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

CERTIFICATION TEST REPORT

FOR

WIRELESS 802.11 A/B/G/N/AC ACCESS POINT

MODEL NUMBER: MR42E-HW

FCC ID: UDX-60063010
IC: 6961A-60063010

REPORT NUMBER: 11799823-E4V1

ISSUE DATE: December 22, 2017

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

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	12/22/17	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: WIRELESS 802.11 A/B/G/N/AC ACCESS POINT

MODEL: MR42E-HW

SERIAL NUMBER: Q2TD-CDJY-H8M9

DATE TESTED: JULY 26 – DECEMBER 19, 2017

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

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

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

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UL Verification Services Inc. By:

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PROJECT LEAD
UL Verification Services Inc.

Prepared By:

HENRY LAU
EMC 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 Report number FCC RF Test Report_FR760613AC 5GHz B1~B4and IC RF Test Report_CR760613AC 5GHz B1~B4.

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. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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 levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Time	± 0.02 %

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

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

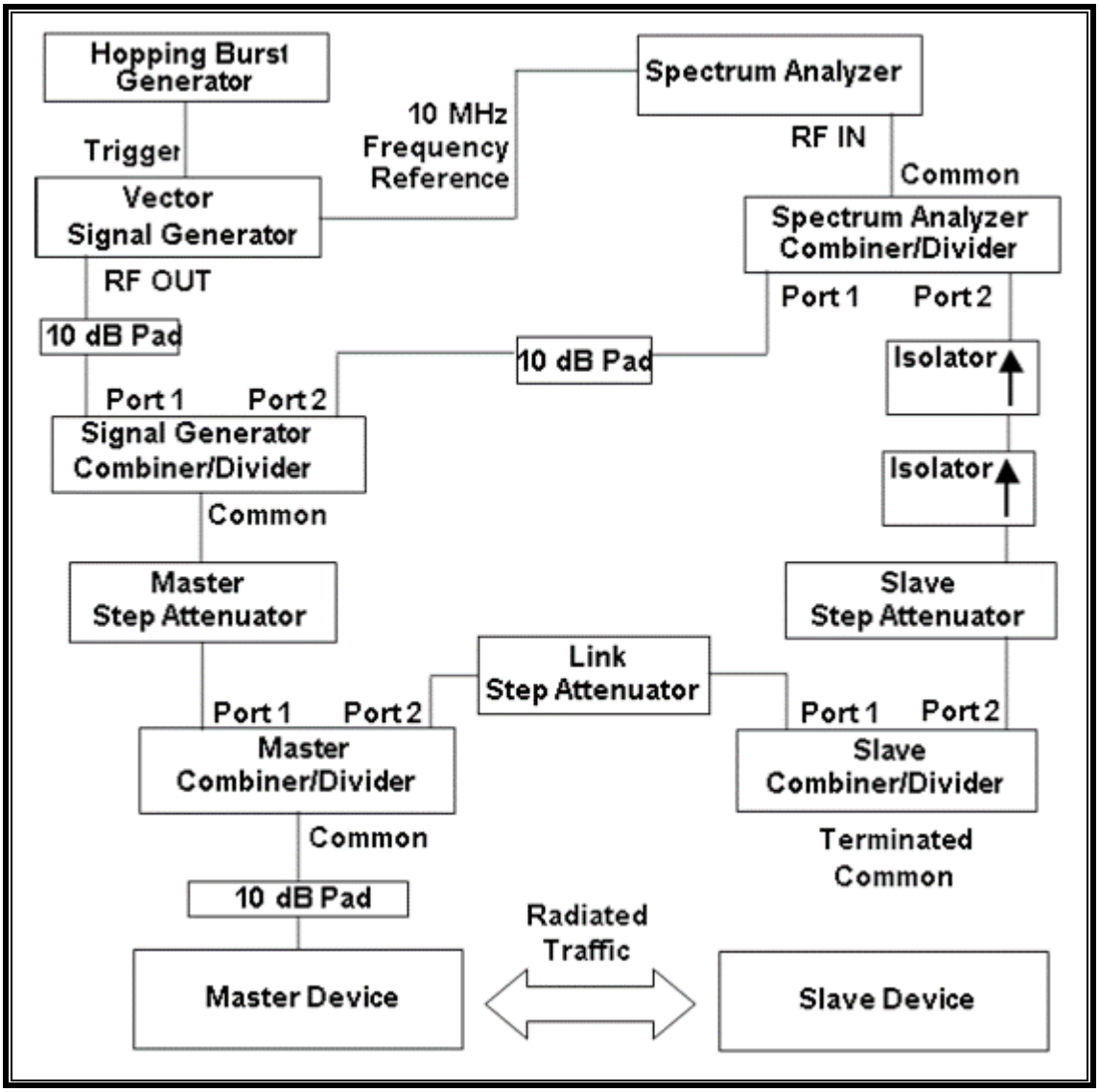
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

CONDUCTED 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.

Should multiple RF ports be utilized for the Master and/or Slave devices (for example, for diversity or MIMO implementations), additional combiner/dividers are inserted between the Master Combiner/Divider and the pad connected to the Master Device (and/or between the Slave Combiner/Divider and the pad connected to the Slave Device). Additional pads may be utilized such that there is one pad at each RF port on each EUT.

SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected in place of the master device. 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 Link Step Attenuator between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. Iperf is used to generate WLAN traffic. The WLAN traffic level, as displayed on the spectrum analyzer, is confirmed to be at lower amplitude than the radar detection threshold and is confirmed to be the Radar Detection Device rather than the associated device. If a different setting of the Master Step Attenuator is required to meet the above conditions, a new System Calibration is performed for the new Master Step Attenuator setting.

TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 8.4GHz	Keysight	N9030A	MY49430179	02/27/18
Signal Generator, MXG X-Series RF Vector	Agilent	N5182B	MY51350337	04/21/18
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/06/18

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

6.1.4. TEST ROOM ENVIRONMENT

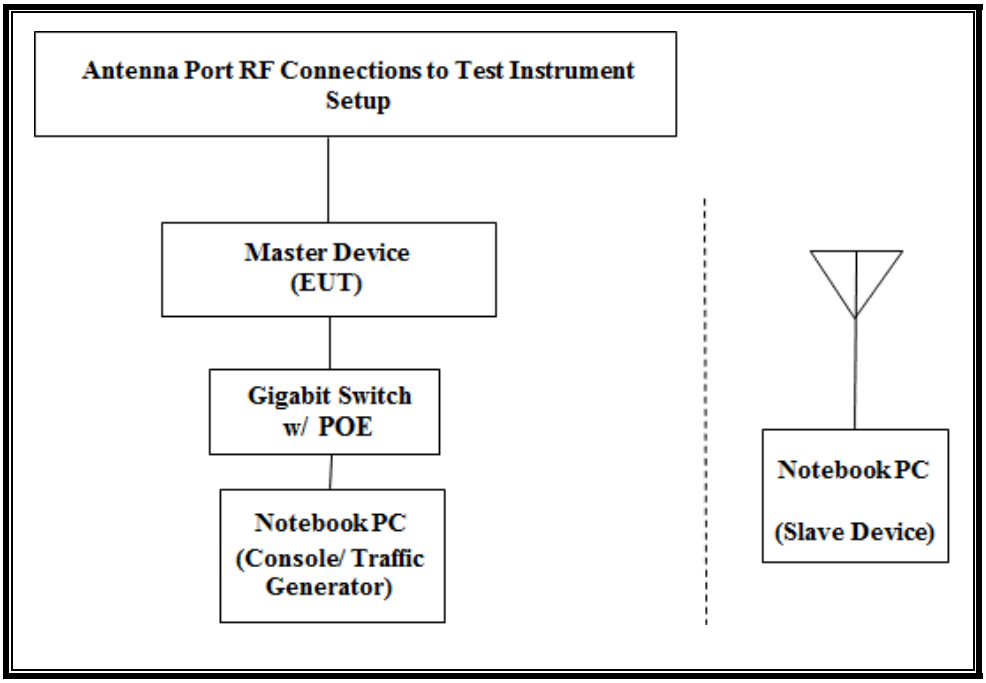
The test room temperature and humidity shall be maintained within normal temperature of 15~35 °C and normal humidity 20~75% (relative humidity).

ENVIRONMENT CONDITION

Parameter	**Value**
Temperature	26 °C
Humidity	21 %

6.1.5. SETUP OF EUT

CONDUCTED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

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

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

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.

For FCC, the highest power level within these bands is 29.94 dBm EIRP in the 5250-5350 MHz band and 29.95 dBm EIRP in the 5470-5725 MHz band.

For FCC Beamforming, the highest power level within these bands is 29.95 dBm EIRP in the 5250-5350 MHz band and 29.97 dBm EIRP in the 5470-5725 MHz band.

For IC, the highest power level within these bands is 22.99 dBm EIRP in the 5250-5350 MHz band and 29.95 dBm EIRP in the 5470-5725 MHz band.

For IC Beamforming, the highest power level within these bands is 29.99 dBm EIRP in the 5250-5350 MHz band and 29.97 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 10.94 dBi. The lowest gain antenna assembly utilized with the EUT has a gain of 3.95 dBi.

Three 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 antenna gain, cable loss and procedural adjustments, the required conducted threshold at the antenna port is –64 + 3.95 -1 + 1 = -60.05 dBm.

The calibrated conducted DFS Detection Threshold level is set to –63 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The EUT uses three transmitter/receiver chains and one receive only chain, each connected to a 50-ohm coaxial antenna port. All antenna ports are connected to the test system via a power divider to perform conducted tests.

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

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

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

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

The software installed in the EUT is firmware_cryptid_version T-201712121516-G42e335b1-L1c89c78cM-dhruvin.

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-60063010. The minimum antenna gain for the Master Device is 3.95 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is –64 + 3 - 1 + 1 = -61 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

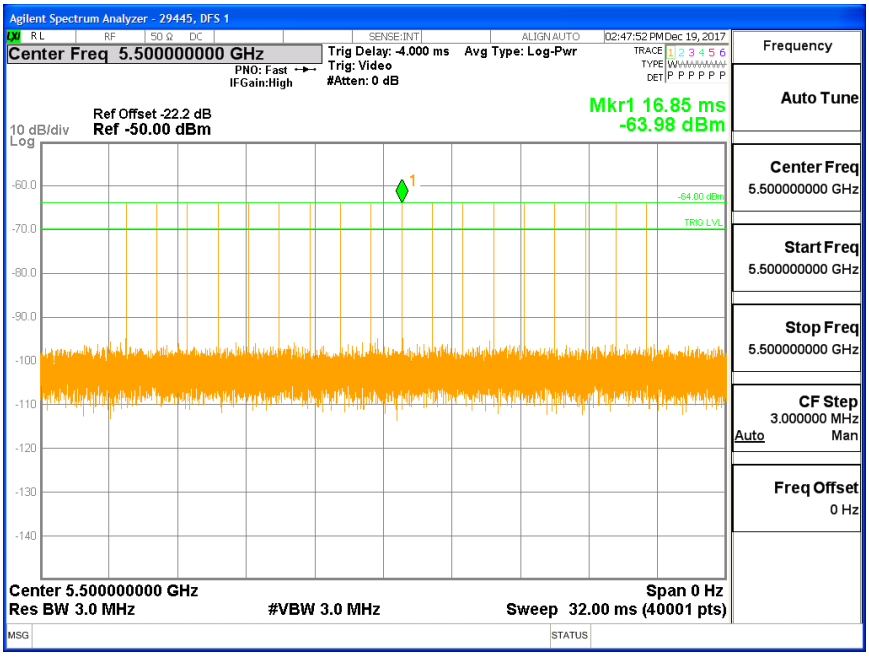
6.2.1. TEST CHANNEL

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

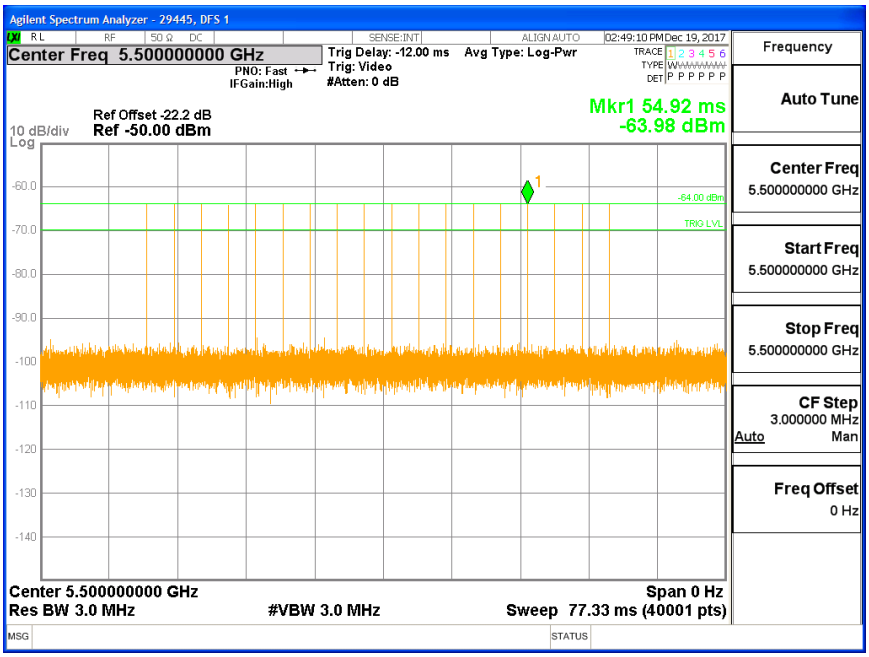
6.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

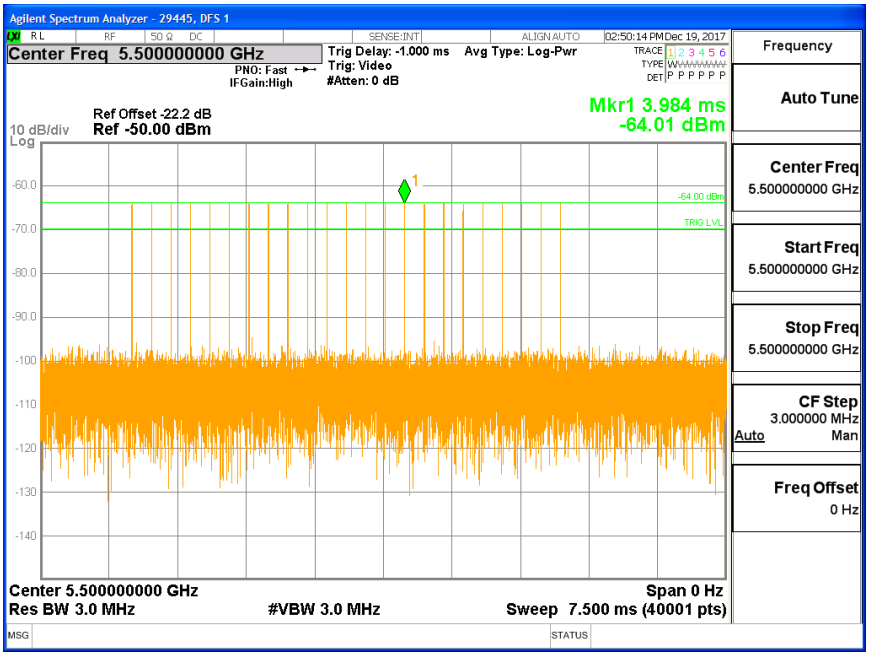
SHORT PULSE RADAR TYPE 0



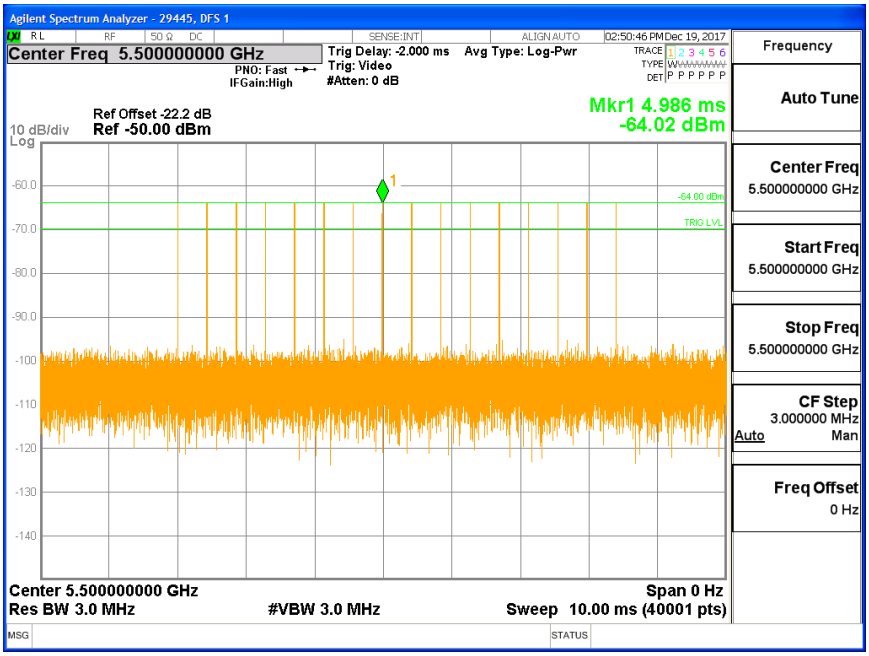
SAMPLE OF RADAR TYPE 1



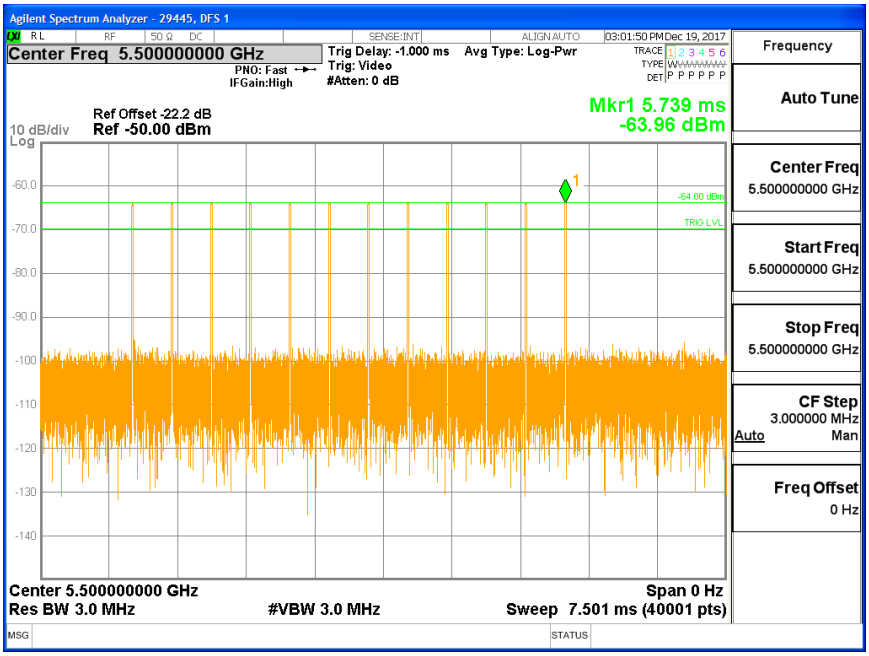
SAMPLE OF RADAR TYPE 2



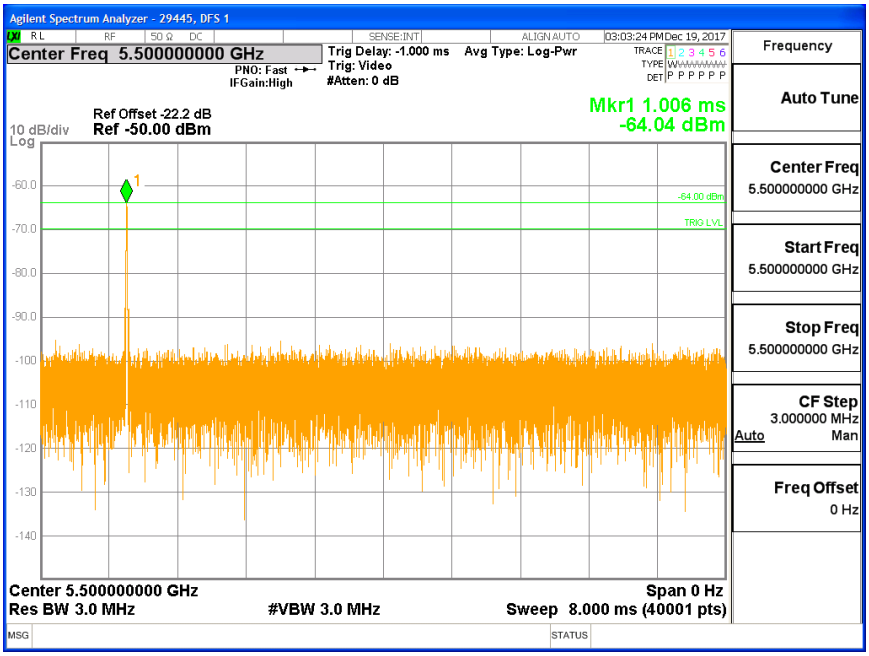
SAMPLE OF RADAR TYPE 3



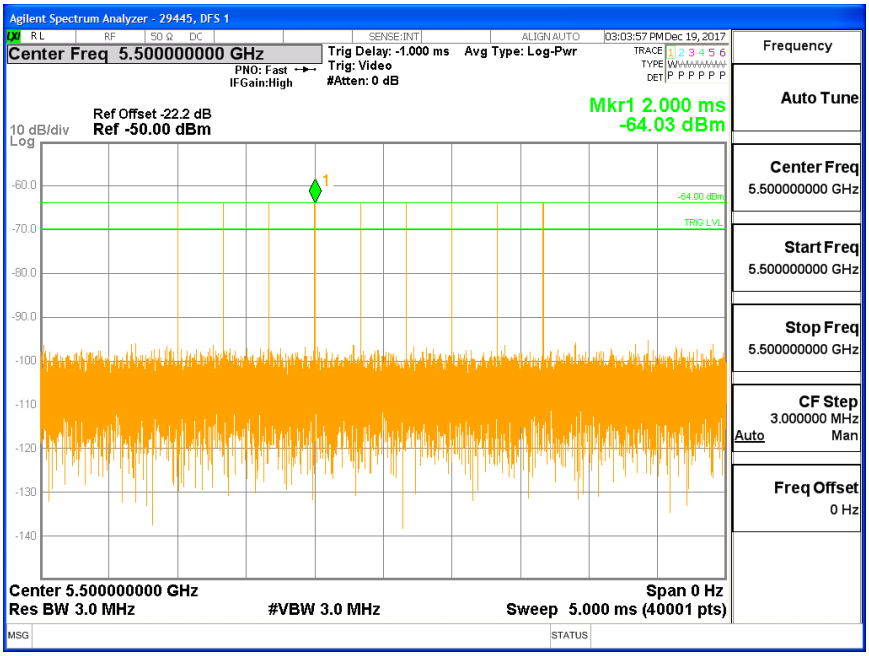
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

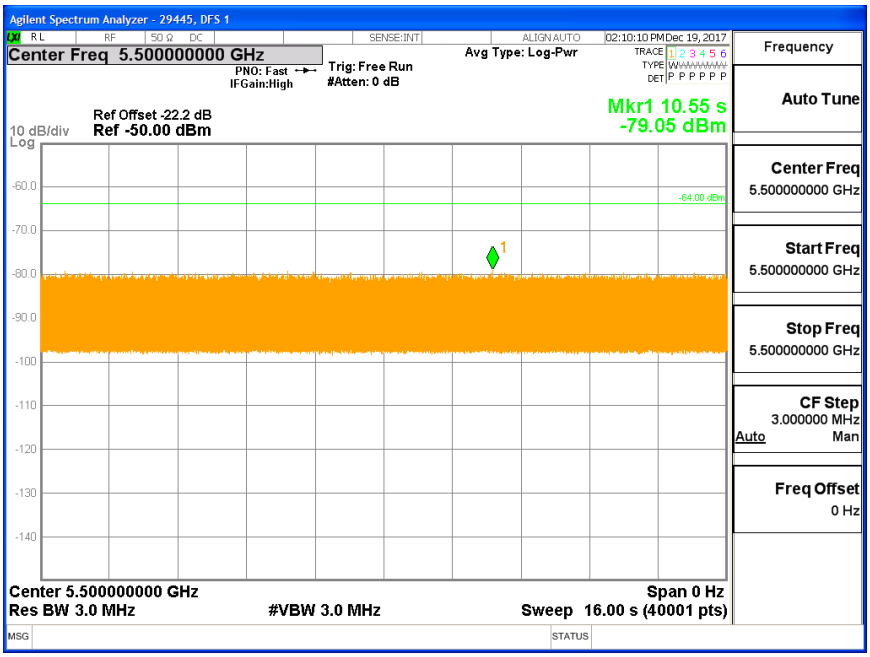


SINGLE BURST OF RADAR TYPE 6

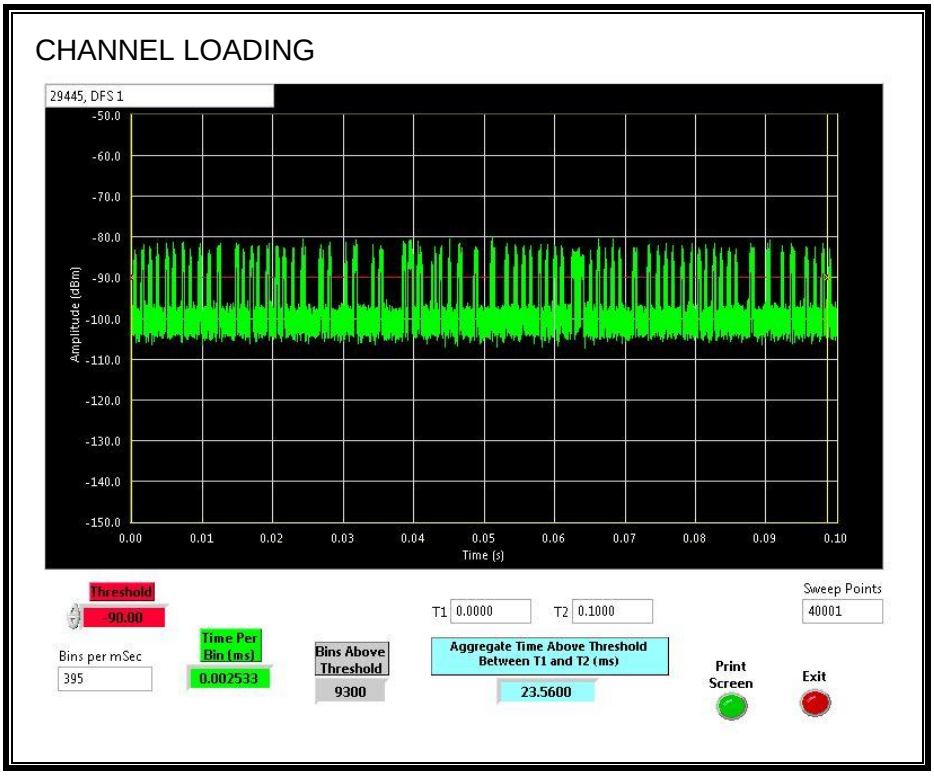


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 23.56%.

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)
30.15	157.0	126.9	66.9

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.48	99.4	69.0	2.1

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.95	154.4	124.5	57.6

QUALITATIVE RESULTS

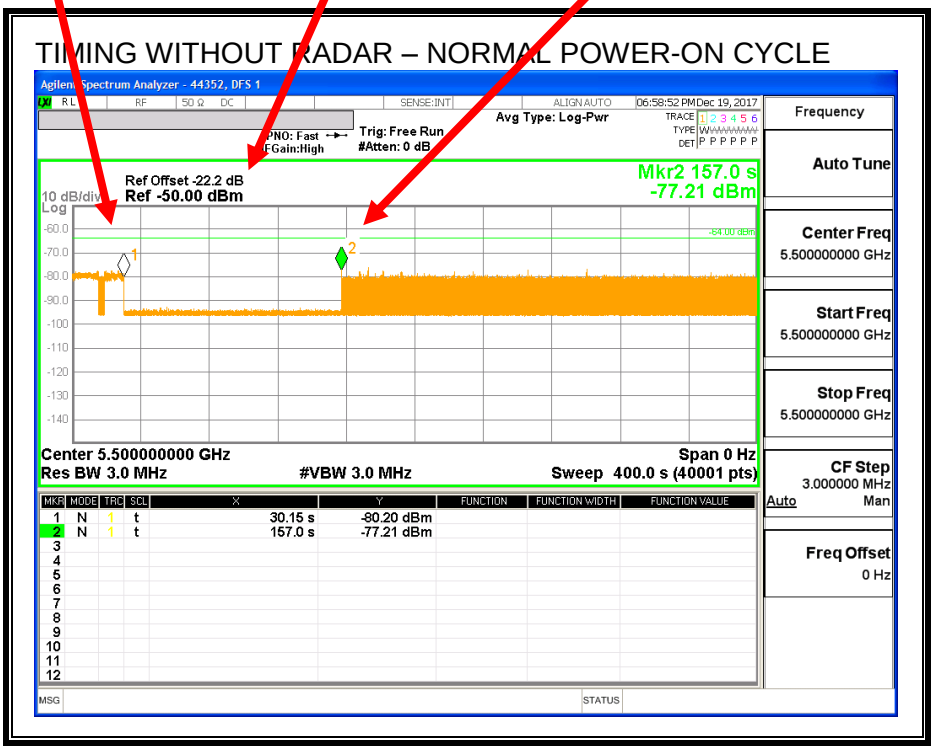
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



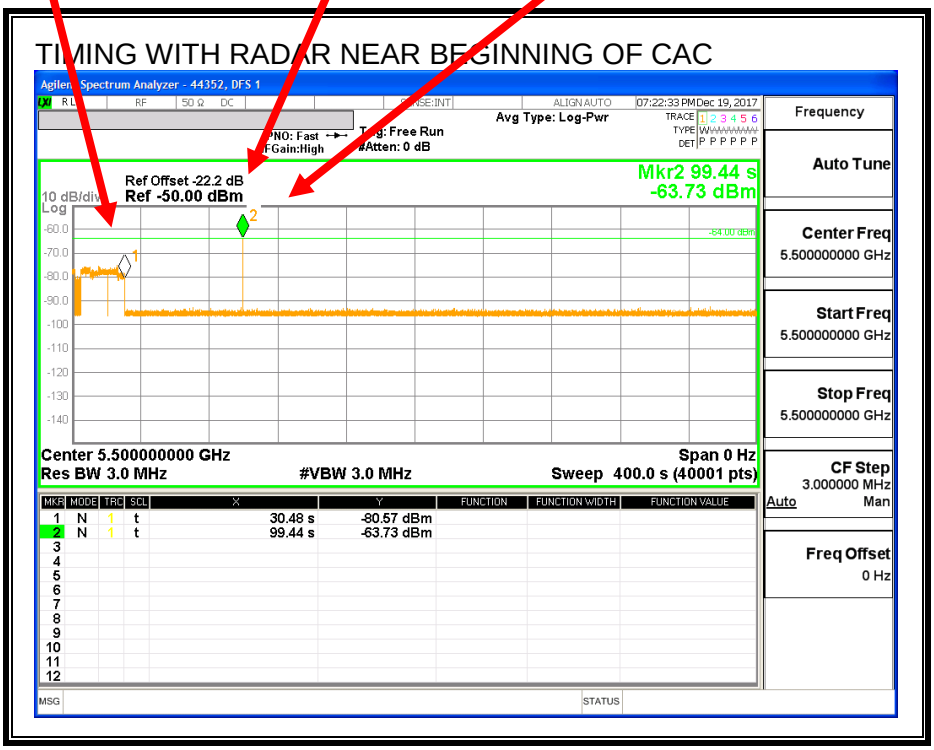
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



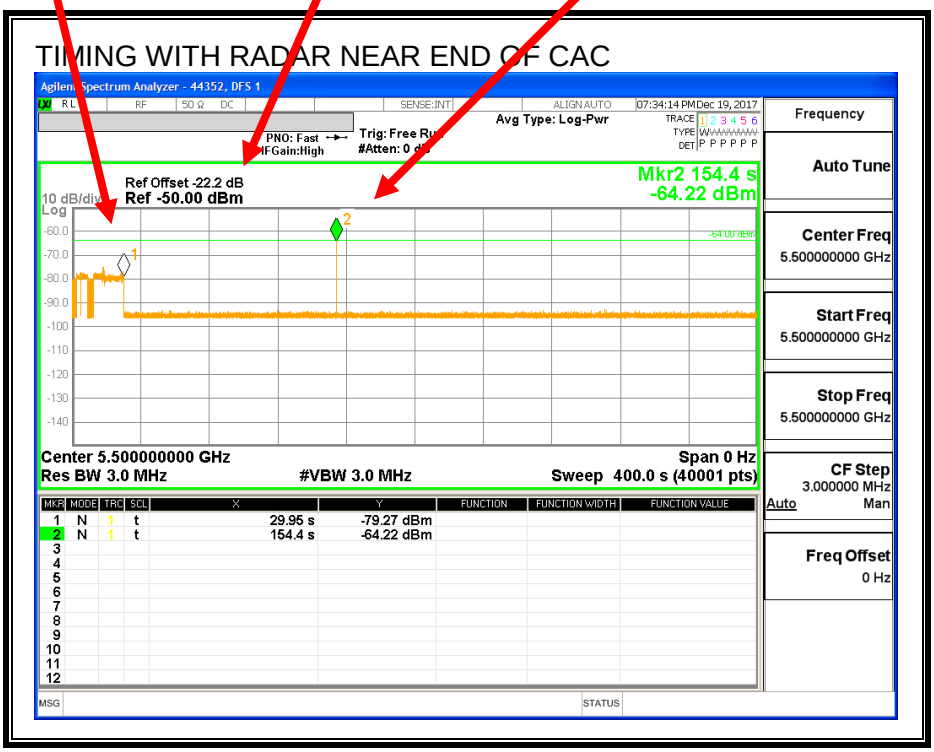
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

6.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

6.2.5. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

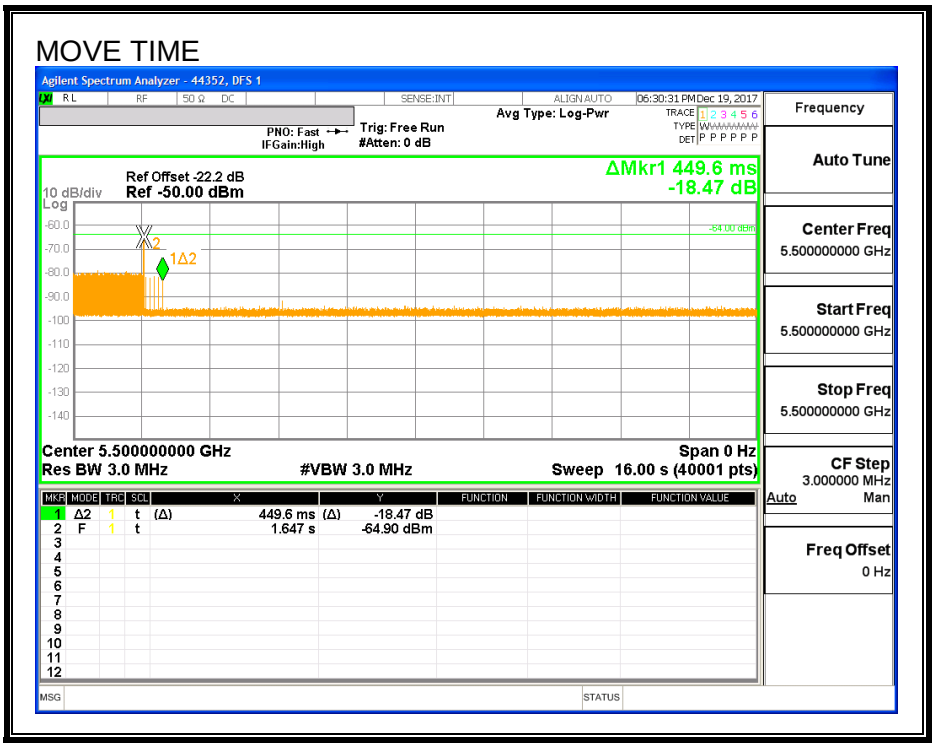
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.450	10

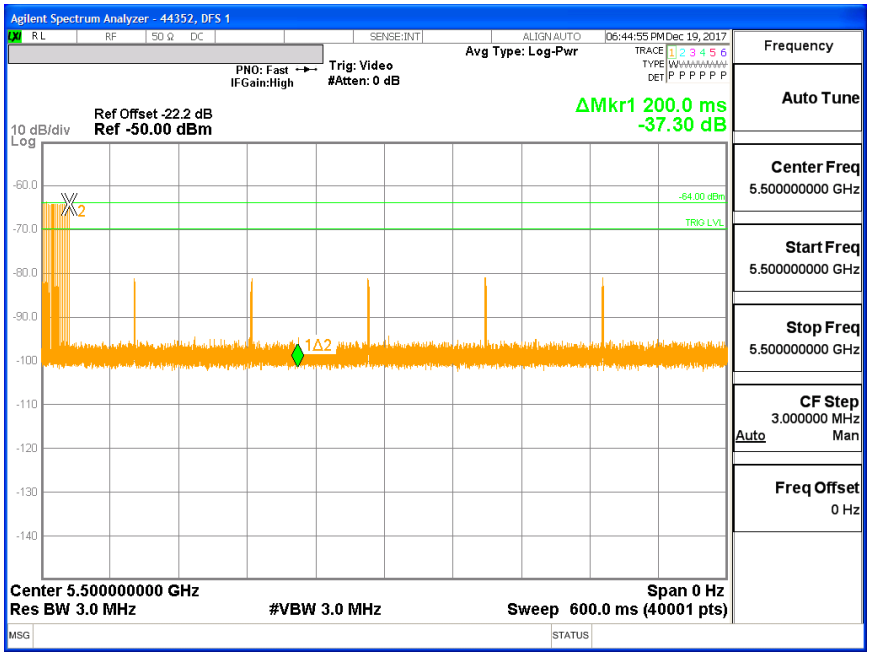
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
4.8	60

MOVE TIME



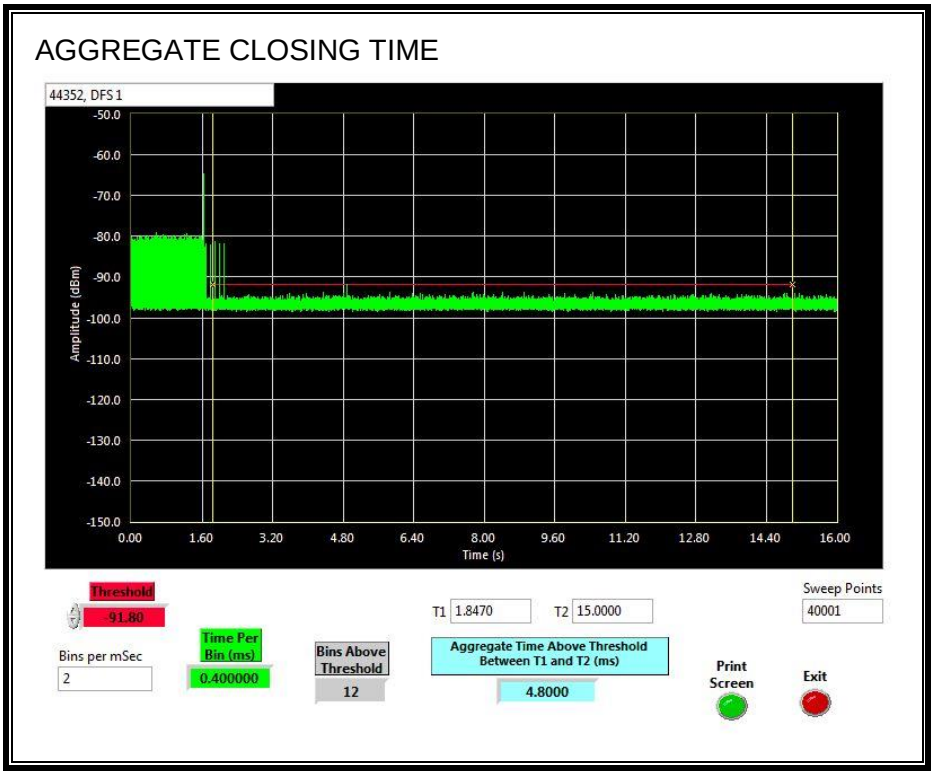
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



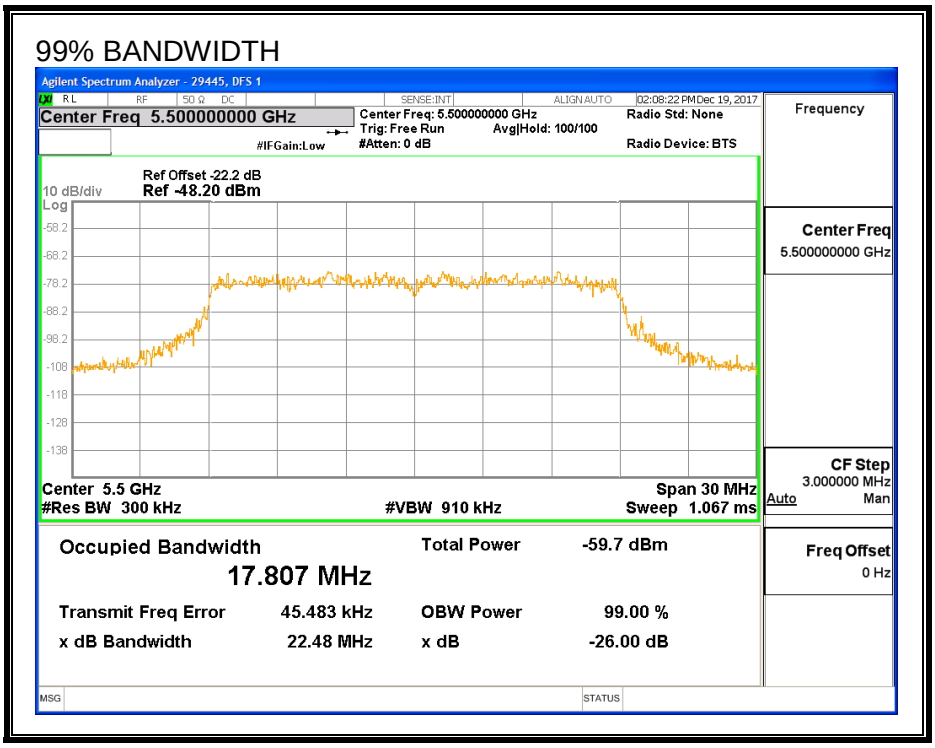
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR

6.2.6. 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	17.807	112.3	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		29445	DFS 1	
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	FH

6.2.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth FL	Detection Bandwidth FH	OBW	Test Location	Employee Number	In-Service Monitoring Version
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5510	17.81	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	96.67	60	Pass	5490	5510	17.81	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5510	17.81	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	66.67	60	Pass	5490	5510	17.81	DFS 1	29445	Version 3.0
Aggregate		85.83	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5510	17.81	DFS 1	29445	Version 3.0
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510		DFS 1	29445	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5501	Yes
1002	1	758	70	A	5493	Yes
1003	1	898	59	A	5492	Yes
1004	1	558	95	A	5498	Yes
1005	1	718	74	A	5510	Yes
1006	1	838	63	A	5497	Yes
1007	1	798	67	A	5492	Yes
1008	1	938	57	A	5508	Yes
1009	1	738	72	A	5506	Yes
1010	1	698	76	A	5492	Yes
1011	1	678	78	A	5497	Yes
1012	1	518	102	A	5491	Yes
1013	1	818	65	A	5491	Yes
1014	1	638	83	A	5496	Yes
1015	1	578	92	A	5500	Yes
1016	1	1713	31	B	5504	Yes
1017	1	927	57	B	5509	Yes
1018	1	624	85	B	5494	Yes
1019	1	1321	40	B	5490	Yes
1020	1	2342	23	B	5499	Yes
1021	1	1975	27	B	5497	Yes
1022	1	1931	28	B	5493	Yes
1023	1	1692	32	B	5499	Yes
1024	1	1777	30	B	5504	Yes
1025	1	1669	32	B	5508	Yes
1026	1	689	77	B	5493	Yes
1027	1	710	75	B	5493	Yes
1028	1	1213	44	B	5505	Yes
1029	1	1363	39	B	5504	Yes
1030	1	1995	27	B	5492	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	213	23	5500	Yes
2002	2.4	201	26	5502	Yes
2003	4.6	220	28	5496	Yes
2004	4.3	212	25	5509	Yes
2005	4.7	197	24	5498	Yes
2006	4.6	155	25	5492	Yes
2007	1.2	226	27	5507	Yes
2008	3.5	226	26	5506	Yes
2009	4.4	181	25	5505	Yes
2010	4.9	228	27	5508	Yes
2011	1.9	188	23	5500	Yes
2012	2.7	159	29	5496	Yes
2013	2	166	26	5498	Yes
2014	3	183	26	5503	Yes
2015	2.6	151	23	5492	Yes
2016	1.9	215	26	5492	Yes
2017	1.7	188	27	5502	Yes
2018	1.1	175	24	5509	Yes
2019	3.3	195	26	5504	No
2020	1.1	229	23	5504	Yes
2021	3.4	172	29	5494	Yes
2022	1.4	211	23	5509	Yes
2023	4	200	29	5498	Yes
2024	2.2	162	23	5505	Yes
2025	3.1	156	23	5500	Yes
2026	3.6	203	28	5495	Yes
2027	4.7	163	28	5509	Yes
2028	1.4	176	27	5507	Yes
2029	4.8	221	24	5498	Yes
2030	1.7	157	23	5506	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	6.3	426	16	5507	No
3002	9.7	374	16	5495	No
3003	9.5	288	18	5505	Yes
3004	6.8	367	17	5503	Yes
3005	8.9	310	17	5503	Yes
3006	6.7	284	18	5497	Yes
3007	9.1	357	16	5497	Yes
3008	7	477	16	5505	Yes
3009	9.6	445	16	5501	Yes
3010	7.8	327	16	5509	Yes
3011	6.8	307	16	5508	Yes
3012	9.2	453	16	5509	Yes
3013	6.2	329	18	5497	Yes
3014	7	370	18	5494	Yes
3015	6.4	258	17	5499	Yes
3016	7.3	312	16	5509	No
3017	6.9	464	17	5502	Yes
3018	6.2	413	17	5507	Yes
3019	8.2	460	17	5496	Yes
3020	7.6	288	16	5508	Yes
3021	7.6	481	16	5510	No
3022	9.5	455	17	5494	Yes
3023	7.8	277	18	5497	Yes
3024	9.8	397	18	5502	Yes
3025	8.3	365	18	5497	Yes
3026	8.7	498	18	5492	Yes
3027	9.6	479	18	5510	No
3028	7.9	374	18	5490	No
3029	7.1	500	17	5510	Yes
3030	9.8	290	17	5505	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	18.1	430	12	5507	No
4002	11.2	483	14	5494	Yes
4003	15.1	384	12	5495	Yes
4004	17.7	333	14	5491	Yes
4005	13	380	13	5494	Yes
4006	11.8	342	15	5500	Yes
4007	16.6	402	16	5499	Yes
4008	15.9	376	12	5505	Yes
4009	12.1	331	13	5499	Yes
4010	16.7	318	14	5495	No
4011	18.2	286	14	5502	Yes
4012	14.1	419	15	5495	Yes
4013	16.1	399	14	5505	Yes
4014	12.5	428	13	5492	Yes
4015	19.7	421	13	5508	No
4016	16.6	462	12	5492	Yes
4017	15.2	350	15	5500	Yes
4018	13.1	404	12	5510	No
4019	12.2	438	15	5496	Yes
4020	14.8	254	13	5501	No
4021	19.2	301	16	5496	Yes
4022	18	262	14	5495	Yes
4023	13.8	322	12	5490	No
4024	13	297	16	5507	No
4025	18.3	252	12	5500	Yes
4026	13.8	490	13	5499	Yes
4027	15.3	457	12	5510	No
4028	11.3	339	13	5494	Yes
4029	13.2	320	13	5504	No
4030	18.7	348	12	5503	No

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	5495	Yes
13	5497	Yes
14	5498	Yes
15	5496	Yes
16	5496	Yes
17	5497	Yes
18	5499	Yes
19	5498	Yes
20	5500	Yes
21	5505	Yes
22	5501	Yes
23	5504	Yes
24	5503	Yes
25	5501	Yes
26	5507	Yes
27	5505	Yes
28	5506	Yes
29	5506	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	354	5490	1	Yes
2	829	5491	2	Yes
3	1304	5492	8	Yes
4	1779	5493	8	Yes
5	2254	5494	5	Yes
6	2729	5495	1	Yes
7	3679	5496	4	Yes
8	4154	5497	4	Yes
9	4629	5498	2	Yes
10	5104	5499	2	Yes
11	5579	5500	1	Yes
12	6054	5501	4	Yes
13	6529	5502	6	Yes
14	7004	5503	2	Yes
15	7479	5504	3	Yes
16	7954	5505	2	Yes
17	8429	5506	3	Yes
18	8904	5507	6	Yes
19	9379	5508	6	Yes
20	9854	5509	4	Yes
21	10329	5510	5	Yes
22	10804	5490	6	Yes
23	11279	5491	5	Yes
24	11754	5492	3	Yes
25	12229	5493	2	Yes
26	12704	5494	5	Yes
27	13179	5495	3	Yes
28	13654	5496	1	Yes
29	14129	5497	5	Yes
30	14604	5498	4	Yes
31	15079	5499	6	Yes
32	15554	5500	2	Yes
33	16029	5501	5	Yes
34	16504	5502	9	Yes
35	16979	5503	5	Yes
36	17454	5504	3	Yes
37	17929	5505	2	Yes
38	18404	5506	5	Yes
39	19354	5507	4	Yes
40	19829	5508	6	Yes
41	20304	5509	3	Yes
42	20779	5510	2	Yes

6.3. RESULTS FOR 40 MHz BANDWIDTH

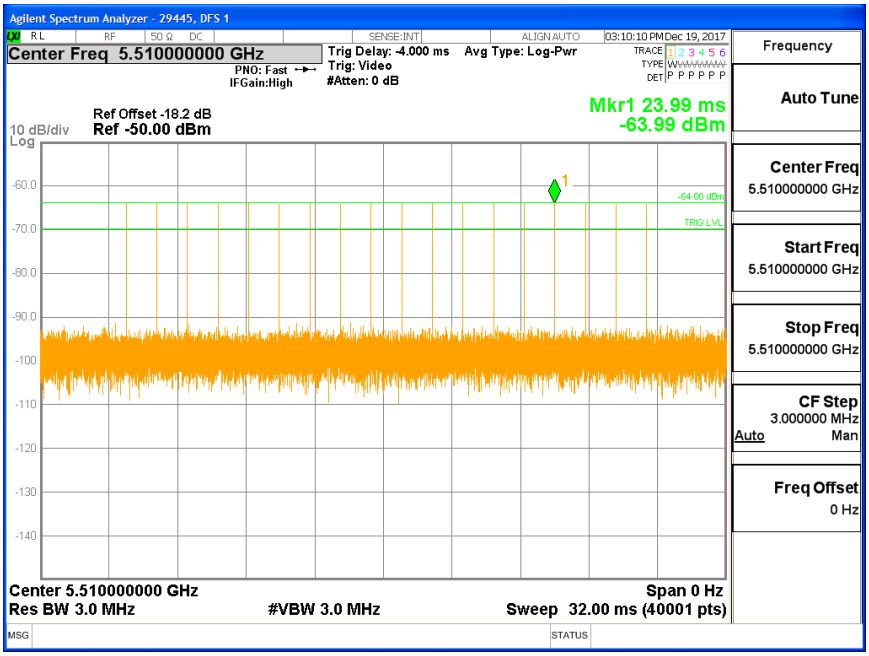
6.3.1. TEST CHANNEL

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

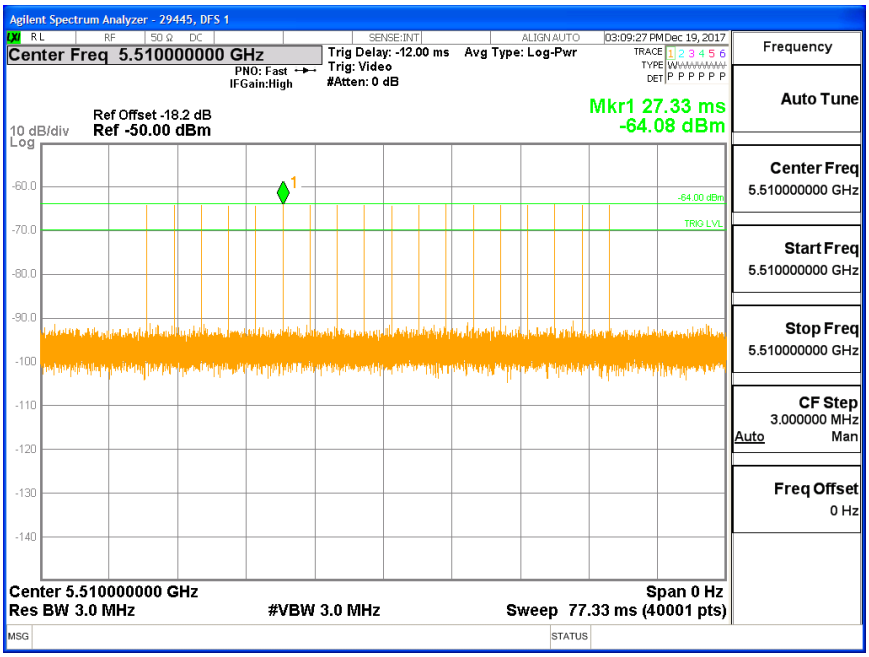
6.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

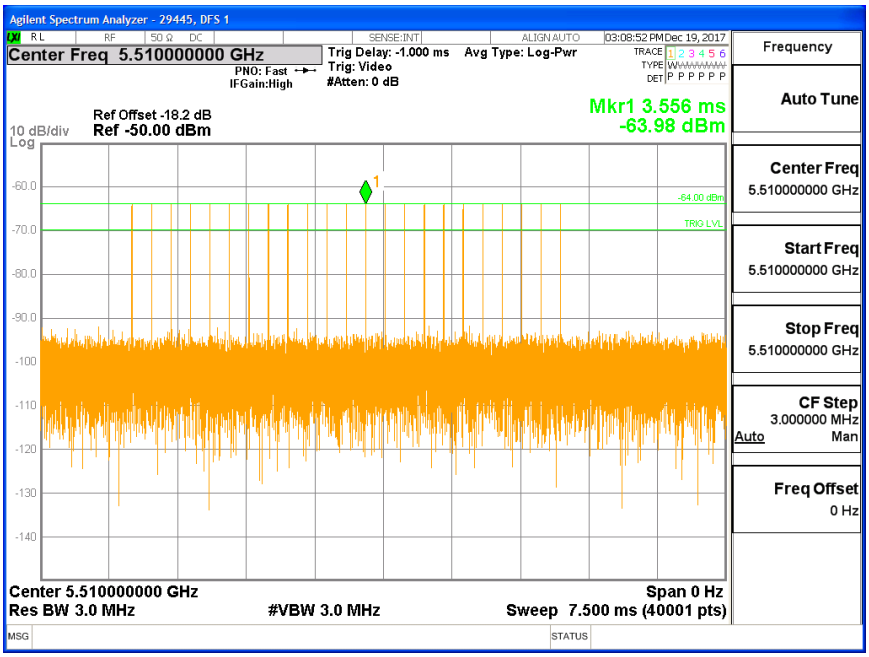
SHORT PULSE RADAR TYPE 0



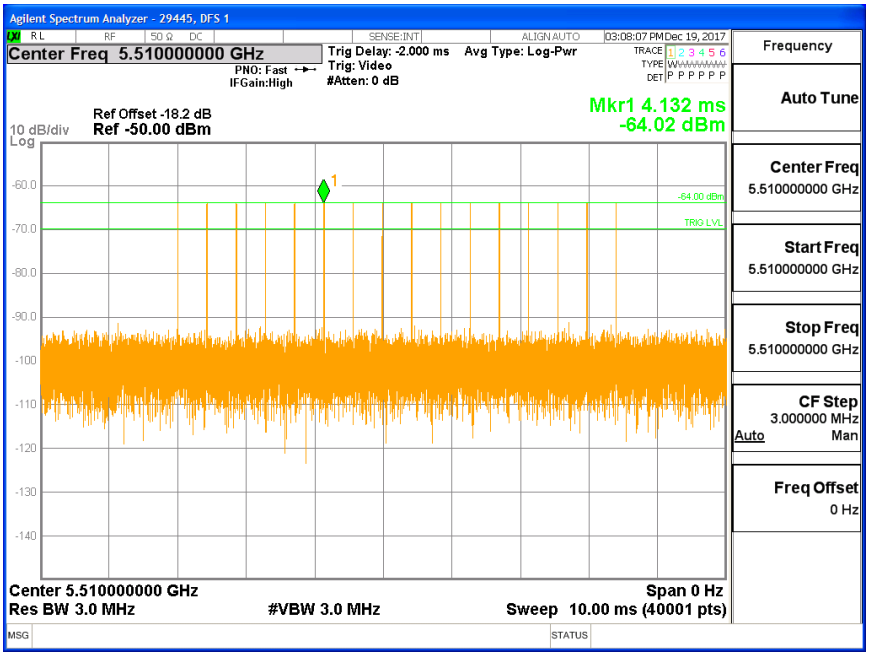
SAMPLE OF RADAR TYPE 1



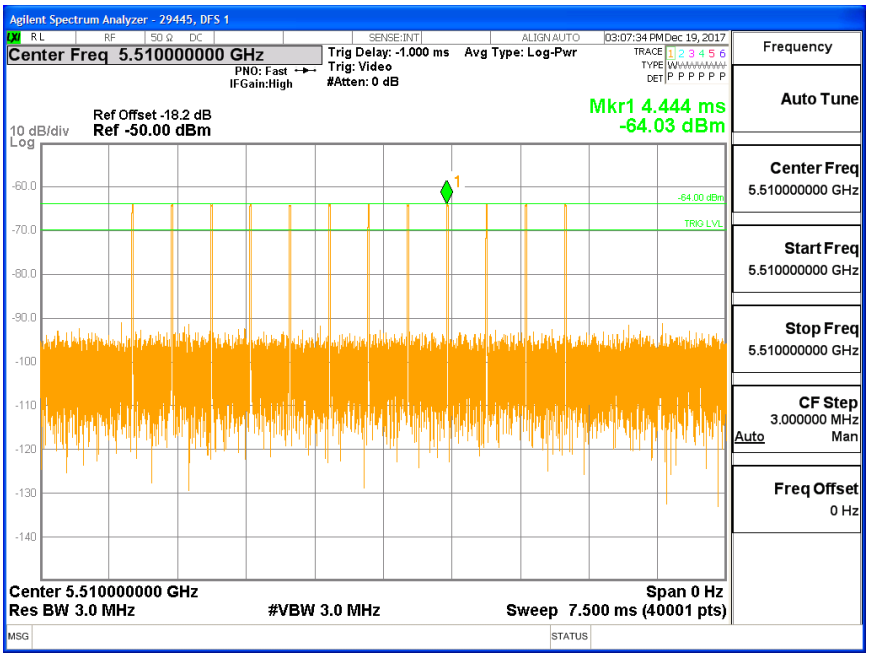
SAMPLE OF RADAR TYPE 2



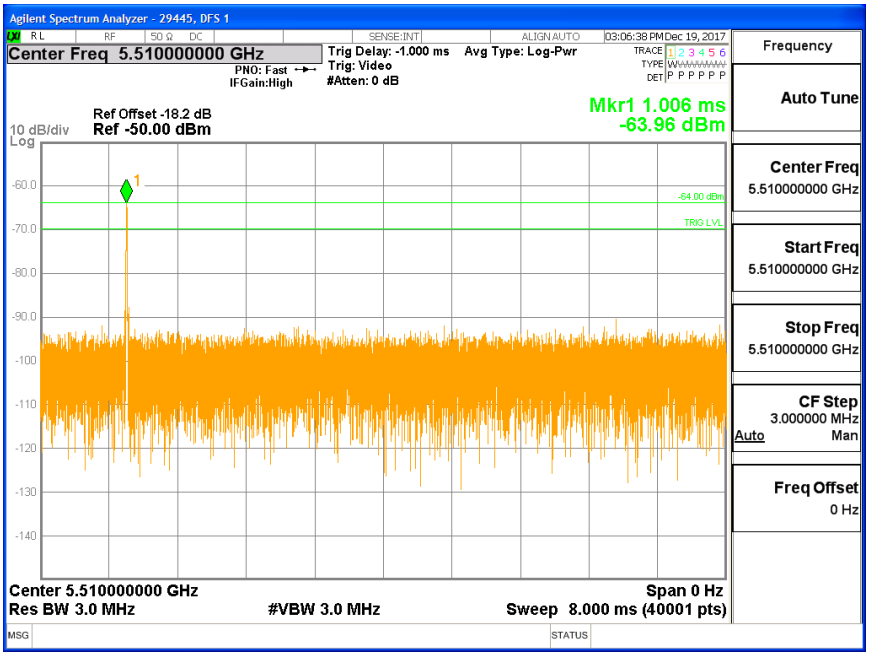
SAMPLE OF RADAR TYPE 3



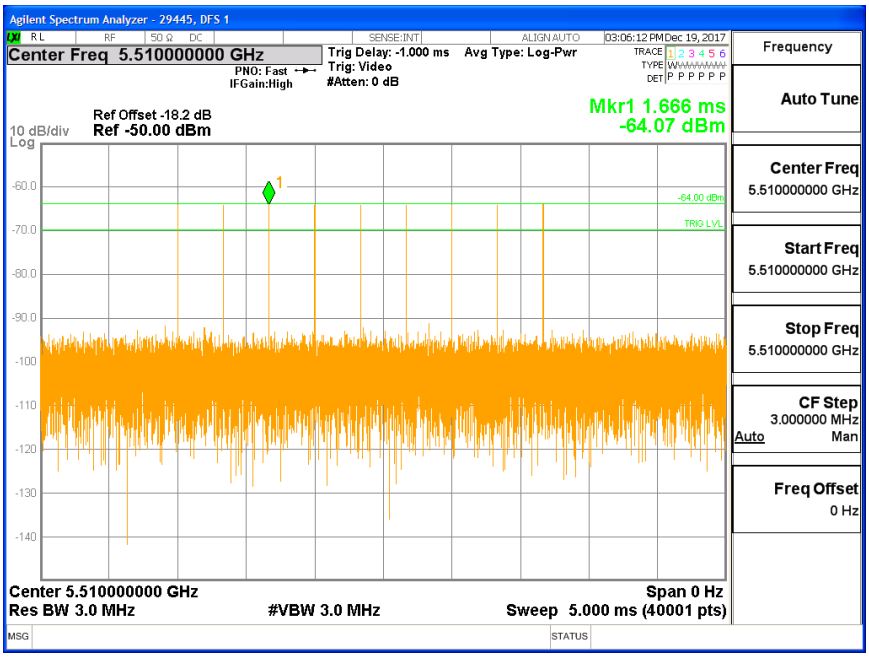
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

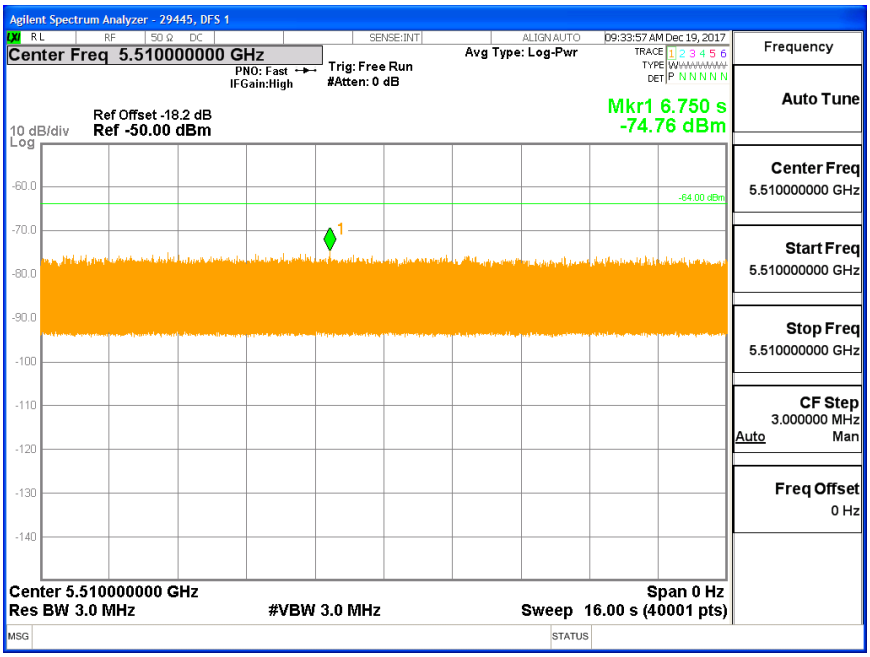


SINGLE BURST OF RADAR TYPE 6

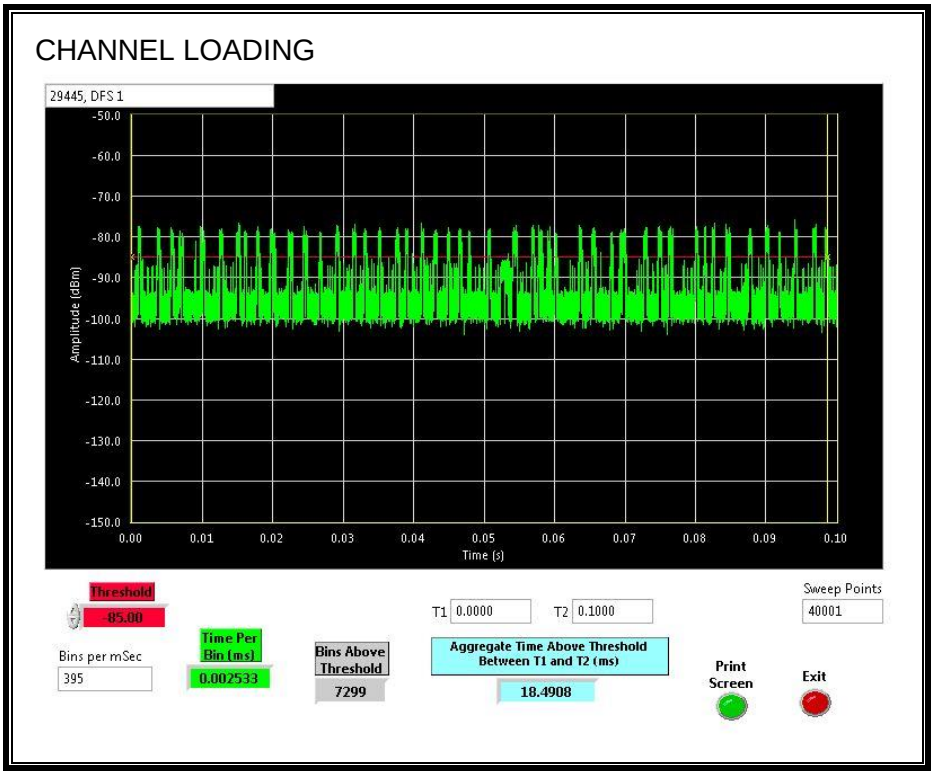


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.49%.

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)
30.42	159.1	128.7	68.7

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)
30.02	100.5	70.5	1.8

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.68	156.5	126.8	58.1

QUALITATIVE RESULTS

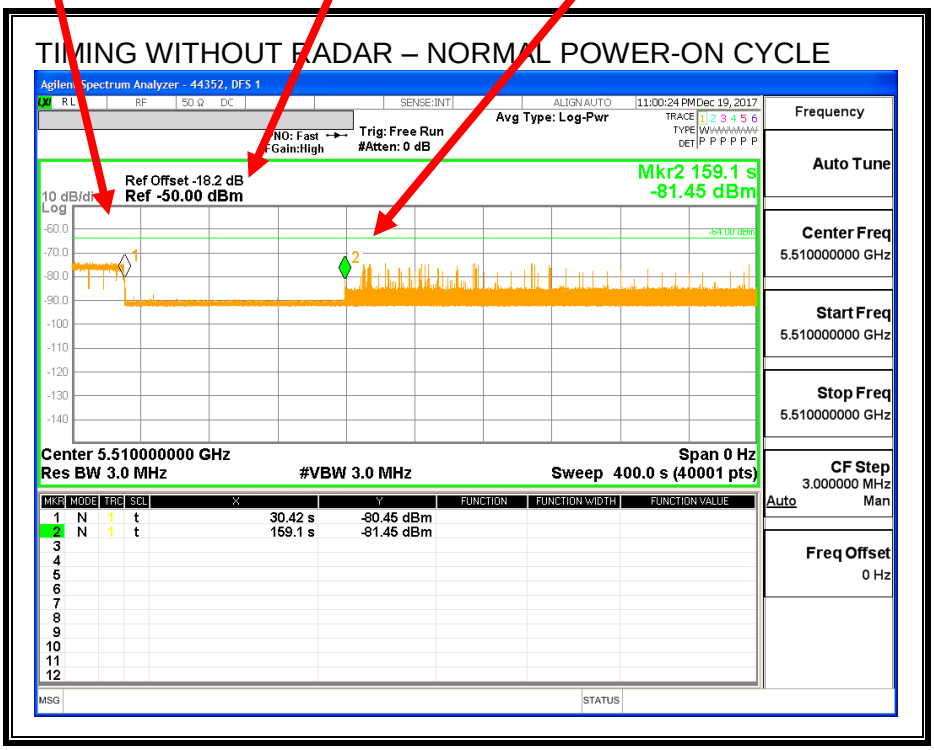
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



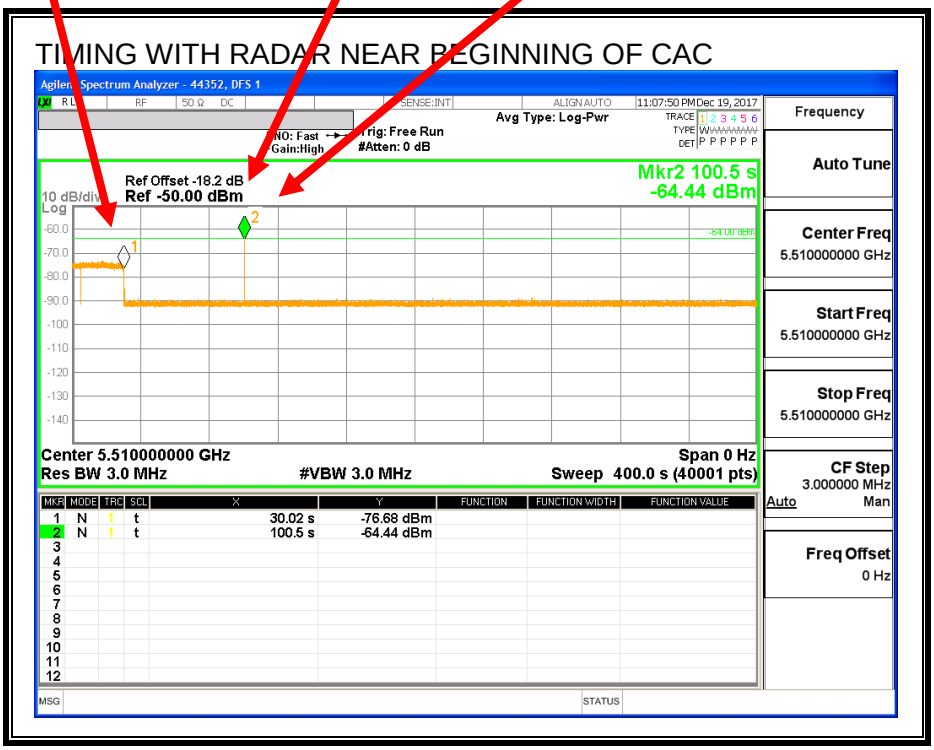
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



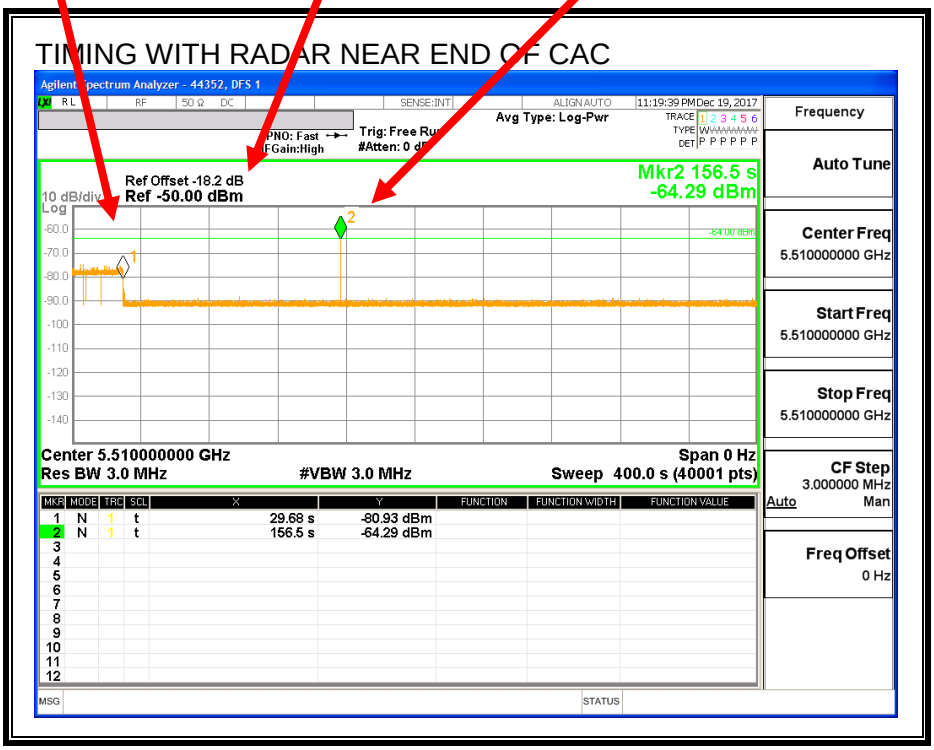
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

6.3.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

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)
0.572	10

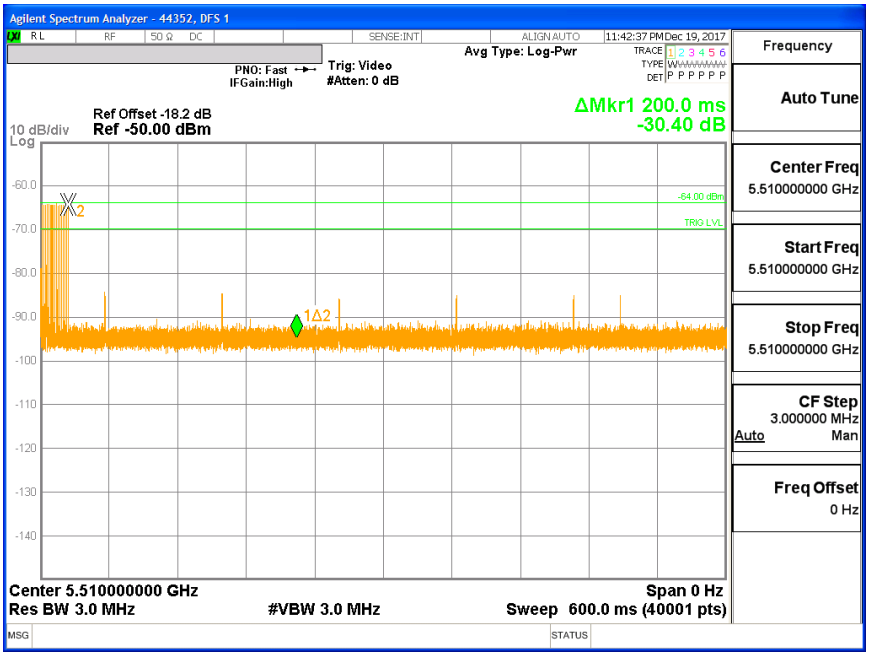
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
5.2	60

MOVE TIME

MOVE TIME

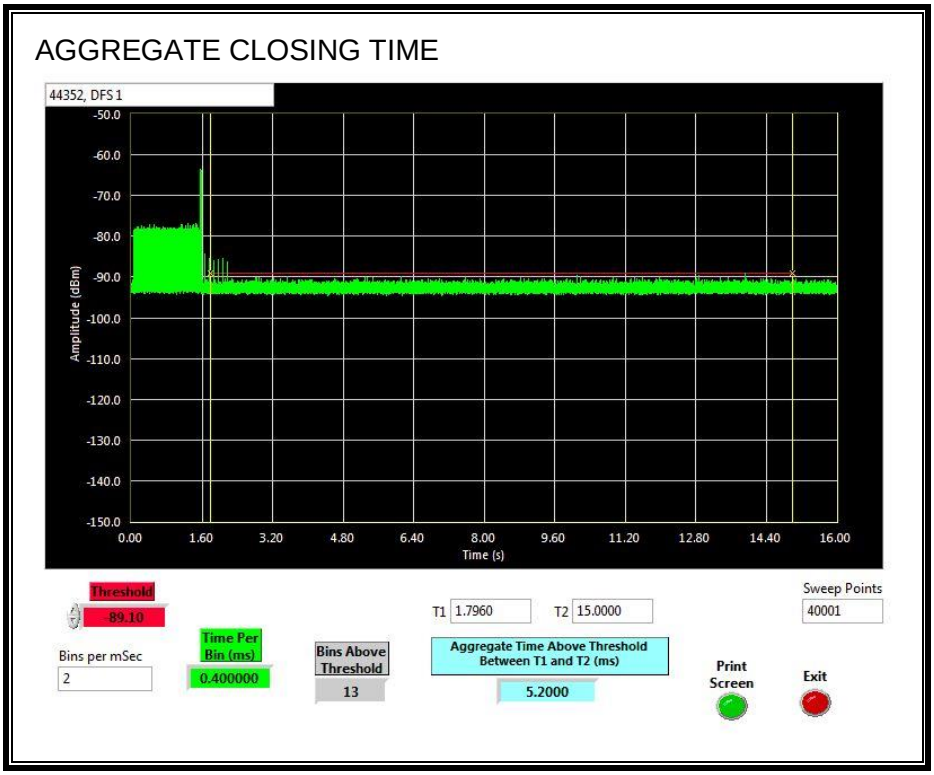
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

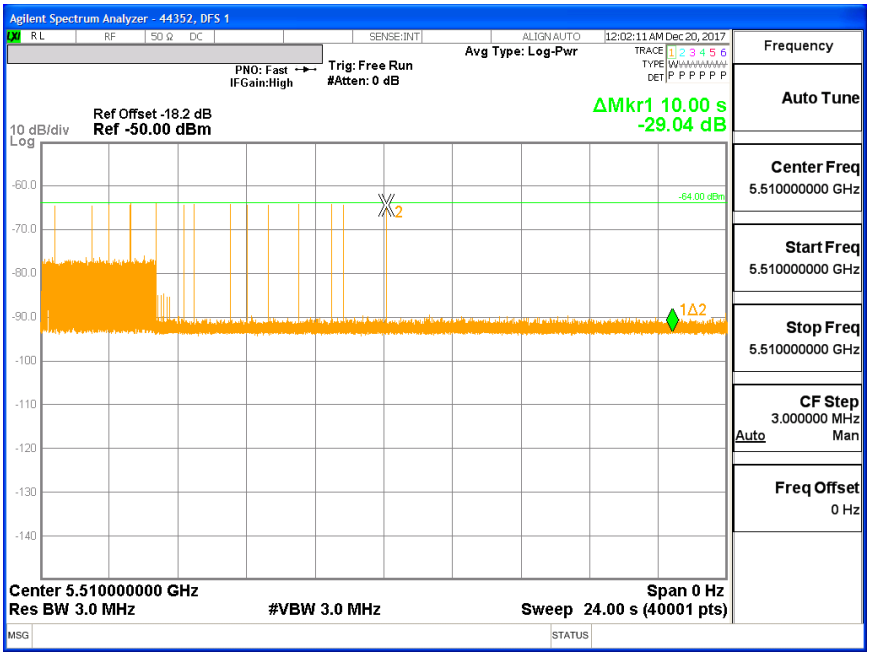
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

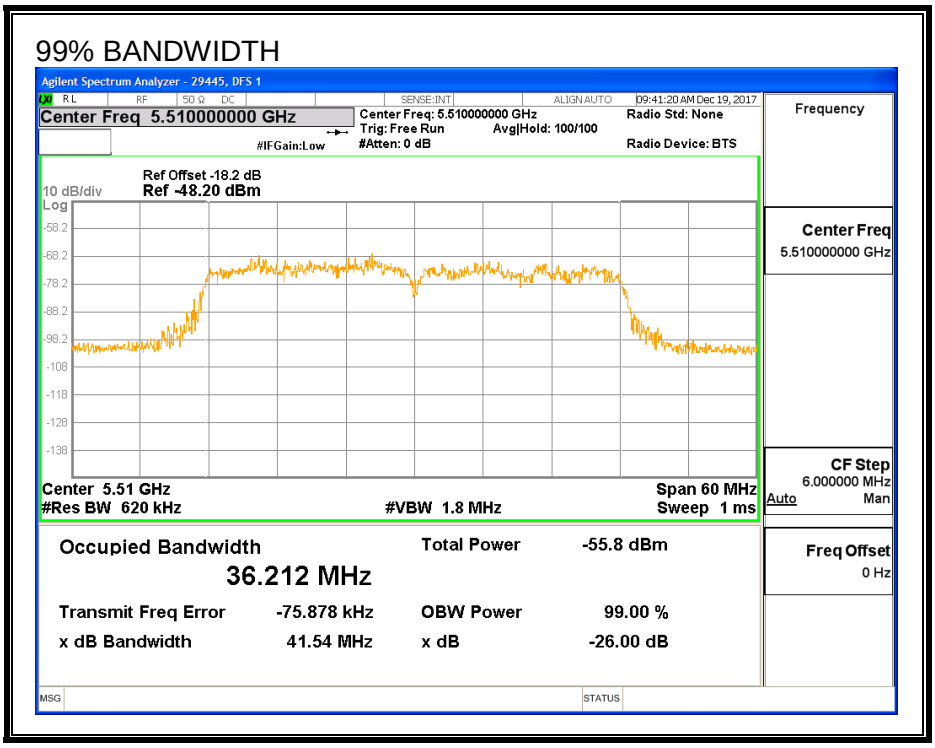
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



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	36.212	110.5	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results		29445	DFS 1	
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5490	10	10	100	FL
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	FH

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	93.33	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.0
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.0
FCC Short Pulse Type 3	30	76.67	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.0
FCC Short Pulse Type 4	30	63.33	60	Pass	5490	5530	36.21	DFS 1	29445	Version 3.0
Aggregate		81.67	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	36.21	DFS 1	29445	Version 3.0
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530		DFS 1	29445	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5528	No
1002	1	758	70	A	5513	Yes
1003	1	898	59	A	5511	Yes
1004	1	558	95	A	5495	Yes
1005	1	718	74	A	5513	Yes
1006	1	838	63	A	5501	Yes
1007	1	798	67	A	5522	Yes
1008	1	938	57	A	5515	Yes
1009	1	738	72	A	5504	Yes
1010	1	698	76	A	5506	Yes
1011	1	678	78	A	5510	Yes
1012	1	518	102	A	5517	No
1013	1	818	65	A	5514	Yes
1014	1	638	83	A	5517	Yes
1015	1	578	92	A	5501	Yes
1016	1	1713	31	B	5497	Yes
1017	1	927	57	B	5529	Yes
1018	1	624	85	B	5498	Yes
1019	1	1321	40	B	5521	Yes
1020	1	2342	23	B	5520	Yes
1021	1	1975	27	B	5522	Yes
1022	1	1931	28	B	5495	Yes
1023	1	1692	32	B	5512	Yes
1024	1	1777	30	B	5524	Yes
1025	1	1669	32	B	5516	Yes
1026	1	689	77	B	5503	Yes
1027	1	710	75	B	5501	Yes
1028	1	1213	44	B	5514	Yes
1029	1	1363	39	B	5520	Yes
1030	1	1995	27	B	5512	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	213	23	5492	Yes
2002	2.4	201	26	5492	Yes
2003	4.6	220	28	5506	Yes
2004	4.3	212	25	5518	Yes
2005	4.7	197	24	5507	Yes
2006	4.6	155	25	5519	Yes
2007	1.2	226	27	5517	Yes
2008	3.5	226	26	5494	No
2009	4.4	181	25	5522	Yes
2010	4.9	228	27	5526	Yes
2011	1.9	188	23	5516	Yes
2012	2.7	159	29	5511	Yes
2013	2	166	26	5493	Yes
2014	3	183	26	5523	Yes
2015	2.6	151	23	5529	Yes
2016	1.9	215	26	5530	No
2017	1.7	188	27	5522	Yes
2018	1.1	175	24	5508	Yes
2019	3.3	195	26	5492	Yes
2020	1.1	229	23	5499	Yes
2021	3.4	172	29	5525	Yes
2022	1.4	211	23	5512	Yes
2023	4	200	29	5515	Yes
2024	2.2	162	23	5510	Yes
2025	3.1	156	23	5514	Yes
2026	3.6	203	28	5500	Yes
2027	4.7	163	28	5522	Yes
2028	1.4	176	27	5510	Yes
2029	4.8	221	24	5494	Yes
2030	1.7	157	23	5523	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	6.3	426	16	5501	Yes
3002	9.7	374	16	5525	Yes
3003	9.5	288	18	5501	Yes
3004	6.8	367	17	5529	Yes
3005	8.9	310	17	5492	Yes
3006	6.7	284	18	5526	Yes
3007	9.1	357	16	5522	No
3008	7	477	16	5503	No
3009	9.6	445	16	5497	No
3010	7.8	327	16	5503	No
3011	6.8	307	16	5529	No
3012	9.2	453	16	5509	Yes
3013	6.2	329	18	5496	Yes
3014	7	370	18	5513	Yes
3015	6.4	258	17	5528	Yes
3016	7.3	312	16	5525	Yes
3017	6.9	464	17	5501	Yes
3018	6.2	413	17	5530	Yes
3019	8.2	460	17	5528	Yes
3020	7.6	288	16	5514	Yes
3021	7.6	481	16	5500	Yes
3022	9.5	455	17	5526	No
3023	7.8	277	18	5505	No
3024	9.8	397	18	5496	Yes
3025	8.3	365	18	5504	Yes
3026	8.7	498	18	5498	Yes
3027	9.6	479	18	5492	Yes
3028	7.9	374	18	5498	Yes
3029	7.1	500	17	5526	Yes
3030	9.8	290	17	5523	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	18.1	430	12	5509	Yes
4002	11.2	483	14	5530	Yes
4003	15.1	384	12	5518	No
4004	17.7	333	14	5510	Yes
4005	13	380	13	5517	Yes
4006	11.8	342	15	5492	Yes
4007	16.6	402	16	5500	No
4008	15.9	376	12	5522	No
4009	12.1	331	13	5516	Yes
4010	16.7	318	14	5523	Yes
4011	18.2	286	14	5505	Yes
4012	14.1	419	15	5511	Yes
4013	16.1	399	14	5492	Yes
4014	12.5	428	13	5515	Yes
4015	19.7	421	13	5504	Yes
4016	16.6	462	12	5527	No
4017	15.2	350	15	5501	No
4018	13.1	404	12	5495	Yes
4019	12.2	438	15	5496	Yes
4020	14.8	254	13	5524	Yes
4021	19.2	301	16	5497	No
4022	18	262	14	5506	No
4023	13.8	322	12	5527	No
4024	13	297	16	5495	Yes
4025	18.3	252	12	5504	No
4026	13.8	490	13	5508	No
4027	15.3	457	12	5519	Yes
4028	11.3	339	13	5513	No
4029	13.2	320	13	5503	Yes
4030	18.7	348	12	5500	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	5496	Yes
13	5498	Yes
14	5499	Yes
15	5497	Yes
16	5496	Yes
17	5498	Yes
18	5500	Yes
19	5498	Yes
20	5500	Yes
21	5524	Yes
22	5520	Yes
23	5523	Yes
24	5522	Yes
25	5521	Yes
26	5526	Yes
27	5524	Yes
28	5525	Yes
29	5525	Yes
30	5525	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	110	5490	5	Yes
2	585	5491	10	Yes
3	1060	5492	7	Yes
4	1535	5493	11	Yes
5	2010	5494	8	Yes
6	2485	5495	10	Yes
7	2960	5496	9	Yes
8	3435	5497	7	Yes
9	3910	5498	5	Yes
10	4385	5499	8	Yes
11	4860	5500	10	Yes
12	5335	5501	6	Yes
13	5810	5502	9	Yes
14	6285	5503	7	Yes
15	6760	5504	8	Yes
16	7235	5505	7	Yes
17	7710	5506	8	Yes
18	8185	5507	11	Yes
19	8660	5508	6	Yes
20	9135	5509	14	Yes
21	9610	5510	10	Yes
22	10085	5511	7	Yes
23	10560	5512	8	Yes
24	11035	5513	11	Yes
25	11510	5514	10	Yes
26	11985	5515	13	Yes
27	12460	5516	8	Yes
28	12935	5517	15	Yes
29	13410	5518	16	Yes
30	13885	5519	4	Yes
31	14360	5520	10	Yes
32	14835	5521	7	Yes
33	15310	5522	10	Yes
34	15785	5523	7	Yes
35	16260	5524	3	Yes
36	16735	5525	8	Yes
37	17210	5526	6	Yes
38	17685	5527	8	Yes
39	18160	5528	12	Yes
40	18635	5529	8	Yes
41	19110	5530	9	Yes

6.4. RESULTS FOR 80 MHz BANDWIDTH

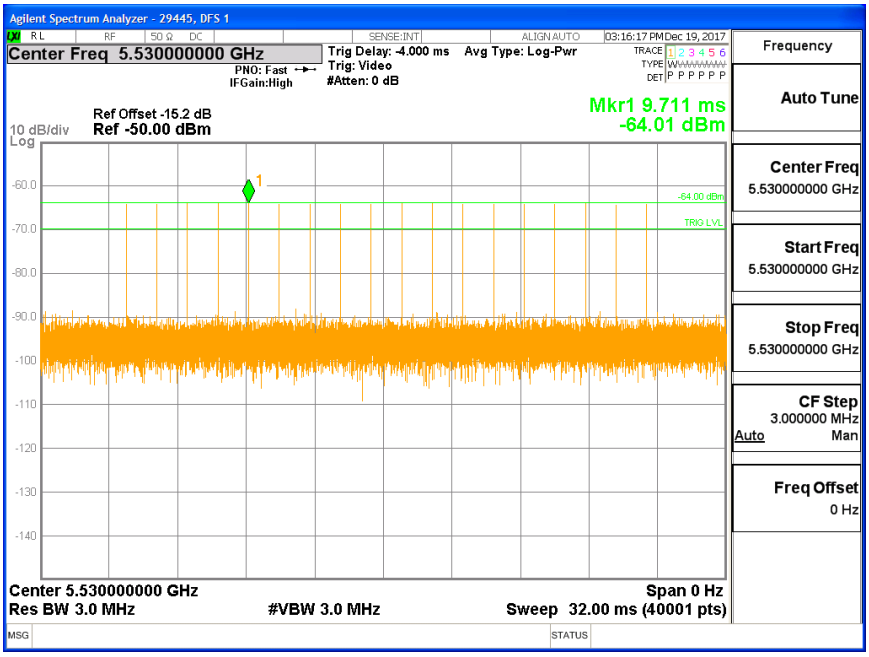
6.4.1. TEST CHANNEL

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

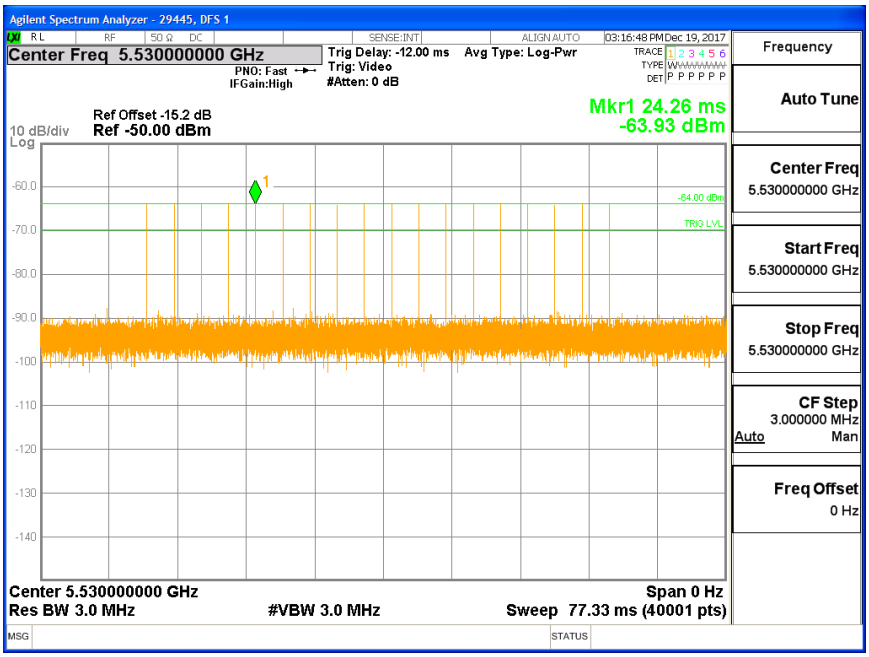
6.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

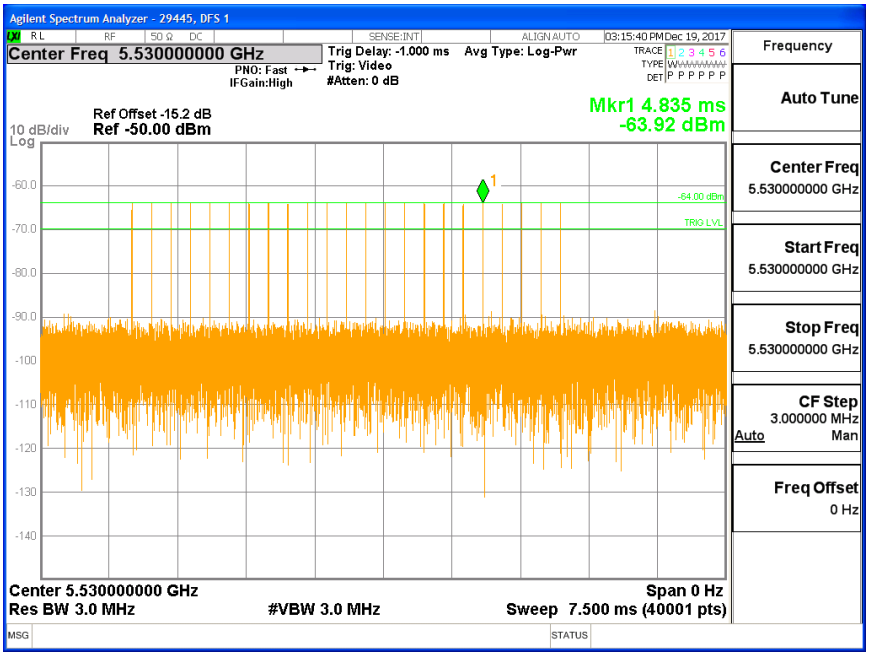
SHORT PULSE RADAR TYPE 0



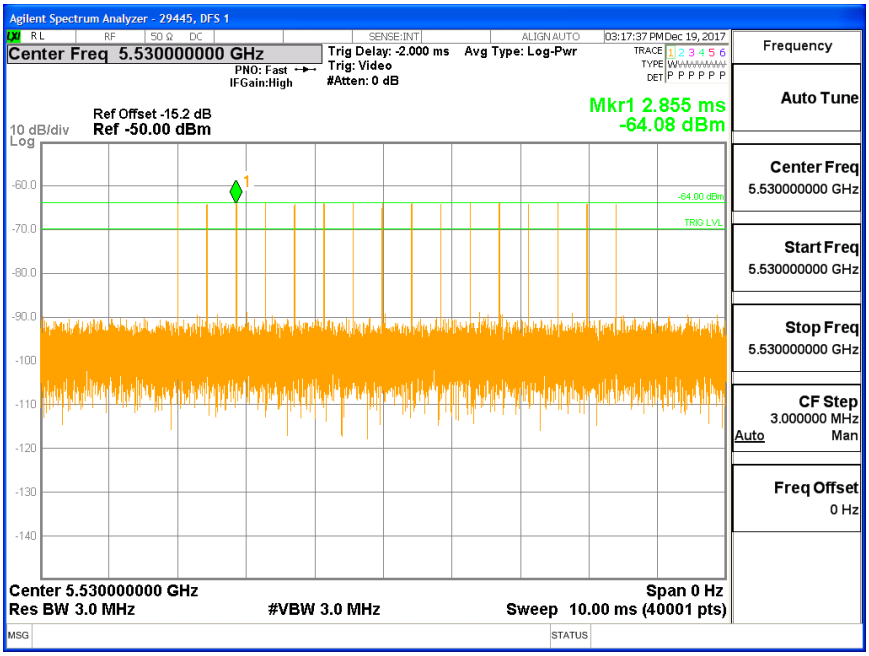
SAMPLE OF RADAR TYPE 1



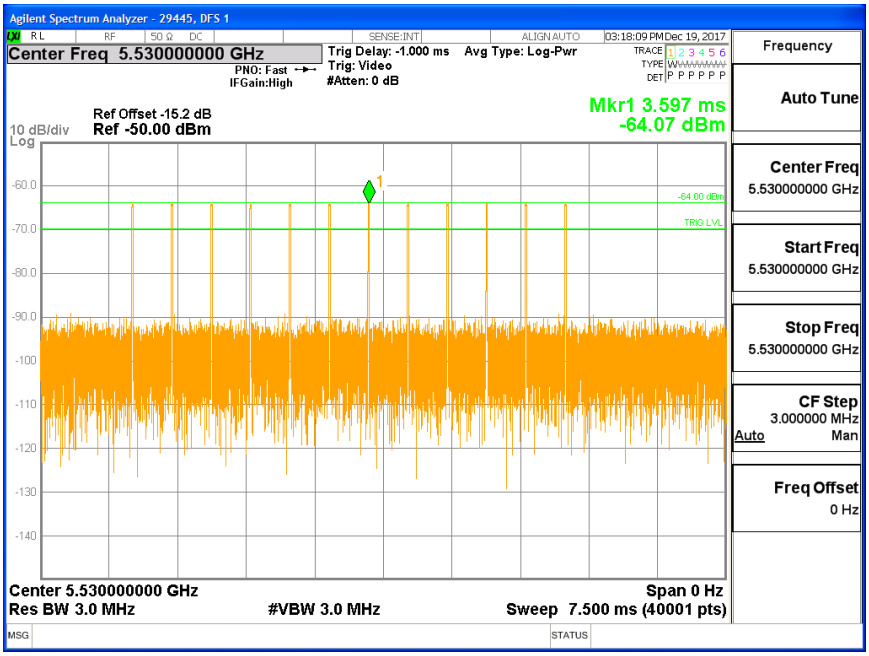
SAMPLE OF RADAR TYPE 2



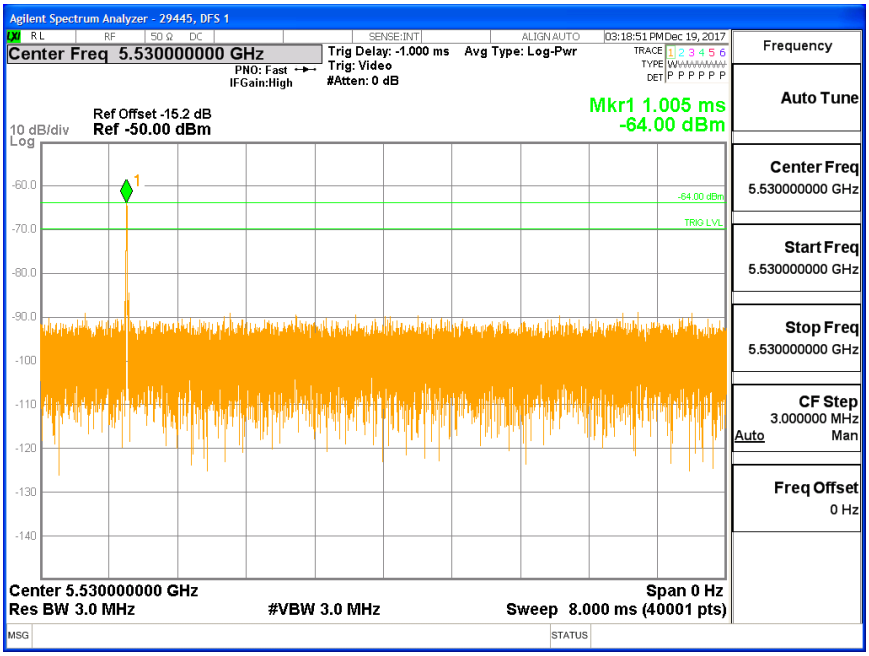
SAMPLE OF RADAR TYPE 3



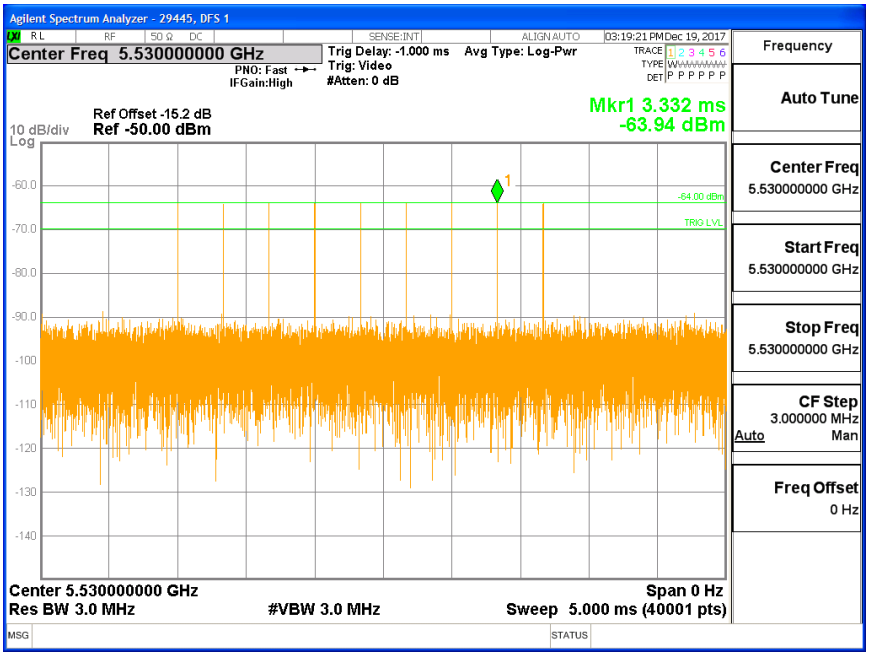
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

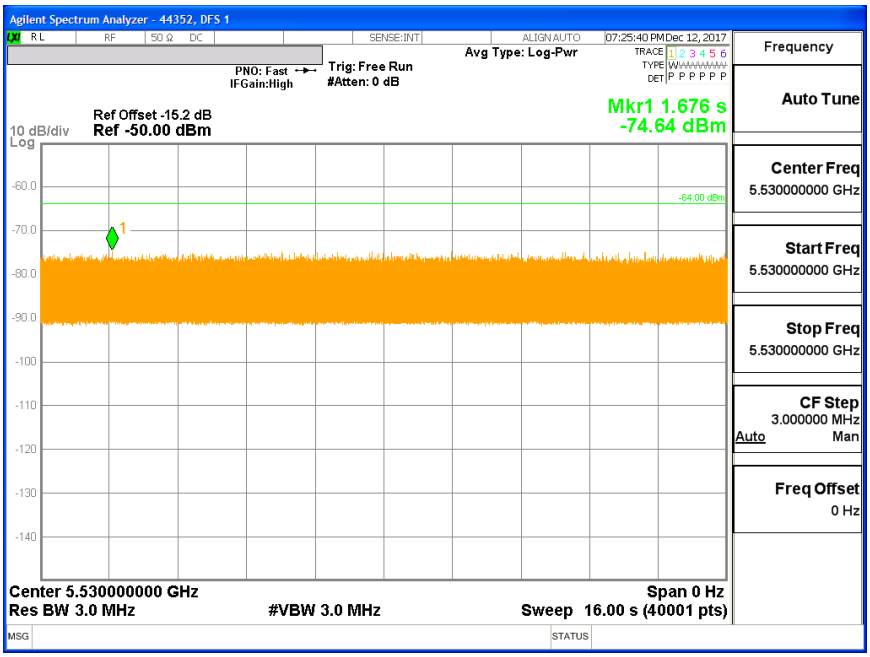


SINGLE BURST OF RADAR TYPE 6

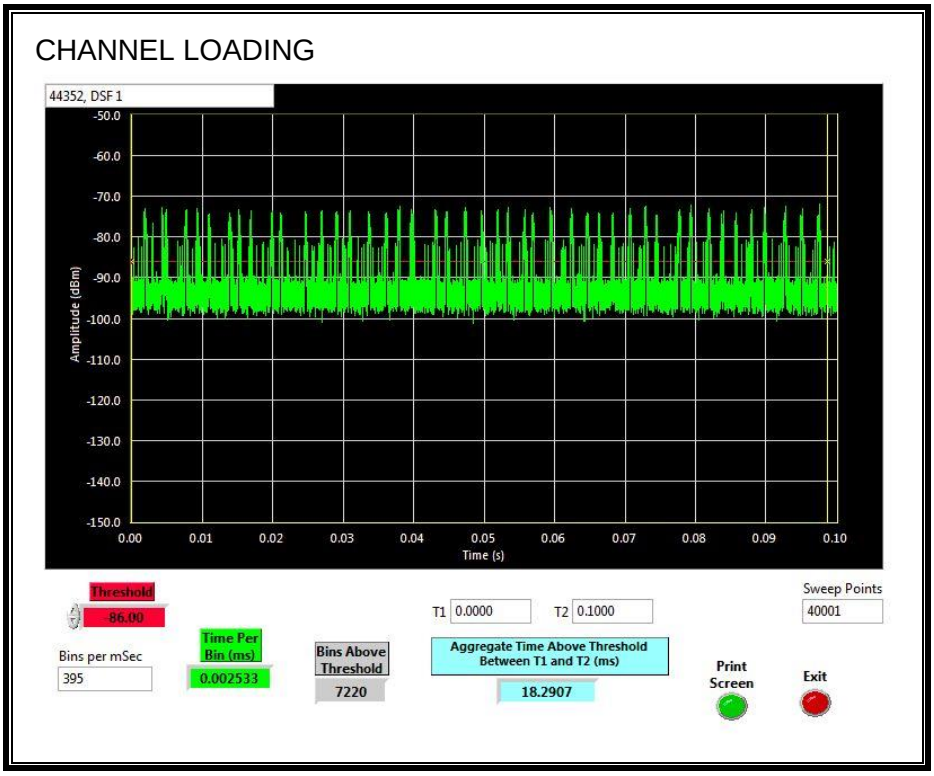


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.29%.

6.4.1. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.12	155.6	125.5	65.5

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)
30.11	98.4	68.3	2.8

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)
31.64	155.4	123.8	58.3

QUALITATIVE RESULTS

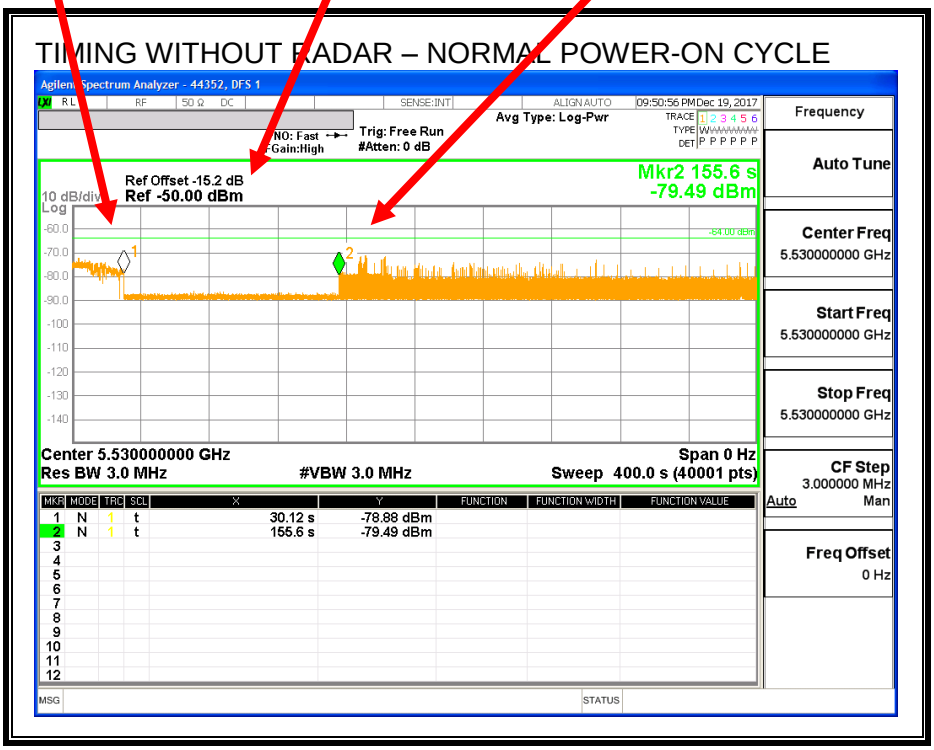
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



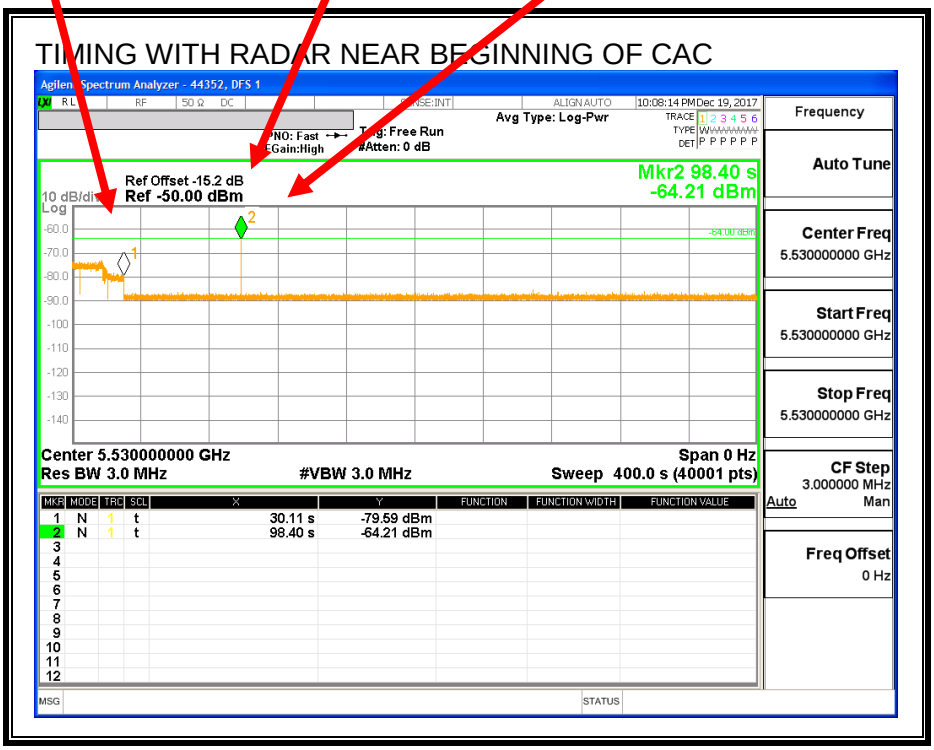
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



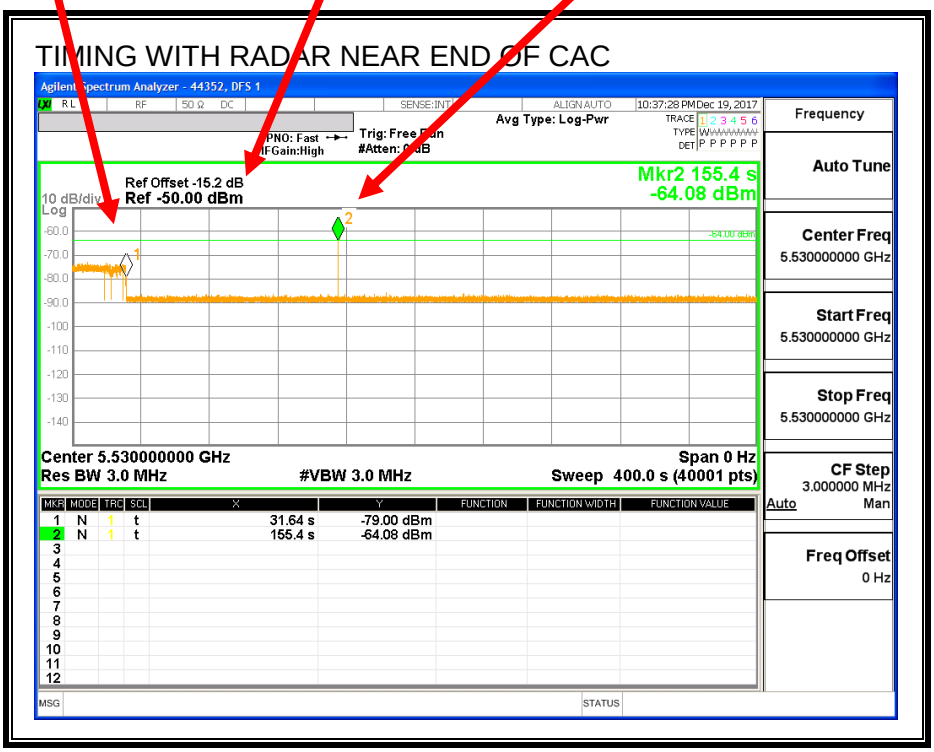
No EUT transmissions were observed after the radar signal.

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.

6.4.2. 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)

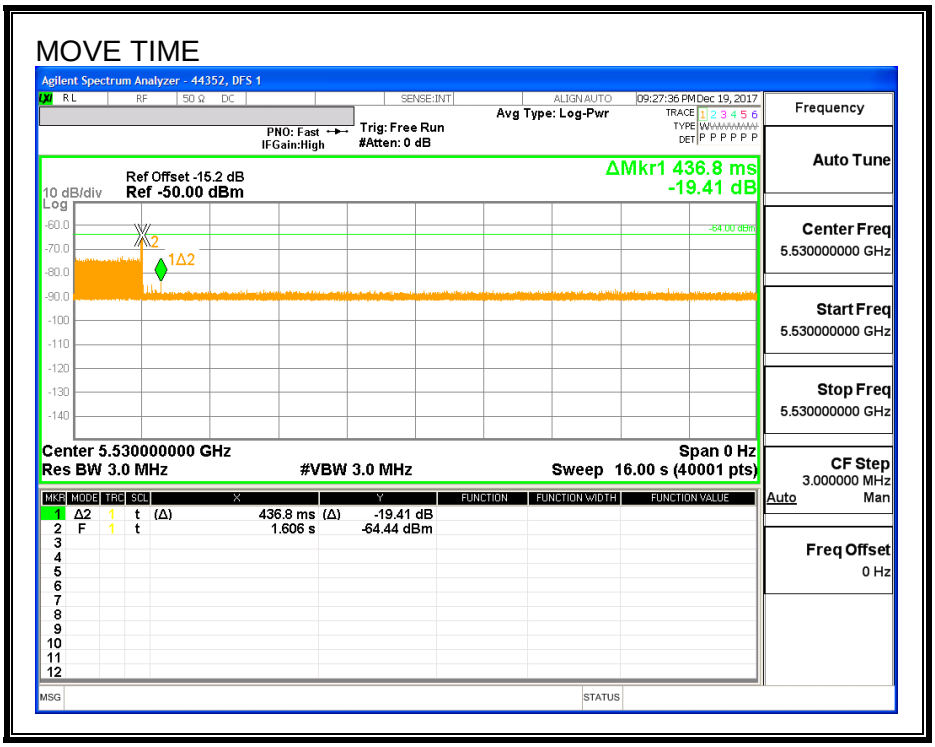
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.437	10

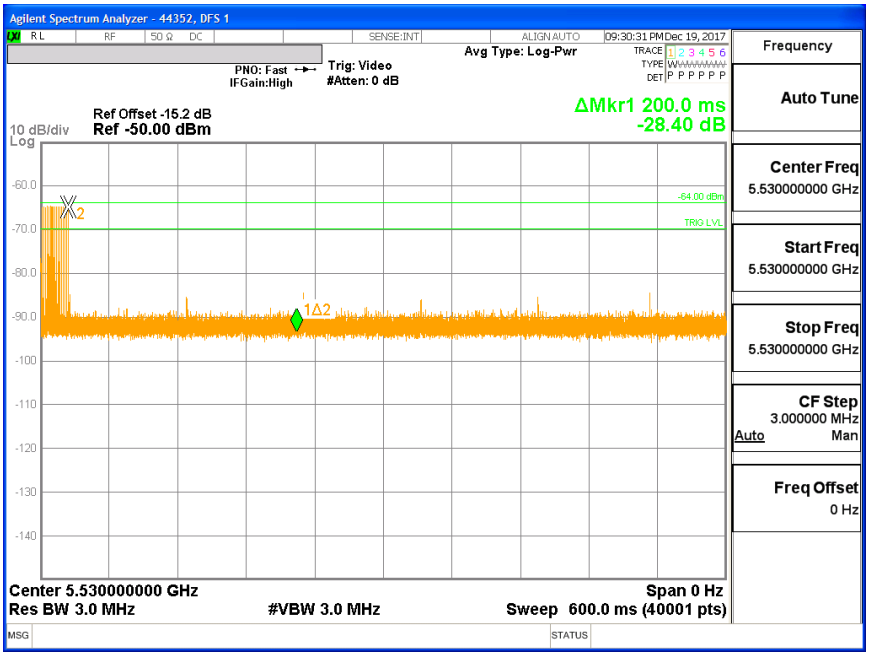
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
1.6	60

MOVE TIME



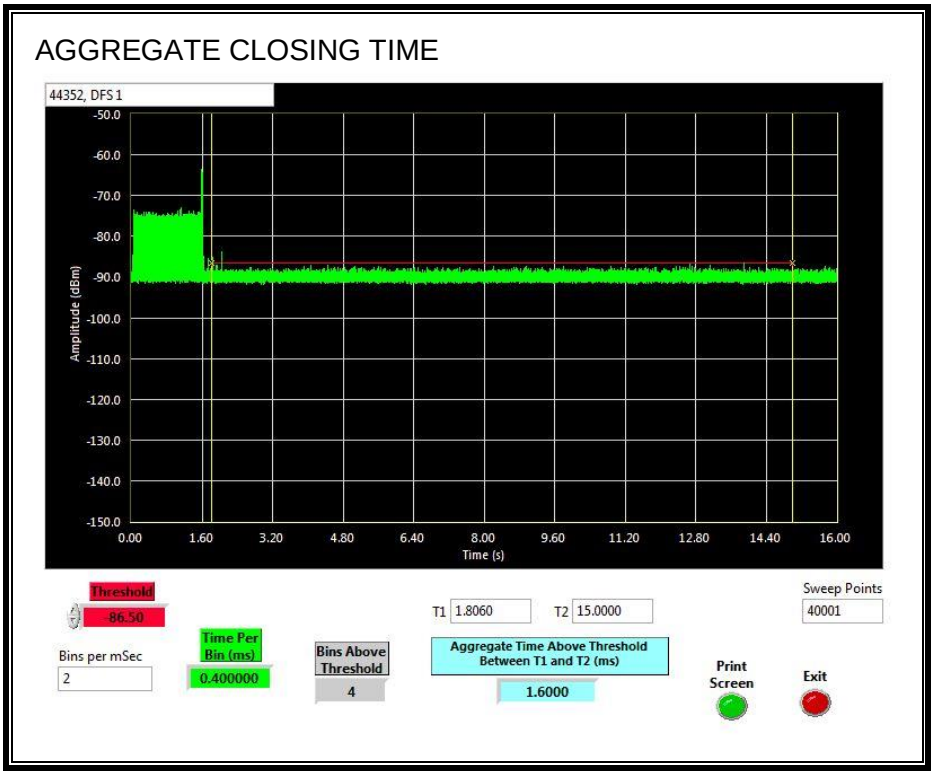
CHANNEL CLOSING TIME

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.

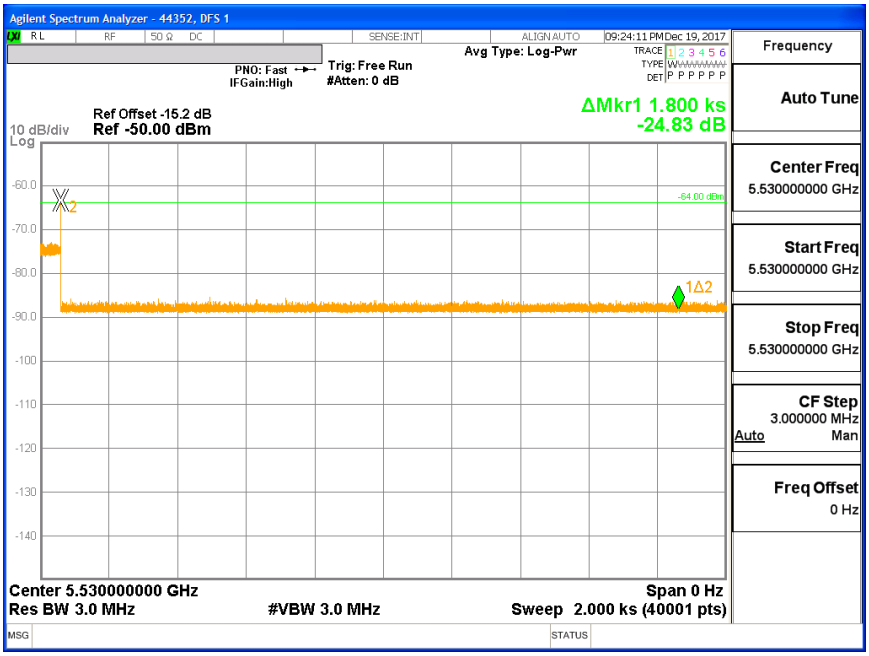
MOVE TIME FOR LONG PULSE RADAR

6.4.4. NON-OCCUPANCY PERIOD

RESULTS

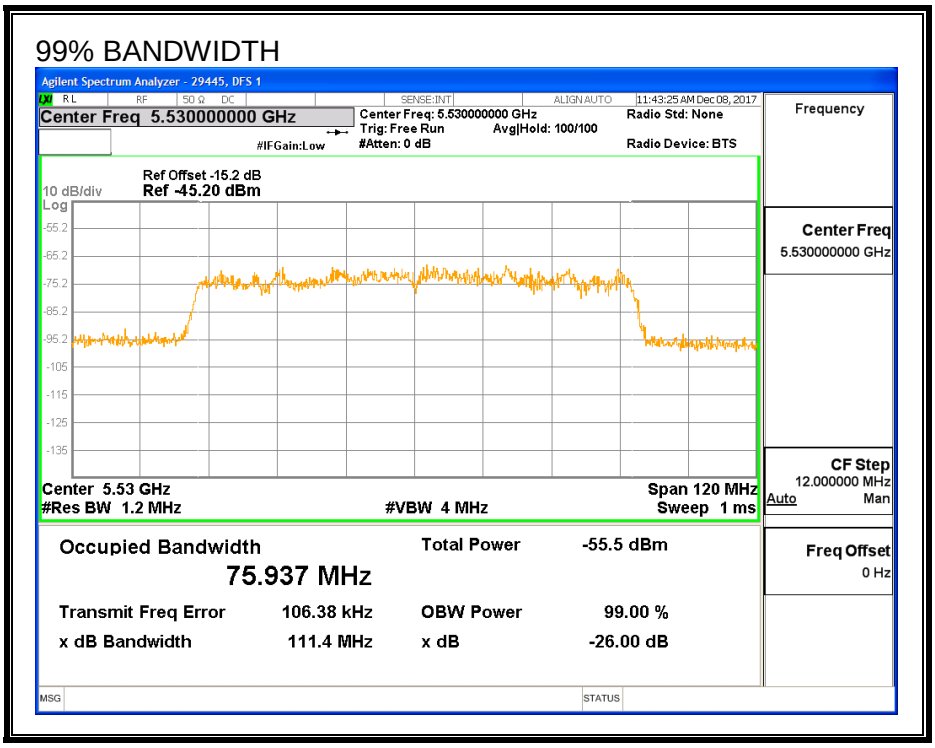
No EUT transmissions were observed on the test channel during the 30-minute observation time.

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	75.937	105.4	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	
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	75.94	DFS 1	44352	Version 3.0
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5570	75.94	DFS 1	44352	Version 3.0
FCC Short Pulse Type 3	30	86.67	60	Pass	5490	5570	75.94	DFS 1	44352	Version 3.0
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5570	75.94	DFS 1	44352	Version 3.0
Aggregate		91.67	80	Pass						
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5570	75.94	DFS 1	44352	Version 3.0
FCC Hopping Type 6	81	100.00	70	Pass	5490	5570		DFS 1	44352	Version 3.0

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5495	Yes
1002	1	758	70	A	5533	Yes
1003	1	898	59	A	5508	Yes
1004	1	558	95	A	5565	Yes
1005	1	718	74	A	5555	Yes
1006	1	838	63	A	5522	Yes
1007	1	798	67	A	5540	Yes
1008	1	938	57	A	5526	Yes
1009	1	738	72	A	5498	Yes
1010	1	698	76	A	5505	Yes
1011	1	678	78	A	5518	Yes
1012	1	518	102	A	5542	Yes
1013	1	818	65	A	5568	Yes
1014	1	638	83	A	5501	Yes
1015	1	578	92	A	5545	Yes
1016	1	1713	31	B	5500	Yes
1017	1	927	57	B	5505	Yes
1018	1	624	85	B	5551	Yes
1019	1	1321	40	B	5508	Yes
1020	1	2342	23	B	5552	Yes
1021	1	1975	27	B	5495	Yes
1022	1	1931	28	B	5518	Yes
1023	1	1692	32	B	5537	Yes
1024	1	1777	30	B	5540	Yes
1025	1	1669	32	B	5492	Yes
1026	1	689	77	B	5510	Yes
1027	1	710	75	B	5512	Yes
1028	1	1213	44	B	5528	Yes
1029	1	1363	39	B	5565	Yes
1030	1	1995	27	B	5531	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	213	23	5523	Yes
2002	2.4	201	26	5551	No
2003	4.6	220	28	5509	Yes
2004	4.3	212	25	5517	Yes
2005	4.7	197	24	5555	Yes
2006	4.6	155	25	5520	Yes
2007	1.2	226	27	5557	Yes
2008	3.5	226	26	5528	Yes
2009	4.4	181	25	5498	Yes
2010	4.9	228	27	5493	Yes
2011	1.9	188	23	5548	Yes
2012	2.7	159	29	5532	Yes
2013	2	166	26	5531	Yes
2014	3	183	26	5538	Yes
2015	2.6	151	23	5523	Yes
2016	1.9	215	26	5569	Yes
2017	1.7	188	27	5506	Yes
2018	1.1	175	24	5516	Yes
2019	3.3	195	26	5559	Yes
2020	1.1	229	23	5501	Yes
2021	3.4	172	29	5557	Yes
2022	1.4	211	23	5528	Yes
2023	4	200	29	5556	Yes
2024	2.2	162	23	5549	No
2025	3.1	156	23	5541	Yes
2026	3.6	203	28	5564	Yes
2027	4.7	163	28	5496	Yes
2028	1.4	176	27	5515	Yes
2029	4.8	221	24	5499	Yes
2030	1.7	157	23	5515	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3					
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	6.3	426	16	5556	Yes
3002	9.7	374	16	5535	Yes
3003	9.5	288	18	5505	Yes
3004	6.8	367	17	5549	Yes
3005	8.9	310	17	5496	Yes
3006	6.7	284	18	5563	Yes
3007	9.1	357	16	5503	No
3008	7	477	16	5515	Yes
3009	9.6	445	16	5514	Yes
3010	7.8	327	16	5524	No
3011	6.8	307	16	5549	Yes
3012	9.2	453	16	5553	Yes
3013	6.2	329	18	5561	Yes
3014	7	370	18	5545	Yes
3015	6.4	258	17	5560	Yes
3016	7.3	312	16	5499	Yes
3017	6.9	464	17	5493	Yes
3018	6.2	413	17	5554	Yes
3019	8.2	460	17	5519	Yes
3020	7.6	288	16	5524	Yes
3021	7.6	481	16	5516	No
3022	9.5	455	17	5564	Yes
3023	7.8	277	18	5496	Yes
3024	9.8	397	18	5548	Yes
3025	8.3	365	18	5527	Yes
3026	8.7	498	18	5533	No
3027	9.6	479	18	5560	Yes
3028	7.9	374	18	5544	Yes
3029	7.1	500	17	5528	Yes
3030	9.8	290	17	5520	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	18.1	430	12	5557	Yes
4002	11.2	483	14	5537	Yes
4003	15.1	384	12	5544	Yes
4004	17.7	333	14	5501	Yes
4005	13	380	13	5498	Yes
4006	11.8	342	15	5492	Yes
4007	16.6	402	16	5570	Yes
4008	15.9	376	12	5553	No
4009	12.1	331	13	5543	Yes
4010	16.7	318	14	5534	Yes
4011	18.2	286	14	5531	Yes
4012	14.1	419	15	5552	Yes
4013	16.1	399	14	5526	Yes
4014	12.5	428	13	5521	Yes
4015	19.7	421	13	5569	Yes
4016	16.6	462	12	5555	Yes
4017	15.2	350	15	5537	Yes
4018	13.1	404	12	5555	Yes
4019	12.2	438	15	5555	Yes
4020	14.8	254	13	5559	Yes
4021	19.2	301	16	5560	Yes
4022	18	262	14	5552	No
4023	13.8	322	12	5515	No
4024	13	297	16	5554	Yes
4025	18.3	252	12	5510	Yes
4026	13.8	490	13	5523	No
4027	15.3	457	12	5492	Yes
4028	11.3	339	13	5534	Yes
4029	13.2	320	13	5509	Yes
4030	18.7	348	12	5542	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	5499	Yes
12	5496	Yes
13	5498	Yes
14	5499	Yes
15	5497	Yes
16	5497	Yes
17	5498	Yes
18	5500	Yes
19	5499	Yes
20	5501	Yes
21	5564	Yes
22	5560	Yes
23	5563	Yes
24	5562	Yes
25	5560	Yes
26	5566	Yes
27	5564	Yes
28	5565	Yes
29	5565	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	190	5490	20	Yes
2	665	5491	12	Yes
3	1140	5492	15	Yes
4	1615	5493	12	Yes
5	2090	5494	19	Yes
6	2565	5495	15	Yes
7	3040	5496	22	Yes
8	3515	5497	15	Yes
9	3990	5498	13	Yes
10	4465	5499	23	Yes
11	4940	5500	16	Yes
12	5415	5501	16	Yes
13	5890	5502	19	Yes
14	6365	5503	16	Yes
15	6840	5504	20	Yes
16	7315	5505	19	Yes
17	7790	5506	22	Yes
18	8265	5507	15	Yes
19	8740	5508	13	Yes
20	9215	5509	24	Yes
21	9690	5510	20	Yes
22	10165	5511	13	Yes
23	10640	5512	13	Yes
24	11115	5513	21	Yes
25	11590	5514	21	Yes
26	12065	5515	17	Yes
27	12540	5516	20	Yes
28	13015	5517	20	Yes
29	13490	5518	15	Yes
30	13965	5519	13	Yes
31	14440	5520	21	Yes
32	14915	5521	18	Yes
33	15390	5522	16	Yes
34	15865	5523	16	Yes
35	16340	5524	22	Yes
36	16815	5525	16	Yes
37	17290	5526	13	Yes
38	17765	5527	17	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

39	18240	5528	15	Yes
40	18715	5529	14	Yes
41	19190	5530	22	Yes
42	19665	5531	20	Yes
43	20140	5532	23	Yes
44	20615	5533	16	Yes
45	21090	5534	6	Yes
46	21565	5535	16	Yes
47	22040	5536	16	Yes
48	22515	5537	18	Yes
49	22990	5538	19	Yes
50	23465	5539	20	Yes
51	23940	5540	19	Yes
52	24415	5541	11	Yes
53	24890	5542	16	Yes
54	25365	5543	12	Yes
55	25840	5544	16	Yes
56	26315	5545	16	Yes
57	26790	5546	17	Yes
58	27265	5547	15	Yes
59	27740	5548	9	Yes
60	28215	5549	16	Yes
61	28690	5550	15	Yes
62	29165	5551	19	Yes
63	29640	5552	19	Yes
64	30115	5553	16	Yes
65	30590	5554	22	Yes
66	31065	5555	19	Yes
67	31540	5556	16	Yes
68	32015	5557	12	Yes
69	32490	5558	16	Yes
70	32965	5559	14	Yes
71	33440	5560	11	Yes
72	33915	5561	21	Yes
73	34390	5562	17	Yes
74	34865	5563	13	Yes
75	35340	5564	19	Yes
76	35815	5565	12	Yes
77	36290	5566	16	Yes
78	36765	5567	16	Yes
79	37240	5568	13	Yes
80	37715	5569	16	Yes
81	38190	5570	15	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.