

Report No.: XEWA2310000073RG06

Rev.: 01

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TEST REPORT

Application No.: XEWA2310000073RG
Applicant: Harman International Industries Incorporated
Address of Applicant: 30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer: Harman International Industries Incorporated
Address of Manufacturer: 30001, Cabot Drive, Novi, MI 48377, USA
EUT Description: Toyota La-DCM
Model No.: TYT25_LT_AA
Trade Mark: HARMAN
FCC ID: 2AHPN-TYT25-LT-AA
Standards: FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart E
Date of Receipt: 2023/11/01
Date of Test: 2023/11/22 to 2024/01/08
Date of Issue: 2024/01/10

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Linus Chen
Wireless Laboratory Manager



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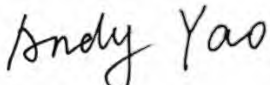
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2024/01/10		Original

Prepared By	 (Leah Chen) / Test Engineer
Checked By	 (Andy Yao) /Reviewer



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2 Test Summary

Test Item	Band ^[1]	FCC rules No.	Test Requirements	Test Result	Result	Lab ^[2]
Antenna Requirement	--	15.203/15.407(a)	--	Clause 4.1	PASS	--
26dB Emission Bandwidth	Band I	15.407(a)(1)	No limit.	Clause 4.5	For Report Purpose	B
	Band II-A	15.407(a)(2)				
	Band II-C	15.407(a)(2)				
6dB Emission Bandwidth	Band III	15.407(e)	≥ 500 kHz.	Clause 4.6	PASS	B
99% Occupied Bandwidth	Band I	KDB 789033 D02§ D	No limit.	Clause 4.7	For Report Purpose	B
	Band II-A					
	Band II-C					
	Band III					
Duty Cycle	Band I Band II-A Band II-C Band III	--	No limit.	Clause 4.3	For Report Purpose	B
Maximum Conducted Output Power	Band I	15.407(a)(ii)	<1W	Clause 4.4	PASS	B
	Band II-A	15.407(a)(2)	<MIN{250mW, 11dBm+10*lg(EBW)}			
	Band II-C					
	Band III	15.407(a)(3)	< 1W			
Maximum Power Spectral Density	Band I	15.407(a)(ii)	< 17dBm/MHz	Clause 4.8	PASS	B
	Band II-A	15.407(a)(2)	<11dBm/MHz			
	Band II-C					
	Band III	15.407(a)(3)	<30dBm/500KHz			
Radiated Spurious Emissions	Band I	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.15-5.35 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).	Clause 4.9	PASS	A
	Band II-A	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.25-5.35 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).		PASS	
	Band II-C	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP). F≥1GHz & out-restricted: <-27dBm/MHz PK e.i.r.p. (exl. 5.47-5.725 GHz). F≥1GHz & in-restricted: §15.209 limit (AV&PK).		PASS	



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	Band III	15.407(b) 15.205/15.209	F<1GHz: §15.209 limit (QP) F≥1GHz &out-restricted:(PK) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. F≥1GHz & in-restricted: §15.209 limit (AV&PK).		PASS																					
Restricted bands around fundamental frequency	Band I Band II-A Band II-C Band III	15.407(b) 15.205/15.209	---	Clause 4.10	PASS	A																				
AC Power Line Conducted Emissions	Band I Band II-A Band II-C Band III	15.207	---	Clause 4.2	PASS	A																				
Dynamic Frequency Selection	Band II-A Band II-C	15.407	DFS Detection Thresholds: <table><tr><th>Maximum Transmit Power</th><th>Value (See Notes 1, 2, and 3)</th></tr><tr><td>EIRP ≥ 200 milliwatt</td><td>-64 dBm</td></tr><tr><td>EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz</td><td>-62 dBm</td></tr><tr><td>EIRP < 200 milliwatt that do not meet the power spectral density requirement</td><td>-64 dBm</td></tr></table> Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01. DFS Response Requirement: <table><tr><th>Parameter</th><th>Value</th></tr><tr><td>Non-occupancy period</td><td>Minimum 30 minutes</td></tr><tr><td>Channel Availability Check Time</td><td>60 seconds</td></tr><tr><td>Channel Move Time</td><td>10 seconds See Note 1.</td></tr><tr><td>Channel Closing Transmission Time</td><td>200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period See Notes 1 and 2.</td></tr><tr><td>U-NII Detection Bandwidth</td><td>Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.</td></tr></table> Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	Maximum Transmit Power	Value (See Notes 1, 2, and 3)	EIRP ≥ 200 milliwatt	-64 dBm	EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm	EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm	Parameter	Value	Non-occupancy period	Minimum 30 minutes	Channel Availability Check Time	60 seconds	Channel Move Time	10 seconds See Note 1.	Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period See Notes 1 and 2.	U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.	Clause 4.1	PASS	B
Maximum Transmit Power	Value (See Notes 1, 2, and 3)																									
EIRP ≥ 200 milliwatt	-64 dBm																									
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm																									
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm																									
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Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period See Notes 1 and 2.																									
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.																									
Frequency Stability	Band I Band II-A Band II-C Band III	15.407(g)	Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual	N/A	N/A	N/A																				
Note 1:																										

Note 1:



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Band I: 5150-5250MHz
Band II-A: 5250-5350MHz
Band II-C: 5470-5725MHz
Band III: 5725-5850MHz

Note 2:

Lab A SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.

Lab B Compliance Certification Services (Kunshan) Inc.



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3 General Information

3.1 Details of Client

Applicant:	Harman International Industries Incorporated
Address of Applicant:	30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer:	Harman International Industries Incorporated
Address of Manufacturer:	30001, Cabot Drive, Novi, MI 48377, USA

3.2 Test Location

Lab A:	
Company:	SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Address:	1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi' an, Shaanxi China
Post code:	710086
Test engineer:	Jacky Xue
Lab B:	
Company:	Compliance Certification Services (Kunshan) Inc.
Address:	No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.
Contact Information:	Tel: +86 512 5735 5888 Fax: +86 512 5737 0818
Test engineer:	Hans Han



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3.3 Test Facility

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

Lab A:

•A2LA (Certificate No. 4854.01)

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0095.

IC#: 25613.

• FCC –Designation Number: CN1337

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized as an accredited testing laboratory.

Designation Number: CN1337.

Test Firm Registration Number: 917410

Lab B:

• A2LA

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

• FCC

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

• ISED

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 2324E

• VCCI

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.:R-20134, R-11600, C-11707, T-11499, G-10216 respectively.



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3.4 General Description of EUT

EUT Description:	Toyota La-DCM	
Model No.:	TYT25_LT_AA	
Trade Mark:	HARMAN	
Hardware Version:	0.0.3	
Software Version:	TYTLLADCM_R04.5D	
Power Supply:	12V	
IMEI:	RF Conducted	356590670015700
	RSE & AC power line	356590670015866
WLAN Mode Supported:	802.11a:	20 MHz channel bandwidth
	802.11n:	20 MHz / 40 MHz channel bandwidth
	802.11ac:	20 MHz / 40 MHz / 80 MHz channel bandwidth
Operation Frequency:	5150MHz to 5250MHz 5250MHz to 5350MHz 5470MHz to 5725MHz 5725MHz to 5850MHz	
Modulation Type:	802.11a:	OFDM (BPSK, QPSK, 16QAM, 64QAM)
	802.11n:	OFDM (BPSK, QPSK, 16QAM, 64QAM)
	802.11ac:	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Spacing:	20MHz:	802.11a/n(HT20)/ac(VHT20)
	40MHz:	802.11n(HT40)/ac(VHT40)
	80MHz:	802.11ac(VHT80)
Antenna Type:	☐ External, ☒ Integrated	
Antenna Gain:	5150MHz to 5250MHz: 3.59 dBi(Ant2); 5250MHz to 5350MHz: 4.08 dBi(Ant2); 5470MHz to 5725MHz: 4.33 dBi(Ant2); 5725MHz to 5850MHz: 4.90 dBi(Ant2);	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
Smart System:	☒ SISO	802.11a/n/ac
	☐ MIMO	CDD: 802.11a/n/ac: Tx & Rx
		STBC: 802.11n/ac: Tx & Rx
		TXBF: 802.11n/ac: Tx & Rx
	☐ Diversity	802.11a: Tx & Rx



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TPC Function:	☒ Support, ☐ Not Support	
Use Conditions:	Indoor	
DFS Function:	☒ Master	
	☐ Slave with radar detection	☐ Slave without radar detection
RF Cable:	1.0dB	
Remark: As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.		

Remark: In FCC 15.31, for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table, and the selected channel to perform the test as below:		
Frequency range over which device operates	Number of Measurement Frequencies Required	Location of Measurement Frequency in Band of Operation
1 MHz or less	1	centre
1 MHz to 10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near centre

For UNII Band I:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5180
	The Middle channel	5200
	The Highest channel	5240
IEEE 802.11n/ac 40MHz	The Lowest channel	5190
	The Highest channel	5230
IEEE 802.11ac 80MHz	The Middle channel	5210



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For UNII Band II-A:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5260
	The Middle channel	5280
	The Highest channel	5320
IEEE 802.11n/ac 40MHz	The Lowest channel	5270
	The Highest channel	5310
IEEE 802.11ac 80MHz	The Middle channel	5290

For UNII Band II-C:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5500
	The Middle channel	5580
	The Highest channel	5700
IEEE 802.11n/ac 40MHz	The Lowest channel	5510
	The Middle channel	5550
	The Highest channel	5670
IEEE 802.11ac 80MHz	The Middle channel	5530

For UNII Band III:		
Mode	Channel	Frequency(MHz)
IEEE 802.11a/n/ac 20MHz	The Lowest channel	5745
	The Middle channel	5785
	The Highest channel	5825
IEEE 802.11n/ac 40MHz	The Lowest channel	5755
	The Highest channel	5795
IEEE 802.11ac 80MHz	The Middle channel	5775



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3.5 Test Environment and Mode

Environment Parameter	96.0~101.0 kPa Selected Values During Tests	
Relative Humidity	40-60 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~25	12
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

The EUT has been tested as an independent unit.

3.7 Worst-case configuration and mode

Low data rate was used to test on antenna port conducted tests and radiated spurious emissions since it has the highest maximum power. Following are the worst-case data rates set for test:

Modulation Type	SISO - Data Rate	MIMO - Data Rate
802.11a	6 Mbps	/
802.11n (HT 20)	MCS0 (6.5 Mbps)	/
802.11n (HT 40)	MCS0 (13.5 Mbps)	/
802.11ac (VHT 20)	MCS0 (6.5 Mbps)	/
802.11ac (VHT 40)	MCS0 (13.5 Mbps)	/
802.11ac (VHT 80)	MCS0 (29.3 Mbps)	/



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15 Section 15.203
The antenna is Integrated Antenna and no consideration of replacement. The best case gain of the antenna is 5150MHz to 5250MHz: 3.59 dBi(Ant2);* 5250MHz to 5350MHz: 4.08 dBi(Ant2);* 5470MHz to 5725MHz: 4.33 dBi(Ant2);* 5725MHz to 5850MHz: 4.90 dBi(Ant2);* <i>*Note:</i> <i>The antenna gain are derived from the gain information report provided by the manufacturer.</i> <i>Remark:</i> <i>As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</i>	



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4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15 Section 15.207		
Test Method:	ANSI C63.10-2013 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
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:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10-2013 on conducted measurement.		



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Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. DC Supply+ Transmitting mode.
Final Test Mode:	Refer to section 3.7 for details. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass

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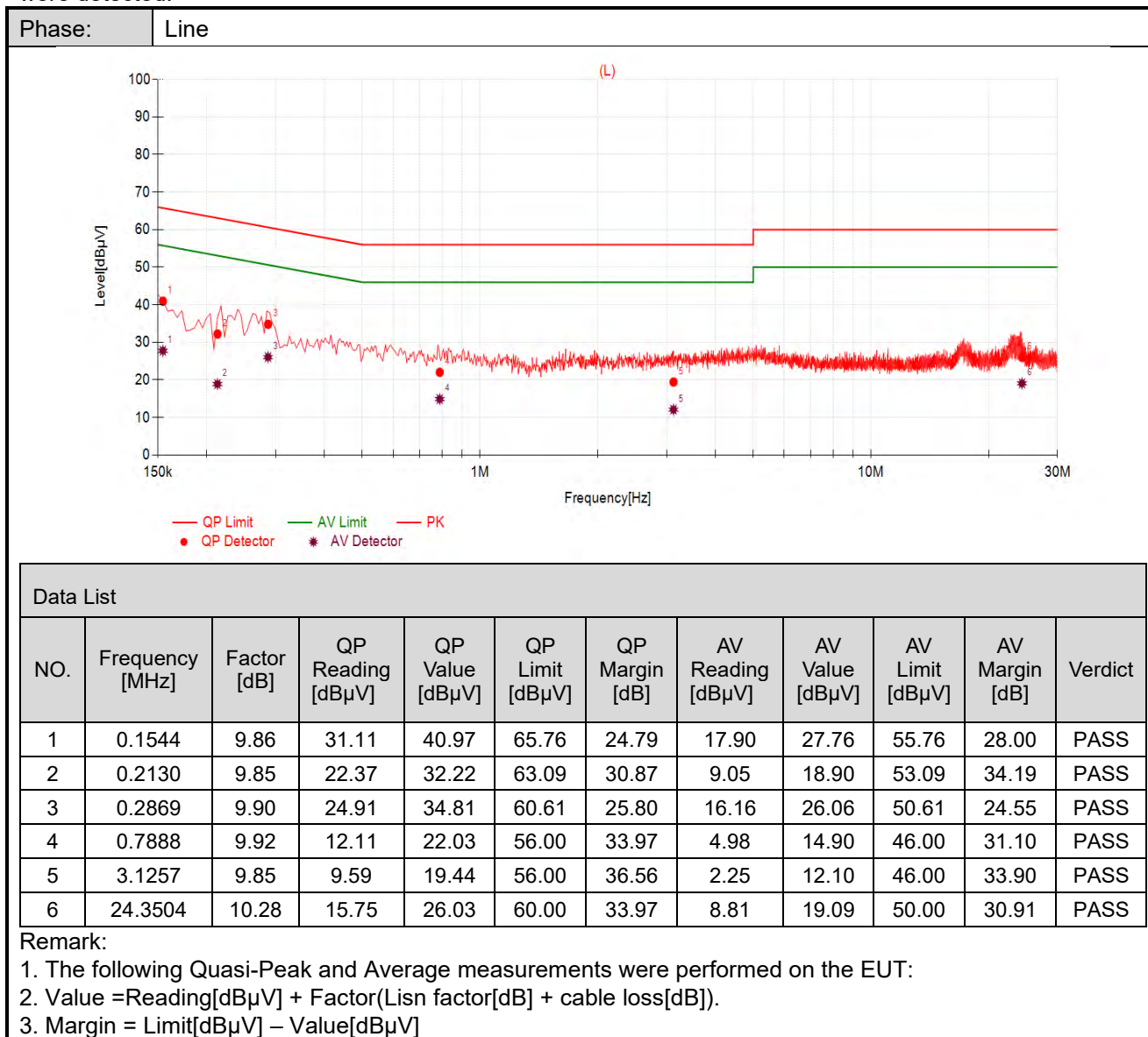
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

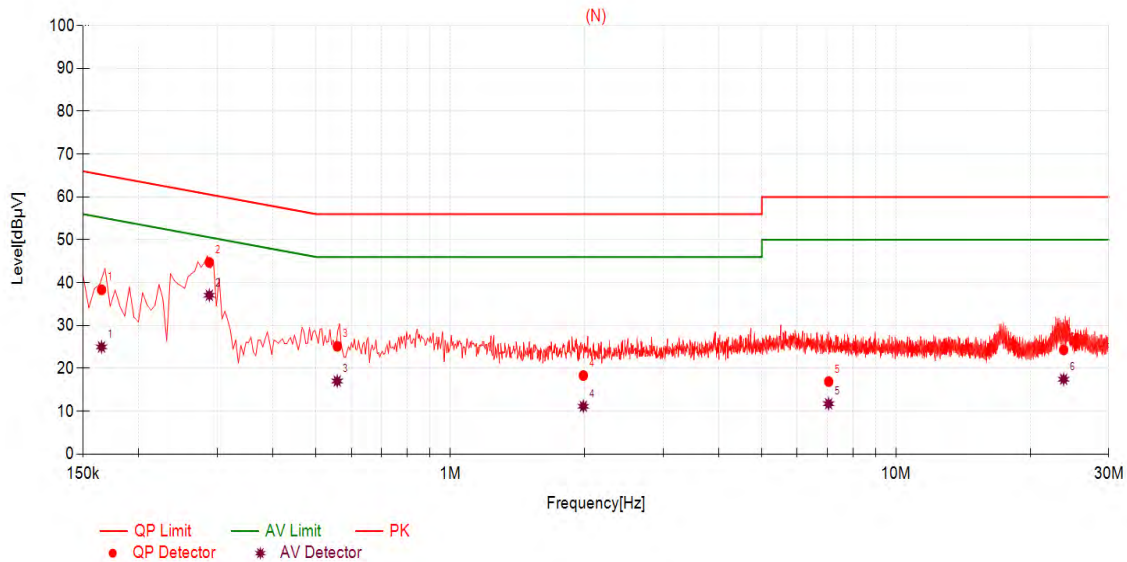


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Phase: Neutral



Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1650	9.79	28.57	38.36	65.21	26.85	15.23	25.02	55.21	30.19	PASS
2	0.2879	9.79	34.94	44.73	60.59	15.86	27.27	37.06	50.59	13.53	PASS
3	0.5575	9.86	15.30	25.16	56.00	30.84	7.19	17.05	46.00	28.95	PASS
4	1.9879	9.85	8.49	18.34	56.00	37.66	1.31	11.16	46.00	34.84	PASS
5	7.0599	10.05	6.88	16.93	60.00	43.07	1.71	11.76	50.00	38.24	PASS
6	23.7701	10.30	14.02	24.32	60.00	35.68	7.17	17.47	50.00	32.53	PASS

Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Value = Reading[dBμV] + Factor(Lin factor[dB] + cable loss[dB]).
3. Margin = Limit[dBμV] – Value[dBμV]



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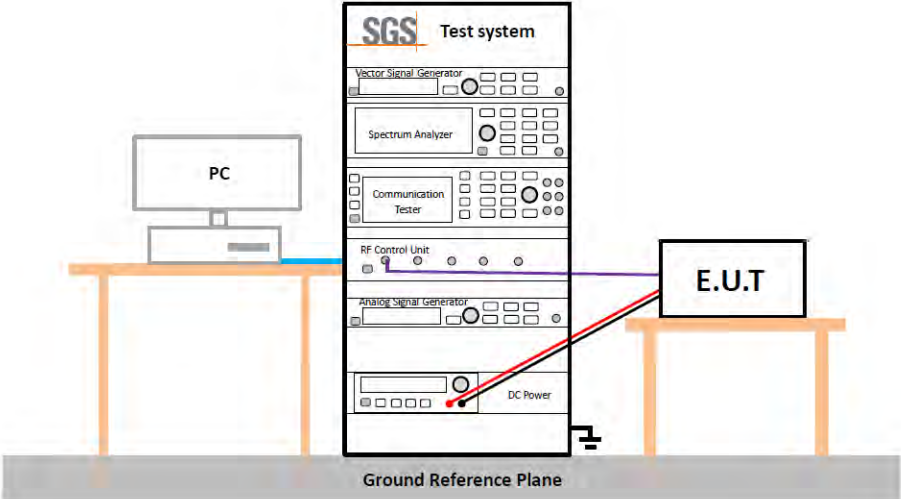
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4.3 Duty Cycle

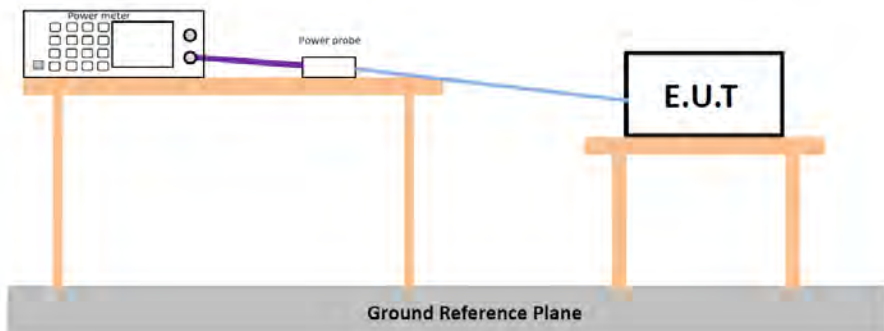
Test Requirement:	ANSI C63.10-2013 Section 12.2
Test Method:	ANSI C63.10-2013 Section 12.2
Test Setup:	
Instruments Used:	Refer to section 6 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits
Test Results:	For report purpose
The detailed test data see: Appendix	

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4.4 Conducted Output Power

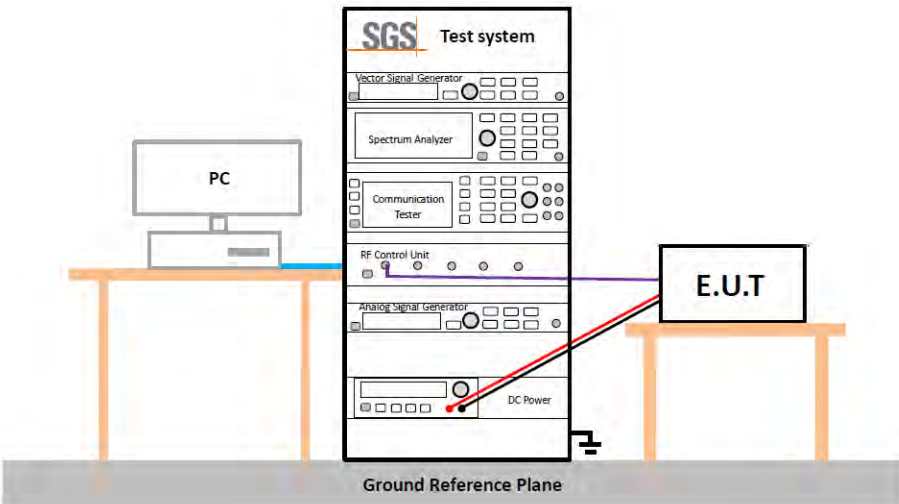
Test Requirement:	47 CFR Part 15 Section 15.407(a)	
Test Method:	ANSI C63.10-2013 Section 12.3.3.2	
Test Setup:	 * Test with power meter (Detector function: Average) Method PM-G is measurement using a gated RF average power meter. Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.	
Test Instruments:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency Band	Limit
	5150-5250MHz	Not exceed 1W(30dBm)
	5250-5350MHz	The lesser of 250mW(23.98dBm) or 11+ 10logB
	5470-5725MHz	The lesser of 250mW(23.98dBm) or 11+ 10logB
	5725-5850MHz	Not exceed 1W(30dBm)
	*Where B is the 26dB emission bandwidth in MHz	
Test Results:	Pass	
The detailed test data see: Appendix		

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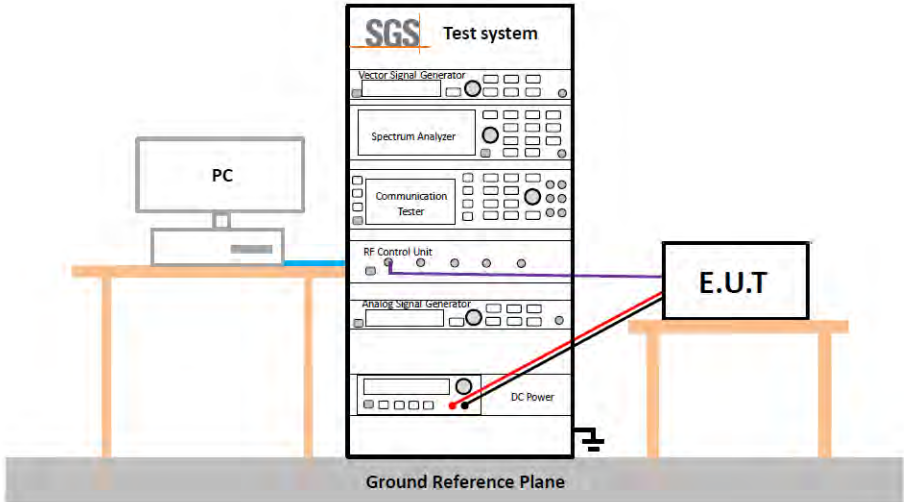
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4.5 26dB Emission Bandwidth

Test Requirement:	47 CFR Part 15 Section 15.407(a), KDB 789033 D02& C
Test Method:	ANSI C63.10-2013 Section 12.4.1
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits
Test Results:	For Report Purpose
The detailed test data see: Appendix	

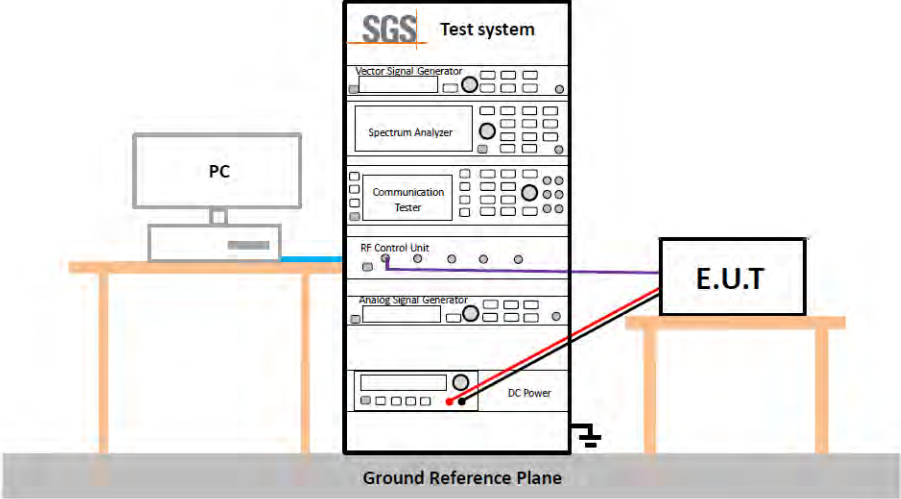
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4.6 6dB Emission Bandwidth

Test Requirement:	47 CFR Part 15 Section 15.407(e)	
Test Method:	ANSI C63.10-2013 Section 12.4.1	
Test Setup:		
Test Instruments:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency Band	Limit
	5725-5850MHz	At least 500kHz
Test Results:	Pass	
The detailed test data see: Appendix		

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4.7 99% Occupied Bandwidth

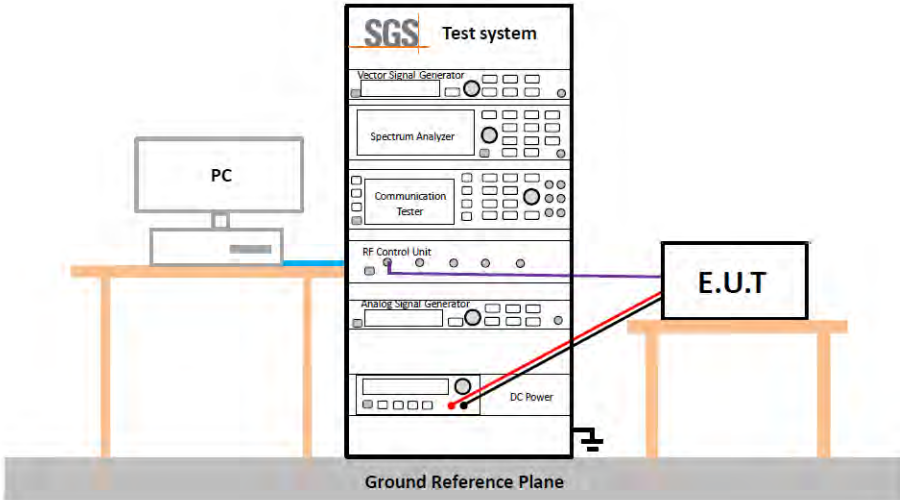
Test Requirement:	KDB 789033 D02§ D
Test Method:	ANSI C63.10-2013 Section 12.4.2
Test Setup:	
Instruments Used:	Refer to section 6 for details.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Refer to section 3.7 for details.
Limit:	No restriction limits
Test Results:	For Report Purpose
The detailed test data see: Appendix	

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4.8 Power Spectral Density

Test Requirement:	47 CFR Part 15 Section 15.407(a)	
Test Method:	ANSI C63.10-2013 Section 12.5 KDB 789033 D02 v02r01, Section F.	
Test Setup:		
Instruments Used:	Refer to section 6 for details.	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates	
Final Test Mode:	Refer to section 3.7 for details.	
Limit:	Frequency Band	Limit
	5150-5250MHz	The power spectral density less than 17dBm/1MHz
	5250-5350MHz	The power spectral density less than 11dBm/1MHz
	5470-5725MHz	The power spectral density less than 11dBm/1MHz
	5725-5850MHz	The power spectral density less than <30dBm/500KHz
Test Results:	Pass	
The detailed test data see: Appendix		

4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15 Section 15.205/15.209/15.407(b)
Test Method:	ANSI C63.10-2013 Section 6.4 / 6.5 / 6.6
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)
Test frequency:	9kHz ~ 40GHz(or 10 Harmonic)

Test Setup:

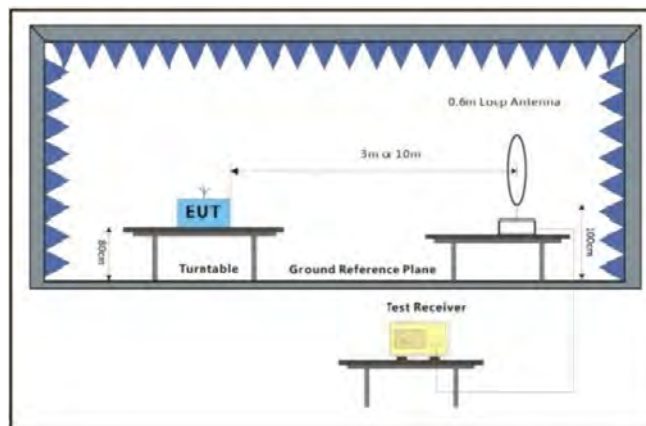


Figure 1. 9kHz to 30MHz

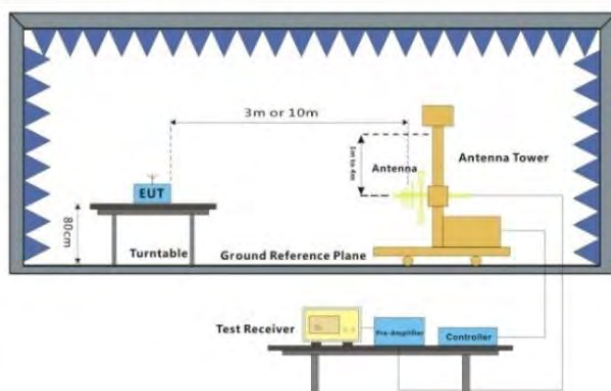


Figure 1. 30MHz to 1GHz

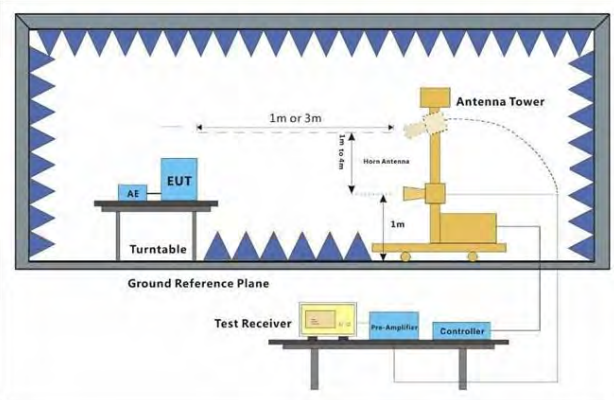


Figure 2. Above 1 GHz

Test Procedure:

- For below 1GHz test, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz test, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. (Distance from antenna to EUT is 1m for measurements >18GHz).
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

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	d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Test the EUT in the outermost channels. h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete. j. The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported k. The disturbance above 18GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. l. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.
Test Configuration:	Measurements below 30MHz • RBW = 10 kHz • VBW = 30 kHz • Detector = Peak & Average & Quasi-peak • Trace mode = max hold Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW $\geq 3 \text{ MHz}$ • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10Hz, when duty cycle is no less than 98 percent. • VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates.



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	DC Supply+ Transmitting mode.
Final Test Mode:	Refer to section 3.7 for details. For below 1GHz part, through pre-scan all channels, but only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



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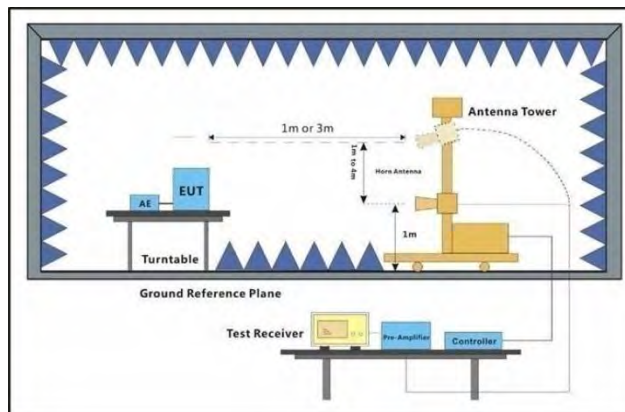
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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15 Section 15.205/15.209/15.407(b)		
Test Method:	ANSI C63.10-2013 Section 12.7		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test Setup:



Test Procedure:

- The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and

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	modulation for lowest and highest channel. g. Test the EUT in the outermost channels. h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete.
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW $\geq$ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10Hz, when duty cycle is no less than 98 percent. • VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. DC Supply+ Transmitting mode.
Final Test Mode:	Refer to section 3.7 for details.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass
The detailed test data see: Appendix	



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4.11 Dynamic Frequency Selection

4.11.1 DFS Measurement Configuration

Test Condition	Conducted Measurement Use 50 Ohms to connect cable/connector calibration and testing, Use wifi2 port for testing. Refer to Section 4.11.7 for test connection.
----------------	---

4.11.2 DFS Threshold level

DFS Threshold level:(-57.92; -57.67)dBm	☒ At the antenna connector ☐ In front of the antenna
The Interference Radar Detection Threshold Level is: (Band II-A: -62dBm + 4.08dBi + 0dB = -57.92dBm); (Band II-C: -62dBm + 4.33dBi + 0dB = -57.67dBm) That had been taken into account the output power range and antenna gain.	

4.11.3 Power-on cycle

The time required for the Master Device and/or Client Device to complete its power-on cycle(1.945S).
--

4.11.4 User Access Restrctions

DFS Controls(Hardware or software) related to radar detection are NOT accessible to the user. Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user.

4.11.5 Channel Loading/Data Streaming

☐	The dara file(MPEG-4) has been transmitting in a streaming mode.
☒	Software to ping the client is permitted to simuate data transfer with random ping intervals.
☒	Minimum channel loading of approximately 17%.
☐	Unicast protocol has been used.



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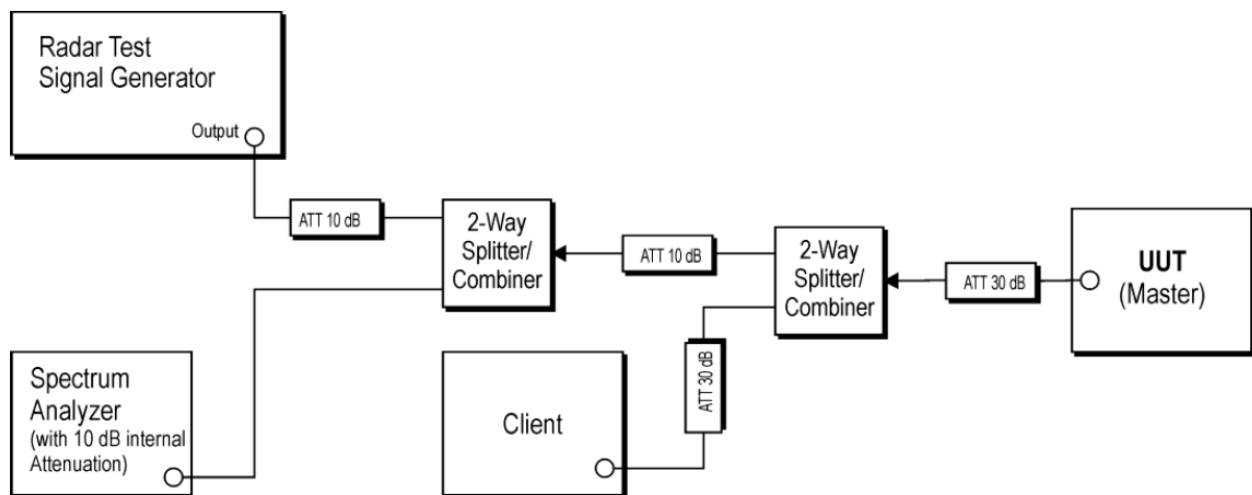
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4.11.6 Conducted Setup of Calibration of DFS Detection Threshold Level



4.11.7 Test Setup



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4.11.8 Test Procedures

4.11.8.1 U-NII Detection Bandwidth

Adjust the equipment to produce a single *Burst* of any one of the Short Pulse Radar Types 0 – 4 in **Table 5** at the center frequency of the UUT *Operating Channel* at the specified *DFS Detection Threshold* level found in **Table 3**.

Set the UUT up as a standalone device (no associated Client or Master, as appropriate) and no traffic. Frame based systems will be set to a talk/listen ratio reflecting the worst case (maximum) that is user configurable during this test.

Generate a single radar *Burst*, and note the response of the UUT. Repeat for a minimum of 10 trials. The UUT must detect the *Radar Waveform* within the DFS band using the specified *U-NII Detection Bandwidth* criterion shown in **Table 4**. In cases where the channel bandwidth may exceed past the DFS band edge on specific channels (i.e., 802.11ac or wideband frame based systems) select a channel that has the entire emission bandwidth within the DFS band. If this is not possible, test the detection BW to the DFS band edge. Starting at the center frequency of the UUT operating *Channel*, increase the radar frequency in 5 MHz steps, repeating the above test sequence, until the detection rate falls below the *U-NII Detection Bandwidth* criterion specified in **Table 4**. Repeat this measurement in 1MHz steps at frequencies 5 MHz below where the detection rate begins to fall. Record the highest frequency (denote as FH) at which detection is greater than or equal to the *U-NII Detection Bandwidth* criterion. Recording the detection rate at frequencies above FH is not required to demonstrate compliance.

Starting at the center frequency of the UUT operating *Channel*, decrease the radar frequency in 5 MHz steps, repeating the above test sequence, until the detection rate falls below the *U-NII Detection Bandwidth* criterion specified in **Table 4**. Repeat this measurement in 1MHz steps at frequencies 5 MHz above where the detection rate begins to fall. Record the lowest frequency (denote as FL) at which detection is greater than or equal to the *U-NII Detection Bandwidth* criterion. Recording the detection rate at frequencies below FL is not required to demonstrate compliance.

The *U-NII Detection Bandwidth* is calculated as follows:

U-NII Detection Bandwidth = FH – FL

The *U-NII Detection Bandwidth* must meet the *U-NII Detection Bandwidth* criterion specified in **Table 4**. Otherwise, the UUT does not comply with DFS requirements. This is essential to ensure that the UUT is capable of detecting *Radar Waveforms* across the same frequency spectrum that contains the significant energy from the system. In the case that the *U-NII Detection Bandwidth* is greater than or equal to the 99 percent power bandwidth for the measured FH and FL, the test can be truncated and the *U-NII Detection Bandwidth* can be reported as the measured FH and FL.

4.11.8.2 Performance Requirements Check

The following tests must be performed for U-NII device certification: Initial *Channel Startup Check* with a radar *Burst* at start of *Channel Availability Check* and with a radar *Burst* at end of *Channel Availability Check*; *In-Service Monitoring*; and the 30 minute *Non-Occupancy Period*.

4.11.8.3 Initial Channel Availability Check Time

The Initial *Channel Availability Check Time* tests that the UUT does not emit beacon, control, or data signals on the test *Channel* until the power-up sequence has been completed and the U-NII device checks for *Radar Waveforms* for one minute on the test *Channel*. This test does not use any *Radar Waveforms* and only needs to be performed one time.

a) The U-NII devices will be powered on and be instructed to operate on the appropriate U-NII *Channel* that must incorporate DFS functions. At the same time the UUT is powered on, the spectrum analyzer will be set to zero span mode with a 3 MHz RBW and 3 MHz VBW on the *Channel* occupied by the radar (Chr) with a 2.5 minute sweep time. The spectrum analyzer's sweep will be started at the same time power is applied to



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the U-NII device.

b) The UUT should not transmit any beacon or data transmissions until at least 1 minute after the completion of the power-on cycle.

c) Confirm that the UUT initiates transmission on the channel

This measurement can be used to determine the length of the power-on cycle if it is not supplied by the manufacturer. If the spectrum analyzer sweep is started at the same time the UUT is powered on and the UUT does not begin transmissions until it has completed the cycle, the power-on time can be determined by comparing the two times.

4.11.8.4 Radar Burst at the Beginning of the Channel Availability Check Time

The steps below define the procedure to verify successful radar detection on the test *Channel* during a period equal to the *Channel Availability Check Time* and avoidance of operation on that *Channel* when a radar *Burst* with a level equal to the *DFS Detection Threshold* + 1 dB occurs at the beginning of the *Channel Availability Check Time*. This is illustrated in **Figure 15**.

a) The *Radar Waveform* generator and UUT are connected using the applicable test setup described in the sections on configuration for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

b) The UUT is powered on at T0. T1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}). The *Channel Availability Check Time* commences on Chr at instant T1 and will end no sooner than T1 + T_{ch_avail_check}.

c) A single *Burst* of one of the Short Pulse Radar Types 0-4 will commence within a 6 second window starting at T1. An additional 1 dB is added to the radar test signal to ensure it is at or above the *DFS Detection Threshold*, accounting for equipment variations/errors.

d) Visual indication or measured results on the UUT of successful detection of the radar *Burst* will be recorded and reported. Observation of Chr for UUT emissions will continue for 2.5 minutes after the radar *Burst* has been generated.

e) Verify that during the 2.5 minute measurement window no UUT transmissions occurred on Chr. The *Channel Availability Check* results will be recorded.



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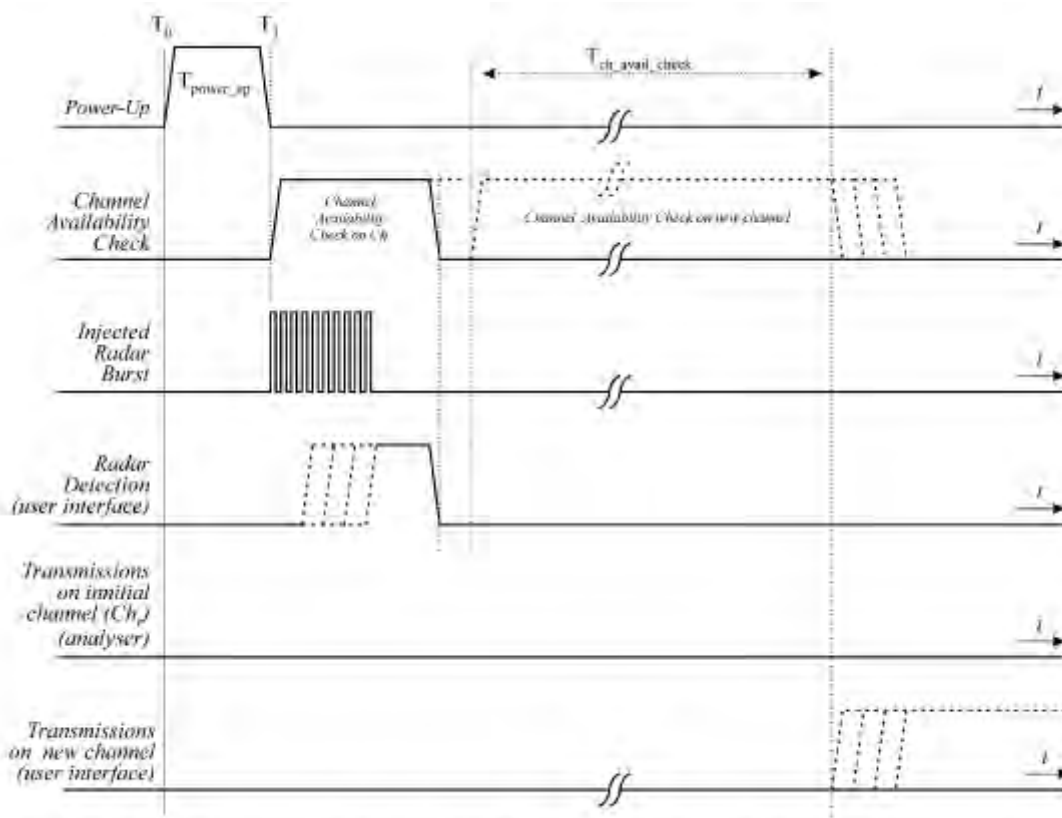


Figure 15: Example of timing for radar testing at the beginning of the Channel Availability Check Time

4.11.8.5 Radar Burst at the End of the Channel Availability Check Time

The steps below define the procedure to verify successful radar detection on the test *Channel* during a period equal to the *Channel Availability Check Time* and avoidance of operation on that *Channel* when a radar *Burst* with a level equal to the *DFS Detection Threshold* + 1dB occurs at the end of the *Channel Availability Check Time*. This is illustrated in **Figure 16**.

- The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.
- The UUT is powered on at T_0 . T_1 denotes the instant when the UUT has completed its power-up sequence (T_{power_up}). The *Channel Availability Check Time* commences on Ch_r at instant T_1 and will end no sooner than $T_1 + Tch_avail_check$.
- A single *Burst* of one of the Short Pulse Radar Types 0-4 will commence within a 6 second window starting at $T_1 + 54$ seconds. An additional 1 dB is added to the radar test signal to ensure it is at or above the *DFS Detection Threshold*, accounting for equipment variations/errors.
- Visual indication or measured results on the UUT of successful detection of the radar *Burst* will be recorded and reported. Observation of Ch_r for UUT emissions will continue for 2.5 minutes after the radar *Burst* has been generated.
- Verify that during the 2.5 minute measurement window no UUT transmissions occurred on Ch_r . The *Channel Availability Check* results will be recorded.



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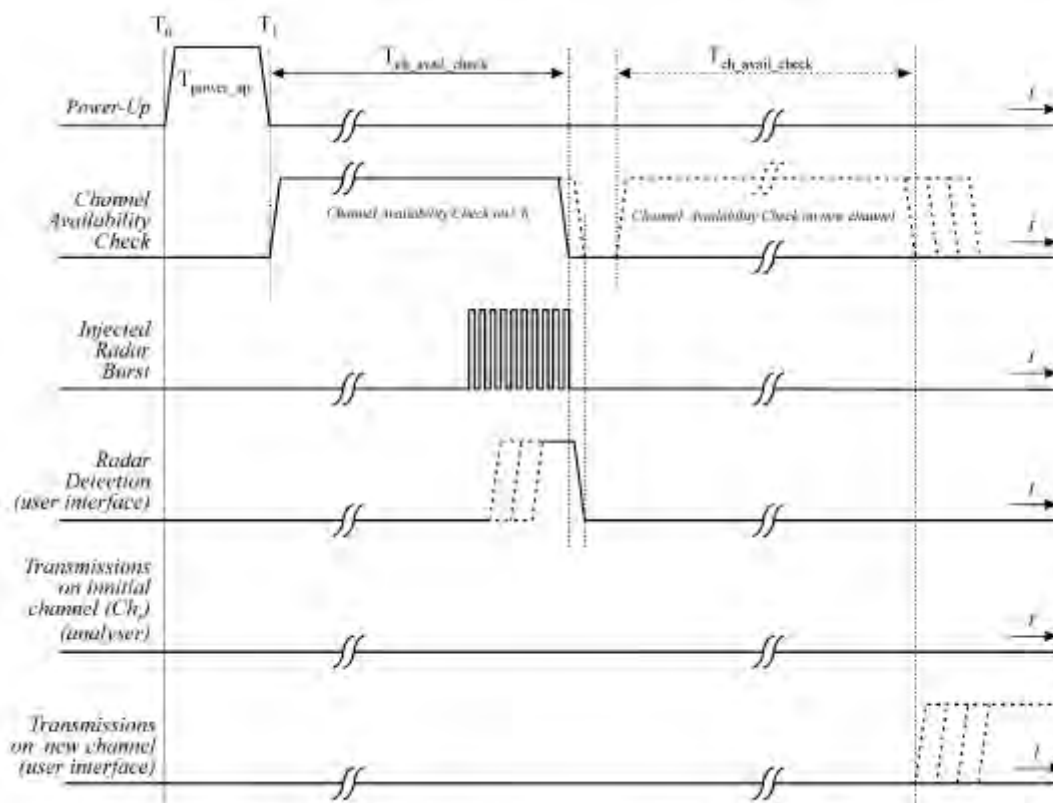


Figure 16: Example of timing for radar testing towards the end of the Channel Availability Check Time

4.11.8.6 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

These tests define how the following DFS parameters are verified during *In-Service Monitoring*;

- Channel Closing Transmission Time
- Channel Move Time
- Non-Occupancy Period

The steps below define the procedure to determine the above mentioned parameters when a radar *Burst* with a level equal to the *DFS Detection Threshold* + 1dB is generated on the *Operating Channel* of the U-NII device (*In-Service Monitoring*).

- One frequency will be chosen from the *Operating Channels* of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands. For 802.11 devices, the test frequency must contain control signals. This can be verified by disabling channel loading and monitoring the spectrum analyzer. If no control signals are detected, another frequency must be selected within the emission bandwidth where control signals are detected.
- In case the UUT is a U-NII device operating as a *Client Device* (with or without DFS), a U-NII device operating as a *Master Device* will be used to allow the UUT (Client device) to *Associate* with the *Master Device*. In case the UUT is a *Master Device*, a U-NII device operating as a *Client Device* will be used and it is assumed that the Client will *Associate* with the UUT (Master). In both cases for conducted tests, the *Radar Waveform* generator will be connected to the *Master Device*. For radiated tests, the emissions of the *Radar Waveform* generator will be directed towards the *Master Device*. If the *Master Device* has antenna gain, the main beam of the antenna will be directed toward the radar emitter. Vertical polarization is used for testing.
- Stream the channel loading test file from the *Master Device* to the *Client Device* on the test *Channel* for



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the entire period of the test.

d) At time T_0 the *Radar Waveform* generator sends a *Burst* of pulses for one of the Radar Type 0 in **Table 5** at levels defined in **Table 3**, on the *Operating Channel*. An additional 1 dB is added to the radar test signal to ensure it is at or above the *DFS Detection Threshold*, accounting for equipment variations/errors.

e) Observe the transmissions of the UUT at the end of the radar *Burst* on the *Operating Channel* for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (*Channel Move Time*). Measure and record the *Channel Move Time* and *Channel Closing Transmission Time* if radar detection occurs. **Figure 17** illustrates *Channel Closing Transmission Time*.

f) When operating as a *Master Device*, monitor the UUT for more than 30 minutes following instant T_2 to verify that the UUT does not resume any transmissions on this *Channel*. Perform this test once and record the measurement result.

g) In case the UUT is a U-NII device operating as a *Client Device* with *In-Service Monitoring*, perform steps a) to f).

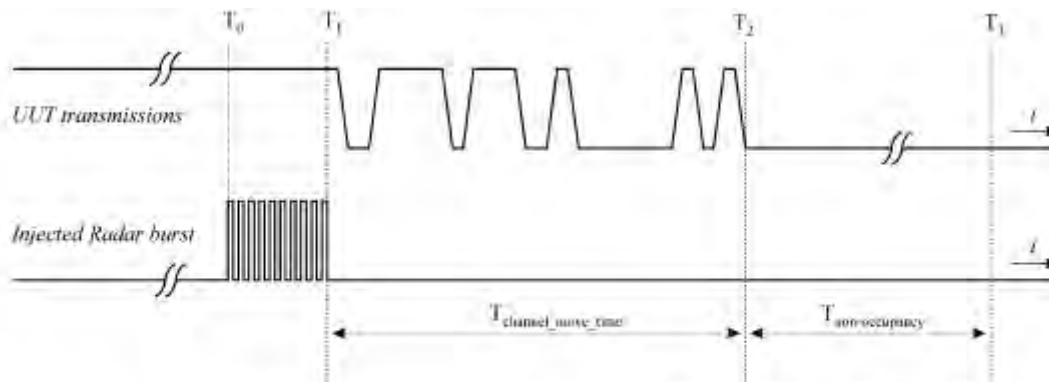


Figure 17: Example of Channel Closing Transmission Time & Channel Closing Time

4.11.8.7 Statistical Performance Check

The steps below define the procedure to determine the minimum percentage of successful detection requirements found in **Tables 5-7** when a radar burst with a level equal to the *DFS Detection Threshold* + 1dB is generated on the *Operating Channel* of the U-NII device (*In-Service Monitoring*).

a) One frequency will be chosen from the *Operating Channels* of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands.

b) In case the UUT is a U-NII device operating as a *Client Device* (with or without Radar Detection), a U-NII device operating as a *Master Device* will be used to allow the UUT (*Client device*) to Associate with the *Master Device*. In case the UUT is a *Master Device*, a U-NII device operating as a *Client Device* will be used and it is assumed that the Client will Associate with the UUT (*Master*). In both cases for conducted tests, the *Radar Waveform* generator will be connected to the *Master Device*. For radiated tests, the emissions of the *Radar Waveform* generator will be directed towards the *Master Device*. If the *Master Device* has antenna gain, the main beam of the antenna will be directed toward the radar emitter. Vertical polarization is used for testing.

c) Stream the channel loading test file from the *Master Device* to the *Client Device* on the test *Channel* for the entire period of the test.

d) At time T_0 the *Radar Waveform* generator sends the individual waveform for each of the Radar Types 1- 6 in **Tables 5-7**, at levels defined in **Table 3**, on the *Operating Channel*. An additional 1 dB is added to the radar test signal to ensure it is at or above the *DFS Detection Threshold*, accounting for equipment variations/errors.

e) Observe the transmissions of the UUT at the end of the Burst on the *Operating Channel* for duration greater than 10 seconds for Radar Type 0 to ensure detection occurs.



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- f) Observe the transmissions of the UUT at the end of the Burst on the *Operating Channel* for duration greater than 22 seconds for Long Pulse Radar Type 5 to ensure detection occurs.
- g) In case the UUT is a U-NII device operating as a *Client Device* with *In-Service Monitoring*, perform steps a) to f).

4.11.8.8 Short Pulse Radar Test

Once the performance requirements check is complete, statistical data will be gathered, to determine the ability of the device to detect the radar test waveforms (Short Pulse Radar Types 1-4) found in **Table 5**. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trials. The percentage of successful detection is calculated by:

$$\frac{\text{Total Waveform Detections}}{\text{Total Waveform Trials}} \times 100 = \text{Percentage of Successful Detection Radar Waveform } N = \text{PdN}$$

In addition an aggregate minimum percentage of successful detection across all Short Pulse Radar Types 1-4 is required and is calculated as follows:

$$\frac{P_d 1 + P_d 2 + P_d 3 + P_d 4}{4}$$

The minimum number of trails, minimum percentage of successful detection and the aggregate minimum percentage of successful detection are found in **Table 5**.

4.11.8.9 Long Pulse Radar Test

Statistical data will be gathered to determine the ability of the device to detect the Long Pulse Radar Type 5 found in **Table 6**. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trials.

Three subsets of trials will be performed with a minimum of ten trials per subset. The subset of trials differ in where the Long Pulse Type 5 Signal is tuned in frequency:

- the *Channel* center frequency (Figure 18);
- tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the low edge of the UUT *Occupied Bandwidth* (Figure 19); and
- tuned frequencies such that 90% of the Long Pulse Type 5 frequency modulation is within the high edge of the UUT *Occupied Bandwidth* (Figure 20).

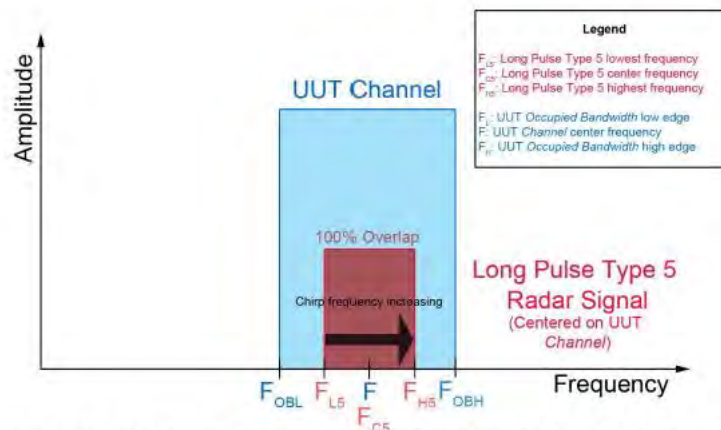


Figure 18: Example of the Relationship Between Long Pulse Type 5 Signal and the U-NII channel when the Signal is Tuned to the UUT Channel Center Frequency

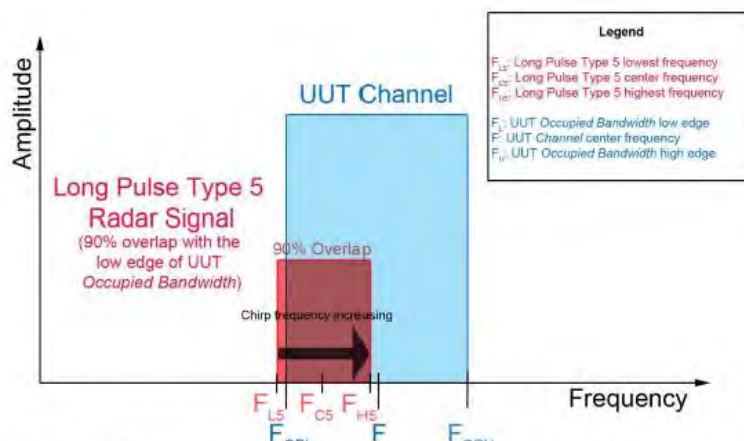


Figure 19: Example of the Relationship Between Long Pulse Type 5 Signal and the U-NII channel when the Signal is Tuned so that 90% of the Radar Signal Overlaps with the Low Edge of the UUT Occupied Bandwidth

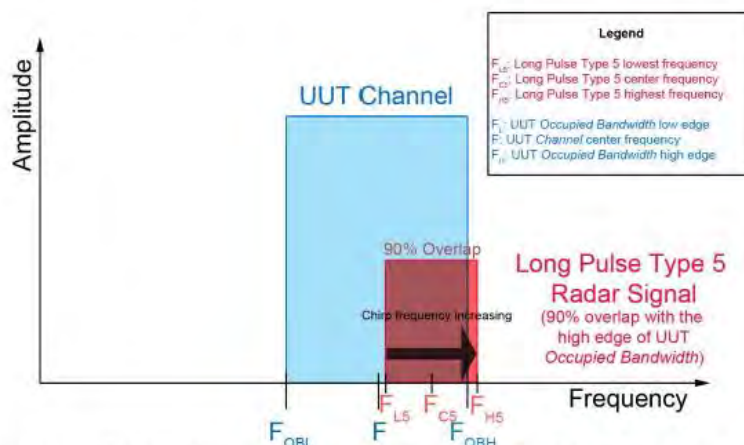


Figure 20: Example of the Relationship Between Long Pulse Type 5 Signal and the U-NII channel when the Signal is Tuned so that 90% of the Radar Signal Overlaps with the High Edge of the UUT Occupied Bandwidth

For subset case 1: the center frequency of the signal generator will remain fixed at the center of the UUT *Channel*.

For subset case 2: to retain 90% frequency overlap between the radar signal and the UUT *Occupied Bandwidth*, the center frequency of the signal generator will vary for each of the ten trials in subset case 2. The center frequency of the signal generator for each trial is calculated by:

$$FL + (0.4 * \text{Chirp Width [in MHz]})$$

For subset case 3: to retain 90% frequency overlap between the radar signal and the UUT *Occupied Bandwidth*, the center frequency of the signal generator will vary for each of the ten trials in subset case 3.

The center frequency of the signal generator for each trial is calculated by:

$$FH - (0.4 * Chirp\ Width\ [in\ MHz])$$

The percentage of successful detection is calculated by dividing the sum of the detections for the three subsets by the sum of trials for the three subsets:

$$\frac{TotalWaveformDetections}{TotalWaveformTrials} \times 100$$



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4.11.8.10 Frequency Hopping Radar Test

Statistical data will be gathered to determine the ability of the device to detect the Frequency Hopping radar test signal (radar type 6) found in **Table 7**. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs. The probability of successful detection is calculated by:

$$\frac{\text{TotalWaveformDetections}}{\text{TotalWaveformTrials}} \times 100$$



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4.11.9 Applicability of DFS Requirements Prior to Use of a Channel

Requirement	DFS Operational mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

4.11.10 Applicability of DFS Requirements During Normal Operation

Requirement	DFS Operational mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Availability Check Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		



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4.11.11 DFS Detection Thresholds

Table 3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.

Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

4.11.12 Response Requirements

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.



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4.11.13 Short Pulse Radar Test Waveforms

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI(μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A	$\text{Roundup} \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 μsec is selected, the number of pulses

would be $6 \cdot 1 \cdot 19 \cdot 10 \cdot \text{Roundup} \left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{3066} \right) \right\} \text{Round up } \{17.2\} = 18$.



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Table 5a - Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4.

For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9%
2	30	18	60%
3	30	27	90%
4	50	44	88%
Aggregate $(82.9\% + 60\% + 90\% + 88\%)/4 = 80.2\%$			



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4.11.14 Long Pulse Radar Test Waveform

Table 6 – Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Each waveform is defined as follows:

- 1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
- 2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst Count.
- 3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
- 4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
- 5) Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a transmission period will have the same chirp width. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
- 6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.
- 7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst Count. Each interval is of length (12,000,000 / Burst Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen randomly.

4.11.15 Frequency Hopping Radar Test Waveform

Table 7 – Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm: If a segment does not contain at least 1 frequency within the U-NII Detection Bandwidth of the UUT, then that segment is not used.

The detailed test data see: **Appendix**



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5 Measurement Uncertainty (95% confidence levels, k=2)

Lab A:

No.	Item	Measurement Uncertainty
1	Conduction Emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
2	Radiated Emission	$\pm 4.6\text{dB}$ (9KHz to 30MHz)
		$\pm 4.9\text{dB}$ (30MHz to 1GHz)
		$\pm 4.9\text{dB}$ (1GHz to 6GHz)
		$\pm 4.7\text{dB}$ (6GHz to 18GHz)
		$\pm 5.26\text{dB}$ (Above 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

Lab B:

No.	Item	Measurement Uncertainty
1	Radio Frequency	$8.4 \times 10^{-8} \text{ GHz}$
2	Timeout	2s
3	Duty Cycle	0.37%
4	Occupied Bandwidth	3%
5	RF Conducted Power	0.6dB
6	RF Power Density	2.9dB
7	Conducted Spurious Emissions	0.75dB

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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6 Equipment List

Lab A:

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	XAW04-03-01	N/A	N/A
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2023/06/30	2024/06/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/08/30	2024/08/29
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-07-01	NCR	NCR
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-07	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-02	2023/06/30	2024/06/29

Remark: NCR=No Calibration Requirement



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RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/d d)	Cal.Due date (yyyy/mm/d d)
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2021/09/09	2024/09/08
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2023/02/16	2024/02/15
Spectrum Analyzer	ROHDE&SCH WARZ	FSV3044	XAW01-13-05	2023/05/15	2024/05/14
Test receiver	ROHDE&SCH WARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2022/07/28	2024/07/27
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2022/07/28	2024/07/27
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2022/07/23	2024/07/22
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP9K3G32	XAW01-41-01	2023/05/15	2024/05/14
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2023/08/30	2024/08/29
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2023/08/30	2024/08/29
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2023/08/30	2024/08/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/09/04	2024/09/03
Radio communication analyzer	ROHDE&SCH WARZ	CMW 500	XAW01-03-07	2023/08/30	2024/08/29
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-05-01	NCR	NCR
Loop Antenna	Schwarzbeck	FMZB 1519B	XAW01-48-02	2022/05/26	2024/05/25

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Lab B:

RF Test Equipment					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Spectrum Analyzer	Keysight	N9020A	KUS1911E004-2	2023/08/24	2024/08/23
Spectrum Analyzer	Keysight	N9020A	KUS2001M001-2	2023/08/24	2024/08/23
Spectrum Analyzer	Keysight	N9030B	KSEM021-1	2023/02/03	2024/02/02
Signal Generator	R&S	SMBV100B	KSEM032	2023/03/16	2024/03/15
Signal Generator	R&S	SMW200A	KSEM020-1	2023/08/24	2024/08/23
Signal Generator	Agilent	N5182A	KUS2001M001-1	2023/08/24	2024/08/23
Radio Communication Test Station	Anritsu	MT8000A	KSEM001-1	2023/08/24	2024/08/23
Radio Communication Analyzer	Anritsu	MT8821C	KSEM002-1	2023/03/16	2024/03/15
Universal Radio Communication Tester	R&S	CMW500	KUS1911E004-1	2023/08/24	2024/08/23
Switcher	CCSRF	FY562	KUS2001M001-3	2023/08/24	2024/08/23
AC Power Source	EXTECH	6605	KS301178	NCR	NCR
DC Power Supply	Aglient	E3632A	KS301180	NCR	NCR
Conducted Test Cable	Thermax	RF01-RF04	CZ301111- CZ301120	2023/02/03	2024/02/02
Temp. / Humidity Chamber	TERCHY	MHK-120AK	KS301190	2023/08/24	2024/08/23
Temperature & Humidity Recorder	Renke Control	RS-WS-N01-6J	KSEM024-5	2023/03/22	2024/03/21
Software	BST	TST-PASS	/	NCR	NCR

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7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Appendix



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Duty Cycle Test Result

Ant2							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
802.11a	SISO	5180	5.402	5.544	97.44	0.11	0.67
		5200	5.402	5.560	97.16	0.13	0.95
		5240	5.400	5.578	96.81	0.14	1.28
		5260	5.402	5.578	96.84	0.14	1.27
		5300	5.402	5.580	96.81	0.14	1.30
		5320	5.402	5.560	97.16	0.13	0.95
		5500	5.402	5.580	96.81	0.14	1.30
		5580	5.402	5.578	96.84	0.14	1.27
		5700	5.402	5.560	97.16	0.13	0.95
		5745	5.402	5.562	97.12	0.13	0.99
		5785	5.416	6.334	85.51	0.68	12.90
802.11n (HT20)	SISO	5180	5.001	5.169	96.75	0.14	1.20
		5200	5.002	5.178	96.60	0.15	1.34
		5240	5.001	5.152	97.07	0.13	0.89
		5260	5.003	5.171	96.75	0.14	1.20
		5300	5.002	5.178	96.60	0.15	1.36
		5320	5.001	5.162	96.88	0.14	1.06
		5500	5.001	5.178	96.58	0.15	1.38
		5580	5.001	5.169	96.75	0.14	1.20
		5700	5.001	5.179	96.56	0.15	1.36
		5745	5.003	5.161	96.94	0.14	1.03
		5785	5.017	5.604	89.53	0.48	8.71
802.11n (HT40)	SISO	5190	2.430	2.607	93.21	0.31	2.68
		5230	2.429	2.597	93.53	0.29	2.37
		5270	2.430	2.607	93.21	0.31	2.64
		5310	2.430	2.606	93.25	0.30	2.65
		5510	2.431	2.607	93.25	0.30	2.68
		5550	2.430	2.588	93.89	0.27	2.02
		5670	2.429	2.606	93.21	0.31	2.68
		5755	2.430	2.606	93.25	0.30	2.68
802.11ac (VHT80)	SISO	5795	2.430	3.197	76.01	1.19	19.95
		5210	1.150	1.317	87.32	0.59	5.08
		5290	1.150	1.327	86.66	0.62	5.67
		5530	1.150	1.326	86.73	0.62	5.65
		5610	1.149	1.317	87.24	0.59	4.41
		5775	1.149	1.317	87.24	0.59	5.07

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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Note:

Radiated Emission Average VBW = 1 / T

TestMode	T[ms]	Period[ms]	Duty Cycle[%]	1/T[kHz]	VBW Setting
802.11a	5.402	5.544	97.44	0.185116623	0.3KHz
802.11n (HT20)	5.001	5.169	96.75	0.199960008	0.3KHz
802.11n (HT40)	2.430	2.607	93.21	0.411522634	0.51KHz
802.11ac (VHT80)	1.150	1.317	87.32	0.869565217	1KHz



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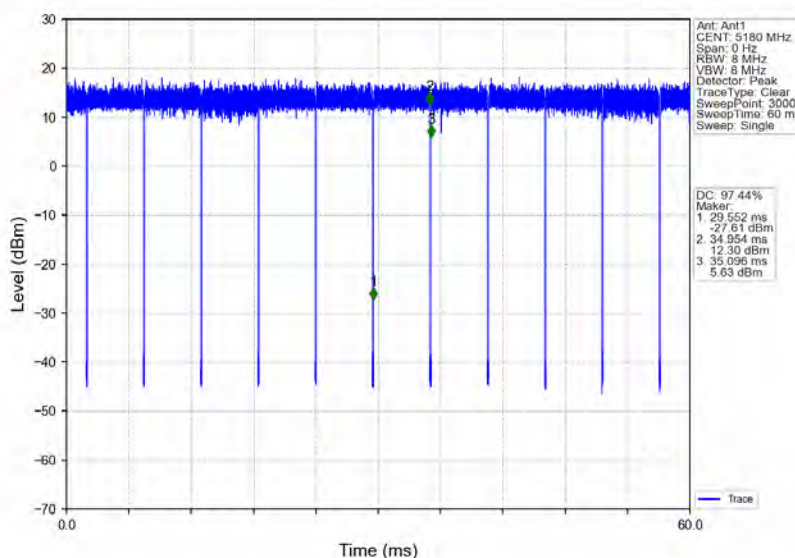
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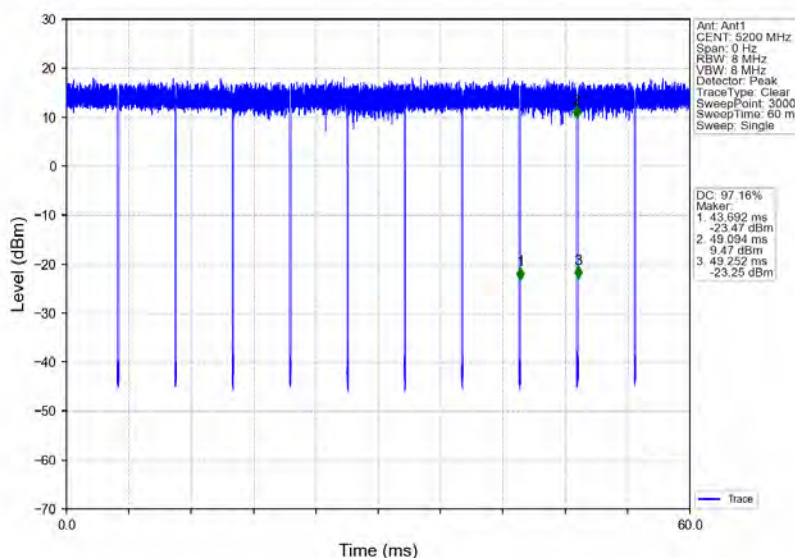
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Test Graphs

802.11a_LCH_5180MHz_Ant2_NTNV



802.11a_MCH_5200MHz_Ant2_NTNV

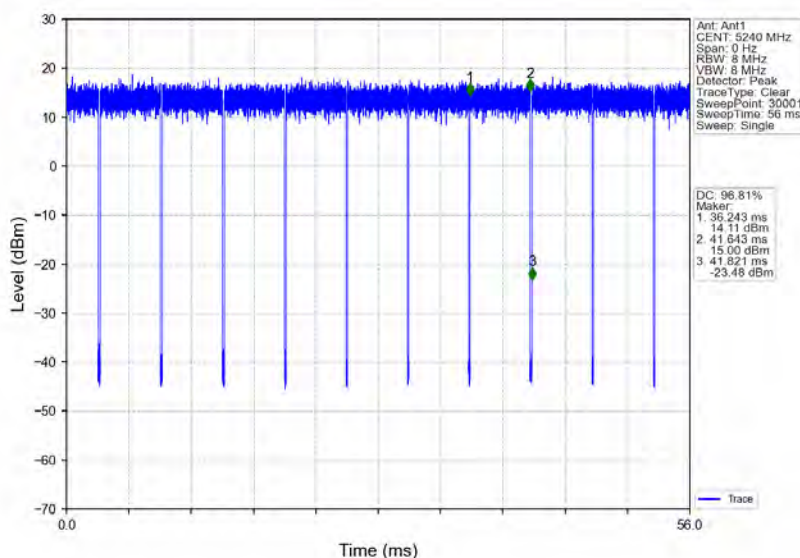


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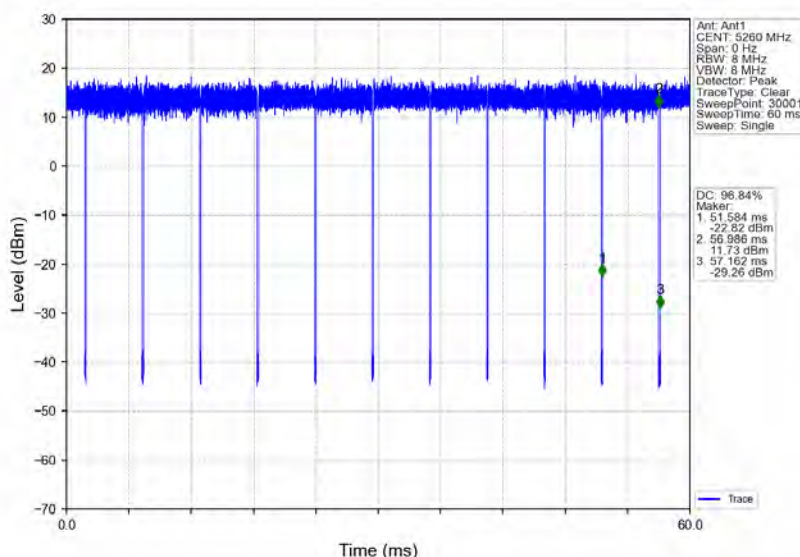
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802.11a_HCH_5240MHz_Ant2_NTNV



802.11a_LCH_5260MHz_Ant2_NTNV



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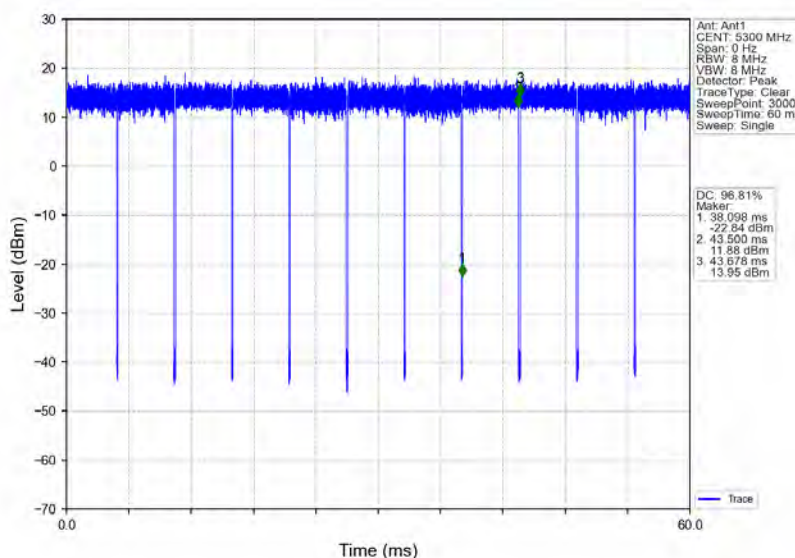
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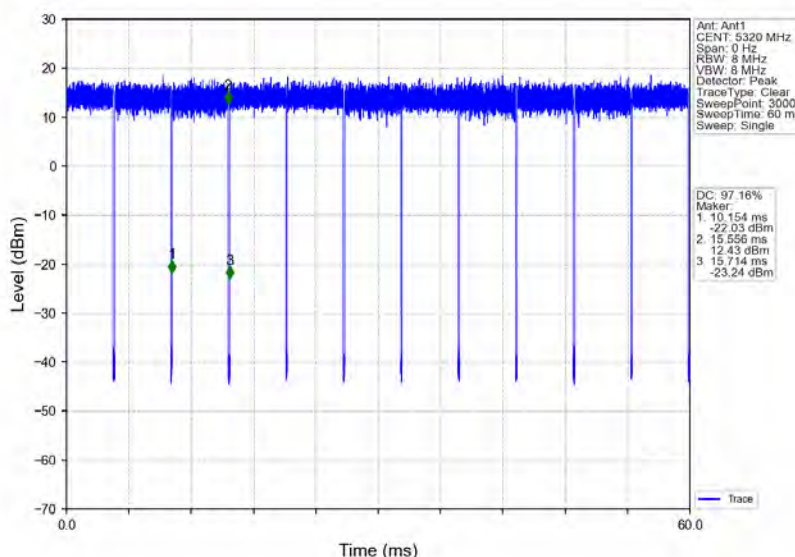
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802.11a_MCH_5300MHz_Ant2_NTNV



802.11a_HCH_5320MHz_Ant2_NTNV



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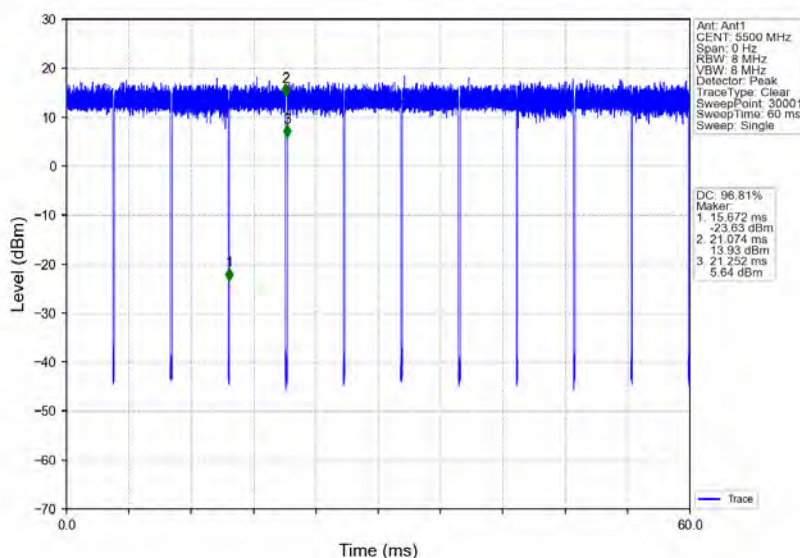
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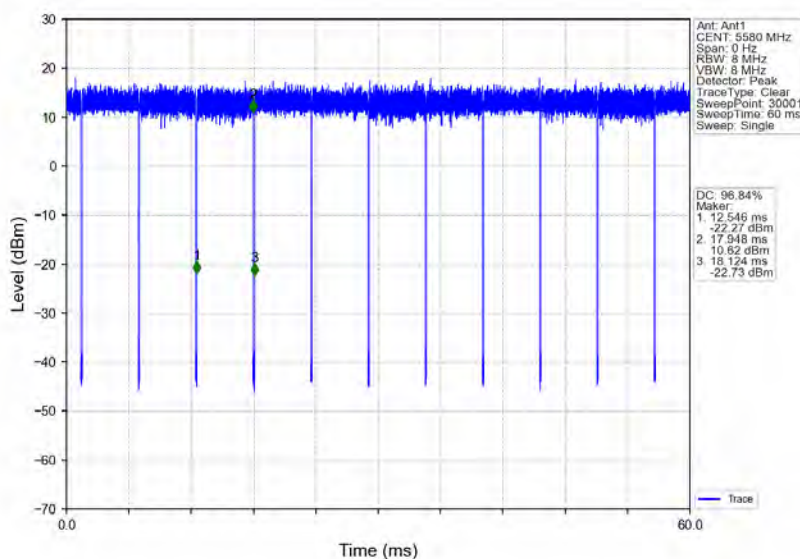
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802.11a_LCH_5500MHz_Ant2_NTNV



802.11a_MCH_5580MHz_Ant2_NTNV



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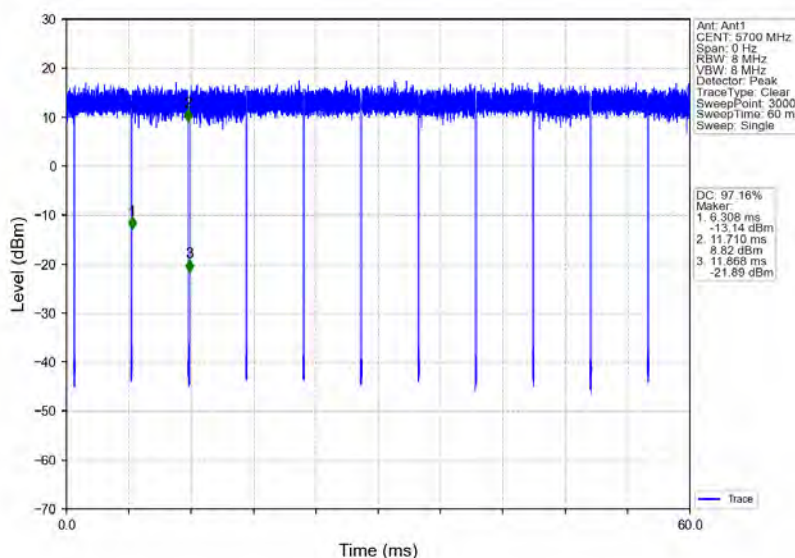
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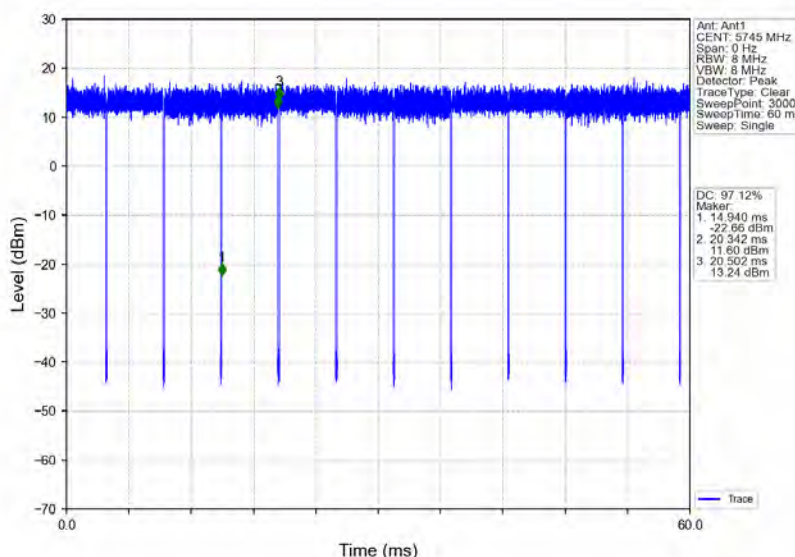
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802.11a_HCH_5700MHz_Ant2_NTNV



802.11a_LCH_5745MHz_Ant2_NTNV



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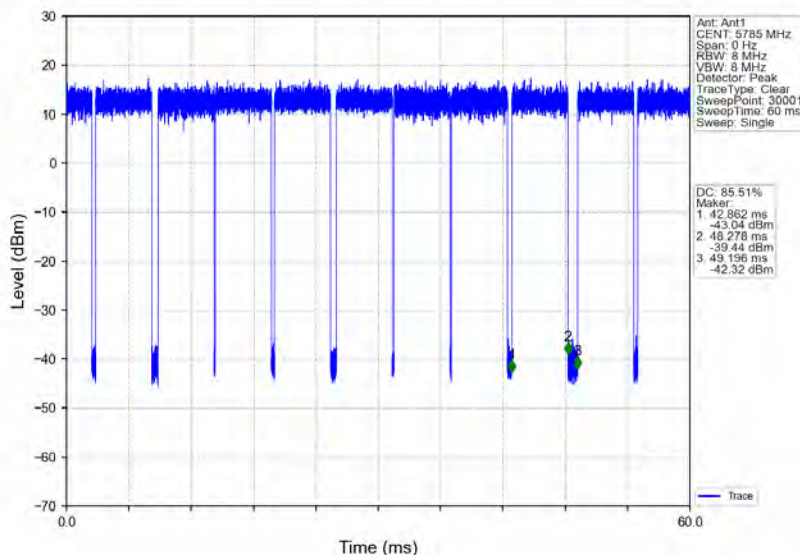
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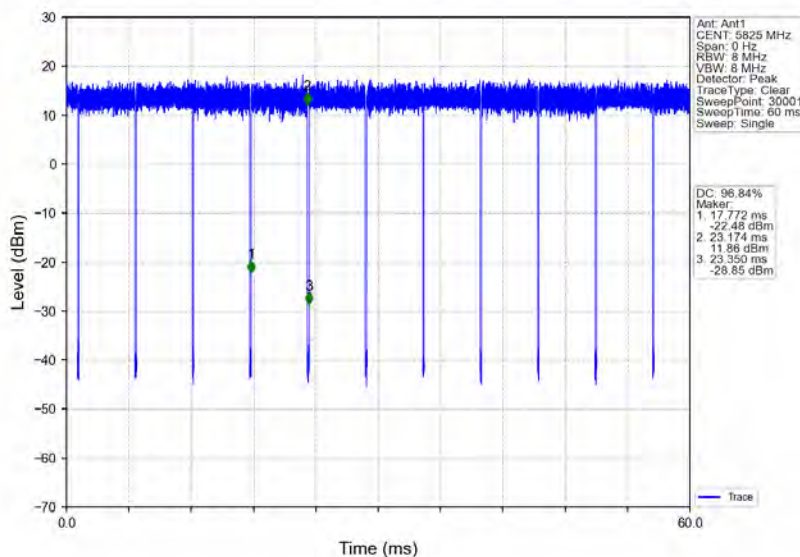
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802.11a_MCH_5785MHz_Ant2_NTNV



802.11a_HCH_5825MHz_Ant2_NTNV



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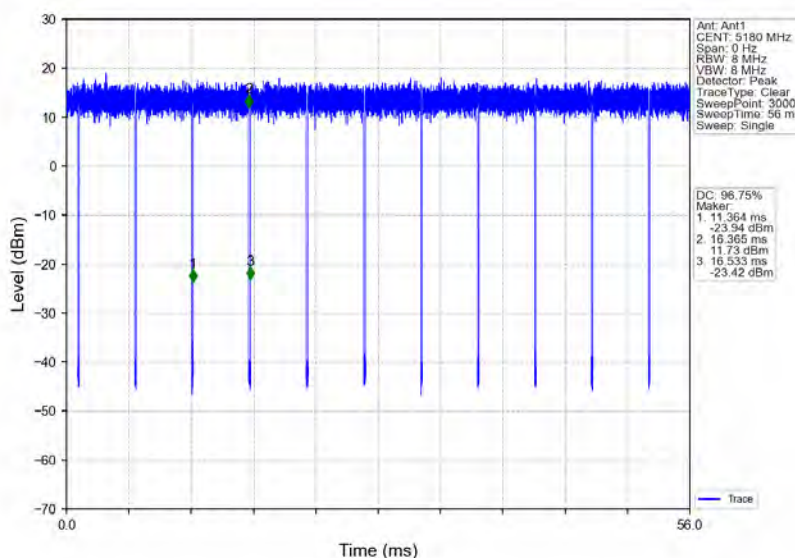
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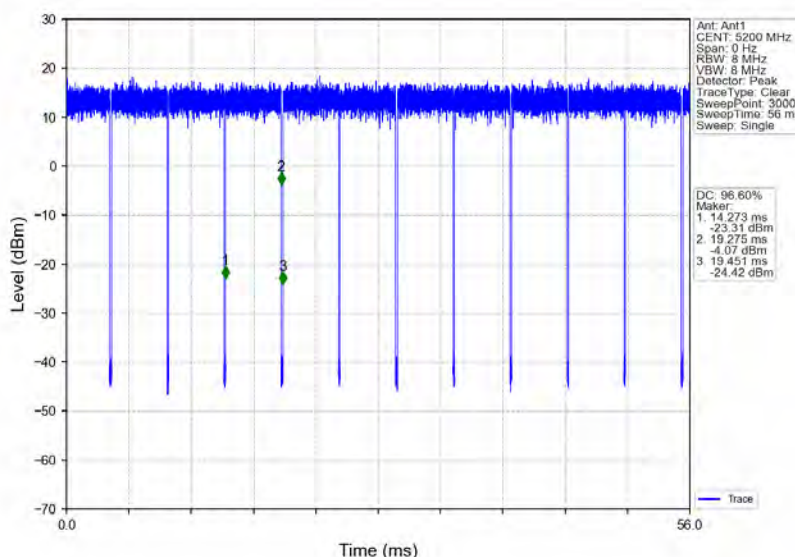
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802.11n(HT20) LCH 5180MHz Ant2 NTN



802.11n(HT20) MCH 5200MHz Ant2 NTN



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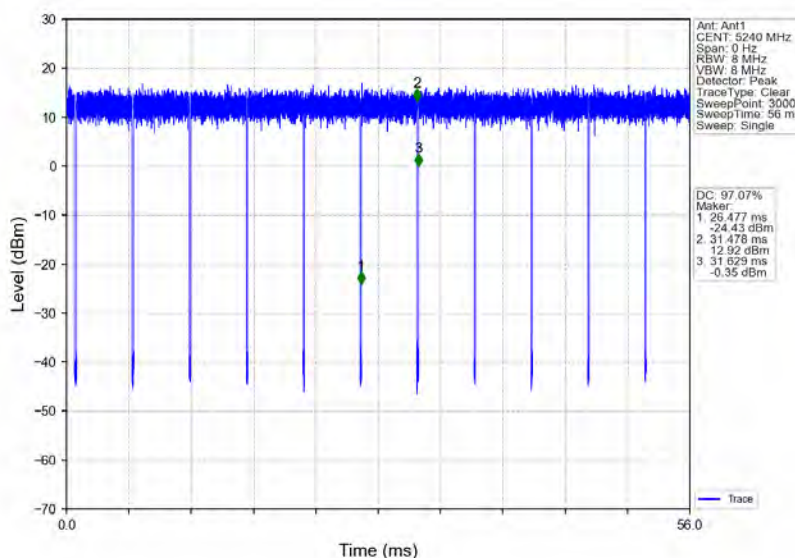
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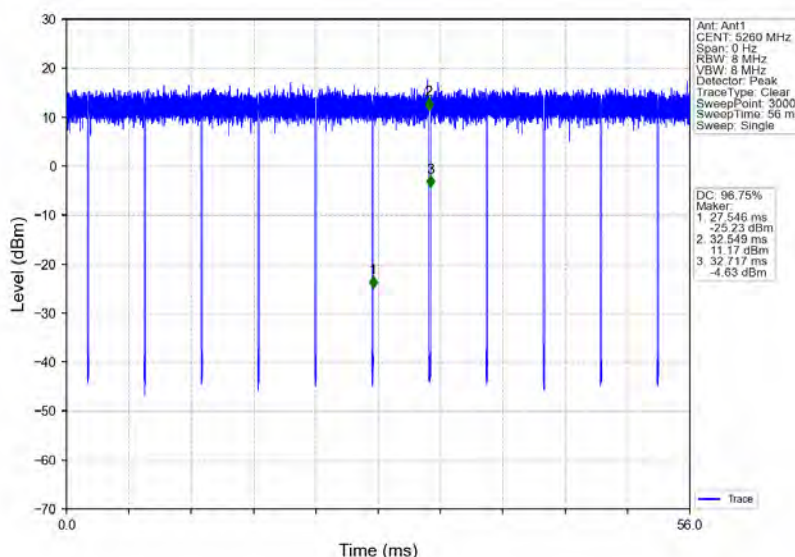
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802.11n(HT20) HCH 5240MHz Ant2 NTN



802.11n(HT20) LCH 5260MHz Ant2 NTN



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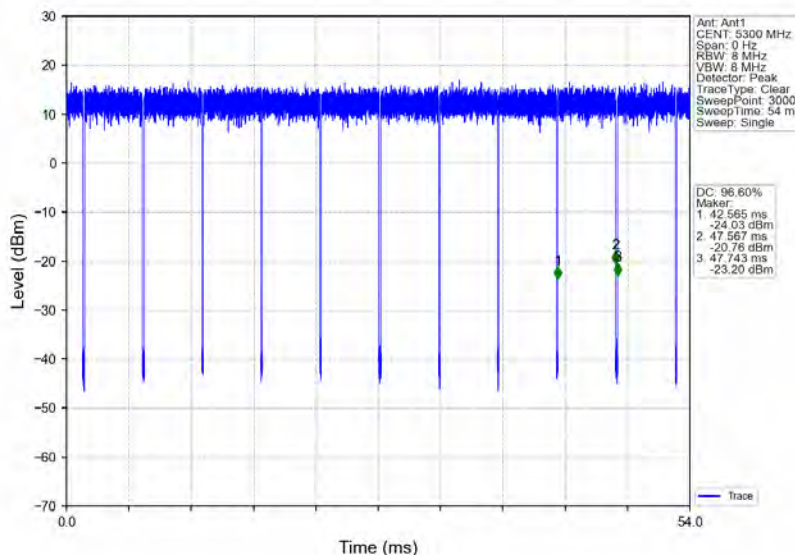
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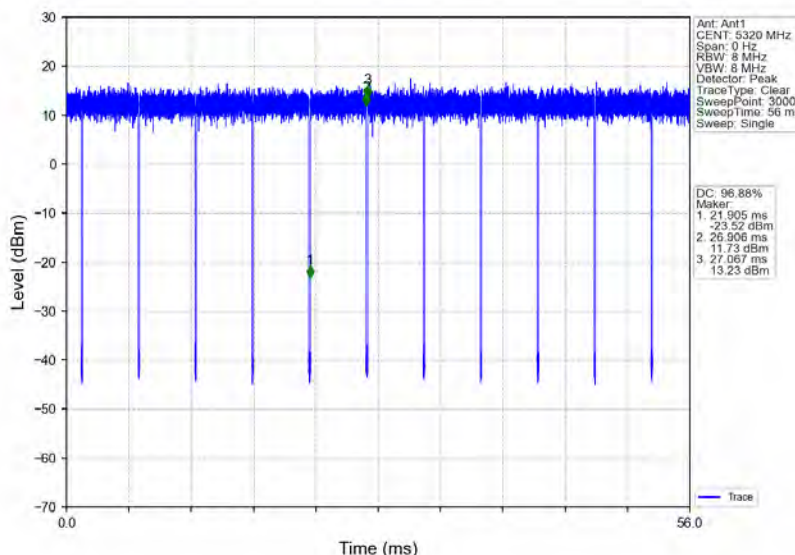
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802.11n(HT20) MCH 5300MHz Ant2 NTN



802.11n(HT20) HCH 5320MHz Ant2 NTN

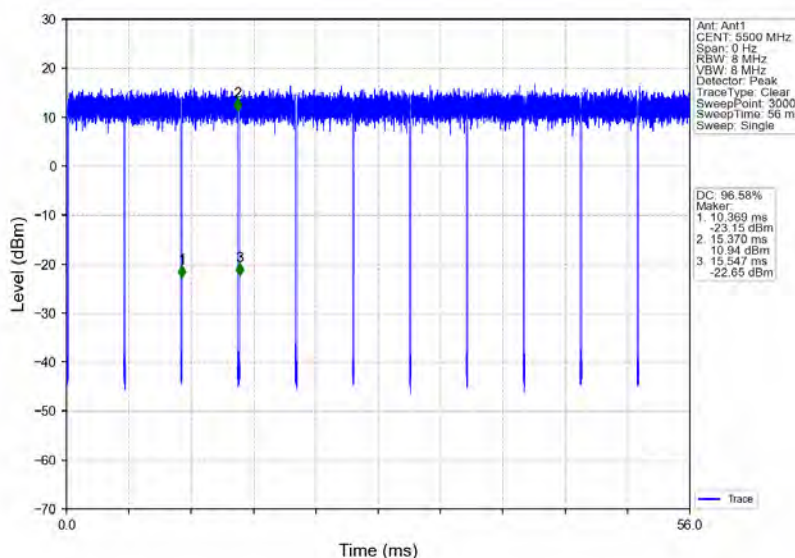


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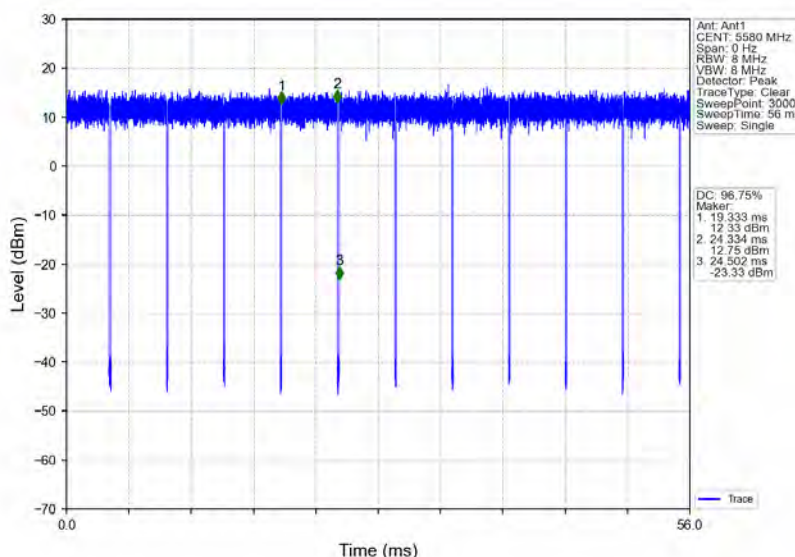
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802.11n(HT20) LCH 5500MHz Ant2 NTN



802.11n(HT20) MCH 5580MHz Ant2 NTN



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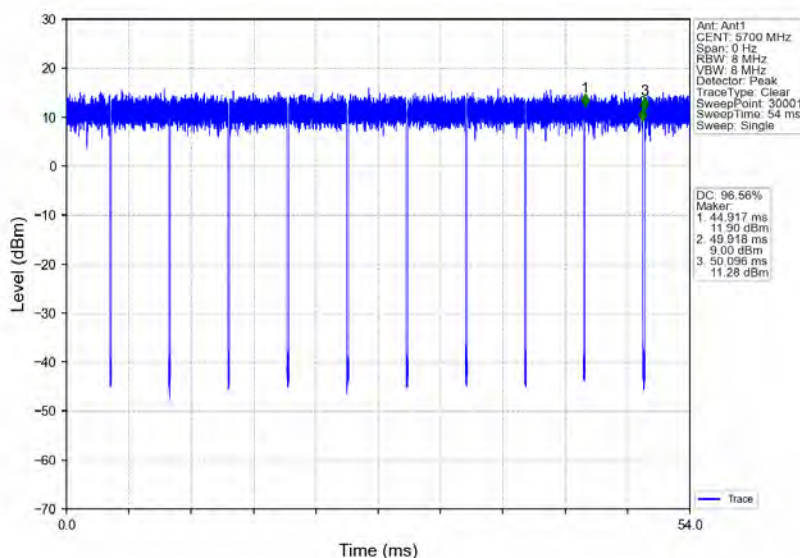
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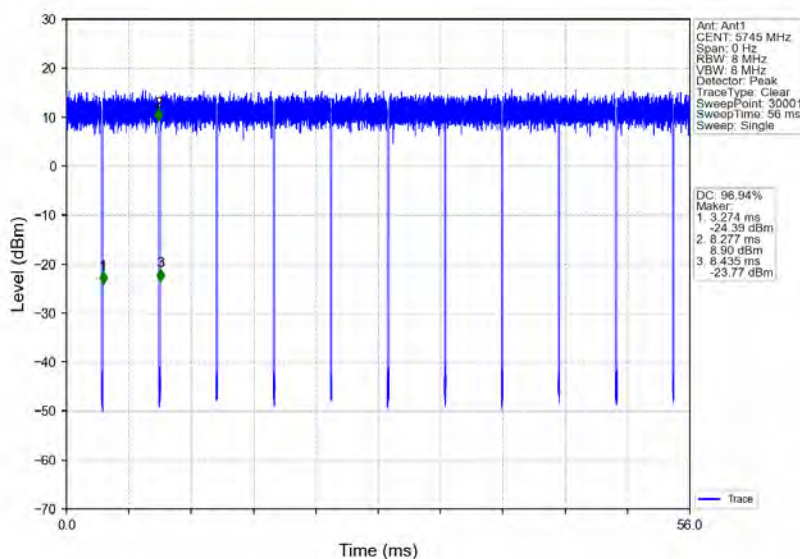
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802.11n(HT20) HCH 5700MHz Ant2 NTN



802.11n(HT20) LCH 5745MHz Ant2 NTN



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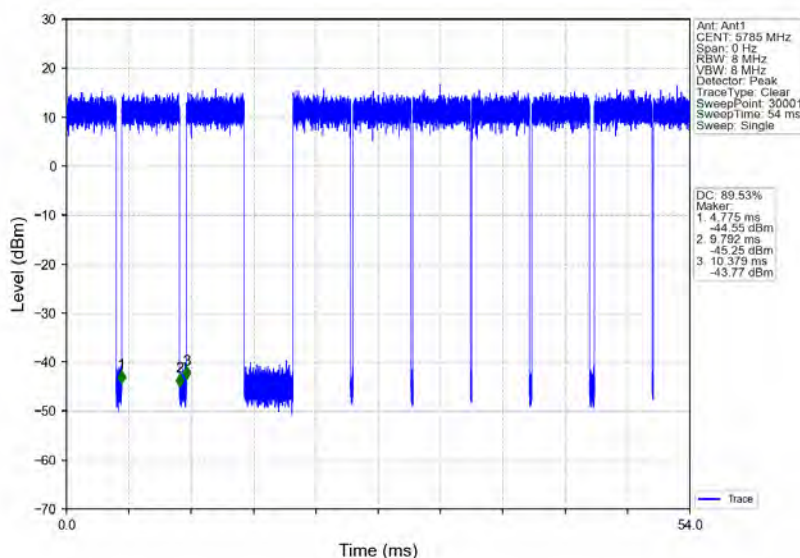
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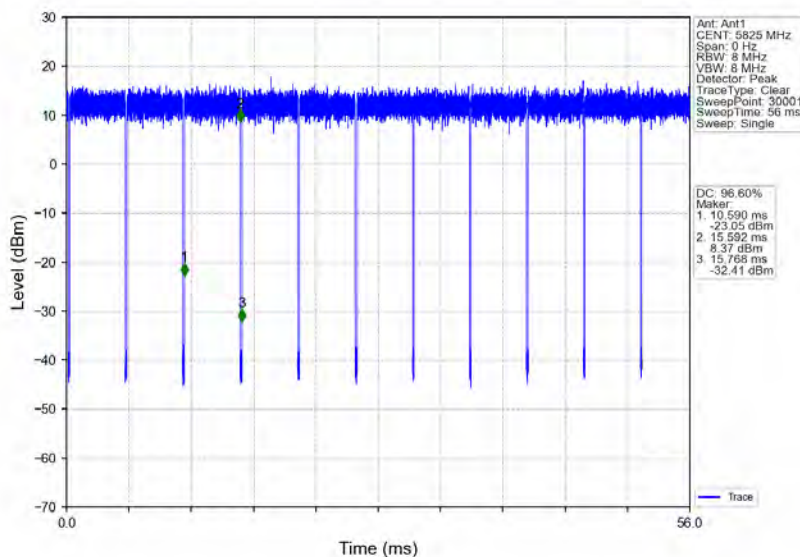
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802.11n(HT20) MCH 5785MHz Ant2 NTN



802.11n(HT20) HCH 5825MHz Ant2 NTN



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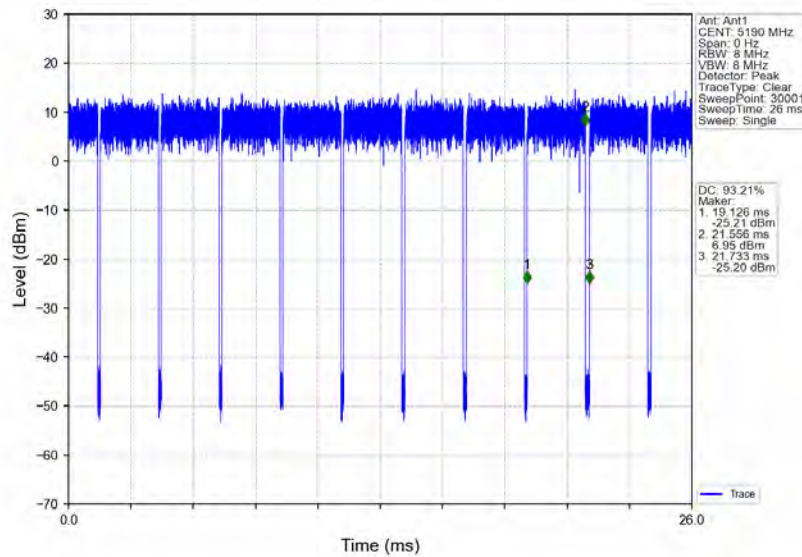
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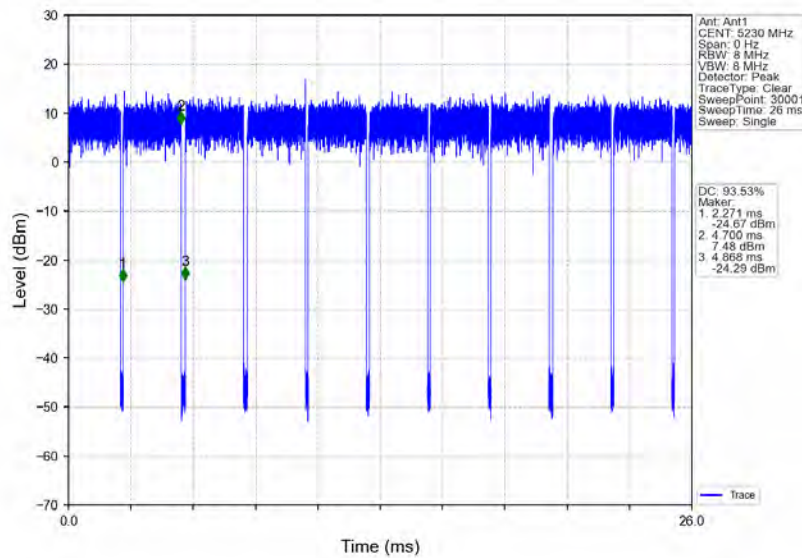
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802.11n(HT40) LCH 5190MHz Ant2 NTN



802.11n(HT40) HCH 5230MHz Ant2 NTN



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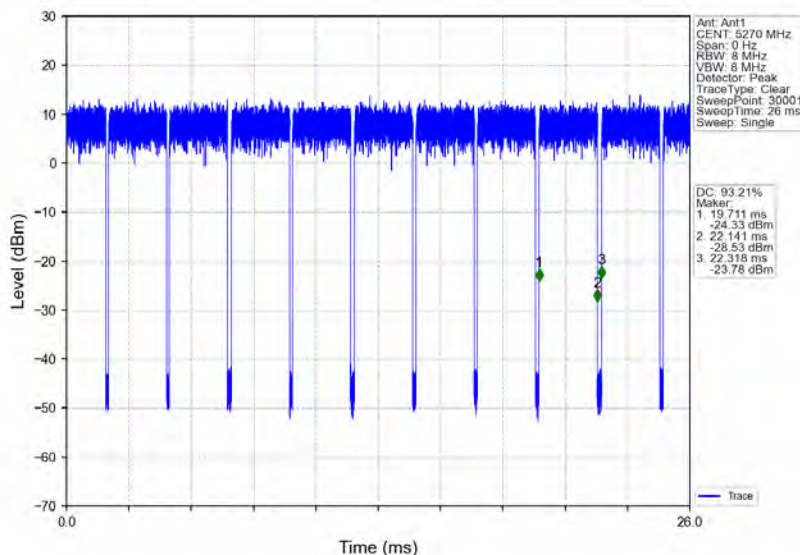
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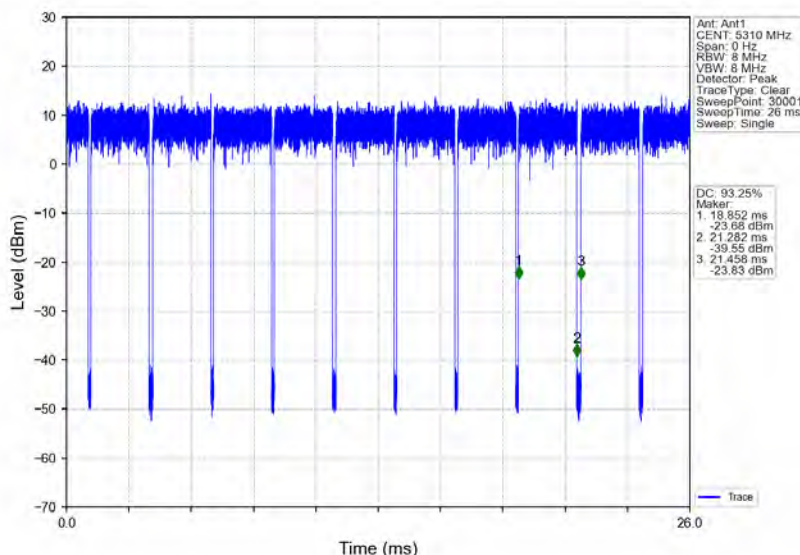
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802.11n(HT40) LCH 5270MHz Ant2 NTN



802.11n(HT40) HCH 5310MHz Ant2 NTN



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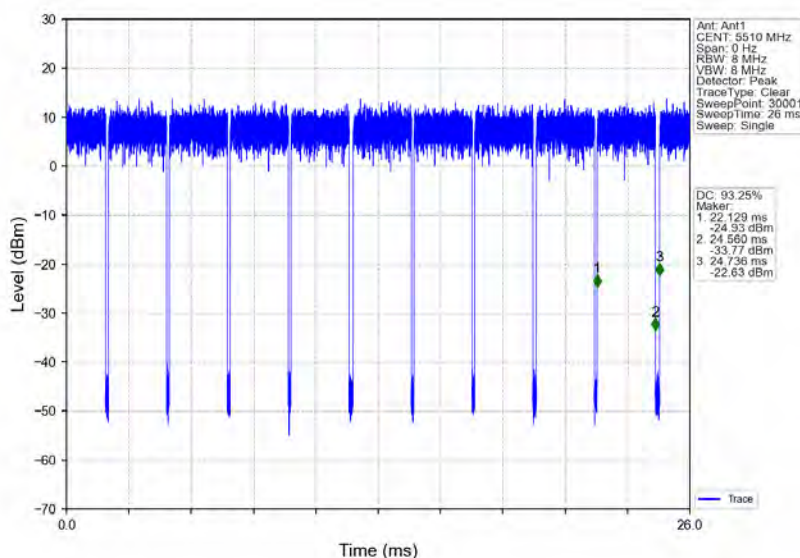
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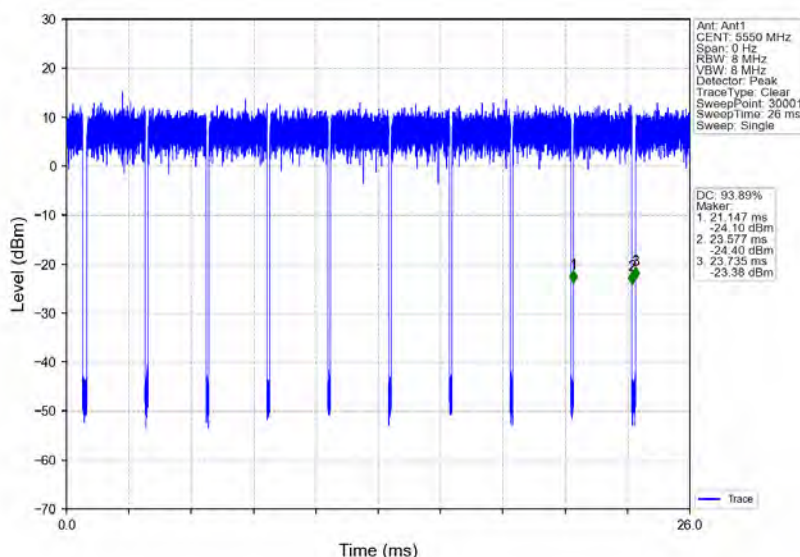
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802.11n(HT40) LCH 5510MHz Ant2 NTN



802.11n(HT40) MCH 5550MHz Ant2 NTN



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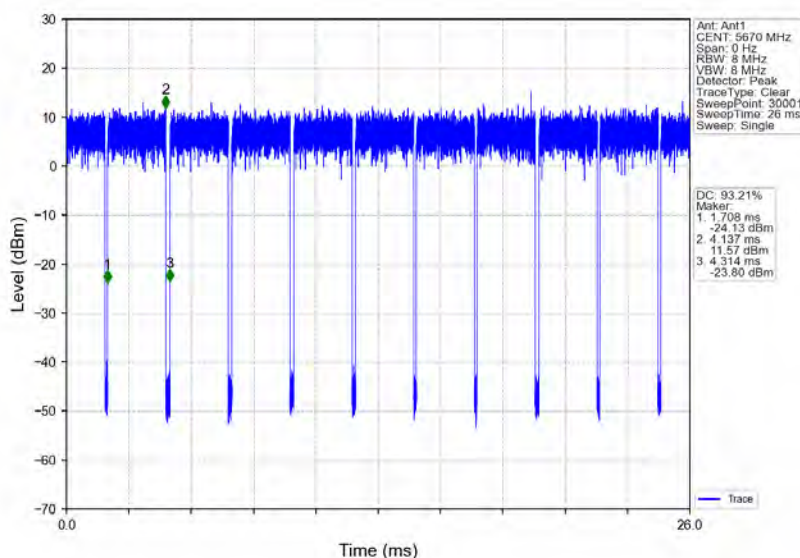
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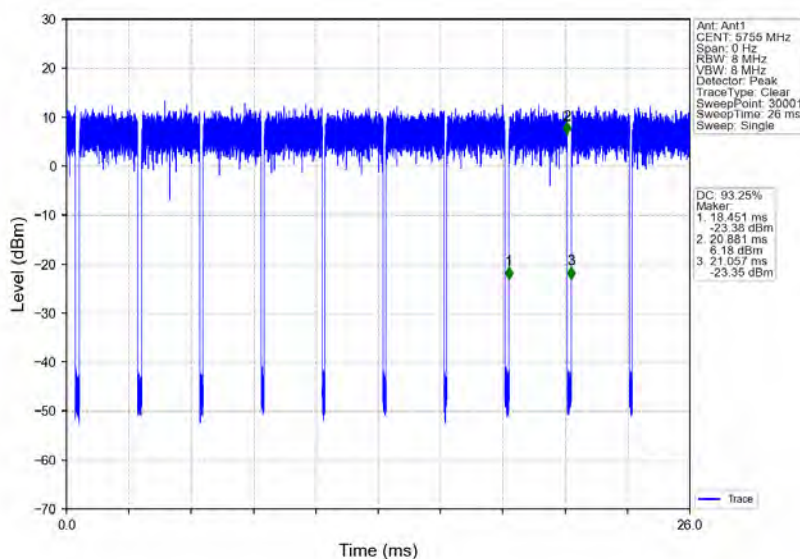
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802.11n(HT40) HCH 5670MHz Ant2 NTN



802.11n(HT40) LCH 5755MHz Ant2 NTN



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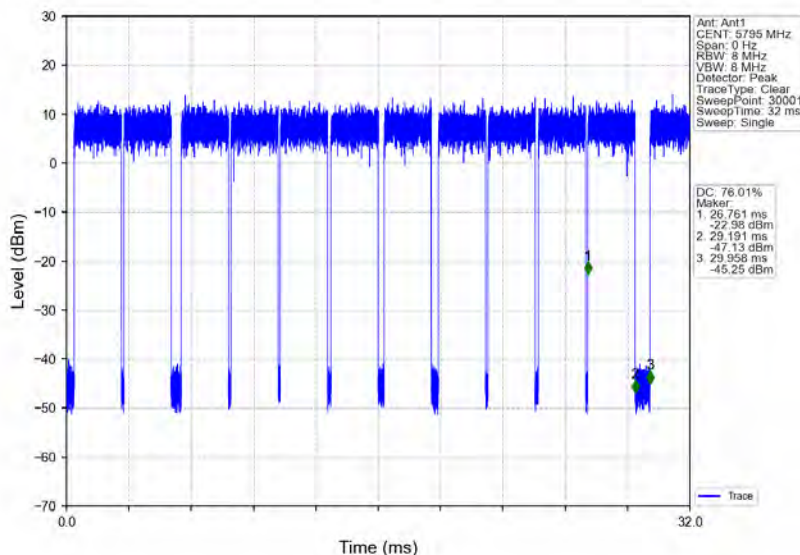
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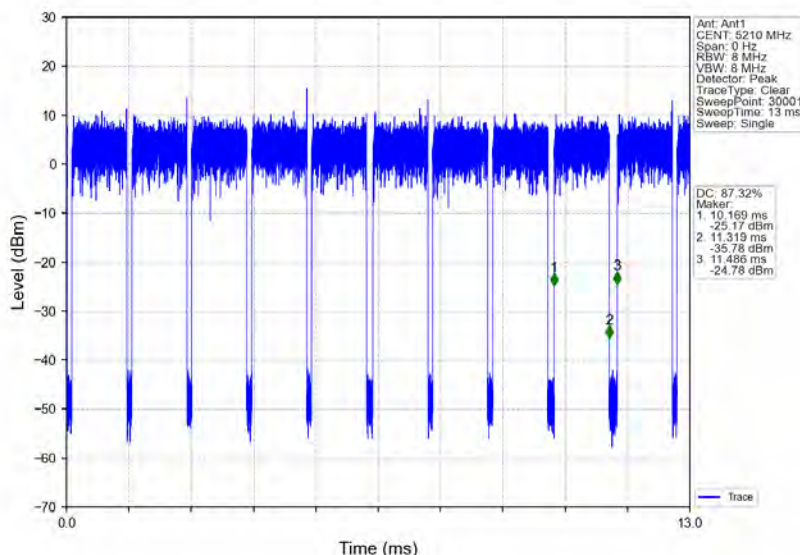
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802.11n(HT40) HCH 5795MHz Ant2 NTN



802.11ac(VHT80) MCH 5210MHz Ant2 NTN



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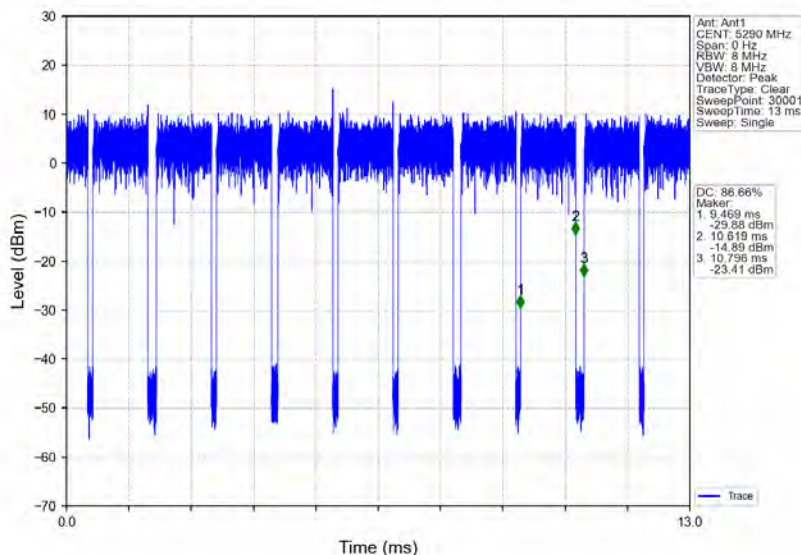
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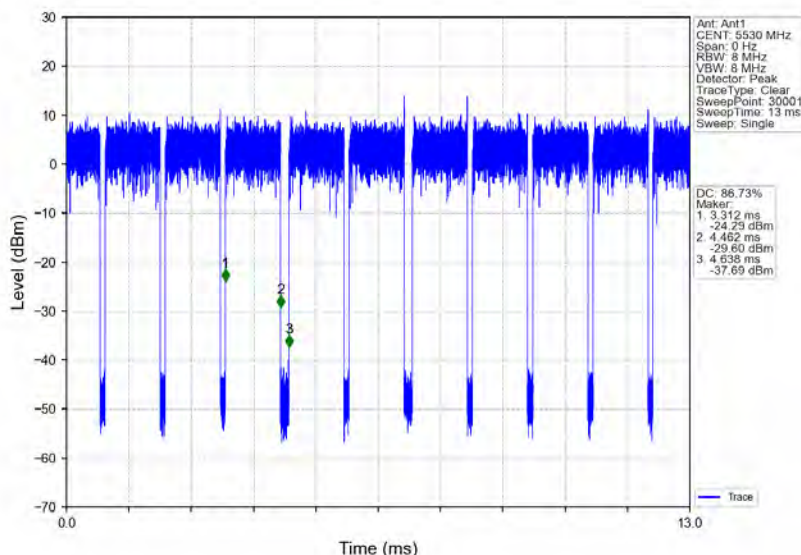
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802.11ac(VHT80) MCH 5290MHz Ant2 NTN



802.11ac(VHT80) LCH 5530MHz Ant2 NTN



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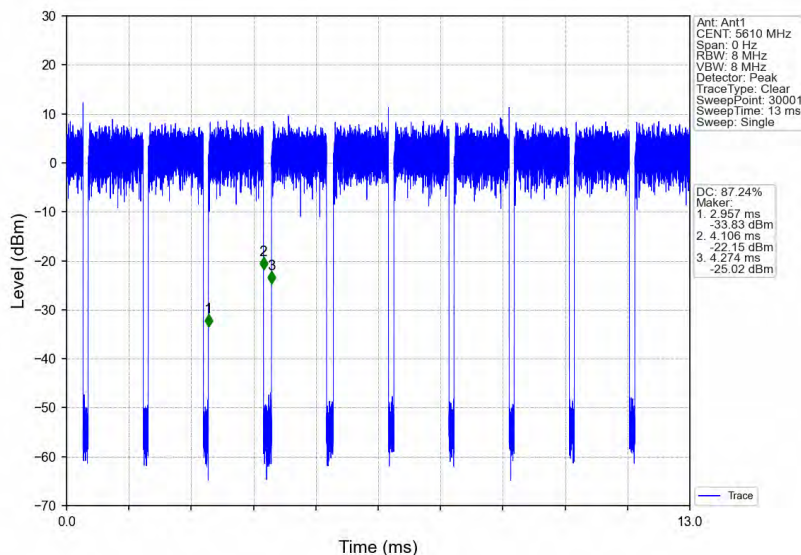
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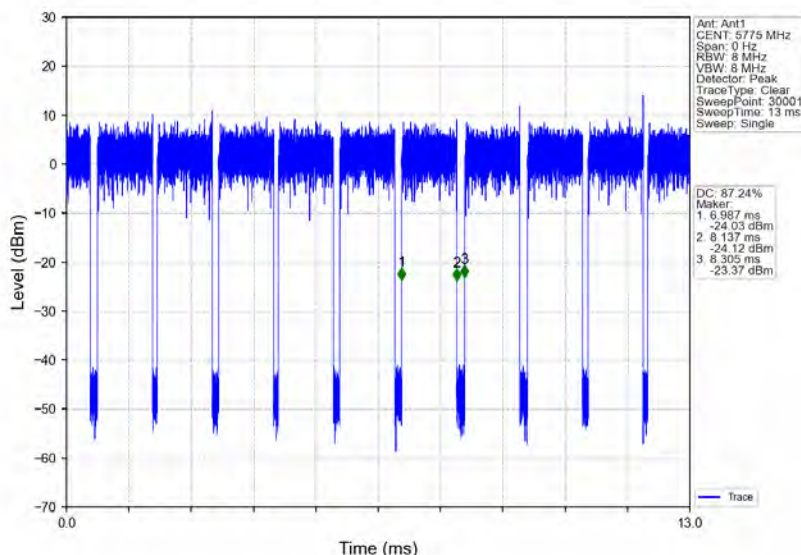
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802.11ac(VHT80) HCH 5610MHz Ant2 NTN



802.11ac(VHT80) MCH 5775MHz Ant2 NTN



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Occupied Channel Bandwidth Test Result

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
802.11a	SISO	5180	2	16.687	/	Pass
		5200	2	16.672	/	Pass
		5240	2	16.672	/	Pass
		5260	2	16.630	/	Pass
		5300	2	16.661	/	Pass
		5320	2	16.676	/	Pass
		5500	2	16.671	/	Pass
		5580	2	16.651	/	Pass
		5700	2	16.631	/	Pass
		5745	2	16.662	/	Pass
		5785	2	16.654	/	Pass
		5825	2	16.662	/	Pass
802.11n (HT20)	SISO	5180	2	17.711	/	Pass
		5200	2	17.711	/	Pass
		5240	2	17.706	/	Pass
		5260	2	17.706	/	Pass
		5300	2	17.724	/	Pass
		5320	2	17.737	/	Pass
		5500	2	17.735	/	Pass
		5580	2	17.702	/	Pass
		5700	2	17.710	/	Pass
		5745	2	17.697	/	Pass
		5785	2	17.722	/	Pass
		5825	2	17.706	/	Pass
802.11n (HT40)	SISO	5190	2	36.047	/	Pass
		5230	2	36.086	/	Pass
		5270	2	36.151	/	Pass
		5310	2	36.102	/	Pass
		5510	2	36.220	/	Pass
		5550	2	36.319	/	Pass
		5670	2	36.207	/	Pass
		5755	2	36.145	/	Pass
		5795	2	36.189	/	Pass
802.11ac (VHT80)	SISO	5210	2	75.034	/	Pass
		5290	2	74.896	/	Pass
		5530	2	74.962	/	Pass
		5610	2	74.901	/	Pass
		5775	2	74.983	/	Pass

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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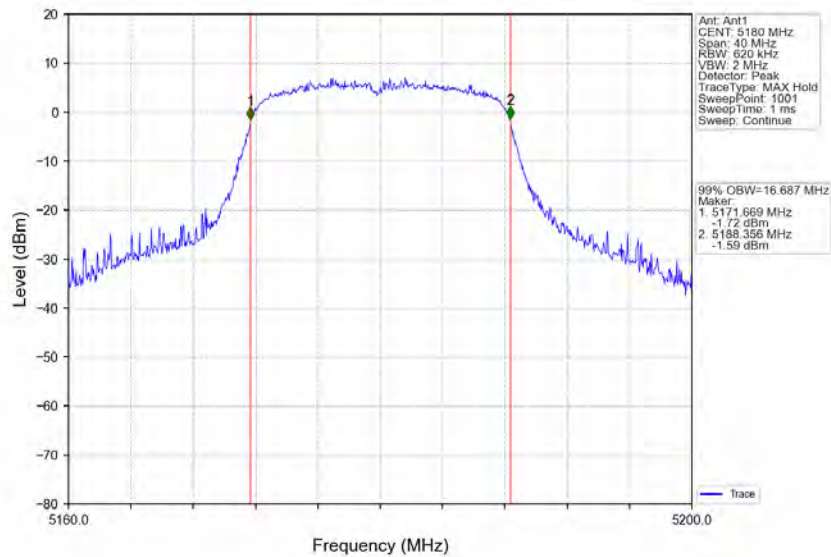
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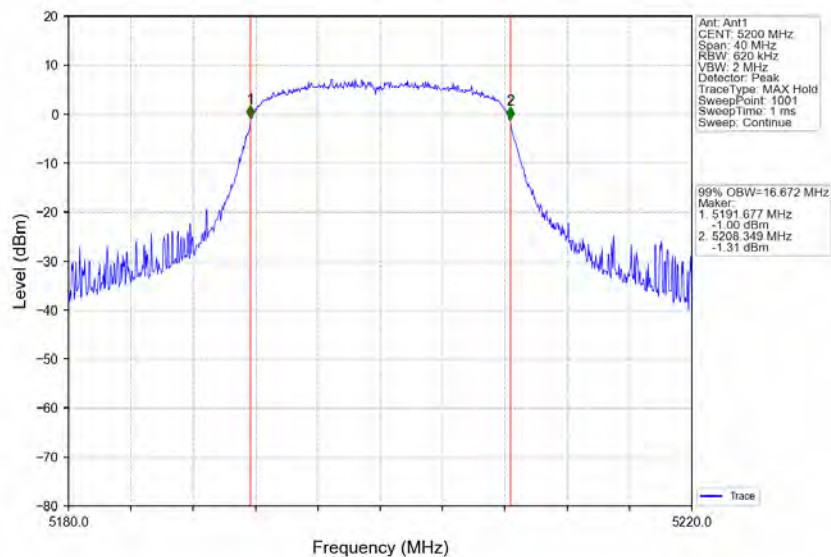
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Test Graphs

802.11a_LCH_5180MHz_Ant2_NTNV



802.11a_MCH_5200MHz_Ant2_NTNV



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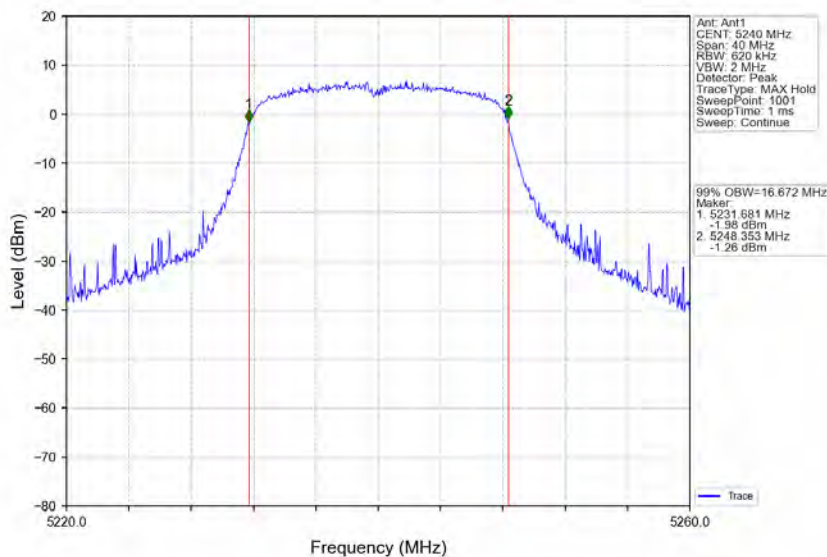
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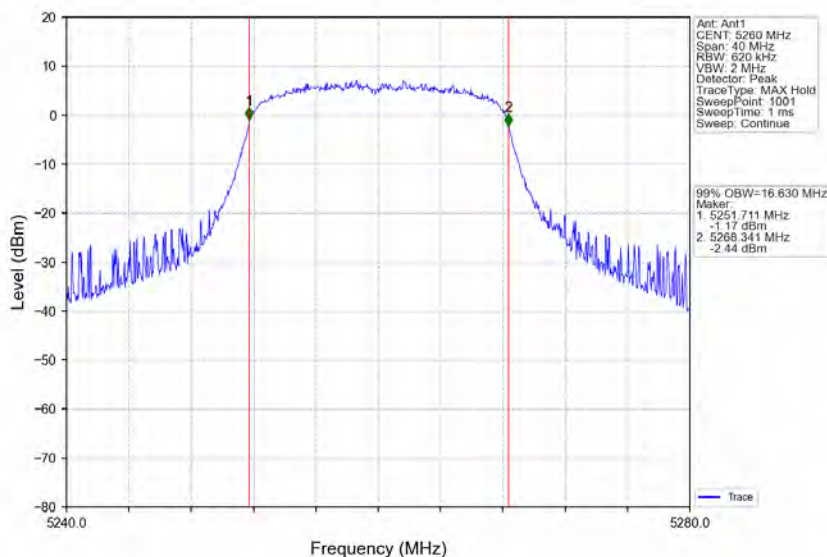
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802.11a_HCH_5240MHz_Ant2_NTNV



802.11a_LCH_5260MHz_Ant2_NTNV



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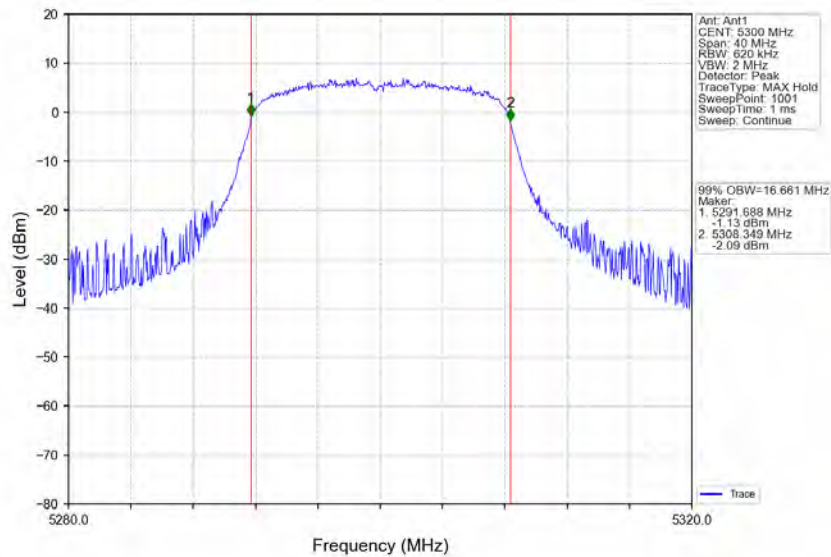
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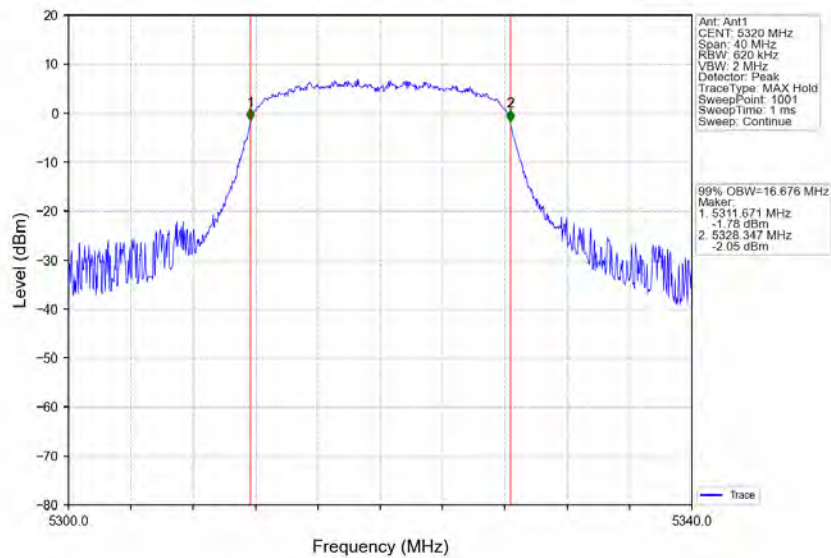
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802.11a_MCH_5300MHz_Ant2_NTNV



802.11a_HCH_5320MHz_Ant2_NTNV



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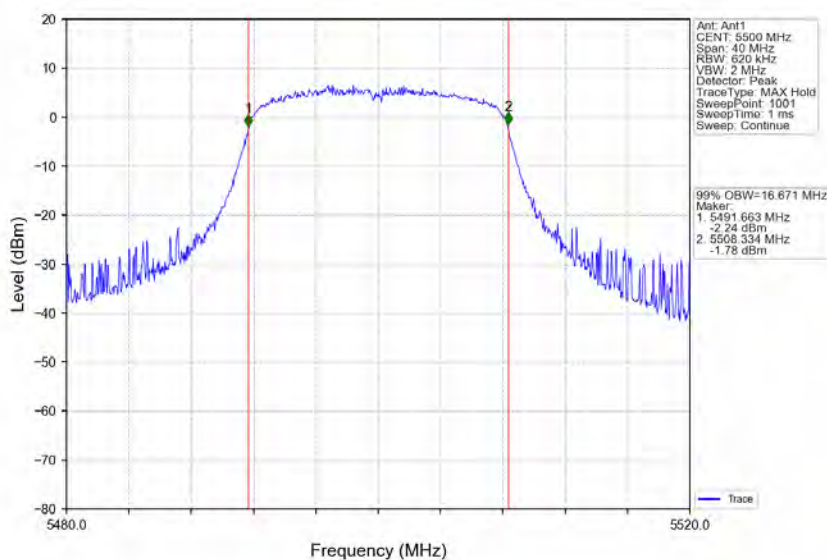
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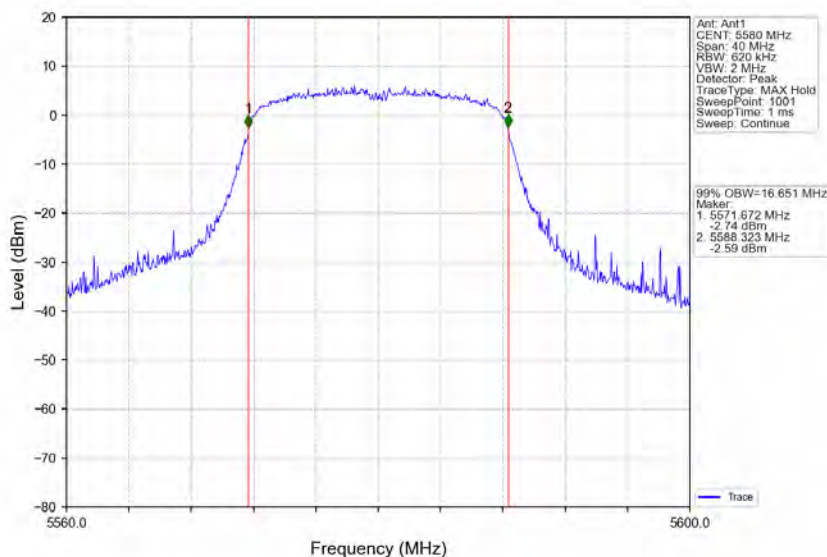
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802.11a_LCH_5500MHz_Ant2_NTNV



802.11a_MCH_5580MHz_Ant2_NTNV



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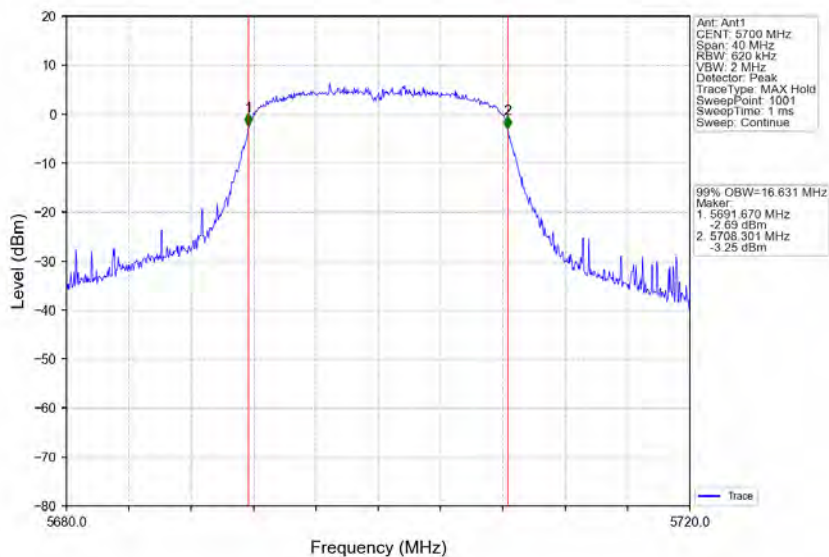
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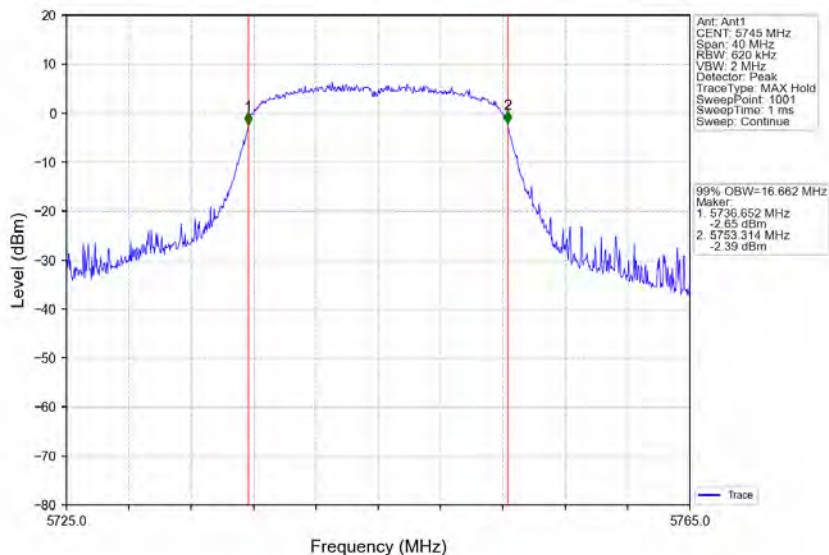
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802.11a_HCH_5700MHz_Ant2_NTNV



802.11a_LCH_5745MHz_Ant2_NTNV



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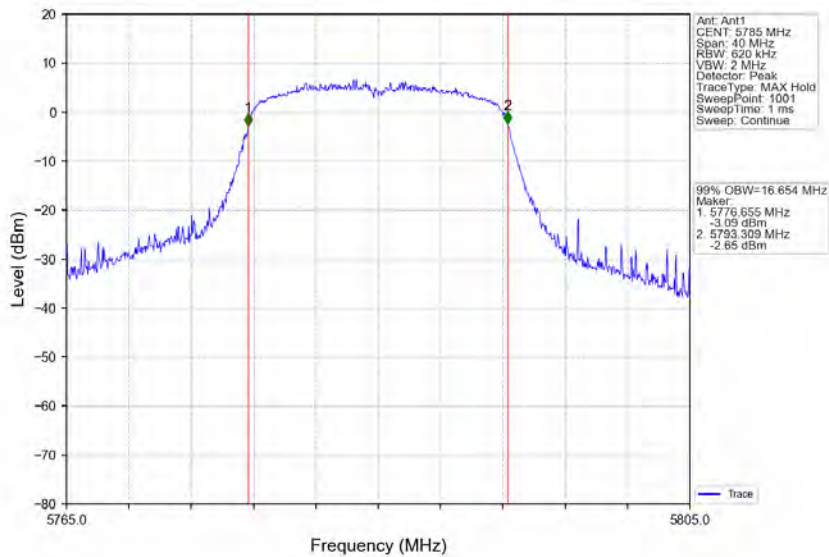
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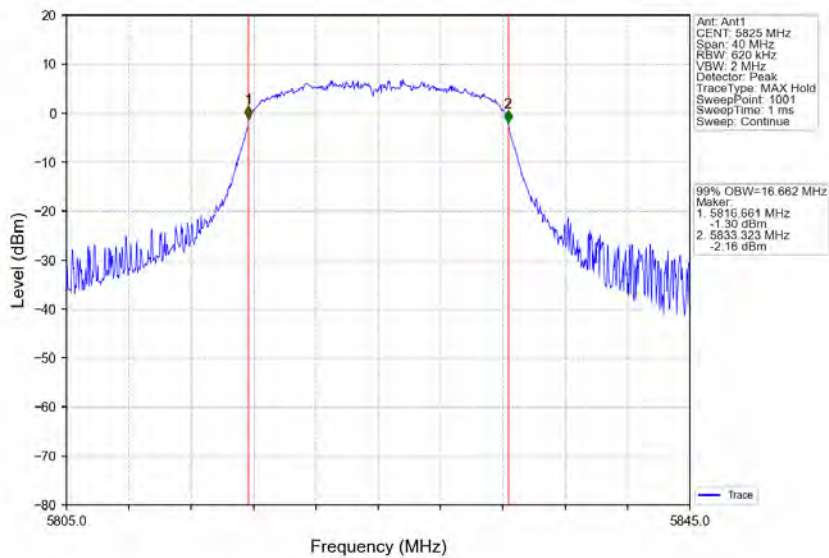
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802.11a_MCH_5785MHz_Ant2_NTNV



802.11a_HCH_5825MHz_Ant2_NTNV



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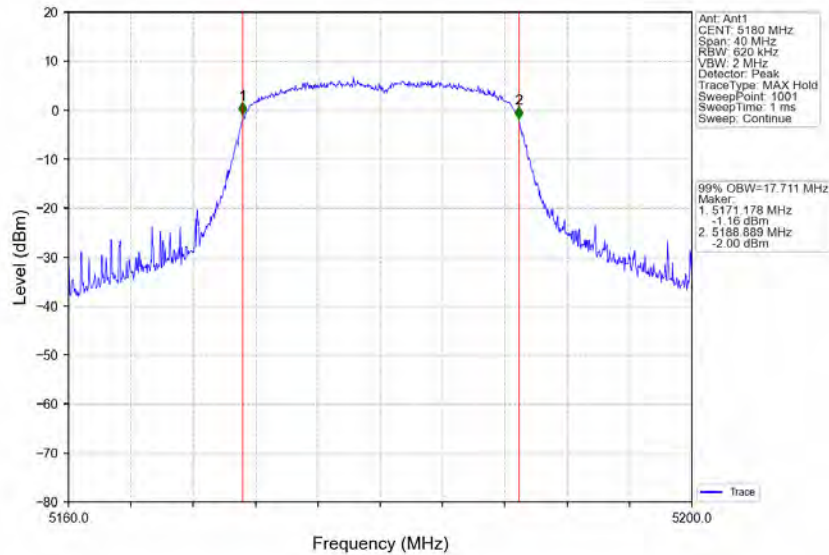
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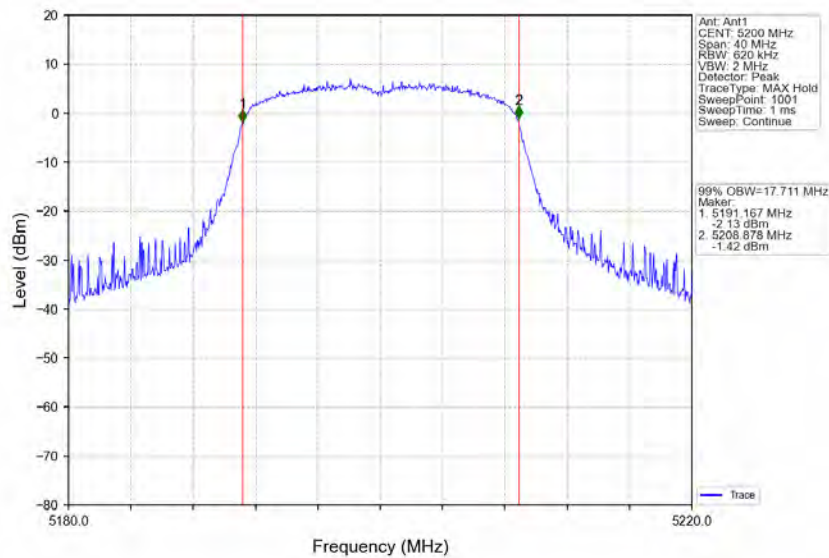
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802.11n(HT20) LCH 5180MHz Ant2 NTN



802.11n(HT20) MCH 5200MHz Ant2 NTN



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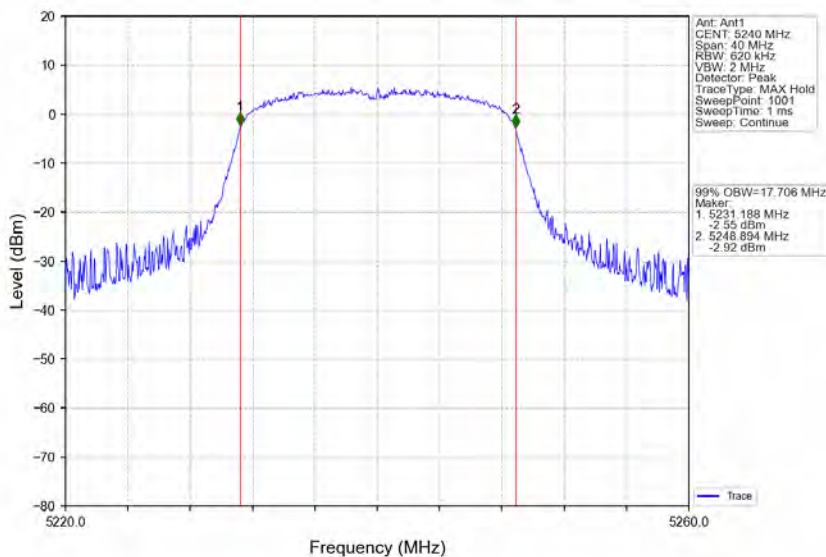
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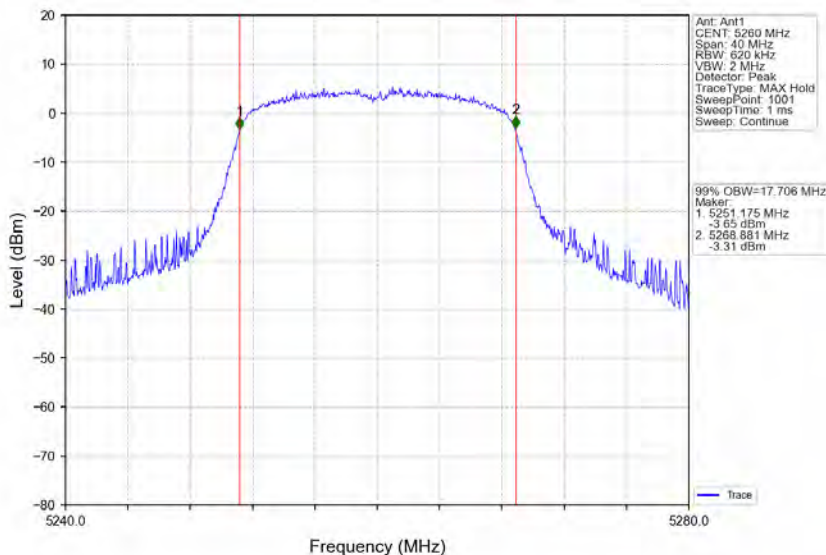
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802.11n(HT20) HCH 5240MHz Ant2 NTN



802.11n(HT20) LCH 5260MHz Ant2 NTN



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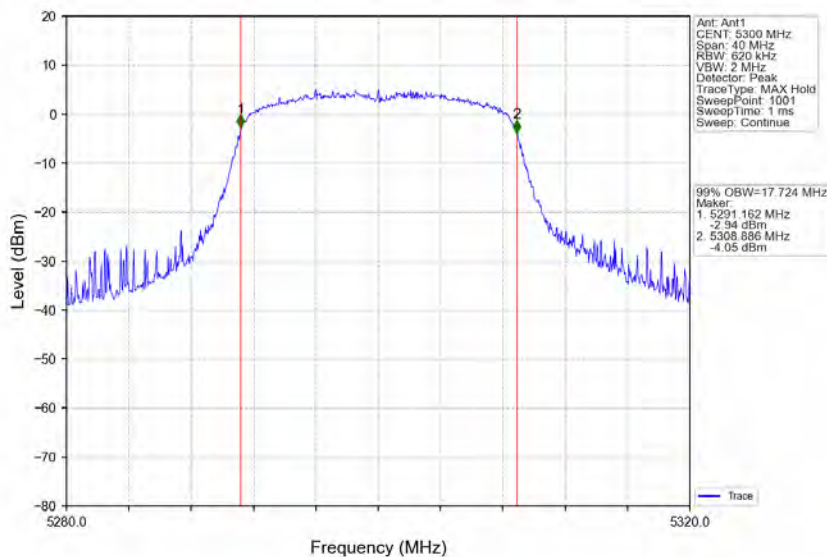
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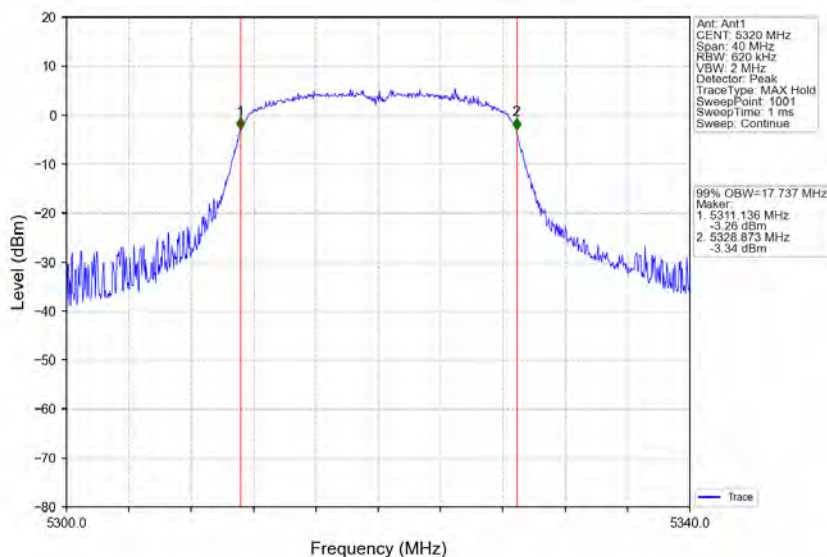
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802.11n(HT20) MCH 5300MHz Ant2 NTN



802.11n(HT20) HCH 5320MHz Ant2 NTN



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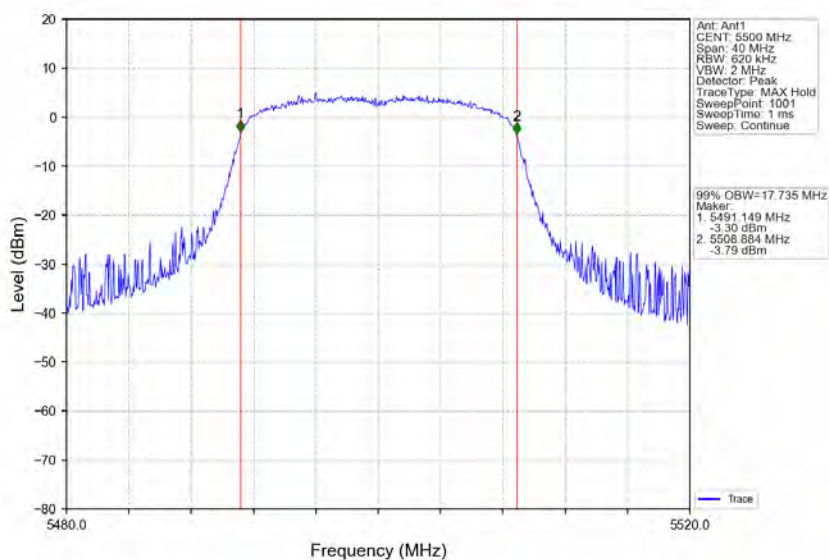
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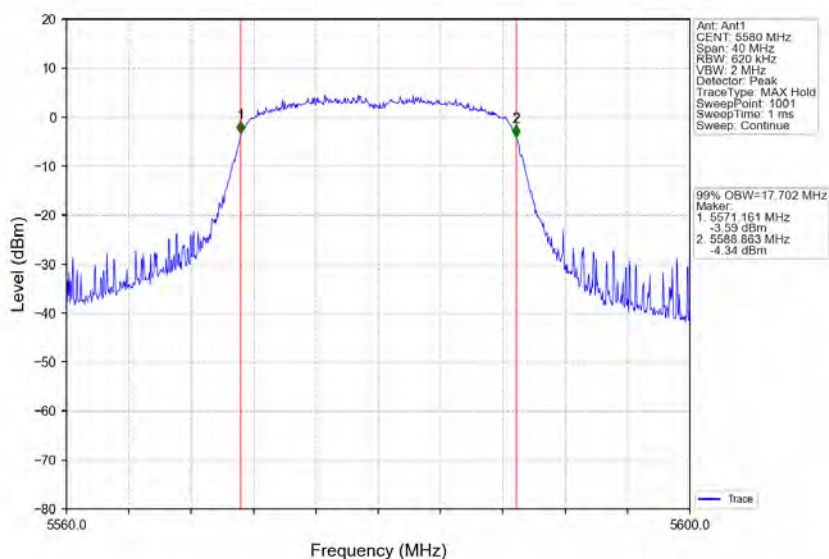
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802.11n(HT20) LCH 5500MHz Ant2 NTN



802.11n(HT20) MCH 5580MHz Ant2 NTN

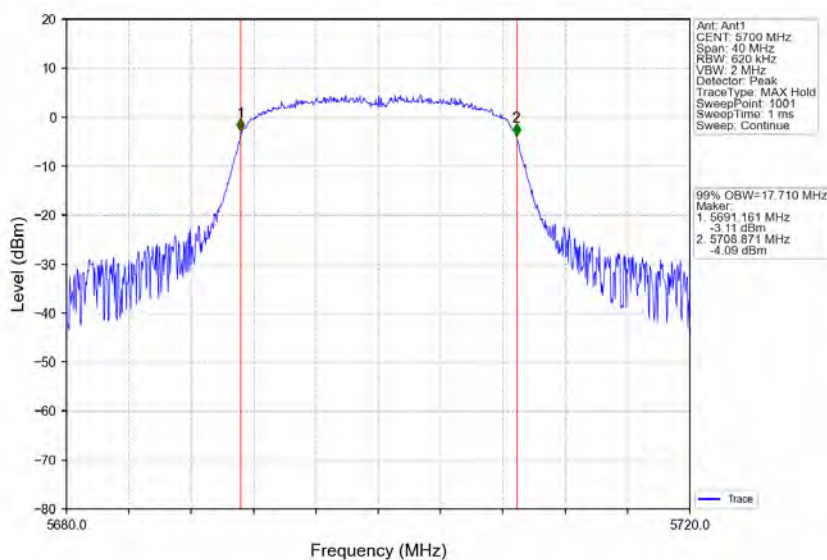


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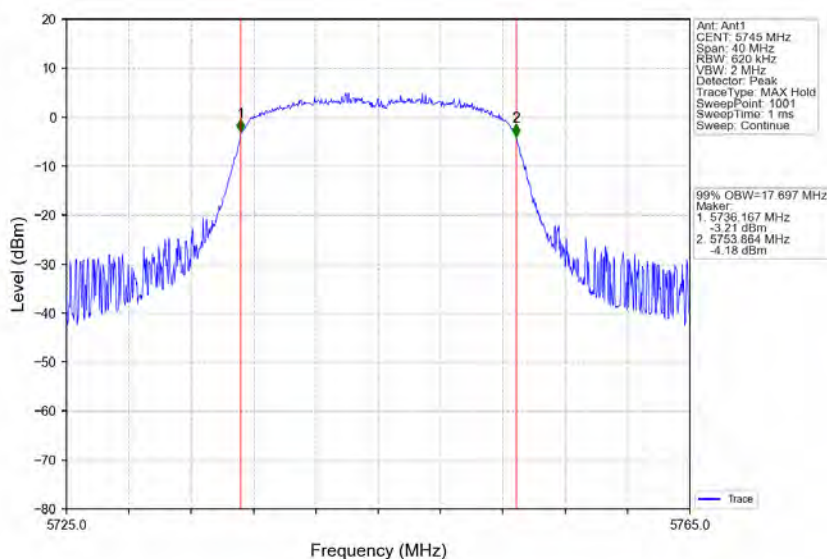
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802.11n(HT20) HCH 5700MHz Ant2 NTN



802.11n(HT20) LCH 5745MHz Ant2 NTN



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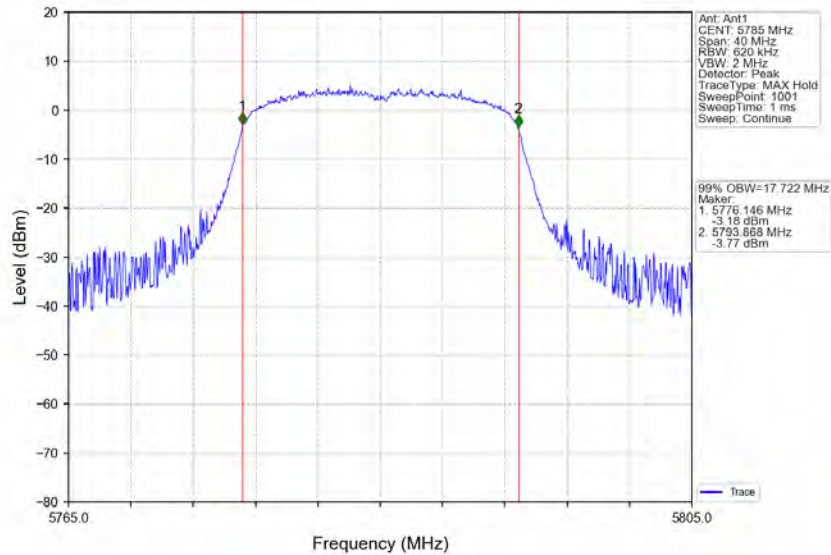
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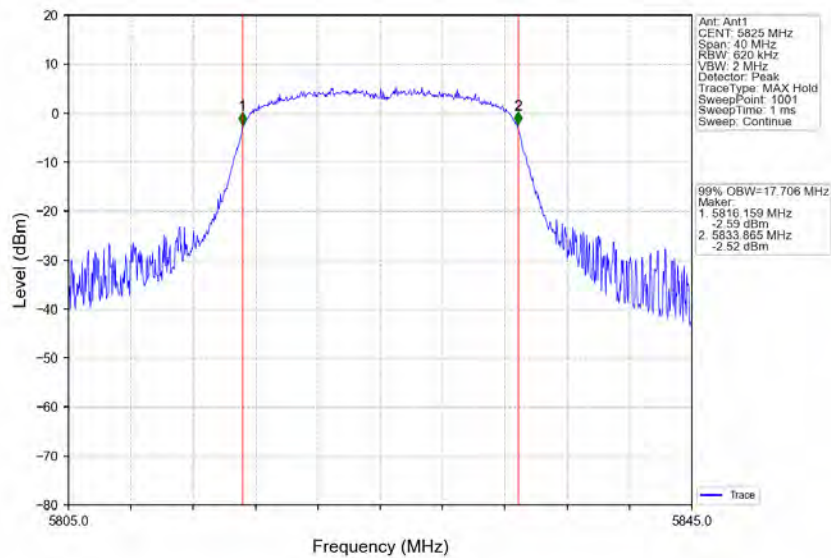
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802.11n(HT20) MCH 5785MHz Ant2 NTN



802.11n(HT20) HCH 5825MHz Ant2 NTN



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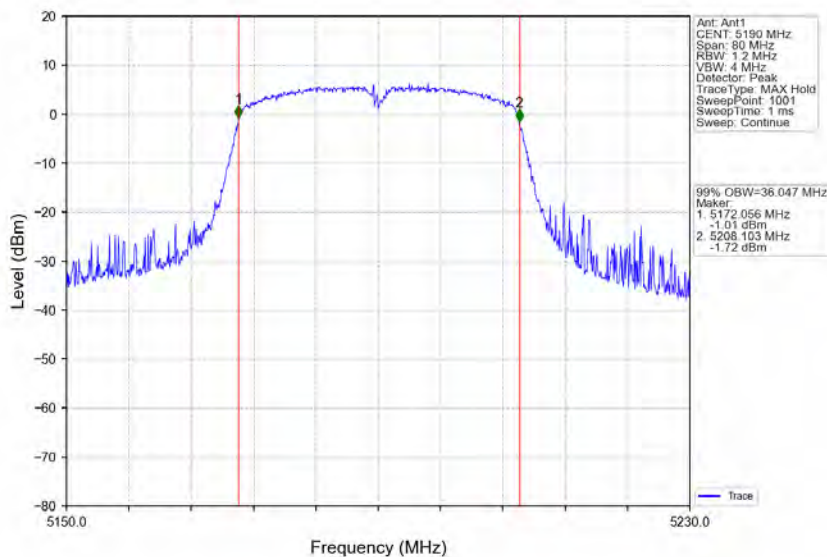
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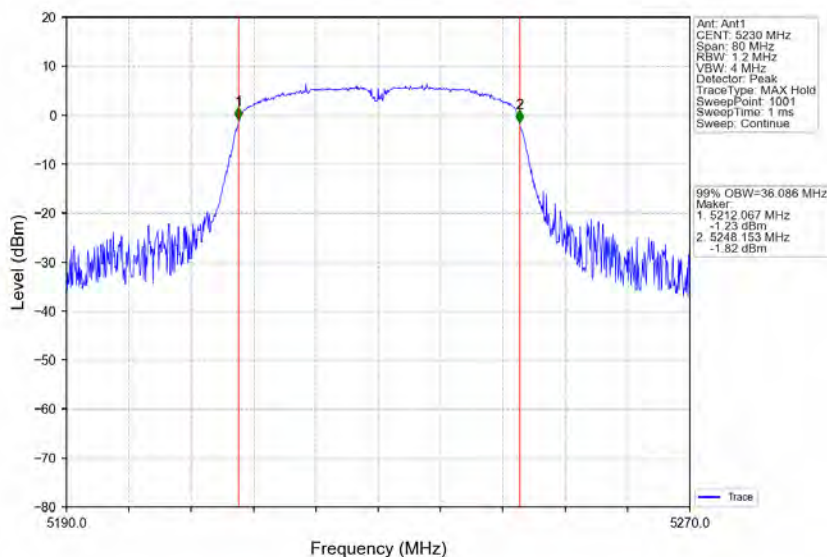
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802.11n(HT40) LCH 5190MHz Ant2 NTN



802.11n(HT40) HCH 5230MHz Ant2 NTN



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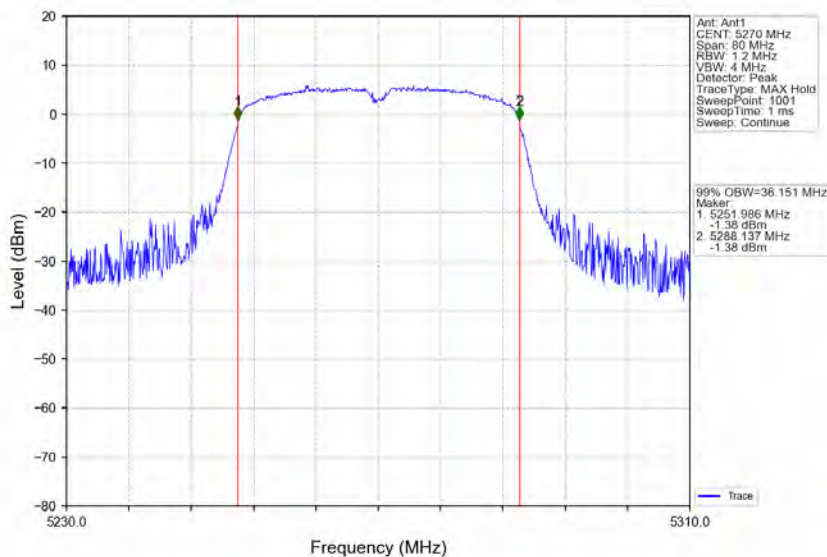
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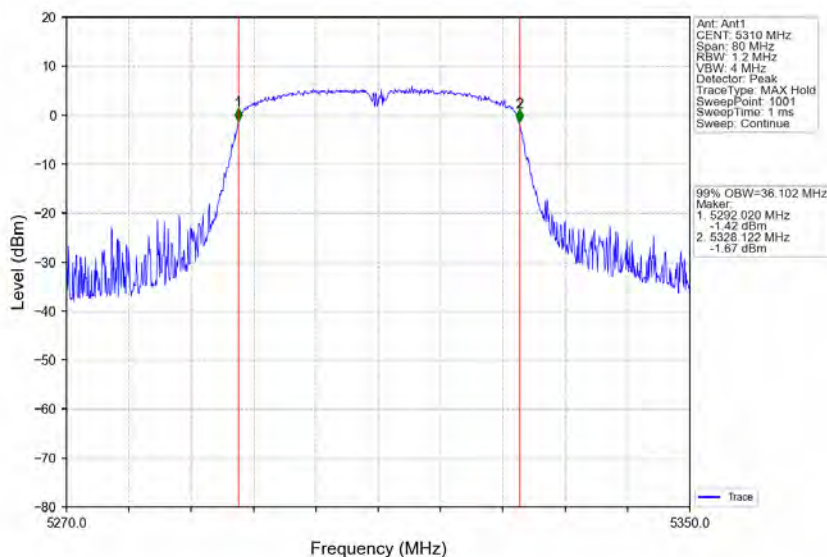
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802.11n(HT40) LCH 5270MHz Ant2 NTN



802.11n(HT40) HCH 5310MHz Ant2 NTN



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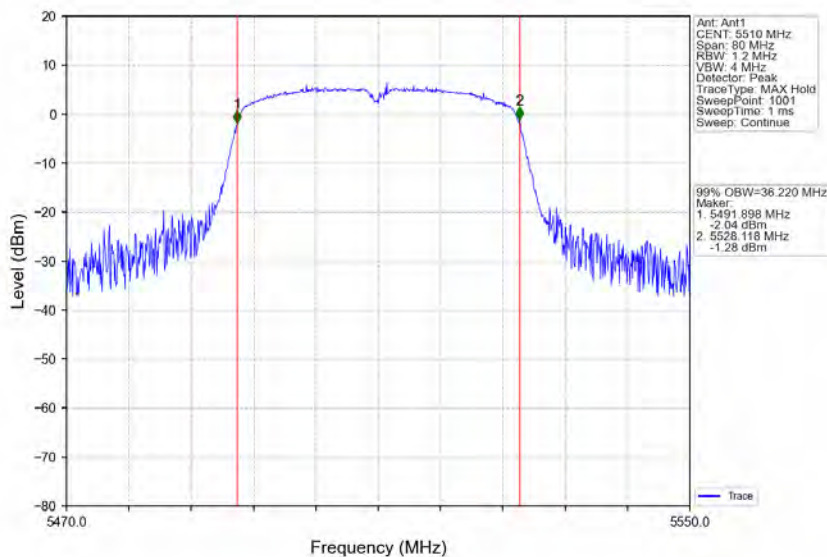
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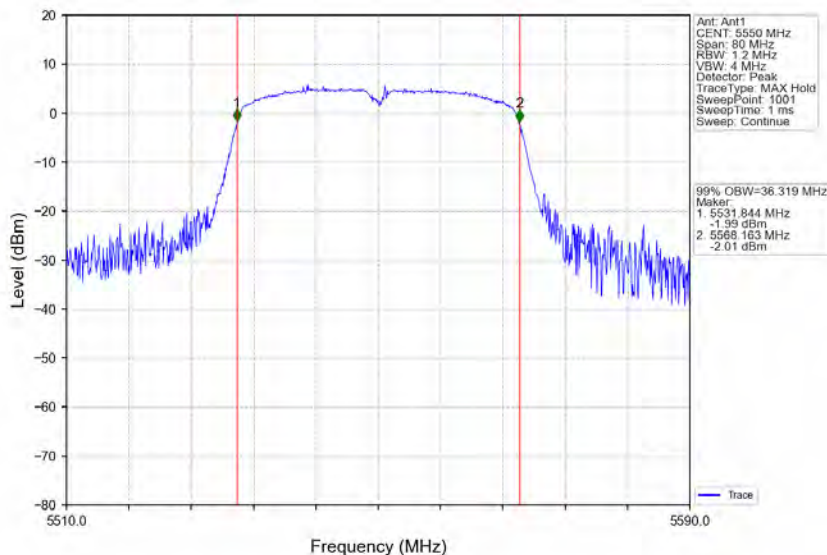
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802.11n(HT40) MCH 5550MHz Ant2 NTN



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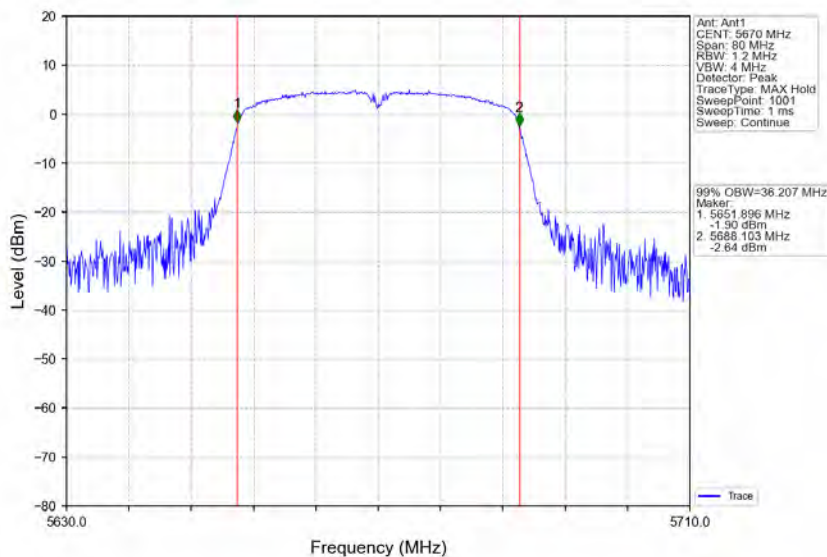
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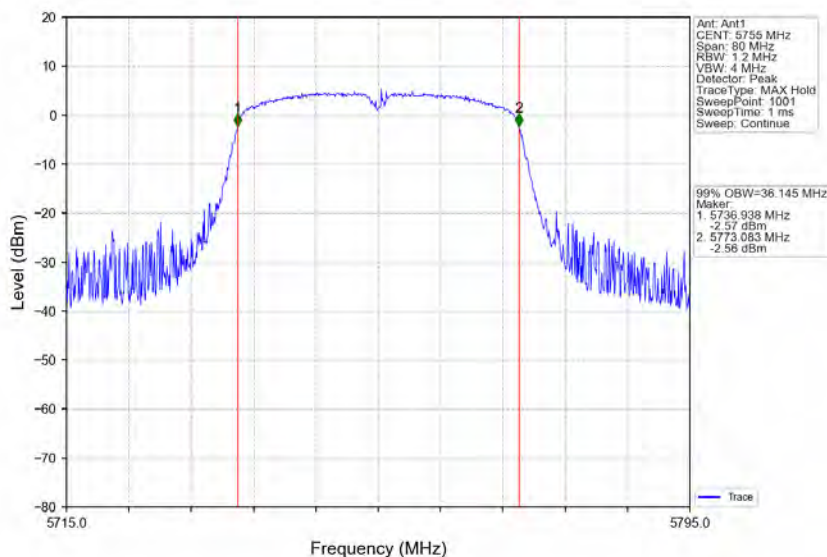
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802.11n(HT40) HCH 5670MHz Ant2 NTN



802.11n(HT40) LCH 5755MHz Ant2 NTN



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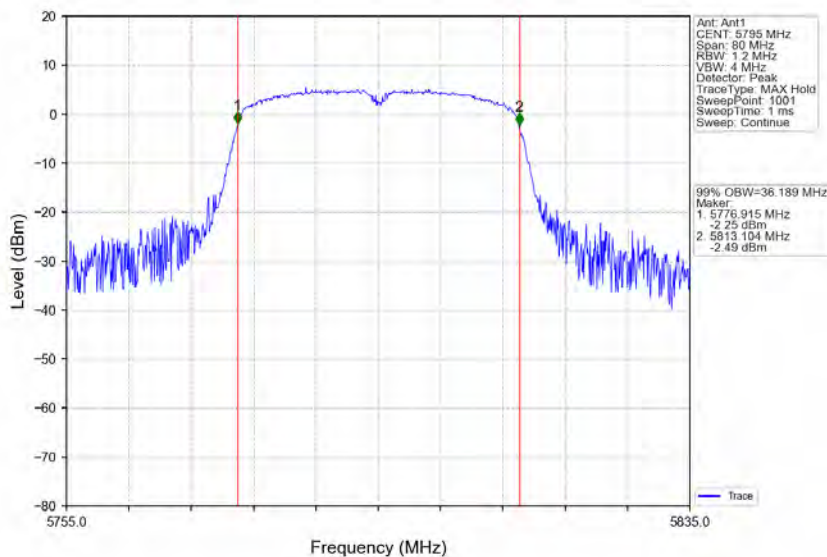
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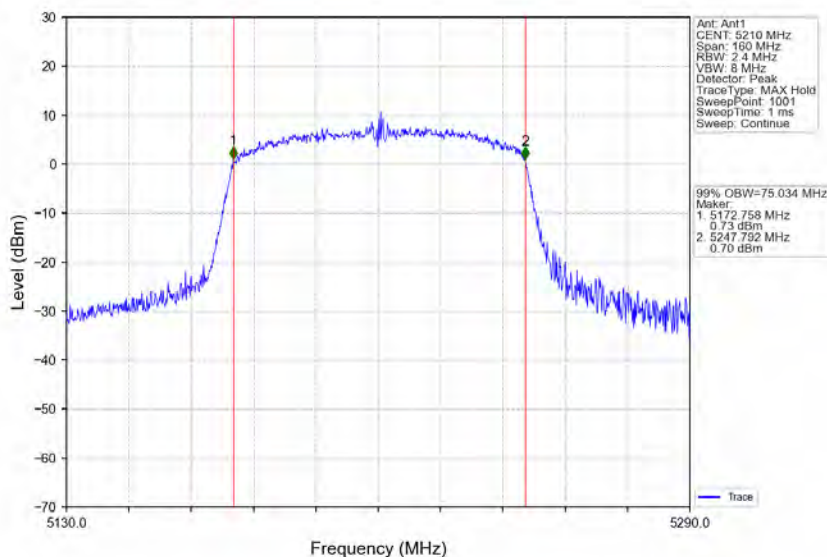
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802.11n(HT40) HCH 5795MHz Ant2 NTN



802.11ac(VHT80) MCH 5210MHz Ant2 NTN



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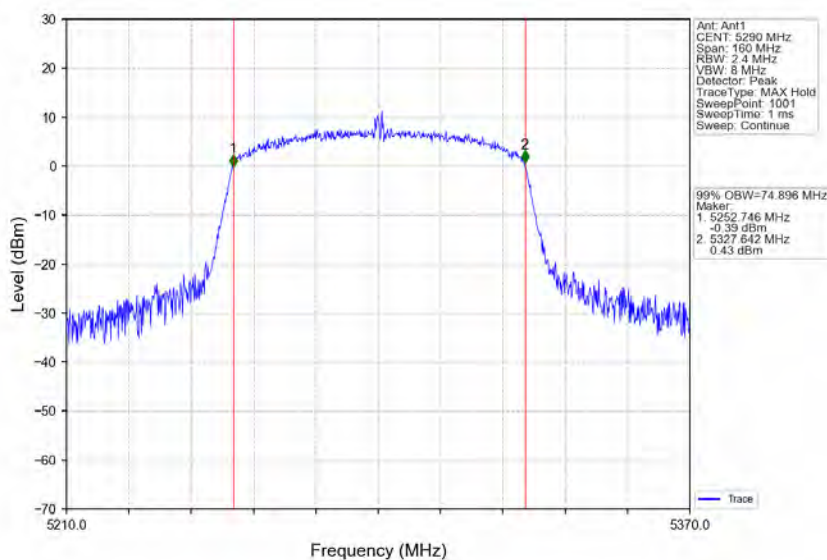
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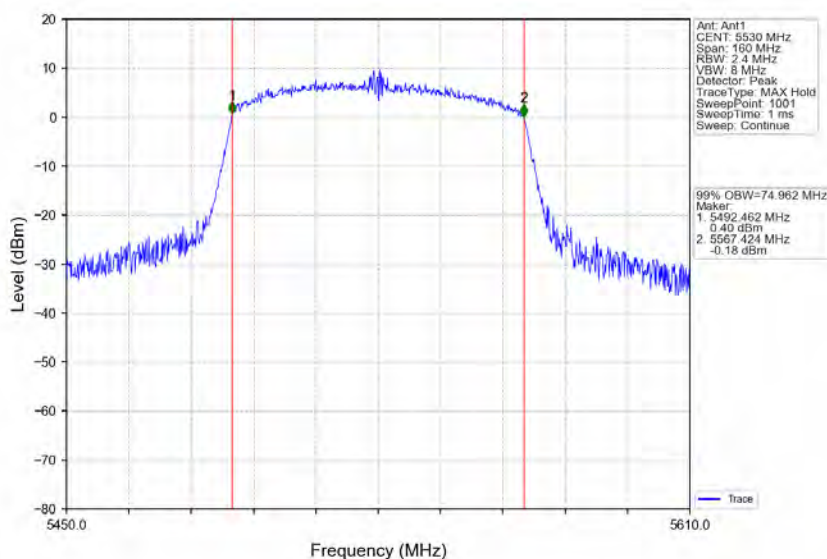
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802.11ac(VHT80) MCH 5290MHz Ant2 NTN



802.11ac(VHT80) LCH 5530MHz Ant2 NTN



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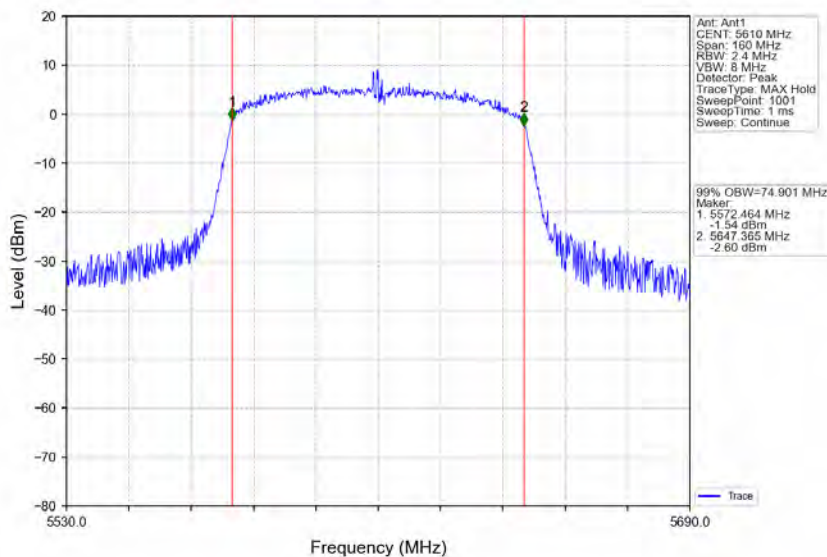
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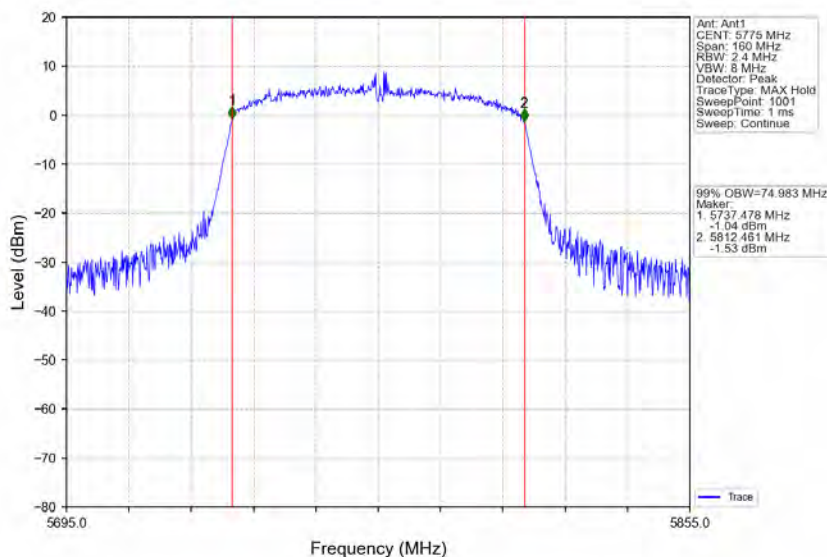
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802.11ac(VHT80) HCH 5610MHz Ant2 NTN



802.11ac(VHT80) MCH 5775MHz Ant2 NTN



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6dB Bandwidth Test Result

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
802.11a	SISO	5745	2	15.154	≥ 0.5	Pass
		5785	2	15.572	≥ 0.5	Pass
		5825	2	14.856	≥ 0.5	Pass
802.11n (HT20)	SISO	5745	2	15.147	≥ 0.5	Pass
		5785	2	15.162	≥ 0.5	Pass
		5825	2	15.163	≥ 0.5	Pass
802.11n (HT40)	SISO	5755	2	35.154	≥ 0.5	Pass
		5795	2	35.146	≥ 0.5	Pass
802.11ac (VHT80)	SISO	5775	2	75.084	≥ 0.5	Pass

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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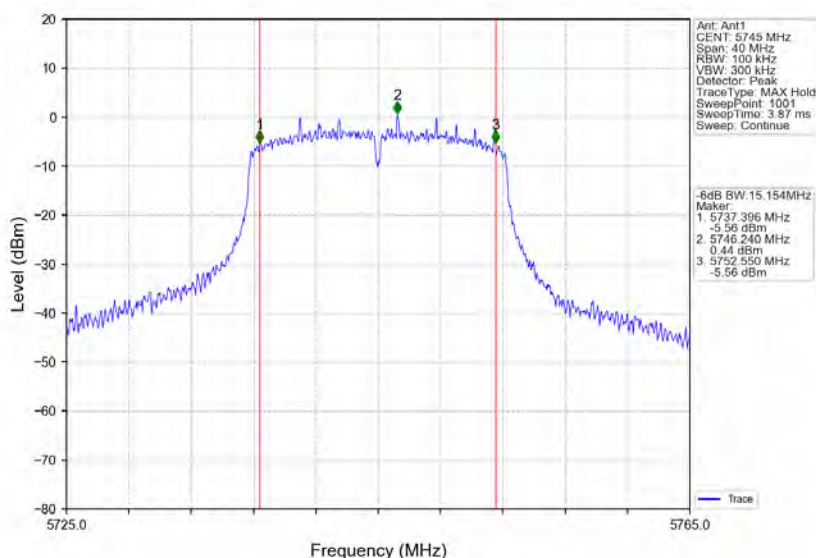
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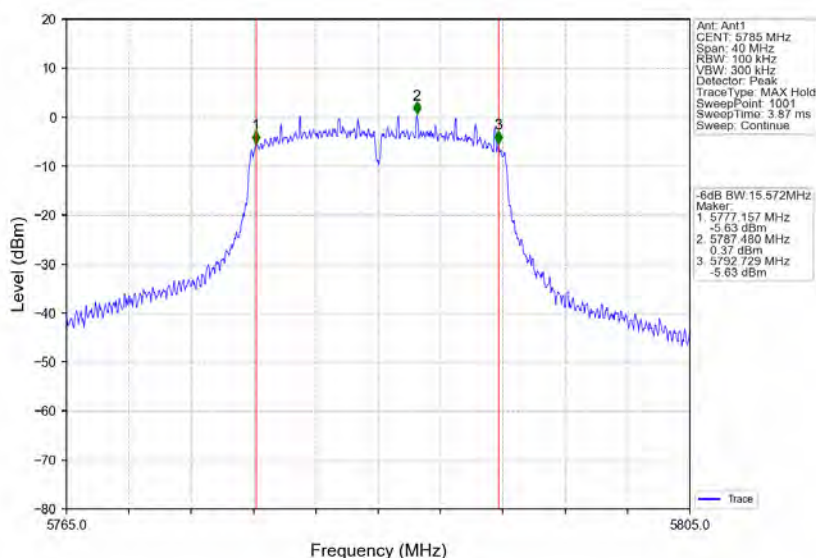
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Test Graphs

802.11a_LCH_5745MHz_Ant2_NTNV



802.11a_MCH_5785MHz_Ant2_NTNV



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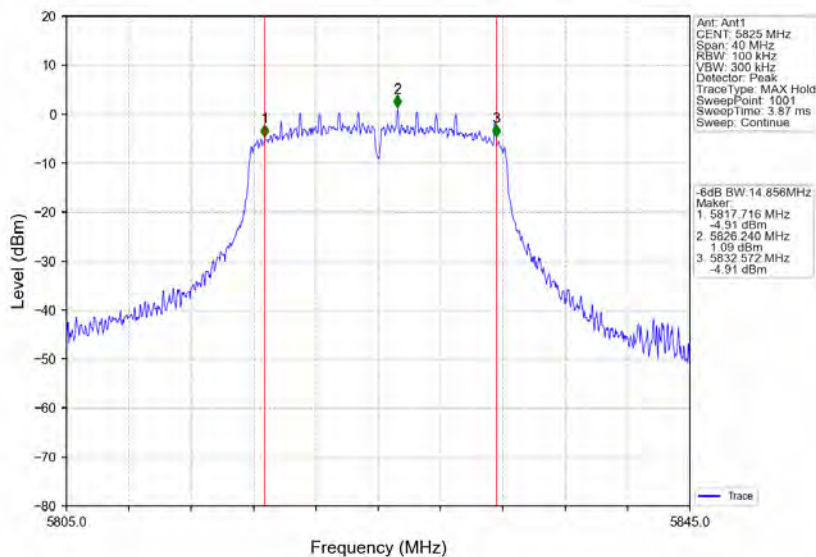
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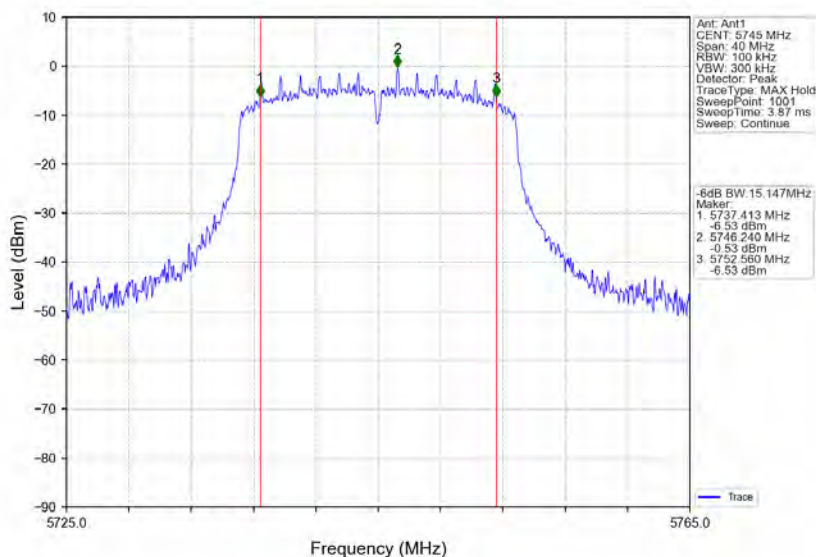
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802.11a HCH 5825MHz Ant2 NTN



802.11n(HT20) LCH 5745MHz Ant2 NTN



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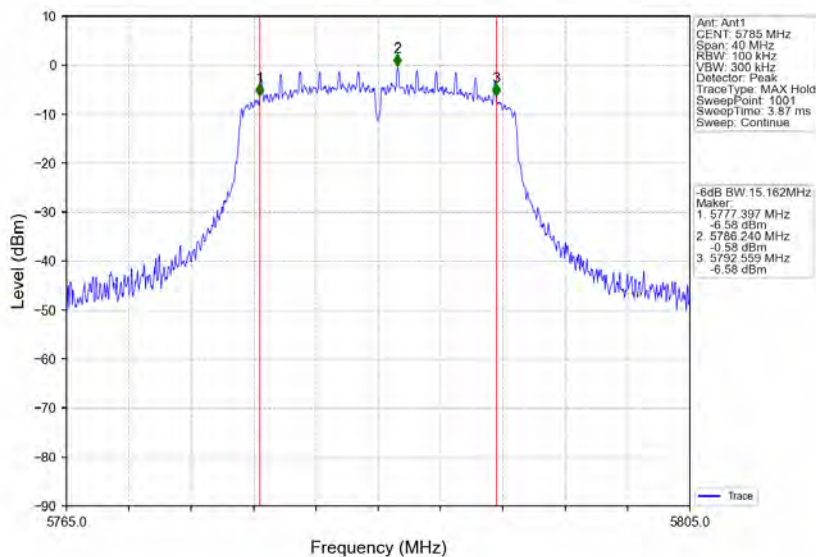
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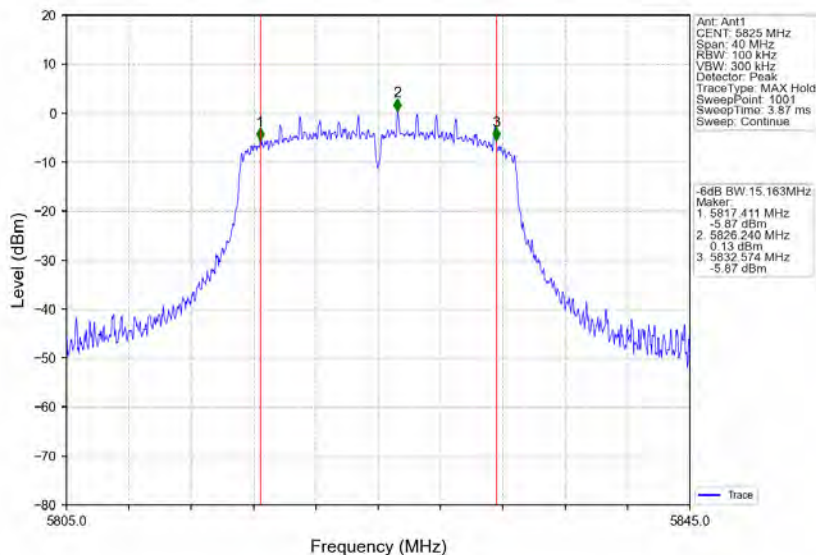
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802.11n(HT20) MCH 5785MHz Ant2 NTN



802.11n(HT20) HCH 5825MHz Ant2 NTN



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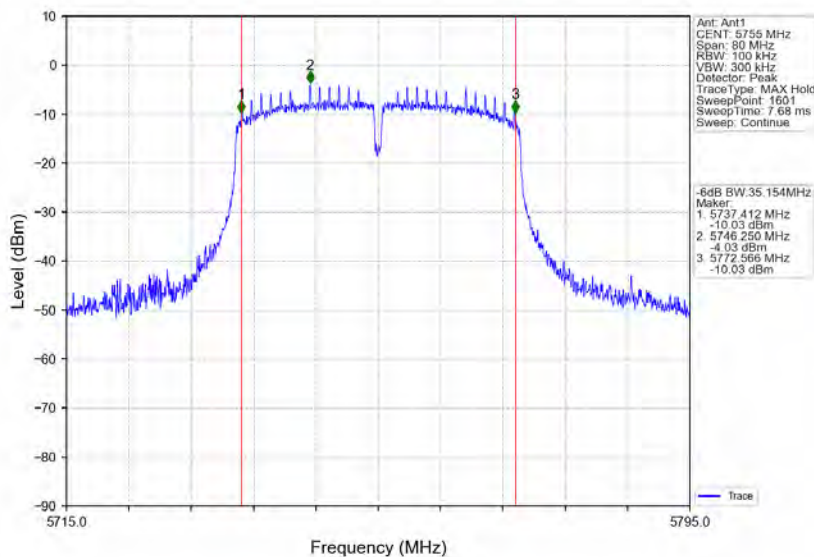
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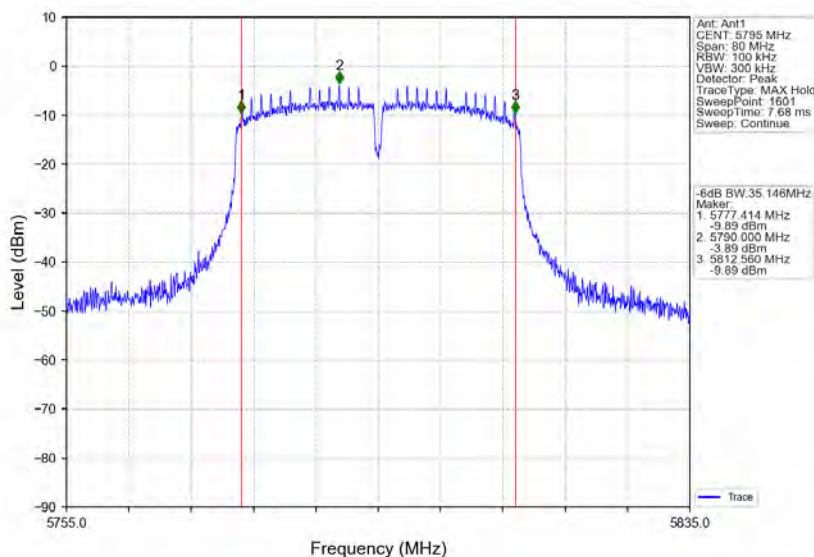
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802.11n(HT40) LCH 5755MHz Ant2 NTN



802.11n(HT40) HCH 5795MHz Ant2 NTN



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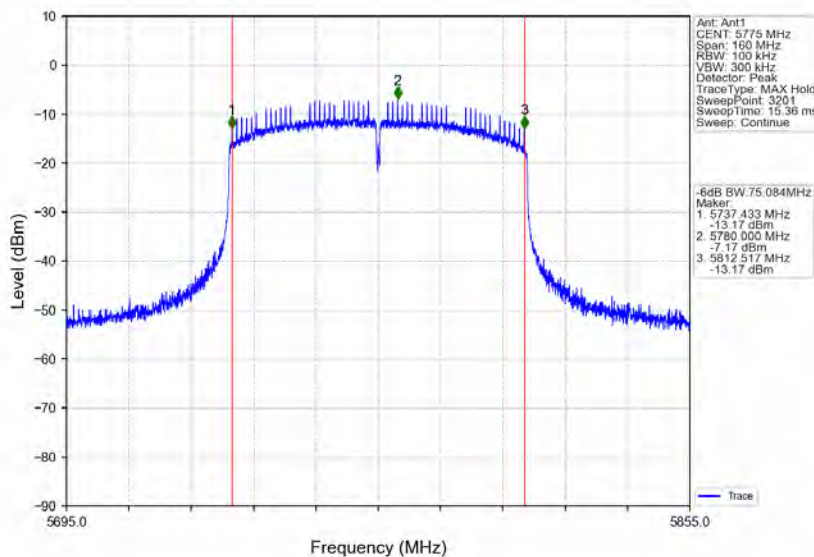
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802.11ac(VHT80) MCH 5775MHz Ant2 NTV



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Emission Bandwidth Test Result

Mode	TX Type	Frequency (MHz)	ANT	26dB Bandwidth (MHz)		Verdict
				Result	Limit	
802.11a	SISO	5180	2	19.879	/	Pass
		5200	2	19.222	/	Pass
		5240	2	19.406	/	Pass
		5260	2	19.345	/	Pass
		5300	2	19.406	/	Pass
		5320	2	19.593	/	Pass
		5500	2	19.145	/	Pass
		5580	2	19.118	/	Pass
		5700	2	19.363	/	Pass
802.11n (HT20)	SISO	5180	2	20.242	/	Pass
		5200	2	19.907	/	Pass
		5240	2	19.928	/	Pass
		5260	2	19.798	/	Pass
		5300	2	19.924	/	Pass
		5320	2	20.341	/	Pass
		5500	2	20.053	/	Pass
		5580	2	19.953	/	Pass
		5700	2	20.227	/	Pass
802.11n (HT40)	SISO	5190	2	40.629	/	Pass
		5230	2	40.448	/	Pass
		5270	2	40.628	/	Pass
		5310	2	40.782	/	Pass
		5510	2	42.077	/	Pass
		5550	2	42.376	/	Pass
802.11ac (VHT80)	SISO	5670	2	41.619	/	Pass
		5210	2	81.964	/	Pass
		5290	2	81.590	/	Pass
		5530	2	81.584	/	Pass
		5610	2	81.795	/	Pass

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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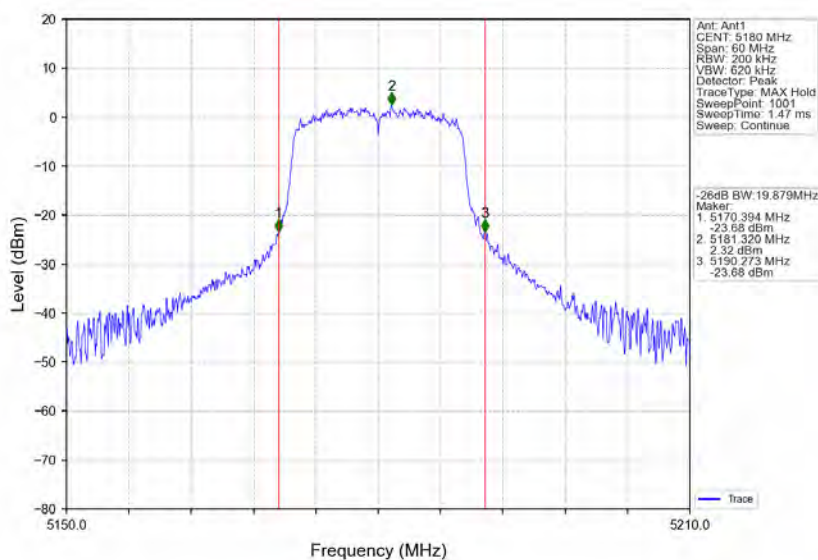
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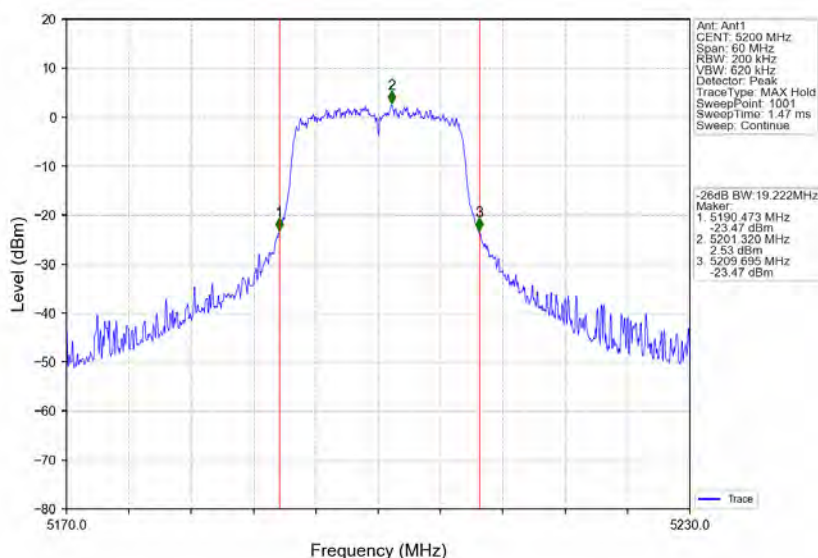
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Test Graphs

802.11a_LCH_5180MHz_Ant2_NTNV



802.11a_MCH_5200MHz_Ant2_NTNV



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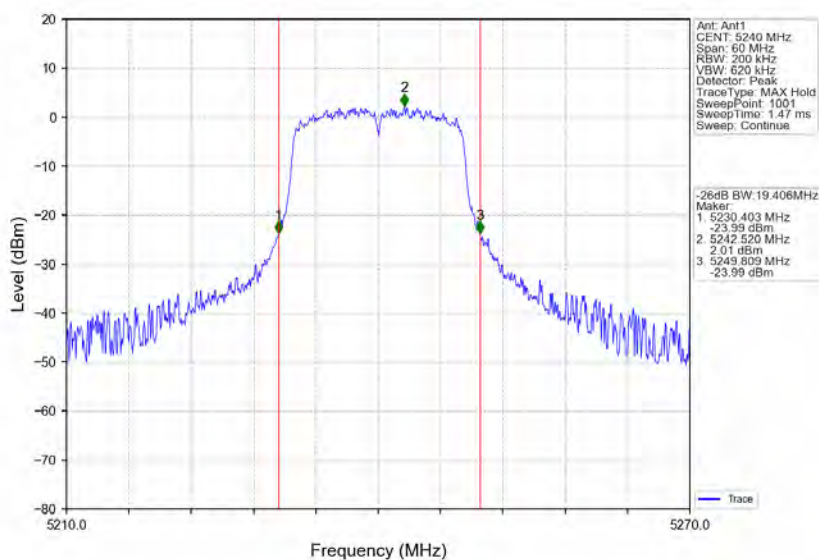
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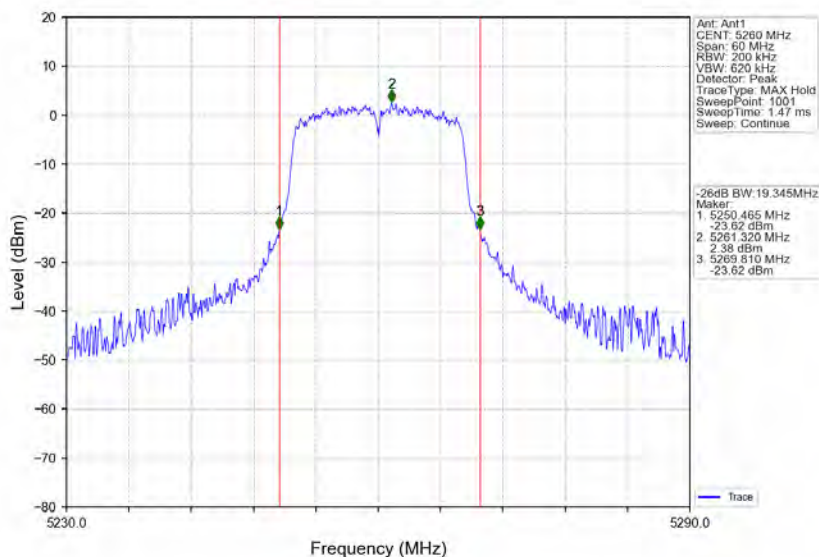
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802.11a_HCH_5240MHz_Ant2_NTNV



802.11a_LCH_5260MHz_Ant2_NTNV



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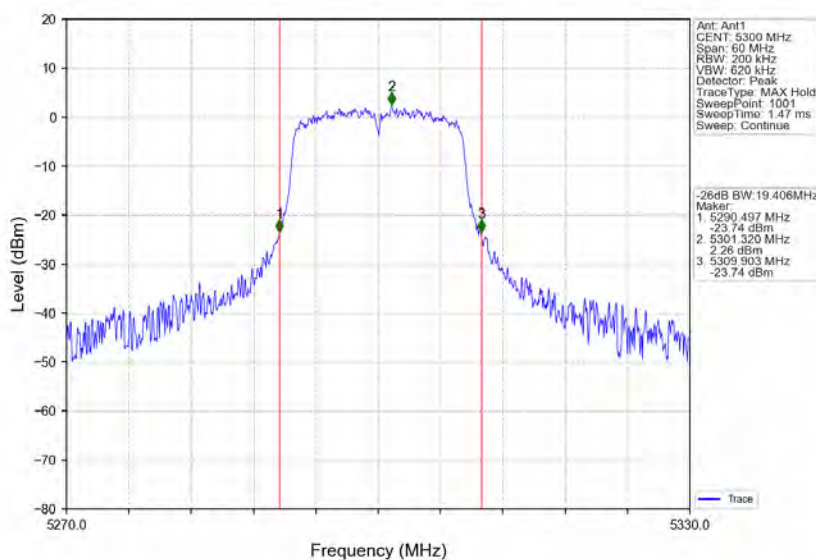
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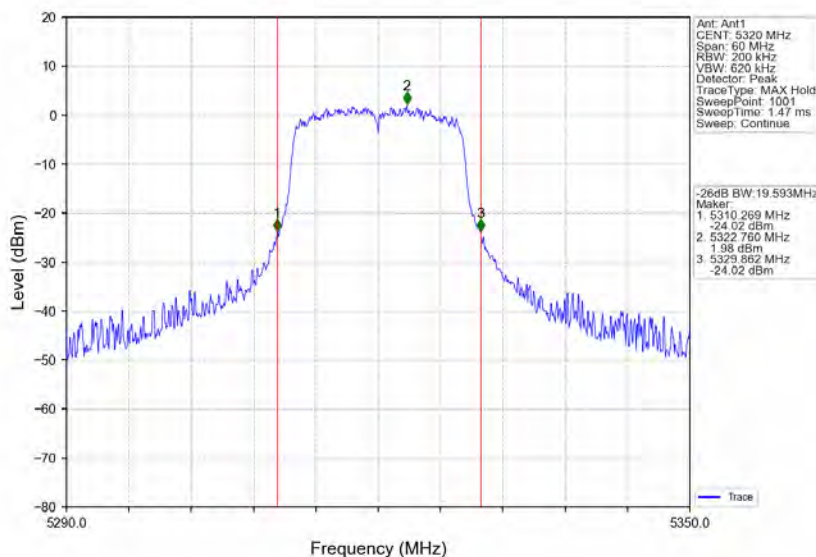
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802.11a_MCH_5300MHz_Ant2_NTNV



802.11a_HCH_5320MHz_Ant2_NTNV



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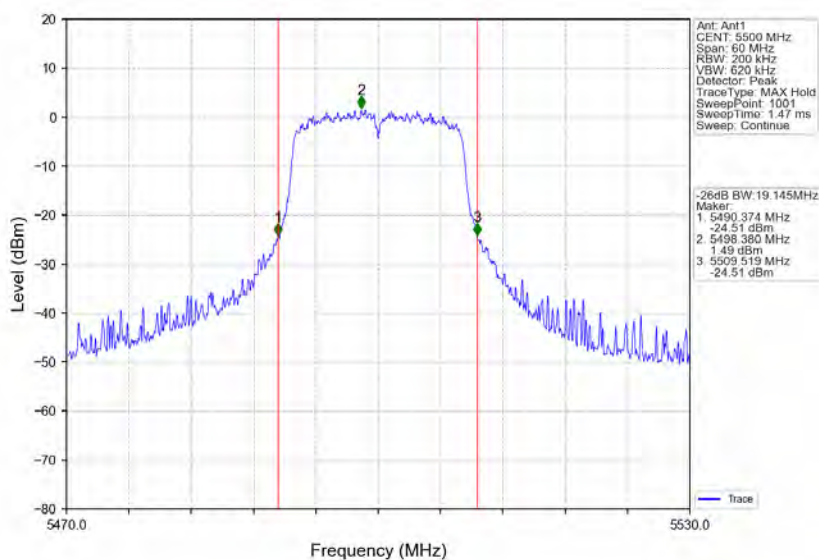
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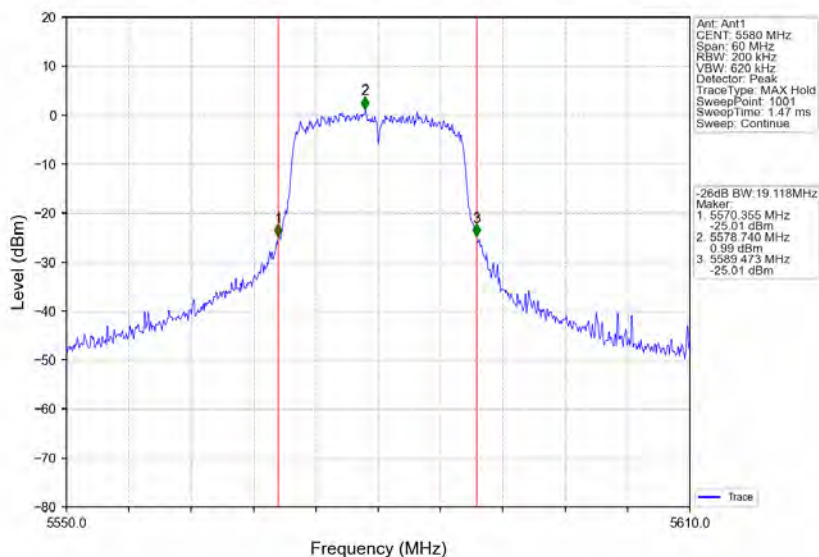
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802.11a LCH 5500MHz Ant2 NTN



802.11a_MCH 5580MHz Ant2 NTN



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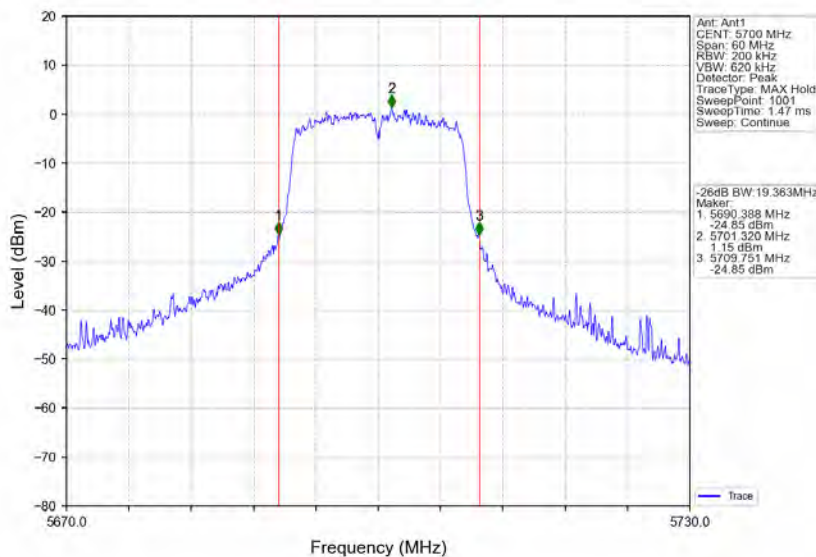
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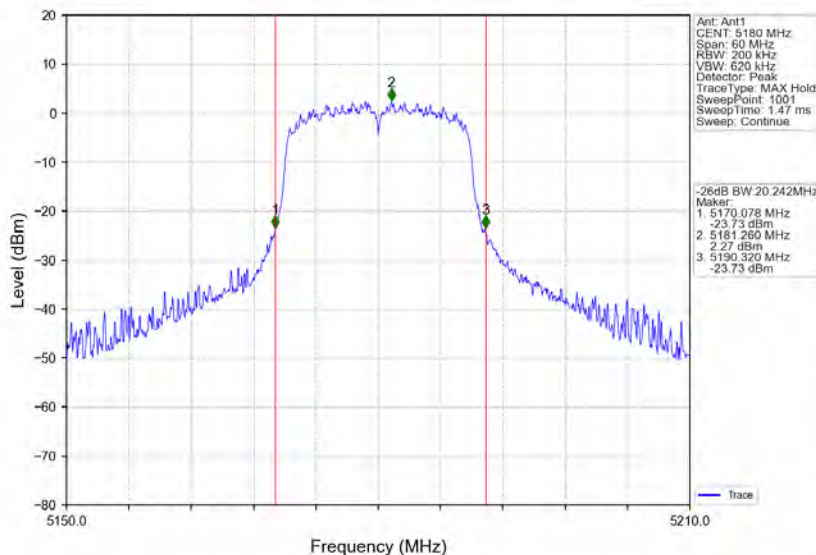
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802.11a HCH 5700MHz Ant2 NTN



802.11n(HT20) LCH 5180MHz Ant2 NTN



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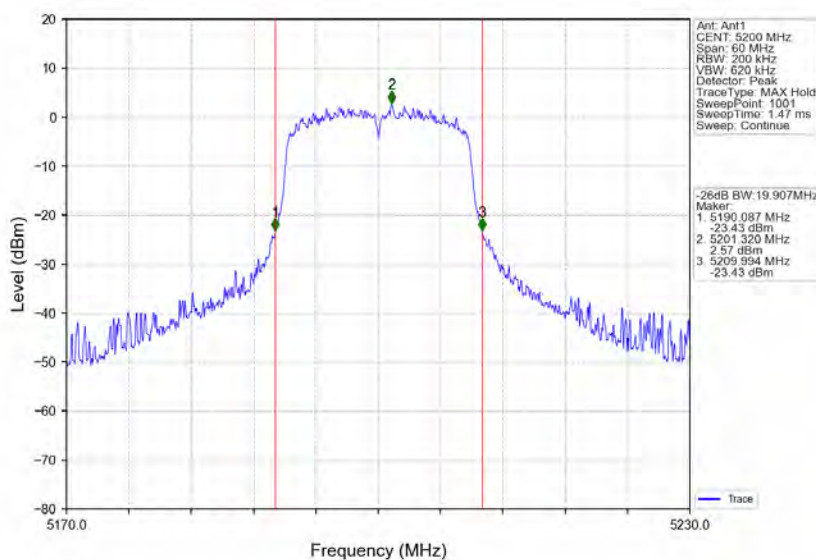
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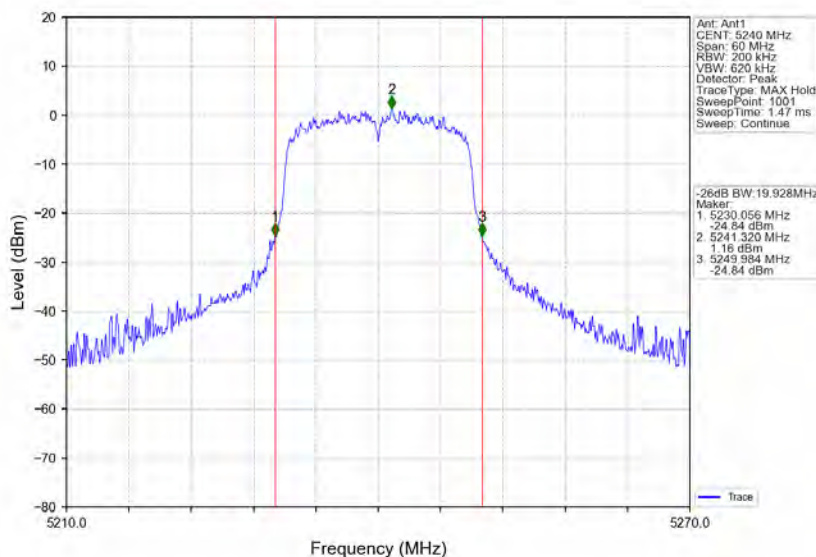
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802.11n(HT20) MCH 5200MHz Ant2 NTN



802.11n(HT20) HCH 5240MHz Ant2 NTN



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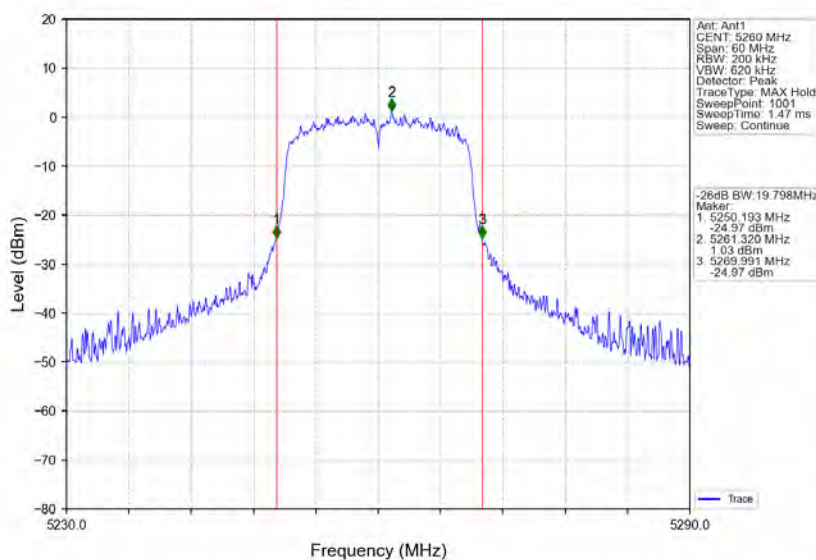
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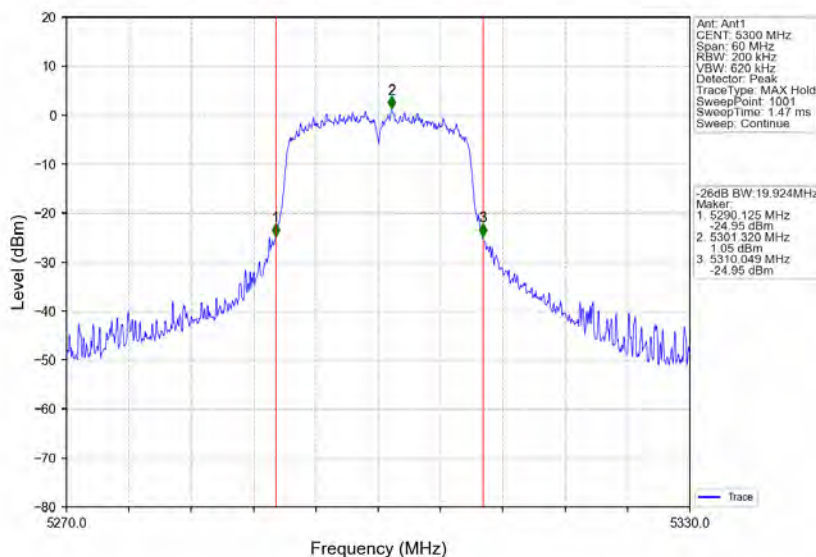
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802.11n(HT20) LCH 5260MHz Ant2 NTN



802.11n(HT20) MCH 5300MHz Ant2 NTN



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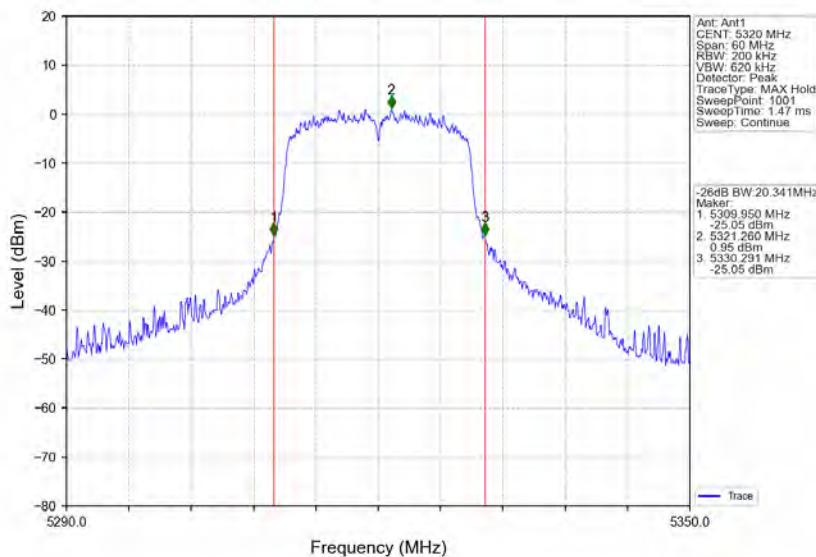
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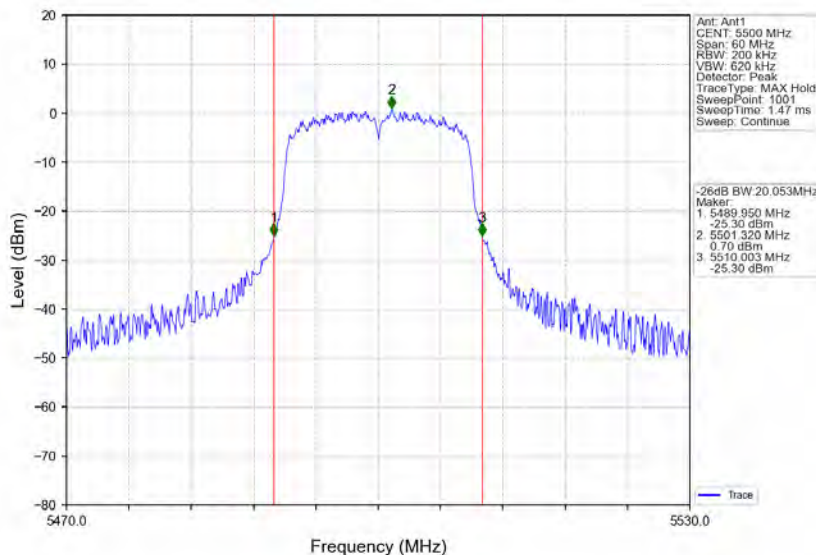
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802.11n(HT20) HCH 5320MHz Ant2 NTN



802.11n(HT20) LCH 5500MHz Ant2 NTN



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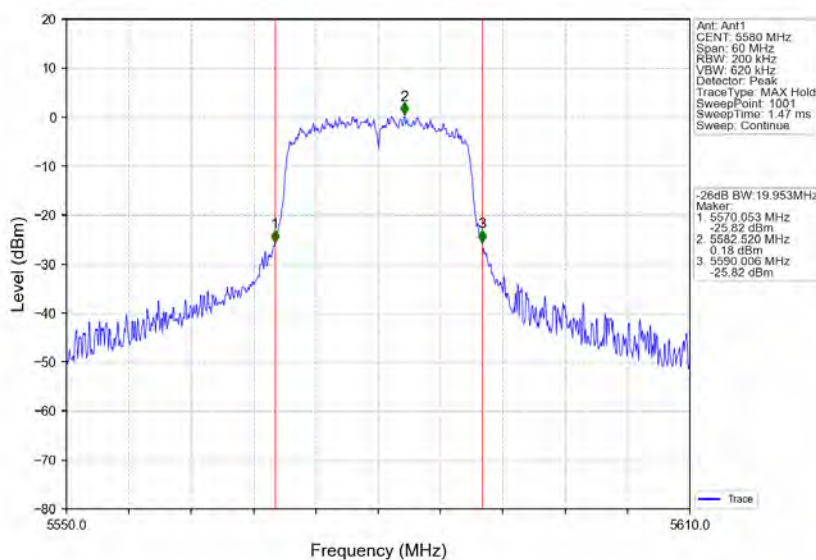
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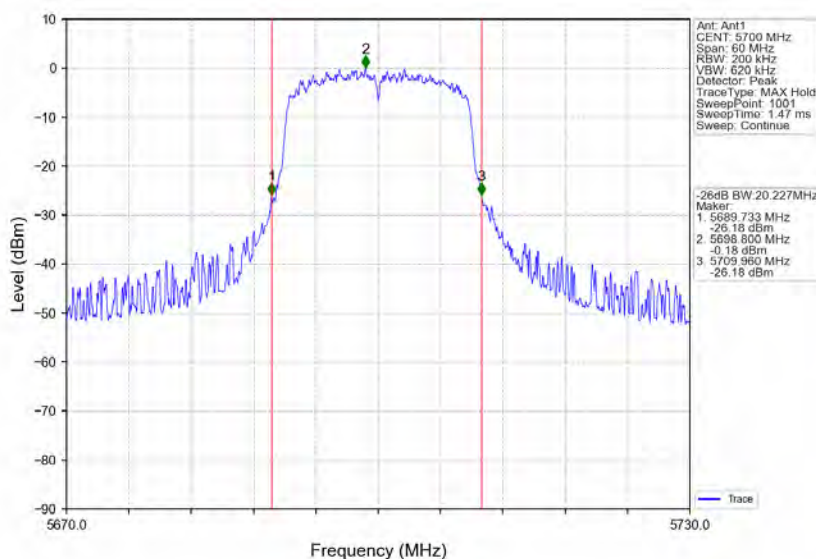
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802.11n(HT20) MCH 5580MHz Ant2 NTN



802.11n(HT20) HCH 5700MHz Ant2 NTN



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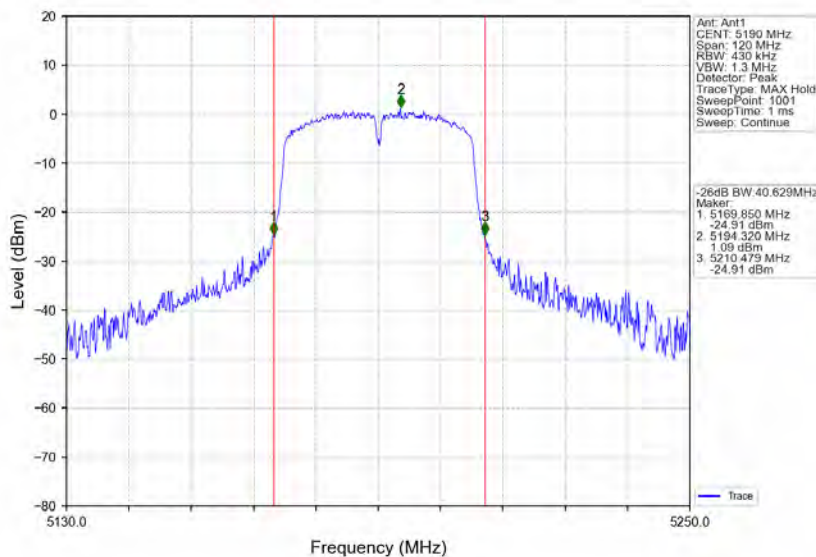
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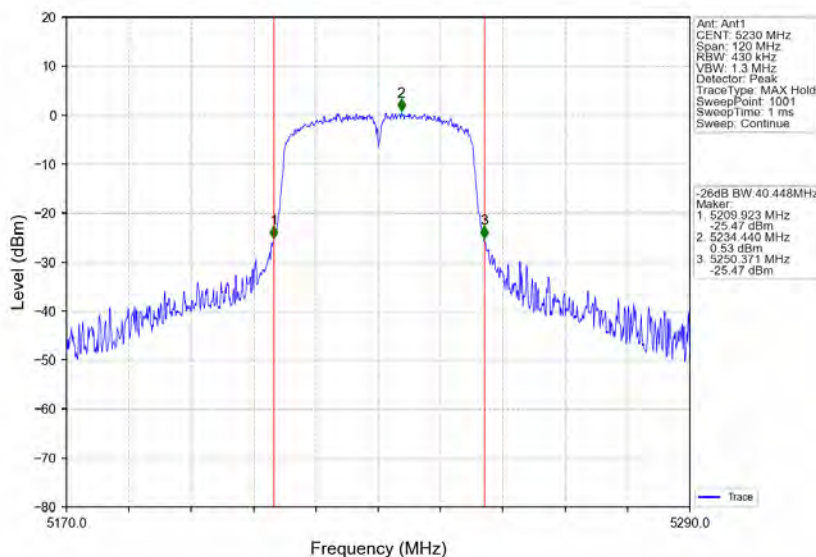
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802.11n(HT40) LCH 5190MHz Ant2 NTN



802.11n(HT40) HCH 5230MHz Ant2 NTN



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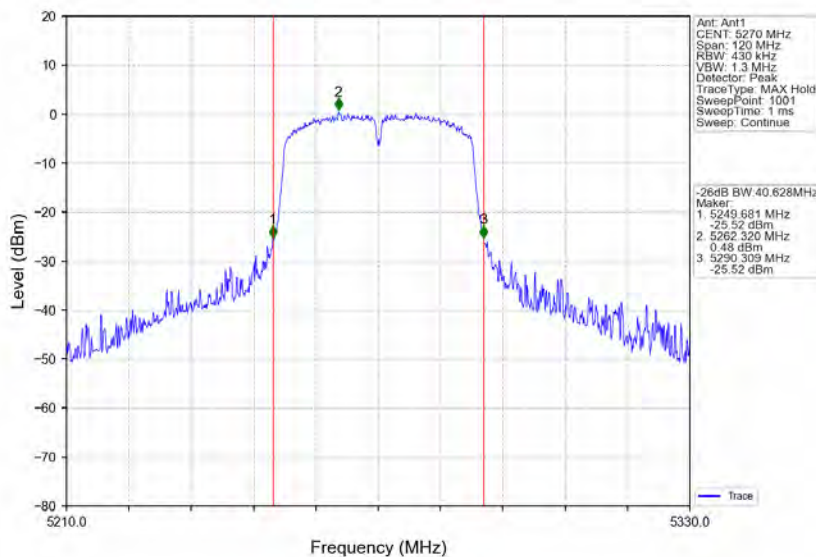
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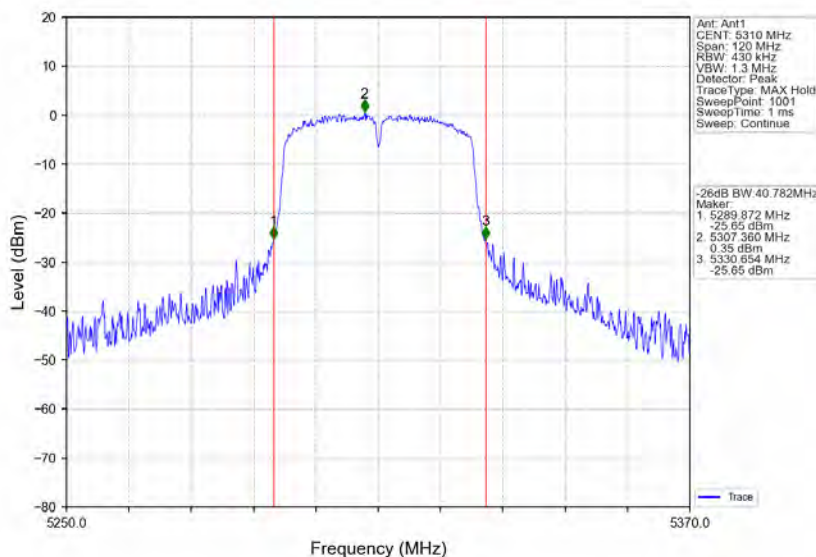
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802.11n(HT40) LCH 5270MHz Ant2 NTN



802.11n(HT40) HCH 5310MHz Ant2 NTN



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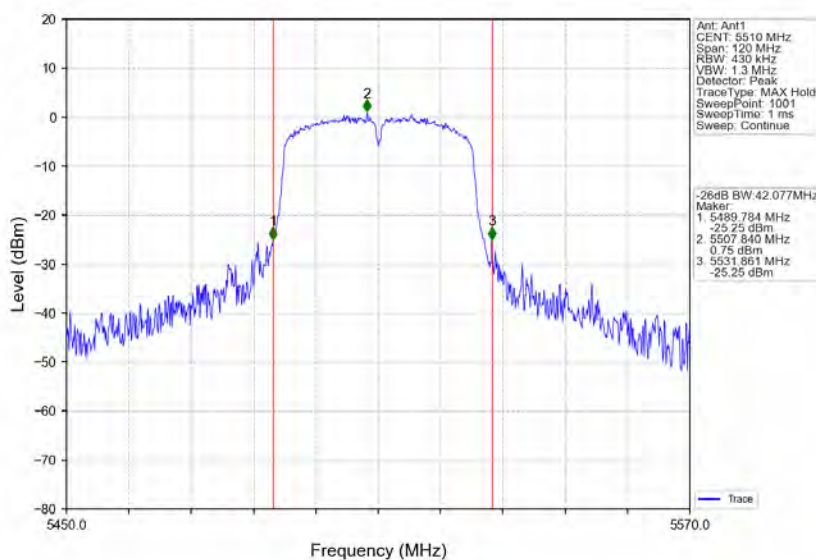
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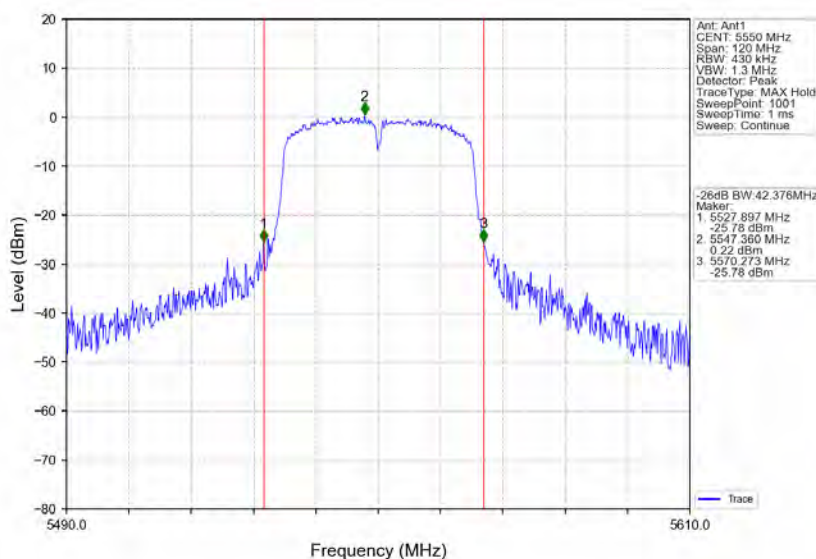
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802.11n(HT40) LCH 5510MHz Ant2 NTN



802.11n(HT40) MCH 5550MHz Ant2 NTN



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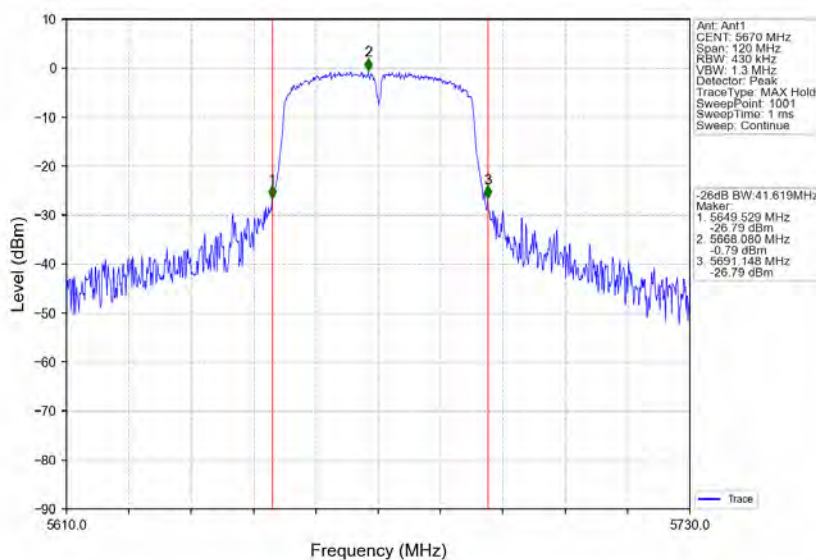
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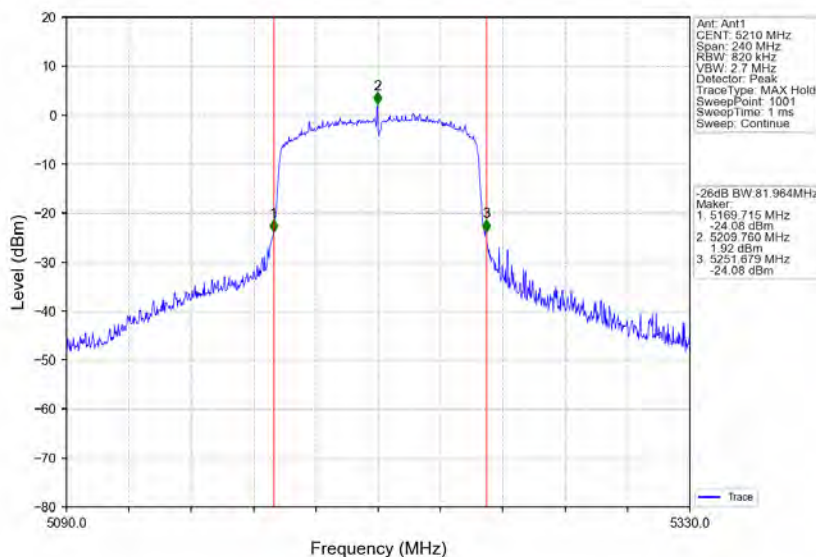
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802.11n(HT40) HCH 5670MHz Ant2 NTN



802.11ac(VHT80) MCH 5210MHz Ant2 NTN



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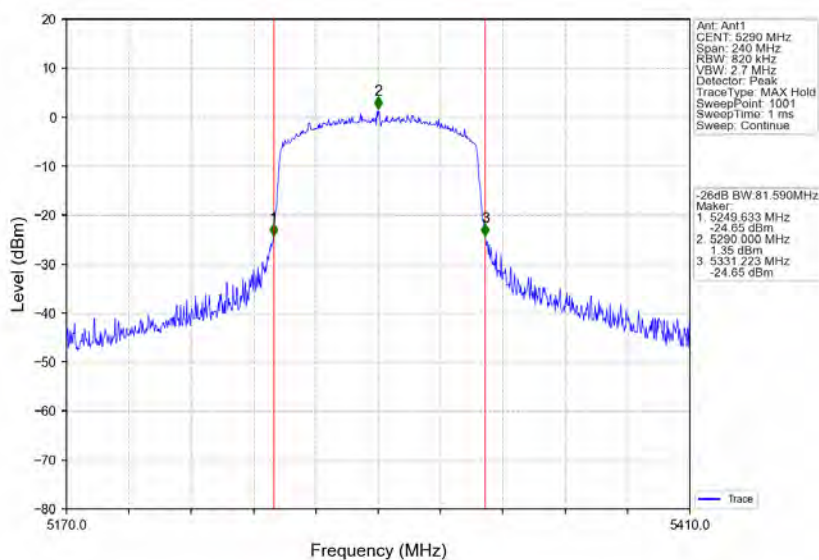
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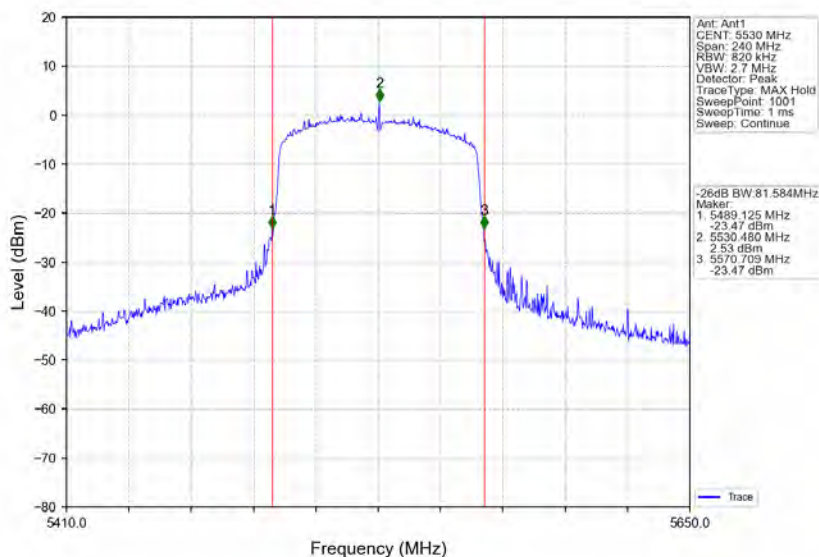
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802.11ac(VHT80) MCH 5290MHz Ant2 NTN



802.11ac(VHT80) LCH 5530MHz Ant2 NTN



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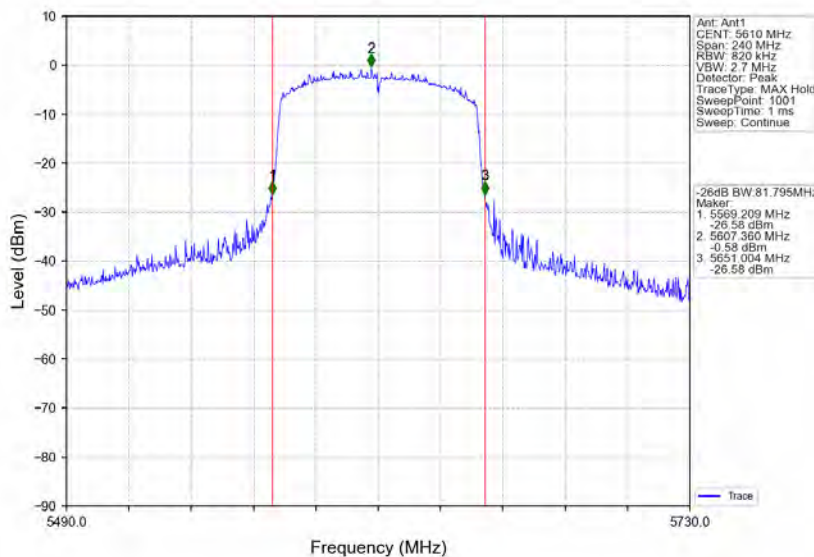
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802.11ac(VHT80) HCH 5610MHz Ant2 NTN



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Maximum conducted output power

Test Result

Mode	TX Type	Frequency (MHz)	Maximum Average Conducted Output Power (dBm)		Verdict
			ANT2	Limit	
802.11a	SISO	5180	11.29	<=30	Pass
		5200	11.51	<=30	Pass
		5240	11.40	<=30	Pass
		5260	11.33	<=23.87	Pass
		5300	11.25	<=23.88	Pass
		5320	11.20	<=23.92	Pass
		5500	10.90	<=23.82	Pass
		5580	10.58	<=23.81	Pass
		5700	10.46	<=23.87	Pass
		5745	10.58	<=30	Pass
		5785	10.06	<=30	Pass
		5825	11.09	<=30	Pass
802.11n (HT20)	SISO	5180	11.38	<=30	Pass
		5200	11.34	<=30	Pass
		5240	10.05	<=30	Pass
		5260	9.82	<=23.97	Pass
		5300	9.85	<=23.98	Pass
		5320	10.10	<=23.98	Pass
		5500	9.67	<=23.98	Pass
		5580	9.37	<=23.98	Pass
		5700	9.07	<=23.98	Pass
		5745	9.06	<=30	Pass
		5785	8.99	<=30	Pass
		5825	9.91	<=30	Pass
802.11n (HT40)	SISO	5190	9.80	<=30	Pass
		5230	9.81	<=30	Pass
		5270	9.73	<=23.98	Pass
		5310	9.74	<=23.98	Pass
		5510	9.53	<=23.98	Pass
		5550	9.23	<=23.98	Pass
		5670	8.72	<=23.98	Pass
		5755	8.84	<=30	Pass
802.11ac (VHT80)	SISO	5795	9.12	<=30	Pass
		5210	9.91	<=30	Pass
		5290	9.75	<=23.98	Pass
		5530	9.47	<=23.98	Pass
		5610	8.29	<=23.98	Pass
		5775	8.45	<=30	Pass

Note1: Antenna Gain:

5150MHz to 5250MHz: 3.59 dBi(Ant2);

5250MHz to 5350MHz: 4.08 dBi(Ant2);

5470MHz to 5725MHz: 4.33 dBi(Ant2);

5725MHz to 5850MHz: 4.90 dBi(Ant2);

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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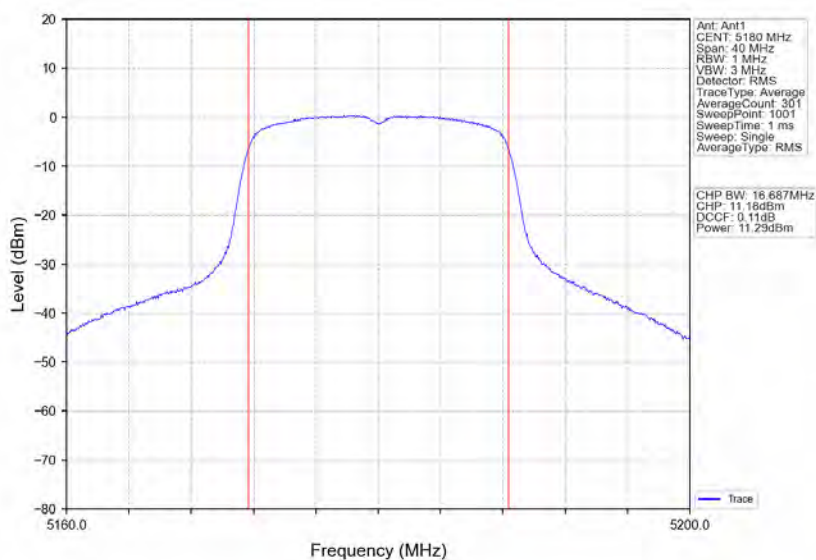
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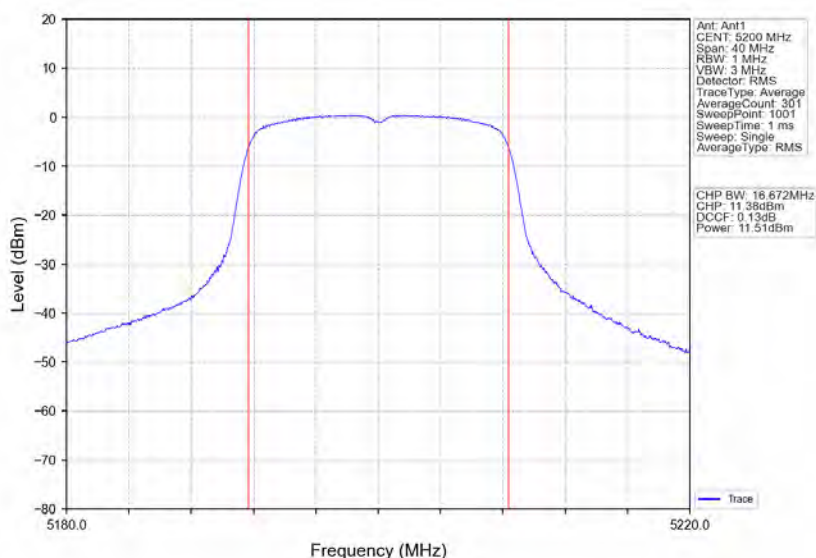
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Test Graphs

802.11a_LCH_5180MHz_Ant2_NTNV



802.11a_MCH_5200MHz_Ant2_NTNV



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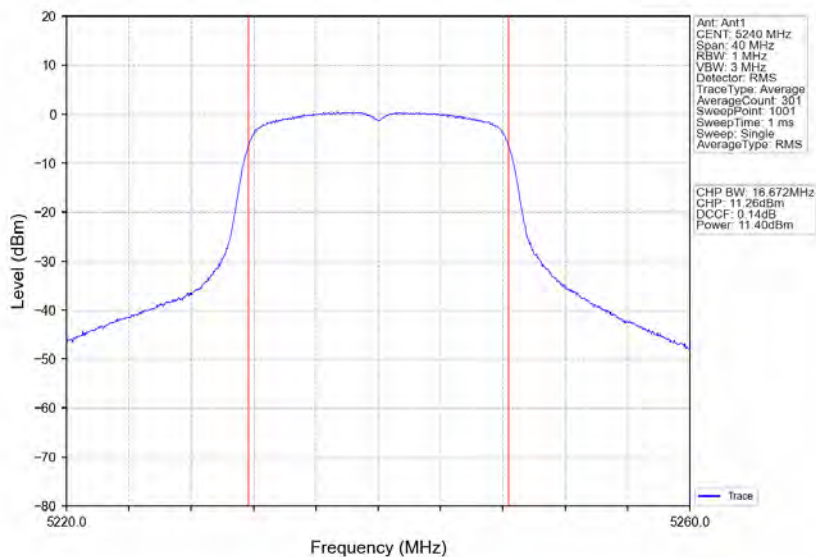
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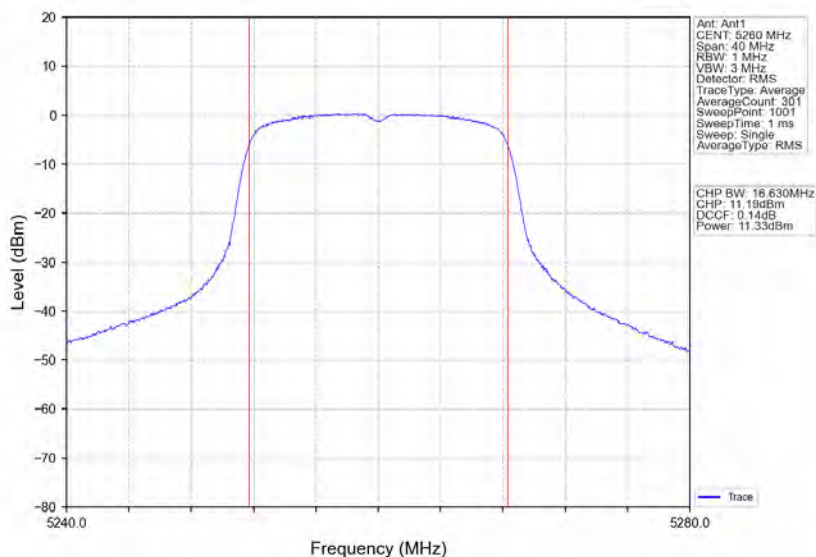
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802.11a HCH 5240MHz Ant2 NTN



802.11a LCH 5260MHz Ant2 NTN



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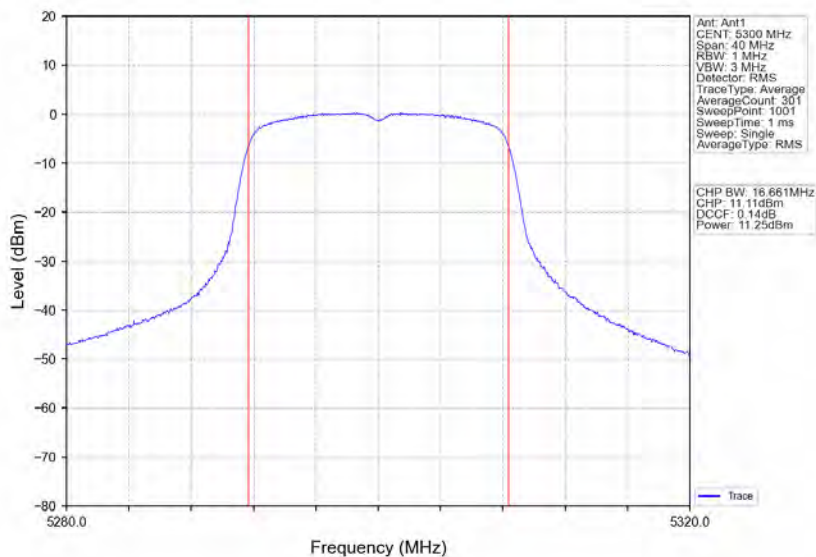
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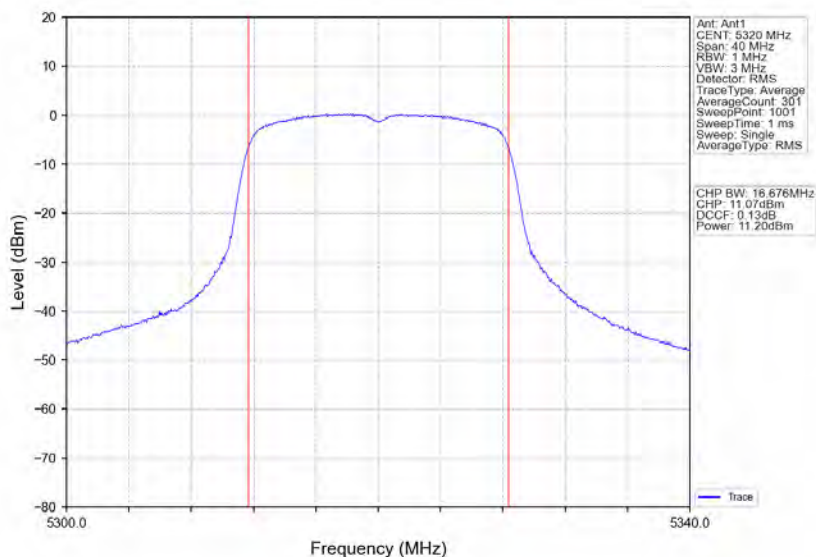
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802.11a_MCH_5300MHz_Ant2_NTNV



802.11a_HCH_5320MHz_Ant2_NTNV



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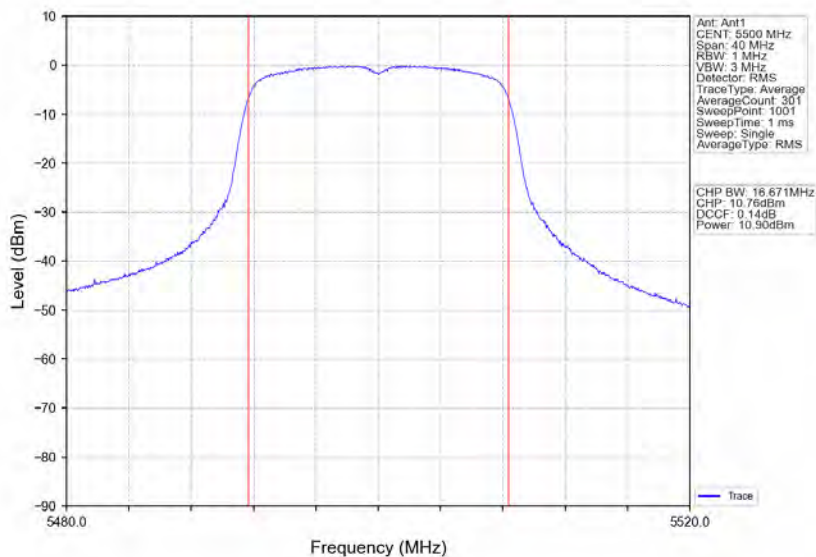
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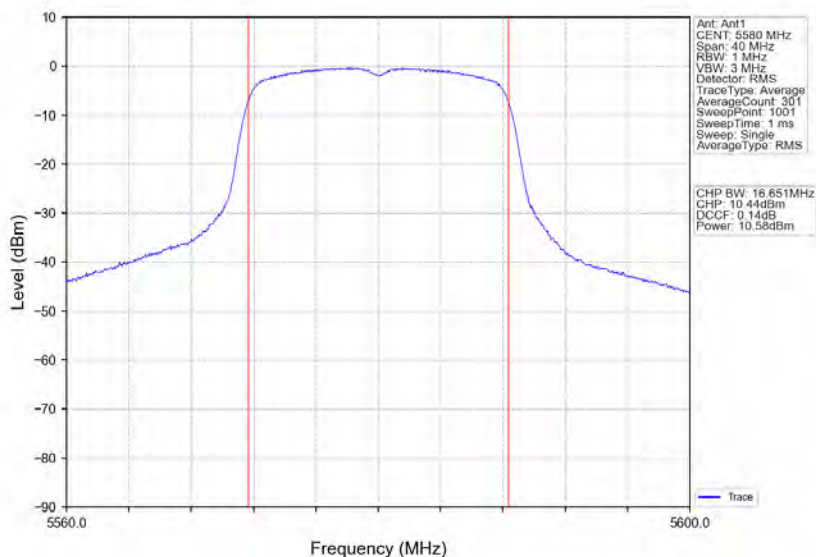
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802.11a_LCH_5500MHz_Ant2_NTNV



802.11a_MCH_5580MHz_Ant2_NTNV



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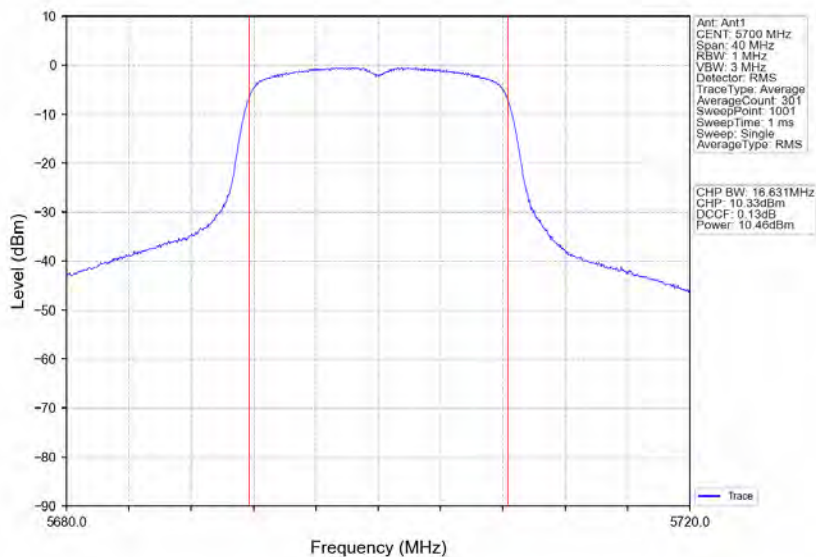
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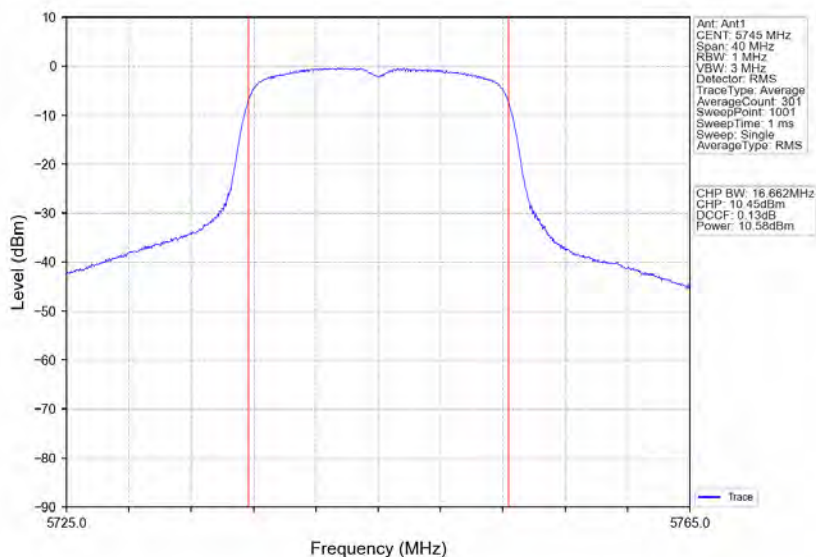
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802.11a HCH 5700MHz Ant2 NTN



802.11a LCH 5745MHz Ant2 NTN



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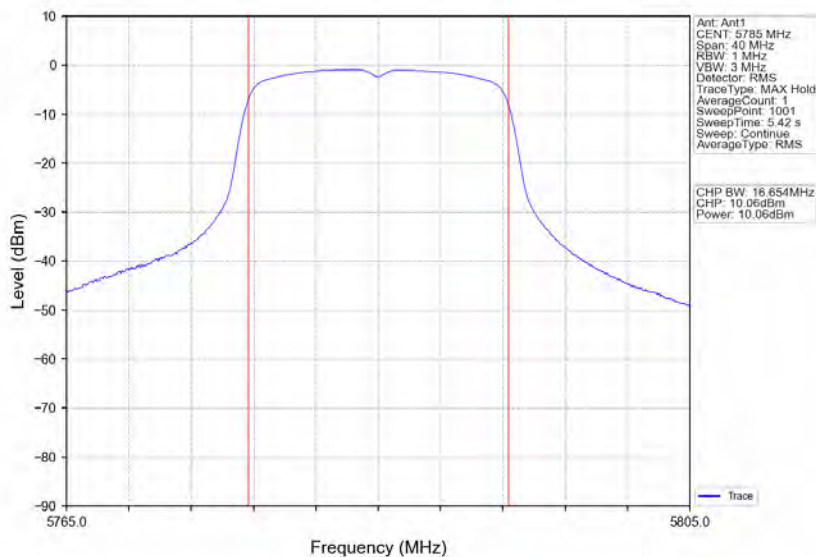
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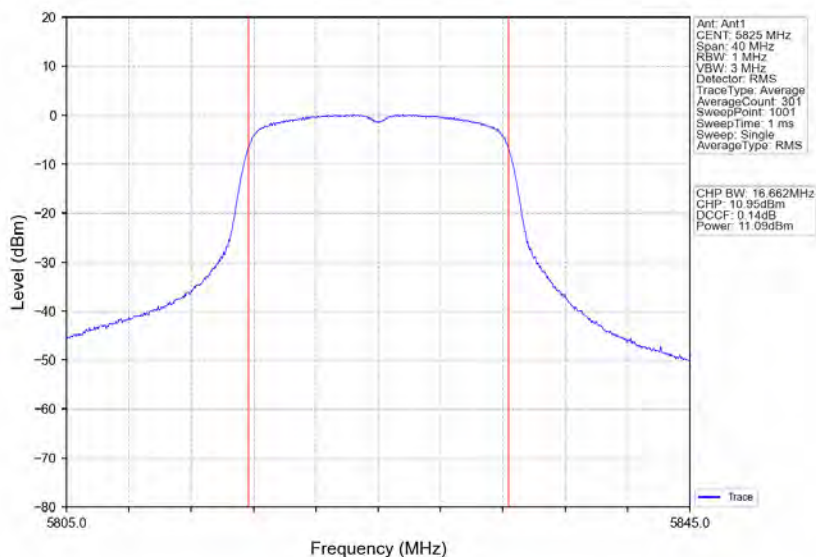
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802.11a_MCH_5785MHz_Ant2_NTNV



802.11a_HCH_5825MHz_Ant2_NTNV



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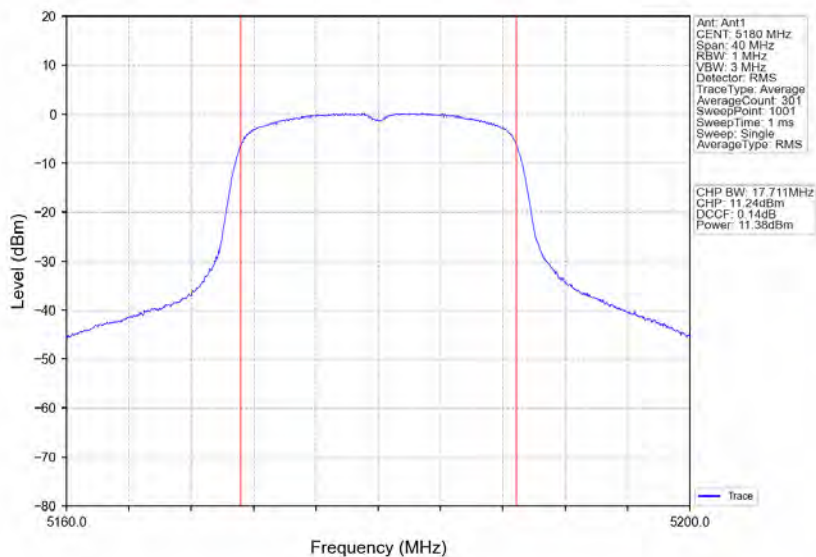
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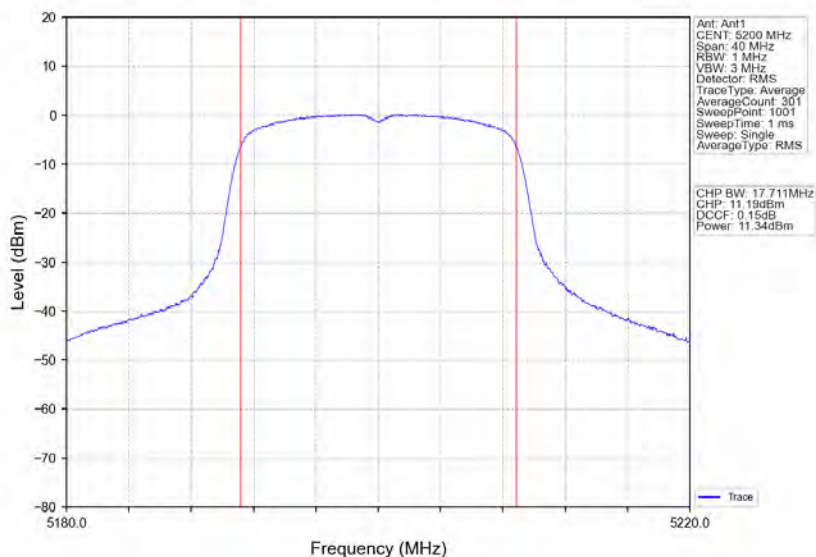
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802.11n(HT20) LCH 5180MHz Ant2 NTN



802.11n(HT20) MCH 5200MHz Ant2 NTN



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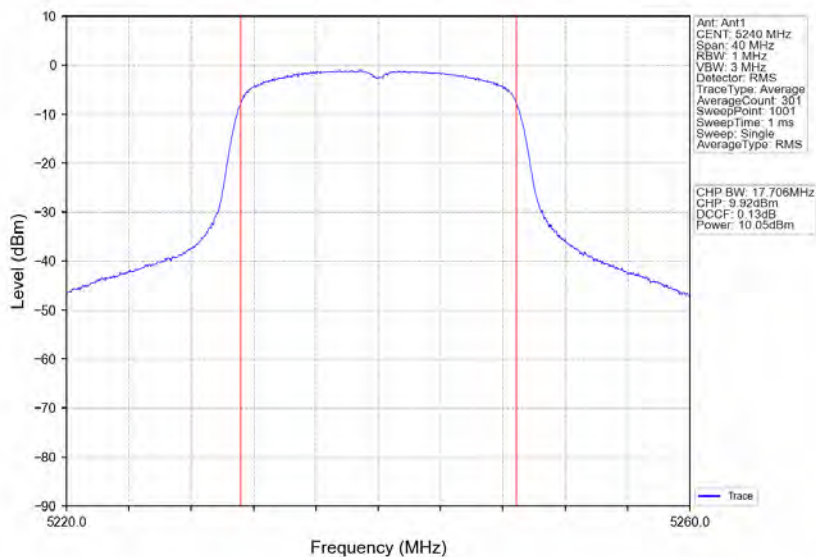
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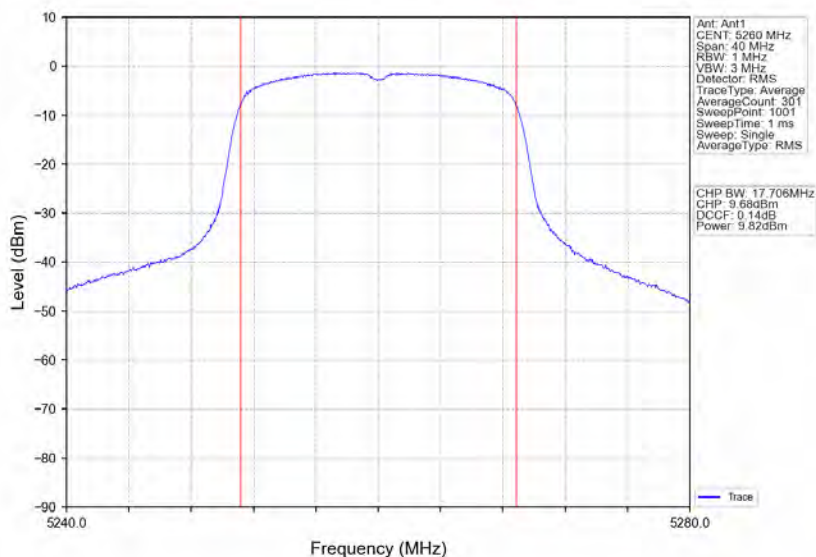
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802.11n(HT20) HCH 5240MHz Ant2 NTN



802.11n(HT20) LCH 5260MHz Ant2 NTN



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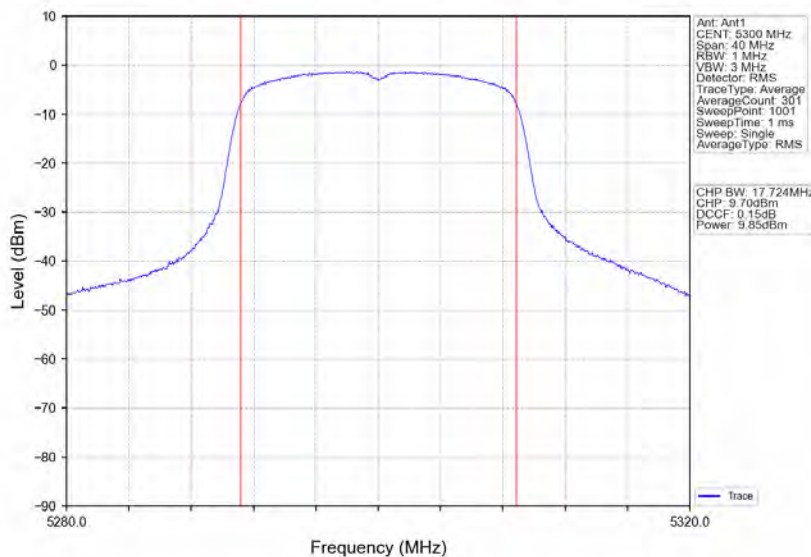
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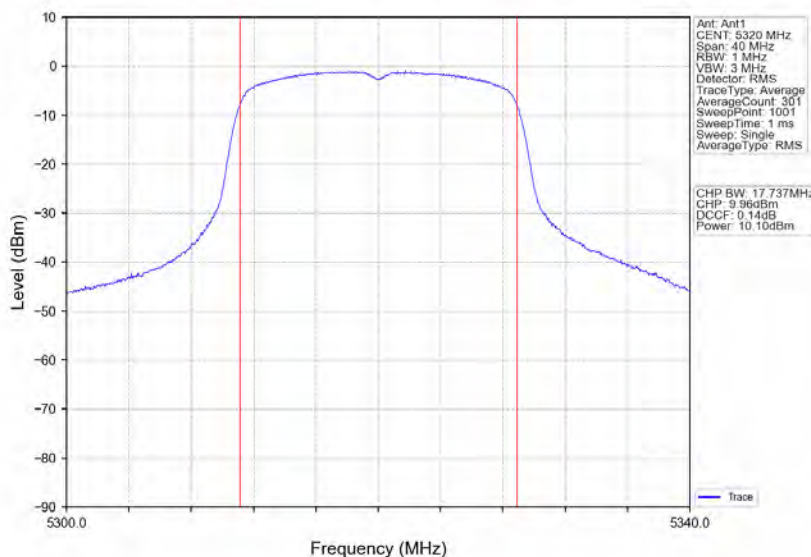
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802.11n(HT20) MCH 5300MHz Ant2 NTN



802.11n(HT20) HCH 5320MHz Ant2 NTN



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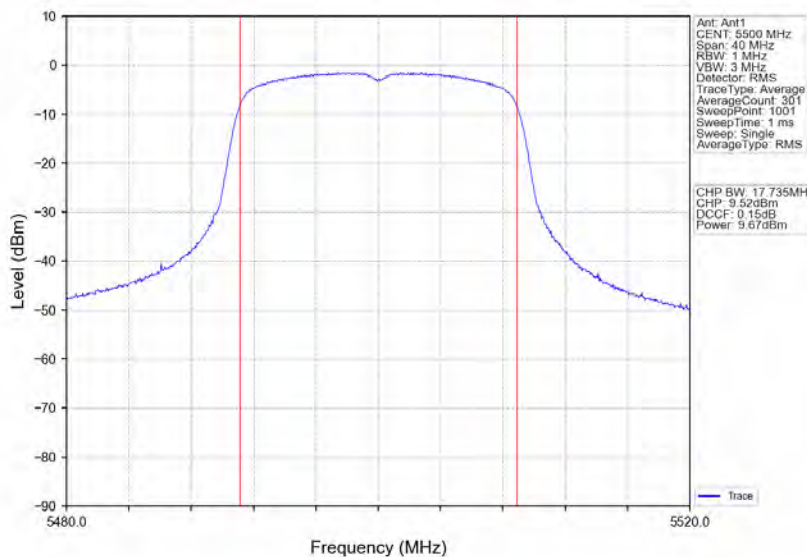
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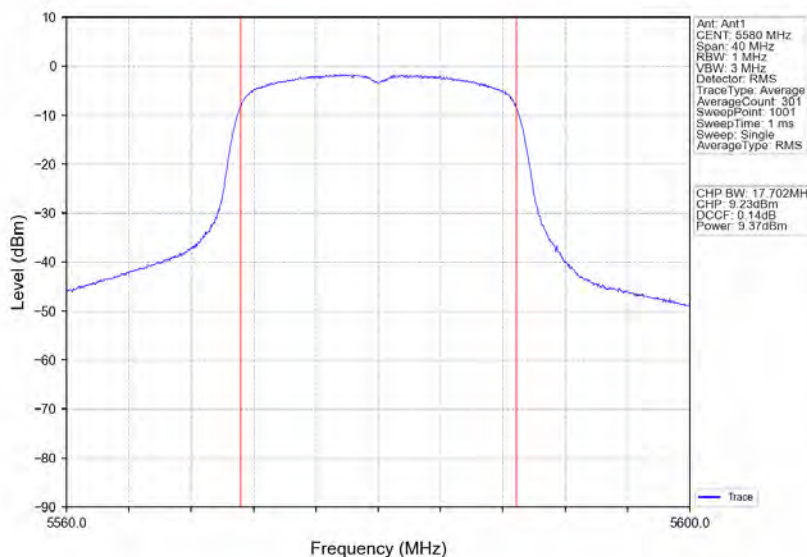
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802.11n(HT20) LCH 5500MHz Ant2 NTN



802.11n(HT20) MCH 5580MHz Ant2 NTN



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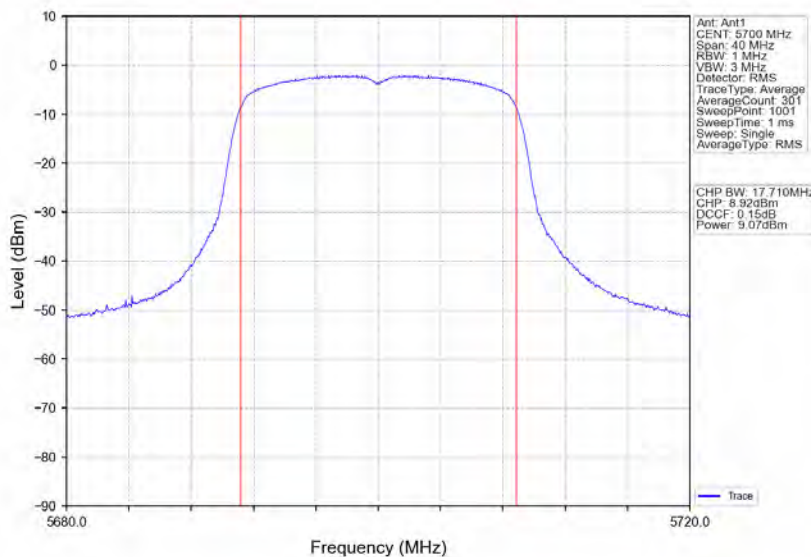
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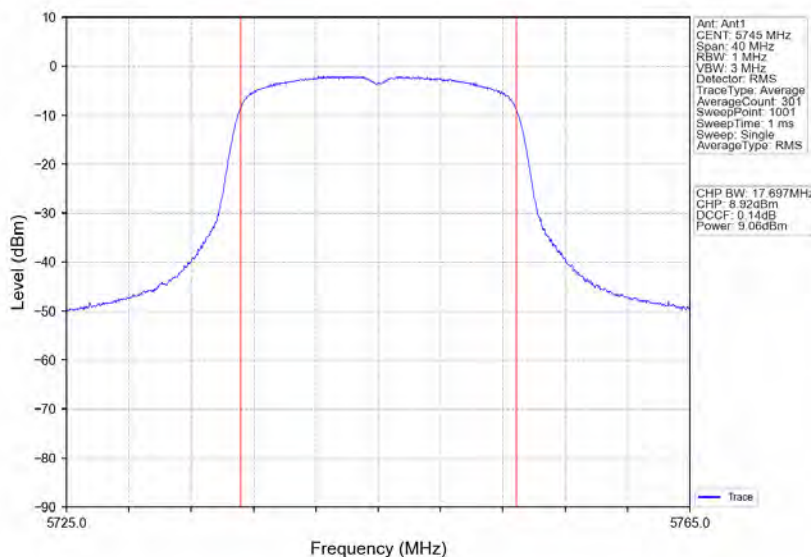
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802.11n(HT20) HCH 5700MHz Ant2 NTN



802.11n(HT20) LCH 5745MHz Ant2 NTN



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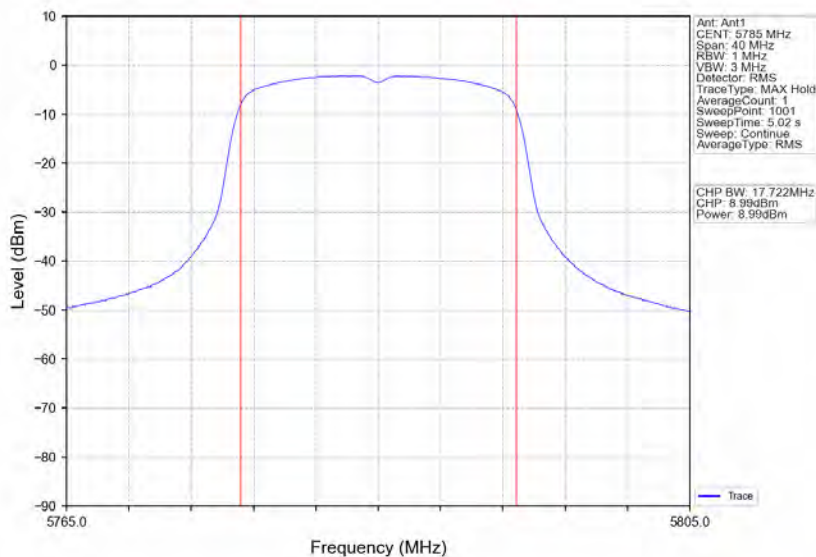
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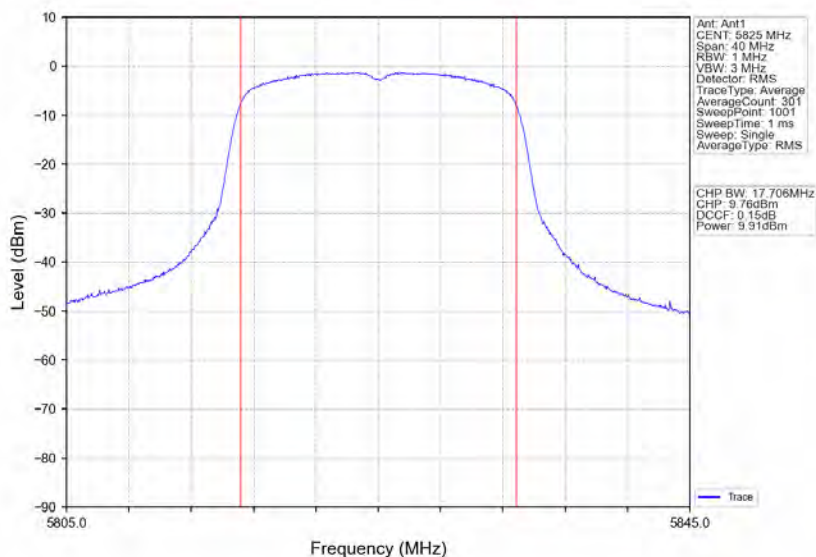
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802.11n(HT20) MCH 5785MHz Ant2 NTN



802.11n(HT20) HCH 5825MHz Ant2 NTN



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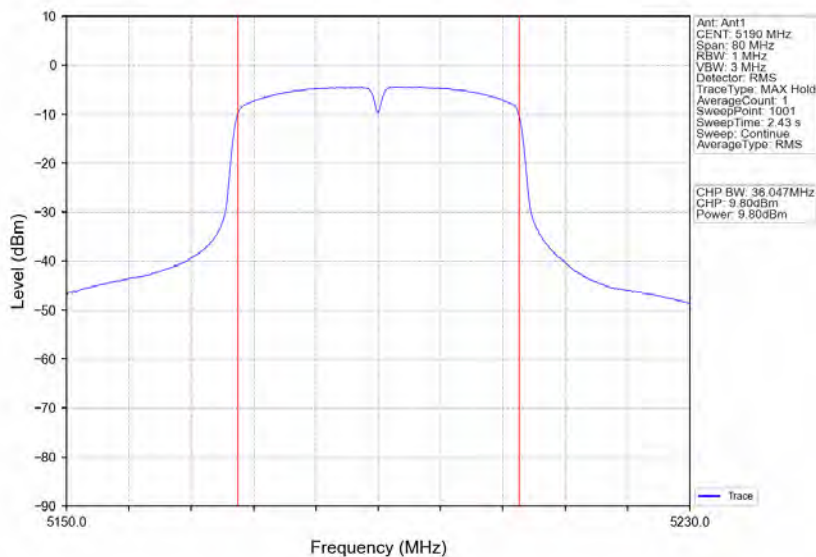
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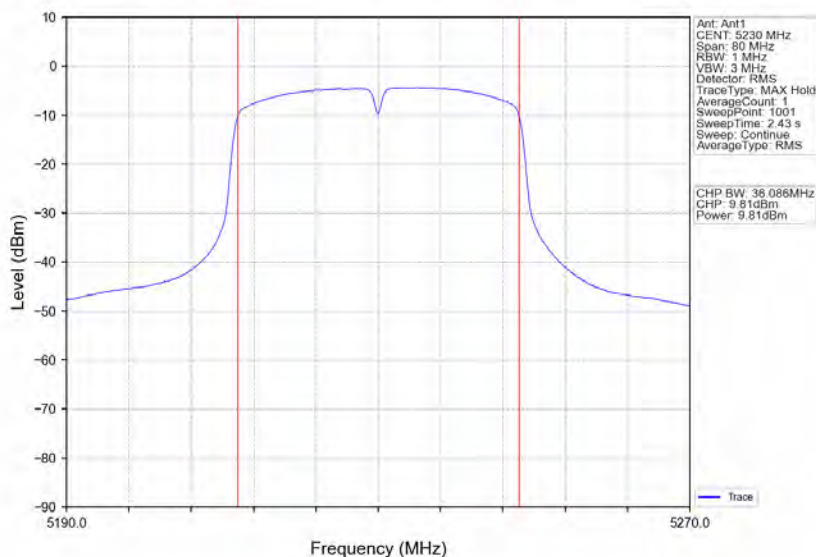
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802.11n(HT40) LCH 5190MHz Ant2 NTN



802.11n(HT40) HCH 5230MHz Ant2 NTN



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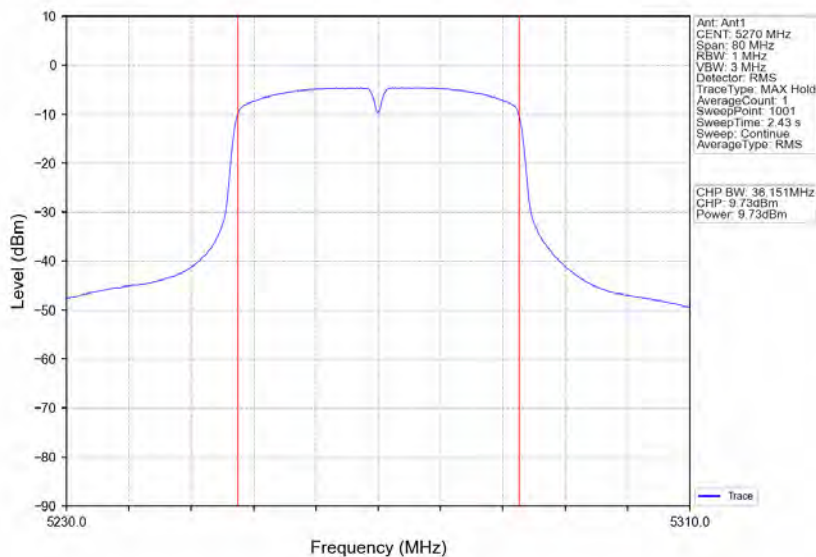
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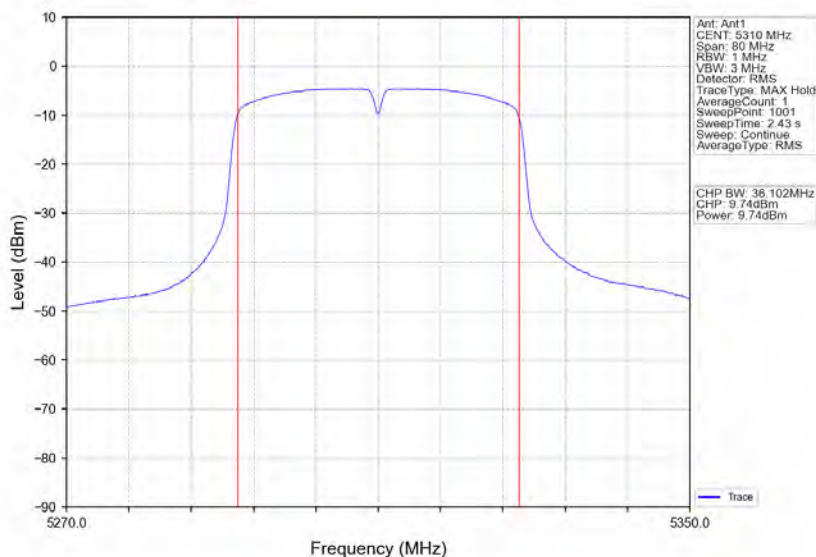
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802.11n(HT40) LCH 5270MHz Ant2 NTN



802.11n(HT40) HCH 5310MHz Ant2 NTN



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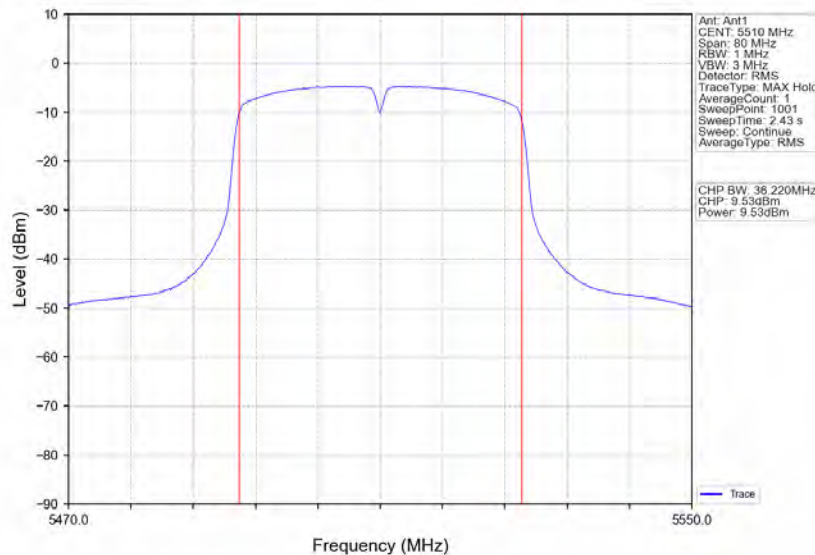
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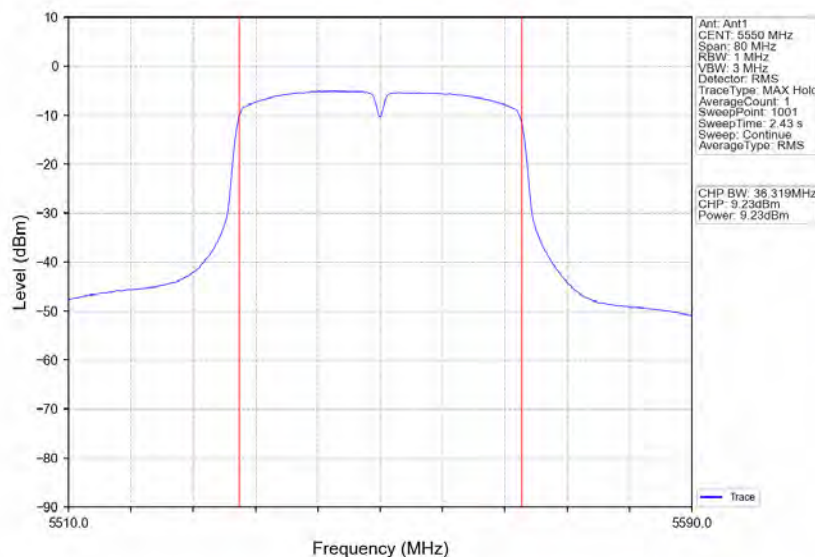
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802.11n(HT40) LCH 5510MHz Ant2 NTN



802.11n(HT40) MCH 5550MHz Ant2 NTN



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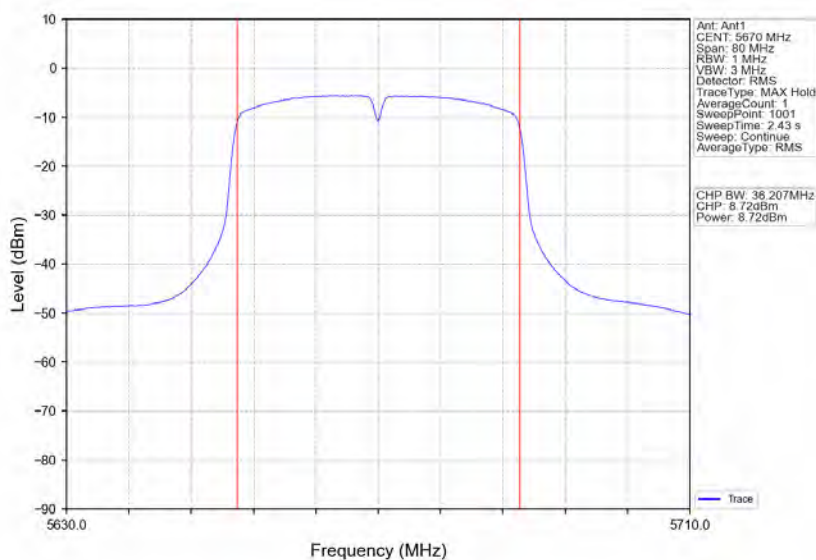
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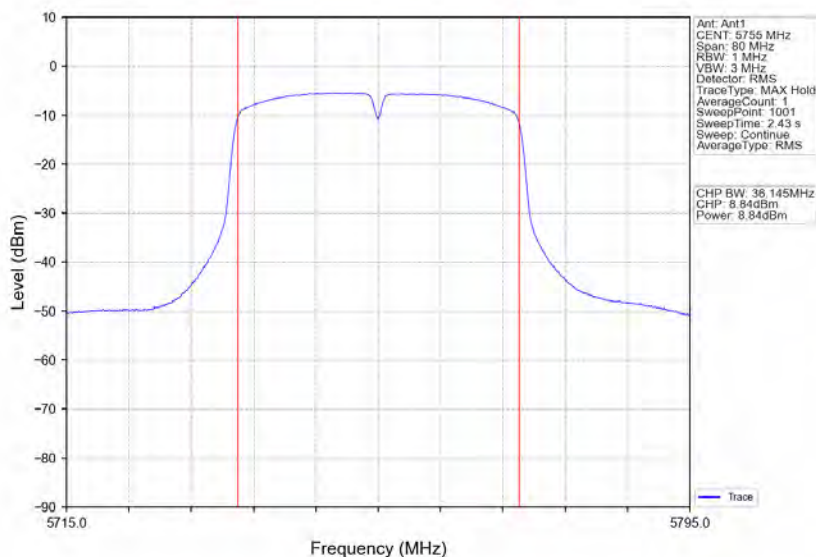
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802.11n(HT40) HCH 5670MHz Ant2 NTN



802.11n(HT40) LCH 5755MHz Ant2 NTN



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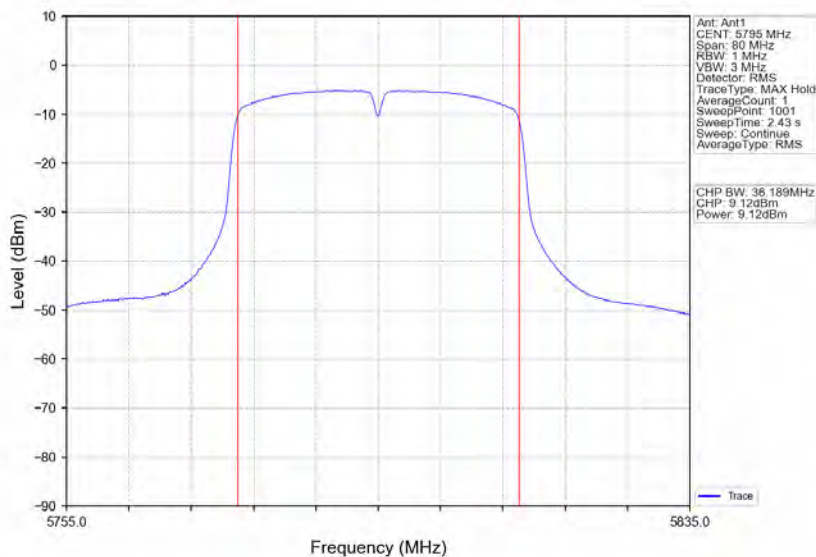
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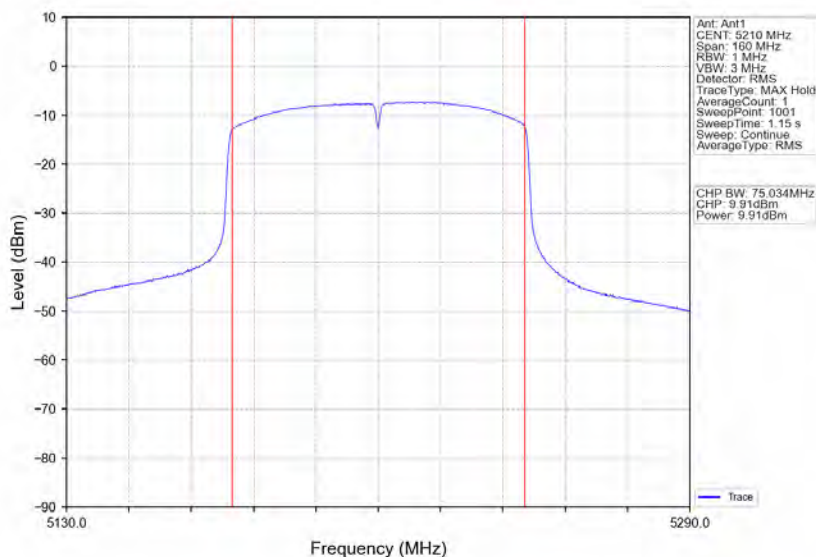
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802.11n(HT40) HCH 5795MHz Ant2 NTN



802.11ac(VHT80) MCH 5210MHz Ant2 NTN



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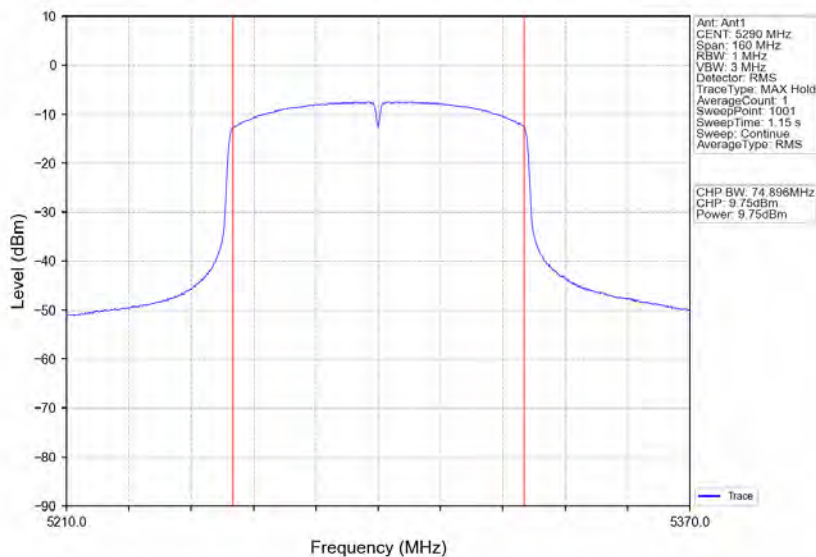
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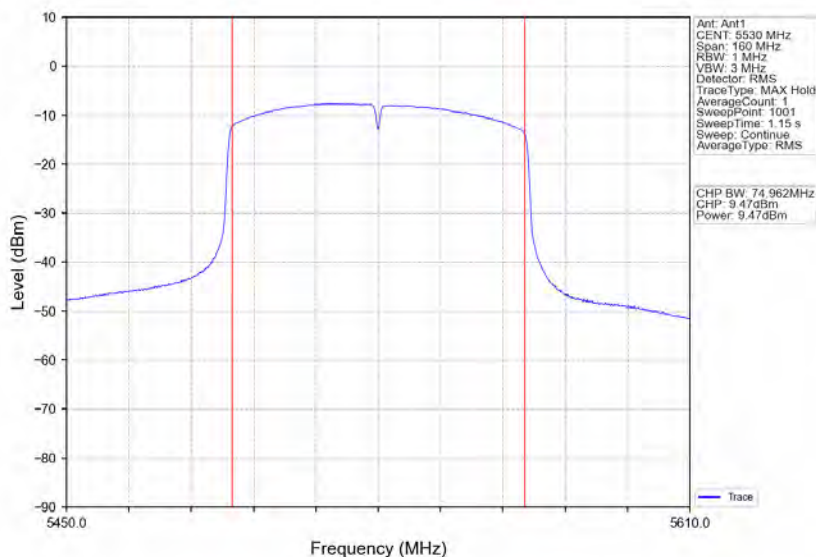
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802.11ac(VHT80) MCH 5290MHz Ant2 NTN



802.11ac(VHT80) LCH 5530MHz Ant2 NTN



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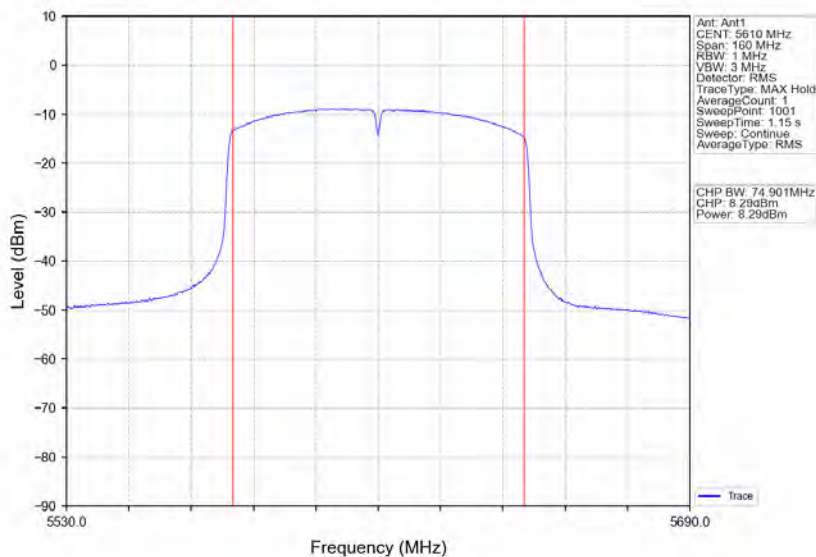
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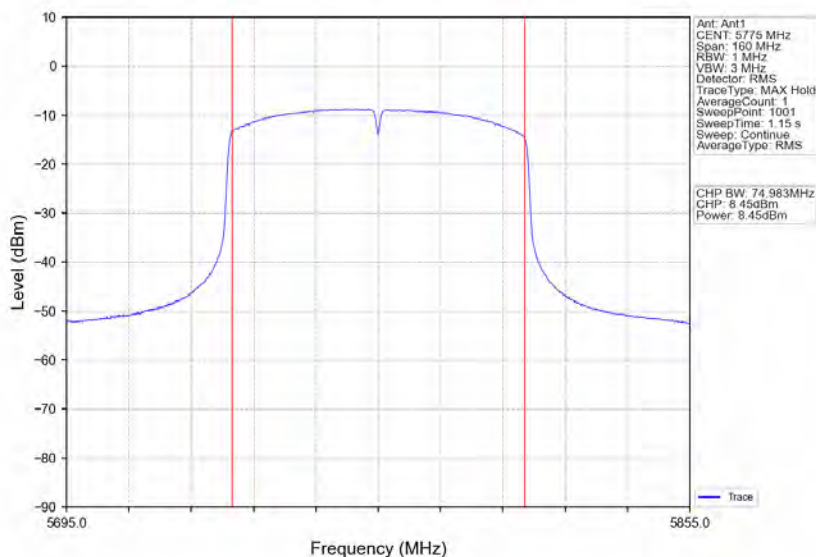
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802.11ac(VHT80) HCH 5610MHz Ant2 NTN



802.11ac(VHT80) MCH 5775MHz Ant2 NTN



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Maximum power spectral density Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/MHz)		Verdict
			ANT2	Limit	
802.11a	SISO	5180	0.44	<=17	Pass
		5200	0.83	<=17	Pass
		5240	0.67	<=17	Pass
		5260	0.72	<=11	Pass
		5300	0.39	<=11	Pass
		5320	0.38	<=11	Pass
		5500	0.13	<=11	Pass
		5580	-0.17	<=11	Pass
802.11n (HT20)	SISO	5700	-0.27	<=11	Pass
		5180	0.43	<=17	Pass
		5200	0.53	<=17	Pass
		5240	-0.84	<=17	Pass
		5260	-1.05	<=11	Pass
		5300	-1.09	<=11	Pass
		5320	-0.84	<=11	Pass
		5500	-1.22	<=11	Pass
802.11n (HT40)	SISO	5580	-1.54	<=11	Pass
		5700	-1.80	<=11	Pass
		5190	-4.35	<=17	Pass
		5230	-4.31	<=17	Pass
		5270	-4.54	<=11	Pass
		5310	-4.54	<=11	Pass
802.11ac (VHT80)	SISO	5510	-4.66	<=11	Pass
		5550	-5.04	<=11	Pass
		5670	-5.54	<=11	Pass
		5210	-7.29	<=17	Pass
		5290	-7.40	<=11	Pass
		5530	-7.63	<=11	Pass
		5610	-8.93	<=11	Pass

Note1: Antenna Gain:

5150MHz to 5250MHz: 3.59 dBi(Ant2);

5250MHz to 5350MHz: 4.08 dBi(Ant2);

5470MHz to 5725MHz: 4.33 dBi(Ant2);

5725MHz to 5850MHz: 4.90 dBi(Ant2);

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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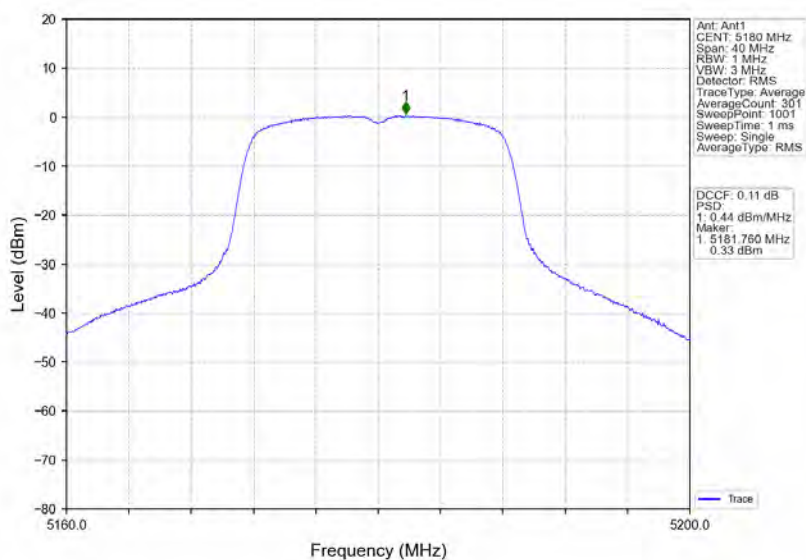
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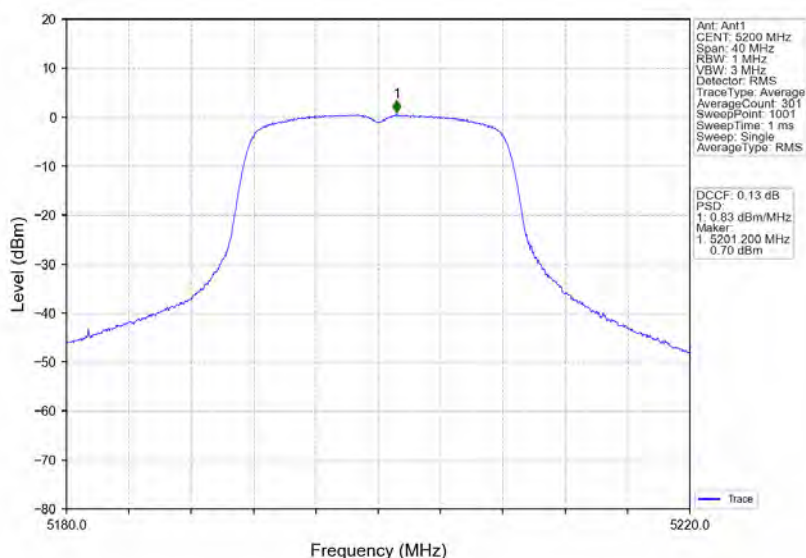
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Test Graphs

802.11a_LCH_5180MHz_Ant2_NTNV



802.11a_MCH_5200MHz_Ant2_NTNV



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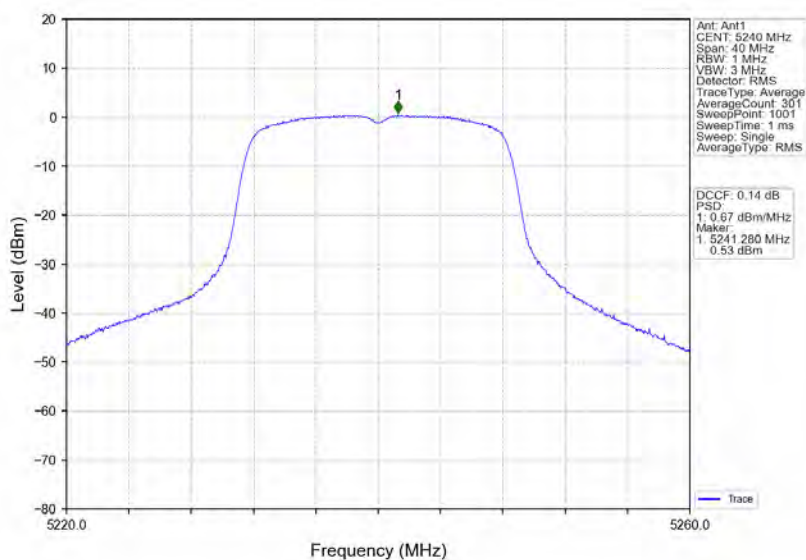
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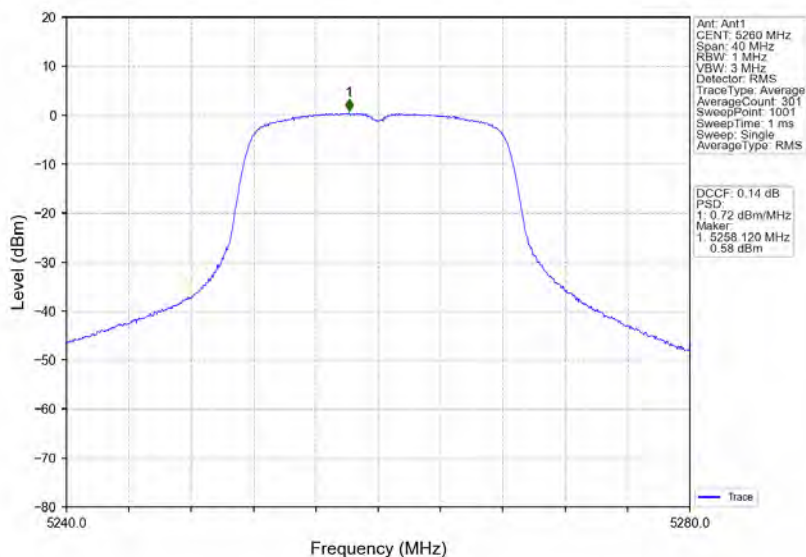
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802.11a HCH 5240MHz Ant2 NTN



802.11a LCH 5260MHz Ant2 NTN



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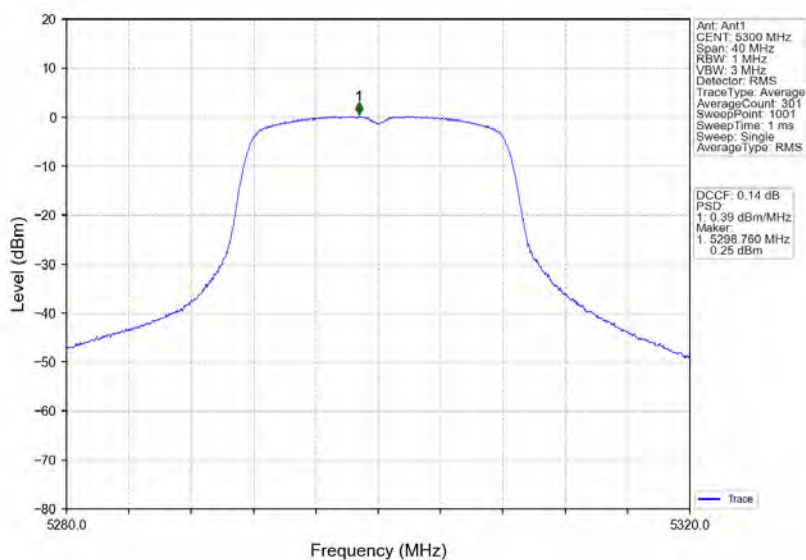
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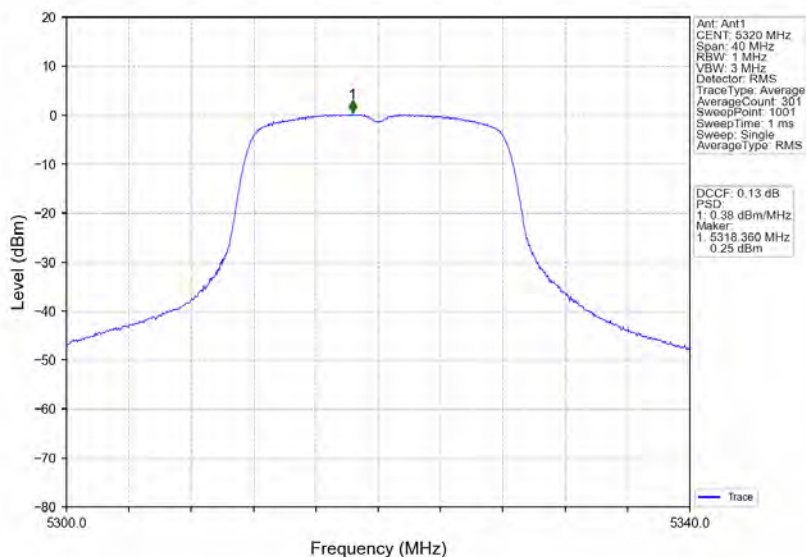
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802.11a_MCH_5300MHz_Ant2_NTNV



802.11a_HCH_5320MHz_Ant2_NTNV



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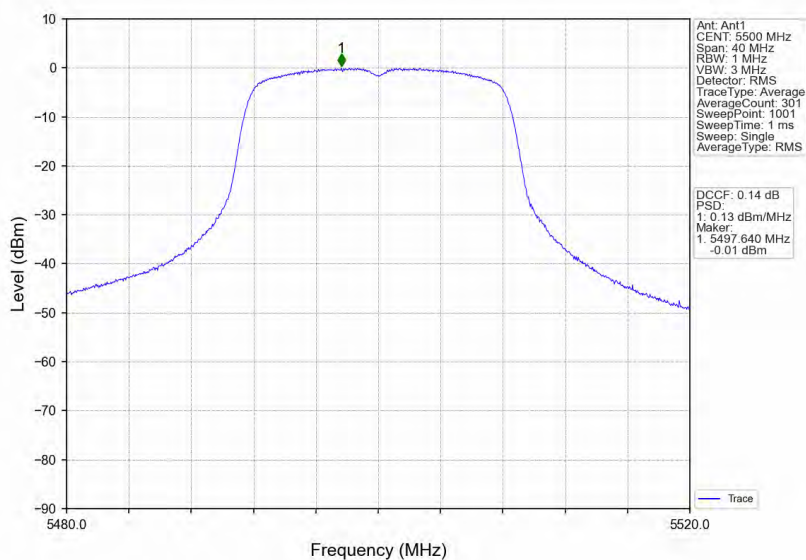
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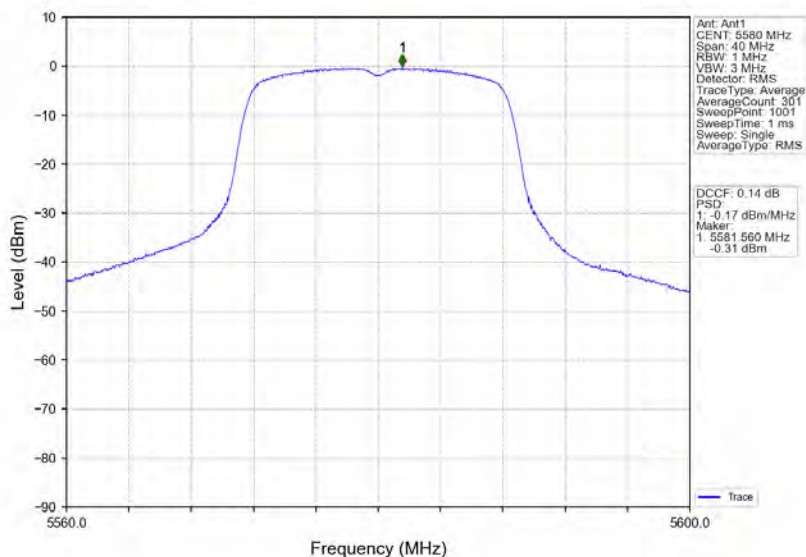
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802.11a LCH 5500MHz Ant2 NTN



802.11a MCH 5580MHz Ant2 NTN



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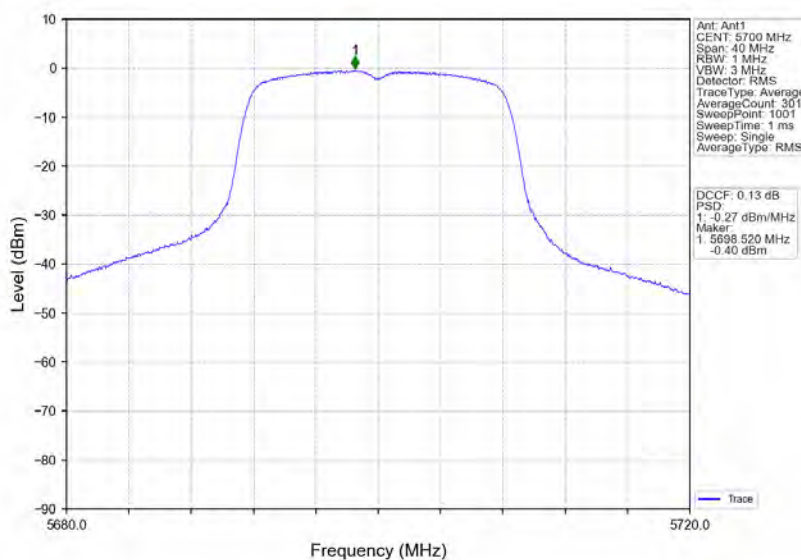
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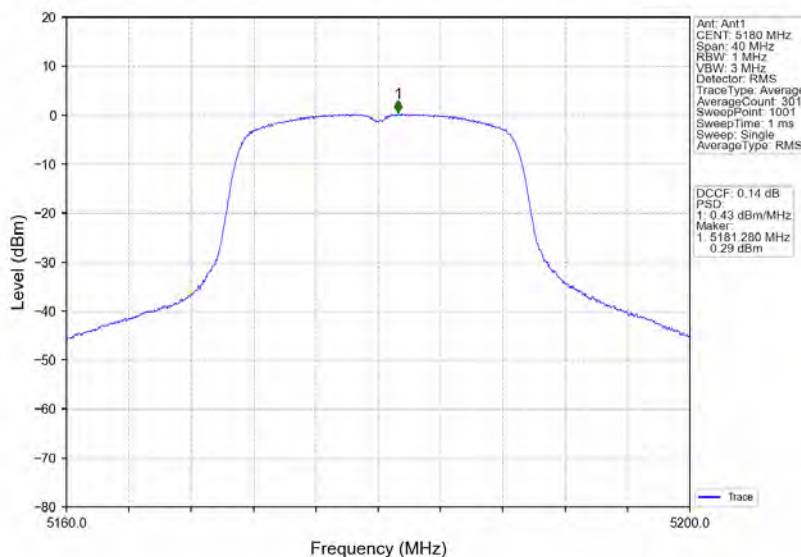
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802.11a HCH 5700MHz Ant2 NTN



802.11n(HT20) LCH 5180MHz Ant2 NTN



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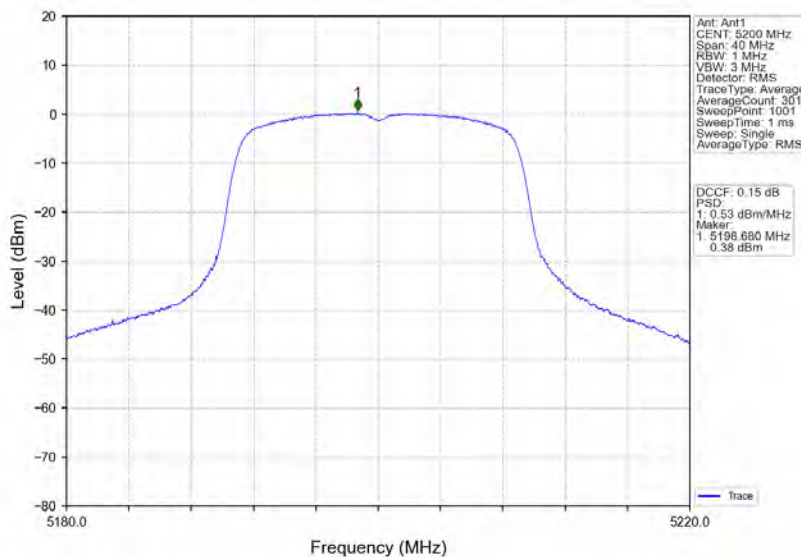
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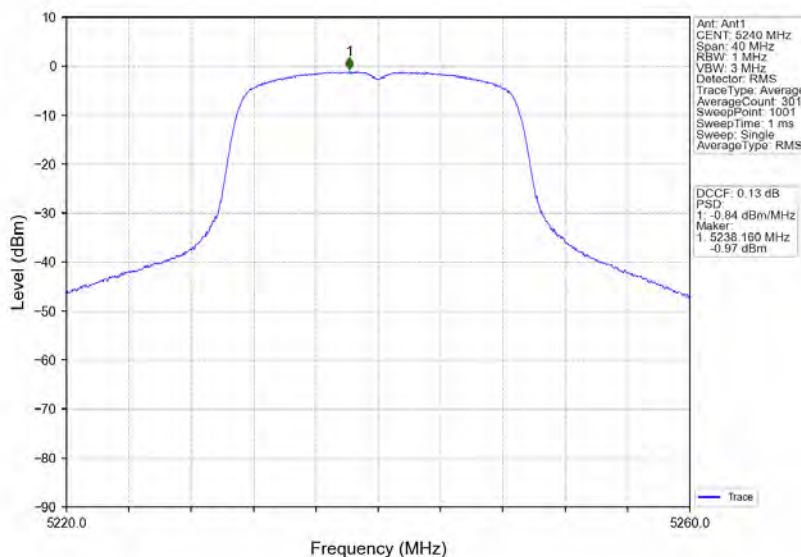
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802.11n(HT20) MCH 5200MHz Ant2 NTN



802.11n(HT20) HCH 5240MHz Ant2 NTN



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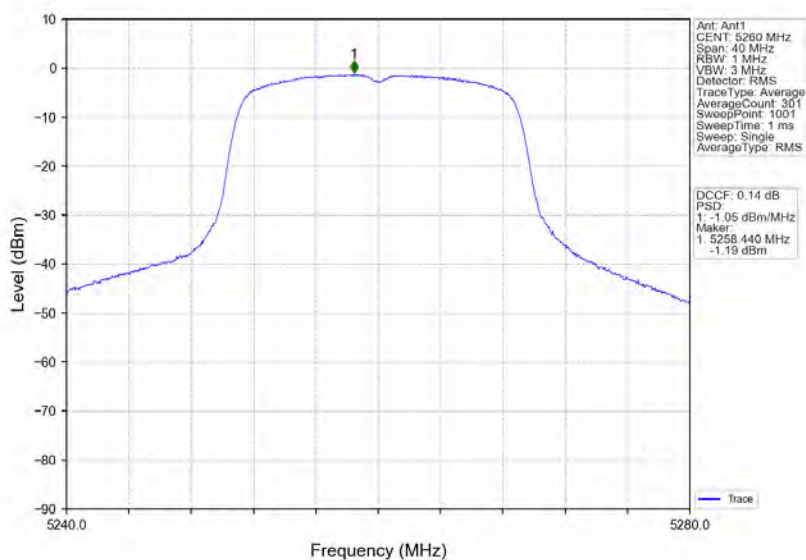
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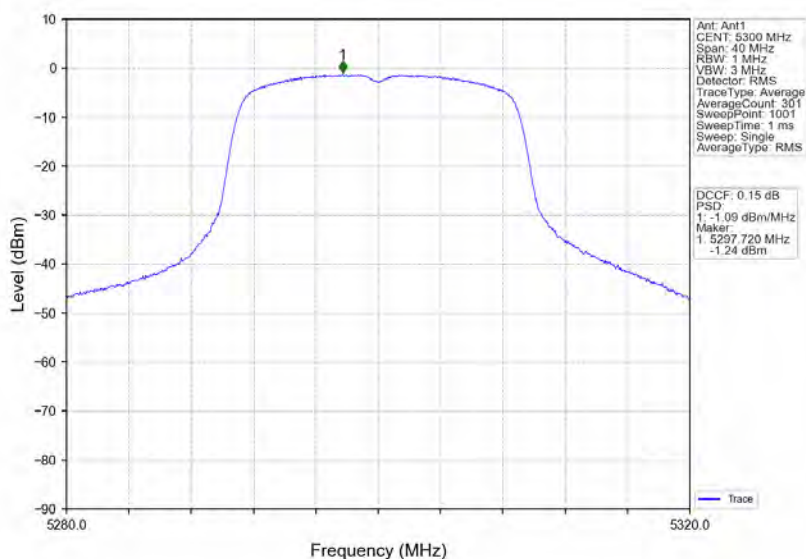
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802.11n(HT20) LCH 5260MHz Ant2 NTN



802.11n(HT20) MCH 5300MHz Ant2 NTN



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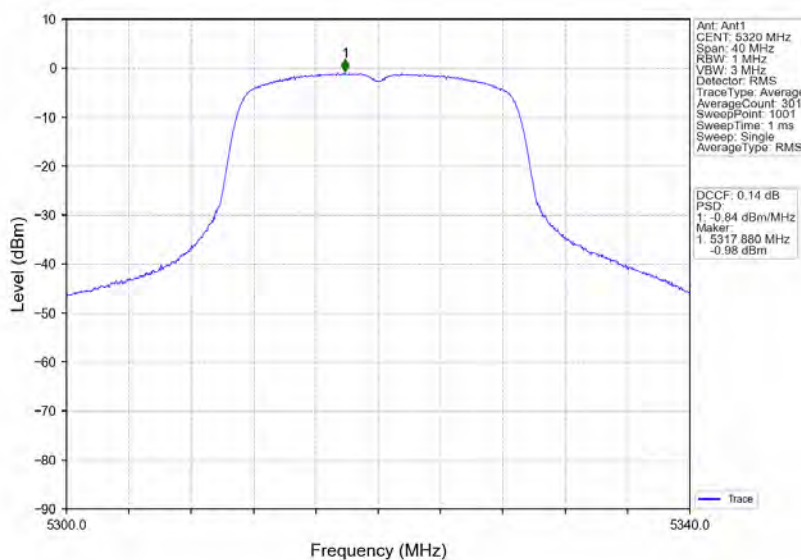
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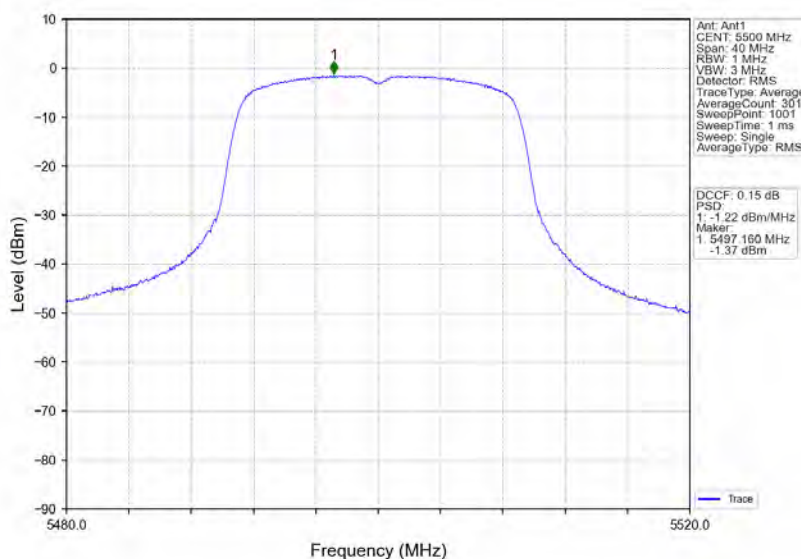
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802.11n(HT20) HCH 5320MHz Ant2 NTN



802.11n(HT20) LCH 5500MHz Ant2 NTN



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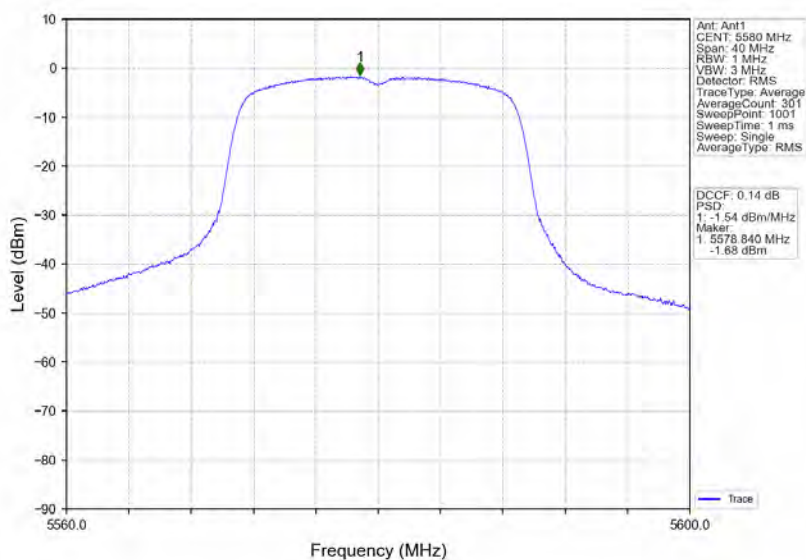
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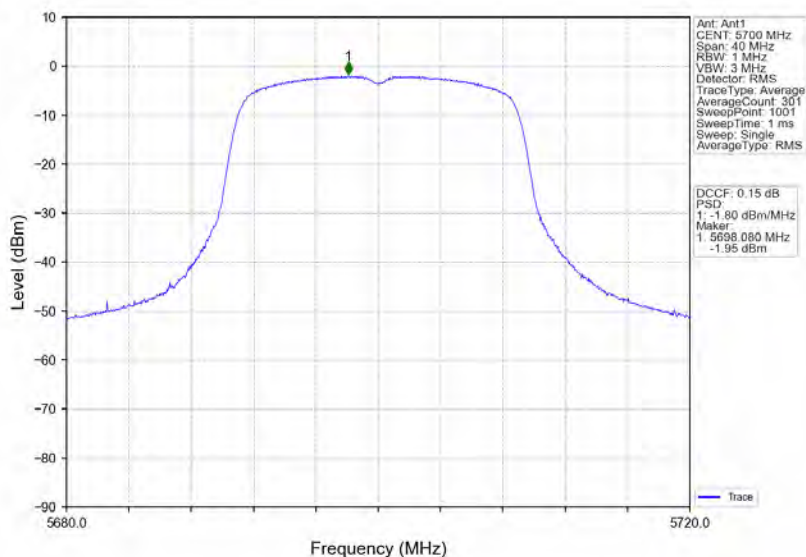
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802.11n(HT20) MCH 5580MHz Ant2 NTN



802.11n(HT20) HCH 5700MHz Ant2 NTN



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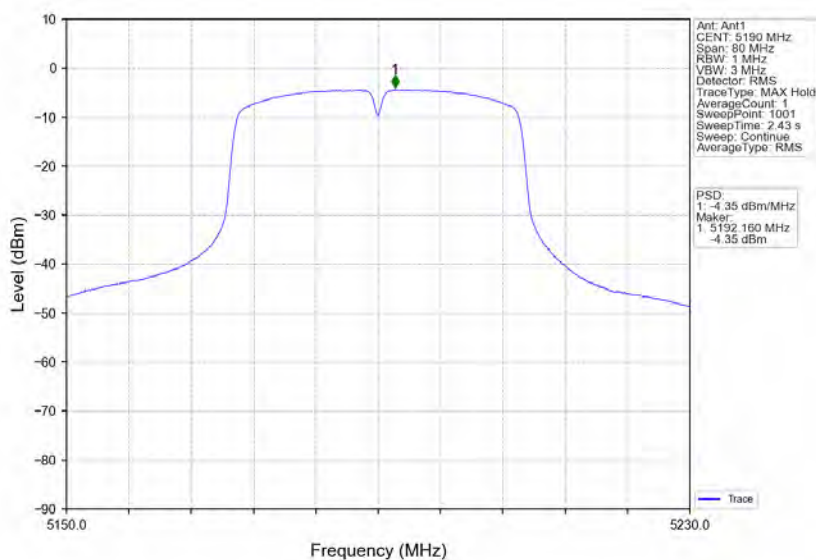
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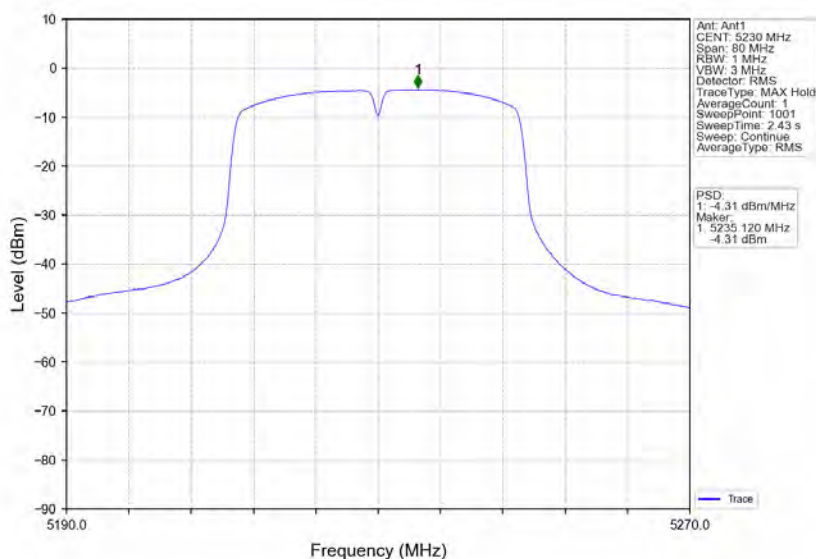
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802.11n(HT40) LCH 5190MHz Ant2 NTN



802.11n(HT40) HCH 5230MHz Ant2 NTN



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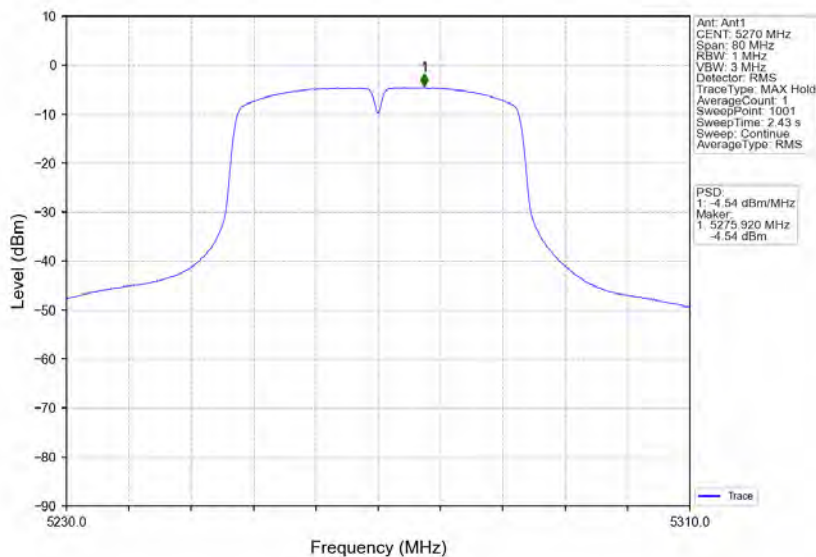
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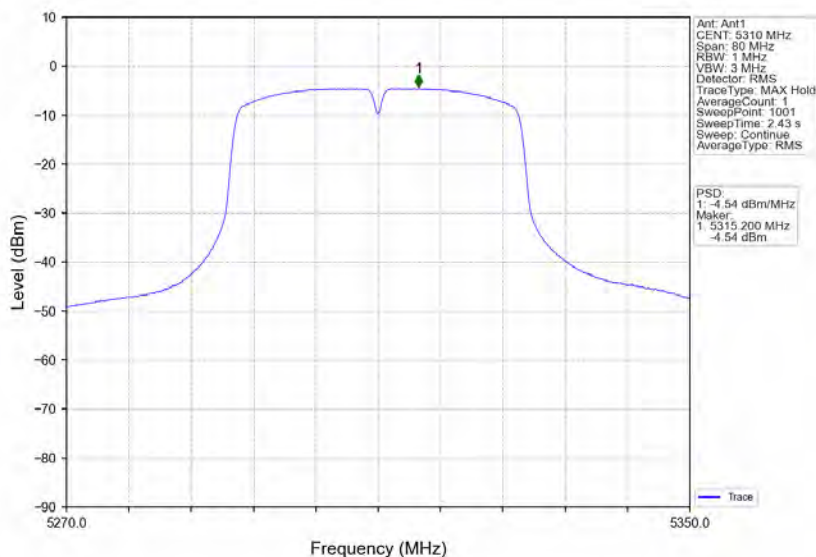
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802.11n(HT40) LCH 5270MHz Ant2 NTN



802.11n(HT40) HCH 5310MHz Ant2 NTN



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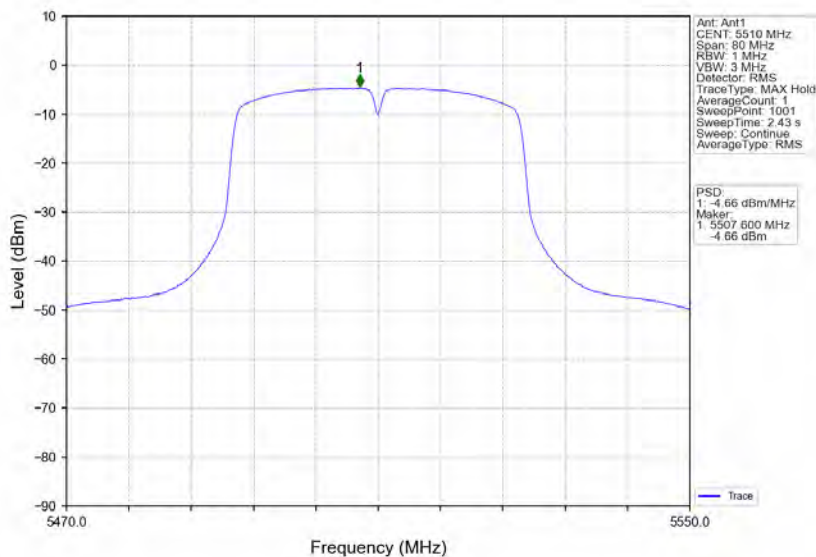
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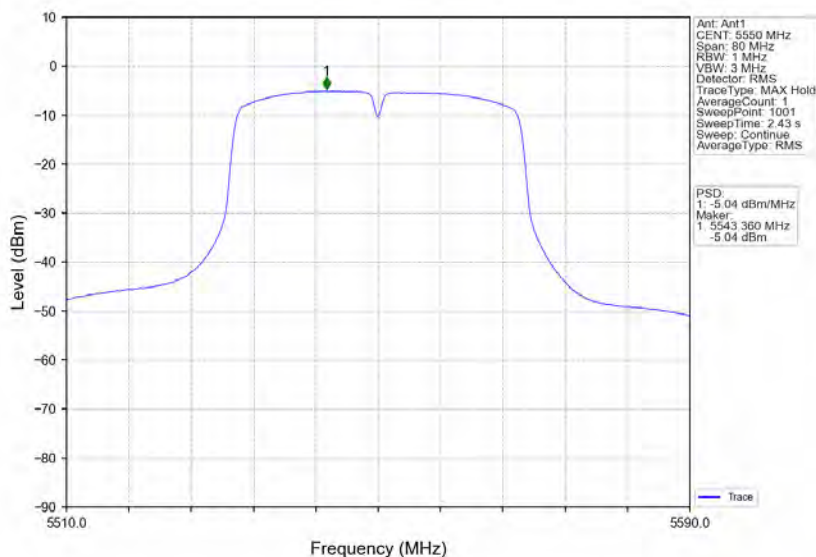
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802.11n(HT40) LCH 5510MHz Ant2 NTN



802.11n(HT40) MCH 5550MHz Ant2 NTN



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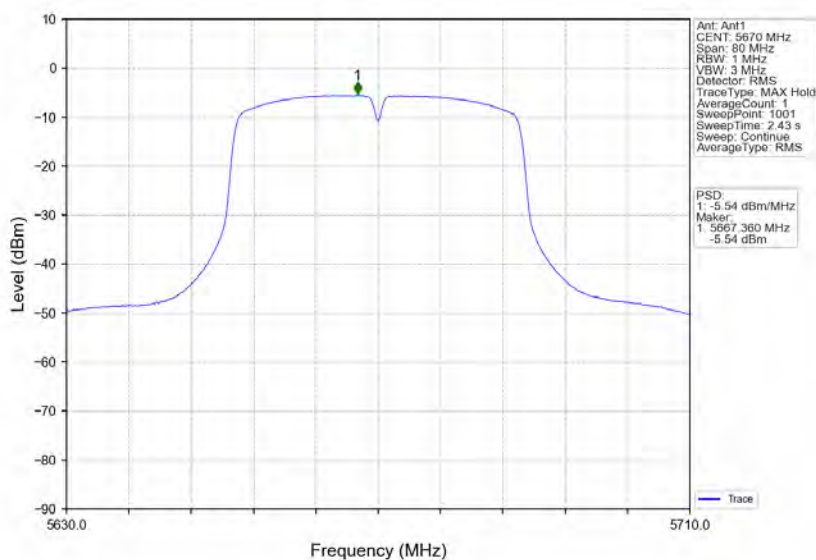
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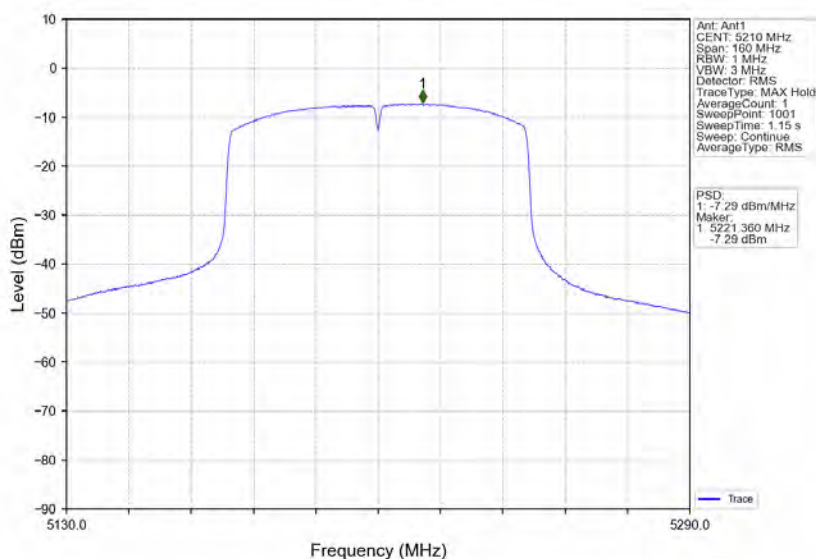
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802.11n(HT40) HCH 5670MHz Ant2 NTN



802.11ac(VHT80) MCH 5210MHz Ant2 NTN



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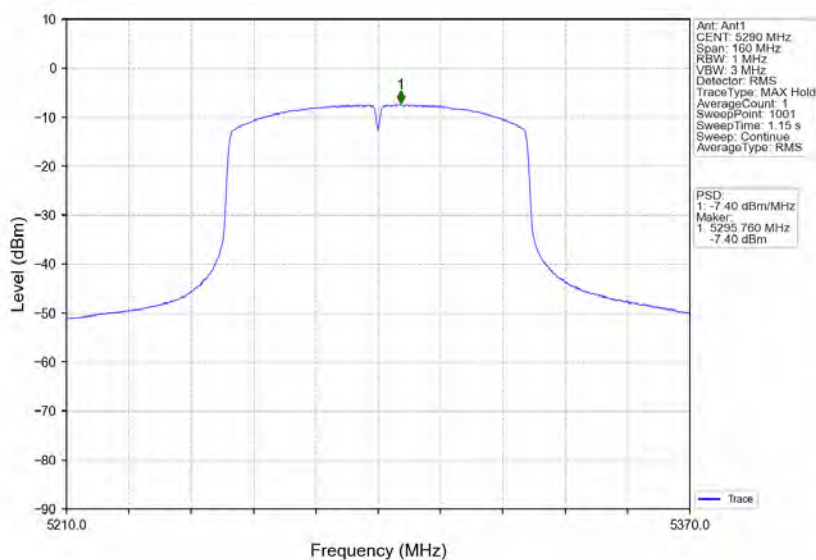
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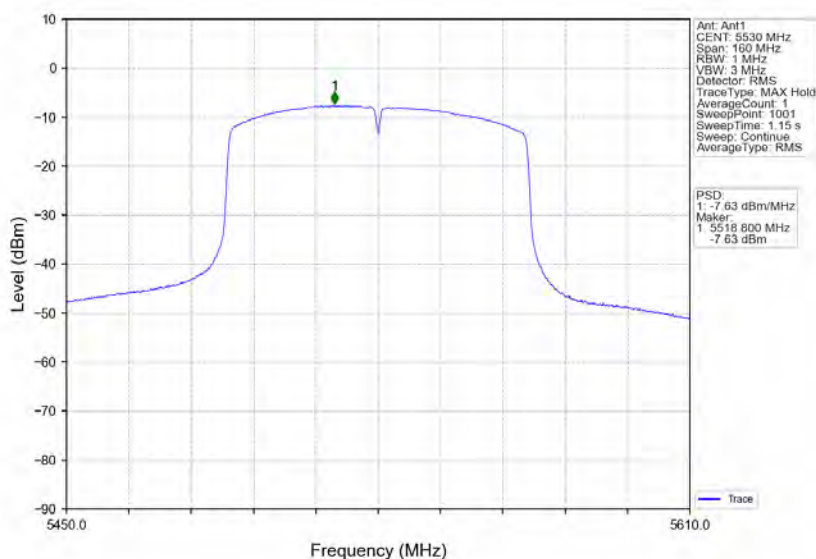
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802.11ac(VHT80) MCH 5290MHz Ant2 NTN



802.11ac(VHT80) LCH 5530MHz Ant2 NTN



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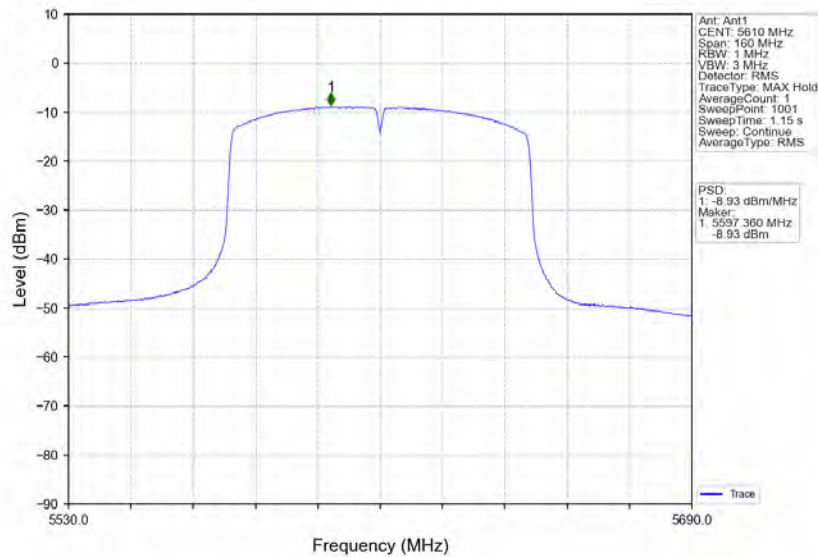
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802.11ac(VHT80) HCH 5610MHz Ant2 NTN



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Power Spectral Density - Band III

Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/500kHz)		Verdict
			ANT2	Limit	
802.11a	SISO	5745	-2.92	<=30	Pass
		5785	-3.10	<=30	Pass
		5825	-2.59	<=30	Pass
802.11n (HT20)	SISO	5745	-4.82	<=30	Pass
		5785	-5.01	<=30	Pass
		5825	-3.86	<=30	Pass
802.11n (HT40)	SISO	5755	-8.27	<=30	Pass
		5795	-8.01	<=30	Pass
802.11ac (VHT80)	SISO	5775	-11.48	<=30	Pass

Note1: Antenna Gain: Ant2: 4.90dBi;

Remark:

For 802.11n HT20/ac VHT20 and 802.11n HT40/ac VHT40 mode, the whole testing have assessed only, 802.11n HT20/40 by referring to their higher output power.



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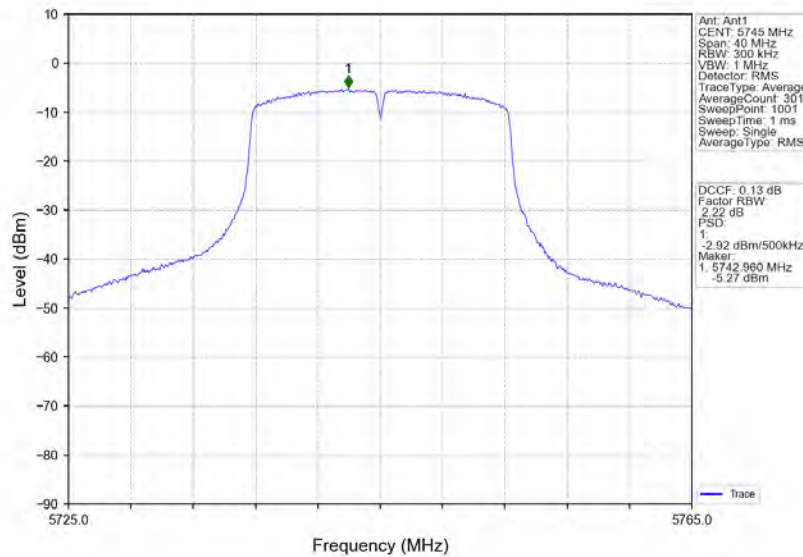
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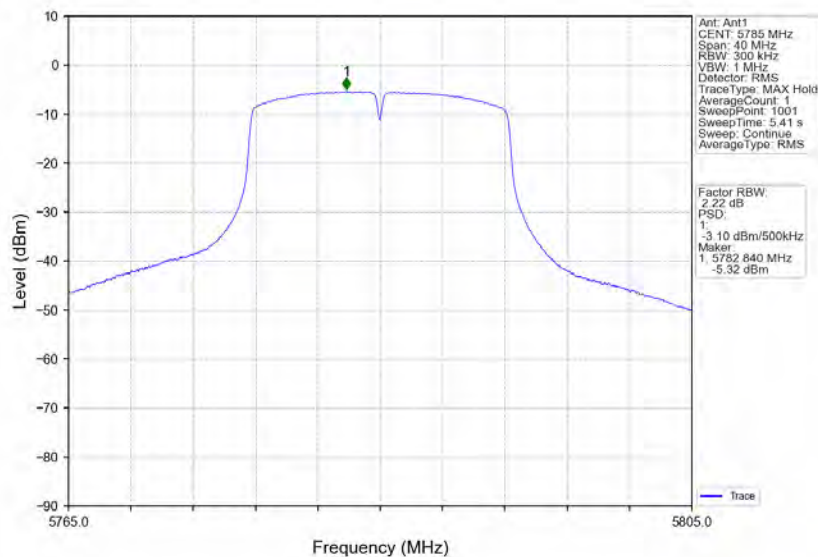
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Test Graphs

802.11a_LCH_5745MHz_Ant2_NTNV



802.11a_MCH_5785MHz_Ant2_NTNV



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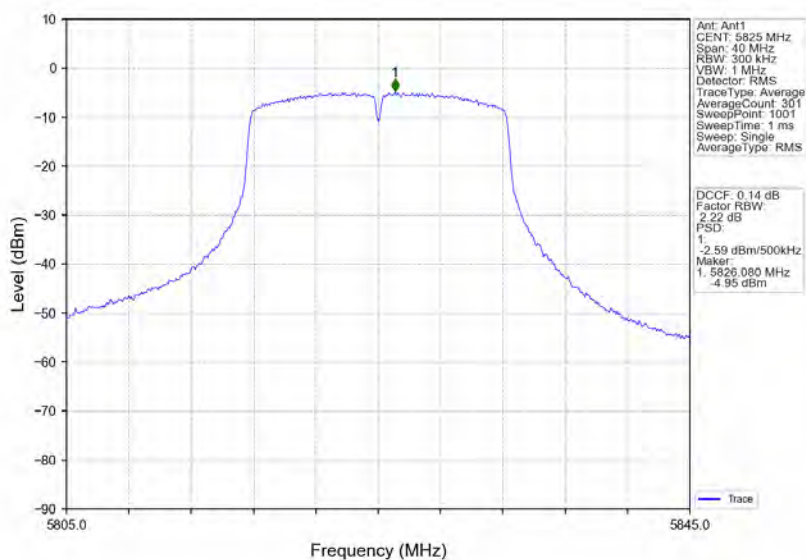
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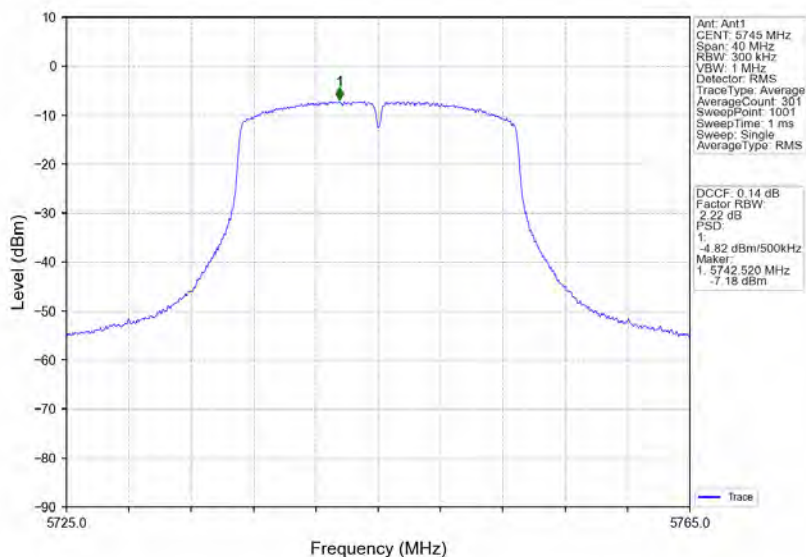
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802.11a HCH 5825MHz Ant2 NTN



802.11n(HT20) LCH 5745MHz Ant2 NTN



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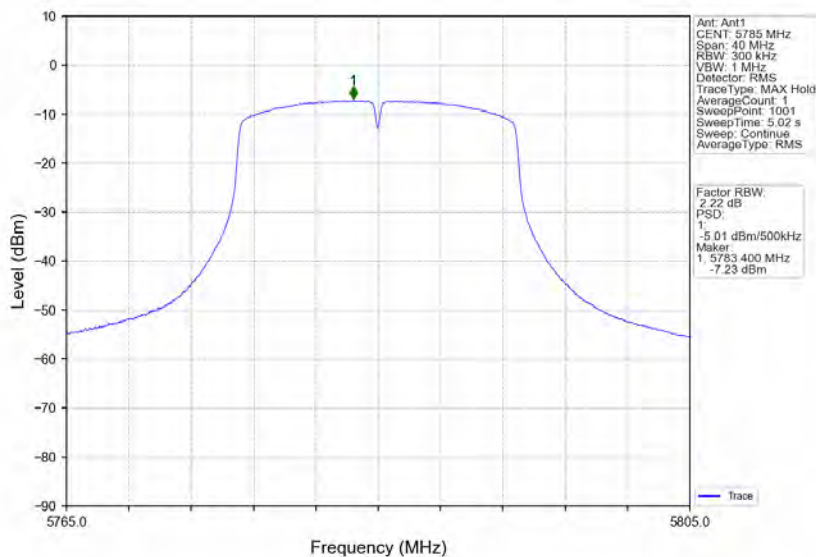
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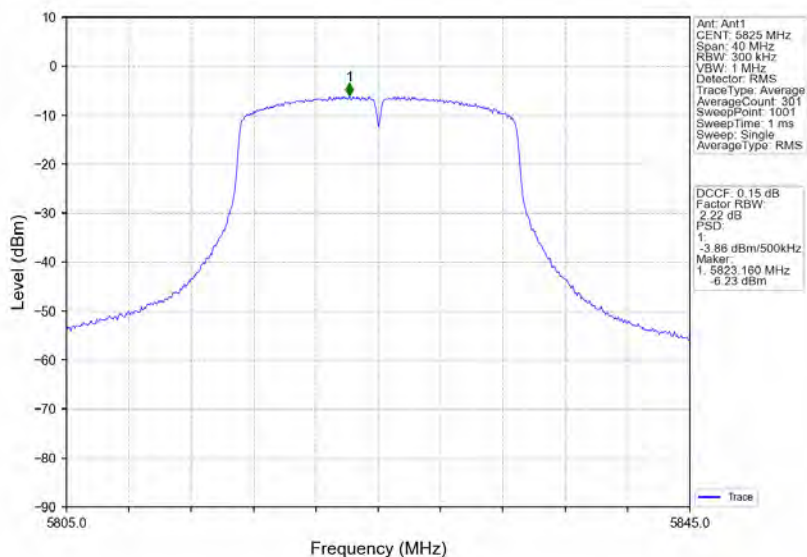
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802.11n(HT20) MCH 5785MHz Ant2 NTN



802.11n(HT20) HCH 5825MHz Ant2 NTN



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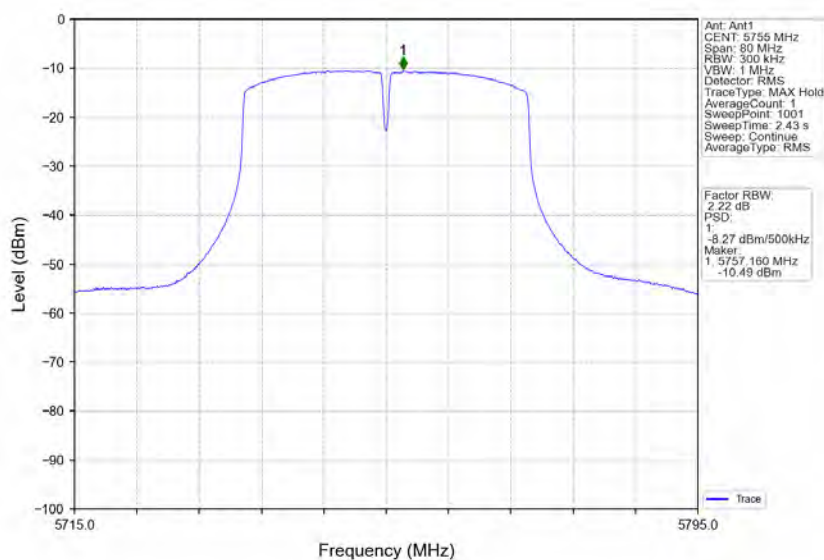
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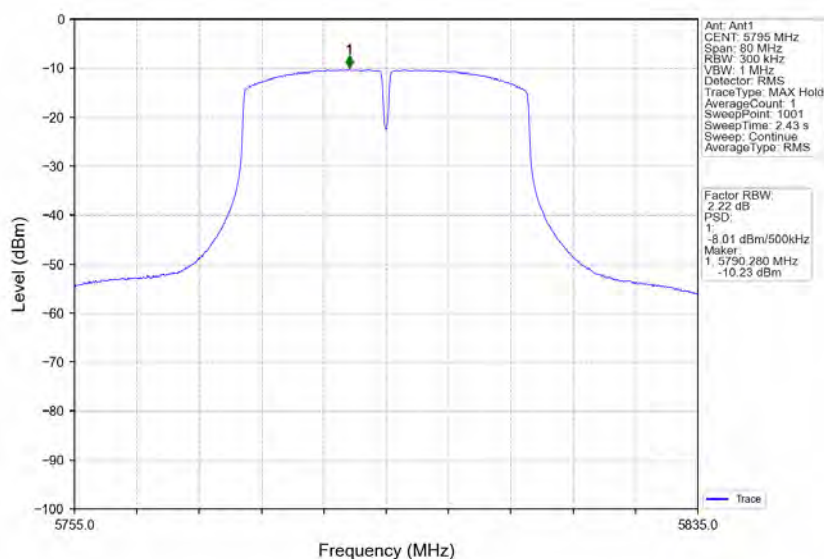
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802.11n(HT40) LCH 5755MHz Ant2 NTN



802.11n(HT40) HCH 5795MHz Ant2 NTN



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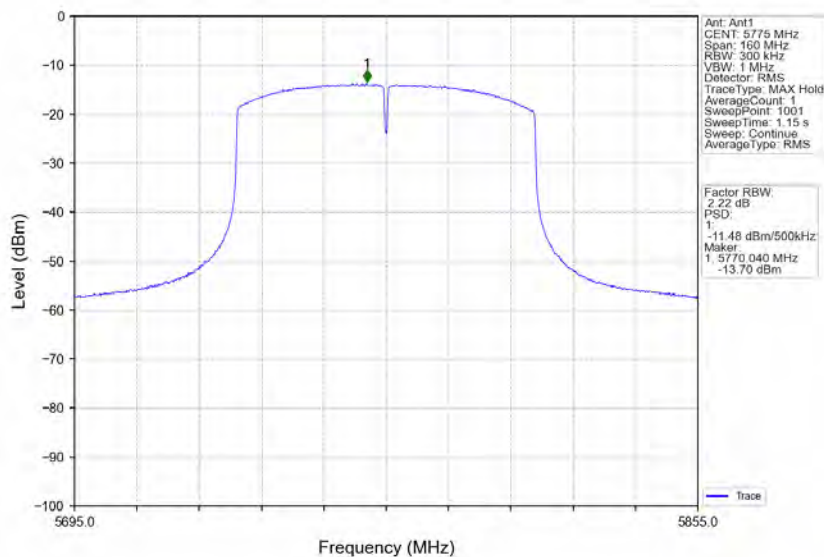
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802.11ac(VHT80) MCH 5775MHz Ant2 NTV



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Signal Calibration SC

Test Result

Band II-A							
Mode	Bandwidth (MHz)	Frequency (MHz)	Radar Signal		Signal Calibration		Verdict
			Type	Trial Id	Result	Limit	
802.11ac (VHT80)	80	5290	0	0	Refer To Test Graph		Pass
			1	0	Refer To Test Graph		Pass
			2	0	Refer To Test Graph		Pass
			3	0	Refer To Test Graph		Pass
			4	0	Refer To Test Graph		Pass
			5	0	Refer To Test Graph		Pass
			6	0	Refer To Test Graph		Pass



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