

FCC REPORT

(WIFI)

Applicant: Autel Robotics Co., Ltd

Address of Applicant: 9th Floor, Bldg.B1, Zhiyuan, 1001 Xueyuan Rd., Xili, Nanshan, Shenzhen, China

Equipment Under Test (EUT)

Product Name: Dragon Fish Remote Control

Model No.: DFRC-1

Trade Mark: AUTEL

FCC ID: 2AGNTDFRC2409A

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: 24 Aug., 2020

Date of Test: 25 Aug., to 27 Oct., 2020

Date of report issued: 03 Dec., 2020

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 JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	04 Nov., 2020	Original
01	03 Dec., 2020	Update ANT No.

Tested by:*Mike.ou***Test Engineer****Date:***03 Dec., 2020***Reviewed by:***Winner Zhang***Project Engineer****Date:***03 Dec., 2020*

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4 Test Summary

Test Items	Section in CFR 47	Result
Antenna requirement	15.203 & 15.247 (b)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
6dB Emission Bandwidth 99% Occupied Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247 (d)	Pass
Spurious Emission	15.205 & 15.209	Pass
<p>Remark:</p> <ol style="list-style-type: none"> 1. Pass: The EUT complies with the essential requirements in the standard. 2. N/A: Not Applicable. 3. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer). 		
Test Method:	ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02	

5 General Information

5.1 Client Information

Applicant:	Autel Robotics Co., Ltd
Address:	9th Floor, Bldg.B1, Zhiyuan, 1001 Xueyuan Rd., Xili, Nanshan, Shenzhen, China
Manufacturer:	Autel Robotics Co.,Ltd
Address:	9th Floor, Bldg.B1, Zhiyuan, 1001 Xueyuan Rd., Xili, Nanshan, Shenzhen, China
Factory:	Autel Robotics Co.,Ltd
Address:	9th Floor, Bldg.B1, Zhiyuan, 1001 Xueyuan Rd., Xili, Nanshan, Shenzhen, China

5.2 General Description of E.U.T.

Product Name:	Dragon Fish Remote Control
Model No.:	DFRC-1
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20))
Channel numbers:	11 for 802.11b/802.11g/802.11(HT20)
Channel separation:	5MHz
Modulation technology: (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation technology: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps
Data speed (IEEE 802.11n):	Up to 150Mbps(MIMO)
Antenna Type:	ANT 1/2/3 Internal Antenna ANT 6 External Antenna
Antenna gain:	Module 1: ANT 3: 2.4G Wi-Fi: 2.8 dBi, ANT 6: 2.4G Wi-Fi: 2.6 dBi, Module 2: ANT 1: 2.4G Wi-Fi: 3.0 dBi, ANT 2: 2.4G Wi-Fi: 3.5 dBi.
Power supply:	Rechargeable Li-ion Battery DC11.4V-8.2Ah
AC adapter:	Model: DF_CHARGER Input: AC100-240V, 50/60Hz, 4.0A Output 1/2/3: DC 26.4V, 7.0A
Test Sample Condition:	The test samples were provided in good working order with no visible defects.
Remark:	Module 1 only support 802.11g and 802.11n(HT20) Module 2 support 802.11b/g and 802.11n(HT20)

Operation Frequency each of channel for 802.11b/g/n(HT20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Note:
1. Channel 1, 6 & 11 selected for 802.11b/g/n-HT20 as Lowest, Middle and Highest channel.

5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Transmitting mode	Keep the EUT in continuous transmitting with modulation
<p>Radiated Emission: The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:</p>	
Per-scan all kind of data rate, the follow list were the worst case.	
Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps
802.11n(HT20)	6.5Mbps

5.4 Description of Support Units

The EUT has been tested as an independent unit.

5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±3.20 dB (k=2)

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen 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 JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

● **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>

5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.110~116, Building B, Jinyuan Business Building, 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>

5.9 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2020	07-21-2021
Loop Antenna	SCHWARZBECK	FMZB1519B	044	03-07-2020	03-06-2021
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-07-2020	03-06-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-07-2020	03-06-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2020	06-21-2021
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-18-2019	11-17-2020
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2020	03-06-2021
Pre-amplifier	CD	PAP-1G18	11804	03-07-2020	03-06-2021
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-05-2020	03-04-2021
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-18-2019	11-17-2020
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-05-2020	03-04-2021
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2020	03-06-2021
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2020	03-06-2021
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2020	03-06-2021
RF Switch Unit	MWRFTTEST	MW200	N/A	N/A	N/A
Test Software	MWRFTTEST	MTS8200	Version: 2.0.0.0		

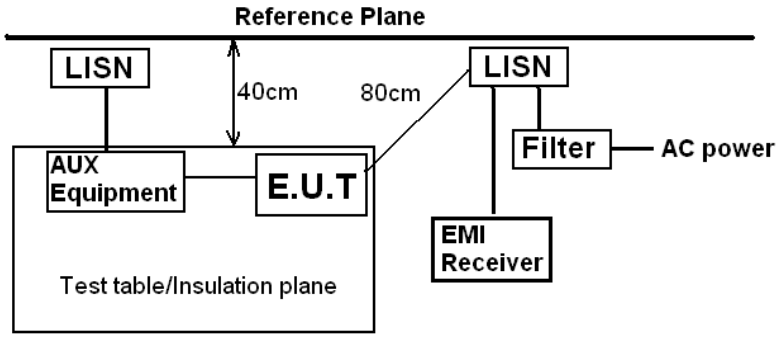
Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-05-2020	03-04-2021
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-05-2020	03-04-2021
LISN	CHASE	MN2050D	1447	03-05-2020	03-04-2021
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2020	07-20-2021
Cable	HP	10503A	N/A	03-05-2020	03-04-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		

6 Test results and Measurement Data

6.1 Antenna requirement

Standard requirement:	FCC Part 15 C Section 15.203 /247(b)										
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>											
E.U.T Antenna:											
<p>The Wi-Fi antenna cannot replace by end-user, the best case gain of the antenna as follow:</p> <table border="1" data-bbox="292 831 1329 994"> <thead> <tr> <th>ANT No</th> <th>ANT Gain</th> </tr> </thead> <tbody> <tr> <td>ANT 3</td> <td>2.8dBi</td> </tr> <tr> <td>ANT 6</td> <td>2.6dBi</td> </tr> <tr> <td>ANT 1</td> <td>3.0dBi</td> </tr> <tr> <td>ANT 2</td> <td>3.5dBi</td> </tr> </tbody> </table>		ANT No	ANT Gain	ANT 3	2.8dBi	ANT 6	2.6dBi	ANT 1	3.0dBi	ANT 2	3.5dBi
ANT No	ANT Gain										
ANT 3	2.8dBi										
ANT 6	2.6dBi										
ANT 1	3.0dBi										
ANT 2	3.5dBi										

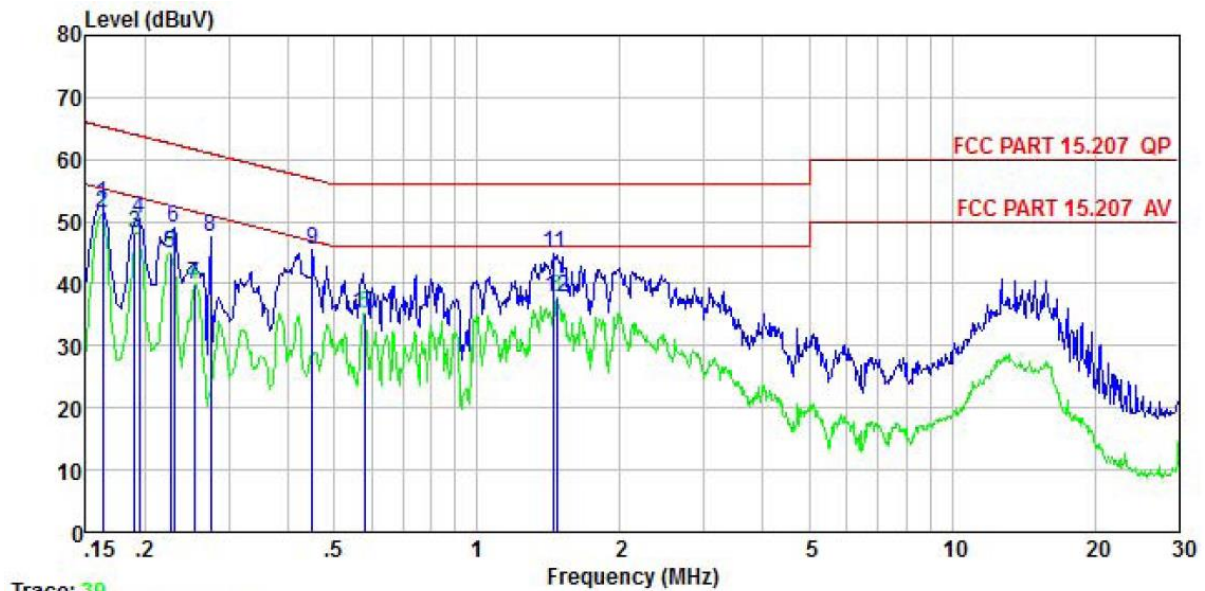
6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.207		
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9 kHz, VBW=30 kHz		
Limit:	Frequency range (MHz)	Limit (dBUV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test procedure	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10(latest version) on conducted measurement. 		
Test setup:	 <p><i>Remark:</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>		
Test Instruments:	Refer to section 5.9 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

Module 1:

Product name:	Dragon Fish Remote Control	Product model:	DFRC-1
Test by:	Mike	Test mode:	Wi-Fi Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%



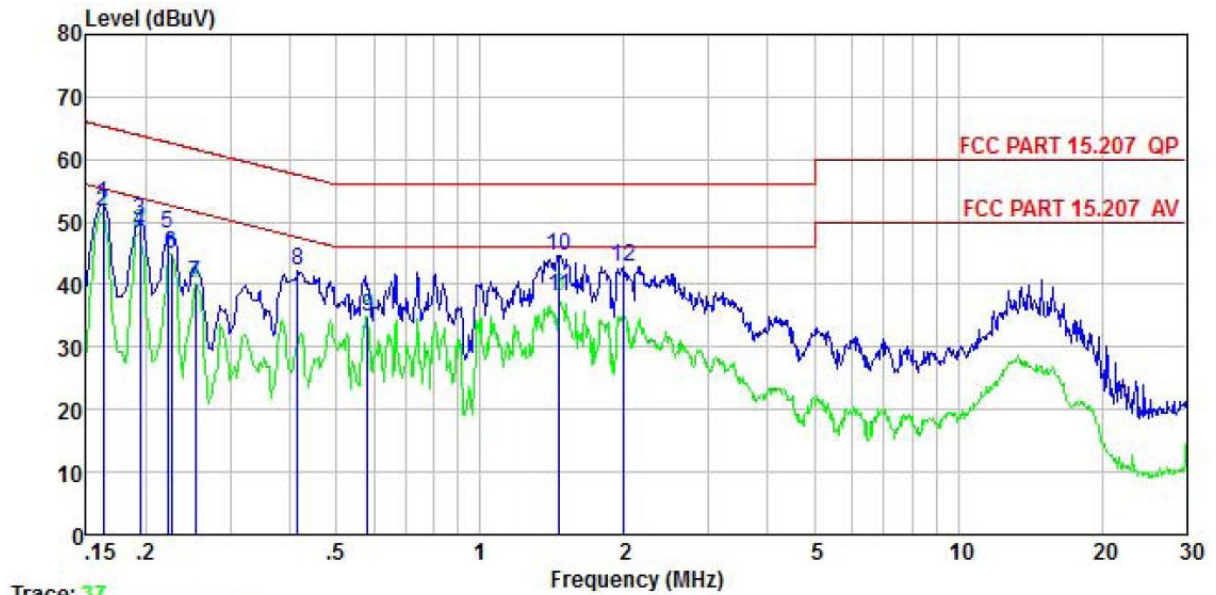
Trace: 39

	Read Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	42.62	-0.58	-0.08	10.77	52.73	65.34	-12.61	QP
2	0.162	41.17	-0.58	-0.08	10.77	51.28	55.34	-4.06	Average
3	0.190	38.17	-0.59	-0.14	10.76	48.20	54.02	-5.82	Average
4	0.194	40.41	-0.59	-0.15	10.76	50.43	63.84	-13.41	QP
5	0.226	35.04	-0.58	-0.19	10.75	45.02	52.61	-7.59	Average
6	0.230	38.93	-0.58	-0.20	10.75	48.90	62.44	-13.54	QP
7	0.253	29.87	-0.57	-0.22	10.75	39.83	51.64	-11.81	Average
8	0.274	37.62	-0.56	-0.24	10.74	47.56	60.98	-13.42	QP
9	0.449	35.26	-0.45	0.02	10.74	45.57	56.89	-11.32	QP
10	0.582	25.30	-0.48	-0.37	10.76	35.21	46.00	-10.79	Average
11	1.449	34.43	-0.56	0.05	10.92	44.84	56.00	-11.16	QP
12	1.472	27.48	-0.56	0.03	10.92	37.87	46.00	-8.13	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Aux Factor + Cable Loss.

Product name:	Dragon Fish Remote Control	Product model:	DFRC-1
Test by:	Mike	Test mode:	Wi-Fi Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%



Trace: 37

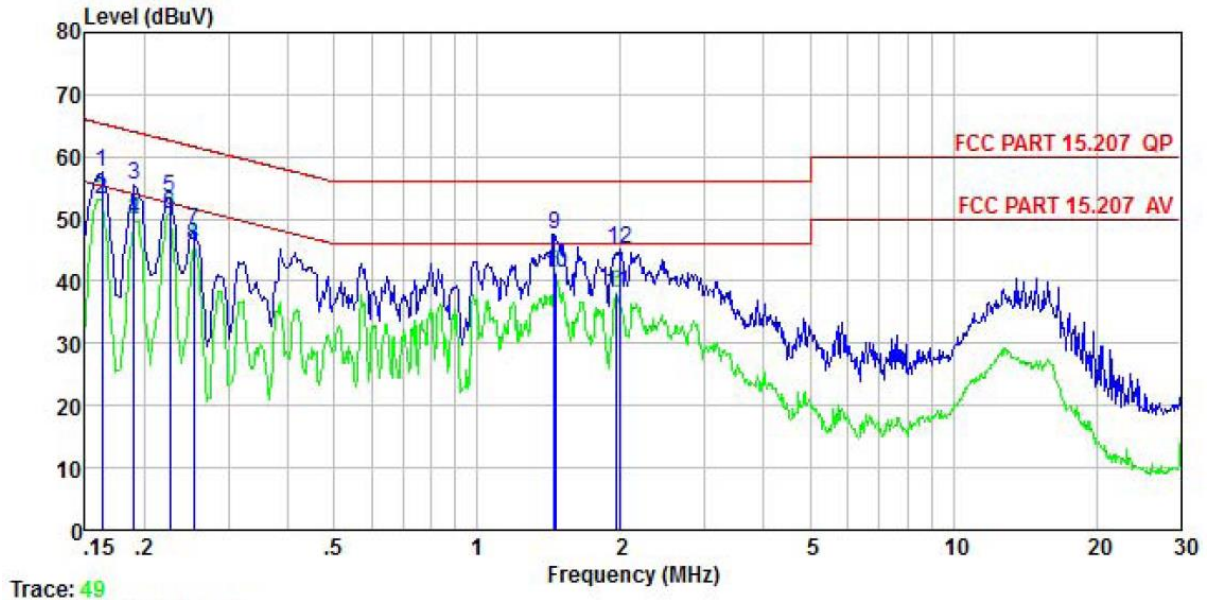
	Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	42.86	-0.68	0.01	10.77	52.96	65.34	-12.38	QP
2	0.162	41.50	-0.68	0.01	10.77	51.60	55.34	-3.74	Average
3	0.194	40.06	-0.67	0.00	10.76	50.15	63.84	-13.69	QP
4	0.194	38.25	-0.67	0.00	10.76	48.34	53.84	-5.50	Average
5	0.222	37.93	-0.67	0.00	10.76	48.02	62.74	-14.72	QP
6	0.226	34.93	-0.67	0.00	10.75	45.01	52.61	-7.60	Average
7	0.253	30.10	-0.67	0.01	10.75	40.19	51.64	-11.45	Average
8	0.415	32.30	-0.63	-0.05	10.73	42.35	57.55	-15.20	QP
9	0.582	24.75	-0.65	0.03	10.76	34.89	46.00	-11.11	Average
10	1.464	34.28	-0.70	0.13	10.92	44.63	56.00	-11.37	QP
11	1.464	27.80	-0.70	0.13	10.92	38.15	46.00	-7.85	Average
12	2.001	32.52	-0.71	0.17	10.96	42.94	56.00	-13.06	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Aux Factor + Cable Loss.

Module 2:

Product name:	Dragon Fish Remote Control	Product model:	DFRC-1
Test by:	Mike	Test mode:	Wi-Fi Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Huni: 55%

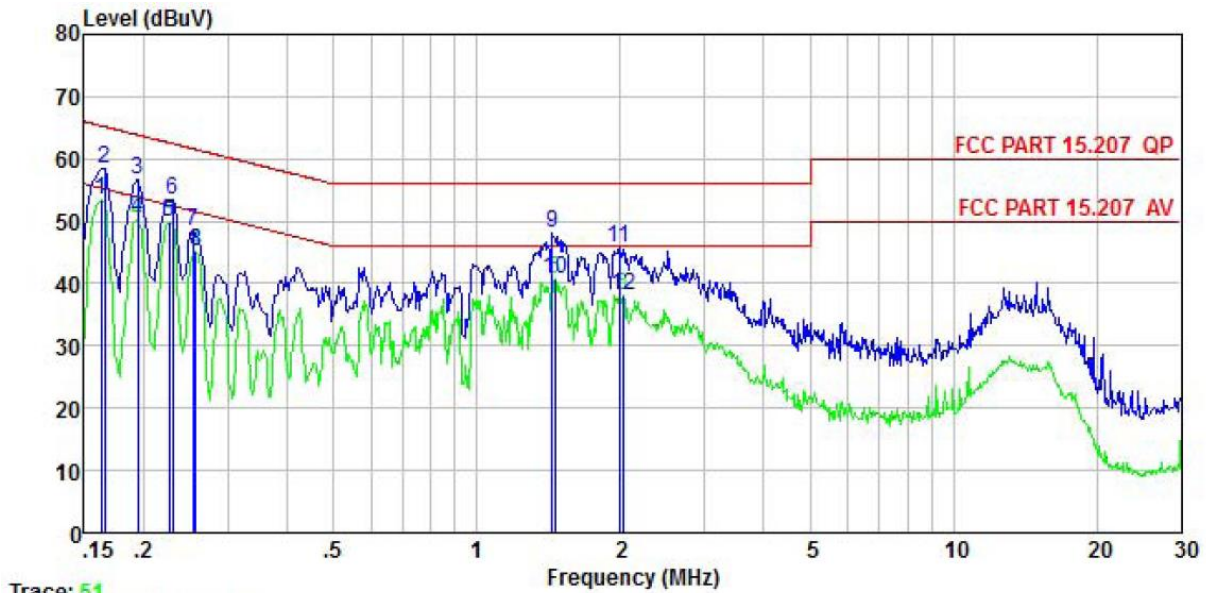


	Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	47.44	-0.58	-0.08	10.77	57.55	65.34	-7.79	QP
2	0.162	42.98	-0.58	-0.08	10.77	53.09	55.34	-2.25	Average
3	0.190	45.52	-0.59	-0.14	10.76	55.55	64.02	-8.47	QP
4	0.190	39.72	-0.59	-0.14	10.76	49.75	54.02	-4.27	Average
5	0.226	43.57	-0.58	-0.19	10.75	53.55	62.61	-9.06	QP
6	0.226	40.80	-0.58	-0.19	10.75	50.78	52.61	-1.83	Average
7	0.253	38.06	-0.57	-0.22	10.75	48.02	61.64	-13.62	QP
8	0.253	35.92	-0.57	-0.22	10.75	45.88	51.64	-5.76	Average
9	1.449	37.12	-0.56	0.05	10.92	47.53	56.00	-8.47	QP
10	1.456	30.81	-0.56	0.04	10.92	41.21	46.00	-4.79	Average
11	1.959	28.08	-0.51	-0.30	10.96	38.23	46.00	-7.77	Average
12	2.001	35.14	-0.51	-0.32	10.96	45.27	56.00	-10.73	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Aux Factor + Cable Loss.

Product name:	Dragon Fish Remote Control	Product model:	DFRC-1
Test by:	Mike	Test mode:	Wi-Fi Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Humi: 55%



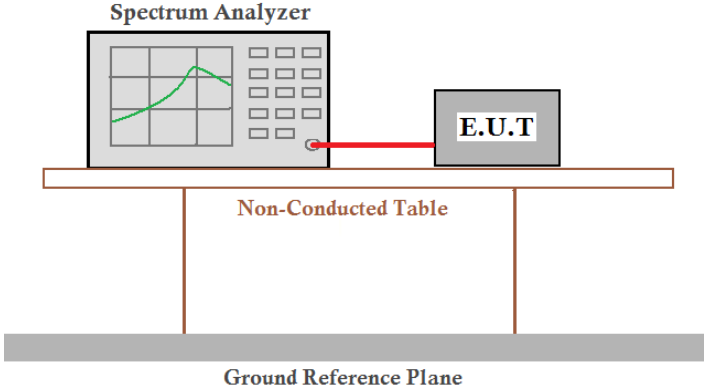
Trace: 51

	Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.162	43.40	-0.68	0.01	10.77	53.50	55.34	-1.84	Average
2	0.166	48.35	-0.68	0.01	10.77	58.45	65.16	-6.71	QP
3	0.194	46.71	-0.67	0.00	10.76	56.80	63.84	-7.04	QP
4	0.194	40.45	-0.67	0.00	10.76	50.54	53.84	-3.30	Average
5	0.226	39.68	-0.67	0.00	10.75	49.76	52.61	-2.85	Average
6	0.230	43.28	-0.67	0.00	10.75	53.36	62.44	-9.08	QP
7	0.253	38.22	-0.67	0.01	10.75	48.31	61.64	-13.33	QP
8	0.258	35.18	-0.67	0.01	10.75	45.27	51.51	-6.24	Average
9	1.441	37.66	-0.70	0.13	10.92	48.01	56.00	-7.99	QP
10	1.456	30.42	-0.70	0.13	10.92	40.77	46.00	-5.23	Average
11	1.991	35.29	-0.71	0.17	10.96	45.71	56.00	-10.29	QP
12	2.023	27.62	-0.71	0.18	10.96	38.05	46.00	-7.95	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Aux Factor + Cable Loss.

6.3 Conducted Output Power

Test Requirement:	FCC Part 15 C Section 15.247 (b)(3)
Limit:	30dBm
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

Module 1:

Mode	Test CH	Ant. Port	Conducted Output power (dBm)	Total power (dBm)	Limit (dBm)	Result
802.11g	Lowest	ANT3	15.03	/	30.00	Pass
		ANT6	15.33			
	Middle	ANT3	15.50	/	30.00	Pass
		ANT6	15.62			
	Highest	ANT3	15.67	/	30.00	Pass
		ANT6	15.72			
802.11n(HT20) (MIMO)	Lowest	ANT3	15.02	18.14	30.00	Pass
		ANT6	15.24			
	Middle	ANT3	15.47	18.55	30.00	Pass
		ANT6	15.60			
	Highest	ANT3	15.76	18.73	30.00	Pass
		ANT6	15.68			

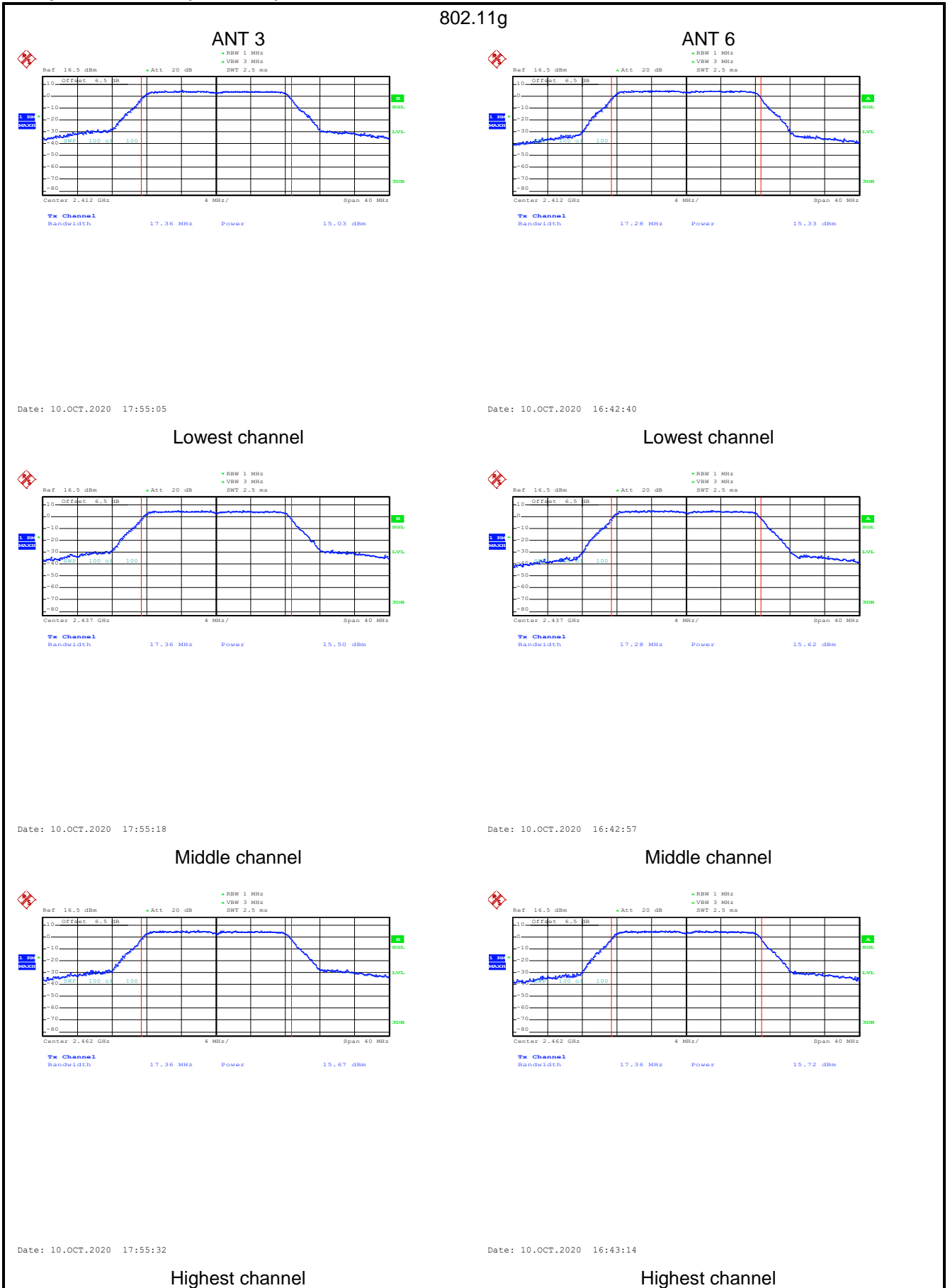
Remark:

1. Pre-scan Duty Cycle, Duty Cycle>98%
2. Because transmit signals are correlated, Directional gain = $10 \log[(10^{(G1/20)} + 10^{(G2/20)} + \dots + 10^{(GN/20)})^2 / N_{ANT}]$, So the MIMO Directional gain = $10 \log[(10^{(2.8/20)} + 10^{(2.6/20)})^2 / 2] = 5.71 \text{ dBi}$
3. The directional Gain of antenna is less than 6 dBi, so the limit of power is 30.0 dBm.

Module 2:

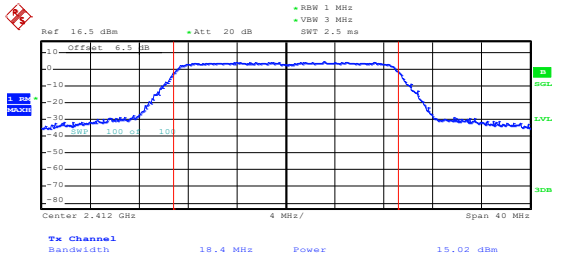
Mode	Test CH	Ant. Port	Conducted Output power (dBm)	Total power (dBm)	Limit (dBm)	Result
802.11b	Lowest	ANT1	14.25	/	30.00	Pass
		ANT2	14.36			
	Middle	ANT1	14.55	/	30.00	Pass
		ANT2	14.52			
	Highest	ANT1	14.66	/	30.00	Pass
		ANT2	14.21			
802.11g	Lowest	ANT1	15.57	/	30.00	Pass
		ANT2	14.36			
	Middle	ANT1	16.01	/	30.00	Pass
		ANT2	14.52			
	Highest	ANT1	15.97	/	30.00	Pass
		ANT2	14.21			
802.11n(HT20) (MIMO)	Lowest	ANT1	15.70	18.75	29.74	Pass
		ANT2	15.78			
	Middle	ANT1	15.85	18.92	29.74	Pass
		ANT2	15.97			
	Highest	ANT1	16.04	18.93	29.74	Pass
		ANT2	15.80			
<p>Remark:</p> <ol style="list-style-type: none"> 1. Pre-scan Duty Cycle, Duty Cycle>98% 2. Because transmit signals are correlated, Directional gain = $10 \log[(10^{(G1/20)} + 10^{(G2/20)} + \dots + 10^{(GN/20)})^2 / N_{ANT}]$, So the MIMO Directional gain = $10 \log[(10^{(3.0/20)} + 10^{(3.5/20)})^2 / 2] = 6.26 \text{dBi}$ 3. The directional Gain of antenna is greater than 6 dBi, so the limit of power is 29.74 dBm. 						

Test plot as follows (module 1):

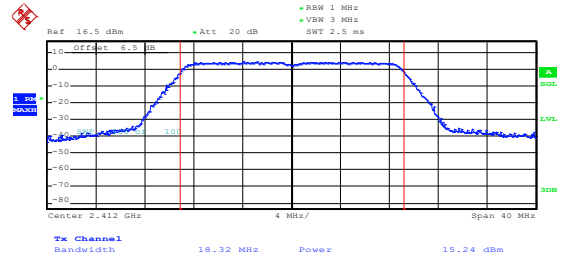


802.11n(HT20)

ANT 3



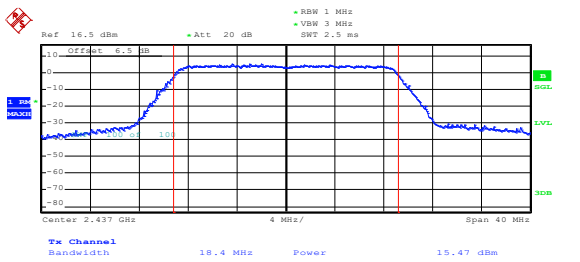
ANT 6



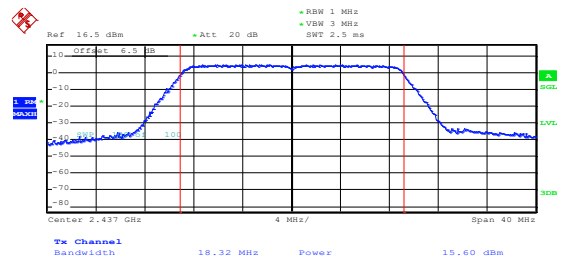
Date: 10.OCT.2020 17:56:15

Date: 10.OCT.2020 16:43:33

Lowest channel



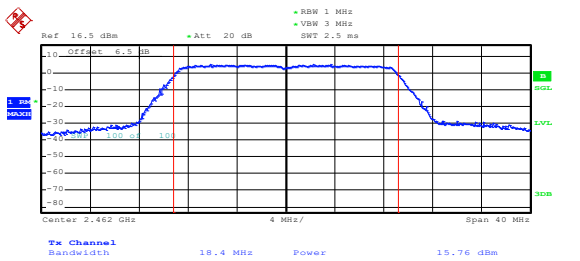
Lowest channel



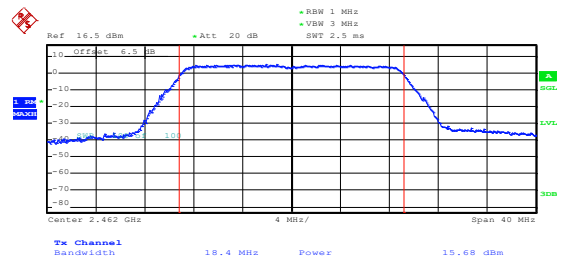
Date: 10.OCT.2020 17:56:04

Date: 10.OCT.2020 16:43:43

Middle channel



Middle channel



Date: 10.OCT.2020 17:55:53

Date: 10.OCT.2020 16:44:00

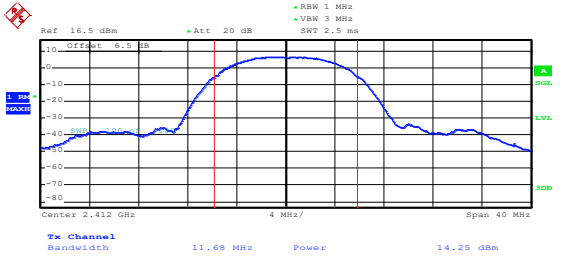
Highest channel

Highest channel

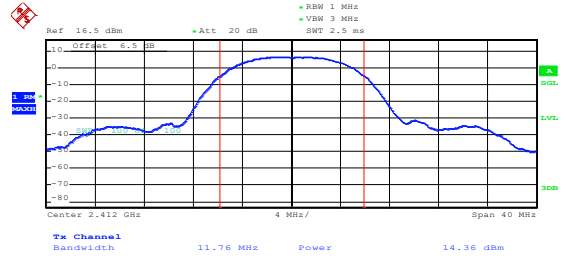
Module 2:

802.11b

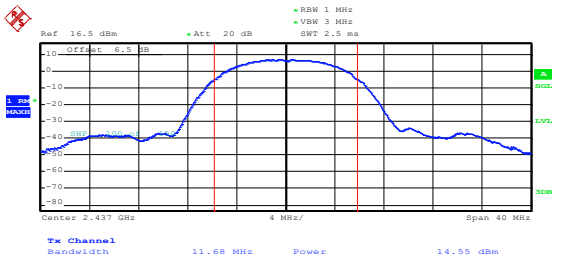
ANT 1



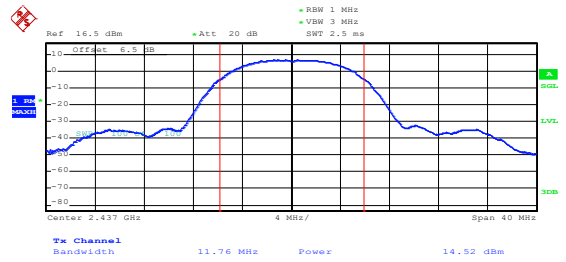
ANT 2



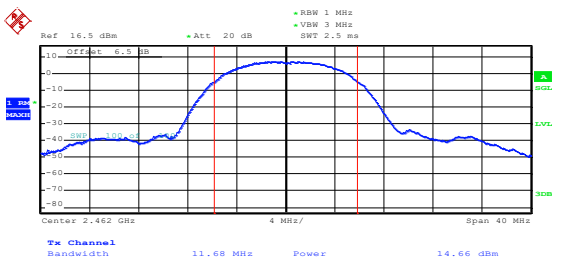
Lowest channel



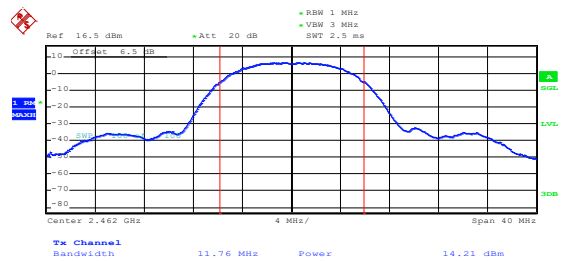
Lowest channel



Middle channel



Middle channel

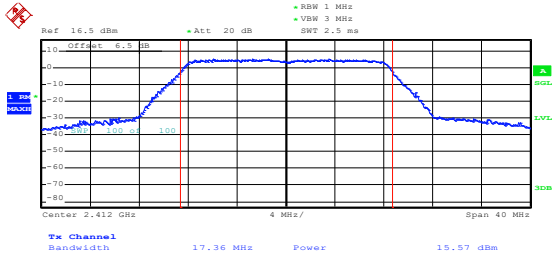


Highest channel

Highest channel

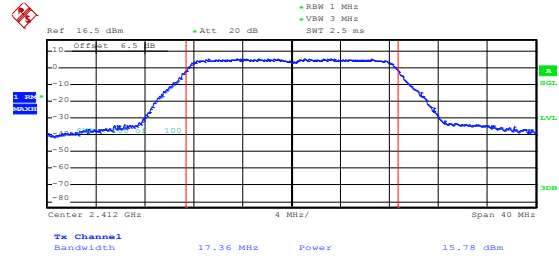
802.11g

ANT 1



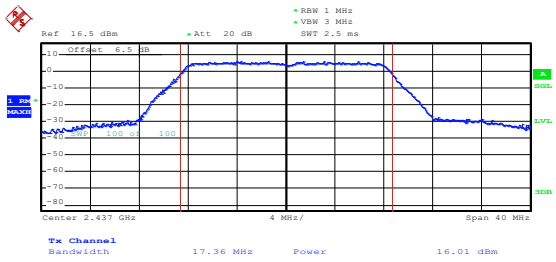
Date: 10.OCT.2020 22:02:53

ANT 2



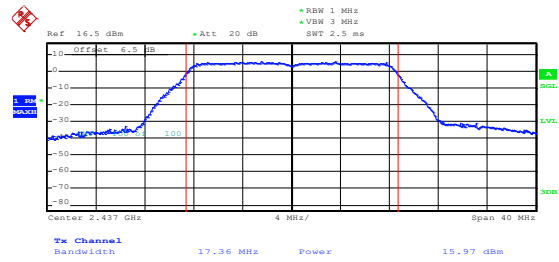
Date: 10.OCT.2020 21:22:47

Lowest channel



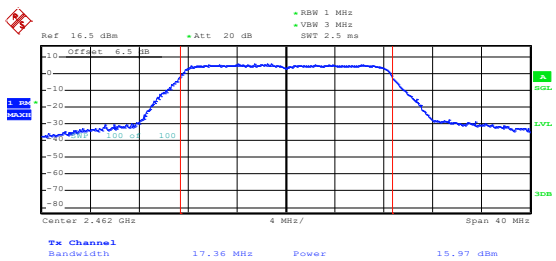
Date: 10.OCT.2020 22:03:03

Lowest channel



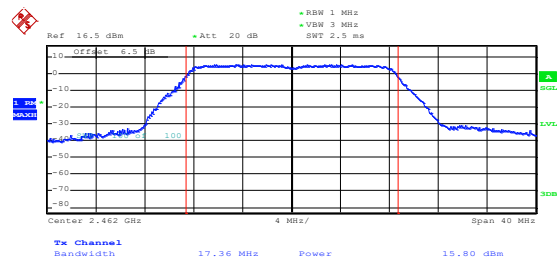
Date: 10.OCT.2020 21:22:55

Middle channel



Date: 10.OCT.2020 22:03:14

Middle channel



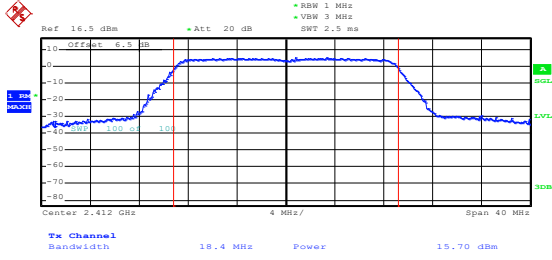
Date: 10.OCT.2020 21:23:05

Highest channel

Highest channel

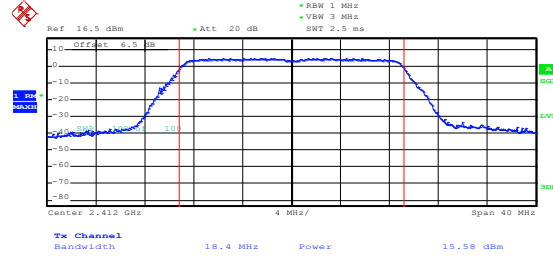
802.11n(HT20)

ANT 1



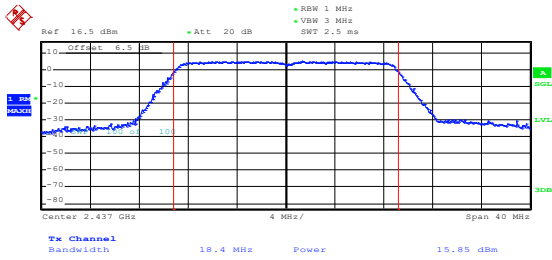
Date: 10.OCT.2020 22:02:40

ANT 2



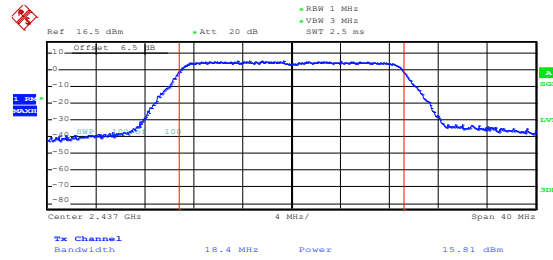
Date: 10.OCT.2020 21:22:26

Lowest channel



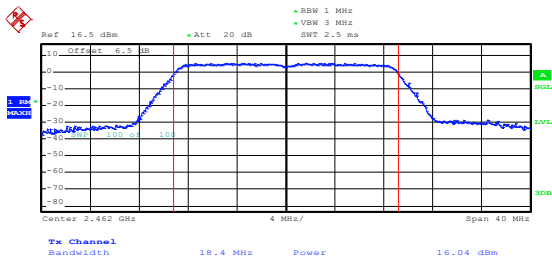
Date: 10.OCT.2020 22:02:30

Lowest channel



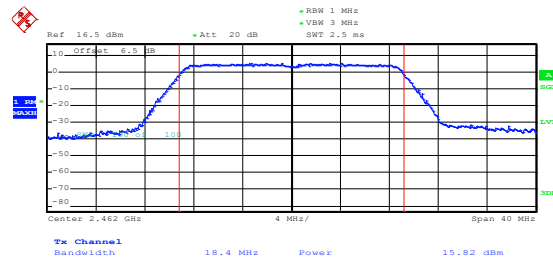
Date: 10.OCT.2020 21:22:15

Middle channel



Date: 10.OCT.2020 22:02:16

Middle channel

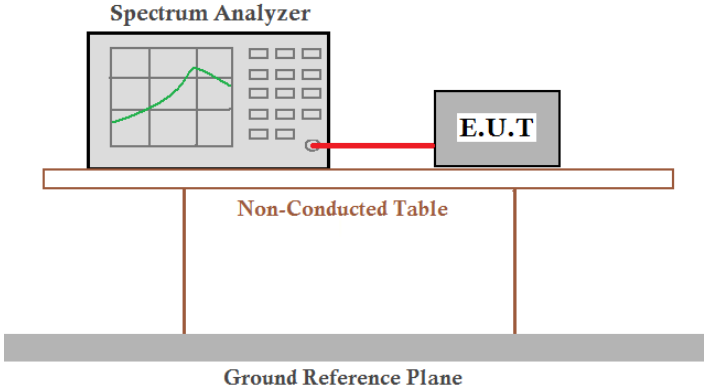


Date: 10.OCT.2020 21:22:05

Highest channel

Highest channel

6.4 Occupy Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
Limit:	>500kHz
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 the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two legs and sits on a Ground Reference Plane, which is represented by a grey horizontal bar at the bottom of the setup.</p>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data (module1 ANT3):

Test CH	6dB Emission Bandwidth (MHz)		Limit(kHz)	Result
	802.11g	802.11n(H20)		
Lowest	16.56	17.84	>500	Pass
Middle	16.56	17.84		
Highest	16.56	17.84		
Test CH	99% Occupy Bandwidth (MHz)		Limit(kHz)	Result
	802.11g	802.11n(H20)		
Lowest	17.36	18.40	N/A	N/A
Middle	17.36	18.40		
Highest	17.36	18.40		

(module1 ANT6):

Test CH	6dB Emission Bandwidth (MHz)		Limit(kHz)	Result
	802.11g	802.11n(H20)		
Lowest	16.56	17.76	>500	Pass
Middle	16.56	17.84		
Highest	16.56	17.84		
Test CH	99% Occupy Bandwidth (MHz)		Limit(kHz)	Result
	802.11g	802.11n(H20)		
Lowest	17.28	18.32	N/A	N/A
Middle	17.28	18.32		
Highest	17.36	18.40		

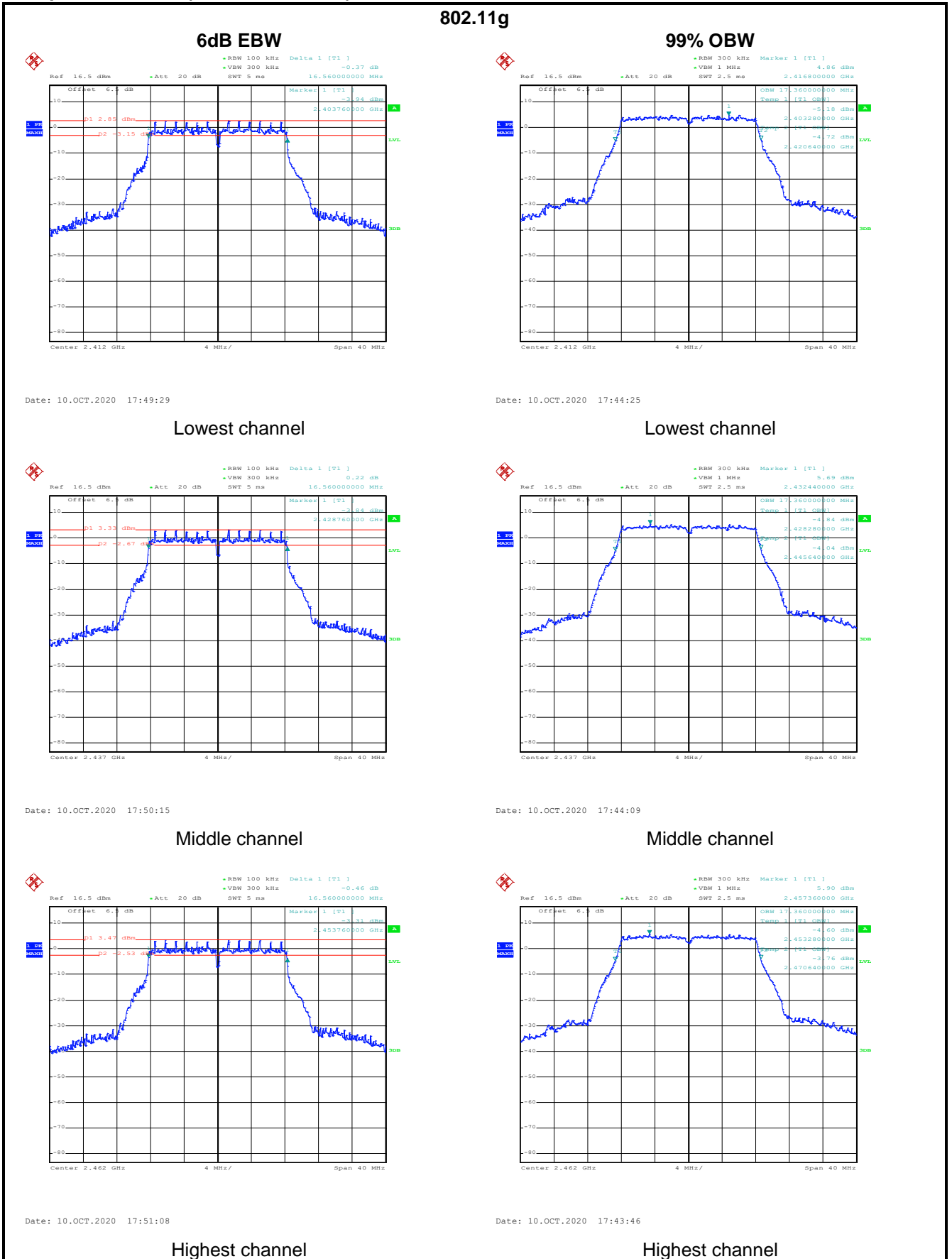
Measurement Data (module2 ANT1):

Test CH	6dB Emission Bandwidth (MHz)			Limit(kHz)	Result
	802.11b	802.11g	802.11n(H20)		
Lowest	9.20	16.56	17.76	>500	Pass
Middle	9.20	16.56	17.84		
Highest	9.28	16.56	17.76		
Test CH	99% Occupy Bandwidth (MHz)			Limit(kHz)	Result
	802.11b	802.11g	802.11n(H20)		
Lowest	11.68	17.36	18.40	N/A	N/A
Middle	11.68	17.36	18.40		
Highest	11.68	17.36	18.40		

Measurement Data (module2 ANT2):

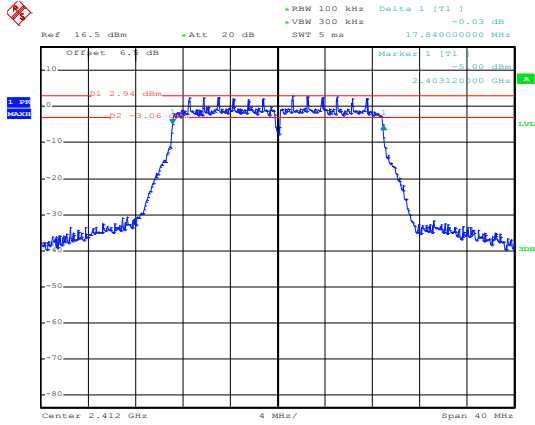
Test CH	6dB Emission Bandwidth (MHz)			Limit(kHz)	Result
	802.11b	802.11g	802.11n(H20)		
Lowest	9.20	16.56	17.76	>500	Pass
Middle	9.20	16.56	17.84		
Highest	9.20	16.56	17.76		
Test CH	99% Occupy Bandwidth (MHz)			Limit(kHz)	Result
	802.11b	802.11g	802.11n(H20)		
Lowest	11.76	17.36	18.40	N/A	N/A
Middle	11.76	17.36	18.40		
Highest	11.76	17.36	18.40		

Test plot as follows (module 1 / ANT3):



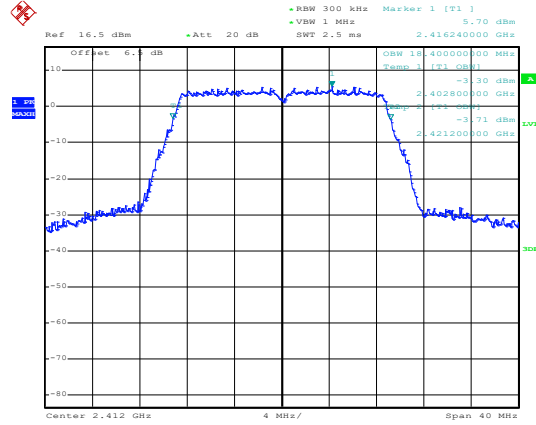
802.11n(HT20)

6dB EBW



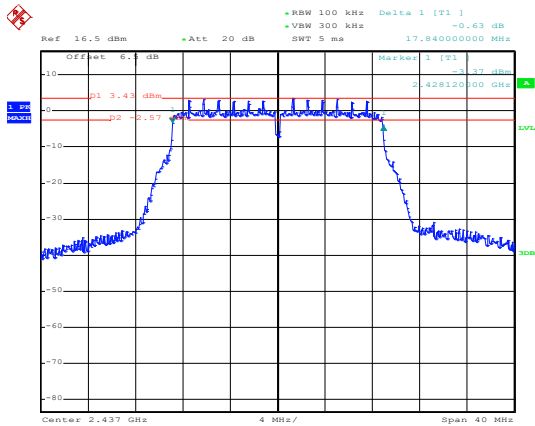
Date: 10.OCT.2020 17:48:43

99% OBW



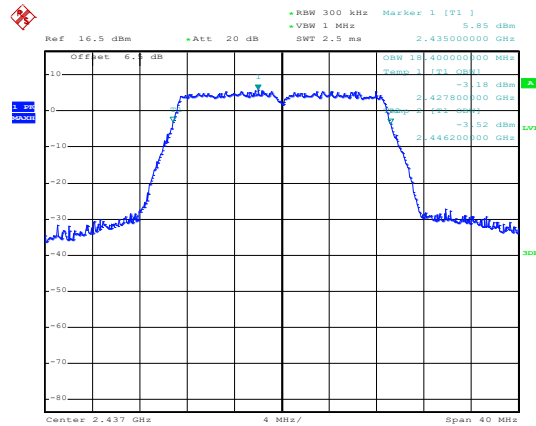
Date: 10.OCT.2020 17:44:54

Lowest channel



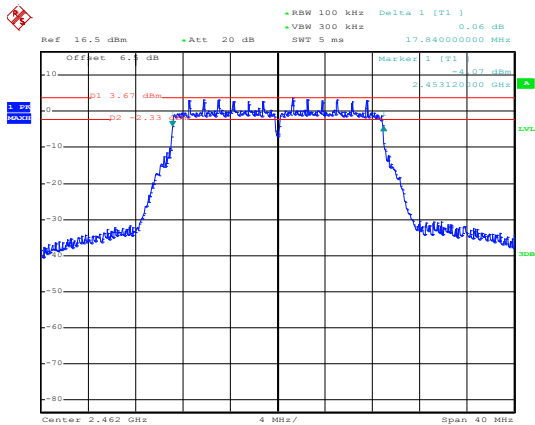
Date: 10.OCT.2020 17:48:02

Lowest channel



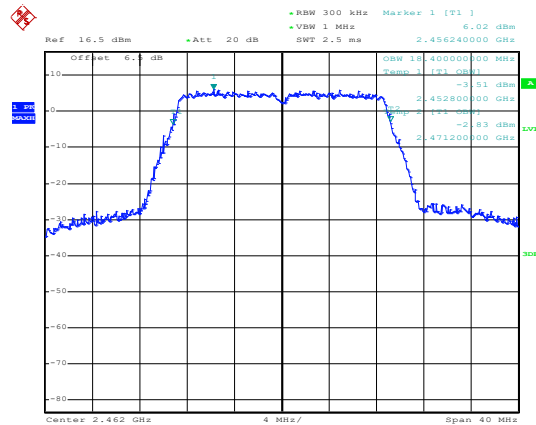
Date: 10.OCT.2020 17:45:26

Middle channel



Date: 10.OCT.2020 17:46:50

Middle channel



Date: 10.OCT.2020 17:45:49

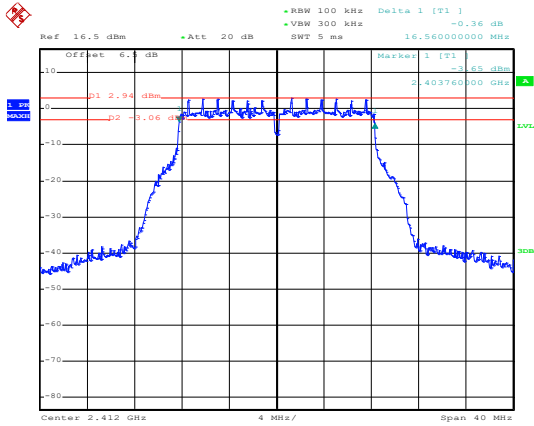
Highest channel

Highest channel

(module 1 / ANT6):

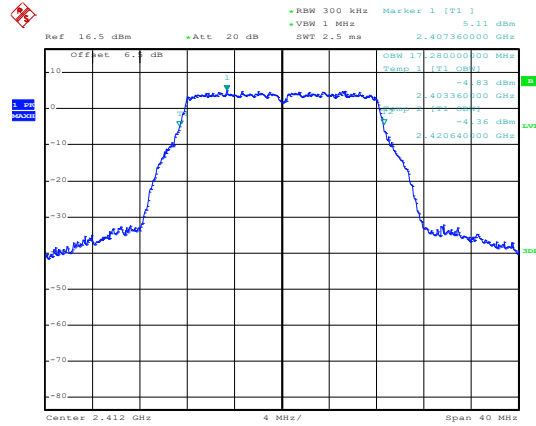
802.11g

6dB EBW



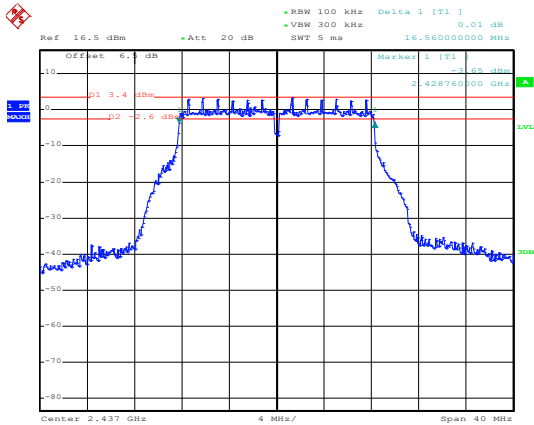
Date: 10.OCT.2020 16:53:31

99% OBW



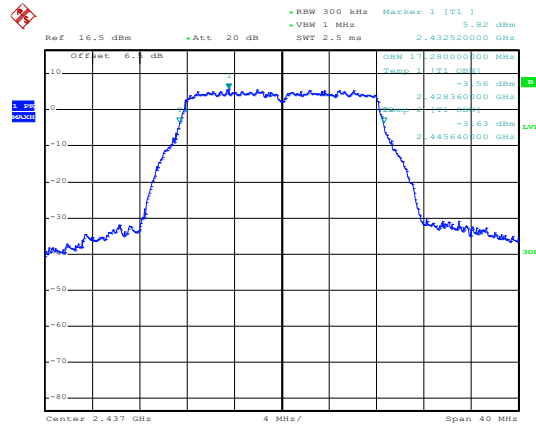
Date: 10.OCT.2020 16:32:43

Lowest channel



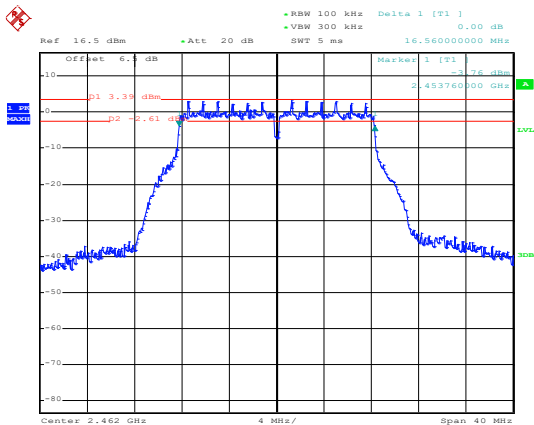
Date: 10.OCT.2020 16:52:33

Lowest channel



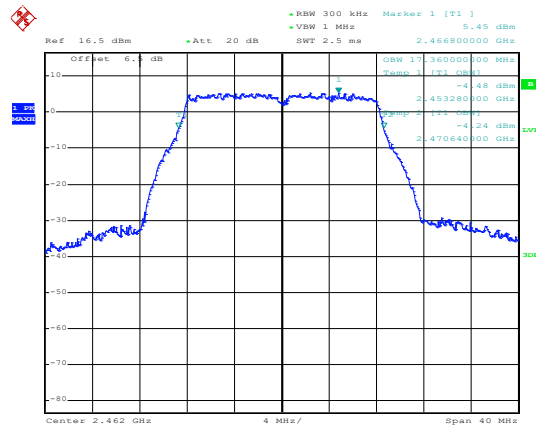
Date: 10.OCT.2020 16:32:26

Middle channel



Date: 10.OCT.2020 16:49:55

Middle channel



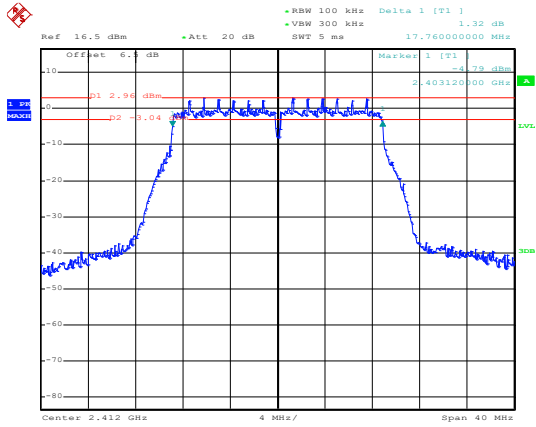
Date: 10.OCT.2020 16:32:05

Highest channel

Highest channel

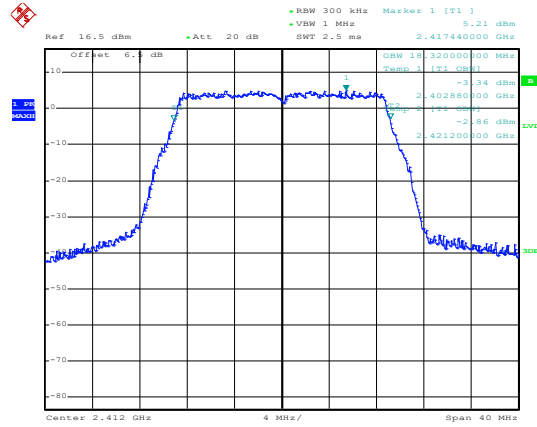
802.11n(HT20)

6dB EBW



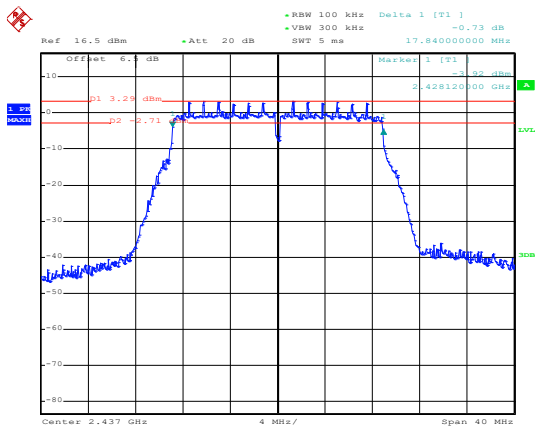
Date: 10.OCT.2020 16:54:40

99% OBW



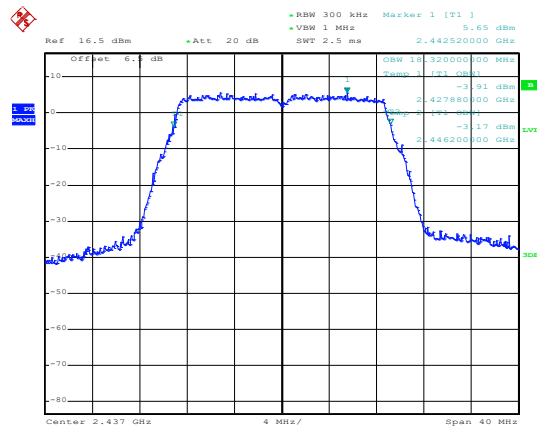
Date: 10.OCT.2020 16:33:06

Lowest channel



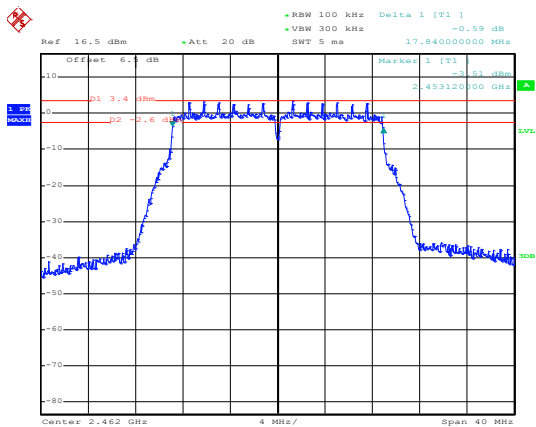
Date: 10.OCT.2020 16:55:29

Lowest channel



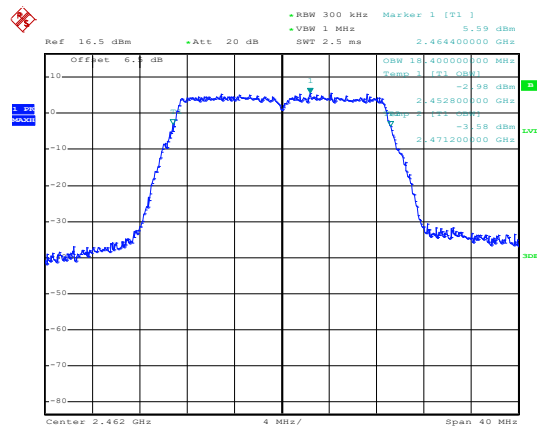
Date: 10.OCT.2020 16:33:25

Middle channel



Date: 10.OCT.2020 16:56:11

Middle channel

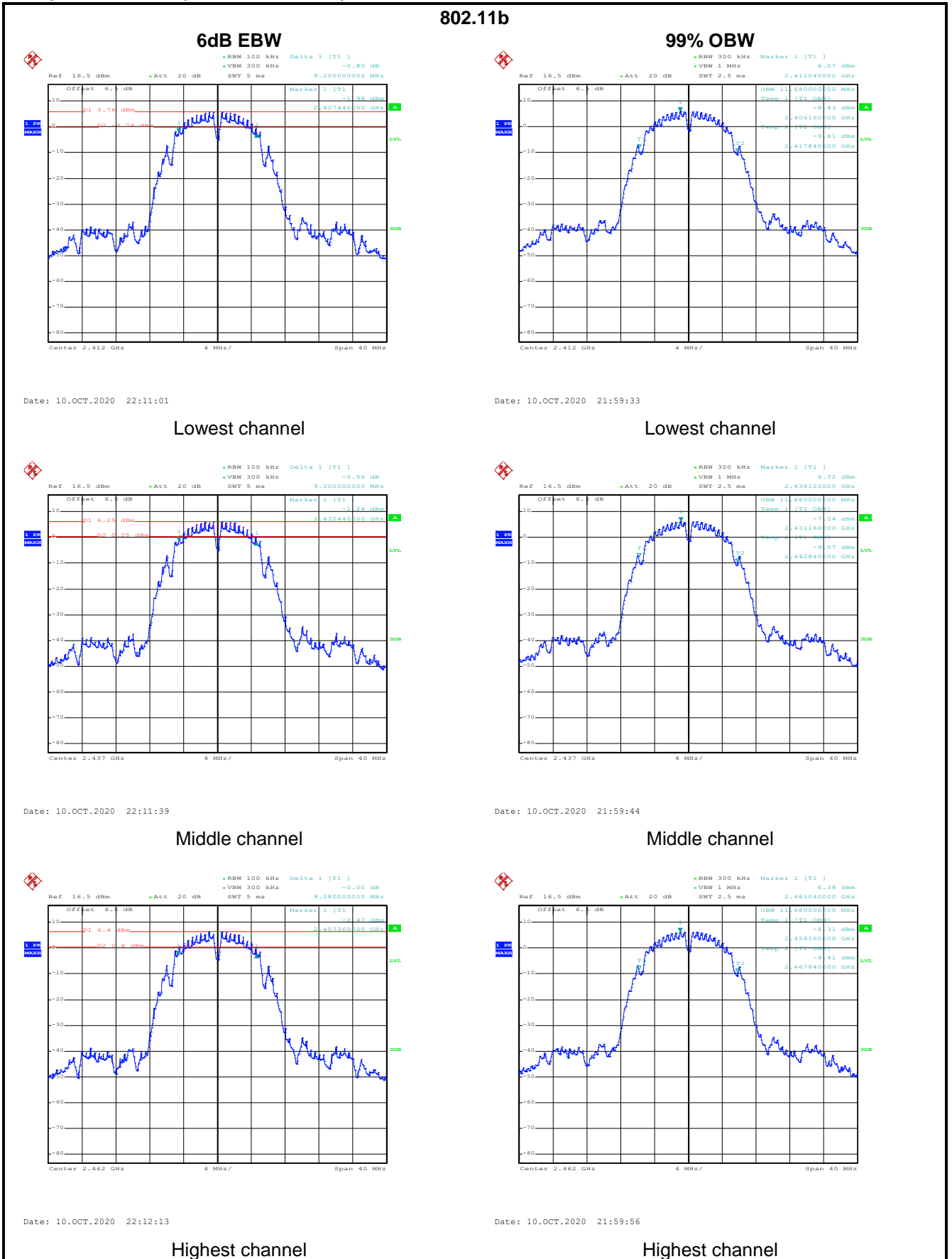


Date: 10.OCT.2020 16:33:38

Highest channel

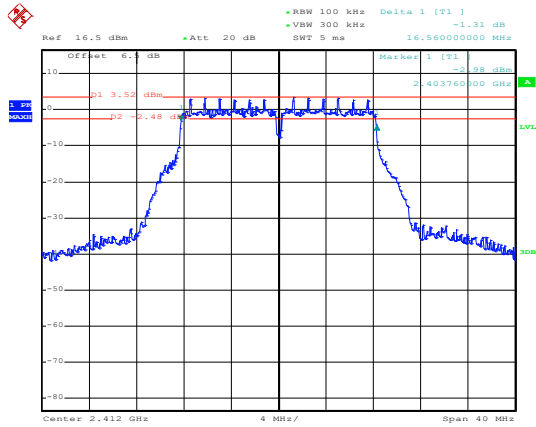
Highest channel

Test plot as follows(module 2 / ANT1):



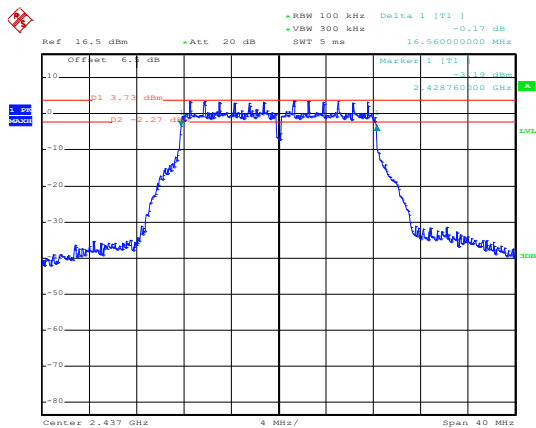
802.11g

6dB EBW



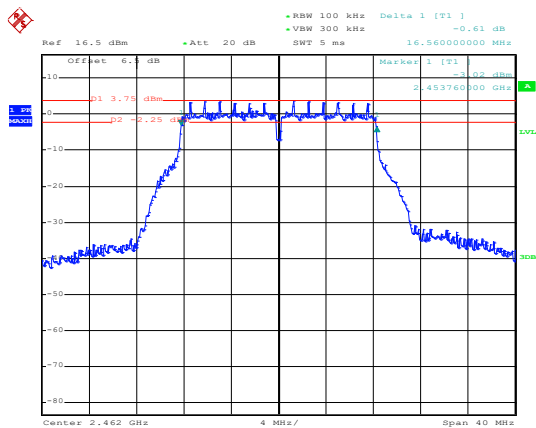
Date: 10.OCT.2020 22:10:04

Lowest channel



Date: 10.OCT.2020 22:09:31

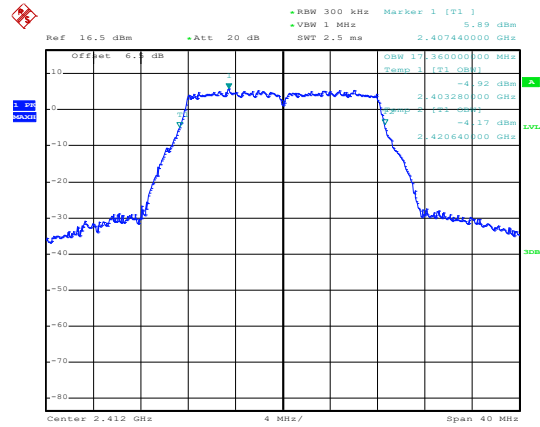
Middle channel



Date: 10.OCT.2020 22:08:59

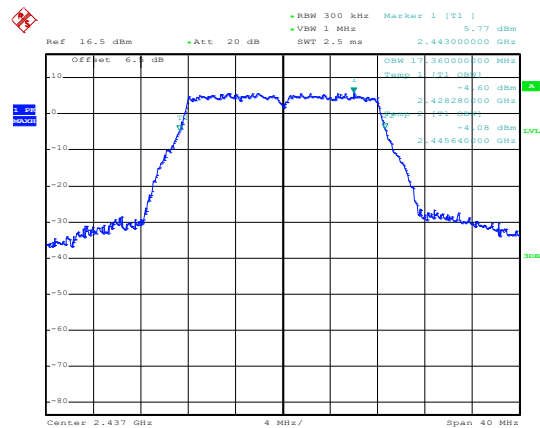
Highest channel

99% OBW



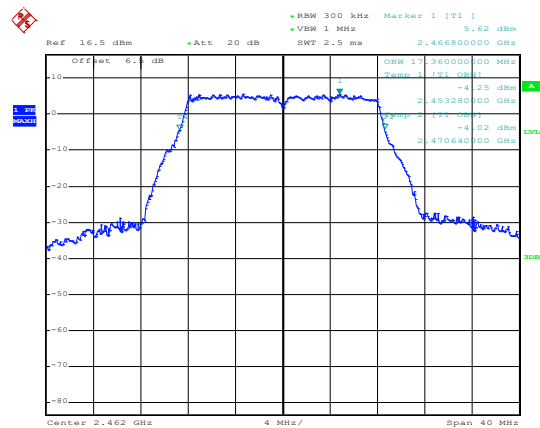
Date: 10.OCT.2020 22:00:55

Lowest channel



Date: 10.OCT.2020 22:00:27

Middle channel

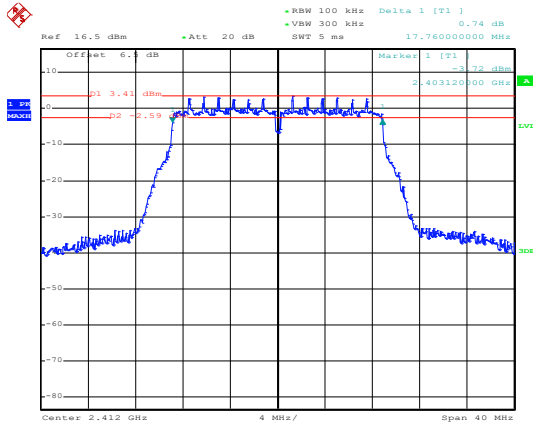


Date: 10.OCT.2020 22:00:41

Highest channel

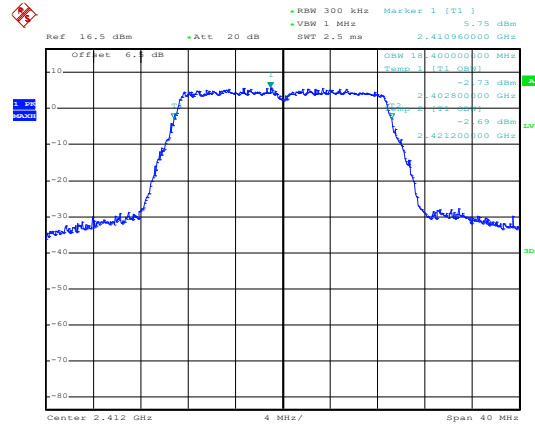
802.11n(HT20)

6dB EBW



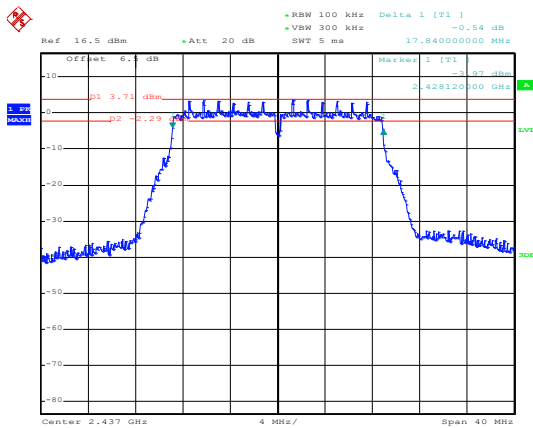
Date: 10.OCT.2020 22:07:01

99% OBW



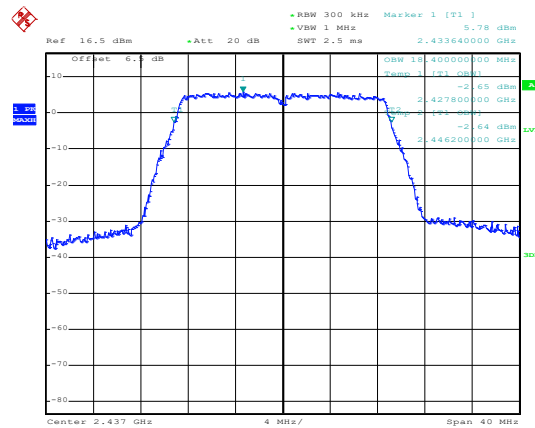
Date: 10.OCT.2020 22:01:17

Lowest channel



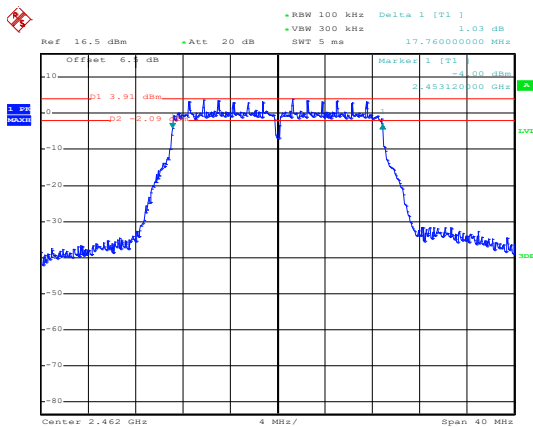
Date: 10.OCT.2020 22:07:42

Lowest channel



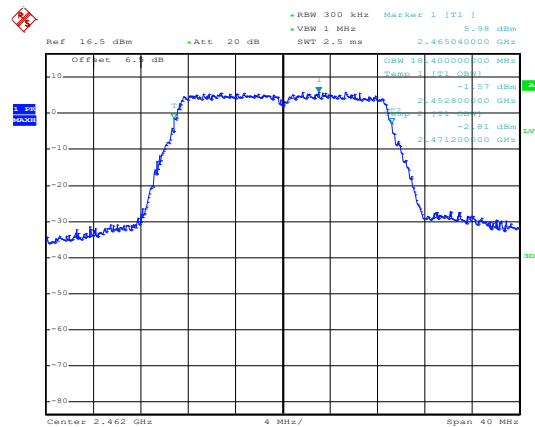
Date: 10.OCT.2020 22:01:38

Middle channel



Date: 10.OCT.2020 22:08:18

Middle channel

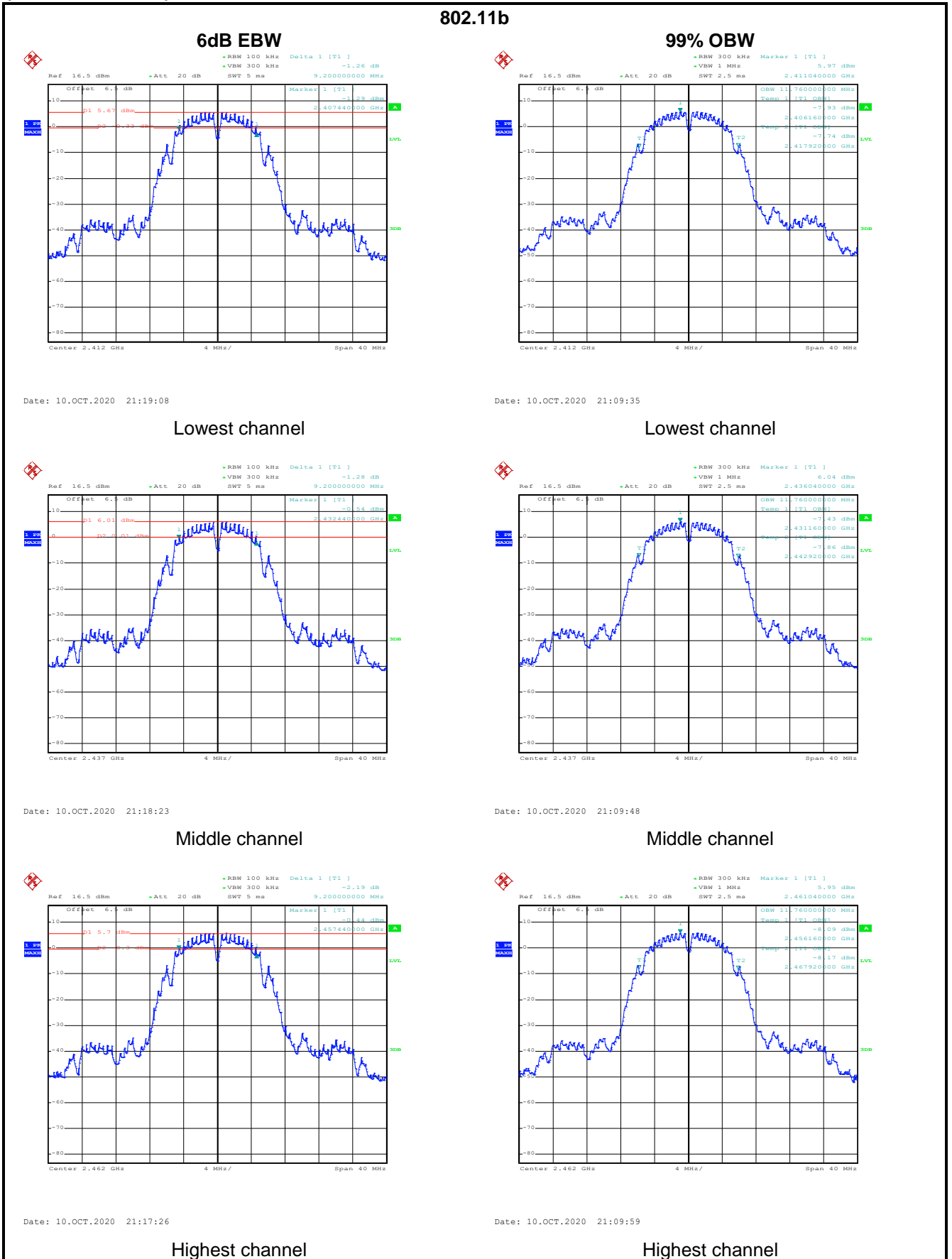


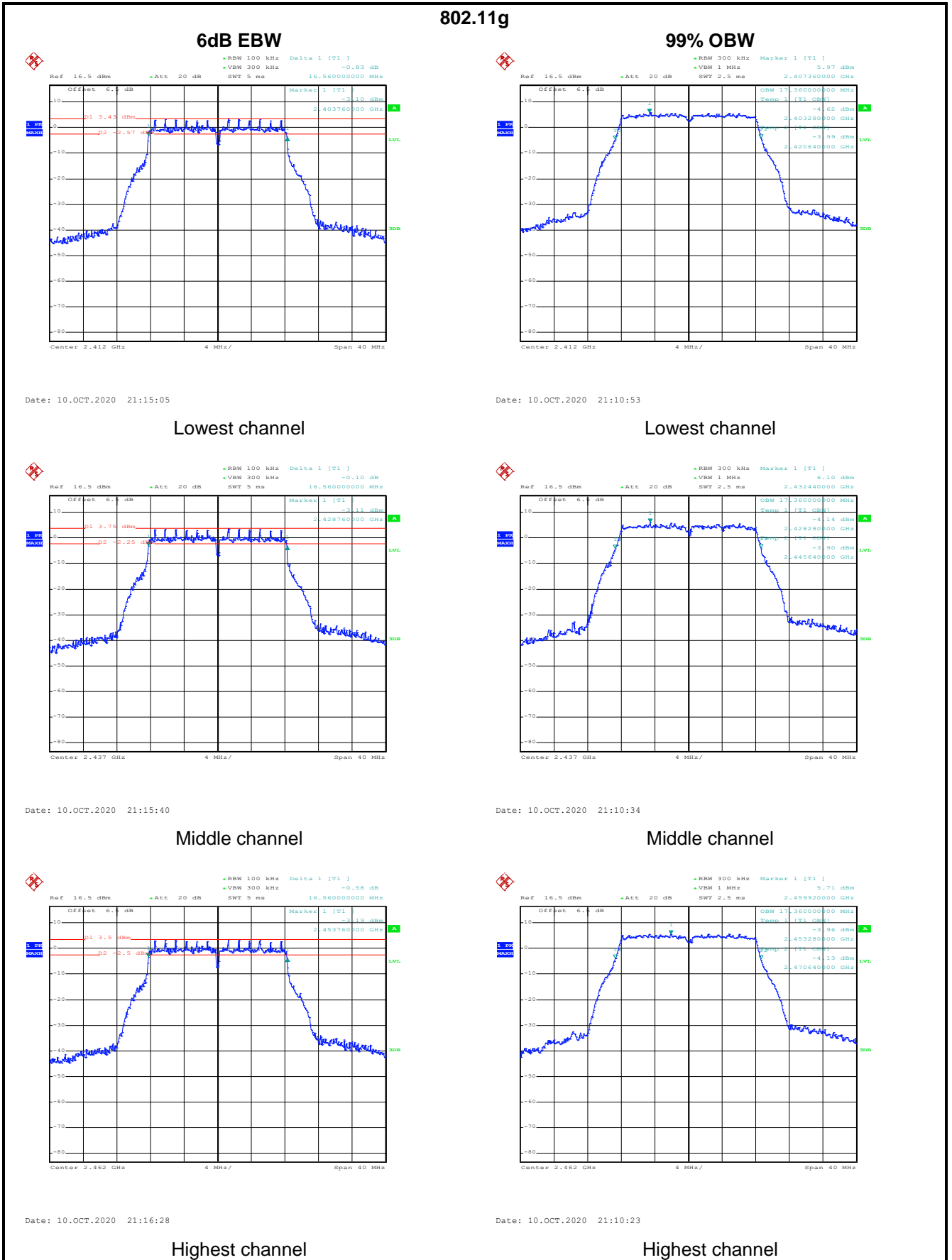
Date: 10.OCT.2020 22:01:51

Highest channel

Highest channel

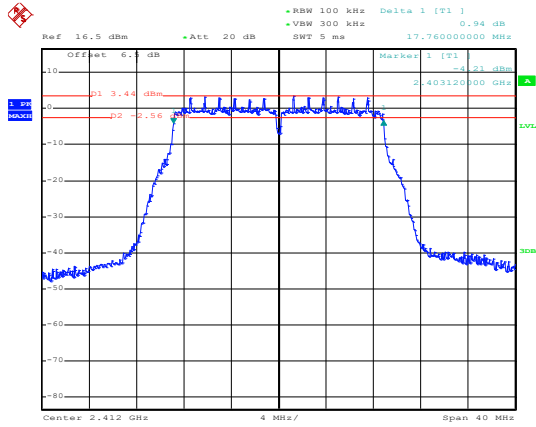
(module 2 / ANT2):





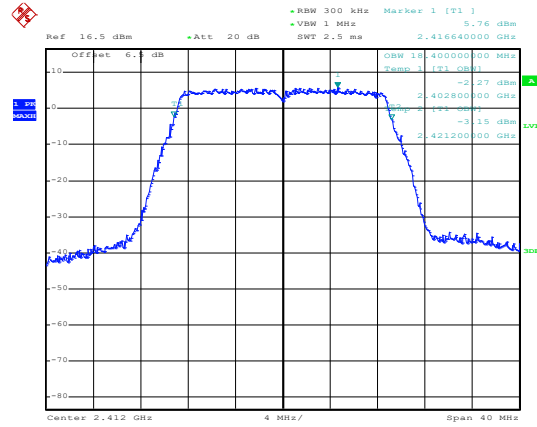
802.11n(HT20)

6dB EBW



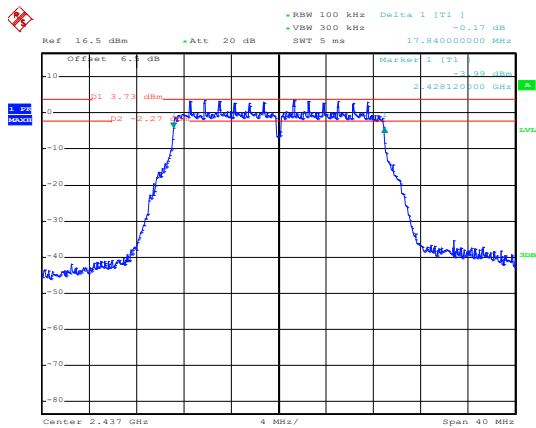
Date: 10.OCT.2020 21:14:02

99% OBW



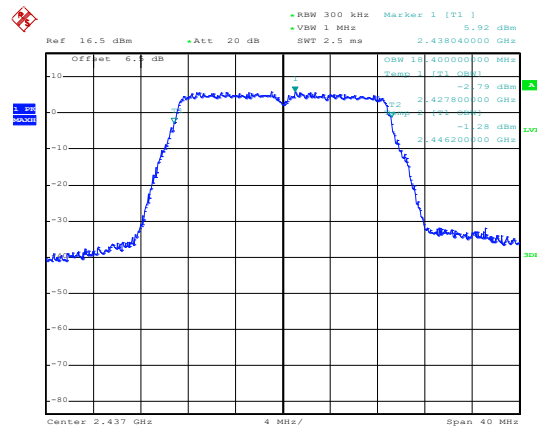
Date: 10.OCT.2020 21:11:21

Lowest channel



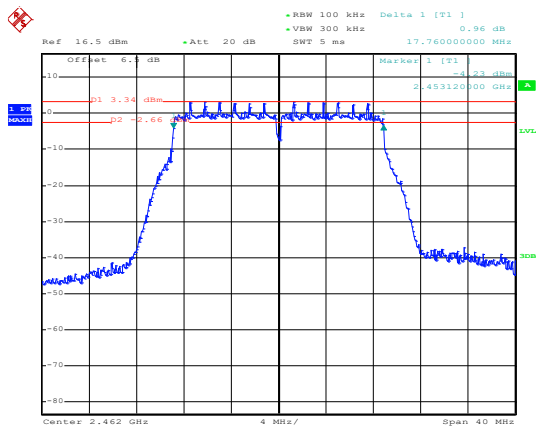
Date: 10.OCT.2020 21:13:26

Lowest channel



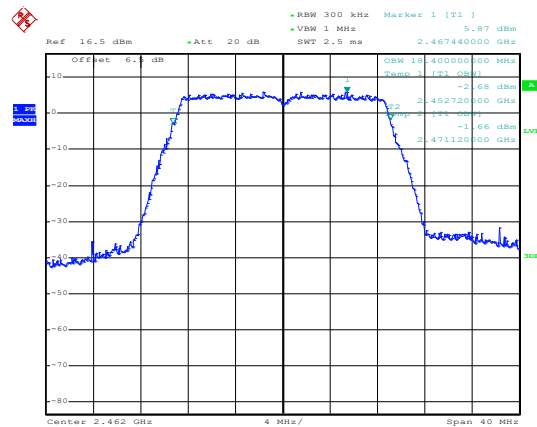
Date: 10.OCT.2020 21:11:39

Middle channel



Date: 10.OCT.2020 21:12:51

Middle channel



Date: 10.OCT.2020 21:12:06

Highest channel

Highest channel

6.5 Power Spectral Density

Test Requirement:	FCC Part 15 C Section 15.247 (e)
Limit:	8dBm/3kHz
Test setup:	
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

Module 1:

Mode	Test Channel	Ant. Port	PSD (dBm/3KHz)	Total PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
802.11g	Lowest	ANT3	-19.89	/	8.00	Pass
		ANT6	-19.38			
	Middle	ANT3	-19.62	/	8.00	Pass
		ANT6	-19.07			
	Highest	ANT3	-19.12	/	8.00	Pass
		ANT6	-19.32			
802.11n(HT20) (MIMO)	Lowest	ANT3	-19.26	-16.72	8.00	Pass
		ANT6	-20.25			
	Middle	ANT3	-19.40	-16.59	8.00	Pass
		ANT6	-19.80			
	Highest	ANT3	-18.73	-16.09	8.00	Pass
		ANT6	-19.51			

Remark:

- Because transmit signals are correlated, Directional gain = $10 \log[(10^{(G1/20)} + 10^{(G2/20)} + \dots + 10^{(GN/20)})^2 / N_{ANT}]$, So the MIMO Directional gain = $10 \log[(10^{(2.8/20)} + 10^{(2.6/20)})^2 / 2] = 5.71 \text{ dBi}$
- The directional Gain of antenna is less than 6 dBi, so the limit of PSD is 30.0 dBm.

Module 2:

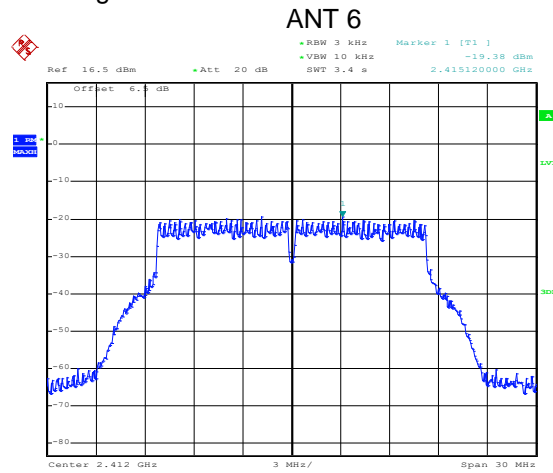
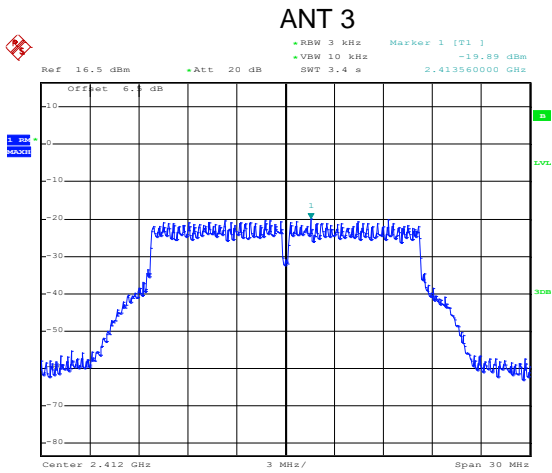
Mode	Test Channel	Ant. Port	PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Result
802.11b	Lowest	ANT1	-16.41	/	8.00	Pass
		ANT2	-16.98			
	Middle	ANT1	-15.91	/	8.00	Pass
		ANT2	-16.62			
	Highest	ANT1	-15.93	/	8.00	Pass
		ANT2	-16.26			
802.11g	Lowest	ANT1	-19.32	/	8.00	Pass
		ANT2	-18.82			
	Middle	ANT1	-18.43	/	8.00	Pass
		ANT2	-19.23			
	Highest	ANT1	-18.44	/	8.00	Pass
		ANT2	-19.15			
802.11n(HT20) (MIMO)	Lowest	ANT1	-19.02	-16.28	7.74	Pass
		ANT2	-19.57			
	Middle	ANT1	-19.51	-16.51	7.74	Pass
		ANT2	-19.53			
	Highest	ANT1	-18.80	-15.81	7.74	Pass
		ANT2	-18.85			

Remark:

1. Because transmit signals are correlated, Directional gain = $10 \log[(10^{(G1/20)} + 10^{(G2/20)} + \dots + 10^{(GN/20)})^2 / N_{ANT}]$, So the MIMO Directional gain = $10 \log[(10^{(3.0/20)} + 10^{(3.5/20)})^2 / 2] = 6.26 \text{dBi}$
2. The directional Gain of antenna is greater than 6 dBi, so the limit of PSD is 7.74 dBm.

Test plot as follows (module 1):

Test mode: 802.11g

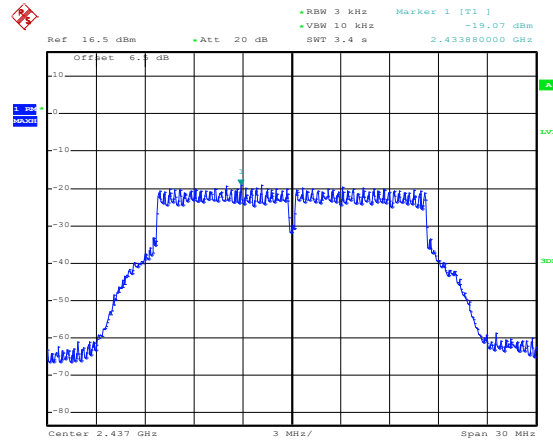
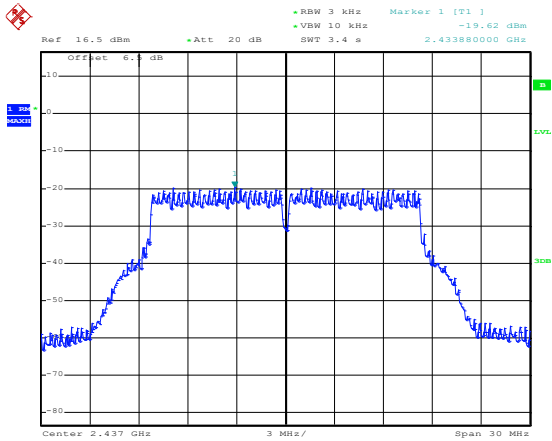


Date: 10.OCT.2020 17:58:33

Date: 10.OCT.2020 16:45:26

Lowest channel

Lowest channel

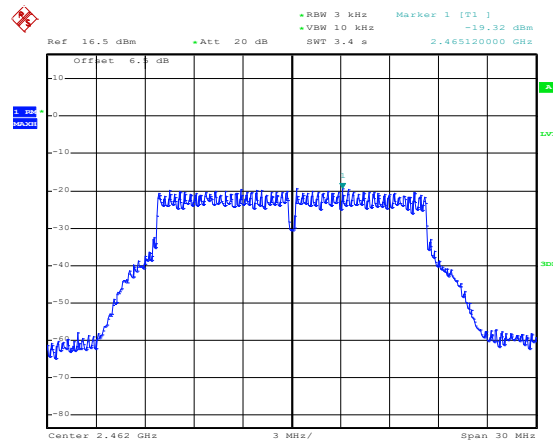
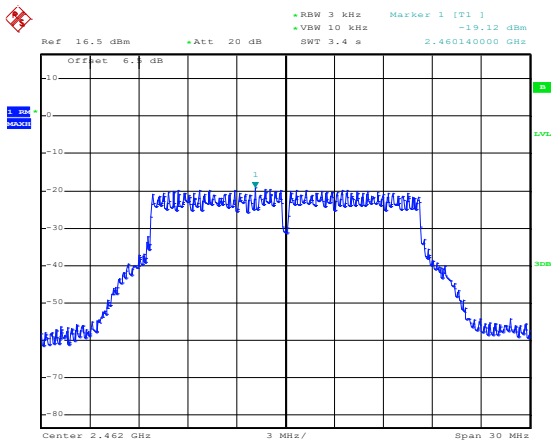


Date: 10.OCT.2020 17:58:21

Date: 10.OCT.2020 16:45:44

Middle channel

Middle channel



Date: 10.OCT.2020 17:58:06

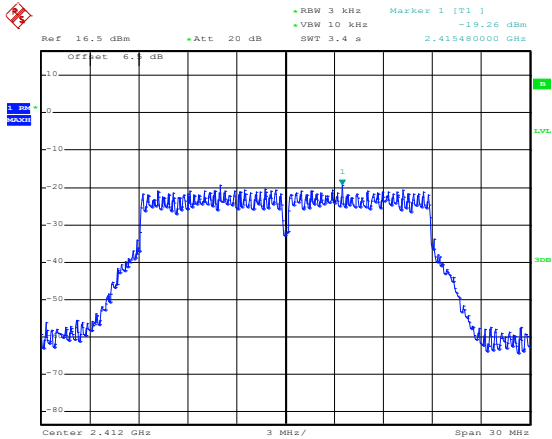
Date: 10.OCT.2020 16:45:59

Highest channel

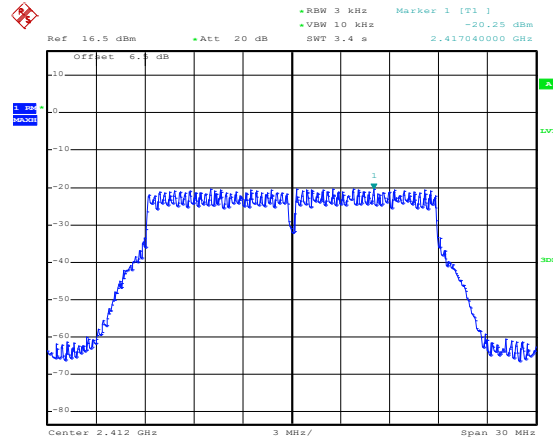
Highest channel

Test mode: 802.11n(HT20)

ANT 3



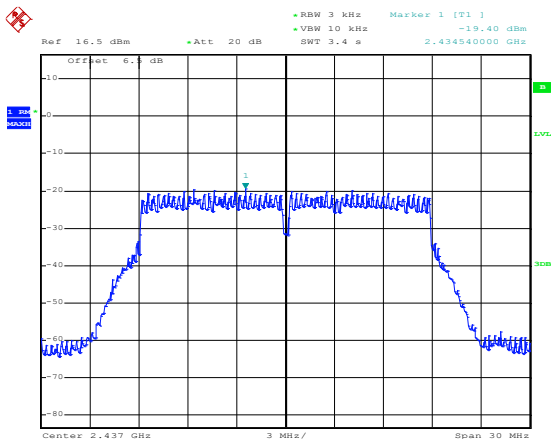
ANT 6



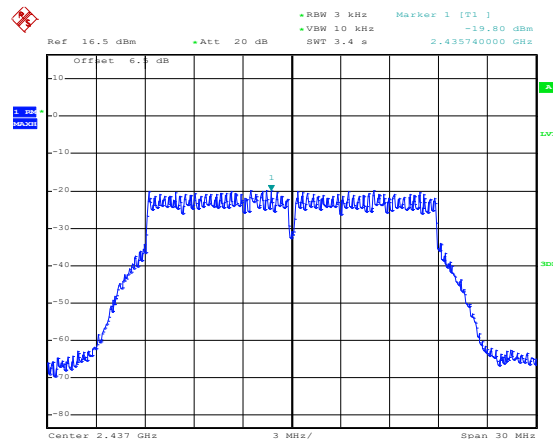
Date: 10.OCT.2020 17:57:19

Date: 10.OCT.2020 16:45:03

Lowest channel



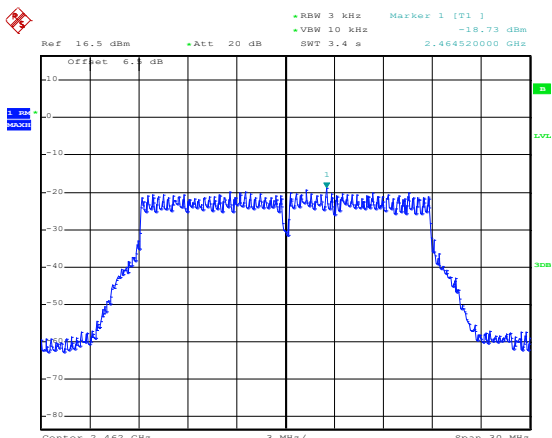
Lowest channel



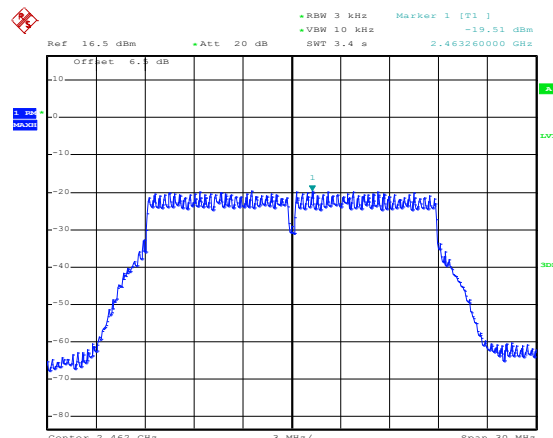
Date: 10.OCT.2020 17:56:57

Date: 10.OCT.2020 16:44:43

Middle channel



Middle channel



Date: 10.OCT.2020 17:57:37

Date: 10.OCT.2020 16:44:28

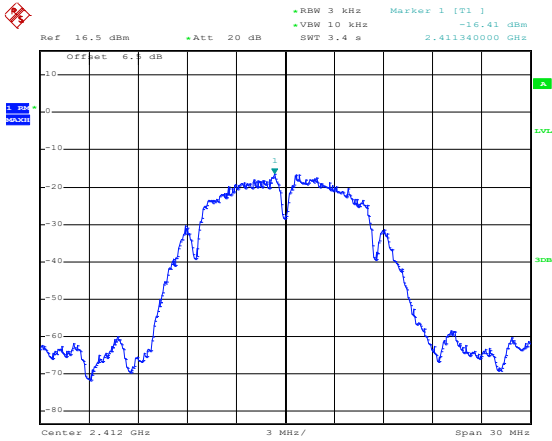
Highest channel

Highest channel

Test plot as follows (module2):

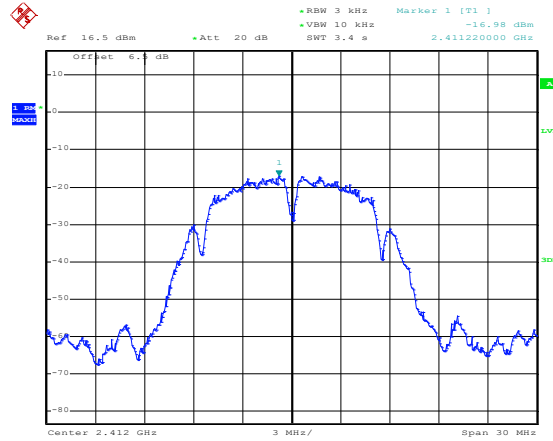
Test mode: 802.11b

ANT 1



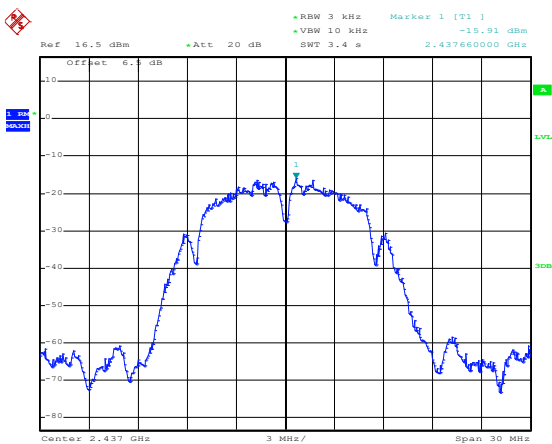
Date: 10.OCT.2020 22:04:45

ANT 2



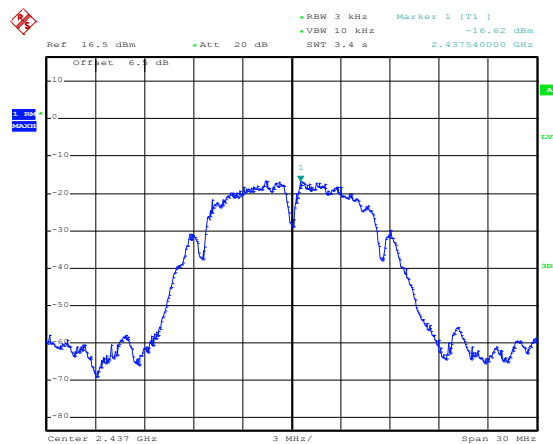
Date: 10.OCT.2020 21:19:30

Lowest channel



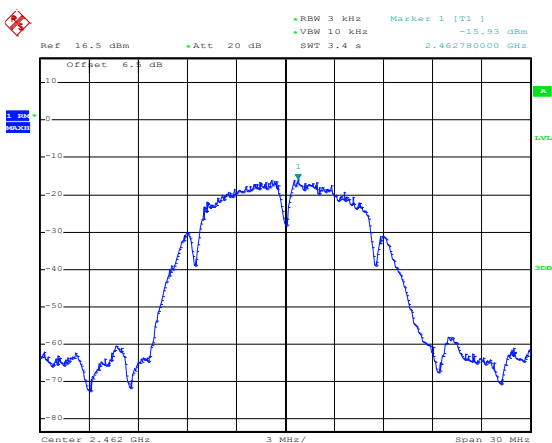
Date: 10.OCT.2020 22:04:31

Lowest channel



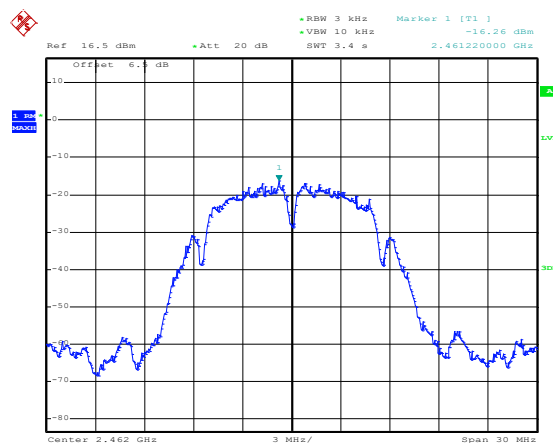
Date: 10.OCT.2020 21:19:46

Middle channel



Date: 10.OCT.2020 22:04:19

Middle channel



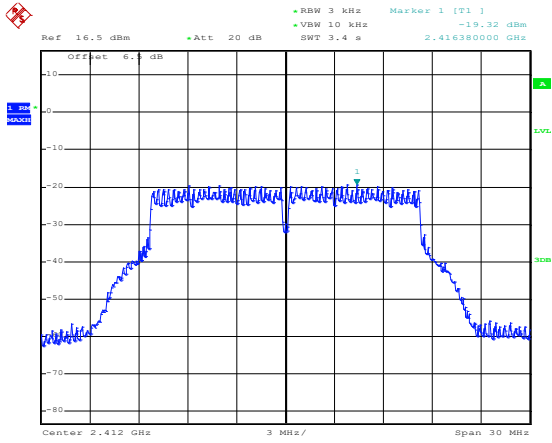
Date: 10.OCT.2020 21:20:00

Highest channel

Highest channel

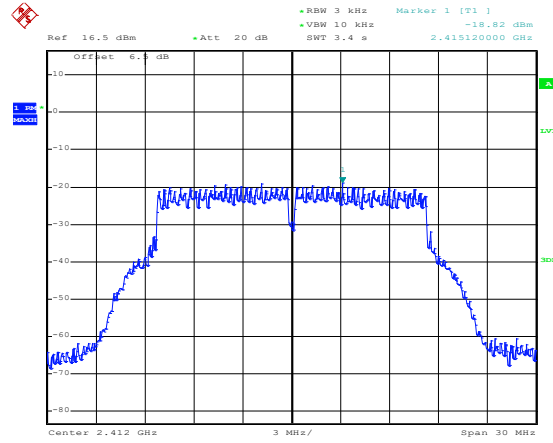
Test mode: 802.11g

ANT 1



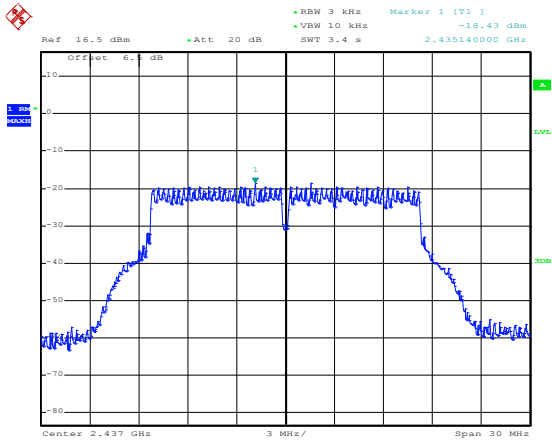
Date: 10.OCT.2020 22:04:59

ANT 2



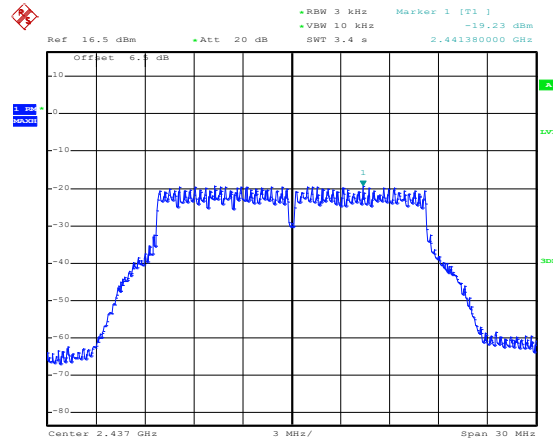
Date: 10.OCT.2020 21:20:44

Lowest channel



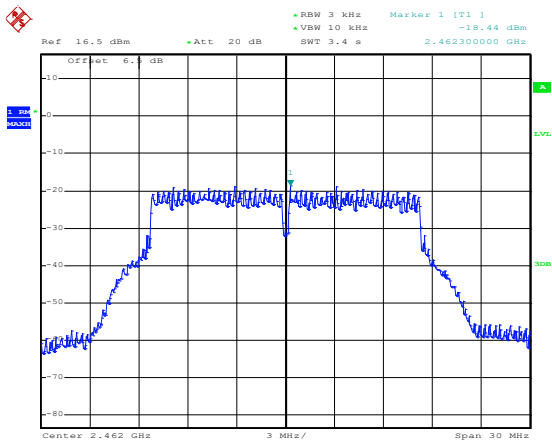
Date: 10.OCT.2020 22:05:13

Lowest channel



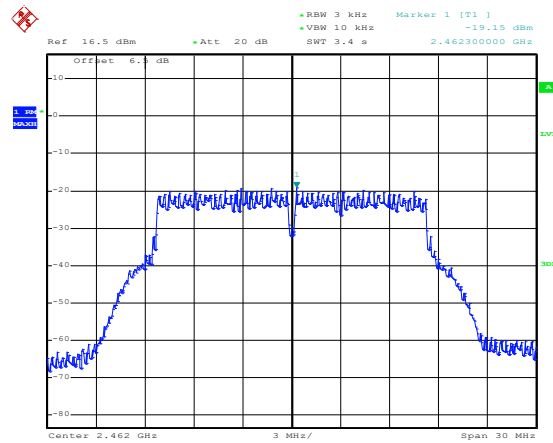
Date: 10.OCT.2020 21:20:32

Middle channel



Date: 10.OCT.2020 22:05:26

Middle channel



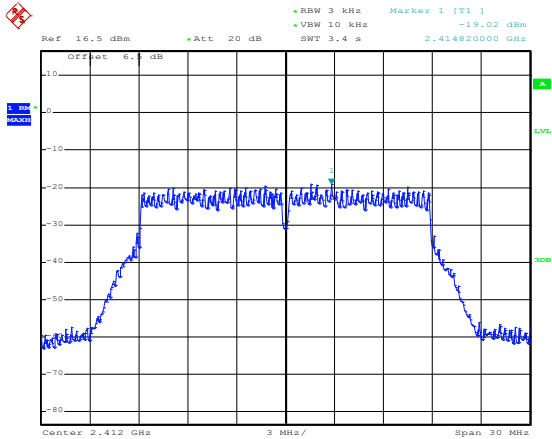
Date: 10.OCT.2020 21:20:16

Highest channel

Highest channel

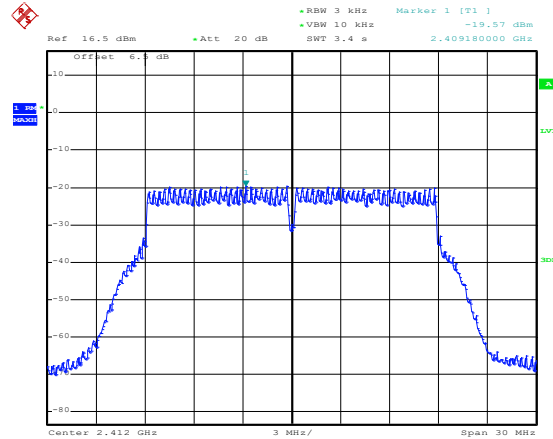
Test mode: 802.11n(HT20)

ANT 1



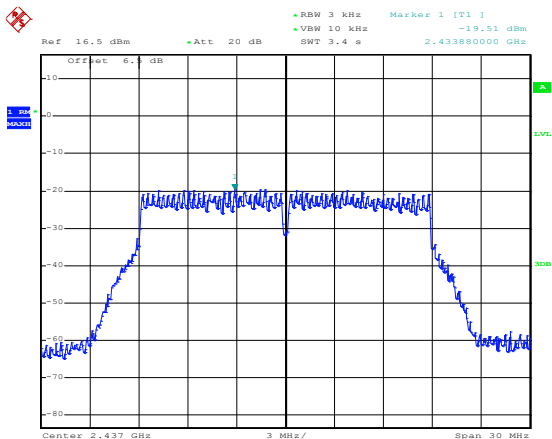
Date: 10.OCT.2020 22:06:20

ANT 2



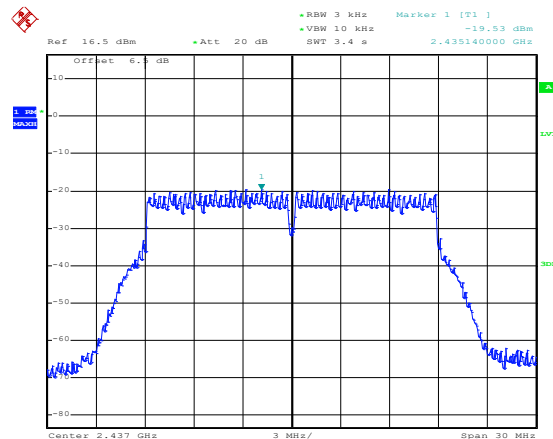
Date: 10.OCT.2020 21:21:08

Lowest channel



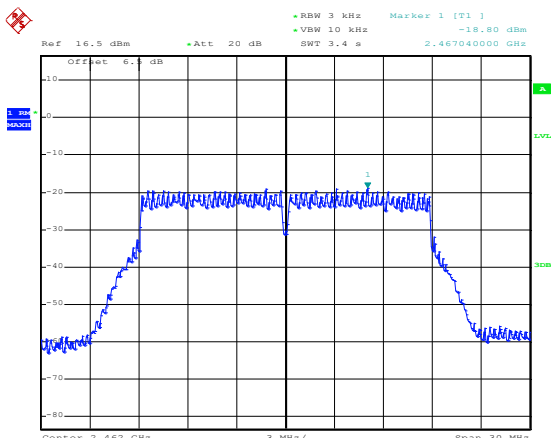
Date: 10.OCT.2020 22:06:03

Lowest channel



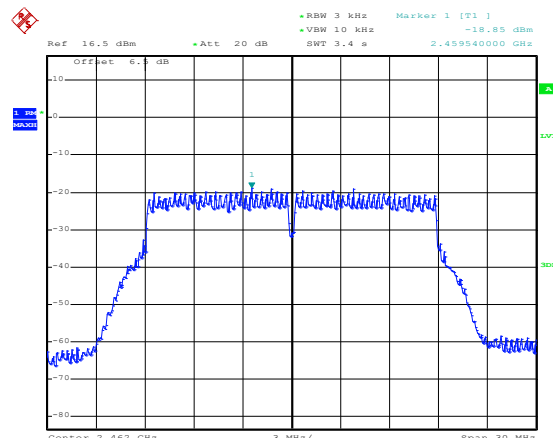
Date: 10.OCT.2020 21:21:23

Middle channel



Date: 10.OCT.2020 22:05:50

Middle channel



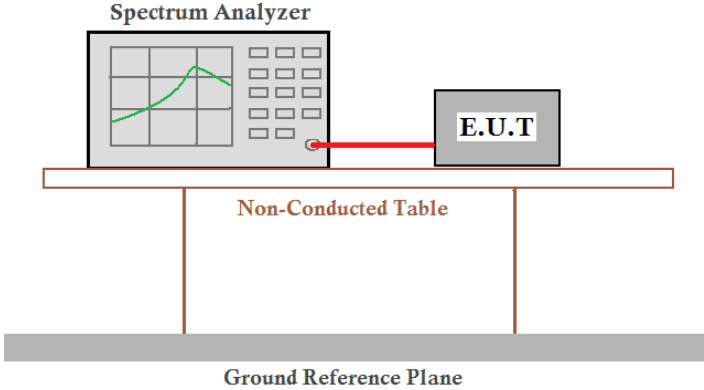
Date: 10.OCT.2020 21:21:39

Highest channel

Highest channel

6.6 Band Edge

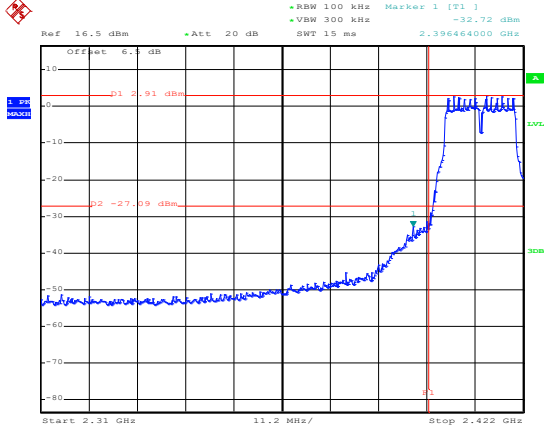
6.6.1 Conducted Emission Method

Test Requirement:	FCC Part 15 C Section 15.247 (d)
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
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 the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two legs and sits on a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Test plot as follows (module 1):

802.11g

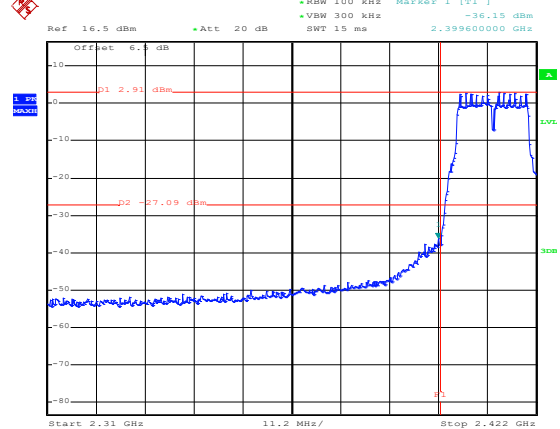
ANT 3



Date: 10.OCT.2020 18:04:25

Lowest channel

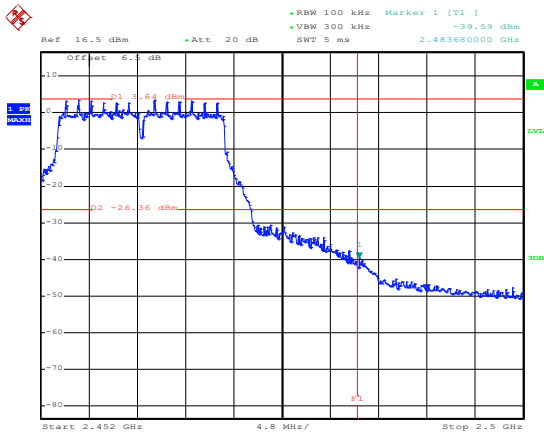
ANT 6



Date: 10.OCT.2020 17:00:10

Lowest channel

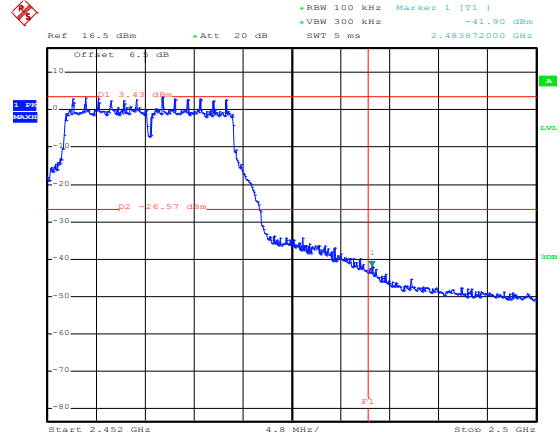
ANT 3



Date: 10.OCT.2020 18:01:33

Highest channel

ANT 6

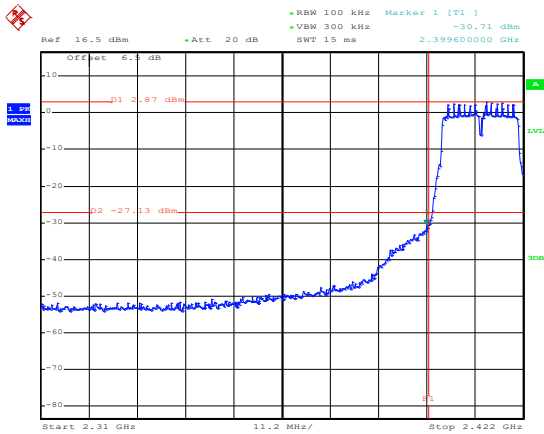


Date: 10.OCT.2020 16:57:45

Highest channel

802.11n(HT20)

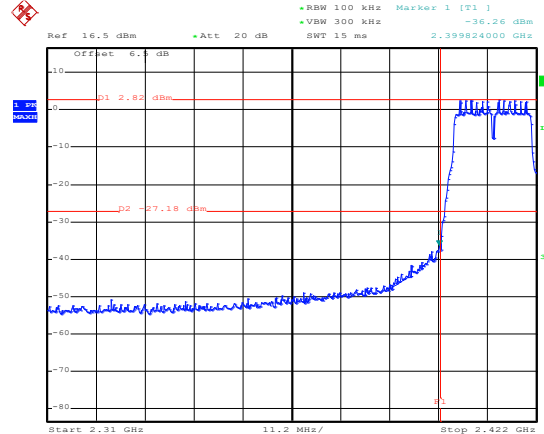
ANT 3



Date: 10.OCT.2020 18:03:26

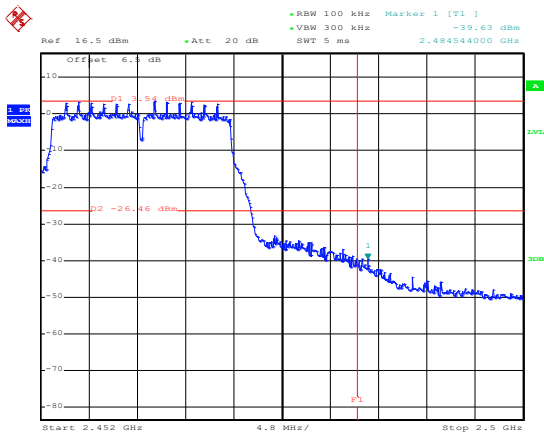
Lowest channel

ANT 6



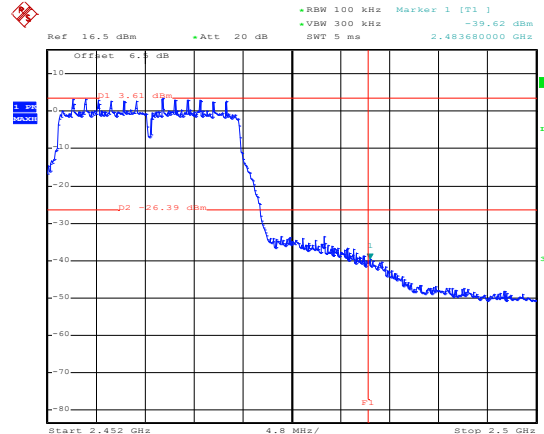
Date: 10.OCT.2020 17:00:52

Lowest channel



Date: 10.OCT.2020 18:02:20

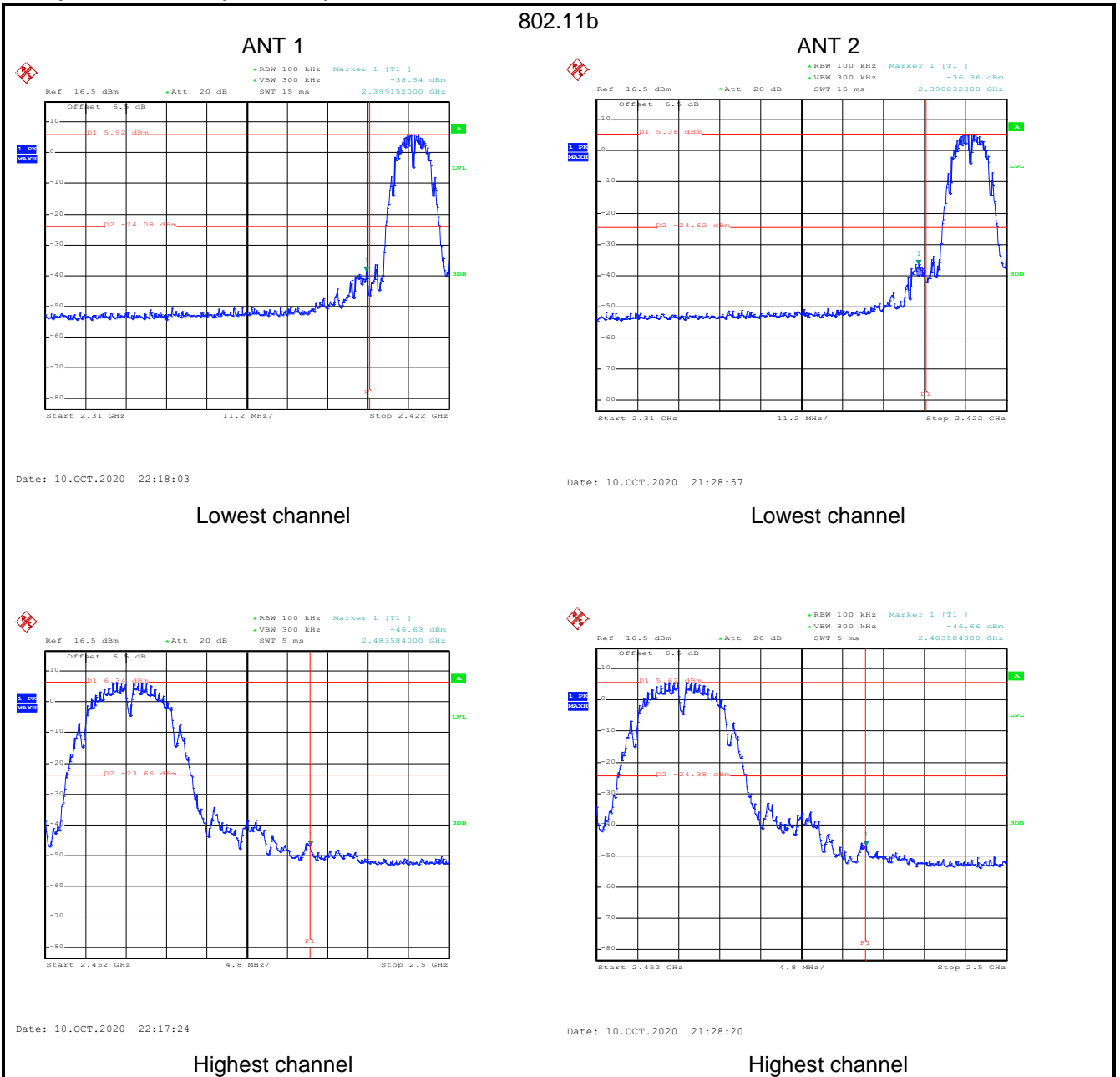
Highest channel



Date: 10.OCT.2020 16:57:04

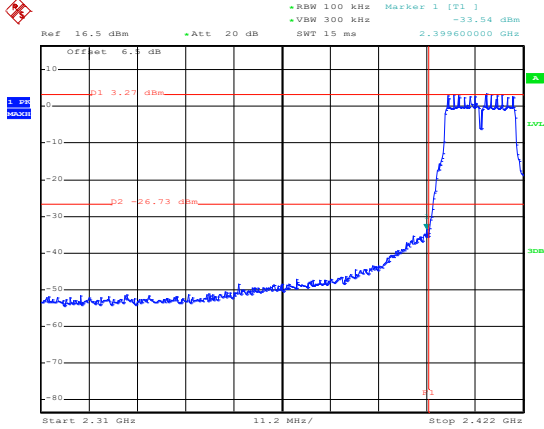
Highest channel

Test plot as follows (module 2):



802.11g

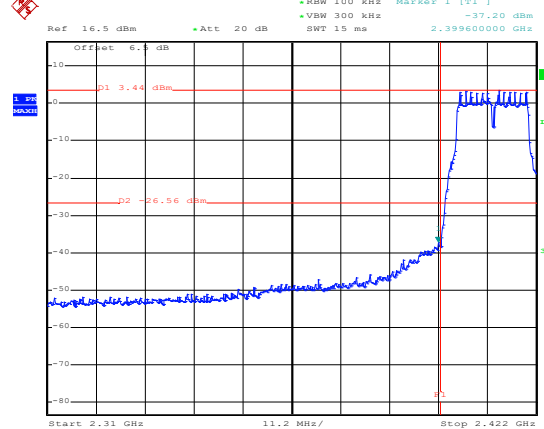
ANT 1



Date: 10.OCT.2020 22:18:48

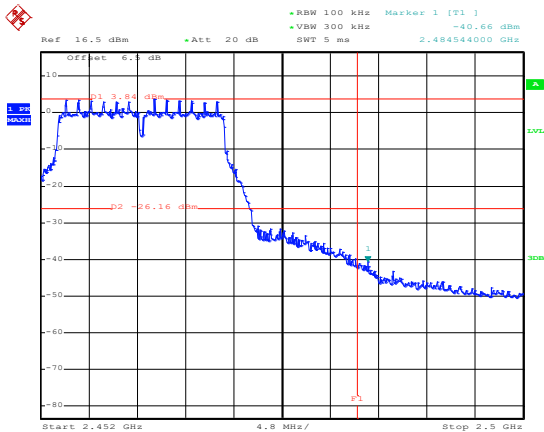
Lowest channel

ANT 2



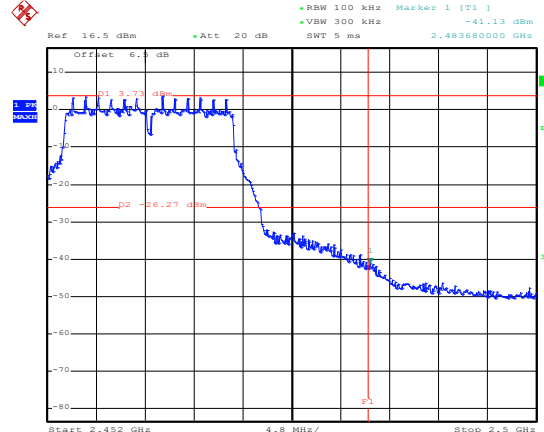
Date: 10.OCT.2020 21:29:38

Lowest channel



Date: 10.OCT.2020 22:16:43

Highest channel



Date: 10.OCT.2020 21:27:44

Highest channel