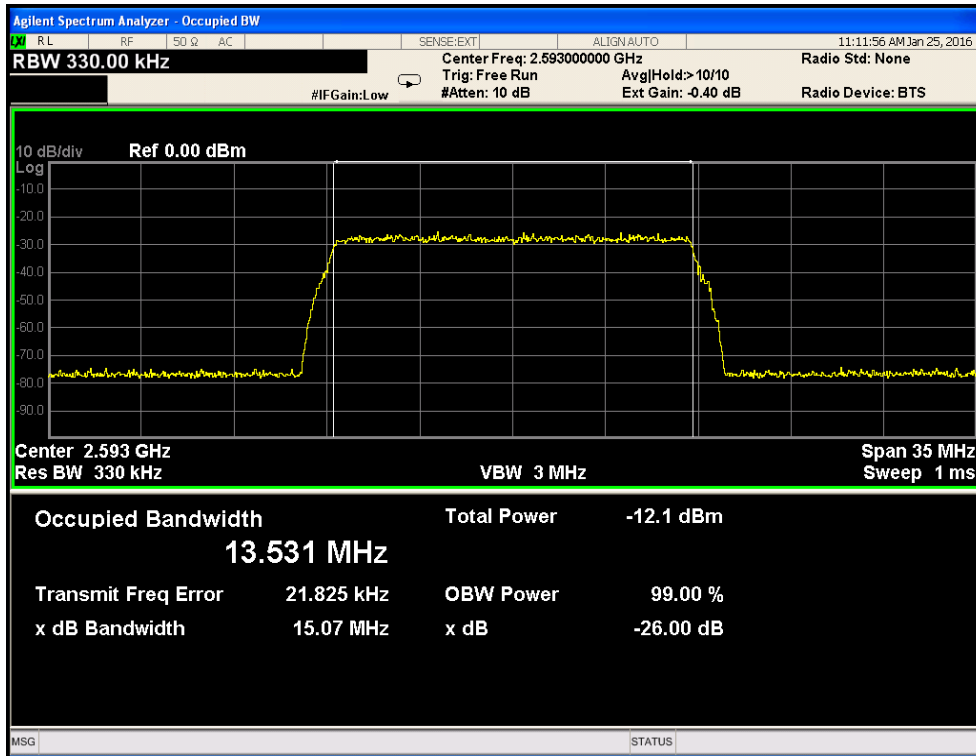
• Input signal bandwidth / 10MHz / 16QAM



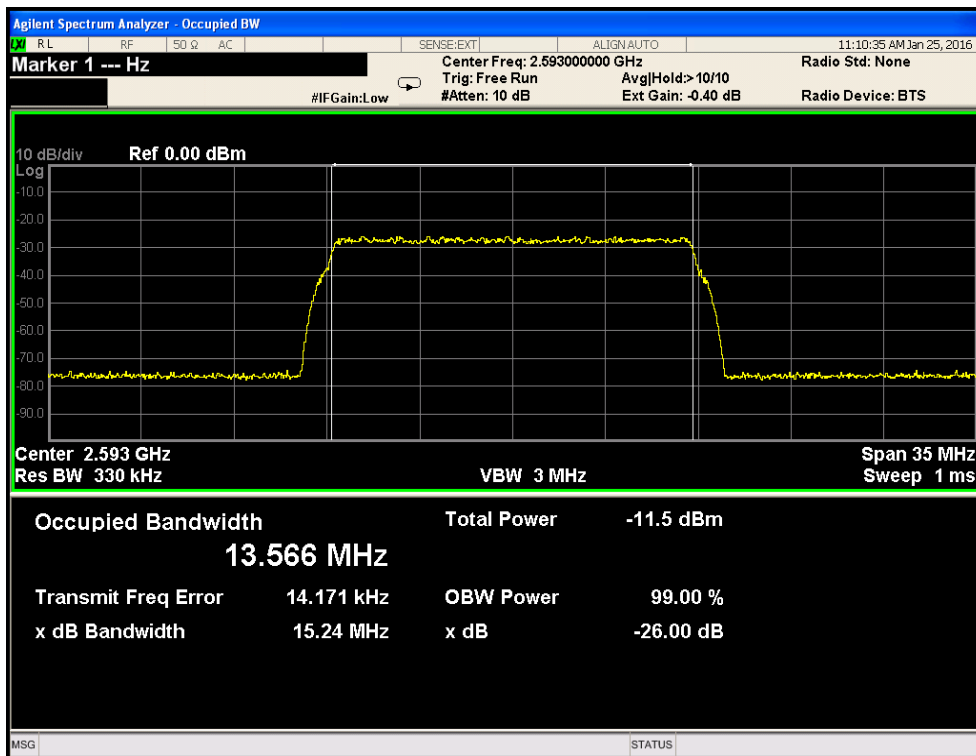
• Input signal bandwidth / 10MHz / 64QAM



• Input signal bandwidth / 15MHz / QPSK

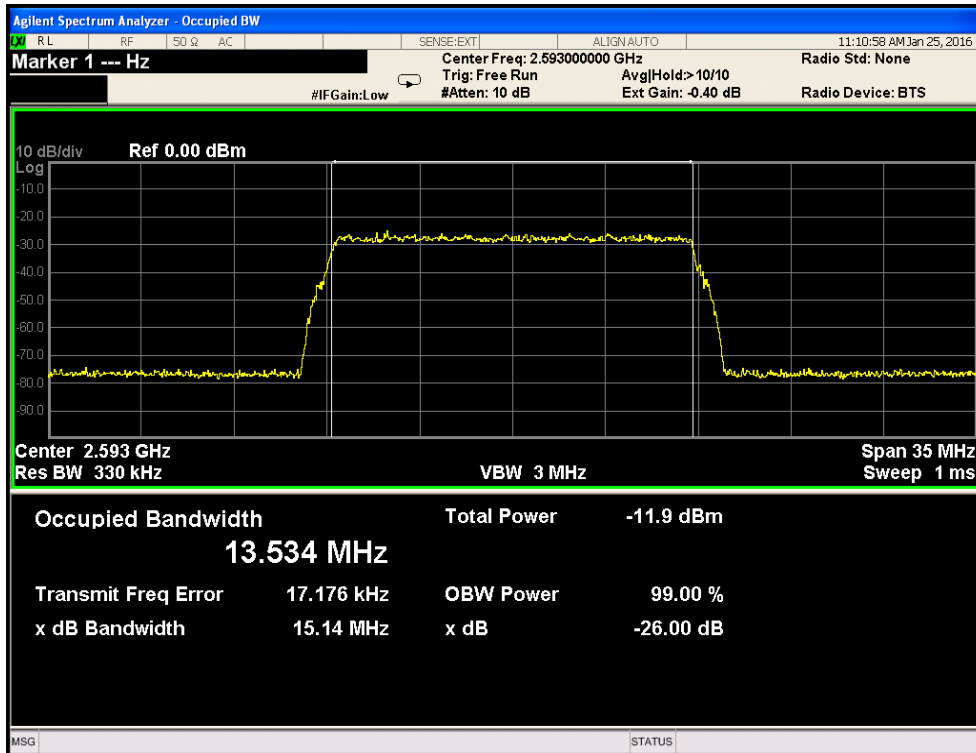


• Input signal bandwidth / 15MHz / 16QAM

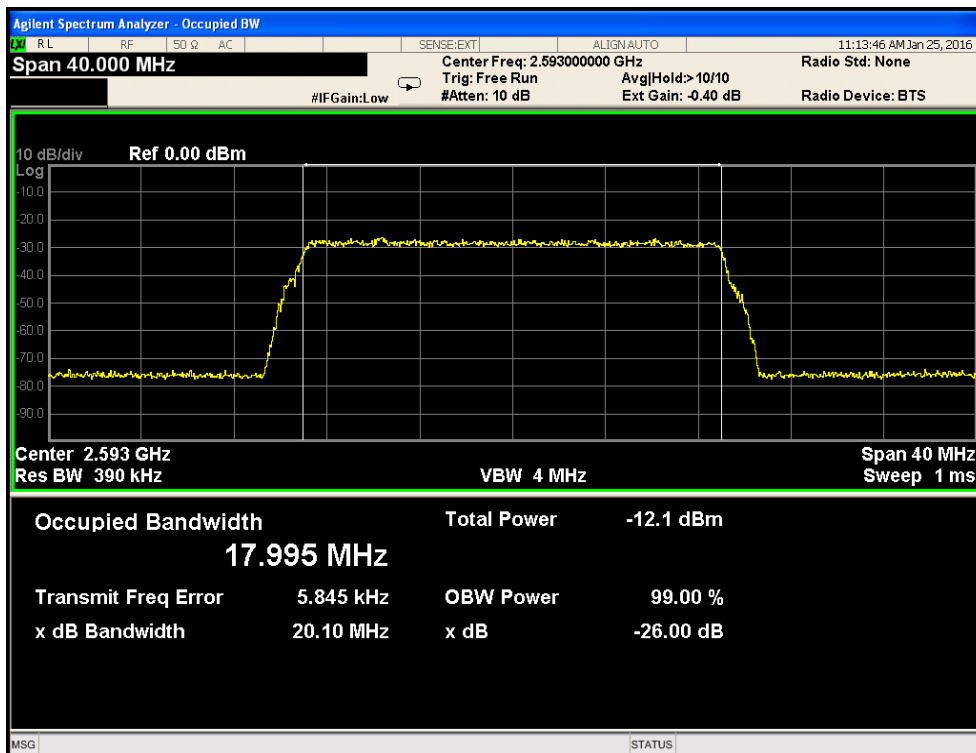




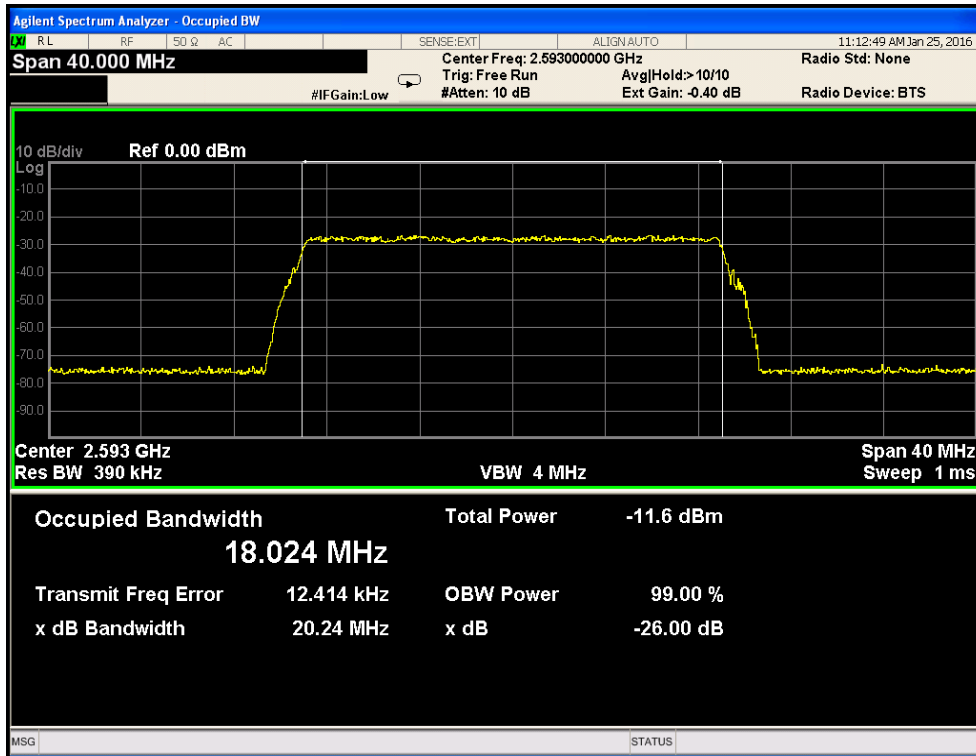
- Input signal bandwidth / 15MHz / 64QAM



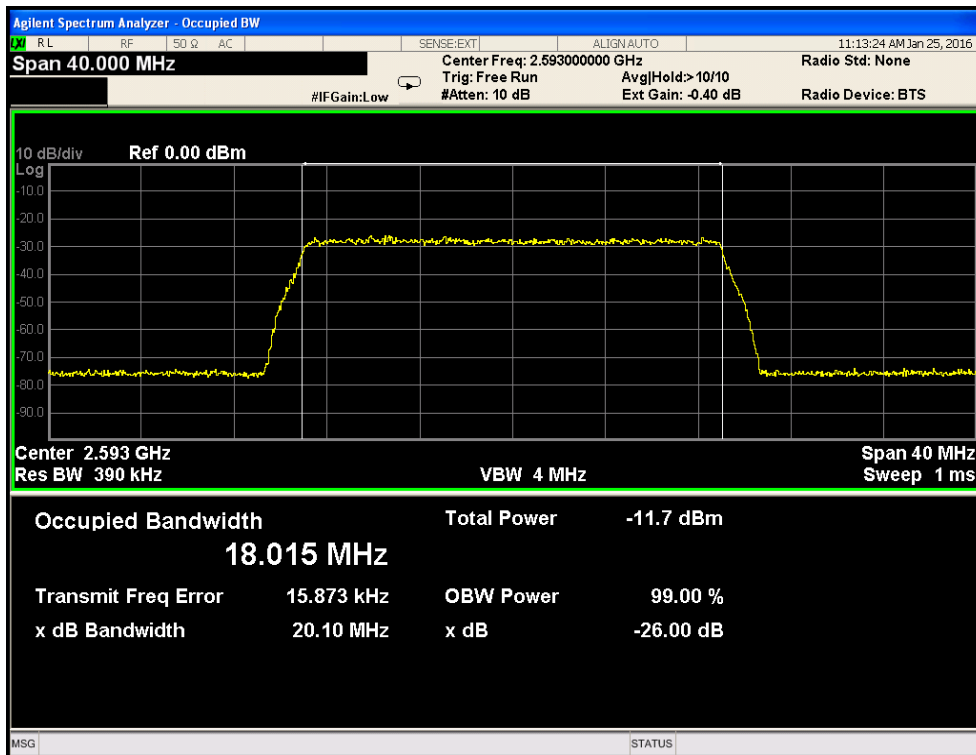
- Input signal bandwidth / 20MHz / QPSK



• Input signal bandwidth / 20MHz / 16QAM



• Input signal bandwidth / 20MHz / 64QAM



## 3.2 Band edge

### 3.2.1 Specification

- FCC Rules Part 2.1051
- FCC Rules Part 27.53 (m)(v)

### 3.2.2 Test description

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer.

For all fixed digital user stations, the attenuation factor shall be not less than  $43 + 10 \log (P)$  dB at the channel edge.

The spectrum was scanned below the lower band edge and above the higher band edge. The resolution bandwidth was set to approximately 1% of the measured emissions bandwidth within the first 1 MHz block adjacent to the transmit band. An average RMS detector was used match the method used during Output power.

UL/DL Allocation : Configuration 3  
Dw/GP/UP length : Configuration 8

### 3.2.3 Test Procedure

The method used is as detailed in FCC KDB 935210 D05 v01.

The method used is as detailed in FCC KDB 971168 D01 v02r02.

The test was performed at three frequencies (low, middle and high channels) at each band using all applicable modulation (QPSK, 16QAM and 64QAM)

The power of any emission in the 1MHz bands immediately outside and adjacent to the channel blocks was attenuated below the transmitting power (P) by a factor as specified in this section.

The EUT antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable

### 3.2.4 Test equipment list

Equipment	Model Name	Manufacturer
EUT	HX-2500-MIMO	Corning Optical Communications Wireless Inc.
MHU	HX-2500-MHU	Corning Optical Communications Wireless Inc.
Signal Generator	N5182A	Agilent
Spectrum Analyzer	N9020A	Agilent
Attenuator	PE7019-20	Pasternack
DC Power Supply	6674A	Agilent

### 3.2.5 Test condition

- Test place: Shield Room
- Test environment: 22.5 °C, 42.5 % R.H.

### 3.2.6 Test results

- Port1

Bandwidth	Modulation	Frequency [MHz]	Band Edge	Emission Level [dBm]	Emission Limit [dBm]	Result
5 MHz	QPSK	2498.5	Lower	-15.50	-13.0	Pass
		2687.5	Upper	-18.40		
	16QAM	2498.5	Lower	-15.14		
		2687.5	Upper	-14.74		
	64QAM	2498.5	Lower	-17.84		
		2687.5	Upper	-16.14		
10 MHz	QPSK	2501.0	Lower	-21.86		
		2685.0	Upper	-20.01		
	16QAM	2501.0	Lower	-21.57		
		2685.0	Upper	-22.74		
	64QAM	2501.0	Lower	-25.84		
		2685.0	Upper	-22.22		
15 MHz	QPSK	2503.5	Lower	-24.76		
		2682.5	Upper	-27.53		
	16QAM	2503.5	Lower	-23.18		
		2682.5	Upper	-25.88		
	64QAM	2503.5	Lower	-26.38		
		2682.5	Upper	-25.64		
20 MHz	QPSK	2506.0	Lower	-25.42		
		2680.0	Upper	-29.27		
	16QAM	2506.0	Lower	-34.09		
		2680.0	Upper	-26.96		
	64QAM	2506.0	Lower	-27.54		
		2680.0	Upper	-26.16		

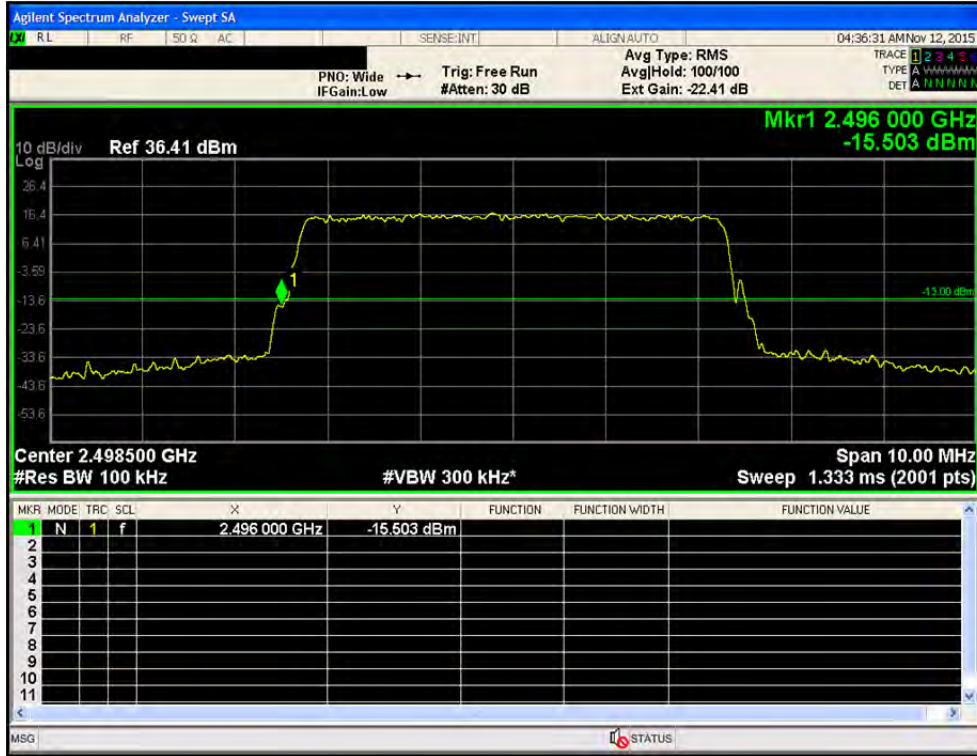


## • Port2

Bandwidth	Modulation	Frequency [MHz]	Band Edge	Emission Level [dBm]	Emission Limit [dBm]	Result
5 MHz	QPSK	2498.5	Lower	-14.42	-13.0	Pass
		2687.5	Upper	-17.55		
	16QAM	2498.5	Lower	-15.19		
		2687.5	Upper	-15.23		
	64QAM	2498.5	Lower	-17.38		
		2687.5	Upper	-14.80		
10 MHz	QPSK	2501.0	Lower	-25.65		
		2685.0	Upper	-21.91		
	16QAM	2501.0	Lower	-20.78		
		2685.0	Upper	-20.41		
	64QAM	2501.0	Lower	-23.12		
		2685.0	Upper	-24.04		
15 MHz	QPSK	2503.5	Lower	-27.04		
		2682.5	Upper	-24.01		
	16QAM	2503.5	Lower	-24.61		
		2682.5	Upper	-24.11		
	64QAM	2503.5	Lower	-28.43		
		2682.5	Upper	-25.84		
20 MHz	QPSK	2506.0	Lower	-25.78		
		2680.0	Upper	-28.24		
	16QAM	2506.0	Lower	-32.78		
		2680.0	Upper	-30.87		
	64QAM	2506.0	Lower	-26.26		
		2680.0	Upper	-27.24		

### 3.2.7 Test Plots

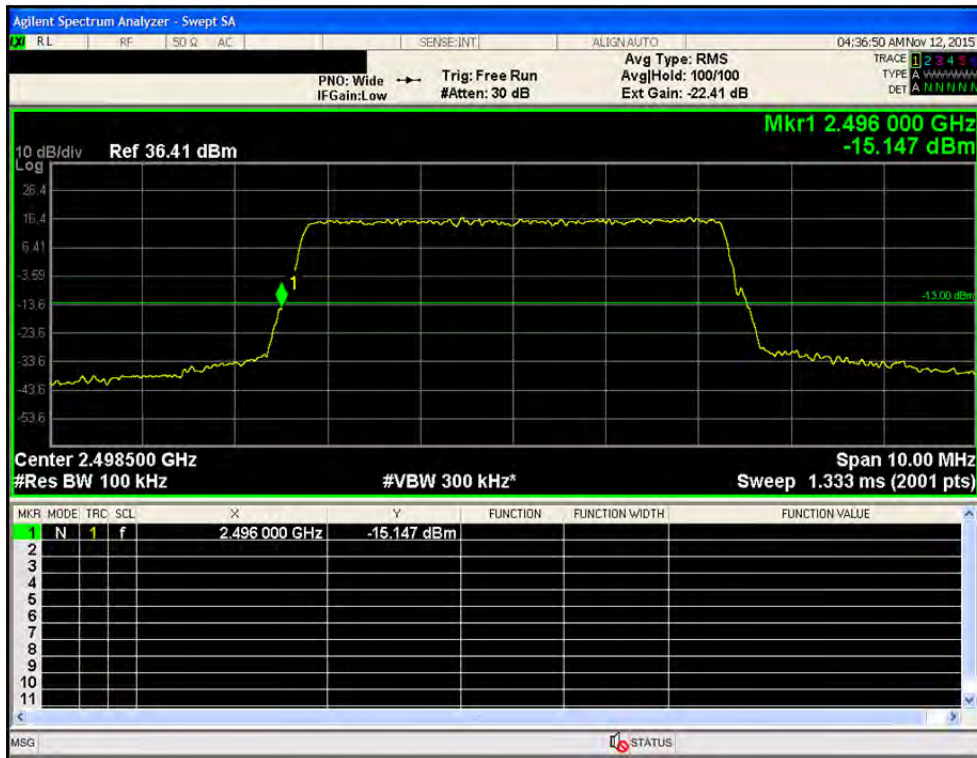
•Port1/ LTE 5M / 2498.5 MHz / QPSK



•Port1/ LTE 5M / 2687.5 MHz / QPSK



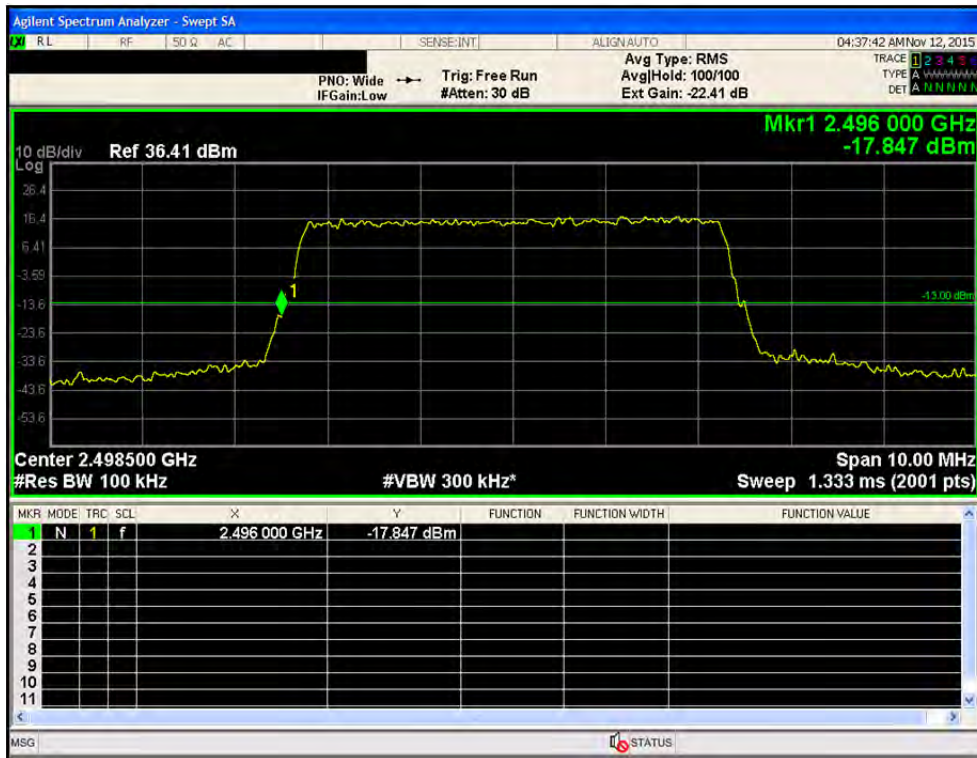
•Port1/ LTE 5M / 2498.5 MHz / 16QAM



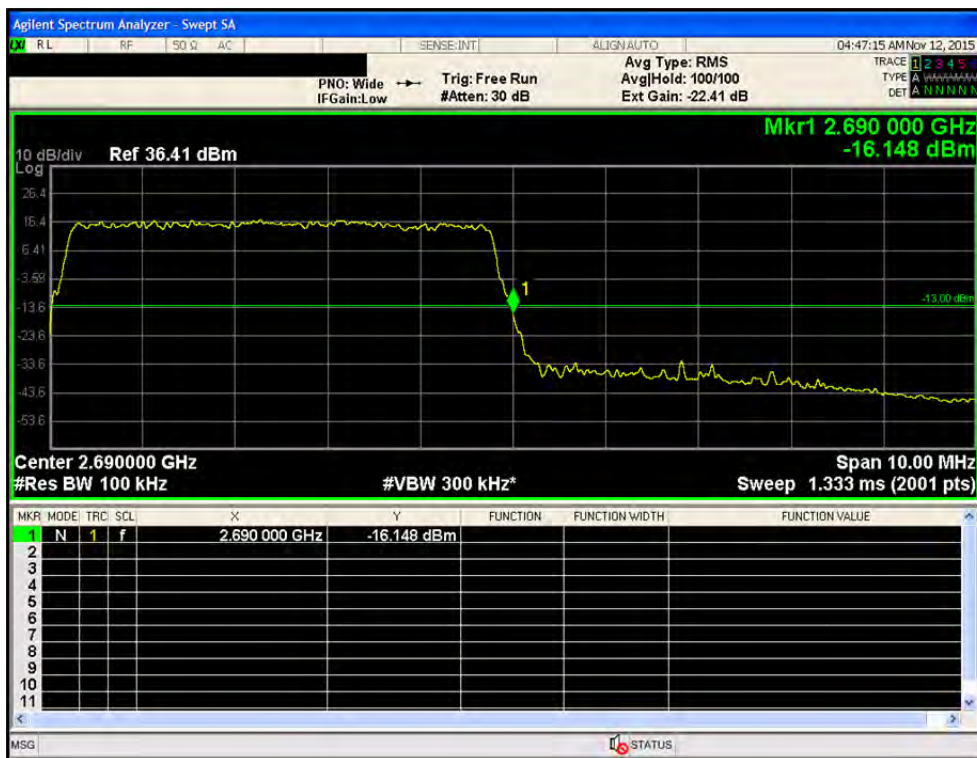
•Port1/ LTE 5M / 2687.5 MHz / 16QAM



•Port1/ LTE 5M / 2498.5 MHz / 64QAM

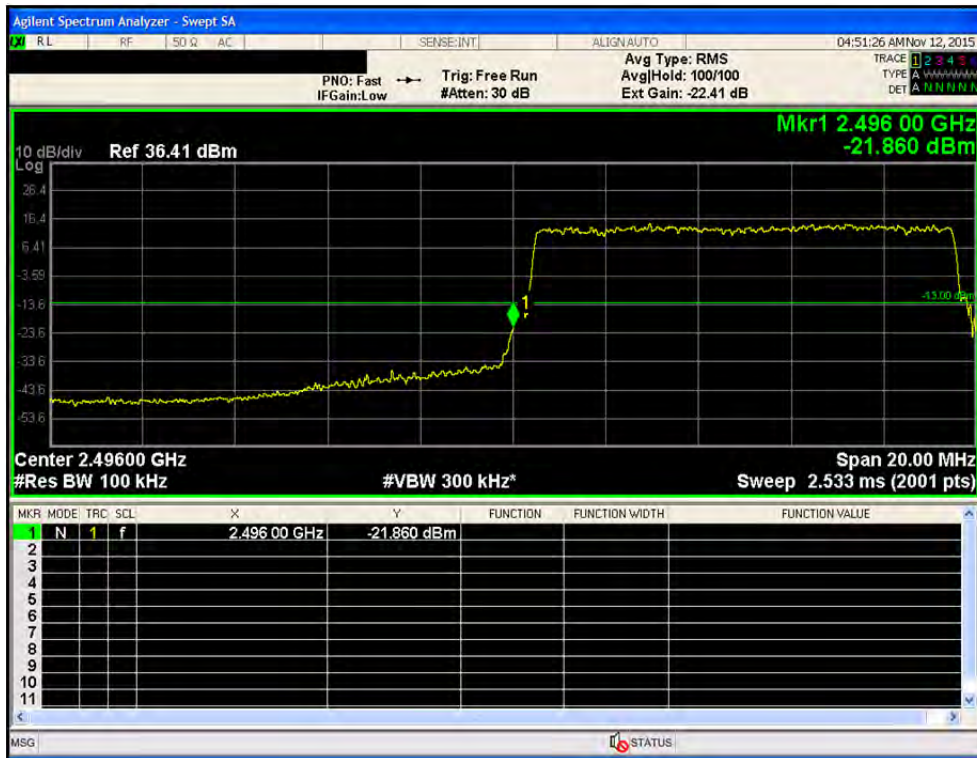


•Port1/ LTE 5M / 2687.5 MHz / 64QAM





•Port1/ LTE 10M / 2501.0 MHz / QPSK



•Port1/ LTE 10M / 2685.0 MHz / QPSK



•Port1/ LTE 10M / 2501.0 MHz / 16QAM



•Port1/ LTE 10M / 2685.0 MHz / 16QAM



•Port1/ LTE 10M / 2501.0 MHz / 64QAM



•Port1/ LTE 10M / 2685.0 MHz / 64QAM





•Port1/ LTE 15M / 2503.5 MHz / QPSK



•Port1/ LTE 15M / 2682.5 MHz / QPSK





•Port1/ LTE 15M / 2503.5 MHz / 16QAM



•Port1/ LTE 15M / 2682.5 MHz / 16QAM



•Port1/ LTE 15M / 2503.5 MHz / 64QAM



•Port1/ LTE 15M / 2682.5 MHz / 64QAM



•Port1/ LTE 20M / 2506.0 MHz / QPSK



•Port1/ LTE 20M / 2680.0 MHz / QPSK





•Port1/ LTE 20M / 2506.0 MHz / 16QAM



•Port1/ LTE 20M / 2680.0 MHz / 16QAM





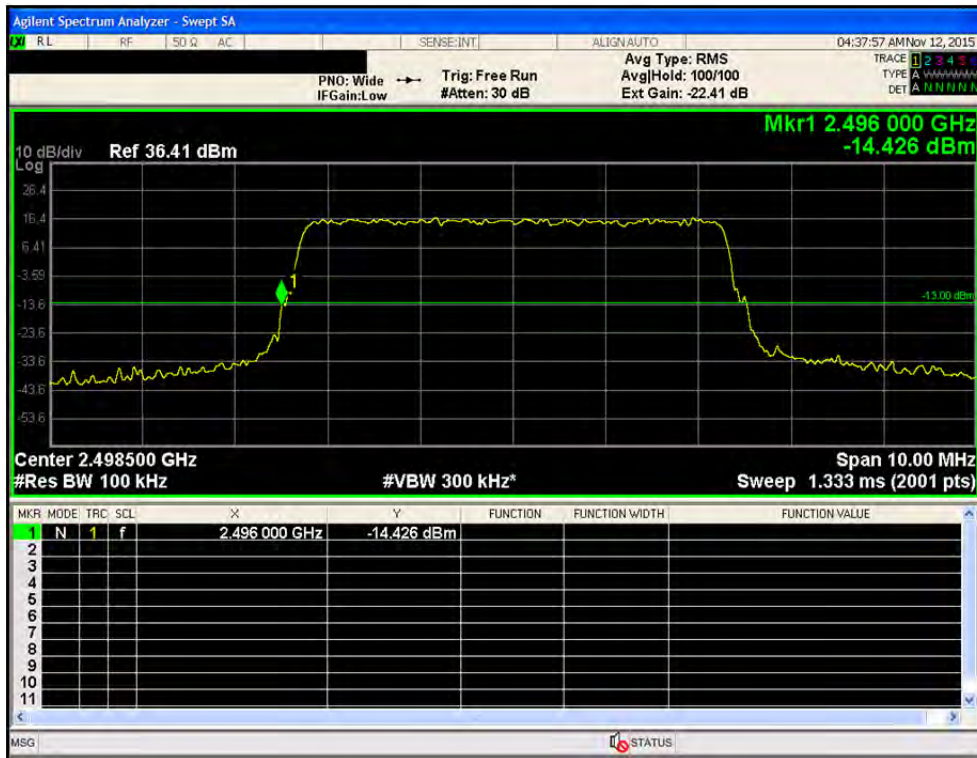
•Port1/ LTE 20M / 2506.0 MHz / 64QAM



•Port1/ LTE 20M / 2680.0 MHz / 64QAM



•Port2/ LTE 5M / 2498.5 MHz / QPSK



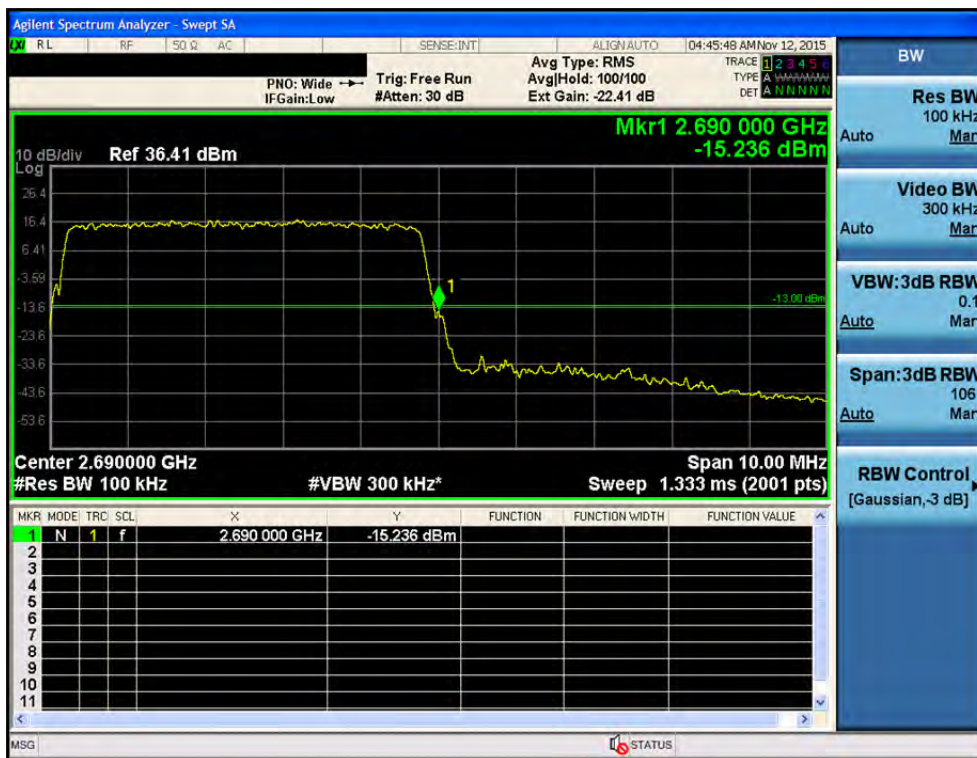
•Port2/ LTE 5M / 2687.5 MHz / QPSK



•Port2/ LTE 5M / 2498.5 MHz / 16QAM

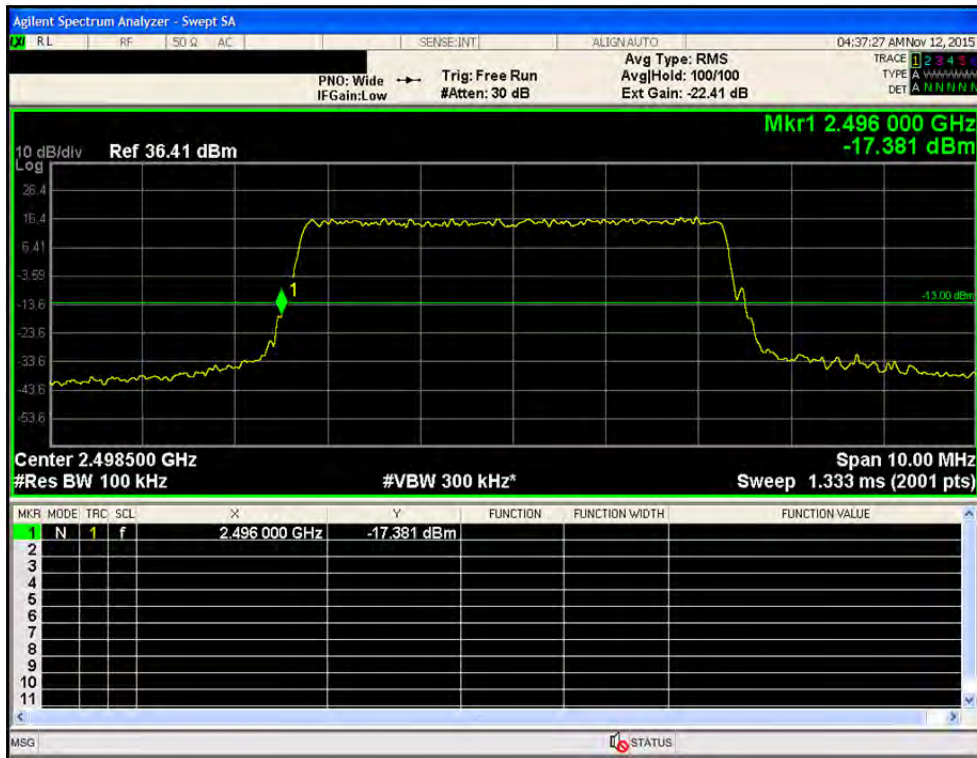


•Port2/ LTE 5M / 2687.5 MHz / 16QAM





•Port2/ LTE 5M / 2498.5 MHz / 64QAM

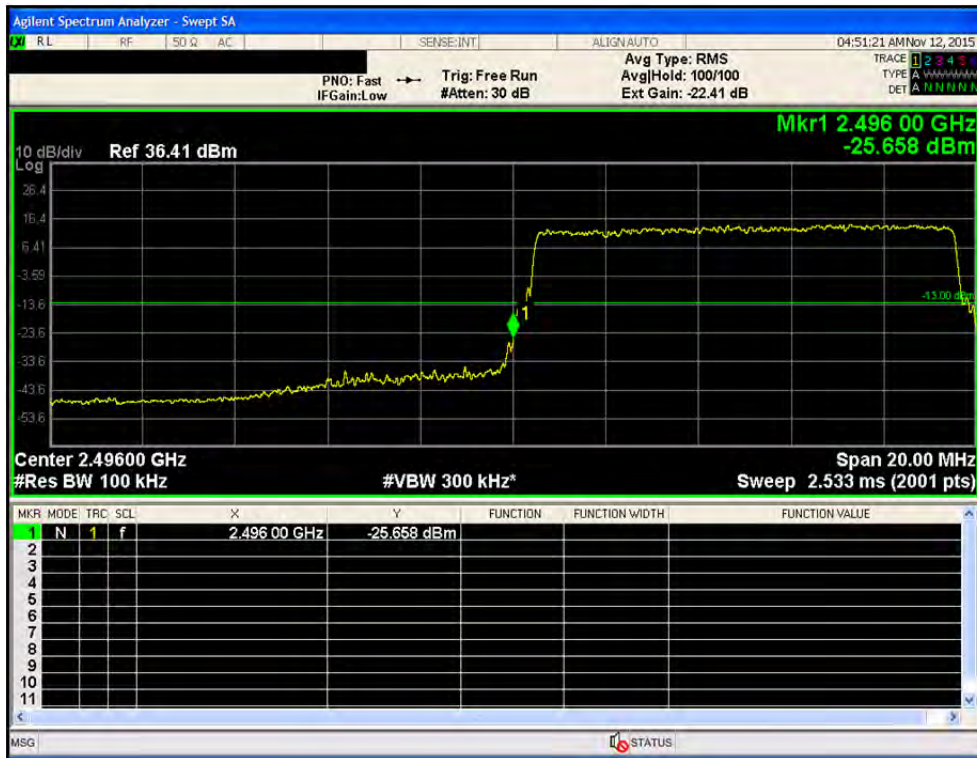


•Port2/ LTE 5M / 2687.5 MHz / 64QAM





•Port2/ LTE 10M / 2501.0 MHz / QPSK



•Port2/ LTE 10M / 2685.0 MHz / QPSK



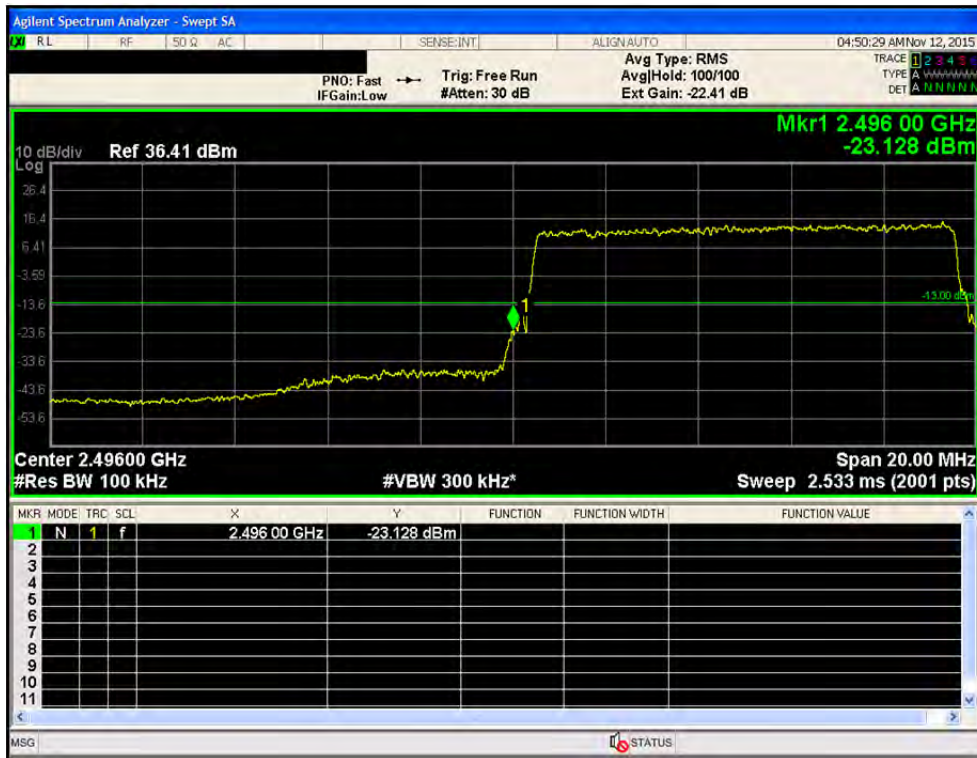
•Port2/ LTE 10M / 2501.0 MHz / 16QAM



•Port2/ LTE 10M / 2685.0 MHz / 16QAM



•Port2/ LTE 10M / 2501.0 MHz / 64QAM



•Port2/ LTE 10M / 2685.0 MHz / 64QAM





•Port2/ LTE 15M / 2503.5 MHz / QPSK

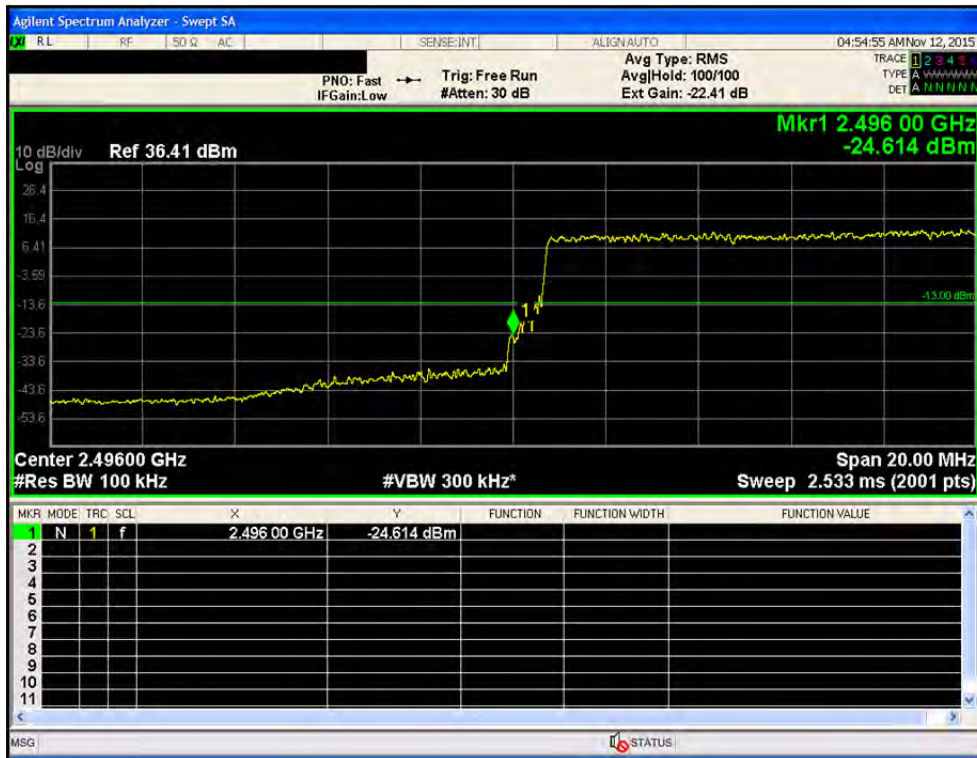


•Port2/ LTE 15M / 2682.5 MHz / QPSK





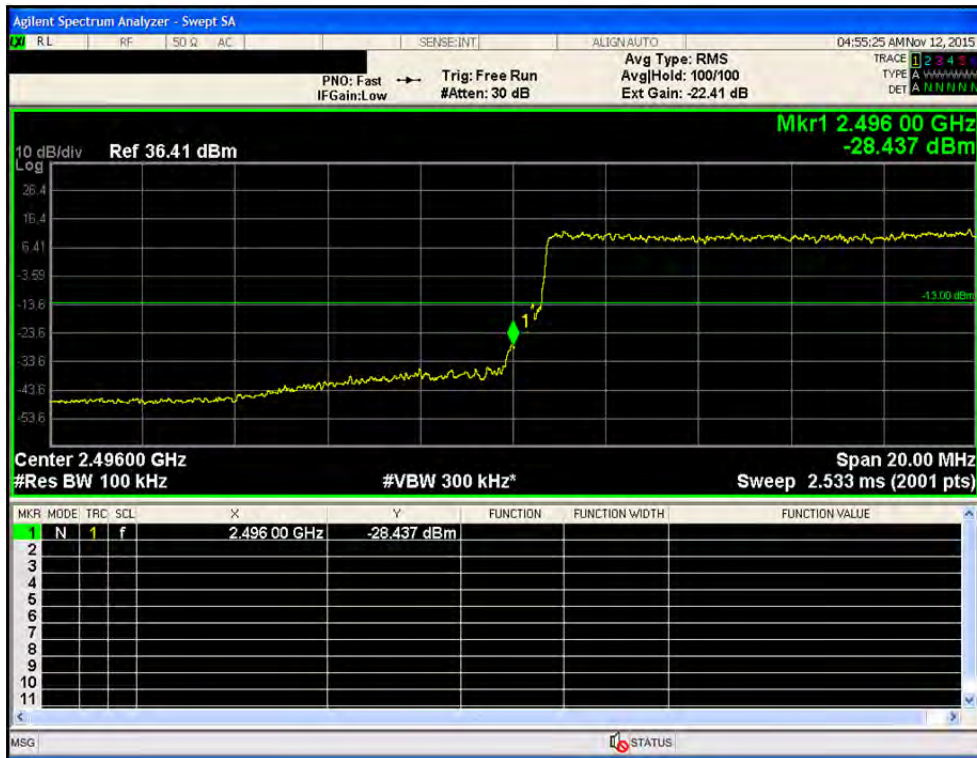
•Port2/ LTE 15M / 2503.5 MHz / 16QAM



•Port2/ LTE 15M / 2682.5 MHz / 16QAM



•Port2/ LTE 15M / 2503.5 MHz / 64QAM



•Port2/ LTE 15M / 2682.5 MHz / 64QAM



•Port2/ LTE 20M / 2506.0 MHz / QPSK



•Port2/ LTE 20M / 2680.0 MHz / QPSK





•Port2/ LTE 20M / 2506.0 MHz / 16QAM



•Port2/ LTE 20M / 2680.0 MHz / 16QAM





•Port2/ LTE 20M / 2506.0 MHz / 64QAM



•Port2/ LTE 20M / 2680.0 MHz / 64QAM

