

FCC Test Report (Part 96)

Report No.: RF180607D01-1

FCC ID: P27P208

Test Model: P208-TP

Received Date: Jun. 7, 2018

Test Date: Jul. 5 ~ 25, 2018

Issued Date: Jul. 30, 2018

Applicant: Sercomm Corp.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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**FCC Registration /
Designation Number:** 198487 / TW2021



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Release Control Record

Issue No.	Description	Date Issued
RF180607D01-1	Original release.	Jul. 30, 2018

1 Certificate of Conformity

Product: CBRS Outdoor Small Cell
Brand: Sercomm
Test Model: P208-TP
Sample Status: Engineering sample
Applicant: Sercomm Corp.
Test Date: Jul. 5 ~ 25, 2018
Standards: 47 CFR FCC Part 96

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Celia Chen , **Date:** Jul. 30, 2018
Celia Chen / Supervisor

Approved by : Rex Lai , **Date:** Jul. 30, 2018
Rex Lai / Associate Technical Manager

2 Summary of Test Results

47 CFR FCC Part 96			
FCC Clause	Test Item	Result	Remarks
2.1046 96.41(b)	Maximum Peak Output Power and Maximum EIRP	Pass	Meet the requirement of limit.
2.1046 96.41(b)	Maximum Power Spectral Density	Pass	Meet the requirement of limit.
2.1047 96.41(a)	Modulation characteristics	Pass	Meet the requirement.
96.41(g)	Peak to Average Ration	Pass	Meet the requirement of limit.
2.1049	Emission Bandwidth	Pass	Meet the requirement of limit.
2.1055	Frequency Stability	Pass	Meet the requirement of limit.
2.1051 96.41(e)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 96.41(e)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -1.03dB at 7250.04MHz.
2.1046 96.41(c)(1)	Transmit Power Control (TPC)	Pass	Meet the requirement.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1GHz	5.54 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.48 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	CBRS Outdoor Small Cell	
Brand	Sercomm	
Test Model	P208-TP	
Status of EUT	Engineering sample	
Power Supply Rating	48Vdc from PoE	
Modulation Type	QPSK, 16QAM, 64QAM	
Operating Frequency	Channel Bandwidth 5MHz	TX: 3552.5 ~ 3697.5 MHz
		RX: 3552.5 ~ 3697.5 MHz
	Channel Bandwidth 10MHz	TX: 3555 ~ 3695 MHz
		RX: 3555 ~ 3695 MHz
	Channel Bandwidth 15MHz	TX: 3557.5 ~ 3692.5 MHz
		RX: 3557.5 ~ 3692.5 MHz
	Channel Bandwidth 20MHz	TX: 3560 ~ 3690 MHz
		RX: 3560 ~ 3690 MHz
Channel Bandwidth	5MHz, 10MHz, 15MHz & 20MHz	
Max. EIRP Power	Channel Bandwidth 5MHz	32.72 dBm
	Channel Bandwidth 10MHz	32.74 dBm
	Channel Bandwidth 15MHz	32.73 dBm
	Channel Bandwidth 20MHz	32.71 dBm
Emission Designator	Channel Bandwidth 5MHz	QPSK: 4M49G7D
		16QAM: 4M50D7W
		64QAM: 4M50D7W
	Channel Bandwidth 10MHz	QPSK: 8M96G7D
		16QAM: 8M94D7W
		64QAM: 8M96D7W
	Channel Bandwidth 15MHz	QPSK: 13M4G7D
		16QAM: 13M4D7W
		64QAM: 13M4D7W
	Channel Bandwidth 20MHz	QPSK: 17M9G7D
		16QAM: 17M9D7W
		64QAM: 17M9D7W
Antenna Type	Refer to note as below	
Antenna Connector	Refer to note as below	
Accessory Device	N/A	
Data Cable Supplied	N/A	

Note:

1. The antennas provided to the EUT, please refer to the following table:

Antenna	Brand	Model	Antenna Type	Antenna Connector	Antenna Gain (dBi)	Frequency Range
Chain 0	Sercomm	617210UG	Patch	IPEX	7.62	3.5~3.7GHz
Chain 1	Sercomm	617210UG	Patch	IPEX	7.16	3.5~3.7GHz

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

Channel Bandwidth (MHz)	Channel
5	Low
	Middle
	High
10	Low
	Middle
	High
15	Low
	Middle
	High
20	Low
	Middle
	High

3.2.1 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports

The worst case was found when positioned on X-plane. Following channel(s) was (were) selected for the final test as listed below:

Test Item	Available Channel (MHz)	Tested Channel (MHz)	Channel Bandwidth	Modulation
EIRP	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK, 16QAM, 64QAM
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK, 16QAM, 64QAM
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK, 16QAM, 64QAM
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK, 16QAM, 64QAM
Modulation Characteristics	3552.5 to 3697.5	3625	5MHz	QPSK, 16QAM, 64QAM
Frequency Stability	3552.5 to 3697.5	3625	5MHz	QPSK
	3555 to 3695	3625	10MHz	QPSK
	3557.5 to 3692.5	3625	15MHz	QPSK
	3560 to 3690	3625	20MHz	QPSK
Occupied Bandwidth	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK, 16QAM, 64QAM
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK, 16QAM, 64QAM
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK, 16QAM, 64QAM
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK, 16QAM, 64QAM
Peak to Average Ratio	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK
Radiated Emission	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK
Conducted Emission	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK

NOTE: All supported modulation types were evaluated. The Worst case of QPSK was selected. Therefore, the Frequency Stability, Peak to Average Ratio, Conducted Emission and Radiated Emission were presented under QPSK mode only.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
EIRP	28deg. C, 78%RH	120Vac, 60Hz	Ian Chang
Modulation Characteristics	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Frequency Stability	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Occupied Bandwidth	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Peak to Average Ratio	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Conducted Emission	20deg. C, 76%RH	120Vac, 60Hz	Saxon Lee
Radiated Emission	28deg. C, 78%RH	120Vac, 60Hz	Ian Chang

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook PC	ASUS	PU401L	E9NXBC002007372	FCC DoC Approved	Provided by Lab
B.	PoE Adapter	Lea	NetPower1800NEMA-A	MFG10108-0B	FCC DoC Approved	Supplied by client

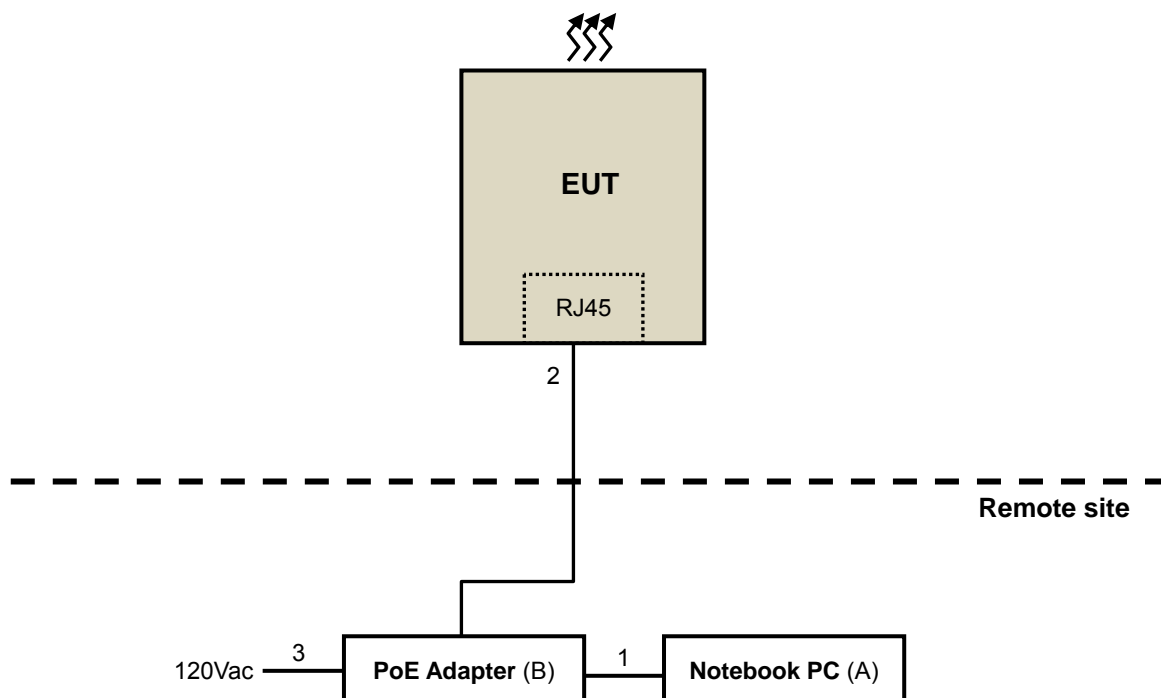
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items A-B acted as communication partners to transfer data.
3. The rating of support unit B as follows:
 Input: 120Vac, 60Hz, 0.6A
 Output: 54Vdc, 0.6A

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN cable	1	1.6	N	0	Supplied by client
2.	LAN cable	1	10	N	0	Provided by Lab
3.	AC power cord	1	1.8	N	0	Provided by Lab

Note: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 96

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 940660 D01 Part 96 CBRS Equipment v01

KDB 552295 CBP Guidance for 3650-3700 Band v03

ANSI/TIA/EIA-603-E 2016

ANSI C63.26-2015

All test items have been performed and recorded as per the above standards.

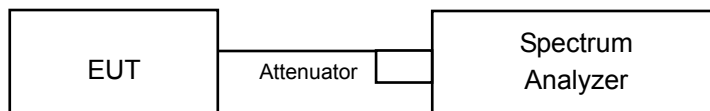
4 Test Types and Results

4.1 Maximum EIRP Measurement

4.1.1 Limits of Maximum EIRP Measurement

Device		Maximum EIRP (dBm/10 MHz)
<input type="checkbox"/>	End User Device	23
<input type="checkbox"/>	Category A CBSD	30
<input checked="" type="checkbox"/>	Category B CBSD	47

4.1.2 Test Setup



4.1.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 21, 2018	Feb. 20, 2019
HP Preamplifier	8449B	3008A01201	Feb. 22, 2018	Feb. 21, 2019
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2018	Feb. 20, 2019
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 6, 2018	Feb. 5, 2019
Schwarzbeck Antenna	VULB 9168	139	Nov. 29, 2017	Nov. 28, 2018
Schwarzbeck Antenna	VHBA 9123	480	May 19, 2017	May 18, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 1, 2017	Nov. 30, 2018
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Dec. 1, 2017	Nov. 30, 2018
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF104	CABLE-CH6	Aug. 14, 2017	Aug. 13, 2018
SUHNER RF cable With 3dB PAD	SF102	Cable-CH8-3.6m	Aug. 14, 2017	Aug. 13, 2018
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	Jun. 4, 2018	Jun. 3, 2019
KEYSIGHT Spectrum Analyzer	N9030A	MY55410176	July 06, 2018	July 05, 2019
Loop Antenna EMCI	LPA600	270	Aug. 11, 2017	Aug. 10, 2019
EMCO Horn Antenna	3115	00028257	Nov. 30, 2017	Nov. 29, 2018
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 29, 2017	Sep. 28, 2018
Anritsu Power Sensor	MA2411B	0738404	Apr. 26, 2018	Apr. 25, 2019
Anritsu Power Meter	ML2495A	0842014	Apr. 26, 2018	Apr. 25, 2019
Temperature & Humidity Chamber	MHU-225AU	920409	May 25, 2018	May 24, 2019
DIGITAL POWER METER IDRC	CP-240	240515	Sep. 8, 2017	Sep. 9, 2018
AC Power Source ExTech	CFW-105	E000603	NA	NA
Programable DC Source IDRC	DSP-030-025HD	500155	Jul. 13, 2018	Jul. 12, 2019

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 3. The test was performed in Chamber No. 6.
 4. The Industry Canada Reference No. IC 7450E-6.

4.1.4 Test Procedures

1. Connect the DUT transmitter output to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set span to $2 \times$ to $3 \times$ the OBW.
3. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
4. Set VBW $\geq 3 \times$ RBW.
5. Set number of points in sweep $\geq 2 \times$ span / RBW.
6. Sweep time = auto-couple.
7. Detector = RMS (power averaging).
8. If the EUT can be configured to transmit continuously (i.e., burst duty cycle $\geq 98\%$), then set the trigger to free run.
9. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle $< 98\%$), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
10. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
11. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

4.1.5 Deviation from Test Standard

No deviation.

4.1.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.1.7 Test Results

Channel	Freq. (MHz)	5MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3552.5	22.04	22.08	25.07	32.69	47.0	Pass
Middle	3625	22.06	22.09	25.09	32.71	47.0	Pass
High	3697.5	22.05	22.12	25.10	32.72	47.0	Pass
Channel	Freq. (MHz)	5MHz				Limit(dBm)	Pass /Fail
		16QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3552.5	22.02	22.08	25.06	32.68	47.0	Pass
Middle	3625	22.04	22.06	25.06	32.68	47.0	Pass
High	3697.5	22.02	22.09	25.07	32.69	47.0	Pass
Channel	Freq. (MHz)	5MHz				Limit(dBm)	Pass /Fail
		64QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3552.5	22.01	22.04	25.04	32.66	47.0	Pass
Middle	3625	22.00	22.02	25.02	32.64	47.0	Pass
High	3697.5	22.04	22.05	25.06	32.68	47.0	Pass

Channel	Freq. (MHz)	10MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3555	22.07	22.12	25.11	32.73	47.0	Pass
Middle	3625	22.06	22.09	25.09	32.71	47.0	Pass
High	3695	22.09	22.12	25.12	32.74	47.0	Pass
Channel	Freq. (MHz)	10MHz				Limit(dBm)	Pass /Fail
		16QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3555	22.07	22.08	25.09	32.71	47.0	Pass
Middle	3625	22.02	22.07	25.06	32.68	47.0	Pass
High	3695	22.08	22.09	25.10	32.72	47.0	Pass
Channel	Freq. (MHz)	10MHz				Limit(dBm)	Pass /Fail
		64QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3555	22.00	22.05	25.04	32.66	47.0	Pass
Middle	3625	22.00	22.07	25.05	32.67	47.0	Pass
High	3695	22.03	22.08	25.07	32.69	47.0	Pass

Channel	Freq. (MHz)	15MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3557.5	22.06	22.13	25.11	32.73	47.0	Pass
Middle	3625	22.01	22.06	25.05	32.67	47.0	Pass
High	3692.5	22.06	22.14	25.11	32.73	47.0	Pass
Channel	Freq. (MHz)	15MHz				Limit(dBm)	Pass /Fail
		16QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3557.5	22.05	22.06	25.07	32.69	47.0	Pass
Middle	3625	22.00	22.04	25.03	32.65	47.0	Pass
High	3692.5	22.08	22.08	25.09	32.71	47.0	Pass
Channel	Freq. (MHz)	15MHz				Limit(dBm)	Pass /Fail
		64QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3557.5	22.02	22.08	25.06	32.68	47.0	Pass
Middle	3625	22.00	22.05	25.04	32.66	47.0	Pass
High	3692.5	22.05	22.07	25.07	32.69	47.0	Pass

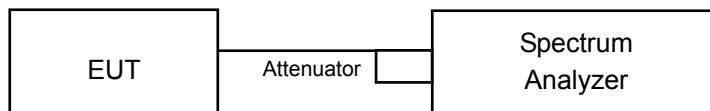
Channel	Freq. (MHz)	20MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3560	22.04	22.09	25.08	32.70	47.0	Pass
Middle	3625	22.00	22.06	25.04	32.66	47.0	Pass
High	3690	22.06	22.10	25.09	32.71	47.0	Pass
Channel	Freq. (MHz)	20MHz				Limit(dBm)	Pass /Fail
		16QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3560	22.00	22.08	25.05	32.67	47.0	Pass
Middle	3625	22.00	22.03	25.03	32.65	47.0	Pass
High	3690	22.03	22.08	25.07	32.69	47.0	Pass
Channel	Freq. (MHz)	20MHz				Limit(dBm)	Pass /Fail
		64QAM					
		Conducted Average Power (dBm/10MHz)			Gain(dBi)	7.62	
		Chain 0	Chain 1	Total	EIRP		
Low	3560	21.99	22.05	25.03	32.65	47.0	Pass
Middle	3625	21.95	22.02	25.00	32.62	47.0	Pass
High	3690	22.02	22.04	25.04	32.66	47.0	Pass

4.2 Maximum Power Spectral Density Measurement

4.2.1 Limits of Maximum Power Spectral Density Measurement

Device		Maximum PSD (dBm/MHz)
<input type="checkbox"/>	End User Device	n/a
<input type="checkbox"/>	Category A CBSD	20
<input checked="" type="checkbox"/>	Category B CBSD	37

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.2.4 Test Procedure

1. Connect the transmitter to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set instrument center frequency to OBW center frequency.
3. Set span to $2 \times$ to $3 \times$ the OBW.
4. Set the RBW to the specified reference bandwidth (often 1 MHz).
5. Set VBW $\geq 3 \times$ RBW.
6. Detector = RMS (power averaging).
7. Ensure that the number of measurement points in the sweep $\geq 2 \times$ span/RBW.
8. Sweep time = auto couple.
9. Employ trace averaging (RMS) mode over a minimum of 100 traces.
10. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

Channel	Freq. (MHz)	5MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Power Density (dBm/MHz)			Gain(dBi)	10.63	
		Chain 0	Chain 1	Total	Power Density	Maximum	
Low	3552.5	15.53	15.59	18.57	29.20	37.0	Pass
Middle	3625	15.55	15.58	18.58	29.21	37.0	Pass
High	3697.5	15.58	15.63	18.62	29.25	37.0	Pass

Note: Directional gain = 7.62dBi + 10log(2) = 10.63dBi

Channel	Freq. (MHz)	10MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Power Density (dBm/MHz)			Gain(dBi)	10.63	
		Chain 0	Chain 1	Total	Power Density	Maximum	
Low	3555	15.57	15.58	18.59	29.22	37.0	Pass
Middle	3625	15.54	15.58	18.57	29.20	37.0	Pass
High	3695	15.61	15.63	18.63	29.26	37.0	Pass

Note: Directional gain = 7.62dBi + 10log(2) = 10.63dBi

Channel	Freq. (MHz)	15MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Power Density (dBm/MHz)			Gain(dBi)	10.63	
		Chain 0	Chain 1	Total	Power Density	Maximum	
Low	3557.5	15.53	15.62	18.59	29.22	37.0	Pass
Middle	3625	15.51	15.58	18.56	29.19	37.0	Pass
High	3692.5	15.58	15.65	18.63	29.26	37.0	Pass

Note: Directional gain = 7.62dBi + 10log(2) = 10.63dBi

Channel	Freq. (MHz)	20MHz				Limit(dBm)	Pass /Fail
		QPSK					
		Conducted Power Density (dBm/MHz)			Gain(dBi)	10.63	
		Chain 0	Chain 1	Total	Power Density	Maximum	
Low	3560	15.52	15.55	18.55	29.18	37.0	Pass
Middle	3625	15.46	15.56	18.52	29.15	37.0	Pass
High	3690	15.57	15.61	18.60	29.23	37.0	Pass

Note: Directional gain = 7.62dBi + 10log(2) = 10.63dBi

4.3 Modulation Characteristics Measurement

4.3.1 Limits of Modulation Characteristics

N/A

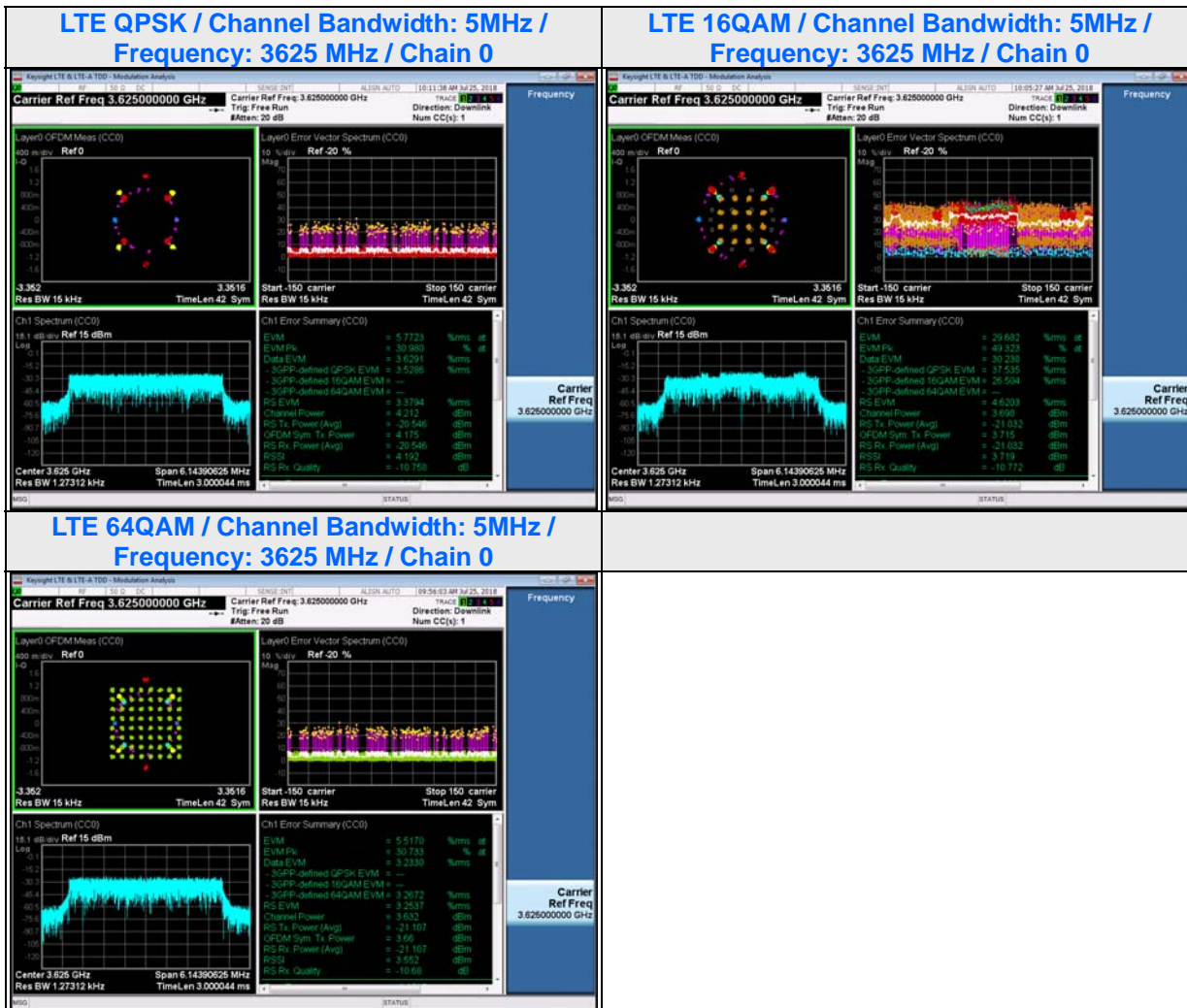
4.3.2 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

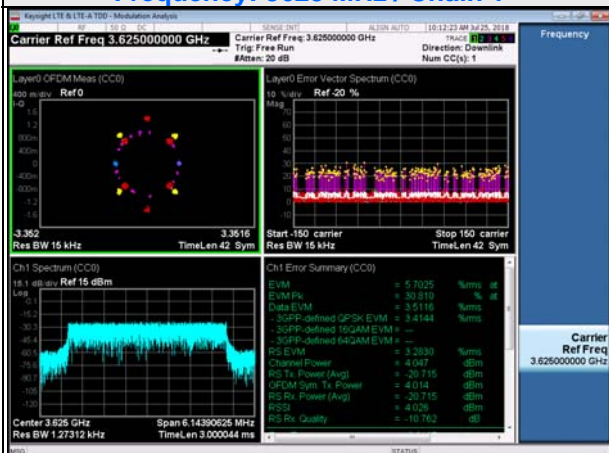
4.3.3 Test Setup



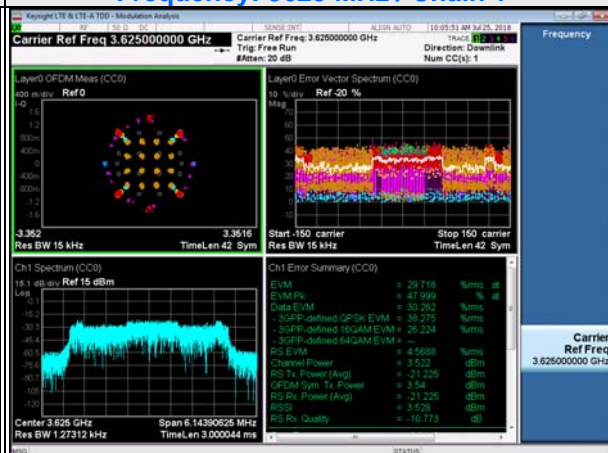
4.3.4 Test Results



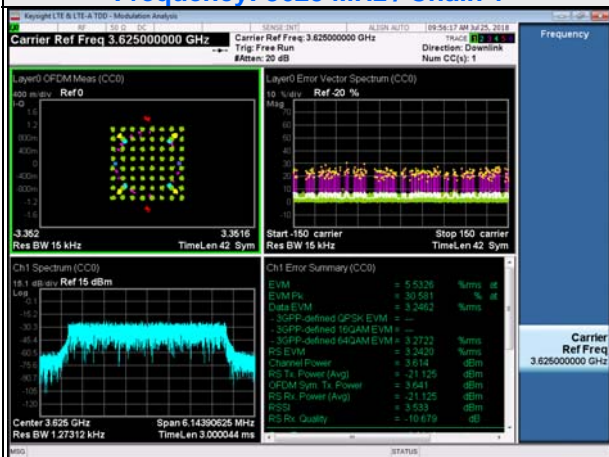
LTE QPSK / Channel Bandwidth: 5MHz / Frequency: 3625 MHz / Chain 1



LTE 16QAM / Channel Bandwidth: 5MHz / Frequency: 3625 MHz / Chain 1



LTE 64QAM / Channel Bandwidth: 5MHz / Frequency: 3625 MHz / Chain 1



4.4 Frequency Stability Measurement

4.4.1 Limits of Frequency Stability Measurement

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency band.

4.4.2 Test Procedure

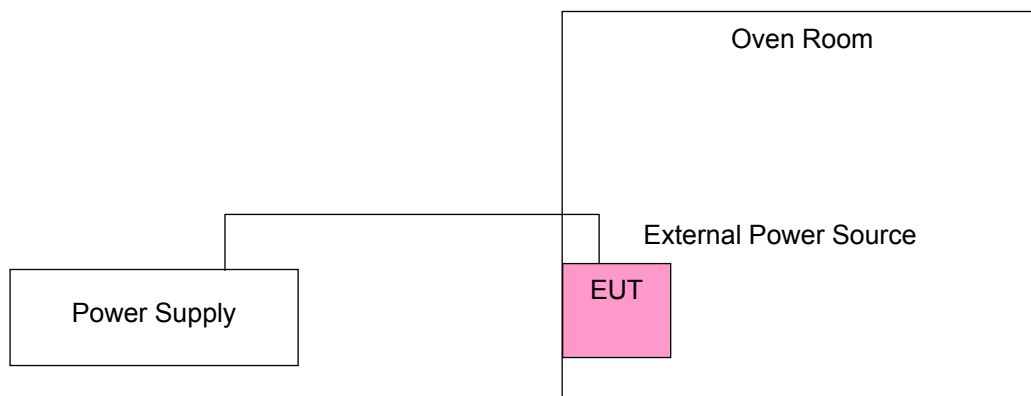
- a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- b. EUT is connected the external power supply to control the AC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

NOTE: The frequency error was recorded frequency error from the communication simulator.

4.4.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.4.4 Test Setup



4.4.5 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	Frequency Error (MHz)				Pass/Fail
	5MHz	10MHz	15MHz	20MHz	
102	3625.000042	3625.000039	3625.000037	3625.000041	Pass
120	3625.000039	3625.000036	3625.000035	3625.000042	Pass
138	3625.000035	3625.000041	3625.000029	3625.000033	Pass

Frequency Error vs. Temperature.

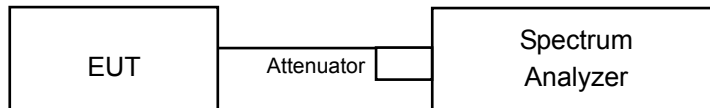
TEMP. (°C)	Frequency Error (MHz)				Pass/Fail
	5MHz	10MHz	15MHz	20MHz	
75	3625.000034	3625.000036	3625.000036	3625.000032	Pass
70	3625.000029	3625.000041	3625.000042	3625.000028	Pass
60	3625.000035	3625.000035	3625.000031	3625.000039	Pass
50	3625.000041	3625.000038	3625.000039	3625.000041	Pass
40	3625.000033	3625.000042	3625.000027	3625.000029	Pass
30	3625.000038	3625.000036	3625.000043	3625.000037	Pass
20	3625.000029	3625.000039	3625.000033	3625.000028	Pass
10	3625.000026	3625.000032	3625.000028	3625.000041	Pass
0	3625.000028	3625.000029	3625.000042	3625.000025	Pass
-10	3625.000031	3625.000027	3625.000035	3625.000028	Pass
-20	3625.000035	3625.000031	3625.000038	3625.000032	Pass
-30	3625.000027	3625.000026	3625.000032	3625.000029	Pass

4.5 Emission Bandwidth Measurement

4.5.1 Limit of Emission Bandwidth Measurement

Reference only

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.5.4 Test Procedure

Occupied Bandwidth:

All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

26dBc Bandwidth:

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW = 51 kHz (5 MHz bandwidth), RBW = 100 kHz (10 MHz bandwidth), RBW = 150 kHz (15 MHz bandwidth), RBW = 200 kHz (20 MHz bandwidth). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 Test Result (-26dB Bandwidth)

Channel	Freq. (MHz)	26dB Down Bandwidth (MHz)					
		5MHz					
		Chain 0			Chain 1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3552.5	4.89	4.93	4.89	4.88	4.90	4.90
Middle	3625	4.88	4.92	4.87	4.90	4.90	4.90
High	3697.5	4.89	4.88	4.87	4.91	4.89	4.88

Channel	Freq. (MHz)	26dB Down Bandwidth (MHz)					
		10MHz					
		Chain 0			Chain 1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3555	9.83	9.73	9.80	9.79	9.72	9.79
Middle	3625	9.77	9.63	9.66	9.64	9.56	9.64
High	3695	9.68	9.58	9.69	9.67	9.68	9.63

Channel	Freq. (MHz)	26dB Down Bandwidth (MHz)					
		15MHz					
		Chain 0			Chain 1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3557.5	14.53	14.48	14.50	14.51	14.27	14.49
Middle	3625	14.28	14.39	14.58	14.46	14.21	14.29
High	3692.5	14.38	14.25	14.06	14.24	14.25	14.61

Channel	Freq. (MHz)	26dB Down Bandwidth (MHz)					
		20MHz					
		Chain 0			Chain 1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3560	19.76	19.43	19.63	19.78	19.38	19.59
Middle	3625	19.28	19.35	19.31	19.10	19.45	19.68
High	3690	19.38	19.30	19.12	19.60	19.34	19.19

5MHz:

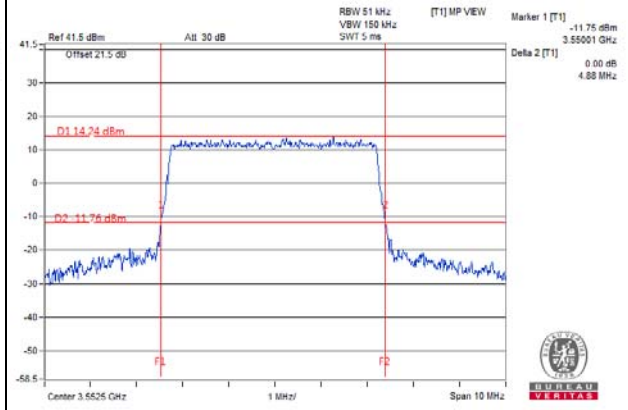
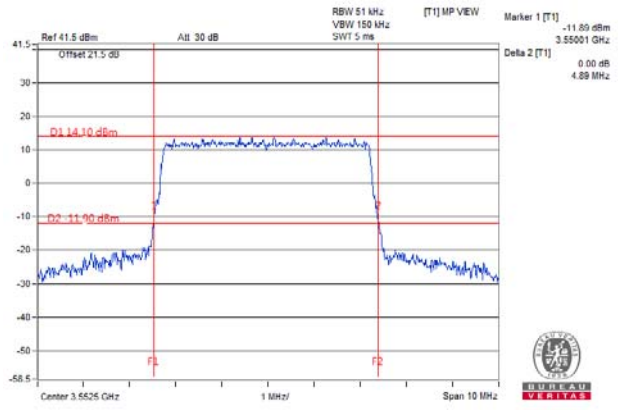
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

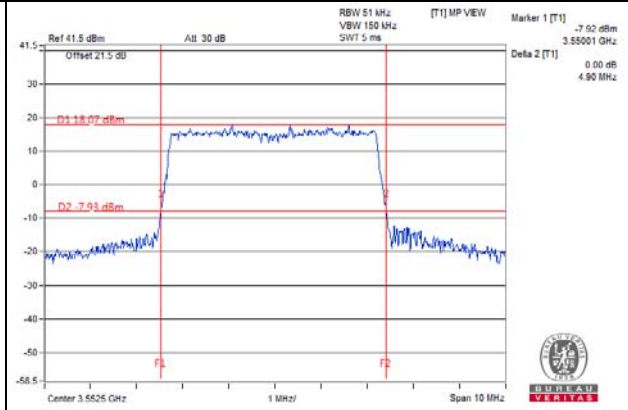
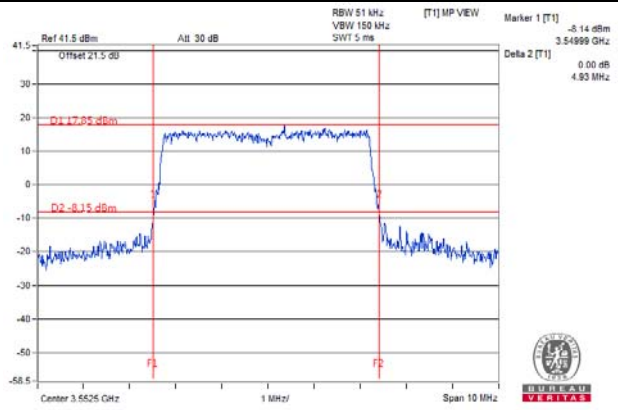
Chain (1)



16QAM

Chain (0)

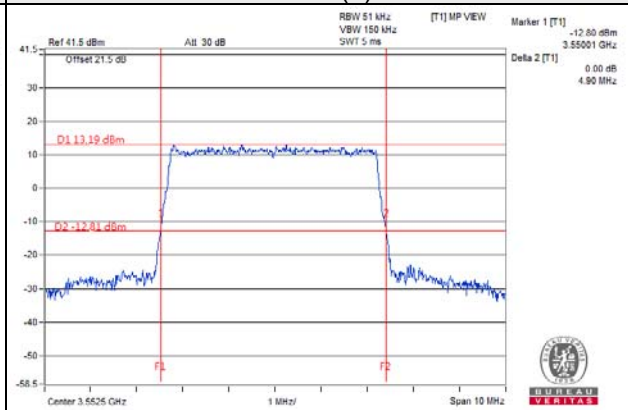
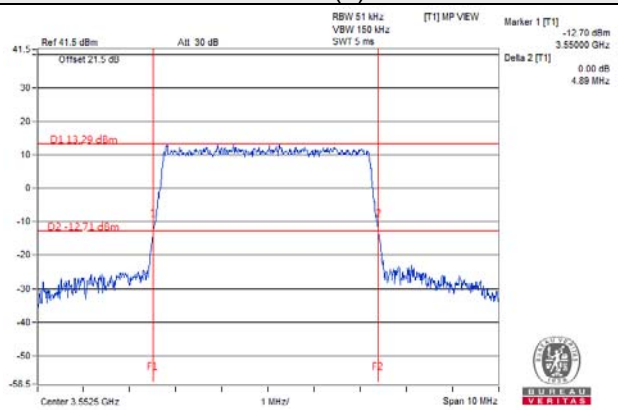
Chain (1)



64QAM

Chain (0)

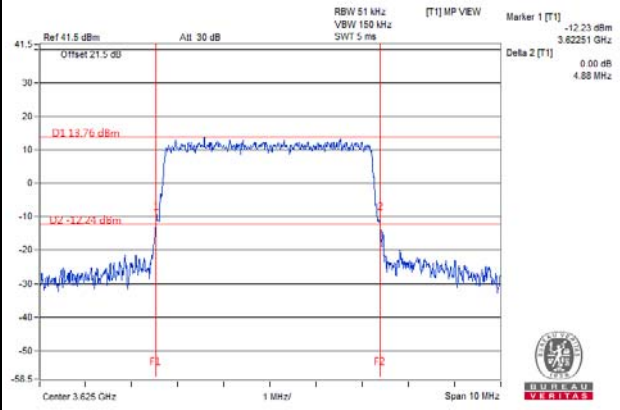
Chain (1)



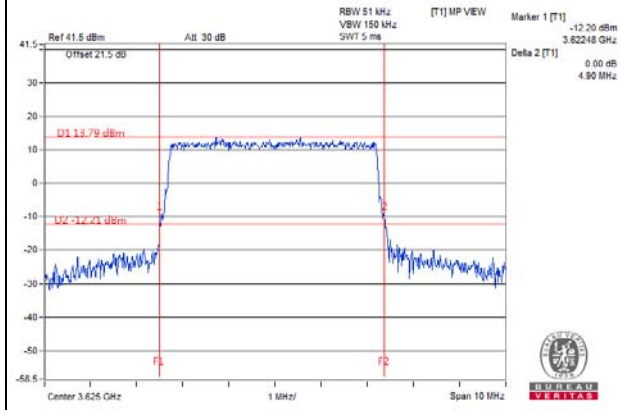
Spectrum Plot Of Worst Value

Middle
QPSK

Chain (0)

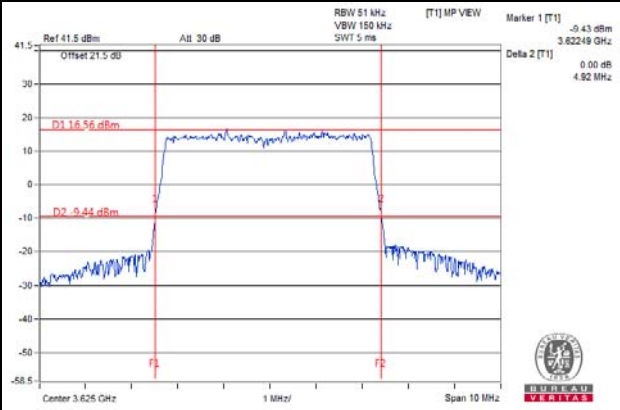


Chain (1)

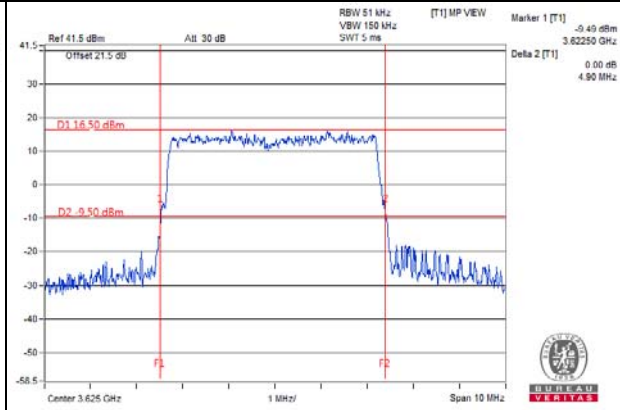


16QAM

Chain (0)

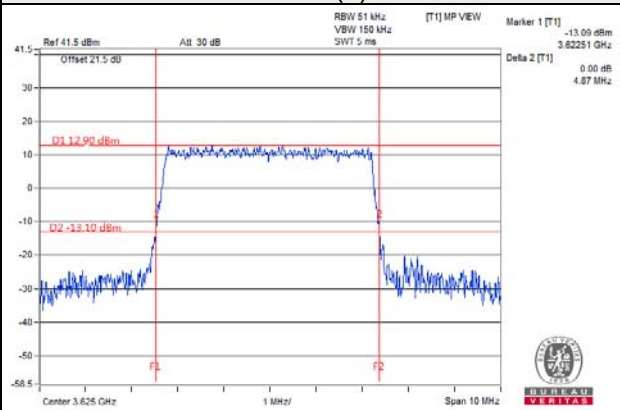


Chain (1)

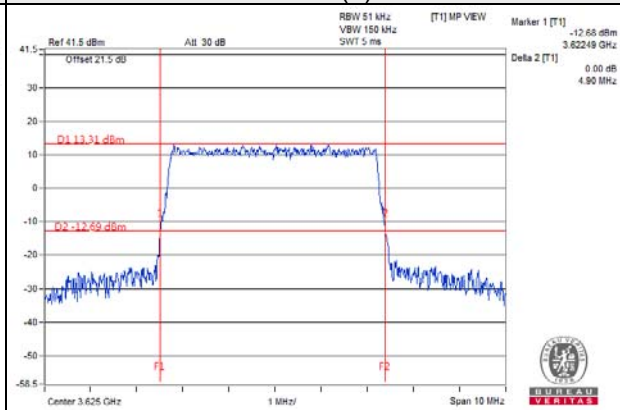


64QAM

Chain (0)



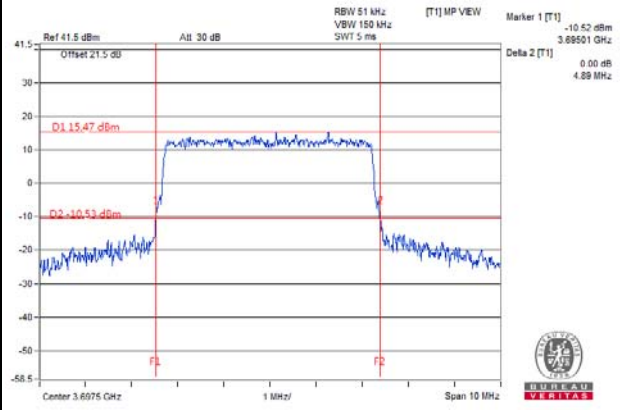
Chain (1)



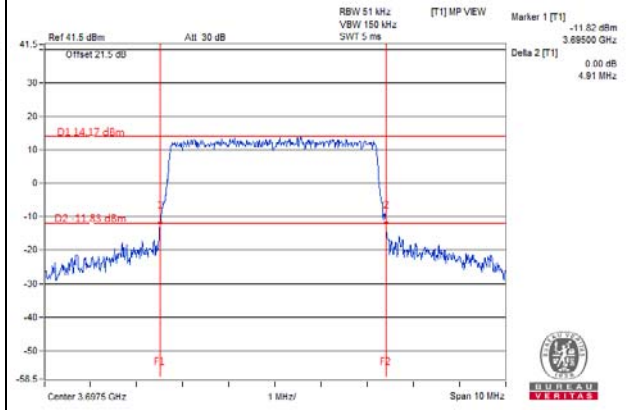
Spectrum Plot Of Worst Value

High QPSK

Chain (0)

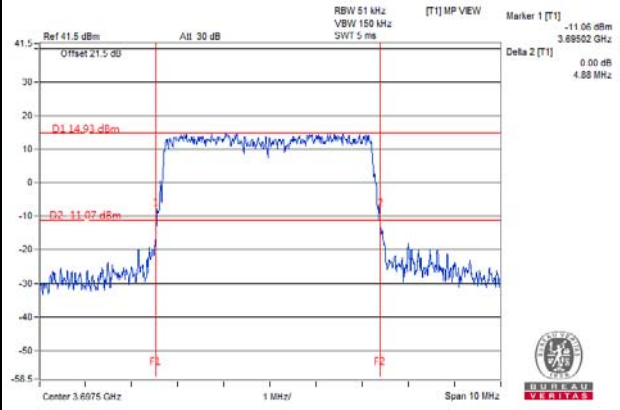


Chain (1)

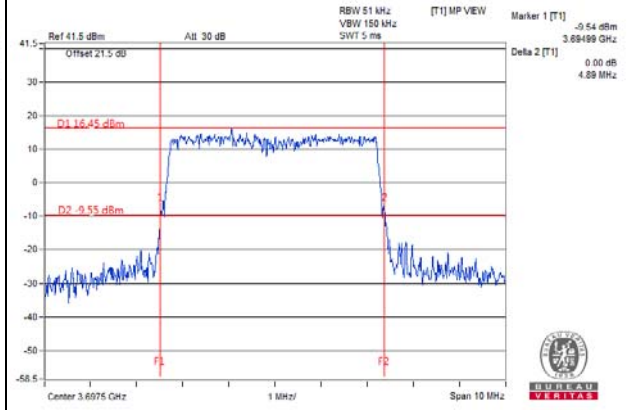


16QAM

Chain (0)

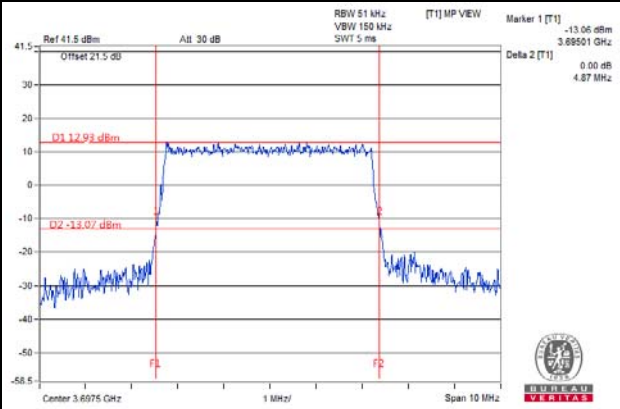


Chain (1)

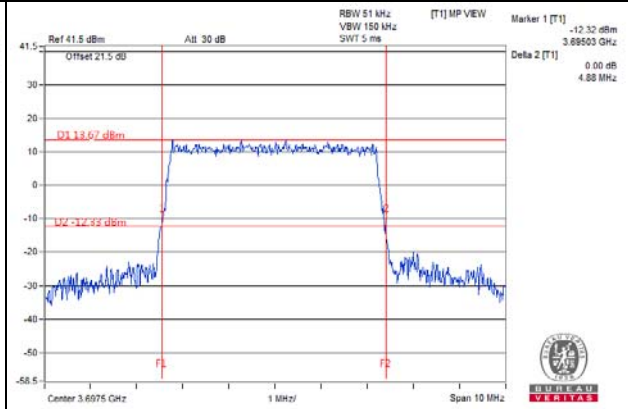


64QAM

Chain (0)



Chain (1)



10MHz:

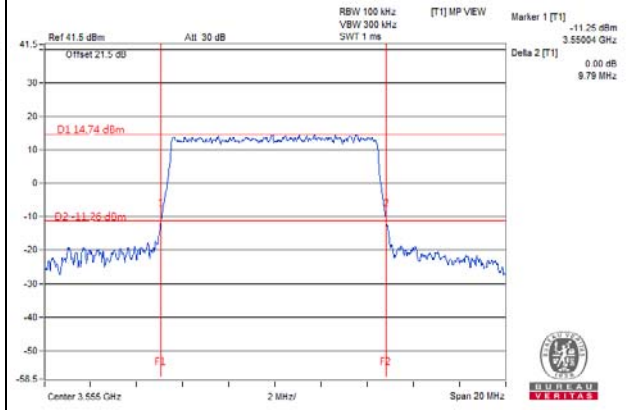
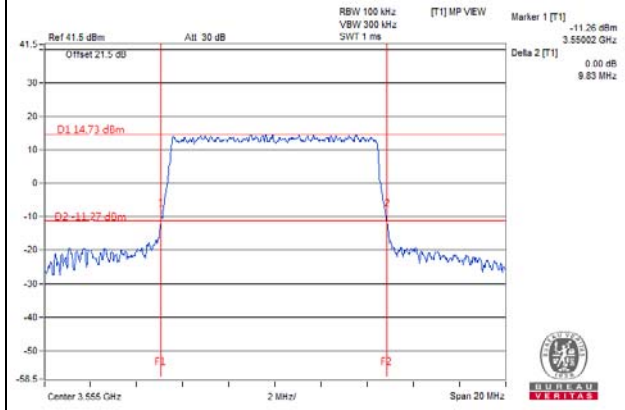
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

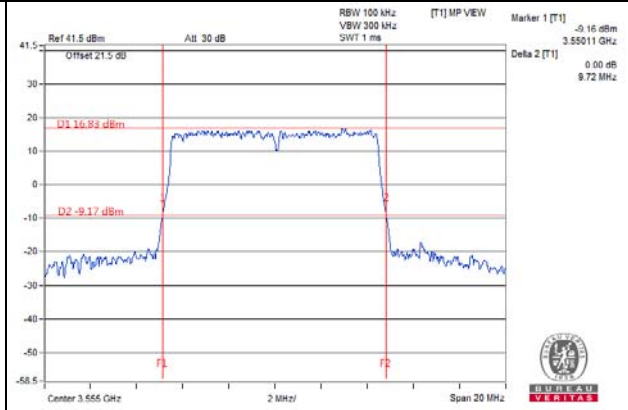
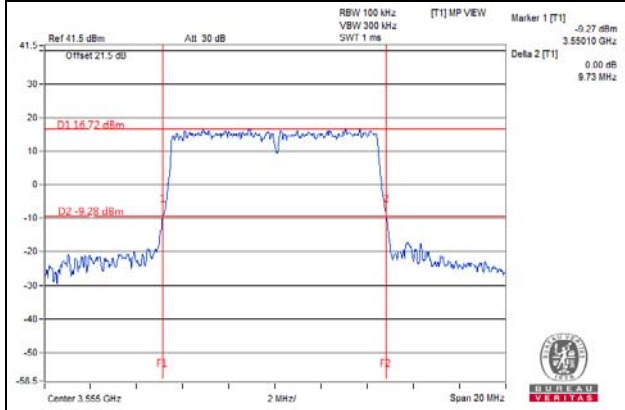
Chain (1)



16QAM

Chain (0)

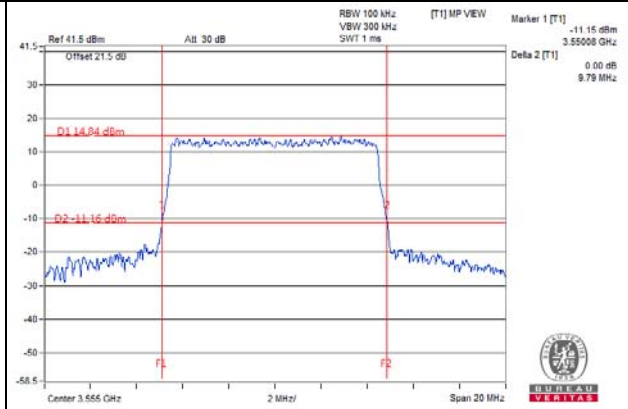
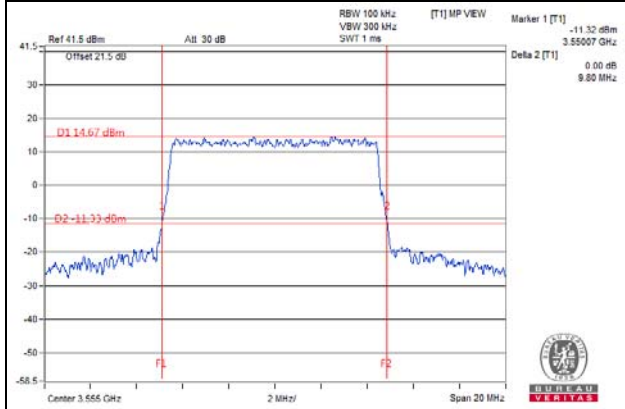
Chain (1)



64QAM

Chain (0)

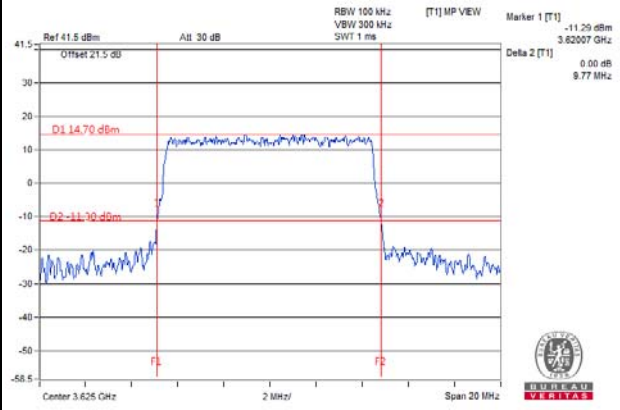
Chain (1)



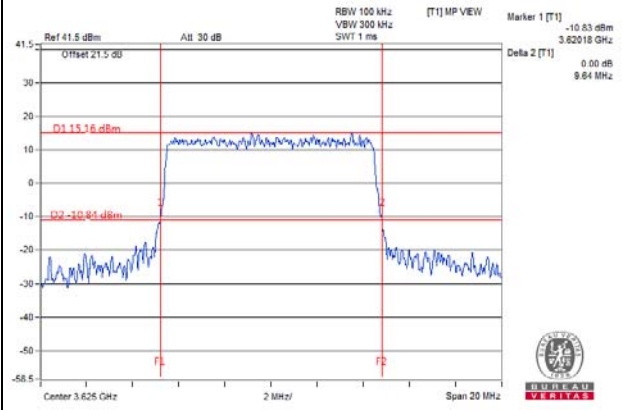
Spectrum Plot Of Worst Value

Middle
QPSK

Chain (0)

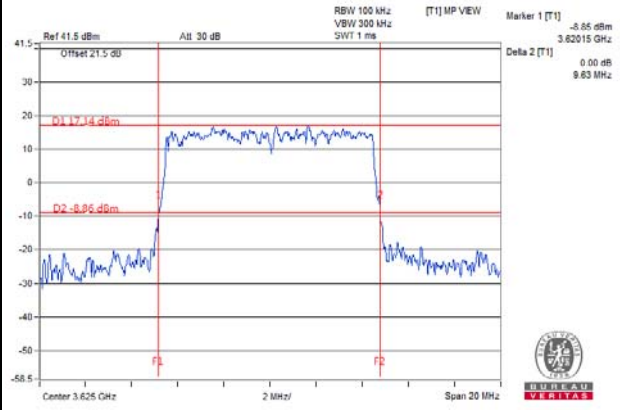


Chain (1)

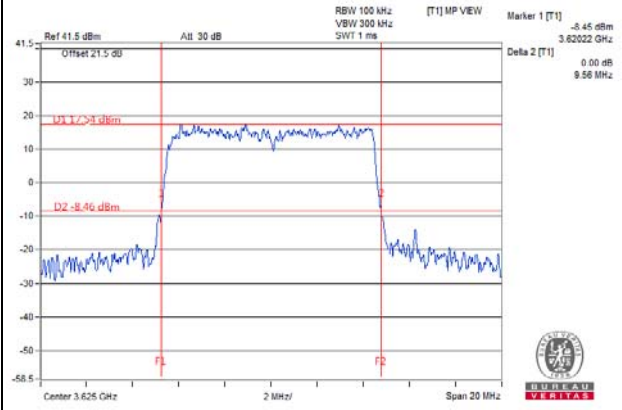


16QAM

Chain (0)

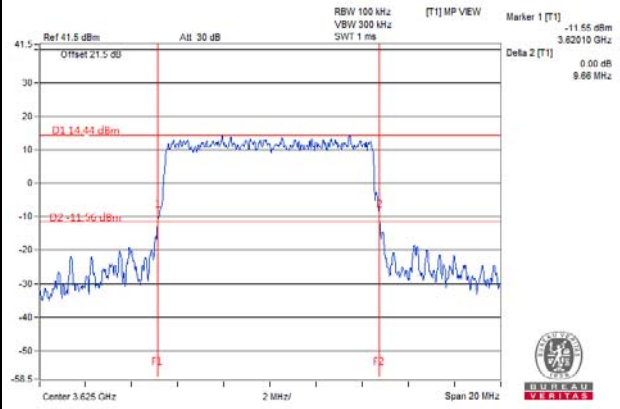


Chain (1)

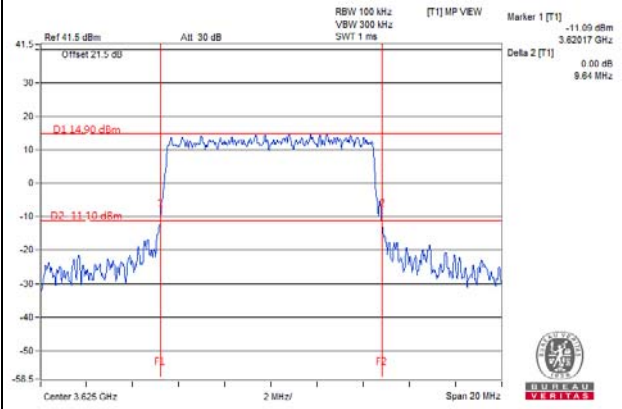


64QAM

Chain (0)



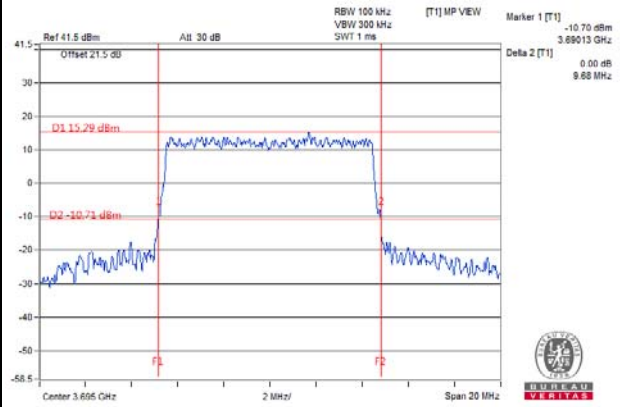
Chain (1)



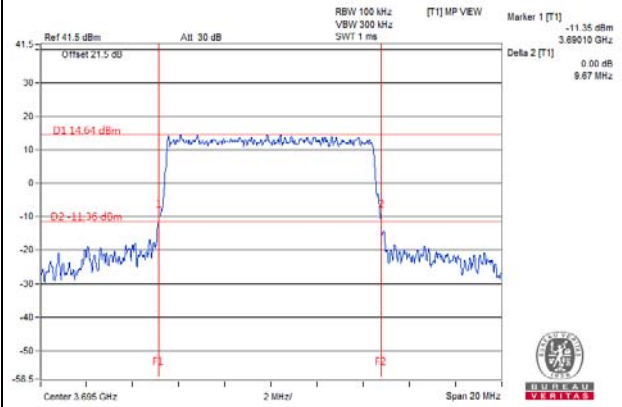
Spectrum Plot Of Worst Value

High
QPSK

Chain (0)

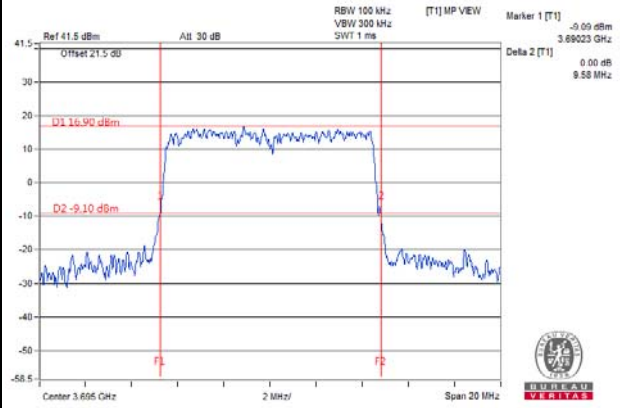


Chain (1)

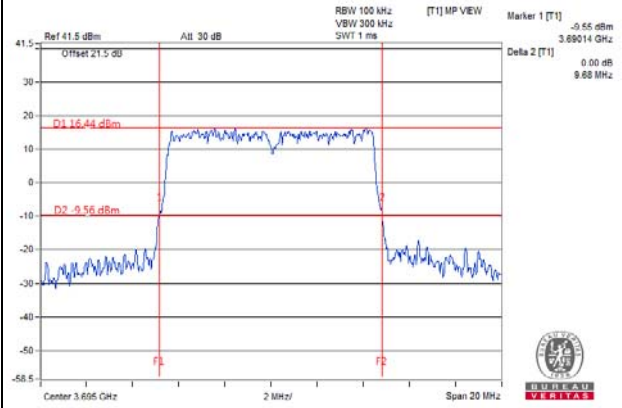


16QAM

Chain (0)

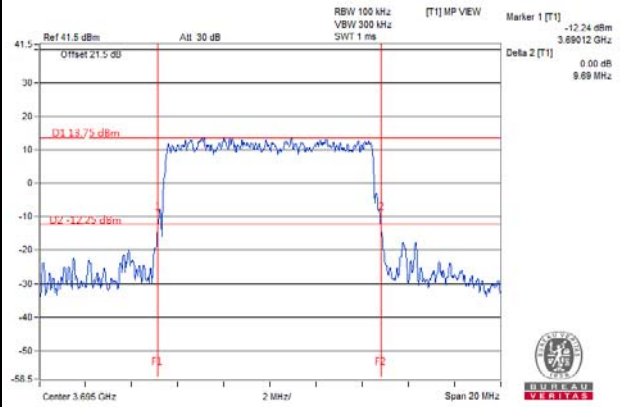


Chain (1)

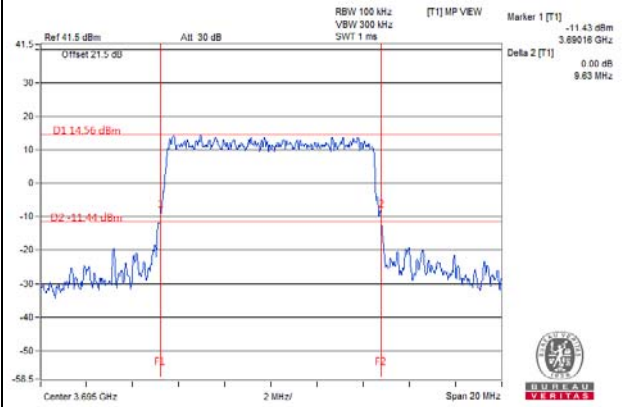


64QAM

Chain (0)



Chain (1)



15MHz:

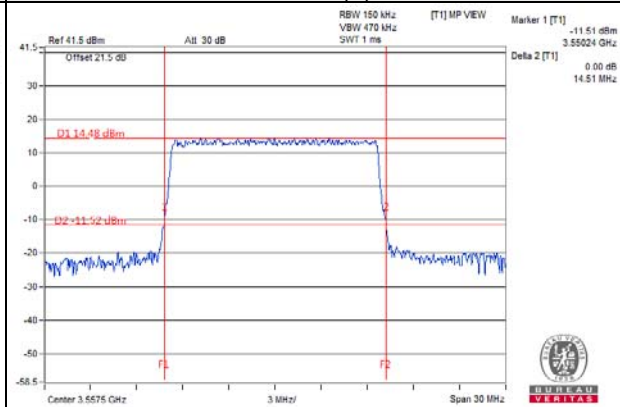
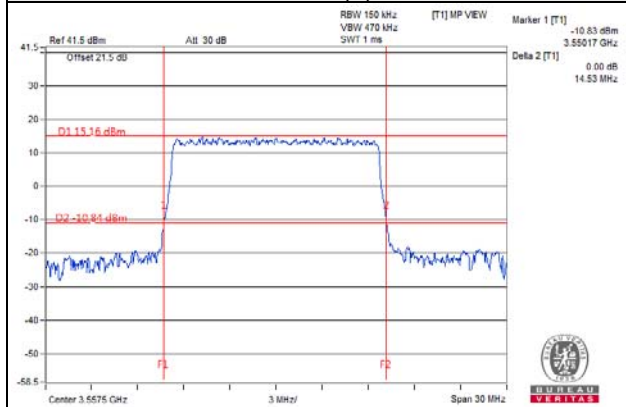
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

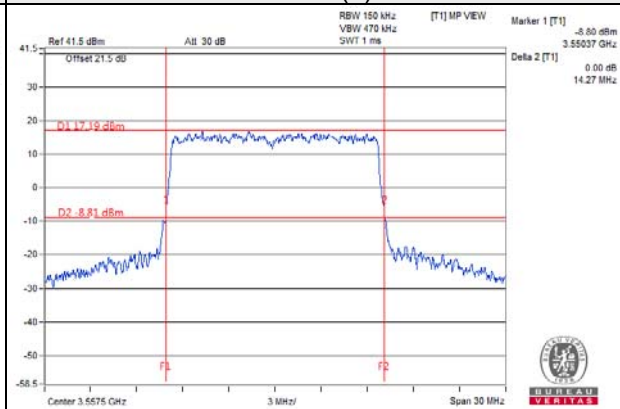
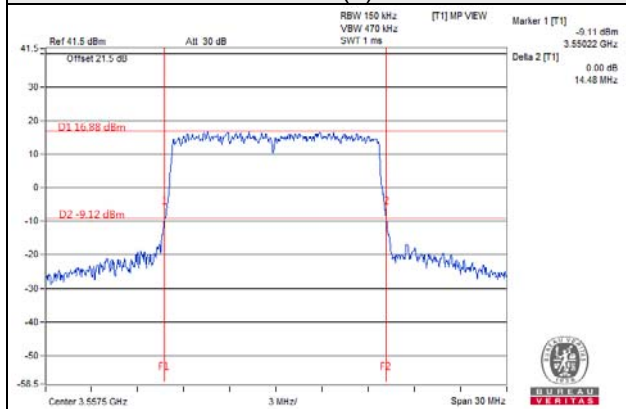
Chain (1)



16QAM

Chain (0)

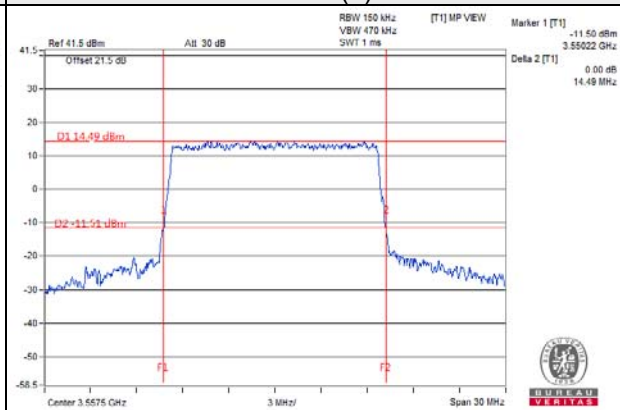
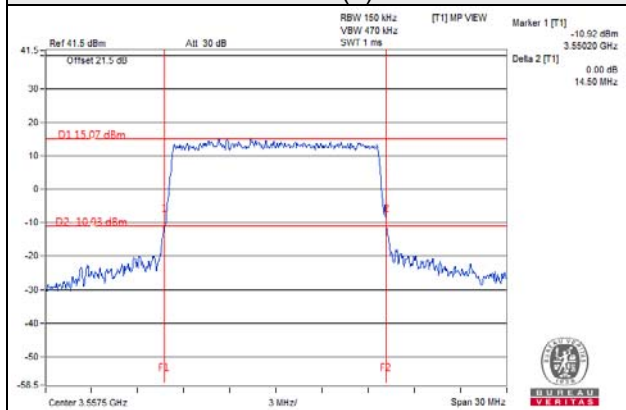
Chain (1)



64QAM

Chain (0)

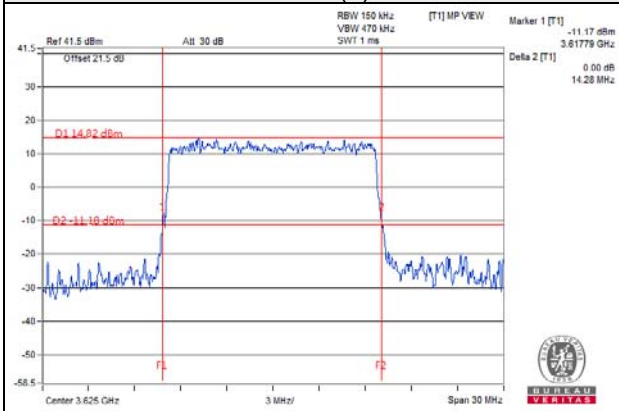
Chain (1)



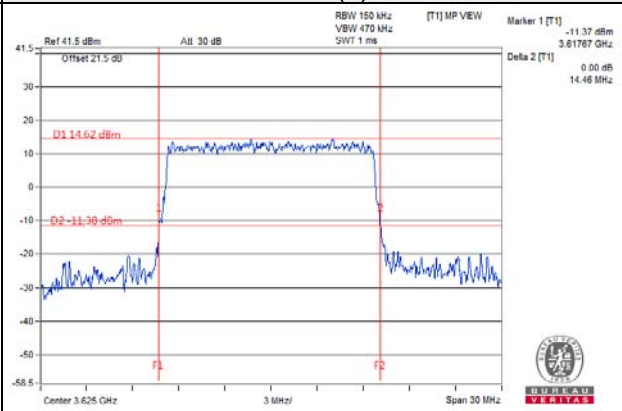
Spectrum Plot Of Worst Value

Middle QPSK

Chain (0)

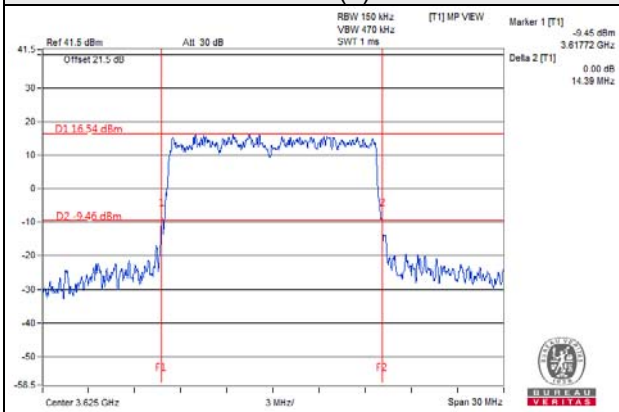


Chain (1)

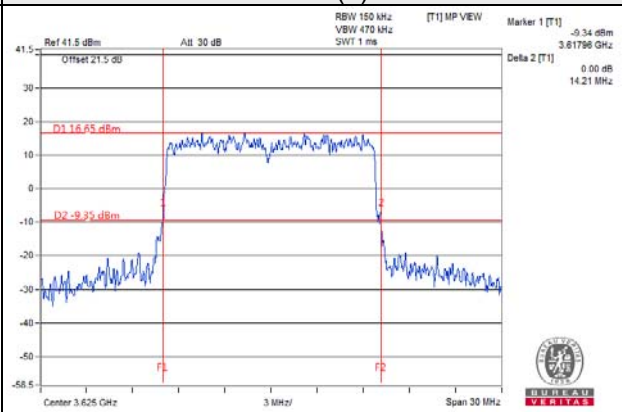


16QAM

Chain (0)

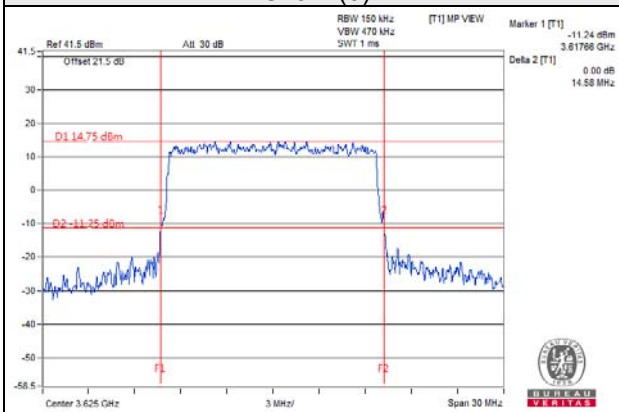


Chain (1)

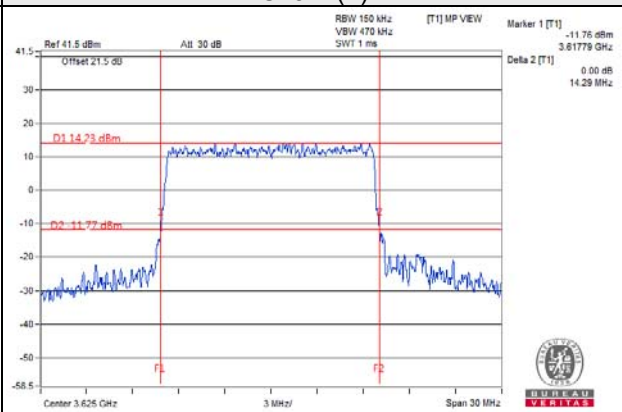


64QAM

Chain (0)



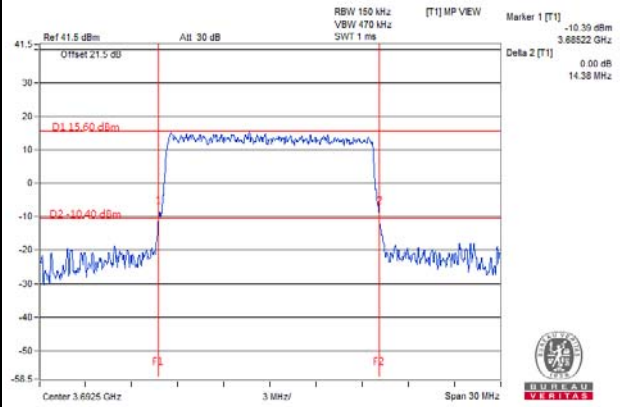
Chain (1)



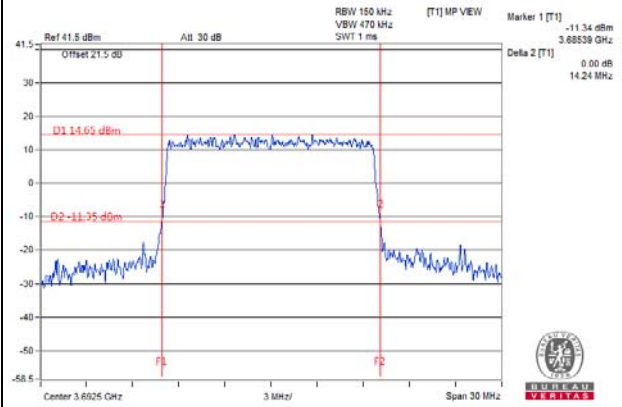
Spectrum Plot Of Worst Value

High QPSK

Chain (0)

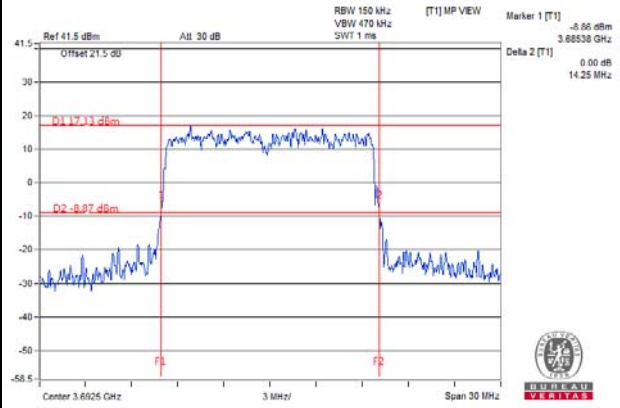


Chain (1)

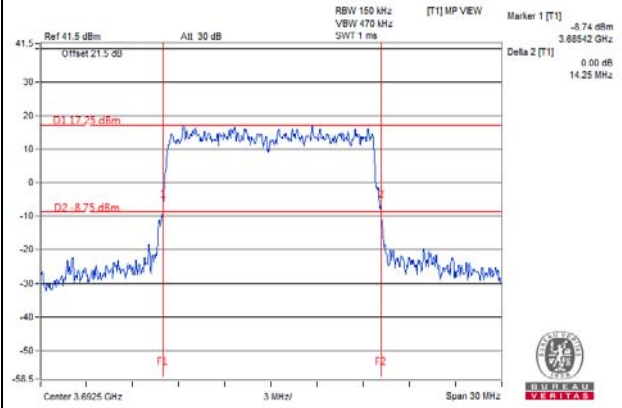


16QAM

Chain (0)

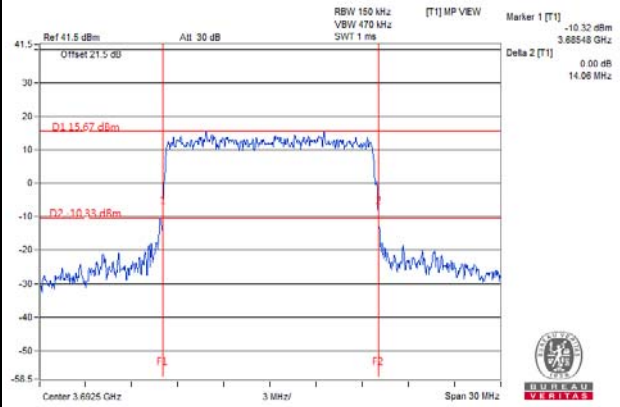


Chain (1)

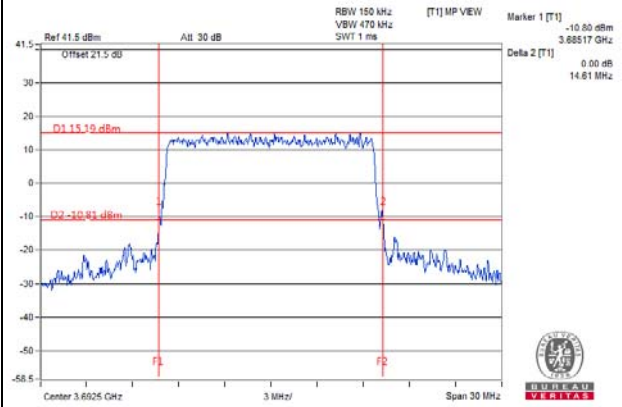


64QAM

Chain (0)



Chain (1)



20MHz:

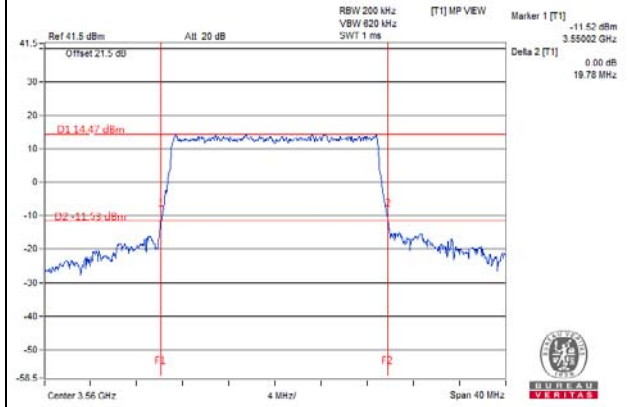
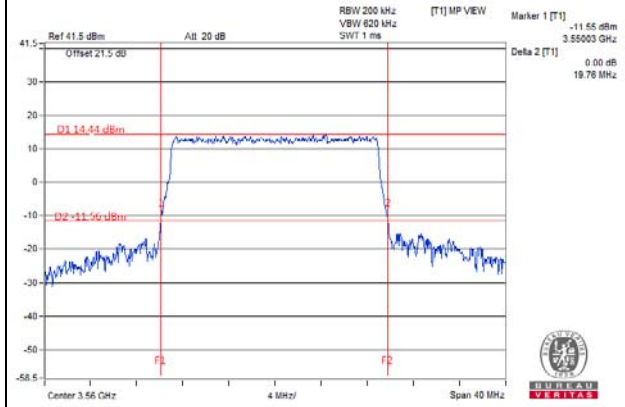
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

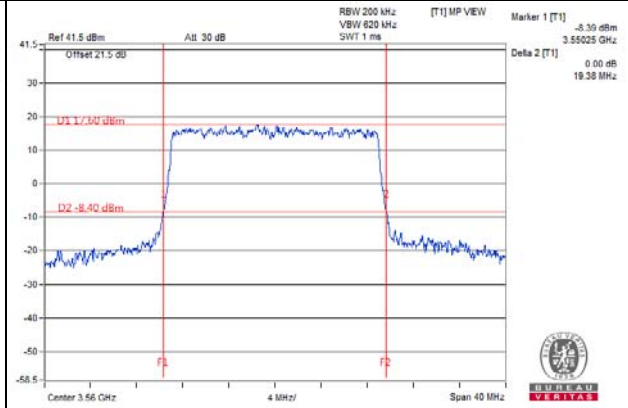
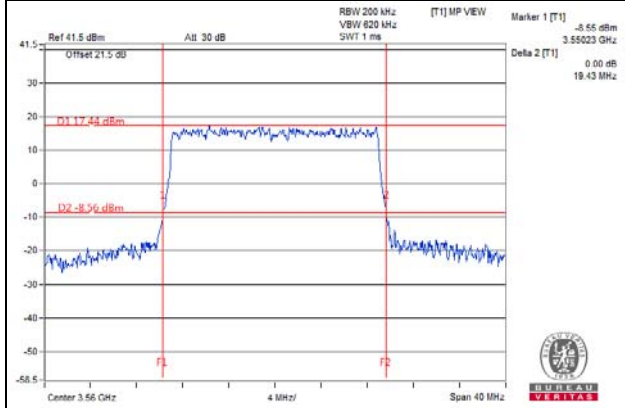
Chain (1)



16QAM

Chain (0)

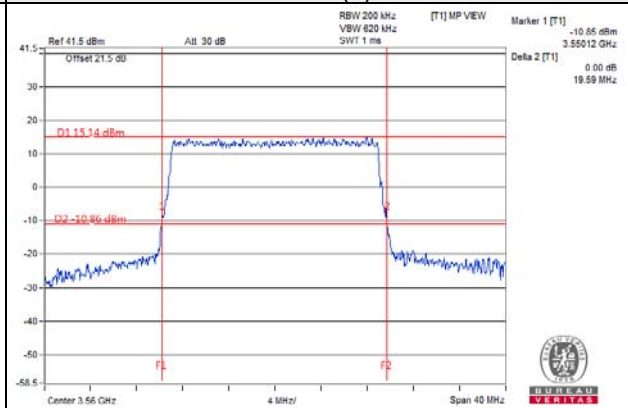
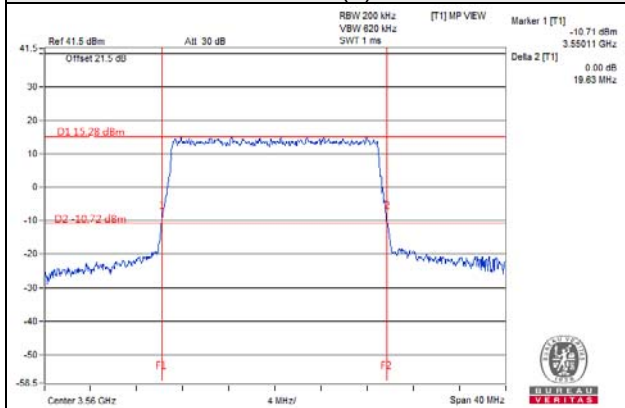
Chain (1)



64QAM

Chain (0)

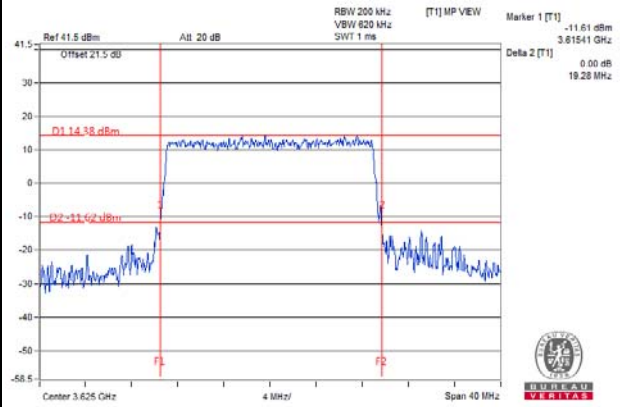
Chain (1)



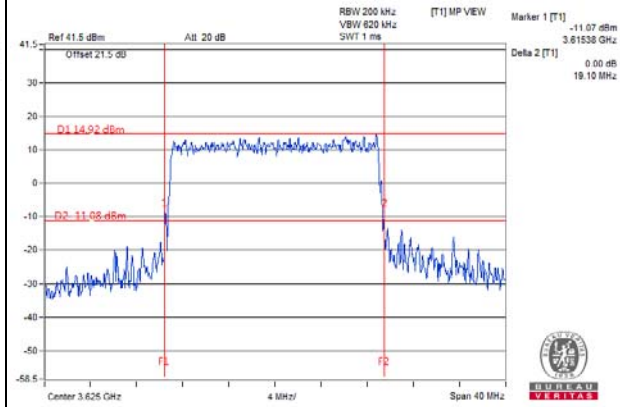
Spectrum Plot Of Worst Value

Middle
QPSK

Chain (0)

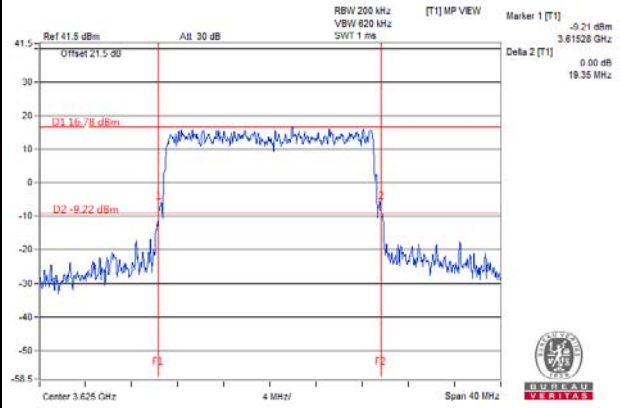


Chain (1)

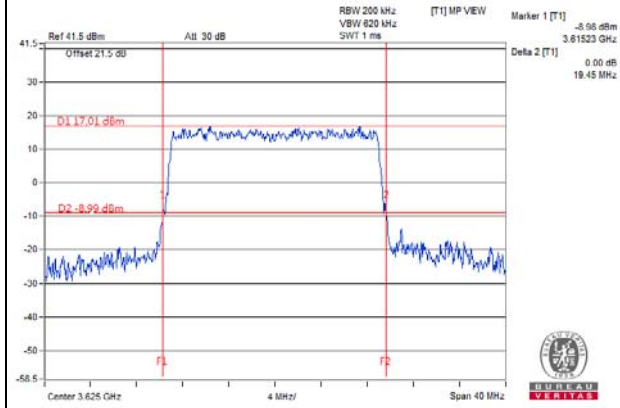


16QAM

Chain (0)

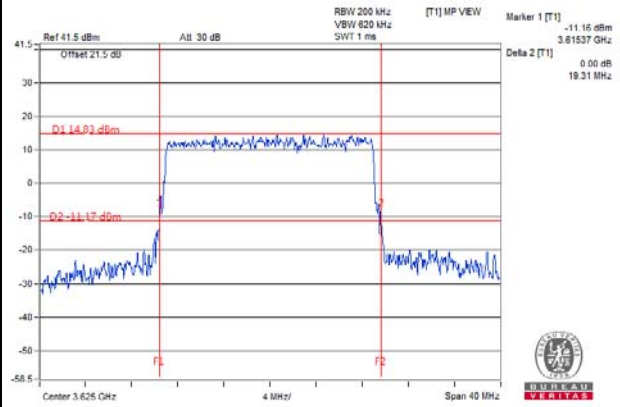


Chain (1)

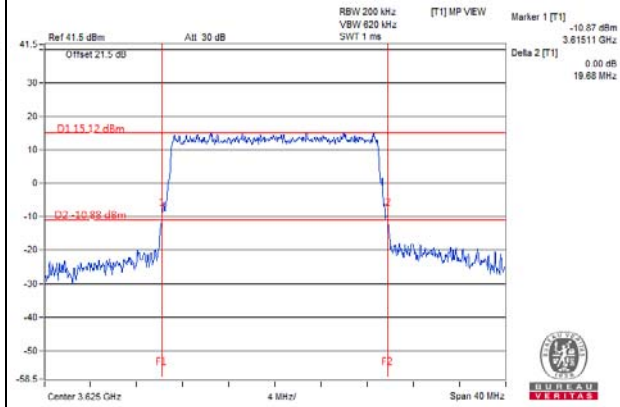


64QAM

Chain (0)



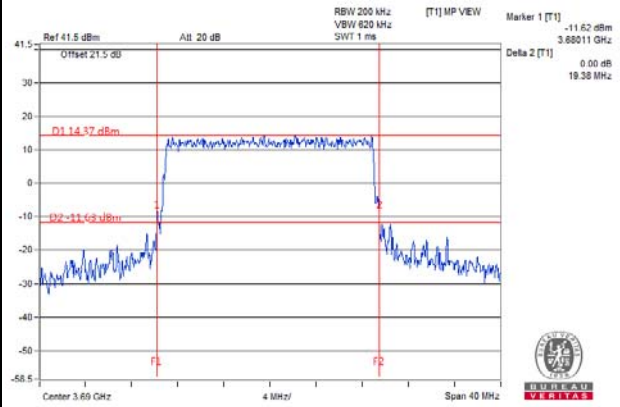
Chain (1)



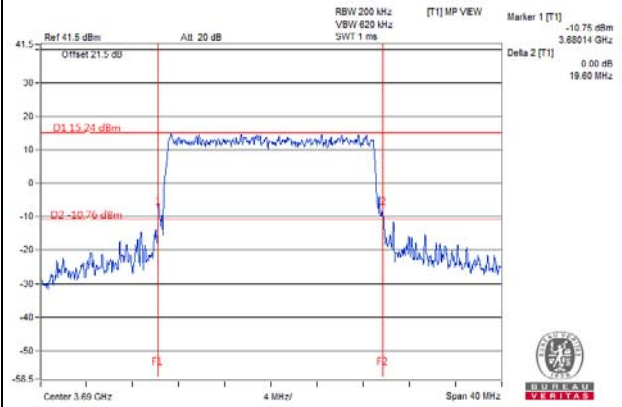
Spectrum Plot Of Worst Value

High QPSK

Chain (0)

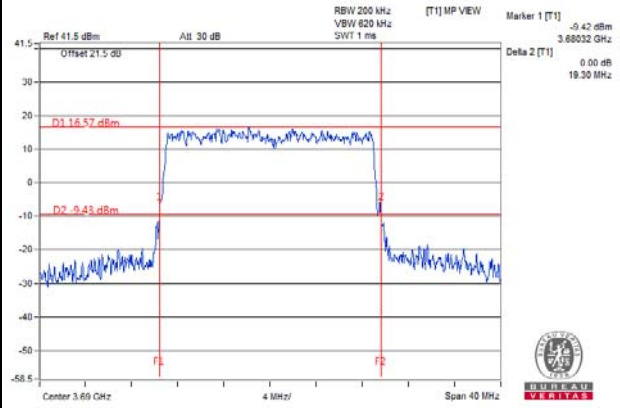


Chain (1)

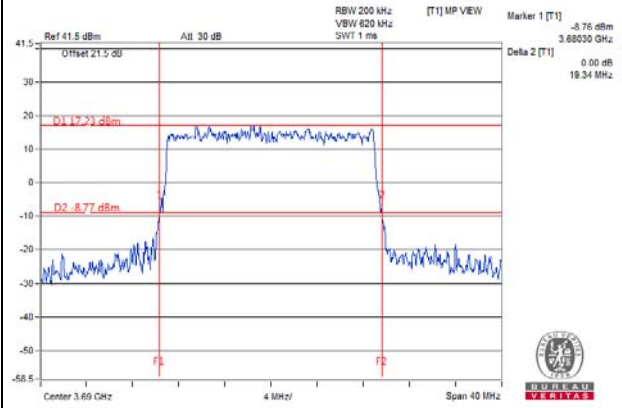


16QAM

Chain (0)

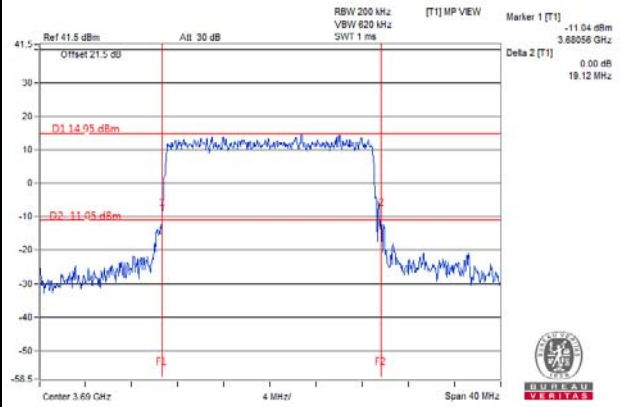


Chain (1)

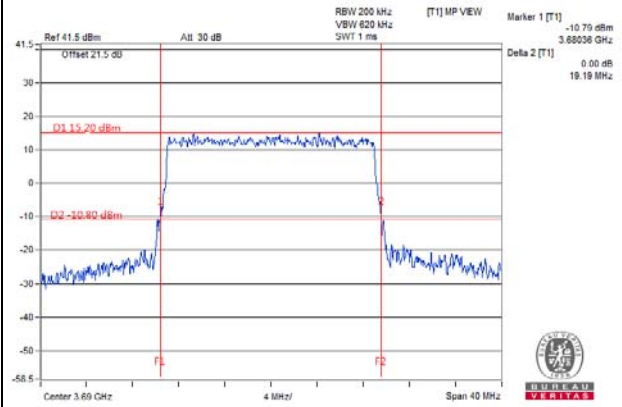


64QAM

Chain (0)



Chain (1)



4.5.8 Test Result (Occupied Bandwidth)

Channel	Freq. (MHz)	OCP 99 Band Width (MHz)					
		5MHz					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3552.5	4.48	4.50	4.50	4.49	4.50	4.49
Middle	3625	4.47	4.49	4.49	4.48	4.49	4.50
High	3697.5	4.49	4.49	4.49	4.49	4.48	4.50

Channel	Freq. (MHz)	OCP 99 Band Width (MHz)					
		10MHz					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3555	8.96	8.94	8.96	8.96	8.92	8.96
Middle	3625	8.96	8.94	8.94	8.96	8.94	8.96
High	3695	8.96	8.94	8.96	8.96	8.92	8.96

Channel	Freq. (MHz)	OCP 99 Band Width (MHz)					
		15MHz					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3557.5	13.41	13.44	13.44	13.38	13.41	13.47
Middle	3625	13.38	13.44	13.41	13.38	13.38	13.41
High	3692.5	13.38	13.44	13.38	13.38	13.41	13.41

Channel	Freq. (MHz)	OCP 99 Band Width (MHz)					
		20MHz					
		Chain0			Chain1		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
Low	3560	17.92	17.92	17.96	17.96	17.92	17.96
Middle	3625	17.92	17.88	17.92	17.92	17.92	17.88
High	3690	17.88	17.92	17.92	17.92	17.92	17.92

5MHz:

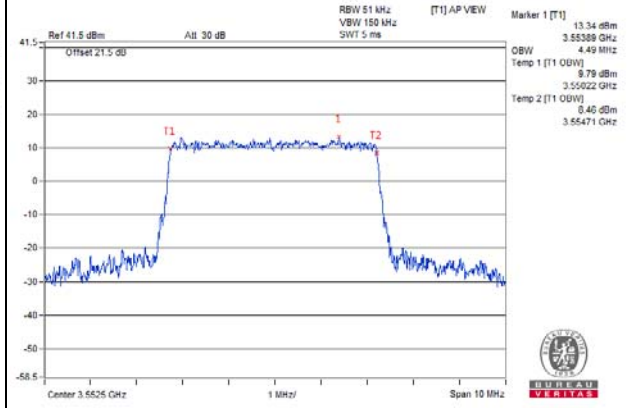
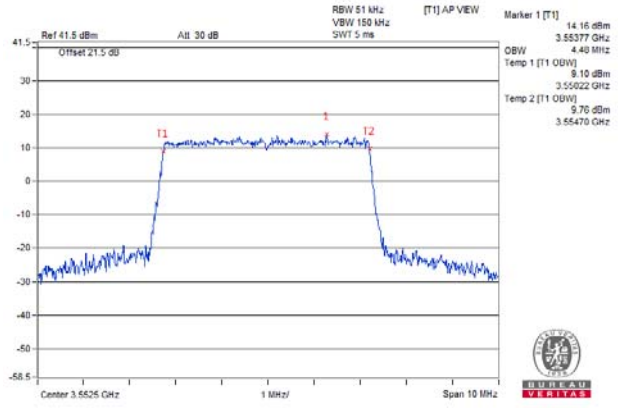
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

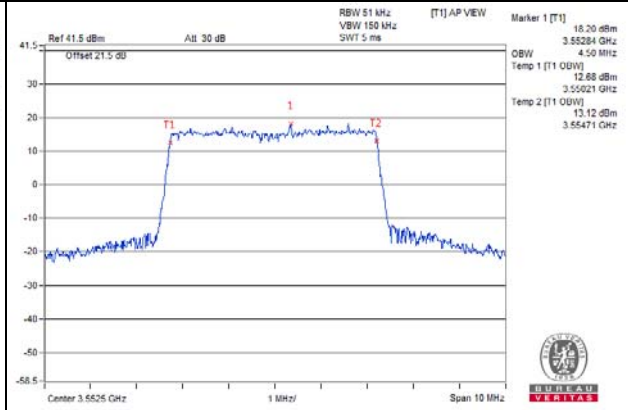
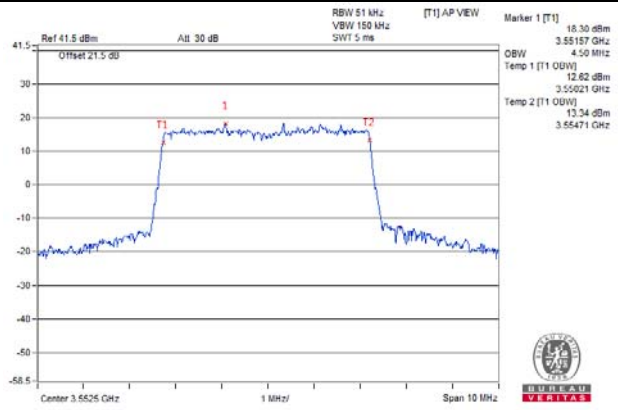
Chain (1)



16QAM

Chain (0)

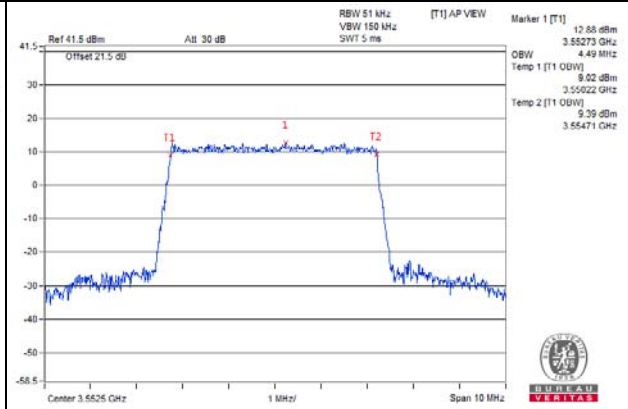
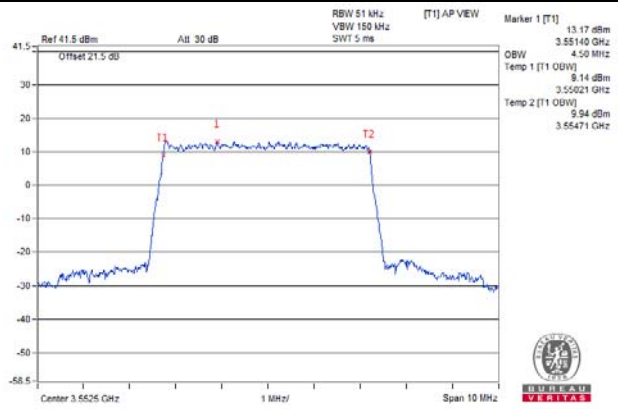
Chain (1)



64QAM

Chain (0)

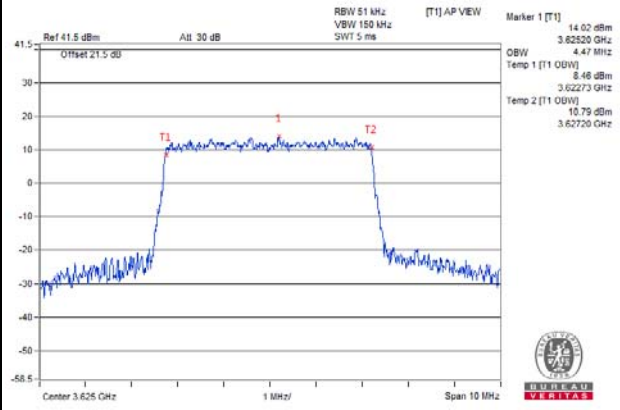
Chain (1)



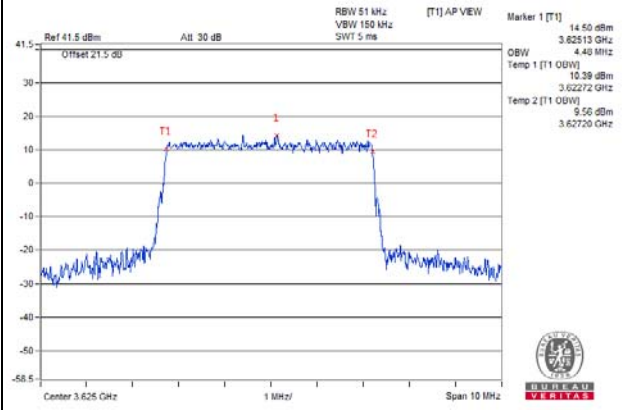
Spectrum Plot Of Worst Value

Middle
QPSK

Chain (0)

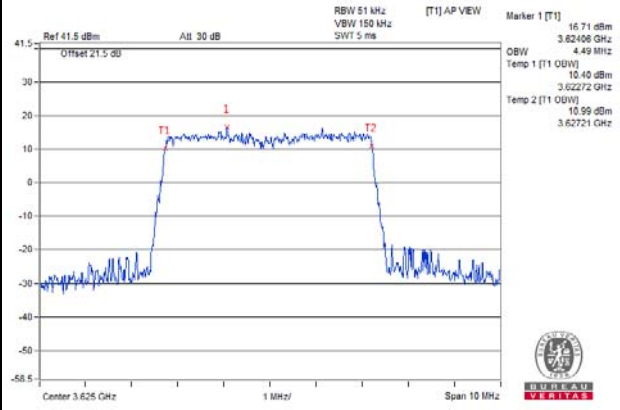


Chain (1)

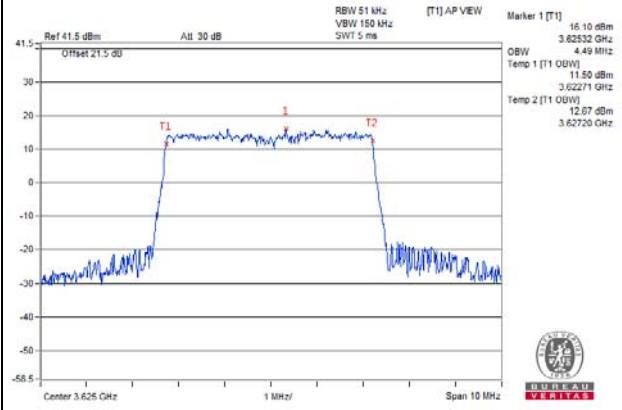


16QAM

Chain (0)

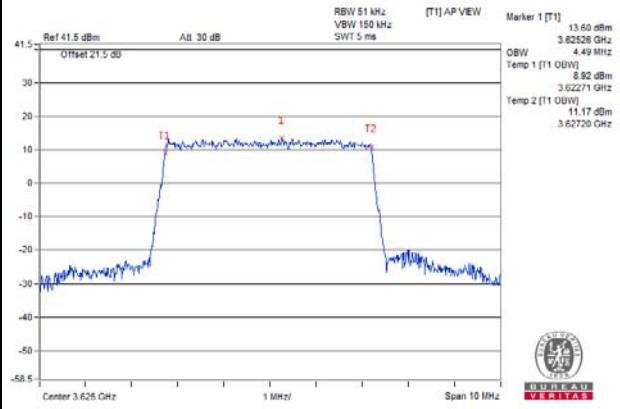


Chain (1)

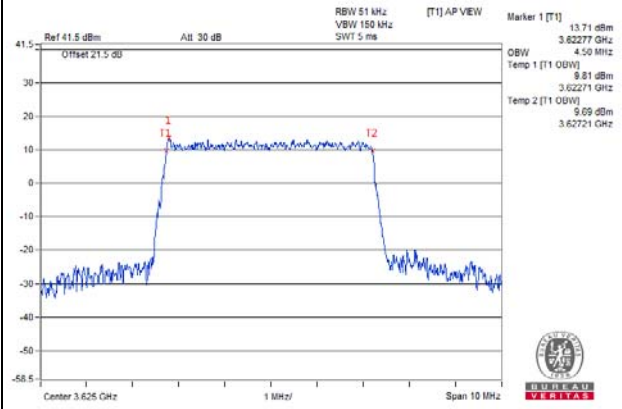


64QAM

Chain (0)



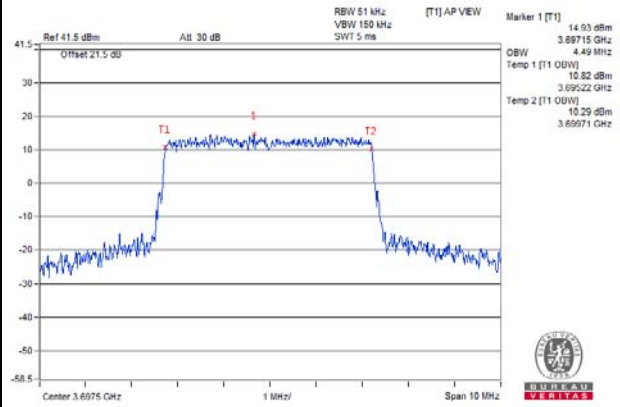
Chain (1)



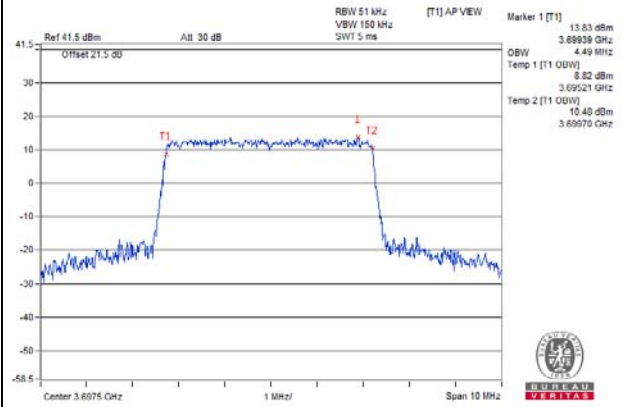
Spectrum Plot Of Worst Value

High QPSK

Chain (0)

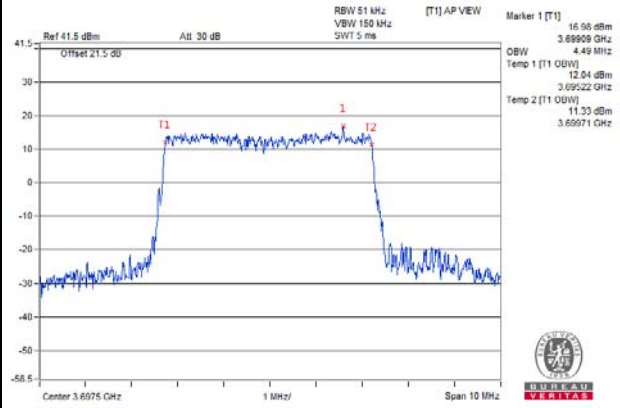


Chain (1)

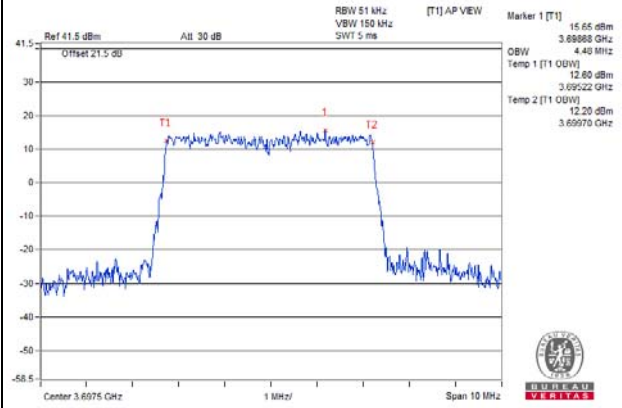


16QAM

Chain (0)

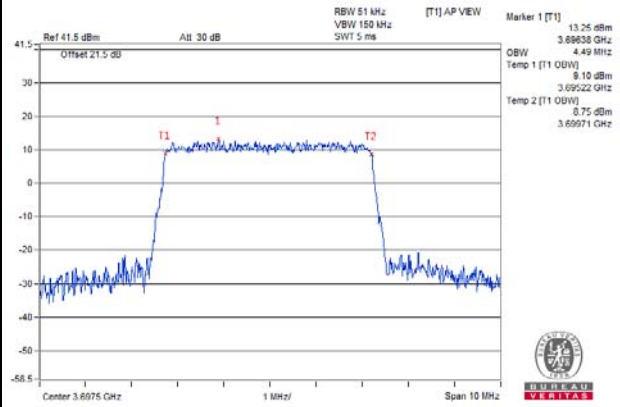


Chain (1)

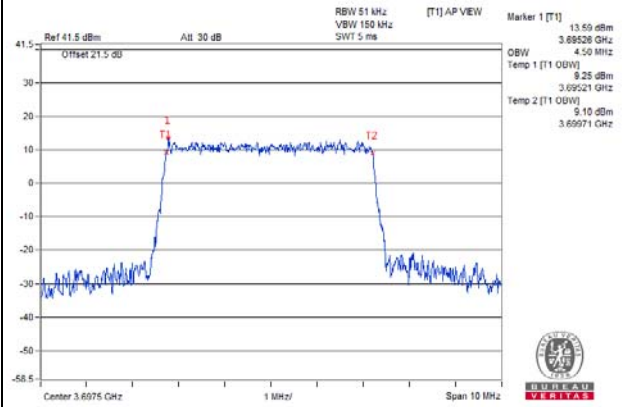


64QAM

Chain (0)



Chain (1)



10MHz:

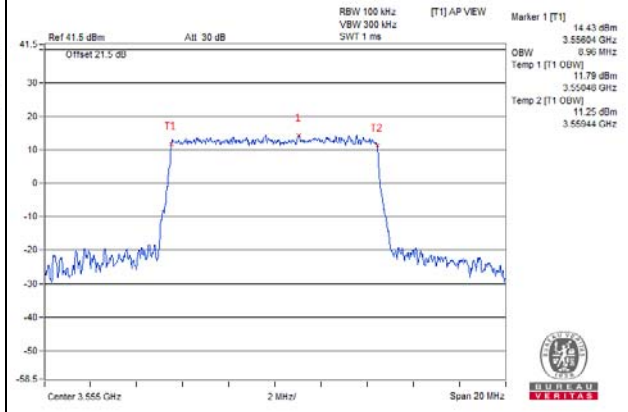
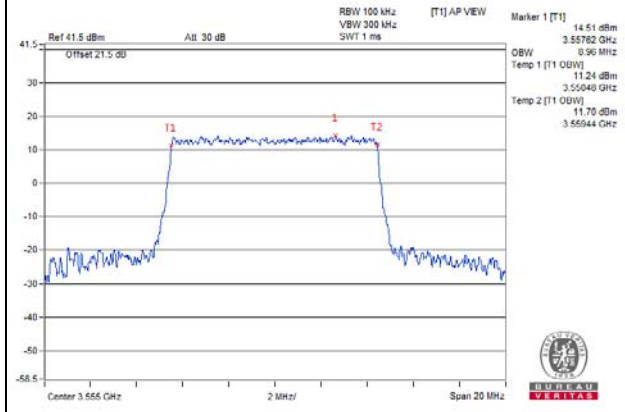
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

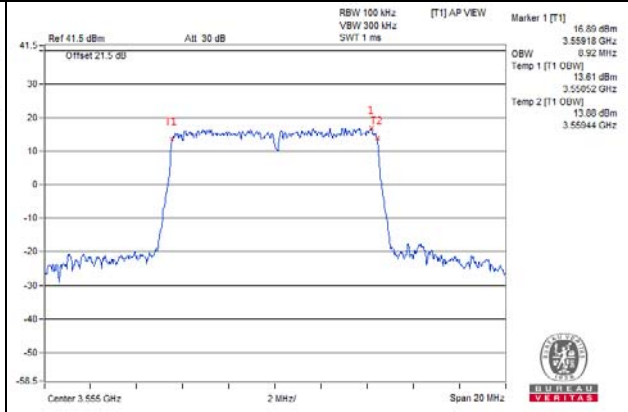
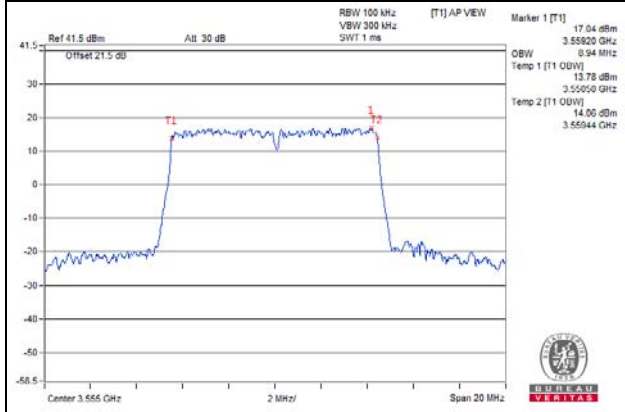
Chain (1)



16QAM

Chain (0)

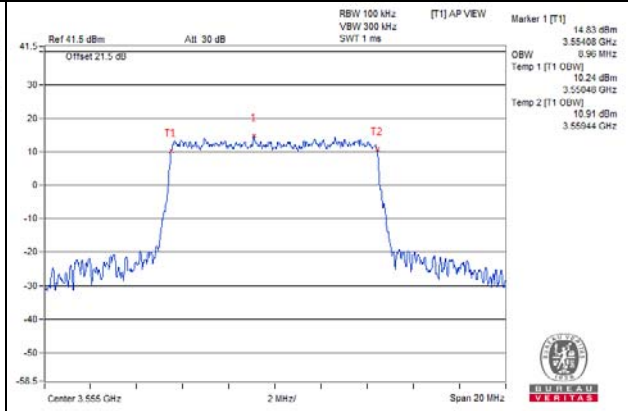
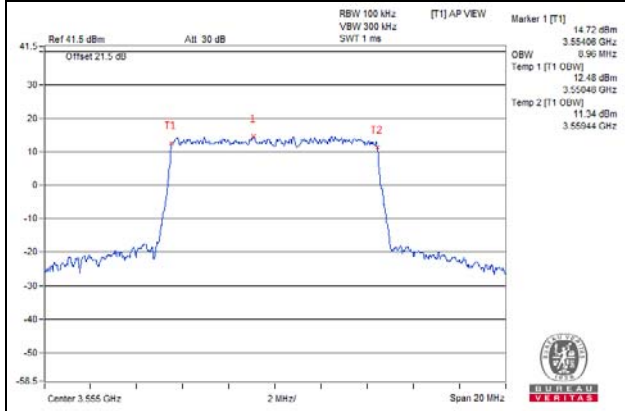
Chain (1)



64QAM

Chain (0)

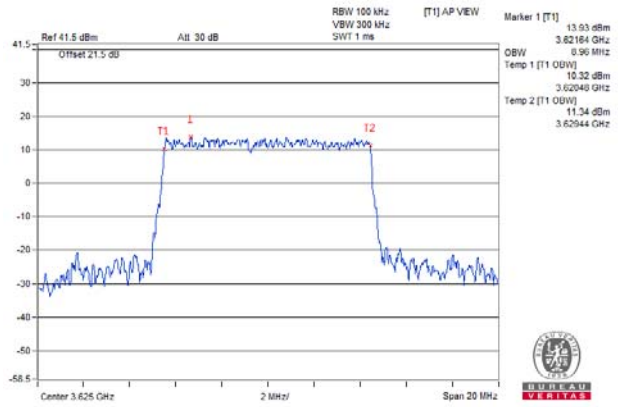
Chain (1)



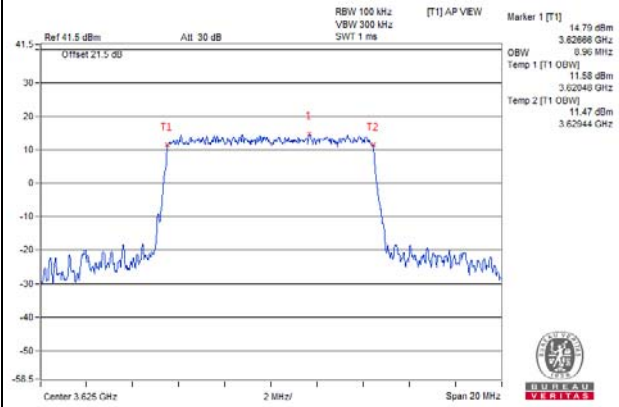
Spectrum Plot Of Worst Value

Middle
QPSK

Chain (0)

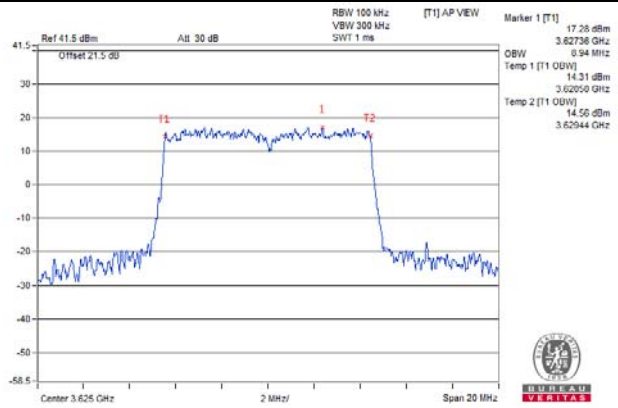


Chain (1)

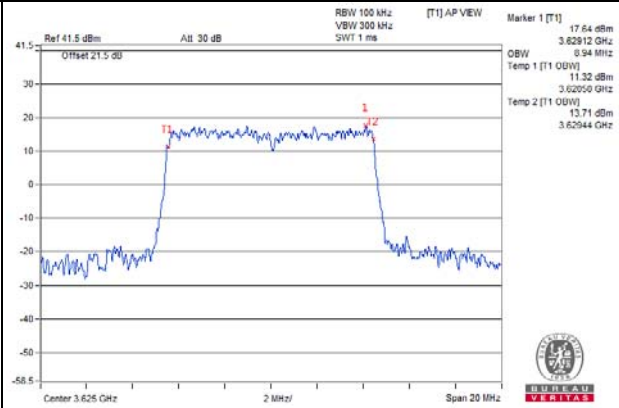


16QAM

Chain (0)

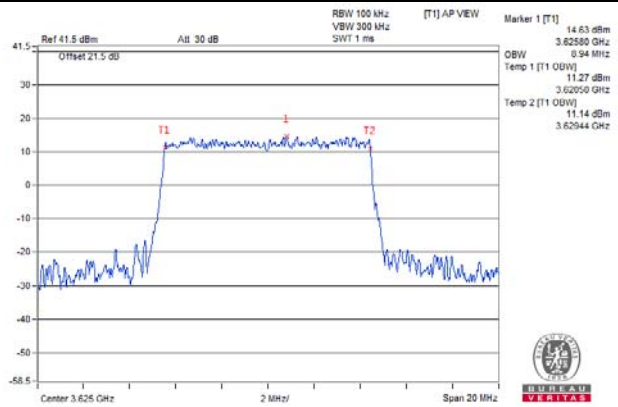


Chain (1)

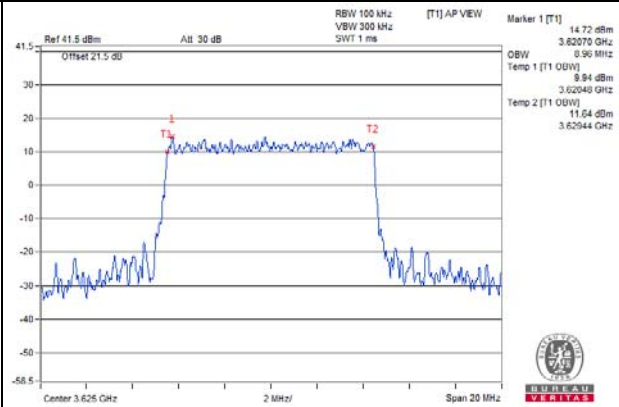


64QAM

Chain (0)



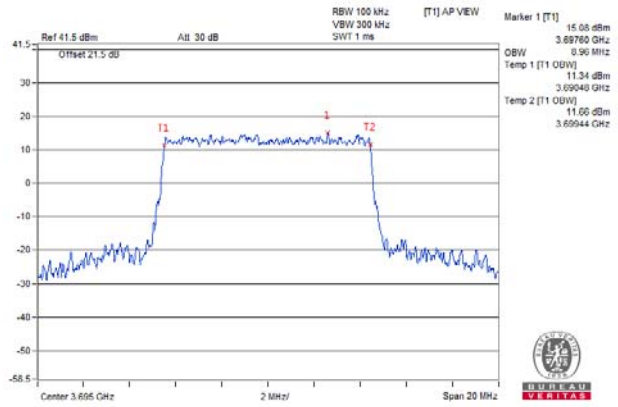
Chain (1)



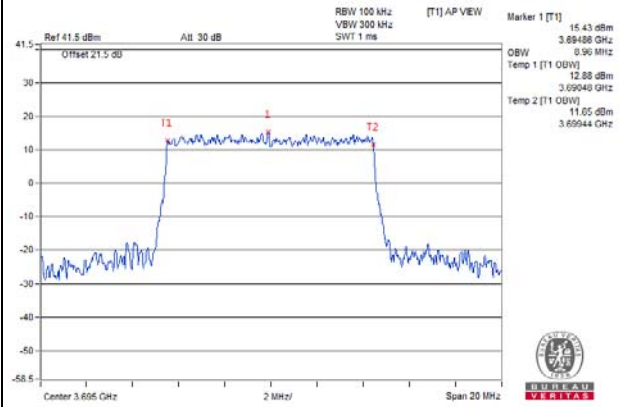
Spectrum Plot Of Worst Value

High QPSK

Chain (0)

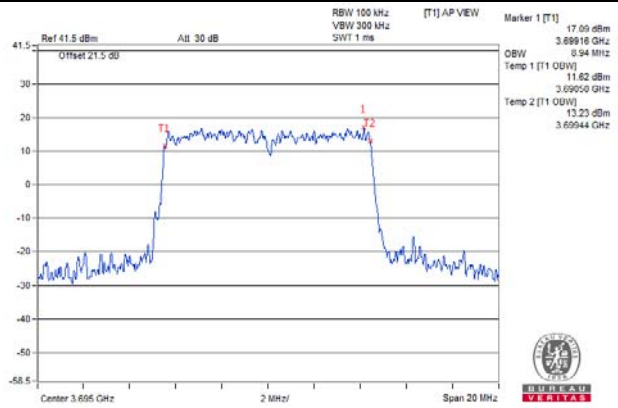


Chain (1)

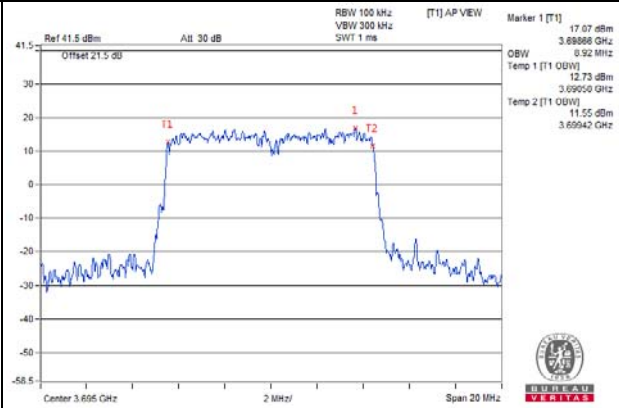


16QAM

Chain (0)

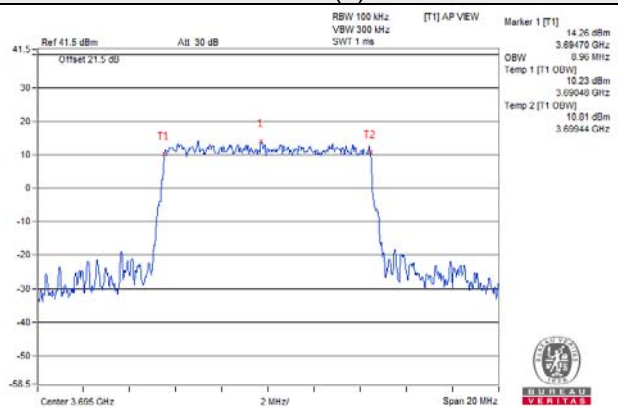


Chain (1)

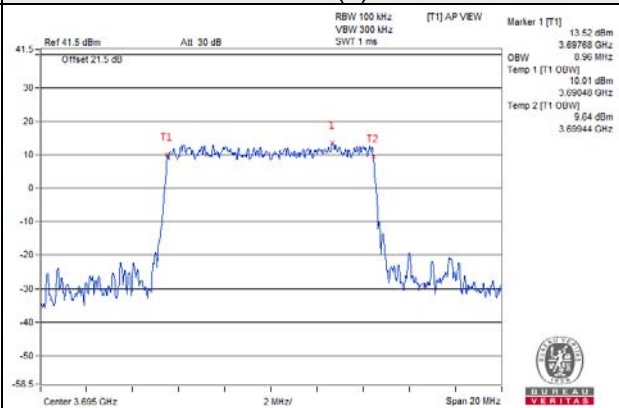


64QAM

Chain (0)



Chain (1)



15MHz:

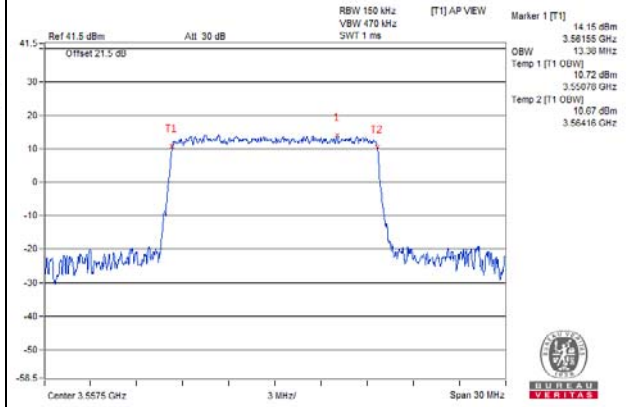
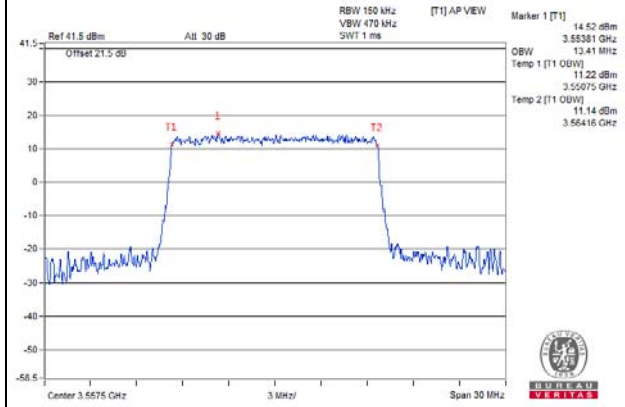
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

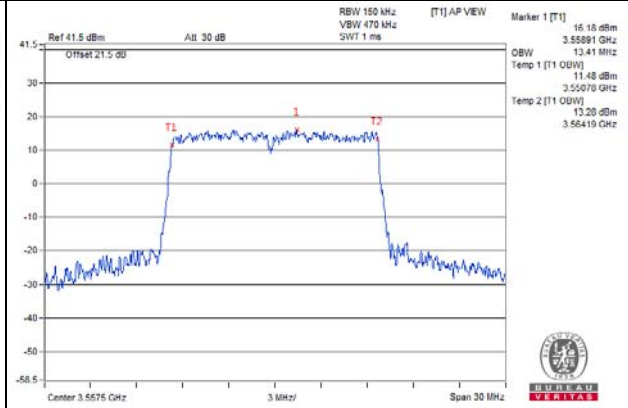
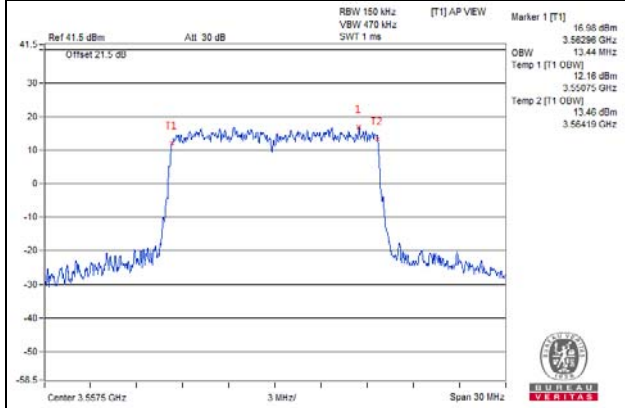
Chain (1)



16QAM

Chain (0)

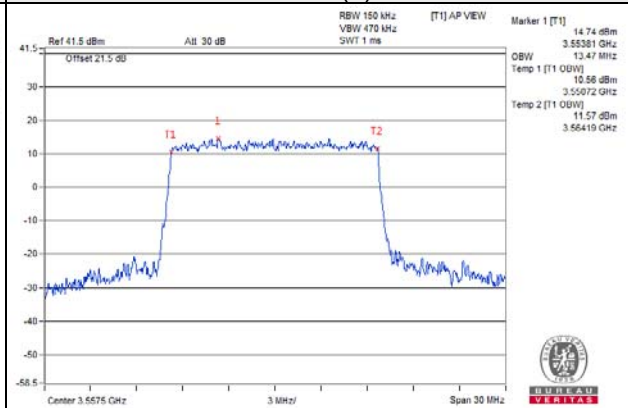
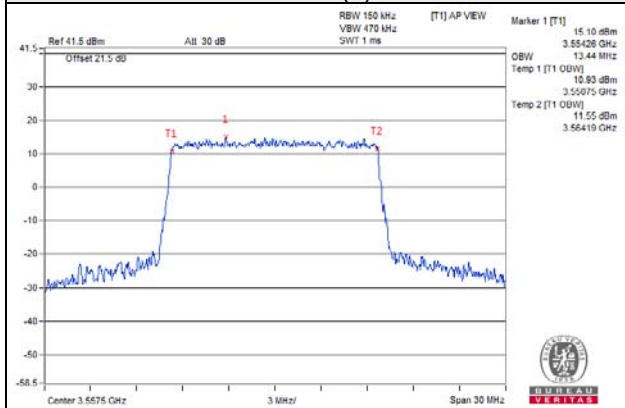
Chain (1)



64QAM

Chain (0)

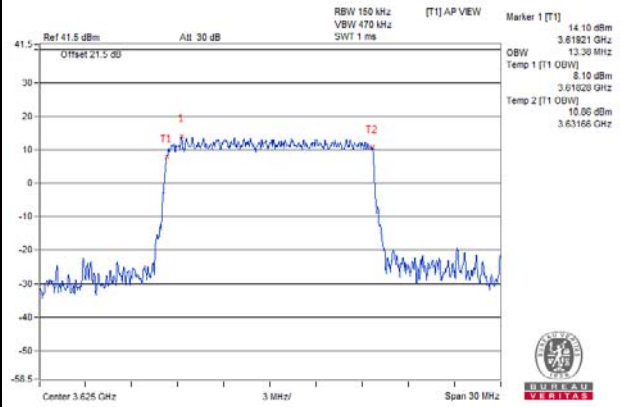
Chain (1)



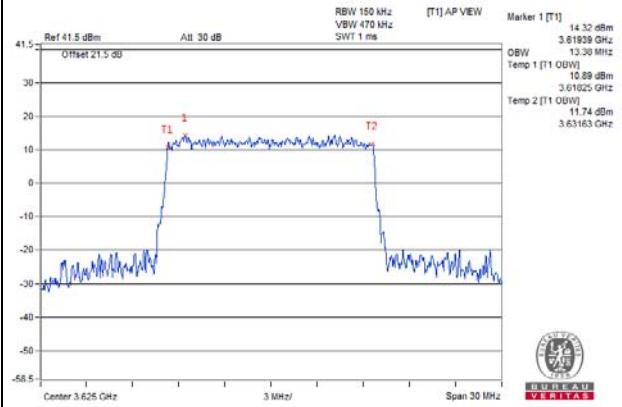
Spectrum Plot Of Worst Value

Middle
QPSK

Chain (0)

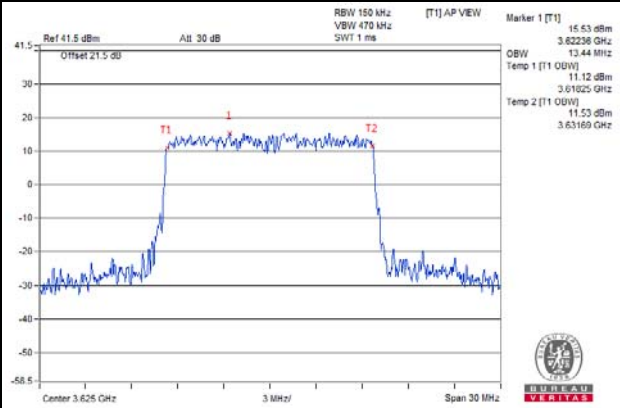


Chain (1)

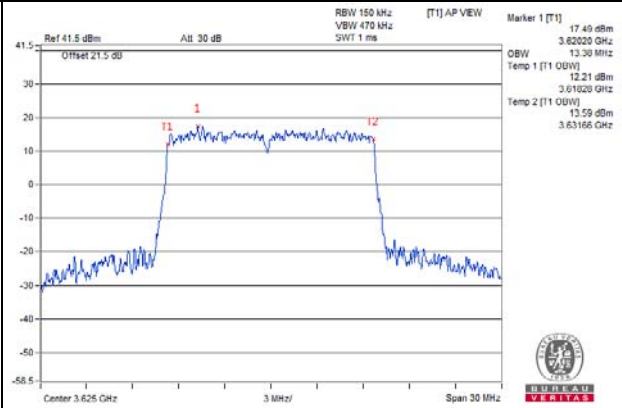


16QAM

Chain (0)

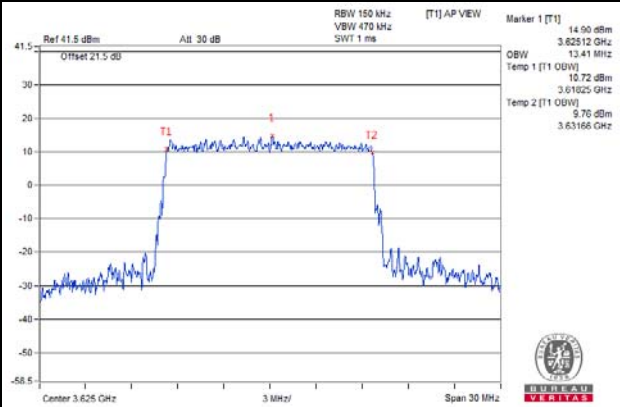


Chain (1)

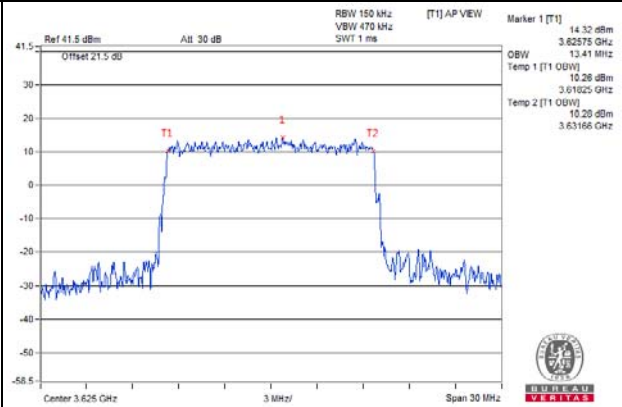


64QAM

Chain (0)



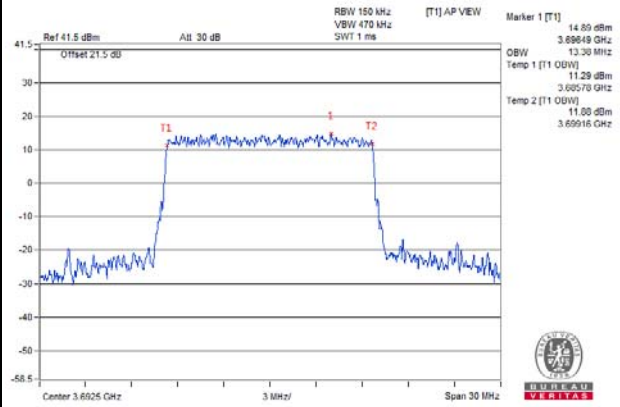
Chain (1)



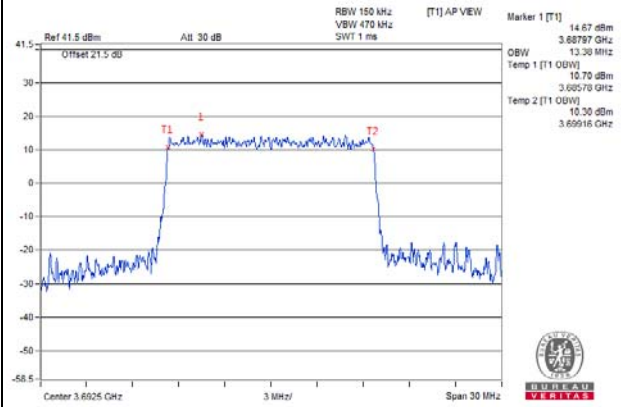
Spectrum Plot Of Worst Value

High
QPSK

Chain (0)

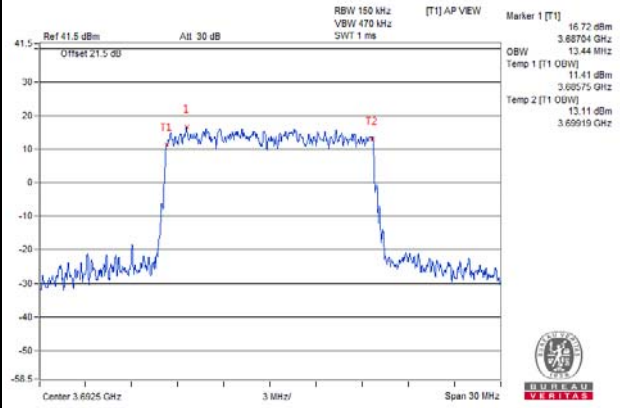


Chain (1)

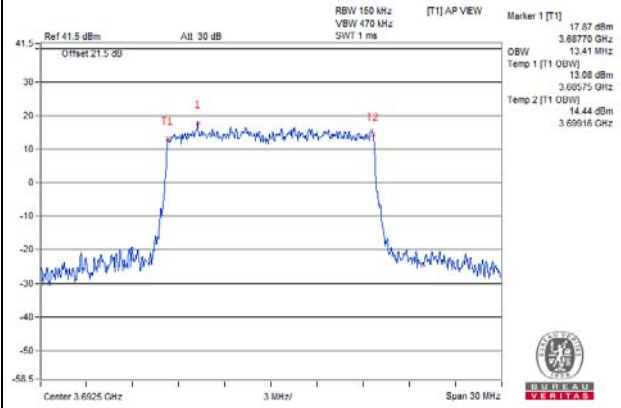


16QAM

Chain (0)

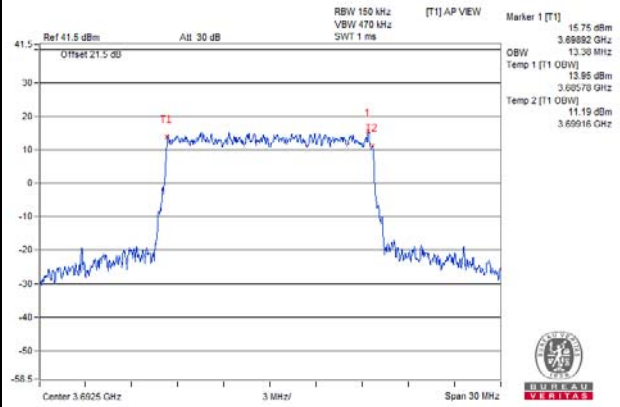


Chain (1)

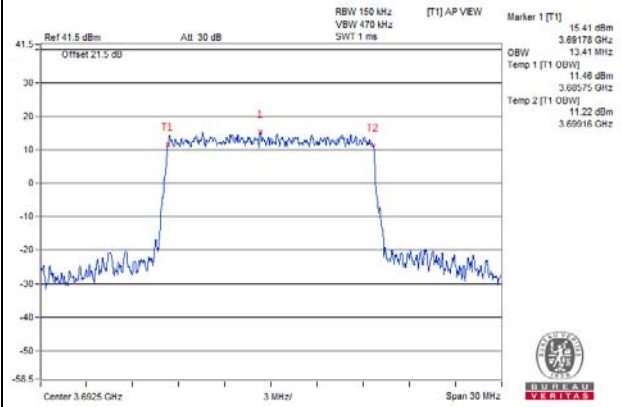


64QAM

Chain (0)



Chain (1)



20MHz:

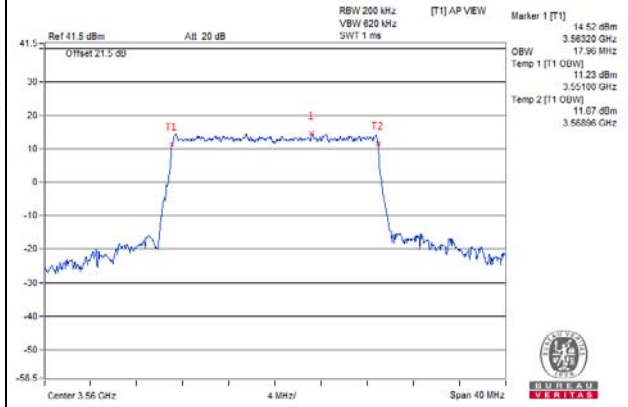
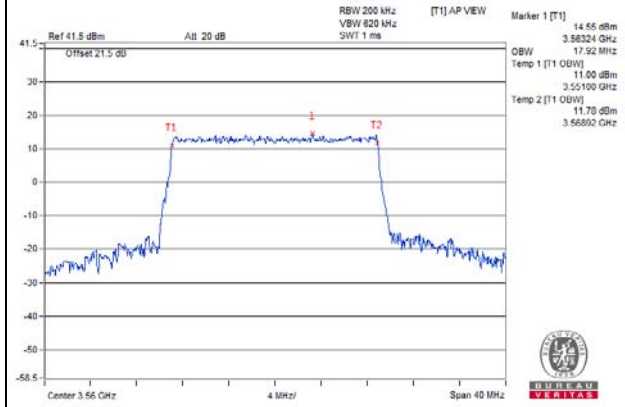
Spectrum Plot Of Worst Value

Low

QPSK

Chain (0)

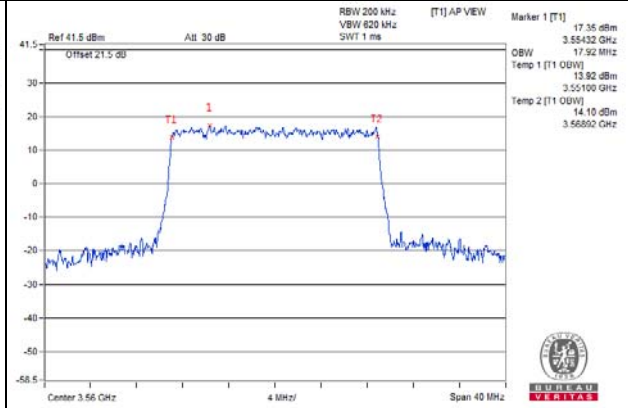
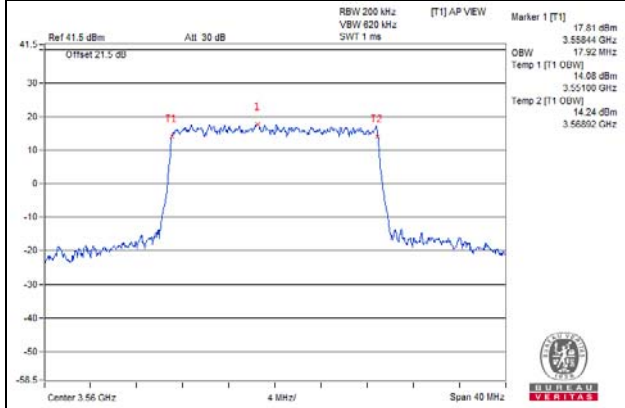
Chain (1)



16QAM

Chain (0)

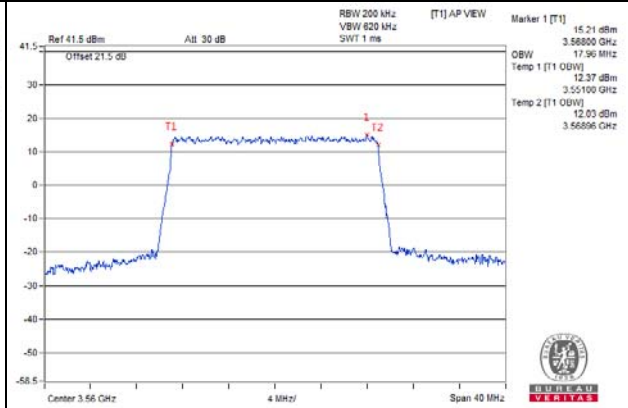
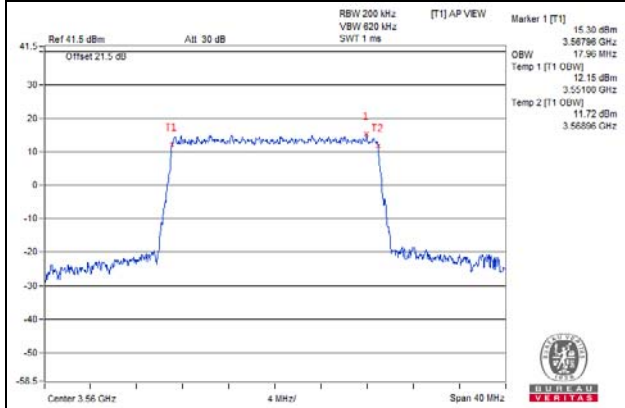
Chain (1)



64QAM

Chain (0)

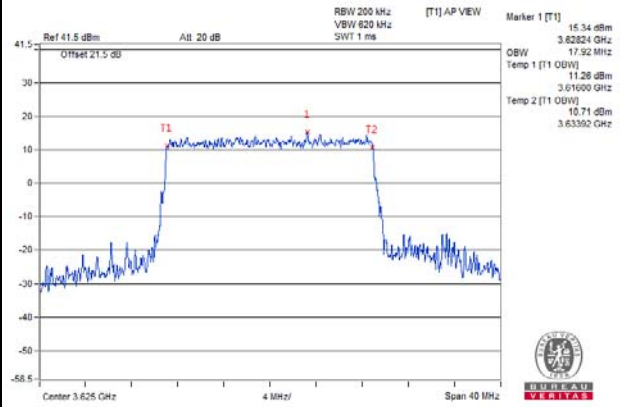
Chain (1)



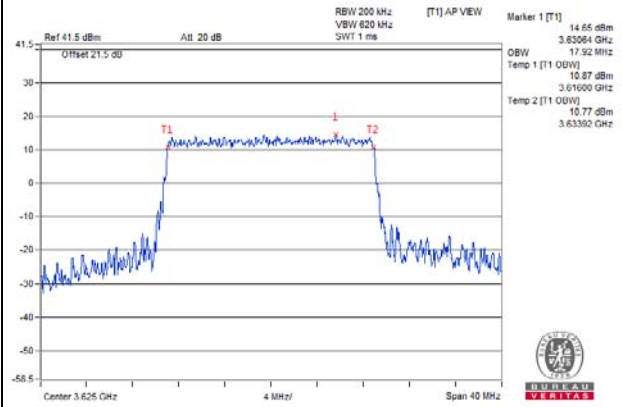
Spectrum Plot Of Worst Value

**Middle
QPSK**

Chain (0)

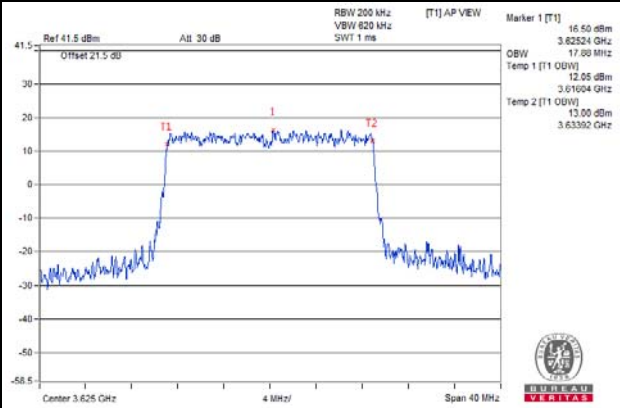


Chain (1)

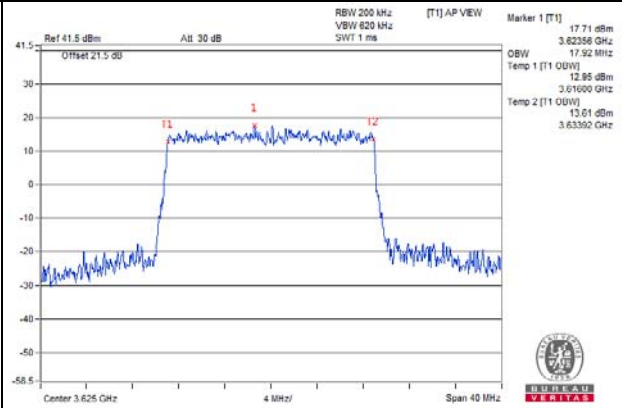


16QAM

Chain (0)

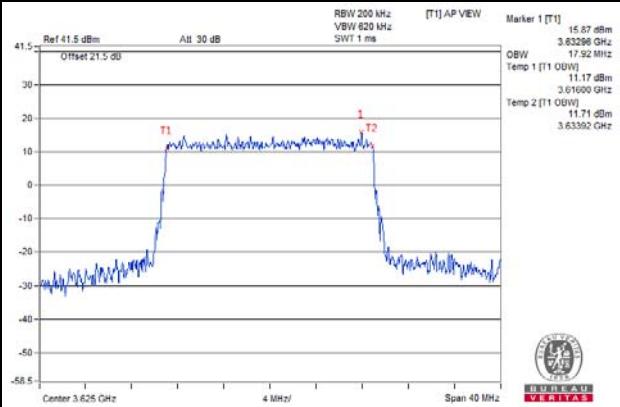


Chain (1)

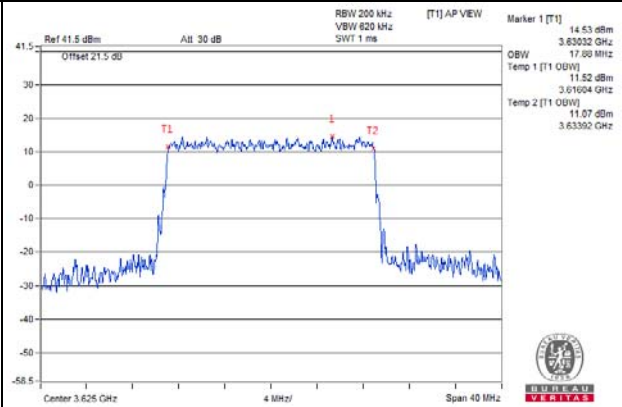


64QAM

Chain (0)



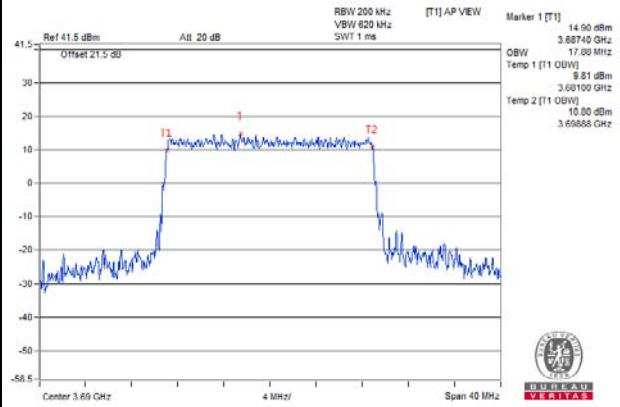
Chain (1)



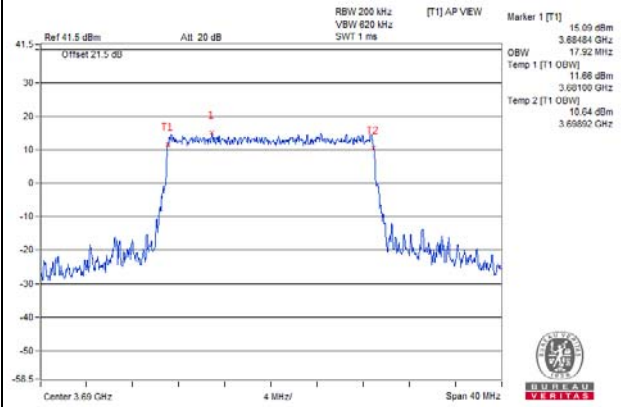
Spectrum Plot Of Worst Value

High
QPSK

Chain (0)

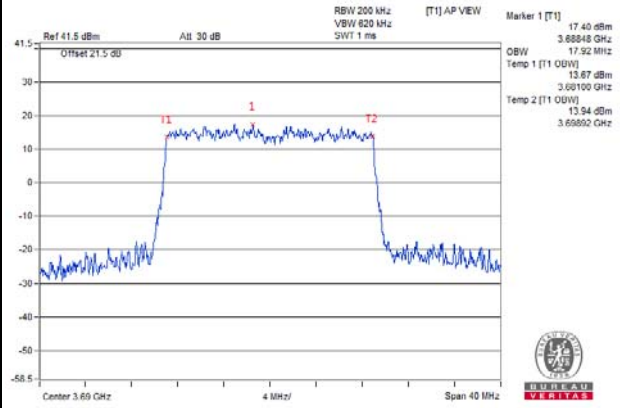


Chain (1)

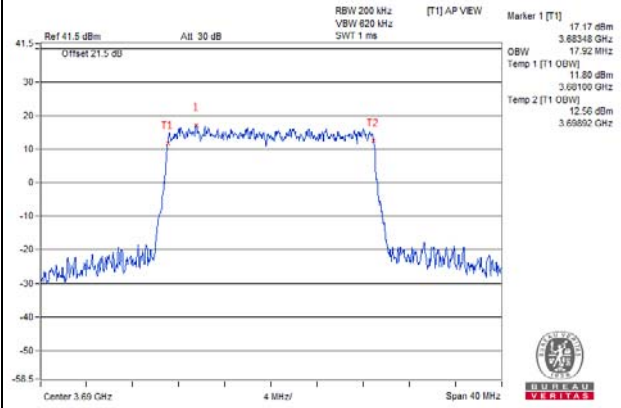


16QAM

Chain (0)

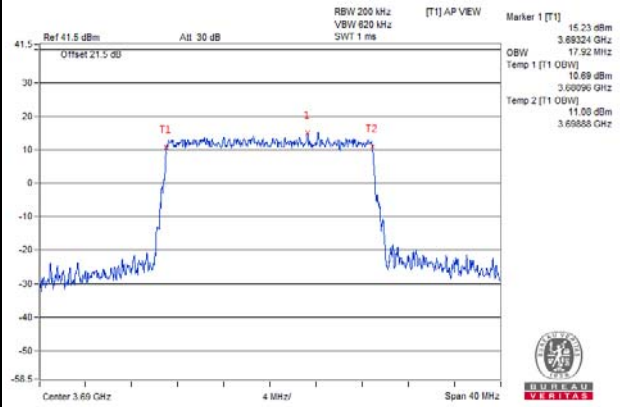


Chain (1)

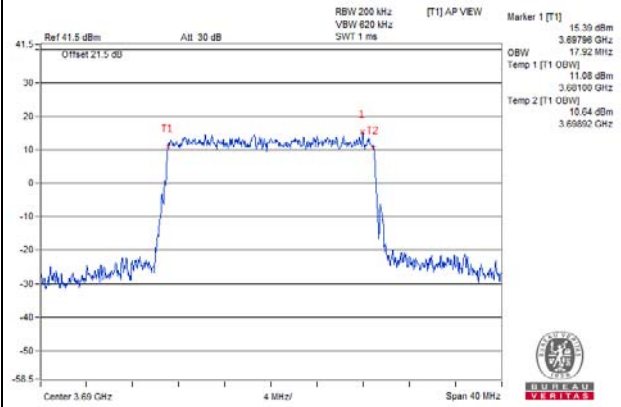


64QAM

Chain (0)



Chain (1)

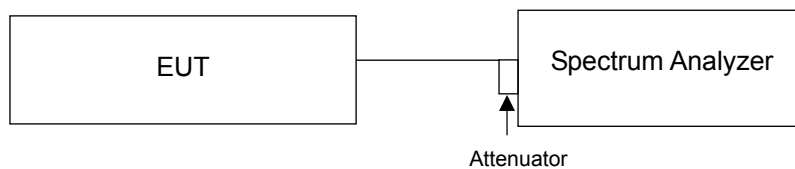


4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.6.2 Test Setup



4.6.3 Test Procedures

- Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

4.6.4 Test Results

Channel	Freq. (MHz)	Peak to Average Ratio (dB)		Limit(dB)	Pass /Fail
		5MHz			
		Chain0	Chain1		
		QPSK	QPSK		
Low	3552.5	9.22	9.18	13	Pass
Middle	3625	9.23	9.27	13	Pass
High	3697.5	9.03	9.10	13	Pass

Channel	Freq. (MHz)	Peak to Average Ratio (dB)		Limit(dB)	Pass /Fail
		10MHz			
		Chain0	Chain1		
		QPSK	QPSK		
Low	3555	9.22	9.15	13	Pass
Middle	3625	9.34	9.25	13	Pass
High	3695	8.92	8.97	13	Pass

Channel	Freq. (MHz)	Peak to Average Ratio (dB)		Limit(dB)	Pass /Fail
		15MHz			
		Chain0	Chain1		
		QPSK	QPSK		
Low	3557.5	9.11	8.86	13	Pass
Middle	3625	9.28	9.30	13	Pass
High	3692.5	8.97	8.94	13	Pass

Channel	Freq. (MHz)	Peak to Average Ratio (dB)		Limit(dB)	Pass /Fail
		20MHz			
		Chain0	Chain1		
		QPSK	QPSK		
Low	3560	8.80	8.75	13	Pass
Middle	3625	9.23	8.99	13	Pass
High	3690	8.81	8.73	13	Pass

5MHz:

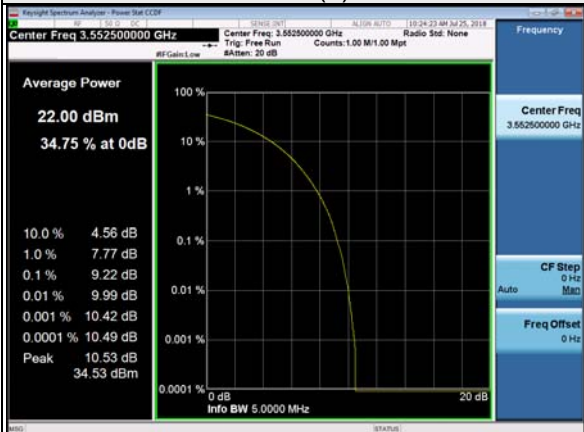
Spectrum Plot Of Worst Value

QPSK

Low

Chain (0)

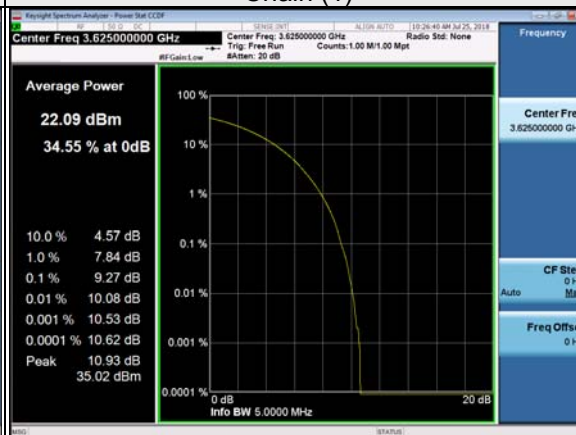
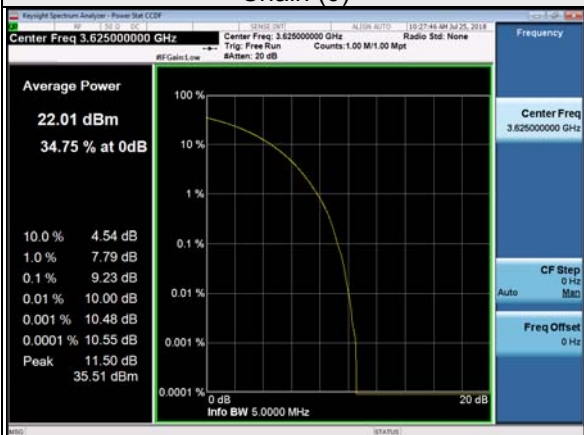
Chain (1)



Middle

Chain (0)

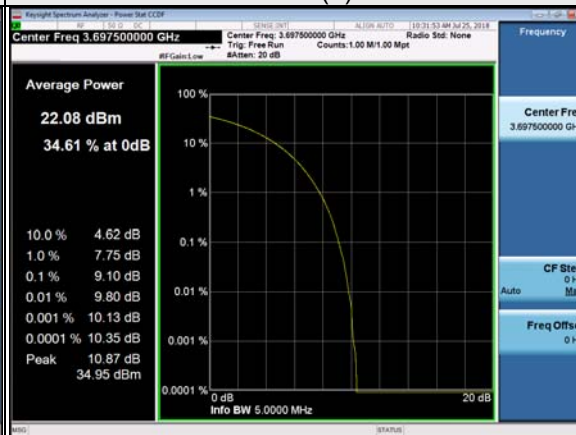
Chain (1)



High

Chain (0)

Chain (1)



10MHz:

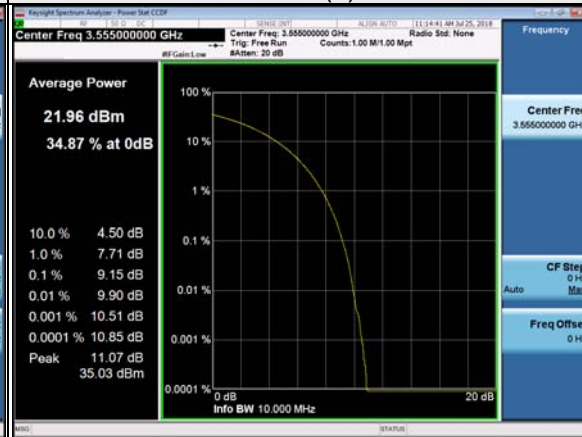
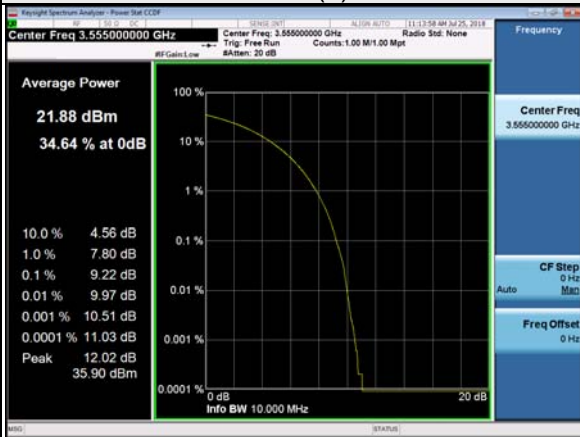
Spectrum Plot Of Worst Value

QPSK

Low

Chain (0)

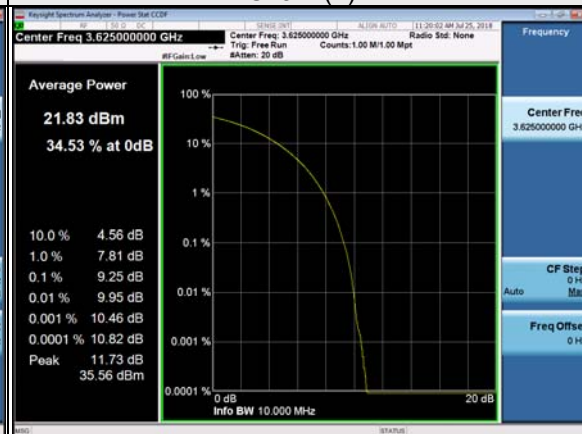
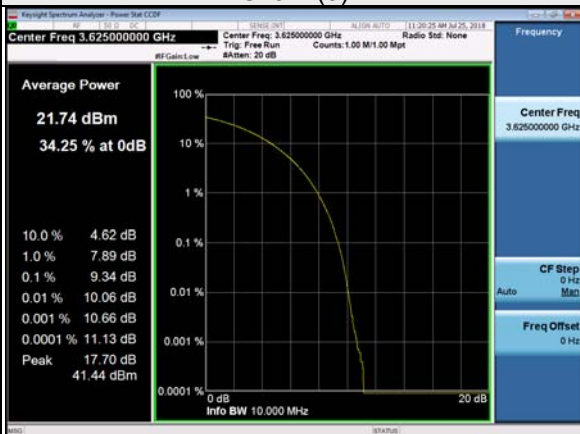
Chain (1)



Middle

Chain (0)

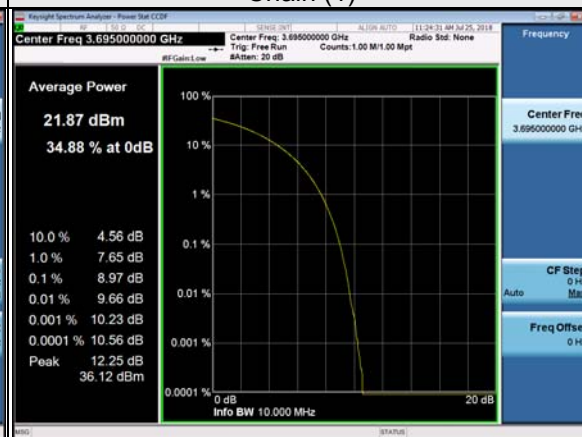
Chain (1)



High

Chain (0)

Chain (1)



15MHz:

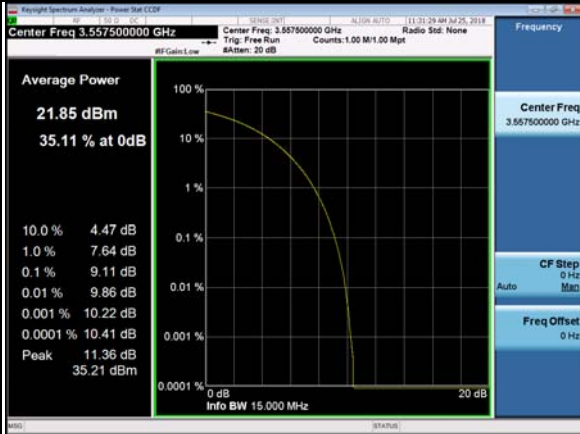
Spectrum Plot Of Worst Value

QPSK

Low

Chain (0)

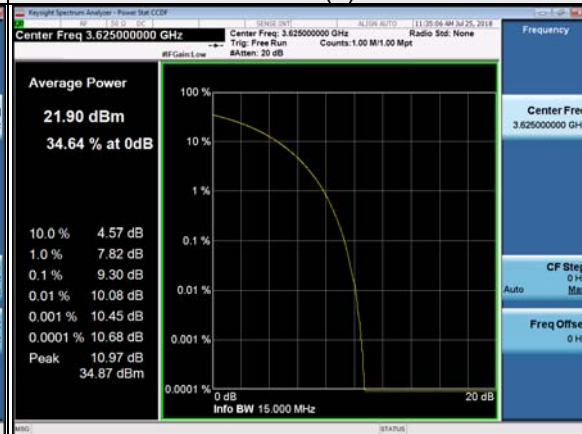
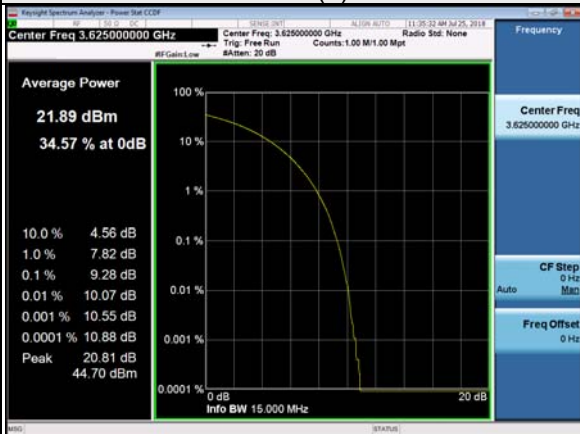
Chain (1)



Middle

Chain (0)

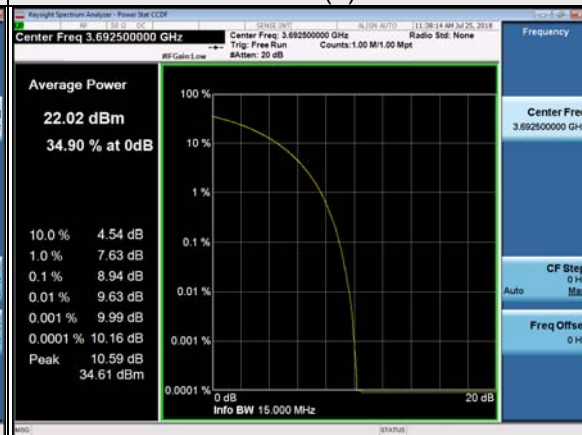
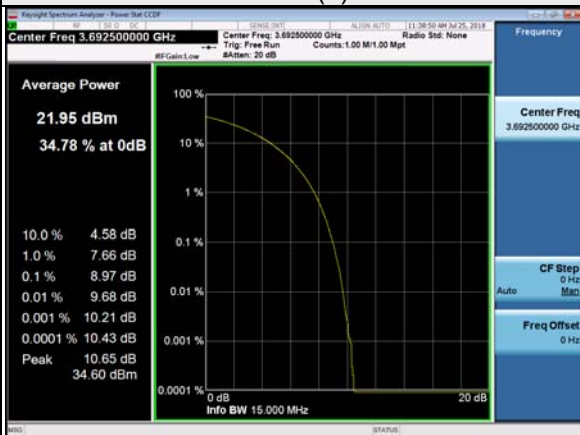
Chain (1)



High

Chain (0)

Chain (1)



20MHz:

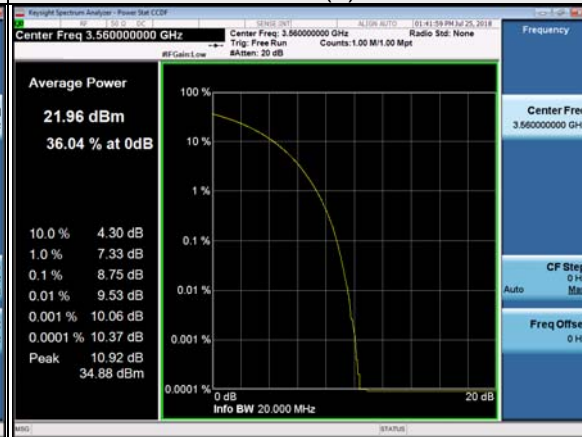
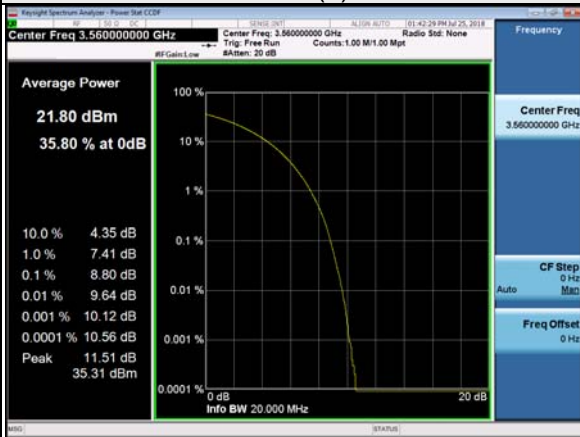
Spectrum Plot Of Worst Value

QPSK

Low

Chain (0)

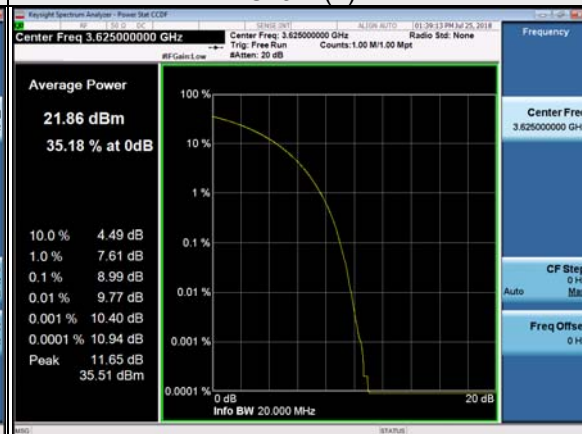
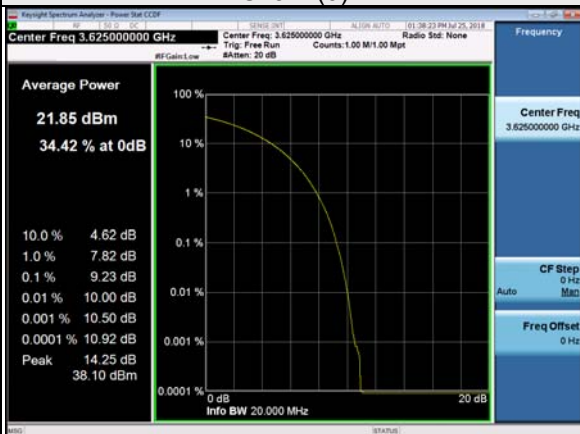
Chain (1)



Middle

Chain (0)

Chain (1)



High

Chain (0)

Chain (1)

