

TEST REPORT

REPORT NUMBER: B19W50225-WWAN_Rev1

ON

Type of Equipment: LTE Tracker
Model Name: AT Plus 4E
Manufacturer: Micron Electronics LLC.

ACCORDING TO

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

PART 22, PUBLIC MOBILE SERVICES;

PART 24, PERSONAL COMMUNICATIONS SERVICES;

PART 27, MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES;

PART 90, PRIVATE LAND MOBILE RADIO SERVICES.

Chongqing Academy of Information and Communications Technology

Month date, year

Sep, 30, 2019

Signature



Zhang Yan

Director

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of Chongqing Academy of Information and Communications Technology.

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Revision Version

Report Number	Revision	Date	Memo
B19W50225	V0.0	2019-08-28	--
B19W50225	V1.0	2019-09-30	--

Chongqing Academy of Information and Communications Technology

Report No.: B19W50225-WWAN_Rev1

FCC ID: ZKQ-ATP4E

Report Date: 2019-09-30

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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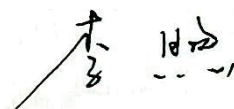
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1.2 Testers

Name: Li Xu
Position: Engineer
Department: Department of RF test
Date: 2019-06-13 to 2019-08-28

Signature:



Editor of this test report:

Name: Chen Wen
Position: Engineer
Department: Department of RF test
Date: 2019-09-30

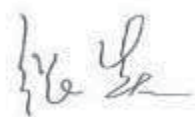
Signature:



Technical responsibility for area of testing:

Name: Zhang Yan
Position: Manager
Department: Director of the laboratory
Date: 2019-09-30

Signature:



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1.3 Testing Laboratory information

1.3.1 Location

Name: Chongqing Academy of Information and Communications Technology

Address: Building B, Technology Innovation Center, No.8, Yuma Road, Chayuan New Area, Nan'an District, Chongqing, People's Republic of China, 401336

Tel: +86-23-88069965

Fax: +86-23-88608777

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: Micron Electronics LLC.
Address: 1001 Yamato Road, Suite 400, Boca Raton, FL 33431,
USA
Country: USA
Telephone: +18885383489
Fax: +18885501805
Contact: Ping Cheng
Email: pcheng@micron-electronics.com

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: Micron Electronics LLC.
Type of Equipment: LTE Tracker
Model Name: AT Plus 4E
Production Status: Product
Hardware Version: A502_V1_PCB
Software Version: P51MAV01.01B01.I03
Receipt date of test item: 2019-06-11

2.2 Outline of Equipment under Test

The AT Plus 4E, referred to as “EUT” hereafter, is a multi-Band wireless modem 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	Covered by Band26 (Band5 is a subset of Band26. 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	--

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Technology	Band	UL Freq.(MHz)	DL Freq.(MHz)	Note
CAT-M	Band2	1850 – 1910	1930 – 1990	--
	Band4	1710 – 1755	2110 – 2155	--
	Band5	824 – 849	869 – 894	Covered by Band26 (Band5 is a subset of Band26. 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.

2.4 Equipment Configuration

Equipment configuration list:

Item	Generic Description	Manufacturer	Type	Serial No.	Remarks
A	Modules	Micron Electronics LLC.	AT Plus 4E	353081090297923	None
B	Modules	Micron Electronics LLC.	AT Plus 4E	353081090308282	None

2.5 Other Information

--

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)	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

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24.232 27.50	Peak to Average Ratio	Pass
FCC Part 24.232(b), 27.50(d), 27.50(h)(2), 27.50(c)	ERP and EIRP	Pass
Note 1: No applicable performance criteria.		

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	2020-03-01
2	Trilog super broadBand test antenna	VULB 9163	9163-544	R&S	2019-11-24
3	Double-Ridged Horn Antenna	HF907	100357	R&S	2021-06-20
4	Fully-Anechoic Chamber	11.8m×6.5m×6.3m	--	ETS	2019-10-23
5	Signal Generator	SMU200A	104517	R&S	2020-03-01
6	spectrum analyzer	FSQ 26		R&S	2020-03-01
7	spectrum analyzer	N9020A	MY50200376	Agilent	2020-03-01
8	Universal Radio Communication Tester	CMU200	112012	R&S	2020-03-01
9	Climate chamber	SH-241	92010759	ESPEC	2020-03-01
10	DC Power Supply	N6705B	MY50000919	Agilent	2019-12-05
11	Universal Radio Communication Tester	CMW500	152395	R&S	2020-03-01
12	Universal Radio Communication Tester	SP8315	SP8315-1249	StarPoint	2020-03-01

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℃-35℃ 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.

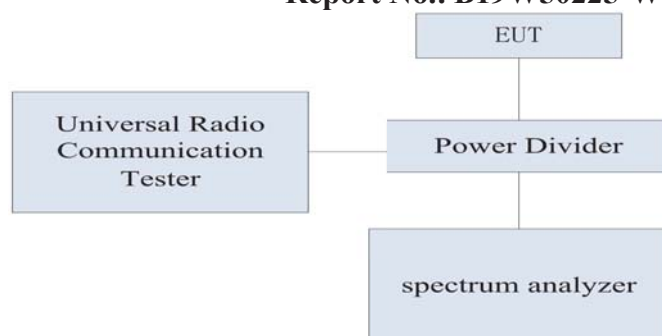
According to Part 90.635(b),the maximum output power of the transmitter for mobile stations is 100 watts (20 dBw);

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.



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: Only worst case result is given below.

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)	33.2	33.4	29.7	27.5
190 (836.6MHz)	33.2	33.2	29.7	27.6
251 (848.8MHz)	32.9	33.0	29.6	27.4

EGPRS GMSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	33.5	33.4	29.7	27.5
190 (836.6MHz)	33.3	33.4	29.8	27.5
251 (848.8MHz)	33.3	33.2	29.7	27.4

EGPRS 8PSK Mode

Channel	Maximum output power(pk) [dBm]
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	1TS	2TS	3TS	4TS
128 (824.2MHz)	27.8	27.9	27.9	27.5
190 (836.6MHz)	27.7	27.8	27.7	27.4
251 (848.8MHz)	27.5	27.6	27.5	27.3

GPRS GMSK Mode:

Channel No.	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	33.1	33.4	29.6	27.5
190 (836.6MHz)	33.2	33.1	29.7	27.5
251 (848.8MHz)	32.8	33.0	29.6	27.4

EGPRS GMSK Mode

Channel No.	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	33.3	33.2	29.6	27.4
190 (836.6MHz)	33.2	33.3	29.6	27.4
251 (848.8MHz)	33.2	33.2	29.5	27.3

EGPRS 8PSK Mode

Channel No.	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
128 (824.2MHz)	27.6	27.7	27.7	27.4
190 (836.6MHz)	27.6	27.6	27.7	27.4
251 (848.8MHz)	27.5	27.5	27.4	27.2

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)	29.7	29.7	29.5	28.8

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661 (1880.0MHz)	29.9	29.9	29.7	28.9
810 (1909.8MHz)	29.6	29.5	29.5	28.6

EGPRS GMSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	29.8	29.6	29.6	28.7
661 (1880.0MHz)	29.9	29.7	29.7	28.8
810 (1909.8MHz)	29.6	29.4	29.7	28.6

EGPRS 8PSK Mode

Channel	Maximum output power(pk) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	26.2	26.3	26.3	26.1
661 (1880.0MHz)	26.3	26.3	26.3	26.2
810 (1909.8MHz)	26.3	26.2	26.2	26.1

GPRS GMSK Mode

Channel	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	29.7	29.6	29.5	28.7
661 (1880.0MHz)	29.8	29.8	29.5	28.8
810 (1909.8MHz)	29.5	29.5	29.4	28.5

EGPRS GMSK Mode

Channel	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	29.7	29.4	29.5	28.7
661 (1880.0MHz)	29.8	29.5	29.6	28.7
810 (1909.8MHz)	29.6	29.3	29.6	28.6

EGPRS 8PSK Mode

Address: No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX: 0086-23-88608777

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Channel	Maximum output power(avg) [dBm]			
	1TS	2TS	3TS	4TS
512 (1850.2MHz)	26.1	26.2	26.2	26.0
661 (1880.0MHz)	26.2	26.2	26.2	26.1
810 (1909.8MHz)	26.1	26.1	26.1	26.1

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	Average	21.92	21.65	21.66
			Peak	24.13	23.99	24.14
		1@47	Average	21.89	21.63	21.63
			Peak	24.10	23.98	24.15
	QPSK	1@0	Average	21.87	21.60	21.66
			Peak	23.58	23.38	23.86
		1@47	Average	21.87	21.59	21.58
			Peak	23.73	23.49	23.68
15	BPSK	1@0	Average	22.11	21.94	21.81
			Peak	23.92	23.84	23.85
		1@11	Average	22.04	21.88	21.76
			Peak	23.85	23.78	23.83
	QPSK	1@0	Average	22.09	21.92	21.76
			Peak	23.91	23.82	23.84
		1@11	Average	22.06	21.92	21.77
			Peak	23.62	23.54	23.78
		12@0	Average	20.73	20.57	20.69
			Peak	27.25	27.38	27.56

5.1.4 NB-IoT Band4 Conducted RF Power Output Results

NB-IoT Band 4

Maximum Average Conducted Power (dBm)			
Sub-carrier	Modulation	N _{tones}	Channel

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Spacing [kHz]				Low	Mid	High
3.75	BPSK	1@0	Average	21.41	21.34	21.40
			Peak	23.50	23.43	23.49
		1@47	Average	21.43	21.33	21.41
			Peak	23.53	23.43	23.54
	QPSK	1@0	Average	21.44	21.38	21.41
			Peak	23.27	23.18	23.10
		1@47	Average	21.44	21.37	21.44
			Peak	23.14	23.13	23.11
15	BPSK	1@0	Average	21.66	21.44	21.52
			Peak	23.36	23.05	23.27
		1@11	Average	21.57	21.47	21.48
			Peak	23.27	23.18	22.96
	QPSK	1@0	Average	21.64	21.55	21.54
			Peak	23.36	23.30	23.27
		1@11	Average	21.61	21.49	21.46
			Peak	23.08	22.94	23.18
		12@0	Average	20.82	20.77	20.53
			Peak	26.40	26.44	26.38

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	Average	22.44	22.36	22.26
			Peak	24.37	24.28	24.19
		1@47	Average	22.47	22.34	22.25
			Peak	24.37	24.26	24.18

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	QPSK	1@0	Average	22.19	22.14	22.26
			Peak	23.81	23.73	23.93
		1@47	Average	22.45	22.31	22.25
			Peak	24.02	23.84	23.79
15	BPSK	1@0	Average	20.79	20.52	20.63
			Peak	22.69	22.06	22.12
		1@11	Average	21.13	20.53	20.61
			Peak	22.64	22.06	22.12
	QPSK	1@0	Average	20.67	20.70	20.69
			Peak	22.40	22.31	22.30
		1@11	Average	21.19	20.60	20.67
			Peak	22.74	22.07	22.12
		12@0	Average	21.09	21.12	21.19
			Peak	27.93	27.62	27.47

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	Average	22.35	21.46	21.45
			Peak	24.72	23.25	23.33
		1@47	Average	21.32	21.42	21.42
			Peak	23.21	23.25	23.27
	QPSK	1@0	Average	21.30	21.36	21.33
			Peak	22.80	22.96	22.95
		1@47	Average	21.30	21.42	21.46
			Peak	22.84	22.98	23.05
15	BPSK	1@0	Average	20.50	20.61	20.53

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		1@11	Peak	21.93	22.05	21.99
			Average	20.41	20.43	20.35
			Peak	21.84	21.84	21.80
	QPSK	1@0	Average	20.42	20.50	20.48
			Peak	21.96	22.01	22.01
		1@11	Average	20.45	20.48	20.45
			Peak	21.72	21.78	21.70
		12@0	Average	20.85	20.83	20.80
			Peak	26.87	26.82	26.78

5.1.7 NB-IoT Band 26 Conducted RF Power Output Results

NB-IoT Band 26

Maximum Average Conducted Power (dBm)						
Sub-carrier Spacing [kHz]	Modulation	N _{tones}		Channel		
				Low	Mid	High
3.75	BPSK	1@0	Average	23.08	22.93	22.92
			Peak	24.92	24.90	25.01
		1@47	Average	23.09	22.89	22.88
			Peak	24.92	24.84	24.94
	QPSK	1@0	Average	23.13	22.89	22.87
			Peak	24.71	24.59	24.65
		1@47	Average	23.14	22.92	22.87
			Peak	24.69	24.56	24.58
15	BPSK	1@0	Average	22.18	21.98	21.97
			Peak	23.55	23.51	23.58
		1@11	Average	22.20	21.96	21.90
			Peak	23.64	23.42	23.44
	QPSK	1@0	Average	22.26	22.03	22.01
			Peak	23.72	23.58	23.60

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		1@11	Average	22.23	22.01	21.97
			Peak	23.49	23.33	23.32
		12@0	Average	21.58	21.43	21.38
			Peak	27.07	27.15	27.38

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	22.66	21.67
			6#0	0	20.83	20.89
		18900	1#0	0	22.61	21.63
			6#0	0	20.57	20.97
		19195	1#5	0	22.59	21.59
			6#0	0	20.72	20.64
	3MHz	18615	1#0	0	22.85	21.52
			6#0	0	20.69	20.91
		18900	1#0	0	22.73	21.66
			6#0	0	20.69	20.83
		19185	1#5	1	22.72	21.62
			6#0	1	20.55	20.94
	5MHz	18620	1#0	0	22.83	22.76
			6#0	0	21.58	21.11
		18900	1#0	0	22.66	22.45
			6#0	0	21.73	20.89

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		19180	1#5	3	22.76	22.63
			6#0	3	21.62	21.05
	10MHz	18640	1#0	0	22.54	22.60
			4#0	0	21.63	21.11
		18900	1#0	0	22.79	22.59
			4#0	0	21.77	20.94
		19160	1#5	7	22.81	22.72
			4#2	7	21.60	20.87
	15MHz	18660	1#0	0	22.72	22.63
			6#0	0	22.61	23.10
		18900	1#0	0	22.72	22.63
			6#0	0	22.61	23.10
		19140	1#5	0	22.89	22.94
			6#0	0	22.77	22.89
	20MHz	18680	1#0	0	21.98	21.78
			6#0	0	21.12	20.94
		18900	1#0	0	22.26	22.16
			6#0	0	21.65	20.81
		19120	1#5	0	22.51	22.17
			6#0	0	21.12	20.89

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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	22.52	21.61
			6#0	0	20.52	20.46
		20175	1#0	0	22.38	21.59
			6#0	0	20.65	20.54
		20393	1#5	0	22.38	21.60
			6#0	0	20.57	20.49
	3MHz	19965	1#0	0	22.42	21.65
			6#0	0	20.49	20.62
		20175	1#0	0	22.24	21.82
			6#0	0	20.63	20.75
		20385	1#5	1	22.13	21.81
			6#0	1	20.59	20.65
	5MHz	19975	1#0	0	21.95	21.58
			6#0	0	20.94	20.50
		20175	1#0	0	21.73	22.21
			6#0	0	20.96	20.51
		20375	1#5	3	21.93	21.89
			6#0	3	21.02	20.81
	10MHz	20000	1#0	0	22.27	22.39

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			4#0	0	22.21	21.38
		20175	1#0	0	22.20	22.36
			4#0	0	22.17	22.32
		20350	1#5	7	21.63	21.62
			4#2	7	21.82	20.87
	15MHz	20025	1#0	0	21.91	21.79
			6#0	0	22.04	22.12
		20175	1#0	0	21.84	22.24
			6#0	0	22.13	22.49
		20325	1#5	0	21.76	21.48
			6#0	0	21.96	22.27
	20MHz	20050	1#0	0	22.15	22.05
			6#0	0	21.97	22.00
		20175	1#0	0	21.98	22.29
			6#0	0	21.90	21.86
		20300	1#5	0	21.59	21.57
			6#0	0	21.86	21.96

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	22.67	22.11
			6#0	0	20.72	20.69

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		23095	1#0	0	22.74	22.09
			6#0	0	20.96	20.81
		23175	1#5	0	22.83	21.62
			6#0	0	21.16	20.91
	3MHz	20320	1#0	0	22.93	22.08
			6#0	0	21.07	20.93
		23095	1#0	0	22.78	22.02
			6#0	0	20.99	20.85
		23170	1#5	1	22.79	21.53
			6#0	1	20.90	21.08
	5MHz	20330	1#0	0	22.74	22.56
			6#0	0	21.89	21.37
		23095	1#0	0	22.82	22.64
			6#0	0	21.86	21.16
		23160	1#5	3	22.70	23.40
			6#0	3	21.88	20.87
	10MHz	20345	1#0	0	22.80	23.22
			4#0	0	22.79	21.72
		23095	1#0	0	21.61	23.40
			4#0	0	22.68	21.59
		23145	1#5	7	22.73	23.62

			4#2	7	22.69	21.63
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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	22.84	22.96
			6#0	0	21.97	20.85
		23230	1#0	0	22.87	22.91
			6#0	3	21.89	20.78
		23254	1#5	3	22.58	23.15
			6#0	3	21.93	21.03
	10MHz	23225	1#0	0	22.87	22.75
			6#0	0	22.72	21.98
		23230	1#0	0	22.65	23.18
			6#0	0	22.72	21.81
		23235	1#5	7	22.75	23.21
			4#2	7	22.80	21.68

5.1.12 CAT-M B26 Conducted RF Power Output Results

Mode	Bandwidth	Channel	RB	Index	Conducted Power	
					QPSK	16QAM
Band26	1.4MHz	26697	1#0	0	23.11	23.06
			6#0	0	22.52	21.87
		26865	1#0	0	23.14	23.29

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			6#0	0	22.71	21.72
		27033	1#5	0	22.98	23.02
			6#0	0	22.61	21.55
	3MHz	26705	1#0	0	23.19	23.02
			6#0	0	22.54	21.40
		26865	1#0	0	23.21	23.42
			6#0	0	22.75	21.66
		27025	1#5	1	23.09	23.41
			6#0	1	22.33	21.54
	5MHz	26715	1#0	0	23.21	23.13
			6#0	0	22.33	21.53
		26865	1#0	0	23.30	23.67
			6#0	0	22.61	21.45
		27015	1#5	3	23.69	23.79
			6#0	3	22.49	21.40
	10MHz	26740	1#0	0	23.26	23.21
			4#0	0	23.48	22.38
		26865	1#0	0	23.33	23.73
			4#0	0	23.58	22.67
		26990	1#5	7	23.42	23.75
			4#2	7	23.57	22.63

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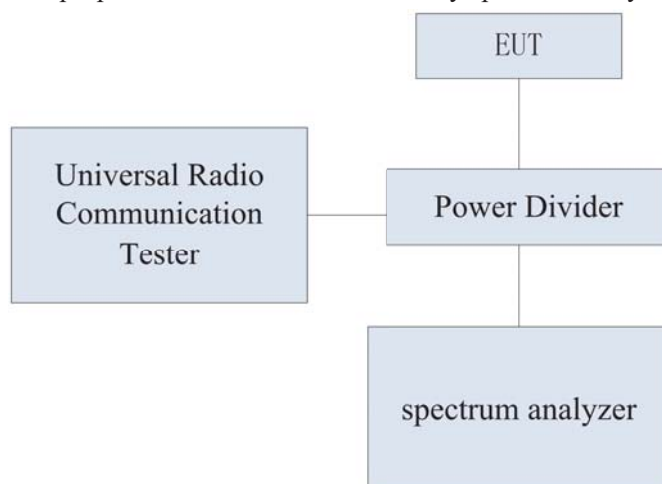
	15MHz	26765	1#0	0	23.04	23.10
			6#0	0	23.20	23.23
		26865	1#0	0	23.16	23.52
			6#0	0	23.26	23.46
		26965	1#5	0	23.21	23.70
			6#0	0	23.33	23.66

5.2 Occupied Bandwidth

Specifications:	FCC Part 2.1049, 22.917(b), 24.238(b)
DUT Serial Number:	353081090297923
Test conditions:	Ambient Temperature:15°C-35°C 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 99% 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.

5.2.1 GSM Mode Occupied Bandwidth Results

Band	Channel	Mode	Occupied Bandwidth 99% (kHz)	Occupied Bandwidth 26dB (kHz)
GSM850	128	GMSK	244.6	315.7
		8PSK	238.8	283.6
	190	GMSK	241.7	320.5
		8PSK	238.8	296.5
	251	GMSK	243.1	310.9
		8PSK	238.8	291.7
PCS1900	512	GMSK	243.1	314.1
		8PSK	243.1	306.1
	661	GMSK	246.0	315.7
		8PSK	243.1	312.5
	810	GMSK	243.1	307.7
		8PSK	244.6	317.3

5.2.2 NB-IoT B2 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	N _{tones}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth(26dB) (kHz)	
				QPSK	BPSK	QPSK	BPSK
Low Range	18601	12@0	15	211.5	244.3	277.1	342.7
Mid Range	18900			211.3	239.4	299.9	336.5
High Range	19199			215.0	245.3	291.0	341.8

5.2.3 NB-IoT B4 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	N _{tones}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth(26dB) (kHz)	
				QPSK	BPSK	QPSK	BPSK
Low Range	19951	12@0	15	208.2	232.6	280.6	336.1
Mid Range	20175			215.5	236.8	306.6	355.3
High Range	20399			208.1	238.8	292.5	334.8

5.2.4 NB-IoT B12 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	N _{tones}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth(26dB) (kHz)	
				QPSK	BPSK	QPSK	BPSK
Low Range	23011	12@0	15	204.75	191.79	272.6	240.0
Mid Range	23095			189.29	185.35	253.4	257.6
High Range	23179			187.42	187.40	253.1	240.9

5.2.5 NB-IoT B13 Mode Occupied Bandwidth Results

Frequency ID	N _{UL}	N _{tones}	Sub-carrier Spacing [kHz]	Occupied Bandwidth (99%) (kHz)		Occupied Bandwidth(26dB) (kHz)	
				QPSK	BPSK	QPSK	BPSK
Low Range	23181	12@0	15	184.03	193.54	236.4	246.5
Mid Range	23230			195.66	194.9	247.8	250.8
High Range	23279			195.13	193.06	257.2	231.7

5.2.6 NB-IoT B26 Mode Occupied Bandwidth Results

(814 MHz ~824MHz)

Mode	Channel/Ferquency (MHz)	Occupied Bandwidth 99% (kHz)	Occupied Bandwidth 26dB (kHz)
BPSK	26691/814.1	186.3	259.0
QPSK	26691/814.1	186.9	243.9

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BPSK	26740/819.0	188.85	256.6
QPSK	26740/819.0	188.42	250.4
BPSK	26789/823.9	182.16	250.4
QPSK	26789/823.9	189.14	246.7

(824 MHz ~849MHz)

Mode	Channel/Ferquency (MHz)	Occupied Bandwidth 99% (kHz)	Occupied Bandwidth 26dB (kHz)
BPSK	26791/824.1	187.26	245.0
QPSK	26791/824.1	201.63	271.8
BPSK	26915/836.5	189.81	251.0
QPSK	26915/836.5	182.89	250.0
BPSK	27039/848.9	187.17	254.9
QPSK	27039/848.9	190.30	264.3

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	1.11	1.78
	16QAM	18900/1880			1.13	1.41
3MHz	QPSK	18900/1880	6#0	0	1.15	1.80
	16QAM	18900/1880			1.13	1.83
5MHz	QPSK	18900/1880	6#0	0	1.33	4.41

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	16QAM	18900/1880			1.21	1.84
10MHz	QPSK	18900/1880	6#0	0	1.15	1.78
	16QAM	18900/1880			1.15	1.78
15MHz	QPSK	18900/1880	6#0	0	1.25	2.23
	16QAM	18900/1880			1.36	2.36
20MHz	QPSK	18900/1880	6#0	0	1.22	1.70
	16QAM	18900/1880			1.22	1.86

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	1.10	1.40
	16QAM	20175/1732.5			1.11	1.38
3MHz	QPSK	20175/1732.5	6#0	0	1.14	1.84
	16QAM	20175/1732.5			1.13	1.77
5MHz	QPSK	20175/1732.5	6#0	0	1.17	1.81
	16QAM	20175/1732.5			1.13	1.83
10MHz	QPSK	20175/1732.5	6#0	0	1.14	1.83
	16QAM	20175/1732.5			1.14	1.85
15MHz	QPSK	20175/1732.5	6#0	0	1.20	2.08
	16QAM	20175/1732.5			1.21	2.11
20MHz	QPSK	20175/1732.5	6#0	0	1.22	1.83
	16QAM	20175/1732.5			1.22	1.86

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	1.11	1.40
	16QAM	23095/707.5			1.11	1.32
3MHz	QPSK	23095/707.5	6#0	0	1.16	1.72
	16QAM	23095/707.5			1.36	2.38
5MHz	QPSK	23095/707.5	6#0	0	1.21	2.37
	16QAM	23095/707.5			1.19	2.25
10MHz	QPSK	23095/707.5	6#0	0	1.21	2.50
	16QAM	23095/707.5			1.46	2.55

5.2.11 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	2.19
	16QAM	23230/782			1.27	2.38
10MHz	QPSK	23230/782	6#0	0	1.15	2.29
	16QAM	23230/782			1.17	2.24

5.2.12 CAT-M B26 Mode Occupied Bandwidth Results

(814 MHz ~824MHz)

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	26740/819	6#0	0	1.09	1.31

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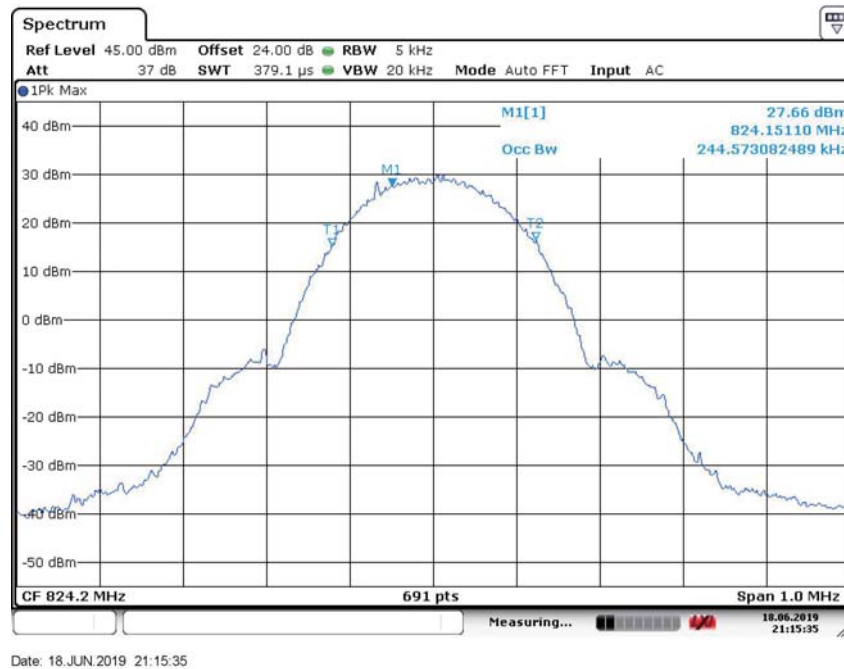
Report No.: B19W50225-WWAN_Rev1

	16QAM	26740/819			1.09	1.31
3MHz	QPSK	26740/819	6#0	0	1.09	1.34
	16QAM	26740/819			1.09	1.33
5MHz	QPSK	26740/819	6#0	0	1.09	1.40
	16QAM	26740/819			1.12	1.43
10MHz	QPSK	26740/819	6#0	0	1.20	1.79
	16QAM	26740/819			1.20	1.69

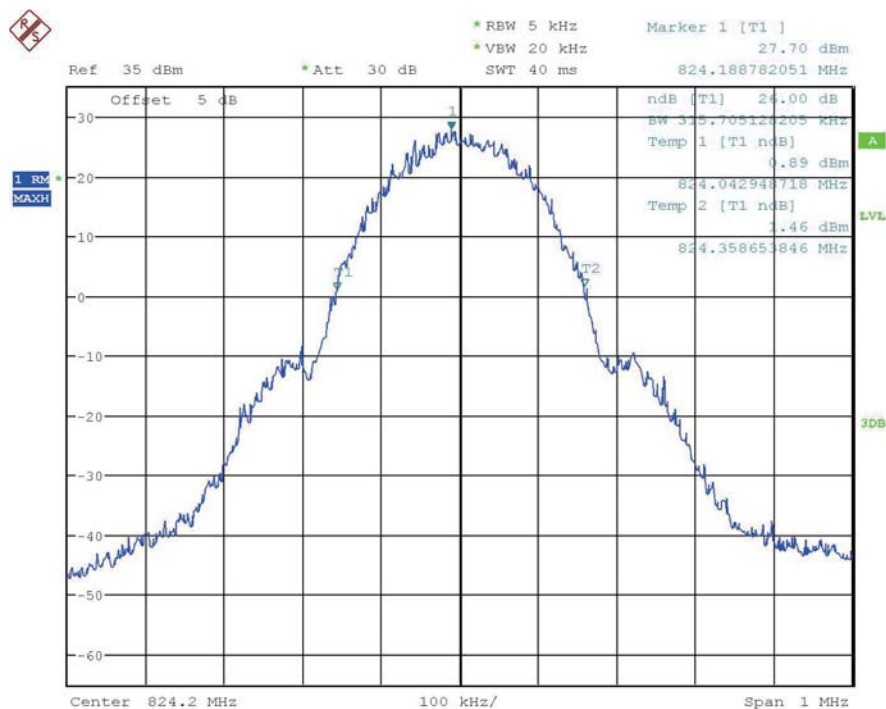
(824 MHz ~849MHz)

Bandwidth	Modulation	Channel/Ferquency (MHz)	RB	Index	Occupied Bandwidth 99% (MHz)	Occupied Bandwidth 26dB (MHz)
1.4MHz	QPSK	26915/836.5	6#0	0	1.09	1.29
	16QAM	26915/836.5			1.11	1.31
3MHz	QPSK	26915/836.5	6#0	0	1.11	1.41
	16QAM	26915/836.5			1.12	1.41
5MHz	QPSK	26915/836.5	6#0	0	1.11	1.33
	16QAM	26915/836.5			1.12	1.41
10MHz	QPSK	26915/836.5	6#0	0	1.18	1.71
	16QAM	26915/836.5			1.18	1.69
15MHz	QPSK	26915/836.5	6#0	0	1.24	2.05
	16QAM	26915/836.5			1.22	1.99

Graphical results for GSM850:

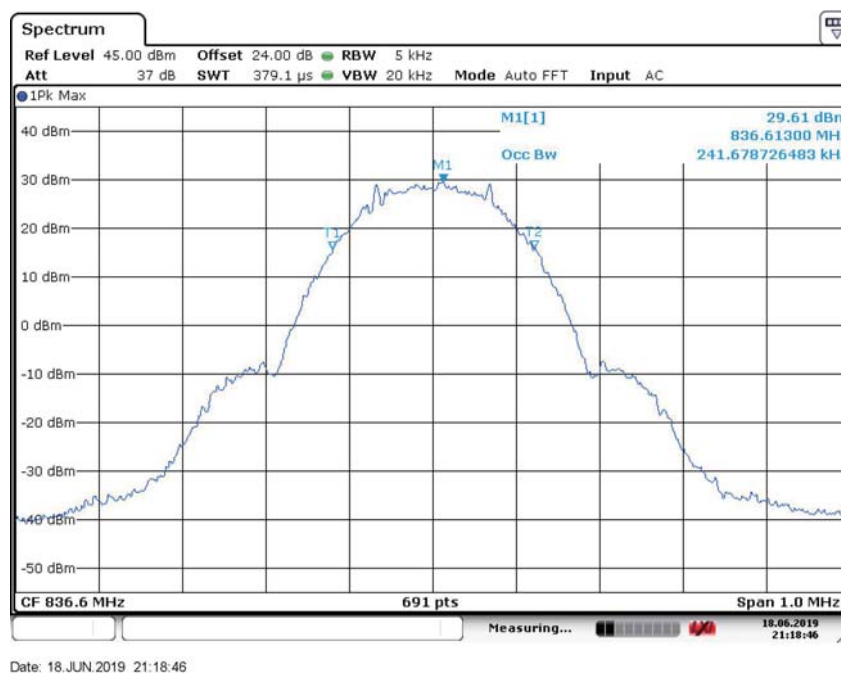


99% OBW-GMSK-Channel 128

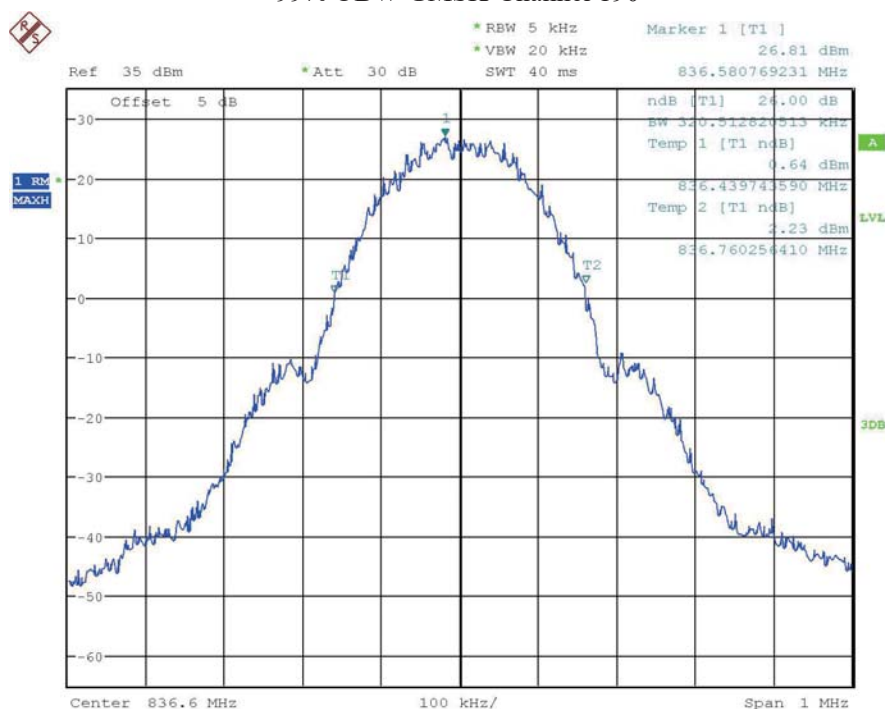


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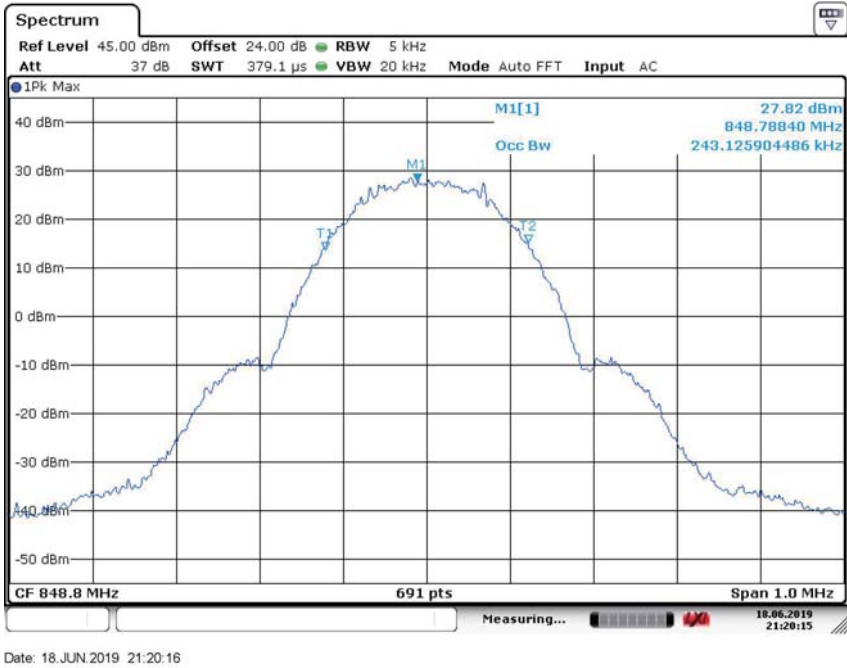
26dB OBW-GMSK-Channel 128



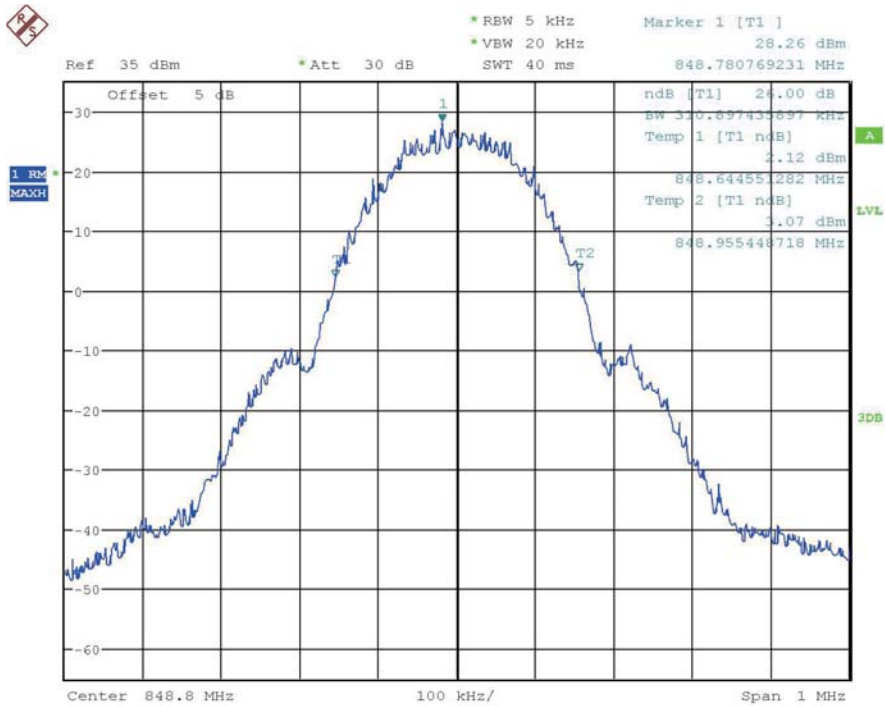
99% OBW-GMSK-Channel 190



26dB OBW-GMSK-Channel-190

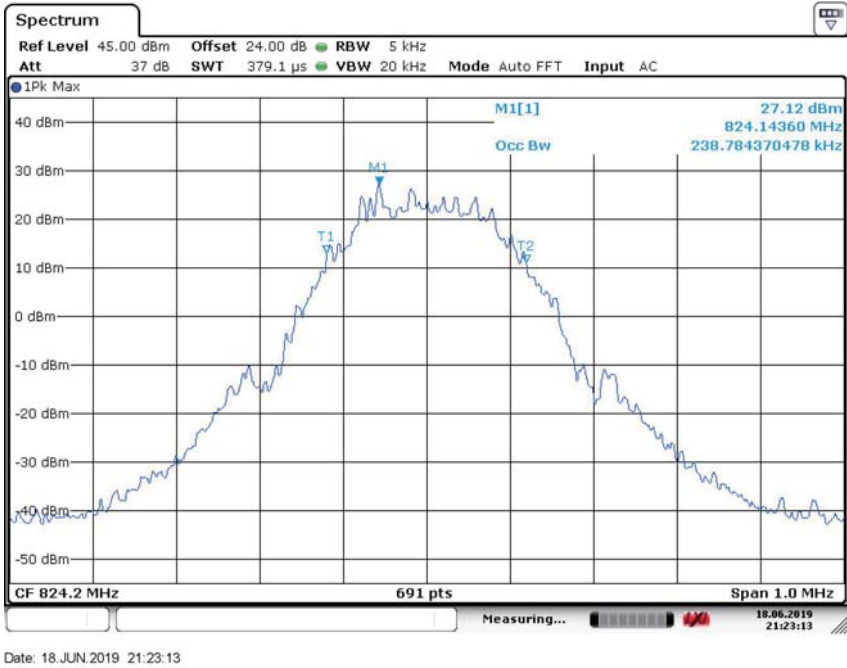


99% OBW-GMSK-Channel 251

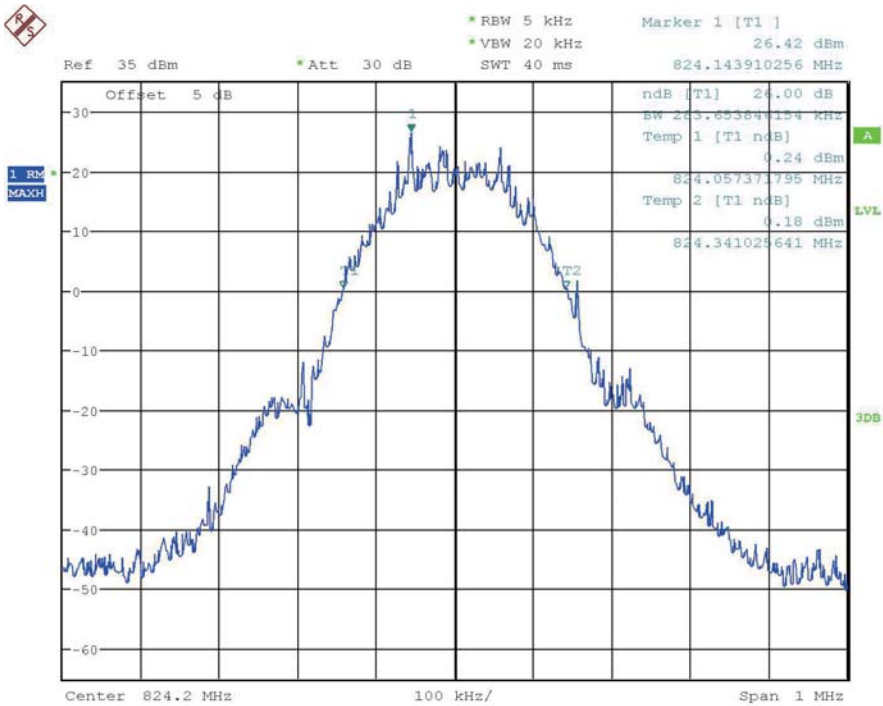


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26dB OBW-GMSK Channel 251

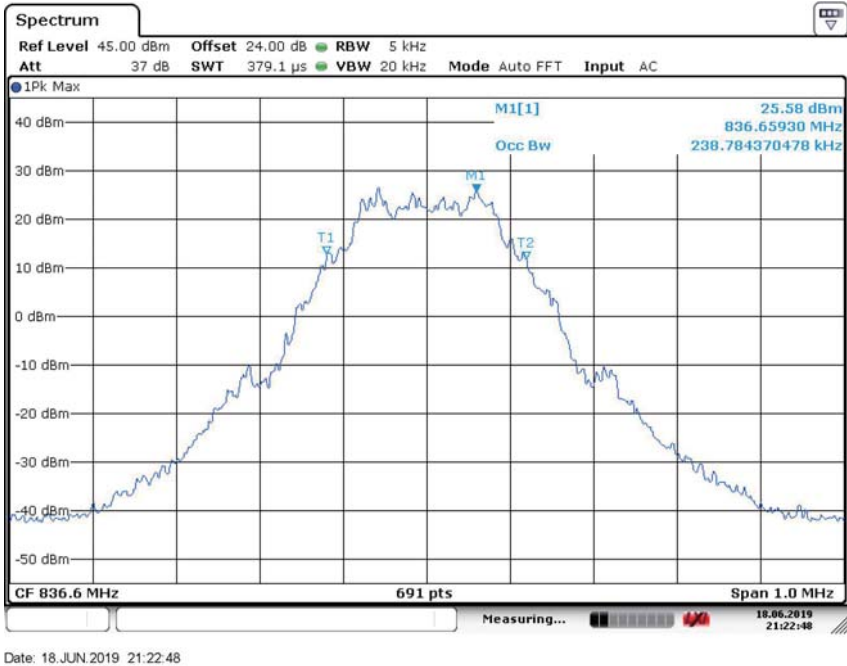


99% OBW-8PSK-Channel 128

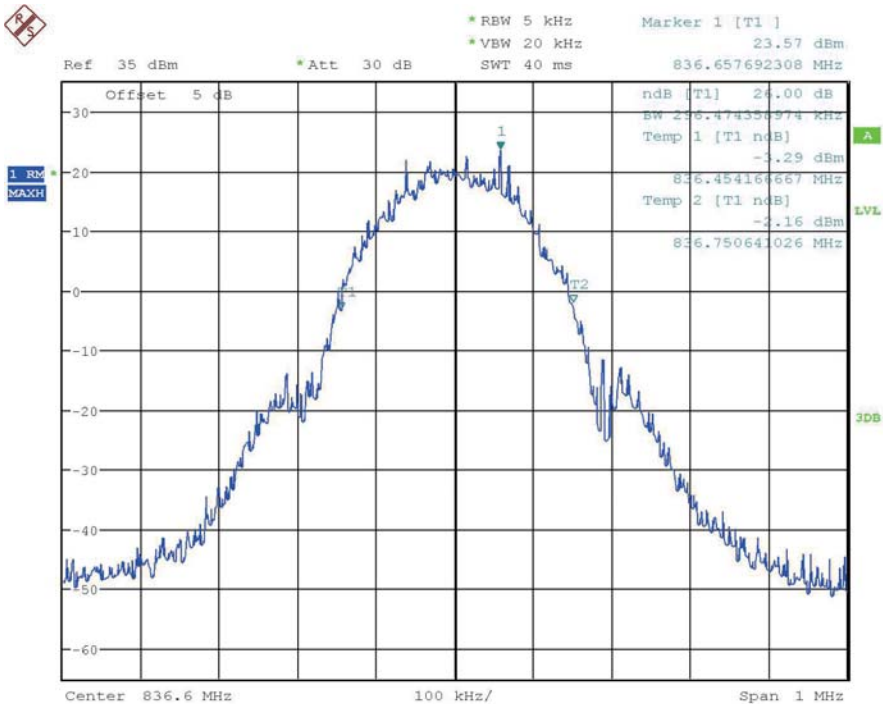


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26dB OBW-8PSK-Channel 128

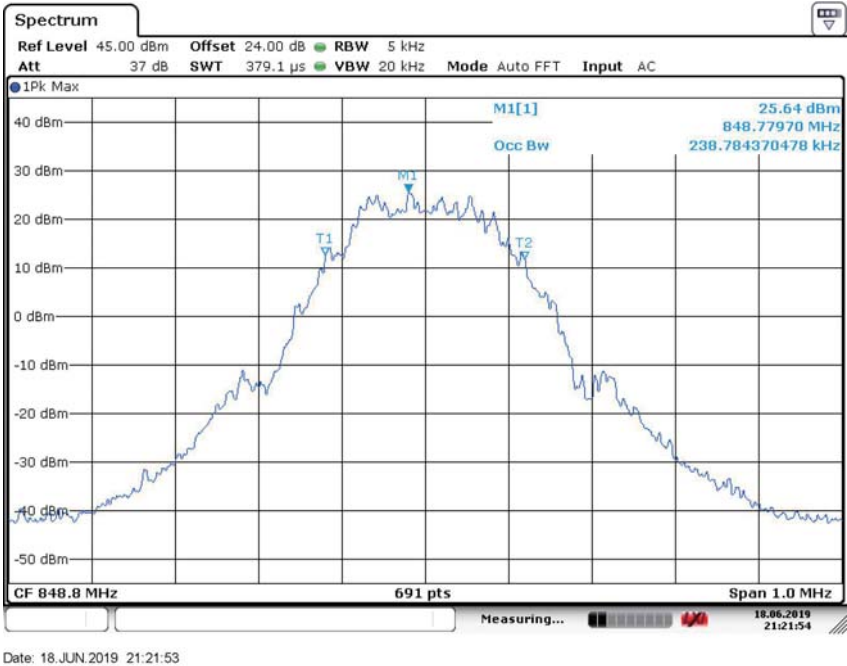


99% OBW-8PSK-Channel 190

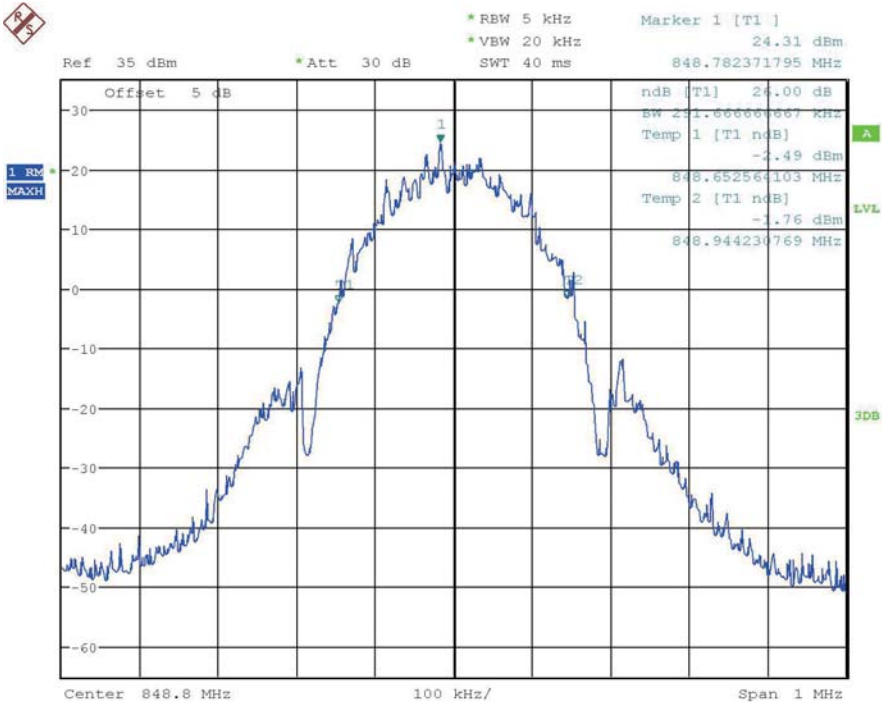


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26dB OBW-8PSK-Channel 190



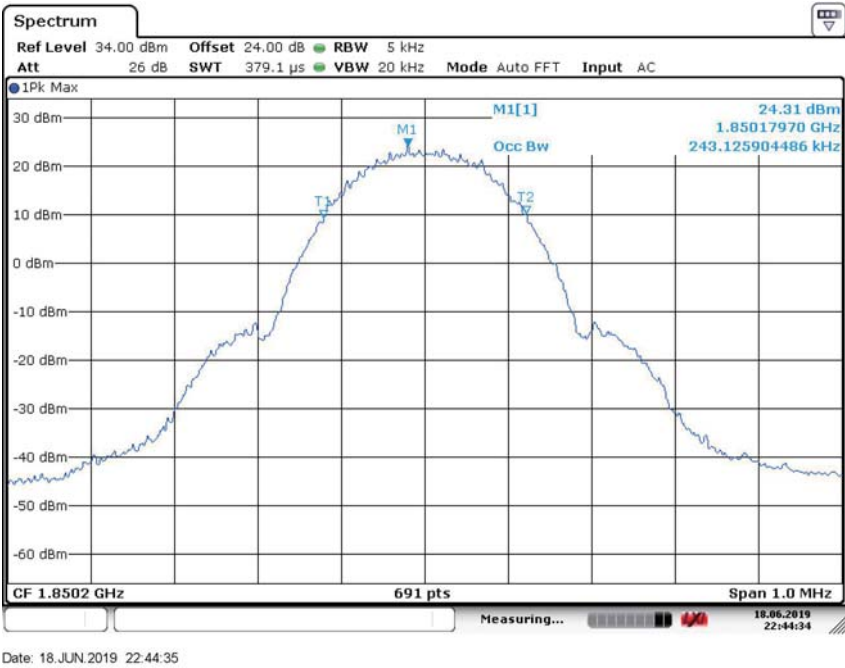
99% OBW-8PSK-Channel 251



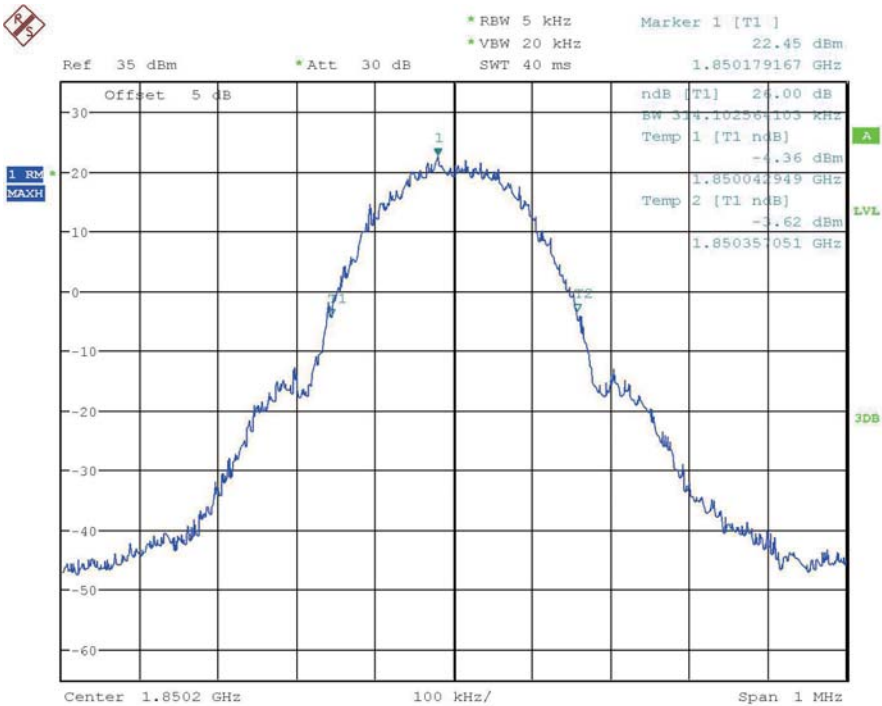
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26dB OBW-8PSK-Channel 251

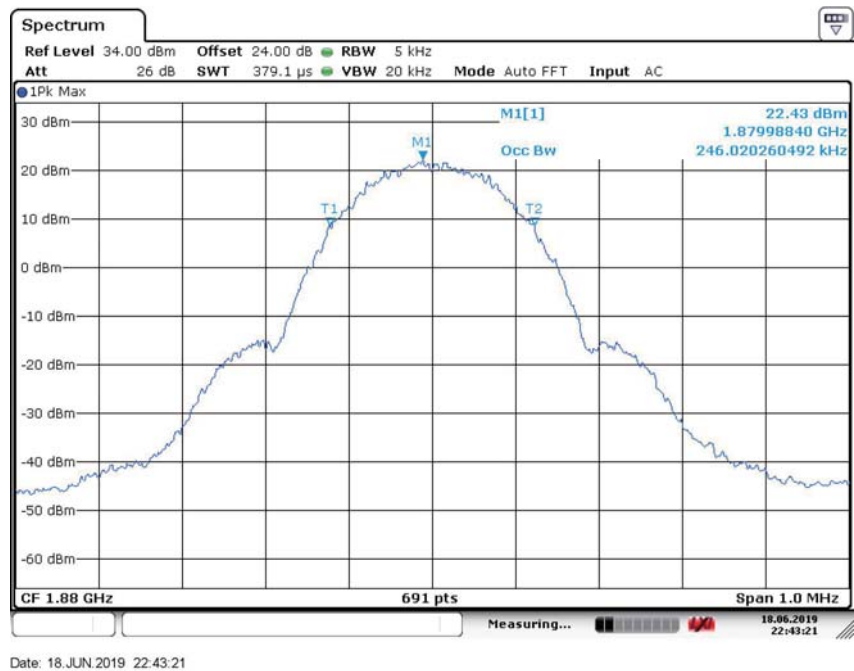
Graphical results for PCS1900:



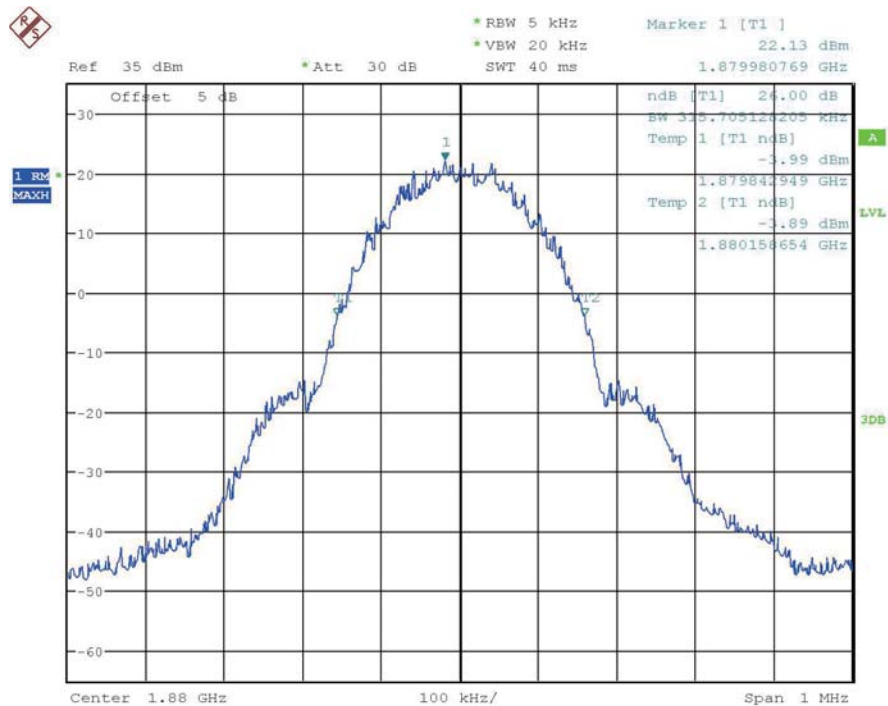
99% OBW-GMSK-Channel 512



26dB OBW-GMSK-Channel 512

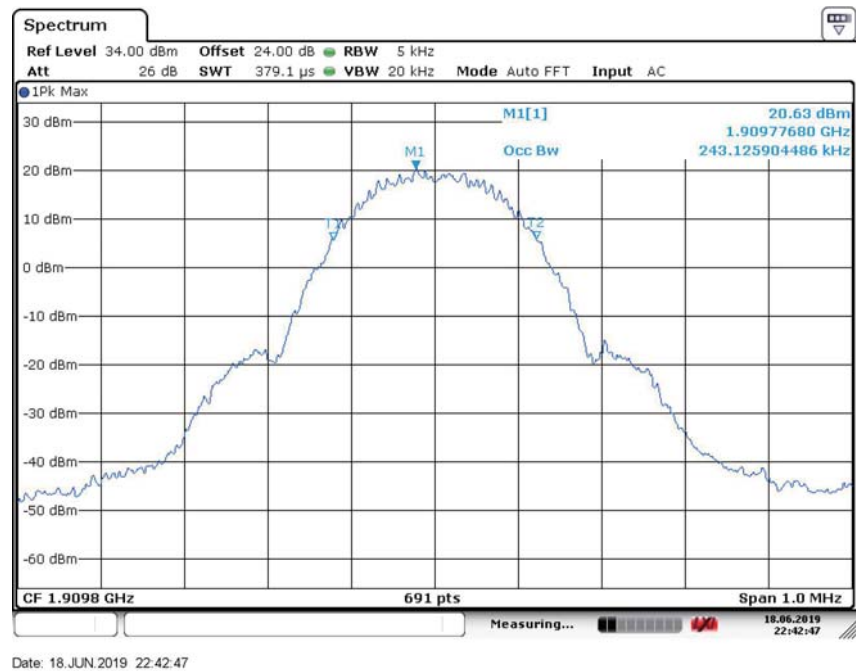


99% OBW-GMSK-Channel 661

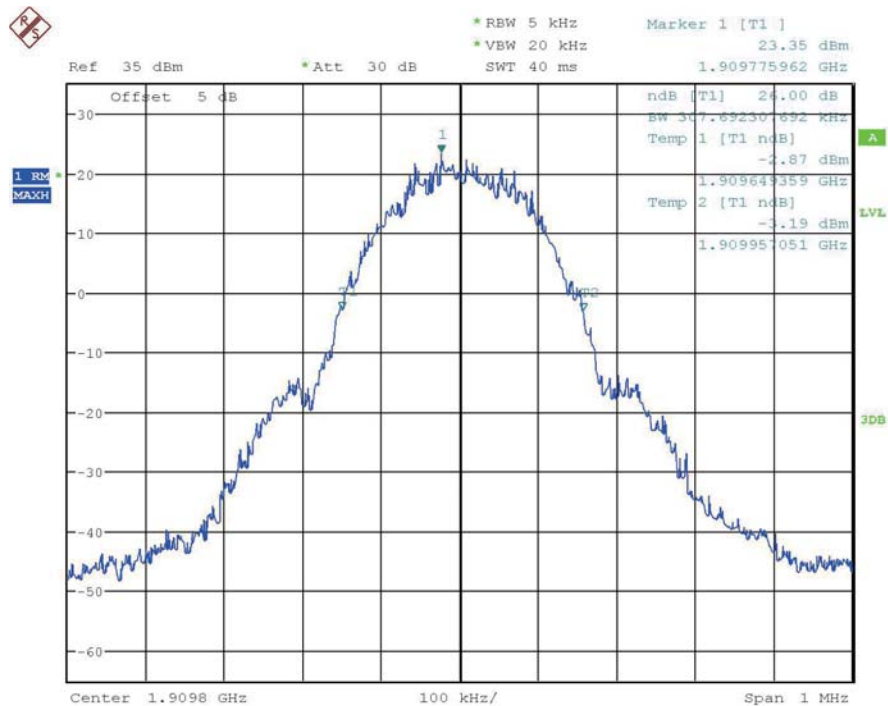


Date: 29.JUL.2019 19:02:03

26dB OBW-GMSK-Channel 661



99% OBW-GMSK-Channel 810

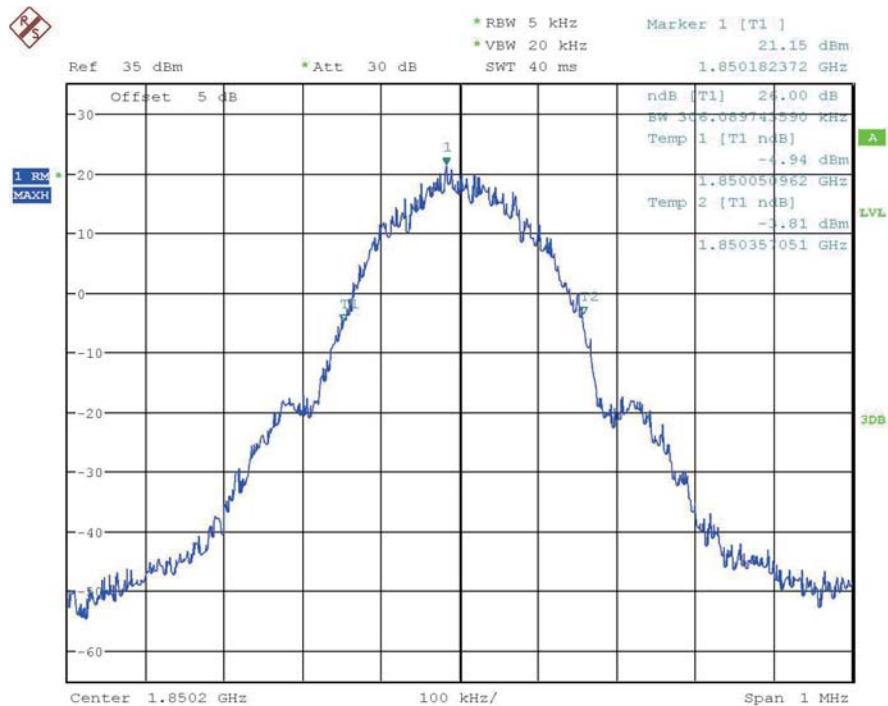


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26dB OBW-GMSK-Channel 810

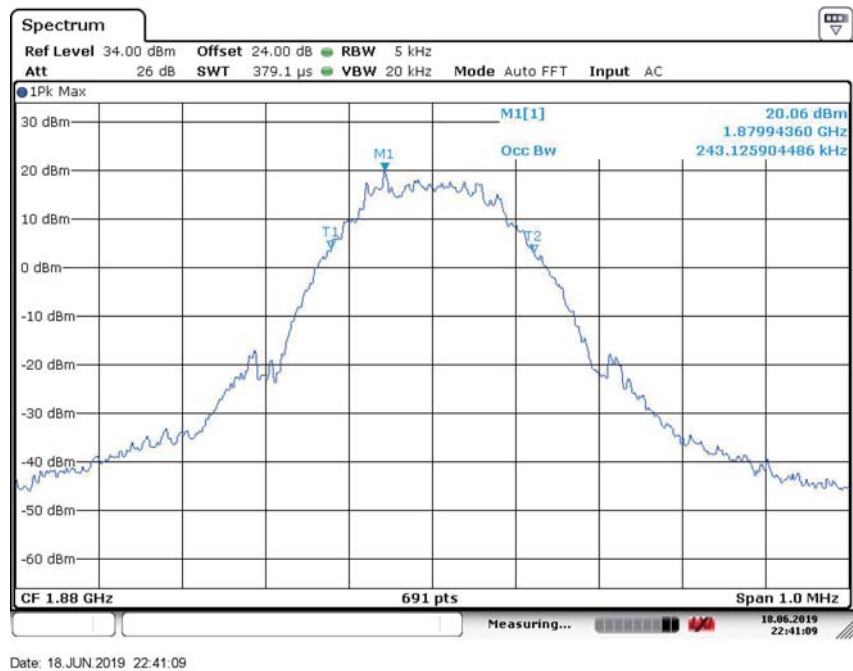


99% OBW-8PSK-Channel 512

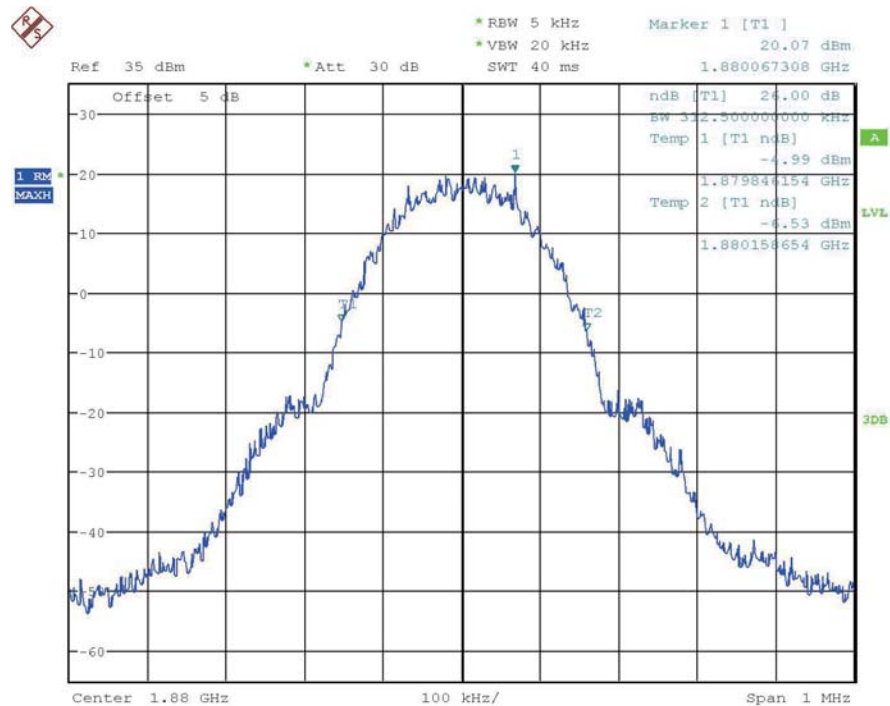


Date: 29.JUL.2019 19:10:21

26dB OBW-8PSK-Channel 512

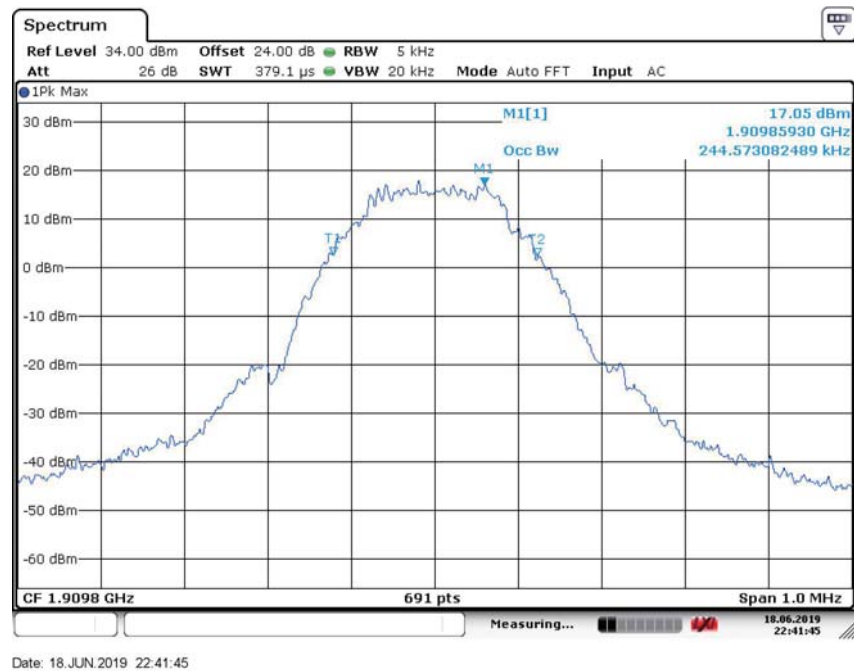


99% OBW-8PSK-Channel 661

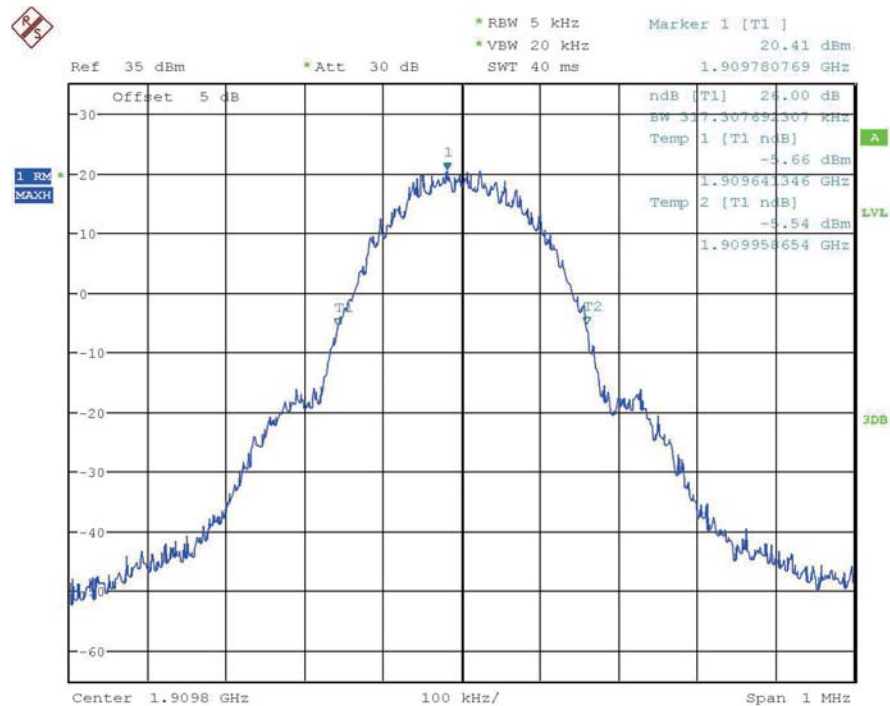


Date: 29.JUL.2019 19:10:03

26dB OBW-8PSK-Channel 661



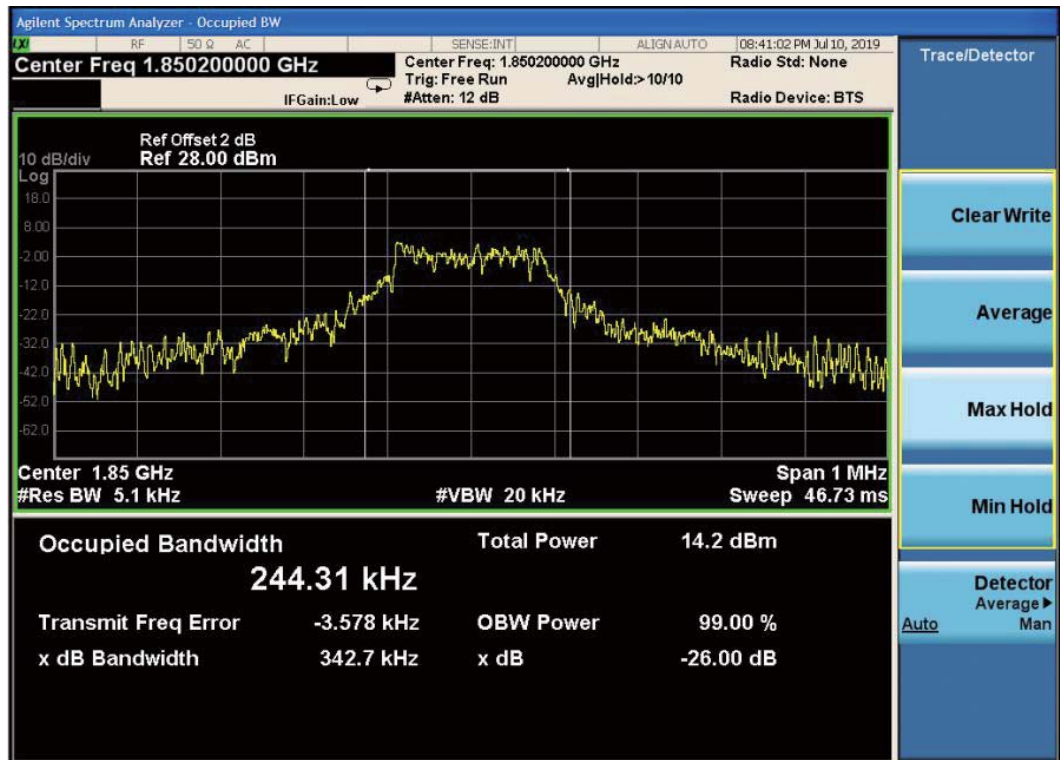
99% OBW-8PSK-Channel 810



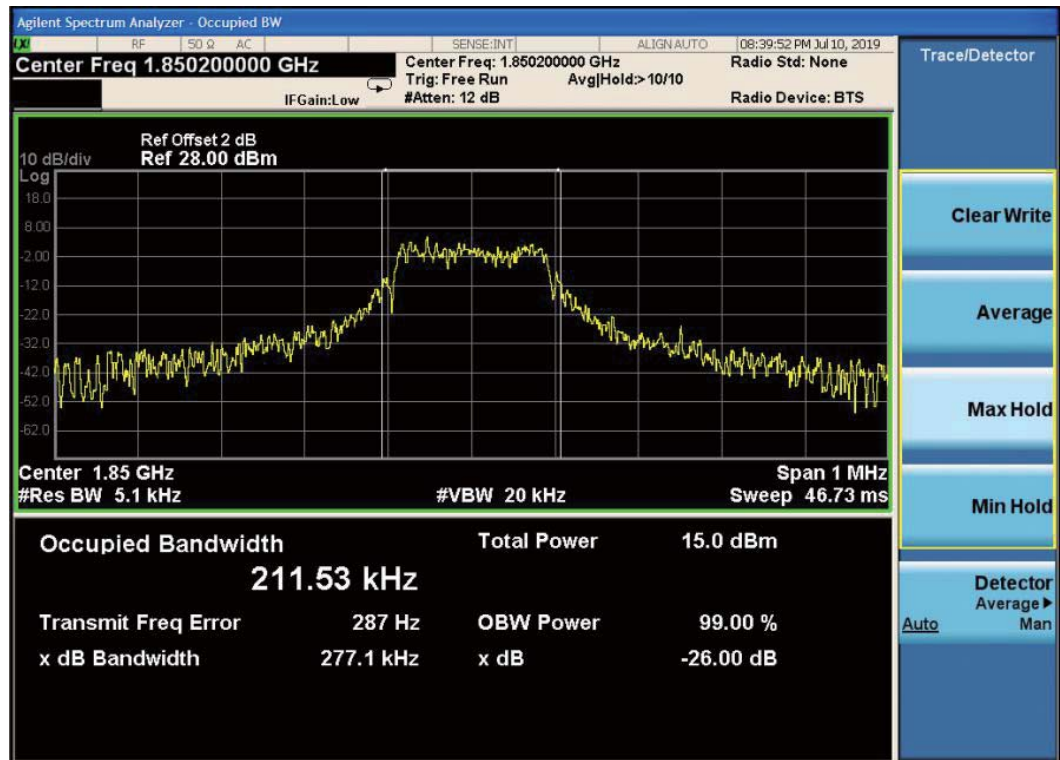
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26dB OBW-8PSK-Channel 810

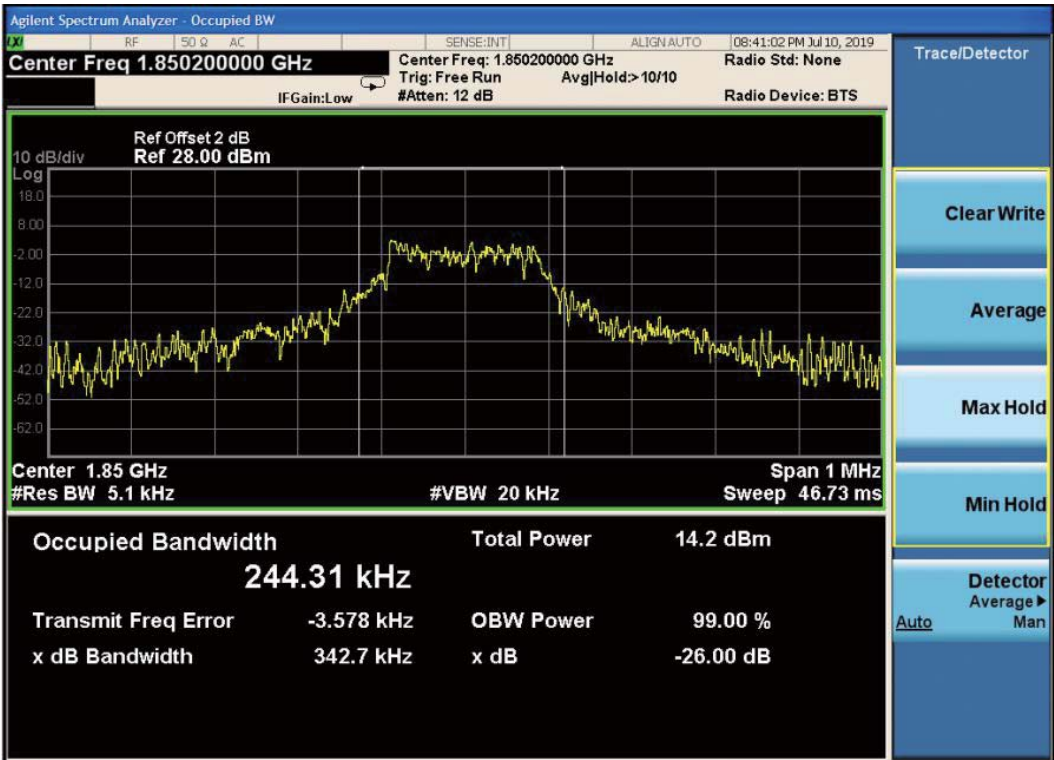
Graphical results for NB-IoT:



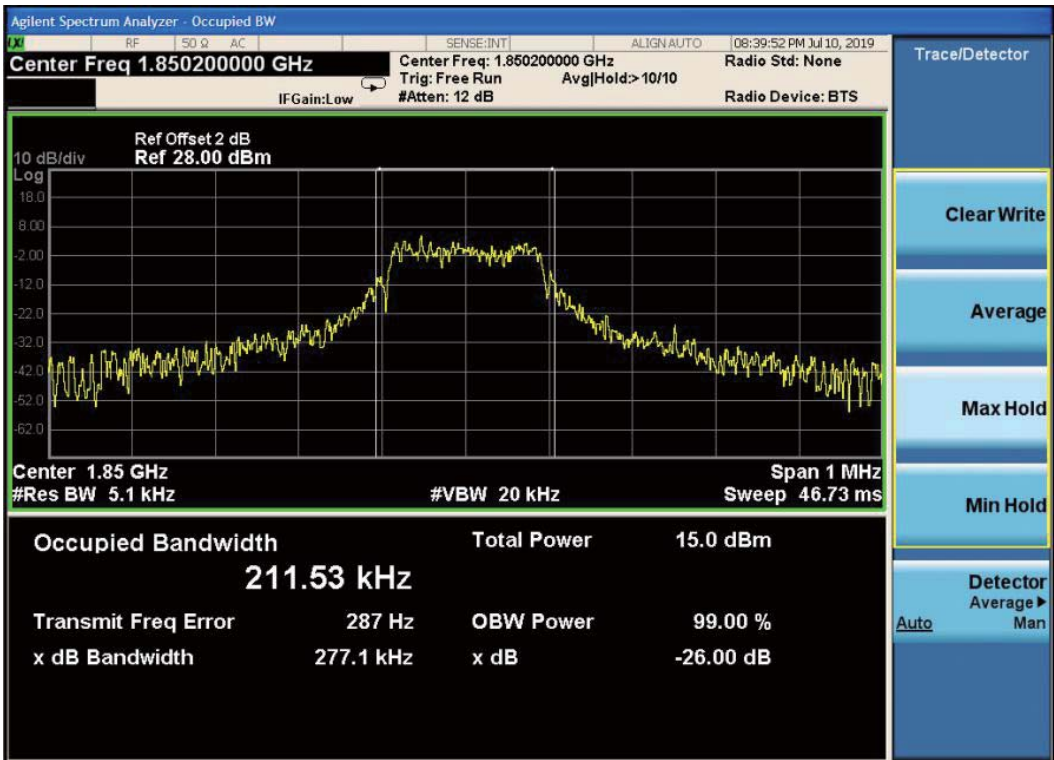
Band2-26dB OBW-18601 Channel-BPSK



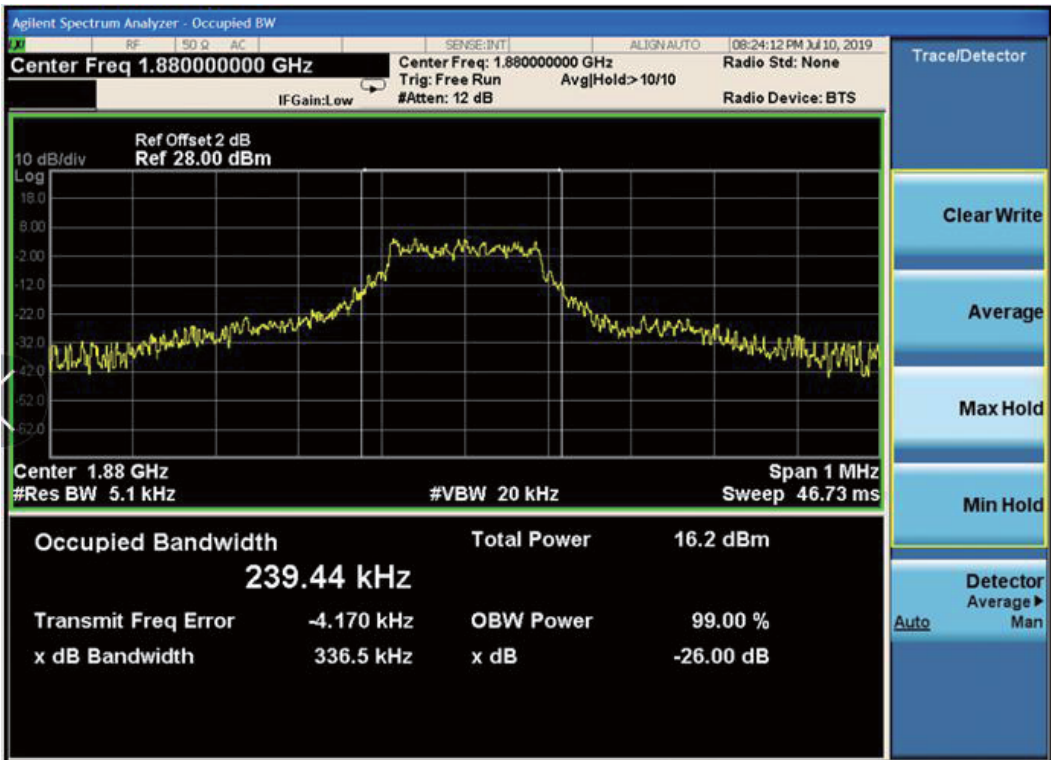
Band2-26dB OBW-18601 Channel-QPSK



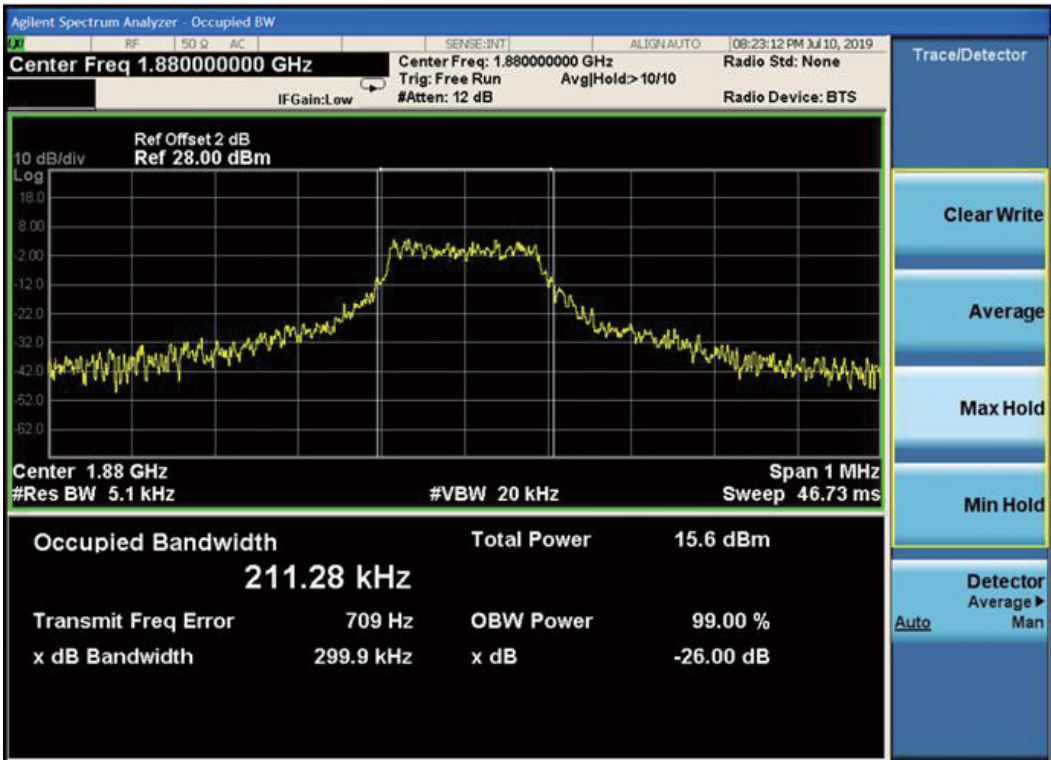
Band2-99% OBW-18601 Channel-BPSK



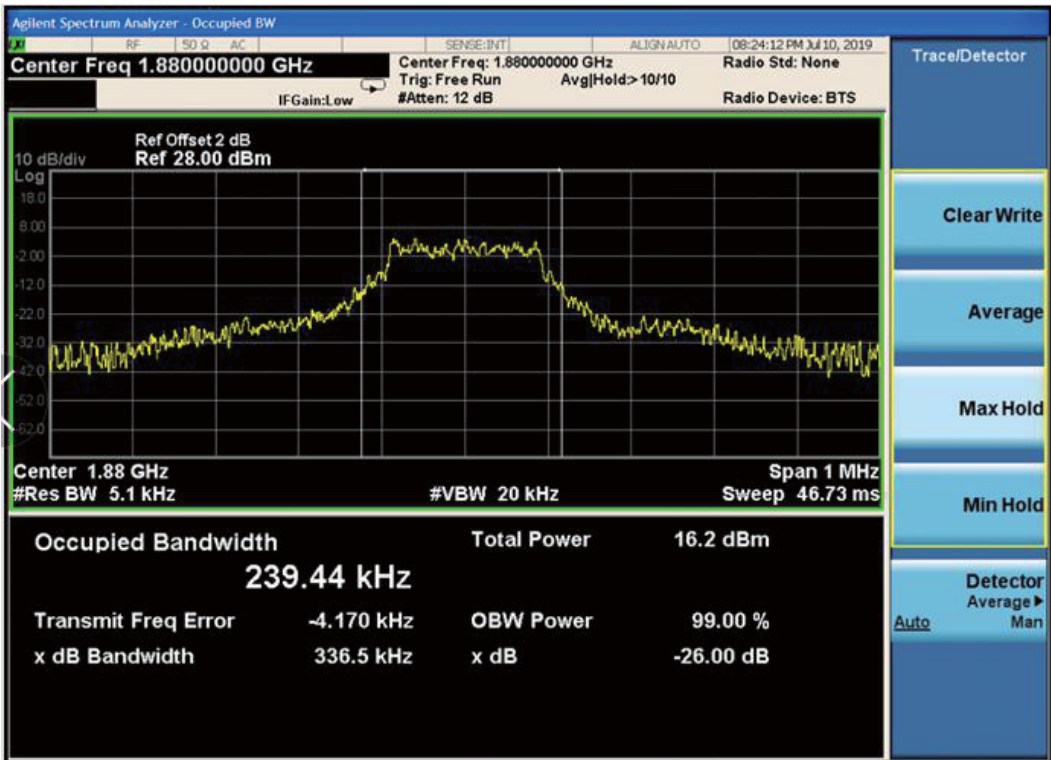
Band2-99% OBW-18601 Channel-QPSK



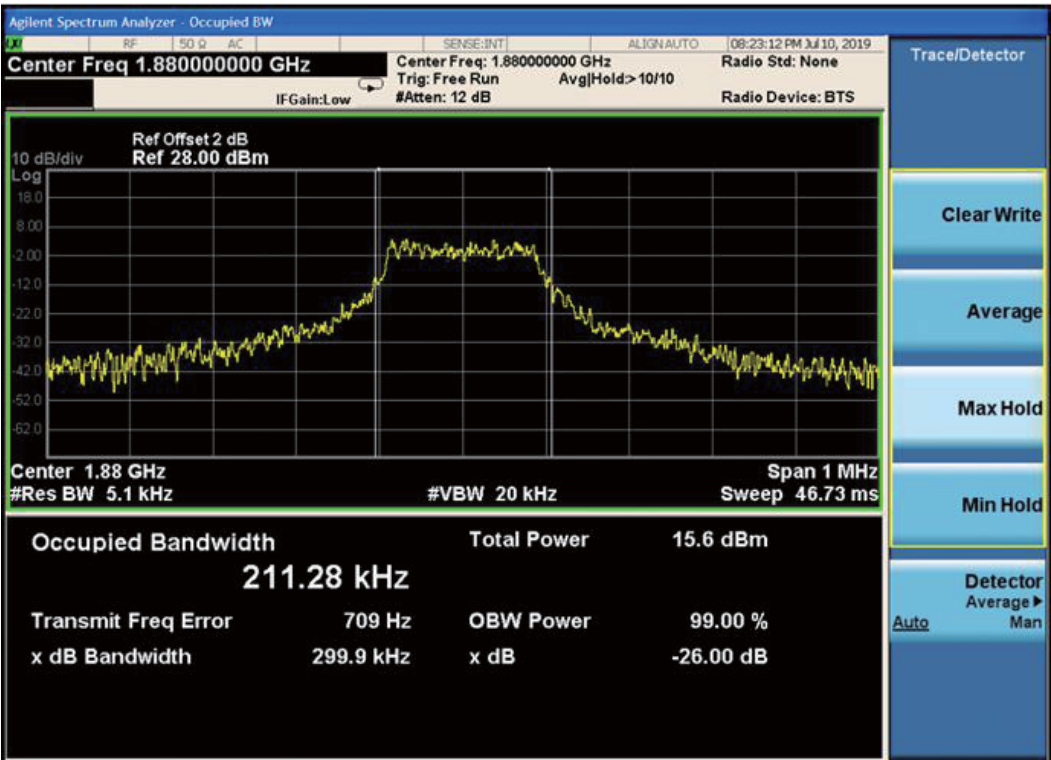
Band2-26dB OBW-18900 Channel-BPSK



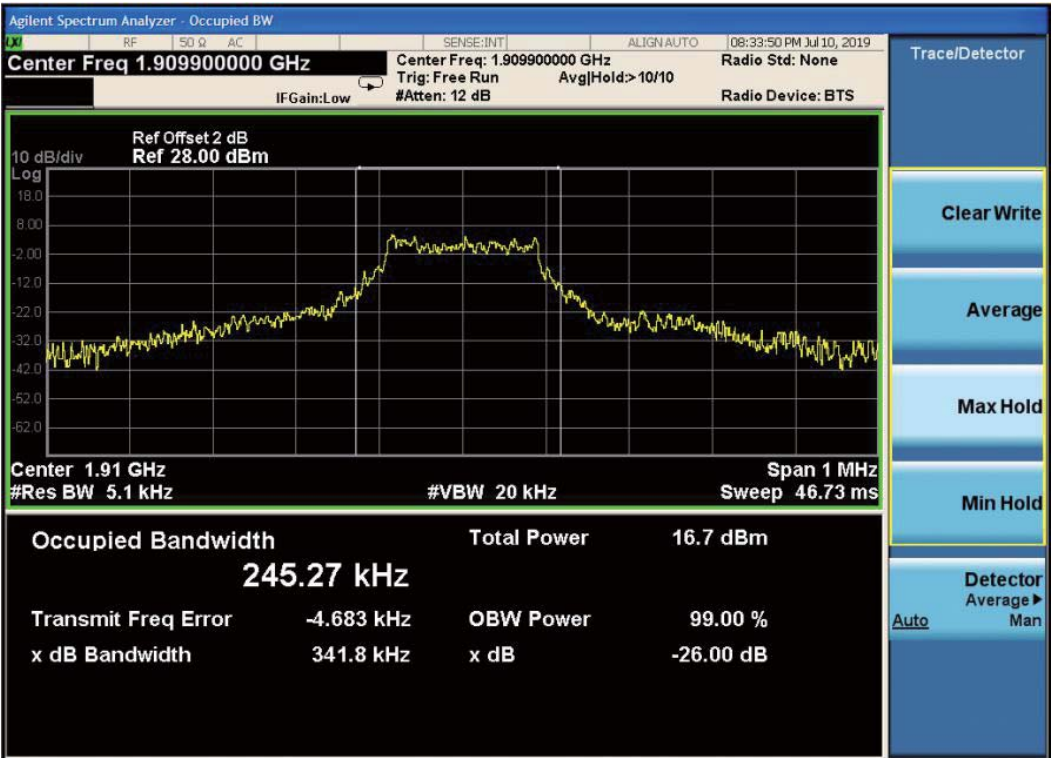
Band2-26dB OBW-18900 Channel-QPSK



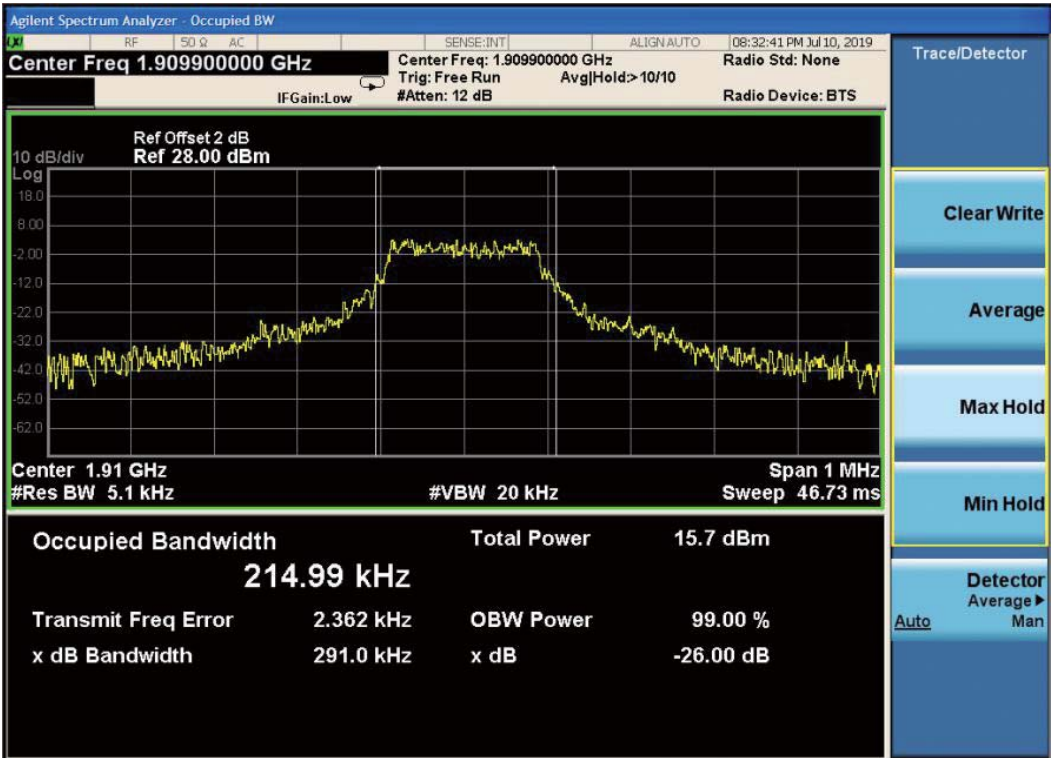
Band2-99% OBW-18900 Channel-BPSK



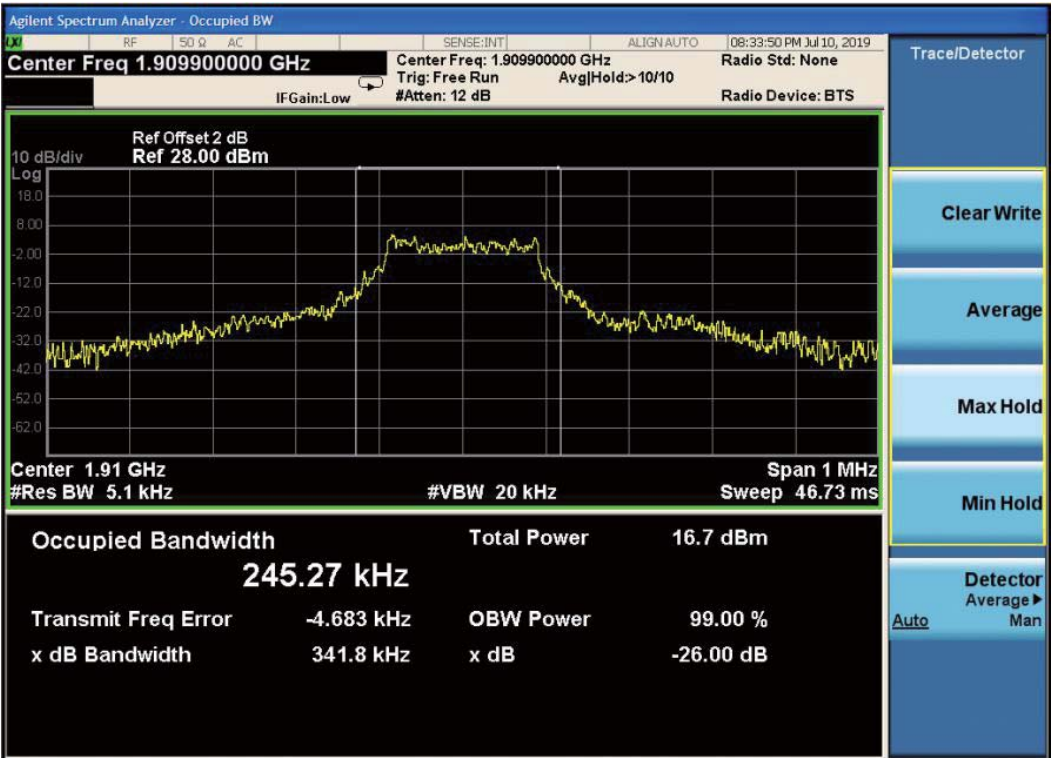
Band2-99% OBW-18900 Channel-QPSK



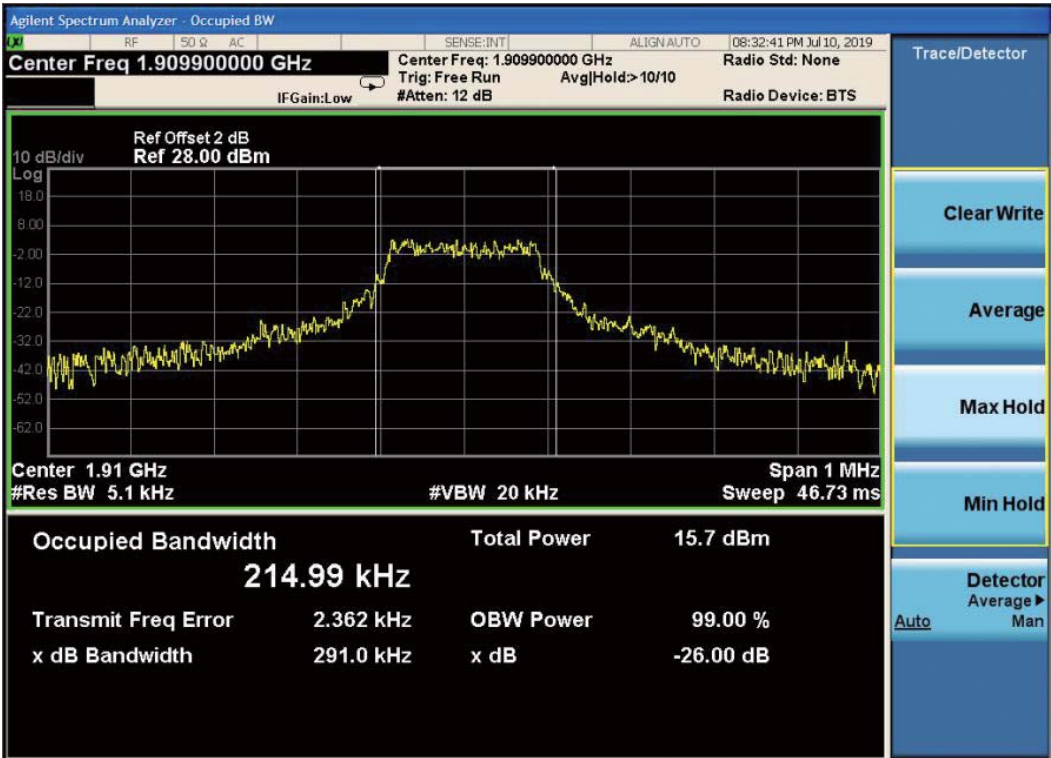
Band2-26dB OBW-19199 Channel-BPSK



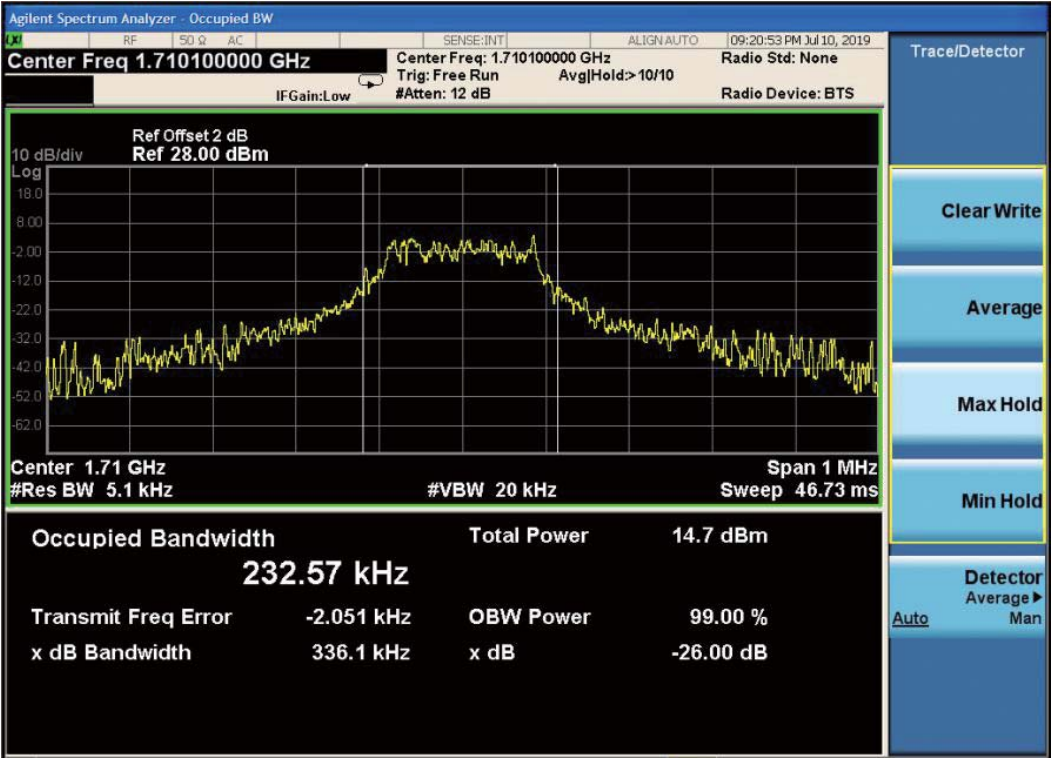
Band2-26dB OBW-19199 Channel-QPSK



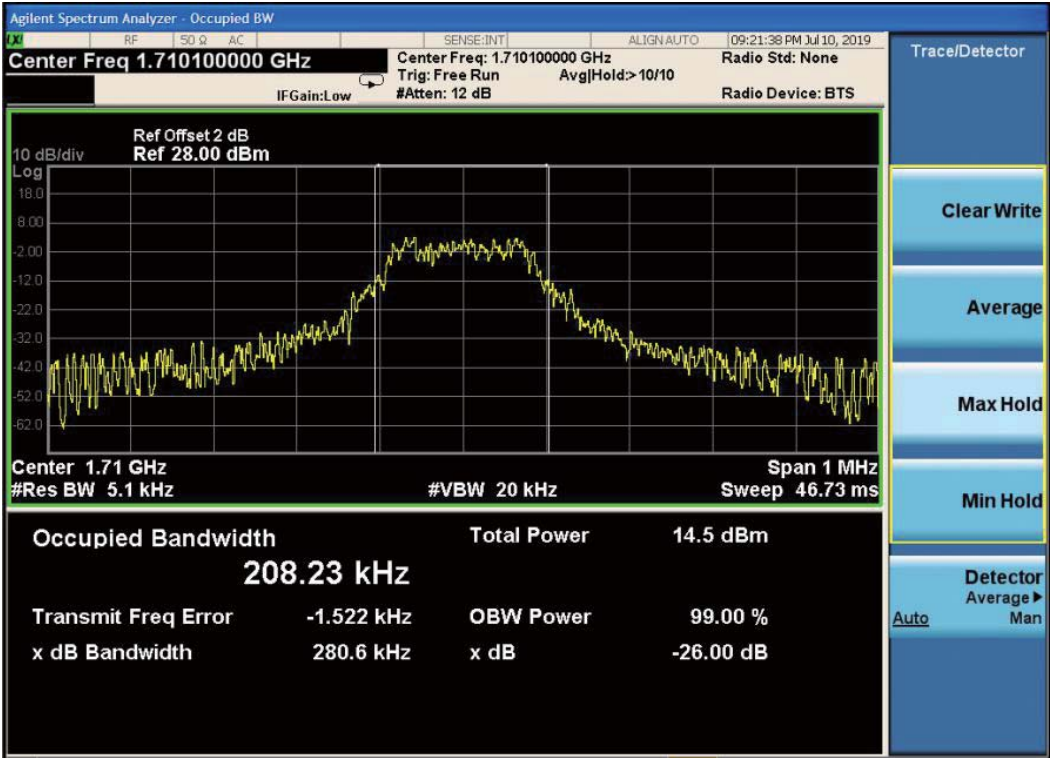
Band2-99% OBW-19199 Channel-BPSK



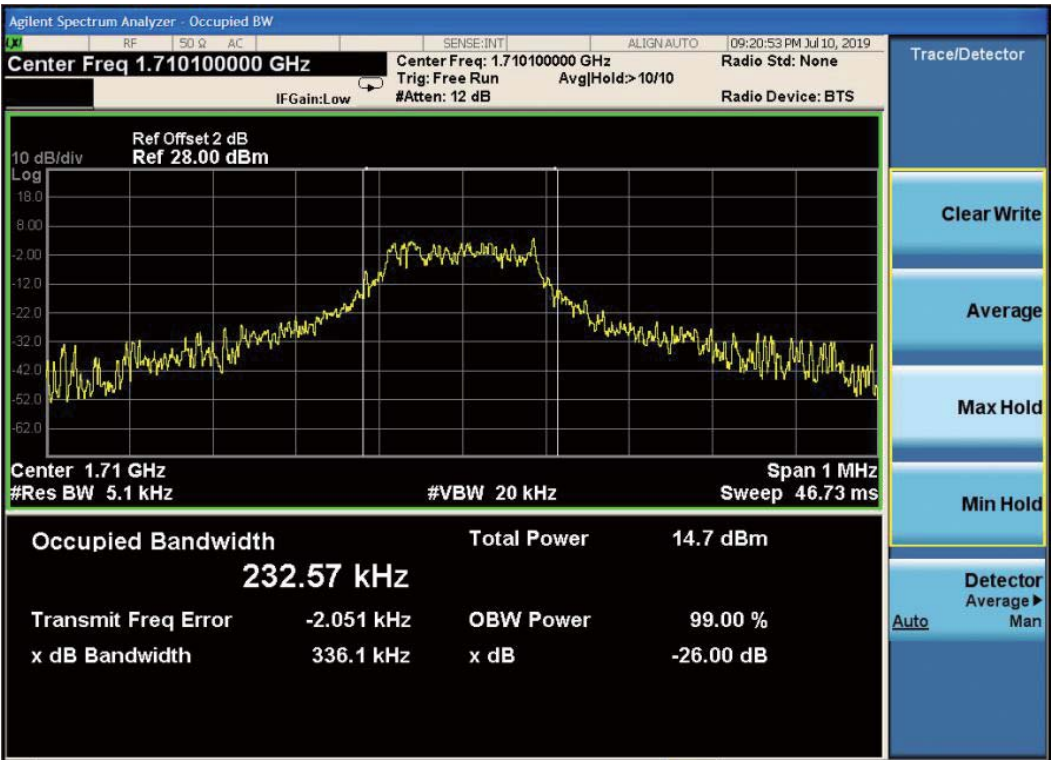
Band2-99% OBW-19199 Channel-QPSK



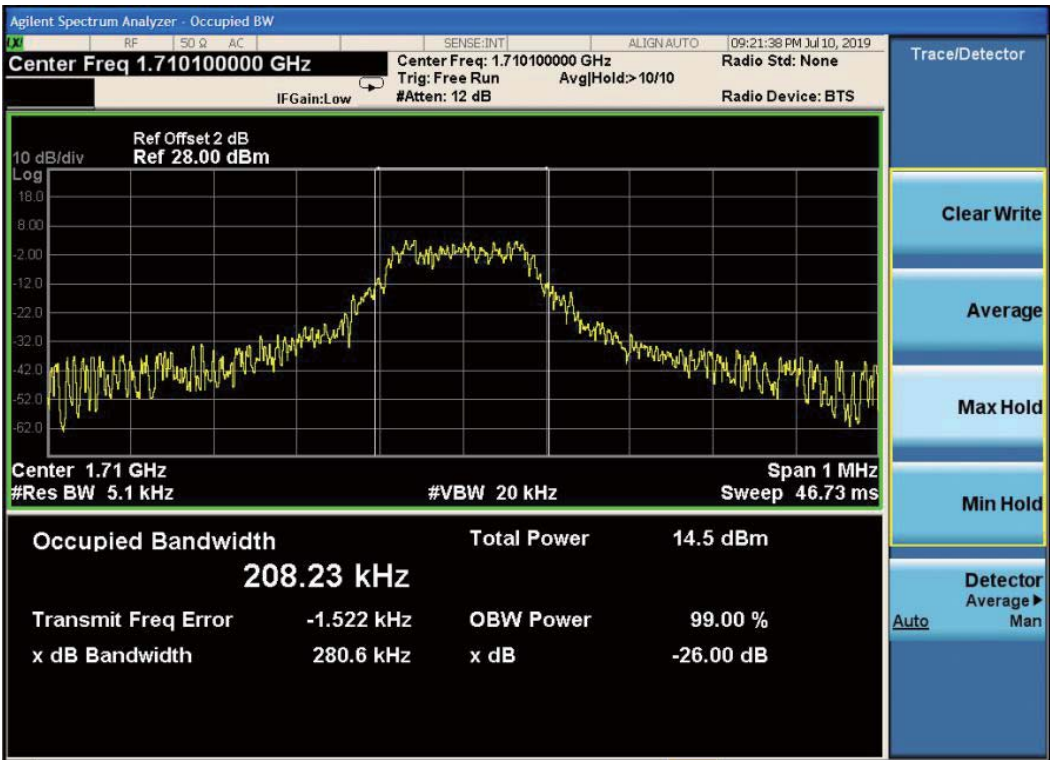
Band4-26dB OBW-19951 Channel-BPSK



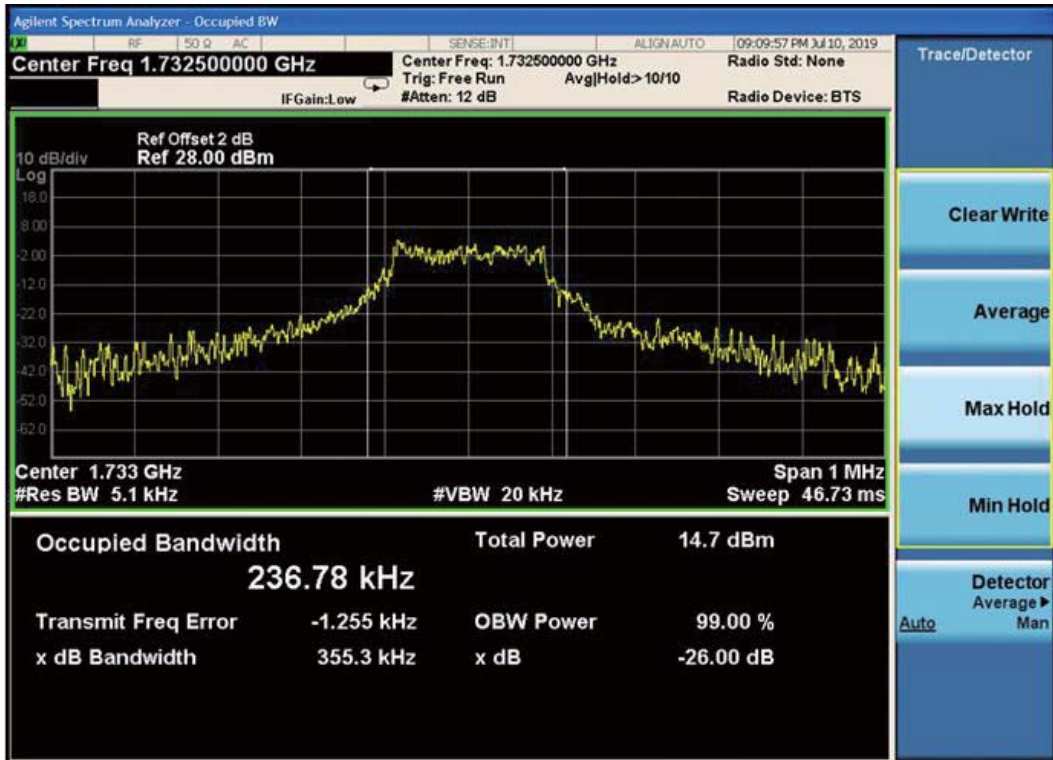
Band4-26dB OBW-19951 Channel-QPSK



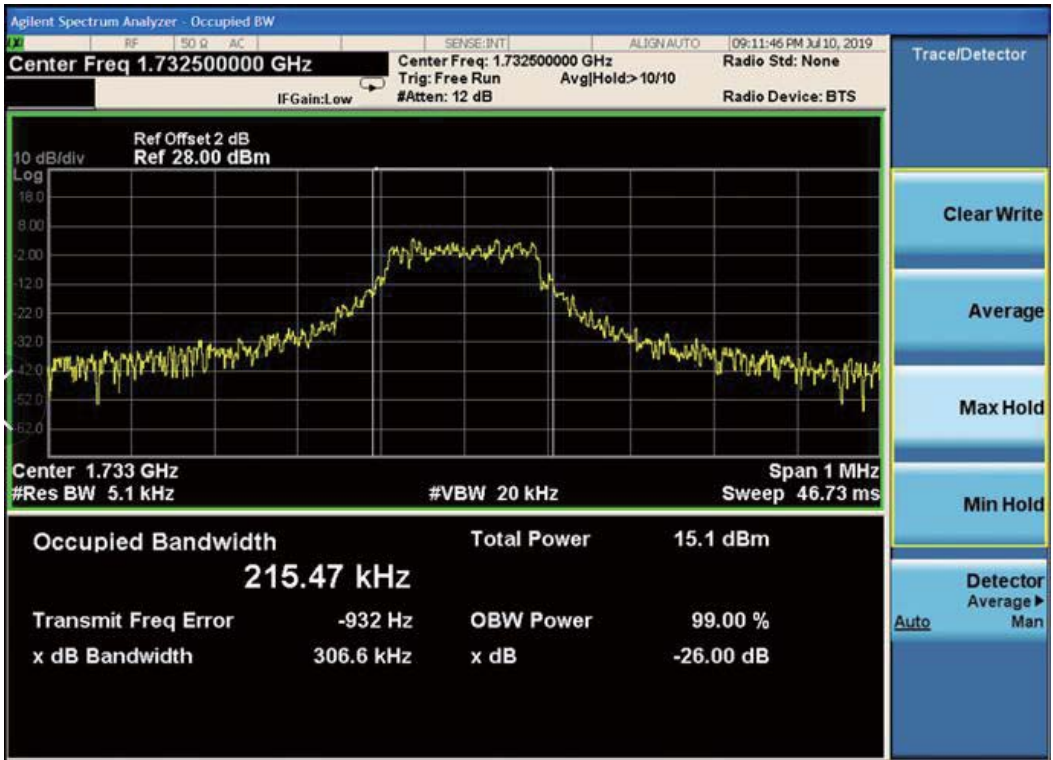
Band4-99% OBW-19951 Channel-BPSK



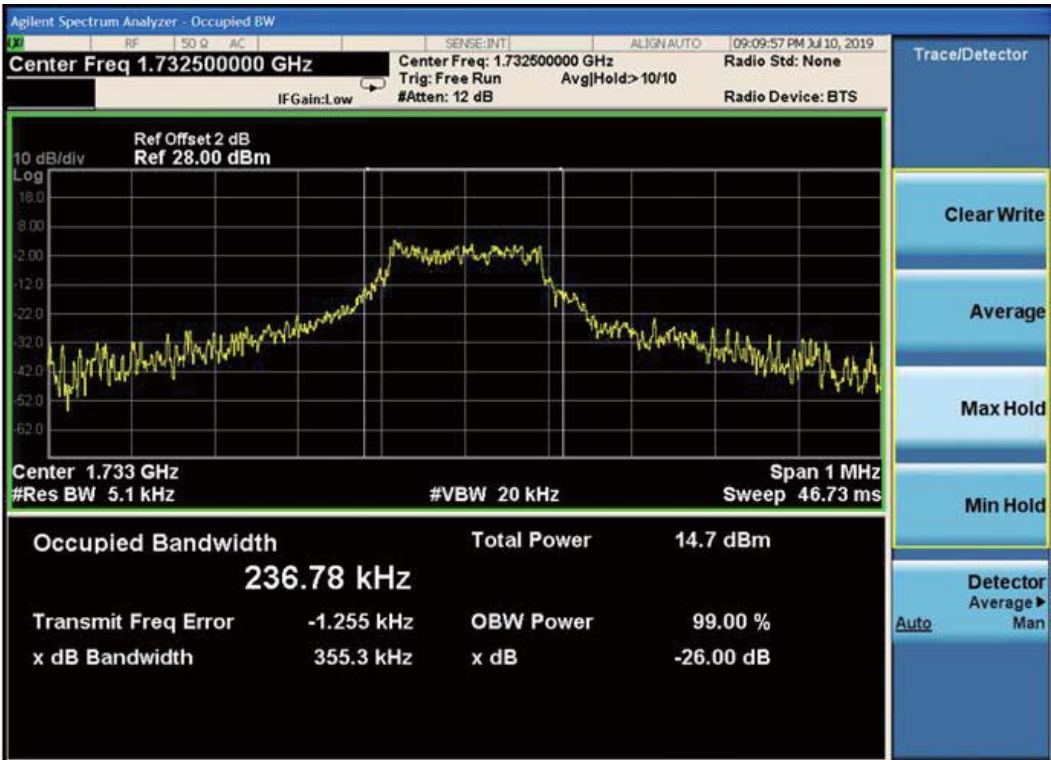
Band4-99% OBW-19951 Channel-QPSK



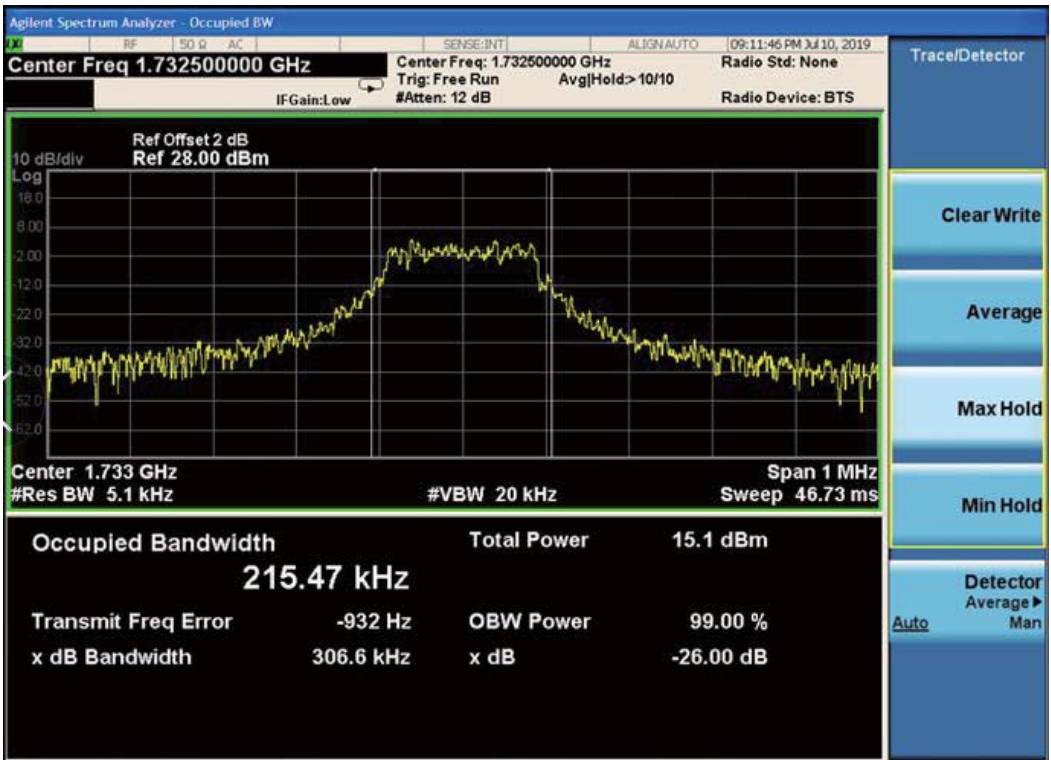
Band4-26dB OBW-20175 Channel-BPSK



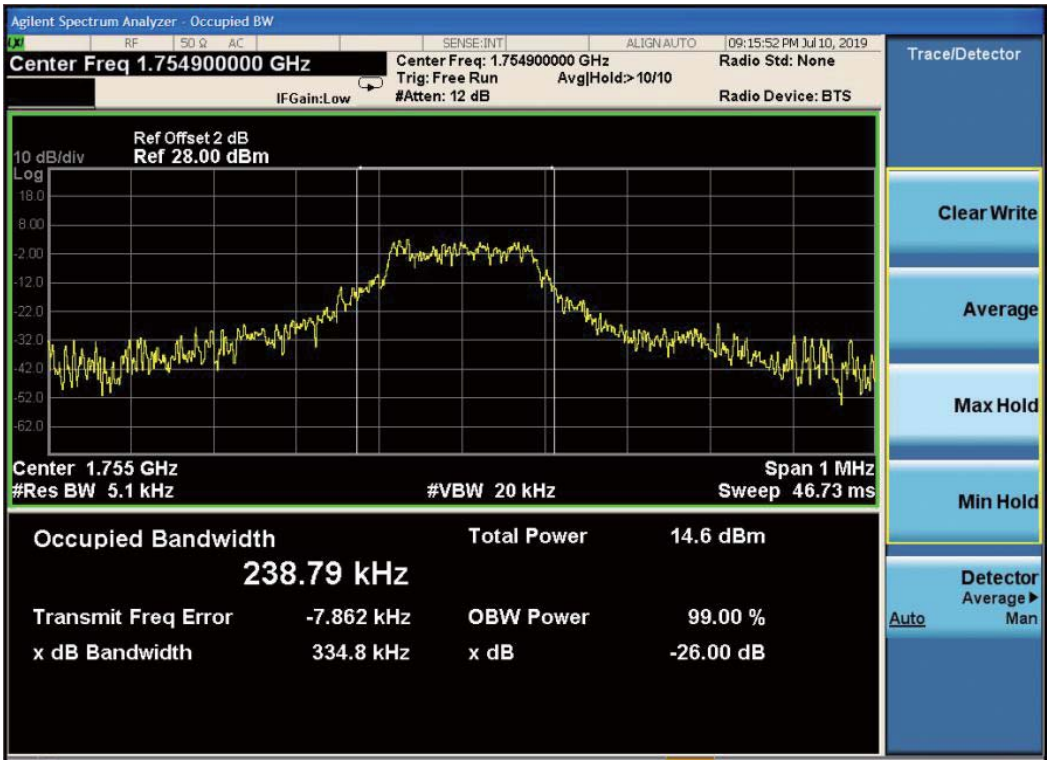
Band4-26dB OBW-20175 Channel-QPSK



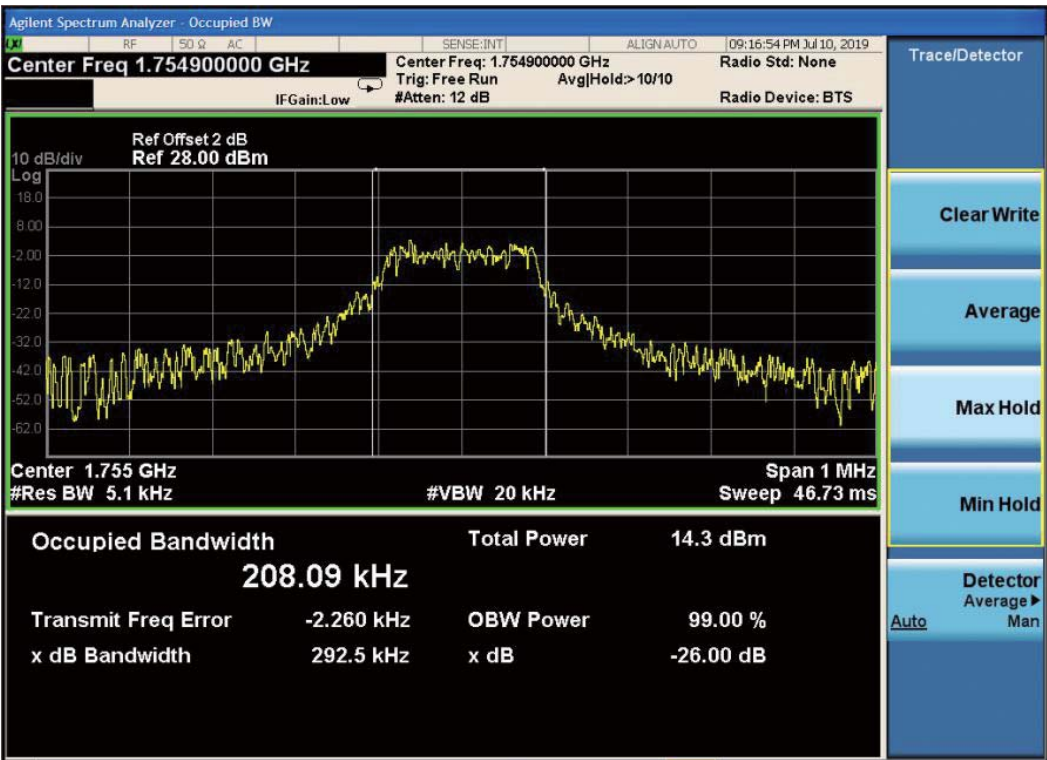
Band4-99% OBW-20175 Channel-BPSK



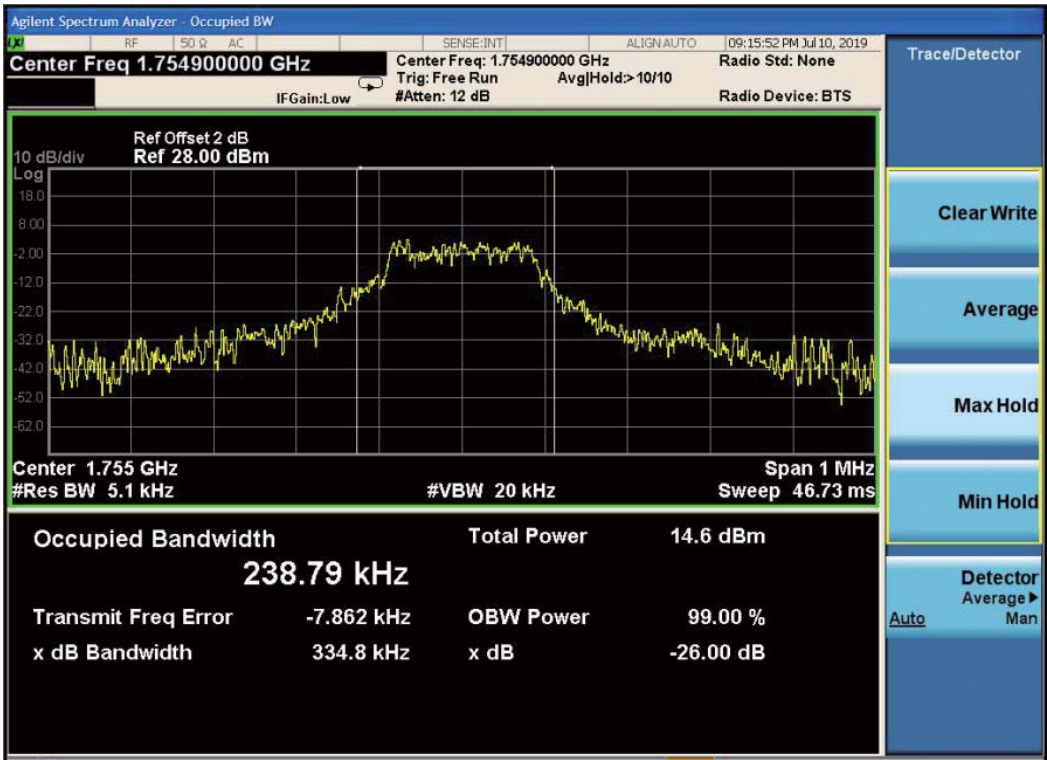
Band4-99% OBW-20175 Channel-QPSK



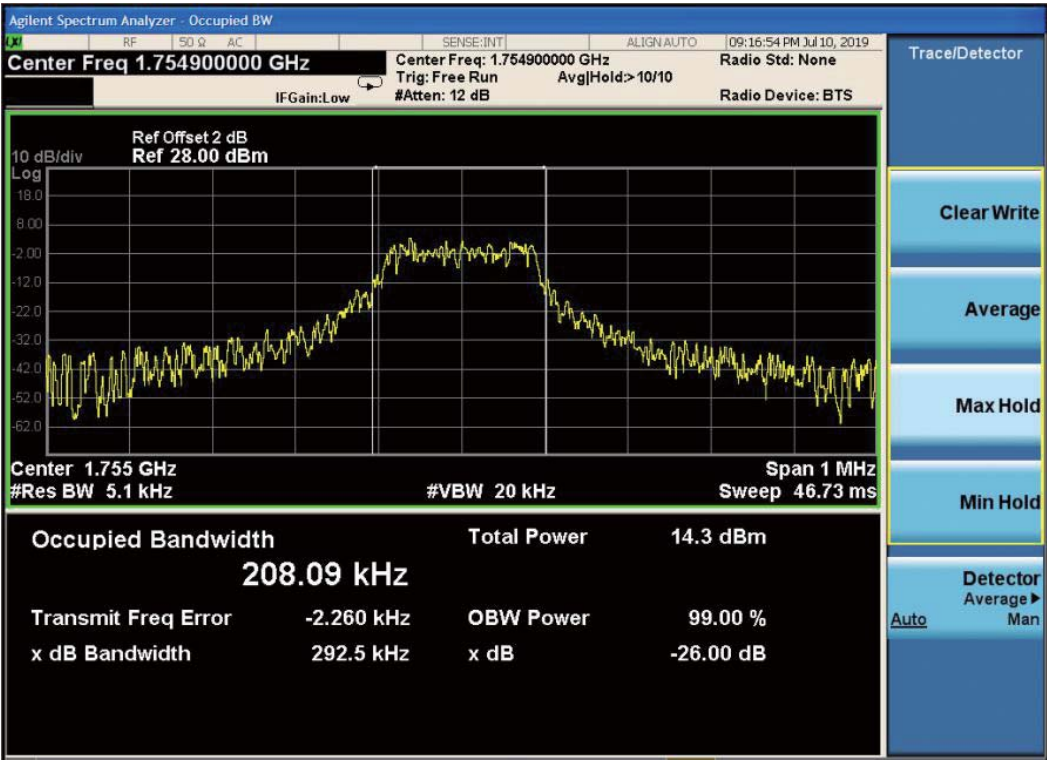
Band4-26dB OBW-20399 Channel-BPSK



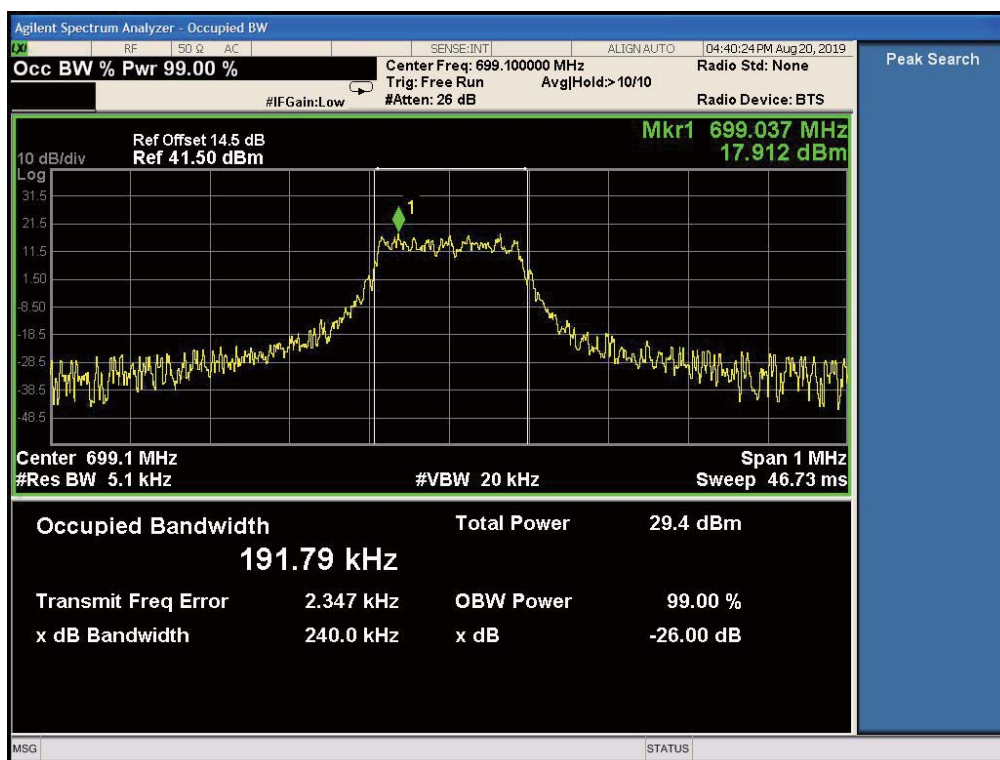
Band4-26dB OBW-20399 Channel-QPSK



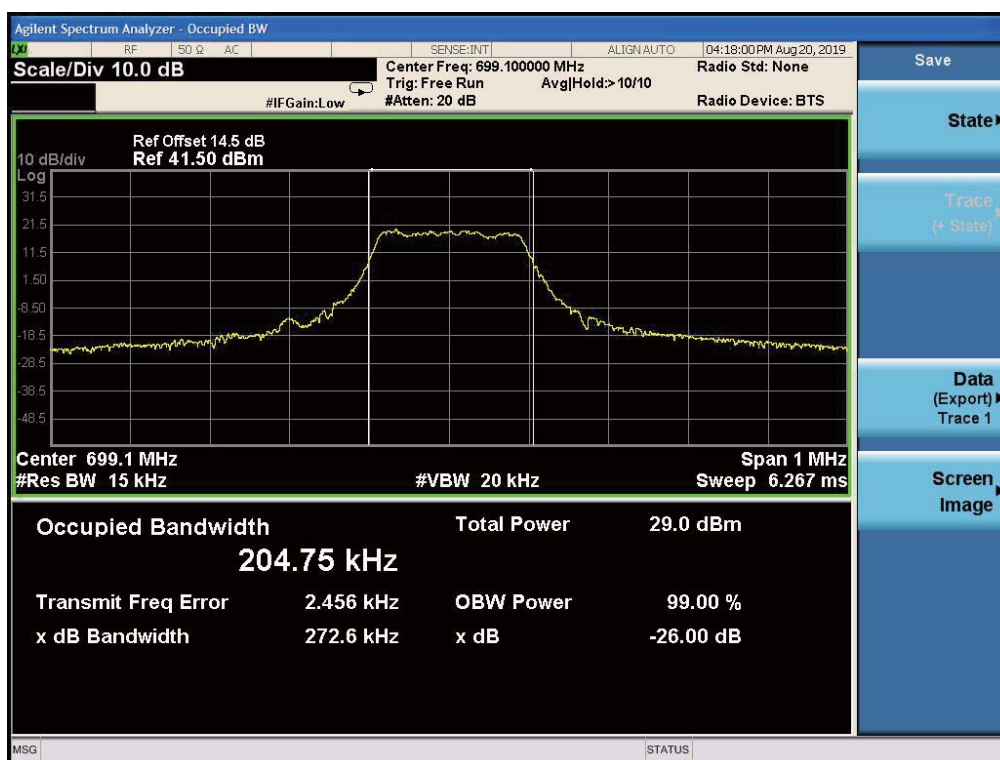
Band4-99% OBW-20399 Channel-BPSK



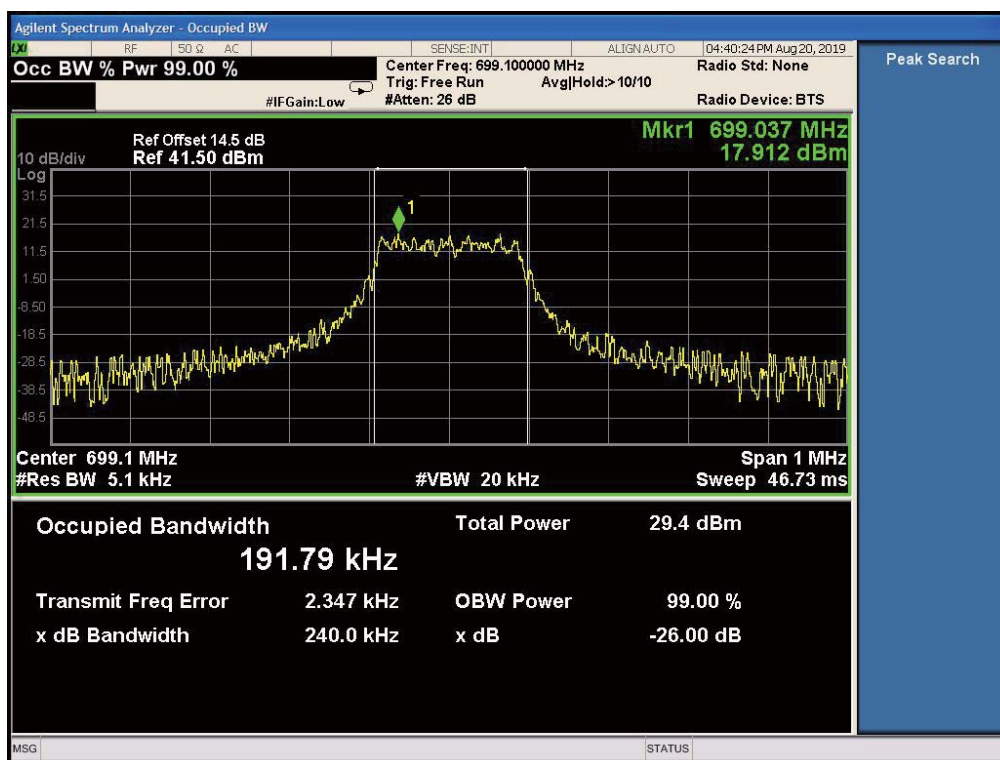
Band4-99% OBW-20399 Channel-QPSK



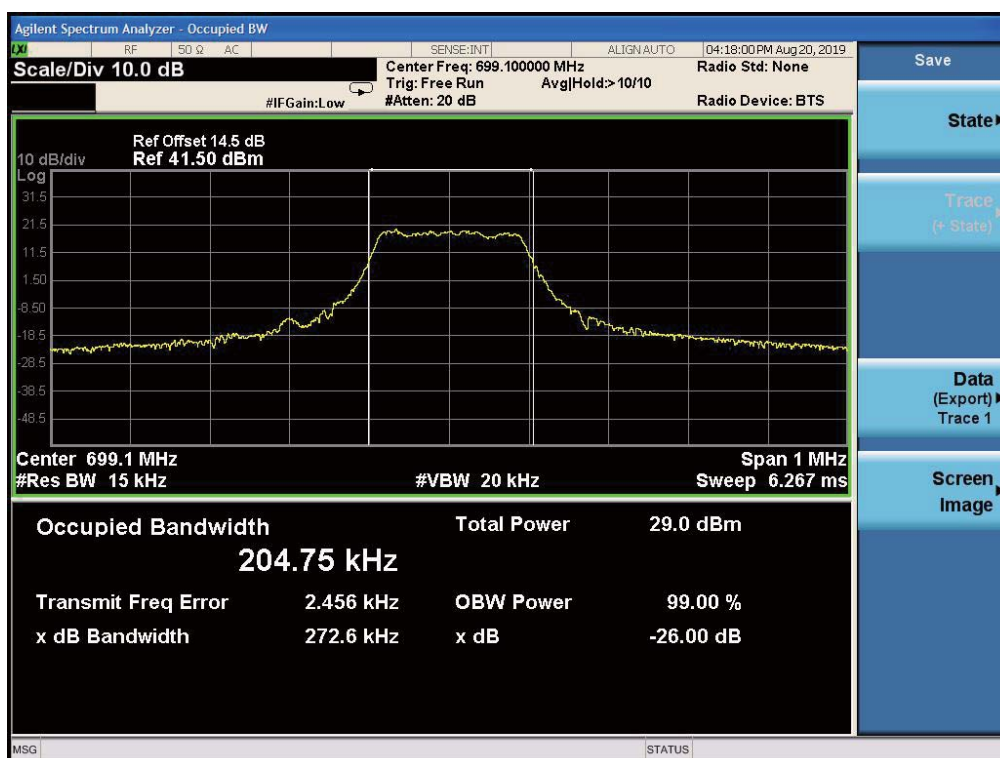
Band12-26dB OBW-23011 Channel-BPSK



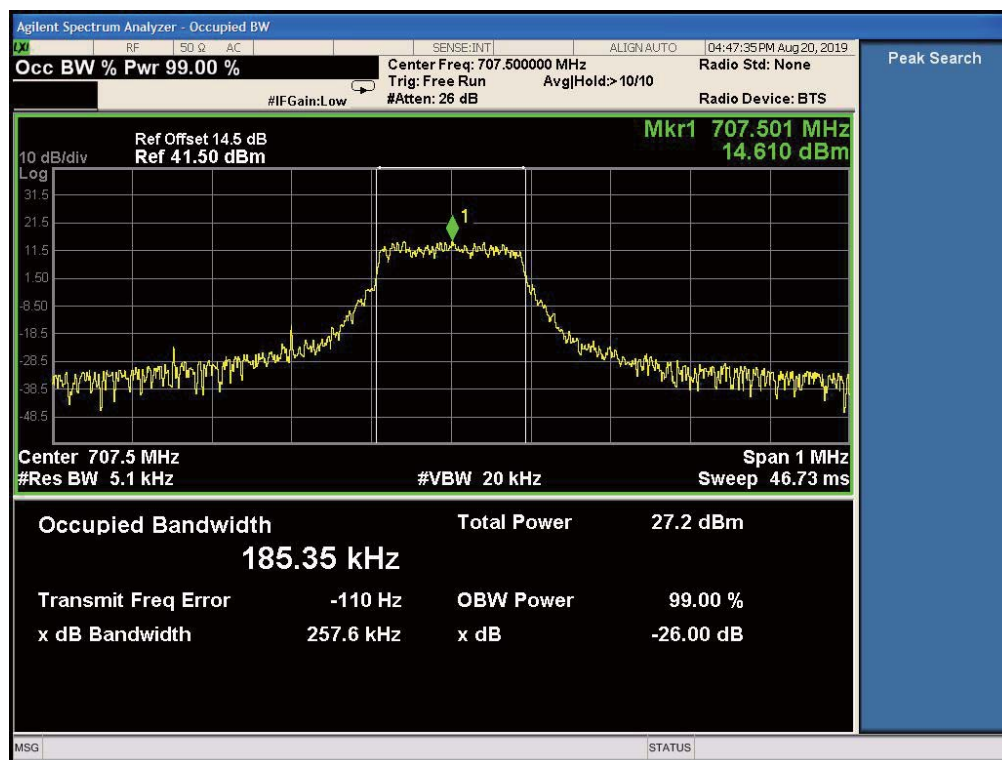
Band12-26dB OBW-23011 Channel-QPSK



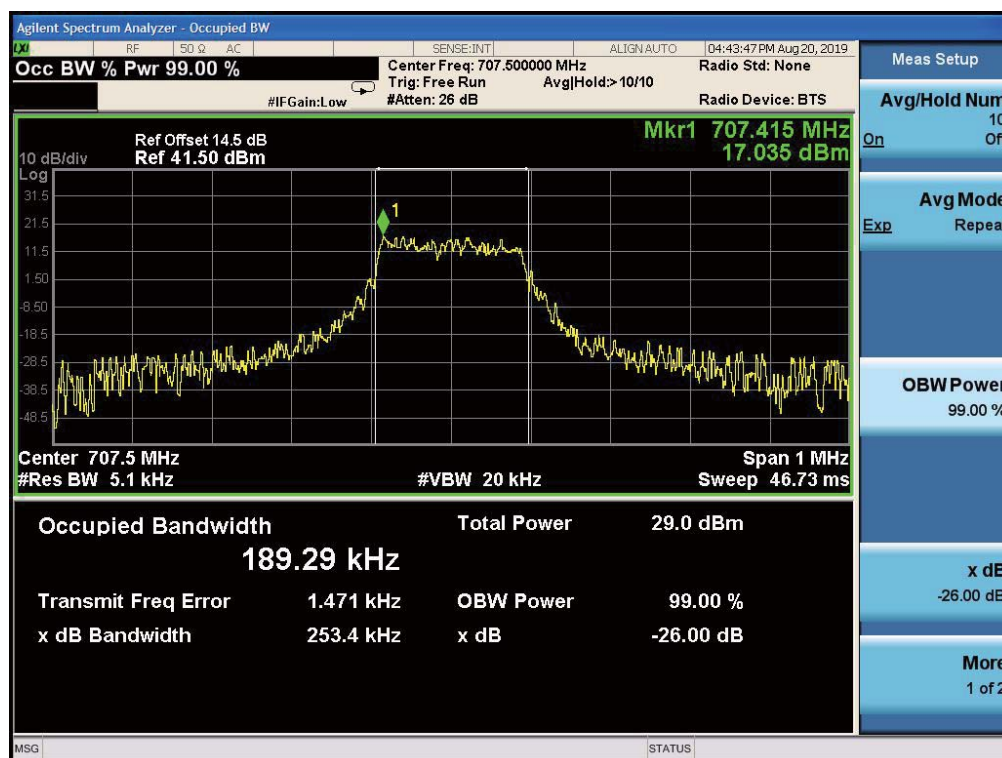
Band12-99% OBW-23011 Channel-BPSK



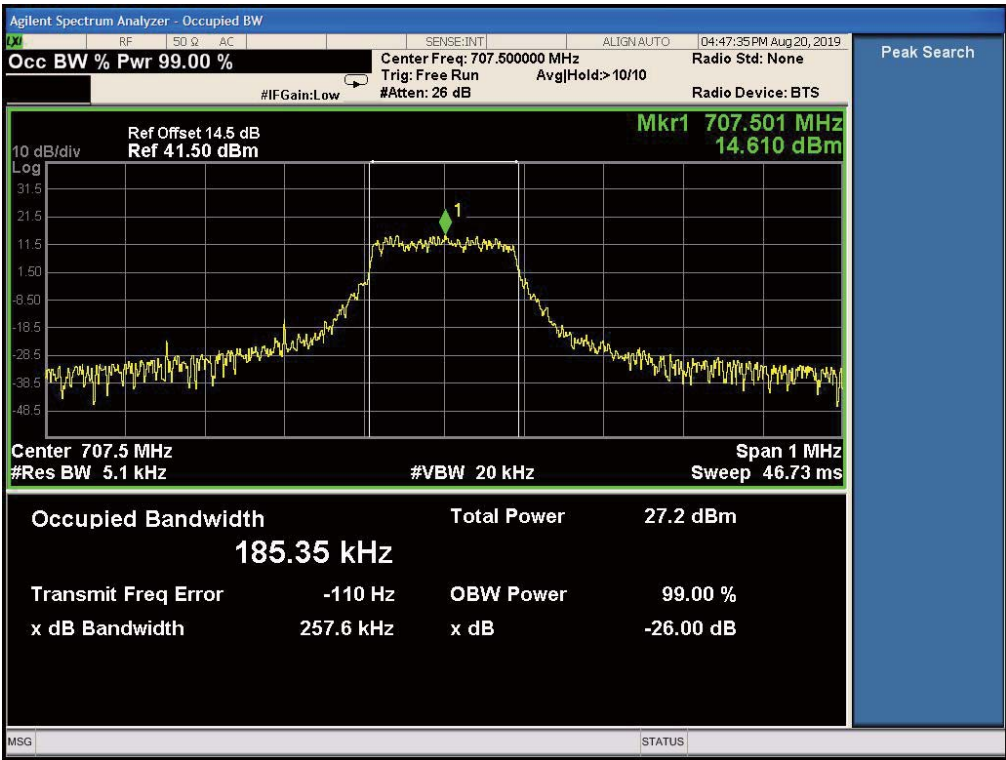
Band12-99% OBW-23011 Channel-QPSK



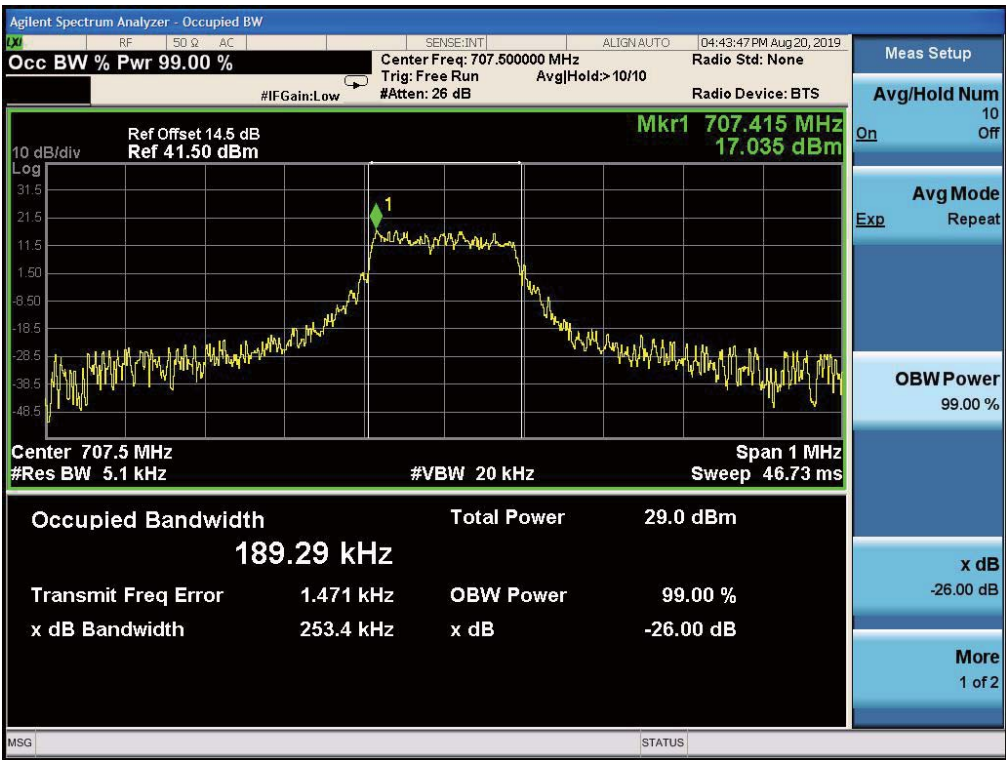
Band12-26dB OBW-23095 Channel-BPSK



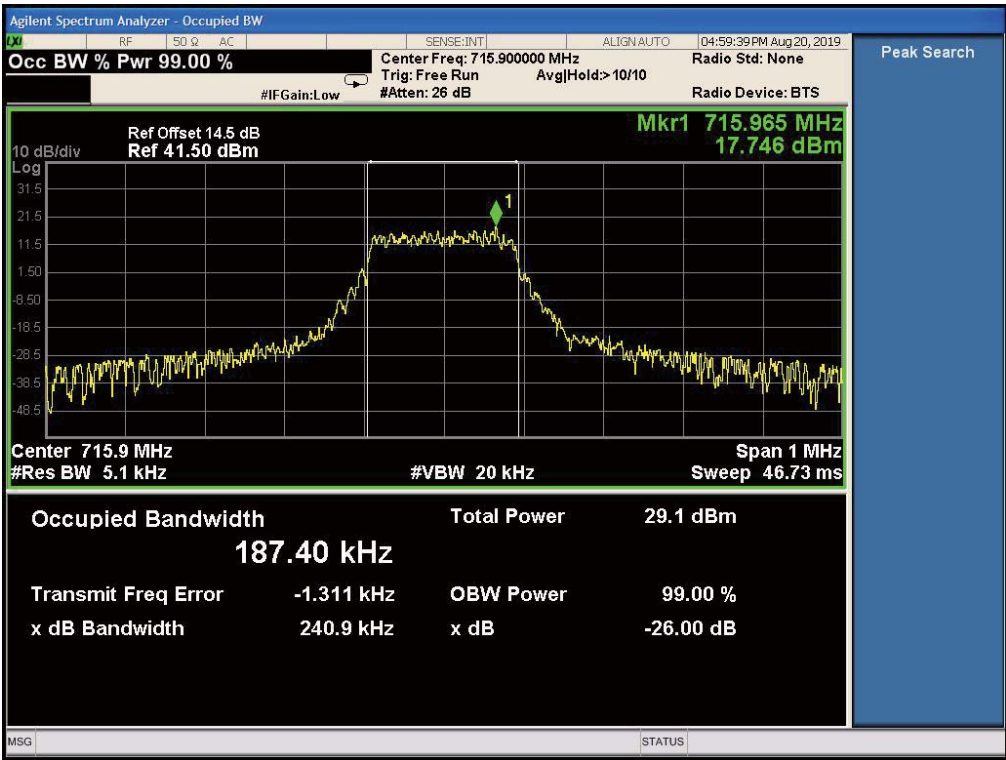
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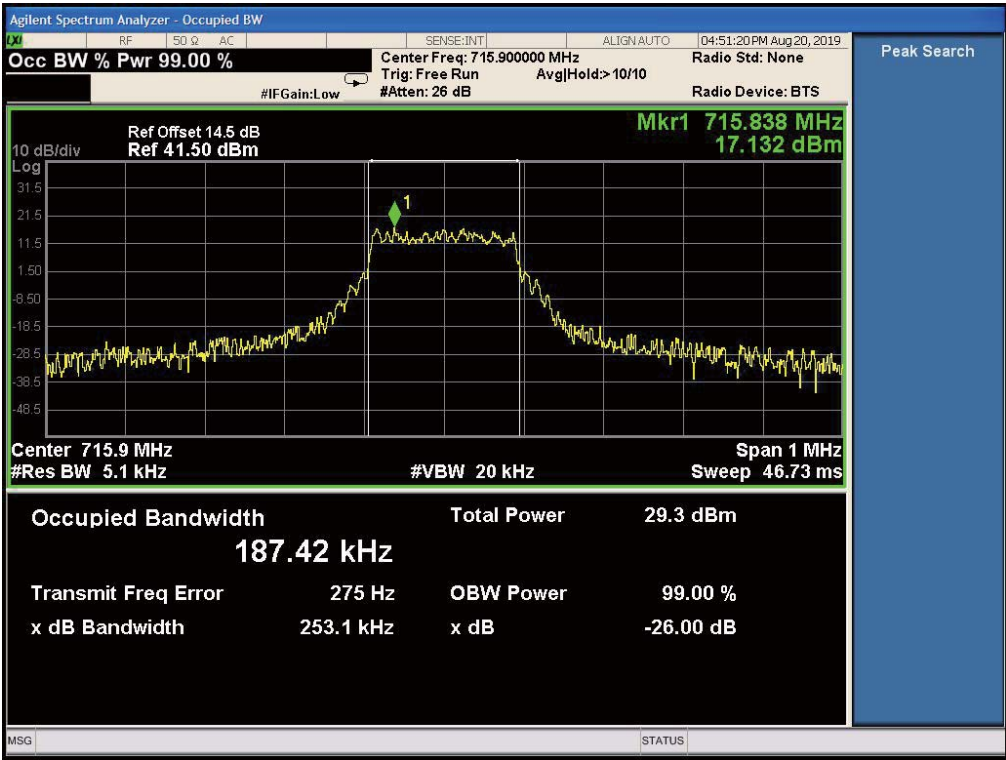
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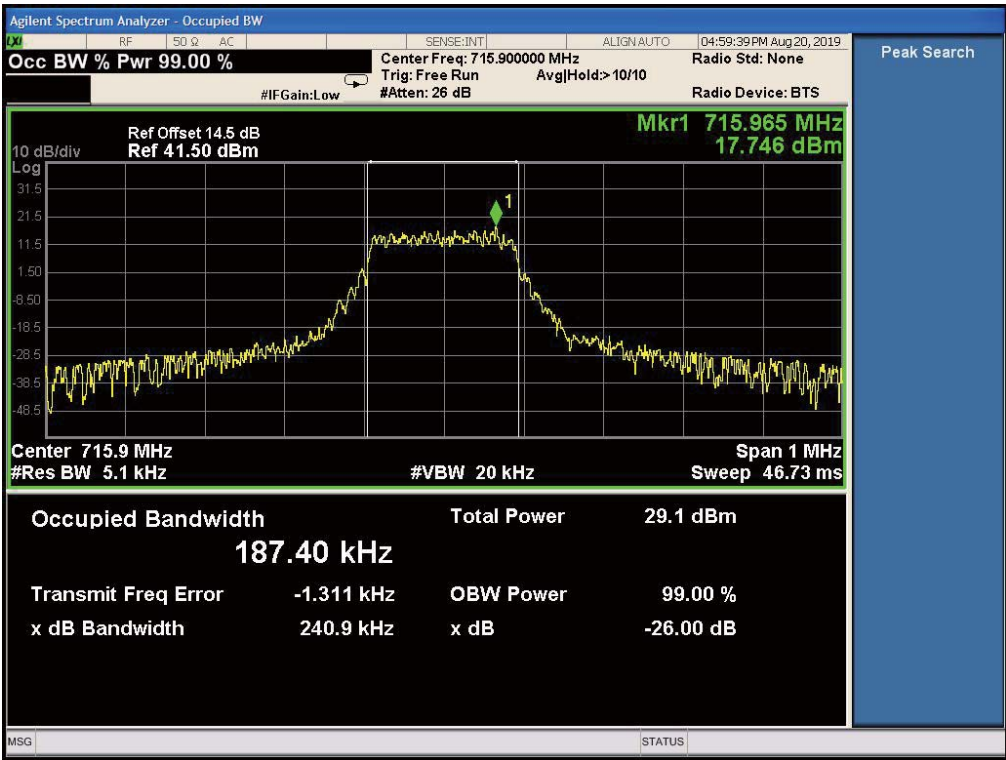
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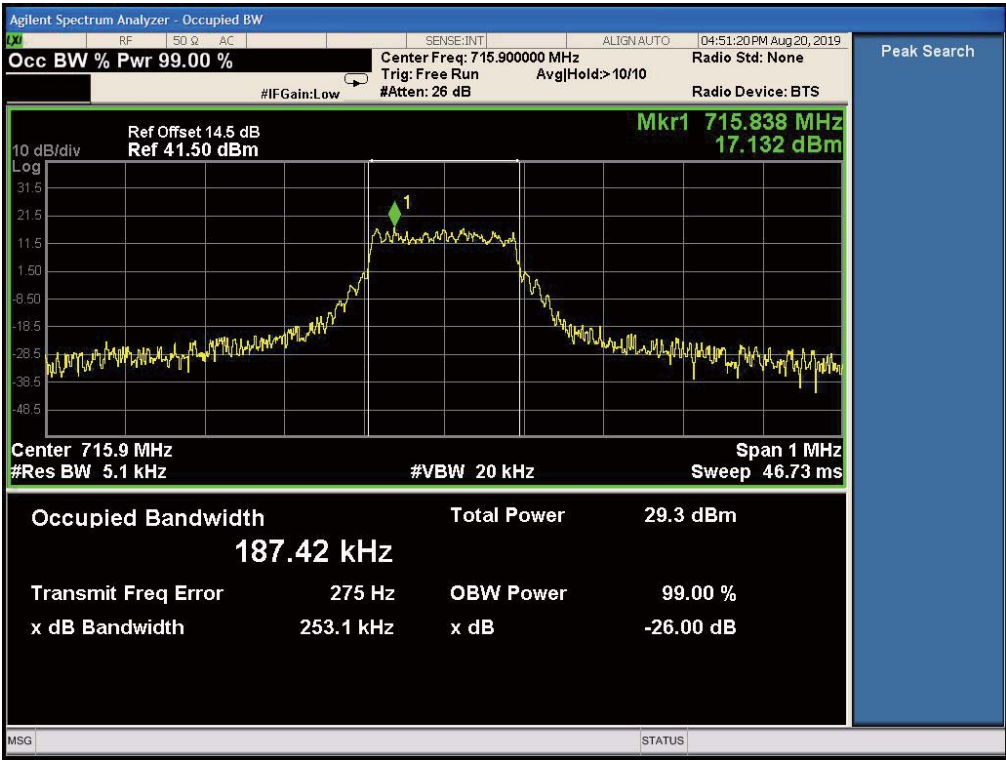
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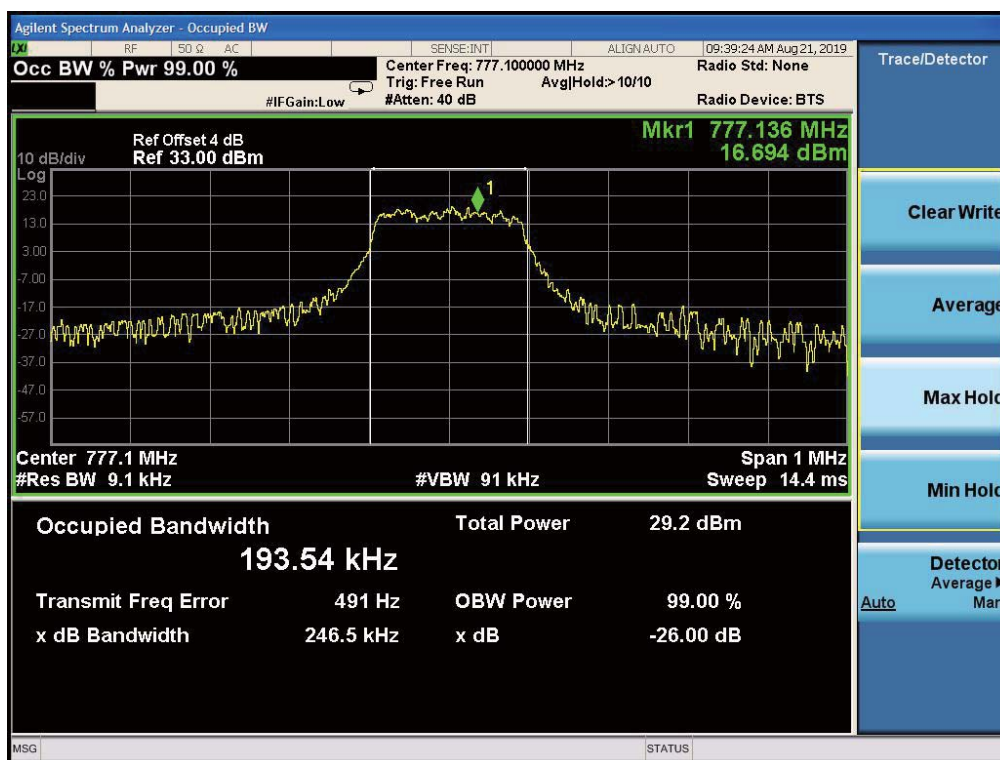
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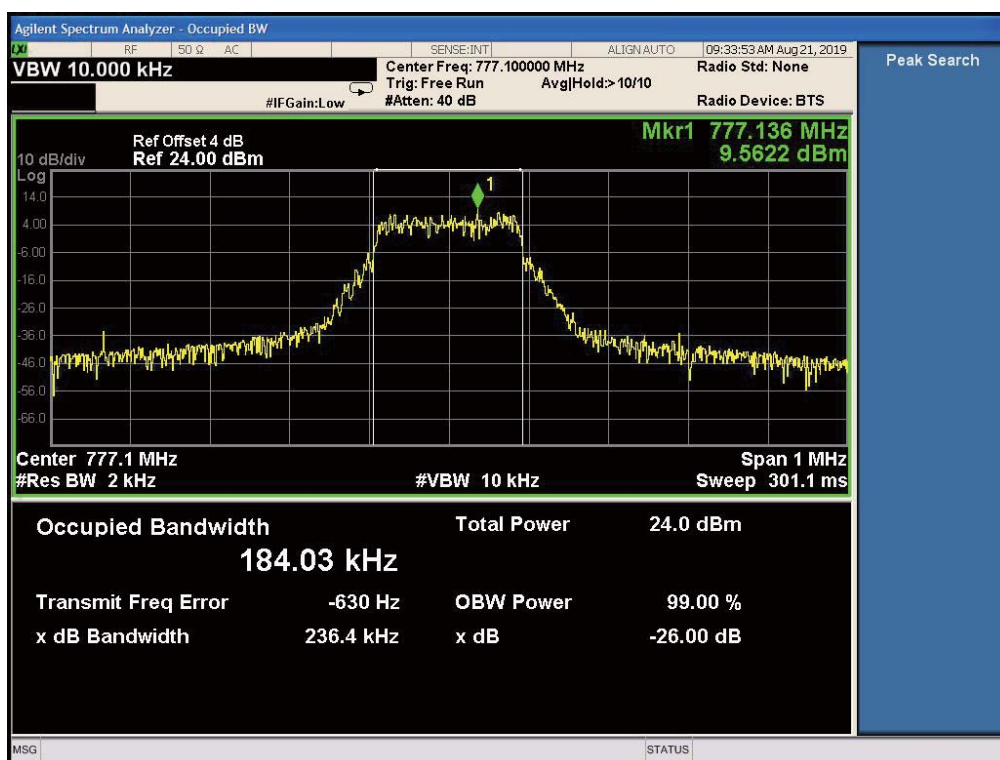
Band12-99% OBW-23179 Channel-BPSK



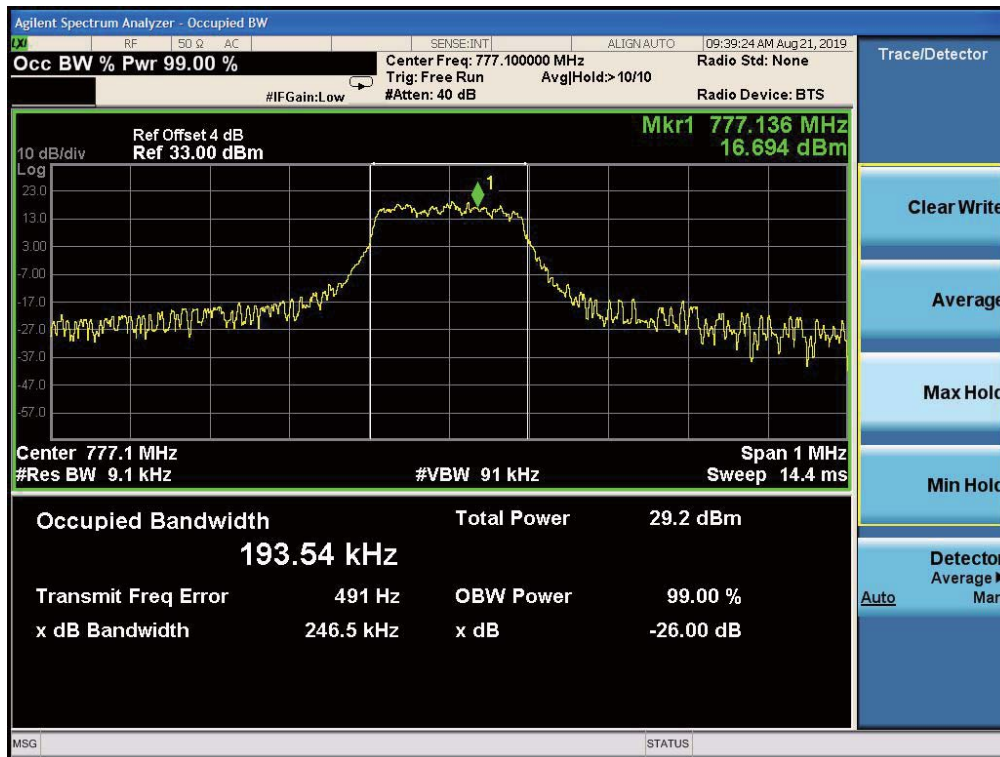
Band12-99% OBW-23179 Channel-QPSK



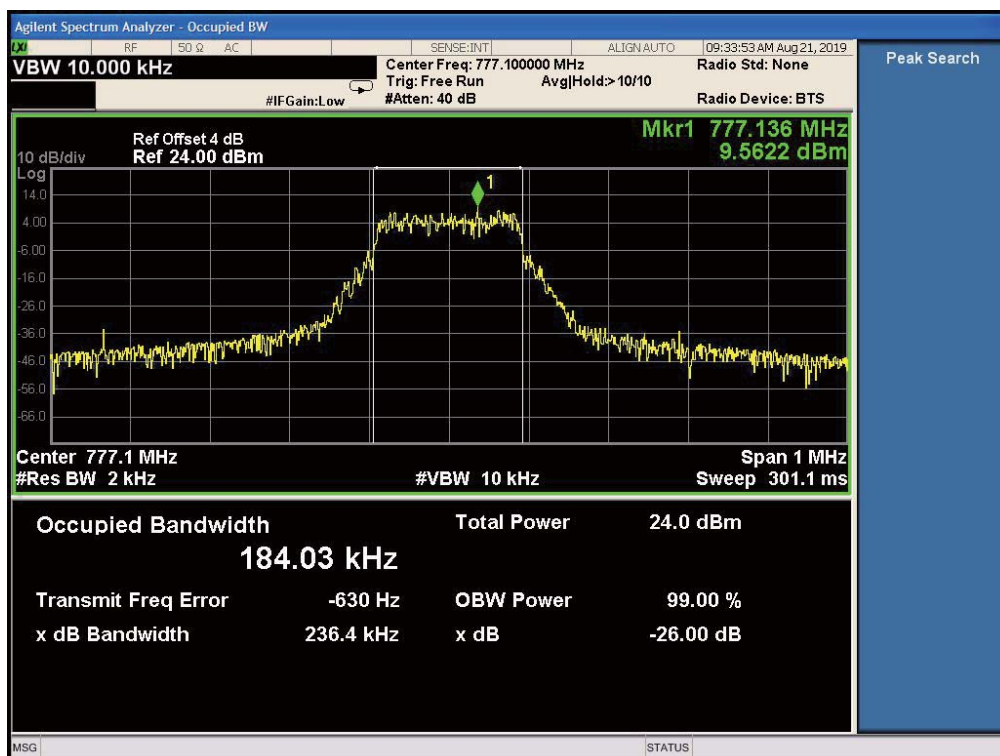
Band13-26dB OBW-23181 Channel-BPSK



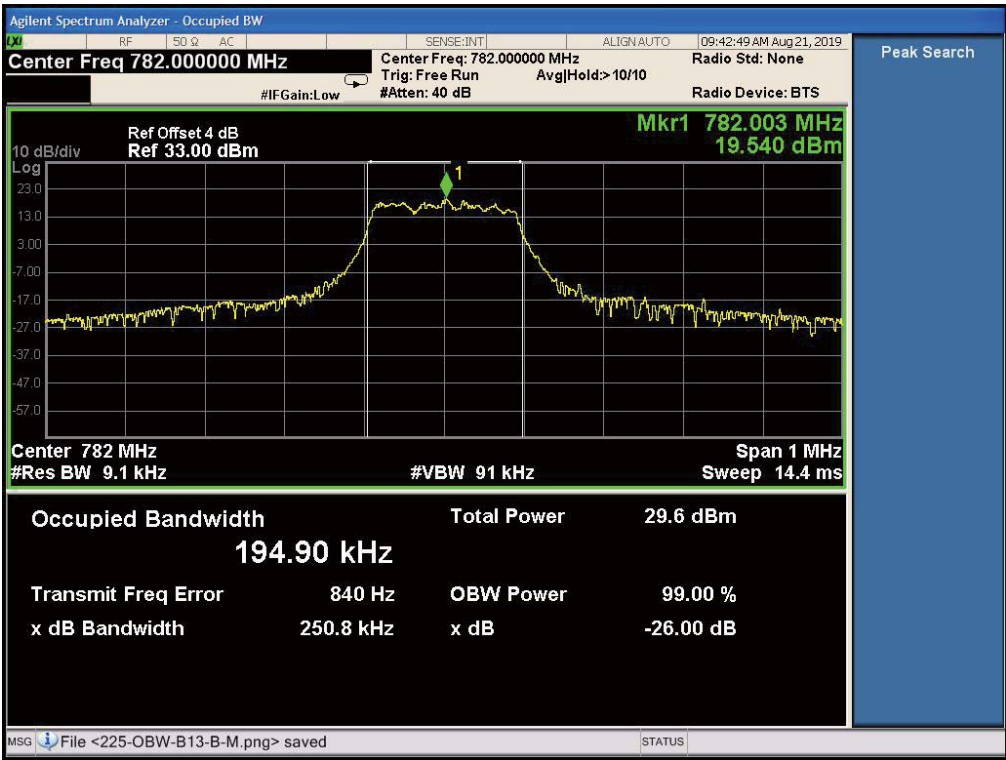
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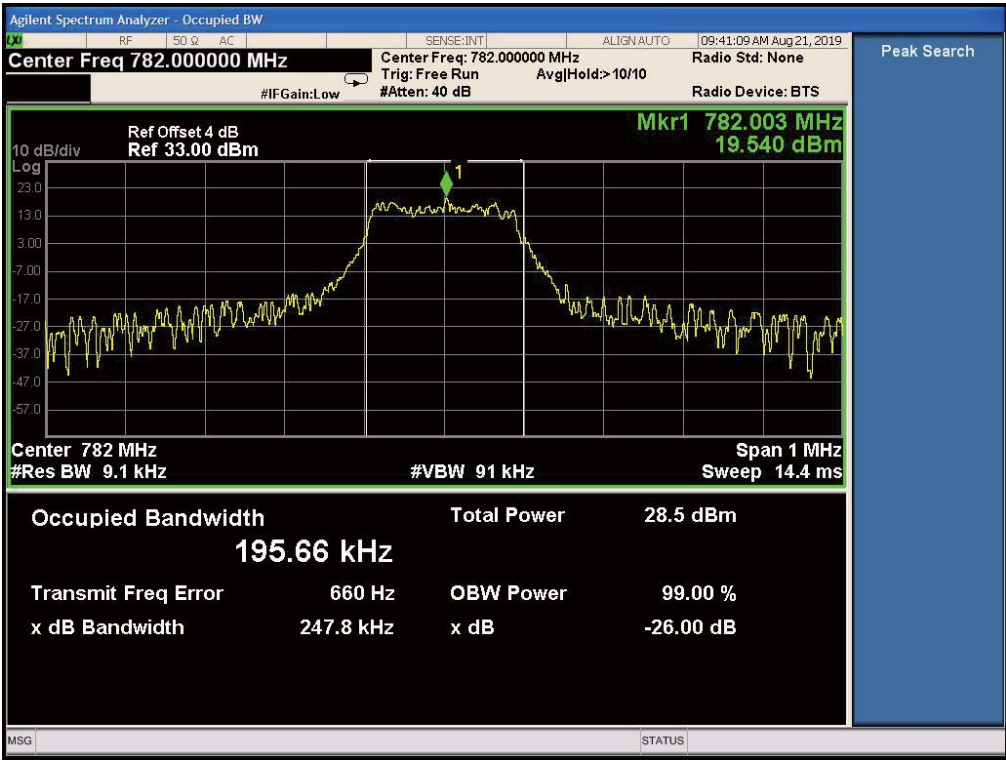
Band13-99% OBW-23181 Channel-BPSK



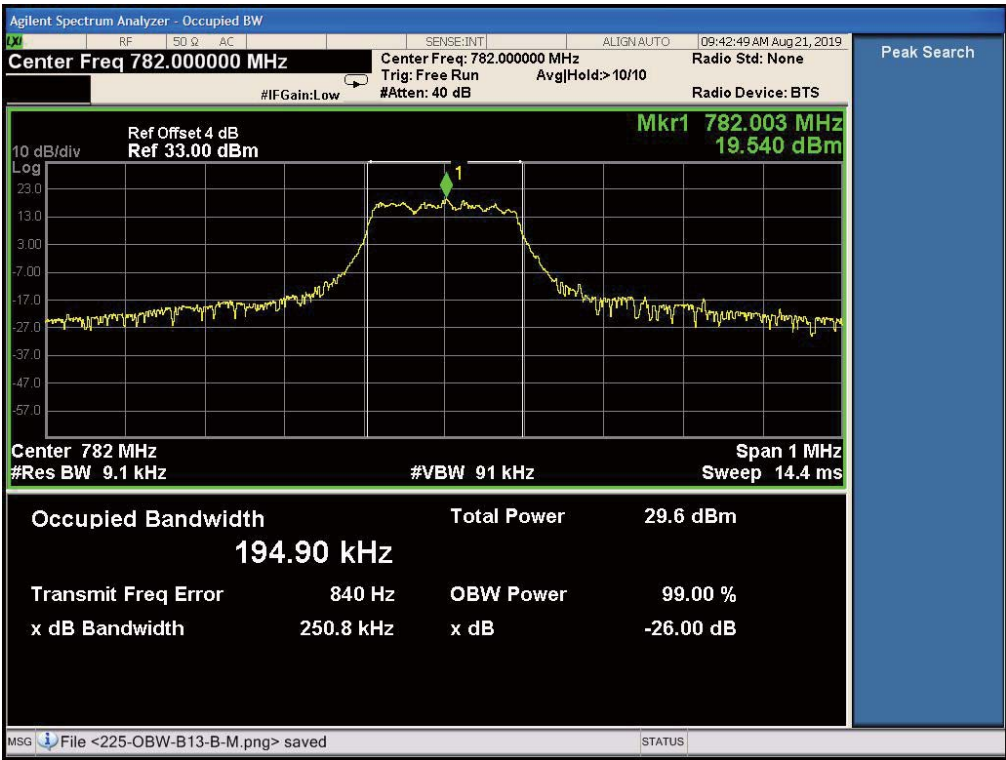
Band13-99% OBW-23181 Channel-QPSK



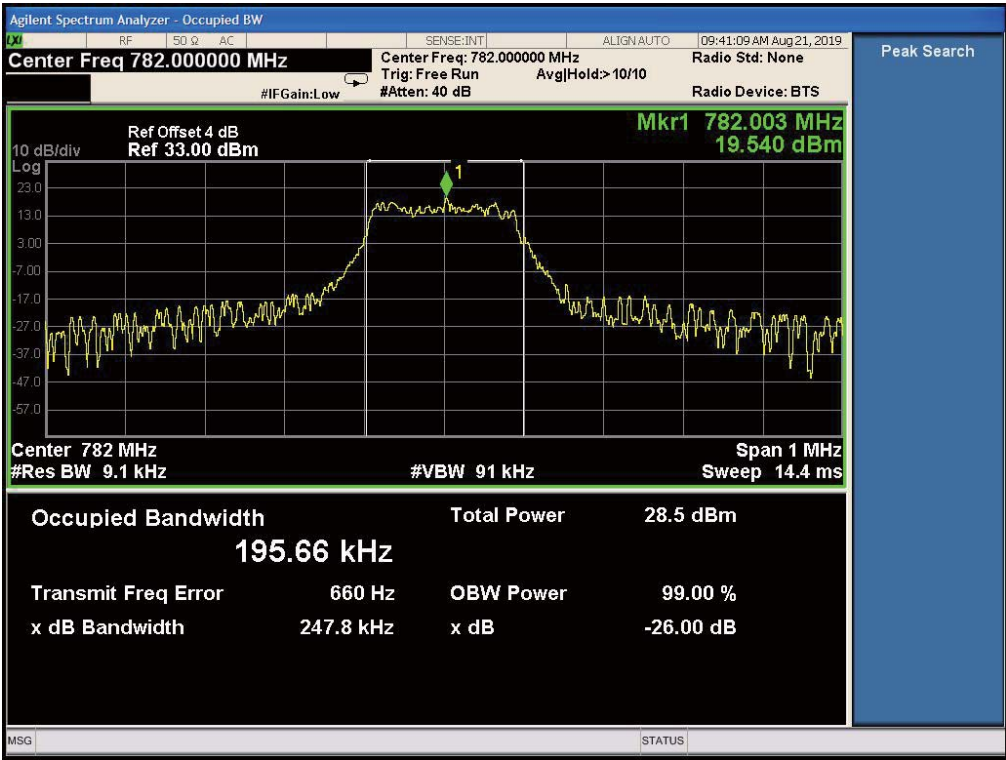
Band13-26dB OBW-23230 Channel-BPSK



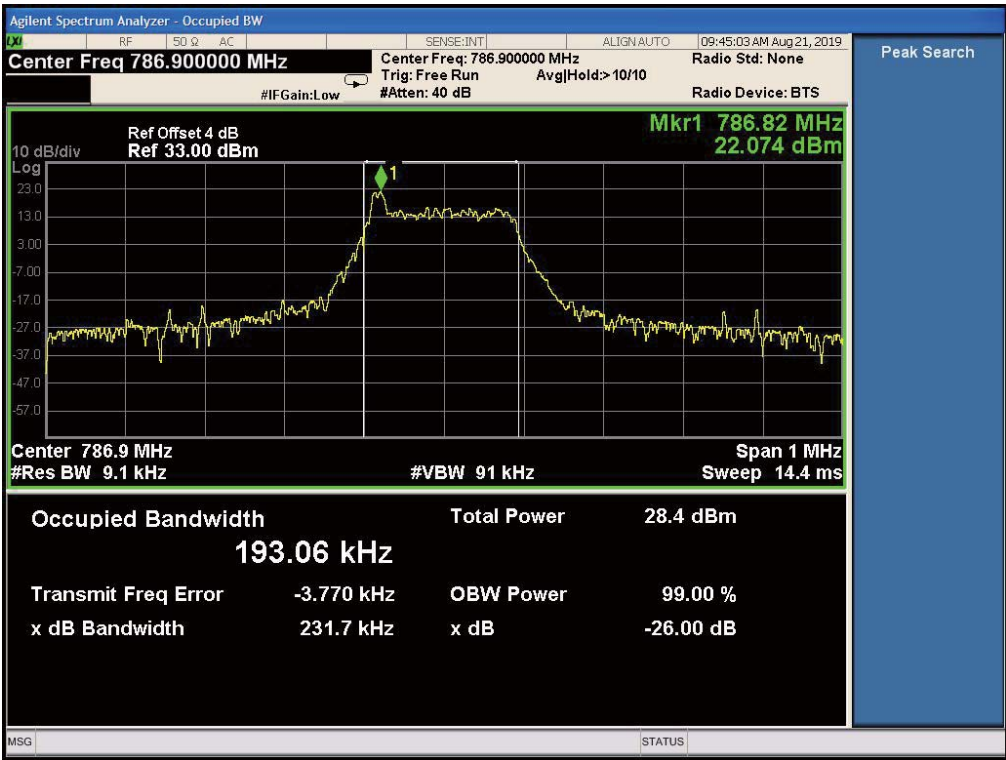
Band13-26dB OBW-23230 Channel-QPSK



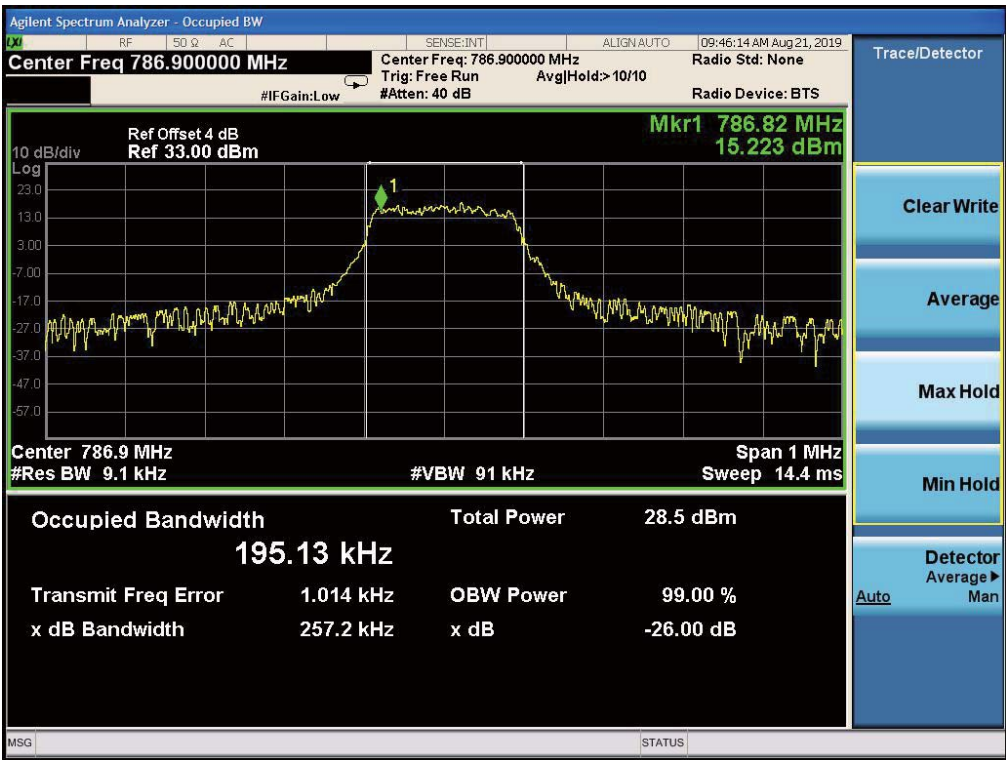
Band13-99% OBW-23230 Channel-BPSK



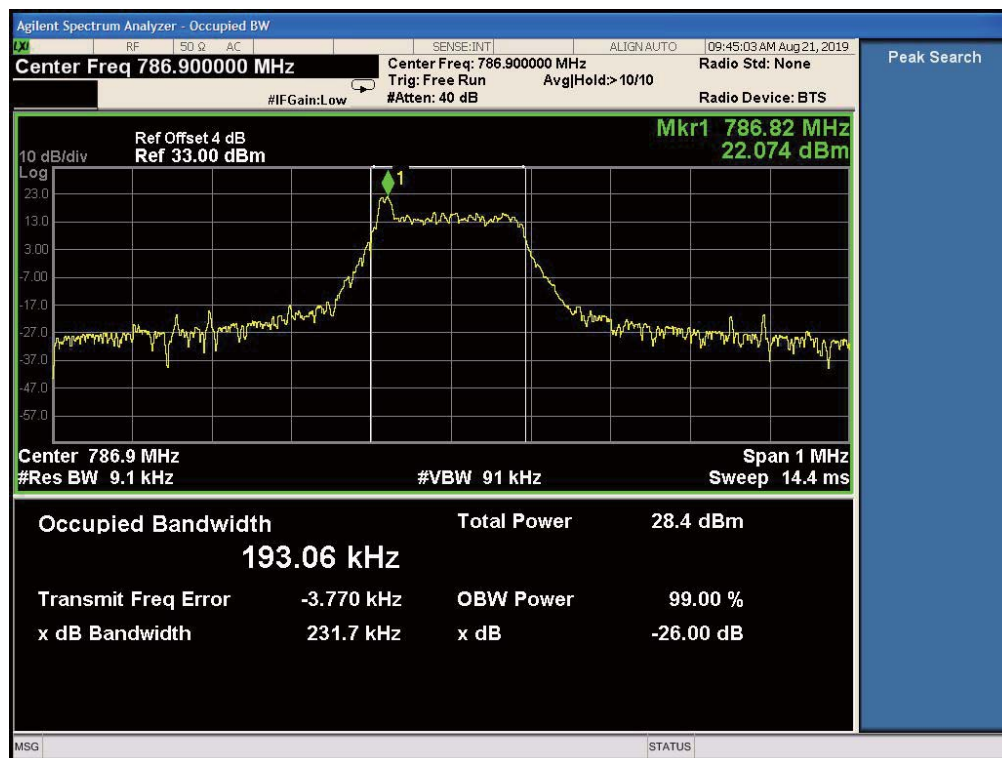
Band13-99% OBW-23095 Channel-QPSK



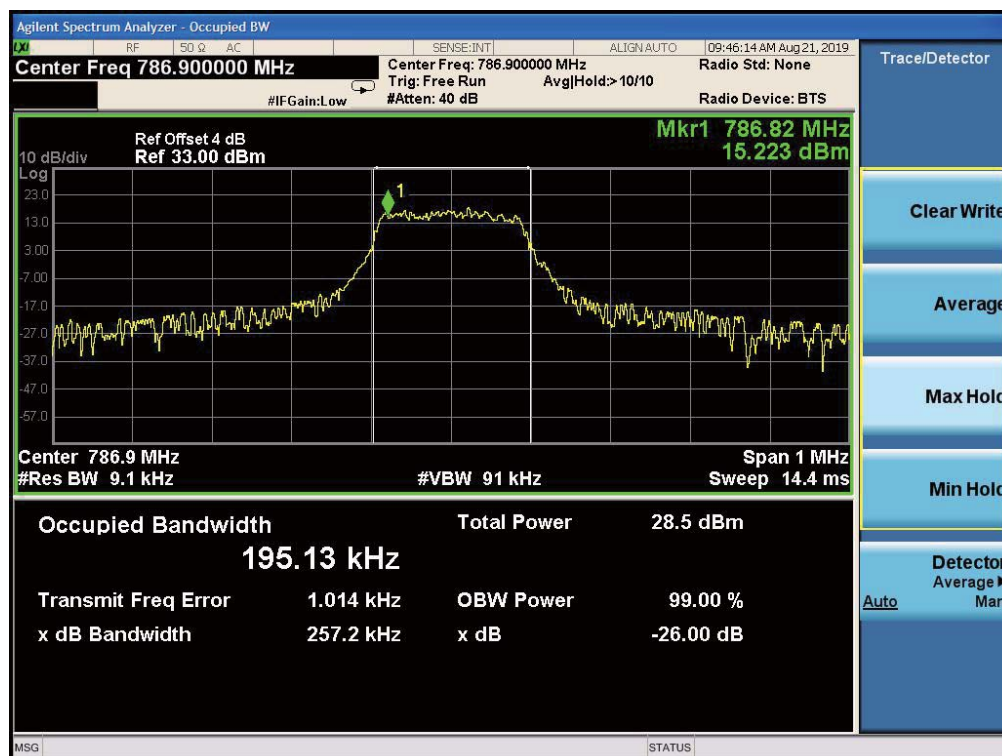
Band13-26dB OBW-23279 Channel-BPSK



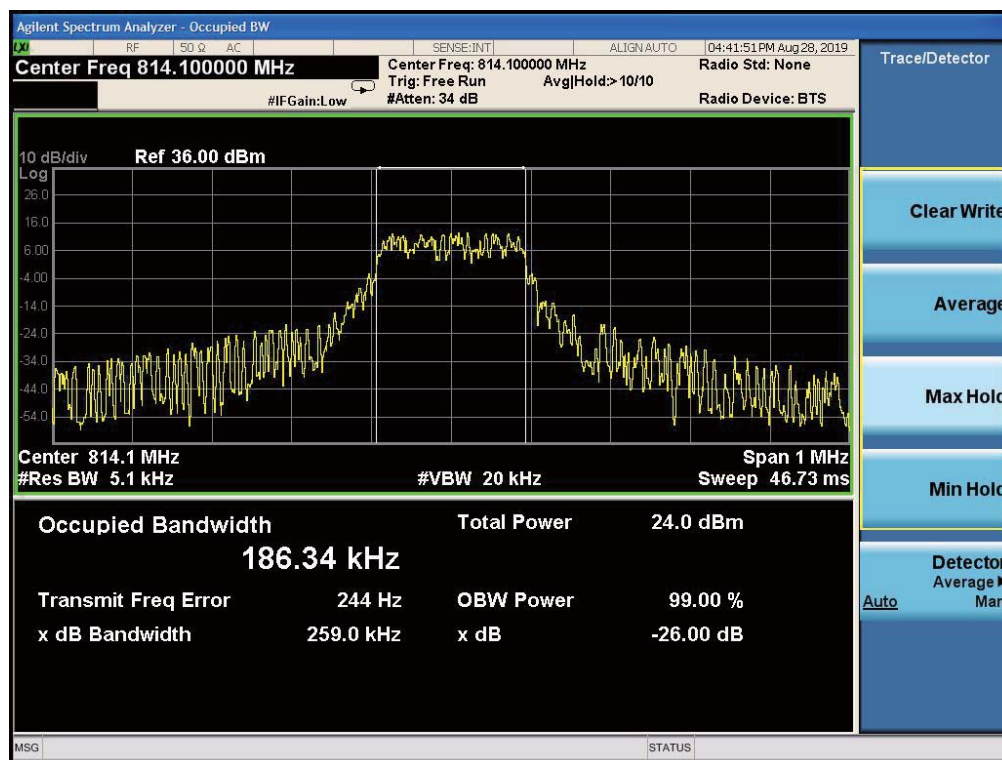
Band13-26dB OBW-23279 Channel-QPSK



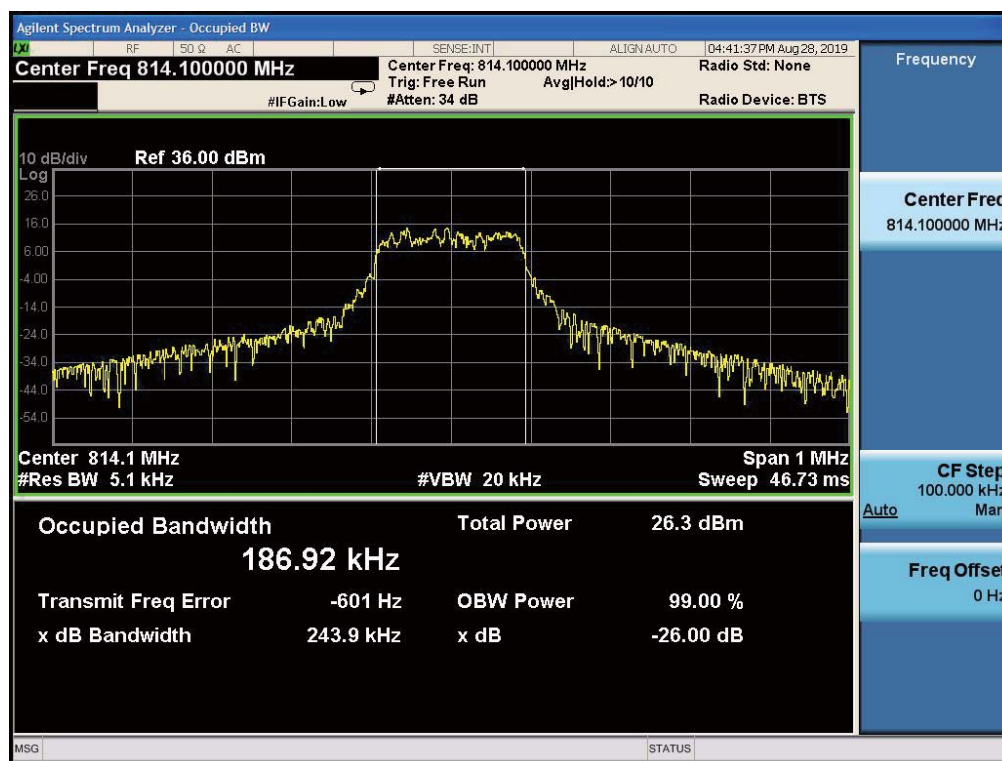
Band13-99% OBW-23279 Channel-BPSK



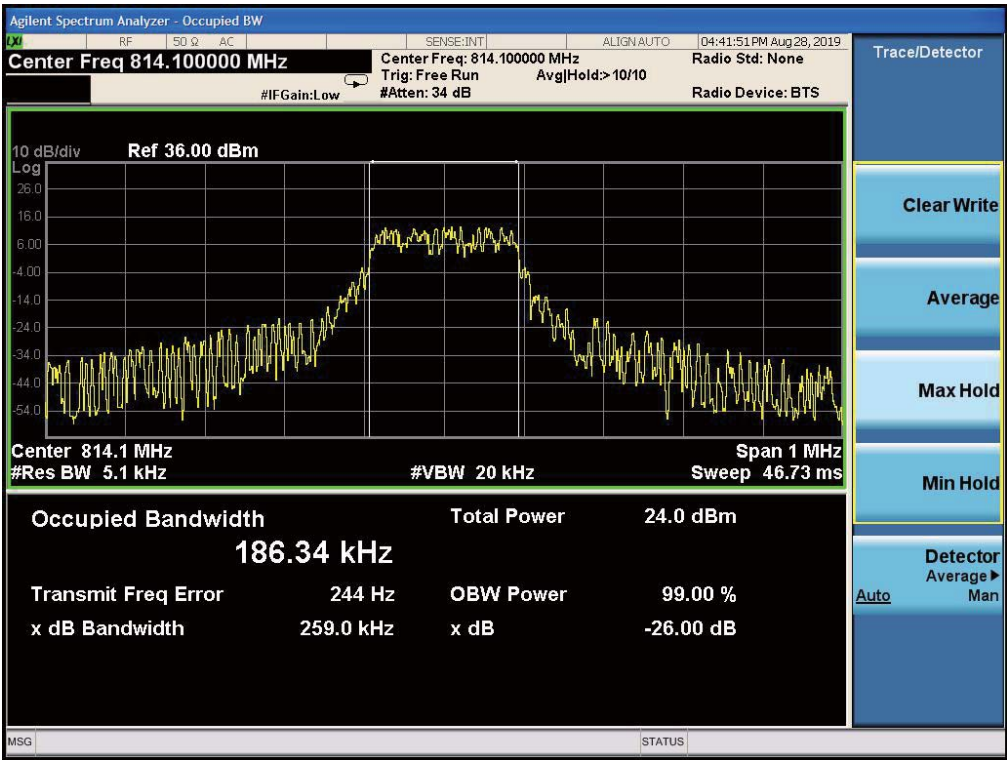
Band13-99% OBW-23279 Channel-QPSK



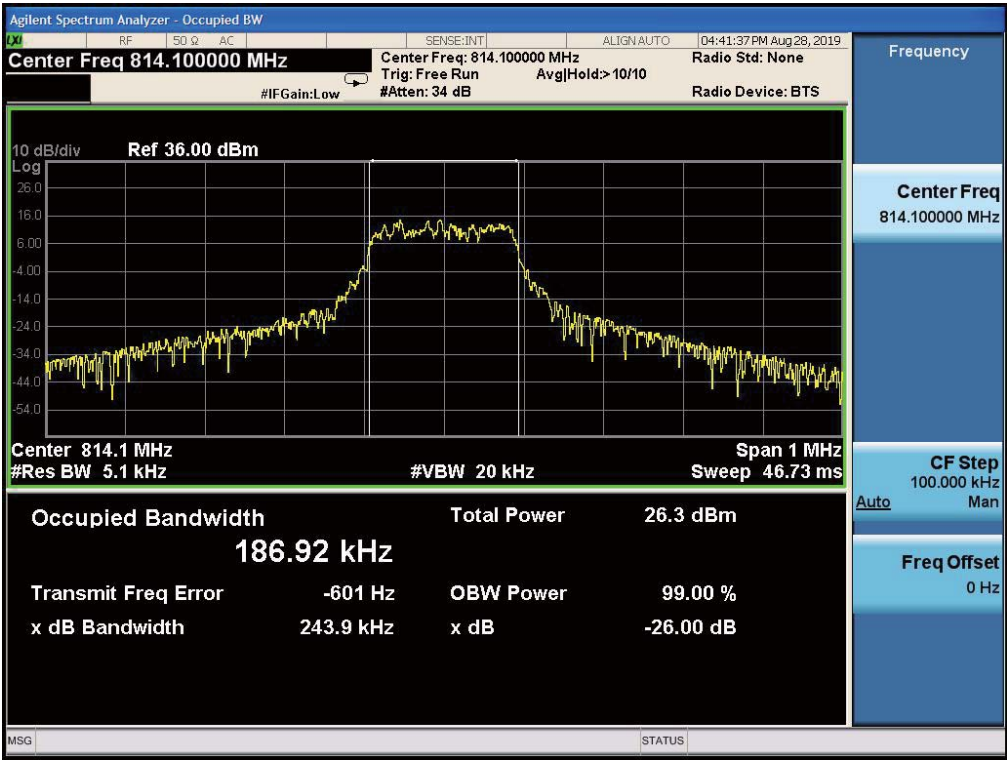
Band26-26dB OBW-26691 Channel-BPSK



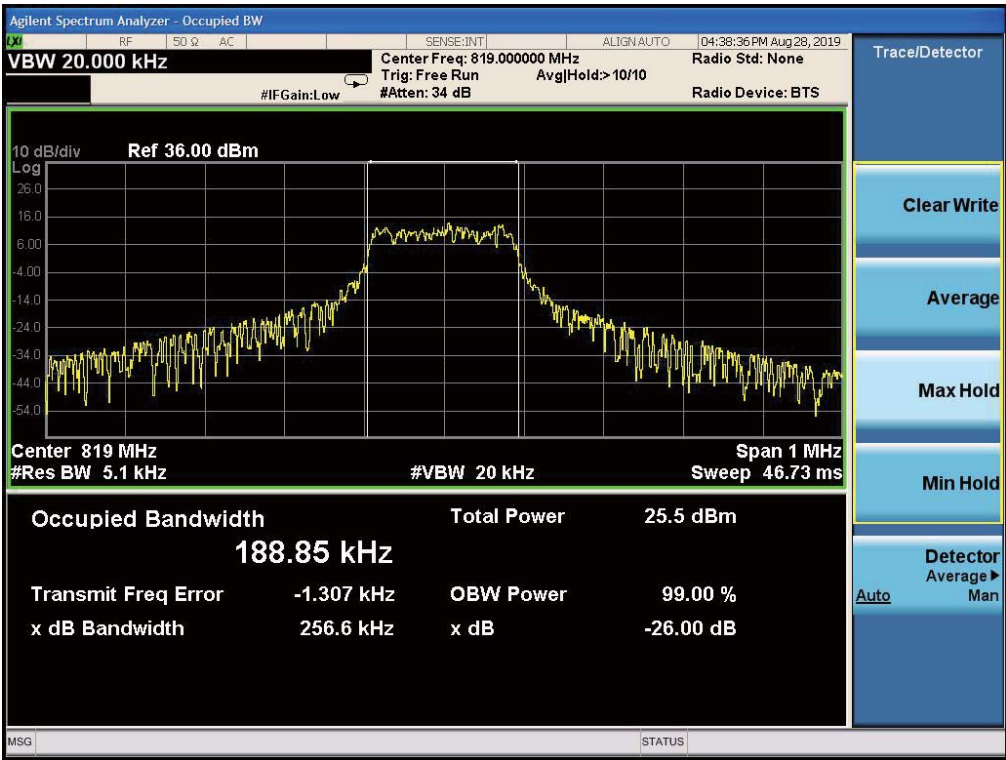
Band26-26dB OBW-26691 Channel-QPSK



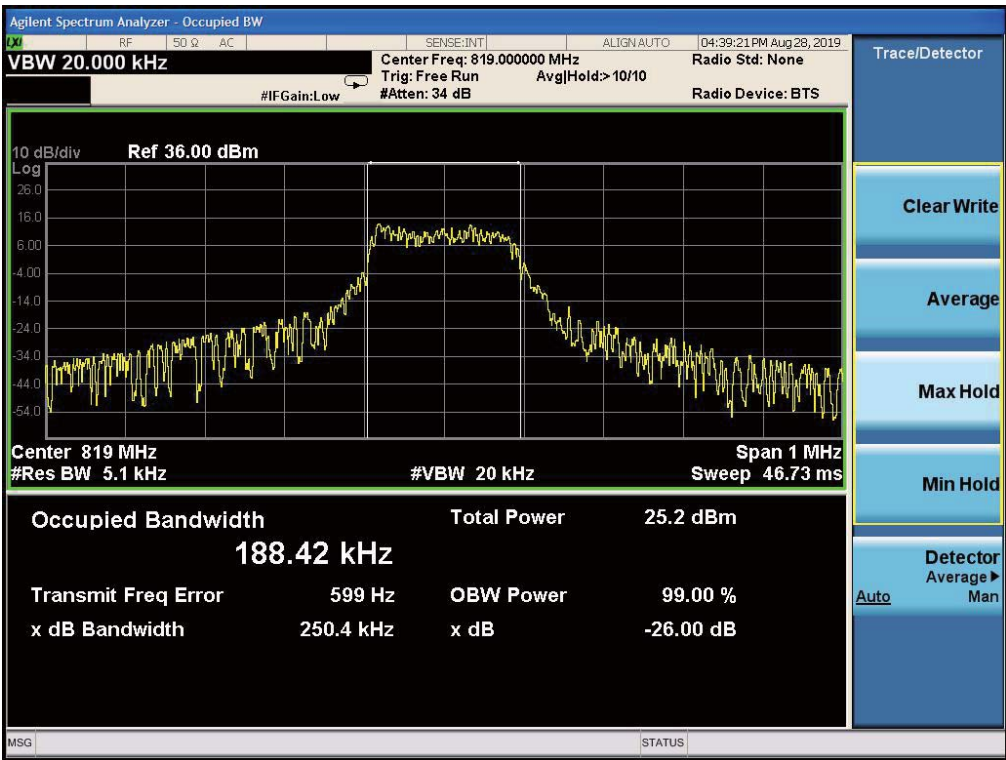
Band26-99% OBW-26691 Channel-BPSK



Band26-99% OBW-26691 Channel-QPSK



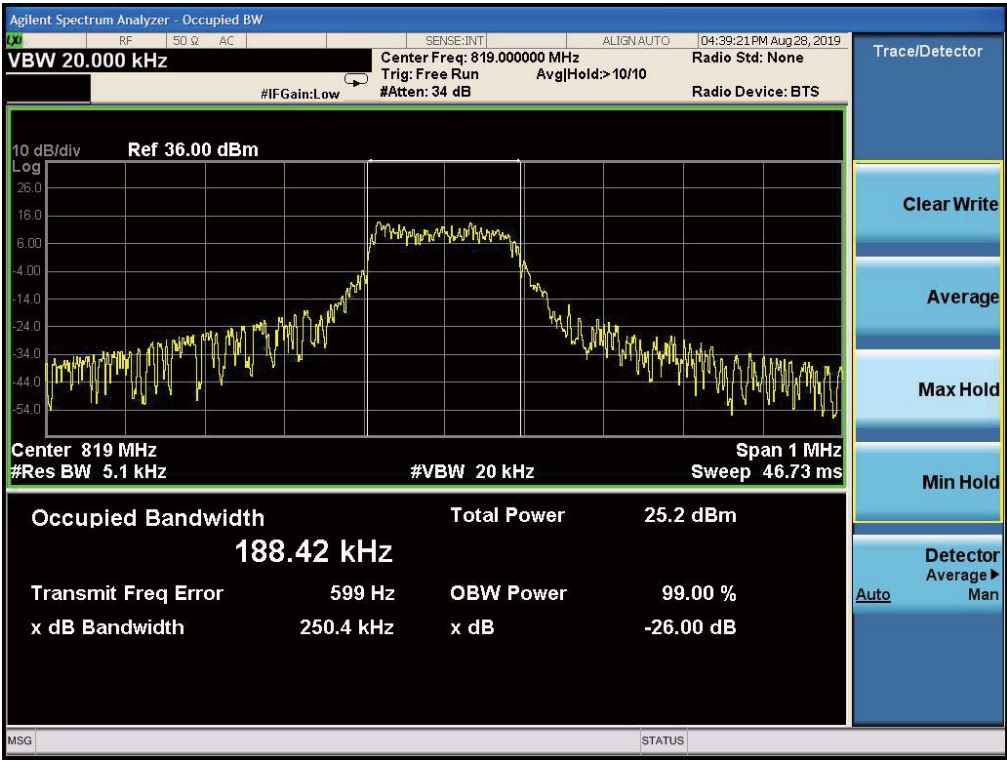
Band26-26dB OBW-26740 Channel-BPSK



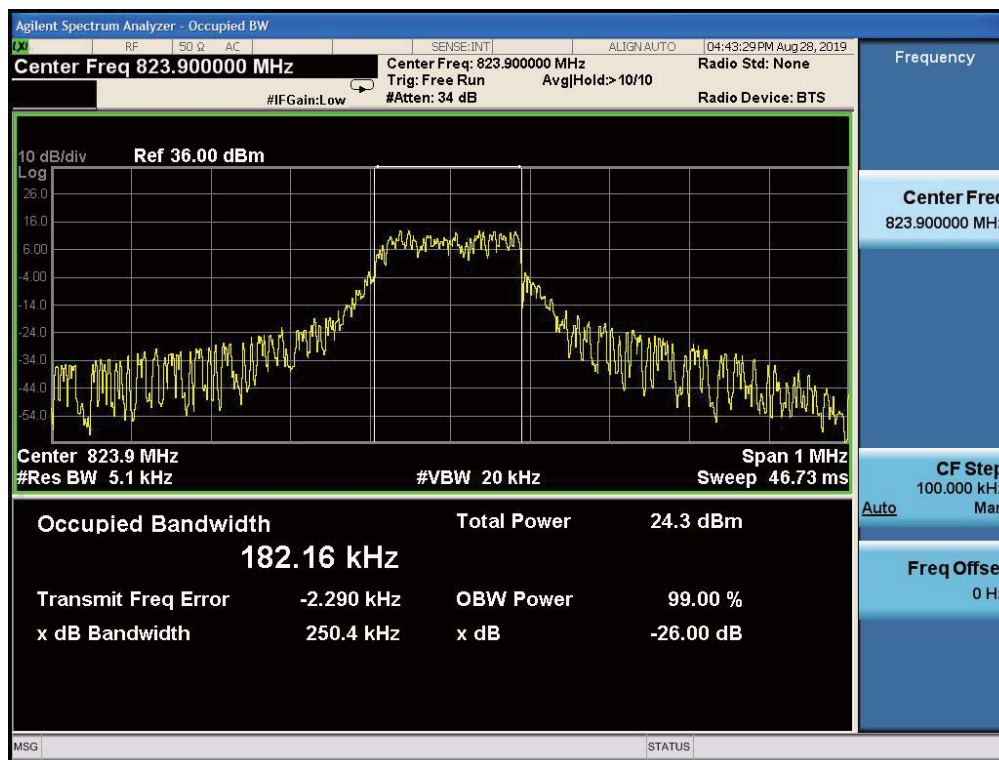
Band26-26dB OBW-26740 Channel-QPSK



Band26-99% OBW-26740 Channel-BPSK



Band26-99% OBW-26740 Channel-QPSK



Band26-26dB OBW-26789 Channel-BPSK



Band26-26dB OBW-26789 Channel-QPSK