Report Reference ID:	387704-5TRFWL

Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter B – Common carrier services Part 96 – CITIZENS BROADBAND RADIO SERVICE

Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Cell hub Mid-power Radio Remote Unit
Model:	XR19AX35WM2/48Y
FCC ID:	XM2-X19AX35M2B

Testing laboratory:	**Nemko Italy Spa** Via del Carroccio, 4 20853 Biassono (MB) – Italy Telephone: +39 039 2201201 Facsimile: +39 039 2201221

	Name and title	Date
Tested by:	P. Barbieri, Wireless/EMC Specialist	12/11/2019
Reviewed by:	D. Guarnone, Wireless/EMC Specialist	12/11/2019

Nemko Spa, 20853 Biassono (MB) - Italy. All rights reserved.
This publication may be reproduced in whole for non-commercial purposes as long as Nemko Spa is acknowledged as copyright owner and source of the material. Nemko Spa takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context. Nemko Spa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This test report may not be partially reproduced, except with the prior written permission of Nemko Spa. The test report merely corresponds to the test sample. The phase of sampling / collection of equipment under test is carried out by the customer.

This Test Report, when bearing the Nemko name and logo is only valid when issued by a Nemko laboratory, or by a laboratory having special agreement with Nemko.

Table of contents

Section 1: Report summary 4
1.1 Test specification 4
1.2 Statement of compliance 4
1.3 Exclusions 4
1.4 Registration number 4
1.5 Test report revision history 4
1.6 Limits of responsibility 4
Section 2: Summary of test results 5
2.1 FCC Part 96, test results 5
Section 3: Equipment under test (EUT) and application details 6
3.1 Applicant details 6
3.2 Modular equipment 6
3.3 Product details 6
3.4 Application purpose 6
3.5 Composite/related equipment 7
3.6 Sample information 7
3.7 EUT technical specifications 7
3.8 Accessories and support equipment 8
3.9 Operation of the EUT during testing 9
3.10 EUT setup diagram 9
Section 4: Engineering considerations 10
4.1 Modifications incorporated in the EUT 10
4.2 Deviations from laboratory tests procedures 10
4.3 Technical judgment 10
Section 5: Test conditions 11
5.1 Deviations from laboratory tests procedures 11
5.2 Test conditions, power source and ambient temperatures 11
5.3 Measurement uncertainty 12
5.4 Test equipment 13
Appendix A: Test results 14
Clause 96.41(e)(3) Occupied bandwidth 14
Clause 96.41(b)(g) Peak output power at RF antenna connector 39
Clause 96.41(e)(1)(2)(3) Spurious emissions at RF antenna connector 80
Clause 96.41(e)(1)(2)(3) Radiated Spurious emissions 210
Clause 2.1055 Frequency stability 404

Appendix B: Block diagrams of test set-ups 423
Appendix C: EUT Photos..... 424

Section 1: Report summary

1.1 Test specification

Specifications	**Part 96 – CITIZENS BROADBAND RADIO SERVICE**

1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant Yes ☒ No ☐ Test method: ANSI C63.26-2015, 662911 D01 Multiple Transmitter Output v02r01, 662911 D02 MIMO with Cross-Polarized Antennas v01

1.3 Exclusions

Exclusions	None

1.4 Registration number

Test site FCC ID number	682159

1.5 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
R1TRF	----

1.6 Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. Nemko Spa authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Nemko Spa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Section 2: Summary of test results

2.1 FCC Part 96, test results

Part	Methods	Test description	Verdict
§96.41(e)(3)	2.1049	Occupied bandwidth	Pass
§96.41(b)	2.1046	Peak output power at RF antenna connector EIRP	Pass
§96.41(b)	2.1046	Peak output power at RF antenna connector PSD	Pass
§96.41(g)	2.1046	Peak output power at RF antenna connector PAPR	Pass
§96.41(e)	2.1051	Spurious emissions at RF antenna connector	Pass
§96.41(e)	2.1053	Radiated spurious emissions	Pass
	2.1055	Frequency stability	Pass
Notes:			

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details

Applicant complete business name	Name:	Teko Telecom Srl
	Federal Registration Number (FRN):	0018963462
	Grantee code	XM2
Mailing address	Address: City: Province/State: Post code: Country:	Via Meucci, 24/a Castel S. Pietro Terme Bologna 40024 Italy

3.2 Modular equipment

a) Single modular approval	Single modular approval Yes ☐ No ☒
b) Limited single modular approval	Limited single modular approval Yes ☐ No ☒

3.3 Product details

FCC ID	Grantee code:	XM2
	Product code:	-X19AX35M2B
Equipment class	PCB	
Description of product as it is marketed	Base Station	
	Model name/number:	XR19AX35WM2/48Y
	Serial number:	1012991001

3.4 Application purpose

Type of application	☒ Original certification ☐ Change in identification of presently authorized equipment Original FCC ID: Grant date: ☐ Class II permissive change or modification of presently authorized equipment

Section 3: Equipment under test

3.5 Composite/related equipment

a) Composite equipment	The EUT is a composite device subject to an additional equipment authorization Yes ☒ No ☐
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes ☐ No ☒
c) Related FCC ID	If either of the above is "yes": ☐ has been granted under the FCC ID(s) listed below: ☒ is in the process of being filled under the FCC ID(s) listed below: ☐ is pending with the FCC ID(s) listed below: ☐ has a mix of pending and granted statues under the FCC ID(s) listed below: i FCC ID: XM2-X19AX35M2B ii FCC ID:

3.6 Sample information

Receipt date:	04/01/2019
Nemko sample ID number:	------

3.7 EUT technical specifications

Operating band:	Down Link: 3550–3700 MHz
Operating frequency:	Wideband
Modulation type:	LTE (16QAM, 64QAM, 256QAM, QPSK)
Occupied bandwidth:	LTE: 5 MHz, 10 MHz, 15 MHz, 20 MHz
Channel spacing:	standard
Emission designator:	LTE: D7W
RF Output	Down Link: 30dBm (1 W)
Category of CBSD	Category B
Antenna type:	External Antenna is not provided, equipment that has an external 50 Ω RF connector
Power source:	48 Vdc

Section 3: Equipment under test

3.8 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

Item # 1	
Type of equipment:	Server
Brand name:	Dell
Model name or number:	E38S
Serial number:	066JJ5
Nemko sample number:	----------
Connection port:	----------
Cable length and type:	----------
Item # 2	
Type of equipment:	
Brand name:	
Model name or number:	
Serial number:	
Nemko sample number:	
Connection port:	
Cable length and type:	
Item # 3	
Type of equipment:	
Brand name:	
Model name or number:	
Serial number:	
Nemko sample number:	
Connection port:	
Cable length and type:	
Item # 4	
Type of equipment:	
Brand name:	
Model name or number:	
Serial number:	
Nemko sample number:	
Connection port:	
Cable length and type:	

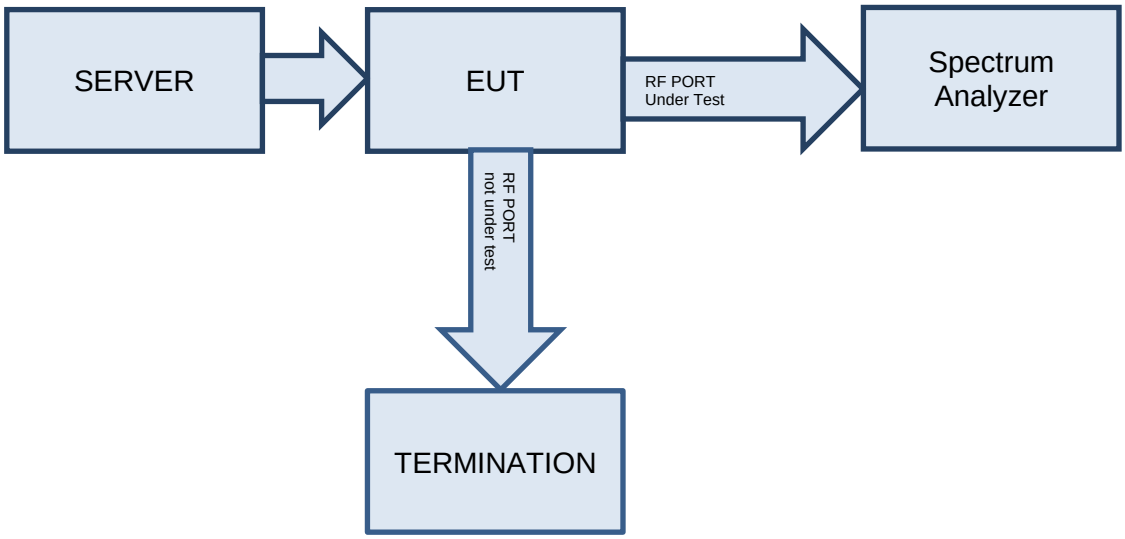
3.9 Operation of the EUT during testing

Details:	In down-link direction, normal working at max gain with max RF power output. This report refer to measurement both RF port 1 and RF port 2. When a RF port has been tested, the other one has been terminated on 50Ω load.

3.10 EUT setup diagram

In this system Cell Hub (Base Station) is the EUT.
The server generates wanted signals in base band frequency and Cell Hub convert the signal to RF band.

Test setup :



Procedure
Connect the server to the input of EUT by means of optical fiber, so the EUT can works at the maximum power.
Connect the spectrum analyzer to the RF output connector of the EUT.

Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications	Modifications performed to the EUT during this assessment None ☒ Yes ☐, performed by Client ☐ or Nemko ☐ Details:

4.2 Deviations from laboratory tests procedures

Deviations	Deviations from laboratory test procedures None ☒ Yes ☐ - details are listed below:

4.3 Technical judgment

Judgment	None

Section 5: Test conditions

5.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

5.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 5: Test conditions, continued

5.3 Measurement uncertainty

EUT	Type	Test	Range and Setup features	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	10 kHz ÷ 30 MHz	1.0 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.6 dB	(1)
		Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)
			26 GHz ÷ 40 GHz	4.5 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 40 GHz	8.0 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26,5 GHz ÷ 40 GHz	8.0 dB	(1)
Receiver	Radiated	Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 40 GHz	8.0 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)
			26 GHz ÷ 40 GHz	4.5 dB	(1)

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2 which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %

5.4 Test equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Spectrum Analyzer	Agilent	N9030A PXA	MY53120882	12/2019
Climatic Chambre	Angelantoni	ACS-Hygros 600	7237	09/2020
Trilog Broad Band Antenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	07/2021
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	07/2021
Double ridge horn antenna (4 ÷ 40 GHz)	RFSpin	DRH40	061106A40	02/2020
Broadband preamplifier (18 ÷ 40 GHz)	Miteq	JS44-18004000-35-8P-R	1.627	09/2019
Broadband preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	9718-137	08/2019
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	01/2020
EMI receiver 2 Hz ÷ 44 GHz	R&S	ESW44	101620	05/2019
Hydraulic revolving platform	Nemko	RTPL 01	4.233	NCR
Turning-table	R&S	HCT	835 803/03	NCR
Antenna mast	R&S	HCM	836 529/05	NCR
Controller	R&S	HCC	836 620/7	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	09/2021
Shielded room	Siemens	10m control room	1947	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	70	NCR
Shielded Room	Siemens	3m semi-anechoic chamber	3	NCR
Motor controller	Emco	1051-25	9012-1559	NCR
Motor controller	Emco	1061-1.521	9012-1508	NCR
Antenna Tower	Emco	2071-2	9601-1940	NCR
Controller pole/table	Emco	2090	9511-1099	NCR

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use
(*) Equipment supplied by manufacturer's

Appendix A: Test results

Clause 96.41(e)(3) Occupied bandwidth

(e) *3.5 GHz Emissions and Interference Limits*

(3) *Measurement procedure.* (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full reference bandwidth (*i.e.,* 1 MHz or 1 percent of emission bandwidth, as specified).
The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Test date: 04/03/2019 to 05/10/2019

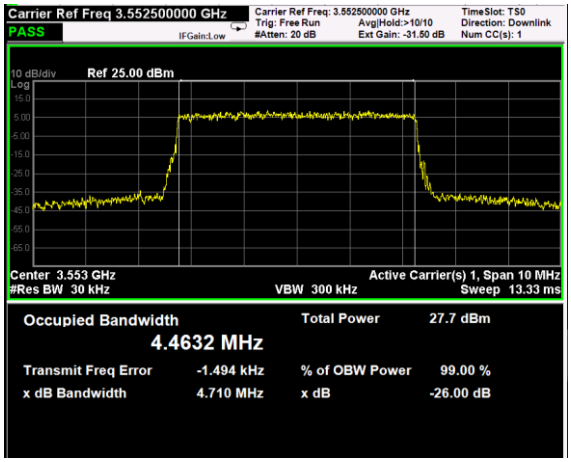
Test results: Pass

Special notes
-

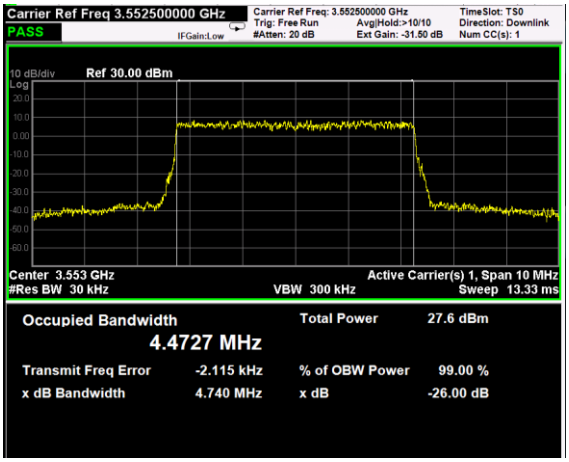
Clause 96.41(e)(3) Occupied bandwidth, continued

Test data

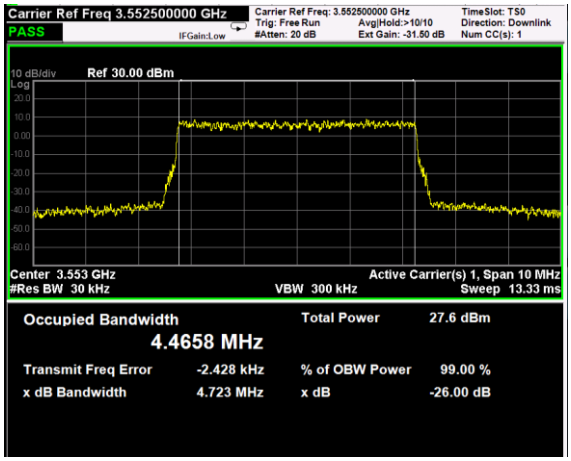
RF PORT 1



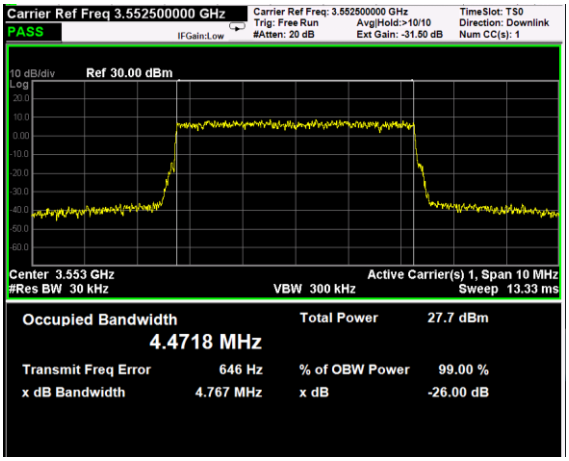
Channel: BOTTOM, Modulation: QPSK, BW=5MHz



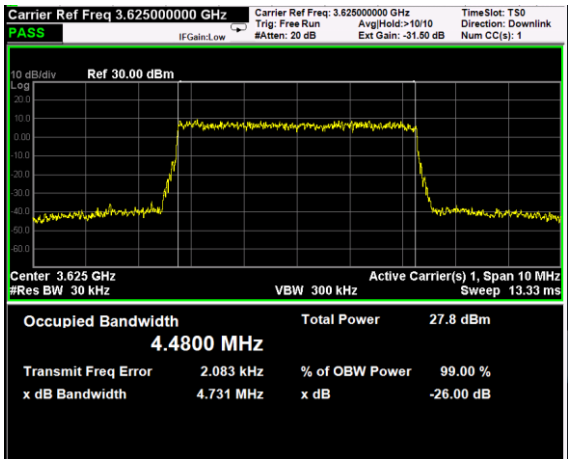
Channel: BOTTOM, Modulation: 16QAM, BW=5MHz



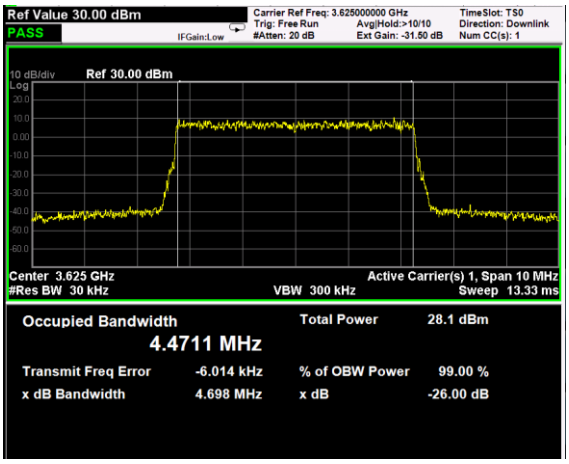
Channel: BOTTOM, Modulation: 64QAM, BW=5MHz



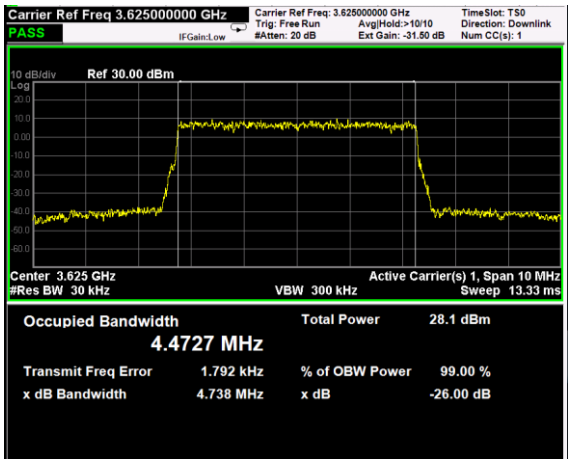
Channel: BOTTOM, Modulation: 256QAM, BW=5MHz



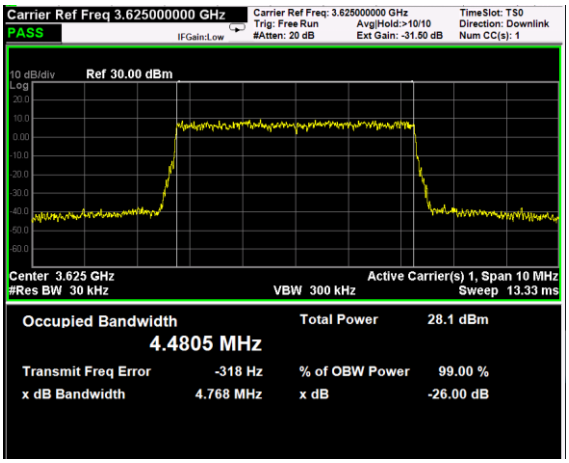
Channel: MIDDLE, Modulation: QPSK, BW=5MHz



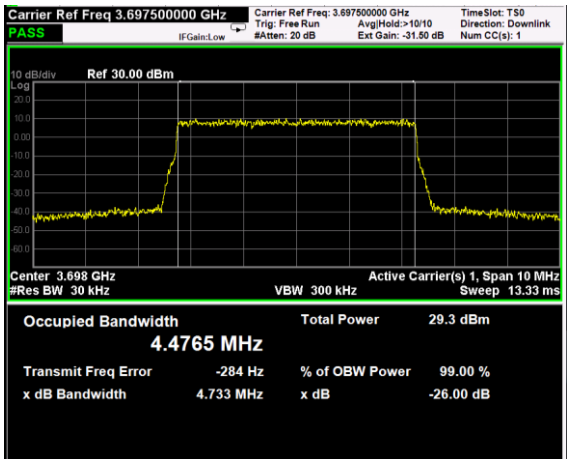
Channel: MIDDLE, Modulation: 16QAM, BW=5MHz



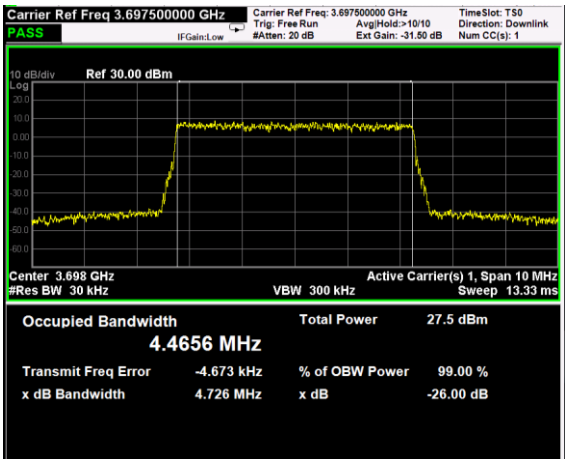
Channel: MIDDLE, Modulation: 64QAM, BW=5MHz



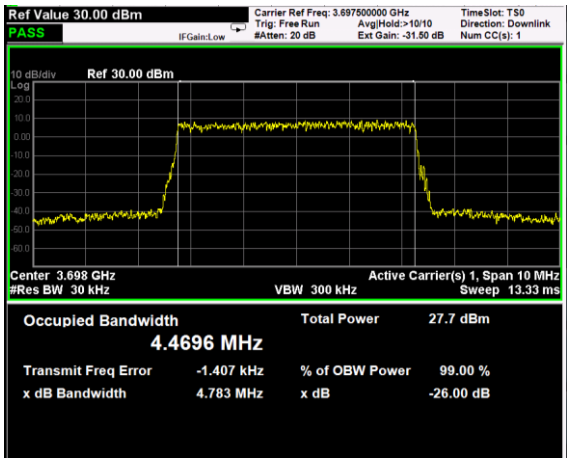
Channel: MIDDLE, Modulation: 256QAM, BW=5MHz



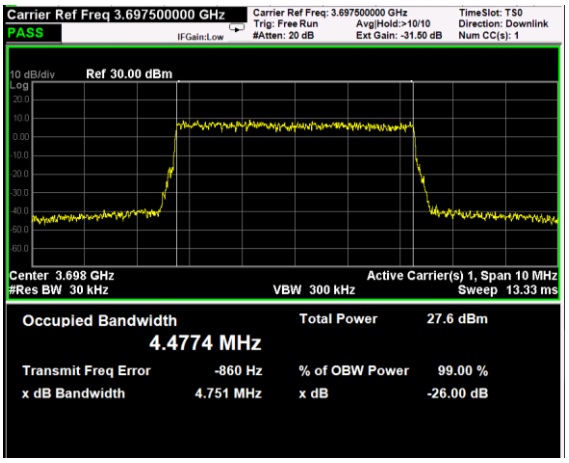
Channel: TOP, Modulation: QPSK, BW=5MHz



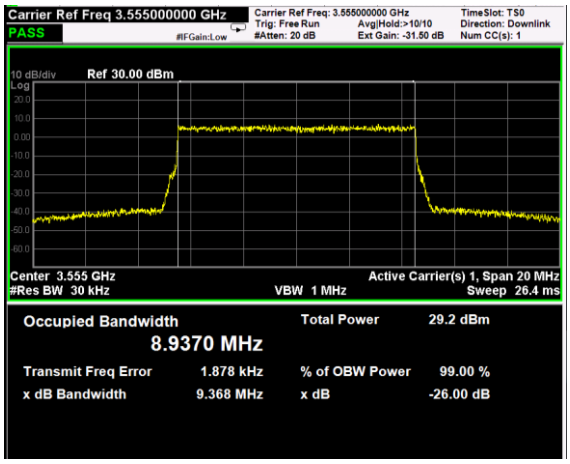
Channel: TOP, Modulation: 16QAM, BW=5MHz



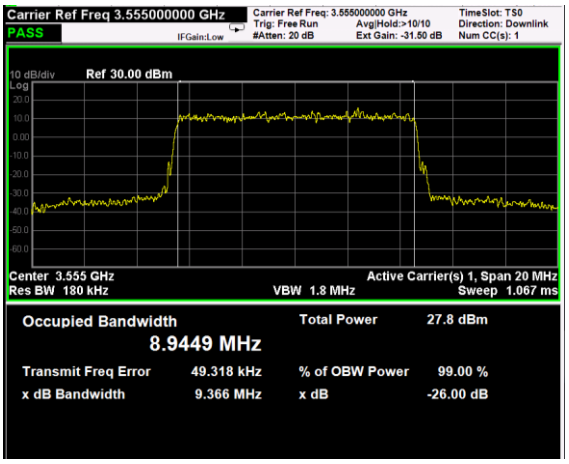
Channel: TOP, Modulation: 64QAM, BW=5MHz



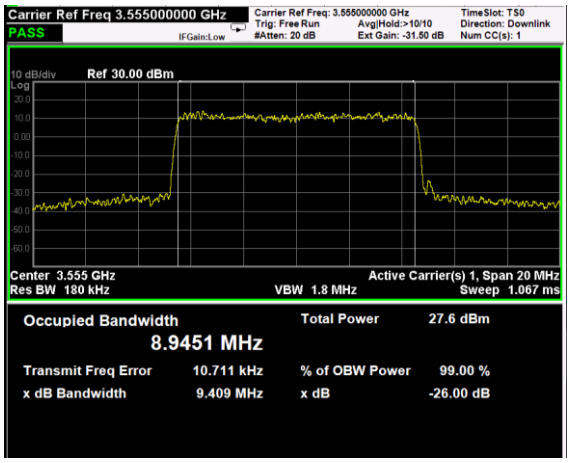
Channel: TOP, Modulation: 256QAM, BW=5MHz



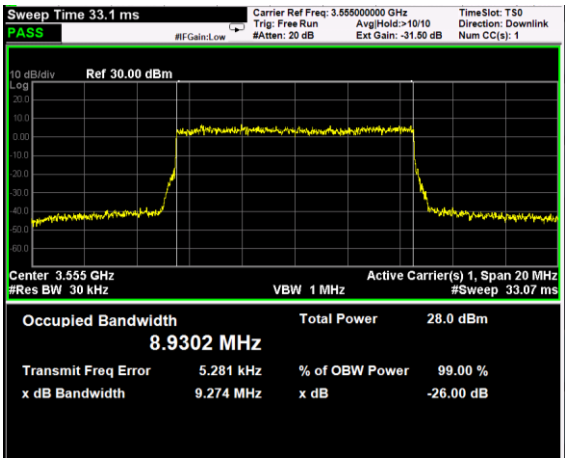
Channel: BOTTOM, Modulation: QPSK, BW=10MHz



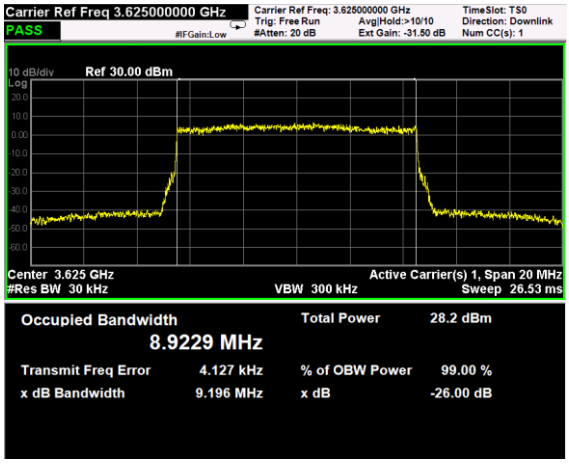
Channel: BOTTOM, Modulation: 16QAM, BW=10MHz



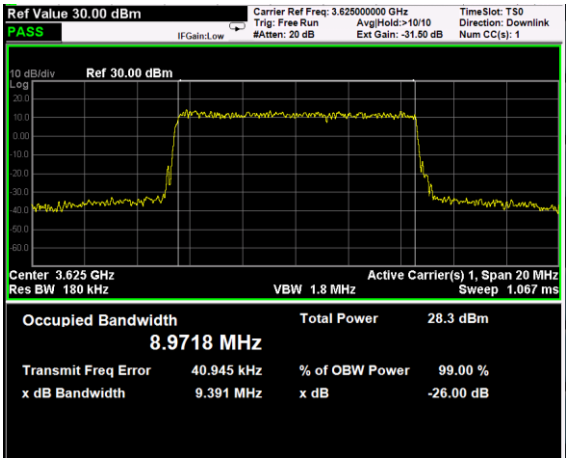
Channel: BOTTOM, Modulation: 64QAM, BW=10MHz



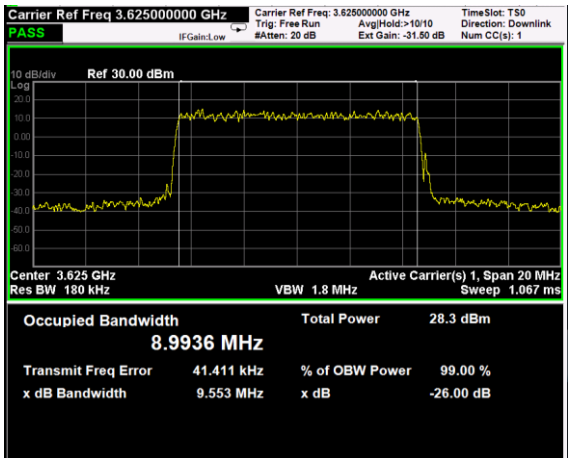
Channel: BOTTOM, Modulation: 256QAM, BW=10MHz



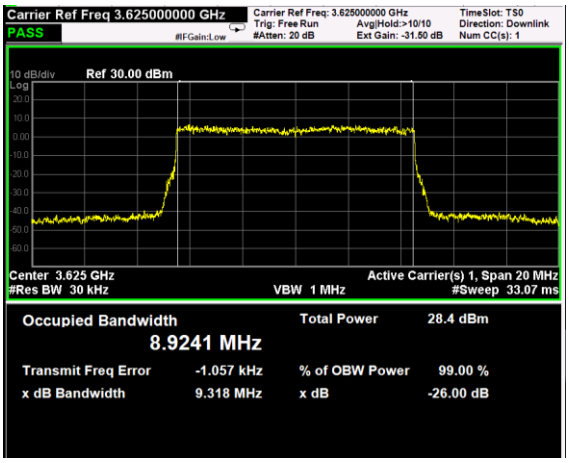
Channel: MIDDLE, Modulation: QPSK, BW=10MHz



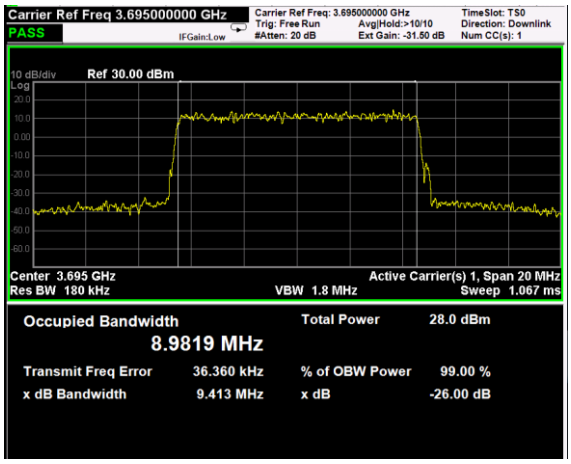
Channel: MIDDLE, Modulation: 16QAM, BW=10MHz



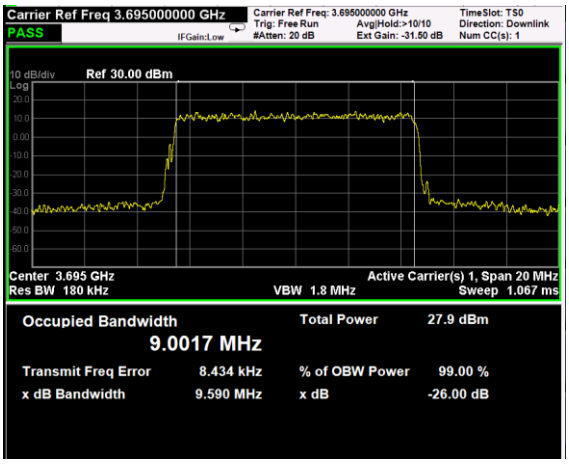
Channel: MIDDLE, Modulation: 64QAM, BW=10MHz



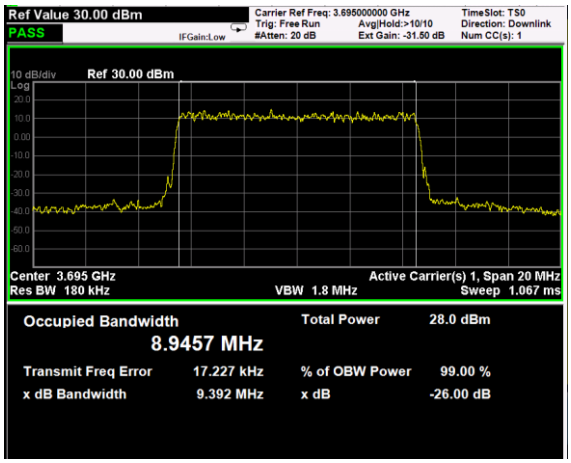
Channel: MIDDLE, Modulation: 256QAM, BW=10MHz



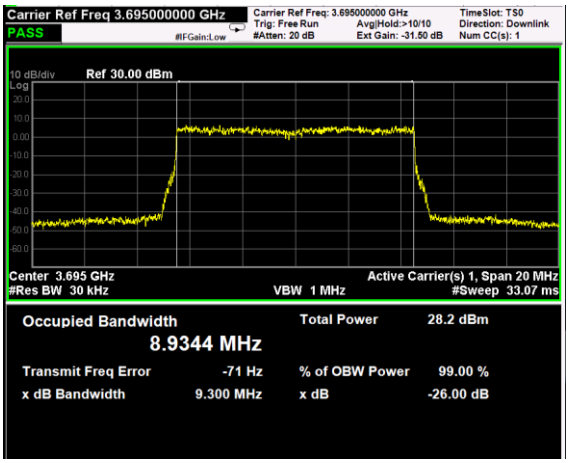
Channel: TOP, Modulation: QPSK, BW=10MHz



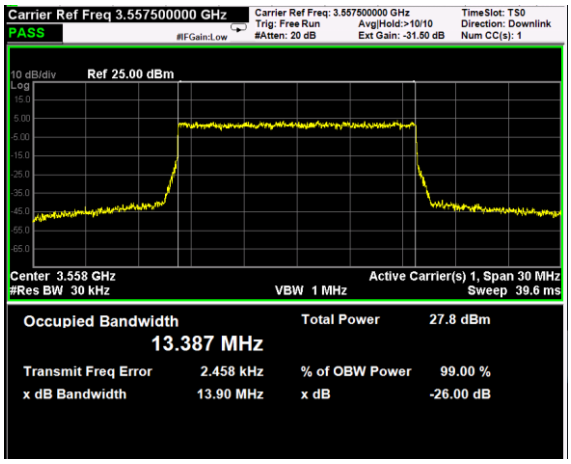
Channel: TOP, Modulation: 16QAM, BW=10MHz



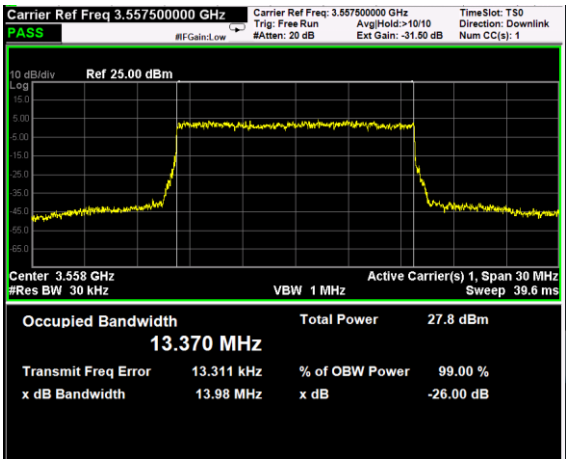
Channel: TOP, Modulation: 64QAM, BW=10MHz



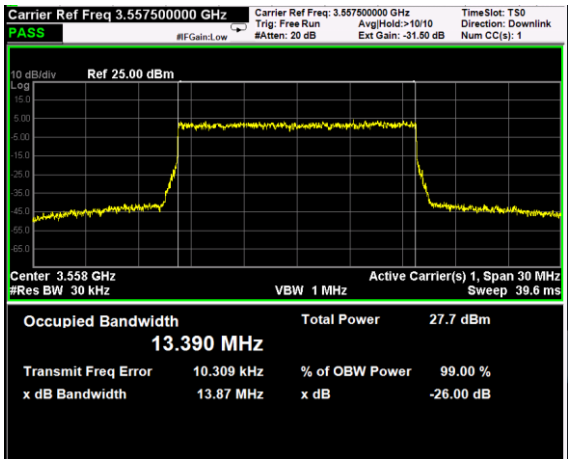
Channel: TOP, Modulation: 256QAM, BW=10MHz



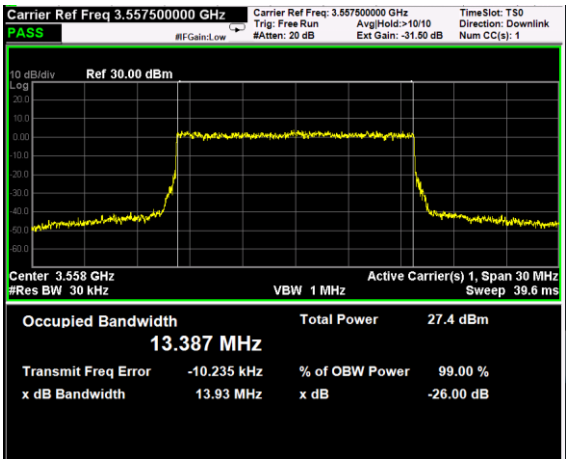
Channel: BOTTOM, Modulation: QPSK, BW=15MHz



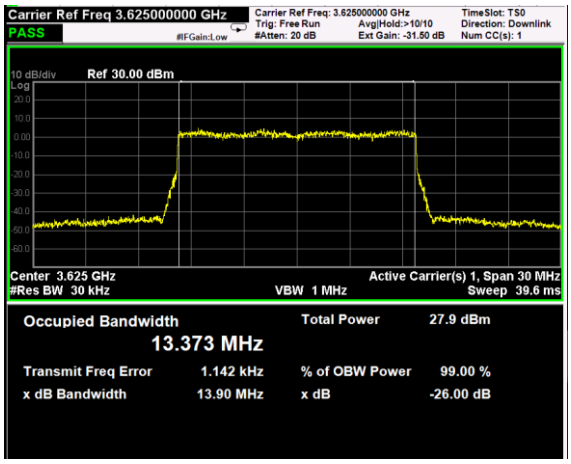
Channel: BOTTOM, Modulation: 16QAM, BW=15MHz



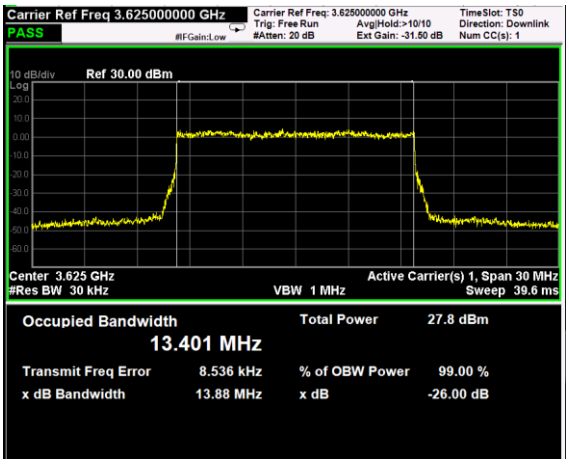
Channel: BOTTOM, Modulation: 64QAM, BW=15MHz



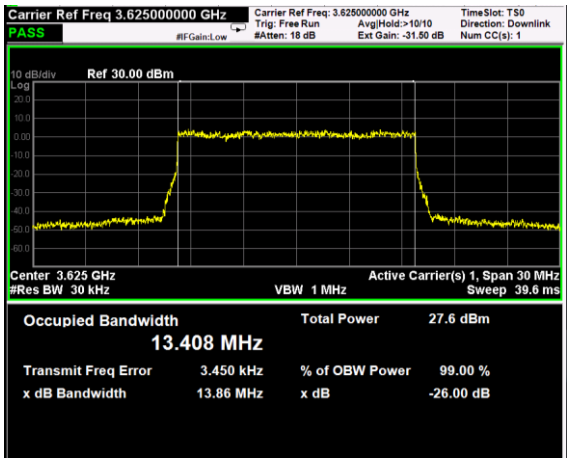
Channel: BOTTOM, Modulation: 256QAM, BW=15MHz



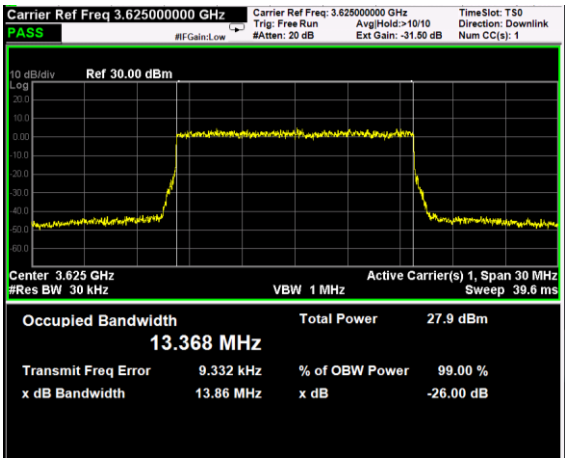
Channel: MIDDLE, Modulation: QPSK, BW=15MHz



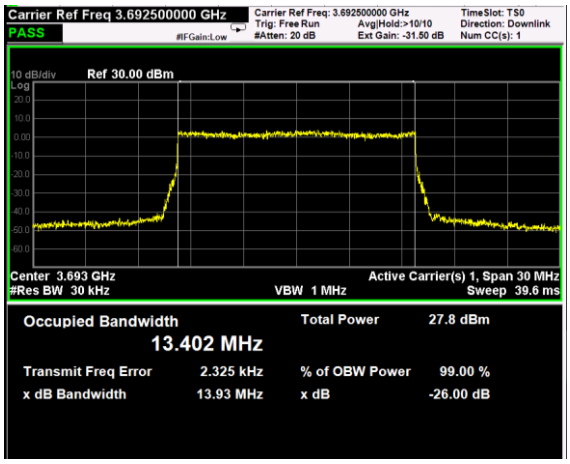
Channel: MIDDLE, Modulation: 16QAM, BW=15MHz



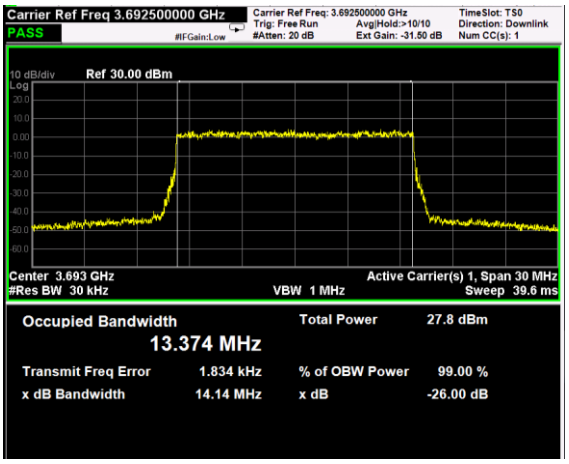
Channel: MIDDLE, Modulation: 64QAM, BW=15MHz



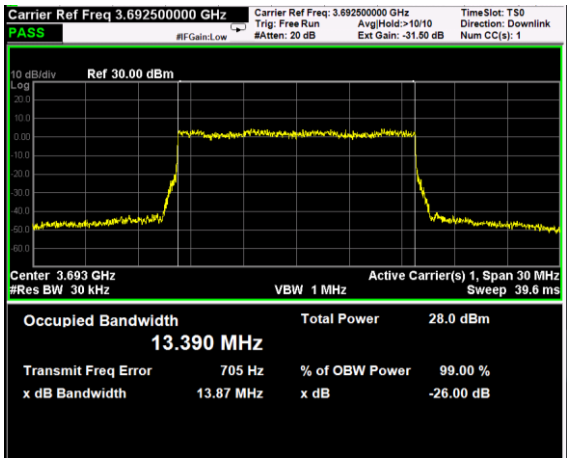
Channel: MIDDLE, Modulation: 256QAM, BW=15MHz



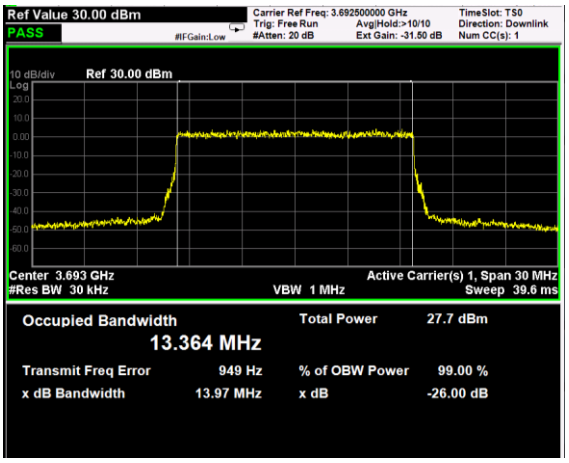
Channel: TOP, Modulation: QPSK, BW=15MHz



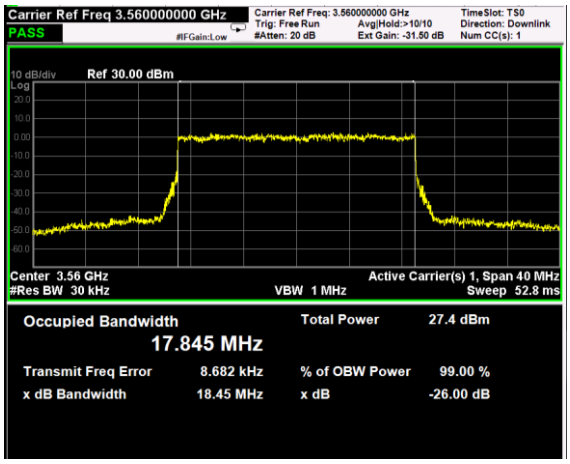
Channel: TOP, Modulation: 16QAM, BW=15MHz



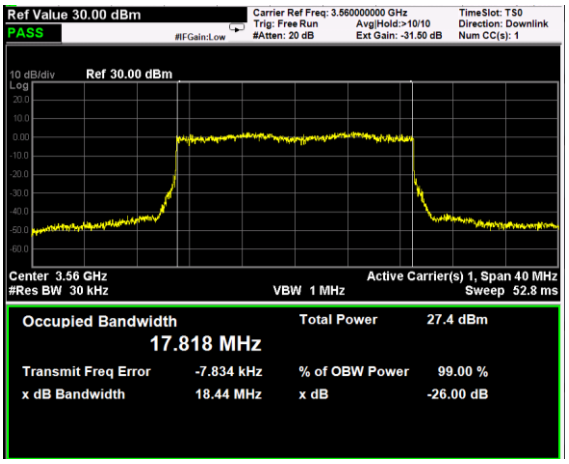
Channel: TOP, Modulation: 64QAM, BW=15MHz



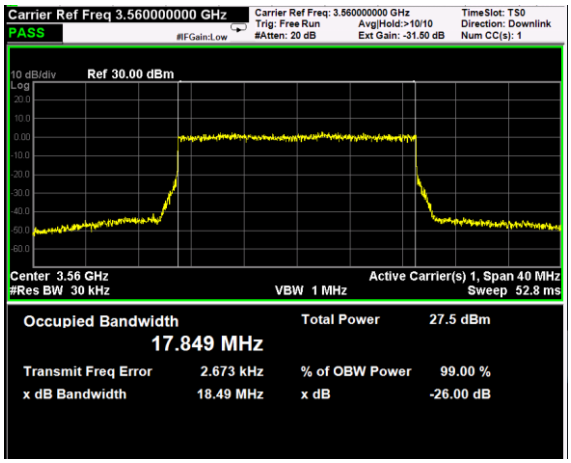
Channel: TOP, Modulation: 256QAM, BW=15MHz



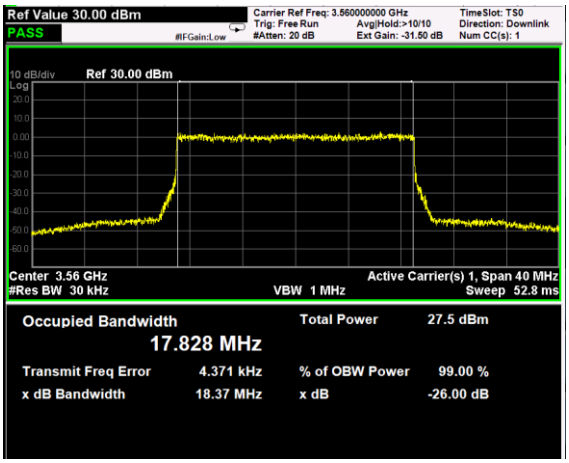
Channel: BOTTOM, Modulation: QPSK, BW=20MHz



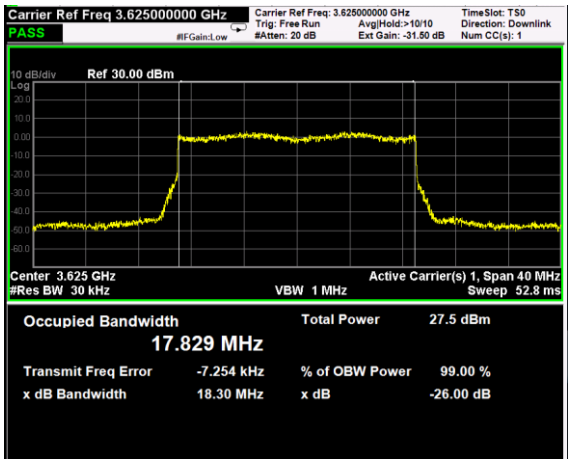
Channel: BOTTOM, Modulation: 16QAM, BW=20MHz



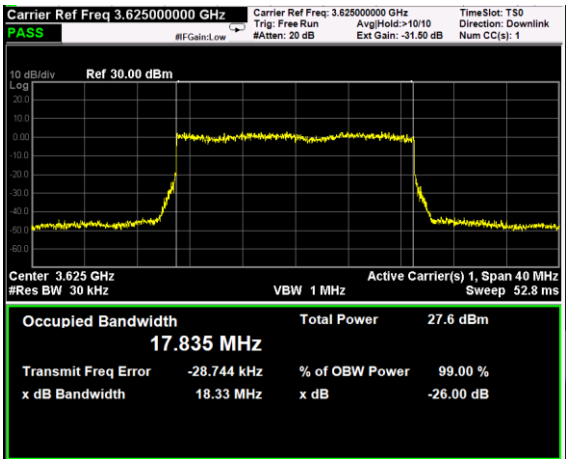
Channel: BOTTOM, Modulation: 64QAM, BW=20MHz



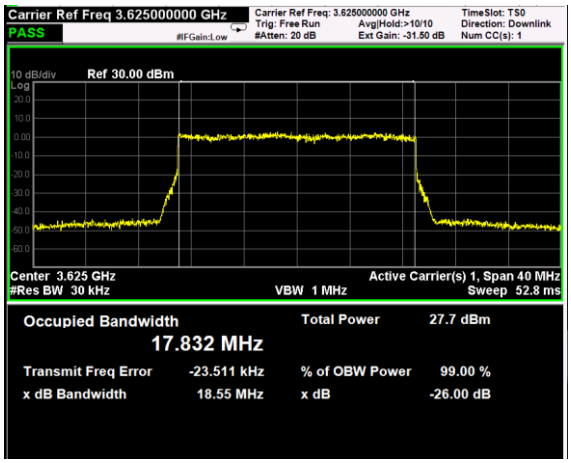
Channel: BOTTOM, Modulation: 256QAM, BW=20MHz



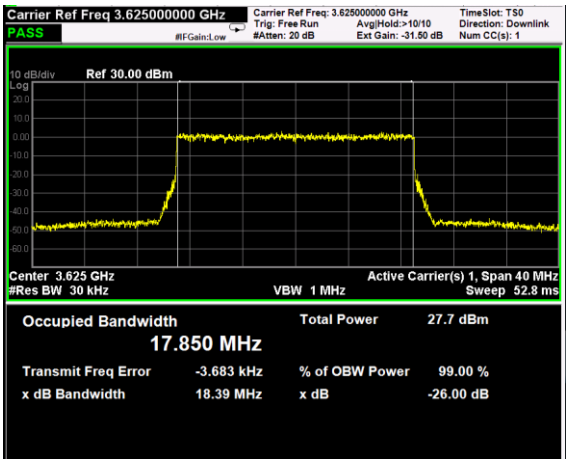
Channel: MIDDLE, Modulation: QPSK, BW=20MHz



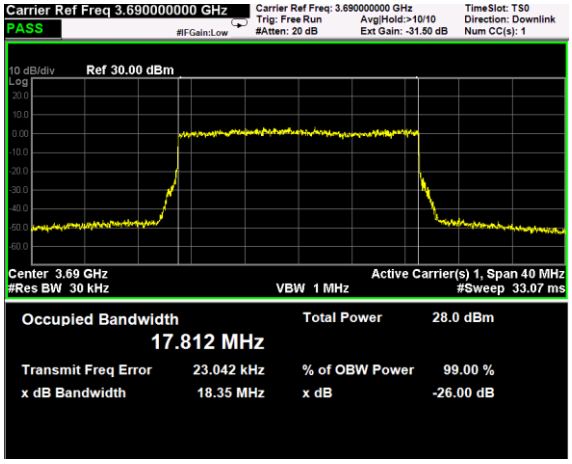
Channel: MIDDLE, Modulation: 16QAM, BW=20MHz



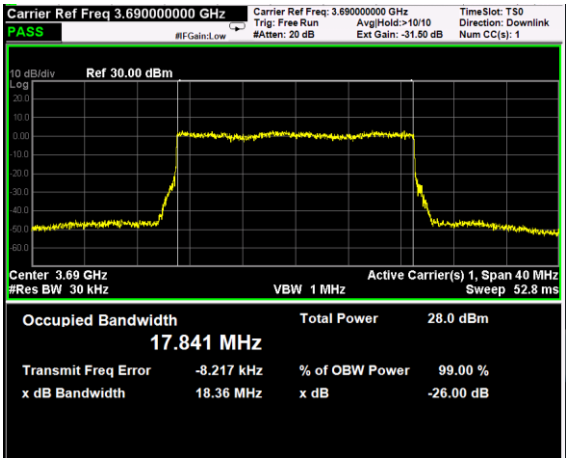
Channel: MIDDLE, Modulation: 64QAM, BW=20MHz



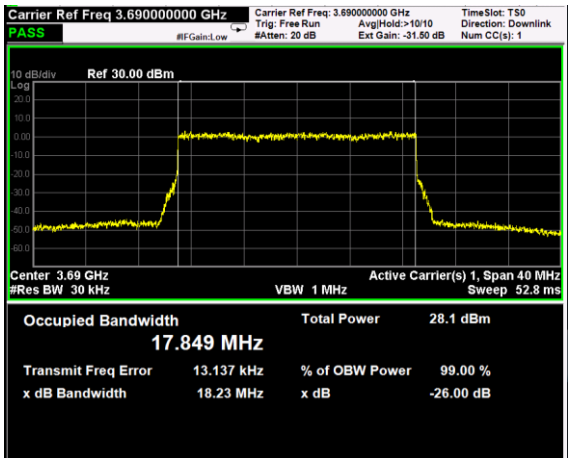
Channel: MIDDLE, Modulation: 256QAM, BW=20MHz



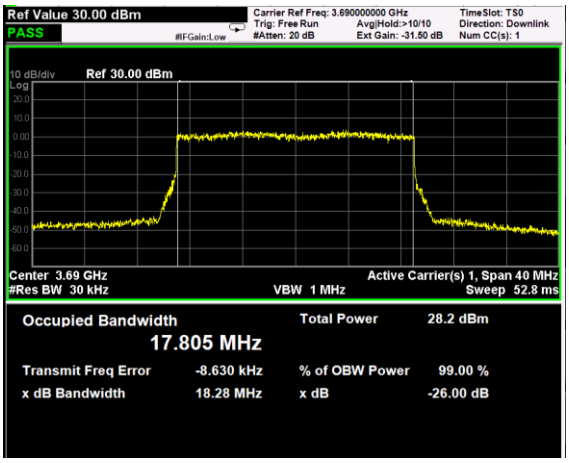
Channel: TOP, Modulation: QPSK, BW=20MHz



Channel: TOP, Modulation: 16QAM, BW=20MHz

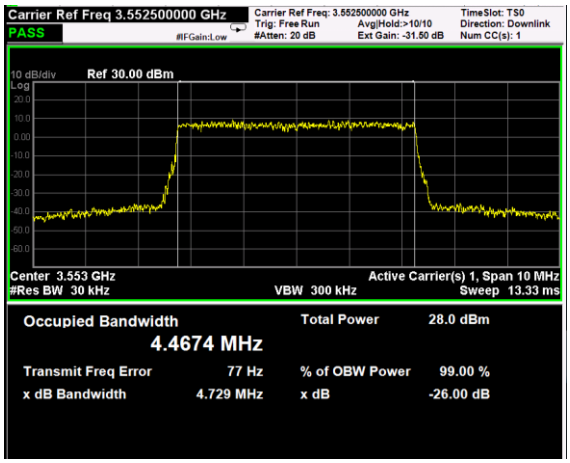


Channel: TOP, Modulation: 64QAM, BW=20MHz

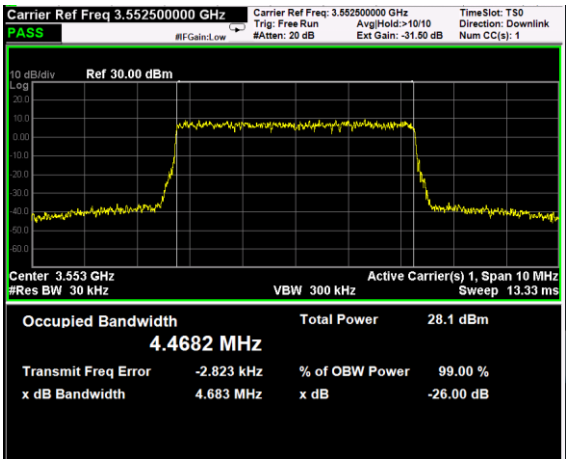


Channel: TOP, Modulation: 256QAM, BW=20MHz

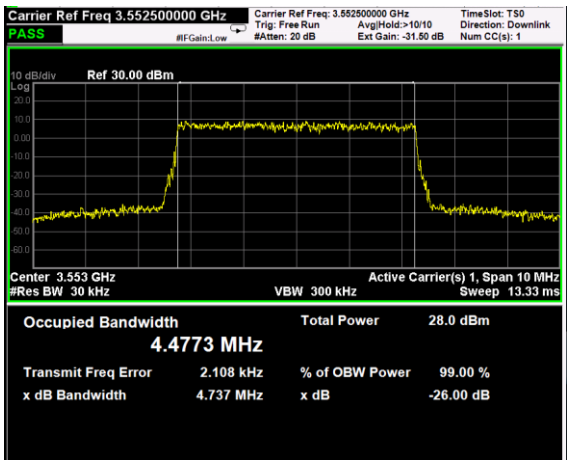
RF PORT 2



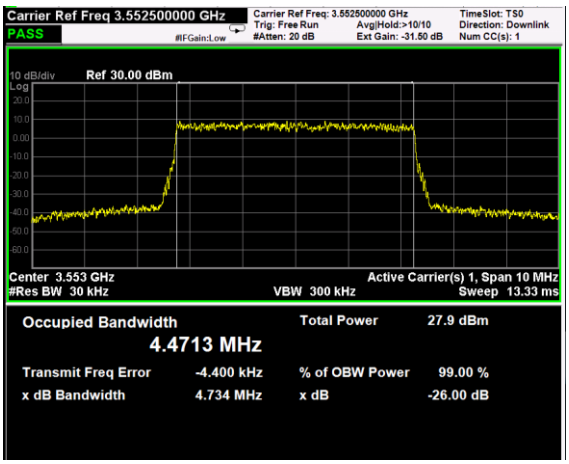
Channel: BOTTOM, Modulation: QPSK, BW=5MHz



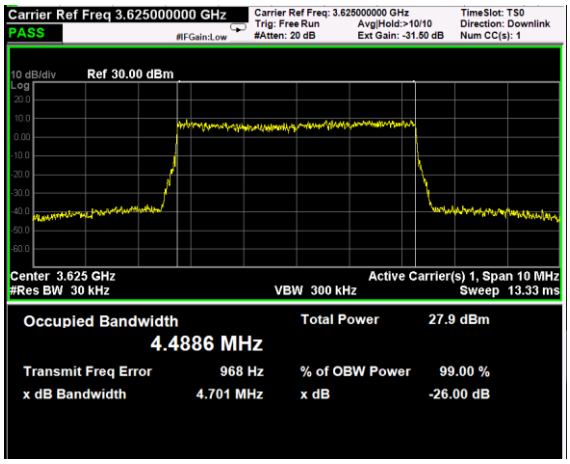
Channel: BOTTOM, Modulation: 16QAM, BW=5MHz



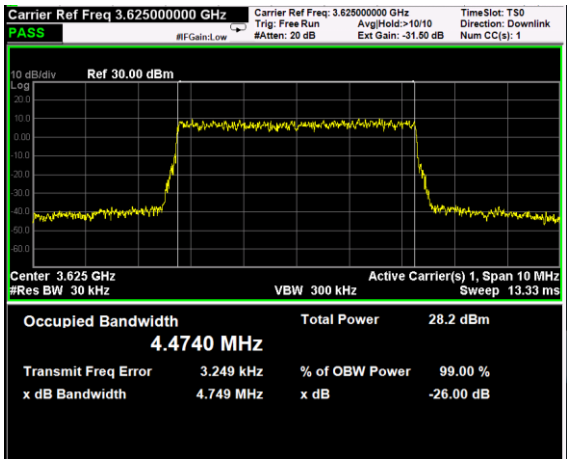
Channel: BOTTOM, Modulation: 64QAM, BW=5MHz



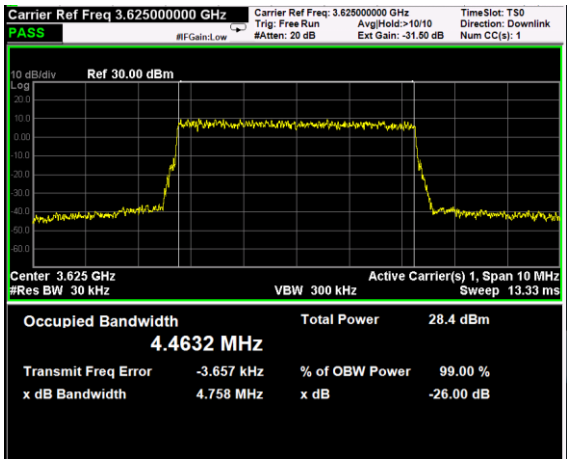
Channel: BOTTOM, Modulation: 256QAM, BW=5MHz



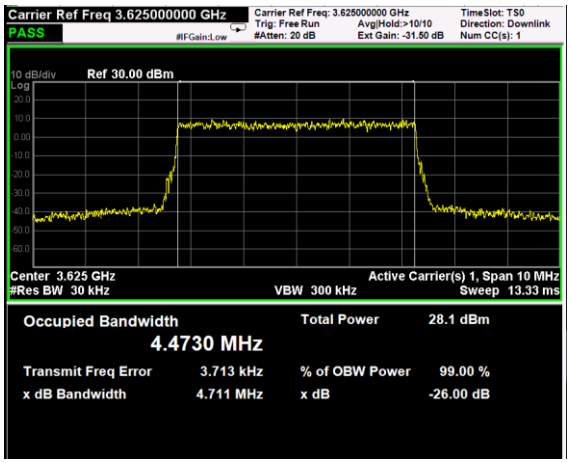
Channel: MIDDLE, Modulation: QPSK, BW=5MHz



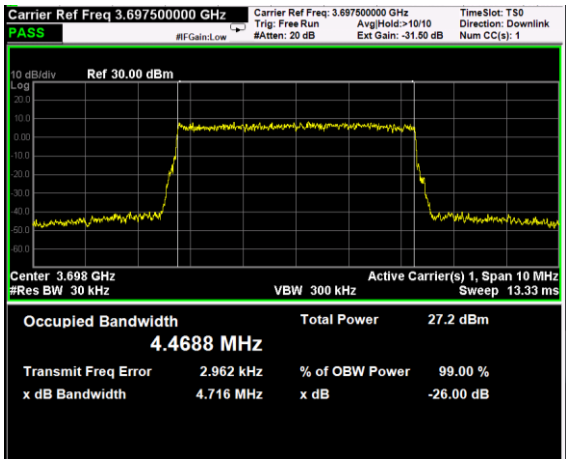
Channel: MIDDLE, Modulation: 16QAM, BW=5MHz



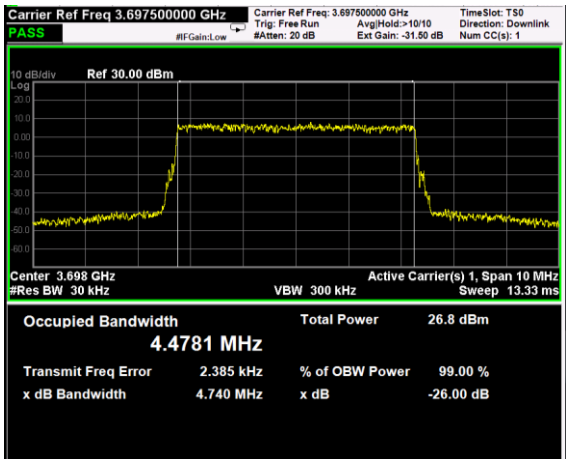
Channel: MIDDLE, Modulation: 64QAM, BW=5MHz



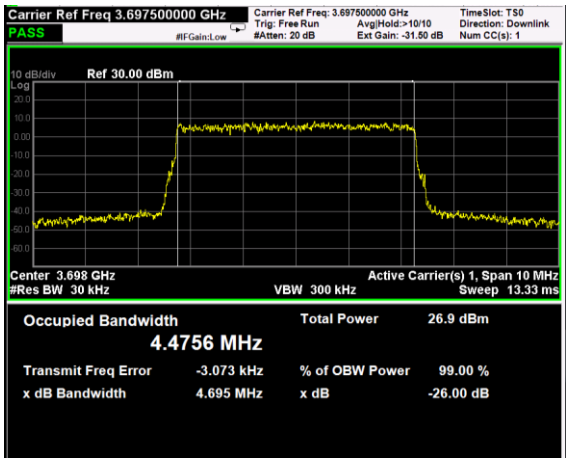
Channel: MIDDLE, Modulation: 256QAM, BW=5MHz



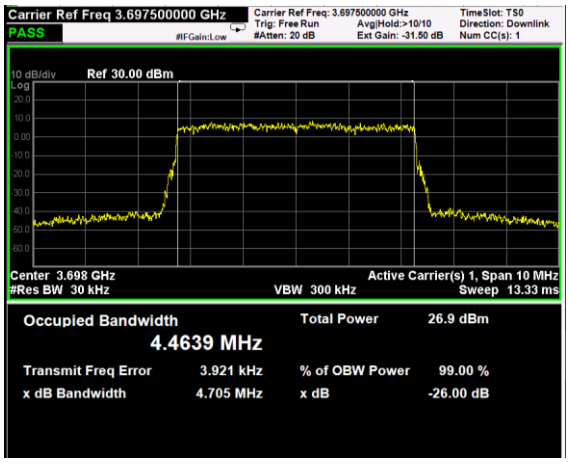
Channel: TOP, Modulation: QPSK, BW=5MHz



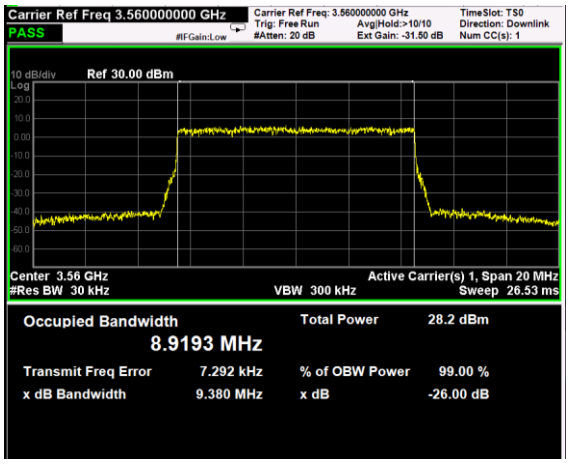
Channel: TOP, Modulation: 16QAM, BW=5MHz



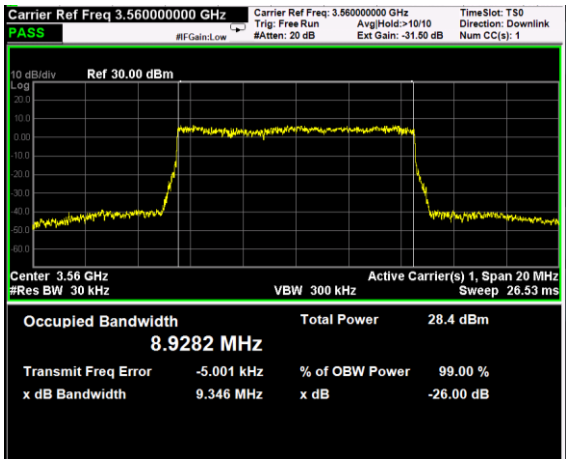
Channel: TOP, Modulation: 64QAM, BW=5MHz



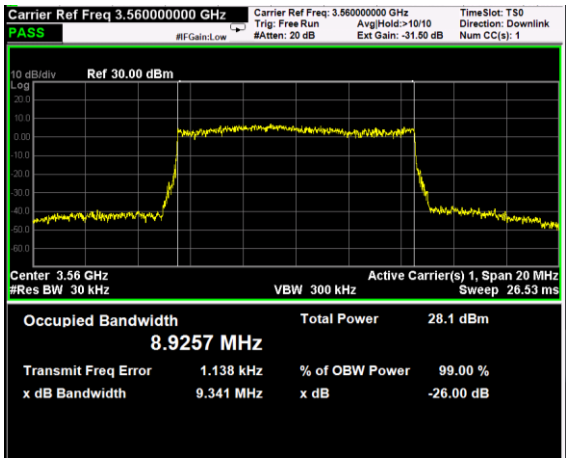
Channel: TOP, Modulation: 256QAM, BW=5MHz



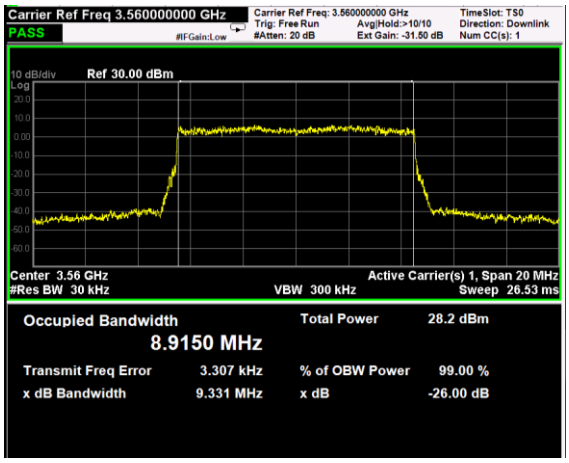
Channel: BOTTOM, Modulation: QPSK, BW=10MHz



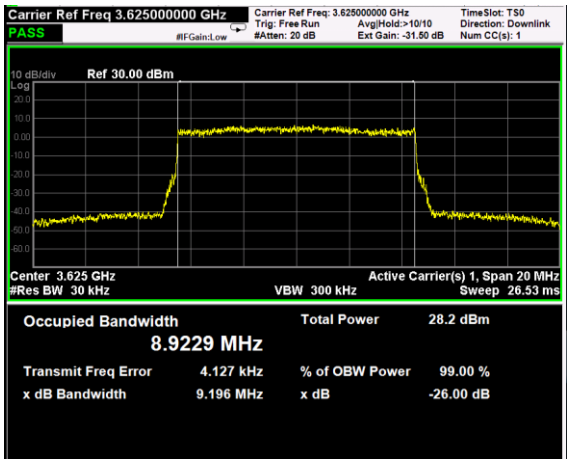
Channel: BOTTOM, Modulation: 16QAM, BW=10MHz



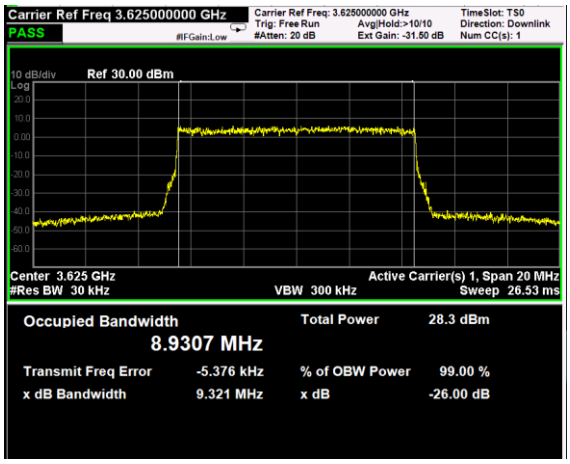
Channel: BOTTOM, Modulation: 64QAM, BW=10MHz



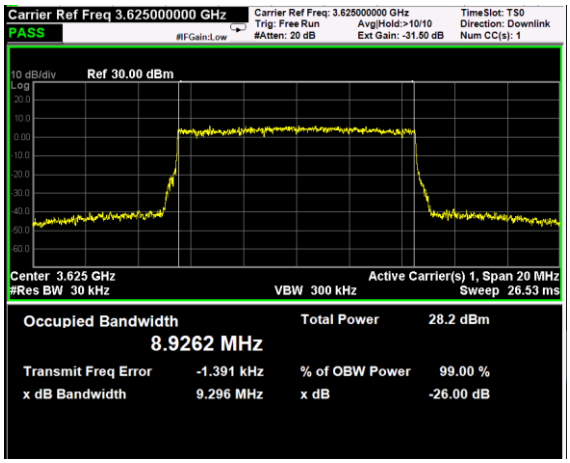
Channel: BOTTOM, Modulation: 256QAM, BW=10MHz



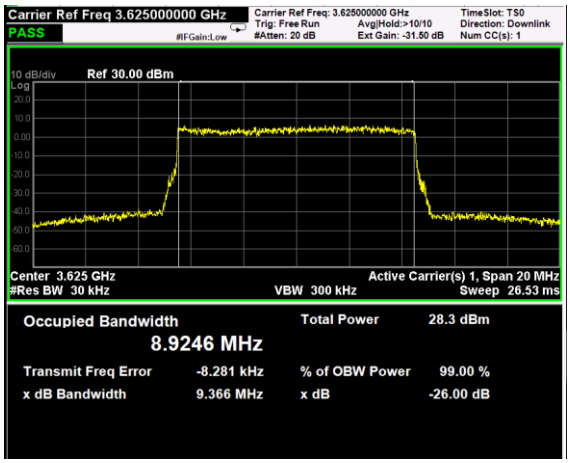
Channel: MIDDLE, Modulation: QPSK, BW=10MHz



Channel: MIDDLE, Modulation: 16QAM, BW=10MHz



Channel: MIDDLE, Modulation: 64QAM, BW=10MHz



Channel: MIDDLE, Modulation: 256QAM, BW=10MHz