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Test report No:
2210511R-RF-US-P09V02

Dynamic Frequency Selection (DFS) Test Report
FCC Part15 Subpart E

Product Name	Tele-matic Control Unit
Model and /or type reference	SRTL-NA
FCC ID	2A673-SRTL-TCU
IC	30545-SRTLTCU
Applicant´s name / address	SiRun (Wuxi) Technology Co., Ltd. 2501, Swan Tower, Wuxi Software Park, Xinwu District,Wuxi City, Jiangsu Province, China
Test method requested, standard	FCC CFR Title 47 Part 15 Subpart E Section 15.407 ANSI C63.10: 2013 FCC OET Order 16-24A1 (2016) KDB 905462 D02 v02 RSS-247 Issue 2
Verdict Summary	IN COMPLIANCE
Documented by (name / position & signature)	Tim Cao/Project Manager
Approved by (name / position & signature)	Jack Zhang/ Manager
Date of issue	2023-05-12
Report Version	V1.0
Report template No	Template_FCC Part 15E-RF-V1.0

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COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.
In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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GENERAL CONDITIONS

Test Location	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Date(receive sample)	Jan. 18, 2022
Date (start test)	Apr. 11, 2022
Date (finish test)	Apr. 28, 2022

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT : Equipment Under Test
QP : Quasi-Peak
CAV : CISPR Average
AV : Average
CDN : Coupling Decoupling Network
SAC : Semi-Anechoic Chamber
OATS : Open Area Test Site
BW : Bandwidth
AM : Amplitude Modulation
PM : Pulse Modulation
HCP : Horizontal Coupling Plane
VCP : Vertical Coupling Plane
U_N : Nominal voltage
*T*x : Transmitter
*R*x : Receiver
N/A : Not Applicable
N/M : Not Measured

DOCUMENT HISTORY

Report No.	Version	Description	Issued Date
2210511R-RF-US-P09V02	V1.0	Initial issue of report.	2023-05-12

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with Part 15 Subpart E Paragraph 15.407.
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:

    - Chapter 1.1 General Description of the Item(s);
    - Chapter 1.2 Antenna Informaion;
    - Chapter 1.3 Channel List;

USED EQUIPMENT

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Spectrum Analyzer	Keysight	N9010A	MY55370495	2021.08.12	2022.08.11
Vector Signal Generator	Agilent	E4438C	MY49070163	2021.07.11	2022.07.10
Pre-Amplifier	SKET	LNPA_0118G-45	SK2021090101	2021.12.13	2022.12.12
Pre-Amplifier	emci	EMC184045SE	980263	2021.05.22	2022.05.21
DRG Horn	ETS-Lindgren	3117	00123988	2021.10.22	2022.10.21
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2021.04.19	2022.04.18
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2022.03.21	2023.03.20
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2022.03.21	2023.03.20
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.21	2023.03.20
EMI Receiver	R&S	ESCI	100906	2022.04.07	2023.04.06
Temperature/Humidity Meter	RTS	RTS-8S	TR1-TH	2021.07.09	2022.07.08

Instrument	Manufacturer	Type No.	Serial No
Splitter/Combiner (Qty: 2)	Mini-Circuits	ZAPD-50W 4.2-6.0 GHz	NN256400424
Splitter/Combiner (Qty: 2)	MCLI	PS3-7	4463/4464
ATT (Qty: 1)	Mini-Circuits	VAT-30+	30912
Laptop PC	Asus	N80V	8BN0AS226971468
RF Cable (Qty: 6)	Mini-Circuits	N/A	DFS-1~6
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	737
DRG Horn	ETS-Lindgren	3117	00167055

Software	Manufacturer	Function
Pulse Building	Agilent	Radar Signal Generation Software
DFS Tool	Agilent	DFS Test Software

UNCERTAINTY

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%

Test item	Uncertainty
U-NII Detection Bandwidth	± 3.9 dB
Channel Availability Check	2.0147ms
In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	2.0147ms
Statistical Performance Check	± 3.9 dB
Radiated Emission Band Edge	± 3.9 dB

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Product Name..... :	Tele-matic Control Unit
Model No. ..... :	SRTL-NA
Manufacturer..... :	SIRUN Tianlang (Wuxi) Technology Co., Ltd
Manufacturer address ..... :	Room 2501, Block D, Cygnus, National Software Park, Xinwu District, Wuxi City, Jiangsu Province

Wireless specifiction..... :	Wi-Fi			
Type of Modulation..... :	OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM			
Frequency Range ..... :	☒	5150MHz~5250MHz	☐	Outdoor AP
			☐	Indoor AP
			☐	Fixed point-to-point AP
			☒	Mobile and Portable Client
	☒	5250MHz~5350MHz		
	☒	5470MHz~5725MHz	☒	With TDWR Channels
			☐	Without TDWR Channels
	☒	5725MHz~5850MHz		
Date Rate ..... :	802.11a: 6/9/12/18/24/36/48/54 Mbps			
	802.11n: up to 300 Mbps			
	802.11ac: up to 866.6 Mbps			
Operate Mode ..... :	☒	Master device		
	☐	Slave device with radar detection function		
	☒	Slave device without radar detection function		
	Switch to AP using instruction: ql_wifi_work_mode_set(QL_WIFI_WORK_MODE_APO). Switch to STA using instruction: ql_wifi_work_mode_set(QL_WIFI_WORK_MODE_STA).			

Rated power supply .....:	Voltage and Frequency	
	☐	AC: 220 – 240 V, 50/60 Hz
	☐	AC: 100 – 120 V, 50/60 Hz
	☒	DC: 12V/ 24V
	☐	Battery: 3.7V
Mounting position.....:	☐	Table top equipment
	☐	Wall/Ceiling mounted equipment
	☐	Floor standing equipment
	☐	Hand-held equipment
	☒	Other: vehicle-mounted equipment

1.2 Antenna Information

Antenna model / type number..... :	N/A			
Antenna serial number ..... :	N/A			
Antenna Delivery ..... :	☒	1TX + 1RX		
	☐	2TX + 2RX		
	☐	3TX + 3RX		
	☐	4TX + 4RX		
	☐	Others:……		
Antenna technology..... :	☒	SISO		
	☐	MIMO	☐	CDD
			☐	Beam-forming
SISO Antenna Gain..... :	1.5 dBi			

1.3 Channel List

802.11a/n/ac (20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz	48	5240 MHz
52	5260 MHz	56	5280 MHz	60	5300 MHz	64	5320 MHz
100	5500 MHz	104	5520 MHz	108	5540 MHz	112	5550 MHz
116	5580 MHz	120	5600 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz	144	5720 MHz
149	5745 MHz	153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz						
802.11n/ac (40MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz	62	5310 MHz
102	5510 MHz	110	5550 MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	151	5755 MHz	159	5795 MHz	N/A	N/A
802.11ac (80MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530MHz	122	5610 MHz
155	5775 MHz	N/A	N/A	N/A	N/A	N/A	N/A

Note 1: The General Description of the Item, antenna information and Channel List in clause 1 are provided and confirmed by the client.

1.4 Operating mode(s) used for tests

Test mode used during test	
Mode	Channel
802.11a	5500 MHz
802.11ac(40MHz)	5510 MHz
802.11ac(80MHz)	5530 MHz

1.5 Overview of results

Test Item	
Performed Test Item	**Verdict**
Channel Availability Check	Pass
U-NII Detection Bandwidth	Pass
Statistical Performance Check	Pass
Channel Closing Transmission Time	Pass
Channel Move Time	Pass
Non-Occupancy Period	Pass

2 DFS DETECTION THRESHOLD AND RESPONSE REQUIREMENT

2.1 Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
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	-62 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.	

2.2 DFS Response requirement values

Parameter	Value
Non-Occupancy Period	Minimum 30 minutes
Channel Availability Check Time	60 Seconds
Channel Move Time	10 Seconds (See Note1)
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.	

3 RADAR WAVE PARAMETERS

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	Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{PRI_{\mu sec}}\right)\right\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μ sec, with a minimum increment of 1 μ sec, excluding PRI values selected in Test A			
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 usec is selected, the number of pulses would be = Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot10^6}{3066}\right)\right\}$ = Roundup{17.2} = 18.

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.

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

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for theLong Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

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.

A representative example of a Long Pulse Radar Type waveform:

1) The total test waveform length is 12 seconds.

2) Eight (8) Bursts are randomly generated for the Burst Count.

3) Burst 1 has 2 randomly generated pulses.

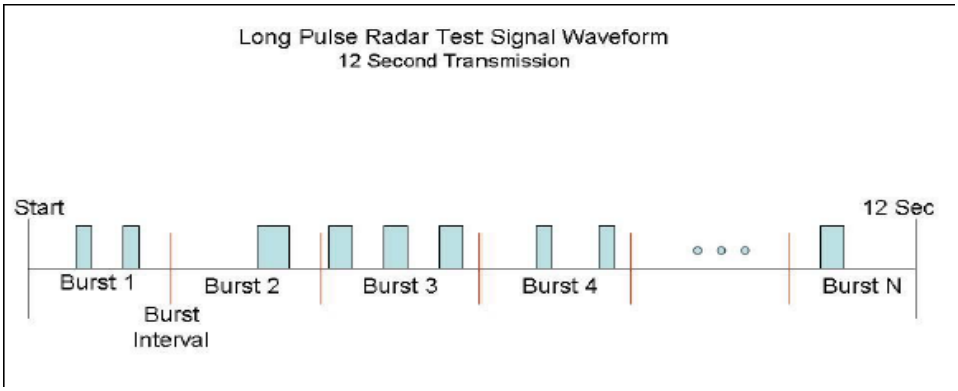
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.

5) The PRI is randomly selected to be at 1213 microseconds.

6) Bursts 2 through 8 are generated using steps 3 – 5.

7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecondrange).

Figure 1 provides a graphical representation of the Long Pulse Radar Test Waveform.



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

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: 4

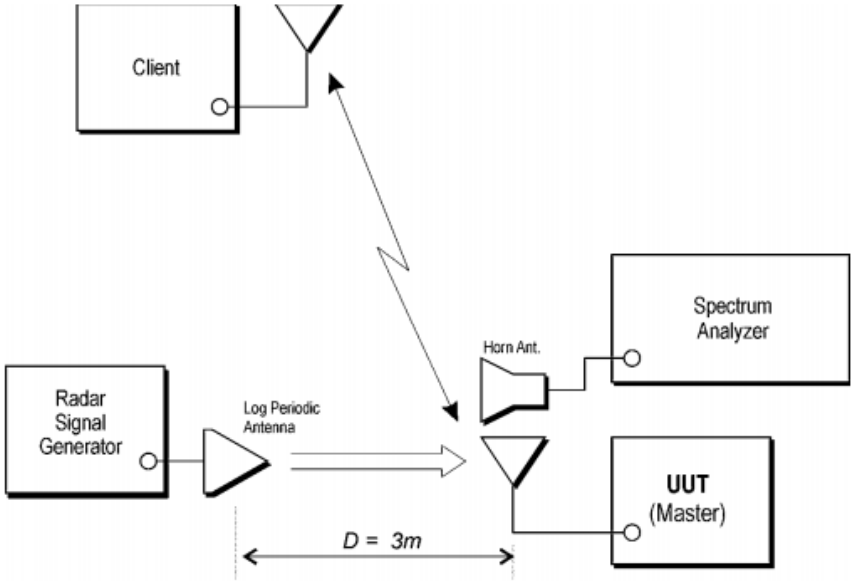
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

4 TEST SETUP

Radiated Test Setup

The subsections below contain simplified block diagrams that illustrate the Radar Waveform injection path for each of the different radiated setups to be used. The basic setup is identical for all cases.

Figure 1



5 RADAR WAVEFORM CALIBRATION

1. Description of calibration setup

a. Block diagram of equipment setup, clearly identifying if a radiated or conducted method was used.

2. Description of calibration procedure

a. Verify DFS Detection Threshold levels

i. Indicate DFS Detection Threshold levels used.

ii. Consider output power range and antenna gain.

b. For the Short Pulse Radar Types, spectrum analyzer plots of the burst of pulses on the Channel frequency should be provided.

c. For the Long Pulse Radar Type, spectrum analyzer plot of a single burst (1-3 pulses) on the Channel frequency should be provided.

d. Describe method used to generate frequency hopping signal.

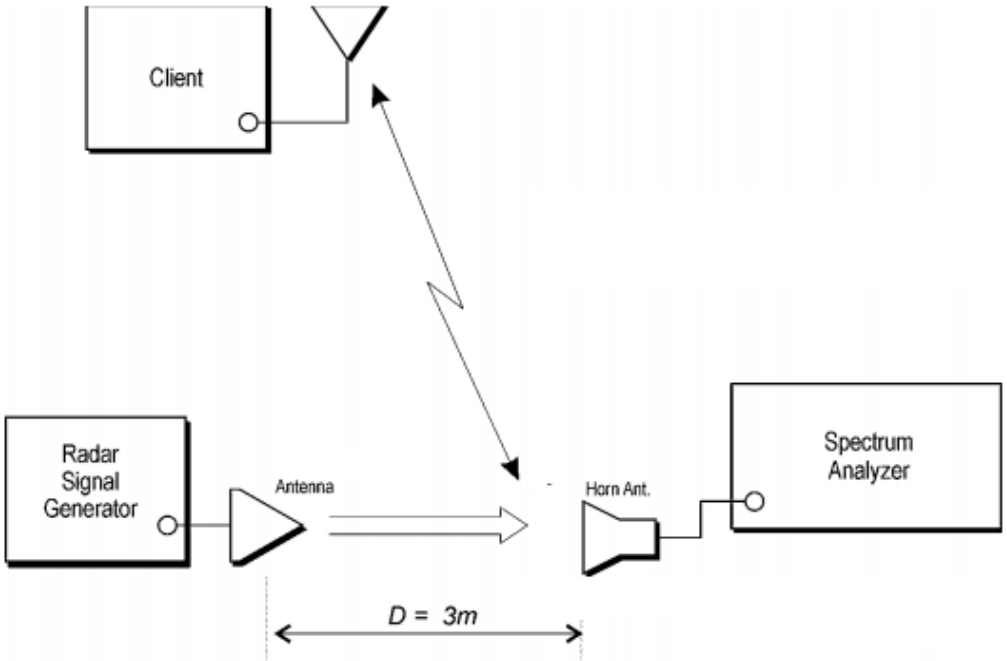
e. The U-NII Detection Bandwidth

f. For the Frequency Hopping waveform, a spectrum analyzer plot showing 9 pulses on one frequency within the U-NII Detection Bandwidth should be provided.

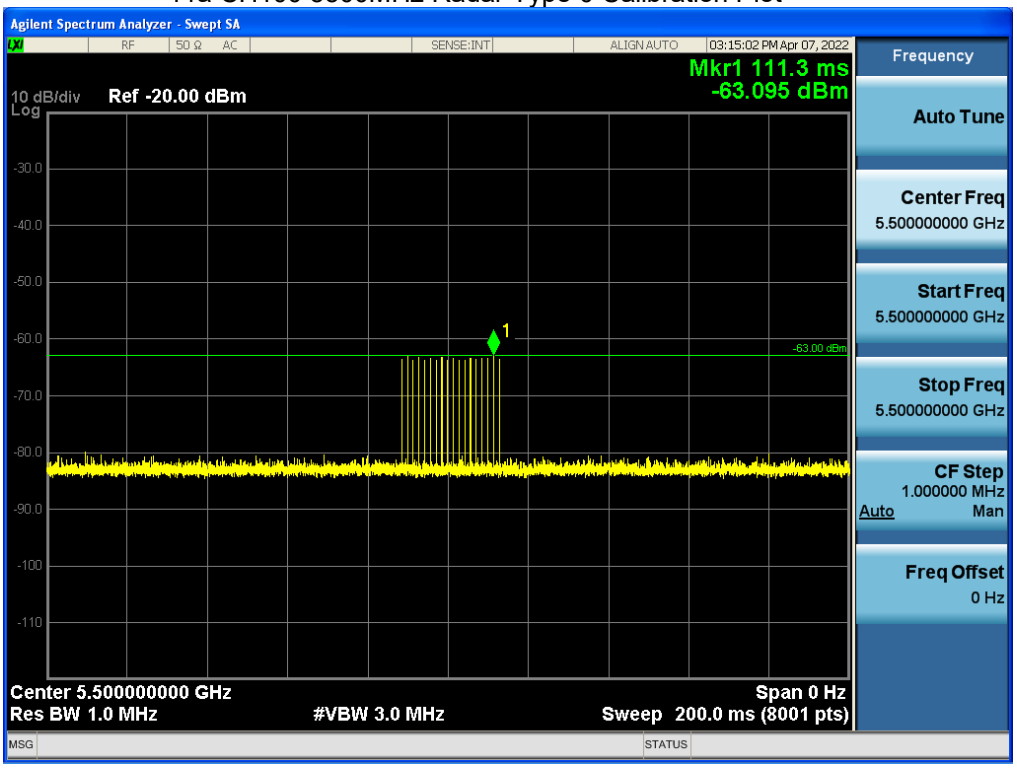
g. Verify use of vertical polarization for testing when using a radiated test method.

3. When testing a Client Device with radar detection capability, verify that the Client Device is responding independently based on the Client Device's self-detection rather than responding to the Master Device. If required, provide a description of the method used to isolate the client from the transmissions from the Master Device to ensure Client Device self detection of the Radar Waveform.

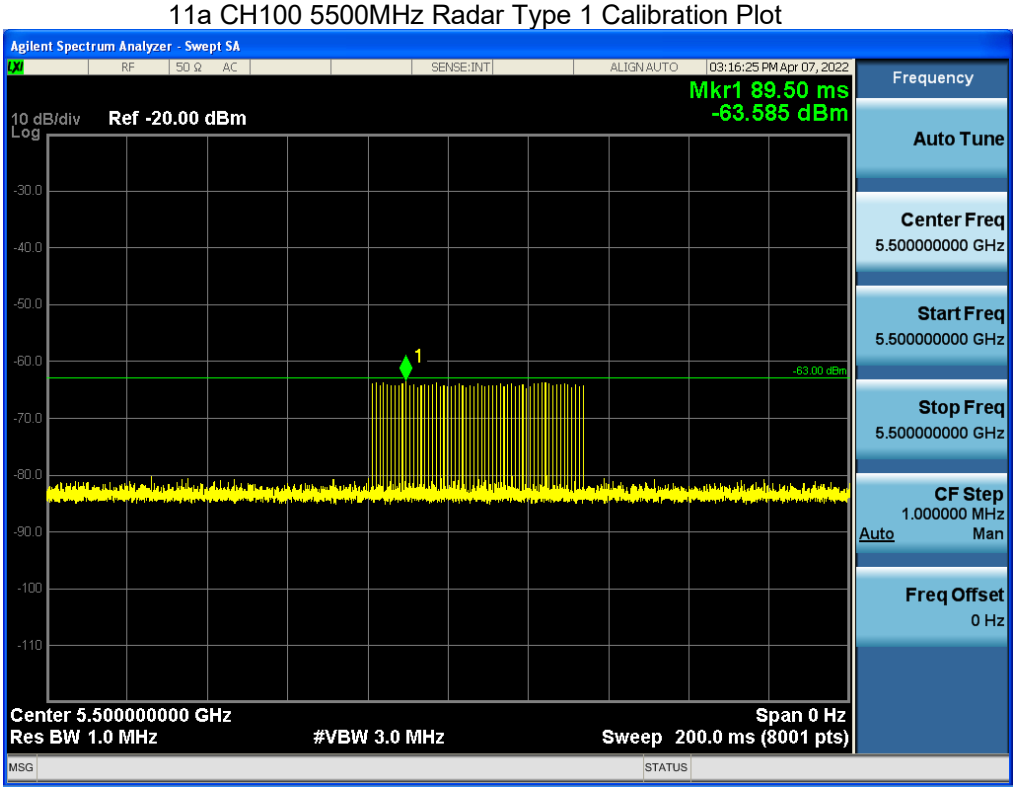
Figure 2: Radiated Calibration Setup



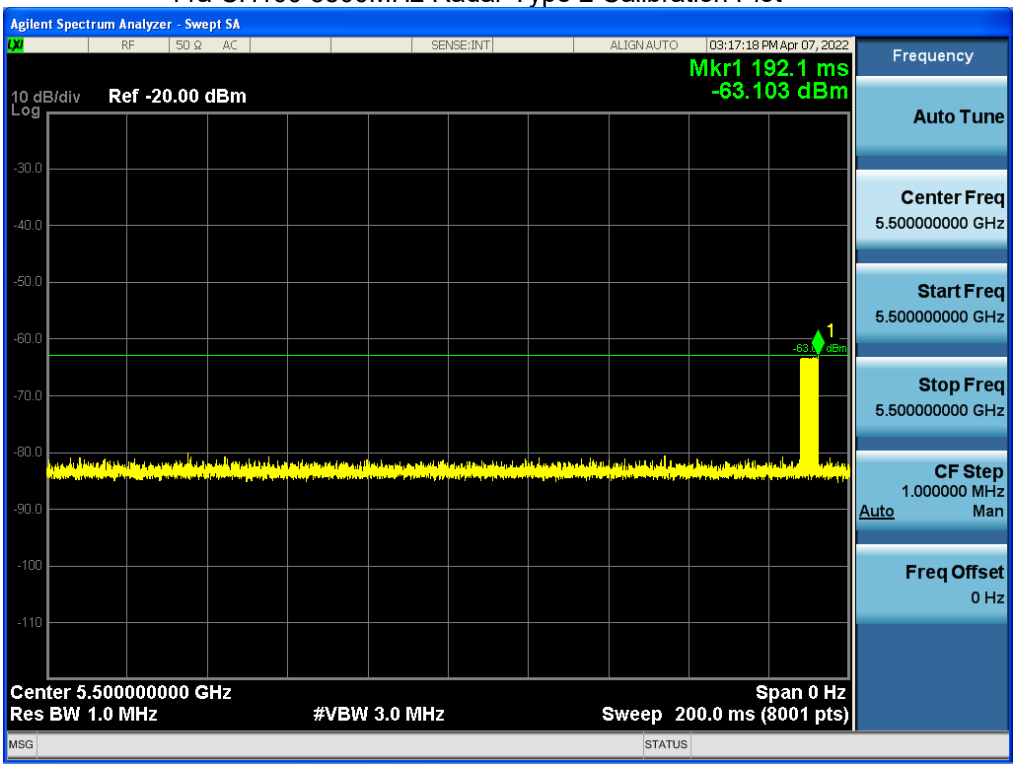
11a CH100 5500MHz Radar Type 0 Calibration Plot



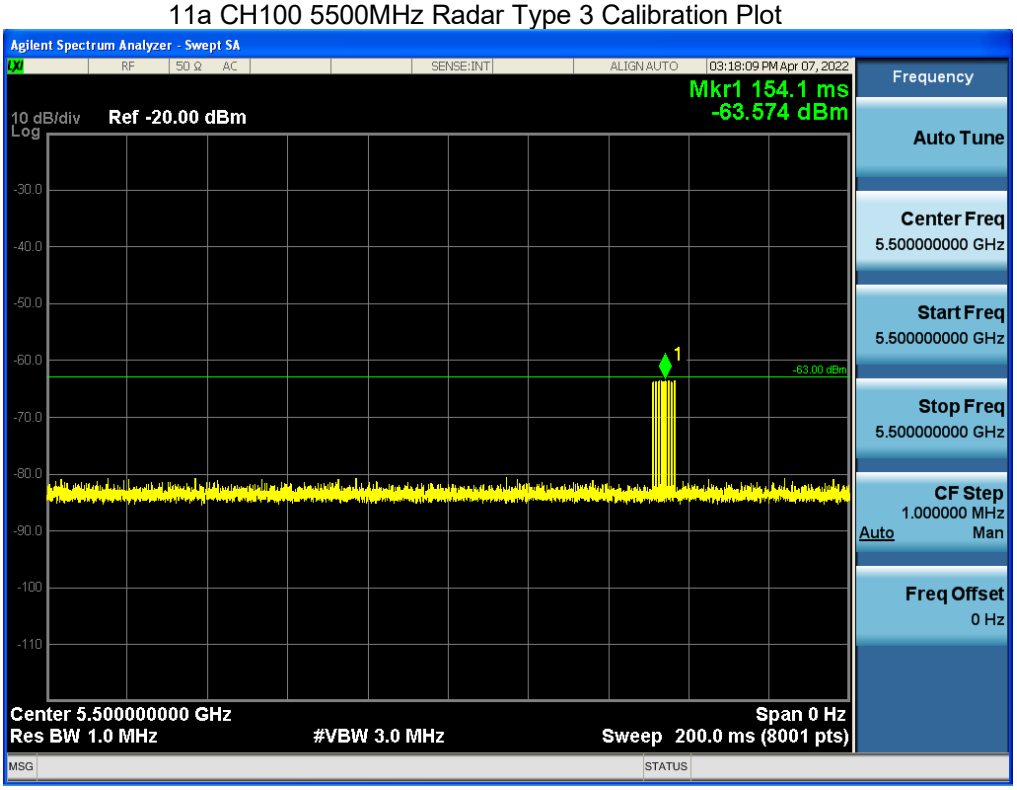
11a CH100 5500MHz Radar Type 1 Calibration Plot



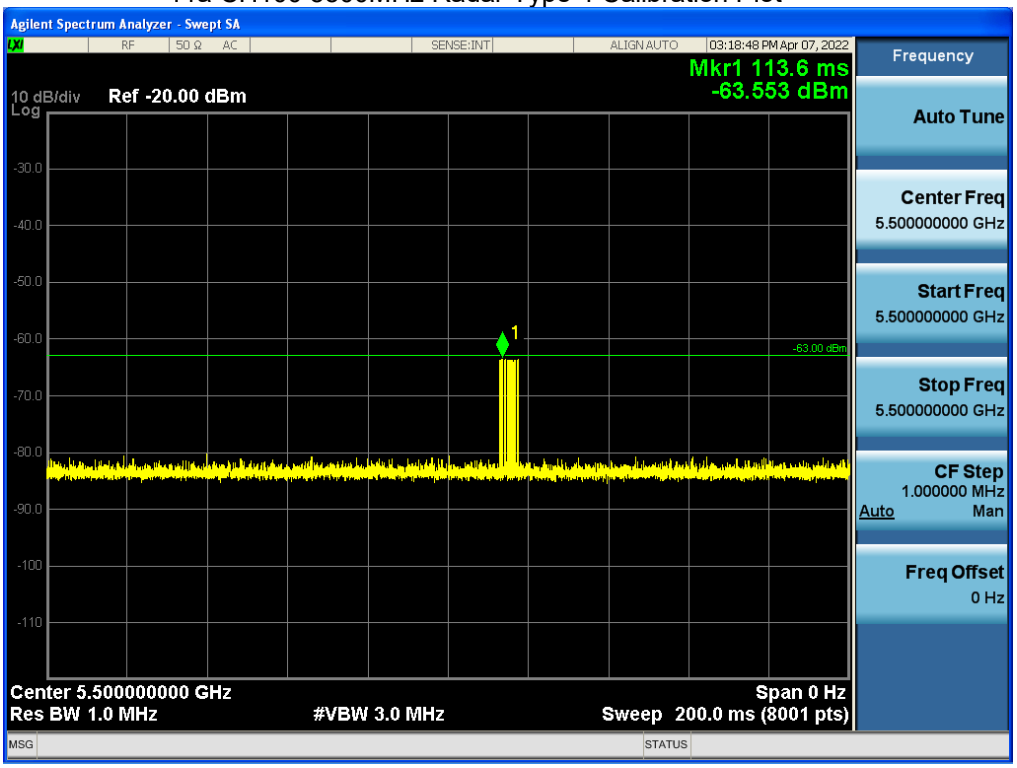
11a CH100 5500MHz Radar Type 2 Calibration Plot



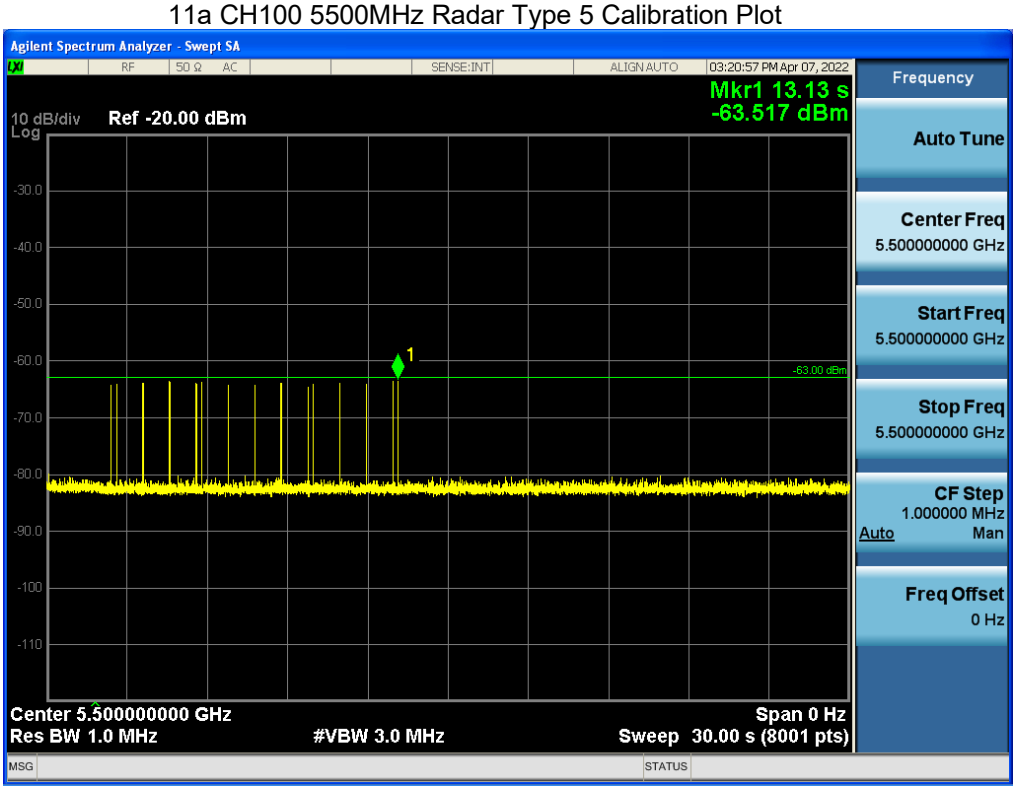
11a CH100 5500MHz Radar Type 3 Calibration Plot



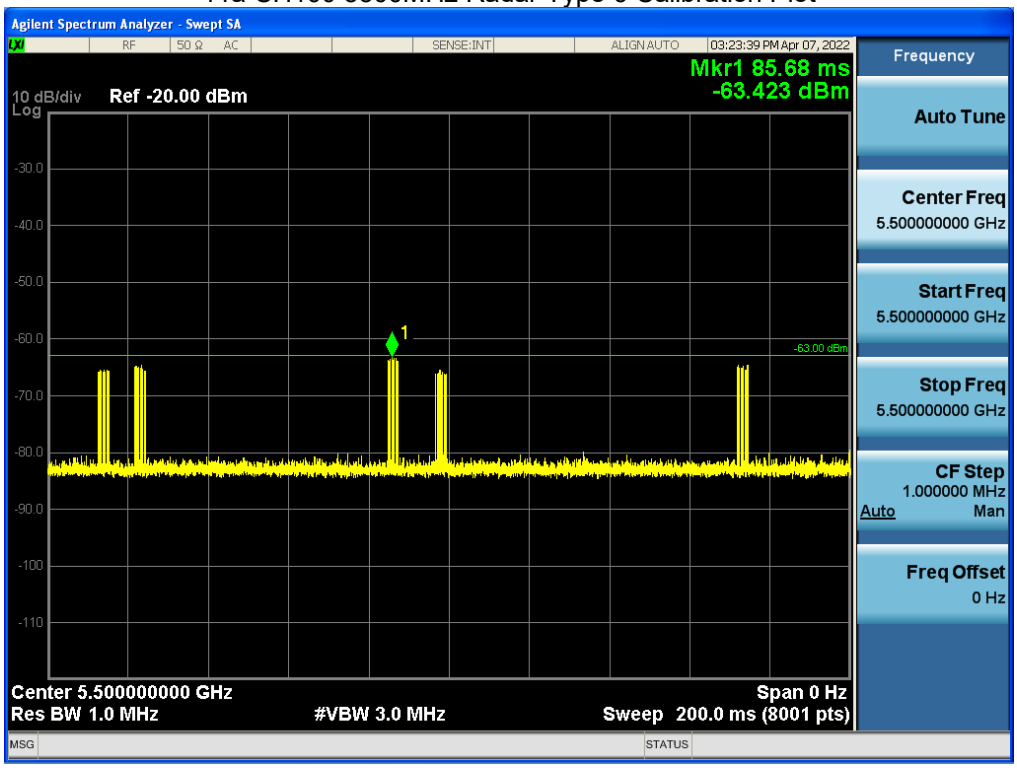
11a CH100 5500MHz Radar Type 4 Calibration Plot



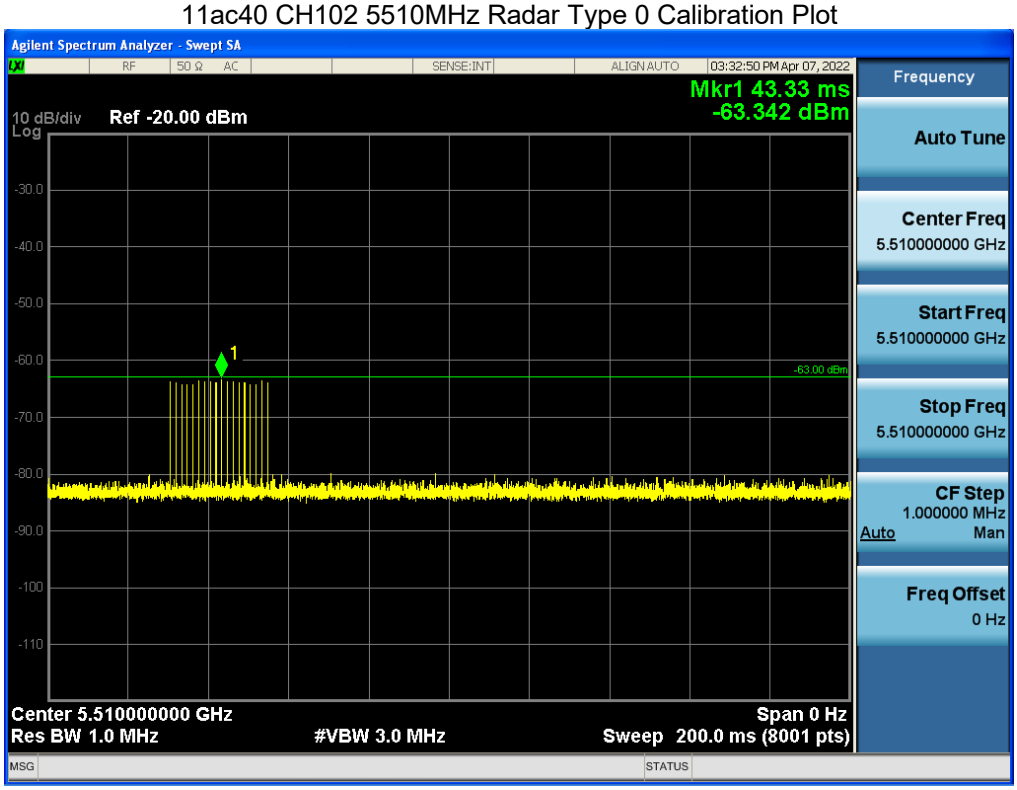
11a CH100 5500MHz Radar Type 5 Calibration Plot



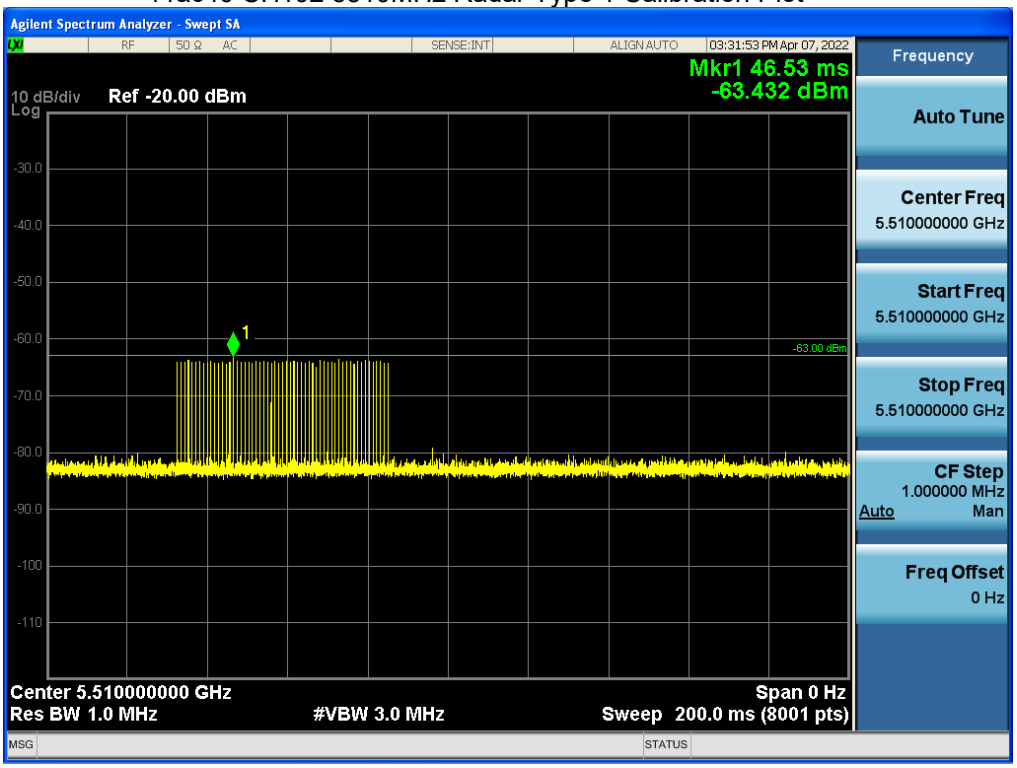
11a CH100 5500MHz Radar Type 6 Calibration Plot



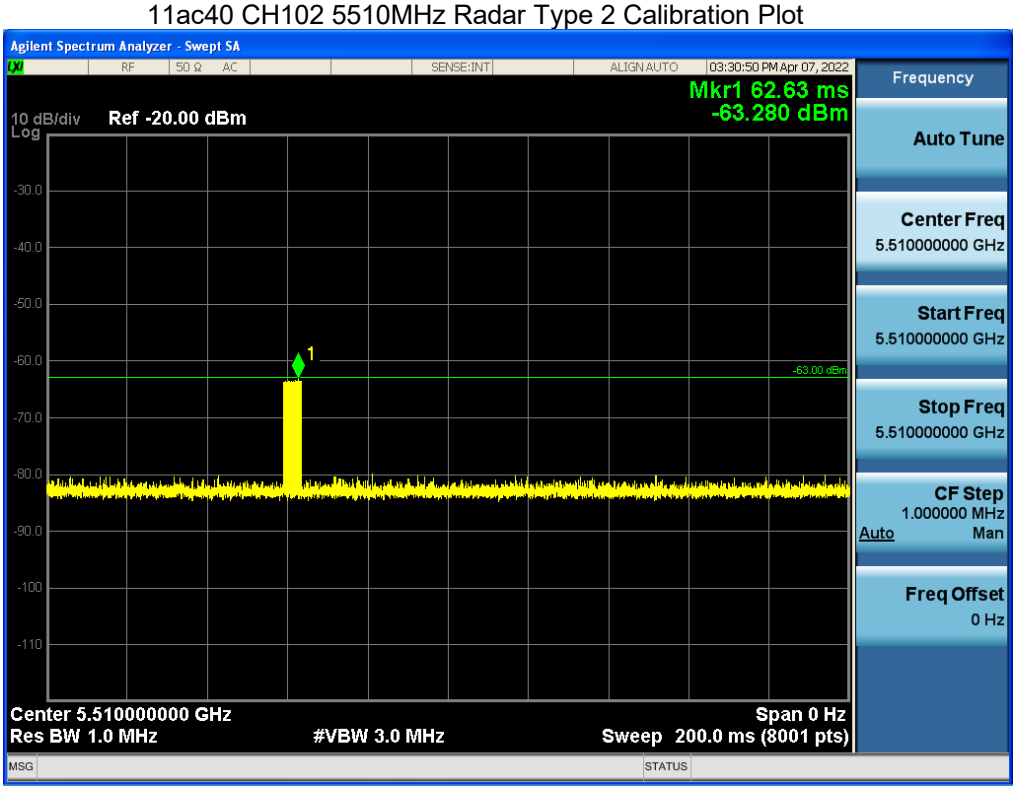
11ac40 CH102 5510MHz Radar Type 0 Calibration Plot



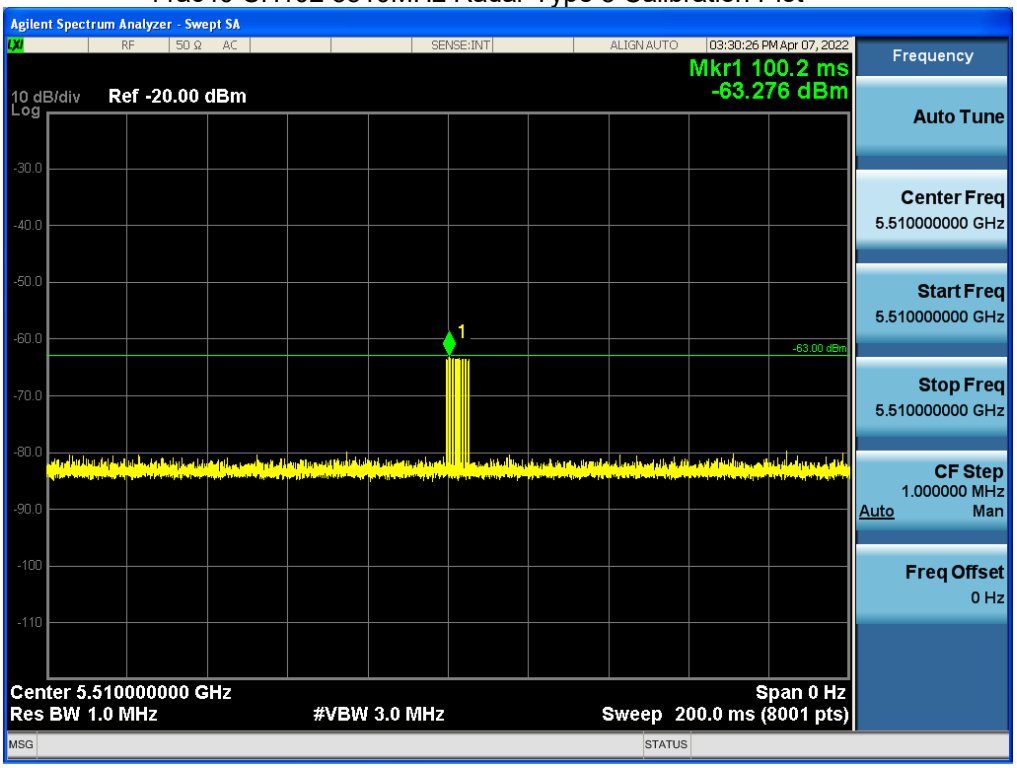
11ac40 CH102 5510MHz Radar Type 1 Calibration Plot



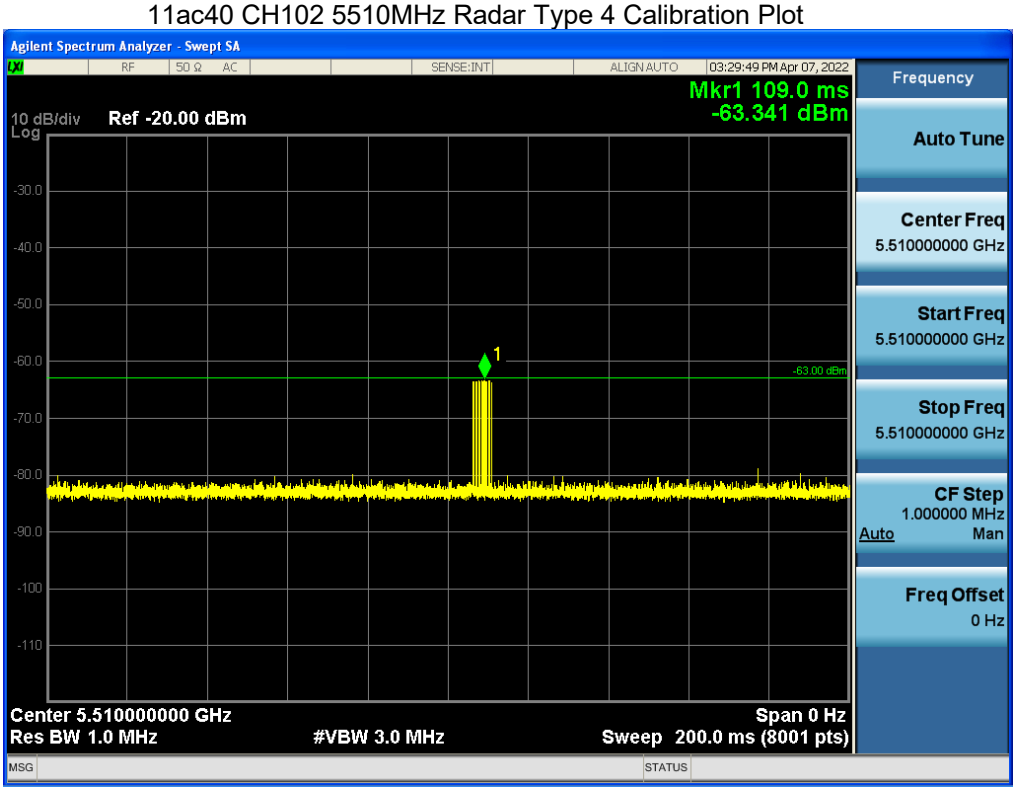
11ac40 CH102 5510MHz Radar Type 2 Calibration Plot



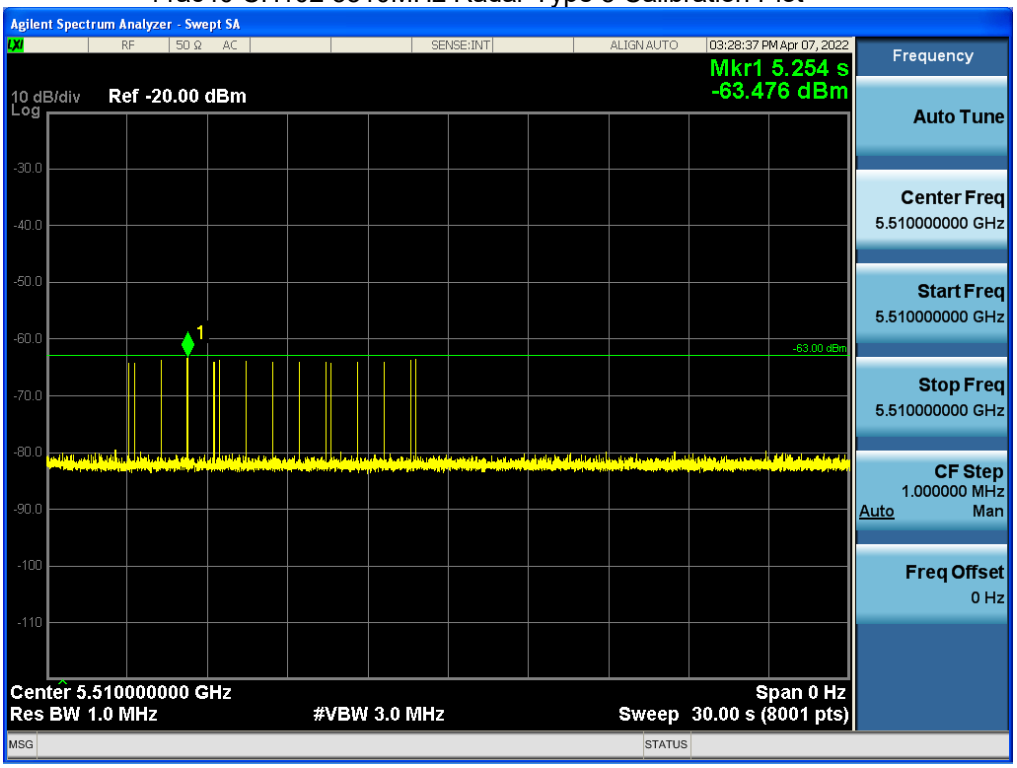
11ac40 CH102 5510MHz Radar Type 3 Calibration Plot



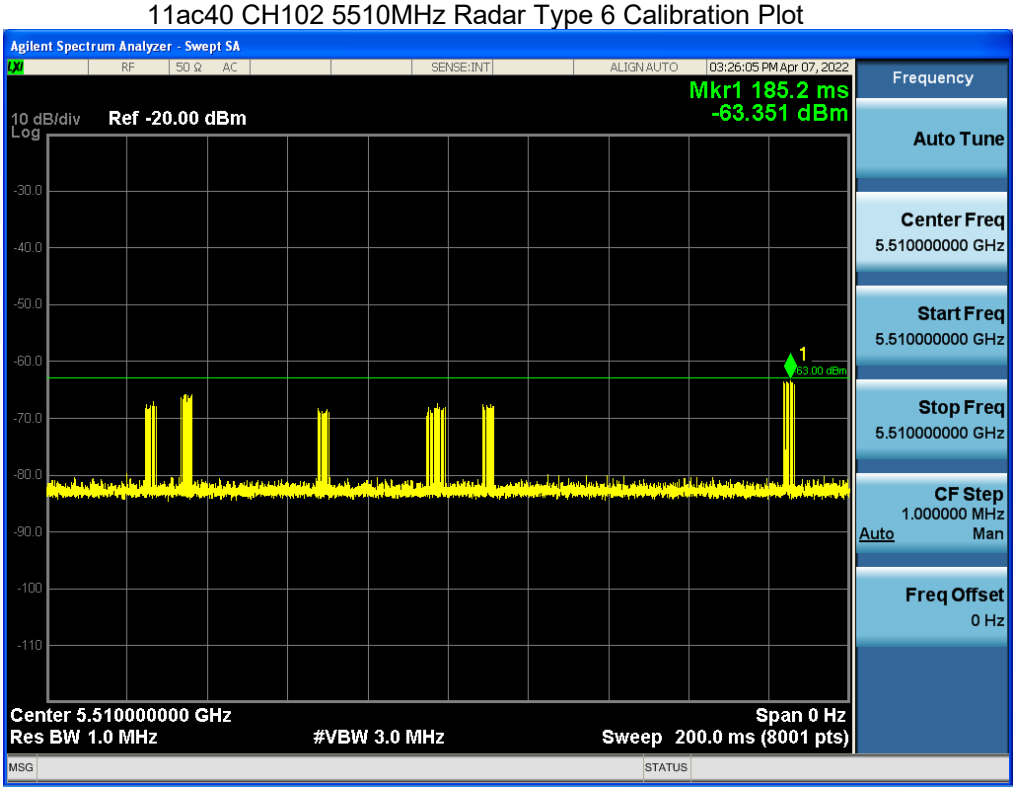
11ac40 CH102 5510MHz Radar Type 4 Calibration Plot



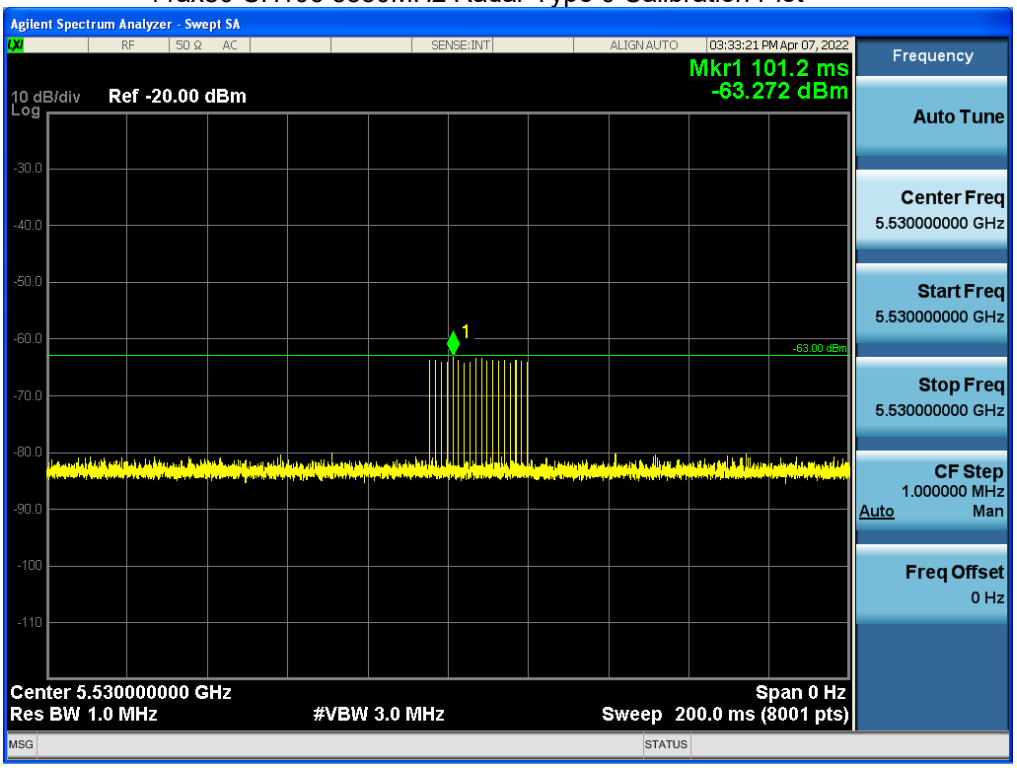
11ac40 CH102 5510MHz Radar Type 5 Calibration Plot



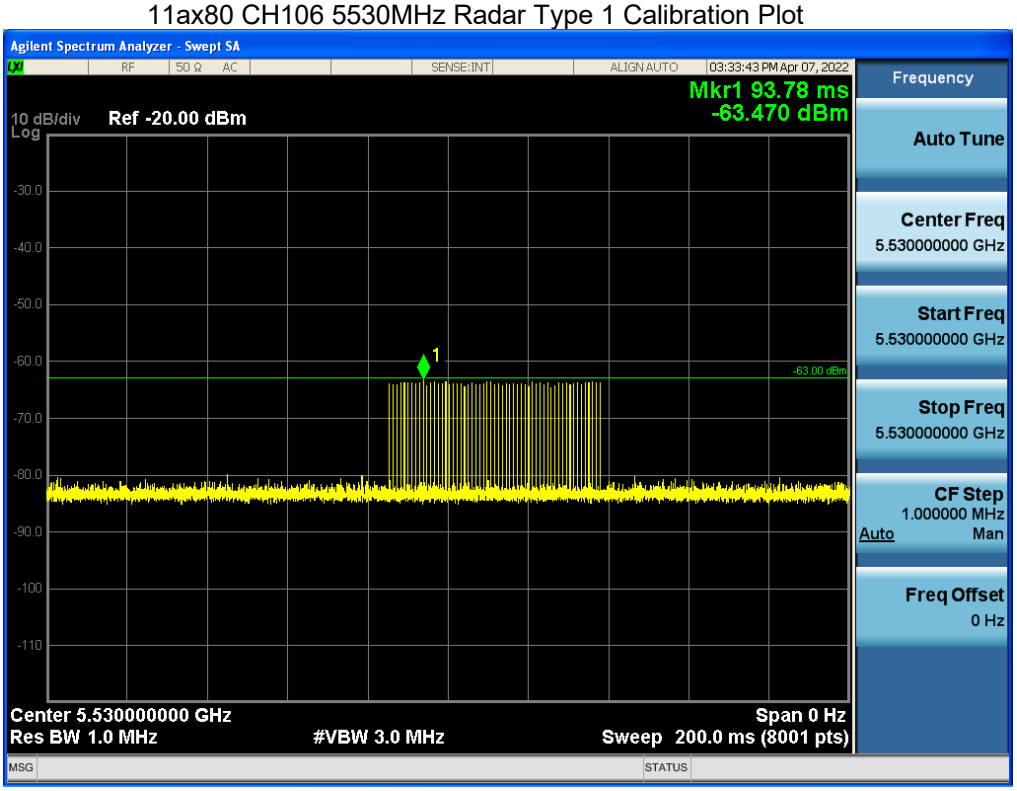
11ac40 CH102 5510MHz Radar Type 6 Calibration Plot



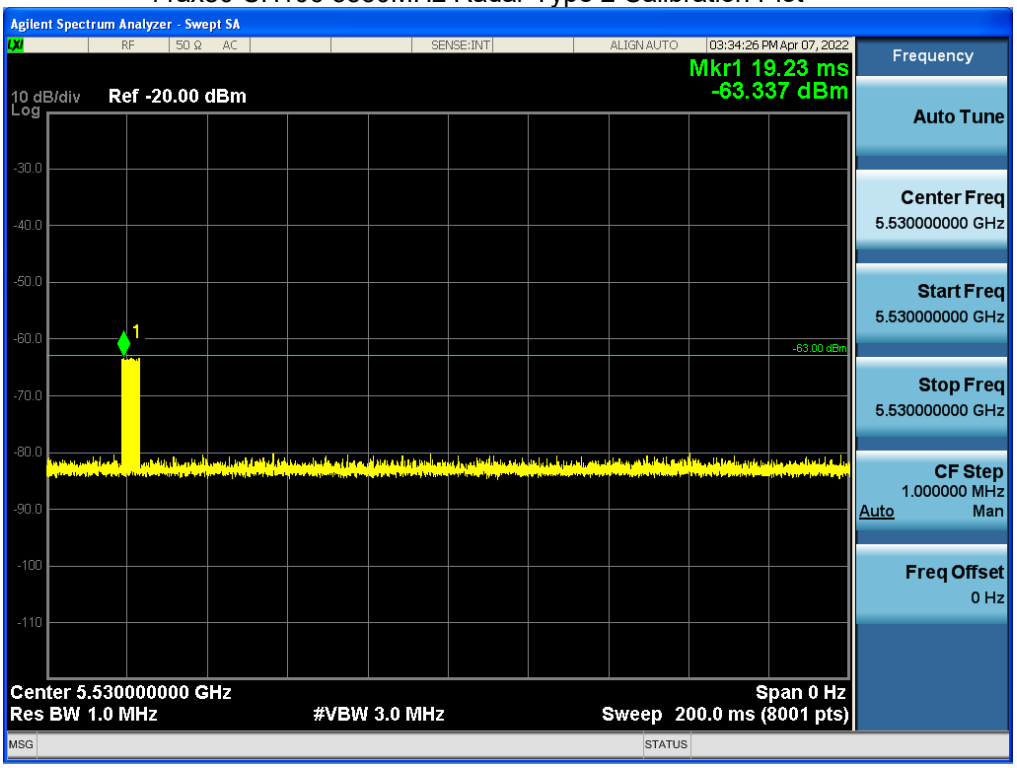
11ax80 CH106 5530MHz Radar Type 0 Calibration Plot



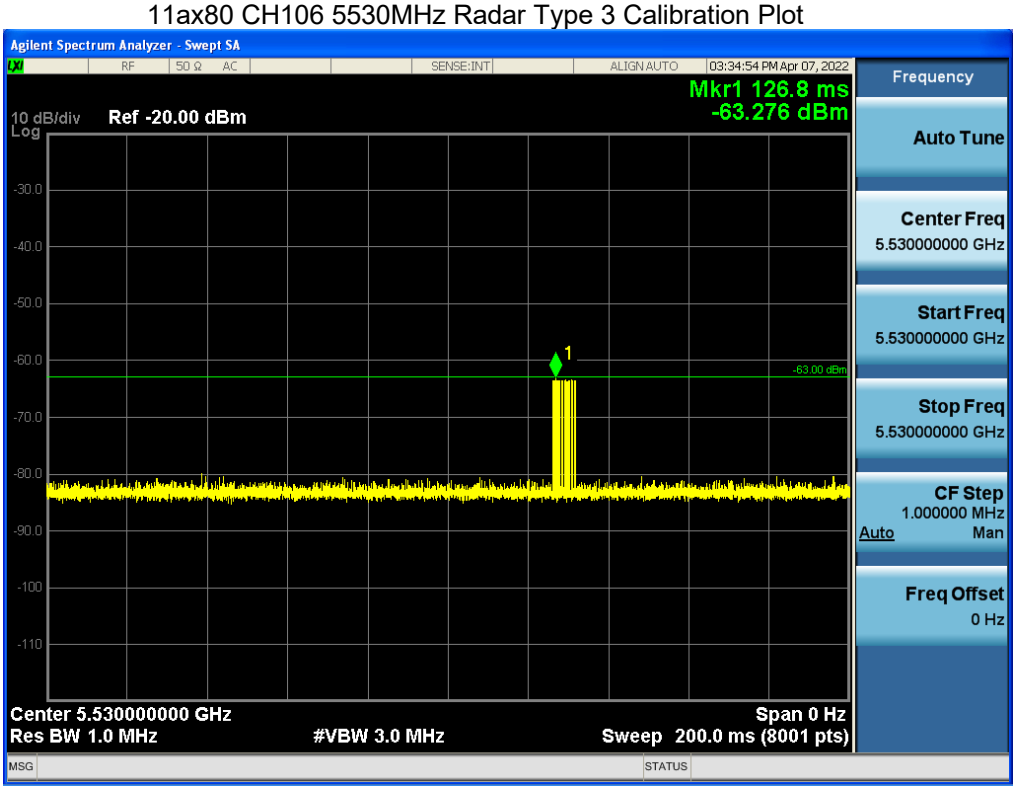
11ax80 CH106 5530MHz Radar Type 1 Calibration Plot



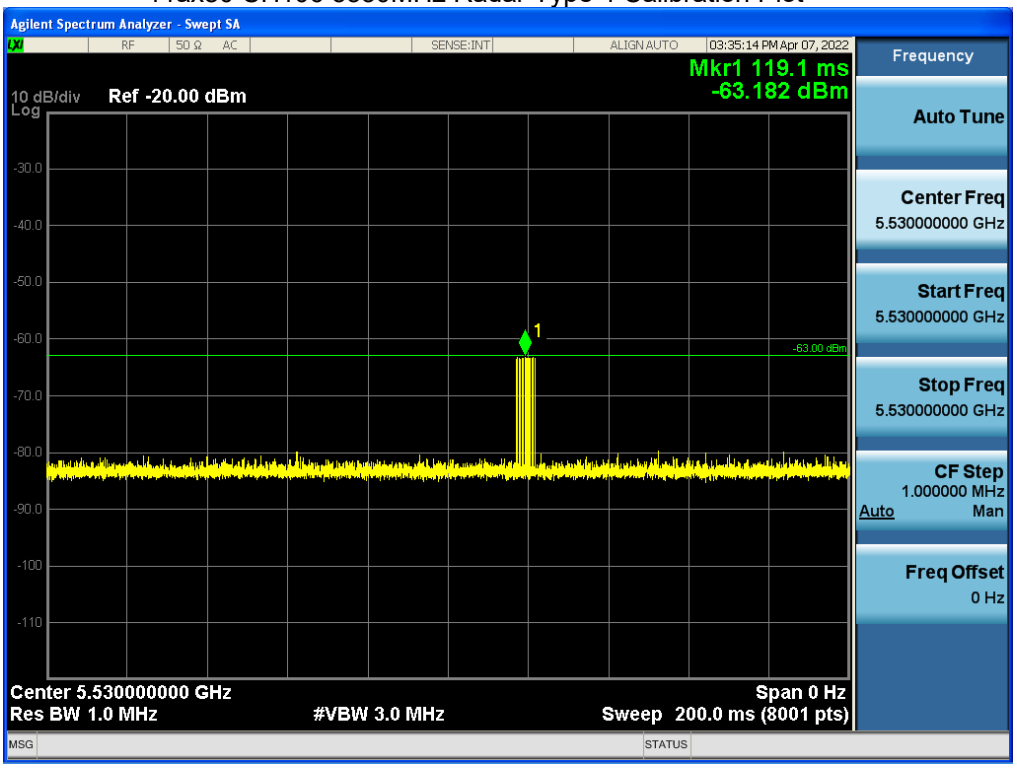
11ax80 CH106 5530MHz Radar Type 2 Calibration Plot



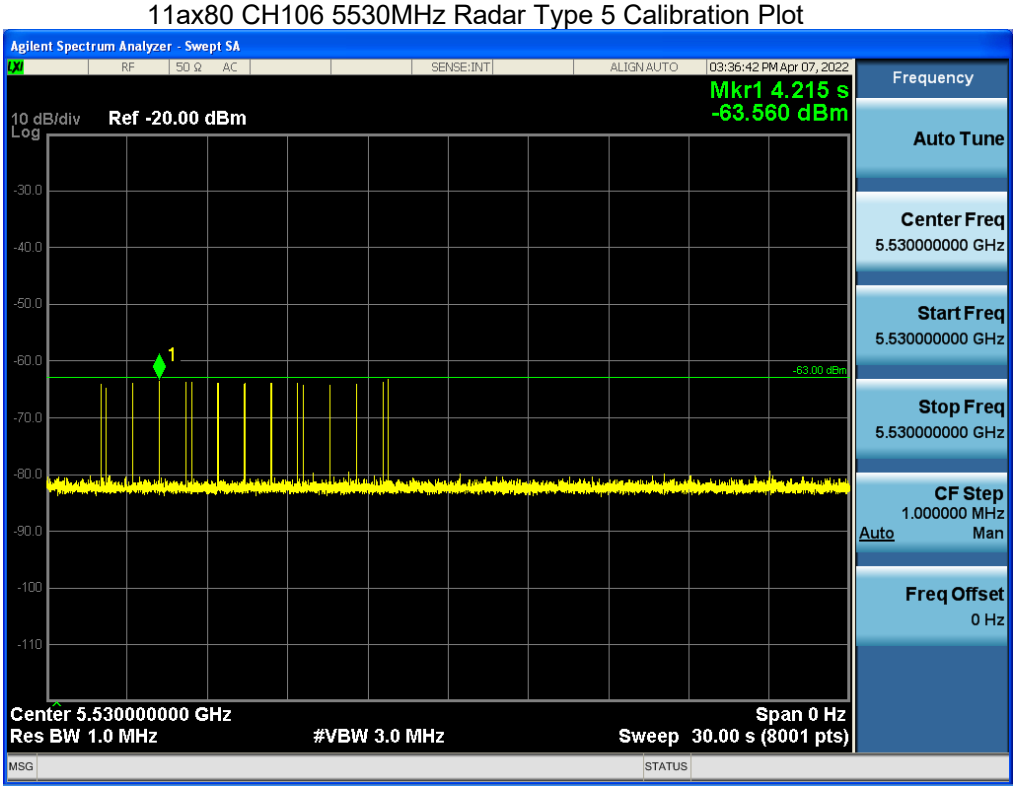
11ax80 CH106 5530MHz Radar Type 3 Calibration Plot



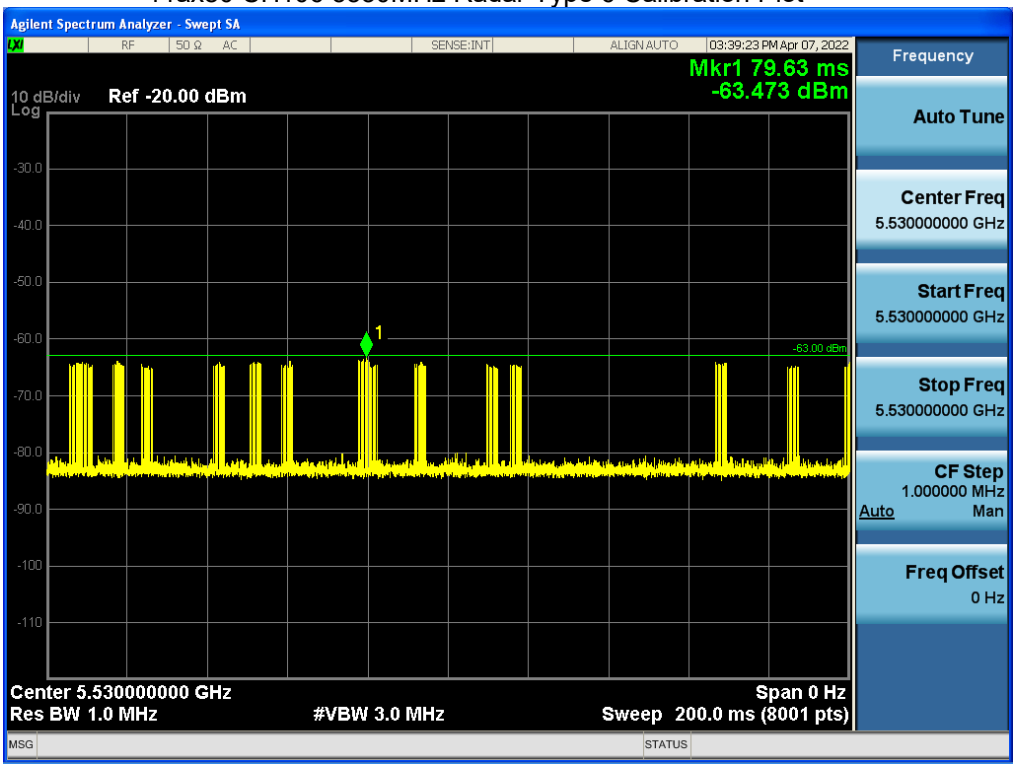
11ax80 CH106 5530MHz Radar Type 4 Calibration Plot



11ax80 CH106 5530MHz Radar Type 5 Calibration Plot



11ax80 CH106 5530MHz Radar Type 6 Calibration Plot



6 CHANNEL LOADING

System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:

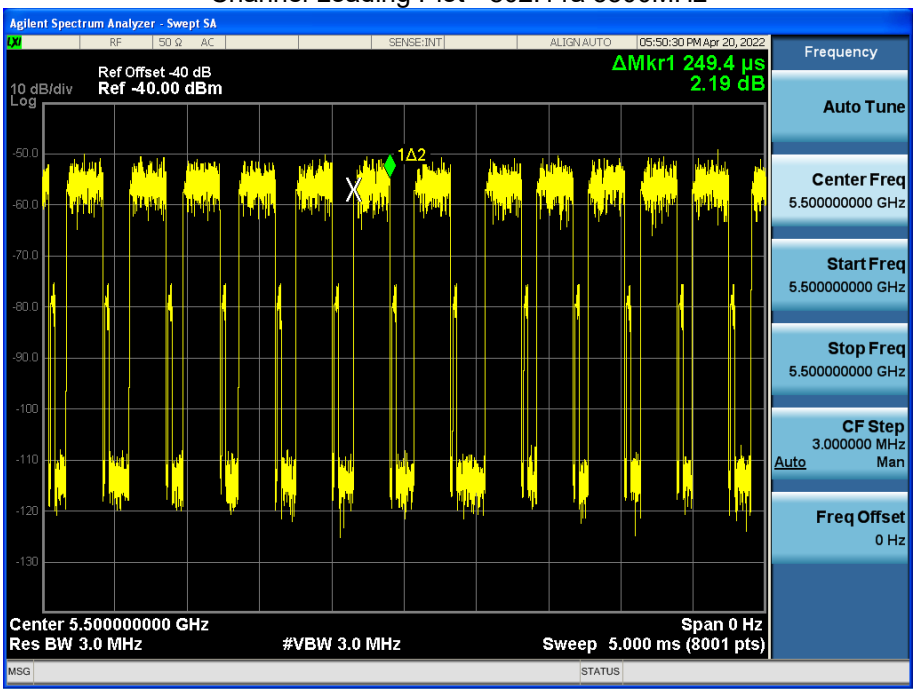
a) The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.

b) Software to ping the client is permitted to simulate data transfer but must have random ping intervals.

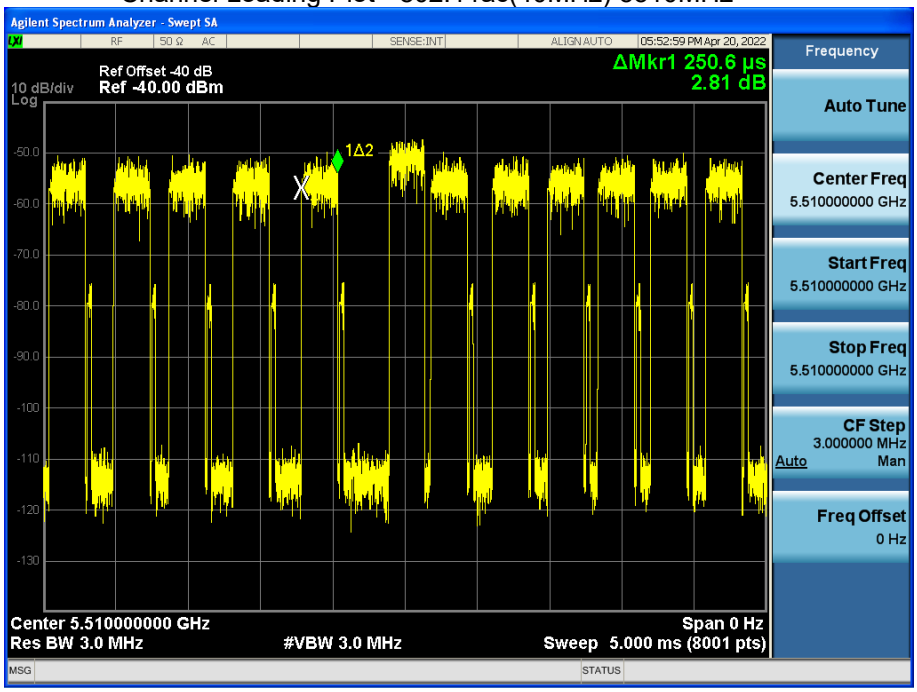
c) Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater. For example, you can zero span the spectrum analyzer and approximate the transmission time.

d) Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.

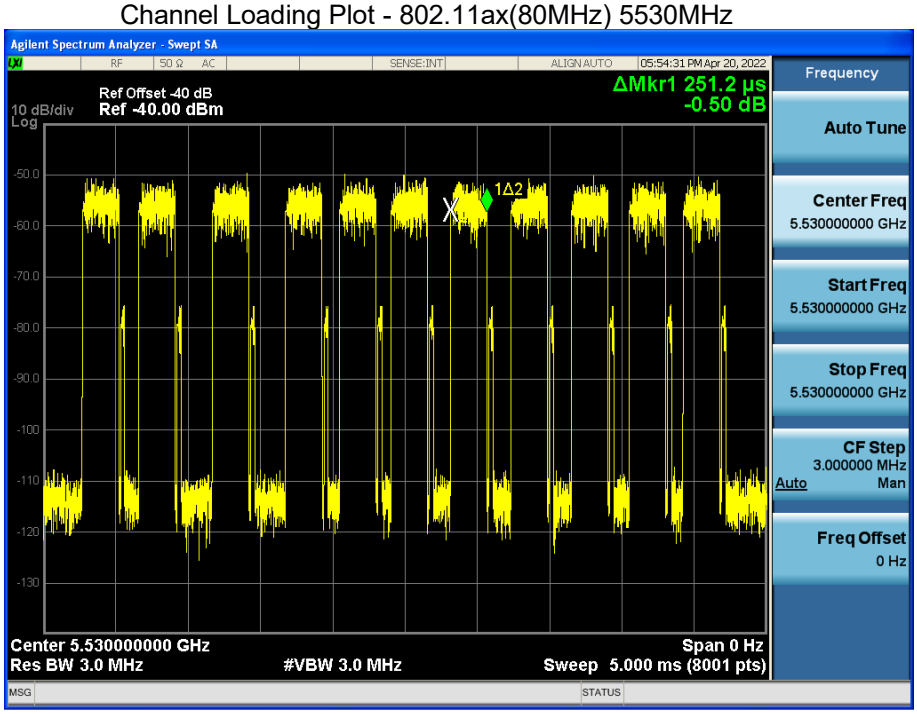
Channel Loading Plot - 802.11a 5500MHz



Channel Loading Plot - 802.11ac(40MHz) 5510MHz



Channel Loading Plot - 802.11ax(80MHz) 5530MHz



Test Mode	Packet ratio	Requirement ratio	Test Result
802.11a	59.86%	>17%	Pass
802.11ac(40MHz)	60.14%	>17%	Pass
802.11ac(80MHz)	55.26%	>17%	Pass

7 TEST PROCEDURES

7.1 U-NII Detection Bandwidth

Set up the generating equipment as shown in Figure 1, or equivalent. Set up the DFS timing monitoring equipment as shown in Figure 1. Set up the overall system for either radiated or conducted coupling to the UUT. Adjust the equipment to produce a single Burst of the Short Pulse Radar Type 1 at the center frequency of the UUT Operating Channel at the specified DFS Detection Threshold level.

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 of 0%/100% 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 using the specified U-NII Detection Bandwidth criterion.

Starting at the center frequency of the UUT operating Channel, increase the radar frequency in 1 MHz steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion. 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 1 MHz steps, repeating the above test sequence, until the detection rate falls below the U-NII Detection Bandwidth criterion specified in Table 4. 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:

$$U\text{-}NII\ Detection\ Bandwidth = FH - FL$$

The U-NII Detection Bandwidth must meet the U-NII Detection Bandwidth criterion. 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.

7.2 Channel Availability Check

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 modes 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 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. 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.

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 as shown below.

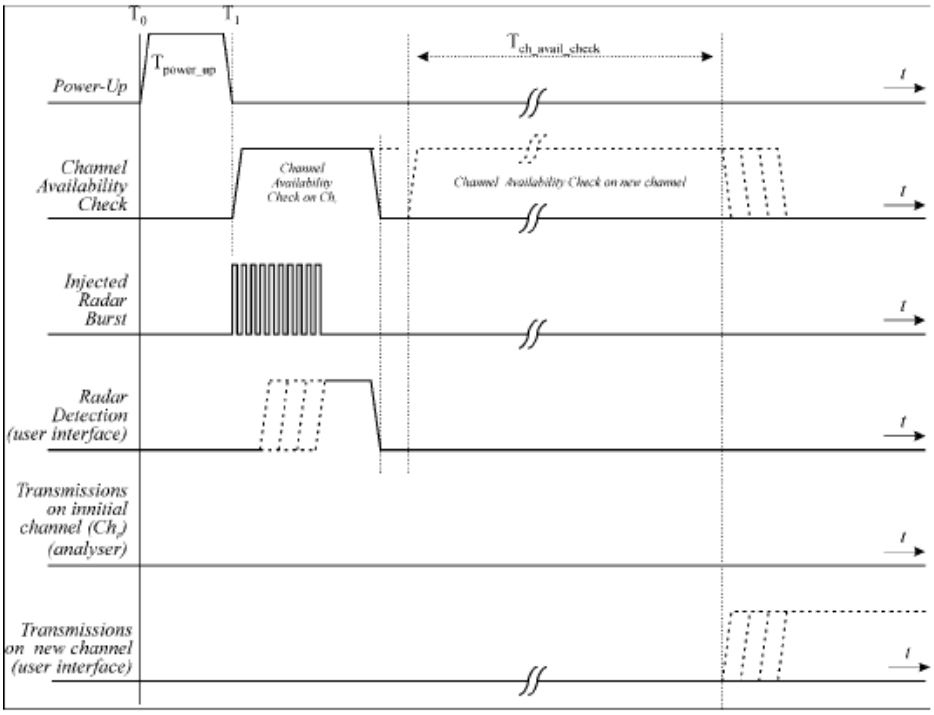
a) The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections on configuration for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

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

c) A single Burst of one of the Short Pulse Radar Types 1-4 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.



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 as shown below.

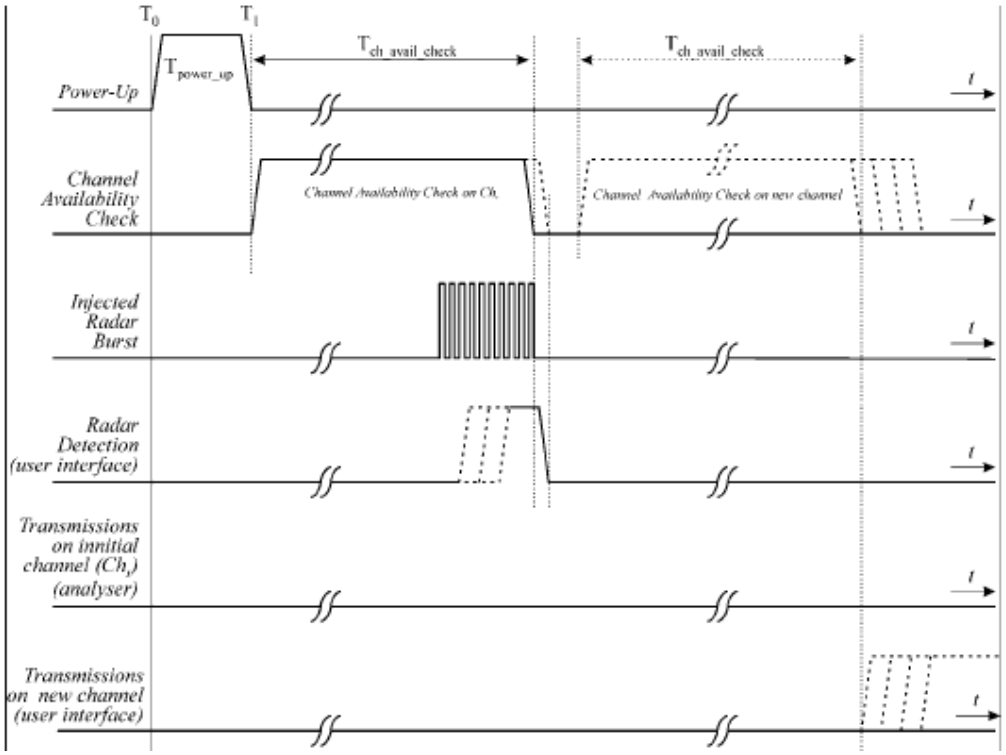
a) The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

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

c) A single Burst of one of the Short Pulse Radar Types 1-4 will commence within a 6 second window starting at T1 + 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.

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.



7.3 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 UNII 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 DFS), a UNII 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.

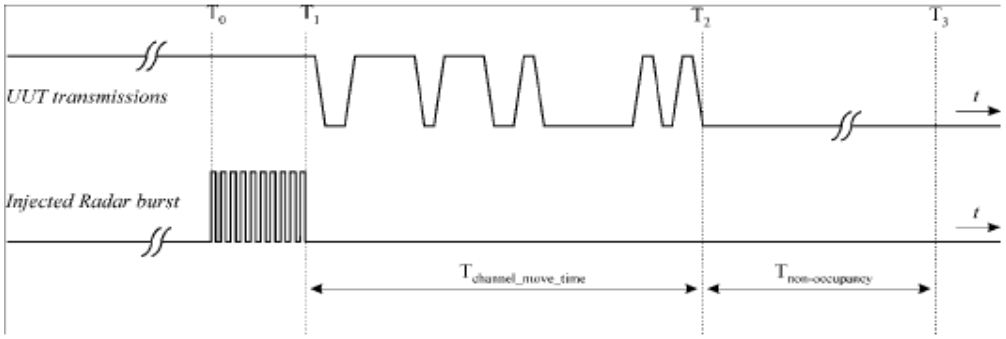
c) Stream the MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test.

d) At time T0 the Radar Waveform generator sends a Burst of pulses for one of the Short Pulse Radar Types 1-4, 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 shown below illustrates Channel Closing Transmission Time.

f) When operating as a Master Device, monitor the UUT for more than 30 minutes following instant T2 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 U-NII device operating as Client Device with In-Service Monitoring, perform steps a) to f).



7.4 Statistical Performance Check

The steps below define the procedure to determine the minimum percentage of successful detection requirements 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 MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test.

d) At time T0 the Radar Waveform generator sends the individual waveform for each of the Radar Types 1-6, at levels defined shown above, 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 Short Pulse Radar Types 1-4 and 6 to ensure detection occurs.

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).

8 TEST RESULTS

8.1 Detection Bandwidth

20 MHz Signal Bandwidth											
EUT Frequency = 5500MHz											
Radar Frequency (MHz)	DFS Detection Trials (1=Detection, Blank= No Detection)										
	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5489	0	0	0	0	0	0	0	0	0	0	0%
5490 Fl	1	1	1	1	1	1	1	1	1	1	100%
5491	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5496	1	1	1	1	1	1	1	1	1	1	100%
5497	1	1	1	1	1	1	1	1	1	1	100%
5498	1	1	1	1	1	1	1	1	1	1	100%
5499	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5501	1	1	1	1	1	1	1	1	1	1	100%
5502	1	1	1	1	1	1	1	1	1	1	100%
5503	1	1	1	1	1	1	1	1	1	1	100%
5504	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5506	1	1	1	1	1	1	1	1	1	1	100%
5507	1	1	1	1	1	1	1	1	1	1	100%
5508	1	1	1	1	1	1	1	1	1	1	100%
5509	1	1	1	1	1	1	1	1	1	1	100%
5510 Fh	1	1	1	1	1	1	1	1	1	1	100%
5511	0	0	0	0	0	0	0	0	0	0	0%
Detection Bandwidth = Fh-Fl = 5510MHz - 5490MHz = 20MHz											
EUT 99% Bandwidth = 16.524MHz											

40 MHz Signal Bandwidth											
EUT Frequency = 5510MHz											
Radar Frequency (MHz)	DFS Detection Trials (1=Detection, Blank= No Detection)										
	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5489	0	0	0	0	0	0	0	0	0	0	0%
5490 Fl	1	1	1	1	1	1	1	1	1	1	100%
5491	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5496	1	1	1	1	1	1	1	1	1	1	100%
5497	1	1	1	1	1	1	1	1	1	1	100%
5498	1	1	1	1	1	1	1	1	1	1	100%
5499	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5501	1	1	1	1	1	1	1	1	1	1	100%
5502	1	1	1	1	1	1	1	1	1	1	100%
5503	1	1	1	1	1	1	1	1	1	1	100%
5504	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5506	1	1	1	1	1	1	1	1	1	1	100%
5507	1	1	1	1	1	1	1	1	1	1	100%
5508	1	1	1	1	1	1	1	1	1	1	100%
5509	1	1	1	1	1	1	1	1	1	1	100%
5510	1	1	1	1	1	1	1	1	1	1	100%
5511	1	1	1	1	1	1	1	1	1	1	100%
5512	1	1	1	1	1	1	1	1	1	1	100%
5513	1	1	1	1	1	1	1	1	1	1	100%
5514	1	1	1	1	1	1	1	1	1	1	100%
5515	1	1	1	1	1	1	1	1	1	1	100%
5516	1	1	1	1	1	1	1	1	1	1	100%
5517	1	1	1	1	1	1	1	1	1	1	100%
5518	1	1	1	1	1	1	1	1	1	1	100%
5519	1	1	1	1	1	1	1	1	1	1	100%
5520	1	1	1	1	1	1	1	1	1	1	100%
5521	1	1	1	1	1	1	1	1	1	1	100%
5522	1	1	1	1	1	1	1	1	1	1	100%
5523	1	1	1	1	1	1	1	1	1	1	100%
5524	1	1	1	1	1	1	1	1	1	1	100%
5525	1	1	1	1	1	1	1	1	1	1	100%
5526	1	1	1	1	1	1	1	1	1	1	100%
5527	1	1	1	1	1	1	1	1	1	1	100%
5528	1	1	1	1	1	1	1	1	1	1	100%
5529	1	1	1	1	1	1	1	1	1	1	100%
5530 Fh	1	1	1	1	1	1	1	1	1	1	100%
5531	0	0	0	0	0	0	0	0	0	0	0%
Detection Bandwidth = Fh-Fl = 5530MHz - 5490MHz = 40MHz											

EUT 99% Bandwidth = 36.025MHz

80 MHz Signal Bandwidth											
EUT Frequency = 5530MHz											
Radar Frequency (MHz)	DFS Detection Trials (1=Detection, Blank= No Detection)										
	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
5489	0	0	0	0	0	0	0	0	0	0	0%
5490 FI	1	1	1	1	1	1	1	1	1	1	100%
5491	1	1	1	1	1	1	1	1	1	1	100%
5492	1	1	1	1	1	1	1	1	1	1	100%
5493	1	1	1	1	1	1	1	1	1	1	100%
5494	1	1	1	1	1	1	1	1	1	1	100%
5495	1	1	1	1	1	1	1	1	1	1	100%
5496	1	1	1	1	1	1	1	1	1	1	100%
5497	1	1	1	1	1	1	1	1	1	1	100%
5498	1	1	1	1	1	1	1	1	1	1	100%
5499	1	1	1	1	1	1	1	1	1	1	100%
5500	1	1	1	1	1	1	1	1	1	1	100%
5501	1	1	1	1	1	1	1	1	1	1	100%
5502	1	1	1	1	1	1	1	1	1	1	100%
5503	1	1	1	1	1	1	1	1	1	1	100%
5504	1	1	1	1	1	1	1	1	1	1	100%
5505	1	1	1	1	1	1	1	1	1	1	100%
5506	1	1	1	1	1	1	1	1	1	1	100%
5507	1	1	1	1	1	1	1	1	1	1	100%
5508	1	1	1	1	1	1	1	1	1	1	100%
5509	1	1	1	1	1	1	1	1	1	1	100%
5510	1	1	1	1	1	1	1	1	1	1	100%
5511	1	1	1	1	1	1	1	1	1	1	100%
5512	1	1	1	1	1	1	1	1	1	1	100%
5513	1	1	1	1	1	1	1	1	1	1	100%
5514	1	1	1	1	1	1	1	1	1	1	100%
5515	1	1	1	1	1	1	1	1	1	1	100%
5516	1	1	1	1	1	1	1	1	1	1	100%
5517	1	1	1	1	1	1	1	1	1	1	100%
5518	1	1	1	1	1	1	1	1	1	1	100%
5519	1	1	1	1	1	1	1	1	1	1	100%
5520	1	1	1	1	1	1	1	1	1	1	100%
5521	1	1	1	1	1	1	1	1	1	1	100%
5522	1	1	1	1	1	1	1	1	1	1	100%
5523	1	1	1	1	1	1	1	1	1	1	100%
5524	1	1	1	1	1	1	1	1	1	1	100%
5525	1	1	1	1	1	1	1	1	1	1	100%
5526	1	1	1	1	1	1	1	1	1	1	100%
5527	1	1	1	1	1	1	1	1	1	1	100%
5528	1	1	1	1	1	1	1	1	1	1	100%
5529	1	1	1	1	1	1	1	1	1	1	100%
5530	1	1	1	1	1	1	1	1	1	1	100%
5531	1	1	1	1	1	1	1	1	1	1	100%
5532	1	1	1	1	1	1	1	1	1	1	100%

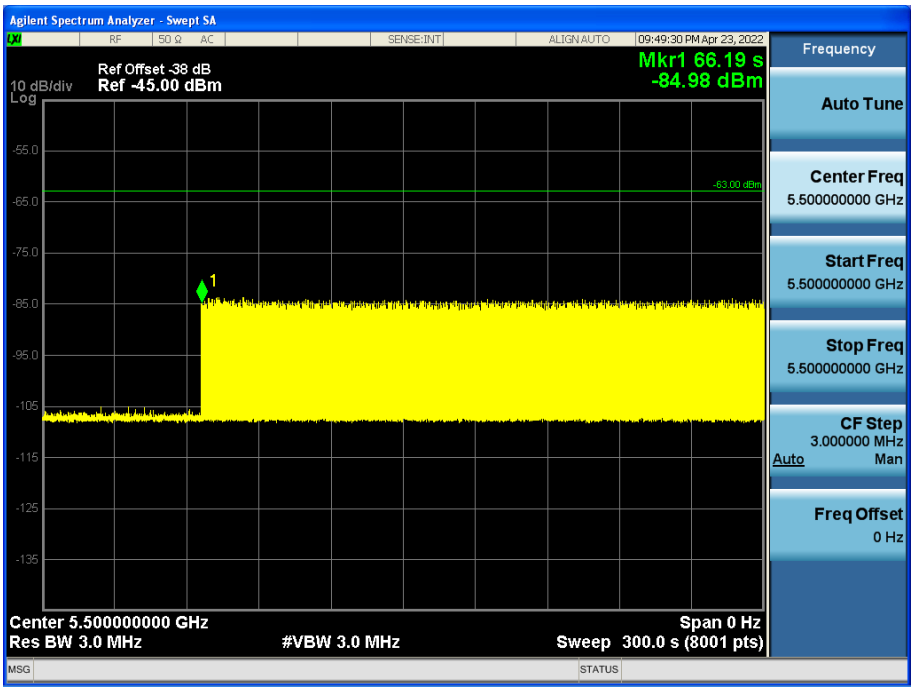
5533	1	1	1	1	1	1	1	1	1	1	100%
5534	1	1	1	1	1	1	1	1	1	1	100%
5535	1	1	1	1	1	1	1	1	1	1	100%
5536	1	1	1	1	1	1	1	1	1	1	100%
5537	1	1	1	1	1	1	1	1	1	1	100%
5538	1	1	1	1	1	1	1	1	1	1	100%
5539	1	1	1	1	1	1	1	1	1	1	100%
5540	1	1	1	1	1	1	1	1	1	1	100%
5541	1	1	1	1	1	1	1	1	1	1	100%
5542	1	1	1	1	1	1	1	1	1	1	100%
5543	1	1	1	1	1	1	1	1	1	1	100%
5544	1	1	1	1	1	1	1	1	1	1	100%
5545	1	1	1	1	1	1	1	1	1	1	100%
5546	1	1	1	1	1	1	1	1	1	1	100%
5547	1	1	1	1	1	1	1	1	1	1	100%
5548	1	1	1	1	1	1	1	1	1	1	100%
5549	1	1	1	1	1	1	1	1	1	1	100%
5550	1	1	1	1	1	1	1	1	1	1	100%
5552	1	1	1	1	1	1	1	1	1	1	100%
5553	1	1	1	1	1	1	1	1	1	1	100%
5554	1	1	1	1	1	1	1	1	1	1	100%
5555	1	1	1	1	1	1	1	1	1	1	100%
5556	1	1	1	1	1	1	1	1	1	1	100%
5557	1	1	1	1	1	1	1	1	1	1	100%
5558	1	1	1	1	1	1	1	1	1	1	100%
5559	1	1	1	1	1	1	1	1	1	1	100%
5560	1	1	1	1	1	1	1	1	1	1	100%
5561	1	1	1	1	1	1	1	1	1	1	100%
5562	1	1	1	1	1	1	1	1	1	1	100%
5563	1	1	1	1	1	1	1	1	1	1	100%
5564	1	1	1	1	1	1	1	1	1	1	100%
5565	1	1	1	1	1	1	1	1	1	1	100%
5566	1	1	1	1	1	1	1	1	1	1	100%
5567	1	1	1	1	1	1	1	1	1	1	100%
5568	1	1	1	1	1	1	1	1	1	1	100%
5569	1	1	1	1	1	1	1	1	1	1	100%
5570 Fh	1	1	1	1	1	1	1	1	1	1	100%
5571	0	0	0	0	0	0	0	0	0	0	0%
Detection Bandwidth = Fh-Fl = 5570MHz - 5490MHz = 80MHz											
EUT 99% Bandwidth =75.197MHz											

8.2 Channel Available Check

The following results reflect all 20 MHz, 40 MHz and 80 MHz Channel Bandwidth operation.

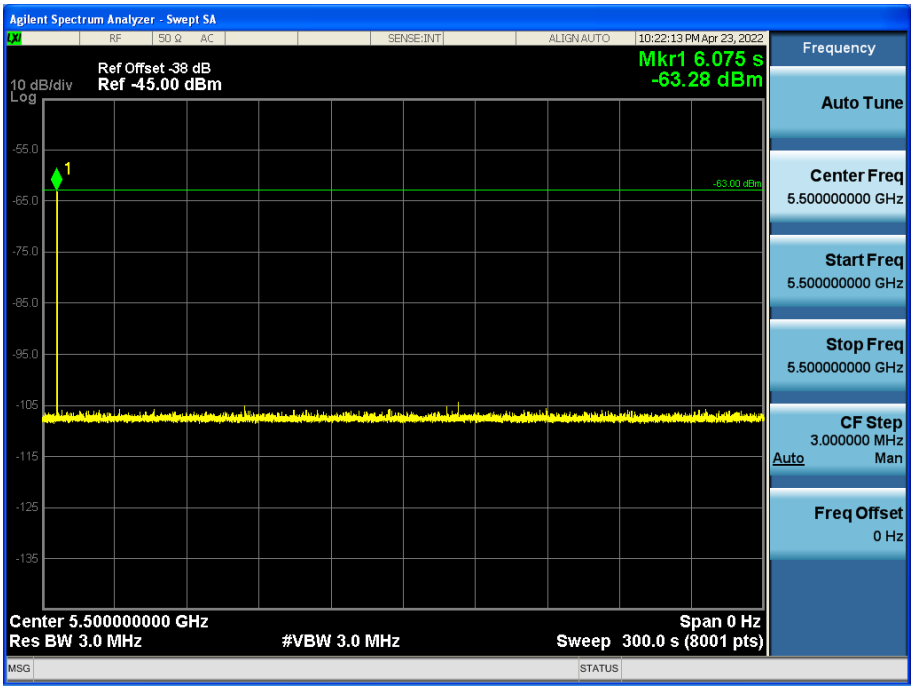
Initial Channel Availability Check Time

11a CH100 5500MHz

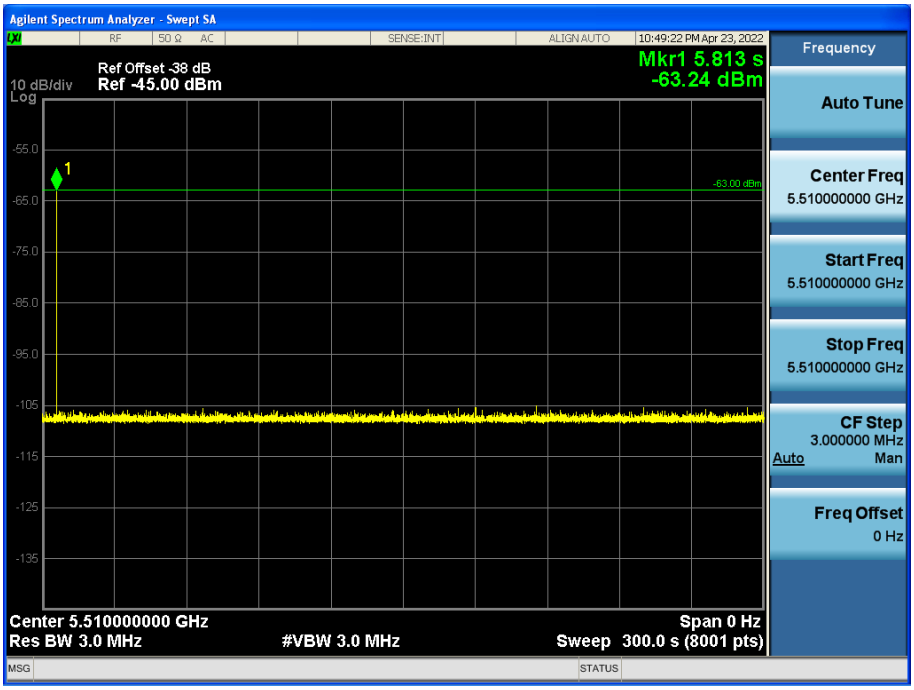


8.3 Test result with a radar burst at the beginning of the Channel Availability Check Time

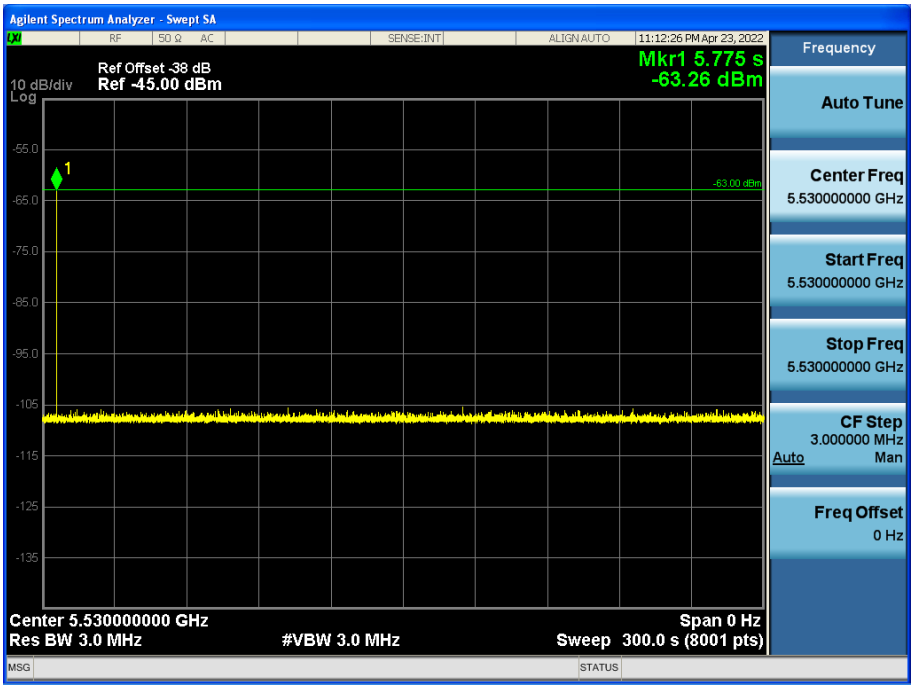
11a CH 100 5500MHz



11ac40MHz CH 102 5510MHz

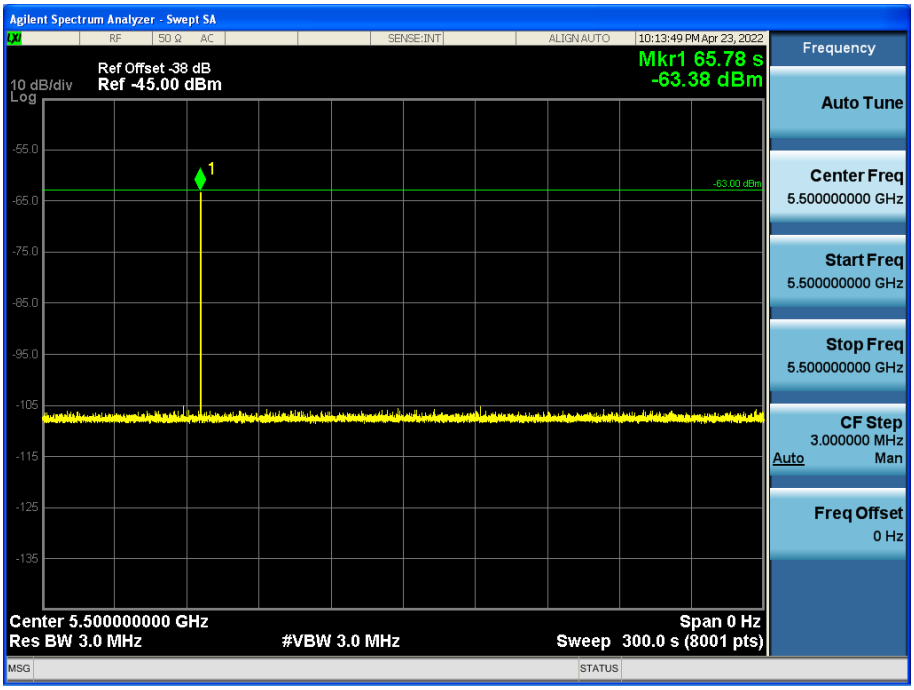


11ac80MHz CH 106 5530MHz

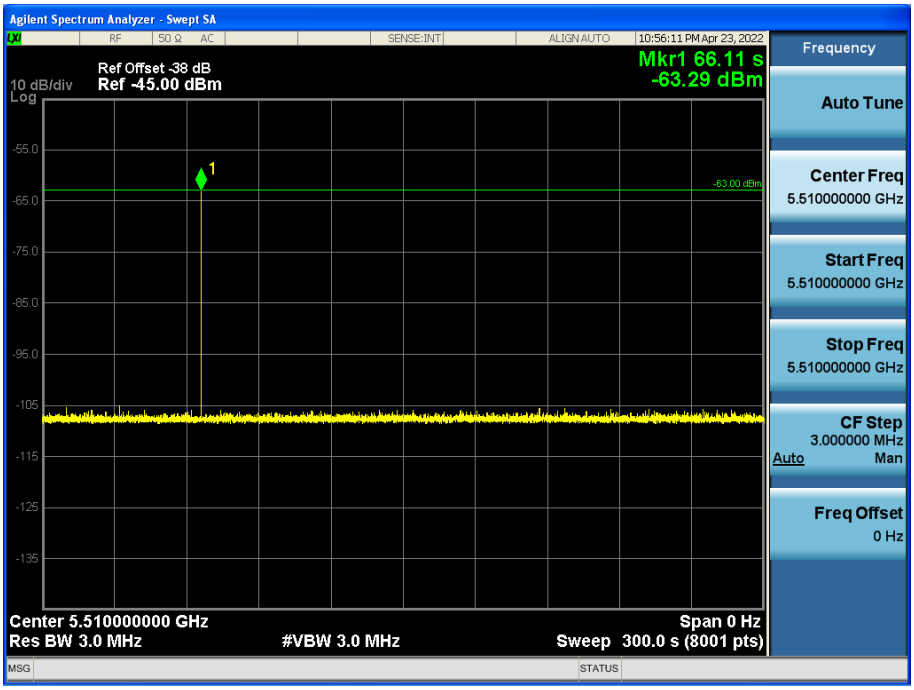


8.4 Test result with radar burst at the end of the Channel Availability Check Time

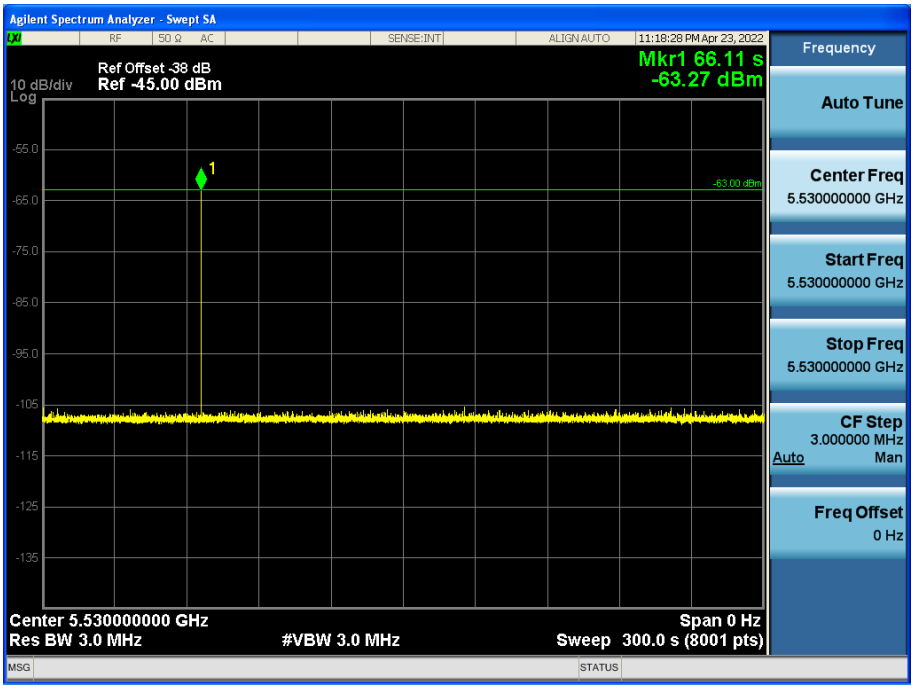
11a CH 100 5500MHz



11ac40MHz CH 102 5510MHz



11ac80MHz CH 106 5530MHz



Test Item	Limit	Results
Channel Availability Check Time	60 s	Pass

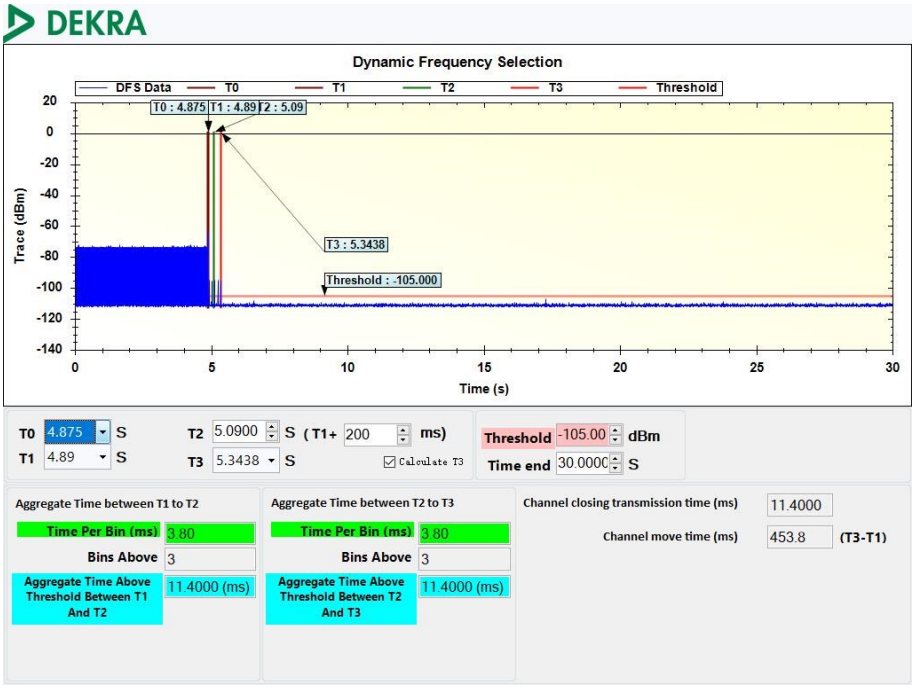
8.5 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

The following results reflect all 20 MHz, 40 MHz and 80MHz Channel Bandwidth operation.

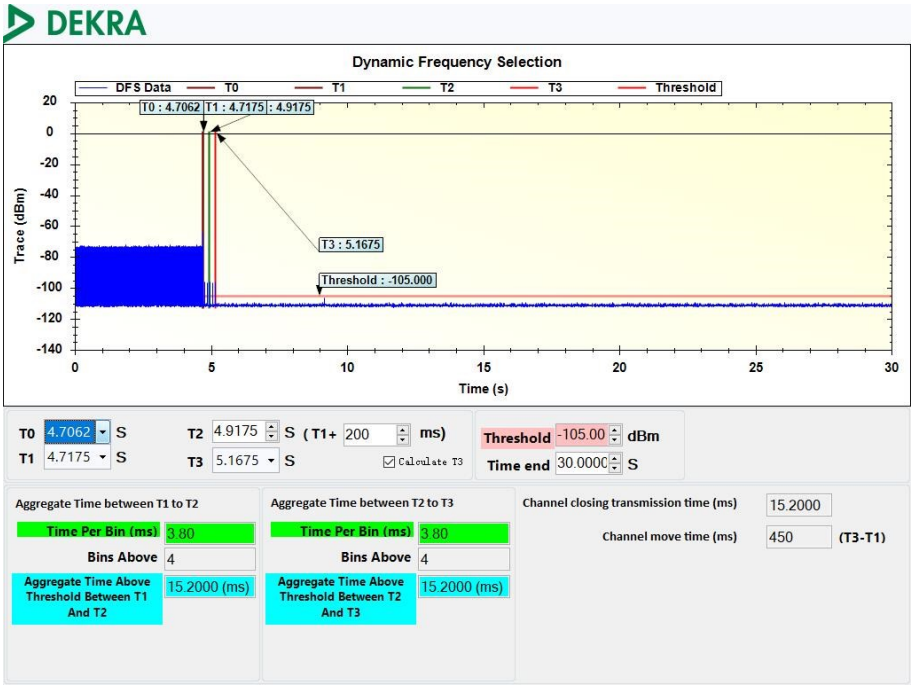
Channel Move Time and Closing Transmission Time

Master Mode:

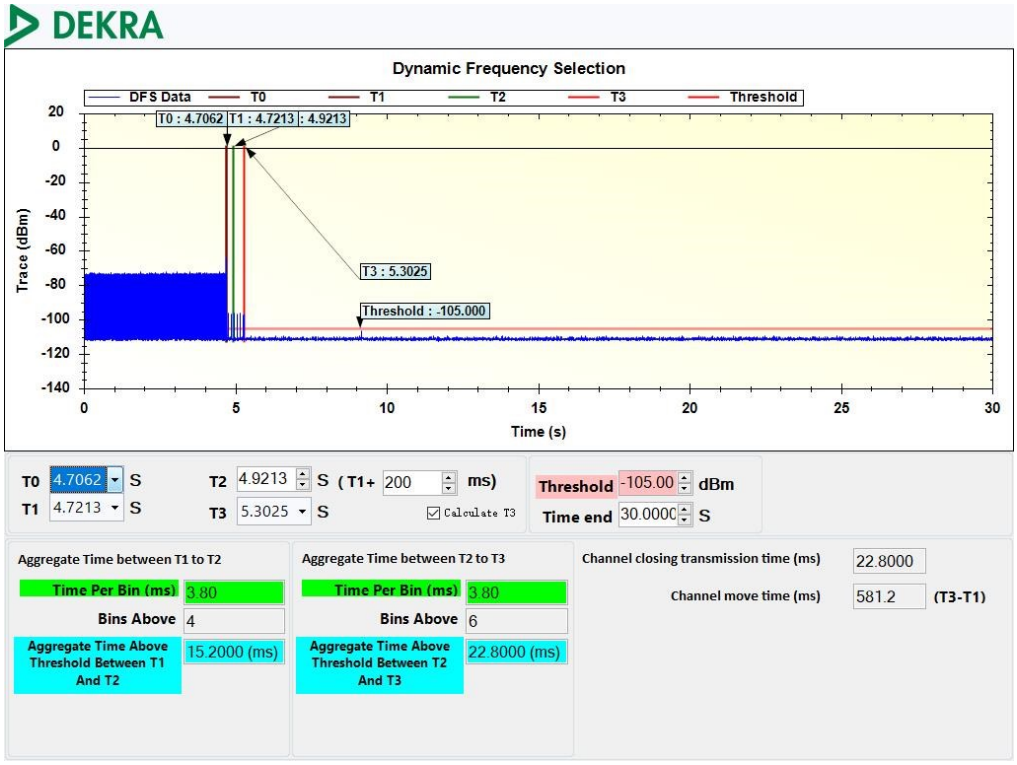
11a CH 100 5500MHz



11ac40MHz CH102 5510MHz



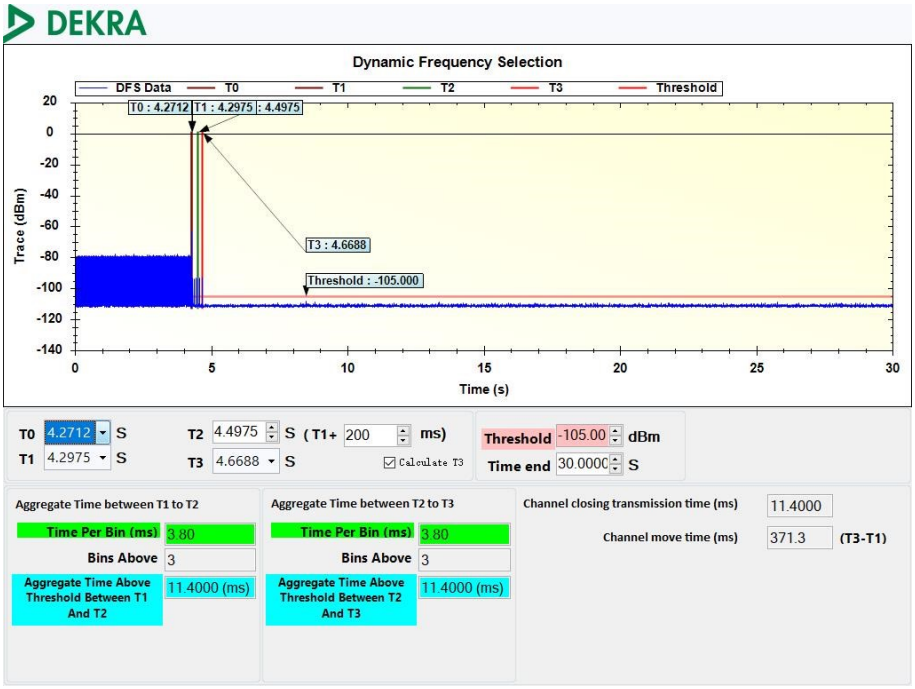
11ac80MHz CH106 5530MHz



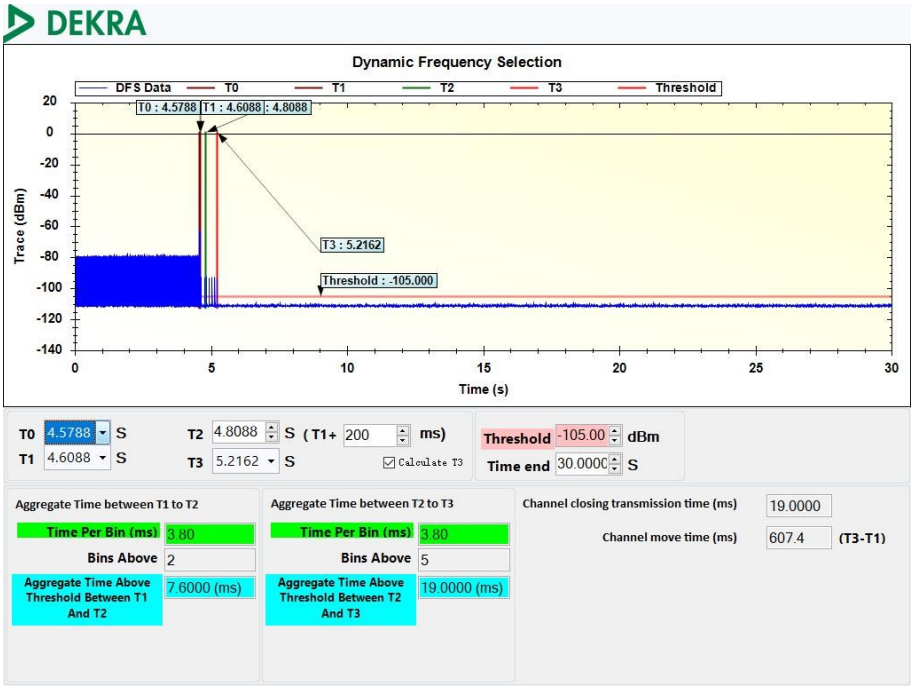
Test Item	Limit	Results
Channel Move Time	10 s	Pass
Channel Closing Transmission Time	200ms + an aggregate of 60ms over remaining 10 second period.	Pass

Slave Mode:

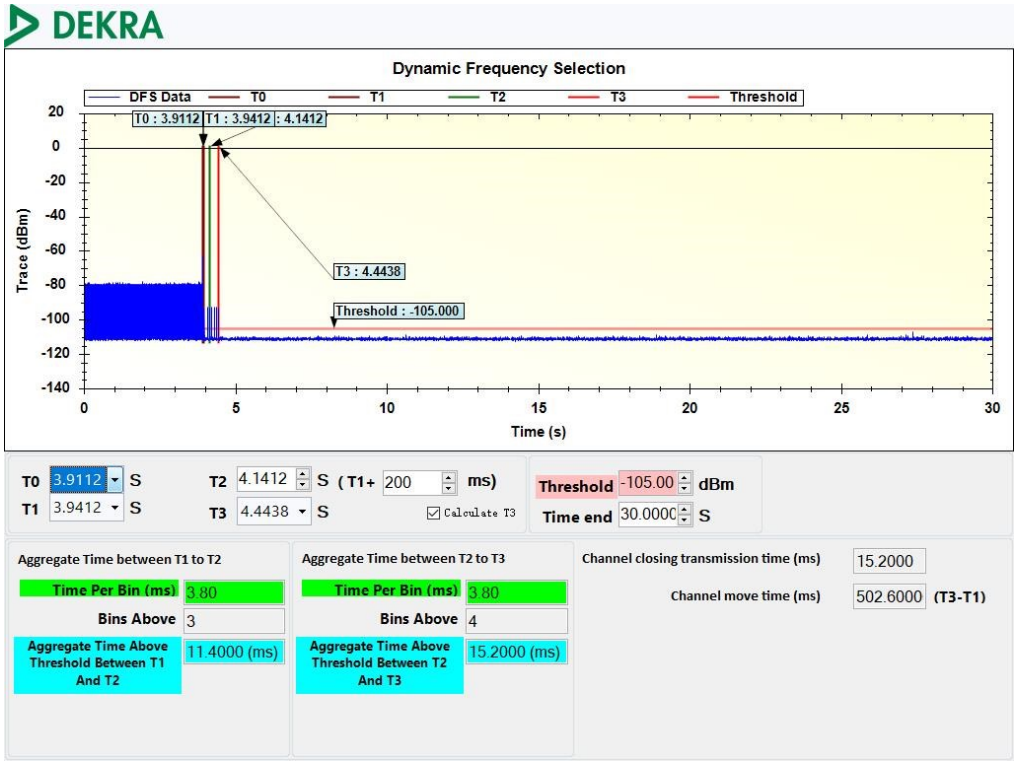
11a CH 100 5500MHz



11ac40MHz CH102 5510MHz



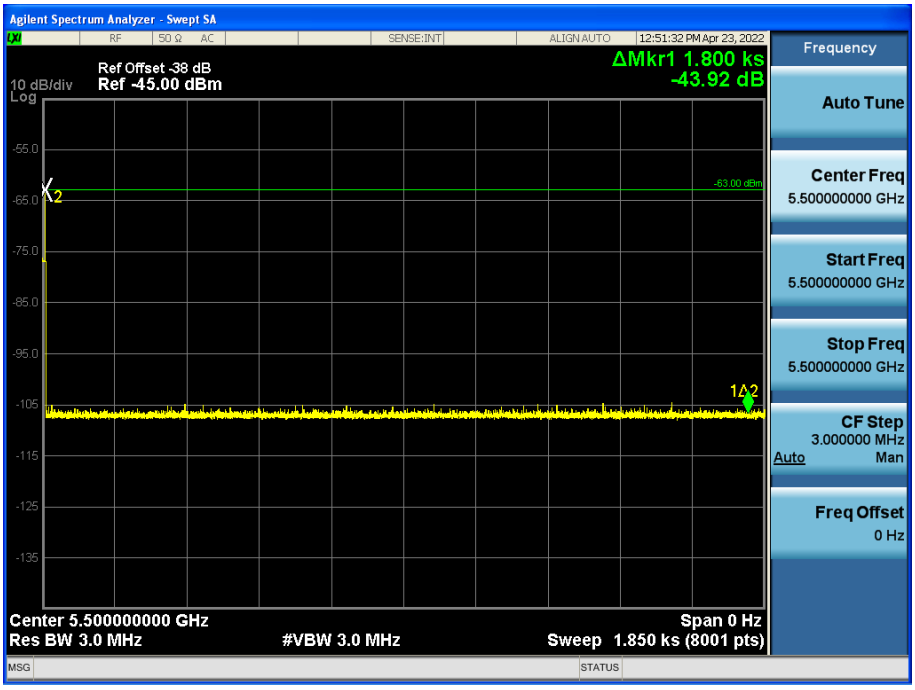
11ac80MHz CH106 5530MHz



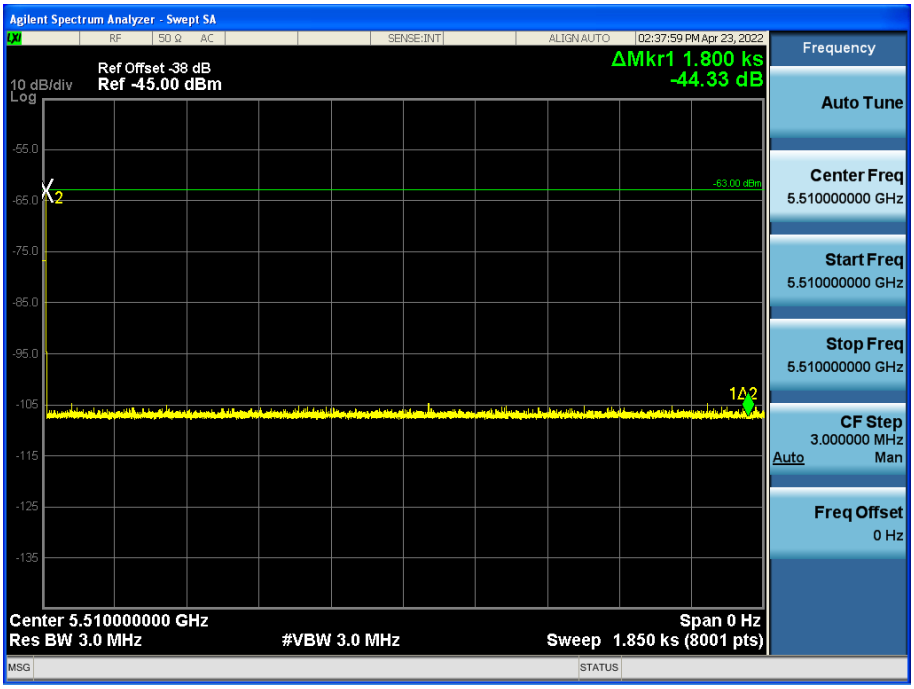
Test Item	Limit	Results
Channel Move Time	10 s	Pass
Channel Closing Transmission Time	200ms + an aggregate of 60ms over remaining 10 second period.	Pass

Non-Occupancy Period
Master Mode:

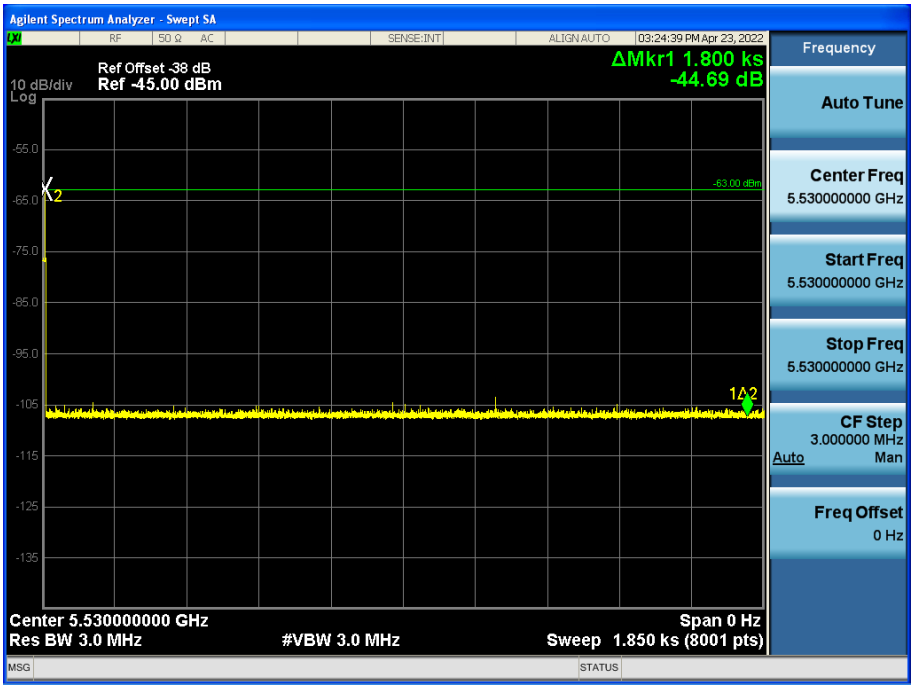
30 Minute Non-Occupancy Period
11a CH100 5500MHz



11ac40MHz CH102 5510MHz



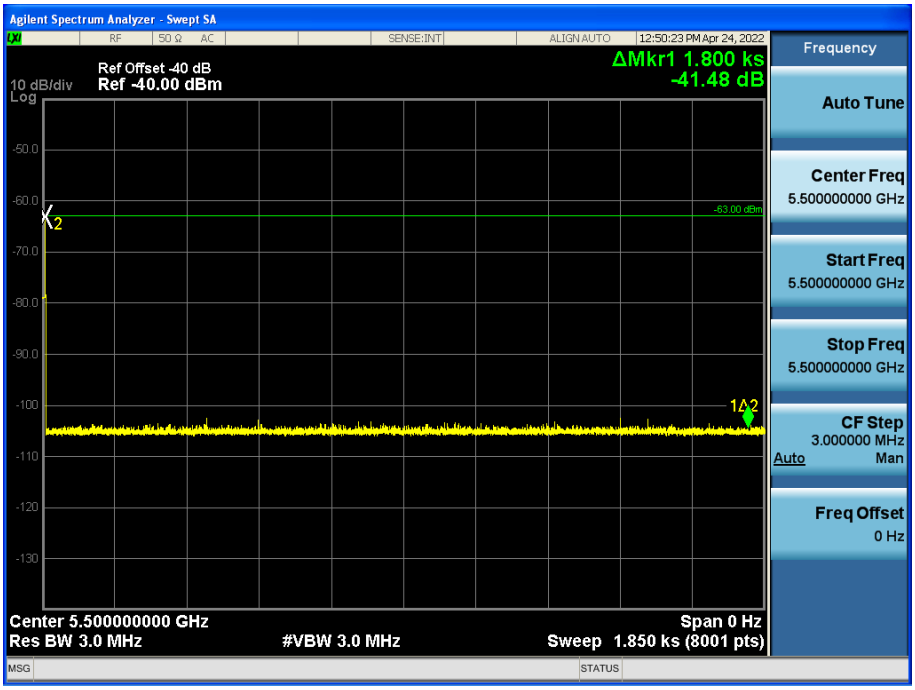
11ac80MHz CH106 5530MHz



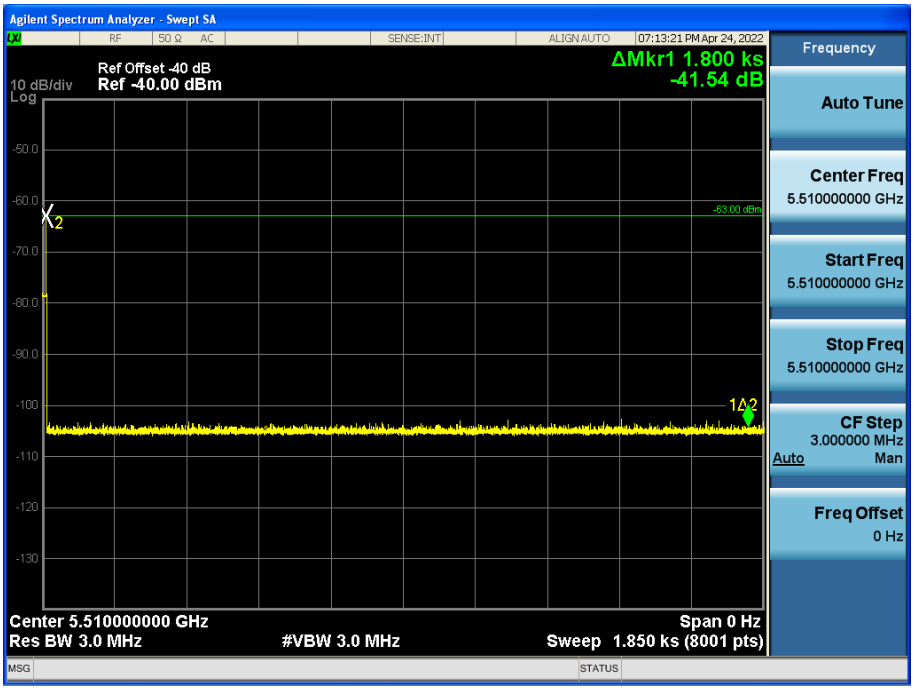
Test Item	Limit	Results
Non-Occupancy Period	30 minutes	Pass

Slave Mode:

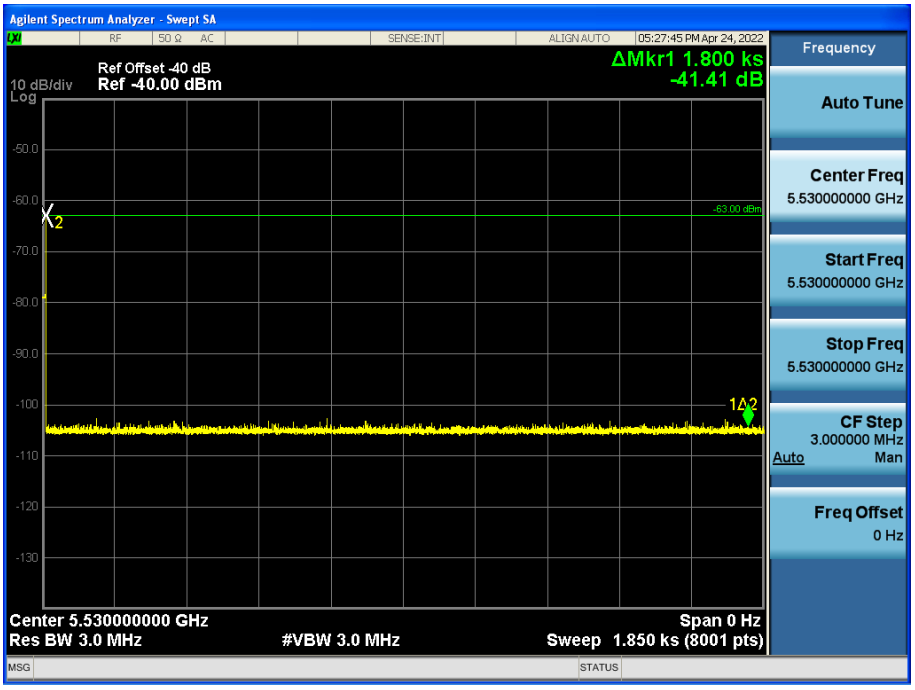
30 Minute Non-Occupancy Period
11a CH100 5500MHz



11ac40MHz CH102 5510MHz



11ac80MHz CH106 5530MHz



Test Item	Limit	Results
Non-Occupancy Period	30 minutes	Pass

8.6 Statistical Performance Check

A U-NII device operating as a Client Device associates with the UUT (Master) at 5500 MHz&5510MHz. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test. The device can also utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs.

The Radar Waveform generator sends the individual waveform for each of radar type 1~6 with a level equal to the DFS detection threshold level + 1dB (-63dBm).

The following results reflect both 20 MHz, 40 MHz and 80MHz Channel Bandwidth operation.

11a CH100 5500MHz
Type 1 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5500	1	938.0	57	53466.0	1
2	5501	1	698.0	76	53048.0	1
3	5502	1	618.0	86	53148.0	1
4	5503	1	538.0	99	53262.0	1
5	5504	1	878.0	61	53558.0	1
6	5505	1	3066.0	18	55188.0	1
7	5506	1	638.0	83	52954.0	1
8	5507	1	918.0	58	53244.0	1
9	5508	1	838.0	63	52794.0	1
10	5509	1	858.0	62	53196.0	1
11	5490	1	798.0	67	53466.0	1
12	5492	1	718.0	74	53132.0	1
13	5493	1	578.0	92	53176.0	1
14	5494	1	598.0	89	53222.0	
15	5495	1	558.0	95	53010.0	1
16	5496	1	2536.0	21	53256.0	1
17	5497	1	966.0	55	53130.0	1
18	5498	1	827.0	64	52928.0	1
19	5499	1	2501.0	22	55022.0	1
20	5500	1	2595.0	21	54495.0	1
21	5501	1	1114.0	48	53472.0	1
22	5502	1	1302.0	41	53382.0	1
23	5503	1	3045.0	18	54810.0	1
24	5504	1	1624.0	33	53592.0	1
25	5505	1	2878.0	19	54682.0	1
26	5506	1	1027.0	52	53404.0	
27	5507	1	2485.0	22	54670.0	1
28	5508	1	1600.0	33	52800.0	1
29	5509	1	1172.0	46	53912.0	1
30	5500	1	1177.0	45	52965.0	1
Detection Percentage						93.33% (>60%)

Type 2 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5500	3.2	179.0	26	4654.0	1
2	5501	1.1	207.0	23	4761.0	1
3	5502	2.1	230.0	24	5520.0	1
4	5503	4.8	200.0	29	5800.0	1
5	5504	3.9	214.0	28	5992.0	1
6	5505	2.9	222.0	26	5772.0	1
7	5506	3.2	204.0	26	5304.0	1
8	5507	2.5	192.0	25	4800.0	1
9	5508	3.1	164.0	26	4264.0	
10	5509	1.2	156.0	23	3588.0	1
11	5490	3.9	210.0	27	5670.0	1
12	5492	4.6	201.0	29	5829.0	1
13	5493	3.2	162.0	26	4212.0	1
14	5494	2.2	197.0	25	4925.0	1
15	5495	4.5	163.0	29	4727.0	1
16	5496	3.0	203.0	26	5278.0	
17	5497	5.0	168.0	29	4872.0	1
18	5498	2.4	217.0	25	5425.0	1
19	5499	2.9	191.0	26	4966.0	1
20	5500	2.3	166.0	25	4150.0	1
21	5501	3.7	150.0	27	4050.0	1
22	5502	2.2	176.0	25	4400.0	
23	5503	4.9	195.0	29	5655.0	1
24	5504	2.9	202.0	26	5252.0	1
25	5505	2.5	178.0	25	4450.0	1
26	5506	1.1	206.0	23	4738.0	1
27	5507	3.8	155.0	27	4185.0	1
28	5508	4.7	157.0	29	4553.0	1
29	5509	2.4	224.0	25	5600.0	1
30	5500	4.2	159.0	28	4452.0	1
Detection Percentage						90% (>60%)

Type 3 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5500	8.2	355.0	17	6035.0	1
2	5501	6.1	487.0	16	7792.0	1
3	5502	7.1	344.0	16	5504.0	1
4	5503	9.8	288.0	18	5184.0	
5	5504	8.9	230.0	18	4140.0	1
6	5505	7.9	432.0	17	7344.0	1
7	5506	8.2	207.0	17	3519.0	1
8	5507	7.5	443.0	17	7531.0	1
9	5508	8.1	439.0	17	7463.0	1
10	5509	6.2	223.0	16	3568.0	1
11	5490	8.9	208.0	18	3744.0	1
12	5492	9.6	463.0	18	8334.0	1
13	5493	8.2	441.0	17	7497.0	1
14	5494	7.2	323.0	16	5168.0	1
15	5495	9.5	297.0	18	5346.0	1
16	5496	8.0	412.0	17	7004.0	1
17	5497	10.0	324.0	18	5832.0	1
18	5498	7.4	271.0	17	4607.0	1
19	5499	7.9	349.0	17	5933.0	1
20	5500	7.3	409.0	16	6544.0	1
21	5501	8.7	373.0	18	6714.0	1
22	5502	7.2	254.0	16	4064.0	1
23	5503	9.9	274.0	18	4932.0	1
24	5504	7.9	278.0	17	4726.0	1
25	5505	7.5	317.0	17	5389.0	1
26	5506	6.1	260.0	16	4160.0	1
27	5507	8.8	211.0	18	3798.0	
28	5508	9.7	272.0	18	4896.0	1
29	5509	7.4	264.0	17	4488.0	1
30	5500	9.2	284.0	18	5112.0	1
Detection Percentage						93.33% (>60%)

Type 4 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5500	16.0	355.0	14	4970.0	1
2	5501	11.3	487.0	12	5844.0	1
3	5502	13.5	344.0	13	4472.0	
4	5503	19.4	288.0	16	4608.0	1
5	5504	17.5	230.0	15	3450.0	1
6	5505	15.3	432.0	14	6048.0	1
7	5506	15.9	207.0	14	2898.0	1
8	5507	14.3	443.0	13	5759.0	1
9	5508	15.8	439.0	14	6146.0	1
10	5509	11.5	223.0	12	2676.0	1
11	5490	17.4	208.0	15	3120.0	
12	5492	19.0	463.0	16	7408.0	1
13	5493	16.0	441.0	14	6174.0	1
14	5494	13.8	323.0	13	4199.0	1
15	5495	18.9	297.0	16	4752.0	1
16	5496	15.5	412.0	14	5768.0	1
17	5497	19.9	324.0	16	5184.0	1
18	5498	14.1	271.0	13	3523.0	1
19	5499	15.2	349.0	14	4886.0	1
20	5500	13.8	409.0	13	5317.0	1
21	5501	17.1	373.0	15	5595.0	1
22	5502	13.8	254.0	13	3302.0	
23	5503	19.8	274.0	16	4384.0	1
24	5504	15.3	278.0	14	3892.0	1
25	5505	14.5	317.0	13	4121.0	1
26	5506	11.3	260.0	12	3120.0	1
27	5507	17.3	211.0	15	3165.0	
28	5508	19.2	272.0	16	4352.0	1
29	5509	14.2	264.0	13	3432.0	1
30	5500	18.2	284.0	15	4260.0	1
Detection Percentage						86.67% (>60%)

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1+P_d2+P_d3+P_d4}{4}$ = (93.33%+90%+93.33%+86.67%)/4 = 90.83% (>80%)

Type 5 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)
0	5.500000000	15	0.8000000	12.0000000	1
1	5.500000000	8	1.5000000	12.0000000	1
2	5.500000000	11	1.0909091	12.0000000	1
3	5.500000000	20	0.6000000	12.0000000	1
4	5.500000000	17	0.7058824	12.0000000	1
5	5.500000000	14	0.8571429	12.0000000	1
6	5.500000000	15	0.8000000	12.0000000	
7	5.500000000	12	1.0000000	12.0000000	1
8	5.500000000	14	0.8571429	12.0000000	1
9	5.500000000	8	1.5000000	12.0000000	1
10	5.496400000	17	0.7058824	12.0000000	1
11	5.497600000	19	0.6315789	12.0000000	1
12	5.495200000	15	0.8000000	12.0000000	1
13	5.494000000	12	1.0000000	12.0000000	1
14	5.497200000	19	0.6315789	12.0000000	1
15	5.494800000	14	0.8571429	12.0000000	1
16	5.498000000	20	0.6000000	12.0000000	1
17	5.494000000	12	1.0000000	12.0000000	1
18	5.494800000	14	0.8571429	12.0000000	1
19	5.494000000	12	1.0000000	12.0000000	1
20	5.504000000	16	0.7500000	12.0000000	1
21	5.506400000	12	1.0000000	12.0000000	1
22	5.502000000	20	0.6000000	12.0000000	1
23	5.505200000	14	0.8571429	12.0000000	1
24	5.505600000	13	0.9230769	12.0000000	
25	5.508000000	8	1.5000000	12.0000000	1
26	5.503600000	17	0.7058824	12.0000000	1
27	5.502400000	19	0.6315789	12.0000000	1
28	5.506000000	12	1.0000000	12.0000000	
29	5.503200000	18	0.6666667	12.0000000	1
Detection Percentage					90% (>80%)

Type 6 Radar Statistical Performance

Trial Number	Pulse Width (us)	PRI (us)	Pulse per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Visible Frequency Number	1=Detection Blank=No Detection
0	1.0	333.3	9	0.3333	300.0000000	4	1
1	1.0	333.3	9	0.3333	300.0000000	1	1
2	1.0	333.3	9	0.3333	300.0000000	3	1
3	1.0	333.3	9	0.3333	300.0000000	5	1
4	1.0	333.3	9	0.3333	300.0000000	4	1
5	1.0	333.3	9	0.3333	300.0000000	3	1
6	1.0	333.3	9	0.3333	300.0000000	5	
7	1.0	333.3	9	0.3333	300.0000000	5	1
8	1.0	333.3	9	0.3333	300.0000000	6	1
9	1.0	333.3	9	0.3333	300.0000000	1	
10	1.0	333.3	9	0.3333	300.0000000	5	1
11	1.0	333.3	9	0.3333	300.0000000	6	1
12	1.0	333.3	9	0.3333	300.0000000	4	1
13	1.0	333.3	9	0.3333	300.0000000	6	
14	1.0	333.3	9	0.3333	300.0000000	5	1
15	1.0	333.3	9	0.3333	300.0000000	5	1
16	1.0	333.3	9	0.3333	300.0000000	5	1
17	1.0	333.3	9	0.3333	300.0000000	3	1
18	1.0	333.3	9	0.3333	300.0000000	3	
19	1.0	333.3	9	0.3333	300.0000000	3	1
20	1.0	333.3	9	0.3333	300.0000000	5	1
21	1.0	333.3	9	0.3333	300.0000000	6	1
22	1.0	333.3	9	0.3333	300.0000000	5	1
23	1.0	333.3	9	0.3333	300.0000000	4	1
24	1.0	333.3	9	0.3333	300.0000000	3	1
25	1.0	333.3	9	0.3333	300.0000000	5	1
26	1.0	333.3	9	0.3333	300.0000000	3	1
27	1.0	333.3	9	0.3333	300.0000000	5	1
28	1.0	333.3	9	0.3333	300.0000000	6	1
29	1.0	333.3	9	0.3333	300.0000000	6	1
Detection Percentage							86.67% (>70%)

11ac40 CH102 5510MHz

Type 1 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5496	1.0	938.0	57	53466.0	1
2	5497	1.0	698.0	76	53048.0	1
3	5498	1.0	618.0	86	53148.0	1
4	5499	1.0	538.0	99	53262.0	1
5	5500	1.0	878.0	61	53558.0	1
6	5501	1.0	3066.0	18	55188.0	1
7	5502	1.0	638.0	83	52954.0	1
8	5503	1.0	918.0	58	53244.0	1
9	5504	1.0	838.0	63	52794.0	1
10	5505	1.0	858.0	62	53196.0	1
11	5506	1.0	798.0	67	53466.0	
12	5507	1.0	718.0	74	53132.0	1
13	5508	1.0	578.0	92	53176.0	1
14	5509	1.0	598.0	89	53222.0	
15	5510	1.0	558.0	95	53010.0	1
16	5511	1.0	2536.0	21	53256.0	1
17	5512	1.0	966.0	55	53130.0	1
18	5513	1.0	827.0	64	52928.0	1
19	5514	1.0	2501.0	22	55022.0	1
20	5515	1.0	2595.0	21	54495.0	1
21	5516	1.0	1114.0	48	53472.0	1
22	5517	1.0	1302.0	41	53382.0	1
23	5518	1.0	3045.0	18	54810.0	1
24	5519	1.0	1624.0	33	53592.0	1
25	5520	1.0	2878.0	19	54682.0	1
26	5521	1.0	1027.0	52	53404.0	1
27	5522	1.0	2485.0	22	54670.0	1
28	5523	1.0	1600.0	33	52800.0	
29	5524	1.0	1172.0	46	53912.0	1
30	5525	1.0	1177.0	45	52965.0	1
Detection Percentage						90% (>60%)

Type 2 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5496	3.2	179.0	26	4654.0	1
2	5497	1.1	207.0	23	4761.0	
3	5498	2.1	230.0	24	5520.0	1
4	5499	4.8	200.0	29	5800.0	1
5	5500	3.9	214.0	28	5992.0	1
6	5501	2.9	222.0	26	5772.0	1
7	5502	3.2	204.0	26	5304.0	1
8	5503	2.5	192.0	25	4800.0	1
9	5504	3.1	164.0	26	4264.0	1
10	5505	1.2	156.0	23	3588.0	1
11	5506	3.9	210.0	27	5670.0	1
12	5507	4.6	201.0	29	5829.0	1
13	5508	3.2	162.0	26	4212.0	1
14	5509	2.2	197.0	25	4925.0	1
15	5510	4.5	163.0	29	4727.0	1
16	5511	3.0	203.0	26	5278.0	1
17	5512	5.0	168.0	29	4872.0	1
18	5513	2.4	217.0	25	5425.0	1
19	5514	2.9	191.0	26	4966.0	1
20	5515	2.3	166.0	25	4150.0	1
21	5516	3.7	150.0	27	4050.0	
22	5517	2.2	176.0	25	4400.0	1
23	5518	4.9	195.0	29	5655.0	1
24	5519	2.9	202.0	26	5252.0	1
25	5520	2.5	178.0	25	4450.0	1
26	5521	1.1	206.0	23	4738.0	1
27	5522	3.8	155.0	27	4185.0	1
28	5523	4.7	157.0	29	4553.0	1
29	5524	2.4	224.0	25	5600.0	1
30	5525	4.2	159.0	28	4452.0	1
Detection Percentage						93.33% (>60%)

Type 3 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5496	8.2	355.0	17	6035.0	1
2	5497	6.1	487.0	16	7792.0	1
3	5498	7.1	344.0	16	5504.0	1
4	5499	9.8	288.0	18	5184.0	1
5	5500	8.9	230.0	18	4140.0	1
6	5501	7.9	432.0	17	7344.0	1
7	5502	8.2	207.0	17	3519.0	1
8	5503	7.5	443.0	17	7531.0	1
9	5504	8.1	439.0	17	7463.0	1
10	5505	6.2	223.0	16	3568.0	1
11	5506	8.9	208.0	18	3744.0	1
12	5507	9.6	463.0	18	8334.0	1
13	5508	8.2	441.0	17	7497.0	1
14	5509	7.2	323.0	16	5168.0	1
15	5510	9.5	297.0	18	5346.0	1
16	5511	8.0	412.0	17	7004.0	1
17	5512	10.0	324.0	18	5832.0	1
18	5513	7.4	271.0	17	4607.0	1
19	5514	7.9	349.0	17	5933.0	1
20	5515	7.3	409.0	16	6544.0	
21	5516	8.7	373.0	18	6714.0	1
22	5517	7.2	254.0	16	4064.0	1
23	5518	9.9	274.0	18	4932.0	1
24	5519	7.9	278.0	17	4726.0	1
25	5520	7.5	317.0	17	5389.0	
26	5521	6.1	260.0	16	4160.0	1
27	5522	8.8	211.0	18	3798.0	1
28	5523	9.7	272.0	18	4896.0	1
29	5524	7.4	264.0	17	4488.0	1
30	5525	9.2	284.0	18	5112.0	1
Detection Percentage						93.33% (>60%)

Type 4 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5496	16.0	355.0	14	4970.0	1
2	5497	11.3	487.0	12	5844.0	1
3	5498	13.5	344.0	13	4472.0	1
4	5499	19.4	288.0	16	4608.0	1
5	5500	17.5	230.0	15	3450.0	1
6	5501	15.3	432.0	14	6048.0	1
7	5502	15.9	207.0	14	2898.0	1
8	5503	14.3	443.0	13	5759.0	1
9	5504	15.8	439.0	14	6146.0	1
10	5505	11.5	223.0	12	2676.0	1
11	5506	17.4	208.0	15	3120.0	1
12	5507	19.0	463.0	16	7408.0	1
13	5508	16.0	441.0	14	6174.0	
14	5509	13.8	323.0	13	4199.0	1
15	5510	18.9	297.0	16	4752.0	1
16	5511	15.5	412.0	14	5768.0	1
17	5512	19.9	324.0	16	5184.0	1
18	5513	14.1	271.0	13	3523.0	1
19	5514	15.2	349.0	14	4886.0	1
20	5515	13.8	409.0	13	5317.0	1
21	5516	17.1	373.0	15	5595.0	1
22	5517	13.8	254.0	13	3302.0	1
23	5518	19.8	274.0	16	4384.0	1
24	5519	15.3	278.0	14	3892.0	1
25	5520	14.5	317.0	13	4121.0	1
26	5521	11.3	260.0	12	3120.0	1
27	5522	17.3	211.0	15	3165.0	1
28	5523	19.2	272.0	16	4352.0	1
29	5524	14.2	264.0	13	3432.0	1
30	5525	18.2	284.0	15	4260.0	1
Detection Percentage						96.67% (>60%)

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1+P_d2+P_d3+P_d4}{4}$ = (90%+93.33%+93.33%+96.67%)/4 = 93.33% (>80%)

Type 5 Radar Statistical Performance

Trial Number	Center Frequency(GHz)	Number of Bursts	Burst Period(s)	Waveform Length(s)	1=Detection Blank=No Detection
0	5.510000000	15	0.8000000	12.0000000	1
1	5.510000000	8	1.5000000	12.0000000	1
2	5.510000000	11	1.0909091	12.0000000	1
3	5.510000000	20	0.6000000	12.0000000	1
4	5.510000000	17	0.7058824	12.0000000	
5	5.510000000	14	0.8571429	12.0000000	1
6	5.510000000	15	0.8000000	12.0000000	1
7	5.510000000	12	1.0000000	12.0000000	1
8	5.510000000	14	0.8571429	12.0000000	1
9	5.510000000	8	1.5000000	12.0000000	
10	5.496400000	17	0.7058824	12.0000000	1
11	5.497600000	19	0.6315789	12.0000000	1
12	5.495200000	15	0.8000000	12.0000000	1
13	5.494000000	12	1.0000000	12.0000000	
14	5.497200000	19	0.6315789	12.0000000	1
15	5.494800000	14	0.8571429	12.0000000	1
16	5.498000000	20	0.6000000	12.0000000	1
17	5.494000000	12	1.0000000	12.0000000	1
18	5.494800000	14	0.8571429	12.0000000	1
19	5.494000000	12	1.0000000	12.0000000	1
20	5.524000000	16	0.7500000	12.0000000	
21	5.526400000	12	1.0000000	12.0000000	1
22	5.522000000	20	0.6000000	12.0000000	1
23	5.525200000	14	0.8571429	12.0000000	1
24	5.525600000	13	0.9230769	12.0000000	1
25	5.528000000	8	1.5000000	12.0000000	
26	5.523600000	17	0.7058824	12.0000000	1
27	5.522400000	19	0.6315789	12.0000000	1
28	5.526000000	12	1.0000000	12.0000000	1
29	5.523200000	18	0.6666667	12.0000000	1
Detection Percentage					83.33% (>80%)

Type 6 Radar Statistical Performance

Trial Number	Pulse Width (us)	PRI (us)	Pulse per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Visible Frequency Number	1=Detection Blank=No Detection
0	1.0	333.3	9	0.3333	300.0000000	4	1
1	1.0	333.3	9	0.3333	300.0000000	1	1
2	1.0	333.3	9	0.3333	300.0000000	3	1
3	1.0	333.3	9	0.3333	300.0000000	5	
4	1.0	333.3	9	0.3333	300.0000000	4	1
5	1.0	333.3	9	0.3333	300.0000000	3	1
6	1.0	333.3	9	0.3333	300.0000000	5	1
7	1.0	333.3	9	0.3333	300.0000000	5	1
8	1.0	333.3	9	0.3333	300.0000000	6	1
9	1.0	333.3	9	0.3333	300.0000000	1	1
10	1.0	333.3	9	0.3333	300.0000000	5	1
11	1.0	333.3	9	0.3333	300.0000000	6	1
12	1.0	333.3	9	0.3333	300.0000000	4	1
13	1.0	333.3	9	0.3333	300.0000000	6	1
14	1.0	333.3	9	0.3333	300.0000000	5	1
15	1.0	333.3	9	0.3333	300.0000000	5	1
16	1.0	333.3	9	0.3333	300.0000000	5	1
17	1.0	333.3	9	0.3333	300.0000000	3	
18	1.0	333.3	9	0.3333	300.0000000	3	1
19	1.0	333.3	9	0.3333	300.0000000	3	1
20	1.0	333.3	9	0.3333	300.0000000	5	1
21	1.0	333.3	9	0.3333	300.0000000	6	1
22	1.0	333.3	9	0.3333	300.0000000	5	1
23	1.0	333.3	9	0.3333	300.0000000	4	
24	1.0	333.3	9	0.3333	300.0000000	3	1
25	1.0	333.3	9	0.3333	300.0000000	5	1
26	1.0	333.3	9	0.3333	300.0000000	3	1
27	1.0	333.3	9	0.3333	300.0000000	5	1
28	1.0	333.3	9	0.3333	300.0000000	6	1
29	1.0	333.3	9	0.3333	300.0000000	6	1
Detection Percentage							90% (>70%)

11ac80 CH106 5530MHz
Type 1 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5516	1	938.0	57	53466.0	1
2	5517	1	698.0	76	53048.0	1
3	5518	1	618.0	86	53148.0	
4	5519	1	538.0	99	53262.0	1
5	5520	1	878.0	61	53558.0	1
6	5521	1	3066.0	18	55188.0	1
7	5522	1	638.0	83	52954.0	1
8	5523	1	918.0	58	53244.0	1
9	5524	1	838.0	63	52794.0	1
10	5525	1	858.0	62	53196.0	1
11	5526	1	798.0	67	53466.0	1
12	5527	1	718.0	74	53132.0	1
13	5528	1	578.0	92	53176.0	1
14	5529	1	598.0	89	53222.0	
15	5530	1	558.0	95	53010.0	1
16	5531	1	2536.0	21	53256.0	1
17	5532	1	966.0	55	53130.0	1
18	5533	1	827.0	64	52928.0	1
19	5534	1	2501.0	22	55022.0	1
20	5535	1	2595.0	21	54495.0	1
21	5536	1	1114.0	48	53472.0	1
22	5537	1	1302.0	41	53382.0	1
23	5538	1	3045.0	18	54810.0	1
24	5539	1	1624.0	33	53592.0	1
25	5540	1	2878.0	19	54682.0	1
26	5541	1	1027.0	52	53404.0	1
27	5542	1	2485.0	22	54670.0	1
28	5543	1	1600.0	33	52800.0	1
29	5544	1	1172.0	46	53912.0	1
30	5545	1	1177.0	45	52965.0	1
Detection Percentage						93.33% (>60%)

Type 2 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5516	3.2	179.0	26	4654.0	1
2	5517	1.1	207.0	23	4761.0	1
3	5518	2.1	230.0	24	5520.0	1
4	5519	4.8	200.0	29	5800.0	1
5	5520	3.9	214.0	28	5992.0	1
6	5521	2.9	222.0	26	5772.0	1
7	5522	3.2	204.0	26	5304.0	1
8	5523	2.5	192.0	25	4800.0	1
9	5524	3.1	164.0	26	4264.0	1
10	5525	1.2	156.0	23	3588.0	1
11	5526	3.9	210.0	27	5670.0	1
12	5527	4.6	201.0	29	5829.0	1
13	5528	3.2	162.0	26	4212.0	1
14	5529	2.2	197.0	25	4925.0	1
15	5530	4.5	163.0	29	4727.0	1
16	5531	3.0	203.0	26	5278.0	1
17	5532	5.0	168.0	29	4872.0	1
18	5533	2.4	217.0	25	5425.0	1
19	5534	2.9	191.0	26	4966.0	1
20	5535	2.3	166.0	25	4150.0	1
21	5536	3.7	150.0	27	4050.0	1
22	5537	2.2	176.0	25	4400.0	1
23	5538	4.9	195.0	29	5655.0	1
24	5539	2.9	202.0	26	5252.0	1
25	5540	2.5	178.0	25	4450.0	1
26	5541	1.1	206.0	23	4738.0	1
27	5542	3.8	155.0	27	4185.0	1
28	5543	4.7	157.0	29	4553.0	1
29	5544	2.4	224.0	25	5600.0	1
30	5545	4.2	159.0	28	4452.0	1
Detection Percentage						100% (>60%)

Type 3 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5516	8.2	355.0	17	6035.0	1
2	5517	6.1	487.0	16	7792.0	1
3	5518	7.1	344.0	16	5504.0	1
4	5519	9.8	288.0	18	5184.0	1
5	5520	8.9	230.0	18	4140.0	1
6	5521	7.9	432.0	17	7344.0	1
7	5522	8.2	207.0	17	3519.0	1
8	5523	7.5	443.0	17	7531.0	1
9	5524	8.1	439.0	17	7463.0	1
10	5525	6.2	223.0	16	3568.0	1
11	5526	8.9	208.0	18	3744.0	1
12	5527	9.6	463.0	18	8334.0	1
13	5528	8.2	441.0	17	7497.0	1
14	5529	7.2	323.0	16	5168.0	1
15	5530	9.5	297.0	18	5346.0	1
16	5531	8.0	412.0	17	7004.0	1
17	5532	10.0	324.0	18	5832.0	
18	5533	7.4	271.0	17	4607.0	1
19	5534	7.9	349.0	17	5933.0	1
20	5535	7.3	409.0	16	6544.0	1
21	5536	8.7	373.0	18	6714.0	1
22	5537	7.2	254.0	16	4064.0	1
23	5538	9.9	274.0	18	4932.0	
24	5539	7.9	278.0	17	4726.0	1
25	5540	7.5	317.0	17	5389.0	1
26	5541	6.1	260.0	16	4160.0	1
27	5542	8.8	211.0	18	3798.0	1
28	5543	9.7	272.0	18	4896.0	1
29	5544	7.4	264.0	17	4488.0	1
30	5545	9.2	284.0	18	5112.0	1
Detection Percentage						93.33% (>60%)

Type 4 Radar Statistical Performance

Trial Number	Freq (MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	Waveform Length(us)	1=Detection Blank=No Detection
1	5516	16.0	355.0	14	4970.0	1
2	5517	11.3	487.0	12	5844.0	1
3	5518	13.5	344.0	13	4472.0	1
4	5519	19.4	288.0	16	4608.0	1
5	5520	17.5	230.0	15	3450.0	1
6	5521	15.3	432.0	14	6048.0	1
7	5522	15.9	207.0	14	2898.0	
8	5523	14.3	443.0	13	5759.0	1
9	5524	15.8	439.0	14	6146.0	1
10	5525	11.5	223.0	12	2676.0	1
11	5526	17.4	208.0	15	3120.0	1
12	5527	19.0	463.0	16	7408.0	1
13	5528	16.0	441.0	14	6174.0	1
14	5529	13.8	323.0	13	4199.0	1
15	5530	18.9	297.0	16	4752.0	1
16	5531	15.5	412.0	14	5768.0	1
17	5532	19.9	324.0	16	5184.0	1
18	5533	14.1	271.0	13	3523.0	
19	5534	15.2	349.0	14	4886.0	1
20	5535	13.8	409.0	13	5317.0	1
21	5536	17.1	373.0	15	5595.0	1
22	5537	13.8	254.0	13	3302.0	1
23	5538	19.8	274.0	16	4384.0	1
24	5539	15.3	278.0	14	3892.0	1
25	5540	14.5	317.0	13	4121.0	1
26	5541	11.3	260.0	12	3120.0	1
27	5542	17.3	211.0	15	3165.0	1
28	5543	19.2	272.0	16	4352.0	
29	5544	14.2	264.0	13	3432.0	1
30	5545	18.2	284.0	15	4260.0	1
Detection Percentage						90.0% (>60%)

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1+P_d2+P_d3+P_d4}{4}$ = (93.33%+100%+93.33%+90%)/4 = 94.17% (>80%)

Type 5 Radar Statistical Performance

Trial Number	Center Frequency(Ghz)	Number of Bursts	Burst Period(s)	Waveform Length(s)	1=Detection Blank=No Detection
0	5.530000000	15	0.8000000	12.0000000	1
1	5.530000000	8	1.5000000	12.0000000	1
2	5.530000000	11	1.0909091	12.0000000	1
3	5.530000000	20	0.6000000	12.0000000	1
4	5.530000000	17	0.7058824	12.0000000	1
5	5.530000000	14	0.8571429	12.0000000	1
6	5.530000000	15	0.8000000	12.0000000	1
7	5.530000000	12	1.0000000	12.0000000	
8	5.530000000	14	0.8571429	12.0000000	1
9	5.530000000	8	1.5000000	12.0000000	1
10	5.496400000	17	0.7058824	12.0000000	1
11	5.497600000	19	0.6315789	12.0000000	1
12	5.495200000	15	0.8000000	12.0000000	1
13	5.494000000	12	1.0000000	12.0000000	1
14	5.497200000	19	0.6315789	12.0000000	1
15	5.494800000	14	0.8571429	12.0000000	1
16	5.498000000	20	0.6000000	12.0000000	1
17	5.494000000	12	1.0000000	12.0000000	1
18	5.494800000	14	0.8571429	12.0000000	1
19	5.494000000	12	1.0000000	12.0000000	1
20	5.564000000	16	0.7500000	12.0000000	1
21	5.566400000	12	1.0000000	12.0000000	1
22	5.562000000	20	0.6000000	12.0000000	1
23	5.565200000	14	0.8571429	12.0000000	1
24	5.565600000	13	0.9230769	12.0000000	1
25	5.568000000	8	1.5000000	12.0000000	1
26	5.563600000	17	0.7058824	12.0000000	1
27	5.562400000	19	0.6315789	12.0000000	1
28	5.566000000	12	1.0000000	12.0000000	1
29	5.563200000	18	0.6666667	12.0000000	1
Detection Percentage					96.67% (>80%)

Type 6 Radar Statistical Performance

Trial Number	Pulse Width (us)	PRI (us)	Pulse per Hop	Hopping Rate (kHz)	Hopping Sequence Length(ms)	Visible Frequency Number	1=Detection Blank=No Detection
0	1.0	333.3	9	0.3333	300.0000000	4	1
1	1.0	333.3	9	0.3333	300.0000000	1	1
2	1.0	333.3	9	0.3333	300.0000000	3	1
3	1.0	333.3	9	0.3333	300.0000000	5	1
4	1.0	333.3	9	0.3333	300.0000000	4	1
5	1.0	333.3	9	0.3333	300.0000000	3	1
6	1.0	333.3	9	0.3333	300.0000000	5	1
7	1.0	333.3	9	0.3333	300.0000000	5	1
8	1.0	333.3	9	0.3333	300.0000000	6	
9	1.0	333.3	9	0.3333	300.0000000	1	
10	1.0	333.3	9	0.3333	300.0000000	5	1
11	1.0	333.3	9	0.3333	300.0000000	6	1
12	1.0	333.3	9	0.3333	300.0000000	4	1
13	1.0	333.3	9	0.3333	300.0000000	6	
14	1.0	333.3	9	0.3333	300.0000000	5	1
15	1.0	333.3	9	0.3333	300.0000000	5	1
16	1.0	333.3	9	0.3333	300.0000000	5	1
17	1.0	333.3	9	0.3333	300.0000000	3	1
18	1.0	333.3	9	0.3333	300.0000000	3	1
19	1.0	333.3	9	0.3333	300.0000000	3	1
20	1.0	333.3	9	0.3333	300.0000000	5	1
21	1.0	333.3	9	0.3333	300.0000000	6	1
22	1.0	333.3	9	0.3333	300.0000000	5	
23	1.0	333.3	9	0.3333	300.0000000	4	1
24	1.0	333.3	9	0.3333	300.0000000	3	1
25	1.0	333.3	9	0.3333	300.0000000	5	1
26	1.0	333.3	9	0.3333	300.0000000	3	1
27	1.0	333.3	9	0.3333	300.0000000	5	1
28	1.0	333.3	9	0.3333	300.0000000	6	1
29	1.0	333.3	9	0.3333	300.0000000	6	1
Detection Percentage							86.67% (>70%)

The End