DFS PORTION of FCC 47 CFR PART 15 SUBPART E
DFS PORTION of INDUSTRY CANADA RSS-247 ISSUE 2

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n/ac WIRELESS ACCESS POINT

MODEL NUMBER: MR70-HW

FCC ID: UDX-60067010
IC: 6961A-60067020

REPORT NUMBER: 11910229-E3V4

ISSUE DATE: JANUARY 12, 2018

Prepared for
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170 WEST TASMAN DRIVE
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	10/24/2017	Initial Issue	Conan Cheung
V2	1/08/2018	Removed model numbers and updated FCC ID	Henry Lau
V3	1/11/2018	Updated FCC ID	Edgard Rincand
V4	1/12/2018	Update IC ID	Ayako Kanamatsu

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ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11a/b/g/n/ac WIRELESS ACCESS POINT

MODEL: MR70-HW

SERIAL NUMBER: Q2YD-F4W6-UQNP

DATE TESTED: SEPTEMBER 12, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DFS Portion of CFR 47 Part 15 Subpart E	Complies
INDUSTRY CANADA RSS-247 Issue 2	Complies

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.

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1. 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 2.

2. 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.

3. CALIBRATION AND UNCERTAINTY

3.1. 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.

3.2. 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

3.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Time	± 0.02 %

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

4. DYNAMIC FREQUENCY SELECTION

4.1. OVERVIEW

4.1.1. LIMITS

INDUSTRY CANADA

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

RSS-247 Issue 2

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

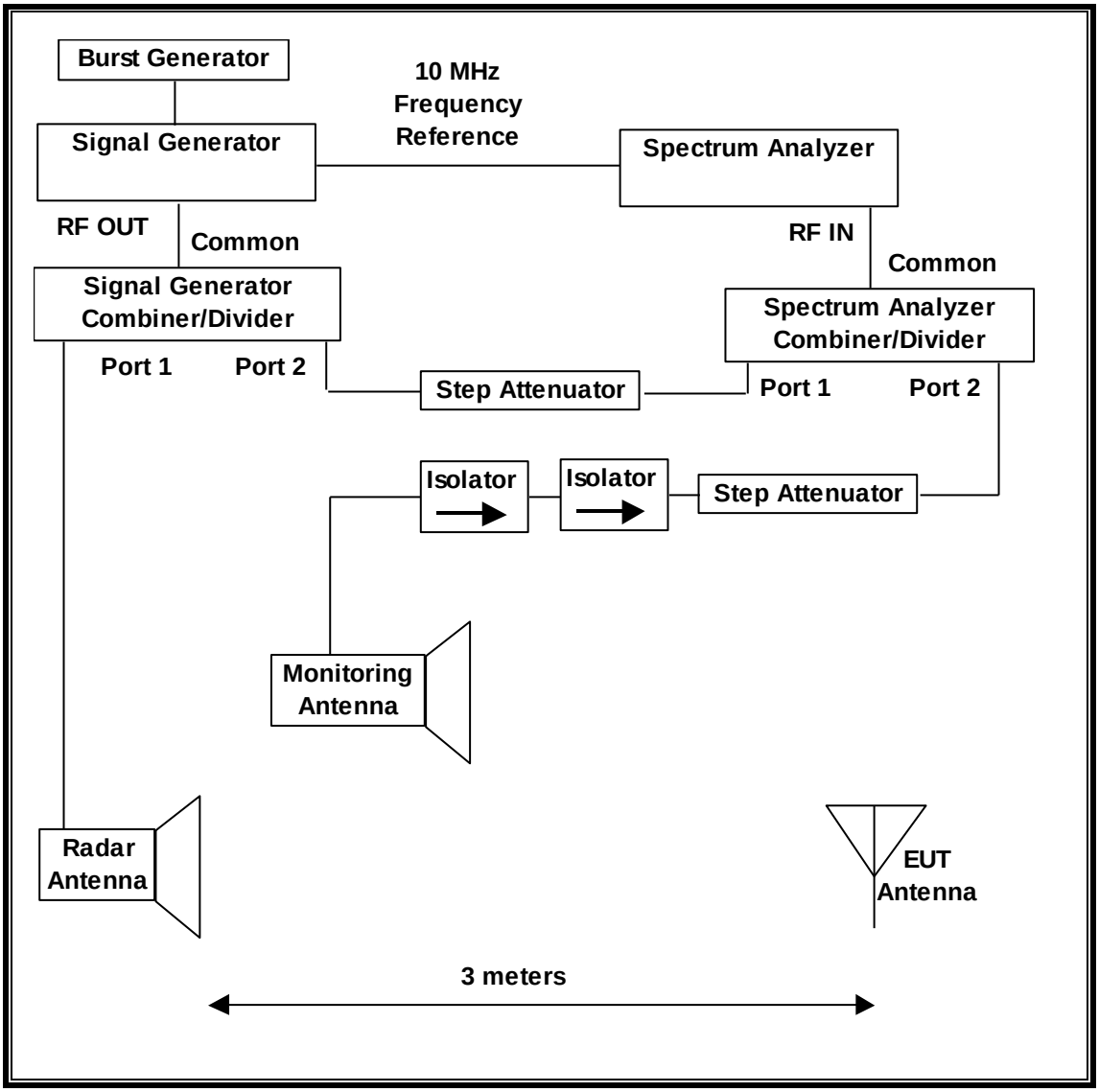
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

4.1.2. 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	06/22/18
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	MY51350337	04/21/18
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/06/18

4.1.3. TEST AND MEASUREMENT SOFTWARE

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

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

4.1.4. TEST ROOM ENVIRONMENT

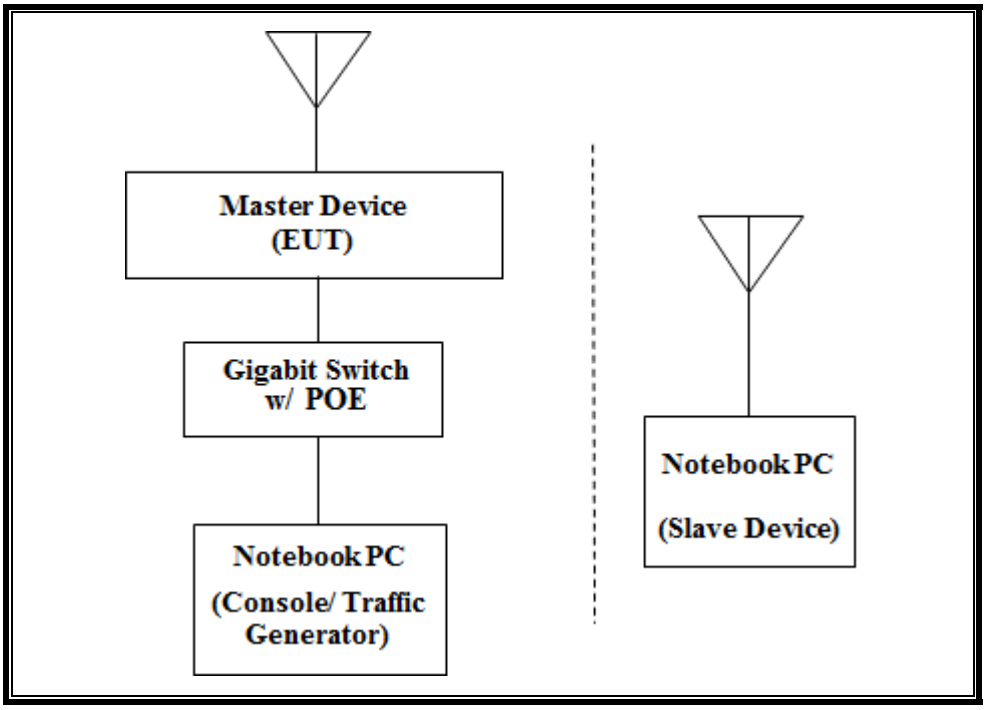
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	25.1 °C
Humidity	35 %

4.1.5. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

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

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Notebook PC (Controller & Traffic Generator)	Apple	A1502	C02NT1VTG3QR	DoC
AC Adapter (Controller PC & Traffic Generator)	Apple	A1435	D39433601B4FTC0A1	DoC
Notebook PC (Slave Device)	Apple	A1465	C02KTGMPF5N7	QDS-BRCM1072
AC Adapter (Slave PC)	Apple	A1435	C04341216J2F288BT	DoC
Gigabit Switch with POE	Meraki	MS220-8P	Q2HP-DR3G-TQZS	DoC

4.1.6. DESCRIPTION OF EUT

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

The EUT is a Master Device.

For FCC, the highest power level within these bands is 28.84 dBm EIRP in the 5250-5350 MHz band and 28.76 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 28.74 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 4.87 dBi & 4.86 dBi.

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

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

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

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

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

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

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

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

The software installed in the EUT is firmware_insect_version toebeta-201709051208-Gee95dc93-rhythm.

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-60067010. The minimum antenna gain for the Master Device is 4.86 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.

4.2. RESULTS FOR 20 MHz BANDWIDTH

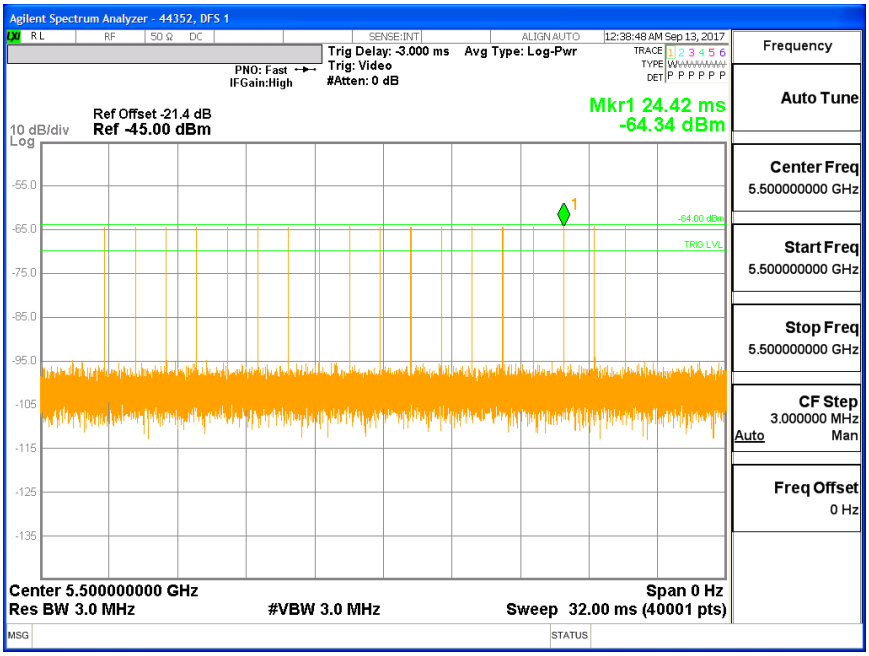
4.2.1. TEST CHANNEL

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

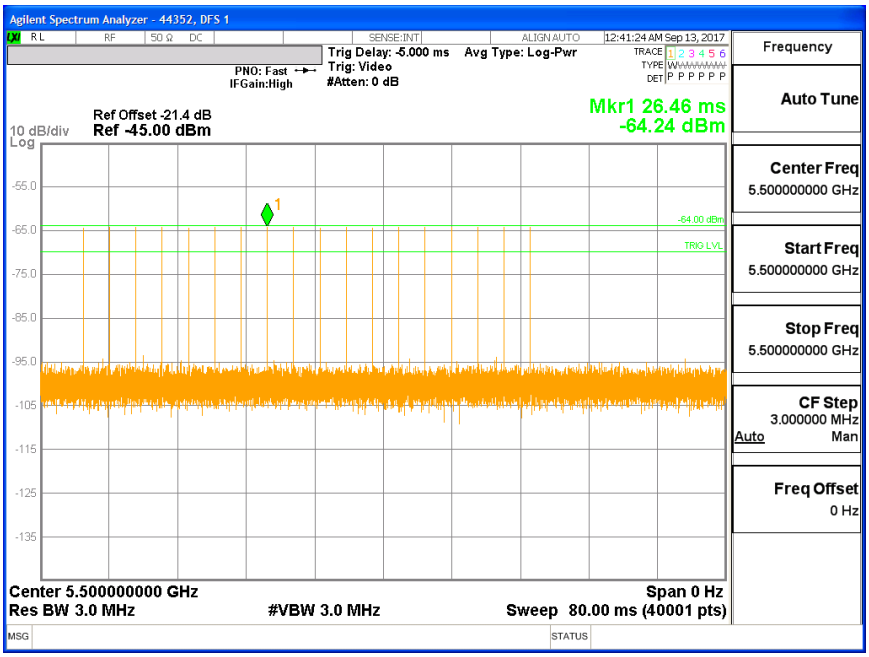
4.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

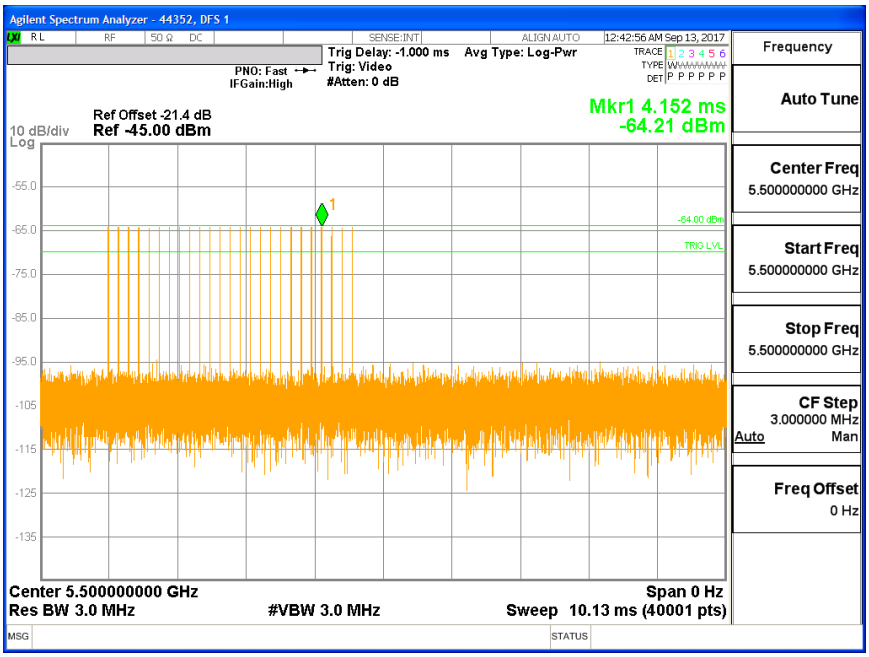
SHORT PULSE RADAR TYPE 0



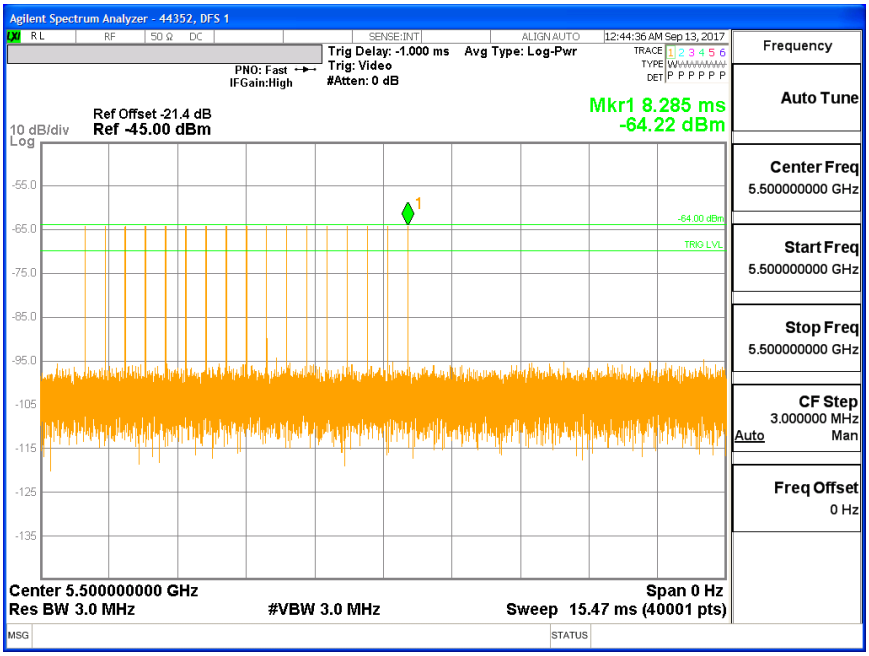
SAMPLE OF RADAR TYPE 1



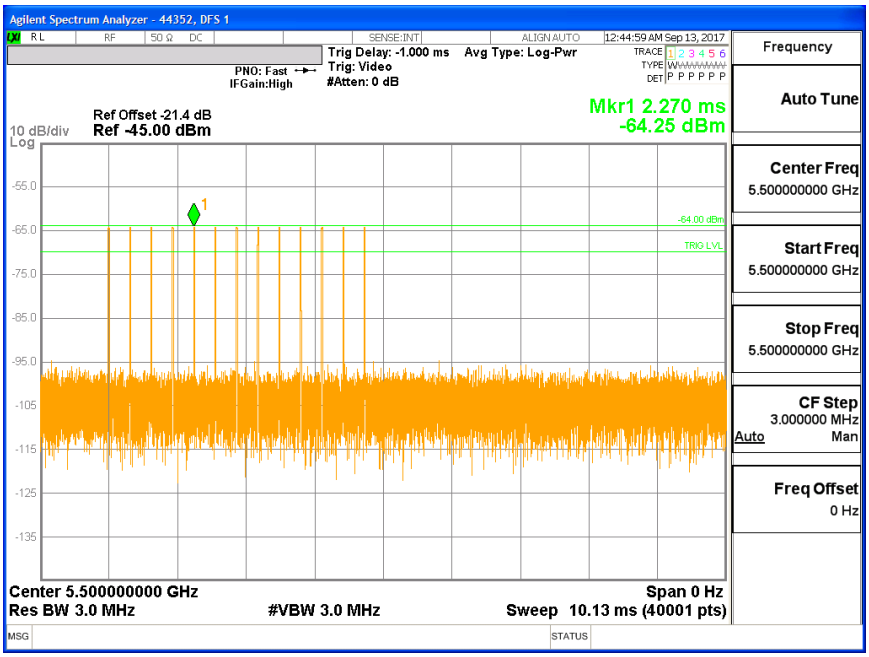
SAMPLE OF RADAR TYPE 2



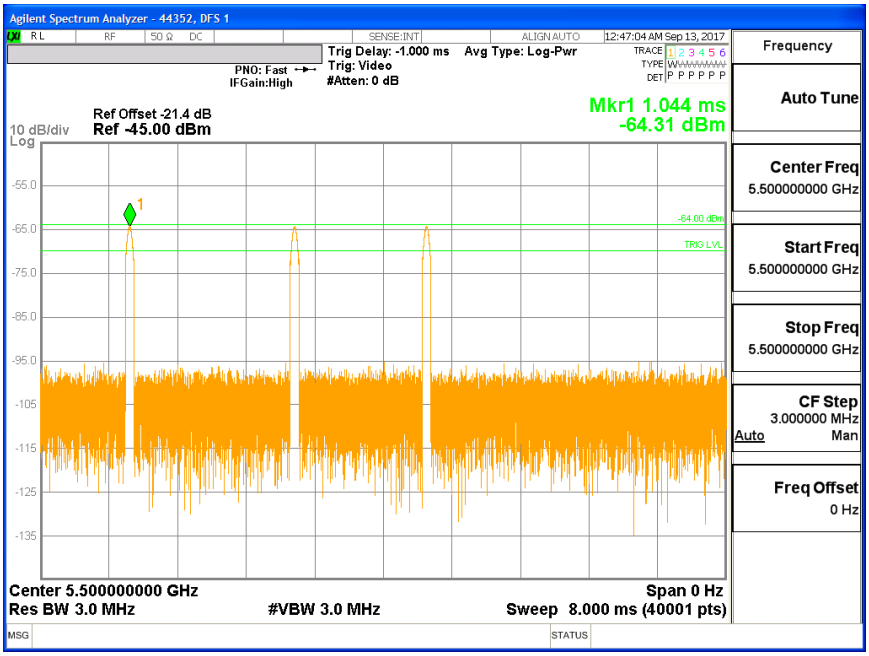
SAMPLE OF RADAR TYPE 3



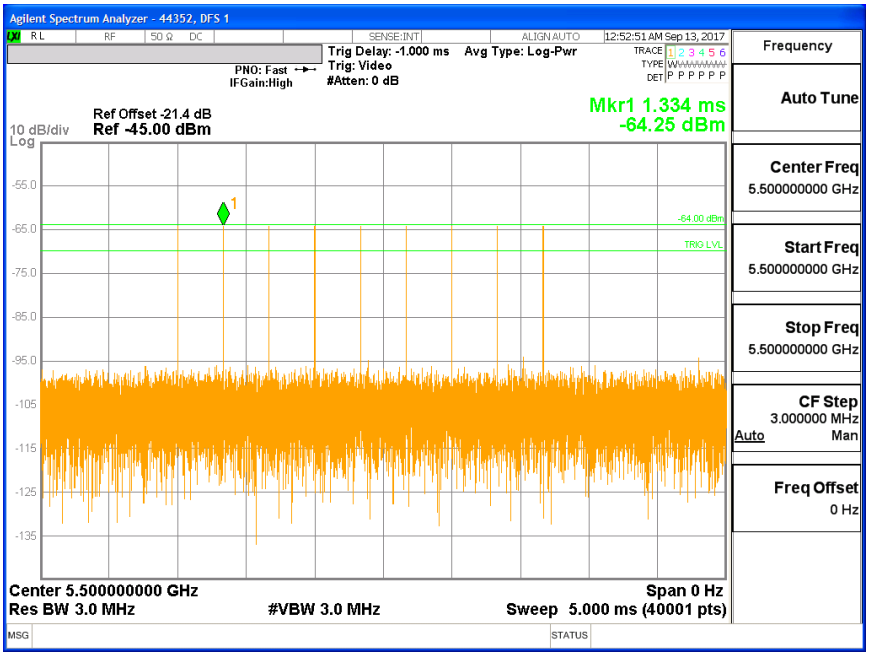
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

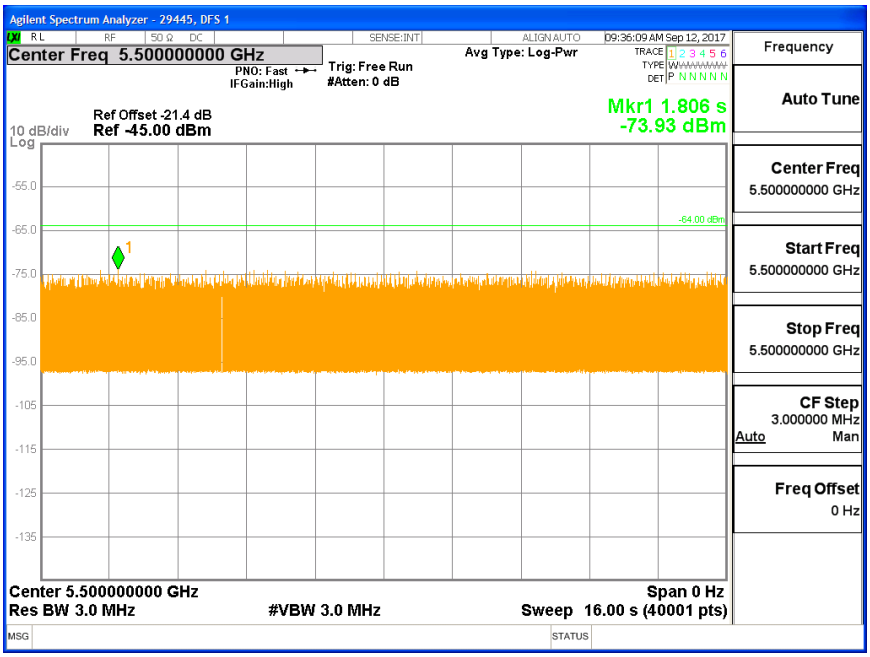


SINGLE BURST OF RADAR TYPE 6

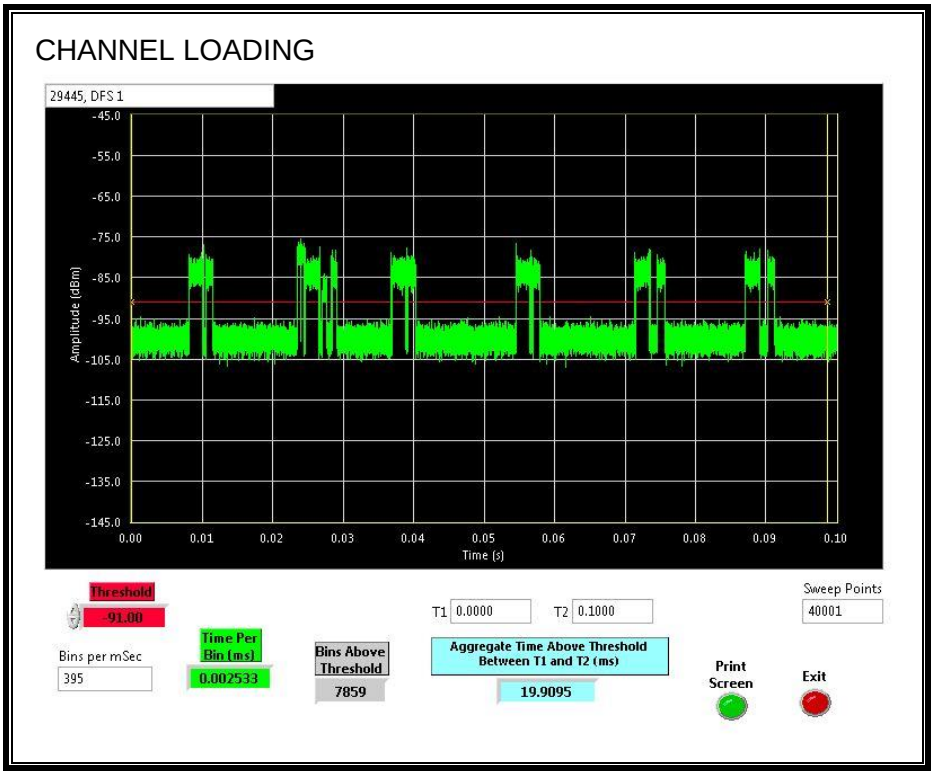


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.9%

4.2.3. 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)
30.45	220.6	190.2	130.2

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)
30.08	161.5	131.4	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)
30.45	217.4	187.0	56.8

QUALITATIVE RESULTS

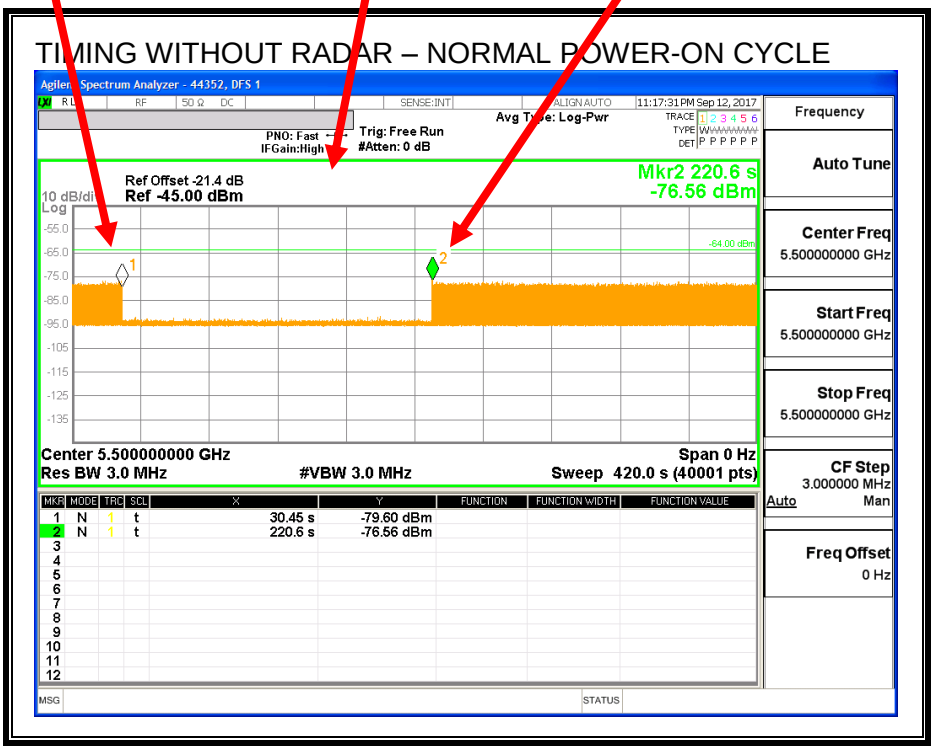
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



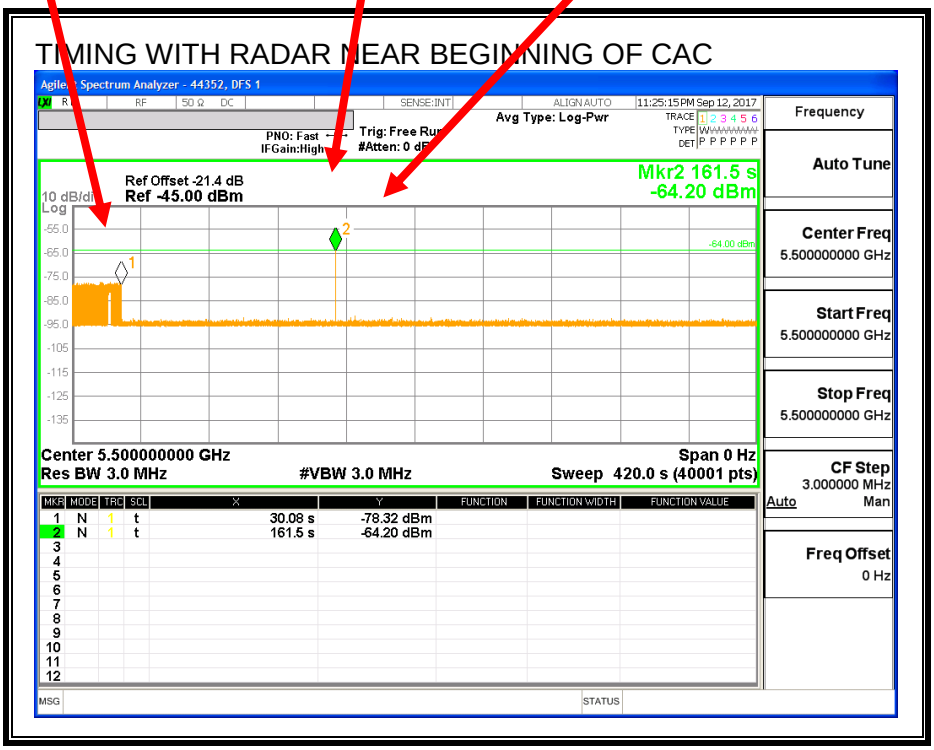
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



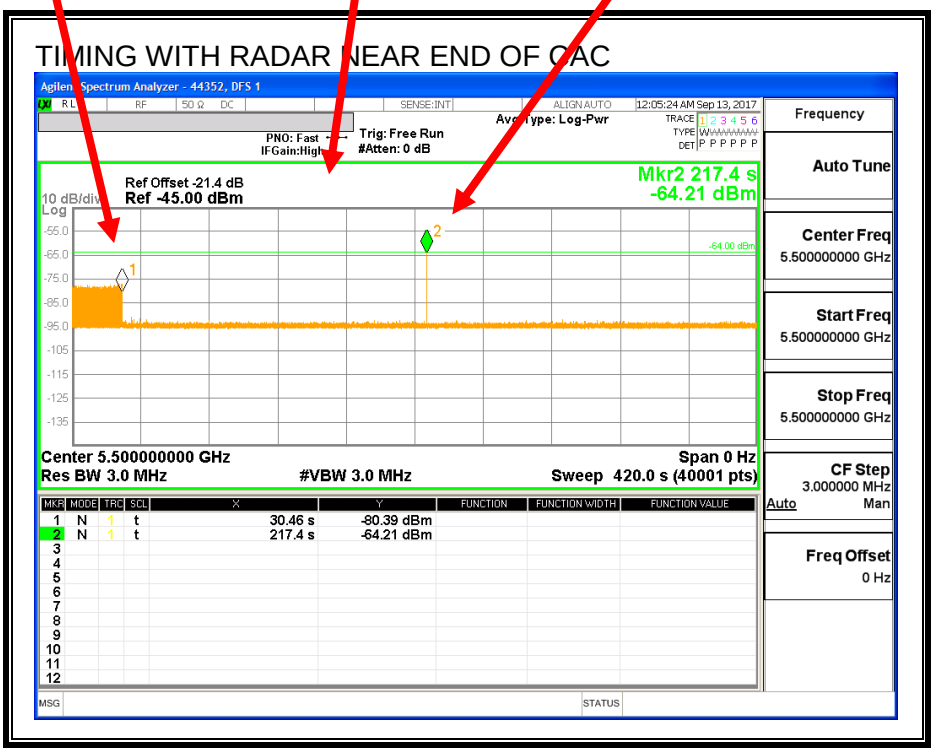
No EUT transmissions were observed after the radar signal.

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.

4.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

4.2.5. 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).

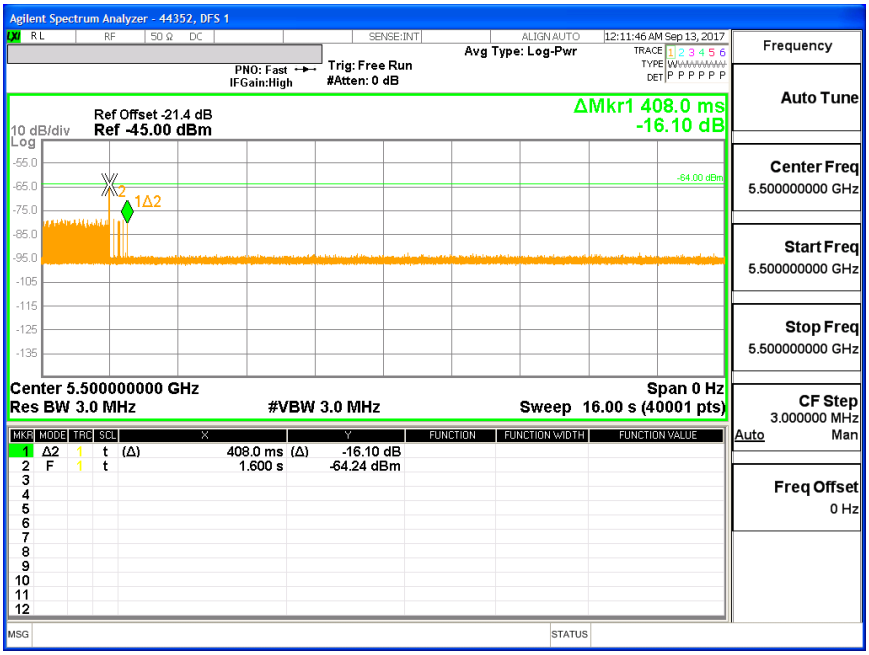
RESULTS

Channel Move Time (sec)	Limit (sec)
0.408	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
7.2	60

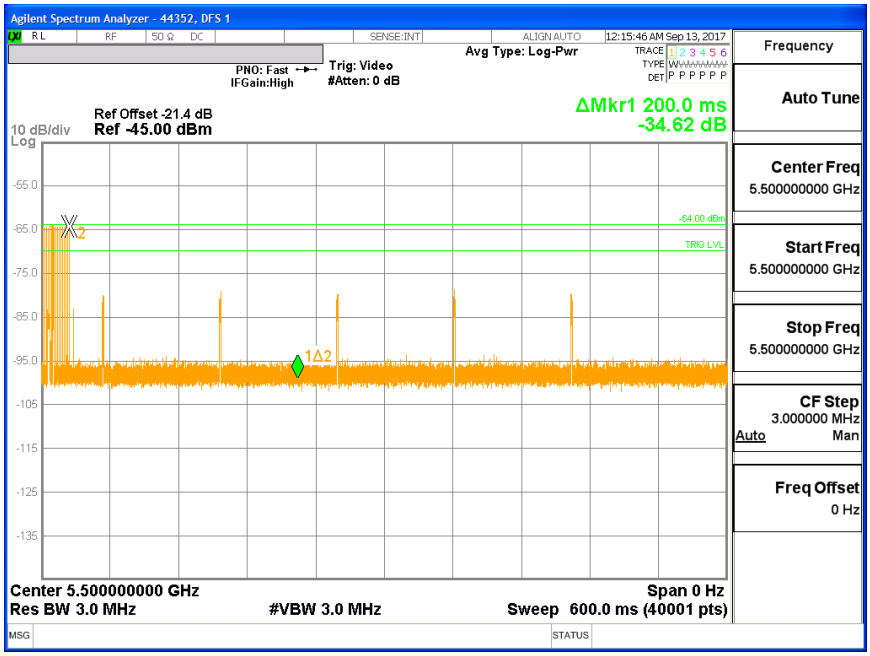
MOVE TIME

MOVE TIME



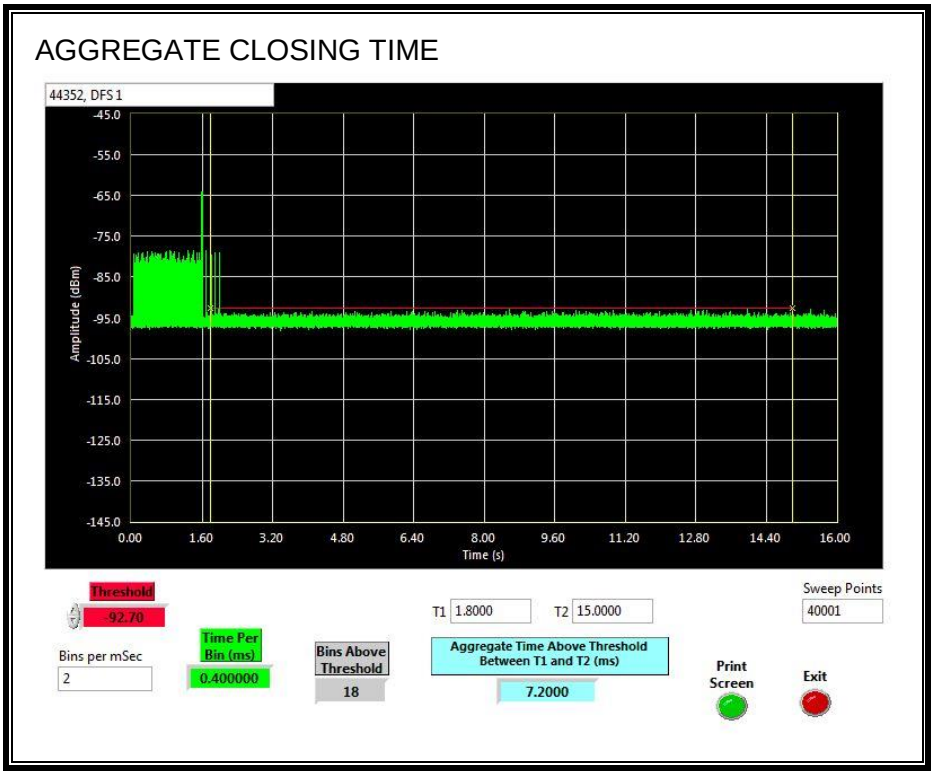
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

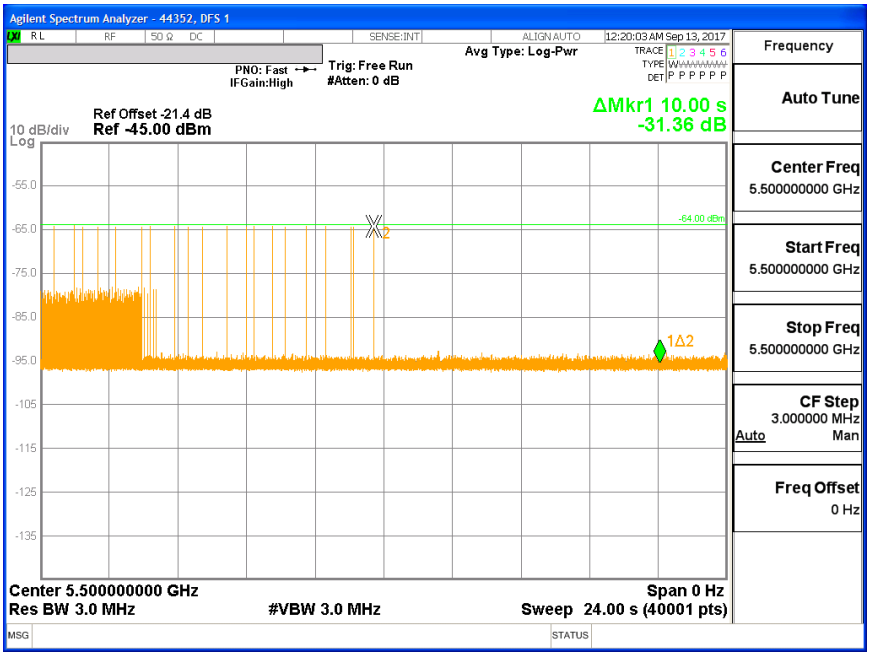
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

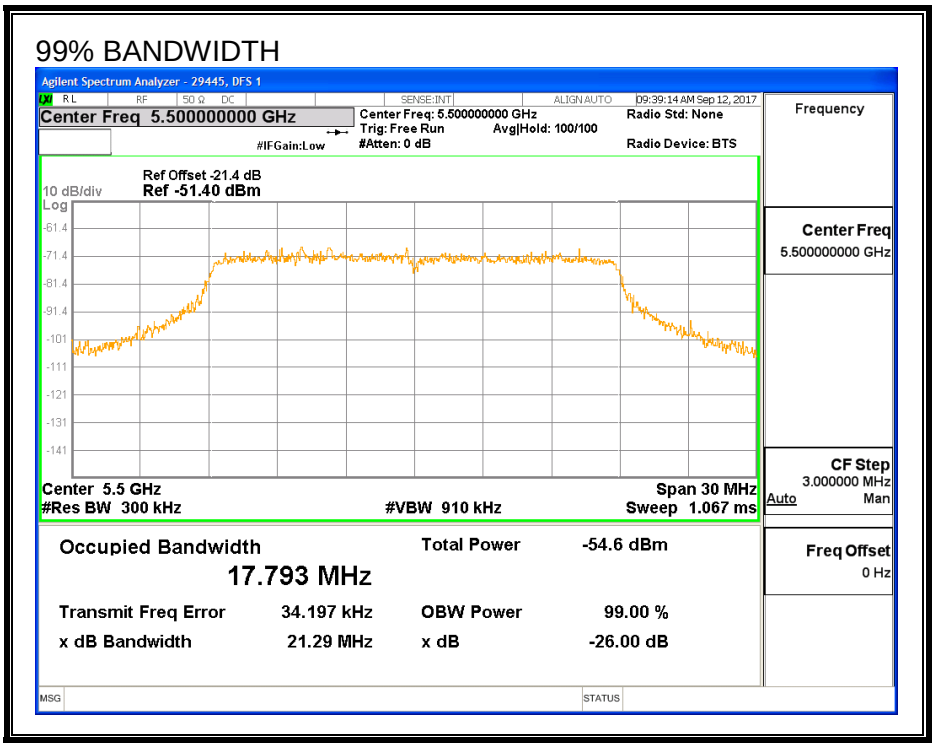
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



4.2.6. 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	17.793	112.4	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	FH

4.2.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5510	17.79	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	83.33	60	Pass	5490	5510	17.79	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	76.67	60	Pass	5490	5510	17.79	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	73.33	60	Pass	5490	5510	17.79	DFS 1	29445	Version 3.0
Aggregate		83.33	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	17.79	DFS 1	29445	Version 3.0
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510		DFS 1	29445	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5494	Yes
1002	1	738	72	A	5492	Yes
1003	1	698	76	A	5506	Yes
1004	1	818	65	A	5497	Yes
1005	1	538	99	A	5495	Yes
1006	1	918	58	A	5505	Yes
1007	1	638	83	A	5505	Yes
1008	1	898	59	A	5504	Yes
1009	1	878	61	A	5503	Yes
1010	1	798	67	A	5510	Yes
1011	1	778	68	A	5492	Yes
1012	1	558	95	A	5509	Yes
1013	1	718	74	A	5498	Yes
1014	1	838	63	A	5509	Yes
1015	1	938	57	A	5495	Yes
1016	1	3006	18	B	5492	Yes
1017	1	1573	34	B	5507	Yes
1018	1	1659	32	B	5500	Yes
1019	1	1550	35	B	5504	Yes
1020	1	570	93	B	5506	Yes
1021	1	1944	28	B	5509	Yes
1022	1	1094	49	B	5502	Yes
1023	1	2597	21	B	5494	Yes
1024	1	1877	29	B	5501	Yes
1025	1	961	55	B	5494	Yes
1026	1	1723	31	B	5496	Yes
1027	1	2291	24	B	5506	Yes
1028	1	635	84	B	5498	Yes
1029	1	1332	40	B	5503	Yes
1030	1	1159	46	B	5508	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	3	150	25	5492	No
2002	4.8	222	26	5495	Yes
2003	3.1	165	28	5498	No
2004	1.1	204	29	5490	Yes
2005	3.7	193	28	5498	Yes
2006	1.8	155	23	5495	Yes
2007	4.9	230	29	5501	Yes
2008	3.3	196	28	5493	Yes
2009	4.4	156	28	5510	Yes
2010	1	169	27	5497	No
2011	4.5	214	23	5491	Yes
2012	1.4	150	23	5494	Yes
2013	1	200	24	5497	Yes
2014	4.3	183	23	5497	No
2015	2.2	198	25	5498	Yes
2016	1.7	186	25	5508	Yes
2017	3.8	167	27	5501	Yes
2018	1.6	159	28	5495	No
2019	4	182	29	5504	Yes
2020	2	221	24	5497	Yes
2021	4.5	211	23	5495	Yes
2022	4.9	173	24	5501	Yes
2023	1.7	166	24	5500	Yes
2024	4.2	214	29	5503	Yes
2025	3.3	173	29	5497	Yes
2026	1.9	187	28	5507	Yes
2027	1.3	151	25	5505	Yes
2028	2.3	168	28	5508	Yes
2029	4	217	25	5497	Yes
2030	1.1	200	29	5493	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	8.1	455	17	5507	Yes
3002	7.5	416	16	5508	Yes
3003	9.7	476	16	5500	No
3004	9.4	450	17	5500	Yes
3005	7.7	405	18	5497	Yes
3006	9.8	392	18	5507	Yes
3007	6.3	360	18	5508	Yes
3008	8.6	493	18	5499	Yes
3009	9.5	474	18	5499	Yes
3010	7.9	251	18	5498	No
3011	7	495	16	5493	Yes
3012	7.8	418	16	5509	Yes
3013	7.2	307	17	5500	No
3014	6.2	360	16	5506	No
3015	9.9	395	17	5498	Yes
3016	7	461	16	5495	Yes
3017	9	257	18	5497	Yes
3018	8.4	470	16	5507	Yes
3019	6.5	279	16	5501	No
3020	6.2	253	17	5502	No
3021	8.6	459	18	5510	Yes
3022	6.5	446	16	5505	Yes
3023	7.2	414	18	5510	Yes
3024	9.5	296	16	5509	Yes
3025	6.3	277	16	5509	Yes
3026	8.7	305	18	5506	Yes
3027	7.9	298	17	5500	Yes
3028	8.7	339	16	5493	Yes
3029	10	478	16	5506	Yes
3030	9	281	18	5492	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	16.8	315	13	5495	Yes
4002	19.5	382	15	5492	Yes
4003	14.7	429	14	5505	Yes
4004	13.6	390	14	5492	Yes
4005	18.4	450	15	5505	Yes
4006	17.7	425	13	5507	No
4007	13.9	380	12	5499	Yes
4008	18.5	367	15	5505	Yes
4009	19.9	335	15	5503	Yes
4010	15.9	468	16	5506	No
4011	17.8	330	13	5509	No
4012	14.3	476	14	5504	No
4013	12.4	352	12	5502	Yes
4014	14.1	259	16	5500	Yes
4015	12.7	399	14	5507	Yes
4016	14.9	452	13	5502	No
4017	14	487	16	5501	Yes
4018	12.3	302	14	5509	Yes
4019	11.9	350	15	5494	No
4020	19.8	311	12	5505	Yes
4021	15.5	371	13	5505	No
4022	14.8	345	16	5494	Yes
4023	15.8	300	15	5500	Yes
4024	15.6	287	14	5498	Yes
4025	17.1	255	13	5504	Yes
4026	13	388	12	5490	Yes
4027	15	251	16	5502	No
4028	16.2	397	13	5508	Yes
4029	18.6	272	15	5491	Yes
4030	11.2	431	15	5495	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	5496	Yes
12	5494	Yes
13	5499	Yes
14	5494	Yes
15	5497	Yes
16	5494	Yes
17	5494	Yes
18	5499	Yes
19	5495	Yes
20	5498	Yes
21	5506	Yes
22	5504	Yes
23	5506	Yes
24	5503	Yes
25	5506	Yes
26	5502	Yes
27	5502	Yes
28	5500	Yes
29	5506	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	165	5490	3	Yes
2	640	5491	6	Yes
3	1115	5492	3	Yes
4	1590	5493	3	Yes
5	2540	5494	5	Yes
6	3015	5495	3	Yes
7	3490	5496	4	Yes
8	3965	5497	5	Yes
9	4440	5498	3	Yes
10	4915	5499	7	Yes
11	5390	5500	7	Yes
12	5865	5501	6	Yes
13	6340	5502	3	Yes
14	6815	5503	5	Yes
15	7290	5504	6	Yes
16	7765	5505	6	Yes
17	8240	5506	7	Yes
18	8715	5507	4	Yes
19	9190	5508	5	Yes
20	9665	5509	5	Yes
21	10140	5510	2	Yes
22	10615	5490	4	Yes
23	11090	5491	5	Yes
24	11565	5492	4	Yes
25	12040	5493	2	Yes
26	12515	5494	5	Yes
27	12990	5495	5	Yes
28	13465	5496	6	Yes
29	13940	5497	2	Yes
30	14415	5498	2	Yes
31	14890	5499	3	Yes
32	15365	5500	6	Yes
33	15840	5501	4	Yes
34	16315	5502	3	Yes
35	16790	5503	4	Yes
36	17265	5504	5	Yes
37	17740	5505	6	Yes
38	18215	5506	5	Yes
39	18690	5507	4	Yes
40	19165	5508	7	Yes
41	19640	5509	4	Yes
42	20115	5510	5	Yes

4.3. RESULTS FOR 40 MHz BANDWIDTH

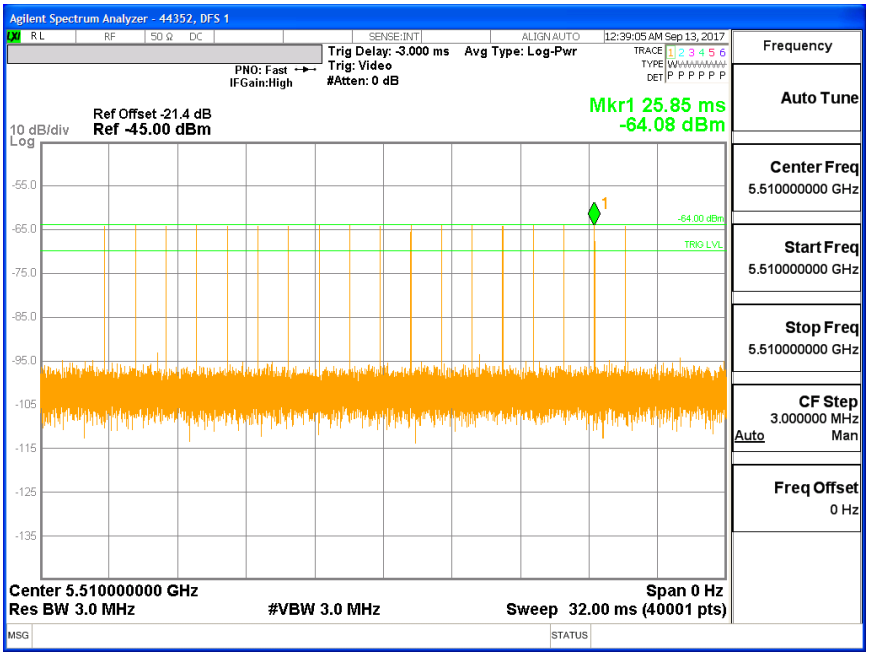
4.3.1. TEST CHANNEL

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

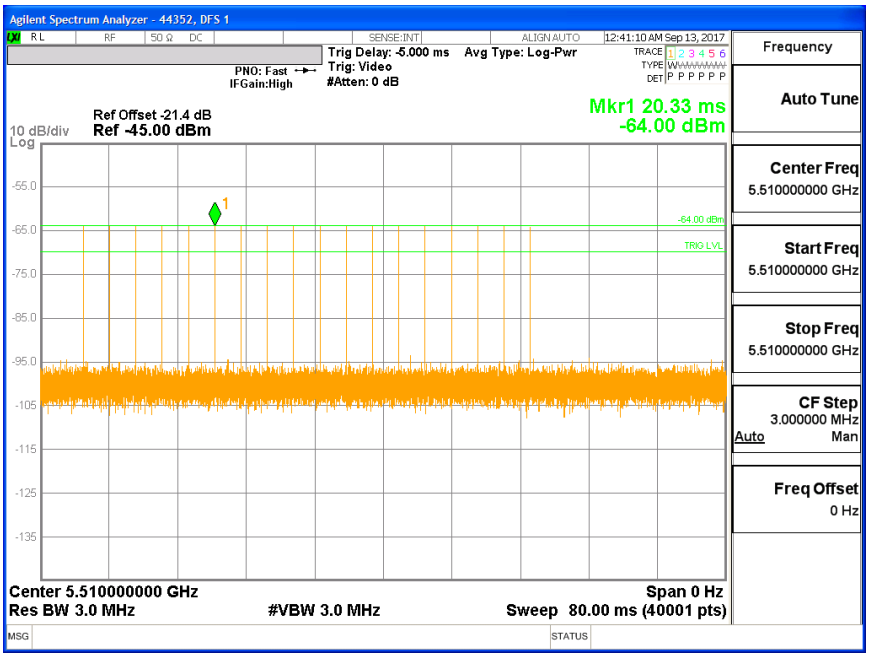
4.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

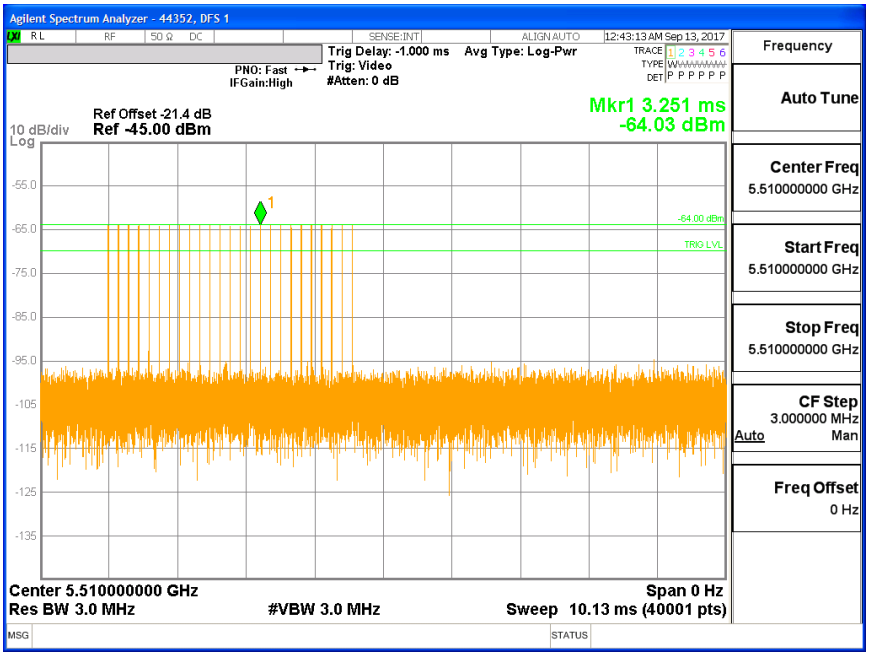
SHORT PULSE RADAR TYPE 0



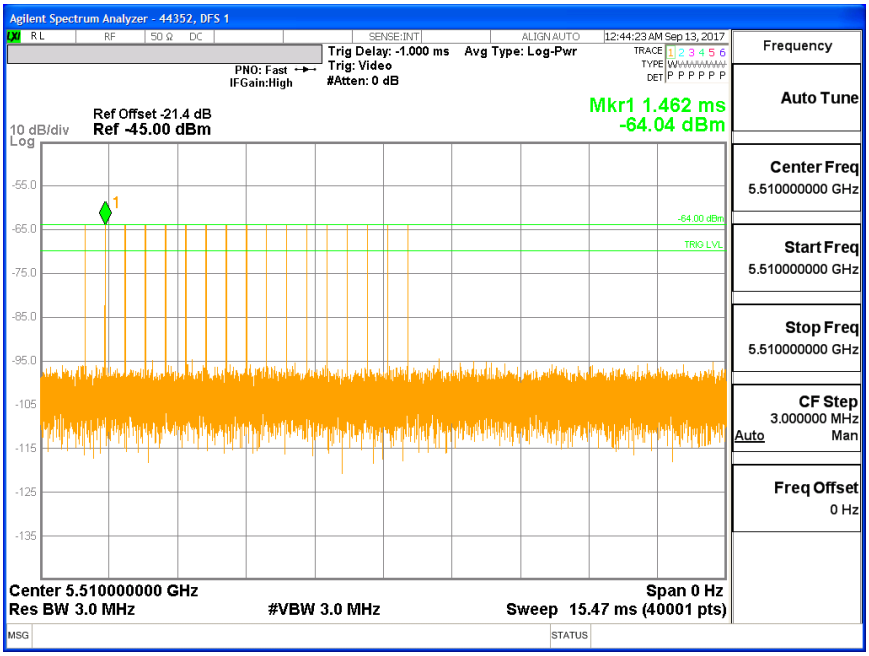
SAMPLE OF RADAR TYPE 1



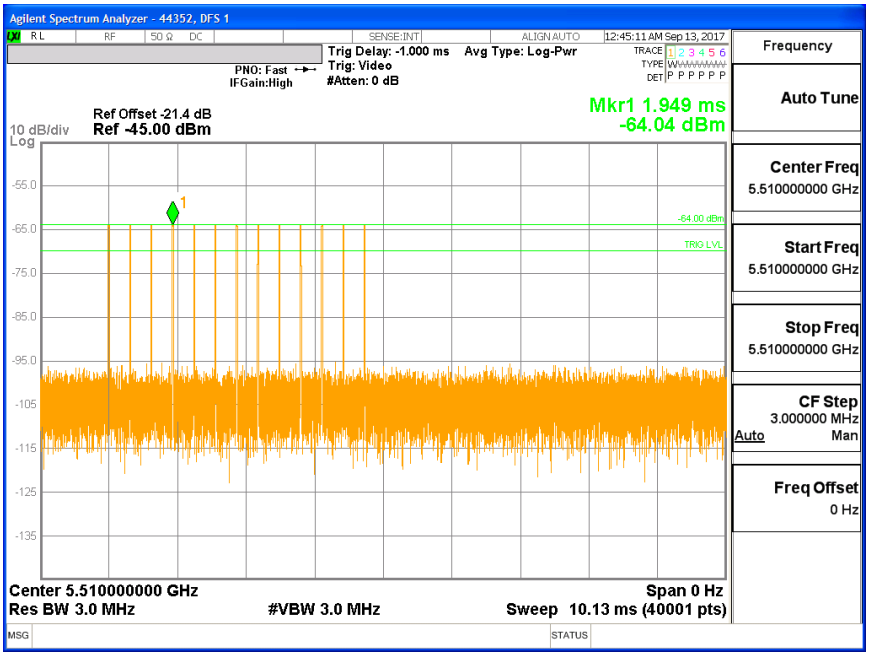
SAMPLE OF RADAR TYPE 2



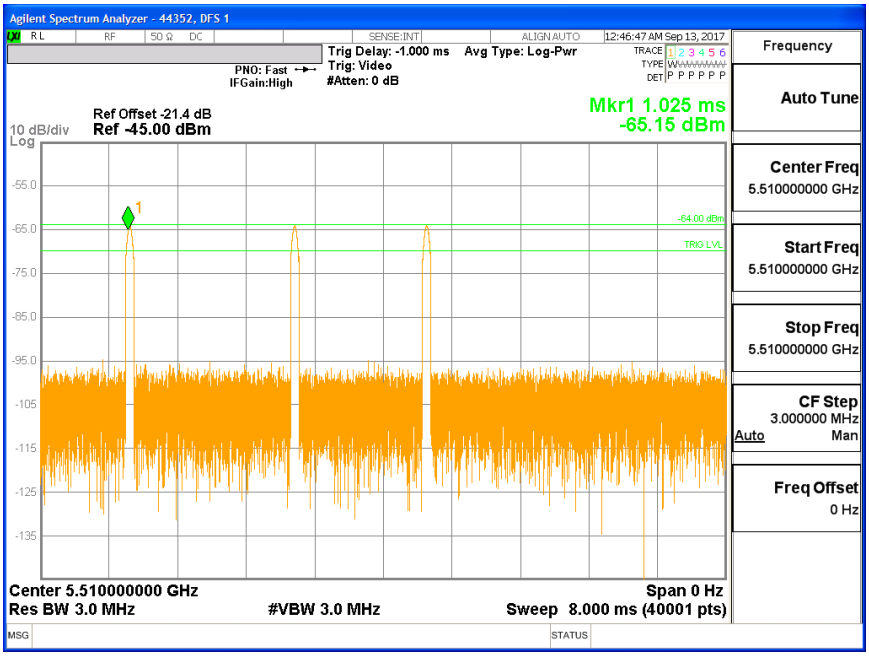
SAMPLE OF RADAR TYPE 3



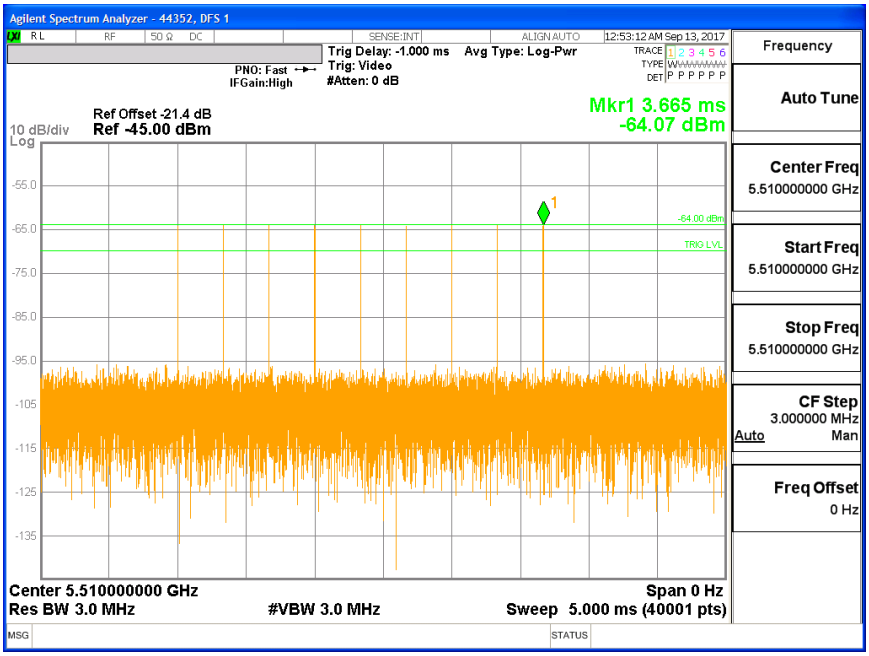
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

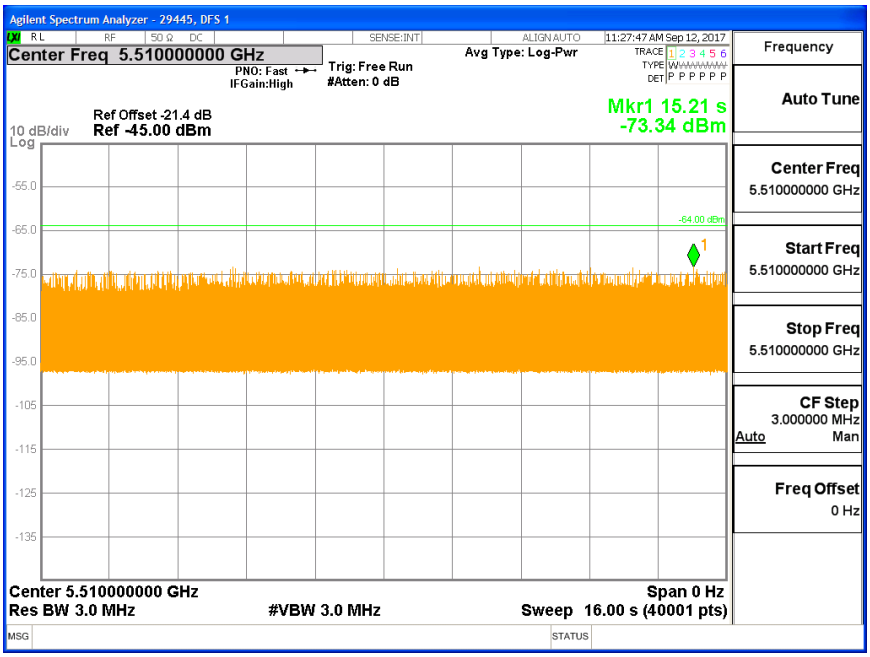


SINGLE BURST OF RADAR TYPE 6

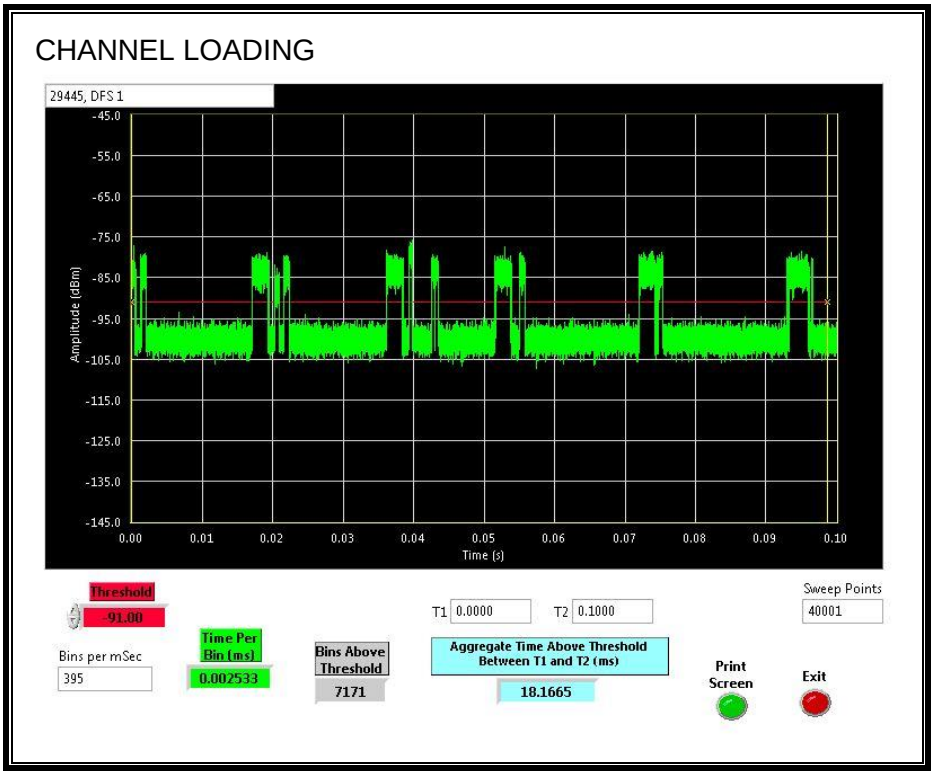


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.16%

4.3.3. 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)
30.25	219.6	189.4	129.4

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)
30.41	161.5	131.1	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)
30.9	217.5	186.6	57.3

QUALITATIVE RESULTS

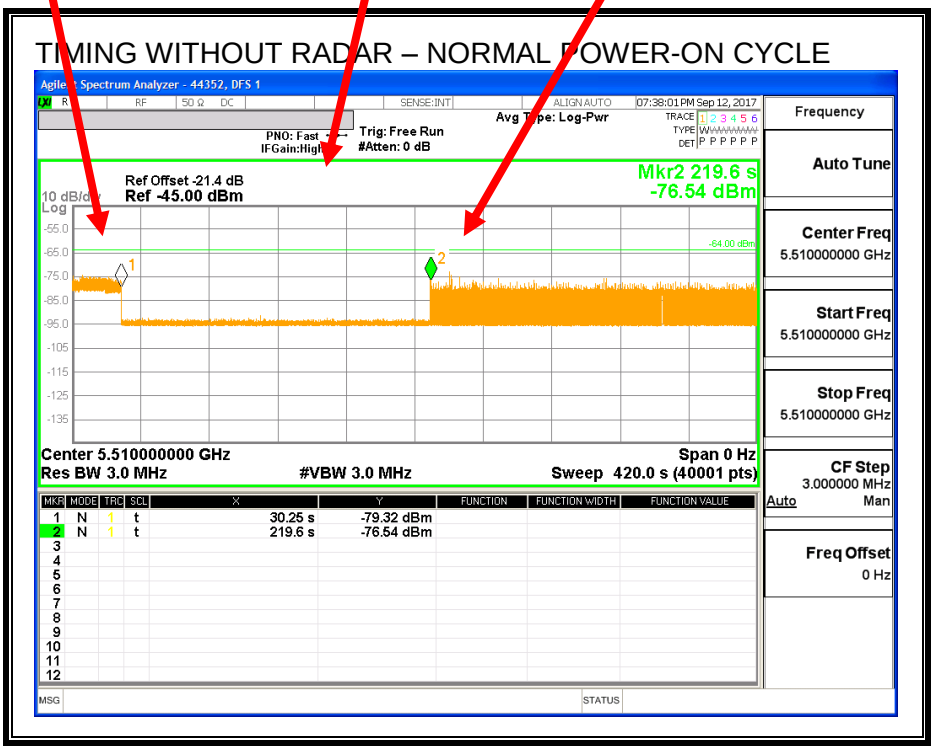
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

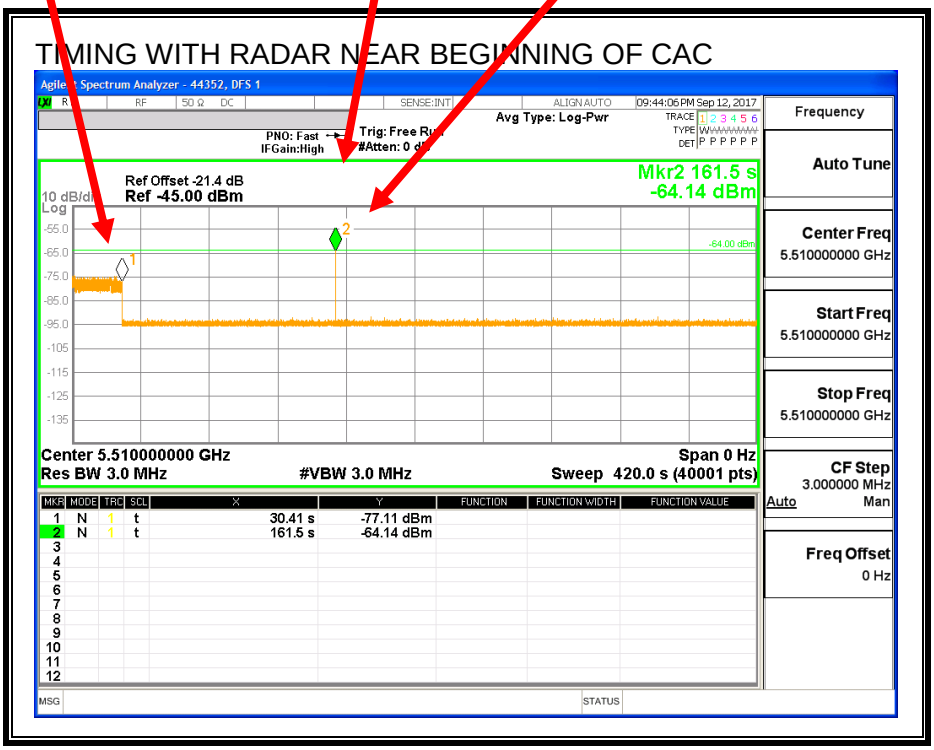
End of CAC
Traffic is Initiated



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

TIMING WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle
End of Initial Power-up cycle
Start of CAC
Radar Signal Applied



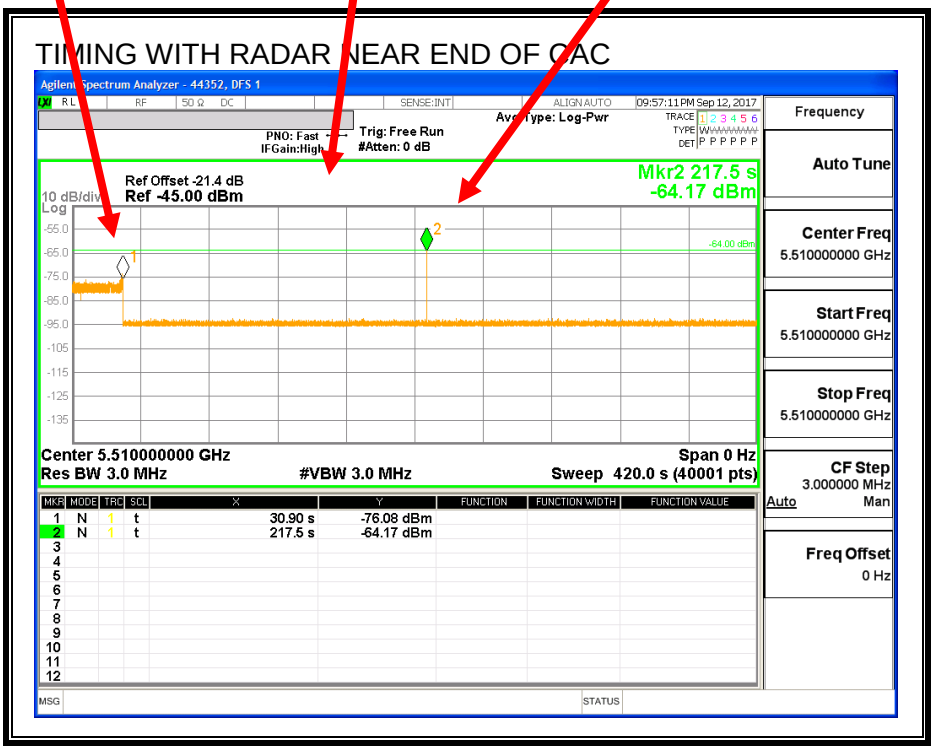
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

4.3.1. OVERLAPPING CHANNEL TESTS

RESULTS

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

4.3.2. 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).

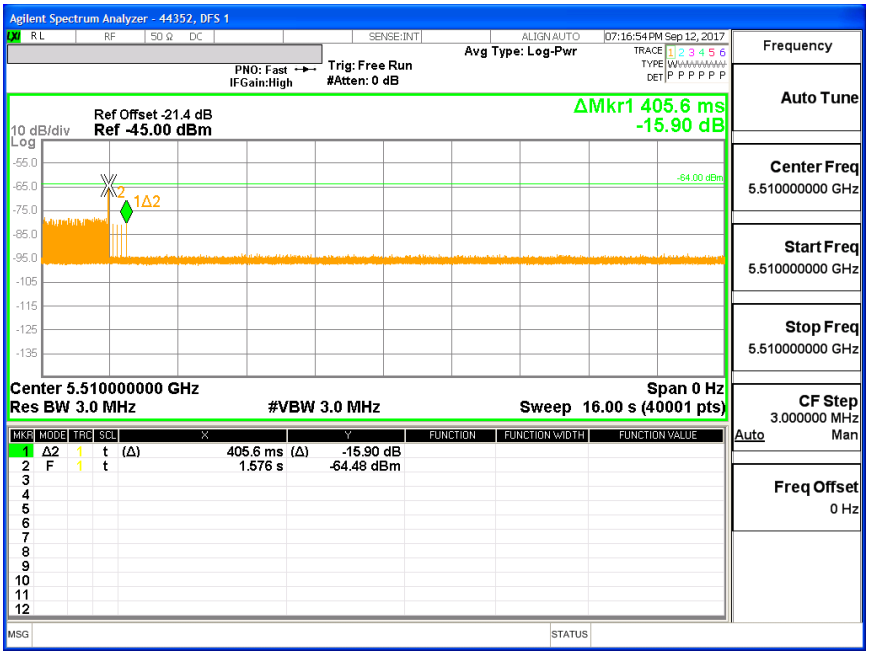
RESULTS

Channel Move Time (sec)	Limit (sec)
0.406	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
4.4	60

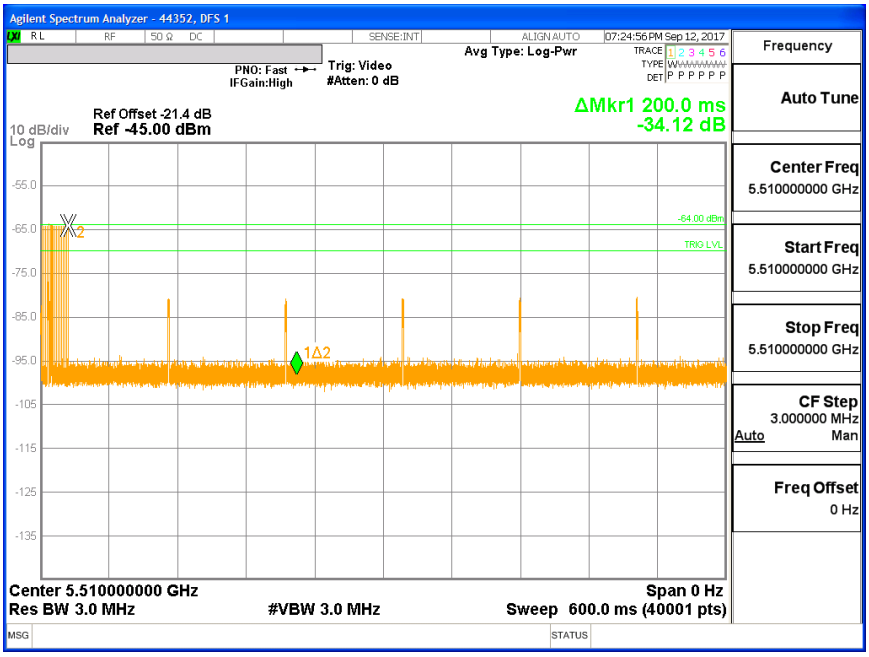
MOVE TIME

MOVE TIME



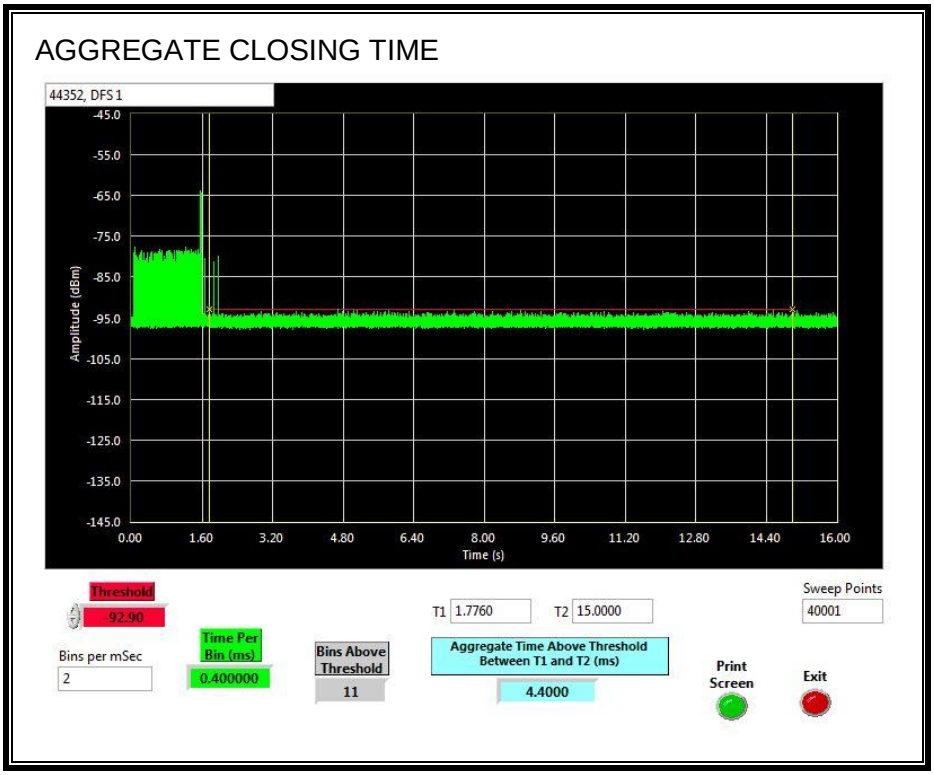
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

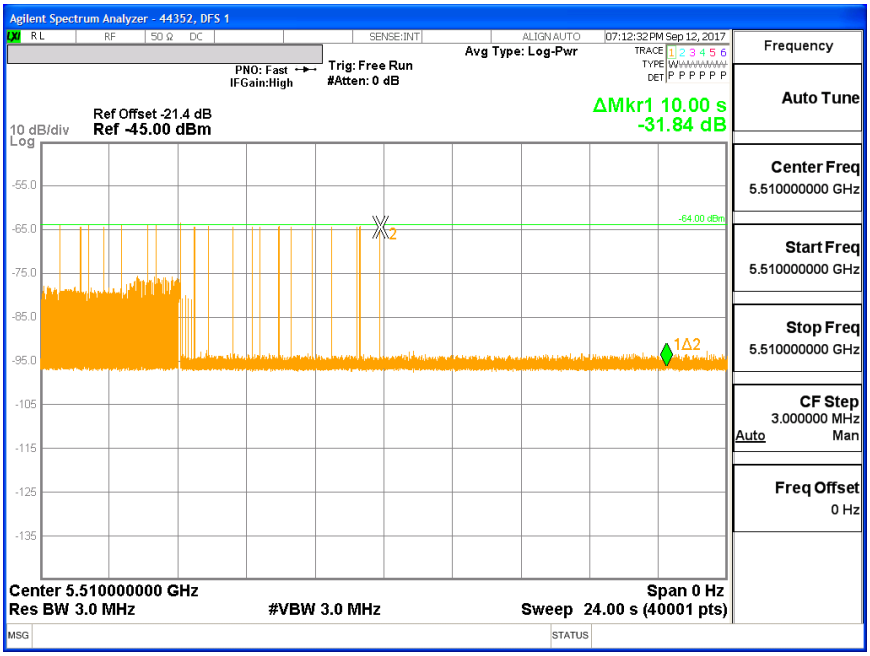
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

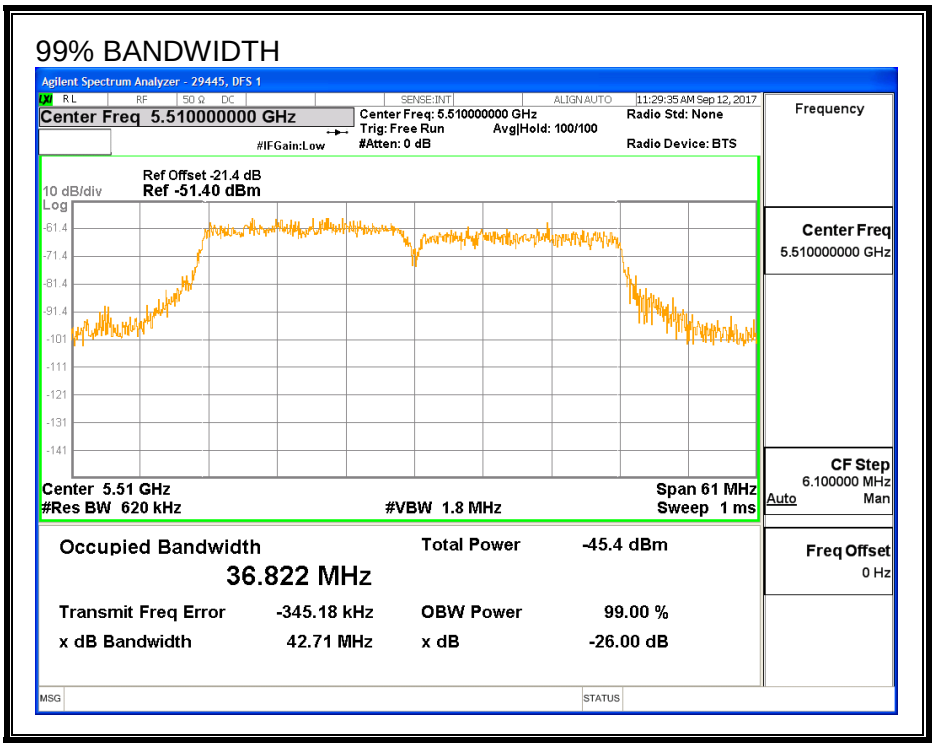
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



4.3.3. 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	36.822	108.6	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

4.3.4. 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	36.82	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5530	36.82	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5530	36.82	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5530	36.82	DFS 1	29445	Version 3.0
Aggregate		90.83	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	36.82	DFS 1	29445	Version 3.0
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530		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	5522	Yes
1002	1	738	72	A	5504	Yes
1003	1	698	76	A	5493	Yes
1004	1	818	65	A	5501	Yes
1005	1	538	99	A	5511	Yes
1006	1	918	58	A	5514	Yes
1007	1	638	83	A	5512	Yes
1008	1	898	59	A	5505	Yes
1009	1	878	61	A	5501	Yes
1010	1	798	67	A	5503	Yes
1011	1	778	68	A	5529	Yes
1012	1	558	95	A	5501	Yes
1013	1	718	74	A	5492	Yes
1014	1	838	63	A	5530	Yes
1015	1	938	57	A	5512	Yes
1016	1	3006	18	B	5496	Yes
1017	1	1573	34	B	5504	Yes
1018	1	1659	32	B	5527	Yes
1019	1	1550	35	B	5514	Yes
1020	1	570	93	B	5523	Yes
1021	1	1944	28	B	5502	Yes
1022	1	1094	49	B	5511	Yes
1023	1	2597	21	B	5519	Yes
1024	1	1877	29	B	5496	Yes
1025	1	961	55	B	5516	Yes
1026	1	1723	31	B	5494	Yes
1027	1	2291	24	B	5510	Yes
1028	1	635	84	B	5492	Yes
1029	1	1332	40	B	5520	Yes
1030	1	1159	46	B	5524	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	3	150	25	5500	No
2002	4.8	222	26	5494	Yes
2003	3.1	165	28	5521	Yes
2004	1.1	204	29	5513	Yes
2005	3.7	193	28	5526	Yes
2006	1.8	155	23	5498	Yes
2007	4.9	230	29	5524	No
2008	3.3	196	28	5508	Yes
2009	4.4	156	28	5502	Yes
2010	1	169	27	5512	Yes
2011	4.5	214	23	5525	Yes
2012	1.4	150	23	5506	Yes
2013	1	200	24	5501	Yes
2014	4.3	183	23	5507	Yes
2015	2.2	198	25	5513	Yes
2016	1.7	186	25	5512	Yes
2017	3.8	167	27	5513	Yes
2018	1.6	159	28	5528	Yes
2019	4	182	29	5506	Yes
2020	2	221	24	5502	Yes
2021	4.5	211	23	5502	Yes
2022	4.9	173	24	5491	Yes
2023	1.7	166	24	5503	Yes
2024	4.2	214	29	5526	Yes
2025	3.3	173	29	5498	Yes
2026	1.9	187	28	5512	Yes
2027	1.3	151	25	5514	Yes
2028	2.3	168	28	5519	Yes
2029	4	217	25	5517	Yes
2030	1.1	200	29	5523	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	8.1	455	17	5513	Yes
3002	7.5	416	16	5509	Yes
3003	9.7	476	16	5523	Yes
3004	9.4	450	17	5512	Yes
3005	7.7	405	18	5510	No
3006	9.8	392	18	5517	No
3007	6.3	360	18	5490	Yes
3008	8.6	493	18	5530	Yes
3009	9.5	474	18	5520	Yes
3010	7.9	251	18	5511	Yes
3011	7	495	16	5529	Yes
3012	7.8	418	16	5506	Yes
3013	7.2	307	17	5525	Yes
3014	6.2	360	16	5503	Yes
3015	9.9	395	17	5524	Yes
3016	7	461	16	5500	Yes
3017	9	257	18	5501	No
3018	8.4	470	16	5528	Yes
3019	6.5	279	16	5495	Yes
3020	6.2	253	17	5504	No
3021	8.6	459	18	5514	Yes
3022	6.5	446	16	5513	Yes
3023	7.2	414	18	5521	Yes
3024	9.5	296	16	5500	Yes
3025	6.3	277	16	5511	Yes
3026	8.7	305	18	5519	Yes
3027	7.9	298	17	5493	Yes
3028	8.7	339	16	5522	No
3029	10	478	16	5518	No
3030	9	281	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	16.8	315	13	5512	Yes
4002	19.5	382	15	5525	Yes
4003	14.7	429	14	5515	Yes
4004	13.6	390	14	5510	Yes
4005	18.4	450	15	5505	Yes
4006	17.7	425	13	5526	Yes
4007	13.9	380	12	5493	Yes
4008	18.5	367	15	5521	Yes
4009	19.9	335	15	5502	Yes
4010	15.9	468	16	5523	Yes
4011	17.8	330	13	5500	Yes
4012	14.3	476	14	5520	Yes
4013	12.4	352	12	5508	Yes
4014	14.1	259	16	5495	No
4015	12.7	399	14	5505	Yes
4016	14.9	452	13	5518	Yes
4017	14	487	16	5497	Yes
4018	12.3	302	14	5519	Yes
4019	11.9	350	15	5517	Yes
4020	19.8	311	12	5519	Yes
4021	15.5	371	13	5503	Yes
4022	14.8	345	16	5522	Yes
4023	15.8	300	15	5529	No
4024	15.6	287	14	5493	No
4025	17.1	255	13	5494	Yes
4026	13	388	12	5511	Yes
4027	15	251	16	5490	Yes
4028	16.2	397	13	5492	Yes
4029	18.6	272	15	5492	Yes
4030	11.2	431	15	5495	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	5496	Yes
12	5494	Yes
13	5499	Yes
14	5495	Yes
15	5498	Yes
16	5495	Yes
17	5494	Yes
18	5499	Yes
19	5495	Yes
20	5499	Yes
21	5526	Yes
22	5524	Yes
23	5525	Yes
24	5523	Yes
25	5525	Yes
26	5521	Yes
27	5522	Yes
28	5520	Yes
29	5525	Yes
30	5523	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	32	5490	13	Yes
2	507	5491	8	Yes
3	982	5492	7	Yes
4	1457	5493	12	Yes
5	1932	5494	17	Yes
6	2407	5495	9	Yes
7	2882	5496	7	Yes
8	3357	5497	8	Yes
9	3832	5498	10	Yes
10	4307	5499	9	Yes
11	4782	5500	8	Yes
12	5257	5501	8	Yes
13	5732	5502	7	Yes
14	6207	5503	14	Yes
15	6682	5504	9	Yes
16	7157	5505	8	Yes
17	7632	5506	14	Yes
18	8107	5507	4	Yes
19	8582	5508	5	Yes
20	9057	5509	11	Yes
21	9532	5510	11	Yes
22	10007	5511	8	Yes
23	10482	5512	7	Yes
24	10957	5513	9	Yes
25	11432	5514	9	Yes
26	11907	5515	8	Yes
27	12382	5516	7	Yes
28	12857	5517	8	Yes
29	13332	5518	13	Yes
30	13807	5519	6	Yes
31	14282	5520	8	Yes
32	14757	5521	6	Yes
33	15232	5522	8	Yes
34	15707	5523	9	Yes
35	16182	5524	9	Yes
36	16657	5525	6	Yes
37	17132	5526	11	Yes
38	17607	5527	12	Yes
39	18082	5528	9	Yes
40	18557	5529	7	Yes
41	19032	5530	4	Yes

4.4. RESULTS FOR 80 MHz BANDWIDTH

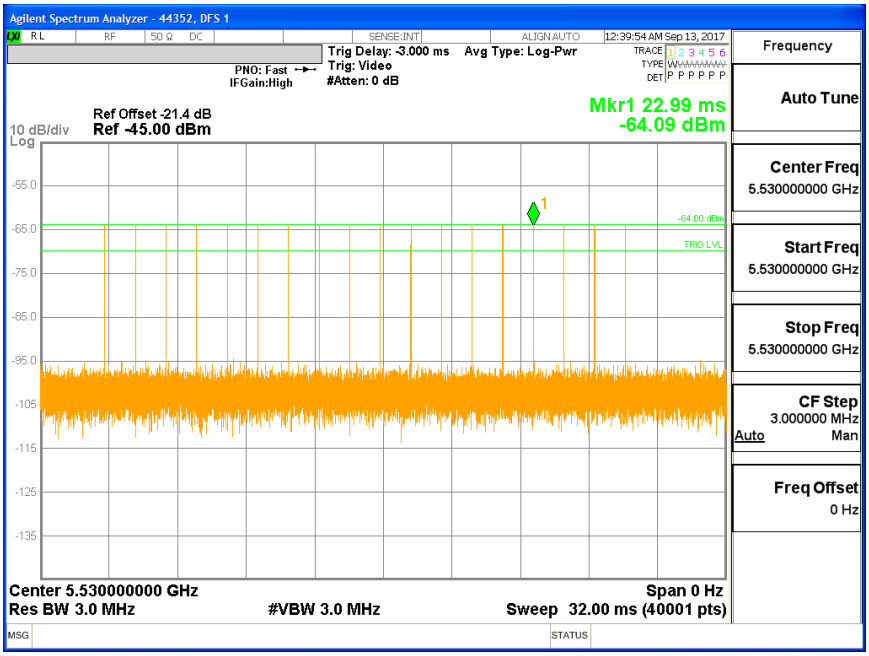
4.4.1. TEST CHANNEL

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

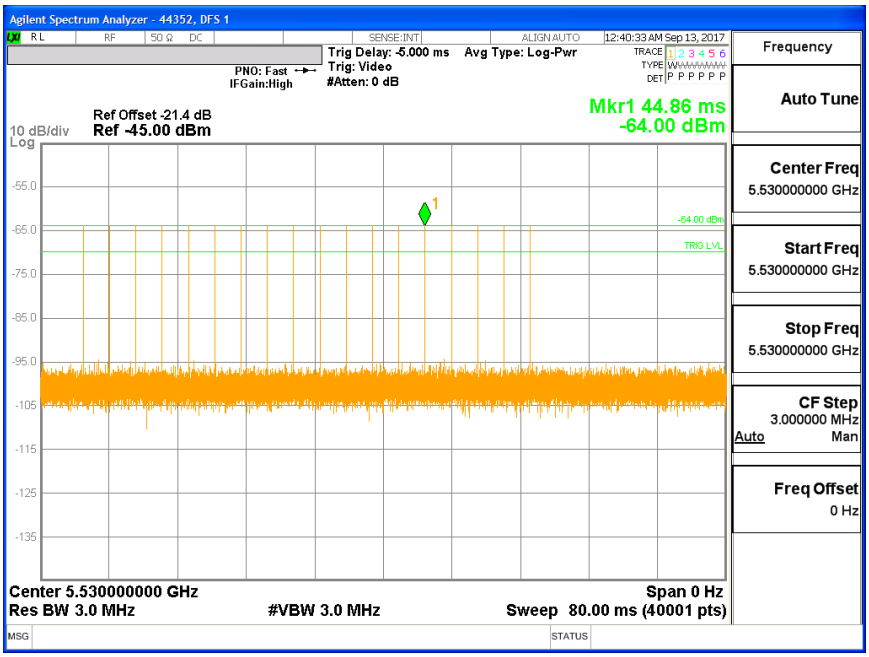
4.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

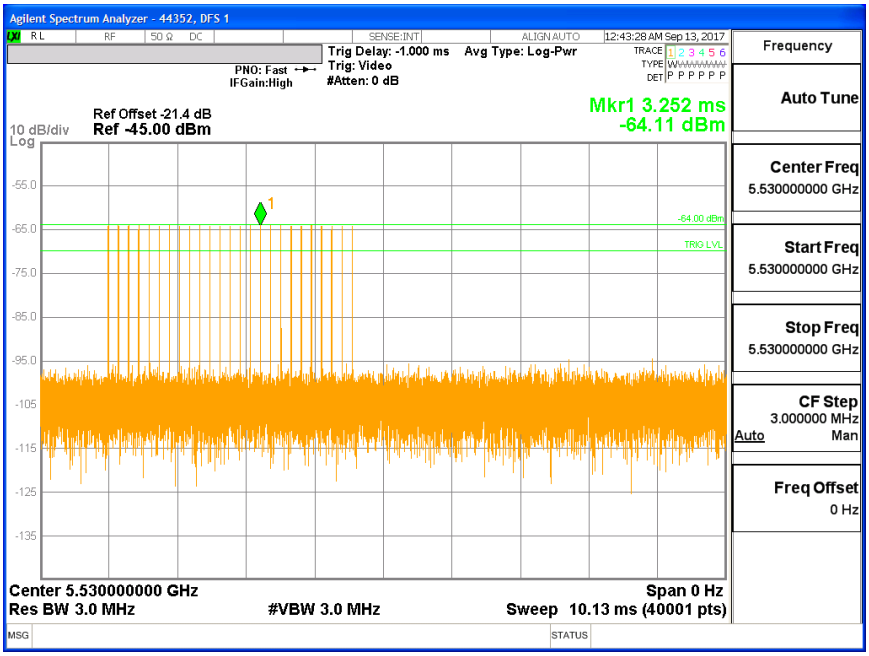
SHORT PULSE RADAR TYPE 0



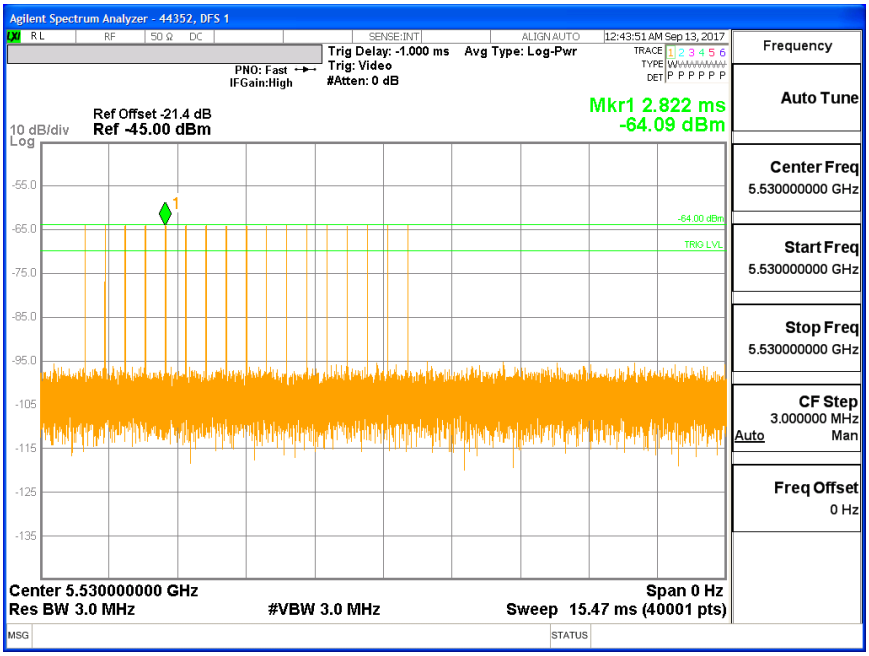
SAMPLE OF RADAR TYPE 1



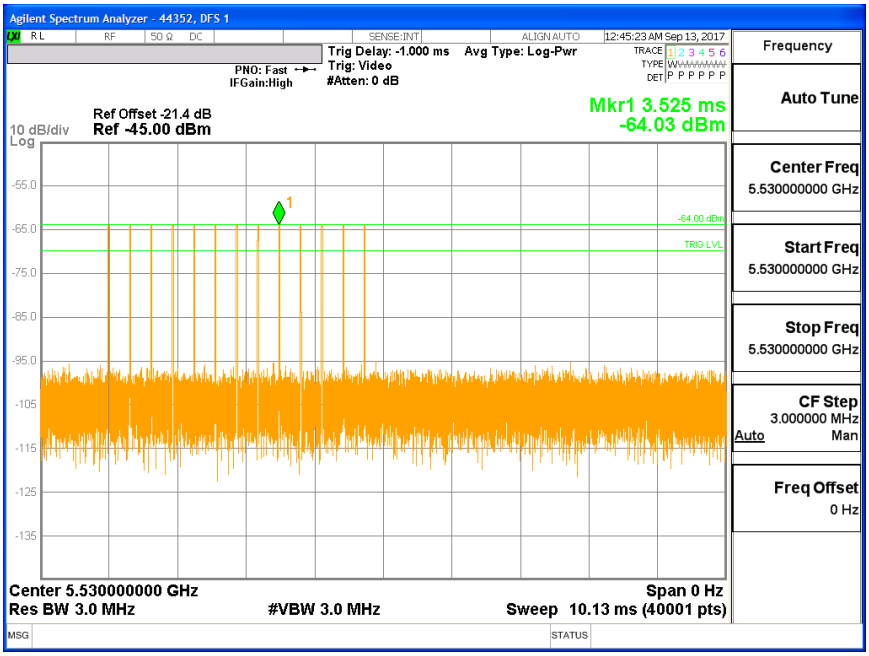
SAMPLE OF RADAR TYPE 2



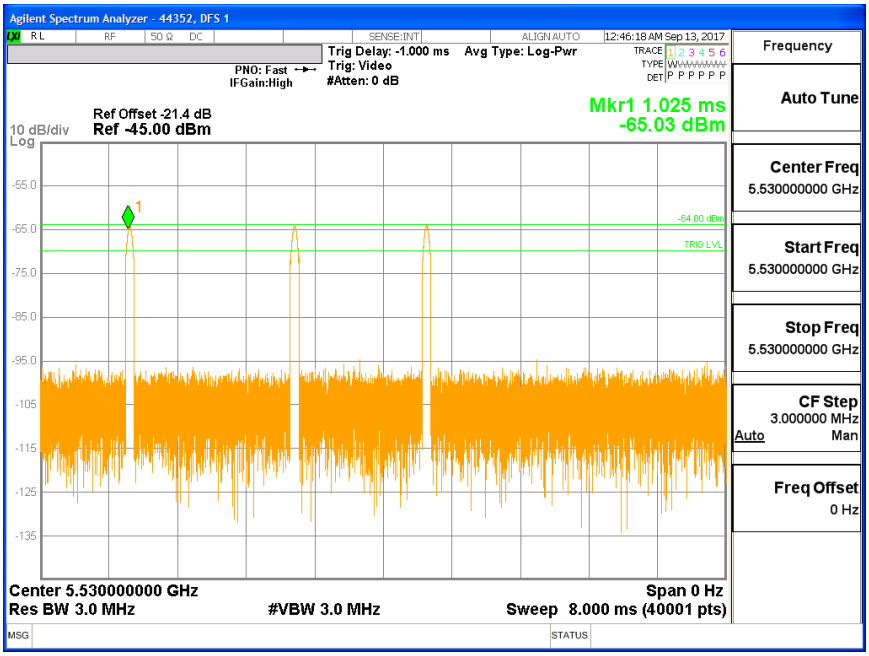
SAMPLE OF RADAR TYPE 3



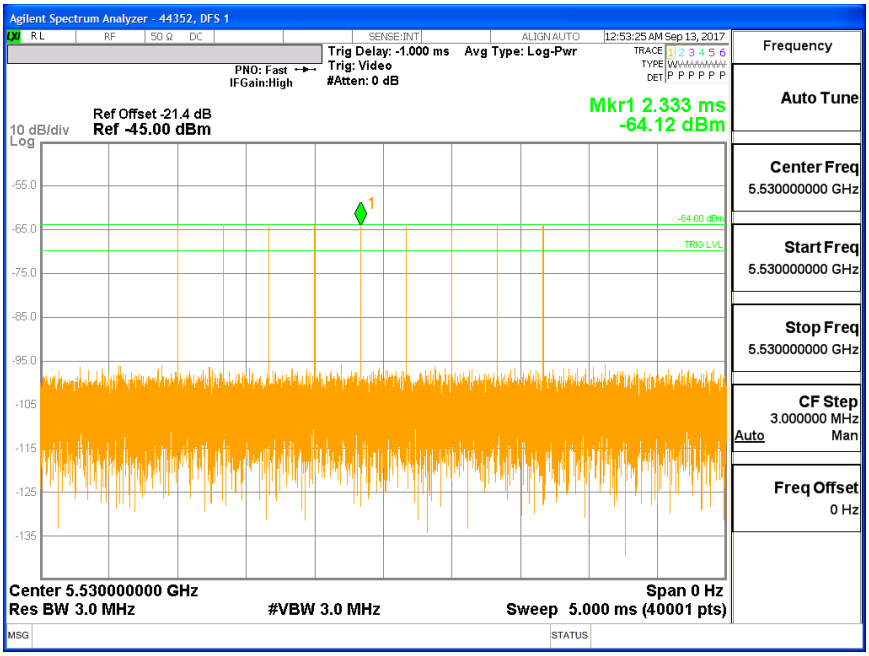
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

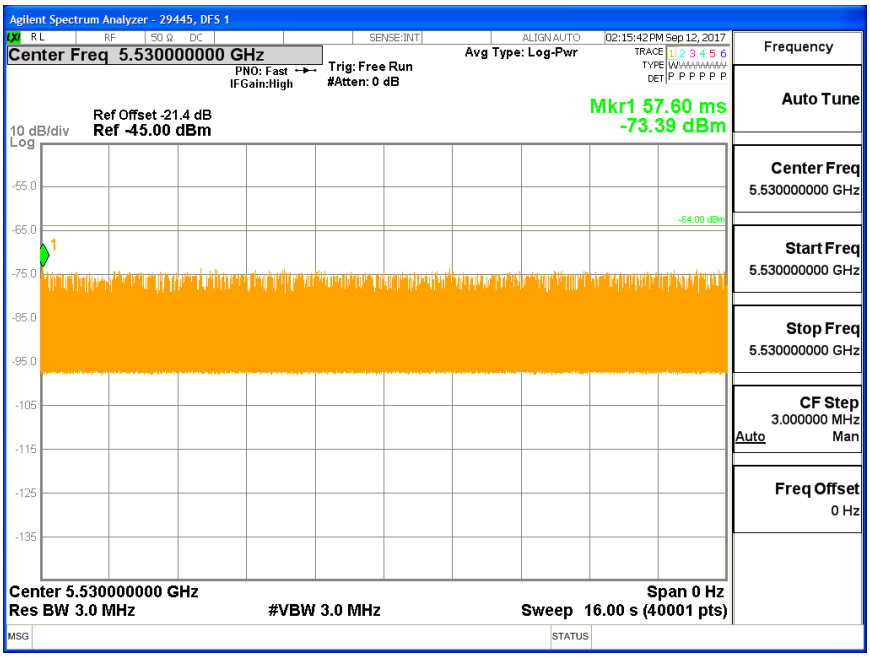


SINGLE BURST OF RADAR TYPE 6

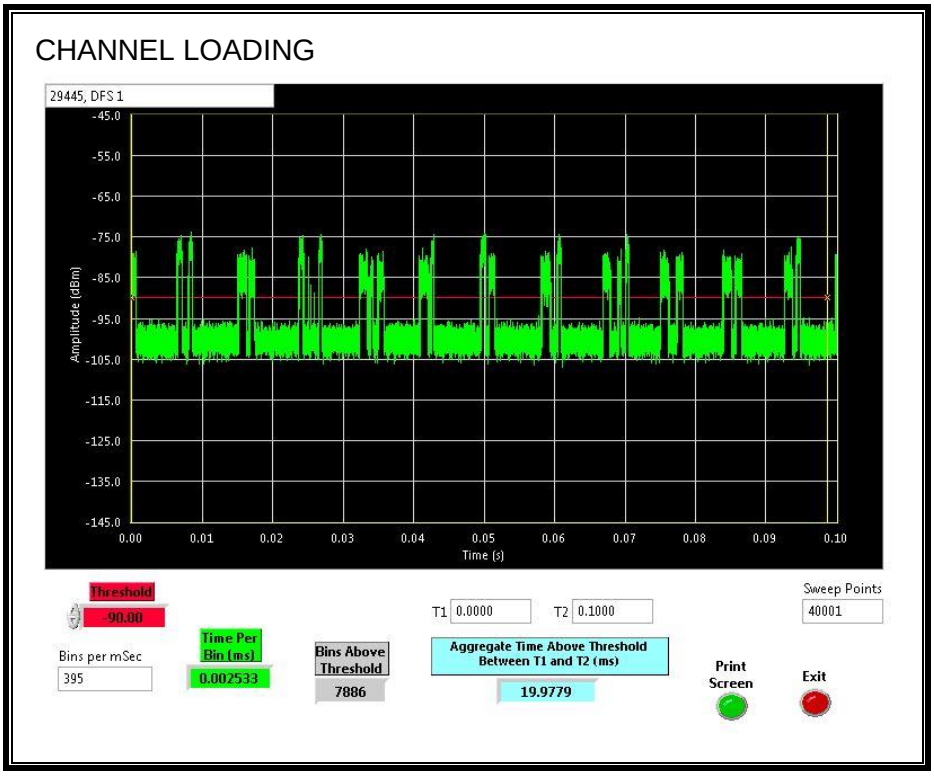


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.97%

4.4.1. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.23	204.5	174.3	114.3

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)
30.37	146.1	115.7	1.5

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)
30.52	202.8	172.3	58.0

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

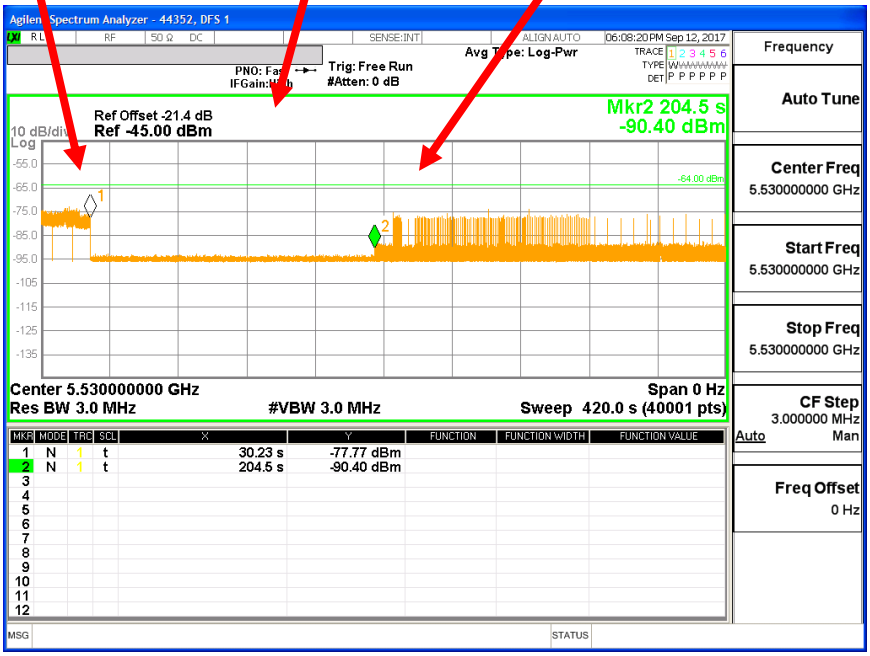
TIMING WITHOUT RADAR DURING CAC

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

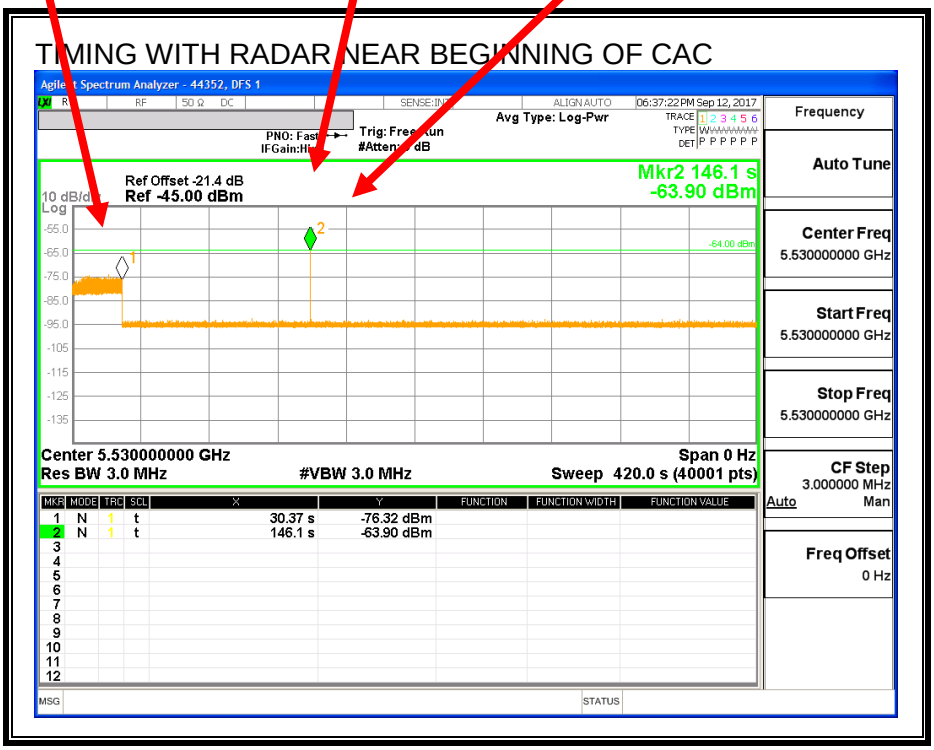
TIMING WITHOUT RADAR – NORMAL POWER-ON CYCLE



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



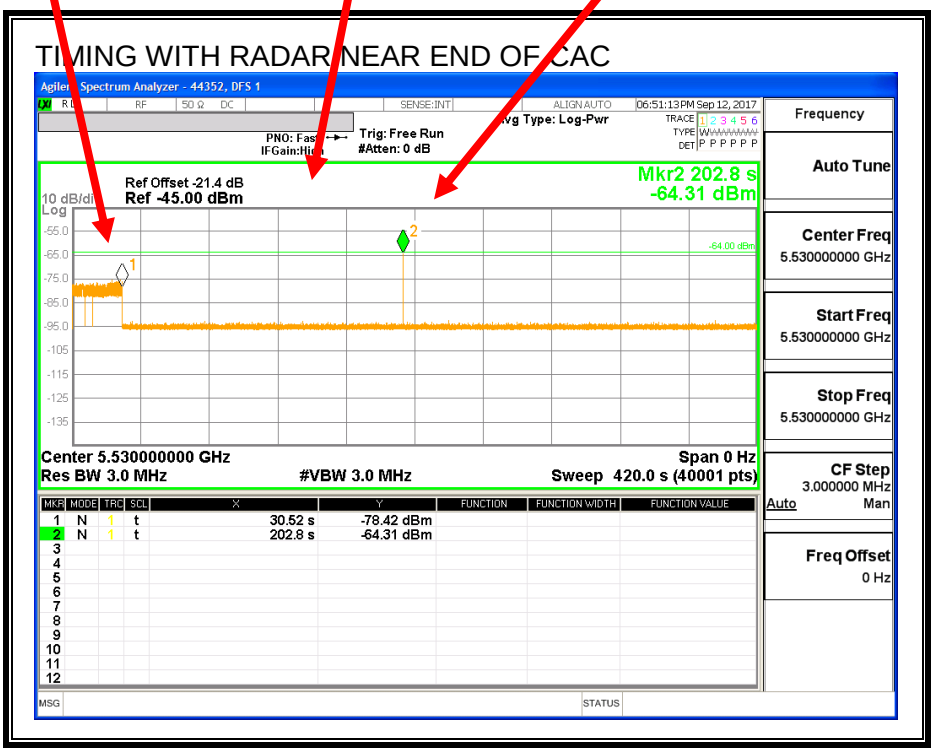
No EUT transmissions were observed after the radar signal.

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.

4.4.2. OVERLAPPING CHANNEL TESTS

RESULTS

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

4.4.3. 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).

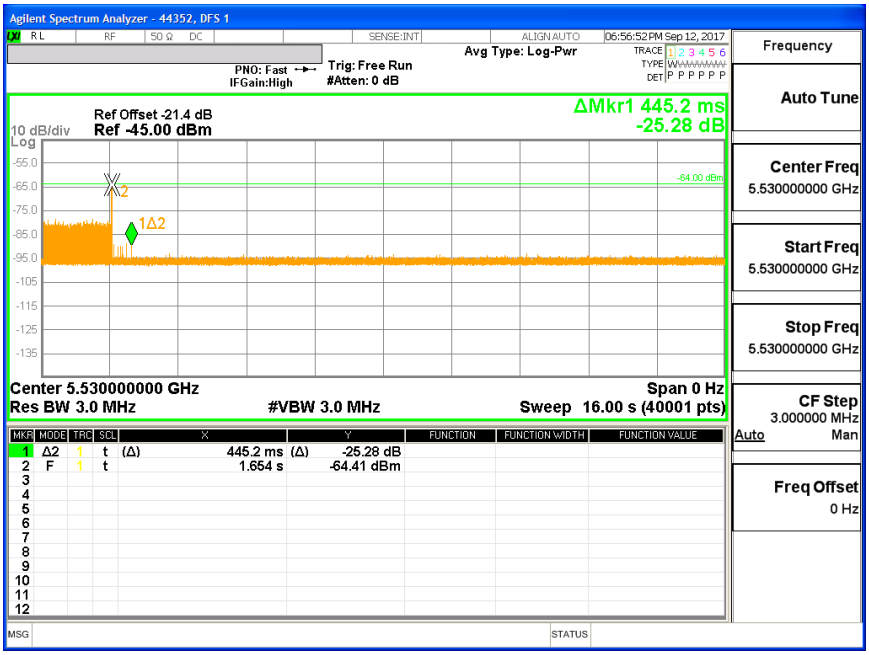
RESULTS

Channel Move Time (sec)	Limit (sec)
0.445	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
2.4	60

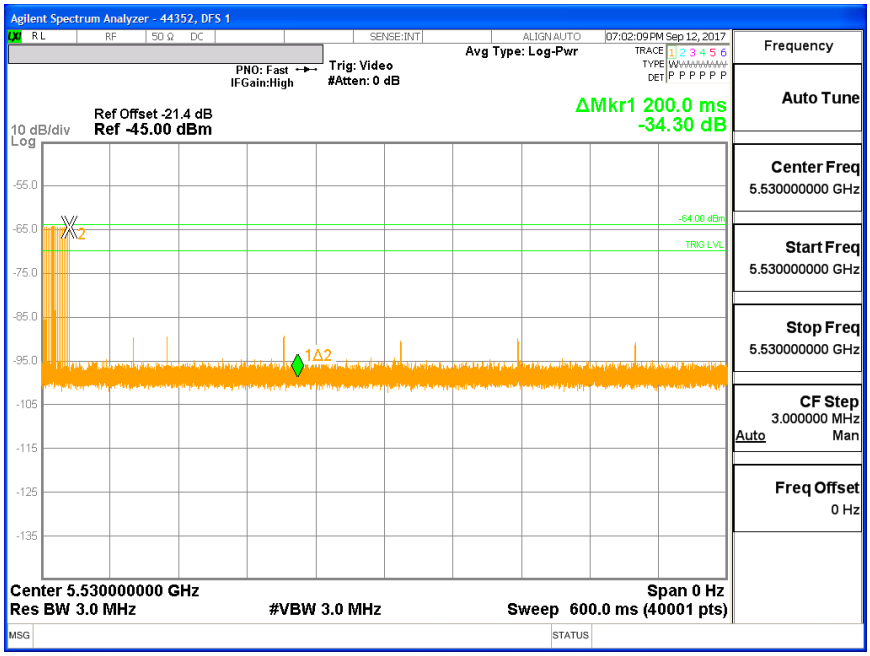
MOVE TIME

MOVE TIME



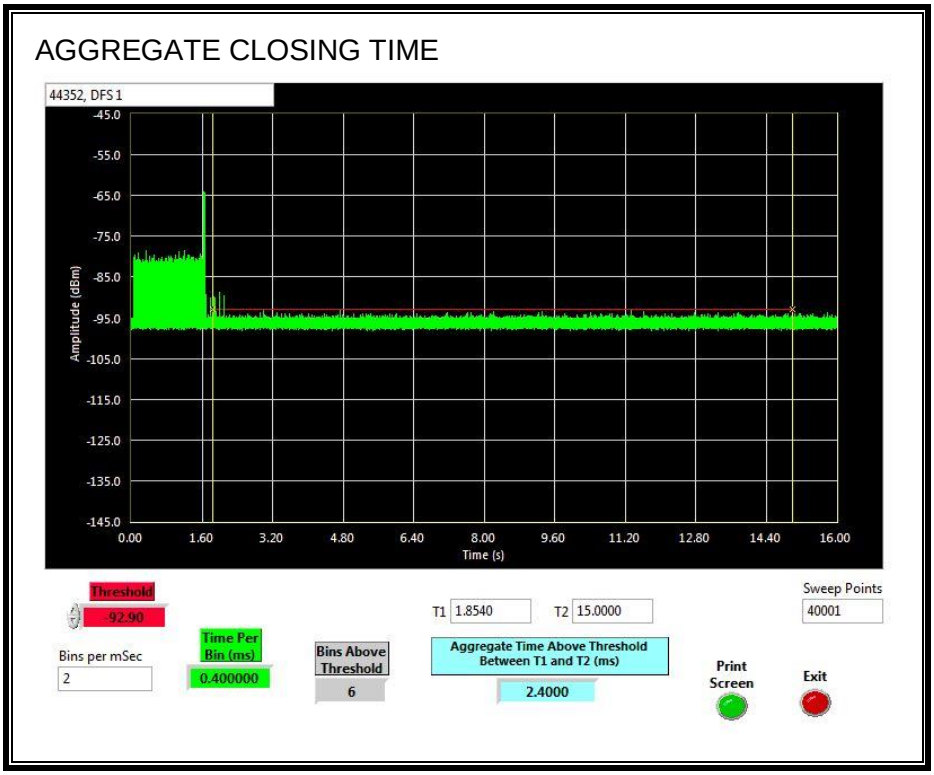
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

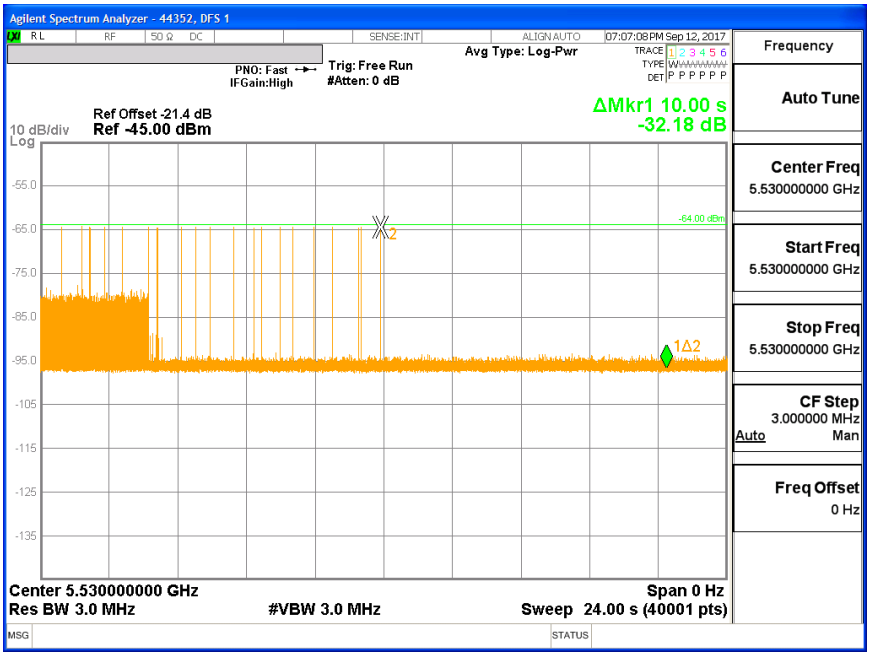
Only intermittent transmissions are observed during the aggregate monitoring period.



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

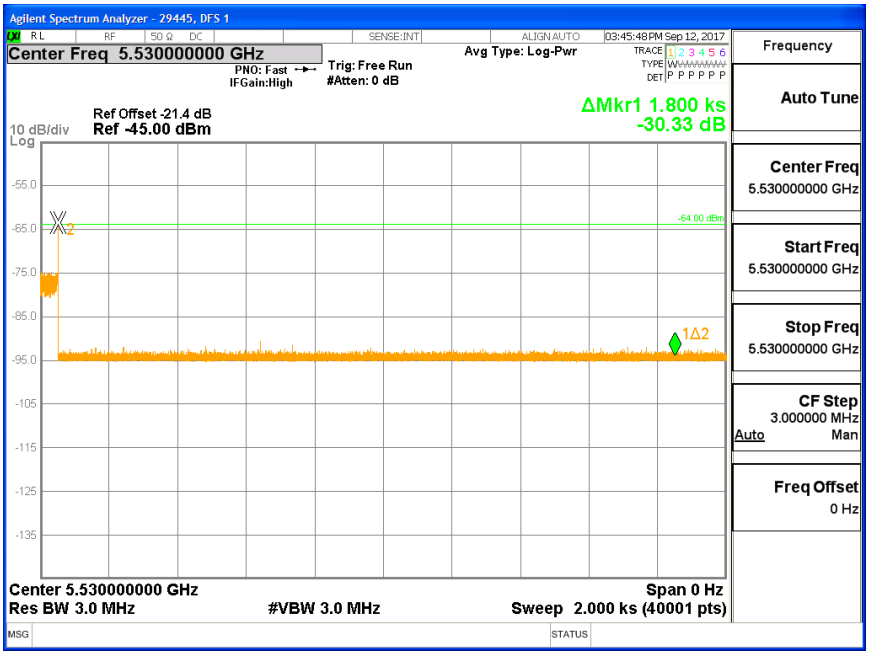


4.4.1. NON-OCCUPANCY PERIOD

RESULTS

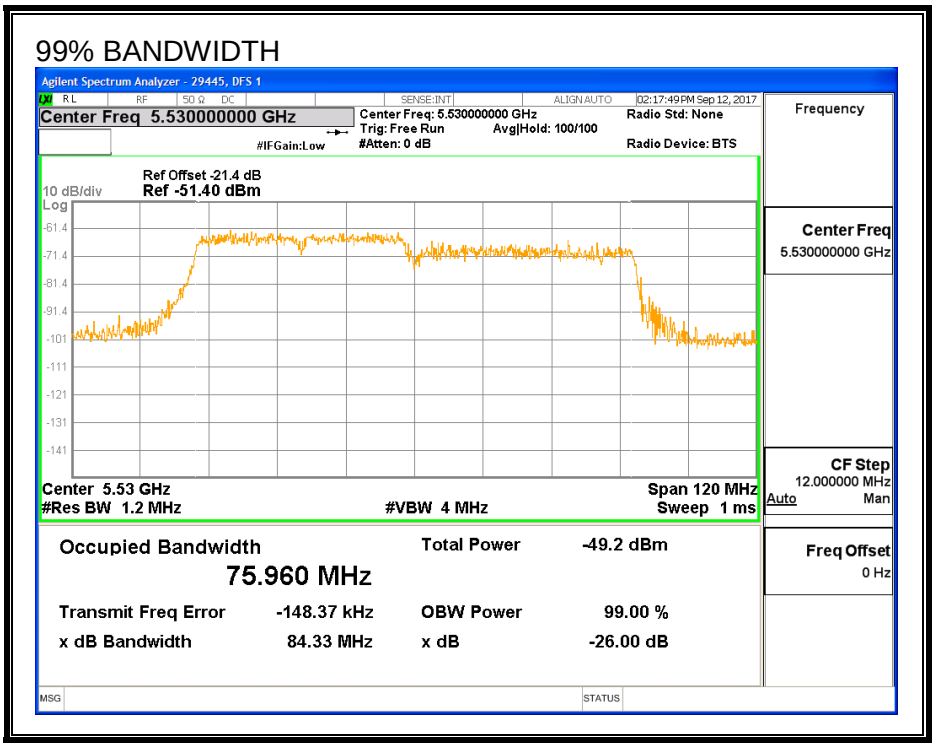
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



4.4.2. 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	75.960	105.3	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	
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

4.4.3. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5570	75.96	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5570	75.96	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	90.00	60	Pass	5490	5570	75.96	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5570	75.96	DFS 1	29445	Version 3.0
Aggregate		93.33	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	75.96	DFS 1	29445	Version 3.0
FCC Hopping Type 6	81	100.00	70	Pass	5490	5570		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	5562	Yes
1002	1	738	72	A	5526	Yes
1003	1	698	76	A	5541	Yes
1004	1	818	65	A	5538	Yes
1005	1	538	99	A	5533	Yes
1006	1	918	58	A	5539	Yes
1007	1	638	83	A	5565	Yes
1008	1	898	59	A	5511	Yes
1009	1	878	61	A	5528	Yes
1010	1	798	67	A	5552	Yes
1011	1	778	68	A	5532	Yes
1012	1	558	95	A	5546	Yes
1013	1	718	74	A	5496	Yes
1014	1	838	63	A	5538	Yes
1015	1	938	57	A	5535	Yes
1016	1	3006	18	B	5509	Yes
1017	1	1573	34	B	5530	Yes
1018	1	1659	32	B	5498	Yes
1019	1	1550	35	B	5495	Yes
1020	1	570	93	B	5531	Yes
1021	1	1944	28	B	5539	Yes
1022	1	1094	49	B	5511	Yes
1023	1	2597	21	B	5493	Yes
1024	1	1877	29	B	5555	Yes
1025	1	961	55	B	5533	Yes
1026	1	1723	31	B	5512	Yes
1027	1	2291	24	B	5496	Yes
1028	1	635	84	B	5548	Yes
1029	1	1332	40	B	5552	Yes
1030	1	1159	46	B	5515	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	3	150	25	5543	Yes
2002	4.8	222	26	5546	Yes
2003	3.1	165	28	5540	Yes
2004	1.1	204	29	5553	Yes
2005	3.7	193	28	5539	Yes
2006	1.8	155	23	5514	Yes
2007	4.9	230	29	5534	Yes
2008	3.3	196	28	5515	Yes
2009	4.4	156	28	5553	Yes
2010	1	169	27	5563	Yes
2011	4.5	214	23	5519	Yes
2012	1.4	150	23	5551	No
2013	1	200	24	5560	Yes
2014	4.3	183	23	5539	Yes
2015	2.2	198	25	5507	Yes
2016	1.7	186	25	5529	Yes
2017	3.8	167	27	5490	Yes
2018	1.6	159	28	5506	No
2019	4	182	29	5551	Yes
2020	2	221	24	5528	Yes
2021	4.5	211	23	5558	Yes
2022	4.9	173	24	5533	Yes
2023	1.7	166	24	5533	Yes
2024	4.2	214	29	5529	Yes
2025	3.3	173	29	5518	Yes
2026	1.9	187	28	5509	Yes
2027	1.3	151	25	5561	Yes
2028	2.3	168	28	5529	Yes
2029	4	217	25	5503	Yes
2030	1.1	200	29	5545	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	8.1	455	17	5540	Yes
3002	7.5	416	16	5558	Yes
3003	9.7	476	16	5554	Yes
3004	9.4	450	17	5542	Yes
3005	7.7	405	18	5502	Yes
3006	9.8	392	18	5554	Yes
3007	6.3	360	18	5526	No
3008	8.6	493	18	5513	Yes
3009	9.5	474	18	5540	Yes
3010	7.9	251	18	5507	Yes
3011	7	495	16	5548	Yes
3012	7.8	418	16	5512	Yes
3013	7.2	307	17	5560	No
3014	6.2	360	16	5523	Yes
3015	9.9	395	17	5523	Yes
3016	7	461	16	5533	Yes
3017	9	257	18	5566	Yes
3018	8.4	470	16	5562	Yes
3019	6.5	279	16	5525	Yes
3020	6.2	253	17	5524	Yes
3021	8.6	459	18	5569	Yes
3022	6.5	446	16	5563	Yes
3023	7.2	414	18	5542	Yes
3024	9.5	296	16	5555	Yes
3025	6.3	277	16	5509	Yes
3026	8.7	305	18	5555	Yes
3027	7.9	298	17	5546	Yes
3028	8.7	339	16	5527	No
3029	10	478	16	5559	Yes
3030	9	281	18	5509	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	16.8	315	13	5511	Yes
4002	19.5	382	15	5514	Yes
4003	14.7	429	14	5510	Yes
4004	13.6	390	14	5499	Yes
4005	18.4	450	15	5558	Yes
4006	17.7	425	13	5547	No
4007	13.9	380	12	5541	No
4008	18.5	367	15	5520	Yes
4009	19.9	335	15	5562	Yes
4010	15.9	468	16	5512	Yes
4011	17.8	330	13	5509	Yes
4012	14.3	476	14	5523	Yes
4013	12.4	352	12	5521	No
4014	14.1	259	16	5530	Yes
4015	12.7	399	14	5566	Yes
4016	14.9	452	13	5496	Yes
4017	14	487	16	5547	Yes
4018	12.3	302	14	5557	Yes
4019	11.9	350	15	5503	Yes
4020	19.8	311	12	5493	Yes
4021	15.5	371	13	5552	Yes
4022	14.8	345	16	5496	Yes
4023	15.8	300	15	5536	Yes
4024	15.6	287	14	5552	Yes
4025	17.1	255	13	5502	Yes
4026	13	388	12	5491	Yes
4027	15	251	16	5505	Yes
4028	16.2	397	13	5514	Yes
4029	18.6	272	15	5493	Yes
4030	11.2	431	15	5490	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	5497	Yes
12	5495	Yes
13	5500	Yes
14	5495	Yes
15	5498	Yes
16	5495	Yes
17	5495	Yes
18	5500	Yes
19	5496	Yes
20	5499	Yes
21	5565	Yes
22	5564	Yes
23	5565	Yes
24	5562	Yes
25	5565	Yes
26	5561	Yes
27	5562	Yes
28	5560	Yes
29	5565	Yes
30	5563	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	291	5490	13	Yes
2	766	5491	18	Yes
3	1241	5492	22	Yes
4	1716	5493	18	Yes
5	2191	5494	11	Yes
6	2666	5495	17	Yes
7	3141	5496	13	Yes
8	3616	5497	13	Yes
9	4091	5498	16	Yes
10	4566	5499	10	Yes
11	5041	5500	12	Yes
12	5516	5501	20	Yes
13	5991	5502	16	Yes
14	6466	5503	15	Yes
15	6941	5504	20	Yes
16	7416	5505	17	Yes
17	7891	5506	25	Yes
18	8366	5507	13	Yes
19	8841	5508	19	Yes
20	9316	5509	13	Yes
21	9791	5510	20	Yes
22	10266	5511	16	Yes
23	10741	5512	15	Yes
24	11216	5513	21	Yes
25	11691	5514	14	Yes
26	12166	5515	15	Yes
27	12641	5516	13	Yes
28	13116	5517	15	Yes
29	13591	5518	17	Yes
30	14066	5519	20	Yes
31	14541	5520	13	Yes
32	15016	5521	15	Yes
33	15491	5522	15	Yes
34	15966	5523	17	Yes
35	16441	5524	18	Yes
36	16916	5525	13	Yes
37	17391	5526	12	Yes
38	17866	5527	19	Yes
39	18341	5528	17	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

40	18816	5529	16	Yes
41	19291	5530	18	Yes
42	19766	5531	21	Yes
43	20241	5532	21	Yes
44	20716	5533	21	Yes
45	21191	5534	25	Yes
46	21666	5535	17	Yes
47	22141	5536	17	Yes
48	22616	5537	21	Yes
49	23091	5538	17	Yes
50	23566	5539	16	Yes
51	24041	5540	11	Yes
52	24516	5541	9	Yes
53	24991	5542	13	Yes
54	25466	5543	16	Yes
55	25941	5544	13	Yes
56	26416	5545	14	Yes
57	26891	5546	18	Yes
58	27366	5547	23	Yes
59	27841	5548	18	Yes
60	28316	5549	22	Yes
61	28791	5550	17	Yes
62	29266	5551	17	Yes
63	29741	5552	14	Yes
64	30216	5553	19	Yes
65	30691	5554	15	Yes
66	31166	5555	18	Yes
67	31641	5556	12	Yes
68	32116	5557	24	Yes
69	32591	5558	17	Yes
70	33066	5559	17	Yes
71	33541	5560	24	Yes
72	34016	5561	13	Yes
73	34491	5562	14	Yes
74	34966	5563	20	Yes
75	35441	5564	16	Yes
76	35916	5565	27	Yes
77	36391	5566	18	Yes
78	36866	5567	20	Yes
79	37341	5568	13	Yes
80	37816	5569	15	Yes
81	38291	5570	18	Yes

4.5. 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.