

FCC REPORT

Applicant: Baicells Technologies Co., Ltd.

Address of Applicant: 3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China

Equipment Under Test (EUT)

Product Name: LTE Wireless Communication Module

Model No.: EM2148M

FCC ID: 2AG32EM2148M

Applicable standards: FCC CFR Title 47 Part 25 Subpart B(Section 25.149)

Date of sample receipt: 24 Jul., 2019

Date of Test: 24 Jul., to 24 Sep., 2019

Date of report issued: 24 Sep., 2019

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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2 Version

Version No.	Date	Description
00	05 Aug., 2019	Original
01	24 Sep., 2019	Updated 26dB, Band Edge, below 1G Conducted Spurious Emission Test.

Tested by:

Carey Chen

Date:

24 Sep., 2019

Test Engineer

Reviewed by:

Winner Zhang

Date:

24 Sep., 2019

Project Engineer

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4 Test Summary

Test Items	Section in CFR 47	Result
Output Power	25.149 (c)(4)(iii)	Pass
Modulation Characteristics	Part 2.1047	Pass
6dB Emission Bandwidth 99% Occupied Bandwidth -26dB Bandwidth	25.149 (c)(4)(ii)(vii)	Pass
Power Spectral Density	25.149 (c)(4)(iv)	Pass
Band Edge	25.149 (c)(4)(v)(vi)(vii)	Pass
Spurious Emission	25.149 (c)(4)(v)(vi)	Pass
Frequency stability vs. temperature	N/A	Pass
Frequency stability vs. voltage	N/A	Pass
All measurement data were performed in accordance with ANSI C63.26: 2015 and KDB 971168 D01v03r01 of test method.		
<i>Remark:</i> 1. <i>Pass: The EUT complies with the essential requirements in the standard.</i> 2. <i>N/A: Not Applicable.</i>		

5 General Information

5.1 Client Information

Applicant:	Baicells Technologies Co., Ltd.
Address:	3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China
Manufacturer:	Baicells Technologies Co., Ltd.
Address:	3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China

5.2 General Description of E.U.T.

Product Name:	LTE Wireless Communication Module
Model No.:	EM2148M
Operation Frequency:	Band 53: 2483.5MHz~2495.0MHz
Modulation technology:	QPSK, 16QAM
Antenna Type:	External antenna ("N" type)
Antenna gain:	10.0 dBi

Test Channel:

Band43

5MHz		10MHz	
Channel:	Frequency (MHz)	Channel:	Frequency (MHz)
Lowest	2486.0	Lowest	2488.5
Middle	2489.0	Middle	2489.0
Highest	2492.5	Highest	2490.0

5.3 Test mode

Data mode (QPSK)	Keep the EUT in data communicating mode (QPSK). (5MHz, 10MHz)
Data mode (16QAM)	Keep the EUT in data communicating mode (16QAM). (5MHz, 10MHz)

5.4 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
Dongguan lianzhao electronics co., LTD	External antenna	KS088-10061-A	N/A	N/A

5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.38 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±3.36 dB (k=2)

5.6 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> ● FCC - Designation No.: CN1211 Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551. ● ISED – CAB identifier.: CN0021 The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1. ● CNAS - Registration No.: CNAS L6048 Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048. ● A2LA - Registration No.: 4346.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf
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5.7 Laboratory Location

<p>Shenzhen Zhongjian Nanfang Testing Co., Ltd. Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road, Bao'an District, Shenzhen, Guangdong, China Tel: +86-755-23118282, Fax: +86-755-23116366 Email: info@ccis-cb.com, Website: http://www.ccis-cb.com</p>

5.8 Test Instruments list

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SAEMC	9(L)*6(W)* 6(H)	CCIS0001	07-22-2017	07-21-2020
BiConiLog Antenna	SCHWARZBECK	VULB9163	CCIS0005	02-25-2019	02-24-2020
Horn Antenna	SCHWARZBECK	BBHA9120D	CCIS0006	02-25-2019	02-24-2020
Pre-amplifier (10kHz-1.3GHz)	HP	8447D	CCIS0003	02-25-2019	02-24-2020
Pre-amplifier (1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	CCIS0011	02-25-2019	02-24-2020
Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	02-25-2019	02-24-2020
Horn Antenna	ETS-LINDGREN	3160	GTS217	02-25-2019	02-24-2020
Spectrum analyzer 9k-30GHz	Rohde & Schwarz	FSP30	CCIS0023	02-25-2019	02-24-2020
Spectrum Analyzer 20Hz-26.5GHz	Agilent	N9020A	MY50510123	02-25-2019	02-24-2020
EMI Test Receiver	Rohde & Schwarz	ESRP7	CCIS0167	02-25-2019	02-24-2020
Loop antenna	Laplace instrument	RF300	EMC0701	02-25-2019	02-24-2020
Coaxial Cable	CCIS	N/A	CCIS0016	02-25-2019	02-24-2020
Coaxial Cable	CCIS	N/A	CCIS0017	02-25-2019	02-24-2020
Coaxial cable	CCIS	N/A	CCIS0018	02-25-2019	02-24-2020
Coaxial Cable	CCIS	N/A	CCIS0019	02-25-2019	02-24-2020
Coaxial Cable	CCIS	N/A	CCIS0087	02-25-2019	02-24-2020
Signal Generator	Rohde & Schwarz	SMR 20	CCIS0024	02-25-2019	02-24-2020
Signal Generator	Rohde & Schwarz	SMX	CCIS0064	02-25-2019	02-24-2020
Signal Analyzer	Rohde & Schwarz	FSIQ3	CCIS0088	02-25-2019	02-24-2020

6 System test configuration

6.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

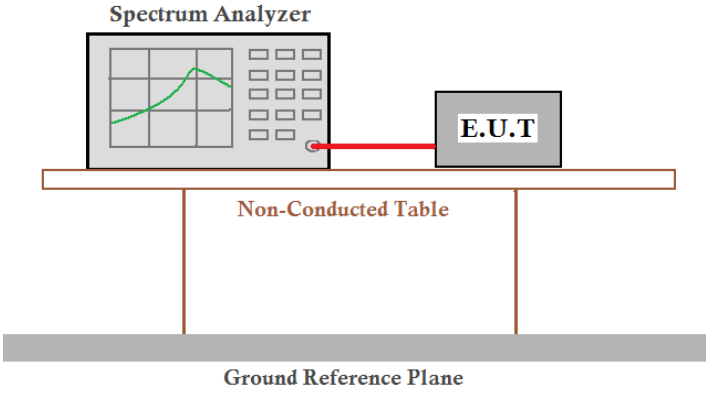
6.2 EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency which was for the purpose of the measurements.

6.3 Description of Test Modes

The EUT has been tested under operating condition.
EUT staying in continuous transmitting mode. Channel Low, Mid and High for each type band with rated data rate were chosen for full testing.
The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for three modes with power adaptor, earphone and Data cable. The worst-case H mode.

6.4 Conducted Output Power

Test Requirement:	FCC Part 25 B Section 25.149 (c)(4)(iii)
Test Method:	ANSI C63.26-2015 and KDB 971168
Limit:	The maximum transmit power is no more than 1 W with a peak EIRP of no more than 6 dBw. EIRP Limit = 6 + 30 = 36 dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

Bandwidth	Modulation	Frequency (MHz)	Output Power (dBm)	Output Power Limit(dBm)	Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
5MHz	QPSK	2486.0	22.65	30.00	10	32.65	36.00	Pass
		2489.0	22.57	30.00	10	32.57	36.00	
		2492.5	22.85	30.00	10	32.85	36.00	
	16QAM	2486.0	22.58	30.00	10	32.58	36.00	
		2489.0	22.55	30.00	10	32.55	36.00	
		2492.5	22.55	30.00	10	32.55	36.00	
10MHz	QPSK	2488.5	22.83	30.00	10	32.83	36.00	
		2489.0	22.89	30.00	10	32.89	36.00	
		2490.0	22.97	30.00	10	32.97	36.00	
	16QAM	2488.5	22.69	30.00	10	32.69	36.00	
		2489.0	22.86	30.00	10	32.86	36.00	
		2490.0	22.90	30.00	10	32.90	36.00	

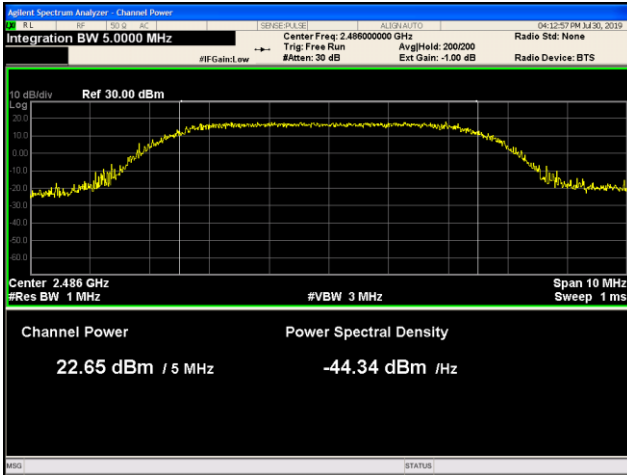
EIRP (dBm) = Average Power (dBm) + Antenna Gain (dBi).

Test plot as follows:

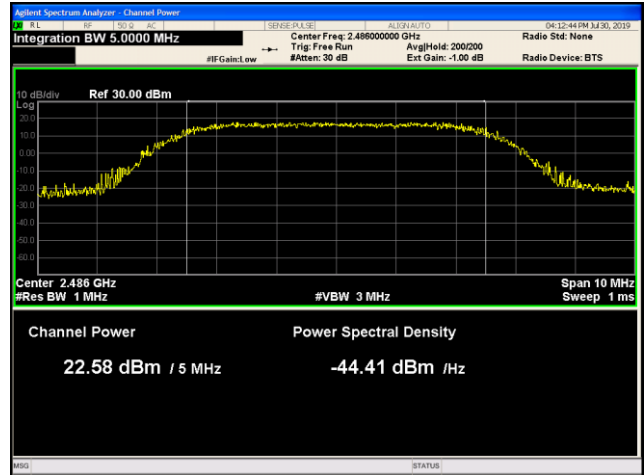
Bandwidth=5MHz

QPSK

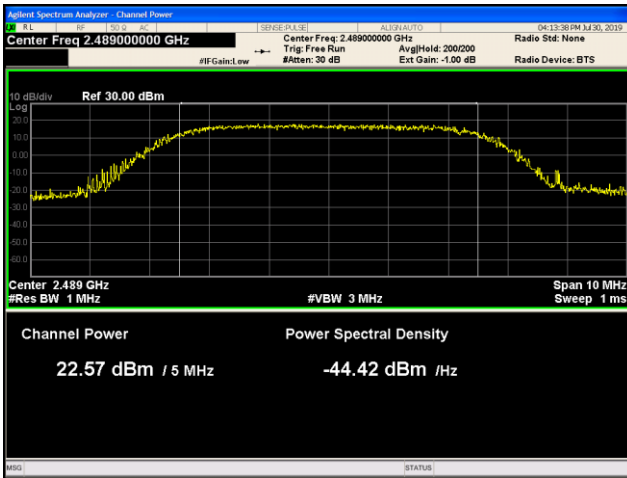
16QAM



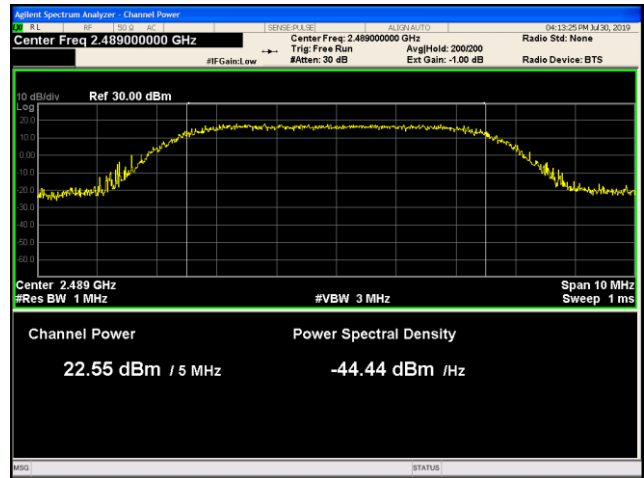
Lowest channel



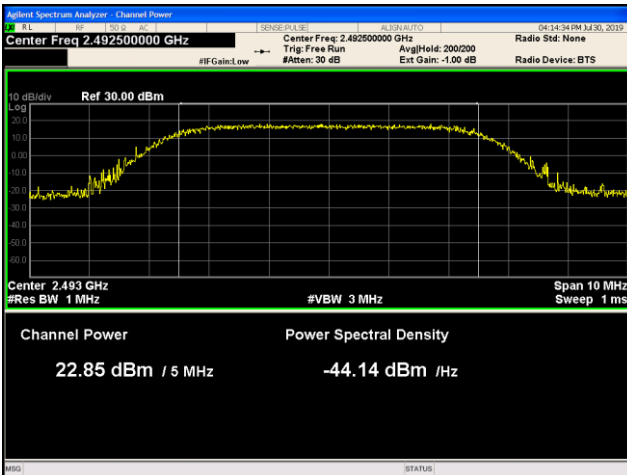
Lowest channel



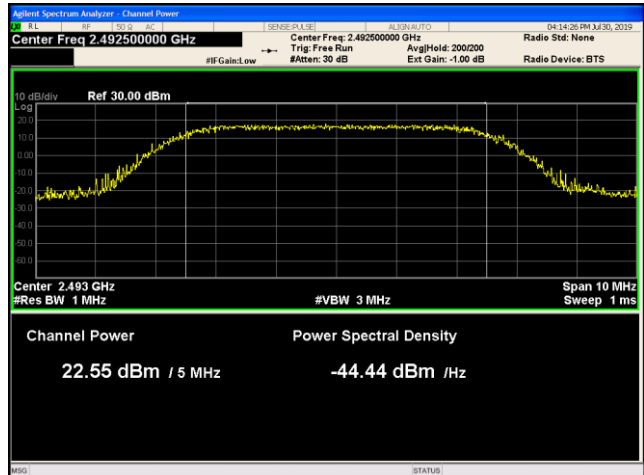
Middle channel



Middle channel



Highest channel

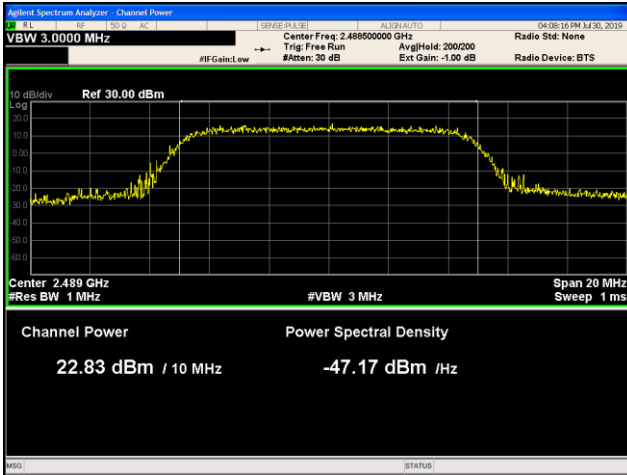


Highest channel

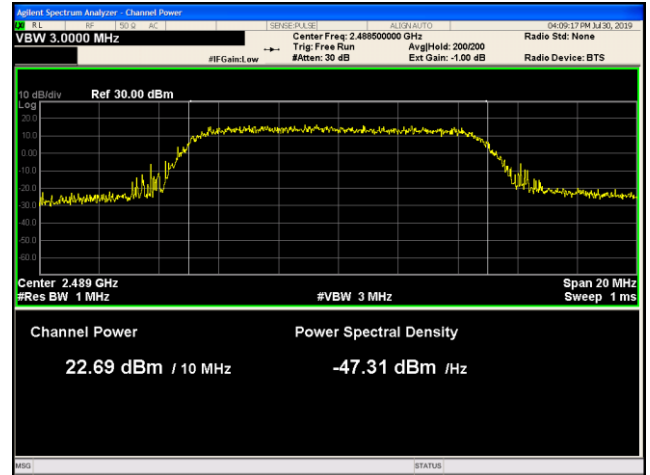
Bandwidth=10MHz

QPSK

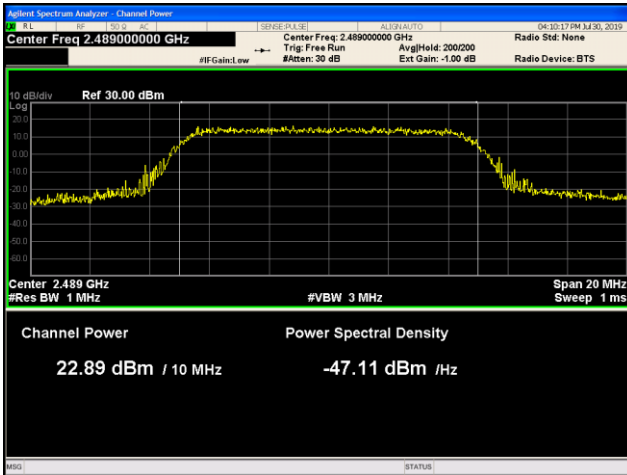
16QAM



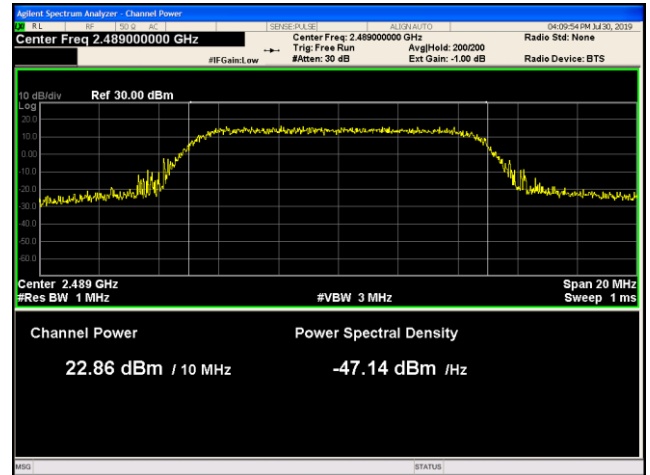
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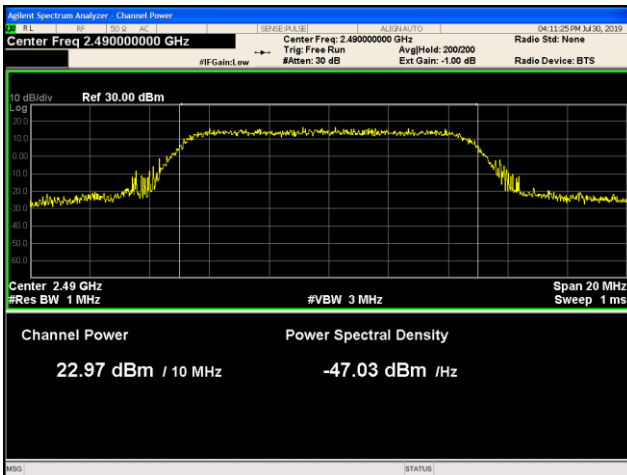
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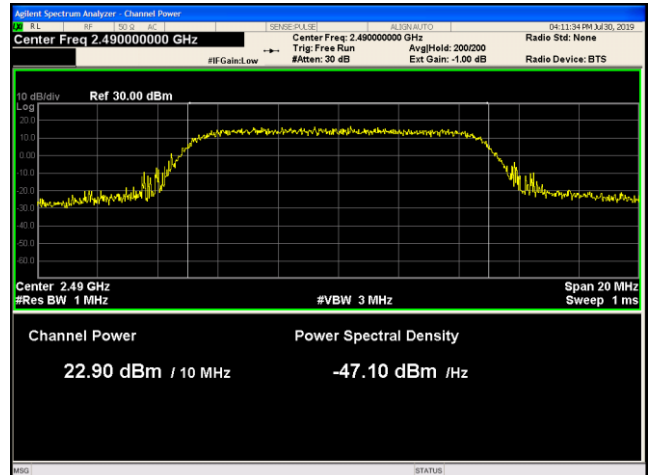
Middle channel



Middle channel

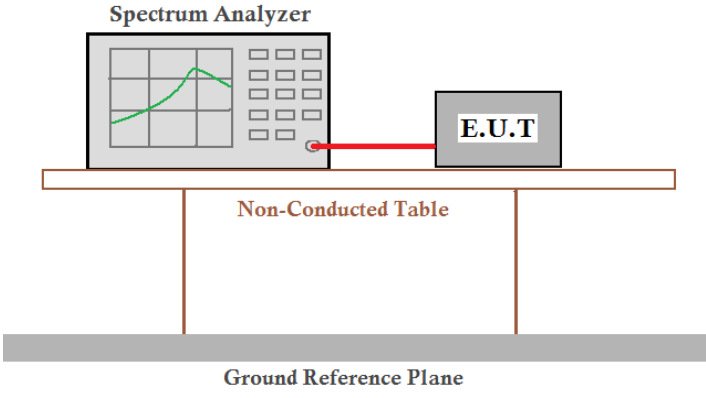


Highest channel



Highest channel

6.5 Occupy Bandwidth

Test Requirement:	FCC Part 25 B Section 25.149 (c)(4)(ii)
Test Method:	ANSI C63.26-2015 and KDB 971168
Limit:	>500kHz
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

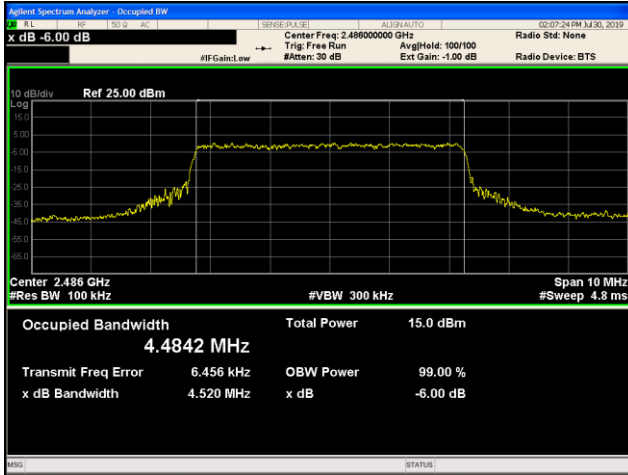
Bandwidth	Modulation	Frequency (MHz)	6dB Occupy bandwidth (MHz)	99% Occupy bandwidth (MHz)	-26dB Emission bandwidth (MHz)	Limit (MHz)	Result
5MHz	QPSK	2486.0	4.520	4.4842	5.306	≥ 0.5	Pass
		2489.0	4.481	4.4667	5.101	≥ 0.5	
		2492.5	4.535	4.4989	5.426	≥ 0.5	
5MHz	16QAM	2486.0	4.499	4.4758	5.259	≥ 0.5	
		2489.0	4.479	4.4699	5.029	≥ 0.5	
		2492.5	4.490	4.4546	4.938	≥ 0.5	
10MHz	QPSK	2488.5	9.001	8.9102	9.608	≥ 0.5	
		2489.0	9.039	8.9497	9.835	≥ 0.5	
		2490.0	9.017	8.9303	9.570	≥ 0.5	
5MHz	16QAM	2488.5	8.988	8.8970	9.425	≥ 0.5	
		2489.0	9.003	8.9165	9.868	≥ 0.5	
		2490.0	9.004	8.9182	9.539	≥ 0.5	

Test plot as follows:

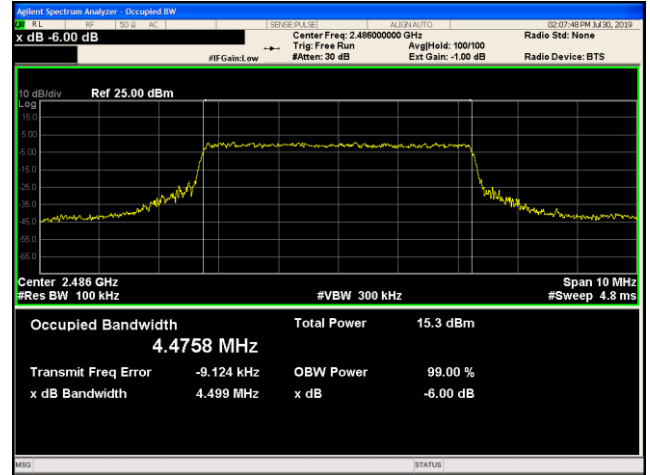
Bandwidth=5MHz

QPSK

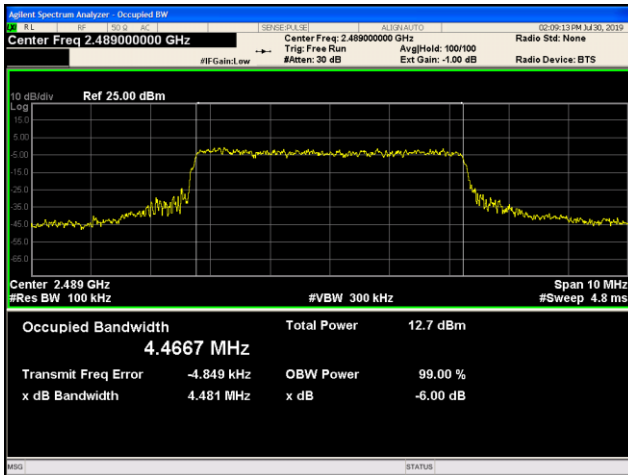
16QAM



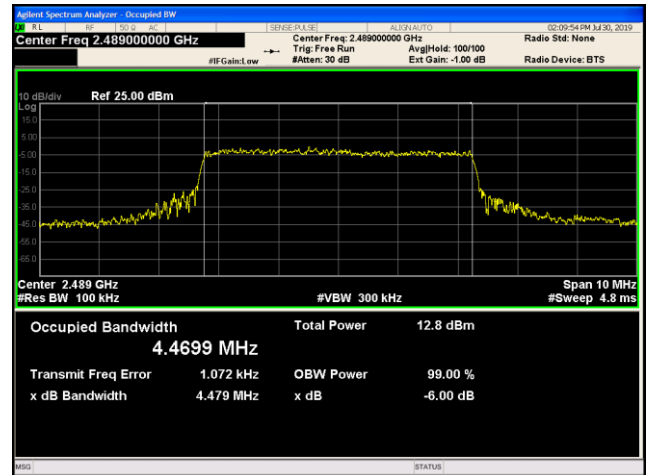
Lowest channel



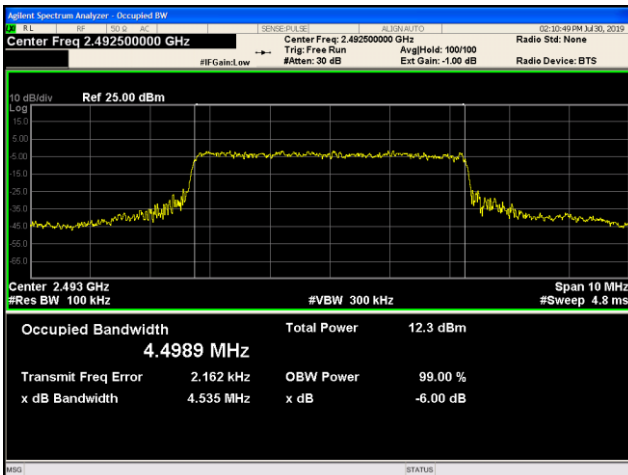
Lowest channel



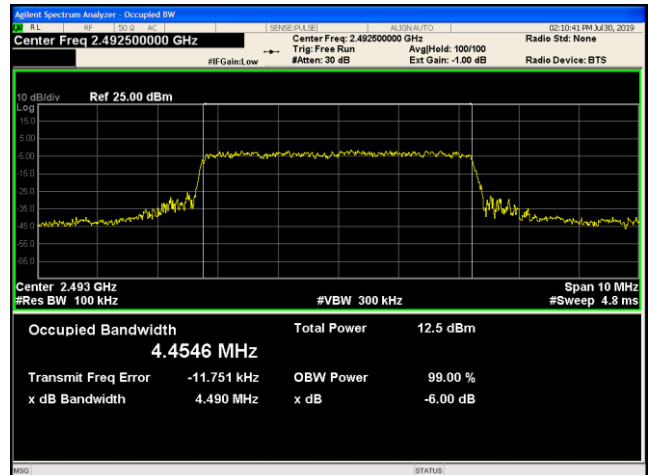
Middle channel



Middle channel



Highest channel

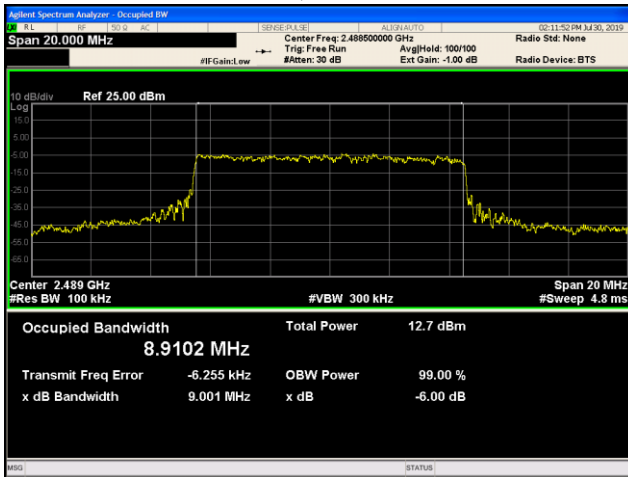


Highest channel

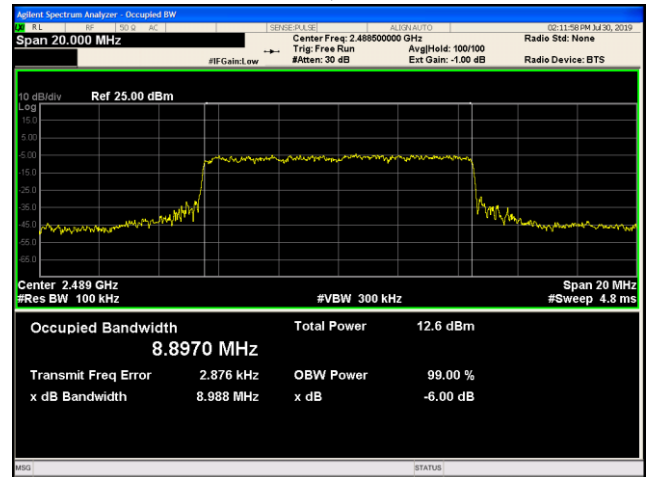
Bandwidth=10MHz

QPSK

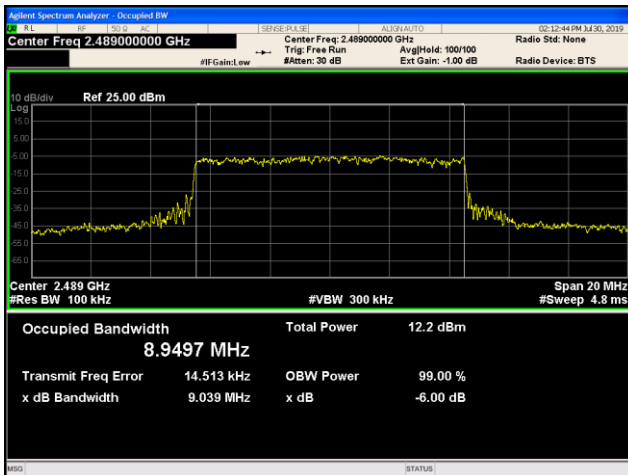
16QAM



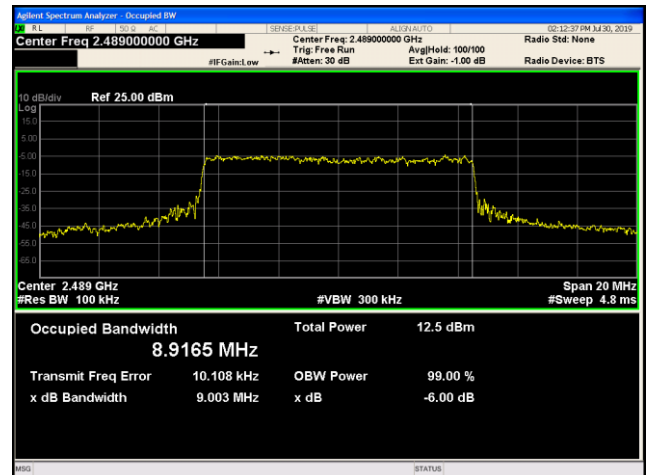
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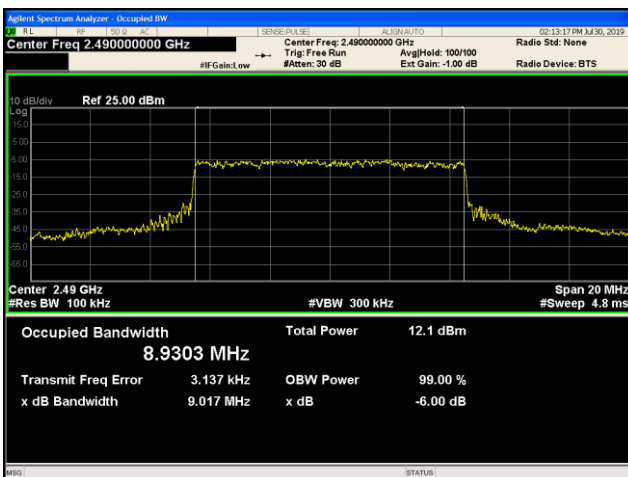
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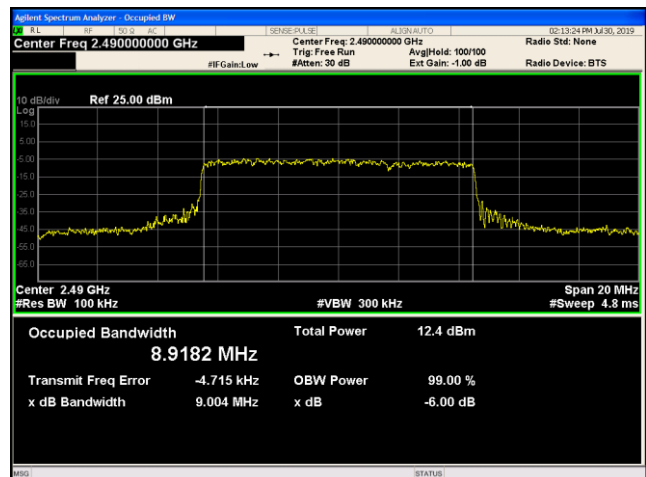
Middle channel



Middle channel



Highest channel



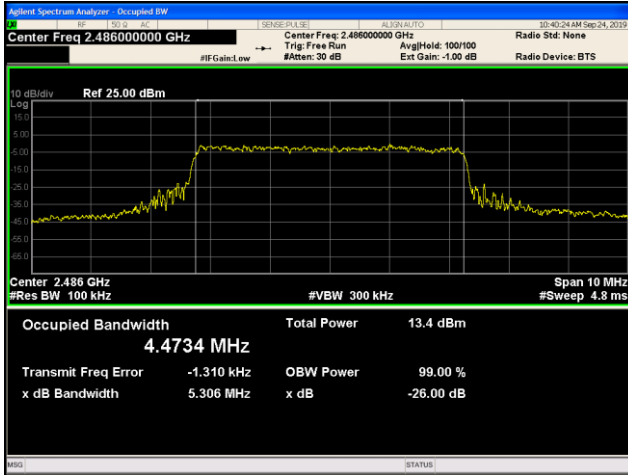
Highest channel

26dB Emission Bandwidth

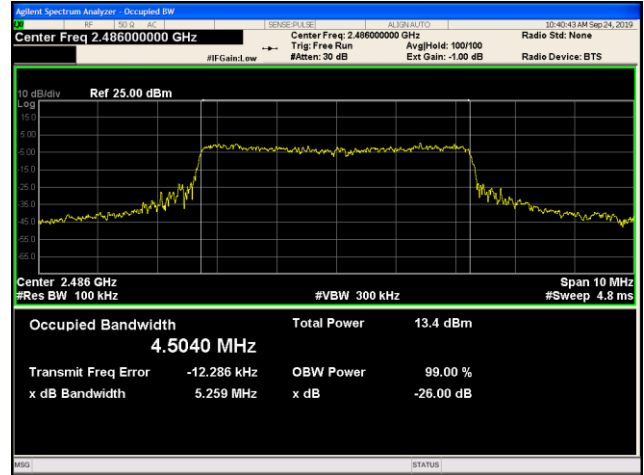
Bandwidth=5MHz

QPSK

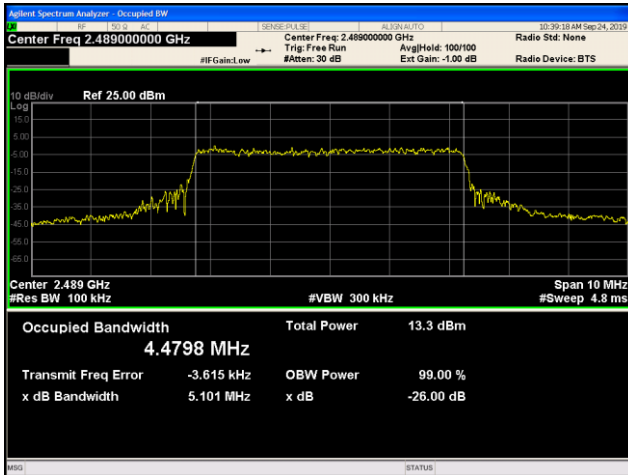
16QAM



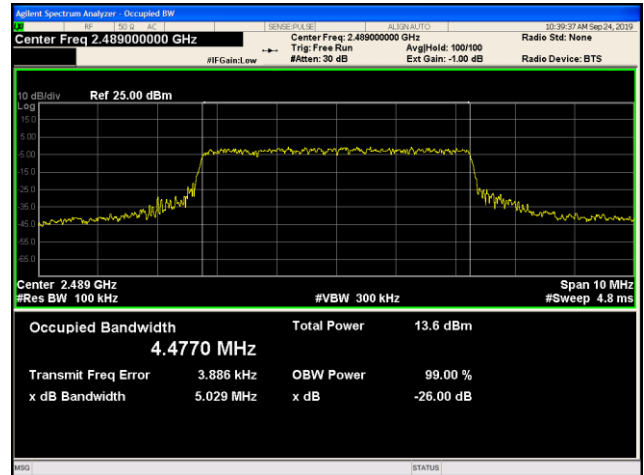
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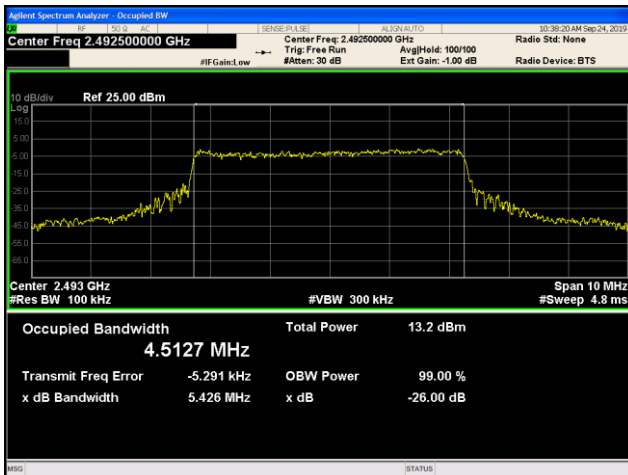
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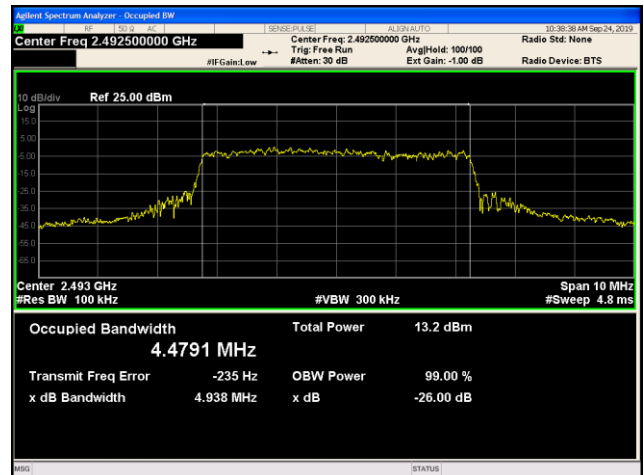
Middle channel



Middle channel



Highest channel

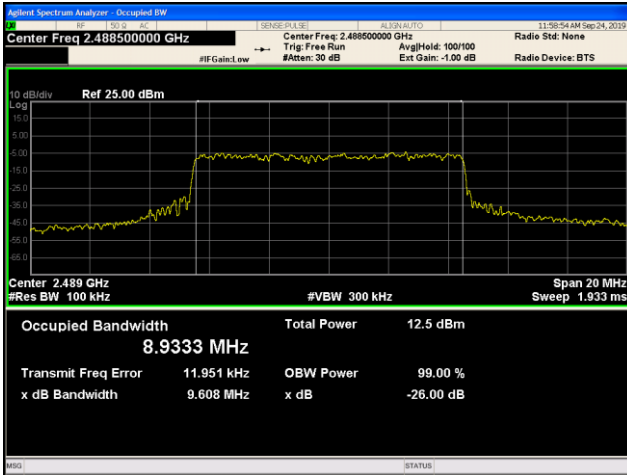


Highest channel

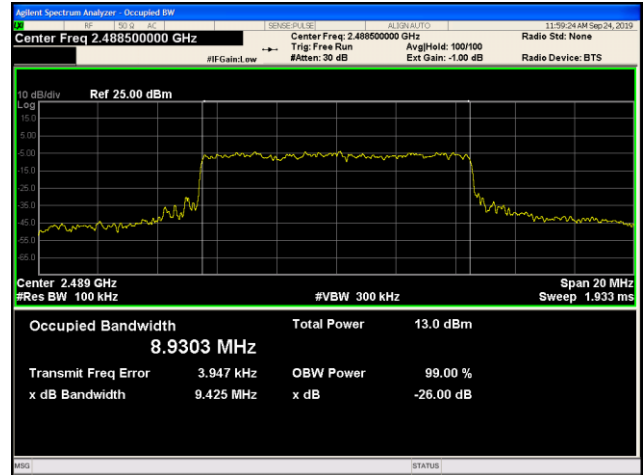
Bandwidth=10MHz

QPSK

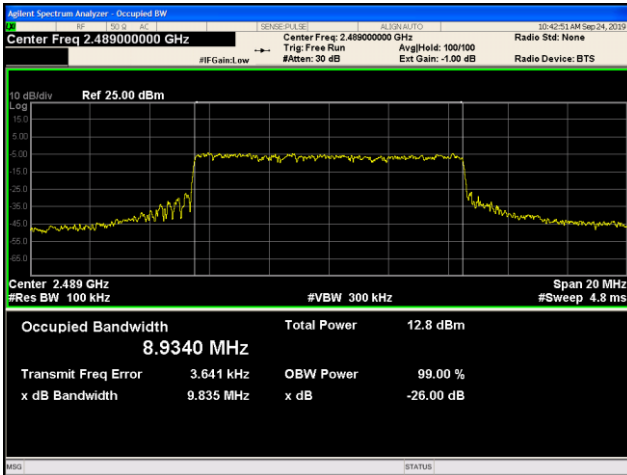
16QAM



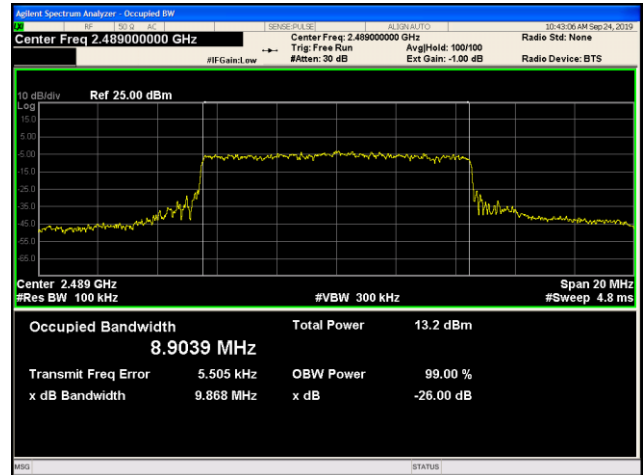
Lowest channel



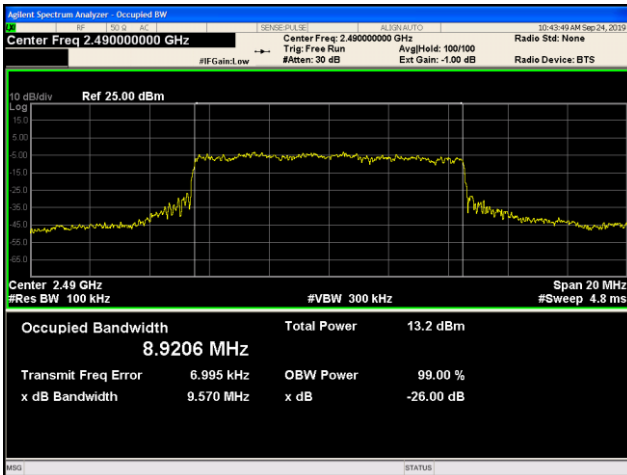
Lowest channel



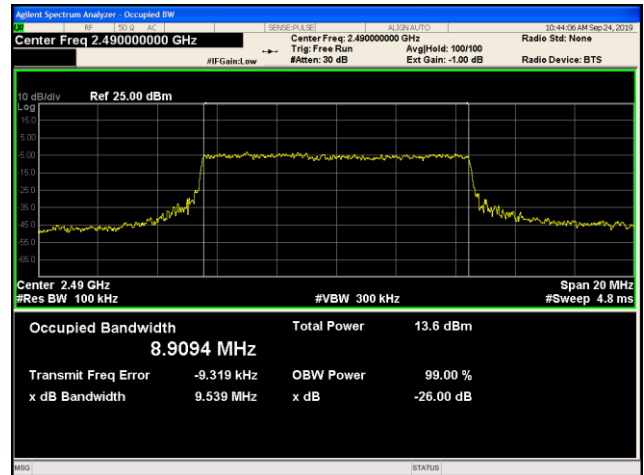
Middle channel



Middle channel

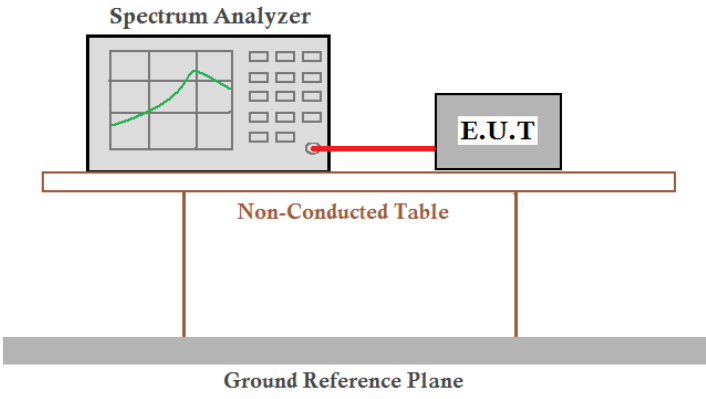


Highest channel



Highest channel

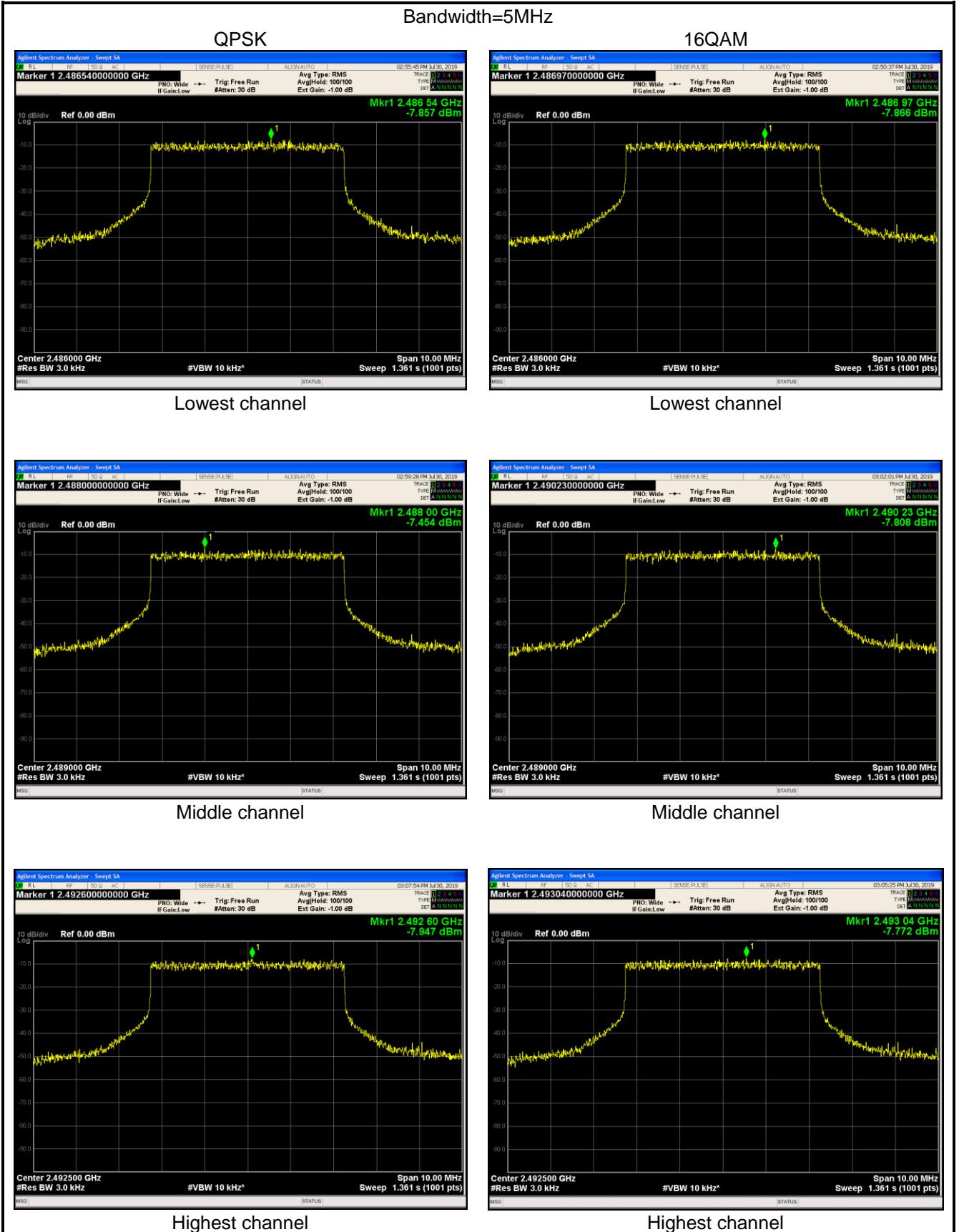
6.6 Power Spectral Density

Test Requirement:	FCC Part 25 B Section 25.149 (c)(4)(iv)
Test Method:	C63.26-2015 and KDB 971168 D01v03r01
Limit:	The maximum power spectral density conducted to the antenna is not greater than 8 dBm in any 3kHz band during any time interval of continuous transmission
Test setup:	 <p>The diagram shows a Spectrum Analyzer connected to an E.U.T (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

Bandwidth	Modulation	Frequency (MHz)	PSD(dBm/3kHz)	Limit (dBm/3kHz)	Result
5MHz	QPSK	2486.0	-7.857	8	Pass
		2489.0	-7.454	8	
		2492.5	-7.947	8	
	16QAM	2486.0	-7.866	8	
		2489.0	-7.808	8	
		2492.5	-7.772	8	
10MHz	QPSK	2488.5	-13.204	8	
		2489.0	-13.281	8	
		2490.0	-13.642	8	
	16QAM	2488.5	-13.546	8	
		2489.0	-13.120	8	
		2490.0	-13.047	8	

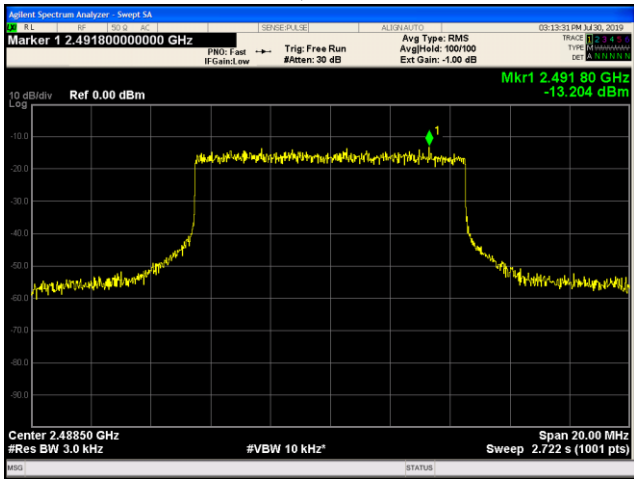
Test plots as follow:



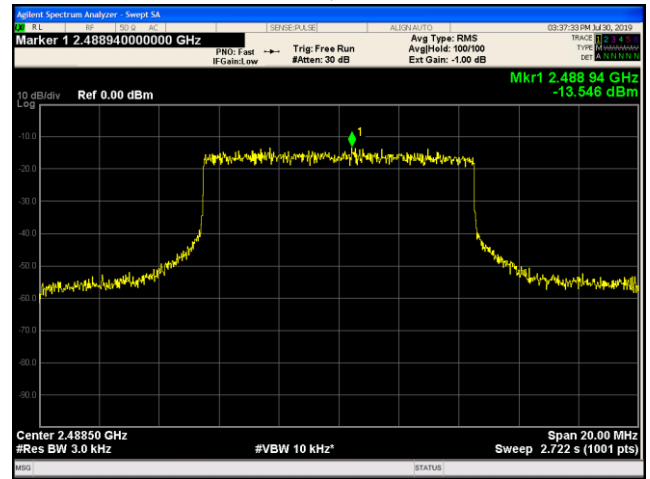
Bandwidth=10MHz

QPSK

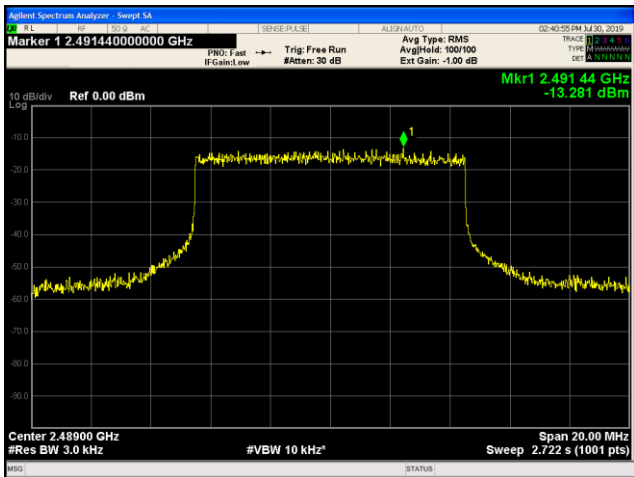
16QAM



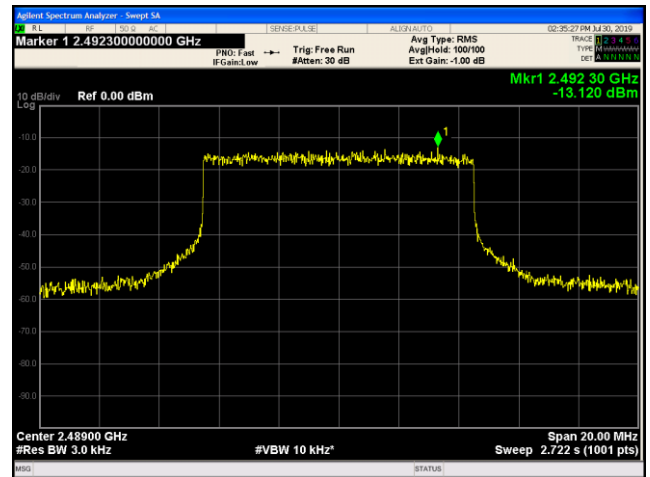
Lowest channel



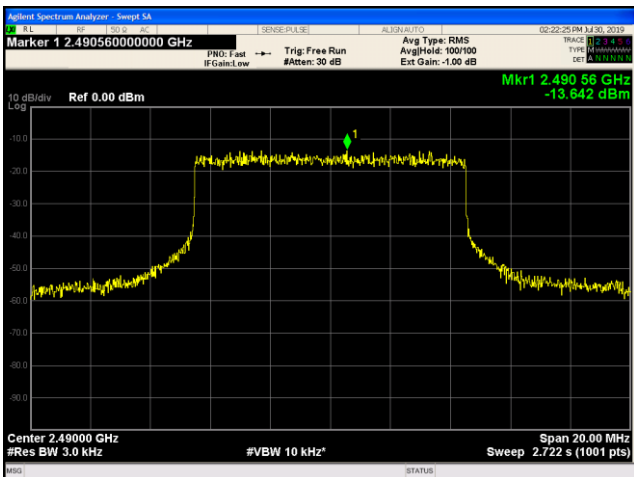
Lowest channel



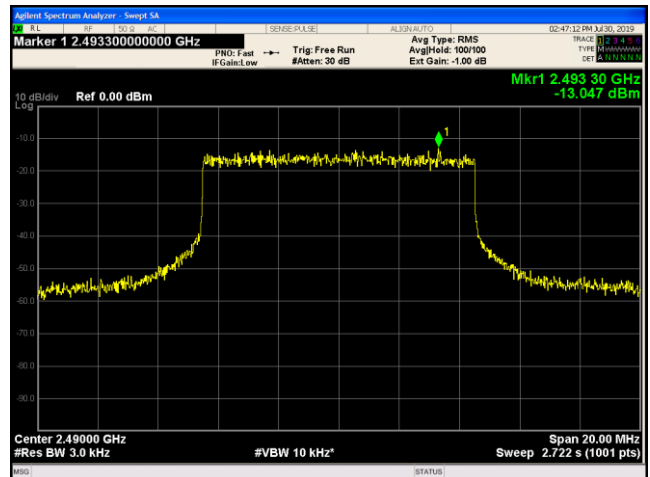
Middle channel



Middle channel

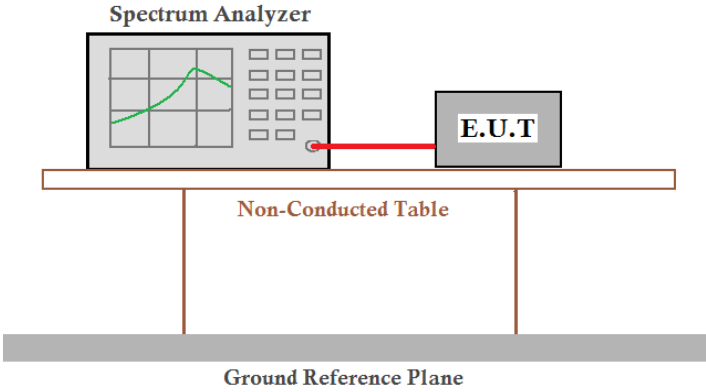


Highest channel



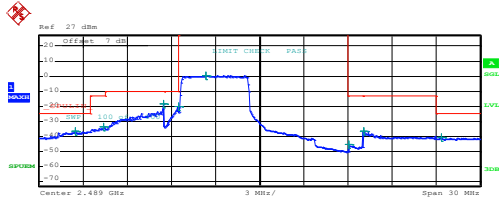
Highest channel

6.7 Band Edge

Test Requirement:	FCC Part 25 B Section 25.149 (c)(4)(v)(vi)(vii)
Test Method:	C63.26-2015 and KDB 971168 D01v03r01
Limit:	<p>Emissions below 2483.5 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least $40 + 10 \log (P)$ dB at the channel edge at 2483.5 MHz, $43 + 10 \log (P)$ dB at 5MHz from the channel edge, and $55 + 10 \log (P)$ dB at X MHz from the channel edge where X is the greater of 6 MHz or the actual emission bandwidth.</p> <p>Emissions above 2495 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least $43 + 10 \log (P)$ dB on all frequencies between the channel edge at 2495 MHz and XMHz from this channel edge and $55 + 10 \log (P)$ dB on all frequencies more than X MHz from this channel edge, where X is the greater of 6 MHz or the actual emission bandwidth.</p>
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plots as follow:

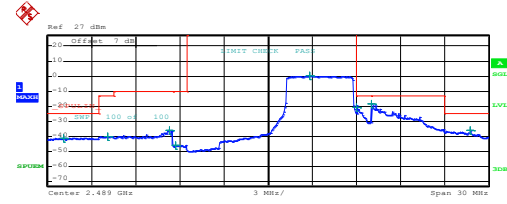
Bandwidth=5MHz QPSK



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAve [dBm]	ΔLimit [dB]
2.474 G	2.478 G	1.00 M	2.476484 G	-36.59	-11.59
2.478 G	2.478 G	1.00 M	2.478395 G	-33.77	-20.77
2.478 G	2.482 G	1.00 M	2.480435 G	-18.04	-8.04
2.482 G	2.483 G	100.00 K	2.483484 G	-20.12	-10.12
2.483 G	2.495 G	100.00 K	2.485355 G	0.41	-32.59
2.495 G	2.496 G	100.00 K	2.495032 G	-45.50	-32.50
2.496 G	2.501 G	1.00 M	2.496081 G	-36.30	-23.30
2.501 G	2.504 G	1.00 M	2.501339 G	-40.67	-15.67

Date: 24.SEP.2019 11:43:44

Lowest channel

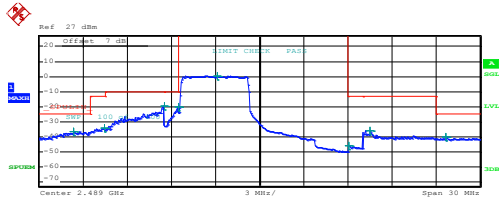


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAve [dBm]	ΔLimit [dB]
2.474 G	2.478 G	1.00 M	2.475073 G	-41.03	-16.03
2.478 G	2.478 G	1.00 M	2.478105 G	-39.90	-26.90
2.478 G	2.482 G	1.00 M	2.482074 G	-35.72	-25.72
2.482 G	2.483 G	100.00 K	2.482685 G	-45.52	-35.52
2.483 G	2.495 G	100.00 K	2.491847 G	0.57	-32.43
2.495 G	2.496 G	100.00 K	2.495024 G	-20.52	-7.52
2.496 G	2.501 G	1.00 M	2.496000 G	-18.16	-5.16
2.501 G	2.504 G	1.00 M	2.502766 G	-36.04	-11.04

Date: 24.SEP.2019 11:48:00

Highest channel

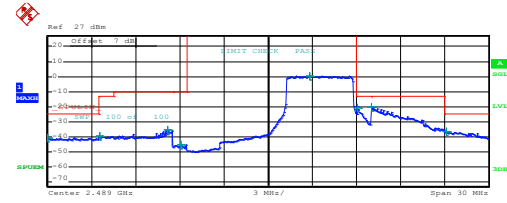
16QAM



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAve [dBm]	ΔLimit [dB]
2.474 G	2.478 G	1.00 M	2.476343 G	-36.40	-11.40
2.478 G	2.478 G	1.00 M	2.478427 G	-34.38	-21.38
2.478 G	2.482 G	1.00 M	2.482500 G	-19.30	-9.30
2.482 G	2.483 G	100.00 K	2.483484 G	-20.11	-10.11
2.483 G	2.495 G	100.00 K	2.485097 G	0.38	-32.62
2.495 G	2.496 G	100.00 K	2.495089 G	-45.53	-32.53
2.496 G	2.501 G	1.00 M	2.496484 G	-35.61	-22.61
2.501 G	2.504 G	1.00 M	2.501677 G	-40.24	-15.24

Date: 24.SEP.2019 11:46:16

Lowest channel

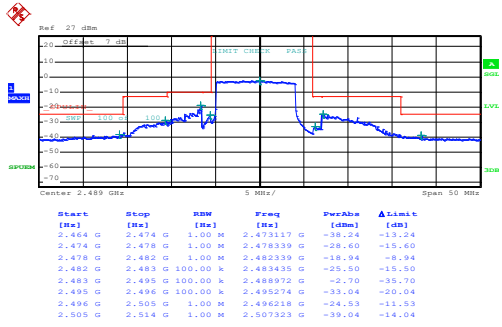


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAve [dBm]	ΔLimit [dB]
2.474 G	2.478 G	1.00 M	2.474028 G	-40.83	-15.83
2.478 G	2.478 G	1.00 M	2.477516 G	-39.53	-26.53
2.478 G	2.482 G	1.00 M	2.482177 G	-35.57	-25.57
2.482 G	2.483 G	100.00 K	2.483056 G	-45.14	-35.14
2.483 G	2.495 G	100.00 K	2.493847 G	0.55	-32.45
2.495 G	2.496 G	100.00 K	2.495032 G	-20.68	-7.68
2.496 G	2.501 G	1.00 M	2.496040 G	-20.20	-7.20
2.501 G	2.504 G	1.00 M	2.501121 G	-36.20	-11.20

Date: 24.SEP.2019 11:49:28

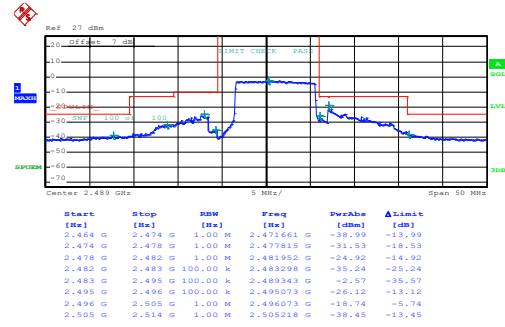
Highest channel

Bandwidth=10MHz
QPSK



Date: 24.SEP.2019 11:57:12

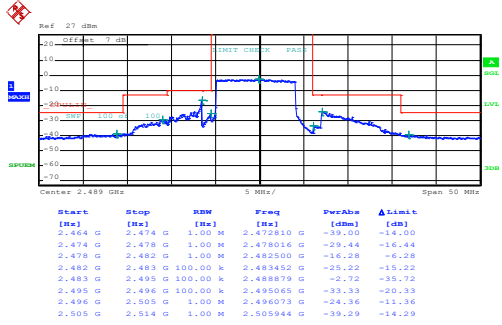
Lowest channel



Date: 24.SEP.2019 12:00:55

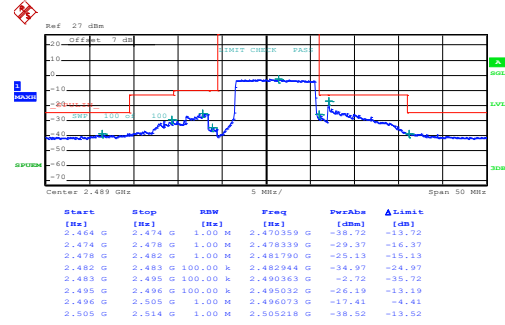
Highest channel

16QAM



Date: 24.SEP.2019 11:57:57

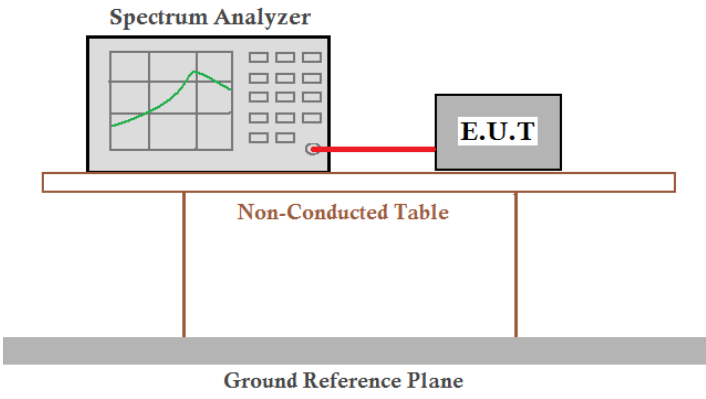
Lowest channel



Date: 24.SEP.2019 12:02:38

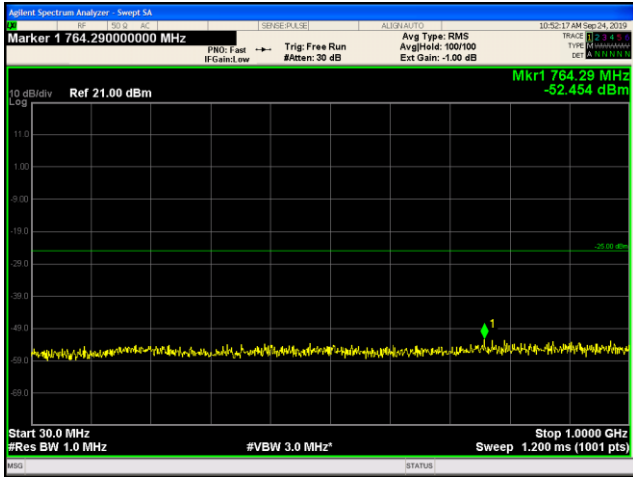
Highest channel

6.8 Conducted Spurious Emission

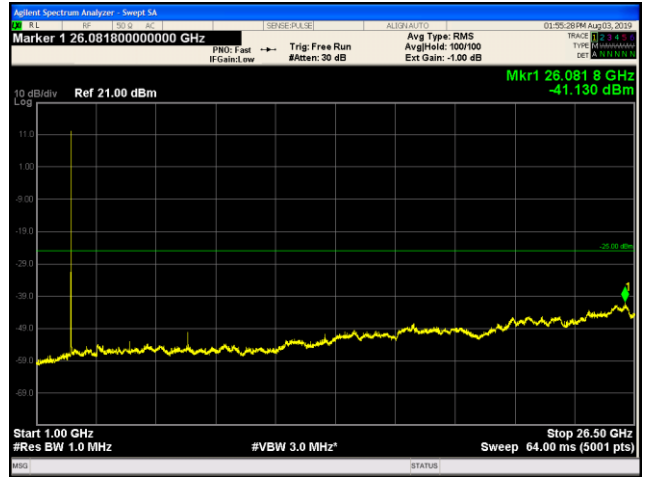
Test Requirement:	FCC Part 25 B Section 25.149 (c)(4)(v)(vi)
Test Method:	C63.26-2015 and KDB 971168 D01v03r01
Limit:	<p>Emissions below 2483.5 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least $40 + 10 \log (P)$ dB at the channel edge at 2483.5 MHz, $43 + 10 \log (P)$ dB at 5MHz from the channel edge, and $55 + 10 \log (P)$ dB at X MHz from the channel edge where X is the greater of 6 MHz or the actual emission bandwidth.</p> <p>Emissions above 2495 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least $43 + 10 \log (P)$ dB on all frequencies between the channel edge at 2495 MHz and XMHz from this channel edge and $55 + 10 \log (P)$ dB on all frequencies more than X MHz from this channel edge, where X is the greater of 6 MHz or the actual emission bandwidth.</p>
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by two legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows:

Bandwidth=5MHz-QPSK Lowest channel

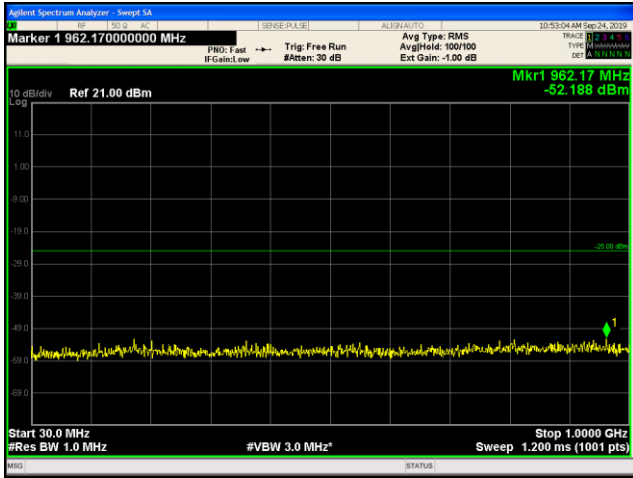


30MHz~1GHz

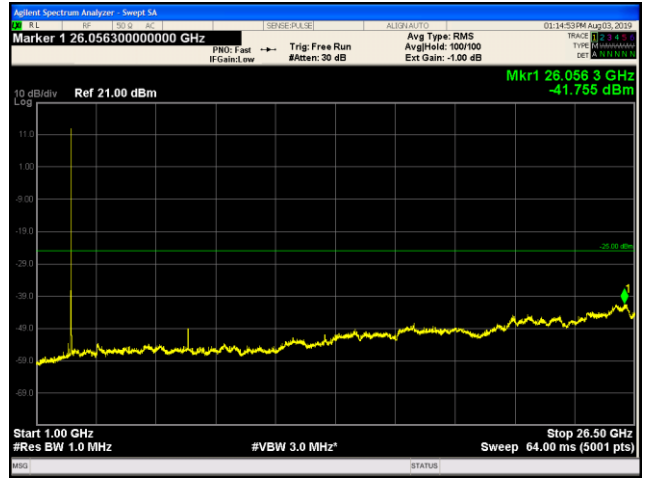


1GHz~26.5GHz

Middle channel

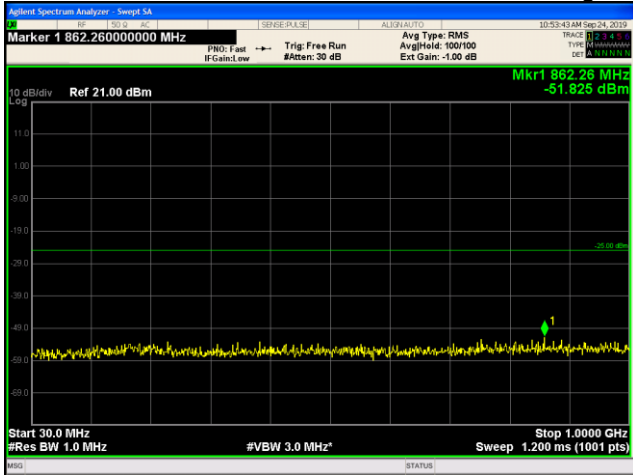


30MHz~1GHz

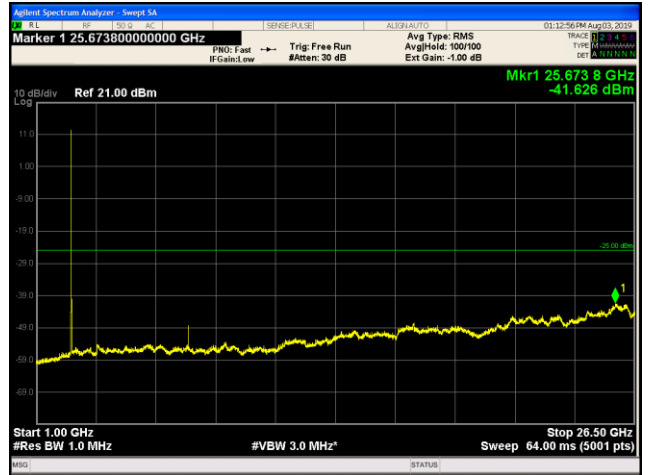


1GHz~26.5GHz

Highest channel

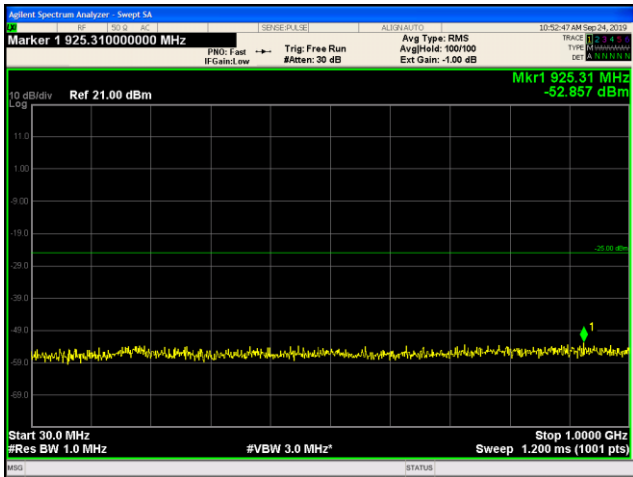


30MHz~1GHz

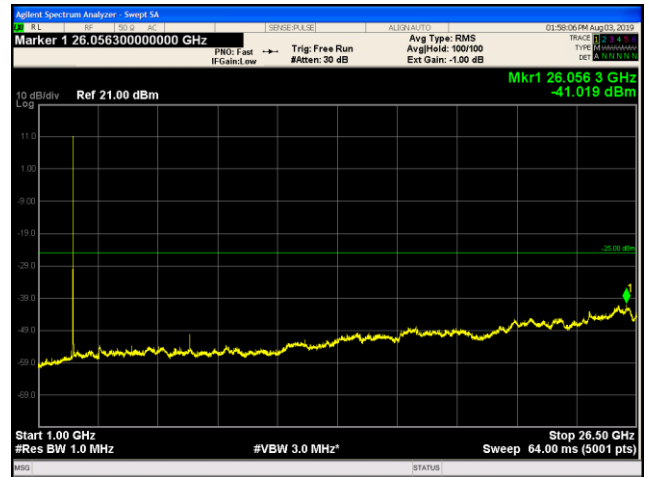


1GHz~26.5GHz

Bandwidth=5MHz-16QAM
Lowest channel

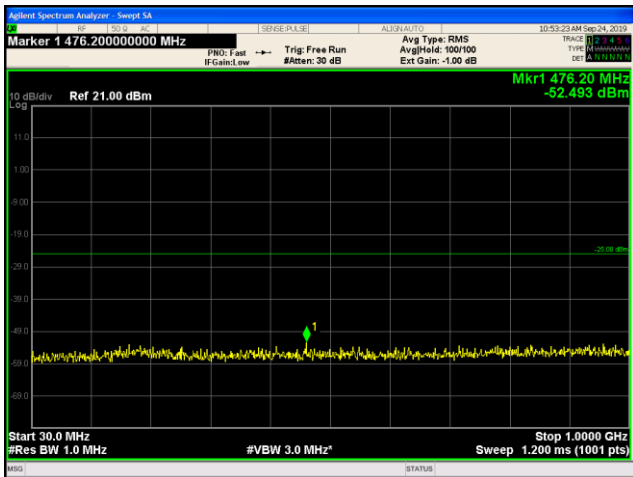


30MHz~1GHz

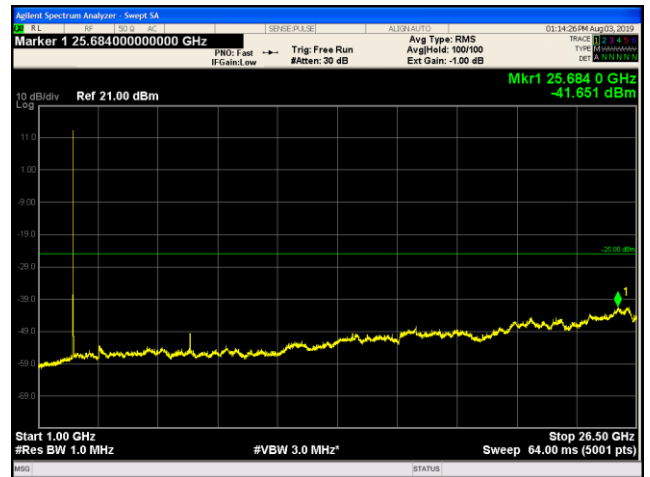


1GHz~26.5GHz

Middle channel

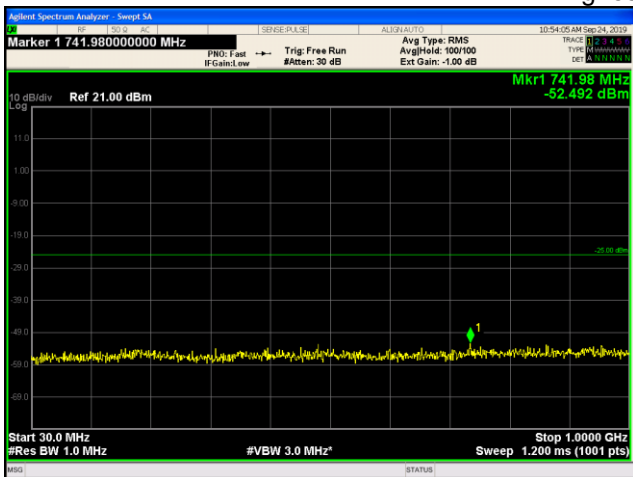


30MHz~1GHz

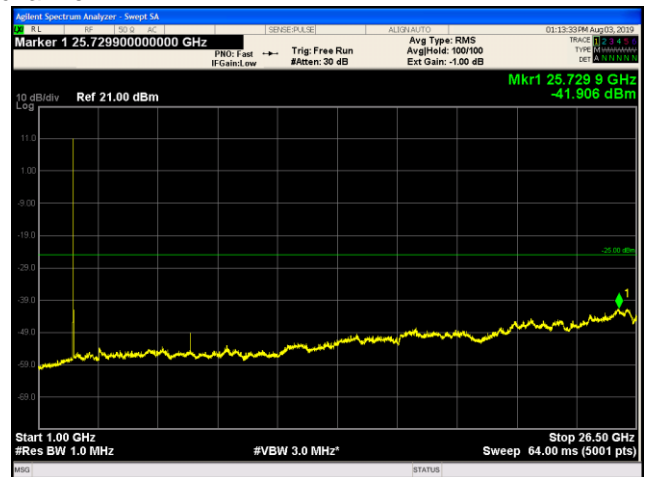


1GHz~26.5GHz

Highest channel

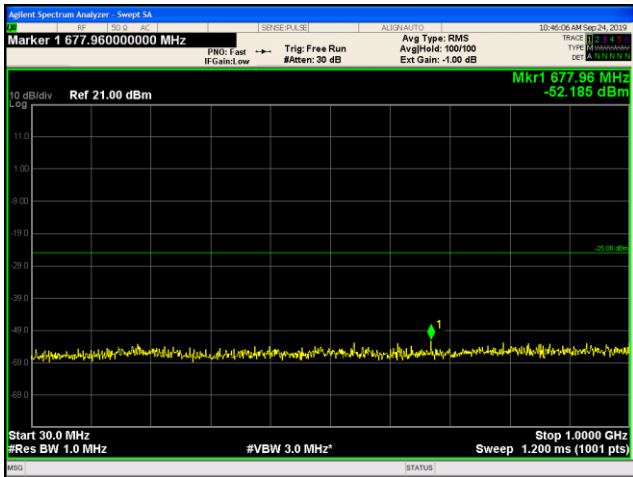


30MHz~1GHz

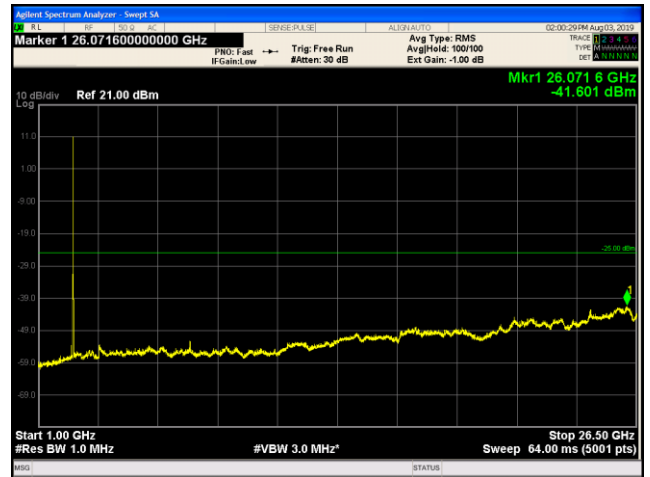


1GHz~26.5GHz

Bandwidth=10MHz-QPSK
Lowest channel

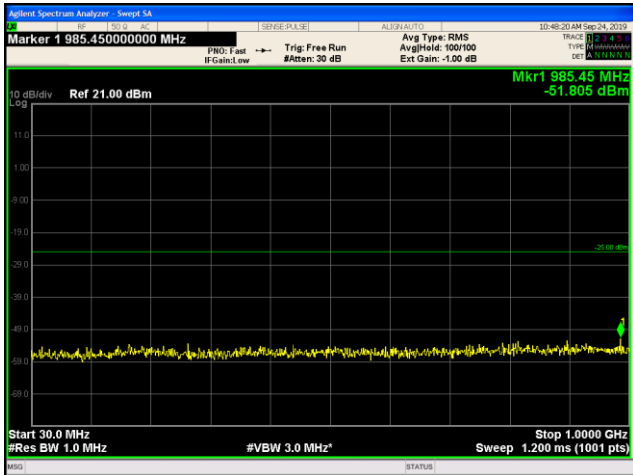


30MHz~1GHz



1GHz~26.5GHz

Middle channel

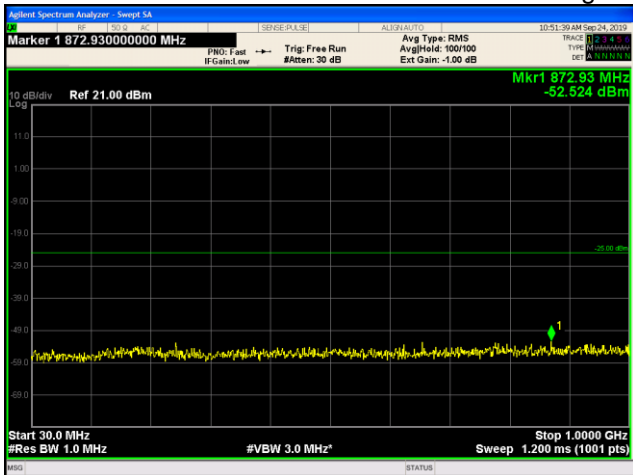


30MHz~1GHz

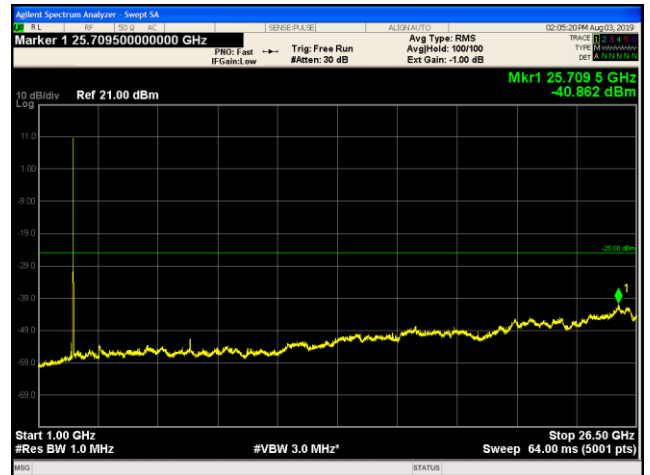


1GHz~26.5GHz

Highest channel

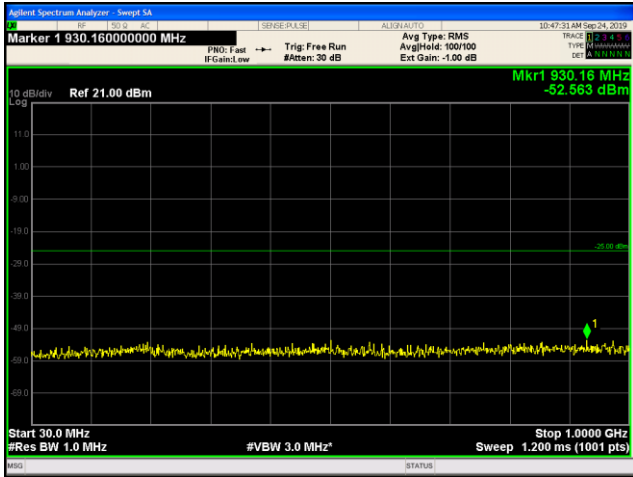


30MHz~1GHz

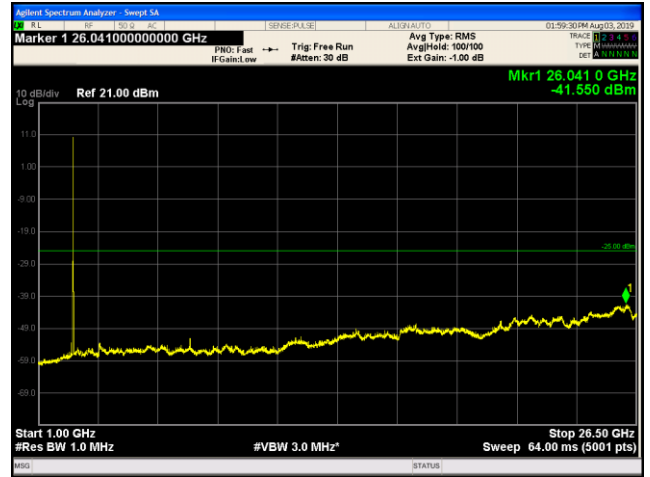


1GHz~26.5GHz

Bandwidth=10MHz-16QAM
Lowest channel

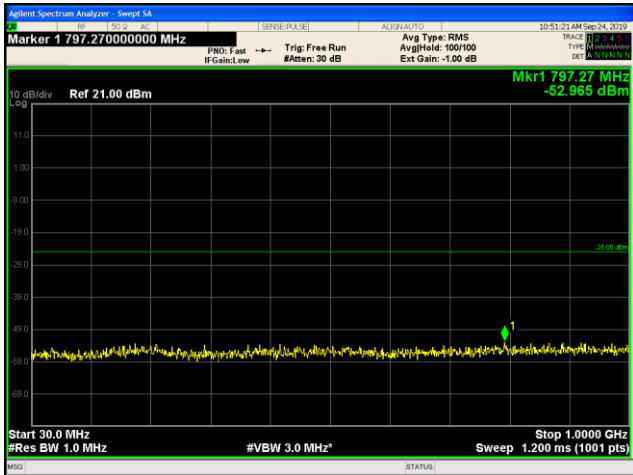


30MHz~1GHz

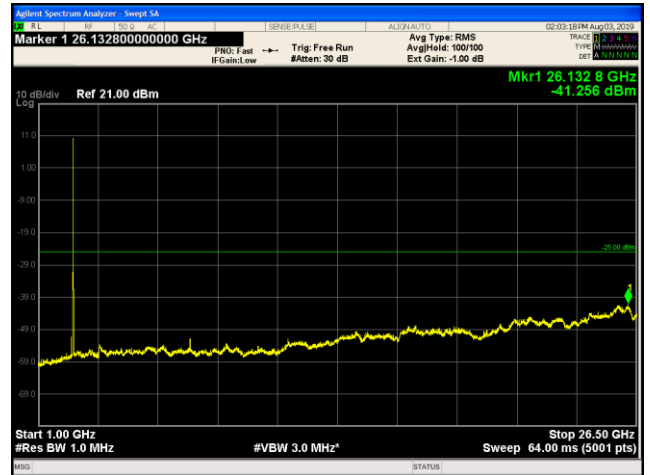


1GHz~26.5GHz

Middle channel

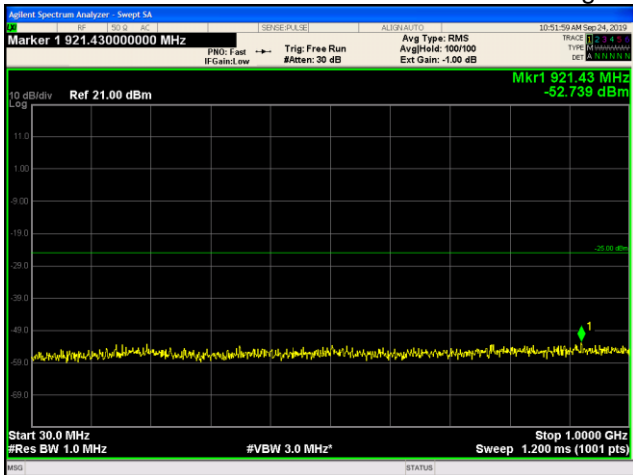


30MHz~1GHz



1GHz~26.5GHz

Highest channel

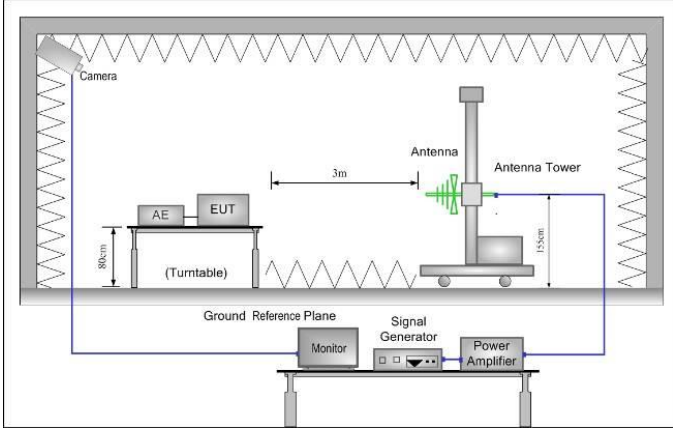


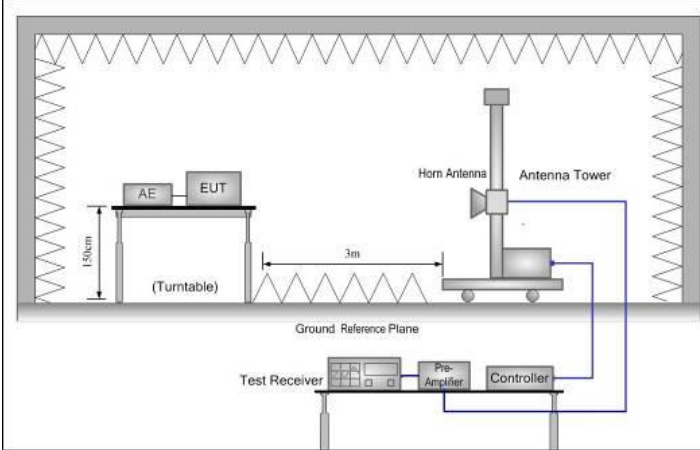
30MHz~1GHz



1GHz~26.5GHz

6.9 Radiated Spurious Emission Method

Test Requirement:	FCC Part 25 B Section 25.149 (c)(4)(v)(vi)
Test Method:	ANSI C63.26-2015 and KDB 971168
Limit:	<p>Emissions below 2483.5 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least $40 + 10 \log (P)$ dB at the channel edge at 2483.5 MHz, $43 + 10 \log (P)$ dB at 5MHz from the channel edge, and $55 + 10 \log (P)$ dB at X MHz from the channel edge where X is the greater of 6 MHz or the actual emission bandwidth.</p> <p>Emissions above 2495 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least $43 + 10 \log (P)$ dB on all frequencies between the channel edge at 2495 MHz and XMHz from this channel edge and $55 + 10 \log (P)$ dB on all frequencies more than X MHz from this channel edge, where X is the greater of 6 MHz or the actual emission bandwidth.</p>
Test Procedure:	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height 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. 4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test setup:	<p>Below 1GHz</p>  <p>Above 1GHz</p>

	
<p>Test Instruments:</p>	<p>Refer to section 5.8 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Passed</p>
<p>Remark:</p>	<ol style="list-style-type: none"> 1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.

Measurement Data (worst case):

Bandwidth=5MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
Lowest Channel				
4972.0	Vertical	-42.36	-25.00	Pass
7458.0	V	-40.42		
9944.0	V	-39.58		
4972.0	Horizontal	-45.21		
7458.0	H	-40.24		
9944.0	H	-38.19		
Middle Channel				
4978.0	Vertical	-42.36	-25.00	Pass
7467.0	V	-40.30		
9956.0	V	-39.79		
4978.0	Horizontal	-45.91		
7467.0	H	-40.90		
9956.0	H	-38.79		
Highest Channel				
4985.0	Vertical	-42.68	-25.00	Pass
7477.5	V	-40.08		
9970.0	V	-39.01		
4985.0	Horizontal	-45.83		
7477.5	H	-40.16		
9970.0	H	-38.34		
<p><i>Note:</i></p> <ol style="list-style-type: none"> <i>The emission levels of below 1 GHz are 20 dB lower than the limit so not show in this report.</i> <i>For above 1 GHz, all test modes were performed, and just the worst case shown in the report.</i> 				

Bandwidth=10MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
Lowest Channel				
4977.0	Vertical	-42.56	-25.00	Pass
7465.5	V	-40.13		
9954.0	V	-39.18		
4977.0	Horizontal	-45.57		
7465.5	H	-40.62		
9954.0	H	-38.96		
Middle Channel				
4978.0	Vertical	-42.48	-25.00	Pass
7467.0	V	-40.51		
9956.0	V	-39.43		
4978.0	Horizontal	-45.48		
7467.0	H	-40.43		
9956.0	H	-38.36		
Highest Channel				
4980.0	Vertical	-42.59	-25.00	Pass
7470.0	V	-40.75		
9960.0	V	-39.41		
4980.0	Horizontal	-45.62		
7470.0	H	-40.89		
9960.0	H	-38.16		
<p><i>Note:</i></p> <p>3. The emission levels of below 1 GHz are 20 dB lower than the limit so not show in this report.</p> <p>4. For above 1 GHz, all test modes were performed, and just the worst case shown in the report.</p>				

6.10 Frequency stability V.S. Temperature measurement

Test Requirement:	N/A
Test Method:	ANSI C63.26-2015
Limit:	N/A
Test setup:	<p style="text-align: center;">Note : Measurement setup for testing on Antenna connector</p>
Test procedure:	<ol style="list-style-type: none"> 1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Measurement Data (the worst channel):

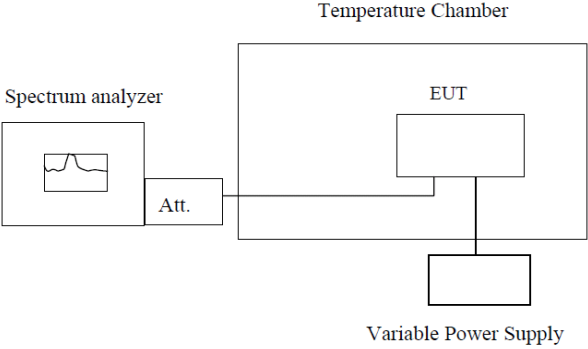
Reference Frequency: Lowest channel=2486.0MHz(5MHz for QPSK)			
Power supplied (Vac)	Temperature (°C)	Frequency error	
		Hz	ppm
120	-40	193	0.077635
	-20	176	0.070796
	-10	180	0.072405
	0	144	0.057924
	10	150	0.060338
	20	132	0.053097
	30	126	0.050684
	40	120	0.048270
	55	113	0.045455

Reference Frequency: Lowest channel=2488.5MHz(10MHz for QPSK)			
Power supplied (Vac)	Temperature (°C)	Frequency error	
		Hz	ppm
120	-40	187	0.075146
	-20	165	0.066305
	-10	174	0.069922
	0	123	0.049427
	10	160	0.064296
	20	144	0.057866
	30	150	0.060277
	40	108	0.043400
	55	133	0.053446

Reference Frequency: Lowest channel=2486.0MHz(5MHz for 16QAM)			
Power supplied (Vac)	Temperature (°C)	Frequency error	
		Hz	ppm
120	-40	191	0.076830
	-20	182	0.073210
	-10	165	0.066372
	0	171	0.068785
	10	123	0.049477
	20	132	0.053097
	30	136	0.054706
	40	128	0.051488
	55	144	0.057924

Reference Frequency: Lowest channel=2488.5MHz(10MHz for 16QAM)			
Power supplied (Vac)	Temperature (°C)	Frequency error	
		Hz	ppm
120	-40	185	0.074342
	-20	180	0.072333
	-10	156	0.062688
	0	132	0.053044
	10	144	0.057866
	20	171	0.068716
	30	105	0.042194
	40	116	0.046614
	55	128	0.051437

6.11 Frequency stability V.S. Voltage measurement

Test Requirement:	N/A
Test Method:	ANSI C63.26-2015
Limit:	N/A
Test setup:	 <p style="text-align: center;">Temperature Chamber</p> <p style="text-align: center;">Spectrum analyzer</p> <p style="text-align: center;">Att.</p> <p style="text-align: center;">EUT</p> <p style="text-align: center;">Variable Power Supply</p> <p>Note : Measurement setup for testing on Antenna connector</p>
Test procedure:	<ol style="list-style-type: none"> 1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. 3. Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details, and all channels have been tested, only shows the worst channel data in this report.
Test results:	Passed
Remark:	All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Measurement Data (the worst channel):

Reference Frequency: Lowest channel=2486.0MHz(5MHz for QPSK)			
Temperature (°C)	Power supplied (Vac)	Frequency error	
		Hz	ppm
25	138.0	89	0.035800
	120.0	78	0.031376
	102.0	90	0.036203
Reference Frequency: Lowest channel=2488.5MHz(10MHz for QPSK)			
Temperature (°C)	Power supplied (Vac)	Frequency error	
		Hz	ppm
25	138.0	99	0.039783
	120.0	71	0.028531
	102.0	80	0.032148

Reference Frequency: Lowest channel=2486.0MHz(5MHz for 16QAM)			
Temperature (°C)	Power supplied (Vac)	Frequency error	
		Hz	ppm
25	138.0	84	0.033789
	120.0	96	0.038616
	102.0	73	0.029364
Reference Frequency: Lowest channel=2488.5MHz(10MHz for 16QAM)			
Temperature (°C)	Power supplied (Vac)	Frequency error	
		Hz	ppm
25	138.0	98	0.039381
	120.0	85	0.034157
	102.0	60	0.024111