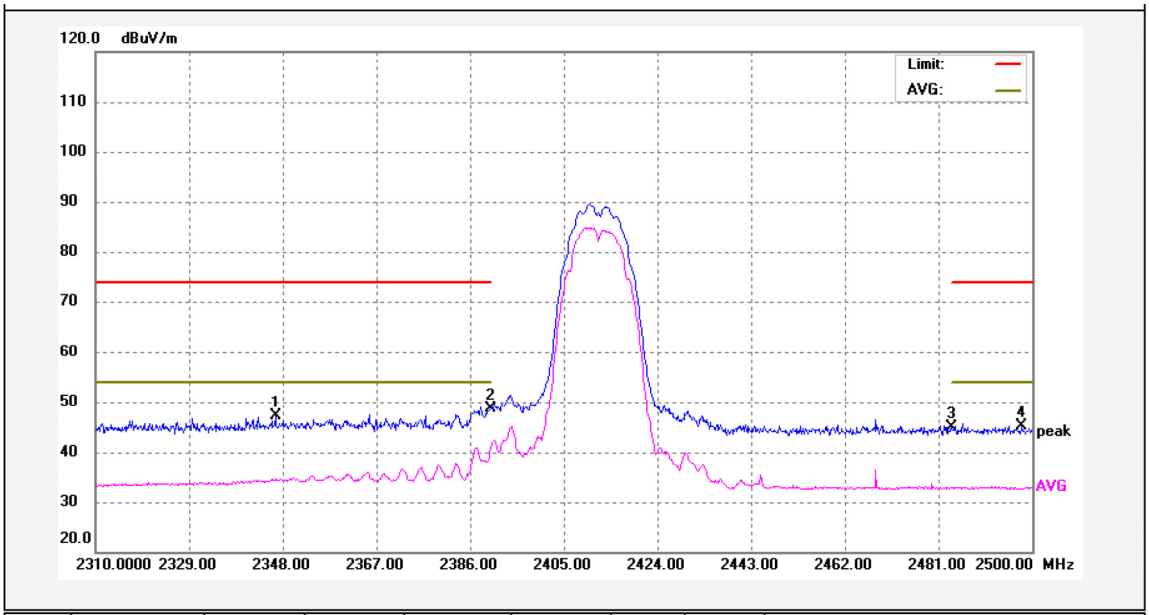
Radiated Restricted Band Emission

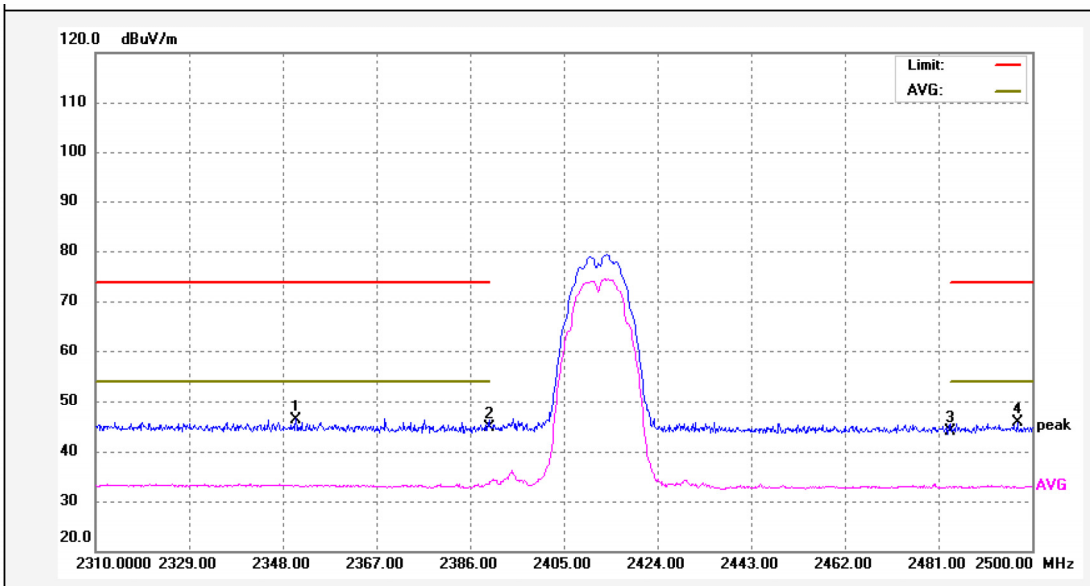
Low-2412:

Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2346.480	57.79	-10.64	47.15	74.00	-26.85	peak	
2	2390.000	59.35	-10.60	48.75	74.00	-25.25	peak	
3	2483.500	55.38	-10.54	44.84	74.00	-29.16	peak	
4	2497.910	55.68	-10.53	45.15	74.00	-28.85	peak	

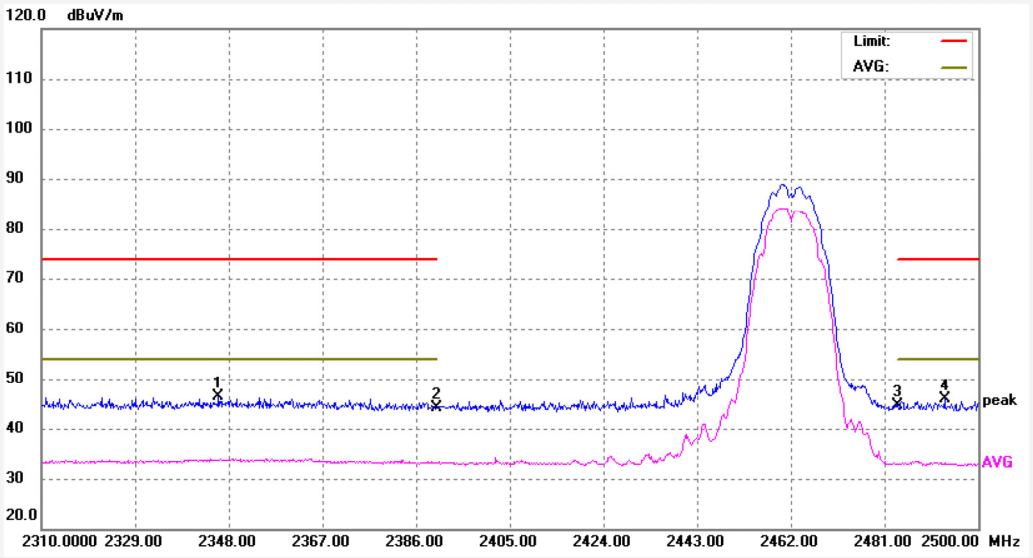
Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2350.660	56.88	-10.63	46.25	74.00	-27.75	peak	
2	2390.000	55.20	-10.60	44.60	74.00	-29.40	peak	
3	2483.500	54.38	-10.54	43.84	74.00	-30.16	peak	
4	2496.960	56.15	-10.53	45.62	74.00	-28.38	peak	

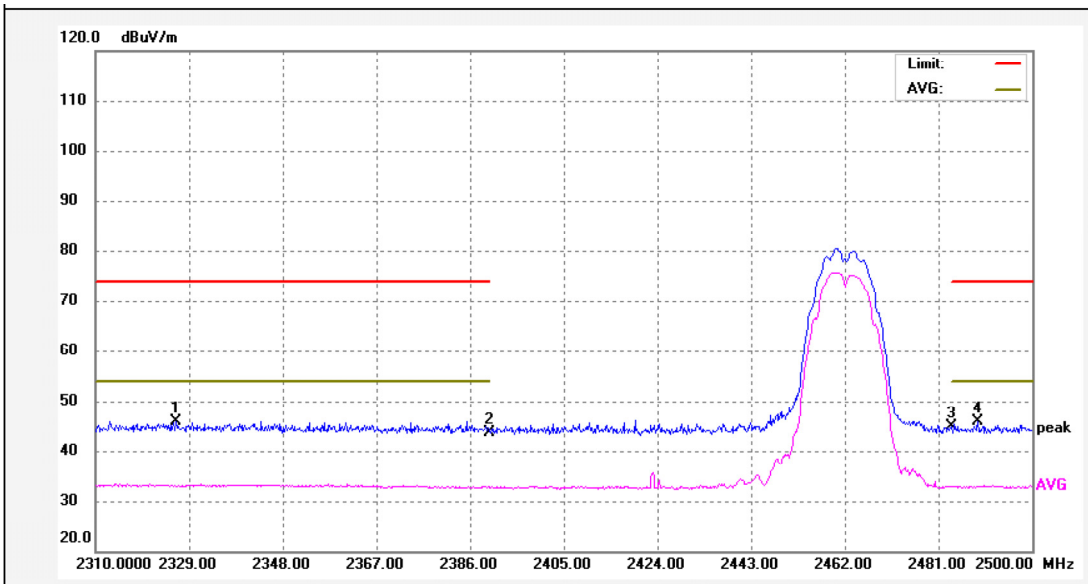
High-2462:

Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2345.910	57.04	-10.64	46.40	74.00	-27.60	peak	
2	2390.000	54.84	-10.60	44.24	74.00	-29.76	peak	
3	2483.500	55.19	-10.54	44.65	74.00	-29.35	peak	
4	2493.160	56.34	-10.53	45.81	74.00	-28.19	peak	

Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2326.340	56.64	-10.65	45.99	74.00	-28.01	peak	
2	2390.000	54.27	-10.60	43.67	74.00	-30.33	peak	
3	2483.500	55.41	-10.54	44.87	74.00	-29.13	peak	
4	2488.980	56.46	-10.53	45.93	74.00	-28.07	peak	

Test Frequency: 18GHz~25GHz

The measurements were more than 20 dB below the limit and not reported.

10 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10-2020

Test Result: PASS

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 30MHz:

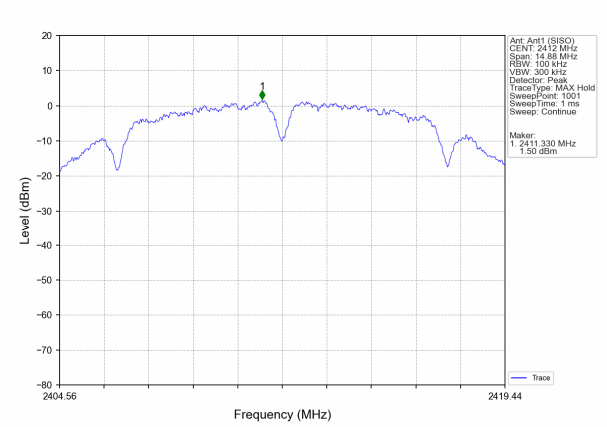
RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

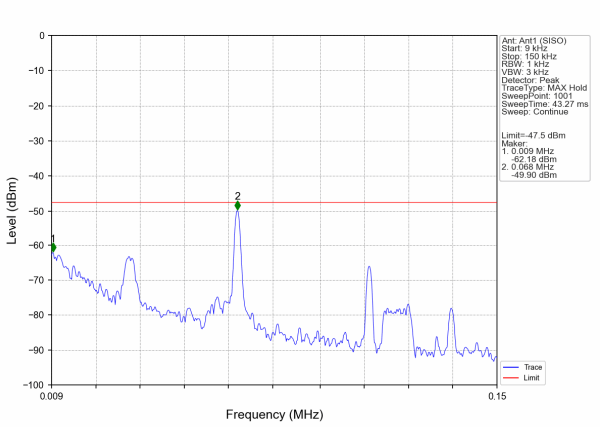
10.2 Test Result

11b_channel 1

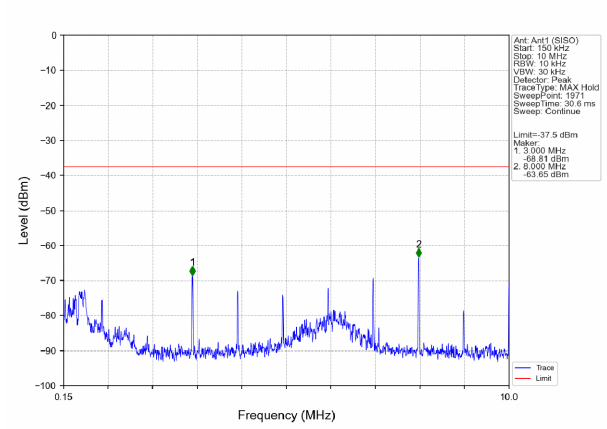
Ref



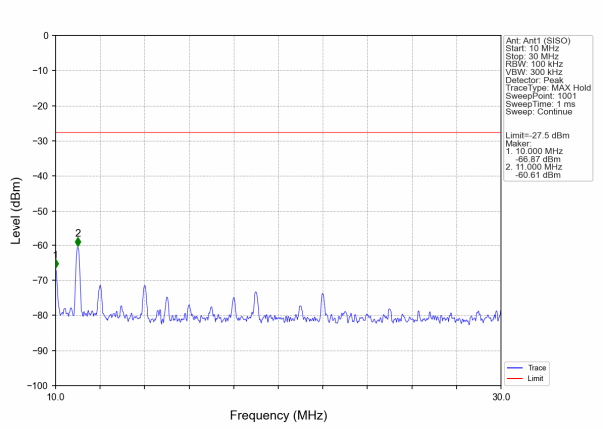
9kHz-150kHz



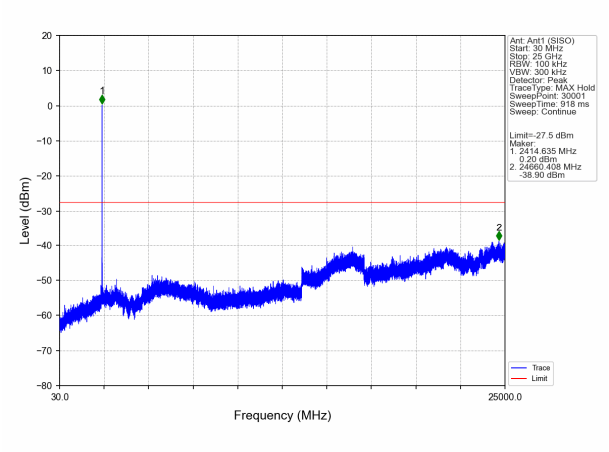
150kHz-10MHz



10MHz-30MHz

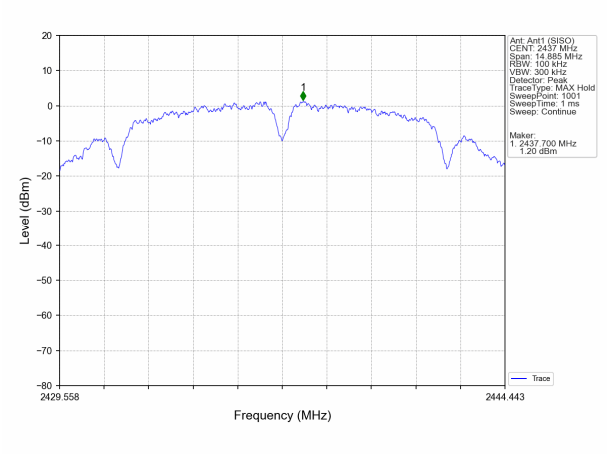


30MHz-25GHz

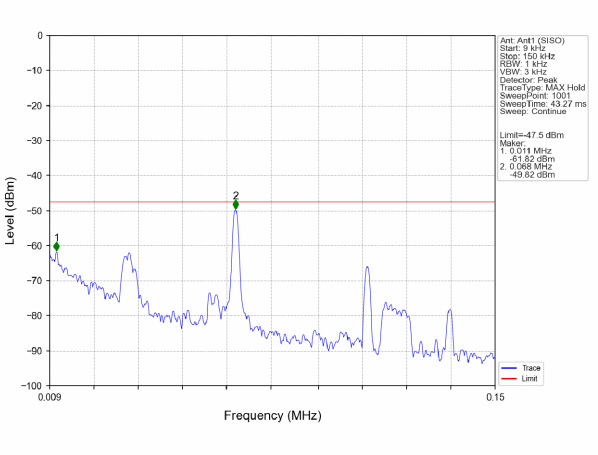

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-27.5 dBm
Maker:
1. 2414.635 MHz
0.20 dBm
2. 24660.408 MHz
-38.90 dBm
Level (dBm)
Frequency (MHz)
30.0
25000.0
Trace
Limit

11b_channel 6

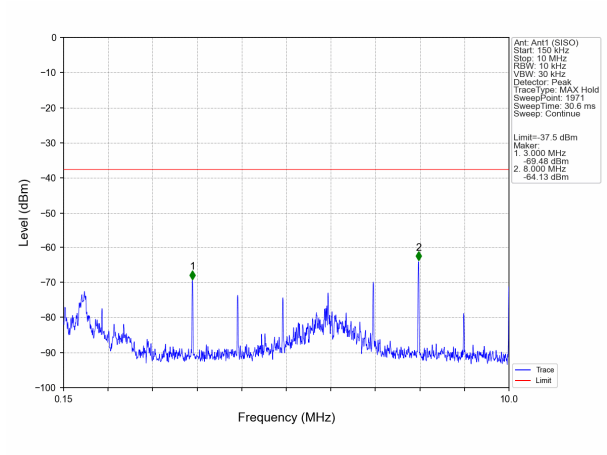
Ref



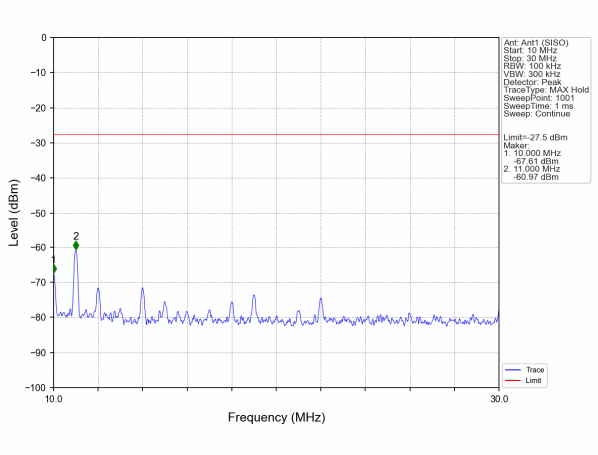
9kHz-150kHz



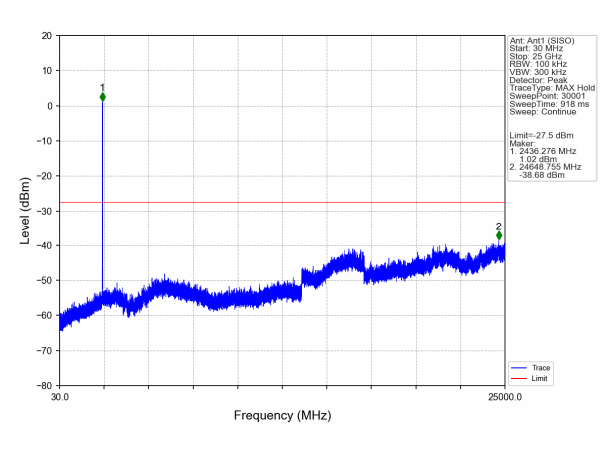
150kHz-10MHz



10MHz-30MHz

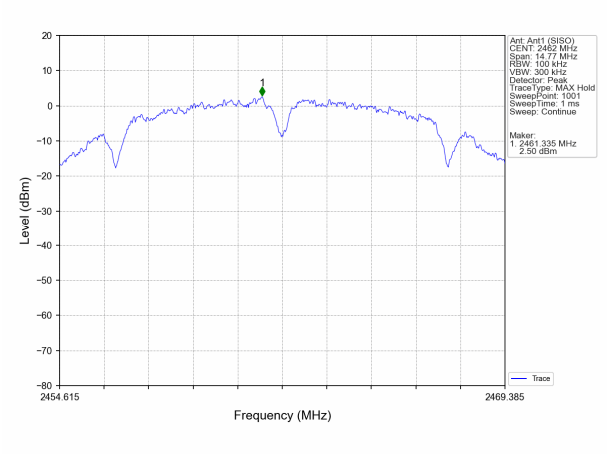


30MHz-25GHz

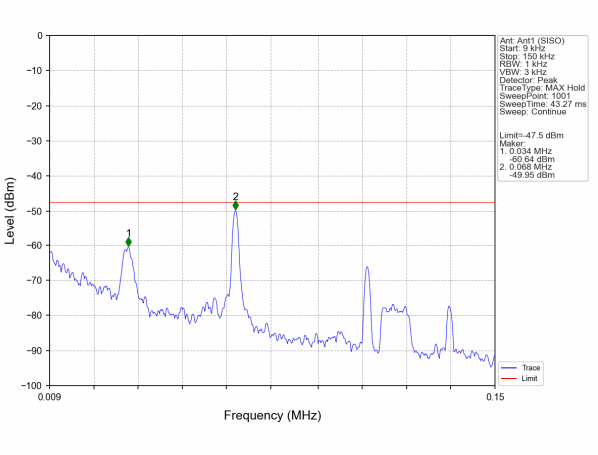

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-27.5 dBm
Maker
1. 2436.276 MHz
1.02 dBm
2. 24648.755 MHz
-38.68 dBm
Level (dBm)
Frequency (MHz)
30.0
25000.0
Trace
Limit

11b_channel 11

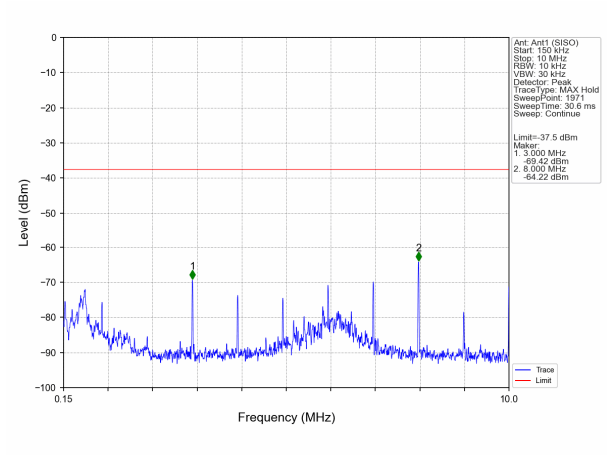
Ref



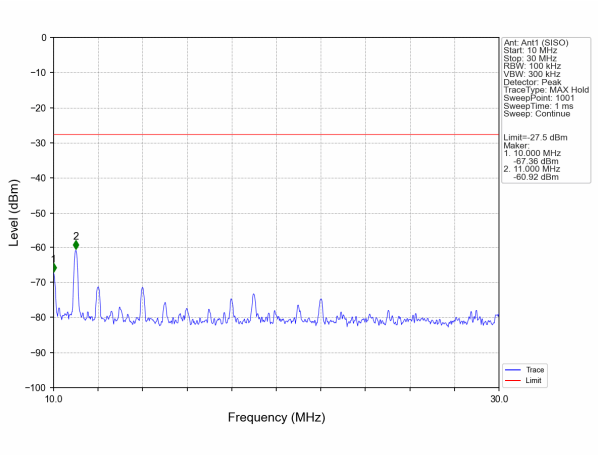
9kHz-150kHz



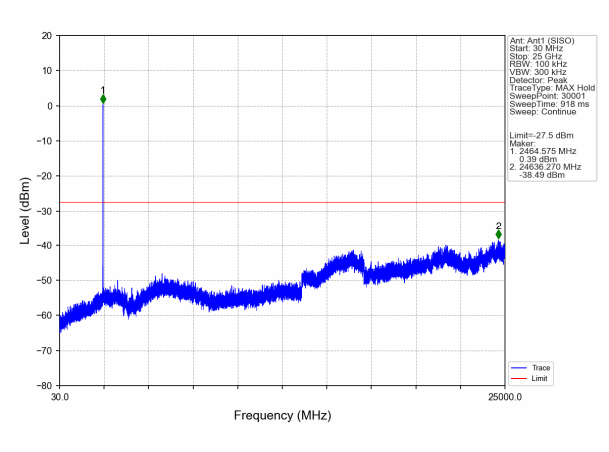
150kHz-10MHz



10MHz-30MHz

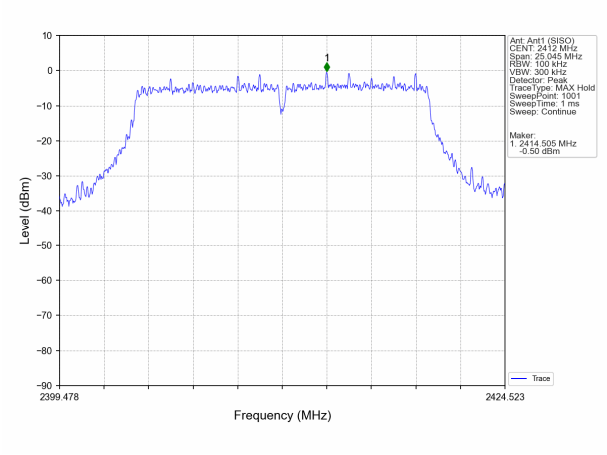


30MHz-25GHz

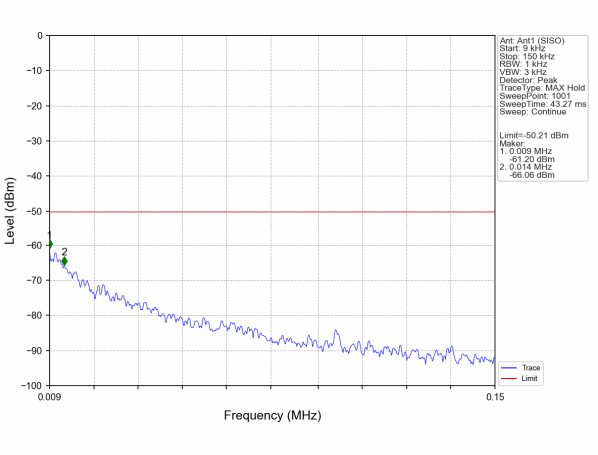

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-27.5 dBm
Maker:
1. 2464.575 MHz
0.39 dBm
2. 24636.270 MHz
-38.49 dBm
Trace
Limit
Level (dBm)
Frequency (MHz)
30.0
25000.0

11g_channel 1

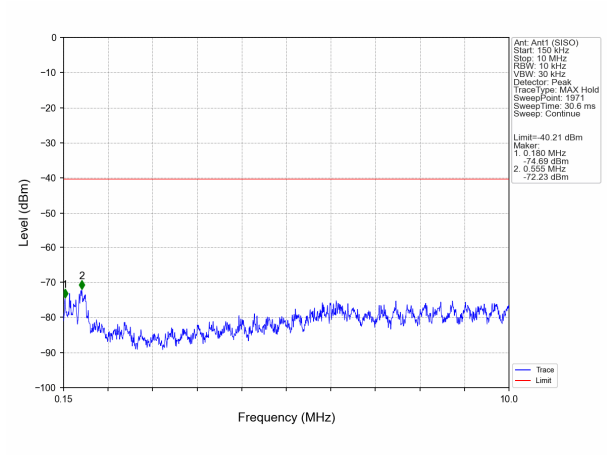
Ref



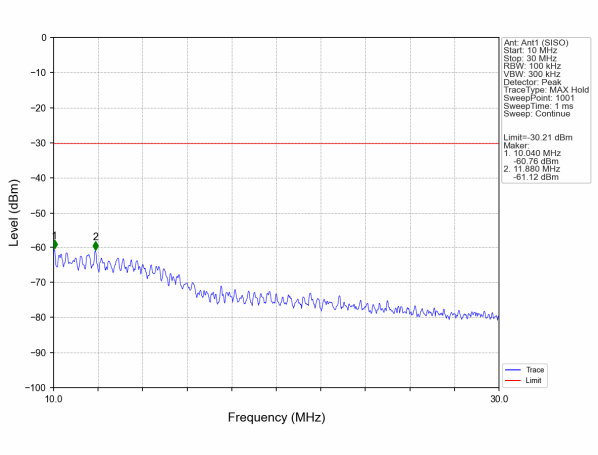
9kHz-150kHz



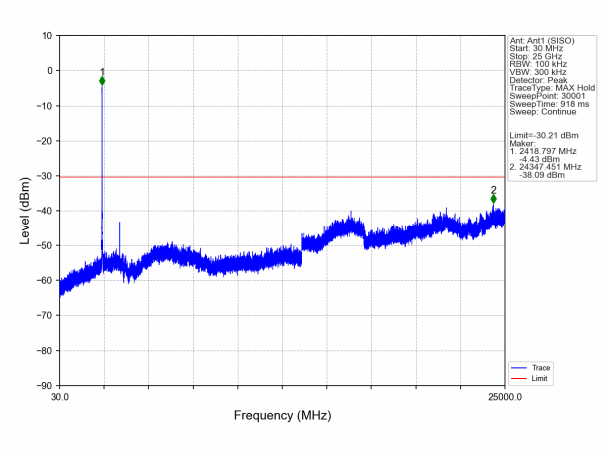
150kHz-10MHz



10MHz-30MHz

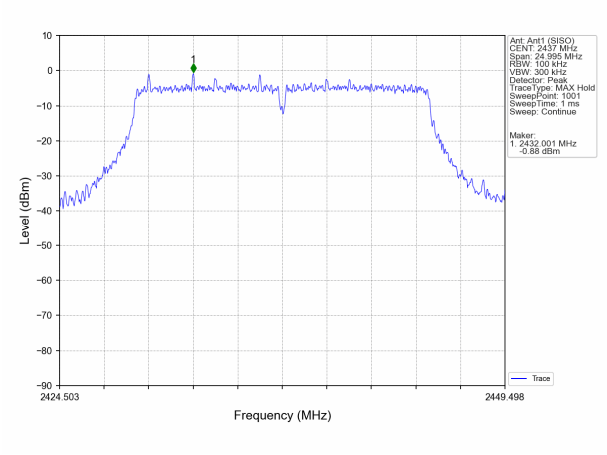


30MHz-25GHz

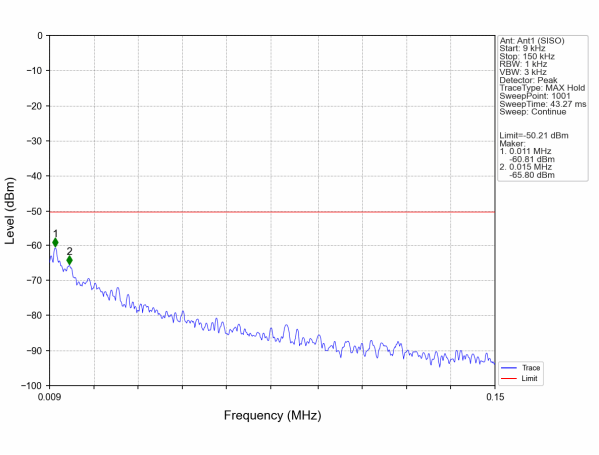

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-30.21 dBm
Maker
1. 2418.797 MHz
-4.43 dBm
2. 24347.451 MHz
-38.09 dBm
Trace
Limit
Level (dBm)
Frequency (MHz)
30.0
25000.0

11g_channel 6

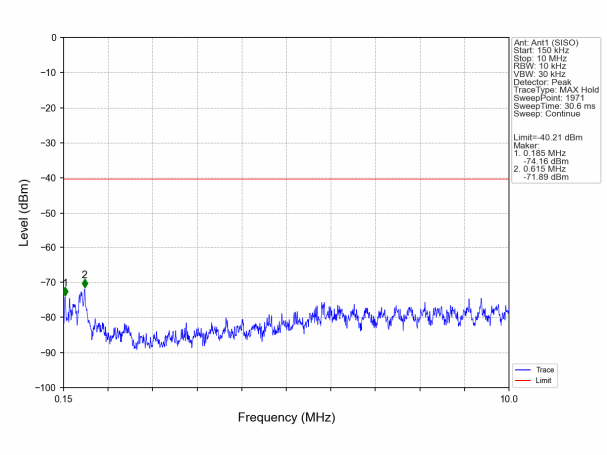
Ref



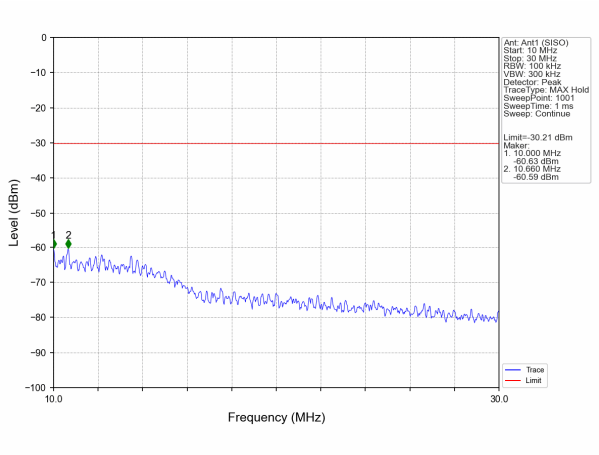
9kHz-150kHz



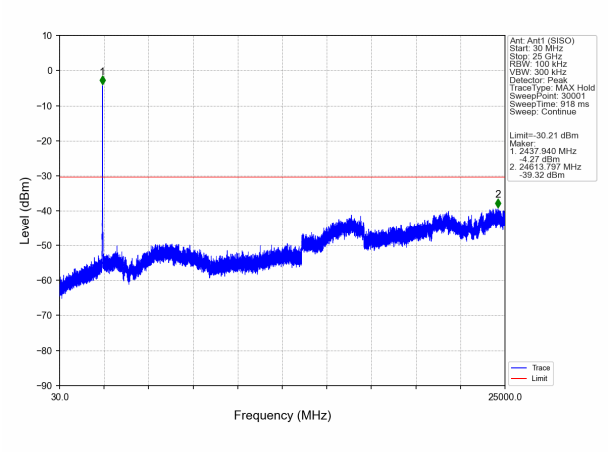
150kHz-10MHz



10MHz-30MHz

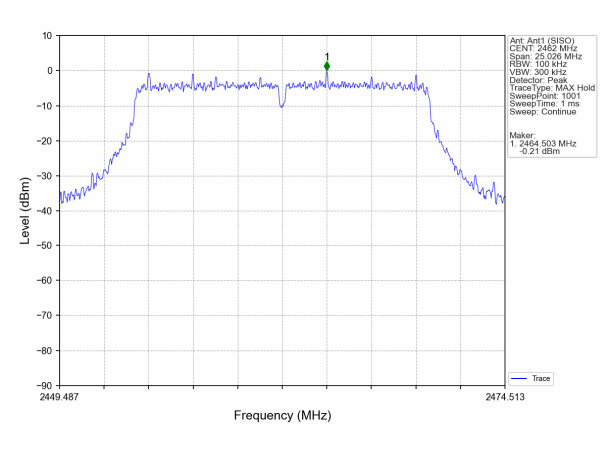


30MHz-25GHz

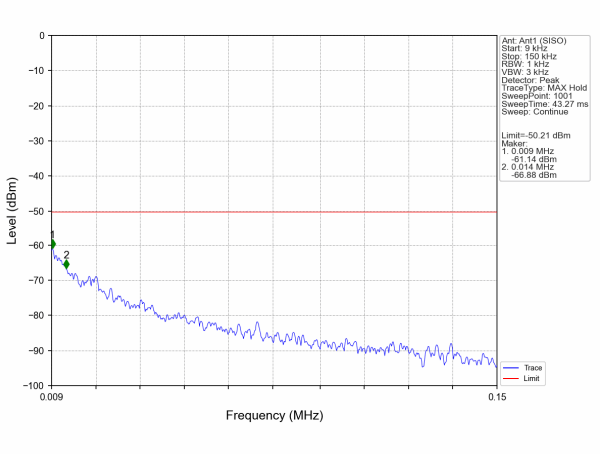

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-30.21 dBm
Maker
1. 2437.940 MHz
-4.27 dBm
2. 24613.797 MHz
-39.32 dBm
Trace
Limit
Level (dBm)
Frequency (MHz)
30.0
25000.0

11g_channel 11

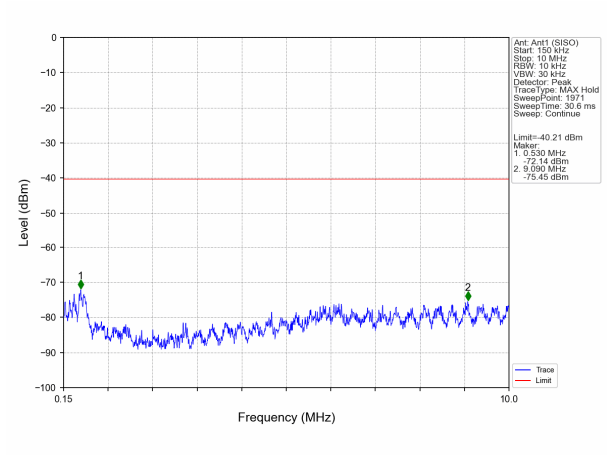
Ref



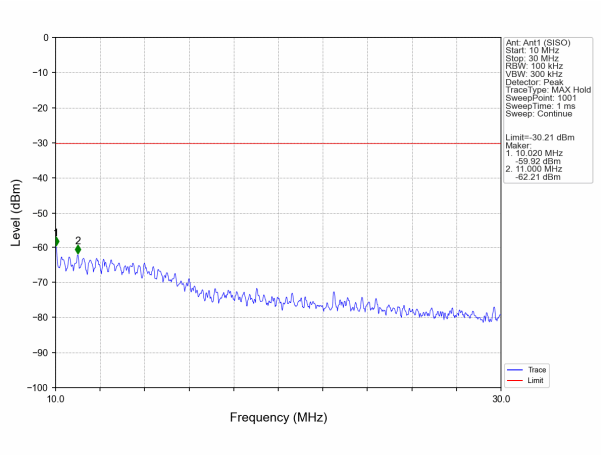
9kHz-150kHz



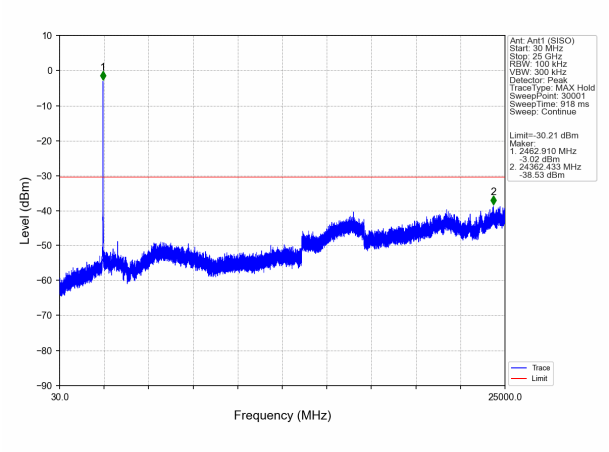
150kHz-10MHz



10MHz-30MHz

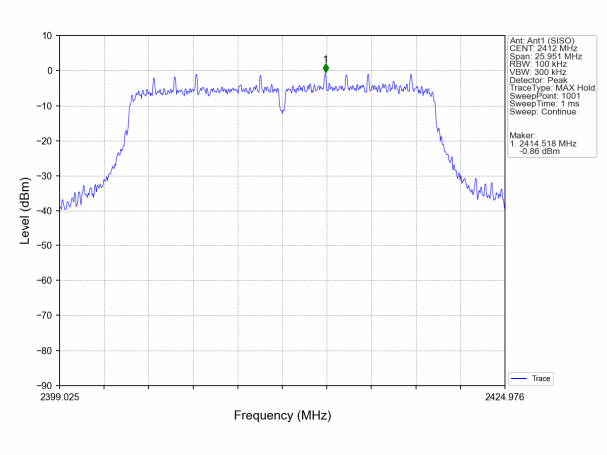


30MHz-25GHz

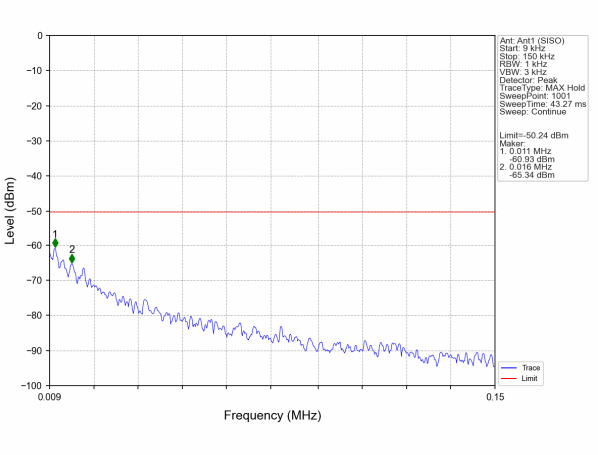

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-30.21 dBm
Maker
1. 2462.910 MHz
-3.02 dBm
2. 24362.433 MHz
-38.53 dBm
Level (dBm)
Frequency (MHz)
30.0
25000.0
Trace
Limit

11n20_channel 1

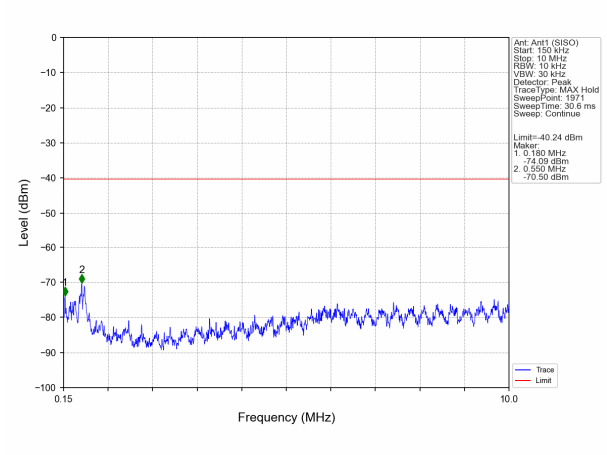
Ref



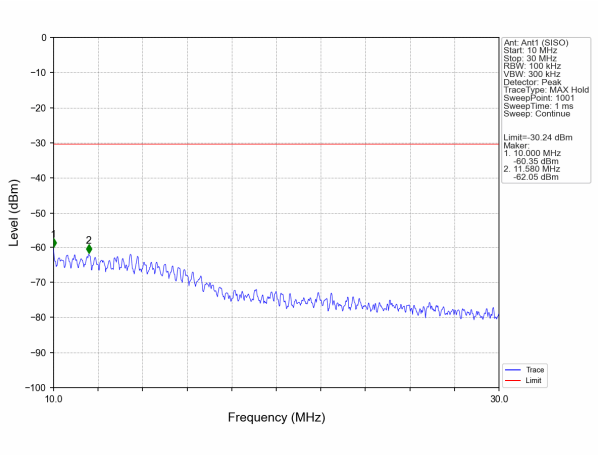
9kHz-150kHz



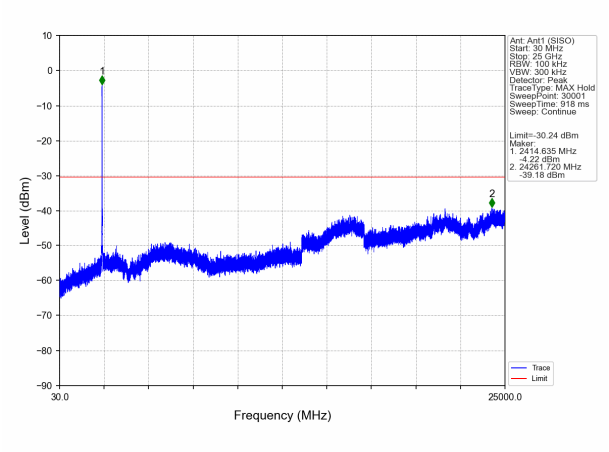
150kHz-10MHz



10MHz-30MHz

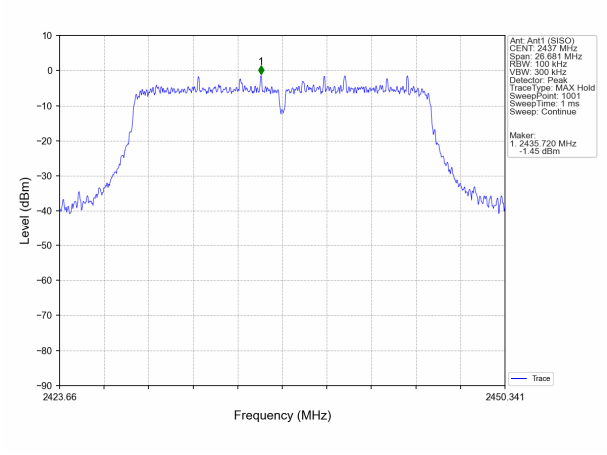


30MHz-25GHz

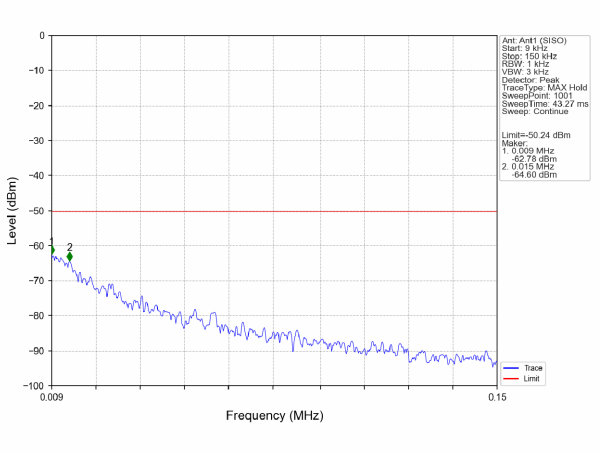

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-30.24 dBm
Maker
1: 2414.635 MHz
-4.22 dBm
2: 24261.720 MHz
-39.18 dBm
Level (dBm)
Frequency (MHz)
30.0
25000.0
Trace
Limit

11n20_channel 6

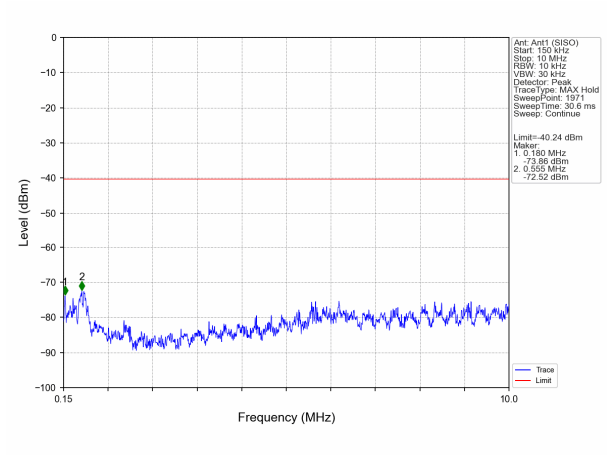
Ref



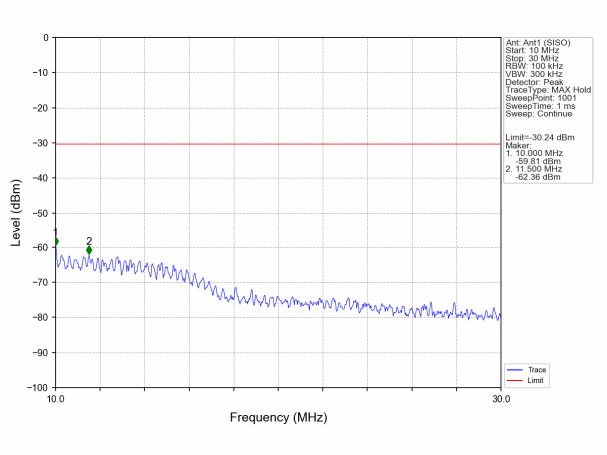
9kHz-150kHz



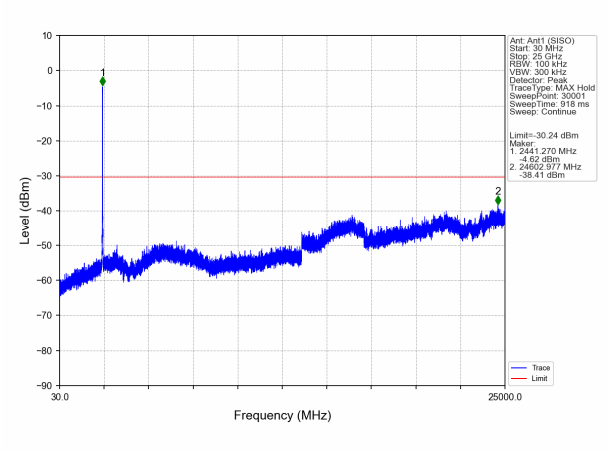
150kHz-10MHz



10MHz-30MHz

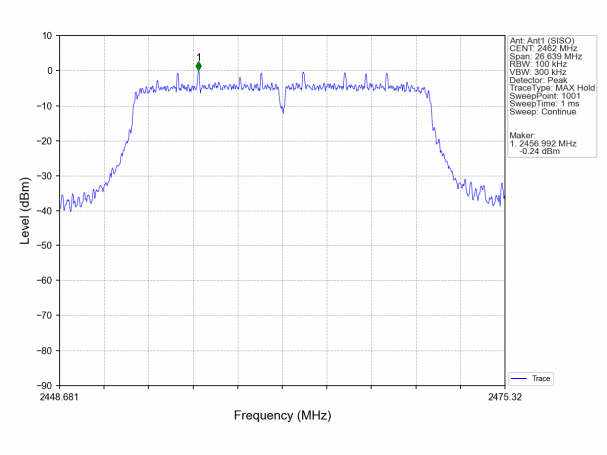


30MHz-25GHz

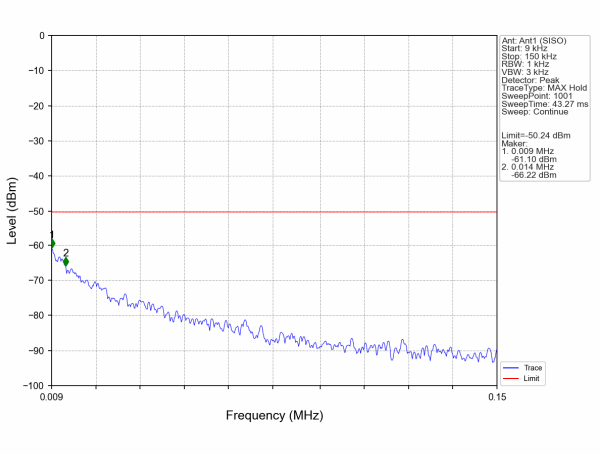

Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-30.24 dBm
Maker
1. 2441.270 MHz
-4.62 dBm
2. 24602.977 MHz
-38.41 dBm
Level (dBm)
Frequency (MHz)
30.0
25000.0
Trace
Limit

11n20_channel 11

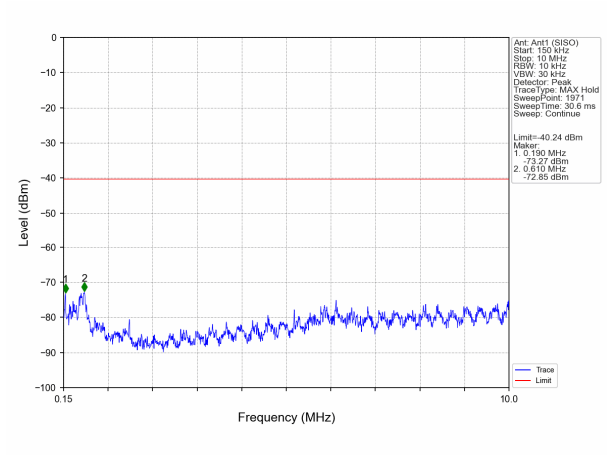
Ref



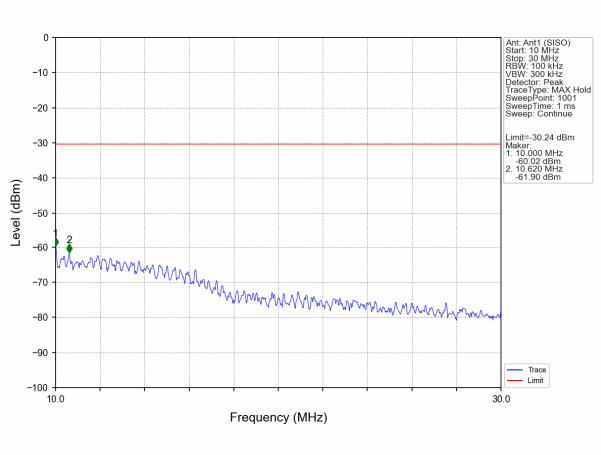
9kHz-150kHz



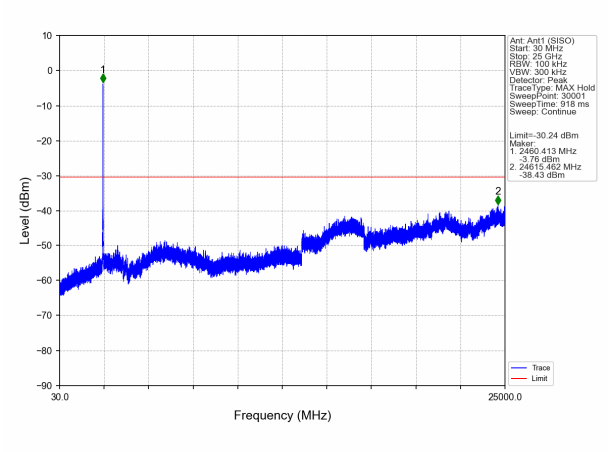
150kHz-10MHz



10MHz-30MHz



30MHz-25GHz


Ant: Ant1 (SISO)
Start: 30 MHz
Stop: 25 GHz
RBW: 100 kHz
VBW: 300 kHz
Detector: Peak
TraceType: MAX Hold
SweepPoint: 30001
SweepTime: 918 ms
Sweep: Continue
Limit=-30.24 dBm
Maker
1. 2460.413 MHz
-3.76 dBm
2. 24615.462 MHz
-38.43 dBm
Trace
Limit
Level (dBm)
Frequency (MHz)
30.0
25000.0

11 Band Edge Measurement

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	Regulation 15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. 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. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

11.1 Test Produce

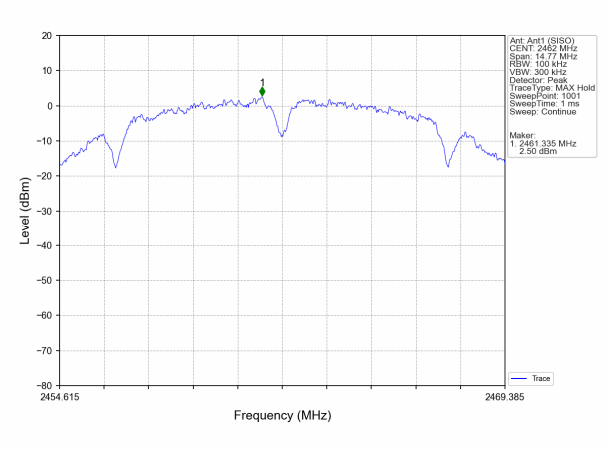
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.2 Test Result

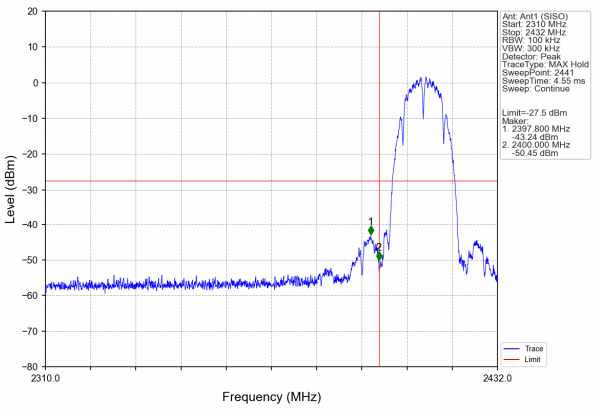
Test result plots shown as follows:

11b:

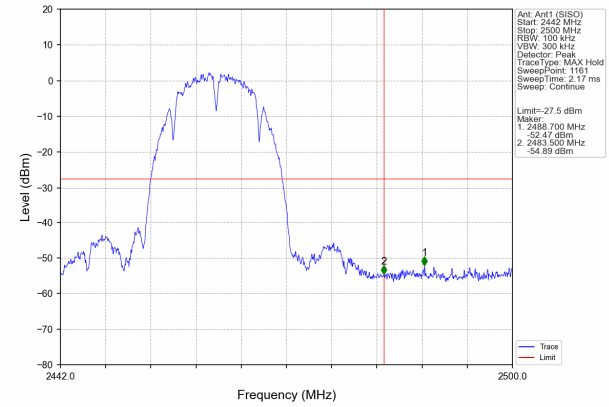
Ref



Band edge-left side

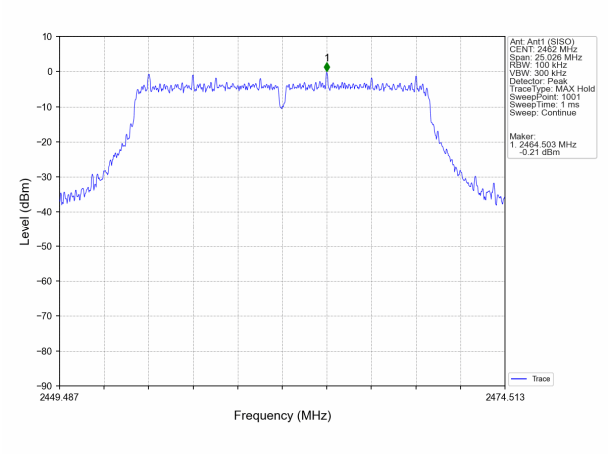


Band edge-right side

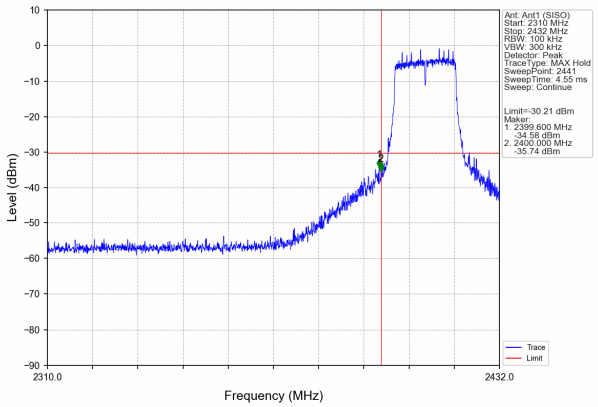


11g:

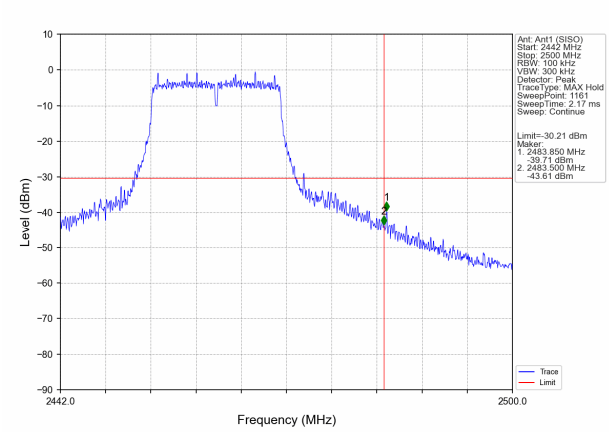
Ref



Band edge-left side

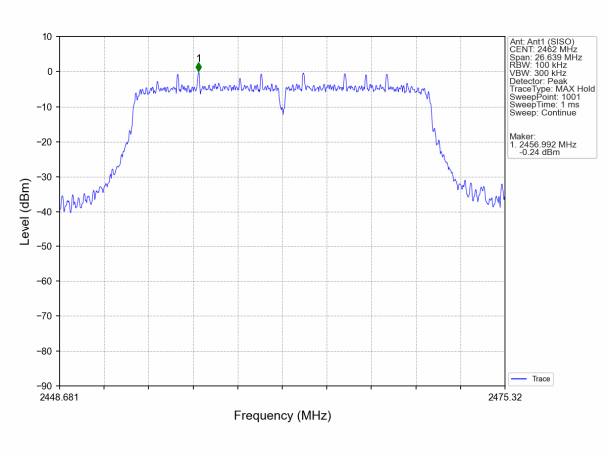


Band edge-right side

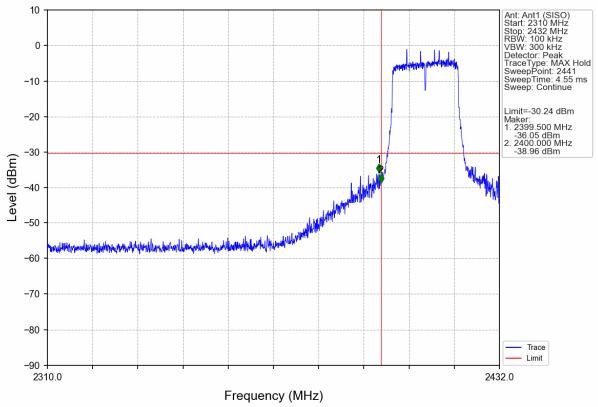


11n20:

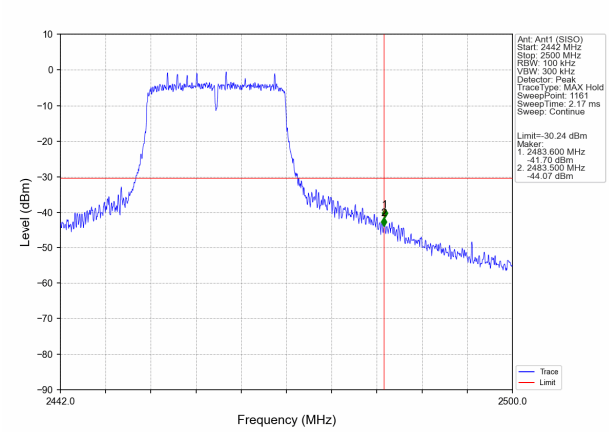
Ref



Band edge-left side



Band edge-right side



12 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	ANSI C63.10-2020 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	§15.247(a)(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Mode:	Transmitting

12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. 6dB Bandwidth Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

99% Bandwidth Set the spectrum analyzer: 1~5% of the OBW, VBW = 3 times the RBW

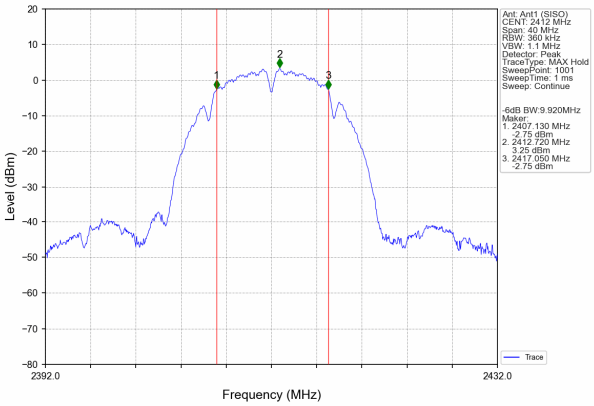
12.2 Test Result

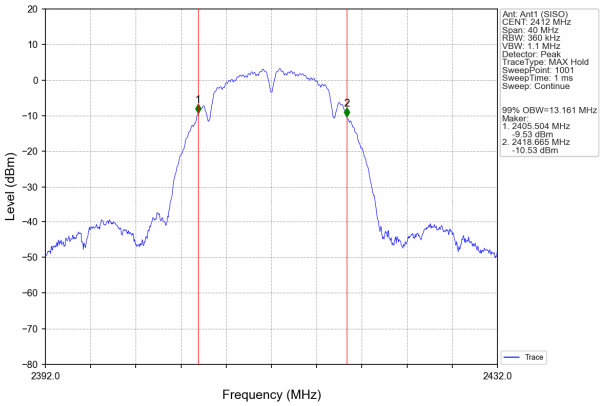
Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX 11b	Channel 1	9.920	13.161
	Channel 6	9.923	13.166
	Channel 11	9.847	13.114
TX 11g	Channel 1	16.697	17.469
	Channel 6	16.663	17.464
	Channel 11	16.684	17.454
TX 11n HT20	Channel 1	17.301	18.282
	Channel 6	17.787	18.303
	Channel 11	17.759	18.240

Test result plot:

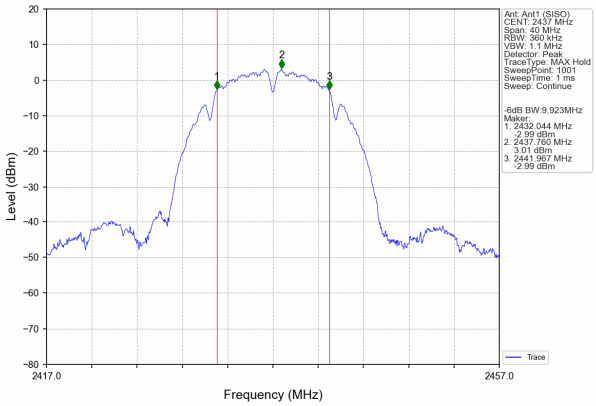
6 dB Bandwidth 99% Bandwidth

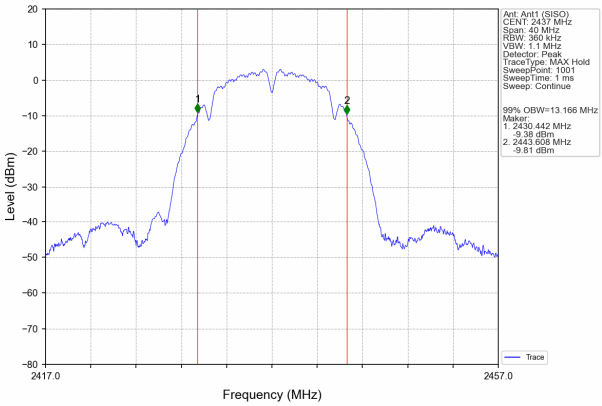
Mode: TX 11b channel 1



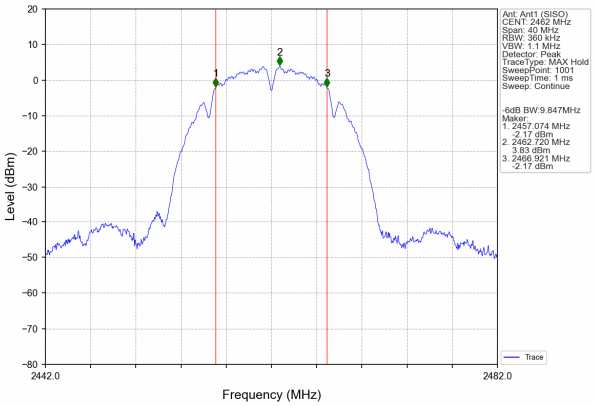


Mode: TX 11b channel 6

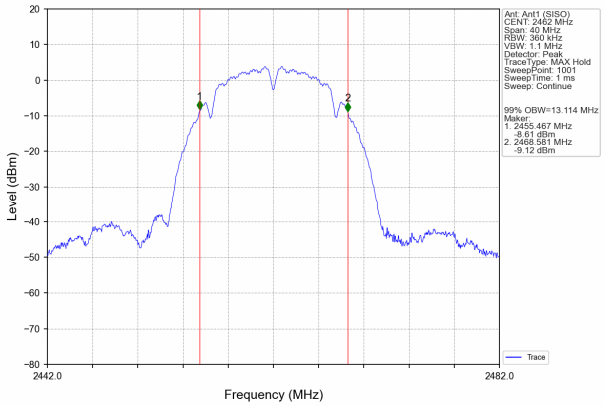




6 dB Bandwidth

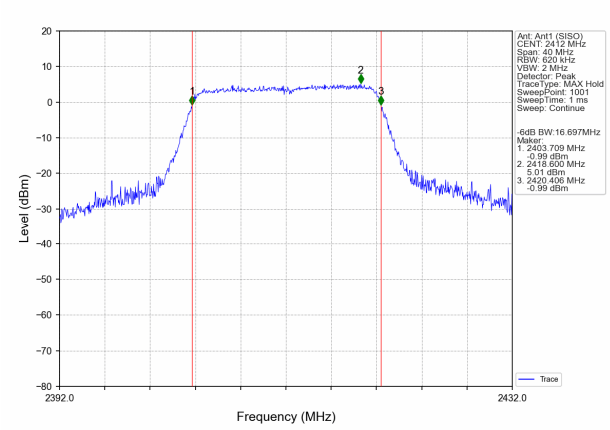


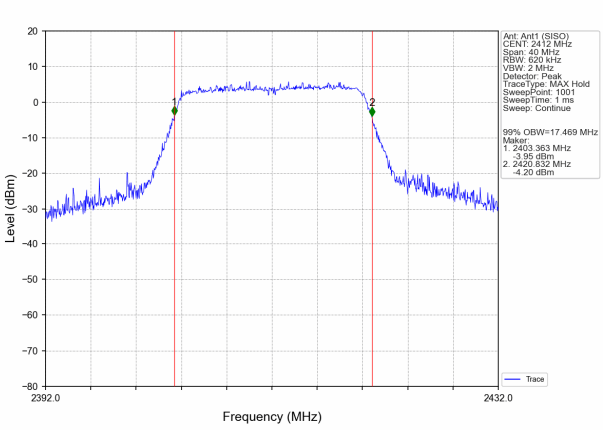
99% Bandwidth



Mode: TX 11b channel 11

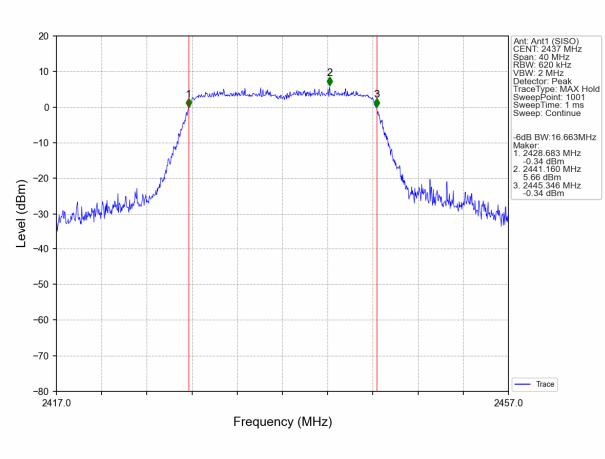
Mode: TX 11g channel 1

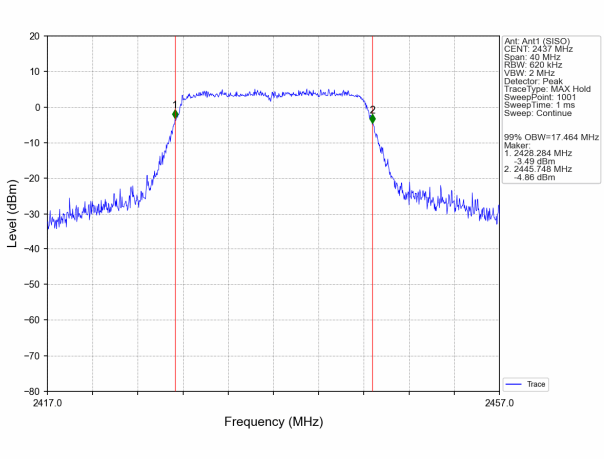




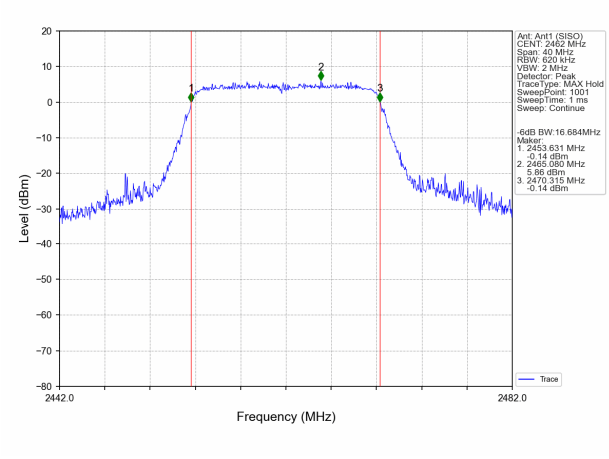
6 dB Bandwidth 99% Bandwidth

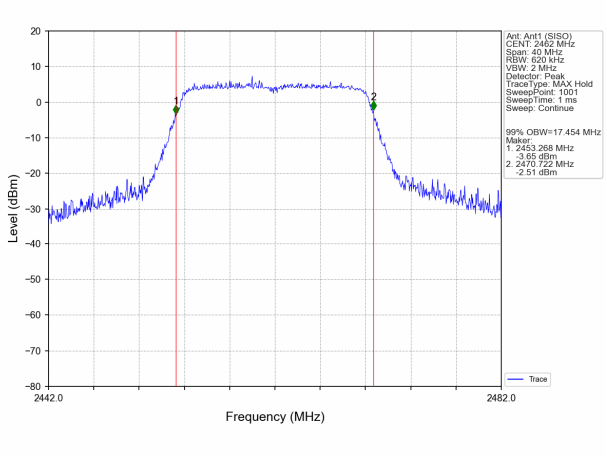
Mode: TX 11g channel 6





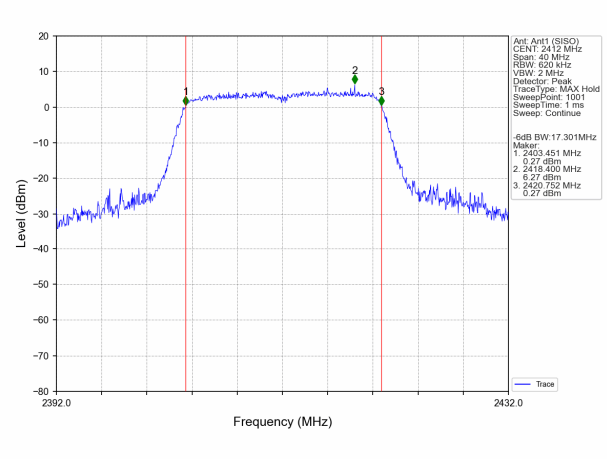
Mode: TX 11g channel 11

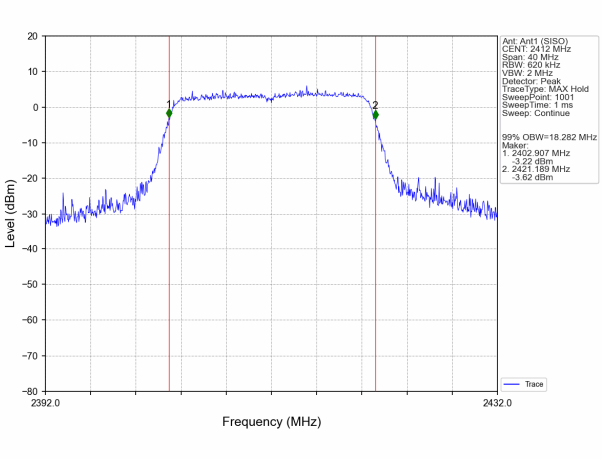




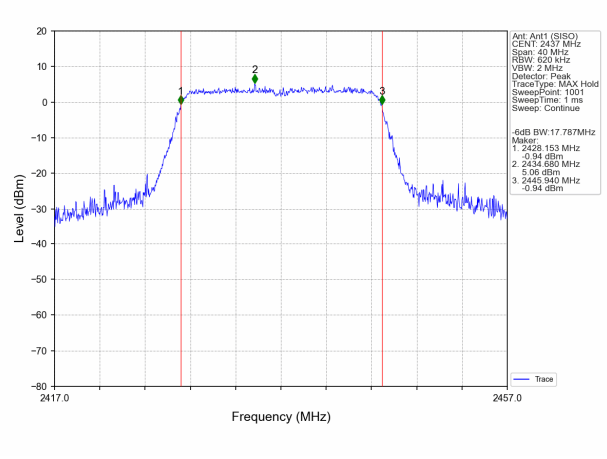
6 dB Bandwidth 99% Bandwidth

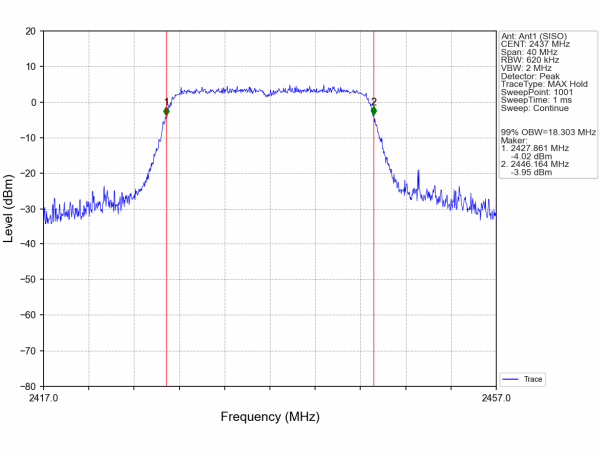
Mode: TX 11n HT20 channel 1





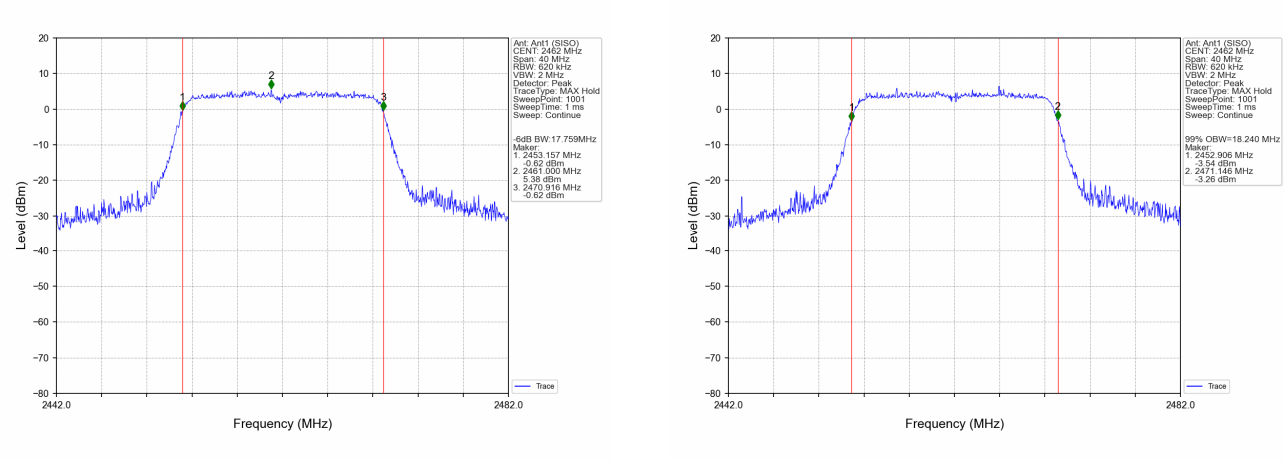
Mode: TX 11n HT20 channel 6





6 dB Bandwidth 99% Bandwidth

Mode: TX 11n HT20 channel 11



13 Maximum Conducted Output Power

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	ANSI C63.10-2020 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	§15.247(b) The maximum peak conducted output power of the intentional radiator shall not exceed 1W.
Test Mode:	Transmitting

13.1 Test Procedure

According to KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019

Section 8.3.1.1 RBW ≥ DTS bandwidth

Subclause 11.9.1.1 of ANSI C63.10 is applicable.

Section 8.3.1.2 Integrated band power method

For measuring the output power of a device transmitting a wide-band noise-like signal where the peak power amplitude is a statistical parameter, the preferred methodology is to use an integrated average power measurement, as described in 8.3.2. The peak integrated band power method of 11.9.1 in ANSI C63.10 is not applicable.

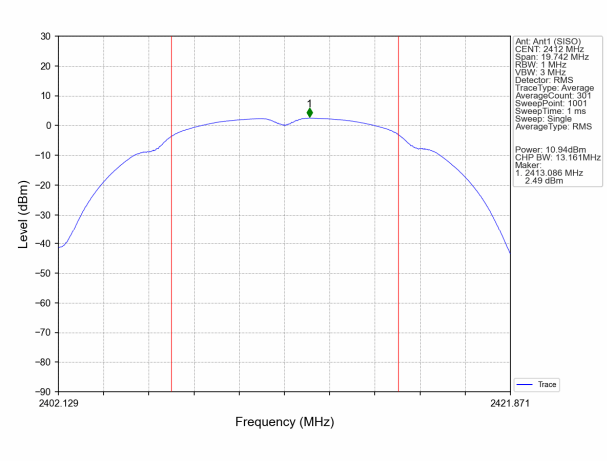
Subclause 11.9.2 of ANSI C63.10 is applicable.

13.2 Test Result

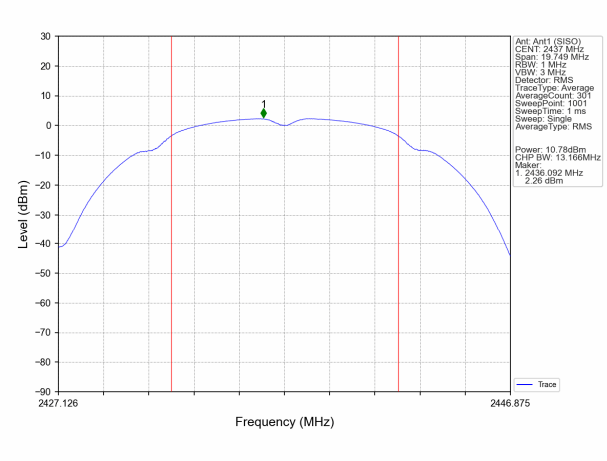
Operation mode	Channel Frequency (MHz)	Conducted Output Power (dBm)	Limit
TX 11b	Low-2412	10.94	1W/30dBm
	Middle-2437	10.78	1W/30dBm
	High-2462	**11.56**	1W/30dBm
TX 11g	Low-2412	10.64	1W/30dBm
	Middle-2437	10.51	1W/30dBm
	High-2462	11.18	1W/30dBm
TX 11n HT20	Low-2412	10.33	1W/30dBm
	Middle-2437	10.24	1W/30dBm
	High-2462	10.89	1W/30dBm

Test Plot:

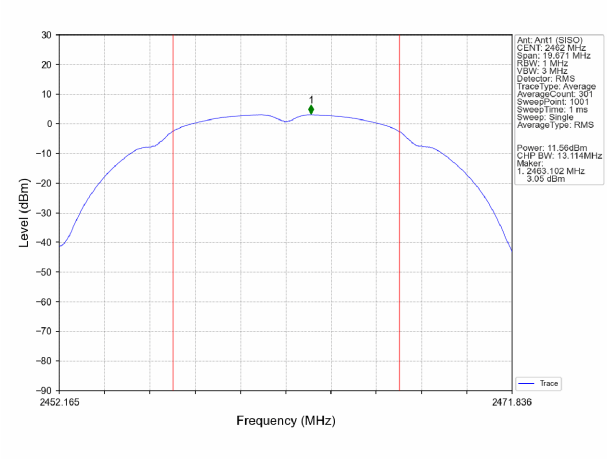
Mode: TX 11b channel 1



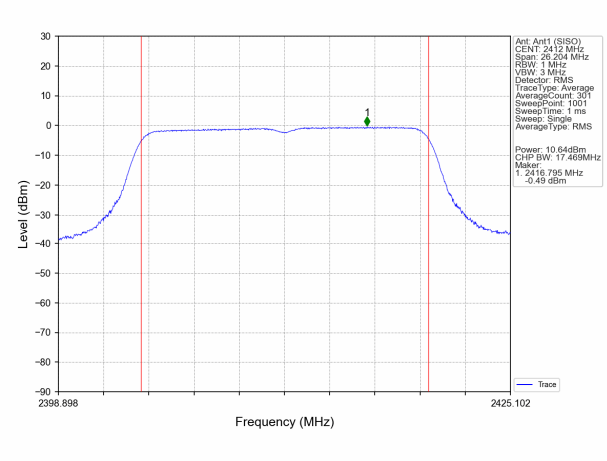
Mode: TX 11b channel 6



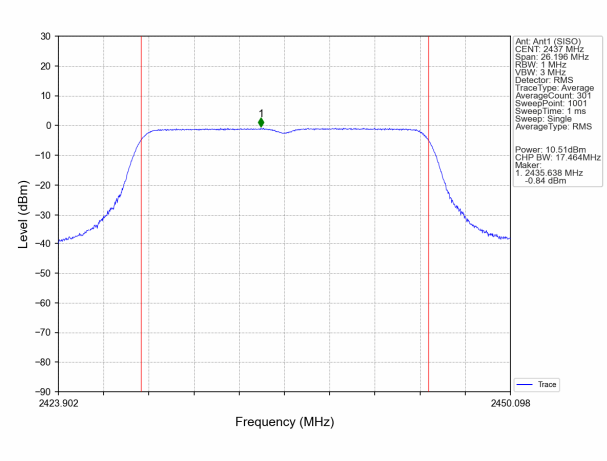
Mode: TX 11b channel 11



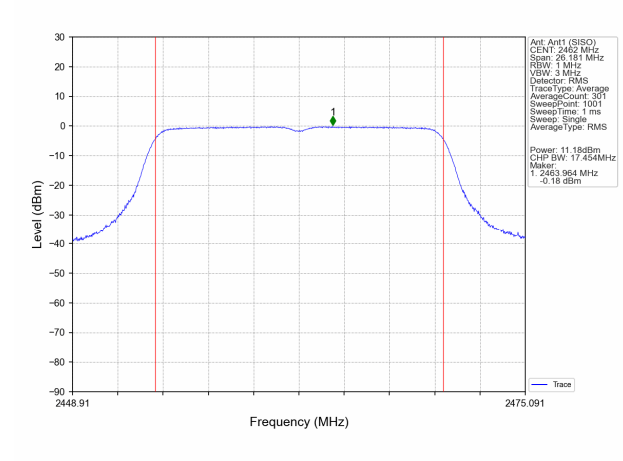
Mode: TX 11g channel 1



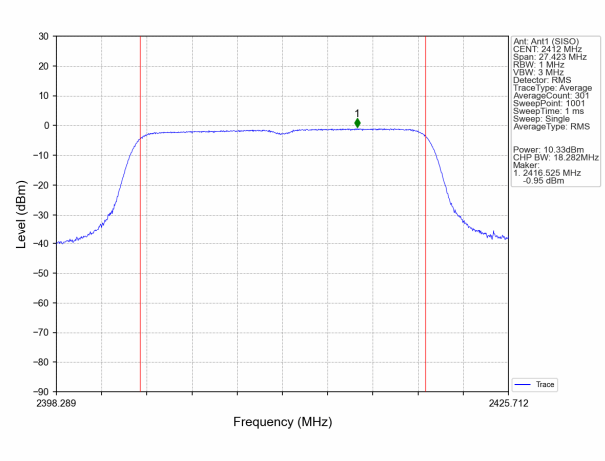
Mode: TX 11g channel 6



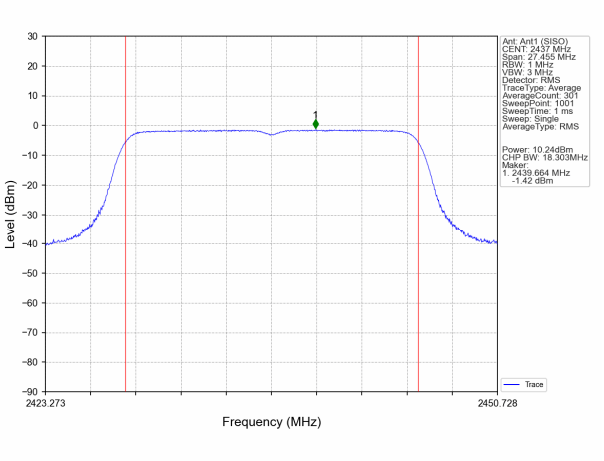
Mode: TX 11g channel 11



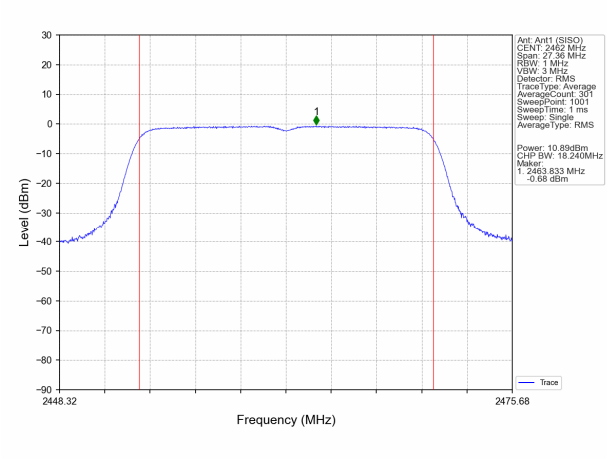
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



14 Power Spectral Density

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	ANSI C63.10-2020 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	§15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
Test Mode:	Transmitting

14.1 Test Procedure

According to KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019 section 8.4

Subclause 11.10 of ANSI C63.10 is applicable.

Choose the test procedure according to the product type

Peak PSD

Subclause 11.10.2 of ANSI C63.10 is applicable.

AVG PSD

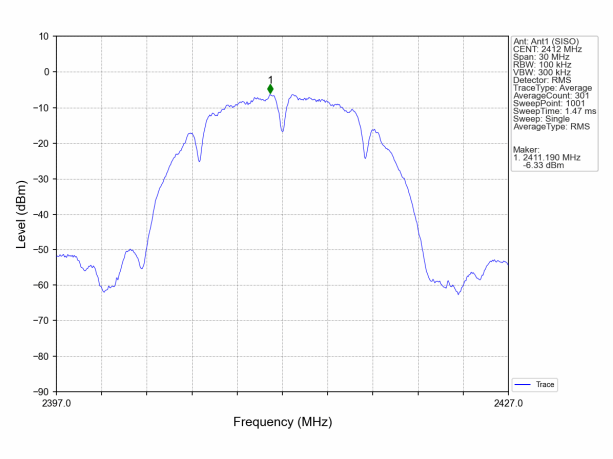
Subclause 11.10.3/4/5/6/7/8 of ANSI C63.10 is applicable.

14.2 Test Result

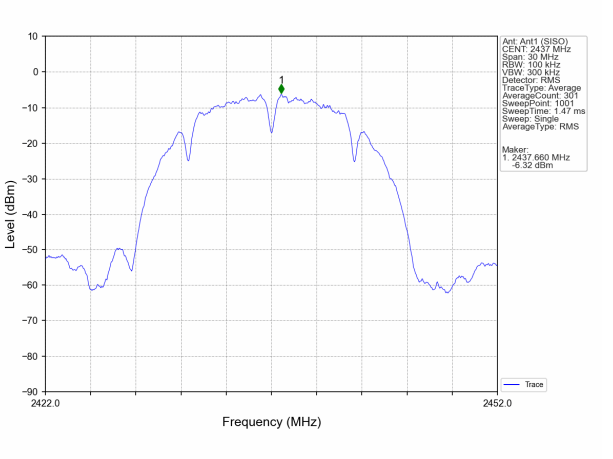
Operation mode	Channel Frequency (MHz)	Power Spectral density (dBm per 100kHz)	Limit
TX 11b	Low-2412	-6.33	8dBm per 3kHz
	Middle-2437	-6.32	8dBm per 3kHz
	High-2462	-5.77	8dBm per 3kHz
TX 11g	Low-2412	-9.17	8dBm per 3kHz
	Middle-2437	-9.65	8dBm per 3kHz
	High-2462	-8.92	8dBm per 3kHz
TX 11n HT20	Low-2412	-9.80	8dBm per 3kHz
	Middle-2437	-10.38	8dBm per 3kHz
	High-2462	-9.55	8dBm per 3kHz

Test Plot:

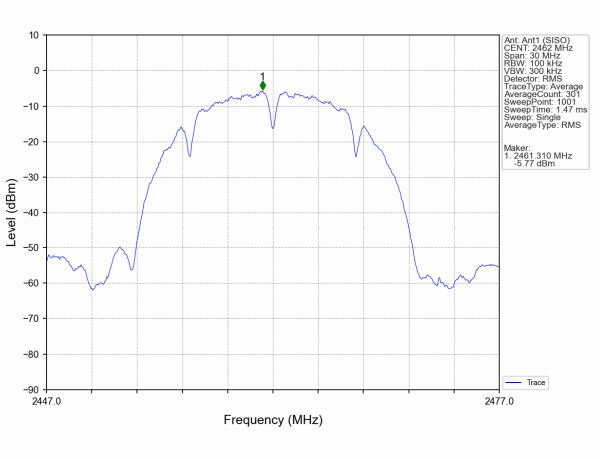
Mode: TX 11b channel 1



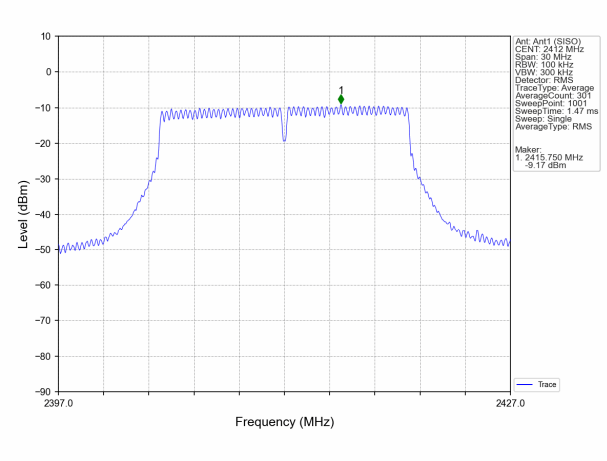
Mode: TX 11b channel 6



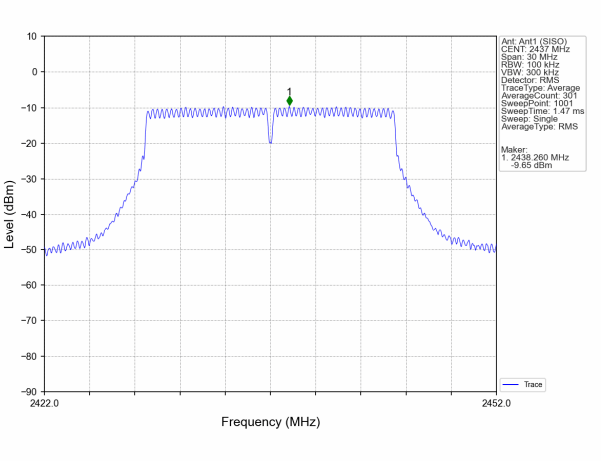
Mode: TX 11b channel 11



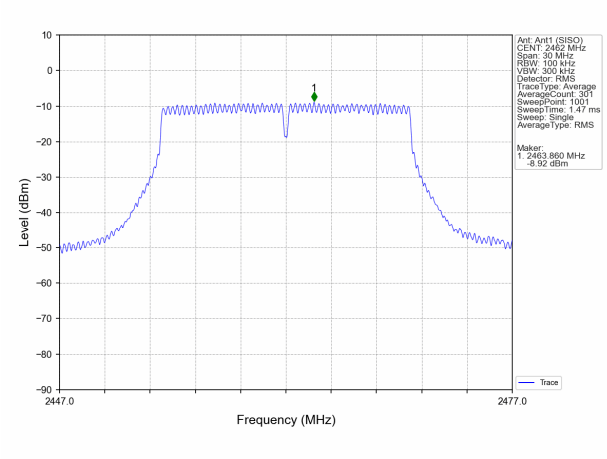
Mode: TX 11g channel 1



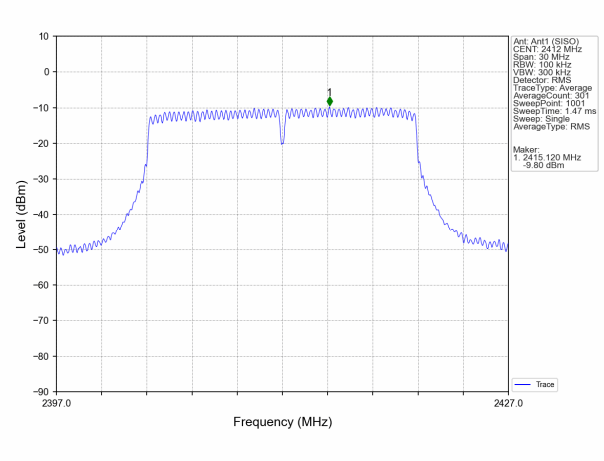
Mode: TX 11g channel 6



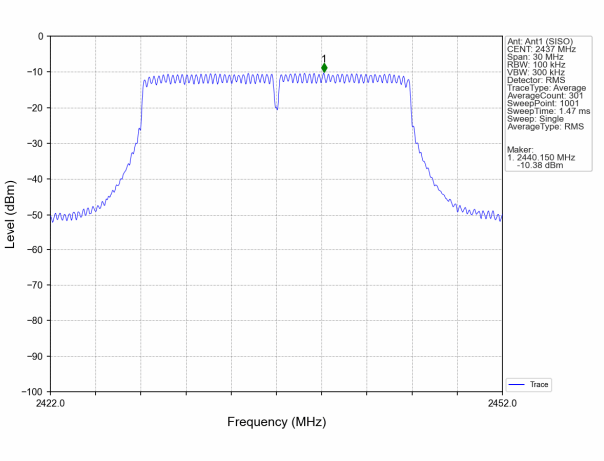
Mode: TX 11g channel 11



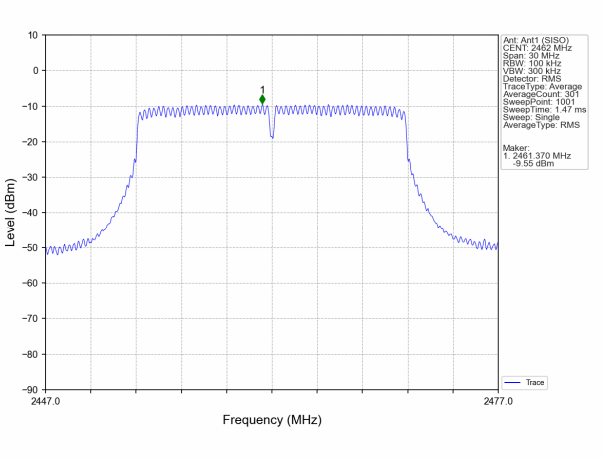
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



15 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, 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. This product has a Ceramic Antenna fulfil the requirement of this section.

Note: Please refer to EUT photos for more details.

16 RF Exposure

Note: Please refer to RF Exposure Report: WTU26D02040331W004.

17 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-CVP-0401-Photos.

======End of Report======