

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: MERCURY Corporation
90, Gajaeul-ro, Seo-gu, Incheon, Republic of Korea

Product Name: acrobox

Brand Name: N/A

Model No.: AM114D

Model Difference: N/A

Report Number: ER/2020/60009-01

FCC ID: 2AVW5AM114D

FCC Rule Part: §15.407, Cat: U-NII

Issue Date: April 12, 2021

Date of Test: This report is only added FCC ID, there will be no date of test.

Date of EUT Received: This report is only added FCC ID, there will be no date of EUT received.

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Approved By:

CHUN-CHIEH, CHEN

Chun Chieh Chen / Supervisor



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Revision History

Report Number	Revision	Description	Issue Date	Revised By
ER/2020/60009	Rev.00	Original.	March 16, 2021	Susan Lin
ER/2020/60009-01	Rev.01	Add FCC ID	April 12, 2021	Susan Lin

Note:

- 1、Measurement results in the original test report ER/2020/60009 are fully leveraged in this test report.
- 2、Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	acrobox
Brand Name:	N/A
Model No.:	AM114D
Model Difference:	N/A
Operation mode:	Master equipment
DFS SW version:	Please refer to DFS FW version print screen as below.
Hardware Version:	ABAP R1B
Software Version:	V0.04.49
Power Supply:	DC12V

DFS FW version:

MERCURY WEB SERVER x +

← → ↻ ⚠ 不安全 | 192.168.0.1:8899/main.asp

MERCURY CORPORATION

AM114D

기본 설정 고급 설정

네트워크 관리

무선랜 관리 [5GHz]

무선랜 관리 [2.4GHz]

NAT/라우터 관리

보안 기능

시스템 관리

시스템 로그

펌웨어 업그레이드

시스템 관리

저장장치 관리

펌웨어 업그레이드

펌웨어 업그레이드를 수행하겠습니다.

펌웨어 정보

펌웨어 1 버전 정보	3.0.0
펌웨어 2 버전 정보	2.0.0
현재 운용중인 펌웨어	1
이미지 생성날짜	Feb 2 2021, 12:46:17

업그레이드

펌웨어 업그레이드 형식

랜에 접속된 PC를 이용

펌웨어 위치

選擇檔案 未選擇任何檔案

적용

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1.2 FCC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Modulation Technology
11a_20	5150~5250	4	OFDM
	5250~5350	4	
	5470~5725	12	
	5725~5850	5	
11n_HT / ac_VHT 20M	5150~5250	4	OFDM
	5250~5350	4	
	5470~5725	12	
	5725~5850	5	
11n_HT / ac_VHT 40M	5150~5250	2	OFDM
	5250~5350	2	
	5470~5725	6	
	5725~5850	2	
11ac VHT80M	5150~5250	1	OFDM
	5250~5350	1	
	5470~5725	3	
	5725~5850	1	

1.3 Antenna Designation:

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Antenna Gain (dBi)
External	SaemON Technology	SME-S2558AC-C140BM-P	5150~5250	6
			5250~5350	6
			5470~5725	6
			5725~5850	6
External	SaemON Technology	SME-S2558AC-C180BM-P	5150~5250	6
			5250~5350	6
			5470~5725	6
			5725~5850	6

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1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

1.5 Test Facility

Laboratory	Test Site Address		FCC Designation number
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	<input checked="" type="checkbox"/>	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	TW0027
	<input type="checkbox"/>	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	TW0028

1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SUMMARY OF TEST RESULT

FCC and ISED Rules	Description Of Test	Result
§15.407(h) FCC KDB 905462 D02	TPC and DFS Measurement	Compliant

3 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
TPC and DFS Measurement	+/- 0.89 Hz
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 1%

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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4 TPC AND DFS MEASUREMENT

4.1 TPC: Standard Applicable

According to §15.407(h)(1), Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

Result: N/A, The e.i.r.p is less than 500mW.

4.2 DFS: Standard Applicable

According to §15.407(h)(2) and FCC KDB 905462 D02 , Radar Detection Function of Dynamic Frequency Selection (DFS).

Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is -64 dBm. For devices that operate with less than 200 mW e.i.r.p. and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is -62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

- (i) Operational Modes. The DFS requirement applies to the following operational modes:
 - (a) The requirement for channel availability check time applies in the master operational mode.
 - (b) The requirement for channel move time applies in both the master and slave operational modes.
- (ii) Channel Availability Check Time. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected within 60 seconds.
- (iii) Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

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Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

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4.2.1 Limit

Table 1: 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	Yes	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Band-width	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission time	Yes	Yes
Channel Move time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

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Additional requirements for devices with multiple bandwidth mode	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.		

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

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
<p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p>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.</p> <p>Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

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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.
<p>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.</p> <p>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.</p> <p>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.</p>	

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Table 5: Radar Test Waveforms
Short Pulse Radar

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	Roundup $\left\lceil \frac{1}{360} \cdot \frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right\rceil$	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.					

Long Pulse Radar

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

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

The applicant of this given application confirms that information regarding the parameters of the detected Radar Waveforms is not available to the end user.

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4.2.2 Test Setup

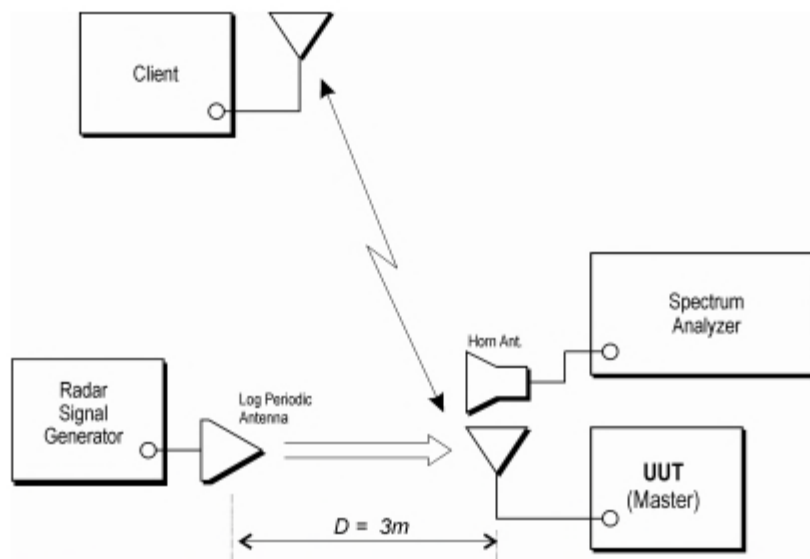


Figure 5: Example Radiated Setup where UUT is a Master and Radar Test Waveforms are injected into the Master

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4.2.3 Test Equipment Used:

Radiated Emission Test Site: FAC III					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn antenna	ETS.LIND-GREN	3117	00139056	11/23/2020	11/22/2021
Horn antenna	ETS.LIND-GREN	3117	00143272	01/26/2021	01/25/2022
Signal Generator	KEYSIGHT	N5182B	MY59100743	06/26/2020	06/25/2021
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071541	06/26/2020	06/25/2021

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4.2.4 Description of EUT:

EUT operates over the 5150-5250MHz, 5250-5350MHz, 5470-5725MHz and 5725-5850MHz ranges and EUT is a Master device with radar detection and DFS capability.

For FCC the EUT operates over the 5150-5250MHz, 5250-5350MHz, 5470-5725MHz and 5725-5850MHz MHz ranges.

The EUT utilizes the 802.11ac architecture. Three nominal channel bandwidths are implemented: 20 MHz, 40 MHz and 80 MHz.

Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.

EUT has no TPC mechanism implemented, the level of output power stays at fixed and not adjustable.

The rated output power of the master unit is >23 dBm(EIRP).therefore the required interference threshold level is -64dBm.after correction for antenna gain and procedural adjustments, the required threshold at the antenna port is -64dBm.

While calibrate the path on antenna port of DFS test equipment (master), measurements equipments (spectrum) is ensured to be 50 Ohms, and therefore verification on antenna gain measurement can be ignored.

The EUT each connected to an antenna to perform radiated tests.

The Slave device associated with the EUT during these tests does not have radar detection capability.

The software installed in the access point is firmware-venom-arm revision 3.0.0

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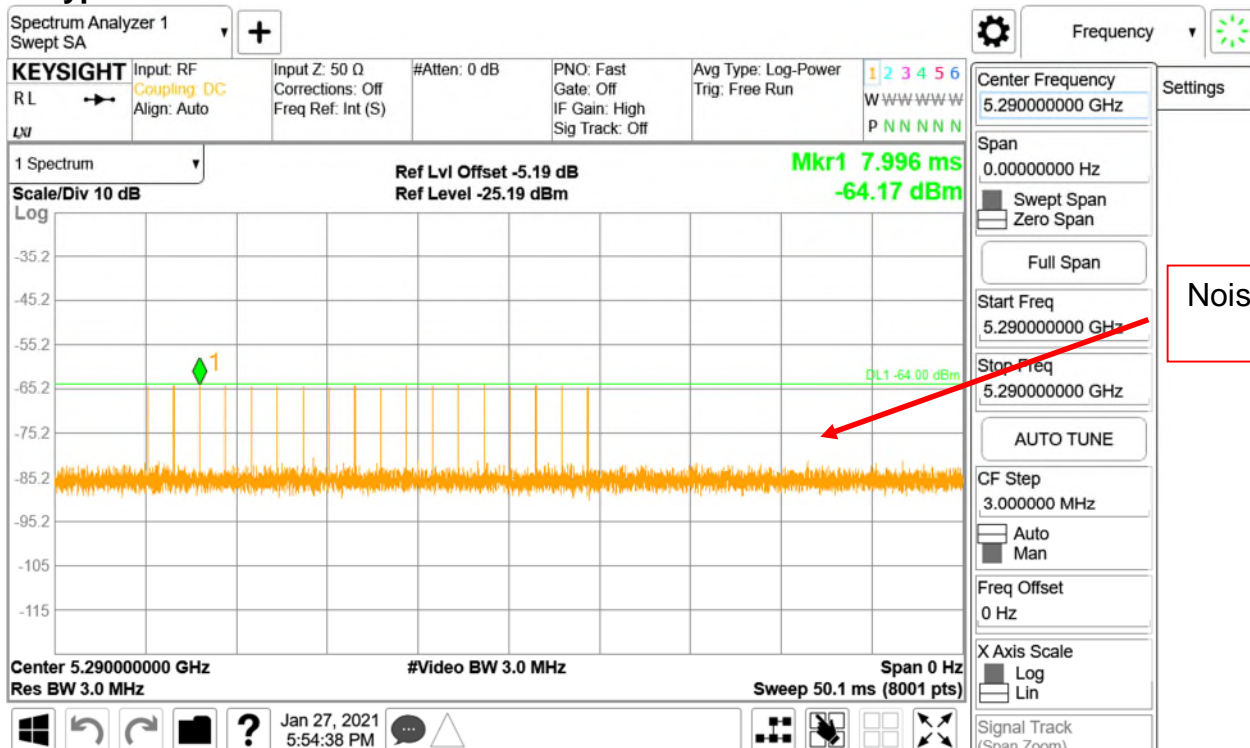
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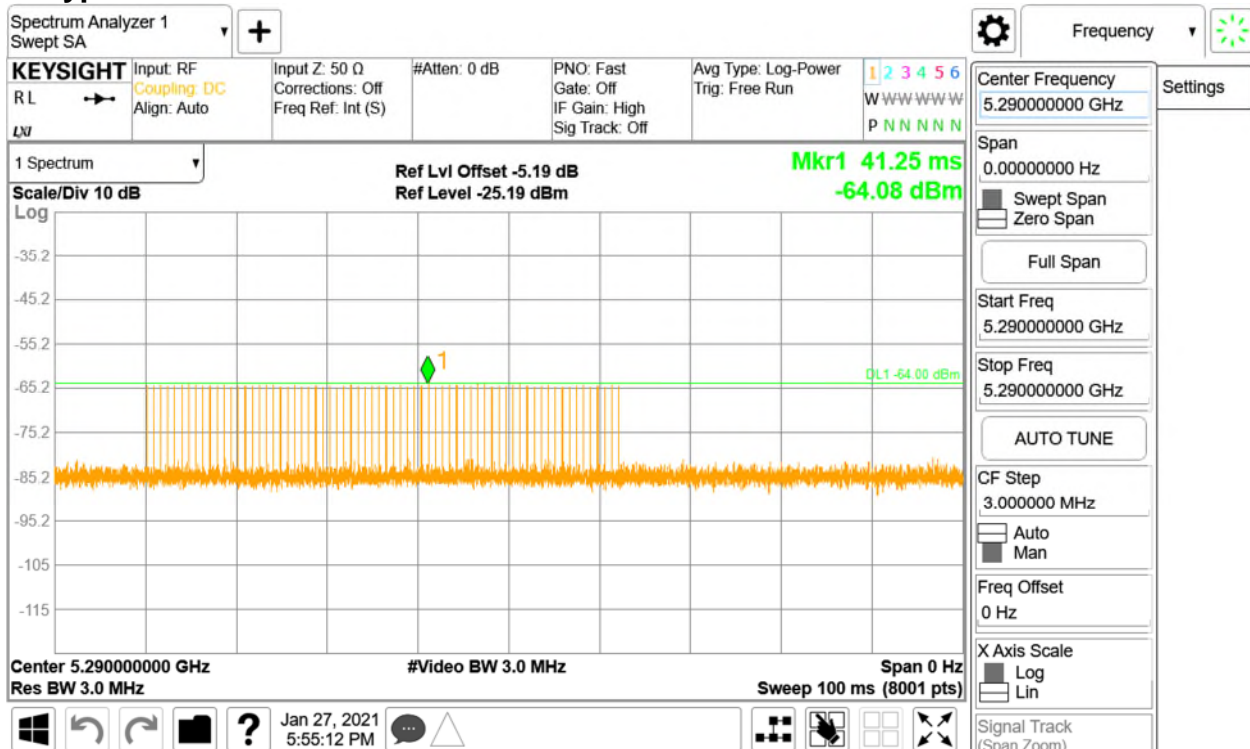
Test results (5290MHz)

Calibration plots for each of the required radar waveforms (DFS Detection Threshold)

Radar type 0



Radar type 1-A

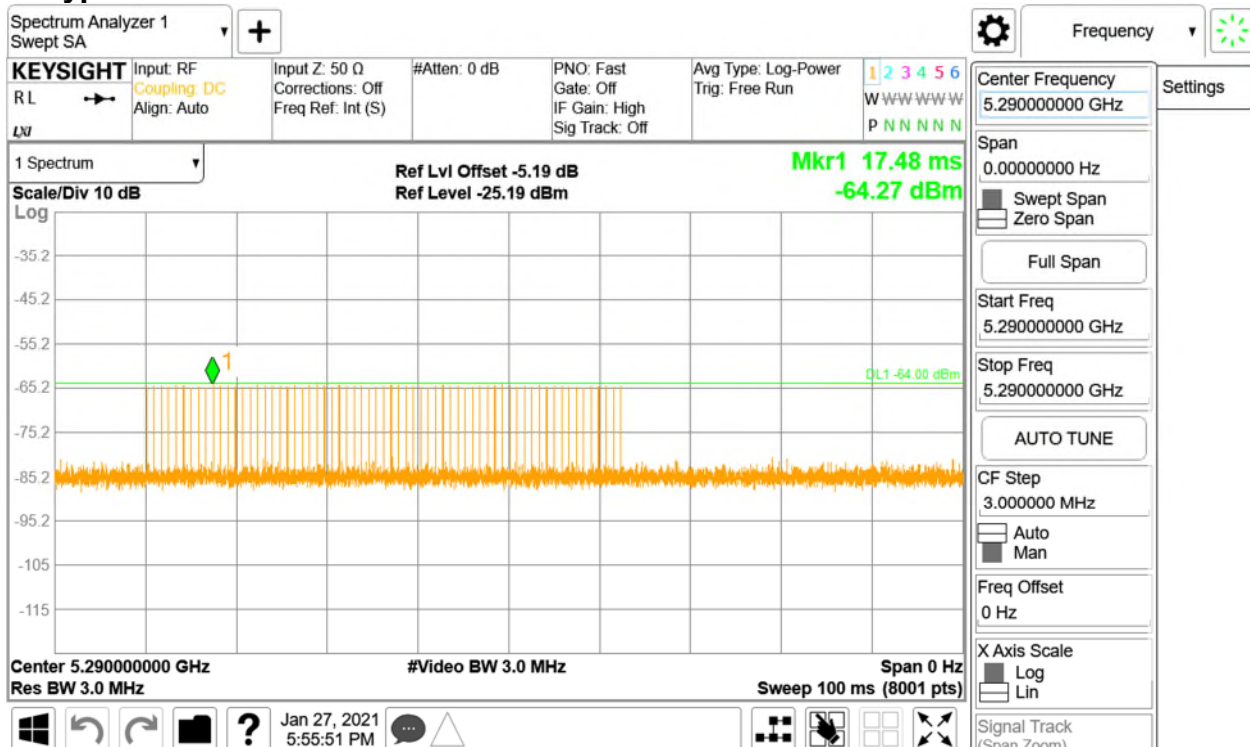


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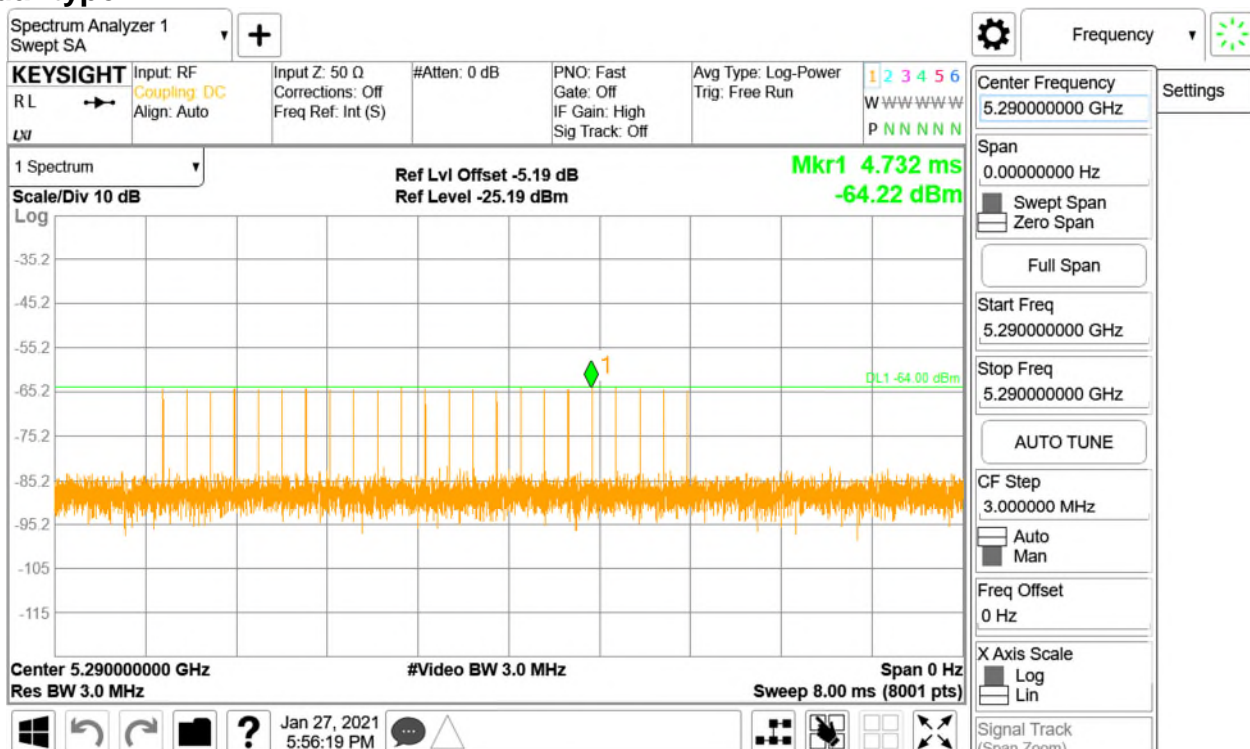
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Radar type 1-B



Radar type 2

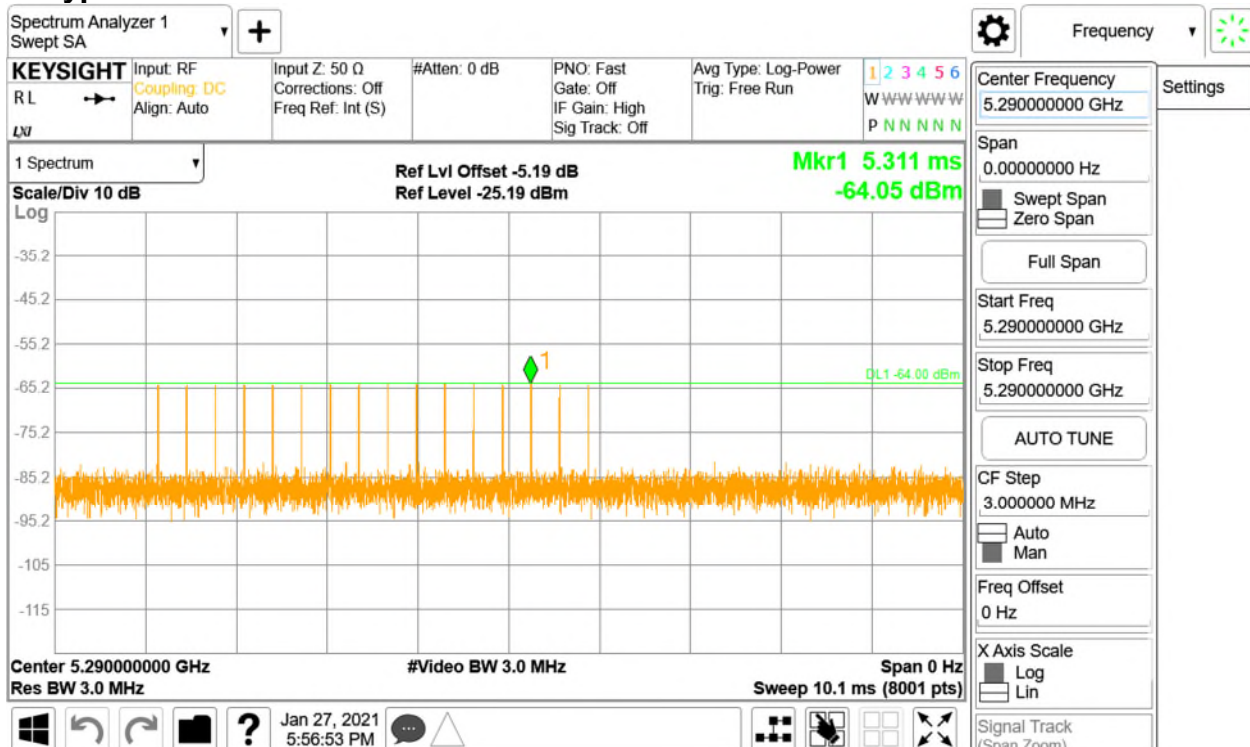


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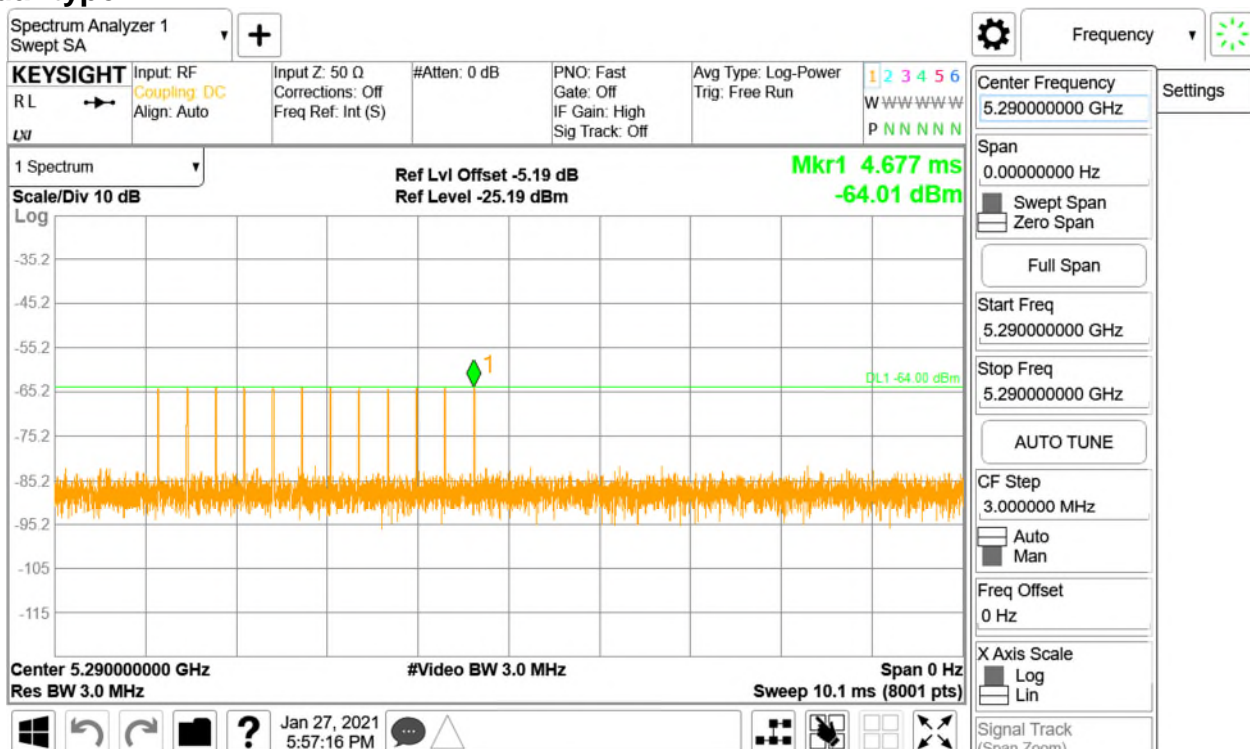
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Radar type 3



Radar type 4

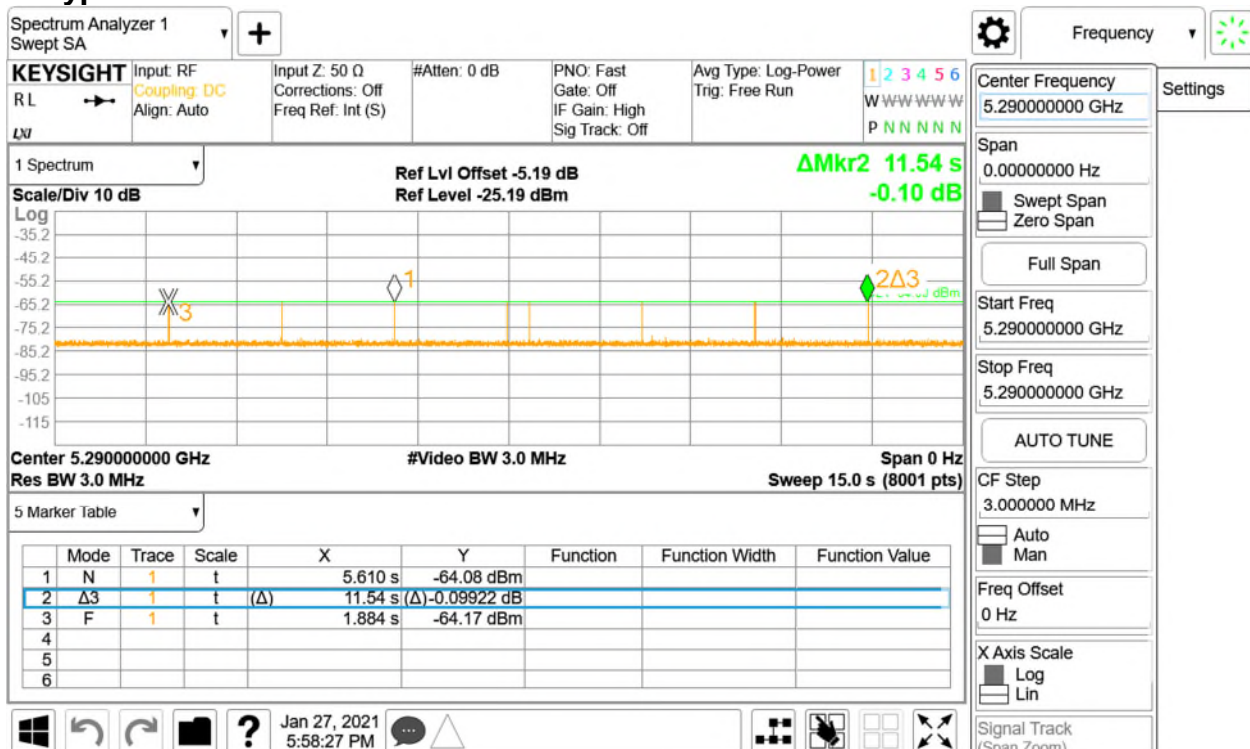


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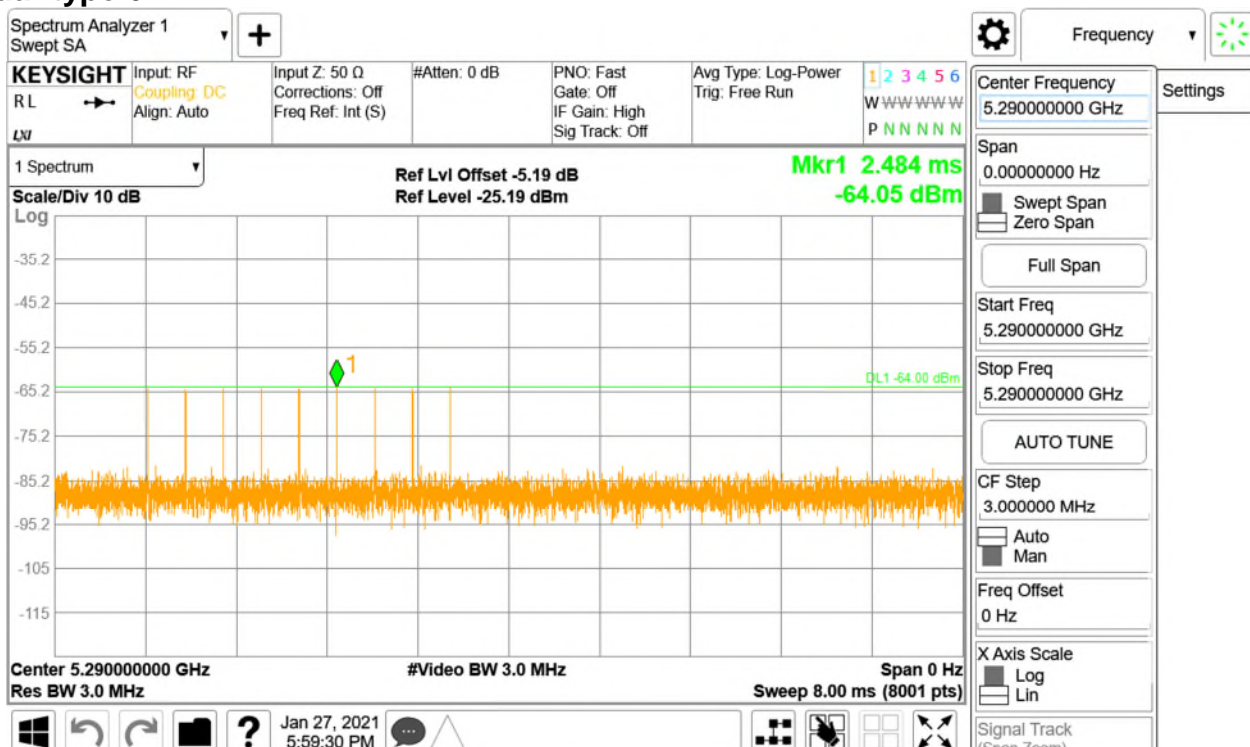
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Radar type 5



Radar type 6

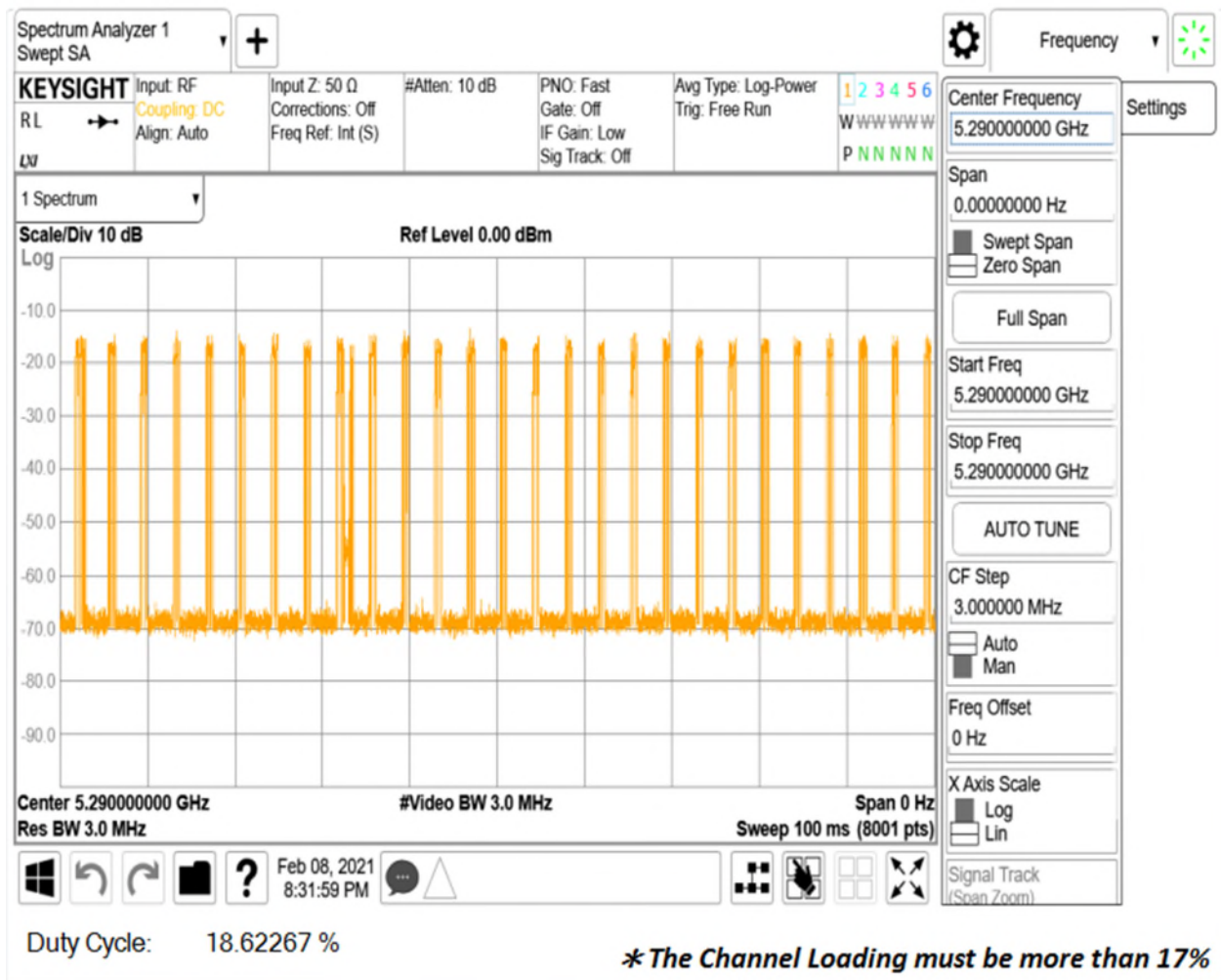


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WLAN traffic



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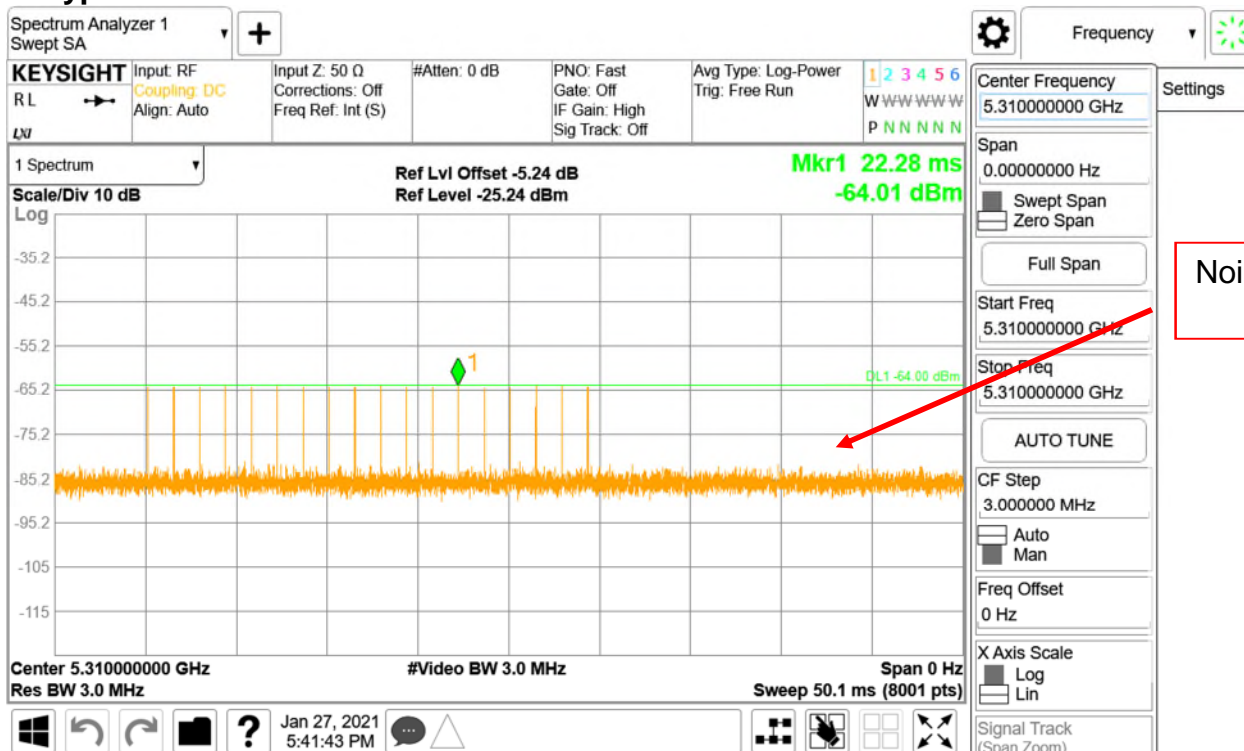
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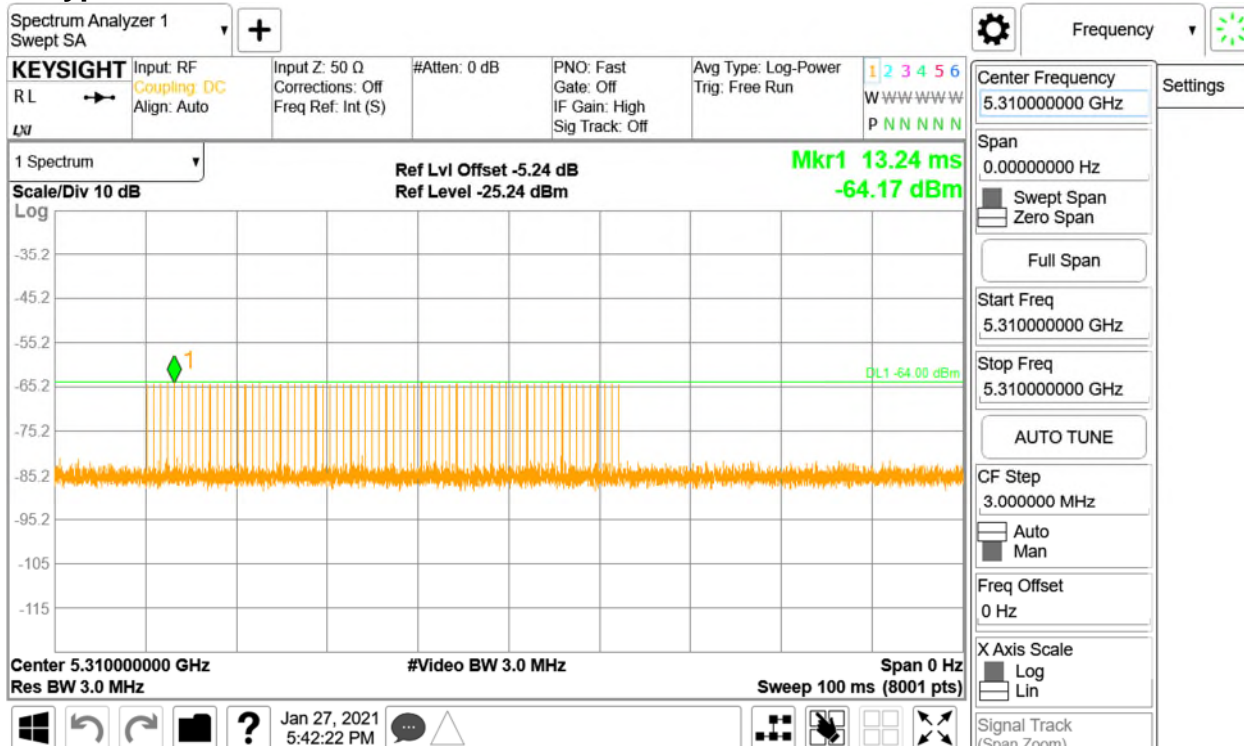
Test results (5310MHz)

Calibration plots for each of the required radar waveforms (DFS Detection Threshold)

Radar type 0



Radar type 1-A

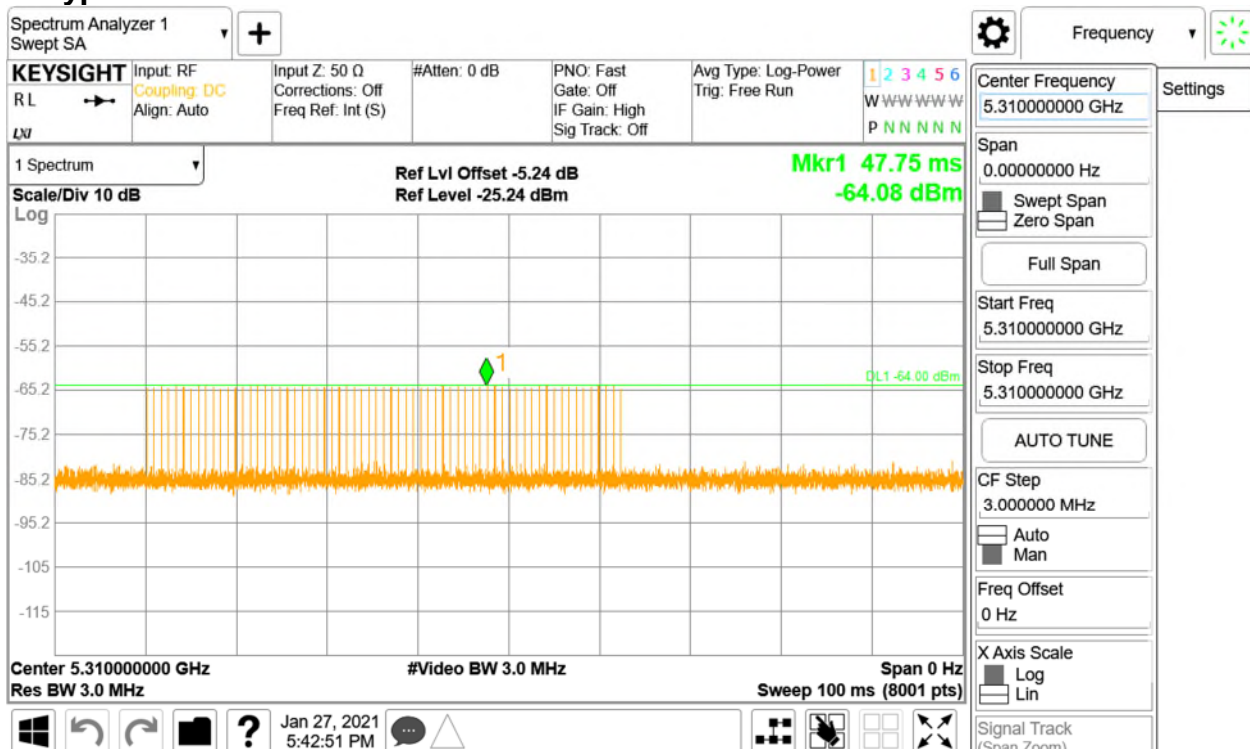


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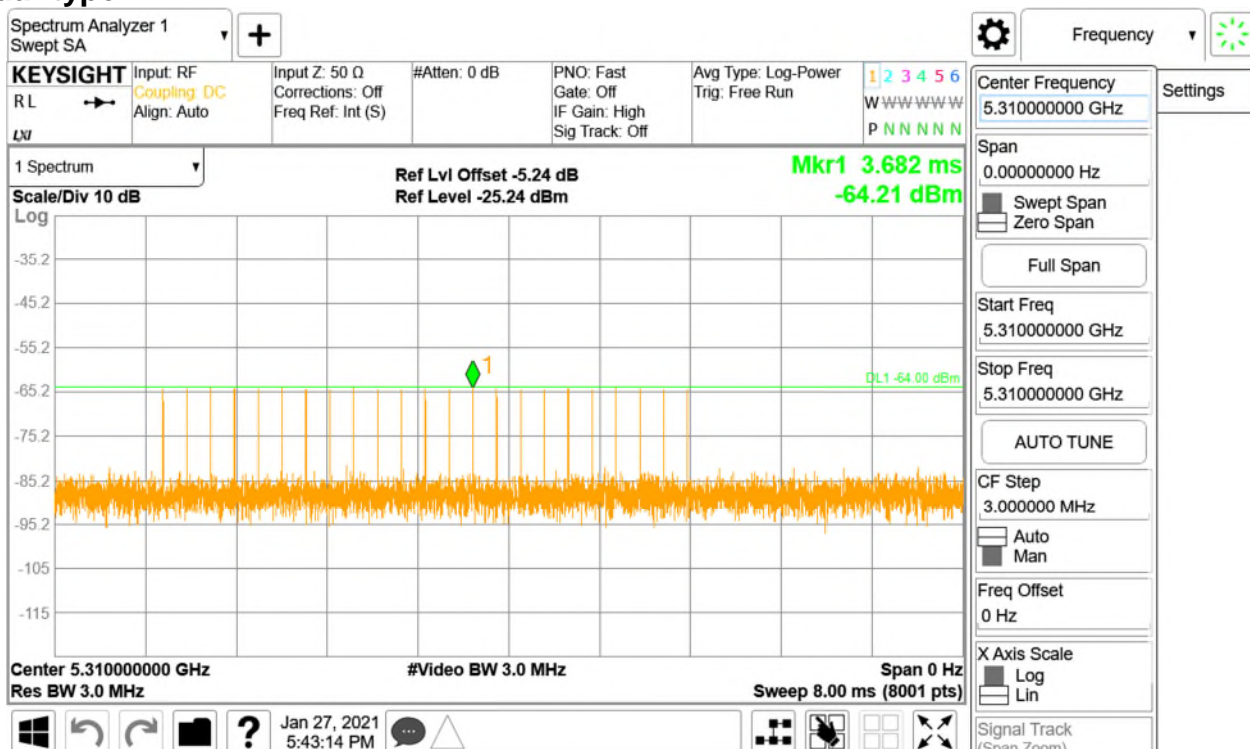
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Radar type 1-B



Radar type 2

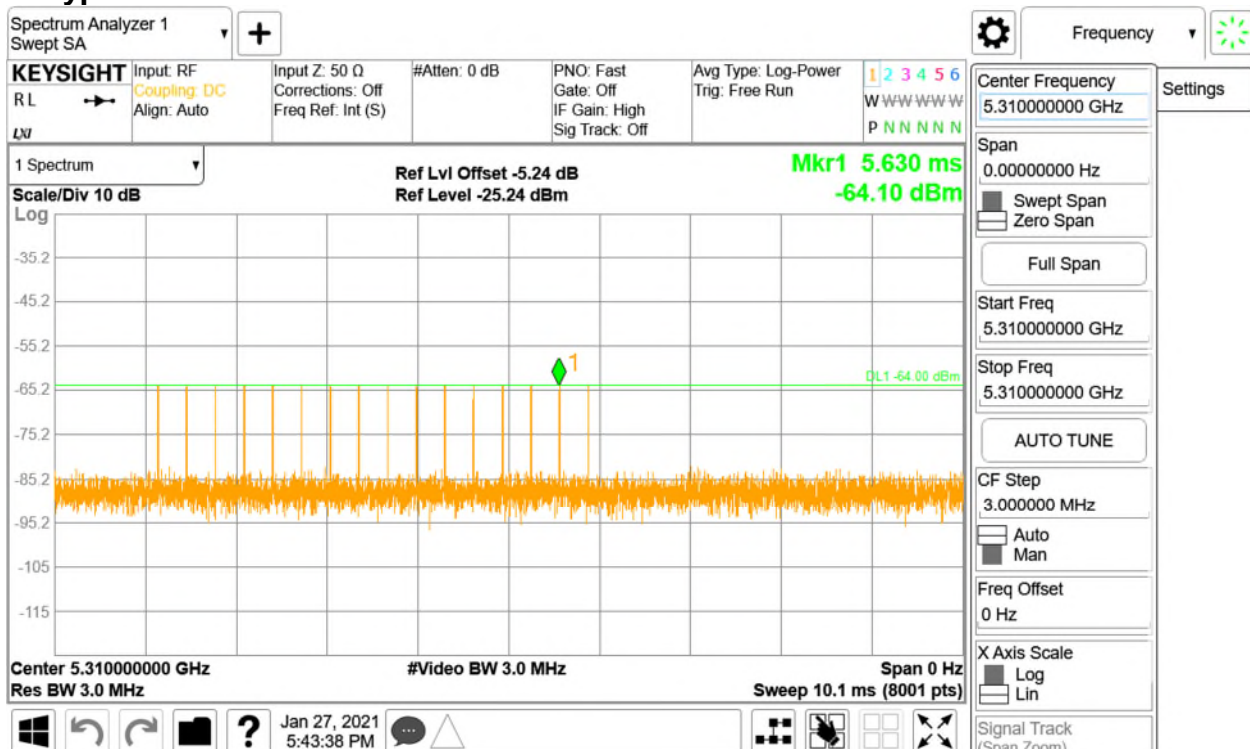


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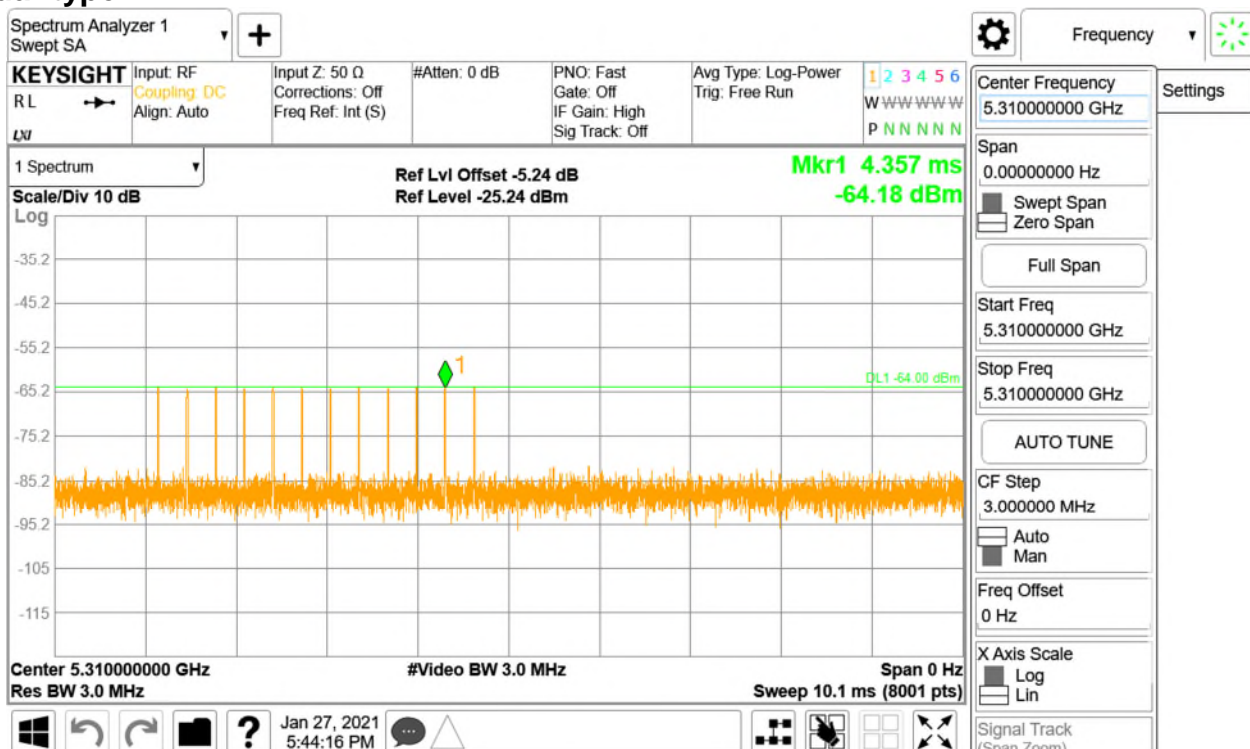
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Radar type 3



Radar type 4

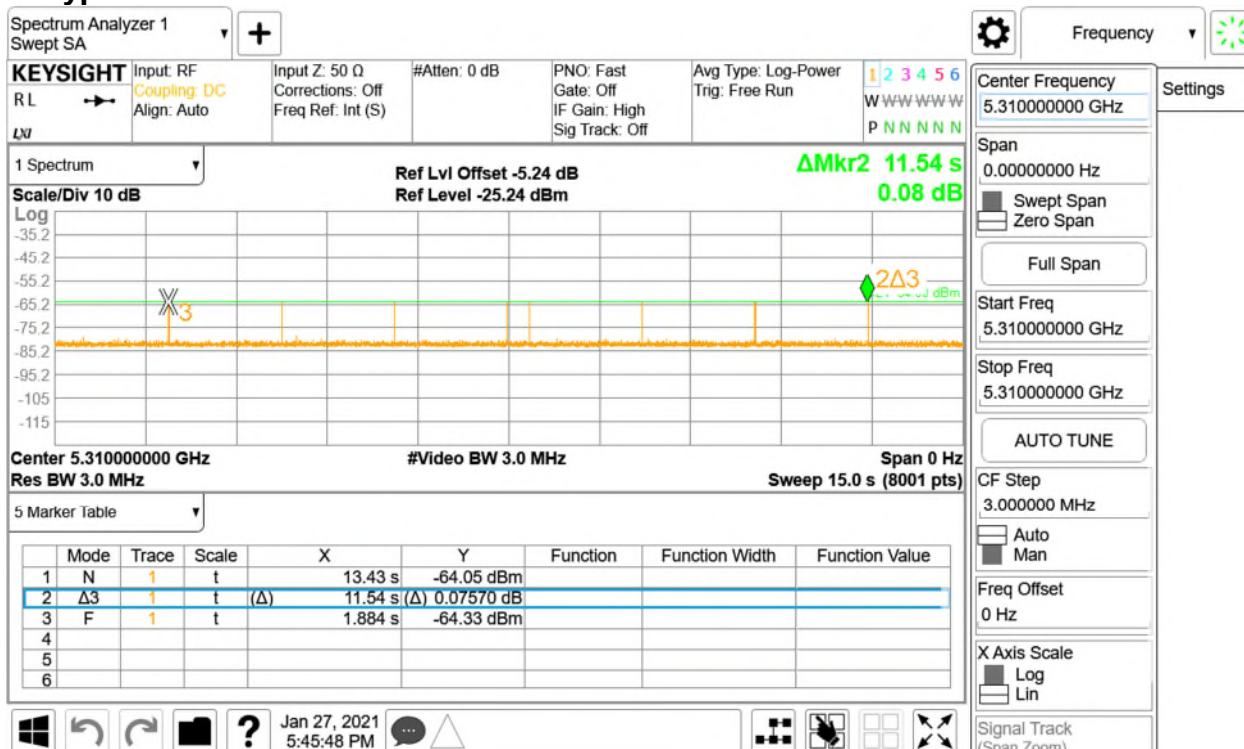


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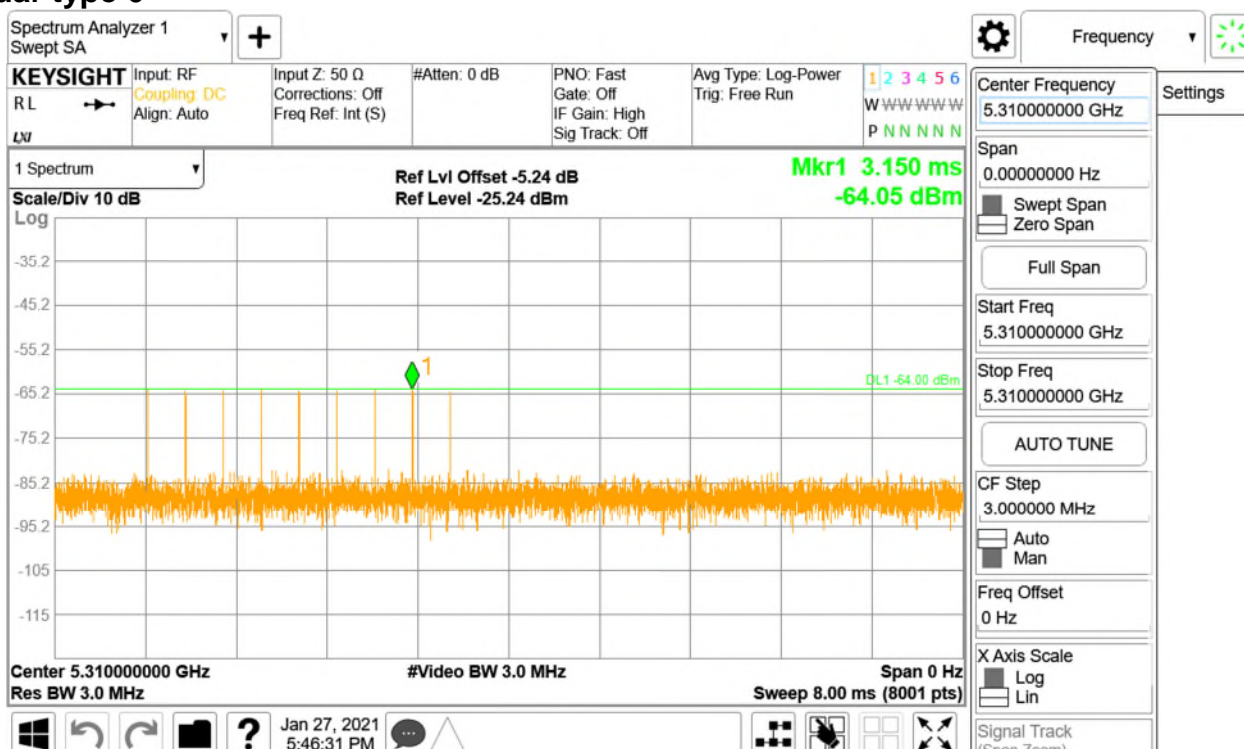
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Radar type 5



Radar type 6

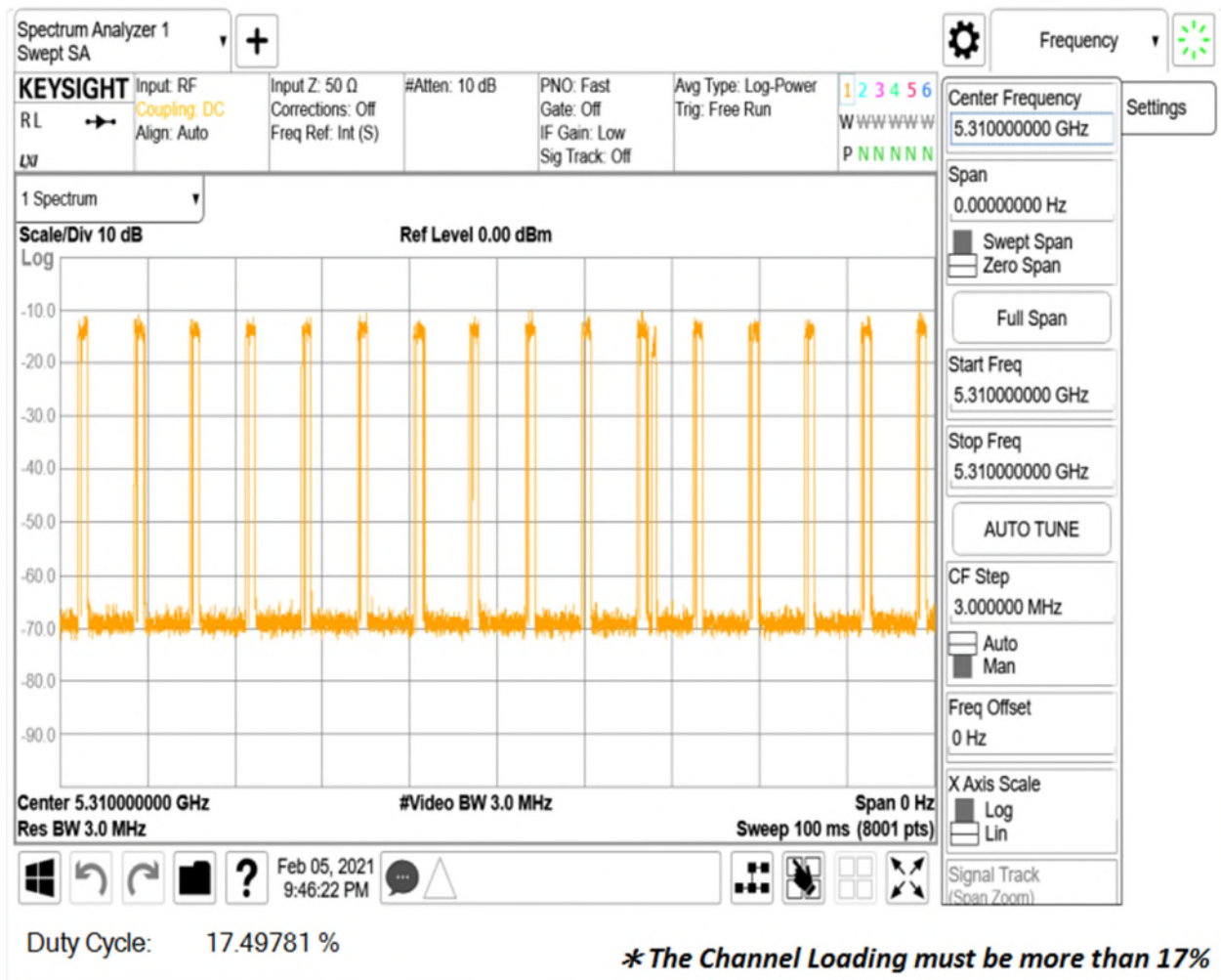


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WLAN traffic



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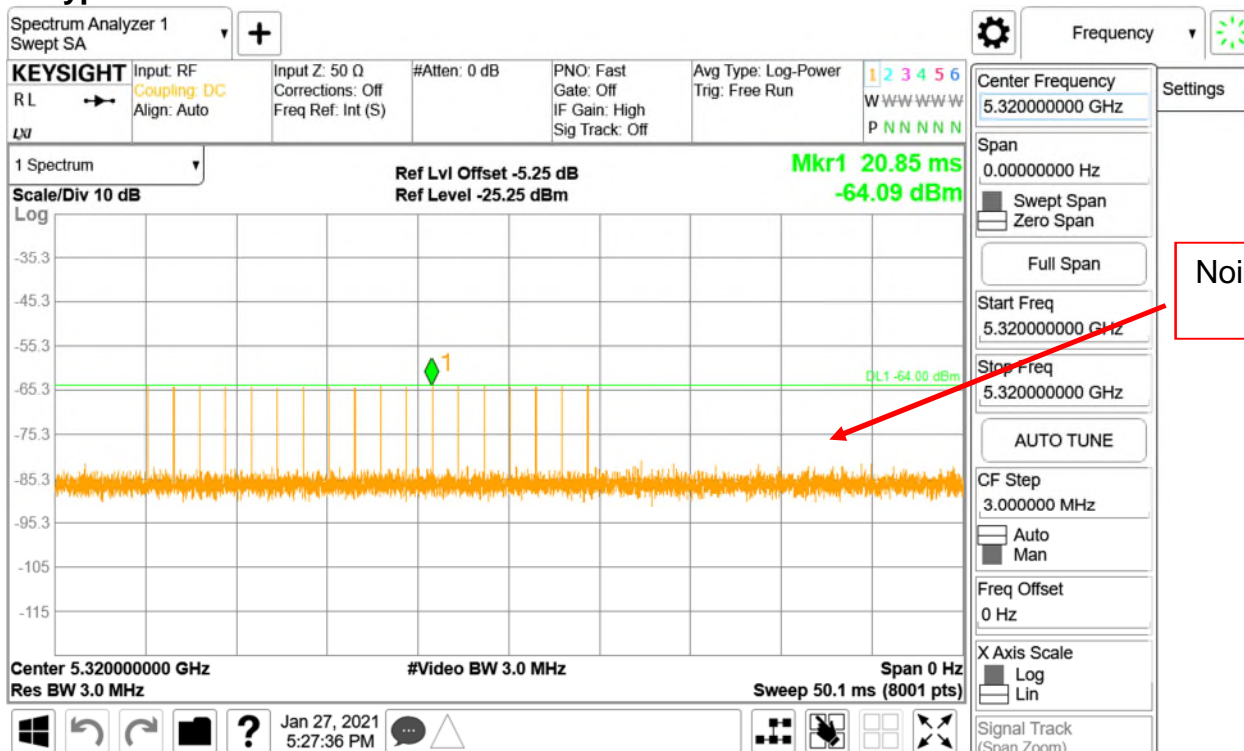
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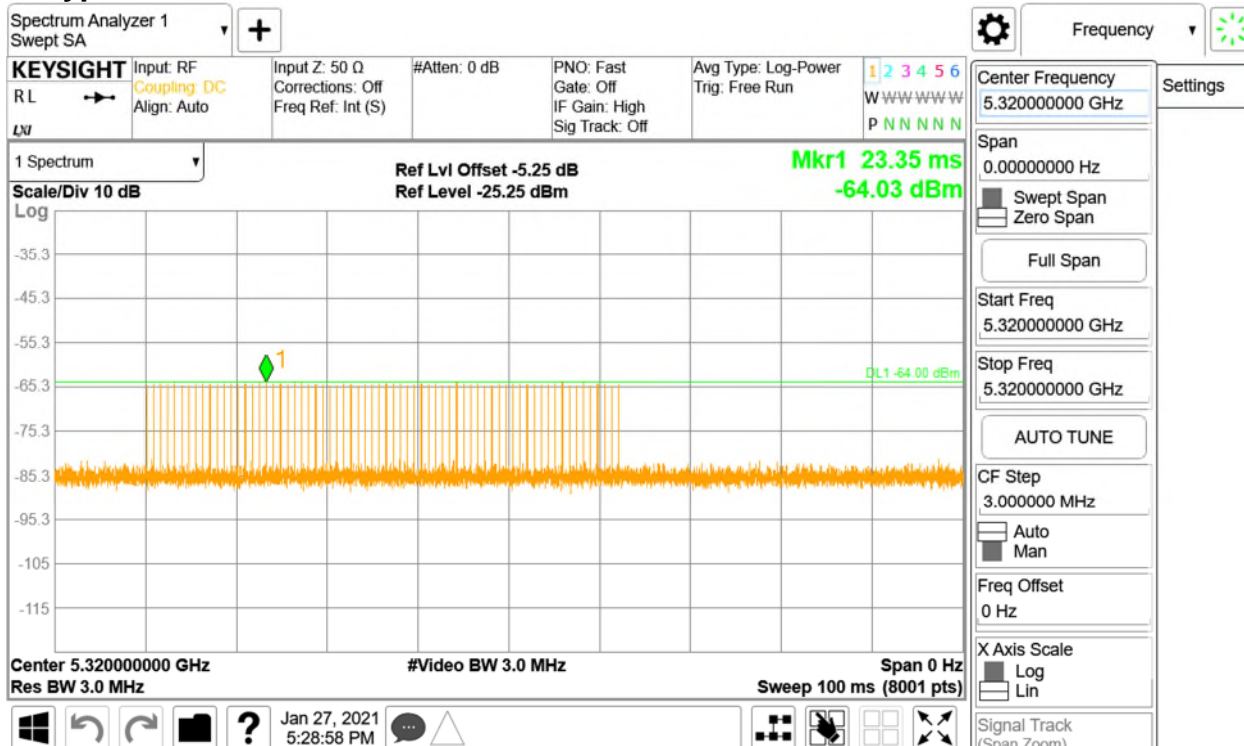
Test results (5320MHz)

Calibration plots for each of the required radar waveforms (DFS Detection Threshold)

Radar type 0



Radar type 1-A

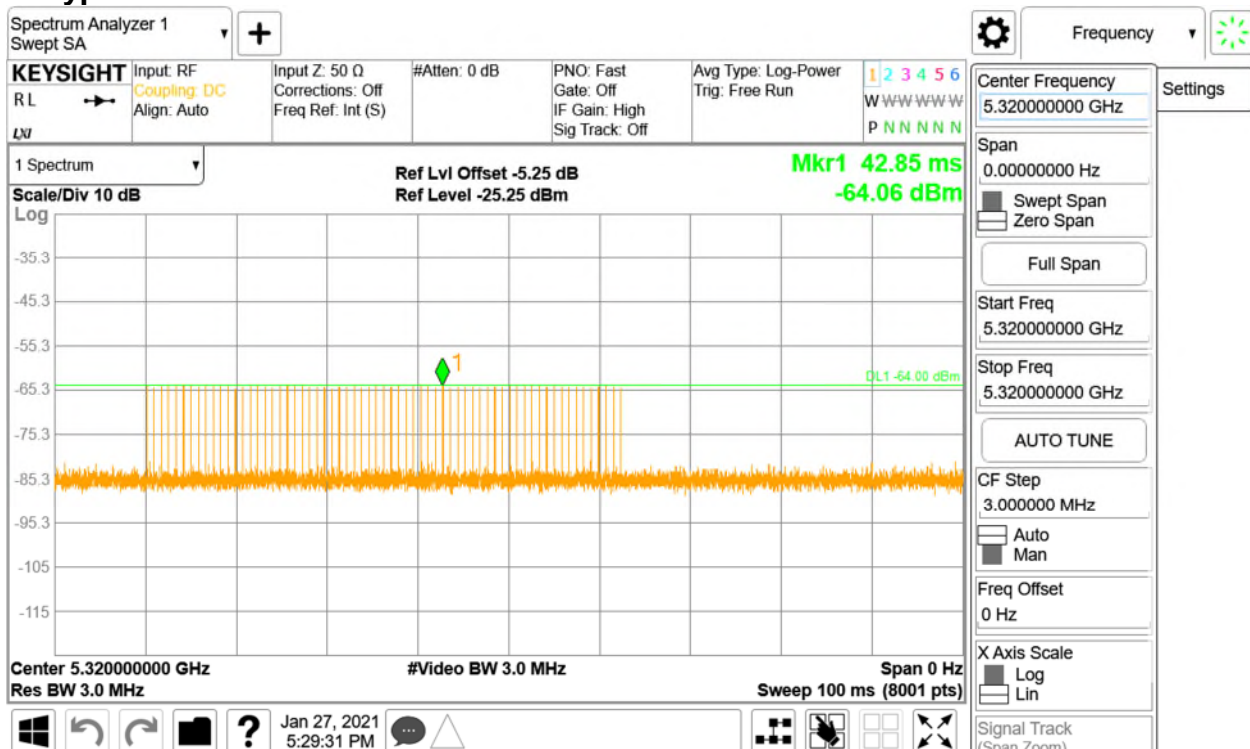


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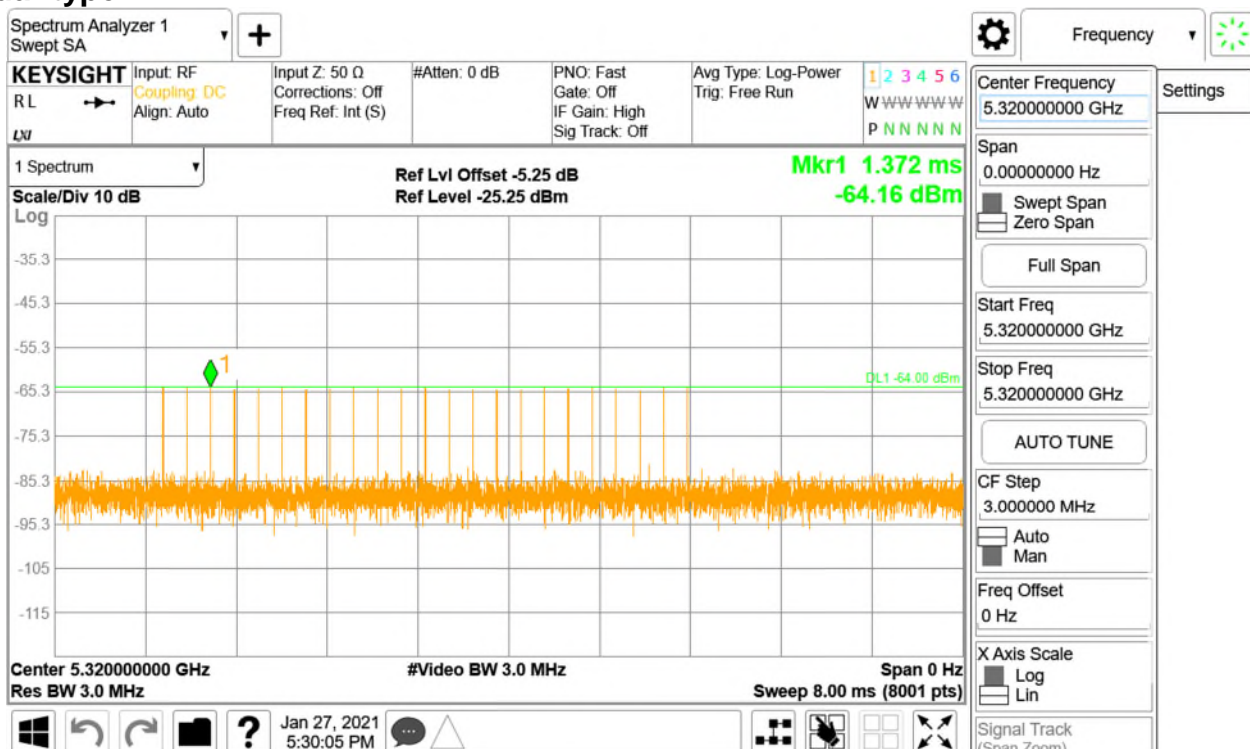
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Radar type 1-B



Radar type 2

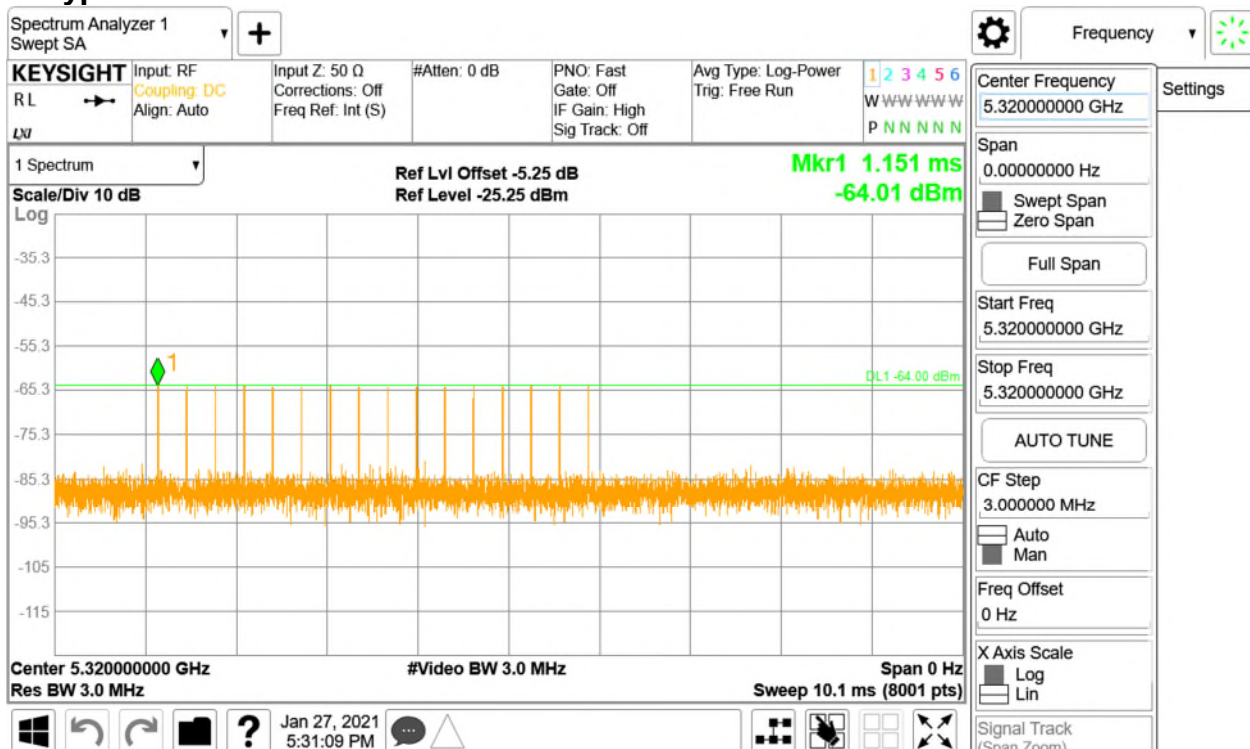


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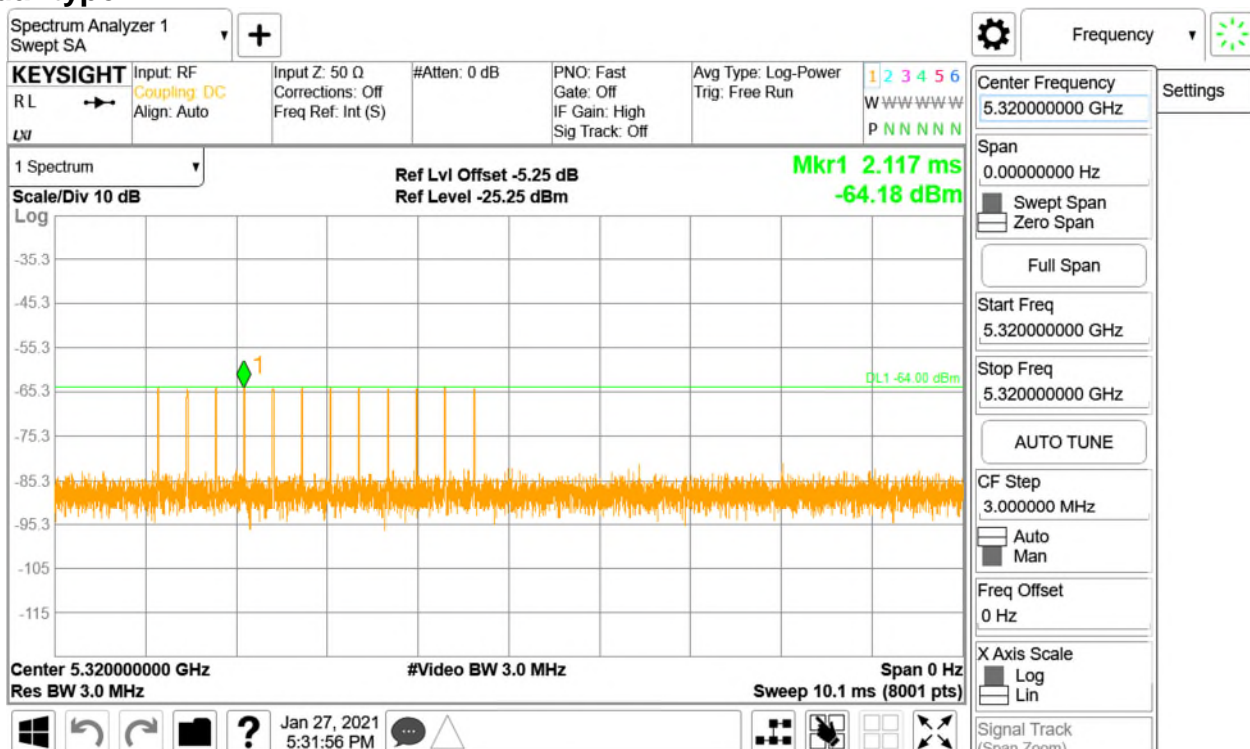
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Radar type 3



Radar type 4

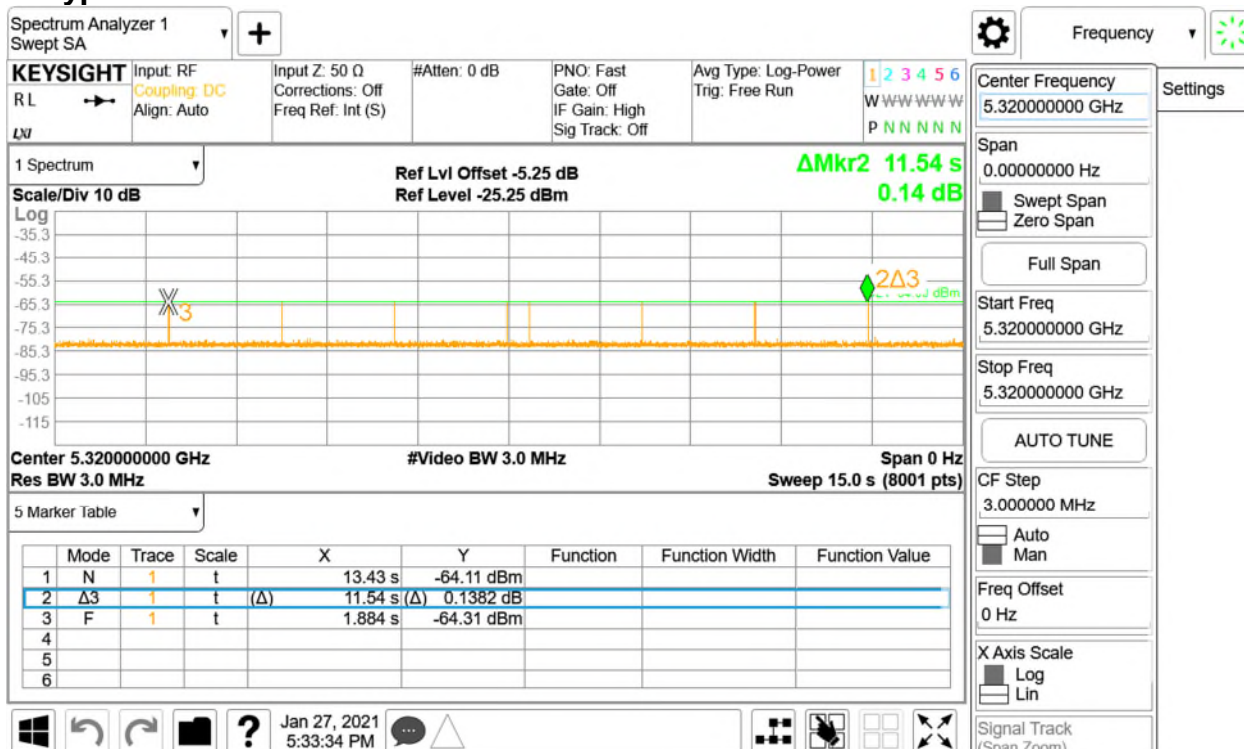


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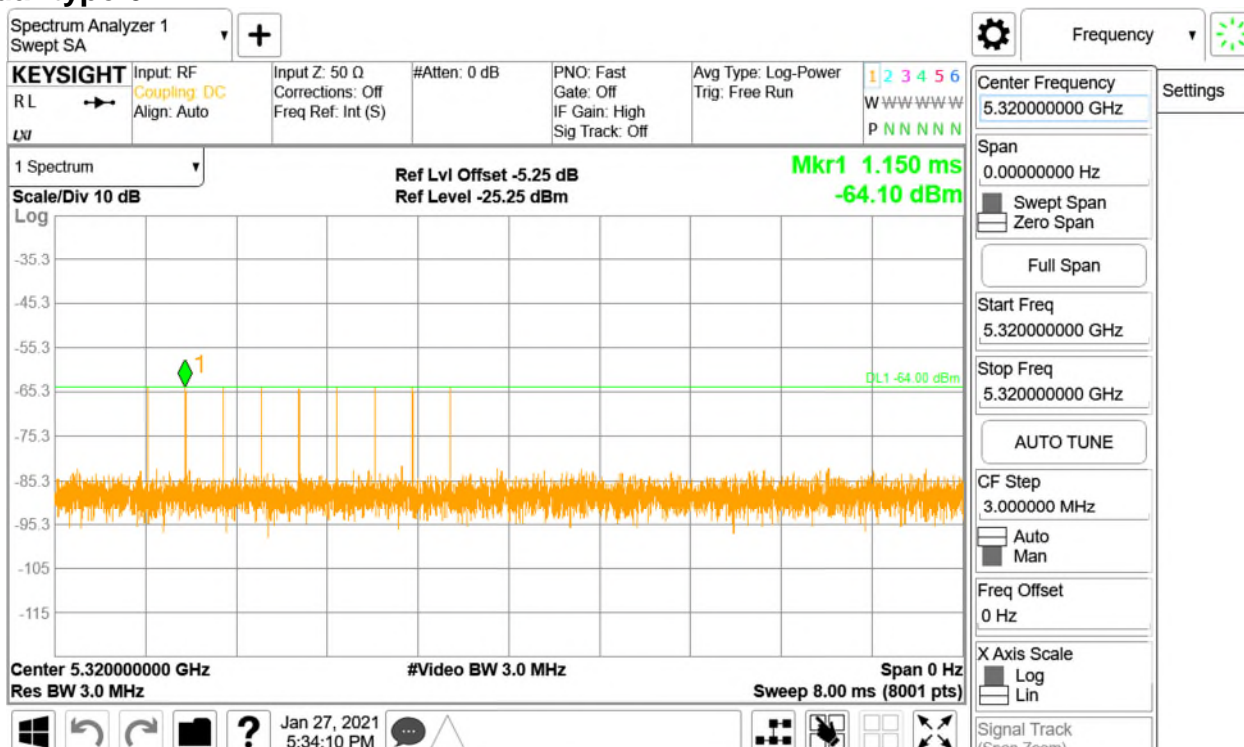
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Radar type 5



Radar type 6

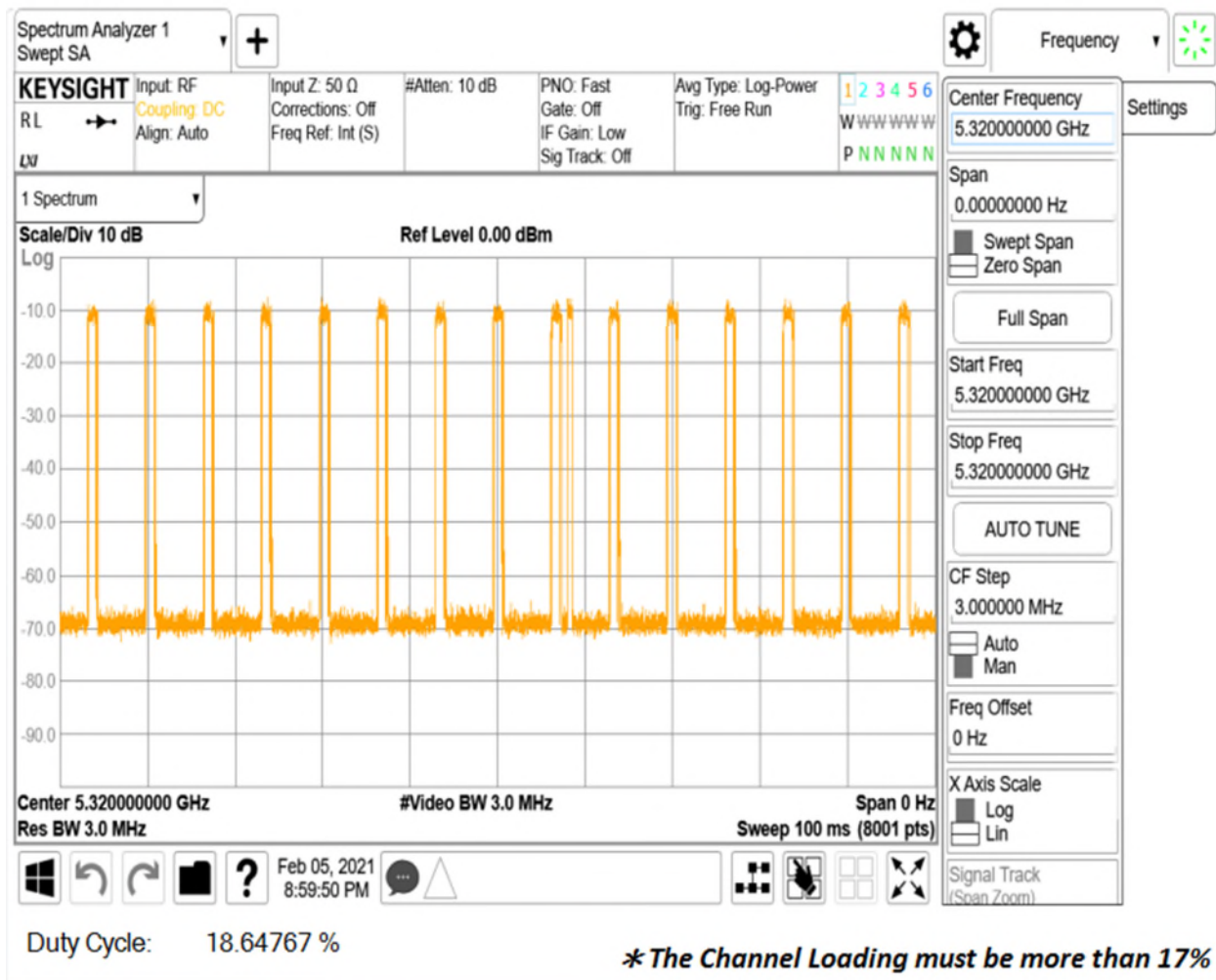


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WLAN traffic



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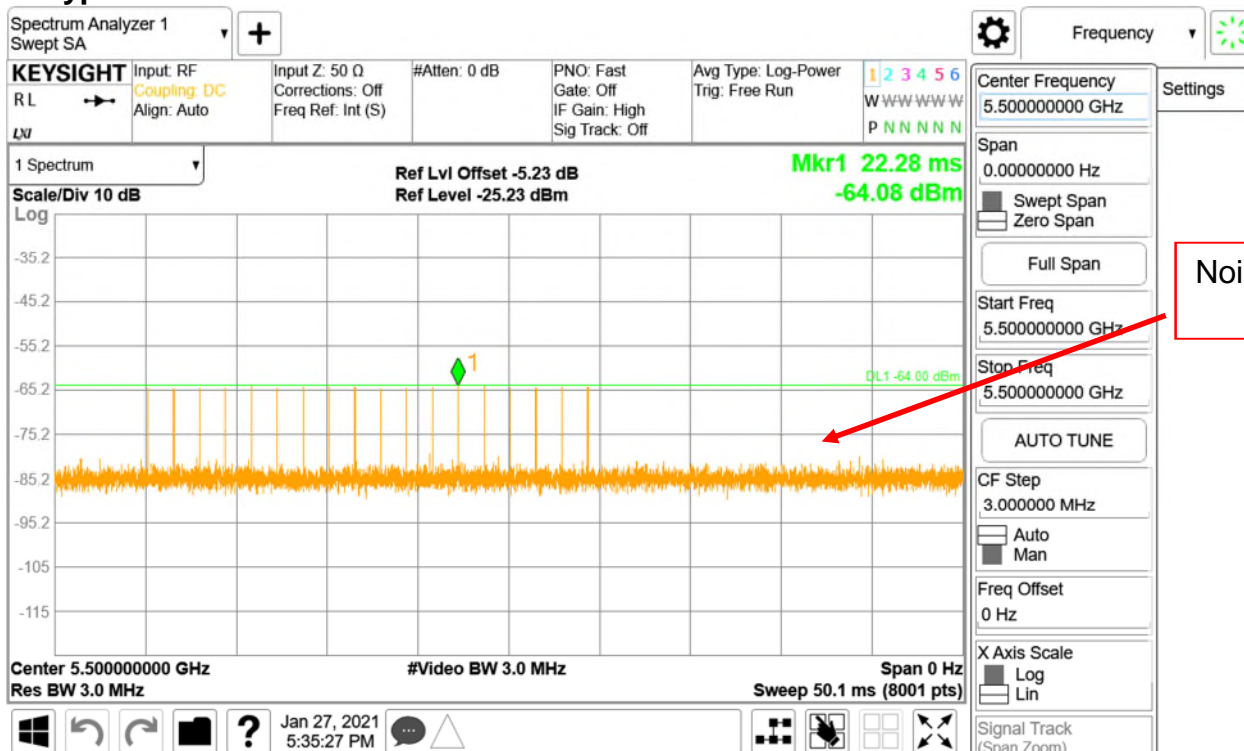
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Test results (5500MHz)

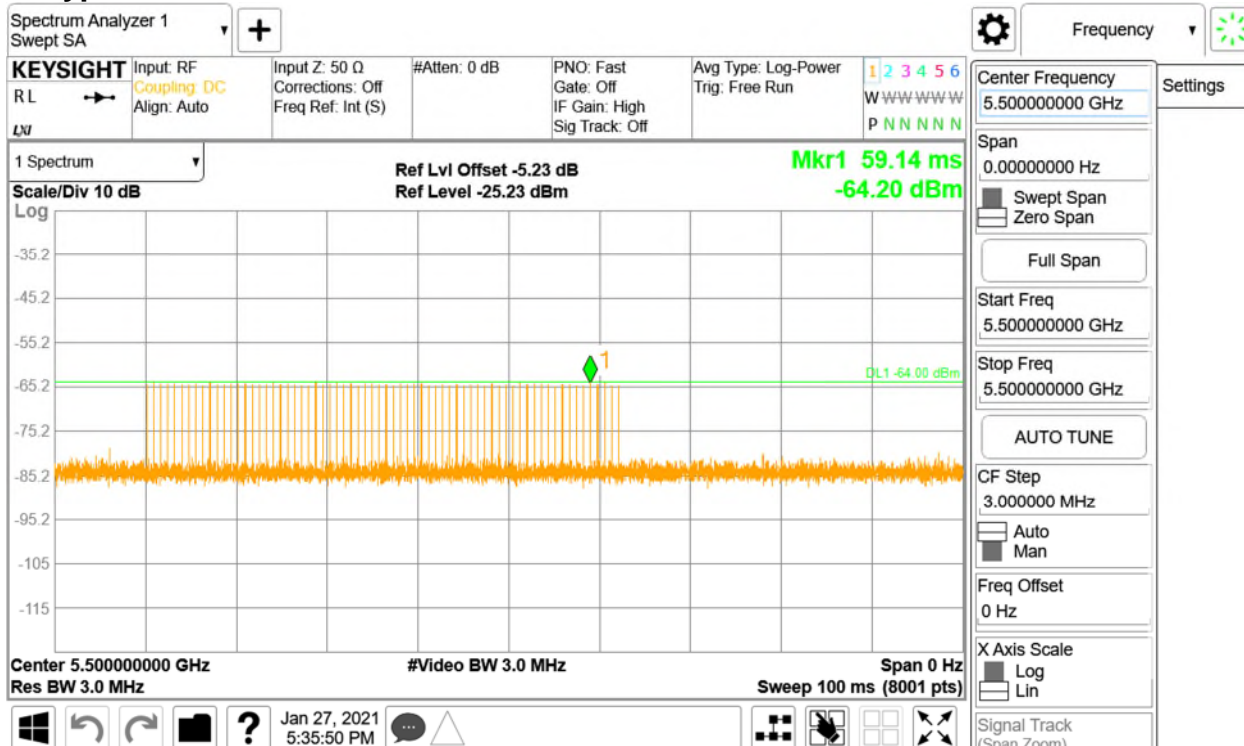
Calibration plots for each of the required radar waveforms (DFS Detection Threshold)

Radar type 0



Noise Floor

Radar type 1-A

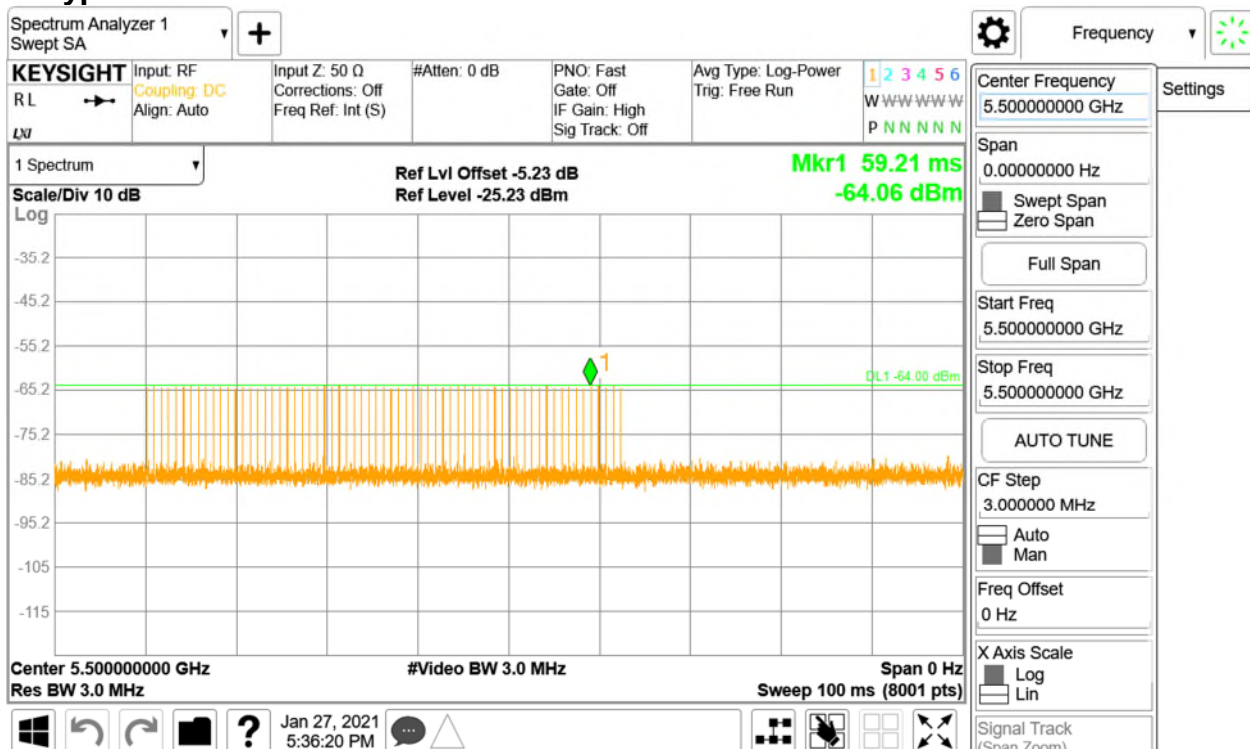


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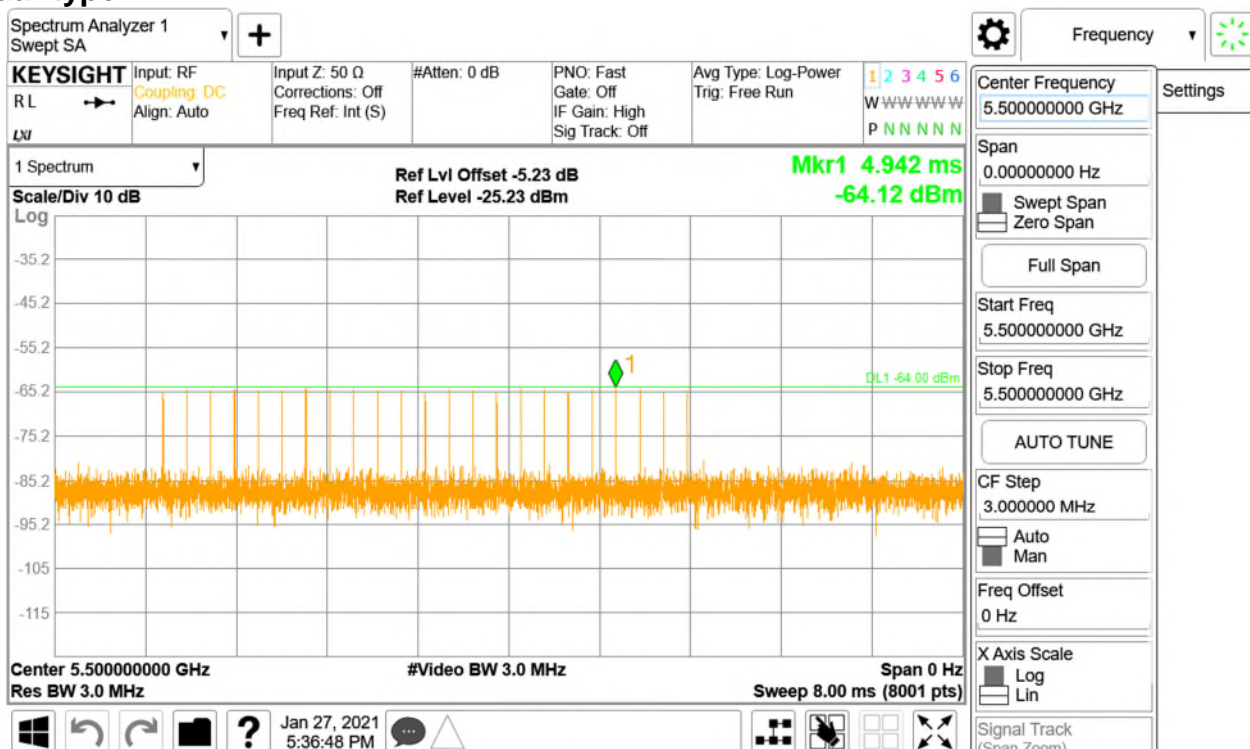
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Radar type 1-B



Radar type 2

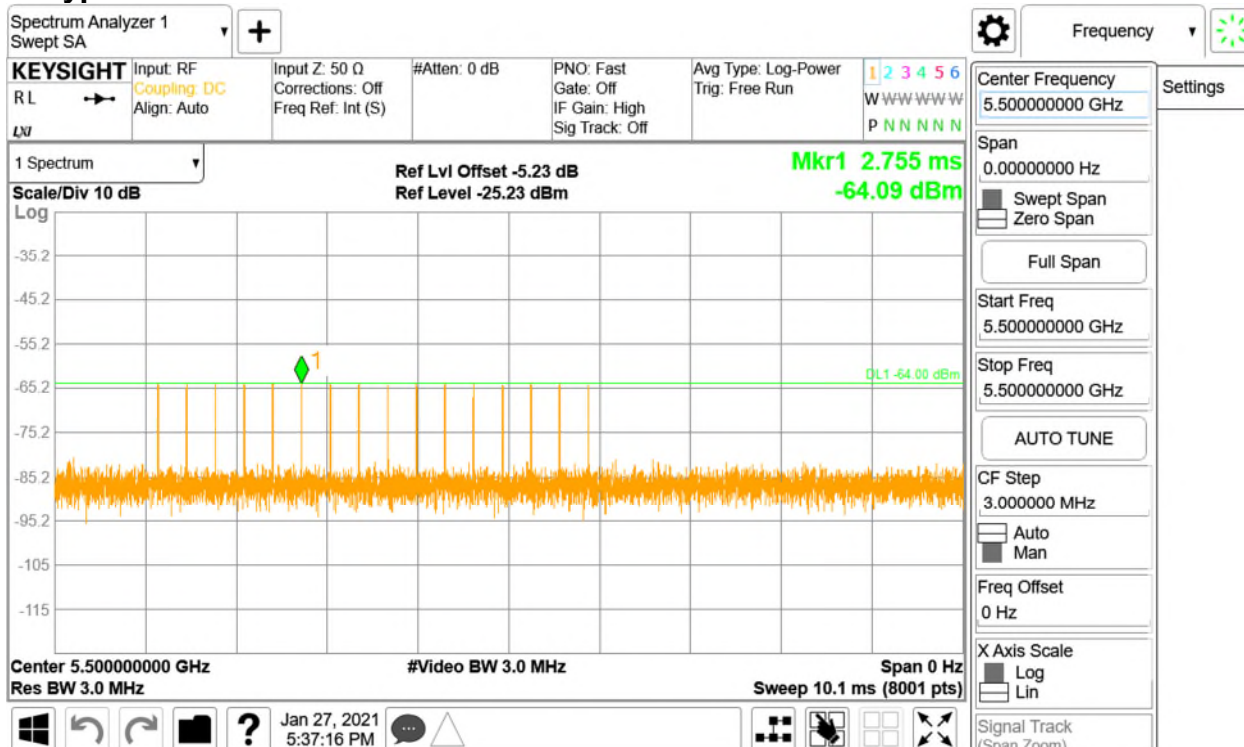


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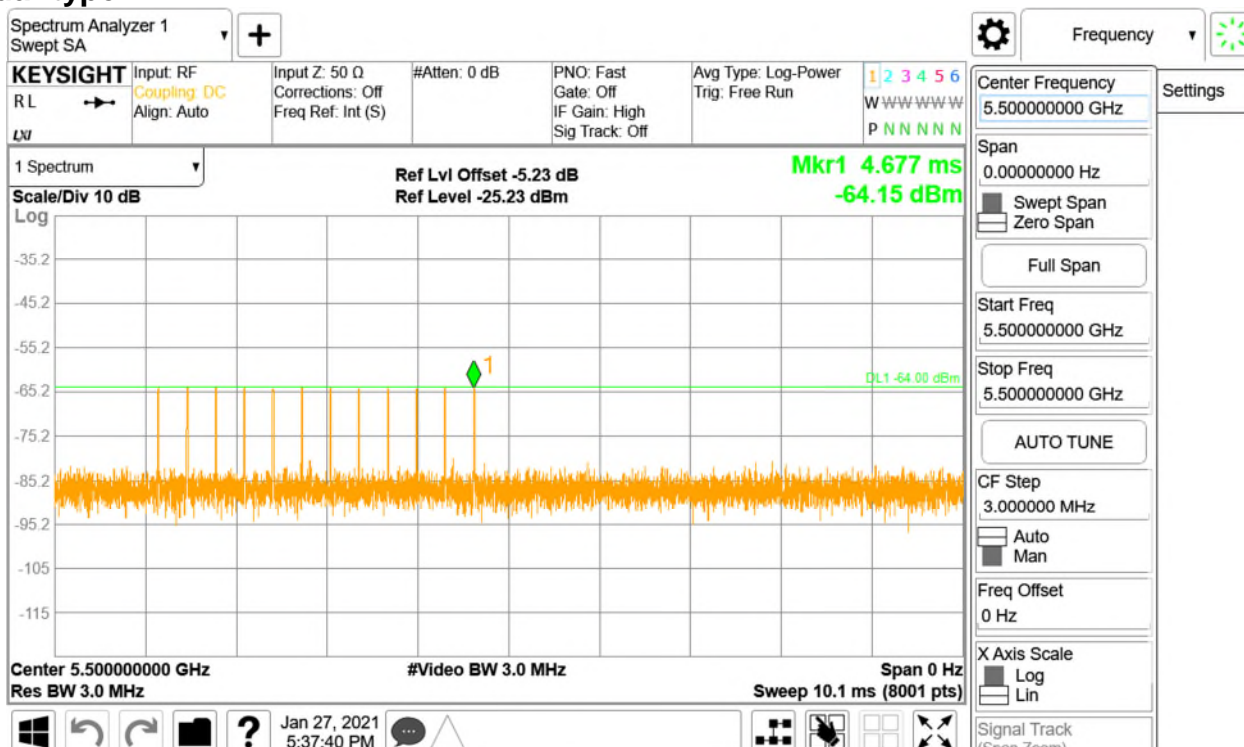
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Radar type 3



Radar type 4

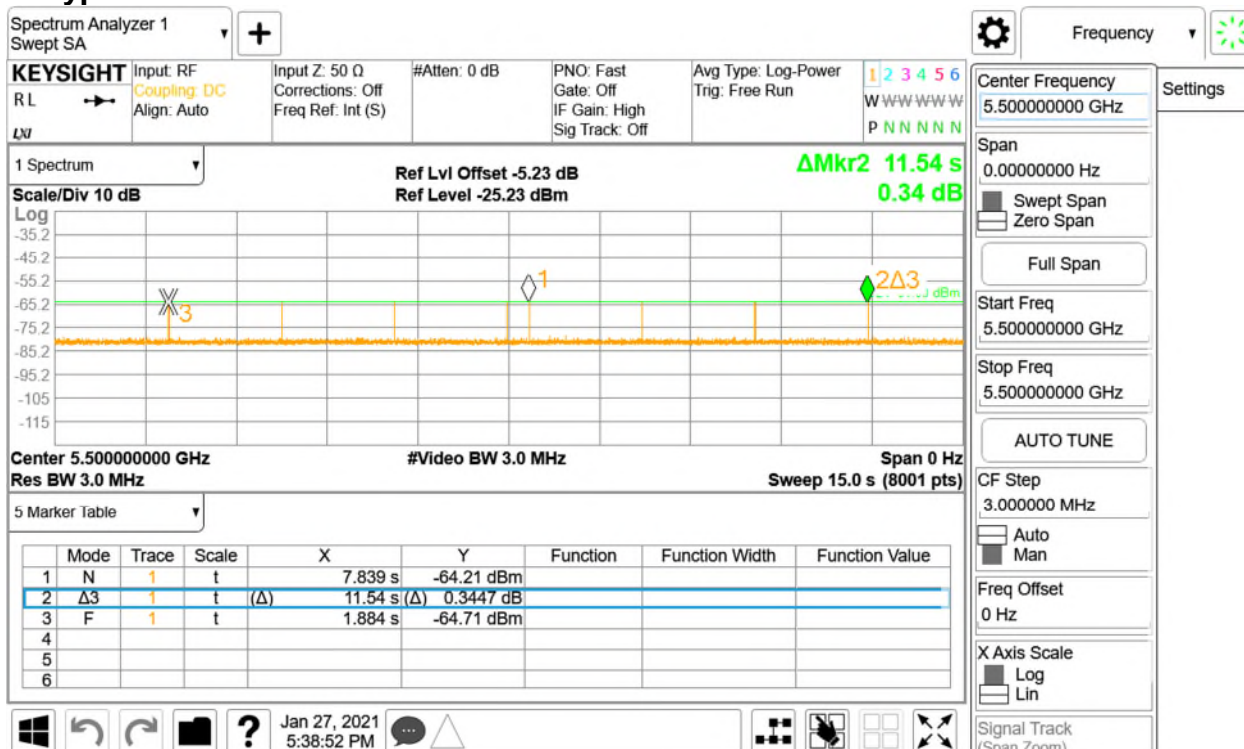


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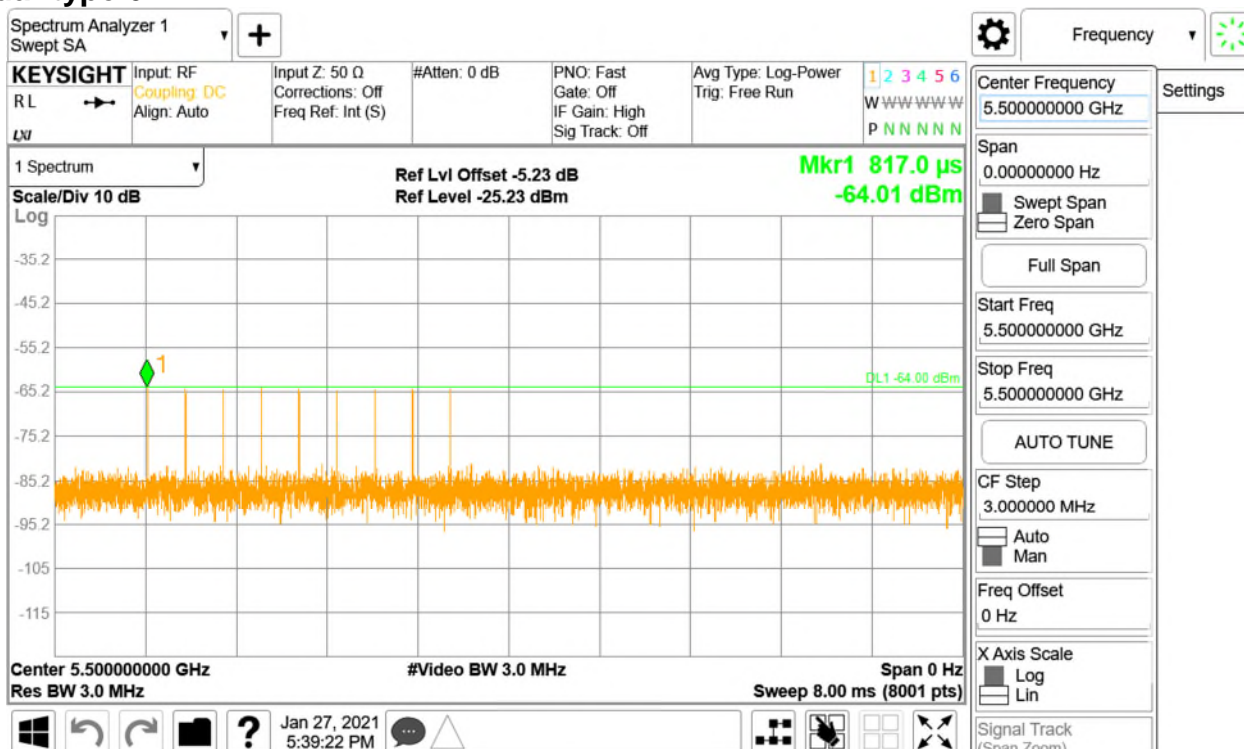
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Radar type 5



Radar type 6

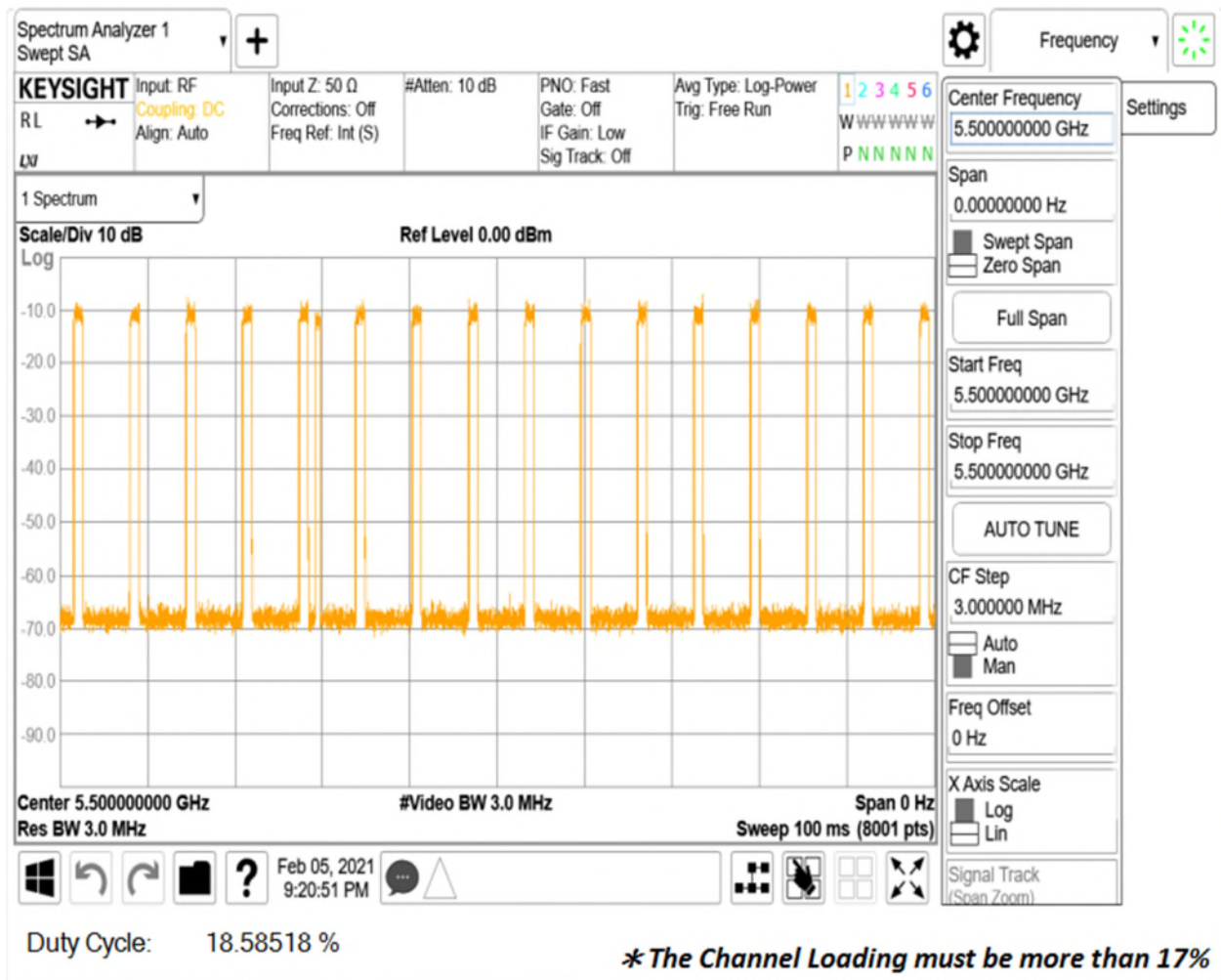


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WLAN traffic



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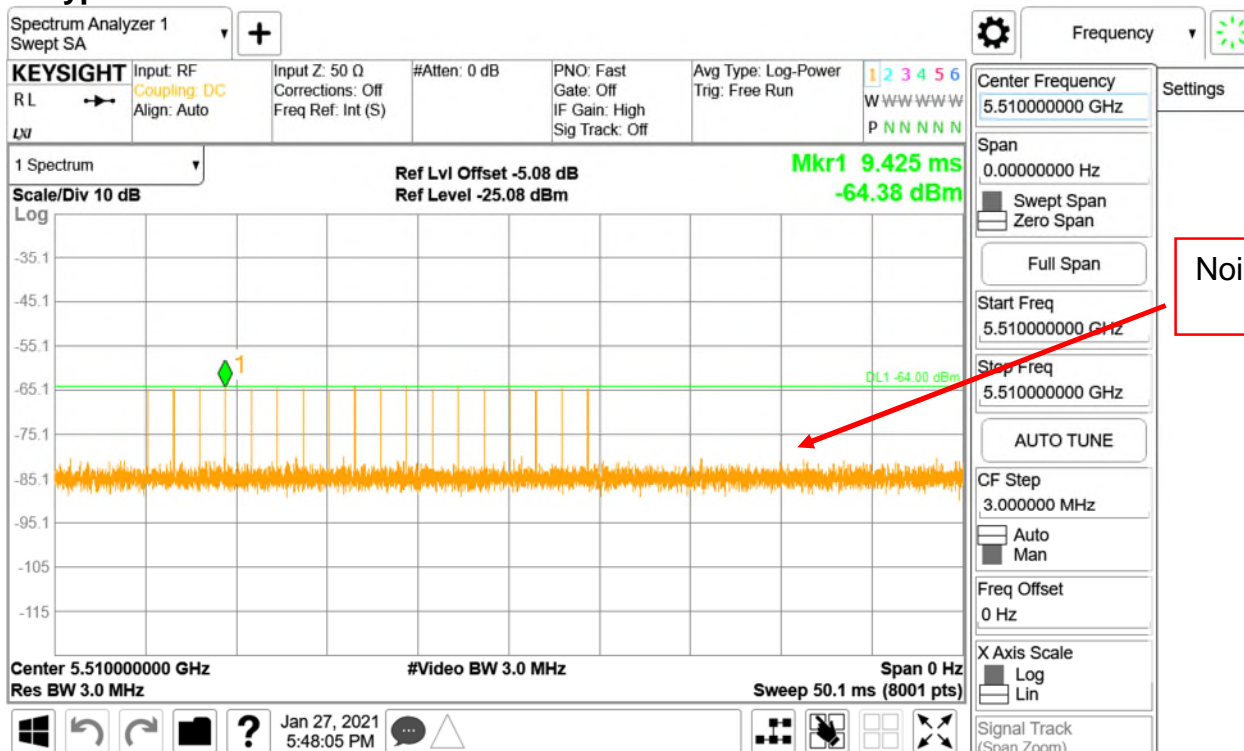
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Test results (5510MHz)

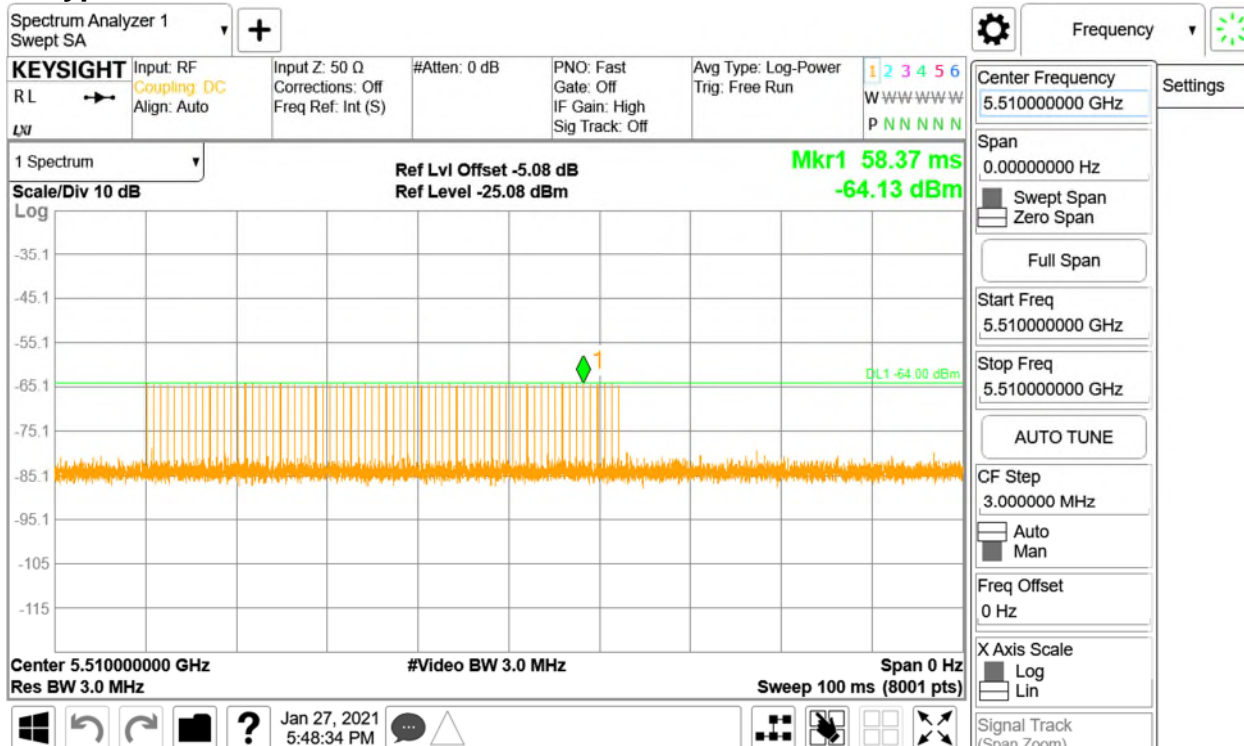
Calibration plots for each of the required radar waveforms (DFS Detection Threshold)

Radar type 0



Noise Floor

Radar type 1-A

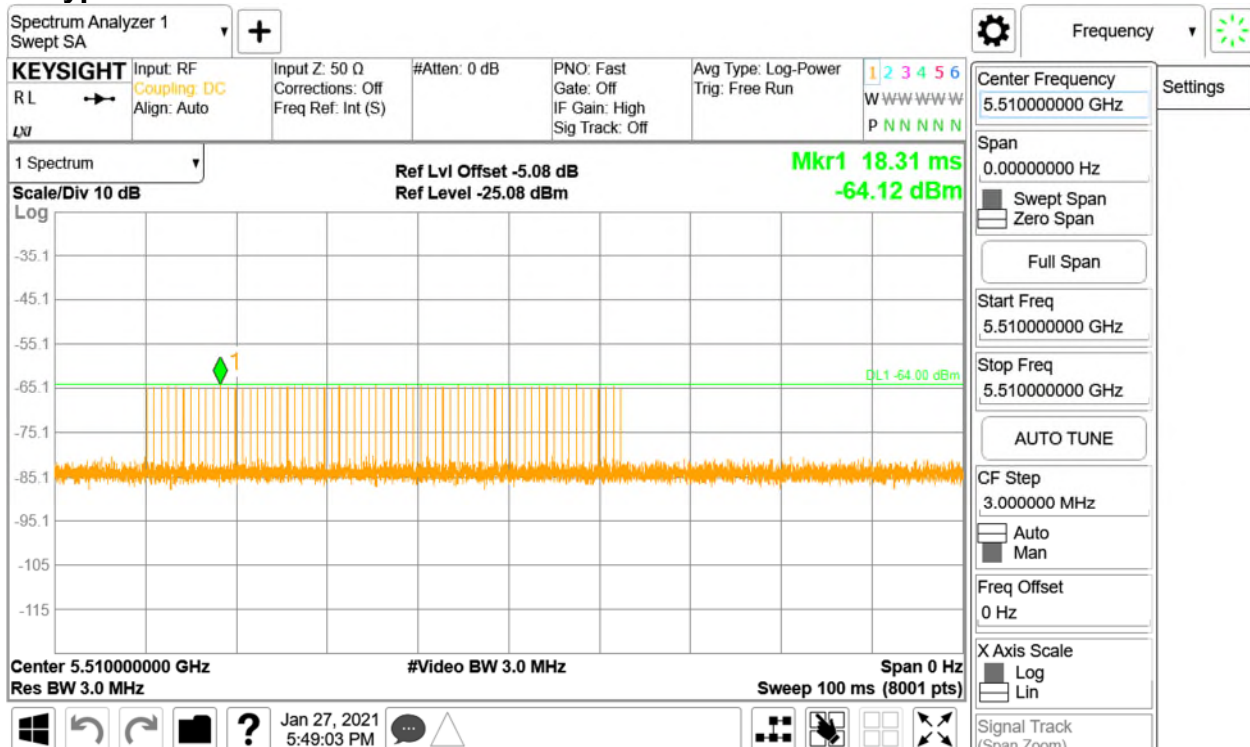


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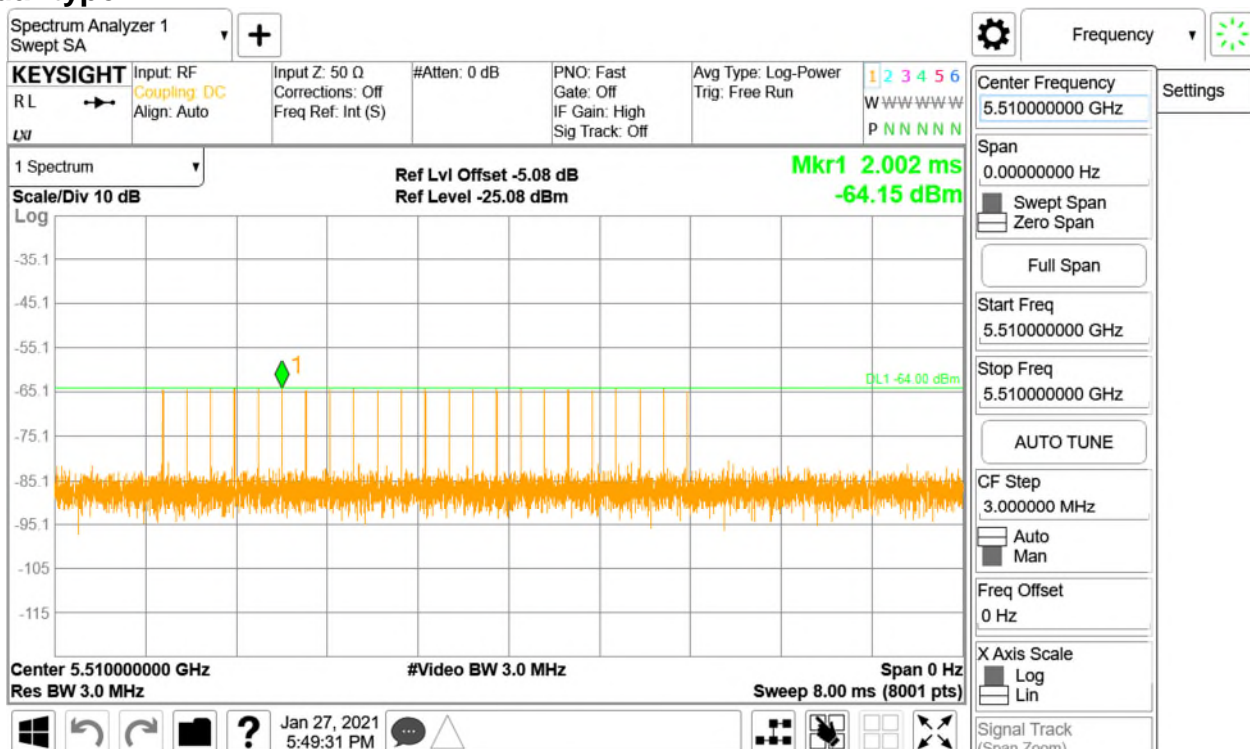
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Radar type 1-B



Radar type 2

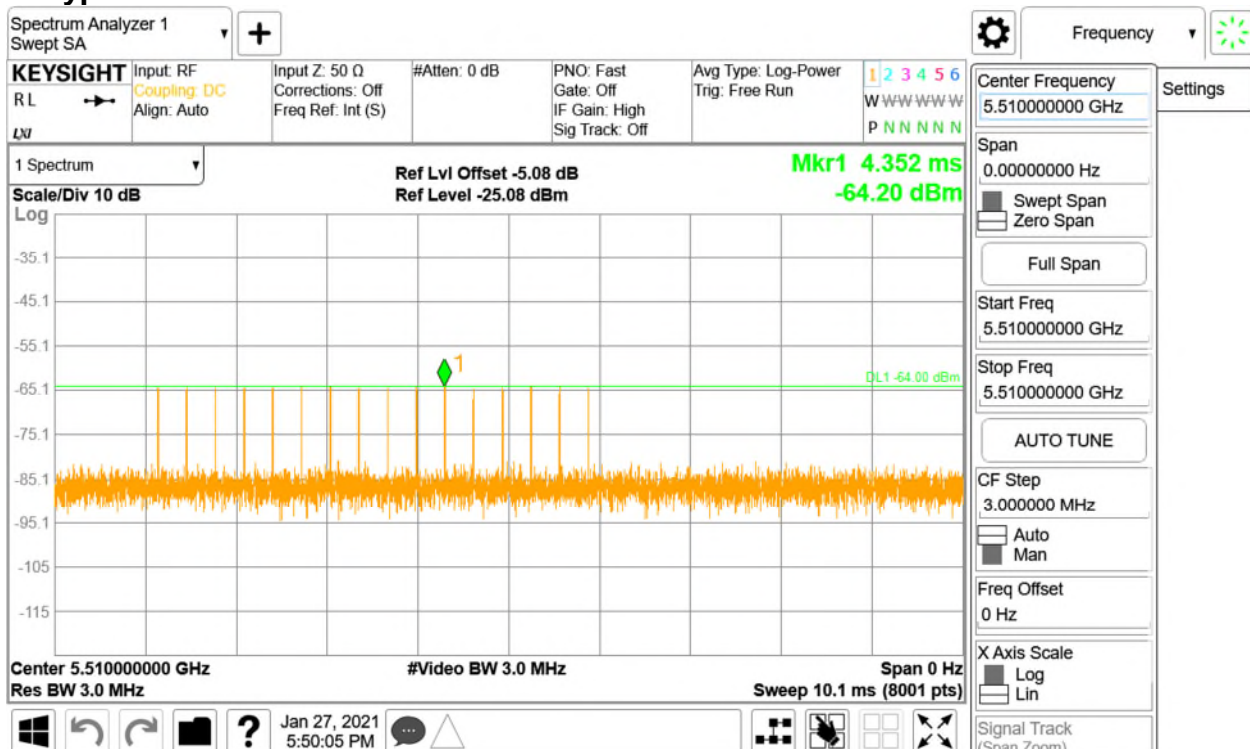


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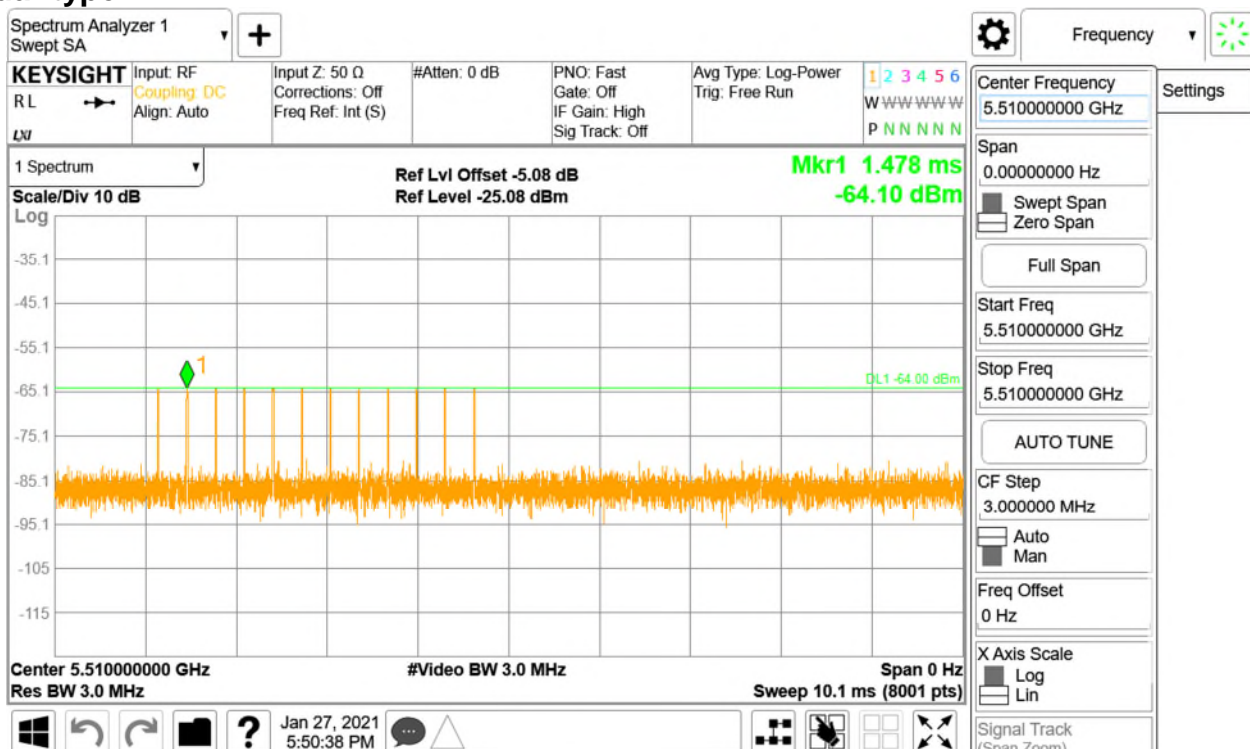
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Radar type 3



Radar type 4

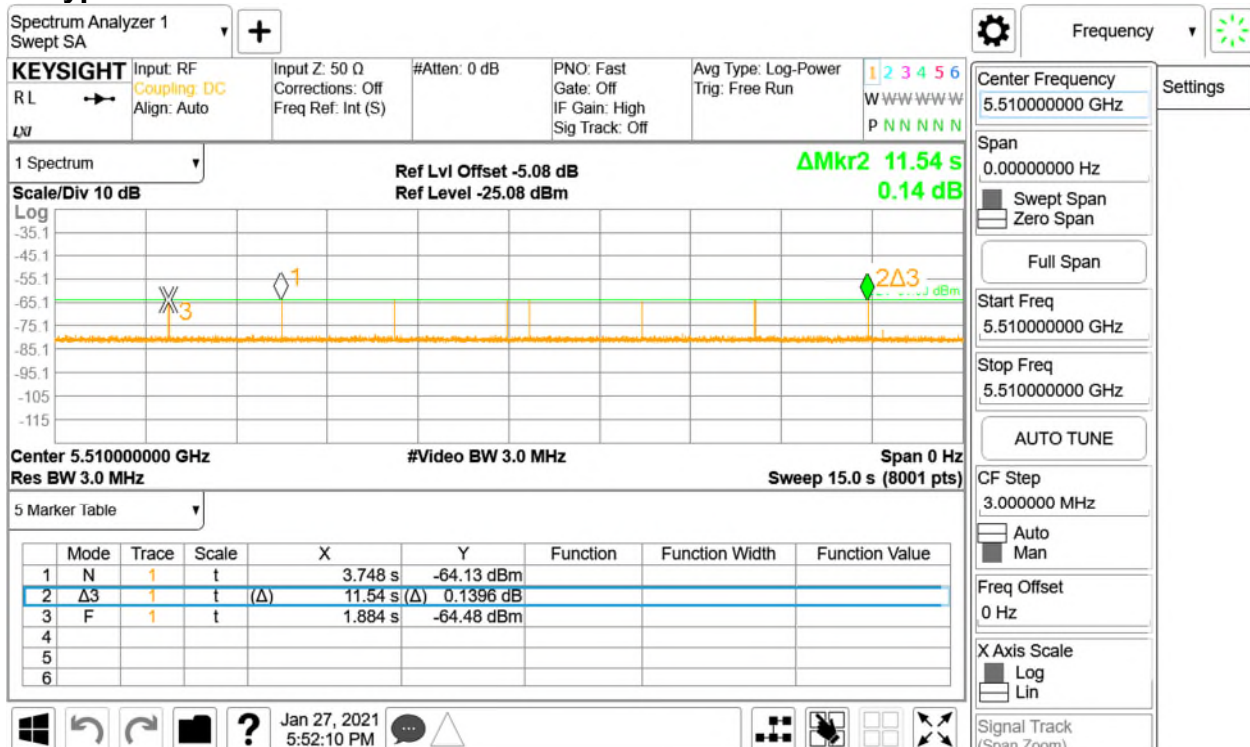


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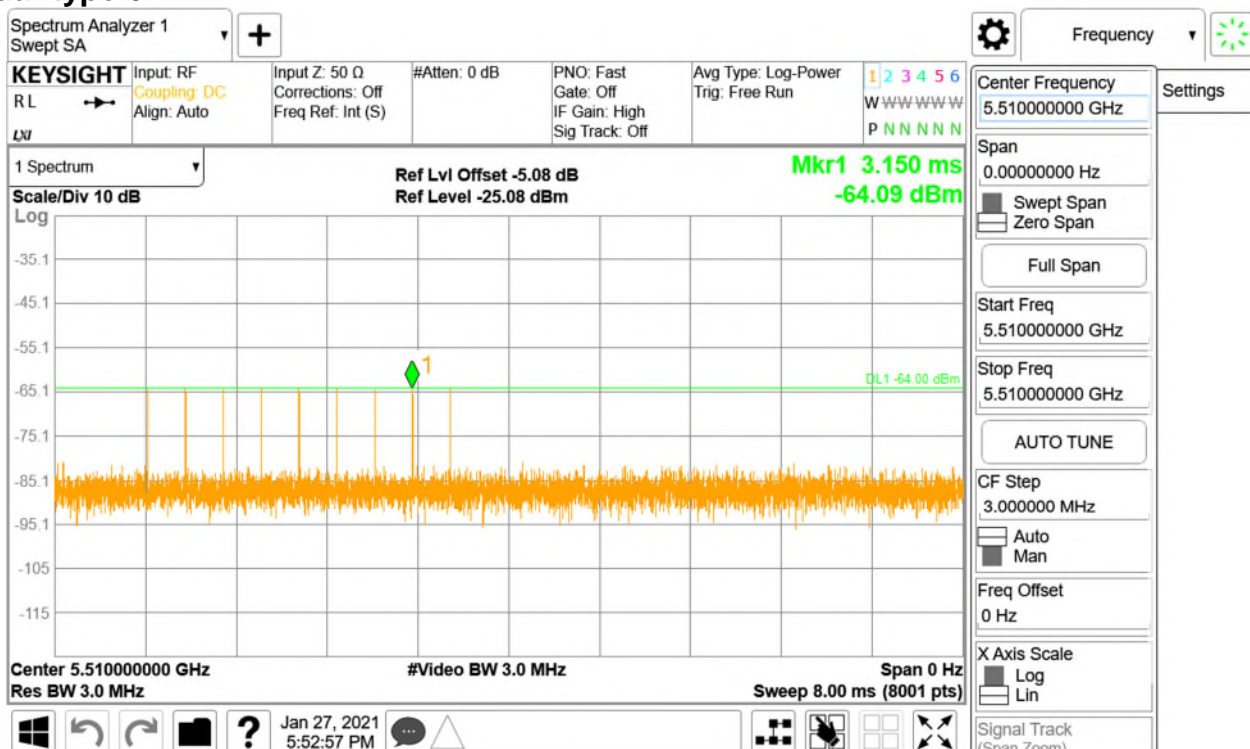
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Radar type 5



Radar type 6

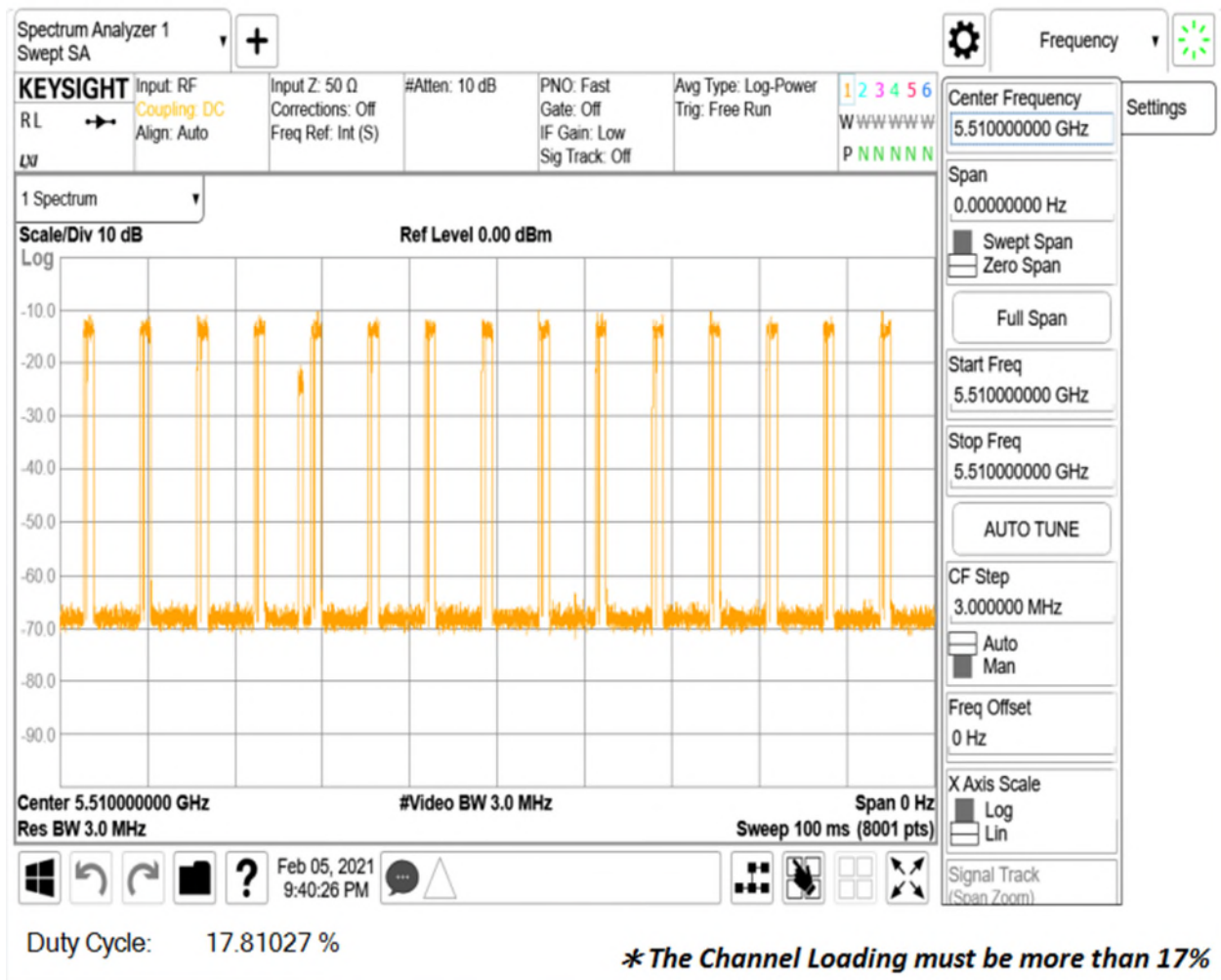


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WLAN traffic



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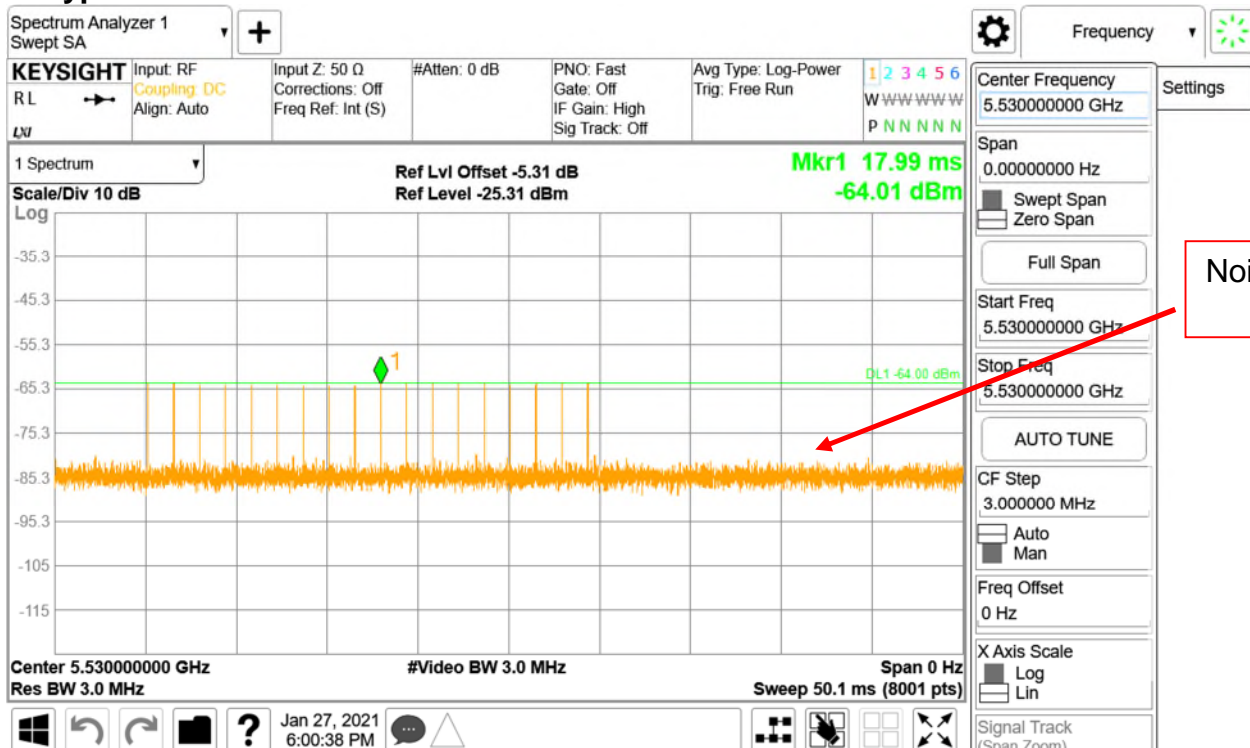
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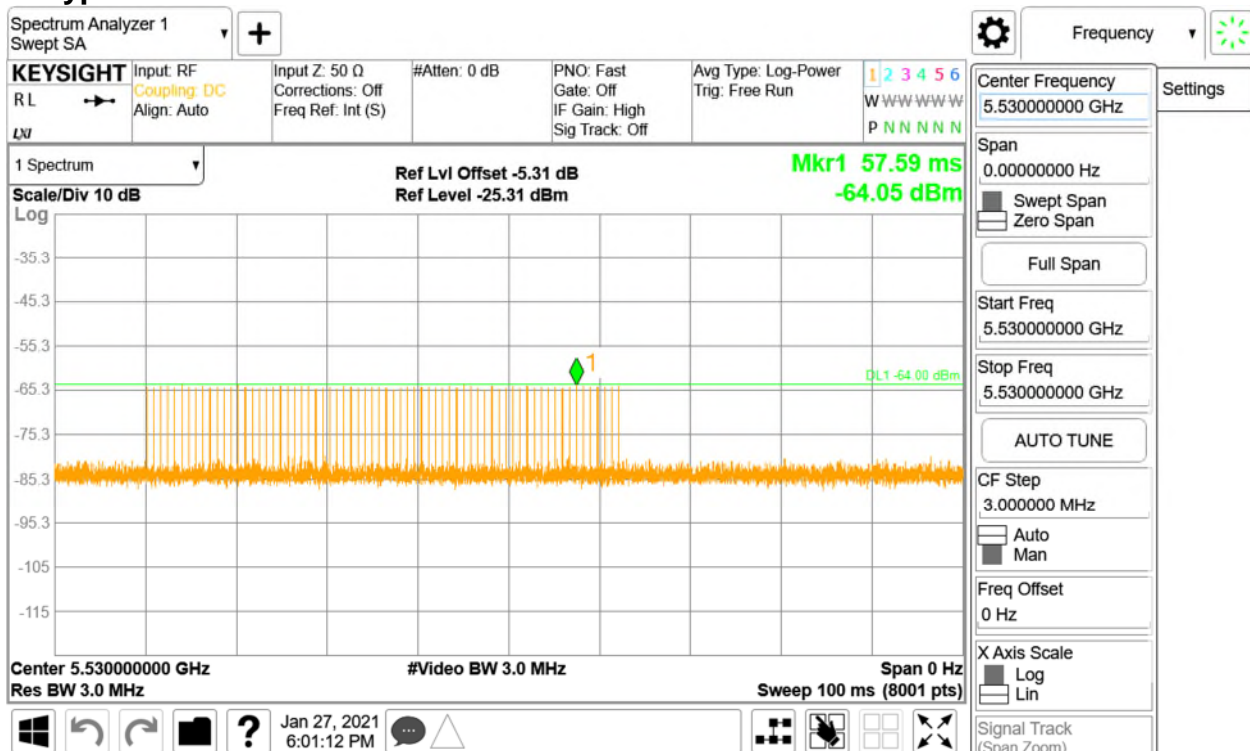
Test results (5530MHz)

Calibration plots for each of the required radar waveforms (DFS Detection Threshold)

Radar type 0



Radar type 1-A

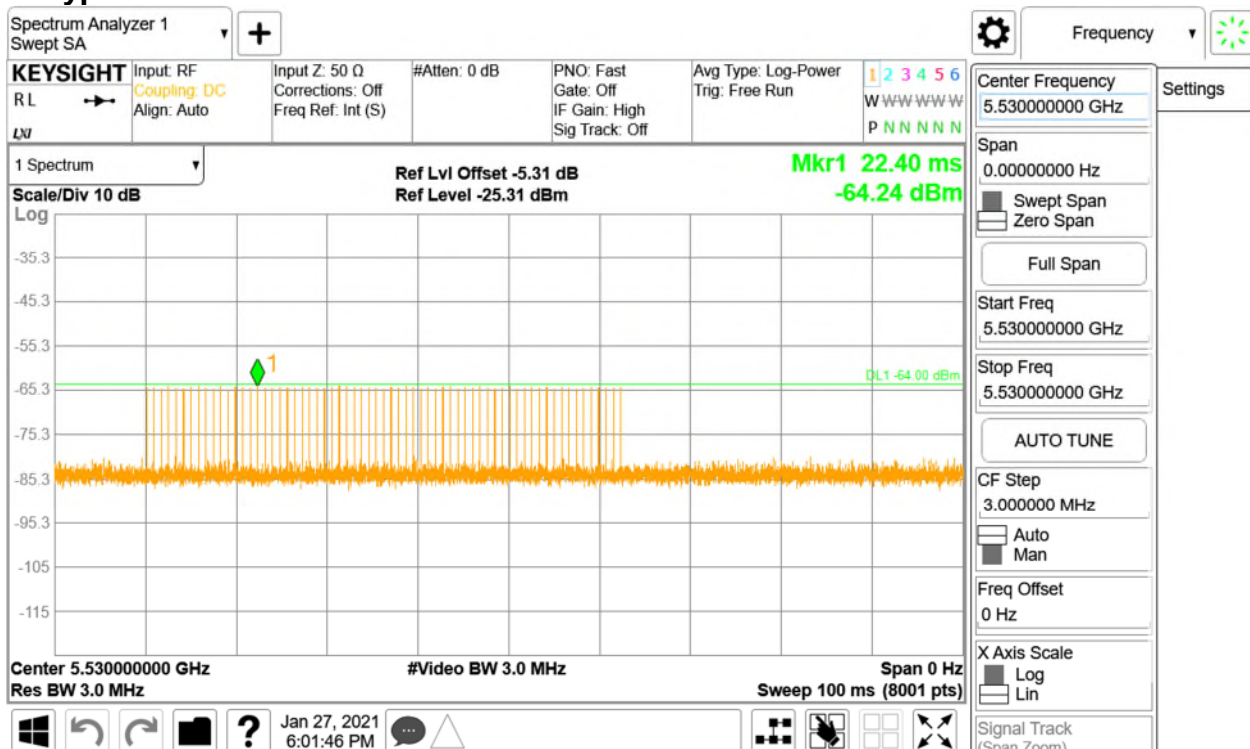


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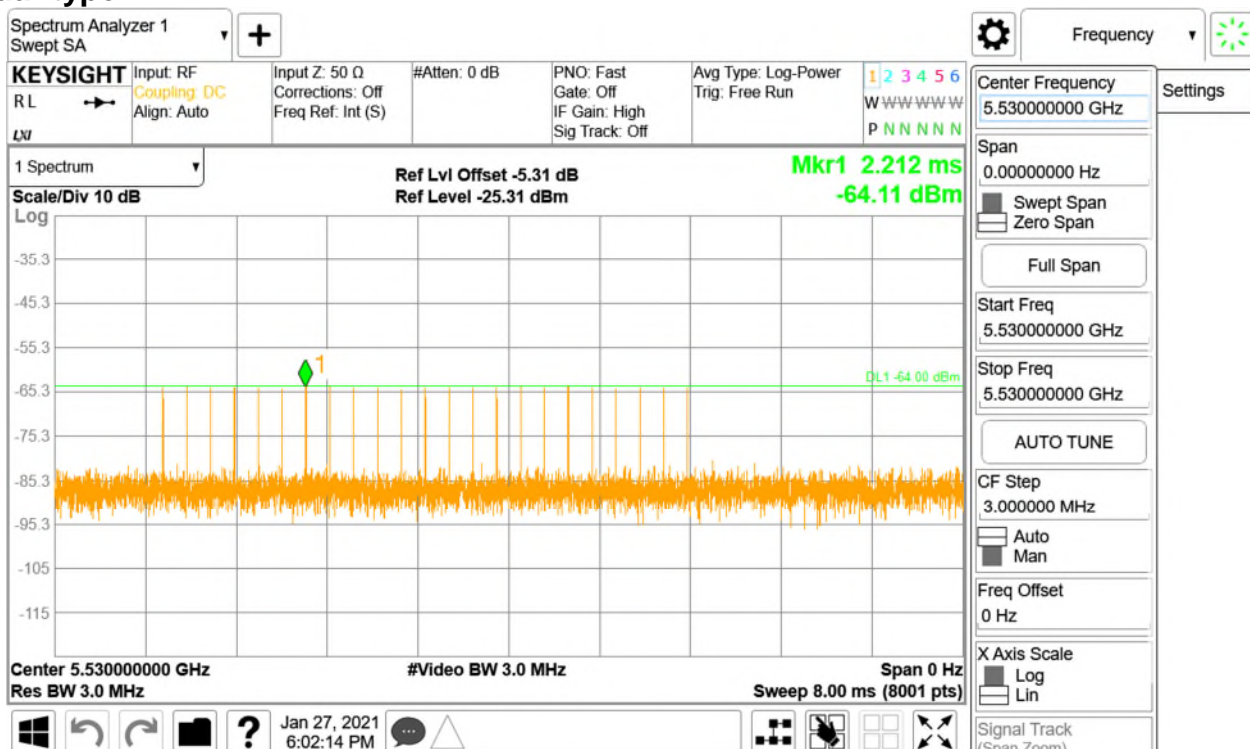
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Radar type 1-B



Radar type 2

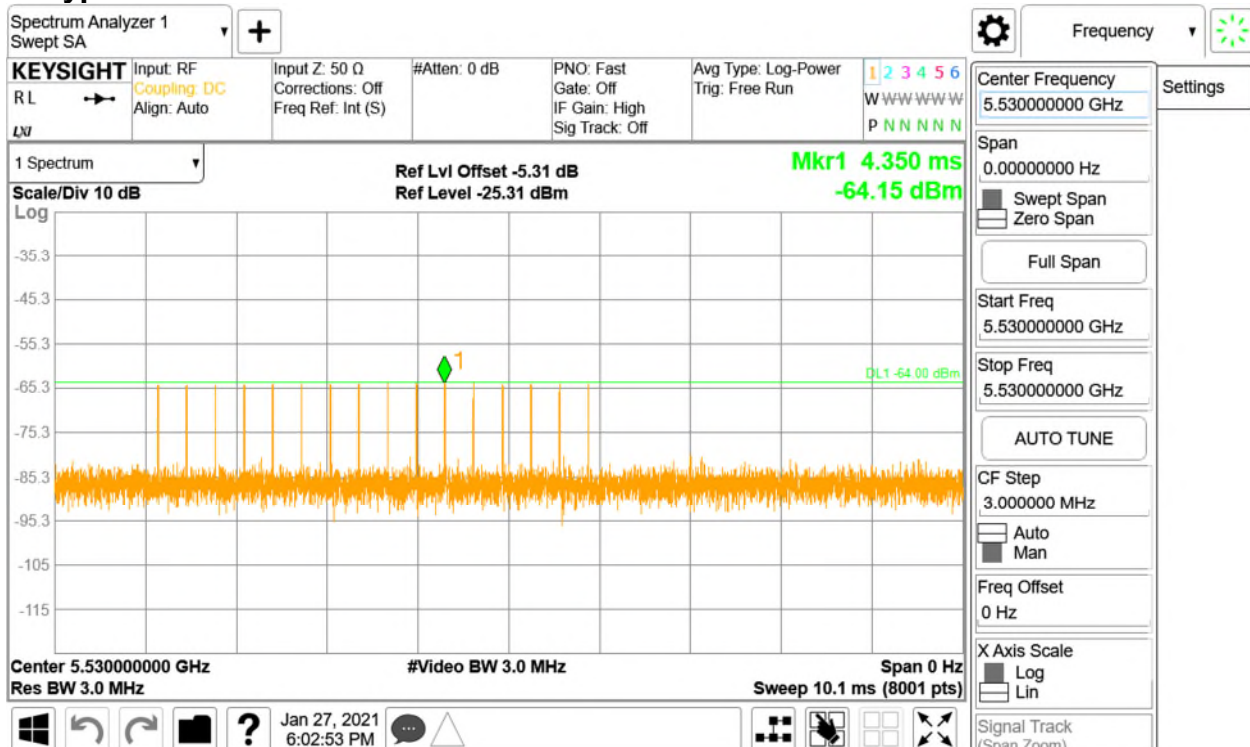


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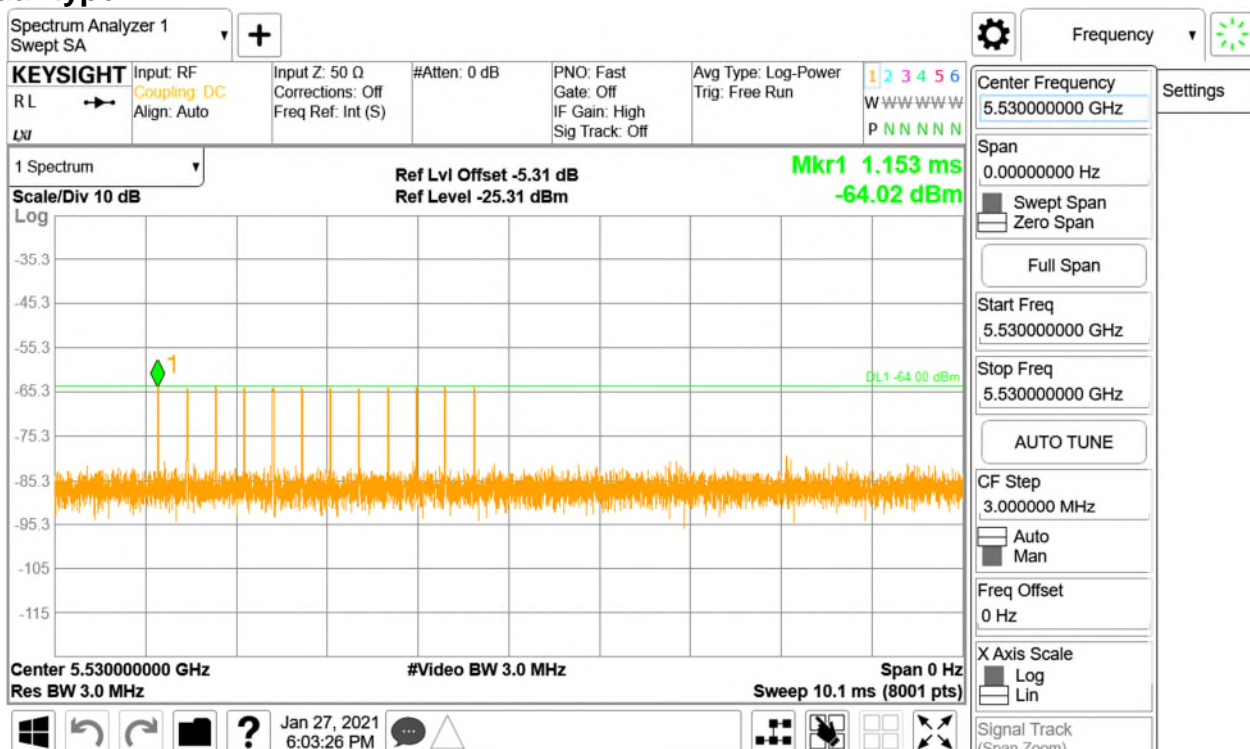
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Radar type 3



Radar type 4

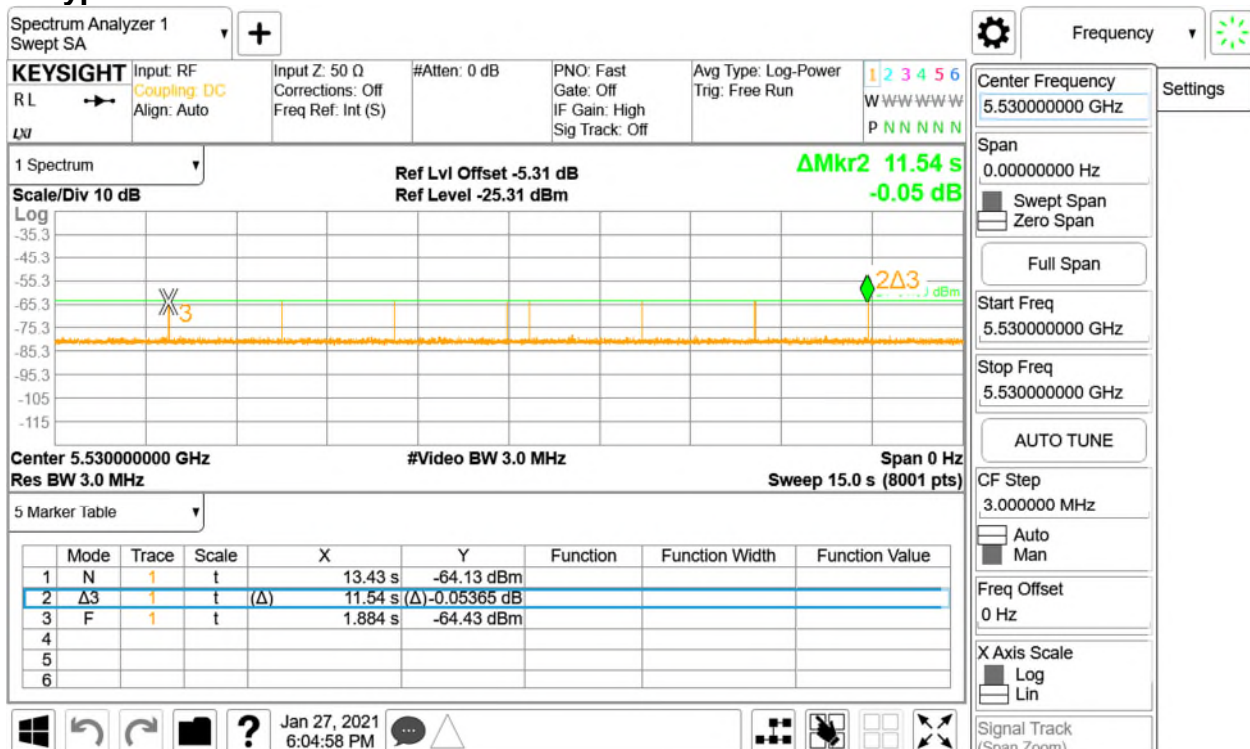


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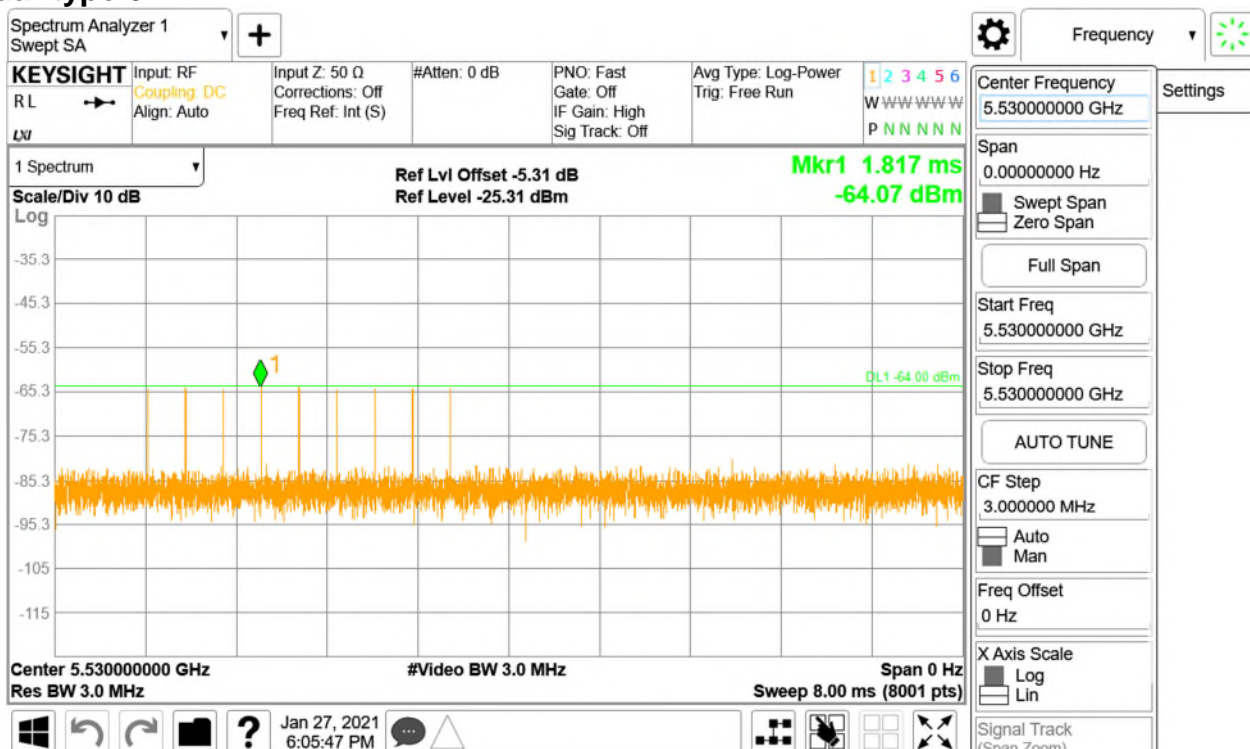
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Radar type 5



Radar type 6

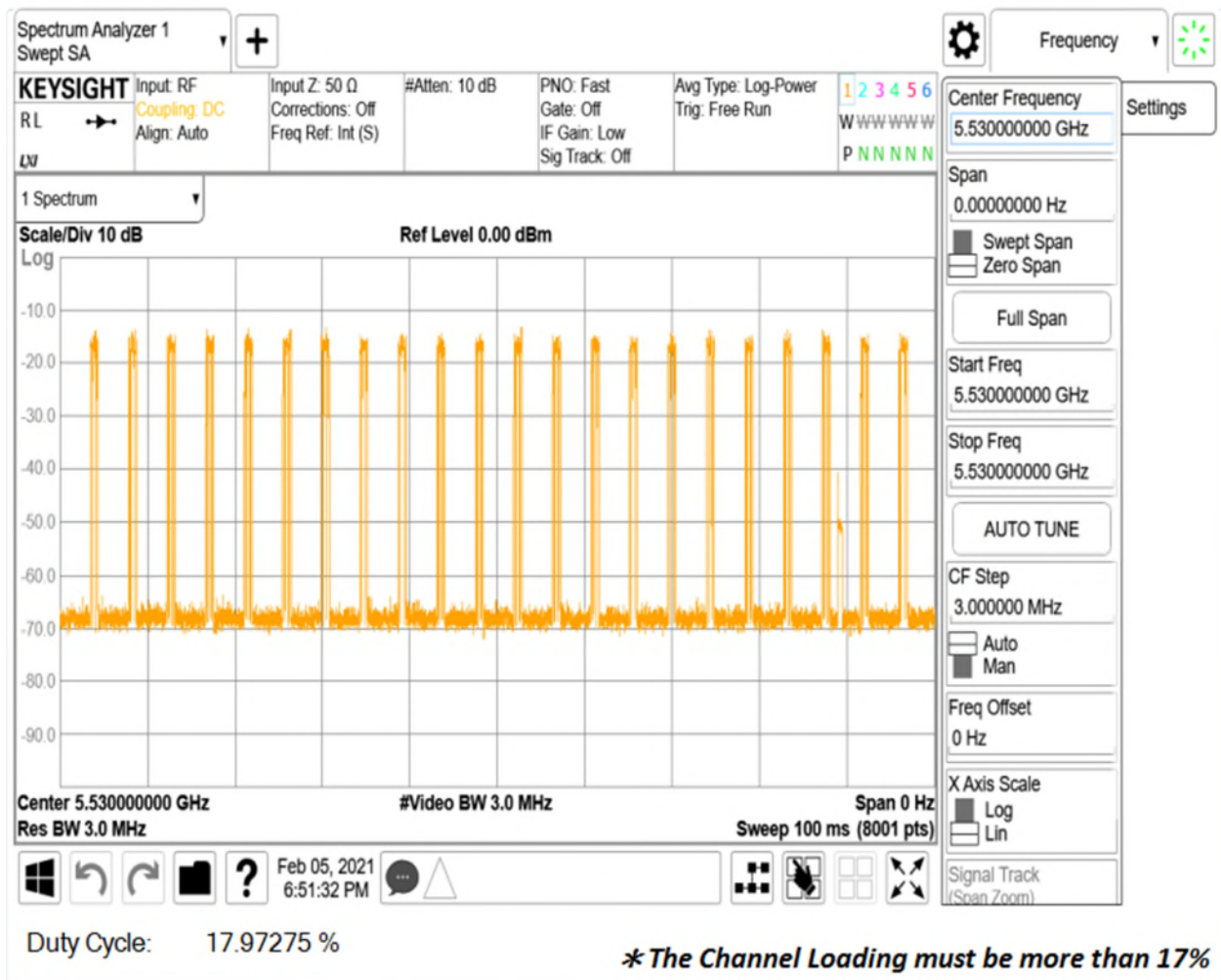


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WLAN traffic

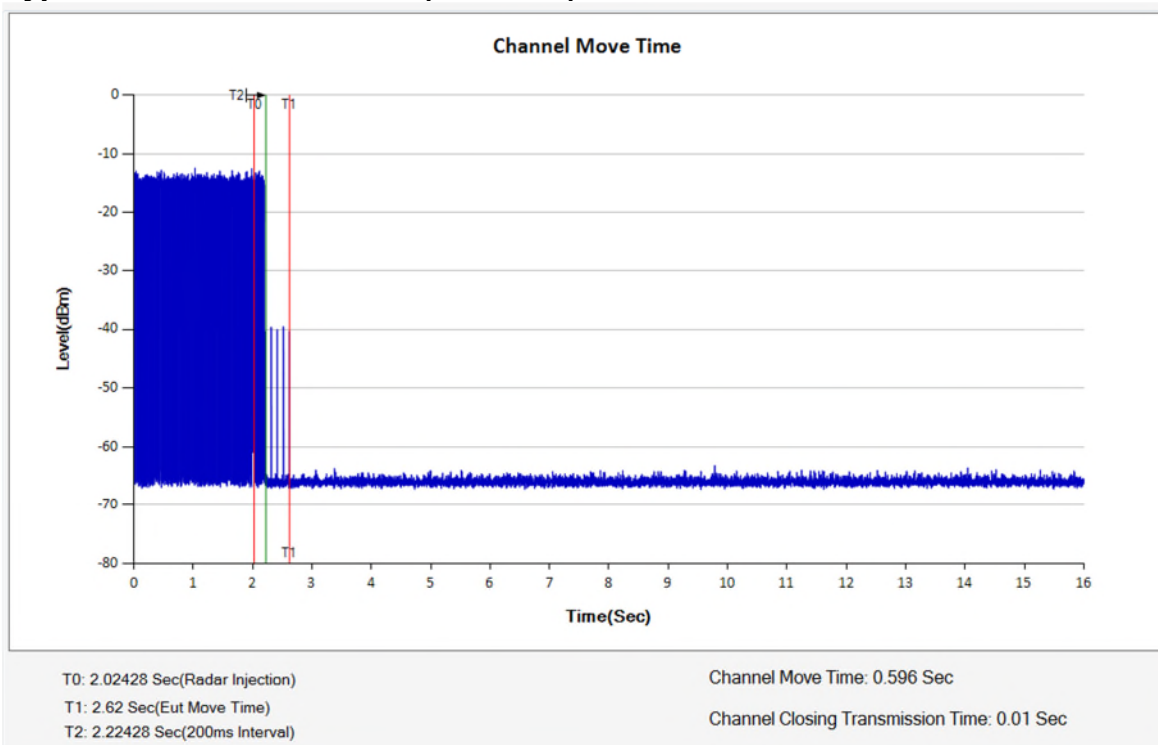


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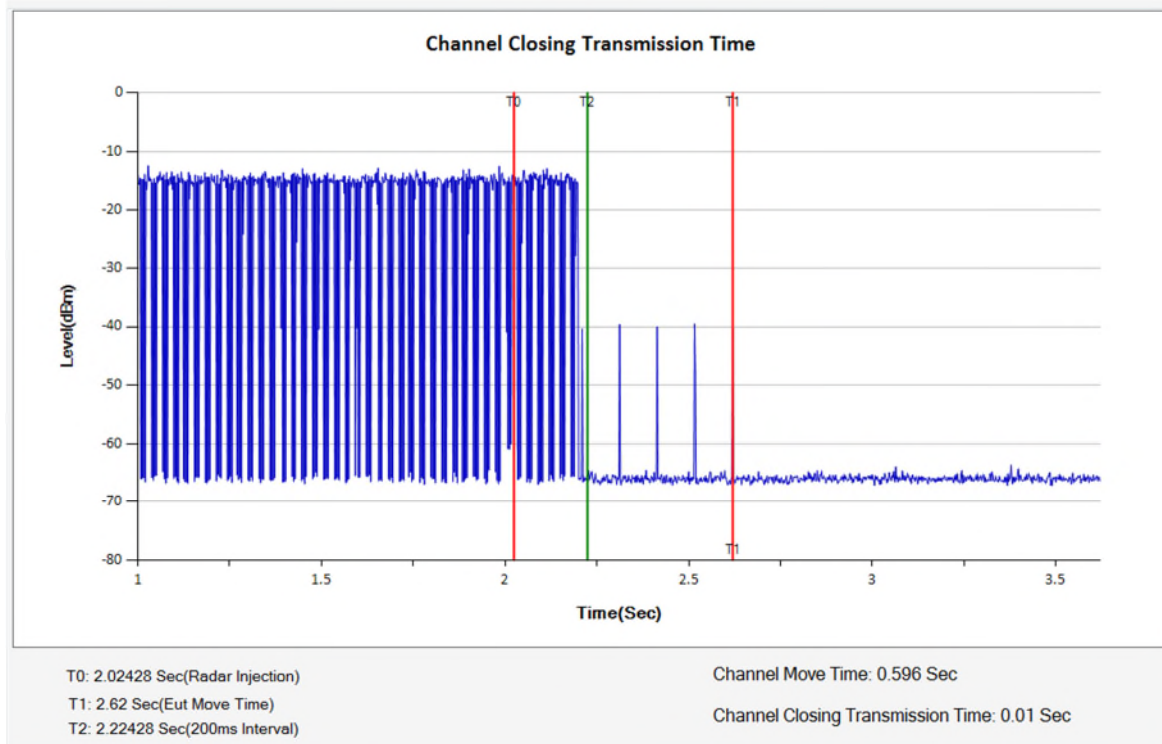
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4.3 Channel Closing Transmission and Channel Move Time Measurement Radar Type 0 Channel Move Time (5290MHz)



Radar Type 0 Channel Closing Transmission Time

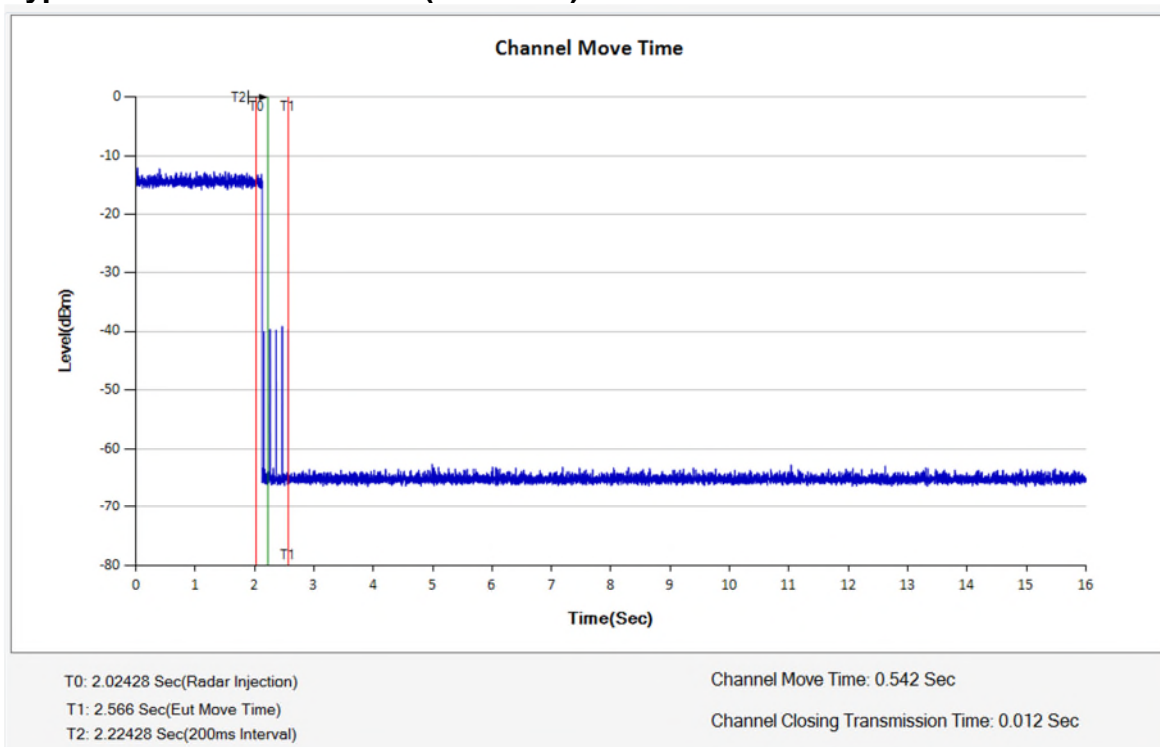


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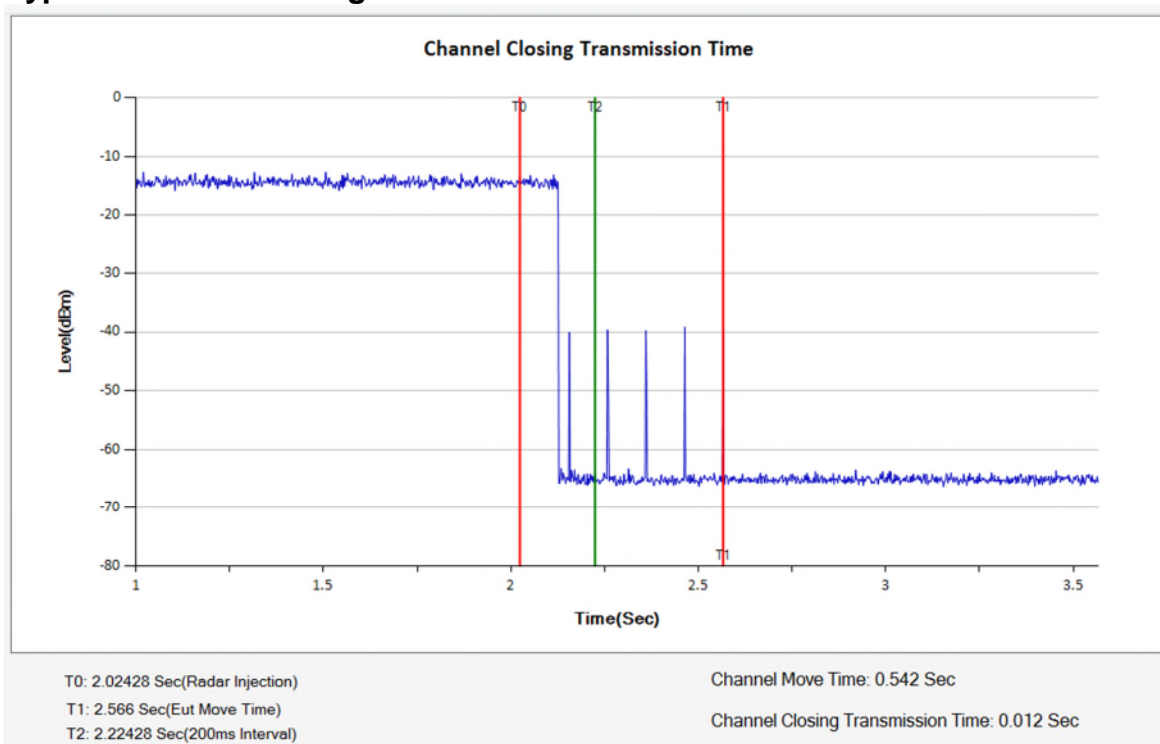
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Radar Type 0 Channel Move Time (5530MHz)



Radar Type 0 Channel Closing Transmission Time



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4.4 Non-occupancy period Measurement

5290MHz

**Verdict:**

To verify whether channel is unavailable to be operated in 30 minutes.

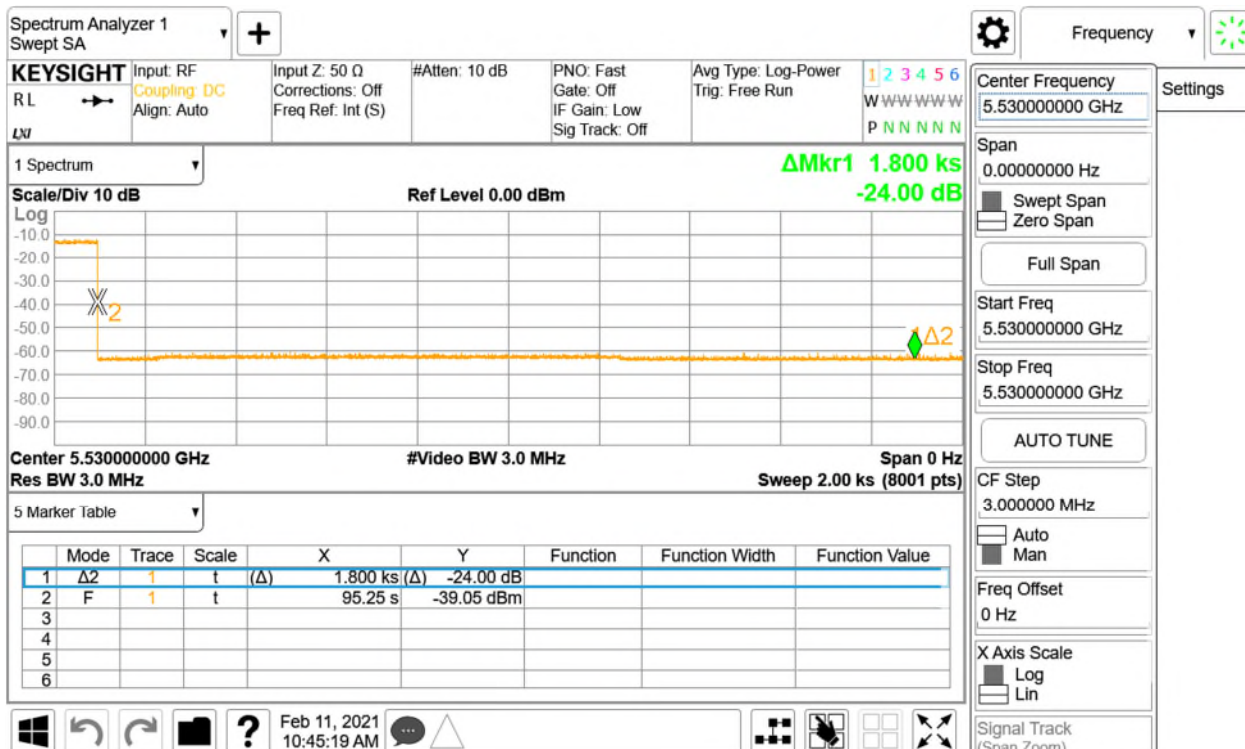
$1.8\text{ks} = 1800\text{s} = 1800\text{ s/min} / 60 = 30\text{minute}$

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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5530MHz



Verdict:

To verify whether channel is unavailable to be operated in 30 minutes.

$1.8\text{ks} = 1800\text{s} = 1800\text{ s/min} / 60 = 30\text{minute}$

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