DFS PORTION of FCC 47 CFR PART 15 SUBPART E
DFS PORTION of INDUSTRY CANADA RSS-247 ISSUE 1

CERTIFICATION TEST REPORT

FOR

WIRELESS 802.11 abgn/ac AP

MODEL NUMBER: MR42-HW

FCC ID: UDX-60039010
IC: 6961A-60039010

REPORT NUMBER: 15U21306-E2V1

ISSUE DATE: SEPTEMBER 28, 2015

Prepared for
CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA, 95134, USA

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/28/15	Initial Issue	C. Cheung

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: WIRELESS 802.11 abgn/ac AP

MODEL: MR42-HW

SERIAL NUMBER: Q2KD-UP9S-BJGW

DATE TESTED: SEPTEMBER 8, 2015 – SEPTEMBER 11, 2015

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DFS Portion of CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass

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:

CONAN CHEUNG
PROJECT LEAD
UL Verification Services Inc.

Tested 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, ANSI C63.10-2013, RSS-247 Issue 1.

3. 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.

4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. 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

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

5. DYNAMIC FREQUENCY SELECTION

5.1. OVERVIEW

5.1.1. LIMITS

INDUSTRY CANADA

IC RSS-247 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-247 Issue 1

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

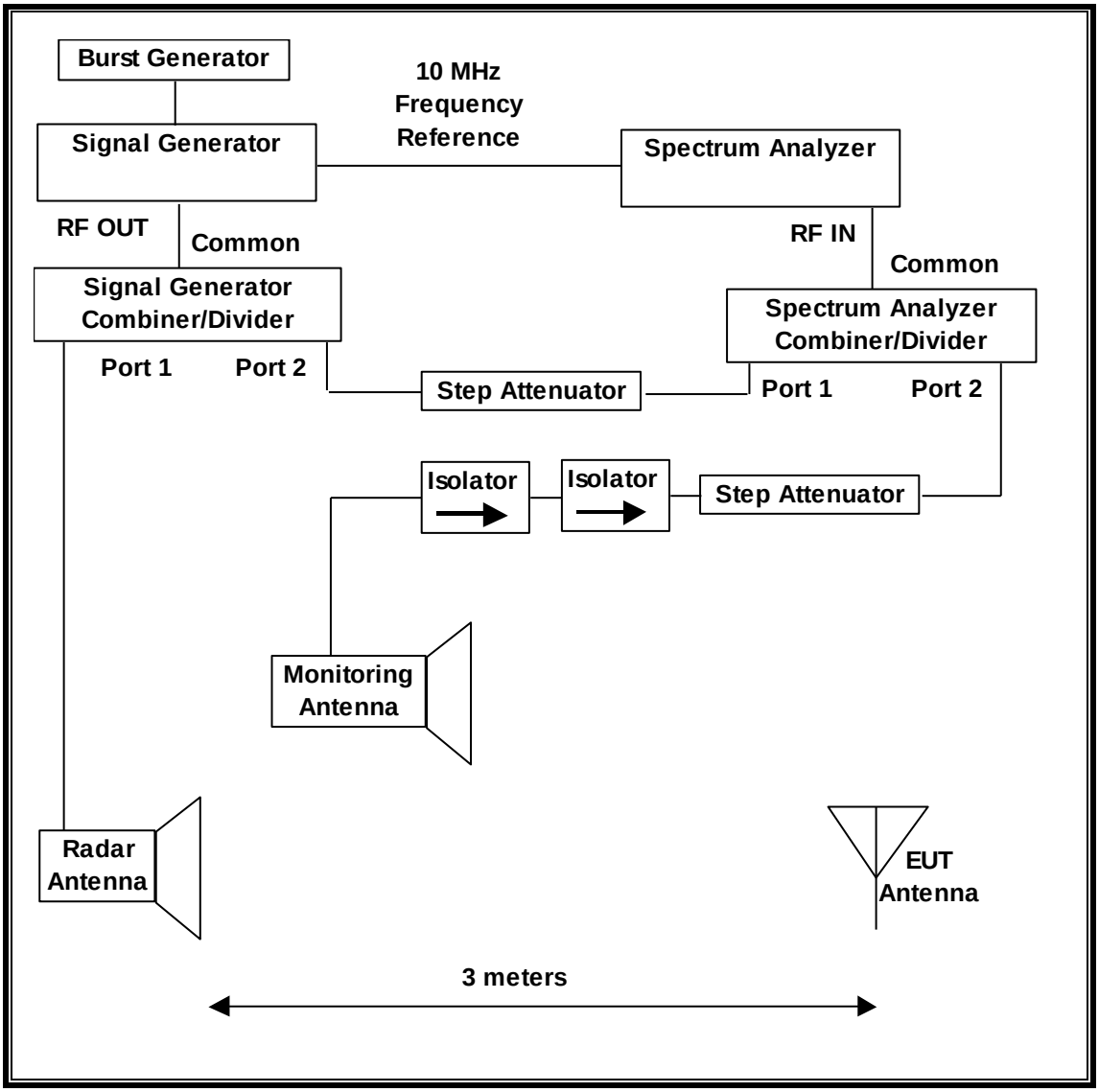
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

5.1.2. 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. The video test file is streamed to generate WLAN traffic. 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.

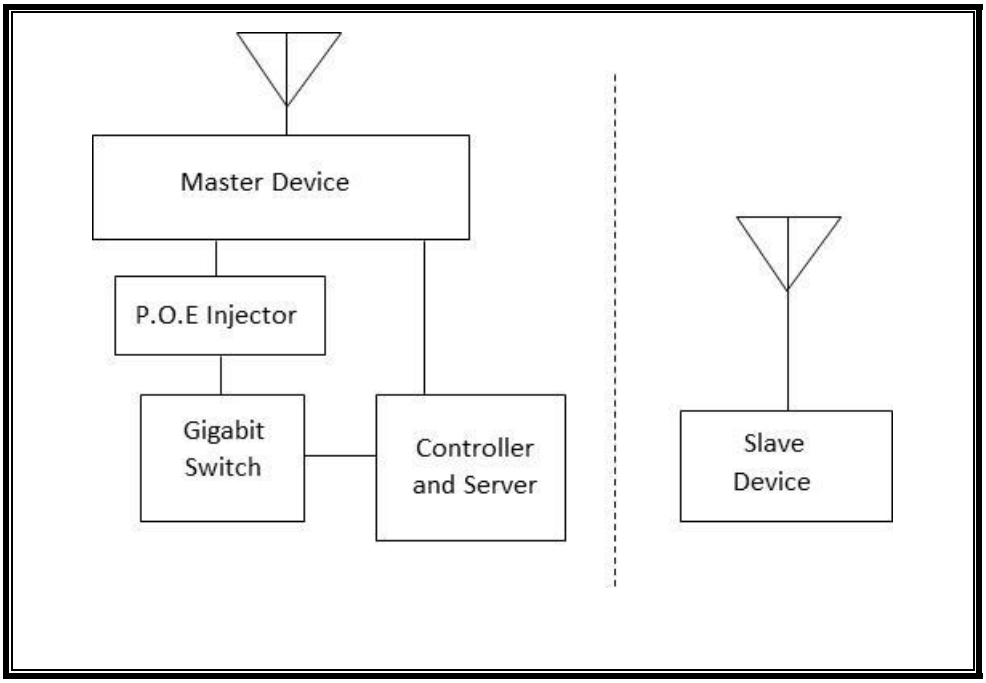
TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	US51350187	06/01/16
Signal Generator, MXG X-Series RF Vector	Agilent	N5172B	MY51350337	02/17/16
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/08/16

5.1.3. 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**
Laptop PC (Controller/Server)	Lenovo	TYPE 3249-2HU	R9-AWVWD 11/01	QDS-BRCM1046
AC Adapter (Controller/Server)	Lenovo	ADLX65NLT2A	11S36200291ZZ300345B5X	DoC
POE Injector	Cisco	PD-9001GR/AT/AC	C14246593000000365	DoC
Gigabit Switch	Meraki	MS220-8-HW	Q2GP-PVL6-8BGK	DoC
Laptop PC (Slave Device)	Apple	A1465	C02KTGMPF5N7	QDS-BRCM1072
AC Adapter (Slave Device)	Apple	A1435	C04341216J2F288BT	DoC

5.1.4. 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 29.75 dBm EIRP in the 5250-5350 MHz band and 28.90 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 7.03 dBi. The lowest gain antenna assembly utilized with the EUT has a gain of 4.53 dBi.

Three identical 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 three transmitter/receiver chains, each connected to an antenna to perform radiated tests.

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

WLAN traffic is generated by streaming the video file W53.mpg “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using Quicktime Player Version 10.3 (727.4).

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 version 24-175056.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

5.2. RESULTS FOR 20 MHz BANDWIDTH

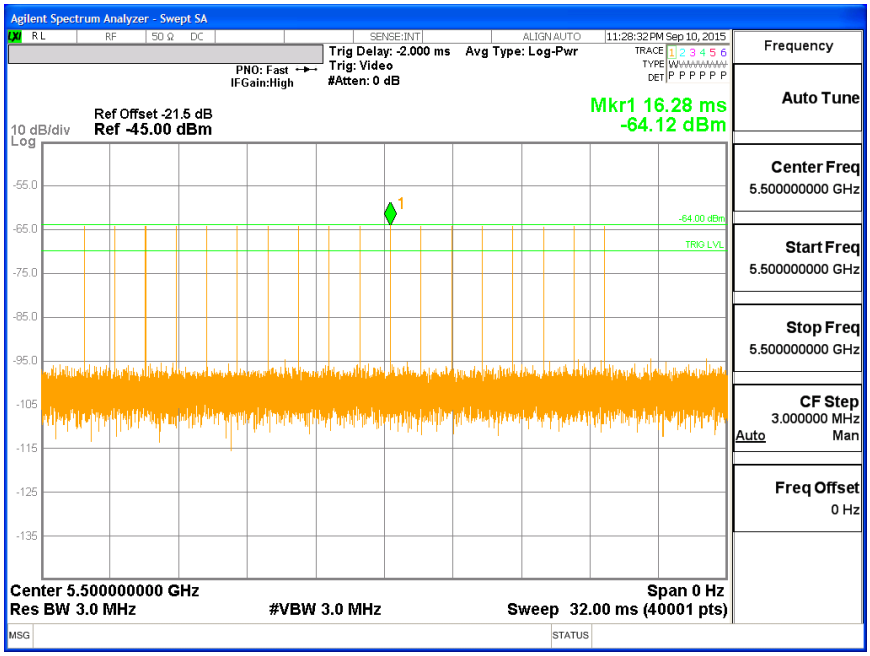
5.2.1. TEST CHANNEL

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

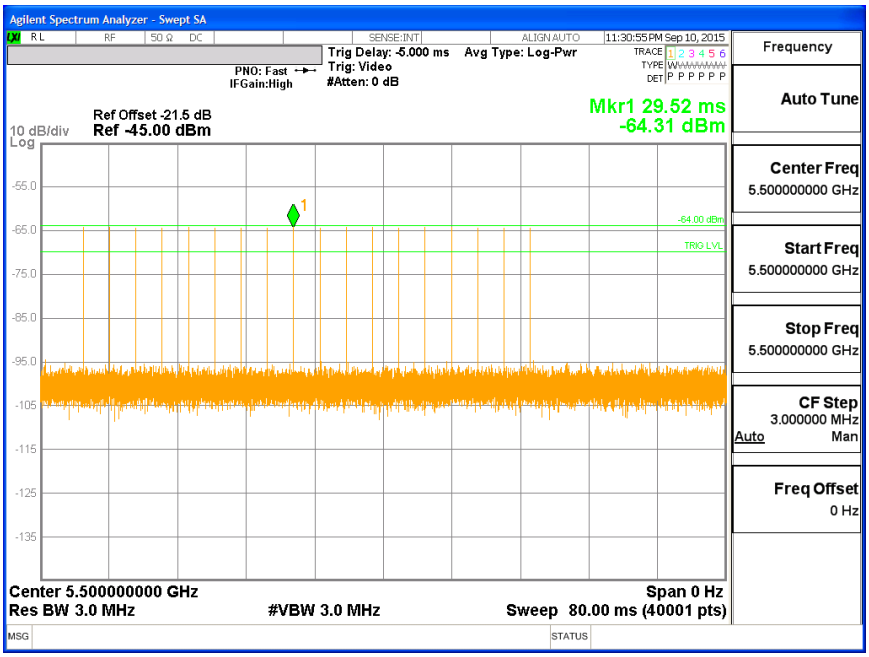
5.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

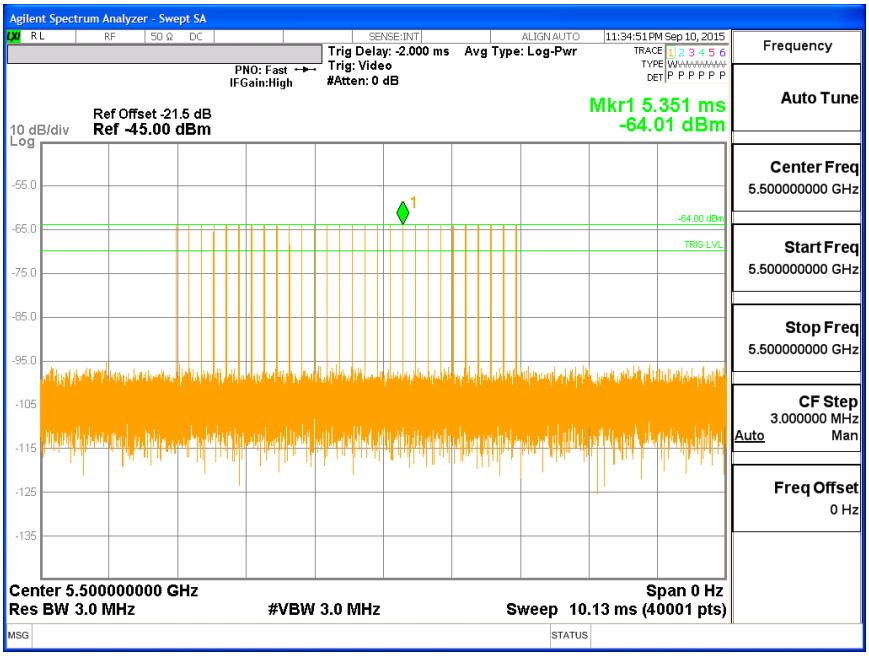
SHORT PULSE RADAR TYPE 0



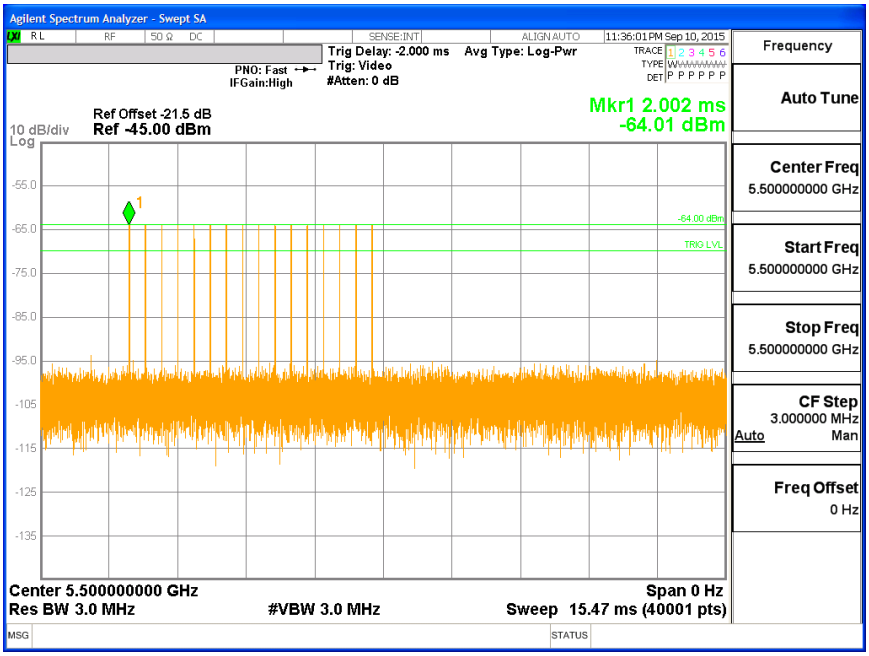
SAMPLE OF RADAR TYPE 1



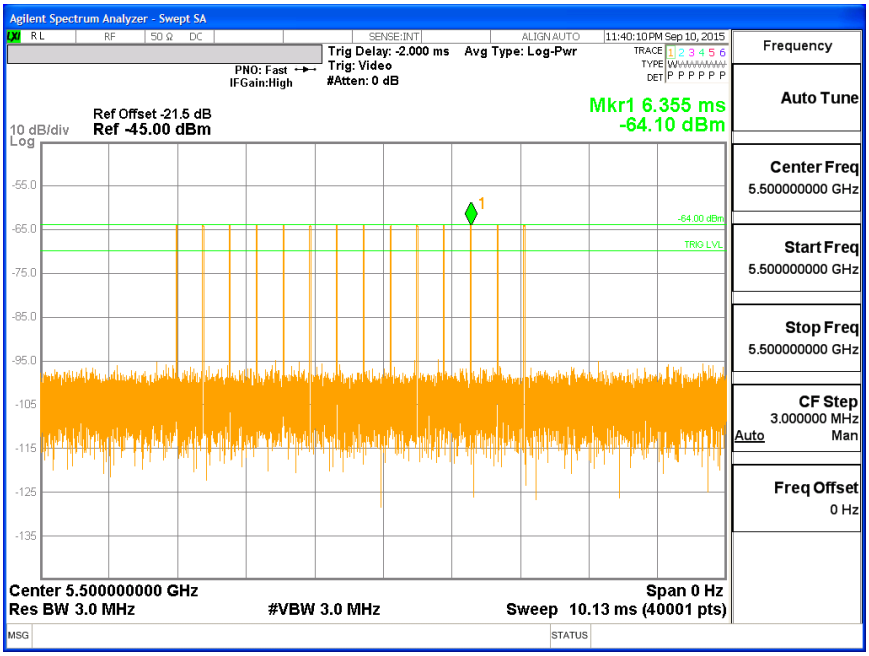
SAMPLE OF RADAR TYPE 2



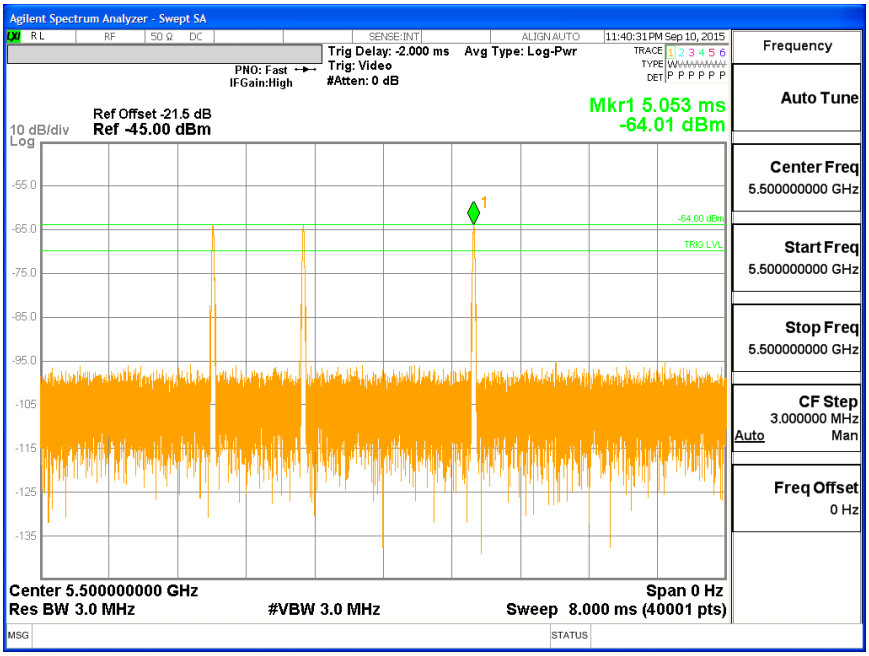
SAMPLE OF RADAR TYPE 3



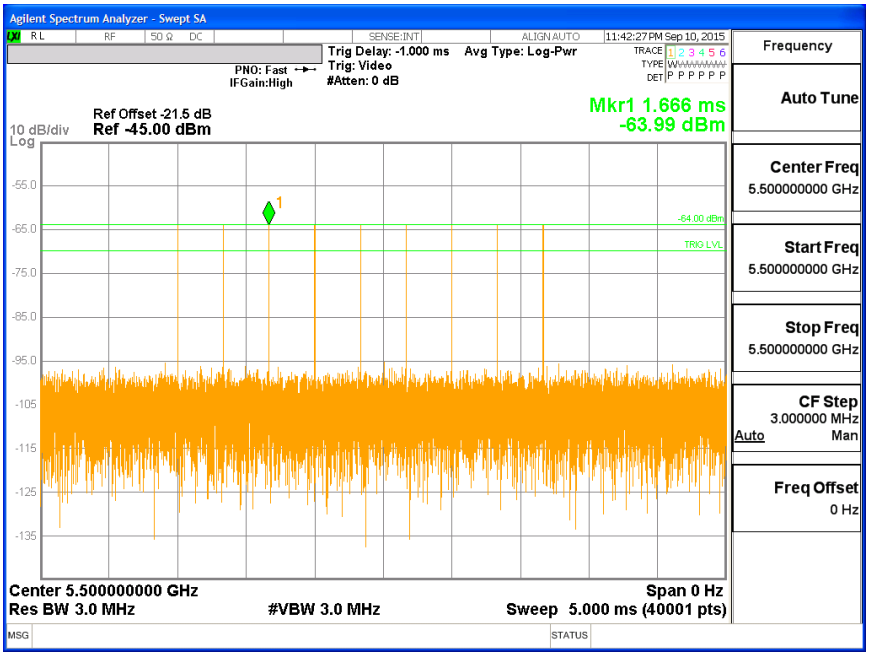
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

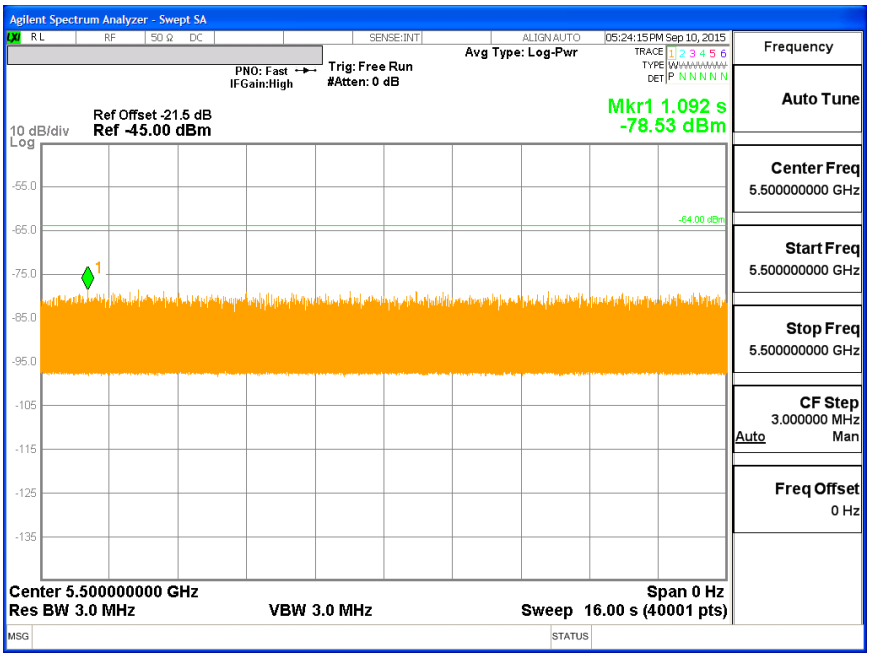


SINGLE BURST OF RADAR TYPE 6

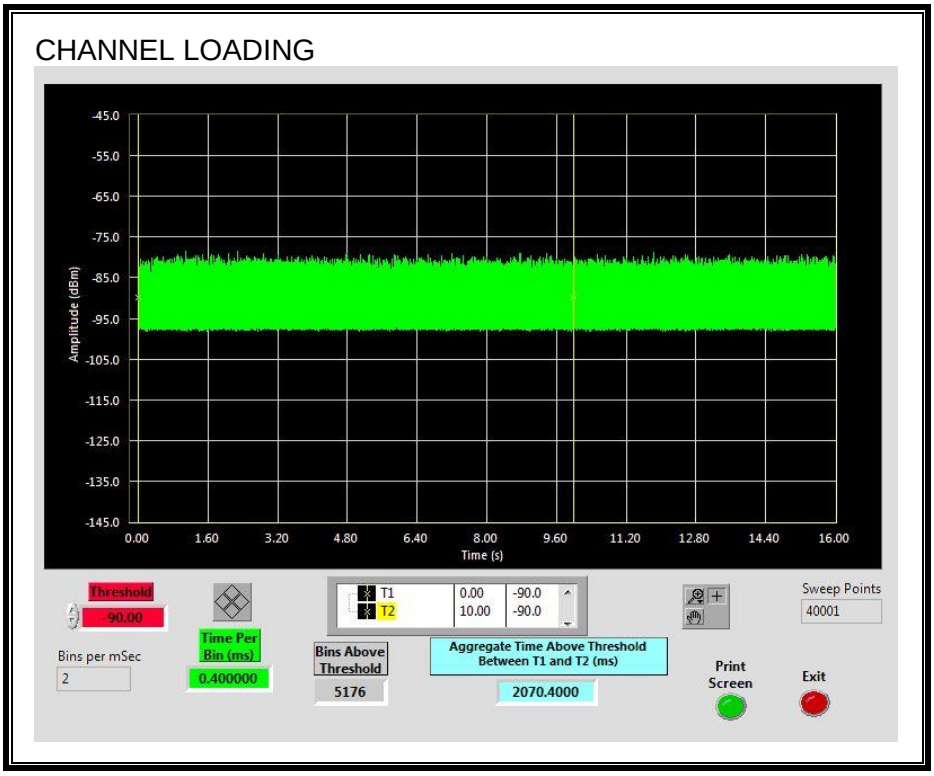


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 20.704%

5.2.3. 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)
30.77	188.7	157.9	97.9

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)
31.28	130.1	98.8	0.9

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)
30.09	186.5	156.4	58.5

QUALITATIVE RESULTS

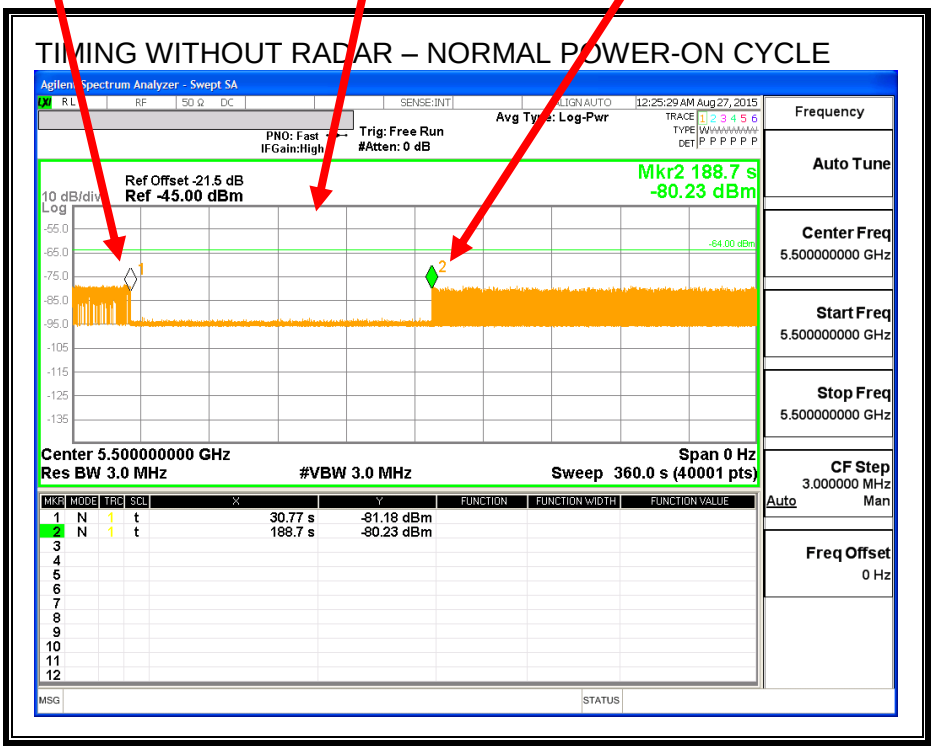
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



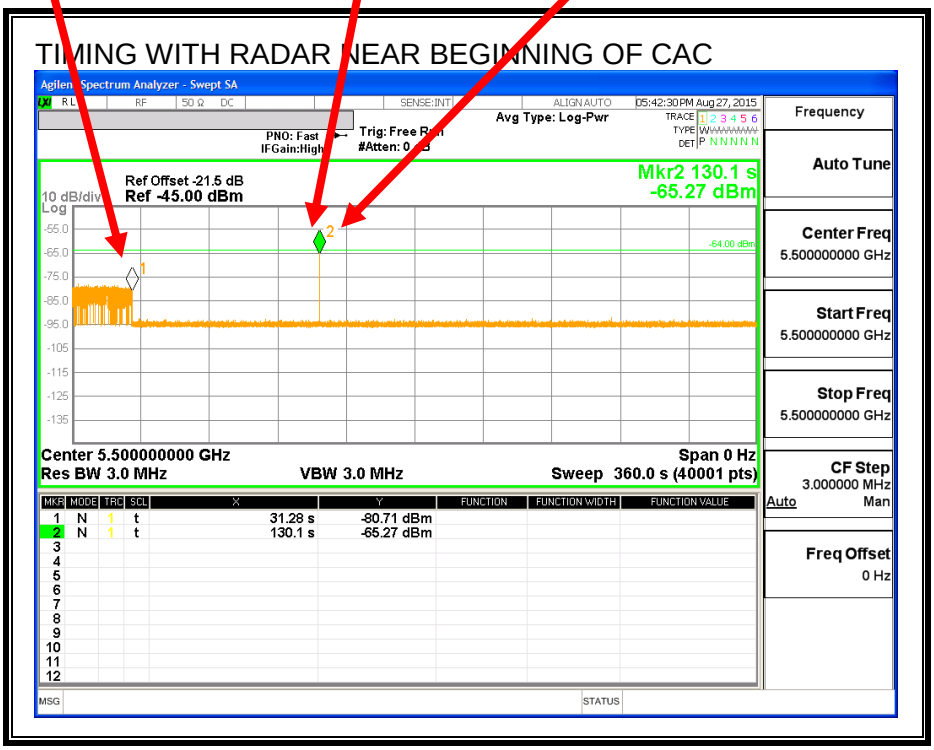
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



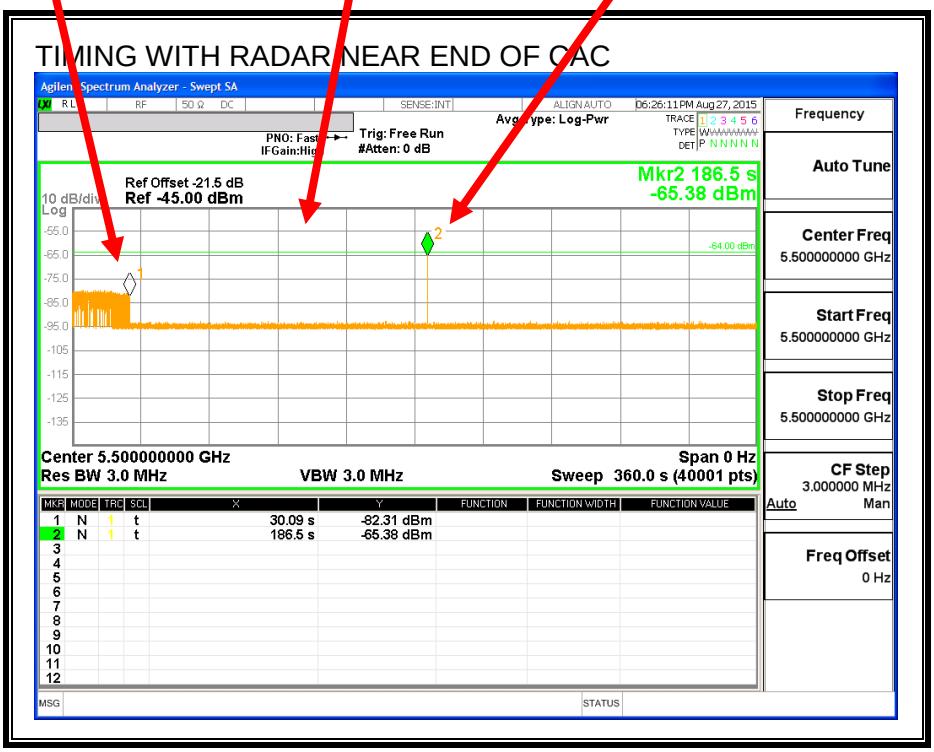
No EUT transmissions were observed after the radar signal.

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.

5.2.4. 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.

5.2.5. 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)

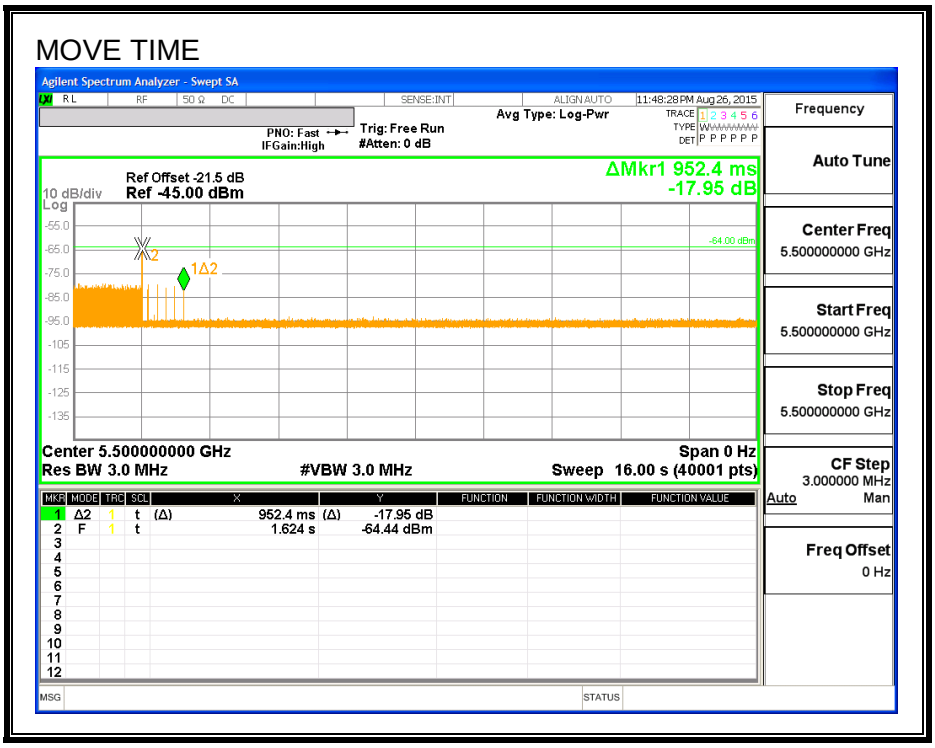
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.952	10

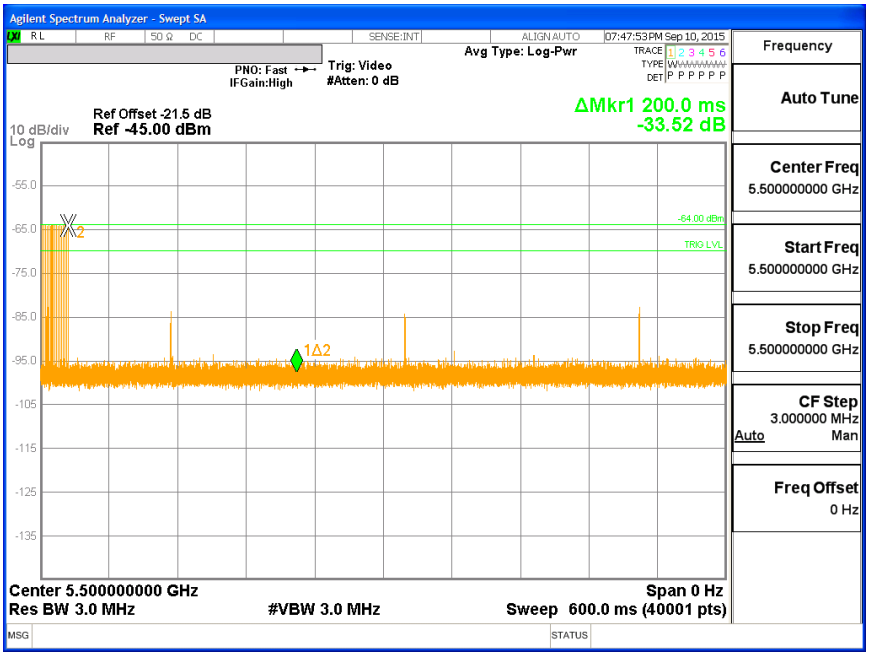
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
3.6	60

MOVE TIME



CHANNEL CLOSING TIME

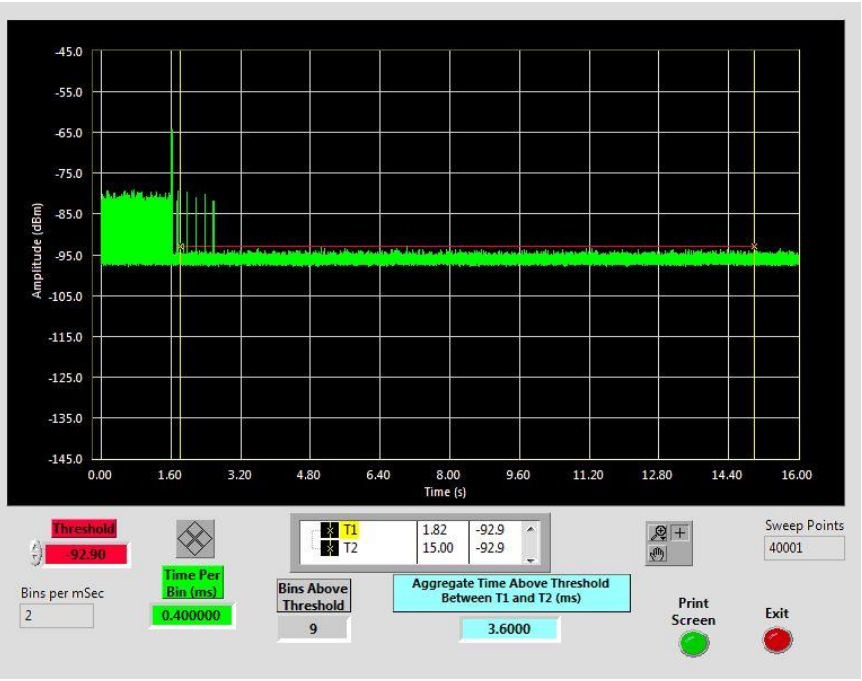
CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME



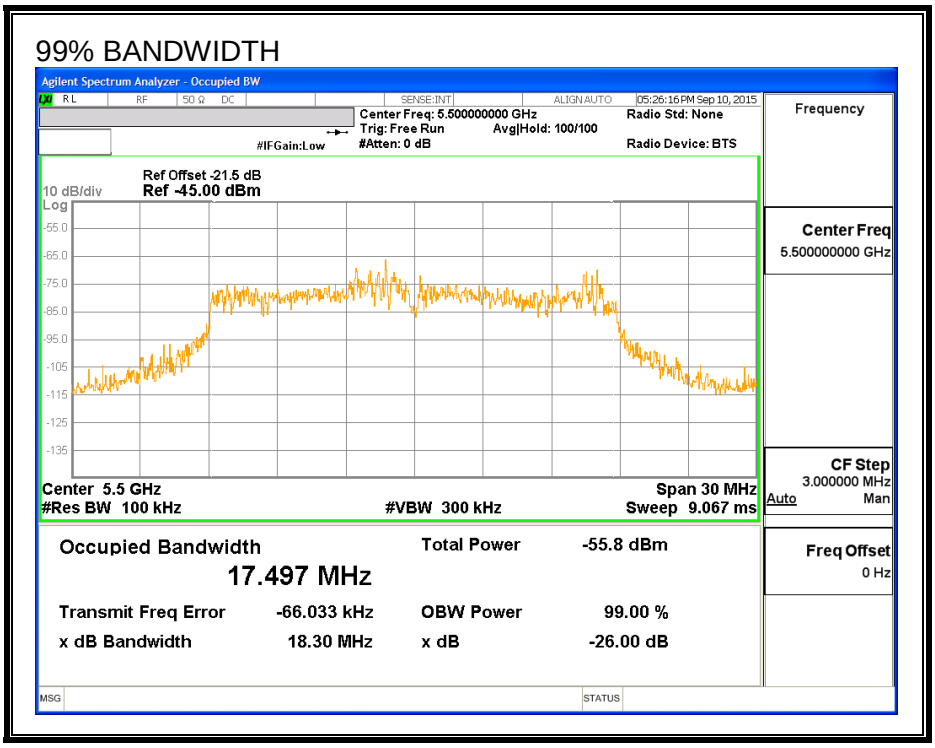
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR

5.2.6. 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	17.497	114.3	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
FCC Type 0 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5489	10	0	0	
5490	10	10	100	FL
5495	10	10	100	
5500	10	9	90	
5505	10	10	100	
5510	10	10	100	FH
5511	10	0	0	

5.2.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth		80% of Det BW	
					FL	FH	FL5	FH5
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5510		
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5510		
FCC Short Pulse Type 3	30	83.33	60	Pass	5490	5510		
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5510		
Aggregate		93.33	80	Pass				
FCC Fixed Long Pulse Type 5	30	100.00	80	Pass	5490	5510	5492	5508
FCC Random Long Pulse Type 5	30	90.00	80	Pass	5490	5510	5492	5508
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510		

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	5500	Yes
1002	1	718	74	A	5500	Yes
1003	1	798	67	A	5500	Yes
1004	1	918	58	A	5500	Yes
1005	1	738	72	A	5500	Yes
1006	1	618	86	A	5500	Yes
1007	1	598	89	A	5500	Yes
1008	1	518	102	A	5500	Yes
1009	1	698	76	A	5500	Yes
1010	1	938	57	A	5500	Yes
1011	1	758	70	A	5500	Yes
1012	1	858	62	A	5500	Yes
1013	1	538	99	A	5500	Yes
1014	1	818	65	A	5500	Yes
1015	1	878	61	A	5500	Yes
1016	1	2506	22	B	5500	Yes
1017	1	785	68	B	5500	Yes
1018	1	741	72	B	5500	Yes
1019	1	3051	18	B	5500	Yes
1020	1	588	90	B	5500	Yes
1021	1	3027	18	B	5500	Yes
1022	1	2047	26	B	5500	Yes
1023	1	2068	26	B	5500	Yes
1024	1	2571	21	B	5500	Yes
1025	1	1527	35	B	5500	Yes
1026	1	806	66	B	5500	Yes
1027	1	2439	22	B	5500	Yes
1028	1	653	81	B	5500	Yes
1029	1	1220	44	B	5500	Yes
1030	1	2112	25	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	3.8	186	28	5500	Yes
2002	1.4	185	25	5500	Yes
2003	2.3	179	25	5500	Yes
2004	4.8	188	24	5500	Yes
2005	4	186	27	5500	Yes
2006	4.7	199	26	5500	Yes
2007	1.9	163	26	5500	Yes
2008	1	181	29	5500	Yes
2009	4.7	192	26	5500	Yes
2010	1.8	213	23	5500	Yes
2011	3.7	228	27	5500	Yes
2012	3.2	216	28	5500	Yes
2013	1.3	154	29	5500	Yes
2014	5	227	27	5500	Yes
2015	3.3	212	25	5500	Yes
2016	1.3	208	23	5500	Yes
2017	2	198	29	5500	Yes
2018	4.2	160	23	5500	Yes
2019	1	197	26	5500	Yes
2020	3.5	163	28	5500	Yes
2021	2.7	204	25	5500	Yes
2022	3.4	174	24	5500	Yes
2023	2.8	219	27	5500	Yes
2024	3.8	155	27	5500	Yes
2025	3.4	166	24	5500	Yes
2026	2.6	188	28	5500	Yes
2027	2.4	203	29	5500	Yes
2028	1.9	190	26	5500	Yes
2029	4.1	210	27	5500	Yes
2030	3.8	201	24	5500	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	9	365	16	5500	Yes
3002	8.9	352	18	5500	Yes
3003	9.7	320	17	5500	Yes
3004	7.4	453	16	5500	Yes
3005	8.5	316	16	5500	Yes
3006	9.2	462	17	5500	Yes
3007	5.5	337	18	5500	No
3008	6.4	496	18	5500	Yes
3009	5.6	384	17	5500	No
3010	6.9	320	16	5500	Yes
3011	6.3	473	18	5500	Yes
3012	5.4	288	17	5500	No
3013	5.2	335	17	5500	No
3014	9.6	297	16	5500	Yes
3015	7.2	357	16	5500	Yes
3016	6.8	331	18	5500	Yes
3017	7.4	286	18	5500	Yes
3018	7.3	406	18	5500	Yes
3019	8.1	374	16	5500	Yes
3020	5.8	374	16	5500	Yes
3021	6.9	488	18	5500	Yes
3022	7.6	382	16	5500	Yes
3023	9	258	18	5500	Yes
3024	9.9	417	17	5500	Yes
3025	9.1	305	17	5500	Yes
3026	7.6	359	17	5500	Yes
3027	7.1	260	16	5500	Yes
3028	6.2	459.00	17	5500	Yes
3029	5.9	373	18	5500	Yes
3030	5.3	335	16	5500	No

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	16	395	14	5500	Yes
4002	10.5	251	12	5500	Yes
4003	16.3	324	16	5500	Yes
4004	11.3	444	12	5500	Yes
4005	17.7	412	16	5500	Yes
4006	13.2	294	12	5500	Yes
4007	15.4	275	12	5500	No
4008	16.8	421	16	5500	Yes
4009	19.4	296	16	5500	Yes
4010	11.2	337	15	5500	Yes
4011	19.8	477	13	5500	Yes
4012	12.1	279	12	5500	Yes
4013	11.1	431	13	5500	Yes
4014	19.3	380	13	5500	Yes
4015	18.8	294	14	5500	Yes
4016	17.5	255	16	5500	Yes
4017	12.8	449	12	5500	No
4018	17.4	423	13	5500	Yes
4019	13.1	496	14	5500	Yes
4020	18.2	365	15	5500	Yes
4021	14.5	333	15	5500	Yes
4022	10	466	16	5500	Yes
4023	17.5	446	15	5500	Yes
4024	13.6	341	14	5500	No
4025	16.2	468	14	5500	Yes
4026	18.1	258	13	5500	Yes
4027	16.6	397	16	5500	Yes
4028	19	451.00	16	5500	Yes
4029	18	352.00	16	5500	Yes
4030	16.1	301.00	16	5500	Yes

TYPE 5 DETECTION PROBABILITY AT THE CHANNEL CENTER FREQUENCY

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	5500	Yes
12	5500	Yes
13	5500	Yes
14	5500	Yes
15	5500	Yes
16	5500	Yes
17	5500	Yes
18	5500	Yes
19	5500	Yes
20	5500	Yes
21	5500	Yes
22	5500	Yes
23	5500	Yes
24	5500	Yes
25	5500	Yes
26	5500	Yes
27	5500	Yes
28	5500	Yes
29	5500	Yes
30	5500	Yes

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

TYPE 5 DETECTION PROBABILITY AT RANDOM FREQUENCIES WITHIN AN 80& SPAN OF THE 99% OCCUPIED BANDWIDTH

Data Sheet for FCC Long Pulse Radar Type 5

Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5502	Yes
2	5505	Yes
3	5497	Yes
4	5500	Yes
5	5504	Yes
6	5506	Yes
7	5501	Yes
8	5492	No
9	5501	Yes
10	5500	Yes
11	5502	Yes
12	5503	Yes
13	5494	Yes
14	5505	Yes
15	5503	Yes
16	5495	Yes
17	5506	Yes
18	5507	Yes
19	5500	Yes
20	5505	Yes
21	5504	Yes
22	5505	Yes
23	5497	Yes
24	5493	No
25	5499	Yes
26	5505	Yes
27	5503	Yes
28	5504	Yes
29	5492	No
30	5497	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	75	5490	3	Yes
2	550	5491	6	Yes
3	1025	5492	4	Yes
4	1500	5493	3	Yes
5	1975	5494	4	Yes
6	2450	5495	7	Yes
7	2925	5496	6	Yes
8	3400	5497	1	Yes
9	3875	5498	4	Yes
10	4350	5499	4	Yes
11	4825	5500	6	Yes
12	5300	5501	6	Yes
13	5775	5502	3	Yes
14	6250	5503	7	Yes
15	6725	5504	3	Yes
16	7200	5505	4	Yes
17	7675	5506	4	Yes
18	8150	5507	3	Yes
19	8625	5508	4	Yes
20	9100	5509	5	Yes
21	9575	5510	3	Yes
22	10050	5490	5	Yes
23	10525	5491	1	Yes
24	11000	5492	5	Yes
25	11475	5493	5	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

26	11950	5494	10	Yes
27	12425	5495	3	Yes
28	12900	5496	6	Yes
29	13375	5497	7	Yes
30	13850	5498	2	Yes
31	14325	5499	5	Yes
32	14800	5500	2	Yes
33	15275	5501	4	Yes
34	15750	5502	3	Yes
35	16225	5503	2	Yes
36	16700	5504	5	Yes
37	17175	5505	3	Yes
38	17650	5506	5	Yes
39	18125	5507	6	Yes
40	18600	5508	4	Yes
41	19075	5509	2	Yes
42	19550	5510	3	Yes

5.3. RESULTS FOR 40 MHz BANDWIDTH

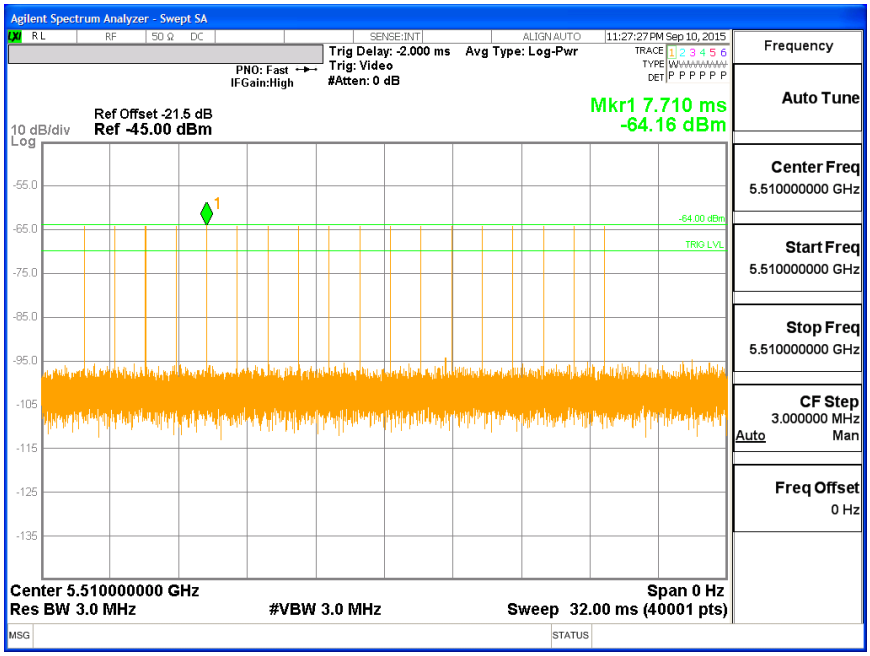
5.3.1. TEST CHANNEL

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

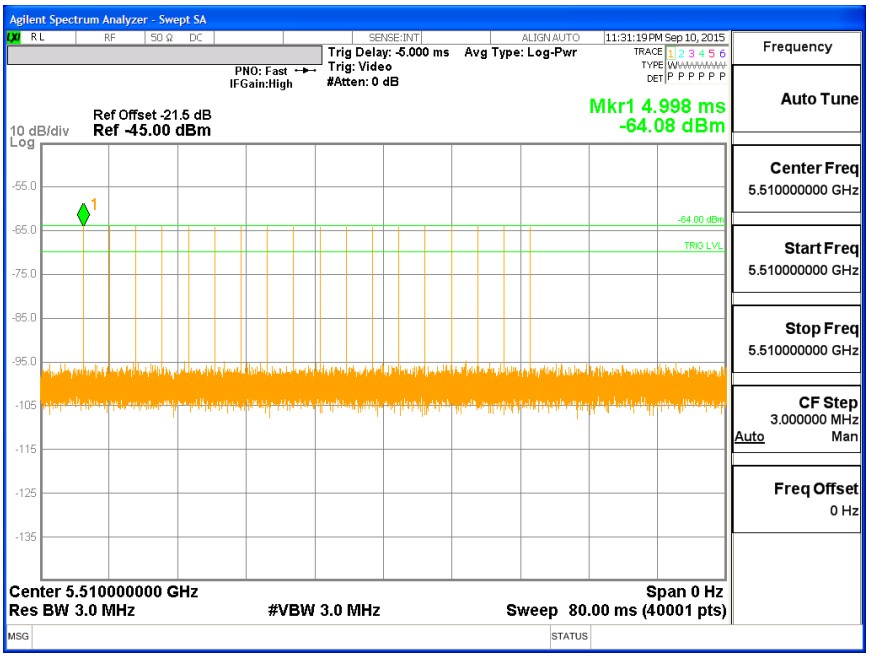
5.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

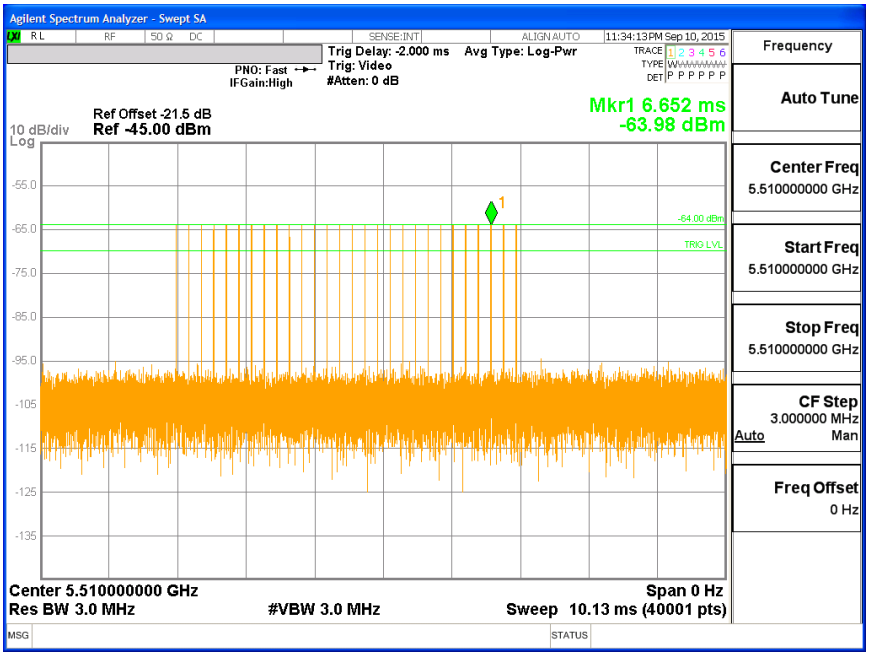
SHORT PULSE RADAR TYPE 0



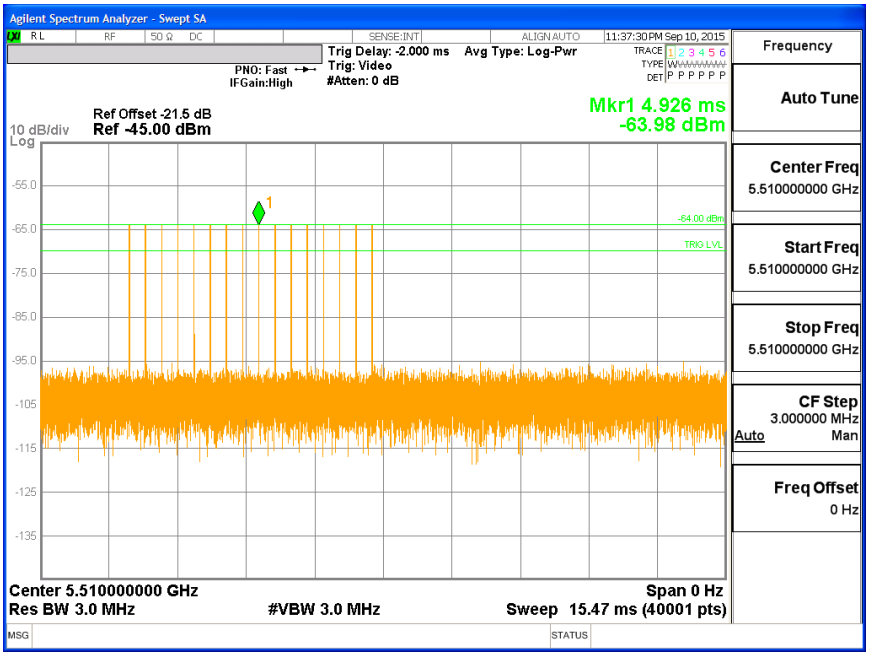
SAMPLE OF RADAR TYPE 1



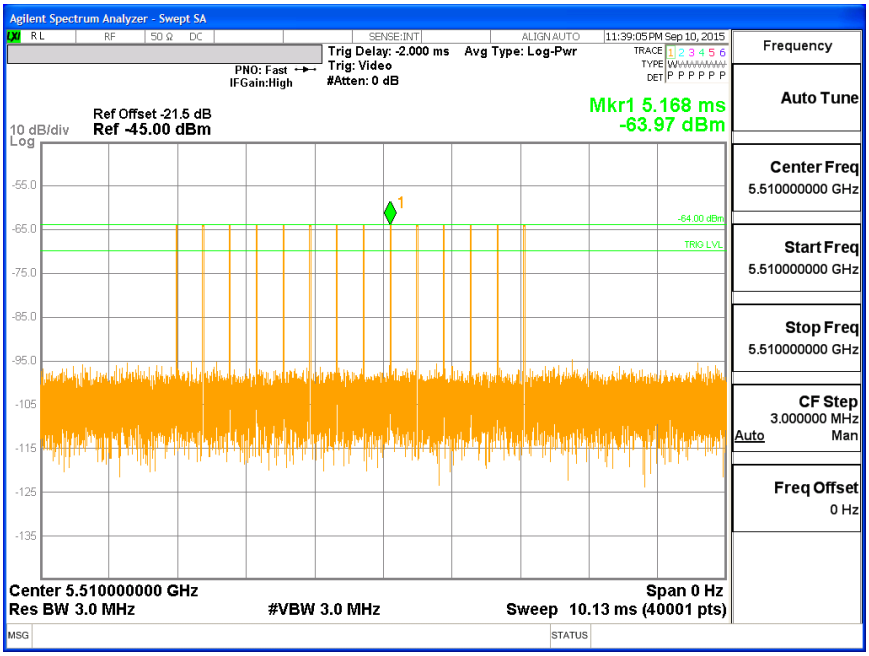
SAMPLE OF RADAR TYPE 2



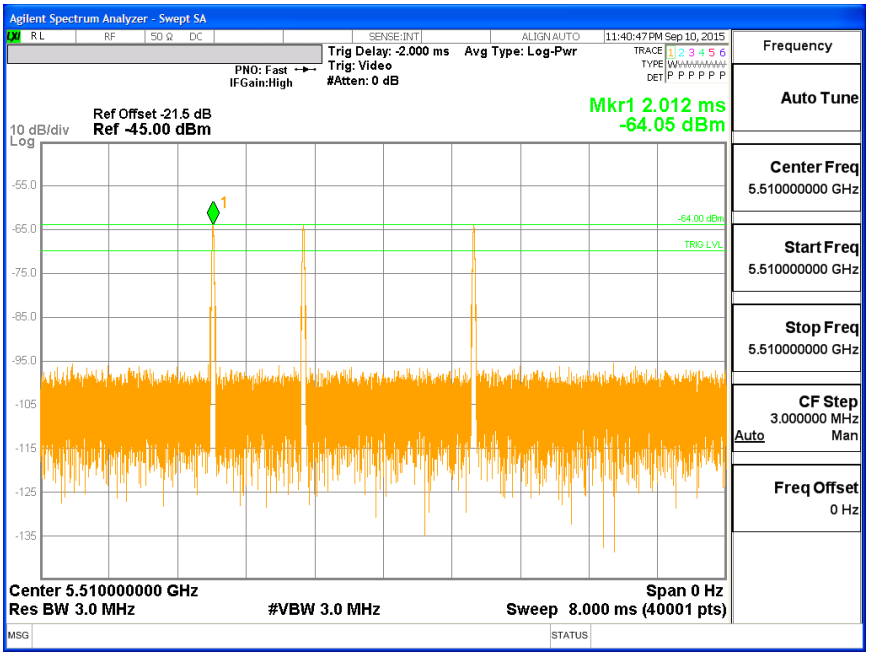
SAMPLE OF RADAR TYPE 3



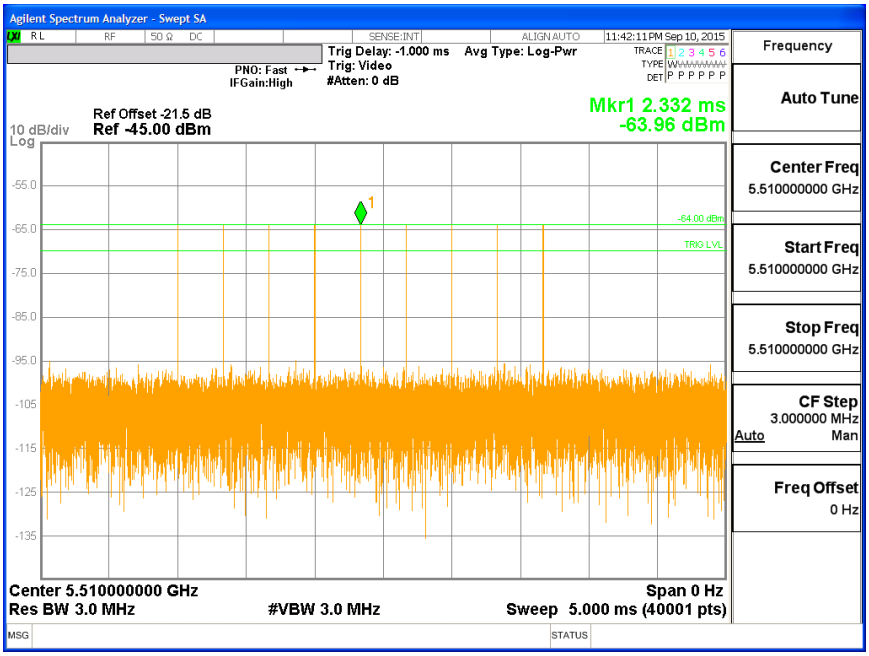
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

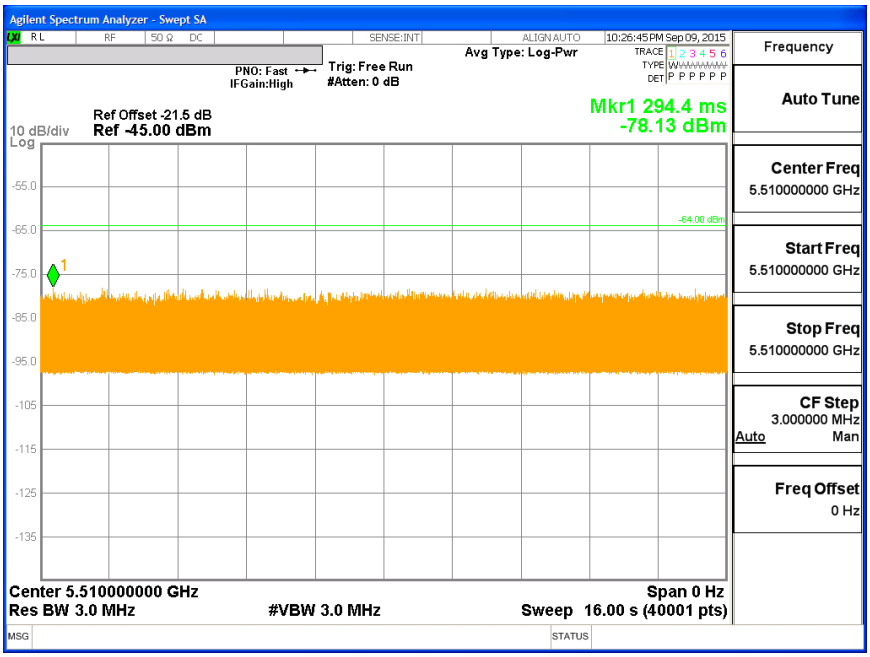


SINGLE BURST OF RADAR TYPE 6

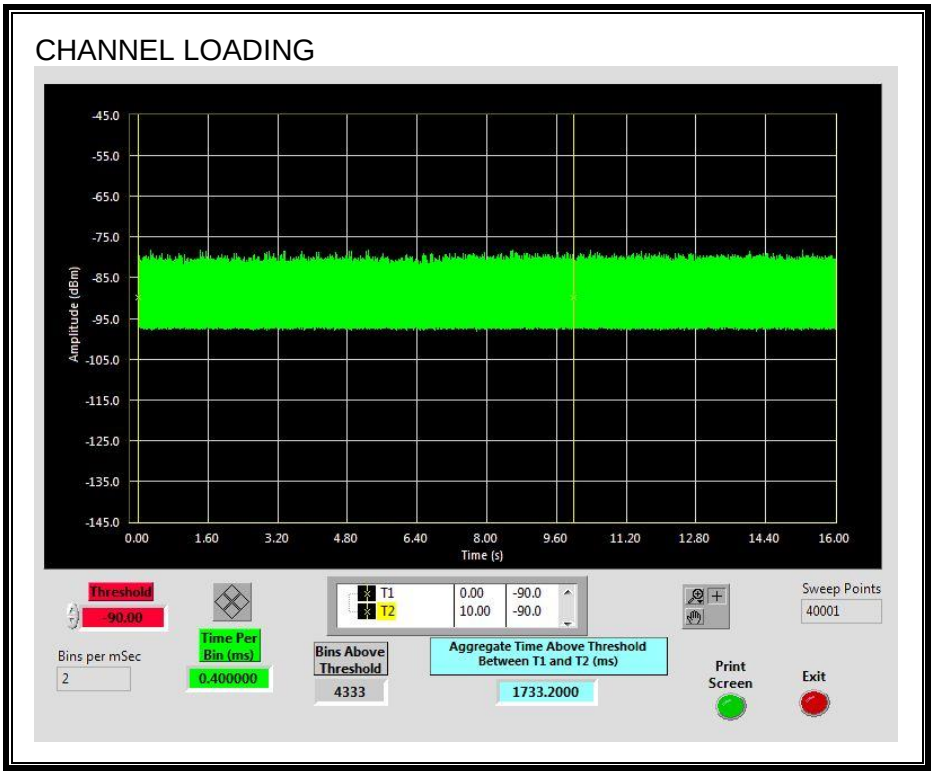


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.332%

5.3.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
29.97	187.9	157.9	97.9

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)
30.09	128.7	98.6	0.7

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.34	185.8	156.5	58.5

QUALITATIVE RESULTS

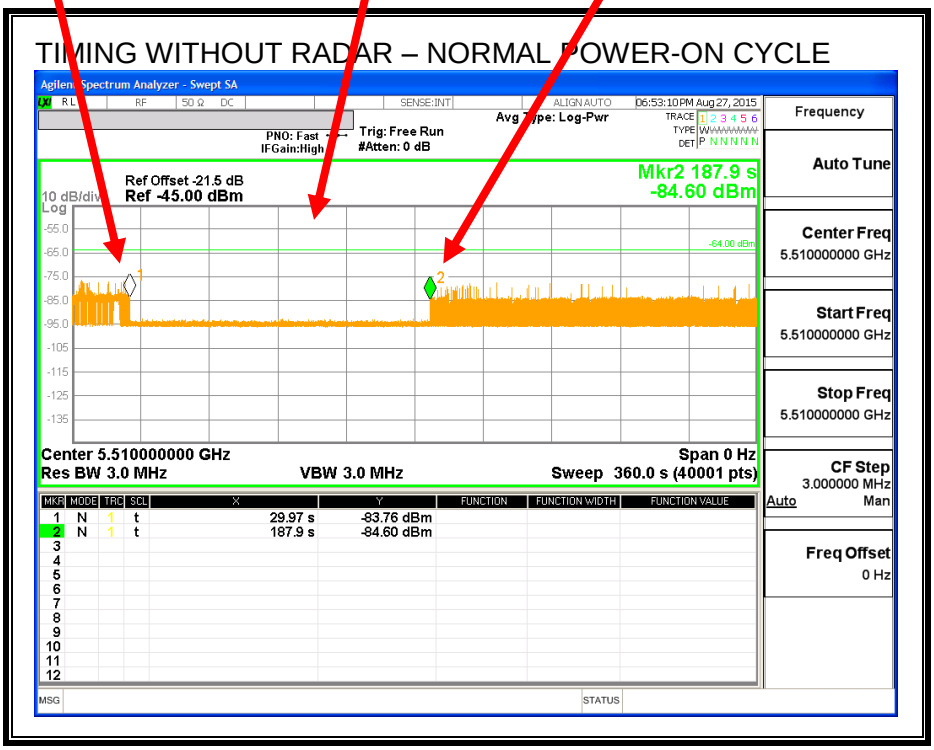
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



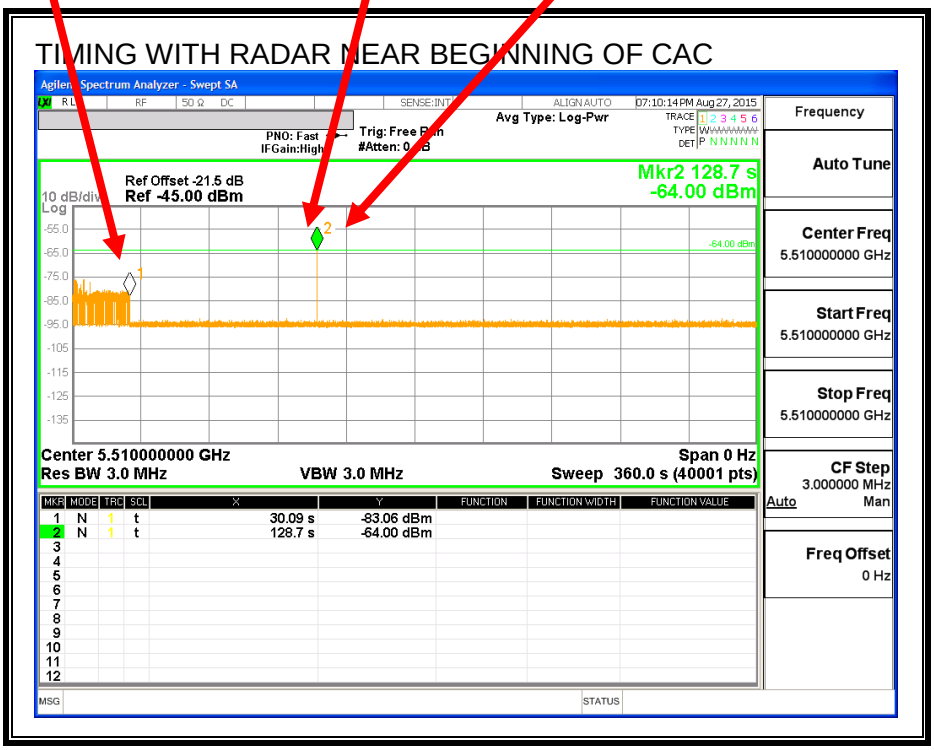
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



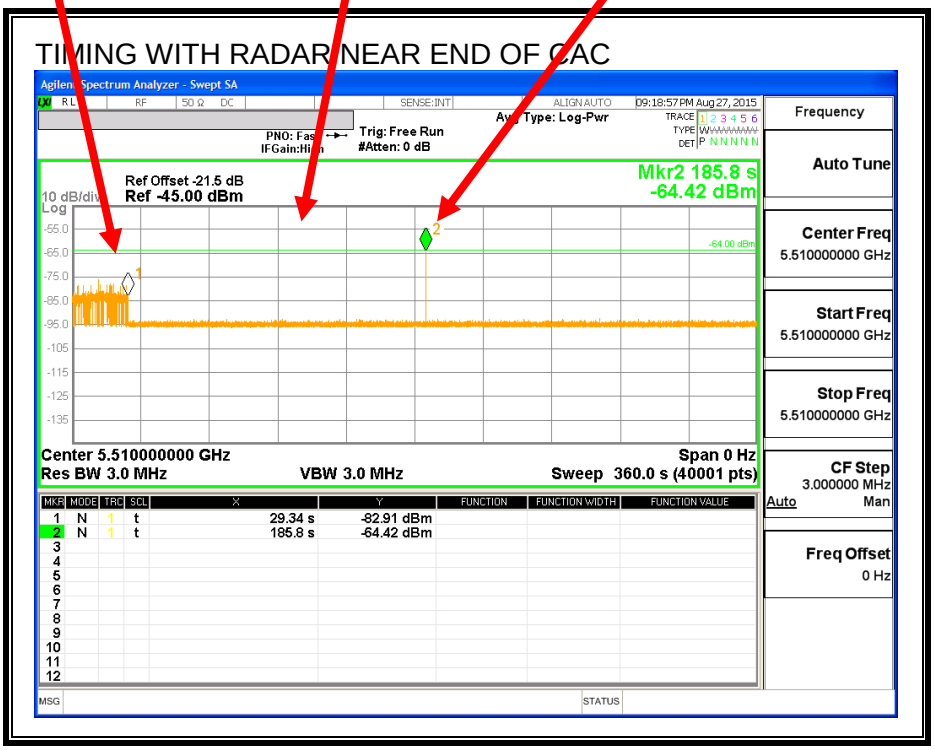
No EUT transmissions were observed after the radar signal.

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.

5.3.1. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

5.3.2. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

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

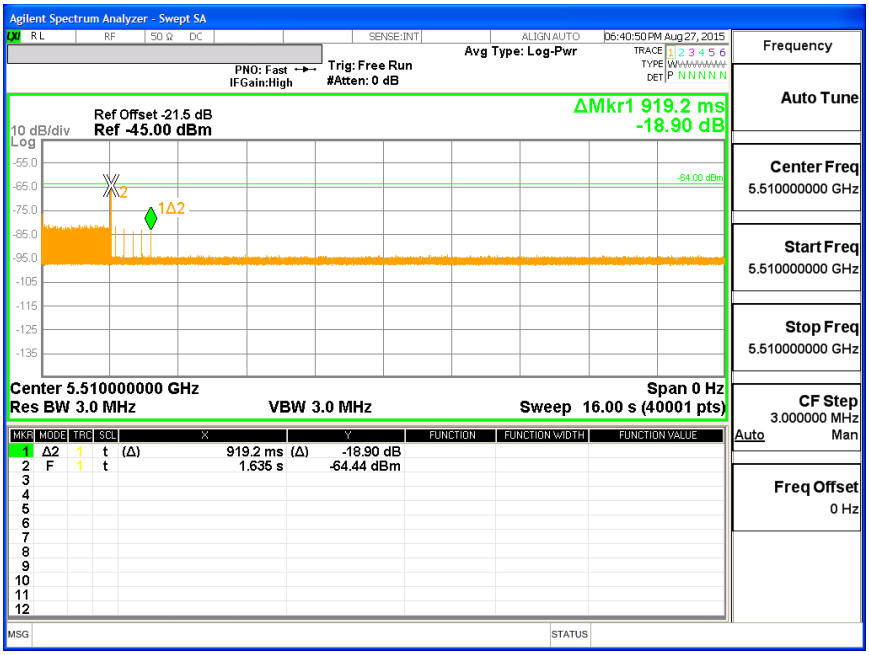
RESULTS

Channel Move Time (sec)	Limit (sec)
0.919	10

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

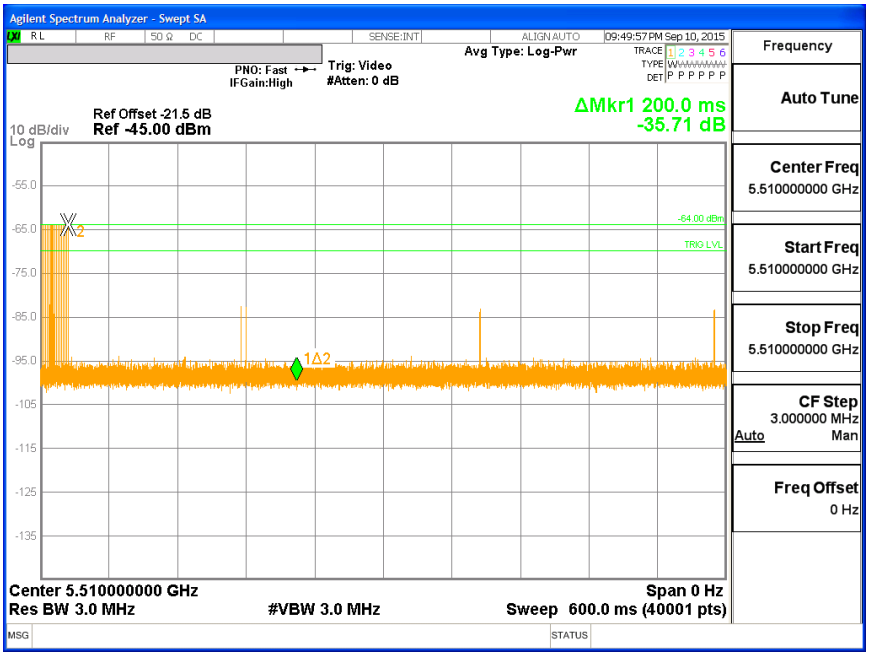
MOVE TIME

MOVE TIME



CHANNEL CLOSING TIME

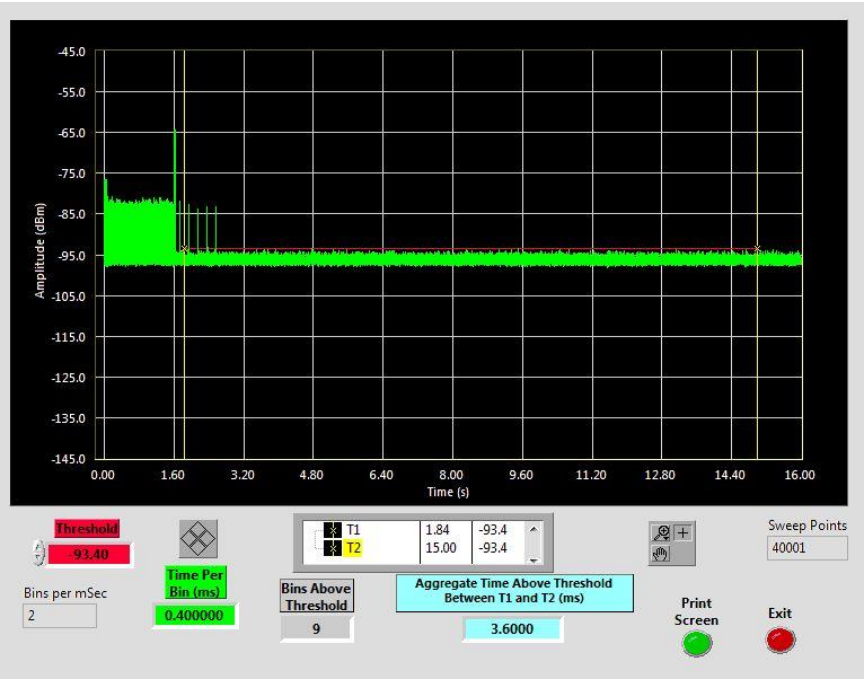
CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

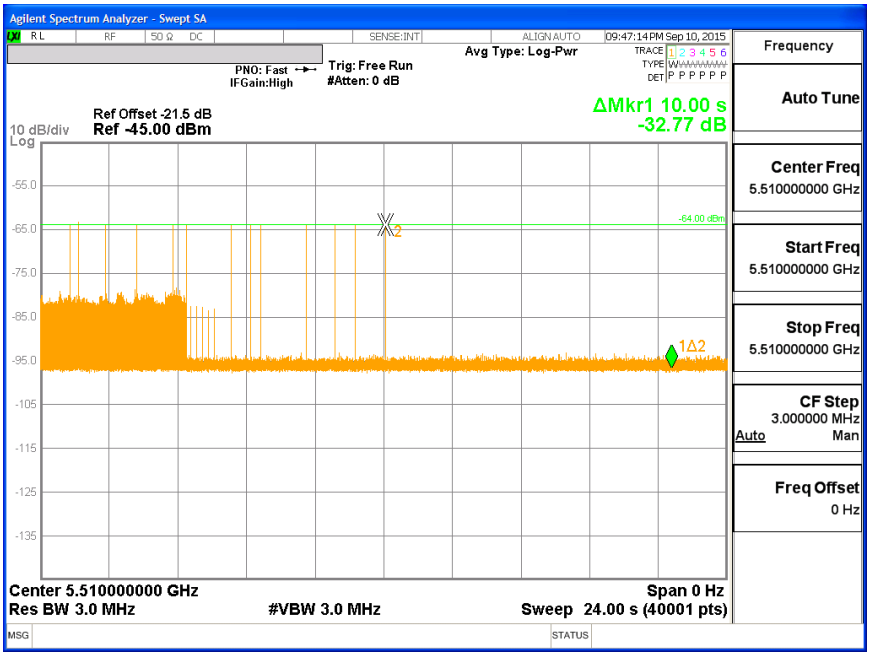
AGGREGATE CLOSING TIME



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

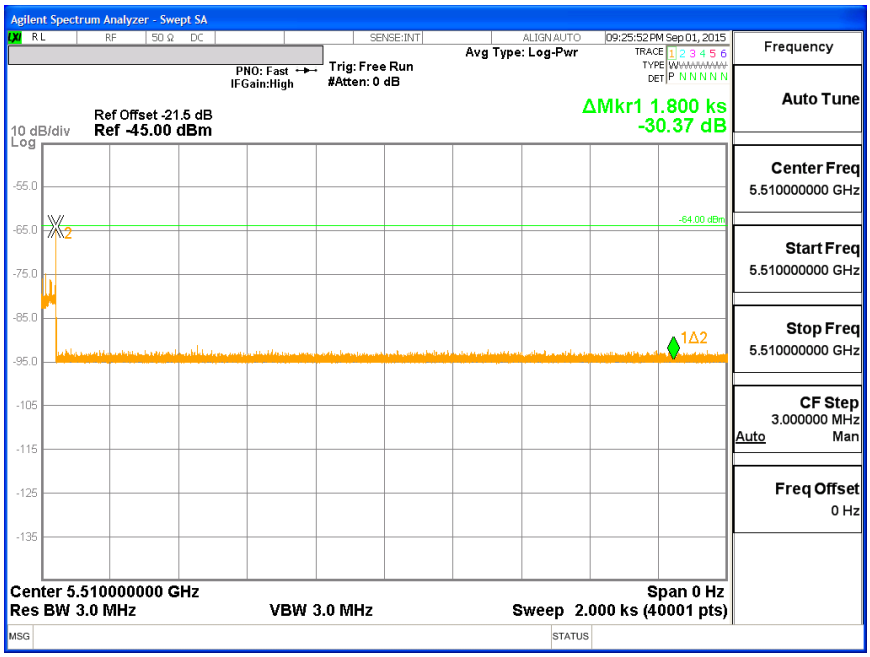


5.3.1. NON-OCCUPANCY PERIOD

RESULTS

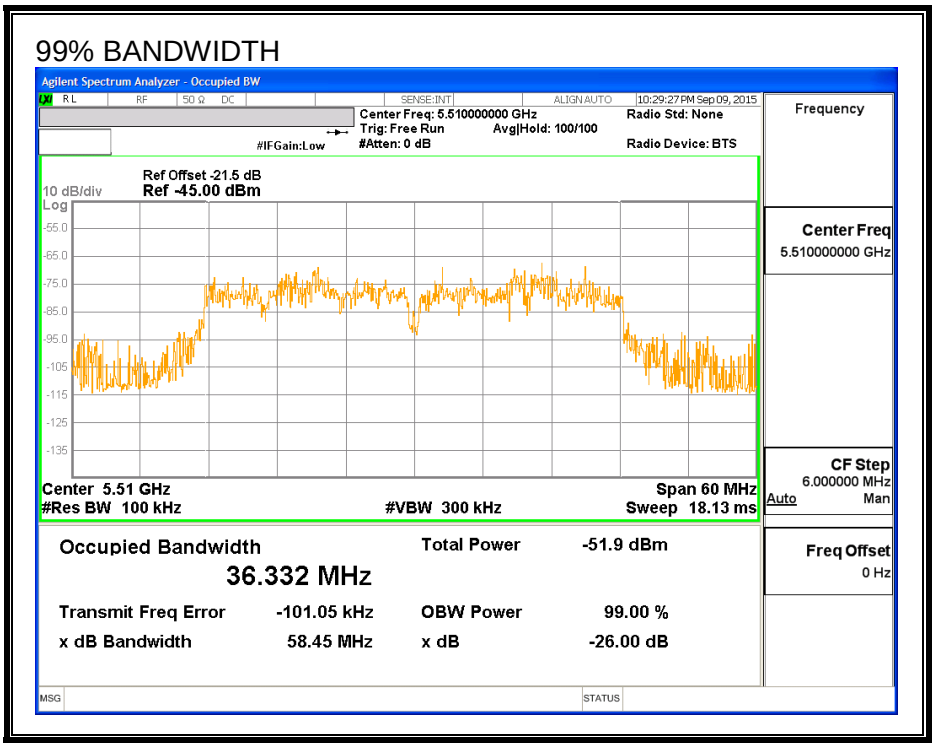
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



5.3.2. 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	36.332	110.1	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
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	9	90	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	FH
5531	10	0	0	

5.3.3. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth		80% of Det BW	
					FL	FH	FL5	FH5
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5530		
FCC Short Pulse Type 2	30	96.67	60	Pass	5490	5530		
FCC Short Pulse Type 3	30	83.33	60	Pass	5490	5530		
FCC Short Pulse Type 4	30	90.00	60	Pass	5490	5530		
Aggregate		92.50	80	Pass				
FCC Fixed Long Pulse Type 5	30	96.67	80	Pass	5490	5530	5494	5526
FCC Random Long Pulse Type 5	30	100.00	80	Pass	5490	5530	5494	5526
FCC Hopping Type 6	41	100.00	70	Pass	5490	5530		

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	5510	Yes
1002	1	718	74	A	5510	Yes
1003	1	798	67	A	5510	Yes
1004	1	918	58	A	5510	Yes
1005	1	738	72	A	5510	Yes
1006	1	618	86	A	5510	Yes
1007	1	598	89	A	5510	Yes
1008	1	518	102	A	5510	Yes
1009	1	698	76	A	5510	Yes
1010	1	938	57	A	5510	Yes
1011	1	758	70	A	5510	Yes
1012	1	858	62	A	5510	Yes
1013	1	538	99	A	5510	Yes
1014	1	818	65	A	5510	Yes
1015	1	878	61	A	5510	Yes
1016	1	2506	22	B	5510	Yes
1017	1	785	68	B	5510	Yes
1018	1	741	72	B	5510	Yes
1019	1	3051	18	B	5510	Yes
1020	1	588	90	B	5510	Yes
1021	1	3027	18	B	5510	Yes
1022	1	2047	26	B	5510	Yes
1023	1	2068	26	B	5510	Yes
1024	1	2571	21	B	5510	Yes
1025	1	1527	35	B	5510	Yes
1026	1	806	66	B	5510	Yes
1027	1	2439	22	B	5510	Yes
1028	1	653	81	B	5510	Yes
1029	1	1220	44	B	5510	Yes
1030	1	2112	25	B	5510	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	3.8	186	28	5510	No
2002	1.4	185	25	5510	Yes
2003	2.3	179	25	5510	Yes
2004	4.8	188	24	5510	Yes
2005	4	186	27	5510	Yes
2006	4.7	199	26	5510	Yes
2007	1.9	163	26	5510	Yes
2008	1	181	29	5510	Yes
2009	4.7	192	26	5510	Yes
2010	1.8	213	23	5510	Yes
2011	3.7	228	27	5510	Yes
2012	3.2	216	28	5510	Yes
2013	1.3	154	29	5510	Yes
2014	5	227	27	5510	Yes
2015	3.3	212	25	5510	Yes
2016	1.3	208	23	5510	Yes
2017	2	198	29	5510	Yes
2018	4.2	160	23	5510	Yes
2019	1	197	26	5510	Yes
2020	3.5	163	28	5510	Yes
2021	2.7	204	25	5510	Yes
2022	3.4	174	24	5510	Yes
2023	2.8	219	27	5510	Yes
2024	3.8	155	27	5510	Yes
2025	3.4	166	24	5510	Yes
2026	2.6	188	28	5510	Yes
2027	2.4	203	29	5510	Yes
2028	1.9	190	26	5510	Yes
2029	4.1	210	27	5510	Yes
2030	3.8	201	24	5510	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	365	16	5510	Yes
3002	8.9	352	18	5510	Yes
3003	9.7	320	17	5510	Yes
3004	7.4	453	16	5510	Yes
3005	8.5	316	16	5510	Yes
3006	9.2	462	17	5510	Yes
3007	5.5	337	18	5510	No
3008	6.4	496	18	5510	Yes
3009	5.6	384	17	5510	No
3010	6.9	320	16	5510	Yes
3011	6.3	473	18	5510	Yes
3012	5.4	288	17	5510	No
3013	5.2	335	17	5510	No
3014	9.6	297	16	5510	Yes
3015	7.2	357	16	5510	Yes
3016	6.8	331	18	5510	Yes
3017	7.4	286	18	5510	Yes
3018	7.3	406	18	5510	Yes
3019	8.1	374	16	5510	Yes
3020	5.8	374	16	5510	Yes
3021	6.9	488	18	5510	Yes
3022	7.6	382	16	5510	Yes
3023	9	258	18	5510	Yes
3024	9.9	417	17	5510	Yes
3025	9.1	305	17	5510	Yes
3026	7.6	359	17	5510	Yes
3027	7.1	260	16	5510	Yes
3028	6.2	459.00	17	5510	Yes
3029	5.9	373	18	5510	Yes
3030	5.3	335	16	5510	No

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	16	395	14	5510	Yes
4002	10.5	251	12	5510	No
4003	16.3	324	16	5510	Yes
4004	11.3	444	12	5510	Yes
4005	17.7	412	16	5510	Yes
4006	13.2	294	12	5510	Yes
4007	15.4	275	12	5510	Yes
4008	16.8	421	16	5510	Yes
4009	19.4	296	16	5510	Yes
4010	11.2	337	15	5510	Yes
4011	19.8	477	13	5510	Yes
4012	12.1	279	12	5510	No
4013	11.1	431	13	5510	Yes
4014	19.3	380	13	5510	Yes
4015	18.8	294	14	5510	Yes
4016	17.5	255	16	5510	Yes
4017	12.8	449	12	5510	No
4018	17.4	423	13	5510	Yes
4019	13.1	496	14	5510	Yes
4020	18.2	365	15	5510	Yes
4021	14.5	333	15	5510	Yes
4022	10	466	16	5510	Yes
4023	17.5	446	15	5510	Yes
4024	13.6	341	14	5510	Yes
4025	16.2	468	14	5510	Yes
4026	18.1	258	13	5510	Yes
4027	16.6	397	16	5510	Yes
4028	19	451.00	16	5510	Yes
4029	18	352.00	16	5510	Yes
4030	16.1	301.00	16	5510	Yes

TYPE 5 DETECTION PROBABILITY AT THE CHANNEL CENTER FREQUENCY

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	5510	Yes
12	5510	Yes
13	5510	Yes
14	5510	Yes
15	5510	Yes
16	5510	Yes
17	5510	Yes
18	5510	Yes
19	5510	Yes
20	5510	No
21	5510	Yes
22	5510	Yes
23	5510	Yes
24	5510	Yes
25	5510	Yes
26	5510	Yes
27	5510	Yes
28	5510	Yes
29	5510	Yes
30	5510	Yes

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

TYPE 5 DETECTION PROBABILITY AT RANDOM FREQUENCIES WITHIN AN 80& SPAN OF THE 99% OCCUPIED BANDWIDTH

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5501	Yes
2	5495	Yes
3	5522	Yes
4	5516	Yes
5	5499	Yes
6	5515	Yes
7	5501	Yes
8	5526	Yes
9	5525	Yes
10	5502	Yes
11	5525	Yes
12	5502	Yes
13	5517	Yes
14	5524	Yes
15	5524	Yes
16	5510	Yes
17	5504	Yes
18	5520	Yes
19	5524	Yes
20	5512	Yes
21	5521	Yes
22	5524	Yes
23	5496	Yes
24	5496	Yes
25	5513	Yes
26	5507	Yes
27	5502	Yes
28	5512	Yes
29	5503	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	1	5490	12	Yes
2	476	5491	10	Yes
3	951	5492	8	Yes
4	1426	5493	10	Yes
5	1901	5494	12	Yes
6	2376	5495	10	Yes
7	2851	5496	10	Yes
8	3326	5497	9	Yes
9	3801	5498	12	Yes
10	4276	5499	10	Yes
11	4751	5500	11	Yes
12	5226	5501	4	Yes
13	5701	5502	7	Yes
14	6176	5503	11	Yes
15	6651	5504	8	Yes
16	7126	5505	10	Yes
17	7601	5506	11	Yes
18	8076	5507	6	Yes
19	8551	5508	9	Yes
20	9026	5509	6	Yes
21	9501	5510	9	Yes
22	9976	5511	10	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

23	10451	5512	7	Yes
24	10926	5513	7	Yes
25	11401	5514	8	Yes
26	11876	5515	5	Yes
27	12351	5516	8	Yes
28	12826	5517	5	Yes
29	13301	5518	8	Yes
30	13776	5519	5	Yes
31	14251	5520	8	Yes
32	14726	5521	12	Yes
33	15201	5522	8	Yes
34	15676	5523	9	Yes
35	16151	5524	9	Yes
36	16626	5525	6	Yes
37	17101	5526	8	Yes
38	17576	5527	11	Yes
39	18051	5528	8	Yes
40	18526	5529	10	Yes
41	19001	5530	6	Yes

5.4. RESULTS FOR 80 MHz BANDWIDTH

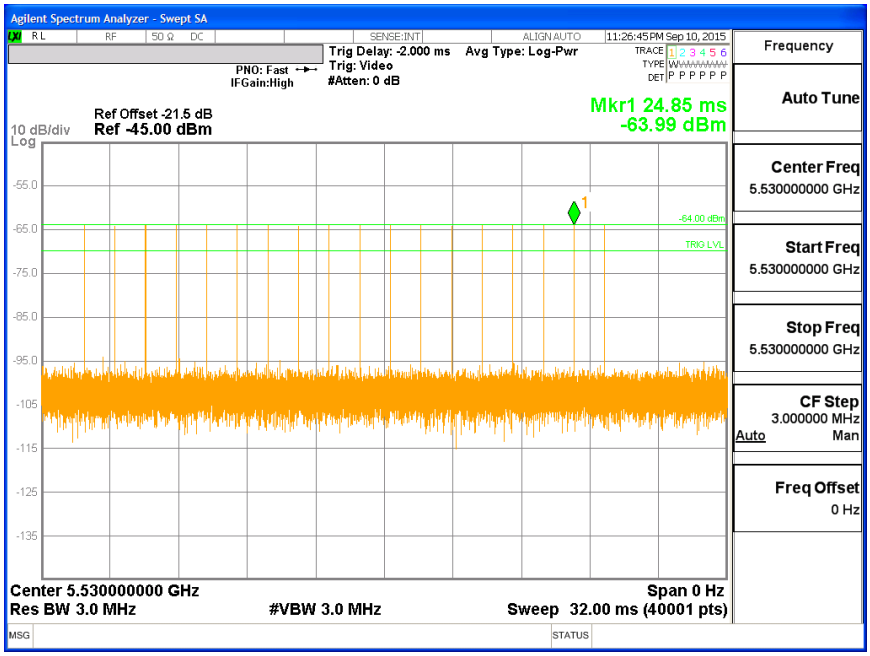
5.4.1. TEST CHANNEL

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

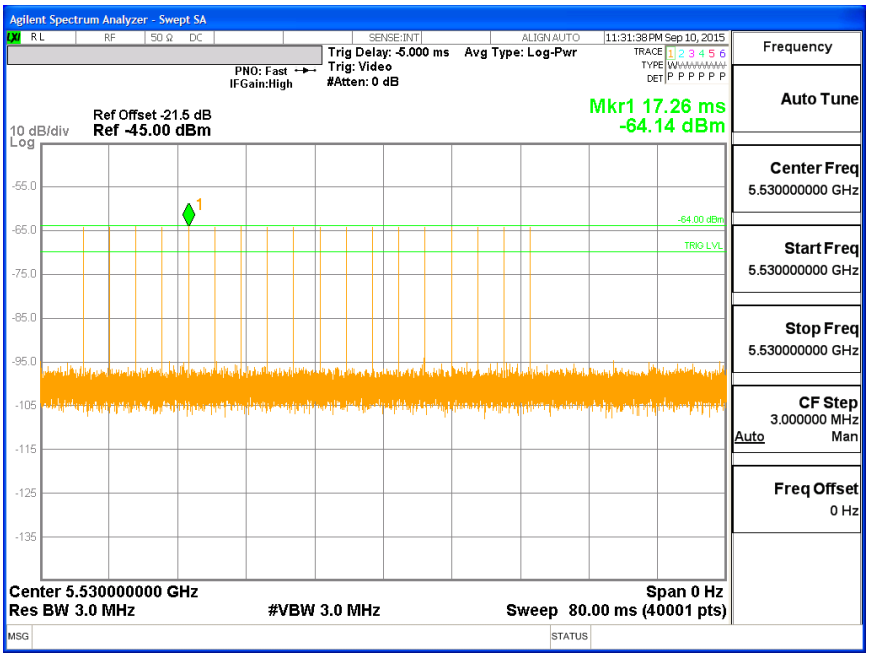
5.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

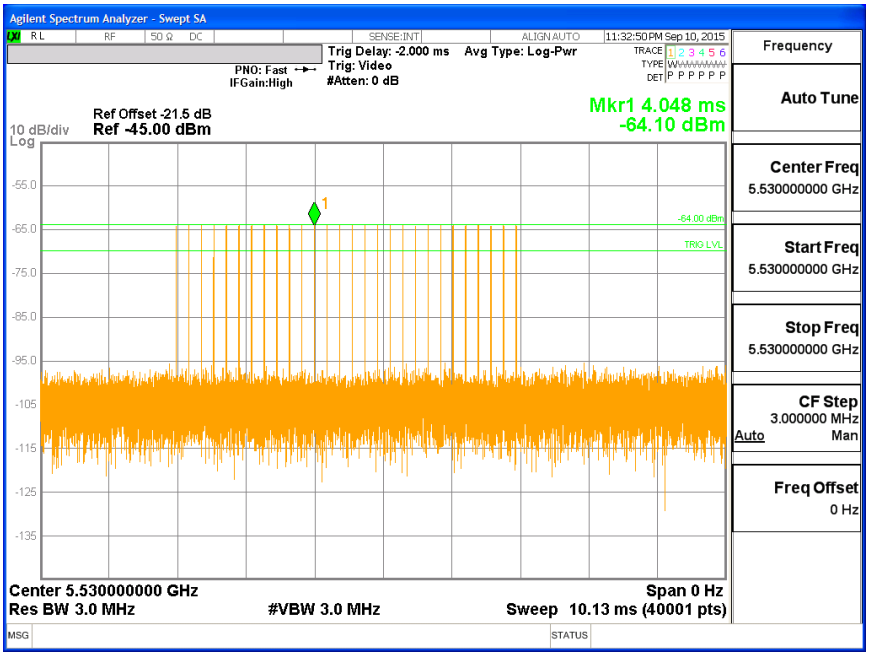
SHORT PULSE RADAR TYPE 0



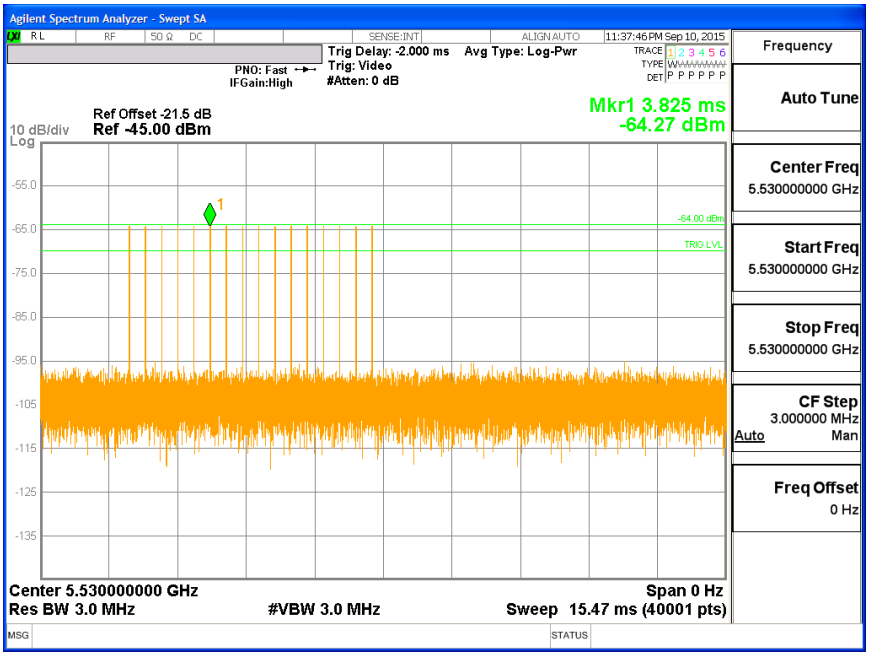
SAMPLE OF RADAR TYPE 1



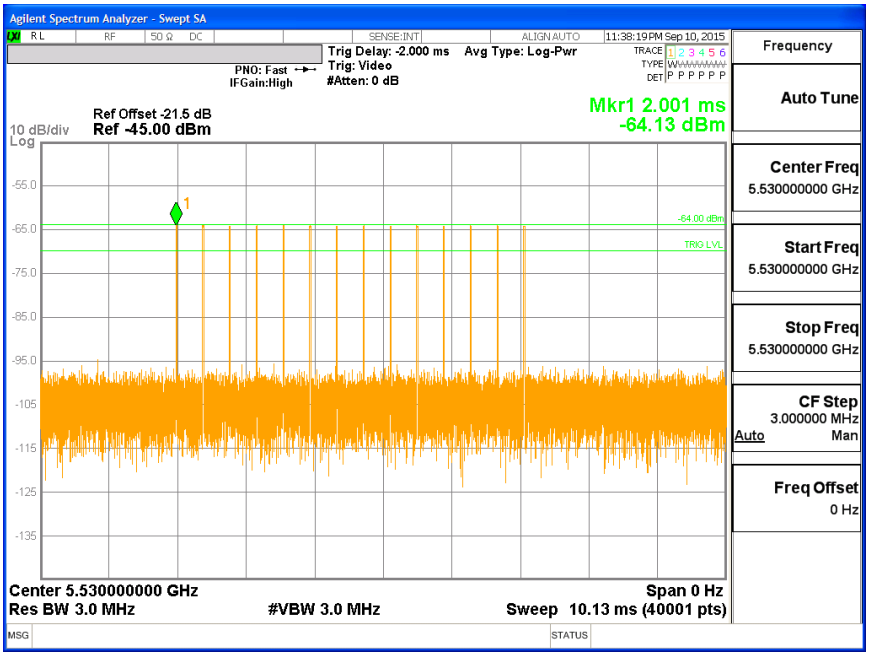
SAMPLE OF RADAR TYPE 2



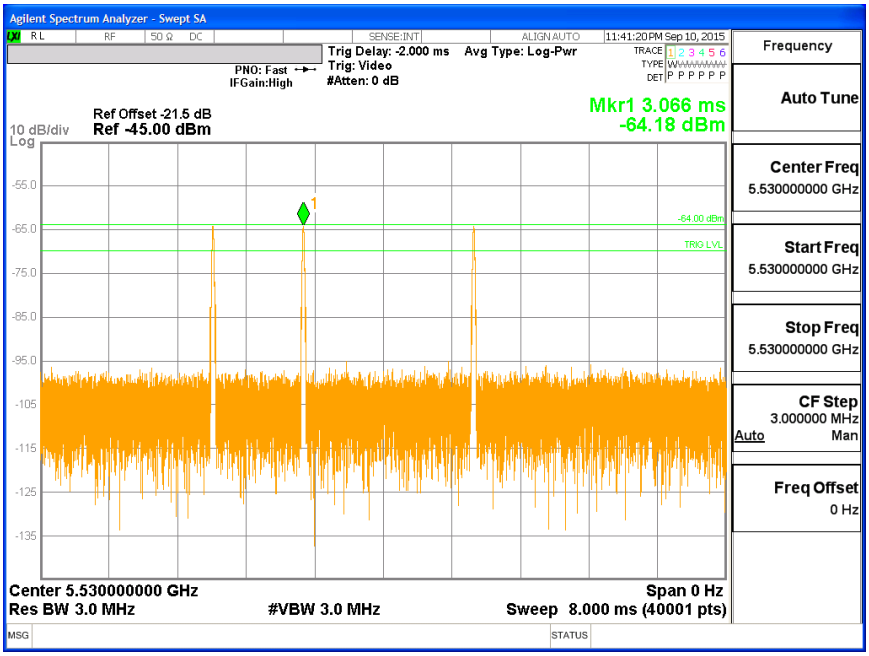
SAMPLE OF RADAR TYPE 3



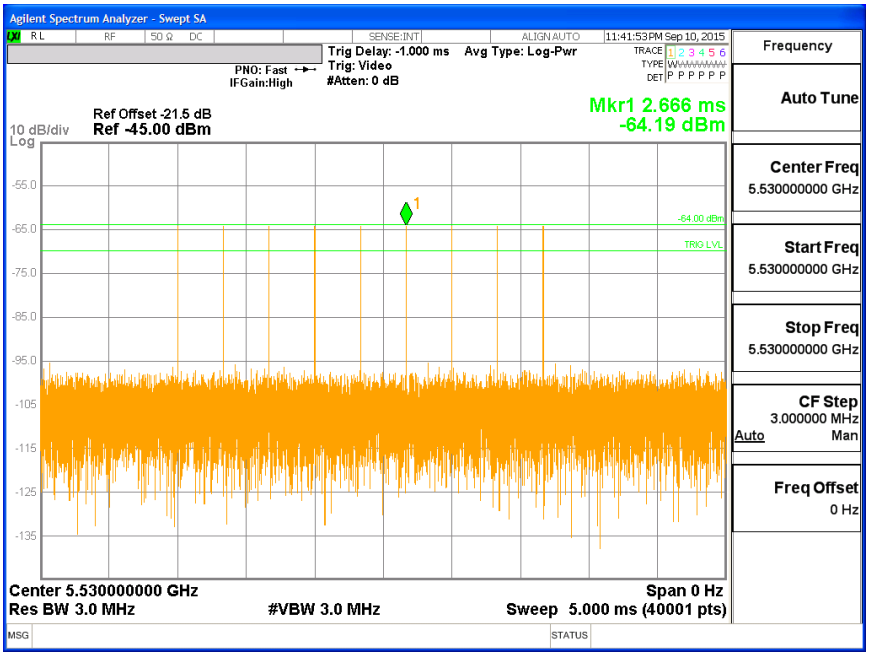
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

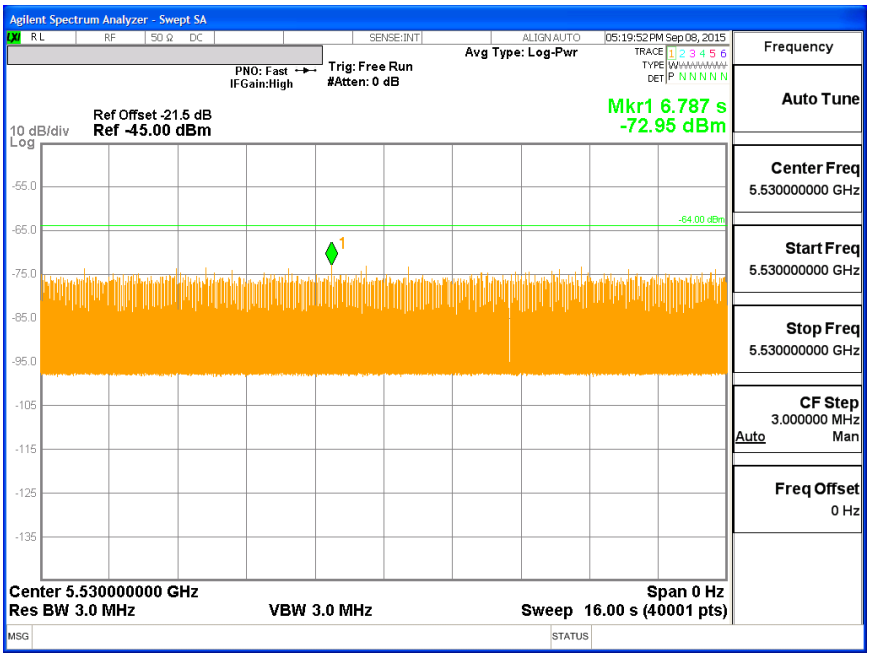


SINGLE BURST OF RADAR TYPE 6

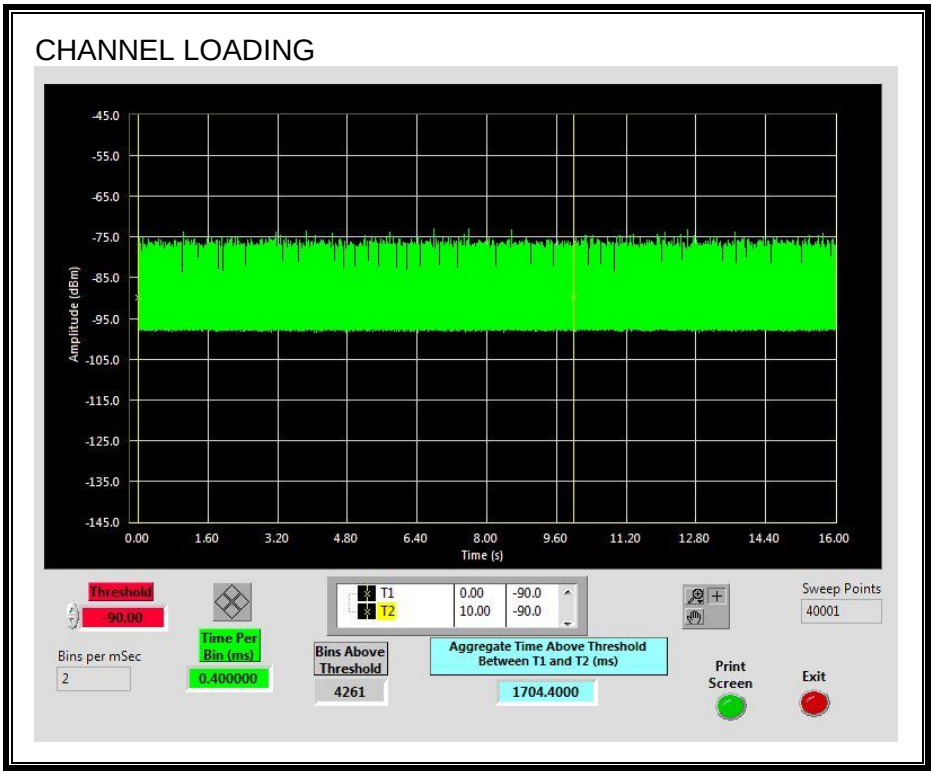


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.044%

5.4.1. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
29.87	187.9	158.0	98.0

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)
30.09	128.9	98.8	0.8

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)
29.75	186.5	156.8	58.7

QUALITATIVE RESULTS

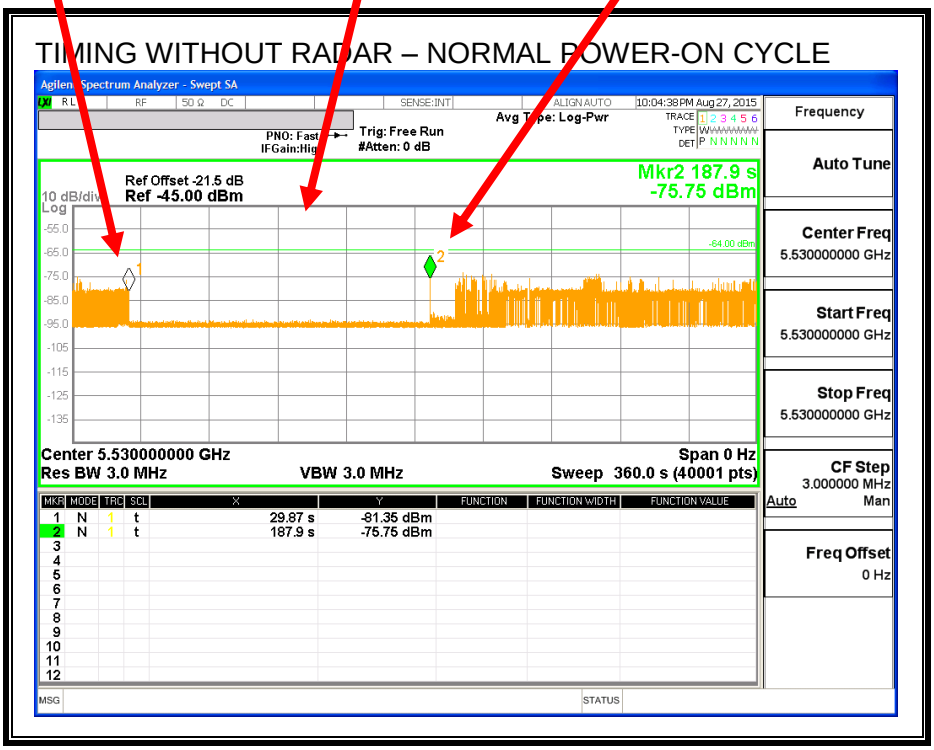
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



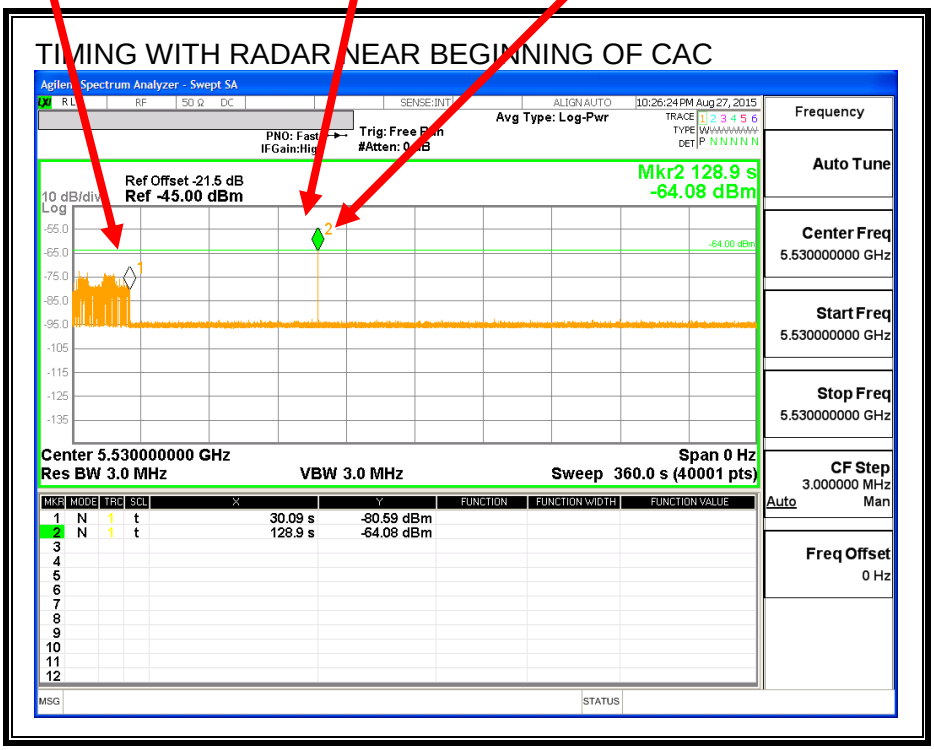
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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

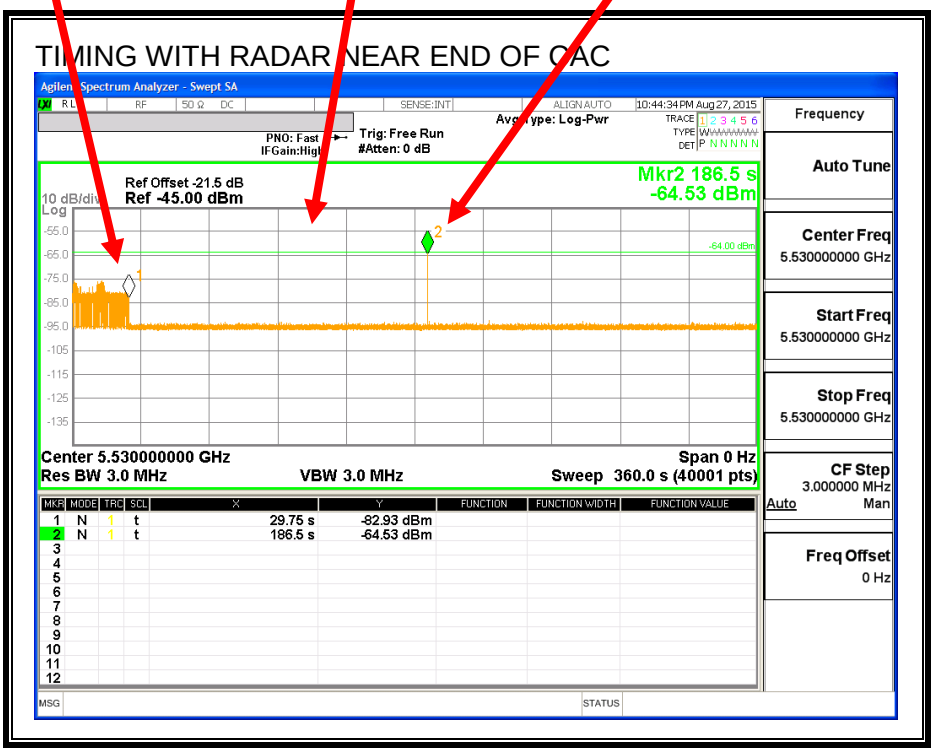
Radar Signal Applied



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.

5.4.2. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

5.4.3. 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).

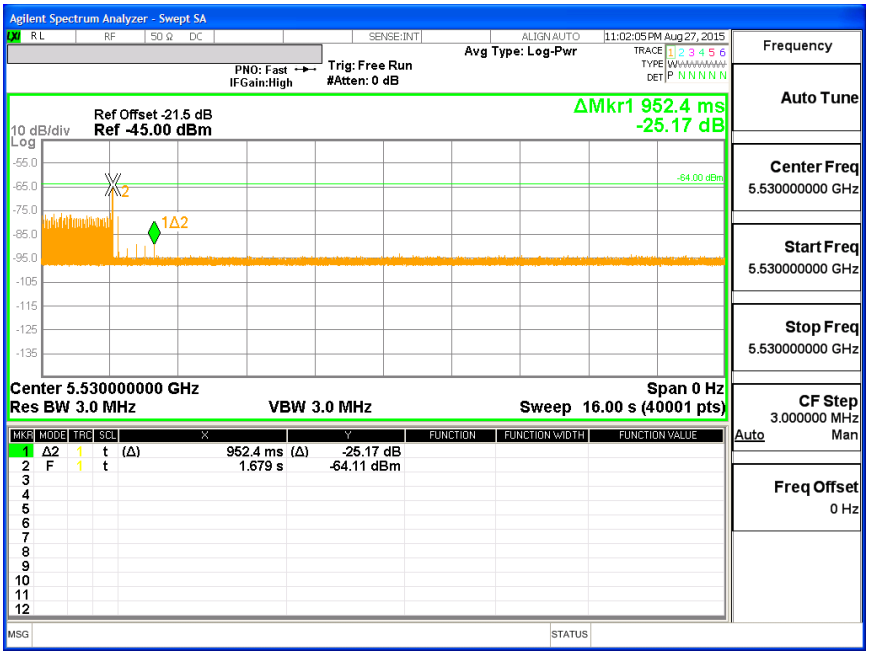
RESULTS

Channel Move Time (sec)	Limit (sec)
0.952	10

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

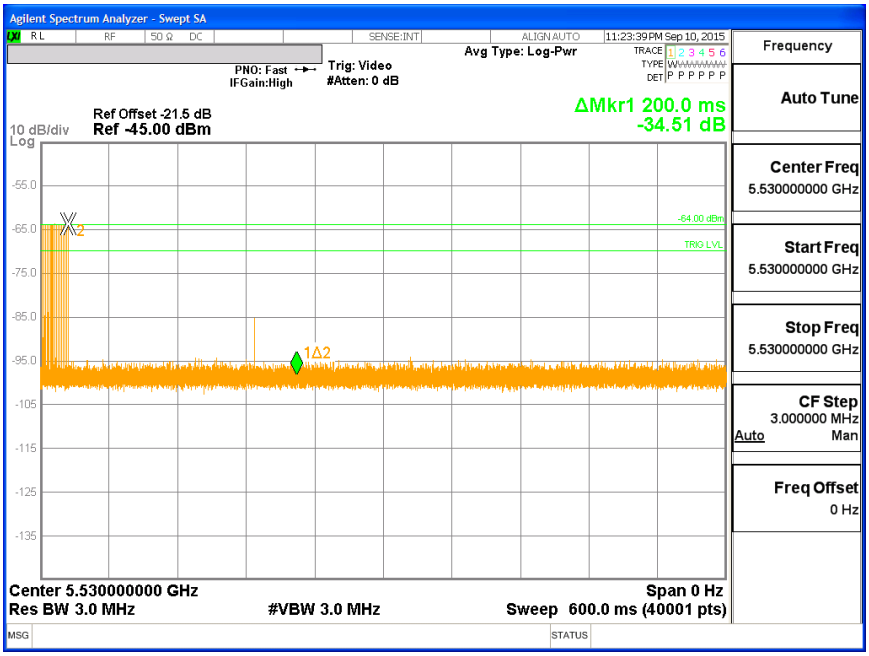
MOVE TIME

MOVE TIME



CHANNEL CLOSING TIME

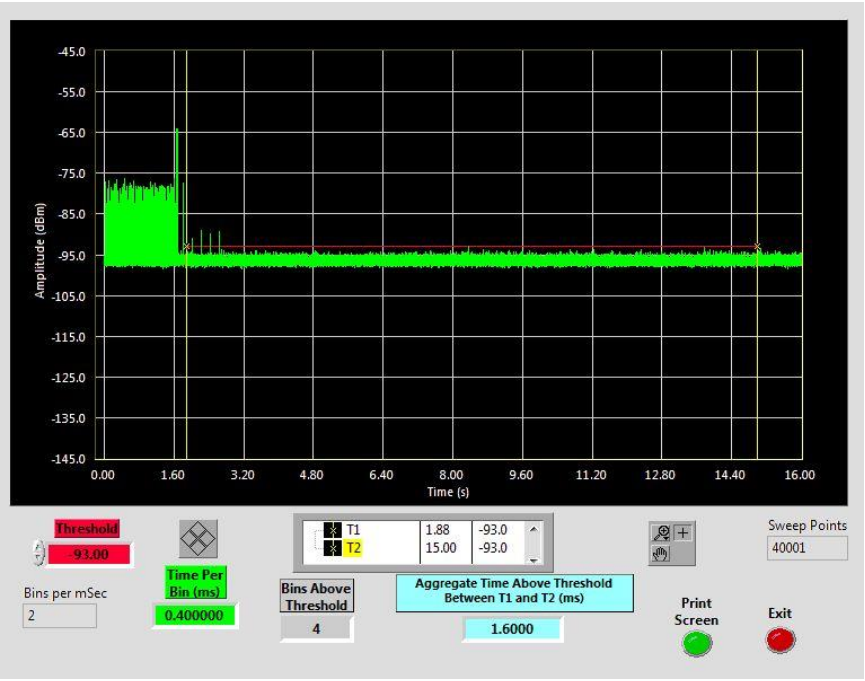
CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

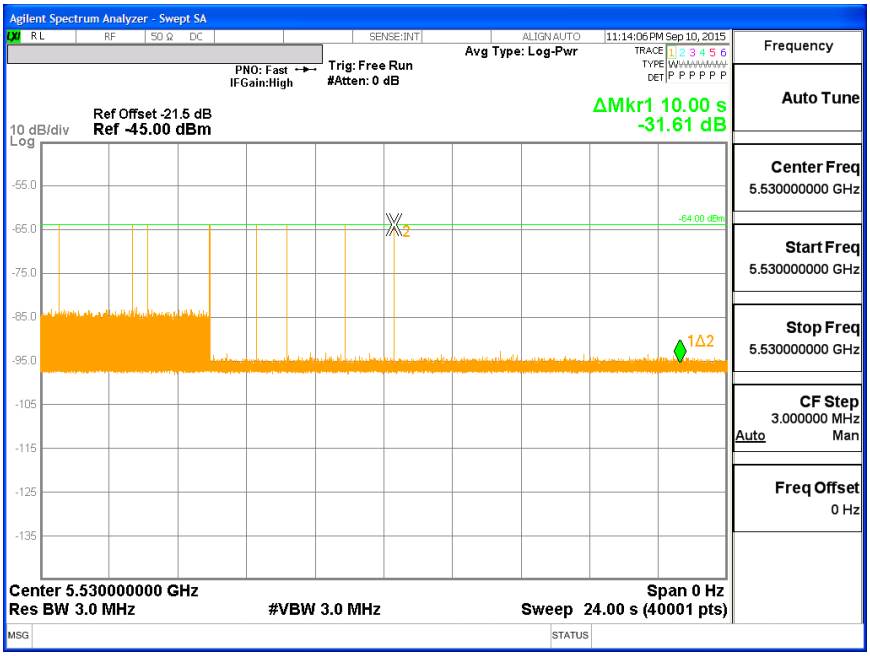
AGGREGATE CLOSING TIME



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

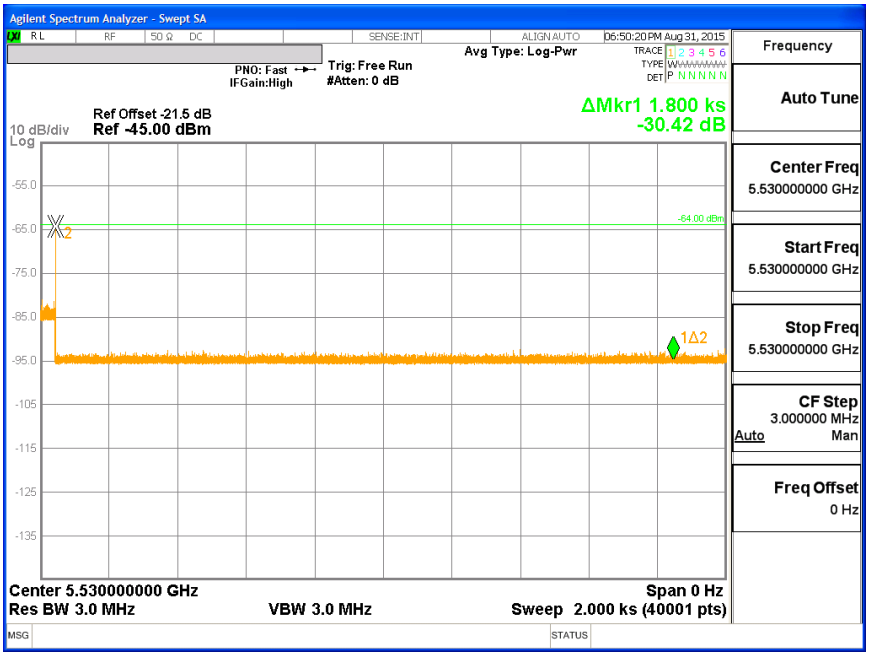


5.4.1. NON-OCCUPANCY PERIOD

RESULTS

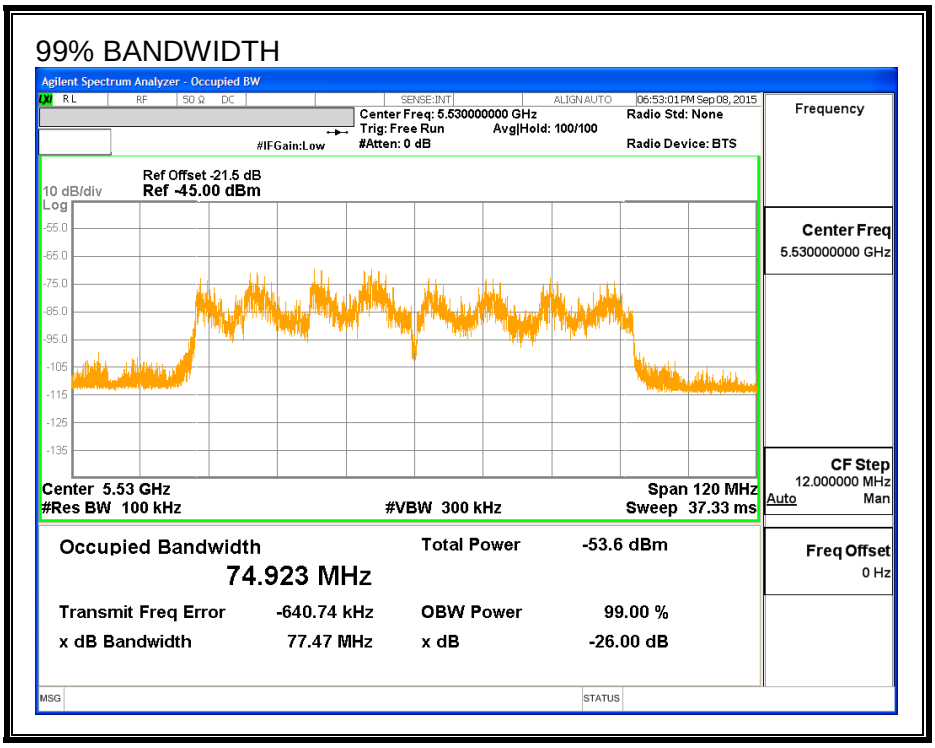
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



5.4.2. 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	74.923	106.8	100

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
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	1	10	
5490	10	10	100	FL
5491	10	10	100	
5492	10	10	100	
5493	10	10	100	
5494	10	10	100	
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	

5.4.3. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth		80% of Det BW	
					FL	FH	FL5	FH5
FCC Short Pulse Type 1	30	100.00	60	Pass	5490	5570		
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5570		
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5570		
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5570		
Aggregate		91.67	80	Pass				
FCC Fixed Long Pulse Type 5	30	96.67	80	Pass	5490	5570	5498	5562
FCC Random Long Pulse Type 5	30	100.00	80	Pass	5490	5570	5498	5562
FCC Hopping Type 6	81	100.00	70	Pass	5490	5570		

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1						
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Test (A/B)	Frequency (MHz)	Successful Detection (Yes/No)
1001	1	3066	18	A	5530	Yes
1002	1	718	74	A	5530	Yes
1003	1	798	67	A	5530	Yes
1004	1	918	58	A	5530	Yes
1005	1	738	72	A	5530	Yes
1006	1	618	86	A	5530	Yes
1007	1	598	89	A	5530	Yes
1008	1	518	102	A	5530	Yes
1009	1	698	76	A	5530	Yes
1010	1	938	57	A	5530	Yes
1011	1	758	70	A	5530	Yes
1012	1	858	62	A	5530	Yes
1013	1	538	99	A	5530	Yes
1014	1	818	65	A	5530	Yes
1015	1	878	61	A	5530	Yes
1016	1	2506	22	B	5530	Yes
1017	1	785	68	B	5530	Yes
1018	1	741	72	B	5530	Yes
1019	1	3051	18	B	5530	Yes
1020	1	588	90	B	5530	Yes
1021	1	3027	18	B	5530	Yes
1022	1	2047	26	B	5530	Yes
1023	1	2068	26	B	5530	Yes
1024	1	2571	21	B	5530	Yes
1025	1	1527	35	B	5530	Yes
1026	1	806	66	B	5530	Yes
1027	1	2439	22	B	5530	Yes
1028	1	653	81	B	5530	Yes
1029	1	1220	44	B	5530	Yes
1030	1	2112	25	B	5530	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	3.8	186	28	5530	Yes
2002	1.4	185	25	5530	Yes
2003	2.3	179	25	5530	Yes
2004	4.8	188	24	5530	Yes
2005	4	186	27	5530	Yes
2006	4.7	199	26	5530	Yes
2007	1.9	163	26	5530	Yes
2008	1	181	29	5530	Yes
2009	4.7	192	26	5530	Yes
2010	1.8	213	23	5530	Yes
2011	3.7	228	27	5530	Yes
2012	3.2	216	28	5530	Yes
2013	1.3	154	29	5530	Yes
2014	5	227	27	5530	Yes
2015	3.3	212	25	5530	Yes
2016	1.3	208	23	5530	Yes
2017	2	198	29	5530	Yes
2018	4.2	160	23	5530	Yes
2019	1	197	26	5530	Yes
2020	3.5	163	28	5530	Yes
2021	2.7	204	25	5530	Yes
2022	3.4	174	24	5530	Yes
2023	2.8	219	27	5530	Yes
2024	3.8	155	27	5530	Yes
2025	3.4	166	24	5530	Yes
2026	2.6	188	28	5530	Yes
2027	2.4	203	29	5530	Yes
2028	1.9	190	26	5530	Yes
2029	4.1	210	27	5530	Yes
2030	3.8	201	24	5530	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	365	16	5530	Yes
3002	8.9	352	18	5530	Yes
3003	9.7	320	17	5530	Yes
3004	7.4	453	16	5530	Yes
3005	8.5	316	16	5530	Yes
3006	9.2	462	17	5530	Yes
3007	5.5	337	18	5530	No
3008	6.4	496	18	5530	Yes
3009	5.6	384	17	5530	No
3010	6.9	320	16	5530	Yes
3011	6.3	473	18	5530	Yes
3012	5.4	288	17	5530	No
3013	5.2	335	17	5530	No
3014	9.6	297	16	5530	Yes
3015	7.2	357	16	5530	Yes
3016	6.8	331	18	5530	Yes
3017	7.4	286	18	5530	No
3018	7.3	406	18	5530	Yes
3019	8.1	374	16	5530	Yes
3020	5.8	374	16	5530	Yes
3021	6.9	488	18	5530	Yes
3022	7.6	382	16	5530	Yes
3023	9	258	18	5530	Yes
3024	9.9	417	17	5530	Yes
3025	9.1	305	17	5530	Yes
3026	7.6	359	17	5530	Yes
3027	7.1	260	16	5530	Yes
3028	6.2	459.00	17	5530	Yes
3029	5.9	373	18	5530	Yes
3030	5.3	335	16	5530	No

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	16	395	14	5530	Yes
4002	10.5	251	12	5530	Yes
4003	16.3	324	16	5530	Yes
4004	11.3	444	12	5530	Yes
4005	17.7	412	16	5530	Yes
4006	13.2	294	12	5530	No
4007	15.4	275	12	5530	Yes
4008	16.8	421	16	5530	Yes
4009	19.4	296	16	5530	Yes
4010	11.2	337	15	5530	Yes
4011	19.8	477	13	5530	Yes
4012	12.1	279	12	5530	Yes
4013	11.1	431	13	5530	Yes
4014	19.3	380	13	5530	Yes
4015	18.8	294	14	5530	Yes
4016	17.5	255	16	5530	Yes
4017	12.8	449	12	5530	Yes
4018	17.4	423	13	5530	No
4019	13.1	496	14	5530	Yes
4020	18.2	365	15	5530	No
4021	14.5	333	15	5530	No
4022	10	466	16	5530	Yes
4023	17.5	446	15	5530	Yes
4024	13.6	341	14	5530	Yes
4025	16.2	468	14	5530	Yes
4026	18.1	258	13	5530	Yes
4027	16.6	397	16	5530	Yes
4028	19	451.00	16	5530	Yes
4029	18	352.00	16	5530	Yes
4030	16.1	301.00	16	5530	Yes

TYPE 5 DETECTION PROBABILITY AT THE CHANNEL CENTER FREQUENCY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5530	Yes
2	5530	No
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	5530	Yes
12	5530	Yes
13	5530	Yes
14	5530	Yes
15	5530	Yes
16	5530	Yes
17	5530	Yes
18	5530	Yes
19	5530	Yes
20	5530	Yes
21	5530	Yes
22	5530	Yes
23	5530	Yes
24	5530	Yes
25	5530	Yes
26	5530	Yes
27	5530	Yes
28	5530	Yes
29	5530	Yes
30	5530	Yes

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

TYPE 5 DETECTION PROBABILITY AT RANDOM FREQUENCIES WITHIN AN 80& SPAN OF THE 99% OCCUPIED BANDWIDTH

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5534	Yes
2	5545	Yes
3	5546	Yes
4	5530	Yes
5	5509	Yes
6	5516	Yes
7	5507	Yes
8	5504	Yes
9	5533	Yes
10	5542	Yes
11	5506	Yes
12	5520	Yes
13	5509	Yes
14	5530	Yes
15	5513	Yes
16	5546	Yes
17	5540	Yes
18	5504	Yes
19	5544	Yes
20	5535	Yes
21	5502	Yes
22	5522	Yes
23	5501	Yes
24	5533	Yes
25	5560	Yes
26	5546	Yes
27	5523	Yes
28	5518	Yes
29	5541	Yes
30	5546	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	325	5490	10	Yes
2	800	5491	15	Yes
3	1275	5492	22	Yes
4	1750	5493	23	Yes
5	2225	5494	21	Yes
6	2700	5495	13	Yes
7	3175	5496	13	Yes
8	3650	5497	12	Yes
9	4125	5498	16	Yes
10	4600	5499	13	Yes
11	5075	5500	9	Yes
12	5550	5501	16	Yes
13	6025	5502	13	Yes
14	6500	5503	15	Yes
15	6975	5504	18	Yes
16	7450	5505	18	Yes
17	7925	5506	13	Yes
18	8400	5507	16	Yes
19	8875	5508	25	Yes
20	9350	5509	14	Yes
21	9825	5510	16	Yes
22	10300	5511	19	Yes
23	10775	5512	18	Yes
24	11250	5513	19	Yes
25	11725	5514	11	Yes
26	12200	5515	15	Yes
27	12675	5516	22	Yes
28	13150	5517	14	Yes
29	13625	5518	12	Yes
30	14100	5519	20	Yes
31	14575	5520	12	Yes
32	15050	5521	15	Yes
33	15525	5522	14	Yes
34	16000	5523	17	Yes
35	16475	5524	16	Yes
36	16950	5525	9	Yes
37	17425	5526	10	Yes
38	17900	5527	12	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

39	18375	5528	13	Yes
40	18850	5529	19	Yes
41	19325	5530	19	Yes
42	19800	5531	19	Yes
43	20275	5532	17	Yes
44	20750	5533	10	Yes
45	21225	5534	22	Yes
46	21700	5535	16	Yes
47	22175	5536	13	Yes
48	22650	5537	19	Yes
49	23125	5538	16	Yes
50	23600	5539	15	Yes
51	24075	5540	13	Yes
52	24550	5541	12	Yes
53	25025	5542	18	Yes
54	25500	5543	16	Yes
55	25975	5544	13	Yes
56	26450	5545	15	Yes
57	26925	5546	16	Yes
58	27400	5547	23	Yes
59	27875	5548	16	Yes
60	28350	5549	21	Yes
61	28825	5550	20	Yes
62	29300	5551	17	Yes
63	29775	5552	11	Yes
64	30250	5553	13	Yes
65	30725	5554	15	Yes
66	31200	5555	18	Yes
67	31675	5556	11	Yes
68	32150	5557	21	Yes
69	32625	5558	16	Yes
70	33100	5559	20	Yes
71	33575	5560	20	Yes
72	34050	5561	22	Yes
73	34525	5562	14	Yes
74	35000	5563	23	Yes
75	35475	5564	19	Yes
76	35950	5565	24	Yes
77	36425	5566	19	Yes
78	36900	5567	20	Yes
79	37375	5568	18	Yes
80	37850	5569	19	Yes
81	38325	5570	15	Yes

6. BRIDGE MODE RESULTS

Per KDB 905462, Section 5.1 (footnote 1):

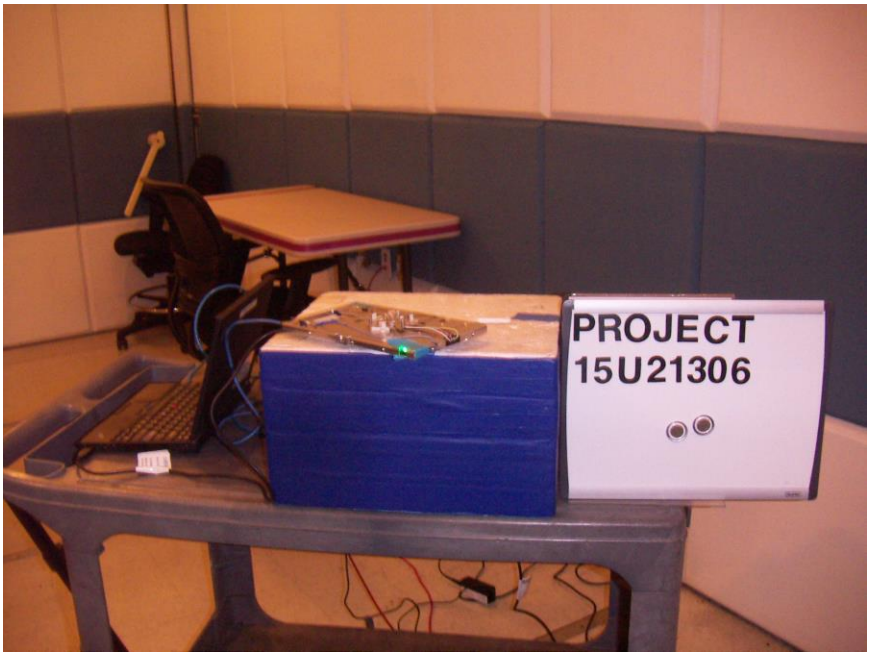
Networks Access Points with Bridge and/or MESH modes of operation are permitted to operate in the DFS bands but must employ a DFS function. The functionality of the Bridge mode as specified in §15.403(a) must be validated in the DFS test report. Devices operating as relays must also employ DFS function. 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.

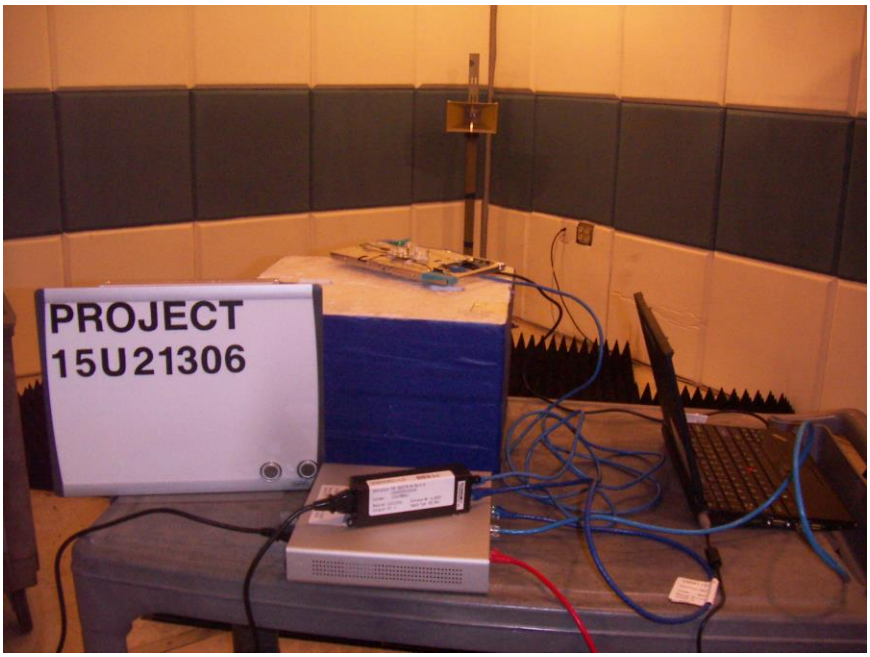
7. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS FRONT PHOTO



DFS BACK PHOTO



END OF REPORT