Dynamic Frequency Selection (DFS) Test Report
FCC Part15 Subpart E & RSS 247 Issue2

Product Name	:	Wireless Access point
Model No.	:	AP122, AP122X
FCC ID	:	WBV-AP122
IC	:	7774A-AP122

Applicant	:	Aerohive Networks, Inc.
Address	:	Aerohive Networks.1011 McCarthy Boulevard Milpitas, CA 95035,United States

Date of Receipt	:	Oct. 10, 2016
Test Date	:	Nov. 11, 2017~ Nov. 24, 2017
Issued Date	:	Jan. 30, 2018
Report No.	:	17A2003R-DFS-US-P08V01
Report Version	:	V1.2

DFS Test Report

Issued Date: Jan. 30, 2018
Report No. : 17A2003R-DFS-US-P08V01

Product Name	:	Wireless Access point
Applicant	:	Aerohive Networks, Inc.
Address	:	Aerohive Networks.1011 McCarthy Boulevard Milpitas, CA 95035,United States
Manufacturer	:	Aerohive Networks, Inc.
Address	:	Aerohive Networks.1011 McCarthy Boulevard Milpitas, CA 95035,United States
Model No.	:	AP122, AP122X
FCC ID	:	WBV-AP122
IC	:	7774A-AP122
EUT Voltage	:	PoE 48V
Brand Name	:	Aerohive
Applicable Standard	:	FCC CFR Title 47 Part 15 Subpart E: 2017 FCC OET Order 16-24A1 (2016) KDB 905462 D02 v02 RSS-Gen Issue 4 RSS-247 Issue 2
Test Result	:	Pass
Performed Location	:	DEKRA Testing & Certification (Suzhou) Co., Ltd. No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098 FCC Designation Number: CN1199
Operation Mode (5250~5350MHz 5470~5725MHz)	:	☒ Master device ☐ Slaver device with radar detection function ☐ Slaver device without radar detection function

Documented By : Kathy Feng

(Project Assistant: Kathy Feng)

Reviewed By : Frank he

(Senior Engineer: Frank He)

Approved By : Harry Zhao

(Engineering Manager: Harry Zhao)

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1.General Information

Antenna Model No.	N/A					
Antenna manufacturer	N/A					
Software Version	HiveOS 8.1r2					
Build Number	177638					
Antenna Delivery	☒	1*TX+1*RX	☒	2*TX+2*RX	☐	3*TX+3*RX
Antenna technology	☒	SISO				
	☒	MIMO	☐	Basic		
			☐	Sectorized antenna systems		
			☐	Cross-polarized antennas		
			☐	Unequal antenna gains, with equal transmit powers		
			☐	Spatial Multiplexing		
			☒	CDD		
			☒	Beam-forming		
Antenna Type	☒	External	☒	Dipole		
	☐	Internal	☐	PIFA		
			☐	PCB		
			☐	Ceramic Chip Antenna		
			☐	Metal plate type F antenna		
			☐	Cross-polarize Antenna		
Antenna Gain #0	4dBi					
Antenna Gain #1	4dBi					

Note:

1. Adding a model AP122X, the difference is as below:

	Antenna Type	Max Antenna Gain(2.4G)	Max Antenna Gain(5G)
AP122	Internal PIFA Antenna	3.8 dBi	5.44 dBi
AP122X	External Dipole Antenna	4 dBi	4 dBi

The UUT operates in the following bands:

1. 5250-5350 MHz
2. 5500-5710 MHz

The maximum mean EIRP of the device for 5GHz band is more than 23dBm.

System test was performed with the designated MPEG test file (download from NTIA) that streams full motion video at 30 frames per second from the Master to the Client IP based system.

The UUT utilizes 802.11a/n/ac IP based architecture. One nominal channel bandwidth, 20 MHz, 40MHz, 80MHz are implemented.

The slaver device is Intel WiFi module 5100.

Information regarding the parameters of the detected Radar Waveforms is not available to the end user.

For the 5250~5350 MHz band, the Master device provides, on aggregate, uniform loading of the spectrum across all devices by selecting an operating channel among the available channels using a random algorithm.

The DFS test software is N7607B 3.2.0.0

2. Test Equipment

Dynamic Frequency Selection (DFS) / AC-8

Instrument	Manufacturer	Type No.	Serial No	Cal. Date
Spectrum Analyzer	Agilent	E4440A	MY49420128	2018.03.28
Vector Signal Generator	Agilent	E4438C	MY49070163	2018.03.28
Preamplifier	Miteq	NSP1800-25	1364185	2018.05.06
Preamplifier	DEKRA Testing & Certification (Suzhou) Co., Ltd.	AP-040G	CHM-0906001	2018.05.06
DRG Horn	ETS-Lindgren	3117	00123988	2018.01.22
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2018.11.25
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2018.03.02
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2018.03.02
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2018.03.02
EMI Receiver	Agilent	N9038A	MY51210196	2018.06.10
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2018.01.04

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

3. DFS Detection Threshold and Response Requirement

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. 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.	

4. 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 $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{PRI_{\mu sec}}\right)\right\}$	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 $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{3066}\right)\right\} = \text{Roundup}\{17.2\} = 18.$

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.

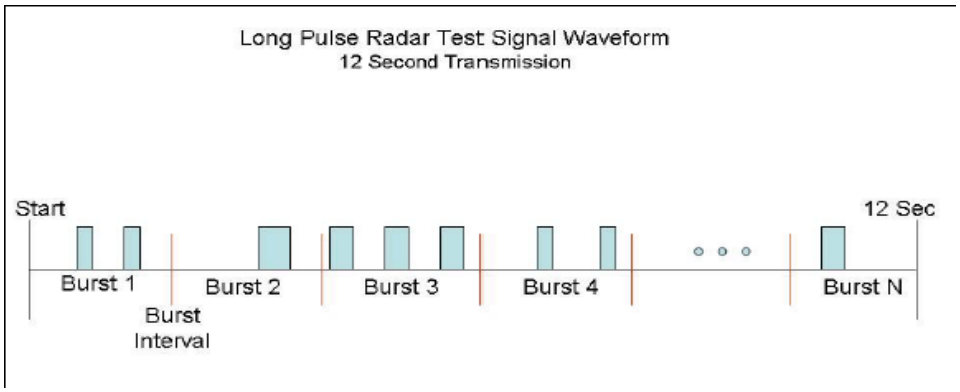
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.

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

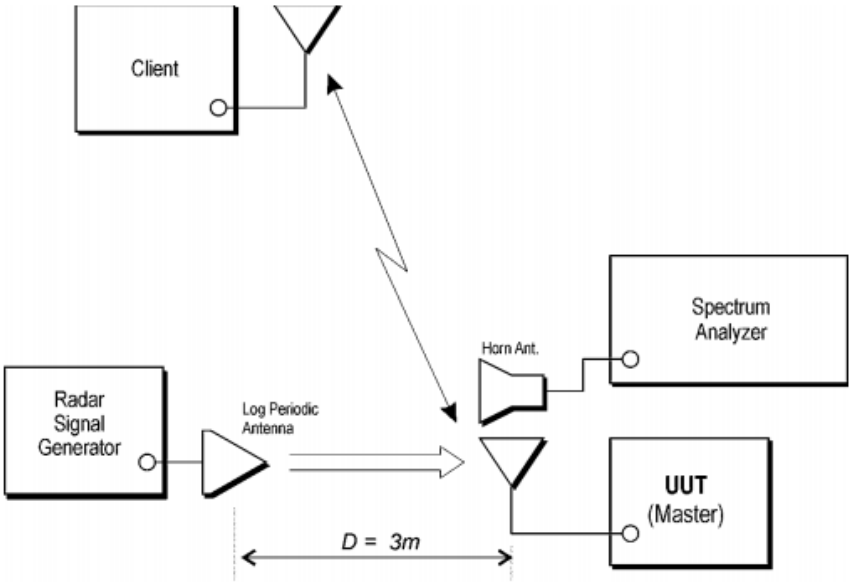
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues 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.

5. 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



DFS Set-up Photo

6. 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.

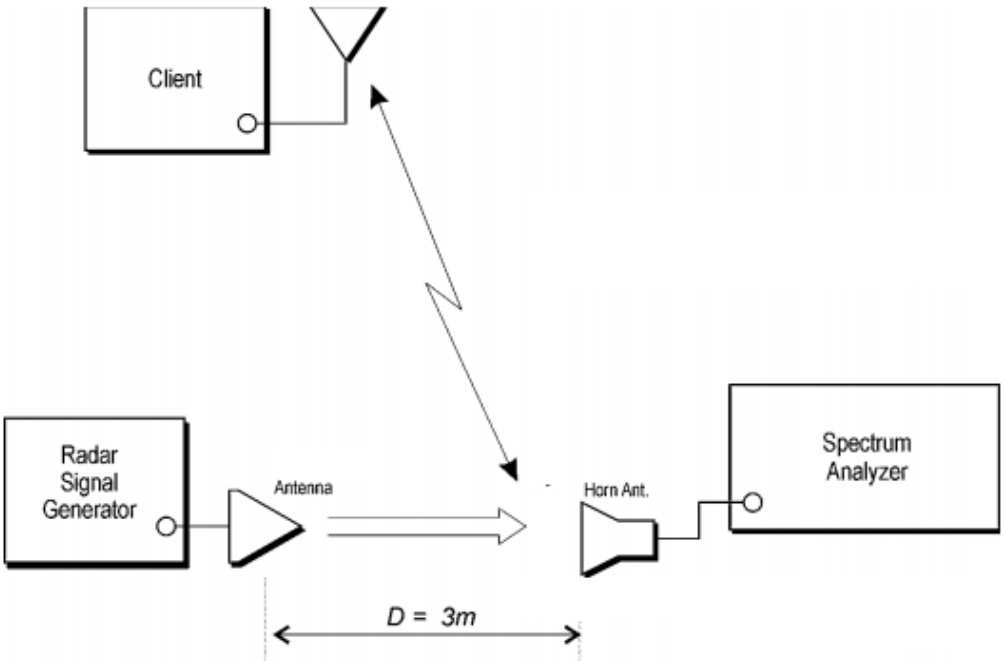
e. The U-NII Detection Bandwidth

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.

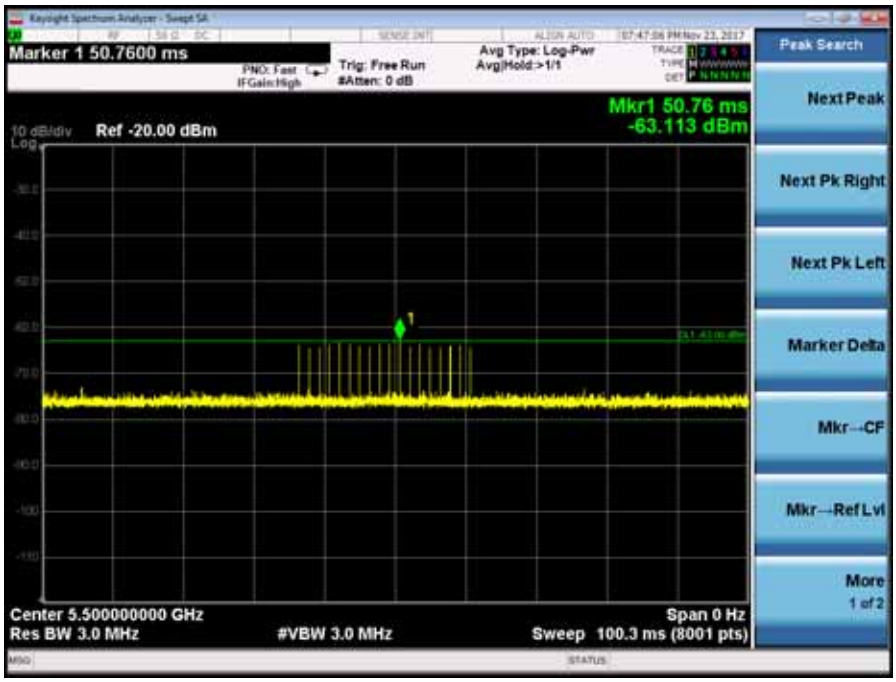
g. Verify use of vertical polarization for testing when using a radiated test method.

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.

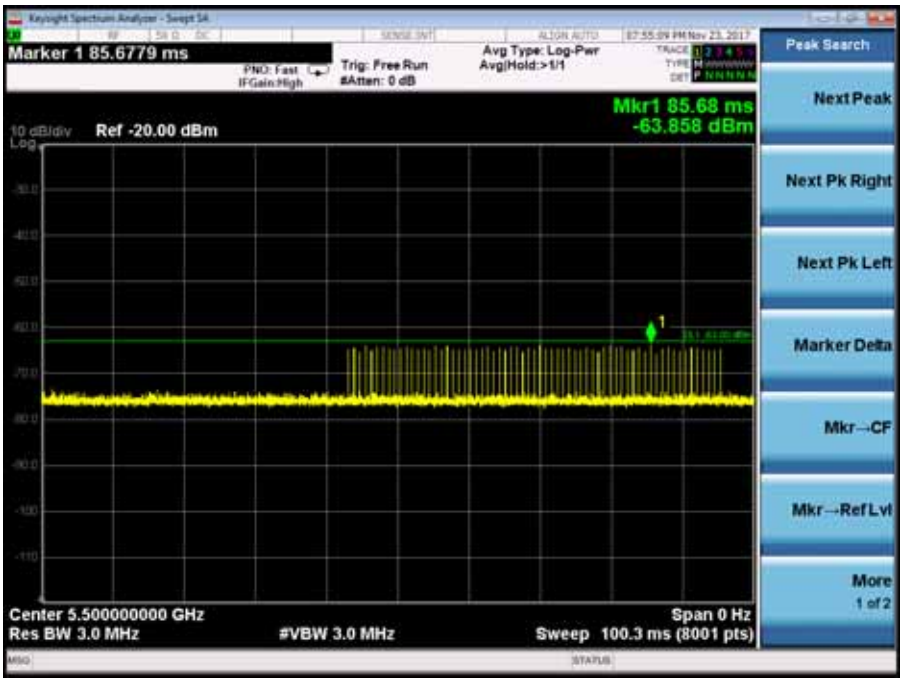
Figure 2: Radiated Calibration Setup



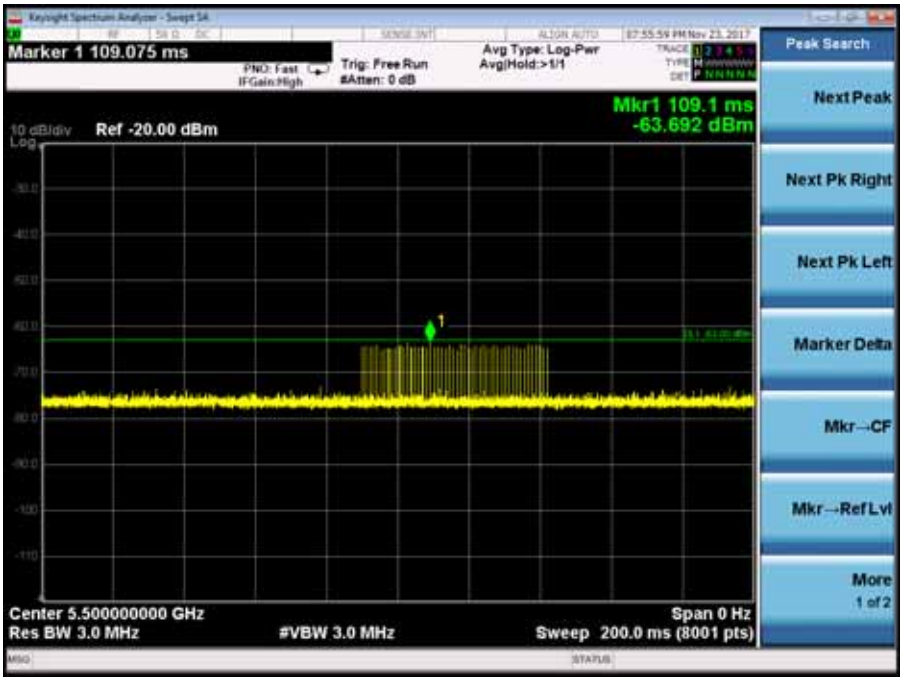
11a CH100 5500MHz Radar Type 0 Calibration Plot



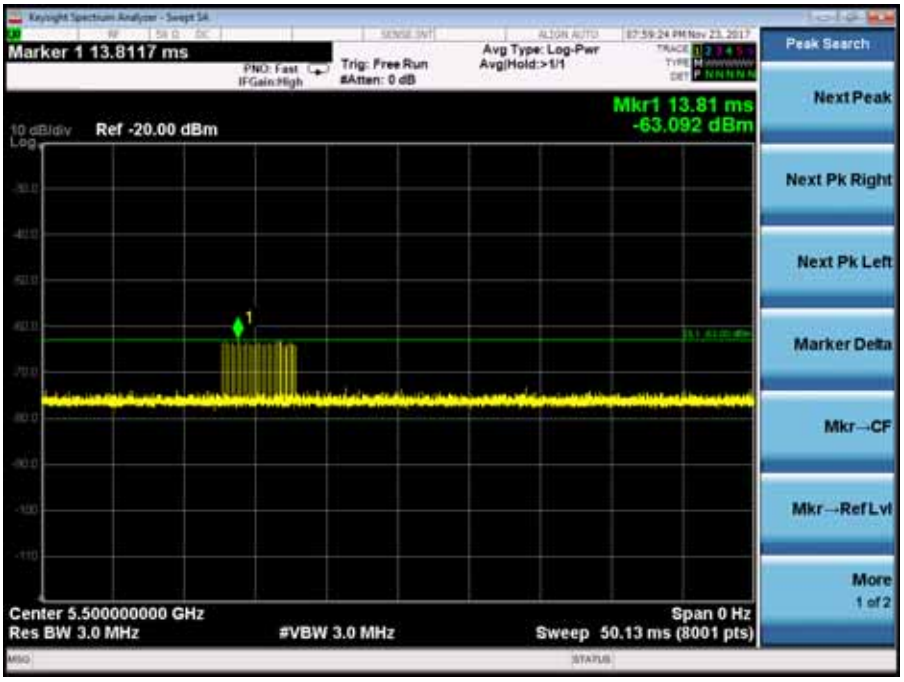
11a CH100 5500MHz Radar Type 1A Calibration Plot



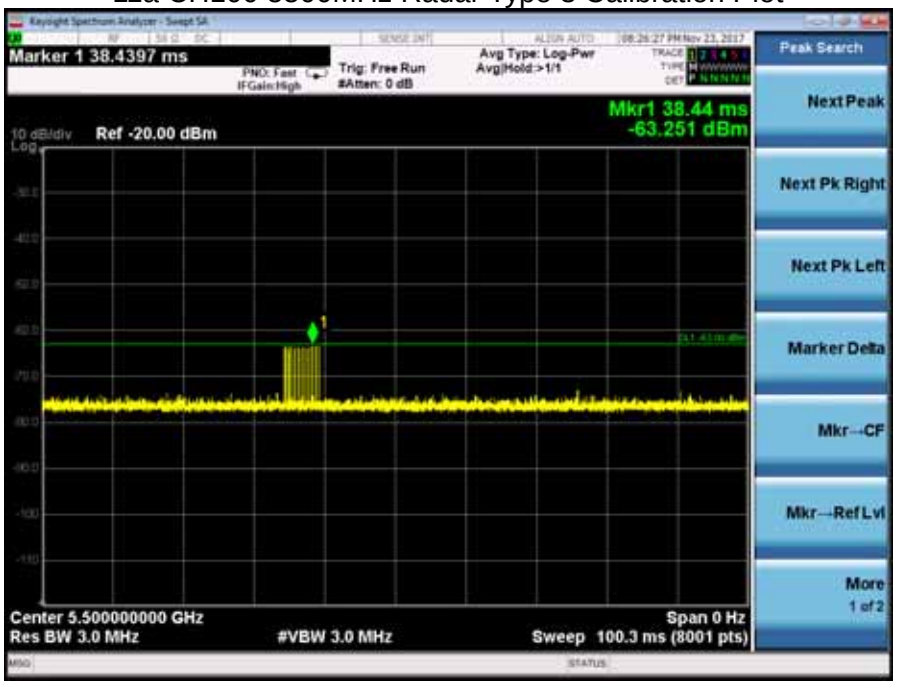
11a CH100 5500MHz Radar Type 1B Calibration Plot



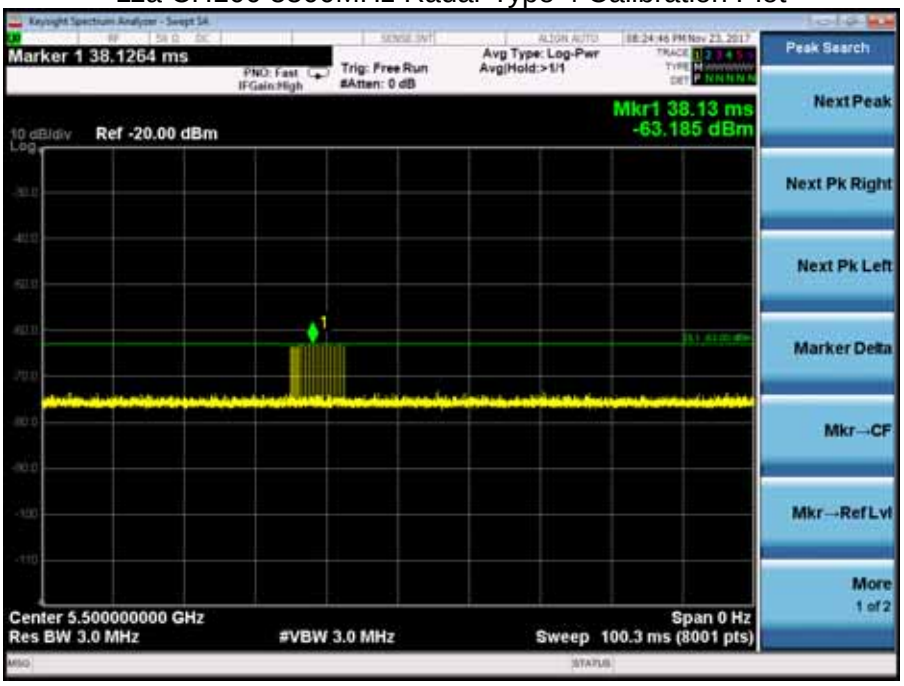
11a CH100 5500MHz Radar Type 2 Calibration Plot



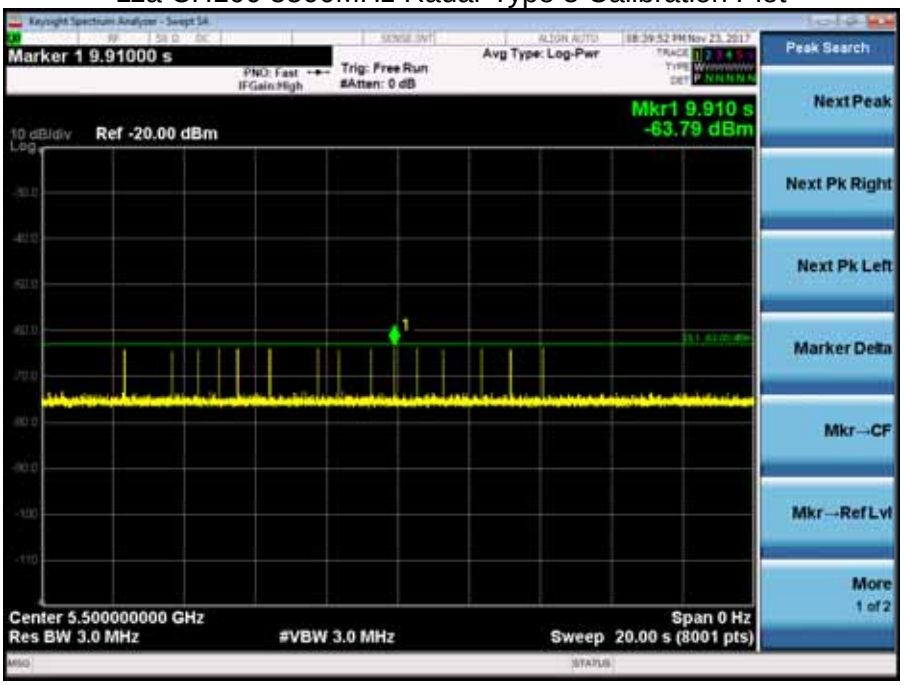
11a CH100 5500MHz Radar Type 3 Calibration Plot



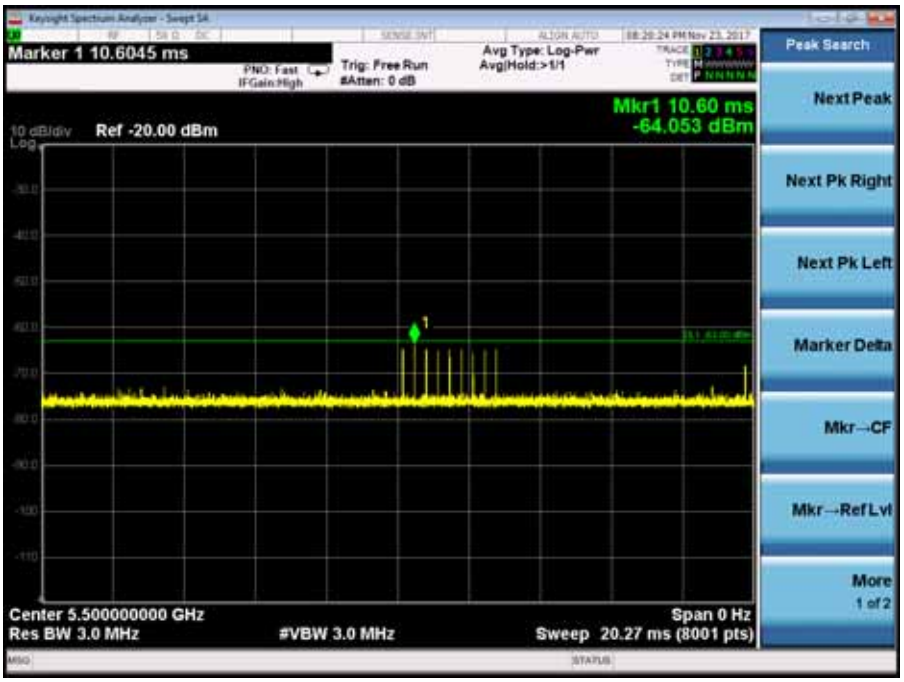
11a CH100 5500MHz Radar Type 4 Calibration Plot



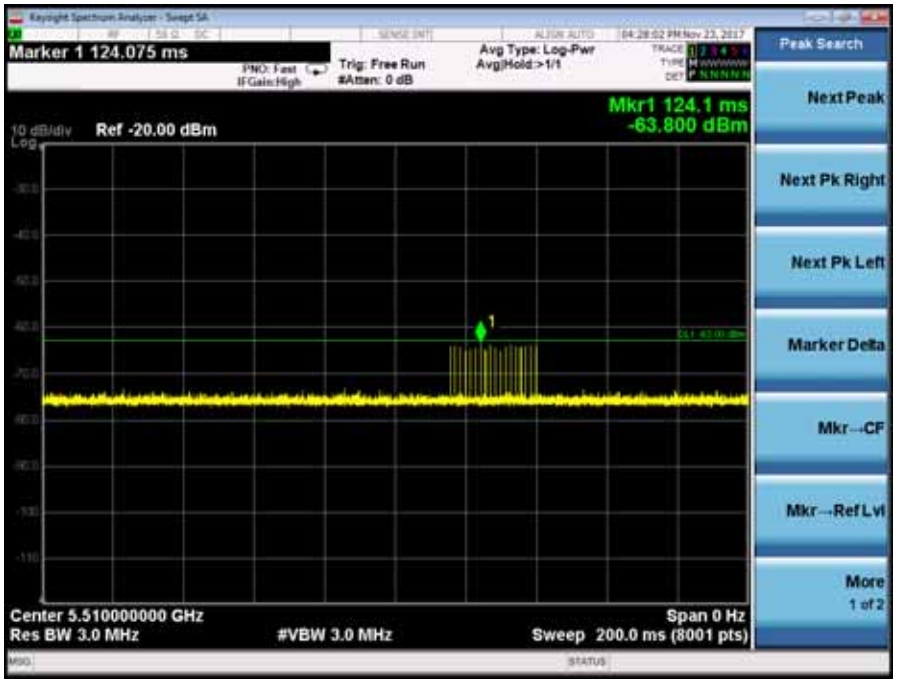
11a CH100 5500MHz Radar Type 5 Calibration Plot



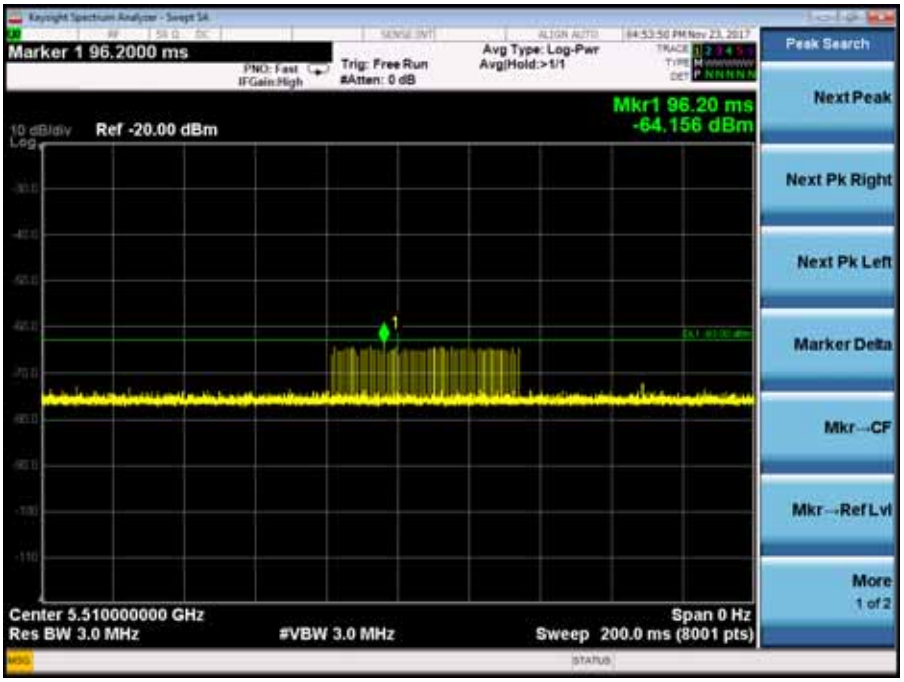
11a CH100 5500MHz Radar Type 6 Calibration Plot



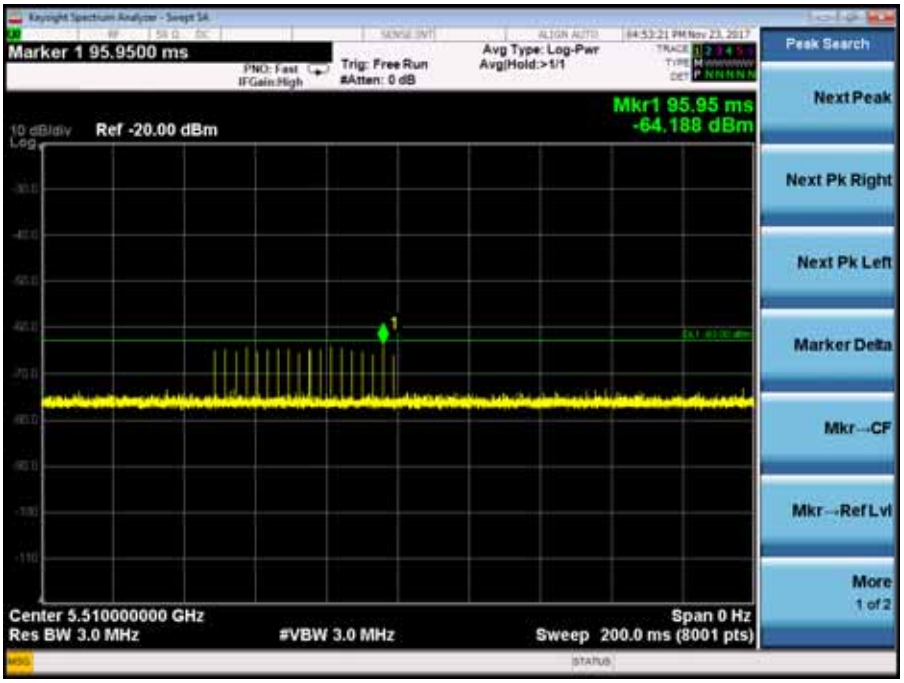
11ac40 CH102 5510MHz Radar Type 0 Calibration Plot



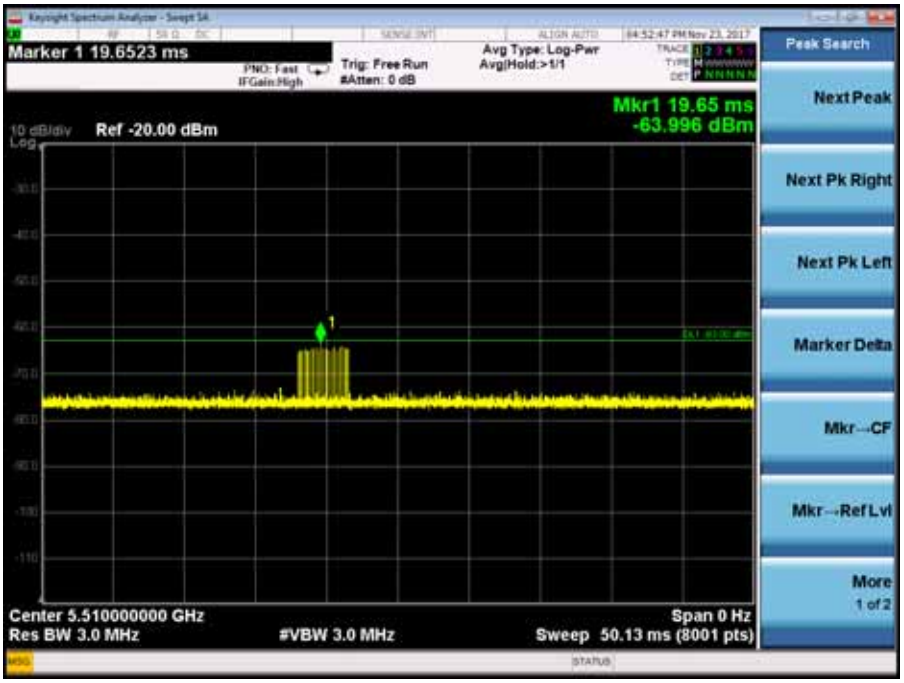
11ac40 CH102 5510MHz Radar Type 1A Calibration Plot



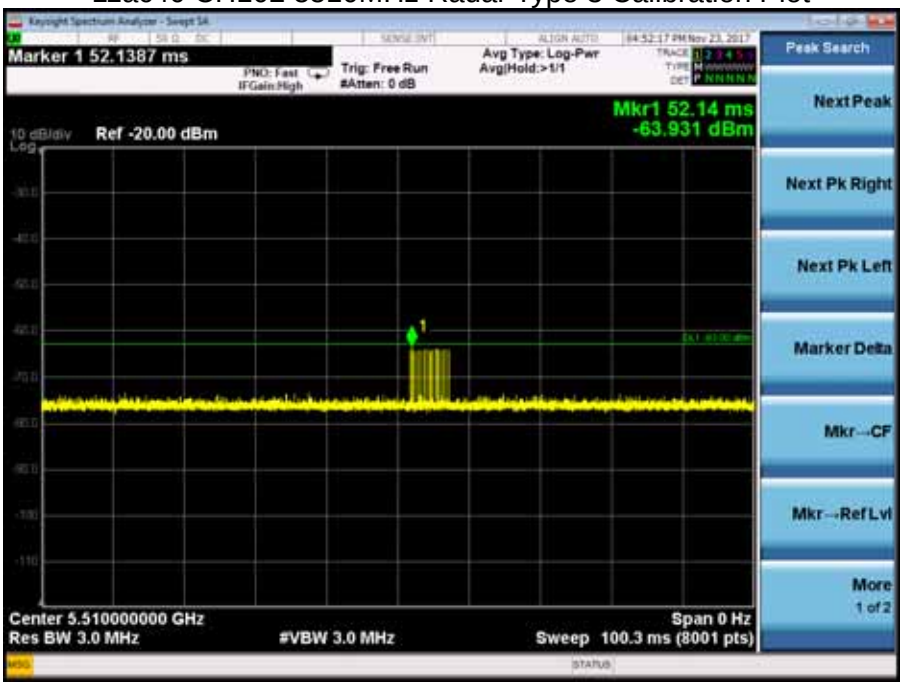
11ac40 CH102 5510MHz Radar Type 1B Calibration Plot



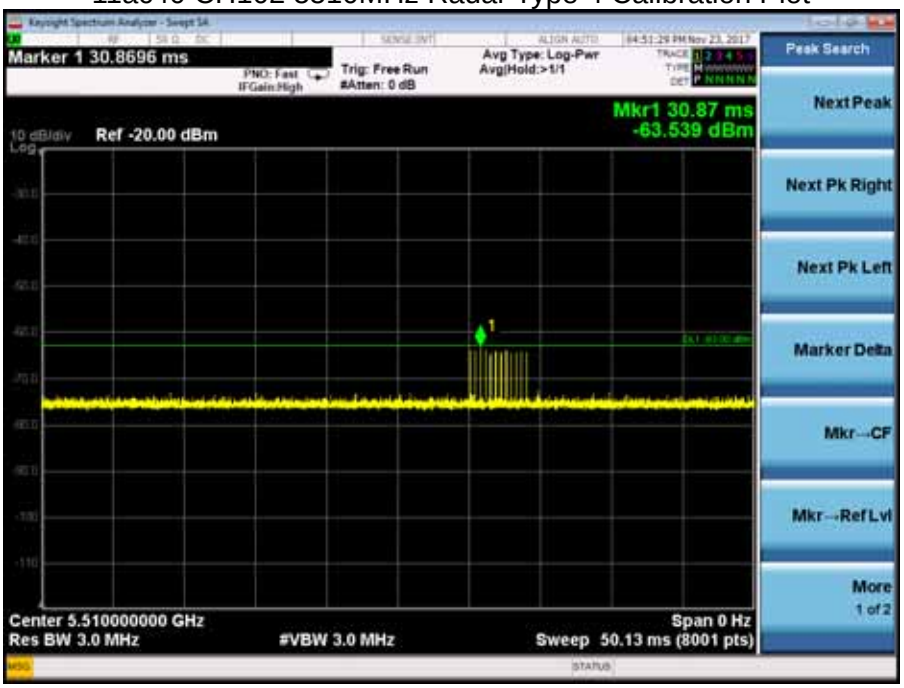
11ac40 CH102 5510MHz Radar Type 2 Calibration Plot



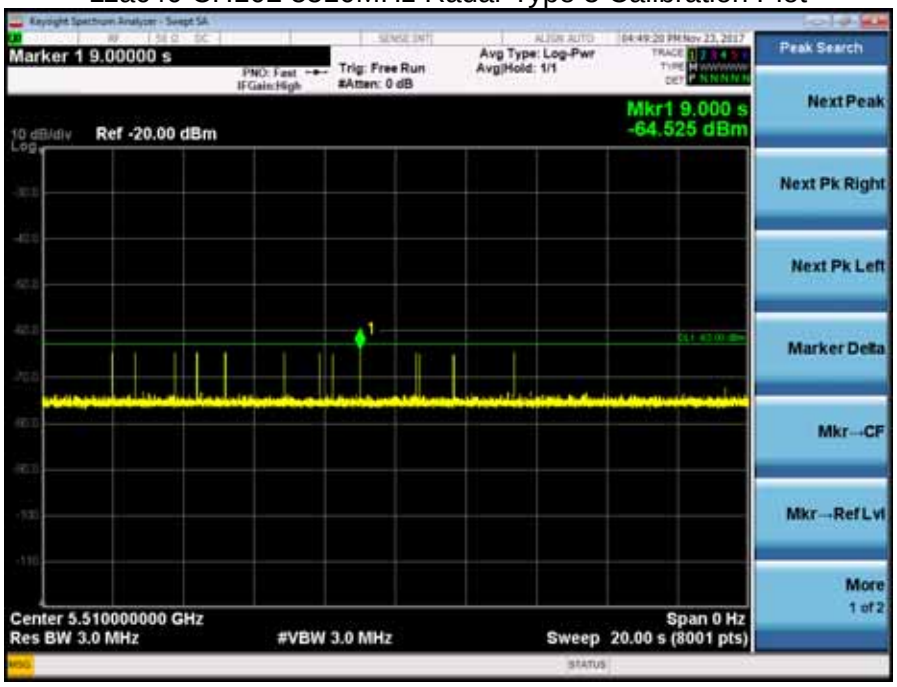
11ac40 CH102 5510MHz Radar Type 3 Calibration Plot



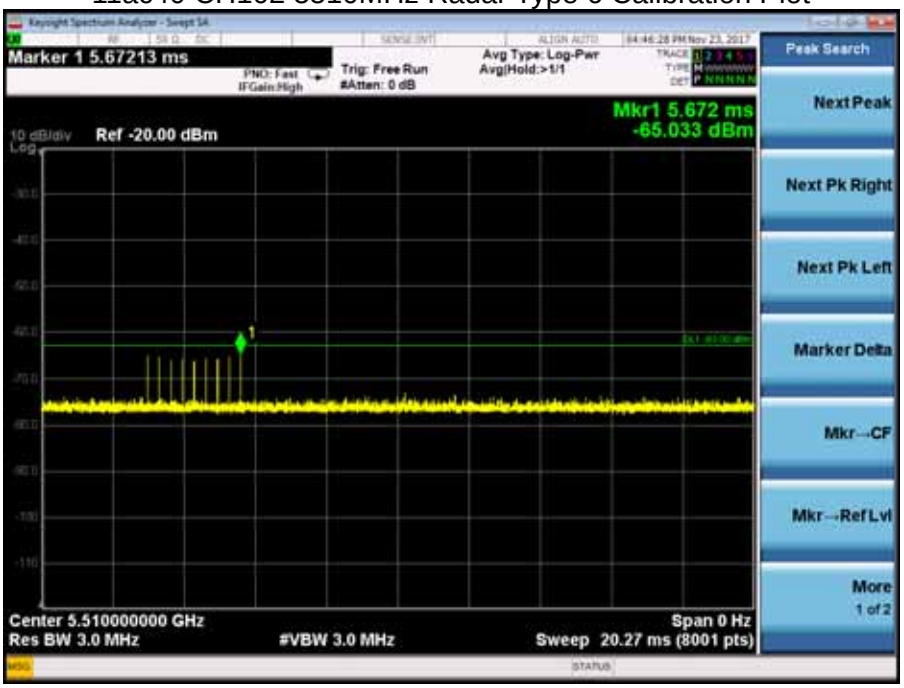
11ac40 CH102 5510MHz Radar Type 4 Calibration Plot



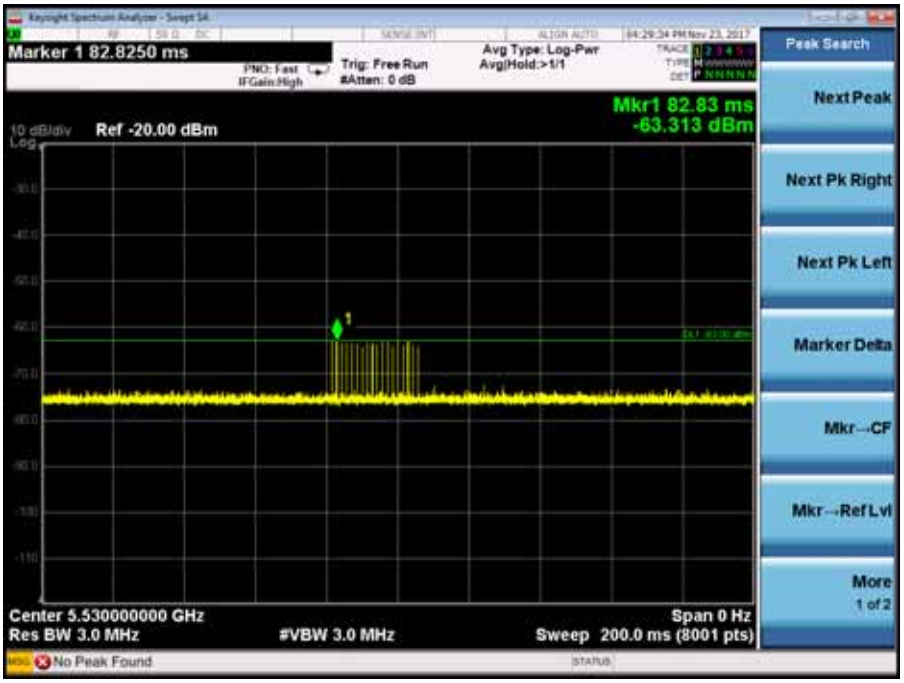
11ac40 CH102 5510MHz Radar Type 5 Calibration Plot



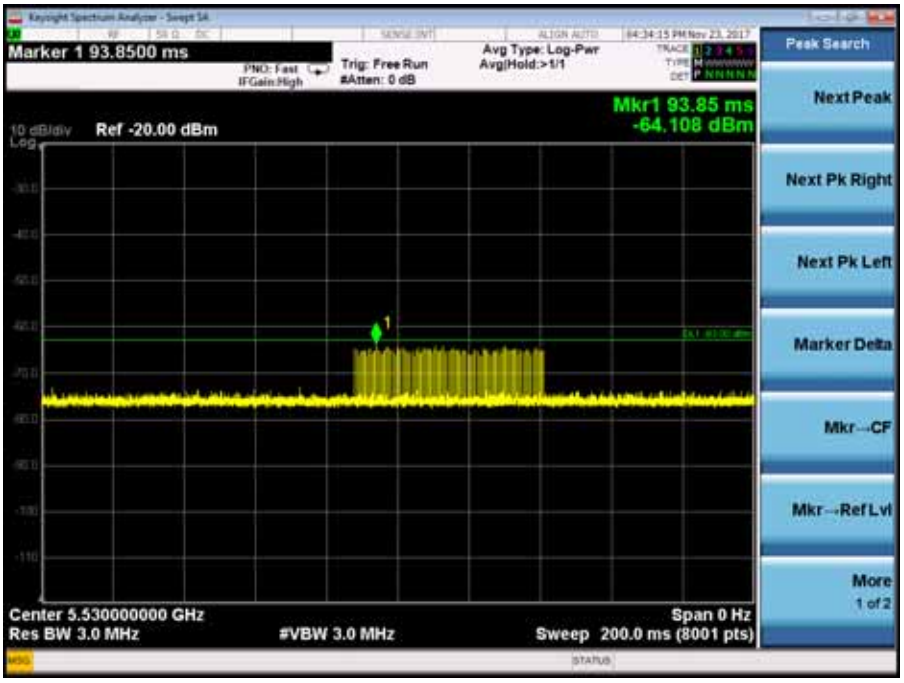
11ac40 CH102 5510MHz Radar Type 6 Calibration Plot



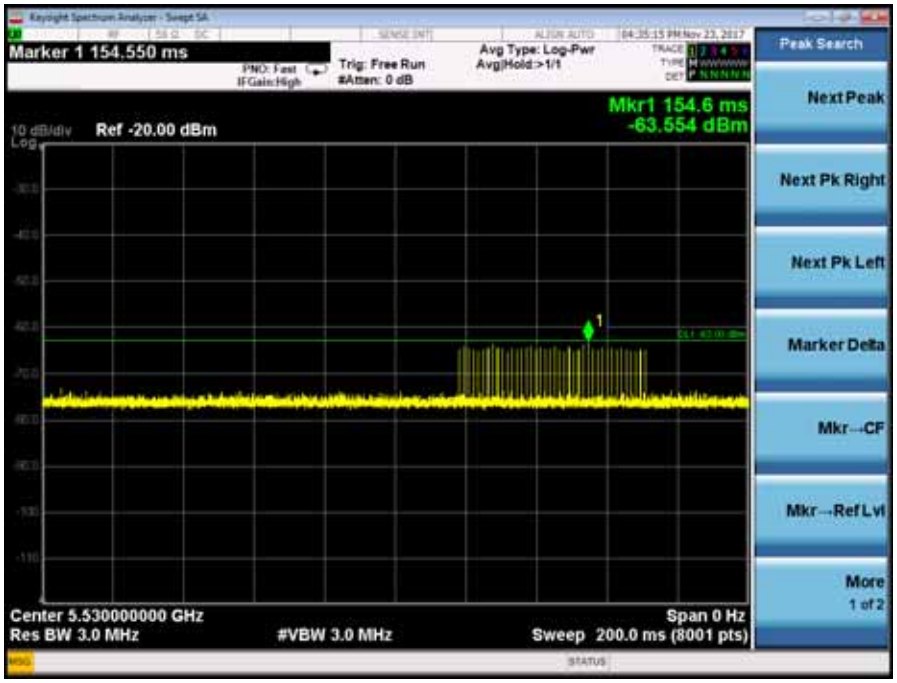
11ac80 CH106 5530MHz Radar Type 0 Calibration Plot



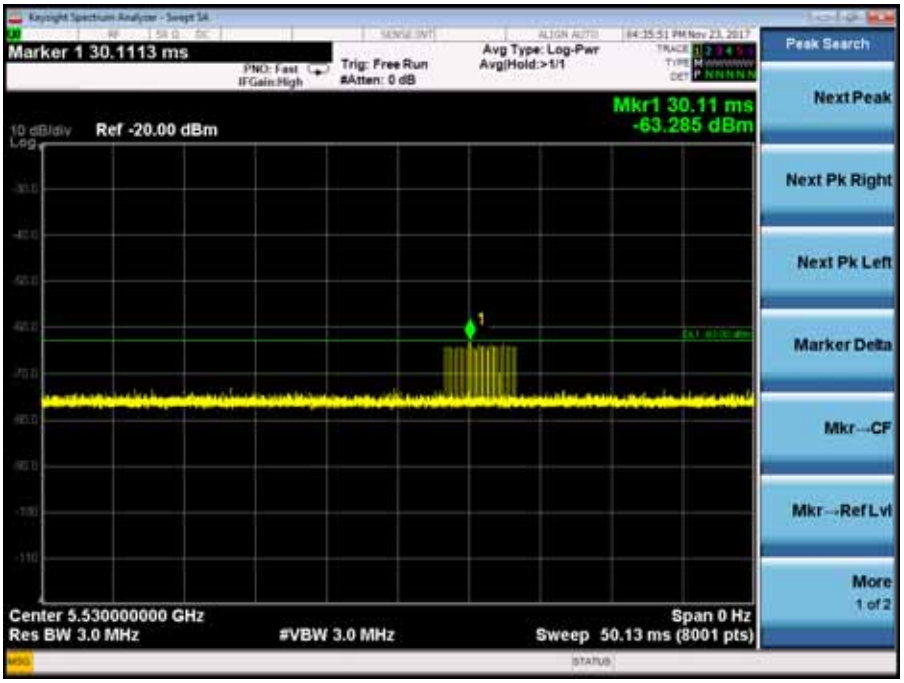
11ac80 CH106 5530MHz Radar Type 1A Calibration Plot



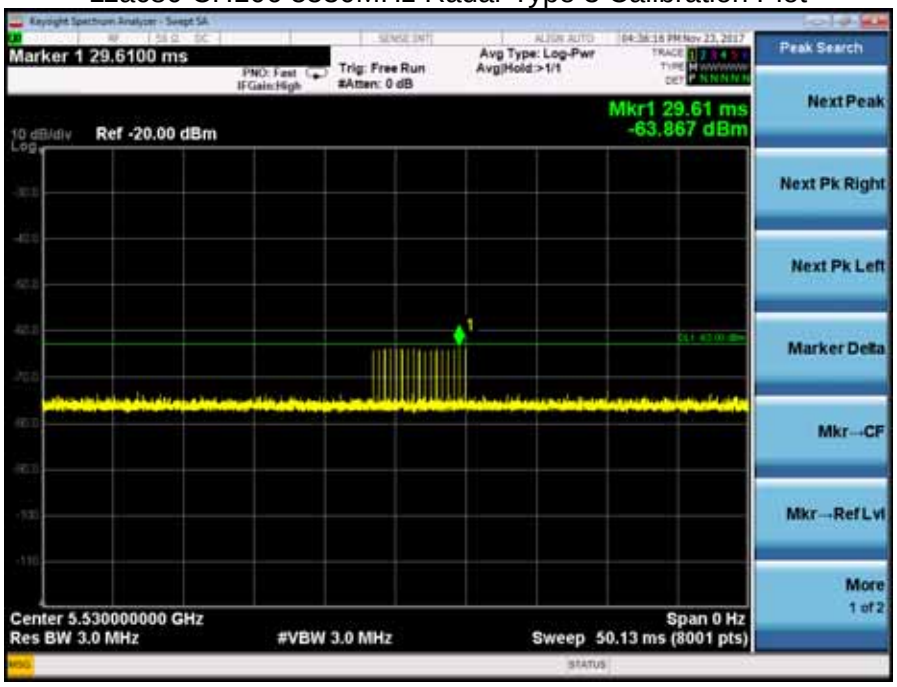
11ac80 CH106 5530MHz Radar Type 1B Calibration Plot



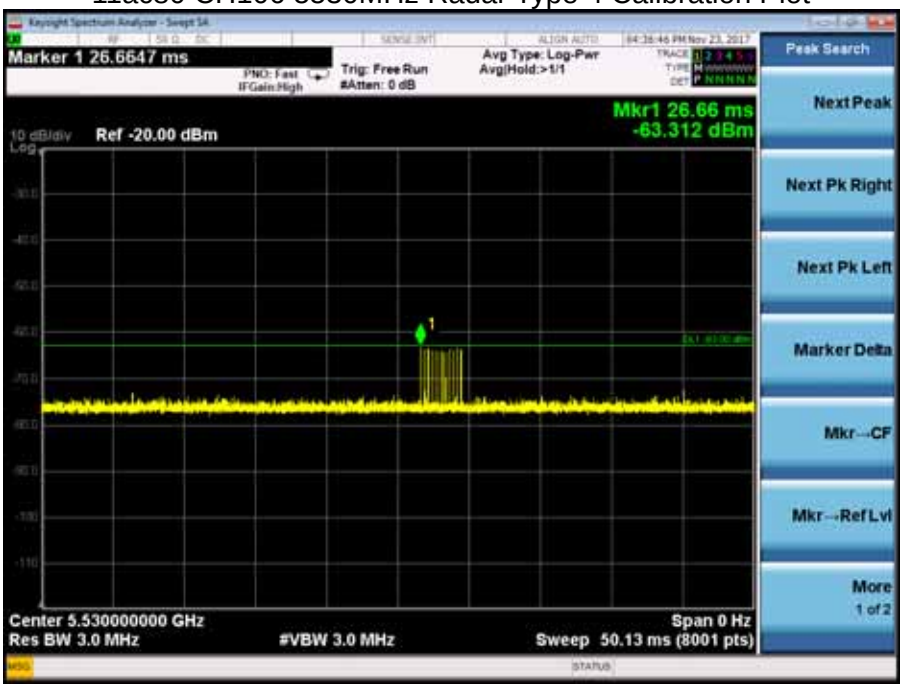
11ac80 CH106 5530MHz Radar Type 2 Calibration Plot



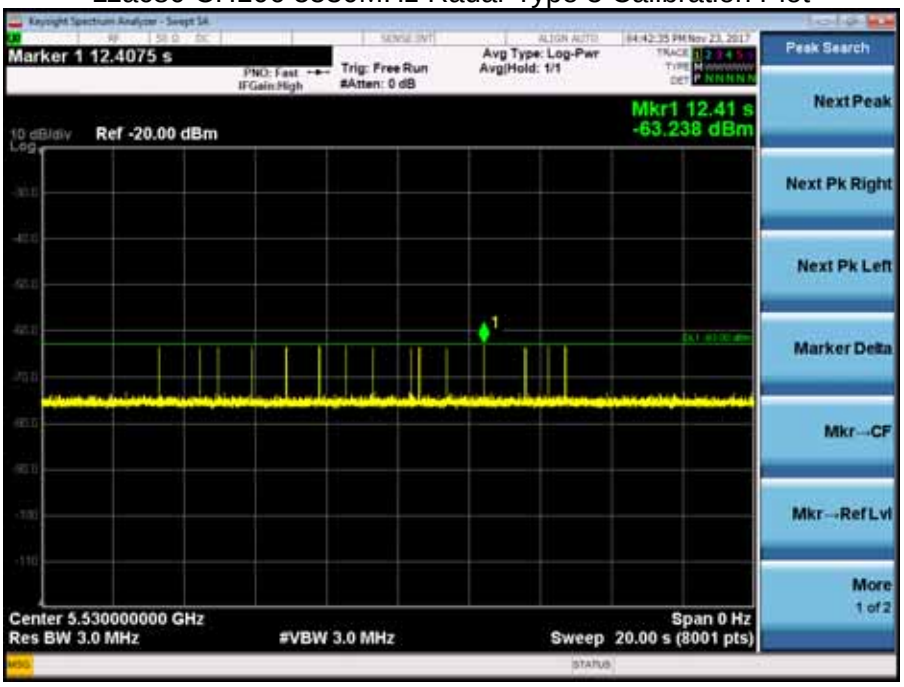
11ac80 CH106 5530MHz Radar Type 3 Calibration Plot



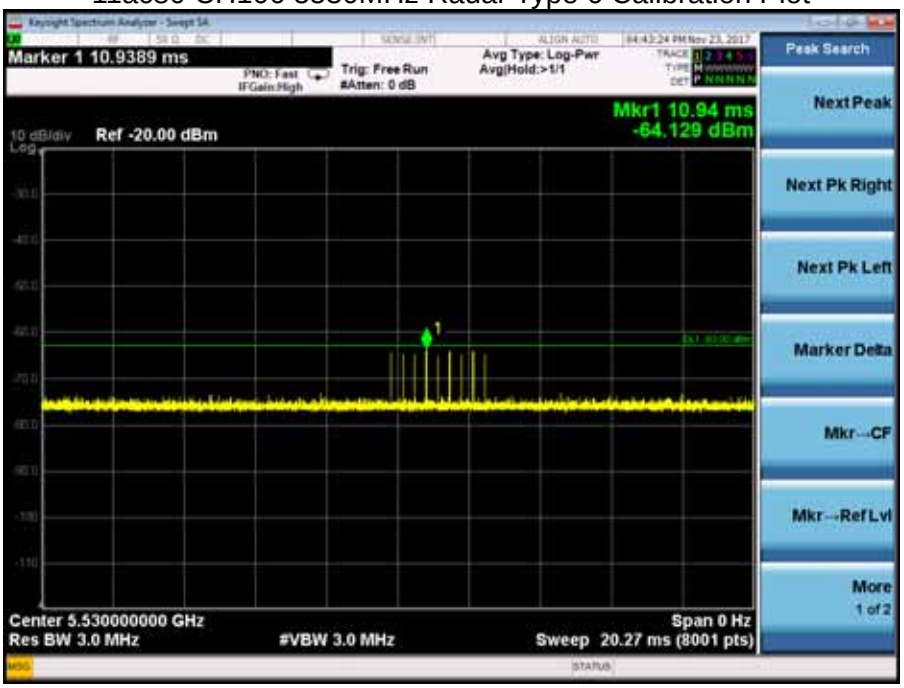
11ac80 CH106 5530MHz Radar Type 4 Calibration Plot



11ac80 CH106 5530MHz Radar Type 5 Calibration Plot



11ac80 CH106 5530MHz Radar Type 6 Calibration Plot



7. 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:

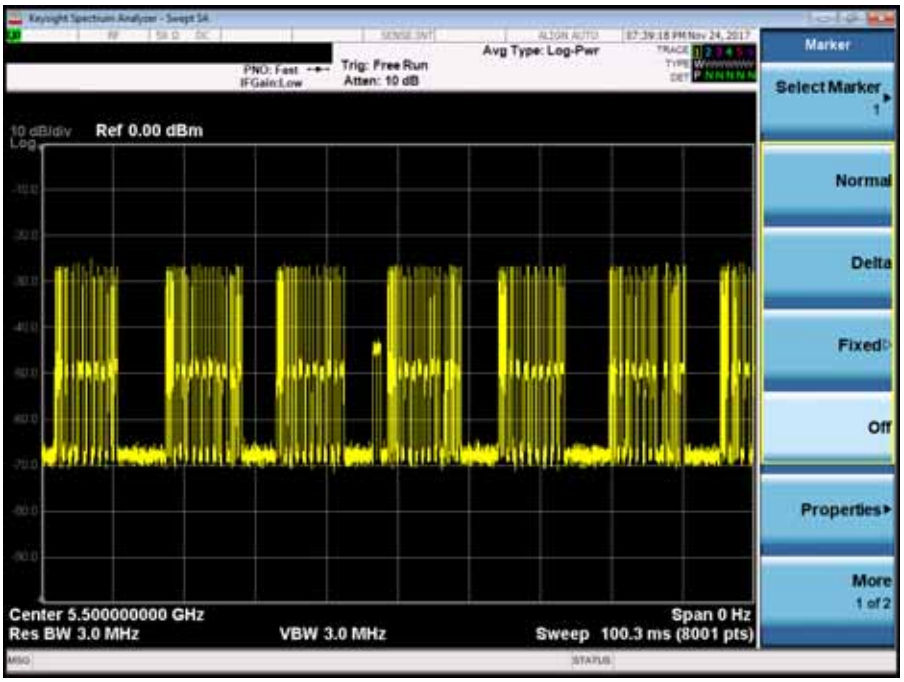
a) The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.

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

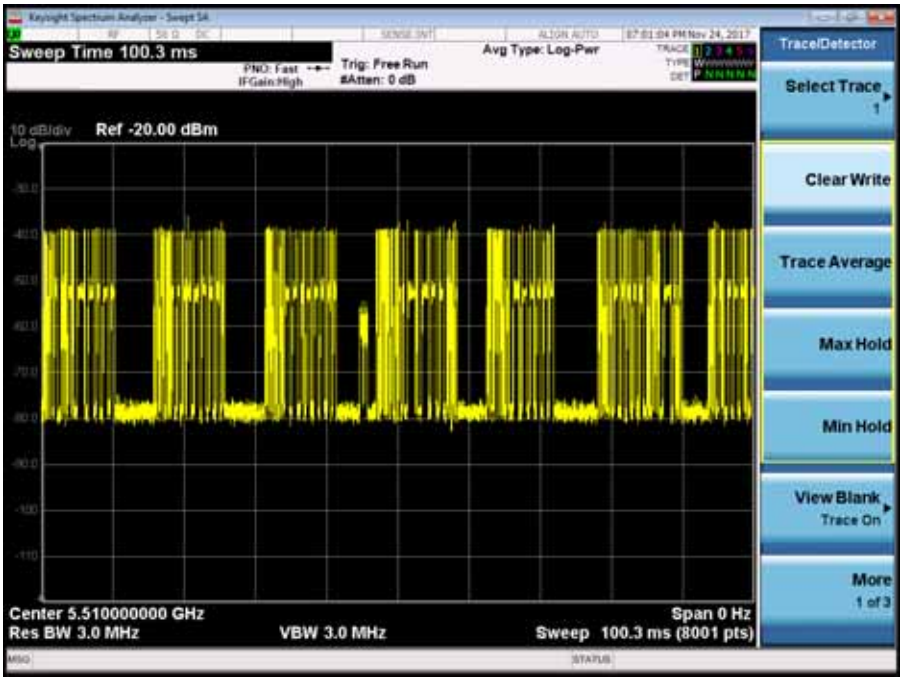
c) Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater. For example, you can zero span the spectrum analyzer and approximate the transmission time.

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

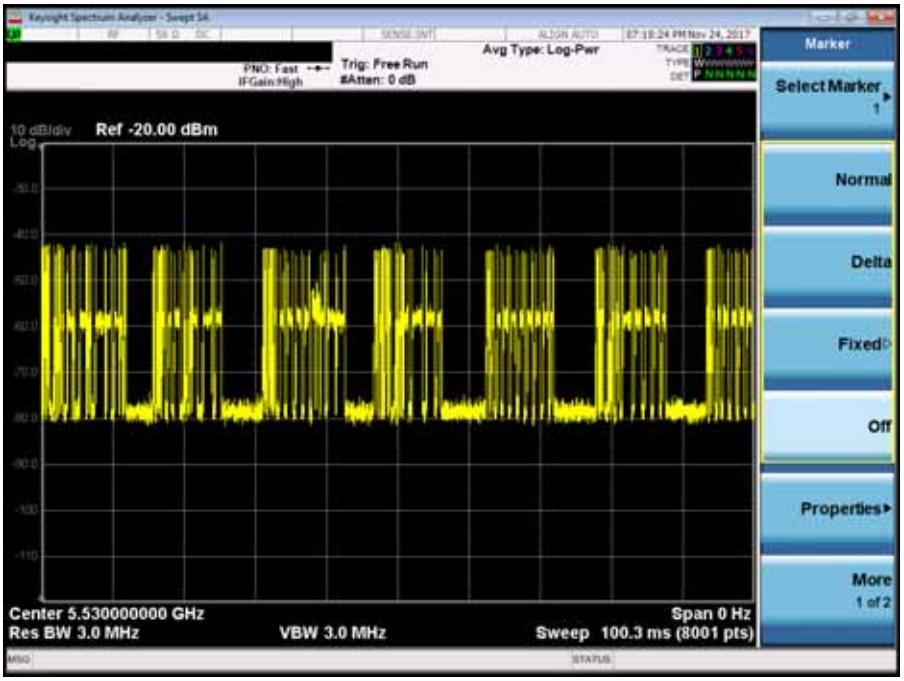
Channel Loading Plot - 802.11a-5500MHz



Channel Loading Plot - 802.11n-HT40 5510MHz



Channel Loading Plot - 802.11ac-VHT80 5530MHz



Test Mode	Packet ratio	Requirement ratio	Test Result
802.11a	28.15%	>17%	Pass
802.11n-HT40	26.57%	>17%	Pass
802.11ac-VHT80	22.88%	>17%	Pass

8. Test Procedures

a) 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.

b) 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.

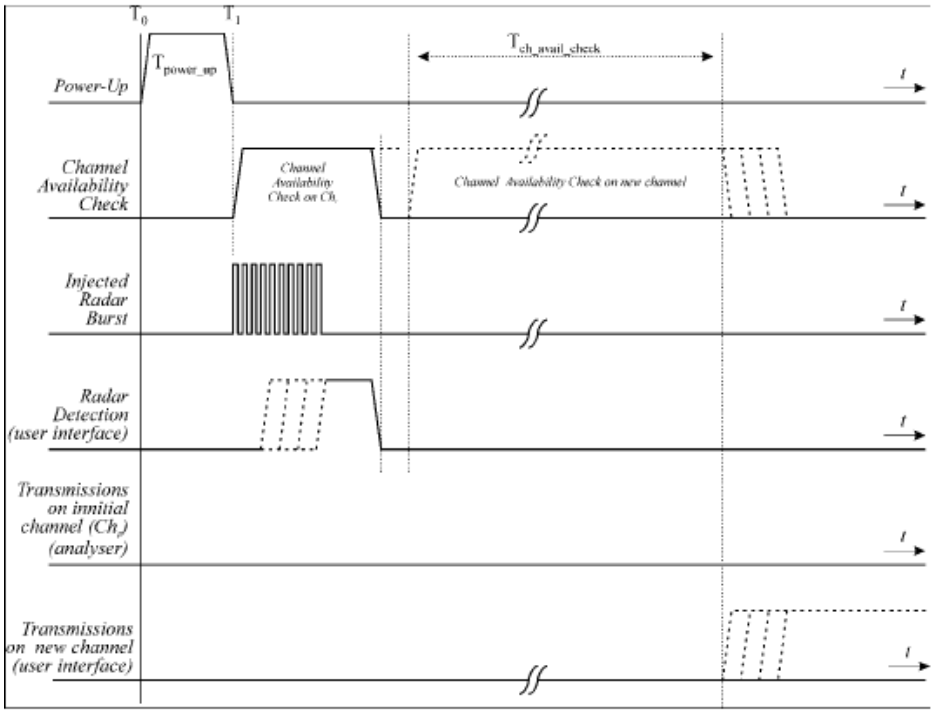
a) The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections on configuration for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

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.

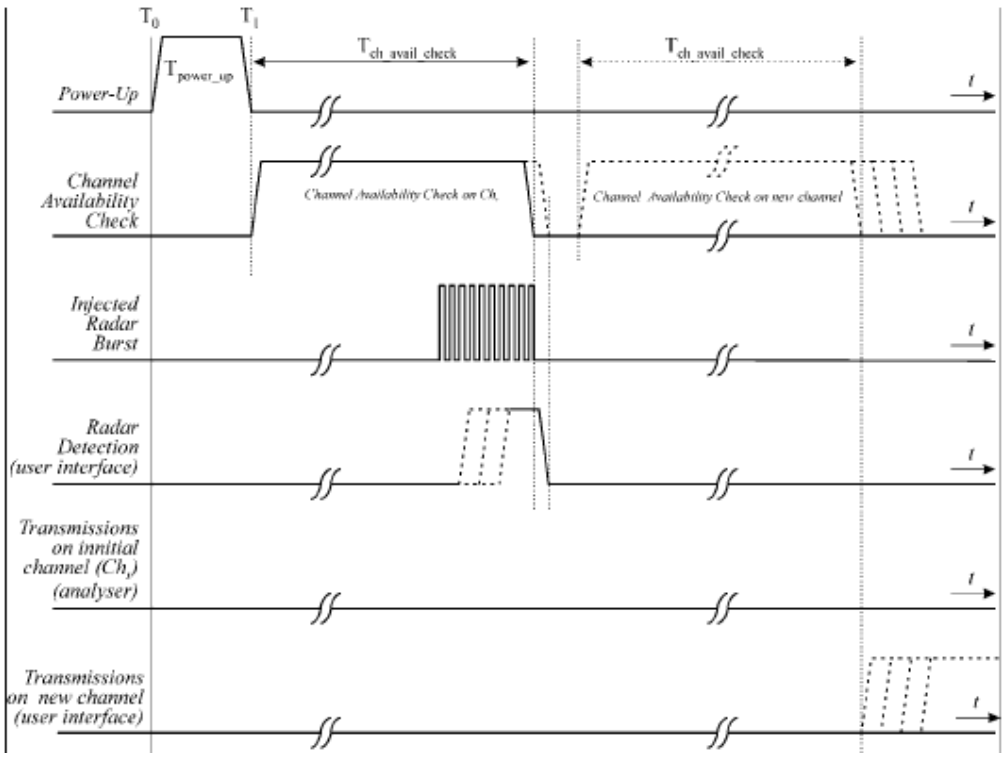
a) The Radar Waveform generator and UUT are connected using the applicable test setup described in the sections for Conducted Tests (7.2) or Radiated Tests (7.3) and the power of the UUT is switched off.

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.



c) 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.

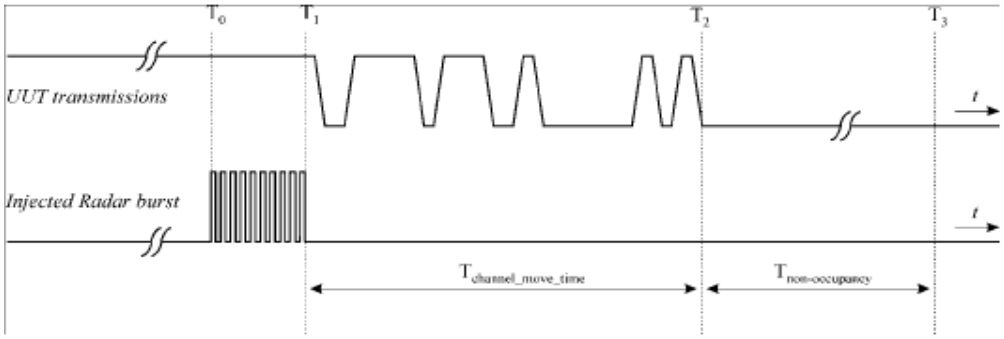
c) Stream the MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test.

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).



d) 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).

9. Test Result

a) Detection Bandwidth

Frequency (MHz)	5500	5510	5530
99% Bandwidth(MHz)	16.503	36.264	75.673

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 = 16.503MHz											
16.92MHz × 80% =13.536MHz											

40 MHz Signal Bandwidth											
EUT Frequency = 5510MHz											
Radar Frequency	DFS Detection Trials (1=Detection, Blank= No Detection)										
(MHz)	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 = 36.264MHz											
36.72MHz × 80% =29.376MHz											

80 MHz Signal Bandwidth											
EUT Frequency = 5530MHz											
Radar Frequency	DFS Detection Trials (1=Detection, Blank= No Detection)										
(MHz)	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	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 =75.673MHz											
76.08MHz × 80% =60.864MHz											

b) Channel Available Check

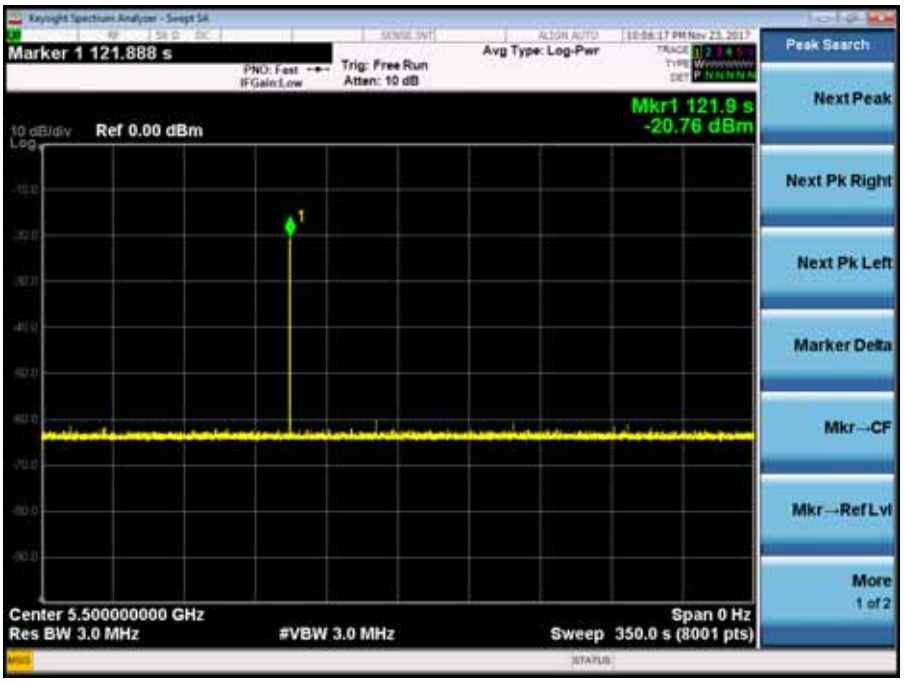
The following results reflect both 20 MHz, 40 MHz and 80 MHz Channel Bandwidth operation.

Initial Channel Availability Check Time

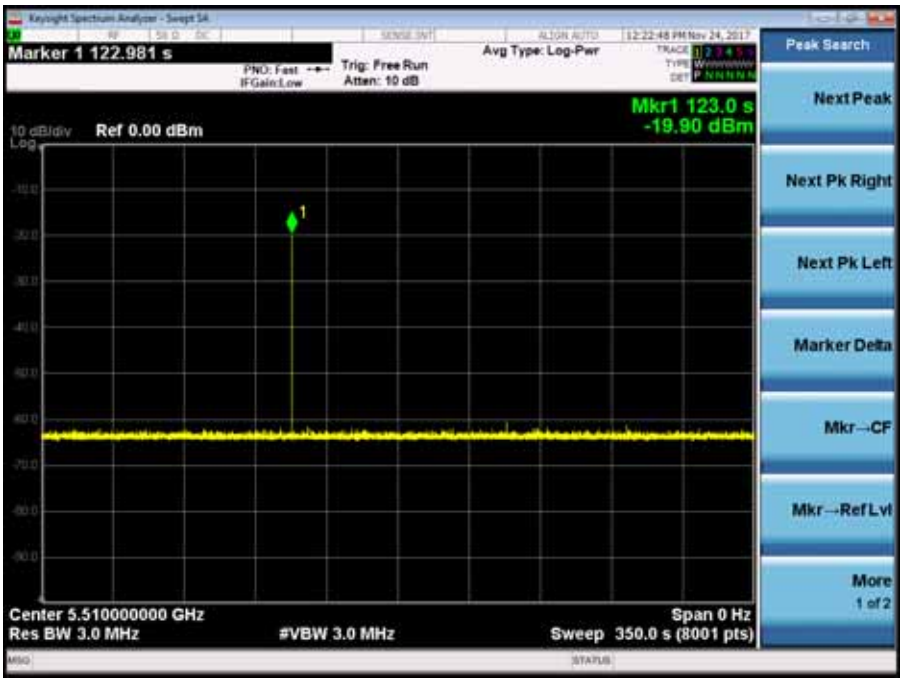
11a CH100 5500MHz

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

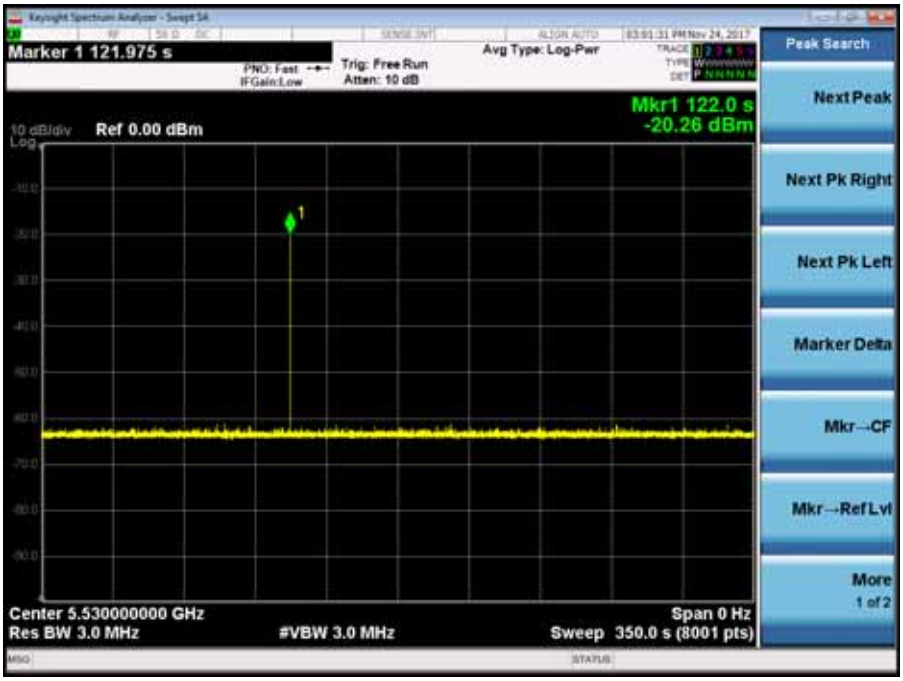
11a CH 100 5500MHz



11n40MHz CH 102 5510MHz

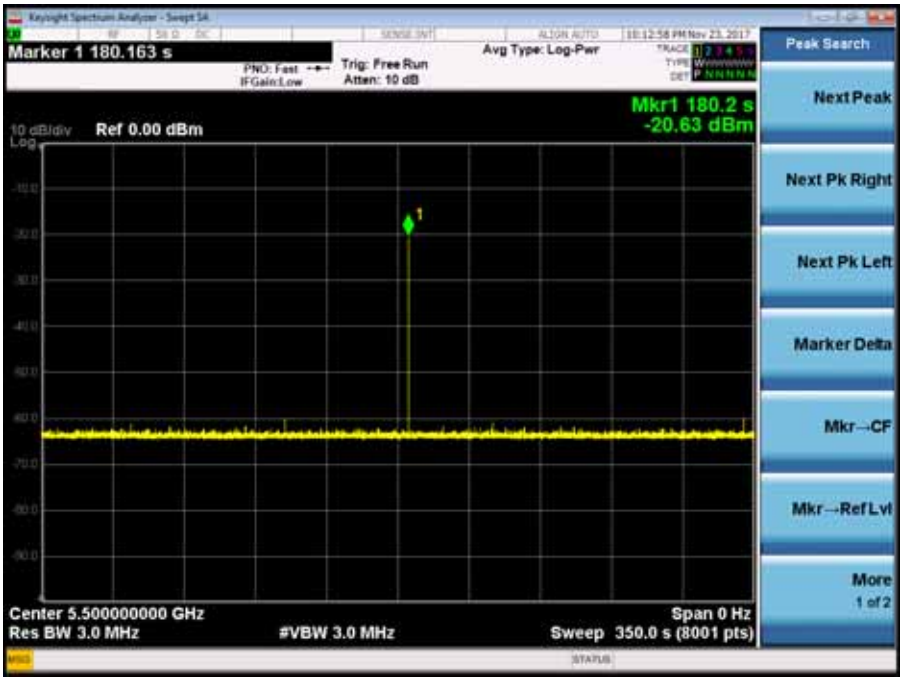


11ac80MHz CH 106 5530MHz

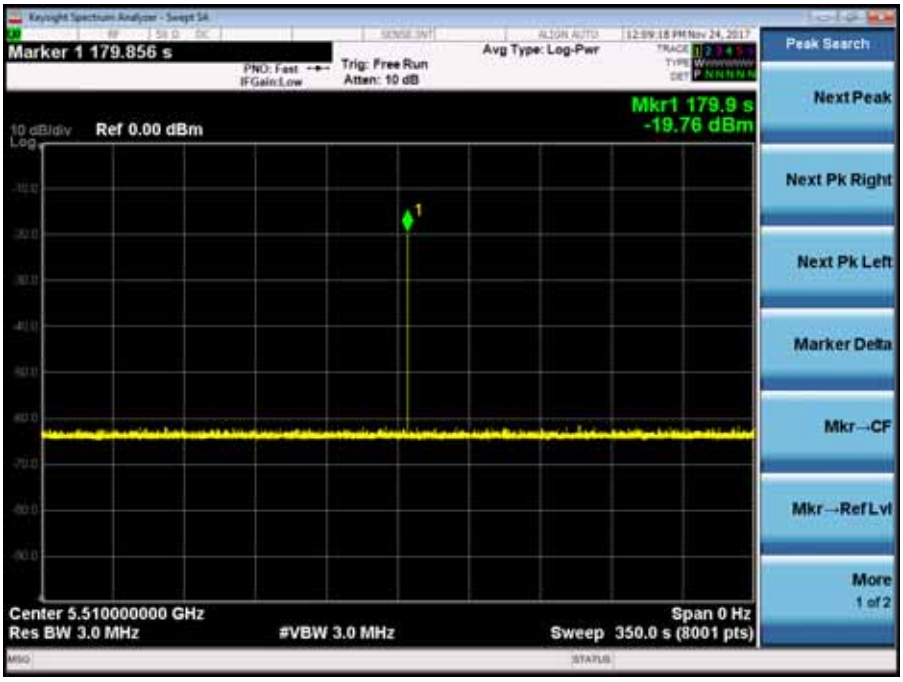


i. Test result with radar burst at the end of the Channel Availability Check Time

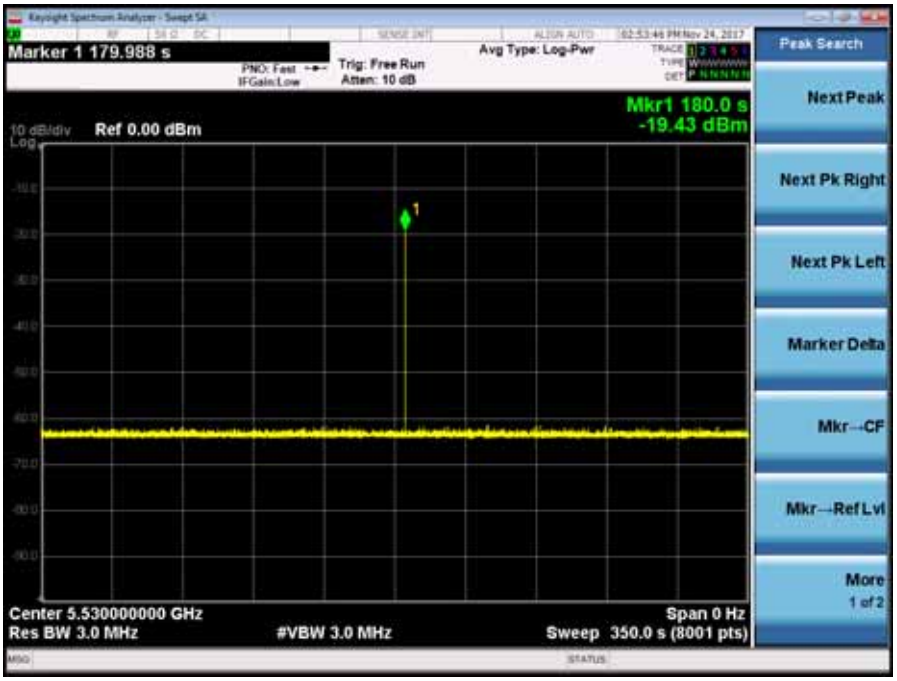
11a CH 100 5500MHz



11n40MHz CH 102 5510MHz



11ac80MHz CH 106 5530MHz



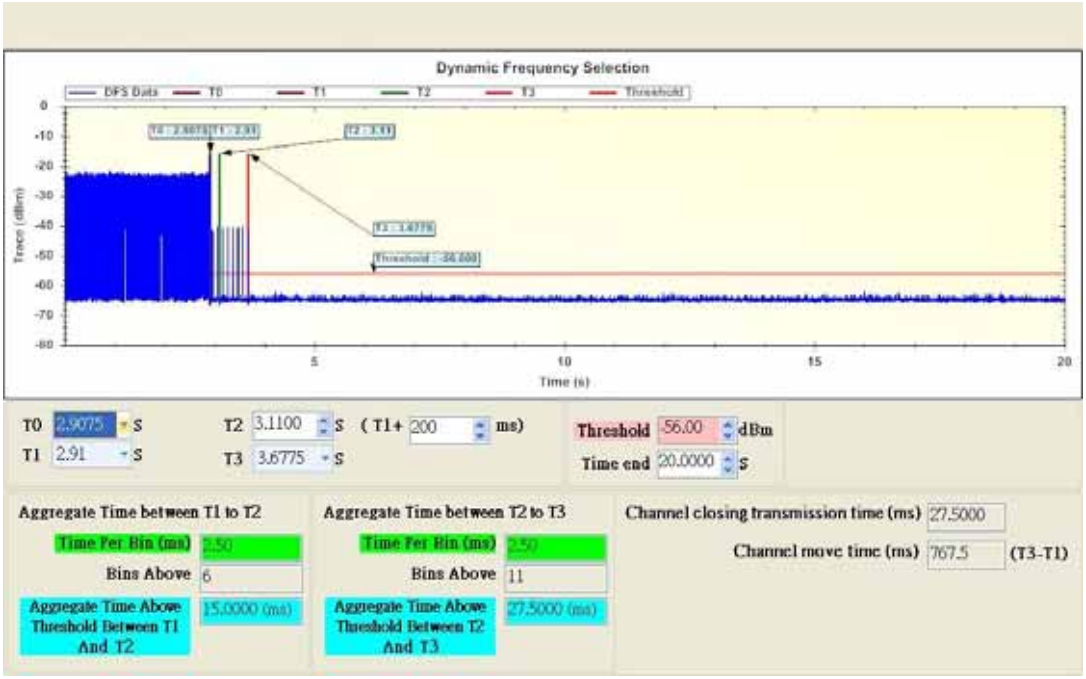
Test Item	Limit	Results
Channel Availability Check Time	60 s	Pass

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

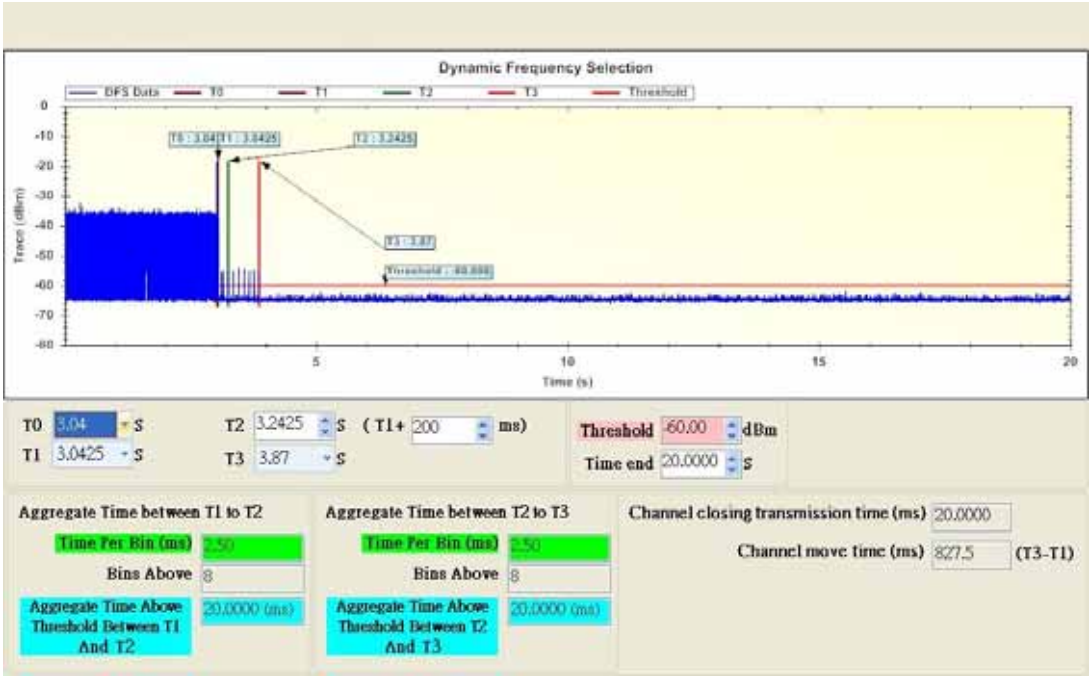
The following results reflect both 20 MHz, 40 MHz and 80 MHz Channel Bandwidth operation.

i. Channel Move Time and Closing Transmission Time

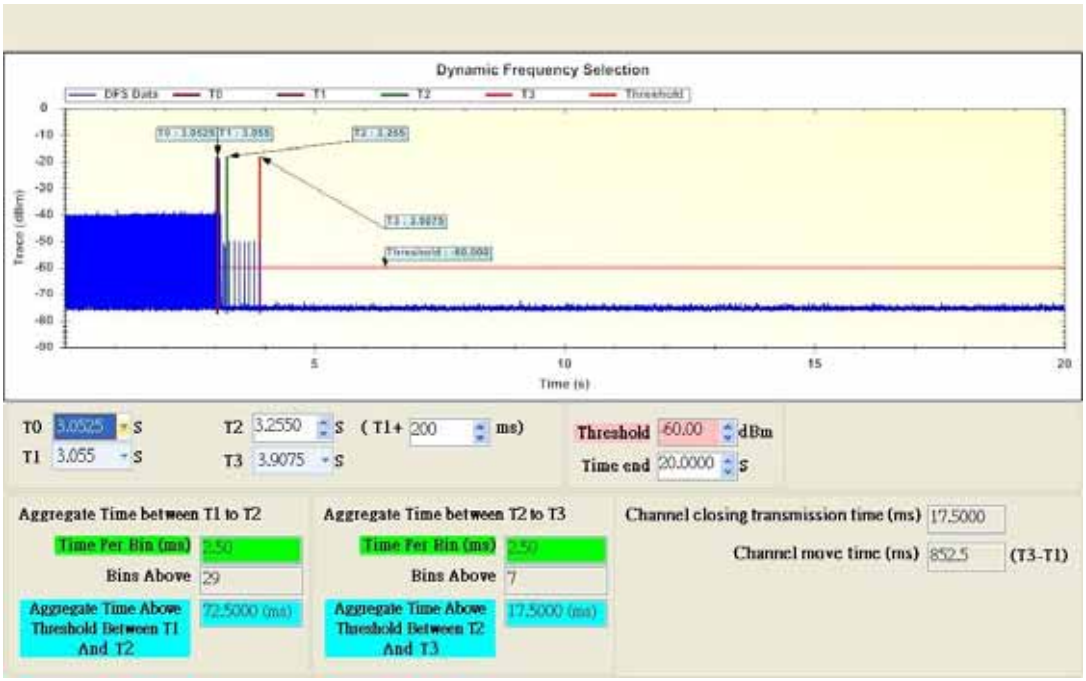
11a CH 100 5500MHz



11n40MHz CH102 5510MHz



11n80MHz CH106 5530MHz

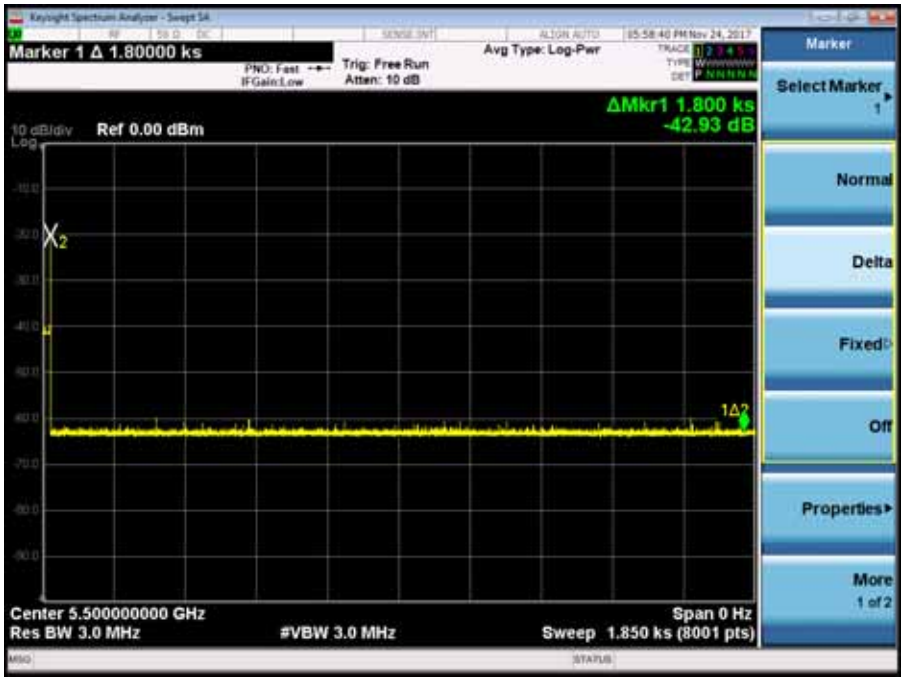


Test Item	Limit	Results
Channel Move Time	10 s	Pass
Channel Closing Transmission Time	200ms + an aggregate of 60ms over remaining 10 second period.	Pass

ii. Non-Occupancy Period

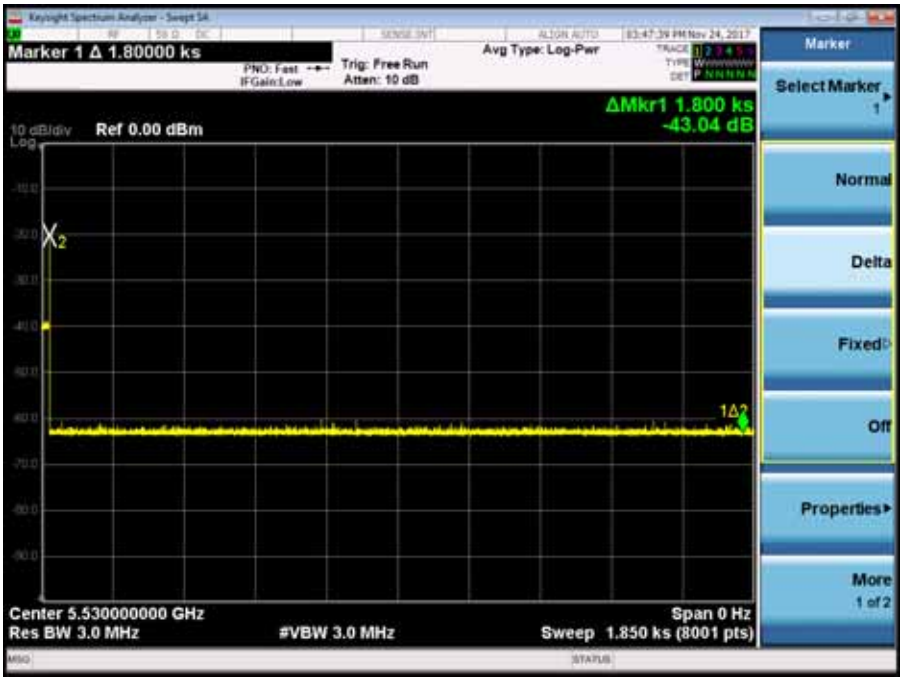
30 Minute Non-Occupancy Period

11a CH100 5500MHz



11n40MHz CH102 5510MHz

11n80MHz CH106 5530MHz



Test Item	Limit	Results
Non-Occupancy Period	30 minutes	Pass

d) 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 80MH Channel Bandwidth operation.

11a CH100 5500MHz

Type 1 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5500	1	818	65	1
2	5501	1	598	89	1
3	5502	1	778	68	1
4	5503	1	798	67	1
5	5504	1	558	95	1
6	5505	1	678	78	1
7	5506	1	878	61	1
8	5507	1	858	62	1
9	5508	1	658	81	1
10	5509	1	698	76	1
11	5490	1	718	74	1
12	5492	1	518	102	1
13	5493	1	938	57	1
14	5494	1	578	92	1
15	5495	1	918	58	1
16	5496	1	1926	28	1
17	5497	1	1181	45	1
18	5498	1	2797	19	1
19	5499	1	536	99	1
20	5500	1	1869	29	1
21	5501	1	1923	28	1
22	5502	1	1816	30	1

23	5503	1	773	69	1
24	5504	1	1138	47	1
25	5505	1	621	85	1
26	5506	1	597	89	1
27	5507	1	2878	19	1
28	5508	1	2347	23	1
29	5509	1	2909	19	1
30	5500	1	3027	18	1
	Detection Percentage				100% (>60%)

Type 2 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5500	2.700000048	188	27	1
2	5501	1.700000048	179	28	1
3	5502	1	179	26	1
4	5503	4.300000191	155	24	1
5	5504	4	180	27	1
6	5505	4.099999905	180	25	1
7	5506	3.299999952	197	23	1
8	5507	1.399999976	204	25	
9	5508	4.900000095	202	27	1
10	5509	3.5	208	25	1
11	5491	4.300000191	162	24	1
12	5492	2.200000048	222	28	1
13	5493	2.200000048	168	27	1
14	5494	4.5	152	29	1
15	5495	1.399999976	167	29	
16	5496	3.299999952	198	29	1
17	5497	3.5	166	29	1
18	5498	5	189	28	1
19	5499	1.600000024	200	29	1
20	5501	1.300000072	163	29	1
21	5502	4.099999905	175	27	1
22	5503	2.100000143	171	24	1
23	5504	4.900000095	163	23	
24	5505	1	187	26	1
25	5506	4.400000095	202	27	1
26	5507	3.400000095	178	27	1
27	5508	1.100000024	153	29	1
28	5509	1.600000024	179	26	1
29	5500	3.400000095	190	26	1
30	5500	2	224	23	1
	Detection Percentage				90.00% (>60%)

Type 3 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5500	9.600000381	253	18	1
2	5501	8.400000572	379	16	1
3	5502	6.400000095	263	17	
4	5503	9.900000572	324	17	1
5	5504	6.400000095	273	16	1
6	5505	6.400000095	255	16	1
7	5506	7.400000095	452	17	1
8	5507	7.5	397	18	1
9	5508	9.5	359	18	1
10	5509	9.600000381	490	16	1
11	5491	7.599999905	351	16	1
12	5492	7.200000286	359	16	1
13	5493	8.199999809	253	16	
14	5494	7.400000095	430	17	1
15	5495	8.400000572	467	17	1
16	5496	7.099999905	423	18	1
17	5497	8.600000381	309	17	1
18	5498	6.5	351	16	1
19	5499	7.900000095	343	16	1
20	5501	6	423	18	1
21	5502	9.600000381	444	18	1
22	5503	7.900000095	267	17	
23	5504	6.700000286	397	16	1
24	5505	8.400000572	368	17	1
25	5506	7.400000095	491	17	1
26	5507	8.699999809	262	18	1
27	5508	7.700000286	303	16	1
28	5509	7.099999905	388	18	1
29	5500	8.900000572	497	17	
30	5500	9.400000572	432	16	1
	Detection Percentage				86.67% (>60%)

Type 4 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5500	16.5	484	14	1
2	5501	13.90000057	491	12	1
3	5502	14.60000038	270	16	1
4	5503	11.40000057	325	13	1
5	5504	14.19999981	356	15	1
6	5505	12.69999981	255	14	1
7	5506	11.40000057	482	15	1
8	5507	11.10000038	301	16	1
9	5508	14.80000019	381	13	1
10	5509	11	401	14	1
11	5491	12.90000057	259	13	1
12	5492	17.60000038	428	13	1
13	5493	11.80000019	281	13	1
14	5494	15.40000057	306	13	
15	5495	19.70000076	310	12	1
16	5496	18.20000076	375	15	1
17	5497	17.80000114	464	15	1
18	5498	19	370	15	1
19	5499	12.60000038	332	16	1
20	5501	13.30000019	287	12	1
21	5502	12.5	297	16	1
22	5503	19.5	271	16	
23	5504	13.5	347	14	1
24	5505	17.89999962	429	16	1
25	5506	14.80000019	417	15	1
26	5507	17.5	259	14	
27	5508	14	376	14	1
28	5509	17.5	308	13	1
29	5500	11.5	275	16	1
30	5500	18.70000076	348	12	1
	Detection Percentage				90.00% (>60%)

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1 + P_d2 + P_d3 + P_d4}{4}$ = (100%+90.00%+86.67%+90.00%)/4 = 91.6675% (>80%)

Type 5 Radar Statistical Performance

Trial Number	Radar Type	Number of Bursts	Burst Period(s)	Waveform Length(s)	Center Frequency(Ghz)	1=Detection Blank=No Detection
0	Type 5	15	0.8000000	12.0000000	5.500000000	1
1	Type 5	8	1.5000000	12.0000000	5.500000000	1
2	Type 5	11	1.0909091	12.0000000	5.500000000	1
3	Type 5	20	0.6000000	12.0000000	5.500000000	1
4	Type 5	17	0.7058824	12.0000000	5.500000000	1
5	Type 5	14	0.8571429	12.0000000	5.500000000	1
6	Type 5	15	0.8000000	12.0000000	5.500000000	1
7	Type 5	12	1.0000000	12.0000000	5.500000000	1
8	Type 5	14	0.8571429	12.0000000	5.500000000	1
9	Type 5	8	1.5000000	12.0000000	5.500000000	1
10	Type 5	17	0.7058824	12.0000000	5.496400000	1
11	Type 5	19	0.6315789	12.0000000	5.497600000	1
12	Type 5	15	0.8000000	12.0000000	5.495200000	1
13	Type 5	12	1.0000000	12.0000000	5.494000000	1
14	Type 5	19	0.6315789	12.0000000	5.497200000	1
15	Type 5	14	0.8571429	12.0000000	5.494800000	
16	Type 5	20	0.6000000	12.0000000	5.498000000	1
17	Type 5	12	1.0000000	12.0000000	5.494000000	1
18	Type 5	14	0.8571429	12.0000000	5.494800000	1
19	Type 5	12	1.0000000	12.0000000	5.494000000	1
20	Type 5	16	0.7500000	12.0000000	5.504000000	1
21	Type 5	12	1.0000000	12.0000000	5.506400000	1
22	Type 5	20	0.6000000	12.0000000	5.502000000	
23	Type 5	14	0.8571429	12.0000000	5.505200000	1
24	Type 5	13	0.9230769	12.0000000	5.505600000	1
25	Type 5	8	1.5000000	12.0000000	5.508000000	
26	Type 5	17	0.7058824	12.0000000	5.503600000	1
27	Type 5	19	0.6315789	12.0000000	5.502400000	1
28	Type 5	12	1.0000000	12.0000000	5.506000000	1
29	Type 5	18	0.6666667	12.0000000	5.503200000	1
		Detection Percentage				90% (>80%)

Type 6 Radar Statistical Performance

Trial Number	Radar Type	Pulse Width (us)	PRI (us)	Pulse per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Wisible Frequency Number	1=Detection Blank=No Detection
0	Type 6	1.0	333.3	9	0.3333	300.0000000	32	1
1	Type 6	1.0	333.3	9	0.3333	300.0000000	27	1
2	Type 6	1.0	333.3	9	0.3333	300.0000000	25	1
3	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
4	Type 6	1.0	333.3	9	0.3333	300.0000000	37	
5	Type 6	1.0	333.3	9	0.3333	300.0000000	30	1
6	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
7	Type 6	1.0	333.3	9	0.3333	300.0000000	27	1
8	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
9	Type 6	1.0	333.3	9	0.3333	300.0000000	30	1
10	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
11	Type 6	1.0	333.3	9	0.3333	300.0000000	36	1
12	Type 6	1.0	333.3	9	0.3333	300.0000000	38	1
13	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
14	Type 6	1.0	333.3	9	0.3333	300.0000000	28	
15	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
16	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
17	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
18	Type 6	1.0	333.3	9	0.3333	300.0000000	27	1
19	Type 6	1.0	333.3	9	0.3333	300.0000000	34	1
20	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
21	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
22	Type 6	1.0	333.3	9	0.3333	300.0000000	41	1
23	Type 6	1.0	333.3	9	0.3333	300.0000000	36	1
24	Type 6	1.0	333.3	9	0.3333	300.0000000	29	1
25	Type 6	1.0	333.3	9	0.3333	300.0000000	32	1
26	Type 6	1.0	333.3	9	0.3333	300.0000000	30	1
27	Type 6	1.0	333.3	9	0.3333	300.0000000	31	1
28	Type 6	1.0	333.3	9	0.3333	300.0000000	31	1
29	Type 6	1.0	333.3	9	0.3333	300.0000000	40	
Detection Percentage								90% (>80%)

11n40 CH102 5510MHz

Type 1 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5496	1	3066	18	1
2	5497	1	758	70	1
3	5498	1	778	68	1
4	5499	1	818	65	1
5	5500	1	798	67	1
6	5501	1	678	78	1
7	5502	1	738	72	1
8	5503	0	858	62	1
9	5504	1	618	86	1
10	5505	1	558	95	1
11	5506	1	878	61	1
12	5507	0	518	102	1
13	5508	1	638	83	1
14	5509	1	718	74	1
15	5510	1	598	89	1
16	5511	1	1359	39	1
17	5512	1	1123	47	1
18	5513	1	1173	45	1
19	5514	1	2703	20	1
20	5515	1	2611	21	1
21	5516	1	1013	53	1
22	5517	1	1249	43	1
23	5518	1	2538	21	1
24	5519	1	2434	22	1
25	5520	1	1829	29	1
26	5521	1	1043	51	1
27	5522	1	1166	46	1
28	5523	1	1030	52	1
29	5524	1	1749	31	1
30	5525	1	532	100	1
	Detection Percentage				100% (>60%)

Type 2 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5496	5	205	25	1
2	5497	3.600000143	178	28	1
3	5498	5	159	24	1
4	5499	5	181	29	1
5	5500	1.300000072	214	29	1
6	5501	2.600000143	217	28	1
7	5502	1.200000048	177	29	1
8	5503	4.5	170	25	
9	5504	3.799999952	169	26	1
10	5505	3.600000143	159	27	1
11	5506	4	213	24	1
12	5507	2	192	26	1
13	5508	5	191	23	1
14	5509	4.5	165	29	1
15	5510	2.799999952	200	26	1
16	5511	3	217	25	1
17	5512	3.700000048	161	28	1
18	5513	4.599999905	170	23	1
19	5514	2.200000048	226	27	1
20	5515	4.800000191	155	28	
21	5516	2	184	27	1
22	5517	3.5	167	26	1
23	5518	1.100000024	175	26	1
24	5519	2.200000048	169	23	1
25	5520	4.200000286	163	23	1
26	5521	4.800000191	191	27	1
27	5522	2.700000048	209	24	1
28	5523	1.300000072	195	29	
29	5524	4.700000286	227	29	1
30	5525	2.700000048	160	25	1
	Detection Percentage				90% (>60%)

Type 3 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5496	9.400000572	283	18	1
2	5497	9.199999809	427	16	1
3	5498	7.300000191	392	17	1
4	5499	9.800000191	394	16	1
5	5500	7.700000286	445	16	1
6	5501	6	461	16	1
7	5502	8.300000191	489	17	1
8	5503	9.100000381	281	16	1
9	5504	6.800000191	378	16	1
10	5505	8.900000572	385	17	1
11	5506	9	450	18	1
12	5507	8	263	17	1
13	5508	9.699999809	254	17	1
14	5509	7.700000286	267	18	1
15	5510	9.900000572	353	18	1
16	5511	8	264	17	1
17	5512	8.5	278	17	
18	5513	7.700000286	426	17	1
19	5514	7	409	17	1
20	5515	7.099999905	282	18	1
21	5516	8.100000381	367	16	1
22	5517	9.199999809	340	16	
23	5518	9.900000572	417	18	1
24	5519	8.900000572	453	16	1
25	5520	9.600000381	372	17	1
26	5521	7.800000191	372	16	1
27	5522	7.400000095	437	17	1
28	5523	6.200000286	308	17	1
29	5524	8.699999809	263	17	1
30	5525	8.900000572	270	18	1
	Detection Percentage				93.33% (>60%)

Type 4 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5496	12.69999981	397	15	1
2	5497	18.39999962	402	13	1
3	5498	19.60000038	359	15	1
4	5499	12	363	16	1
5	5500	19.89999962	404	14	1
6	5501	19.30000114	267	16	1
7	5502	13.10000038	316	15	1
8	5503	11.69999981	303	13	1
9	5504	13.19999981	399	16	1
10	5505	19.10000038	305	16	
11	5506	16	271	14	1
12	5507	15.5	376	15	1
13	5508	16.5	406	13	1
14	5509	18.80000114	374	13	1
15	5510	16.10000038	373	16	1
16	5511	19.5	416	14	
17	5512	11	399	15	1
18	5513	18	484	13	1
19	5514	11.60000038	290	12	1
20	5515	16.5	439	15	1
21	5516	16.30000114	466	14	1
22	5517	14	328	15	1
23	5518	19.30000114	287	13	1
24	5519	12.80000019	307	12	1
25	5520	15.40000057	352	16	1
26	5521	14.10000038	267	15	1
27	5522	15.19999981	400	13	1
28	5523	15.10000038	427	16	1
29	5524	11.90000057	292	14	
30	5525	14.90000057	361	14	1
	Detection Percentage				90.00% (>60%)

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is as follows: $\frac{P_d1 + P_d2 + P_d3 + P_d4}{4}$ = (100%+90%+93.33%+90%)/4 = 94.3325% (>80%)

Type 5 Radar Statistical Performance

Trial Number	Radar Type	Number of Bursts	Burst Period(s)	Waveform Length(s)	Center Frequency(Ghz)	1=Detection Blank=No Detection
0	Type 5	15	0.8000000	12.0000000	5.510000000	1
1	Type 5	8	1.5000000	12.0000000	5.510000000	1
2	Type 5	11	1.0909091	12.0000000	5.510000000	1
3	Type 5	20	0.6000000	12.0000000	5.510000000	1
4	Type 5	17	0.7058824	12.0000000	5.510000000	1
5	Type 5	14	0.8571429	12.0000000	5.510000000	1
6	Type 5	15	0.8000000	12.0000000	5.510000000	
7	Type 5	12	1.0000000	12.0000000	5.510000000	1
8	Type 5	14	0.8571429	12.0000000	5.510000000	1
9	Type 5	8	1.5000000	12.0000000	5.510000000	1
10	Type 5	17	0.7058824	12.0000000	5.496400000	1
11	Type 5	19	0.6315789	12.0000000	5.497600000	1
12	Type 5	15	0.8000000	12.0000000	5.495200000	1
13	Type 5	12	1.0000000	12.0000000	5.494000000	1
14	Type 5	19	0.6315789	12.0000000	5.497200000	
15	Type 5	14	0.8571429	12.0000000	5.494800000	1
16	Type 5	20	0.6000000	12.0000000	5.498000000	1
17	Type 5	12	1.0000000	12.0000000	5.494000000	1
18	Type 5	14	0.8571429	12.0000000	5.494800000	1
19	Type 5	12	1.0000000	12.0000000	5.494000000	1
20	Type 5	16	0.7500000	12.0000000	5.524000000	1
21	Type 5	12	1.0000000	12.0000000	5.526400000	1
22	Type 5	20	0.6000000	12.0000000	5.522000000	1
23	Type 5	14	0.8571429	12.0000000	5.525200000	1
24	Type 5	13	0.9230769	12.0000000	5.525600000	1
25	Type 5	8	1.5000000	12.0000000	5.528000000	1
26	Type 5	17	0.7058824	12.0000000	5.523600000	1
27	Type 5	19	0.6315789	12.0000000	5.522400000	1
28	Type 5	12	1.0000000	12.0000000	5.526000000	1
29	Type 5	18	0.6666667	12.0000000	5.523200000	1
		Detection Percentage				93.33% (>80%)

Type 6 Radar Statistical Performance

Trial Number	Radar Type	Pulse Width (us)	PRI (us)	Pulse per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Wisible Frequency Number	1=Detection Blank=No Detection
0	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
1	Type 6	1.0	333.3	9	0.3333	300.0000000	29	1
2	Type 6	1.0	333.3	9	0.3333	300.0000000	28	1
3	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
4	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
5	Type 6	1.0	333.3	9	0.3333	300.0000000	31	1
6	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
7	Type 6	1.0	333.3	9	0.3333	300.0000000	29	1
8	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
9	Type 6	1.0	333.3	9	0.3333	300.0000000	32	1
10	Type 6	1.0	333.3	9	0.3333	300.0000000	36	1
11	Type 6	1.0	333.3	9	0.3333	300.0000000	40	1
12	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
13	Type 6	1.0	333.3	9	0.3333	300.0000000	34	
14	Type 6	1.0	333.3	9	0.3333	300.0000000	31	1
15	Type 6	1.0	333.3	9	0.3333	300.0000000	39	1
16	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
17	Type 6	1.0	333.3	9	0.3333	300.0000000	36	1
18	Type 6	1.0	333.3	9	0.3333	300.0000000	29	1
19	Type 6	1.0	333.3	9	0.3333	300.0000000	32	1
20	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
21	Type 6	1.0	333.3	9	0.3333	300.0000000	38	1
22	Type 6	1.0	333.3	9	0.3333	300.0000000	40	1
23	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
24	Type 6	1.0	333.3	9	0.3333	300.0000000	31	1
25	Type 6	1.0	333.3	9	0.3333	300.0000000	33	1
26	Type 6	1.0	333.3	9	0.3333	300.0000000	29	1
27	Type 6	1.0	333.3	9	0.3333	300.0000000	35	1
28	Type 6	1.0	333.3	9	0.3333	300.0000000	32	1
29	Type 6	1.0	333.3	9	0.3333	300.0000000	37	1
Detection Percentage								96.67% (>80%)

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Type 1 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5516	1	618	86	1
2	5517	1	758	70	1
3	5518	1	578	92	1
4	5519	1	738	72	1
5	5520	1	798	67	1
6	5521	1	938	57	1
7	5522	1	598	89	1
8	5523	1	658	81	1
9	5524	1	718	74	1
10	5525	1	638	83	1
11	5526	1	838	63	1
12	5527	1	818	65	1
13	5528	1	558	95	1
14	5529	1	3066	18	1
15	5530	1	778	68	1
16	5531	1	2577	21	1
17	5532	1	2666	20	1
18	5533	1	1834	29	
19	5534	1	2165	25	1
20	5535	1	1160	46	1
21	5536	1	1217	44	1
22	5537	1	1943	28	1
23	5538	1	2347	23	
24	5539	1	2476	22	1
25	5540	1	2046	26	1
26	5541	1	2425	22	1
27	5542	1	1674	32	1
28	5543	1	1061	50	
29	5544	1	633	84	1
30	5545	1	2137	25	1
	Detection Percentage				90% (>60%)

Type 2 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5516	4.400000095	181	28	1
2	5517	1.700000048	180	28	1
3	5518	2.600000143	208	25	1
4	5519	1.700000048	187	29	1
5	5520	4.599999905	177	25	1
6	5521	2.400000095	228	23	1
7	5522	2.900000095	163	23	1
8	5523	4.099999905	174	28	1
9	5524	1.300000072	195	28	1
10	5525	2.900000095	168	24	1
11	5526	2.900000095	210	25	1
12	5527	2.700000048	190	25	1
13	5528	1.200000048	161	25	1
14	5529	3	219	23	1
15	5530	4.400000095	210	27	1
16	5531	3.5	206	24	1
17	5532	2	217	25	1
18	5533	1.700000048	155	25	1
19	5534	1.399999976	161	28	1
20	5535	3.700000048	176	28	1
21	5536	4.099999905	162	25	1
22	5537	4.599999905	205	29	1
23	5538	4.5	156	29	1
24	5539	1.300000072	205	27	1
25	5540	3.700000048	159	25	1
26	5541	1	223	26	1
27	5542	4.700000286	153	27	1
28	5543	4.700000286	157	23	1
29	5544	2.400000095	165	24	1
30	5545	2.5	186	27	1
	Detection Percentage				100% (>60%)

Type 3 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5516	6.5	479	16	1
2	5517	7.599999905	425	18	1
3	5518	9.199999809	284	17	1
4	5519	6.900000095	251	16	1
5	5520	8.900000572	433	18	1
6	5521	9.199999809	446	17	1
7	5522	6.700000286	391	16	1
8	5523	7.599999905	382	17	1
9	5524	8.100000381	279	16	1
10	5525	7.200000286	482	17	1
11	5526	7.099999905	334	17	1
12	5527	9.5	444	16	1
13	5528	8.800000191	267	17	1
14	5529	6.599999905	384	16	1
15	5530	9.800000191	449	17	1
16	5531	0	0	0	
17	5532	7.900000095	447	17	1
18	5533	9.600000381	367	16	1
19	5534	7.700000286	322	16	1
20	5535	7	361	18	1
21	5536	8.5	265	16	1
22	5537	7.400000095	371	16	
23	5538	7.099999905	318	18	1
24	5539	8.900000572	411	16	1
25	5540	6.099999905	380	18	1
26	5541	9.699999809	363	18	1
27	5542	8.699999809	296	18	1
28	5543	7.599999905	444	18	
29	5544	8.699999809	327	18	1
30	5545	9.800000191	386	18	1
	Detection Percentage				90% (>60%)

Type 4 Radar Statistical Performance

Trial Number	Freq(MHz)	Pulse Width (us)	PRI (us)	Pulses/Burst	1=Detection Blank=No Detection
1	5516	17	351	16	1
2	5517	18.39999962	387	16	1
3	5518	17.10000038	479	12	1
4	5519	12.30000019	424	15	1
5	5520	11.5	378	14	1
6	5521	16.80000114	398	16	1
7	5522	12.10000038	495	14	1
8	5523	13.80000019	463	12	1
9	5524	17.20000076	315	12	1
10	5525	16.60000038	429	12	1
11	5526	14.69999981	445	16	1
12	5527	18.60000038	445	14	1
13	5528	19	461	14	1
14	5529	14.10000038	344	13	1
15	5530	14.90000057	413	13	
16	5531	19.89999962	351	13	1
17	5532	17.30000114	486	14	1
18	5533	12.90000057	359	16	1
19	5534	18.5	255	13	1
20	5535	15.30000019	299	16	1
21	5536	12.80000019	250	13	1
22	5537	11.90000057	450	14	1
23	5538	16	488	16	
24	5539	12.5	444	16	1
25	5540	12.30000019	254	14	1
26	5541	13.40000057	468	13	1
27	5542	13.60000038	296	14	1
28	5543	12.69999981	481	15	1
29	5544	14.69999981	335	13	1
30	5545	13.30000019	315	15	1
	Detection Percentage				93.33% (>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%+100%+90%+93.33%)/4 = 99.3325% (>80%)

Type 5 Radar Statistical Performance

Trial Number	Radar Type	Number of Bursts	Burst Period(s)	Waveform Length(s)	Center Frequency(Ghz)	1=Detection Blank=No Detection
0	Type 5	15	0.8000000	12.0000000	5.530000000	1
1	Type 5	8	1.5000000	12.0000000	5.530000000	1
2	Type 5	11	1.0909091	12.0000000	5.530000000	1
3	Type 5	20	0.6000000	12.0000000	5.530000000	1
4	Type 5	17	0.7058824	12.0000000	5.530000000	1
5	Type 5	14	0.8571429	12.0000000	5.530000000	1
6	Type 5	15	0.8000000	12.0000000	5.530000000	1
7	Type 5	12	1.0000000	12.0000000	5.530000000	1
8	Type 5	14	0.8571429	12.0000000	5.530000000	1
9	Type 5	8	1.5000000	12.0000000	5.530000000	
10	Type 5	17	0.7058824	12.0000000	5.496400000	1
11	Type 5	19	0.6315789	12.0000000	5.497600000	1
12	Type 5	15	0.8000000	12.0000000	5.495200000	1
13	Type 5	12	1.0000000	12.0000000	5.494000000	1
14	Type 5	19	0.6315789	12.0000000	5.497200000	1
15	Type 5	14	0.8571429	12.0000000	5.494800000	1
16	Type 5	20	0.6000000	12.0000000	5.498000000	1
17	Type 5	12	1.0000000	12.0000000	5.494000000	1
18	Type 5	14	0.8571429	12.0000000	5.494800000	1
19	Type 5	12	1.0000000	12.0000000	5.494000000	
20	Type 5	16	0.7500000	12.0000000	5.564000000	1
21	Type 5	12	1.0000000	12.0000000	5.566400000	1
22	Type 5	20	0.6000000	12.0000000	5.562000000	1
23	Type 5	14	0.8571429	12.0000000	5.565200000	1
24	Type 5	13	0.9230769	12.0000000	5.565600000	1
25	Type 5	8	1.5000000	12.0000000	5.568000000	1
26	Type 5	17	0.7058824	12.0000000	5.563600000	1
27	Type 5	19	0.6315789	12.0000000	5.562400000	1
28	Type 5	12	1.0000000	12.0000000	5.566000000	
29	Type 5	18	0.6666667	12.0000000	5.563200000	1
		Detection Percentage				90.00% (>80%)

Type 6 Radar Statistical Performance

Trial Number	Radar Type	Pulse Width (us)	PRI (us)	Pulse per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Wisible Frequency Number	1=Detection Blank=No Detection
0	Type 6	1.0	333.3	9	0.3333	300.0000000	17	1
1	Type 6	1.0	333.3	9	0.3333	300.0000000	14	1
2	Type 6	1.0	333.3	9	0.3333	300.0000000	16	1
3	Type 6	1.0	333.3	9	0.3333	300.0000000	19	1
4	Type 6	1.0	333.3	9	0.3333	300.0000000	11	1
5	Type 6	1.0	333.3	9	0.3333	300.0000000	13	1
6	Type 6	1.0	333.3	9	0.3333	300.0000000	15	1
7	Type 6	1.0	333.3	9	0.3333	300.0000000	17	1
8	Type 6	1.0	333.3	9	0.3333	300.0000000	15	1
9	Type 6	1.0	333.3	9	0.3333	300.0000000	17	1
10	Type 6	1.0	333.3	9	0.3333	300.0000000	16	1
11	Type 6	1.0	333.3	9	0.3333	300.0000000	23	1
12	Type 6	1.0	333.3	9	0.3333	300.0000000	22	1
13	Type 6	1.0	333.3	9	0.3333	300.0000000	17	1
14	Type 6	1.0	333.3	9	0.3333	300.0000000	15	1
15	Type 6	1.0	333.3	9	0.3333	300.0000000	22	1
16	Type 6	1.0	333.3	9	0.3333	300.0000000	14	1
17	Type 6	1.0	333.3	9	0.3333	300.0000000	22	1
18	Type 6	1.0	333.3	9	0.3333	300.0000000	13	1
19	Type 6	1.0	333.3	9	0.3333	300.0000000	17	1
20	Type 6	1.0	333.3	9	0.3333	300.0000000	21	1
21	Type 6	1.0	333.3	9	0.3333	300.0000000	18	1
22	Type 6	1.0	333.3	9	0.3333	300.0000000	24	1
23	Type 6	1.0	333.3	9	0.3333	300.0000000	14	1
24	Type 6	1.0	333.3	9	0.3333	300.0000000	13	1
25	Type 6	1.0	333.3	9	0.3333	300.0000000	16	
26	Type 6	1.0	333.3	9	0.3333	300.0000000	15	1
27	Type 6	1.0	333.3	9	0.3333	300.0000000	20	1
28	Type 6	1.0	333.3	9	0.3333	300.0000000	19	1
29	Type 6	1.0	333.3	9	0.3333	300.0000000	16	1
Detection Percentage								96.67% (>80%)