# RF TEST REPORT

| | |
|---|---|
| **Report No.:** | 20230417G03483X-W8 |
| **Product Name:** | LTE Smart Phone |
| **Model No.:** | SH4650 |
| **FCC ID:** | 2AWF6-SH4650 |
| **Applicant:** | START USA, INC. |
| **Address:** | 6860 Dallas Parkway, Suite 200, Plano, TX 75024, USA |
| **Dates of Testing:** | 04/23/2023 - 06/16/2023 |
| **Issued by:** | CCIC Southern Testing Co., Ltd. |
| **Lab Location:** | Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China.<br>**Tel**：86 755 26627338 **Fax**：86 755 26627238 |

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# Test Report

| | |
|---|---|
| **Product .....:** | LTE Smart Phone |
| **Brand Name.....:** | START, Consumer Cellular, Verve, IRIS |
| **Trade Name .....:** | START, Consumer Cellular, Verve, IRIS |
| **Marketing Name .....:** | Roadrunner |
| **Applicant.....:** | START USA, INC. |
| **Applicant Address .....:** | 6860 Dallas Parkway, Suite 200, Plano, TX 75024, USA |
| **Manufacturer .....:** | THINKSTART ELECTRONIC TECHNOLOGY CO., LTD. |
| **Manufacturer Address .....:** | Unit A1-403, Kexing Science Park, 15 Keyuan Road, Nanshan District, Shenzhen, CHINA |
| **Test Standards .....:** | 47 CFR Part 15 Subpart E 15.407 |
| **Test Result.....:** | Pass |

| | | |
|---|---|---|
| **Tested by .....:** | Kim Li | 2023.06.21 |
| | Kim Li, Test Engineer | |
| **Reviewed by .....:** | Chris You | 2023.06.21 |
| | Chris You, Senior Engineer | |
| **Approved by .....:** | Yang Fan | 2023.06.21 |
| | Yang Fan, Manager | |

# Table of Contents

| Change History | | |
|---|---|---|
| Issue | Date | Reason for change |
| 1.0 | 2023.06.21 | First edition |
| | | |

# 1. GENERAL INFORMATION

## 1.1. EUT Description

| | |
|---|---|
| Product Name | LTE Smart Phone |
| Model No. | SH4650 |
| Hardware Version | SH4650HV1.0 |
| Software Version | SH4650SV1.0.5 |
| Operation | ☐Master device |
| | ☐Slaver device with radar detection function |
| | ☒Slaver device without radar detection function |
| TPC | Not suppport |
| EUT supports Radios application | WLAN5.0GHz 802.11a/n/ac |
| Modulation Type | 802.11a/n: OFDM (BPSK/QPSK/16QAM/64QAM)<br>802.11ac: OFDM (BPSK/QPSK/16QAM/64QAM/256QAM) |
| Transfer Rate | 802.11a: 54/48/36/24/18/12/9/6 Mbps<br>802.11n: up to 150 Mbps<br>802.11ac: up to 433.333 Mbps |
| Frequency Range | UNII-1: 5150 ~ 5250MHz<br>UNII-2a: 5250 ~ 5350MHz<br>UNII-2c: 5470 ~ 5725MHz<br>UNII-3: 5725 ~ 5850MHz |
| Channel Bandwidth | 802.11a: 20MHz<br>802.11n: 20MHz/40MHz<br>802.11ac: 20MHz/40MHz/80MHz |
| Antenna Type | Internal Antenna |
| Antenna Gain | 0.80dBi |
| Power supply | Rechargeable Li-ion Polymer Battery DC3.85V/4000mAh |

## 1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E:

| No. | Identity | Document Title |
|---|---|---|
| 1 | 47 CFR Part 15 Subpart E §15.407 | Radio Frequency Devices |
| 2 | KDB Publication 905462 D02v02 | UNII DFS Compliance Procedures New Rules |
| 3 | KDB Publication 905462 D03v01 | UNII Clients Without Radar Detection New Rules |

Test detailed items/section required by FCC rules and results are as below:

| No. | FCC Rule | Description | Result |
|---|---|---|---|
| 1 | 15.407 (h)(2) | Channel Move Time | PASS |
| 2 | | Channel Closing Transmission Time | PASS |
| 3 | | Non- Occupancy Period | PASS |

## 1.3. Laboratory Facilities

**FCC-Registration No.: 406086**

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until June 30, 2023.

**ISED Registration: 11185A-1**

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until June 30, 2023.

**A2LA Code: 5721.01**

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

# 2. U-NII DFS Rule Requirements

## 2.1. Working modes and required test items

The manufacturer shall state whether the UUT is capable of operating as a Master and/or a Client. If the UUT is capable of operating in more than one operating mode then each operating mode shall be tested separately. See tables 1 and 2 for the applicability of DFS requirements for each of the operational modes.

Table 1: Applicability of DFS Requirements prior to use a channel

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client without radar detection | Client with radar detection |
| Non-Occupancy Period | √ | Not required | √ |
| DFS Detection Threshold | √ | Not required | √ |
| Channel Availability Check Time | √ | Not required | Not required |
| Uniform Spreading | √ | Not required | Not required |
| U-NII Detection Bandwidth | √ | Not required | √ |

Table 2: Applicability of DFS Requirements during normal operation

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client without radar detection | Client with radar detection |
| DFS Detection Threshold | √ | Not required | √ |
| Channel Closing Transmission Time | √ | √ | √ |
| Channel Move Time | √ | √ | √ |
| U-NII Detection Bandwidth | √ | Not required | √ |

## 2.2. Test limits and radar signal parameters

DFS Detection thresholds for Master Devices and Client Devices with Radar Detection

| Maximum Transmit Power | Value (See Note 1 and 2) |
|---|---|
| ≥ 200 millwatt | -64 dBm |
| < 200 millwatt | -62 dBm |
| Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.<br>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. | |

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 | 100% of the UNII transmission power bandwidth. See Note 3. |
| Note 1: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:<br>• For the Short Pulse Radar Test Signals this instant is the end of the Burst.<br>• For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.<br>• For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the Radar Waveform.<br>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.<br>Note 3: During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic. | |

Parameters of DFS test signals

Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short pluse 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<br>Test B:15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1μsec, excluding PRI values selected in Test A | $\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{PRI_{\mu sec}}\right)\right\}$ | 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. | | | | | |

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 |

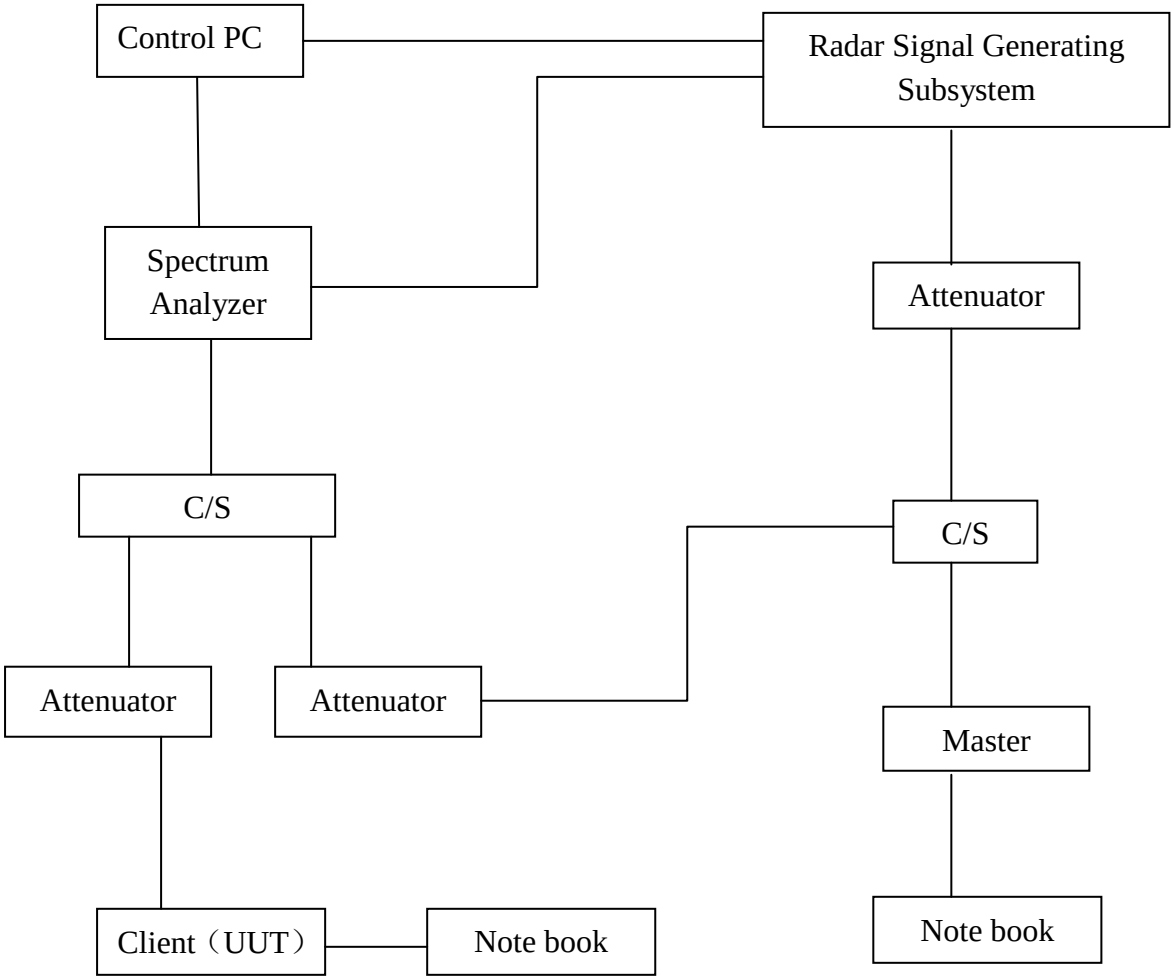
Frequency hopping radar test waveform

| 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 |

# 3. Test Procedure

## 3.1. DFS Test Setup configuration

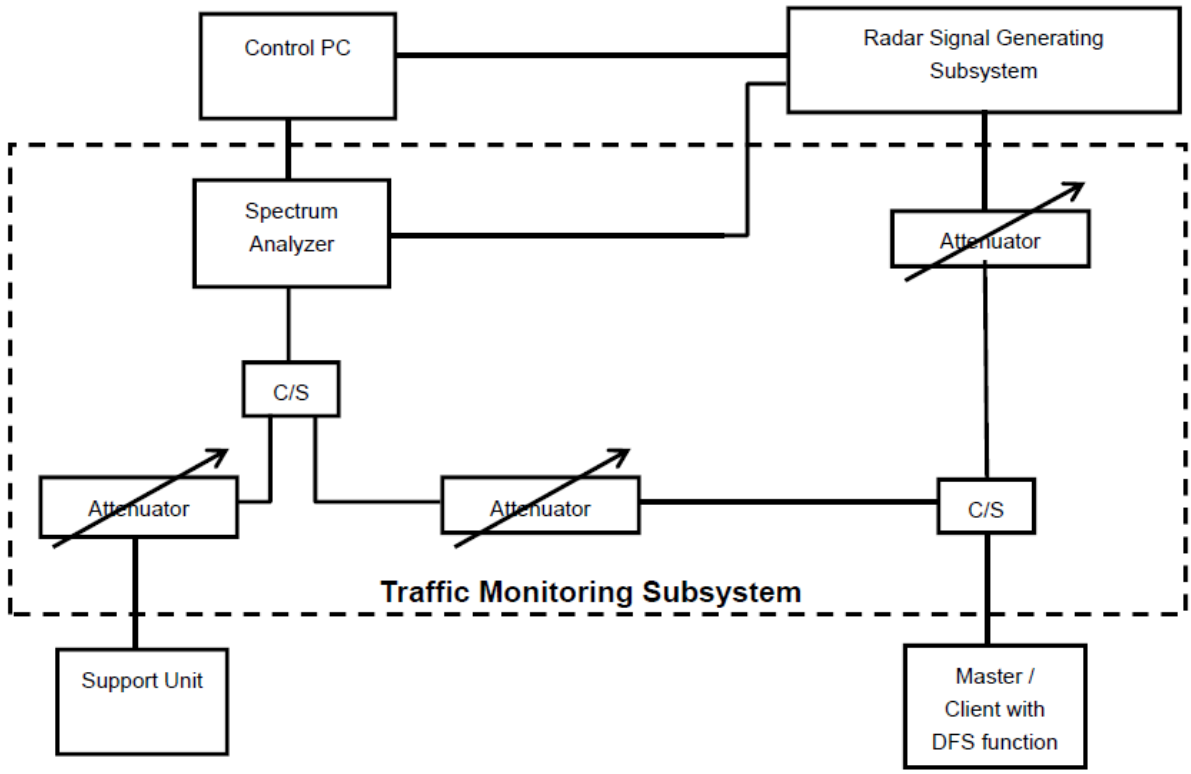
**Client without Radar Detection Mode**




The UUT is a UNII device operating in client mode without radar detection. The radar test signals are injected into the master device.

## 3.2. BVADT DFS Measurement system

A complete BVADT DFS Measurement System consists of two subsystems: (1) the Radar Signal Generating Subsystem and (2) the Traffic Monitoring Subsystem. The control PC is necessary for generating the Radar waveforms in Table 1, 2. The traffic monitoring subsystem is specified to the type of unit under test (UUT).

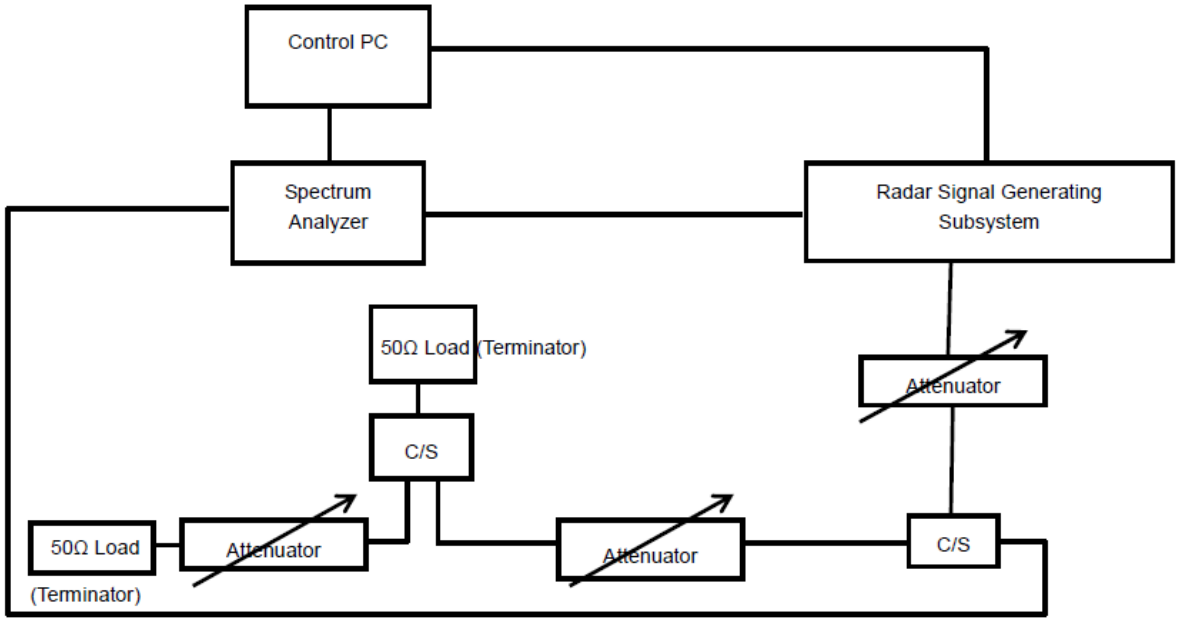



The test transmission will always be from the Master Device to the Client Device. While the Client device is set up to associate with the Master device and play the MPEG file (6 1/2Magic Hours) from Master device, the designated MPEG test file and instructions are located at: http://ntiacsd.ntia.doc.gov/dfs/.

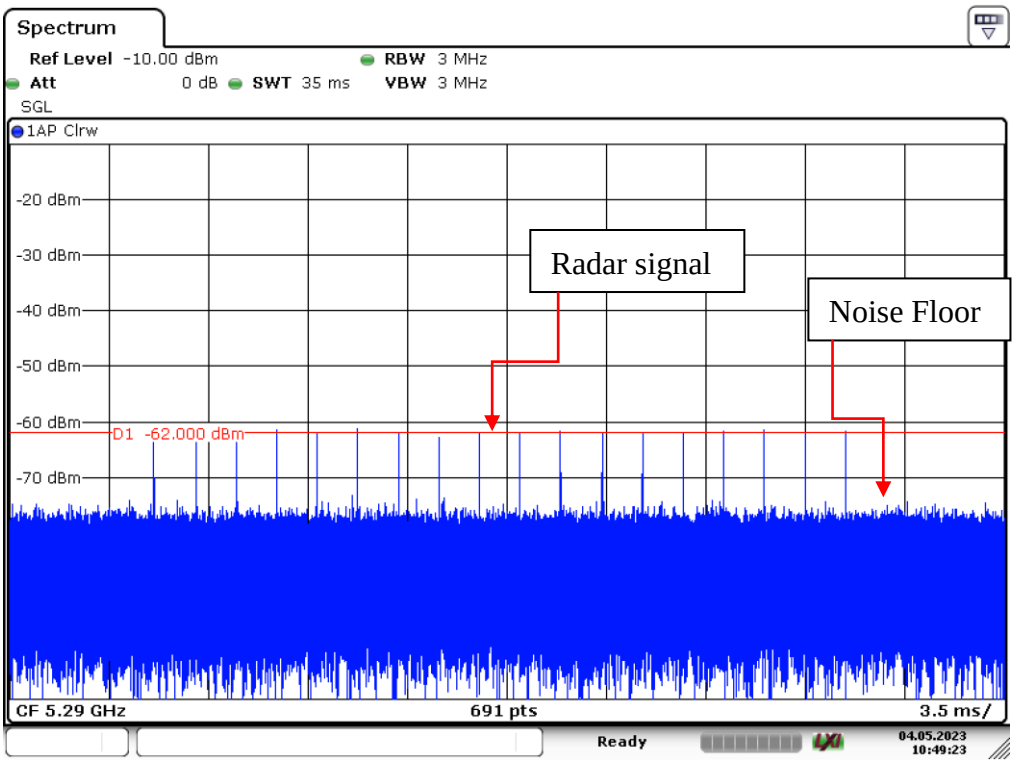
**Calibration of DFS detection threshold level:**

The measured channel is 5290 MHz and 5530MHz in 80MHz Bandwidth. The radar signal was the same as transmitted channels, and injected into the antenna port of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time.

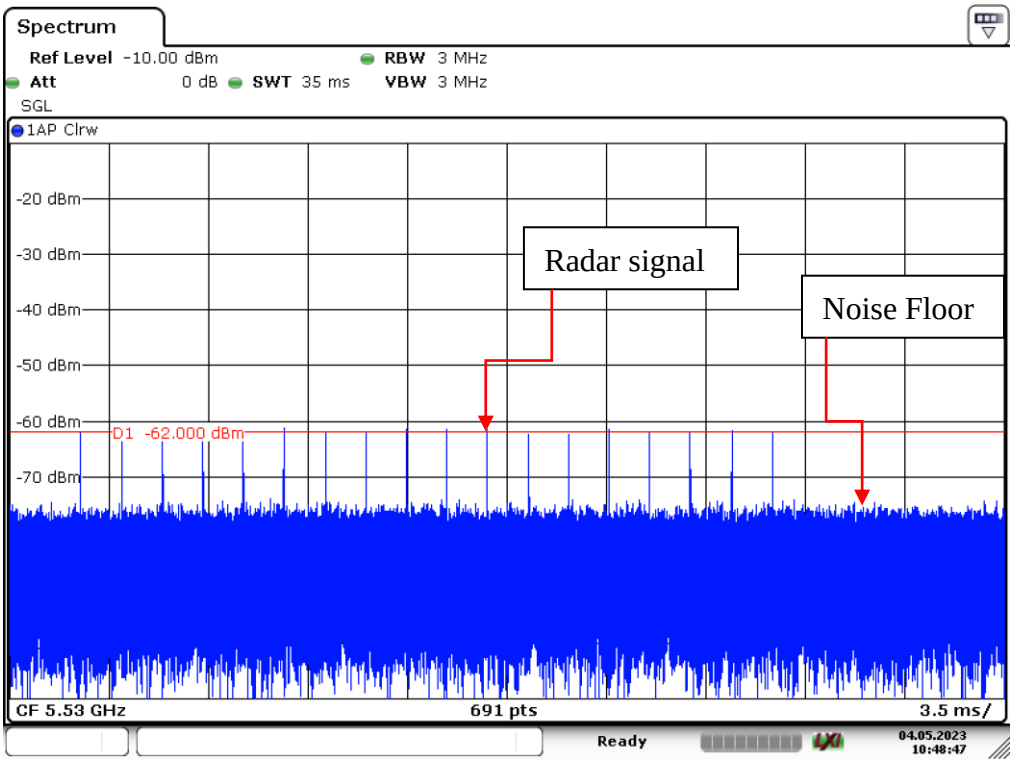
**Conducted setup configuration of calibration of DFS detection threshold level**



**Calibration plots for each of the required radar waveforms**
**Radar type 0**

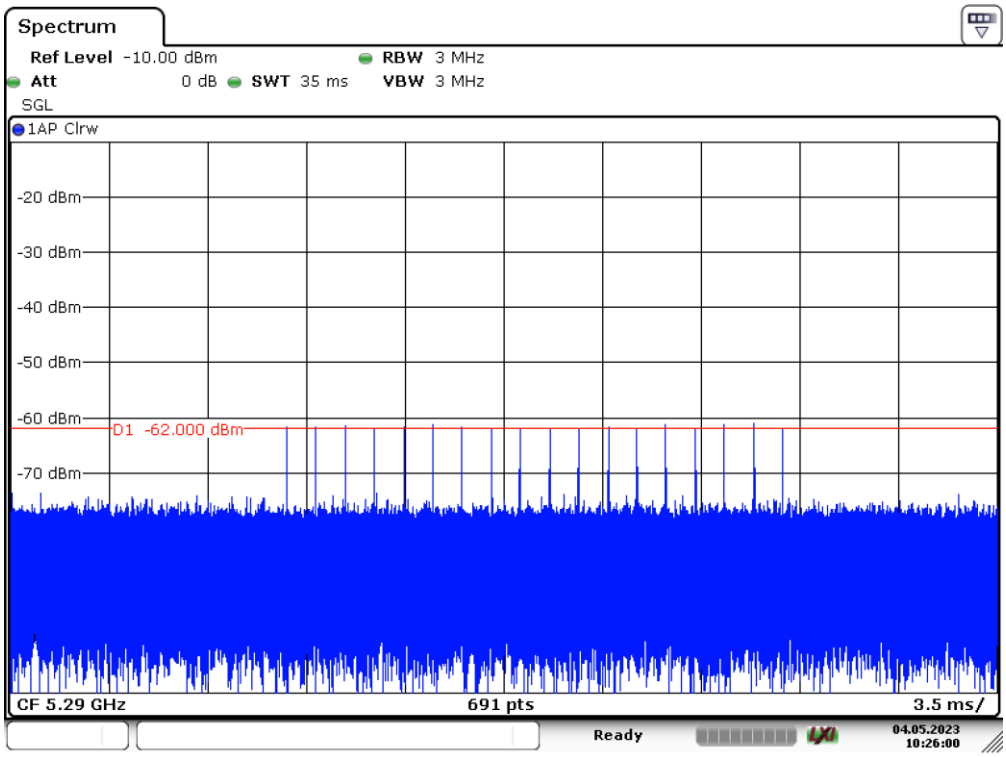



Radar Type 0 – 5290MHz

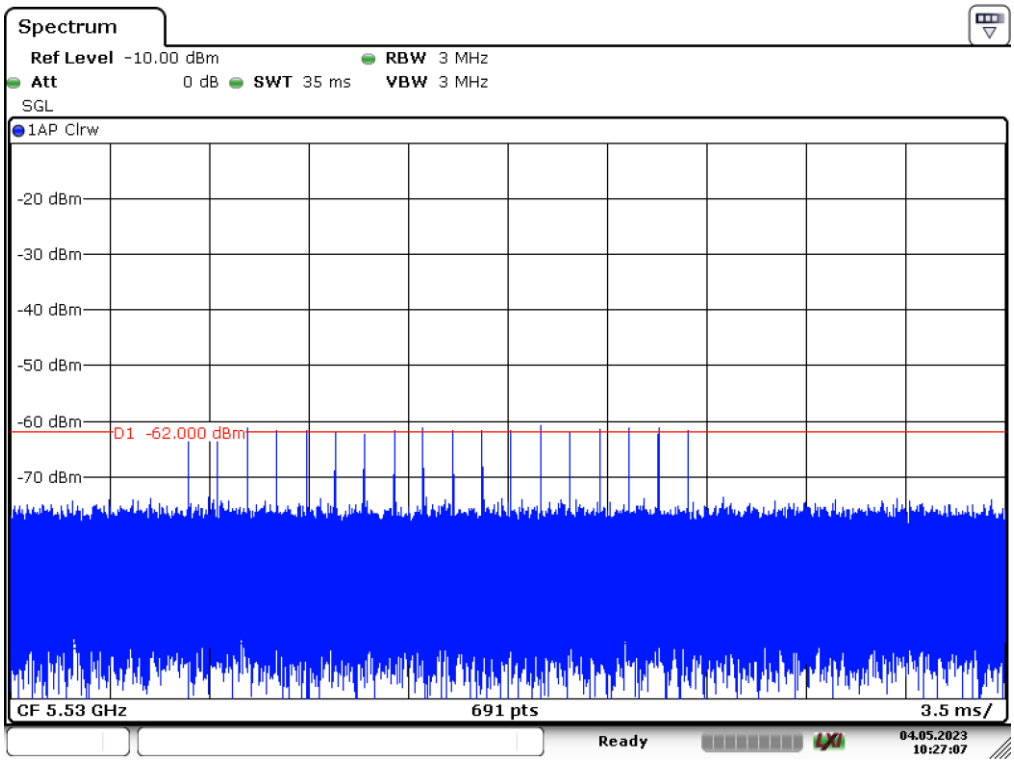



Radar Type 0 – 5530MHz

**Radar type 1A**

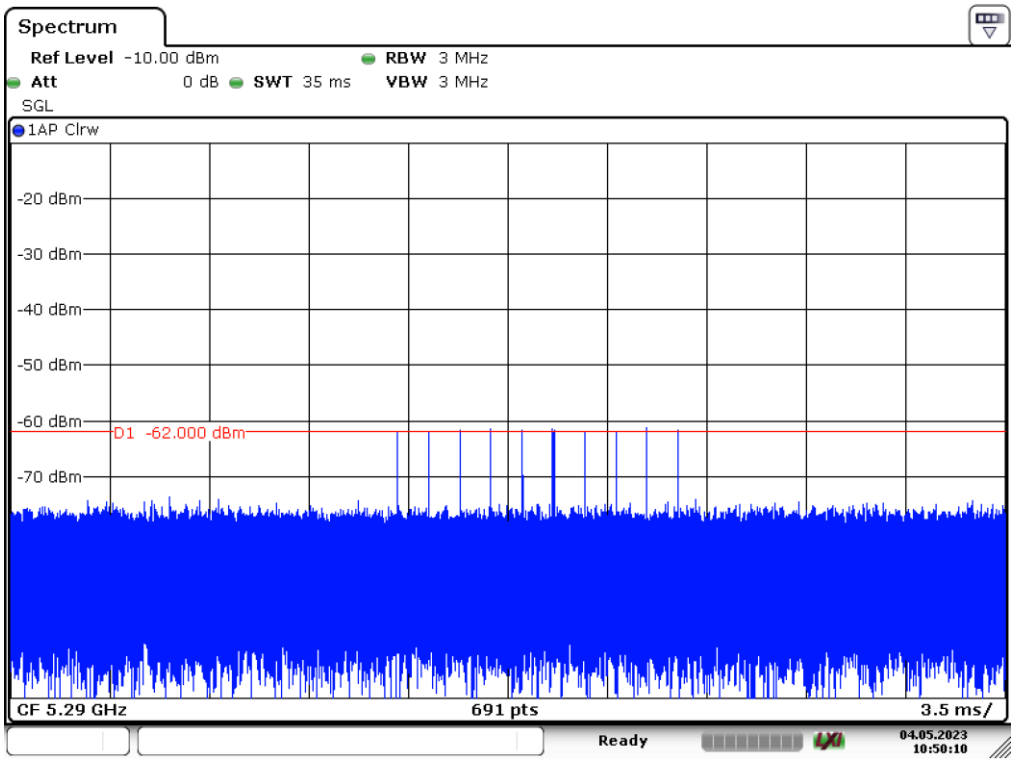



Radar Type 1A – 5290MHz

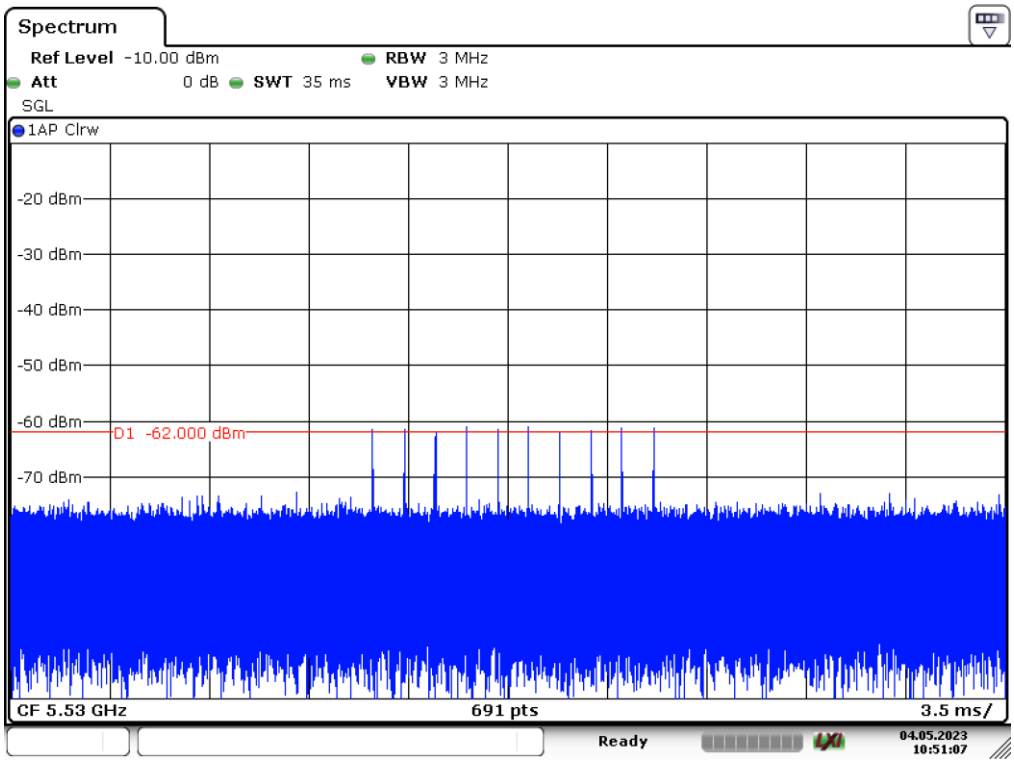



Radar Type 1A – 5530MHz

**Radar type 1B**

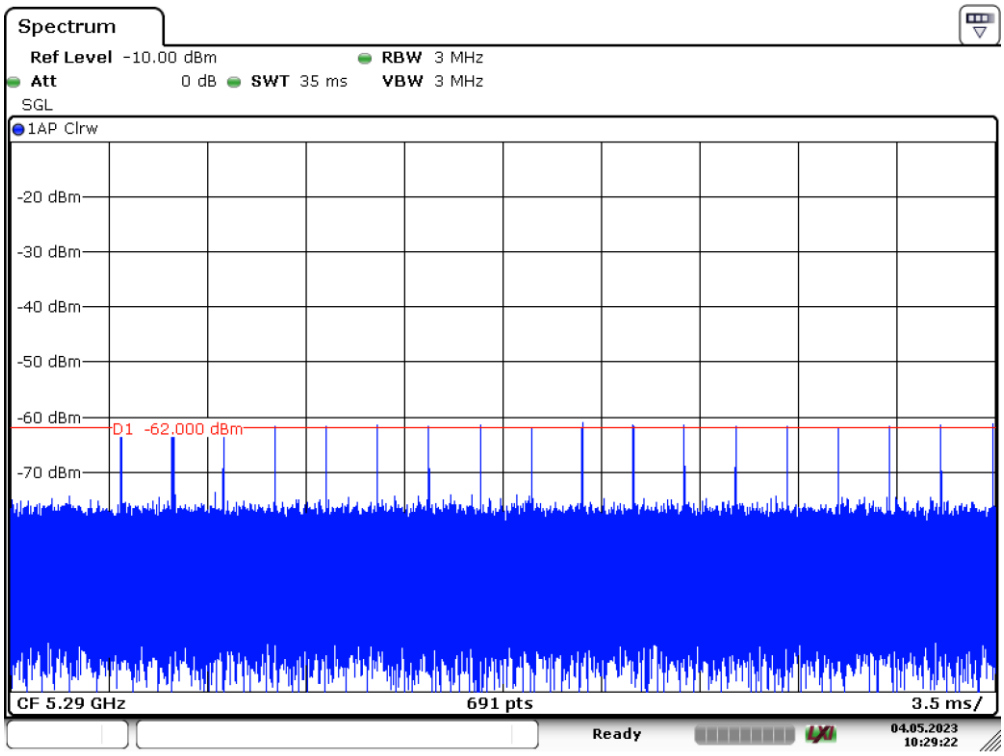



Radar Type 1B – 5290MHz

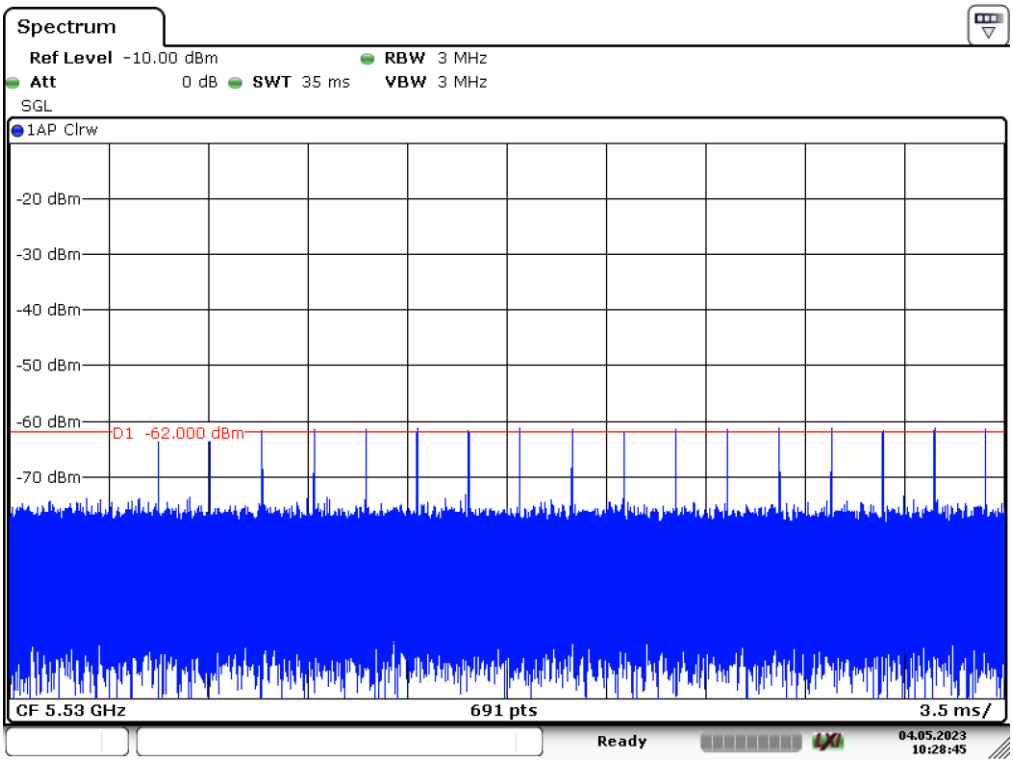



Radar Type 1B – 5530MHz

**Radar type 2**

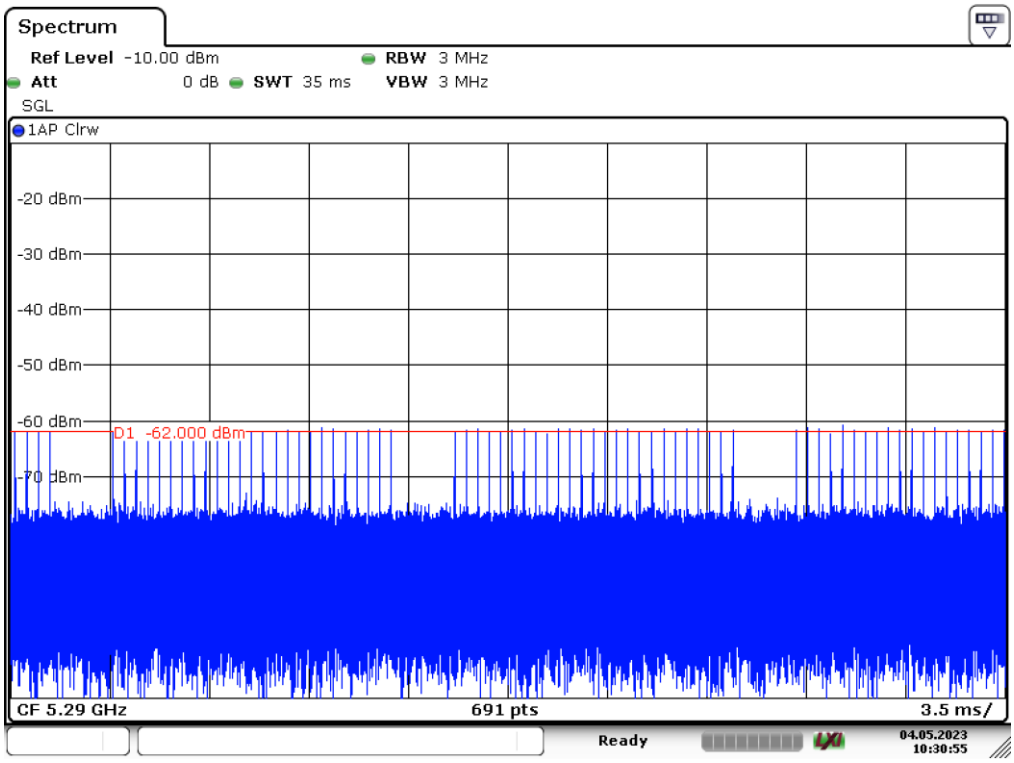



Radar Type 2 – 5290MHz

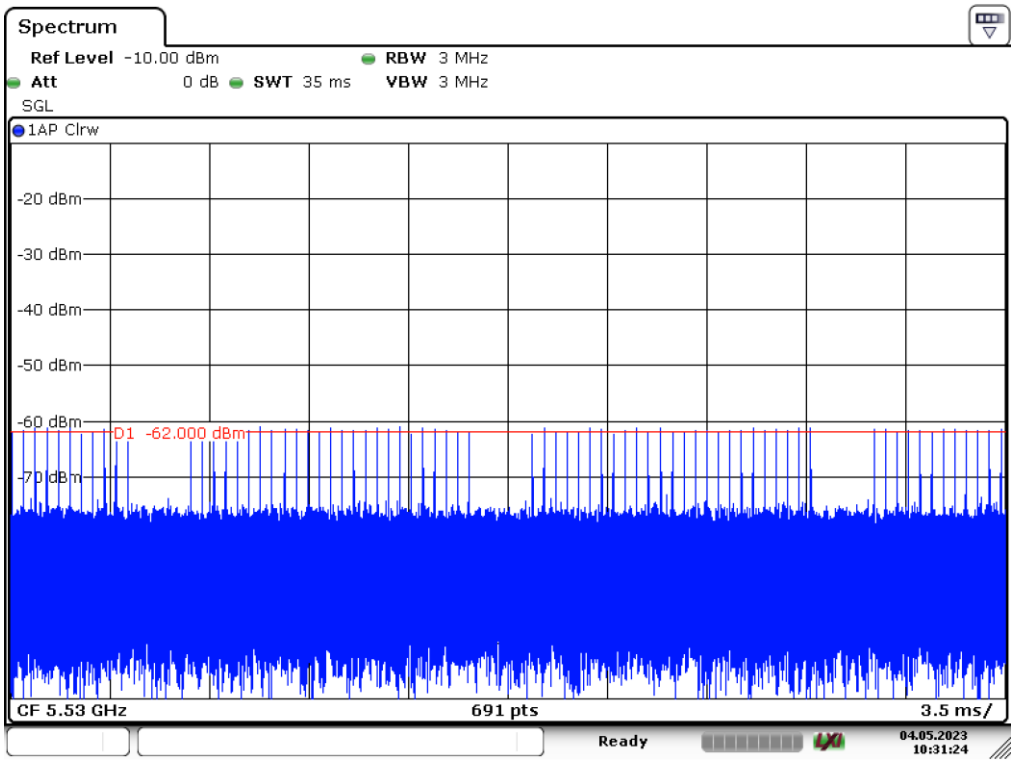



Radar Type 2 – 5530MHz

**Radar type 3**

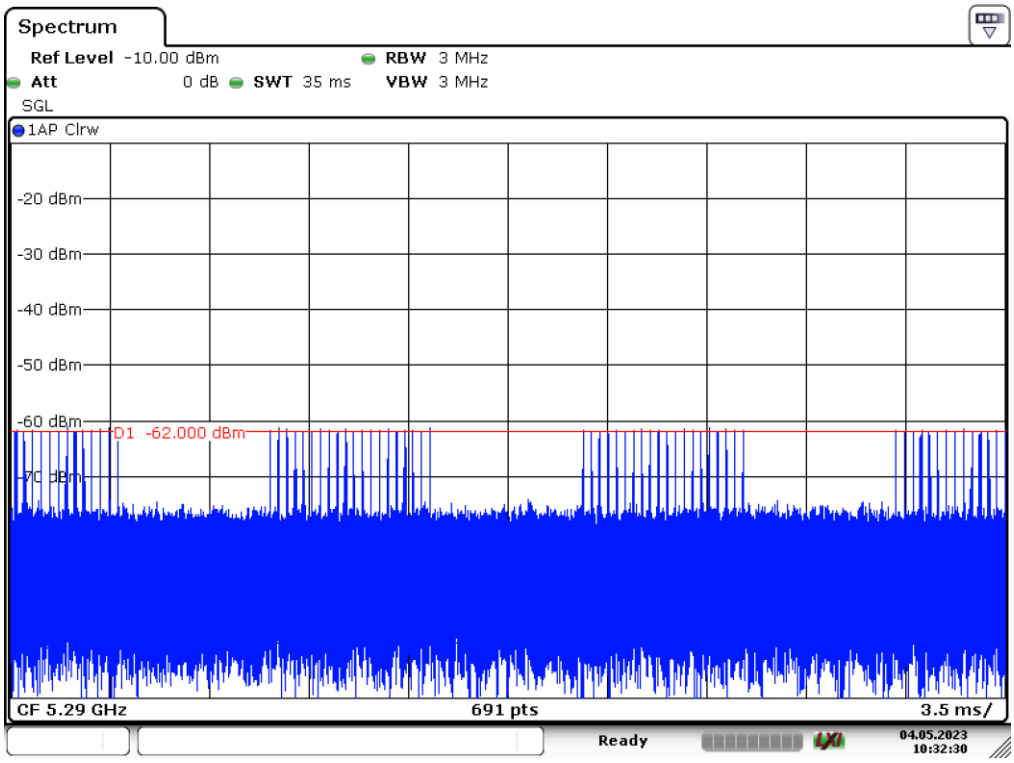



Radar Type 3 – 5290MHz

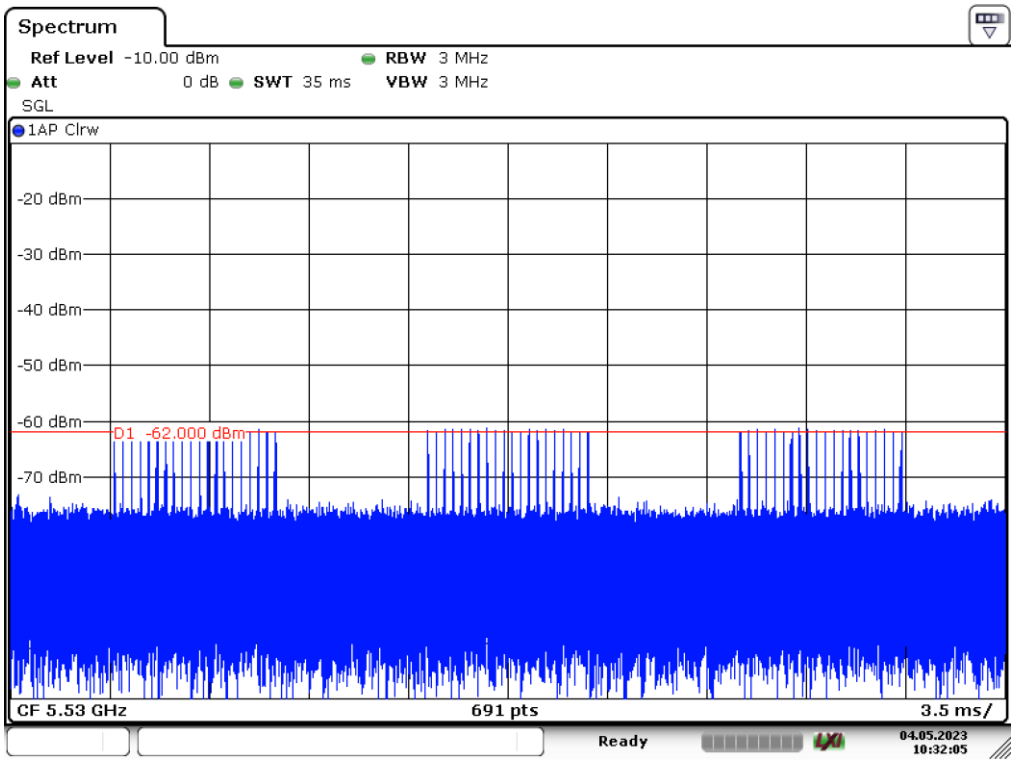



Radar Type 3 – 5530MHz

**Radar type 4**

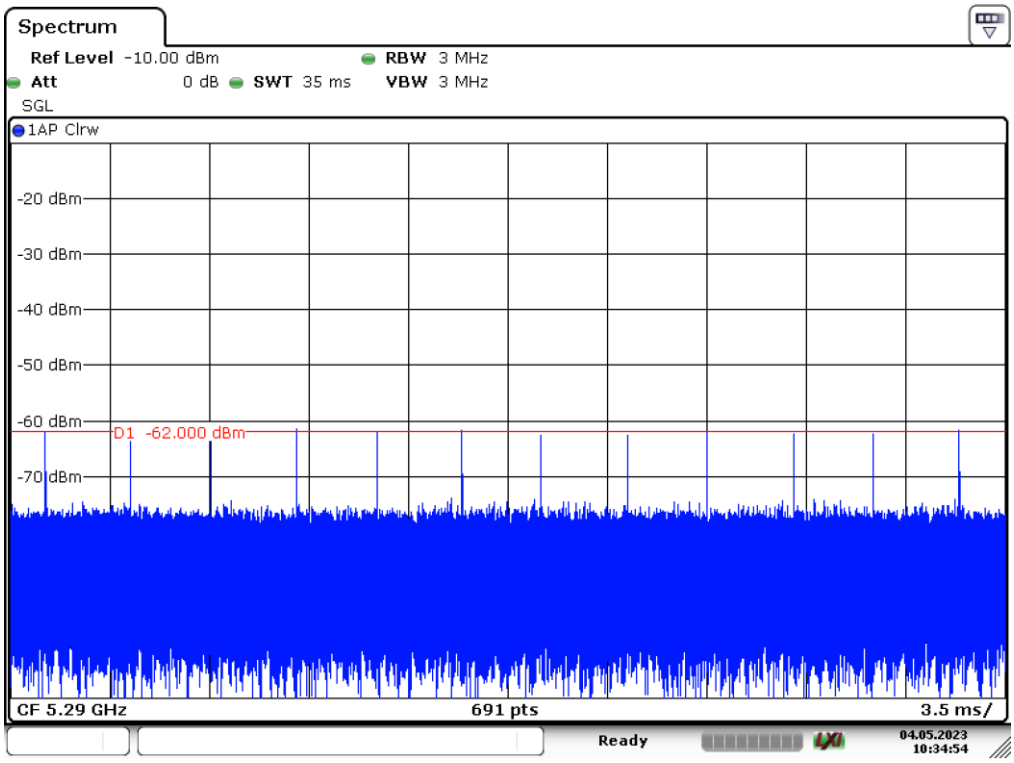



Radar Type 4 – 5290MHz

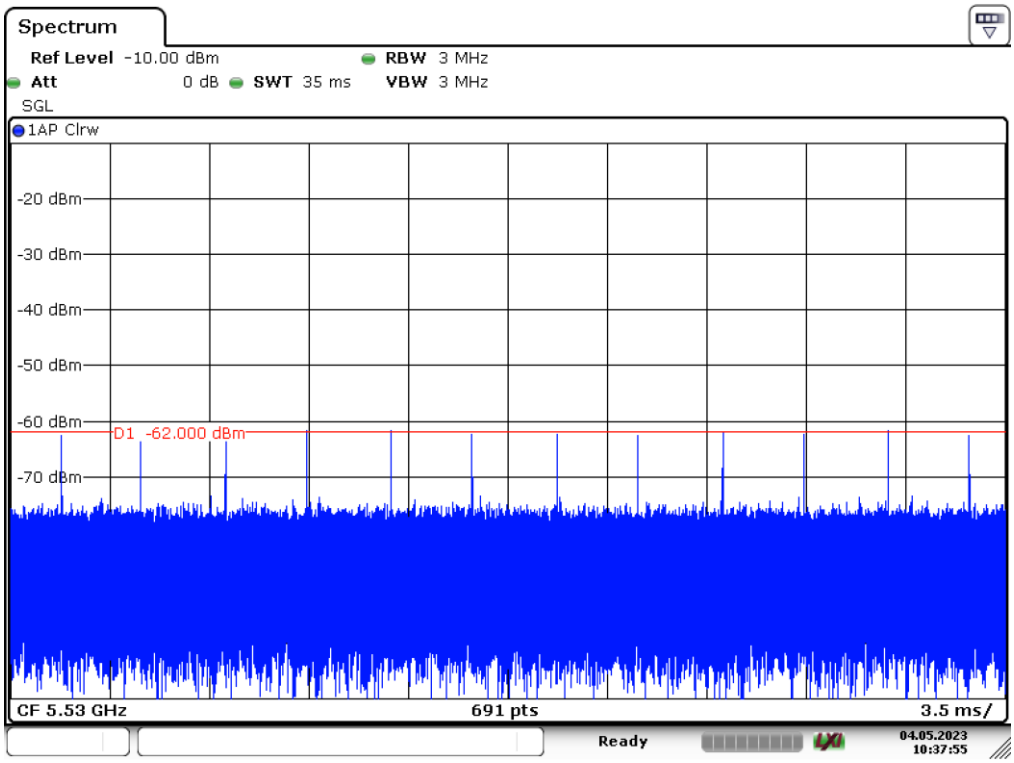



Radar Type 4 – 5530MHz

**Radar type 5**

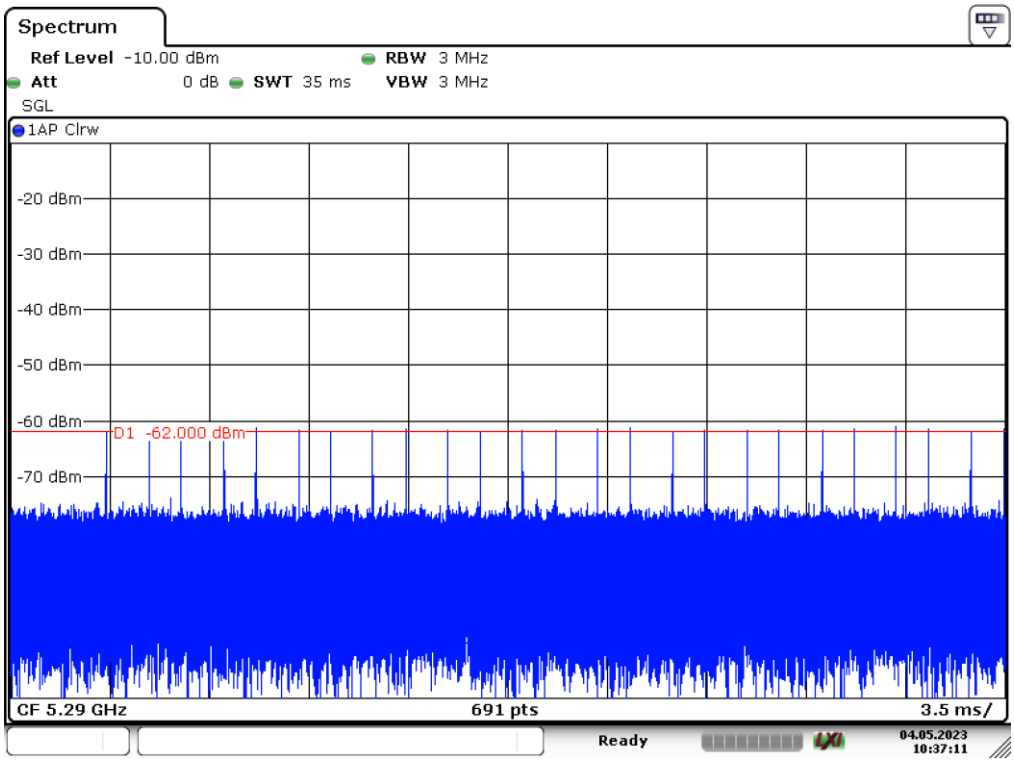



Radar Type 5 – 5290MHz

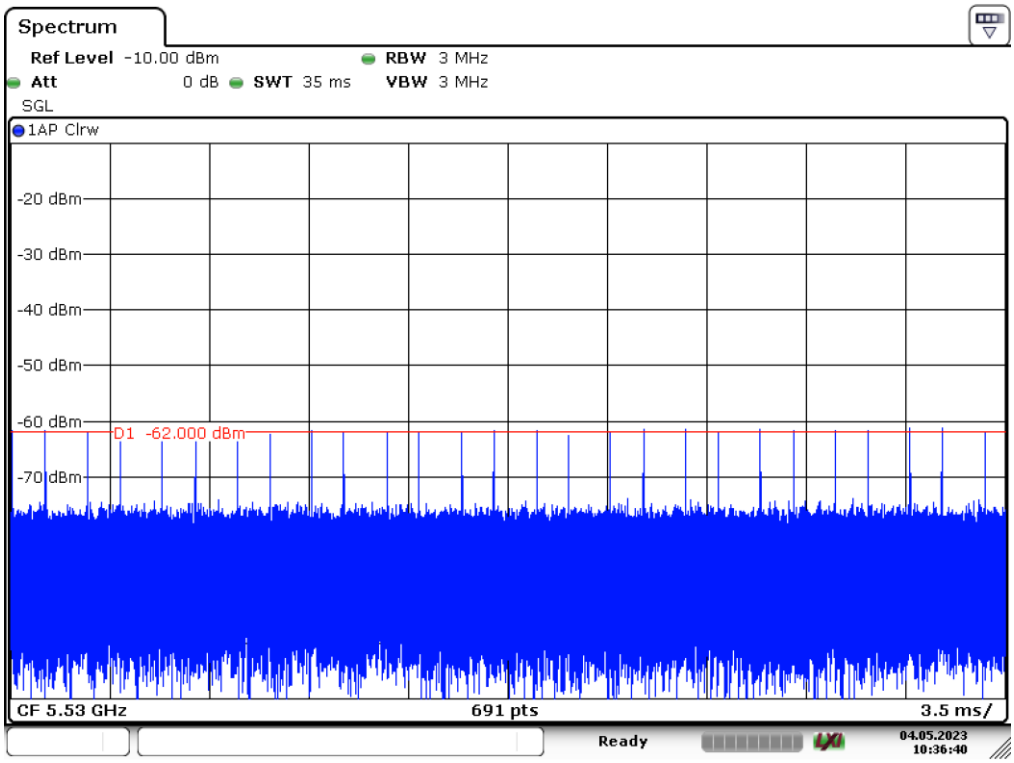



Radar Type 5 – 5530MHz

**Radar type 6**



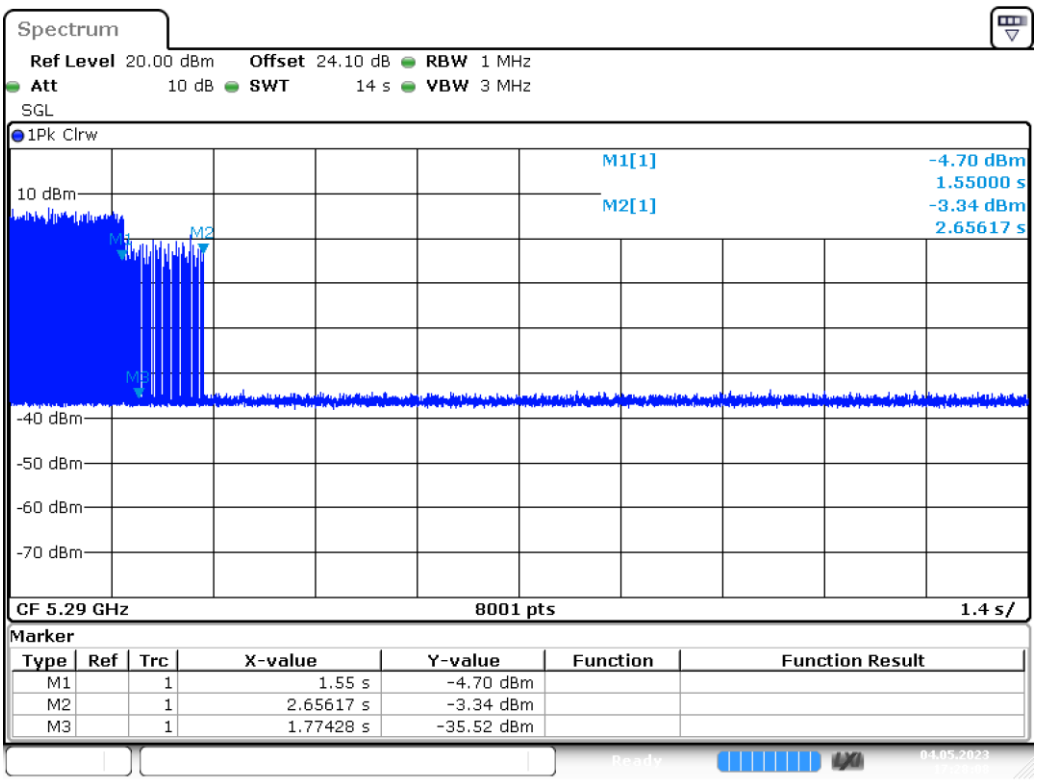

Radar Type 6 – 5290MHz



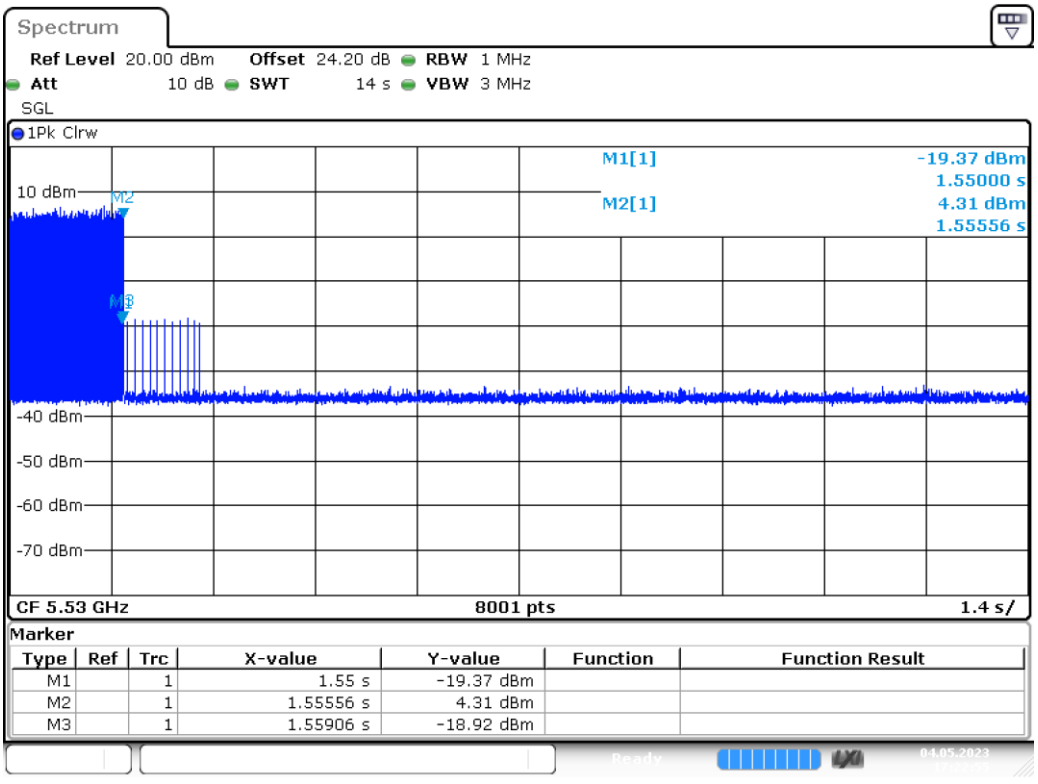

Radar Type 6 – 5530MHz

# 4. U-NII DFS Rule Requirements

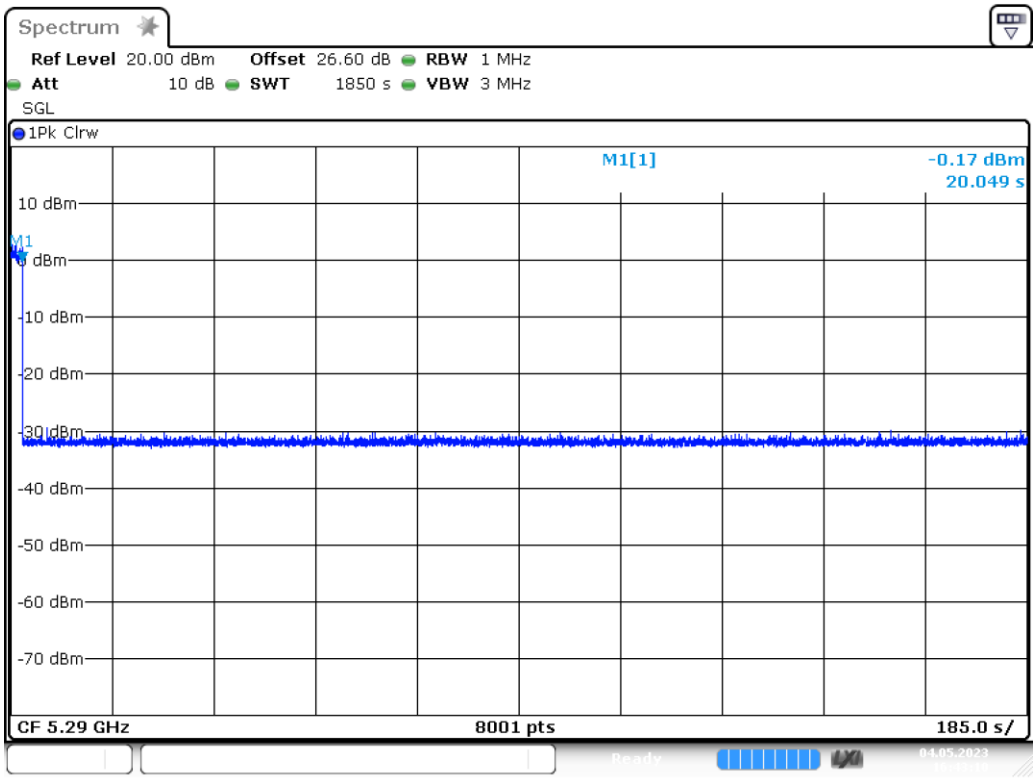
| Test Item | Operation Channel | Test Result | Limit | Result |
|---|---|---|---|---|
| Channel Move Time | 58 | 1.106s | < 10s | Pass |
| Channel Closing Transmission Time | | 304.462ms | < 260ms | Pass |
| Non-Occupancy period | | ≥ 30 | ≥ 30min | Pass |
| Channel Move Time | 106 | 0.006s | < 10s | Pass |
| Channel Closing Transmission Time | | 10.499ms | < 260ms | Pass |
| Non-Occupancy period | | ≥ 30 | ≥ 30min | Pass |




80MHz_5290_Closing Transmission Time and Channel Move Time




80MHz_5530_Closing Transmission Time and Channel Move Time

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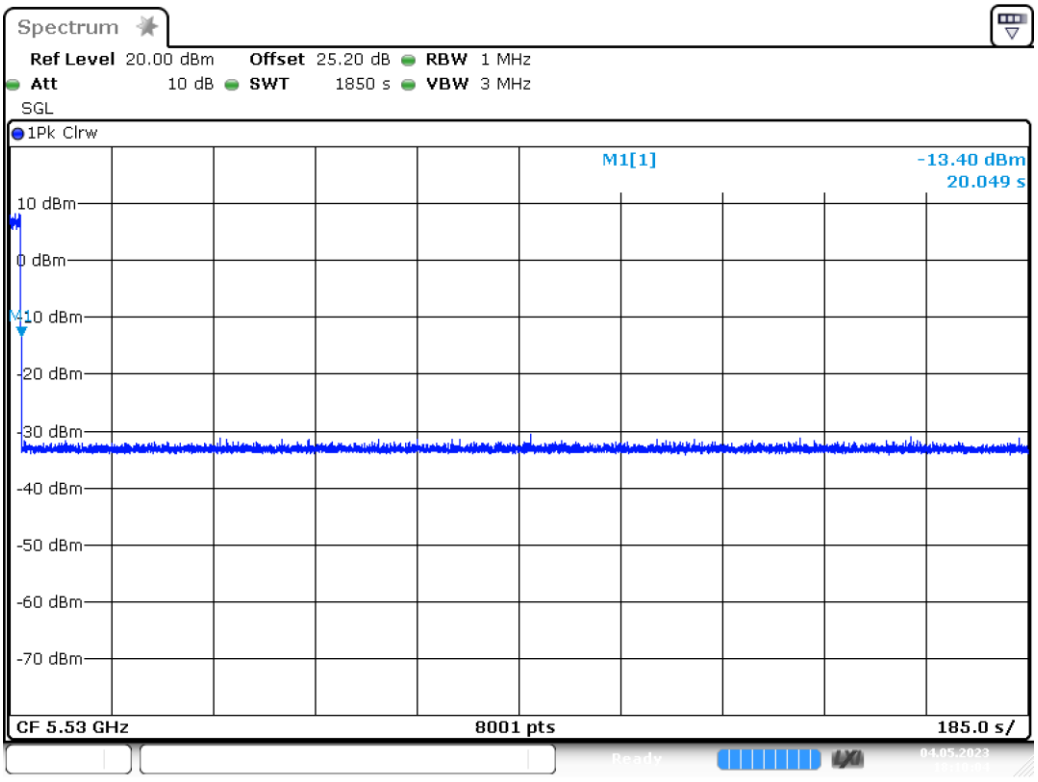
80MHz_5290_Non Occupancy Period

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80MHz_5530_Non Occupancy Period

# 5. U-NII DFS Rule Requirements

| DFS Test System | | | | | | |
|---|---|---|---|---|---|---|
| No. | Equipment Name | Serial No. | Model No. | Manufacturer | Cal Date | Due Date |
| 1 | Spectrum Analyzer | A140801886 | FSV-40 | R&S | 2022.12.13 | 2023.12.12 |
| 2 | Vector Signal Generator | A130901494 | SMBV100A | R&S | 2023.02.20 | 2024.02.19 |

| Support Unit used in test configuration and system | | | |
|---|---|---|---|
| Equipment | Brand Name | Model Name | FCC ID |
| WLAN AP | ASUS | GT-AXE11000 | MSQ-RTAXJF00 |
| Notebook | HP | TPN-Q221 | N/A |

** END OF REPORT **