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

CERTIFICATION TEST REPORT

FOR

ACCESS POINT

MODEL NUMBER: MR45-HW

FCC ID: UDX-60079010
IC: 6961A-60079010

REPORT NUMBER: 12659283-E1V2

ISSUE DATE: MARCH 27, 2019

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

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	03/13/19	Initial Issue	Conan Cheung
V2	03/27/19	Section 6.1.5, 6.3.6, 6.3.7, 6.4.8 updated.	Henry Lau

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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: ACCESS POINT

MODEL: MR45-HW

SERIAL NUMBER: Q3AA-V9U3-W3G5

DATE TESTED: MARCH 06, 2019 & MARCH 27, 2019

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
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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 Bureau Veritas Consumer Products Services report number RF180704E03D-1.

4. FACILITIES AND ACCREDITATION

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

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

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

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

5.3. 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

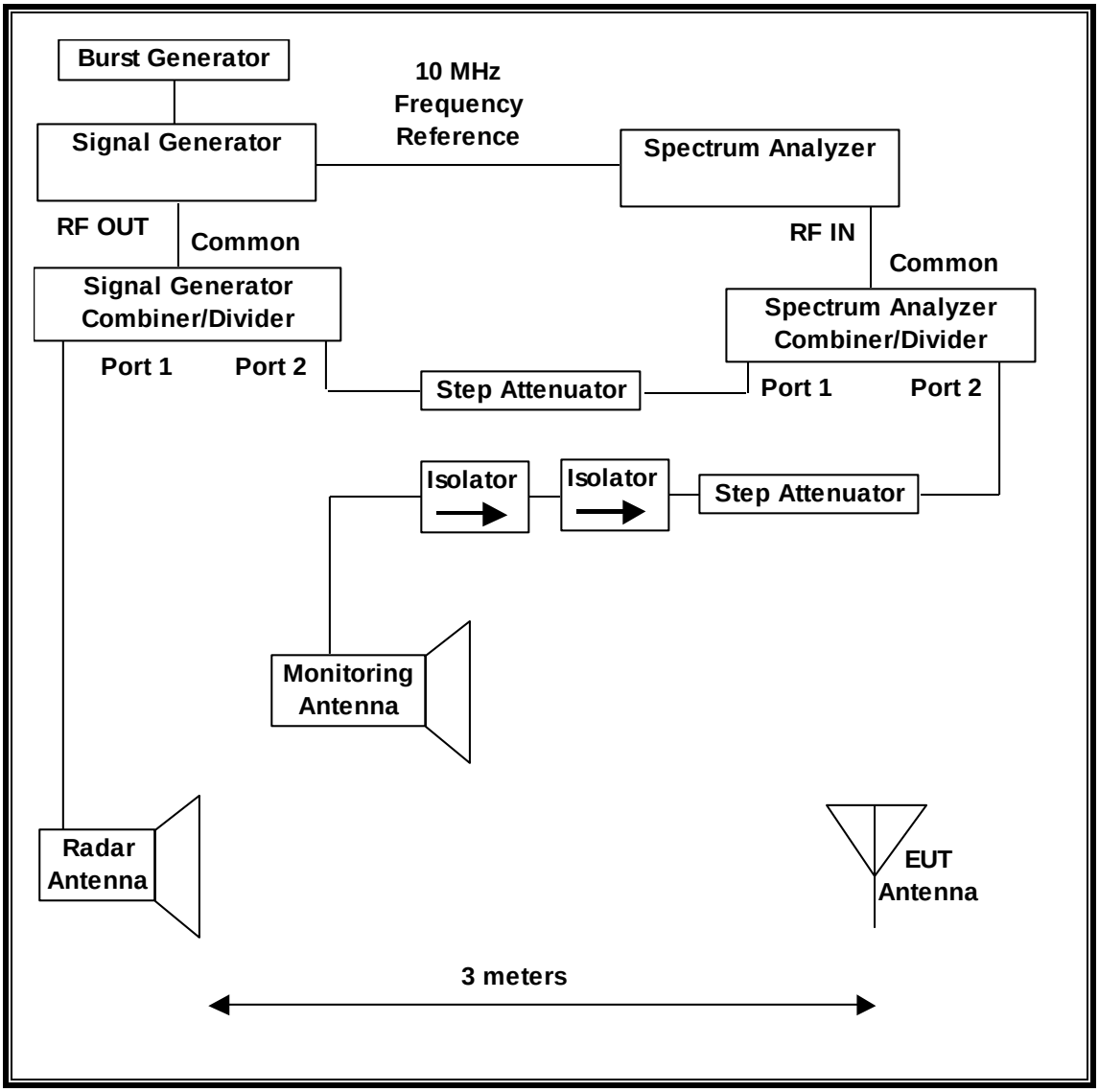
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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. Iperf is utilized to generate WLAN traffic that meets or exceed the minimum loading requirement. 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	01/24/20
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	T1633	02/08/20
Arbitrary Waveform Generator	Agilent / HP	33220A	T190	01/31/20

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

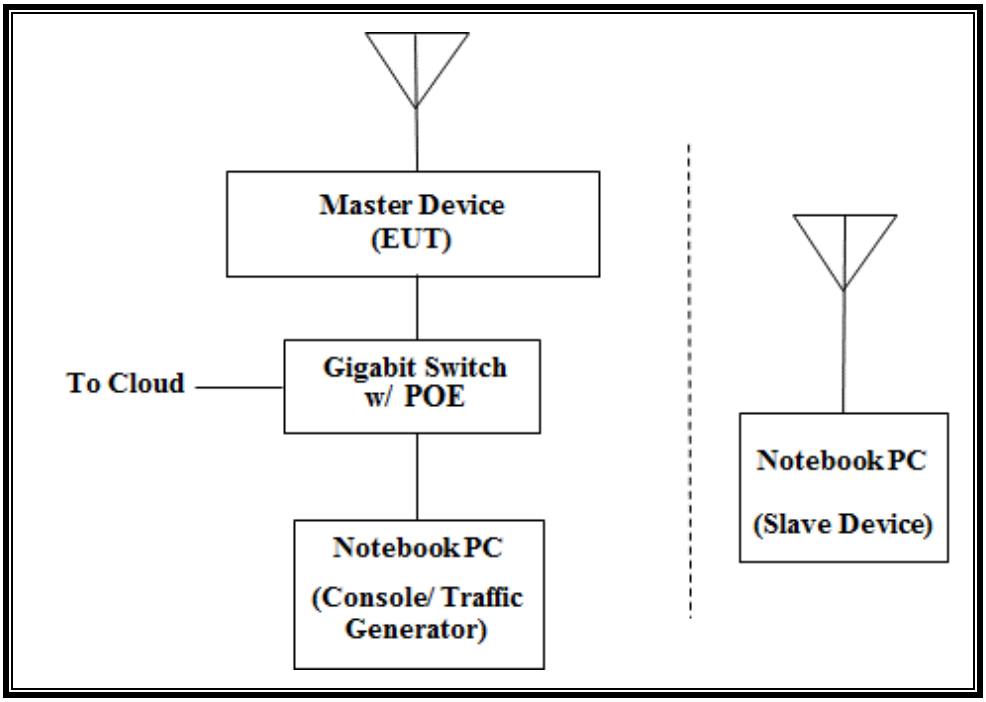
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	Value
Temperature	24.2 °C
Humidity	40 %

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)	Lenovo	TYPE 20F6-005HUS	PC-0D9Y3U 16/06	DoC
AC Adapter (Controller PC & Traffic Generator)	Lenovo	ADLX45NDC2A	8SSA10E75790D1SG7 6K04T5	DoC
Notebook PC (Slave Device)	Lenovo	TYPE 20CM-0046US	PC-082D5Y 15/10	PD97265NGU
AC Adapter (Slave PC)	Lenovo	ADLX45DLC2A	8SSA10E75792L1CZ73 D0N4C	DoC
Gigabit Switch	Meraki	MS220-8P	Q2HP-DR3G-TQZS	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 29.89 dBm EIRP in the 5250-5350 MHz band and 29.99 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 5.23 dBi in the 5250-5350 MHz band and 5.44 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 3.72 dBi in the 5250-5350 MHz band and 4.43 dBi in the 5470-5725 MHz band.

Four 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 Four transmitter/receiver chains and one receive only chain, each connected to an antenna to perform radiated tests.

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

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

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

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

The software installed in the EUT is firmware_axe_version T-201903052123-G2b2dfdd5-L630f066d-samrat-brook.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Cisco Meraki Access Point, FCC ID: UDX-60079010. The minimum antenna gain for the Master Device is 3.72 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.

The software installed in the EUT is firmware_axe_version T-201903052123-G2b2dfdd5-L630f066d-samrat-brook.

6.2. RESULTS FOR 20 MHz BANDWIDTH

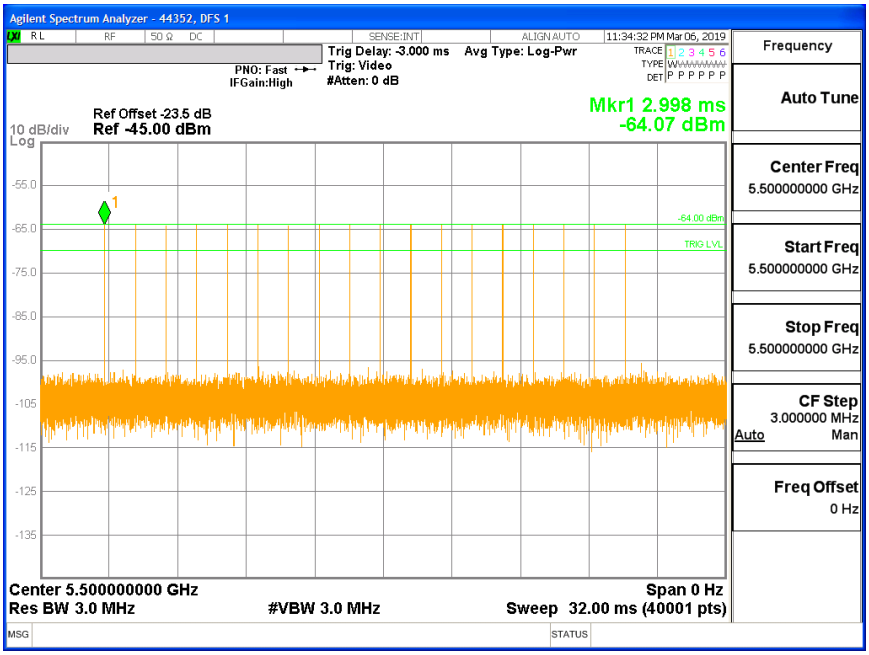
6.2.1. TEST CHANNEL

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

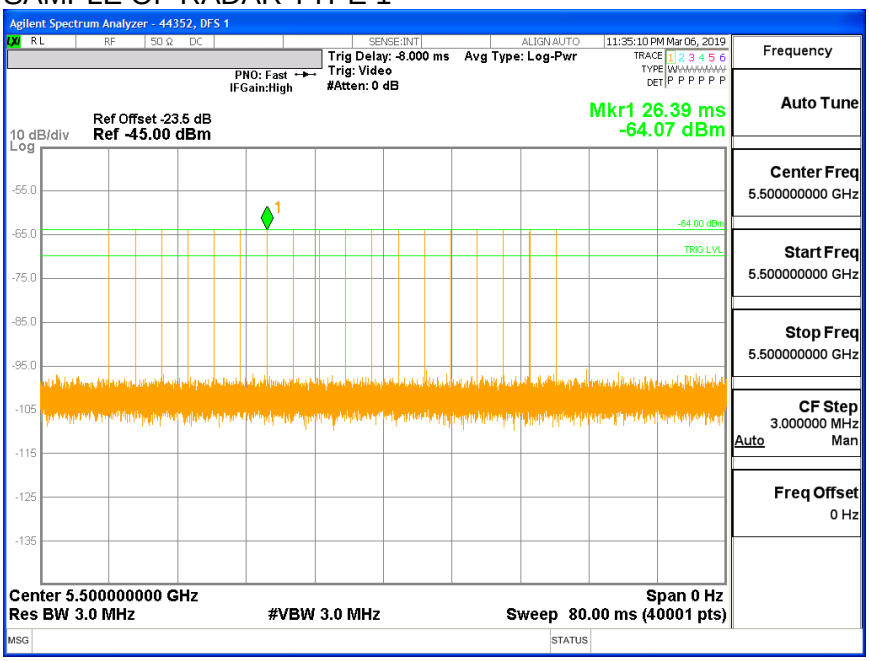
6.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

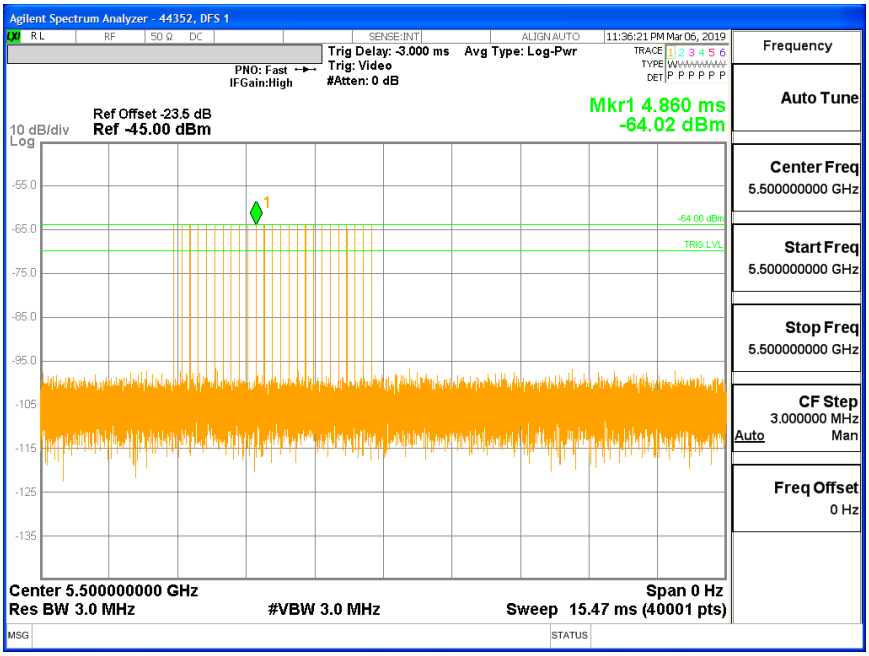
SHORT PULSE RADAR TYPE 0



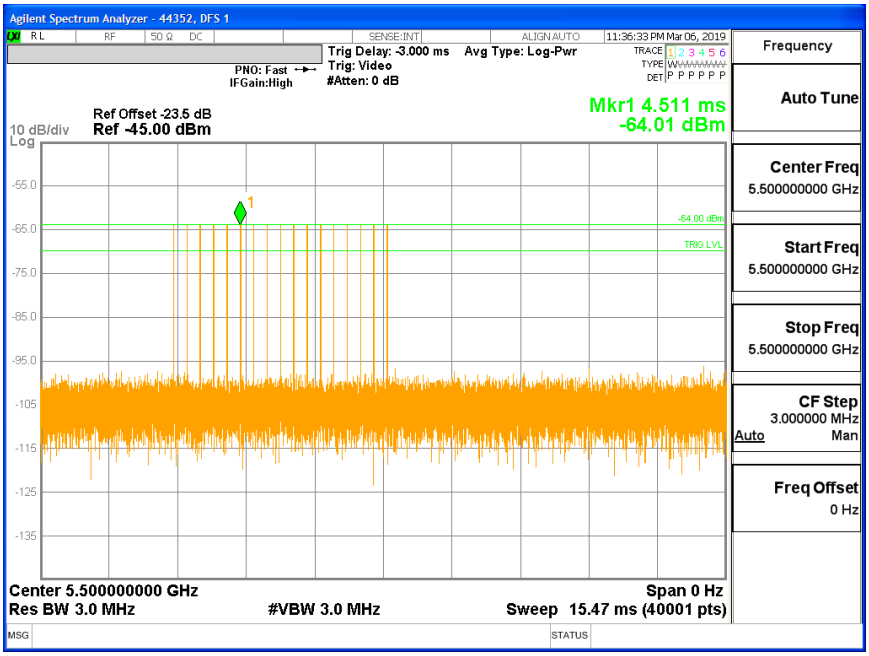
SAMPLE OF RADAR TYPE 1



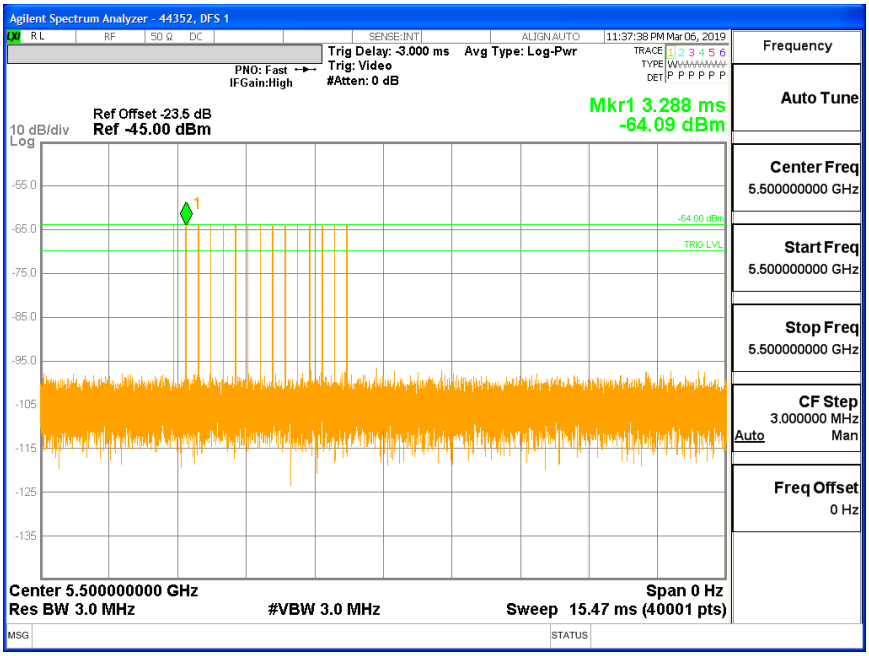
SAMPLE OF RADAR TYPE 2



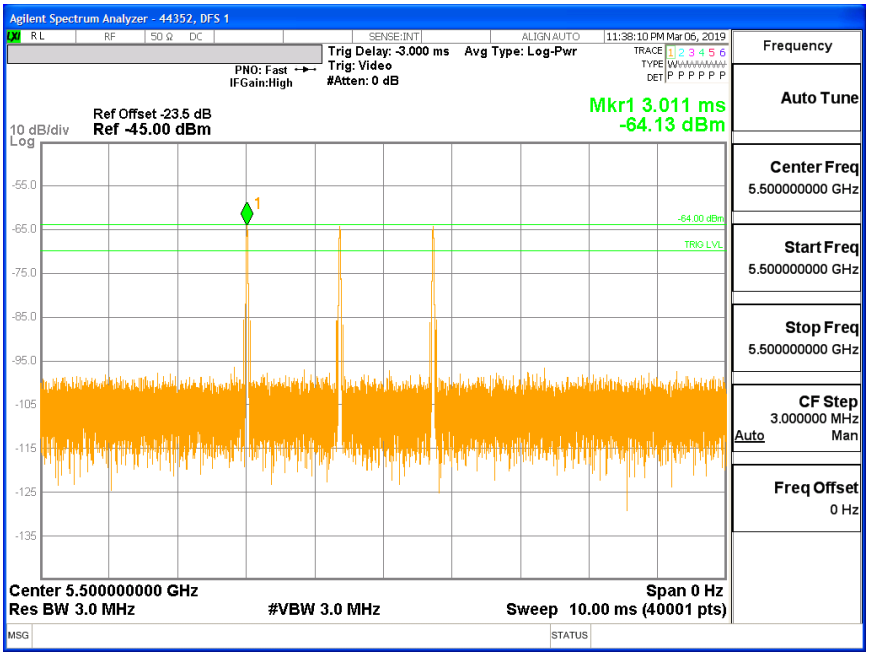
SAMPLE OF RADAR TYPE 3



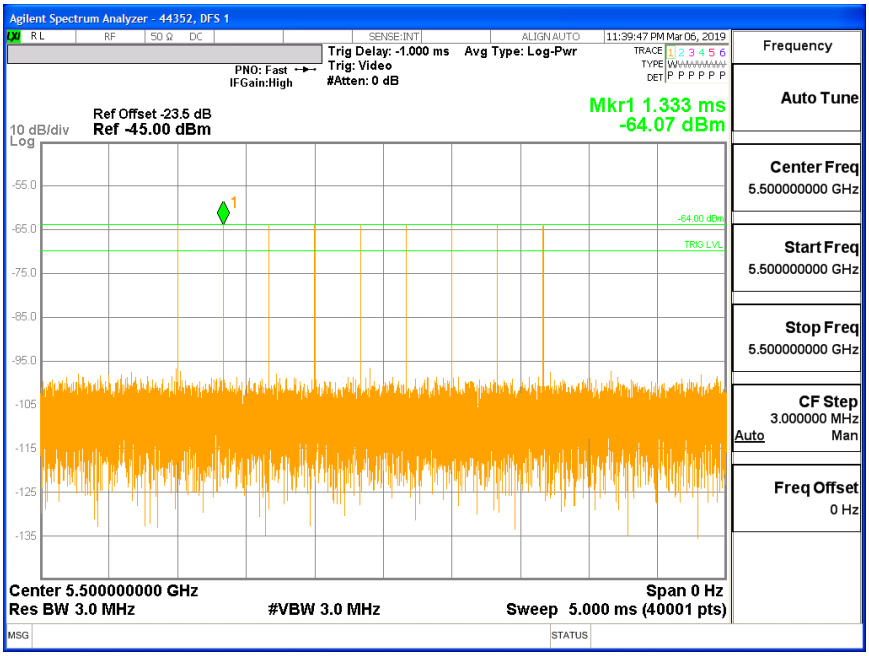
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

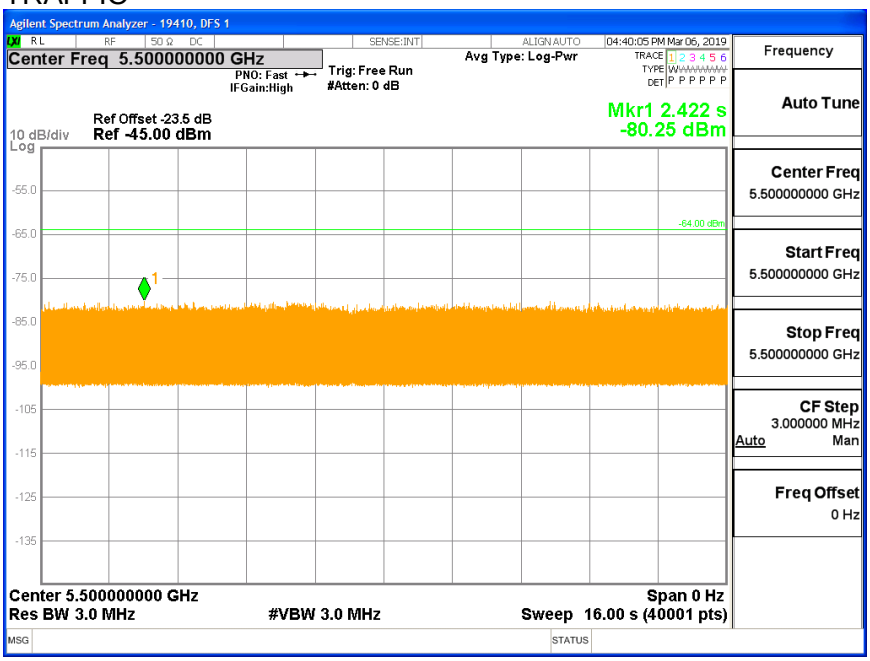


SINGLE BURST OF RADAR TYPE 6

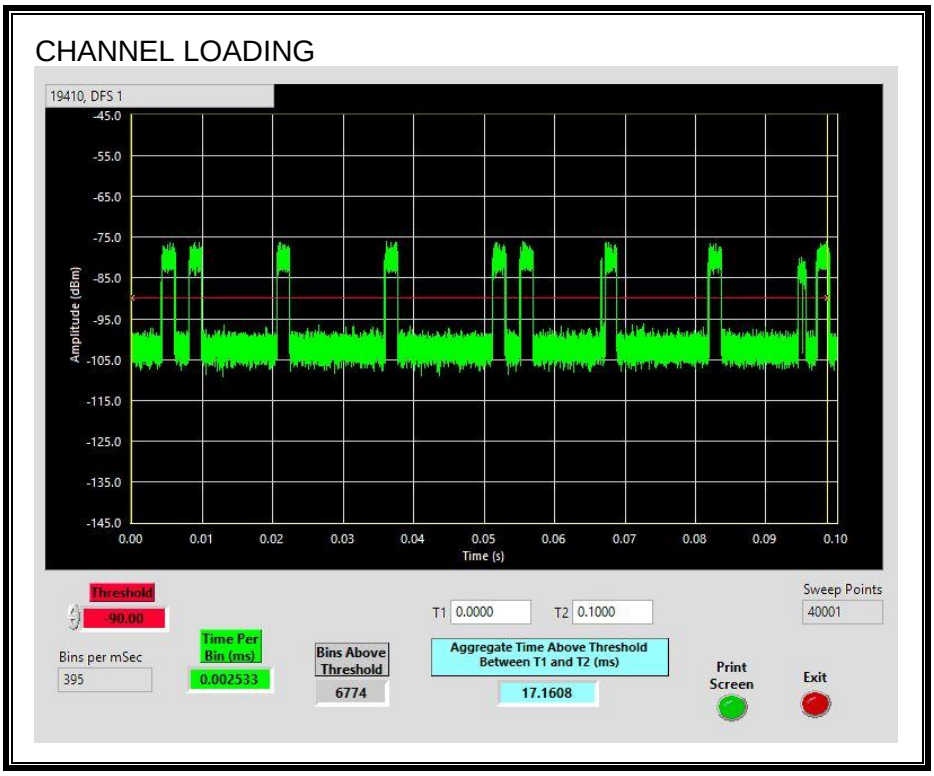


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.16%

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)
30.24	178.2	148.0	88.0

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)
30.32	119.3	89.0	1.0

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.45	176.7	146.3	58.3

QUALITATIVE RESULTS

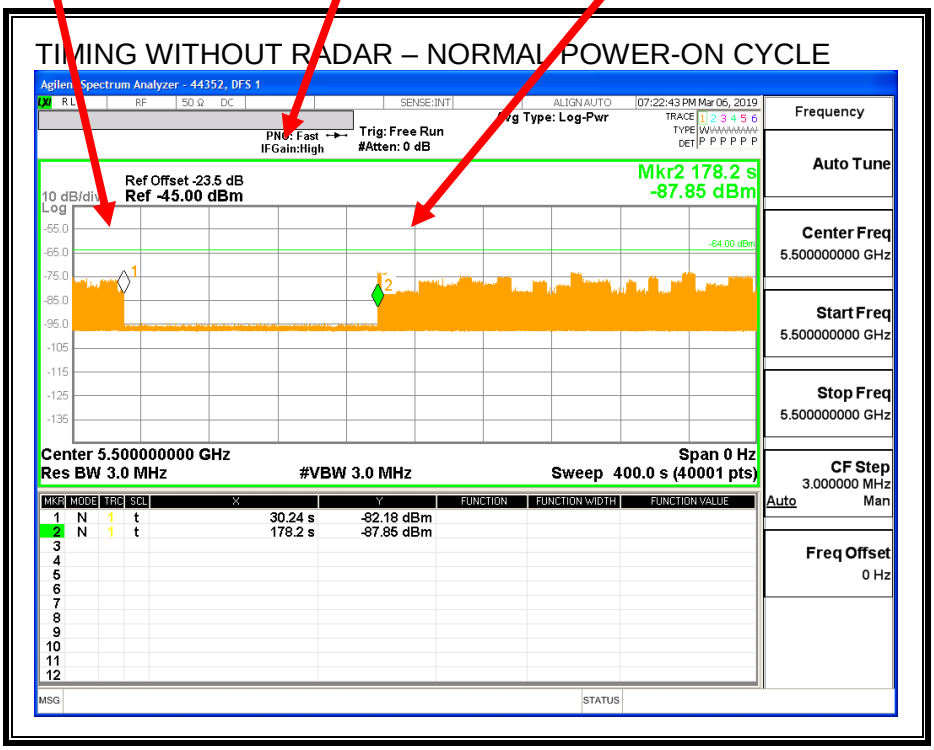
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

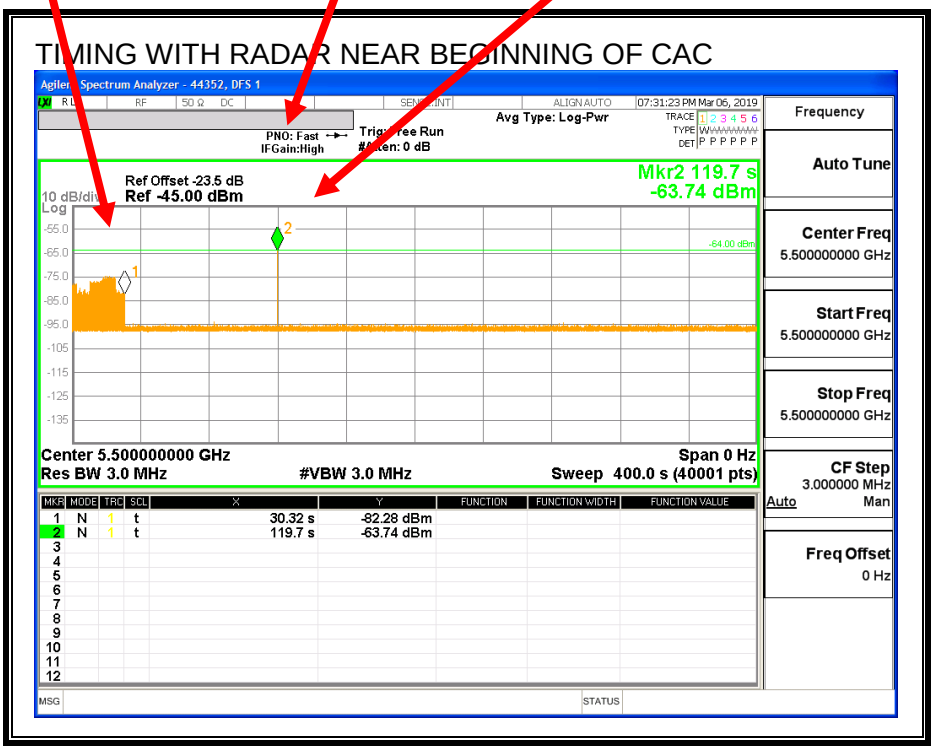
End of CAC
Traffic is Initiated



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



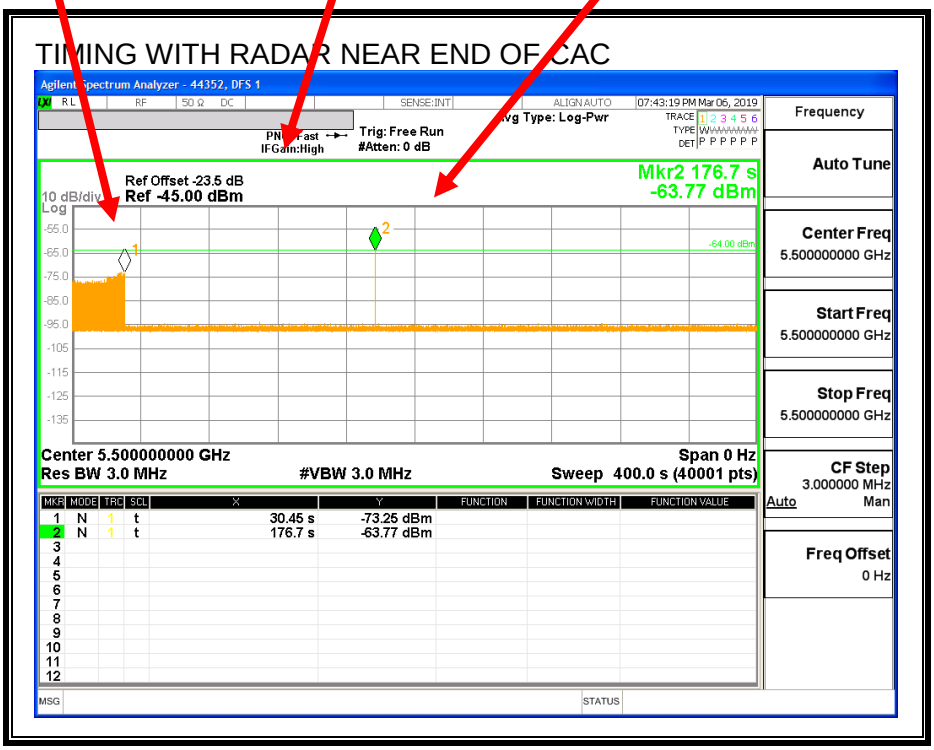
No EUT transmissions were observed after the radar signal.

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.

These tests are not applicable.

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).

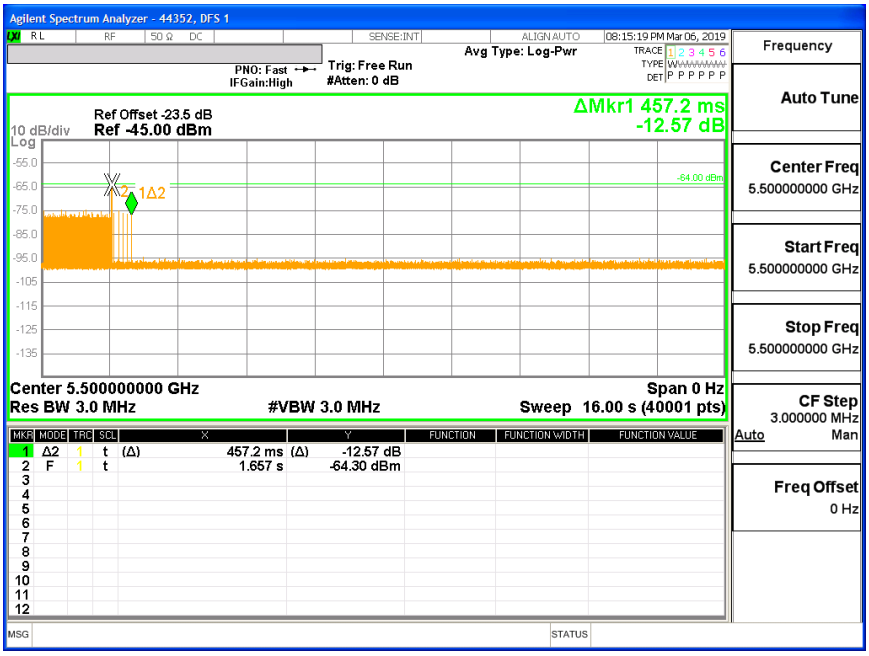
RESULTS

Channel Move Time (sec)	Limit (sec)
0.457	10

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

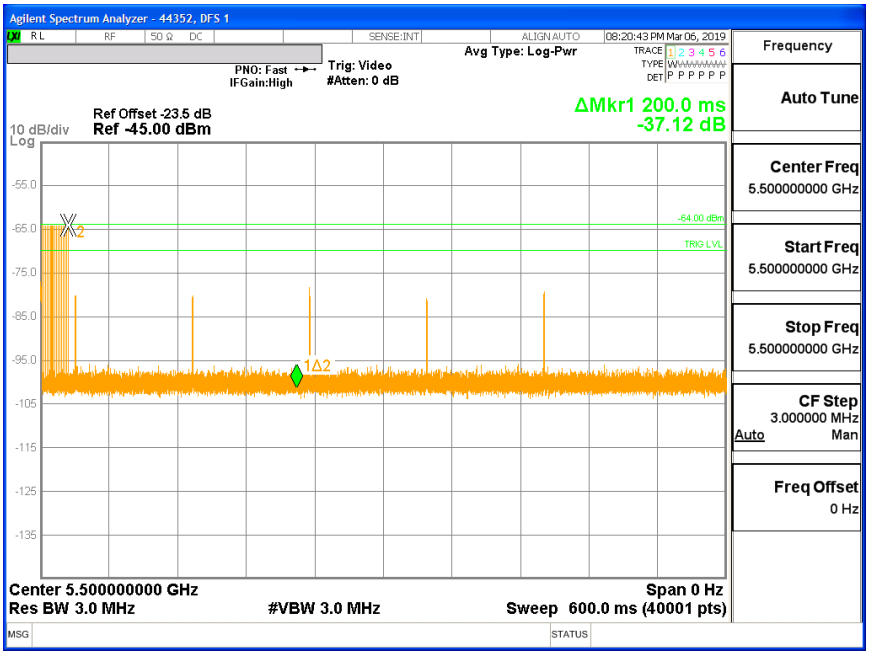
MOVE TIME

MOVE TIME



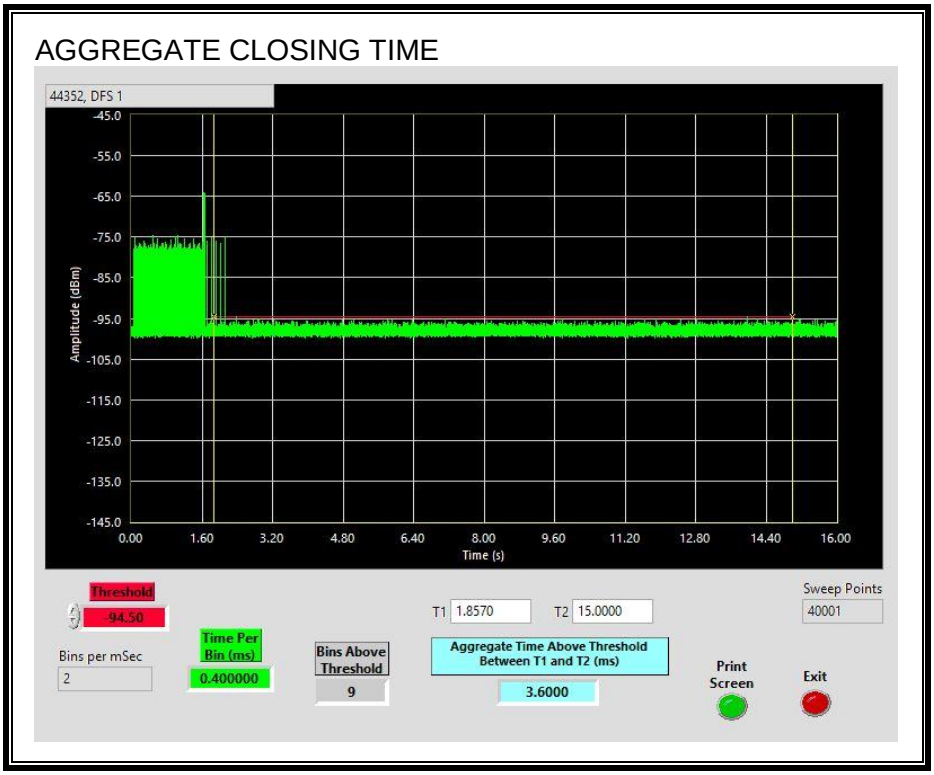
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

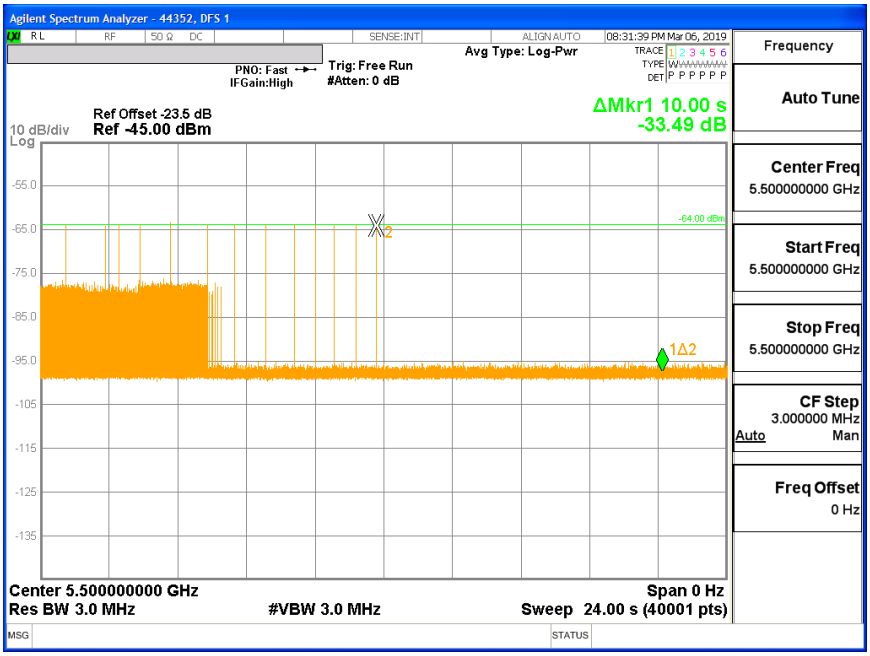
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

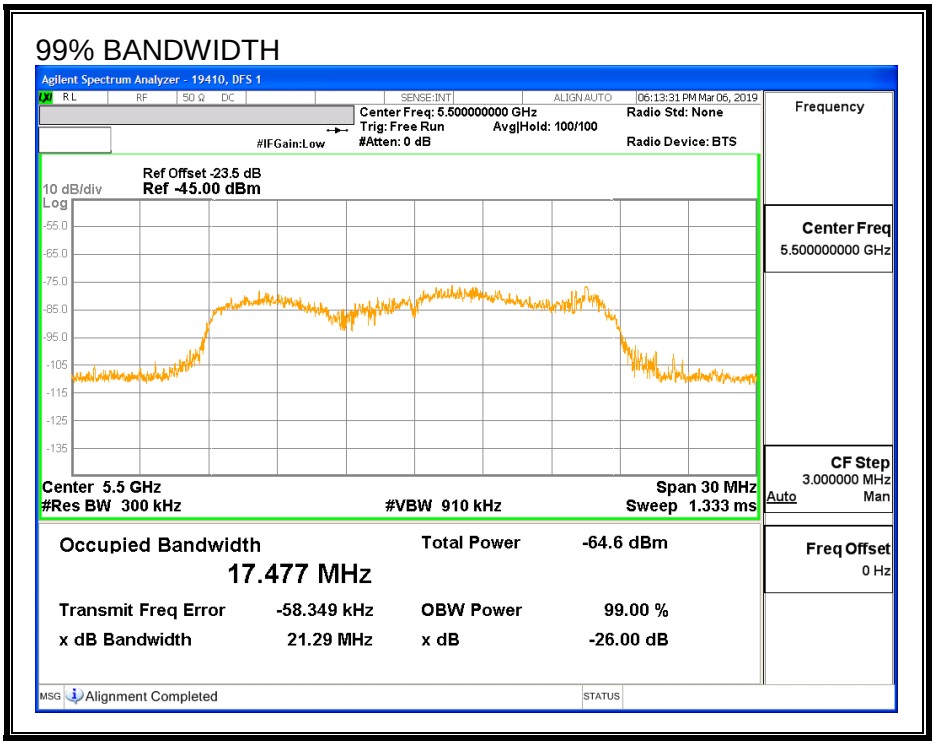
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



6.2.6. 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	17.477	114.4	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	93.33	60	Pass	5490	5510	17.48	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 2	30	90.00	60	Pass	5490	5510	17.48	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 3	30	93.33	60	Pass	5490	5510	17.48	DFS 1	44352	Version 3.3.4
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5510	17.48	DFS 1	44352	Version 3.3.4
Aggregate		90.83	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	17.48	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	5491	Yes
1002	1	938	57	A	5509	Yes
1003	1	658	81	A	5498	Yes
1004	1	778	68	A	5498	Yes
1005	1	758	70	A	5509	Yes
1006	1	898	59	A	5506	Yes
1007	1	678	78	A	5491	Yes
1008	1	838	63	A	5494	Yes
1009	1	638	83	A	5502	Yes
1010	1	918	58	A	5497	Yes
1011	1	578	92	A	5507	Yes
1012	1	698	76	A	5506	Yes
1013	1	538	99	A	5508	Yes
1014	1	598	89	A	5510	Yes
1015	1	718	74	A	5495	No
1016	1	1649	33	B	5505	Yes
1017	1	1410	38	B	5499	Yes
1018	1	1495	36	B	5496	Yes
1019	1	1387	39	B	5504	Yes
1020	1	2955	18	B	5500	Yes
1021	1	2976	18	B	5503	Yes
1022	1	931	57	B	5498	Yes
1023	1	1081	49	B	5504	No
1024	1	1713	31	B	5500	Yes
1025	1	798	67	B	5497	Yes
1026	1	1560	34	B	5496	Yes
1027	1	2128	25	B	5493	Yes
1028	1	3020	18	B	5506	Yes
1029	1	1169	46	B	5498	Yes
1030	1	995	54	B	5500	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.9	186	25	5500	Yes
2002	2.6	178	29	5497	Yes
2003	3	163	28	5493	Yes
2004	2.9	202	29	5505	No
2005	3.6	192	24	5503	Yes
2006	1.8	192	23	5506	Yes
2007	2.6	228	29	5502	Yes
2008	3.2	195	24	5496	No
2009	4.3	154	27	5497	Yes
2010	1	206	27	5493	Yes
2011	4.4	213	23	5506	Yes
2012	1.3	230	23	5505	Yes
2013	5	198	27	5500	Yes
2014	4.2	181	23	5505	Yes
2015	4	154	24	5508	Yes
2016	3.5	222	28	5508	Yes
2017	1.6	161	23	5493	Yes
2018	3.4	195	27	5500	Yes
2019	1.7	219	26	5505	Yes
2020	3.8	177	27	5495	Yes
2021	2.3	166	26	5497	No
2022	4.6	209	28	5507	Yes
2023	1.3	203	27	5500	Yes
2024	1.9	169	26	5492	Yes
2025	3	210	25	5497	Yes
2026	3.8	223	24	5494	Yes
2027	3.1	187	28	5494	Yes
2028	4.1	204	27	5495	Yes
2029	3.7	210	25	5495	Yes
2030	4.9	194	24	5502	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	301	17	5504	Yes
3002	9.1	262	18	5510	Yes
3003	7.2	455	16	5495	Yes
3004	9.1	430	16	5497	Yes
3005	7.3	251	17	5502	Yes
3006	9.4	372	18	5495	Yes
3007	7.9	339	17	5498	Yes
3008	6.1	473	18	5507	Yes
3009	9.1	453	18	5504	Yes
3010	7.5	348	17	5507	Yes
3011	8.6	475	17	5497	Yes
3012	9.4	264	17	5492	Yes
3013	8.8	404	18	5499	Yes
3014	9.7	457	18	5495	Yes
3015	9.3	359	18	5499	Yes
3016	8.6	307	18	5491	Yes
3017	6.4	355	16	5498	Yes
3018	10	434	17	5504	No
3019	10	376	18	5499	Yes
3020	7.8	350	16	5510	Yes
3021	6.1	423	16	5504	Yes
3022	8.1	292	17	5498	Yes
3023	6.6	260	16	5500	Yes
3024	7	393	17	5509	Yes
3025	7.8	374	17	5501	Yes
3026	6.2	268	16	5500	Yes
3027	9.5	395	16	5494	Yes
3028	8.1	436	16	5497	Yes
3029	7.5	324	17	5498	No
3030	8.4	378	16	5497	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	11.3	279	15	5496	Yes
4002	13.9	479	12	5497	Yes
4003	18.3	275	15	5496	Yes
4004	17.1	488	13	5492	No
4005	12.8	297	14	5497	Yes
4006	12.1	271	15	5498	Yes
4007	17.4	477	16	5492	Yes
4008	12.9	464	12	5508	Yes
4009	14.4	432	16	5504	Yes
4010	19.4	314	13	5498	Yes
4011	12.3	294	12	5508	No
4012	17.8	322	16	5504	Yes
4013	15.9	316	16	5505	Yes
4014	12.8	357	15	5491	No
4015	11.4	496	13	5494	Yes
4016	18.4	299	15	5504	Yes
4017	17.5	333	13	5492	Yes
4018	11	399	16	5509	Yes
4019	15.4	447	14	5493	Yes
4020	14.2	408	12	5497	Yes
4021	19	468	15	5497	Yes
4022	18.3	442	13	5490	No
4023	14.5	397	15	5501	Yes
4024	19.1	384	16	5503	Yes
4025	11.5	352	15	5495	Yes
4026	16.5	485	16	5504	Yes
4027	18.5	466	16	5499	Yes
4028	14.9	494	15	5495	Yes
4029	13	487	12	5508	Yes
4030	14.8	277	16	5502	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	5498	Yes
12	5499	Yes
13	5498	Yes
14	5499	Yes
15	5498	Yes
16	5499	Yes
17	5495	Yes
18	5495	Yes
19	5500	Yes
20	5496	Yes
21	5506	Yes
22	5502	Yes
23	5502	Yes
24	5505	Yes
25	5500	Yes
26	5503	Yes
27	5502	Yes
28	5506	Yes
29	5500	Yes
30	5504	Yes

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

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	**Starting Index Within Sequence**	**Signal Generator Frequency (MHz)**	**Hops within Detection BW**	**Successful Detection (Yes/No)**
1	243	5490	5	Yes
2	718	5491	4	Yes
3	1193	5492	3	Yes
4	1668	5493	2	Yes
5	2143	5494	7	Yes
6	3093	5495	6	Yes
7	3568	5496	3	Yes
8	4043	5497	2	Yes
9	4518	5498	6	Yes
10	4993	5499	3	Yes
11	5468	5500	7	Yes
12	5943	5501	1	Yes
13	6418	5502	3	Yes
14	6893	5503	5	Yes
15	7368	5504	4	Yes
16	7843	5505	4	Yes
17	8318	5506	3	Yes
18	8793	5507	1	Yes
19	9268	5508	3	Yes
20	9743	5509	3	Yes
21	10218	5510	4	Yes
22	10693	5490	5	Yes
23	11168	5491	3	Yes
24	11643	5492	4	Yes
25	12118	5493	1	Yes
26	12593	5494	3	Yes
27	13068	5495	5	Yes
28	13543	5496	2	Yes
29	14018	5497	4	Yes
30	14493	5498	6	Yes
31	14968	5499	3	Yes
32	15443	5500	5	Yes
33	15918	5501	5	Yes
34	16393	5502	3	Yes
35	16868	5503	3	Yes
36	17343	5504	4	Yes
37	17818	5505	3	Yes
38	18293	5506	4	Yes
39	18768	5507	2	Yes
40	19243	5508	4	Yes
41	19718	5509	4	Yes
42	20193	5510	4	Yes

6.3. RESULTS FOR 40 MHz BANDWIDTH

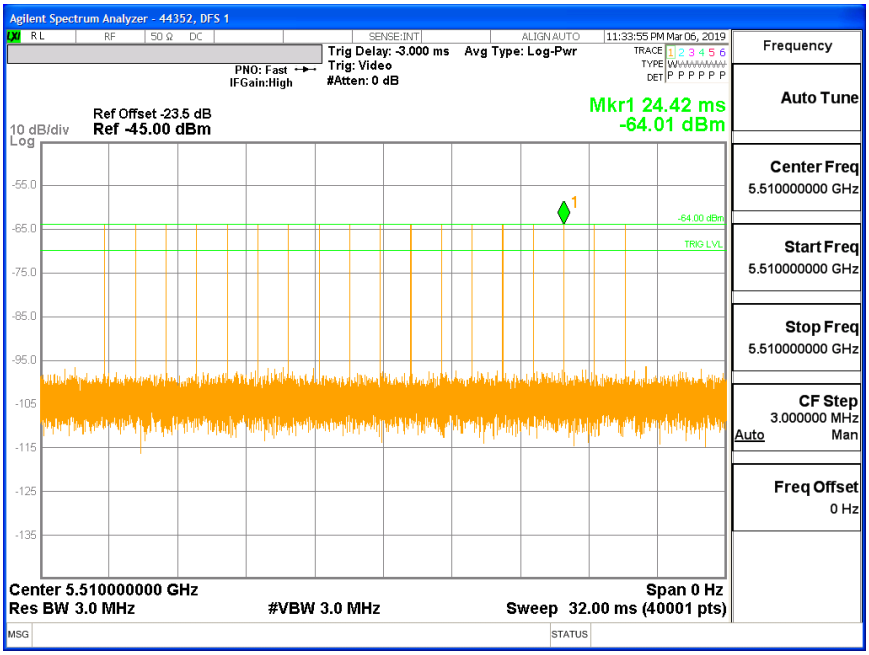
6.3.1. TEST CHANNEL

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

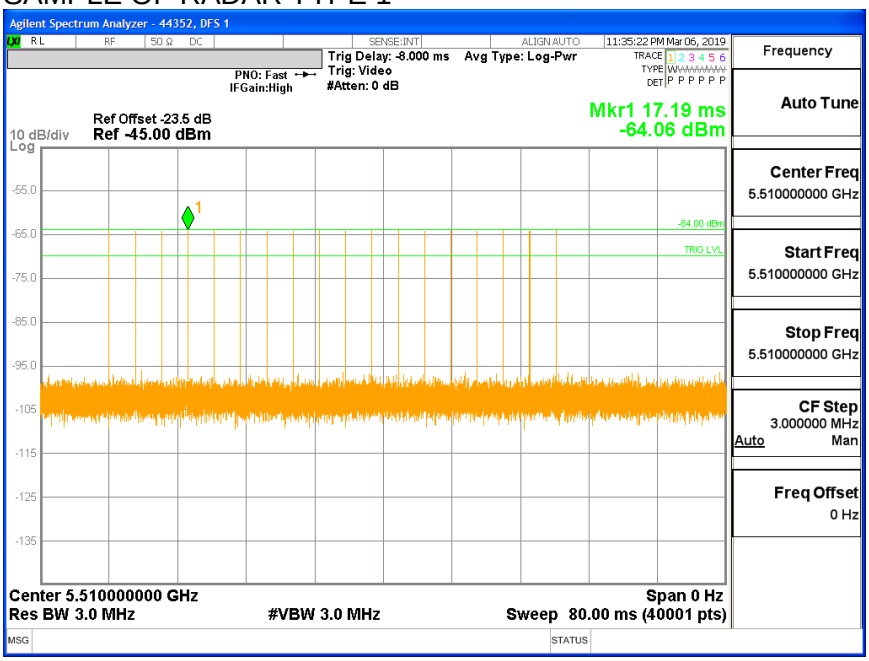
6.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

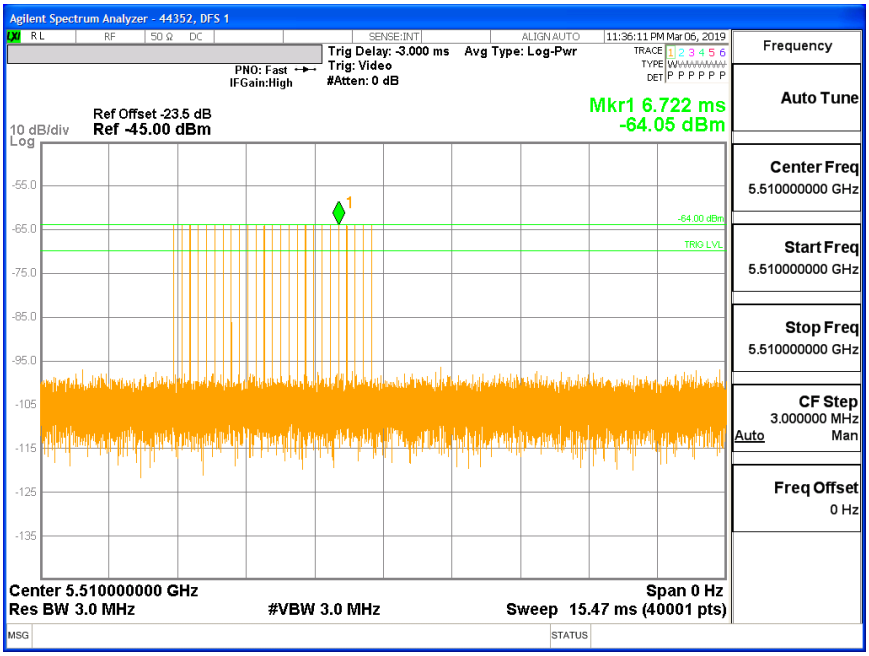
SHORT PULSE RADAR TYPE 0



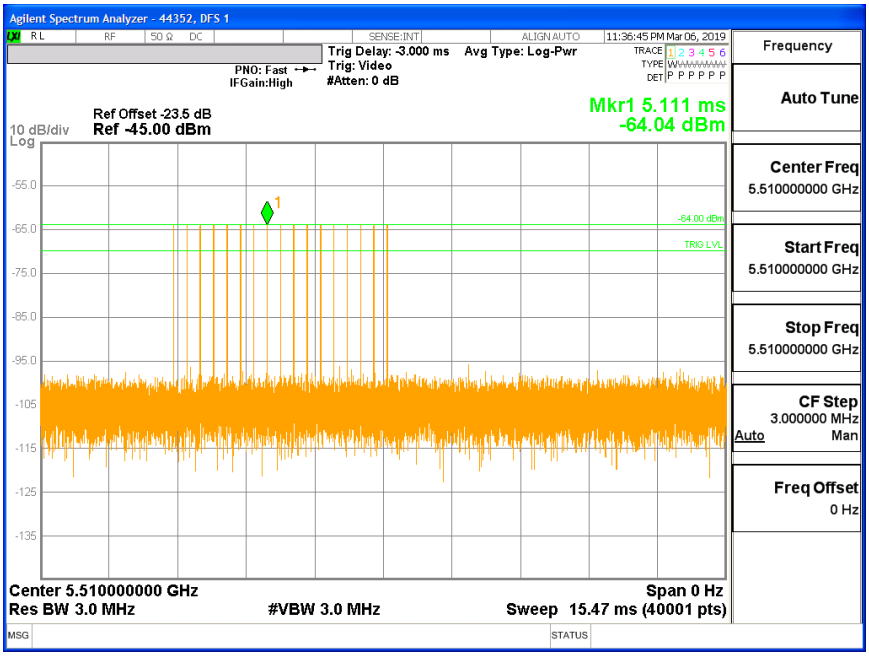
SAMPLE OF RADAR TYPE 1



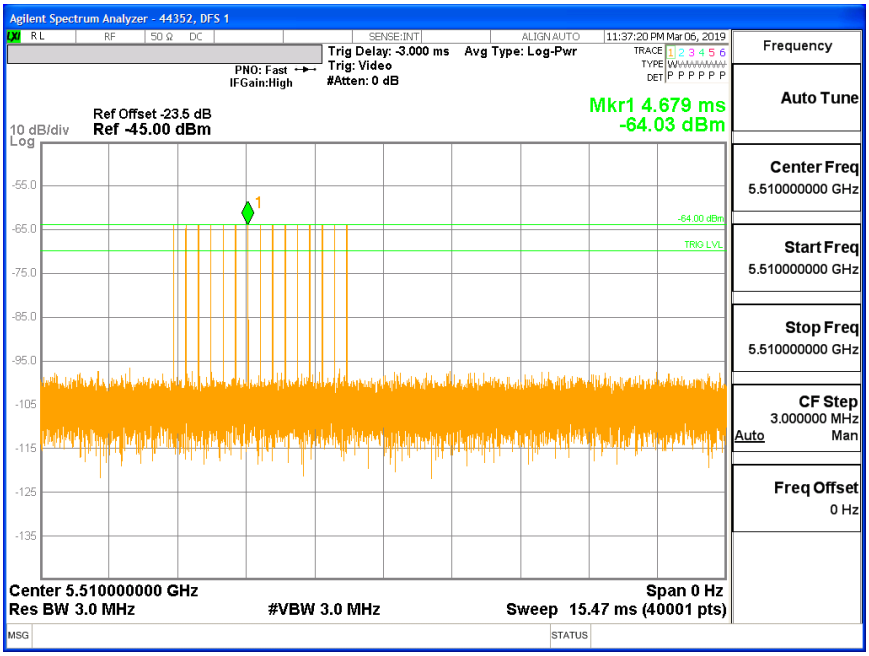
SAMPLE OF RADAR TYPE 2



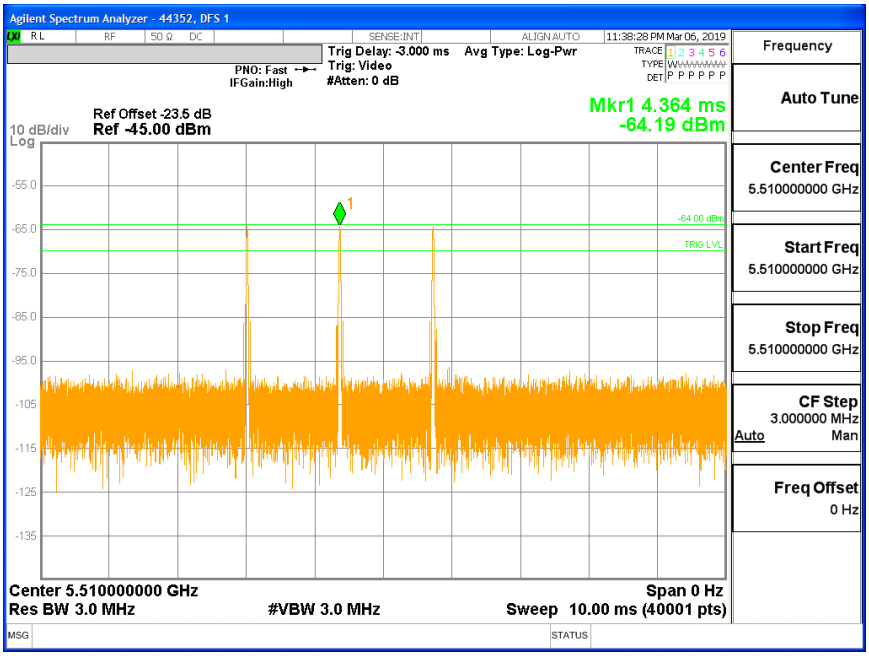
SAMPLE OF RADAR TYPE 3



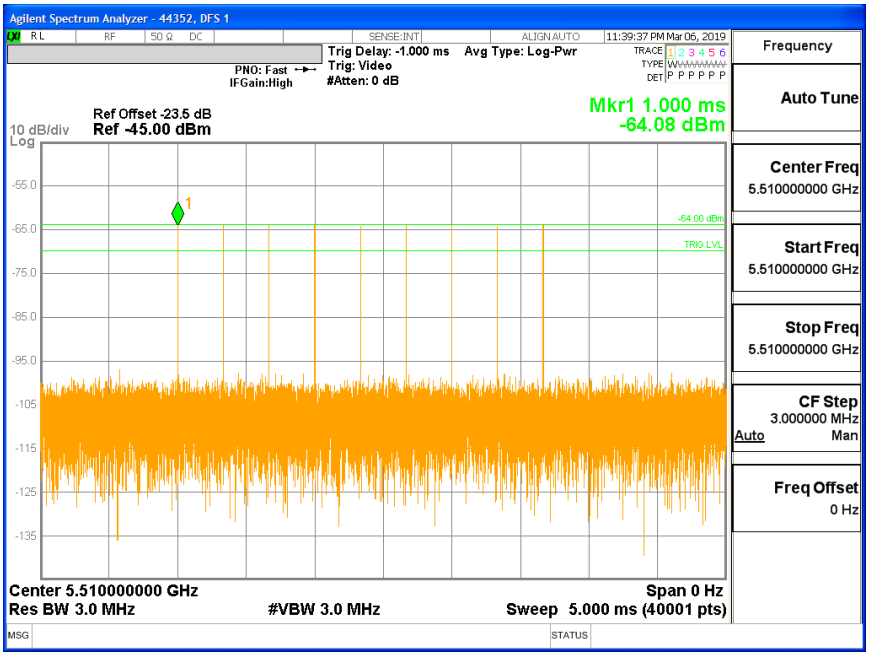
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

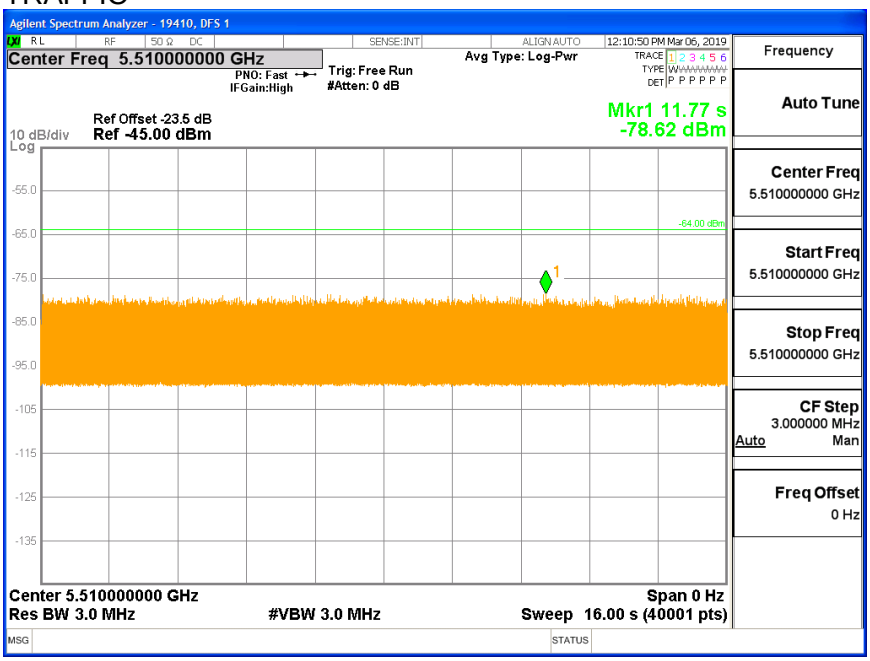


SINGLE BURST OF RADAR TYPE 6

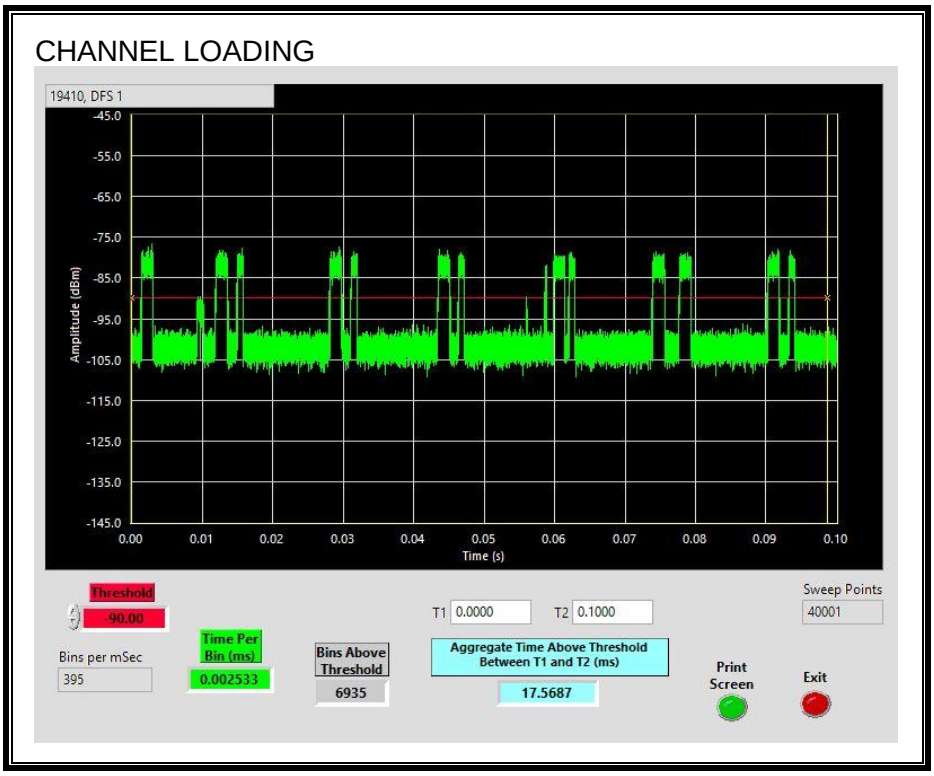


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.57%

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)
30.3	177.8	147.5	87.5

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.07	119.0	88.9	1.4

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)
30.16	175.9	145.7	58.2

QUALITATIVE RESULTS

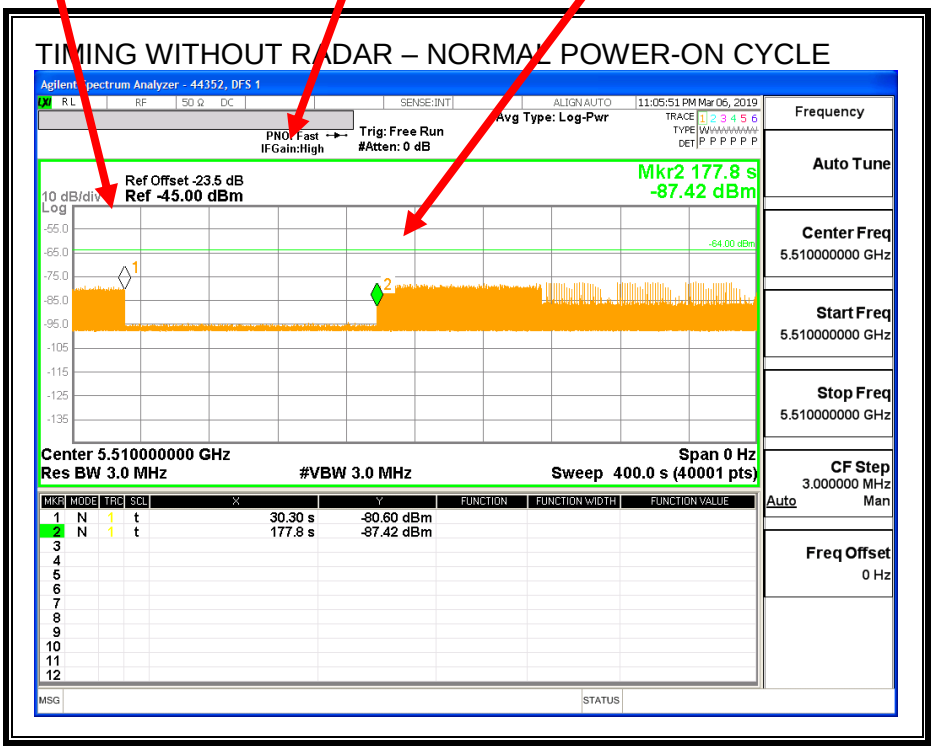
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



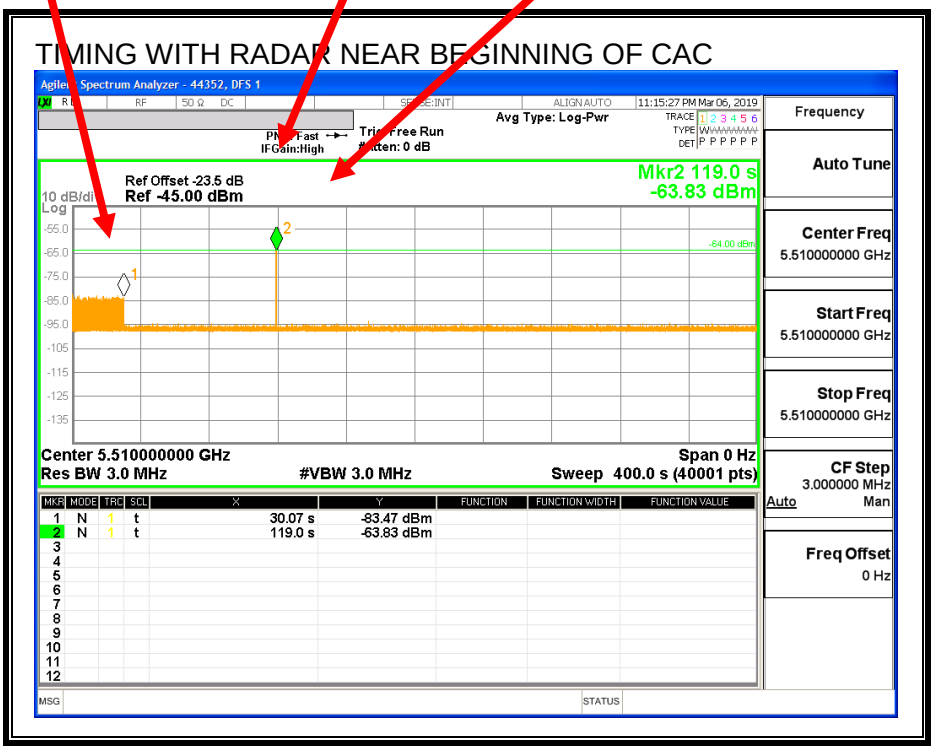
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



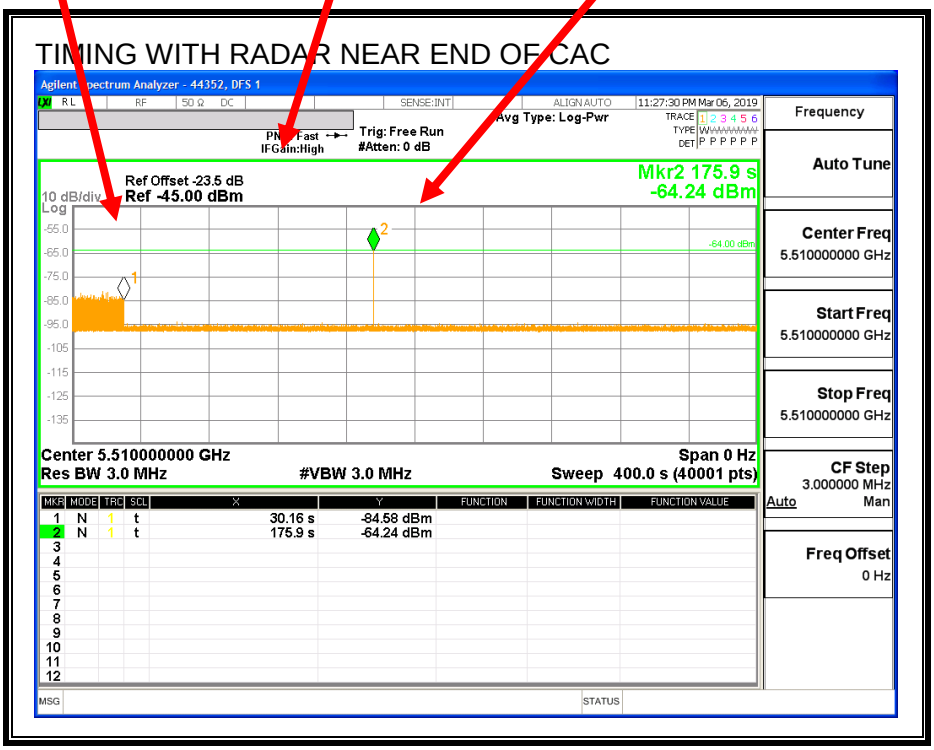
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

6.3.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

6.3.5. 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).

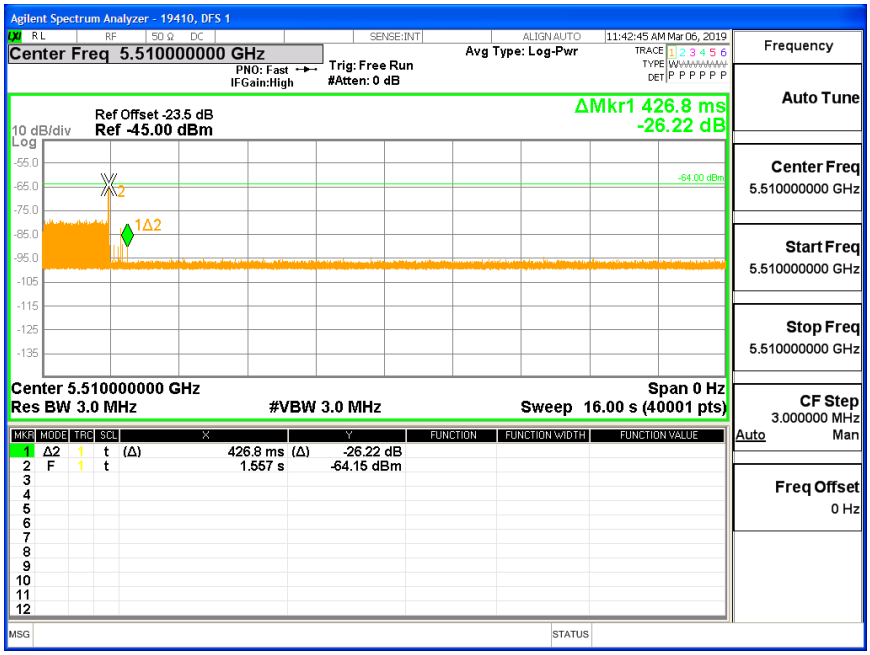
RESULTS

Channel Move Time (sec)	Limit (sec)
0.426	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
6.0	60

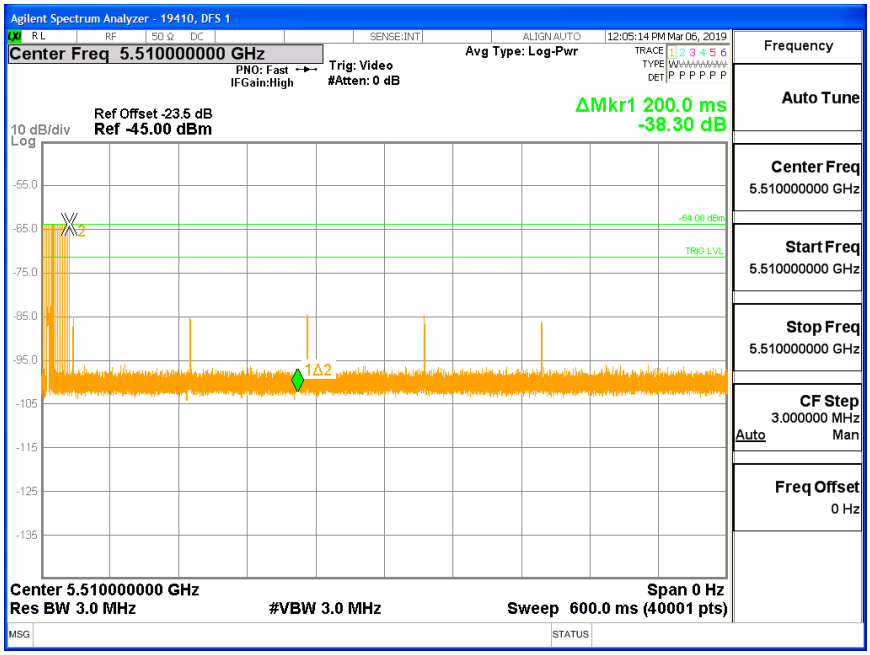
MOVE TIME

MOVE TIME



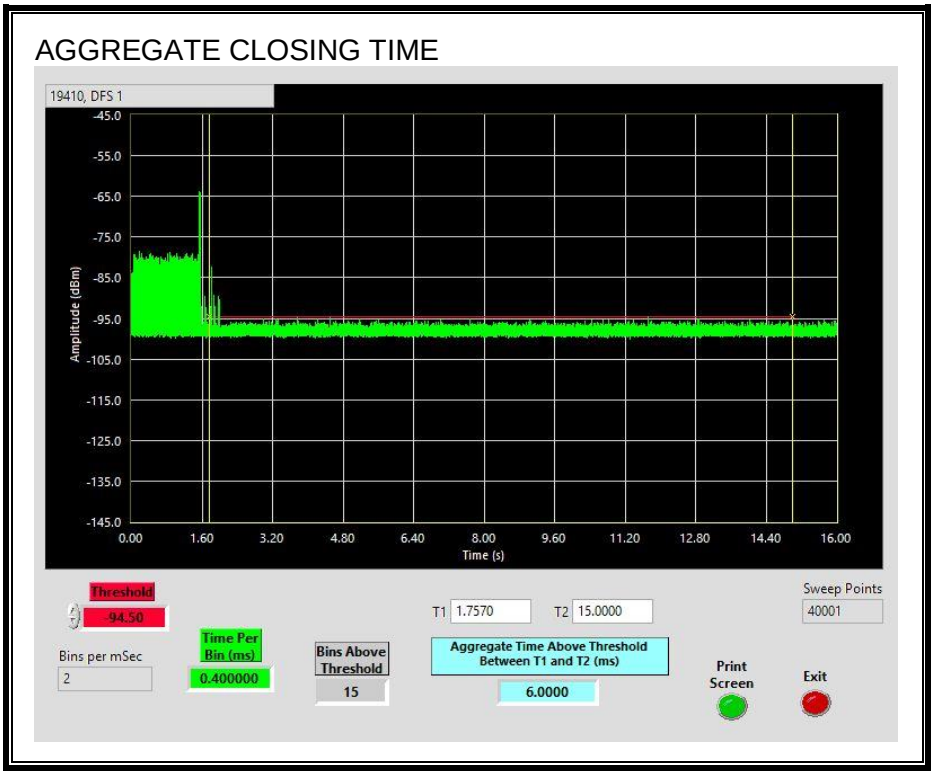
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

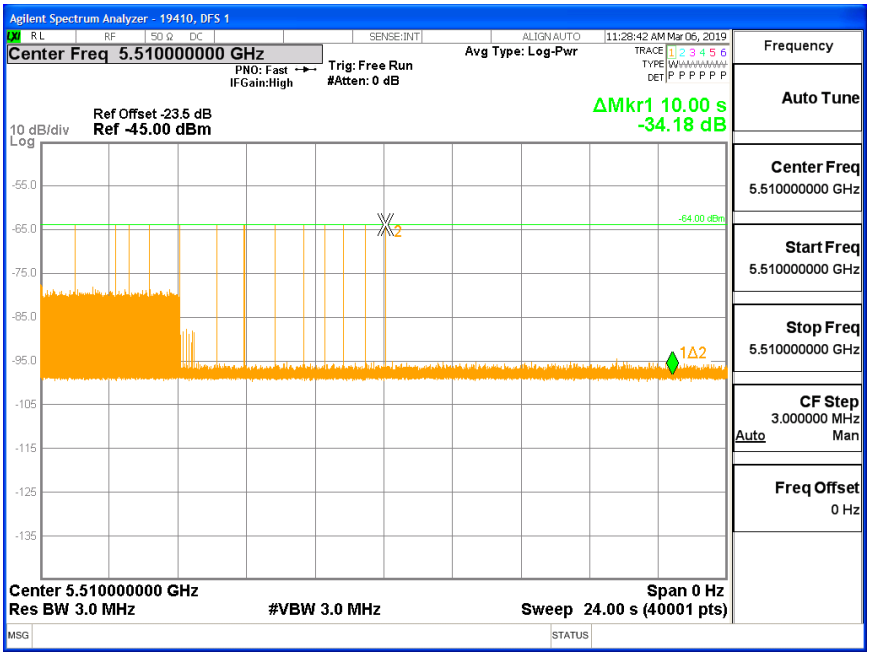
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

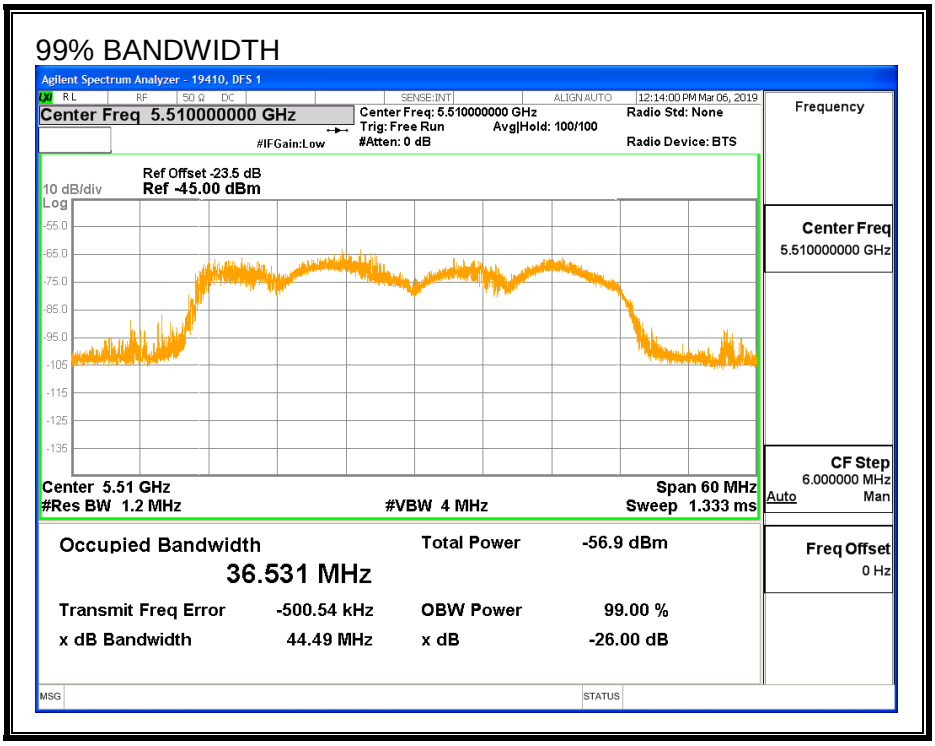
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



6.3.6. 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	5530	40	36.531	109.5	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		19410	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	9	90	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	

6.3.7. 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	96.67	60	Pass	5490	5530	36.53	DFS 1	19410	Version 3.3.4
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5530	36.53	DFS 1	19410	Version 3.3.4
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5530	36.53	DFS 1	19410	Version 3.3.4
FCC Short Pulse Type 4	30	96.67	60	Pass	5490	5530	36.53	DFS 1	19410	Version 3.3.4
Aggregate		96.67	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	36.53	DFS 1	19410	Version 3.3.4
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530	36.53	DFS 1	19410	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	5490	Yes
1002	1	938	57	A	5522	Yes
1003	1	658	81	A	5500	Yes
1004	1	778	68	A	5501	Yes
1005	1	758	70	A	5492	Yes
1006	1	898	59	A	5509	Yes
1007	1	678	78	A	5521	Yes
1008	1	838	63	A	5526	Yes
1009	1	638	83	A	5520	Yes
1010	1	918	58	A	5510	Yes
1011	1	578	92	A	5530	Yes
1012	1	698	76	A	5502	Yes
1013	1	538	99	A	5509	Yes
1014	1	598	89	A	5500	Yes
1015	1	718	74	A	5508	No
1016	1	1649	33	B	5508	Yes
1017	1	1410	38	B	5515	Yes
1018	1	1495	36	B	5529	Yes
1019	1	1387	39	B	5507	Yes
1020	1	2955	18	B	5530	Yes
1021	1	2976	18	B	5518	Yes
1022	1	931	57	B	5524	Yes
1023	1	1081	49	B	5512	Yes
1024	1	1713	31	B	5494	Yes
1025	1	798	67	B	5526	Yes
1026	1	1560	34	B	5493	Yes
1027	1	2128	25	B	5507	Yes
1028	1	3020	18	B	5502	Yes
1029	1	1169	46	B	5525	Yes
1030	1	995	54	B	5528	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.9	186	25	5494	Yes
2002	2.6	178	29	5530	Yes
2003	3	163	28	5511	Yes
2004	2.9	202	29	5520	Yes
2005	3.6	192	24	5510	Yes
2006	1.8	192	23	5517	Yes
2007	2.6	228	29	5522	Yes
2008	3.2	195	24	5515	Yes
2009	4.3	154	27	5511	No
2010	1	206	27	5515	Yes
2011	4.4	213	23	5492	Yes
2012	1.3	230	23	5508	Yes
2013	5	198	27	5504	Yes
2014	4.2	181	23	5528	Yes
2015	4	154	24	5528	Yes
2016	3.5	222	28	5497	Yes
2017	1.6	161	23	5527	Yes
2018	3.4	195	27	5528	Yes
2019	1.7	219	26	5498	Yes
2020	3.8	177	27	5519	Yes
2021	2.3	166	26	5525	Yes
2022	4.6	209	28	5508	Yes
2023	1.3	203	27	5509	Yes
2024	1.9	169	26	5491	Yes
2025	3	210	25	5528	Yes
2026	3.8	223	24	5504	Yes
2027	3.1	187	28	5528	Yes
2028	4.1	204	27	5513	Yes
2029	3.7	210	25	5518	No
2030	4.9	194	24	5502	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	301	17	5530	Yes
3002	9.1	262	18	5508	Yes
3003	7.2	455	16	5501	Yes
3004	9.1	430	16	5524	Yes
3005	7.3	251	17	5529	Yes
3006	9.4	372	18	5490	Yes
3007	7.9	339	17	5525	Yes
3008	6.1	473	18	5495	Yes
3009	9.1	453	18	5500	Yes
3010	7.5	348	17	5512	Yes
3011	8.6	475	17	5503	Yes
3012	9.4	264	17	5526	Yes
3013	8.8	404	18	5501	Yes
3014	9.7	457	18	5527	Yes
3015	9.3	359	18	5501	Yes
3016	8.6	307	18	5502	Yes
3017	6.4	355	16	5501	Yes
3018	10	434	17	5507	Yes
3019	10	376	18	5516	Yes
3020	7.8	350	16	5518	Yes
3021	6.1	423	16	5515	Yes
3022	8.1	292	17	5495	Yes
3023	6.6	260	16	5506	Yes
3024	7	393	17	5491	Yes
3025	7.8	374	17	5514	Yes
3026	6.2	268	16	5505	Yes
3027	9.5	395	16	5510	Yes
3028	8.1	436	16	5508	Yes
3029	7.5	324	17	5517	Yes
3030	8.4	378	16	5504	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	11.3	279	15	5517	Yes
4002	13.9	479	12	5512	Yes
4003	18.3	275	15	5507	Yes
4004	17.1	488	13	5513	Yes
4005	12.8	297	14	5512	Yes
4006	12.1	271	15	5509	Yes
4007	17.4	477	16	5514	Yes
4008	12.9	464	12	5501	Yes
4009	14.4	432	16	5505	Yes
4010	19.4	314	13	5509	Yes
4011	12.3	294	12	5497	Yes
4012	17.8	322	16	5518	Yes
4013	15.9	316	16	5498	Yes
4014	12.8	357	15	5503	Yes
4015	11.4	496	13	5503	Yes
4016	18.4	299	15	5516	Yes
4017	17.5	333	13	5530	Yes
4018	11	399	16	5508	No
4019	15.4	447	14	5499	Yes
4020	14.2	408	12	5528	Yes
4021	19	468	15	5517	Yes
4022	18.3	442	13	5508	Yes
4023	14.5	397	15	5510	Yes
4024	19.1	384	16	5525	Yes
4025	11.5	352	15	5502	Yes
4026	16.5	485	16	5509	Yes
4027	18.5	466	16	5502	Yes
4028	14.9	494	15	5502	Yes
4029	13	487	12	5527	Yes
4030	14.8	277	16	5504	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	5499	Yes
12	5499	Yes
13	5499	Yes
14	5499	Yes
15	5499	Yes
16	5499	Yes
17	5496	Yes
18	5496	Yes
19	5500	Yes
20	5497	Yes
21	5526	Yes
22	5521	Yes
23	5521	Yes
24	5525	Yes
25	5520	Yes
26	5522	Yes
27	5521	Yes
28	5526	Yes
29	5520	Yes
30	5524	Yes

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

TYPE 6 DETECTION PROBABILITY

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

Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	226	5490	12	Yes
2	701	5491	10	Yes
3	1176	5492	8	Yes
4	1651	5493	2	Yes
5	2126	5494	5	Yes
6	2601	5495	10	Yes
7	3076	5496	9	Yes
8	3551	5497	8	Yes
9	4026	5498	9	Yes
10	4501	5499	12	Yes
11	4976	5500	7	Yes
12	5451	5501	13	Yes
13	5926	5502	8	Yes
14	6401	5503	8	Yes
15	6876	5504	6	Yes
16	7351	5505	8	Yes
17	7826	5506	13	Yes
18	8301	5507	7	Yes
19	8776	5508	8	Yes
20	9251	5509	6	Yes
21	9726	5510	14	Yes
22	10201	5511	8	Yes
23	10676	5512	8	Yes
24	11151	5513	4	Yes
25	11626	5514	11	Yes
26	12101	5515	6	Yes
27	12576	5516	6	Yes
28	13051	5517	9	Yes
29	13526	5518	3	Yes
30	14001	5519	10	Yes
31	14476	5520	10	Yes
32	14951	5521	6	Yes
33	15426	5522	9	Yes
34	15901	5523	9	Yes
35	16376	5524	8	Yes
36	16851	5525	9	Yes
37	17326	5526	10	Yes
38	17801	5527	13	Yes
39	18276	5528	4	Yes
40	18751	5529	6	Yes
41	19226	5530	7	Yes

6.4. RESULTS FOR 80 MHz BANDWIDTH

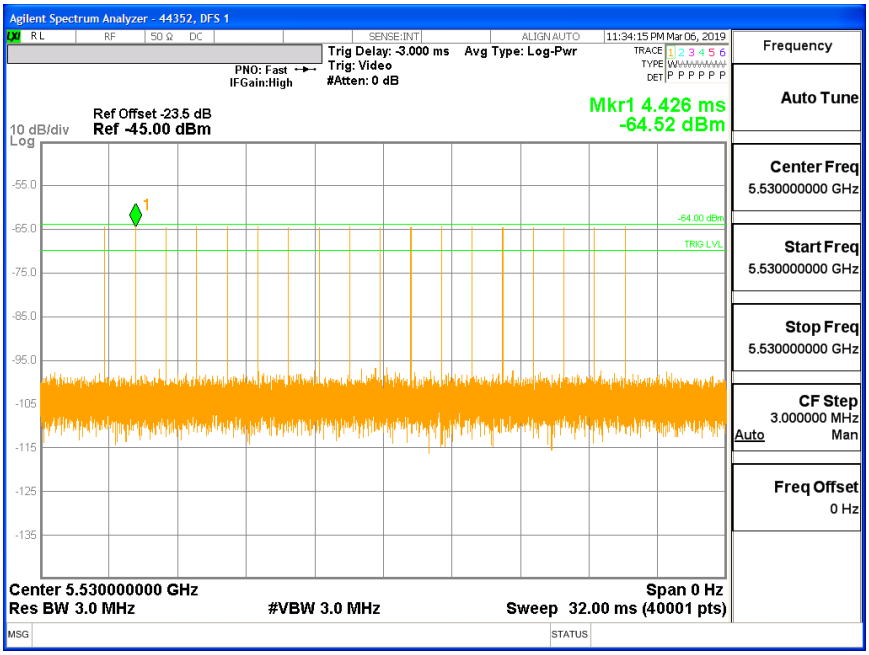
6.4.1. TEST CHANNEL

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

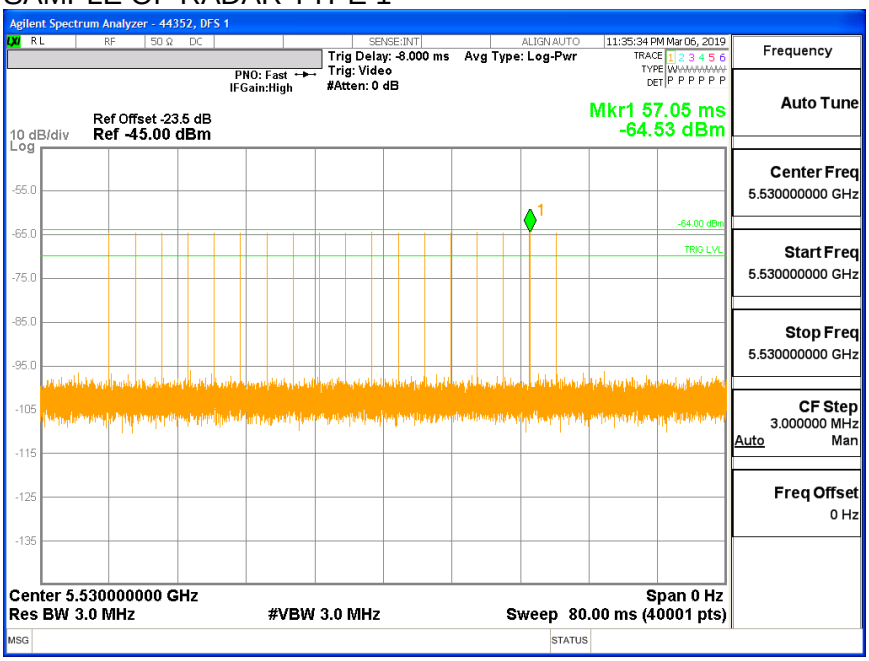
6.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

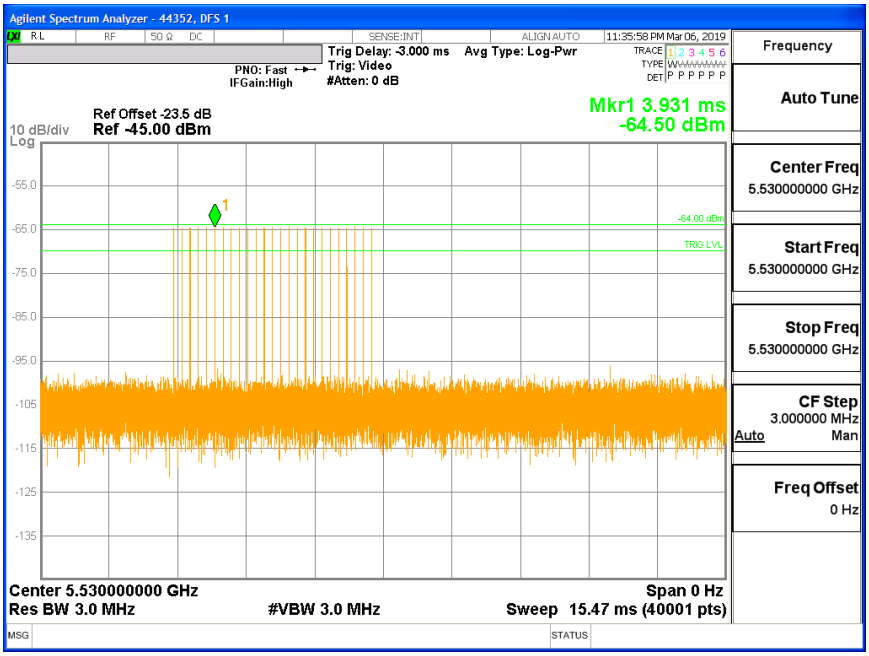
SHORT PULSE RADAR TYPE 0



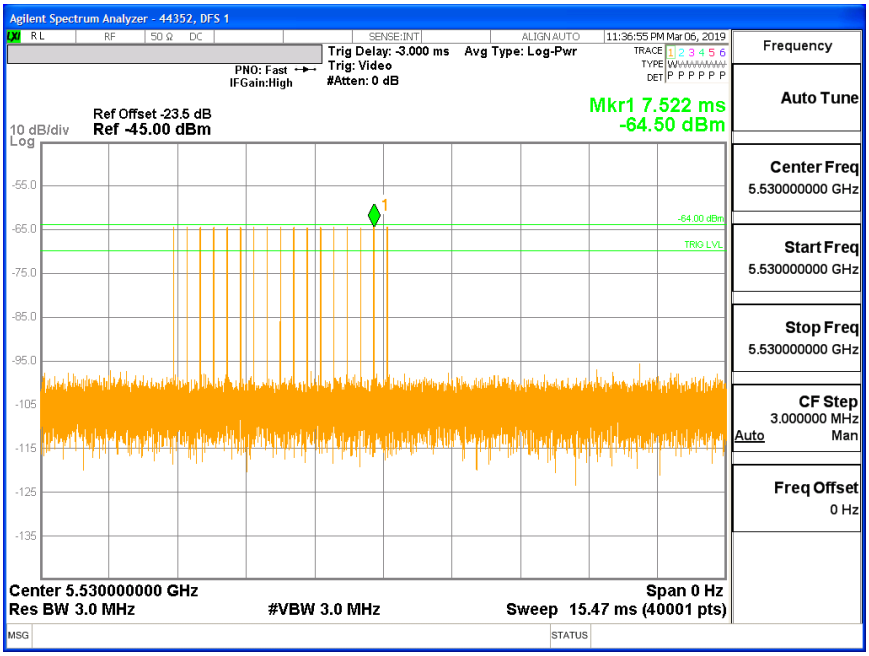
SAMPLE OF RADAR TYPE 1



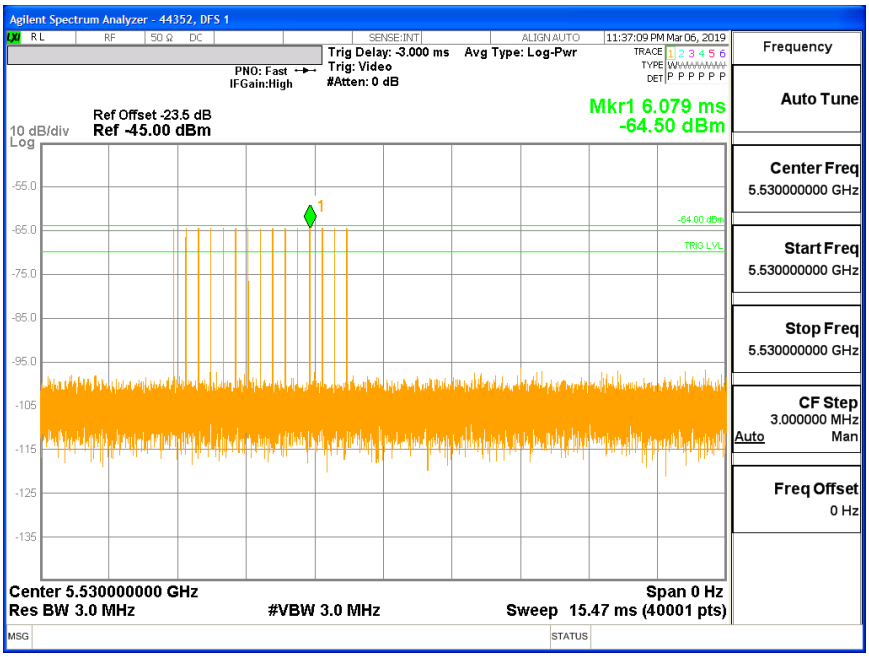
SAMPLE OF RADAR TYPE 2



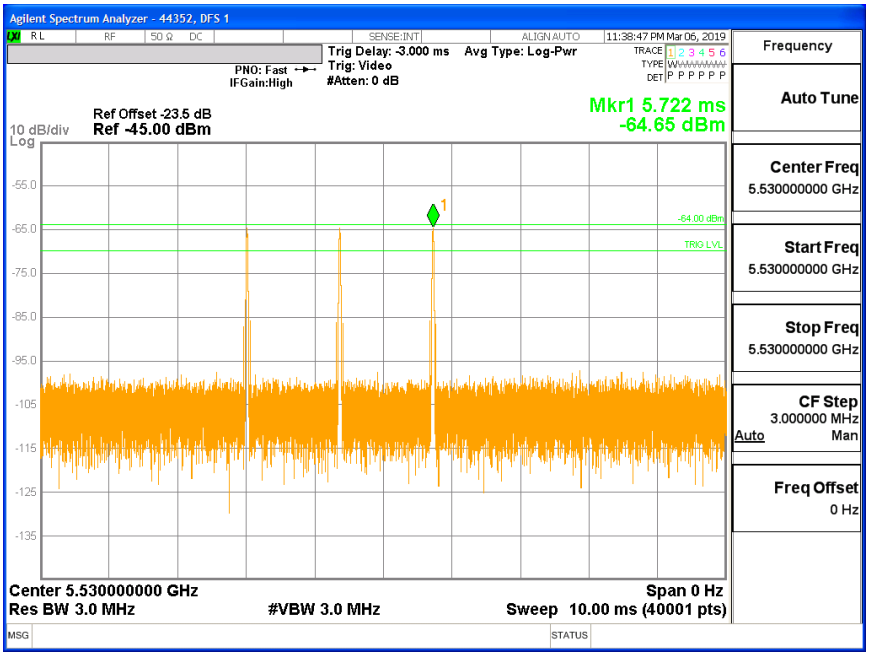
SAMPLE OF RADAR TYPE 3



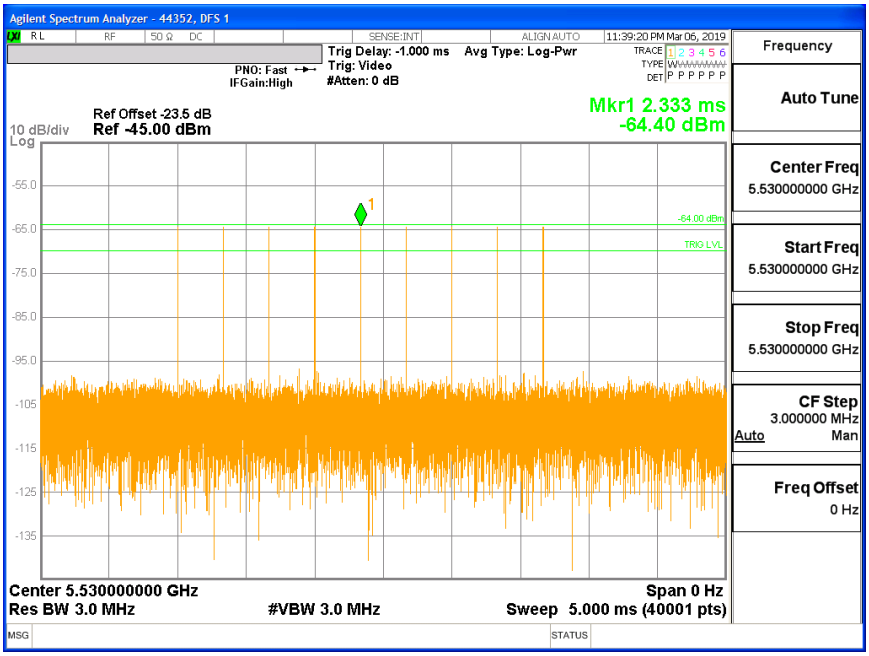
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

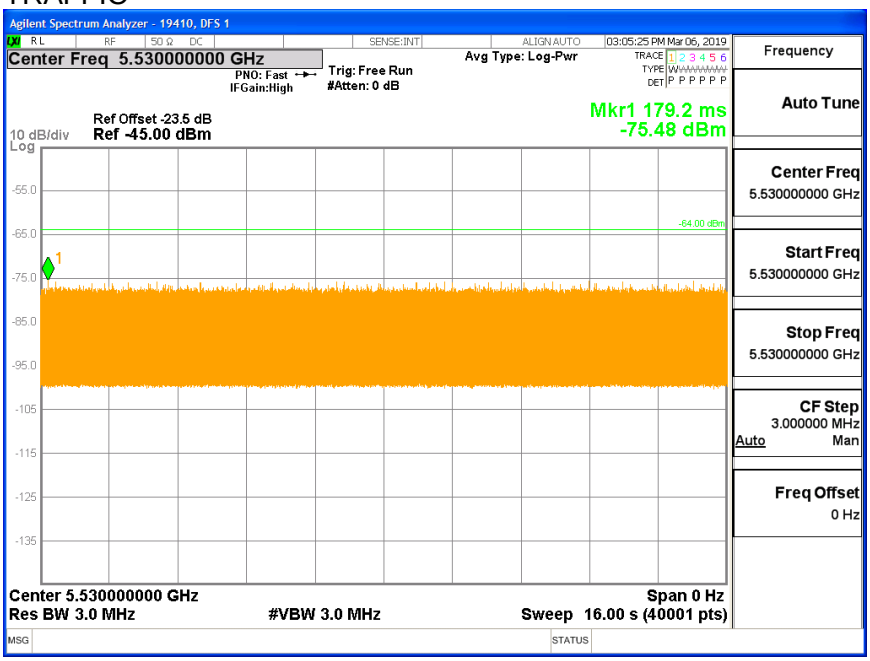


SINGLE BURST OF RADAR TYPE 6

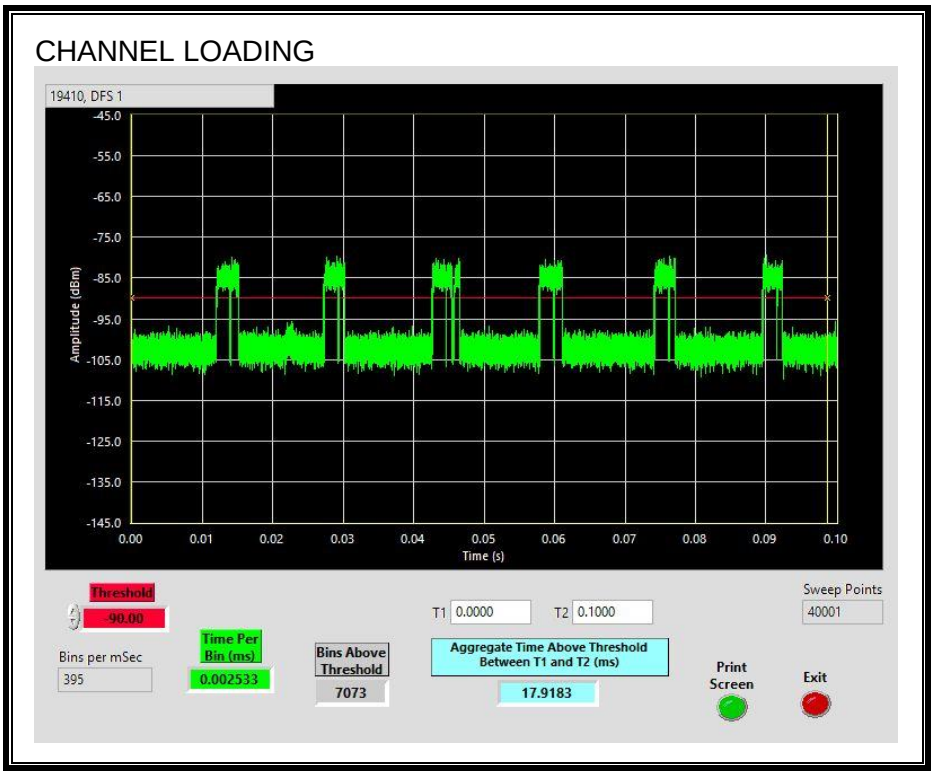


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.91%

6.4.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.25	178.3	148.1	88.1

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)
30.26	119.6	89.3	1.3

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.3	175.8	145.5	57.5

QUALITATIVE RESULTS

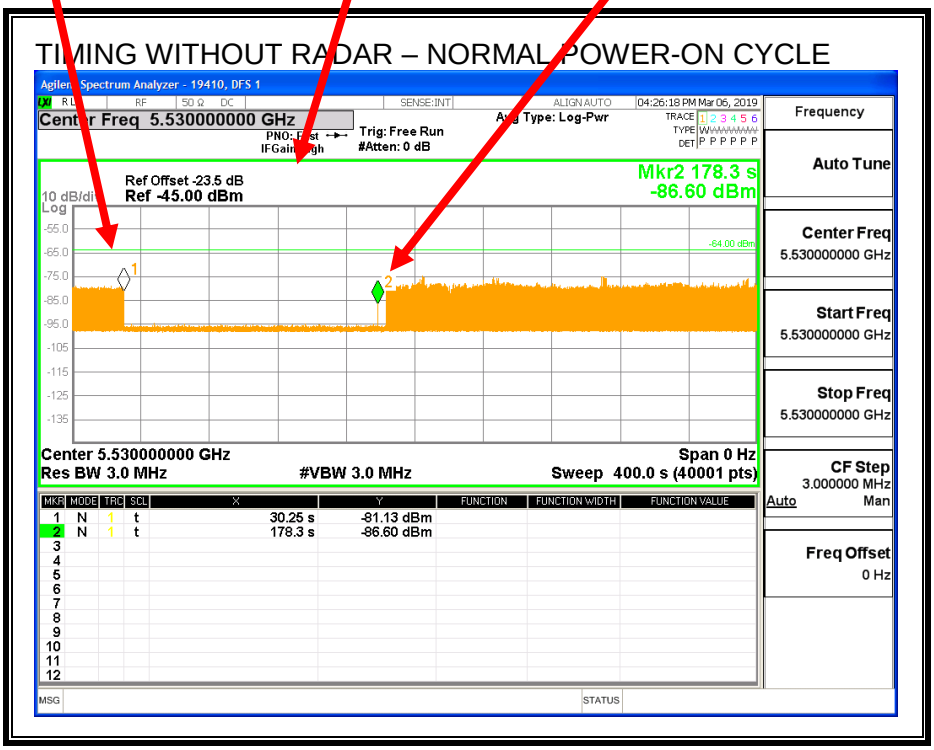
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



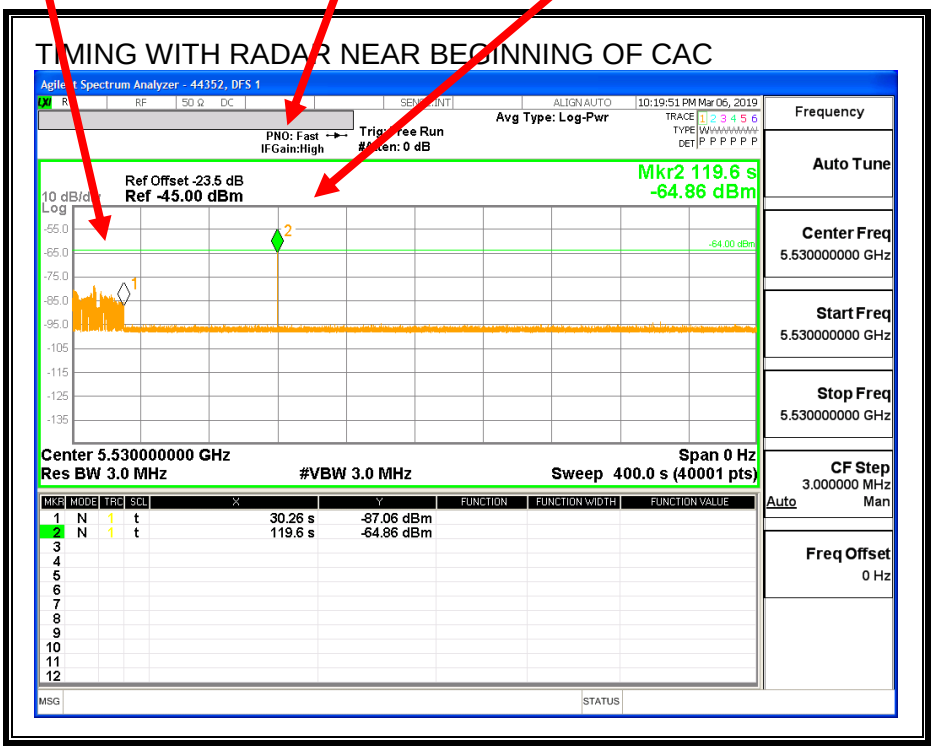
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



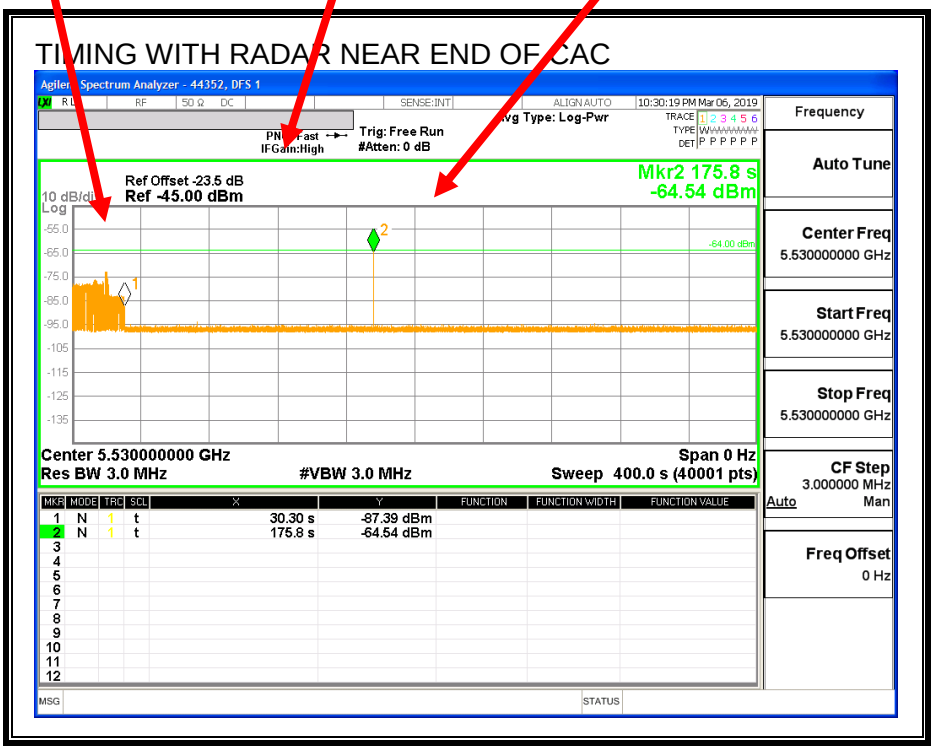
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

6.4.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

6.4.5. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

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

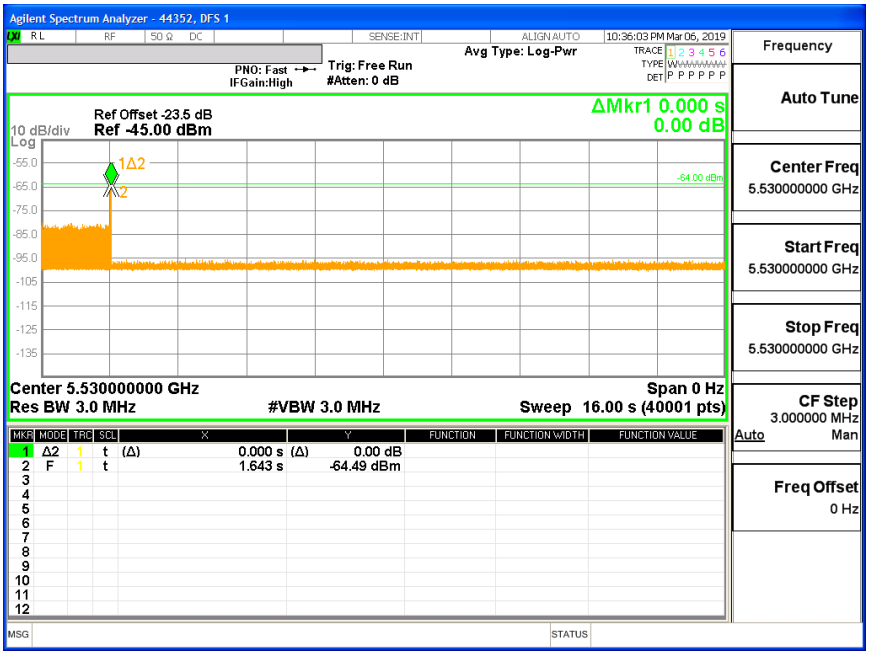
RESULTS

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

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

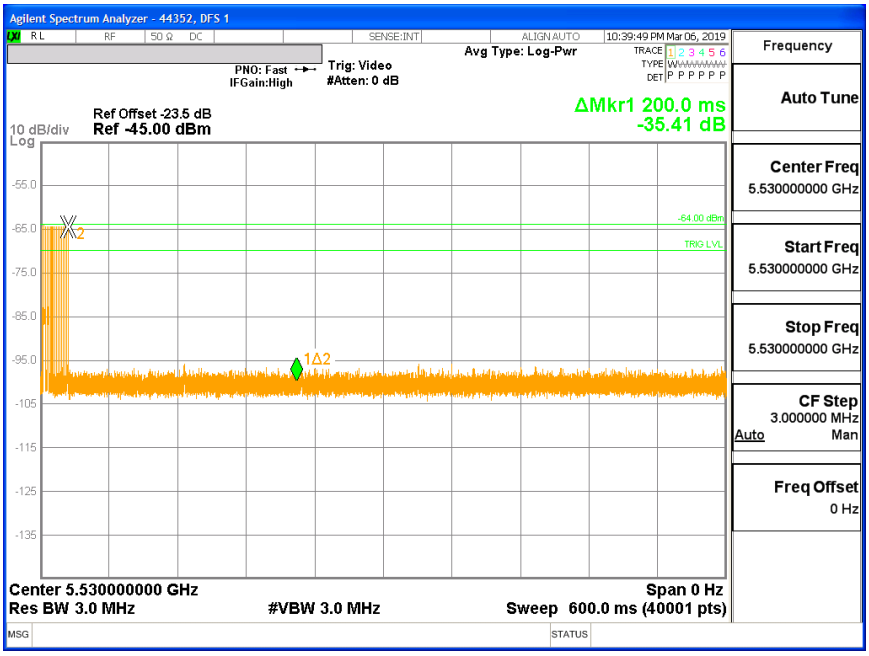
MOVE TIME

MOVE TIME



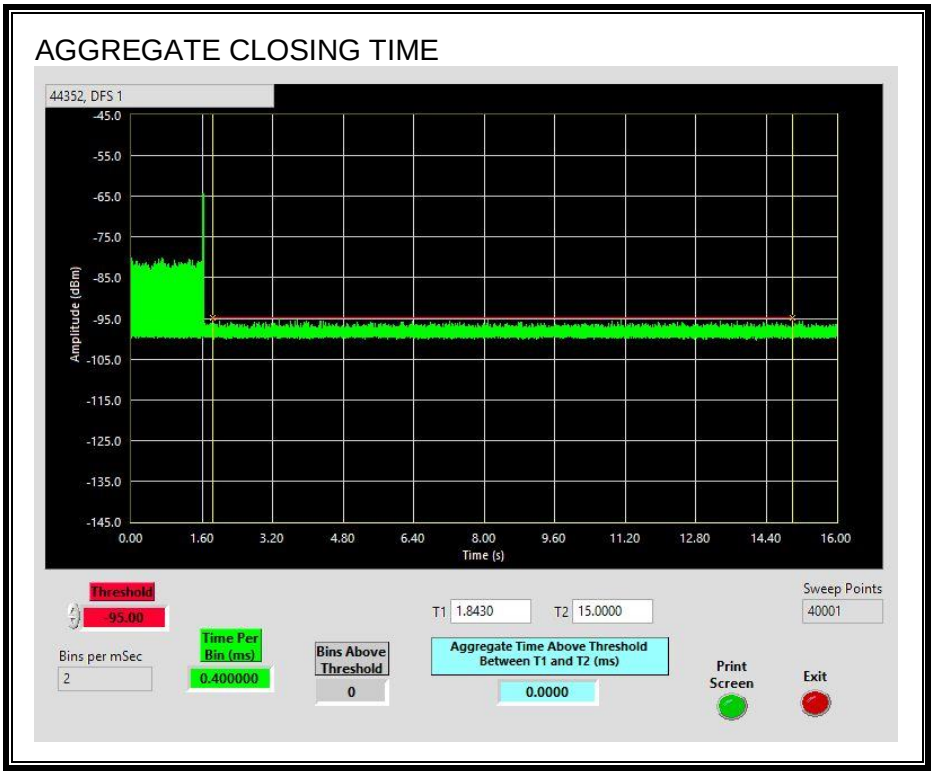
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

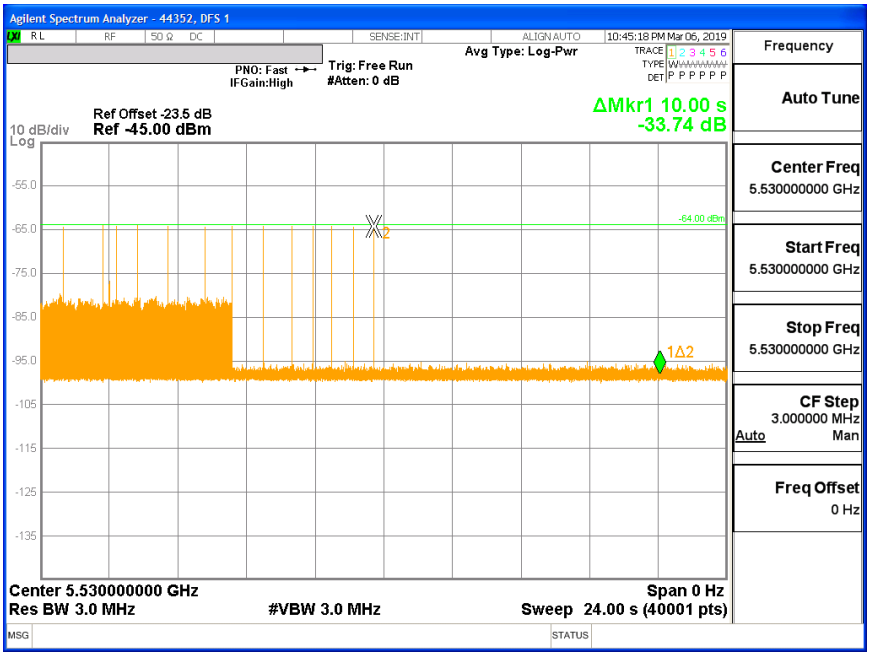
No transmissions are observed during the aggregate monitoring period.



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

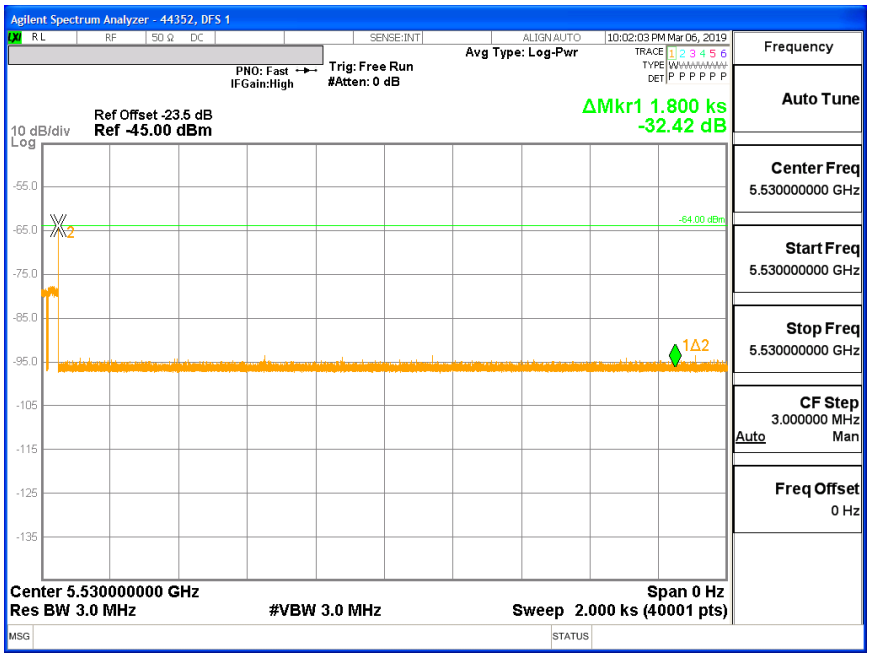


6.4.6. NON-OCCUPANCY PERIOD

RESULTS

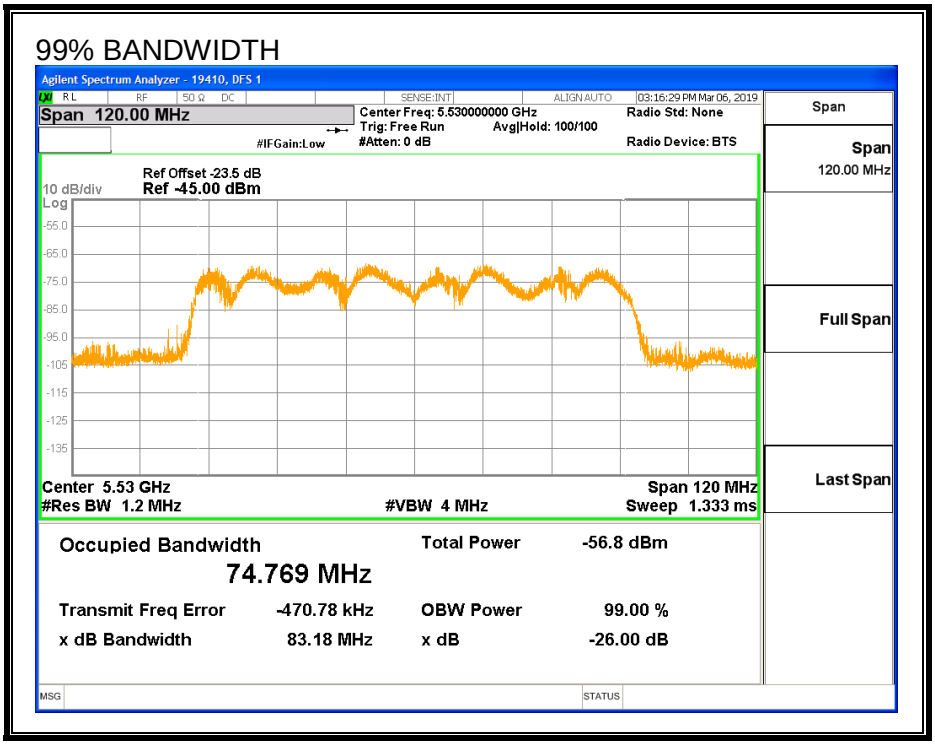
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



6.4.7. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5495	5570	75	74.769	100.3	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		19410	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
5494	10	5	50	
5495	10	9	90	FL
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	9	90	
5565	10	9	90	
5570	10	10	100	FH
5571	10	0	0	

6.4.8. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5495	5570	74.77	DFS 1	19410	Version 3.3.4
FCC Short Pulse Type 2	30	90.00	60	Pass	5495	5570	74.77	DFS 1	19410	Version 3.3.4
FCC Short Pulse Type 3	30	96.67	60	Pass	5495	5570	74.77	DFS 1	19410	Version 3.3.4
FCC Short Pulse Type 4	30	83.33	60	Pass	5495	5570	74.77	DFS 1	19410	Version 3.3.4
Aggregate		92.50	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5495	5570	74.77	DFS 1	19410	Version 3.3.4
FCC Hopping Type 6	76	100.00	70	Pass	5495	5570	74.77	DFS 1	19410	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	5564	Yes
1002	1	938	57	A	5539	Yes
1003	1	658	81	A	5540	Yes
1004	1	778	68	A	5553	Yes
1005	1	758	70	A	5564	Yes
1006	1	898	59	A	5500	Yes
1007	1	678	78	A	5524	Yes
1008	1	838	63	A	5499	Yes
1009	1	638	83	A	5535	Yes
1010	1	918	58	A	5557	Yes
1011	1	578	92	A	5542	Yes
1012	1	698	76	A	5528	Yes
1013	1	538	99	A	5519	Yes
1014	1	598	89	A	5503	Yes
1015	1	718	74	A	5561	Yes
1016	1	1649	33	B	5500	Yes
1017	1	1410	38	B	5533	Yes
1018	1	1495	36	B	5495	Yes
1019	1	1387	39	B	5523	Yes
1020	1	2955	18	B	5560	Yes
1021	1	2976	18	B	5498	Yes
1022	1	931	57	B	5496	Yes
1023	1	1081	49	B	5542	Yes
1024	1	1713	31	B	5527	Yes
1025	1	798	67	B	5517	Yes
1026	1	1560	34	B	5504	Yes
1027	1	2128	25	B	5512	Yes
1028	1	3020	18	B	5537	Yes
1029	1	1169	46	B	5499	Yes
1030	1	995	54	B	5537	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.9	186	25	5551	Yes
2002	2.6	178	29	5548	Yes
2003	3	163	28	5501	Yes
2004	2.9	202	29	5513	Yes
2005	3.6	192	24	5566	Yes
2006	1.8	192	23	5522	Yes
2007	2.6	228	29	5564	Yes
2008	3.2	195	24	5526	Yes
2009	4.3	154	27	5565	No
2010	1	206	27	5508	Yes
2011	4.4	213	23	5537	Yes
2012	1.3	230	23	5555	Yes
2013	5	198	27	5537	Yes
2014	4.2	181	23	5528	Yes
2015	4	154	24	5515	Yes
2016	3.5	222	28	5504	Yes
2017	1.6	161	23	5516	No
2018	3.4	195	27	5560	Yes
2019	1.7	219	26	5564	Yes
2020	3.8	177	27	5562	Yes
2021	2.3	166	26	5516	Yes
2022	4.6	209	28	5552	Yes
2023	1.3	203	27	5570	Yes
2024	1.9	169	26	5566	Yes
2025	3	210	25	5511	Yes
2026	3.8	223	24	5544	Yes
2027	3.1	187	28	5502	Yes
2028	4.1	204	27	5518	Yes
2029	3.7	210	25	5508	No
2030	4.9	194	24	5557	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	301	17	5526	Yes
3002	9.1	262	18	5513	Yes
3003	7.2	455	16	5516	Yes
3004	9.1	430	16	5496	Yes
3005	7.3	251	17	5565	Yes
3006	9.4	372	18	5570	No
3007	7.9	339	17	5566	Yes
3008	6.1	473	18	5554	Yes
3009	9.1	453	18	5565	Yes
3010	7.5	348	17	5530	Yes
3011	8.6	475	17	5502	Yes
3012	9.4	264	17	5513	Yes
3013	8.8	404	18	5510	Yes
3014	9.7	457	18	5527	Yes
3015	9.3	359	18	5568	Yes
3016	8.6	307	18	5552	Yes
3017	6.4	355	16	5507	Yes
3018	10	434	17	5544	Yes
3019	10	376	18	5566	Yes
3020	7.8	350	16	5555	Yes
3021	6.1	423	16	5556	Yes
3022	8.1	292	17	5503	Yes
3023	6.6	260	16	5507	Yes
3024	7	393	17	5569	Yes
3025	7.8	374	17	5530	Yes
3026	6.2	268	16	5539	Yes
3027	9.5	395	16	5526	Yes
3028	8.1	436	16	5542	Yes
3029	7.5	324	17	5514	Yes
3030	8.4	378	16	5496	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
4001	11.3	279	15	5549	Yes
4002	13.9	479	12	5505	No
4003	18.3	275	15	5542	Yes
4004	17.1	488	13	5565	Yes
4005	12.8	297	14	5534	Yes
4006	12.1	271	15	5547	Yes
4007	17.4	477	16	5547	Yes
4008	12.9	464	12	5511	Yes
4009	14.4	432	16	5505	Yes
4010	19.4	314	13	5505	Yes
4011	12.3	294	12	5503	Yes
4012	17.8	322	16	5561	Yes
4013	15.9	316	16	5528	Yes
4014	12.8	357	15	5533	Yes
4015	11.4	496	13	5522	No
4016	18.4	299	15	5560	No
4017	17.5	333	13	5554	No
4018	11	399	16	5529	Yes
4019	15.4	447	14	5564	Yes
4020	14.2	408	12	5528	Yes
4021	19	468	15	5522	Yes
4022	18.3	442	13	5527	Yes
4023	14.5	397	15	5536	Yes
4024	19.1	384	16	5544	Yes
4025	11.5	352	15	5563	Yes
4026	16.5	485	16	5502	Yes
4027	18.5	466	16	5512	Yes
4028	14.9	494	15	5540	Yes
4029	13	487	12	5562	No
4030	14.8	277	16	5563	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	5500	Yes
12	5500	Yes
13	5500	Yes
14	5500	Yes
15	5500	Yes
16	5500	Yes
17	5497	Yes
18	5496	Yes
19	5501	Yes
20	5498	Yes
21	5565	Yes
22	5560	Yes
23	5561	Yes
24	5564	Yes
25	5559	Yes
26	5561	Yes
27	5561	Yes
28	5565	Yes
29	5559	Yes
30	5563	Yes

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

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	345	5495	11	Yes
2	820	5496	14	Yes
3	1295	5497	19	Yes
4	1770	5498	20	Yes
5	2245	5499	19	Yes
6	2720	5500	15	Yes
7	3195	5501	10	Yes
8	3670	5502	11	Yes
9	4145	5503	18	Yes
10	4620	5504	15	Yes
11	5095	5505	12	Yes
12	5570	5506	15	Yes
13	6045	5507	10	Yes
14	6520	5508	15	Yes
15	6995	5509	16	Yes
16	7470	5510	12	Yes
17	7945	5511	12	Yes
18	8420	5512	18	Yes
19	8895	5513	23	Yes
20	9370	5514	13	Yes
21	9845	5515	13	Yes
22	10320	5516	17	Yes
23	10795	5517	20	Yes
24	11270	5518	17	Yes
25	11745	5519	12	Yes
26	12220	5520	13	Yes
27	12695	5521	26	Yes
28	13170	5522	15	Yes
29	13645	5523	13	Yes
30	14120	5524	17	Yes
31	14595	5525	12	Yes
32	15070	5526	14	Yes
33	15545	5527	15	Yes
34	16020	5528	20	Yes
35	16495	5529	18	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

36	16970	5530	14	Yes
37	17445	5531	13	Yes
38	17920	5532	14	Yes
39	18395	5533	15	Yes
40	18870	5534	18	Yes
41	19345	5535	21	Yes
42	19820	5536	15	Yes
43	20295	5537	13	Yes
44	20770	5538	10	Yes
45	21245	5539	21	Yes
46	21720	5540	14	Yes
47	22195	5541	10	Yes
48	22670	5542	14	Yes
49	23145	5543	13	Yes
50	23620	5544	15	Yes
51	24095	5545	16	Yes
52	24570	5546	13	Yes
53	25045	5547	15	Yes
54	25520	5548	19	Yes
55	25995	5549	16	Yes
56	26470	5550	17	Yes
57	26945	5551	14	Yes
58	27420	5552	17	Yes
59	27895	5553	20	Yes
60	28370	5554	15	Yes
61	28845	5555	18	Yes
62	29320	5556	19	Yes
63	29795	5557	12	Yes
64	30270	5558	12	Yes
65	30745	5559	15	Yes
66	31220	5560	17	Yes
67	31695	5561	14	Yes
68	32170	5562	18	Yes
69	32645	5563	21	Yes
70	33120	5564	17	Yes
71	33595	5565	20	Yes
72	34070	5566	21	Yes
73	34545	5567	14	Yes
74	35020	5568	23	Yes
75	35495	5569	17	Yes
76	35970	5570	25	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.