



TEST REPORT

REPORT NUMBER: B19W50622-WWAN_Rev2

ON

Type of Equipment:

IoT Module

Model Name:

L710

Manufacturer:

Shanghai MobileTek Communication Ltd.

ACCORDING TO

FCC CFR Part 2, FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS, e-CFR, 2019

PART 22, PUBLIC MOBILE SERVICES, e-CFR, 2019

PART 24, PERSONAL COMMUNICATIONS SERVICES, e-CFR, 2019

PART 27, MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES, e-CFR, 2019

PART 90, PRIVATE LAND MOBILE RADIO SERVICES, e-CFR, 2019

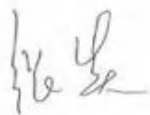
ANSI C63.26-2015

Chongqing Academy of Information and Communications Technology

Month date, year

Jul, 07, 2020

Signature



Zhang Yan

Director

Note:

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Revision Version

Report Number	Revision	Date	Memo
B19W50622	V0.0	2020-06-09	--
B19W50622	V1.0	2020-07-02	--
B19W50622	V2.0	2020-07-07	--

Report No.: B19W50622-WWAN_Rev2**FCC ID:** 2AK9D-L710**Report Date:** 2020-07-07**Test Firm Name:** Chongqing Academy of Information and Communications Technology**FCC Registration Number:** CN1239**Statement**

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported tests were carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Parts 2, 22, 24, 27,90,The sample tested was found to comply with the requirements defined in the applied rules.

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1 General Information

1.1 Notes

All reported tests were carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Parts 2, 22, 24, 27,90.

The test results of this test report relate exclusively to the item(s) tested as specified in section 2.

The following deviation from, additions to, or exclusions from the test specifications have been made. See Annex B.

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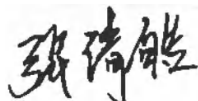
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1.2 Testers

Name: Zhang qinghao
Position: Engineer
Department: Department of RF test
Date: 2019-11-20 to 2020-07-02

Signature:



Editor of this test report:

Name: Chen Wen
Position: Engineer
Department: Department of RF test
Date: 2020-07-07

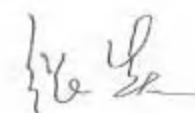
Signature:



Technical responsibility for area of testing:

Name: Zhang Yan
Position: Manager
Department: Director of the laboratory
Date: 2020-07-07

Signature:



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1.3 Testing Laboratory information

1.3.1 Location

Name: Chongqing Academy of Information and Communications Technology
Address: No. 8, Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China
4th Floor, Block B1-3, 19 East Road, XTB Valley, Yubei District, Chongqing, P. R. China
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Tel: +86-23-88069965
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Email: liqiao@caict.ac.cn

1.3.2 Test location, where different from section 1.3.1

Name: -----
Street: -----
City: -----
Country: -----
Telephone: -----
Fax: -----
Postcode: -----

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1.4 Details of applicant or manufacturer

1.4.1 Applicant

Name: Shanghai MobileTek Communication Ltd.
Address: Free Trade Zone No.33, No.17 building 6H Xiya Road,
shanghai
Country: China
Telephone: +18616835910
Fax: +86-21-54451877
Contact: bin yang
Email: b.yang@mobiletek.cn

1.4.2 Manufacturer (if different from applicant in section 1.4.1)

Name: --
Address: --
Country: --
Telephone: --
Fax: --
Contact: --
Email: --

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2 Test Item

2.1 General Information

Manufacturer:	Shanghai MobileTek Communication Ltd.
Type of Equipment:	IoT Module
Model Name:	L710
Production Status:	Product
Hardware Version:	V2
Software Version:	L710v07.01b01
Receipt date of test item:	2019-11-20
Nominal Voltage:	3.8V
Extreme High Voltage:	4.2V
Extreme Low Voltage:	3.4V

2.2 Outline of Equipment under Test

The L710, referred to as “EUT” hereafter, is a multi-Band wireless module operating on the GSM/CAT-M1/NB-IoT networks. The table below shows the supported Bands for the EUT.

Technology	Band	UL Freq.(MHz)	DL Freq.(MHz)	Note
GSM	GSM850	824 – 849	869 – 894	--
	PCS1900	1850 – 1910	1930 – 1990	--
NB-IoT	Band2	1850 – 1910	1930 – 1990	--
	Band4	1710–1755	2110–2155	--
	Band5	824 – 849	869 – 894	Band26 and Band5 have the same frequency range from 824MHz to 849MHz,Both Bands share the same hardware and have the same radio performance. Separate measurement in Band5 is not required.
	Band12	699 – 716	729 – 746	--

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Technology	Band	UL Freq.(MHz)	DL Freq.(MHz)	Note
CAT-M	Band13	777 - 787	746 - 756	--
	Band26	814 – 849	859 – 894	--
	Band2	1850 – 1910	1930 – 1990	--
	Band4	1710 – 1755	2110 – 2155	--
	Band5	824 – 849	869 – 894	Band26 and Band5 have the same frequency range from 824MHz to 849MHz,Both Bands share the same hardware and have the same radio performance. Separate measurement in Band5 is not required.
	Band12	699 – 716	729 – 746	--
	Band13	777 - 787	746 - 756	--
	Band26	814 – 849	859 – 894	--

2.3 Modifications Incorporated in EUT

The EUT has not been modified from what is described by the brand name and unique type identification stated above.

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2.4 Equipment Configuration

Equipment configuration list:

Item	Generic Description	Manufacturer	Type	Serial No.	Remarks
A	Modules	Micron Electronics LLC.	L710	353081090297923	None
B	Modules	Micron Electronics LLC.	L710	353081090308282	None

2.5 Other Information

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3 Summary of Test Results

A brief summary of the tests carried out is shown as following.

FCC Rules	Name of Test	Result
2.1046,22.913(a),24.232(c),27.50,90.635(b)	Conducted RF Power Output	Pass
2.1049,22.917(b),24.238(b),90.209	Occupied Bandwidth	--
2.1051,2.1053,24.238,22.917,27.53,90.691	Conducted spurious emissions	Pass
2.1051,2.1053,24.238,22.917,27.53,90.691	Radiated Spurious Emission	Pass
2.1051,2.1053,24.238,22.917,27.53,90.691	Band Edge	Pass
2.1055,22.355,24.235,27.54,90.213	Frequency Stability over Temperature Variation	Pass
2.1055,22.355,24.235,27.54,90.213	Frequency Stability over Voltage Variation	Pass
24.232,27.50	Peak to Average Ratio	Pass
24.232(b),27.50(d),27.50(h)(2),27.50(c),90.635(b)	ERP and EIRP	Pass
Note 1: No applicable performance criteria.		

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4 Test Equipments and Ancillaries Used For Tests

The test equipments and ancillaries used are as follows.

No.	Equipment	Model	SN	Manufacture	Cal. Due Date
1	EMI Test Receiver	ESU26	100367	R&S	2021-02-28
2	Loop antenna	6502	00143163	ETS	2020-12-05
3	Trilog super broadBand test antenna	VULB 9163	9163-544	R&S	2020-11-23
4	Double-Ridged Horn Antenna	HF907	100357	R&S	2021-06-20
5	Fully-Anechoic Chamber	11.8m×6.5m×6.3m	--	ETS	2020-10-22
6	Signal Generator	SMU200A	104517	R&S	2021-02-28
7	spectrum analyzer	FSQ 26	201137/026	R&S	2021-02-28
8	spectrum analyzer	N9020A	MY50200376	Agilent	2021-02-28
9	Universal Radio Communication Tester	CMU200	112012	R&S	2021-02-28
10	Climate chamber	SH-241	92010759	ESPEC	2021-02-28
11	DC Power Supply	N6705B	MY50000919	Agilent	2020-12-04
12	Universal Radio Communication Tester	CMW500	152395	R&S	2021-02-28
13	Universal Radio Communication Tester	SP8315	SP8315-1249	StarPoint	2021-02-28

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5 Test Results

5.1 Conducted RF Power Output

Specifications:	FCC Part 2.1046, 22.913(a),24.232(c), 27.50,90.635(b)
DUT Serial Number:	353081090297923
Test conditions:	Ambient Temperature:15°C-35°C Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

According to Part 22.913(a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

According to Part24.232(c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to Part 27.50(c), portable stations (hand-held devices) in the 600 MHz uplink Band and the 698-746 MHz Band, and fixed and mobile stations in the 600 MHz uplink Band are limited to 3 watts ERP;

According to Part 27.50(d), fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz Band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz Bands are limited to 1 watt EIRP.

According to Part 90.635 (b),The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

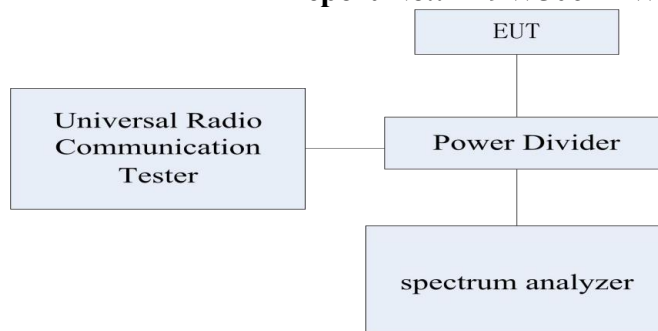
Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty	0.52 dB (k=2)

Test Setup:

During the test, the EUT was controlled via the Wireless Telecommunications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.

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Test Method:

- 1) The EUT was coupled to the spectrum analyzer and the Wireless Telecommunications Test Set through a power divider. The loss of the RF cables of the test system is calibrated to correct the readings.
- 2) For RMS power test, the spectrum analyzer was set to RMS Detector function and Maximum hold mode.
- 3) For Peak power test, the spectrum analyzer was set to Maxpeak Detector function and Maximum hold mode.
- 4) The resolution Bandwidth of the spectrum analyzer was comparable to the emission Bandwidth.

Note: --.

5.1.1 GSM850 Conducted RF Power Output Results

GPRS GMSK Mode:

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	31.19	31.05	31.24	29.52
190 (836.6MHz)	30.58	30.72	29.89	28.59
251 (848.8MHz)	29.76	30.34	30.14	30.14

EGPRS GMSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	31.20	31.04	31.24	29.53
190 (836.6MHz)	30.58	30.72	29.90	28.58
251 (848.8MHz)	29.76	30.33	30.14	30.14

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EGPRS 8PSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	27.5	26.4	26.1	25.7
190 (836.6MHz)	27.2	26.4	25.7	25.1
251 (848.8MHz)	27.0	26.1	25.2	24.9

GPRS GMSK Mode:

Channel No.	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	30.90	30.31	30.96	27.76
190 (836.6MHz)	30.42	30.18	28.64	27.83
251 (848.8MHz)	29.49	30.00	28.64	27.75

EGPRS GMSK Mode

Channel No.	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	30.92	30.31	30.97	27.76
190 (836.6MHz)	30.38	30.21	28.62	27.84
251 (848.8MHz)	29.48	30.01	28.63	27.73

EGPRS 8PSK Mode

Channel No.	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	24.2	23.2	22.7	22.2
190 (836.6MHz)	23.8	22.8	22.1	21.8
251 (848.8MHz)	23.7	22.6	21.9	21.6

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5.1.2 PCS1900 Conducted RF Power Output Results

GPRS GMSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	30.82	30.15	30.40	30.31
661 (1880.0MHz)	30.37	30.07	30.22	30.12
810 (1909.8MHz)	29.99	30.41	30.20	29.80

EGPRS GMSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	30.81	30.17	30.43	30.33
661 (1880.0MHz)	30.37	30.07	30.21	30.11
810 (1909.8MHz)	29.97	30.43	30.19	29.78

EGPRS 8PSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	29.2	29.4	29.2	29.1
661 (1880.0MHz)	28.9	28.7	28.8	28.6
810 (1909.8MHz)	28.6	28.3	28.34	28.3

GPRS GMSK Mode

Channel	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	30.84	29.90	29.92	29.51
661 (1880.0MHz)	30.33	29.80	29.40	29.60
810 (1909.8MHz)	29.96	30.29	30.01	29.52

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Report No.: B19W50622-WWAN_Rev2**EGPRS GMSK Mode**

Channel	Maximum output power(avg [dBm])			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	30.87	29.90	29.90	29.50
661 (1880.0MHz)	30.31	29.81	29.37	29.60
810 (1909.8MHz)	29.95	30.29	30.00	29.51

EGPRS 8PSK Mode

Channel	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	26.0	26.1	26.1	25.9
661 (1880.0MHz)	25.6	25.6	25.5	25.3
810 (1909.8MHz)	25.3	25.4	25.3	25.1

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5.1.3 NB-IoT Band2 Conducted RF Power Output Results

NB-IoT Band 2

Maximum Average Conducted Power (dBm)					
Sub-carrier Spacing [kHz]	Modulation	N _{tones}	Channel		
			Low	Mid	High
3.75	BPSK	1@0	21.17	21.08	21.24
		1@47	21.28	21.11	21.20
	QPSK	1@0	21.27	21.11	21.26
		1@47	21.30	21.03	21.22
15	BPSK	1@0	20.99	21.05	21.23
		1@11	20.91	21.06	21.14
	QPSK	1@0	20.95	21.02	21.23
		1@11	21.91	21.06	21.19
		12@0	20.01	19.95	19.98

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5.1.4 NB-IoT Band4 Conducted RF Power Output Results

NB-IoT Band 4

Maximum Average Conducted Power (dBm)					
Sub-carrier Spacing [kHz]	Modulation	N _{tones}	Channel		
			Low	Mid	High
3.75	BPSK	1@0	20.44	20.41	20.61
		1@47	20.45	20.48	20.58
	QPSK	1@0	20.41	20.42	20.67
		1@47	20.29	20.44	20.60
15	BPSK	1@0	20.38	20.51	20.47
		1@11	20.32	20.45	20.51
	QPSK	1@0	20.28	20.39	20.55
		1@11	20.32	20.37	20.41
		12@0	19.20	19.27	19.24

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5.1.5 NB-IoT Band12 Conducted RF Power Output Results

NB-IoT Band12

Maximum Average Conducted Power (dBm)					
Sub-carrier Spacing [kHz]	Modulation	N _{tones}	Channel		
			Low	Mid	High
3.75	BPSK	1@0	20.61	20.76	-15.79
		1@47	20.69	20.65	-15.86
	QPSK	1@0	20.57	20.62	-15.80
		1@47	20.61	20.61	-15.82
15	BPSK	1@0	20.67	20.57	-15.93
		1@11	20.73	20.53	-16.01
	QPSK	1@0	20.71	20.55	-15.92
		1@11	20.68	20.59	-15.95
		12@0	20.63	20.44	-18.02

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5.1.6 NB-IoT Band13 Conducted RF Power Output Results

NB-IoT Band13

Maximum Average Conducted Power (dBm)					
Sub-carrier Spacing [kHz]	Modulation	N _{tones}	Channel		
			Low	Mid	High
3.75	BPSK	1@0	20.37	20.38	20.35
		1@47	20.38	20.43	20.44
	QPSK	1@0	20.40	20.40	20.39
		1@47	20.35	20.39	20.32
15	BPSK	1@0	20.48	20.65	20.57
		1@11	20.32	20.58	20.40
	QPSK	1@0	20.37	20.53	20.43
		1@11	20.32	20.49	20.38
		12@0	19.58	19.78	19.59

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5.1.7 NB-IoT Band 26 Conducted RF Power Output Results

(824MHz-849MHz)

Maximum Average Conducted Power (dBm)					
Sub-carrier Spacing [kHz]	Modulation	N _{tones}	Channel		
			Low	Mid	High
3.75	BPSK	1@0	20.49	20.44	20.29
		1@47	20.48	20.46	20.32
	QPSK	1@0	20.46	20.45	20.33
		1@47	20.50	20.51	20.26
15	BPSK	1@0	20.57	20.54	20.17
		1@11	20.59	20.47	20.19
	QPSK	1@0	20.60	20.59	20.20
		1@11	20.53	20.45	20.20
		12@0	19.67	19.55	19.22

(814MHz-824MHz)

Maximum Average Conducted Power (dBm)					
Sub-carrier Spacing [kHz]	Modulation	N _{tones}	Channel		
			Low	Mid	High
3.75	BPSK	1@0	20.53	20.39	20.44
		1@47	20.52	20.31	20.39
	QPSK	1@0	20.59	20.47	20.47
		1@47	20.33	20.45	20.38
15	BPSK	1@0	20.46	20.49	20.36
		1@11	20.42	20.50	20.31
	QPSK	1@0	20.53	20.51	20.33
		1@11	20.48	20.41	20.28
		12@0	19.74	19.63	19.27

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5.1.8 CAT-M B2 Conducted RF Power Output Results

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band2	1.4MHz	18607	1#0	0	20.81	20.97
			6#0	0	19.63	19.42
		18900	1#0	0	21.11	20.51
			6#0	0	20.85	20.73
		19195	1#5	0	20.88	21.40
			6#0	0	19.79	19.47
	3MHz	18615	1#0	0	20.61	21.10
			6#0	0	19.59	19.28
		18900	1#0	0	20.72	21.06
			6#0	0	19.66	19.36
		19185	1#5	1	21.01	21.16
			6#0	1	19.69	19.40
	5MHz	18620	1#0	0	20.63	21.13
			6#0	0	20.62	20.17
		18900	1#0	0	20.74	21.28
			6#0	0	20.71	20.43
		19180	1#5	3	20.57	21.23
			6#0	3	20.82	20.55
	10MHz	18640	1#0	0	20.73	20.85

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			4#0	0	20.68	20.02
		18900	1#0	0	20.89	20.97
			4#0	0	20.78	20.11
		19160	1#5	7	20.57	20.95
			4#2	7	20.55	20.21
	15MHz	18660	1#0	0	20.49	20.86
			6#0	0	20.44	20.06
		18900	1#0	0	20.77	20.89
			6#0	0	20.65	20.10
		19140	1#5	0	20.49	20.97
			6#0	0	20.35	20.15
	20MHz	18680	1#0	0	20.77	21.15
			6#0	0	20.73	20.26
		18900	1#0	0	20.55	20.96
			6#0	0	20.62	20.15
		19120	1#5	0	20.59	20.88
			6#0	0	20.52	20.09

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5.1.9 CAT-M B4 Conducted RF Power Output Results

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band4	1.4MHz	19957	1#0	0	20.71	21.06
			6#0	0	19.41	19.32
		20175	1#0	0	20.41	20.85
			6#0	0	20.30	20.12
		20393	1#5	0	20.65	20.84
			6#0	0	20.59	20.05
	3MHz	19965	1#0	0	20.69	21.11
			6#0	0	19.98	19.35
		20175	1#0	0	20.76	20.69
			6#0	0	20.58	19.86
		20385	1#5	1	20.66	21.03
			6#0	1	20.62	20.09
	5MHz	19975	1#0	0	20.74	21.16
			6#0	0	20.70	20.22
		20175	1#0	0	20.64	20.82
			6#0	0	20.59	20.01
		20375	1#5	3	20.53	21.10
			6#0	3	20.57	20.19
	10MHz	20000	1#0	0	20.65	20.87

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			4#0	0	20.63	19.92
		20175	1#0	0	20.77	21.03
			4#0	0	20.72	20.26
		20350	1#5	7	20.69	20.87
			4#2	7	20.57	19.85
	15MHz	20025	1#0	0	20.61	20.94
			6#0	0	20.49	20.15
		20175	1#0	0	20.77	21.16
			6#0	0	20.64	20.27
		20325	1#5	0	20.59	20.93
			6#0	0	20.55	20.04
	20MHz	20050	1#0	0	20.70	20.97
			6#0	0	20.71	20.16
		20175	1#0	0	20.63	21.03
			6#0	0	20.57	20.14
		20300	1#5	0	20.68	20.95
			6#0	0	20.63	20.07

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5.1.10 CAT-M B12 Conducted RF Power Output Results

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band12	1.4MHz	20315	1#0	0	20.72	20.22
			6#0	0	20.74	21.02
		23095	1#0	0	20.88	20.28
			6#0	0	20.86	21.04
		23175	1#5	0	20.44	20.48
			6#0	0	21.07	21.28
	3MHz	20320	1#0	0	20.84	20.31
			6#0	0	20.73	20.77
		23095	1#0	0	20.84	20.38
			6#0	0	20.42	21.07
		23170	1#5	1	21.04	20.52
			6#0	1	20.82	21.03
	5MHz	20330	1#0	0	20.84	20.27
			6#0	0	20.75	20.74
		23095	1#0	0	20.91	20.34
			6#0	0	20.84	20.91
		23160	1#5	3	20.44	20.95
			6#0	3	20.98	21.08
	10MHz	20345	1#0	0	20.80	20.33
			4#0	0	20.64	20.52
		23095	1#0	0	20.88	20.34
			4#0	0	20.74	20.62
		23145	1#5	7	20.87	20.20
			4#2	7	20.76	20.57

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5.1.11 CAT-M B13 Conducted RF Power Output Results

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band13	5MHz	23200	1#0	0	20.93	20.62
			6#0	0	20.72	20.87
		23230	1#0	0	21.01	20.33
			6#0	3	20.90	20.98
		23254	1#5	3	20.99	20.19
			6#0	3	20.81	20.99
	10MHz	23225	1#0	0	20.84	20.30
			6#0	0	20.95	20.99
		23230	1#0	0	20.93	20.62
			6#0	0	20.72	20.87
		23235	1#5	7	21.01	20.33
			4#2	7	20.90	20.98

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5.1.12 CAT-M B26 Conducted RF Power Output Results

(824MHz-849MHz)

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band26	1.4MHz	26797	1#0	0	20.43	19.64
			6#0	0	20.41	19.66
		26915	1#0	0	20.93	20.23
			6#0	0	20.91	20.06
		27033	1#5	0	20.58	19.67
			6#0	0	20.59	19.83
	3MHz	26805	1#0	0	20.43	19.65
			6#0	0	20.41	19.56
		26915	1#0	0	20.79	20.06
			6#0	0	20.88	19.99
		27025	1#5	1	20.44	19.67
			6#0	1	20.56	19.80
	5MHz	26815	1#0	0	20.38	19.48
			6#0	0	20.36	20.53
		26915	1#0	0	20.71	20.10
			6#0	0	20.82	21.07
		27015	1#5	3	20.45	19.77
			6#0	3	20.57	20.80
	10MHz	26840	1#0	0	20.37	19.51
			4#0	0	20.34	20.55
		26915	1#0	0	20.78	20.01
			4#0	0	20.71	20.40
		26990	1#5	7	20.68	19.99
			4#2	7	20.66	20.39

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(814MHz-824MHz)

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band26	1.4MHz	26697	1#0	0	20.52	19.71
			6#0	0	20.35	19.77
		26740	1#0	0	20.84	20.43
			6#0	0	20.75	20.16
		26783	1#5	0	20.63	19.60
			6#0	0	20.48	19.93
	3MHz	26705	1#0	0	20.39	19.72
			6#0	0	20.44	19.63
		26740	1#0	0	20.84	19.97
			6#0	0	20.83	19.89
		26775	1#5	1	20.57	19.81
			6#0	1	20.49	19.85
	5MHz	26715	1#0	0	20.47	19.54
			6#0	0	20.48	20.55
		26740	1#0	0	20.76	20.03
			6#0	0	20.89	21.11
		26765	1#5	3	20.40	19.86
			6#0	3	20.53	20.87
	10MHz	26740	1#0	0	20.37	19.51
			4#0	0	20.50	20.45

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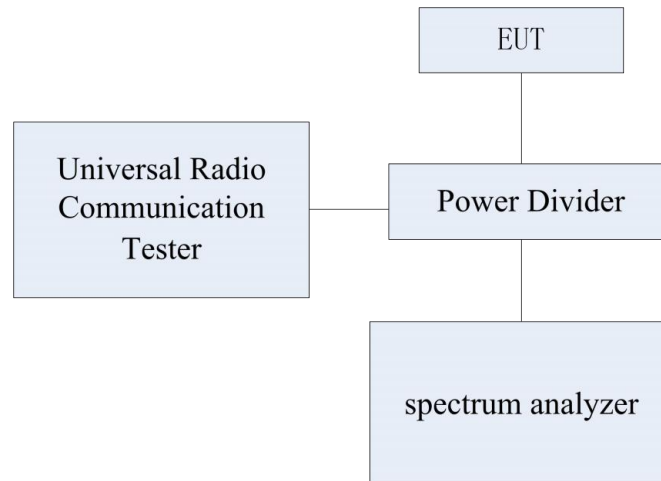
Report No.: B19W50622-WWAN_Rev2

5.2 Occupied Bandwidth

Specifications:	FCC Part 2.1049, 22.917(b), 24.238(b),90.209
DUT Serial Number:	353081090297923
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	--

Test Setup

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty	69 kHz (k=2)

Test Method

The occupied Bandwidth was calculated from the spectrum analyzer. Markers in the spectrum analyzer were then placed between the calculated frequencies to show the calculated 99% power Band. The 26dB Bandwidth was also measured and recorded.

Note: Only worst case result is given below.

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5.2.1 GSM Mode Occupied Bandwidth Results

Band	Channel	Mode	Occupied Bandwidth 99% (kHz)	Occupied Bandwidth 26dB (kHz)
GSM850	190	GMSK	241.99	314.10
		8PSK	238.78	318.91
PCS1900	661	GMSK	246.79	315.71
		8PSK	237.18	317.31

5.2.2 NB-IoT B2 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth (26dB) (kHz)	
			QPSK	BPSK	QPSK	BPSK
Mid Range	18900	15	192.54	145.21	268.30	118.10

5.2.3 NB-IoT B4 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth (26dB) (kHz)	
			QPSK	BPSK	QPSK	BPSK
Mid Range	20175	15	198.77	136.26	253.80	114.00

5.2.4 NB-IoT B12 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth (26dB) (kHz)	
			QPSK	BPSK	QPSK	BPSK
Mid Range	23095	15	185.84	133.49	243.60	115.10

5.2.5 NB-IoT B13 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth (26dB) (kHz)	
			QPSK	BPSK	QPSK	BPSK
Mid Range	23230	15	224.39	251.31	319.10	243.00

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5.2.6 NB-IoT B26 Mode Occupied Bandwidth Results

(824MHz-849MHz)

Frequency ID	N _{UL}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth (26dB) (kHz)	
			QPSK	BPSK	QPSK	BPSK
Mid Range	26915	15	223.04	248.80	316.40	243.70

(814MHz-824MHz)

Frequency ID	N _{UL}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth (26dB) (kHz)	
			QPSK	BPSK	QPSK	BPSK
Mid Range	26740	15	246.77	232.37	363.8	245.1

5.2.7 CAT-M B2 Mode Occupied Bandwidth Results

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	18900/1880	6#0	0	1.21	1.69
	16QAM	18900/1880			1.05	1.50
3MHz	QPSK	18900/1880	6#0	0	1.18	1.57
	16QAM	18900/1880			1.22	1.69
5MHz	QPSK	18900/1880	6#0	0	1.17	1.54
	16QAM	18900/1880			1.01	1.41
10MHz	QPSK	18900/1880	6#0	0	1.17	1.62
	16QAM	18900/1880			1.01	1.42
15MHz	QPSK	18900/1880	6#0	0	1.17	1.55
	16QAM	18900/1880			0.99	1.45
20MHz	QPSK	18900/1880	6#0	0	1.19	1.74
	16QAM	18900/1880			1.02	1.41

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5.2.8 CAT-M B4 Mode Occupied Bandwidth Results

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	20175/1732.5	6#0	0	1.15	1.40
	16QAM	20175/1732.5			1.15	1.40
3MHz	QPSK	20175/1732.5	6#0	0	1.26	2.56
	16QAM	20175/1732.5			1.12	2.22
5MHz	QPSK	20175/1732.5	6#0	0	1.64	3.74
	16QAM	20175/1732.5			1.11	2.73
10MHz	QPSK	20175/1732.5	6#0	0	1.71	3.26
	16QAM	20175/1732.5			1.25	2.90
15MHz	QPSK	20175/1732.5	6#0	0	1.84	4.07
	16QAM	20175/1732.5			2.48	3.85
20MHz	QPSK	20175/1732.5	6#0	0	2.86	3.80
	16QAM	20175/1732.5			1.29	2.69

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5.2.9 CAT-M B12 Mode Occupied Bandwidth Results

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	23095/707.5	6#0	0	1.16	1.36
	16QAM	23095/707.5			0.99	1.41
3MHz	QPSK	23095/707.5	6#0	0	1.17	1.54
	16QAM	23095/707.5			1.01	1.43
5MHz	QPSK	23095/707.5	6#0	0	1.18	1.68
	16QAM	23095/707.5			1.00	1.41
10MHz	QPSK	23095/707.5	6#0	0	1.19	1.61
	16QAM	23095/707.5			1.02	1.44

5.2.10 CAT-M B13 Mode Occupied Bandwidth Results

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
5MHz	QPSK	23230/782	6#0	0	1.17	1.56
	16QAM	23230/782			1.01	1.43
10MHz	QPSK	23230/782	6#0	0	1.19	1.61
	16QAM	23230/782			1.01	1.37

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5.2.11 CAT-M B26 Mode Occupied Bandwidth Results

(824MHz-849MHz)

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	26915/836.5	6#0	0	1.12	1.57
	16QAM	26915/836.5			1.03	1.98
3MHz	QPSK	26915/836.5	6#0	0	1.18	1.90
	16QAM	26915/836.5			1.06	1.95
5MHz	QPSK	26915/836.5	6#0	0	1.17	1.61
	16QAM	26915/836.5			1.02	1.56
10MHz	QPSK	26915/836.5	6#0	0	1.18	2.02
	16QAM	26915/836.5			1.10	2.05

(814MHz-824MHz)

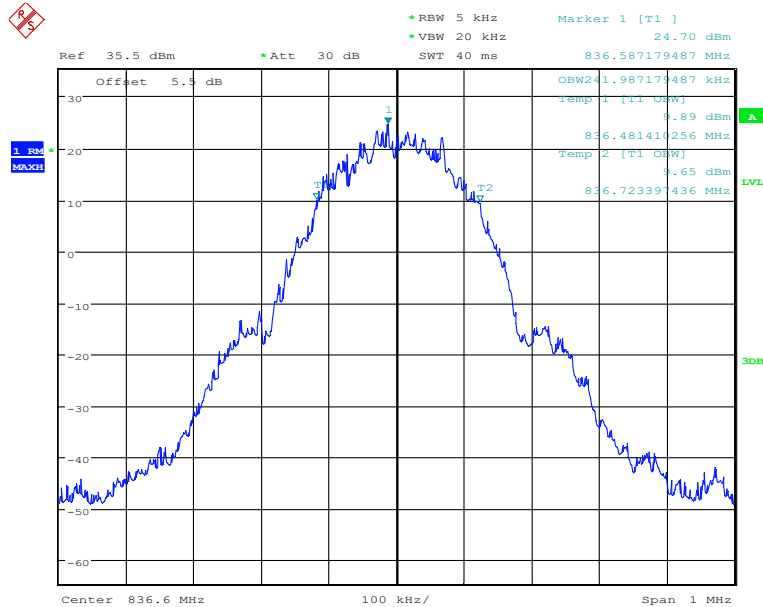
Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	26740/819	6#0	0	1.12	1.35
	16QAM	26740/819			0.94	1.18
3MHz	QPSK	26740/819	6#0	0	1.12	1.39
	16QAM	26740/819			1.11	1.27
5MHz	QPSK	26740/819	6#0	0	1.12	1.39
	16QAM	26740/819			1.12	1.41
10MHz	QPSK	26740/819	6#0	0	1.12	1.33
	16QAM	26740/819			0.94	1.11

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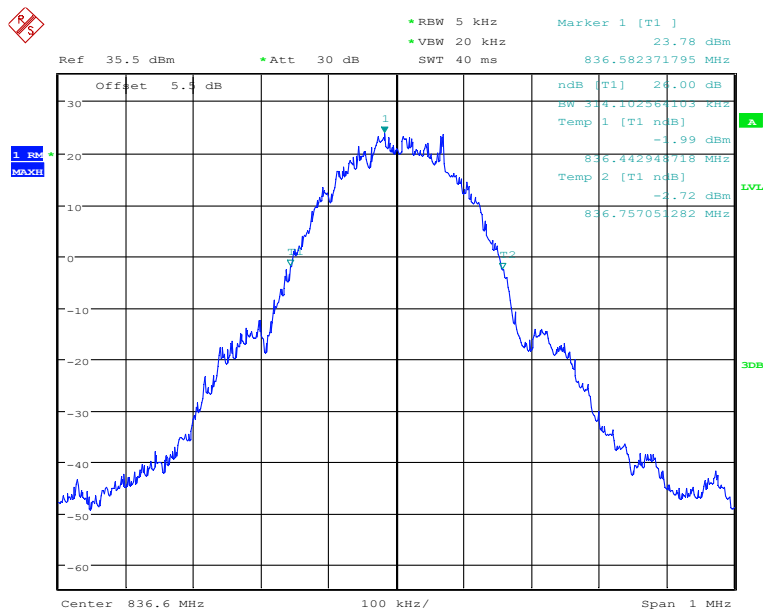
Report No.: B19W50622-WWAN_Rev2

Graphical results for GSM850:



Date: 14.DEC.2019 23:01:54

99% OBW-GMSK-Channel 190



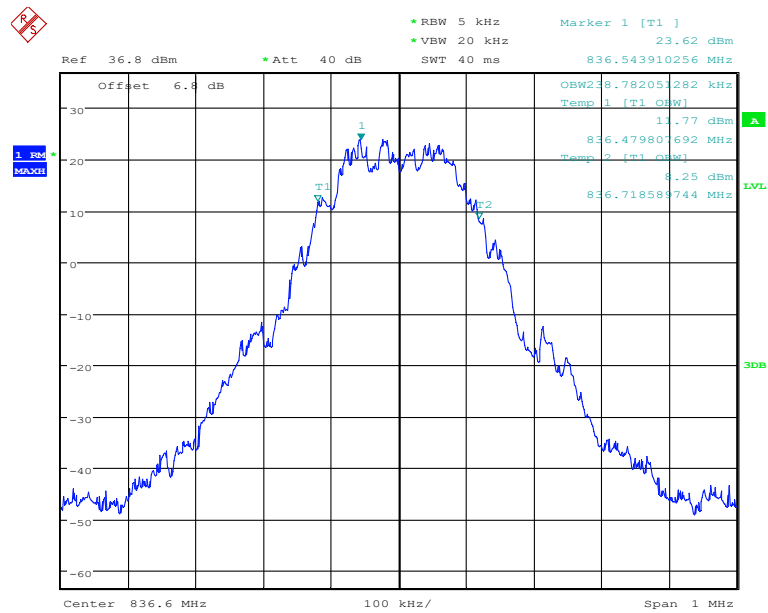
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26dB OBW-GMSK-Channel-190

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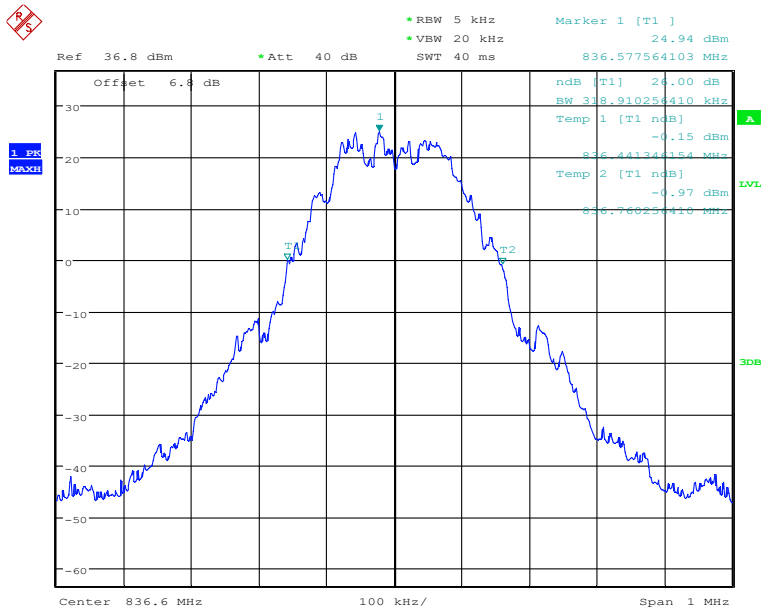
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Date: 19.DEC.2019 06:46:10

99% OBW-8PSK-Channel 190



Date: 19.DEC.2019 07:11:11

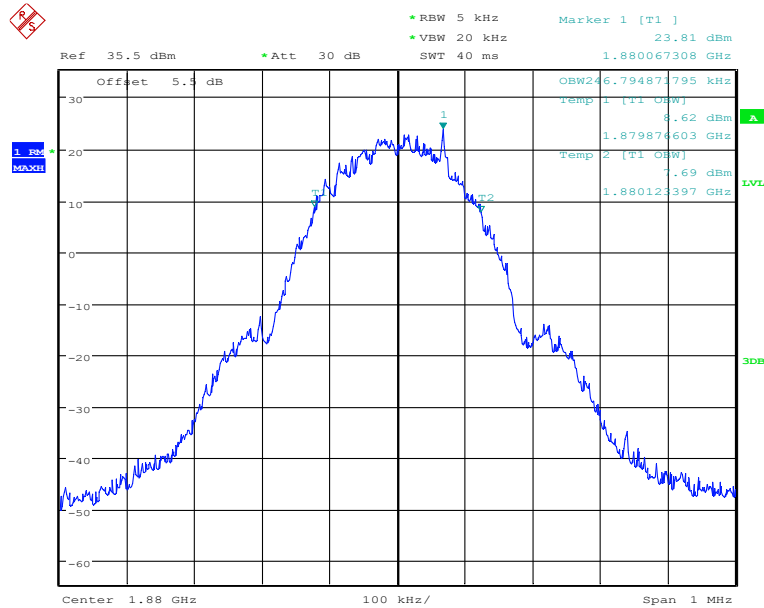
26dB OBW-8PSK-Channel 190

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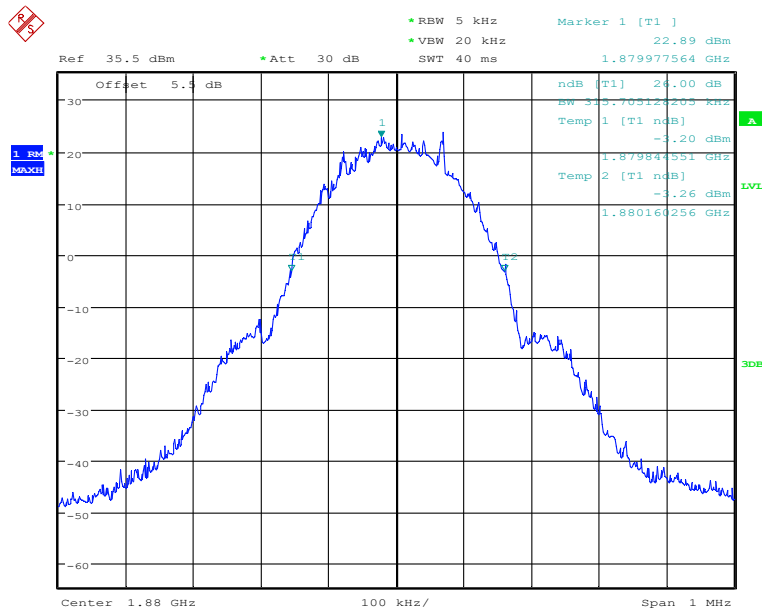
Report No.: B19W50622-WWAN_Rev2

Graphical results for PCS1900:



Date: 14.DEC.2019 22:55:59

99% OBW-GMSK-Channel 661



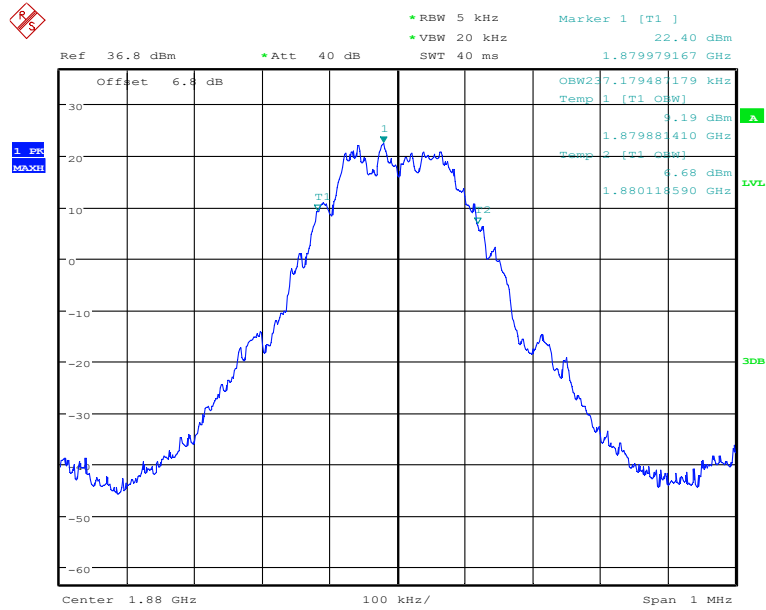
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26dB OBW-GMSK-Channel 661

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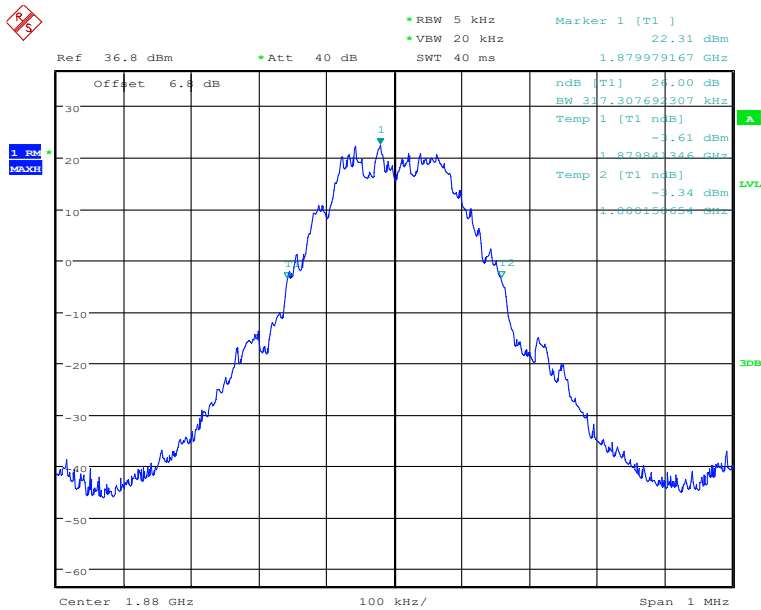
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Report No.: B19W50622-WWAN_Rev2



Date: 19.DEC.2019 06:53:35

99% OBW-8PSK-Channel 661



Date: 19.DEC.2019 06:55:25

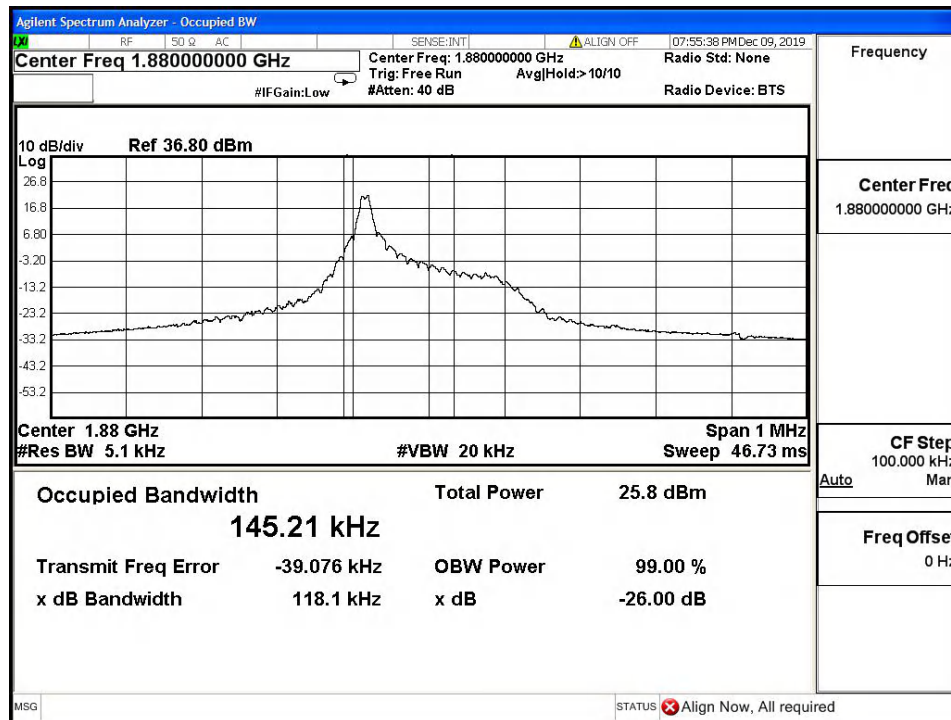
26dB OBW-8PSK-Channel 661

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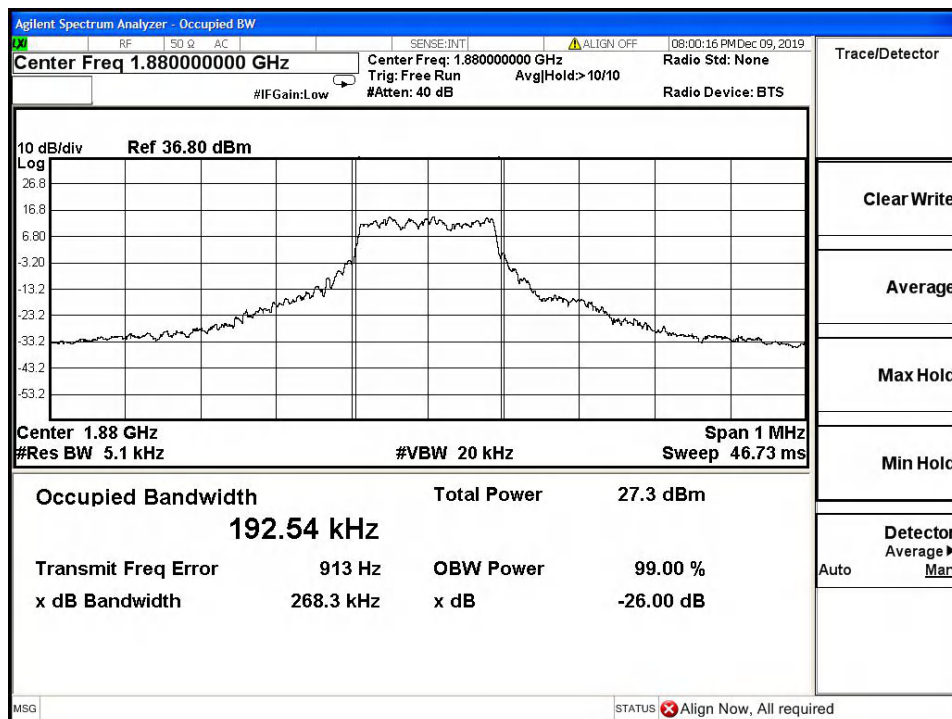
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Graphical results for NB-IoT:



Band2-26dB OBW-18900 Channel-BPSK

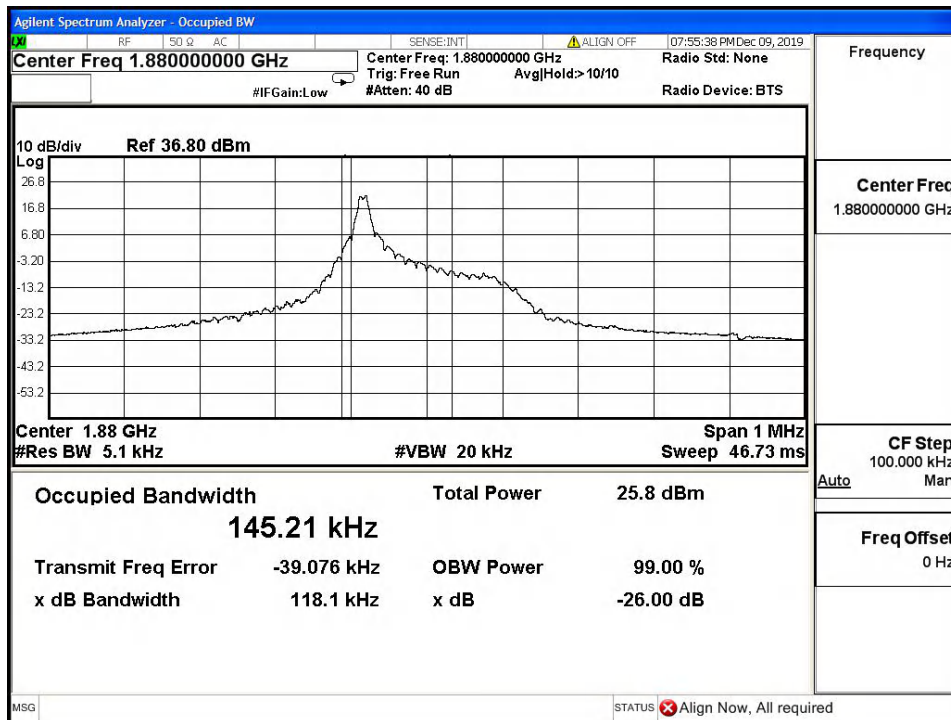


Band2-26dB OBW-18900 Channel-QPSK

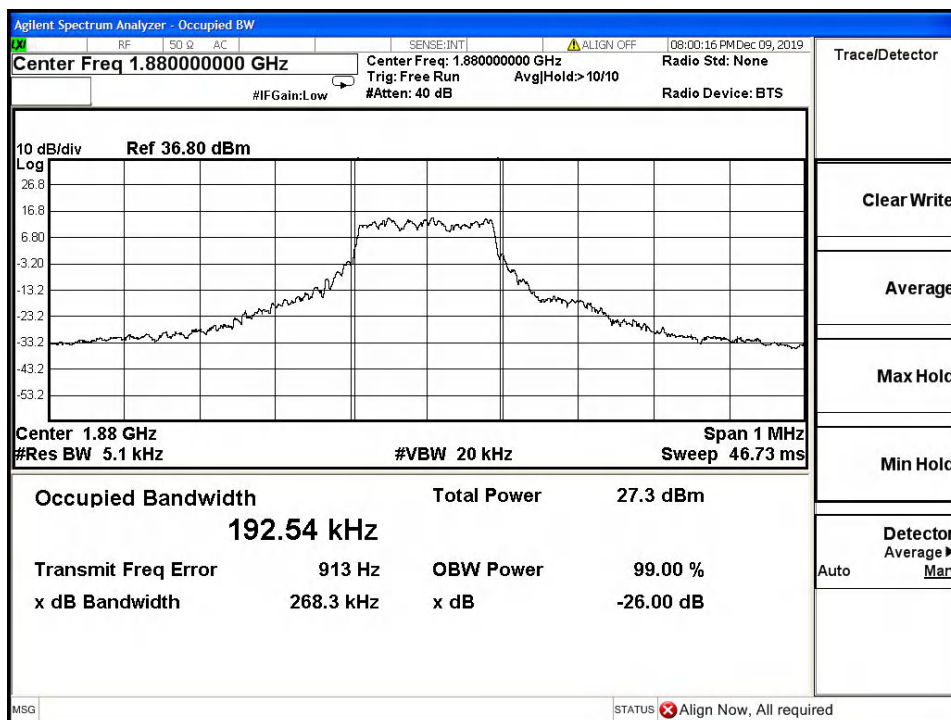
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Band2-99% OBW-18900 Channel-BPSK

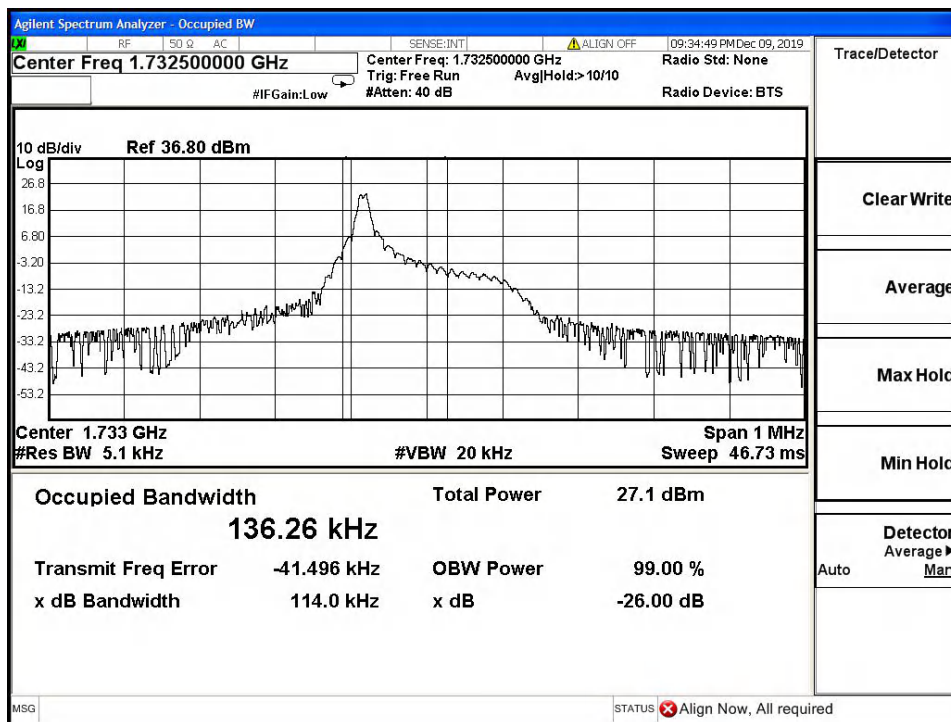


Band2-99% OBW-18900 Channel-QPSK

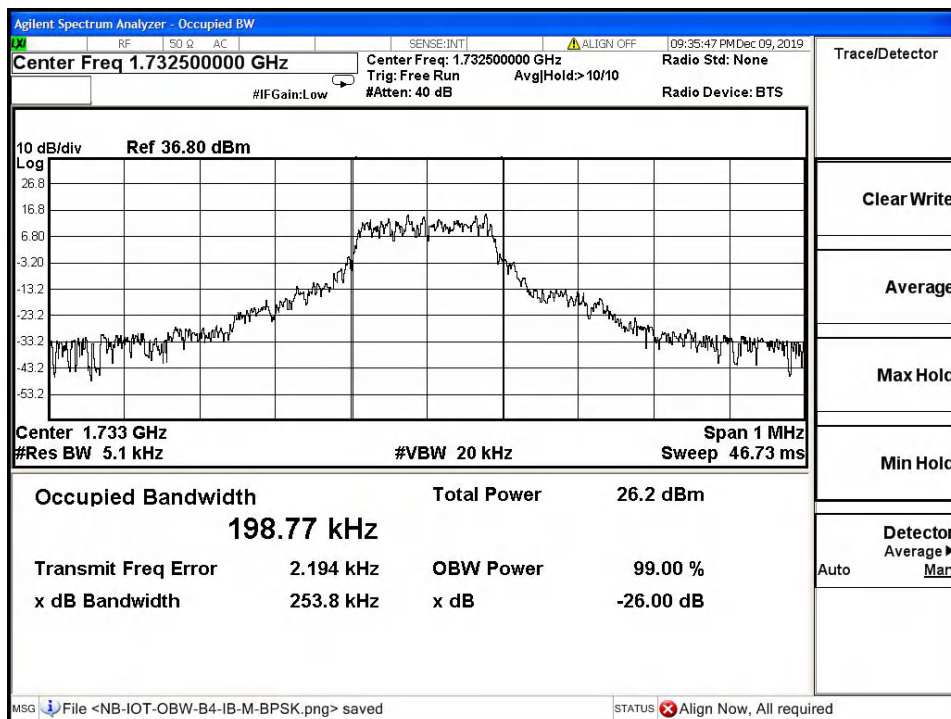
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Band4-26dB OBW-20175 Channel-BPSK

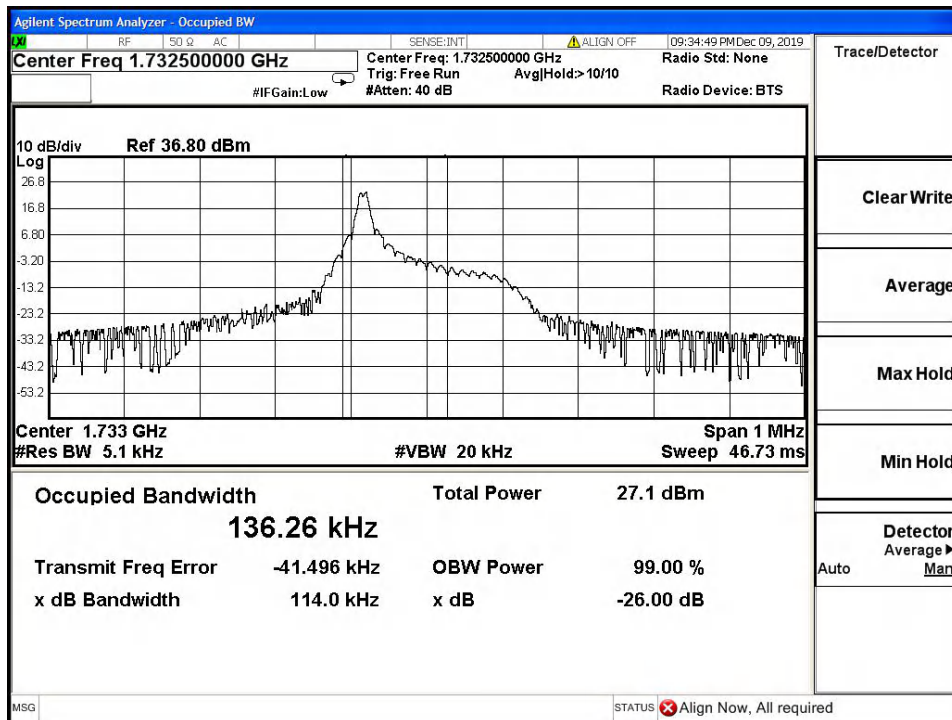


Band4-26dB OBW-20175 Channel-QPSK

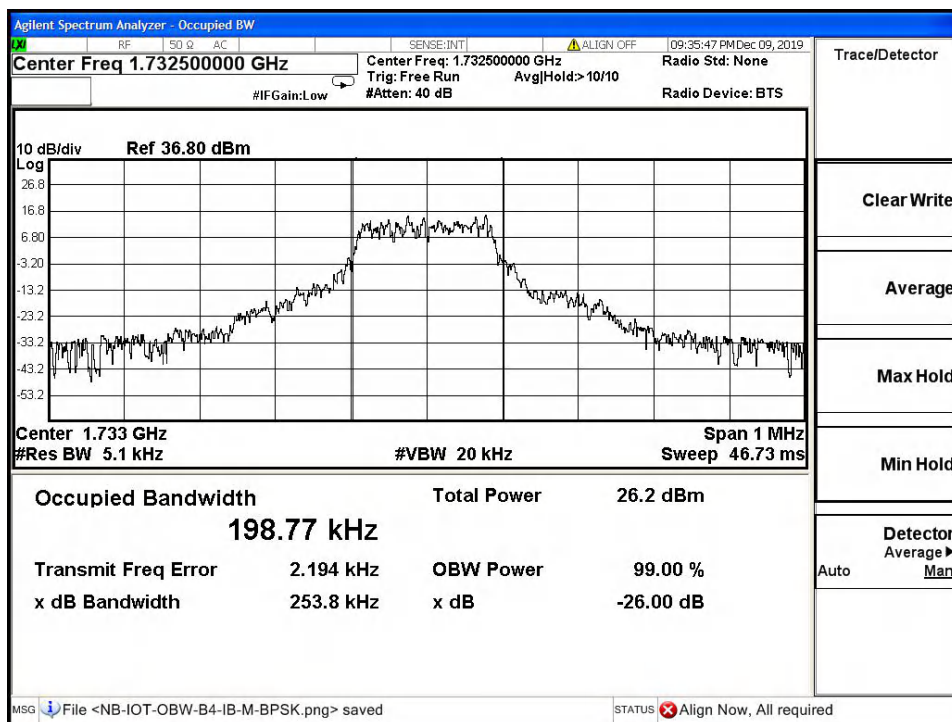
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Band4-99% OBW-20175 Channel-BPSK

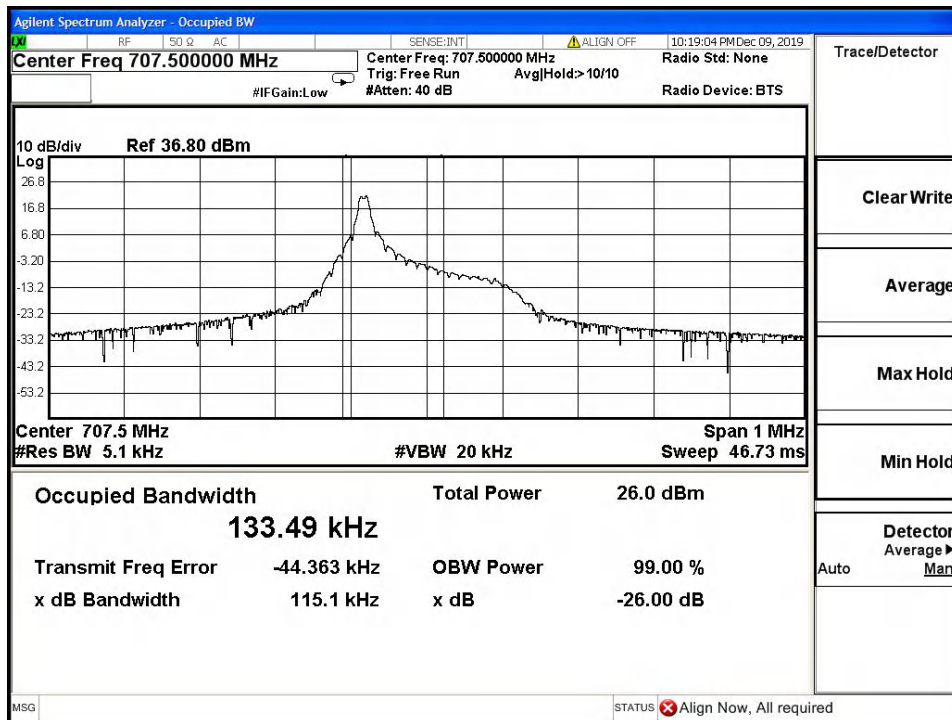


Band4-99% OBW-20175 Channel-QPSK

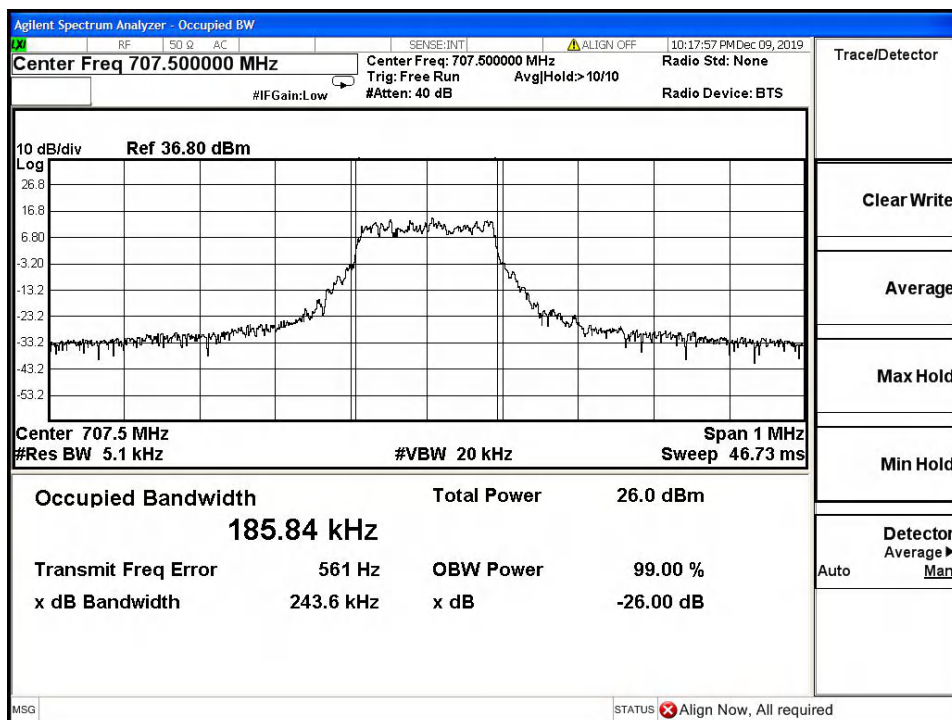
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Band12-26dB OBW-23095 Channel-BPSK

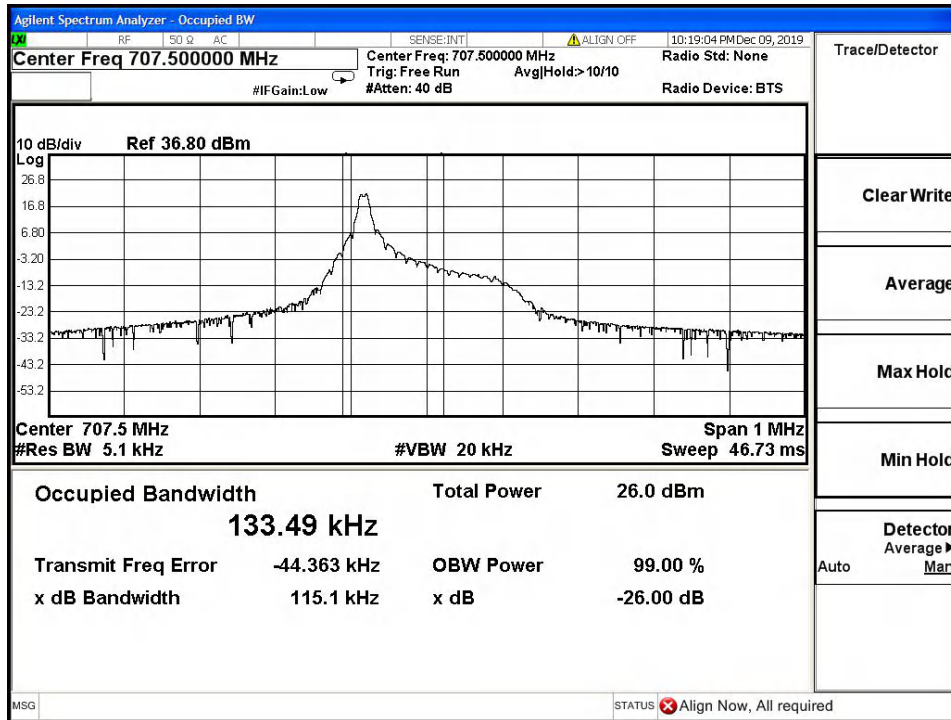


Band12-26dB OBW-23095 Channel-QPSK

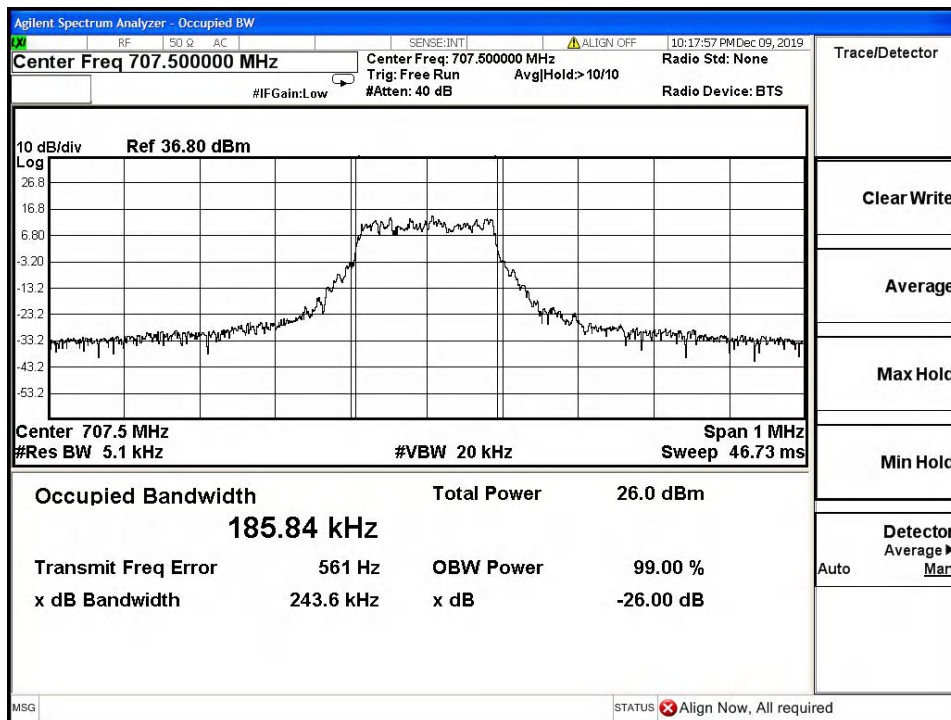
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Band12-99% OBW-23095 Channel-BPSK

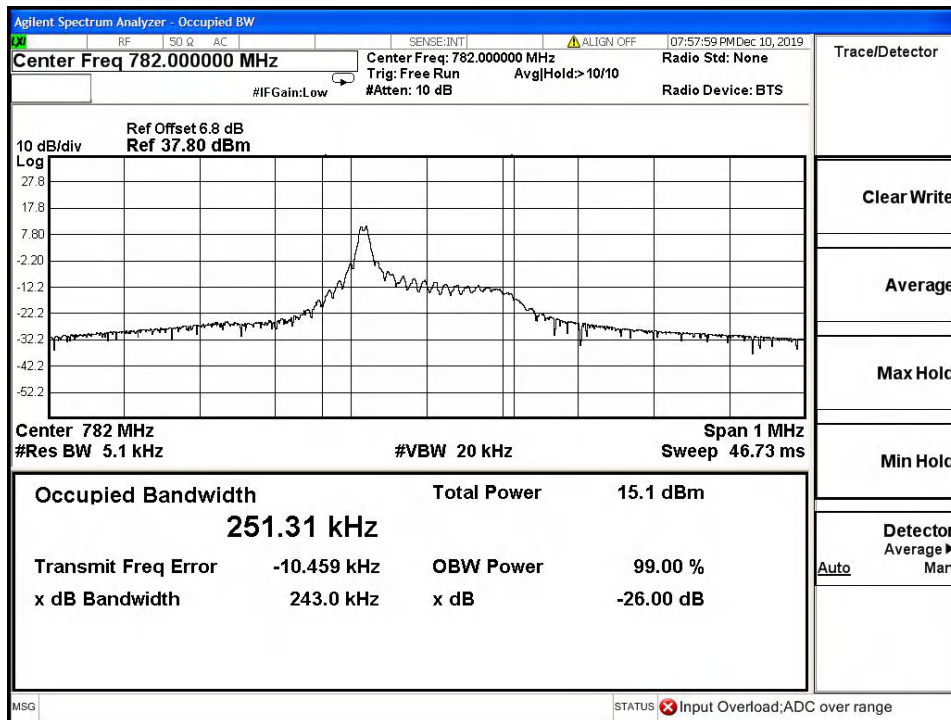


Band12-99% OBW-23095 Channel-QPSK

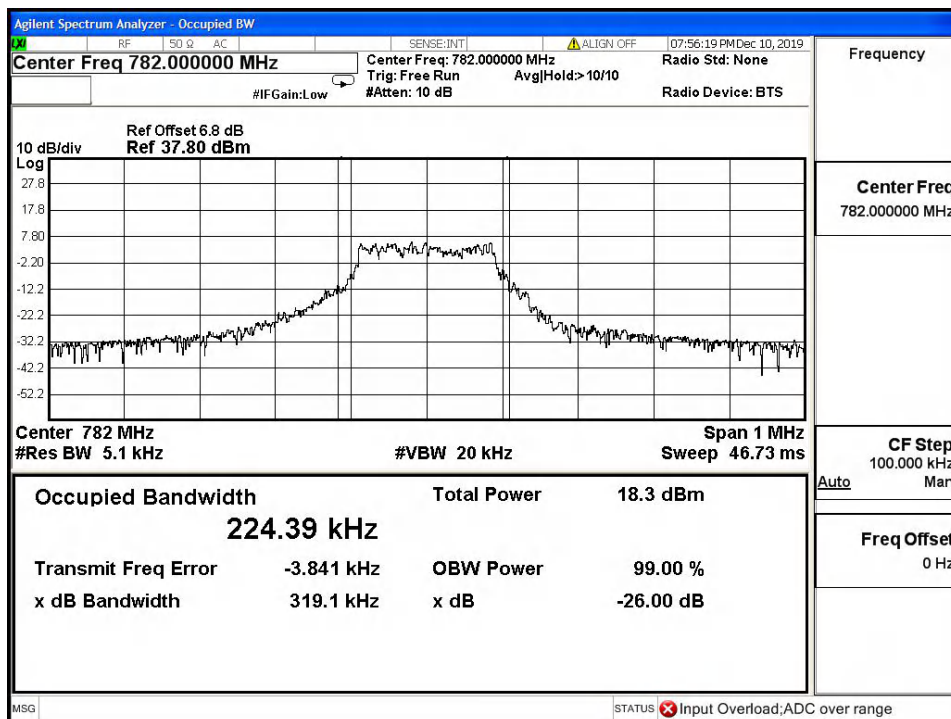
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Band13-26dB OBW-23230 Channel-BPSK

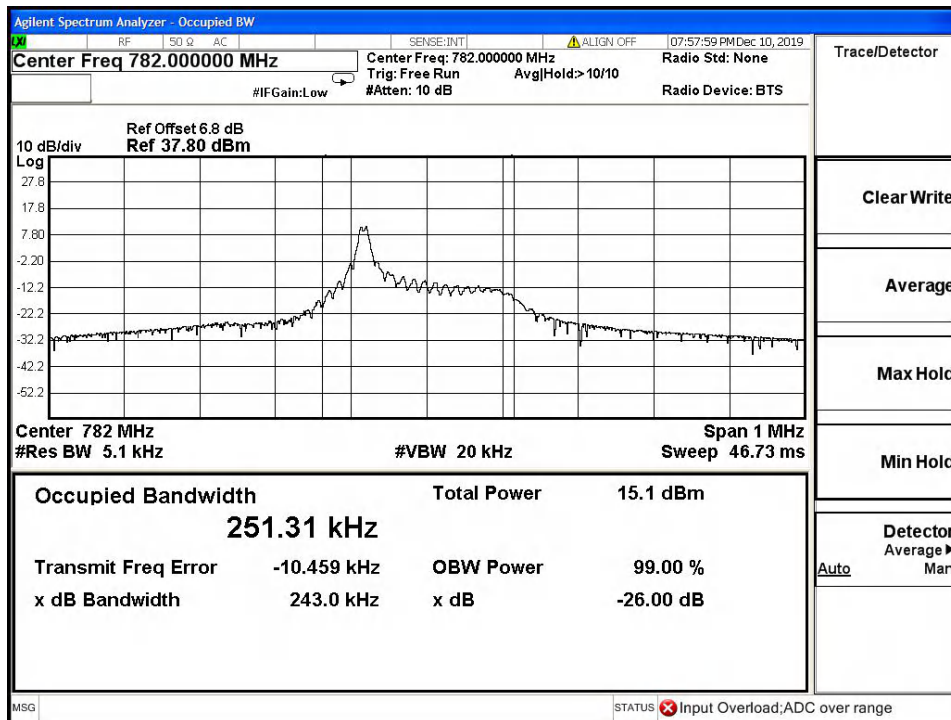


Band13-26dB OBW-23230 Channel-QPSK

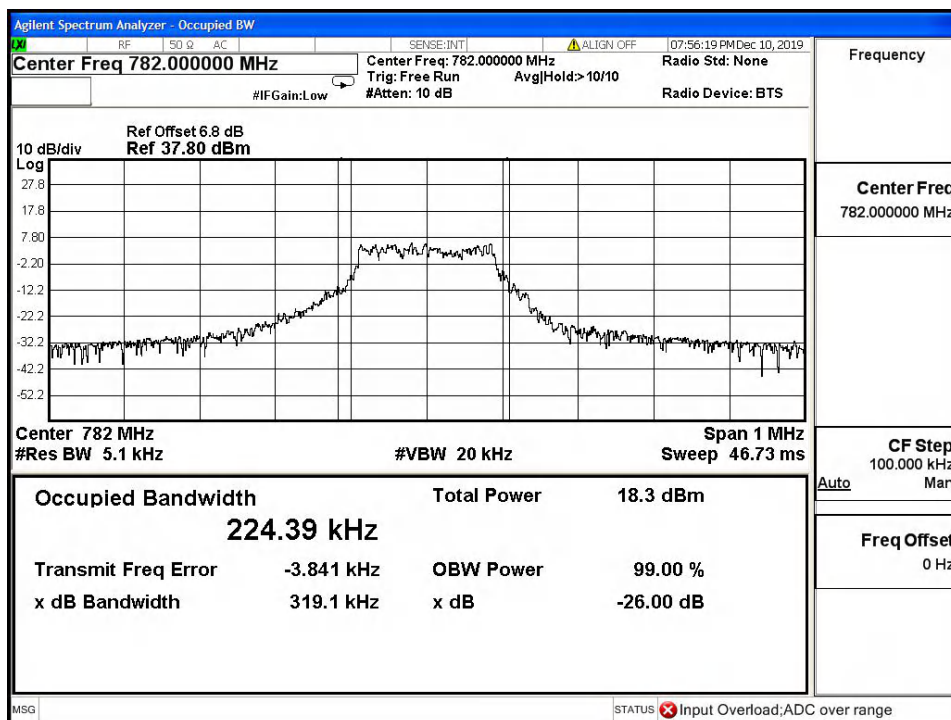
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Band13-99% OBW-23230 Channel-BPSK

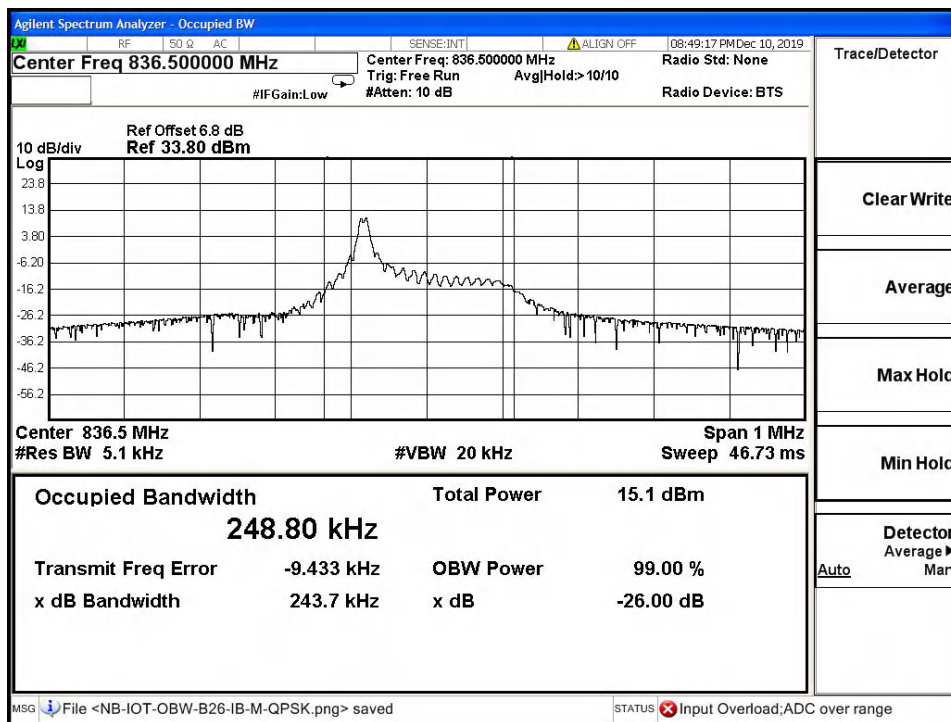


Band13-99% OBW-23095 Channel-QPSK

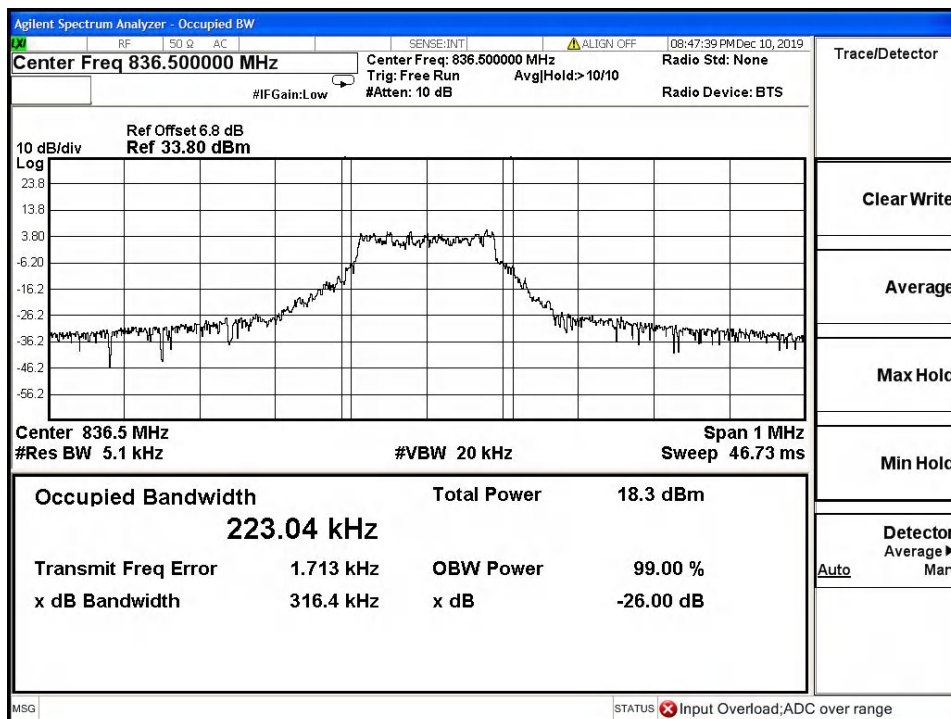
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Band26-26dB OBW-26915 Channel-BPSK

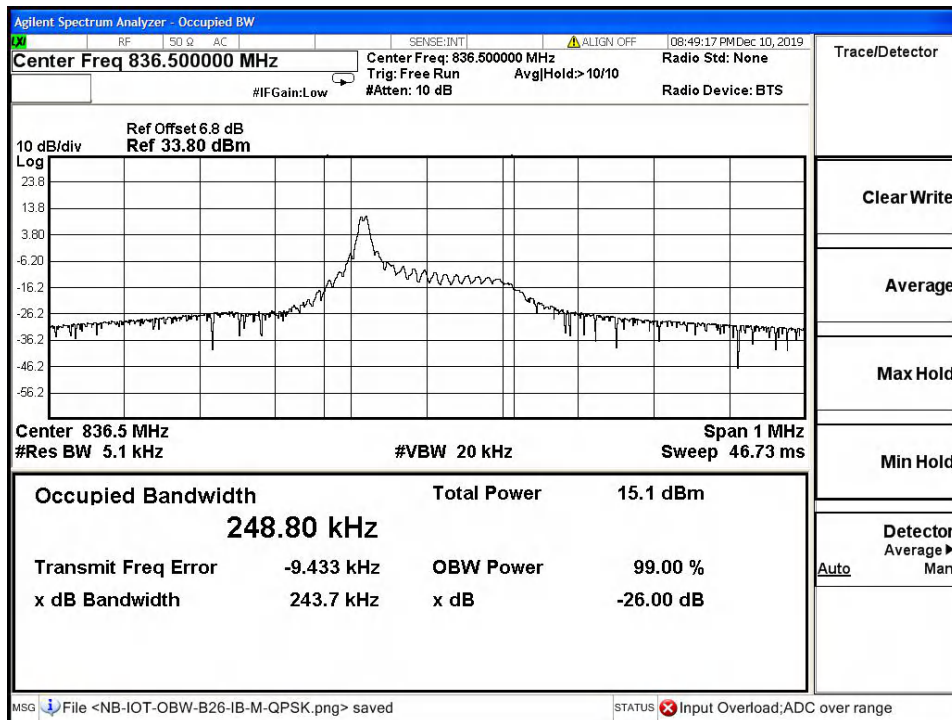


Band26-26dB OBW-26915 Channel-QPSK

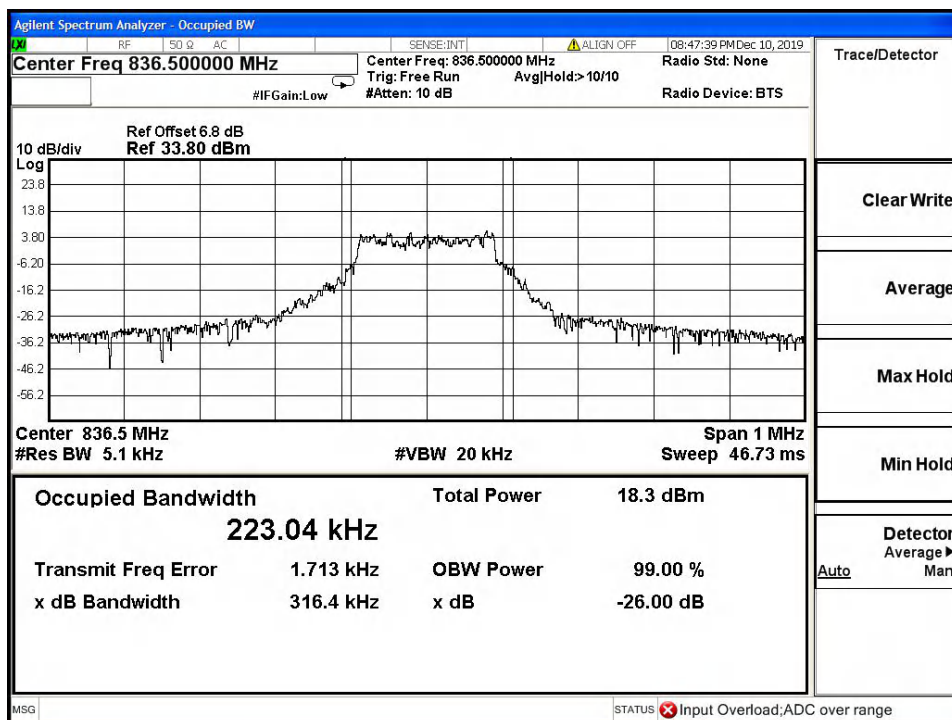
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Band26-99% OBW-26915 Channel-BPSK

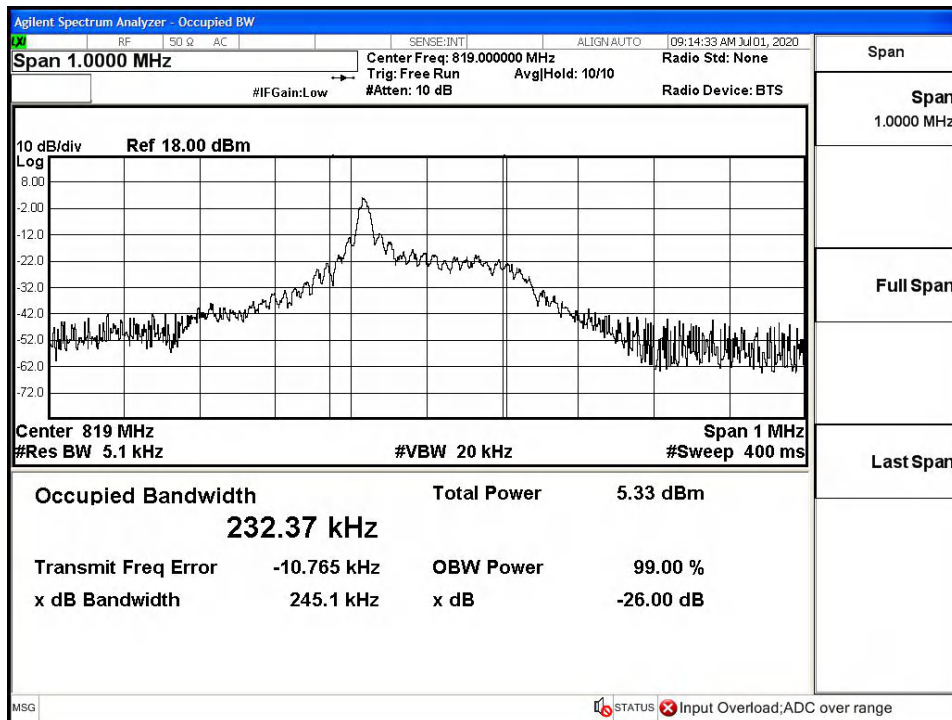


Band26-99% OBW-26915 Channel-QPSK

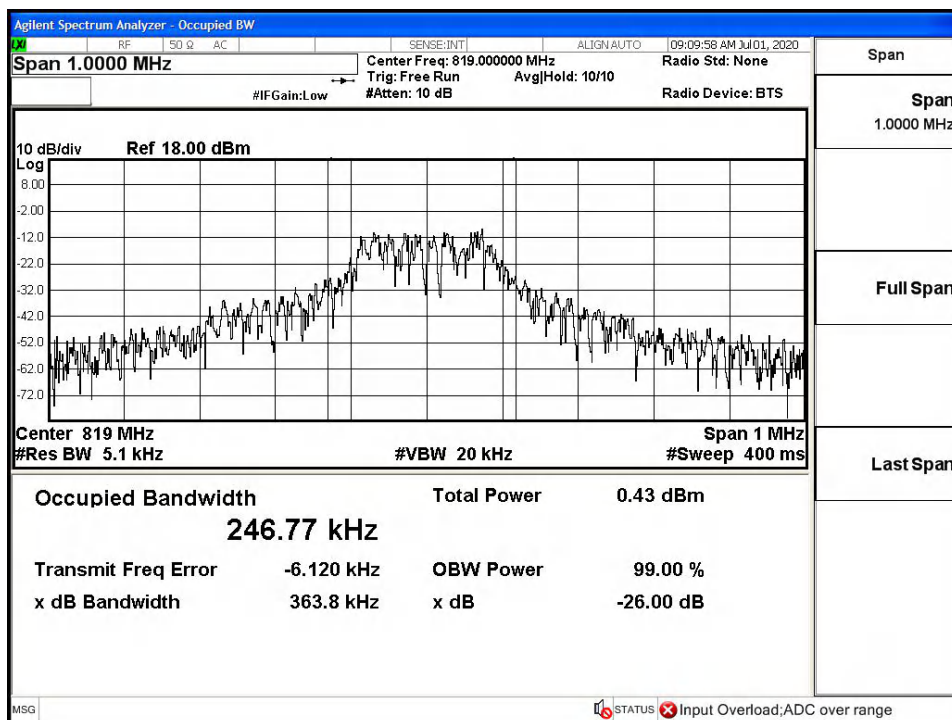
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Band26-26dB OBW-26740 Channel-BPSK

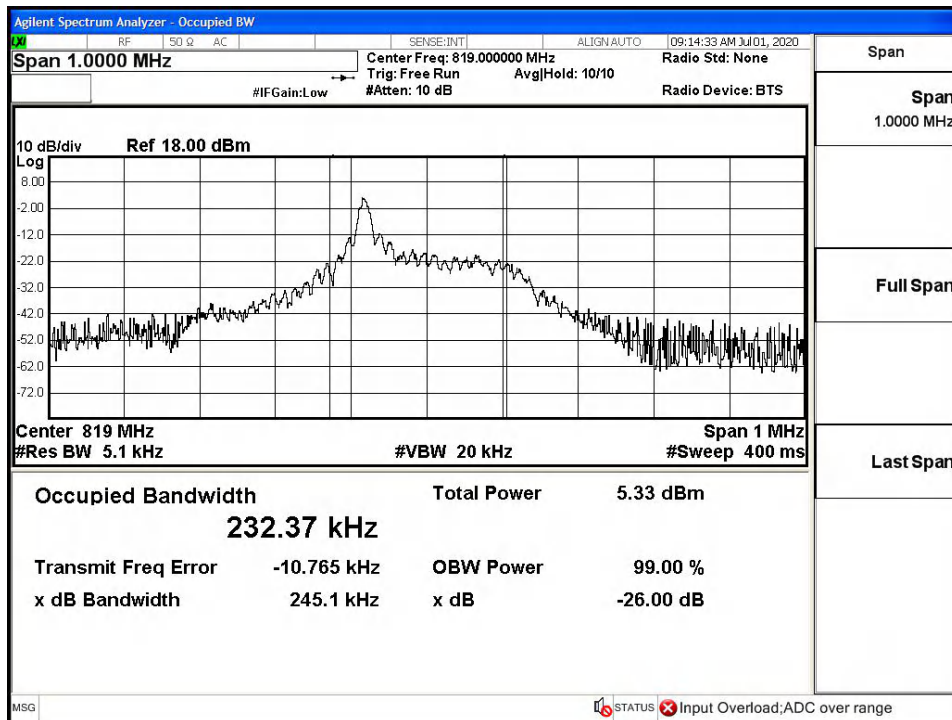


Band26-26dB OBW-26740 Channel-QPSK

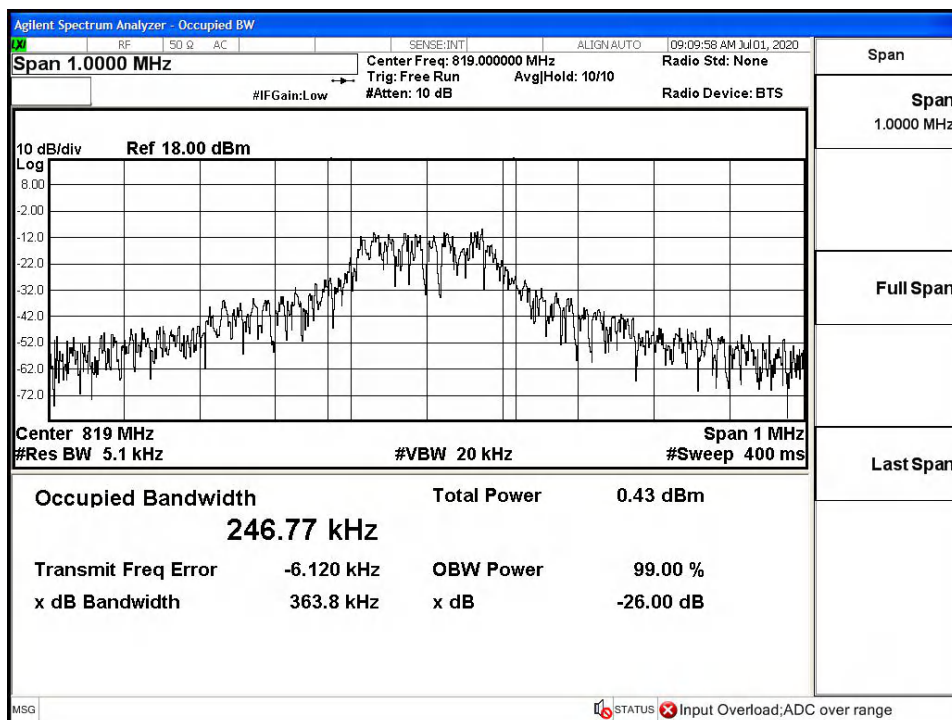
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Band26-99% OBW-26915 Channel-BPSK



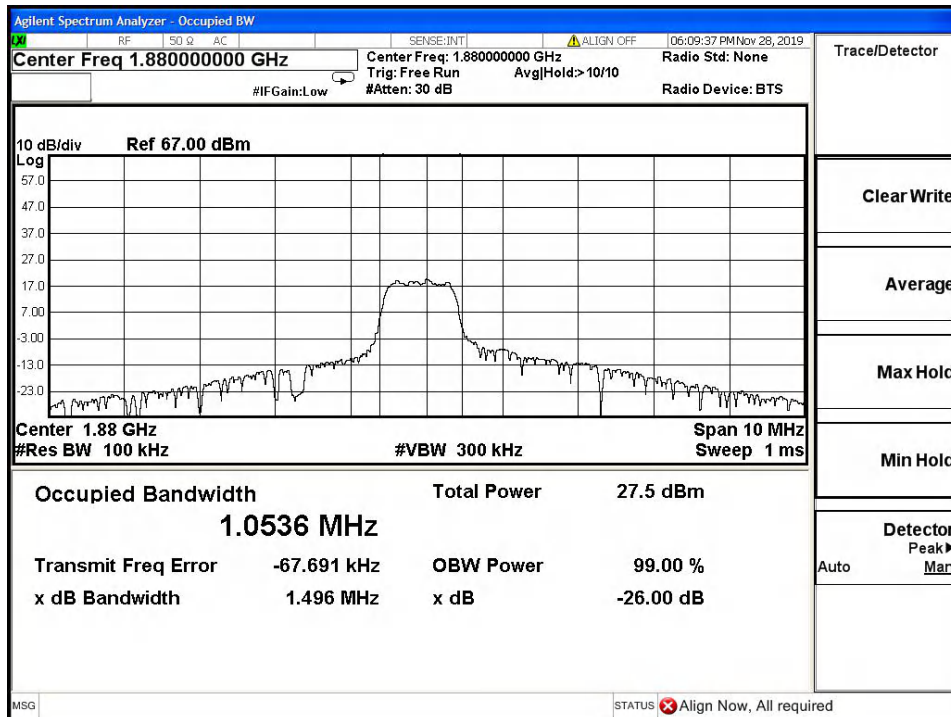
Band26-99% OBW-26915 Channel-QPSK

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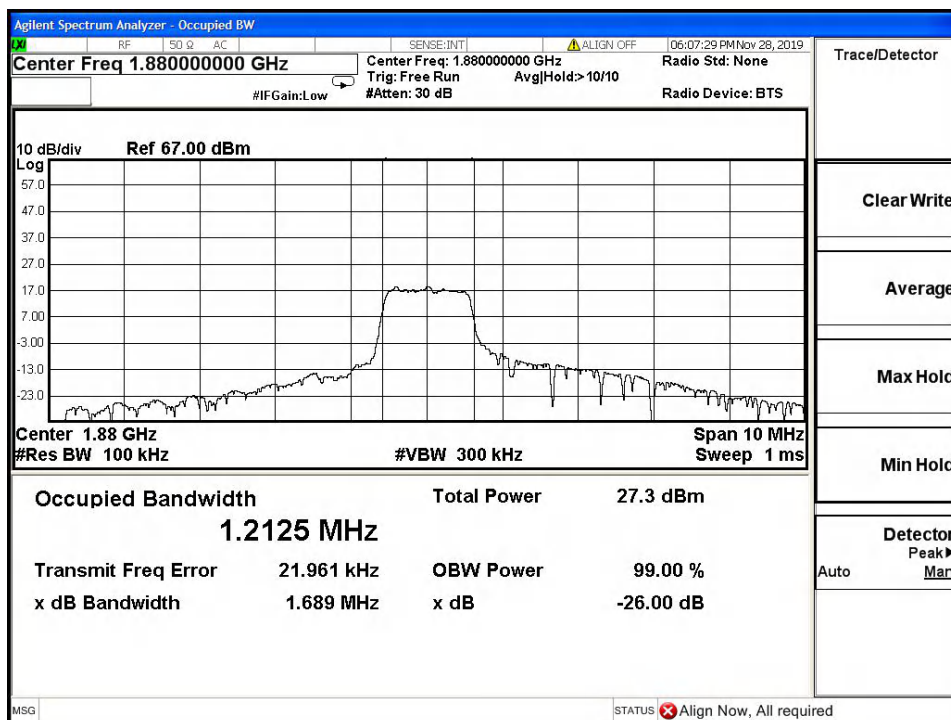
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Graphical results for CAT-M:



Band2-26dB OBW-1.4MHz Bandwidth-16QAM

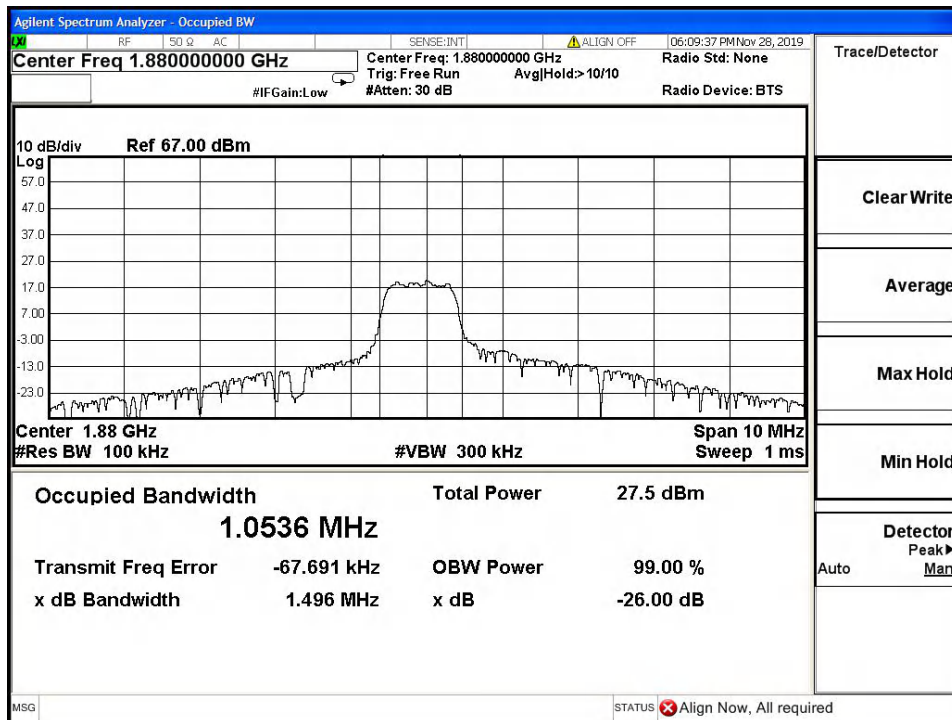


Band2-26dB OBW-1.4MHz Bandwidth-QPSK

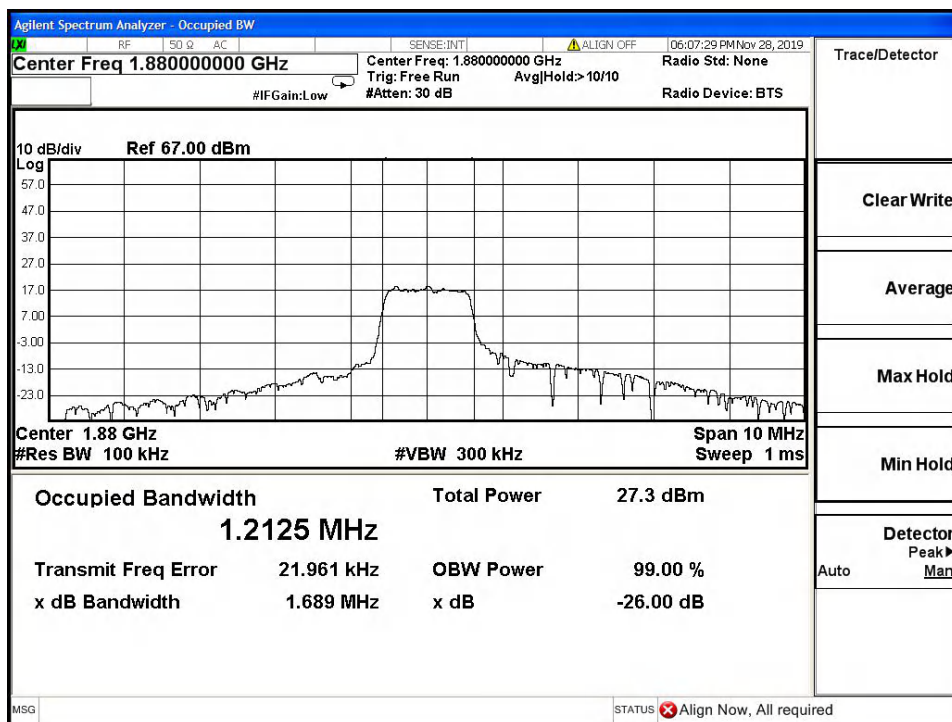
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Band2-99% OBW-1.4MHz Bandwidth-16QAM

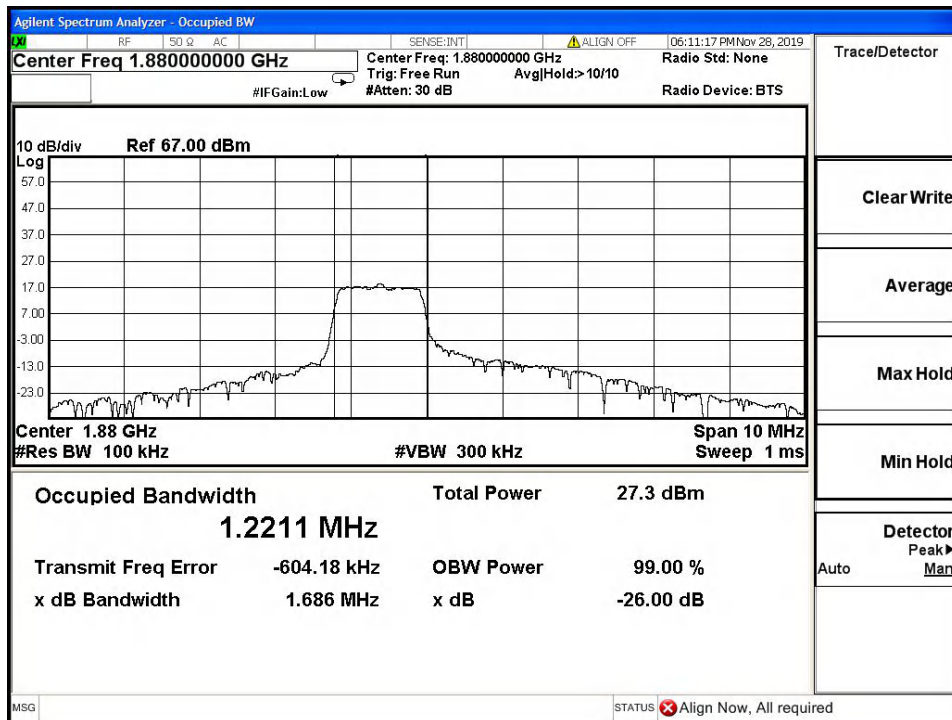


Band2-99% OBW-1.4MHz Bandwidth-QPSK

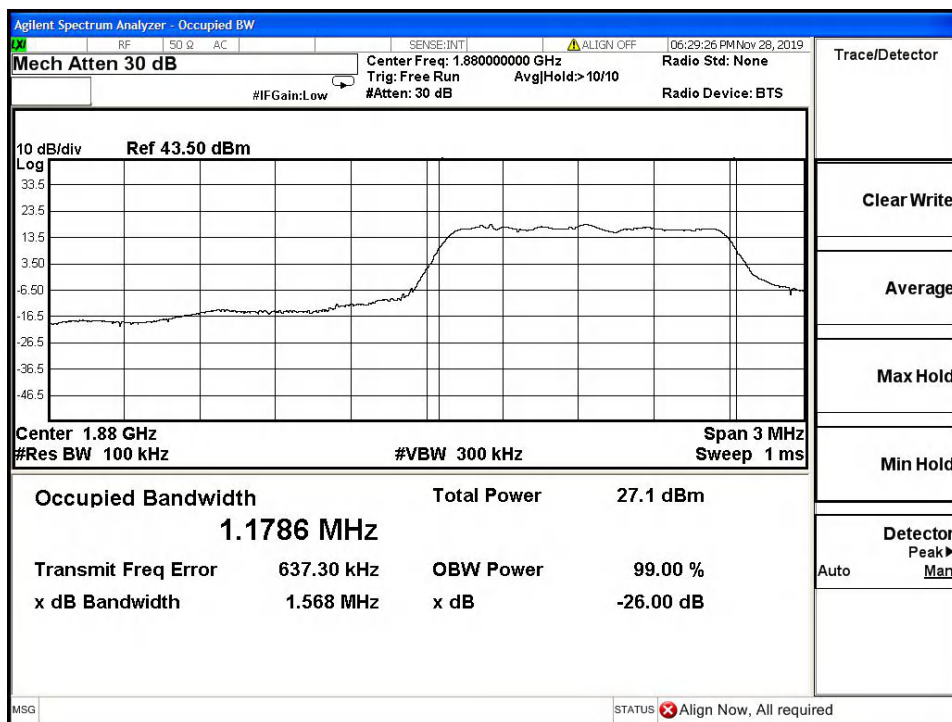
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Band2-26dB OBW-3MHz Bandwidth-16QAM

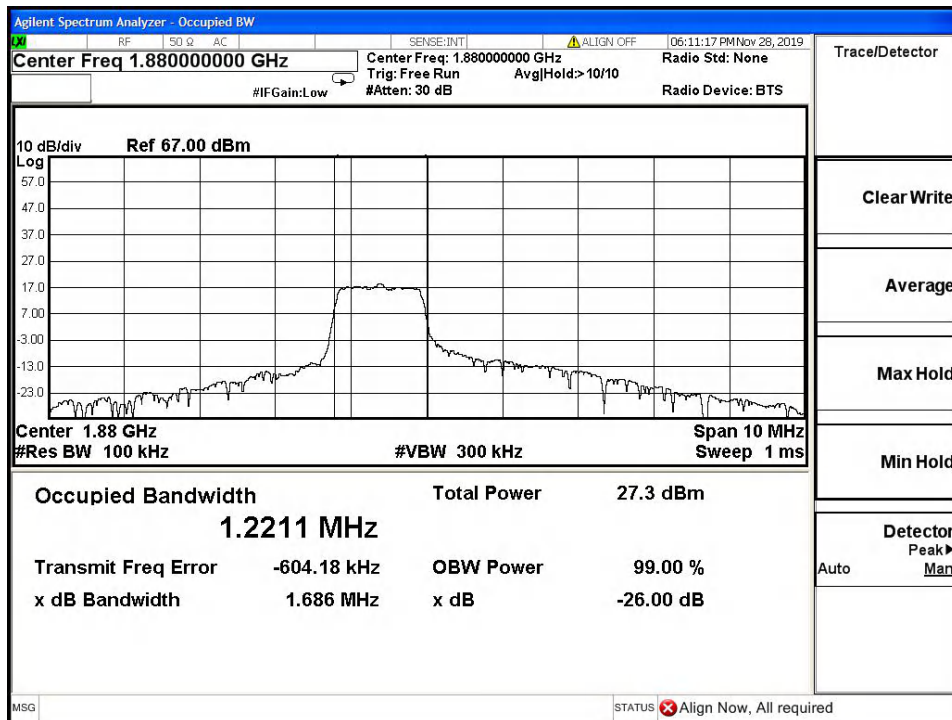


Band2-26dB OBW-3MHz Bandwidth-QPSK

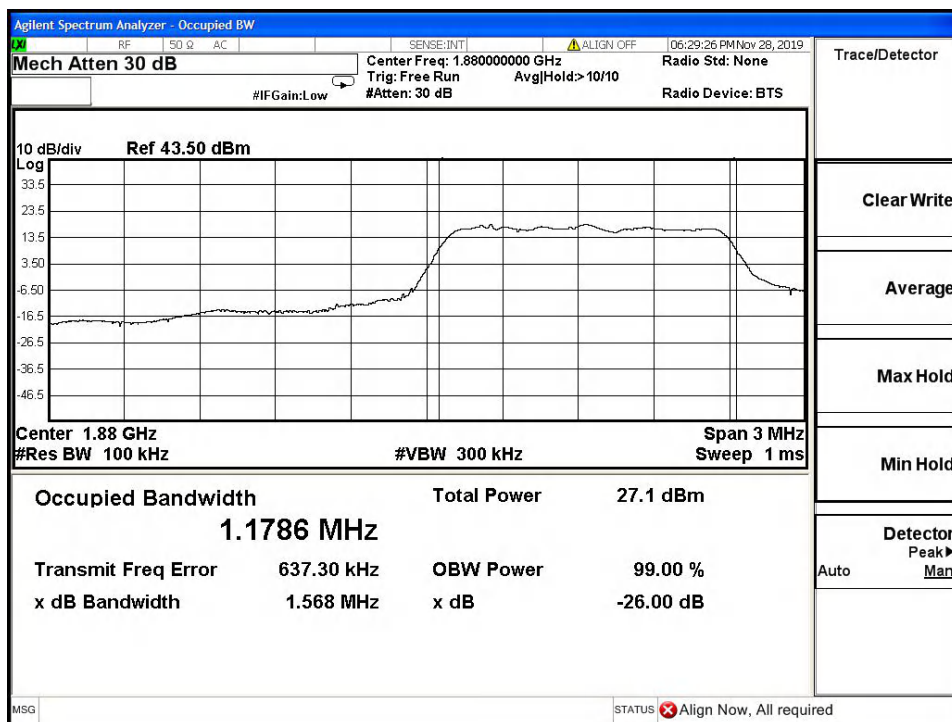
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Band2-99% OBW-3MHz Bandwidth-16QAM

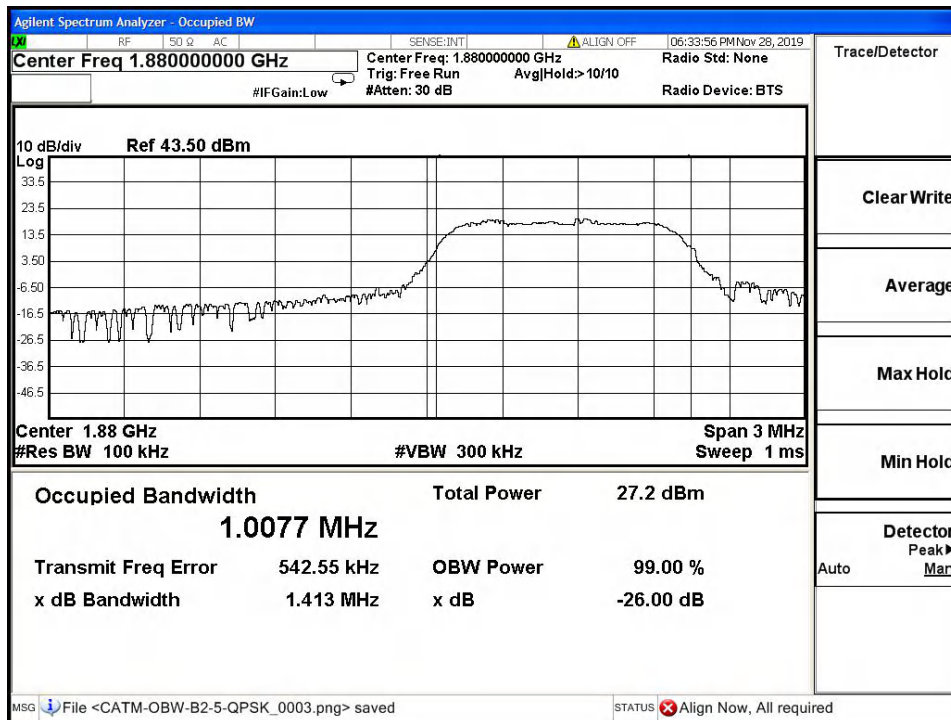


Band2-99% OBW-3MHz Bandwidth-QPSK

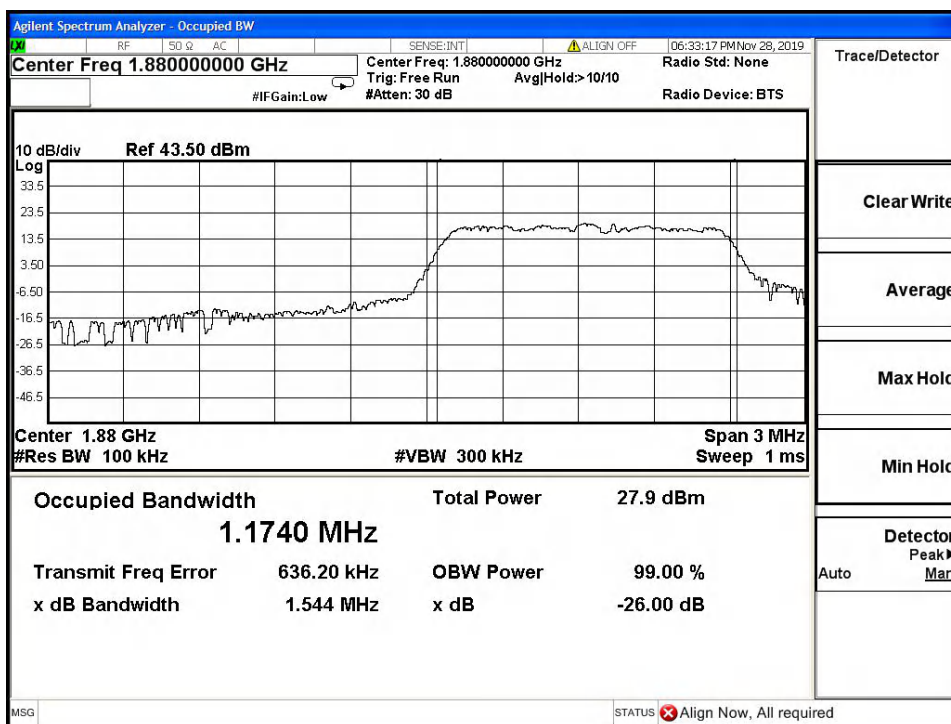
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Band2-26dB OBW-5MHz Bandwidth-16QAM

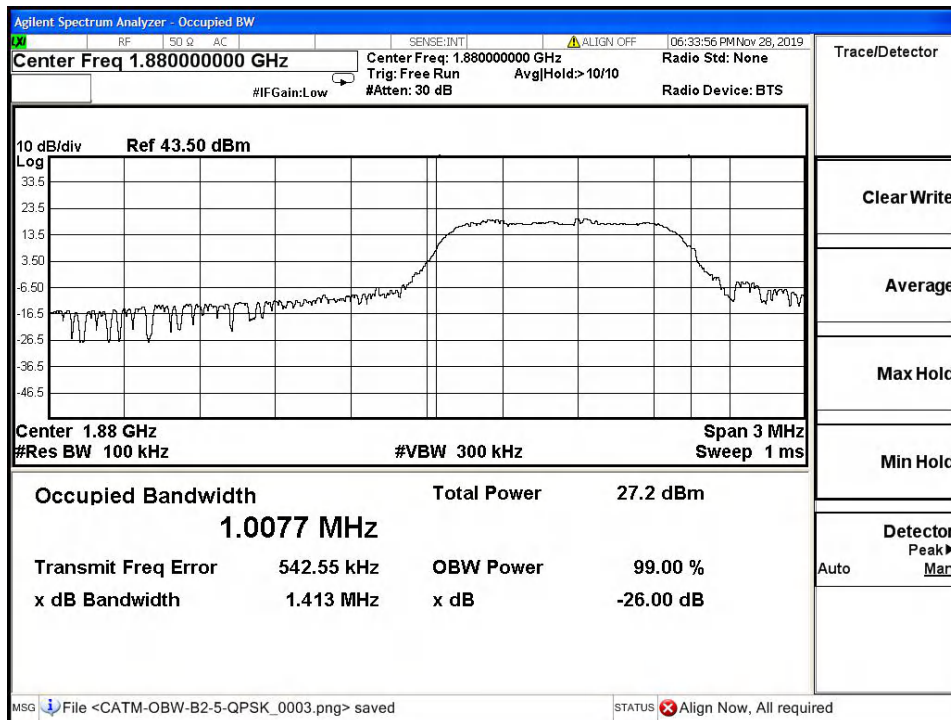


Band2-26dB OBW-5MHz Bandwidth-QPSK

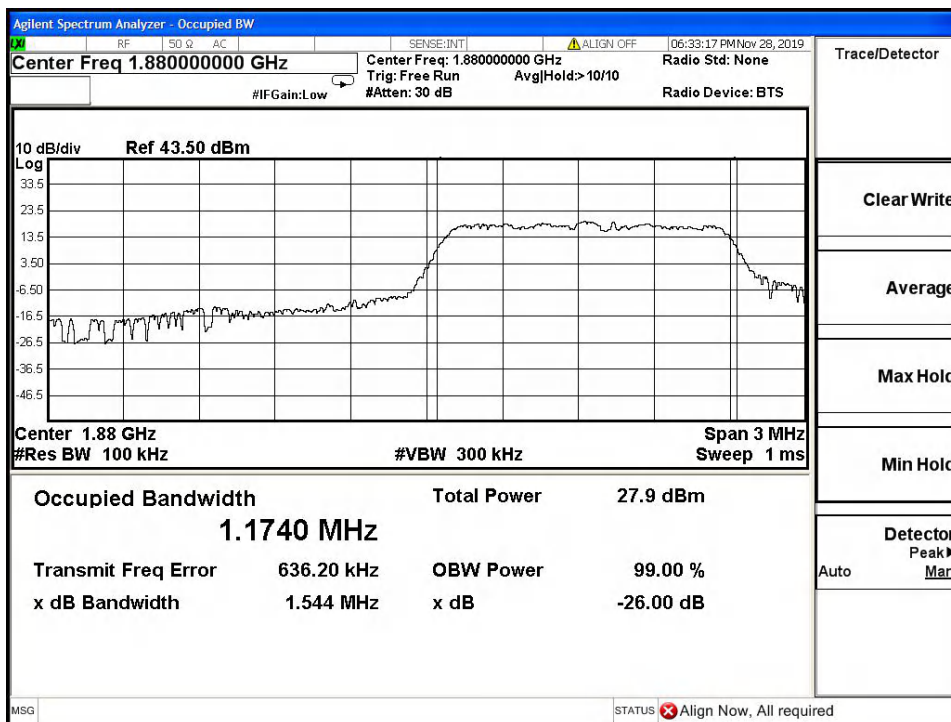
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Band2-99% OBW-5MHz Bandwidth-16QAM

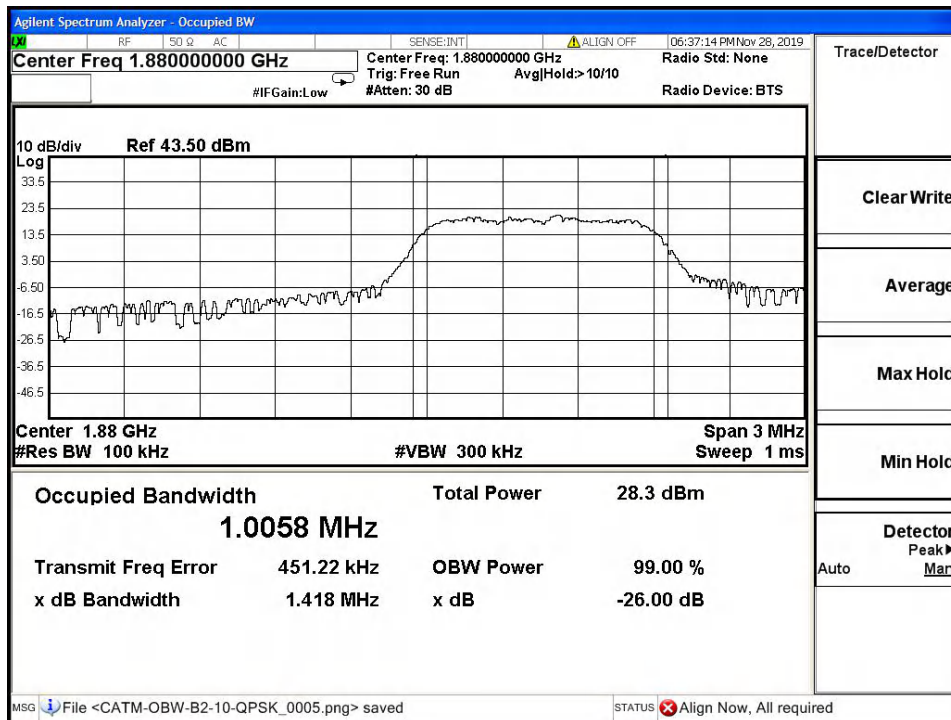


Band2-99% OBW-5MHz Bandwidth-QPSK

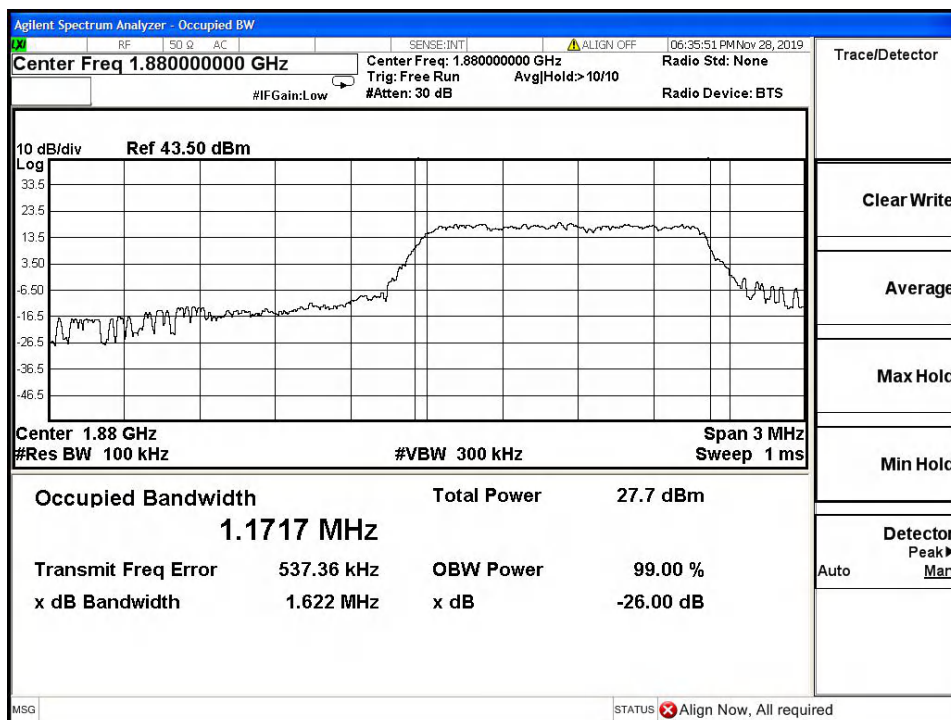
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Band2-26dB OBW-10MHz Bandwidth-16QAM

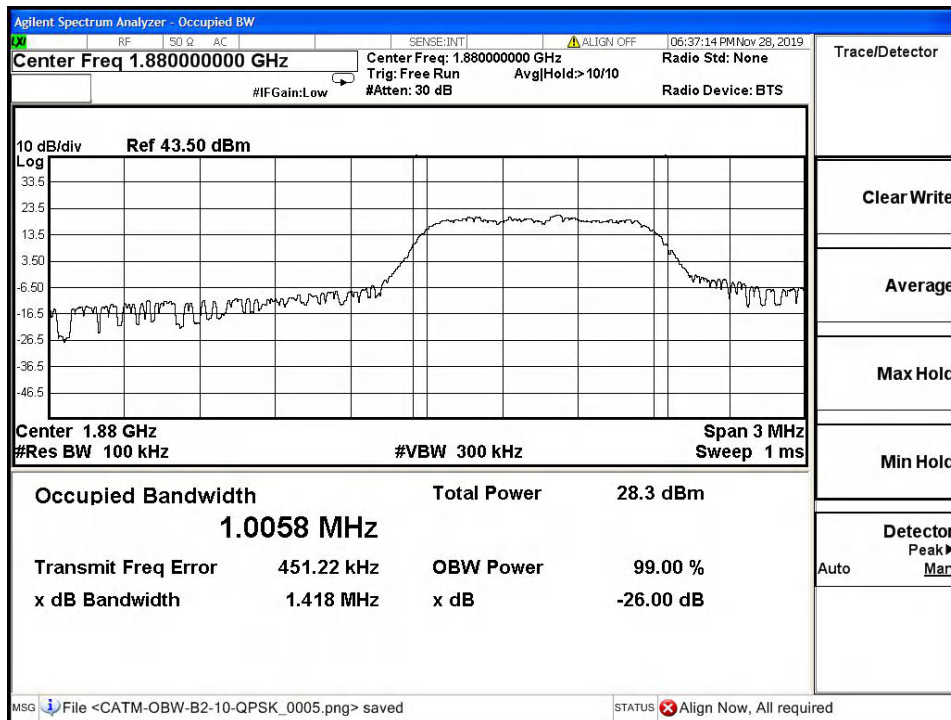


Band2-26dB OBW-10MHz Bandwidth-QPSK

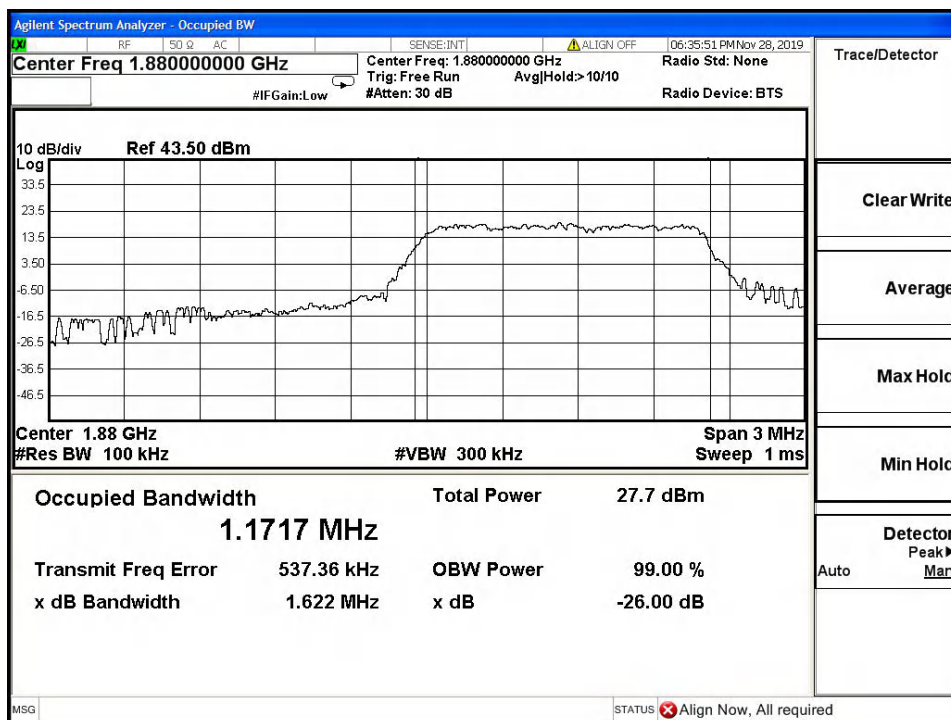
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Band2-99% OBW-10MHz Bandwidth-16QAM

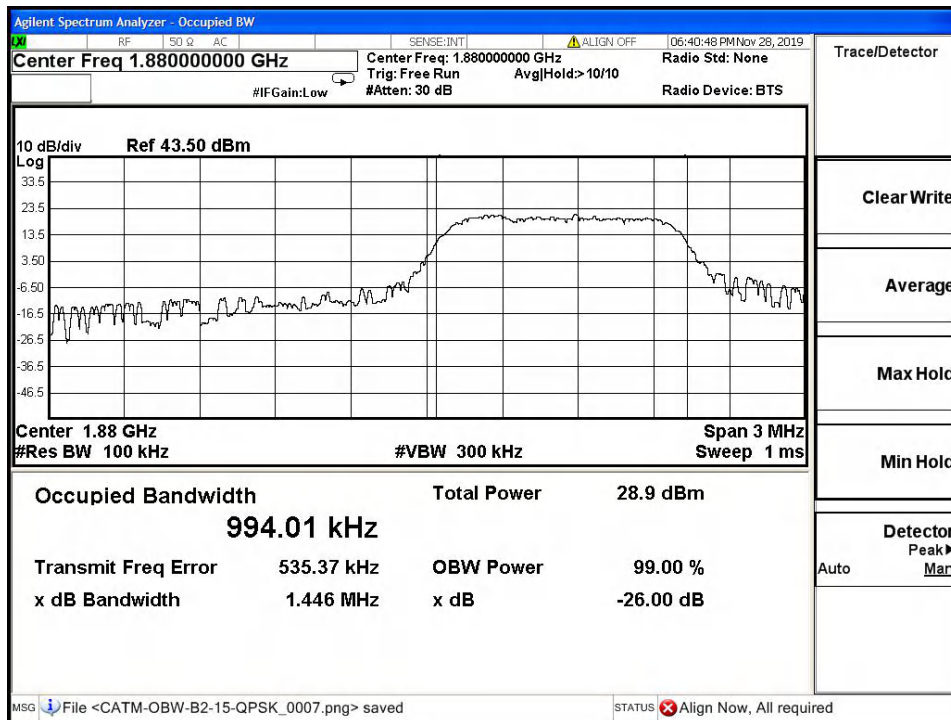


Band2-99% OBW-10MHz Bandwidth-QPSK

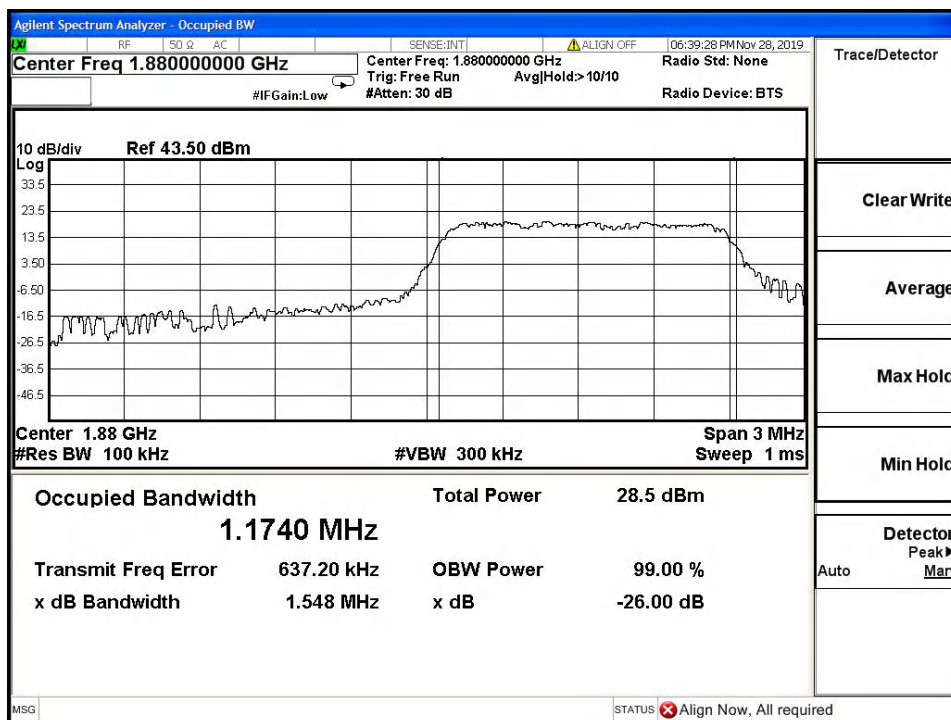
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Band2-26dB OBW-15MHz Bandwidth-16QAM

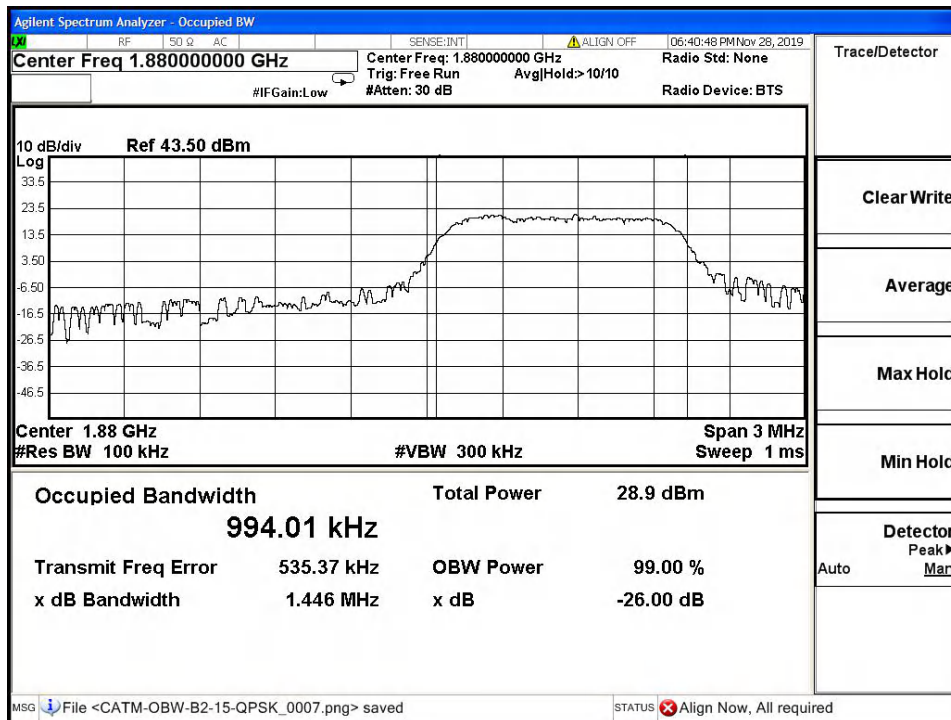


Band2-26dB OBW-15MHz Bandwidth-QPSK

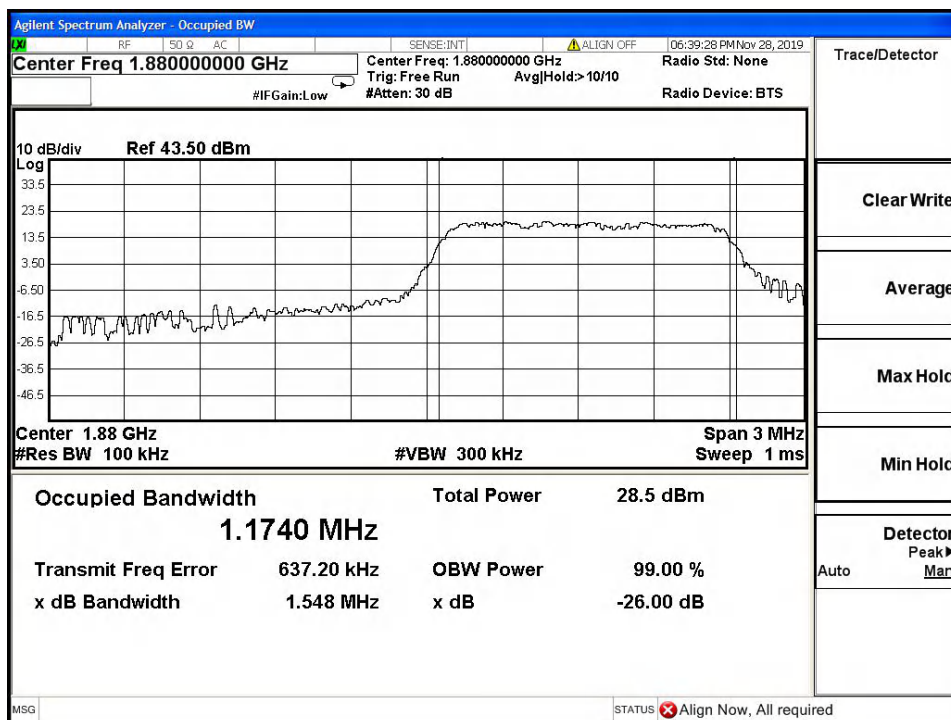
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Band2-99% OBW-15MHz Bandwidth-16QAM

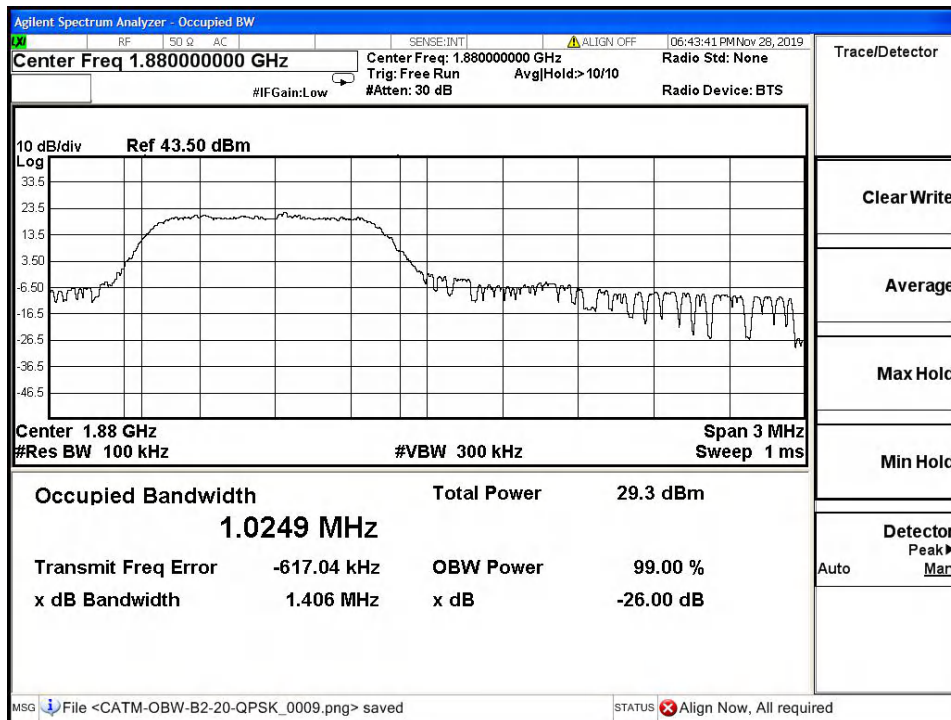


Band2-99% OBW-15MHz Bandwidth-QPSK

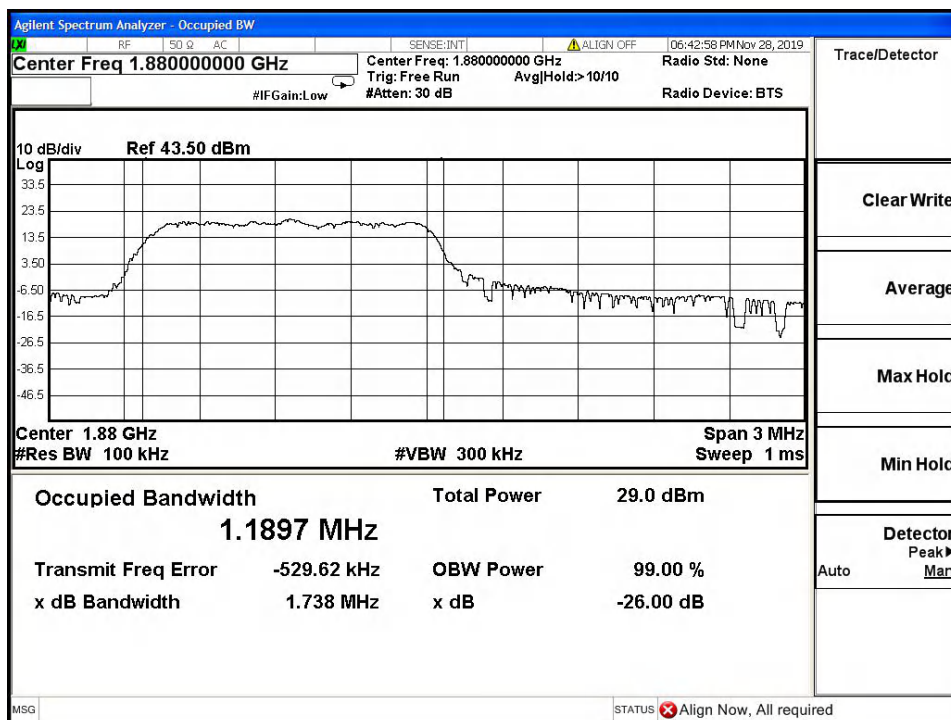
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Band2-26dB OBW-20MHz Bandwidth-16QAM

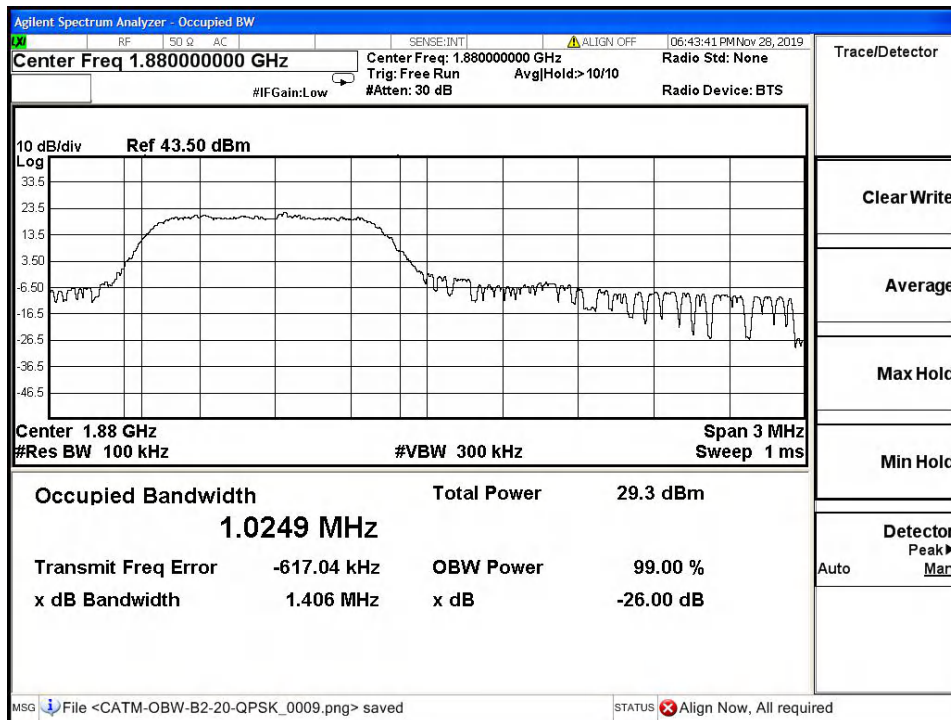


Band2-26dB OBW-20MHz Bandwidth-QPSK

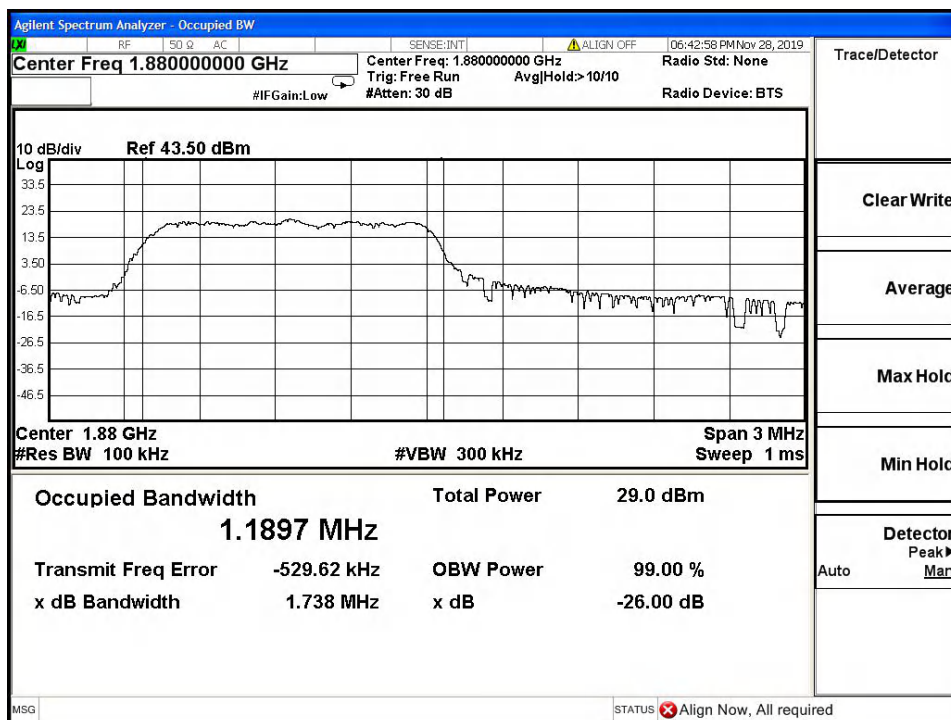
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Band2-99% OBW-20MHz Bandwidth-16QAM

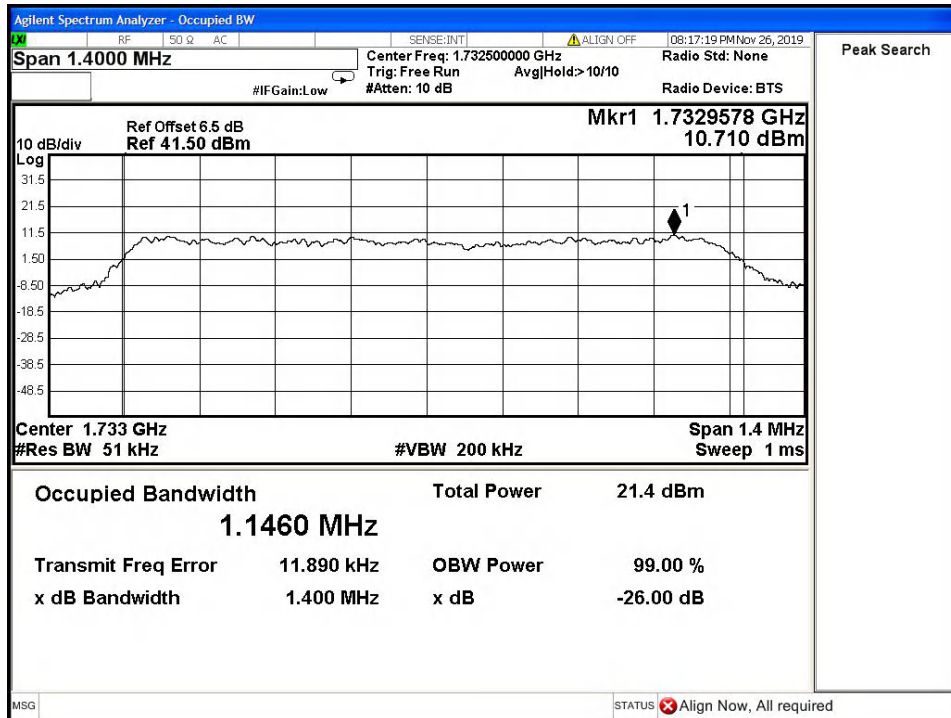


Band2-99% OBW-20MHz Bandwidth-QPSK

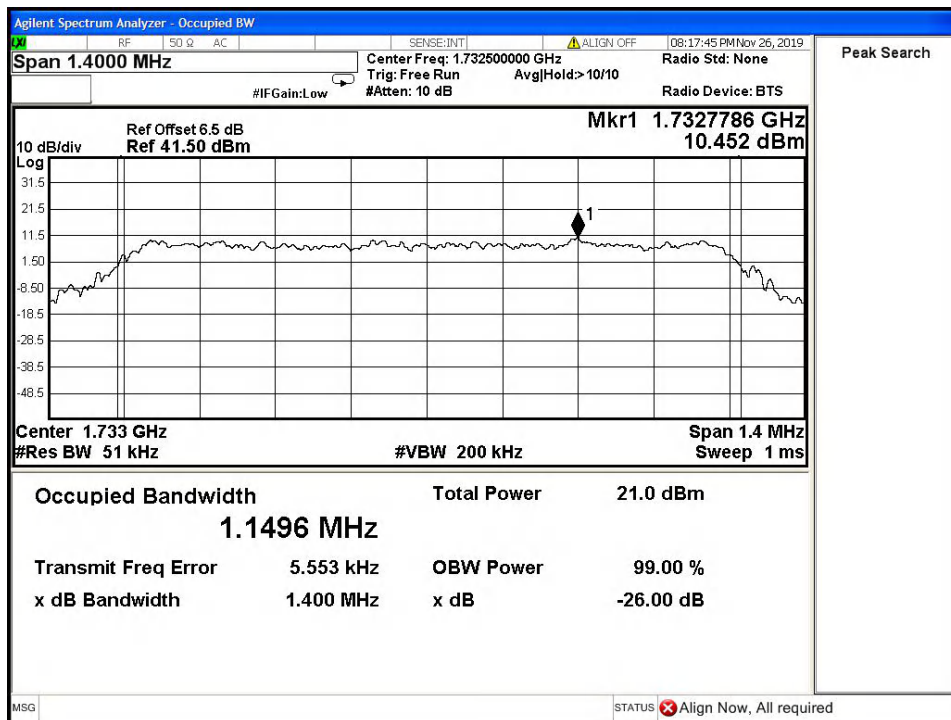
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Band4-26dB OBW-1.4MHz Bandwidth-16QAM

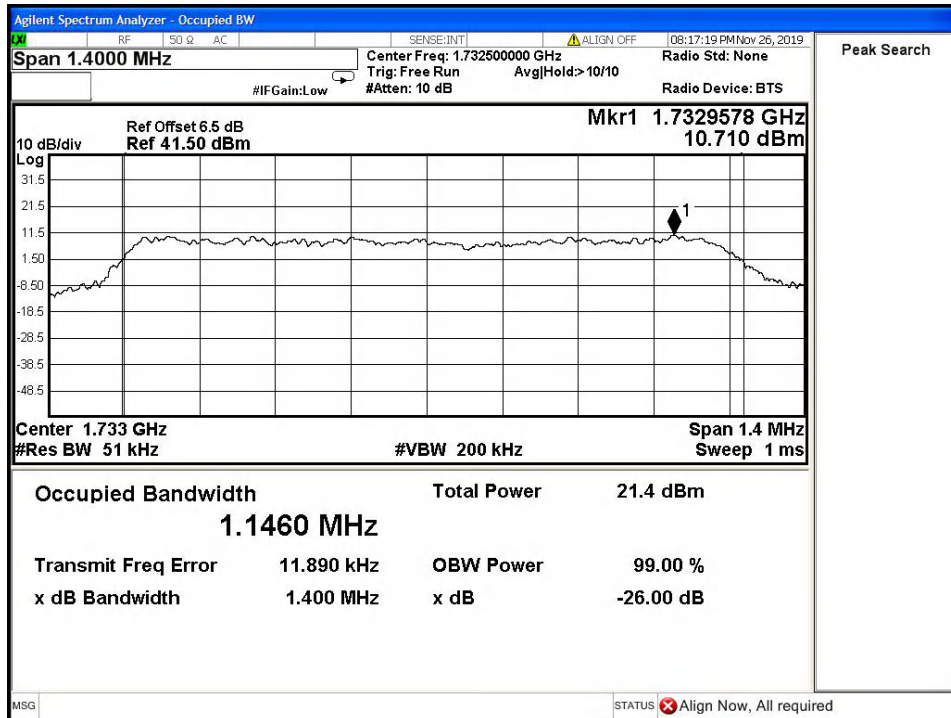


Band4-26dB OBW-1.4MHz Bandwidth-QPSK

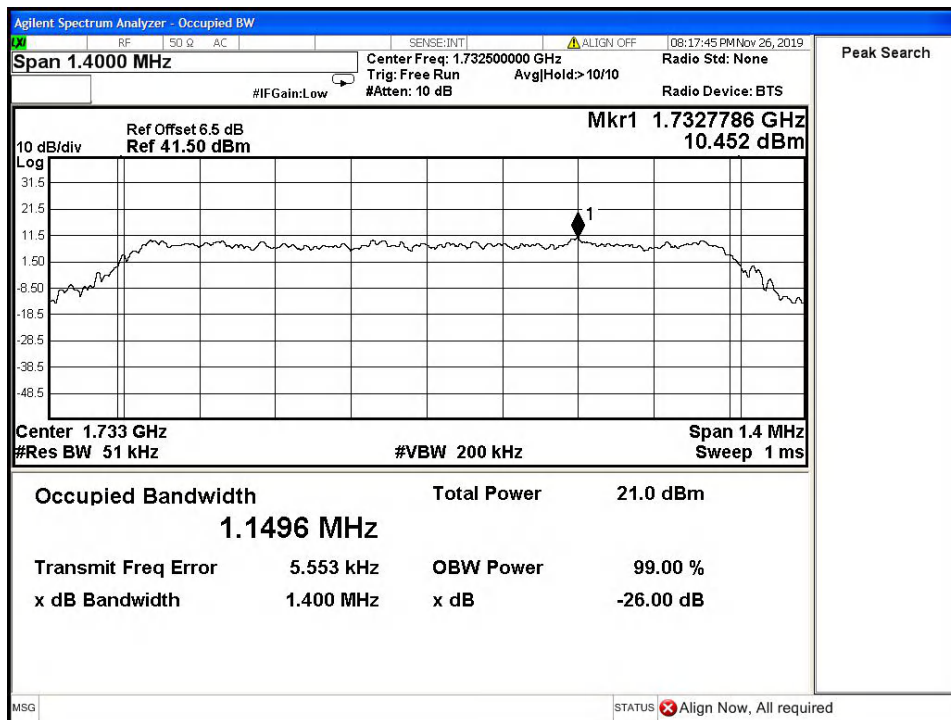
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Band4-99% OBW-1.4MHz Bandwidth-16QAM

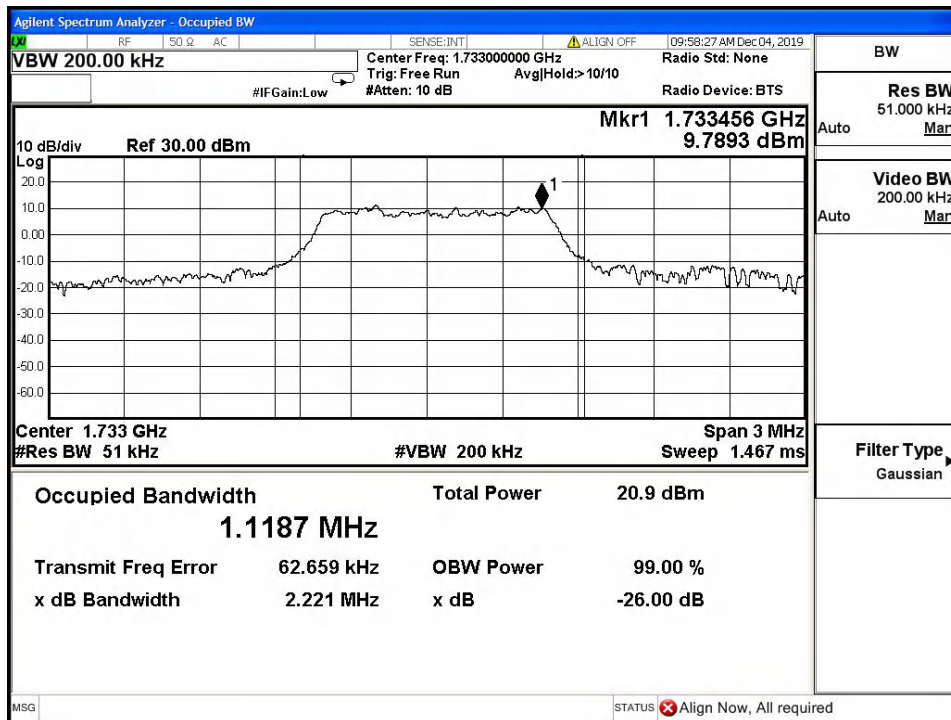


Band4-99% OBW-1.4MHz Bandwidth-QPSK

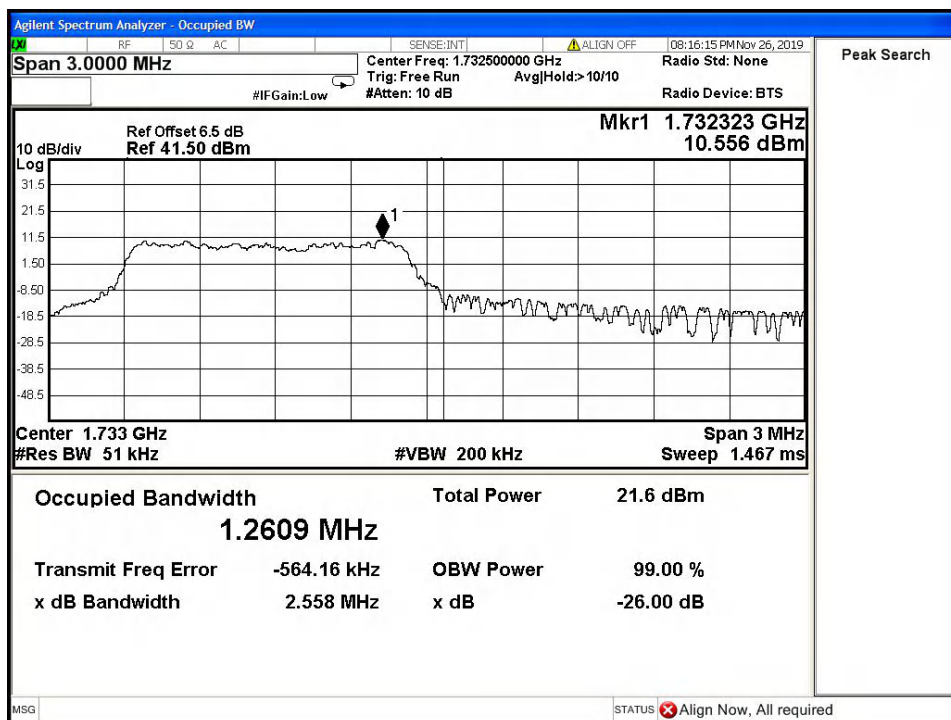
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Band4-26dB OBW-3MHz Bandwidth-16QAM

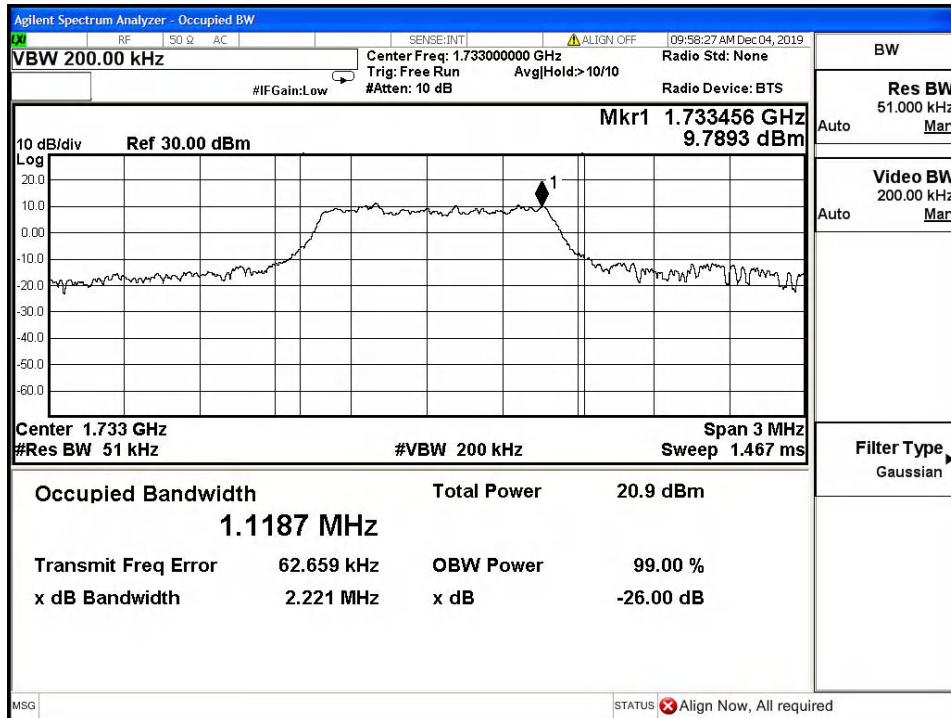


Band4-26dB OBW-3MHz Bandwidth-QPSK

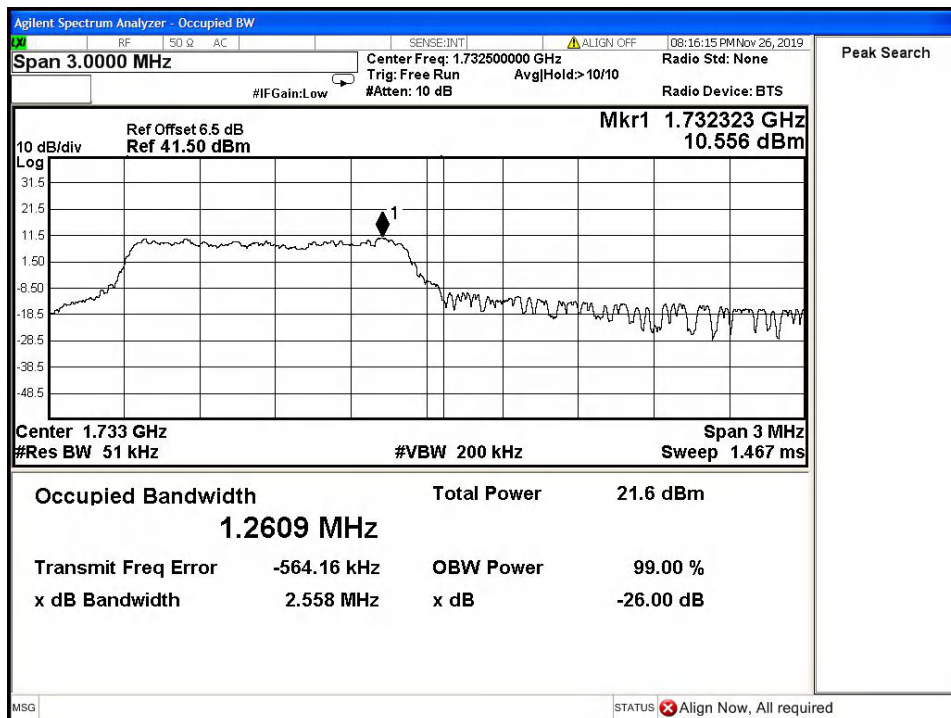
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Report No.: B19W50622-WWAN_Rev2



Band4-99% OBW-3MHz Bandwidth-16QAM

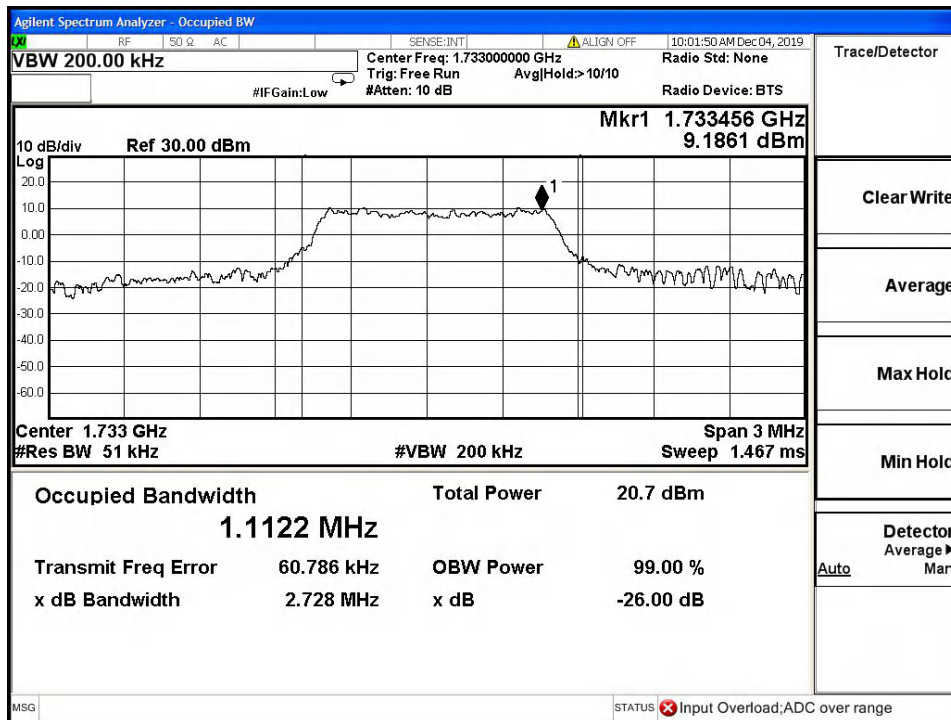


Band4-99% OBW-3MHz Bandwidth-QPSK

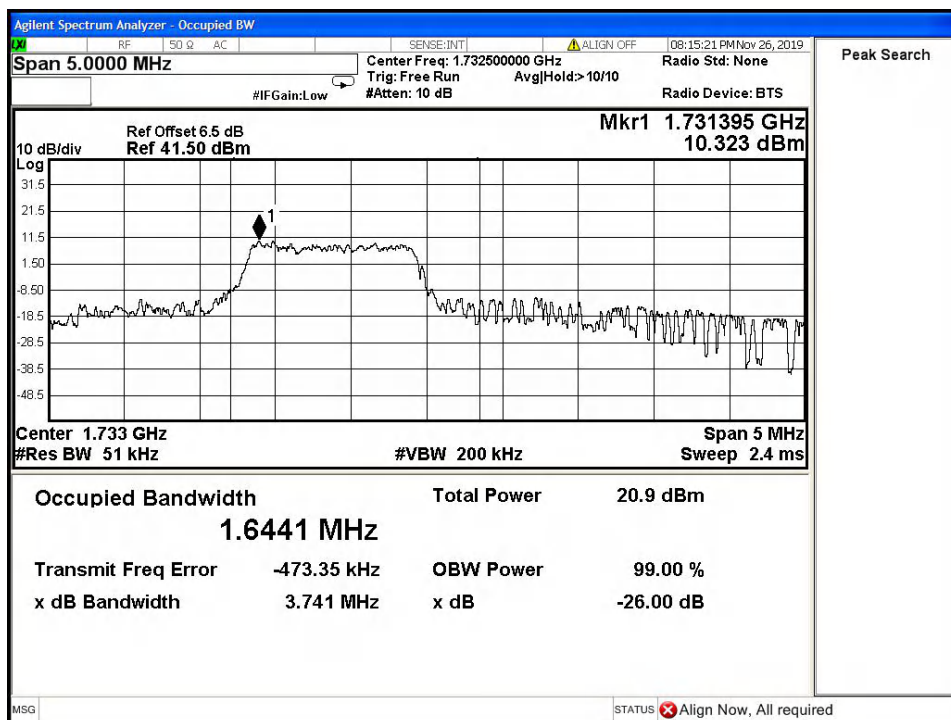
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Band4-26dB OBW-5MHz Bandwidth-16QAM

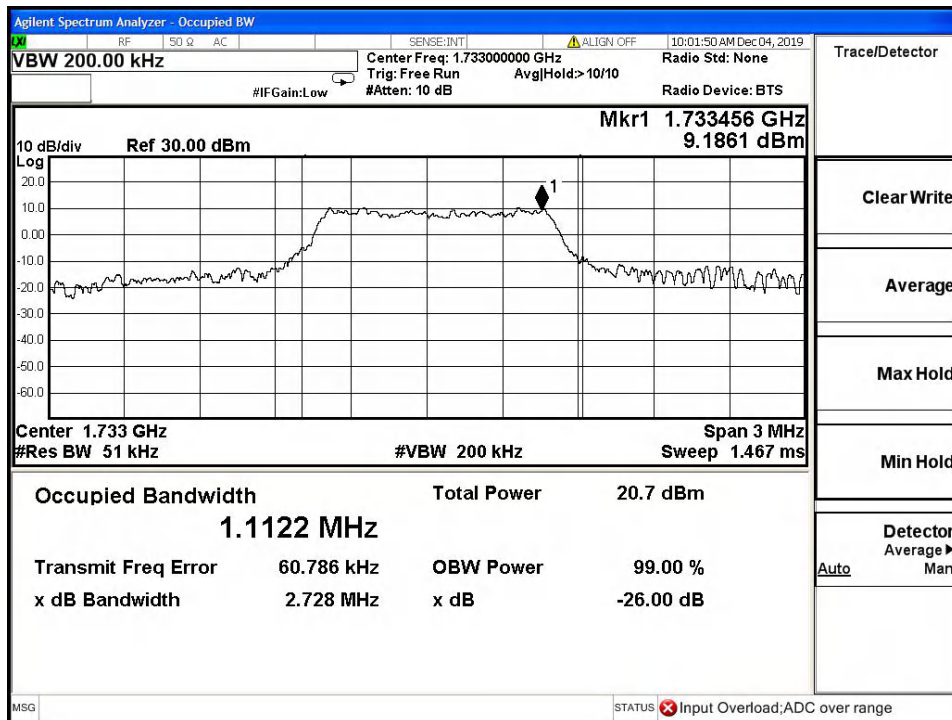


Band4-26dB OBW-5MHz Bandwidth-QPSK

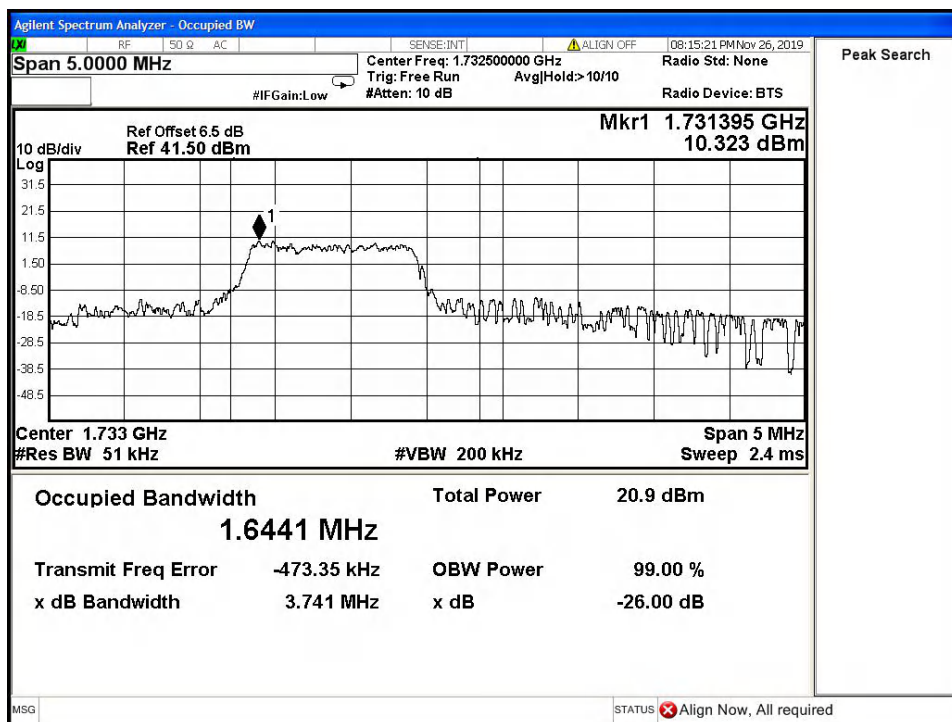
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Band4-99% OBW-5MHz Bandwidth-16QAM

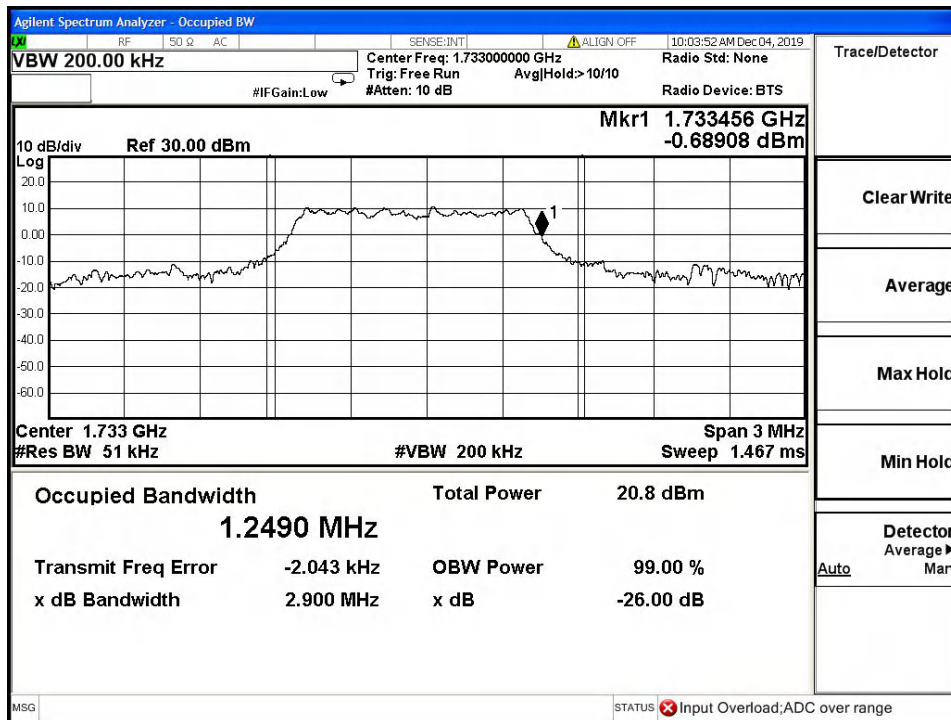


Band4-99% OBW-5MHz Bandwidth-QPSK

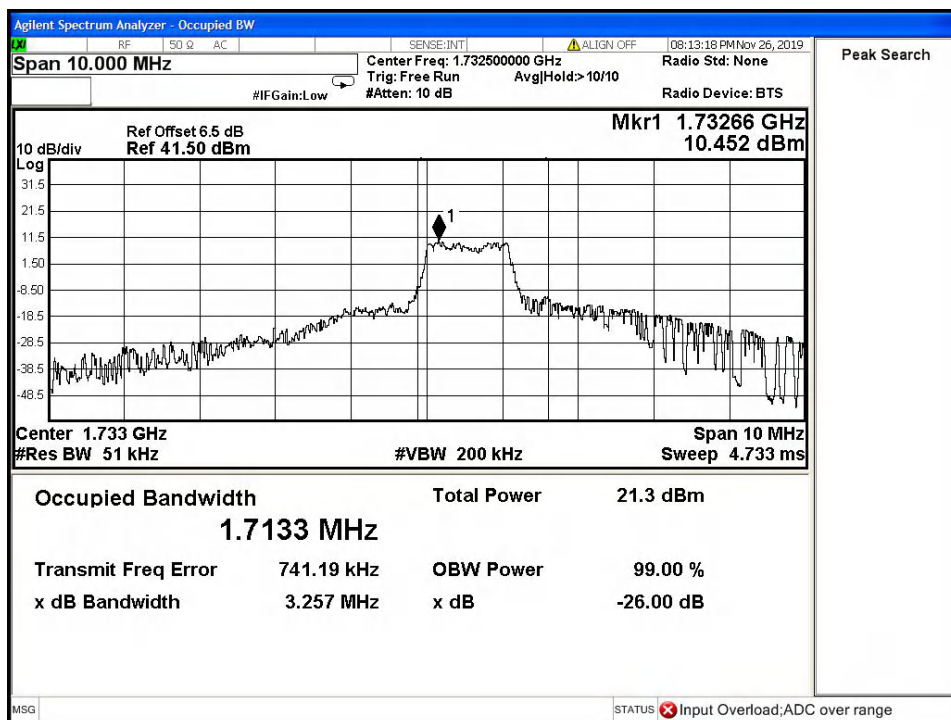
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Band4-26dB OBW-10MHz Bandwidth-16QAM

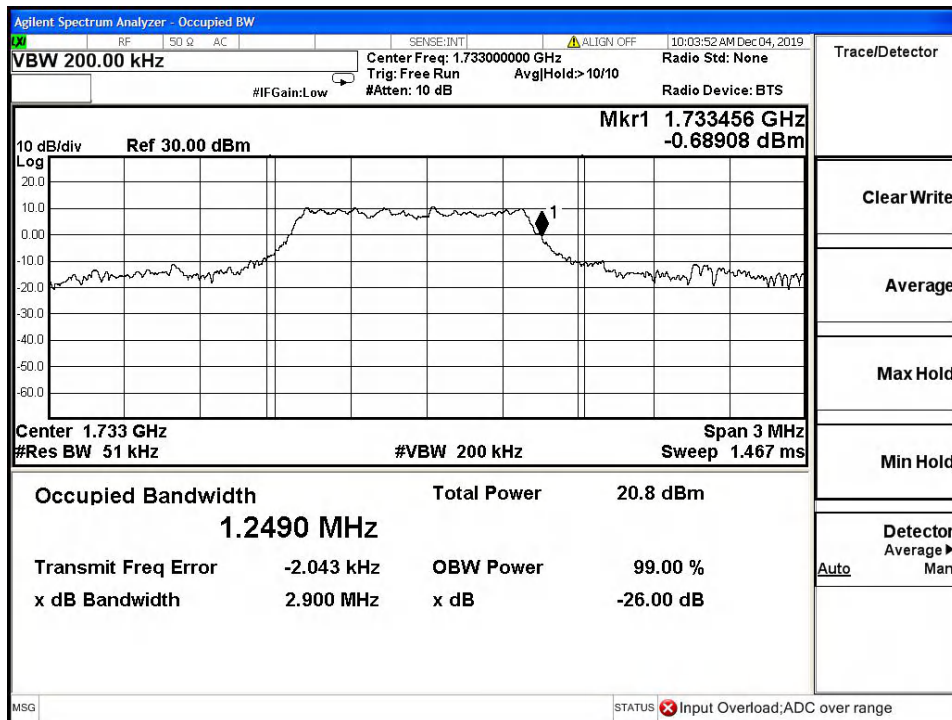


Band4-26dB OBW-10MHz Bandwidth-QPSK

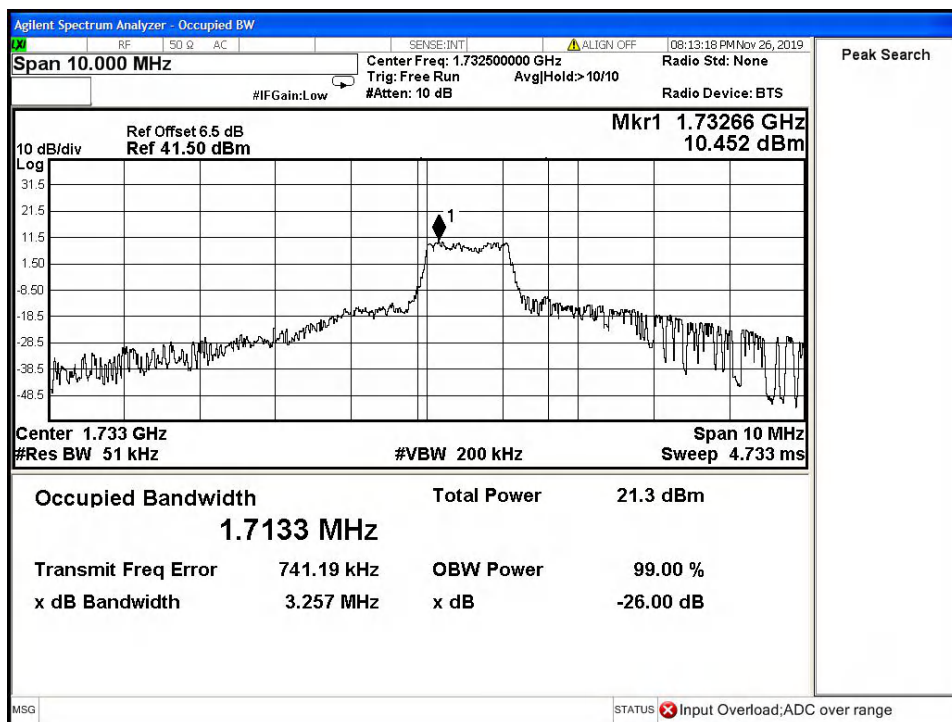
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Band4-99% OBW-10MHz Bandwidth-16QAM

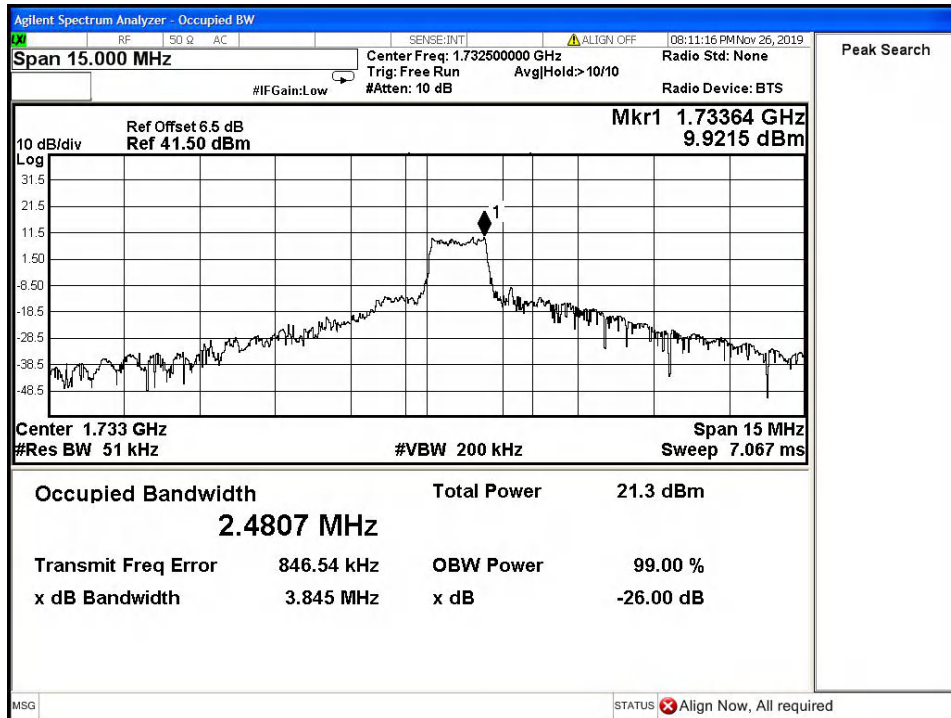


Band4-99% OBW-10MHz Bandwidth-QPSK

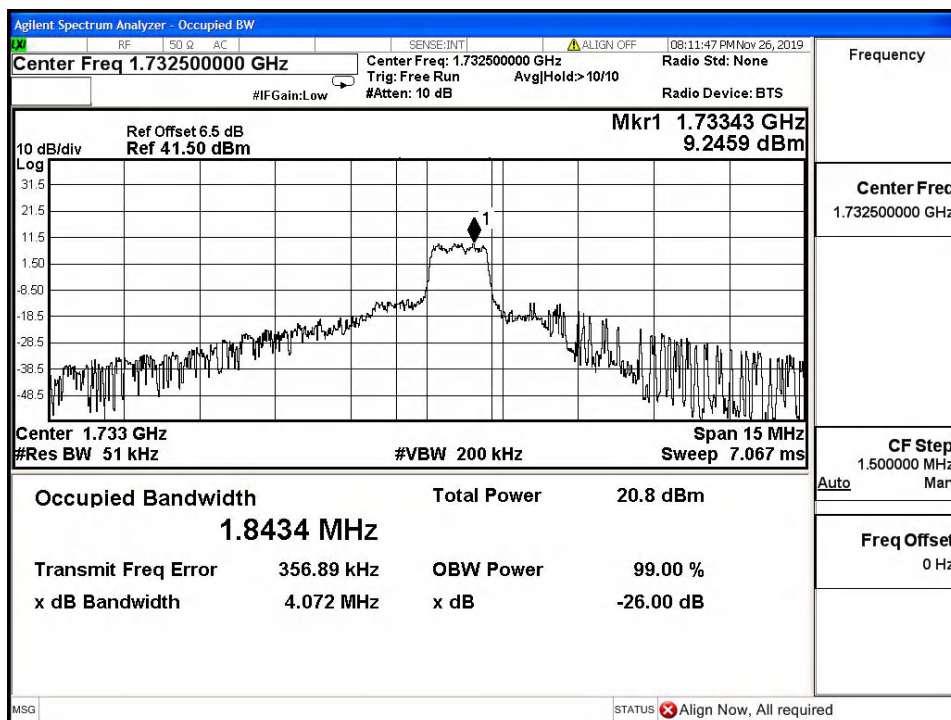
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Band4-26dB OBW-15MHz Bandwidth-16QAM

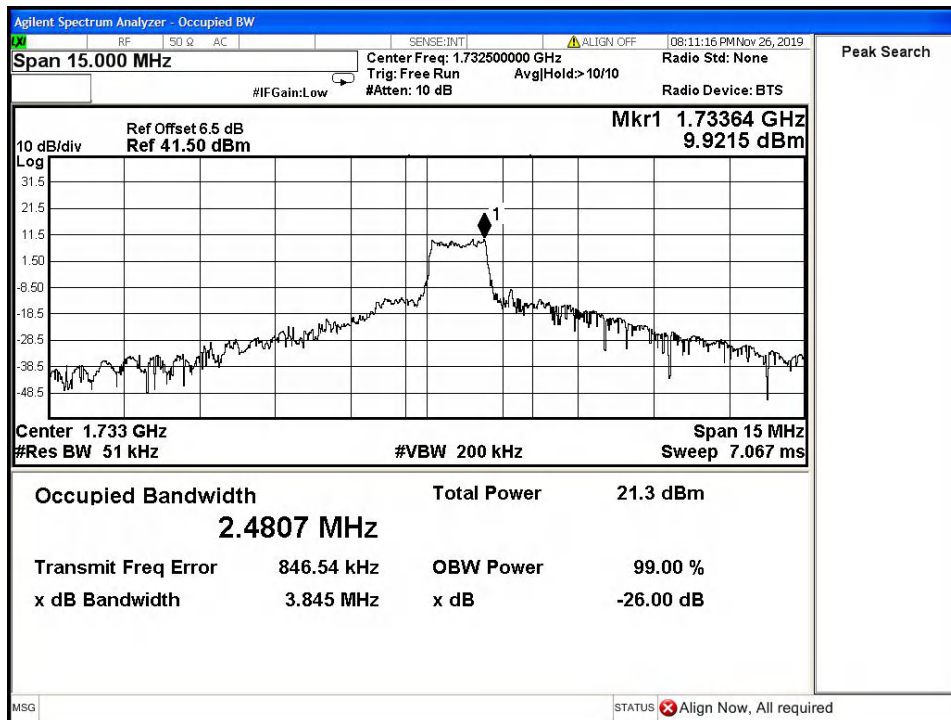


Band4-26dB OBW-15MHz Bandwidth-QPSK

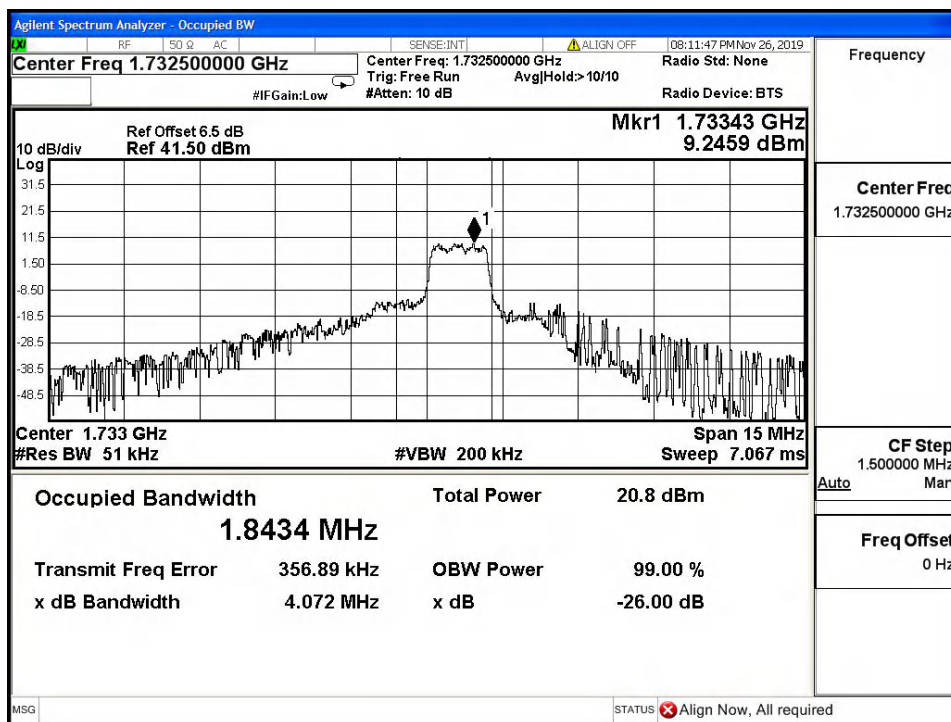
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Band4-99% OBW-15MHz Bandwidth-16QAM

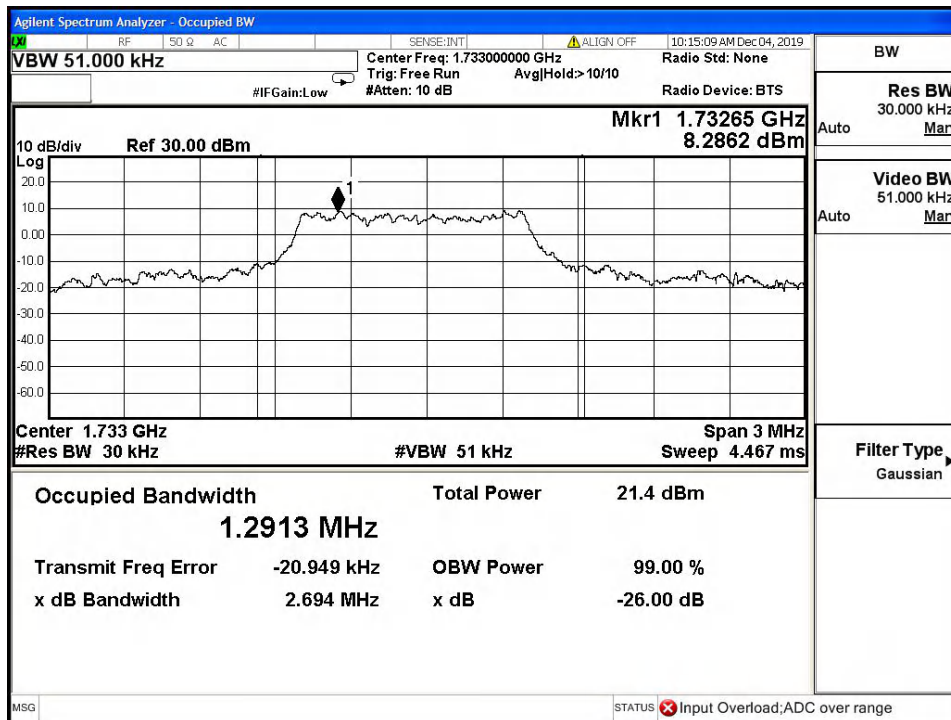


Band4-99% OBW-15MHz Bandwidth-QPSK

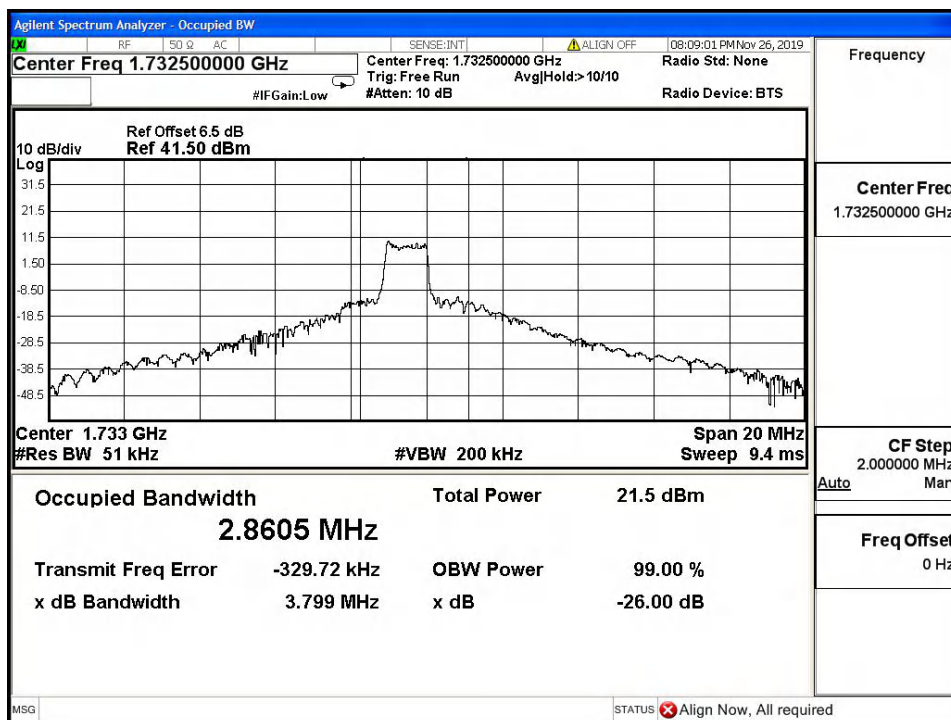
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Band4-26dB OBW-20MHz Bandwidth-16QAM

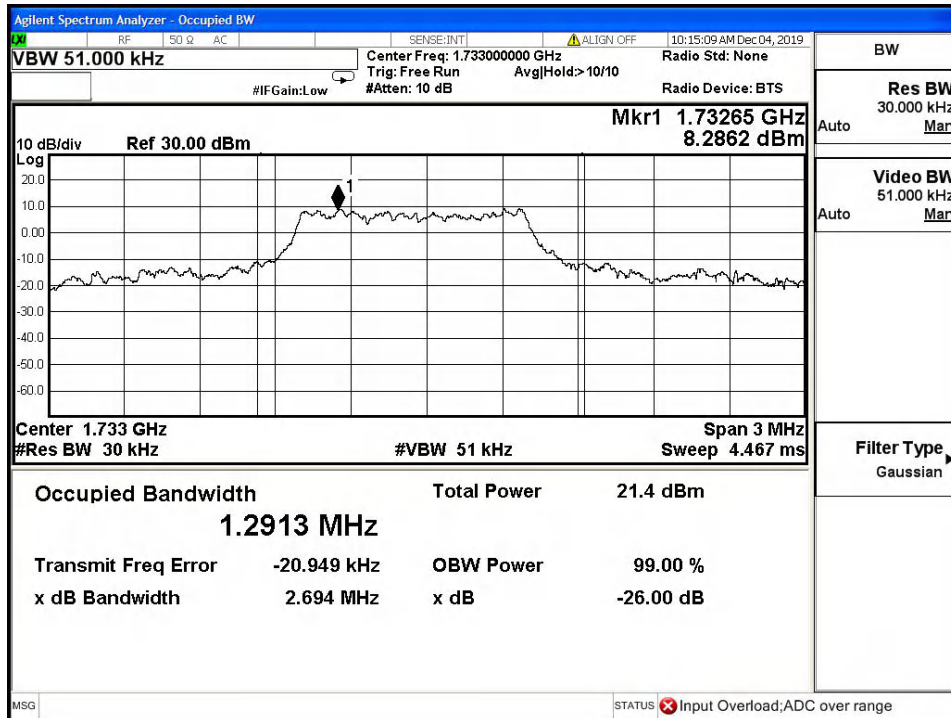


Band4-26dB OBW-20MHz Bandwidth-QPSK

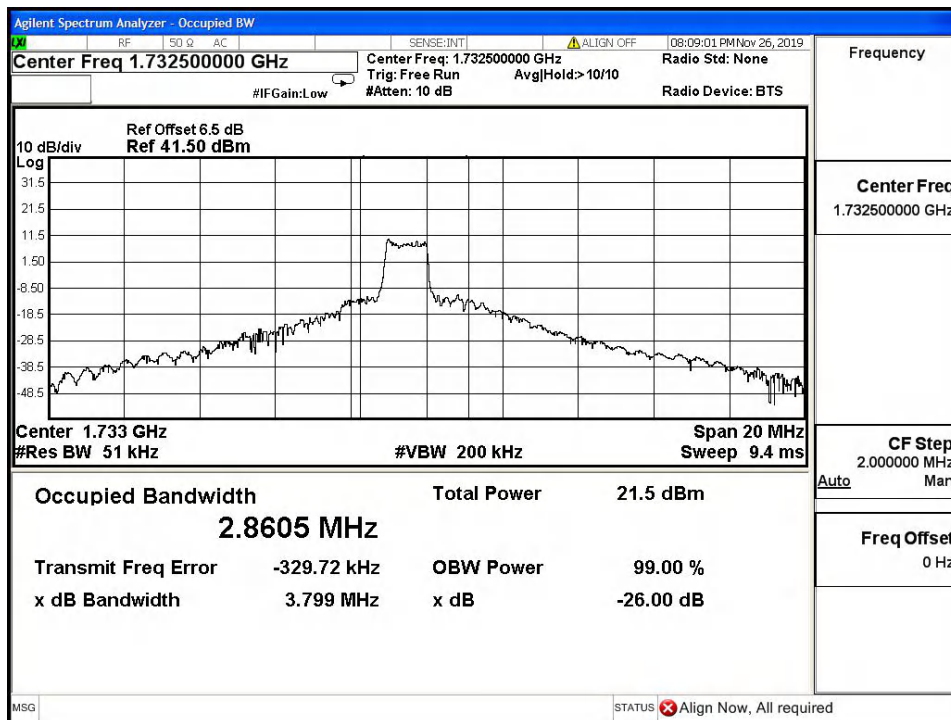
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Band4-99% OBW-20MHz Bandwidth-16QAM

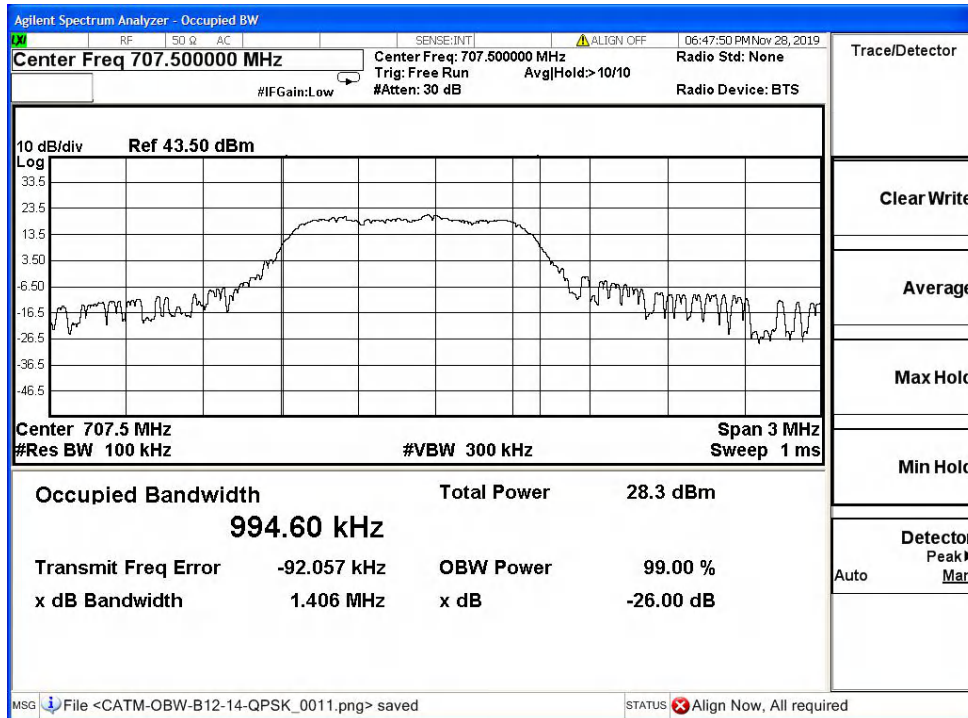


Band4-99% OBW-20MHz Bandwidth-QPSK

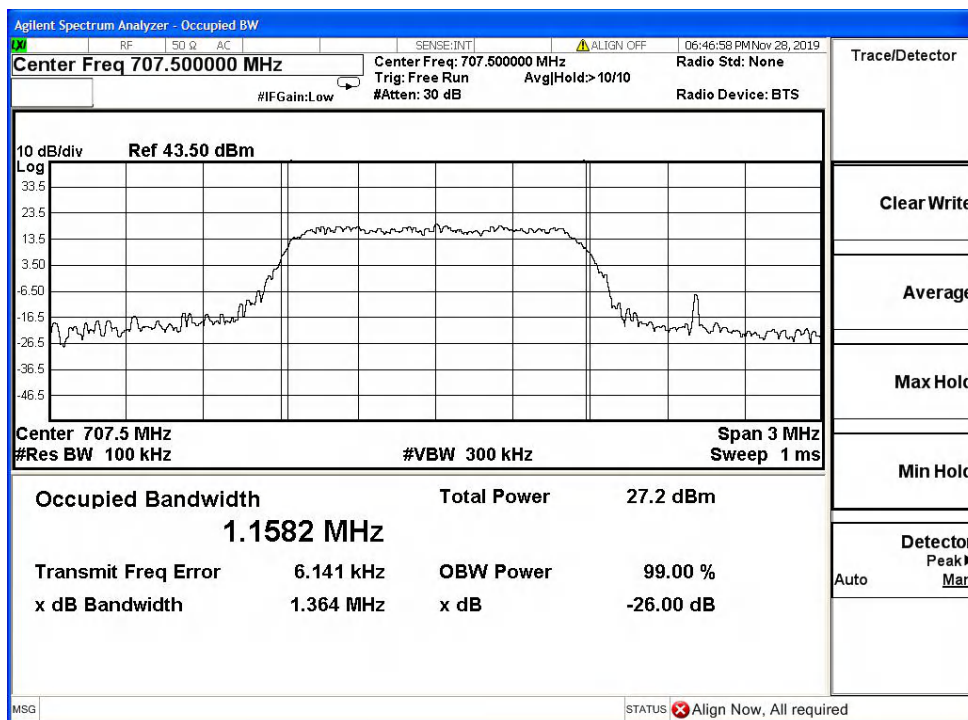
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Band12-26dB OBW-1.4MHz Bandwidth-16QAM

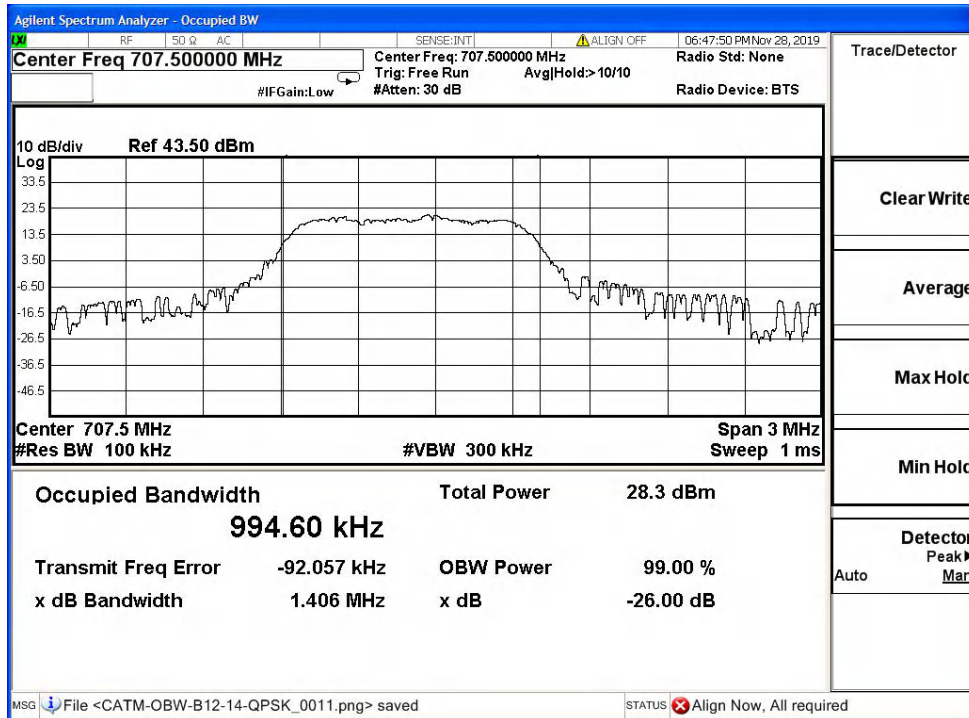


Band12-26dB OBW-1.4MHz Bandwidth-QPSK

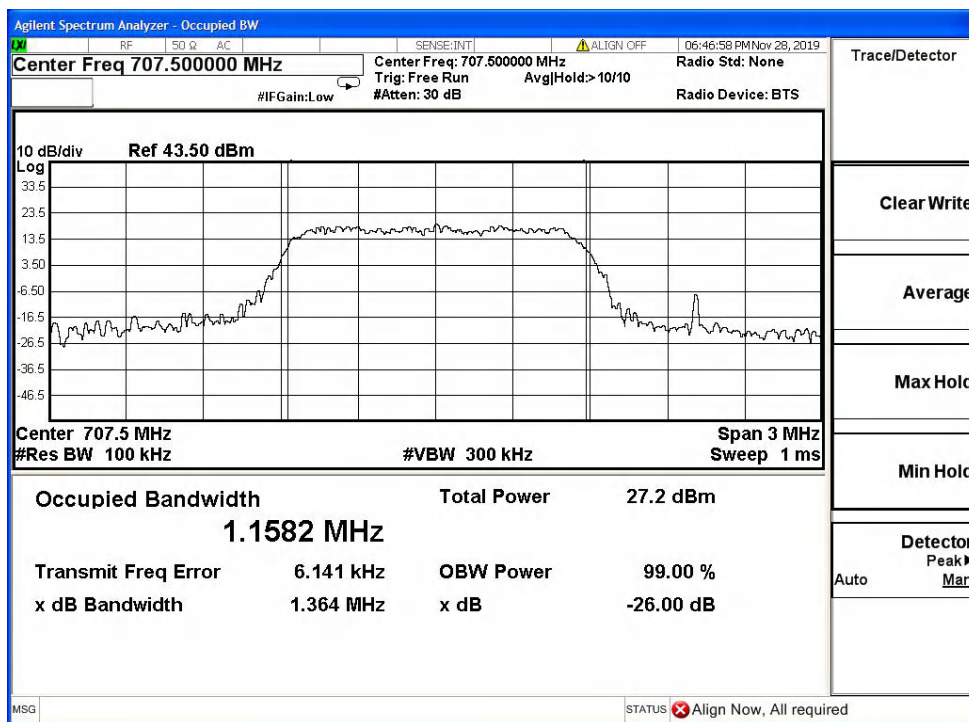
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Band12-99% OBW-1.4MHz Bandwidth-16QAM

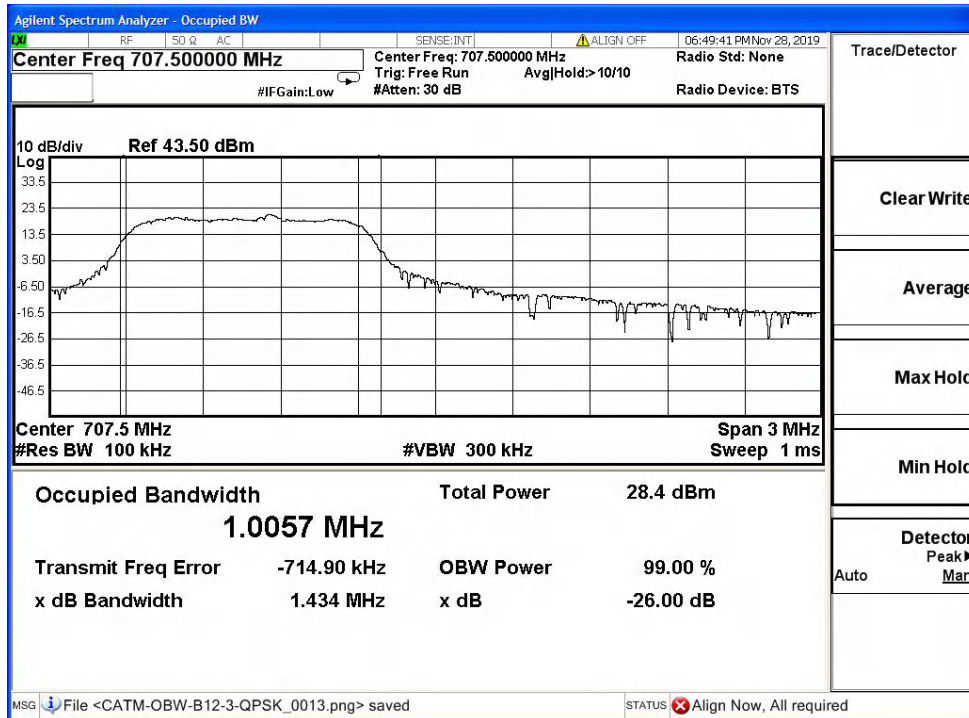


Band12-99% OBW-1.4MHz Bandwidth-QPSK

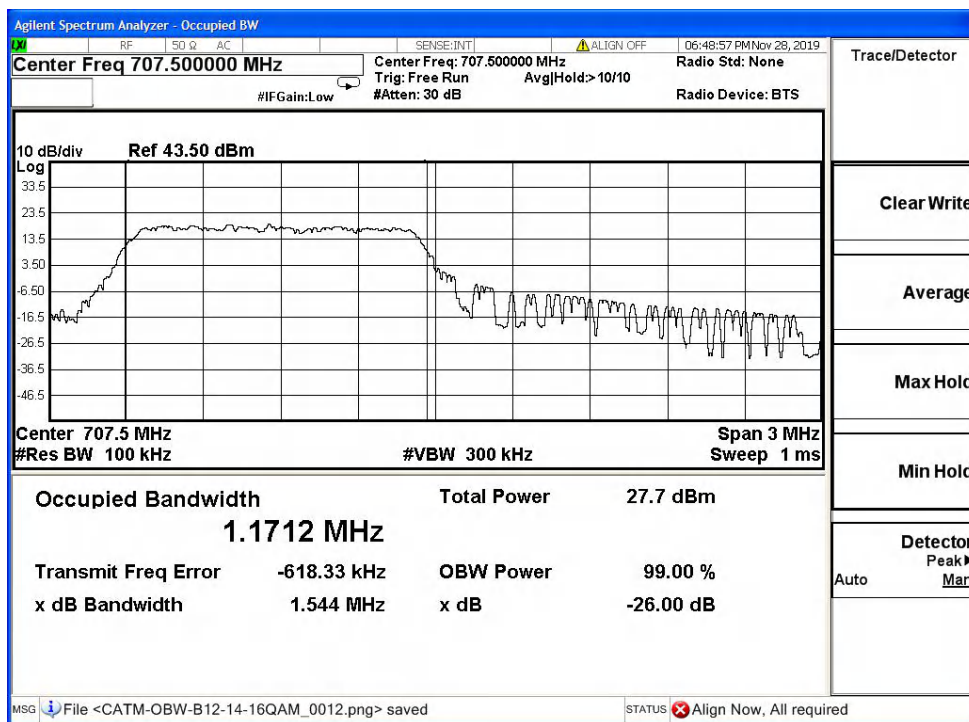
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Band12-26dB OBW-3MHz Bandwidth-16QAM

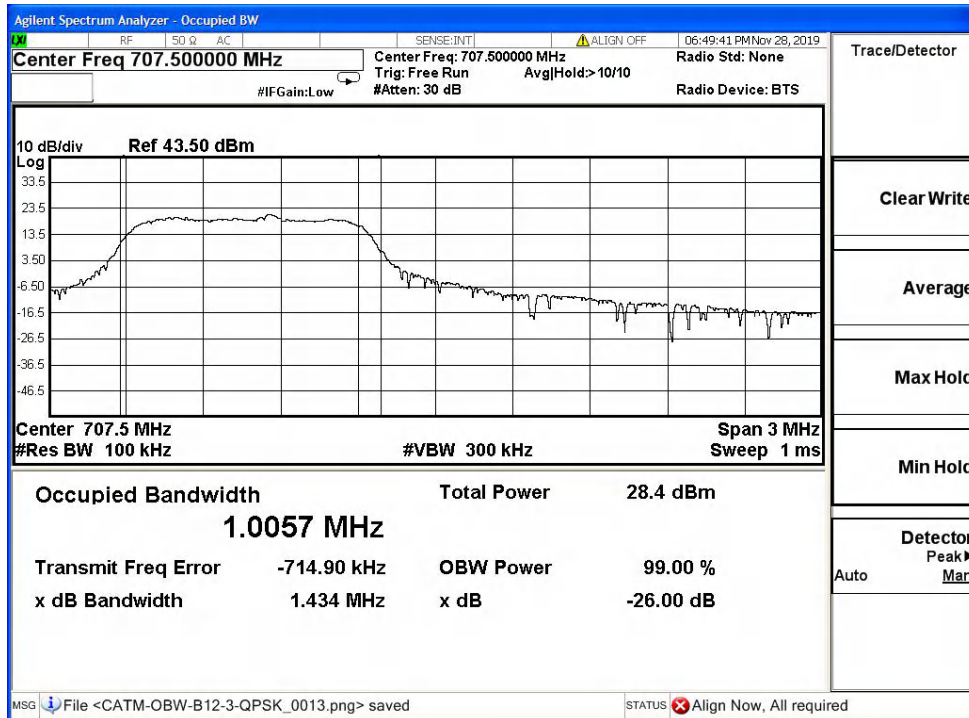


Band12-26dB OBW-3MHz Bandwidth-QPSK

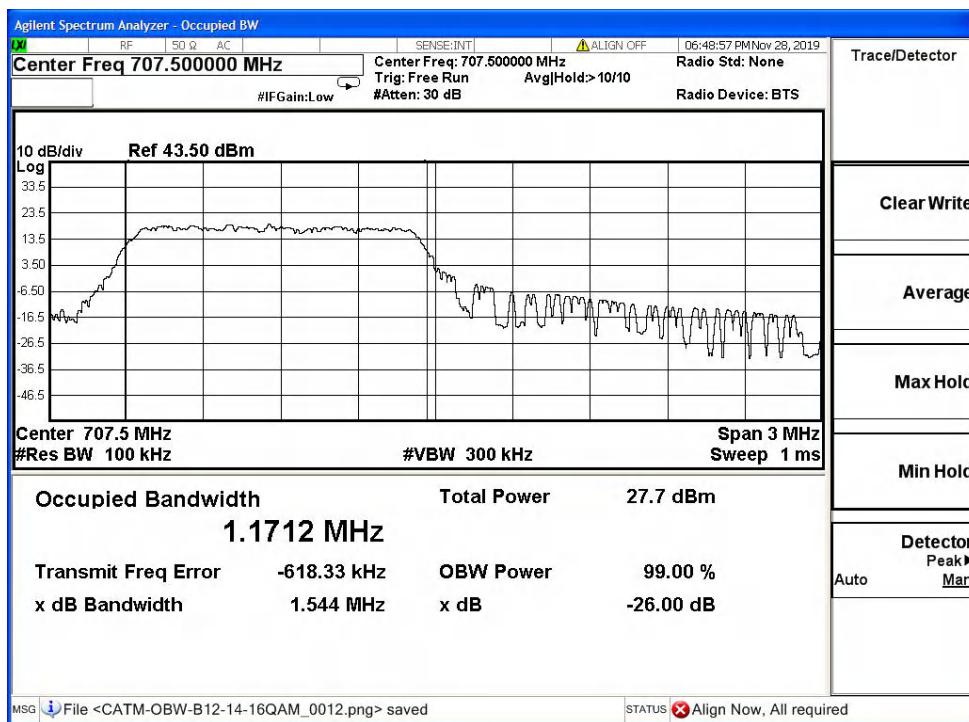
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Band12-99% OBW-3MHz Bandwidth-16QAM

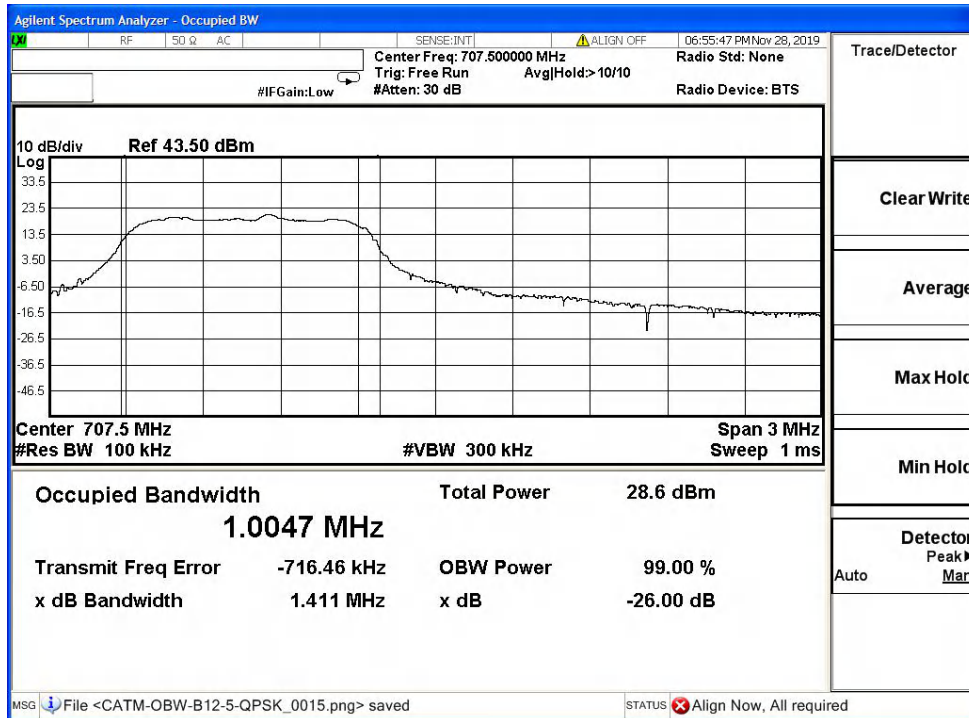


Band12-99% OBW-3MHz Bandwidth-QPSK

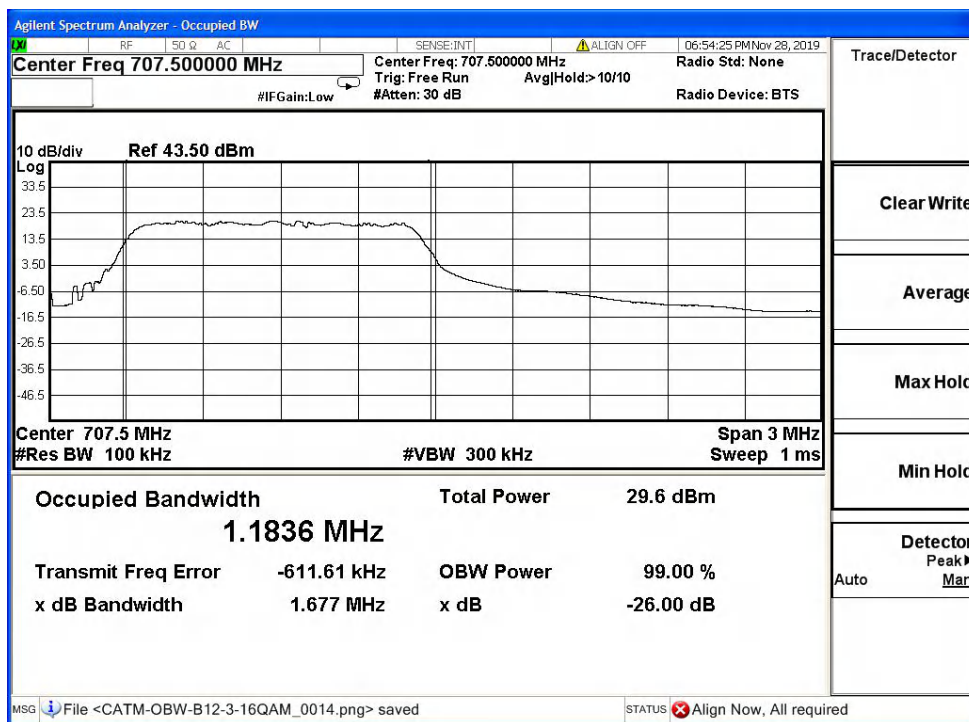
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Band12-26dB OBW-5MHz Bandwidth-16QAM

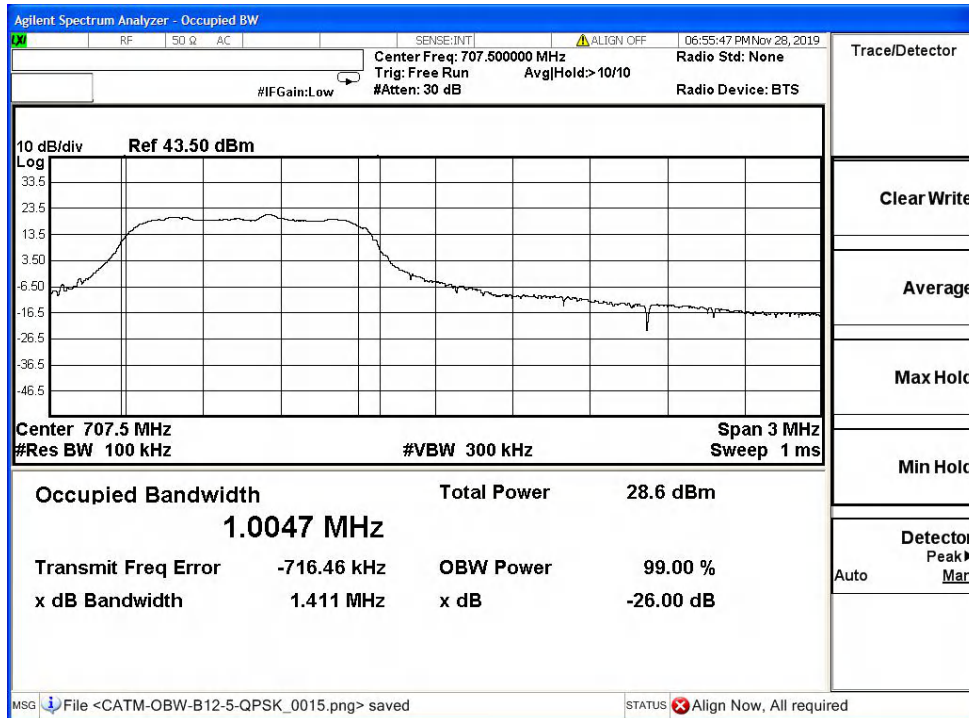


Band12-26dB OBW-5MHz Bandwidth-QPSK

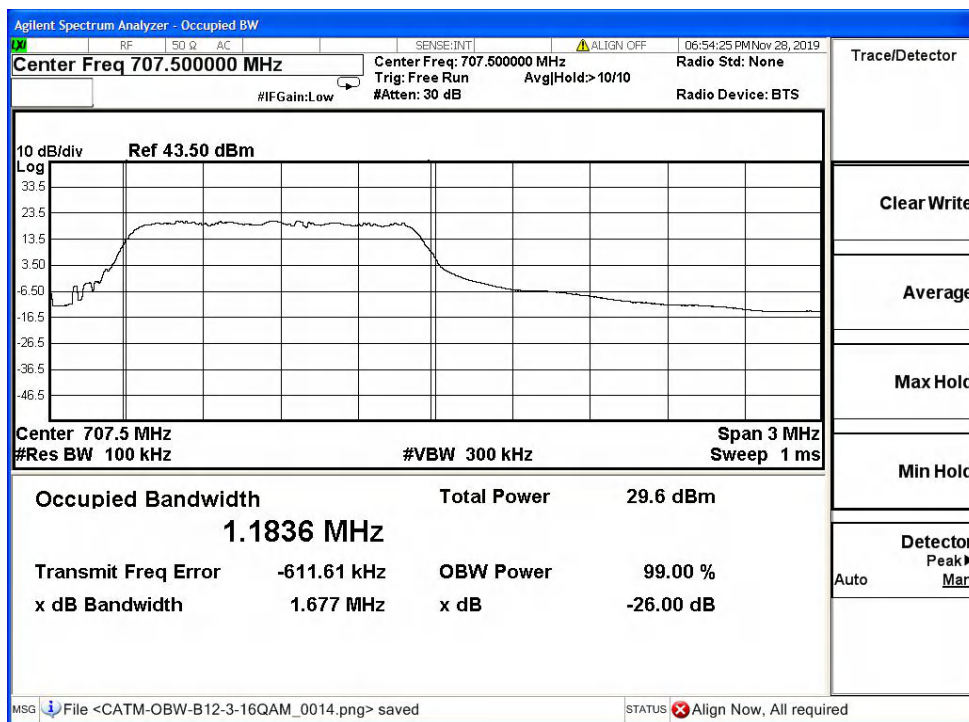
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Band12-99% OBW-5MHz Bandwidth-16QAM

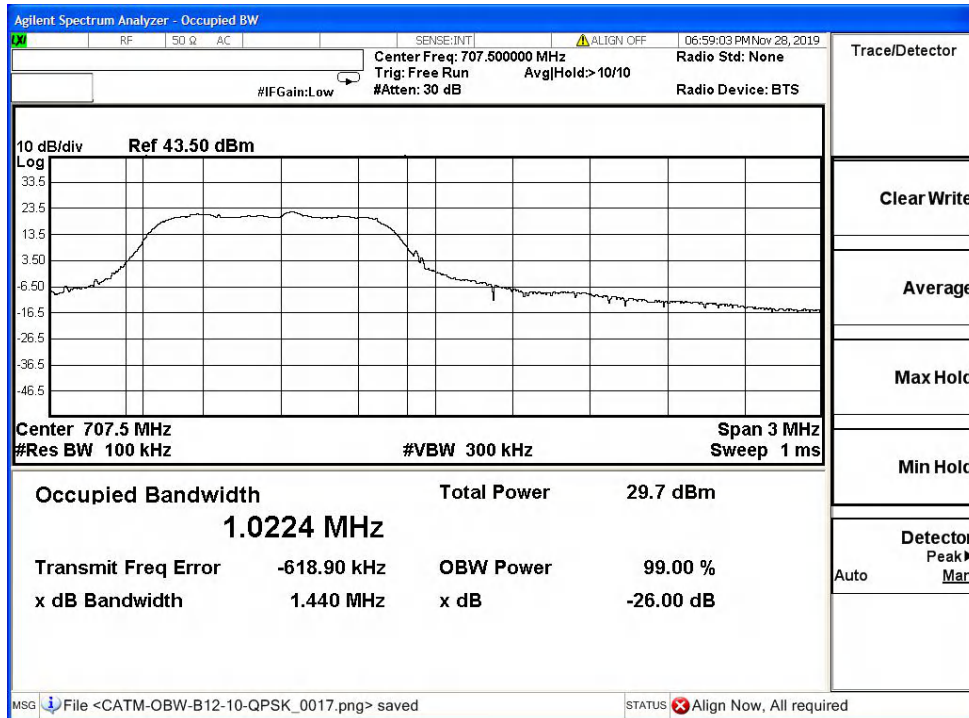


Band12-99% OBW-5MHz Bandwidth-QPSK

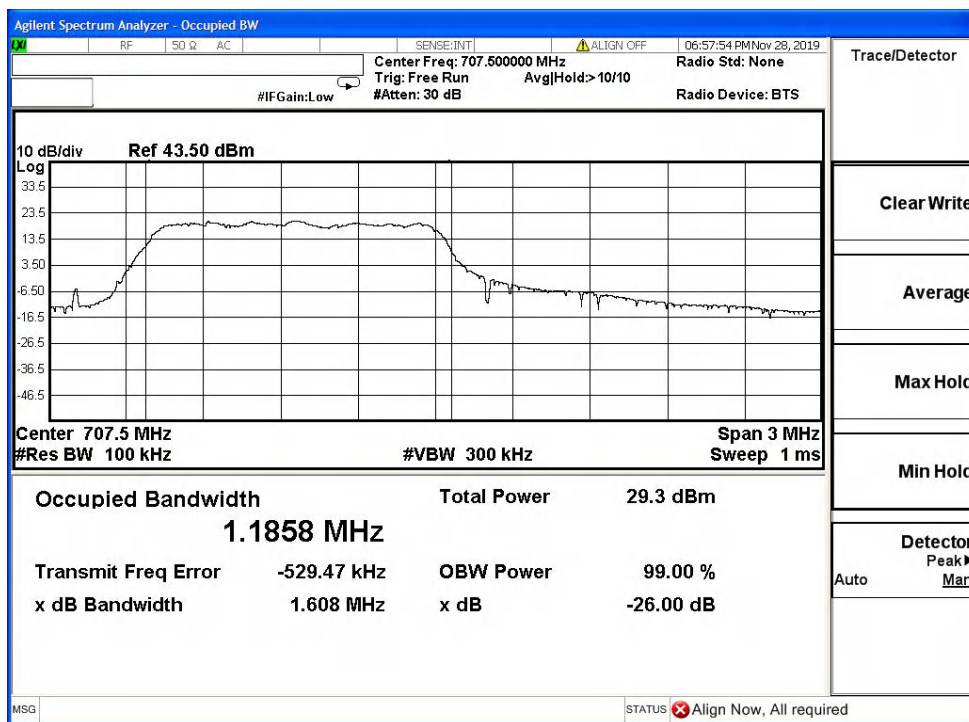
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Band12-26dB OBW-10MHz Bandwidth-16QAM

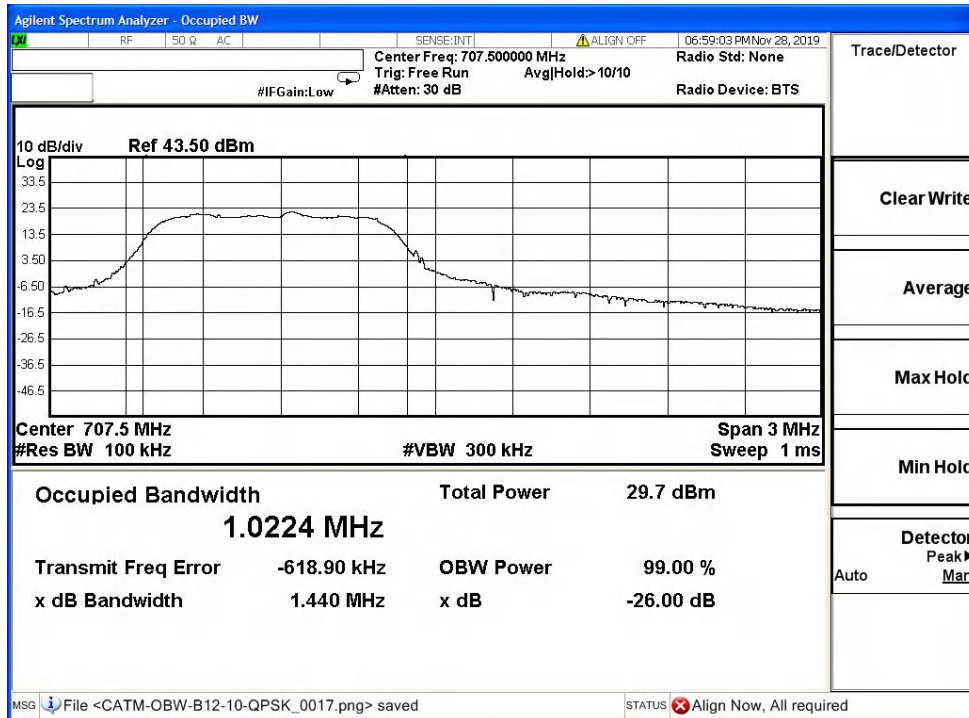


Band12-26dB OBW-10MHz Bandwidth-QPSK

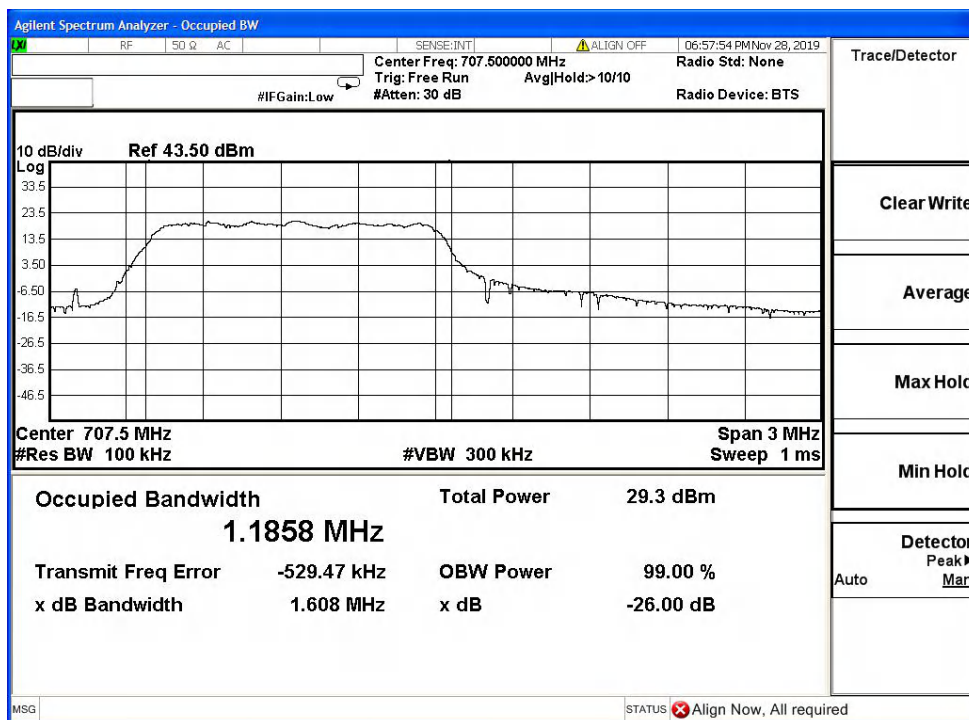
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Band12-99% OBW-10MHz Bandwidth-16QAM



Band12-99% OBW-10MHz Bandwidth-QPSK

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