FCC IC Test Report

Report No.:	FCC_IC_RF_SL20030501-PHA-101 Rev 4.0
FCC ID:	2AOHB-PI00034
Test Model:	PI-N261-DF10400A
Received Date:	05/18/2020
Test Date:	05/20/2020 - 05/29/2020
Issued Date:	12/04/2020
Applicant:	JMA Tech, PHAZR
Address:	8 Prestige Circle, Suite 104, Allen, TX 75002
Manufacturer:	JMA Wireless, John Mezzalingua Associates
Address:	7645 Henry Clay Boulevard, Liverpool, NY 13088
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035
FCC Registration / Designation Number:	540430
ISED# / CAB identifier:	4842D

ACCREDITED
TESTING CERT # 2742-01

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Release Control Record

Issue No.	Description	Date Issued
FCC_IC_RF_SL20030501-PHA-101	Initial Release	06/01/2020
FCC_IC_RF_SL20030501-PHA-101 Rev 1.0	Updated per client	06/02/2020
FCC_IC_RF_SL20030501-PHA-101 Rev 2.0	Updated per client	06/08/2020
FCC_IC_RF_SL20030501-PHA-101 Rev 3.0	Updated per client	06/11/2020
FCC_IC_RF_SL20030501-PHA-101 Rev 4.0	Address TCB questions	12/04/2020

1 Certificate of Conformity

Product:	PI-N261-DF10400A
Brand:	JMA
Test Model:	PI-N261-DF10400A
Sample Status:	Engineering sample
Applicant:	JMA Tech, PHAZR
Test Date:	05/20/2020 - 05/29/2020
Standards:	47 CFR FCC Part 30 RSS 191 Issue3, April 2008 SRSP-325.25 ANSI C63.26: 2015 RSS Gen Issue5, March 2019

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas 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 EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** 12/04/2020

Deon Dai / Test Engineer

Approved by : _____ , **Date:** 12/04/2020

Chen Ge / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 30 RSS 191 Iss 3, 2008 SRSP-325.25			
FCC / IC Clause	Test Item	Result	Remarks
2.1055	Frequency Stability	PASS	Meet the requirement of limit.
30.202 RSS-191	E.I.R.P Density	PASS	Meet the requirement of limit.
2.1049 RSS-GEN	99% bandwidth	PASS	Meet the requirement of limit.
2.1051 30.203 RSS-191	Out-of-Band emission at band edges	PASS	Meet the requirement of limit.
2.1051 30.203 RSS-191	Out-of-Band emission spurious emissions	PASS	Meet the requirement of limit.

Note: All testing are done using radiated measurement.

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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	PI-N261-DF10400A
Brand	JMA
Test Model	PI-N261-DF10400A
Identification No. of EUT	IO28353001A
Status of EUT	Engineering Sample
Power Supply Rating	N/A
Modulation Type	QPSK, 16QAM, 64QAM
Modulation Technology	OFDM, MIMO
Operating Frequency	27.50 ~ 28.35GHz
Output Power	44dBm EIRP
Antenna Type	Integrated dual circular polarized patch antenna array
Antenna Gain	13dBi
Antenna Connector	N/A

3.1.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	-	-	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
NOTE: "-" means no effect.

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
L, M, H	L, M, H	QPSK, 16QAM, 64QAM

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
M	L, M, H	QPSK, 16QAM, 64QAM

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Deon Dai
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Deon Dai

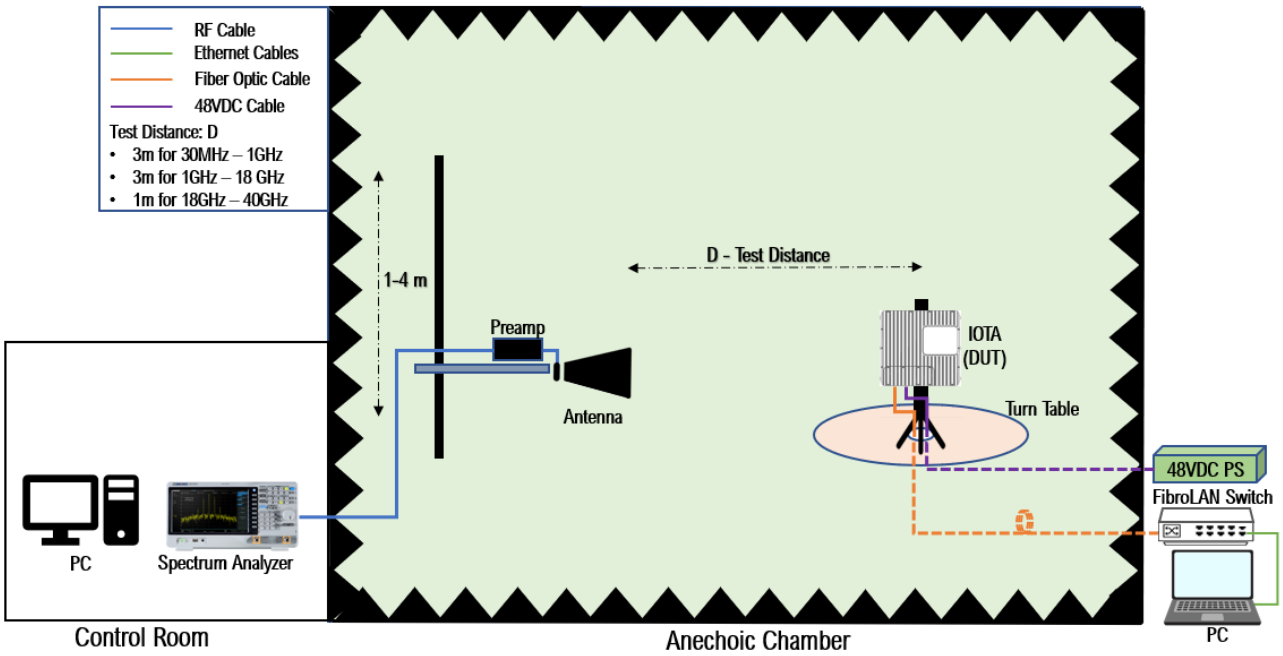
3.2 Description of Support Units

ID	Product	Brand	Model	Serial No.	Remarks
A.	Laptop	HP	HSTNN-142C	5CG7292MFN	Provided by customer
B.	Ethernet Switch	FibroLAN	uFalcon-MX/A	708318090039	Provided by customer
C.	48VDC Power Supply	MeanWell	UHP-350-48	N/A	Provided by customer
D.	Small Form-factor Pluggable (SFP+) transceiver Module	FINISAR	FTLX1471D3BTL	A37AQMY	Provided by customer
E.	Mounting Kits	N/A	N/A	N/A	Provided by customer

ID	Description	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Fiber Optic Cable	1	2	No	0	Provided by customer
2.	Ethernet Cable	1	15	No	0	Provided by customer

3.2.1 Configuration of System under Test

Radiated Measurement Configuration:



3.3 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 30
RSS 191 Issue3, April 2008
ANSI C63.26: 2015
RSS Gen Issue5, March 2019
SRSP-325.25

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

4 Test Types and Results

4.1 Frequency Stability Measurement

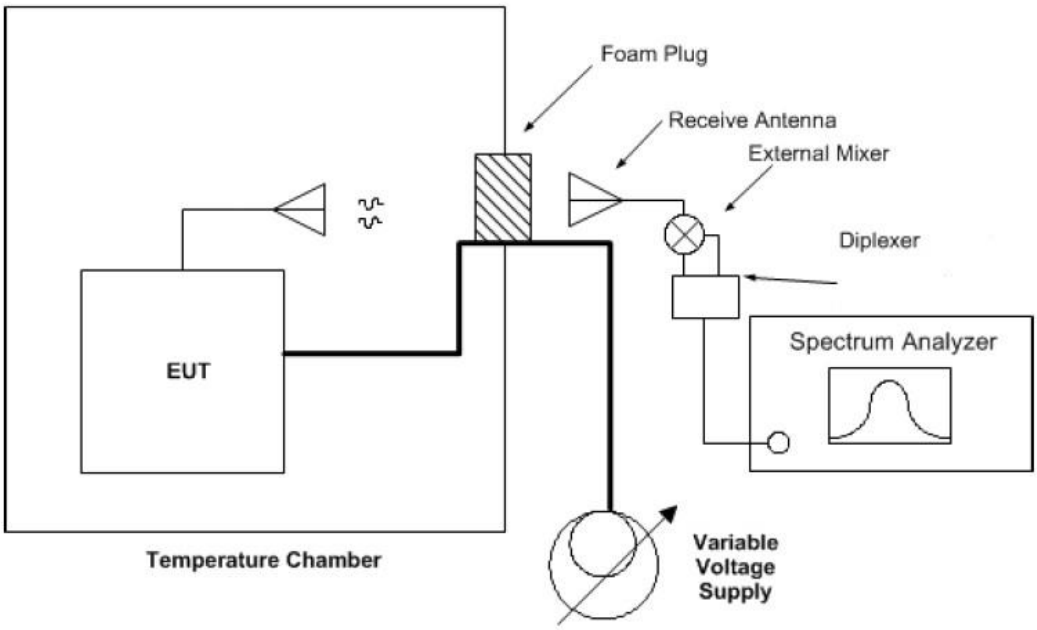
4.1.1 Limits of Frequency Stability Measurement

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015. The Frequency stability of the transmitter is measured by:

a. Temperature: The temperature is varied from -40°C to +55°C in 10°C increments using an environmental chamber.

b. Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

4.1.2 Test Setup



4.1.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.1.4 Test Procedure

a. Arrange EUT and test equipment as above setup configuration.
b. With the EUT at ambient temperature and voltage source set to the EUT nominal operating voltage (100%), record the spectrum mask of the EUT emission on the spectrum analyzer.
c. Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask.
d. Set the power supply to 100% nominal setting, and raise EUT operating temperature to 55 °C. Record the frequency excursion of the EUT emission mask.
e. Repeat step d) at each 10 °C increment down to −40 °C

4.1.5 Deviation from Test Standard

No deviation.

4.1.6 EUT Operating Condition

Same as Item 4.3.6

4.1.7 Test Results

Frequency Stability Versus Temp.			
Operating Frequency: 27925 MHz			
TEMP. (℃)	**Power Supply (Vdc)**	**Measured Frequency (MHz)**	**Pass/Fail**
-40	48	**27925.00**	**Pass**
-30	48	**27925.00**	**Pass**
-20	48	**27925.00**	**Pass**
-10	48	**27925.00**	**Pass**
0	48	**27925.00**	**Pass**
10	48	**27925.00**	**Pass**
20	48	**27925.00**	**Pass**
30	48	**27925.00**	**Pass**
40	48	**27925.00**	**Pass**
50	48	**27925.00**	**Pass**
55	48	**27925.00**	**Pass**

Frequency Stability Versus Voltage			
Operating Frequency: 27925 MHz			
TEMP. (℃)	**Power Supply (Vdc)**	**Measured Frequency(MHz)**	**Pass/Fail**
25	40.8	**27925.00**	**Pass**
	48	**27925.00**	**Pass**
	55.2	**27925.00**	**Pass**

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. AS such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band (27.50 ~ 28.35GHz) over the temperature and voltage range as tested.

4.2 Radiated Emission

4.2.1 Limits of Radiated Emission Measurement

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

(b)

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

(c) For fixed point-to-point and point-to-multipoint limits see § 30.404.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Receiver Rohde & Schwarz	ESW 44	1328.4100K-101662-MH	08/30/2019	08/30/2020
Biconilog Antenna Sunol	JB1	A030702	03/09/2020	03/09/2021
Pre-Amplifier RF Bay, Inc.	LPA-6-30	11170601	04/27/2020	04/27/2021
Horn Antenna ETS-Lindgren	3117	218554	12/20/2019	12/20/2020
Pre-Amplifier RF-Lambda	RAMP00M50GA	17032300048	06/18/2019	06/18/2020

4.2.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

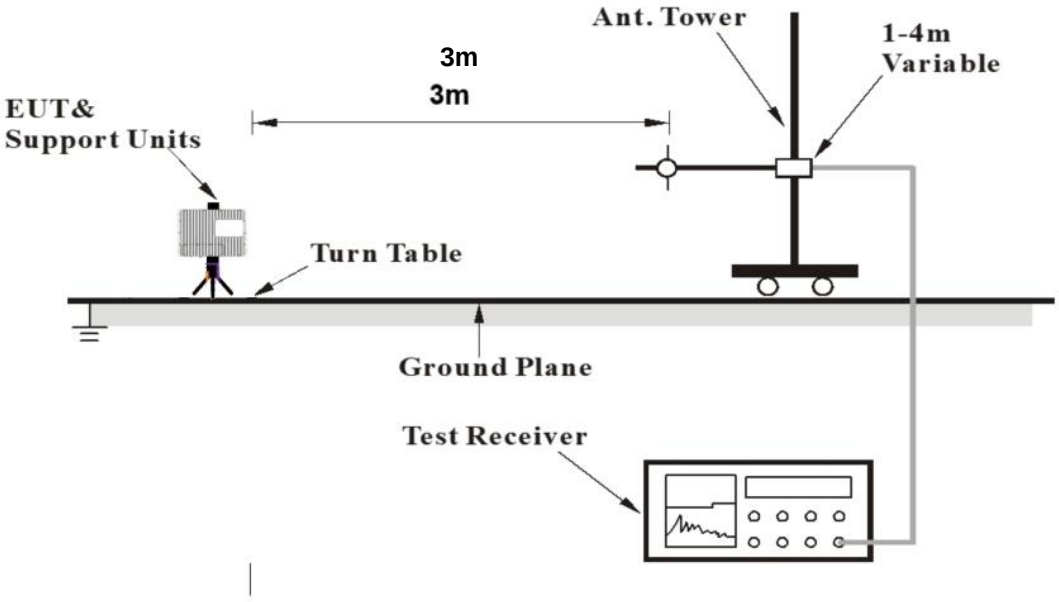
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

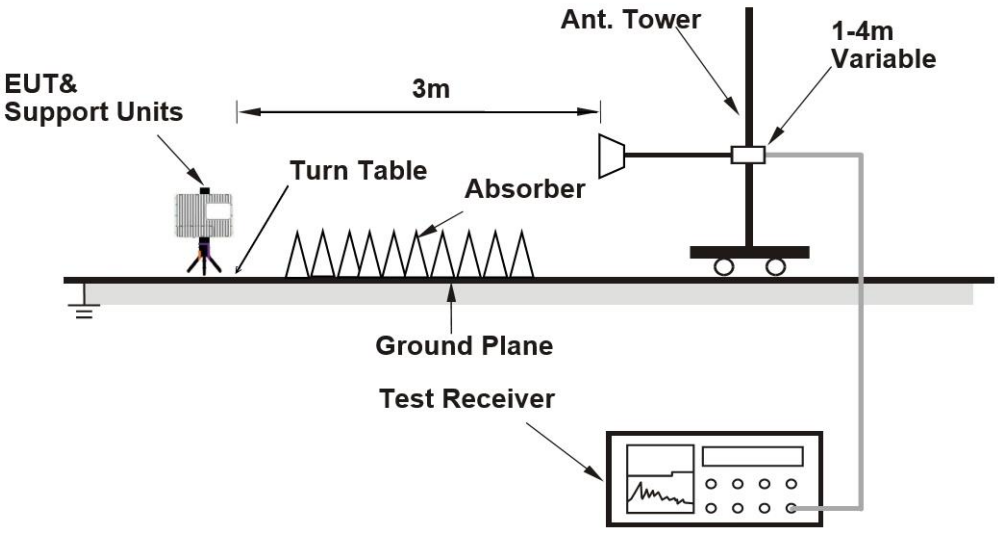
No deviation.

4.2.5 Test Setup

For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

a. Connected the EUT with the Notebook Computer which is placed on remote site.
b. Controlling software has been activated to set the EUT on specific status.

4.2.7 Test Results

30MHz – 1GHz

CHANNEL	400MHz, Mid Channel	**DETECTOR FUNCTION**	Average
FREQUENCY RANGE	30MHz – 1GHz		

Indicated			Test Antenna		Substituted						
Frequency (MHz)	**Raw (dBm)**	**Degree**	**Height (cm)**	**Polarity**	**Frequency (MHz)**	**Level (dBm)**	**Ant Gain (dBi)**	**Cable Loss (dB)**	**Absolute Level (dBm)**	**Limit (dBm)**	**Margin (dB)**
47.23	-41.5	154	143	V	47.23	-35.34	0	0.22	-35.56	-13	-22.56
47.23	-43.2	18	144	H	47.23	-36.21	0	0.22	-36.43	-13	-23.43
126.77	-41.8	44	165	V	126.77	-37.53	0	0.47	-38	-13	-25
126.77	-42.4	259	155	H	126.77	-36.21	0	0.47	-36.68	-13	-23.68
233.41	-47.5	198	165	V	233.41	-41.36	0	0.49	-41.85	-13	-28.85
233.41	-45.9	266	149	H	233.41	-38.66	0	0.49	-39.15	-13	-26.15

REMARKS:

1. Margin = Level (dBm) - Limit value (dBm)

1GHz – 40GHz

CHANNEL	400MHz, Low Channel	DETECTOR FUNCTION	Average
FREQUENCY RANGE	1GHz – 40GHz		

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
2698.6	-58.1	254	102	V	2698.6	-51.58	9.45	2.1	-44.23	-13	-31.23
2698.6	-59.0	22	200	H	2698.6	-52.53	9.45	2.1	-45.18	-13	-32.18
11733.5	-46.9	244	110	V	11733.5	-40.2	11.27	4.63	-33.56	-13	-20.56
11733.5	-46.7	298	210	H	11733.5	-40.01	11.27	4.63	-33.37	-13	-20.37

CHANNEL	400MHz, Mid Channel	DETECTOR FUNCTION	Average
FREQUENCY RANGE	1GHz – 40GHz		

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
2123.56	-58.2	214	102	V	2123.56	-50.99	7.82	1.76	-44.93	-13	-31.93
2123.56	-57.4	146	200	H	2123.56	-50.19	7.82	1.76	-44.13	-13	-31.13
11590.75	-47.5	21	110	V	11590.75	-40.57	11.27	4.63	-33.93	-13	-20.93
11590.75	-47.8	355	201	H	11590.75	-40.83	11.27	4.63	-34.19	-13	-21.19

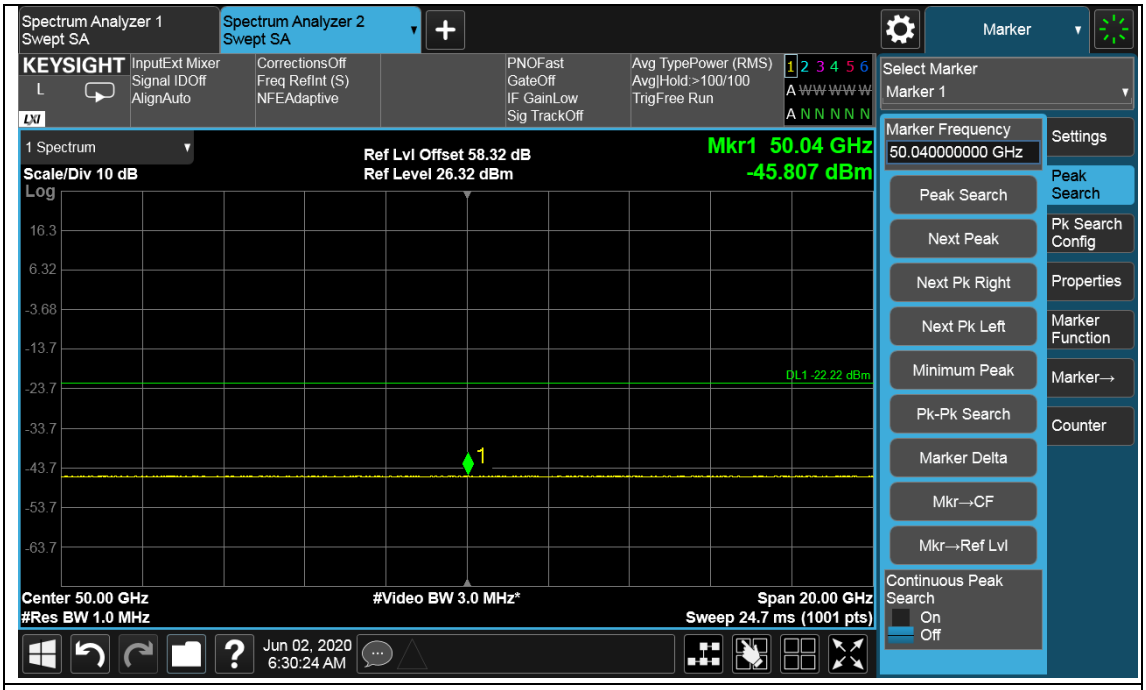
CHANNEL	400MHz, High Channel	**DETECTOR FUNCTION**	Average
FREQUENCY RANGE	1GHz – 40GHz		

Indicated			Test Antenna		Substituted						
Frequency (MHz)	**Raw (dBm)**	**Degree**	**Height (cm)**	**Polarity**	**Frequency (MHz)**	**Level (dBm)**	**Ant Gain (dBi)**	**Cable Loss (dB)**	**Absolute Level (dBm)**	**Limit (dBm)**	**Margin (dB)**
3465.5	-57.8	132	100	V	3465.5	-51.09	9.45	2.1	-43.74	-13	-30.74
3465.5	-57.6	256	109	H	3465.5	-50.89	9.45	2.1	-43.54	-13	-30.54
11550	-44.7	144	120	V	11550	-37.98	11.37	4.86	-31.47	-13	-18.47
11550	-47.0	29	114	H	11550	-40.29	11.37	4.86	-33.78	-13	-20.78

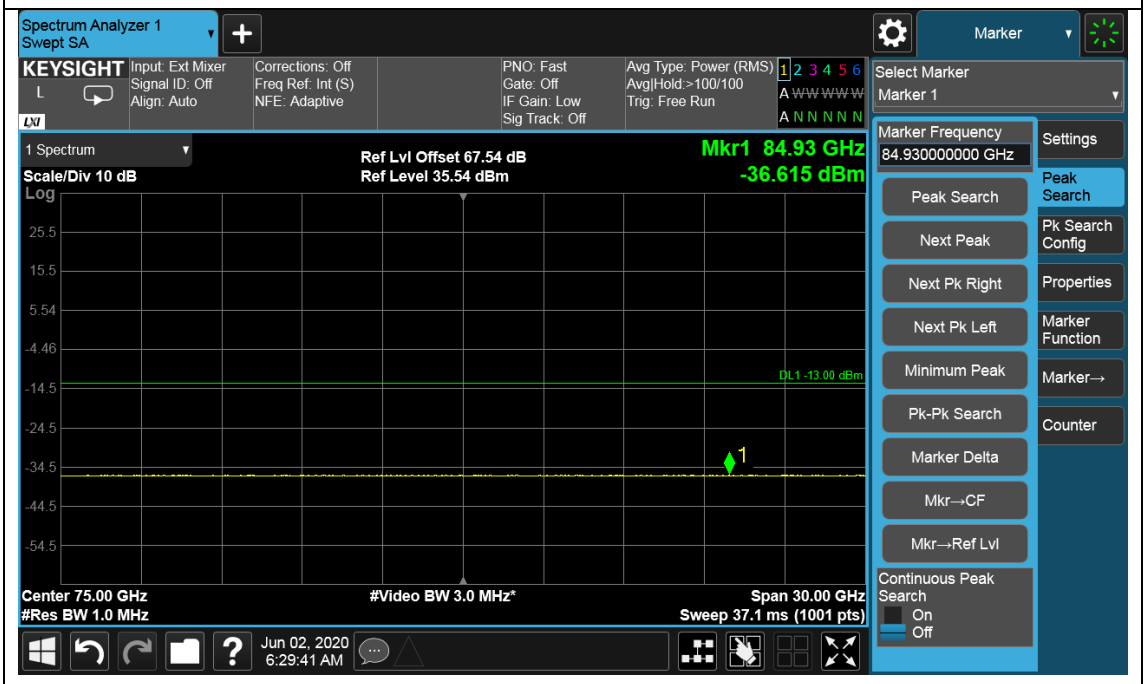
REMARKS:

1. Margin = Level (dBm) - Limit value (dBm)

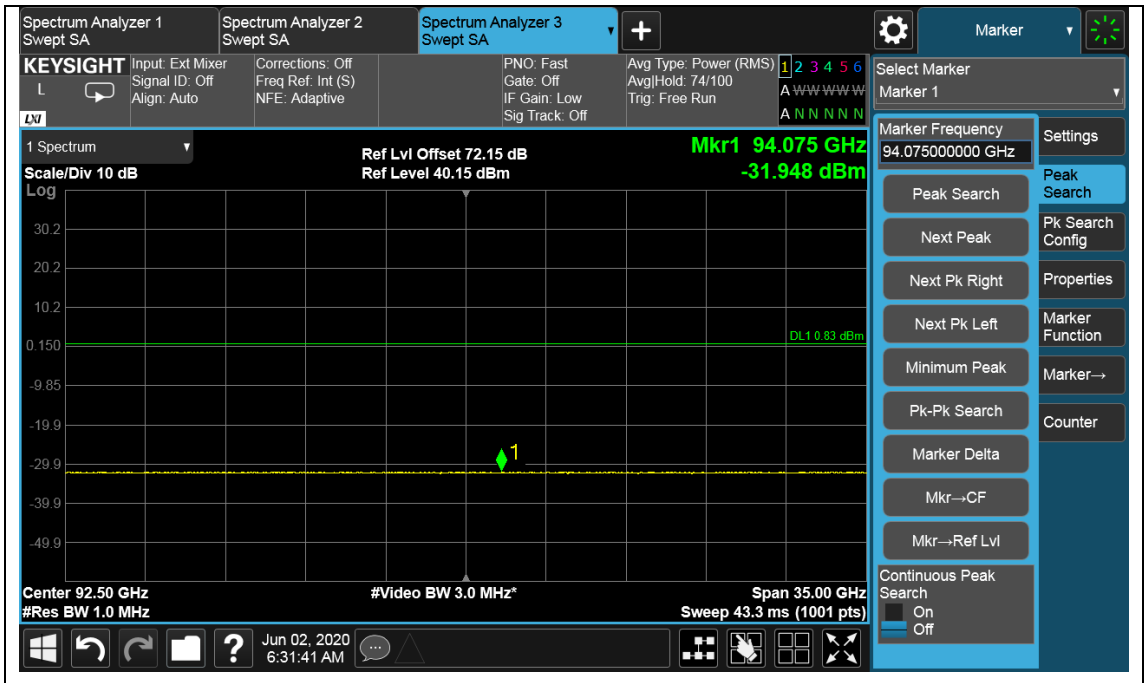
Radiated Emissions 40GHz-110GHz



Radiated emission 40 - 60GHz



Radiated emission 60 - 90GHz



Radiated emission 75 - 110GHz

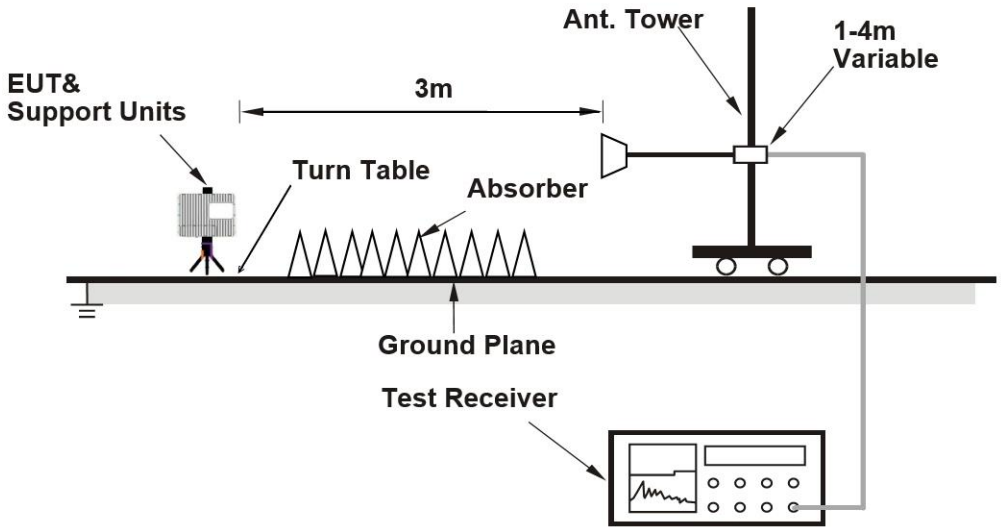
Note: All emissions above 40GHz are at the noise floor level, only worst case channel is tested.

4.3 99% Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The occupied bandwidth, that is the frequency such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 1MHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission.

4.3.5 Deviation fromTest Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

100MHz BW

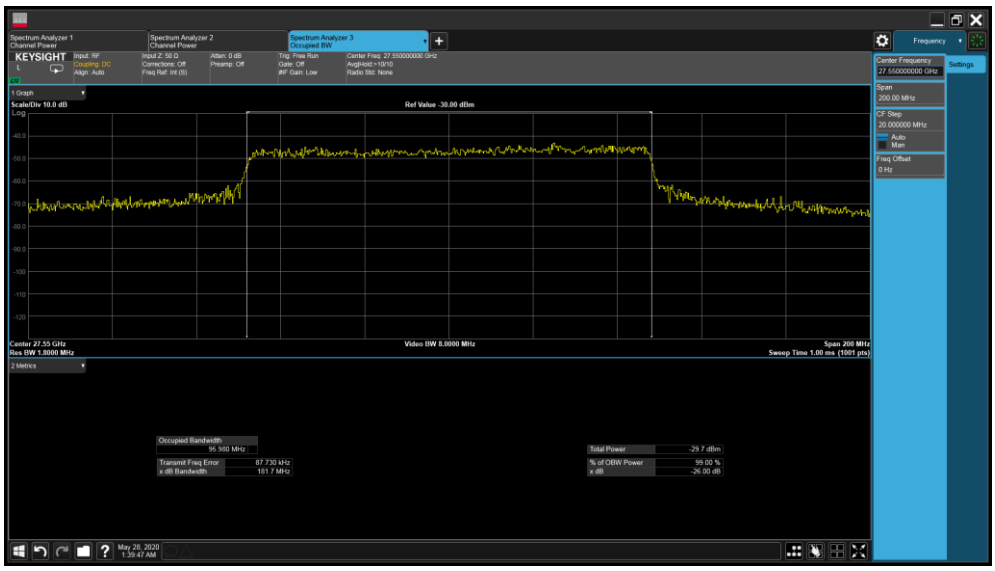
Channel	Modulation	Frequency (GHz)	99% Bandwidth (MHz)	Limit
Low	QPSK	27.55	95.98	N/A
Mid	QPSK	27.925	95.30	N/A
High	QPSK	28.30	95.17	N/A
Low	16QAM	27.55	94.83	N/A
Mid	16QAM	27.925	95.21	N/A
High	16QAM	28.30	95.20	N/A
Low	64QAM	27.55	95.34	N/A
Mid	64QAM	27.925	95.69	N/A
High	64QAM	28.30	96.08	N/A

400MHz BW

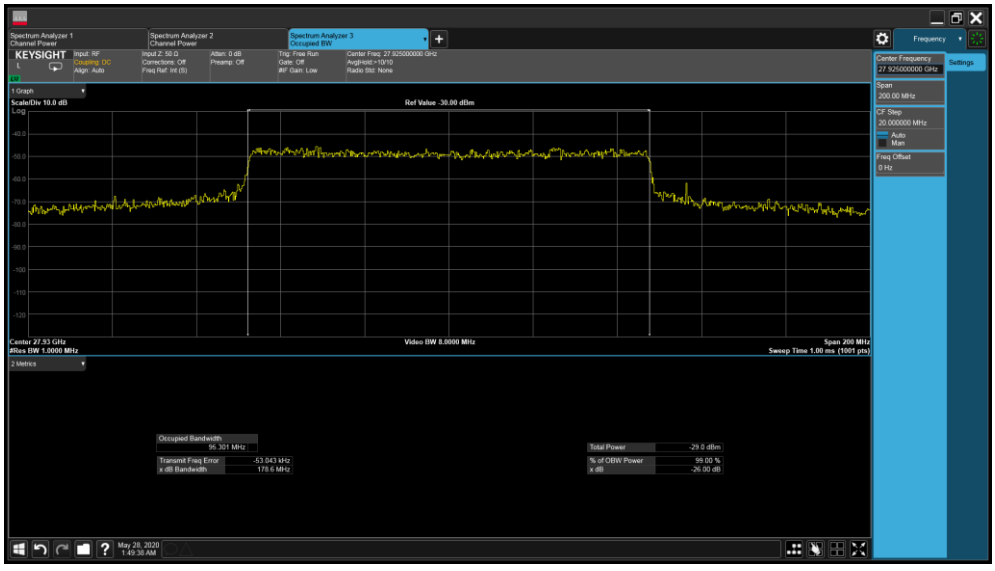
Channel	Modulation	Frequency (GHz)	99% Bandwidth (MHz)	Limit
Low	QPSK	27.70	394.70	N/A
High	QPSK	28.15	394.04	N/A
Low	16QAM	27.70	393.79	N/A
High	16QAM	28.15	396.18	N/A
Low	64QAM	27.70	397.56	N/A
High	64QAM	28.15	395.38	N/A

Test Plots:

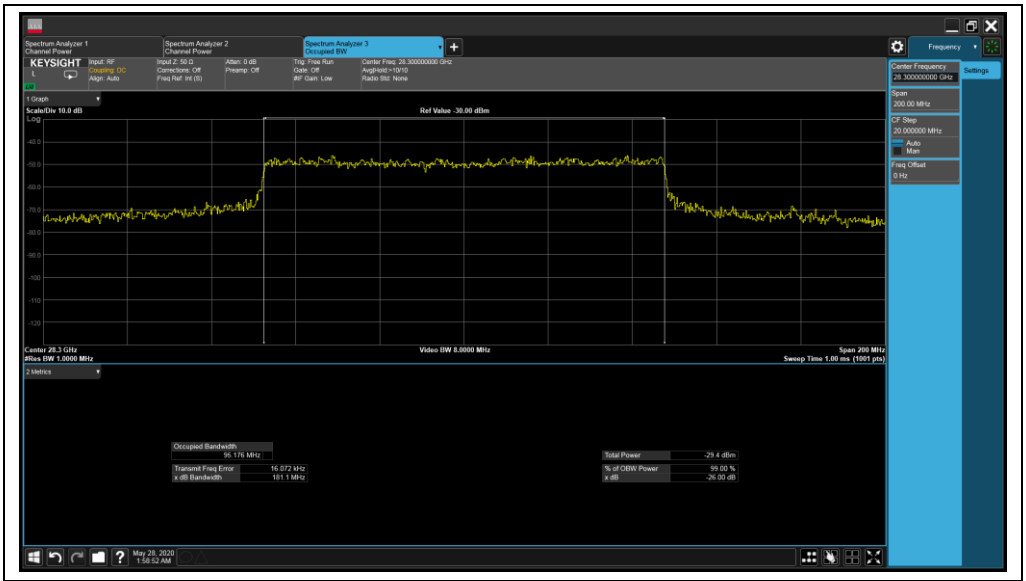
100MHz BW



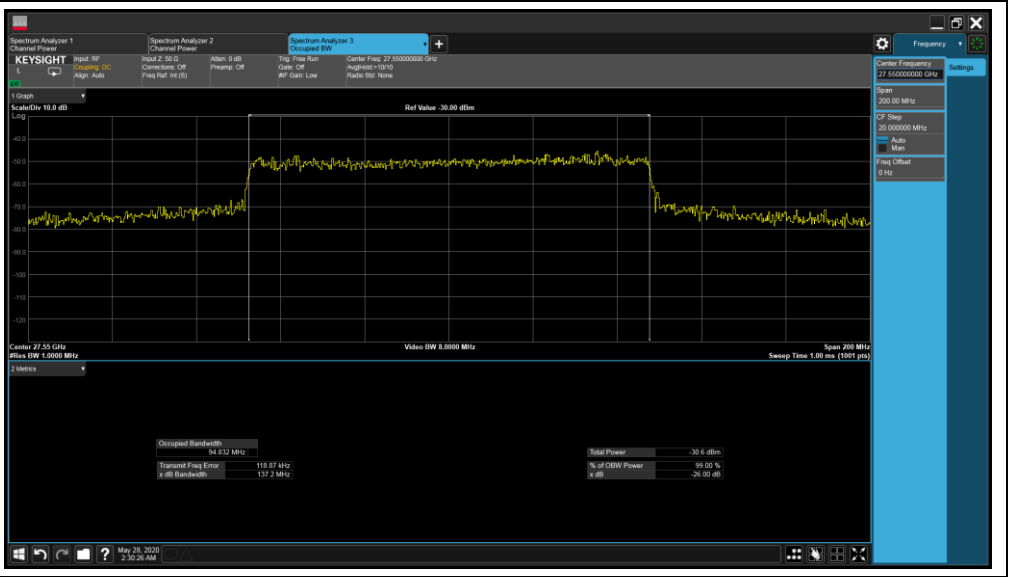
QPSK - Low



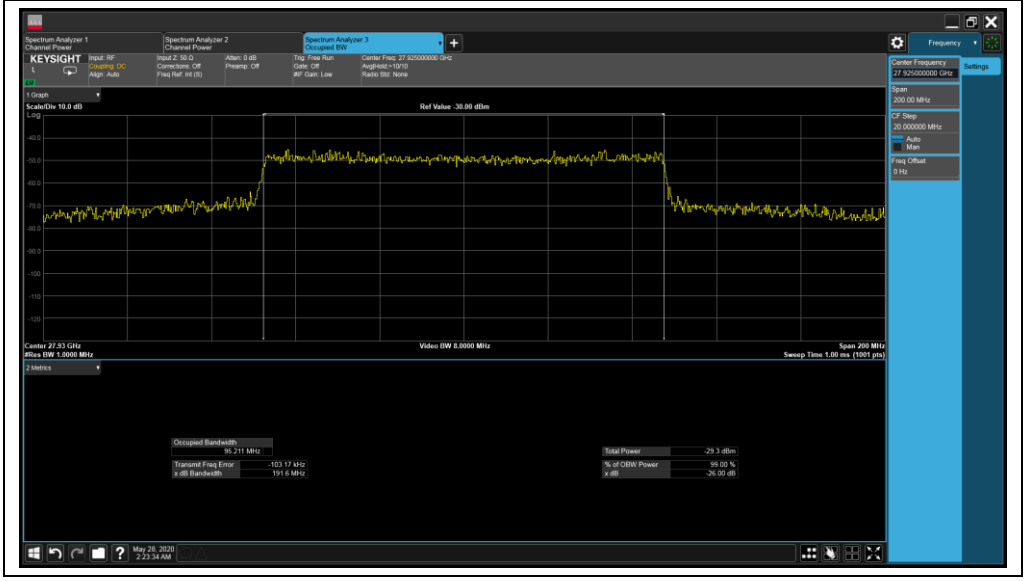
QPSK - Mid

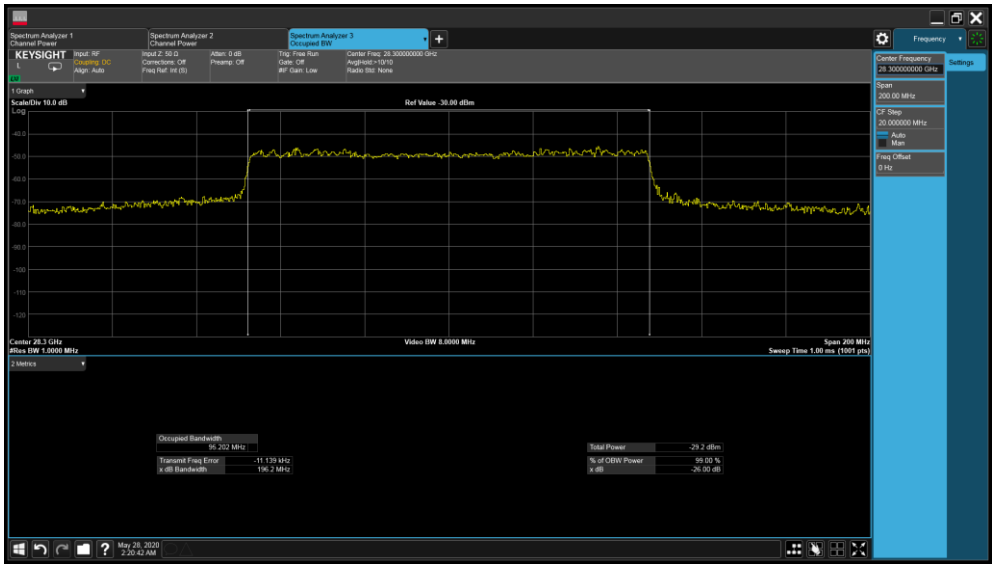
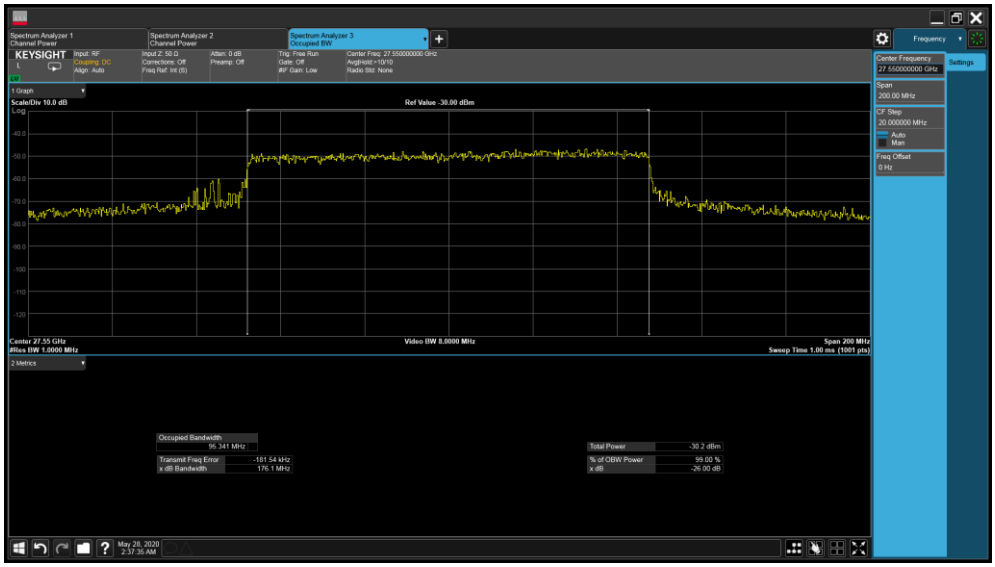


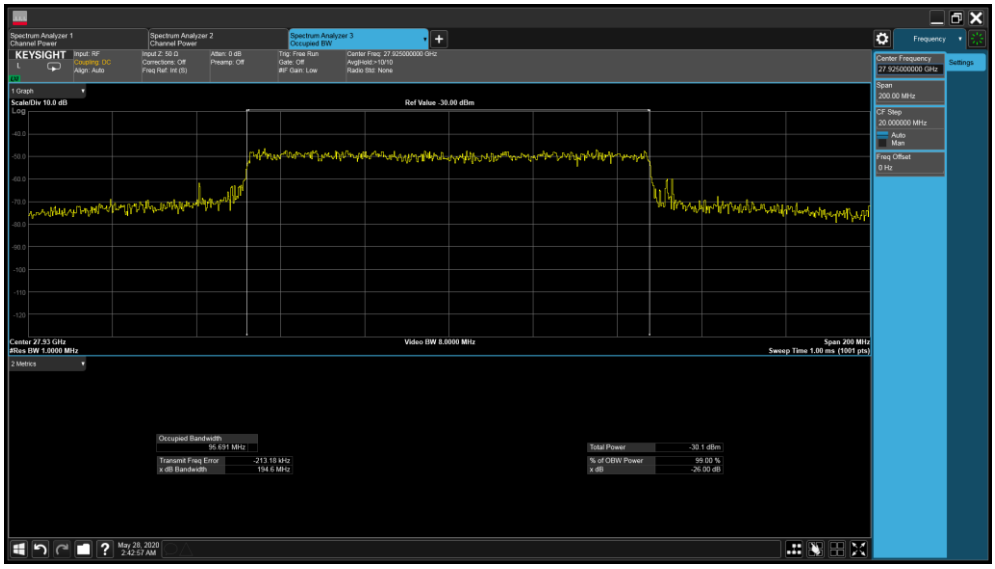
QPSK - High



16QAM - Low



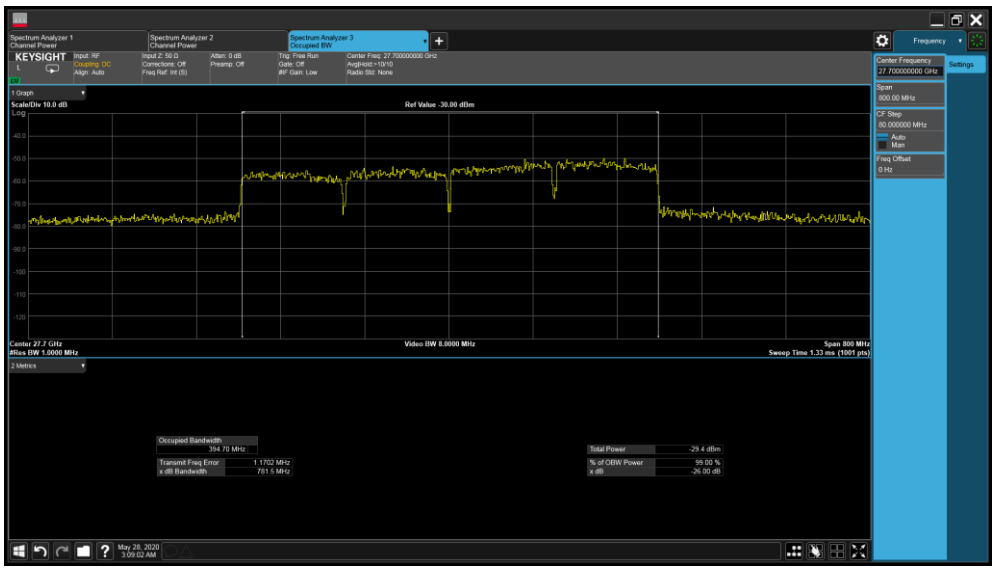
16QAM - Mid

16QAM - High

64QAM - Low



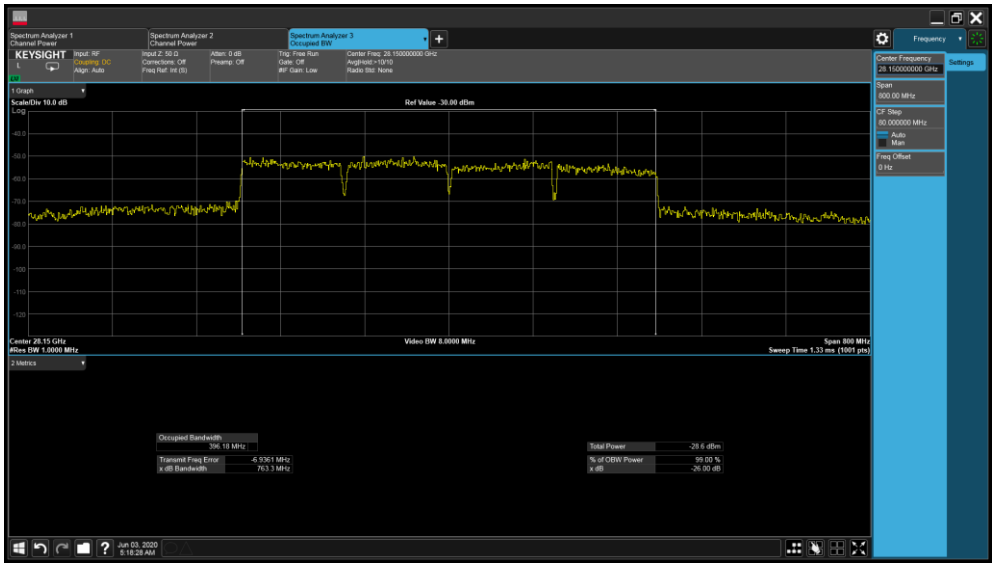
64QAM - Mid

64QAM - High

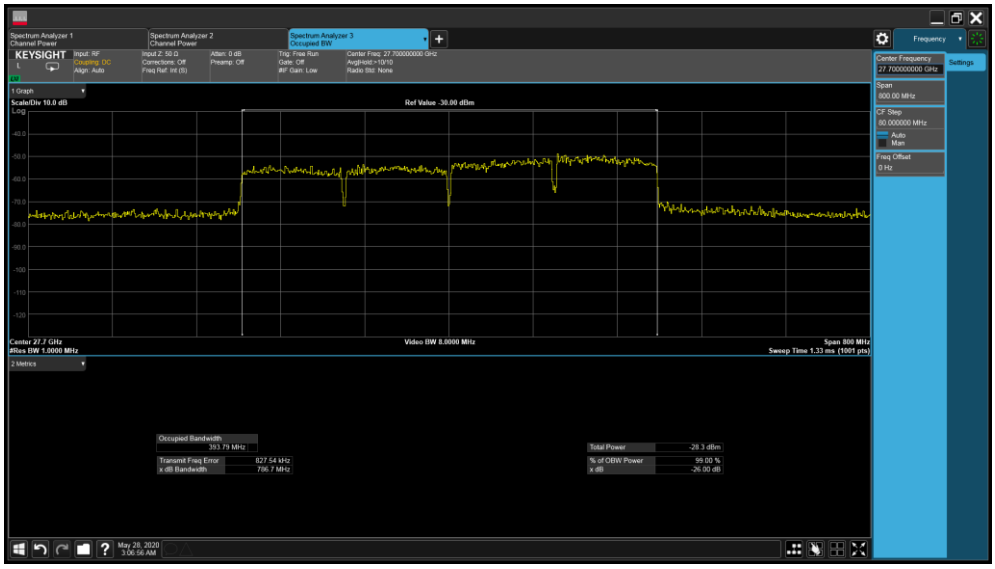
400MHz BW



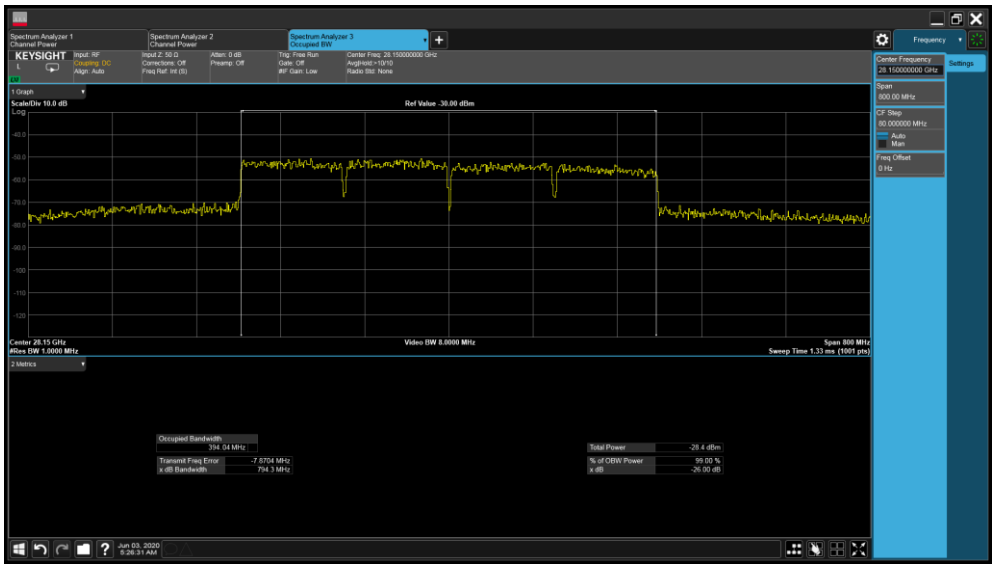
QPSK - Low



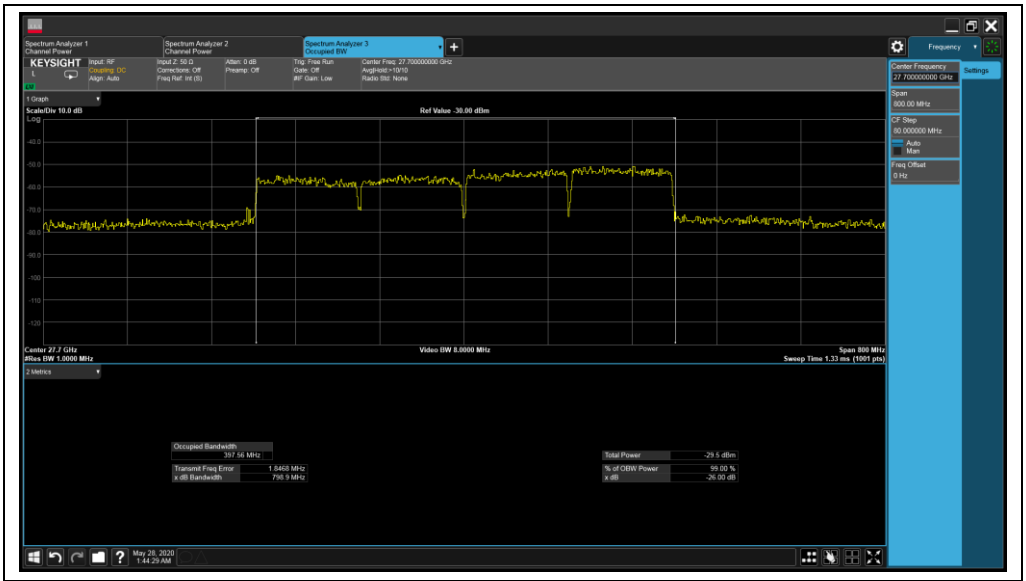
QPSK - High



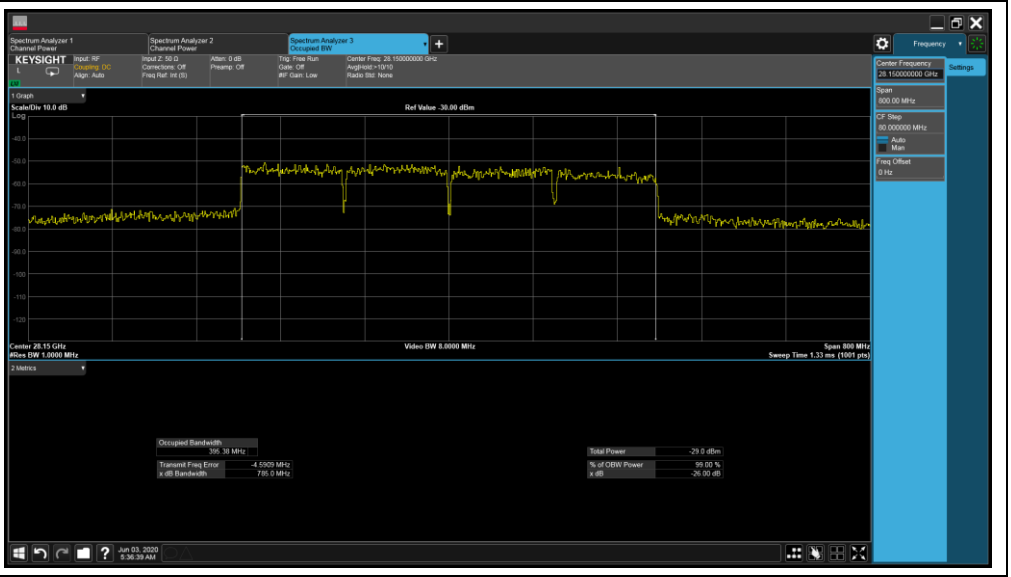
16QAM - Low



16QAM - High



64QAM - Low



64QAM - High

4.4 E.I.R.P Density Measurement

4.4.1 Limits of E.I.R.P Density Measurement

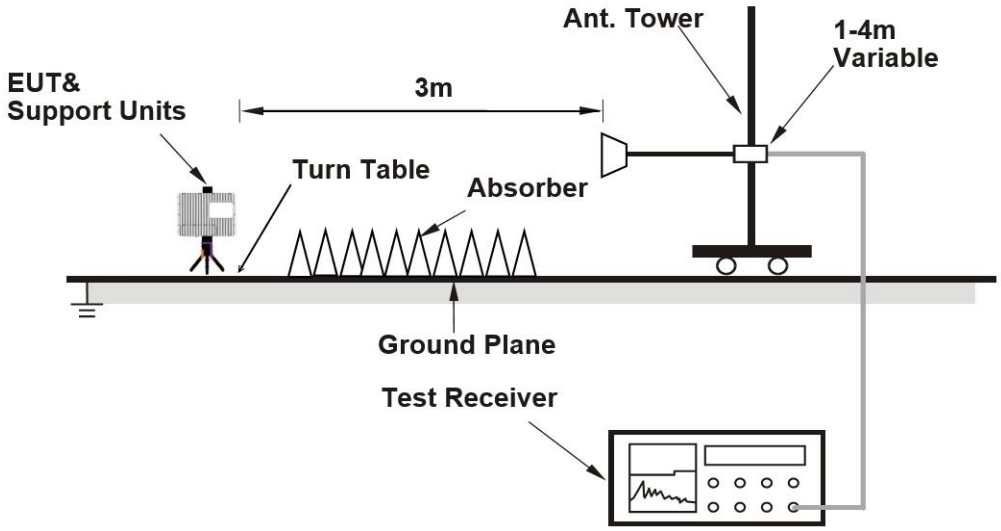
(a) For fixed and base stations operating in connection with mobile systems, the average power of the sum of all antenna elements is limited to an equivalent isotopically radiated power (EIRP) density of +75dBm/100 MHz. For channel bandwidths less than 100 megahertz the EIRP must be reduced proportionally and linearly based on the bandwidth relative to 100 megahertz.

(b) For mobile stations, the average power of the sum of all antenna elements is limited to a maximum EIRP of +43 dBm.

(c) For transportable stations, as defined in § 30.2, the average power of the sum of all antenna elements is limited to a maximum EIRP of +55 dBm.

(d) For fixed point-to-point and point-to-multipoint limits see § 30.405.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

ANSI C63.26-2015 Section 5.2.4.4.1
ANSI C63.26-2015 Section 6.4
- Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
- RBW = 1-5% of the expected OBW
- VBW >= 3 * RBW
- Span = 2 * to 3 * the OBW
- Detector = RMS
- Trigger is set to "free run"
- Trace mode = trace averaging (RMS) over 100 sweeps
- Allow trace to fully stabilize.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

4.4.7 Test Results

100MHz BW, Horizontal

Channel	Modulation	Frequency (GHz)	ANT1 (dBm/100MHz)	ANT2 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.55	31.88	31.47	3	37.69
Mid	QPSK	27.925	32.63	32.27	3	38.46
High	QPSK	28.30	32.33	32.00	3	38.18
Low	16QAM	27.55	31.93	31.55	3	37.75
Mid	16QAM	27.925	31.92	31.56	3	37.75
High	16QAM	28.30	32.12	31.79	3	37.97
Low	64QAM	27.55	32.15	31.82	3	38.00
Mid	64QAM	27.925	31.36	31.03	3	37.21
High	64QAM	28.30	32.35	31.96	3	38.17

Channel	Modulation	Frequency (GHz)	ANT3 (dBm/100MHz)	ANT4 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.55	31.52	31.70	3	37.62
Mid	QPSK	27.925	32.11	32.44	3	38.29
High	QPSK	28.30	31.70	32.12	3	37.93
Low	16QAM	27.55	31.54	31.73	3	37.65
Mid	16QAM	27.925	31.40	31.73	3	37.58
High	16QAM	28.30	31.74	31.92	3	37.84
Low	64QAM	27.55	31.76	31.95	3	37.87
Mid	64QAM	27.925	30.80	31.19	3	37.01
High	64QAM	28.30	31.90	32.15	3	38.04

100MHz BW, Vertical

Channel	Modulation	Frequency (GHz)	ANT1 (dBm/100MHz)	ANT2 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.55	30.19	29.79	3	36.00
Mid	QPSK	27.925	30.94	30.60	3	36.78
High	QPSK	28.30	30.72	30.36	3	36.55
Low	16QAM	27.55	30.30	29.89	3	36.11
Mid	16QAM	27.925	30.23	29.89	3	36.07
High	16QAM	28.30	30.43	30.14	3	36.30
Low	64QAM	27.55	30.51	30.16	3	36.35
Mid	64QAM	27.925	29.68	29.37	3	35.54
High	64QAM	28.30	30.73	30.33	3	36.54

Channel	Modulation	Frequency (GHz)	ANT3 (dBm/100MHz)	ANT4 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.55	29.90	30.02	3	35.97
Mid	QPSK	27.925	30.47	30.79	3	36.64
High	QPSK	28.30	30.04	30.48	3	36.28
Low	16QAM	27.55	29.90	30.12	3	36.02
Mid	16QAM	27.925	29.75	30.04	3	35.91
High	16QAM	28.30	30.05	30.24	3	36.16
Low	64QAM	27.55	30.16	30.27	3	36.23
Mid	64QAM	27.925	29.12	29.51	3	35.33
High	64QAM	28.30	30.20	30.46	3	36.34

Channel	Modulation	Frequency (GHz)	Horizontal (dBm/100MHz)	Vertical (dBm/100MHz)	Total EIRP Density (dBm/100MHz)	Limit (dBm/100MHz)
Low	QPSK	27.55	40.67	39.00	42.93	75
Mid	QPSK	27.925	41.39	39.72	43.65	75
High	QPSK	28.30	41.07	39.43	43.34	75
Low	16QAM	27.55	40.71	39.08	42.98	75
Mid	16QAM	27.925	40.68	39.00	42.93	75
High	16QAM	28.30	40.92	39.24	43.17	75
Low	64QAM	27.55	40.95	39.30	43.21	75
Mid	64QAM	27.925	40.12	38.45	42.38	75
High	64QAM	28.30	41.12	39.45	43.38	75

Note: The final result includes the antenna factor (dB/m), Cable Loss and distance correction factor, the plot shows the original reading without factors.
EUT is a point-to-multipoint fixed base stations operating in connection with mobile systems.
55dBW = 85dBm.

400MHz BW, Horizontal

Channel	Modulation	Frequency (GHz)	ANT1 (dBm/100MHz)	ANT2 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.70	24.45	24.19	3	30.33
High	QPSK	28.15	26.82	26.45	3	32.65
Low	16QAM	27.70	25.15	24.80	3	30.99
High	16QAM	28.15	26.75	26.45	3	32.61
Low	64QAM	27.70	25.66	25.32	3	31.50
High	64QAM	28.15	27.35	27.07	3	33.22

Channel	Modulation	Frequency (GHz)	ANT3 (dBm/100MHz)	ANT4 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.70	24.25	24.32	3	30.30
High	QPSK	28.15	26.41	26.66	3	32.55
Low	16QAM	27.70	24.80	25.00	3	30.91
High	16QAM	28.15	26.24	26.57	3	32.42
Low	64QAM	27.70	25.34	25.49	3	31.43
High	64QAM	28.15	26.93	27.19	3	33.07

400MHz BW, Vertical

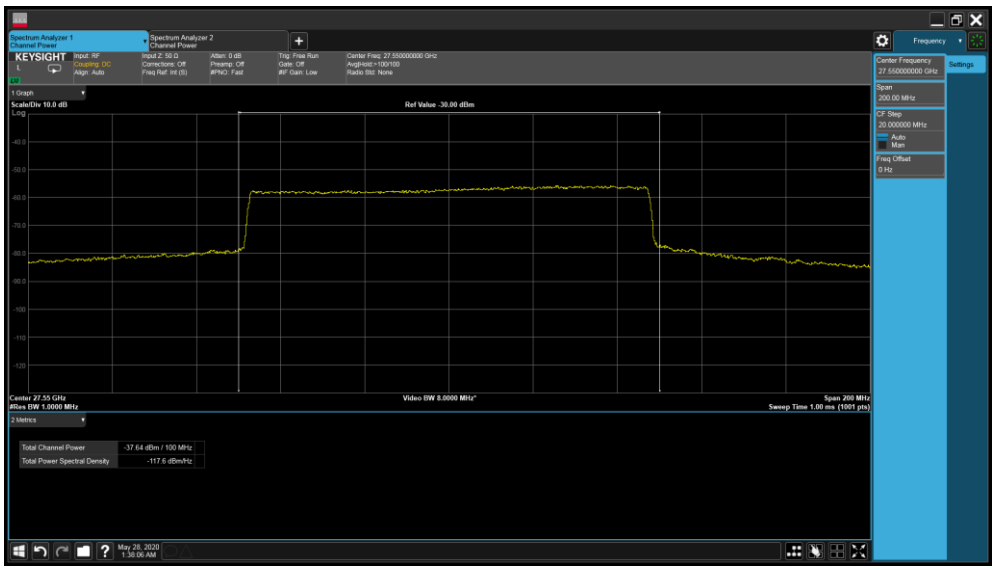
Channel	Modulation	Frequency (GHz)	ANT1 (dBm/100MHz)	ANT2 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.70	22.72	22.51	3	28.63
High	QPSK	28.15	25.13	24.77	3	30.96
Low	16QAM	27.70	23.46	23.06	3	29.27
High	16QAM	28.15	25.09	24.74	3	30.93
Low	64QAM	27.70	23.91	23.58	3	29.76
High	64QAM	28.15	25.68	25.35	3	31.53

Channel	Modulation	Frequency (GHz)	ANT3 (dBm/100MHz)	ANT4 (dBm/100MHz)	Correlated Factor (dB)	Total (dBm/100MHz)
Low	QPSK	27.70	22.57	22.63	3	28.61
High	QPSK	28.15	24.67	24.93	3	30.81
Low	16QAM	27.70	23.09	23.32	3	29.22
High	16QAM	28.15	24.58	24.89	3	30.75
Low	64QAM	27.70	23.65	23.77	3	29.72
High	64QAM	28.15	25.21	25.48	3	31.36

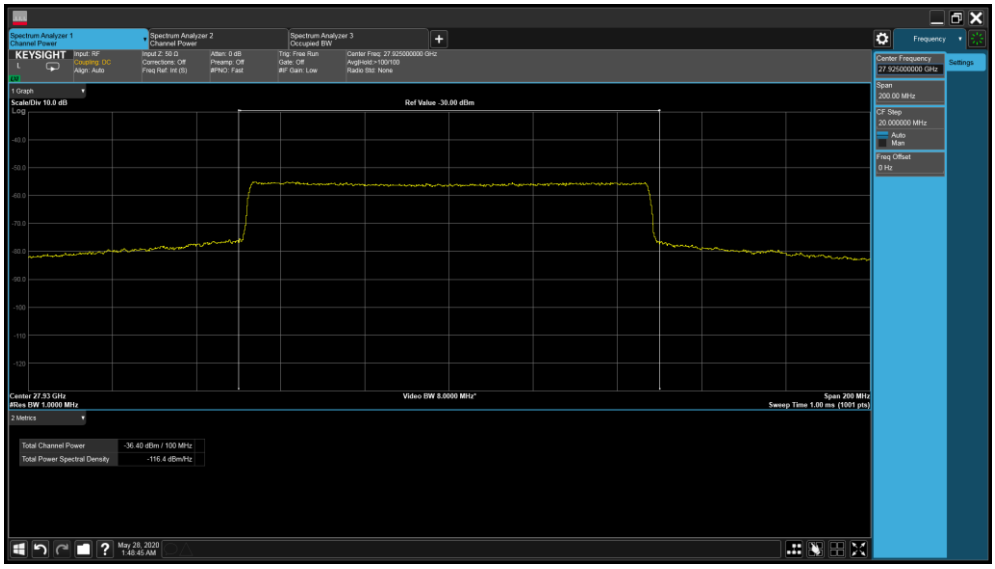
Channel	Modulation	Frequency (GHz)	Horizontal (dBm/100MHz)	Vertical (dBm/100MHz)	Total EIRP Density (dBm/100MHz)	Limit (dBm/100MHz)
Low	QPSK	27.70	33.32	31.63	35.57	75
High	QPSK	28.15	35.61	33.89	37.84	75
Low	16QAM	27.70	33.96	32.25	36.20	75
High	16QAM	28.15	35.52	33.85	37.77	75
Low	64QAM	27.70	34.47	32.75	36.70	75
High	64QAM	28.15	36.15	34.45	38.39	75

Note: The final result includes the antenna factor (dB/m), Cable Loss and distance correction factor, the plot shows the original reading without factors.
EUT is a point-to-multipoint fixed base stations operating in connection with mobile systems.
55dBW = 85dBm.

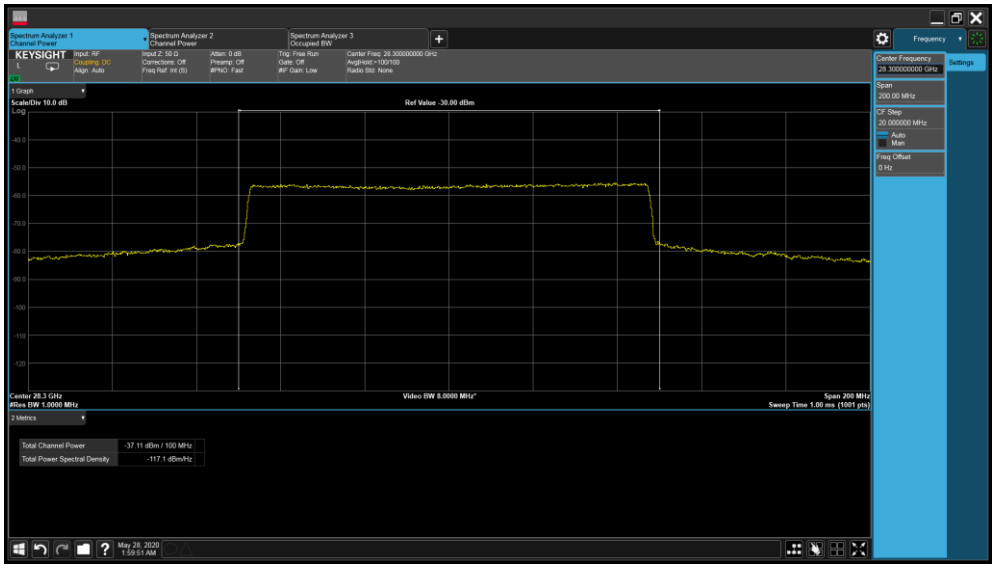
Test Plots for worst case (ANT 1, Horizontal)
100MHz BW



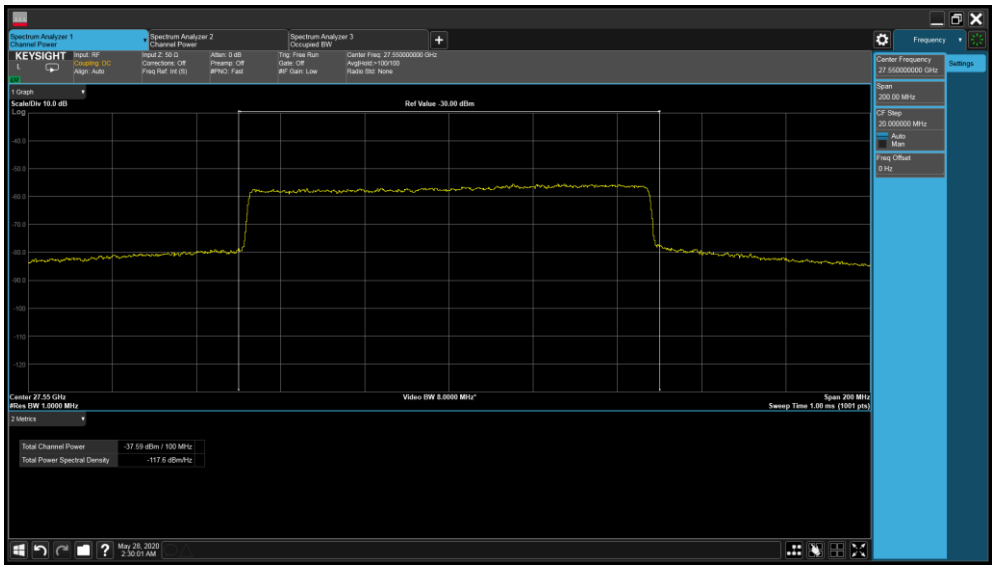
QPSK - Low



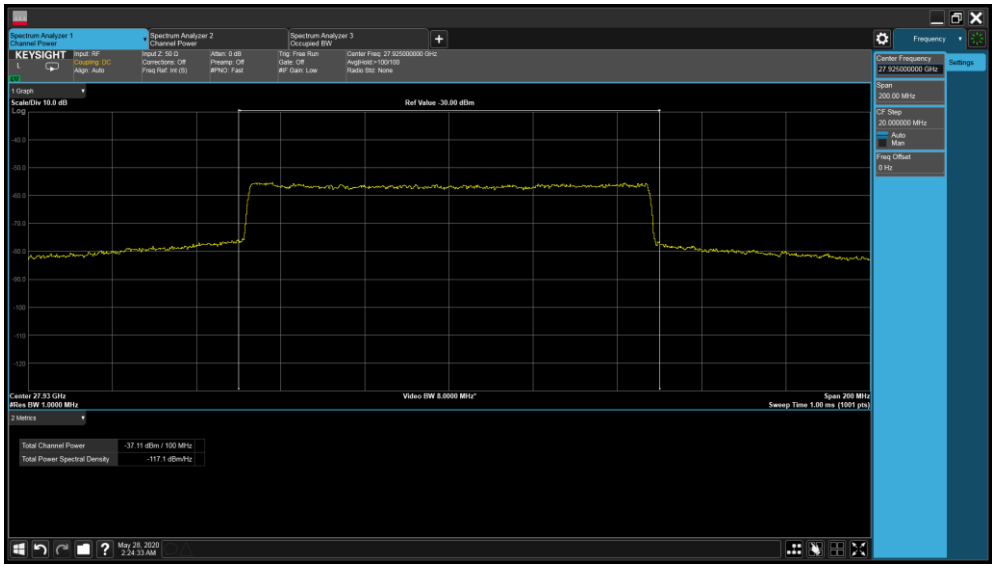
QPSK - Mid



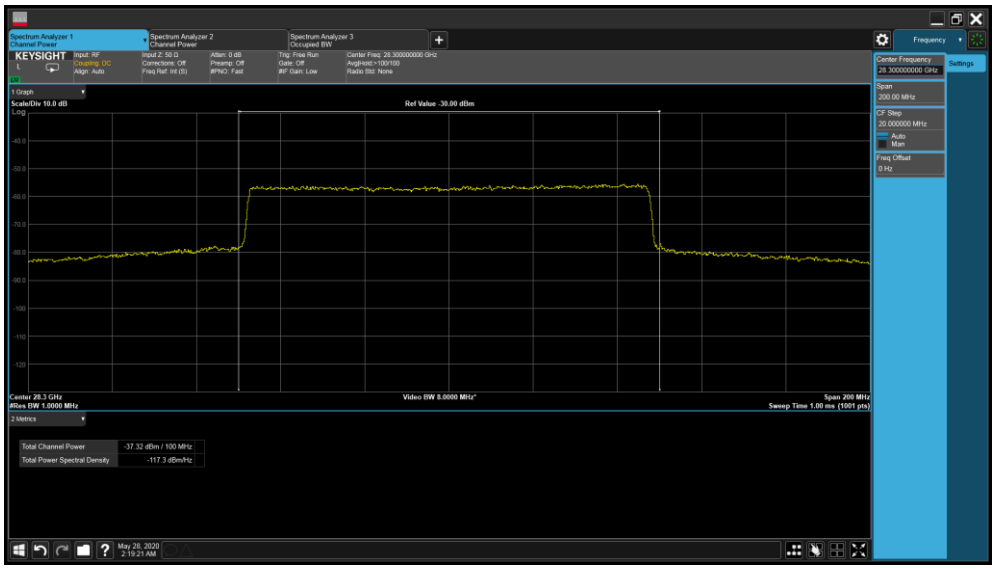
QPSK - High



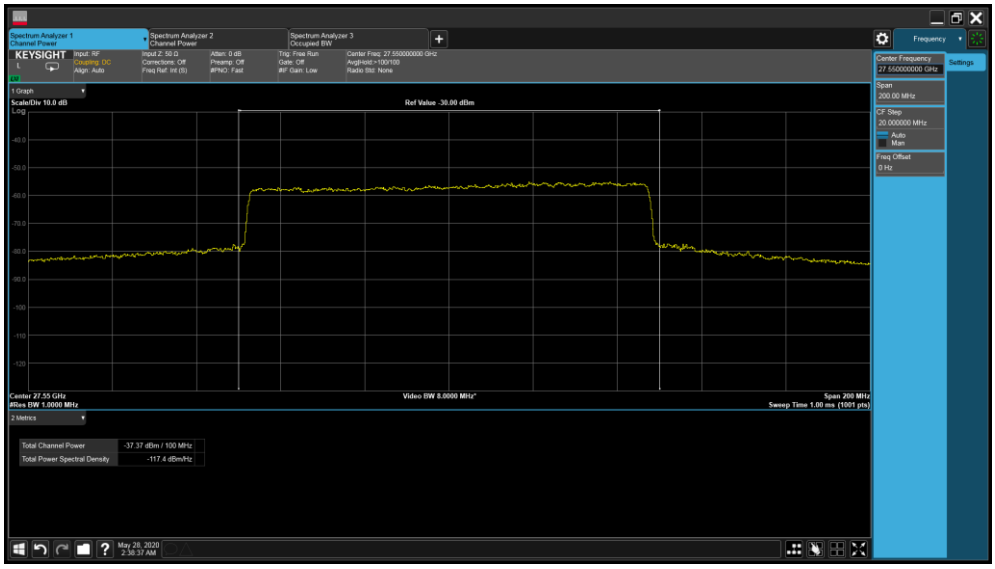
16QAM - Low



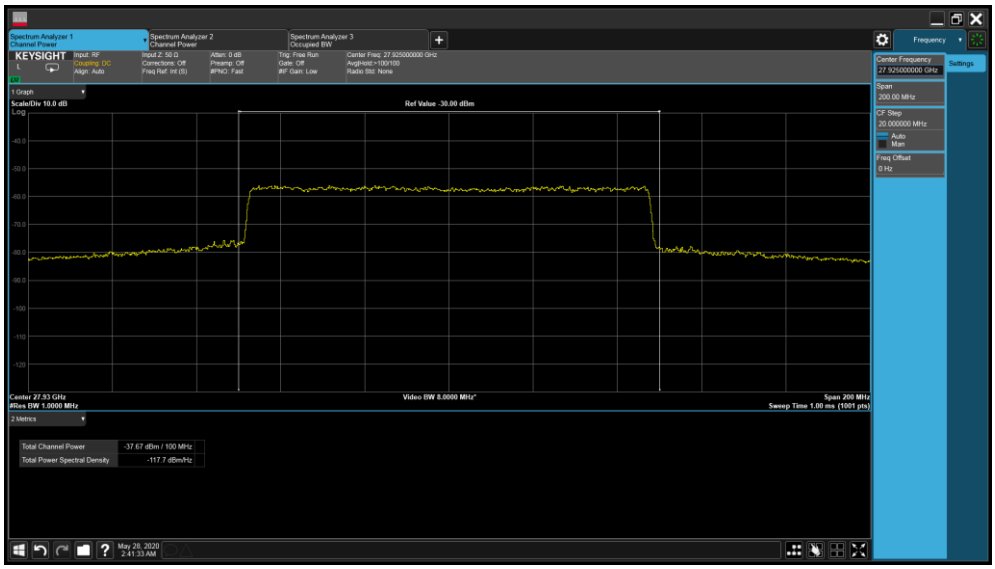
16QAM - Mid



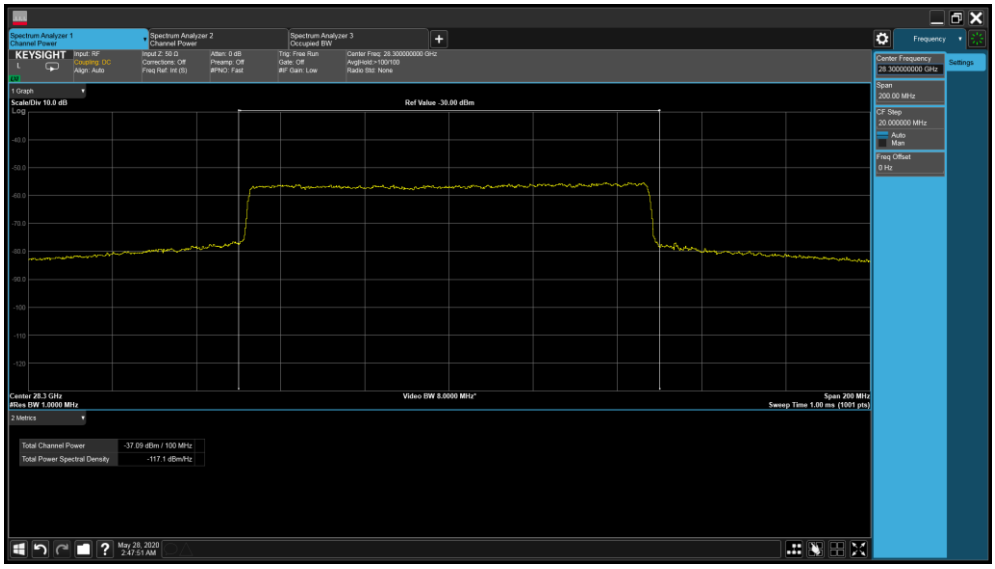
16QAM - High



64QAM - Low

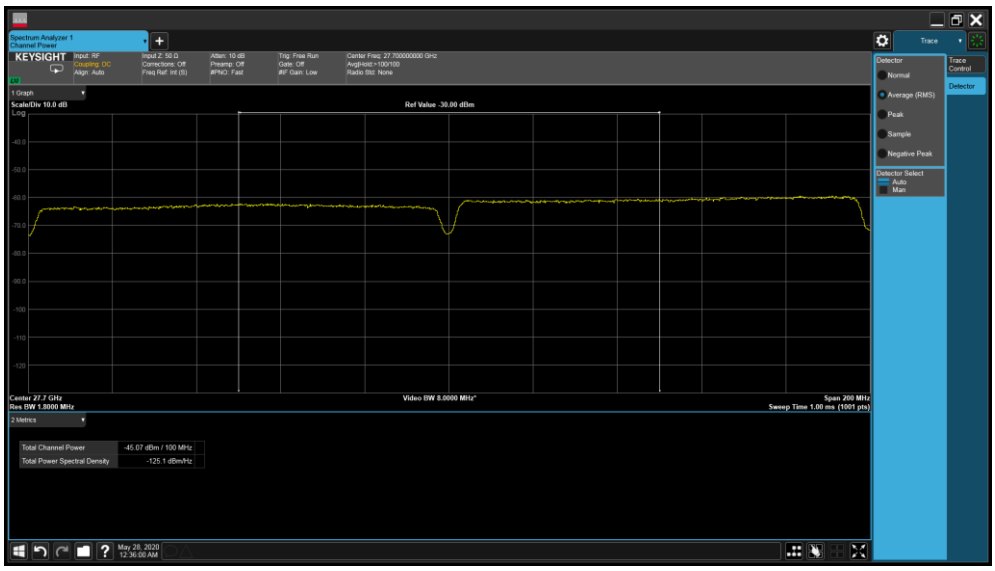


64QAM - Mid

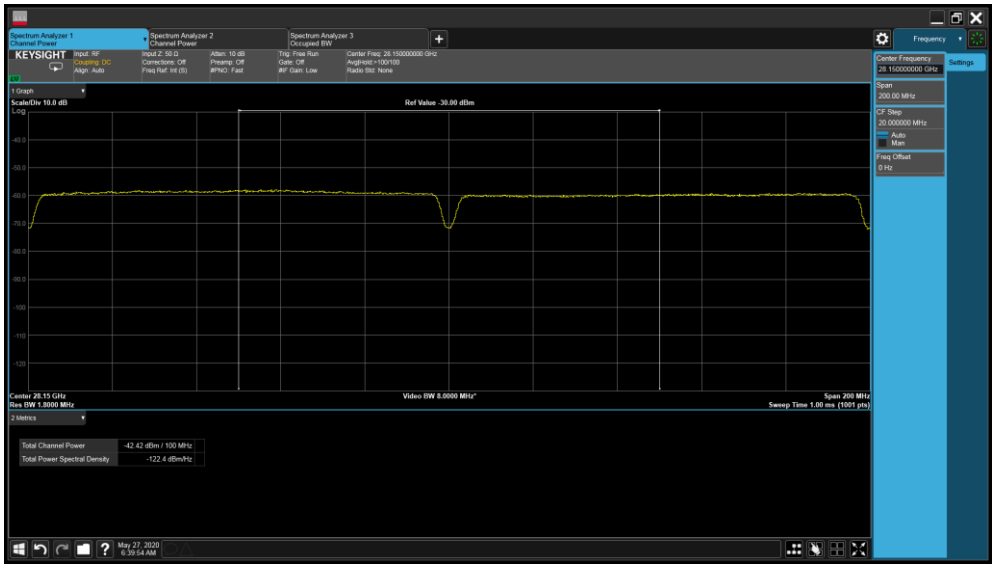

KEYSIGHT
Ref Value -30.00 dBm
Center 28.3 GHz
#Res BW 1.0000 MHz
Video BW 8.0000 MHz*
Span 200 MHz
Sweep Time 1.00 ms (1001 pts)
Total Channel Power
-37.09 dBm / 100 MHz
Total Power Spectral Density
-117.1 dBm/Hz

64QAM - High

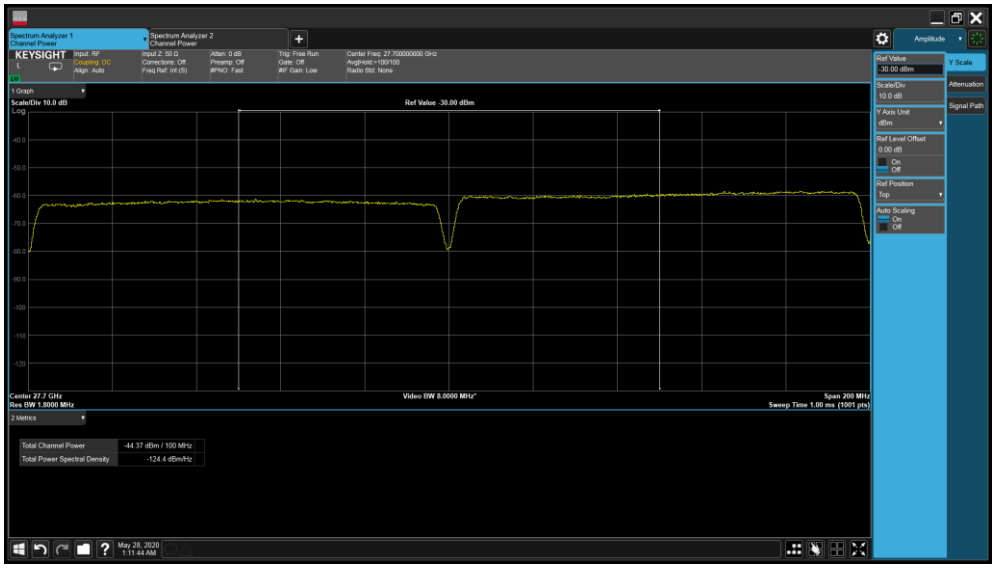
400MHz BW



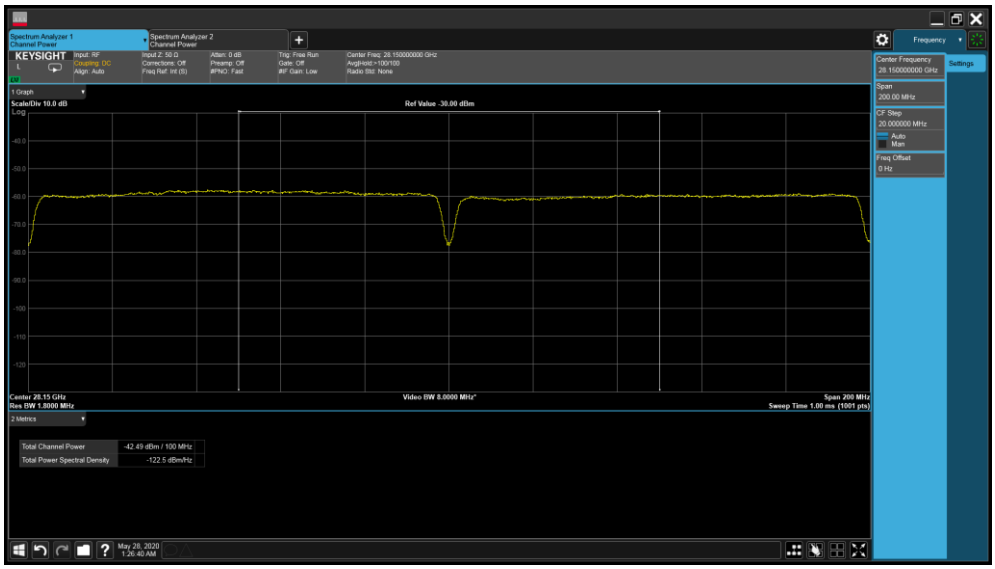
QPSK - Low



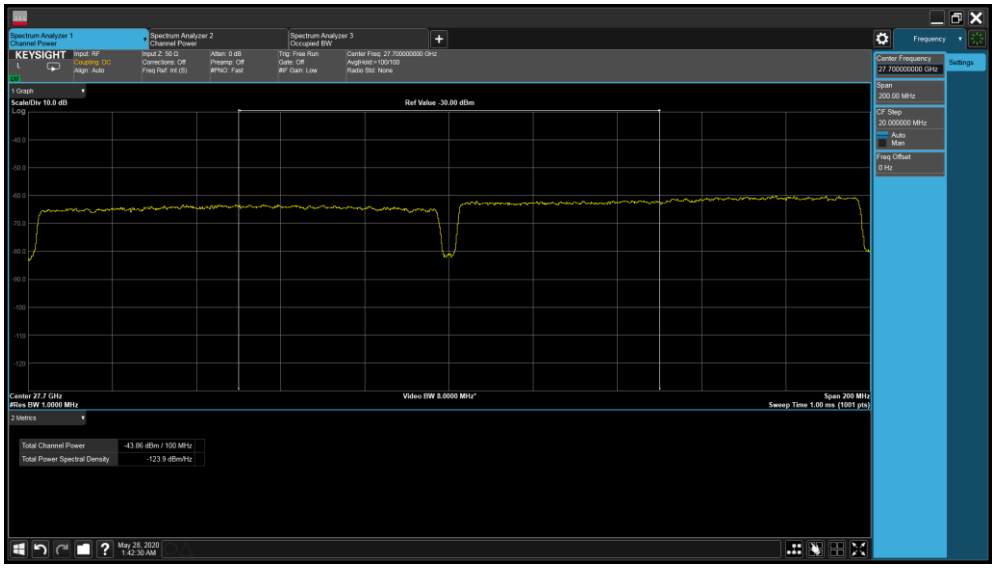
QPSK - High



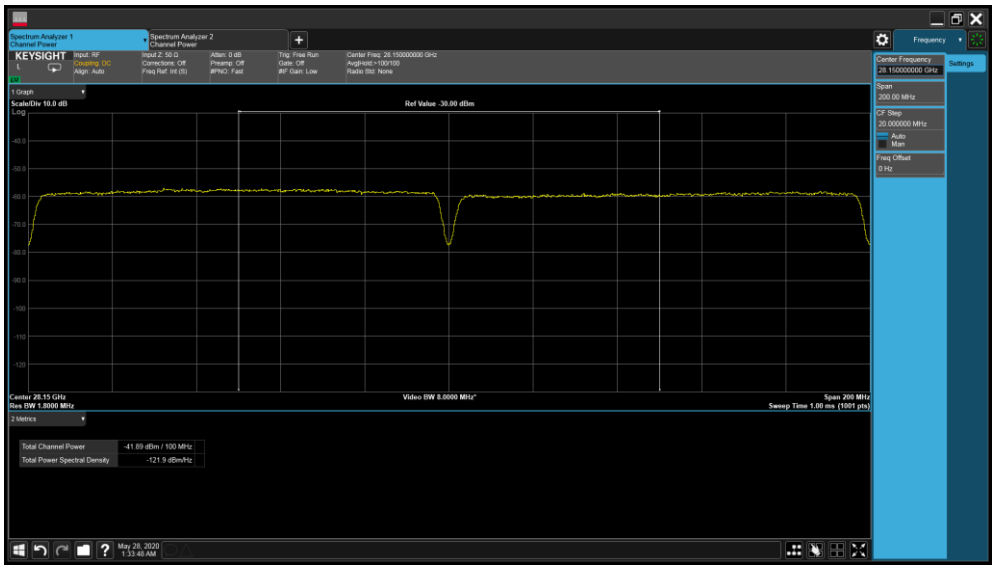
16QAM - Low



16QAM - High



64QAM - Low



64QAM - High

4.5 E.I.R.P Measurement

4.5.1 Limits of E.I.R.P Measurement

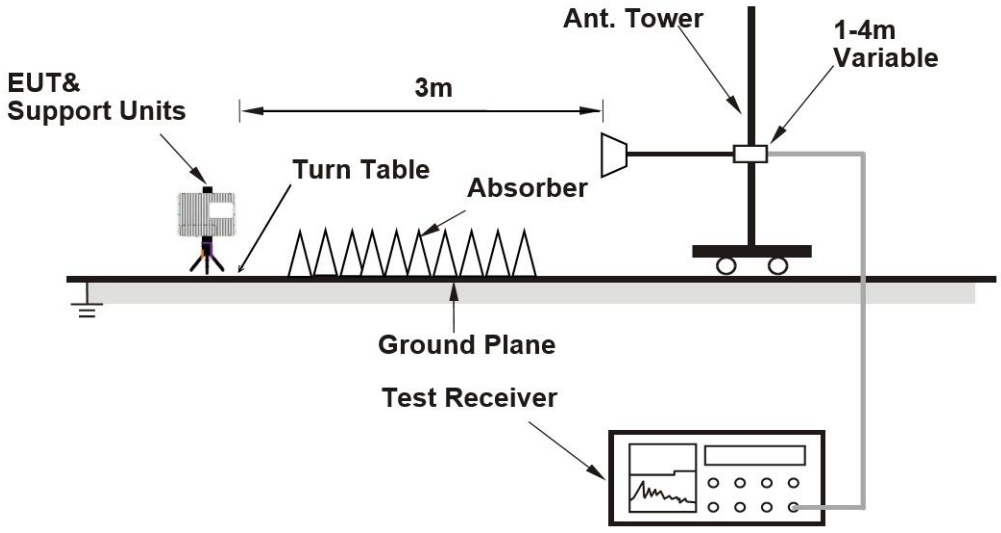
On any authorized frequency, the average power delivered to an antenna in this service must be the minimum amount of power necessary to carry out the communications desired. Application of this principle includes, but is not to be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the following:

Maximum Allowable EIRP

Frequency band (MHz)	Fixed (dBW)
27,500-28,350 [1]	+55
38,600-40,000	+55

[1] For Point-to-multipoint user stations authorized in these bands, the EIRP shall not exceed 55 dBW or 42 dBW/MHz.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

ANSI C63.26-2015 Section 5.2.4.4.1
ANSI C63.26-2015 Section 6.4
- Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
- RBW = 1-5% of the expected OBW
- VBW >= 3 * RBW

- Span = 2 * to 3 * the OBW
- Detector = RMS
- Trigger is set to “free run”
- Trace mode = trace averaging (RMS) over 100 sweeps
- Allow trace to fully stabilize.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

100MHz BW, Horizontal

Channel	Modulation	Frequency (GHz)	ANT1 (dBm)	ANT2 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.55	31.88	31.47	3	37.69
Mid	QPSK	27.925	32.63	32.27	3	38.46
High	QPSK	28.30	32.33	32.00	3	38.18
Low	16QAM	27.55	31.93	31.55	3	37.75
Mid	16QAM	27.925	31.92	31.56	3	37.75
High	16QAM	28.30	32.12	31.79	3	37.97
Low	64QAM	27.55	32.15	31.82	3	38.00
Mid	64QAM	27.925	31.36	31.03	3	37.21
High	64QAM	28.30	32.35	31.96	3	38.17

Channel	Modulation	Frequency (GHz)	ANT3 (dBm)	ANT4 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.55	31.52	31.70	3	37.62
Mid	QPSK	27.925	32.11	32.44	3	38.29
High	QPSK	28.30	31.70	32.12	3	37.93
Low	16QAM	27.55	31.54	31.73	3	37.65
Mid	16QAM	27.925	31.40	31.73	3	37.58
High	16QAM	28.30	31.74	31.92	3	37.84
Low	64QAM	27.55	31.76	31.95	3	37.87
Mid	64QAM	27.925	30.80	31.19	3	37.01
High	64QAM	28.30	31.90	32.15	3	38.04

100MHz BW, Vertical

Channel	Modulation	Frequency (GHz)	ANT1 (dBm)	ANT2 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.55	30.19	29.79	3	36.00
Mid	QPSK	27.925	30.94	30.60	3	36.78
High	QPSK	28.30	30.72	30.36	3	36.55
Low	16QAM	27.55	30.30	29.89	3	36.11
Mid	16QAM	27.925	30.23	29.89	3	36.07
High	16QAM	28.30	30.43	30.14	3	36.30
Low	64QAM	27.55	30.51	30.16	3	36.35
Mid	64QAM	27.925	29.68	29.37	3	35.54
High	64QAM	28.30	30.73	30.33	3	36.54

Channel	Modulation	Frequency (GHz)	ANT3 (dBm)	ANT4 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.55	29.90	30.02	3	35.97
Mid	QPSK	27.925	30.47	30.79	3	36.64
High	QPSK	28.30	30.04	30.48	3	36.28
Low	16QAM	27.55	29.90	30.12	3	36.02
Mid	16QAM	27.925	29.75	30.04	3	35.91
High	16QAM	28.30	30.05	30.24	3	36.16
Low	64QAM	27.55	30.16	30.27	3	36.23
Mid	64QAM	27.925	29.12	29.51	3	35.33
High	64QAM	28.30	30.20	30.46	3	36.34

Channel	Modulation	Frequency (GHz)	Horizontal (dBm)	Vertical (dBm)	Total EIRP (dBm)	Limit (dBm)
Low	QPSK	27.55	40.67	39.00	42.93	85
Mid	QPSK	27.925	41.39	39.72	43.65	85
High	QPSK	28.30	41.07	39.43	43.34	85
Low	16QAM	27.55	40.71	39.08	42.98	85
Mid	16QAM	27.925	40.68	39.00	42.93	85
High	16QAM	28.30	40.92	39.24	43.17	85
Low	64QAM	27.55	40.95	39.30	43.21	85
Mid	64QAM	27.925	40.12	38.45	42.38	85
High	64QAM	28.30	41.12	39.45	43.38	85

Note: The final result includes the antenna factor (dB/m), Cable Loss and distance correction factor, the plot shows the original reading without factors.
EUT is a point-to-multipoint fixed base stations operating in connection with mobile systems.

400MHz BW, Horizontal

Channel	Modulation	Frequency (GHz)	ANT1 (dBm)	ANT2 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.70	30.80	30.40	3	36.61
High	QPSK	28.15	32.55	32.19	3	38.38
Low	16QAM	27.70	31.77	31.44	3	37.62
High	16QAM	28.15	32.47	32.09	3	38.29
Low	64QAM	27.70	32.07	31.75	3	37.92
High	64QAM	28.15	33.07	32.66	3	38.88

Channel	Modulation	Frequency (GHz)	ANT3 (dBm)	ANT4 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.70	30.43	30.64	3	36.55
High	QPSK	28.15	31.91	32.35	3	38.15
Low	16QAM	27.70	31.40	31.58	3	37.50
High	16QAM	28.15	32.07	32.27	3	38.18
Low	64QAM	27.70	31.72	31.89	3	37.82
High	64QAM	28.15	32.56	32.87	3	38.73

400MHz BW, Vertical

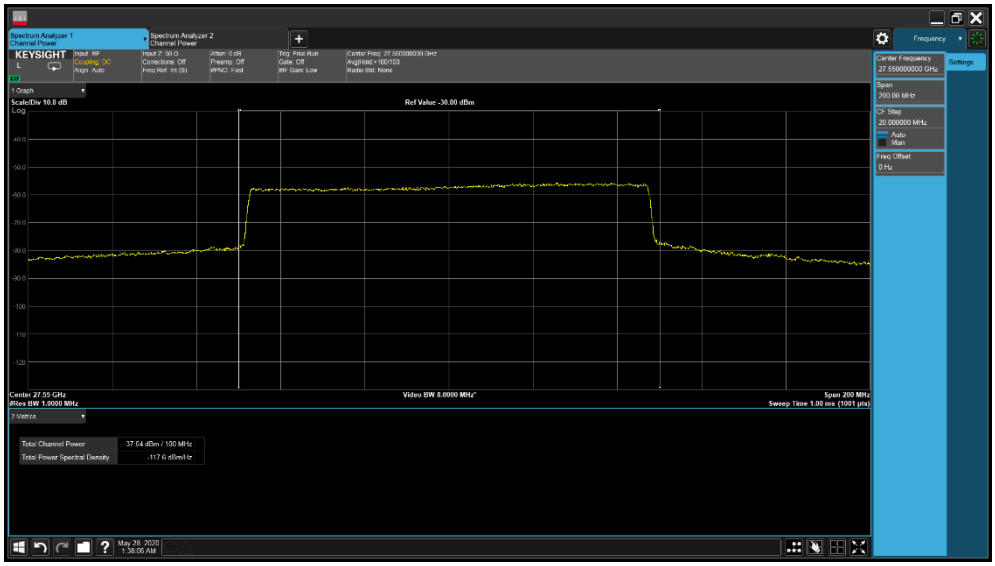
Channel	Modulation	Frequency (GHz)	ANT1 (dBm)	ANT2 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.70	29.14	28.69	3	34.93
High	QPSK	28.15	30.86	30.51	3	36.70
Low	16QAM	27.70	30.08	29.77	3	35.94
High	16QAM	28.15	30.82	30.48	3	36.66
Low	64QAM	27.70	30.45	30.13	3	36.30
High	64QAM	28.15	31.45	30.97	3	37.23

Channel	Modulation	Frequency (GHz)	ANT3 (dBm)	ANT4 (dBm)	Correlated Factor (dB)	Total (dBm)
Low	QPSK	27.70	28.80	28.94	3	34.88
High	QPSK	28.15	30.25	30.66	3	36.47
Low	16QAM	27.70	29.75	29.88	3	35.83
High	16QAM	28.15	30.40	30.61	3	36.52
Low	64QAM	27.70	30.08	30.25	3	36.18
High	64QAM	28.15	30.91	31.25	3	37.09

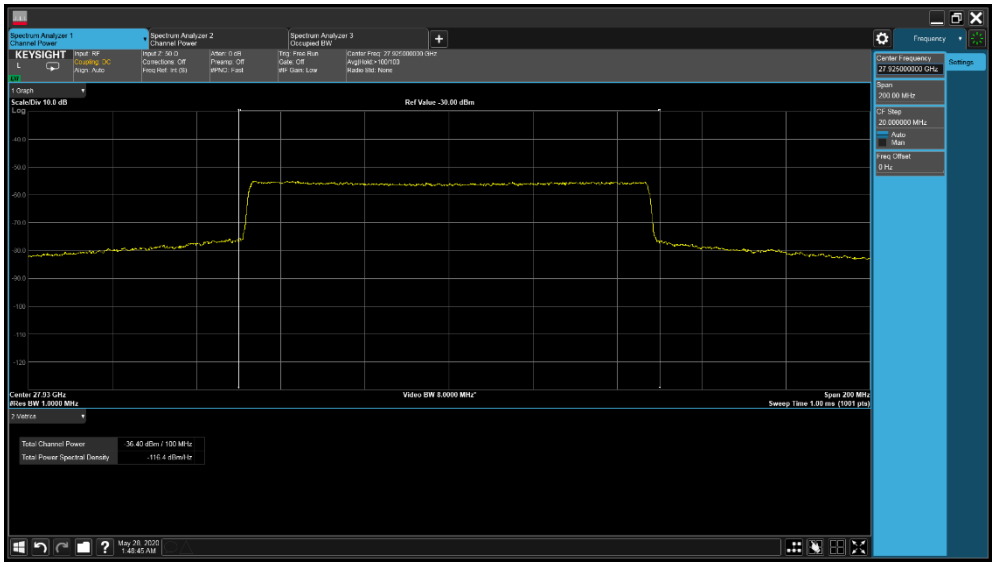
Channel	Modulation	Frequency (GHz)	Horizontal (dBm)	Vertical (dBm)	Total EIRP (dBm)	Limit (dBm)
Low	QPSK	27.70	39.59	37.92	41.85	85
High	QPSK	28.15	41.28	39.60	43.53	85
Low	16QAM	27.70	40.57	38.90	42.83	85
High	16QAM	28.15	41.25	39.60	43.51	85
Low	64QAM	27.70	40.88	39.25	43.15	85
High	64QAM	28.15	41.82	40.17	44.08	85

Note: The final result includes the antenna factor (dB/m), Cable Loss and distance correction factor, the plot shows the original reading without factors.
EUT is a point-to-multipoint fixed base stations operating in connection with mobile systems.

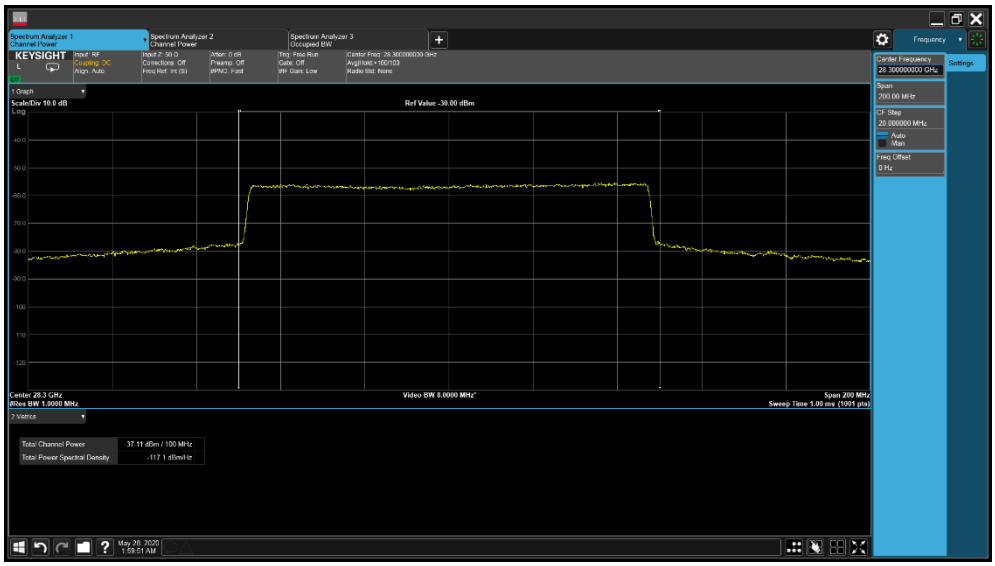
Test Plots for worst case (ANT 1, Horizontal)
100MHz BW



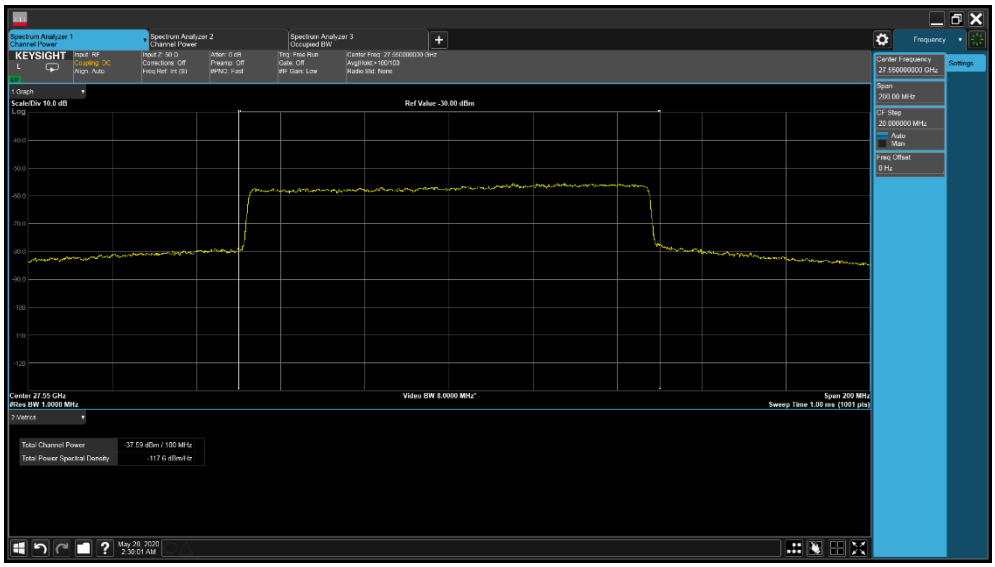
QPSK - Low



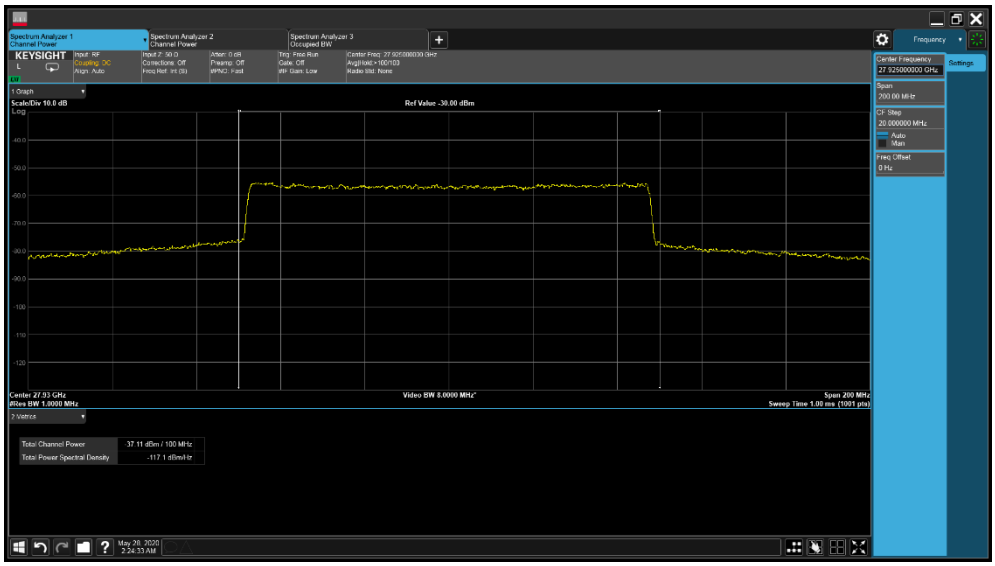
QPSK - Mid



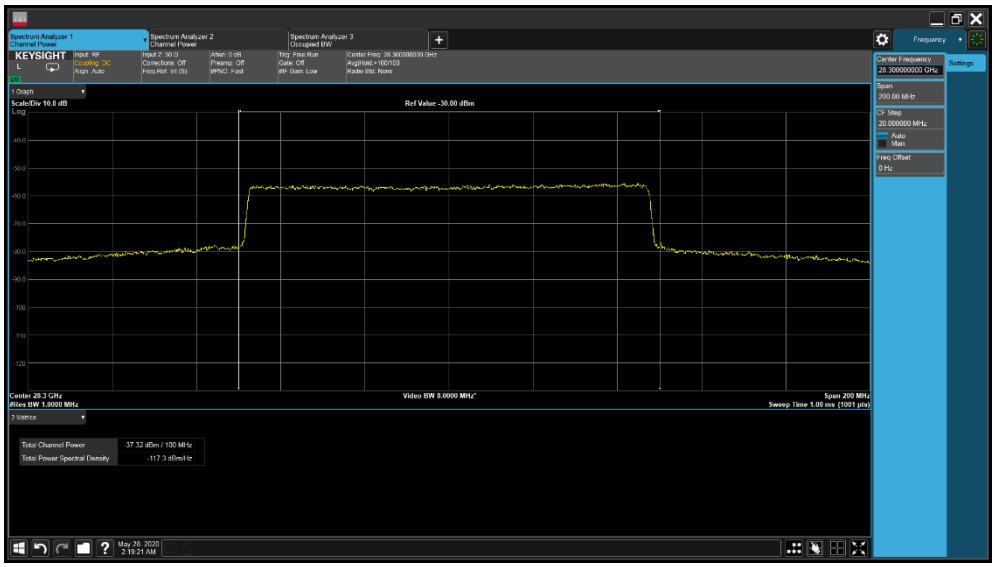
QPSK - High



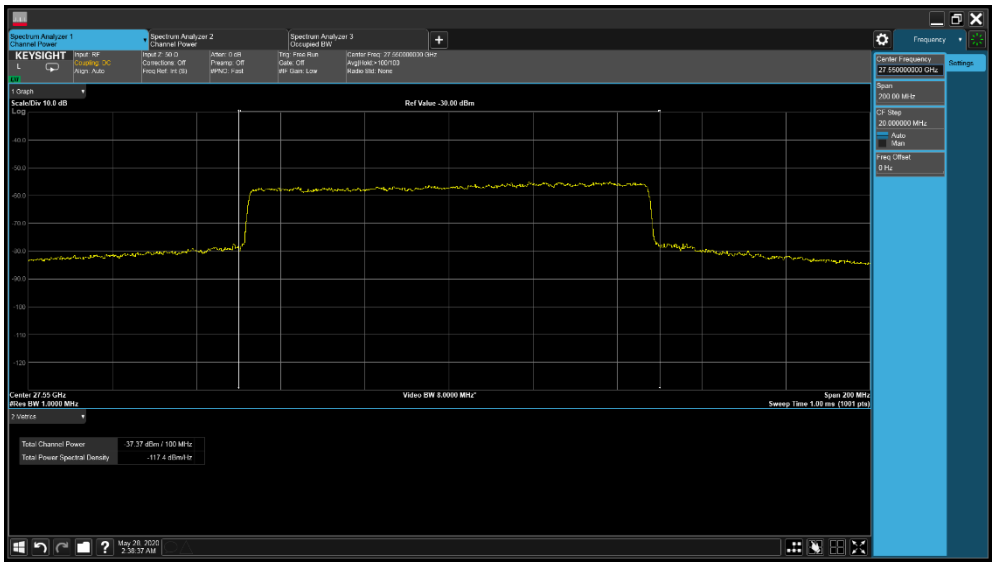
16QAM - Low



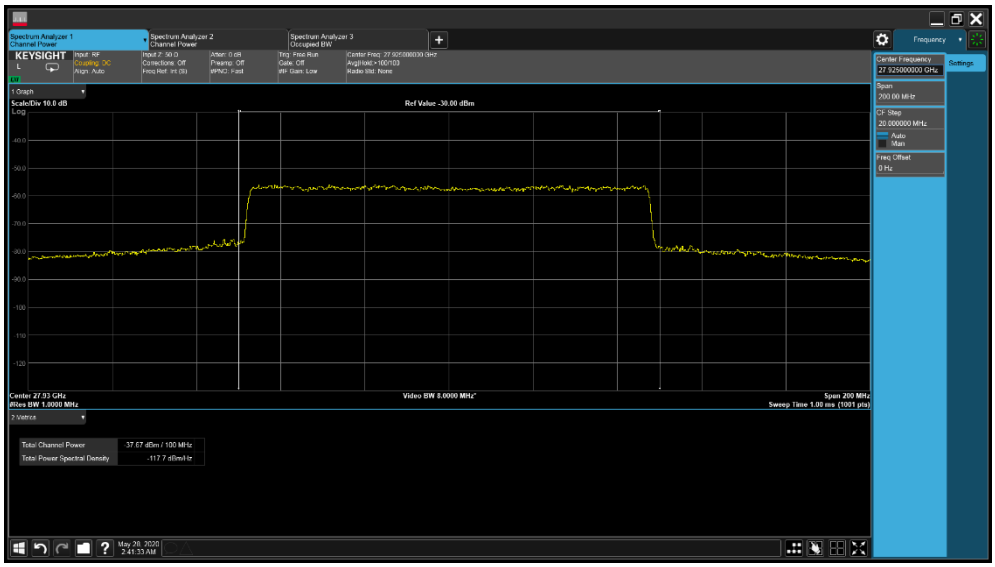
16QAM - Mid



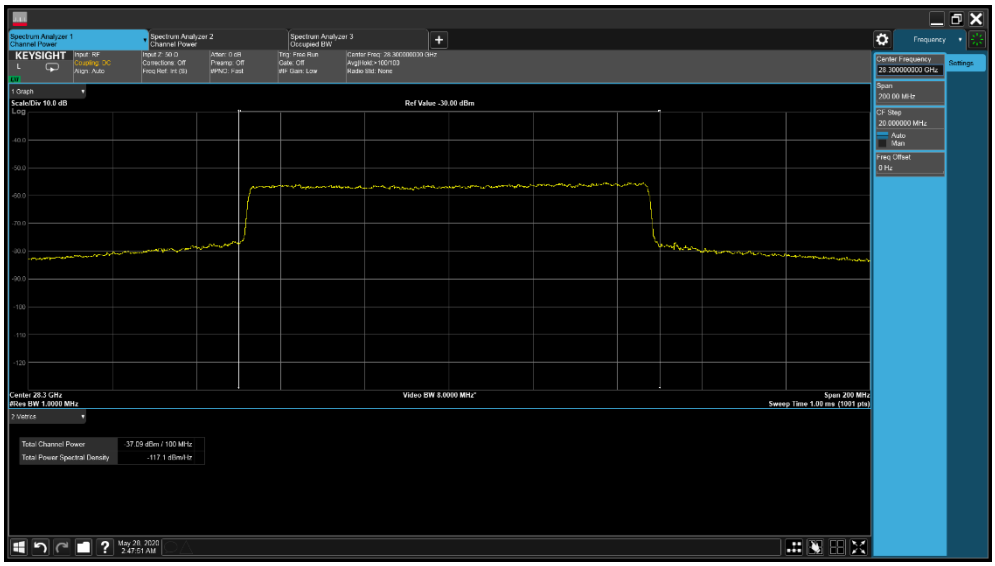
16QAM - High



64QAM - Low

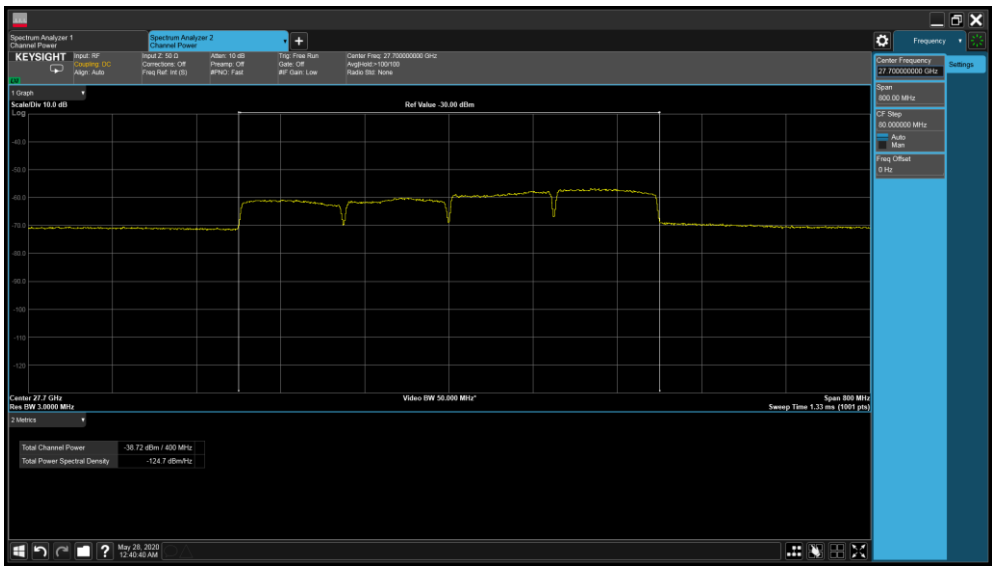


64QAM - Mid

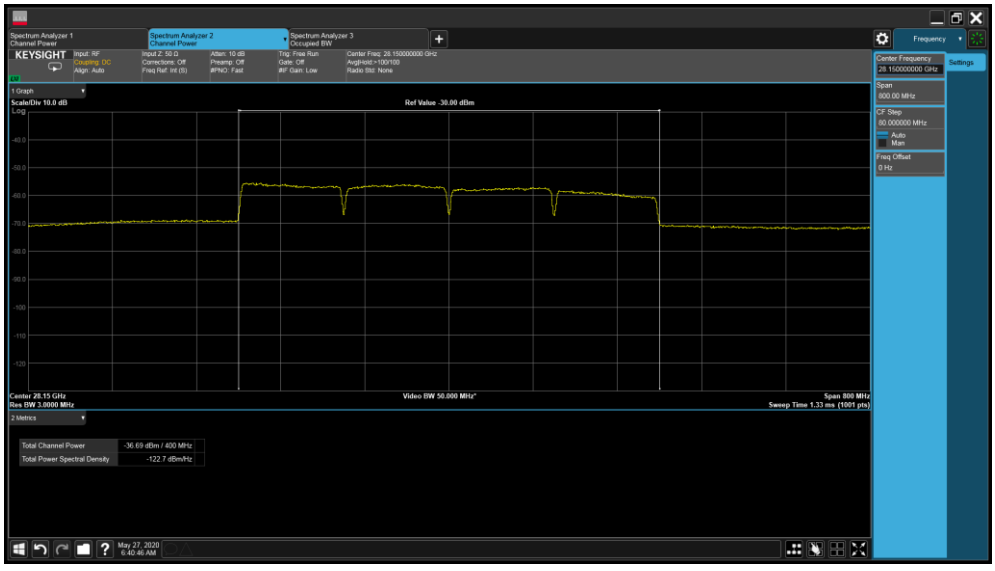

KEYSIGHT
Ref Value -30.00 dBm
Center 28.3 GHz
Video BW 8.0000 MHz*
Span 200 MHz
Total Channel Power
-37.09 dBm / 100 MHz
Total Power Spectral Density
-117.1 dBm/Hz

64QAM - High

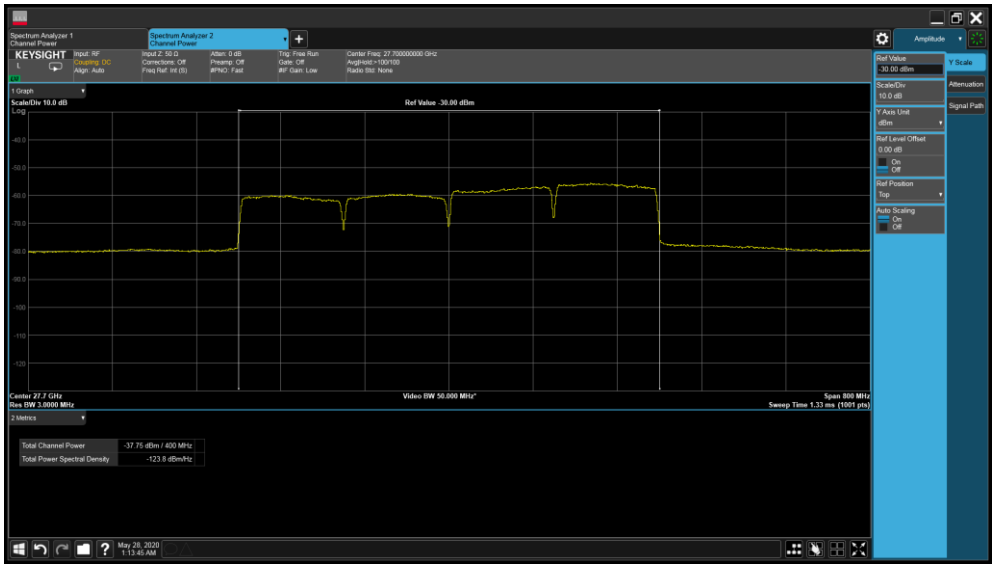
400MHz BW



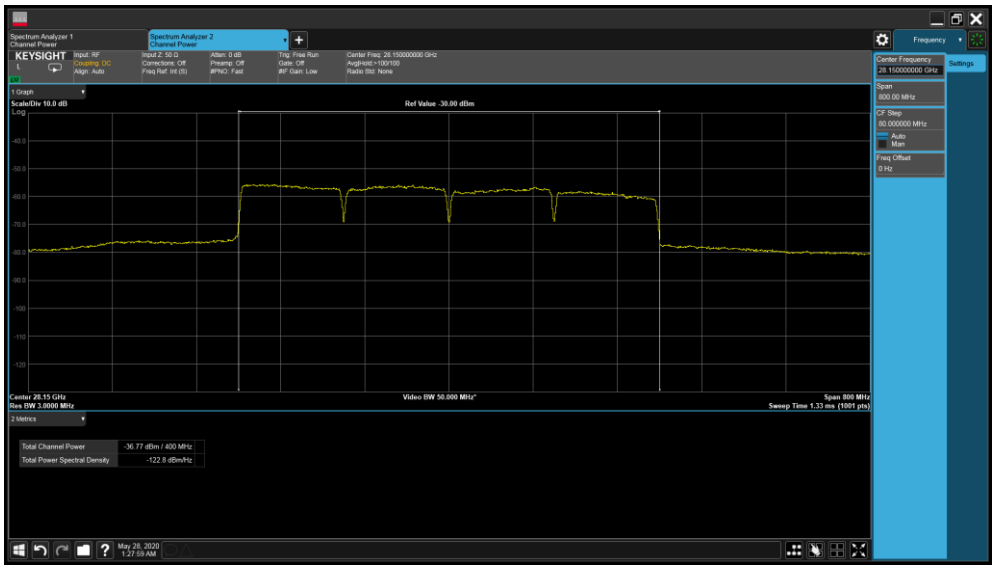
QPSK - Low



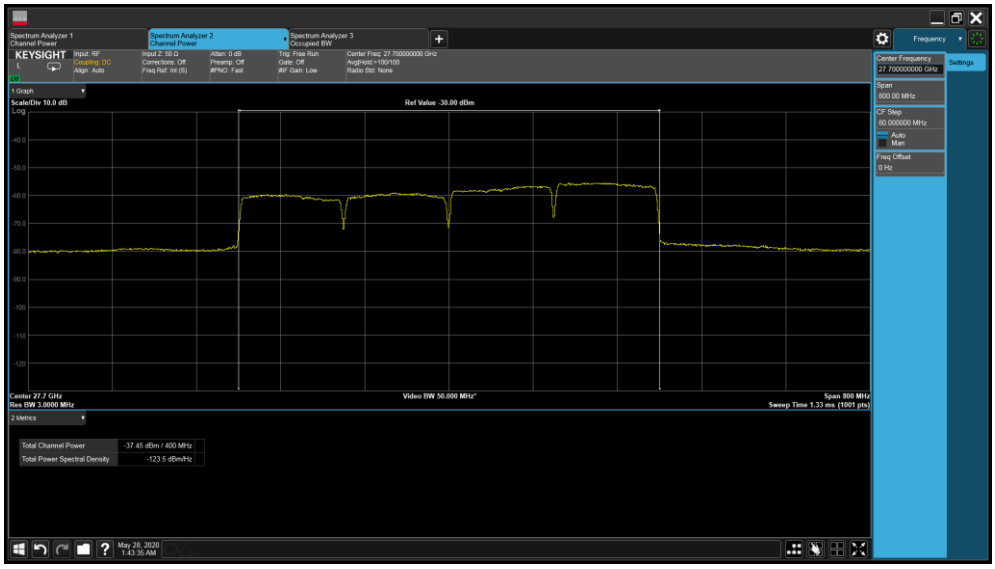
QPSK - High



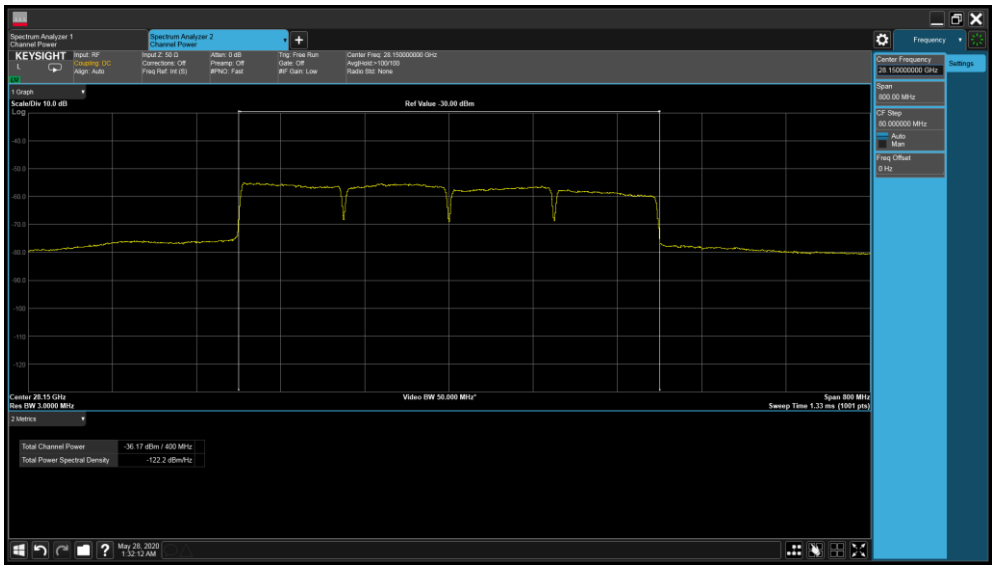
16QAM - Low



16QAM - High



64QAM - Low



64QAM - High

4.6 Out-Of Band Emission at Band Edges MEASUREMENT

4.6.1 Limits of Out-Of Band Emission at Band Edges Measurement

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

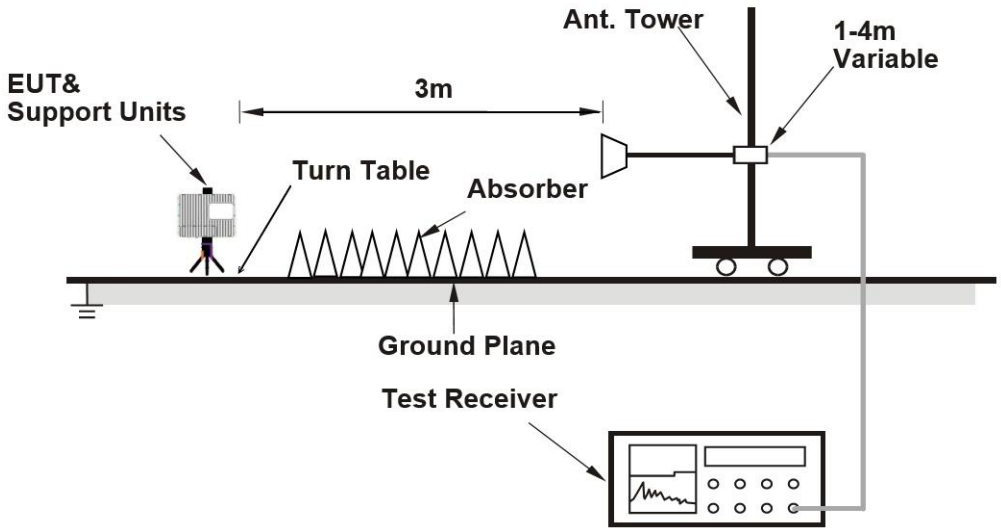
(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

(c) For fixed point-to-point and point-to-multipoint limits see § 30.404.

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

ANSI C63.26-2015 Section 5.7.3
ANSI C63.26-2015 Section 6.4
- Start and stop frequency were set such that both upper and lower band edges are measured.
- Span was set large enough so as to capture all out of band emissions near the band edge.
- RBW = 1MHz
- VBW >= 3 * RBW
- Detector = RMS
- Trigger is set to “free run”
- Trace mode = trace averaging
- Allow trace to fully stabilize.

4.6.5 Deviation from Test Standard
No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6

4.6.7 Summary of MIMO Beam Out-of Band Emission:

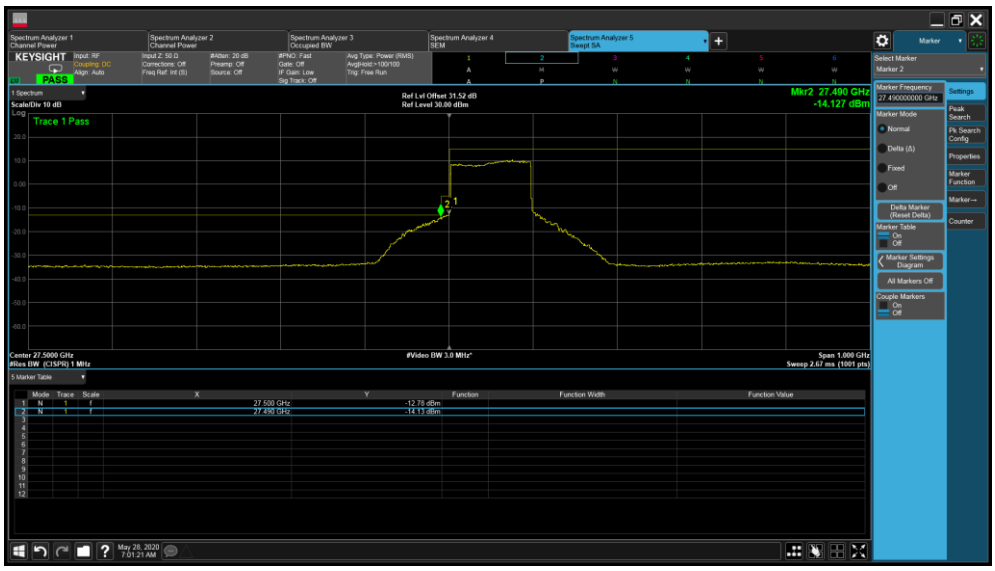
To address compliance of MIMO Out-of Band emission per KDB 662911 D01, the MIMO Out-of Band emission EIRP is calculated by summing the worst-case H Beam EIRP and V Beam EIRP in linear powers units then converted back to dBm.

For example:

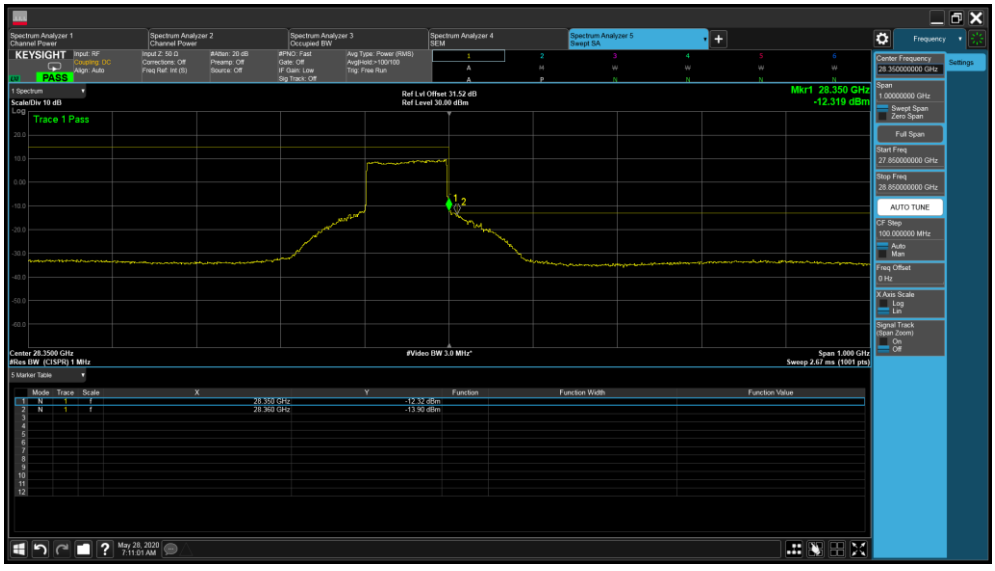
EIRP for V Beam (dBm)	EIRP for H Beam (dBm)	EIRP for V+H Beam (dBm)	Limit(dBm)	Margin(dB)	Result
-18.29	-21.32	-16.54	-5	-11.54	Pass
-20.29	-24.34	-18.85	-13	-5.85	Pass

4.6.8 Test Plots

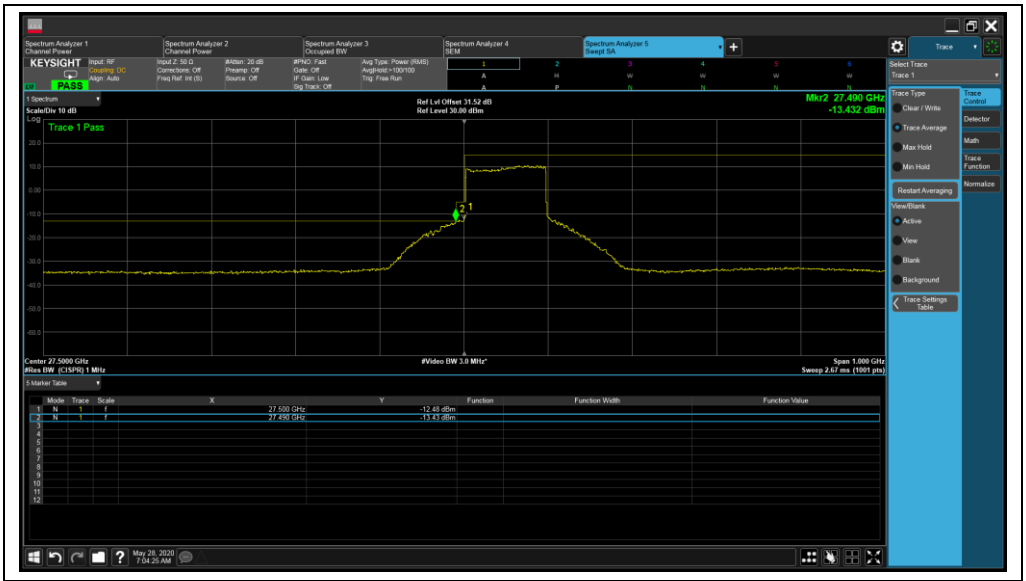
100MHz BW



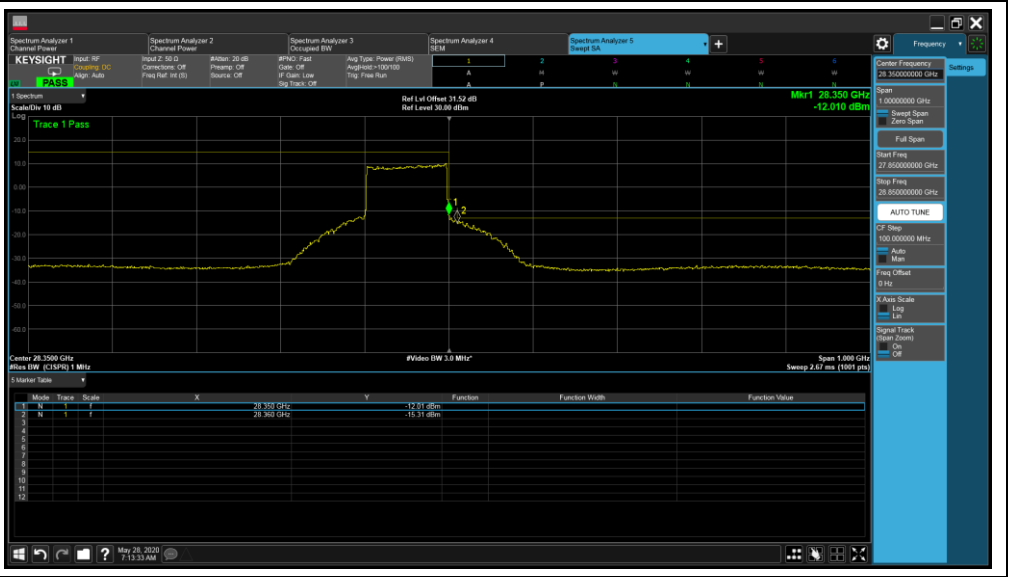
QPSK - Low



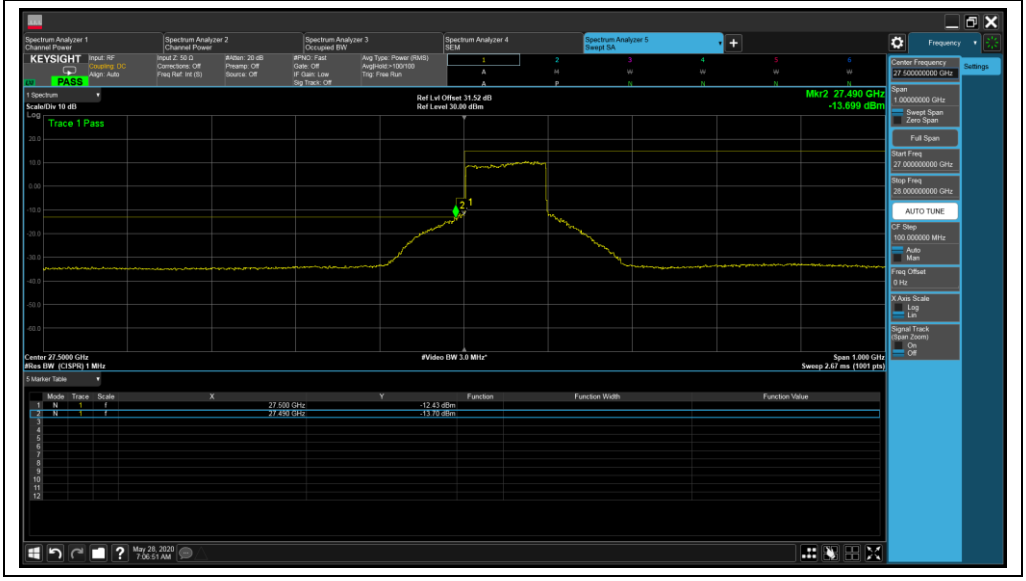
QPSK - High

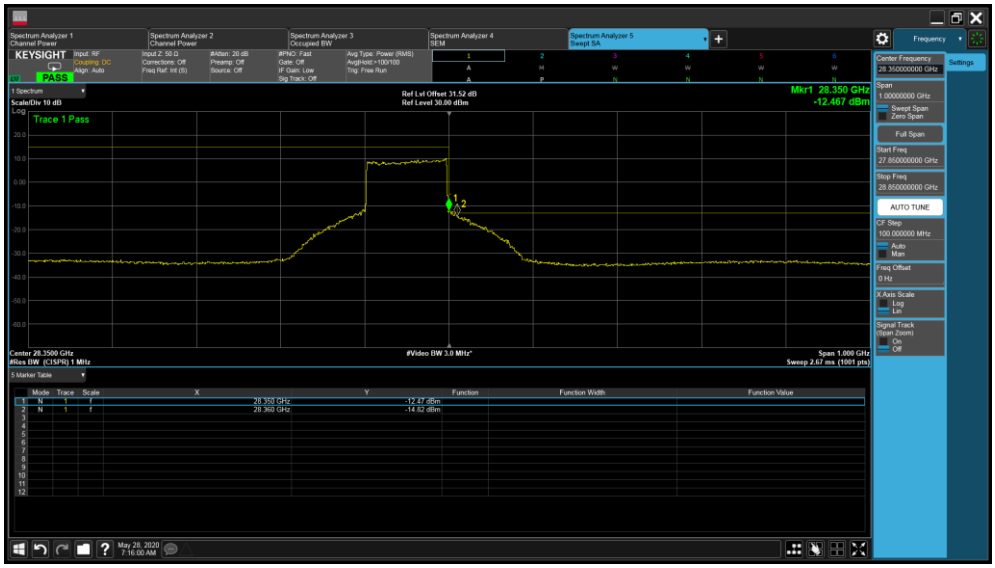


16QAM - Low

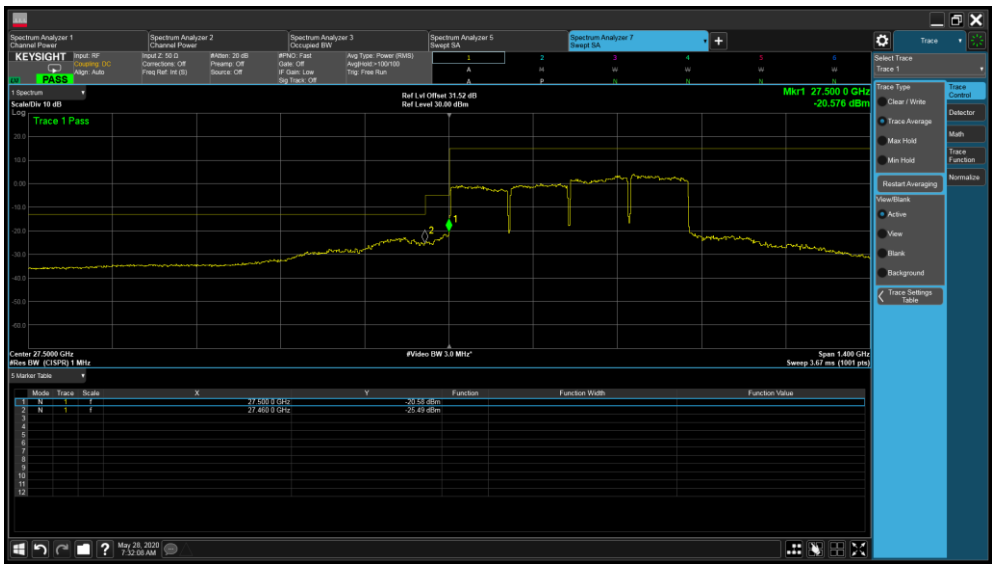


16QAM - High

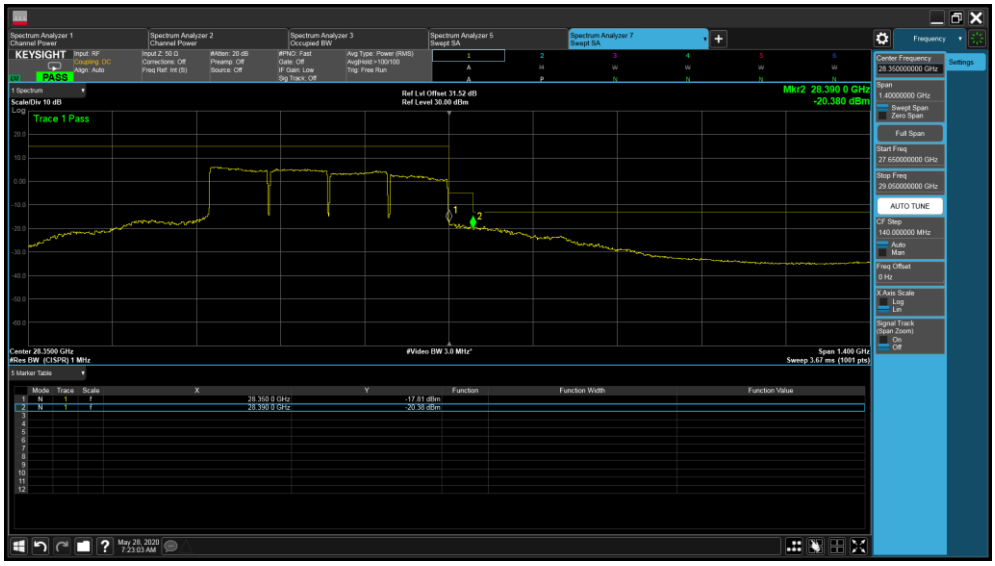


64QAM - Low

64QAM - High

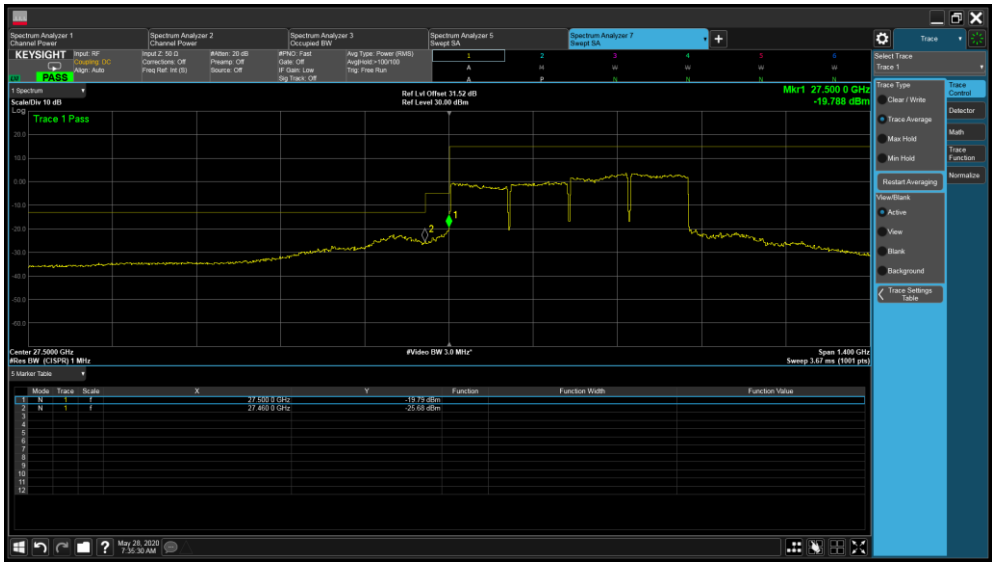
400MHz BW



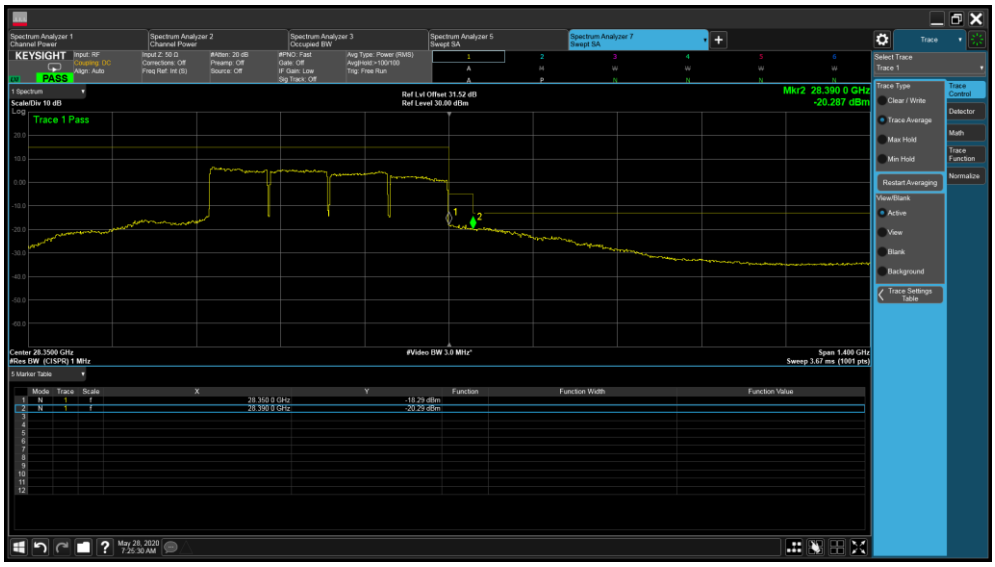
QPSK - Low



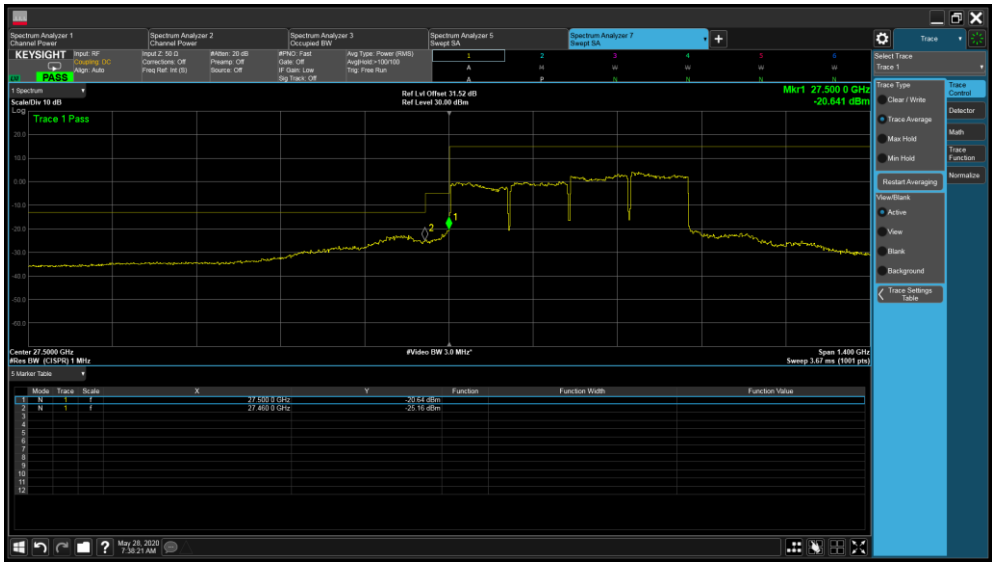
QPSK - High



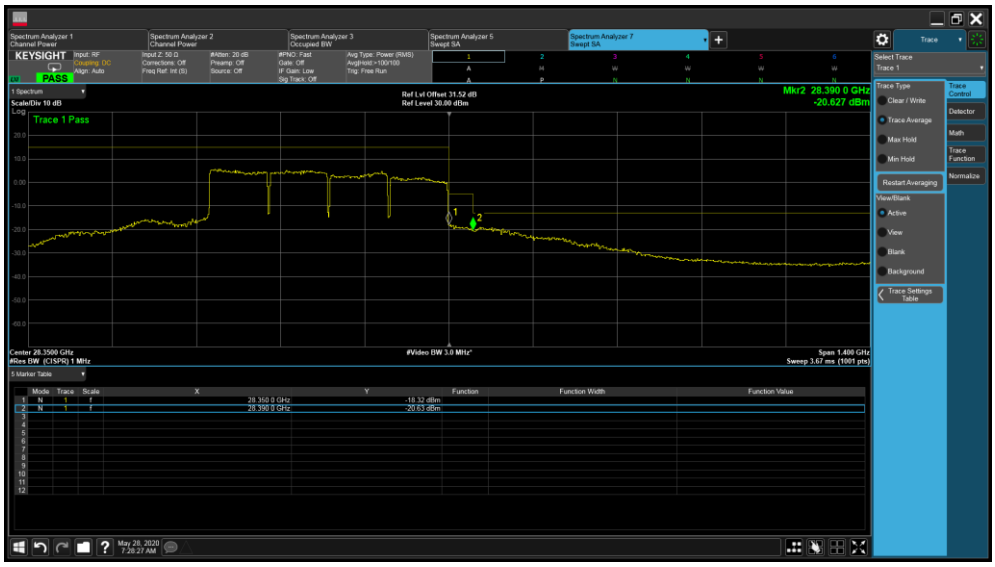
16QAM - Low



16QAM - High



64QAM - Low



64QAM - High

5 Pictures of Test Arrangements

Please see setup photo file.

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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Email: sales.eaw@us.bureauveritas.com
Web Site: www.cpsusa-bureauveritas.com

The address and road map of all our labs can be found in our web site also.

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