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: MX67W-HW

FCC ID: UDX-60076015
IC: 6961A-60076015

REPORT NUMBER: 12391259-E4V1

ISSUE DATE: AUGUST 29, 2018

Prepared for
CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/29/18	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: MX67W-HW

SERIAL NUMBER: Q2GY-KZ2A-VXBC

DATE TESTED: AUGUST 24 – 27, 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. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

Conan Cheung
REVIEWER
UL Verification Services Inc.

Prepared By:

HENRY LAU
TEST ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the DFS portion of FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, KDB 905462 D02 and D03 and RSS-247 Issue 2.

3. REFERENCE DOCUMENTS

Measurements of transmitter parameters as referenced in this report are documented in Sporton International Inc. report number FR831426_R01.

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

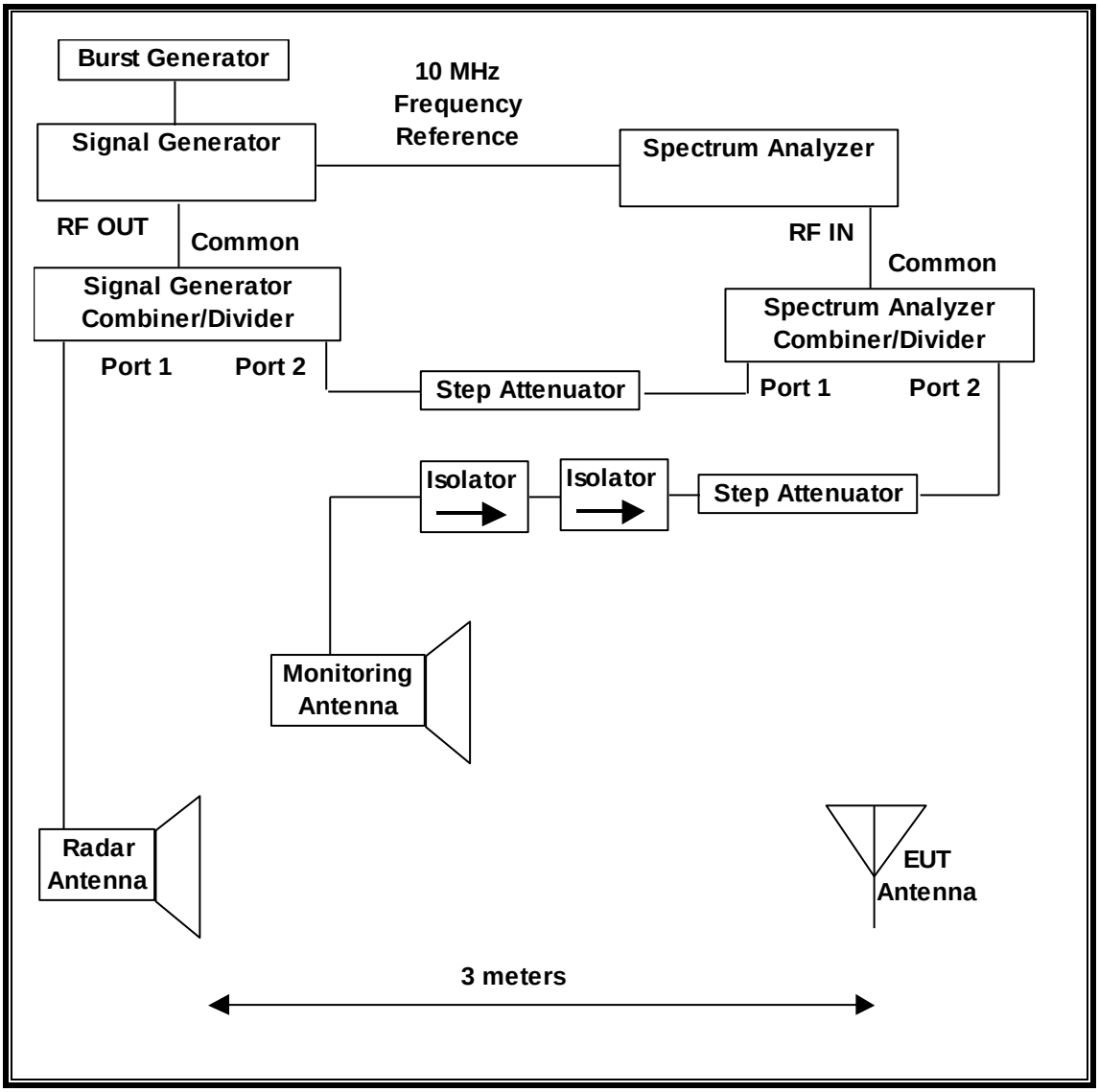
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

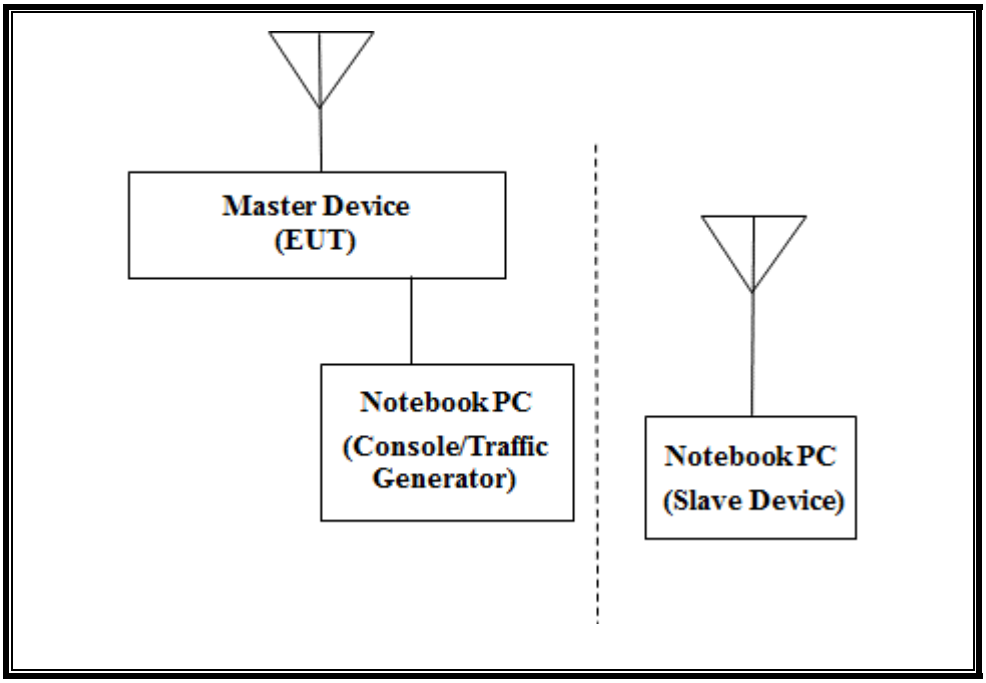
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	25.3 °C
Humidity	41 %

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)	Delta Electronics Inc.	ADP-30KR B	HWVD79V0N1B	DoC

6.1.6. DESCRIPTION OF EUT

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

The EUT is a Master Device.

The highest power level within these bands is 26.71 dBm EIRP in the 5250-5350 MHz band and 26.65 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 3.1 dBi in the 5250-5350 MHz band and 2.8 dBi in the 5470-5725 MHz band.

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 not required since the maximum EIRP is less 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-201807131655-Geff7ac40-rel-liquid

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-60076015. The minimum antenna gain for the Master Device is 2.8 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

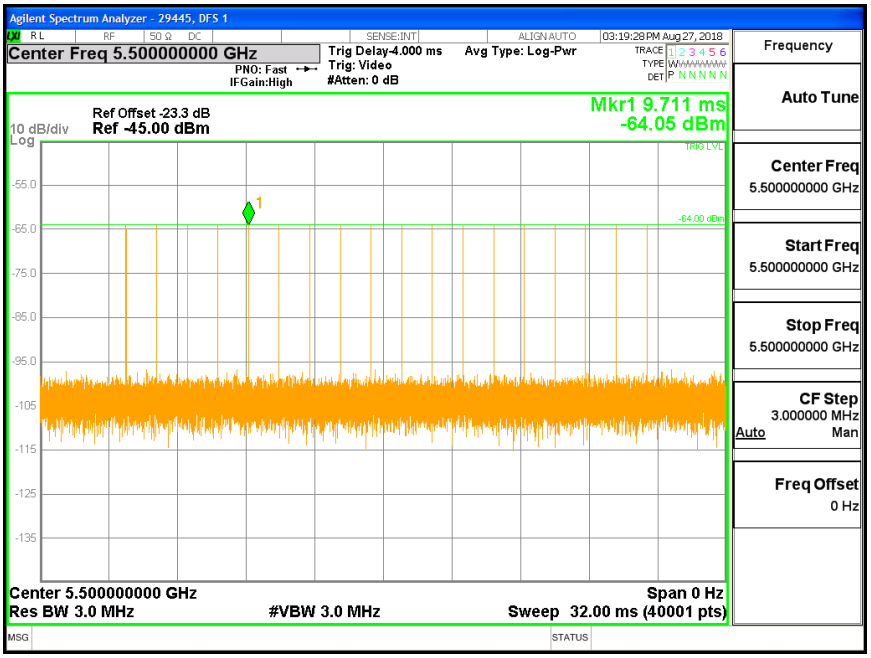
6.2.1. TEST CHANNEL

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

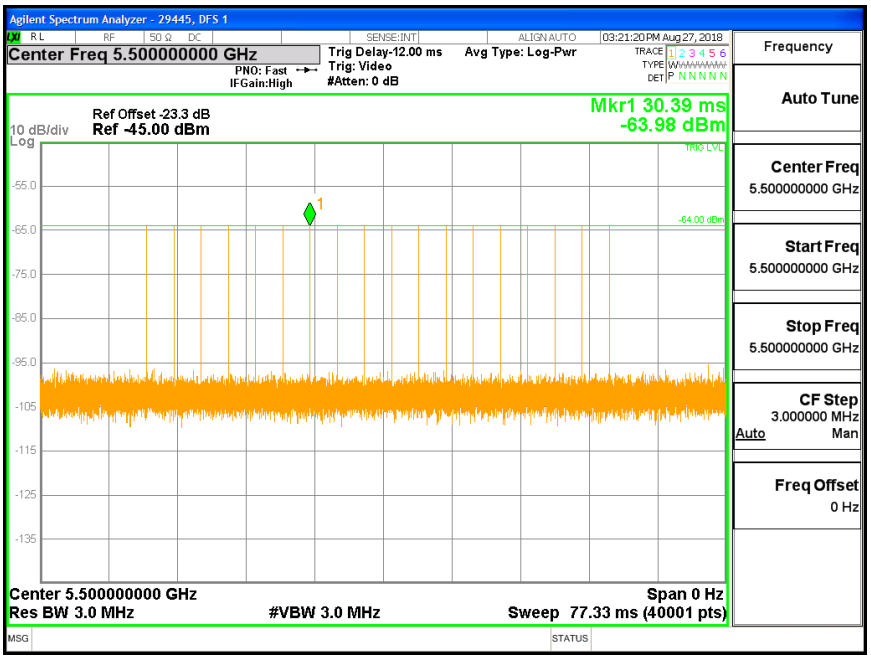
6.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

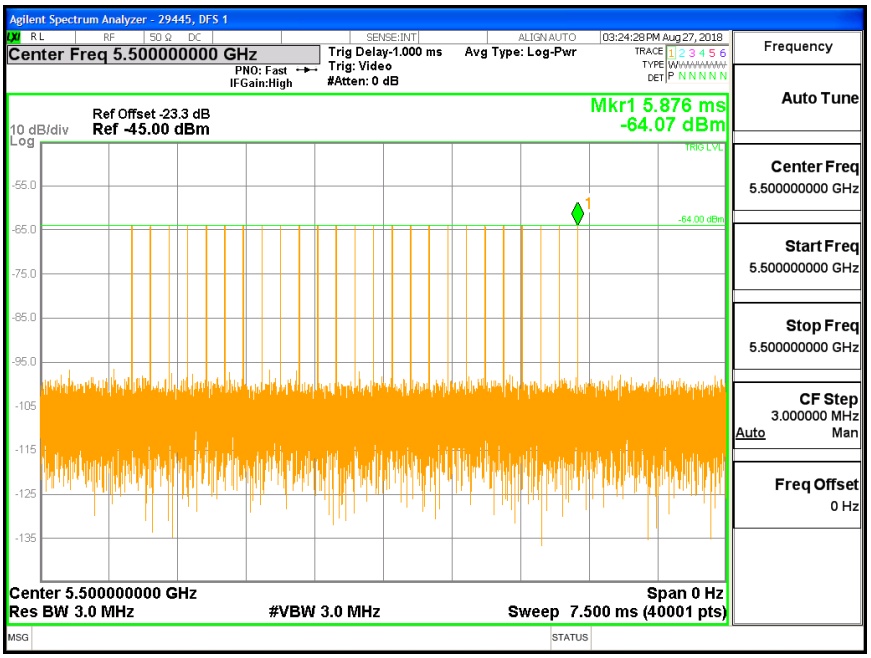
SHORT PULSE RADAR TYPE 0



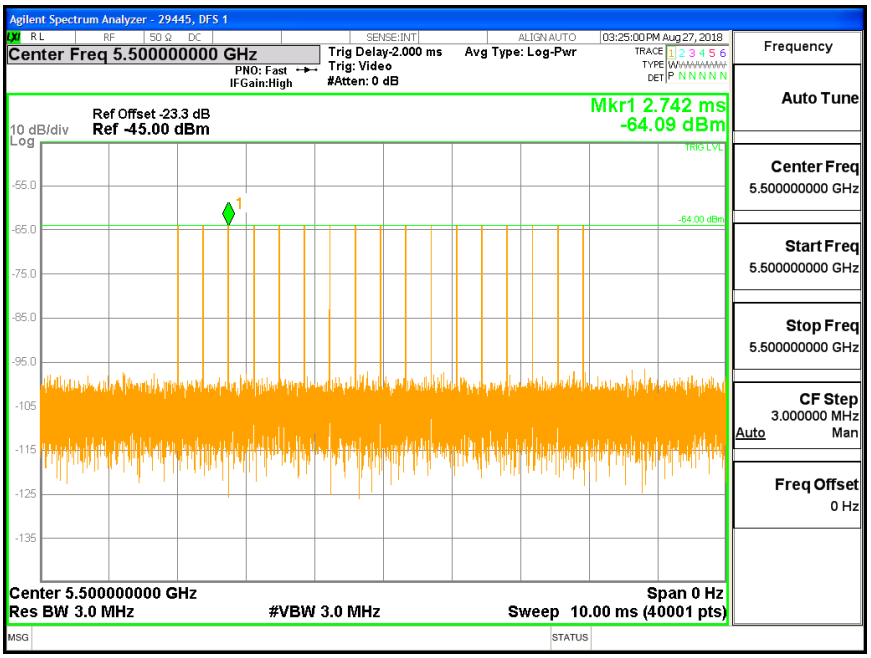
SAMPLE OF RADAR TYPE 1



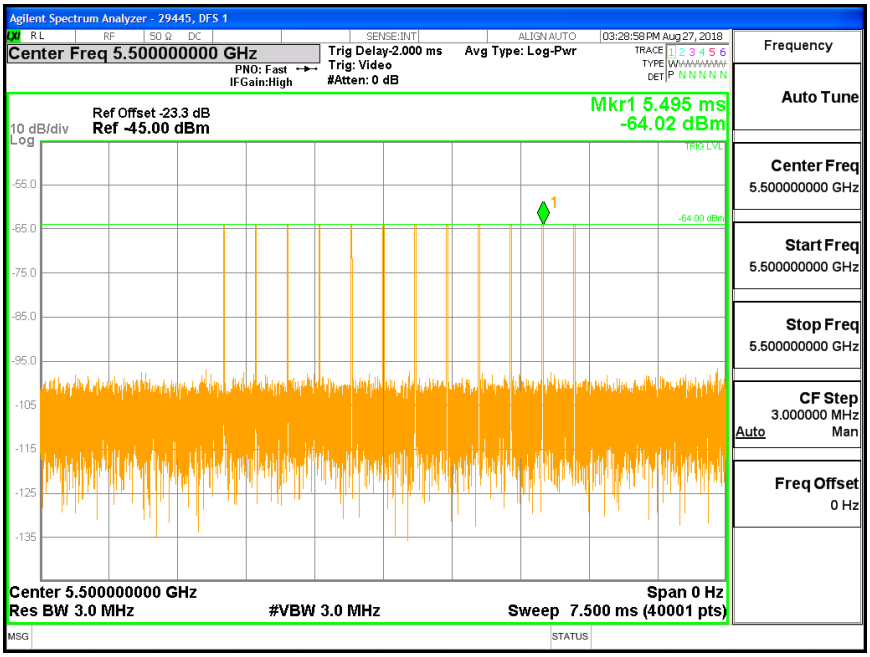
SAMPLE OF RADAR TYPE 2



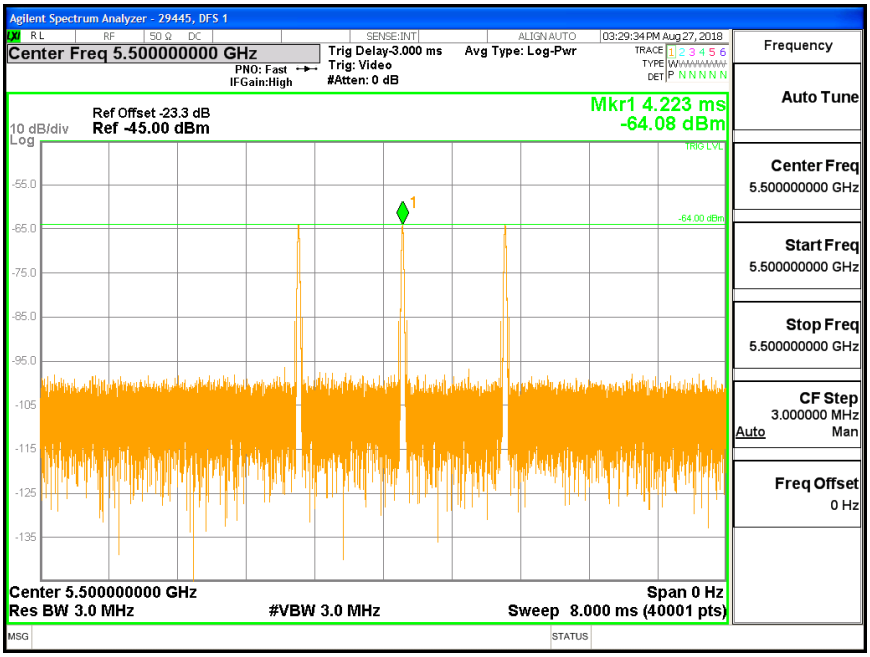
SAMPLE OF RADAR TYPE 3



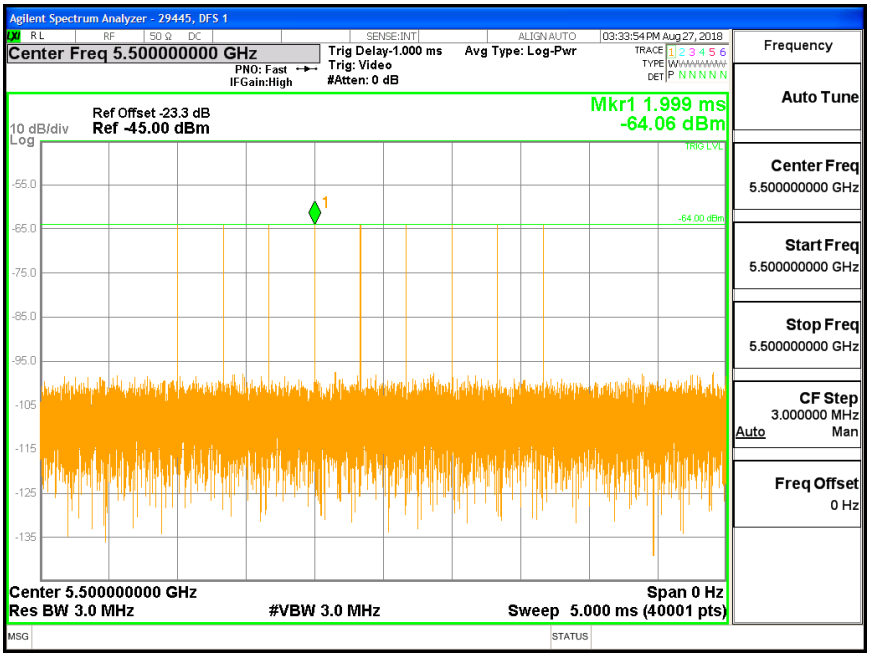
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

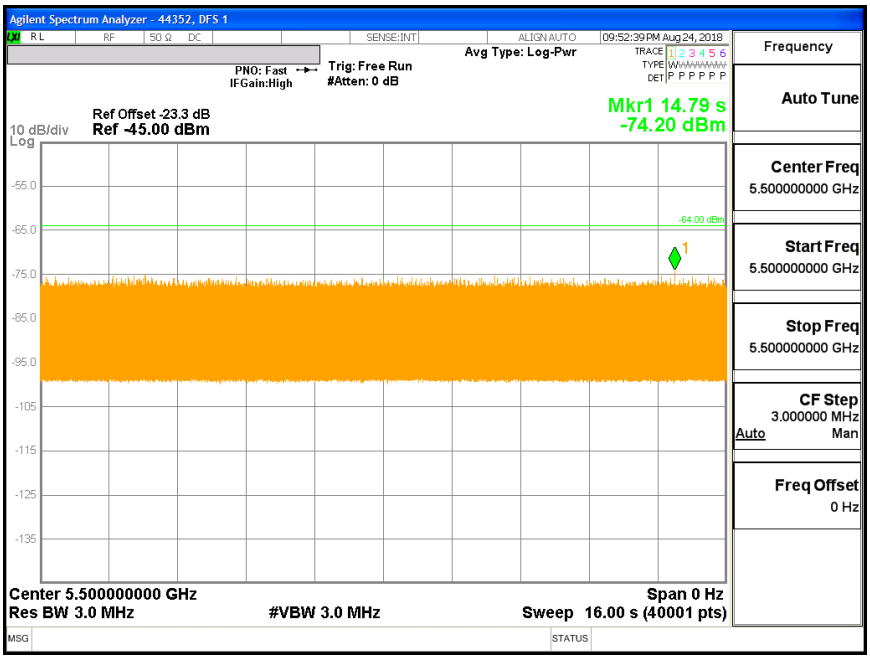


SINGLE BURST OF RADAR TYPE 6

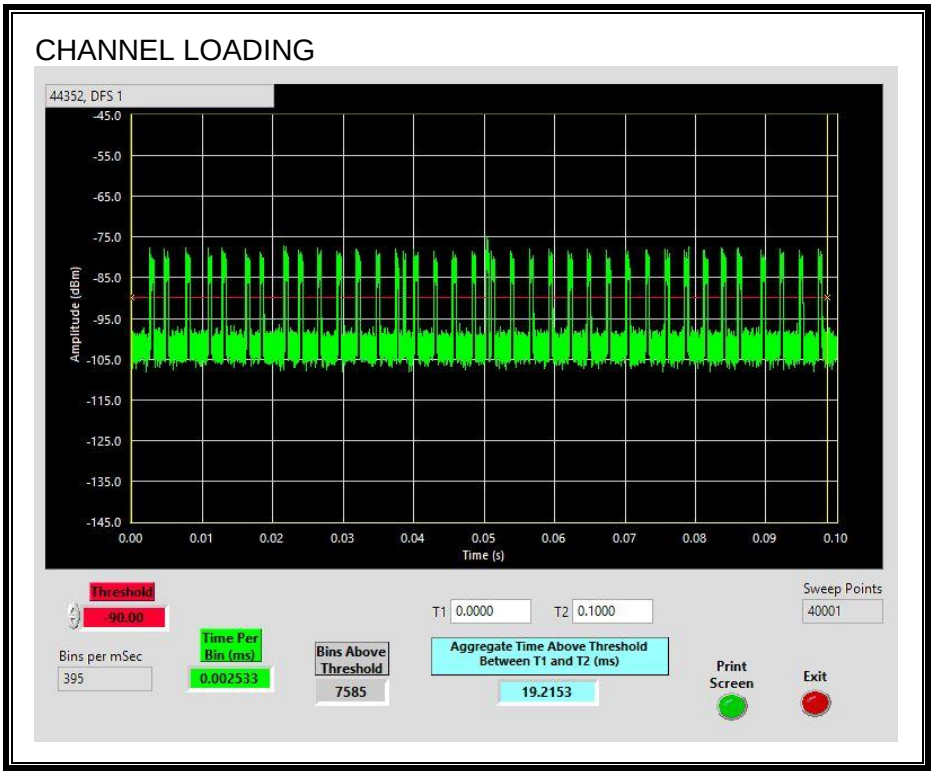


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.2153%

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)
30.25	175.8	145.6	85.6

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)
30.39	119.2	88.8	3.3

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.24	172.1	141.9	56.3

QUALITATIVE RESULTS

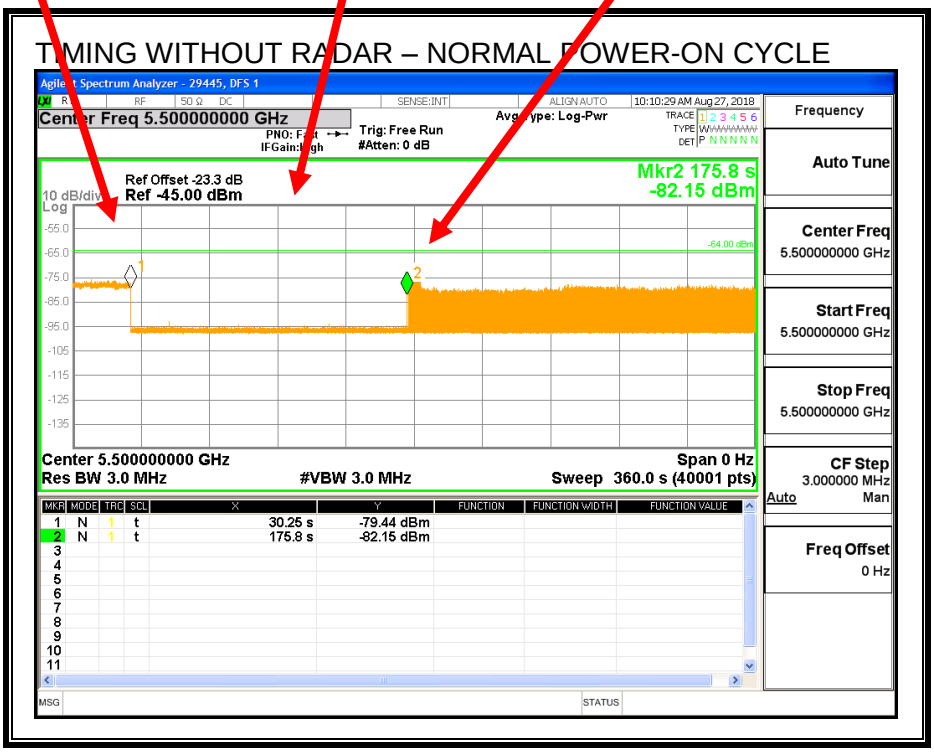
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

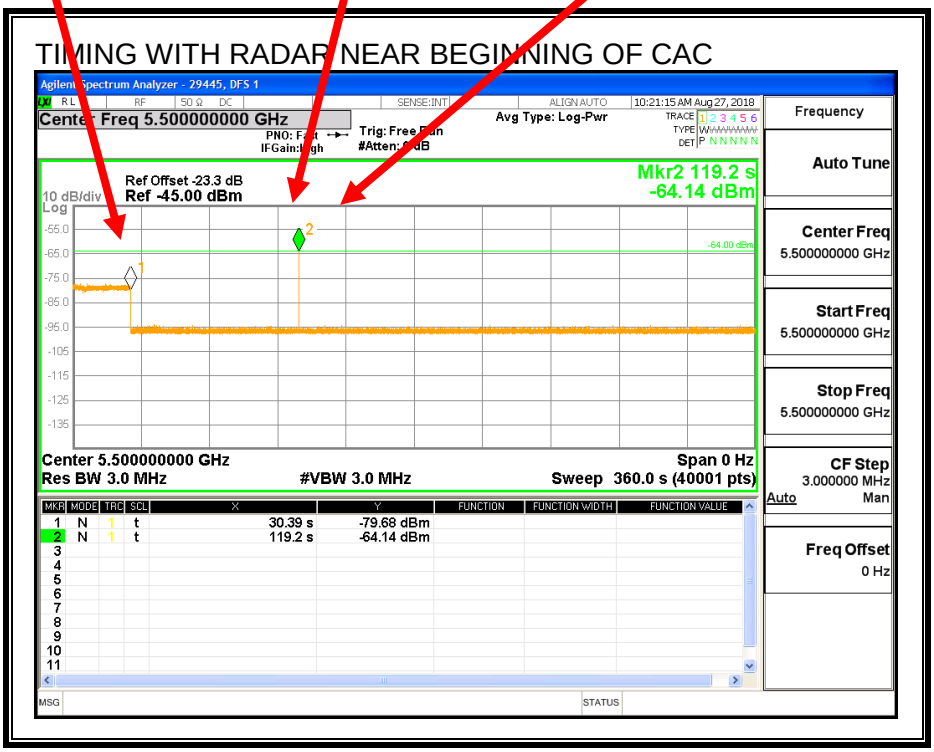
End of CAC
Traffic is Initiated



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

TIMING WITH RADAR NEAR BEGINNING OF CAC

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



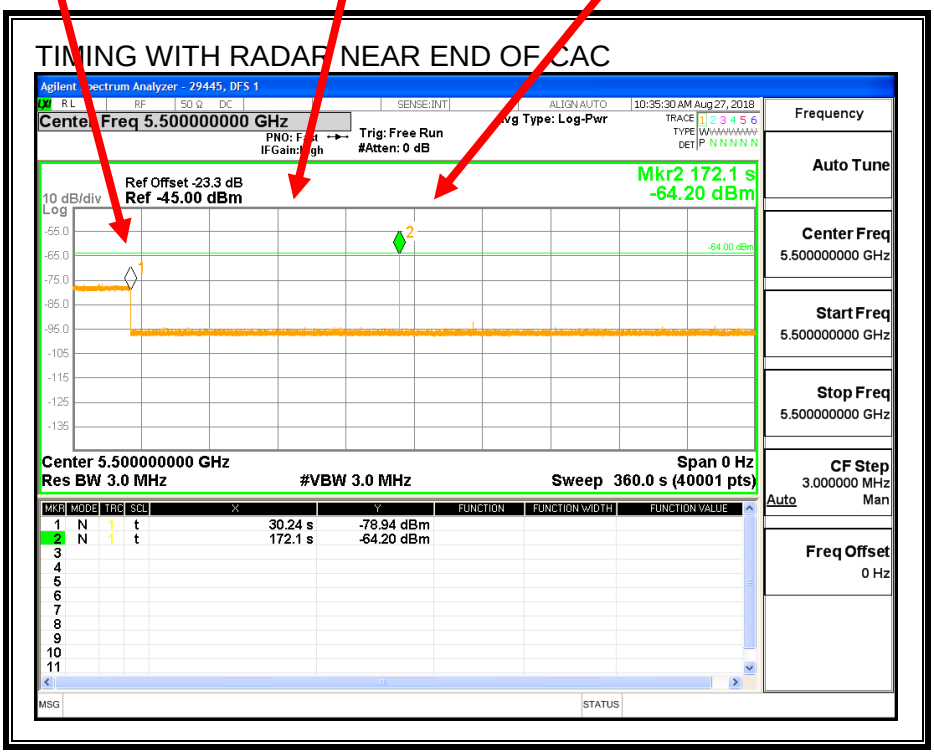
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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)

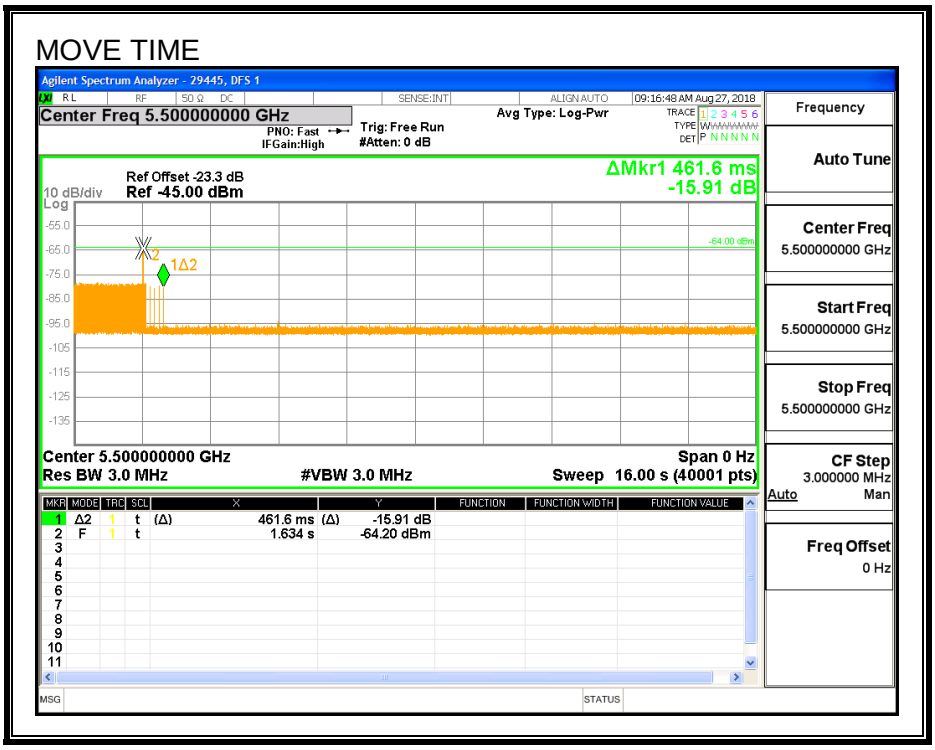
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.4616	10

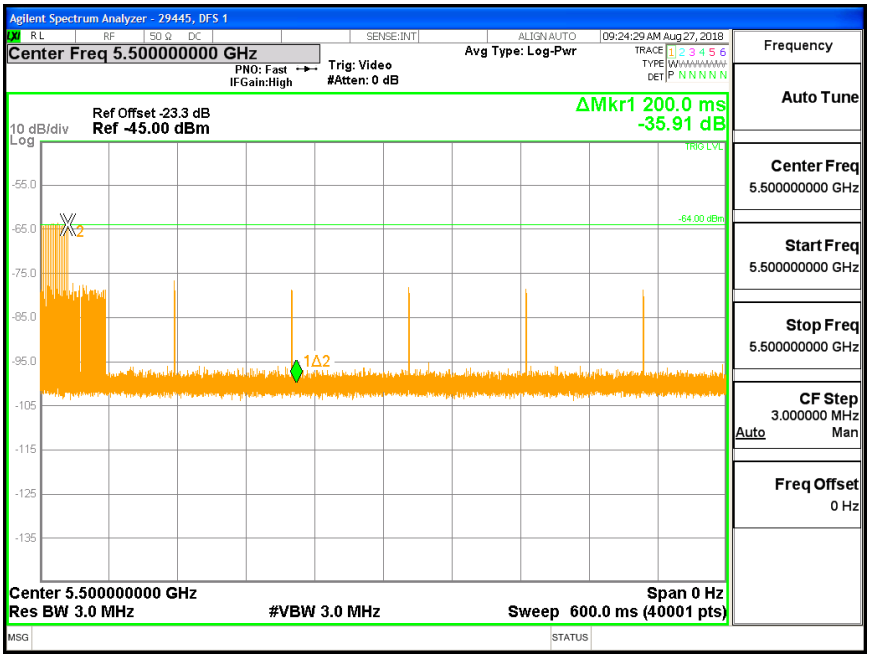
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
3.6	60

MOVE TIME



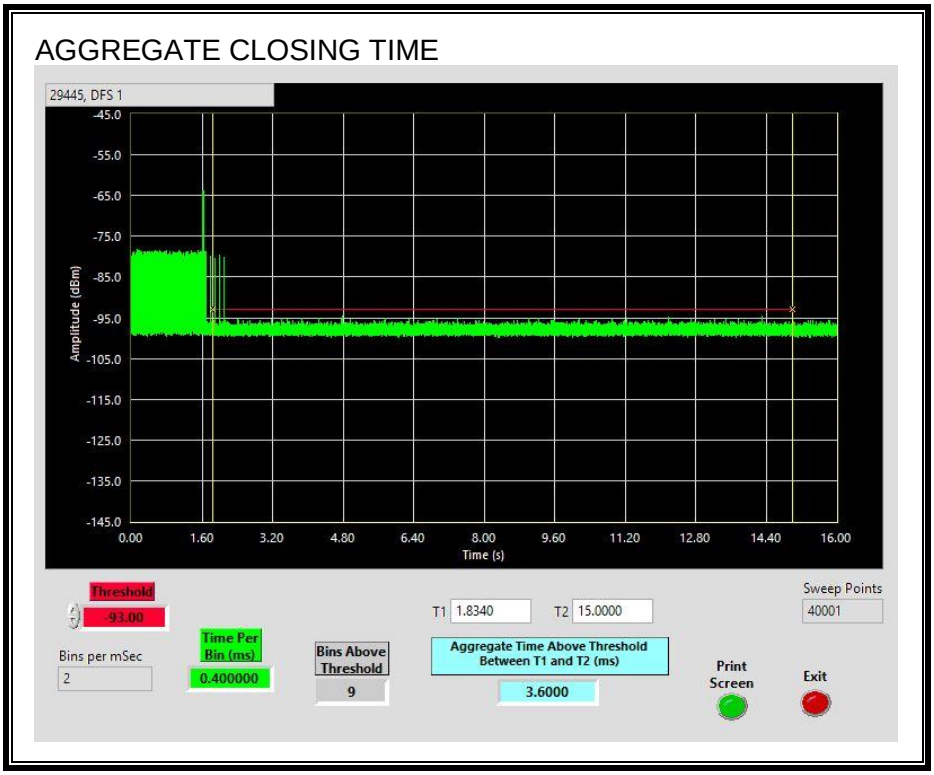
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

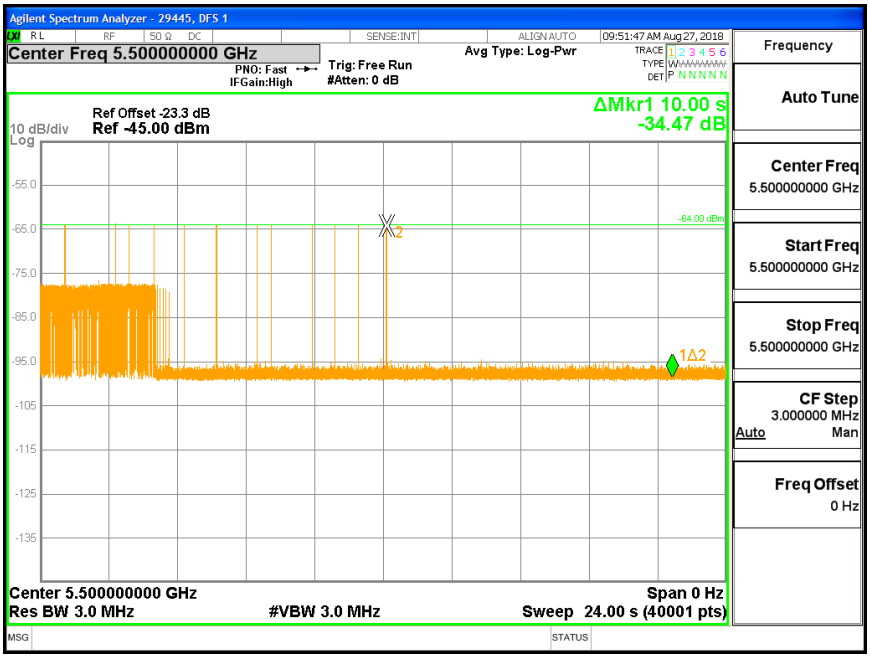
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

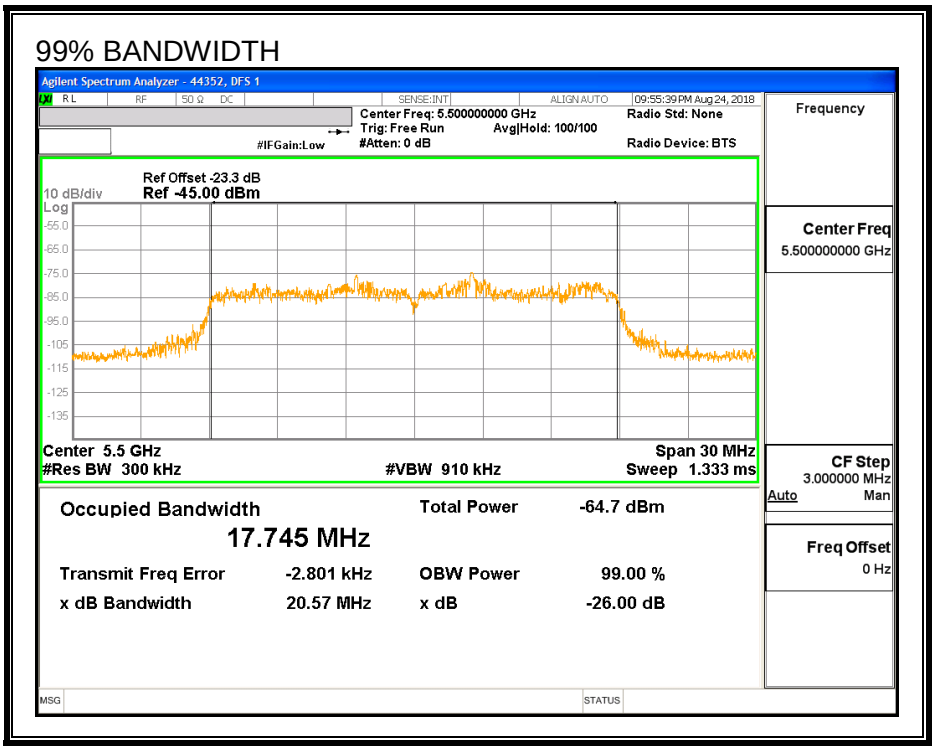
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



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	17.745	112.7	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	

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	17.75	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	96.67	60	Pass	5490	5510	17.75	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	96.67	60	Pass	5490	5510	17.75	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	96.67	60	Pass	5490	5510	17.75	DFS 1	44352	Version 3.3.4
Aggregate		97.50	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	17.75	DFS 1	44352	Version 3.3.4
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510	17.75	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	5496	Yes
1002	1	818	65	A	5506	Yes
1003	1	778	68	A	5494	Yes
1004	1	578	92	A	5506	Yes
1005	1	558	95	A	5499	Yes
1006	1	598	89	A	5493	Yes
1007	1	838	63	A	5504	Yes
1008	1	698	76	A	5508	Yes
1009	1	518	102	A	5490	Yes
1010	1	618	86	A	5496	Yes
1011	1	898	59	A	5501	Yes
1012	1	638	83	A	5505	Yes
1013	1	798	67	A	5496	Yes
1014	1	858	62	A	5492	Yes
1015	1	538	99	A	5509	Yes
1016	1	1302	41	B	5509	Yes
1017	1	2935	18	B	5494	Yes
1018	1	1149	46	B	5509	Yes
1019	1	1717	31	B	5490	Yes
1020	1	2608	21	B	5505	Yes
1021	1	758	70	B	5493	Yes
1022	1	584	91	B	5496	Yes
1023	1	1411	38	B	5506	Yes
1024	1	1367	39	B	5502	Yes
1025	1	1129	47	B	5497	Yes
1026	1	1214	44	B	5491	Yes
1027	1	1105	48	B	5507	Yes
1028	1	2673	20	B	5508	Yes
1029	1	1499	36	B	5496	Yes
1030	1	649	82	B	5504	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	4.8	203	25	5506	Yes
2002	3.4	217	24	5508	Yes
2003	2.8	181	27	5495	Yes
2004	1.9	198	24	5504	Yes
2005	1.4	209	28	5505	Yes
2006	2.6	230	24	5498	Yes
2007	4.6	165	29	5499	Yes
2008	4.1	152	26	5510	Yes
2009	2.1	172	24	5491	Yes
2010	1.8	163	28	5501	Yes
2011	4.2	230	23	5497	Yes
2012	2.2	226	24	5500	Yes
2013	2.8	215	23	5510	Yes
2014	1	177	25	5509	Yes
2015	1.9	171	24	5492	Yes
2016	4.4	180	23	5502	Yes
2017	3.5	178	26	5504	Yes
2018	4.3	191	25	5504	No
2019	1.5	155	25	5491	Yes
2020	4.7	172	28	5493	Yes
2021	4.2	183	25	5497	Yes
2022	1.3	205	29	5507	Yes
2023	3.3	220	26	5490	Yes
2024	2.8	208	27	5494	Yes
2025	4.9	227	29	5504	Yes
2026	4.6	219	26	5509	Yes
2027	2.9	204	24	5494	Yes
2028	5	200	29	5510	Yes
2029	1.5	189	28	5495	Yes
2030	3.8	151	23	5493	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	9.7	369	17	5508	Yes
3002	8.1	264	18	5493	Yes
3003	7.2	391	16	5501	Yes
3004	8	298	16	5498	Yes
3005	7.4	438	17	5508	Yes
3006	8.4	491	17	5493	Yes
3007	7.9	275	16	5503	Yes
3008	7.2	341	17	5493	Yes
3009	7	389	18	5496	Yes
3010	6.5	350	16	5505	Yes
3011	8.6	410	17	5490	Yes
3012	8.3	384	16	5505	No
3013	8.8	339	18	5509	Yes
3014	8.7	326	17	5498	Yes
3015	9.3	294	17	5502	Yes
3016	7.5	427	16	5505	Yes
3017	8.4	290	16	5504	Yes
3018	9	436	17	5500	Yes
3019	10	311	18	5510	Yes
3020	6.7	470	18	5505	Yes
3021	6.1	358	16	5497	Yes
3022	7.1	294	16	5500	Yes
3023	6.6	446	18	5498	Yes
3024	10	262	16	5492	Yes
3025	9.8	309	17	5506	Yes
3026	9.3	271	16	5501	Yes
3027	7.3	331	16	5494	Yes
3028	7	305	18	5494	Yes
3029	7.5	260	17	5501	Yes
3030	7.4	380	18	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	15.6	348	12	5504	Yes
4002	11.6	348	16	5509	Yes
4003	13.5	462	16	5493	Yes
4004	14.8	356	12	5505	Yes
4005	17.2	483	14	5506	Yes
4006	18.9	391	14	5510	Yes
4007	17.5	412	16	5502	Yes
4008	19.6	466	16	5500	Yes
4009	18.7	367	14	5505	Yes
4010	17.1	316	16	5493	Yes
4011	16.6	481	12	5508	Yes
4012	15.4	442	15	5510	Yes
4013	11.2	251	16	5509	Yes
4014	15.3	359	14	5508	Yes
4015	11.5	431	13	5494	Yes
4016	16.1	301	14	5502	Yes
4017	12.7	269	13	5491	Yes
4018	17.8	402	14	5496	Yes
4019	19.7	382	14	5502	Yes
4020	11.9	277	13	5509	Yes
4021	14.3	404	13	5501	Yes
4022	16	444	12	5499	No
4023	14.6	333	15	5508	Yes
4024	16.8	386	14	5509	Yes
4025	15.8	288	15	5495	Yes
4026	14.2	487	15	5496	Yes
4027	13.7	401	16	5496	Yes
4028	12.6	363	13	5494	Yes
4029	17.4	305	14	5506	Yes
4030	12.4	279	15	5499	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5500	Yes
2	5500	Yes
3	5500	Yes
4	5500	Yes
5	5500	Yes
6	5500	Yes
7	5500	Yes
8	5500	Yes
9	5500	Yes
10	5500	Yes
11	5494	Yes
12	5494	Yes
13	5494	Yes
14	5494	Yes
15	5494	Yes
16	5495	Yes
17	5496	Yes
18	5495	Yes
19	5496	Yes
20	5495	Yes
21	5504	Yes
22	5505	Yes
23	5504	Yes
24	5505	Yes
25	5504	Yes
26	5505	Yes
27	5504	Yes
28	5505	Yes
29	5504	Yes
30	5505	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	192	5490	5	Yes
2	667	5491	5	Yes
3	1142	5492	1	Yes
4	1617	5493	1	Yes
5	2092	5494	3	Yes
6	2567	5495	2	Yes
7	3042	5496	3	Yes
8	3517	5497	5	Yes
9	3992	5498	5	Yes
10	4467	5499	5	Yes
11	4942	5500	6	Yes
12	5417	5501	5	Yes
13	5892	5502	6	Yes
14	6367	5503	4	Yes
15	6842	5504	4	Yes
16	7317	5505	6	Yes
17	7792	5506	7	Yes
18	8267	5507	5	Yes
19	8742	5508	4	Yes
20	9217	5509	5	Yes
21	9692	5510	2	Yes
22	10167	5490	2	Yes
23	10642	5491	5	Yes
24	11117	5492	3	Yes
25	11592	5493	5	Yes
26	12067	5494	1	Yes
27	12542	5495	5	Yes
28	13017	5496	5	Yes
29	13492	5497	3	Yes
30	13967	5498	5	Yes
31	14442	5499	2	Yes
32	14917	5500	2	Yes
33	15392	5501	5	Yes
34	15867	5502	5	Yes
35	16342	5503	3	Yes
36	16817	5504	5	Yes
37	17292	5505	2	Yes
38	17767	5506	4	Yes
39	18242	5507	5	Yes
40	18717	5508	4	Yes
41	19192	5509	6	Yes
42	19667	5510	5	Yes

6.3. RESULTS FOR 40 MHz BANDWIDTH

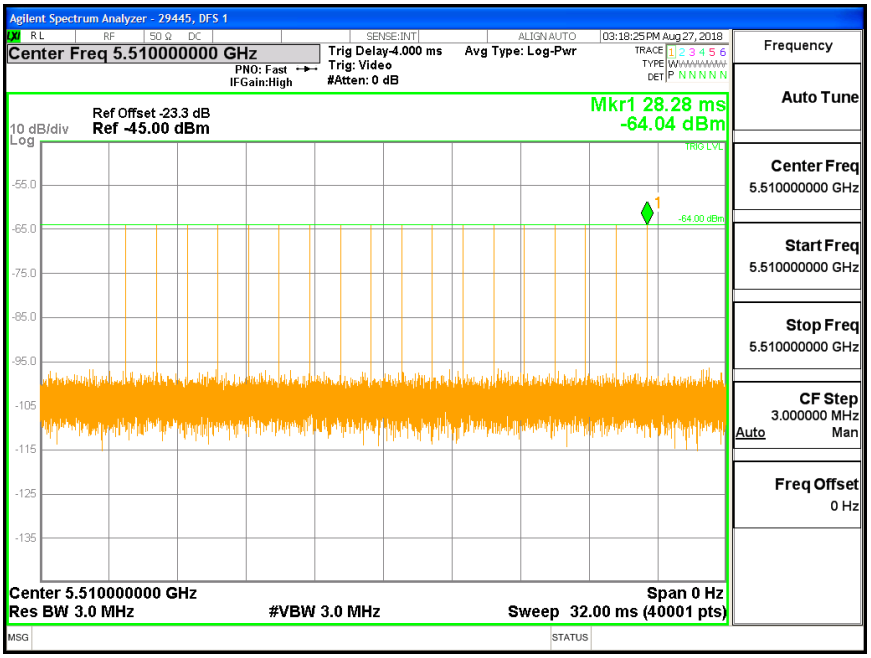
6.3.1. TEST CHANNEL

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

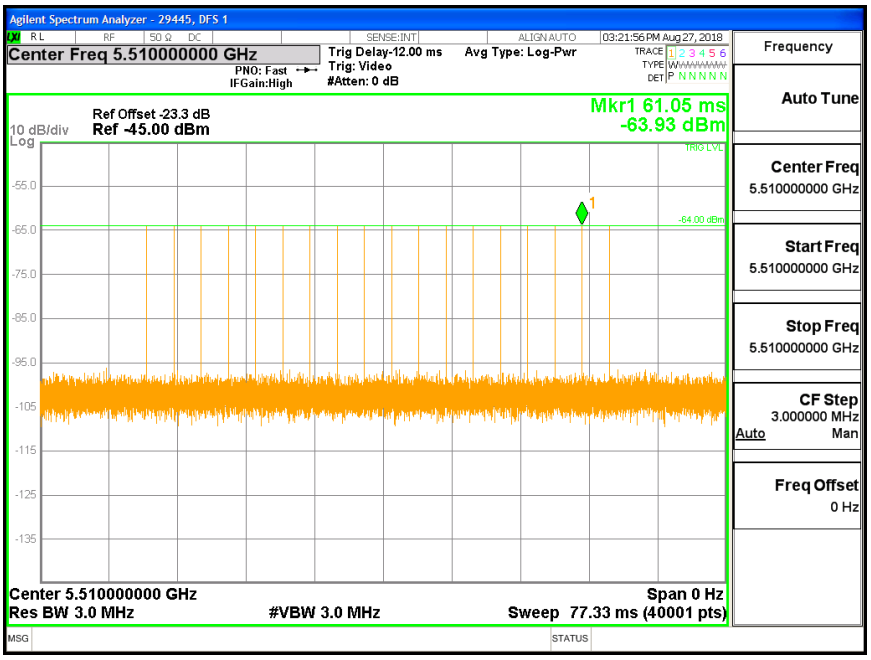
6.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

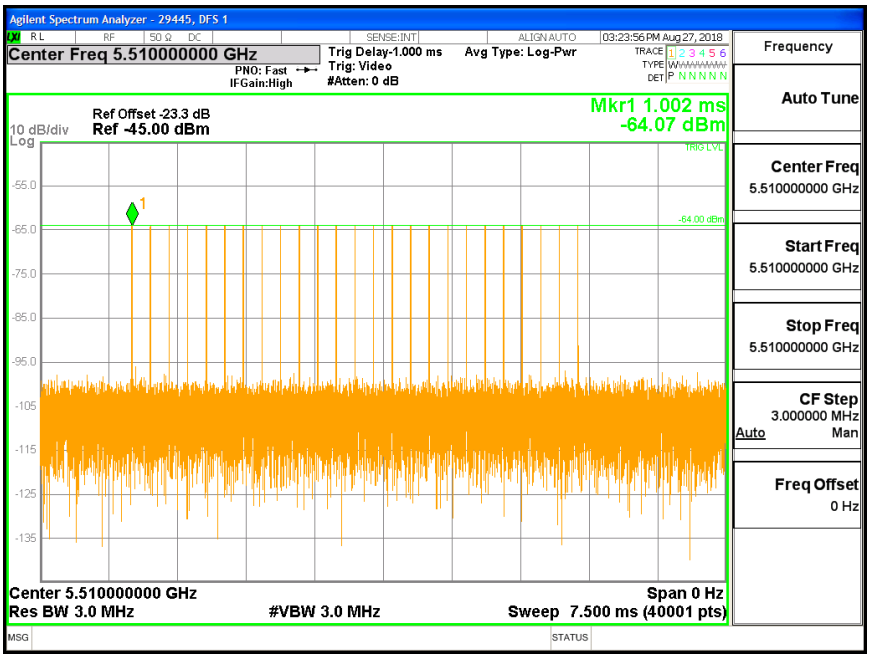
SHORT PULSE RADAR TYPE 0



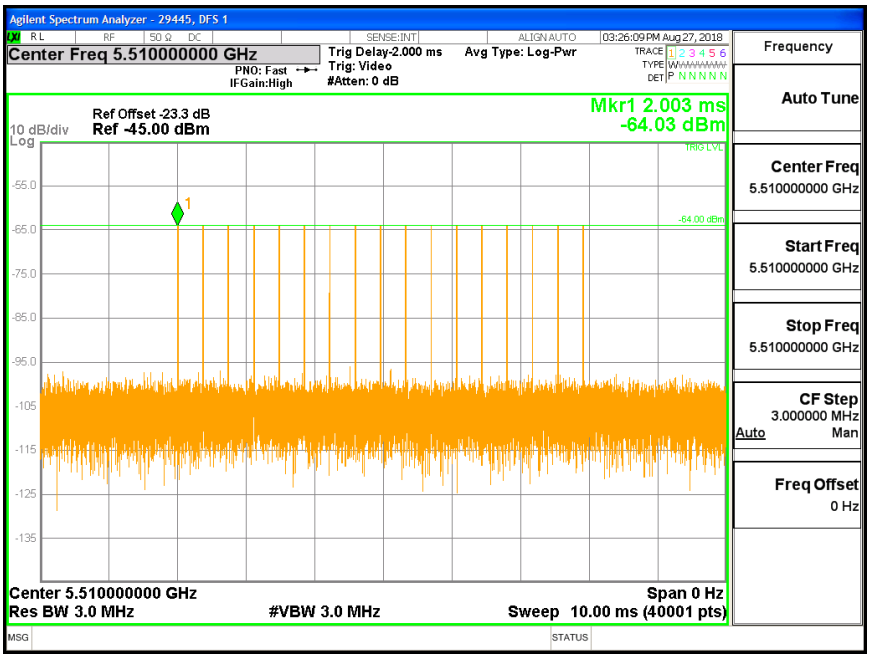
SAMPLE OF RADAR TYPE 1



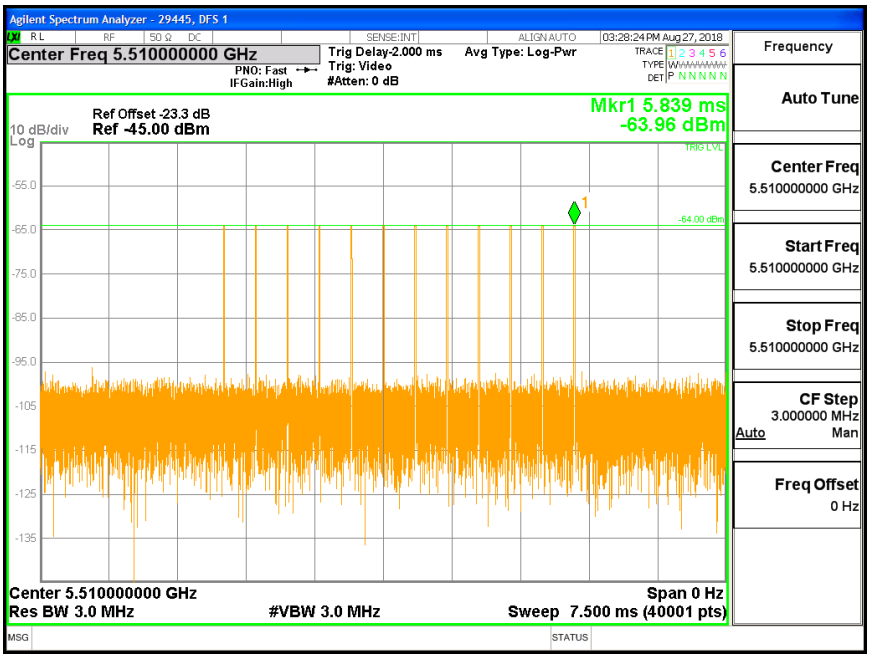
SAMPLE OF RADAR TYPE 2



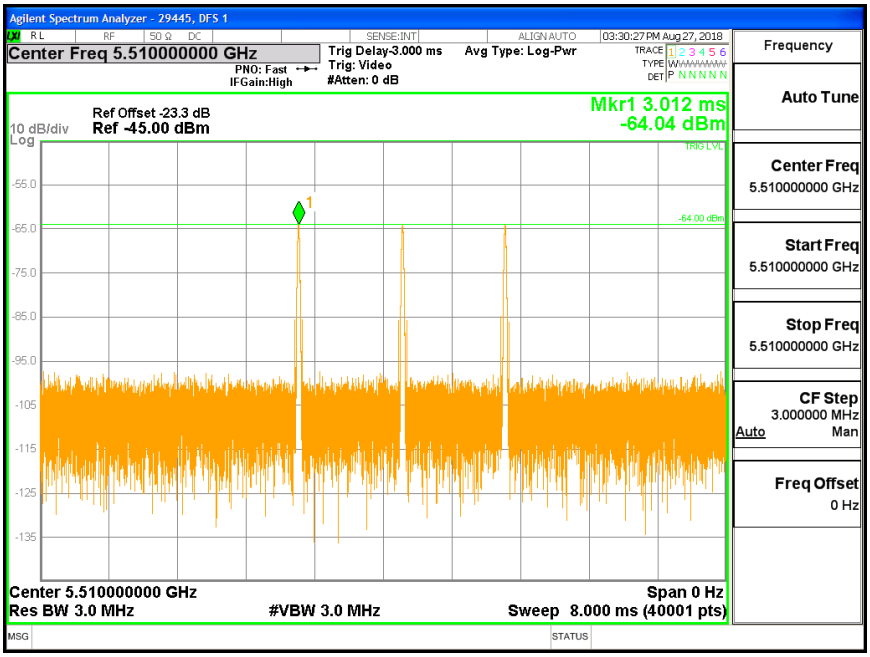
SAMPLE OF RADAR TYPE 3



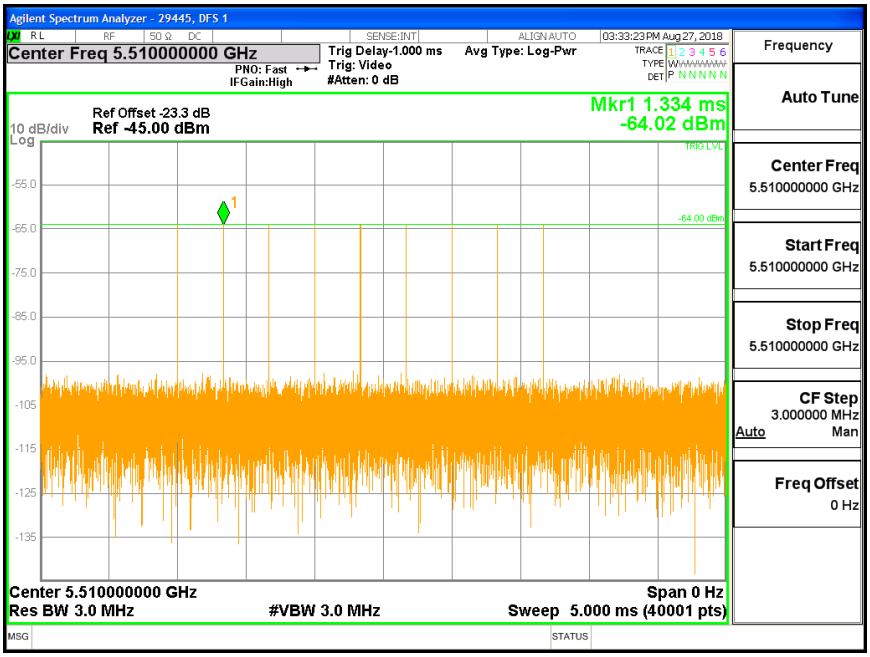
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

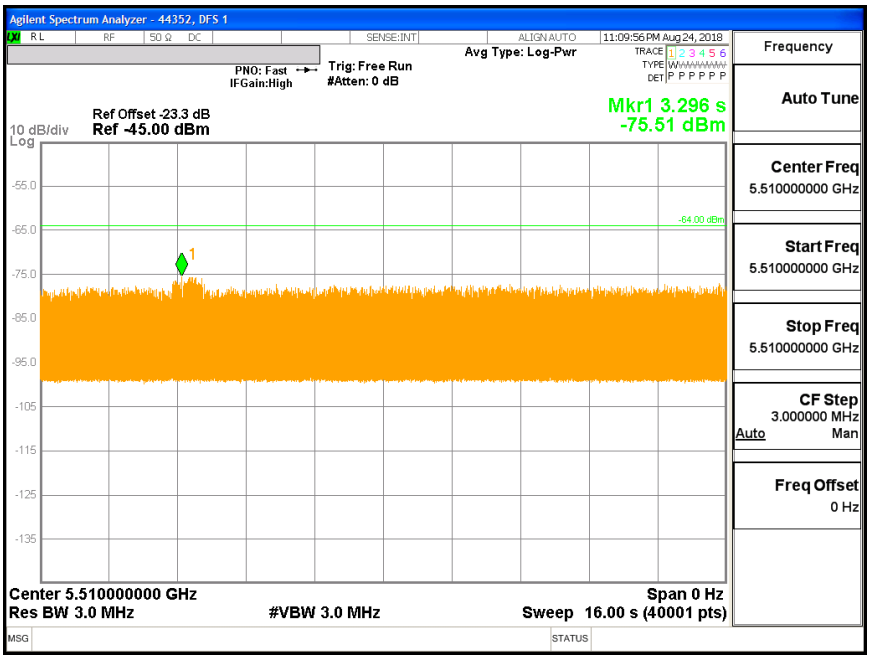


SINGLE BURST OF RADAR TYPE 6

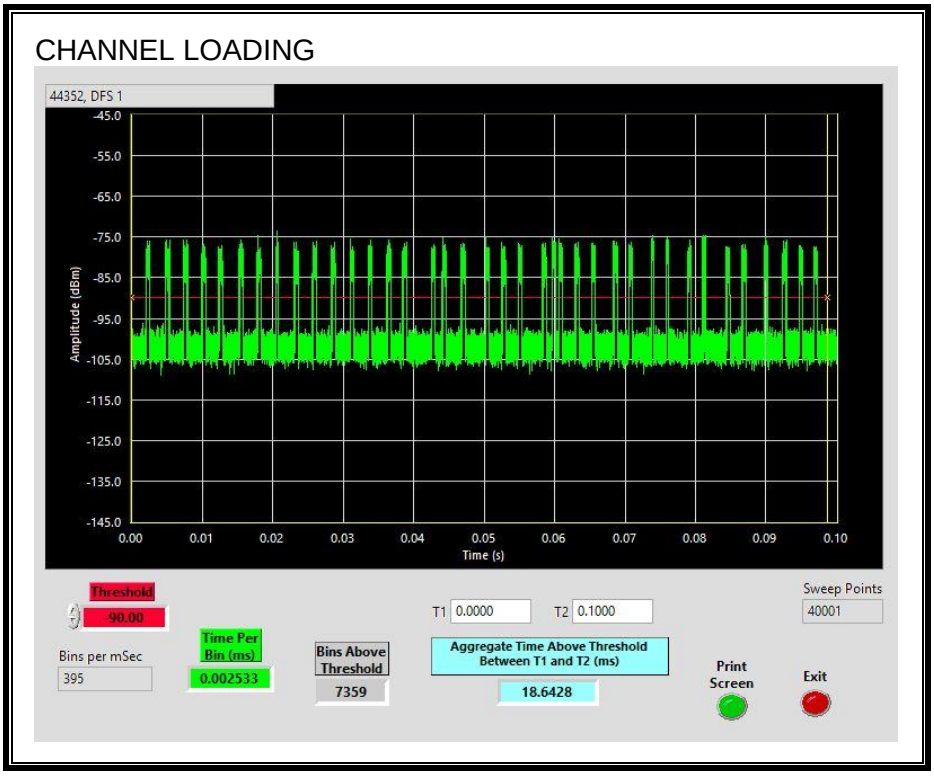


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.6428%.

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)
30.39	175.8	145.4	85.4

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)
30.31	118.9	88.6	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)
30.4	173.2	142.8	57.4

QUALITATIVE RESULTS

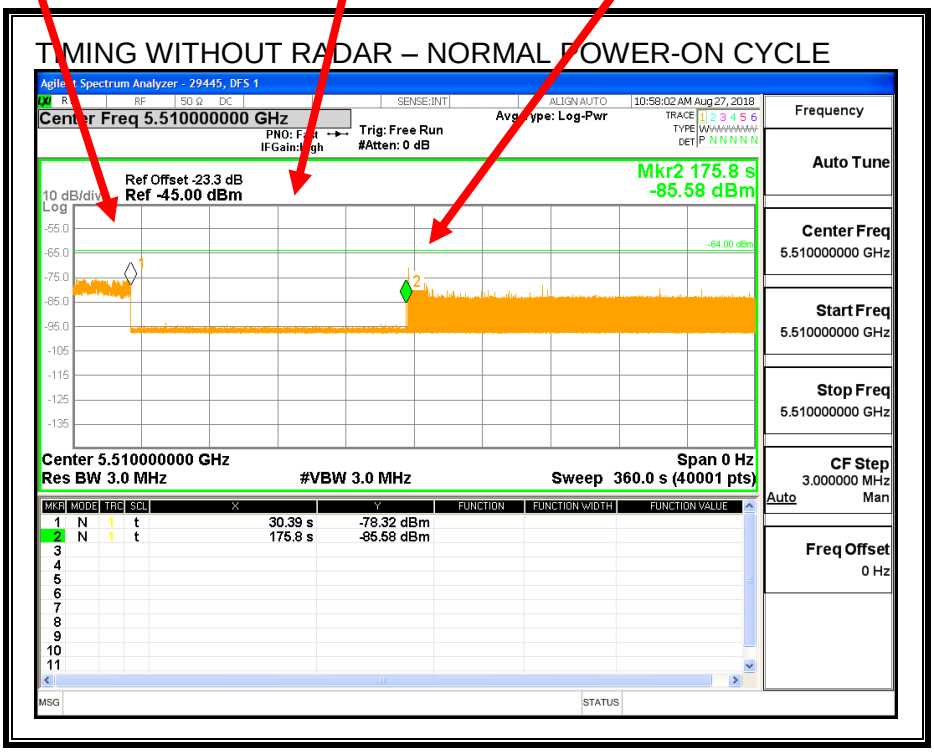
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

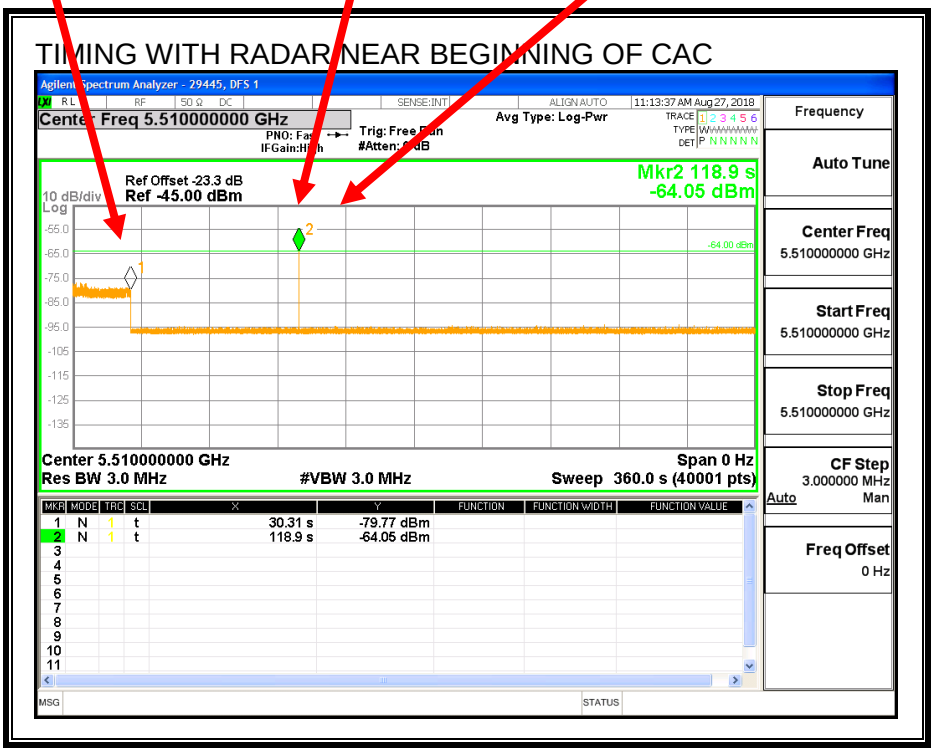
End of CAC
Traffic is Initiated



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

TIMING WITH RADAR NEAR BEGINNING OF CAC

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



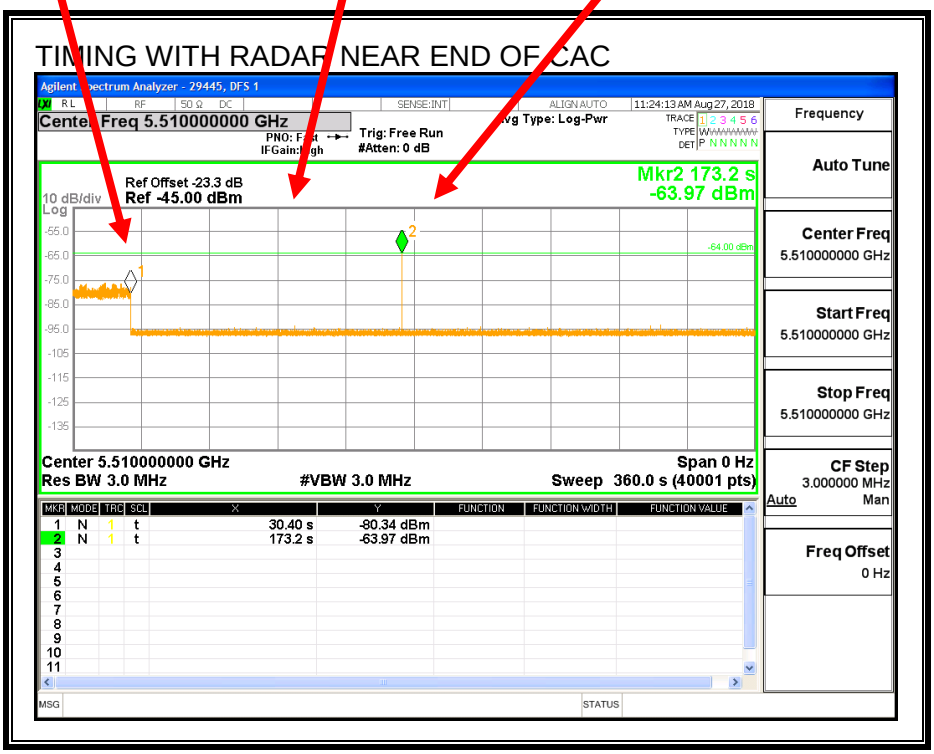
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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)

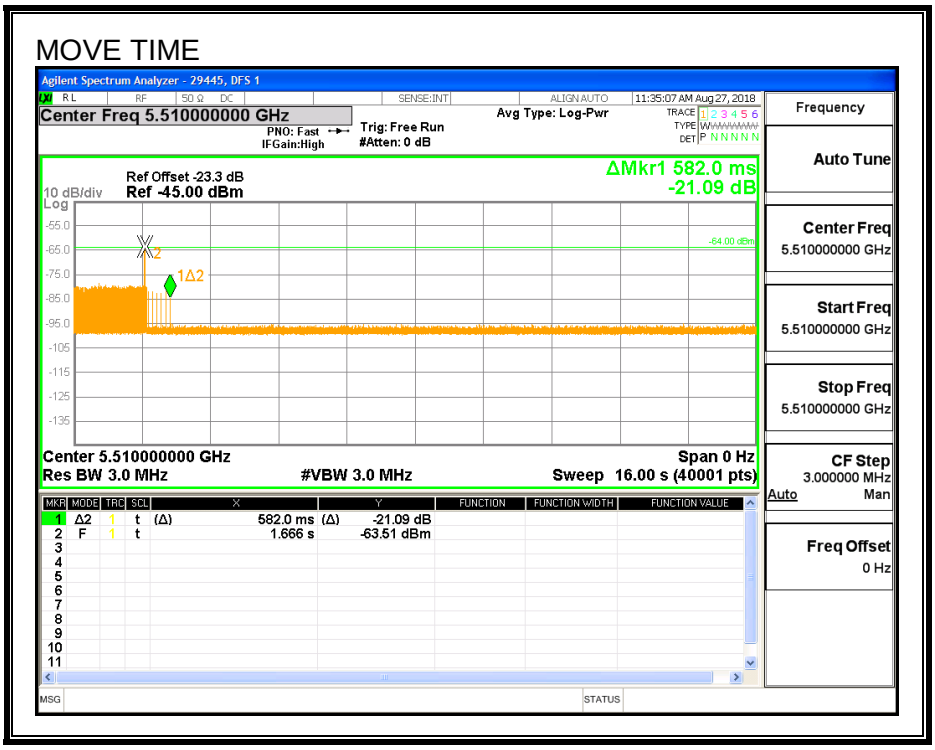
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.582	10

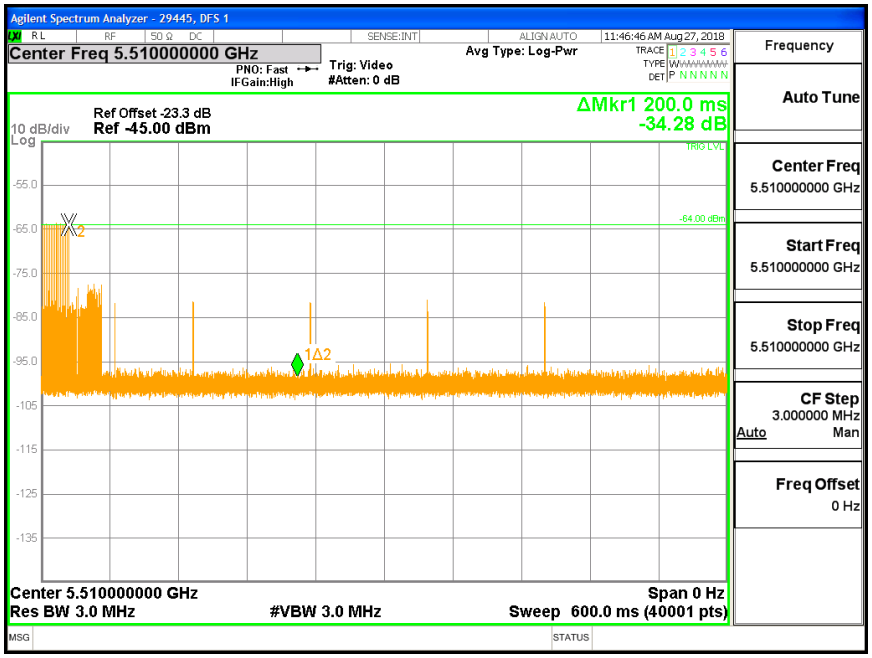
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
2.8	60

MOVE TIME



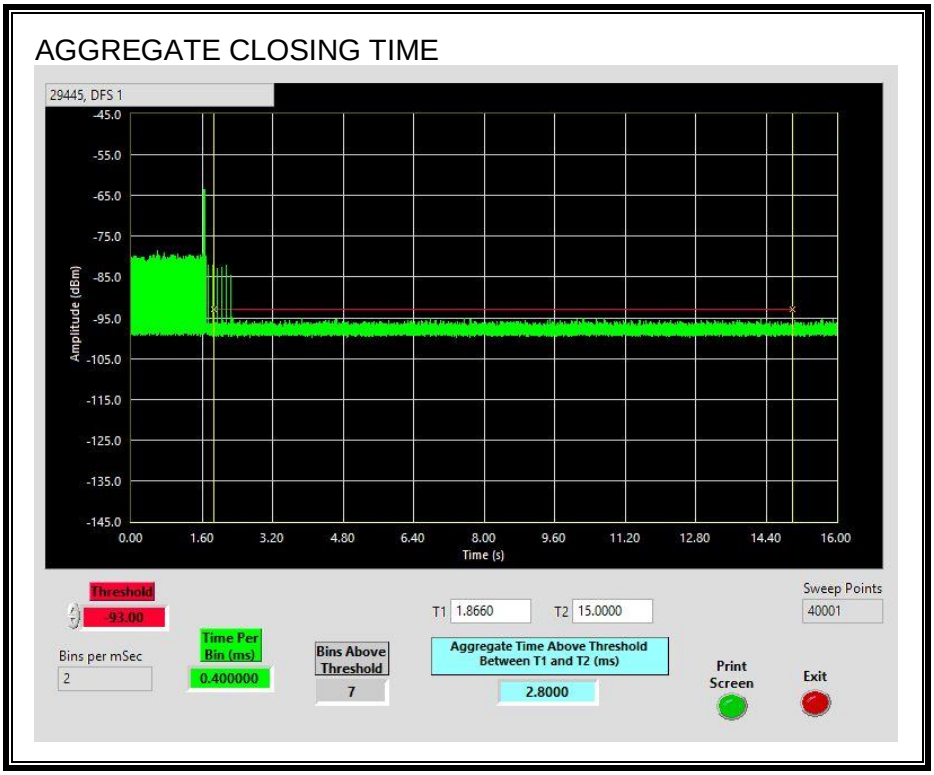
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

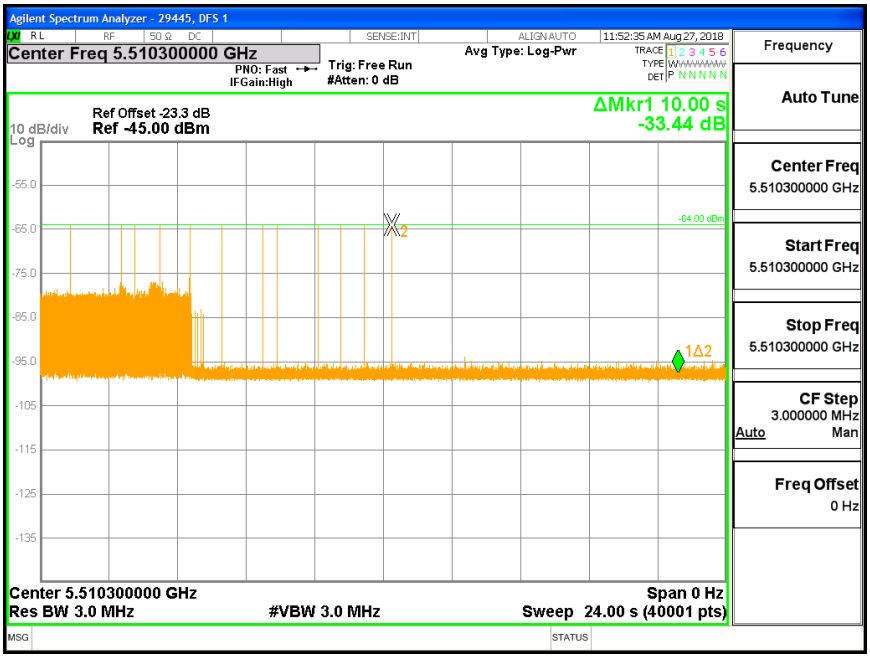
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

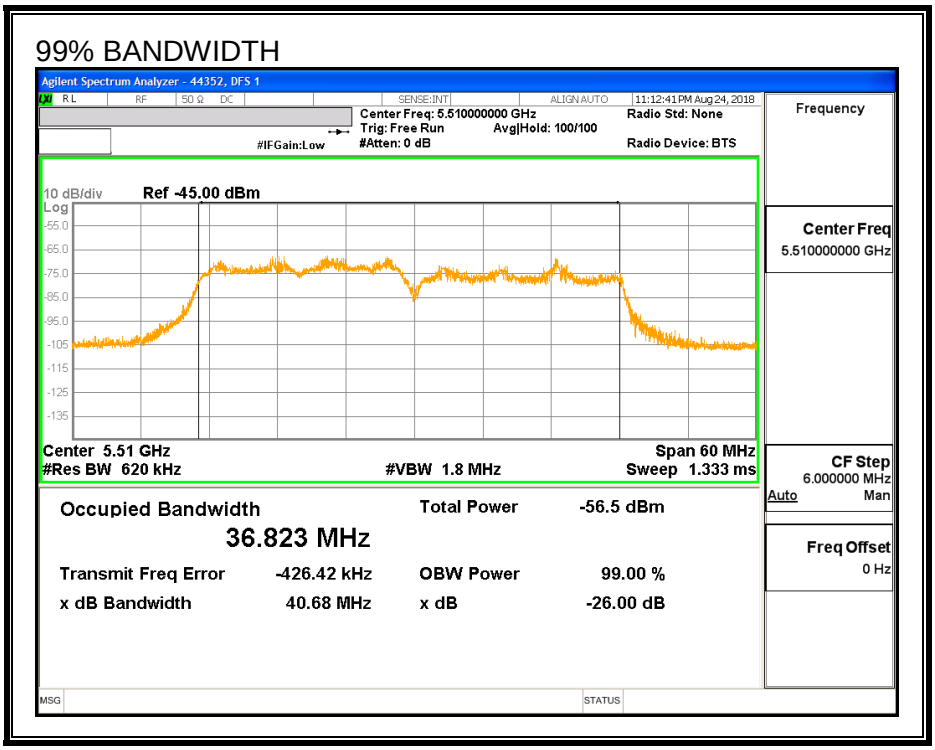
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



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	36.823	108.6	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		44352	DFS 1	
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	0	0	
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
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	36.82	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5530	36.82	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5530	36.82	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5530	36.82	DFS 1	44352	Version 3.3.4
Aggregate		98.33	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	36.82	DFS 1	44352	Version 3.3.4
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530	36.82	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	5528	Yes
1002	1	818	65	A	5505	Yes
1003	1	778	68	A	5518	Yes
1004	1	578	92	A	5521	Yes
1005	1	558	95	A	5508	Yes
1006	1	598	89	A	5515	Yes
1007	1	838	63	A	5512	Yes
1008	1	698	76	A	5515	Yes
1009	1	518	102	A	5509	Yes
1010	1	618	86	A	5526	Yes
1011	1	898	59	A	5501	Yes
1012	1	638	83	A	5529	Yes
1013	1	798	67	A	5503	Yes
1014	1	858	62	A	5504	Yes
1015	1	538	99	A	5517	Yes
1016	1	1302	41	B	5498	Yes
1017	1	2935	18	B	5514	Yes
1018	1	1149	46	B	5522	Yes
1019	1	1717	31	B	5522	Yes
1020	1	2608	21	B	5527	Yes
1021	1	758	70	B	5515	Yes
1022	1	584	91	B	5519	Yes
1023	1	1411	38	B	5524	Yes
1024	1	1367	39	B	5519	Yes
1025	1	1129	47	B	5500	Yes
1026	1	1214	44	B	5505	Yes
1027	1	1105	48	B	5504	Yes
1028	1	2673	20	B	5521	Yes
1029	1	1499	36	B	5507	Yes
1030	1	649	82	B	5504	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	4.8	203	25	5511	Yes
2002	3.4	217	24	5526	Yes
2003	2.8	181	27	5507	Yes
2004	1.9	198	24	5529	Yes
2005	1.4	209	28	5530	Yes
2006	2.6	230	24	5495	Yes
2007	4.6	165	29	5521	Yes
2008	4.1	152	26	5499	Yes
2009	2.1	172	24	5514	Yes
2010	1.8	163	28	5492	Yes
2011	4.2	230	23	5506	Yes
2012	2.2	226	24	5526	Yes
2013	2.8	215	23	5526	Yes
2014	1	177	25	5523	Yes
2015	1.9	171	24	5517	Yes
2016	4.4	180	23	5530	Yes
2017	3.5	178	26	5492	Yes
2018	4.3	191	25	5517	Yes
2019	1.5	155	25	5522	Yes
2020	4.7	172	28	5491	Yes
2021	4.2	183	25	5500	Yes
2022	1.3	205	29	5530	Yes
2023	3.3	220	26	5530	Yes
2024	2.8	208	27	5528	Yes
2025	4.9	227	29	5520	Yes
2026	4.6	219	26	5504	Yes
2027	2.9	204	24	5522	Yes
2028	5	200	29	5503	Yes
2029	1.5	189	28	5517	Yes
2030	3.8	151	23	5504	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	9.7	369	17	5509	Yes
3002	8.1	264	18	5503	Yes
3003	7.2	391	16	5521	Yes
3004	8	298	16	5504	Yes
3005	7.4	438	17	5517	Yes
3006	8.4	491	17	5492	Yes
3007	7.9	275	16	5510	Yes
3008	7.2	341	17	5507	Yes
3009	7	389	18	5507	Yes
3010	6.5	350	16	5504	Yes
3011	8.6	410	17	5523	Yes
3012	8.3	384	16	5523	Yes
3013	8.8	339	18	5526	Yes
3014	8.7	326	17	5513	Yes
3015	9.3	294	17	5507	Yes
3016	7.5	427	16	5501	Yes
3017	8.4	290	16	5499	Yes
3018	9	436	17	5529	Yes
3019	10	311	18	5496	Yes
3020	6.7	470	18	5527	Yes
3021	6.1	358	16	5514	Yes
3022	7.1	294	16	5496	Yes
3023	6.6	446	18	5506	Yes
3024	10	262	16	5492	Yes
3025	9.8	309	17	5510	Yes
3026	9.3	271	16	5525	Yes
3027	7.3	331	16	5492	Yes
3028	7	305	18	5528	Yes
3029	7.5	260	17	5529	Yes
3030	7.4	380	18	5508	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	15.6	348	12	5508	No
4002	11.6	348	16	5528	Yes
4003	13.5	462	16	5500	Yes
4004	14.8	356	12	5527	No
4005	17.2	483	14	5523	Yes
4006	18.9	391	14	5504	Yes
4007	17.5	412	16	5529	Yes
4008	19.6	466	16	5503	Yes
4009	18.7	367	14	5516	Yes
4010	17.1	316	16	5501	Yes
4011	16.6	481	12	5525	Yes
4012	15.4	442	15	5517	Yes
4013	11.2	251	16	5493	Yes
4014	15.3	359	14	5492	Yes
4015	11.5	431	13	5510	Yes
4016	16.1	301	14	5512	Yes
4017	12.7	269	13	5526	Yes
4018	17.8	402	14	5493	Yes
4019	19.7	382	14	5503	Yes
4020	11.9	277	13	5522	Yes
4021	14.3	404	13	5517	Yes
4022	16	444	12	5510	Yes
4023	14.6	333	15	5528	Yes
4024	16.8	386	14	5510	Yes
4025	15.8	288	15	5510	Yes
4026	14.2	487	15	5518	Yes
4027	13.7	401	16	5526	Yes
4028	12.6	363	13	5515	Yes
4029	17.4	305	14	5518	Yes
4030	12.4	279	15	5528	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5510	Yes
2	5510	Yes
3	5510	Yes
4	5510	Yes
5	5510	Yes
6	5510	Yes
7	5510	Yes
8	5510	Yes
9	5510	Yes
10	5510	Yes
11	5495	Yes
12	5495	Yes
13	5495	Yes
14	5495	Yes
15	5495	Yes
16	5496	Yes
17	5497	Yes
18	5496	Yes
19	5497	Yes
20	5496	Yes
21	5523	Yes
22	5524	Yes
23	5523	Yes
24	5524	Yes
25	5523	Yes
26	5524	Yes
27	5523	Yes
28	5524	Yes
29	5523	Yes
30	5524	Yes

Note: The Type 5 randomized parameters tested are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	327	5490	5	Yes
2	802	5491	3	Yes
3	1277	5492	11	Yes
4	1752	5493	9	Yes
5	2227	5494	9	Yes
6	2702	5495	6	Yes
7	3177	5496	8	Yes
8	3652	5497	9	Yes
9	4127	5498	5	Yes
10	4602	5499	5	Yes
11	5077	5500	6	Yes
12	5552	5501	6	Yes
13	6027	5502	7	Yes
14	6502	5503	7	Yes
15	6977	5504	10	Yes
16	7452	5505	7	Yes
17	7927	5506	4	Yes
18	8402	5507	8	Yes
19	8877	5508	11	Yes
20	9352	5509	8	Yes
21	9827	5510	6	Yes
22	10302	5511	8	Yes
23	10777	5512	8	Yes
24	11252	5513	13	Yes
25	11727	5514	6	Yes
26	12202	5515	10	Yes
27	12677	5516	12	Yes
28	13152	5517	6	Yes
29	13627	5518	7	Yes
30	14102	5519	11	Yes
31	14577	5520	6	Yes
32	15052	5521	10	Yes
33	15527	5522	9	Yes
34	16002	5523	8	Yes
35	16477	5524	10	Yes
36	16952	5525	6	Yes
37	17427	5526	6	Yes
38	17902	5527	3	Yes
39	18377	5528	5	Yes
40	18852	5529	10	Yes
41	19327	5530	10	Yes

6.4. RESULTS FOR 80 MHz BANDWIDTH

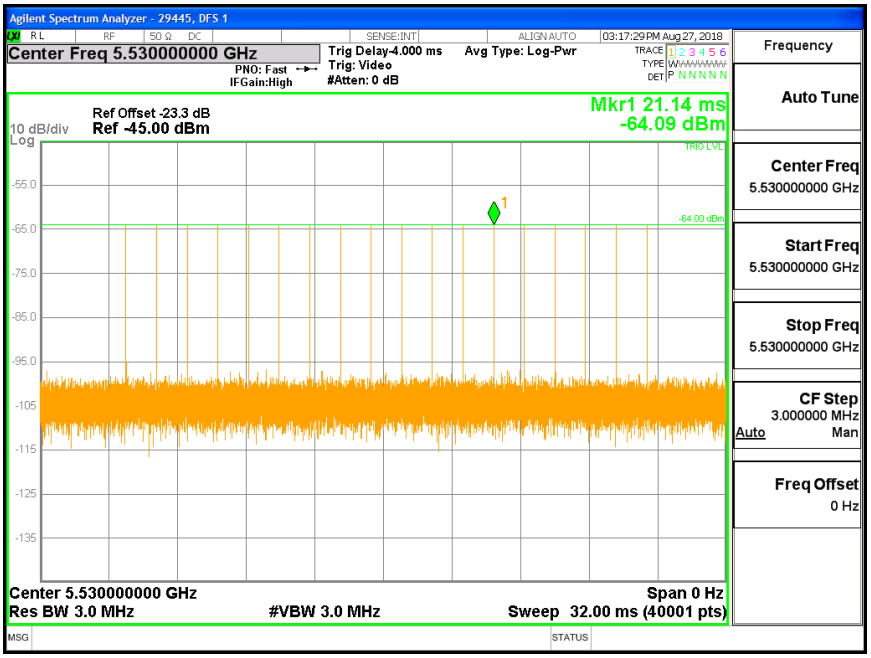
6.4.1. TEST CHANNEL

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

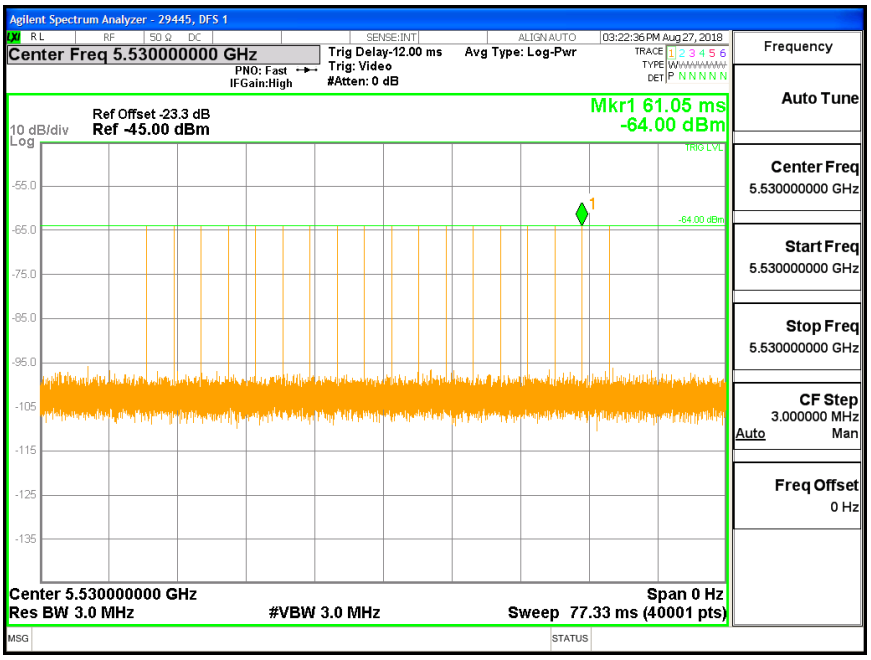
6.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

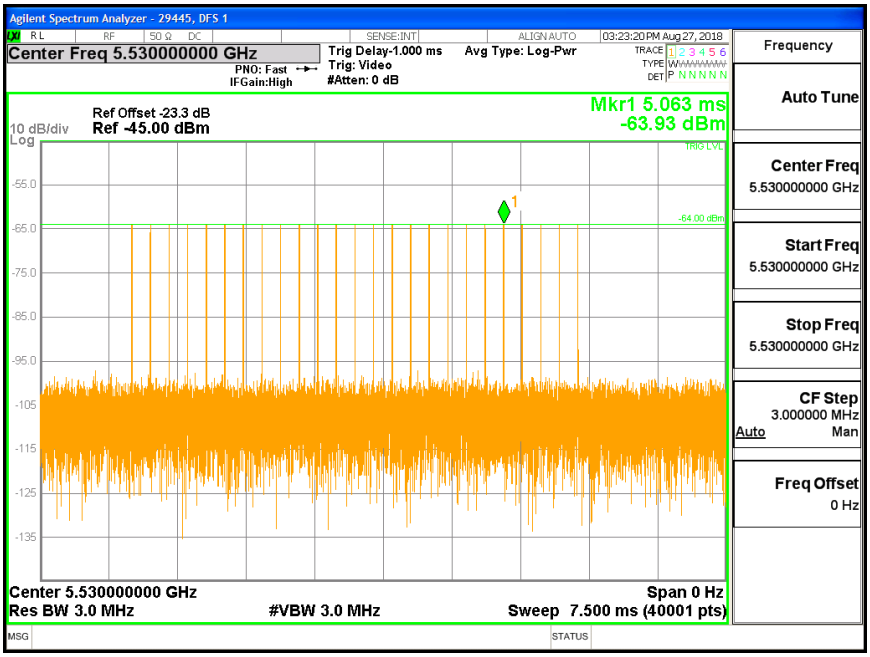
SHORT PULSE RADAR TYPE 0



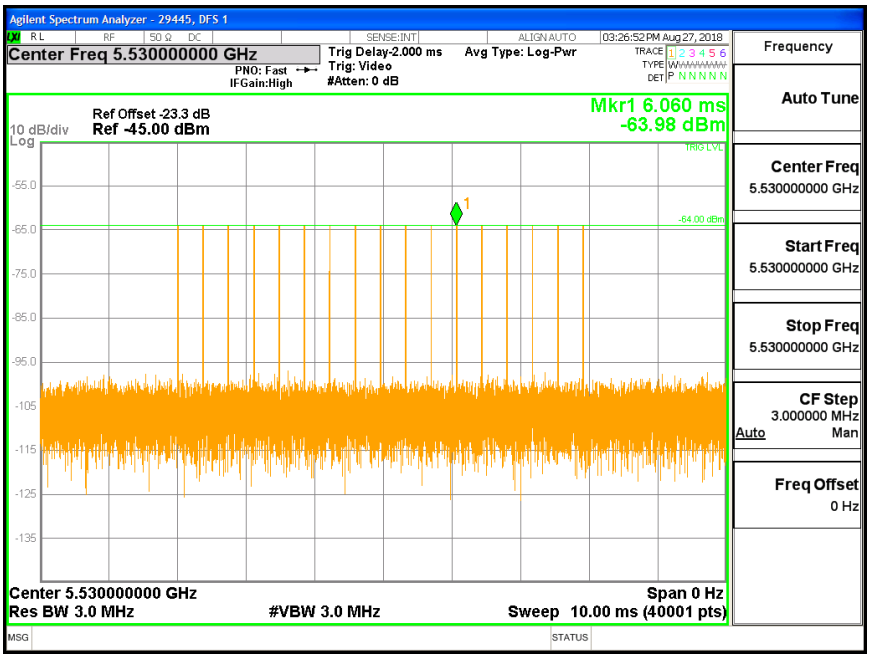
SAMPLE OF RADAR TYPE 1



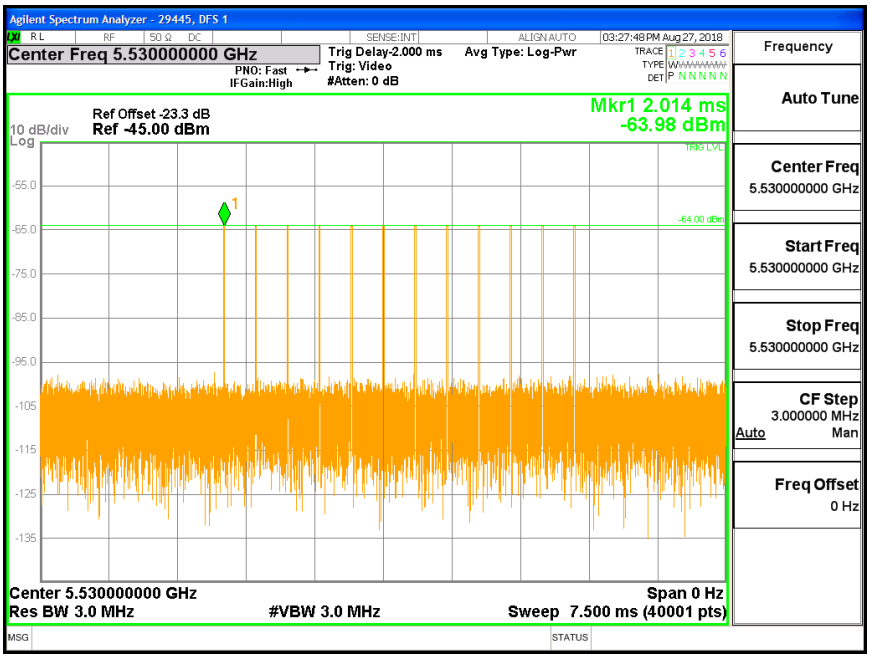
SAMPLE OF RADAR TYPE 2



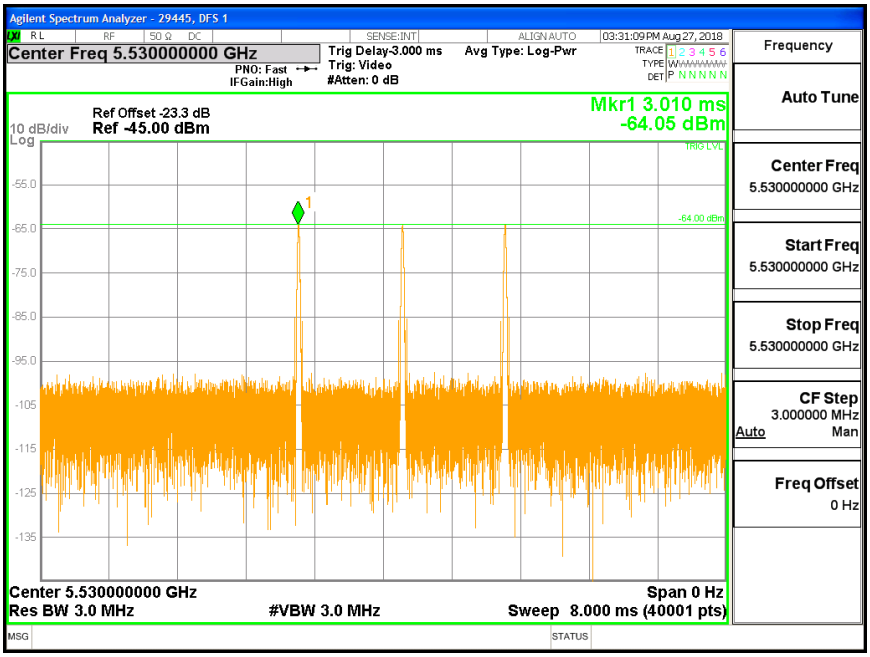
SAMPLE OF RADAR TYPE 3



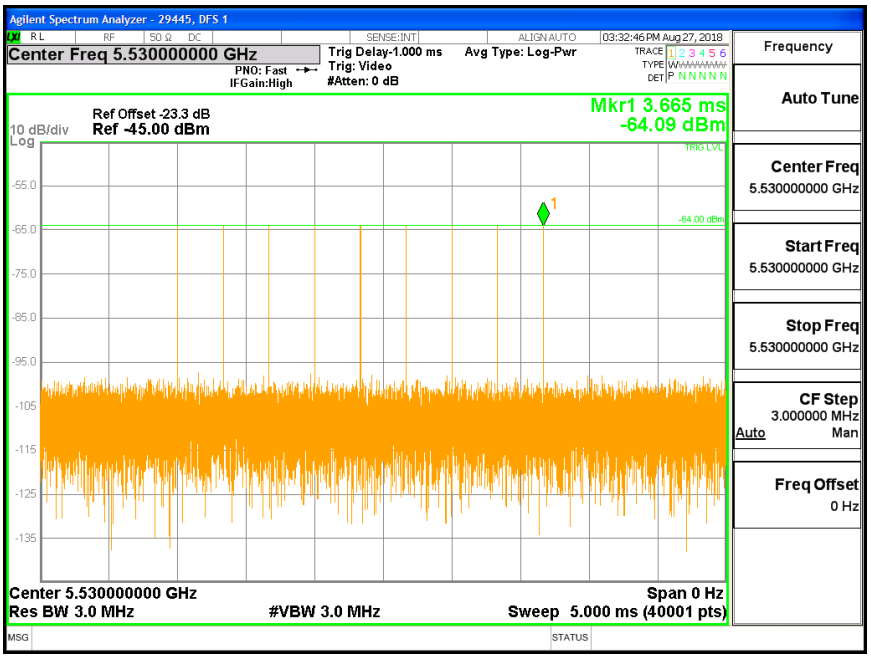
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

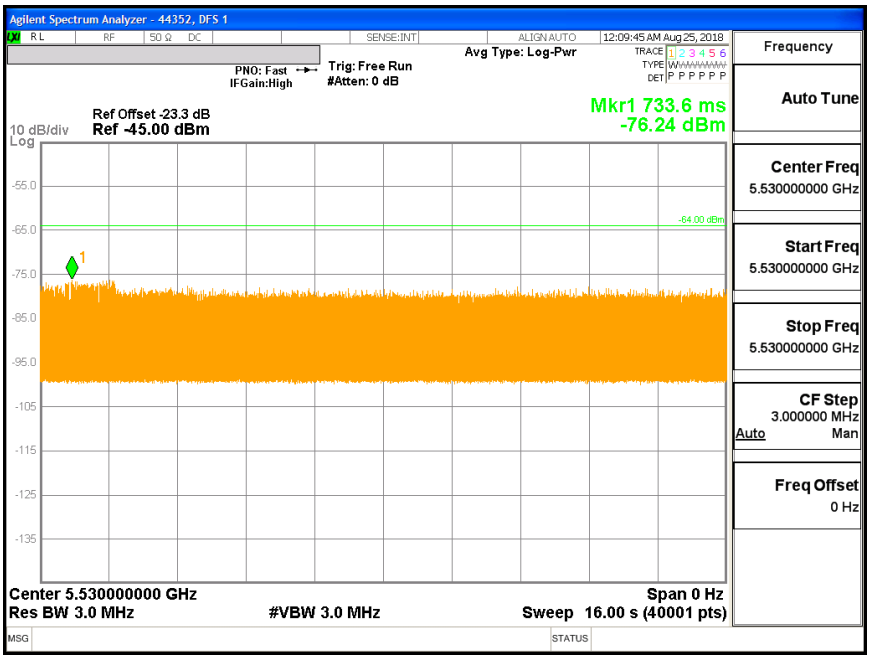


SINGLE BURST OF RADAR TYPE 6

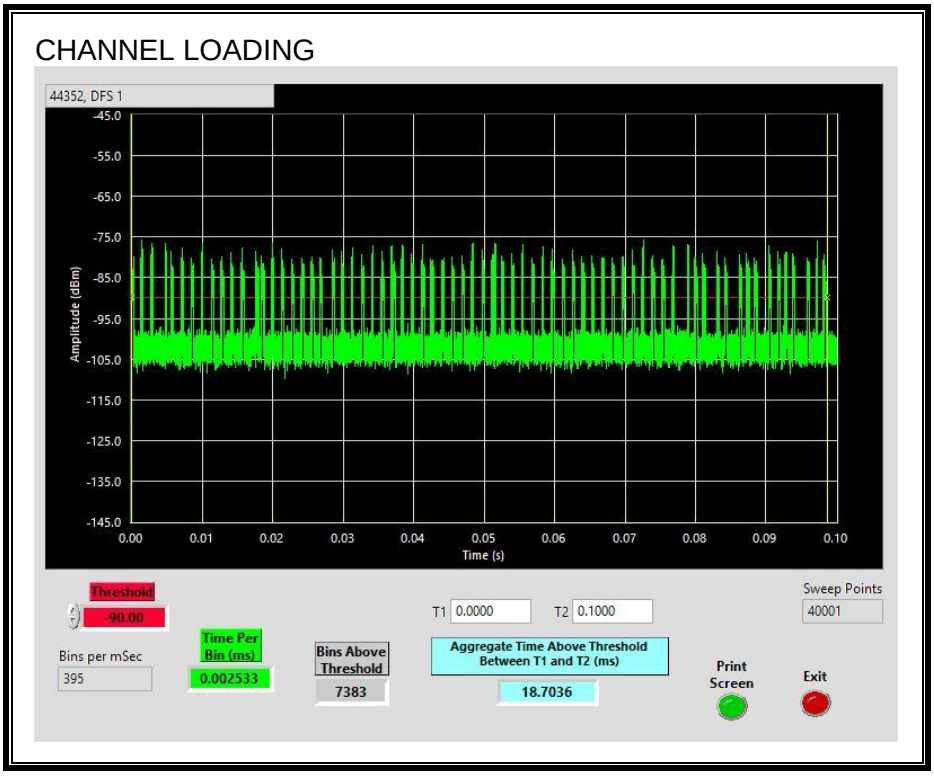


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.7036%

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)
29.71	175.0	145.3	85.3

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)
30.23	119.0	88.8	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)
30.39	172.9	142.5	57.2

QUALITATIVE RESULTS

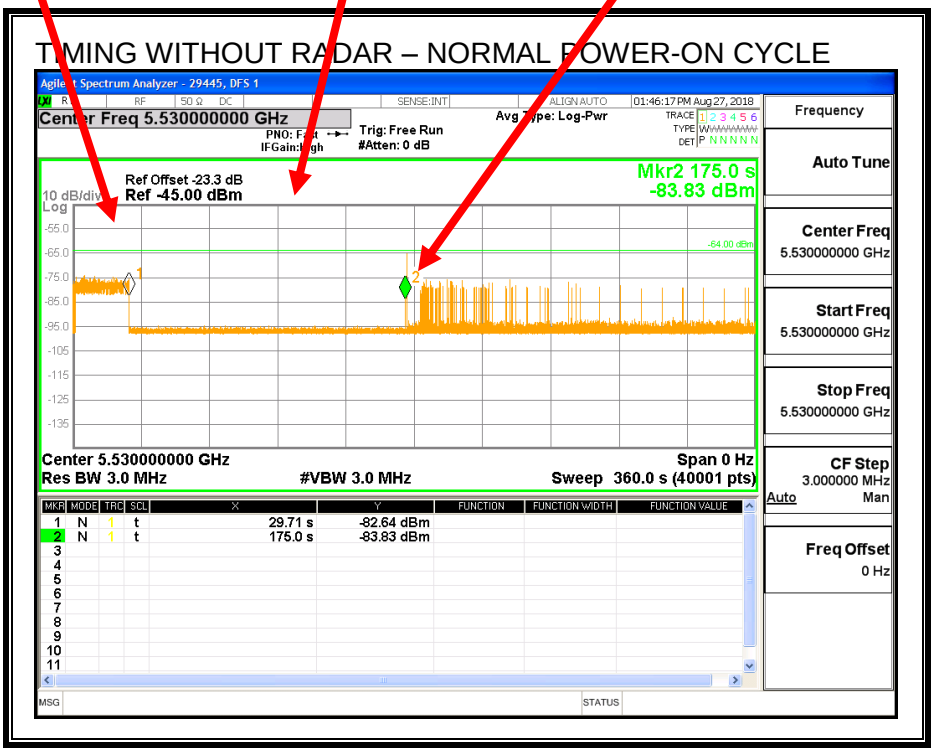
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

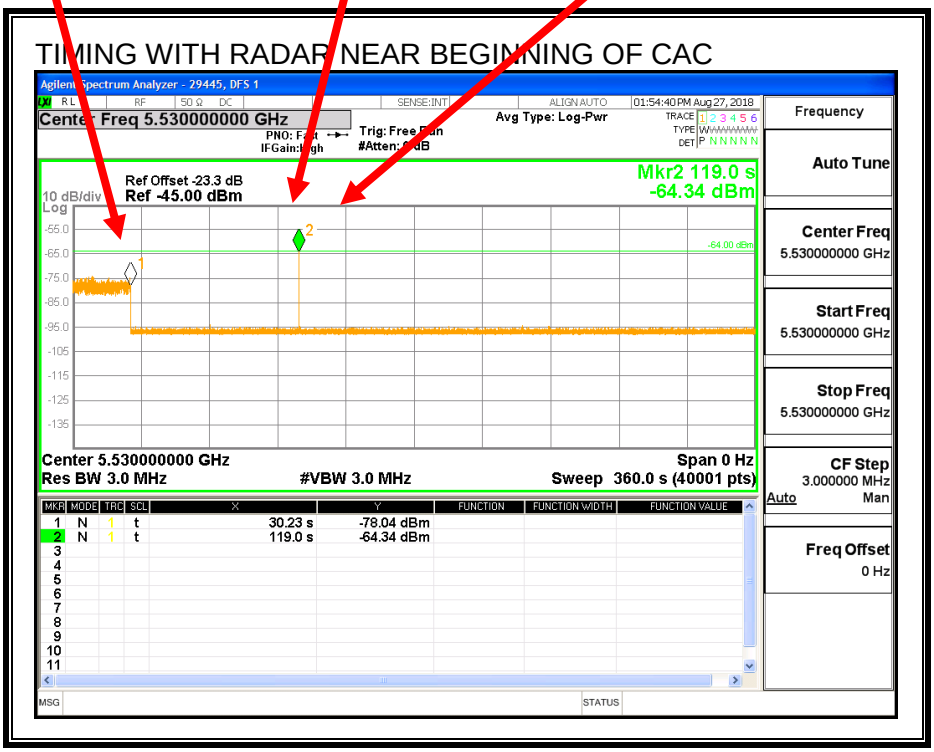
End of CAC
Traffic is Initiated



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



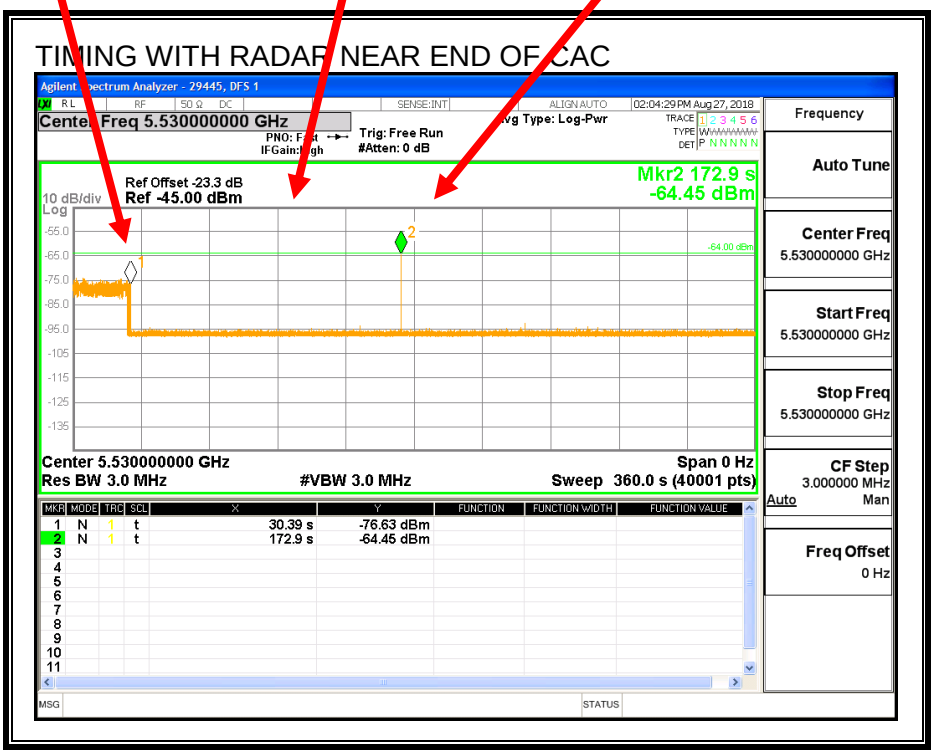
No EUT transmissions were observed after the radar signal.

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.

6.4.2. 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)

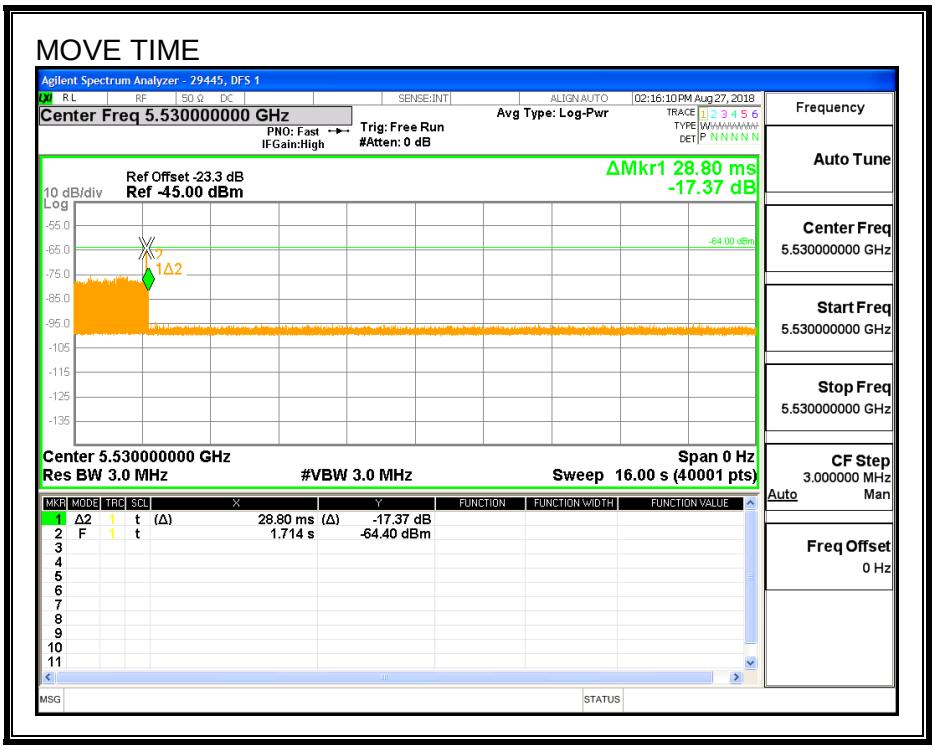
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.0288	10

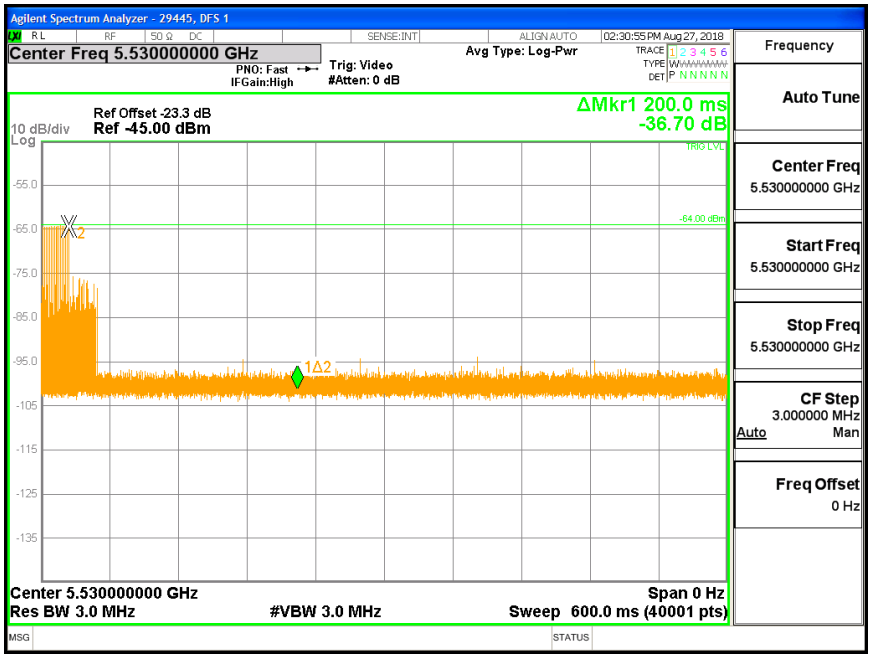
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60

MOVE TIME



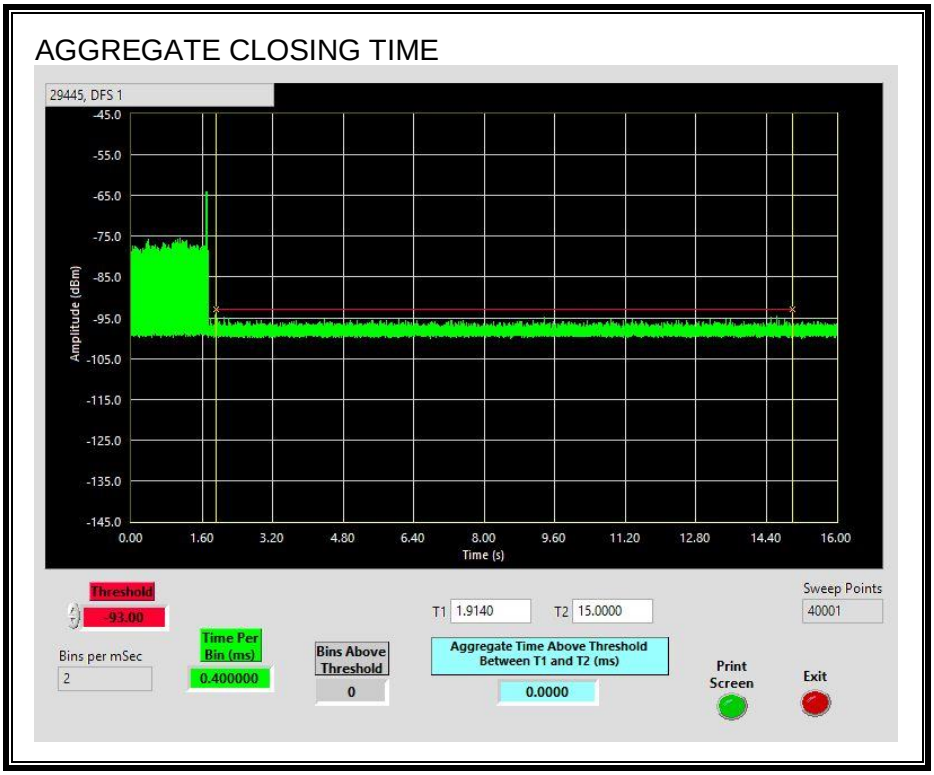
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

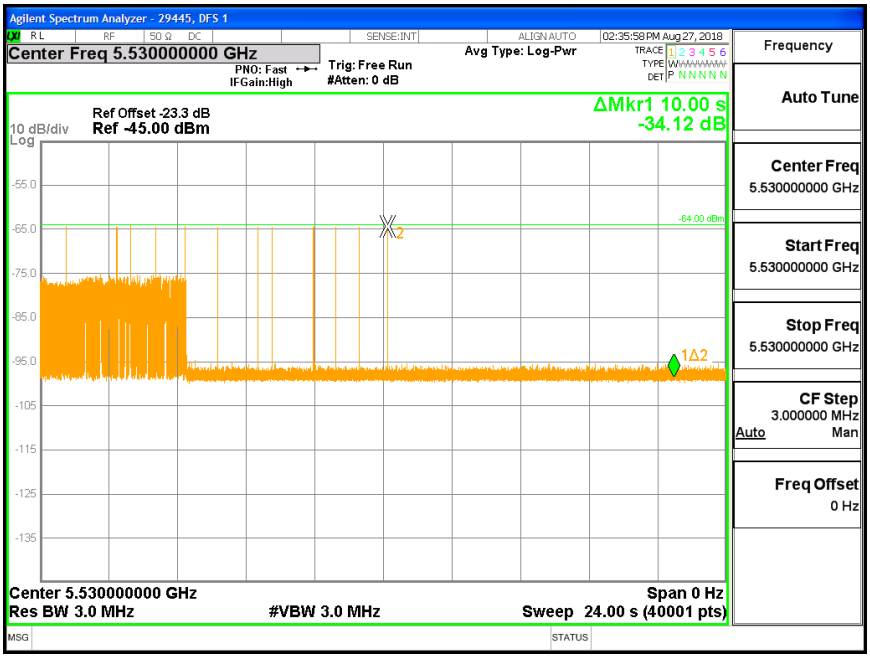
No transmissions are observed during the aggregate monitoring period.



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

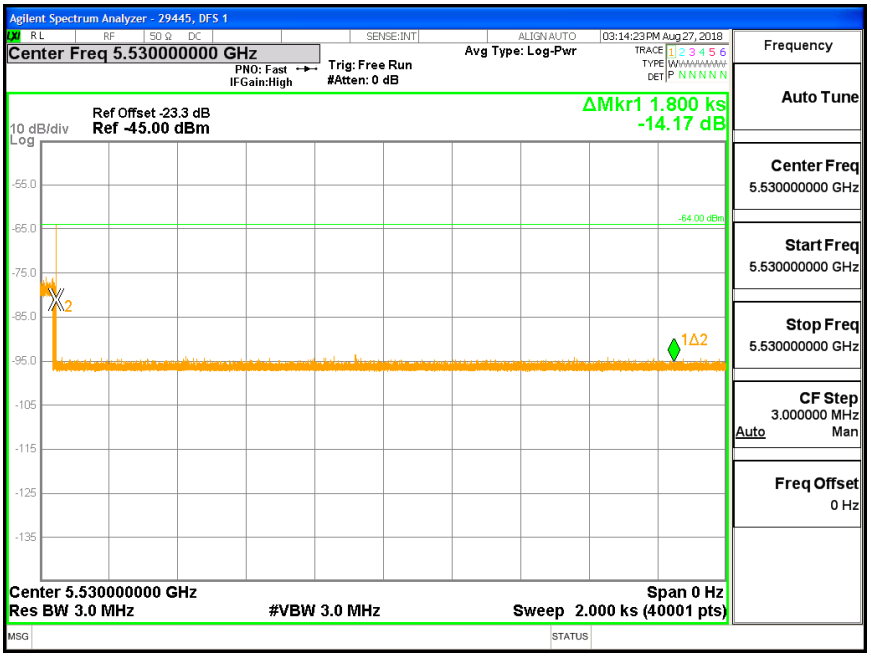


6.4.4. NON-OCCUPANCY PERIOD

RESULTS

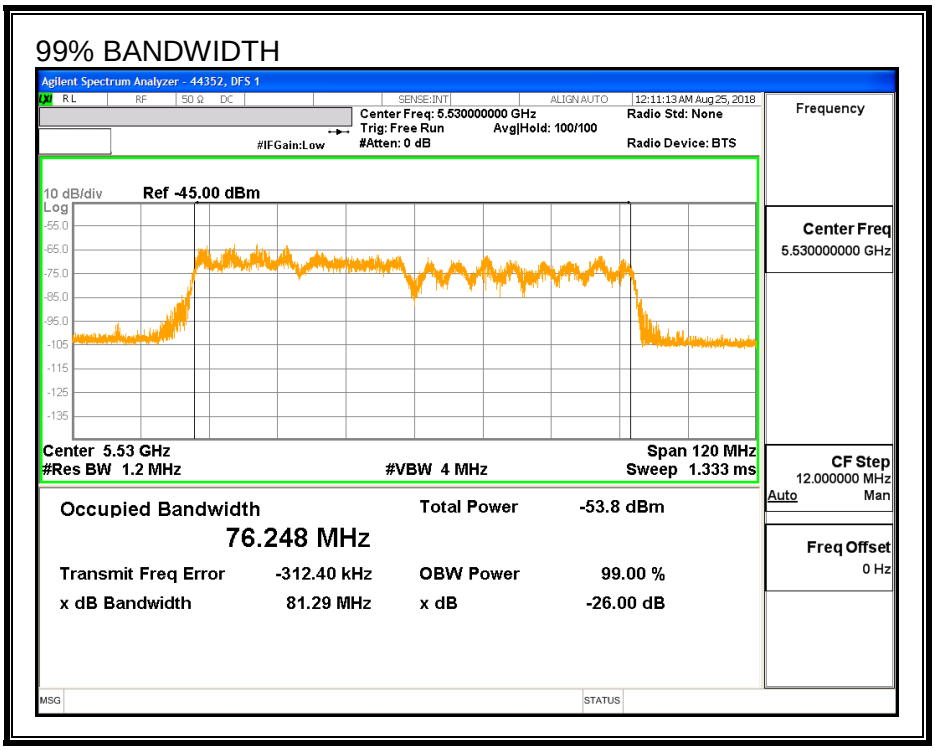
No EUT transmissions were observed on the test channel during the 30-minute observation time.

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	76.248	104.9	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	76.25	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5570	76.25	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	93.33	60	Pass	5490	5570	76.25	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	96.67	60	Pass	5490	5570	76.25	DFS 1	44352	Version 3.3.4
Aggregate		97.50	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	76.25	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	5541	Yes
1002	1	818	65	A	5560	Yes
1003	1	778	68	A	5496	Yes
1004	1	578	92	A	5524	Yes
1005	1	558	95	A	5533	Yes
1006	1	598	89	A	5527	Yes
1007	1	838	63	A	5499	Yes
1008	1	698	76	A	5543	Yes
1009	1	518	102	A	5561	Yes
1010	1	618	86	A	5493	Yes
1011	1	898	59	A	5515	Yes
1012	1	638	83	A	5534	Yes
1013	1	798	67	A	5561	Yes
1014	1	858	62	A	5545	Yes
1015	1	538	99	A	5493	Yes
1016	1	1302	41	B	5563	Yes
1017	1	2935	18	B	5511	Yes
1018	1	1149	46	B	5513	Yes
1019	1	1717	31	B	5543	Yes
1020	1	2608	21	B	5554	Yes
1021	1	758	70	B	5540	Yes
1022	1	584	91	B	5556	Yes
1023	1	1411	38	B	5495	Yes
1024	1	1367	39	B	5539	Yes
1025	1	1129	47	B	5500	Yes
1026	1	1214	44	B	5563	Yes
1027	1	1105	48	B	5555	Yes
1028	1	2673	20	B	5505	Yes
1029	1	1499	36	B	5561	Yes
1030	1	649	82	B	5539	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	4.8	203	25	5542	Yes
2002	3.4	217	24	5527	Yes
2003	2.8	181	27	5519	Yes
2004	1.9	198	24	5507	Yes
2005	1.4	209	28	5532	Yes
2006	2.6	230	24	5493	Yes
2007	4.6	165	29	5531	Yes
2008	4.1	152	26	5526	Yes
2009	2.1	172	24	5538	Yes
2010	1.8	163	28	5560	Yes
2011	4.2	230	23	5542	Yes
2012	2.2	226	24	5498	Yes
2013	2.8	215	23	5538	Yes
2014	1	177	25	5492	Yes
2015	1.9	171	24	5518	Yes
2016	4.4	180	23	5563	Yes
2017	3.5	178	26	5536	Yes
2018	4.3	191	25	5547	Yes
2019	1.5	155	25	5539	Yes
2020	4.7	172	28	5564	Yes
2021	4.2	183	25	5548	Yes
2022	1.3	205	29	5516	Yes
2023	3.3	220	26	5566	Yes
2024	2.8	208	27	5554	Yes
2025	4.9	227	29	5560	Yes
2026	4.6	219	26	5550	Yes
2027	2.9	204	24	5541	Yes
2028	5	200	29	5511	Yes
2029	1.5	189	28	5567	Yes
2030	3.8	151	23	5518	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	9.7	369	17	5498	Yes
3002	8.1	264	18	5564	Yes
3003	7.2	391	16	5526	Yes
3004	8	298	16	5530	Yes
3005	7.4	438	17	5498	Yes
3006	8.4	491	17	5528	Yes
3007	7.9	275	16	5568	Yes
3008	7.2	341	17	5564	Yes
3009	7	389	18	5559	Yes
3010	6.5	350	16	5567	Yes
3011	8.6	410	17	5567	Yes
3012	8.3	384	16	5538	Yes
3013	8.8	339	18	5526	Yes
3014	8.7	326	17	5502	Yes
3015	9.3	294	17	5524	Yes
3016	7.5	427	16	5563	Yes
3017	8.4	290	16	5540	No
3018	9	436	17	5541	Yes
3019	10	311	18	5557	Yes
3020	6.7	470	18	5505	Yes
3021	6.1	358	16	5524	Yes
3022	7.1	294	16	5493	Yes
3023	6.6	446	18	5498	Yes
3024	10	262	16	5495	Yes
3025	9.8	309	17	5526	Yes
3026	9.3	271	16	5545	No
3027	7.3	331	16	5512	Yes
3028	7	305	18	5569	Yes
3029	7.5	260	17	5513	Yes
3030	7.4	380	18	5546	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	15.6	348	12	5537	Yes
4002	11.6	348	16	5519	Yes
4003	13.5	462	16	5501	Yes
4004	14.8	356	12	5570	Yes
4005	17.2	483	14	5530	Yes
4006	18.9	391	14	5503	Yes
4007	17.5	412	16	5540	Yes
4008	19.6	466	16	5499	Yes
4009	18.7	367	14	5541	Yes
4010	17.1	316	16	5531	Yes
4011	16.6	481	12	5507	Yes
4012	15.4	442	15	5527	Yes
4013	11.2	251	16	5543	Yes
4014	15.3	359	14	5529	Yes
4015	11.5	431	13	5513	Yes
4016	16.1	301	14	5556	Yes
4017	12.7	269	13	5511	Yes
4018	17.8	402	14	5505	Yes
4019	19.7	382	14	5547	Yes
4020	11.9	277	13	5540	Yes
4021	14.3	404	13	5544	Yes
4022	16	444	12	5567	Yes
4023	14.6	333	15	5549	Yes
4024	16.8	386	14	5517	Yes
4025	15.8	288	15	5549	No
4026	14.2	487	15	5561	Yes
4027	13.7	401	16	5535	Yes
4028	12.6	363	13	5502	Yes
4029	17.4	305	14	5569	Yes
4030	12.4	279	15	5531	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5530	Yes
2	5530	Yes
3	5530	Yes
4	5530	Yes
5	5530	Yes
6	5530	Yes
7	5530	Yes
8	5530	Yes
9	5530	Yes
10	5530	Yes
11	5495	Yes
12	5495	Yes
13	5495	Yes
14	5495	Yes
15	5495	Yes
16	5496	Yes
17	5497	Yes
18	5496	Yes
19	5497	Yes
20	5496	Yes
21	5563	Yes
22	5564	Yes
23	5563	Yes
24	5564	Yes
25	5563	Yes
26	5564	Yes
27	5563	Yes
28	5564	Yes
29	5563	Yes
30	5564	Yes

Note: The Type 5 randomized parameters tested are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop
NTIA August 2005 Hopping Sequence

Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	11	5490	19	Yes
2	486	5491	16	Yes
3	961	5492	17	Yes
4	1436	5493	17	Yes
5	1911	5494	21	Yes
6	2386	5495	21	Yes
7	2861	5496	17	Yes
8	3336	5497	22	Yes
9	3811	5498	23	Yes
10	4286	5499	16	Yes
11	4761	5500	20	Yes
12	5236	5501	15	Yes
13	5711	5502	15	Yes
14	6186	5503	21	Yes
15	6661	5504	12	Yes
16	7136	5505	20	Yes
17	7611	5506	16	Yes
18	8086	5507	16	Yes
19	8561	5508	11	Yes
20	9036	5509	11	Yes
21	9511	5510	12	Yes
22	9986	5511	18	Yes
23	10461	5512	13	Yes
24	10936	5513	18	Yes
25	11411	5514	18	Yes
26	11886	5515	16	Yes
27	12361	5516	12	Yes
28	12836	5517	13	Yes
29	13311	5518	21	Yes
30	13786	5519	12	Yes
31	14261	5520	16	Yes
32	14736	5521	21	Yes
33	15211	5522	17	Yes
34	15686	5523	21	Yes
35	16161	5524	13	Yes
36	16636	5525	15	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

37	17111	5526	24	Yes
38	17586	5527	16	Yes
39	18061	5528	18	Yes
40	18536	5529	18	Yes
41	19011	5530	14	Yes
42	19486	5531	17	Yes
43	19961	5532	14	Yes
44	20436	5533	14	Yes
45	20911	5534	19	Yes
46	21386	5535	14	Yes
47	21861	5536	16	Yes
48	22336	5537	13	Yes
49	22811	5538	10	Yes
50	23286	5539	22	Yes
51	23761	5540	20	Yes
52	24236	5541	16	Yes
53	24711	5542	16	Yes
54	25186	5543	17	Yes
55	25661	5544	15	Yes
56	26136	5545	21	Yes
57	26611	5546	16	Yes
58	27086	5547	19	Yes
59	27561	5548	19	Yes
60	28036	5549	15	Yes
61	28511	5550	20	Yes
62	28986	5551	19	Yes
63	29461	5552	17	Yes
64	29936	5553	16	Yes
65	30411	5554	15	Yes
66	30886	5555	17	Yes
67	31361	5556	21	Yes
68	31836	5557	15	Yes
69	32311	5558	17	Yes
70	32786	5559	19	Yes
71	33261	5560	19	Yes
72	33736	5561	21	Yes
73	34211	5562	20	Yes
74	34686	5563	12	Yes
75	35161	5564	13	Yes
76	35636	5565	14	Yes
77	36111	5566	15	Yes
78	36586	5567	11	Yes
79	37061	5568	19	Yes
80	37536	5569	19	Yes
81	38011	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.