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

CERTIFICATION TEST REPORT

FOR

WIRELESS 802.11 ABGN/AC INDOOR AP

MODEL NUMBER: MR33-HW

FCC ID: UDX-60052010
IC: 6961A-60052010

REPORT NUMBER: 11445064-E4V1

ISSUE DATE: DECEMBER 14, 2016

Prepared for
CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA 95134, U.S.A.

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/14/16	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, U.S.A.

EUT DESCRIPTION: WIRELESS 802.11 ABGN/AC INDOOR AP

MODEL: MR33-HW

SERIAL NUMBER: Q2PD-T2PJ-UUHK

DATE TESTED: OCTOBER 3 – DECEMBER 13, 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 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

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

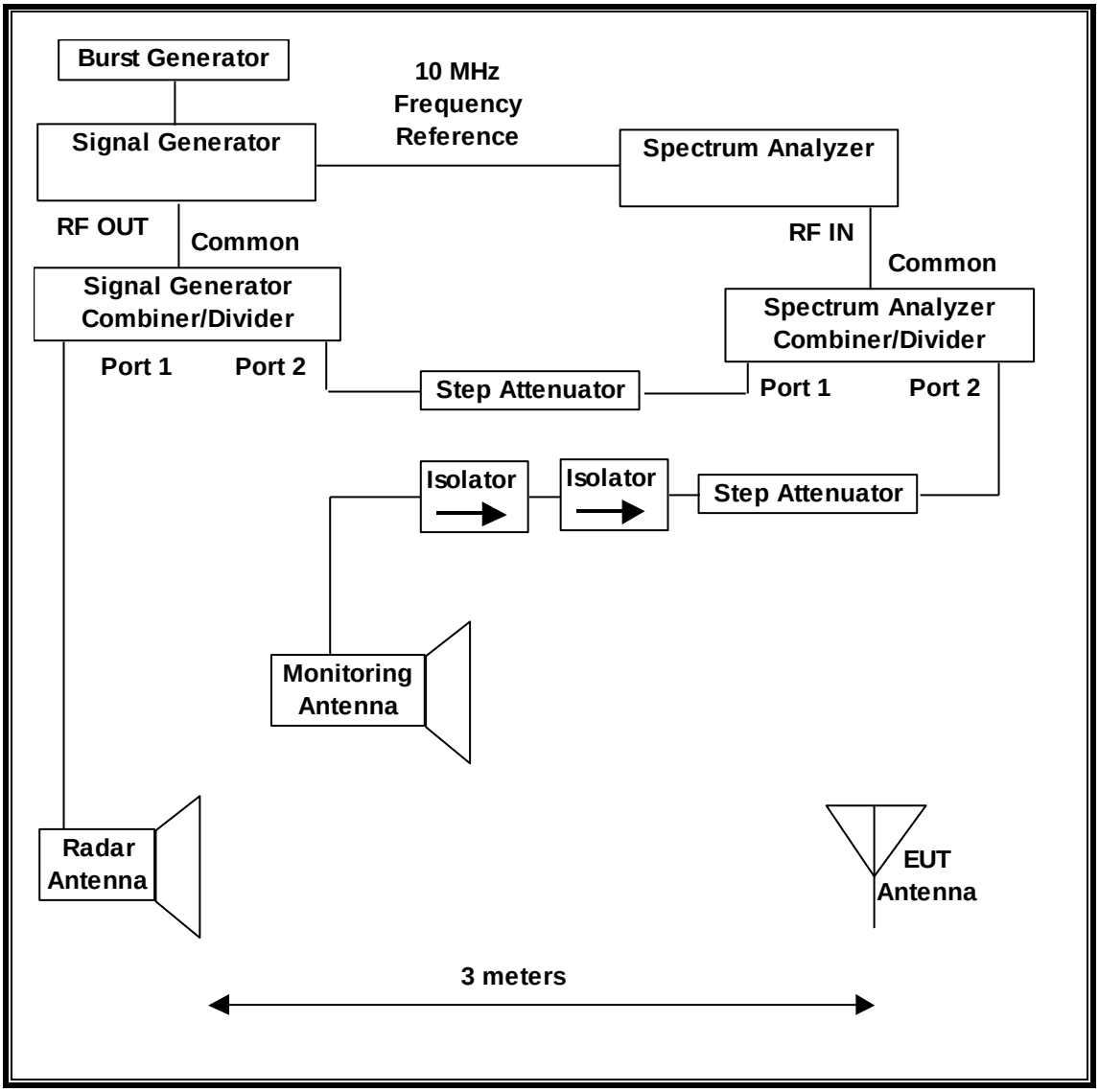
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

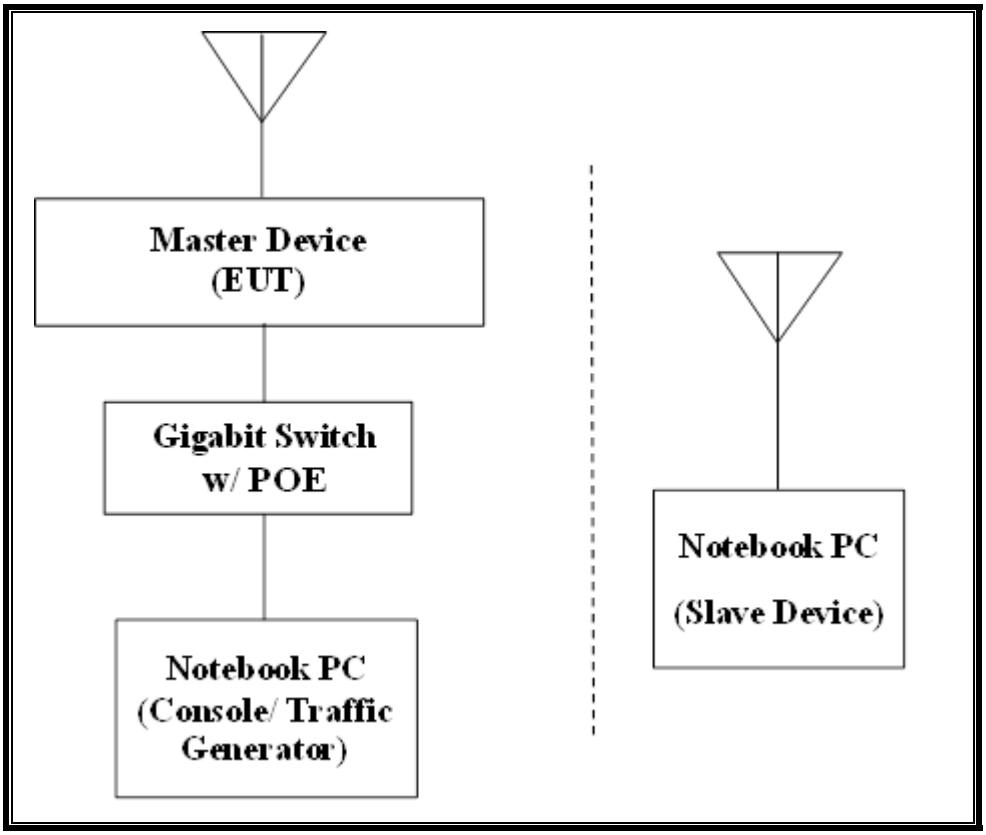
5.1.3. TEST AND MEASUREMENT SOFTWARE

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 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. 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 (Console/Traffic Generator)	Apple	A1502	C02NT1VTG3QR	DoC
AC Adapter (Consoler PC)	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.

The highest power level within these bands is 29.86 dBm EIRP in the 5250-5350 MHz band and 29.84 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 5.34 dBi, 5.71 dBi, and 5.5 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-Laa1d571eM-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-60052010. The minimum antenna gain for the Master Device is 5.34 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

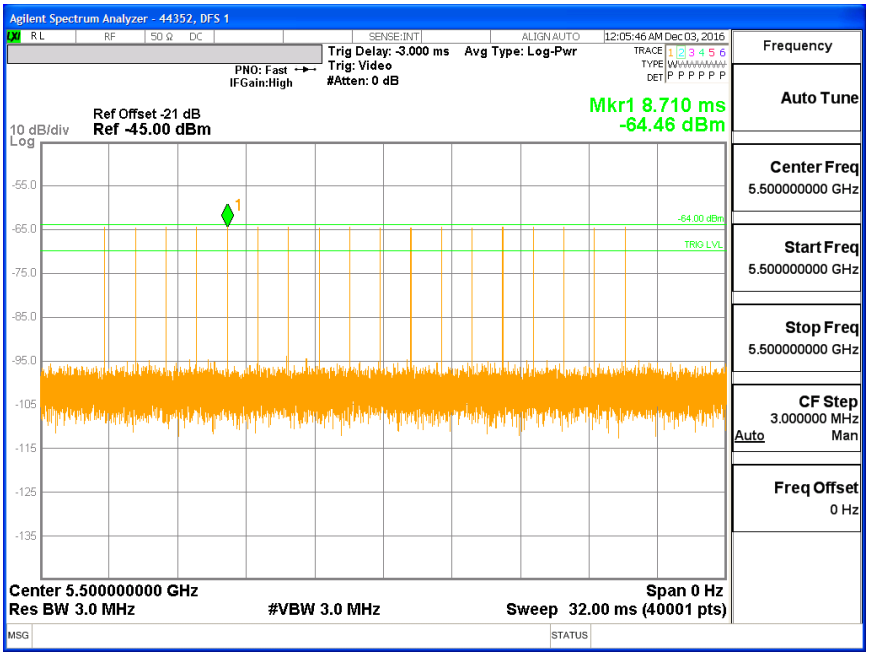
5.2.1. TEST CHANNEL

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

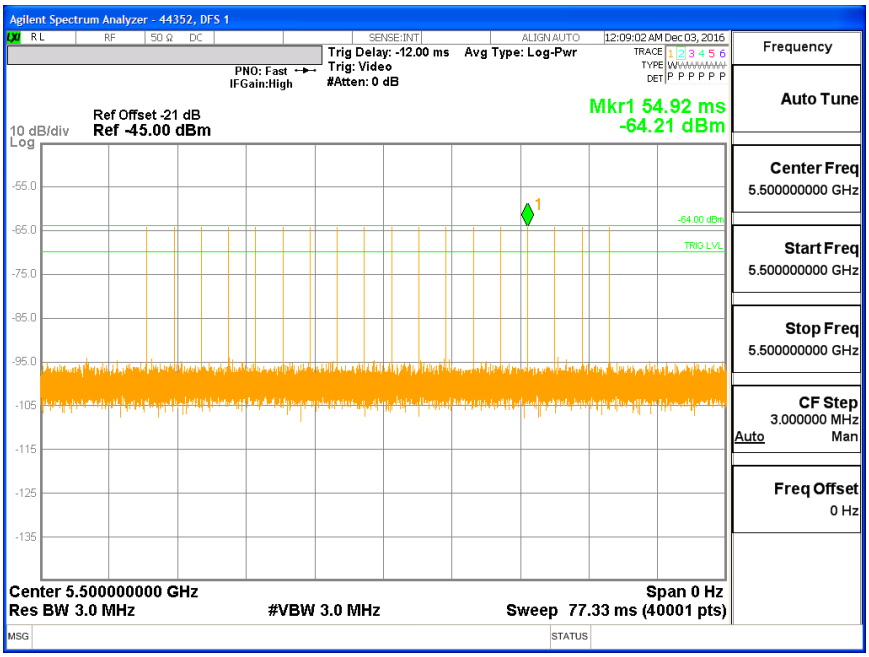
5.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

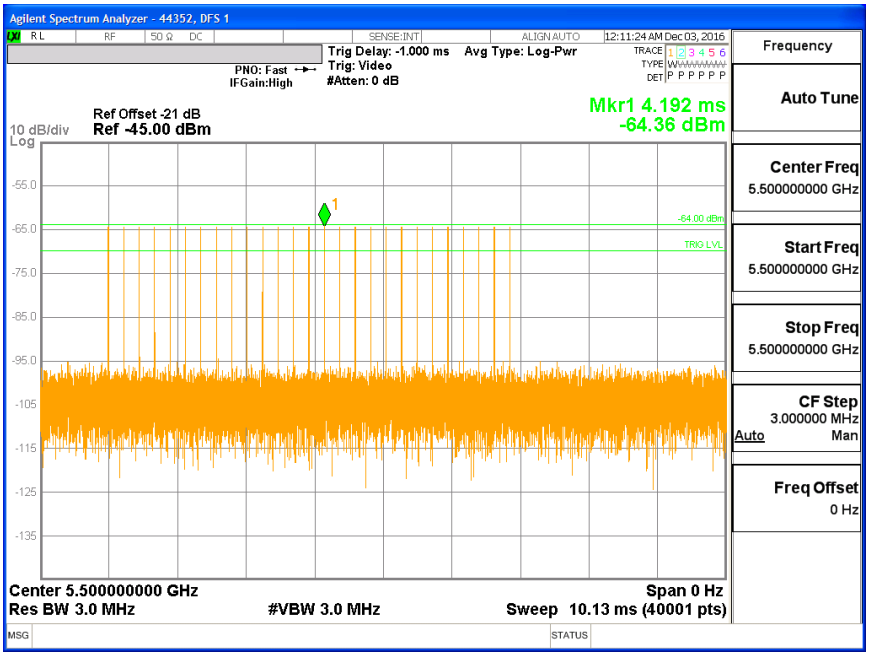
SHORT PULSE RADAR TYPE 0



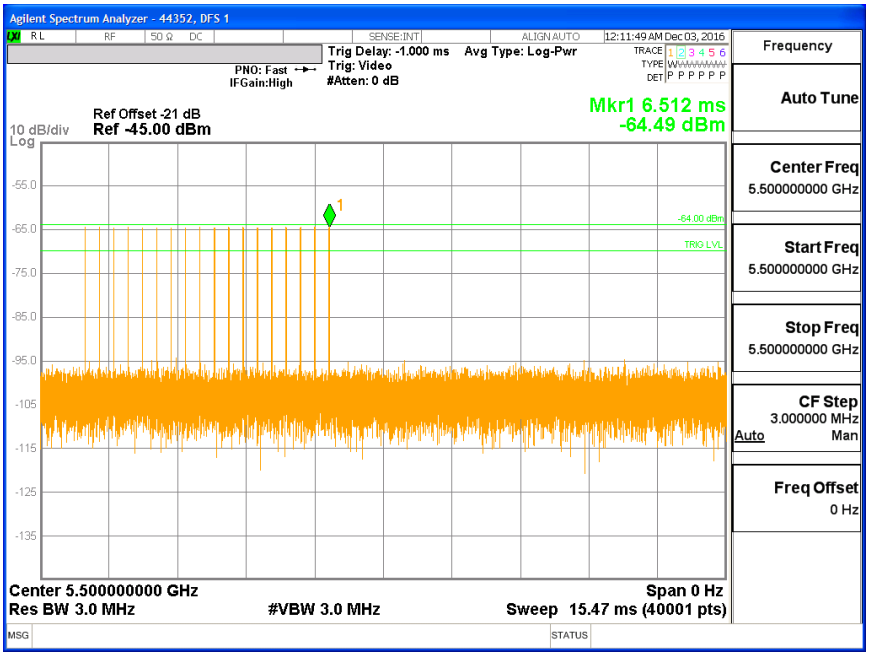
SAMPLE OF RADAR TYPE 1



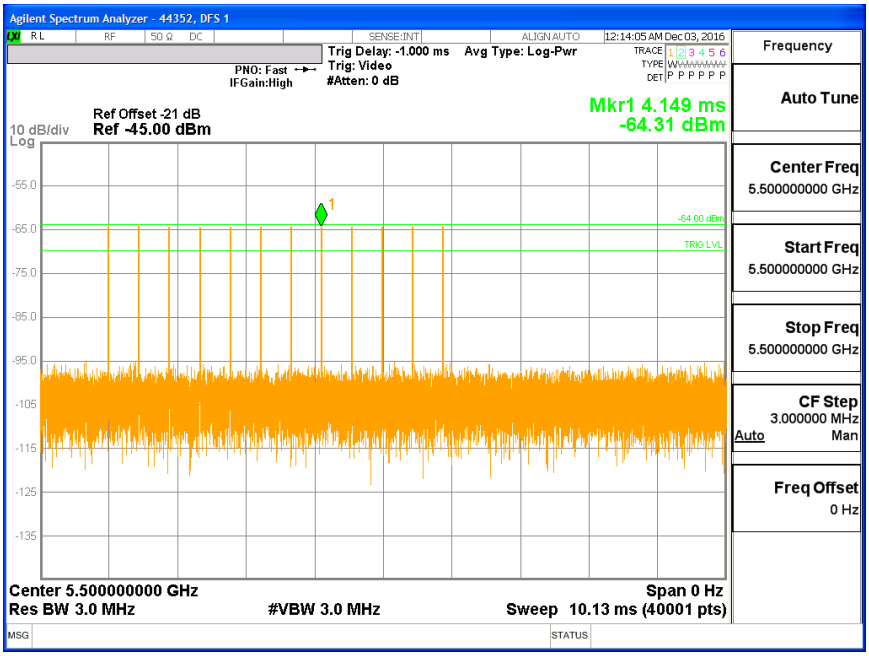
SAMPLE OF RADAR TYPE 2



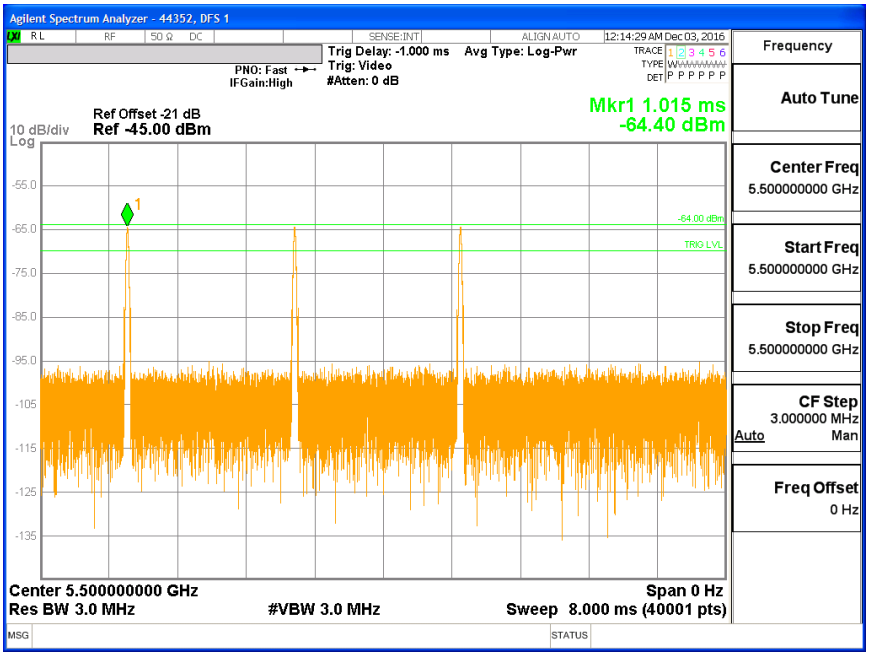
SAMPLE OF RADAR TYPE 3



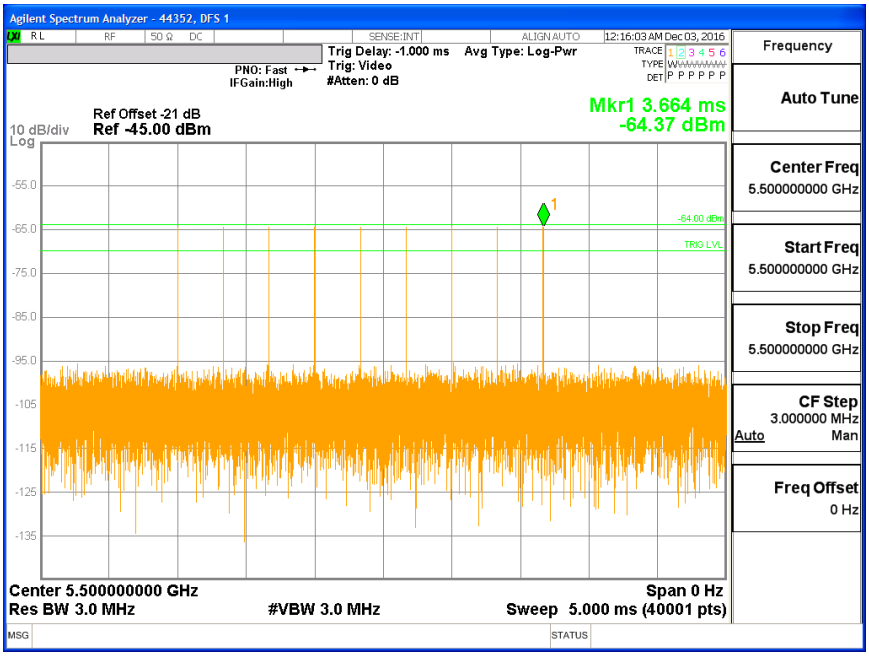
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

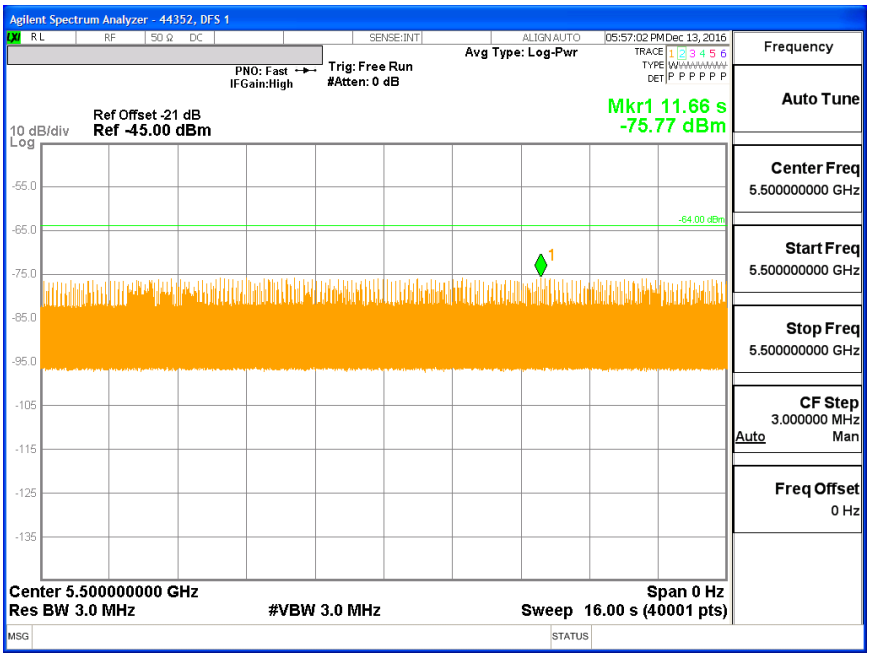


SINGLE BURST OF RADAR TYPE 6

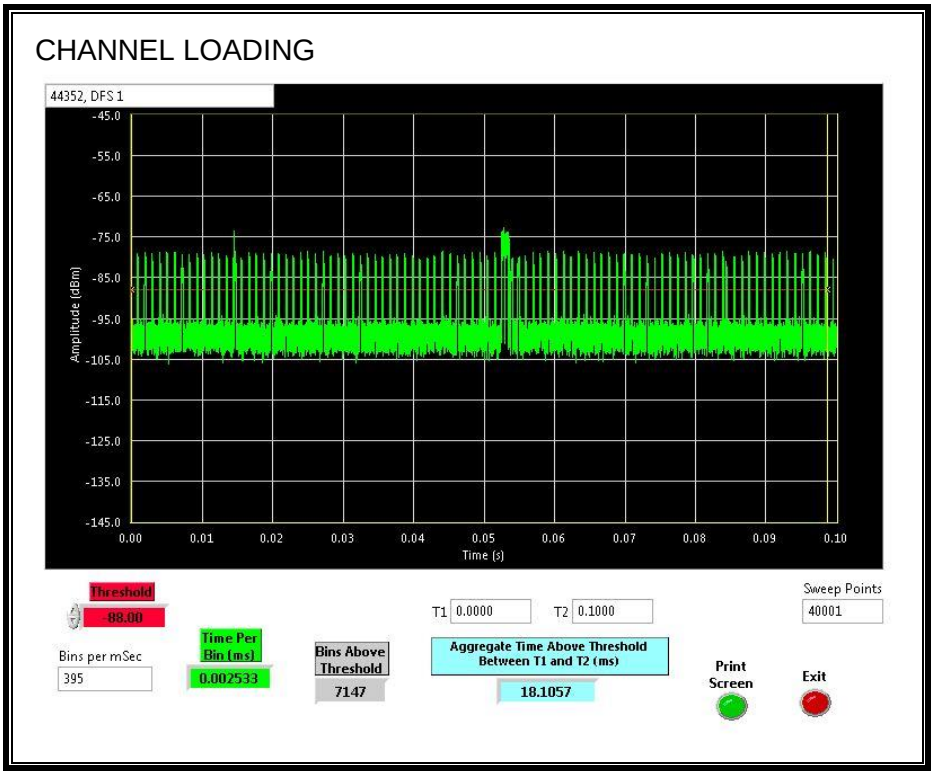


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.1057%

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)
30.29	206.8	176.5	116.5

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)
30.14	148.4	118.3	1.7

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)
30.23	204.9	174.7	58.2

QUALITATIVE RESULTS

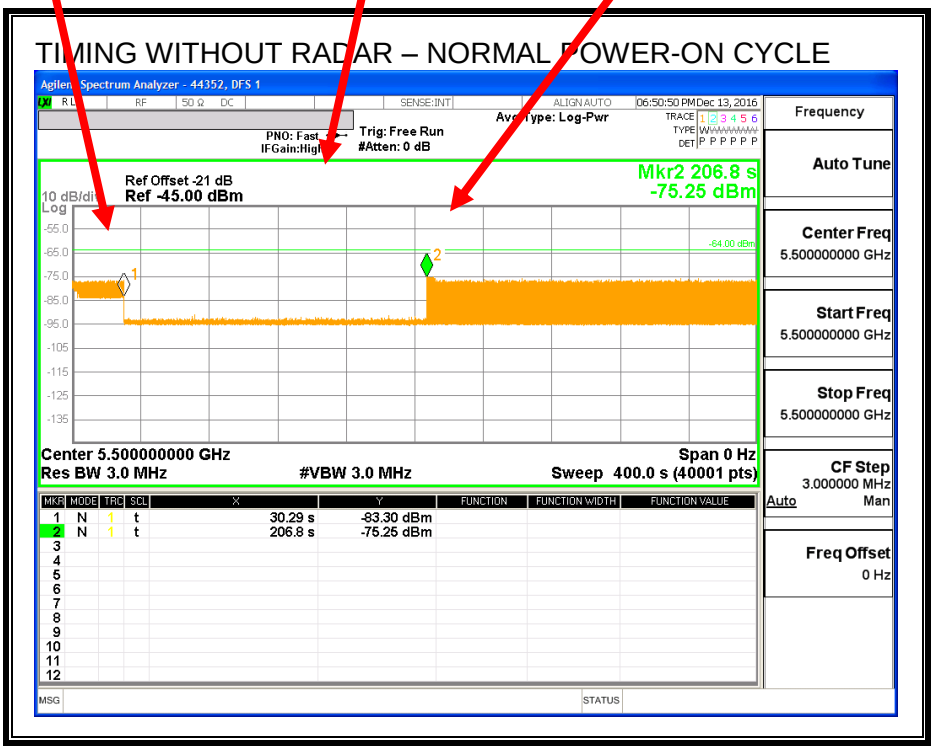
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



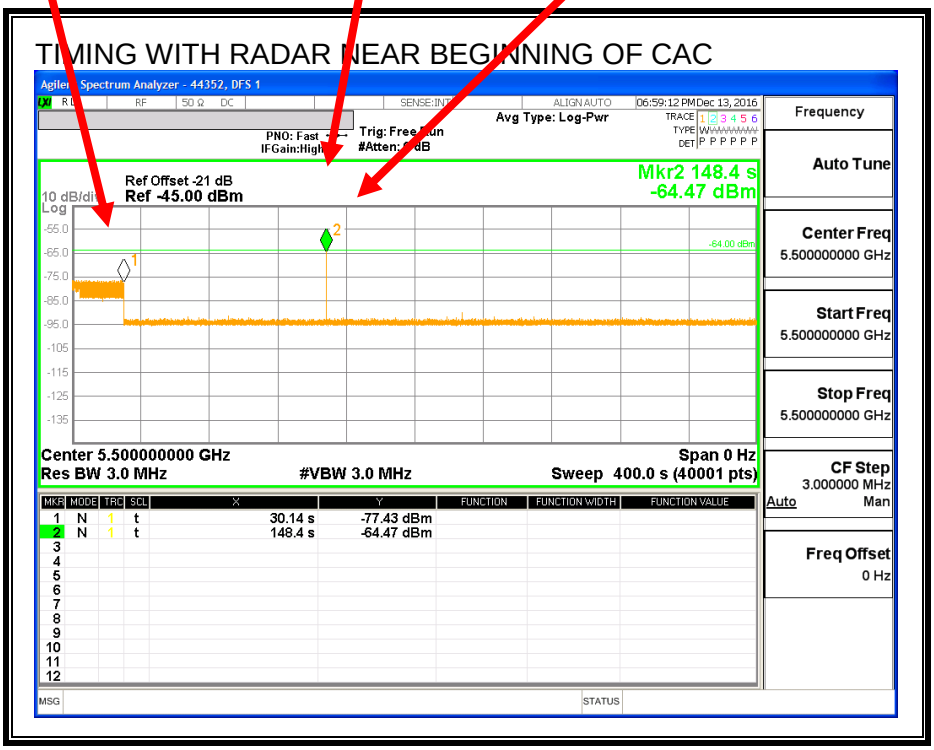
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



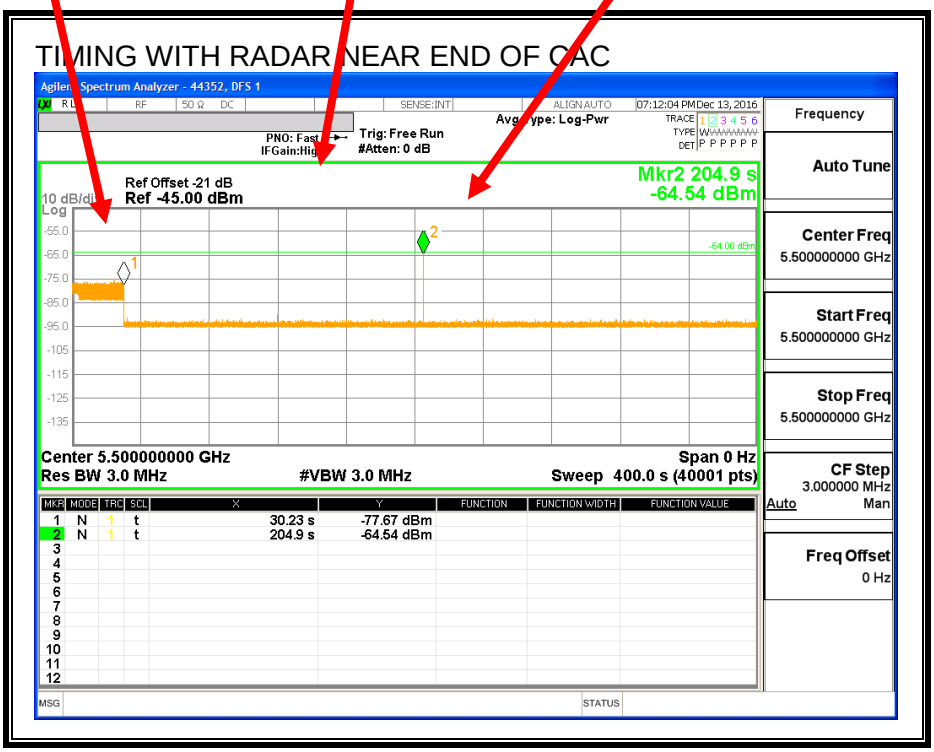
No EUT transmissions were observed after the radar signal.

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)

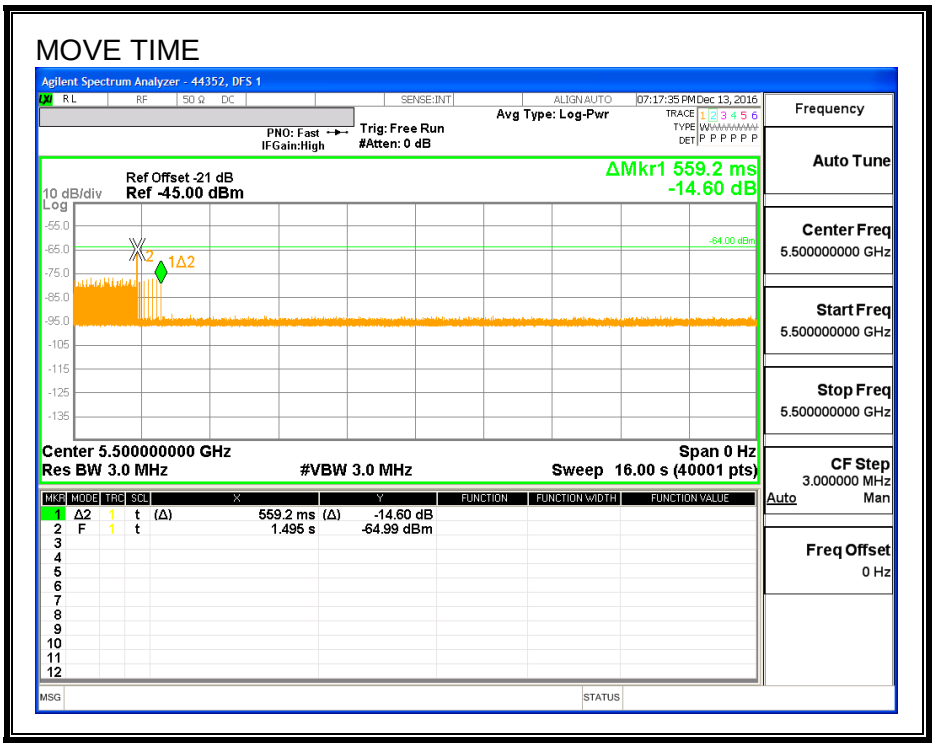
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.559	10

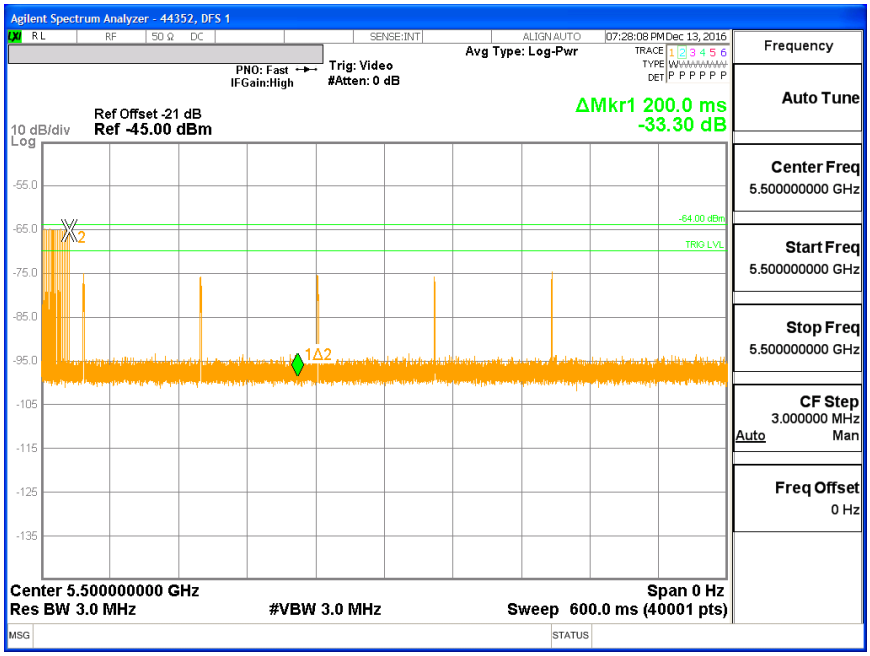
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
4.0	60

MOVE TIME



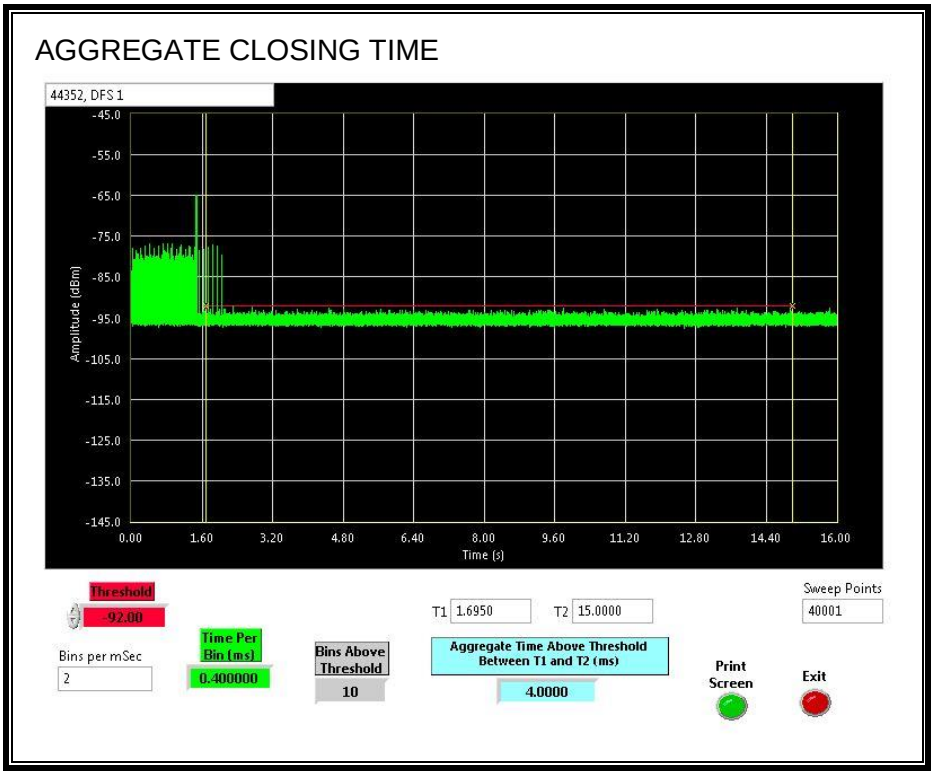
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



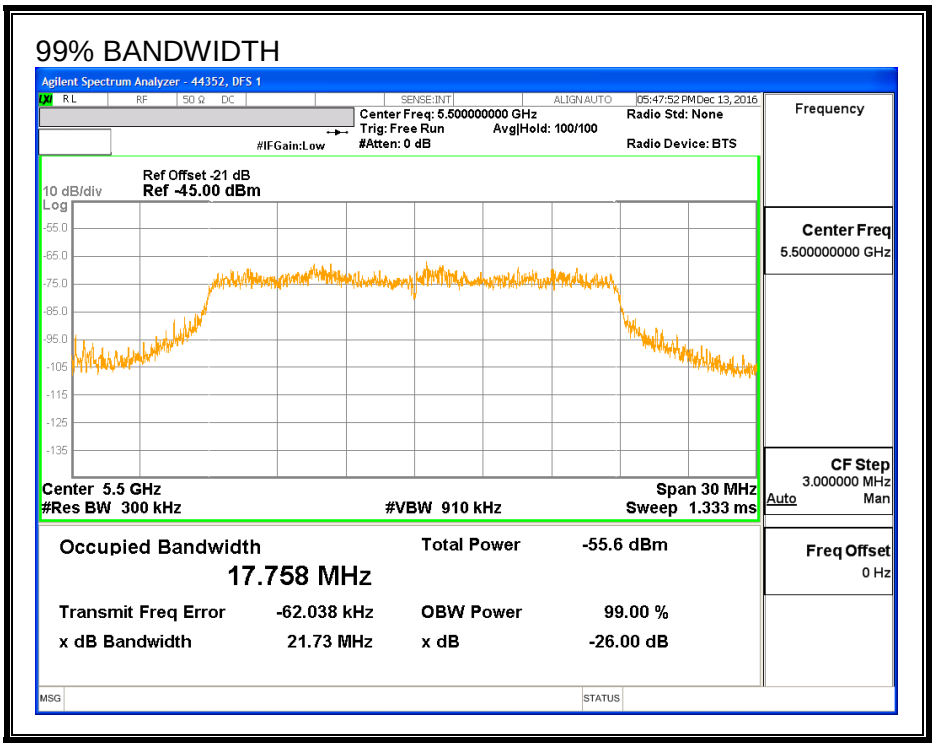
LONG PULSE CHANNEL MOVE TIME

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	17.758	112.6	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	5492		17.76	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5510	5492	5508	17.76	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5510	5492	5508	17.76	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	100.00	60	Pass	5490	5510	5492	5508	17.76	DFS 1	44352	Version 3.0
Aggregate		100.00	80	Pass								
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	5492	5508	17.76	DFS 1	44352	Version 3.0
FCC Hopping Type 6	42	97.62	70	Pass	5490	5510	5492	5508	17.76	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	758	70	A	5500	Yes
1003	1	898	59	A	5500	Yes
1004	1	698	76	A	5500	Yes
1005	1	858	62	A	5500	Yes
1006	1	658	81	A	5500	Yes
1007	1	638	83	A	5500	Yes
1008	1	918	58	A	5500	Yes
1009	1	778	68	A	5500	Yes
1010	1	598	89	A	5500	Yes
1011	1	538	99	A	5500	Yes
1012	1	678	78	A	5500	Yes
1013	1	618	86	A	5500	Yes
1014	1	718	74	A	5500	Yes
1015	1	938	57	A	5500	Yes
1016	1	3034	18	B	5500	Yes
1017	1	989	54	B	5500	Yes
1018	1	1140	47	B	5500	Yes
1019	1	1772	30	B	5500	Yes
1020	1	857	62	B	5500	Yes
1021	1	1619	33	B	5500	Yes
1022	1	2187	25	B	5500	Yes
1023	1	530	100	B	5500	Yes
1024	1	1228	43	B	5500	Yes
1025	1	1054	51	B	5500	Yes
1026	1	1881	29	B	5500	Yes
1027	1	1837	29	B	5500	Yes
1028	1	1599	34	B	5500	Yes
1029	1	1684	32	B	5500	Yes
1030	1	1575	34	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	2.7	228	27	5500	Yes
2002	1.9	225	23	5500	Yes
2003	2.6	158	29	5500	Yes
2004	3.9	203	29	5500	Yes
2005	3	220	26	5500	Yes
2006	2.6	150	23	5500	Yes
2007	3.7	172	26	5500	Yes
2008	1.6	187	24	5500	Yes
2009	1.1	174	24	5500	Yes
2010	3.3	194	26	5500	Yes
2011	2.9	185	23	5500	Yes
2012	1.2	171	28	5500	Yes
2013	3.3	167	26	5500	Yes
2014	4	156	25	5500	Yes
2015	2.1	199	27	5500	Yes
2016	3	155	23	5500	Yes
2017	1.4	202	25	5500	Yes
2018	4.7	162	28	5500	Yes
2019	1.3	213	27	5500	Yes
2020	4.8	177	24	5500	Yes
2021	1.7	194	23	5500	Yes
2022	1.3	205	27	5500	Yes
2023	4.6	227	24	5500	Yes
2024	4.4	161	25	5500	Yes
2025	3.9	230	29	5500	Yes
2026	2	168	23	5500	Yes
2027	1.6	160	28	5500	Yes
2028	2.1	226	26	5500	Yes
2029	2	222	24	5500	Yes
2030	2.7	212	23	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	9.9	324	18	5500	Yes
3002	6.7	438	18	5500	Yes
3003	7.3	333	18	5500	Yes
3004	8.4	459	17	5500	Yes
3005	9.1	367	17	5500	Yes
3006	8.5	255	18	5500	Yes
3007	9.5	442	18	5500	Yes
3008	9.1	344	17	5500	Yes
3009	8.3	410	18	5500	Yes
3010	8.1	457	16	5500	Yes
3011	7.6	419	17	5500	Yes
3012	9.8	479	18	5500	Yes
3013	9.4	453	17	5500	Yes
3014	9.9	408	16	5500	Yes
3015	9.8	277	17	5500	Yes
3016	6.4	496	18	5500	Yes
3017	8.6	496	17	5500	Yes
3018	9.5	359	17	5500	Yes
3019	6	253	18	5500	Yes
3020	7.1	380	16	5500	Yes
3021	7.8	288	16	5500	Yes
3022	7.2	309	17	5500	Yes
3023	8.2	363	17	5500	Yes
3024	7.8	264	16	5500	Yes
3025	7	464	17	5500	Yes
3026	6.8	378	18	5500	Yes
3027	6.3	339	16	5500	Yes
3028	8.5	399	17	5500	Yes
3029	6.2	256	16	5500	Yes
3030	8.6	328	18	5500	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	12.3	449	12	5500	Yes
4002	18.1	417	16	5500	Yes
4003	14	299	12	5500	Yes
4004	16	279	12	5500	Yes
4005	17.2	425	16	5500	Yes
4006	19.6	301	16	5500	Yes
4007	12.3	342	15	5500	Yes
4008	20	481	13	5500	Yes
4009	13	284	12	5500	Yes
4010	12.1	436	13	5500	Yes
4011	19.6	384	13	5500	Yes
4012	19.1	298	14	5500	Yes
4013	17.9	260	16	5500	Yes
4014	13.7	453	12	5500	Yes
4015	17.8	427	13	5500	Yes
4016	14	500	14	5500	Yes
4017	18.6	369	15	5500	Yes
4018	15.2	337	15	5500	Yes
4019	11.2	470	16	5500	Yes
4020	17.9	451	15	5500	Yes
4021	14.4	346	14	5500	Yes
4022	16.8	472	14	5500	Yes
4023	18.5	262	14	5500	Yes
4024	17.1	402	16	5500	Yes
4025	19.3	455	16	5500	Yes
4026	18.3	356	16	5500	Yes
4027	16.7	305	16	5500	Yes
4028	12	352	12	5500	Yes
4029	19.9	431	15	5500	Yes
4030	19.9	374	16	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	5494	Yes
12	5500	Yes
13	5496	Yes
14	5497	Yes
15	5494	Yes
16	5496	Yes
17	5494	Yes
18	5500	Yes
19	5496	Yes
20	5497	Yes
21	5500	Yes
22	5504	Yes
23	5503	Yes
24	5504	Yes
25	5501	Yes
26	5504	Yes
27	5501	Yes
28	5504	Yes
29	5501	Yes
30	5504	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	294	5490	5	Yes
2	769	5491	3	Yes
3	1244	5492	6	Yes
4	1719	5493	4	Yes
5	2194	5494	4	Yes
6	2669	5495	5	Yes
7	3144	5496	3	Yes
8	3619	5497	5	Yes
9	4094	5498	4	Yes
10	4569	5499	2	Yes
11	5044	5500	2	Yes
12	5519	5501	5	Yes
13	5994	5502	3	Yes
14	6469	5503	5	Yes
15	6944	5504	4	Yes
16	7419	5505	4	Yes
17	7894	5506	2	Yes
18	8369	5507	2	Yes
19	8844	5508	4	Yes
20	9319	5509	6	Yes
21	9794	5510	3	Yes
22	10269	5490	4	Yes
23	10744	5491	3	Yes
24	11219	5492	4	Yes
25	11694	5493	3	Yes
26	12169	5494	4	Yes
27	12644	5495	1	Yes
28	13119	5496	4	Yes
29	13594	5497	3	No
30	14069	5498	4	Yes
31	14544	5499	6	Yes
32	15019	5500	3	Yes
33	15494	5501	4	Yes
34	15969	5502	7	Yes
35	16444	5503	4	Yes
36	16919	5504	3	Yes
37	17394	5505	4	Yes
38	17869	5506	4	Yes
39	18344	5507	3	Yes
40	18819	5508	3	Yes
41	19294	5509	3	Yes
42	19769	5510	5	Yes

5.3. RESULTS FOR 40 MHz BANDWIDTH

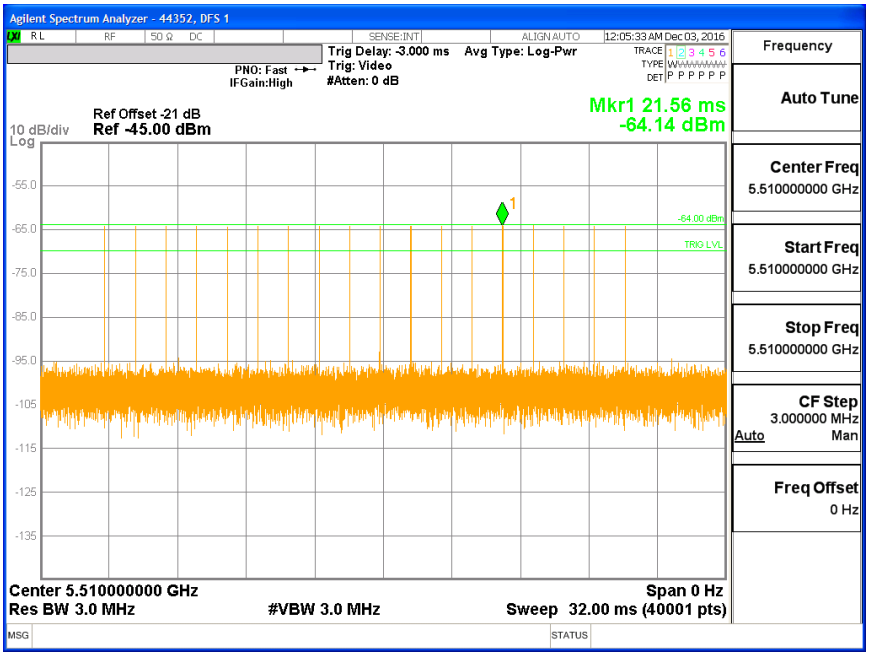
5.3.1. TEST CHANNEL

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

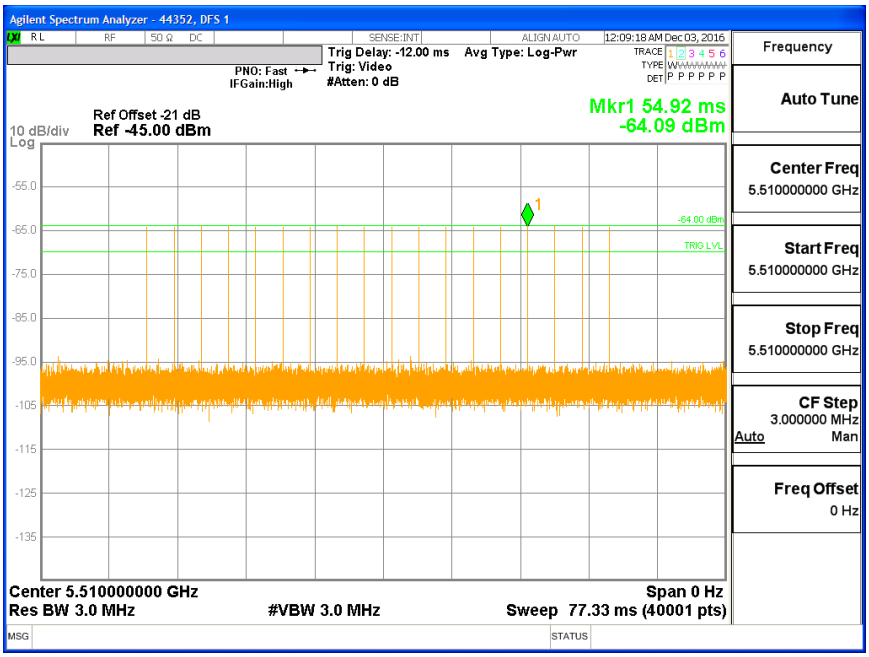
5.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

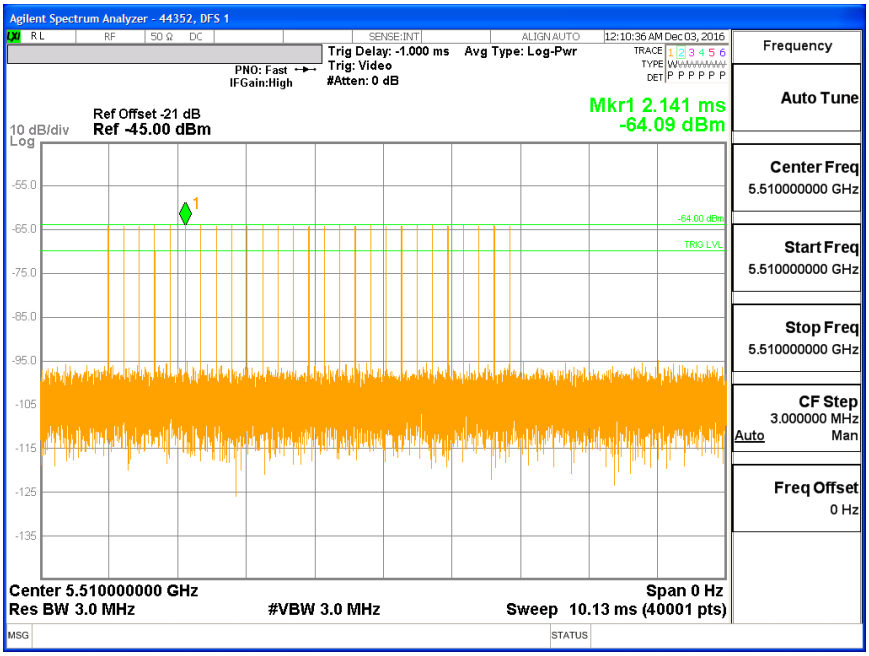
SHORT PULSE RADAR TYPE 0



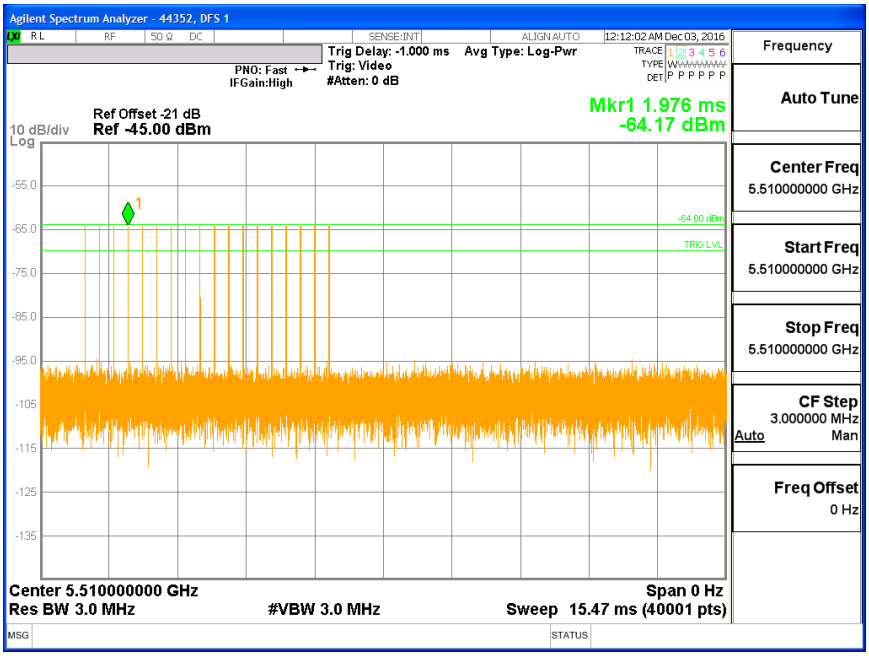
SAMPLE OF RADAR TYPE 1



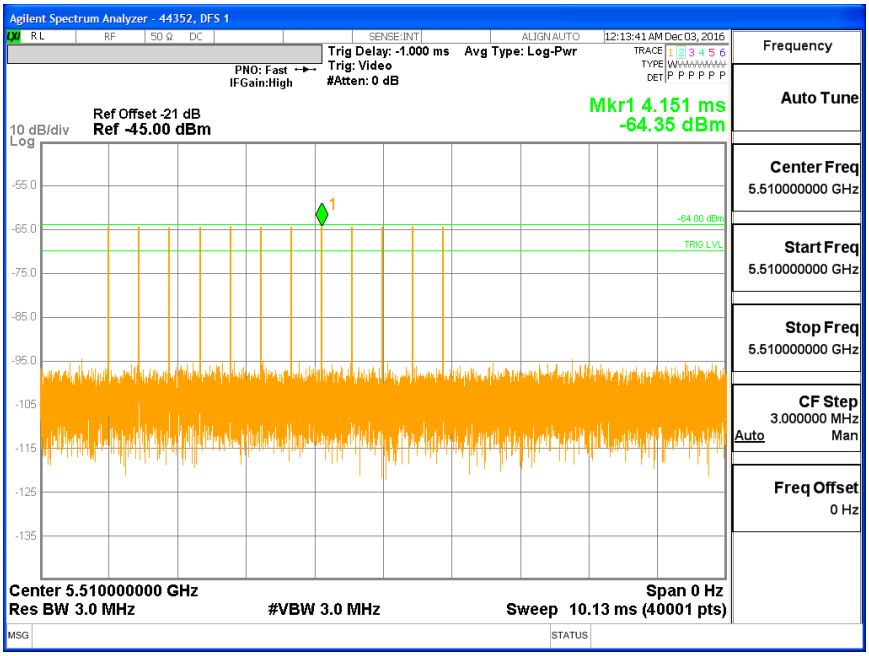
SAMPLE OF RADAR TYPE 2



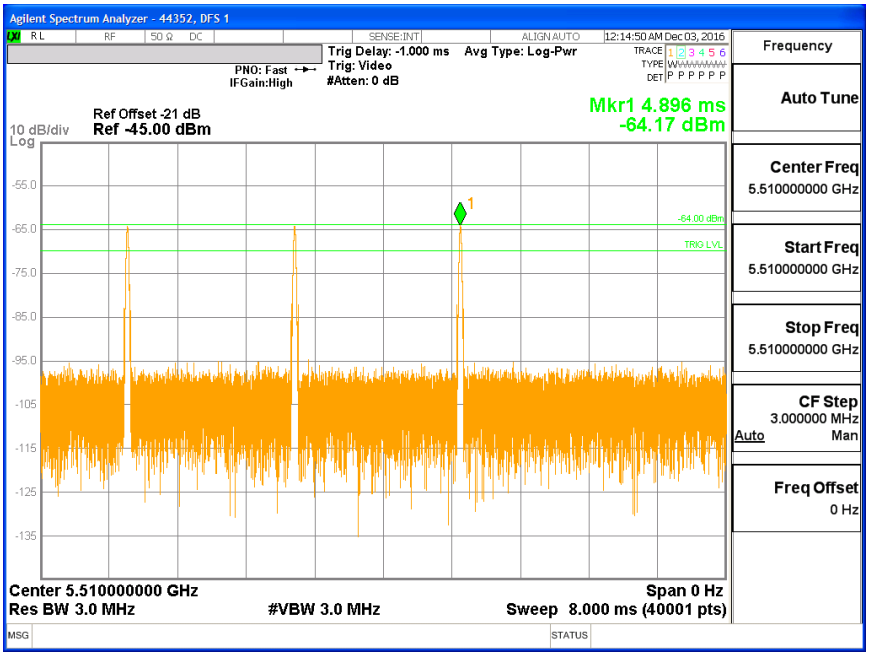
SAMPLE OF RADAR TYPE 3



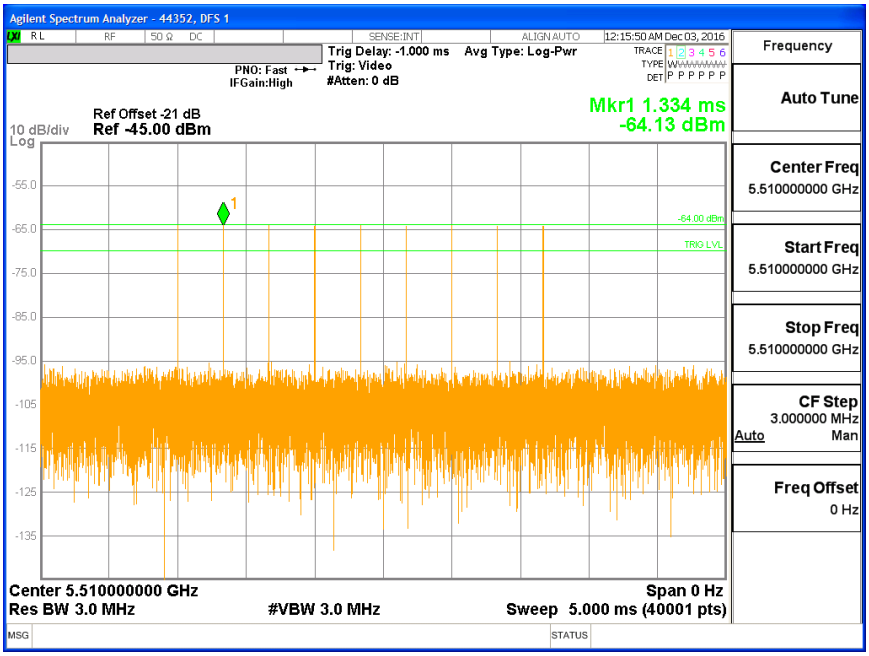
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

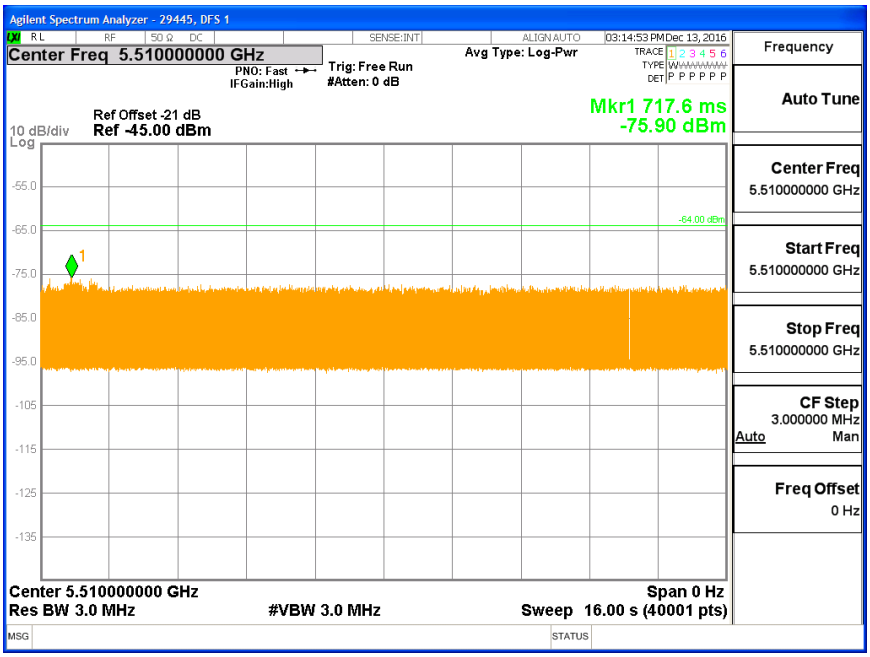


SINGLE BURST OF RADAR TYPE 6

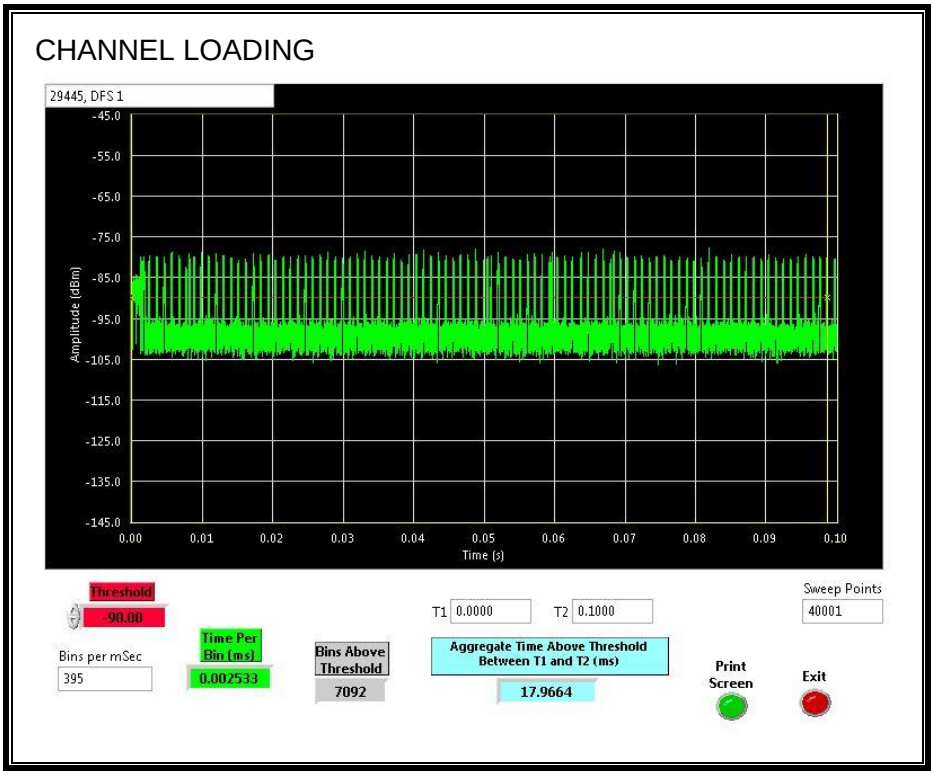


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.9664%

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)
29.89	206.6	176.7	116.7

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)
30.44	147.9	117.5	0.8

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)
30.43	205.0	174.6	57.9

QUALITATIVE RESULTS

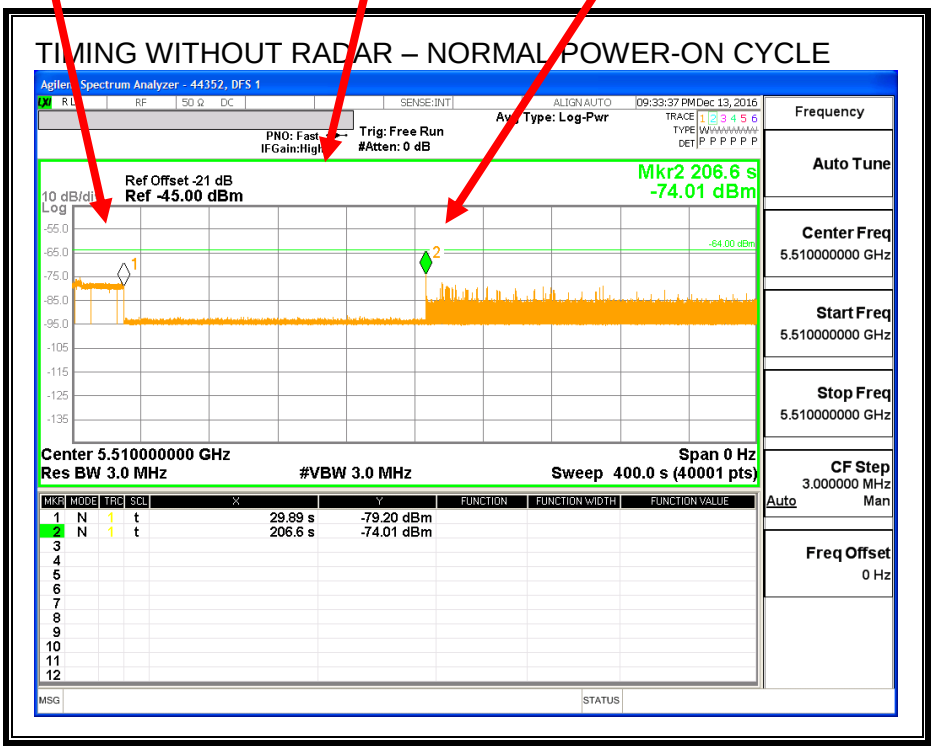
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

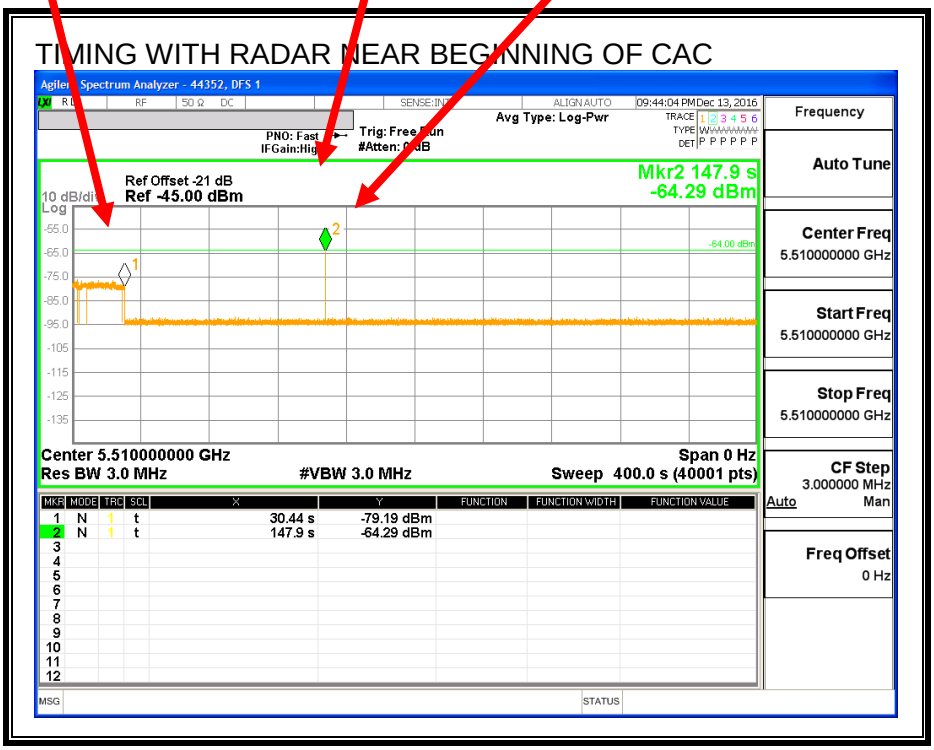
End of CAC
Traffic is Initiated



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



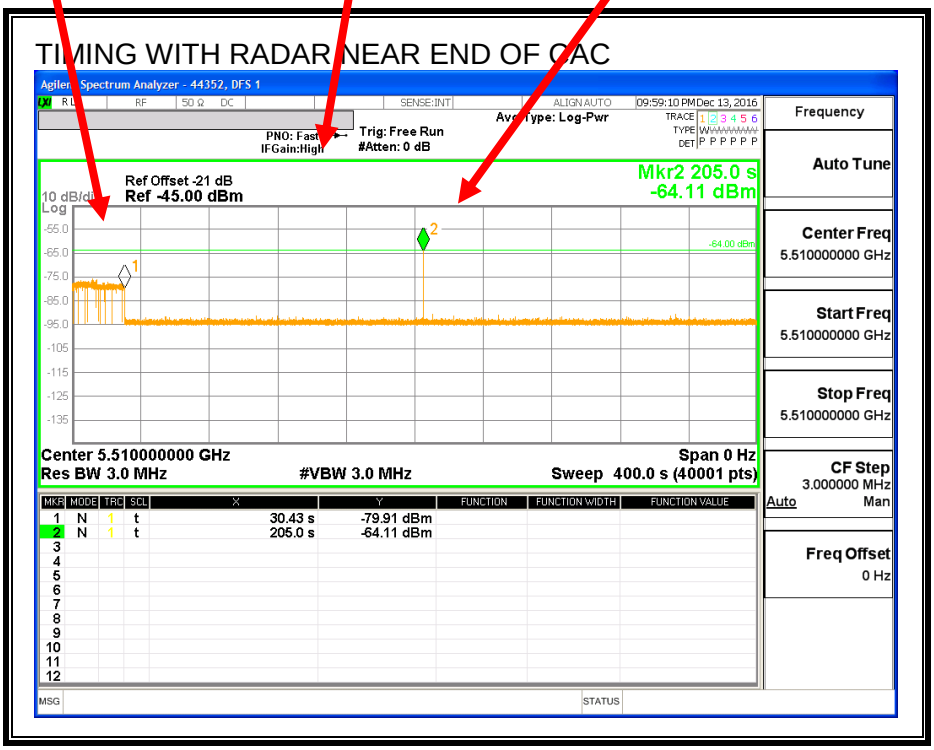
No EUT transmissions were observed after the radar signal.

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.

5.3.1. 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)

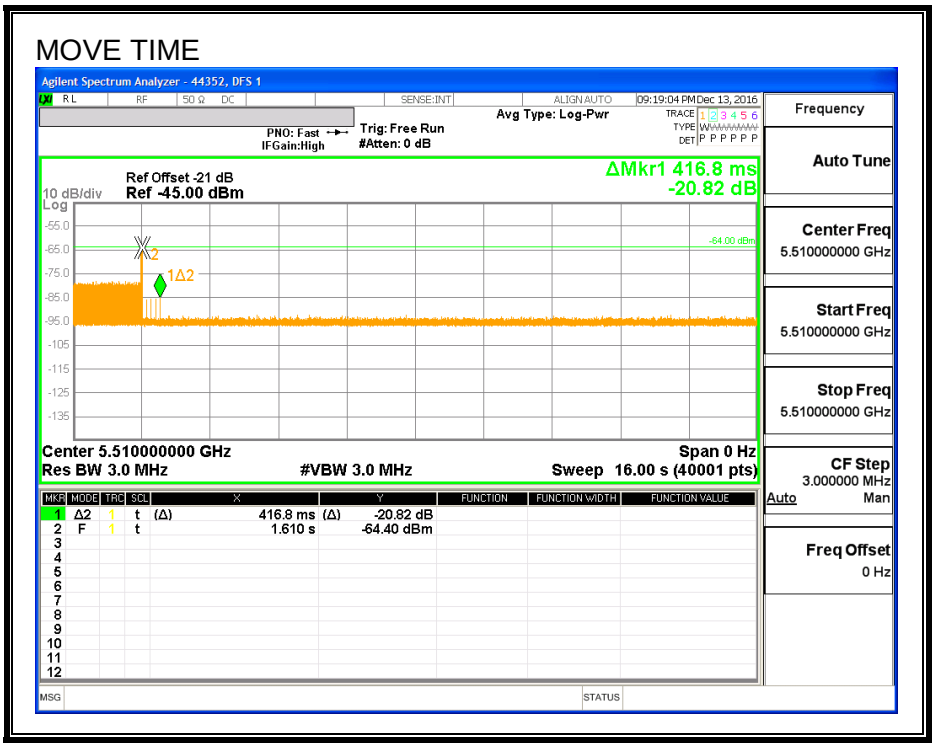
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.417	10

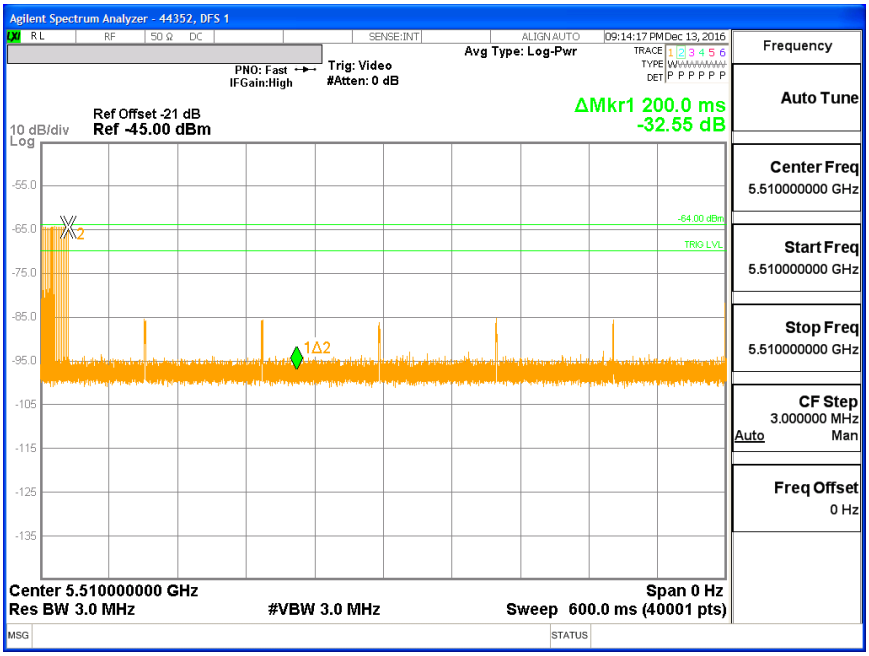
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
3.6	60

MOVE TIME



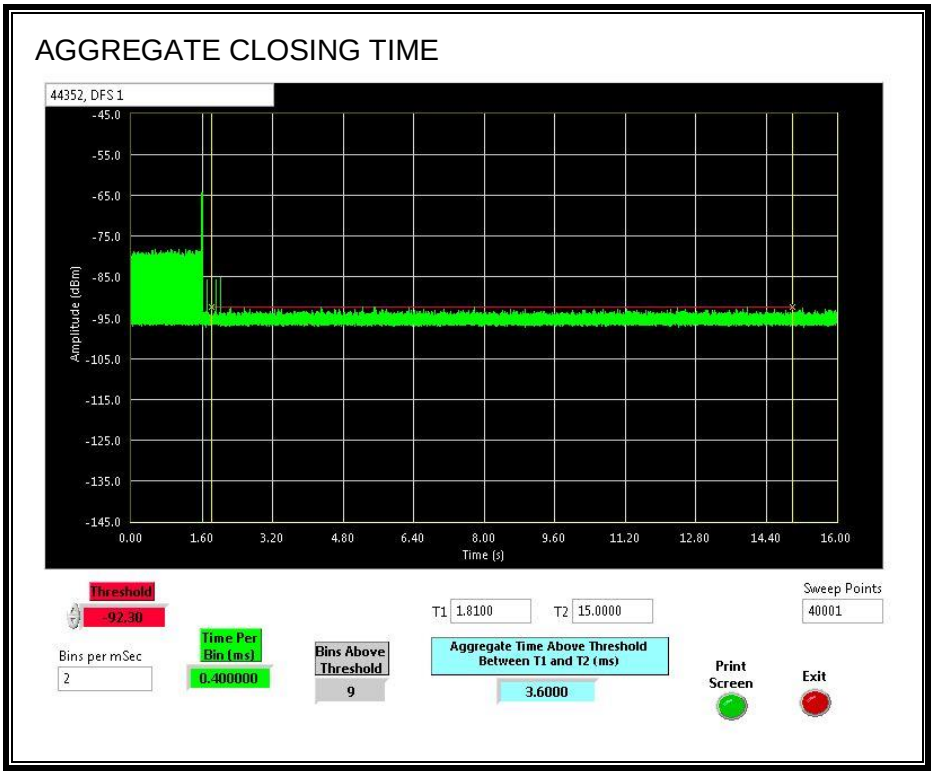
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

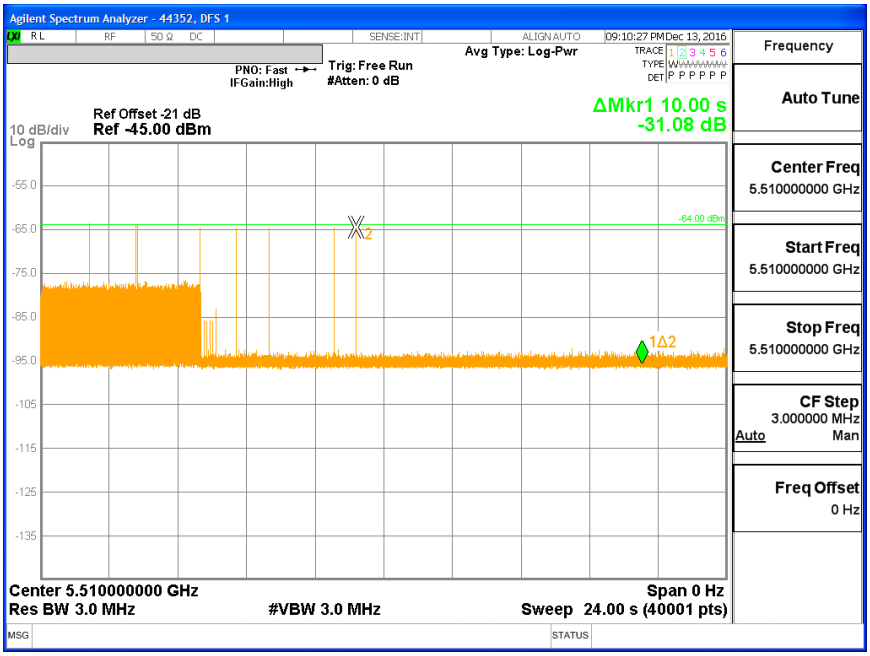
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

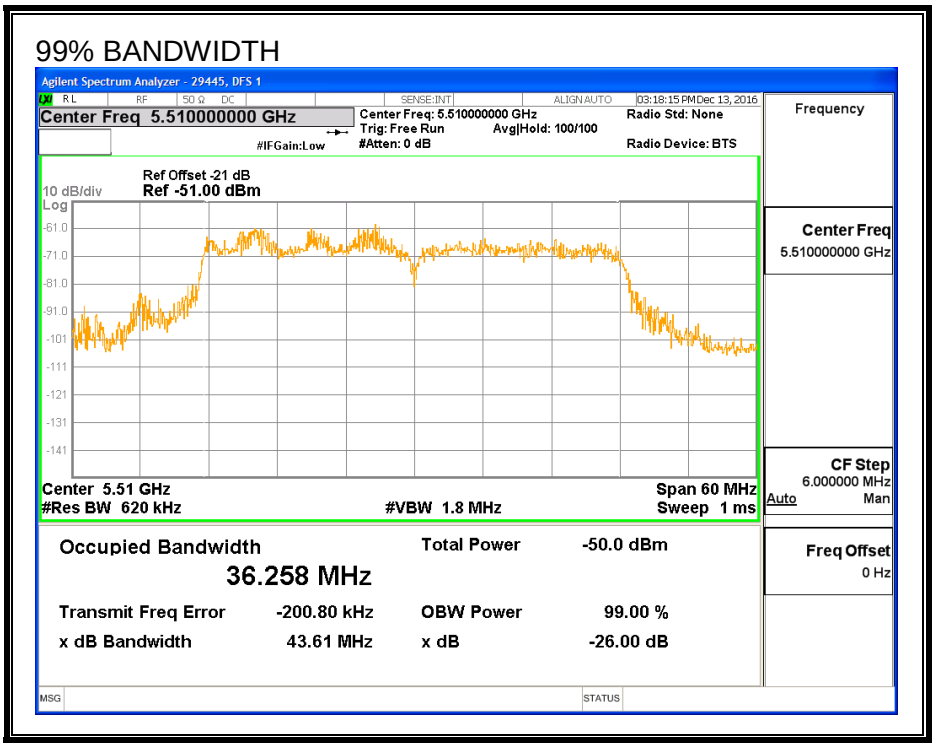
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



5.3.3. 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	5530	40	36.258	110.3	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		29445	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
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

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	100.00	60	Pass	5490	5530	36.26	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	80.00	60	Pass	5490	5530	36.26	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	90.00	60	Pass	5490	5530	36.26	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5530	36.26	DFS 1	29445	Version 3.0
Aggregate		90.00	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	36.26	DFS 1	29445	Version 3.0
FCC Hopping Type 6	41	87.81	70	Pass	5490	5530	36.26	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	Yes
1002	1	758	70	A	5510	Yes
1003	1	898	59	A	5510	Yes
1004	1	698	76	A	5510	Yes
1005	1	858	62	A	5510	Yes
1006	1	658	81	A	5510	Yes
1007	1	638	83	A	5510	Yes
1008	1	918	58	A	5510	Yes
1009	1	778	68	A	5510	Yes
1010	1	598	89	A	5510	Yes
1011	1	538	99	A	5510	Yes
1012	1	678	78	A	5510	Yes
1013	1	618	86	A	5510	Yes
1014	1	718	74	A	5510	Yes
1015	1	938	57	A	5510	Yes
1016	1	3034	18	B	5510	Yes
1017	1	989	54	B	5510	Yes
1018	1	1140	47	B	5510	Yes
1019	1	1772	30	B	5510	Yes
1020	1	857	62	B	5510	Yes
1021	1	1619	33	B	5510	Yes
1022	1	2187	25	B	5510	Yes
1023	1	530	100	B	5510	Yes
1024	1	1228	43	B	5510	Yes
1025	1	1054	51	B	5510	Yes
1026	1	1881	29	B	5510	Yes
1027	1	1837	29	B	5510	Yes
1028	1	1599	34	B	5510	Yes
1029	1	1684	32	B	5510	Yes
1030	1	1575	34	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	2.7	228	27	5510	Yes
2002	1.9	225	23	5510	Yes
2003	2.6	158	29	5510	No
2004	3.9	203	29	5510	No
2005	3	220	26	5510	Yes
2006	2.6	150	23	5510	Yes
2007	3.7	172	26	5510	Yes
2008	1.6	187	24	5510	Yes
2009	1.1	174	24	5510	Yes
2010	3.3	194	26	5510	Yes
2011	2.9	185	23	5510	Yes
2012	1.2	171	28	5510	Yes
2013	3.3	167	26	5510	Yes
2014	4	156	25	5510	No
2015	2.1	199	27	5510	Yes
2016	3	155	23	5510	Yes
2017	1.4	202	25	5510	Yes
2018	4.7	162	28	5510	Yes
2019	1.3	213	27	5510	Yes
2020	4.8	177	24	5510	No
2021	1.7	194	23	5510	No
2022	1.3	205	27	5510	Yes
2023	4.6	227	24	5510	Yes
2024	4.4	161	25	5510	No
2025	3.9	230	29	5510	Yes
2026	2	168	23	5510	Yes
2027	1.6	160	28	5510	Yes
2028	2.1	226	26	5510	Yes
2029	2	222	24	5510	Yes
2030	2.7	212	23	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	9.9	324	18	5510	Yes
3002	6.7	438	18	5510	Yes
3003	7.3	333	18	5510	Yes
3004	8.4	459	17	5510	Yes
3005	9.1	367	17	5510	Yes
3006	8.5	255	18	5510	Yes
3007	9.5	442	18	5510	Yes
3008	9.1	344	17	5510	Yes
3009	8.3	410	18	5510	Yes
3010	8.1	457	16	5510	Yes
3011	7.6	419	17	5510	Yes
3012	9.8	479	18	5510	Yes
3013	9.4	453	17	5510	Yes
3014	9.9	408	16	5510	Yes
3015	9.8	277	17	5510	Yes
3016	6.4	496	18	5510	No
3017	8.6	496	17	5510	Yes
3018	9.5	359	17	5510	Yes
3019	6	253	18	5510	Yes
3020	7.1	380	16	5510	No
3021	7.8	288	16	5510	Yes
3022	7.2	309	17	5510	Yes
3023	8.2	363	17	5510	No
3024	7.8	264	16	5510	Yes
3025	7	464	17	5510	Yes
3026	6.8	378	18	5510	Yes
3027	6.3	339	16	5510	Yes
3028	8.5	399	17	5510	Yes
3029	6.2	256	16	5510	Yes
3030	8.6	328	18	5510	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	12.3	449	12	5510	Yes
4002	18.1	417	16	5510	Yes
4003	14	299	12	5510	Yes
4004	16	279	12	5510	Yes
4005	17.2	425	16	5510	Yes
4006	19.6	301	16	5510	Yes
4007	12.3	342	15	5510	Yes
4008	20	481	13	5510	Yes
4009	13	284	12	5510	Yes
4010	12.1	436	13	5510	Yes
4011	19.6	384	13	5510	No
4012	19.1	298	14	5510	Yes
4013	17.9	260	16	5510	Yes
4014	13.7	453	12	5510	Yes
4015	17.8	427	13	5510	No
4016	14	500	14	5510	Yes
4017	18.6	369	15	5510	Yes
4018	15.2	337	15	5510	No
4019	11.2	470	16	5510	Yes
4020	17.9	451	15	5510	Yes
4021	14.4	346	14	5510	Yes
4022	16.8	472	14	5510	Yes
4023	18.5	262	14	5510	Yes
4024	17.1	402	16	5510	Yes
4025	19.3	455	16	5510	Yes
4026	18.3	356	16	5510	Yes
4027	16.7	305	16	5510	Yes
4028	12	352	12	5510	Yes
4029	19.9	431	15	5510	Yes
4030	19.9	374	16	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	5495	Yes
12	5500	Yes
13	5496	Yes
14	5497	Yes
15	5494	Yes
16	5496	Yes
17	5495	Yes
18	5500	Yes
19	5496	Yes
20	5497	Yes
21	5520	Yes
22	5523	Yes
23	5522	Yes
24	5524	Yes
25	5520	Yes
26	5524	Yes
27	5520	Yes
28	5524	Yes
29	5520	Yes
30	5524	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	205	5490	9	Yes
2	680	5491	9	Yes
3	1155	5492	7	Yes
4	1630	5493	5	Yes
5	2105	5494	8	Yes
6	2580	5495	9	Yes
7	3055	5496	8	Yes
8	3530	5497	9	Yes
9	4005	5498	7	Yes
10	4480	5499	14	Yes
11	4955	5500	9	Yes
12	5430	5501	12	Yes
13	5905	5502	7	Yes
14	6380	5503	7	Yes
15	6855	5504	7	Yes
16	7330	5505	9	Yes
17	7805	5506	10	Yes
18	8280	5507	6	Yes
19	8755	5508	7	Yes
20	9230	5509	4	Yes
21	9705	5510	10	Yes
22	10180	5511	8	Yes
23	10655	5512	8	Yes
24	11130	5513	5	No
25	11605	5514	12	No
26	12080	5515	5	Yes
27	12555	5516	8	Yes
28	13030	5517	8	Yes
29	13505	5518	4	No
30	13980	5519	11	Yes
31	14455	5520	9	Yes
32	14930	5521	7	No
33	15405	5522	10	Yes
34	15880	5523	8	No
35	16355	5524	8	Yes
36	16830	5525	9	Yes
37	17305	5526	8	Yes
38	17780	5527	7	Yes
39	18255	5528	5	Yes
40	18730	5529	7	Yes
41	19205	5530	10	Yes

5.4. RESULTS FOR 80 MHz BANDWIDTH

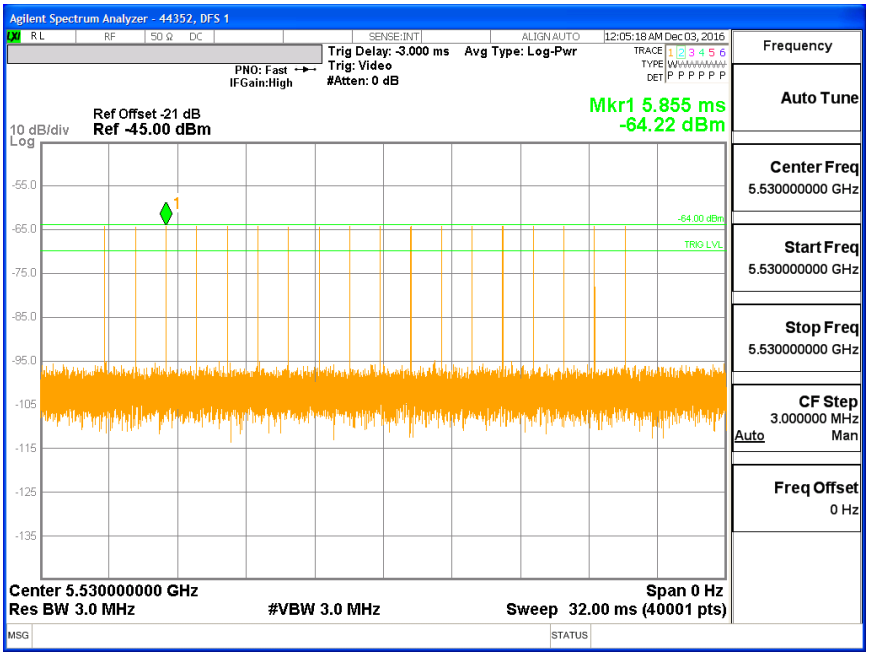
5.4.1. TEST CHANNEL

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

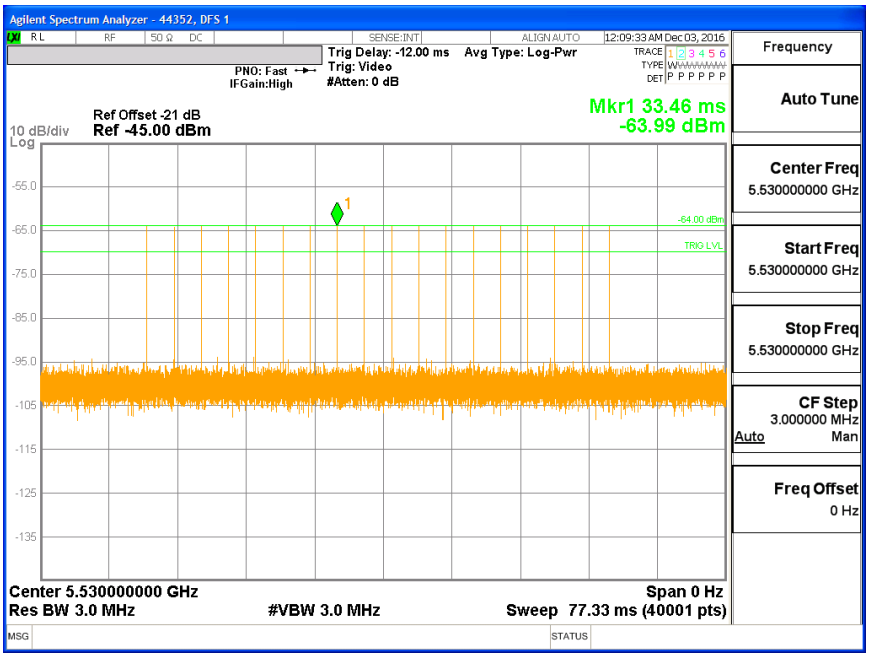
5.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

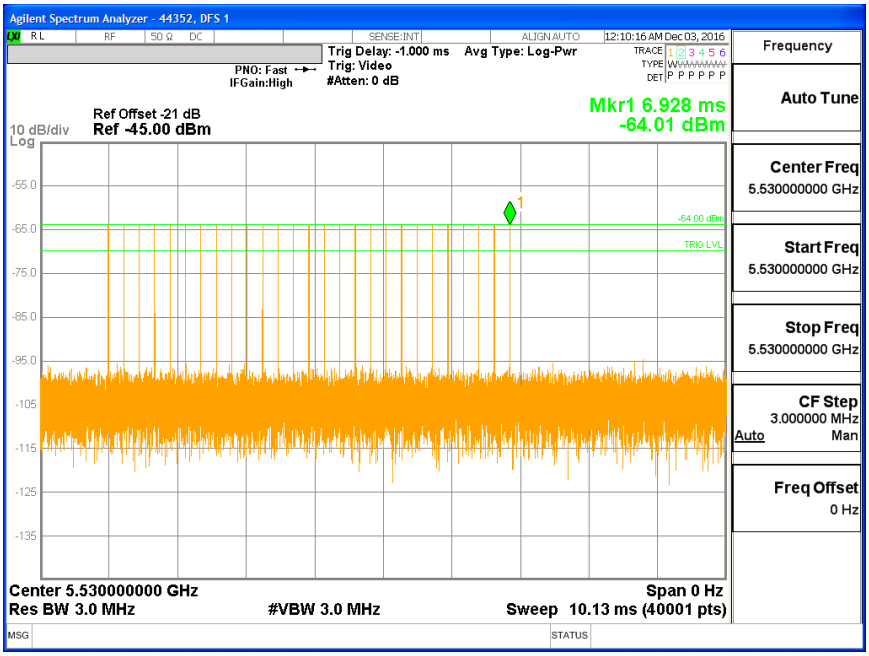
SHORT PULSE RADAR TYPE 0



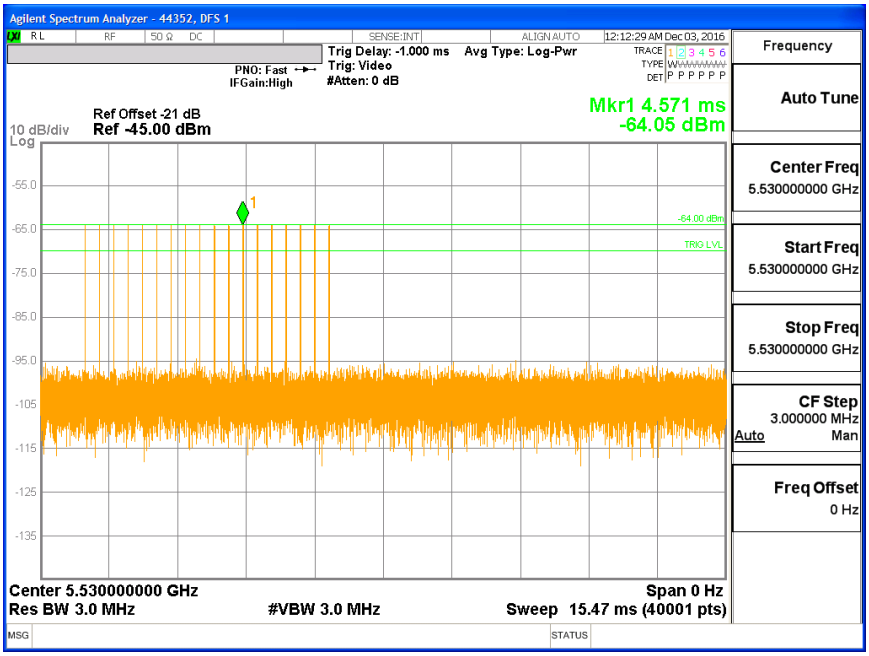
SAMPLE OF RADAR TYPE 1



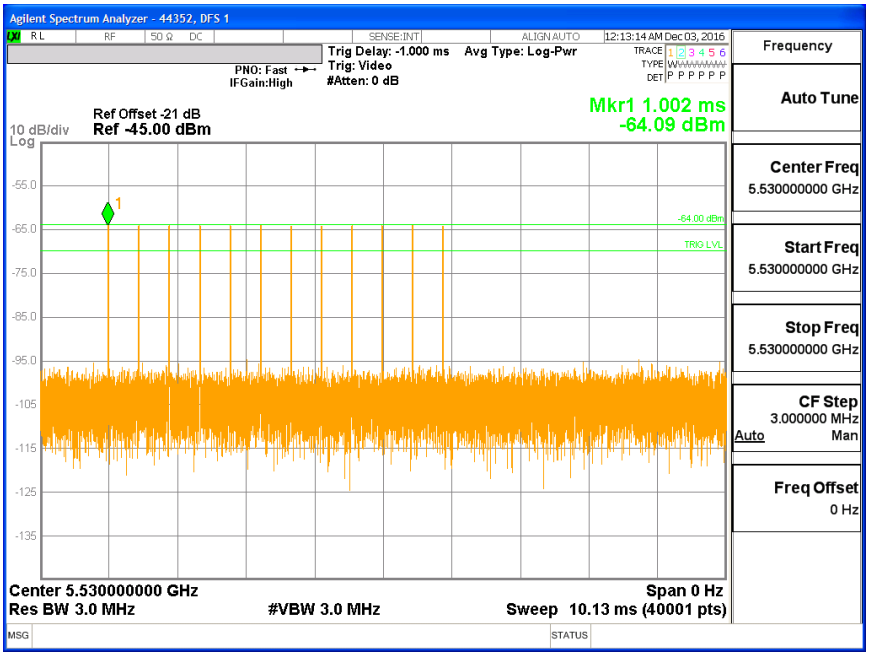
SAMPLE OF RADAR TYPE 2



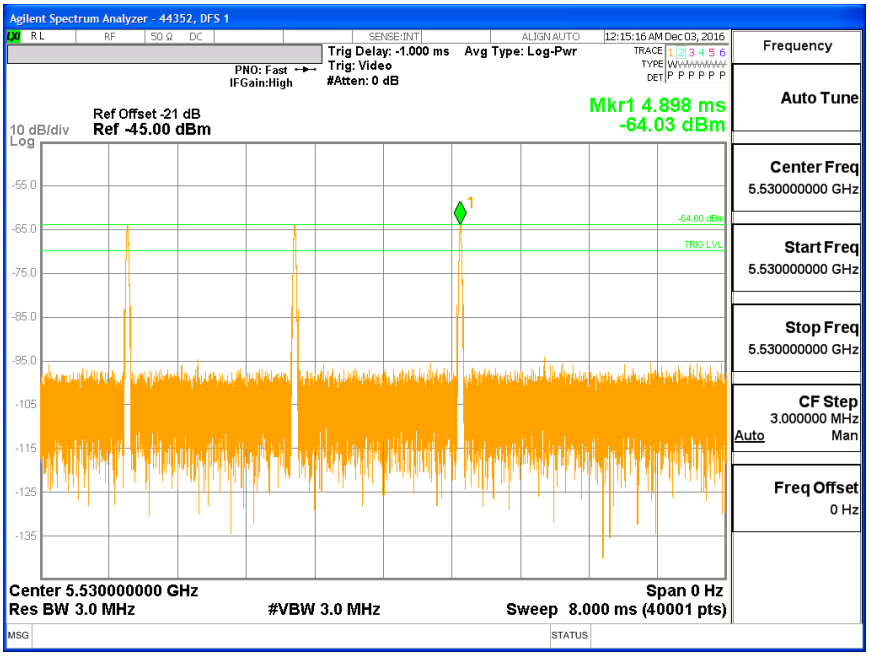
SAMPLE OF RADAR TYPE 3



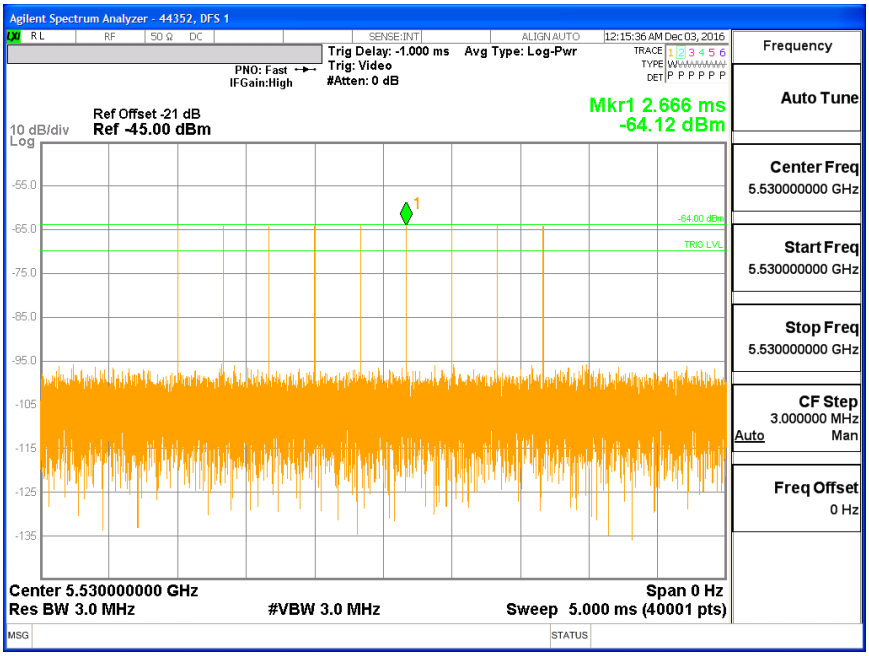
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

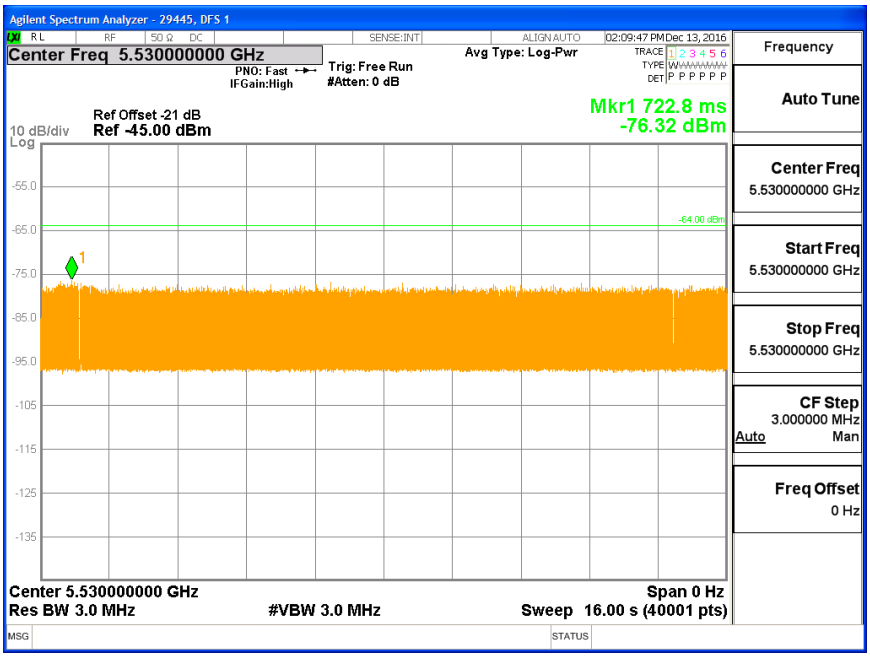


SINGLE BURST OF RADAR TYPE 6

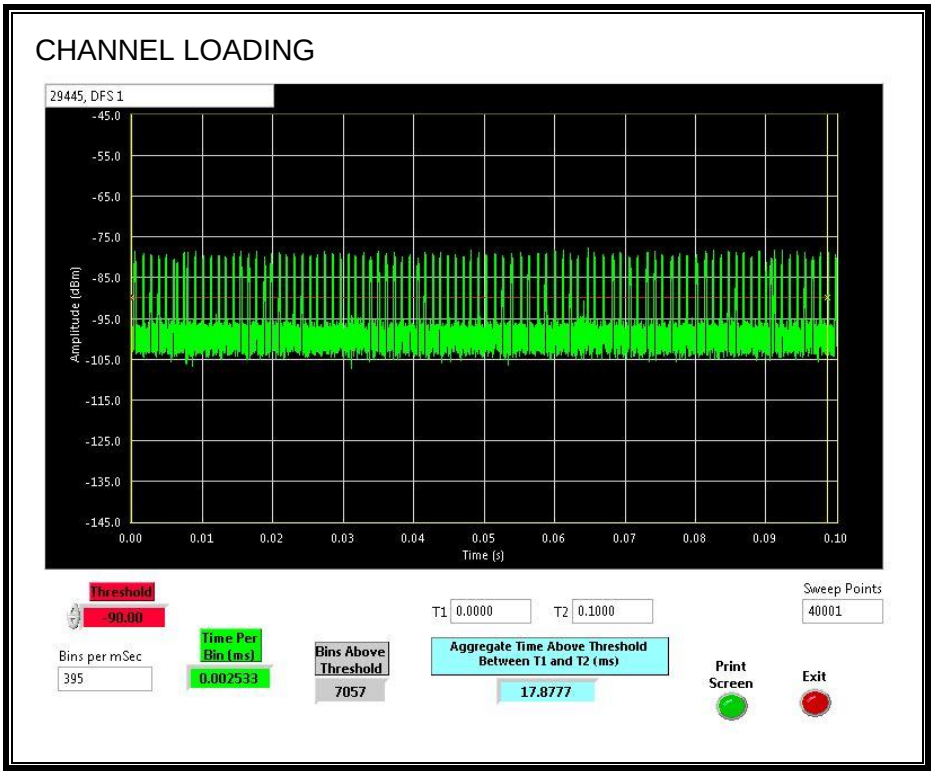


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.8777%

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)
30.24	207.0	176.8	116.8

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)
30.24	148.6	118.4	1.6

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)
30.04	204.9	174.9	58.1

QUALITATIVE RESULTS

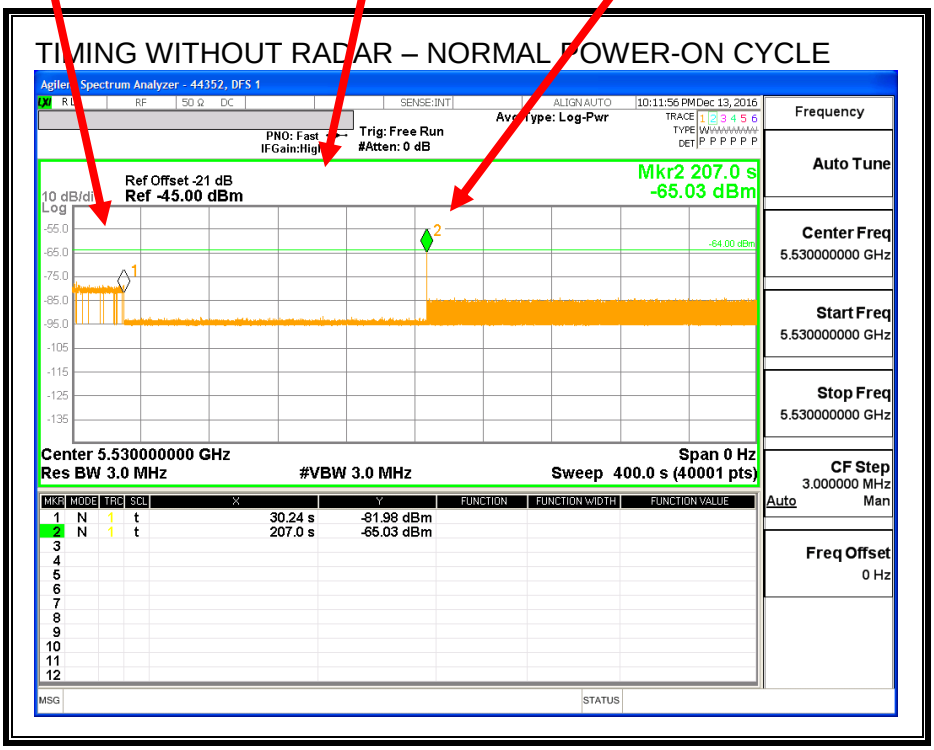
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



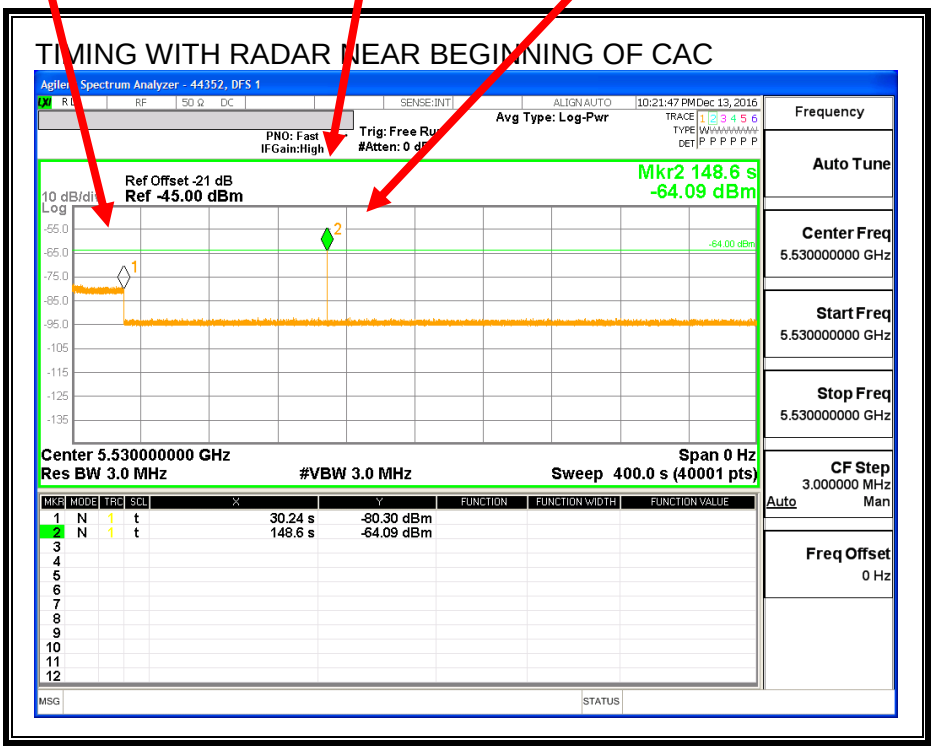
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



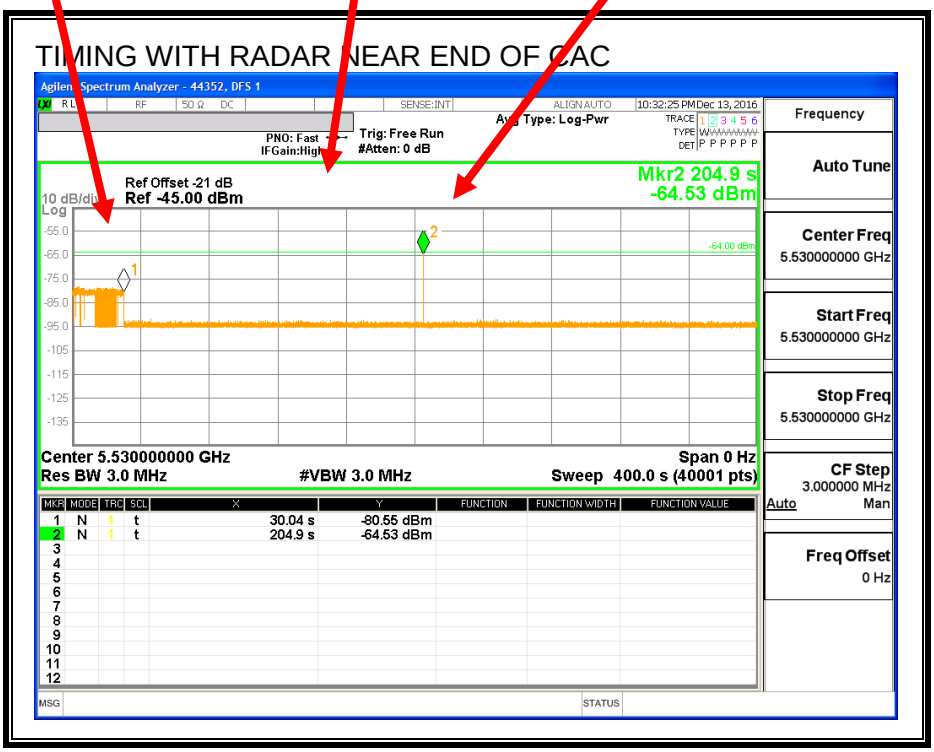
No EUT transmissions were observed after the radar signal.

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)

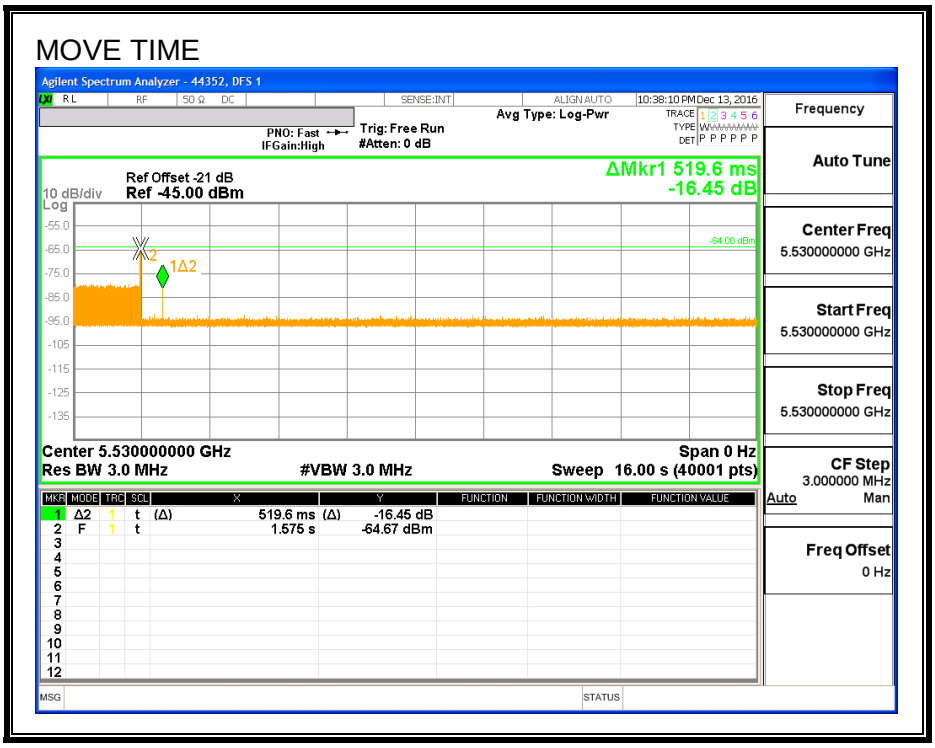
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.520	10

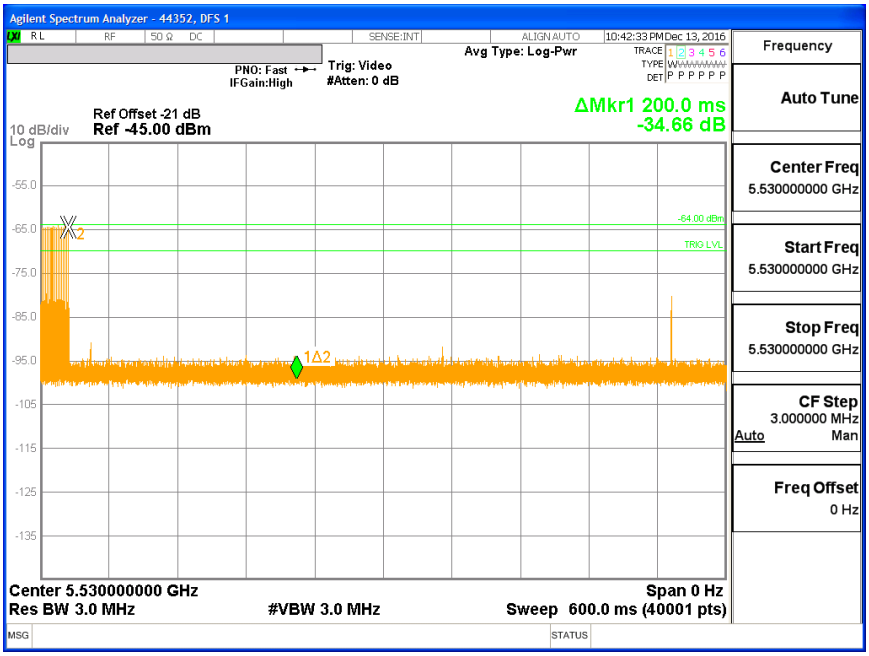
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.4	60

MOVE TIME



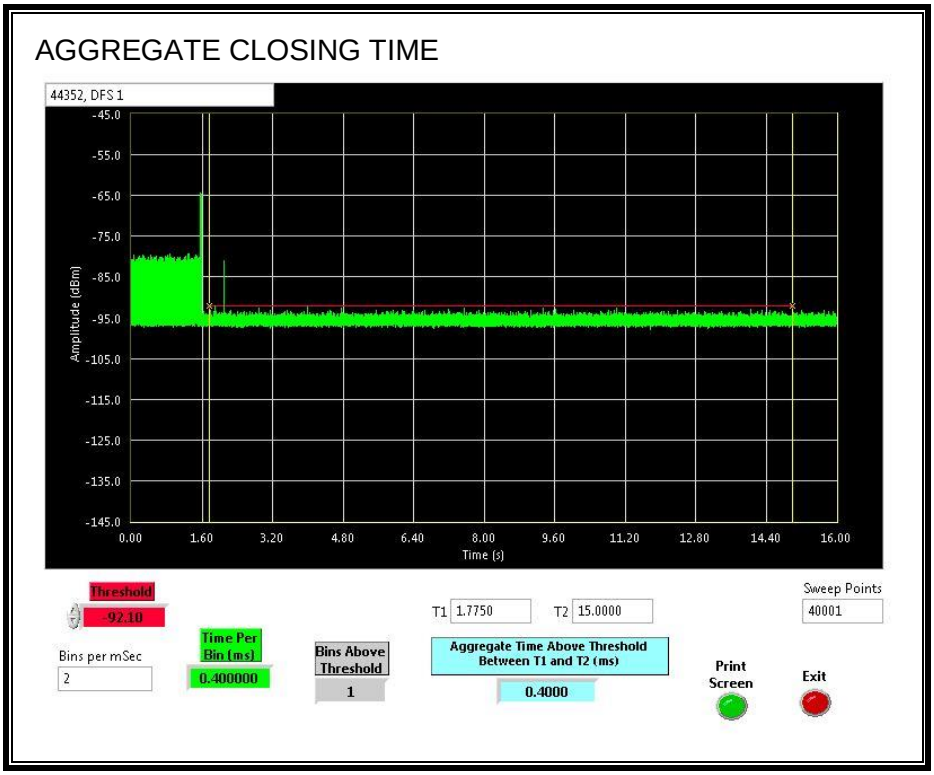
CHANNEL CLOSING TIME

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.

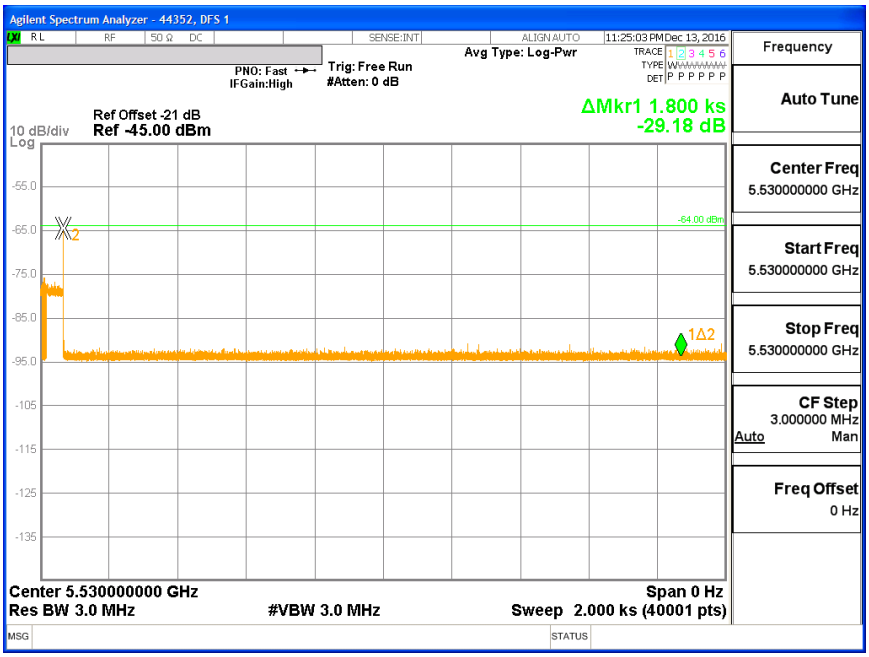
MOVE TIME FOR LONG PULSE RADAR

5.4.1. NON-OCCUPANCY PERIOD

RESULTS

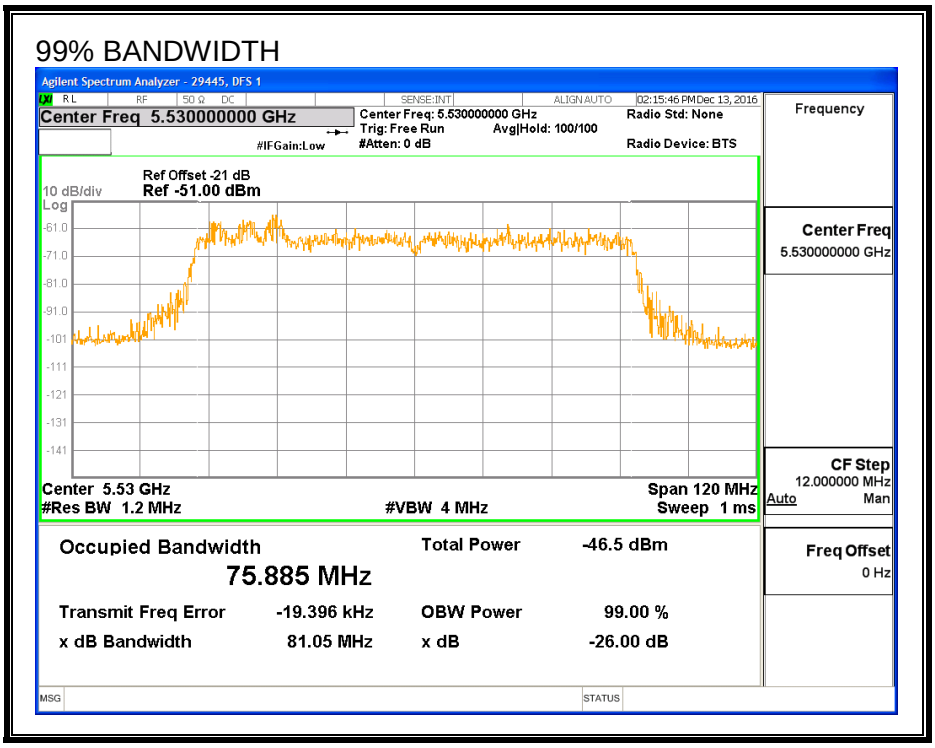
No EUT transmissions were observed on the test channel during the 30-minute observation time.

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	75.885	105.4	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		29445	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
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

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	80.00	60	Pass	5490	5570	75.89	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	73.33	60	Pass	5490	5570	75.89	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	86.67	60	Pass	5490	5570	75.89	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5570	75.89	DFS 1	29445	Version 3.0
Aggregate		81.67	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	75.89	DFS 1	29445	Version 3.0
FCC Hopping Type 6	81	98.77	70	Pass	5490	5570	75.89	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	5530	No
1002	1	758	70	A	5530	Yes
1003	1	898	59	A	5530	Yes
1004	1	698	76	A	5530	Yes
1005	1	858	62	A	5530	Yes
1006	1	658	81	A	5530	Yes
1007	1	638	83	A	5530	Yes
1008	1	918	58	A	5530	No
1009	1	778	68	A	5530	Yes
1010	1	598	89	A	5530	Yes
1011	1	538	99	A	5530	Yes
1012	1	678	78	A	5530	Yes
1013	1	618	86	A	5530	Yes
1014	1	718	74	A	5530	Yes
1015	1	938	57	A	5530	Yes
1016	1	3034	18	B	5530	No
1017	1	989	54	B	5530	Yes
1018	1	1140	47	B	5530	No
1019	1	1772	30	B	5530	Yes
1020	1	857	62	B	5530	Yes
1021	1	1619	33	B	5530	Yes
1022	1	2187	25	B	5530	Yes
1023	1	530	100	B	5530	Yes
1024	1	1228	43	B	5530	Yes
1025	1	1054	51	B	5530	Yes
1026	1	1881	29	B	5530	Yes
1027	1	1837	29	B	5530	Yes
1028	1	1599	34	B	5530	No
1029	1	1684	32	B	5530	Yes
1030	1	1575	34	B	5530	No

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	2.7	228	27	5530	Yes
2002	1.9	225	23	5530	Yes
2003	2.6	158	29	5530	Yes
2004	3.9	203	29	5530	Yes
2005	3	220	26	5530	Yes
2006	2.6	150	23	5530	Yes
2007	3.7	172	26	5530	Yes
2008	1.6	187	24	5530	No
2009	1.1	174	24	5530	No
2010	3.3	194	26	5530	Yes
2011	2.9	185	23	5530	Yes
2012	1.2	171	28	5530	No
2013	3.3	167	26	5530	Yes
2014	4	156	25	5530	No
2015	2.1	199	27	5530	No
2016	3	155	23	5530	Yes
2017	1.4	202	25	5530	No
2018	4.7	162	28	5530	Yes
2019	1.3	213	27	5530	No
2020	4.8	177	24	5530	Yes
2021	1.7	194	23	5530	No
2022	1.3	205	27	5530	Yes
2023	4.6	227	24	5530	Yes
2024	4.4	161	25	5530	Yes
2025	3.9	230	29	5530	Yes
2026	2	168	23	5530	Yes
2027	1.6	160	28	5530	Yes
2028	2.1	226	26	5530	Yes
2029	2	222	24	5530	Yes
2030	2.7	212	23	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	9.9	324	18	5530	Yes
3002	6.7	438	18	5530	No
3003	7.3	333	18	5530	Yes
3004	8.4	459	17	5530	Yes
3005	9.1	367	17	5530	Yes
3006	8.5	255	18	5530	Yes
3007	9.5	442	18	5530	Yes
3008	9.1	344	17	5530	Yes
3009	8.3	410	18	5530	Yes
3010	8.1	457	16	5530	Yes
3011	7.6	419	17	5530	Yes
3012	9.8	479	18	5530	Yes
3013	9.4	453	17	5530	Yes
3014	9.9	408	16	5530	Yes
3015	9.8	277	17	5530	Yes
3016	6.4	496	18	5530	Yes
3017	8.6	496	17	5530	Yes
3018	9.5	359	17	5530	Yes
3019	6	253	18	5530	No
3020	7.1	380	16	5530	Yes
3021	7.8	288	16	5530	Yes
3022	7.2	309	17	5530	Yes
3023	8.2	363	17	5530	Yes
3024	7.8	264	16	5530	Yes
3025	7	464	17	5530	Yes
3026	6.8	378	18	5530	Yes
3027	6.3	339	16	5530	No
3028	8.5	399	17	5530	Yes
3029	6.2	256	16	5530	No
3030	8.6	328	18	5530	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	12.3	449	12	5530	Yes
4002	18.1	417	16	5530	Yes
4003	14	299	12	5530	Yes
4004	16	279	12	5530	Yes
4005	17.2	425	16	5530	Yes
4006	19.6	301	16	5530	Yes
4007	12.3	342	15	5530	Yes
4008	20	481	13	5530	Yes
4009	13	284	12	5530	Yes
4010	12.1	436	13	5530	No
4011	19.6	384	13	5530	Yes
4012	19.1	298	14	5530	Yes
4013	17.9	260	16	5530	Yes
4014	13.7	453	12	5530	Yes
4015	17.8	427	13	5530	Yes
4016	14	500	14	5530	Yes
4017	18.6	369	15	5530	Yes
4018	15.2	337	15	5530	Yes
4019	11.2	470	16	5530	No
4020	17.9	451	15	5530	Yes
4021	14.4	346	14	5530	Yes
4022	16.8	472	14	5530	Yes
4023	18.5	262	14	5530	No
4024	17.1	402	16	5530	Yes
4025	19.3	455	16	5530	Yes
4026	18.3	356	16	5530	Yes
4027	16.7	305	16	5530	Yes
4028	12	352	12	5530	Yes
4029	19.9	431	15	5530	No
4030	19.9	374	16	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	5495	Yes
12	5501	Yes
13	5497	Yes
14	5497	Yes
15	5495	Yes
16	5497	Yes
17	5495	Yes
18	5501	Yes
19	5497	Yes
20	5497	Yes
21	5560	Yes
22	5563	Yes
23	5562	Yes
24	5564	Yes
25	5560	Yes
26	5564	Yes
27	5560	Yes
28	5564	Yes
29	5560	Yes
30	5564	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	112	5490	15	Yes
2	587	5491	21	Yes
3	1062	5492	13	Yes
4	1537	5493	19	Yes
5	2012	5494	12	Yes
6	2487	5495	21	Yes
7	2962	5496	16	Yes
8	3437	5497	20	Yes
9	3912	5498	11	Yes
10	4387	5499	17	Yes
11	4862	5500	15	Yes
12	5337	5501	15	Yes
13	5812	5502	19	Yes
14	6287	5503	14	Yes
15	6762	5504	16	Yes
16	7237	5505	14	Yes
17	7712	5506	13	Yes
18	8187	5507	20	Yes
19	8662	5508	16	Yes
20	9137	5509	27	Yes
21	9612	5510	21	Yes
22	10087	5511	13	Yes
23	10562	5512	19	Yes
24	11037	5513	15	Yes
25	11512	5514	17	Yes
26	11987	5515	19	Yes
27	12462	5516	18	Yes
28	12937	5517	26	Yes
29	13412	5518	18	Yes
30	13887	5519	12	Yes
31	14362	5520	18	Yes
32	14837	5521	15	Yes
33	15312	5522	17	Yes
34	15787	5523	15	Yes
35	16262	5524	10	Yes
36	16737	5525	20	Yes
37	17212	5526	16	Yes
38	17687	5527	15	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

39	18162	5528	23	Yes
40	18637	5529	20	Yes
41	19112	5530	16	Yes
42	19587	5531	12	Yes
43	20062	5532	21	Yes
44	20537	5533	22	Yes
45	21012	5534	17	Yes
46	21487	5535	19	Yes
47	21962	5536	19	Yes
48	22437	5537	20	Yes
49	22912	5538	20	Yes
50	23387	5539	12	Yes
51	23862	5540	16	Yes
52	24337	5541	26	Yes
53	24812	5542	21	Yes
54	25287	5543	15	Yes
55	25762	5544	22	Yes
56	26237	5545	15	Yes
57	26712	5546	17	Yes
58	27187	5547	12	Yes
59	27662	5548	13	Yes
60	28137	5549	16	Yes
61	28612	5550	19	Yes
62	29087	5551	11	Yes
63	29562	5552	14	Yes
64	30037	5553	18	Yes
65	30512	5554	18	Yes
66	30987	5555	15	Yes
67	31462	5556	21	Yes
68	31937	5557	13	Yes
69	32412	5558	16	Yes
70	32887	5559	15	Yes
71	33362	5560	10	Yes
72	33837	5561	13	Yes
73	34312	5562	14	Yes
74	34787	5563	16	Yes
75	35262	5564	18	Yes
76	35737	5565	10	Yes
77	36212	5566	22	Yes
78	36687	5567	22	Yes
79	37162	5568	20	Yes
80	37637	5569	15	Yes
81	38112	5570	16	No

5.5. BRIDGE MODE RESULTS

Per KDB 905462, Section 5.1 (footnote 1):

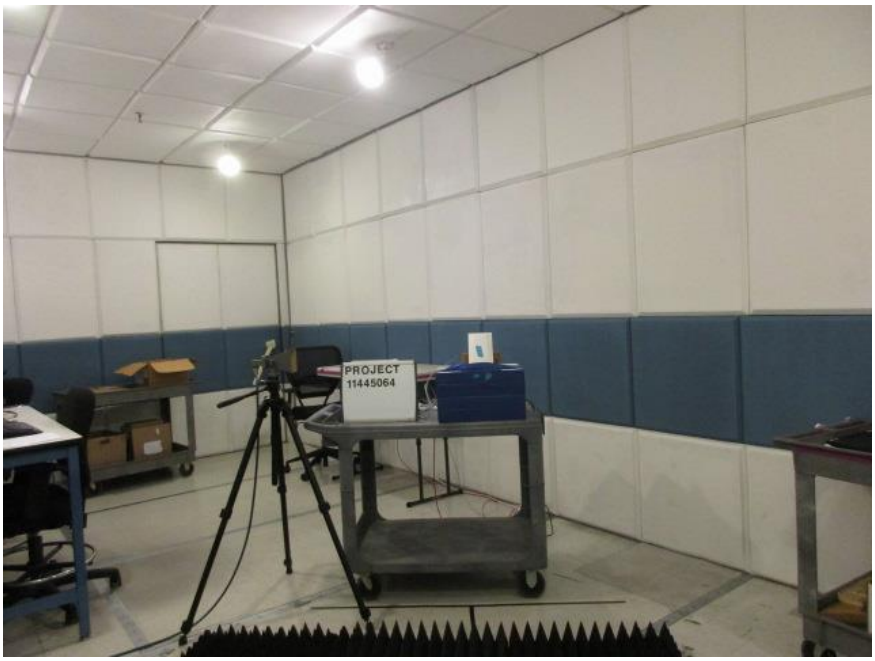
Networks Access Points with Bridge and/or MESH modes of operation are permitted to operate in the DFS bands but must employ a DFS function. The functionality of the Bridge mode as specified in §15.403(a) must be validated in the DFS test report. Devices operating as relays must also employ DFS function.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

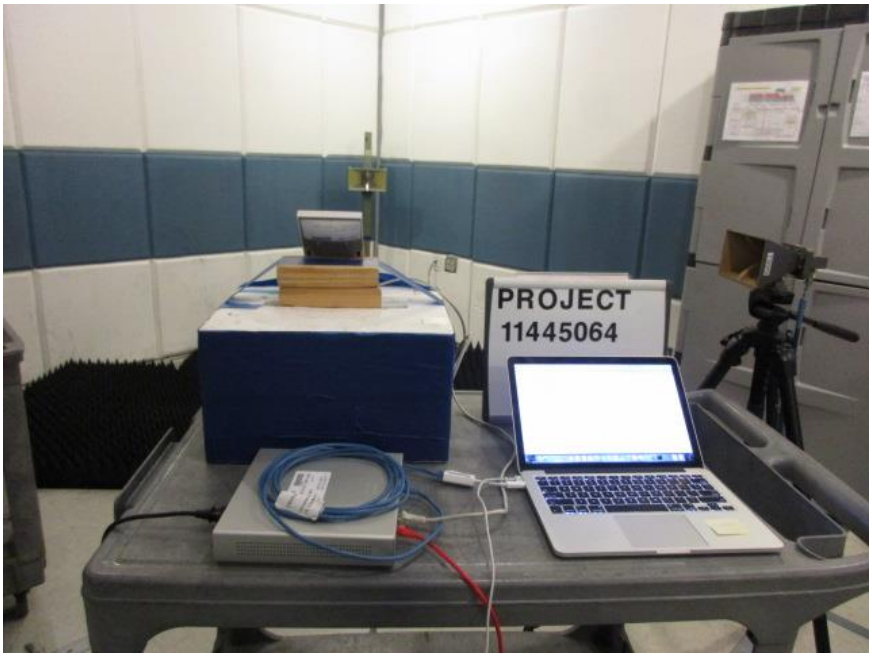
6. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS FRONT PHOTO



DFS BACK PHOTO



END OF REPORT