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

CERTIFICATION TEST REPORT

FOR

LTE & WI-FI Router

MODEL NUMBER: Z3C-HW-NA

FCC ID: UDX-60053020
IC: 6961A-60053020

REPORT NUMBER: 12391260-E3V1

ISSUE DATE: November 27, 2018

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

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	11/27/18	Initial Issue	Conan Cheung

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: LTE & WI-FI ROUTER

MODEL: Z3C-HW-NA

SERIAL NUMBER: Q2PY-WDW9-4J59

DATE TESTED: SEPTEMBER 5 – OCTOBER 16

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
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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 International Inc. report number FR811724D.

4. 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.

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

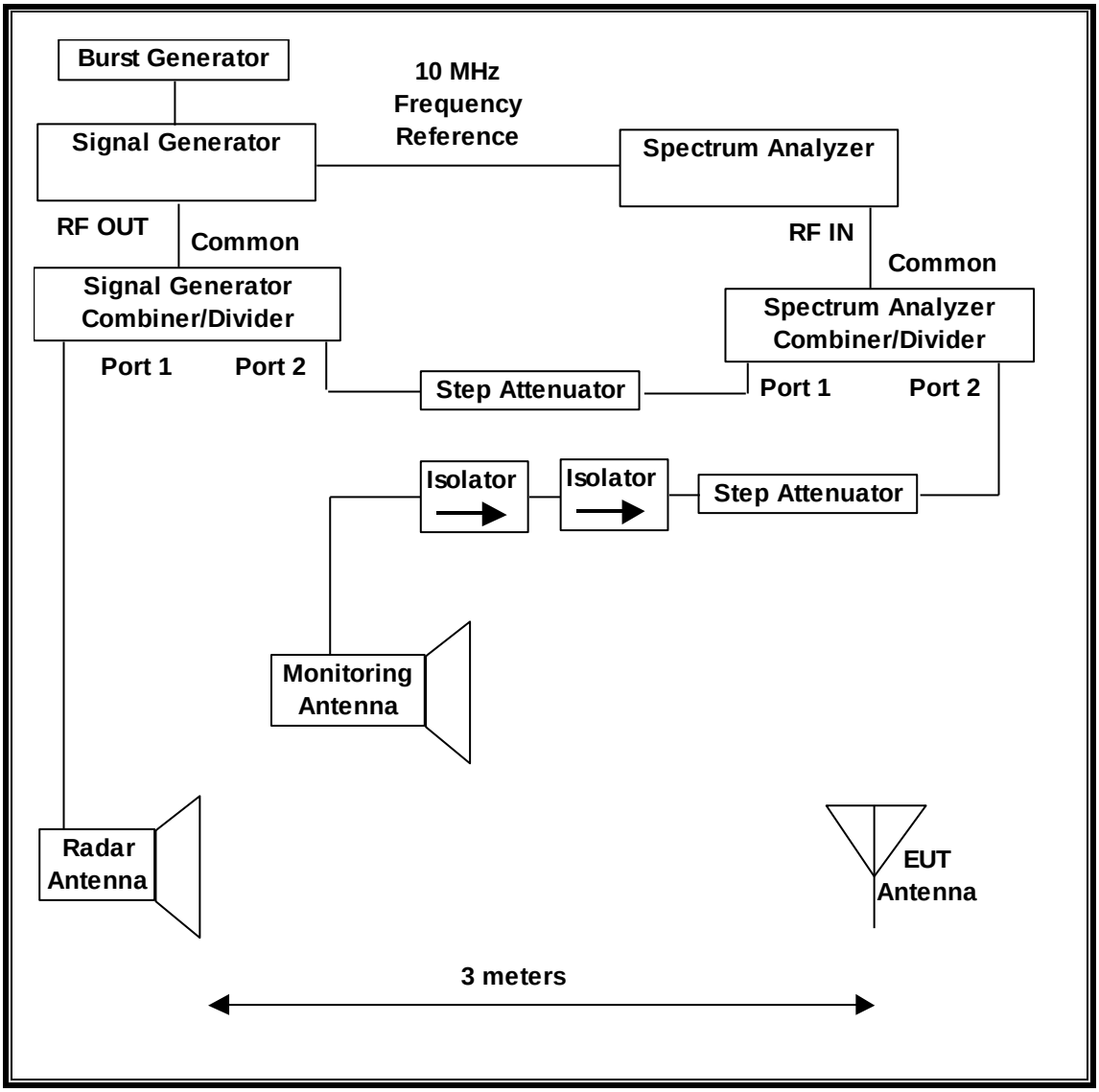
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

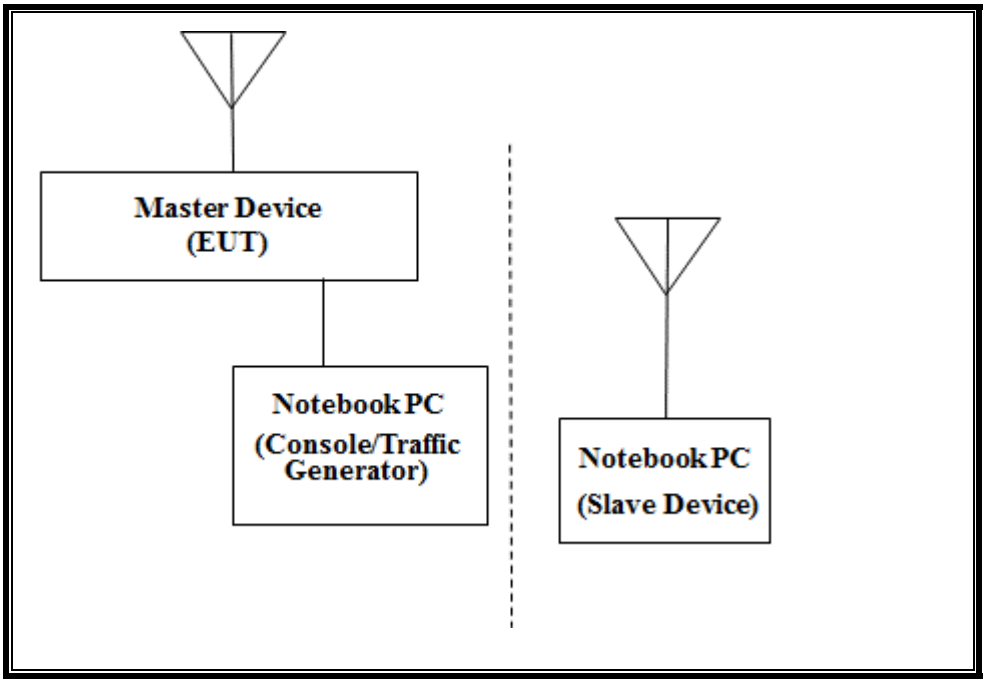
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	23.2 °C
Humidity	28 %

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-50WAC	CS0219435 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 26.33 dBm EIRP in the 5250-5350 MHz band and 27.48 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 4 dBi. The lowest gain antenna assembly utilized with the EUT has a gain of 3.5 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_arm_qca_version T-201810041129-Ge9510aa0-Lfed6e51aM-dhruvin-liner.

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 Access Point, FCC ID:. UDX-60053020 The minimum antenna gain for the Master Device is 3.5 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

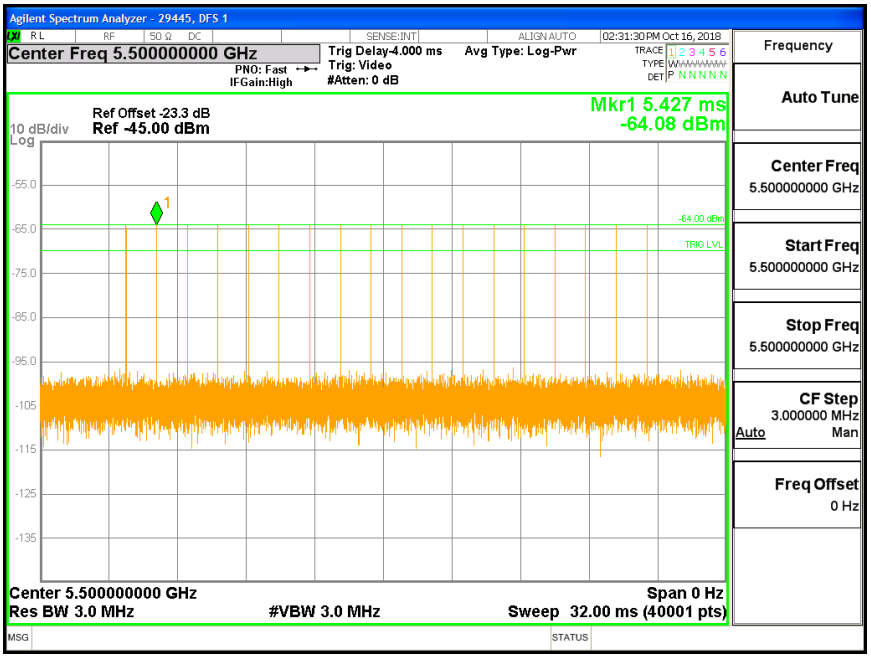
6.2.1. TEST CHANNEL

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

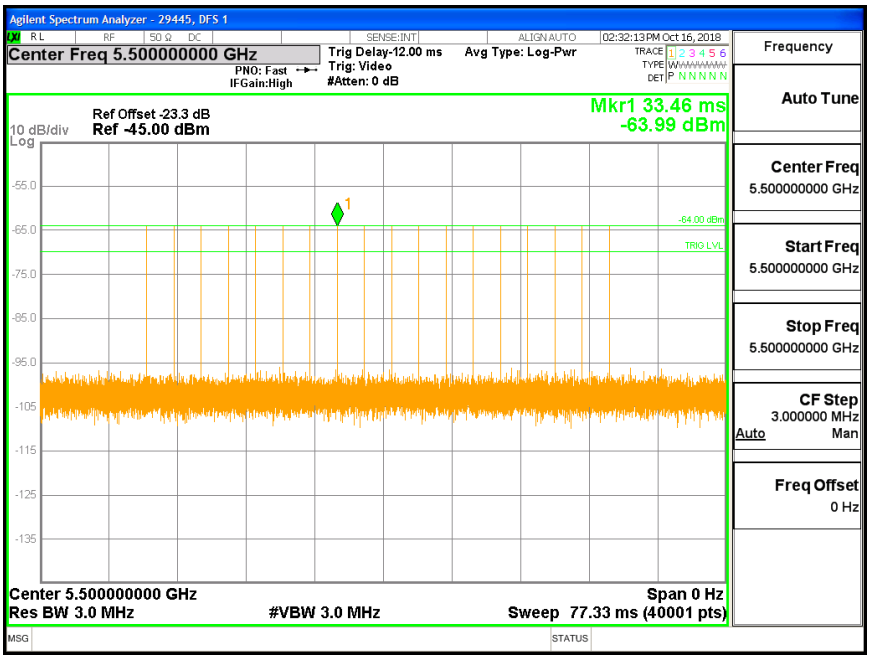
6.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

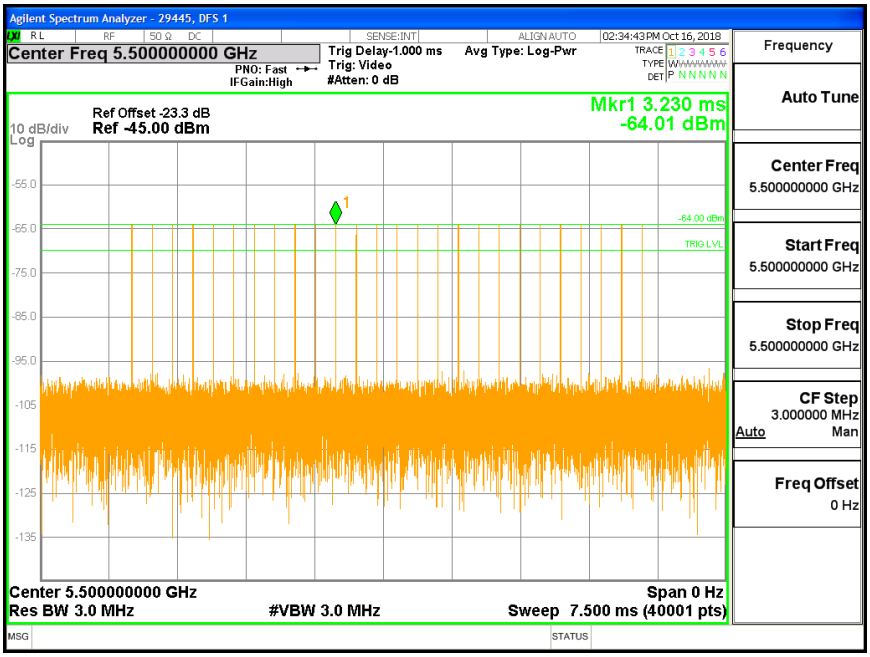
SHORT PULSE RADAR TYPE 0



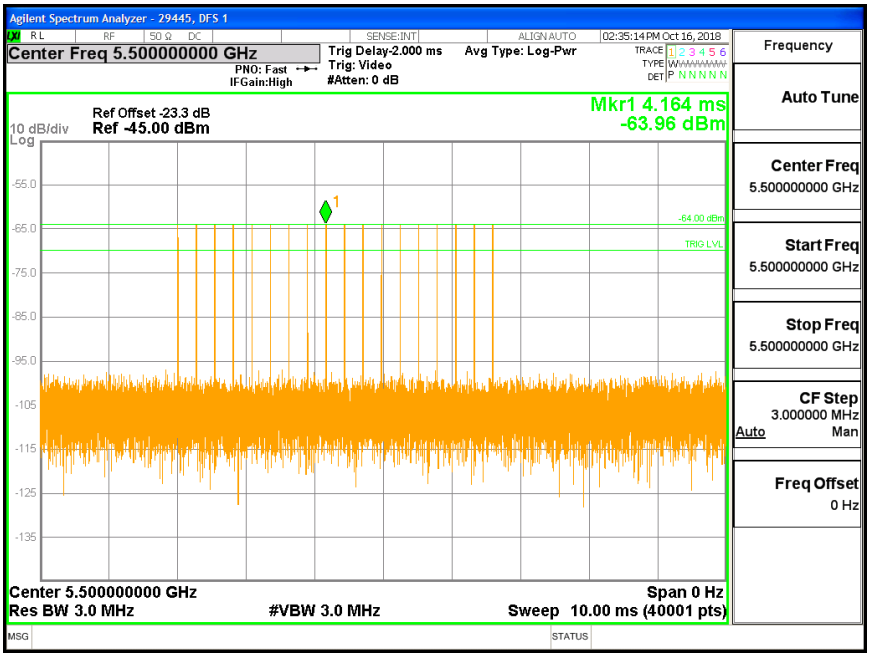
SAMPLE OF RADAR TYPE 1



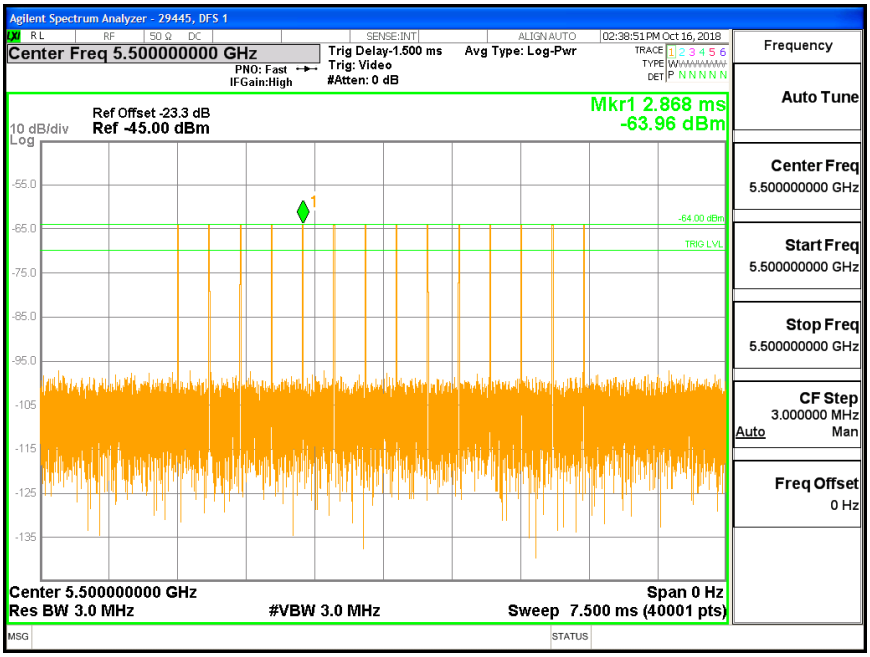
SAMPLE OF RADAR TYPE 2



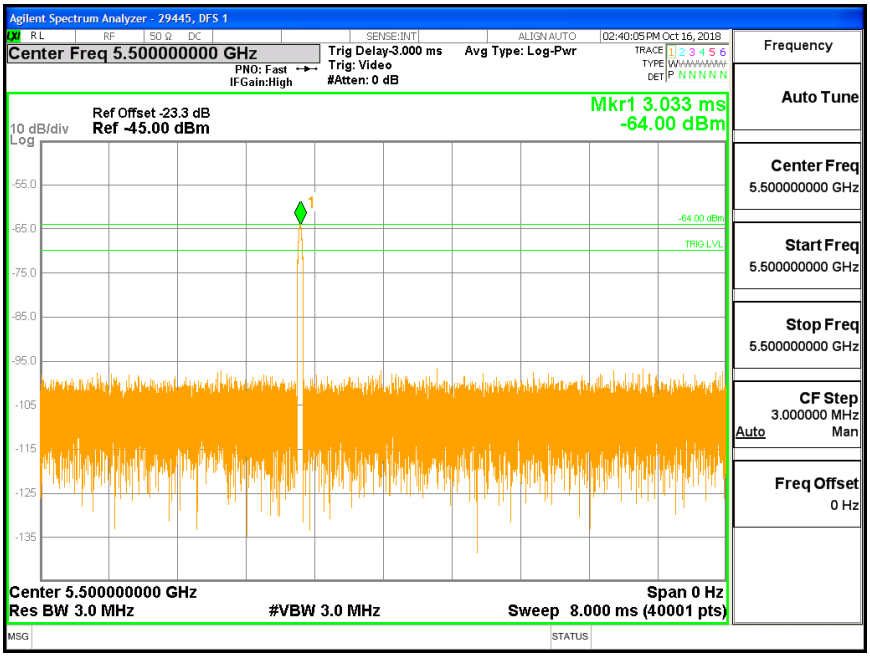
SAMPLE OF RADAR TYPE 3



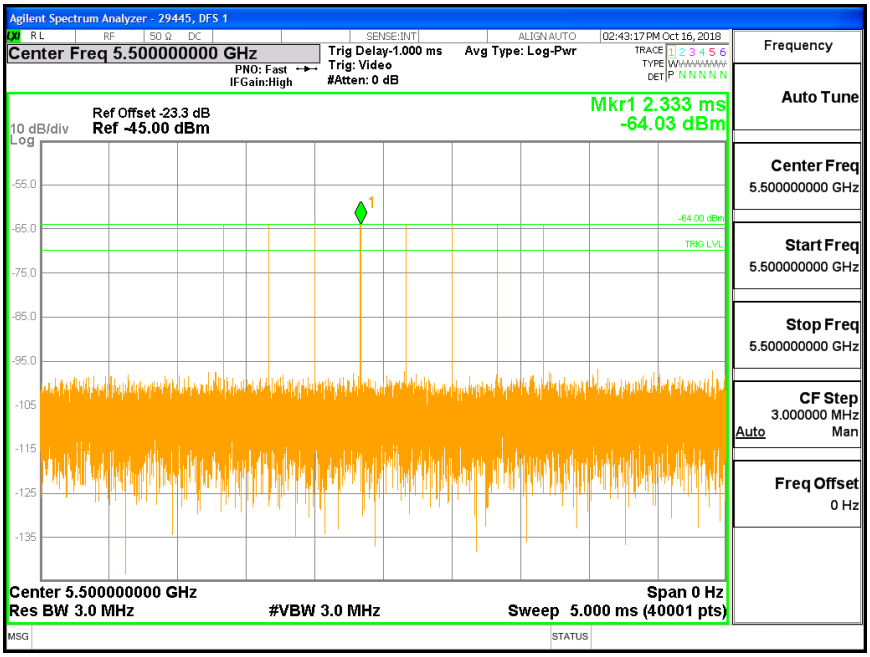
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

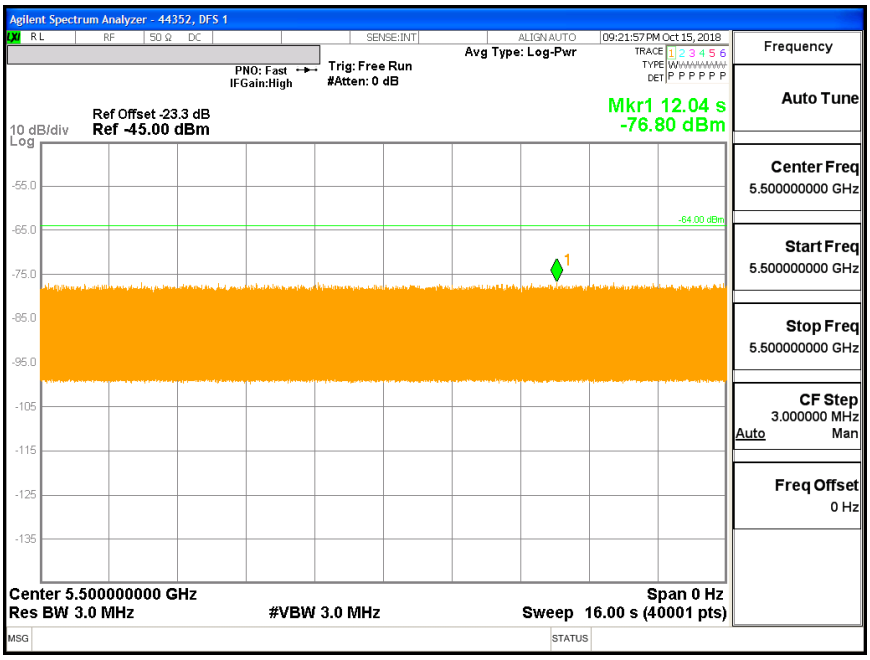


SINGLE BURST OF RADAR TYPE 6

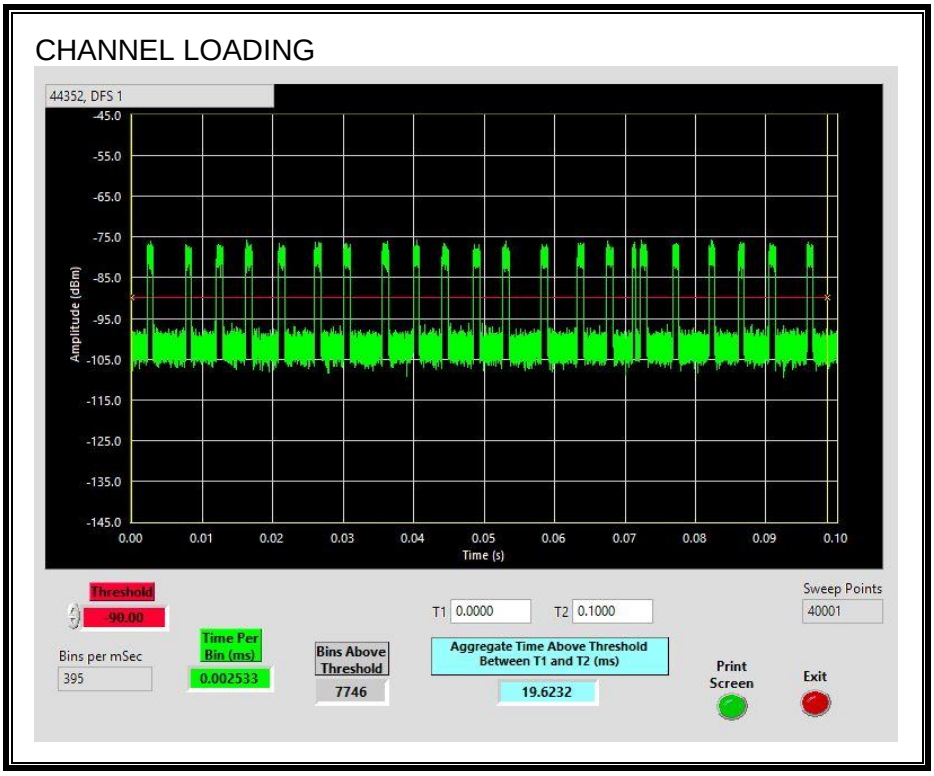


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.6232%.

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)
30.51	214.3	183.8	123.8

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)
30.36	155.4	125.0	1.2

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.86	210.2	180.3	56.6

QUALITATIVE RESULTS

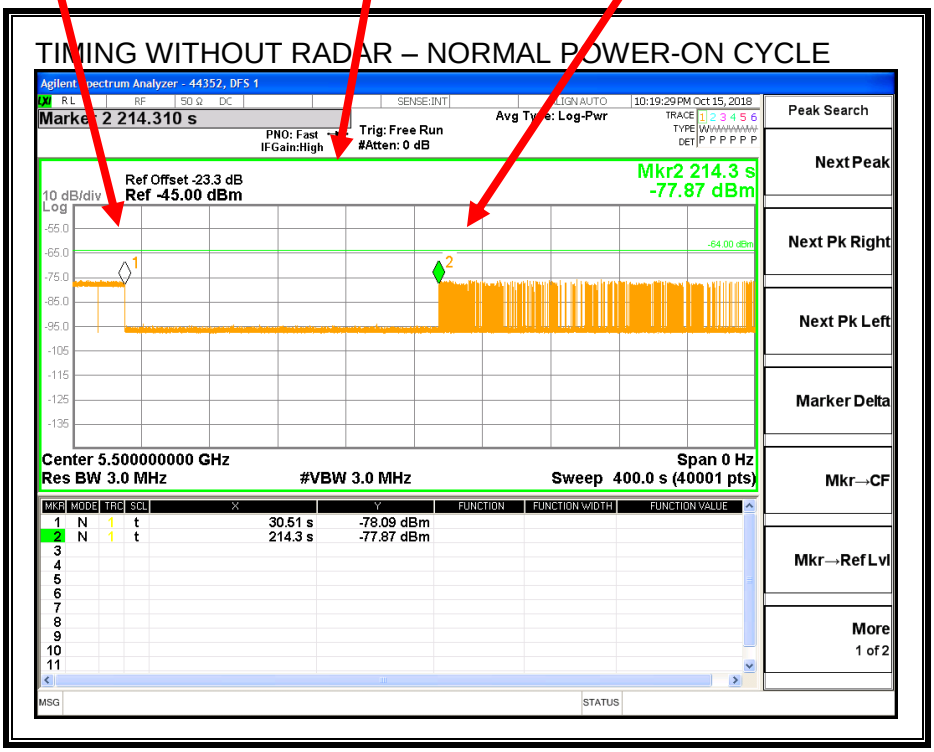
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

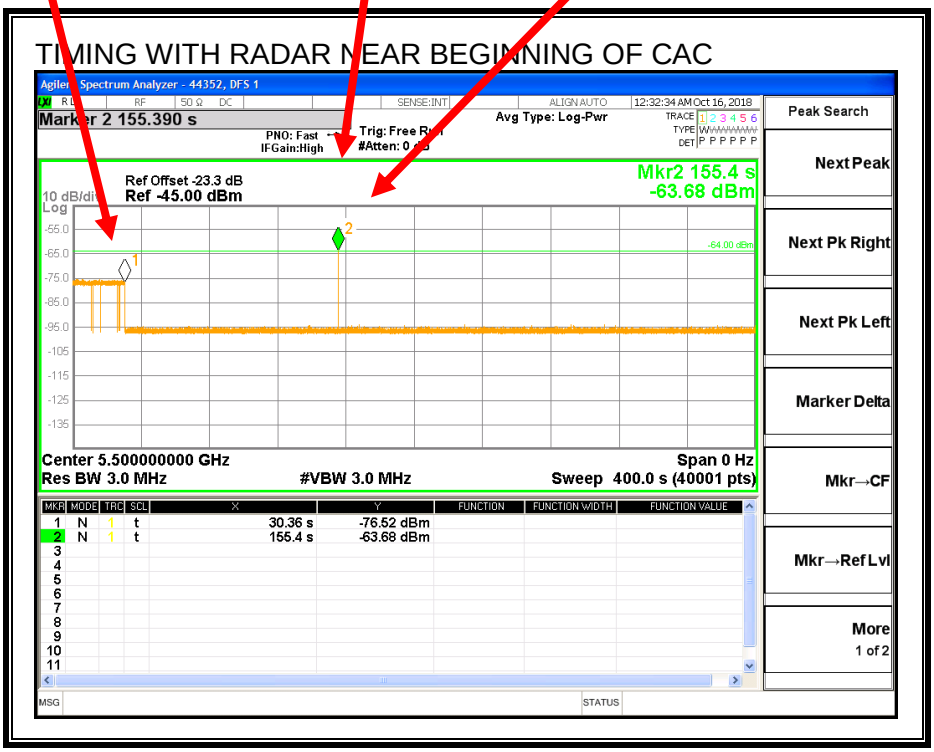
End of CAC
Traffic is Initiated



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

TIMING WITH RADAR NEAR BEGINNING OF CAC

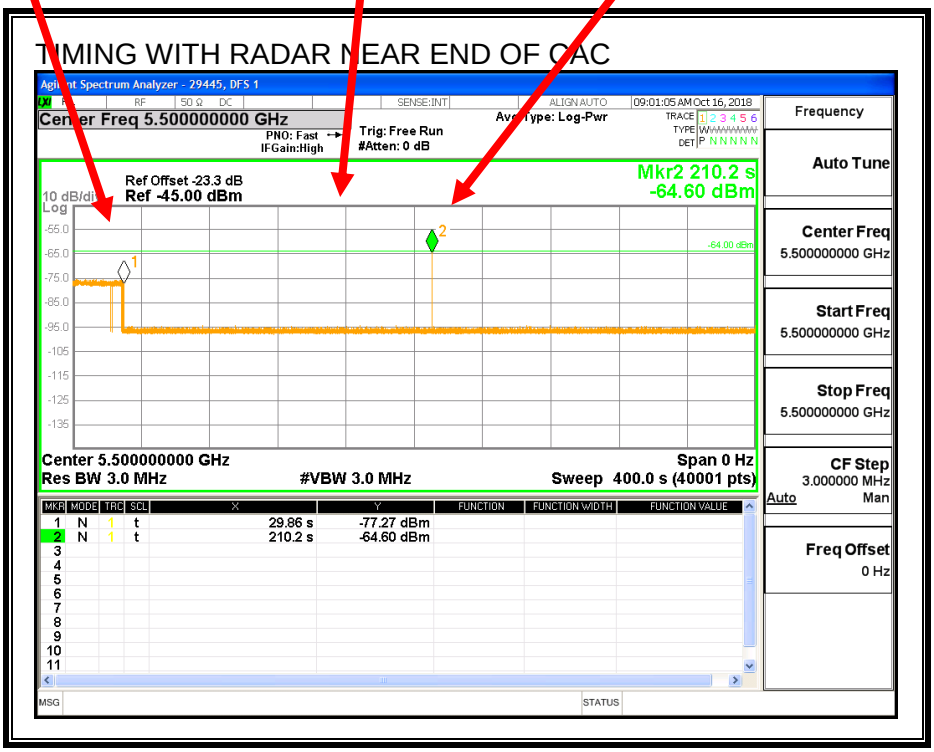
AP is rebooted
Traffic ceases
Start of Initial Power-up cycle
End of Initial Power-up cycle
Start of CAC
Radar Signal Applied



No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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



No EUT transmissions were observed after the radar signal.

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)

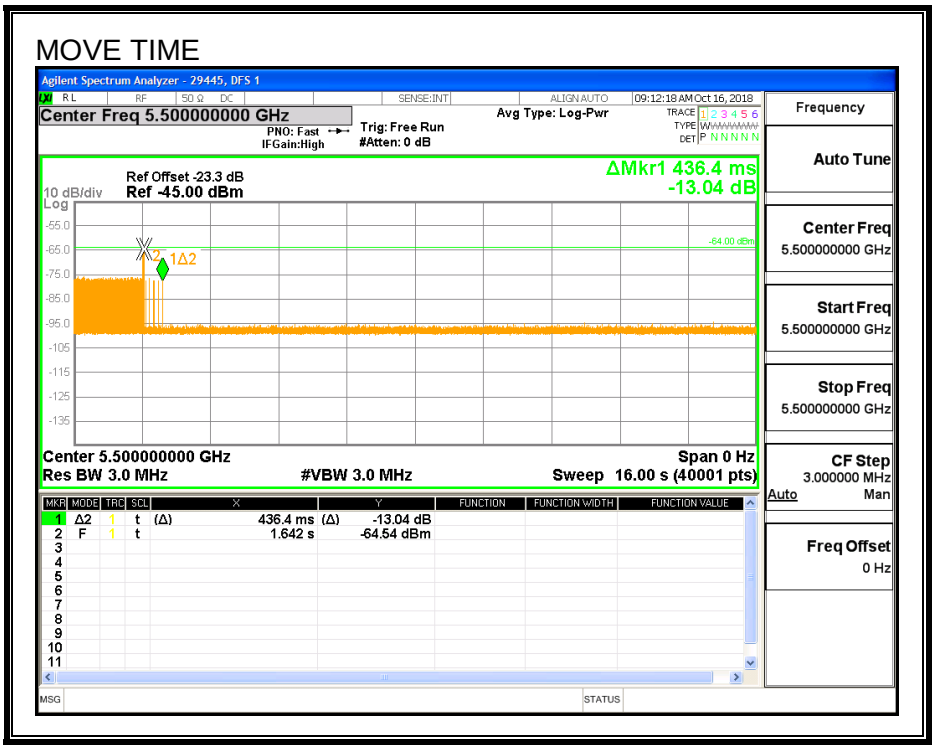
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.4364	10

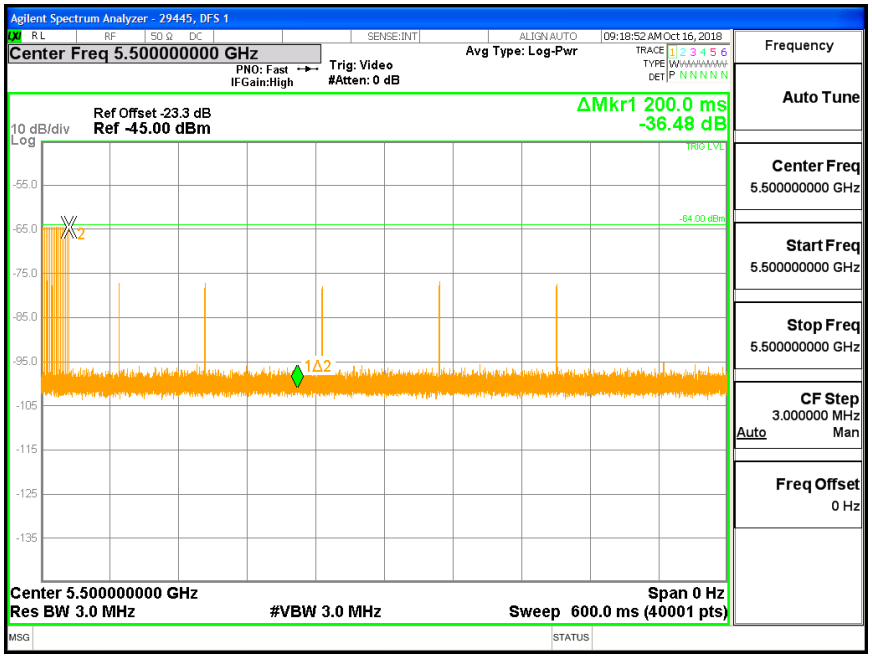
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
2.4	60

MOVE TIME



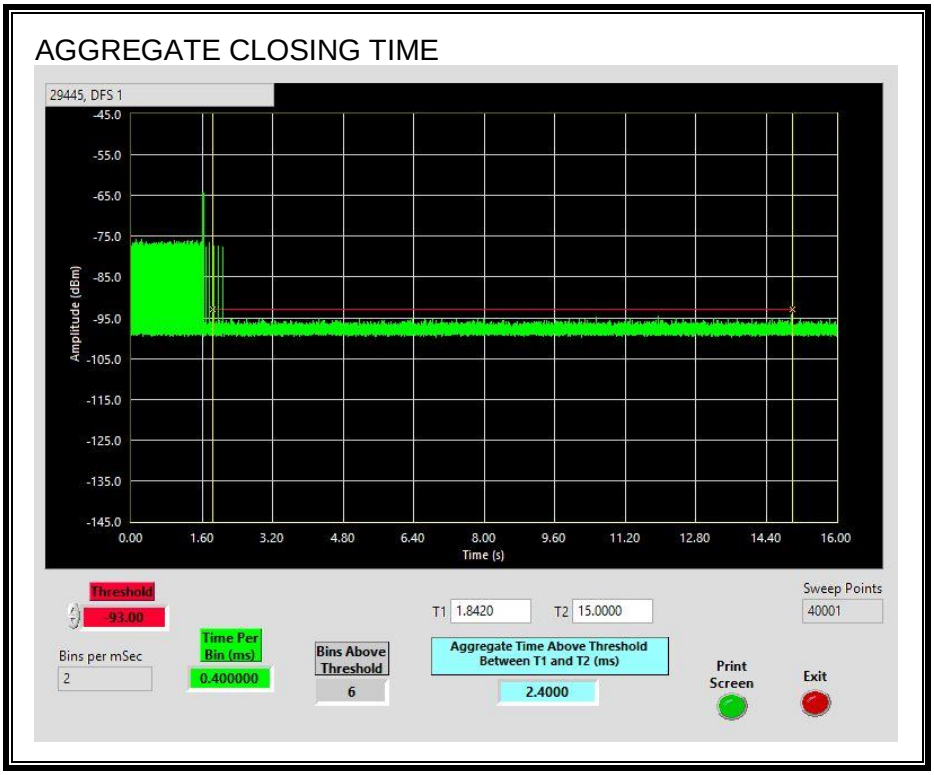
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

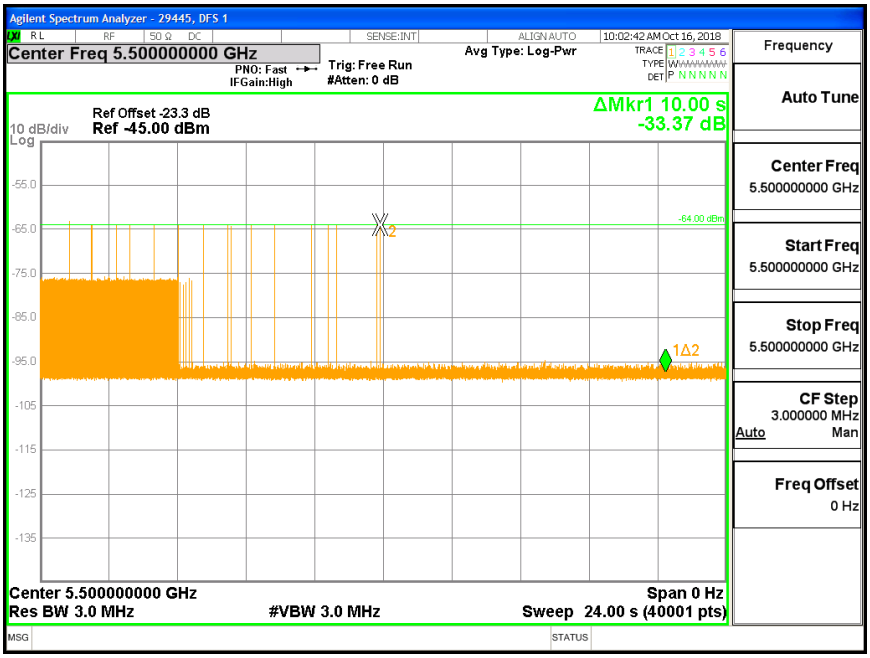
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

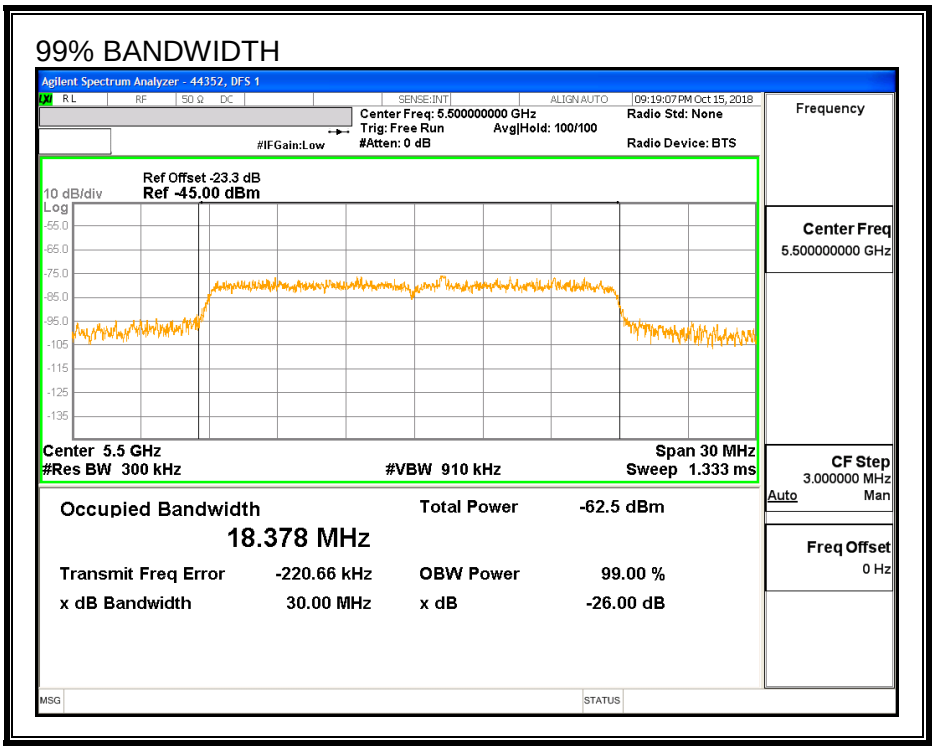
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



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	18.378	108.8	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

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

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	93.33	60	Pass	5490	5510	18.38	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5510	18.38	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5510	18.38	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	100.00	60	Pass	5490	5510	18.38	DFS 1	44352	Version 3.3.4
Aggregate		98.33	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	18.38	DFS 1	44352	Version 3.3.4
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510		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	5494	Yes
1002	1	778	68	A	5508	Yes
1003	1	718	74	A	5503	No
1004	1	698	76	A	5492	Yes
1005	1	658	81	A	5505	Yes
1006	1	678	78	A	5504	No
1007	1	938	57	A	5500	Yes
1008	1	578	92	A	5496	Yes
1009	1	618	86	A	5492	Yes
1010	1	558	95	A	5504	Yes
1011	1	798	67	A	5505	Yes
1012	1	598	89	A	5498	Yes
1013	1	738	72	A	5506	Yes
1014	1	518	102	A	5490	Yes
1015	1	758	70	A	5502	Yes
1016	1	1076	50	B	5500	Yes
1017	1	2580	21	B	5509	Yes
1018	1	1859	29	B	5506	Yes
1019	1	2297	23	B	5493	Yes
1020	1	3059	18	B	5496	Yes
1021	1	2274	24	B	5494	Yes
1022	1	1971	27	B	5490	Yes
1023	1	1315	41	B	5496	Yes
1024	1	1141	47	B	5508	Yes
1025	1	1968	27	B	5506	Yes
1026	1	729	73	B	5492	Yes
1027	1	1685	32	B	5497	Yes
1028	1	576	92	B	5502	Yes
1029	1	3015	18	B	5505	Yes
1030	1	2035	26	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	1.9	223	26	5510	Yes
2002	4	180	27	5491	Yes
2003	2.5	170	26	5497	Yes
2004	2.8	213	28	5499	Yes
2005	3.7	207	27	5493	Yes
2006	2.1	173	26	5497	Yes
2007	1.3	214	26	5504	Yes
2008	4	227	25	5492	Yes
2009	3.3	191	28	5509	Yes
2010	4.3	208	25	5501	Yes
2011	2	176	29	5505	Yes
2012	3.1	160	25	5507	Yes
2013	1	175	23	5505	Yes
2014	4.6	163	26	5493	Yes
2015	2.7	182	28	5499	Yes
2016	2.3	174	29	5495	Yes
2017	4.7	159	24	5505	Yes
2018	2.7	155	25	5505	Yes
2019	3.4	225	24	5509	Yes
2020	1.5	187	26	5502	Yes
2021	2.4	181	25	5494	Yes
2022	4.9	190	24	5494	Yes
2023	4.1	188	23	5497	Yes
2024	2.7	201	29	5490	Yes
2025	2	165	26	5509	Yes
2026	1.1	183	29	5510	Yes
2027	4.8	194	26	5500	Yes
2028	1.9	215	23	5493	Yes
2029	3.8	230	27	5506	Yes
2030	3.3	218	24	5500	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	6.4	270	18	5491	Yes
3002	6	496	17	5497	Yes
3003	8.4	451	18	5502	Yes
3004	6.4	438	16	5502	Yes
3005	7.1	405	18	5498	Yes
3006	9.3	288	16	5492	Yes
3007	6.1	268	16	5498	Yes
3008	8.6	296	18	5494	Yes
3009	7.8	290	16	5498	Yes
3010	8.5	330	16	5495	Yes
3011	9.8	470	16	5499	Yes
3012	8.9	272	17	5496	Yes
3013	8.5	307	16	5507	Yes
3014	9.7	373	18	5498	Yes
3015	7.5	421	17	5498	Yes
3016	7	382	17	5493	Yes
3017	9.2	442	18	5493	Yes
3018	8.8	416	16	5510	Yes
3019	7.1	371	16	5495	Yes
3020	9.2	358	18	5495	Yes
3021	9.9	326	17	5493	Yes
3022	8	459	18	5495	Yes
3023	8.9	322	16	5491	Yes
3024	7.3	468	17	5491	Yes
3025	6.5	343	16	5509	Yes
3026	7.2	251	18	5490	Yes
3027	6.6	390	17	5503	Yes
3028	7.6	444	17	5498	Yes
3029	7.2	479	18	5507	Yes
3030	6.4	294	17	5495	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
4001	11.6	341	14	5506	Yes
4002	19.5	303	12	5509	Yes
4003	15.2	363	13	5505	Yes
4004	14.5	337	16	5506	Yes
4005	15.5	292	15	5491	Yes
4006	15.3	279	14	5494	Yes
4007	16.8	498	13	5510	Yes
4008	12.7	380	12	5502	Yes
4009	14.7	494	16	5496	Yes
4010	15.9	388	13	5500	Yes
4011	18.3	264	15	5497	Yes
4012	20	423	14	5497	Yes
4013	18.6	311	12	5495	Yes
4014	11.7	498	12	5509	Yes
4015	19.9	399	15	5492	Yes
4016	18.2	465	12	5495	Yes
4017	17.8	262	13	5494	Yes
4018	16.6	474	16	5496	Yes
4019	12.3	283	12	5501	Yes
4020	11.6	257	15	5499	Yes
4021	12.6	463	14	5496	Yes
4022	12.4	333	15	5504	Yes
4023	13.9	301	16	5509	Yes
4024	18.9	300	15	5491	Yes
4025	11.8	414	15	5508	Yes
4026	13	309	16	5496	Yes
4027	15.4	436	13	5493	Yes
4028	17.2	343	13	5496	Yes
4029	15.8	365	15	5510	Yes
4030	17.9	419	15	5490	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	5497	Yes
12	5498	Yes
13	5497	Yes
14	5497	Yes
15	5498	Yes
16	5497	Yes
17	5497	Yes
18	5493	Yes
19	5499	Yes
20	5494	Yes
21	5506	Yes
22	5501	Yes
23	5507	Yes
24	5501	Yes
25	5506	Yes
26	5506	Yes
27	5501	Yes
28	5507	Yes
29	5501	Yes
30	5506	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	274	5490	6	Yes
2	749	5491	4	Yes
3	1224	5492	3	Yes
4	1699	5493	5	Yes
5	2174	5494	2	Yes
6	2649	5495	6	Yes
7	3124	5496	5	Yes
8	3599	5497	4	Yes
9	4074	5498	3	Yes
10	4549	5499	4	Yes
11	5024	5500	2	Yes
12	5499	5501	5	Yes
13	5974	5502	3	Yes
14	6449	5503	5	Yes
15	6924	5504	4	Yes
16	7399	5505	4	Yes
17	7874	5506	2	Yes
18	8349	5507	2	Yes
19	8824	5508	2	Yes
20	9299	5509	4	Yes
21	9774	5510	3	Yes
22	10249	5490	5	Yes
23	10724	5491	6	Yes
24	11199	5492	2	Yes
25	11674	5493	3	Yes
26	12149	5494	4	Yes
27	12624	5495	2	Yes
28	13099	5496	5	Yes
29	13574	5497	3	Yes
30	14049	5498	5	Yes
31	14524	5499	6	Yes
32	14999	5500	2	Yes
33	15474	5501	4	Yes
34	15949	5502	7	Yes
35	16424	5503	3	Yes
36	16899	5504	3	Yes
37	17374	5505	4	Yes
38	17849	5506	3	Yes
39	18324	5507	4	Yes
40	18799	5508	3	Yes
41	19274	5509	2	Yes
42	19749	5510	3	Yes

6.3. RESULTS FOR 40 MHz BANDWIDTH

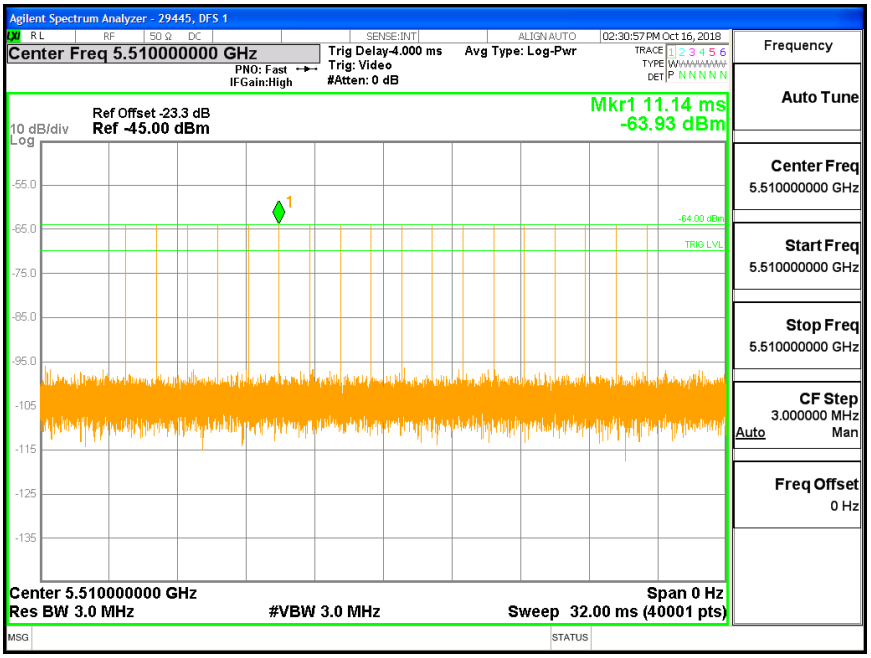
6.3.1. TEST CHANNEL

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

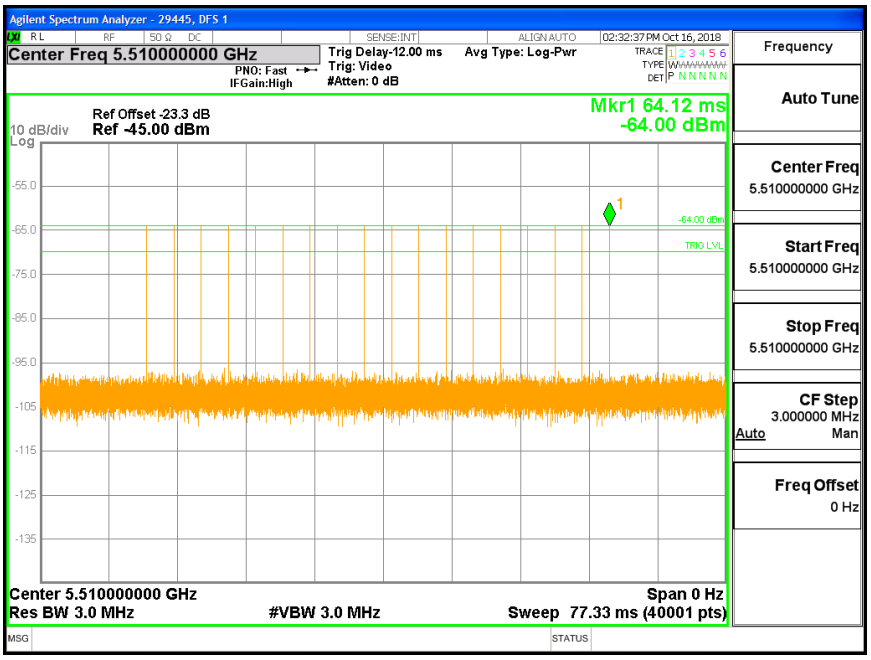
6.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

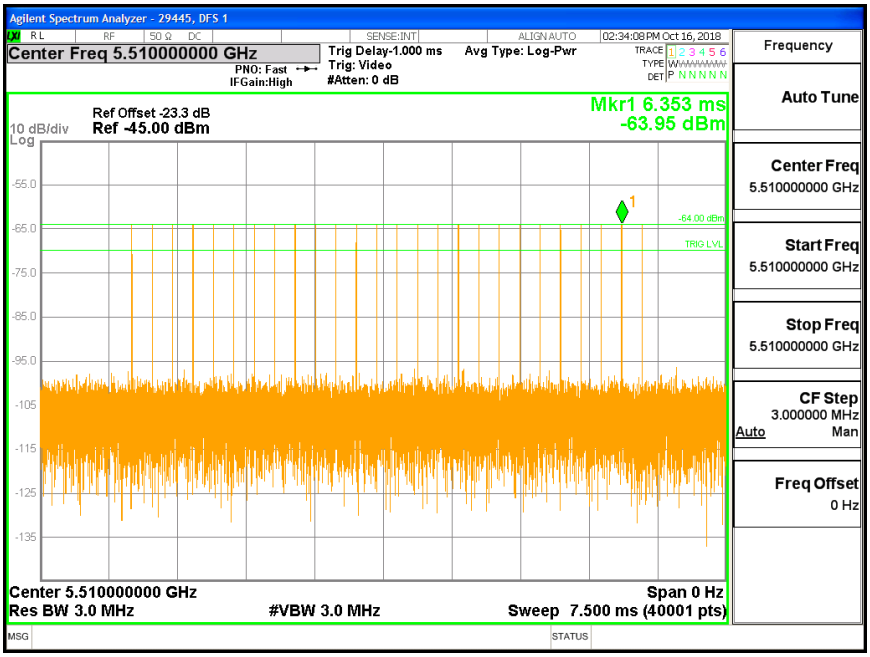
SHORT PULSE RADAR TYPE 0



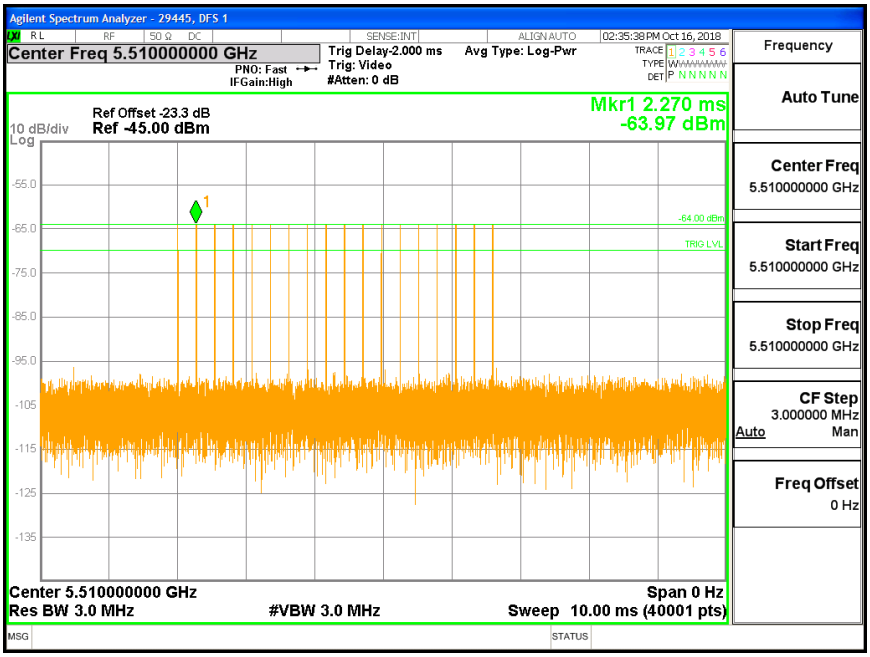
SAMPLE OF RADAR TYPE 1



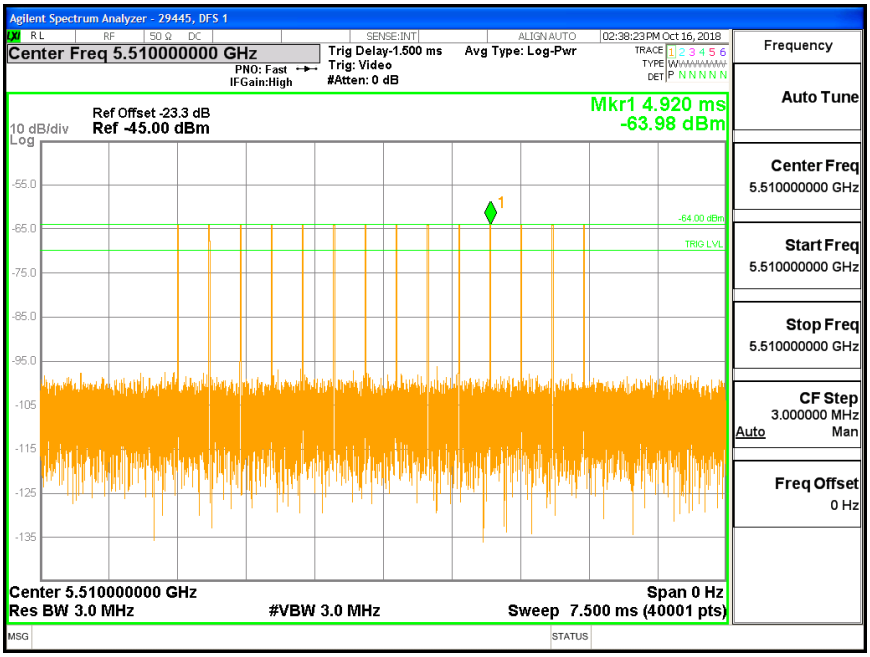
SAMPLE OF RADAR TYPE 2



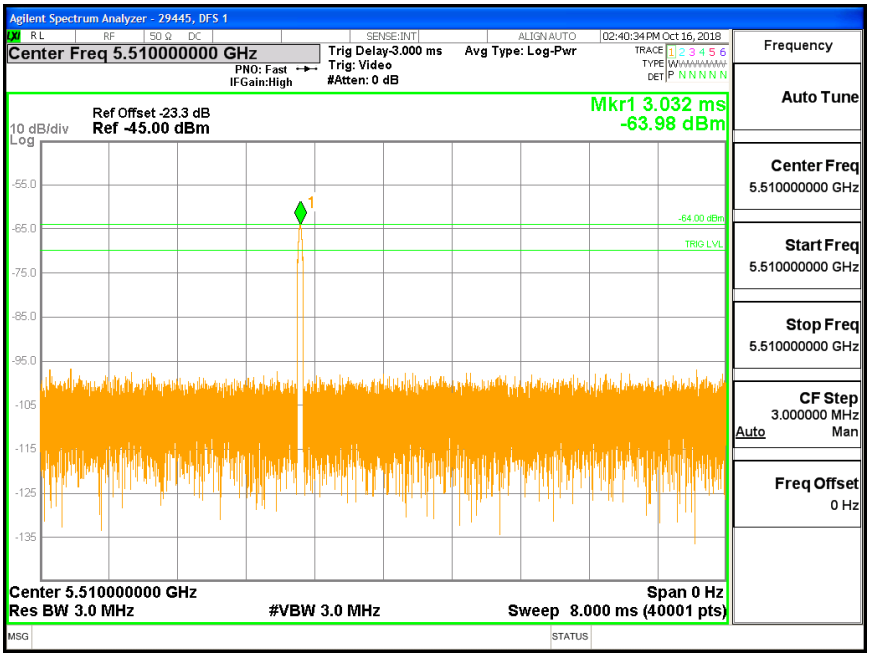
SAMPLE OF RADAR TYPE 3



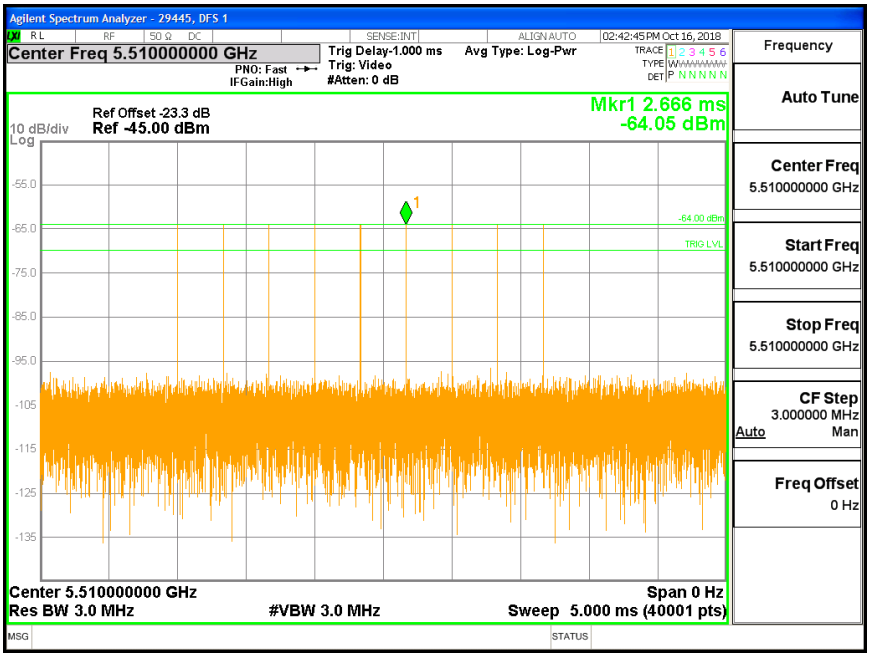
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

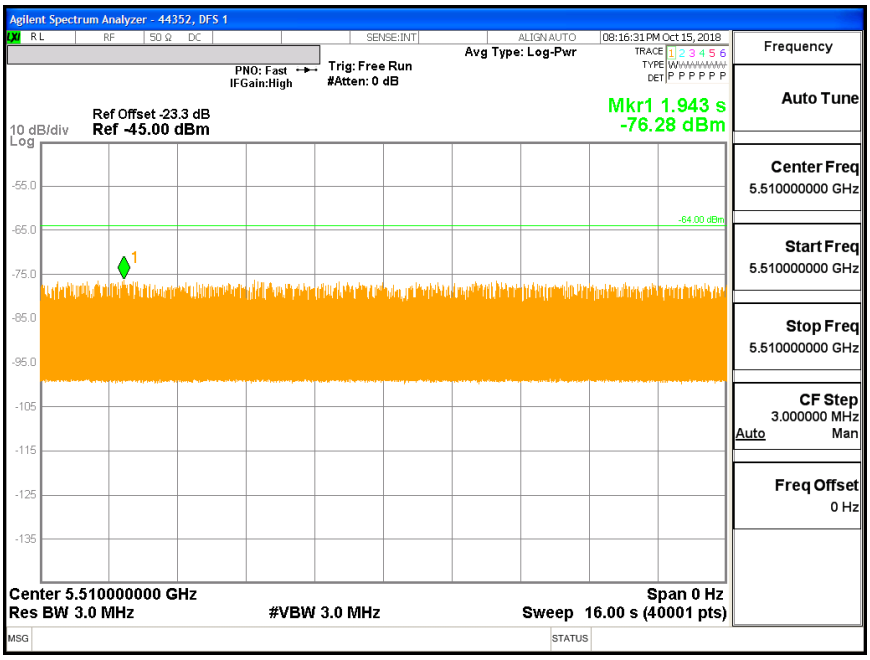


SINGLE BURST OF RADAR TYPE 6

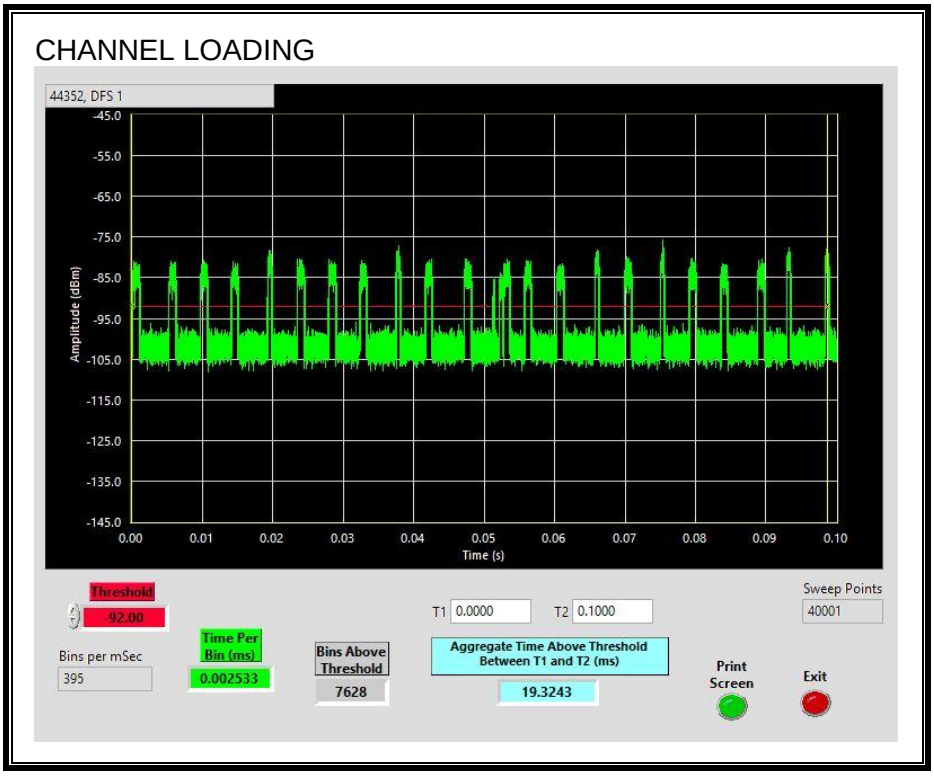


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.3243%.

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)
29.99	209.3	179.3	119.3

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)
30.26	152.8	122.5	3.2

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.28	206.6	176.3	57.0

QUALITATIVE RESULTS

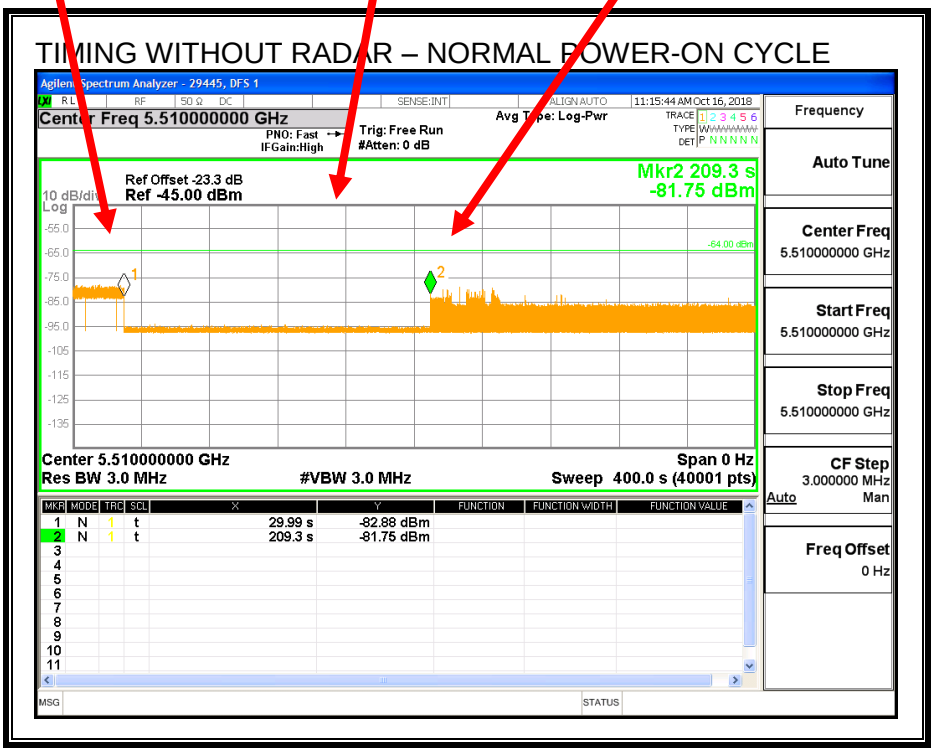
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



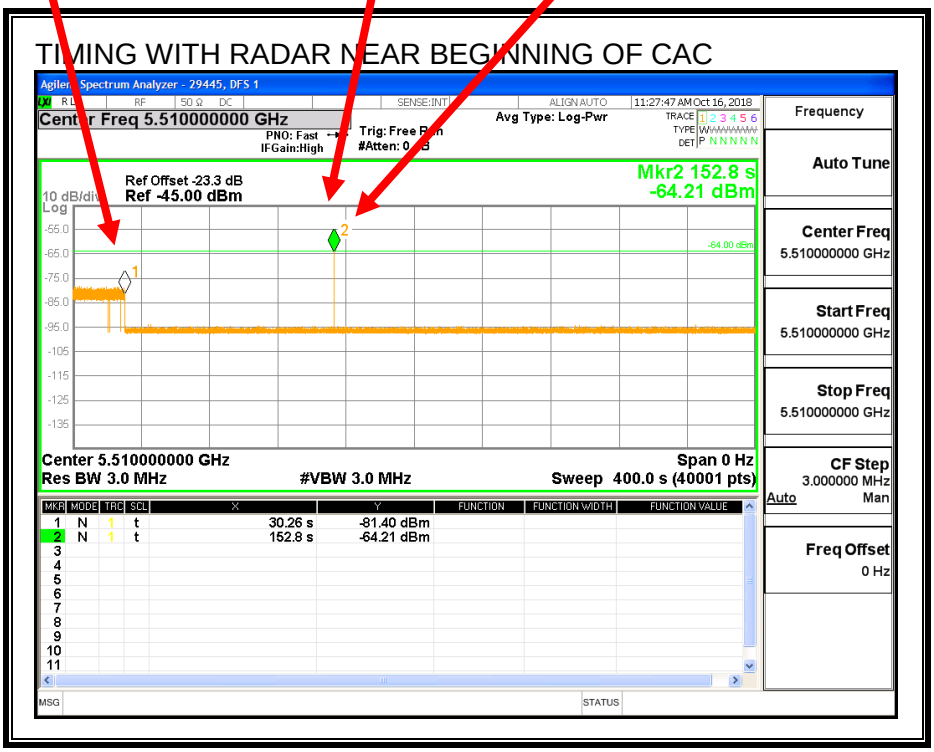
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



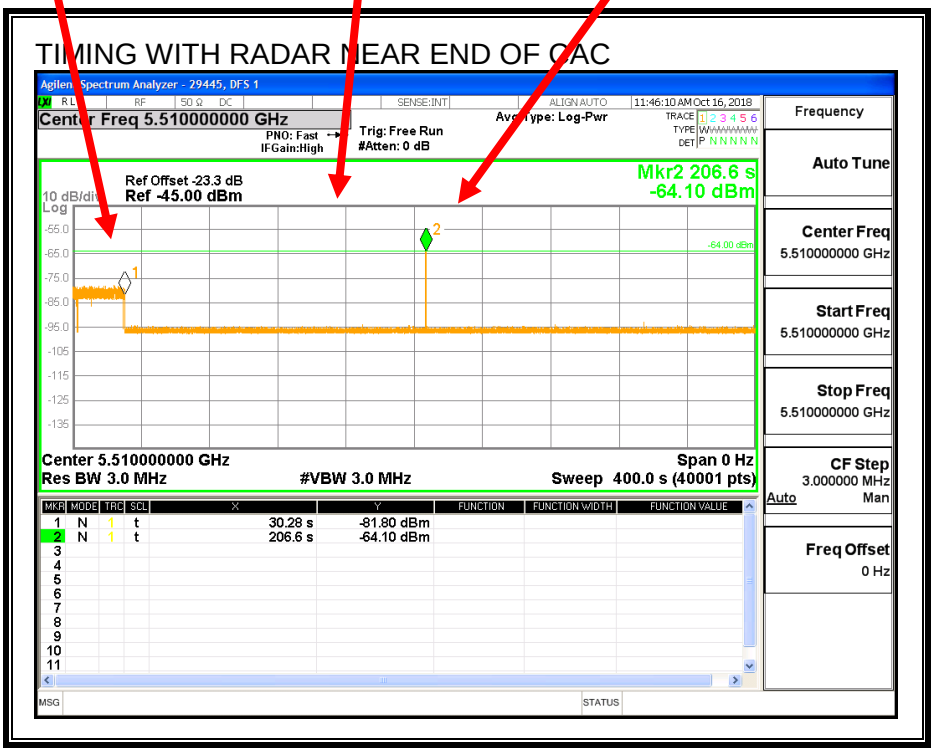
No EUT transmissions were observed after the radar signal.

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.

6.3.1. 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)
0.4116	10

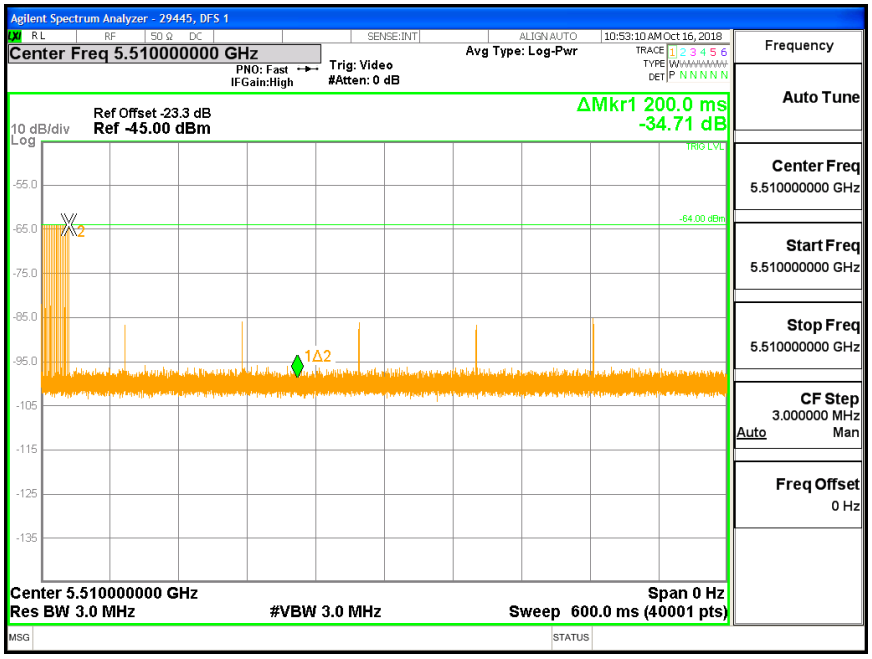
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
3.6	60

MOVE TIME

MOVE TIME

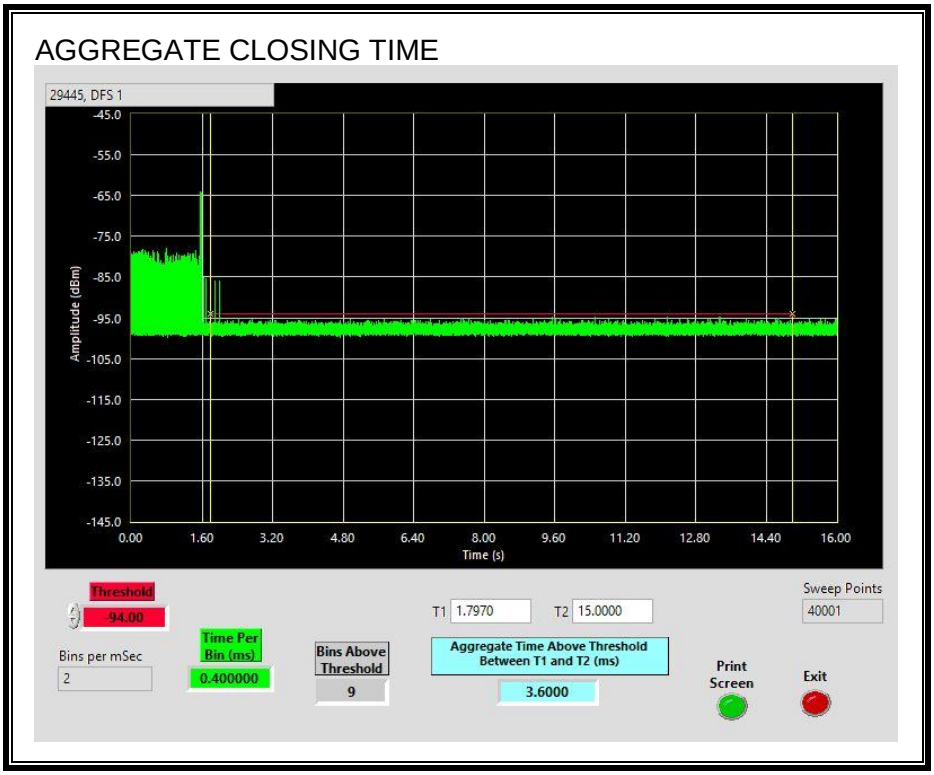
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

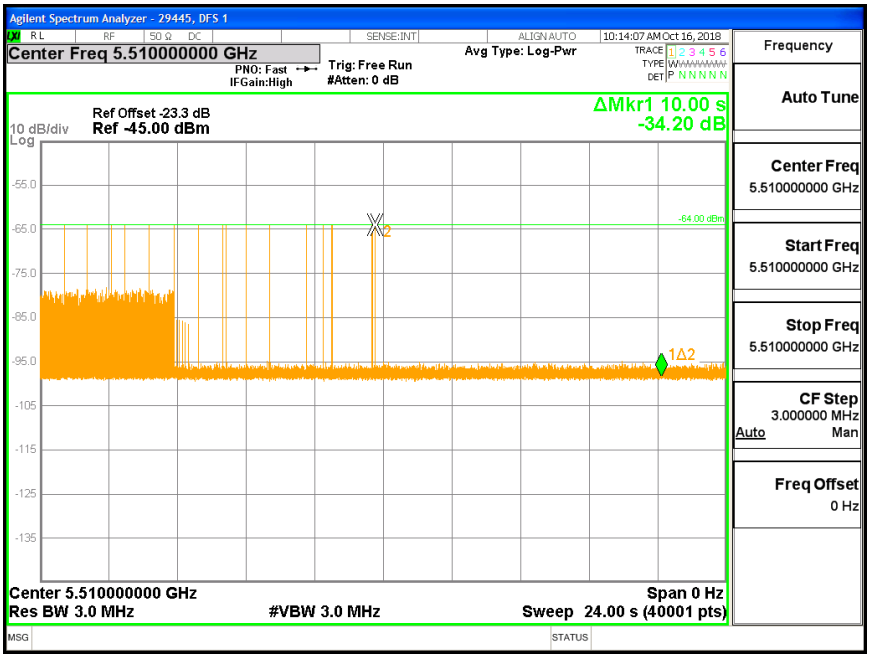
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

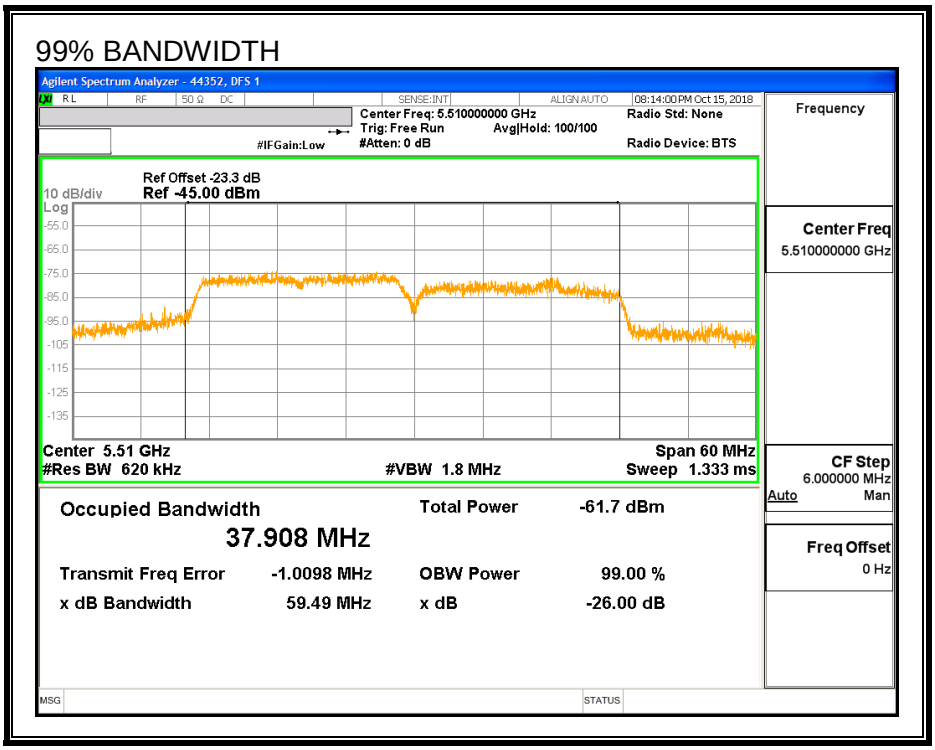
The traffic ceases prior to 10 seconds after the end of the radar waveform.

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	37.908	105.5	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	37.91	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5530	37.91	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	93.33	60	Pass	5490	5530	37.91	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5530	37.91	DFS 1	44352	Version 3.3.4
Aggregate		96.67	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	37.91	DFS 1	44352	Version 3.3.4
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530		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	5509	Yes
1002	1	778	68	A	5492	Yes
1003	1	718	74	A	5502	Yes
1004	1	698	76	A	5505	Yes
1005	1	658	81	A	5502	Yes
1006	1	678	78	A	5500	Yes
1007	1	938	57	A	5494	Yes
1008	1	578	92	A	5516	Yes
1009	1	618	86	A	5510	Yes
1010	1	558	95	A	5517	Yes
1011	1	798	67	A	5502	Yes
1012	1	598	89	A	5501	Yes
1013	1	738	72	A	5524	Yes
1014	1	518	102	A	5518	Yes
1015	1	758	70	A	5505	Yes
1016	1	1076	50	B	5520	Yes
1017	1	2580	21	B	5527	Yes
1018	1	1859	29	B	5524	Yes
1019	1	2297	23	B	5522	Yes
1020	1	3059	18	B	5503	Yes
1021	1	2274	24	B	5496	Yes
1022	1	1971	27	B	5527	Yes
1023	1	1315	41	B	5491	Yes
1024	1	1141	47	B	5498	Yes
1025	1	1968	27	B	5513	Yes
1026	1	729	73	B	5491	Yes
1027	1	1685	32	B	5502	Yes
1028	1	576	92	B	5526	Yes
1029	1	3015	18	B	5505	Yes
1030	1	2035	26	B	5513	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	1.9	223	26	5525	Yes
2002	4	180	27	5529	Yes
2003	2.5	170	26	5493	Yes
2004	2.8	213	28	5524	Yes
2005	3.7	207	27	5500	Yes
2006	2.1	173	26	5502	Yes
2007	1.3	214	26	5497	Yes
2008	4	227	25	5524	Yes
2009	3.3	191	28	5508	Yes
2010	4.3	208	25	5496	Yes
2011	2	176	29	5496	Yes
2012	3.1	160	25	5505	Yes
2013	1	175	23	5506	Yes
2014	4.6	163	26	5521	Yes
2015	2.7	182	28	5515	Yes
2016	2.3	174	29	5495	Yes
2017	4.7	159	24	5512	Yes
2018	2.7	155	25	5496	Yes
2019	3.4	225	24	5530	Yes
2020	1.5	187	26	5505	Yes
2021	2.4	181	25	5524	Yes
2022	4.9	190	24	5529	Yes
2023	4.1	188	23	5517	Yes
2024	2.7	201	29	5517	Yes
2025	2	165	26	5515	Yes
2026	1.1	183	29	5526	Yes
2027	4.8	194	26	5490	Yes
2028	1.9	215	23	5525	Yes
2029	3.8	230	27	5501	Yes
2030	3.3	218	24	5526	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	6.4	270	18	5493	Yes
3002	6	496	17	5519	No
3003	8.4	451	18	5507	Yes
3004	6.4	438	16	5508	Yes
3005	7.1	405	18	5516	Yes
3006	9.3	288	16	5511	Yes
3007	6.1	268	16	5516	Yes
3008	8.6	296	18	5521	Yes
3009	7.8	290	16	5520	Yes
3010	8.5	330	16	5526	Yes
3011	9.8	470	16	5517	Yes
3012	8.9	272	17	5527	Yes
3013	8.5	307	16	5521	Yes
3014	9.7	373	18	5494	Yes
3015	7.5	421	17	5500	Yes
3016	7	382	17	5526	Yes
3017	9.2	442	18	5497	Yes
3018	8.8	416	16	5502	Yes
3019	7.1	371	16	5511	Yes
3020	9.2	358	18	5521	Yes
3021	9.9	326	17	5510	No
3022	8	459	18	5522	Yes
3023	8.9	322	16	5511	Yes
3024	7.3	468	17	5509	Yes
3025	6.5	343	16	5500	Yes
3026	7.2	251	18	5506	Yes
3027	6.6	390	17	5517	Yes
3028	7.6	444	17	5530	Yes
3029	7.2	479	18	5506	Yes
3030	6.4	294	17	5502	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	11.6	341	14	5510	Yes
4002	19.5	303	12	5504	Yes
4003	15.2	363	13	5522	Yes
4004	14.5	337	16	5496	Yes
4005	15.5	292	15	5525	Yes
4006	15.3	279	14	5528	Yes
4007	16.8	498	13	5527	Yes
4008	12.7	380	12	5529	Yes
4009	14.7	494	16	5507	Yes
4010	15.9	388	13	5499	Yes
4011	18.3	264	15	5509	Yes
4012	20	423	14	5495	Yes
4013	18.6	311	12	5528	Yes
4014	11.7	498	12	5514	No
4015	19.9	399	15	5506	Yes
4016	18.2	465	12	5492	Yes
4017	17.8	262	13	5507	Yes
4018	16.6	474	16	5497	Yes
4019	12.3	283	12	5510	Yes
4020	11.6	257	15	5512	Yes
4021	12.6	463	14	5518	Yes
4022	12.4	333	15	5524	No
4023	13.9	301	16	5526	Yes
4024	18.9	300	15	5514	Yes
4025	11.8	414	15	5504	Yes
4026	13	309	16	5520	Yes
4027	15.4	436	13	5508	Yes
4028	17.2	343	13	5527	Yes
4029	15.8	365	15	5517	Yes
4030	17.9	419	15	5527	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	5497	Yes
12	5498	Yes
13	5497	Yes
14	5497	Yes
15	5498	Yes
16	5497	Yes
17	5497	Yes
18	5494	Yes
19	5500	Yes
20	5494	Yes
21	5526	Yes
22	5521	Yes
23	5527	Yes
24	5521	Yes
25	5526	Yes
26	5526	Yes
27	5521	Yes
28	5527	Yes
29	5521	Yes
30	5526	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	3	5490	13	Yes
2	478	5491	9	Yes
3	953	5492	8	Yes
4	1428	5493	10	Yes
5	1903	5494	12	Yes
6	2378	5495	11	Yes
7	2853	5496	10	Yes
8	3328	5497	8	Yes
9	3803	5498	12	Yes
10	4278	5499	10	Yes
11	4753	5500	10	Yes
12	5228	5501	5	Yes
13	5703	5502	7	Yes
14	6178	5503	11	Yes
15	6653	5504	8	Yes
16	7128	5505	10	Yes
17	7603	5506	12	Yes
18	8078	5507	6	Yes
19	8553	5508	8	Yes
20	9028	5509	6	Yes
21	9503	5510	9	Yes
22	9978	5511	11	Yes
23	10453	5512	7	Yes
24	10928	5513	7	Yes
25	11403	5514	8	Yes
26	11878	5515	5	Yes
27	12353	5516	8	Yes
28	12828	5517	6	Yes
29	13303	5518	7	Yes
30	13778	5519	5	Yes
31	14253	5520	8	Yes
32	14728	5521	12	Yes
33	15203	5522	8	Yes
34	15678	5523	9	Yes
35	16153	5524	9	Yes
36	16628	5525	7	Yes
37	17103	5526	9	Yes
38	17578	5527	11	Yes
39	18053	5528	9	Yes
40	18528	5529	10	Yes
41	19003	5530	5	Yes

6.4. RESULTS FOR 80 MHz BANDWIDTH

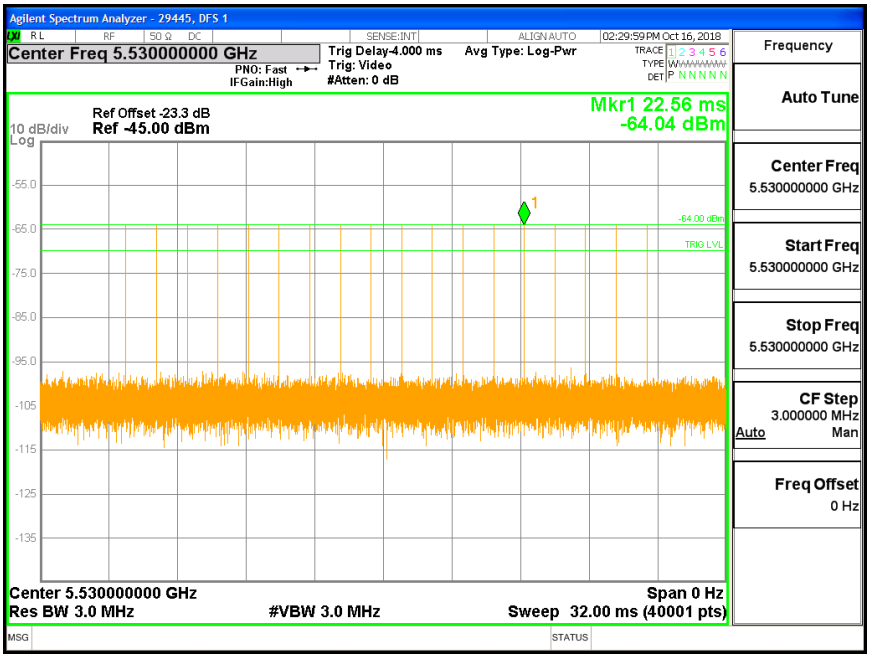
6.4.1. TEST CHANNEL

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

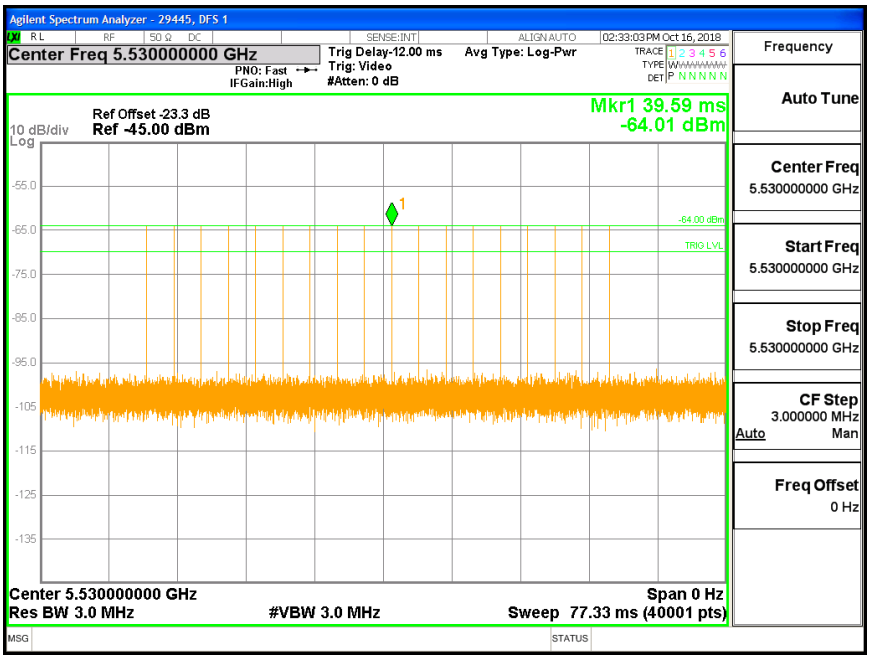
6.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

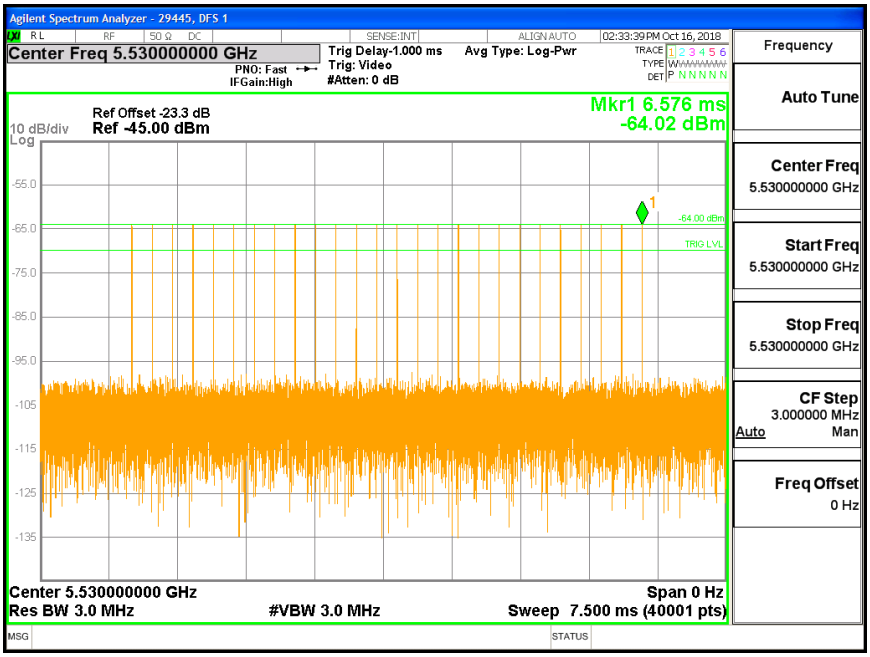
SHORT PULSE RADAR TYPE 0



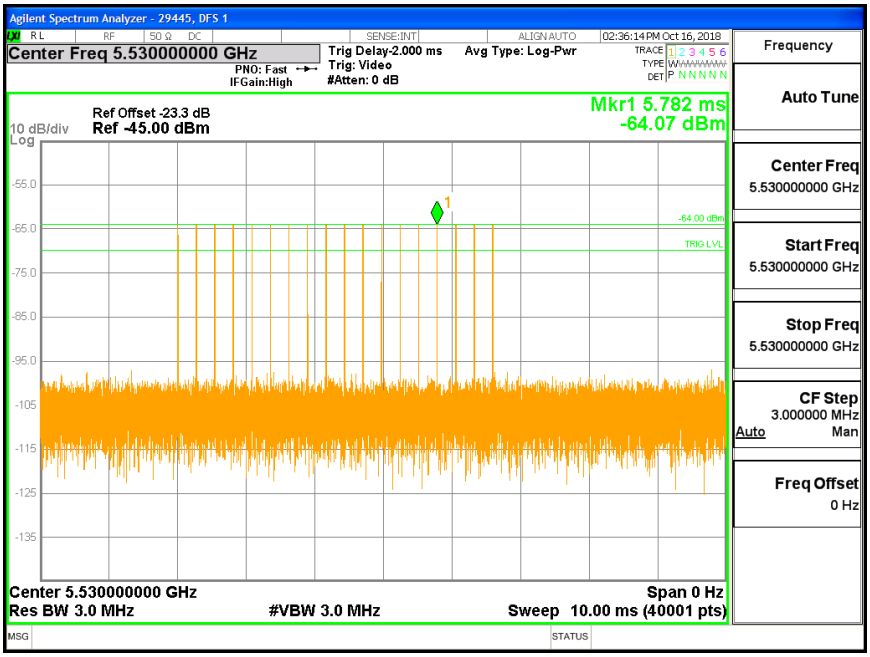
SAMPLE OF RADAR TYPE 1



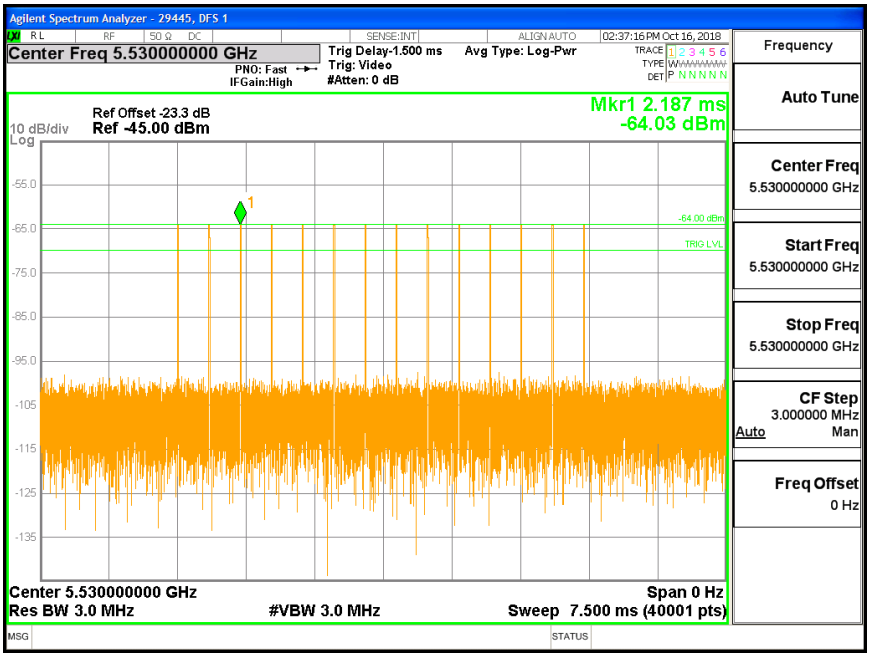
SAMPLE OF RADAR TYPE 2



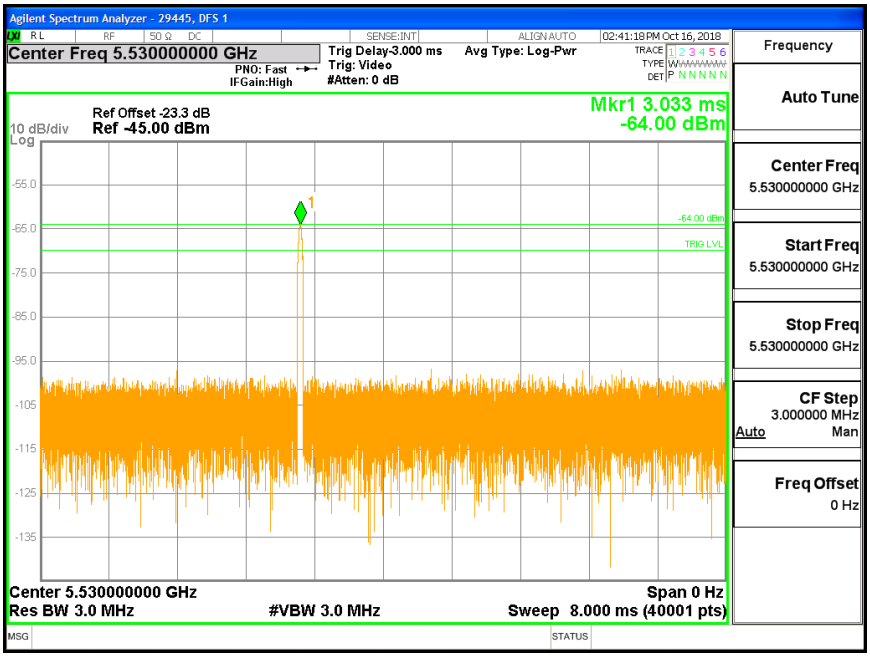
SAMPLE OF RADAR TYPE 3



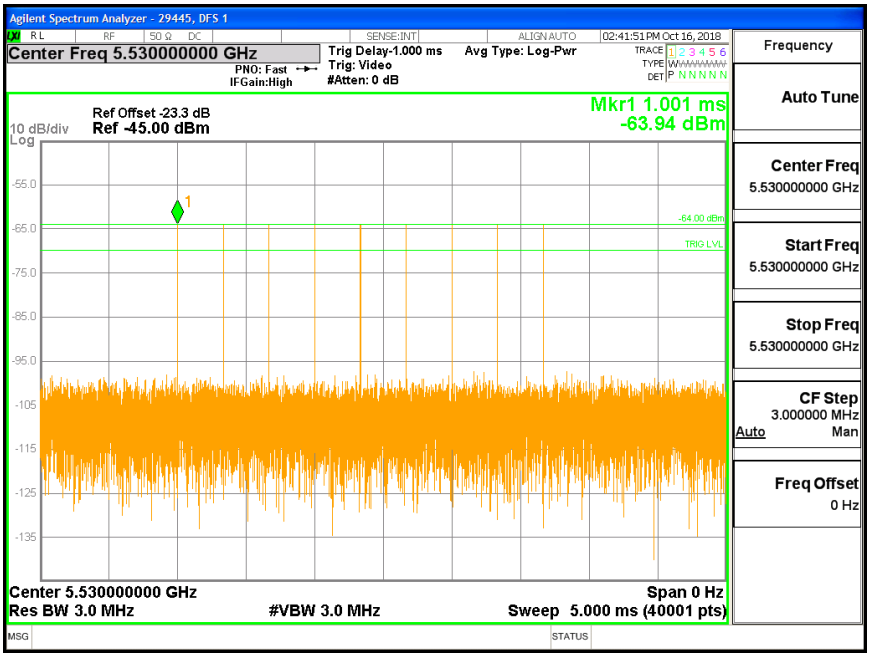
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

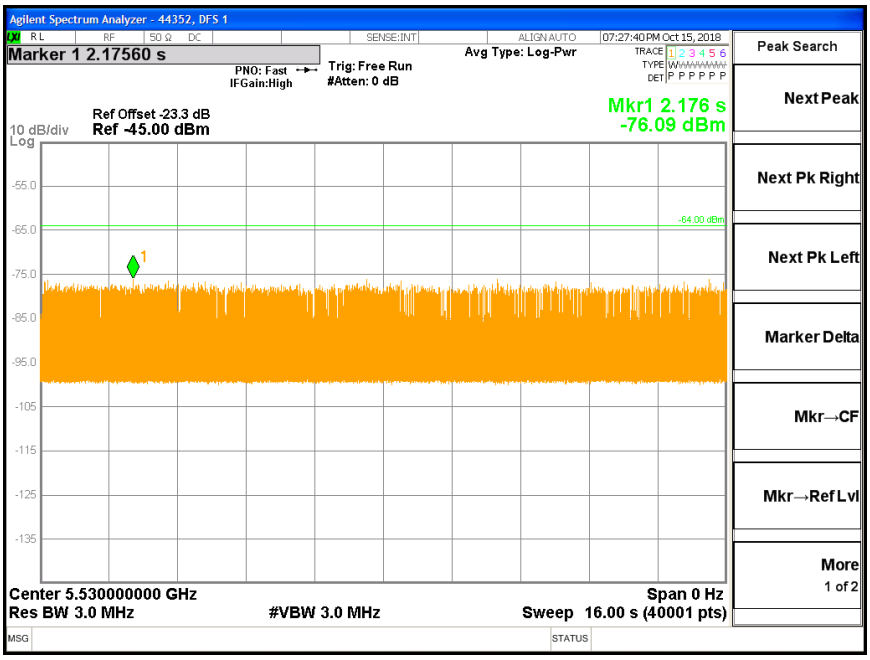


SINGLE BURST OF RADAR TYPE 6

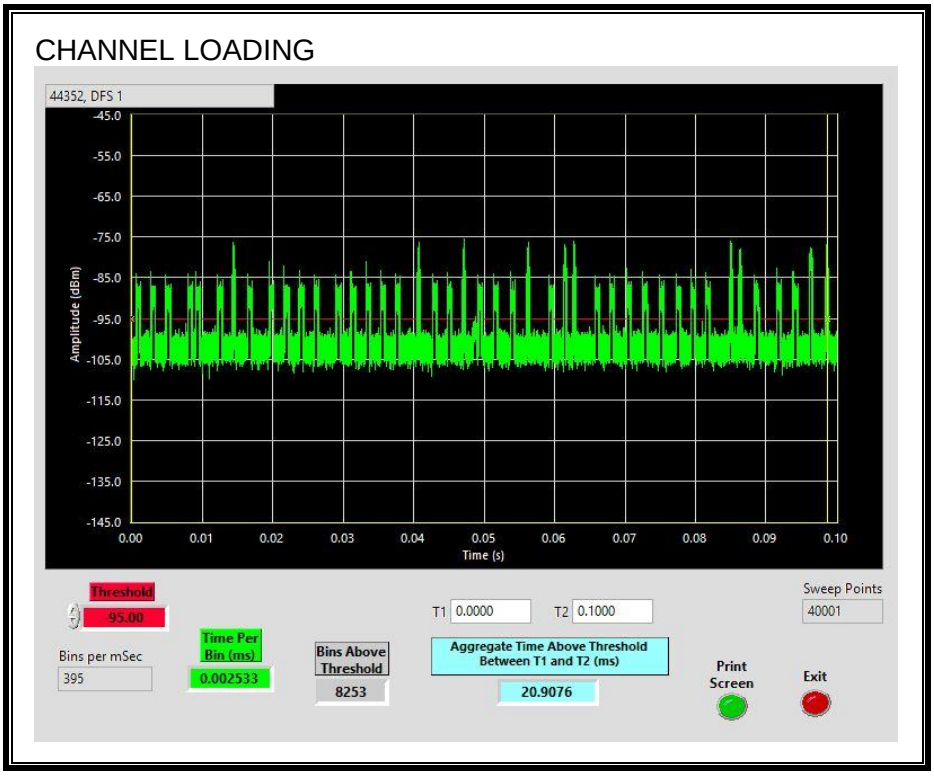


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 20.9076%.

6.4.1. 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)
30.16	209.3	179.1	119.1

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.18	152.8	122.6	3.5

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)
30.41	206.4	176.0	56.9

QUALITATIVE RESULTS

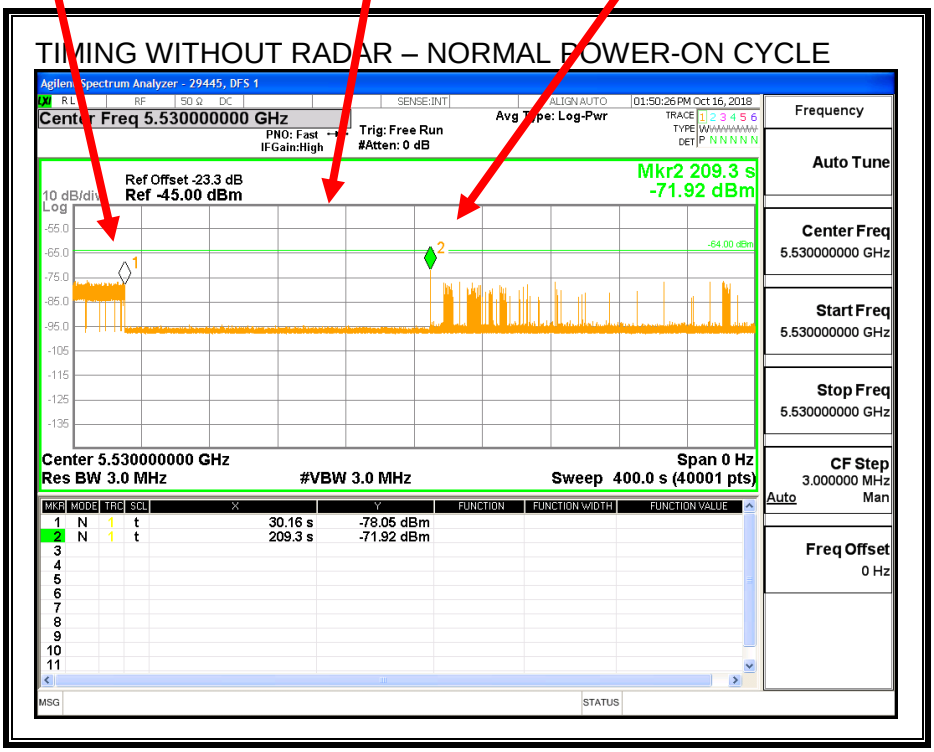
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

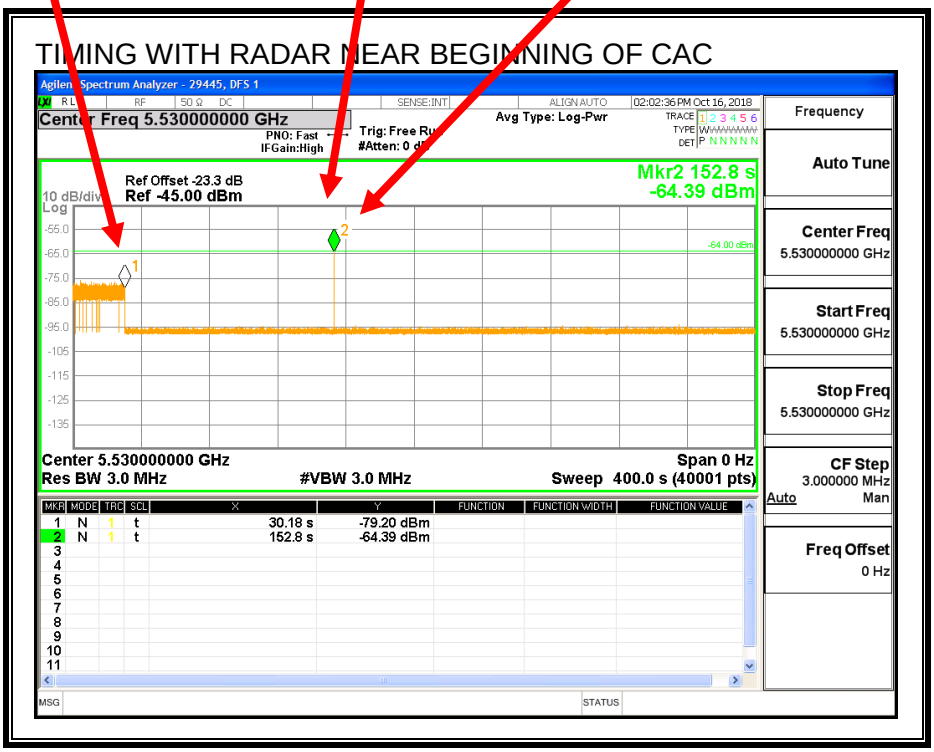
End of CAC
Traffic is Initiated



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

TIMING WITH RADAR NEAR BEGINNING OF CAC

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



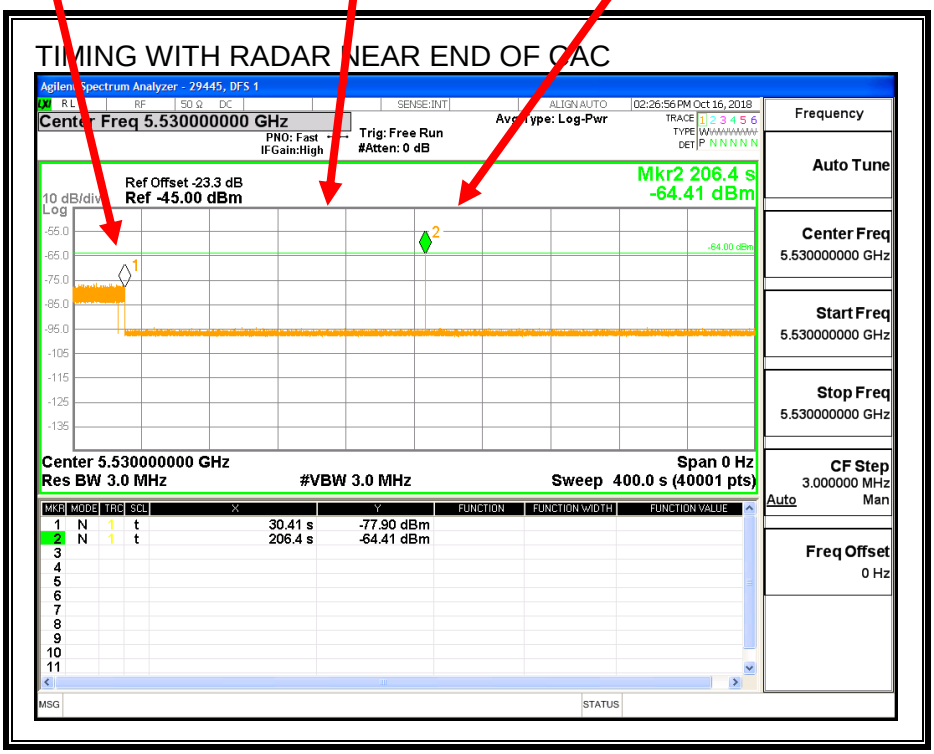
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

6.4.2. OVERLAPPING CHANNEL TESTS

RESULTS

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

6.4.3. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

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

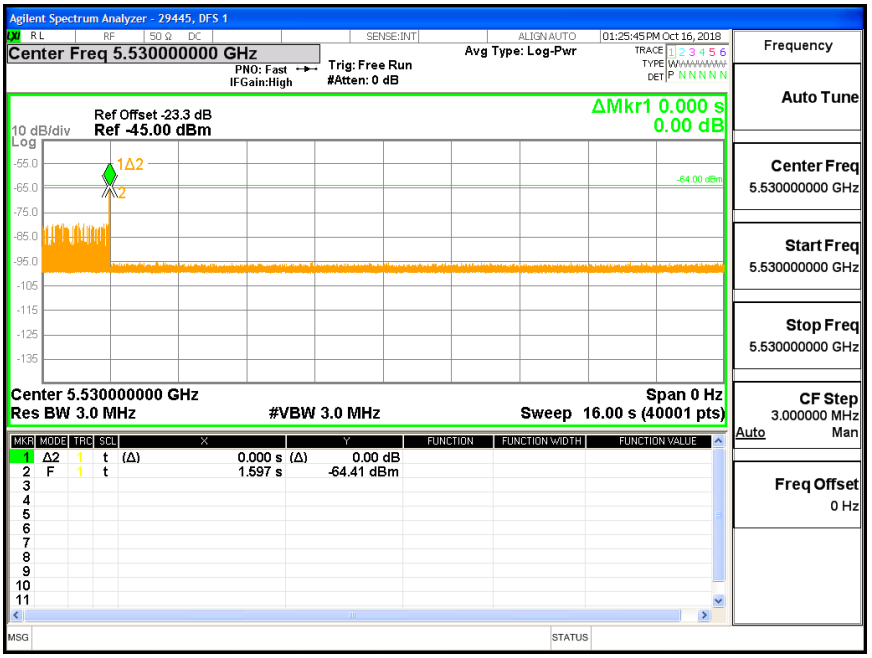
RESULTS

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

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

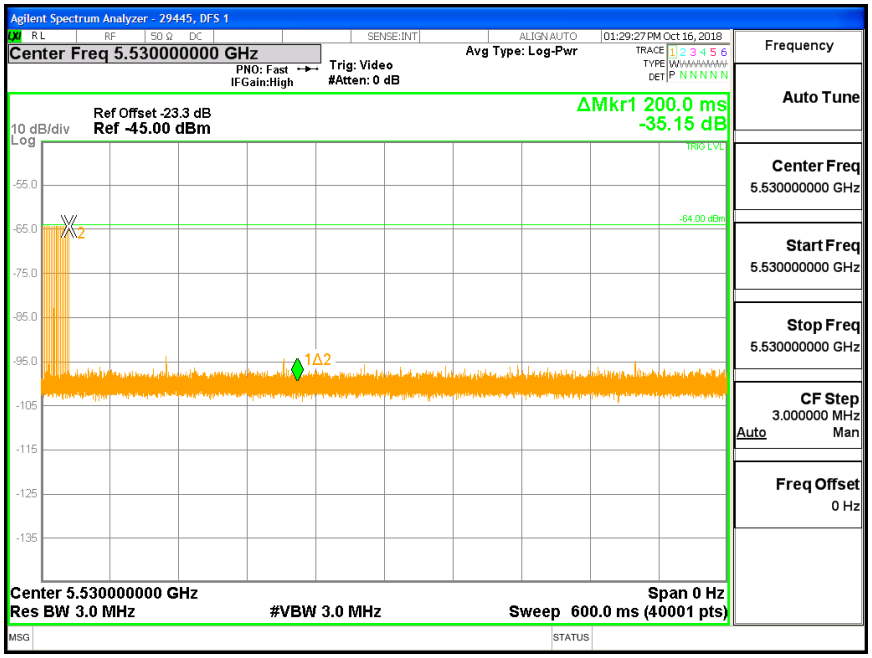
MOVE TIME

MOVE TIME



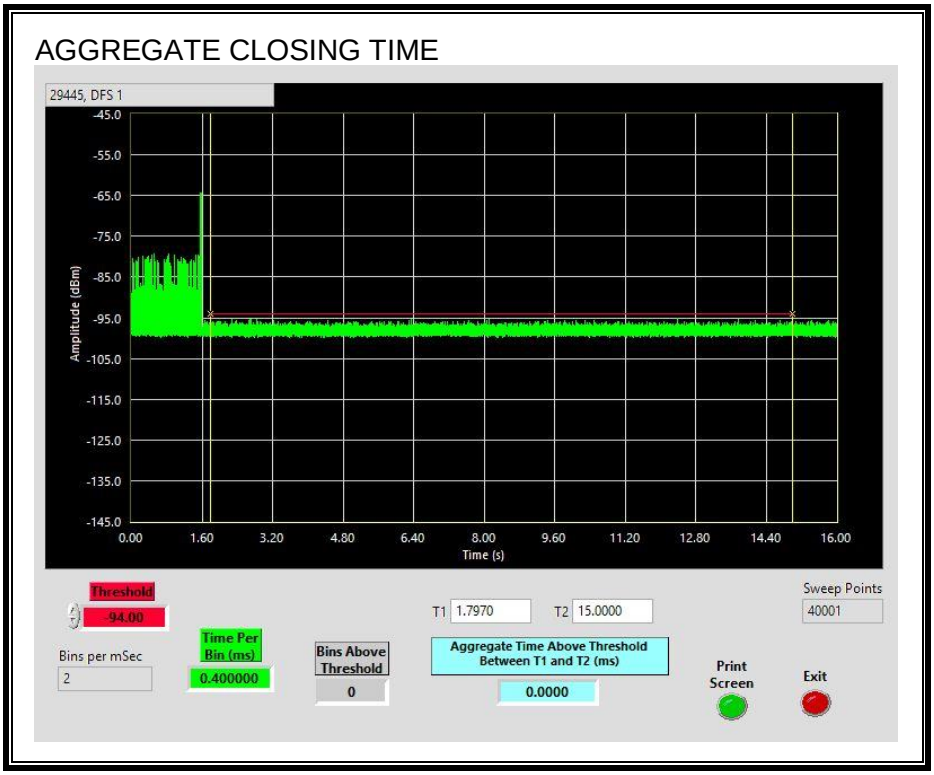
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

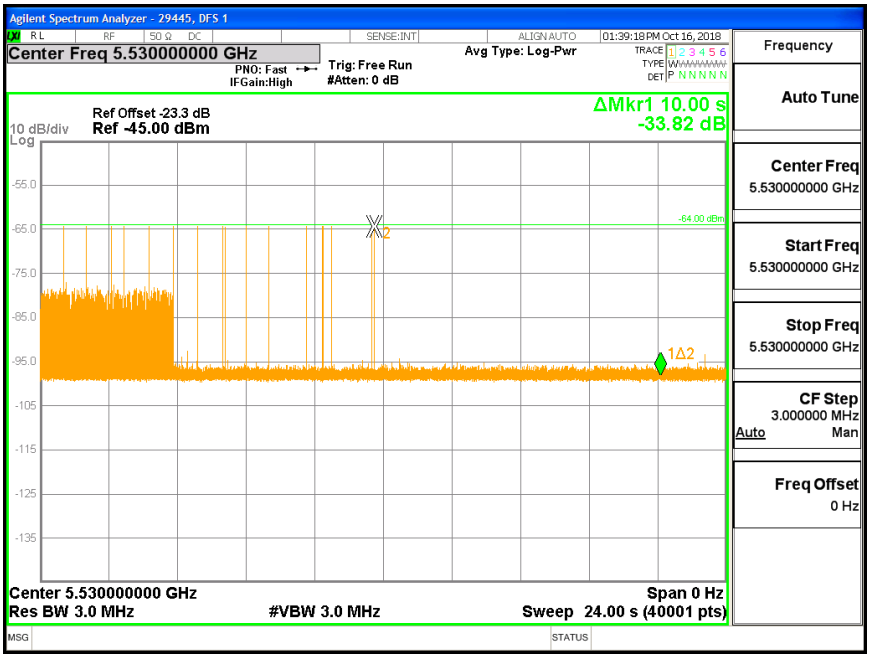
No transmissions are observed during the aggregate monitoring period.



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

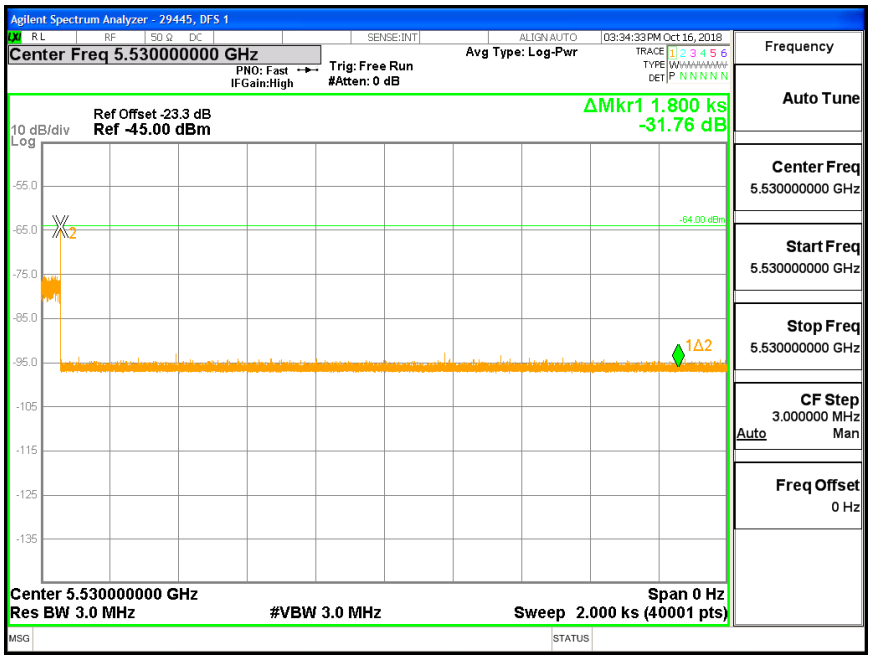


6.4.4. NON-OCCUPANCY PERIOD

RESULTS

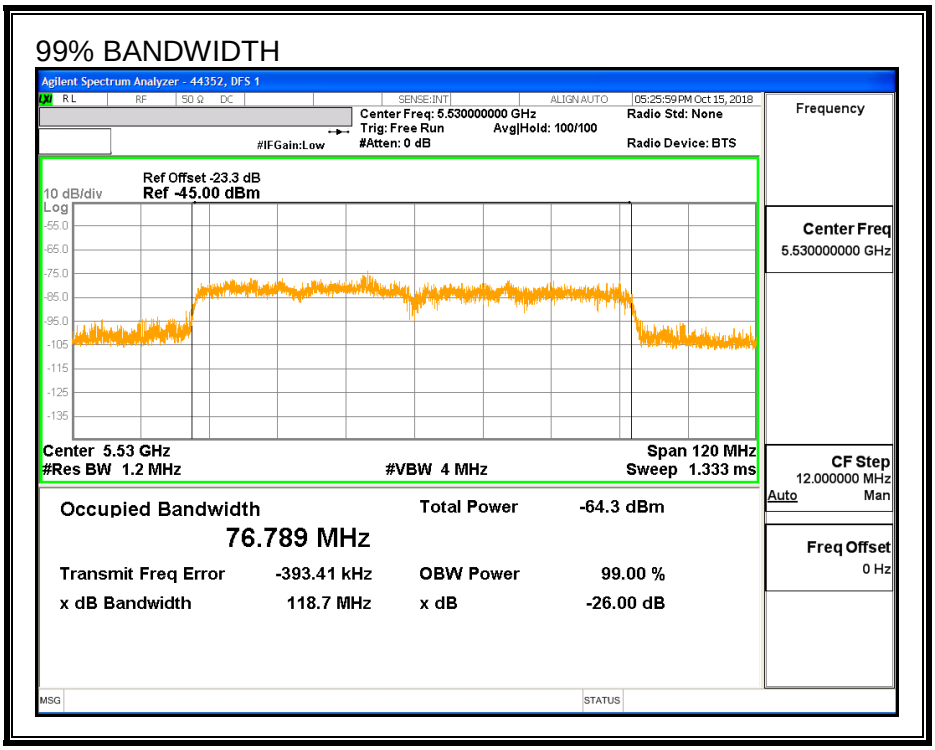
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



6.4.5. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5570	80	76.789	104.2	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

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

6.4.6. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5570	76.79	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5570	76.79	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	93.33	60	Pass	5490	5570	76.79	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5570	76.79	DFS 1	44352	Version 3.3.4
Aggregate		96.67	80	Pass						
FCC Long Pulse Type 5	30	93.33	80	Pass	5490	5570	76.79	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	5523	Yes
1002	1	778	68	A	5526	Yes
1003	1	718	74	A	5556	Yes
1004	1	698	76	A	5526	Yes
1005	1	658	81	A	5548	Yes
1006	1	678	78	A	5568	Yes
1007	1	938	57	A	5508	Yes
1008	1	578	92	A	5509	Yes
1009	1	618	86	A	5544	Yes
1010	1	558	95	A	5492	Yes
1011	1	798	67	A	5492	Yes
1012	1	598	89	A	5559	Yes
1013	1	738	72	A	5544	Yes
1014	1	518	102	A	5539	Yes
1015	1	758	70	A	5543	Yes
1016	1	1076	50	B	5497	Yes
1017	1	2580	21	B	5506	Yes
1018	1	1859	29	B	5533	Yes
1019	1	2297	23	B	5505	Yes
1020	1	3059	18	B	5510	Yes
1021	1	2274	24	B	5555	Yes
1022	1	1971	27	B	5503	Yes
1023	1	1315	41	B	5509	Yes
1024	1	1141	47	B	5540	Yes
1025	1	1968	27	B	5542	Yes
1026	1	729	73	B	5550	Yes
1027	1	1685	32	B	5500	Yes
1028	1	576	92	B	5552	Yes
1029	1	3015	18	B	5532	Yes
1030	1	2035	26	B	5505	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	1.9	223	26	5536	Yes
2002	4	180	27	5505	Yes
2003	2.5	170	26	5566	Yes
2004	2.8	213	28	5493	Yes
2005	3.7	207	27	5556	Yes
2006	2.1	173	26	5498	Yes
2007	1.3	214	26	5550	Yes
2008	4	227	25	5568	Yes
2009	3.3	191	28	5522	Yes
2010	4.3	208	25	5548	Yes
2011	2	176	29	5525	Yes
2012	3.1	160	25	5504	Yes
2013	1	175	23	5567	Yes
2014	4.6	163	26	5521	Yes
2015	2.7	182	28	5548	Yes
2016	2.3	174	29	5565	Yes
2017	4.7	159	24	5503	Yes
2018	2.7	155	25	5546	Yes
2019	3.4	225	24	5554	Yes
2020	1.5	187	26	5562	Yes
2021	2.4	181	25	5551	Yes
2022	4.9	190	24	5517	Yes
2023	4.1	188	23	5532	Yes
2024	2.7	201	29	5533	Yes
2025	2	165	26	5553	Yes
2026	1.1	183	29	5567	Yes
2027	4.8	194	26	5534	Yes
2028	1.9	215	23	5552	Yes
2029	3.8	230	27	5539	Yes
2030	3.3	218	24	5516	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	6.4	270	18	5493	No
3002	6	496	17	5548	No
3003	8.4	451	18	5557	Yes
3004	6.4	438	16	5496	Yes
3005	7.1	405	18	5556	Yes
3006	9.3	288	16	5515	Yes
3007	6.1	268	16	5497	Yes
3008	8.6	296	18	5552	Yes
3009	7.8	290	16	5516	Yes
3010	8.5	330	16	5501	Yes
3011	9.8	470	16	5532	Yes
3012	8.9	272	17	5521	Yes
3013	8.5	307	16	5499	Yes
3014	9.7	373	18	5535	Yes
3015	7.5	421	17	5502	Yes
3016	7	382	17	5569	Yes
3017	9.2	442	18	5551	Yes
3018	8.8	416	16	5494	Yes
3019	7.1	371	16	5529	Yes
3020	9.2	358	18	5493	Yes
3021	9.9	326	17	5549	Yes
3022	8	459	18	5493	Yes
3023	8.9	322	16	5565	Yes
3024	7.3	468	17	5496	Yes
3025	6.5	343	16	5500	Yes
3026	7.2	251	18	5540	Yes
3027	6.6	390	17	5504	Yes
3028	7.6	444	17	5568	Yes
3029	7.2	479	18	5496	Yes
3030	6.4	294	17	5539	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	11.6	341	14	5558	Yes
4002	19.5	303	12	5504	Yes
4003	15.2	363	13	5554	Yes
4004	14.5	337	16	5525	Yes
4005	15.5	292	15	5533	Yes
4006	15.3	279	14	5511	Yes
4007	16.8	498	13	5524	Yes
4008	12.7	380	12	5492	Yes
4009	14.7	494	16	5531	Yes
4010	15.9	388	13	5537	No
4011	18.3	264	15	5543	Yes
4012	20	423	14	5491	Yes
4013	18.6	311	12	5517	Yes
4014	11.7	498	12	5497	Yes
4015	19.9	399	15	5515	Yes
4016	18.2	465	12	5491	Yes
4017	17.8	262	13	5501	No
4018	16.6	474	16	5546	Yes
4019	12.3	283	12	5501	Yes
4020	11.6	257	15	5496	Yes
4021	12.6	463	14	5503	Yes
4022	12.4	333	15	5523	Yes
4023	13.9	301	16	5556	Yes
4024	18.9	300	15	5555	Yes
4025	11.8	414	15	5522	Yes
4026	13	309	16	5550	Yes
4027	15.4	436	13	5496	Yes
4028	17.2	343	13	5548	Yes
4029	15.8	365	15	5546	Yes
4030	17.9	419	15	5519	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	5499	Yes
13	5498	Yes
14	5497	Yes
15	5499	Yes
16	5498	Yes
17	5497	Yes
18	5494	Yes
19	5500	Yes
20	5495	Yes
21	5565	No
22	5560	Yes
23	5566	Yes
24	5560	Yes
25	5565	Yes
26	5565	No
27	5560	Yes
28	5566	Yes
29	5560	Yes
30	5565	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	62	5490	18	Yes
2	537	5491	18	Yes
3	1012	5492	20	Yes
4	1487	5493	18	Yes
5	1962	5494	21	Yes
6	2437	5495	18	Yes
7	2912	5496	16	Yes
8	3387	5497	18	Yes
9	3862	5498	20	Yes
10	4337	5499	15	Yes
11	4812	5500	18	Yes
12	5287	5501	18	Yes
13	5762	5502	22	Yes
14	6237	5503	21	Yes
15	6712	5504	14	Yes
16	7187	5505	14	Yes
17	7662	5506	13	Yes
18	8137	5507	20	Yes
19	8612	5508	12	Yes
20	9087	5509	18	Yes
21	9562	5510	20	Yes
22	10037	5511	18	Yes
23	10512	5512	16	Yes
24	10987	5513	17	Yes
25	11462	5514	19	Yes
26	11937	5515	16	Yes
27	12412	5516	14	Yes
28	12887	5517	17	Yes
29	13362	5518	23	Yes
30	13837	5519	18	Yes
31	14312	5520	16	Yes
32	14787	5521	14	Yes
33	15262	5522	21	Yes
34	15737	5523	19	Yes
35	16212	5524	15	Yes
36	16687	5525	16	Yes
37	17162	5526	13	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

38	17637	5527	15	Yes
39	18112	5528	18	Yes
40	18587	5529	17	Yes
41	19062	5530	15	Yes
42	19537	5531	20	Yes
43	20012	5532	14	Yes
44	20487	5533	21	Yes
45	20962	5534	19	Yes
46	21437	5535	18	Yes
47	21912	5536	21	Yes
48	22387	5537	13	Yes
49	22862	5538	17	Yes
50	23337	5539	18	Yes
51	23812	5540	22	Yes
52	24287	5541	24	Yes
53	24762	5542	17	Yes
54	25237	5543	15	Yes
55	25712	5544	16	Yes
56	26187	5545	14	Yes
57	26662	5546	15	Yes
58	27137	5547	17	Yes
59	27612	5548	16	Yes
60	28087	5549	15	Yes
61	28562	5550	14	Yes
62	29037	5551	12	Yes
63	29512	5552	16	Yes
64	29987	5553	16	Yes
65	30462	5554	13	Yes
66	30937	5555	12	Yes
67	31412	5556	22	Yes
68	31887	5557	18	Yes
69	32362	5558	15	Yes
70	32837	5559	12	Yes
71	33312	5560	15	Yes
72	33787	5561	18	Yes
73	34262	5562	16	Yes
74	34737	5563	9	Yes
75	35212	5564	18	Yes
76	35687	5565	13	Yes
77	36162	5566	18	Yes
78	36637	5567	17	Yes
79	37112	5568	19	Yes
80	37587	5569	16	Yes
81	38062	5570	16	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.