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

CERTIFICATION TEST REPORT

FOR

AP OUTDOOR

MODEL NUMBER: MR74-HW

FCC ID: UDX-60057010
IC: 6961A-60057010

REPORT NUMBER: 11466708-E3V1

ISSUE DATE: DECEMBER 12, 2016

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

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/12/16	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: AP OUTDOOR

MODEL: MR74-HW

SERIAL NUMBER: Q2QD-VNQE-7D9Z

DATE TESTED: NOVEMBER 16, 17, & 22, 2016

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, ANSI C63.10-2013, 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

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

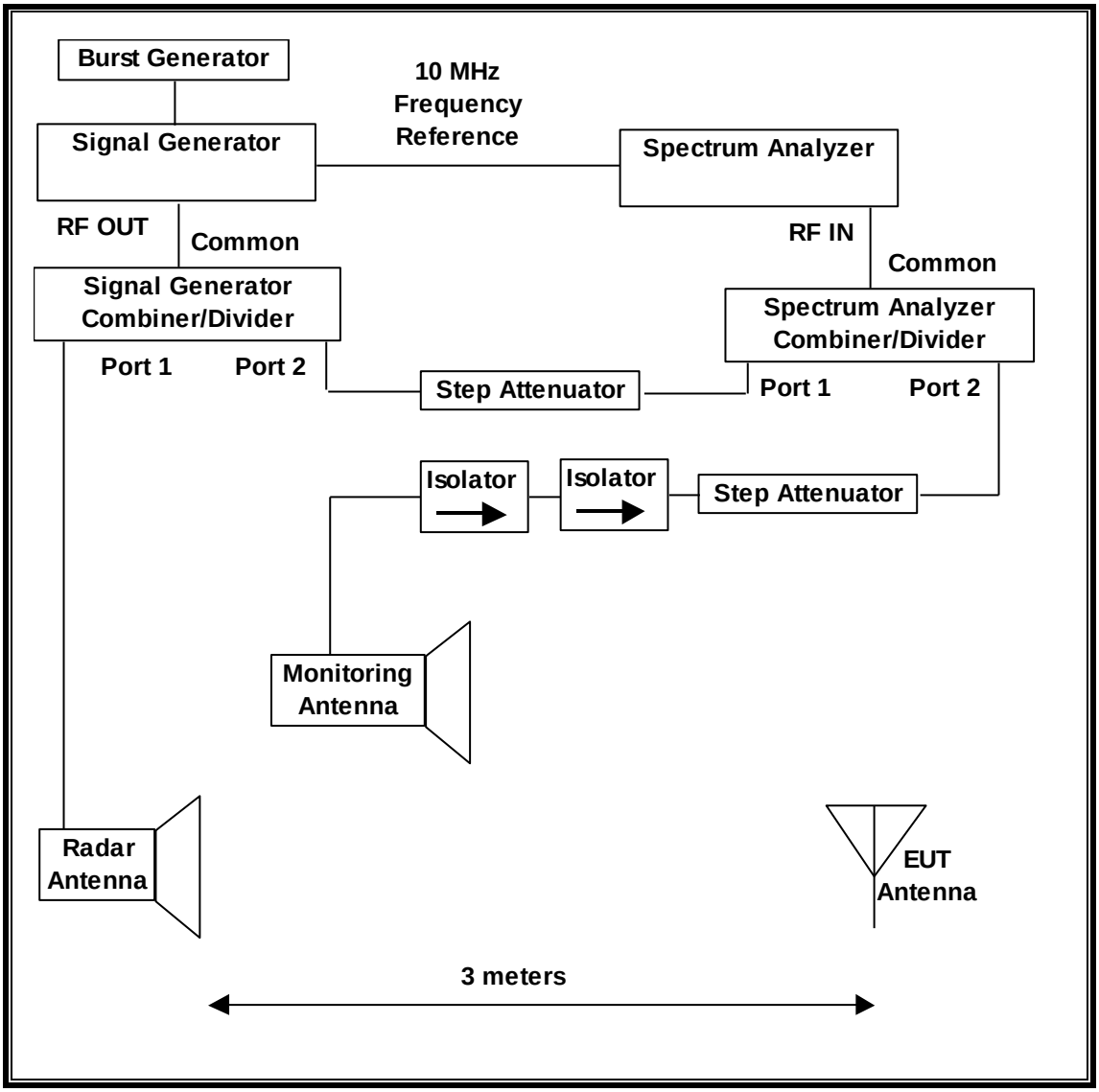
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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. The video test file is streamed 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	US51350187	06/13/17
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	MY51350337	03/11/17
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/11/17

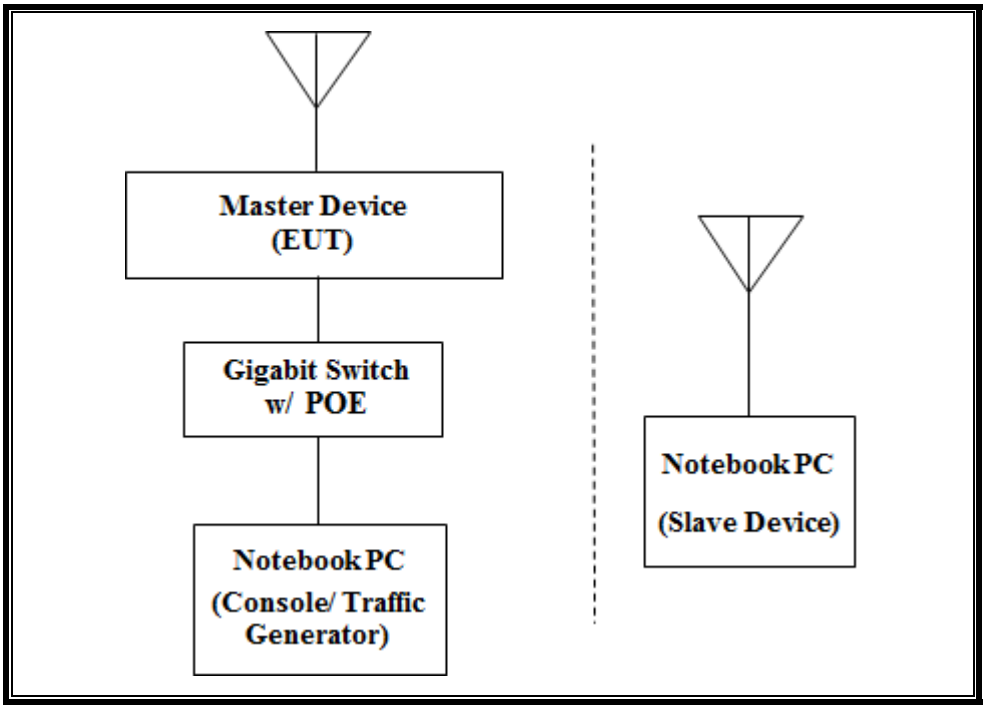
5.1.3. TEST AND MEASUREMENT SOFTWARE

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 2014 Detection	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. 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 with POE	Meraki	MS220-8P	Q2HP-DR3G-TQZS	DoC

5.1.5. DESCRIPTION OF EUT

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

For IC 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.

For FCC, the highest power level within these bands is 29.63 dBm EIRP in the 5250-5350 MHz band and 29.82 dBm EIRP in the 5470-5725 MHz band.

For IC, the highest power level within these bands is 22.94 dBm EIRP in the 5250-5350 MHz band and 29.82 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 13 dBi. The lowest gain antenna assembly utilized with the EUT has a gain of 4.1 dBi.

Two identical 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 and one receive only chain, 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_insect_version T-201610271804-Gf01d5fb0-Lfc56584bM-dhruvin.

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-60057010. The minimum antenna gain for the Master Device is 4.1 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

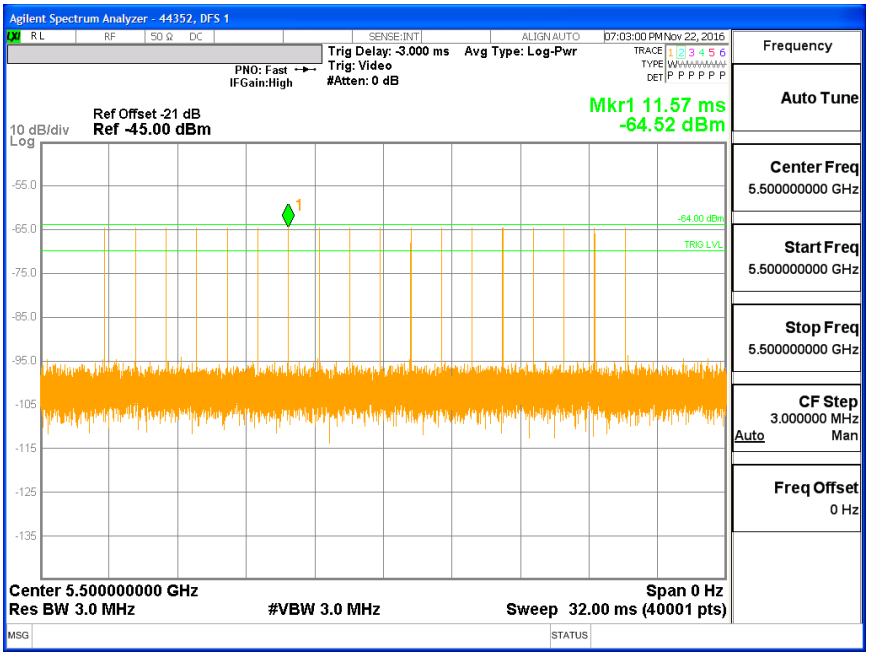
5.2.1. TEST CHANNEL

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

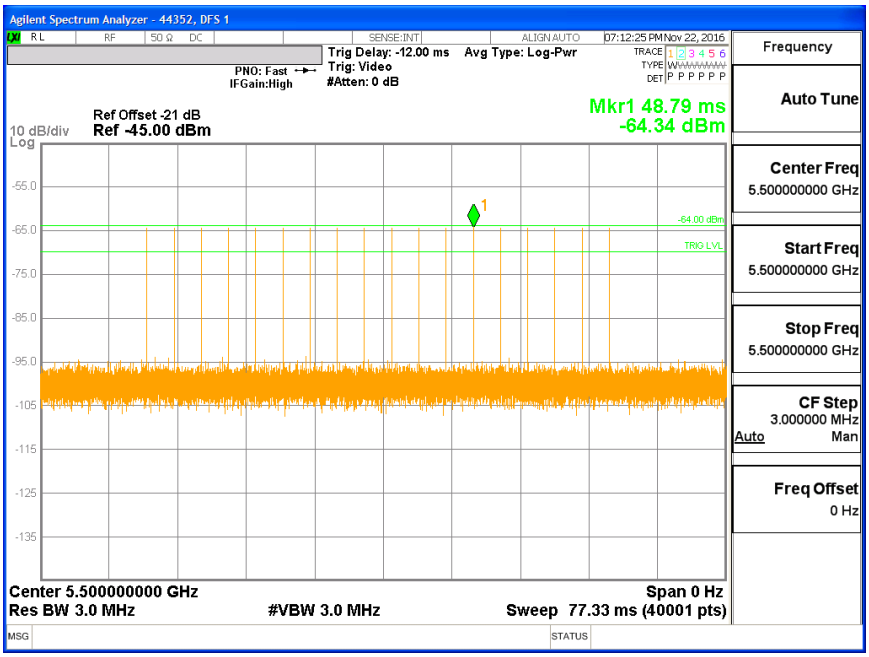
5.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

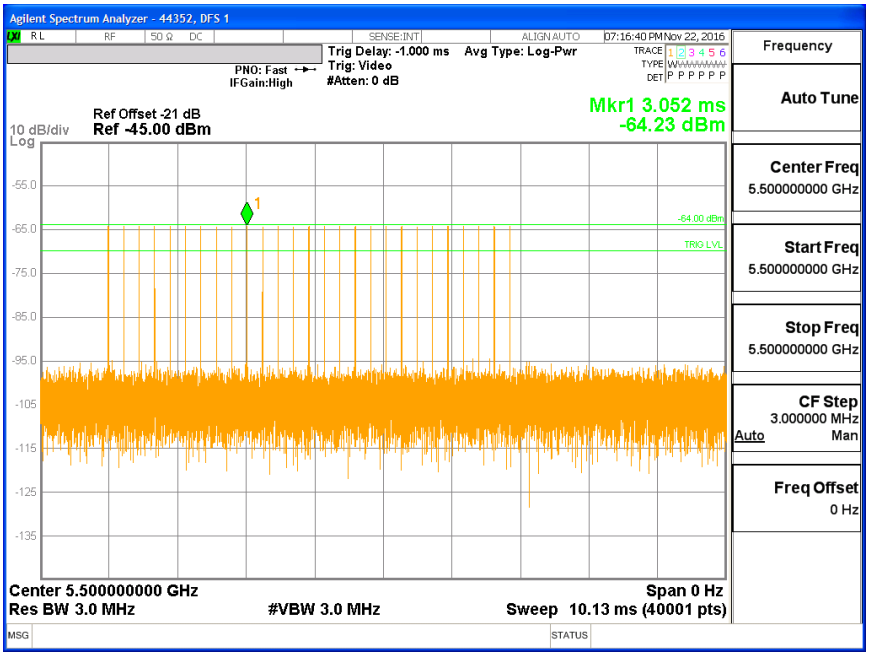
SHORT PULSE RADAR TYPE 0



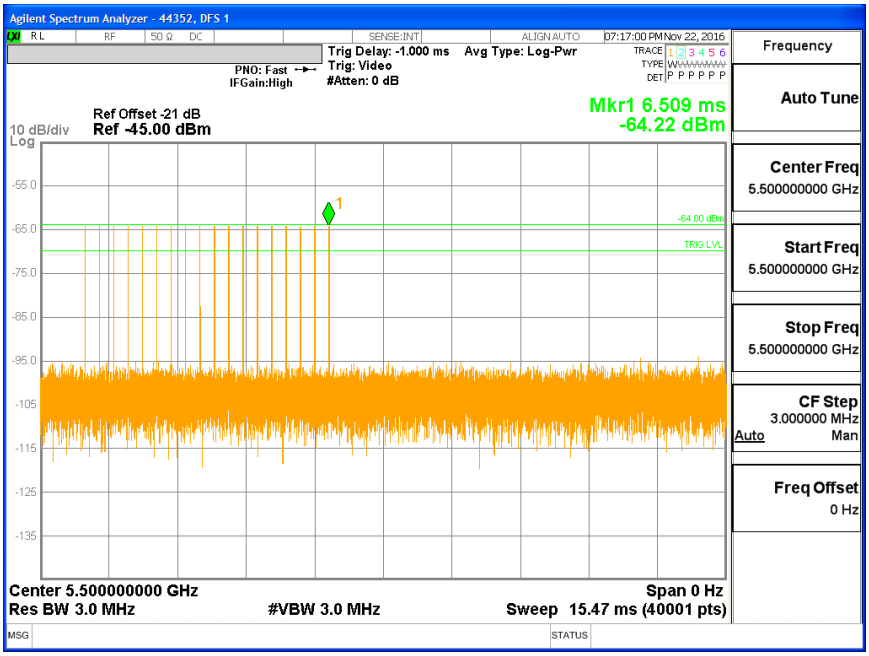
SAMPLE OF RADAR TYPE 1



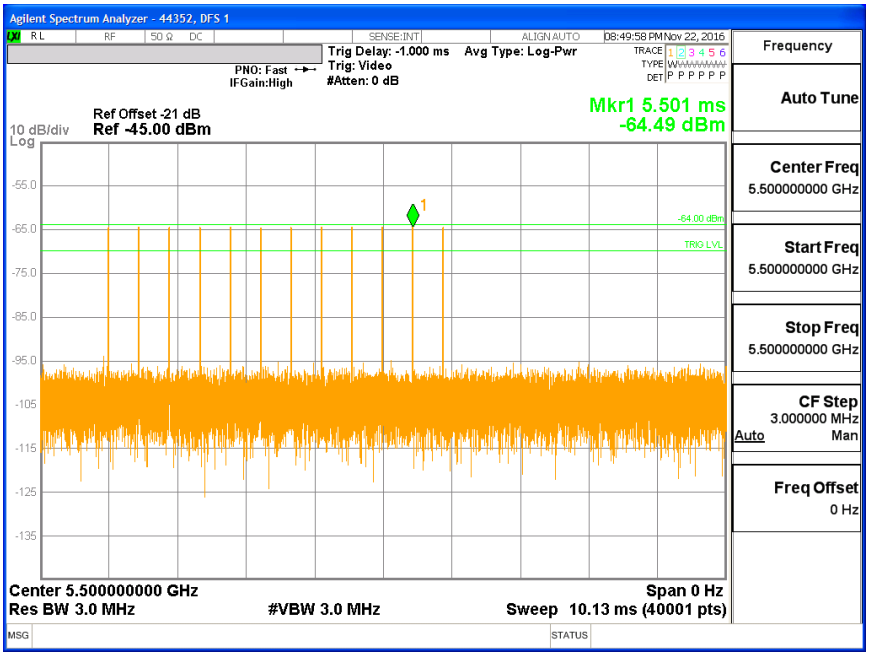
SAMPLE OF RADAR TYPE 2



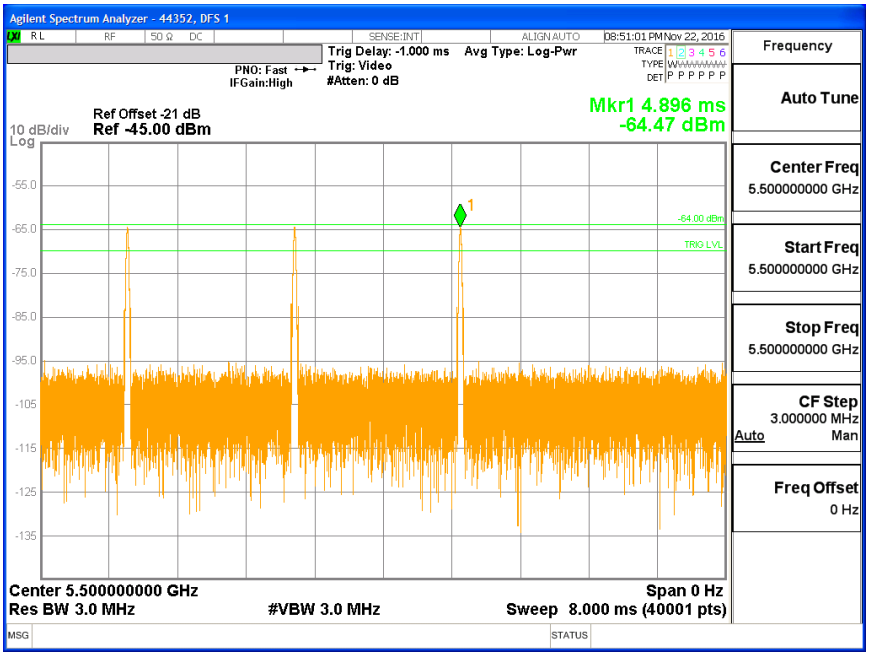
SAMPLE OF RADAR TYPE 3



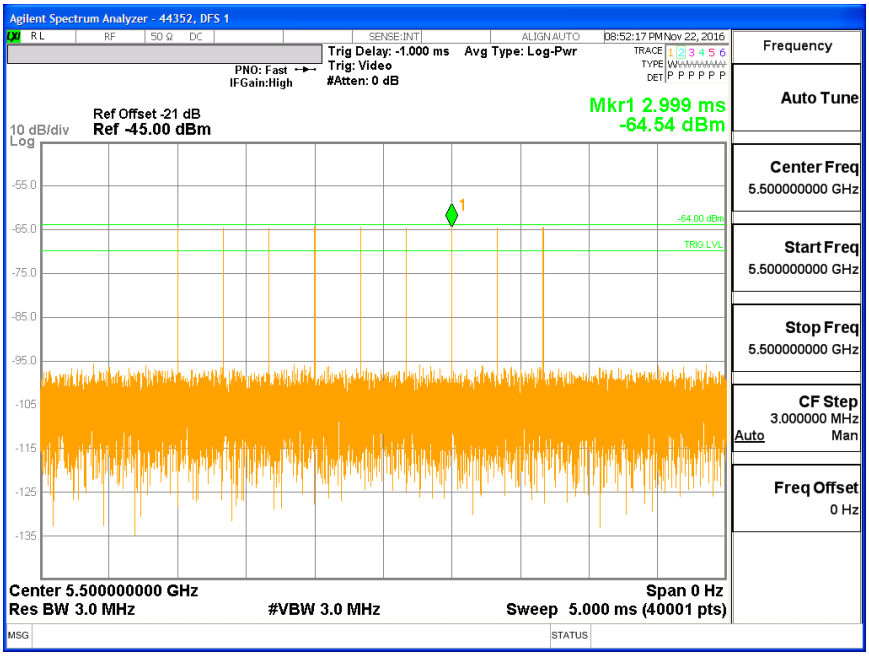
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

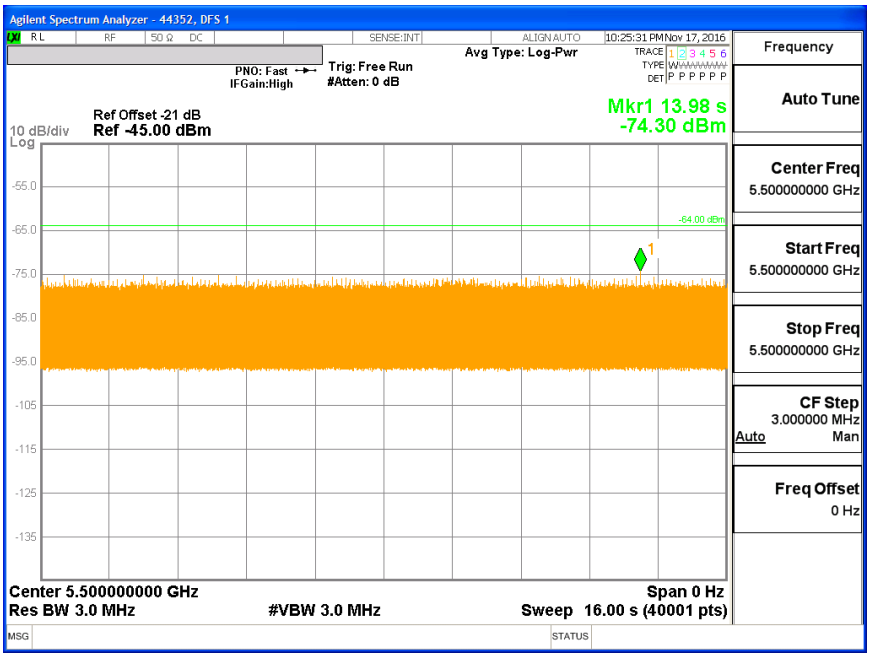


SINGLE BURST OF RADAR TYPE 6

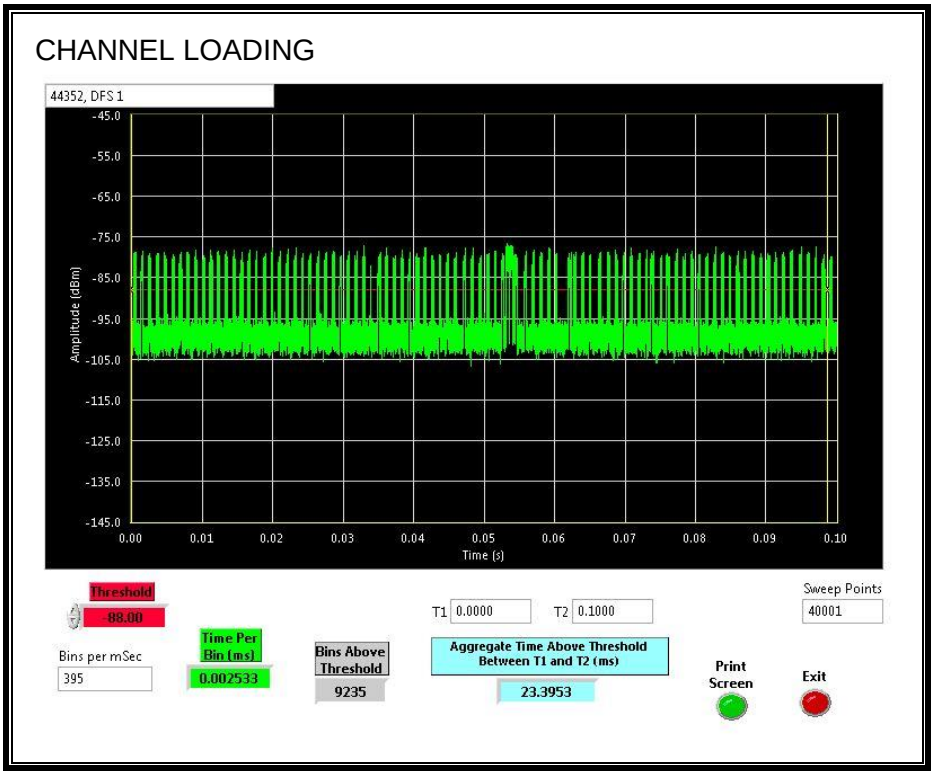


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 23.3953%

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)
29.96	205.2	175.2	115.2

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)
29.81	146.4	116.6	1.4

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)
30.34	204.0	173.7	58.4

QUALITATIVE RESULTS

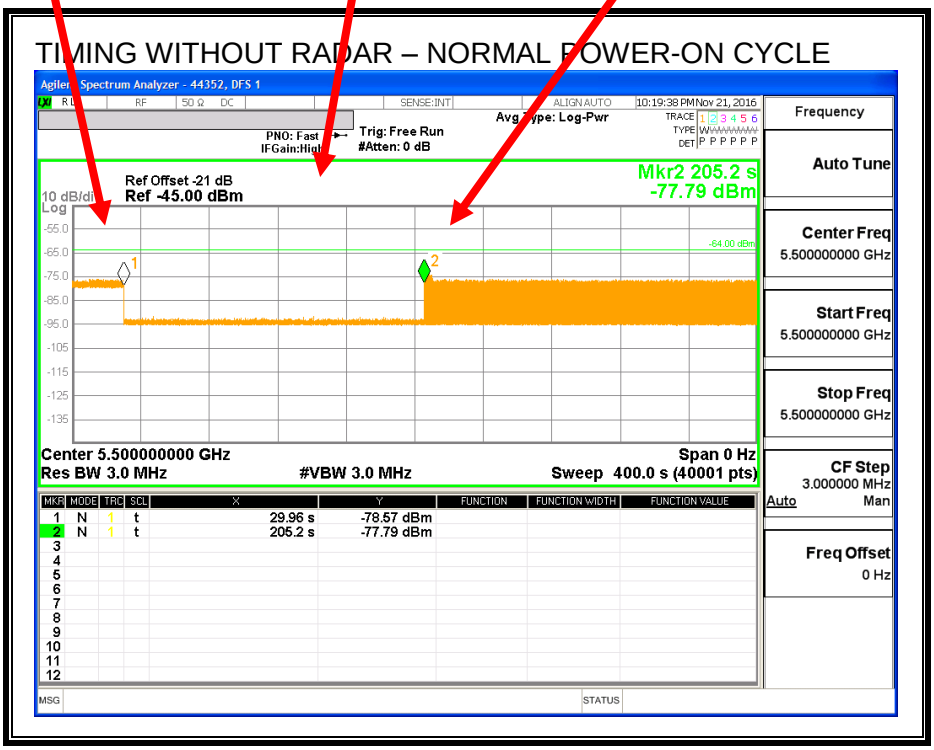
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



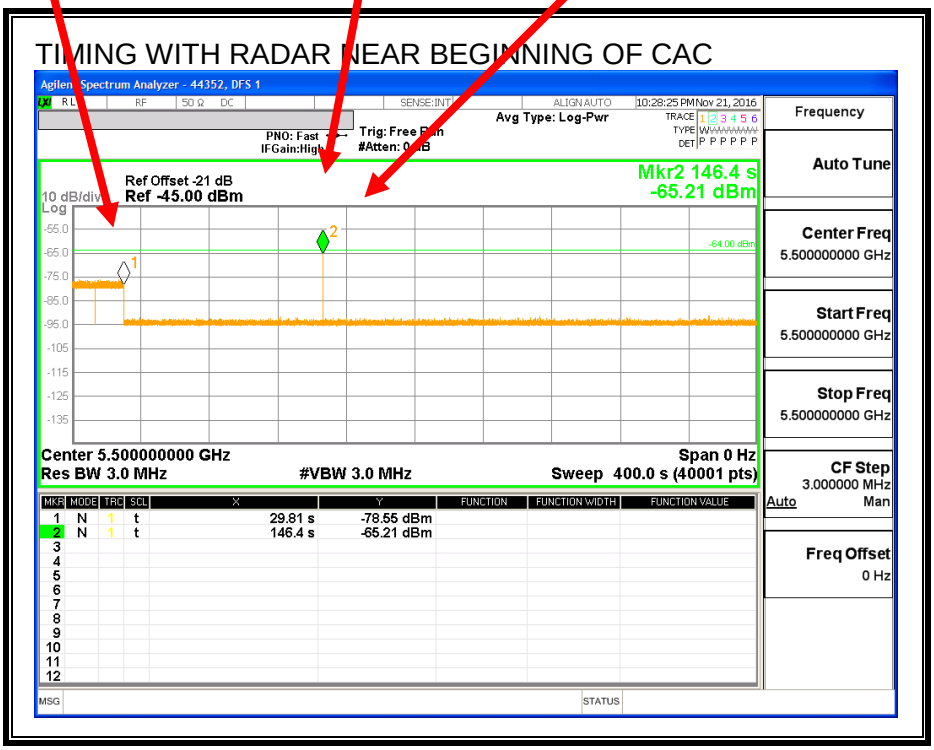
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



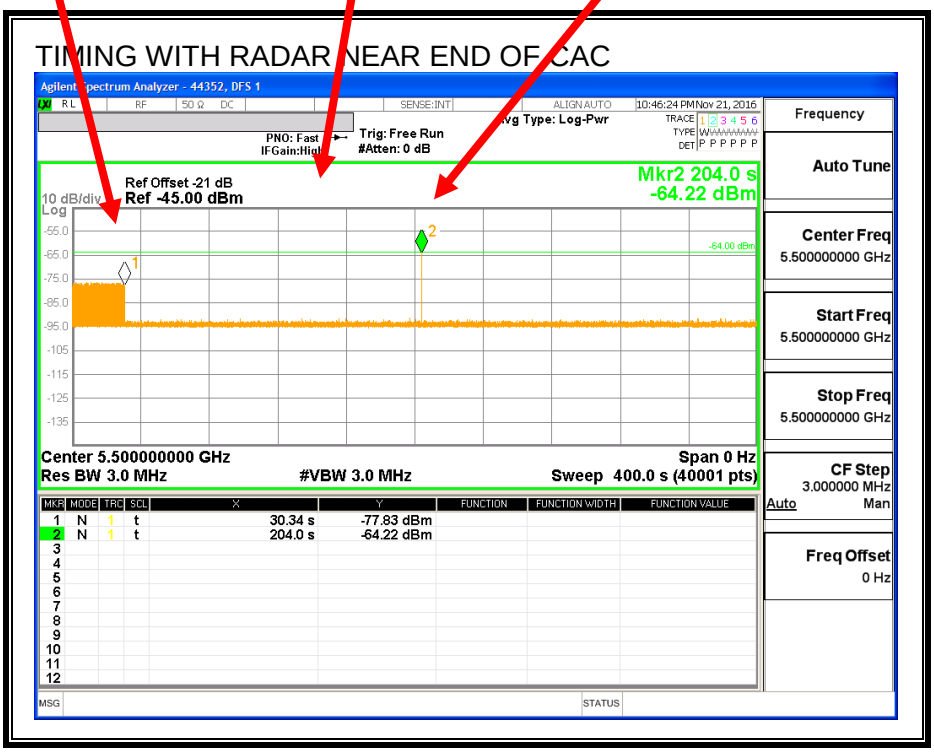
No EUT transmissions were observed after the radar signal.

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.

5.2.4. 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)

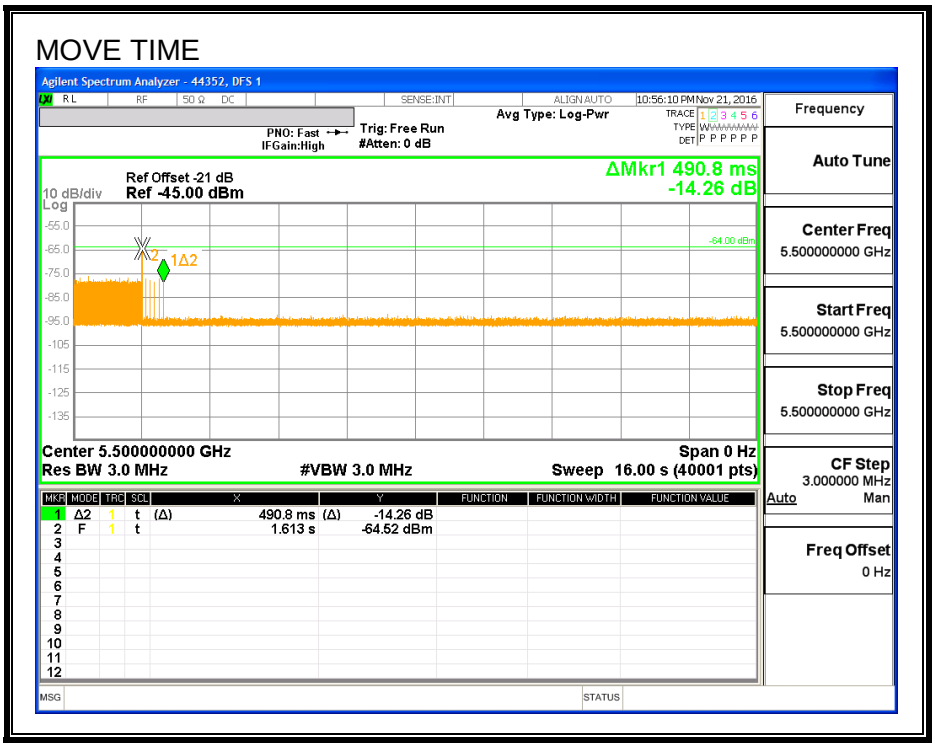
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.491	10

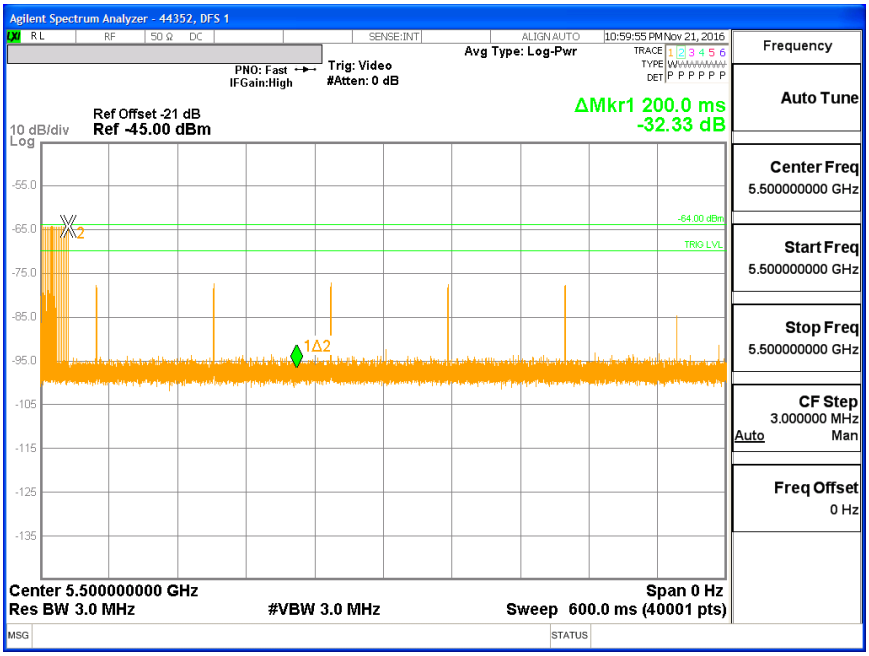
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
4.8	60

MOVE TIME



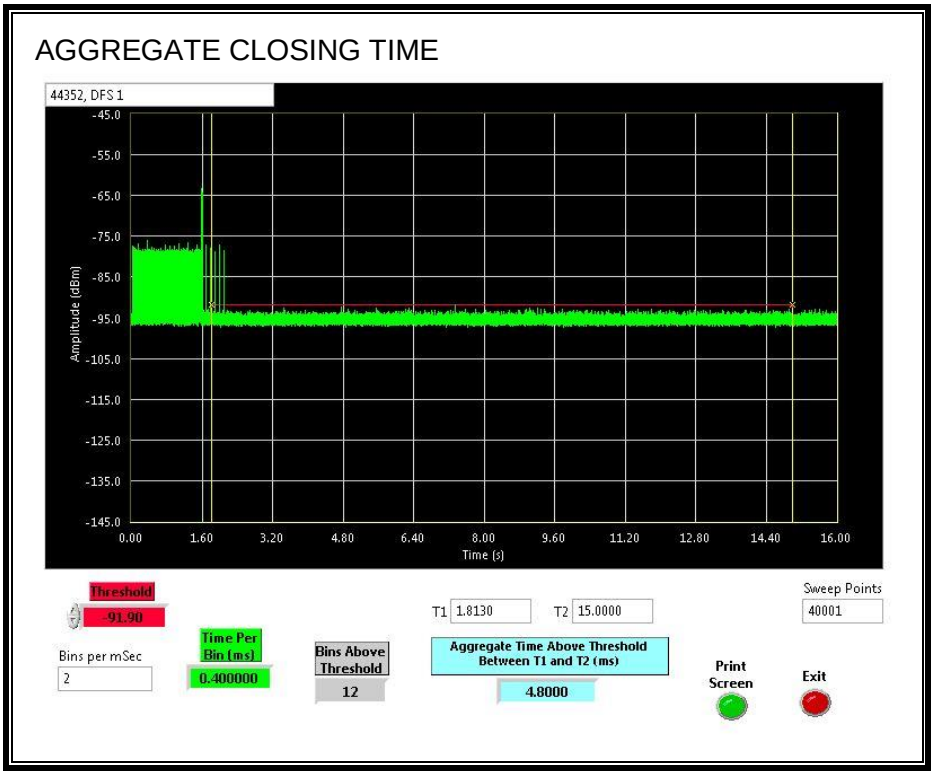
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

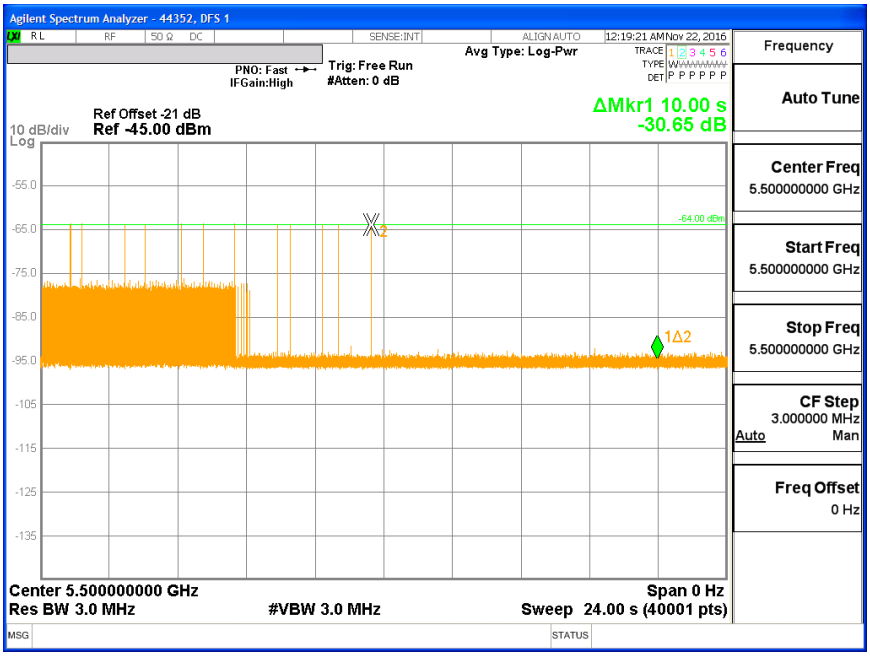
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

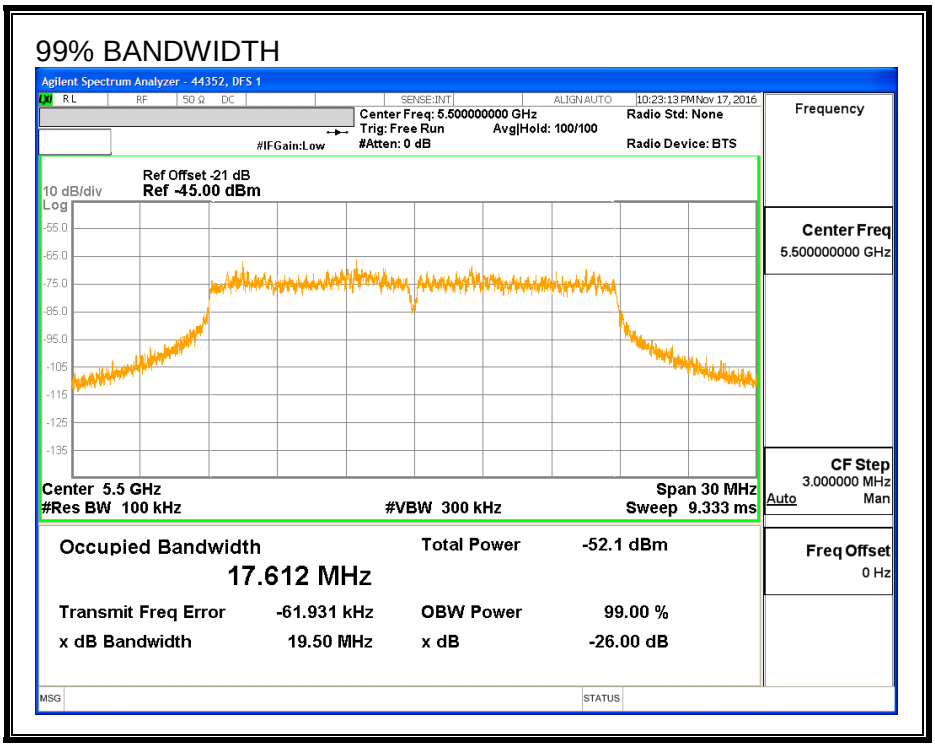
The traffic ceases prior to 10 seconds after the end of the radar waveform.

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	17.612	113.6	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	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	80% of Det BW FL5	80% of Det BW FH5	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5510			17.61	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	90.00	60	Pass	5490	5510			17.61	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5510			17.61	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5510			17.61	DFS 1	44352	Version 3.0
Aggregate		90.00	80	Pass								
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	5492	5508	17.61	DFS 1	44352	Version 3.0
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510				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	5500	Yes
1002	1	618	86	A	5500	Yes
1003	1	738	72	A	5500	Yes
1004	1	578	92	A	5500	Yes
1005	1	718	74	A	5500	Yes
1006	1	518	102	A	5500	Yes
1007	1	638	83	A	5500	Yes
1008	1	818	65	A	5500	Yes
1009	1	758	70	A	5500	Yes
1010	1	918	58	A	5500	Yes
1011	1	698	76	A	5500	Yes
1012	1	538	99	A	5500	Yes
1013	1	598	89	A	5500	Yes
1014	1	838	63	A	5500	Yes
1015	1	658	81	A	5500	Yes
1016	1	1242	43	B	5500	Yes
1017	1	2068	26	B	5500	Yes
1018	1	2024	27	B	5500	Yes
1019	1	1786	30	B	5500	Yes
1020	1	1871	29	B	5500	Yes
1021	1	1762	30	B	5500	Yes
1022	1	783	68	B	5500	Yes
1023	1	2157	25	B	5500	Yes
1024	1	1306	41	B	5500	Yes
1025	1	2810	19	B	5500	Yes
1026	1	2089	26	B	5500	Yes
1027	1	1174	45	B	5500	Yes
1028	1	1936	28	B	5500	Yes
1029	1	2504	22	B	5500	Yes
1030	1	847	63	B	5500	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	4.7	219	24	5500	Yes
2002	3.8	155	27	5500	Yes
2003	3.4	166	24	5500	Yes
2004	4.5	187	28	5500	No
2005	2.4	203	25	5500	No
2006	1.9	190	29	5500	No
2007	4.1	210	27	5500	Yes
2008	3.7	201	24	5500	Yes
2009	2	187	26	5500	Yes
2010	4.1	183	27	5500	Yes
2011	4.8	172	26	5500	Yes
2012	2.9	215	28	5500	Yes
2013	3.8	209	27	5500	Yes
2014	2.2	218	26	5500	Yes
2015	1.4	216	29	5500	Yes
2016	2.1	229	29	5500	Yes
2017	3.4	193	29	5500	Yes
2018	2.5	210	25	5500	Yes
2019	2.1	221	29	5500	Yes
2020	3.3	162	25	5500	Yes
2021	1.1	177	23	5500	Yes
2022	4.7	165	23	5500	Yes
2023	2.8	184	25	5500	Yes
2024	2.4	176	29	5500	Yes
2025	4.8	161	28	5500	Yes
2026	2.8	157	25	5500	Yes
2027	3.5	228	24	5500	Yes
2028	1.6	189	26	5500	Yes
2029	2.5	226	29	5500	Yes
2030	5	192	24	5500	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	9	258	18	5500	Yes
3002	9.9	416	17	5500	Yes
3003	9.1	305	16	5500	Yes
3004	5.2	358	18	5500	No
3005	9.8	393	17	5500	Yes
3006	8.9	459	16	5500	Yes
3007	8.6	255	16	5500	Yes
3008	8	468	18	5500	Yes
3009	5.6	277	16	5500	No
3010	5.2	251	16	5500	No
3011	8.5	339	18	5500	Yes
3012	8.3	326	17	5500	Yes
3013	9.2	294	17	5500	Yes
3014	6.9	427	16	5500	Yes
3015	8	290	16	5500	Yes
3016	8.7	436	17	5500	Yes
3017	10	312	18	5500	Yes
3018	5.9	470	18	5500	Yes
3019	5.1	359	16	5500	No
3020	6.3	295	16	5500	Yes
3021	5.8	447	18	5500	Yes
3022	10	262	16	5500	Yes
3023	9.7	309	17	5500	Yes
3024	9.1	271	16	5500	Yes
3025	6.7	331	16	5500	Yes
3026	6.3	305	18	5500	Yes
3027	6.9	260	17	5500	No
3028	6.7	380	18	5500	Yes
3029	7.6	348	16	5500	Yes
3030	5.3	348	18	5500	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	12.8	462	16	5500	Yes
4002	14.2	357	12	5500	No
4003	16.8	483	14	5500	Yes
4004	18.7	391	14	5500	Yes
4005	17.2	412	16	5500	Yes
4006	19.6	466	16	5500	Yes
4007	18.6	367	14	5500	Yes
4008	16.8	316	16	5500	Yes
4009	16.2	481	12	5500	Yes
4010	14.9	442	15	5500	Yes
4011	10.2	251	16	5500	Yes
4012	14.8	359	14	5500	Yes
4013	10.5	432	13	5500	Yes
4014	15.6	301	14	5500	Yes
4015	11.9	269	13	5500	Yes
4016	17.5	402	14	5500	Yes
4017	19.7	382	14	5500	Yes
4018	11	277	13	5500	No
4019	13.7	404	13	5500	No
4020	15.6	445	12	5500	Yes
4021	14	333	15	5500	Yes
4022	16.4	387	14	5500	Yes
4023	15.4	288	15	5500	Yes
4024	13.6	488	15	5500	Yes
4025	13	401	16	5500	Yes
4026	11.7	363	13	5500	Yes
4027	17.1	305	14	5500	Yes
4028	11.6	279	15	5500	Yes
4029	17.5	352	16	5500	Yes
4030	12.4	472	12	5500	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5500	Yes
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	5499	Yes
12	5499	Yes
13	5499	Yes
14	5499	Yes
15	5496	Yes
16	5498	Yes
17	5498	Yes
18	5494	Yes
19	5495	Yes
20	5499	Yes
21	5503	Yes
22	5500	Yes
23	5503	Yes
24	5500	Yes
25	5503	Yes
26	5500	Yes
27	5503	Yes
28	5500	Yes
29	5503	Yes
30	5500	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	110	5490	1	Yes
2	585	5491	5	Yes
3	1060	5492	4	Yes
4	1535	5493	2	Yes
5	2010	5494	4	Yes
6	2485	5495	6	Yes
7	2960	5496	6	Yes
8	3435	5497	2	Yes
9	3910	5498	2	Yes
10	4385	5499	4	Yes
11	4860	5500	7	Yes
12	5335	5501	4	Yes
13	5810	5502	3	Yes
14	6285	5503	5	Yes
15	6760	5504	5	Yes
16	7235	5505	2	Yes
17	7710	5506	5	Yes
18	8185	5507	5	Yes
19	8660	5508	2	Yes
20	9135	5509	5	Yes
21	9610	5510	7	Yes
22	10085	5490	4	Yes
23	10560	5491	4	Yes
24	11035	5492	7	Yes
25	11510	5493	5	Yes
26	11985	5494	10	Yes
27	12460	5495	4	Yes
28	12935	5496	8	Yes
29	13410	5497	9	Yes
30	13885	5498	2	Yes
31	14360	5499	4	Yes
32	14835	5500	2	Yes
33	15310	5501	3	Yes
34	15785	5502	4	Yes
35	16260	5503	5	Yes
36	17210	5504	4	Yes
37	17685	5505	4	Yes
38	18160	5506	6	Yes
39	18635	5507	4	Yes
40	19110	5508	5	Yes
41	19585	5509	2	Yes
42	20060	5510	6	Yes

5.3. RESULTS FOR 40 MHz BANDWIDTH

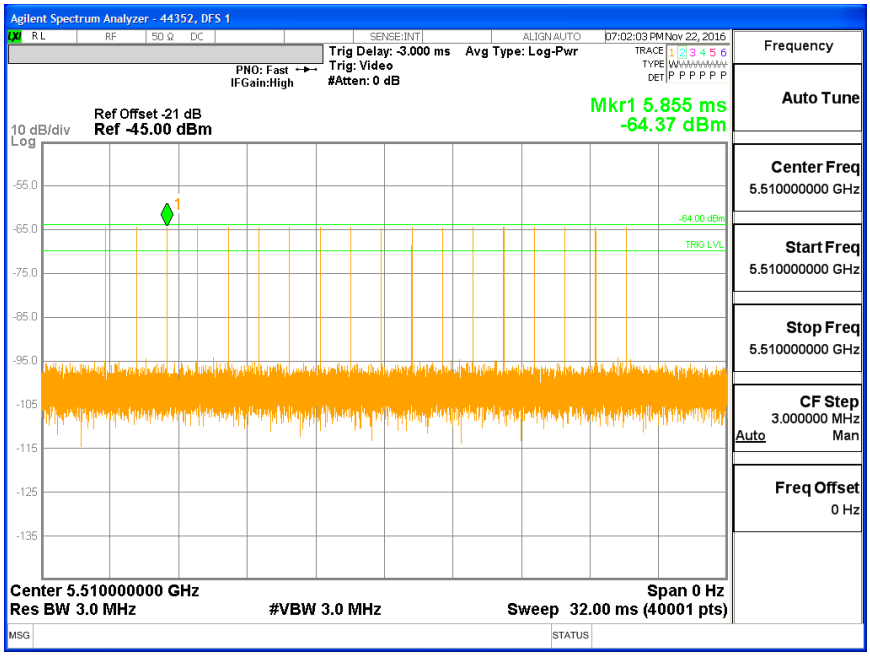
5.3.1. TEST CHANNEL

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

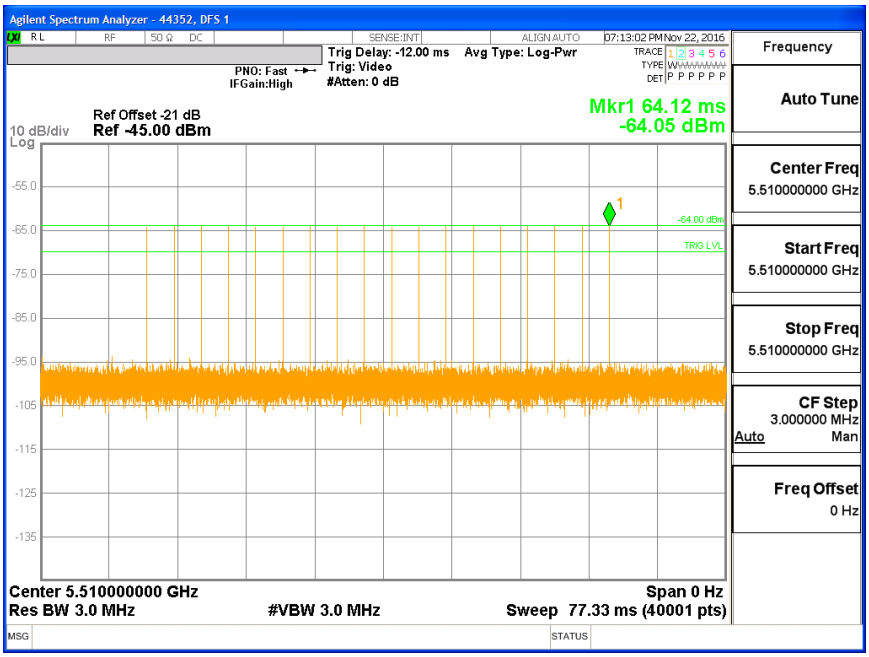
5.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

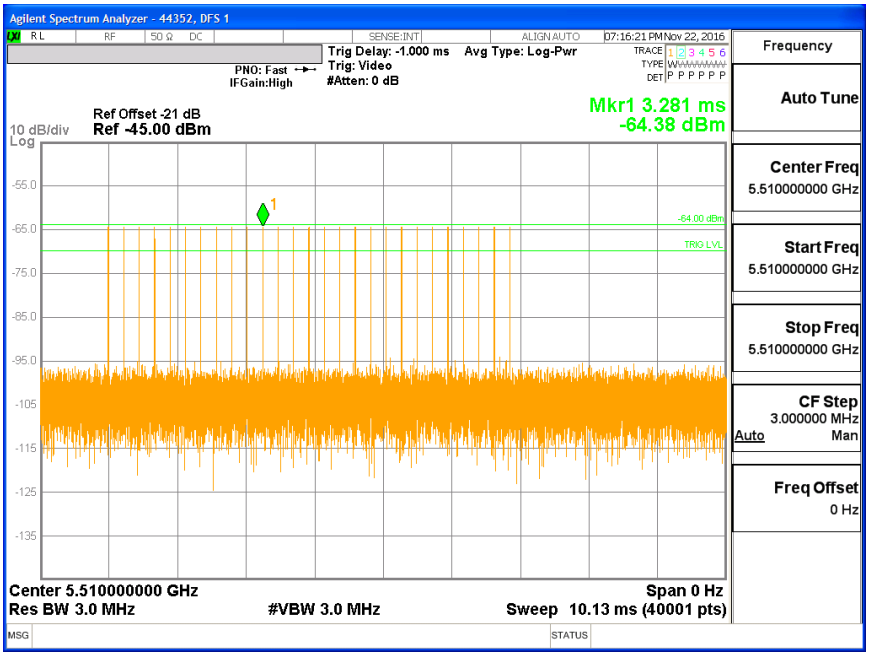
SHORT PULSE RADAR TYPE 0



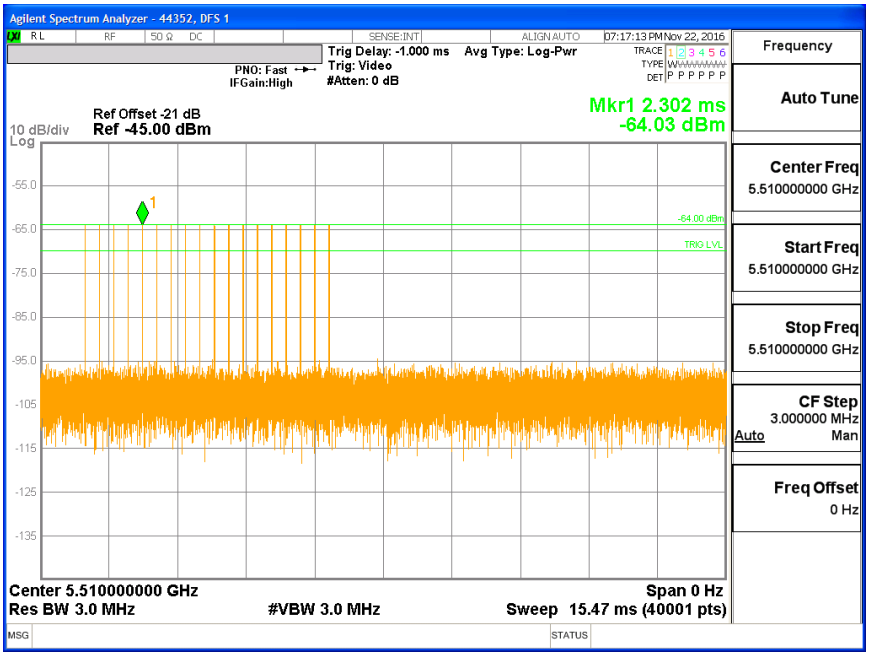
SAMPLE OF RADAR TYPE 1



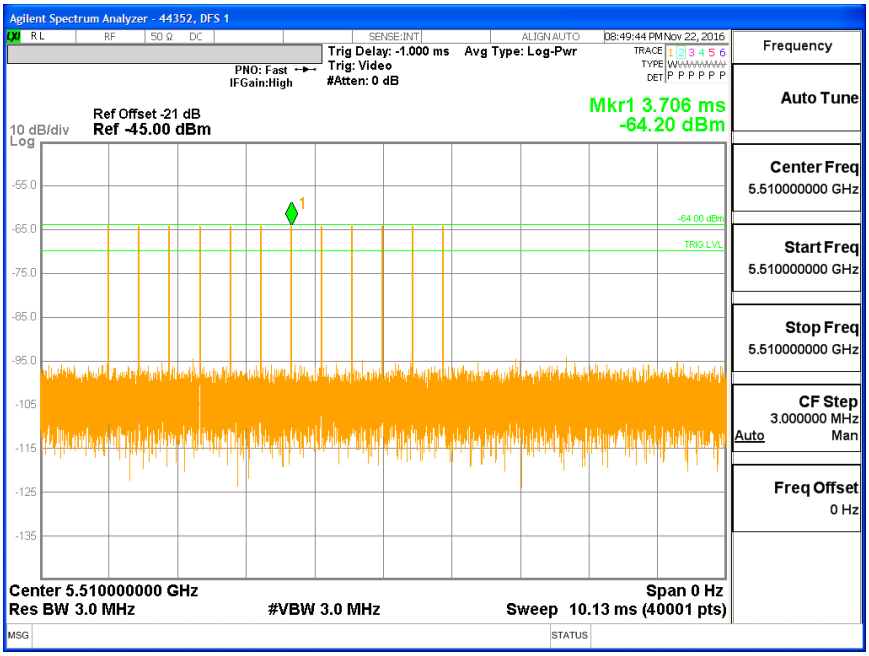
SAMPLE OF RADAR TYPE 2



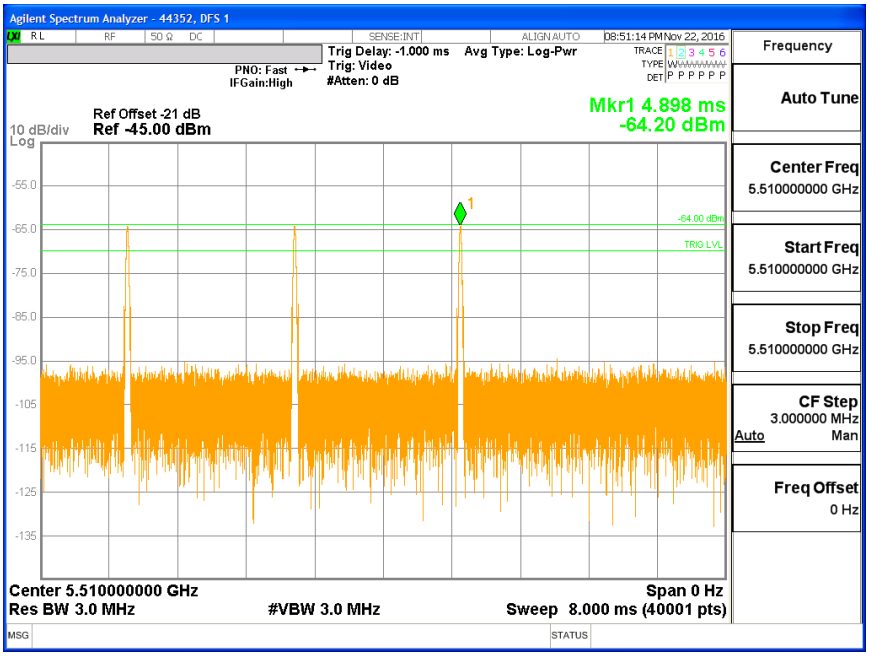
SAMPLE OF RADAR TYPE 3



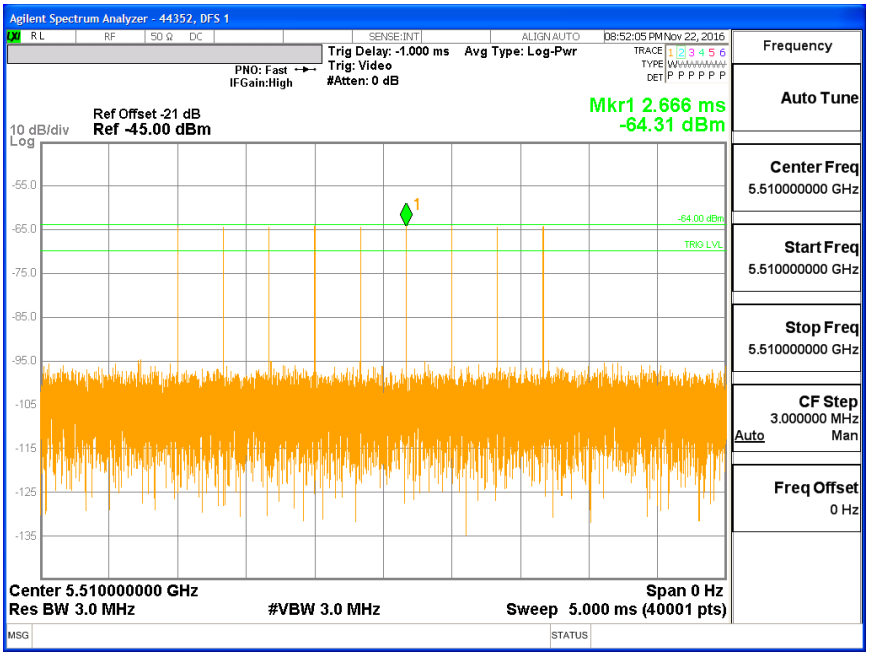
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

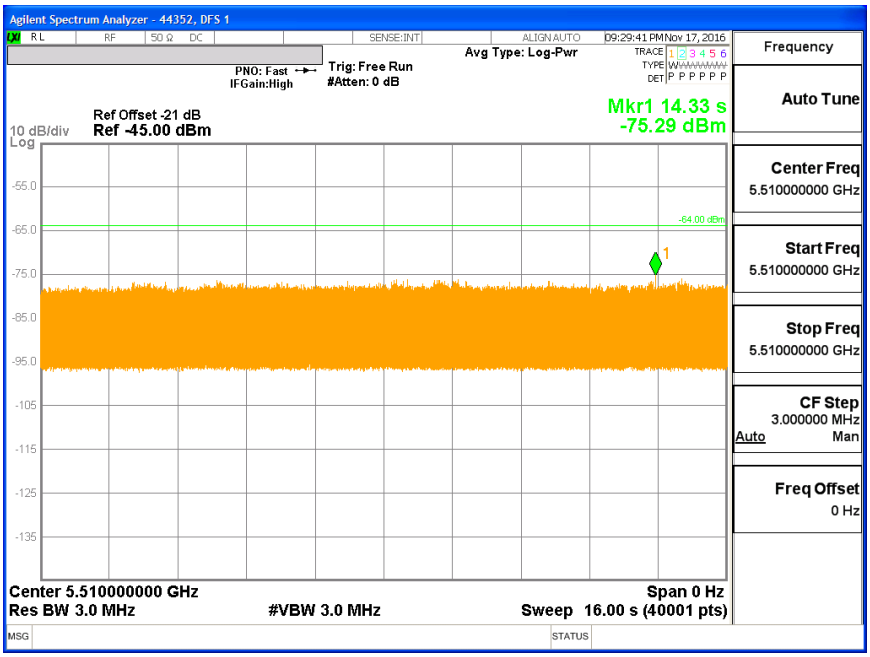


SINGLE BURST OF RADAR TYPE 6

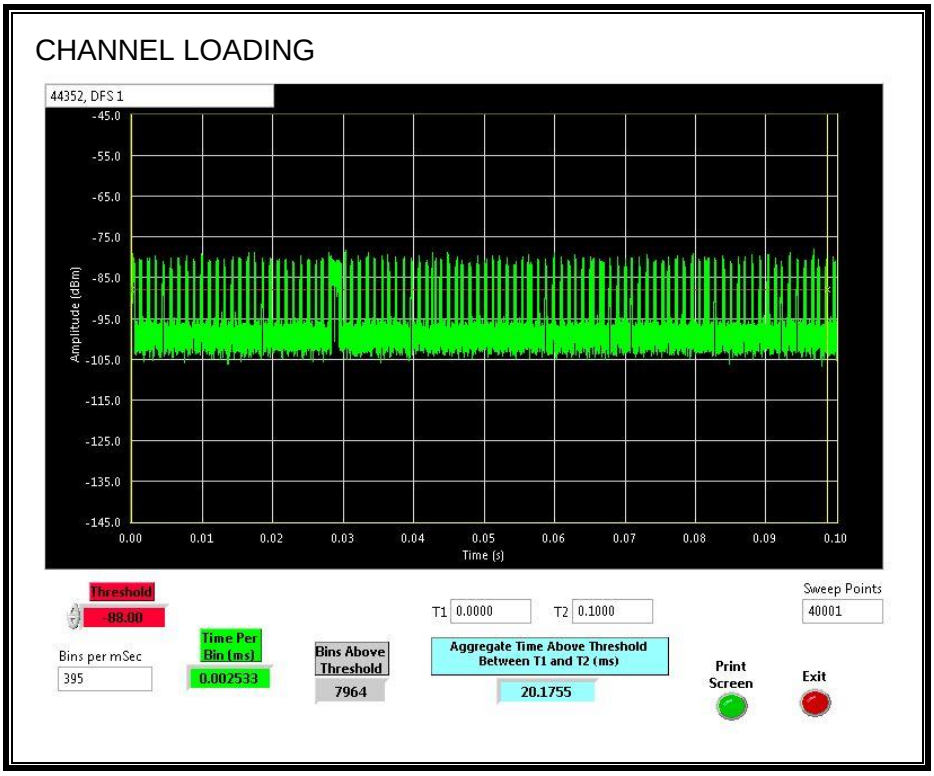


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 20.1755%

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)
30.06	206.2	176.1	116.1

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)
29.96	147.4	117.4	1.3

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)
30.27	205.0	174.7	58.6

QUALITATIVE RESULTS

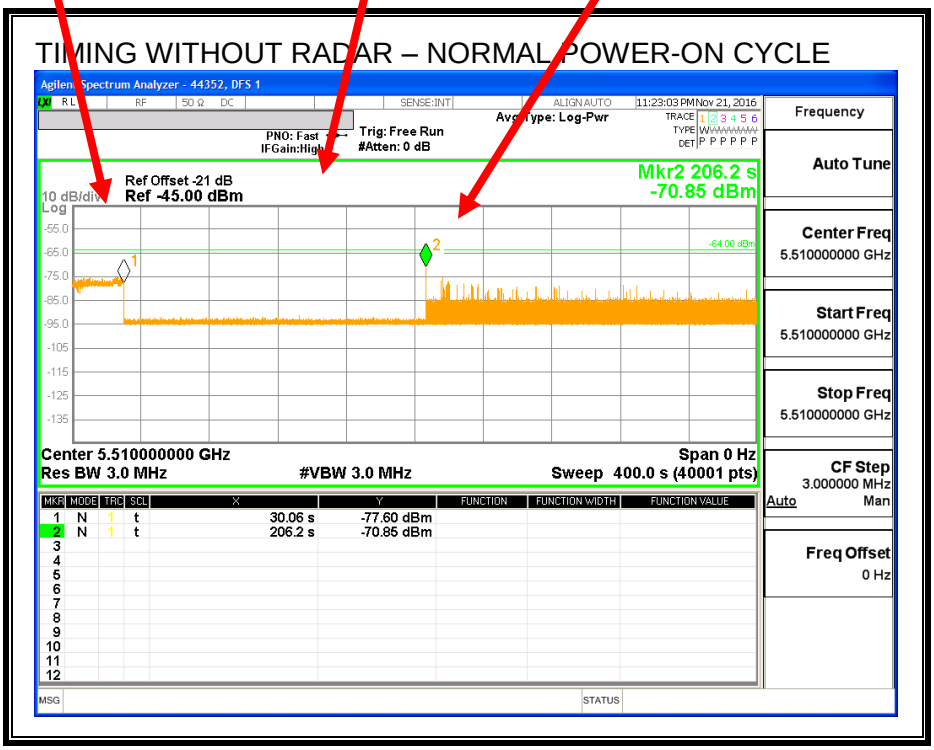
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

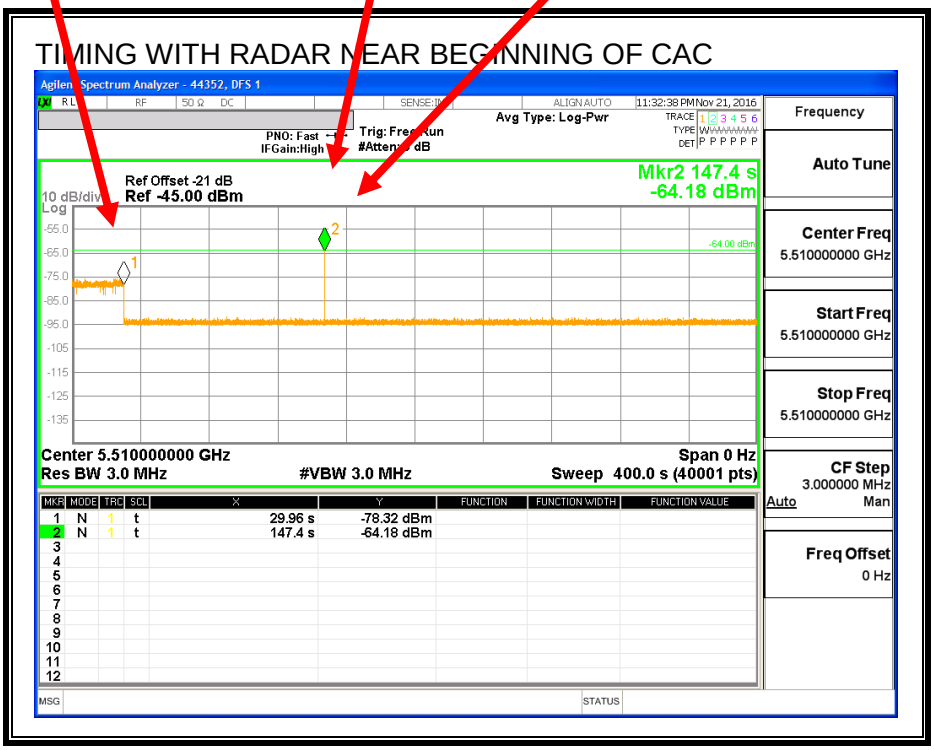
End of CAC
Traffic is Initiated



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



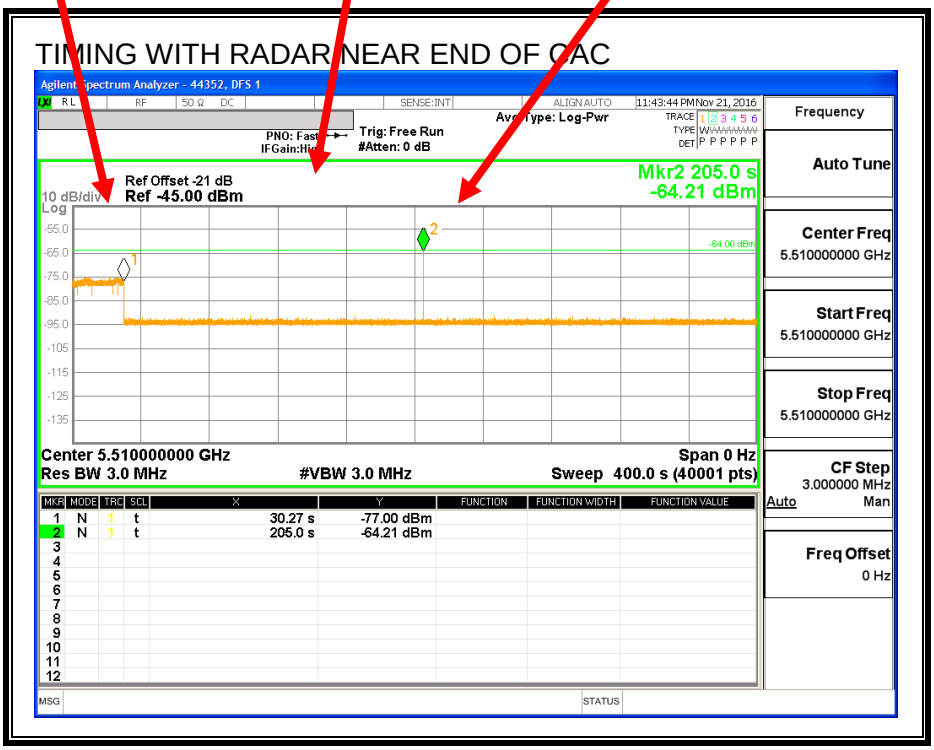
No EUT transmissions were observed after the radar signal.

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)

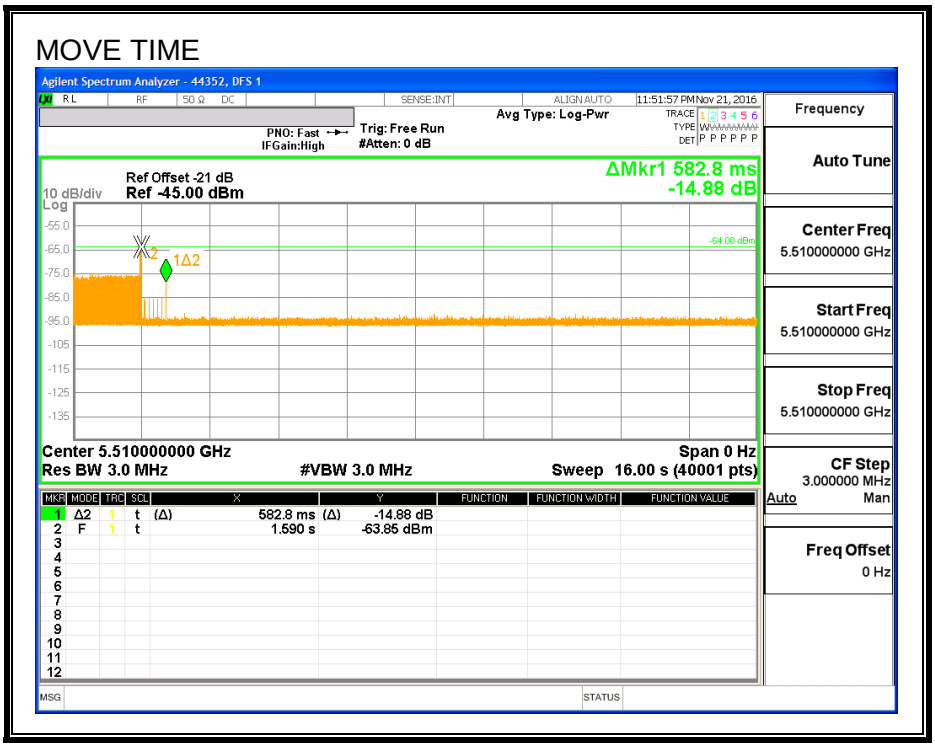
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.583	10

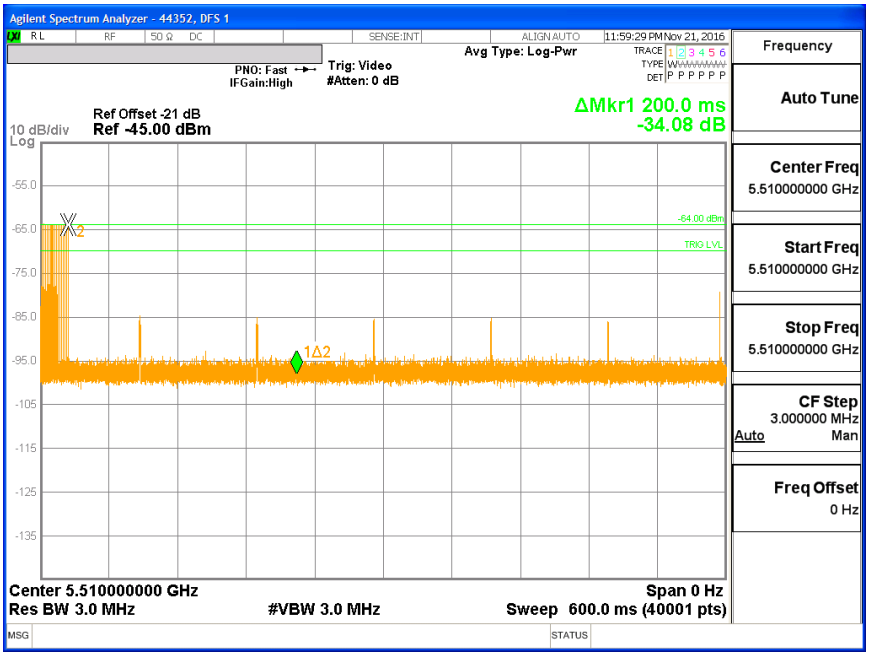
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
5.2	60

MOVE TIME



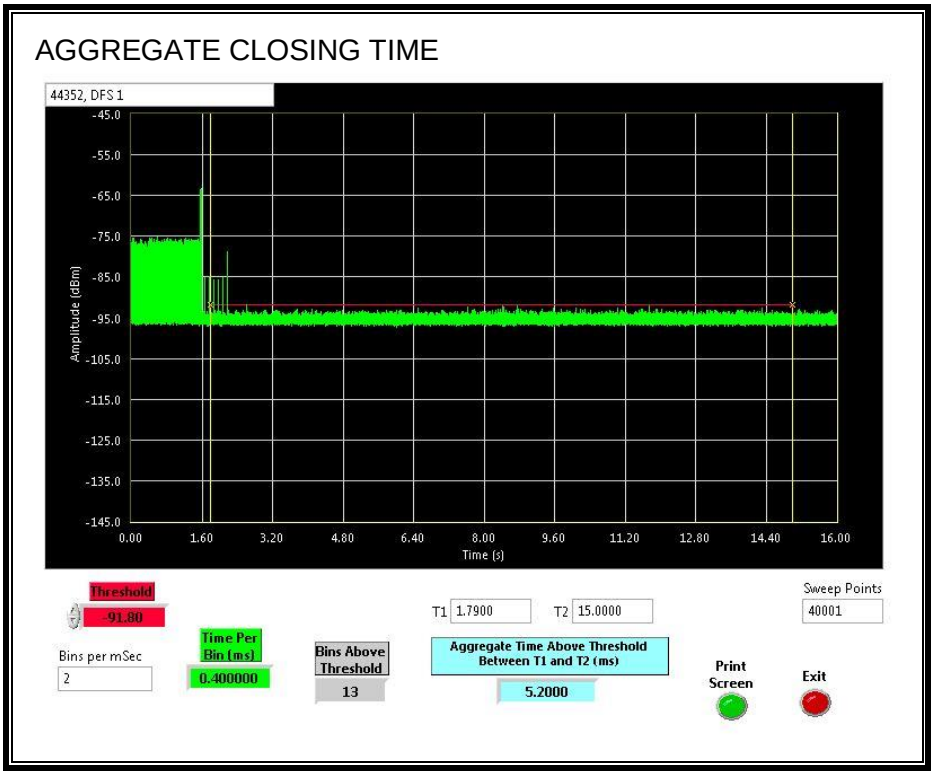
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

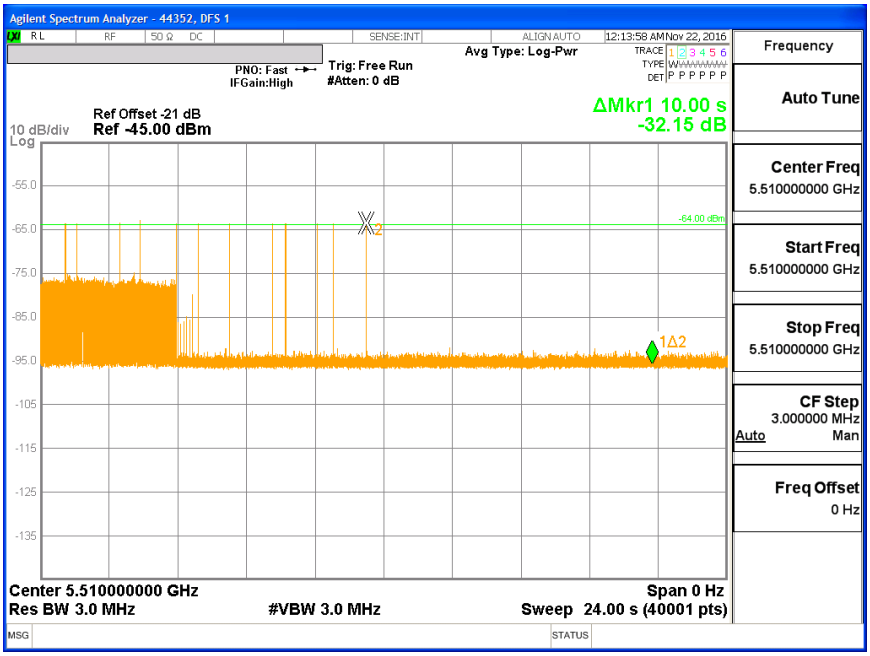
Only intermittent transmissions are observed during the aggregate monitoring period.



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

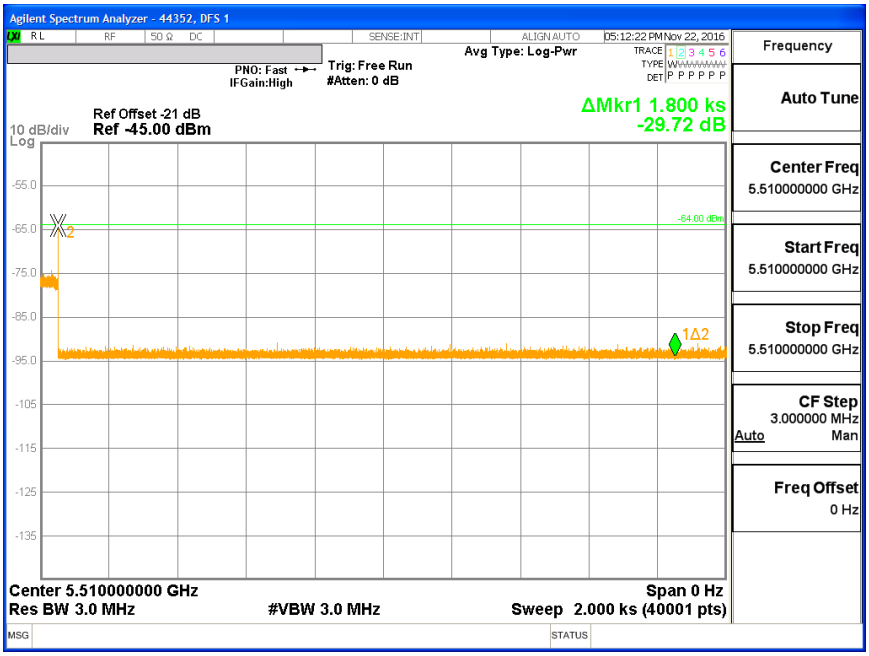


5.3.1. NON-OCCUPANCY PERIOD

RESULTS

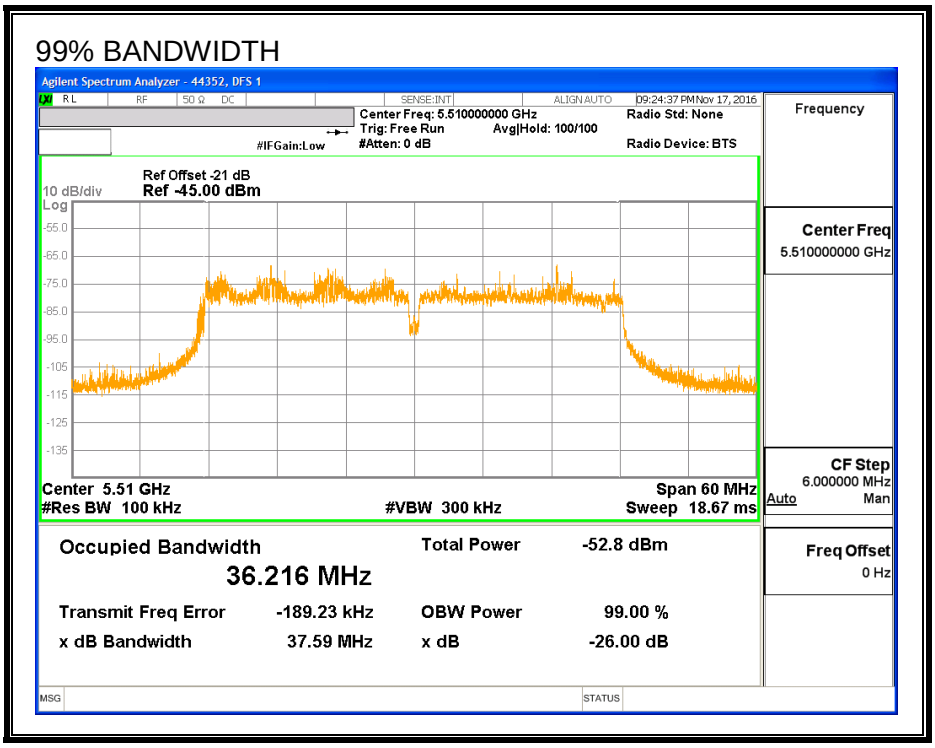
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



5.3.2. 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	5530	40	36.216	110.4	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	FH
5531	10	0	0	

5.3.3. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	80% of Det BW FL5	80% of Det BW FH5	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	96.67	60	Pass	5490	5530			36.22	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5530			36.22	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	73.33	60	Pass	5490	5530			36.22	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5530			36.22	DFS 1	44352	Version 3.0
Aggregate		90.83	80	Pass								
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	5494	5526	36.22	DFS 1	44352	Version 3.0
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530				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	5510	No
1002	1	618	86	A	5510	Yes
1003	1	738	72	A	5510	Yes
1004	1	578	92	A	5510	Yes
1005	1	718	74	A	5510	Yes
1006	1	518	102	A	5510	Yes
1007	1	638	83	A	5510	Yes
1008	1	818	65	A	5510	Yes
1009	1	758	70	A	5510	Yes
1010	1	918	58	A	5510	Yes
1011	1	698	76	A	5510	Yes
1012	1	538	99	A	5510	Yes
1013	1	598	89	A	5510	Yes
1014	1	838	63	A	5510	Yes
1015	1	658	81	A	5510	Yes
1016	1	1242	43	B	5510	Yes
1017	1	2068	26	B	5510	Yes
1018	1	2024	27	B	5510	Yes
1019	1	1786	30	B	5510	Yes
1020	1	1871	29	B	5510	Yes
1021	1	1762	30	B	5510	Yes
1022	1	783	68	B	5510	Yes
1023	1	2157	25	B	5510	Yes
1024	1	1306	41	B	5510	Yes
1025	1	2810	19	B	5510	Yes
1026	1	2089	26	B	5510	Yes
1027	1	1174	45	B	5510	Yes
1028	1	1936	28	B	5510	Yes
1029	1	2504	22	B	5510	Yes
1030	1	847	63	B	5510	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	4.7	219	24	5510	Yes
2002	3.8	155	27	5510	Yes
2003	3.4	166	24	5510	Yes
2004	4.5	187	28	5510	Yes
2005	2.4	203	25	5510	Yes
2006	1.9	190	29	5510	Yes
2007	4.1	210	27	5510	Yes
2008	3.7	201	24	5510	Yes
2009	2	187	26	5510	Yes
2010	4.1	183	27	5510	Yes
2011	4.8	172	26	5510	Yes
2012	2.9	215	28	5510	Yes
2013	3.8	209	27	5510	Yes
2014	2.2	218	26	5510	Yes
2015	1.4	216	29	5510	Yes
2016	2.1	229	29	5510	Yes
2017	3.4	193	29	5510	Yes
2018	2.5	210	25	5510	Yes
2019	2.1	221	29	5510	Yes
2020	3.3	162	25	5510	Yes
2021	1.1	177	23	5510	Yes
2022	4.7	165	23	5510	Yes
2023	2.8	184	25	5510	Yes
2024	2.4	176	29	5510	Yes
2025	4.8	161	28	5510	Yes
2026	2.8	157	25	5510	Yes
2027	3.5	228	24	5510	Yes
2028	1.6	189	26	5510	Yes
2029	2.5	226	29	5510	Yes
2030	5	192	24	5510	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	9	258	18	5510	Yes
3002	9.9	416	17	5510	Yes
3003	9.1	305	16	5510	Yes
3004	5.2	358	18	5510	No
3005	9.8	393	17	5510	Yes
3006	8.9	459	16	5510	Yes
3007	8.6	255	16	5510	Yes
3008	8	468	18	5510	Yes
3009	5.6	277	16	5510	No
3010	5.2	251	16	5510	No
3011	8.5	339	18	5510	Yes
3012	8.3	326	17	5510	Yes
3013	9.2	294	17	5510	Yes
3014	6.9	427	16	5510	Yes
3015	8	290	16	5510	Yes
3016	8.7	436	17	5510	Yes
3017	10	312	18	5510	Yes
3018	5.9	470	18	5510	Yes
3019	5.1	359	16	5510	No
3020	6.3	295	16	5510	Yes
3021	5.8	447	18	5510	No
3022	10	262	16	5510	No
3023	9.7	309	17	5510	No
3024	9.1	271	16	5510	Yes
3025	6.7	331	16	5510	Yes
3026	6.3	305	18	5510	Yes
3027	6.9	260	17	5510	Yes
3028	6.7	380	18	5510	Yes
3029	7.6	348	16	5510	Yes
3030	5.3	348	18	5510	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	12.8	462	16	5510	Yes
4002	14.2	357	12	5510	Yes
4003	16.8	483	14	5510	Yes
4004	18.7	391	14	5510	No
4005	17.2	412	16	5510	Yes
4006	19.6	466	16	5510	Yes
4007	18.6	367	14	5510	Yes
4008	16.8	316	16	5510	Yes
4009	16.2	481	12	5510	Yes
4010	14.9	442	15	5510	Yes
4011	10.2	251	16	5510	Yes
4012	14.8	359	14	5510	Yes
4013	10.5	432	13	5510	Yes
4014	15.6	301	14	5510	Yes
4015	11.9	269	13	5510	Yes
4016	17.5	402	14	5510	Yes
4017	19.7	382	14	5510	Yes
4018	11	277	13	5510	Yes
4019	13.7	404	13	5510	No
4020	15.6	445	12	5510	Yes
4021	14	333	15	5510	Yes
4022	16.4	387	14	5510	Yes
4023	15.4	288	15	5510	Yes
4024	13.6	488	15	5510	Yes
4025	13	401	16	5510	Yes
4026	11.7	363	13	5510	Yes
4027	17.1	305	14	5510	Yes
4028	11.6	279	15	5510	Yes
4029	17.5	352	16	5510	Yes
4030	12.4	472	12	5510	Yes

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	5500	Yes
12	5500	Yes
13	5500	Yes
14	5499	Yes
15	5496	Yes
16	5499	Yes
17	5498	Yes
18	5494	Yes
19	5496	Yes
20	5500	Yes
21	5522	Yes
22	5520	Yes
23	5522	Yes
24	5520	Yes
25	5522	Yes
26	5520	Yes
27	5522	Yes
28	5520	Yes
29	5522	Yes
30	5520	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	193	5490	8	Yes
2	668	5491	8	Yes
3	1143	5492	7	Yes
4	1618	5493	6	Yes
5	2093	5494	8	Yes
6	2568	5495	7	Yes
7	3043	5496	8	Yes
8	3518	5497	10	Yes
9	3993	5498	6	Yes
10	4468	5499	13	Yes
11	4943	5500	10	Yes
12	5418	5501	9	Yes
13	5893	5502	8	Yes
14	6368	5503	6	Yes
15	6843	5504	9	Yes
16	7318	5505	10	Yes
17	7793	5506	11	Yes
18	8268	5507	8	Yes
19	8743	5508	7	Yes
20	9218	5509	7	Yes
21	9693	5510	9	Yes
22	10168	5511	7	Yes
23	10643	5512	6	Yes
24	11118	5513	7	Yes
25	11593	5514	12	Yes
26	12068	5515	4	Yes
27	12543	5516	8	Yes
28	13018	5517	10	Yes
29	13493	5518	5	Yes
30	13968	5519	9	Yes
31	14443	5520	9	Yes
32	14918	5521	9	Yes
33	15393	5522	8	Yes
34	15868	5523	8	Yes
35	16343	5524	7	Yes
36	16818	5525	8	Yes
37	17293	5526	5	Yes
38	17768	5527	6	Yes
39	18243	5528	6	Yes
40	18718	5529	9	Yes
41	19193	5530	11	Yes

5.4. RESULTS FOR 80 MHz BANDWIDTH

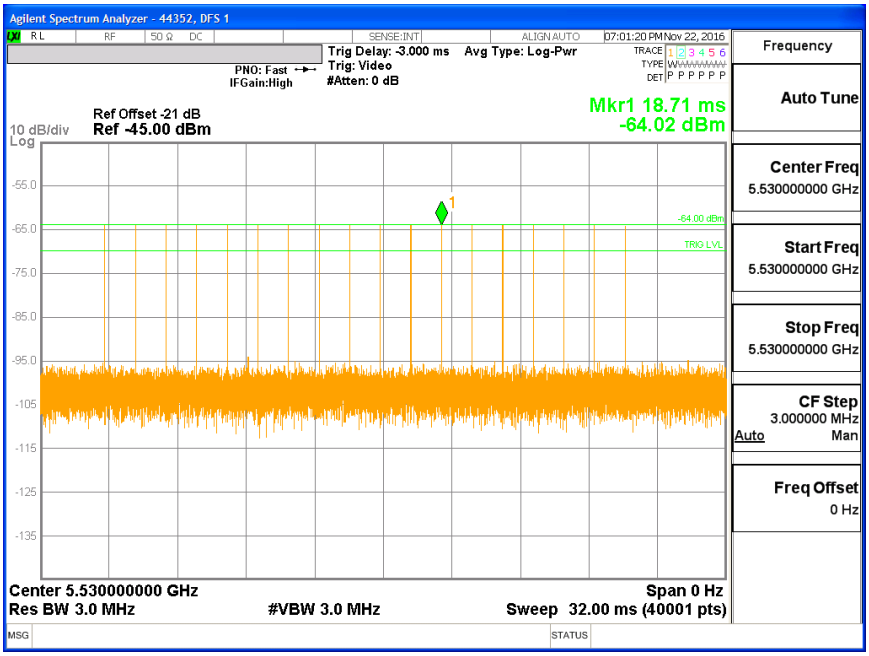
5.4.1. TEST CHANNEL

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

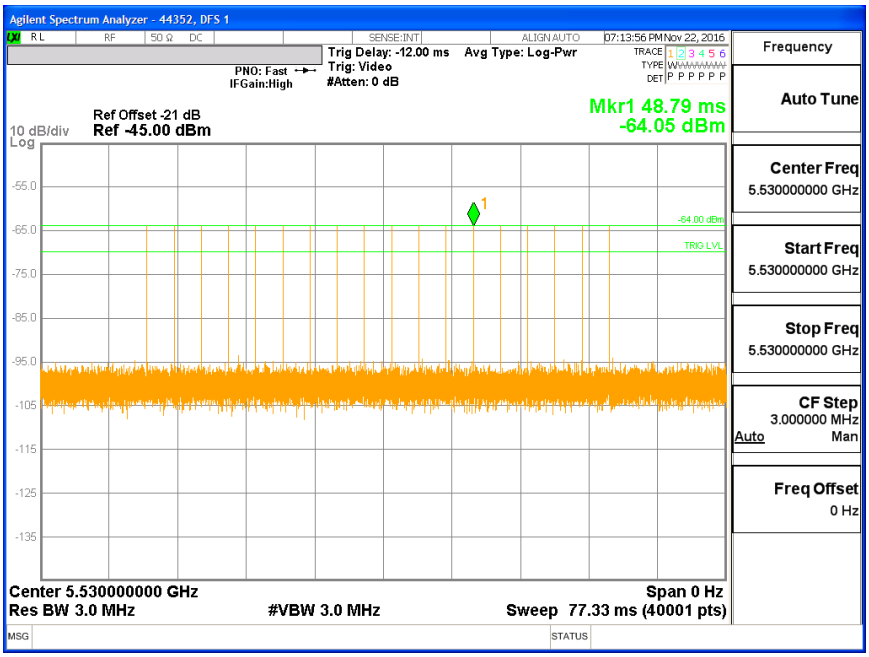
5.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

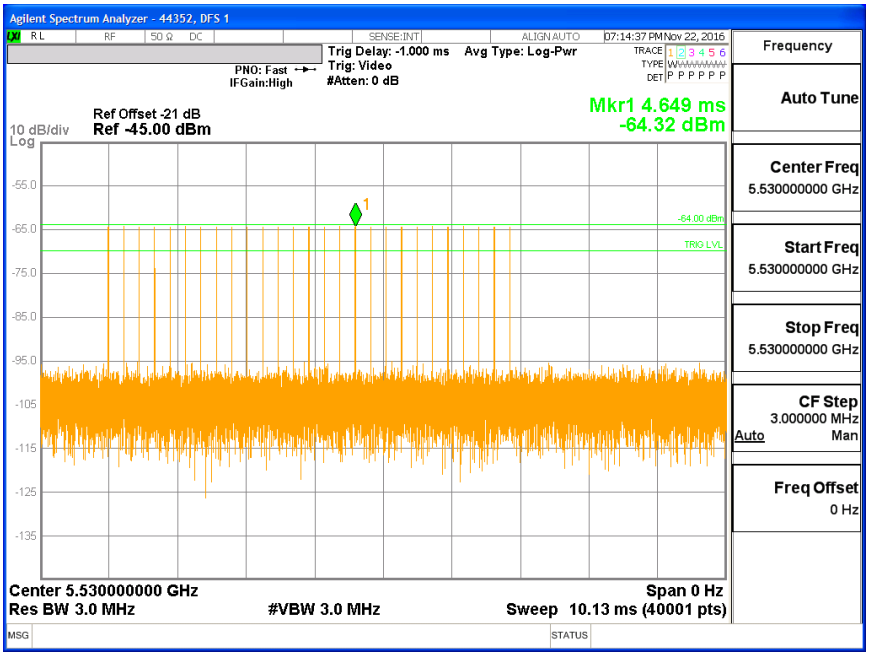
SHORT PULSE RADAR TYPE 0



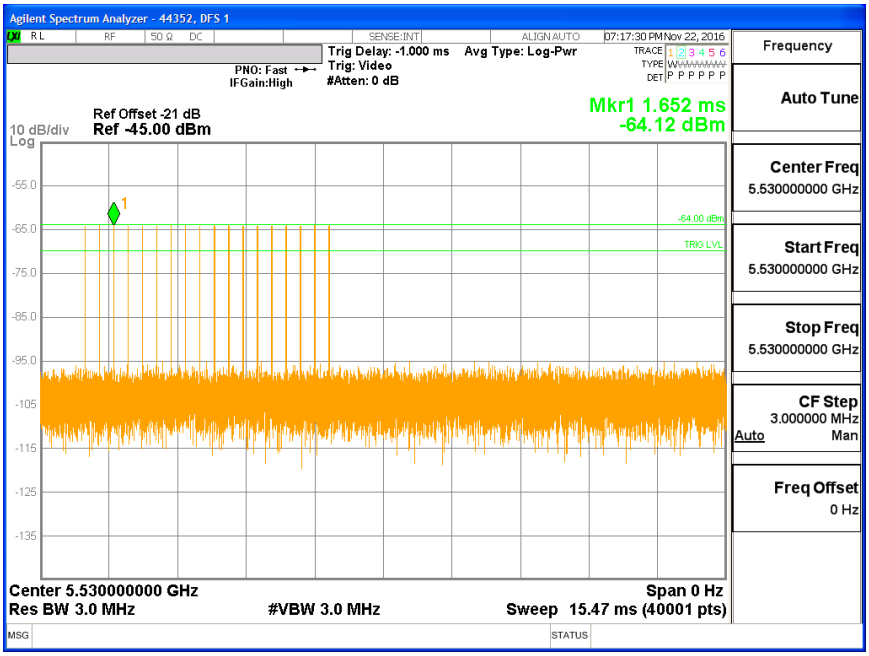
SAMPLE OF RADAR TYPE 1



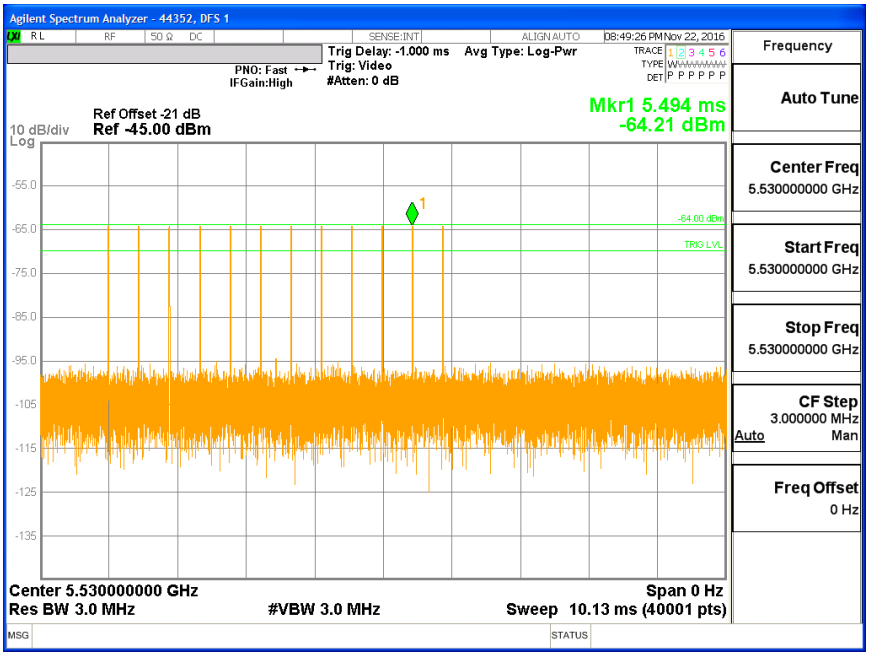
SAMPLE OF RADAR TYPE 2



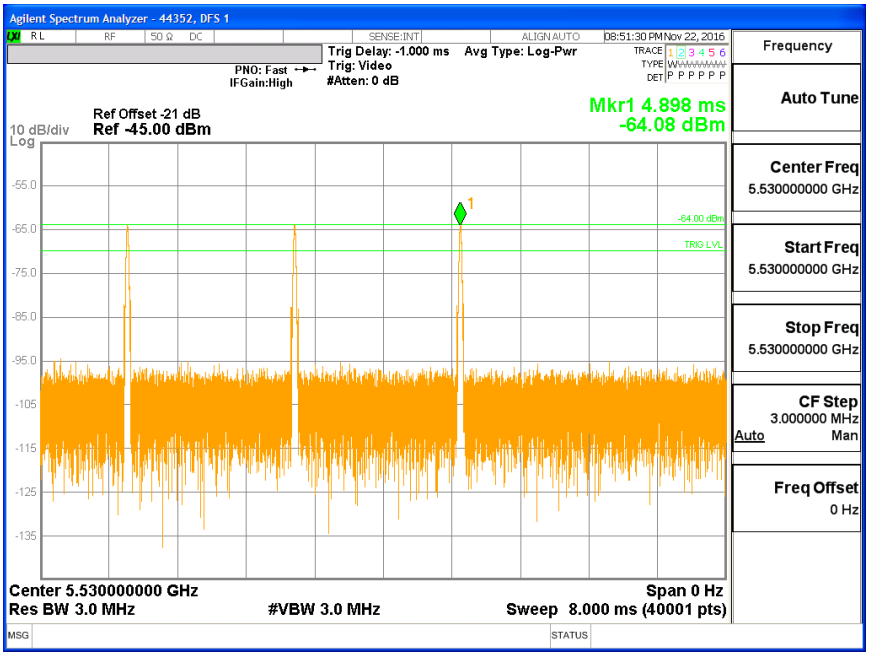
SAMPLE OF RADAR TYPE 3



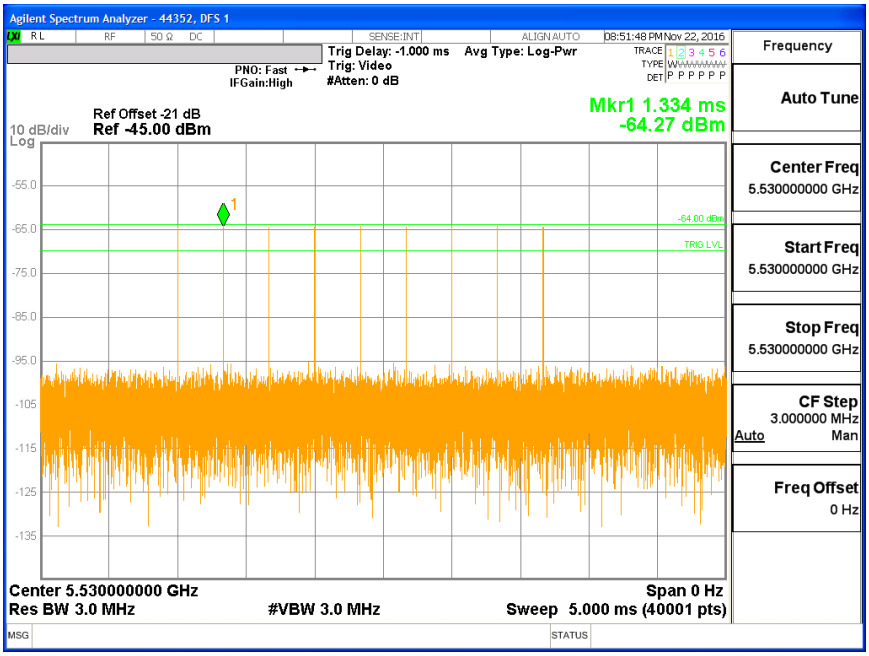
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

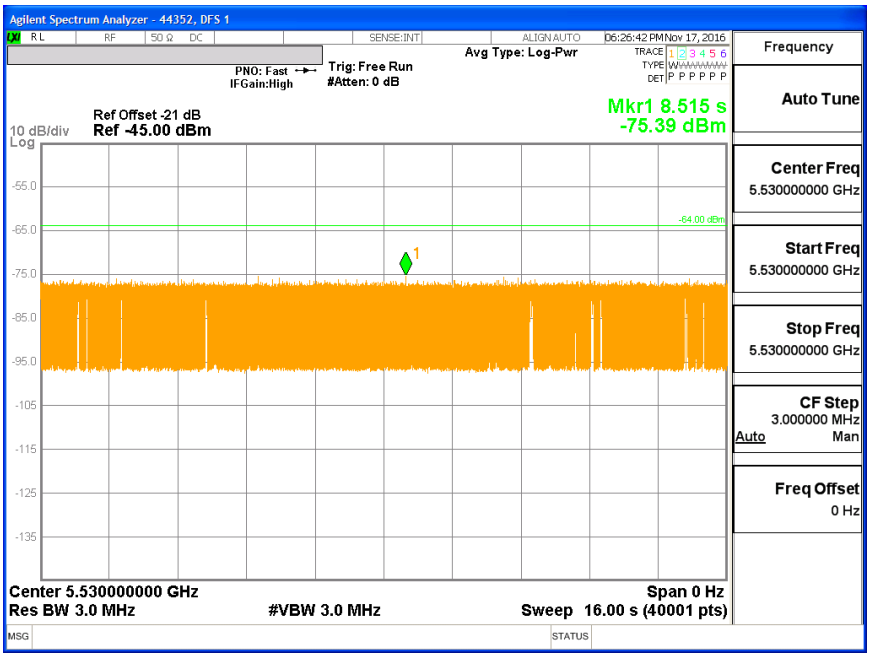


SINGLE BURST OF RADAR TYPE 6

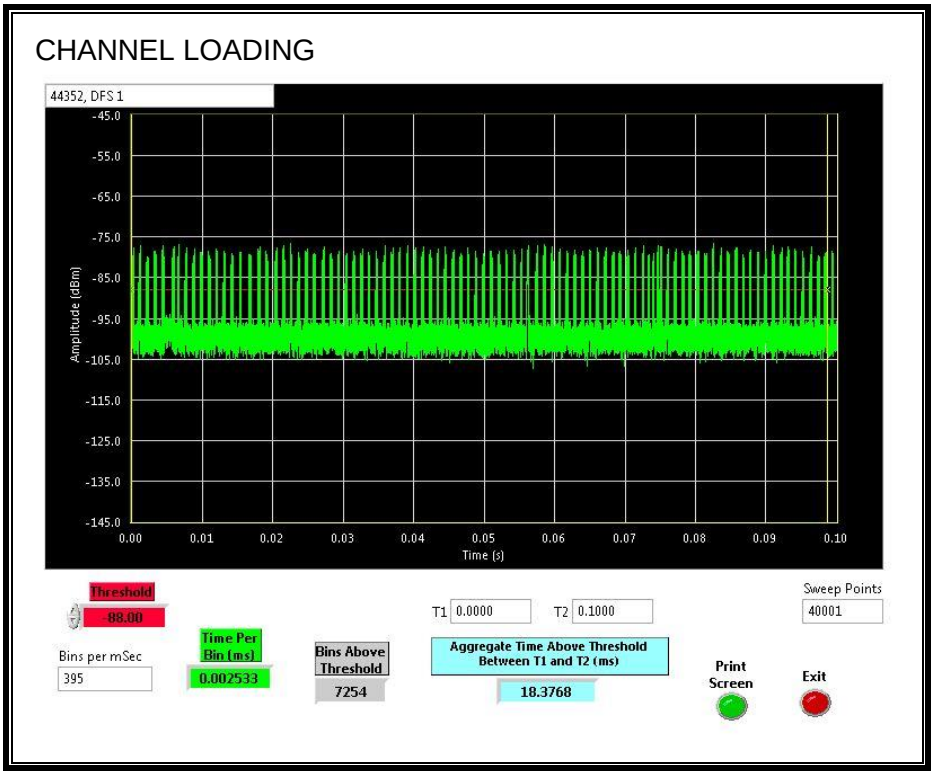


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.3768%

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)
30.14	207.3	177.2	117.2

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)
30.13	148.4	118.3	1.1

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)
30.22	205.9	175.7	58.5

QUALITATIVE RESULTS

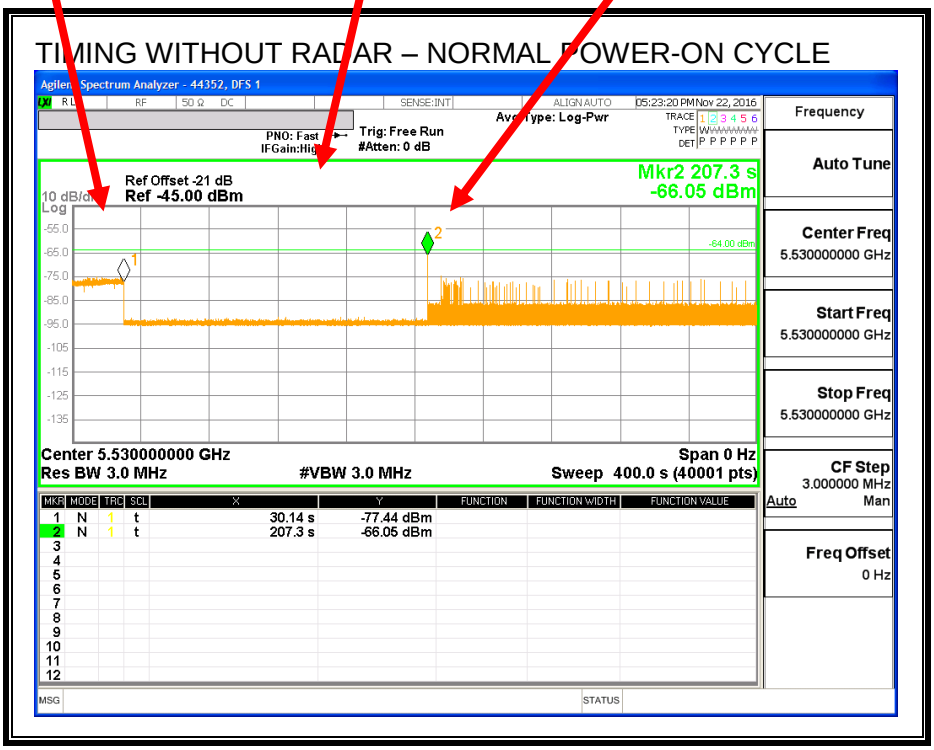
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



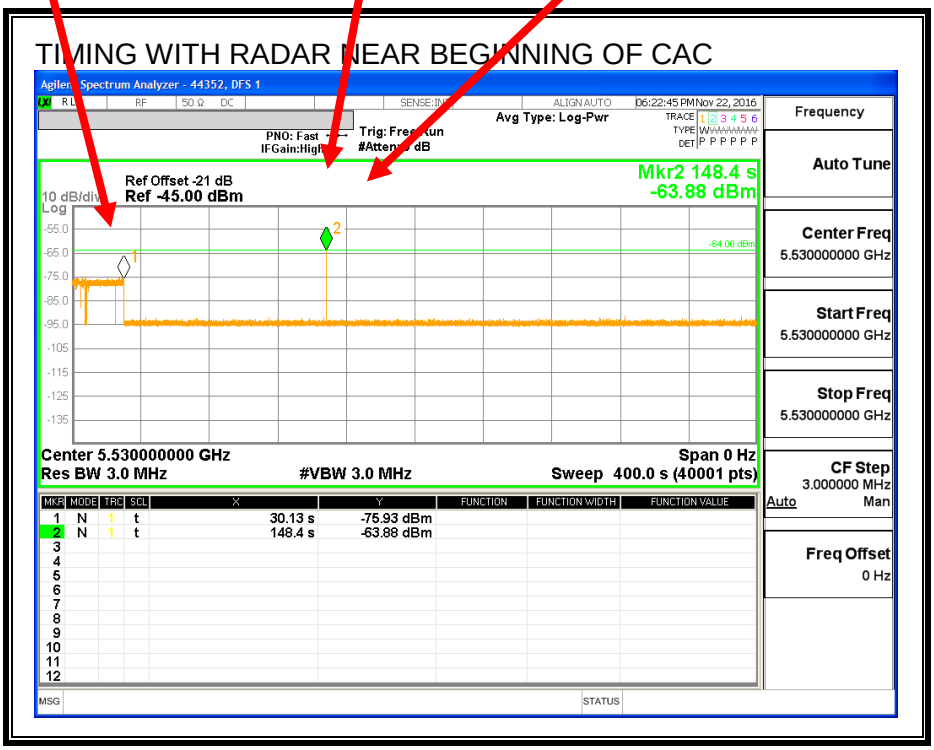
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



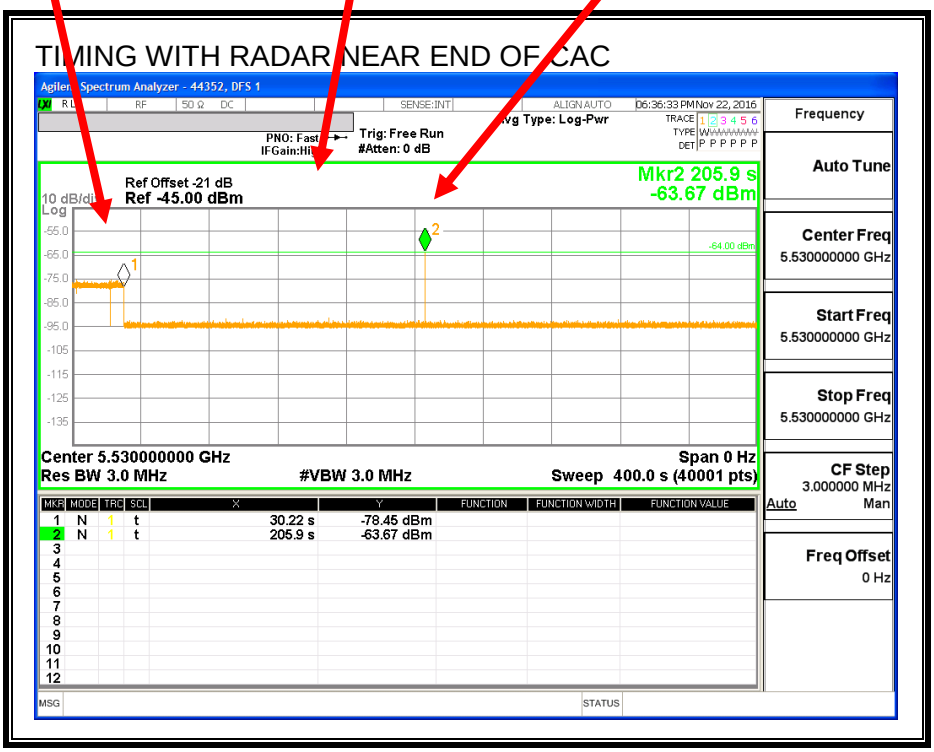
No EUT transmissions were observed after the radar signal.

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)

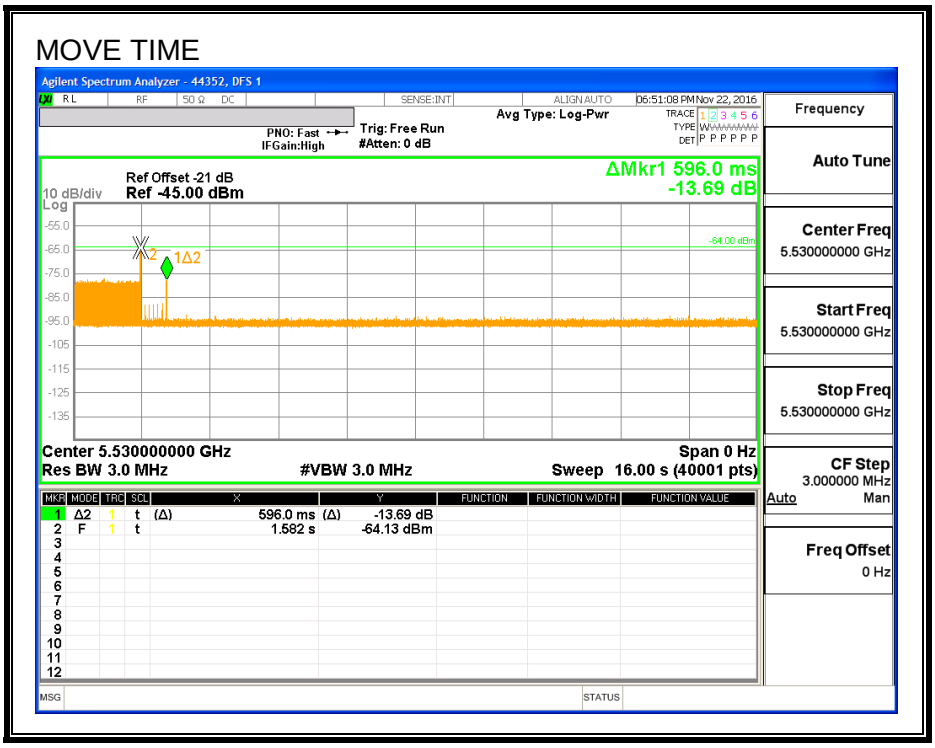
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.596	10

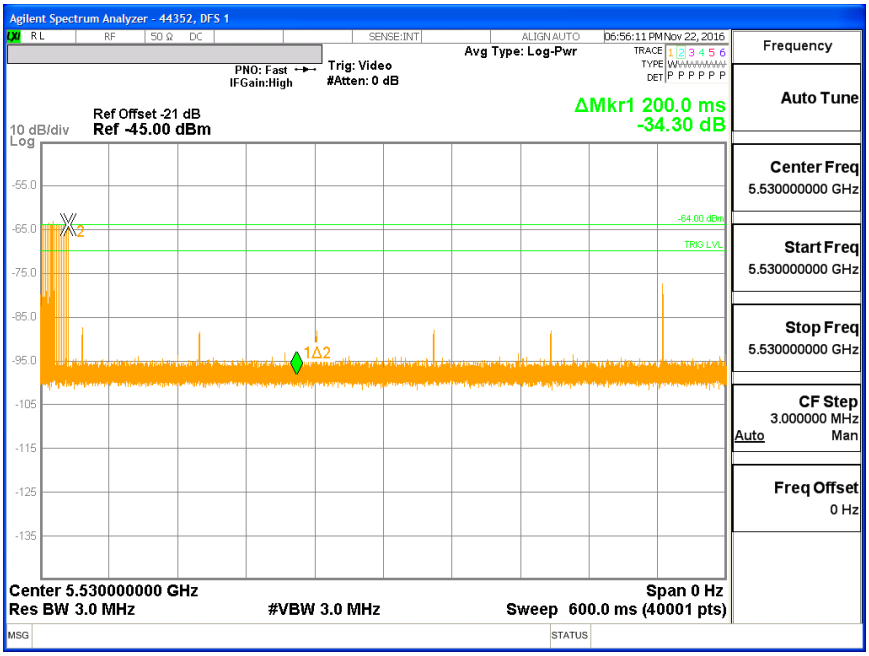
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
2.8	60

MOVE TIME



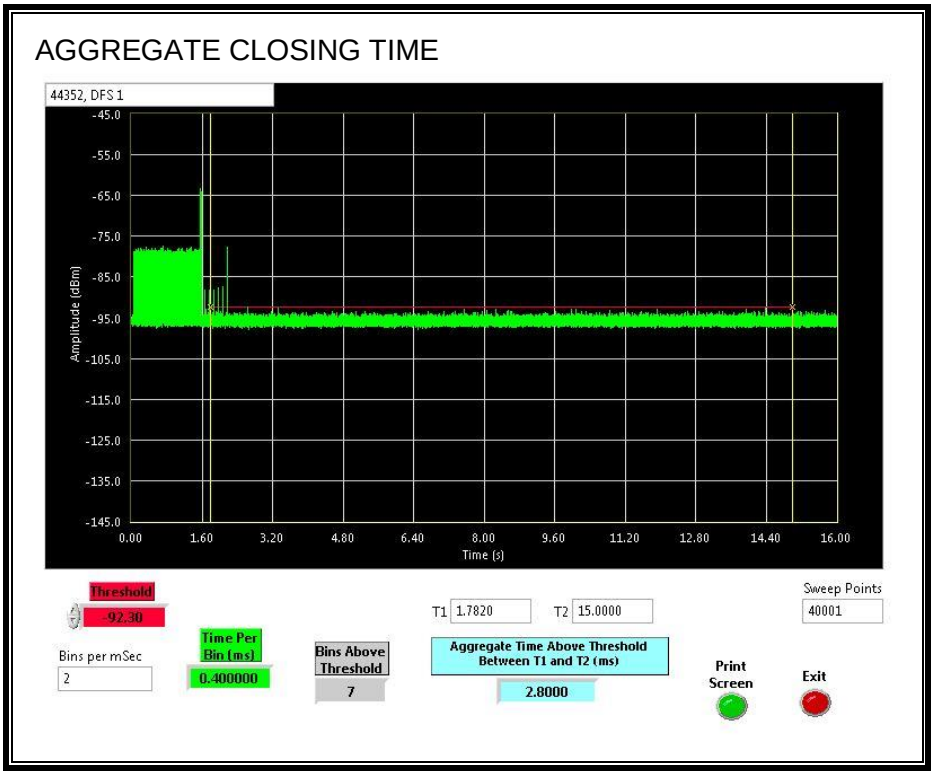
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

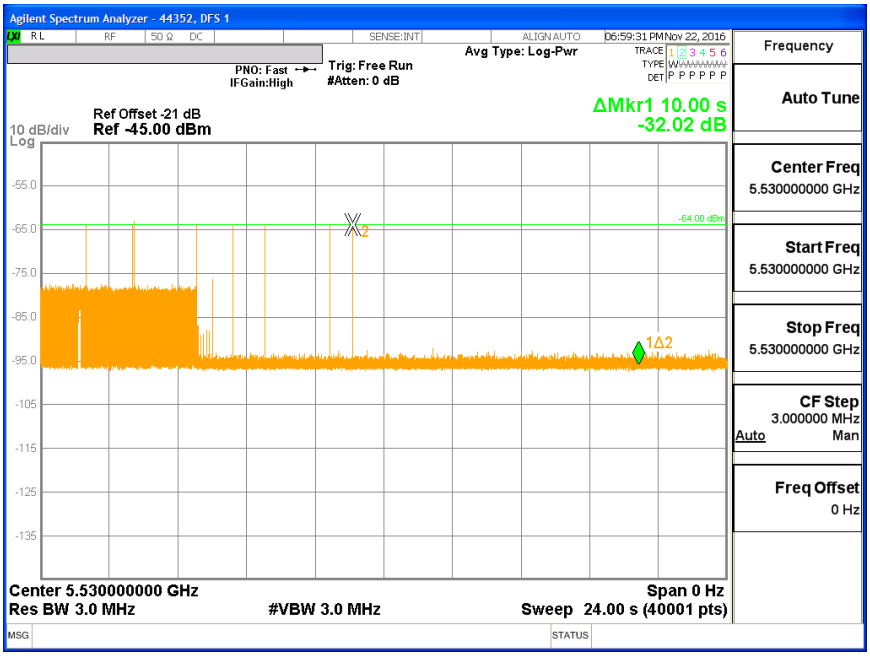
Only intermittent transmissions are observed during the aggregate monitoring period.



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

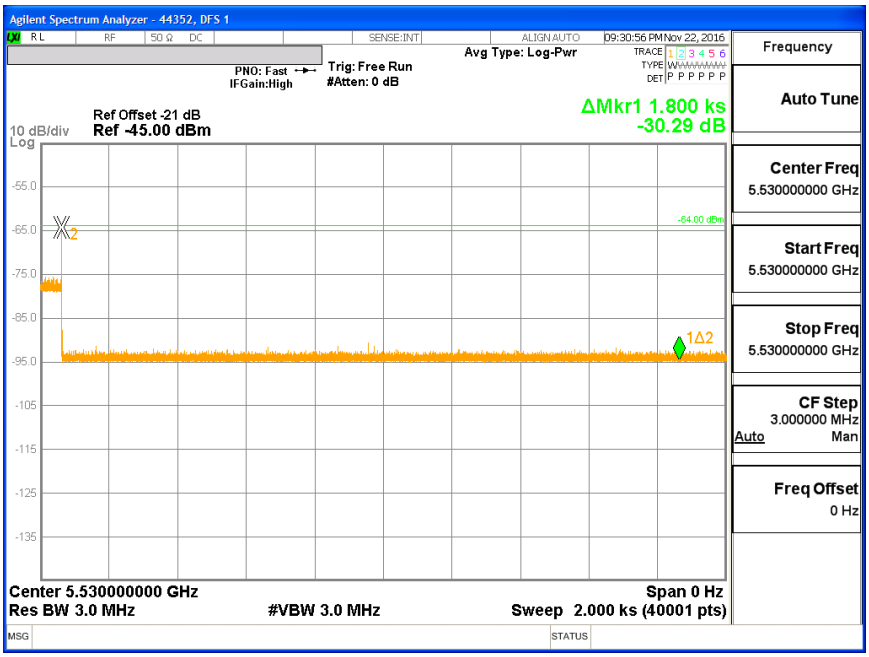


5.4.1. NON-OCCUPANCY PERIOD

RESULTS

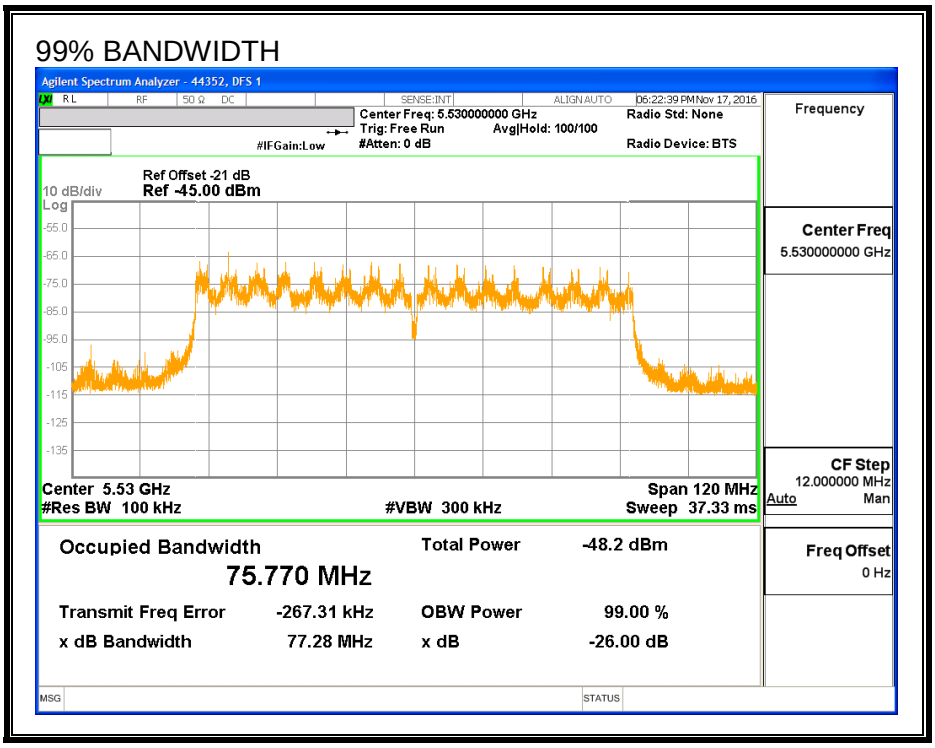
No EUT transmissions were observed on the test channel during the 30-minute observation time.

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	75.770	105.6	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	1	10	
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	80% of Det BW FL5	80% of Det BW FH5	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	96.67	60	Pass	5490	5570			75.77	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	86.67	60	Pass	5490	5570			75.77	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5570			75.77	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5570			75.77	DFS 1	44352	Version 3.0
Aggregate		88.33	80	Pass								
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	5498	5562	75.77	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	5530	Yes
1002	1	618	86	A	5530	Yes
1003	1	738	72	A	5530	Yes
1004	1	578	92	A	5530	Yes
1005	1	718	74	A	5530	Yes
1006	1	518	102	A	5530	Yes
1007	1	638	83	A	5530	Yes
1008	1	818	65	A	5530	Yes
1009	1	758	70	A	5530	Yes
1010	1	918	58	A	5530	Yes
1011	1	698	76	A	5530	Yes
1012	1	538	99	A	5530	Yes
1013	1	598	89	A	5530	Yes
1014	1	838	63	A	5530	Yes
1015	1	658	81	A	5530	Yes
1016	1	1242	43	B	5530	Yes
1017	1	2068	26	B	5530	Yes
1018	1	2024	27	B	5530	Yes
1019	1	1786	30	B	5530	Yes
1020	1	1871	29	B	5530	Yes
1021	1	1762	30	B	5530	Yes
1022	1	783	68	B	5530	Yes
1023	1	2157	25	B	5530	Yes
1024	1	1306	41	B	5530	Yes
1025	1	2810	19	B	5530	No
1026	1	2089	26	B	5530	Yes
1027	1	1174	45	B	5530	Yes
1028	1	1936	28	B	5530	Yes
1029	1	2504	22	B	5530	Yes
1030	1	847	63	B	5530	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	4.7	219	24	5530	Yes
2002	3.8	155	27	5530	Yes
2003	3.4	166	24	5530	Yes
2004	4.5	187	28	5530	Yes
2005	2.4	203	25	5530	Yes
2006	1.9	190	29	5530	Yes
2007	4.1	210	27	5530	No
2008	3.7	201	24	5530	Yes
2009	2	187	26	5530	Yes
2010	4.1	183	27	5530	Yes
2011	4.8	172	26	5530	Yes
2012	2.9	215	28	5530	Yes
2013	3.8	209	27	5530	Yes
2014	2.2	218	26	5530	Yes
2015	1.4	216	29	5530	Yes
2016	2.1	229	29	5530	Yes
2017	3.4	193	29	5530	Yes
2018	2.5	210	25	5530	Yes
2019	2.1	221	29	5530	Yes
2020	3.3	162	25	5530	Yes
2021	1.1	177	23	5530	Yes
2022	4.7	165	23	5530	Yes
2023	2.8	184	25	5530	Yes
2024	2.4	176	29	5530	No
2025	4.8	161	28	5530	Yes
2026	2.8	157	25	5530	Yes
2027	3.5	228	24	5530	No
2028	1.6	189	26	5530	No
2029	2.5	226	29	5530	Yes
2030	5	192	24	5530	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	9	258	18	5530	Yes
3002	9.9	416	17	5530	Yes
3003	9.1	305	16	5530	Yes
3004	5.2	358	18	5530	No
3005	9.8	393	17	5530	Yes
3006	8.9	459	16	5530	Yes
3007	8.6	255	16	5530	No
3008	8	468	18	5530	Yes
3009	5.6	277	16	5530	No
3010	5.2	251	16	5530	No
3011	8.5	339	18	5530	Yes
3012	8.3	326	17	5530	Yes
3013	9.2	294	17	5530	Yes
3014	6.9	427	16	5530	Yes
3015	8	290	16	5530	Yes
3016	8.7	436	17	5530	Yes
3017	10	312	18	5530	Yes
3018	5.9	470	18	5530	Yes
3019	5.1	359	16	5530	No
3020	6.3	295	16	5530	Yes
3021	5.8	447	18	5530	Yes
3022	10	262	16	5530	Yes
3023	9.7	309	17	5530	Yes
3024	9.1	271	16	5530	Yes
3025	6.7	331	16	5530	Yes
3026	6.3	305	18	5530	Yes
3027	6.9	260	17	5530	Yes
3028	6.7	380	18	5530	Yes
3029	7.6	348	16	5530	Yes
3030	5.3	348	18	5530	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	12.8	462	16	5530	Yes
4002	14.2	357	12	5530	Yes
4003	16.8	483	14	5530	No
4004	18.7	391	14	5530	Yes
4005	17.2	412	16	5530	Yes
4006	19.6	466	16	5530	Yes
4007	18.6	367	14	5530	Yes
4008	16.8	316	16	5530	Yes
4009	16.2	481	12	5530	Yes
4010	14.9	442	15	5530	Yes
4011	10.2	251	16	5530	Yes
4012	14.8	359	14	5530	Yes
4013	10.5	432	13	5530	Yes
4014	15.6	301	14	5530	Yes
4015	11.9	269	13	5530	Yes
4016	17.5	402	14	5530	Yes
4017	19.7	382	14	5530	Yes
4018	11	277	13	5530	Yes
4019	13.7	404	13	5530	Yes
4020	15.6	445	12	5530	Yes
4021	14	333	15	5530	Yes
4022	16.4	387	14	5530	Yes
4023	15.4	288	15	5530	Yes
4024	13.6	488	15	5530	Yes
4025	13	401	16	5530	Yes
4026	11.7	363	13	5530	No
4027	17.1	305	14	5530	No
4028	11.6	279	15	5530	Yes
4029	17.5	352	16	5530	Yes
4030	12.4	472	12	5530	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	5500	Yes
12	5500	Yes
13	5500	Yes
14	5500	Yes
15	5497	Yes
16	5499	Yes
17	5499	Yes
18	5495	Yes
19	5496	Yes
20	5500	Yes
21	5562	Yes
22	5559	Yes
23	5562	Yes
24	5559	Yes
25	5562	Yes
26	5559	Yes
27	5562	Yes
28	5559	Yes
29	5562	Yes
30	5559	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	221	5490	20	Yes
2	696	5491	16	Yes
3	1171	5492	20	Yes
4	1646	5493	9	Yes
5	2121	5494	17	Yes
6	2596	5495	14	Yes
7	3071	5496	21	Yes
8	3546	5497	17	Yes
9	4021	5498	13	Yes
10	4496	5499	21	Yes
11	4971	5500	17	Yes
12	5446	5501	22	Yes
13	5921	5502	21	Yes
14	6396	5503	15	Yes
15	6871	5504	19	Yes
16	7346	5505	14	Yes
17	7821	5506	27	Yes
18	8296	5507	14	Yes
19	8771	5508	15	Yes
20	9246	5509	16	Yes
21	9721	5510	24	Yes
22	10196	5511	13	Yes
23	10671	5512	13	Yes
24	11146	5513	20	Yes
25	11621	5514	23	Yes
26	12096	5515	18	Yes
27	12571	5516	14	Yes
28	13046	5517	13	Yes
29	13521	5518	17	Yes
30	13996	5519	18	Yes
31	14471	5520	23	Yes
32	14946	5521	17	Yes
33	15421	5522	18	Yes
34	15896	5523	15	Yes
35	16371	5524	24	Yes
36	16846	5525	20	Yes
37	17321	5526	15	Yes
38	17796	5527	20	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

39	18271	5528	12	Yes
40	18746	5529	11	Yes
41	19221	5530	14	Yes
42	19696	5531	23	Yes
43	20171	5532	17	Yes
44	20646	5533	23	Yes
45	21121	5534	10	Yes
46	21596	5535	17	Yes
47	22071	5536	19	Yes
48	22546	5537	19	Yes
49	23021	5538	20	Yes
50	23496	5539	20	Yes
51	23971	5540	14	Yes
52	24446	5541	8	Yes
53	24921	5542	16	Yes
54	25396	5543	15	Yes
55	25871	5544	13	Yes
56	26346	5545	17	Yes
57	26821	5546	21	Yes
58	27296	5547	17	Yes
59	27771	5548	13	Yes
60	28246	5549	18	Yes
61	28721	5550	14	Yes
62	29196	5551	19	Yes
63	29671	5552	22	Yes
64	30146	5553	19	Yes
65	30621	5554	18	Yes
66	31096	5555	21	Yes
67	31571	5556	13	Yes
68	32046	5557	15	Yes
69	32521	5558	16	Yes
70	32996	5559	14	Yes
71	33471	5560	18	Yes
72	33946	5561	18	Yes
73	34421	5562	19	Yes
74	34896	5563	13	Yes
75	35371	5564	16	Yes
76	35846	5565	16	Yes
77	36321	5566	13	Yes
78	36796	5567	19	Yes
79	37271	5568	13	Yes
80	37746	5569	17	Yes
81	38221	5570	18	Yes

5.5. BRIDGE MODE RESULTS

Per KDB 905462, Section 5.1 (footnote 1):

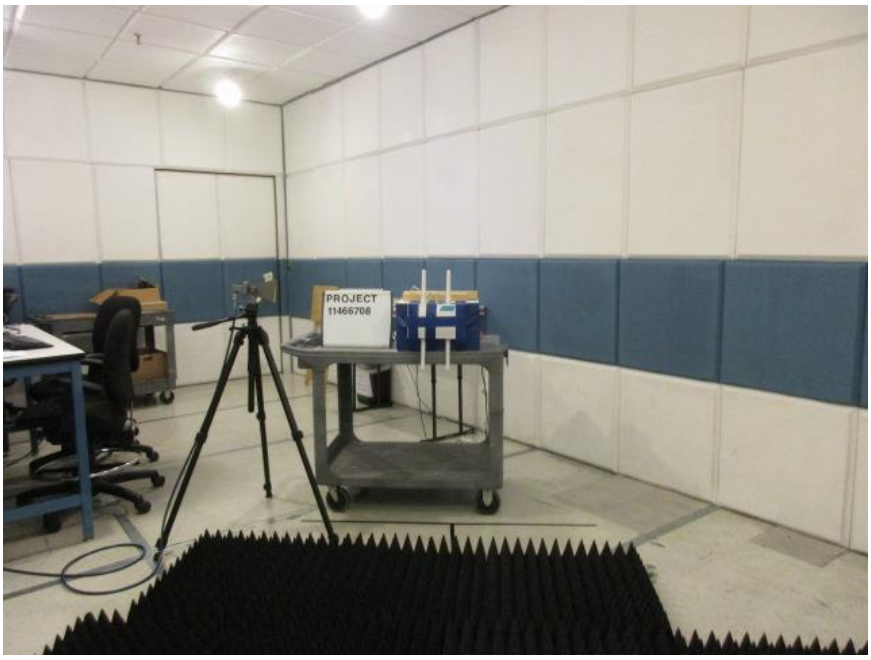
Networks Access Points with Bridge and/or MESH modes of operation are permitted to operate in the DFS bands but must employ a DFS function. The functionality of the Bridge mode as specified in §15.403(a) must be validated in the DFS test report. Devices operating as relays must also employ DFS function. 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.

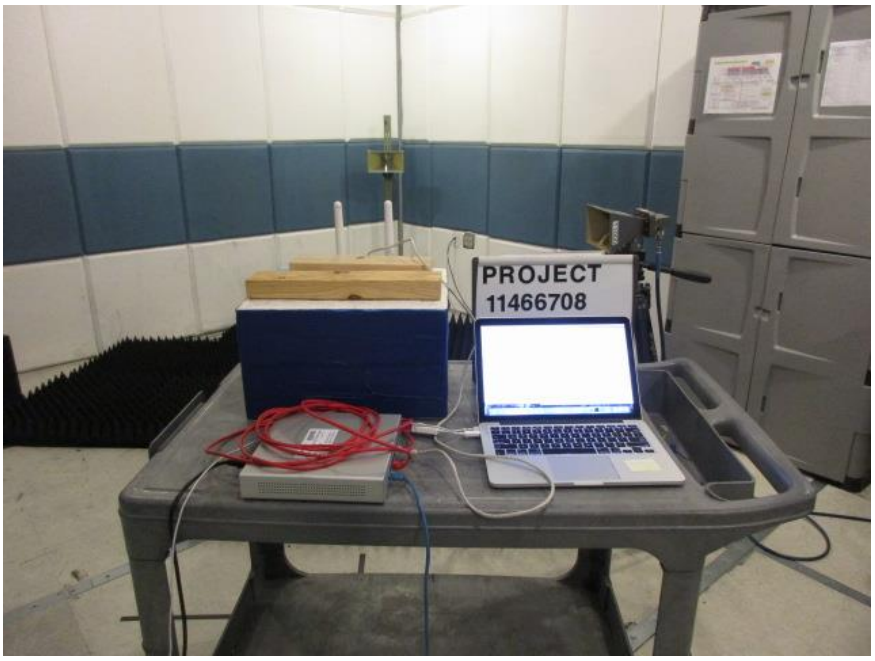
6. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS FRONT PHOTO



DFS BACK PHOTO



END OF REPORT