DFS PORTION of FCC 47 CFR PART 15 SUBPART E
DFS PORTION of INDUSTRY CANADA RSS-247 ISSUE 1

CERTIFICATION TEST REPORT

FOR

802.11A/B/G/N/AC WIRELESS SECURITY APPLIANCE

MODEL NUMBER: Z3-HW

FCC ID: UDX-60053010
IC: 6961A-60053010

REPORT NUMBER: 11765639-E3V1

ISSUE DATE: JULY 24, 2017

Prepared for
CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA, 95134, USA

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/24/17	Initial Issue	Conan Cheung

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA, 95134, USA

EUT DESCRIPTION: 802.11A/B/G/N/AC WIRELESS SECURITY APPLIANCE

MODEL: Z3-HW

SERIAL NUMBER: Q2TN-2Y93-8V3X

DATE TESTED: JUNE 19 – JULY 6, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DFS Portion of CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

CONAN CHEUNG
PROJECT LEAD
UL Verification Services Inc.

Tested By:

HENRY LAU
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the DFS portion of FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, KDB 905462 D02 and D03 and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services, Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB
Occupied Channel Bandwidth	± 0.39 dB
Time	± 0.02 %

Uncertainty figures are valid to a confidence level of 95%.

5. DYNAMIC FREQUENCY SELECTION

5.1. OVERVIEW

5.1.1. LIMITS

INDUSTRY CANADA

IC RSS-247 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-247 Issue 1

Note: For the band 5600–5650 MHz, no operation is permitted.

Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.

FCC

§15.407 (h), FCC KDB 905462 D02 “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION” and KDB 905462 D03 “U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY”.

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

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client **(without DFS)**	Client **(with DFS)**
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar DFS	Client (without DFS)
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in all 20 MHz channel blocks and a null frequency between the bonded 20 MHz channel blocks.		

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

Maximum Transmit Power	Value (see notes)
E.I.R.P. ≥ 200 mill watt	-64 dBm
E.I.R.P. < 200 mill watt and power spectral density < 10 dBm/MHz	-62 dBm
E.I.R.P. < 200 mill watt that do not meet power spectral density requirement	-64 dBm

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.
Note 3: E.I.R.P. is based on the highest antenna gain. For MIMO devices refer to KDB publication 662911 D01.

Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + approx. 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.

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (usec)	PRI (usec)	Pulses	Minimum Percentage of Successful Detection	Minimum 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: {(1/360) x (19 x 10^6 PRI_{usec})}	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 usec. With a minimum increment of 1 usec, 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.

Table 6 – Long Pulse Radar Test Signal

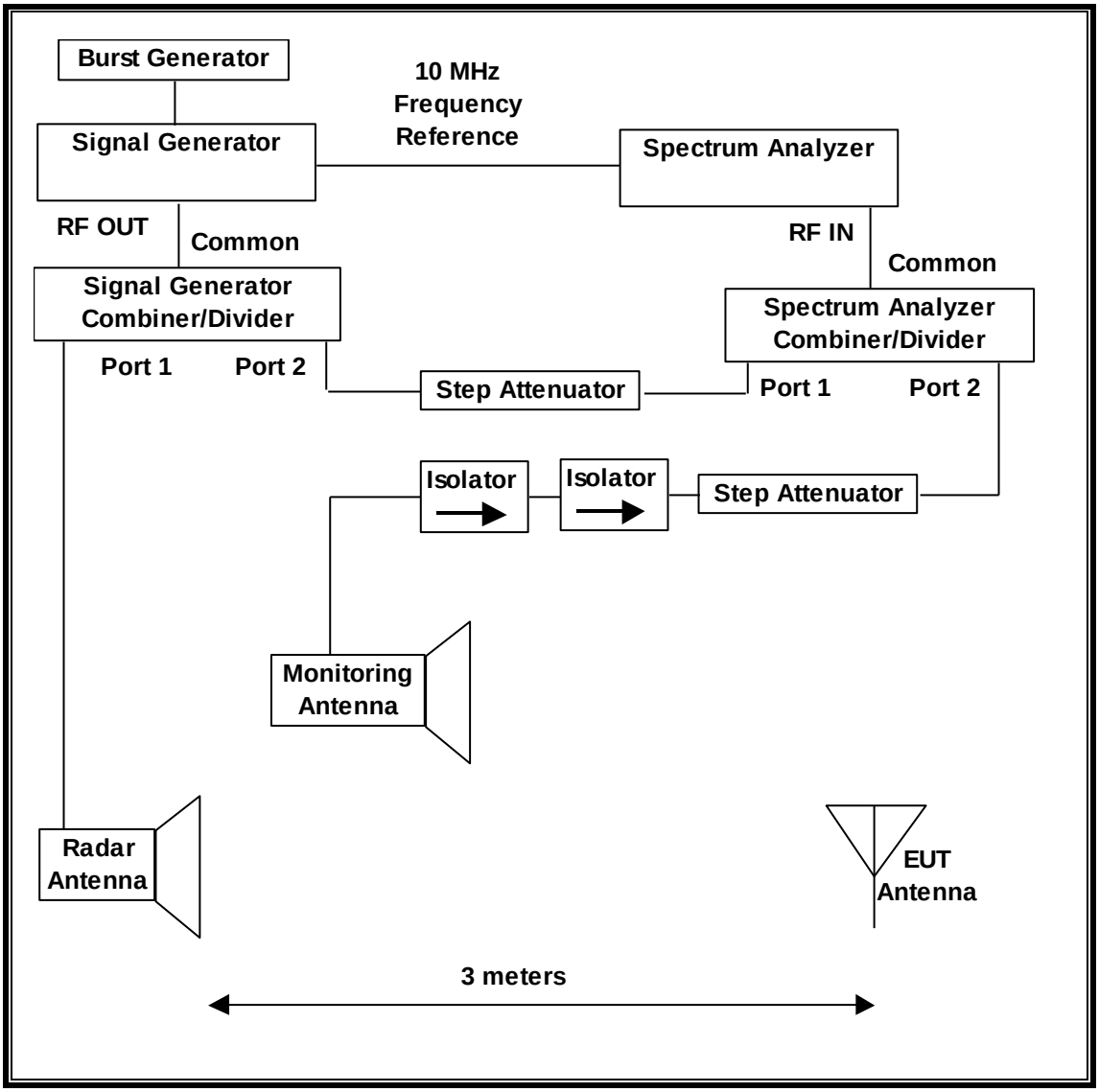
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

5.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 1, 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of KDB 905462 D02. The frequency of the signal generator is incremented in 1 MHz steps from F_L to F_H for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. Iperf is utilized to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the DFS tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	MY55410147	12/15/17
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	MY51350337	04/21/18
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/06/18

5.1.3. TEST AND MEASUREMENT SOFTWARE

The following test and measurement software was utilized for the tests documented in this report:

TEST SOFTWARE LIST		
Name	**Version**	**Test / Function**
Aggregate Time-PXA	3.0	Channel Loading and Aggregate Closing Time
FCC 2006 Detection Bandwidth-PXA	3.0	Detection Bandwidth in 1 MHz Steps
FCC 2014 Detection Bandwidth-PXA	3.0	Detection Bandwidth in 5 MHz Steps
In Service Monitoring-PXA	3.0	In-Service Monitoring (Probability of Detection)
PXA Read	3.0.0.9	Signal Generator Screen Capture
SGXProject.exe	1.7	Radar Waveform Generation and Download

5.1.4. TEST ROOM ENVIRONMENT

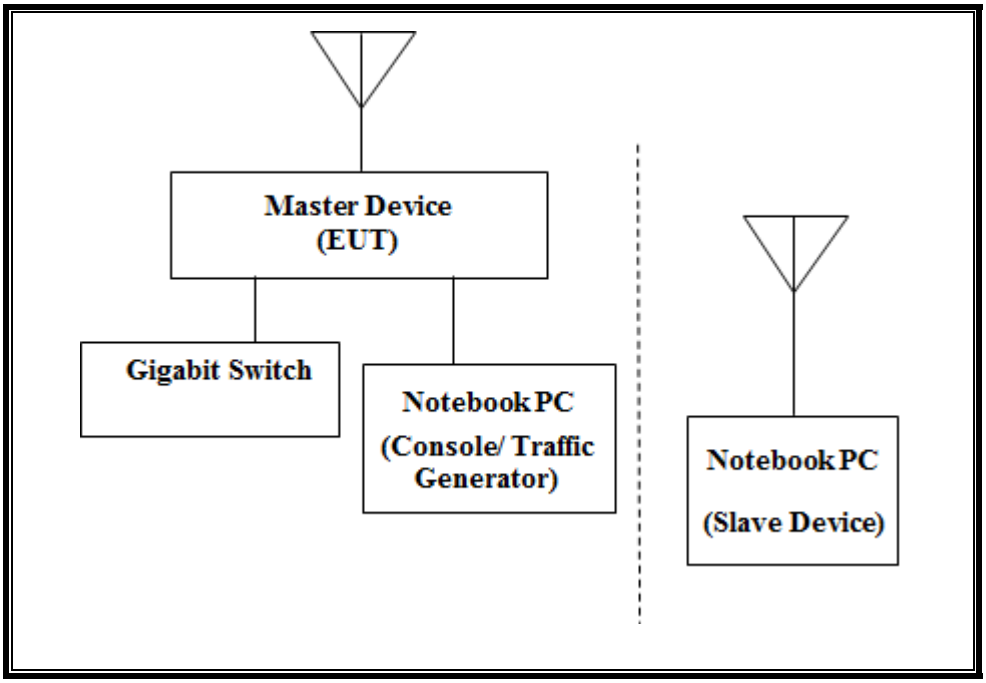
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	26.2 °C
Humidity	32 %

5.1.5. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Notebook PC (Controller & Traffic Generator)	Apple	A1502	C02NT1VTG3QR	DoC
AC Adapter (Controller PC & Traffic Generator)	Apple	A1435	D39433601B4FTC0A1	DoC
Notebook PC (Slave Device)	Apple	A1465	C02KTGMPF5N7	QDS-BRCM1072
AC Adapter (Slave PC)	Apple	A1435	C04341216J2F288BT	DoC
Gigabit Switch	Meraki	MS220-8P	Q2HP-DR3G-TQZS	DoC
AC Adapter (EUT)	Universal Microelectronics Co.,Ltd	MA-PWR-50WAC	CR083J126 53G	DoC

5.1.6. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding the 5600-5650 MHz range.

The EUT is a Master Device.

The highest power level within these bands is 22.62 dBm EIRP in the 5250-5350 MHz band and 28.40 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 5.2 & 5.8 dBi.

Two PIFA antennas are utilized to meet the diversity and MIMO operational requirements.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The EUT uses two transmitter/receiver chains, each connected to an antenna to perform radiated tests.

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

WLAN traffic that meets or exceeds the minimum required loading was generated by transferring a data stream from the Master Device to the Slave Device using iPerf version 2.0.5 software package.

TPC is required since the maximum EIRP is greater than 500 mW (27 dBm).

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

The software installed in the EUT is firmware_wired_arm_qca_version T-201705251430-G5859bcae-clay.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Cisco Meraki Access Point, FCC ID: UDX-60053010. The minimum antenna gain for the Master Device is 5.2 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

5.2. RESULTS FOR 20 MHz BANDWIDTH

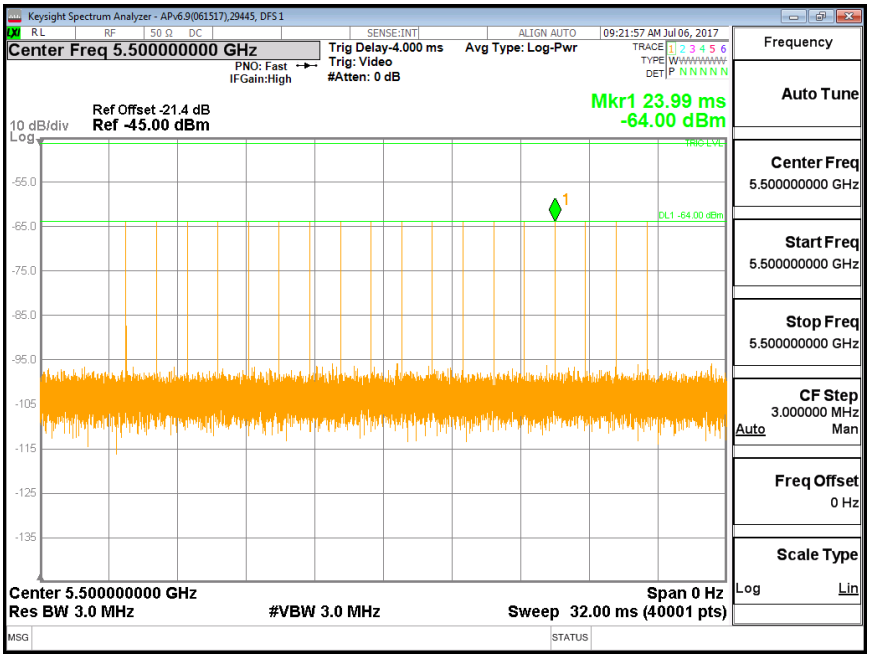
5.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

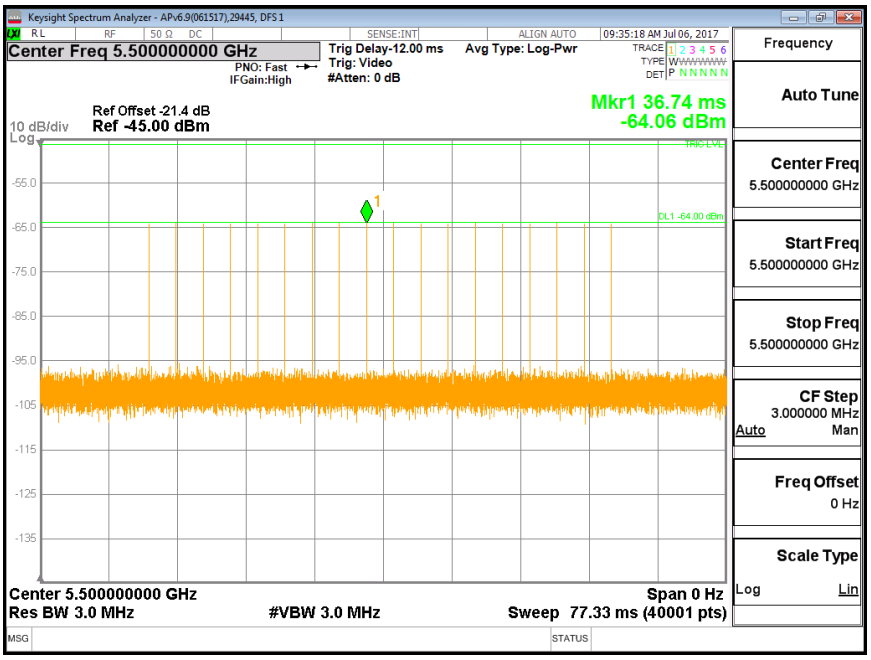
5.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

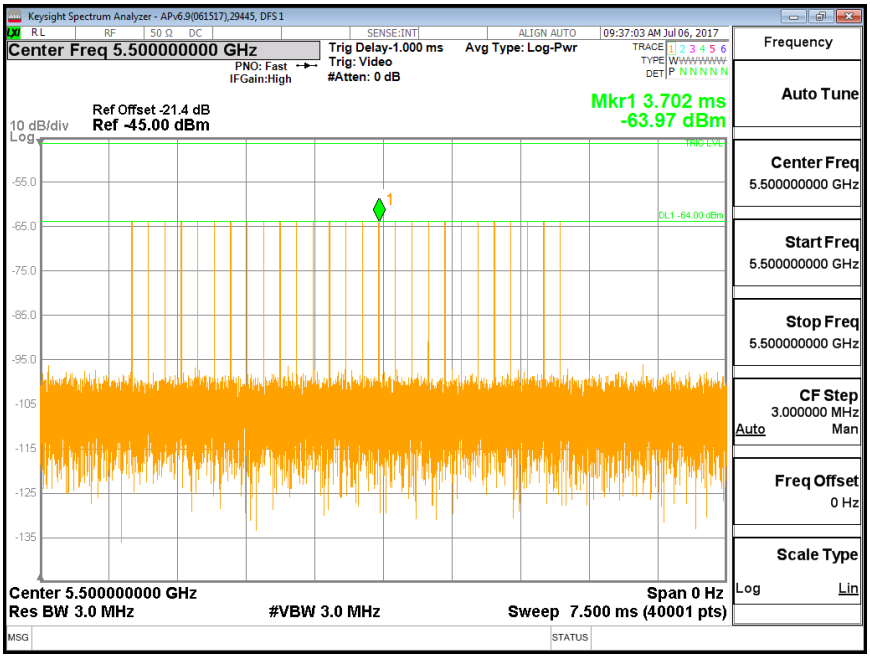
SHORT PULSE RADAR TYPE 0



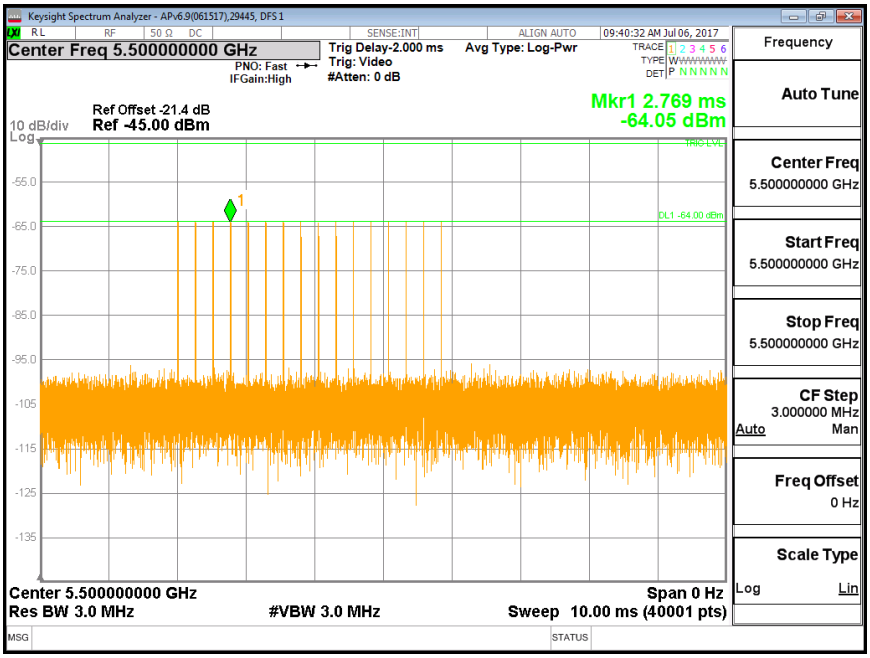
SAMPLE OF RADAR TYPE 1



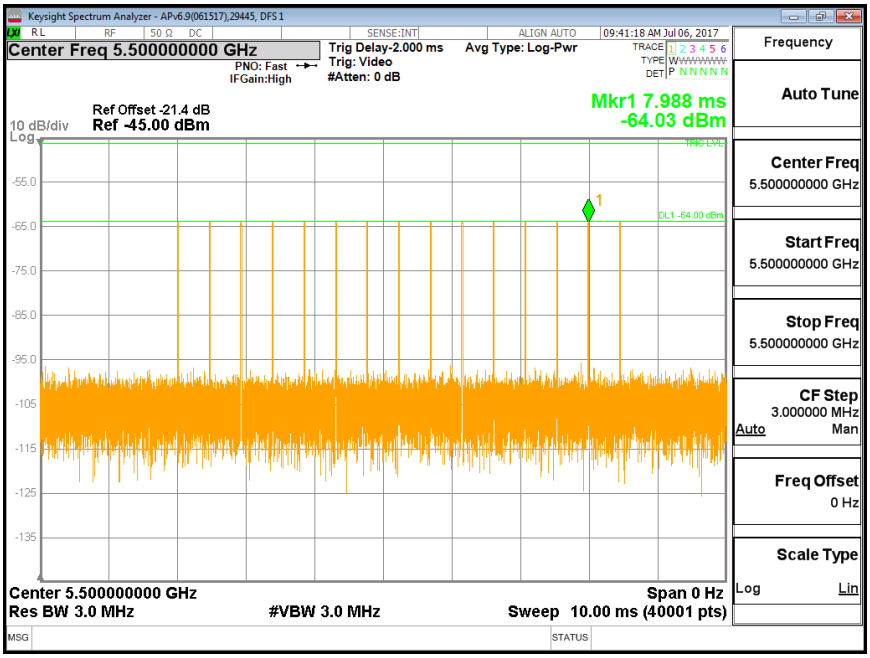
SAMPLE OF RADAR TYPE 2



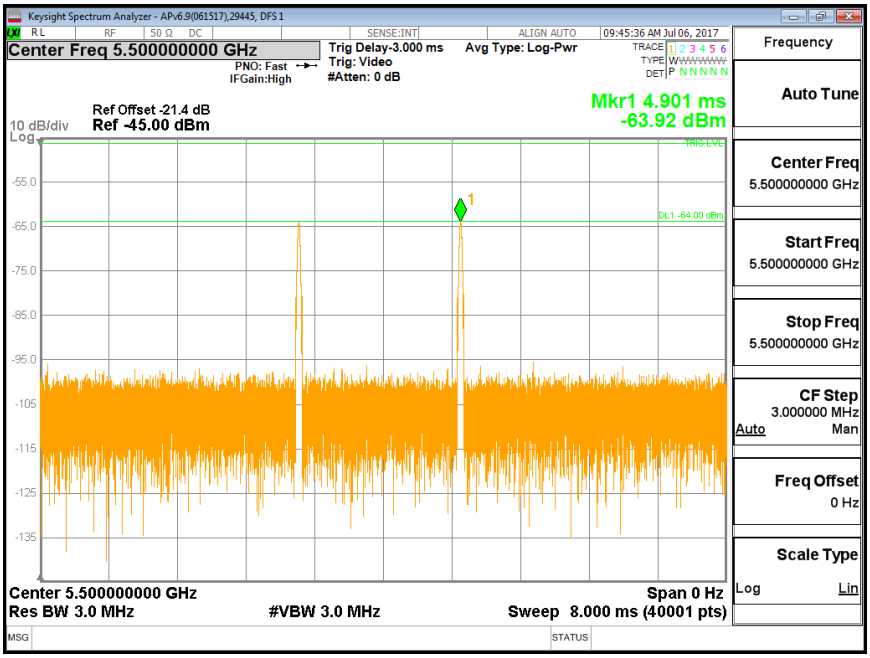
SAMPLE OF RADAR TYPE 3



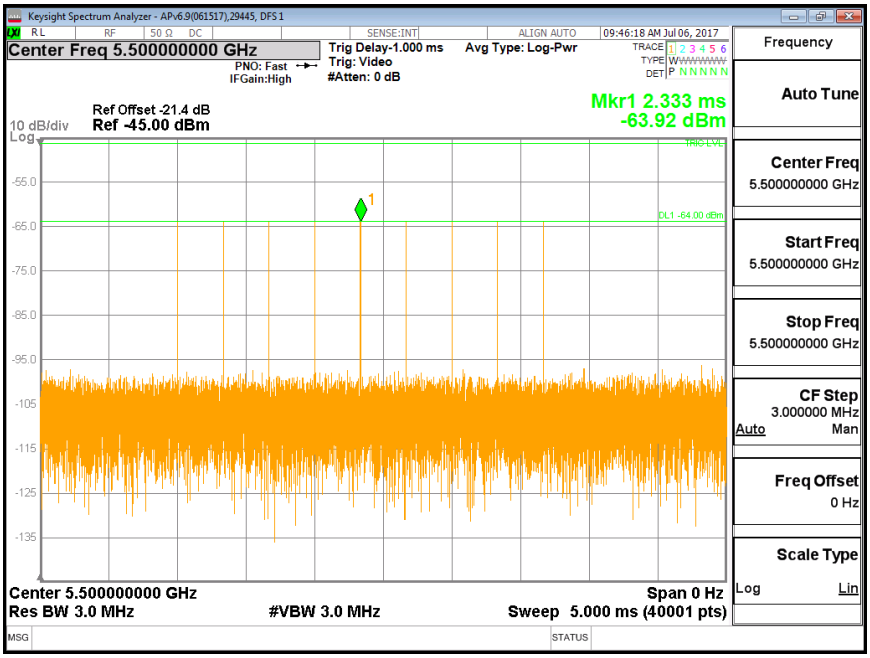
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

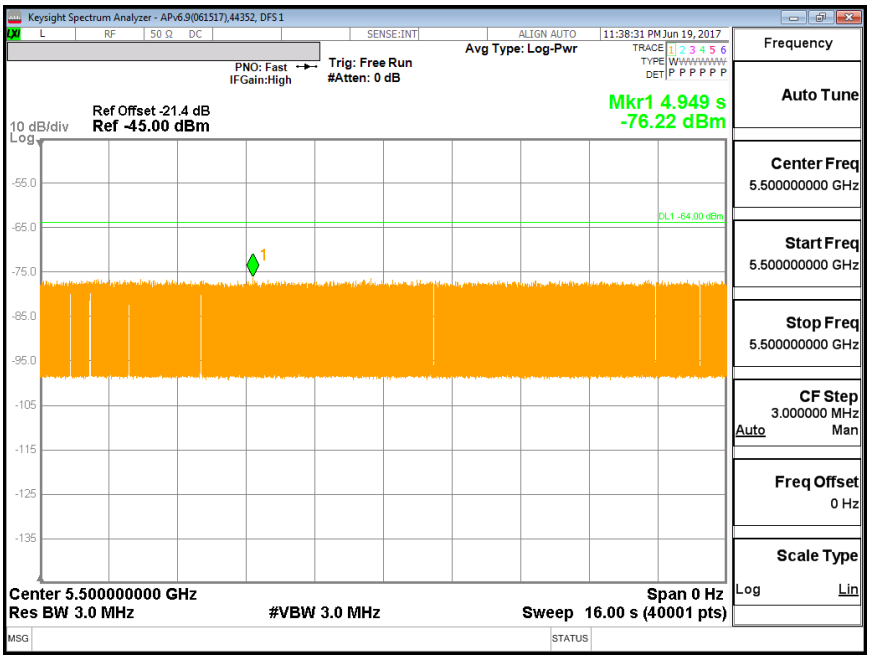


SINGLE BURST OF RADAR TYPE 6

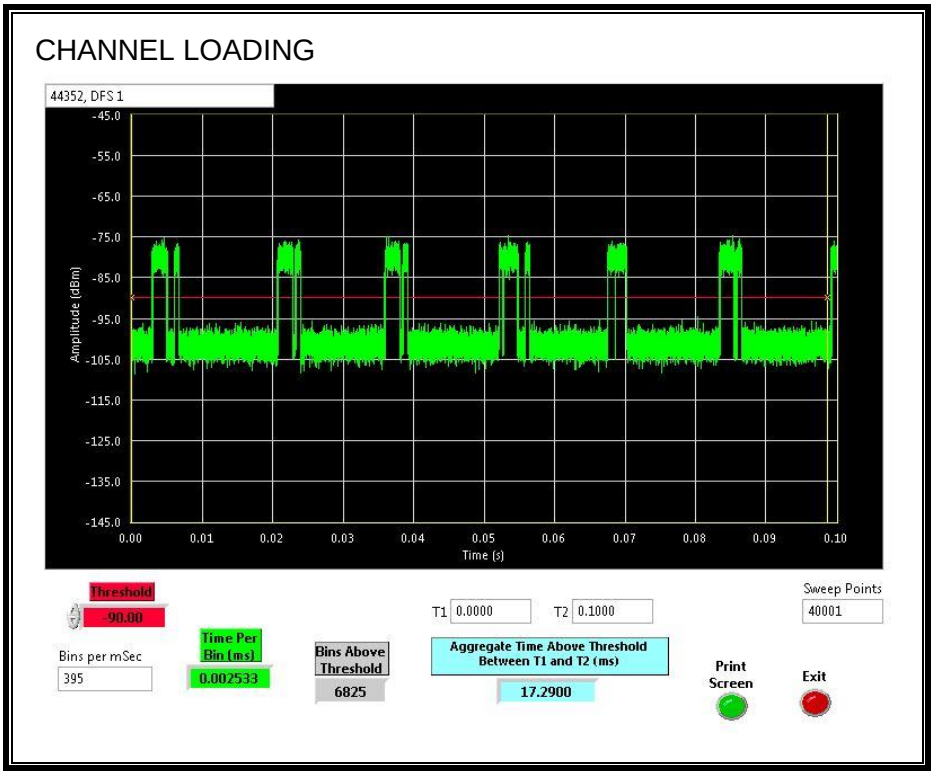


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.29%

5.2.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.42	189.5	159.1	99.1

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.6	132.9	102.3	3.2

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.42	177.4	147.0	47.9

QUALITATIVE RESULTS

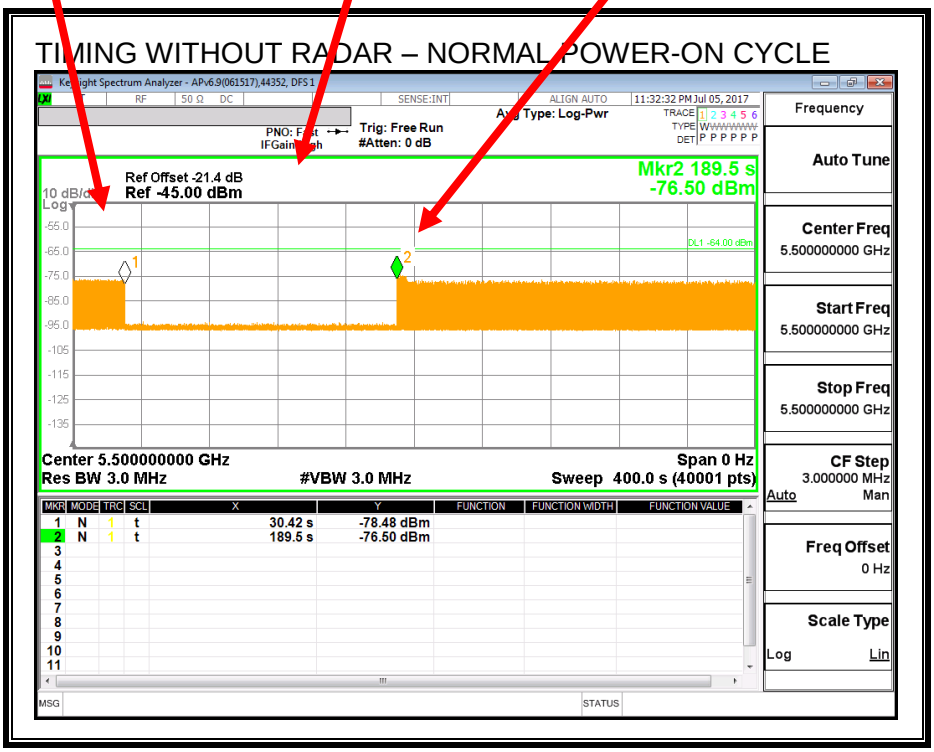
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within 54 to 60 second window	EUT indicates radar detected	No transmissions on channel

TIMING WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



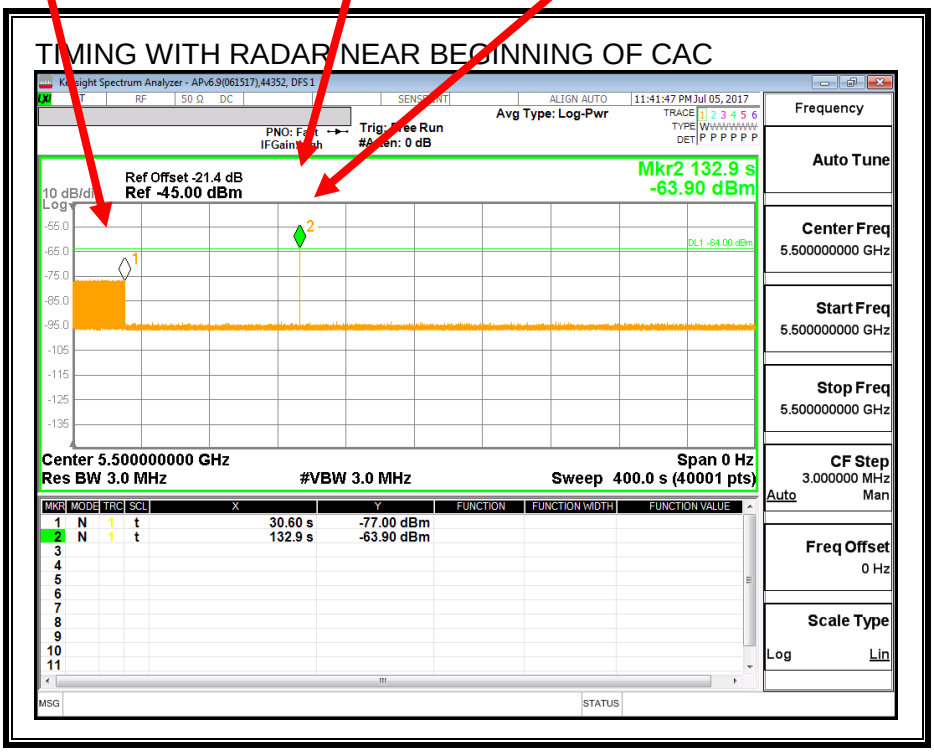
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



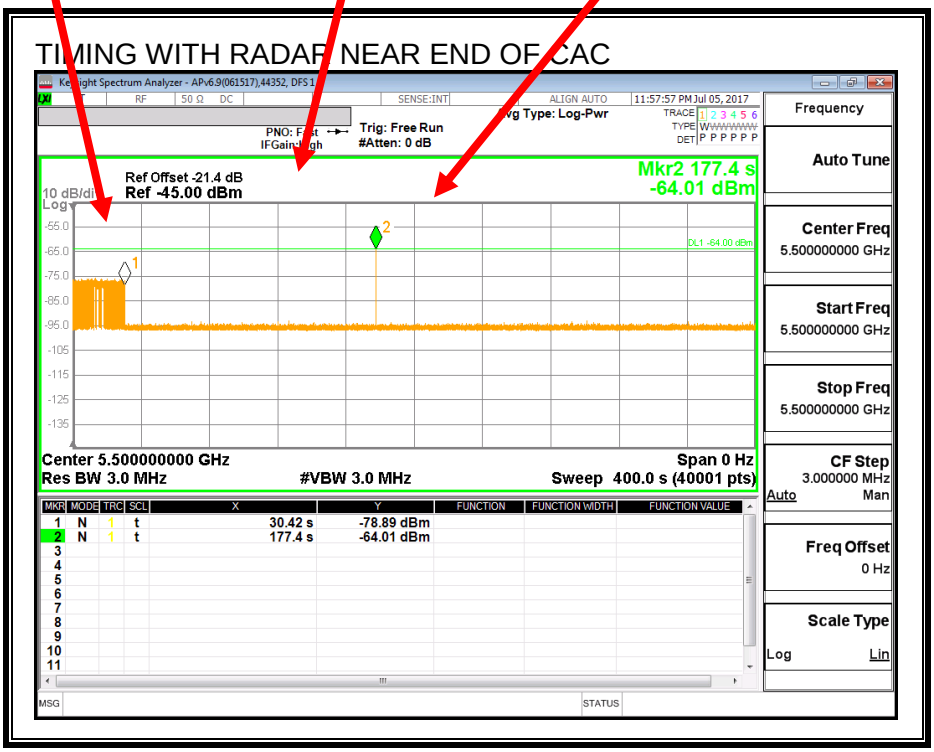
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

5.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

The channel spacing is not less than the channel bandwidth therefore the EUT does not have an overlapping channel plan.

These tests are not applicable.

5.2.5. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

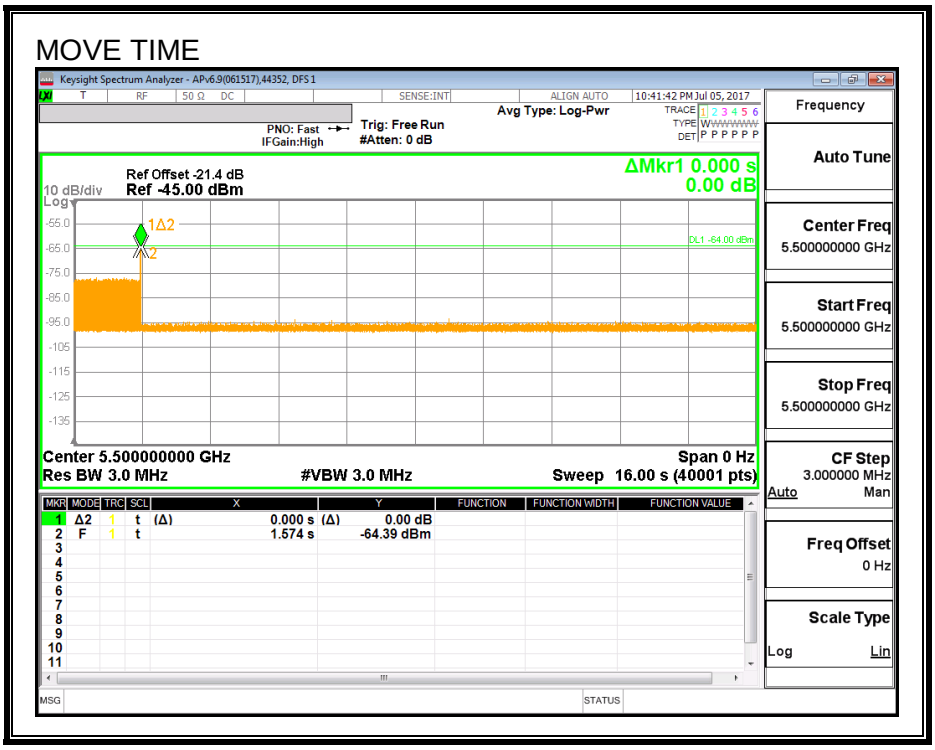
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.000	10

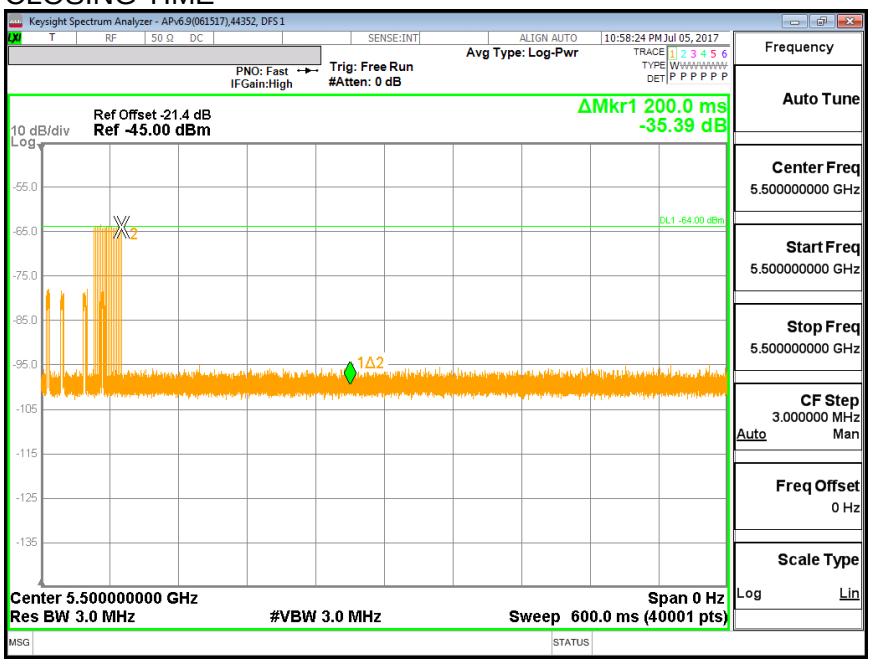
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60

MOVE TIME



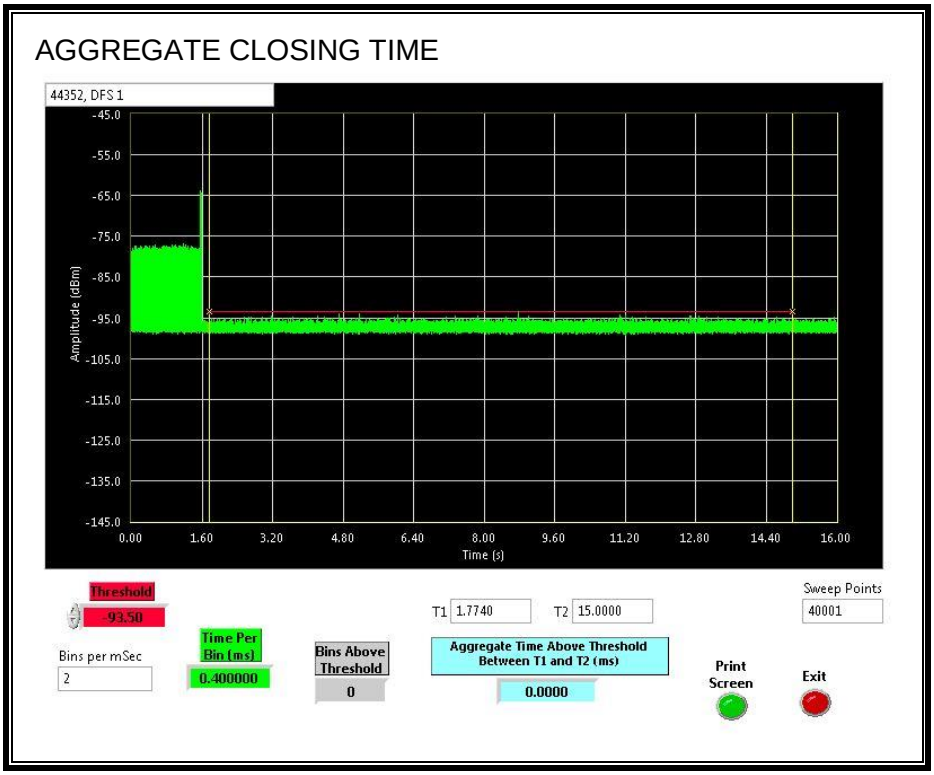
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

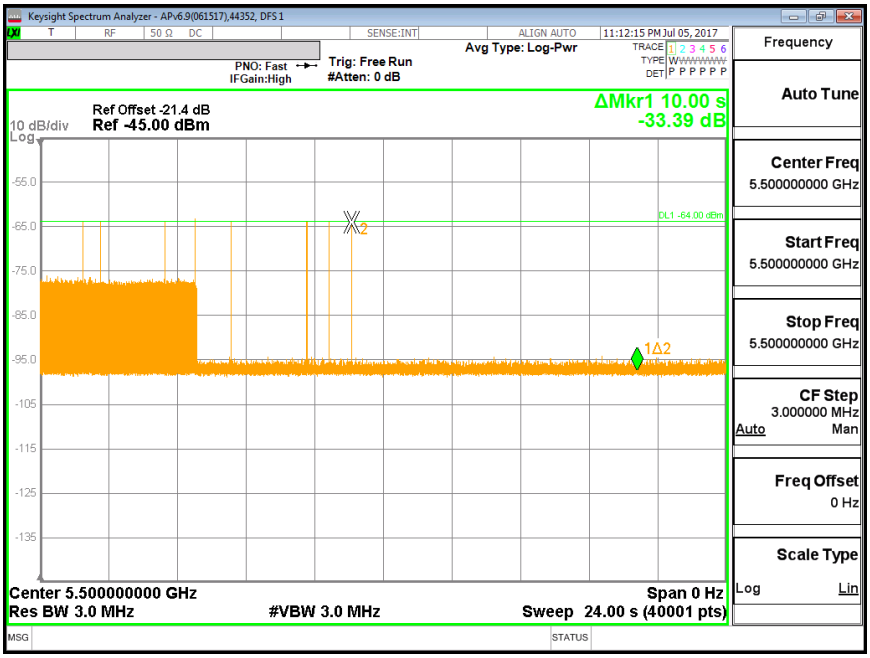
No transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

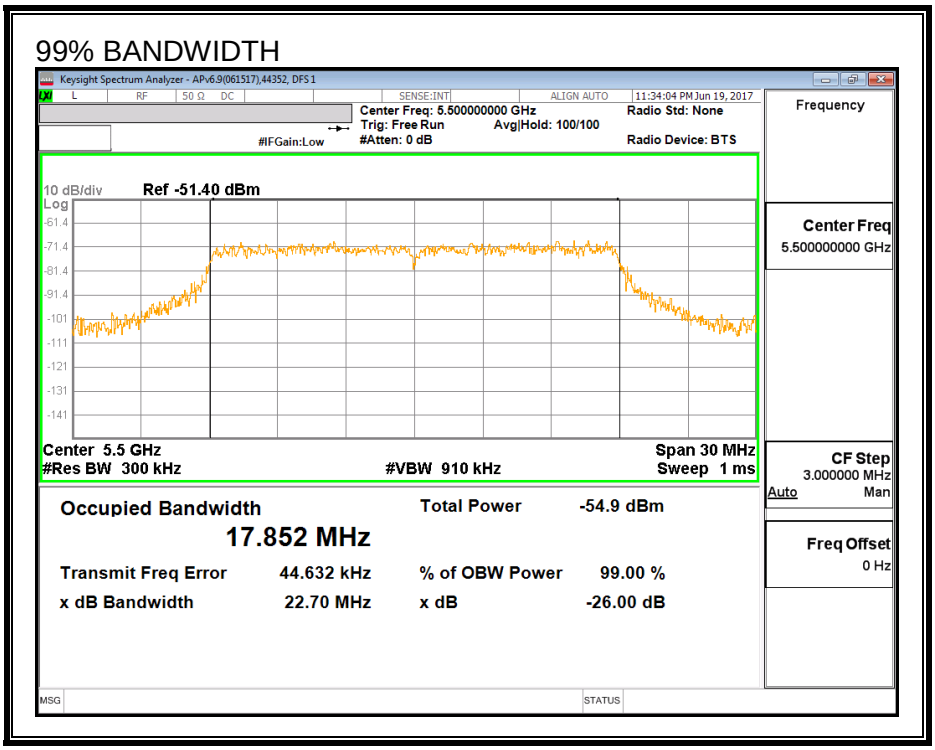
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



5.2.6. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5510	20	17.852	112.0	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		44352	DFS 1	
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	0	0	
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	9	90	FH
5511	10	0	0	

5.2.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5510	17.85	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	83.33	60	Pass	5490	5510	17.85	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	73.33	60	Pass	5490	5510	17.85	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	83.33	60	Pass	5490	5510	17.85	DFS 1	44352	Version 3.0
Aggregate		85.00	80	Pass						
FCC Long Pulse Type 5	30	96.67	80	Pass	5490	5510	17.85	DFS 1	44352	Version 3.0
FCC Hopping Type 6	42	90.48	70	Pass	5490	5510		DFS 1	29445	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5506	Yes
1002	1	538	99	A	5510	Yes
1003	1	838	63	A	5492	Yes
1004	1	798	67	A	5501	Yes
1005	1	678	78	A	5510	Yes
1006	1	638	83	A	5500	Yes
1007	1	778	68	A	5491	Yes
1008	1	578	92	A	5499	Yes
1009	1	738	72	A	5503	Yes
1010	1	658	81	A	5507	Yes
1011	1	918	58	A	5495	Yes
1012	1	858	62	A	5491	Yes
1013	1	558	95	A	5499	Yes
1014	1	818	65	A	5491	Yes
1015	1	938	57	A	5509	Yes
1016	1	2794	19	B	5500	Yes
1017	1	1073	50	B	5490	Yes
1018	1	1029	52	B	5506	Yes
1019	1	790	67	B	5500	Yes
1020	1	876	61	B	5498	Yes
1021	1	767	69	B	5509	Yes
1022	1	2335	23	B	5499	Yes
1023	1	2356	23	B	5496	Yes
1024	1	2859	19	B	5504	Yes
1025	1	1814	30	B	5491	Yes
1026	1	1093	49	B	5503	Yes
1027	1	2726	20	B	5493	Yes
1028	1	940	57	B	5505	Yes
1029	1	1508	35	B	5504	Yes
1030	1	2400	22	B	5505	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.8	180	27	5504	Yes
2002	3.7	197	24	5495	Yes
2003	1.4	165	28	5506	Yes
2004	2.6	230	24	5505	No
2005	4.6	164	29	5497	No
2006	4	152	25	5509	No
2007	2.1	171	27	5496	Yes
2008	1.8	163	28	5505	Yes
2009	4.2	229	23	5499	Yes
2010	2.1	225	24	5498	Yes
2011	2.8	215	23	5494	Yes
2012	1	176	25	5500	Yes
2013	1.9	170	24	5494	Yes
2014	4.3	179	23	5505	Yes
2015	3.5	177	29	5499	Yes
2016	2.1	190	28	5493	Yes
2017	1.5	154	25	5502	Yes
2018	4.6	172	28	5504	Yes
2019	4.2	183	25	5510	Yes
2020	1.3	204	29	5493	Yes
2021	3.3	219	26	5505	Yes
2022	2.7	207	23	5508	Yes
2023	4.9	226	28	5499	Yes
2024	4.6	218	26	5496	No
2025	2.9	203	28	5503	Yes
2026	4.9	199	29	5494	No
2027	1.5	189	28	5507	Yes
2028	3.8	151	29	5502	Yes
2029	4.7	226	29	5491	Yes
2030	3	154	28	5498	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	7.2	256	16	5499	Yes
3002	8	297	16	5503	Yes
3003	9.3	436	16	5509	Yes
3004	8.3	490	17	5501	Yes
3005	7.9	273	16	5495	Yes
3006	9.1	339	17	5499	Yes
3007	7	387	16	5505	Yes
3008	6.4	348	16	5501	No
3009	8.6	408	17	5495	No
3010	8.3	382	16	5506	Yes
3011	6.6	337	18	5507	Yes
3012	8.6	324	17	5493	No
3013	9.3	292	17	5507	Yes
3014	7.5	425	18	5505	Yes
3015	8.4	288	16	5490	Yes
3016	6.8	434	17	5498	Yes
3017	10	310	18	5502	Yes
3018	6.7	468	18	5494	Yes
3019	6.1	357	16	5503	No
3020	7	410	16	5497	Yes
3021	6.6	445	18	5507	No
3022	10	260	16	5498	Yes
3023	9.8	307	17	5501	Yes
3024	9.2	269	16	5495	No
3025	7.3	329	16	5498	No
3026	7	303	18	5507	Yes
3027	7.5	258	17	5504	Yes
3028	7.3	496	16	5508	Yes
3029	8	464	16	5498	No
3030	6.2	346	18	5495	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
4001	13.4	460	15	5504	Yes
4002	14.7	355	12	5495	Yes
4003	17.1	481	14	5501	Yes
4004	18.8	389	14	5509	Yes
4005	17.4	277	16	5501	Yes
4006	19.6	464	16	5503	Yes
4007	18.6	365	14	5504	Yes
4008	17	432	16	5491	Yes
4009	16.5	479	12	5492	Yes
4010	15.4	440	15	5494	Yes
4011	11.1	500	16	5500	No
4012	19.5	474	14	5503	Yes
4013	11.4	430	13	5508	Yes
4014	11.2	299	14	5497	Yes
4015	12.7	267	16	5504	Yes
4016	17.7	266	14	5503	No
4017	19.7	380	14	5495	Yes
4018	11.8	275	15	5506	Yes
4019	14.2	402	13	5491	Yes
4020	15.9	309	12	5491	Yes
4021	14.5	331	15	5500	No
4022	16.7	385	14	5507	Yes
4023	15.8	286	12	5501	Yes
4024	14.1	486	15	5496	Yes
4025	13.7	399	16	5494	No
4026	12.5	361	13	5491	Yes
4027	17.3	421	14	5501	Yes
4028	12.4	277	12	5498	Yes
4029	17.6	350	16	5501	Yes
4030	13.1	470	12	5494	No

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5500	No
2	5500	Yes
3	5500	Yes
4	5500	Yes
5	5500	Yes
6	5500	Yes
7	5500	Yes
8	5500	Yes
9	5500	Yes
10	5500	Yes
11	5494	Yes
12	5494	Yes
13	5496	Yes
14	5496	Yes
15	5498	Yes
16	5496	Yes
17	5496	Yes
18	5497	Yes
19	5498	Yes
20	5498	Yes
21	5501	Yes
22	5501	Yes
23	5503	Yes
24	5507	Yes
25	5505	Yes
26	5501	Yes
27	5506	Yes
28	5507	Yes
29	5503	Yes
30	5501	Yes

Note: The Type 5 randomized parameters tested are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6

1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop

NTIA August 2005 Hopping Sequence

Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	54	5490	6	Yes
2	529	5491	5	Yes
3	1004	5492	4	Yes
4	1479	5493	6	Yes
5	1954	5494	5	Yes
6	2429	5495	6	Yes
7	2904	5496	5	Yes
8	3379	5497	2	Yes
9	3854	5498	4	Yes
10	4329	5499	4	Yes
11	4804	5500	7	Yes
12	5279	5501	4	No
13	5754	5502	3	Yes
14	6229	5503	7	Yes
15	6704	5504	4	Yes
16	7179	5505	4	No
17	7654	5506	6	Yes
18	8129	5507	2	Yes
19	8604	5508	4	Yes
20	9079	5509	5	Yes
21	9554	5510	6	Yes
22	10029	5490	5	Yes
23	10504	5491	1	Yes
24	10979	5492	4	Yes
25	11454	5493	6	Yes
26	11929	5494	7	Yes
27	12404	5495	3	No
28	12879	5496	3	Yes
29	13354	5497	7	Yes
30	13829	5498	2	Yes
31	14304	5499	6	Yes
32	14779	5500	2	Yes
33	15254	5501	5	Yes
34	15729	5502	4	Yes
35	16204	5503	3	Yes
36	16679	5504	2	Yes
37	17154	5505	3	Yes
38	17629	5506	6	Yes
39	18104	5507	3	No
40	18579	5508	4	Yes
41	19054	5509	1	Yes
42	19529	5510	4	Yes

5.3. RESULTS FOR 40 MHz BANDWIDTH

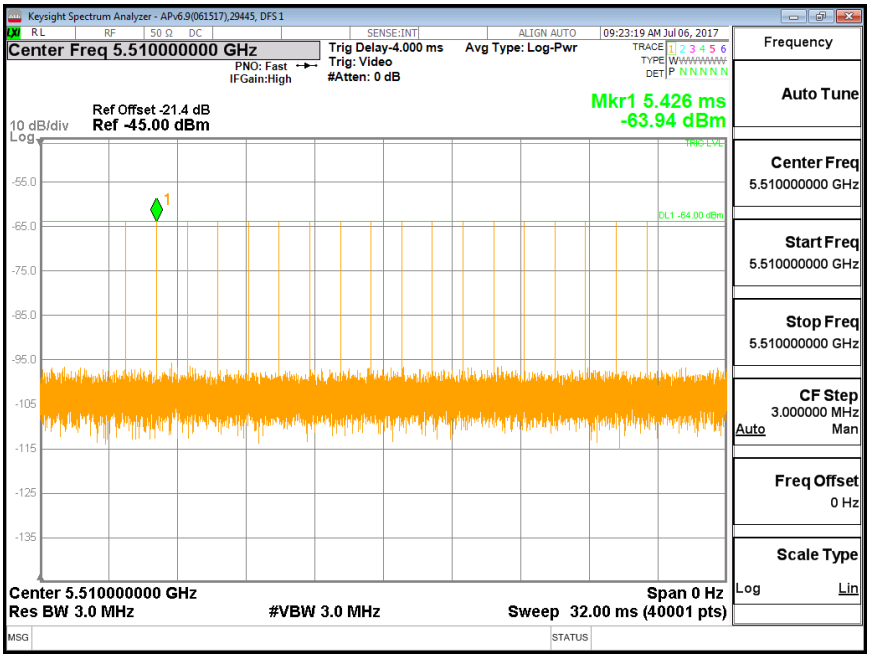
5.3.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5510 MHz.

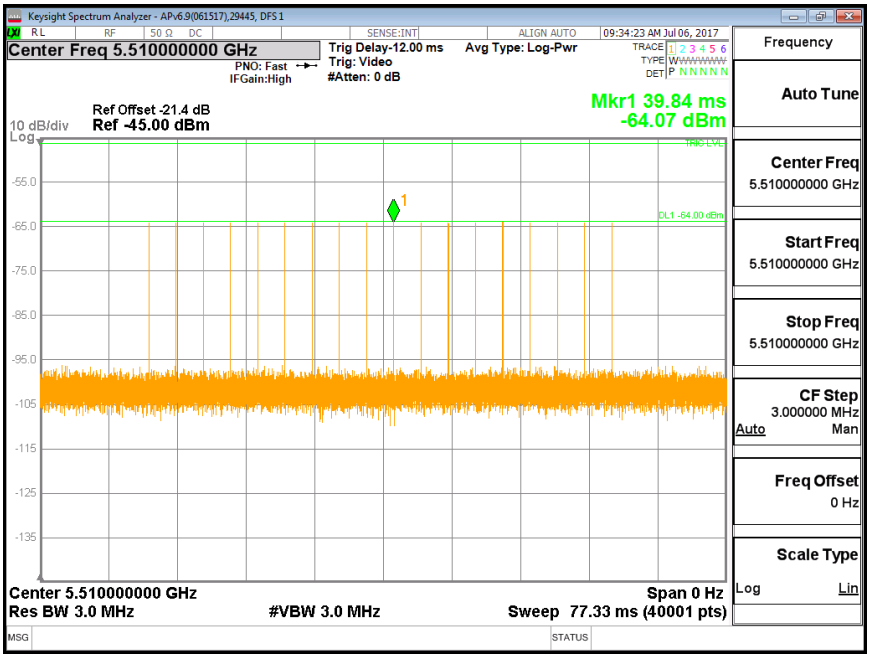
5.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

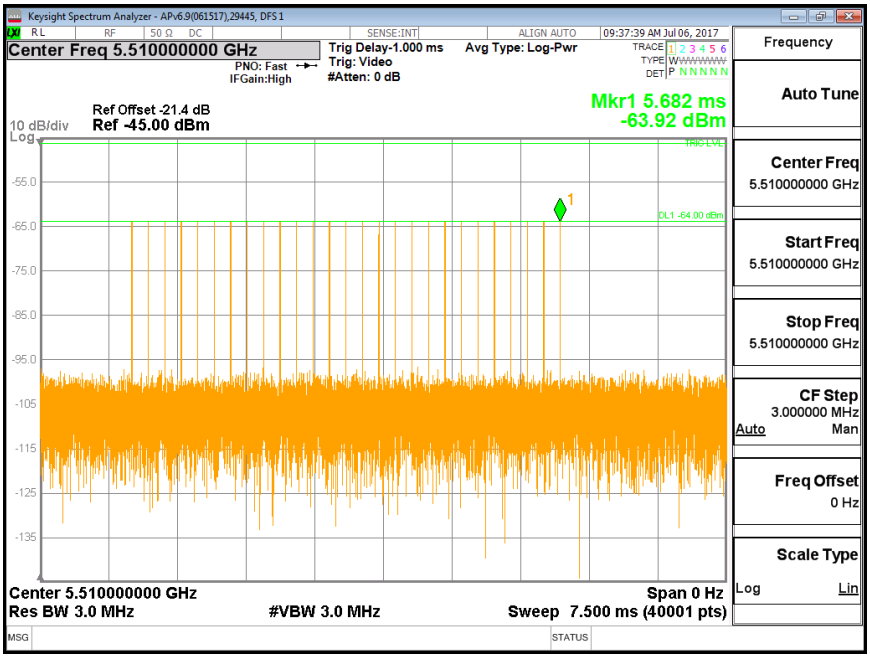
SHORT PULSE RADAR TYPE 0



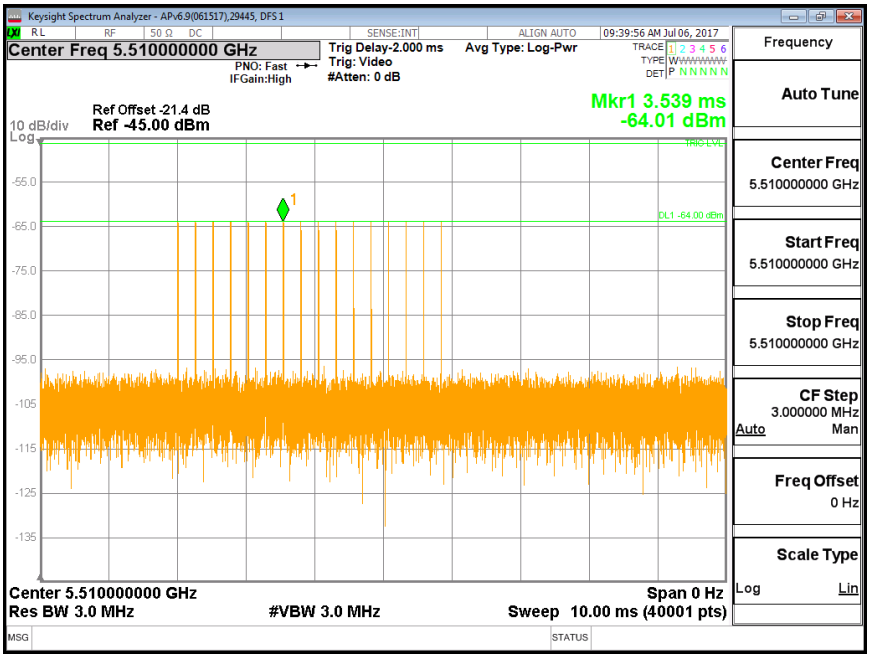
SAMPLE OF RADAR TYPE 1



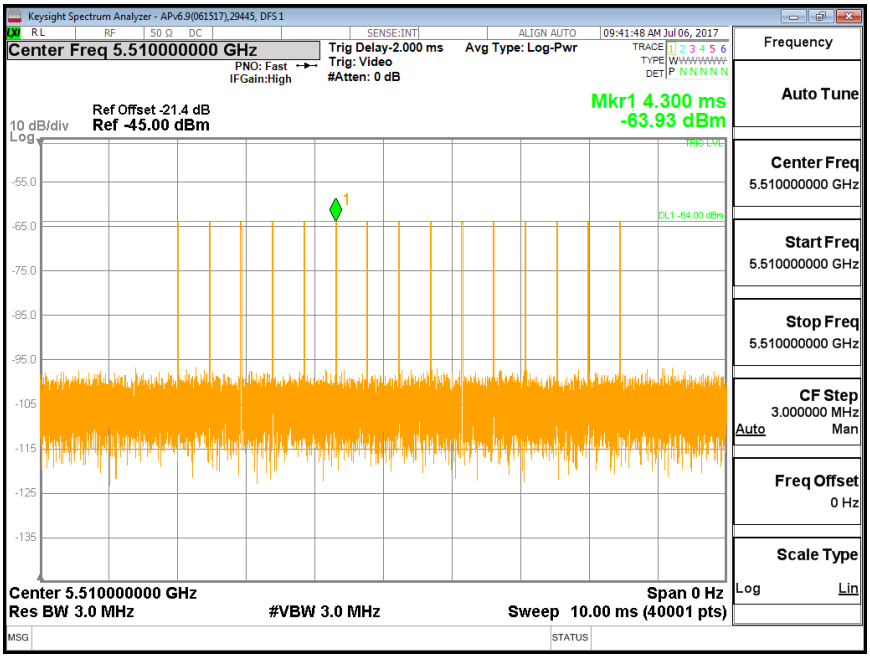
SAMPLE OF RADAR TYPE 2



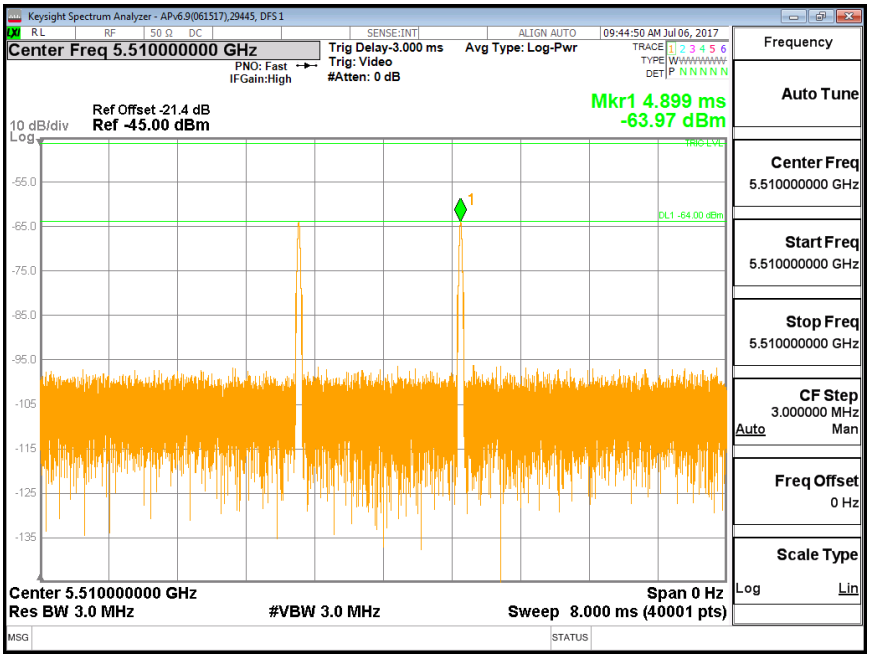
SAMPLE OF RADAR TYPE 3



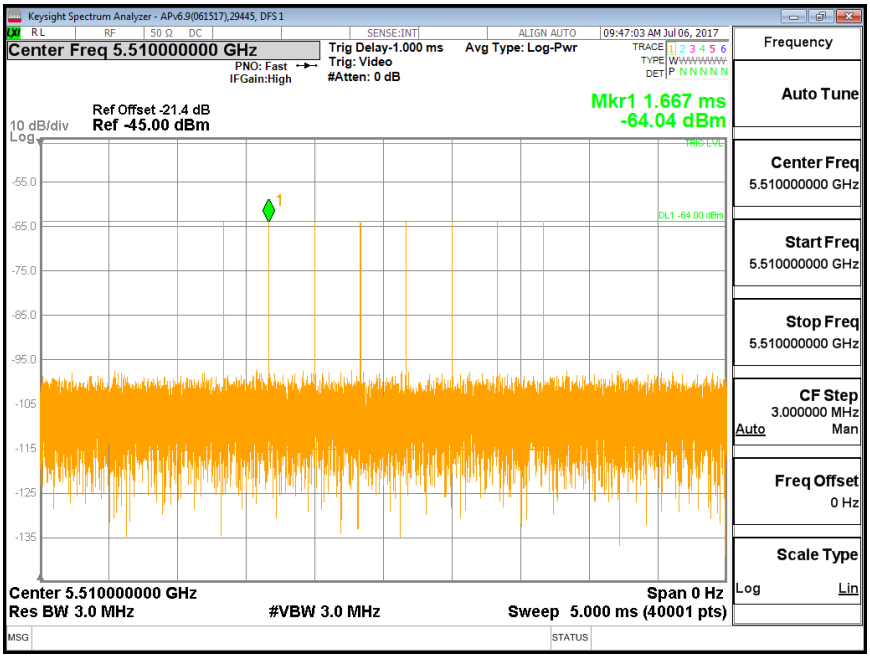
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

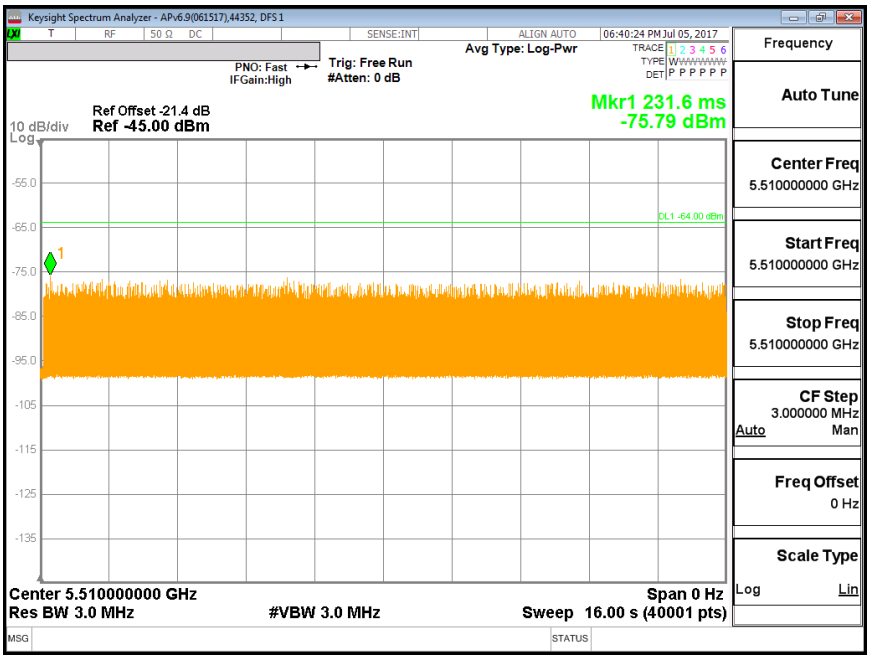


SINGLE BURST OF RADAR TYPE 6

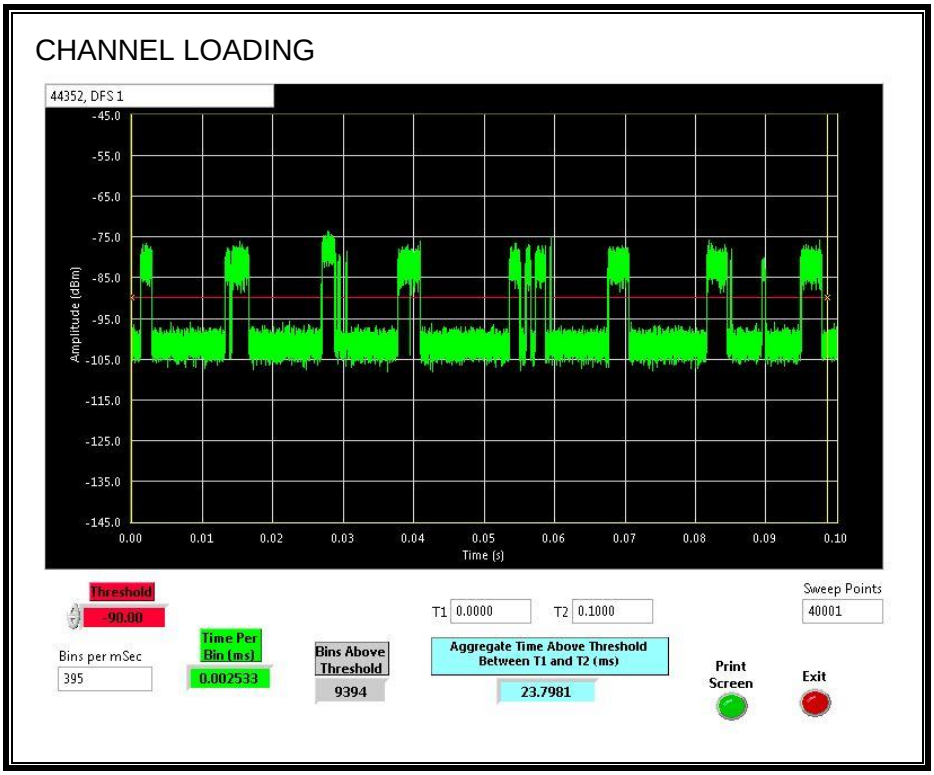


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 23.7981%

5.3.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.54	189.7	159.2	99.2

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.4	133.0	102.6	3.4

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.3	186.9	156.6	57.4

QUALITATIVE RESULTS

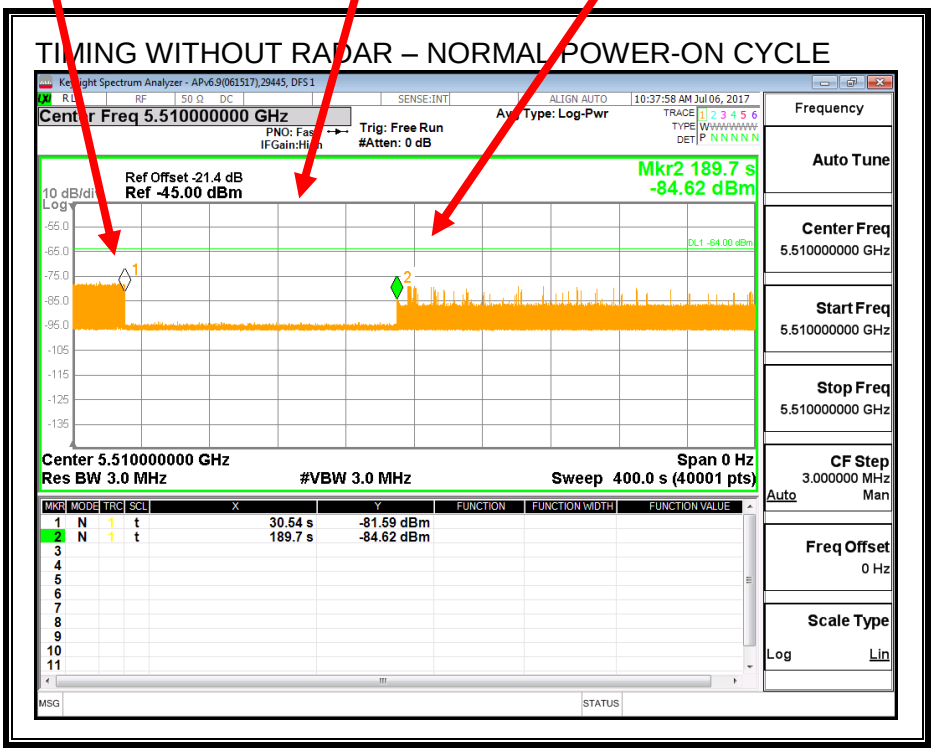
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within 54 to 60 second window	EUT indicates radar detected	No transmissions on channel

TIMING WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



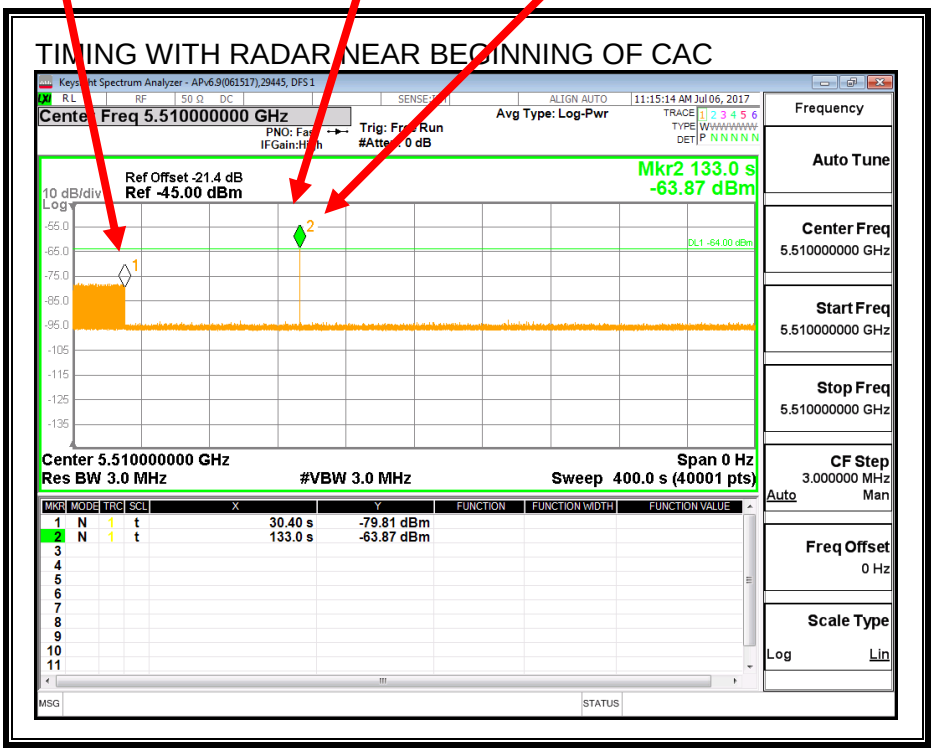
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



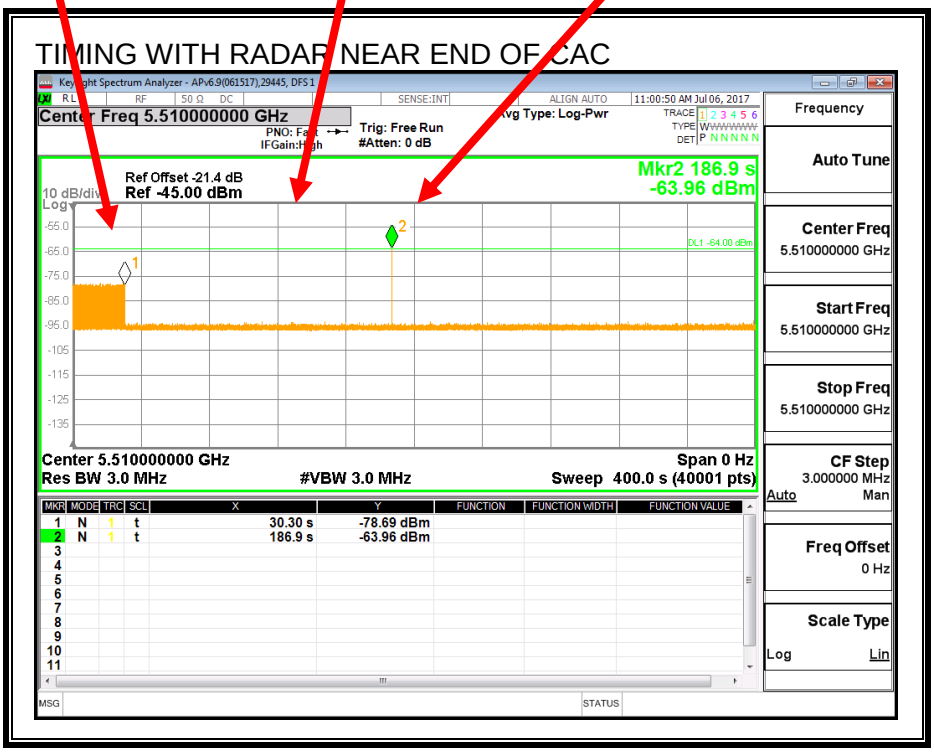
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

5.3.1. OVERLAPPING CHANNEL TESTS

RESULTS

The channel spacing is not less than the channel bandwidth therefore the EUT does not have an overlapping channel plan.

These tests are not applicable.

5.3.2. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

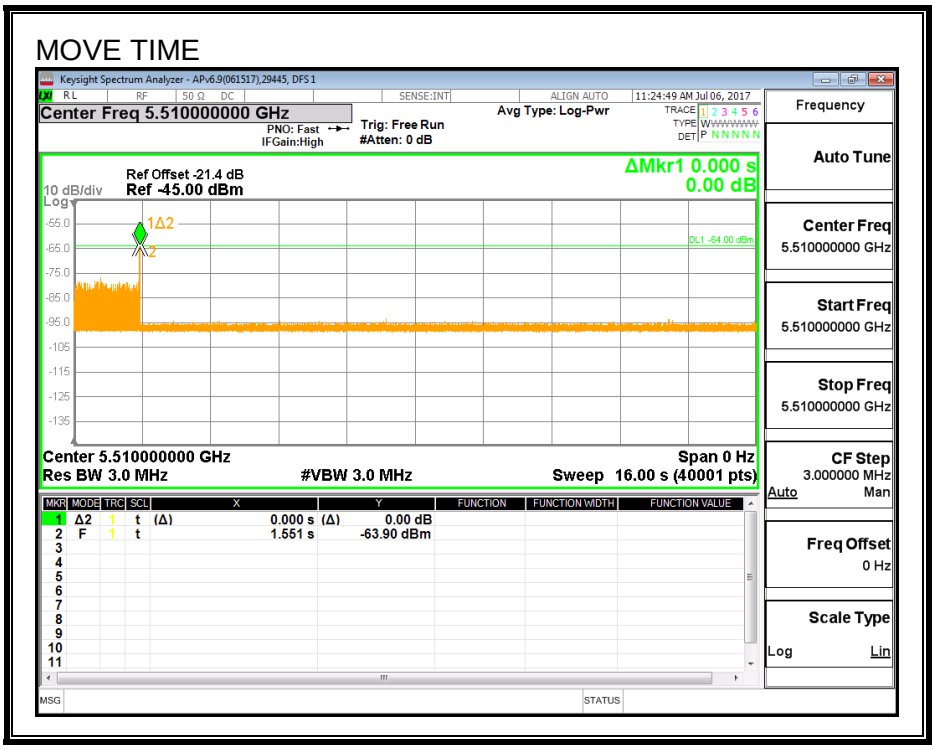
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.000	10

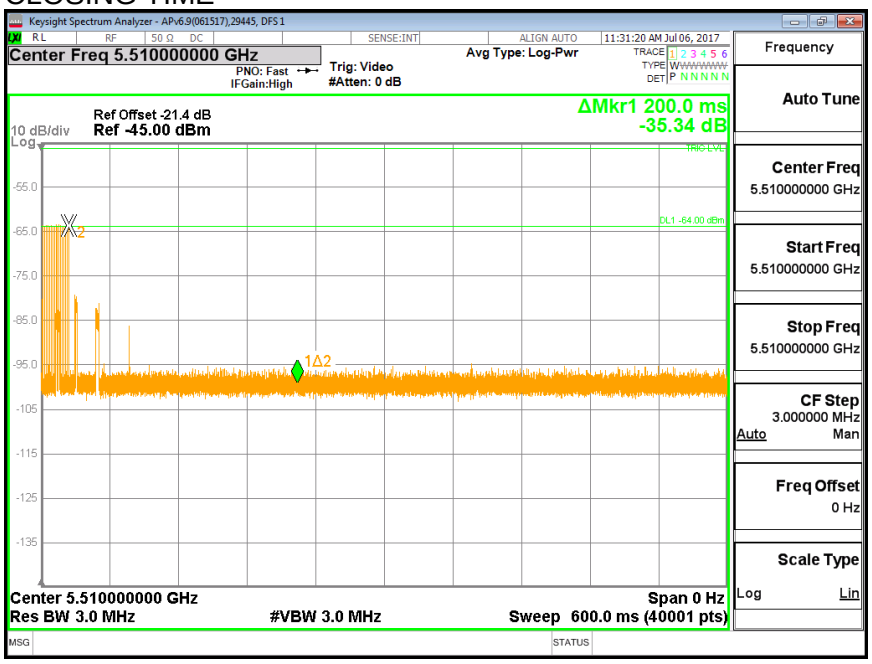
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60

MOVE TIME



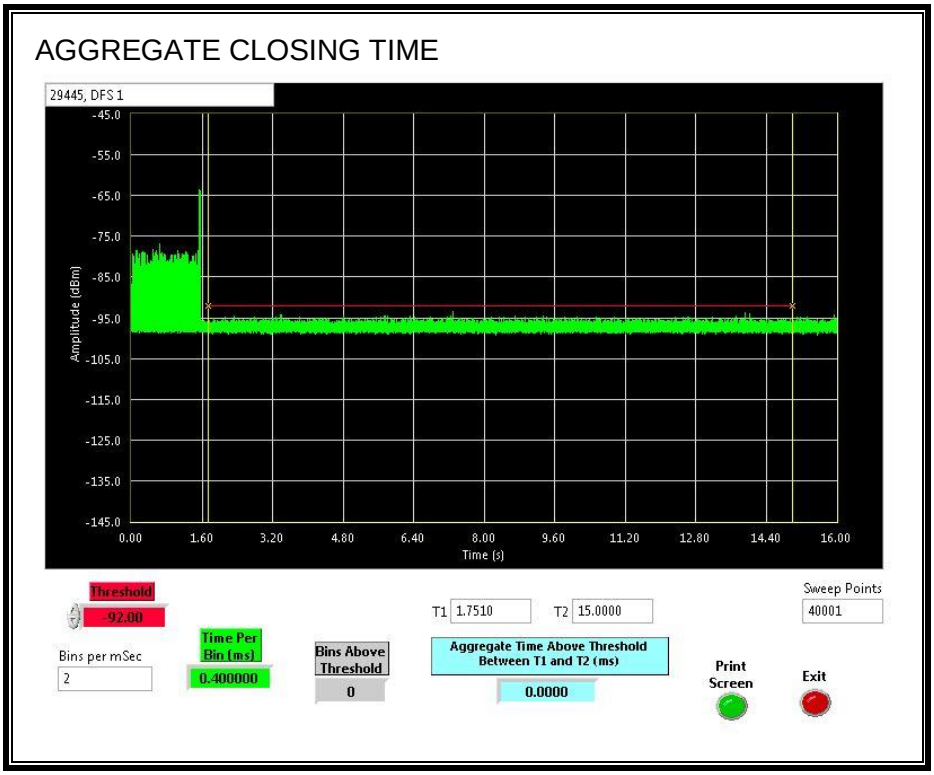
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

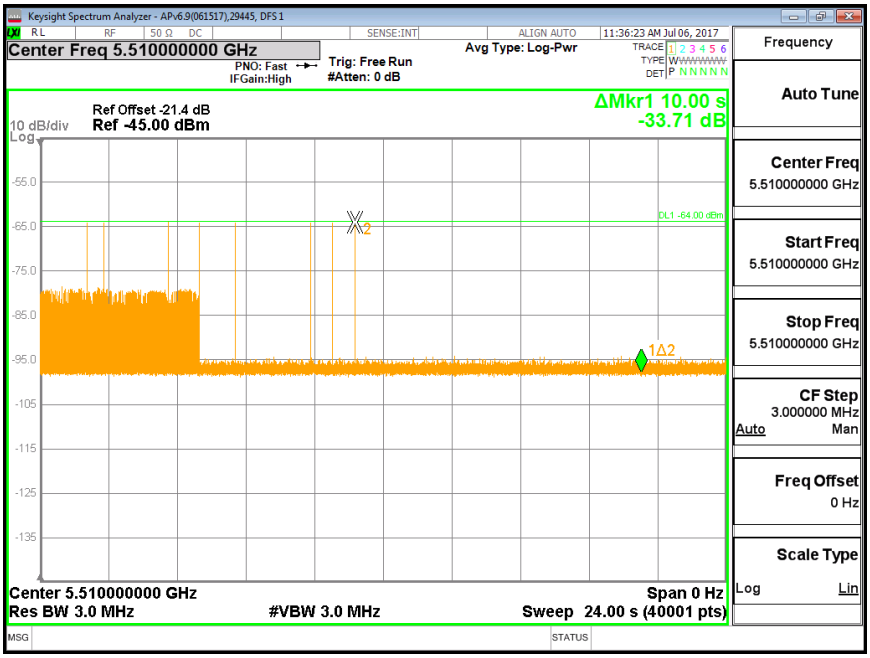
No transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

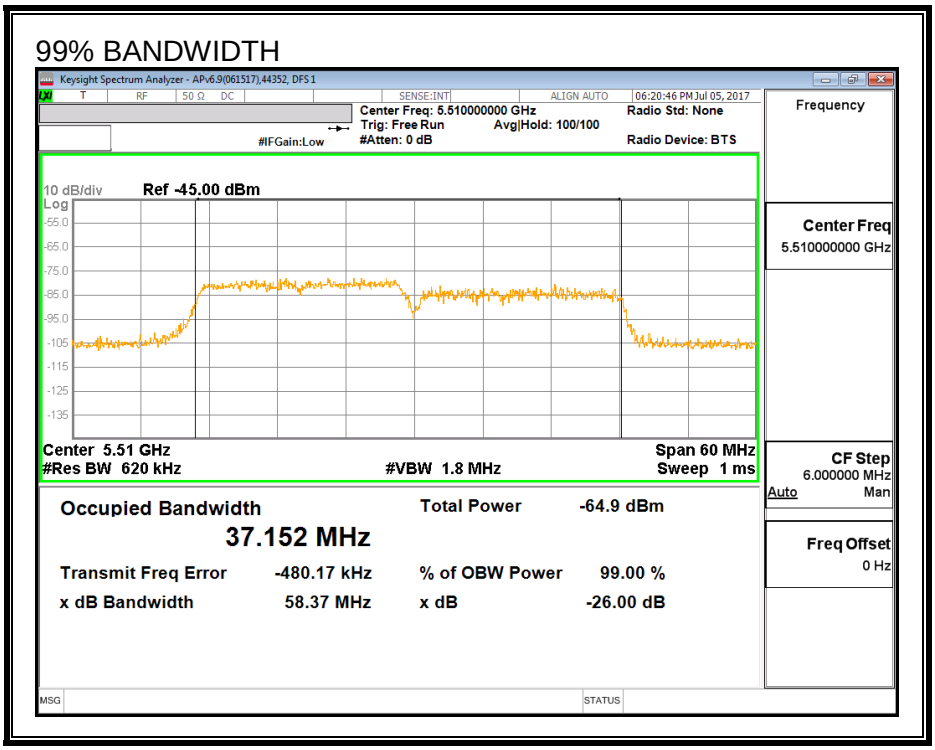
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



5.3.3. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5533	43	37.152	115.7	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results	44352	DFS 1		
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	3	30	
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	
5531	10	10	100	
5532	10	10	100	
5533	10	10	100	FH
5534	10	0	0	

5.3.4. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	96.67	60	Pass	5490	5533	37.15	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	83.33	60	Pass	5490	5533	37.15	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	73.33	60	Pass	5490	5533	37.15	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	70.00	60	Pass	5490	5533	37.15	DFS 1	44352	Version 3.0
Aggregate		80.83	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5533	37.15	DFS 1	44352	Version 3.0
FCC Hopping Type 6	44	97.73	70	Pass	5490	5533		DFS 1	44352	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5492	Yes
1002	1	538	99	A	5507	Yes
1003	1	838	63	A	5523	Yes
1004	1	798	67	A	5513	Yes
1005	1	678	78	A	5521	Yes
1006	1	638	83	A	5521	Yes
1007	1	778	68	A	5512	Yes
1008	1	578	92	A	5525	Yes
1009	1	738	72	A	5532	Yes
1010	1	658	81	A	5512	Yes
1011	1	918	58	A	5508	Yes
1012	1	858	62	A	5493	Yes
1013	1	558	95	A	5491	Yes
1014	1	818	65	A	5499	Yes
1015	1	938	57	A	5492	Yes
1016	1	2794	19	B	5515	Yes
1017	1	1073	50	B	5502	Yes
1018	1	1029	52	B	5495	Yes
1019	1	790	67	B	5529	Yes
1020	1	876	61	B	5500	Yes
1021	1	767	69	B	5493	Yes
1022	1	2335	23	B	5509	Yes
1023	1	2356	23	B	5532	Yes
1024	1	2859	19	B	5523	Yes
1025	1	1814	30	B	5518	Yes
1026	1	1093	49	B	5531	No
1027	1	2726	20	B	5530	Yes
1028	1	940	57	B	5500	Yes
1029	1	1508	35	B	5493	Yes
1030	1	2400	22	B	5521	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.8	180	27	5525	No
2002	3.7	197	24	5506	No
2003	1.4	165	28	5495	Yes
2004	2.6	230	24	5532	No
2005	4.6	164	29	5522	No
2006	4	152	25	5529	Yes
2007	2.1	171	27	5526	Yes
2008	1.8	163	28	5509	Yes
2009	4.2	229	23	5518	Yes
2010	2.1	225	24	5501	Yes
2011	2.8	215	23	5527	Yes
2012	1	176	25	5507	Yes
2013	1.9	170	24	5520	Yes
2014	4.3	179	23	5513	Yes
2015	3.5	177	29	5495	Yes
2016	2.1	190	28	5495	Yes
2017	1.5	154	25	5512	Yes
2018	4.6	172	28	5494	Yes
2019	4.2	183	25	5494	Yes
2020	1.3	204	29	5525	Yes
2021	3.3	219	26	5532	No
2022	2.7	207	23	5519	Yes
2023	4.9	226	28	5530	Yes
2024	4.6	218	26	5503	Yes
2025	2.9	203	28	5527	Yes
2026	4.9	199	29	5504	Yes
2027	1.5	189	28	5502	Yes
2028	3.8	151	29	5523	Yes
2029	4.7	226	29	5530	Yes
2030	3	154	28	5507	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	7.2	256	16	5522	No
3002	8	297	16	5500	Yes
3003	9.3	436	16	5510	Yes
3004	8.3	490	17	5509	Yes
3005	7.9	273	16	5526	Yes
3006	9.1	339	17	5506	Yes
3007	7	387	16	5517	Yes
3008	6.4	348	16	5502	No
3009	8.6	408	17	5496	Yes
3010	8.3	382	16	5528	No
3011	6.6	337	18	5518	Yes
3012	8.6	324	17	5512	Yes
3013	9.3	292	17	5505	No
3014	7.5	425	18	5513	Yes
3015	8.4	288	16	5514	Yes
3016	6.8	434	17	5491	No
3017	10	310	18	5499	Yes
3018	6.7	468	18	5527	Yes
3019	6.1	357	16	5516	Yes
3020	7	410	16	5512	No
3021	6.6	445	18	5519	Yes
3022	10	260	16	5510	Yes
3023	9.8	307	17	5513	Yes
3024	9.2	269	16	5513	Yes
3025	7.3	329	16	5511	Yes
3026	7	303	18	5498	Yes
3027	7.5	258	17	5522	Yes
3028	7.3	496	16	5511	No
3029	8	464	16	5518	Yes
3030	6.2	346	18	5531	No

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
4001	13.4	460	15	5495	Yes
4002	14.7	355	12	5509	No
4003	17.1	481	14	5502	Yes
4004	18.8	389	14	5517	Yes
4005	17.4	277	16	5514	Yes
4006	19.6	464	16	5523	Yes
4007	18.6	365	14	5511	No
4008	17	432	16	5507	Yes
4009	16.5	479	12	5511	No
4010	15.4	440	15	5530	Yes
4011	11.1	500	16	5515	Yes
4012	19.5	474	14	5533	No
4013	11.4	430	13	5501	No
4014	11.2	299	14	5519	No
4015	12.7	267	16	5523	Yes
4016	17.7	266	14	5522	Yes
4017	19.7	380	14	5526	Yes
4018	11.8	275	15	5508	Yes
4019	14.2	402	13	5512	Yes
4020	15.9	309	12	5492	Yes
4021	14.5	331	15	5509	Yes
4022	16.7	385	14	5494	Yes
4023	15.8	286	12	5510	Yes
4024	14.1	486	15	5533	No
4025	13.7	399	16	5499	Yes
4026	12.5	361	13	5524	Yes
4027	17.3	421	14	5504	Yes
4028	12.4	277	12	5526	Yes
4029	17.6	350	16	5498	No
4030	13.1	470	12	5518	No

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5510	Yes
2	5510	Yes
3	5510	Yes
4	5510	Yes
5	5510	Yes
6	5510	Yes
7	5510	Yes
8	5510	Yes
9	5510	Yes
10	5510	Yes
11	5494	Yes
12	5494	Yes
13	5496	Yes
14	5496	Yes
15	5498	Yes
16	5497	Yes
17	5496	Yes
18	5498	Yes
19	5498	Yes
20	5499	Yes
21	5520	Yes
22	5521	Yes
23	5523	Yes
24	5526	Yes
25	5525	Yes
26	5521	Yes
27	5526	Yes
28	5526	Yes
29	5523	Yes
30	5521	Yes

Note: The Type 5 randomized parameters tested are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop
NTIA August 2005 Hopping Sequence

Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	134	5490	7	Yes
2	609	5491	13	Yes
3	1084	5492	8	Yes
4	1559	5493	9	Yes
5	2034	5494	6	Yes
6	2509	5495	8	Yes
7	2984	5496	9	Yes
8	3459	5497	10	Yes
9	3934	5498	7	Yes
10	4409	5499	10	Yes
11	4884	5500	14	Yes
12	5359	5501	9	Yes
13	5834	5502	12	Yes
14	6309	5503	6	Yes
15	6784	5504	9	Yes
16	7259	5505	10	Yes
17	7734	5506	7	Yes
18	8209	5507	12	Yes
19	8684	5508	7	Yes
20	9159	5509	11	Yes
21	9634	5510	8	Yes
22	10109	5511	6	Yes
23	10584	5512	6	Yes
24	11059	5513	8	Yes
25	11534	5514	9	Yes
26	12009	5515	11	Yes
27	12484	5516	6	Yes
28	12959	5517	17	Yes
29	13434	5518	13	Yes
30	13909	5519	5	Yes
31	14384	5520	10	Yes
32	14859	5521	11	Yes
33	15334	5522	10	Yes
34	15809	5523	7	Yes
35	16284	5524	6	Yes
36	16759	5525	6	Yes
37	17234	5526	7	Yes
38	17709	5527	10	Yes
39	18184	5528	17	Yes
40	18659	5529	11	Yes
41	19134	5530	11	Yes
42	19609	5531	4	No
43	20084	5532	14	Yes
44	20559	5533	10	Yes

5.4. RESULTS FOR 80 MHz BANDWIDTH

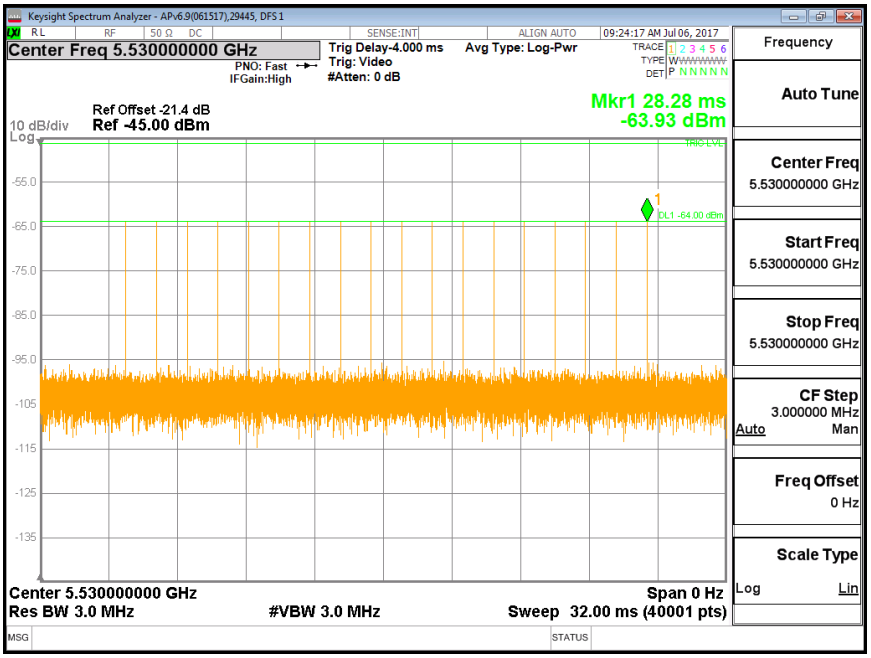
5.4.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5530 MHz.

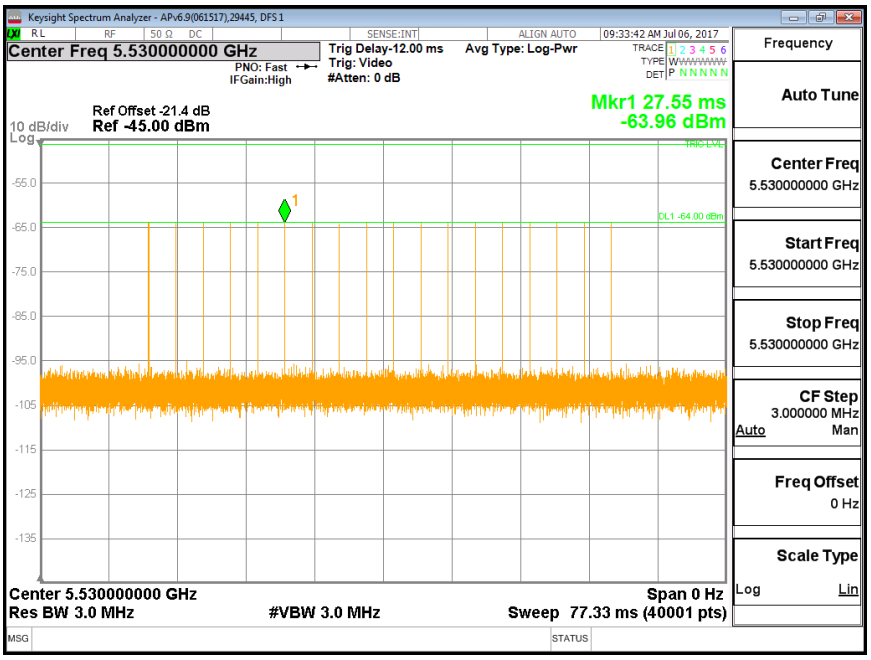
5.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

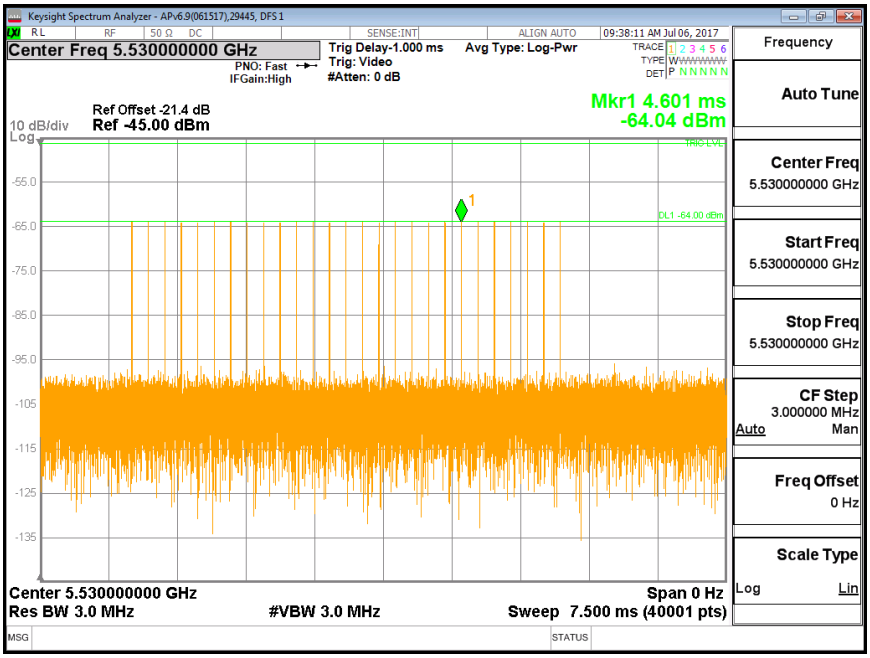
SHORT PULSE RADAR TYPE 0



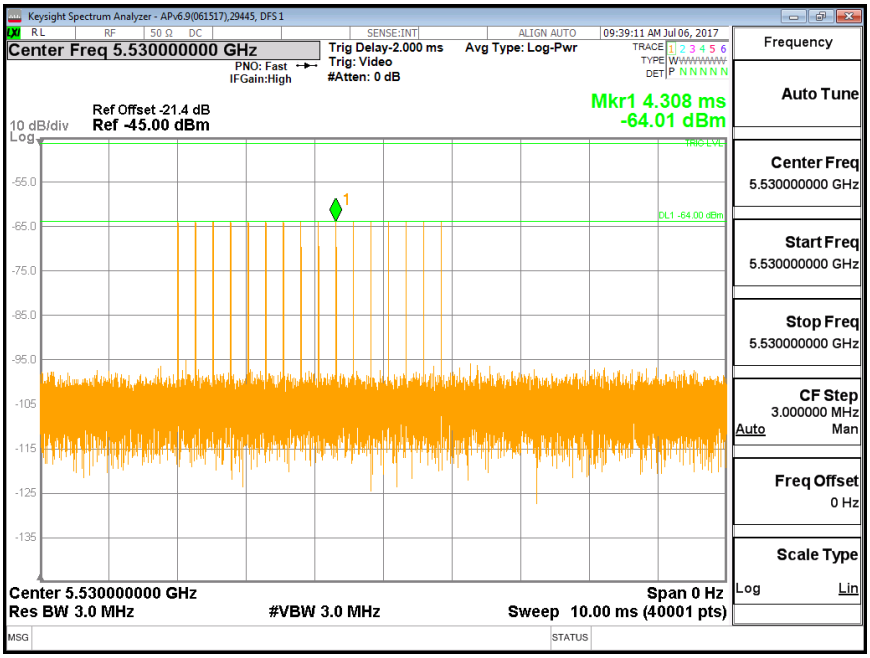
SAMPLE OF RADAR TYPE 1



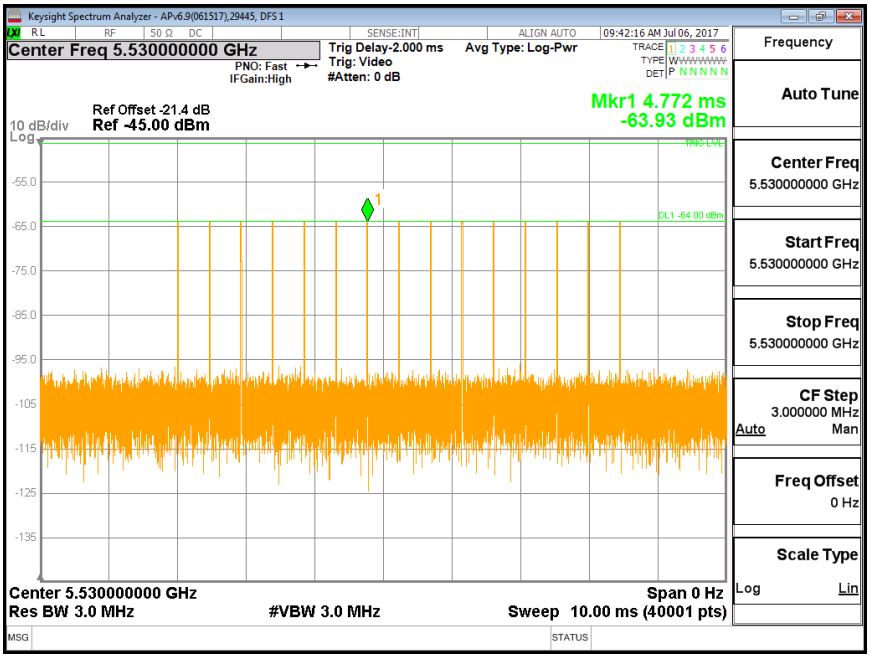
SAMPLE OF RADAR TYPE 2



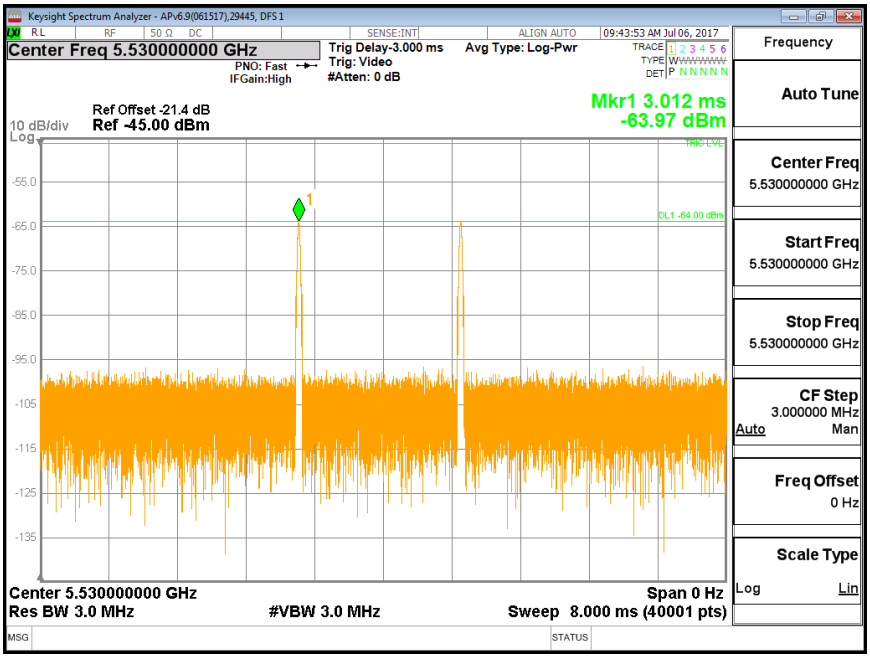
SAMPLE OF RADAR TYPE 3



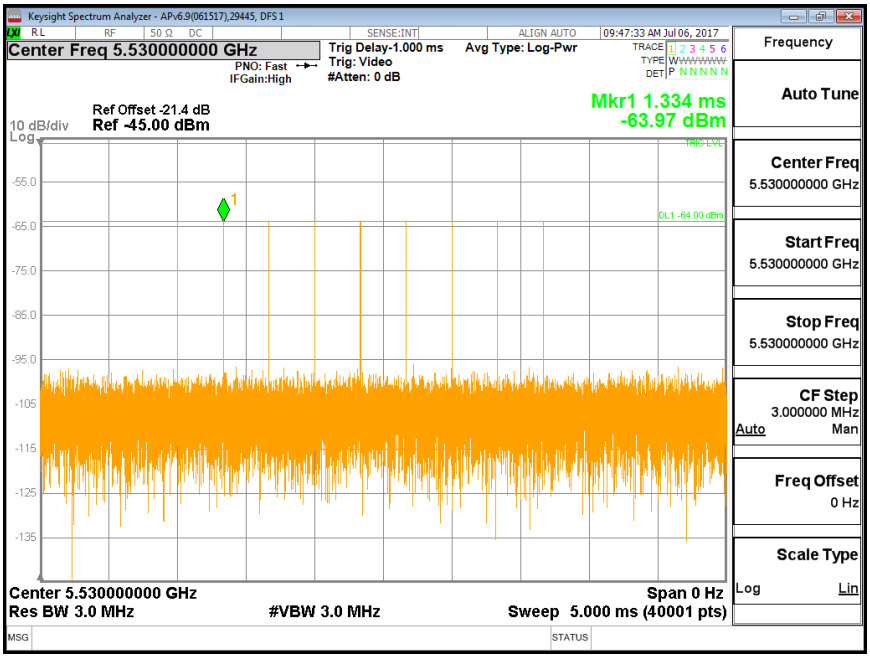
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

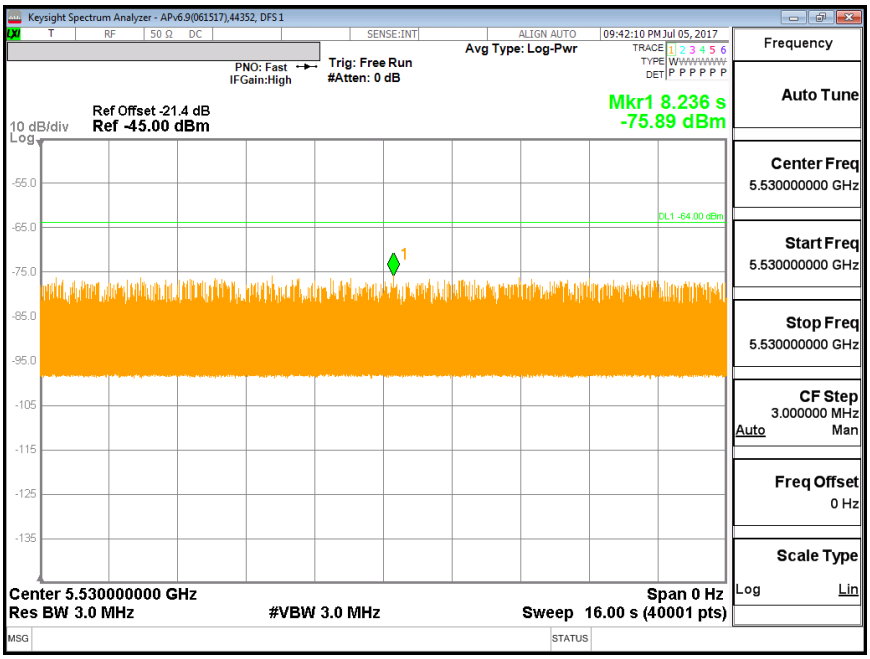


SINGLE BURST OF RADAR TYPE 6

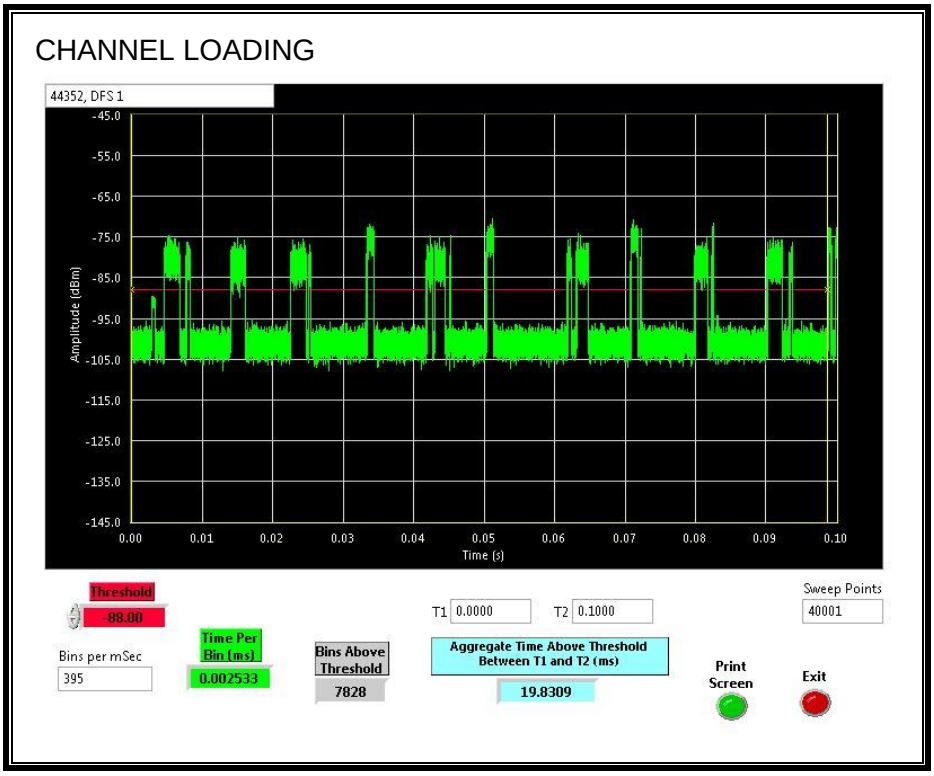


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.8309%.

5.4.1. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.23	188.9	158.7	98.7

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.32	132.3	102.0	3.3

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.64	186.6	156.0	57.3

QUALITATIVE RESULTS

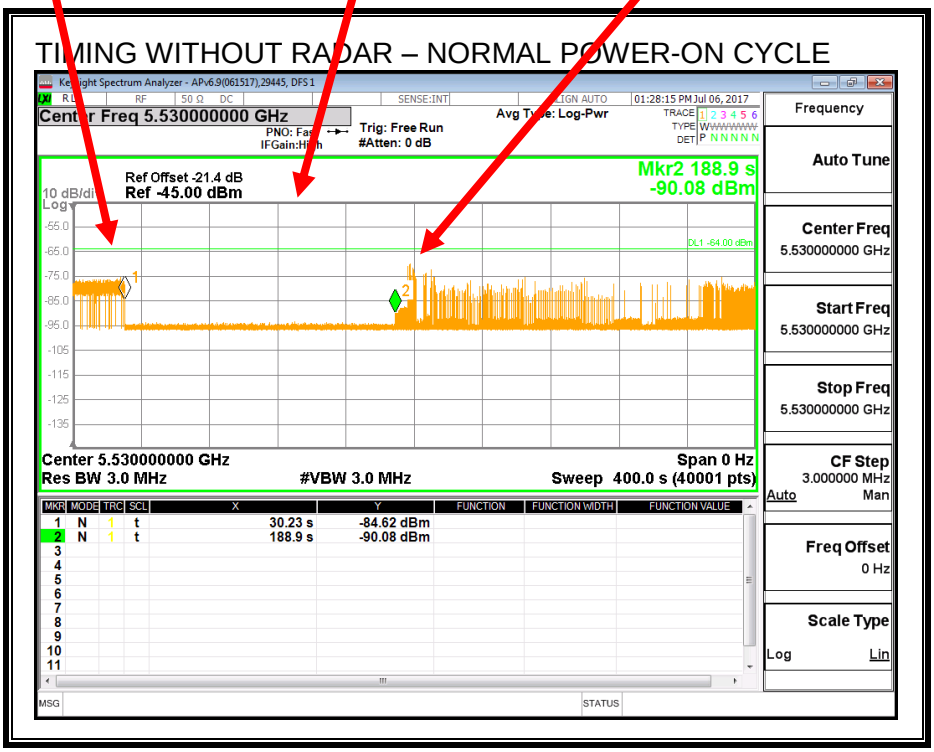
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within 54 to 60 second window	EUT indicates radar detected	No transmissions on channel

TIMING WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



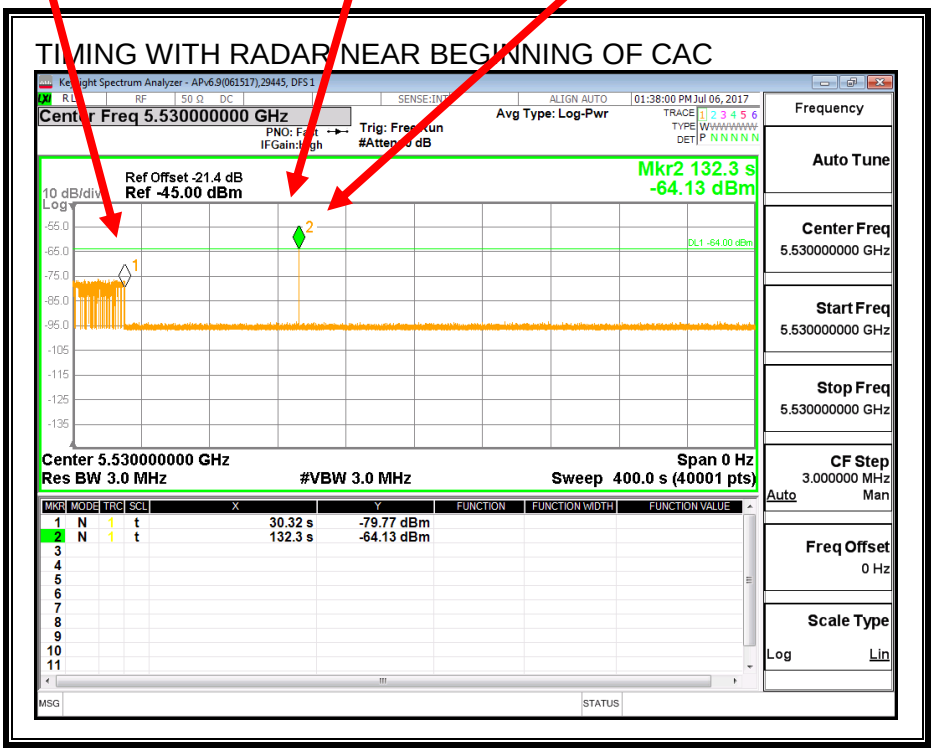
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



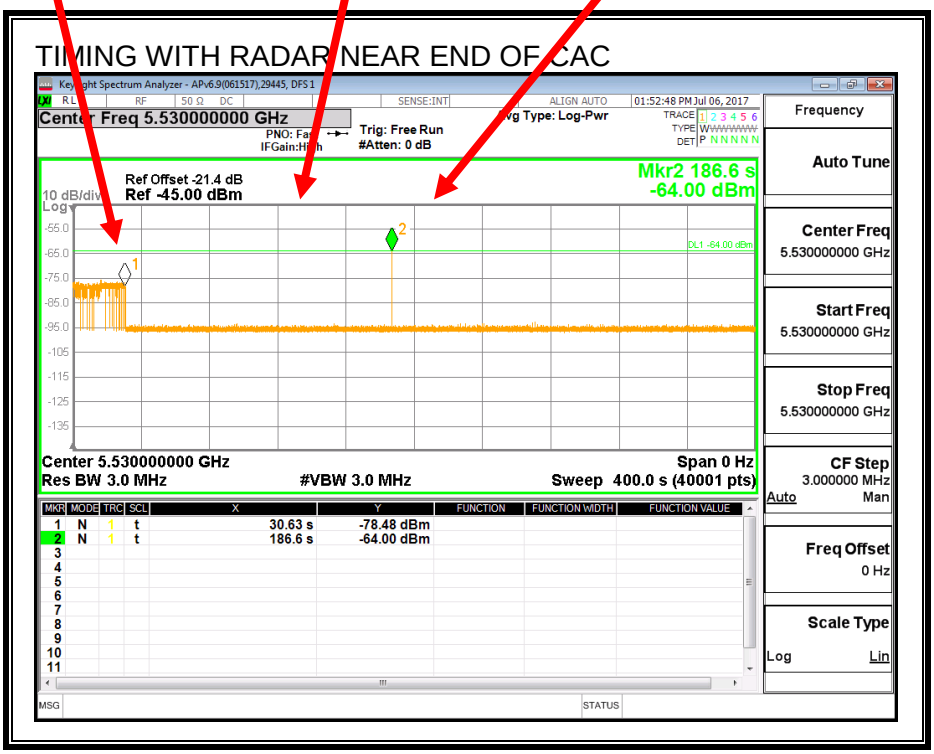
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

5.4.2. OVERLAPPING CHANNEL TESTS

RESULTS

The channel spacing is not less than the channel bandwidth therefore the EUT does not have an overlapping channel plan.

These tests are not applicable.

5.4.3. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

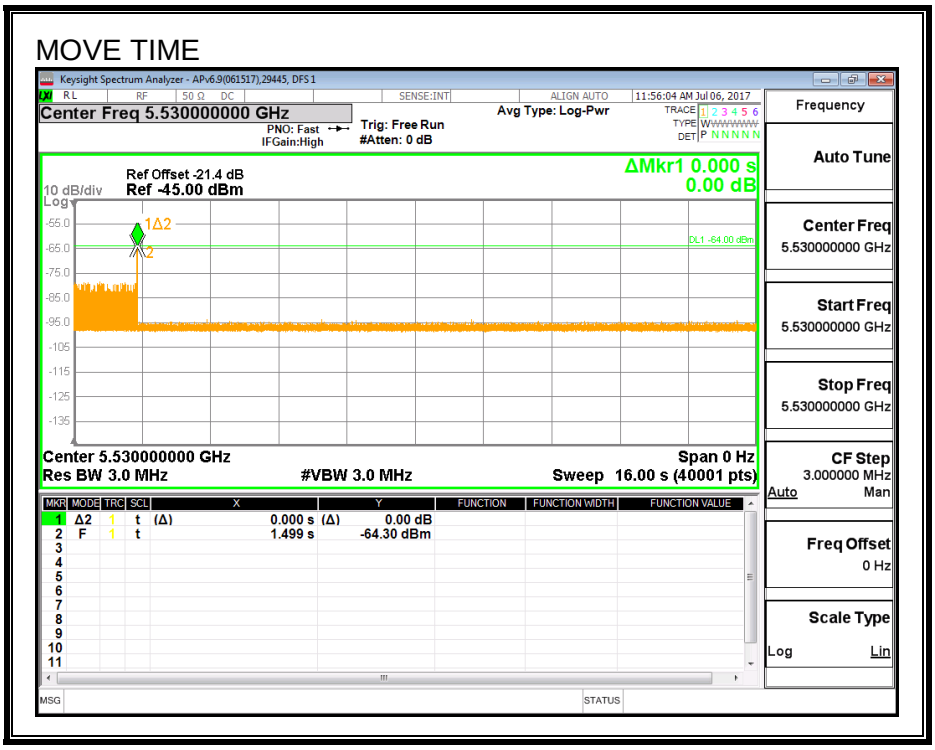
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.000	10

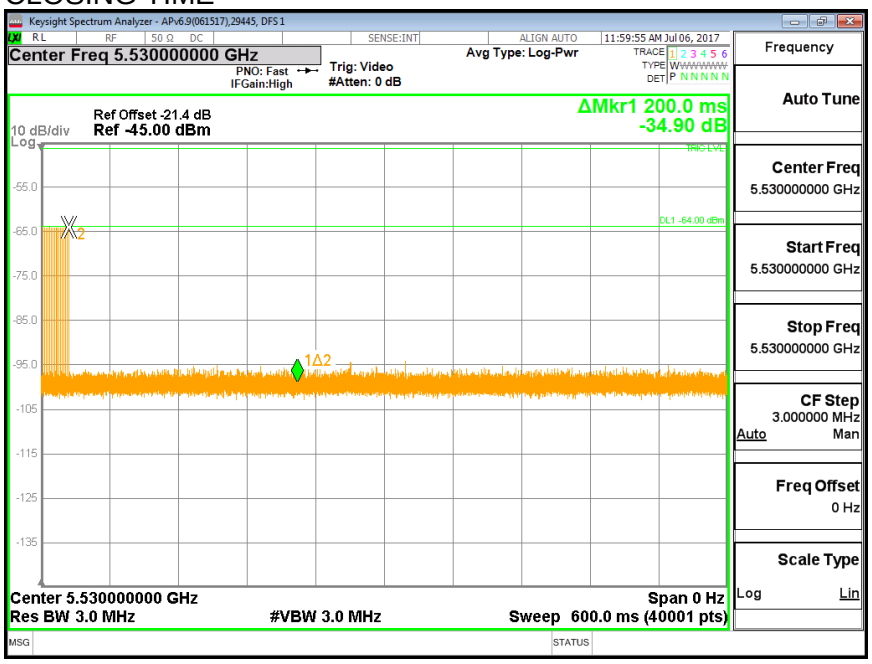
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60

MOVE TIME



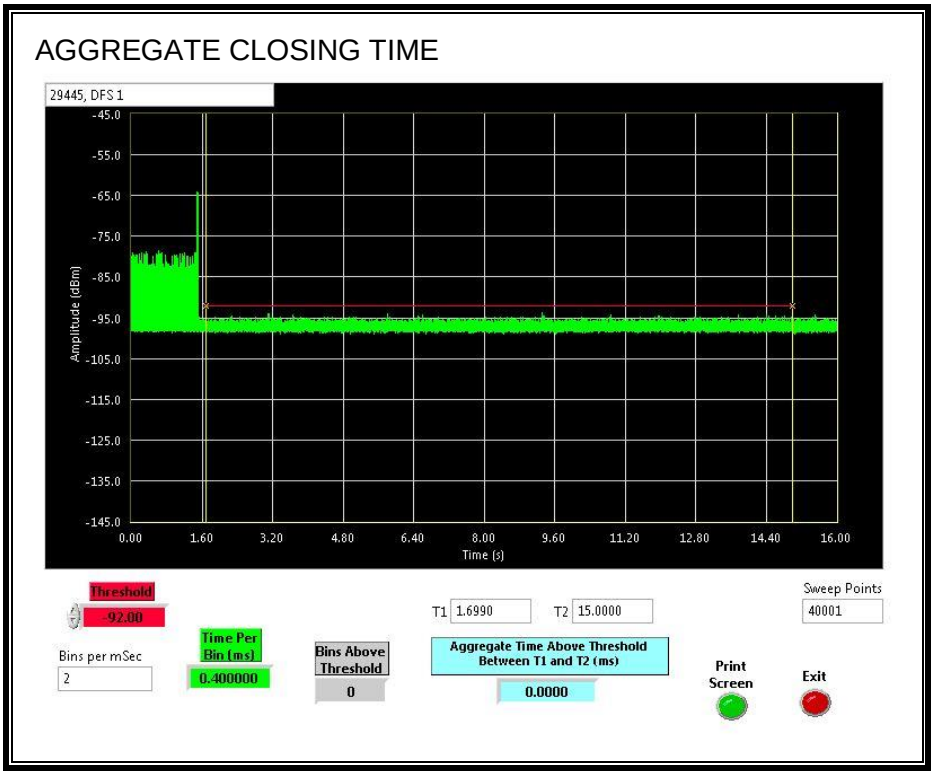
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

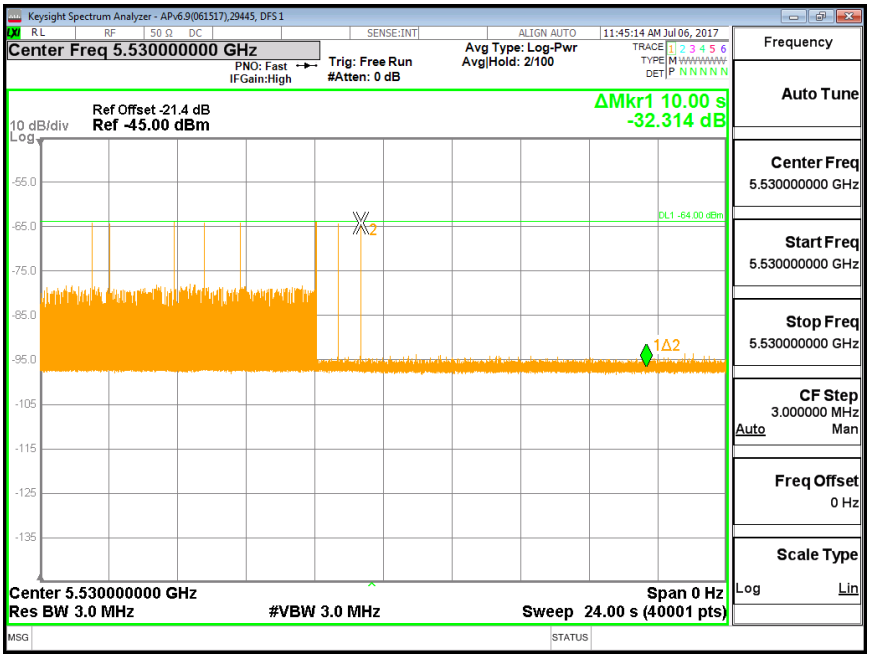
No transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR

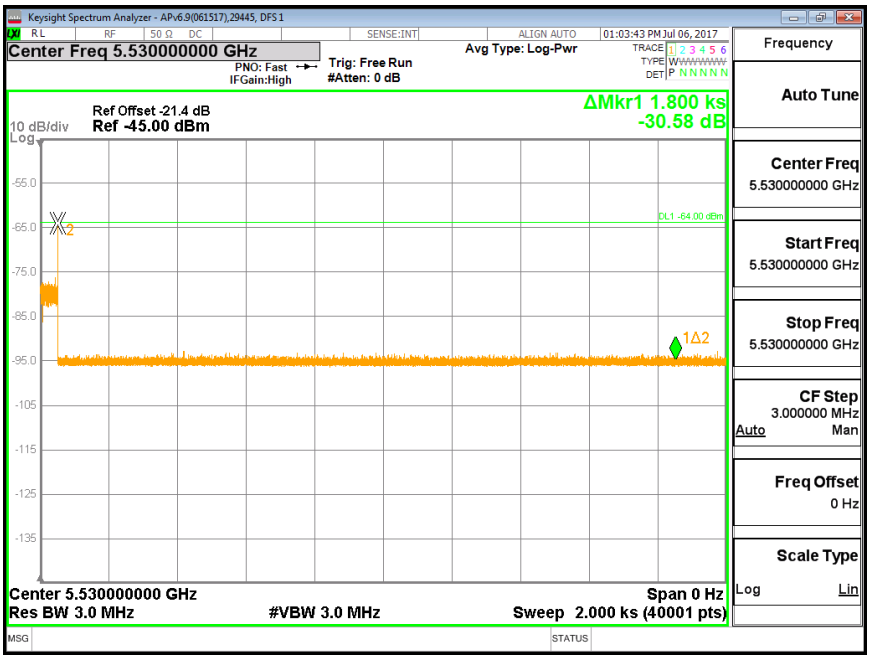


5.4.1. NON-OCCUPANCY PERIOD

RESULTS

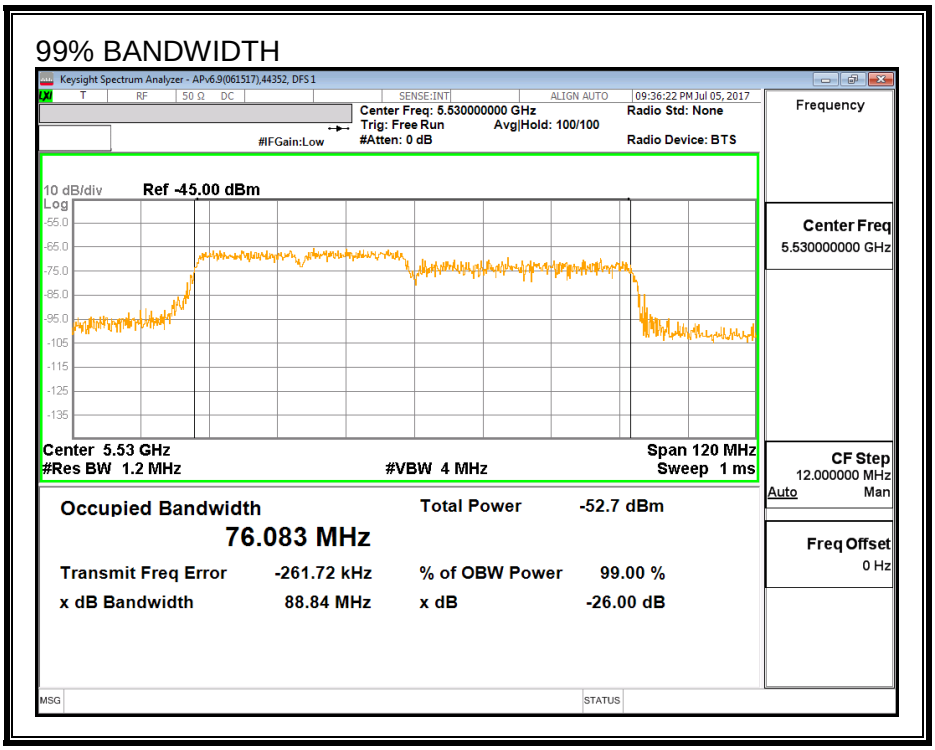
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



5.4.2. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5570	80	76.083	105.1	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		44352	DFS 1	
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	0	0	
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	
5535	10	10	100	
5540	10	10	100	
5545	10	10	100	
5550	10	10	100	
5555	10	10	100	
5560	10	10	100	
5565	10	10	100	
5570	10	10	100	FH
5571	10	0	0	

5.4.3. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5570	76.08	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5570	76.08	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5570	76.08	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5570	76.08	DFS 1	44352	Version 3.0
Aggregate		95.00	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	76.08	DFS 1	44352	Version 3.0
FCC Hopping Type 6	81	100.00	70	Pass	5490	5570		DFS 1	44352	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5543	Yes
1002	1	538	99	A	5519	Yes
1003	1	838	63	A	5533	Yes
1004	1	798	67	A	5545	Yes
1005	1	678	78	A	5520	Yes
1006	1	638	83	A	5499	Yes
1007	1	778	68	A	5544	Yes
1008	1	578	92	A	5517	Yes
1009	1	738	72	A	5559	Yes
1010	1	658	81	A	5523	Yes
1011	1	918	58	A	5519	Yes
1012	1	858	62	A	5503	Yes
1013	1	558	95	A	5512	Yes
1014	1	818	65	A	5567	Yes
1015	1	938	57	A	5509	Yes
1016	1	2794	19	B	5568	Yes
1017	1	1073	50	B	5561	Yes
1018	1	1029	52	B	5522	Yes
1019	1	790	67	B	5497	Yes
1020	1	876	61	B	5563	Yes
1021	1	767	69	B	5518	Yes
1022	1	2335	23	B	5500	Yes
1023	1	2356	23	B	5555	Yes
1024	1	2859	19	B	5557	Yes
1025	1	1814	30	B	5543	Yes
1026	1	1093	49	B	5543	Yes
1027	1	2726	20	B	5544	Yes
1028	1	940	57	B	5494	Yes
1029	1	1508	35	B	5514	Yes
1030	1	2400	22	B	5502	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.8	180	27	5528	Yes
2002	3.7	197	24	5538	Yes
2003	1.4	165	28	5555	Yes
2004	2.6	230	24	5494	Yes
2005	4.6	164	29	5564	Yes
2006	4	152	25	5518	Yes
2007	2.1	171	27	5505	Yes
2008	1.8	163	28	5526	Yes
2009	4.2	229	23	5568	No
2010	2.1	225	24	5554	Yes
2011	2.8	215	23	5552	No
2012	1	176	25	5510	Yes
2013	1.9	170	24	5562	Yes
2014	4.3	179	23	5555	Yes
2015	3.5	177	29	5548	Yes
2016	2.1	190	28	5569	Yes
2017	1.5	154	25	5514	Yes
2018	4.6	172	28	5525	Yes
2019	4.2	183	25	5504	Yes
2020	1.3	204	29	5536	Yes
2021	3.3	219	26	5500	Yes
2022	2.7	207	23	5511	Yes
2023	4.9	226	28	5501	Yes
2024	4.6	218	26	5521	Yes
2025	2.9	203	28	5518	Yes
2026	4.9	199	29	5561	Yes
2027	1.5	189	28	5491	Yes
2028	3.8	151	29	5528	Yes
2029	4.7	226	29	5491	Yes
2030	3	154	28	5561	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	7.2	256	16	5535	Yes
3002	8	297	16	5560	Yes
3003	9.3	436	16	5537	Yes
3004	8.3	490	17	5568	Yes
3005	7.9	273	16	5498	Yes
3006	9.1	339	17	5535	Yes
3007	7	387	16	5564	Yes
3008	6.4	348	16	5512	Yes
3009	8.6	408	17	5515	Yes
3010	8.3	382	16	5529	Yes
3011	6.6	337	18	5562	Yes
3012	8.6	324	17	5521	Yes
3013	9.3	292	17	5542	Yes
3014	7.5	425	18	5518	Yes
3015	8.4	288	16	5545	Yes
3016	6.8	434	17	5520	Yes
3017	10	310	18	5541	Yes
3018	6.7	468	18	5526	Yes
3019	6.1	357	16	5546	Yes
3020	7	410	16	5496	Yes
3021	6.6	445	18	5553	Yes
3022	10	260	16	5518	Yes
3023	9.8	307	17	5503	Yes
3024	9.2	269	16	5504	Yes
3025	7.3	329	16	5564	Yes
3026	7	303	18	5559	Yes
3027	7.5	258	17	5550	Yes
3028	7.3	496	16	5548	Yes
3029	8	464	16	5565	Yes
3030	6.2	346	18	5513	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
4001	13.4	460	15	5551	Yes
4002	14.7	355	12	5568	Yes
4003	17.1	481	14	5553	Yes
4004	18.8	389	14	5528	Yes
4005	17.4	277	16	5560	Yes
4006	19.6	464	16	5507	Yes
4007	18.6	365	14	5508	Yes
4008	17	432	16	5508	Yes
4009	16.5	479	12	5510	Yes
4010	15.4	440	15	5563	Yes
4011	11.1	500	16	5556	Yes
4012	19.5	474	14	5519	No
4013	11.4	430	13	5542	No
4014	11.2	299	14	5523	Yes
4015	12.7	267	16	5497	Yes
4016	17.7	266	14	5563	Yes
4017	19.7	380	14	5534	No
4018	11.8	275	15	5550	Yes
4019	14.2	402	13	5565	Yes
4020	15.9	309	12	5539	Yes
4021	14.5	331	15	5558	Yes
4022	16.7	385	14	5558	Yes
4023	15.8	286	12	5492	Yes
4024	14.1	486	15	5570	Yes
4025	13.7	399	16	5518	No
4026	12.5	361	13	5536	Yes
4027	17.3	421	14	5495	Yes
4028	12.4	277	12	5534	Yes
4029	17.6	350	16	5533	Yes
4030	13.1	470	12	5510	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5530	Yes
2	5530	Yes
3	5530	Yes
4	5530	Yes
5	5530	Yes
6	5530	Yes
7	5530	Yes
8	5530	Yes
9	5530	Yes
10	5530	Yes
11	5495	Yes
12	5495	Yes
13	5497	Yes
14	5497	Yes
15	5499	Yes
16	5497	Yes
17	5497	Yes
18	5498	Yes
19	5499	Yes
20	5499	Yes
21	5560	Yes
22	5560	Yes
23	5562	Yes
24	5566	Yes
25	5564	Yes
26	5560	Yes
27	5565	Yes
28	5566	Yes
29	5562	Yes
30	5560	Yes

Note: The Type 5 randomized parameters tested are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop
NTIA August 2005 Hopping Sequence

Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	44	5490	16	Yes
2	519	5491	19	Yes
3	994	5492	18	Yes
4	1469	5493	18	Yes
5	1944	5494	25	Yes
6	2419	5495	19	Yes
7	2894	5496	18	Yes
8	3369	5497	21	Yes
9	3844	5498	21	Yes
10	4319	5499	16	Yes
11	4794	5500	14	Yes
12	5269	5501	16	Yes
13	5744	5502	18	Yes
14	6219	5503	23	Yes
15	6694	5504	14	Yes
16	7169	5505	19	Yes
17	7644	5506	18	Yes
18	8119	5507	17	Yes
19	8594	5508	11	Yes
20	9069	5509	17	Yes
21	9544	5510	20	Yes
22	10019	5511	20	Yes
23	10494	5512	13	Yes
24	10969	5513	18	Yes
25	11444	5514	18	Yes
26	11919	5515	16	Yes
27	12394	5516	13	Yes
28	12869	5517	15	Yes
29	13344	5518	26	Yes
30	13819	5519	18	Yes
31	14294	5520	15	Yes
32	14769	5521	14	Yes
33	15244	5522	21	Yes
34	15719	5523	18	Yes
35	16194	5524	14	Yes
36	16669	5525	14	Yes
37	17144	5526	18	Yes
38	17619	5527	18	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

39	18094	5528	15	Yes
40	18569	5529	19	Yes
41	19044	5530	12	Yes
42	19519	5531	18	Yes
43	19994	5532	12	Yes
44	20469	5533	22	Yes
45	20944	5534	20	Yes
46	21419	5535	16	Yes
47	21894	5536	21	Yes
48	22369	5537	11	Yes
49	22844	5538	17	Yes
50	23319	5539	19	Yes
51	23794	5540	23	Yes
52	24269	5541	25	Yes
53	24744	5542	19	Yes
54	25219	5543	14	Yes
55	25694	5544	14	Yes
56	26169	5545	18	Yes
57	26644	5546	17	Yes
58	27119	5547	21	Yes
59	27594	5548	16	Yes
60	28069	5549	15	Yes
61	28544	5550	14	Yes
62	29019	5551	14	Yes
63	29494	5552	19	Yes
64	29969	5553	18	Yes
65	30444	5554	15	Yes
66	30919	5555	14	Yes
67	31394	5556	22	Yes
68	31869	5557	16	Yes
69	32344	5558	15	Yes
70	32819	5559	14	Yes
71	33294	5560	18	Yes
72	33769	5561	22	Yes
73	34244	5562	18	Yes
74	34719	5563	11	Yes
75	35194	5564	16	Yes
76	35669	5565	12	Yes
77	36144	5566	15	Yes
78	36619	5567	16	Yes
79	37094	5568	18	Yes
80	37569	5569	17	Yes
81	38044	5570	18	Yes

5.5. BRIDGE MODE RESULTS

Per KDB 905462, Section 5.1 (footnote 1):

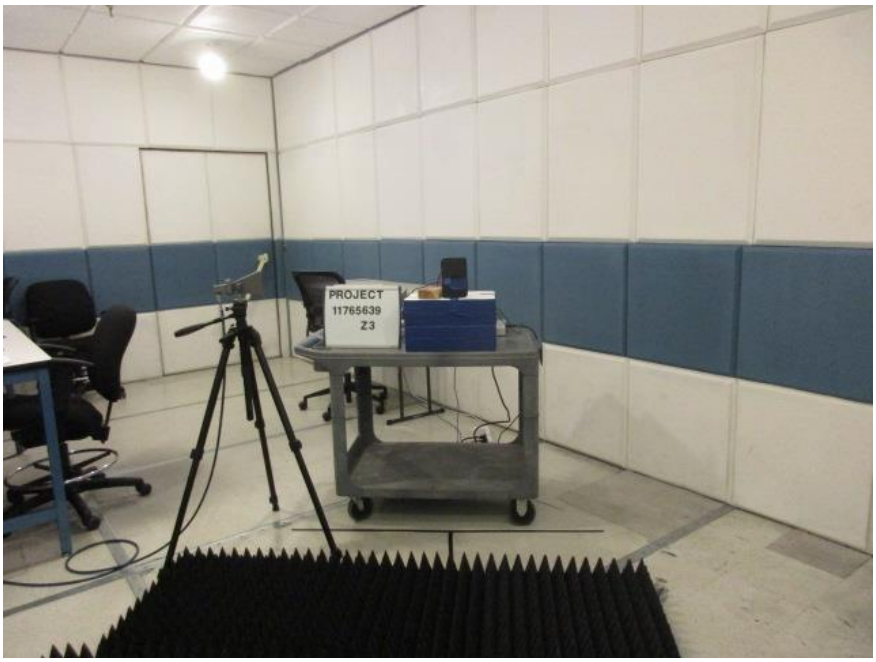
Networks Access Points with Bridge and/or MESH modes of operation are permitted to operate in the DFS bands but must employ a DFS function. The functionality of the Bridge mode as specified in §15.403(a) must be validated in the DFS test report. Devices operating as relays must also employ DFS function. The method used to validate the functionality must be documented and validation data must be documented. Bridge mode can be validated by performing a test statistical performance check (Section 7.8.4) on any one of the radar types. This is an abbreviated test to verify DFS functionality. MESH mode operational methodology must be submitted in the application for certification for evaluation by the FCC.

This device does not support Bridge Mode therefore this test was not performed.

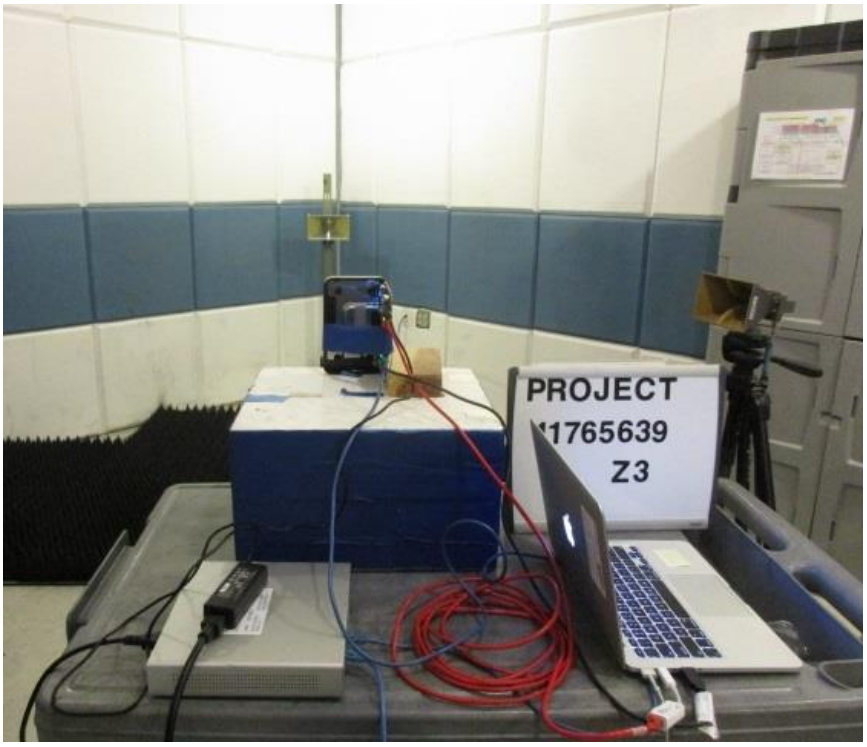
6. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS FRONT PHOTO



DFS BACK PHOTO



END OF REPORT