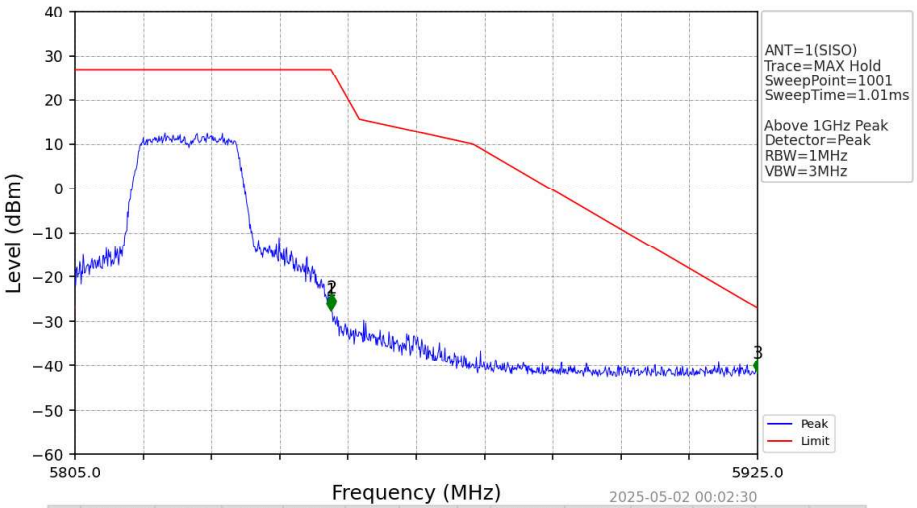
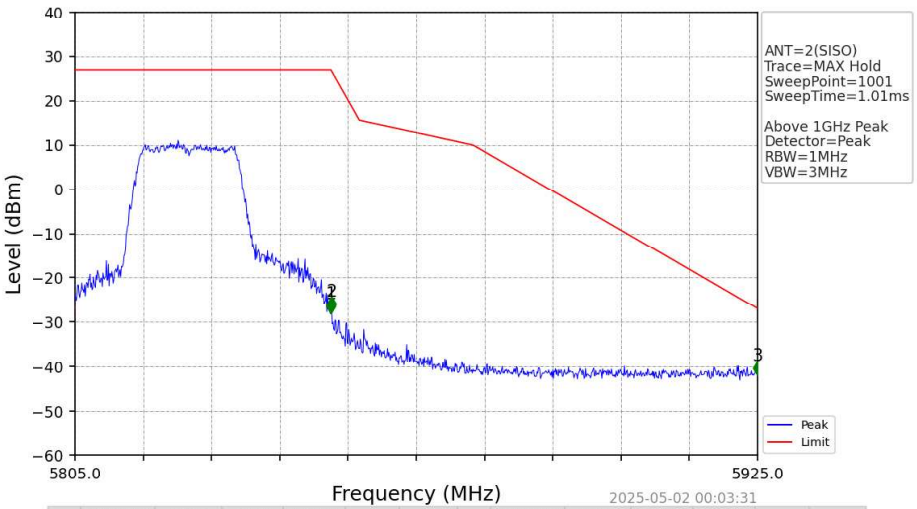
802.11ac(VHT20)_HCH_5825MHz_Ant1_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	5850.000	-23.51	27.00	50.51	Pass	Peak	3	5925.000	-37.59	-27.00	10.59	Pass	Peak
2	5850.120	-23.03	26.73	49.75	Pass	Peak							

802.11ac(VHT20)_HCH_5825MHz_Ant2_NTNV



No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark	No	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Status	Remark
1	5850.000	-24.09	27.00	51.09	Pass	Peak	3	5925.000	-37.87	-27.00	10.87	Pass	Peak
2	5850.120	-23.52	26.73	50.25	Pass	Peak							

8 Dynamic Frequency Selection Technical Requirements

8.1 *Applicability*

Applicability of DFS Requirements Prior to Use of a Channel			
Requirement	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

Applicability of DFS requirements during normal operation			
Requirement	Operational Mode		
	Master	Client without radar detection	Client with Radar detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

8.2 *Test Requirements for Client Devices*

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.
e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear.

DFS Detection Thresholds	
Maximum Transmit Power	Value[1,2,3]
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
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.	

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

8.3 *Radar Test Waveforms*

For a Client Device without DFS, the Channel Move Time and Channel Closing Transmission Time requirements will be verified with one of the defined Short Pulse Radar Types. Radar Pulse Type 0 was used for the channel move time and channel closing time tests.

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		
1	1	Refer to KDB 905462 D02		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 of Radar Types 1-4				80%	120

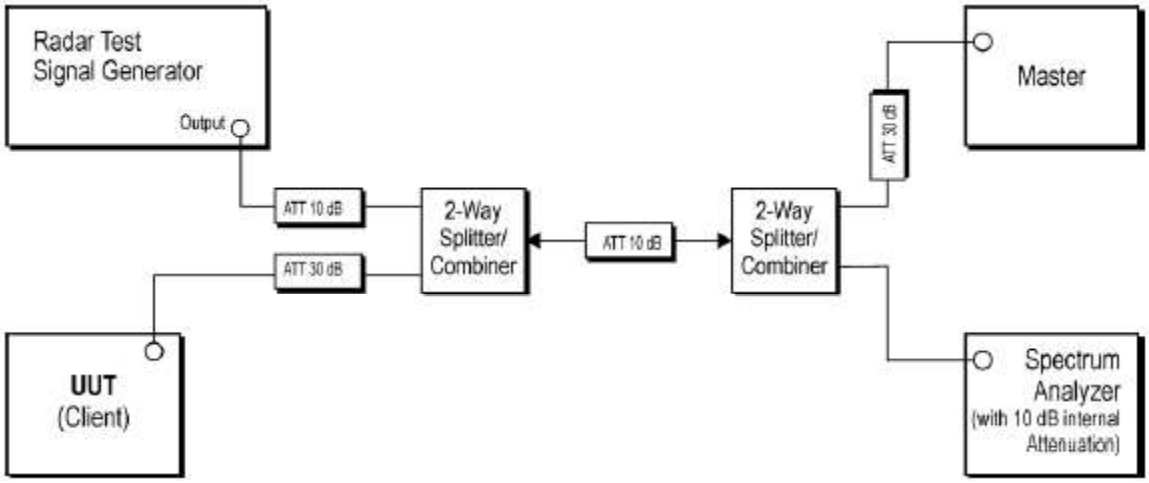
Long Pulse Radar Test Waveforms							
Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Frequency Hopping Radar Test Waveform							
Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per hop	Hopping rate (kHz)	Hopping Sequence length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

8.4 *Test Procedures*

The conducted test setup was used for this testing. One channel was chosen for testing.

1. Connect equipment to the R&S TS8997. The figure below shows the concept of the connections.



2. The radar test signal level was set at the Master Device – Radar Detection Device according to the appropriate DFS Detection Threshold.
3. Communication between the Master and the Client (EUT) was established and was on a channel that contains control signals.
4. System testing was performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following method was used:
    - Software with random ping intervals was used to ping the client in order to simulate data transfer.
5. Timing plots were recorded that demonstrate a minimum channel loading of approximately 17% or greater. The channel loading was estimated by setting the spectrum analyzer for zero span which shows the approximate the Time On/ (Time On + Off Time).
6. At T_0 the Radar Waveform generator sent a Burst of Type 0 pulses. The test level was set to the appropriate detection level with 1 dB added to the radar test signal to ensure it was at or above the DFS Detection Threshold.
7. The transmissions of the Client Device were observed and measured at the end of the radar Burst on the operating channel for a duration greater than 10 seconds.
8. After the initial radar burst, the channel is monitored for 30 minutes to ensure no transmissions or beacons occur.

8.5 *Test Equipment*

Test End Date: 27-March-2025 Tester: SGM

Equipment	Manufacturer	Model	Asset Number	Cal Date	Cal Due Date
RF CABLE (TS8997)	HUBER & SUHNER	141	B095587	8-Jul-2024	8-Jul-2025
ATTENUATOR	HEWLETT PACKARD	8496B	B094944	5-Jul-2024	5-Jul-2025
ATTENUATOR, STEP 0-110DB	HEWLETT PACKARD	8494B	B094945	5-Jul-2024	5-Jul-2025
RF CABLE SMA TO SMA, 0.01-40GHZ	084-0505-059	TELEDYNE STORM MICROWAVE	20109	3-Apr-2025	3-Apr-2026
RF ENCLOSURE	LINDGREN RF ENCLOSURE	T/T	17011	CNR	CNR
VECTOR SIGNAL GENERATOR (TS8997)	SMBV 100A	ROHDE & SCHWARZ	15002	3-Mar-2025	3-Mar-2028
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	4-Mar-2025	4-Mar-2026
TSTPASS SWITCHBOX	TSTPASS	SB2	23009	8-Apr-2024	8-Apr-2025

Note: The equipment calibration period is 1 year for the SF102, OSP, OPS-B157. The calibration period is 2 years for the FSV30, SMBV 100A, and SMB 100A. VBU = Verified before use

A DFS-compliant Master device was used for testing. It is the CISCO AIR-SAP2602E-A-K9, FCC ID:LDK1002080, IC:2461B-102080.

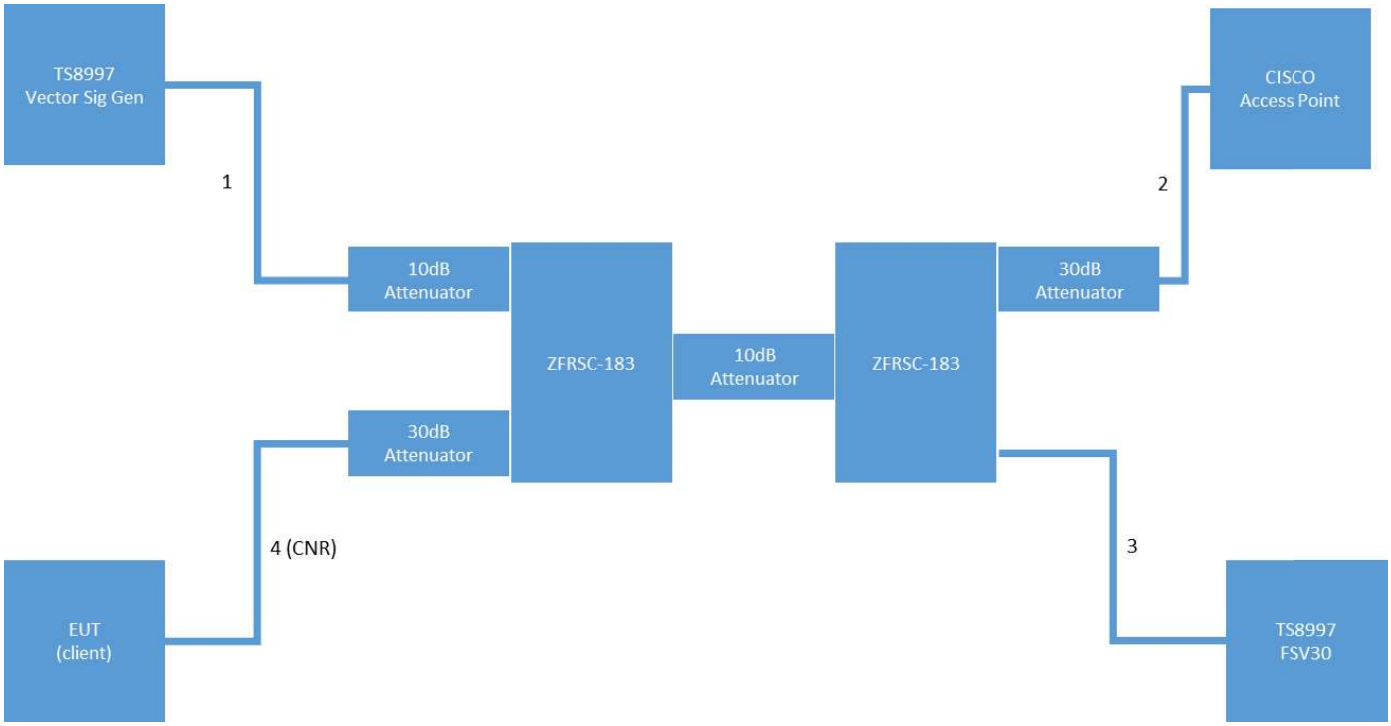
8.6 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

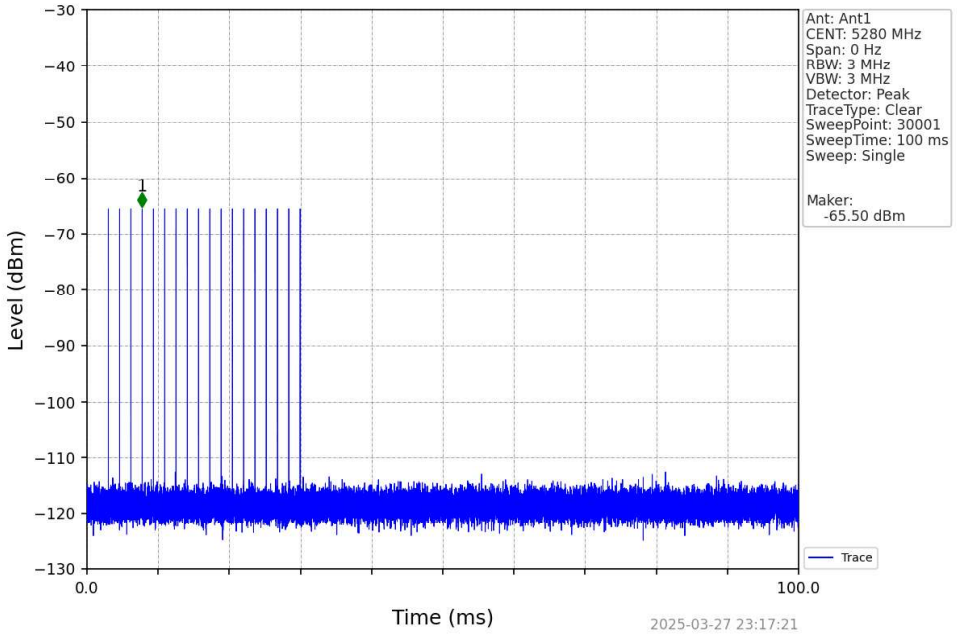
Temperature:	24.51 °C
Relative Humidity:	21.5 %
Atmospheric Pressure:	98.81 kPa

8.7 *DFS Setup Diagram*

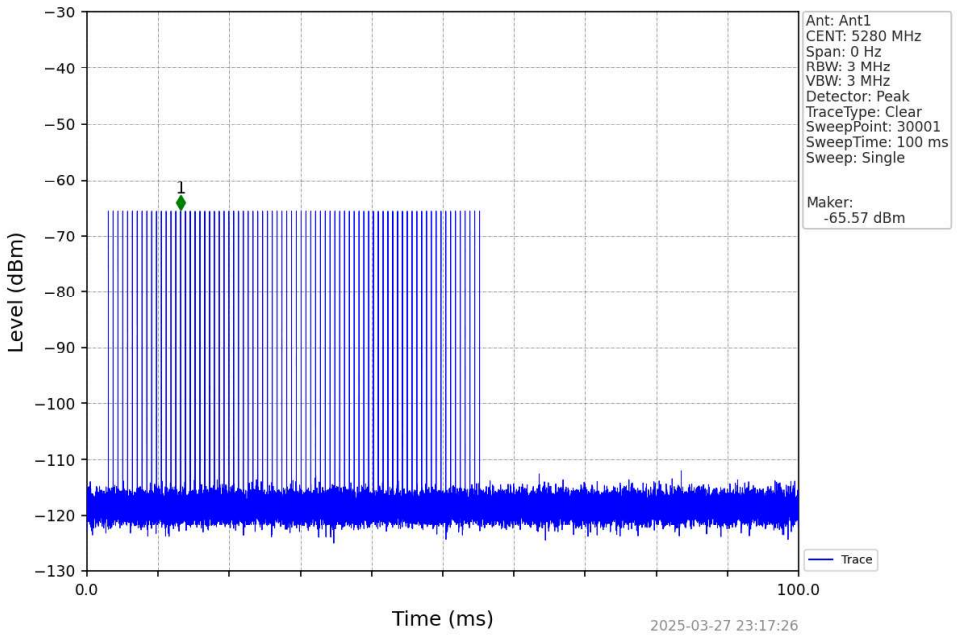


8.8 *DFS Cal Level*

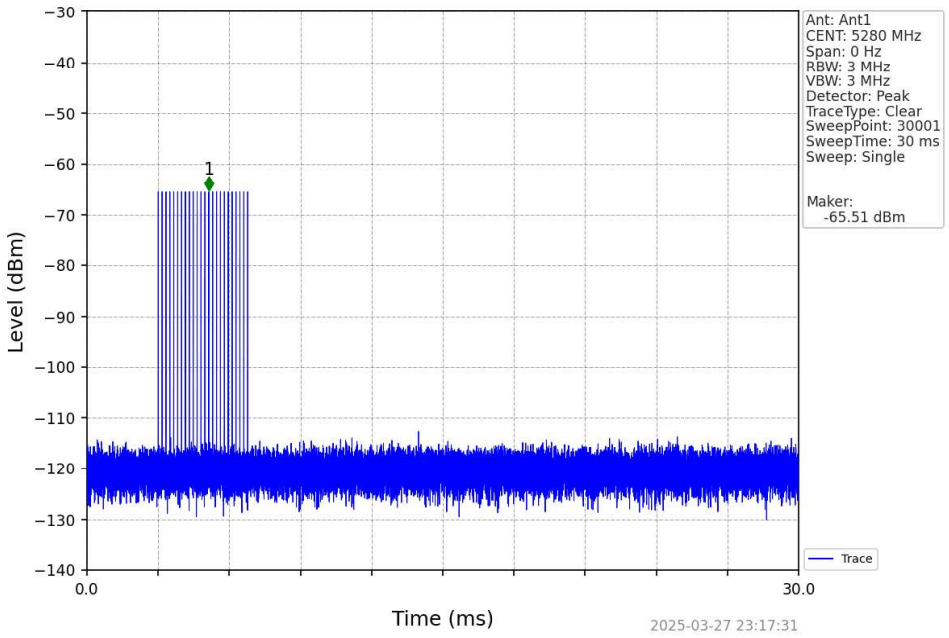
Signal Calibration_802.11a_2A_5280MHz_RadarType0_Trial0



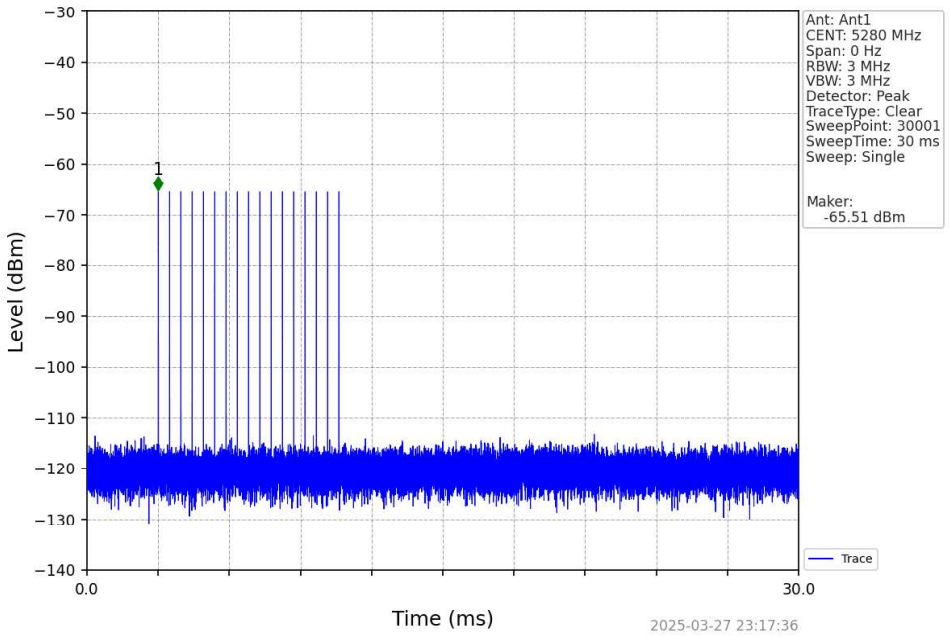
Signal Calibration_802.11a_2A_5280MHz_RadarType1_Trial0



Signal Calibration_802.11a_2A_5280MHz_RadarType2_Trial0



Signal Calibration_802.11a_2A_5280MHz_RadarType3_Trial0



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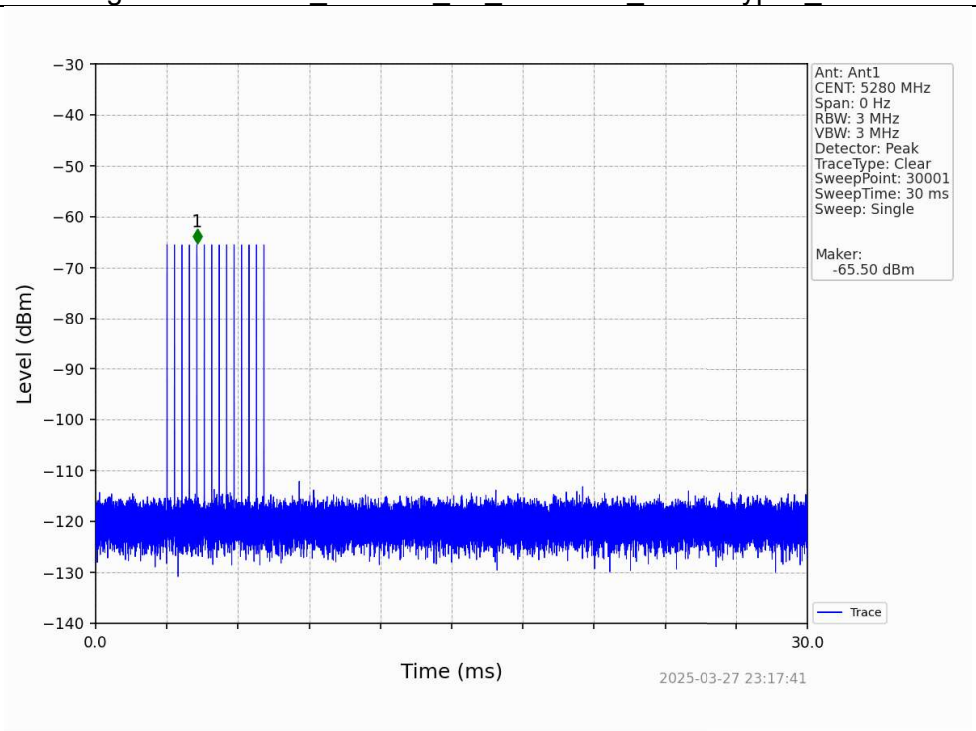

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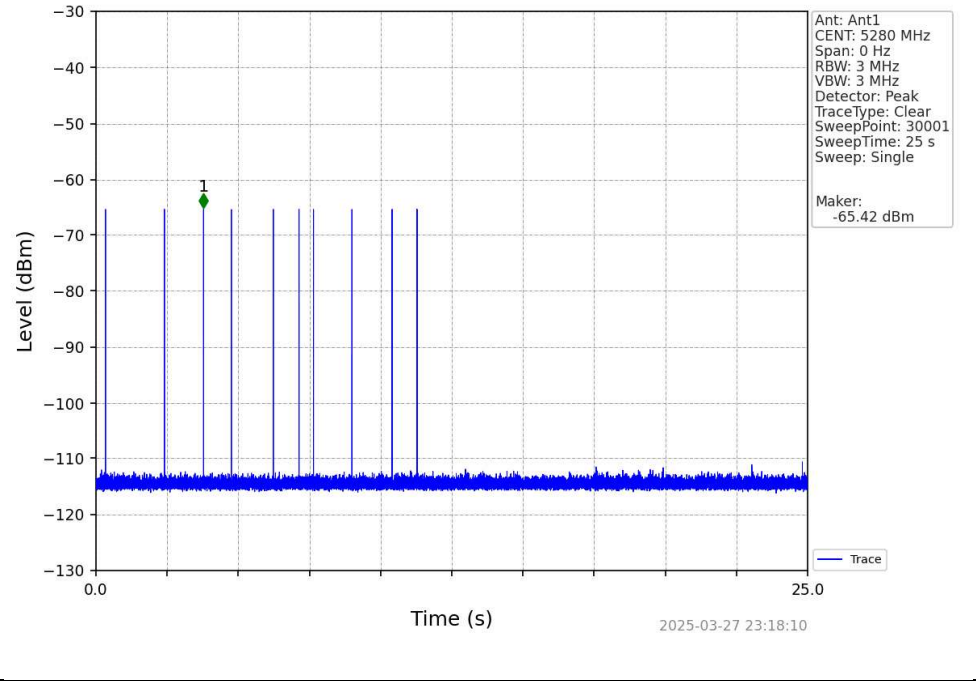
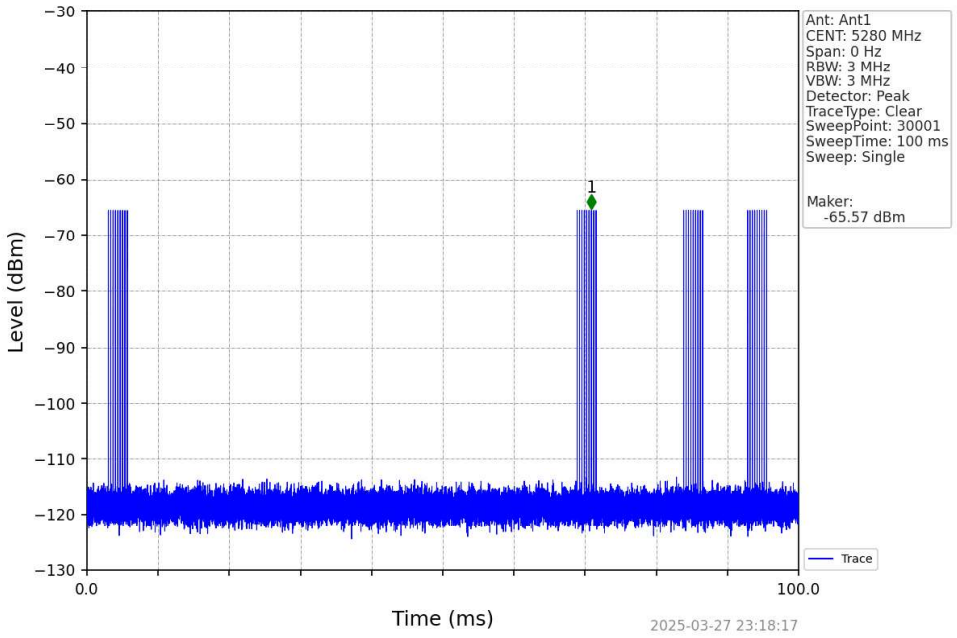
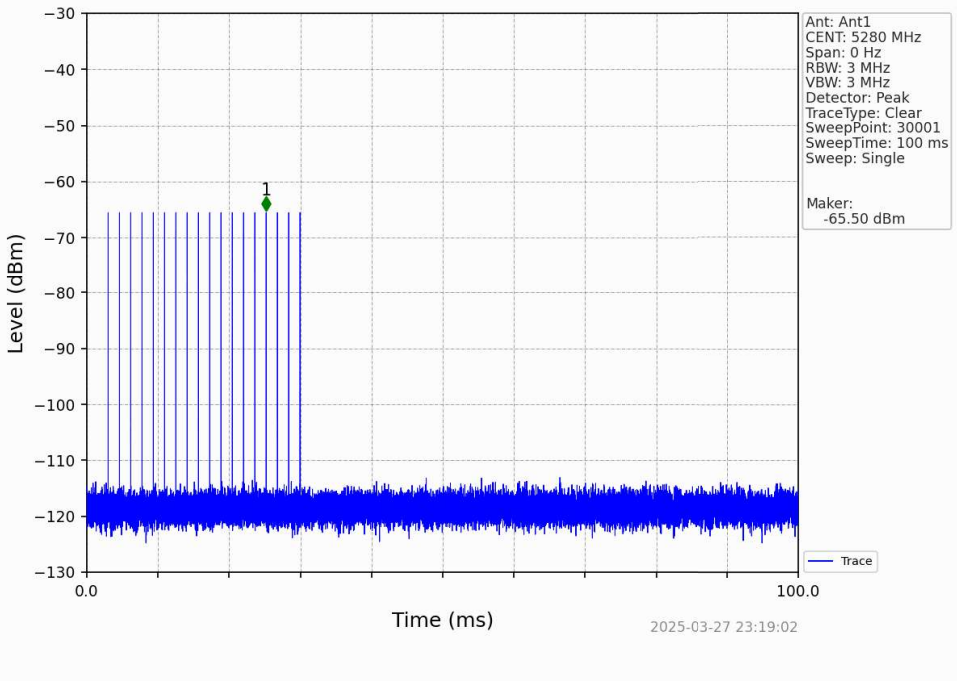


Signal Calibration_802.11a_2A_5280MHz_RadarType6_Trial0



Signal Calibration_802.11n(HT20)_2A_5280MHz_RadarType0_Trial0



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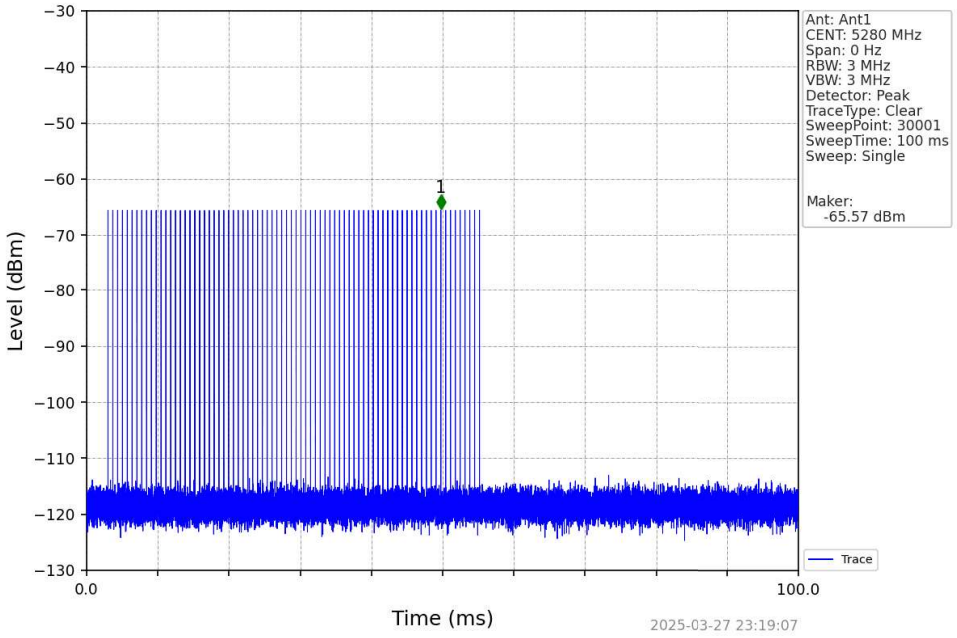

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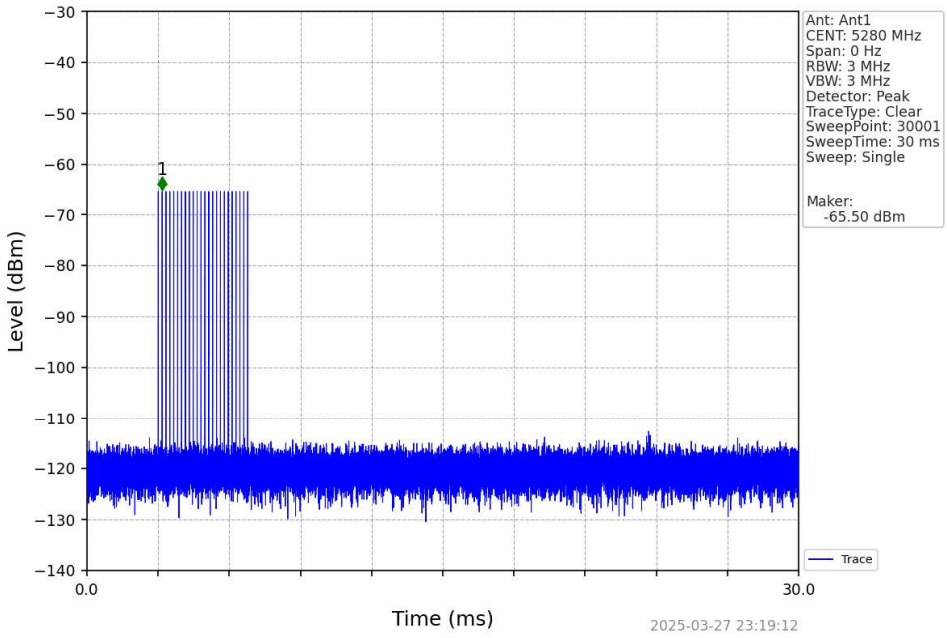
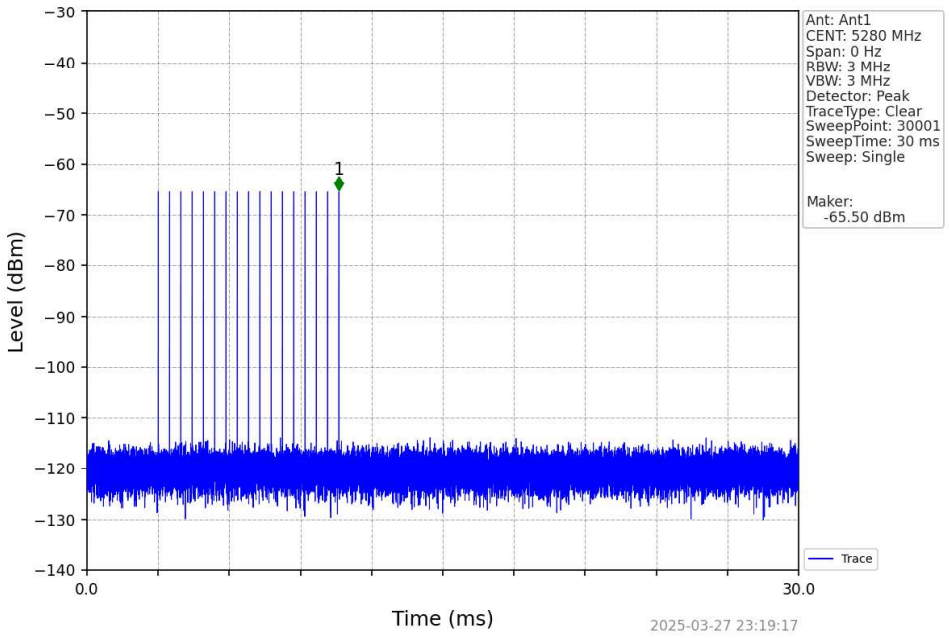


Signal Calibration_802.11n(HT20)_2A_5280MHz_RadarType3_Trial0



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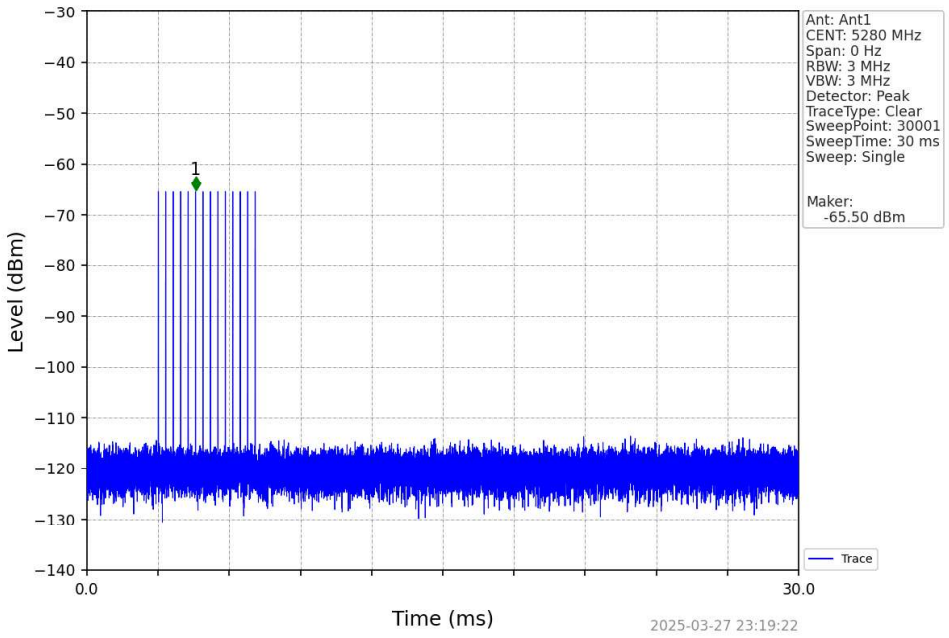

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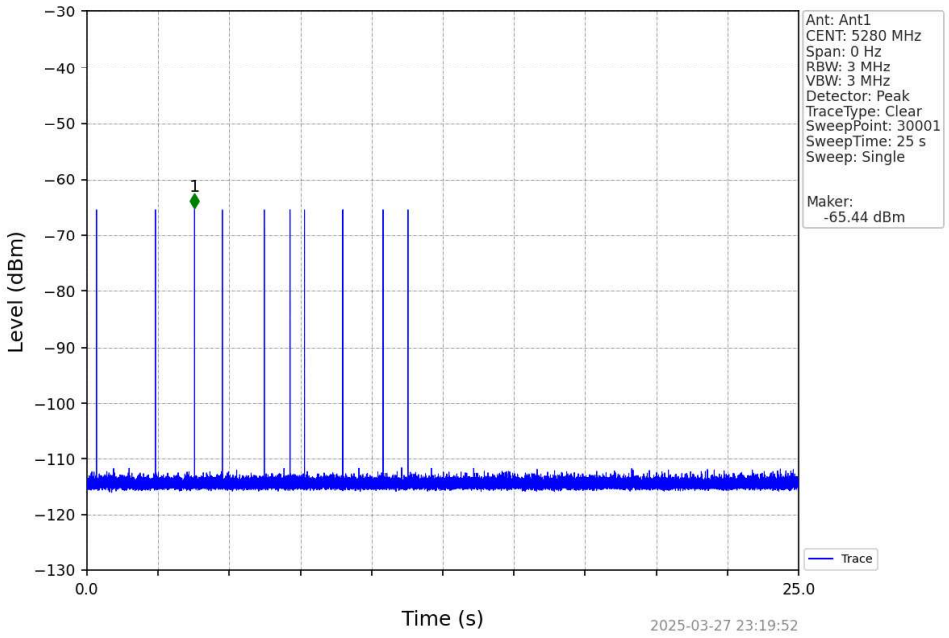
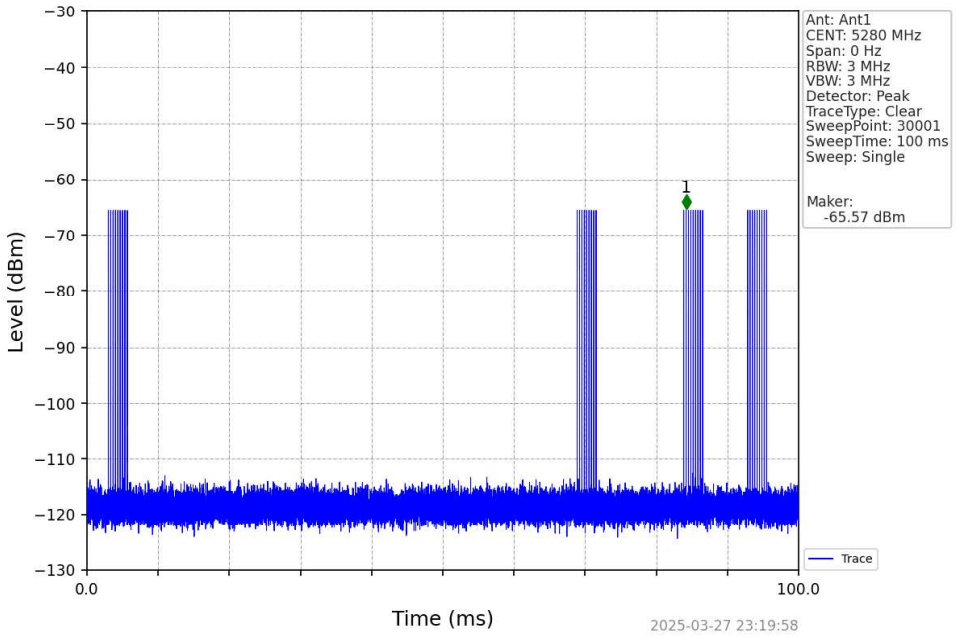
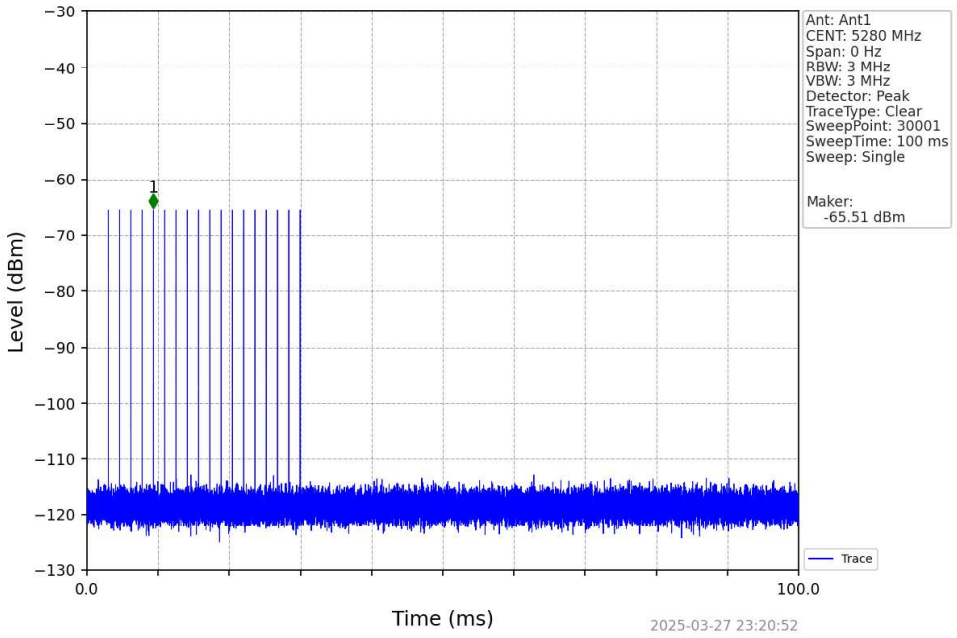


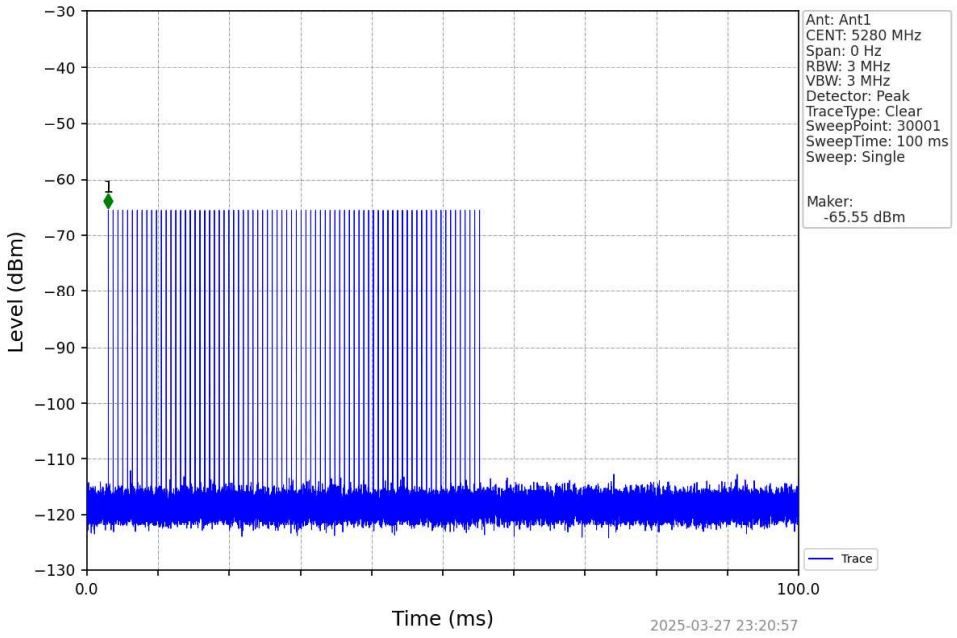
Signal Calibration_802.11n(HT20)_2A_5280MHz_RadarType6_Trial0



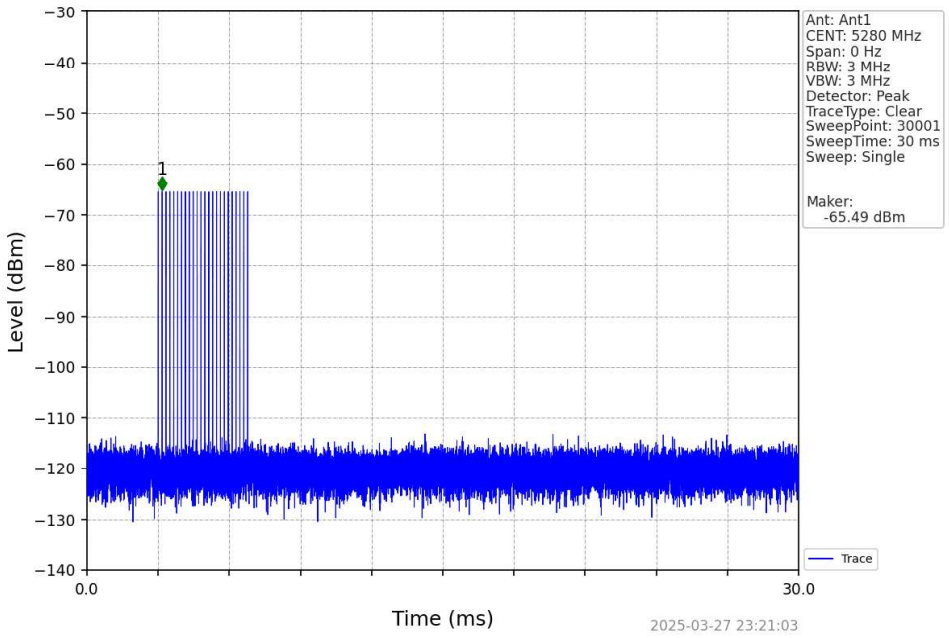
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType0_Trial0



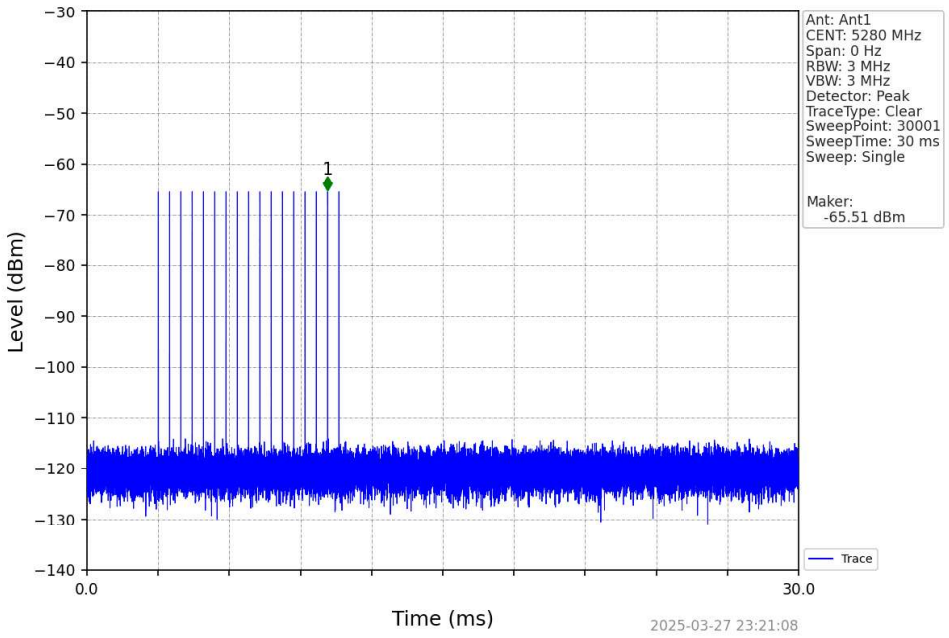
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType1_Trial0



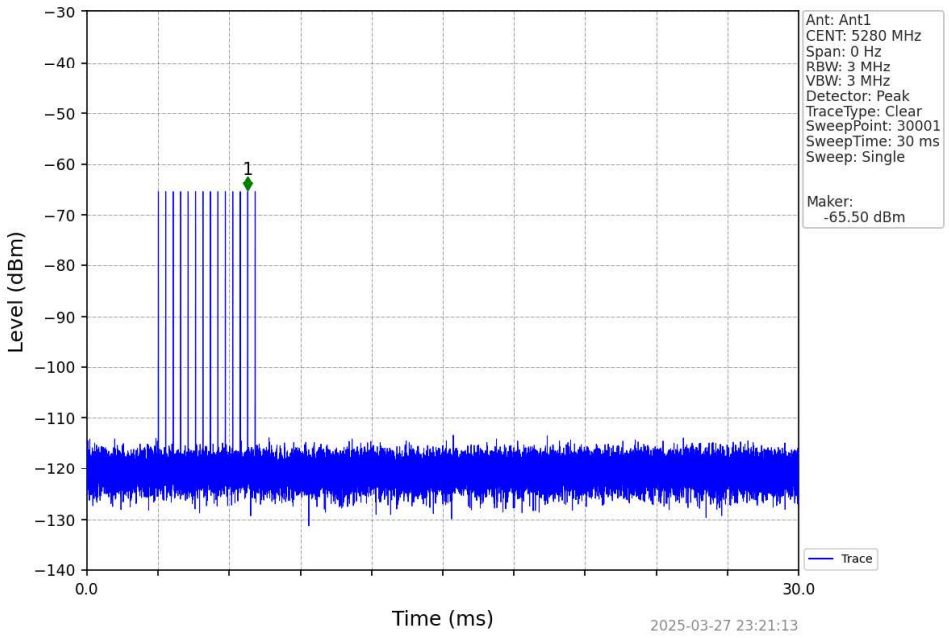
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType2_Trial0



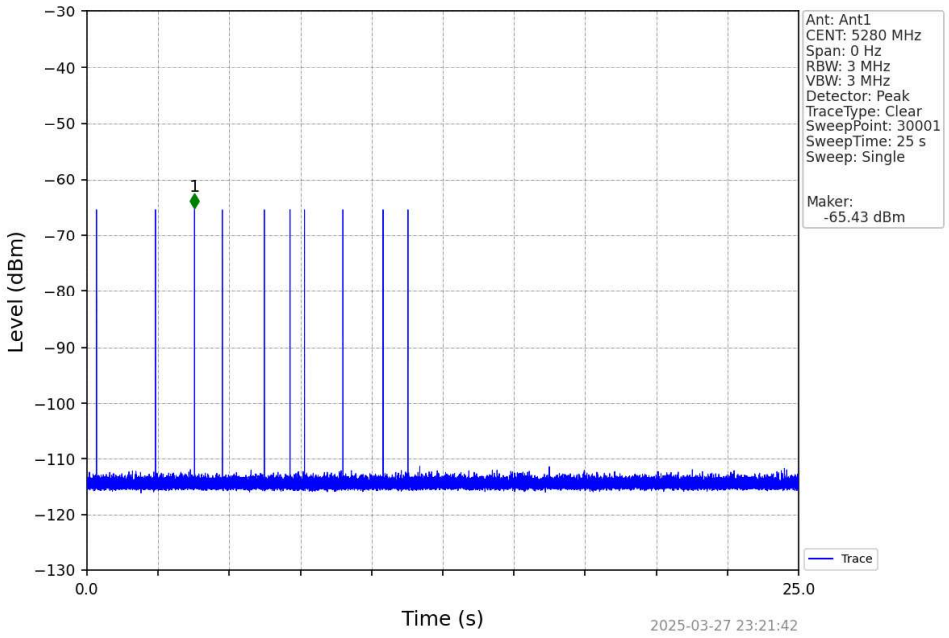
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType3_Trial0



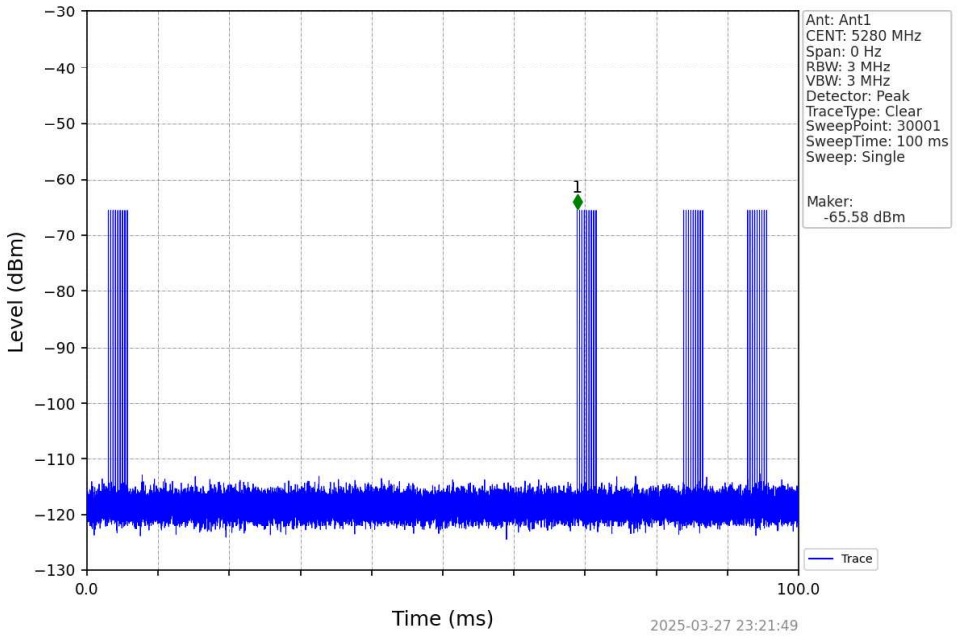
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType4_Trial0



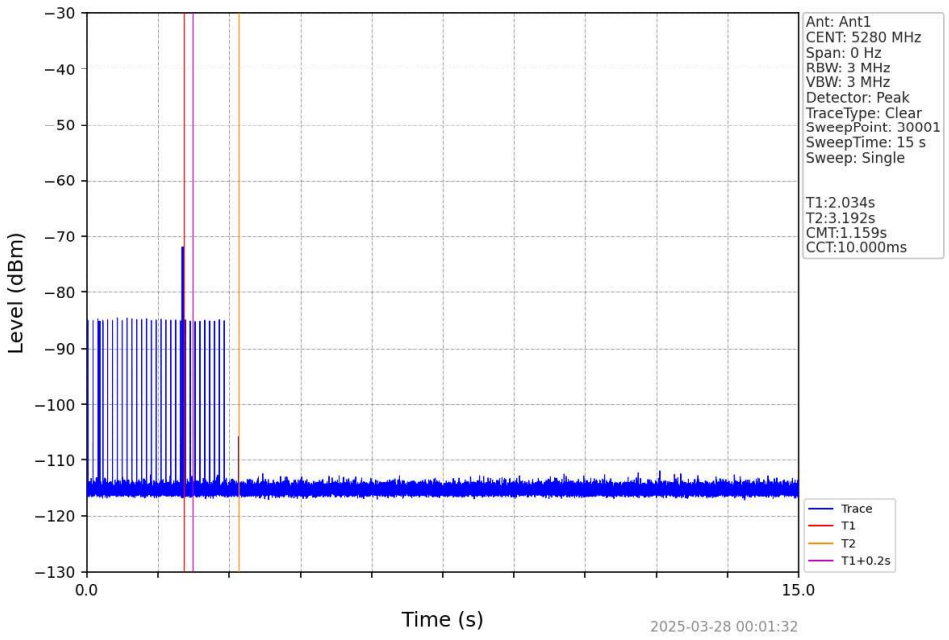
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType5_Trial0



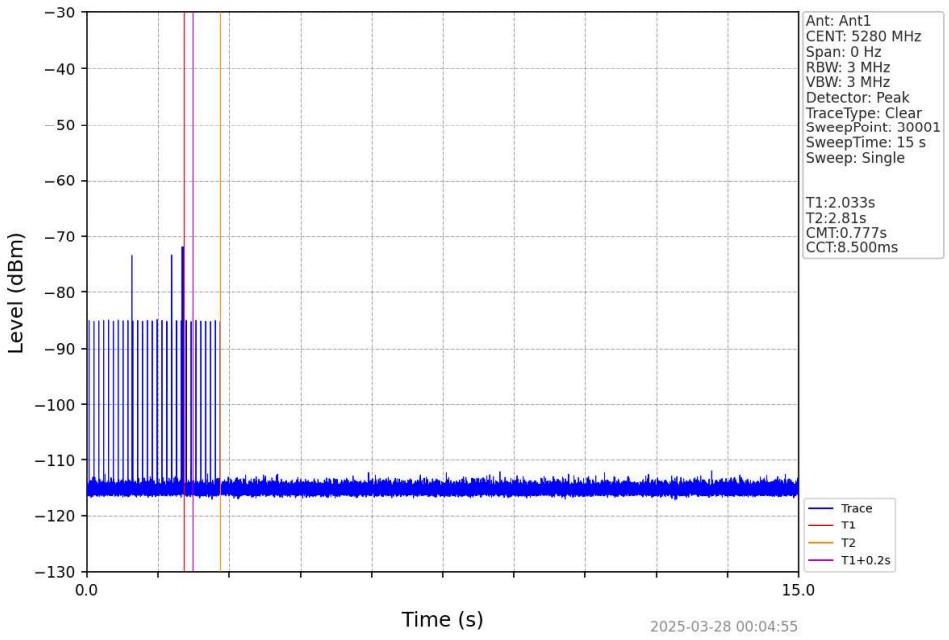
Signal Calibration_802.11ac(VHT20)_2A_5280MHz_RadarType6_Trial0



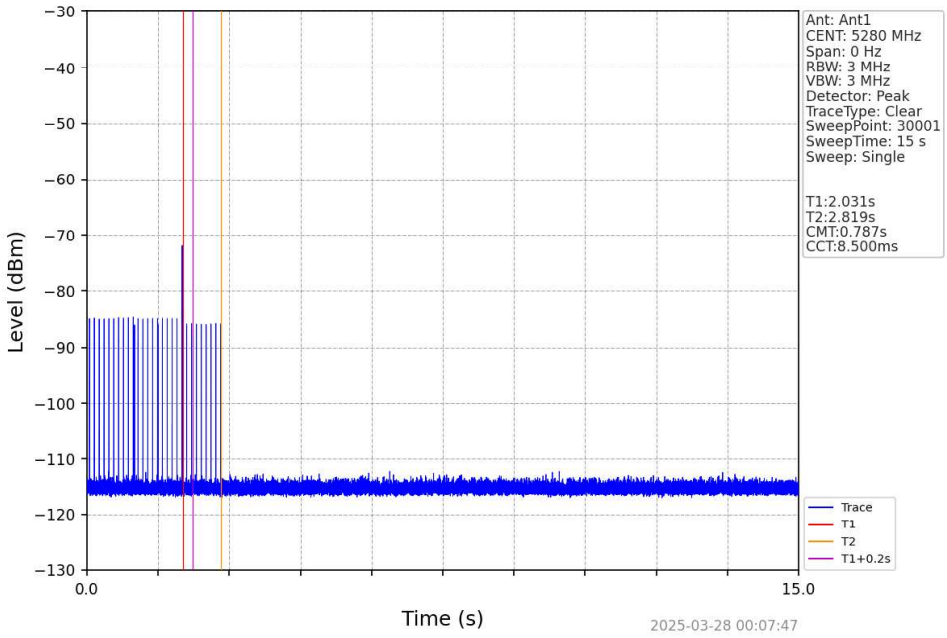
8.9 *Move Time and Aggregate Time*



Channel Move Time and Closing Transmission Time_802.11n(HT20)_2A_5280MHz



Channel Move Time and Closing Transmission Time_802.11ac(VHT20)_2A_5280MHz



9 Antenna Requirement

9.1 *Result*

Test Description	Test Specification		Test Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.203	RSS-GEN S8.3	Compliant

9.2 *Requirement*

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

9.3 *Conclusion*

The Device utilizes an internal PCB antenna that is not accessible and cannot be disconnected. This meets the requirements of the standard.

10 Measurement Uncertainty

The measurement uncertainty figures are be calculated in accordance with TR 100 028-1 [2] and correspond to an expansion factor (coverage factor) k = 2 (which provide confidence levels of 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

	Expanded Uncertainty for Normal k factor equal to 2	
Parameter	Required	Laboratory Actual
Radio Frequency	±1 x 10-5	±9.8 x 10-8
total RF power, conducted	±1.5 dB	±1.2 dB
RF power density, conducted	±3 dB	±0.7 dB
spurious emissions, conducted	±3 dB	±2.1 dB
all emissions, radiated	±6 dB	±4.8 dB
temperature	±1°C	±0.5°C
humidity	±5 %	±3.5%
DC and low frequency voltages	±3 %	±0.4%

11 Revision History

Revision Level	Description of changes	Revision Date
0	Initial Release	29 May 2025
1	Updated standard to 15.407 & KBD KDB 789033 D02 General UNII Test Procedures New Rules v02r01 requirements. Updated battery voltage in section 2.3 to 3.6 VDC.	06 June 2025
2	Added EIRP to Max Output power section.	11 June 2025
3	RSS-247 26 dB data was added to section 8.5. Added straddle channel data.	12 June 2025
4	Updated section 5.2. Removed references to 802.11ax in section 9.7 and 9.8.	20 June 2025
5	Additional Data points were taken and Plots at 10cm distance for section 6.11 added to report	21 July 2025