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

CERTIFICATION TEST REPORT

FOR

WI-FI ROUTER

MODEL NUMBER: MX68W-HW

FCC ID: UDX-60076025
IC: 6961A-60076025

REPORT NUMBER: 12391259-E12V1

ISSUE DATE: NOVEMBER 09, 2018

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	11/09/18	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: WI-FI ROUTER

MODEL: MX68W-HW

SERIAL NUMBER: Q2LY-JGPR-52Q9

DATE TESTED: OCTOBER 16 – OCTOBER 17, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DFS Portion of CFR 47 Part 15 Subpart E	Complies
DFS Portion of 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. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 the U.S. government.

Approved & Released For
UL Verification Services Inc. By:

Conan Cheung
UL Reviewer
CONSUMER TECHNOLOGY DIVISION
UL Verification Services Inc.

Prepared By:

Henry Lau
Test Engineer
CONSUMER TECHNOLOGY DIVISION
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 2.

3. REFERENCE DOCUMENTS

Measurements of transmitter parameters as referenced in this report are documented in Sporton Labs report number FR832026C.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Specific facilities are also identified in the test results sections.

The test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty level has been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Time	± 0.02 %

The Uncertainty figure is valid to a confidence level of 95%.

6. DYNAMIC FREQUENCY SELECTION

6.1. OVERVIEW

6.1.1. 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

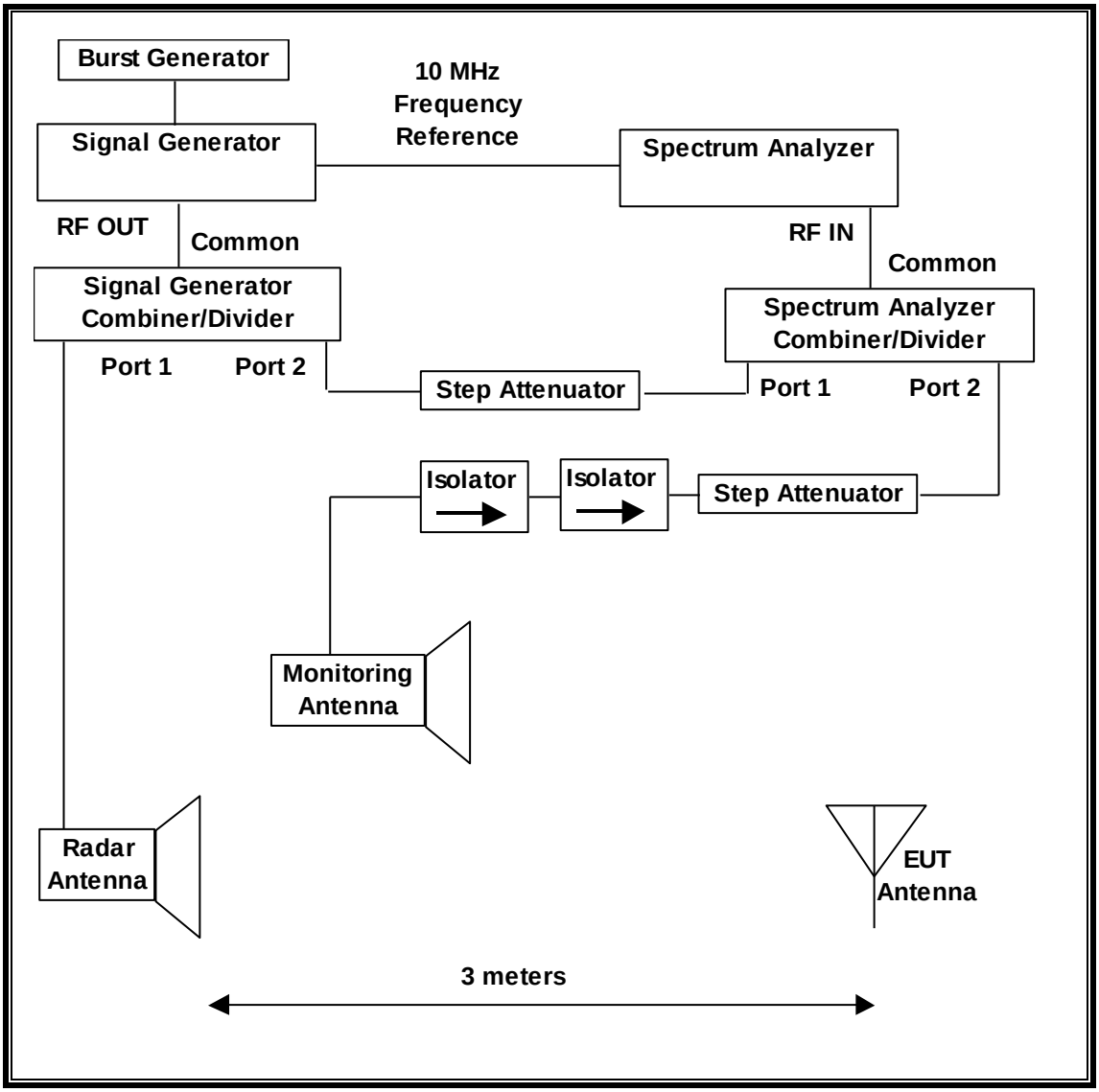
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

6.1.2. 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. Traffic that meets or exceed the minimum loading requirement is streamed from the Master device to the Slave Device. 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**	**ID No.**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T459	07/25/19
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	T1134	04/23/19
Arbitrary Waveform Generator	Agilent / HP	33220A	T190	04/23/19

6.1.3. 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	3.1	Channel Loading and Aggregate Closing Time
FCC 2014 Detection Bandwidth-PXA	3.1.1	Detection Bandwidth in 5 MHz Steps
In Service Monitoring-PXA	3.3.4	In-Service Monitoring (Probability of Detection)
PXA Read	3.1	Signal Generator Screen Capture Utility
SGXProject.exe	1.7	Radar Waveform Generation and Download

6.1.4. TEST ROOM ENVIRONMENT

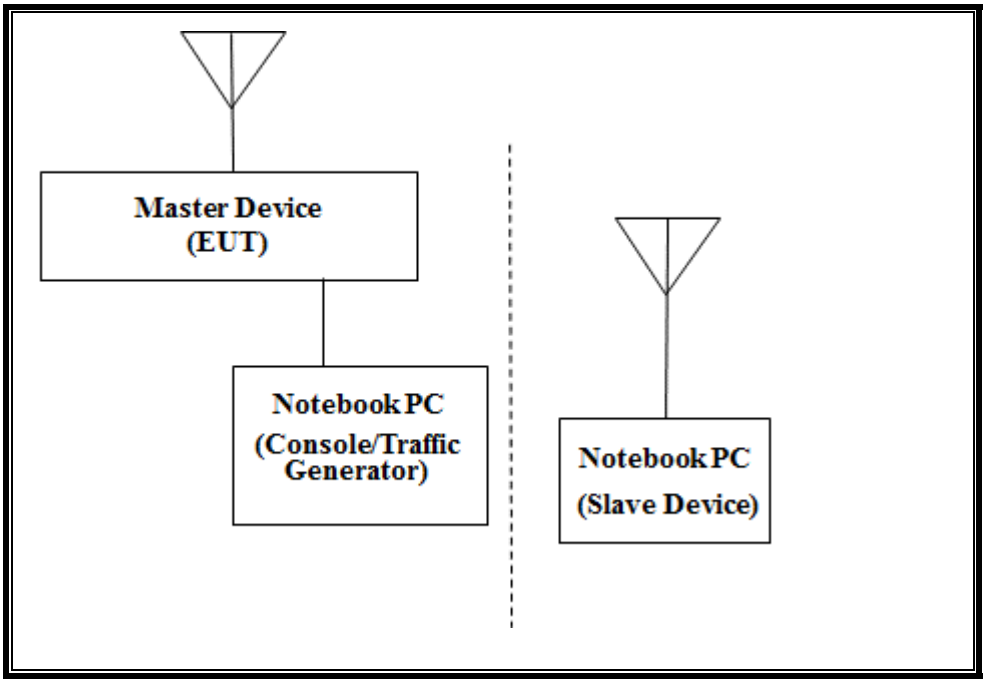
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	22.5°C
Humidity	44%

6.1.5. 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)	Apple	A1435	D39433601B4FTC0A1	DoC
Notebook PC (Slave Device)	Apple	A1465	C02KTGMPF5N7	QDS-BRCM1072
AC Adapter (Slave PC)	Apple	A1435	C04341216J2F288BT	DoC
AC Adapter (EUT)	Universal Microelectronics Co.	MA-PWR-100WAC	CS1400422 53G	DoC

6.1.6. 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 27.04 dBm EIRP in the 5250-5350 MHz band and 26.65 dBm EIRP in the 5470-5725 MHz band.

Two antenna assemblies are utilized with the EUT with gains of 3.1 dBi and 2.8 dBi..

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

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

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

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

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

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

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

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

The software installed in the EUT is firmware_wired_arm64_version T-201808212155-Ga2b73031-L58644711-mtahmed-egypt.

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-60076025 . The minimum antenna gain for the Master Device is 3.1 dBi.

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

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

6.2. RESULTS FOR 20 MHz BANDWIDTH

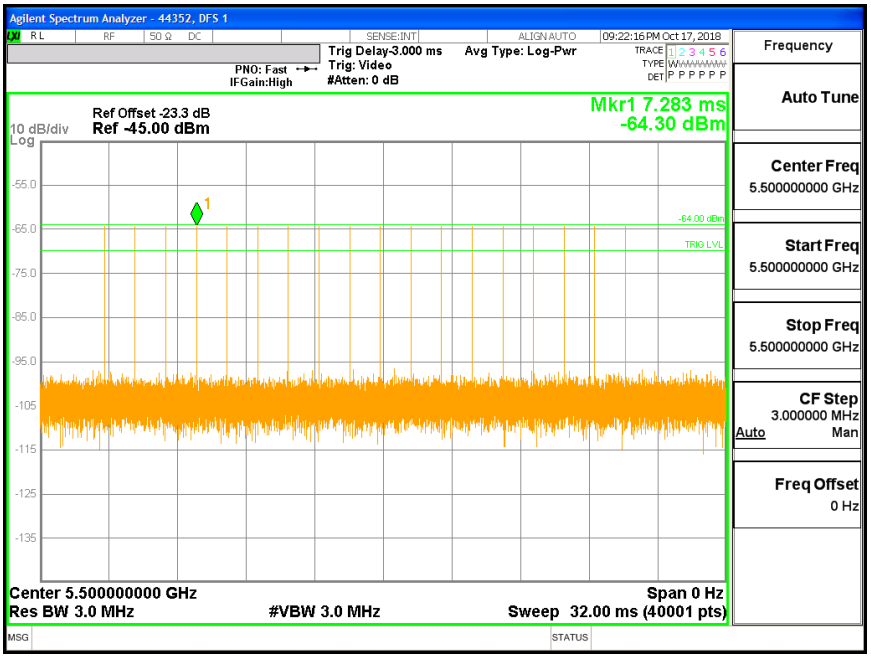
6.2.1. TEST CHANNEL

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

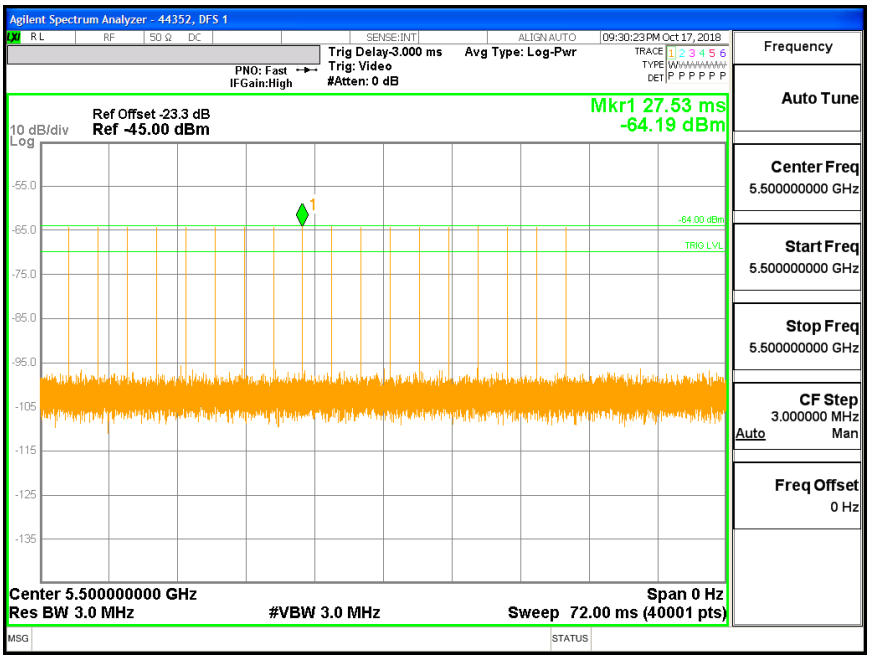
6.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

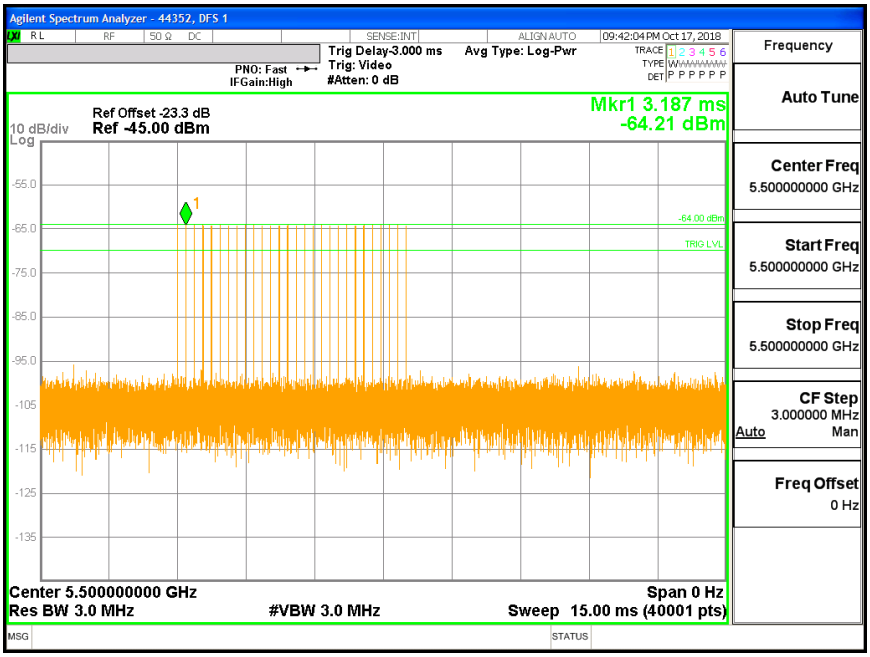
SHORT PULSE RADAR TYPE 0



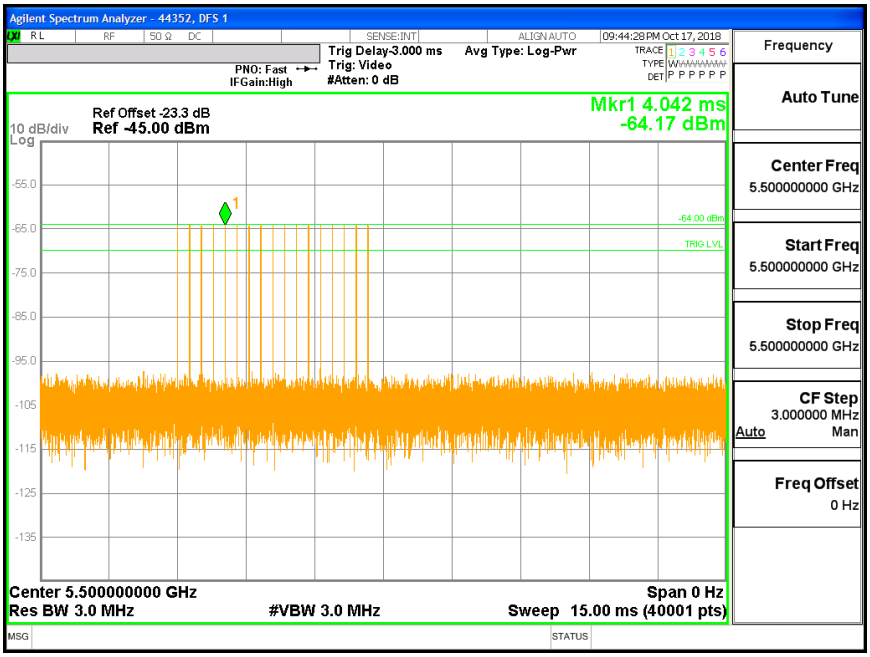
SAMPLE OF RADAR TYPE 1



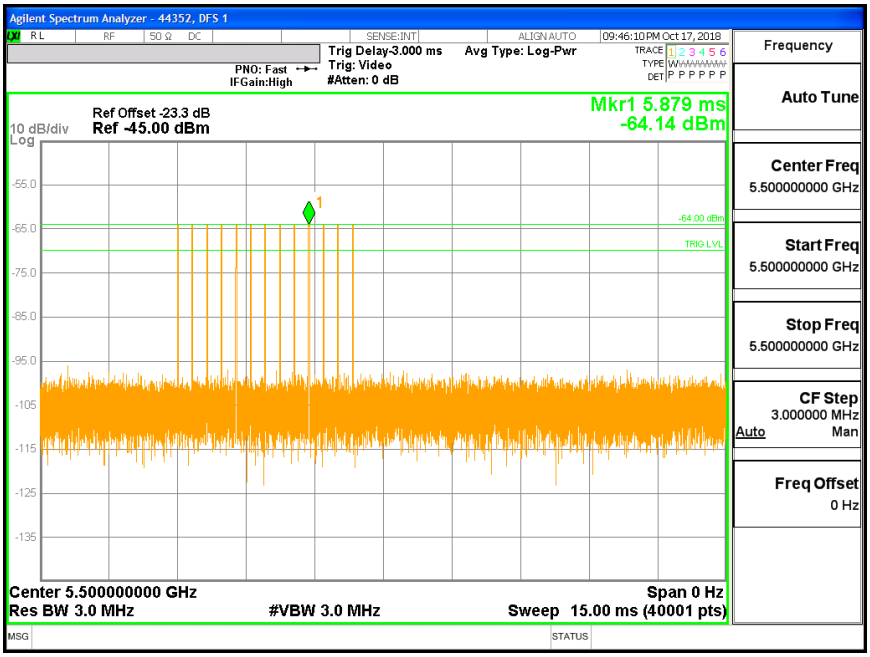
SAMPLE OF RADAR TYPE 2



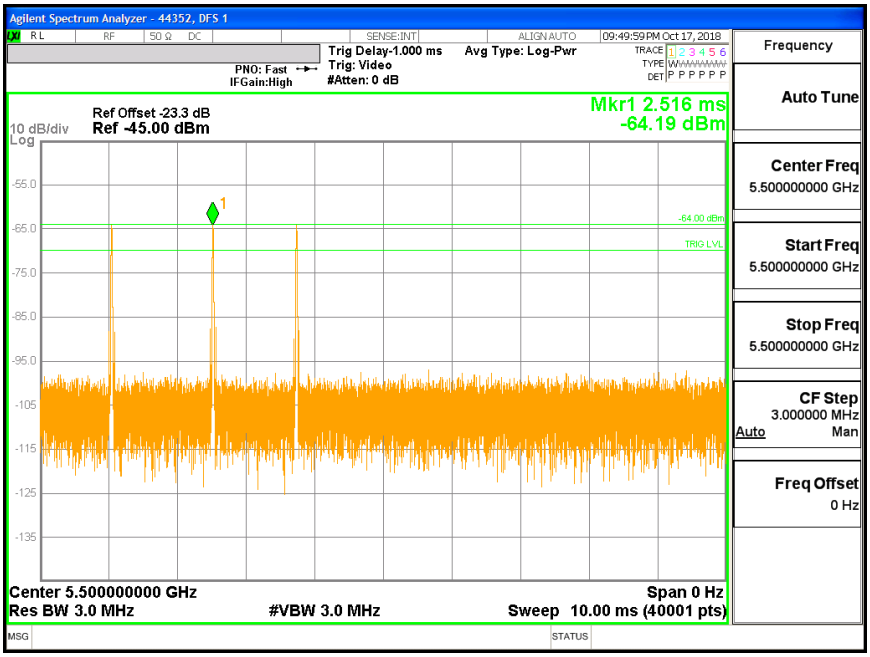
SAMPLE OF RADAR TYPE 3



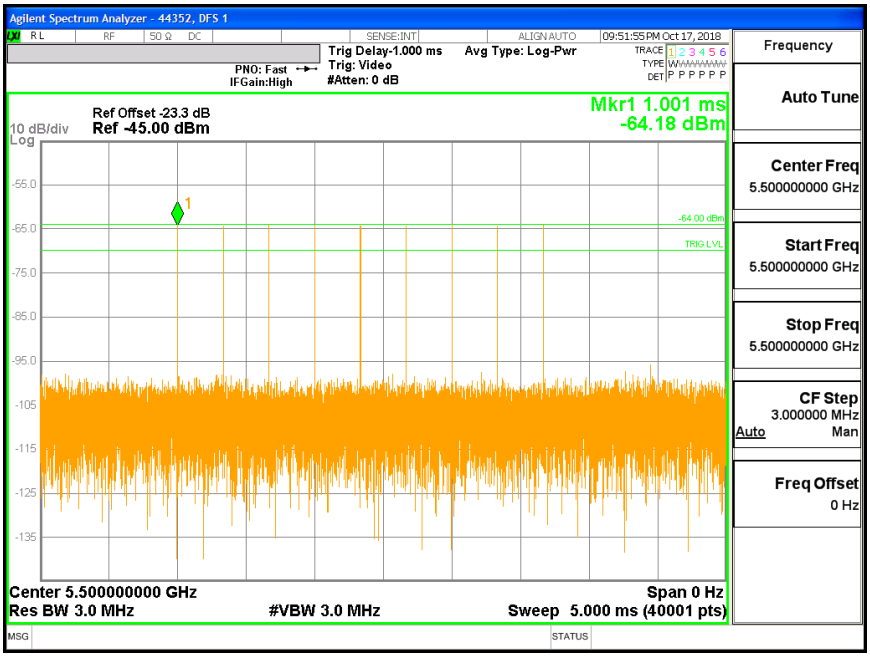
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

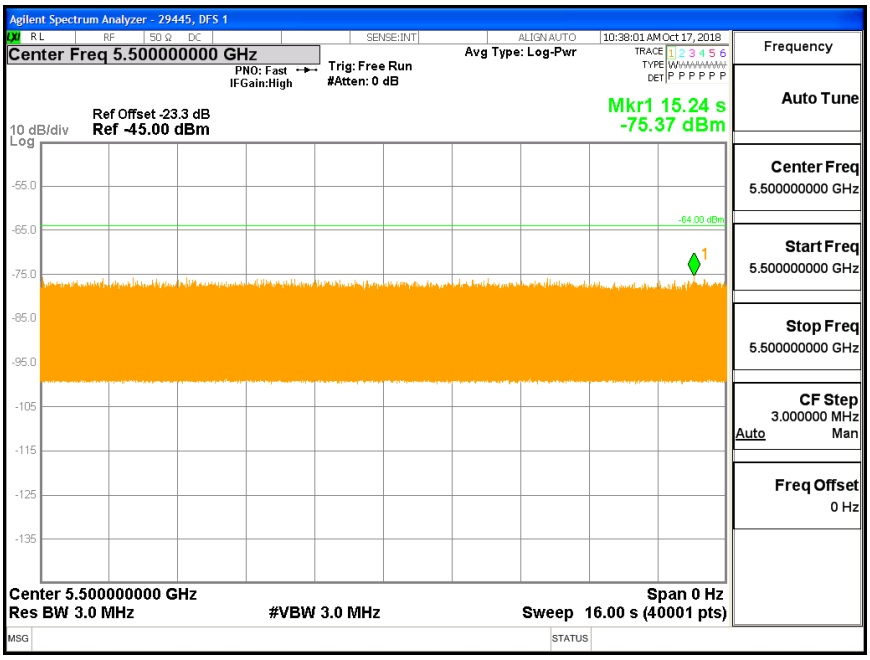


SINGLE BURST OF RADAR TYPE 6

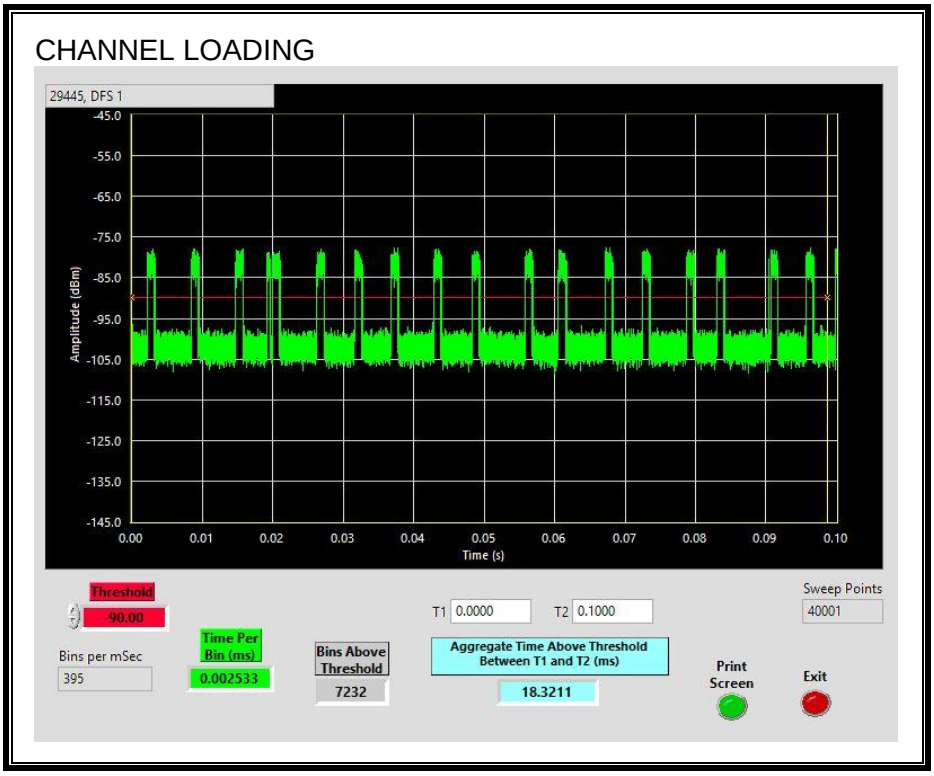


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.32%.

6.2.3. 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)
30.28	179.1	148.8	88.8

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)
30.14	122.0	91.9	3.0

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)
30.41	176.4	146.0	57.2

QUALITATIVE RESULTS

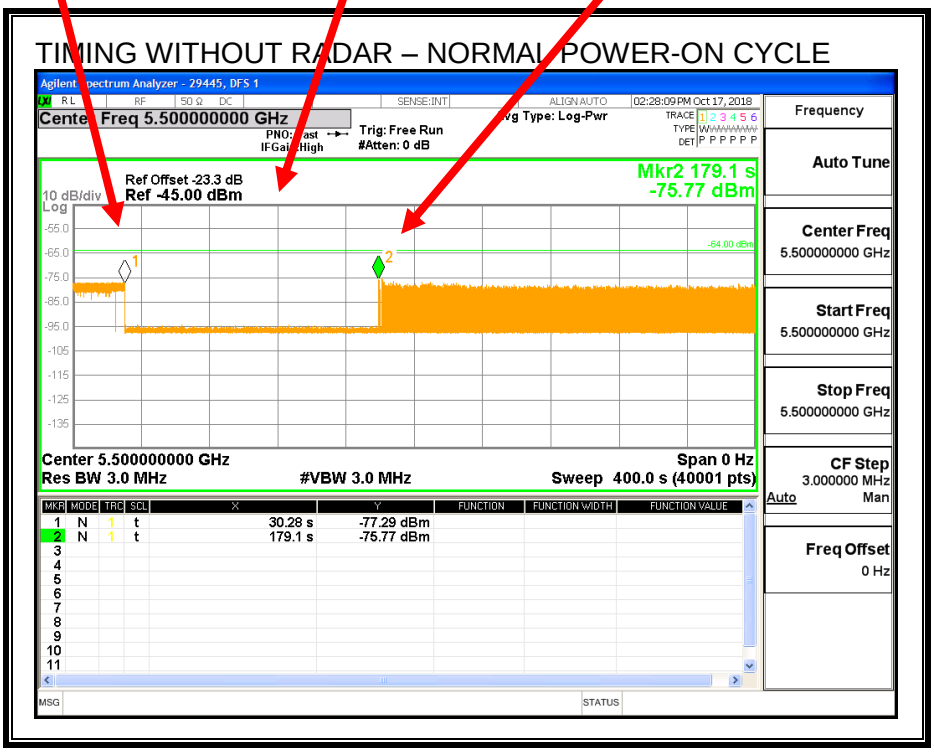
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

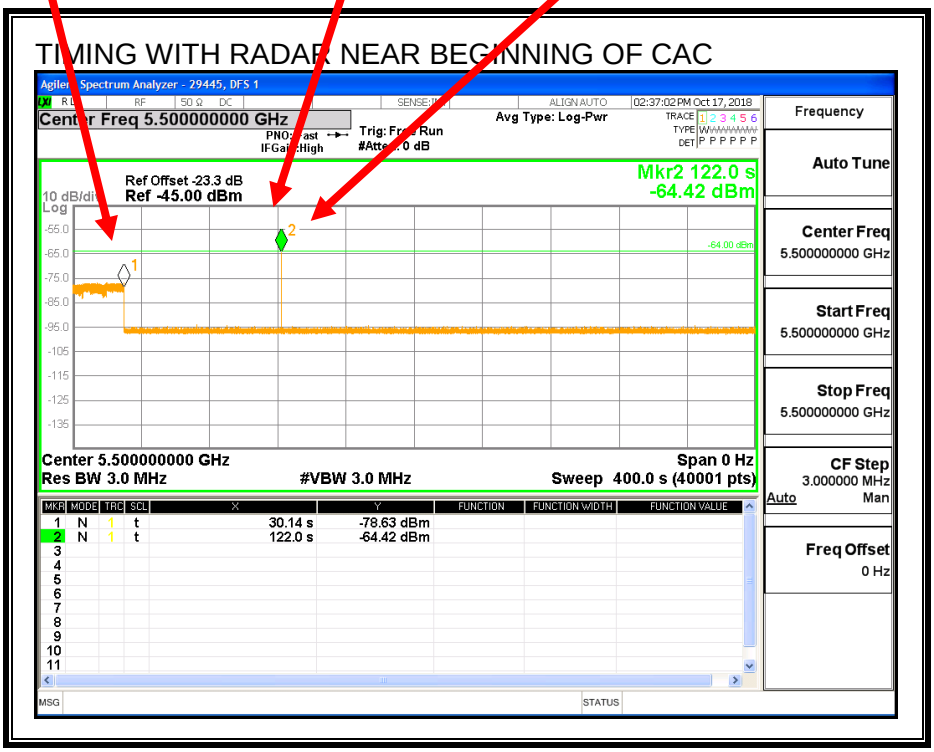
End of CAC
Traffic is Initiated



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



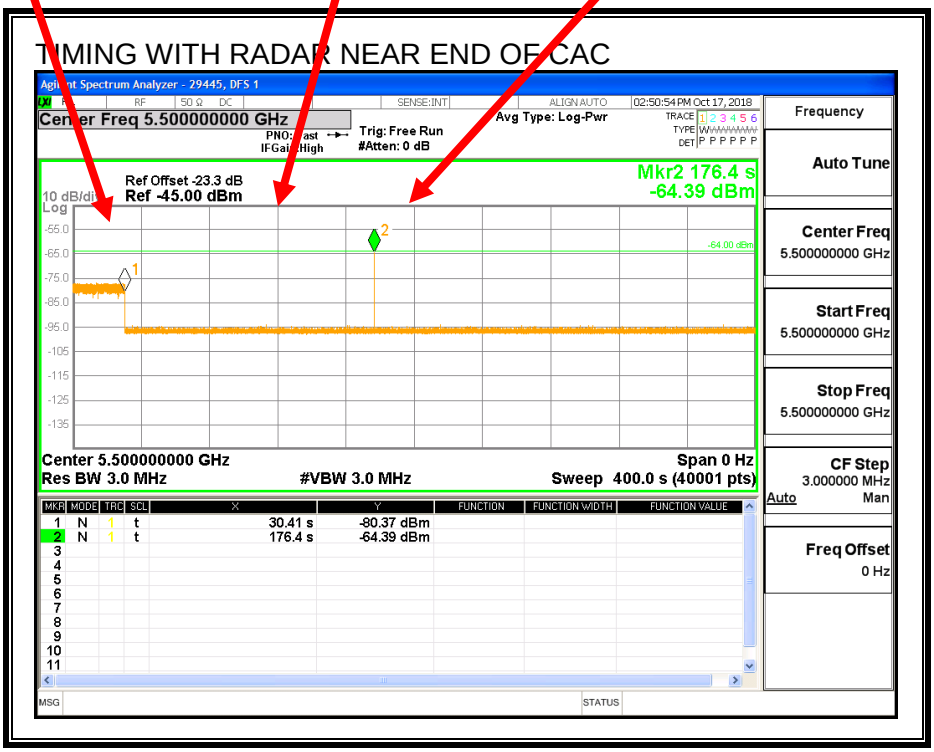
No EUT transmissions were observed after the radar signal.

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.

6.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

6.2.5. 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).

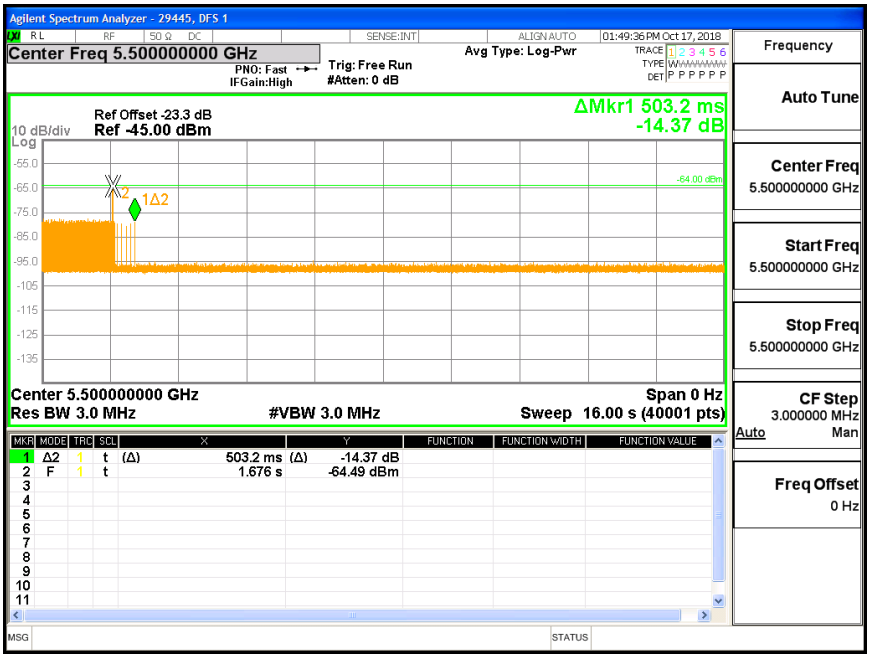
RESULTS

Channel Move Time (sec)	Limit (sec)
0.5032	10

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

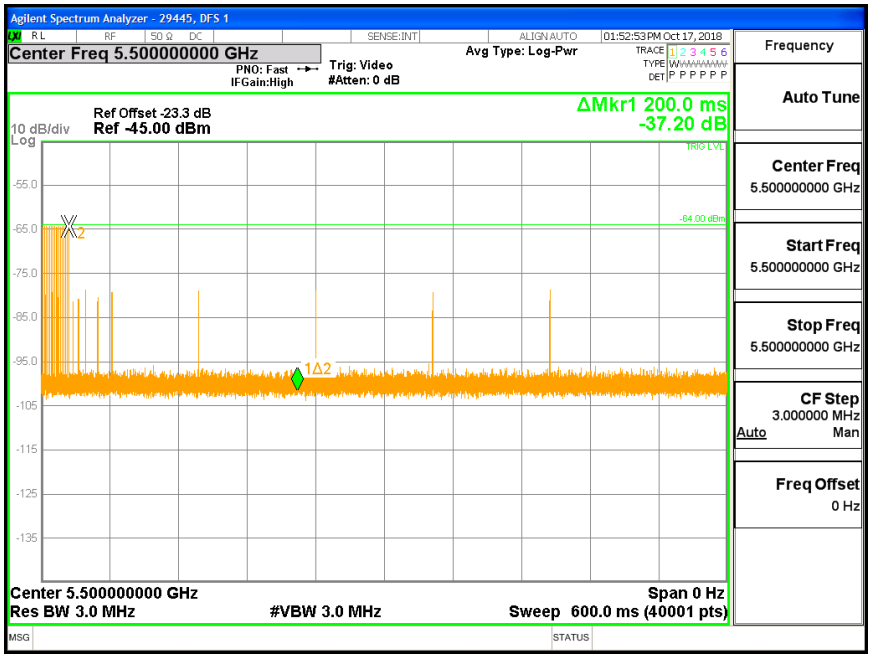
MOVE TIME

MOVE TIME



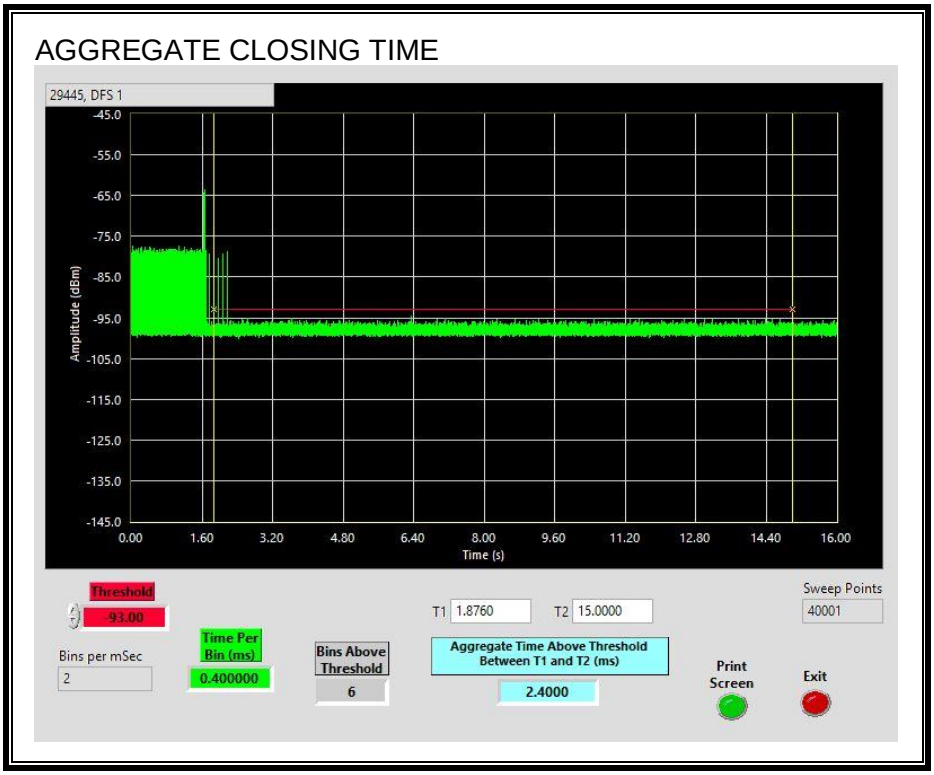
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

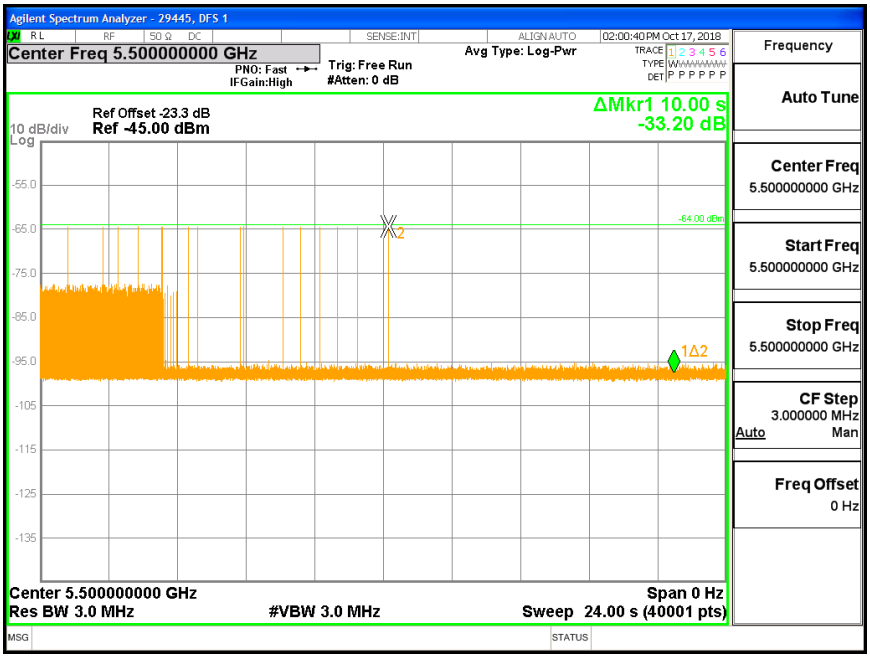
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

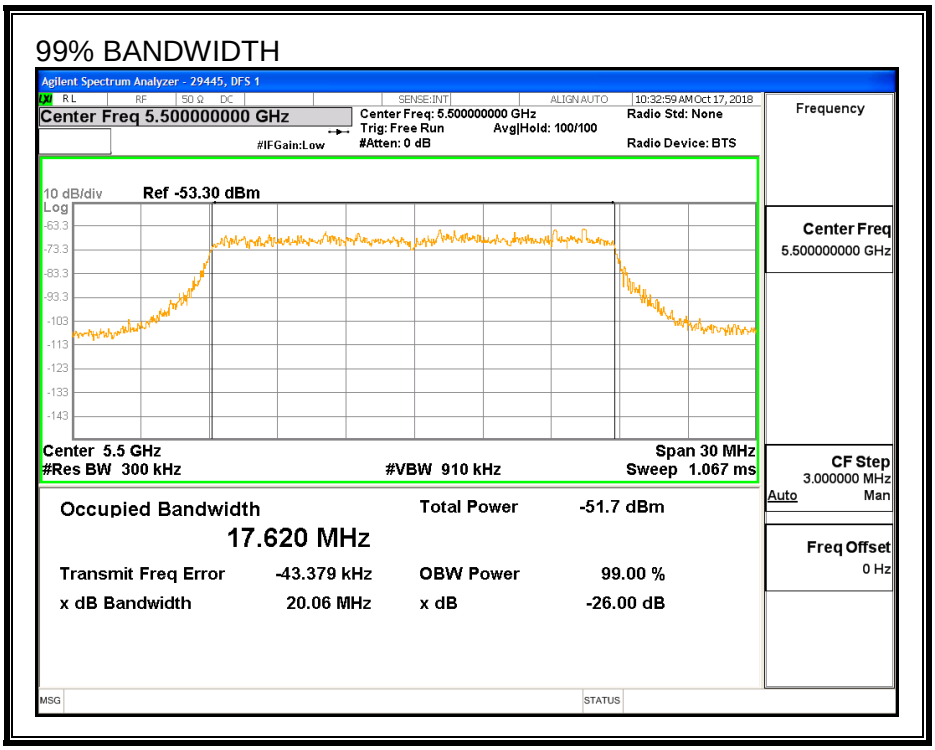
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



6.2.6. 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	17.620	113.5	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

6.2.7. 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	17.62	DFS 1	29445	Version 3.3.4
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5510	17.62	DFS 1	29445	Version 3.3.4
FCC Short Pulse Type 3	30	96.67	60	Pass	5490	5510	17.62	DFS 1	29445	Version 3.3.4
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5510	17.62	DFS 1	29445	Version 3.3.4
Aggregate		97.50	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	17.62	DFS 1	29445	Version 3.3.4
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510		DFS 1	29445	Version 3.3.4

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	5502	Yes
1002	1	738	72	A	5498	Yes
1003	1	598	89	A	5499	Yes
1004	1	858	62	A	5510	Yes
1005	1	818	65	A	5492	Yes
1006	1	938	57	A	5499	Yes
1007	1	798	67	A	5510	Yes
1008	1	758	70	A	5497	Yes
1009	1	638	83	A	5502	Yes
1010	1	618	86	A	5505	Yes
1011	1	538	99	A	5507	Yes
1012	1	698	76	A	5510	Yes
1013	1	518	102	A	5507	Yes
1014	1	878	61	A	5504	Yes
1015	1	558	95	A	5491	Yes
1016	1	2393	23	B	5497	Yes
1017	1	607	87	B	5498	Yes
1018	1	2370	23	B	5508	Yes
1019	1	2066	26	B	5495	Yes
1020	1	2764	20	B	5499	Yes
1021	1	2590	21	B	5497	Yes
1022	1	869	61	B	5501	Yes
1023	1	825	64	B	5494	Yes
1024	1	587	90	B	5499	Yes
1025	1	672	79	B	5494	Yes
1026	1	563	94	B	5500	Yes
1027	1	2131	25	B	5491	Yes
1028	1	2152	25	B	5497	Yes
1029	1	2655	20	B	5499	Yes
1030	1	1610	33	B	5503	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	4.2	185	28	5502	Yes
2002	4.9	175	27	5504	Yes
2003	3.1	218	28	5491	Yes
2004	4	174	24	5494	Yes
2005	2.3	221	26	5496	Yes
2006	1.5	181	23	5509	Yes
2007	2.3	151	29	5492	Yes
2008	1.6	196	25	5493	Yes
2009	2.6	213	25	5505	Yes
2010	2.2	224	29	5491	Yes
2011	1.5	165	26	5495	Yes
2012	1.3	180	27	5506	Yes
2013	4.8	167	24	5504	Yes
2014	2.9	187	25	5496	Yes
2015	2.6	178	29	5500	Yes
2016	3	164	28	5503	Yes
2017	2.9	160	25	5504	Yes
2018	3.6	230	24	5505	Yes
2019	1.8	192	23	5502	Yes
2020	2.7	229	29	5500	Yes
2021	3.2	195	24	5493	Yes
2022	4.3	155	27	5496	Yes
2023	1	206	27	5495	Yes
2024	4.4	170	23	5499	Yes
2025	1.3	230	23	5496	Yes
2026	5	199	27	5497	Yes
2027	4.3	220	23	5506	Yes
2028	4.1	154	24	5497	Yes
2029	3.5	223	28	5506	Yes
2030	1.6	161	23	5509	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	6.3	260	17	5498	Yes
3002	6.7	466	17	5510	Yes
3003	6.6	335	17	5501	Yes
3004	7.3	303	18	5498	Yes
3005	9.6	303	18	5499	Yes
3006	6.4	416	17	5493	Yes
3007	6.9	311	18	5495	Yes
3008	8	438	17	5507	Yes
3009	8.8	345	16	5493	Yes
3010	8.2	367	18	5508	Yes
3011	9.1	421	18	5510	Yes
3012	8.7	322	16	5505	Yes
3013	8	271	18	5495	Yes
3014	7.8	436	18	5495	Yes
3015	7.2	397	17	5498	No
3016	9.4	457	18	5495	Yes
3017	7.2	314	17	5502	Yes
3018	9.6	386	16	5494	Yes
3019	7.5	256	16	5504	Yes
3020	6	474	16	5506	Yes
3021	8.3	356	17	5499	Yes
3022	9.2	337	16	5494	Yes
3023	9.7	483	16	5500	Yes
3024	6.7	358	16	5507	Yes
3025	7.5	399	18	5504	Yes
3026	6.9	288	17	5509	Yes
3027	7.8	341	17	5510	Yes
3028	7.4	494	17	5495	Yes
3029	6.7	442	17	5500	Yes
3030	6.5	356	17	5503	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	20	318	13	5499	Yes
4002	15.8	260	14	5507	Yes
4003	19.9	485	14	5504	Yes
4004	16.1	307	16	5496	Yes
4005	11.6	427	12	5497	Yes
4006	17.3	395	16	5496	Yes
4007	13.3	277	12	5495	Yes
4008	20	258	16	5497	Yes
4009	16.5	403	16	5507	Yes
4010	18.9	279	15	5498	Yes
4011	11.5	320	15	5495	No
4012	19.2	459	12	5491	No
4013	12.3	262	12	5507	Yes
4014	11.3	414	12	5490	Yes
4015	18.8	363	12	5496	Yes
4016	14	410	13	5493	Yes
4017	12.9	489	16	5491	Yes
4018	12.9	432	12	5505	Yes
4019	17	406	13	5507	Yes
4020	13.2	478	14	5502	Yes
4021	17.8	348	15	5510	Yes
4022	14.4	316	14	5505	Yes
4023	15.2	449	15	5510	Yes
4024	17.2	429	15	5502	Yes
4025	13.6	324	14	5499	Yes
4026	11.7	451	14	5506	Yes
4027	17.7	492	13	5501	Yes
4028	16.3	380	16	5502	Yes
4029	18.5	434	13	5508	Yes
4030	13.3	335	16	5507	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	5499	Yes
15	5498	Yes
16	5496	Yes
17	5497	Yes
18	5494	Yes
19	5497	Yes
20	5499	Yes
21	5506	Yes
22	5503	Yes
23	5506	Yes
24	5503	Yes
25	5506	Yes
26	5503	Yes
27	5506	Yes
28	5503	Yes
29	5506	Yes
30	5503	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	331	5490	2	Yes
2	806	5491	2	Yes
3	1281	5492	7	Yes
4	1756	5493	6	Yes
5	2231	5494	6	Yes
6	2706	5495	2	Yes
7	3181	5496	3	Yes
8	3656	5497	4	Yes
9	4131	5498	4	Yes
10	4606	5499	2	Yes
11	5081	5500	3	Yes
12	5556	5501	1	Yes
13	6031	5502	3	Yes
14	6506	5503	5	Yes
15	6981	5504	2	Yes
16	7456	5505	4	Yes
17	7931	5506	1	Yes
18	8406	5507	4	Yes
19	8881	5508	6	Yes
20	9356	5509	4	Yes
21	9831	5510	4	Yes
22	10306	5490	5	Yes
23	10781	5491	4	Yes
24	11256	5492	5	Yes
25	11731	5493	4	Yes
26	12206	5494	4	Yes
27	12681	5495	4	Yes
28	13156	5496	3	Yes
29	13631	5497	3	Yes
30	14106	5498	5	Yes
31	14581	5499	3	Yes
32	15056	5500	5	Yes
33	15531	5501	3	Yes
34	16006	5502	4	Yes
35	16481	5503	6	Yes
36	16956	5504	3	Yes
37	17431	5505	4	Yes
38	17906	5506	2	Yes
39	18381	5507	2	Yes
40	18856	5508	6	Yes
41	19331	5509	3	Yes
42	19806	5510	6	Yes

6.3. RESULTS FOR 40 MHz BANDWIDTH

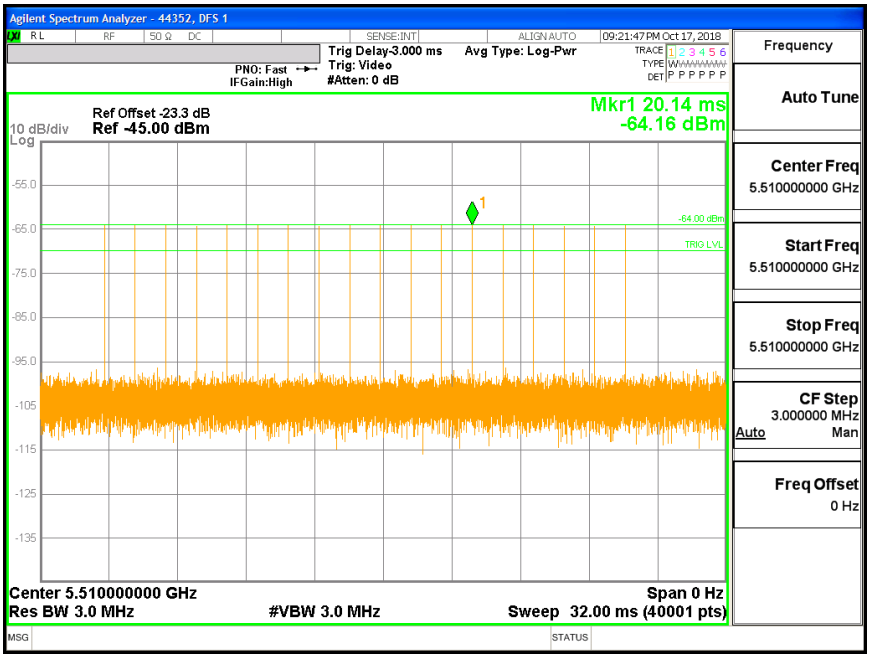
6.3.1. TEST CHANNEL

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

6.3.2. RADAR WAVEFORMS AND TRAFFIC

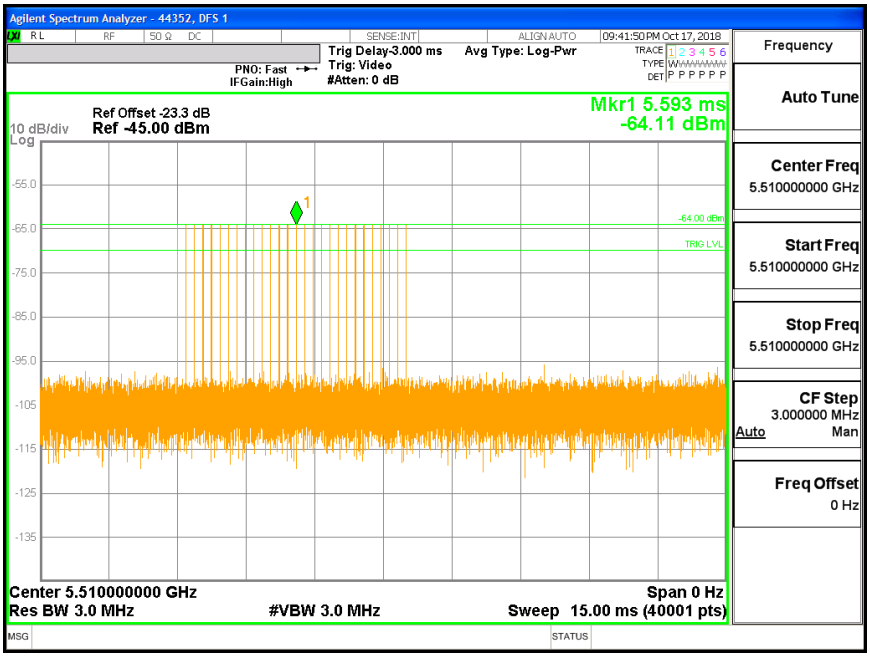
RADAR WAVEFORMS

SHORT PULSE RADAR TYPE 0

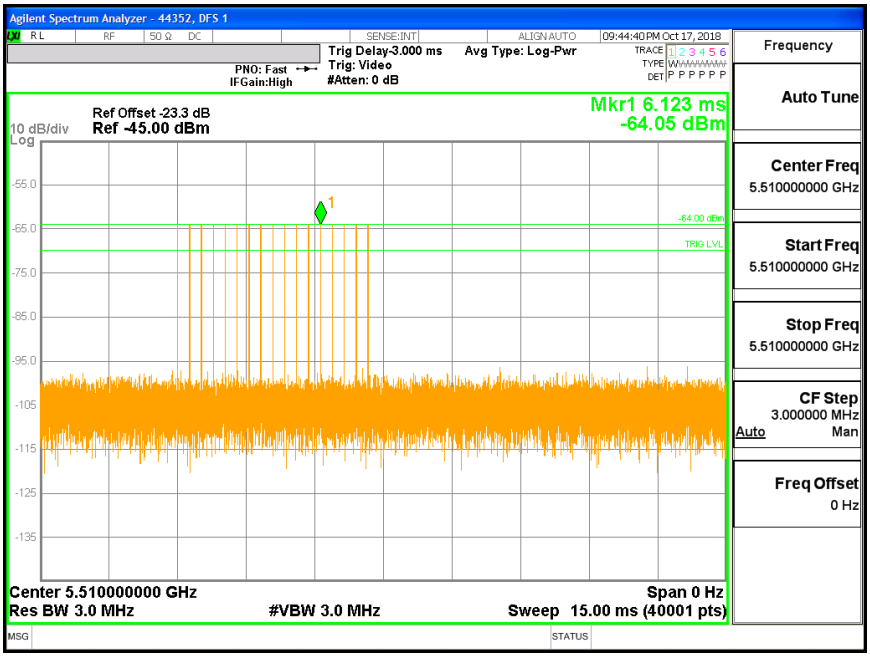


SAMPLE OF RADAR TYPE 1

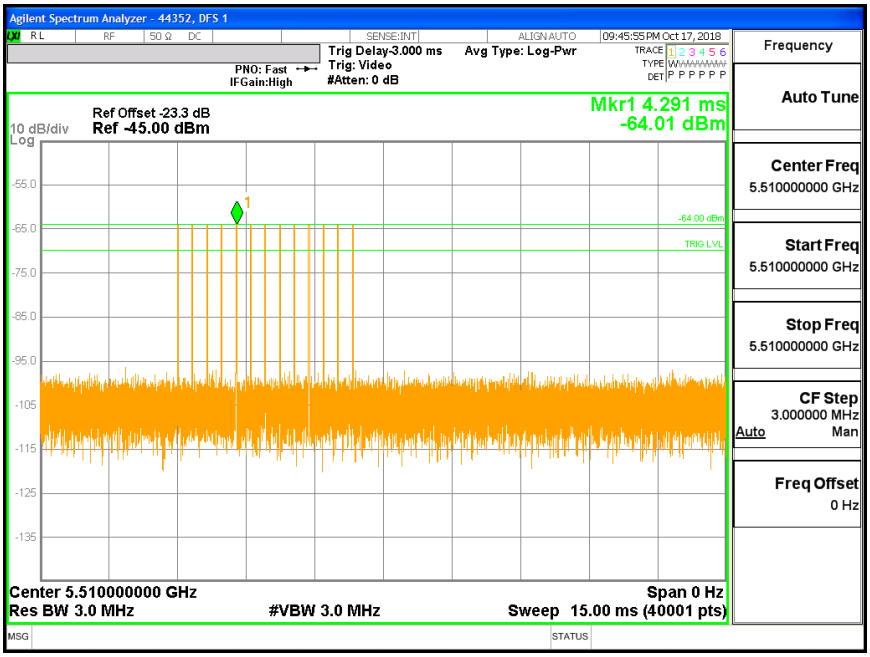
SAMPLE OF RADAR TYPE 2



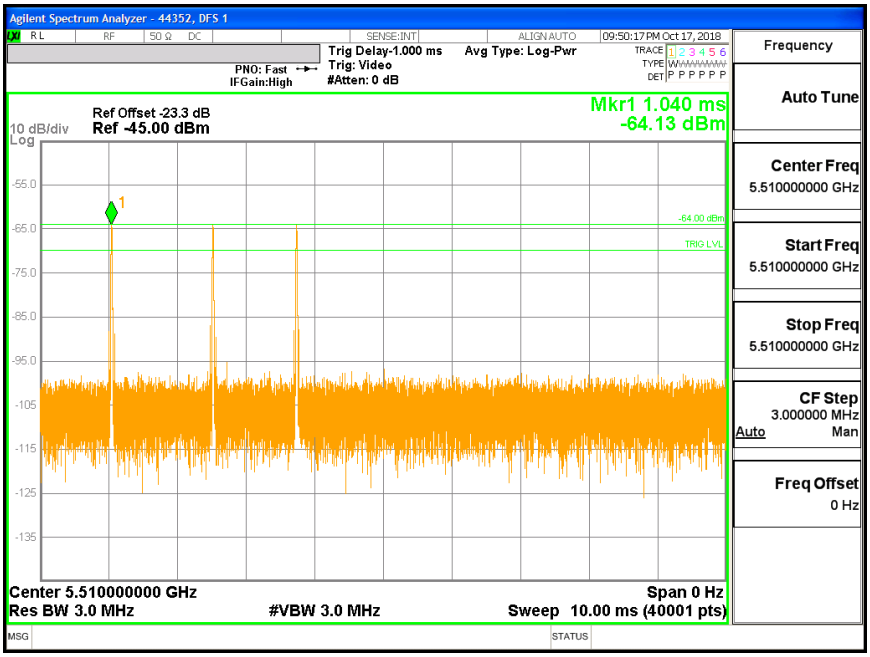
SAMPLE OF RADAR TYPE 3



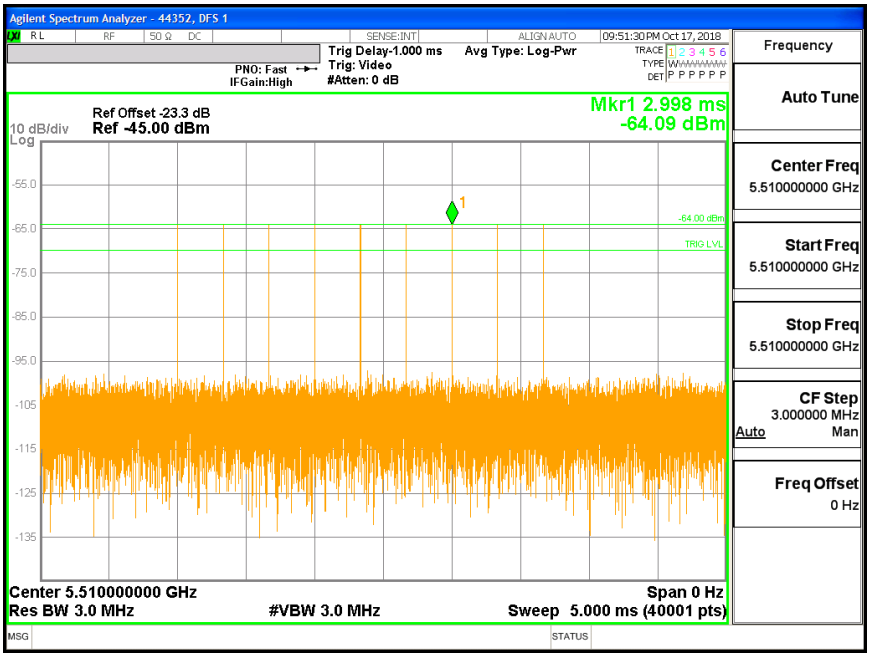
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

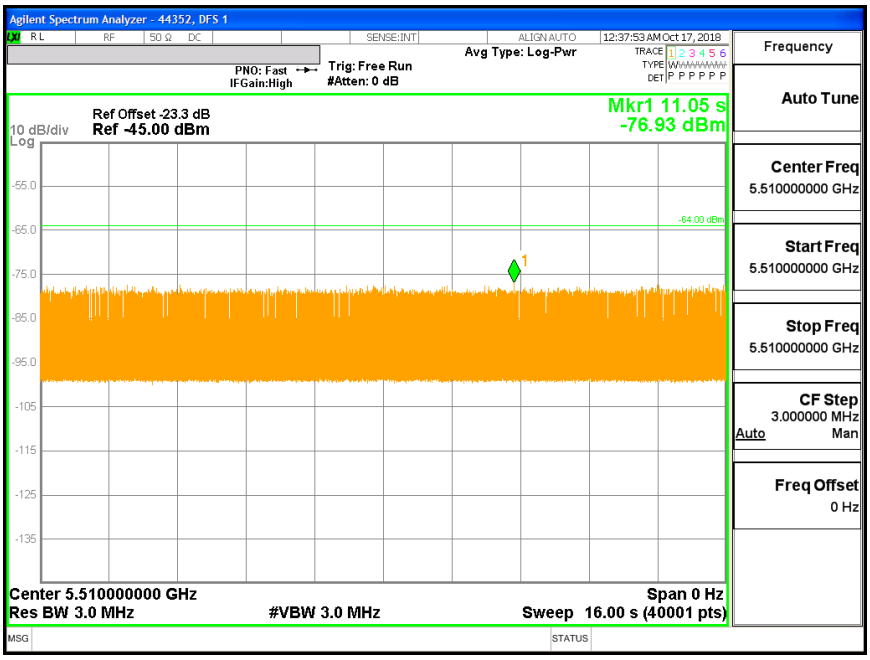


SINGLE BURST OF RADAR TYPE 6

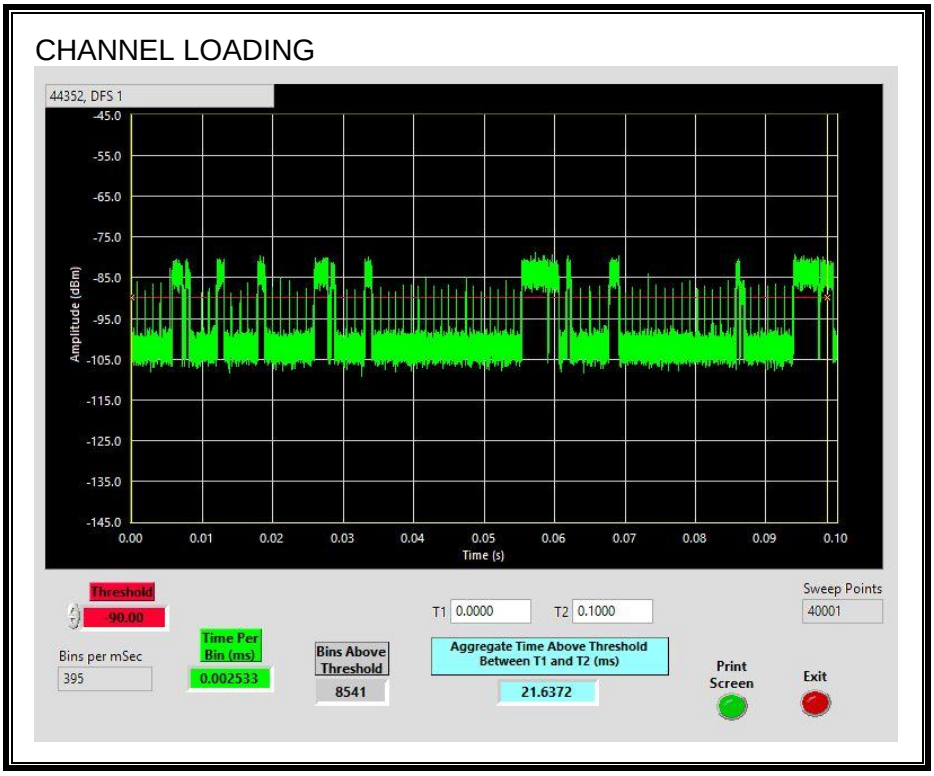


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 21.6372%.

6.3.3. 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)
30.34	178.2	147.9	87.9

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	121.2	90.8	3.0

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)
30.28	175.3	145.0	57.2

QUALITATIVE RESULTS

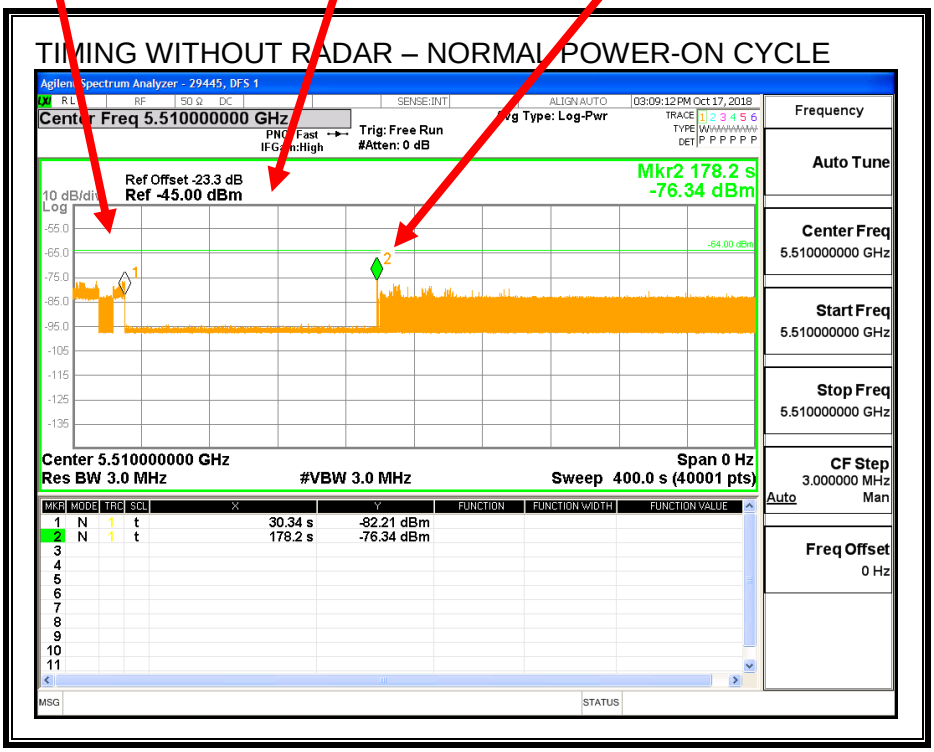
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



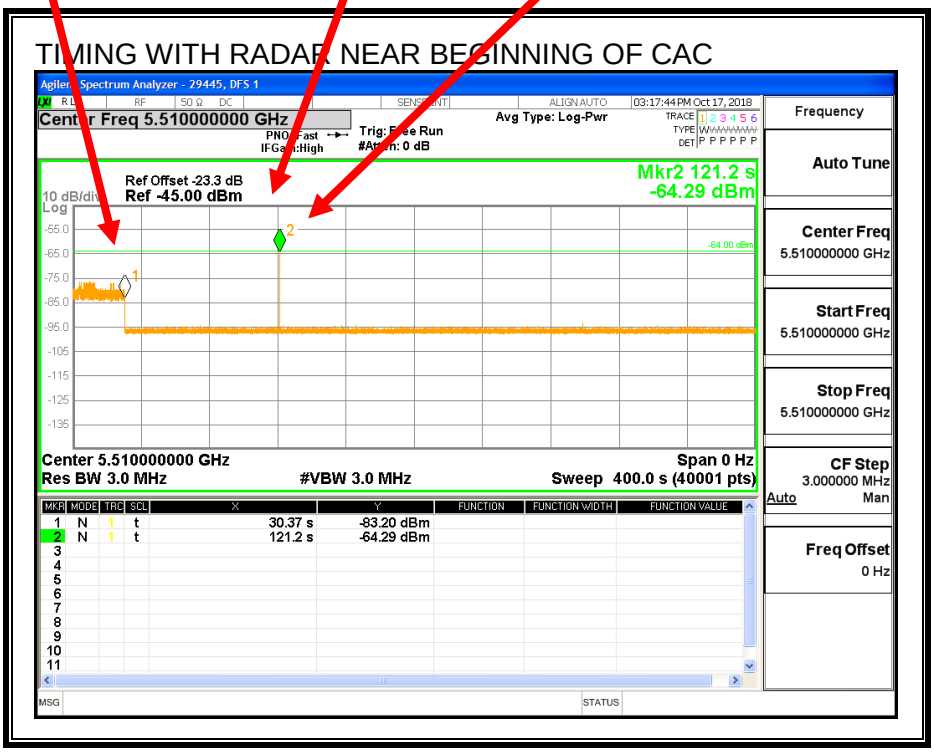
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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

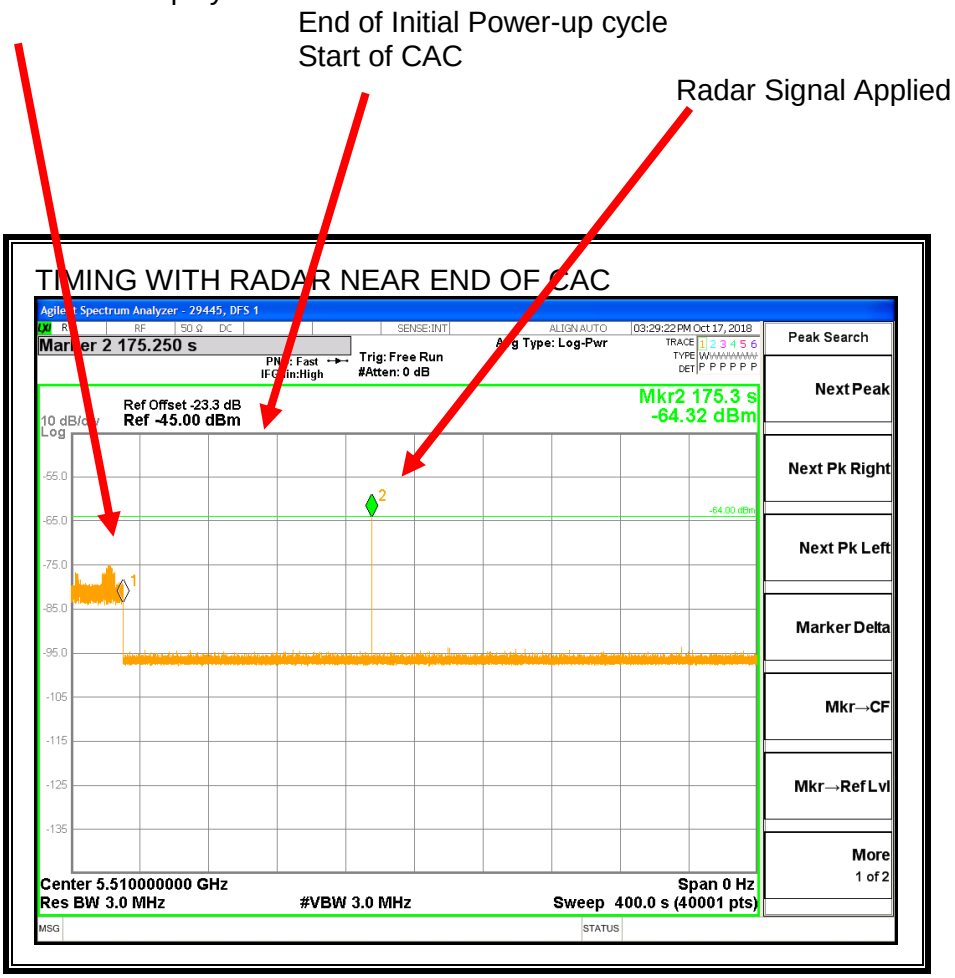
Radar Signal Applied



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



No EUT transmissions were observed after the radar signal.

6.3.1. OVERLAPPING CHANNEL TESTS

RESULTS

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

6.3.2. 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).

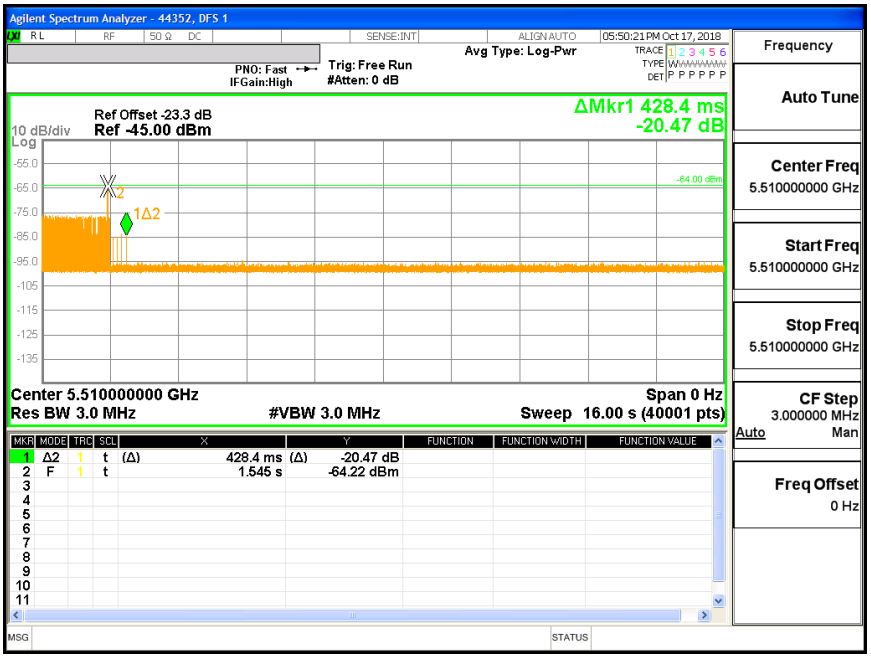
RESULTS

Channel Move Time (sec)	Limit (sec)
0.4284	10

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

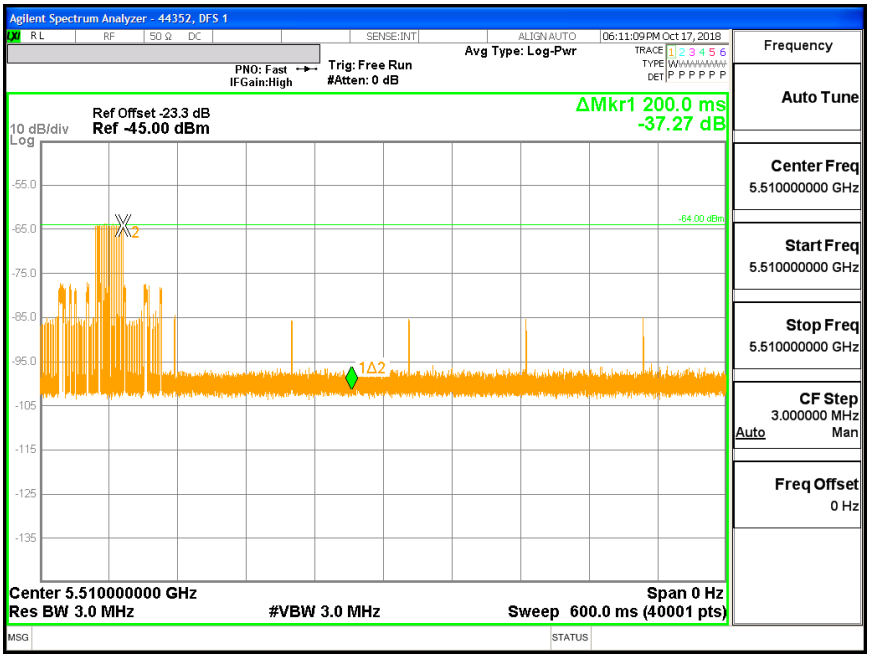
MOVE TIME

MOVE TIME



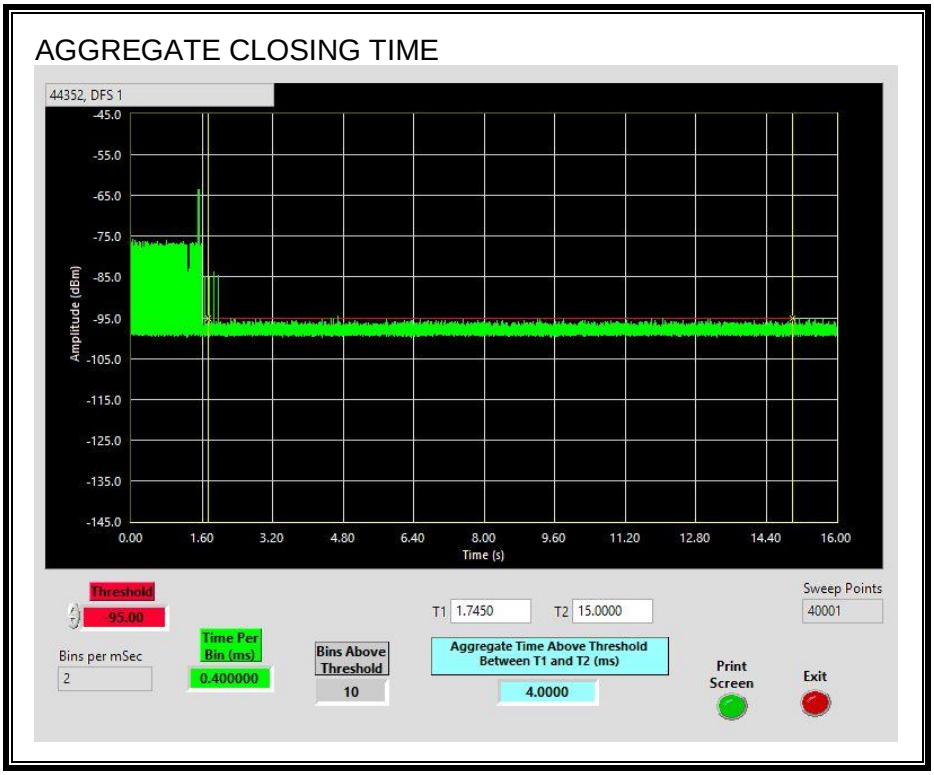
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

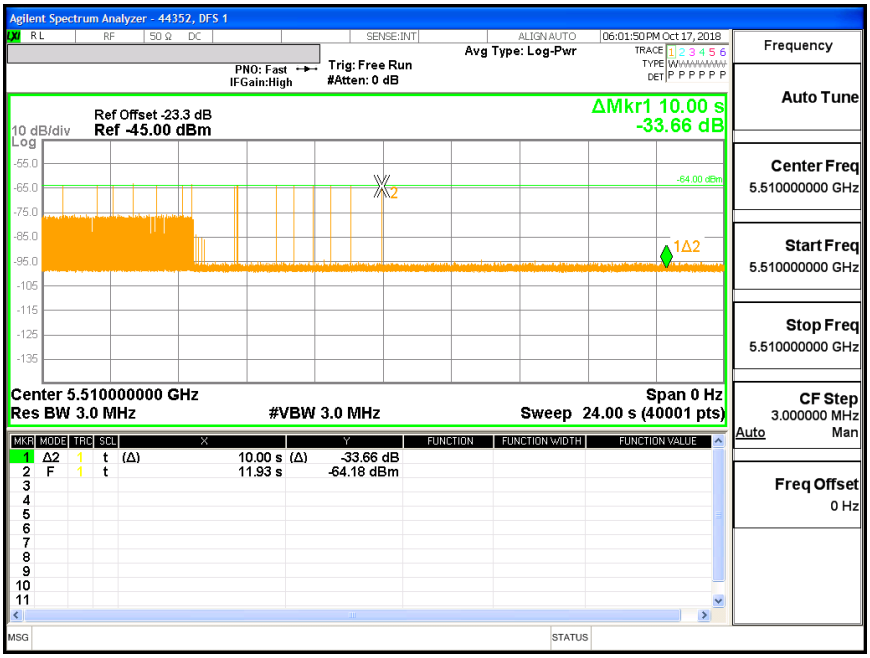
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

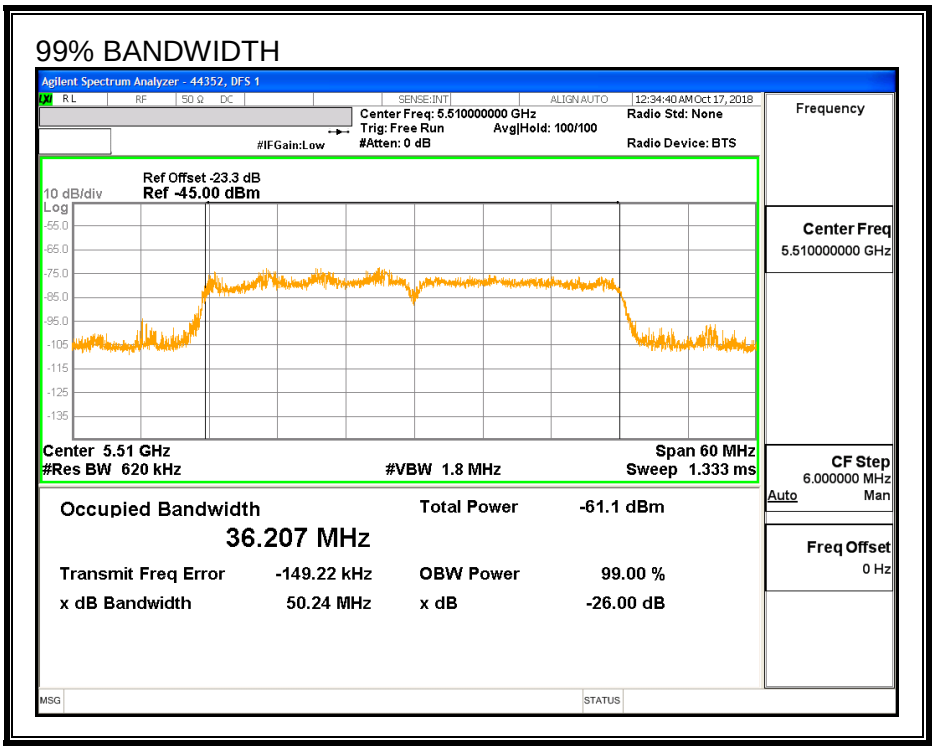
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



6.3.3. 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	36.207	110.5	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results 44352 DFS 1

FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst

Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	0	0	
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	FH
5531	10	0	0	

6.3.4. 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	36.21	DFS 1	29445	Version 3.3.4
FCC Short Pulse Type 2	30	90.00	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.3.4
FCC Short Pulse Type 3	30	76.67	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.3.4
FCC Short Pulse Type 4	30	63.33	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.3.4
Aggregate		82.50	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	36.21	DFS 1	29445	Version 3.3.4
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530		DFS 1	29445	Version 3.3.4

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5530	Yes
1002	1	738	72	A	5525	Yes
1003	1	598	89	A	5513	Yes
1004	1	858	62	A	5507	Yes
1005	1	818	65	A	5507	Yes
1006	1	938	57	A	5504	Yes
1007	1	798	67	A	5503	Yes
1008	1	758	70	A	5524	Yes
1009	1	638	83	A	5510	Yes
1010	1	618	86	A	5504	Yes
1011	1	538	99	A	5503	Yes
1012	1	698	76	A	5495	Yes
1013	1	518	102	A	5517	Yes
1014	1	878	61	A	5510	Yes
1015	1	558	95	A	5515	Yes
1016	1	2393	23	B	5522	Yes
1017	1	607	87	B	5508	Yes
1018	1	2370	23	B	5509	Yes
1019	1	2066	26	B	5515	Yes
1020	1	2764	20	B	5524	Yes
1021	1	2590	21	B	5522	Yes
1022	1	869	61	B	5505	Yes
1023	1	825	64	B	5518	Yes
1024	1	587	90	B	5517	Yes
1025	1	672	79	B	5522	Yes
1026	1	563	94	B	5518	Yes
1027	1	2131	25	B	5499	Yes
1028	1	2152	25	B	5521	Yes
1029	1	2655	20	B	5524	Yes
1030	1	1610	33	B	5496	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	4.2	185	28	5519	Yes
2002	4.9	175	27	5503	Yes
2003	3.1	218	28	5495	Yes
2004	4	174	24	5529	Yes
2005	2.3	221	26	5512	Yes
2006	1.5	181	23	5527	No
2007	2.3	151	29	5521	Yes
2008	1.6	196	25	5525	Yes
2009	2.6	213	25	5530	Yes
2010	2.2	224	29	5516	Yes
2011	1.5	165	26	5509	Yes
2012	1.3	180	27	5515	Yes
2013	4.8	167	24	5523	Yes
2014	2.9	187	25	5514	Yes
2015	2.6	178	29	5496	No
2016	3	164	28	5509	Yes
2017	2.9	160	25	5515	Yes
2018	3.6	230	24	5506	No
2019	1.8	192	23	5512	Yes
2020	2.7	229	29	5498	Yes
2021	3.2	195	24	5529	Yes
2022	4.3	155	27	5524	Yes
2023	1	206	27	5528	Yes
2024	4.4	170	23	5526	Yes
2025	1.3	230	23	5495	Yes
2026	5	199	27	5495	Yes
2027	4.3	220	23	5499	Yes
2028	4.1	154	24	5505	Yes
2029	3.5	223	28	5512	Yes
2030	1.6	161	23	5528	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	6.3	260	17	5514	Yes
3002	6.7	466	17	5498	No
3003	6.6	335	17	5507	Yes
3004	7.3	303	18	5526	Yes
3005	9.6	303	18	5493	Yes
3006	6.4	416	17	5496	Yes
3007	6.9	311	18	5495	Yes
3008	8	438	17	5530	No
3009	8.8	345	16	5502	No
3010	8.2	367	18	5517	Yes
3011	9.1	421	18	5516	Yes
3012	8.7	322	16	5504	No
3013	8	271	18	5521	Yes
3014	7.8	436	18	5530	Yes
3015	7.2	397	17	5500	Yes
3016	9.4	457	18	5504	No
3017	7.2	314	17	5523	Yes
3018	9.6	386	16	5528	Yes
3019	7.5	256	16	5511	Yes
3020	6	474	16	5530	No
3021	8.3	356	17	5518	Yes
3022	9.2	337	16	5526	No
3023	9.7	483	16	5500	Yes
3024	6.7	358	16	5523	Yes
3025	7.5	399	18	5515	Yes
3026	6.9	288	17	5502	Yes
3027	7.8	341	17	5508	Yes
3028	7.4	494	17	5512	Yes
3029	6.7	442	17	5521	Yes
3030	6.5	356	17	5496	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	20	318	13	5513	Yes
4002	15.8	260	14	5497	Yes
4003	19.9	485	14	5528	No
4004	16.1	307	16	5520	Yes
4005	11.6	427	12	5529	No
4006	17.3	395	16	5516	No
4007	13.3	277	12	5511	No
4008	20	258	16	5524	Yes
4009	16.5	403	16	5521	No
4010	18.9	279	15	5492	No
4011	11.5	320	15	5503	No
4012	19.2	459	12	5503	No
4013	12.3	262	12	5494	No
4014	11.3	414	12	5516	No
4015	18.8	363	12	5497	Yes
4016	14	410	13	5511	Yes
4017	12.9	489	16	5491	Yes
4018	12.9	432	12	5499	Yes
4019	17	406	13	5493	Yes
4020	13.2	478	14	5497	Yes
4021	17.8	348	15	5507	No
4022	14.4	316	14	5516	Yes
4023	15.2	449	15	5496	Yes
4024	17.2	429	15	5508	Yes
4025	13.6	324	14	5498	Yes
4026	11.7	451	14	5523	Yes
4027	17.7	492	13	5510	Yes
4028	16.3	380	16	5510	Yes
4029	18.5	434	13	5512	Yes
4030	13.3	335	16	5514	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	5500	Yes
14	5500	Yes
15	5499	Yes
16	5496	Yes
17	5498	Yes
18	5494	Yes
19	5498	Yes
20	5500	Yes
21	5526	Yes
22	5522	Yes
23	5526	Yes
24	5522	Yes
25	5526	Yes
26	5522	Yes
27	5526	Yes
28	5522	Yes
29	5526	Yes
30	5522	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	364	5490	4	Yes
2	839	5491	4	Yes
3	1314	5492	10	Yes
4	1789	5493	8	Yes
5	2264	5494	8	Yes
6	2739	5495	6	Yes
7	3214	5496	6	Yes
8	3689	5497	7	Yes
9	4164	5498	7	Yes
10	4639	5499	7	Yes
11	5114	5500	5	Yes
12	5589	5501	7	Yes
13	6064	5502	7	Yes
14	6539	5503	7	Yes
15	7014	5504	8	Yes
16	7489	5505	6	Yes
17	7964	5506	3	Yes
18	8439	5507	10	Yes
19	8914	5508	10	Yes
20	9389	5509	9	Yes
21	9864	5510	6	Yes
22	10339	5511	6	Yes
23	10814	5512	12	Yes
24	11289	5513	9	Yes
25	11764	5514	6	Yes
26	12239	5515	8	Yes
27	12714	5516	14	Yes
28	13189	5517	7	Yes
29	13664	5518	6	Yes
30	14139	5519	13	Yes
31	14614	5520	9	Yes
32	15089	5521	8	Yes
33	15564	5522	8	Yes
34	16039	5523	9	Yes
35	16514	5524	13	Yes
36	16989	5525	13	Yes
37	17464	5526	9	Yes
38	17939	5527	3	Yes
39	18414	5528	7	Yes
40	18889	5529	9	Yes
41	19364	5530	9	Yes

6.4. RESULTS FOR 80 MHz BANDWIDTH

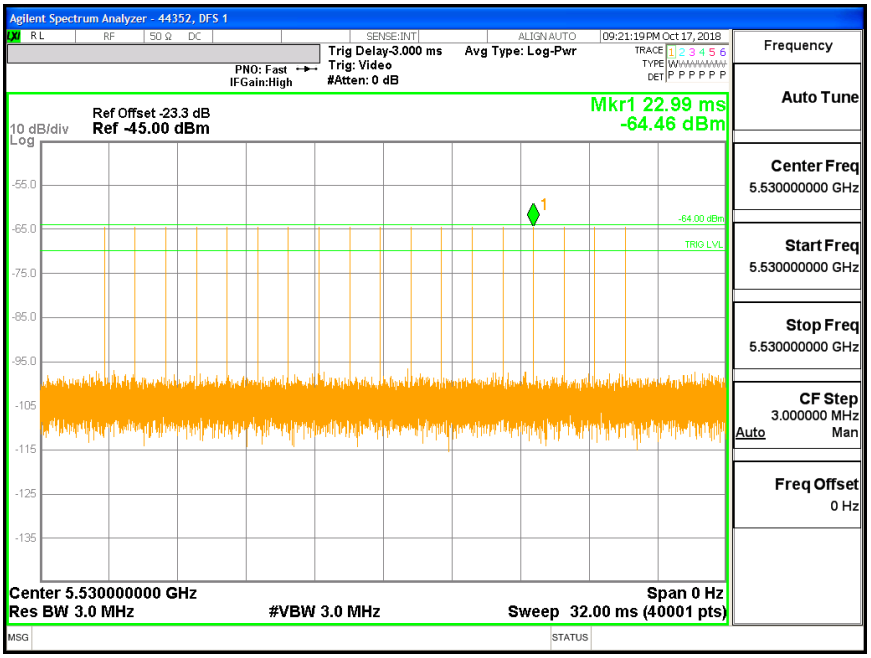
6.4.1. TEST CHANNEL

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

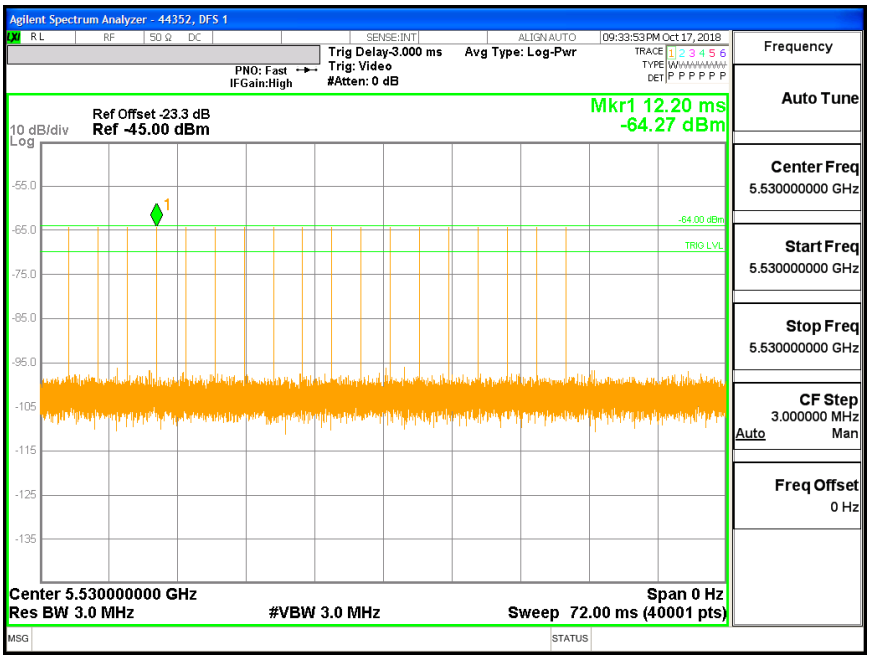
6.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

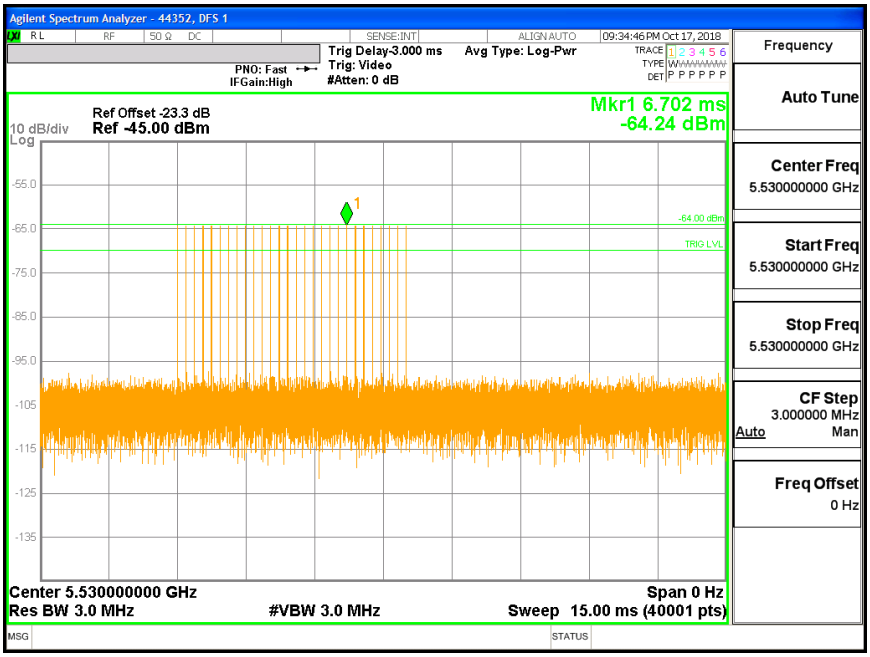
SHORT PULSE RADAR TYPE 0



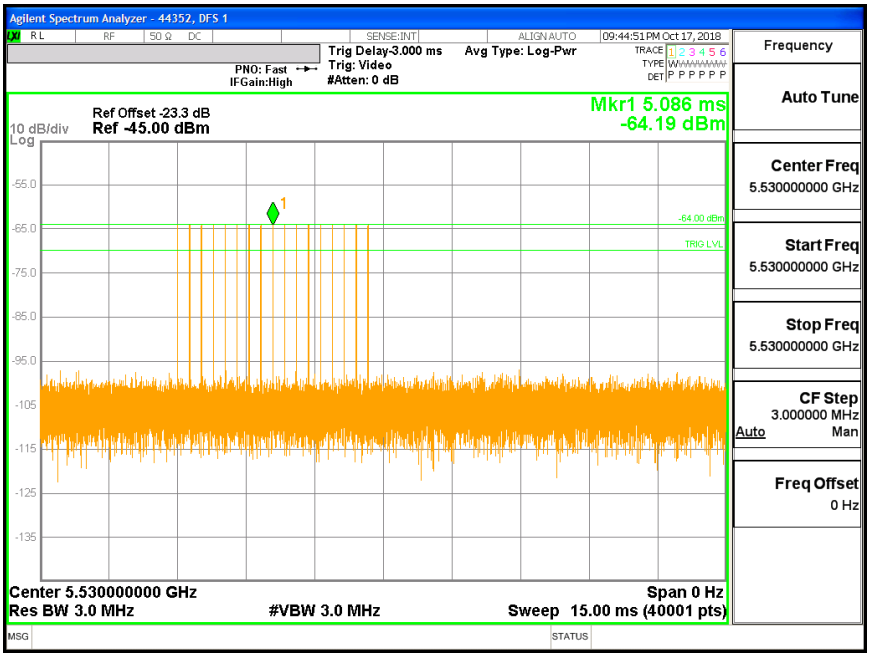
SAMPLE OF RADAR TYPE 1



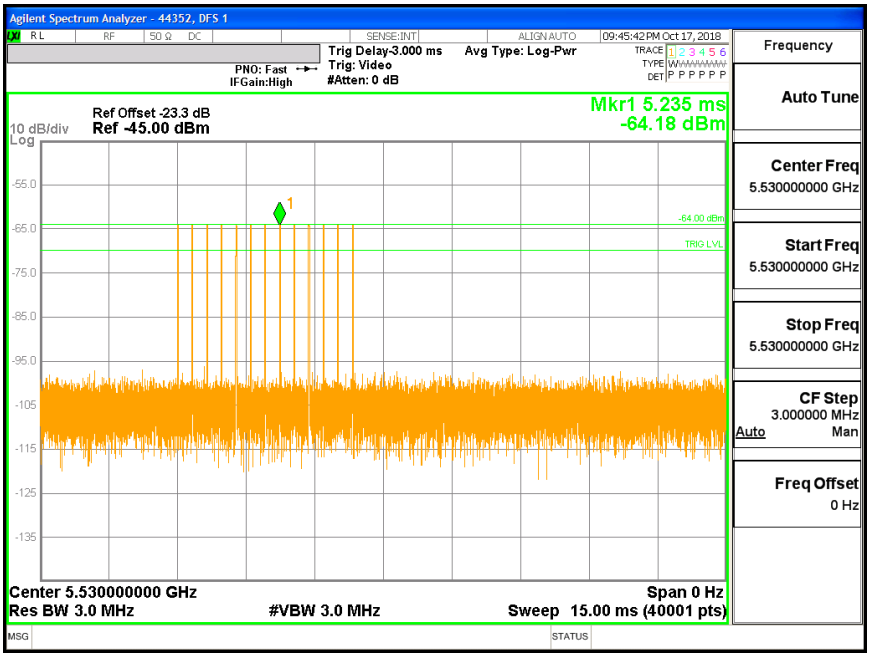
SAMPLE OF RADAR TYPE 2



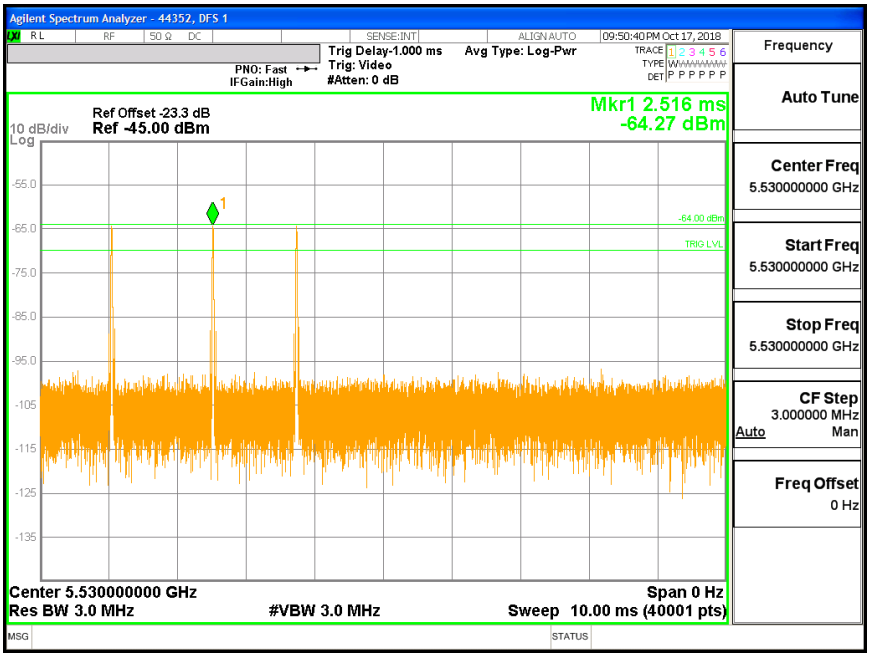
SAMPLE OF RADAR TYPE 3



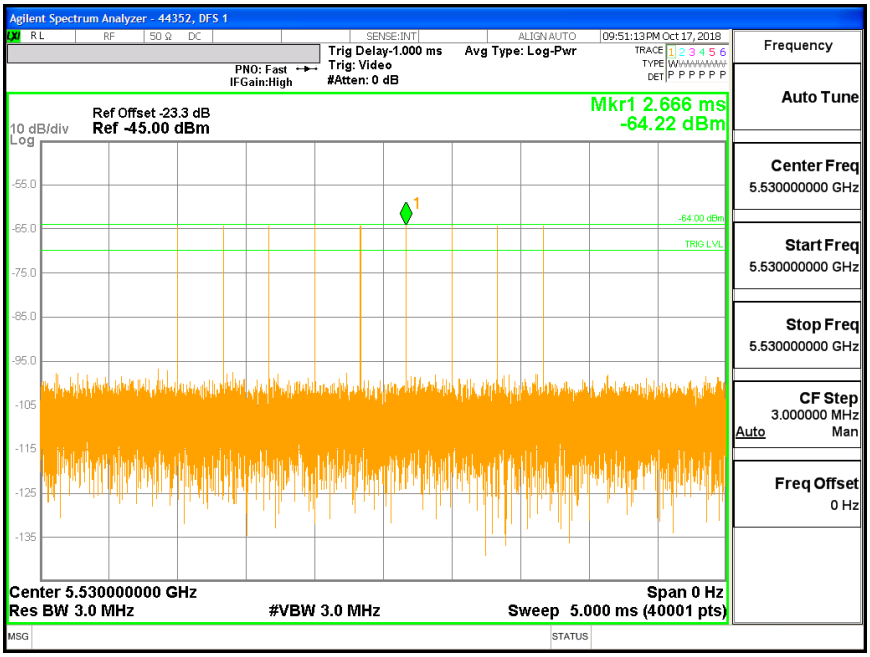
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

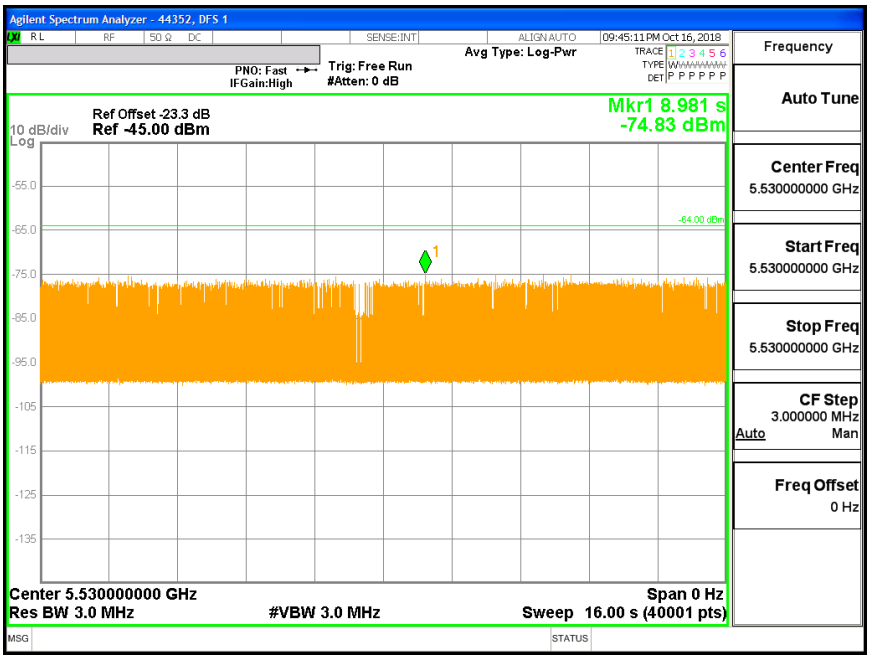


SINGLE BURST OF RADAR TYPE 6

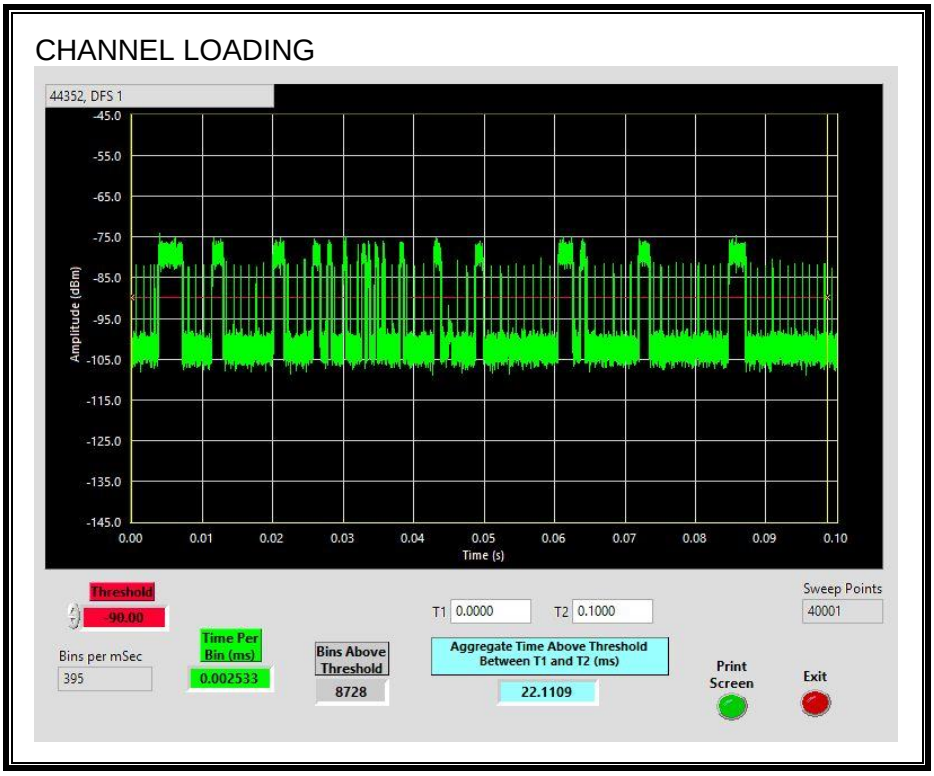


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 22.11%.

6.4.3. 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)
30.49	176.9	146.4	86.4

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)
30.47	118.6	88.1	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)
30.03	174.5	144.5	58.1

QUALITATIVE RESULTS

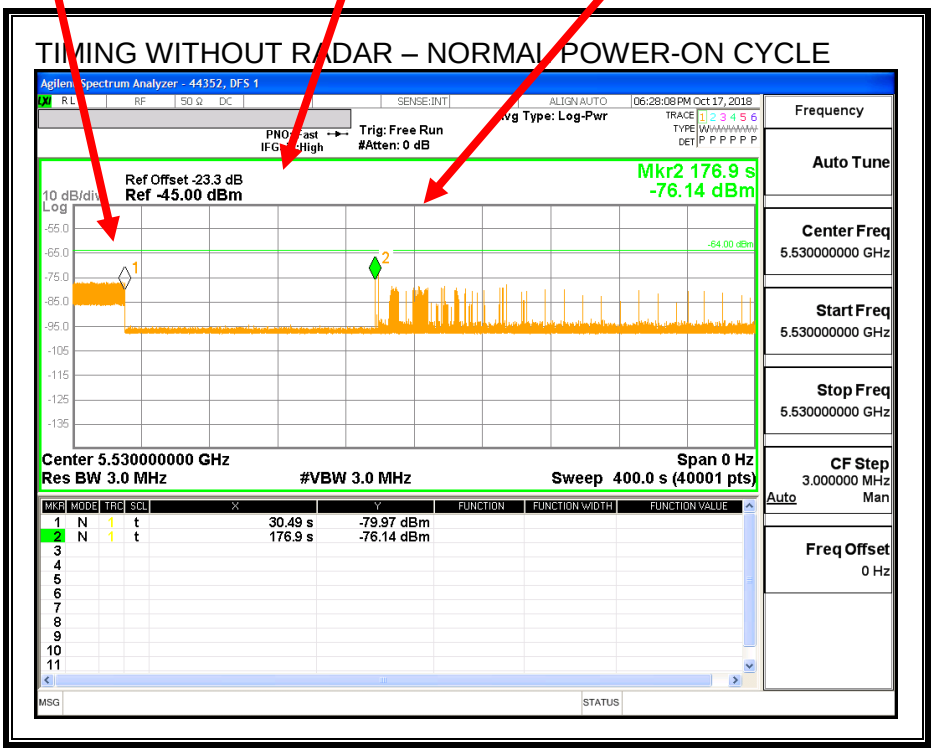
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

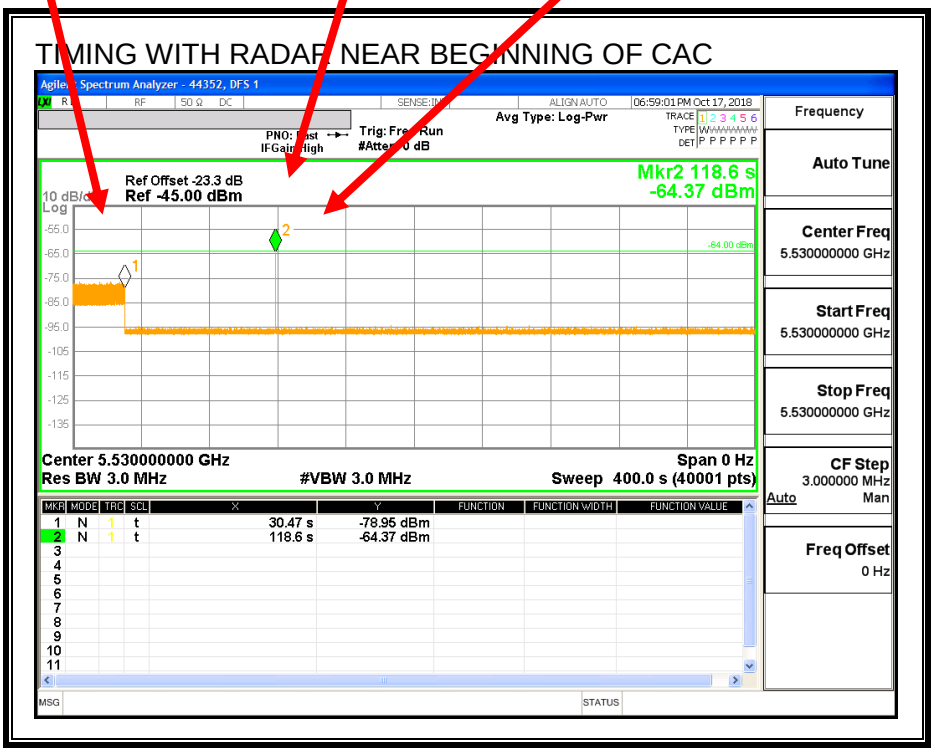
End of CAC
Traffic is Initiated



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



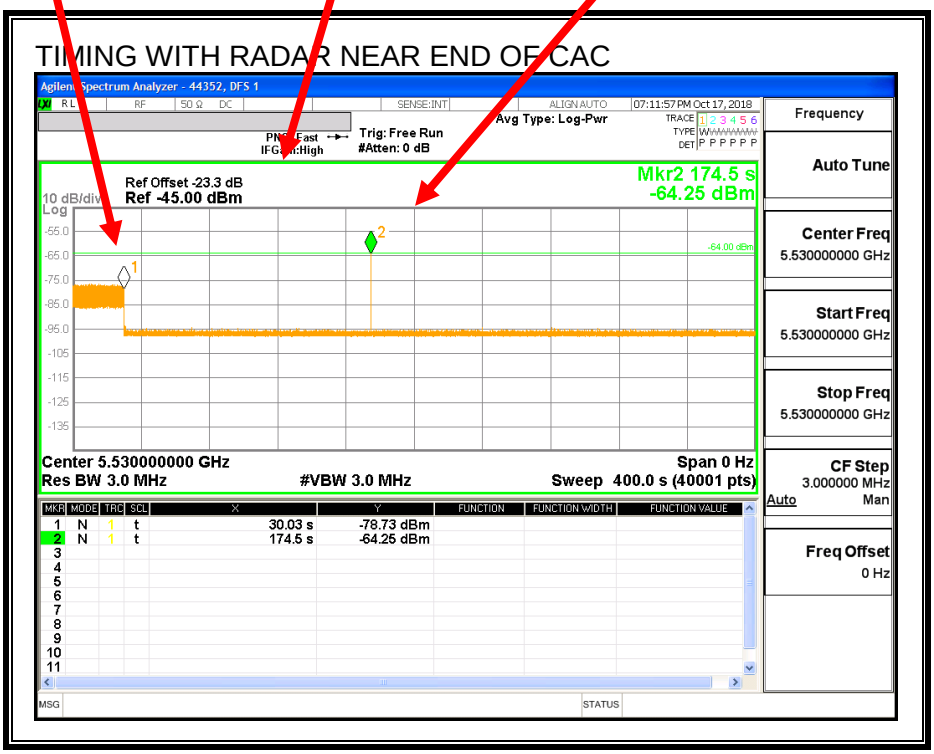
No EUT transmissions were observed after the radar signal.

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.

6.4.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

6.4.5. 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).

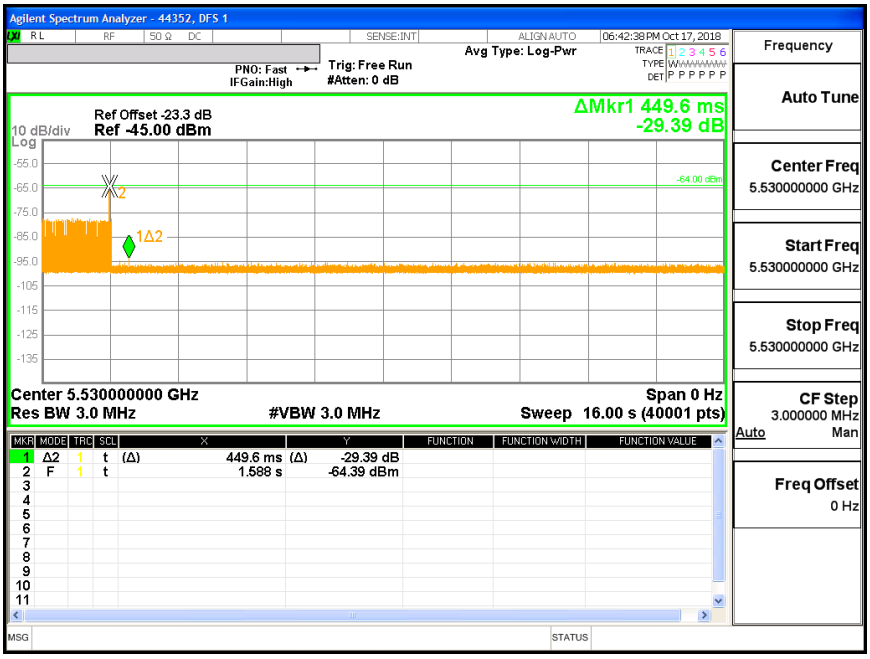
RESULTS

Channel Move Time (sec)	Limit (sec)
0.4496	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.8	60

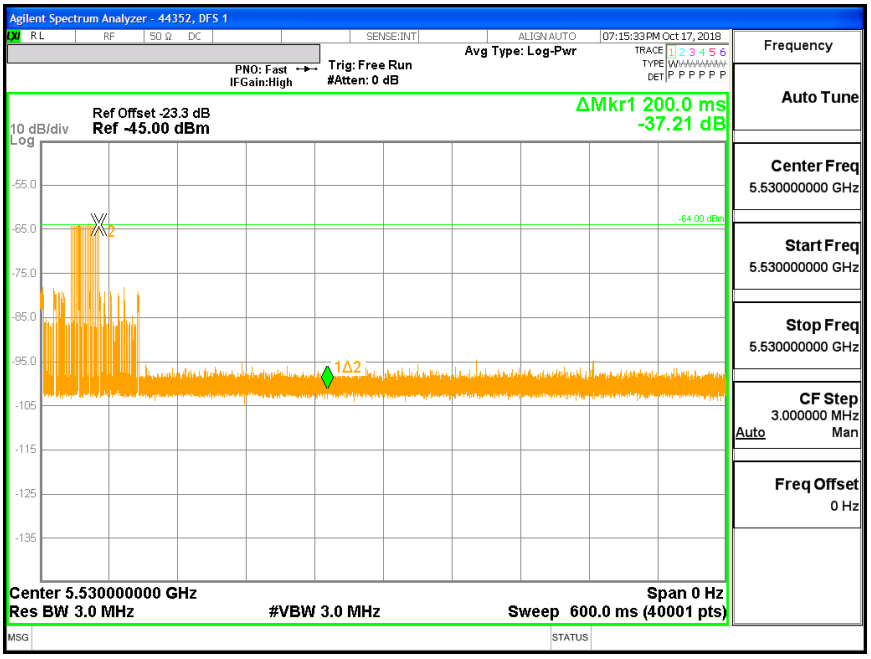
MOVE TIME

MOVE TIME



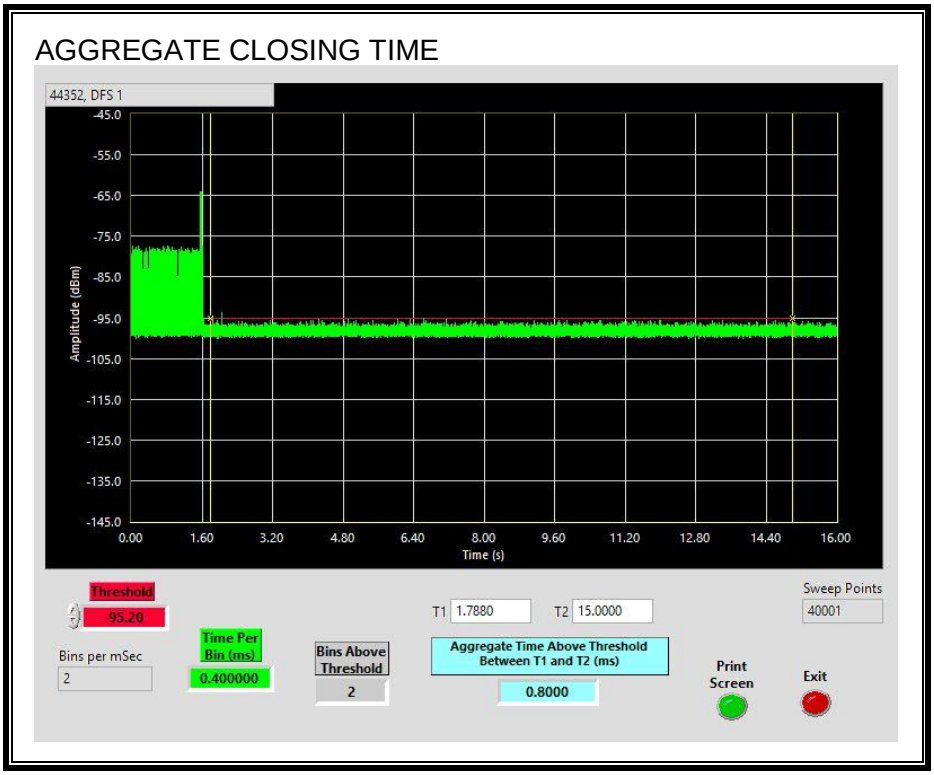
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

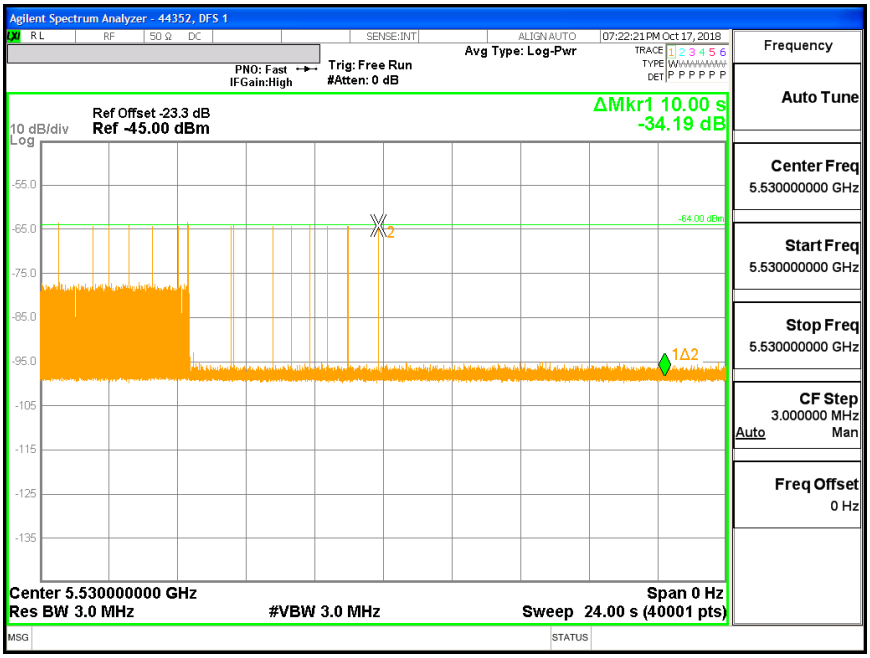
No transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR

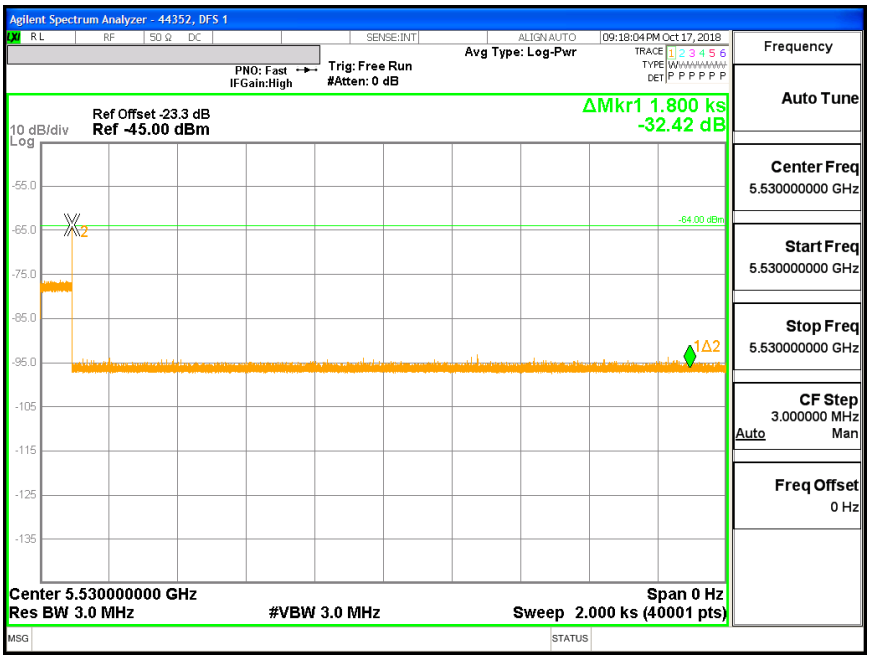


6.4.6. NON-OCCUPANCY PERIOD

RESULTS

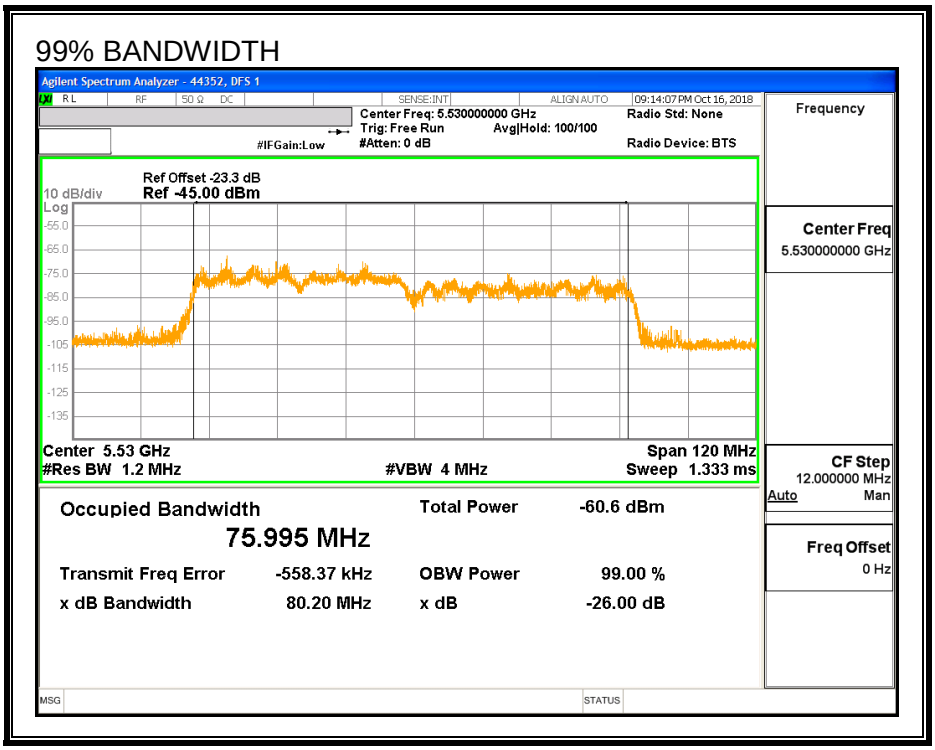
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



6.4.7. 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	75.995	105.3	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	9	90	
5505	10	10	100	
5510	10	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	9	90	
5535	10	10	100	
5540	10	9	90	
5545	10	10	100	
5550	10	10	100	
5555	10	10	100	
5560	10	9	90	
5565	10	10	100	
5570	10	9	90	FH
5571	10	0	0	

6.4.8. 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	83.33	60	Pass	5490	5570			76	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	83.33	60	Pass	5490	5570			76	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5570			76	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	80.00	60	Pass	5490	5570			76	DFS 1	44352	Version 3.3.4
Aggregate		81.67	80	Pass								
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	5498	5562	76	DFS 1	44352	Version 3.3.4
FCC Hopping Type 6	81	100.00	70	Pass	5490	5570				DFS 1	44352	Version 3.3.4

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	5548	Yes
1002	1	738	72	A	5560	Yes
1003	1	598	89	A	5527	Yes
1004	1	858	62	A	5503	Yes
1005	1	818	65	A	5522	No
1006	1	938	57	A	5545	Yes
1007	1	798	67	A	5516	No
1008	1	758	70	A	5499	Yes
1009	1	638	83	A	5494	Yes
1010	1	618	86	A	5507	Yes
1011	1	538	99	A	5566	Yes
1012	1	698	76	A	5562	Yes
1013	1	518	102	A	5505	No
1014	1	878	61	A	5529	Yes
1015	1	558	95	A	5517	Yes
1016	1	2393	23	B	5562	Yes
1017	1	607	87	B	5499	Yes
1018	1	2370	23	B	5511	Yes
1019	1	2066	26	B	5521	Yes
1020	1	2764	20	B	5555	Yes
1021	1	2590	21	B	5502	Yes
1022	1	869	61	B	5526	Yes
1023	1	825	64	B	5522	Yes
1024	1	587	90	B	5562	Yes
1025	1	672	79	B	5494	Yes
1026	1	563	94	B	5539	Yes
1027	1	2131	25	B	5519	Yes
1028	1	2152	25	B	5532	Yes
1029	1	2655	20	B	5570	No
1030	1	1610	33	B	5523	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	4.2	185	28	5546	Yes
2002	4.9	175	27	5497	No
2003	3.1	218	28	5552	Yes
2004	4	174	24	5531	Yes
2005	2.3	221	26	5556	Yes
2006	1.5	181	23	5562	Yes
2007	2.3	151	29	5540	No
2008	1.6	196	25	5567	Yes
2009	2.6	213	25	5513	Yes
2010	2.2	224	29	5549	Yes
2011	1.5	165	26	5570	Yes
2012	1.3	180	27	5501	Yes
2013	4.8	167	24	5546	No
2014	2.9	187	25	5551	Yes
2015	2.6	178	29	5533	No
2016	3	164	28	5569	Yes
2017	2.9	160	25	5494	No
2018	3.6	230	24	5511	Yes
2019	1.8	192	23	5567	Yes
2020	2.7	229	29	5494	Yes
2021	3.2	195	24	5550	Yes
2022	4.3	155	27	5501	Yes
2023	1	206	27	5525	Yes
2024	4.4	170	23	5551	Yes
2025	1.3	230	23	5536	Yes
2026	5	199	27	5553	Yes
2027	4.3	220	23	5567	Yes
2028	4.1	154	24	5498	Yes
2029	3.5	223	28	5519	Yes
2030	1.6	161	23	5535	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	6.3	260	17	5542	Yes
3002	6.7	466	17	5558	No
3003	6.6	335	17	5535	Yes
3004	7.3	303	18	5554	Yes
3005	9.6	303	18	5551	Yes
3006	6.4	416	17	5520	No
3007	6.9	311	18	5543	Yes
3008	8	438	17	5552	Yes
3009	8.8	345	16	5548	Yes
3010	8.2	367	18	5514	Yes
3011	9.1	421	18	5504	Yes
3012	8.7	322	16	5526	Yes
3013	8	271	18	5523	Yes
3014	7.8	436	18	5518	Yes
3015	7.2	397	17	5491	No
3016	9.4	457	18	5512	Yes
3017	7.2	314	17	5564	Yes
3018	9.6	386	16	5508	Yes
3019	7.5	256	16	5508	Yes
3020	6	474	16	5536	Yes
3021	8.3	356	17	5551	No
3022	9.2	337	16	5497	No
3023	9.7	483	16	5498	Yes
3024	6.7	358	16	5503	Yes
3025	7.5	399	18	5529	Yes
3026	6.9	288	17	5492	Yes
3027	7.8	341	17	5564	Yes
3028	7.4	494	17	5541	No
3029	6.7	442	17	5543	Yes
3030	6.5	356	17	5564	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	20	318	13	5495	Yes
4002	15.8	260	14	5552	Yes
4003	19.9	485	14	5565	Yes
4004	16.1	307	16	5512	Yes
4005	11.6	427	12	5501	Yes
4006	17.3	395	16	5505	Yes
4007	13.3	277	12	5502	No
4008	20	258	16	5491	Yes
4009	16.5	403	16	5519	Yes
4010	18.9	279	15	5539	No
4011	11.5	320	15	5536	Yes
4012	19.2	459	12	5531	Yes
4013	12.3	262	12	5544	No
4014	11.3	414	12	5496	Yes
4015	18.8	363	12	5525	No
4016	14	410	13	5566	Yes
4017	12.9	489	16	5561	Yes
4018	12.9	432	12	5532	Yes
4019	17	406	13	5548	Yes
4020	13.2	478	14	5508	Yes
4021	17.8	348	15	5548	Yes
4022	14.4	316	14	5494	No
4023	15.2	449	15	5552	Yes
4024	17.2	429	15	5529	Yes
4025	13.6	324	14	5515	Yes
4026	11.7	451	14	5550	Yes
4027	17.7	492	13	5504	Yes
4028	16.3	380	16	5510	No
4029	18.5	434	13	5495	Yes
4030	13.3	335	16	5508	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	5500	Yes
15	5499	Yes
16	5497	Yes
17	5498	Yes
18	5495	Yes
19	5498	Yes
20	5500	Yes
21	5566	Yes
22	5562	Yes
23	5566	Yes
24	5562	Yes
25	5566	Yes
26	5562	Yes
27	5566	Yes
28	5562	Yes
29	5566	Yes
30	5562	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	73	5490	18	Yes
2	548	5491	17	Yes
3	1023	5492	18	Yes
4	1498	5493	18	Yes
5	1973	5494	19	Yes
6	2448	5495	19	Yes
7	2923	5496	16	Yes
8	3398	5497	18	Yes
9	3873	5498	16	Yes
10	4348	5499	15	Yes
11	4823	5500	18	Yes
12	5298	5501	18	Yes
13	5773	5502	21	Yes
14	6248	5503	21	Yes
15	6723	5504	13	Yes
16	7198	5505	15	Yes
17	7673	5506	11	Yes
18	8148	5507	21	Yes
19	8623	5508	12	Yes
20	9098	5509	20	Yes
21	9573	5510	18	Yes
22	10048	5511	16	Yes
23	10523	5512	15	Yes
24	10998	5513	15	Yes
25	11473	5514	18	Yes
26	11948	5515	18	Yes
27	12423	5516	14	Yes
28	12898	5517	20	Yes
29	13373	5518	21	Yes
30	13848	5519	14	Yes
31	14323	5520	19	Yes
32	14798	5521	12	Yes
33	15273	5522	19	Yes
34	15748	5523	17	Yes
35	16223	5524	15	Yes
36	16698	5525	18	Yes
37	17173	5526	13	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

38	17648	5527	15	Yes
39	18123	5528	20	Yes
40	18598	5529	16	Yes
41	19073	5530	14	Yes
42	19548	5531	21	Yes
43	20023	5532	14	Yes
44	20498	5533	20	Yes
45	20973	5534	19	Yes
46	21448	5535	19	Yes
47	21923	5536	23	Yes
48	22398	5537	16	Yes
49	22873	5538	18	Yes
50	23348	5539	15	Yes
51	23823	5540	21	Yes
52	24298	5541	23	Yes
53	24773	5542	19	Yes
54	25248	5543	15	Yes
55	25723	5544	17	Yes
56	26198	5545	16	Yes
57	26673	5546	15	Yes
58	27148	5547	14	Yes
59	27623	5548	17	Yes
60	28098	5549	15	Yes
61	28573	5550	15	Yes
62	29048	5551	12	Yes
63	29523	5552	13	Yes
64	29998	5553	17	Yes
65	30473	5554	13	Yes
66	30948	5555	14	Yes
67	31423	5556	22	Yes
68	31898	5557	17	Yes
69	32373	5558	13	Yes
70	32848	5559	15	Yes
71	33323	5560	13	Yes
72	33798	5561	19	Yes
73	34273	5562	15	Yes
74	34748	5563	14	Yes
75	35223	5564	18	Yes
76	35698	5565	11	Yes
77	36173	5566	19	Yes
78	36648	5567	21	Yes
79	37123	5568	20	Yes
80	37598	5569	15	Yes
81	38073	5570	17	Yes

6.5. 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.