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

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n/ac WIRELESS ACCESS POINT

MODEL NUMBER: MR52-HW

FCC ID: UDX-60041010
IC: 69610A-60041010

REPORT NUMBER: 16U22944-E2V3

ISSUE DATE: AUGUST 01, 2016

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
V1	03/15/16	Initial Issue	Conan Cheung
V2	07/29/16	Update Test & Measurement Equipment	Conan Cheung
V3	08/01/2016	Add Testing Software Information	Conan Cheung

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ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11a/b/g/n/ac WIRELESS ACCESS POINT

MODEL: MR52-HW

SERIAL NUMBER: Q2LD-2N28-N2FF

DATE TESTED: FEBRUARY 26, 2016 & MARCH 1, 2016

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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1. 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.

2. 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.

3. CALIBRATION AND UNCERTAINTY

3.1. 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.

3.2. 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

3.3. 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%.

4. DYNAMIC FREQUENCY SELECTION

4.1. OVERVIEW

4.1.1. LIMITS

INDUSTRY CANADA

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

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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

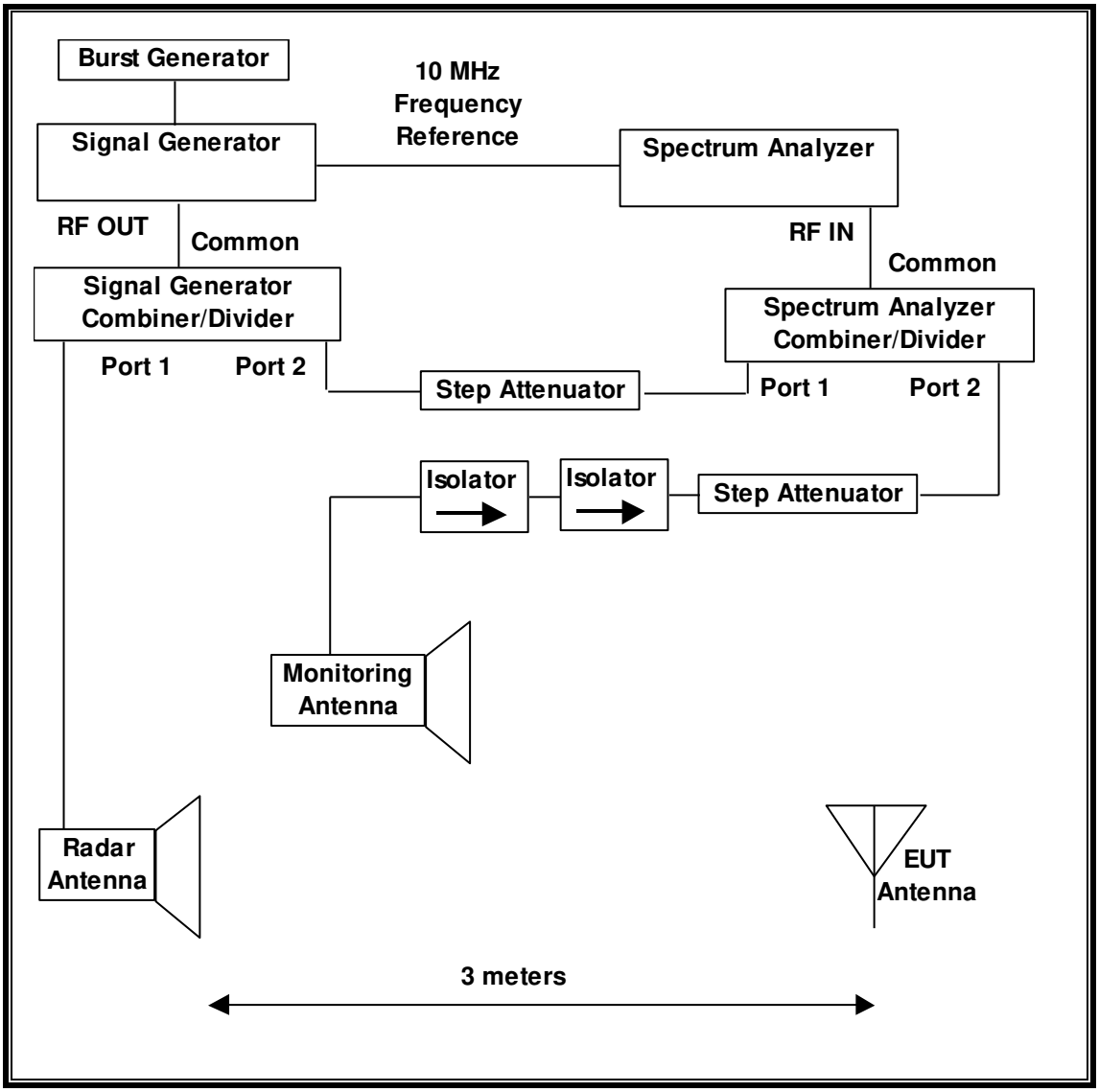
Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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

4.1.2. 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	N5182B	MY51350128	04/06/16
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/08/16

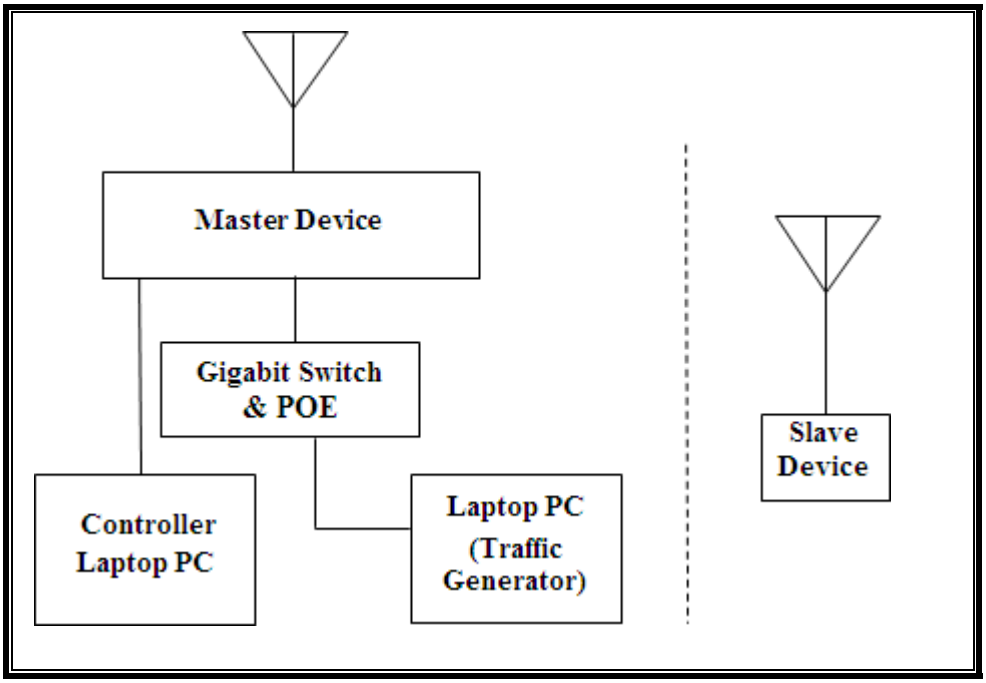
4.1.1. TEST AND MEASUREMENT SOFTWARE

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	2.0.0.6	Channel Loading and Aggregate Closing Time
FCC 2006 Detection	2.0.0.2	Detection Bandwidth in 1 MHz Steps
FCC 2014 Detection	2.0.0.2	Detection Bandwidth in 5 MHz Steps
In Service Monitoring-PXA	2	In-Service Monitoring (Probability of Detection)
PXA Read	3.0.0.7	Signal Generator Screen Capture
SGXProject.exe	2	Radar Waveform Generation and Download

4.1.2. 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)	Lenovo	TYPE 3249-2HU	R9-AWVWD 11/01	QDS-BRCM1046
AC Adapter (Controller)	Lenovo	ADLX65NLT2A	11S36200291ZZ300345B5X	DoC
Gigabit Switch	Meraki	MS220-8P	Q2HP-DR3G-TQZS	DoC
Laptop PC (Slave Device)	Apple	A1465	C02KTGMPF5N7	QDS-BRCM1072
AC Adapter (Slave Device)	Apple	A1435	C04341216J2F288BT	DoC
Laptop PC (Traffic Generator)	Lenovo	TYPE 4287-5TU	R9-PLM9D 12/06	QDS-BRCM1046
AC Adapter (Traffic Generator)	Lenovo	45N0121	11S45N0121Z1ZHXU213DMG	DoC

4.1.3. 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 29.21 dBm EIRP in the 5250-5350 MHz band and 29.96 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 5.68 dBi in the 5250-5350 MHz band and 6.5 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 3.64 dBi in the 5250-5350 MHz band and 4.75 dBi in the 5470-5725 MHz band.

Four antennas are utilized to meet the diversity and MIMO operational requirements.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The EUT uses four transmitter/receiver chains, each connected to an antenna to perform radiated tests.

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

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

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

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

The software installed in the EUT is firmware_cryptid_version T-193877M-gf292c4a6-mprokos.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

4.2. RESULTS FOR 20 MHz BANDWIDTH

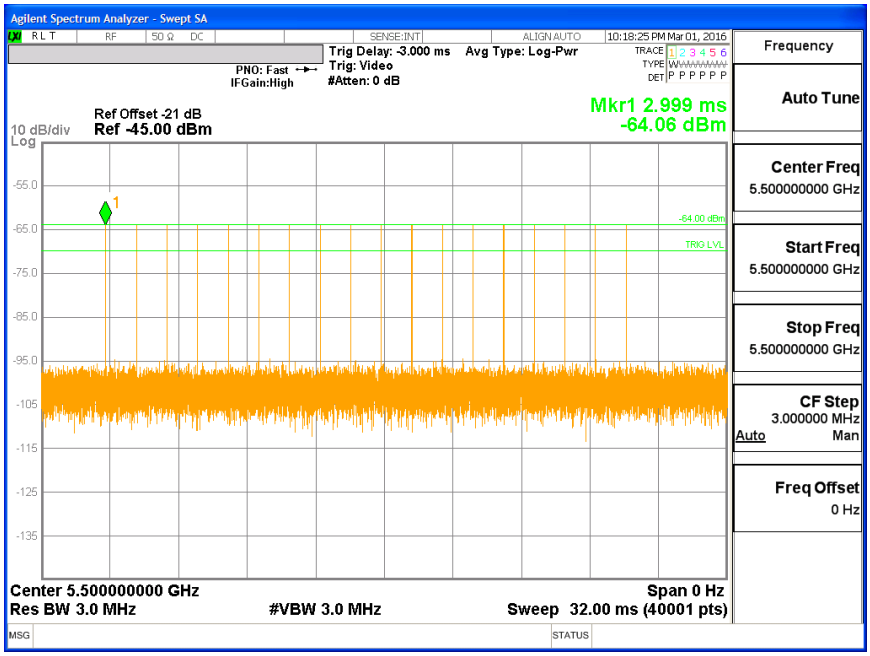
4.2.1. TEST CHANNEL

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

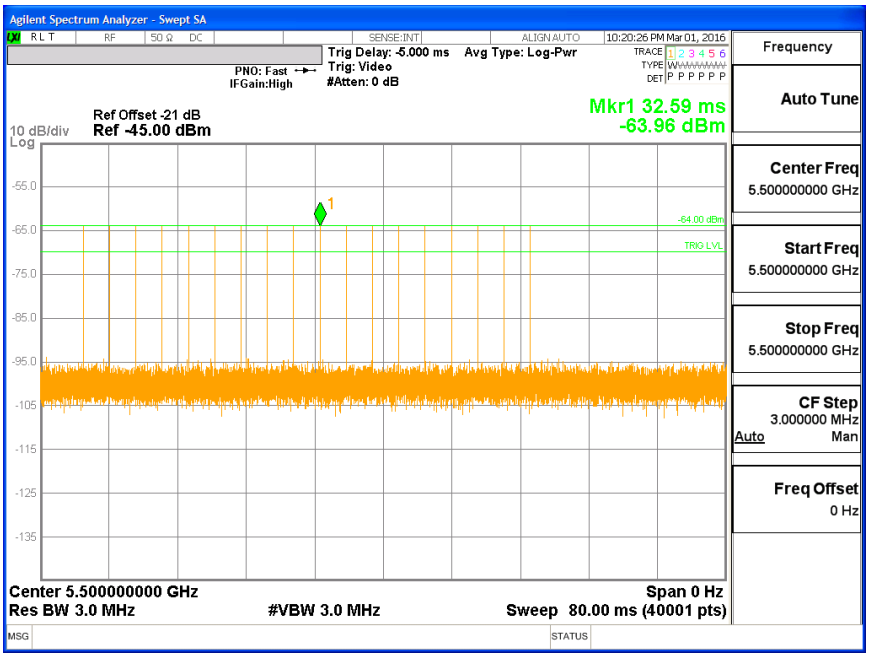
4.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

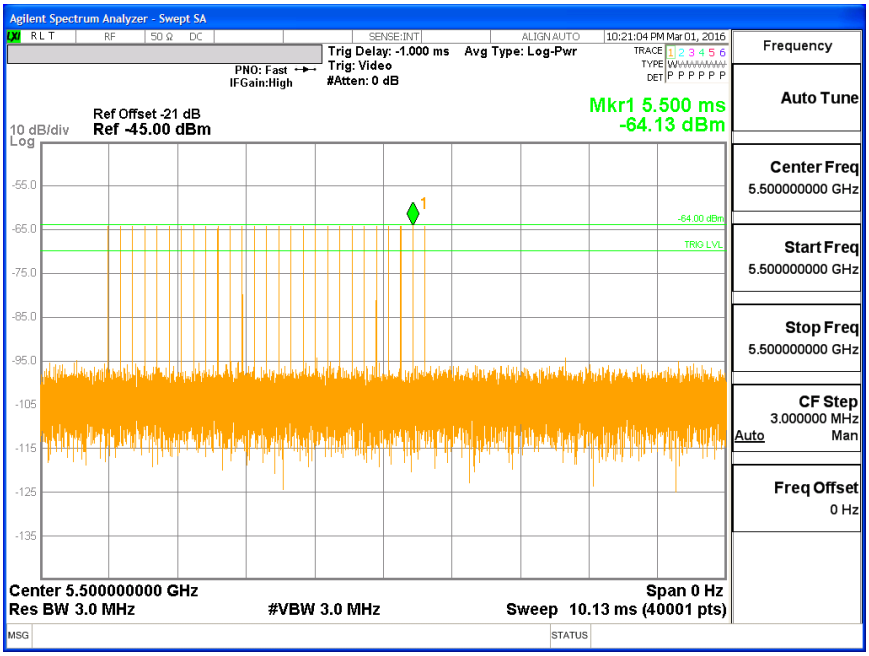
SHORT PULSE RADAR TYPE 0



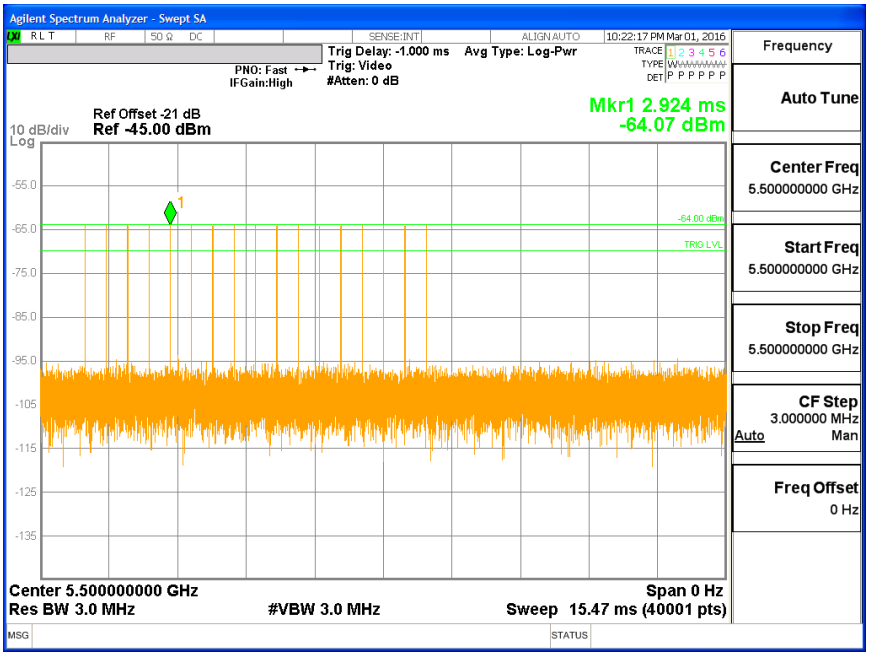
SAMPLE OF RADAR TYPE 1



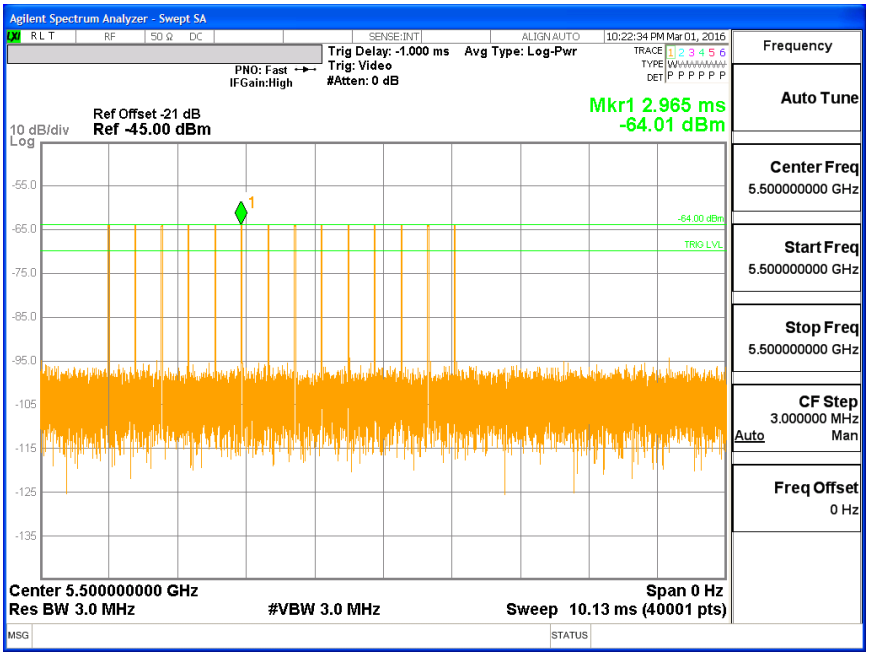
SAMPLE OF RADAR TYPE 2



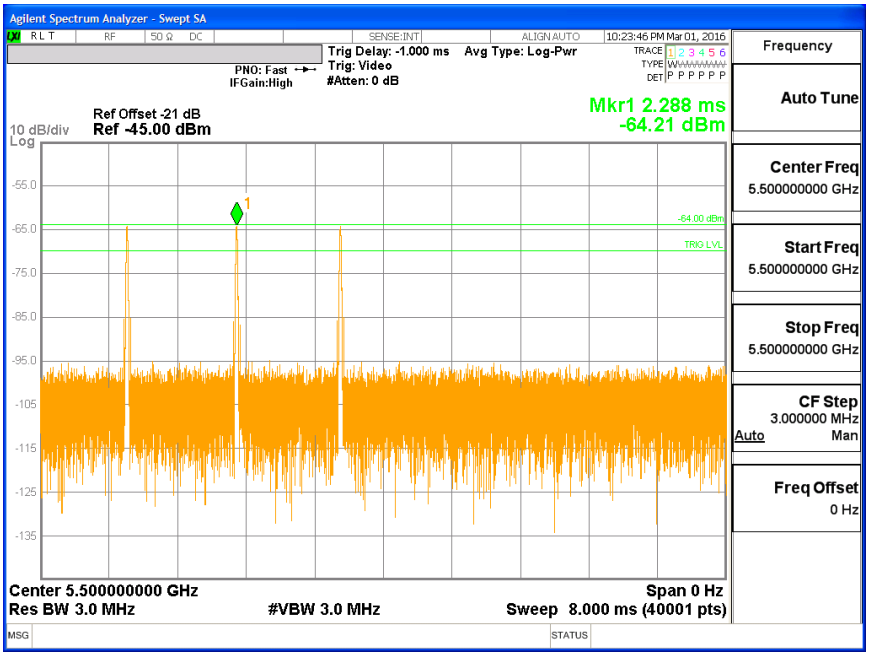
SAMPLE OF RADAR TYPE 3



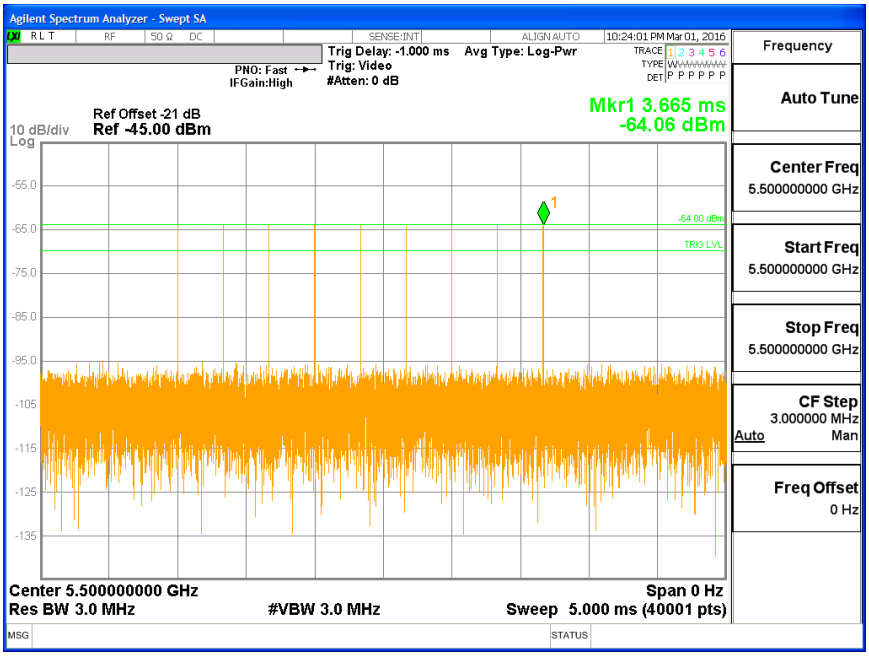
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

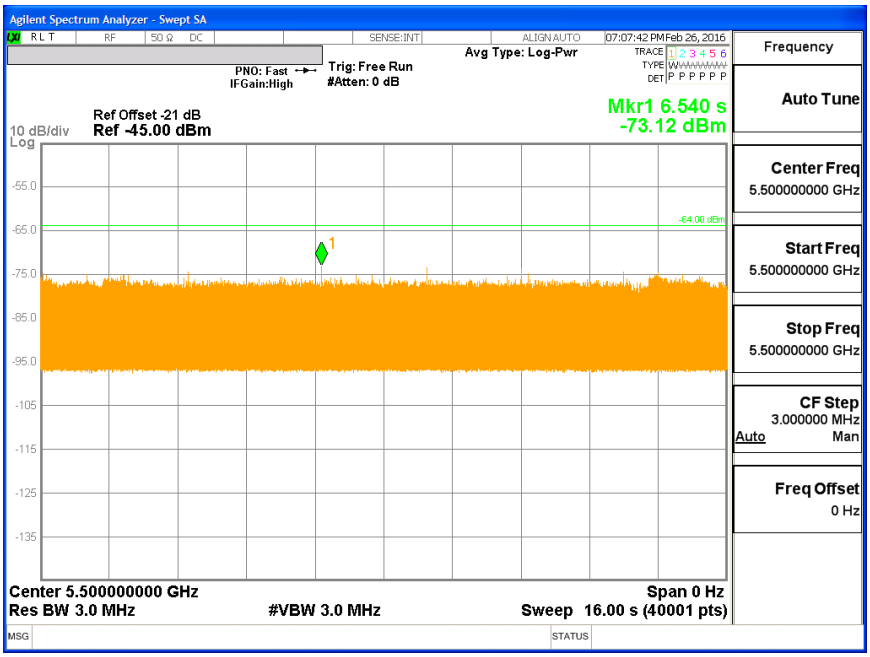


SINGLE BURST OF RADAR TYPE 6

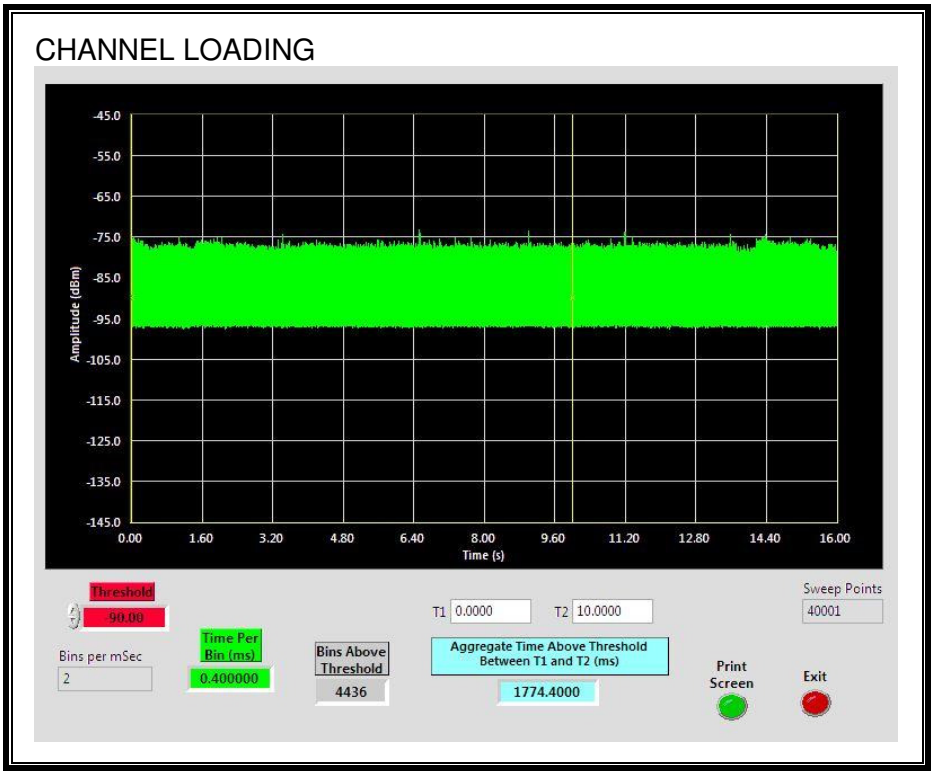


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.744%

4.2.3. 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)
30.14	186.6	156.5	96.5

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)
29.95	127.3	97.4	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)
30.13	184.9	154.8	58.3

QUALITATIVE RESULTS

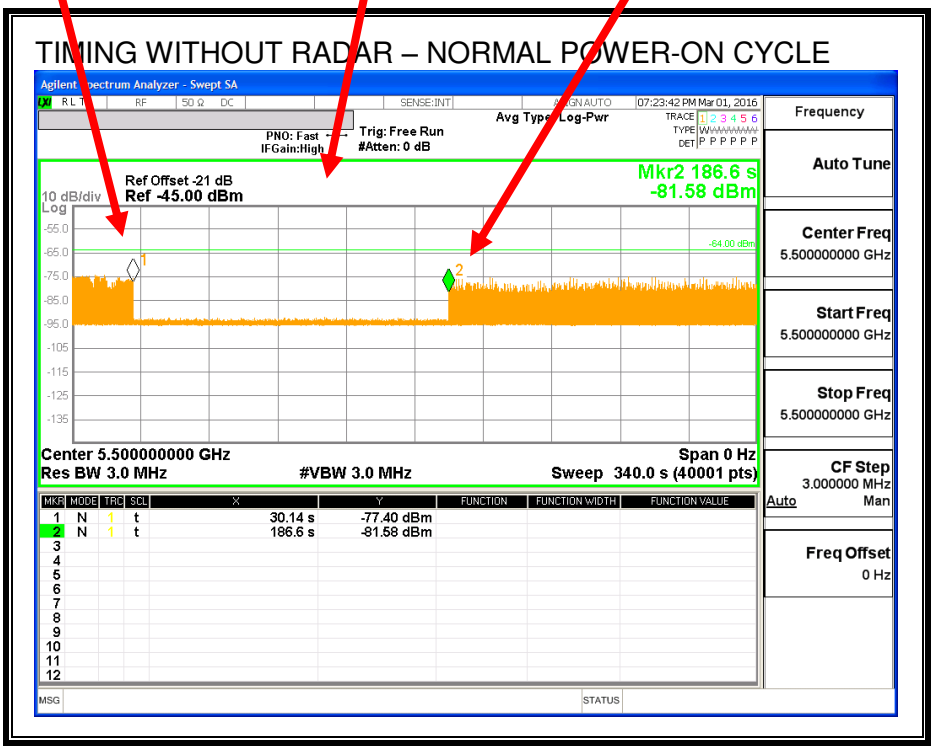
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



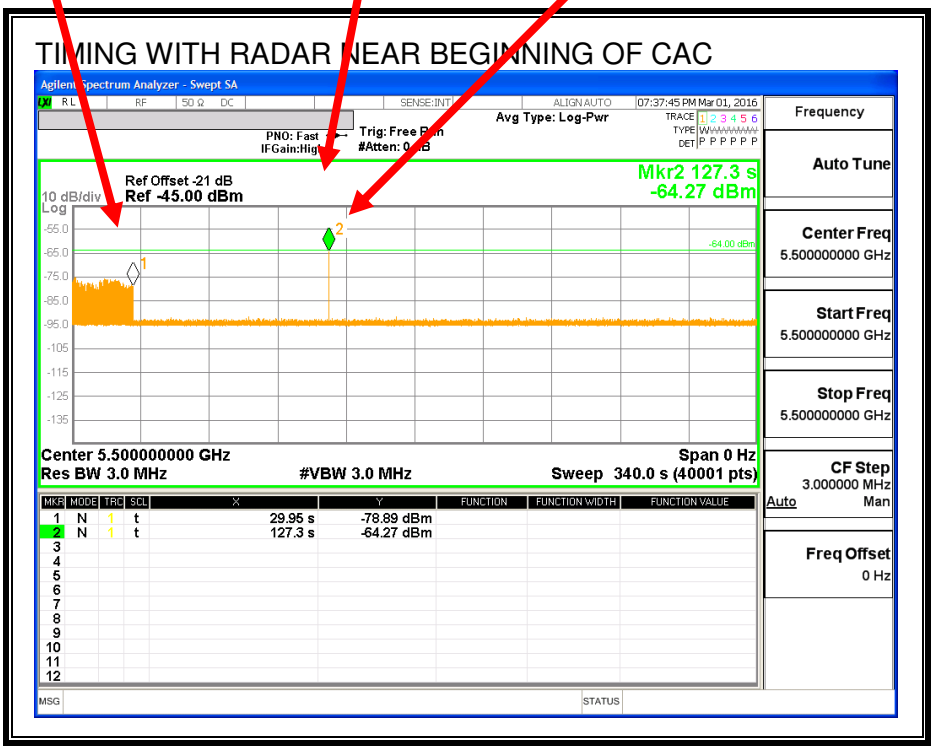
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



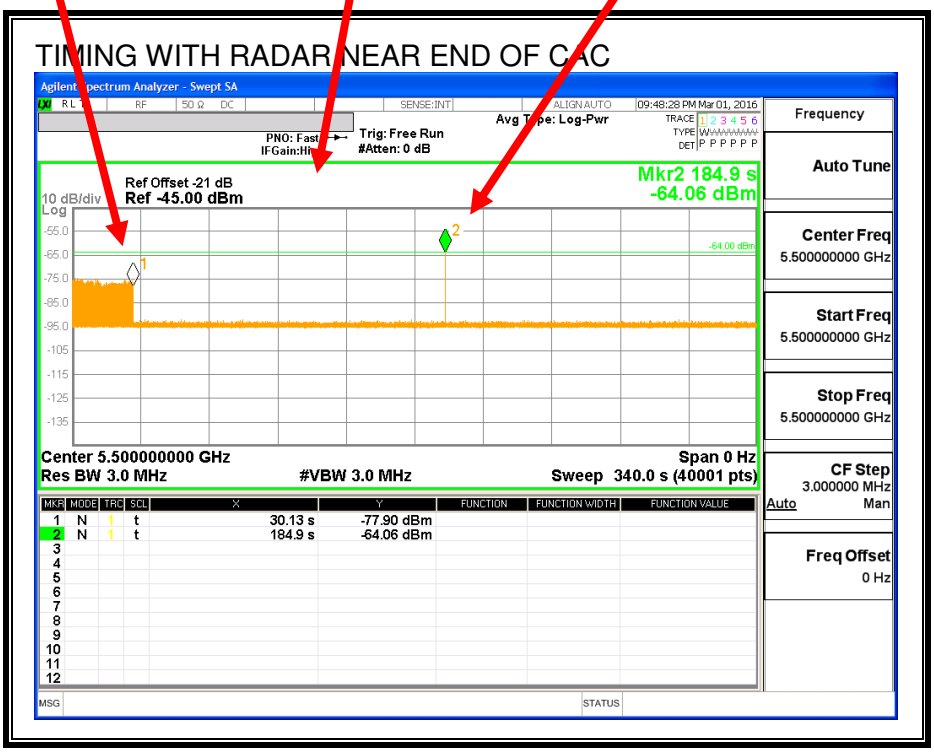
No EUT transmissions were observed after the radar signal.

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.

4.2.4. 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.

4.2.5. 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)

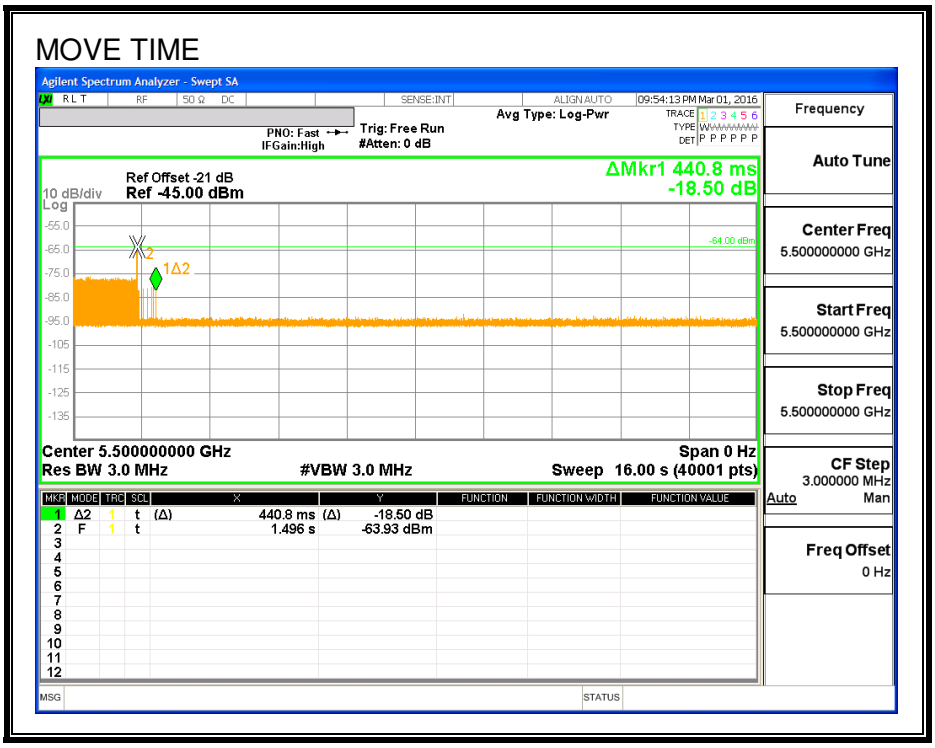
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.441	10

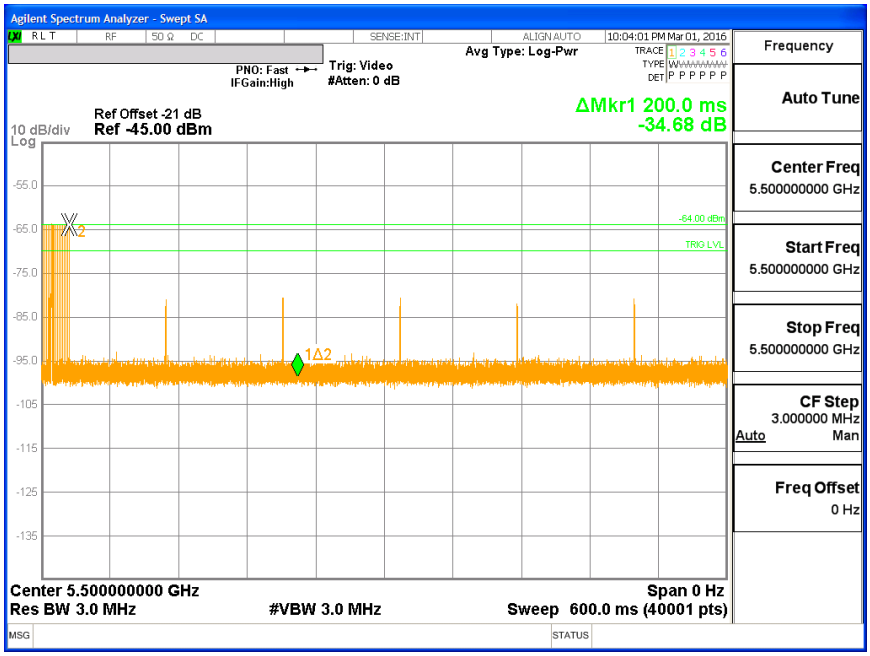
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
4.0	60

MOVE TIME



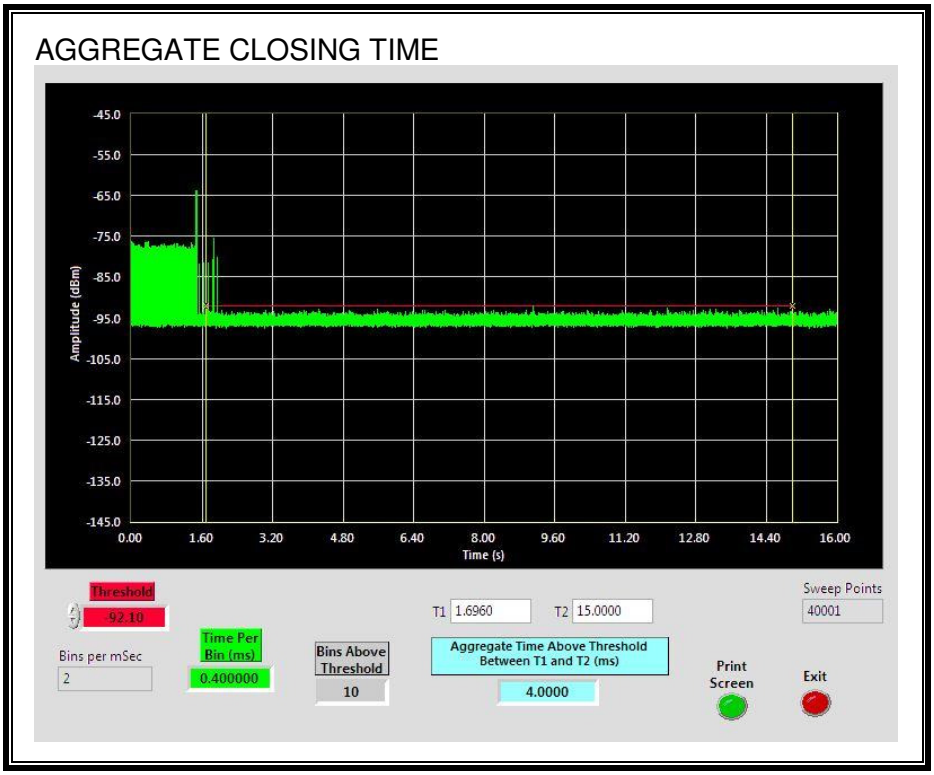
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

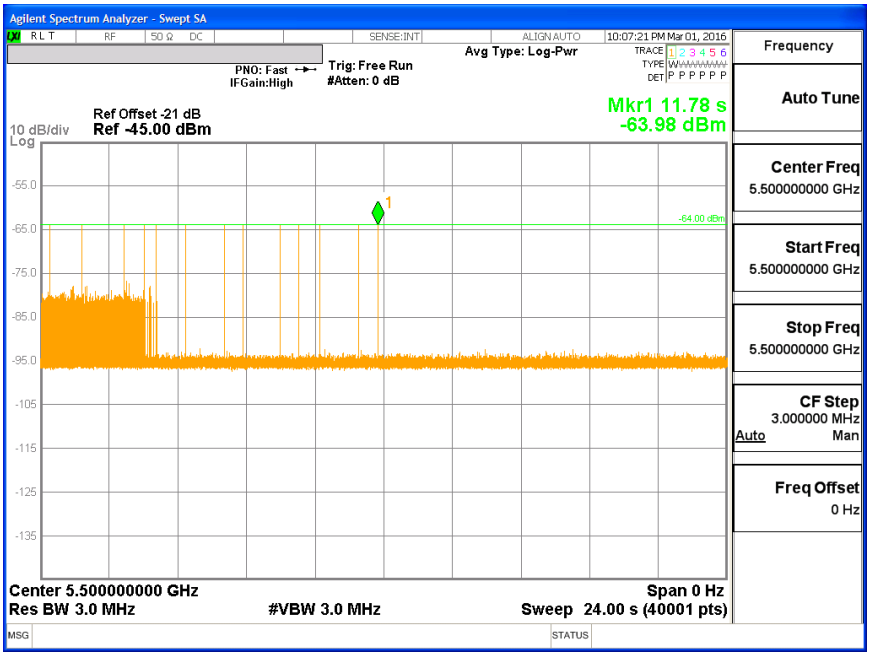
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

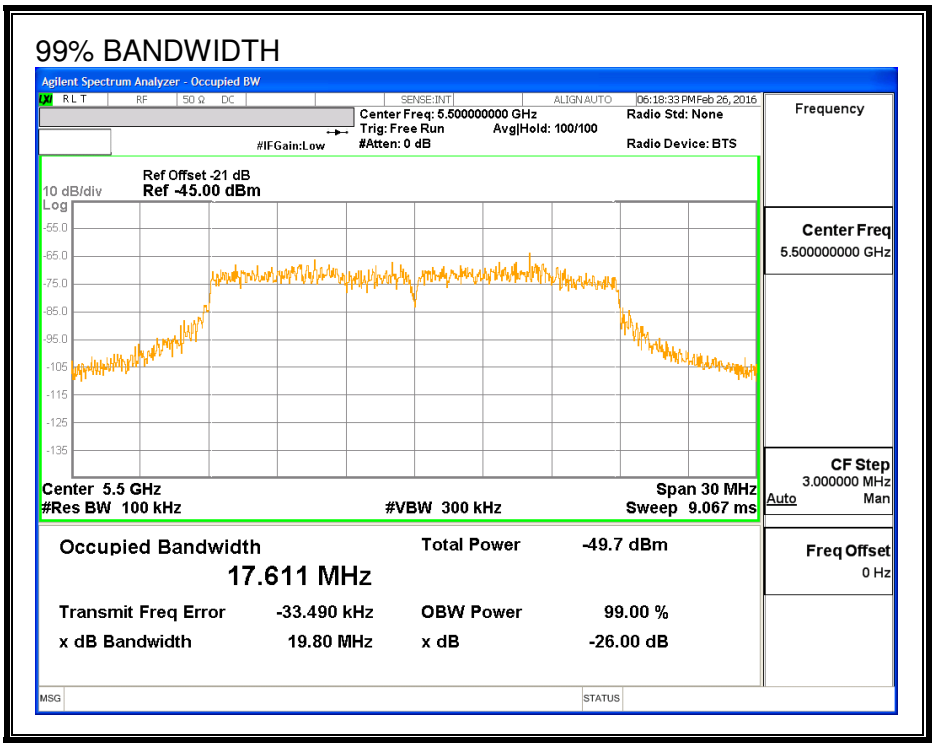
The traffic ceases prior to 10 seconds after the end of the radar waveform.

MOVE TIME FOR LONG PULSE RADAR



4.2.6. 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	17.611	113.6	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	

4.2.7. 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	93.33	60	Pass	5490	5510		
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5510		
Aggregate		96.67	80	Pass				
FCC Long Pulse Type 5	30	96.67	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	598	89	A	5500	Yes
1003	1	578	92	A	5500	Yes
1004	1	858	62	A	5500	Yes
1005	1	658	81	A	5500	Yes
1006	1	938	57	A	5500	Yes
1007	1	758	70	A	5500	Yes
1008	1	638	83	A	5500	Yes
1009	1	918	58	A	5500	Yes
1010	1	618	86	A	5500	Yes
1011	1	718	74	A	5500	Yes
1012	1	538	99	A	5500	Yes
1013	1	518	102	A	5500	Yes
1014	1	878	61	A	5500	Yes
1015	1	838	63	A	5500	Yes
1016	1	1458	37	B	5500	Yes
1017	1	1479	36	B	5500	Yes
1018	1	629	84	B	5500	Yes
1019	1	2132	25	B	5500	Yes
1020	1	2765	20	B	5500	Yes
1021	1	1850	29	B	5500	Yes
1022	1	2612	21	B	5500	Yes
1023	1	1826	29	B	5500	Yes
1024	1	1523	35	B	5500	Yes
1025	1	2221	24	B	5500	Yes
1026	1	694	77	B	5500	Yes
1027	1	2874	19	B	5500	Yes
1028	1	2830	19	B	5500	Yes
1029	1	2591	21	B	5500	Yes
1030	1	2677	20	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	1	180	27	5500	Yes
2002	3.3	223	29	5500	Yes
2003	4.2	216	28	5500	Yes
2004	2.6	226	27	5500	Yes
2005	1.7	223	23	5500	Yes
2006	2.5	156	29	5500	Yes
2007	3.8	201	29	5500	Yes
2008	2.9	218	25	5500	Yes
2009	2.4	229	29	5500	Yes
2010	3.6	169	26	5500	Yes
2011	1.5	185	23	5500	Yes
2012	1	172	24	5500	Yes
2013	3.1	192	25	5500	Yes
2014	2.8	183	23	5500	Yes
2015	1.1	169	28	5500	Yes
2016	3.2	165	26	5500	Yes
2017	3.9	154	25	5500	Yes
2018	2	197	26	5500	Yes
2019	2.9	153	29	5500	Yes
2020	1.3	200	25	5500	Yes
2021	4.6	160	28	5500	Yes
2022	1.2	211	27	5500	Yes
2023	4.7	175	24	5500	Yes
2024	1.6	192	23	5500	Yes
2025	1.2	203	27	5500	Yes
2026	4.5	225	24	5500	Yes
2027	4.3	159	25	5500	Yes
2028	3.8	228	29	5500	Yes
2029	1.9	166	23	5500	Yes
2030	1.5	158	28	5500	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
3001	6.2	481	17	5500	Yes
3002	6.1	468	16	5500	Yes
3003	6.9	435	16	5500	Yes
3004	9.8	317	18	5500	Yes
3005	5.8	431	18	5500	Yes
3006	6.5	326	18	5500	Yes
3007	7.8	453	17	5500	Yes
3008	8.8	360	16	5500	Yes
3009	8	500	18	5500	Yes
3010	9.2	436	18	5500	Yes
3011	8.7	337	17	5500	Yes
3012	7.8	403	18	5500	Yes
3013	7.5	451	16	5500	Yes
3014	6.9	412	17	5500	Yes
3015	9.6	472	18	5500	Yes
3016	9.2	446	17	5500	Yes
3017	9.7	401	16	5500	Yes
3018	9.6	271	17	5500	Yes
3019	5.3	489	18	5500	Yes
3020	8.2	489	17	5500	Yes
3021	9.3	352	17	5500	Yes
3022	10	498	17	5500	Yes
3023	6.2	373	16	5500	Yes
3024	7.2	281	16	5500	Yes
3025	6.4	303	17	5500	Yes
3026	7.6	356	17	5500	No
3027	7.1	258	16	5500	Yes
3028	6.2	457	17	5500	Yes
3029	5.9	371	18	5500	Yes
3030	5.2	333	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	15.9	393	14	5500	Yes
4002	10.4	500	12	5500	Yes
4003	16.2	322	16	5500	Yes
4004	11.2	442	12	5500	No
4005	17.6	410	16	5500	Yes
4006	13.1	292	12	5500	Yes
4007	15.3	273	12	5500	Yes
4008	16.7	418	16	5500	Yes
4009	19.3	294	16	5500	Yes
4010	11.1	335	15	5500	Yes
4011	19.7	474	13	5500	Yes
4012	12	277	12	5500	Yes
4013	11	429	13	5500	Yes
4014	19.3	378	13	5500	Yes
4015	18.7	292	13	5500	Yes
4016	17.4	253	16	5500	Yes
4017	12.7	446	12	5500	Yes
4018	17.3	421	13	5500	Yes
4019	13	493	14	5500	Yes
4020	18.1	363	15	5500	Yes
4021	14.4	331	14	5500	Yes
4022	20	464	16	5500	Yes
4023	17.4	444	15	5500	Yes
4024	13.5	339	14	5500	Yes
4025	16.1	466	14	5500	Yes
4026	18	255	13	5500	Yes
4027	16.5	395	16	5500	Yes
4028	18.9	449	16	5500	Yes
4029	17.9	350	16	5500	Yes
4030	16.1	298	16	5500	No

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5498	Yes
2	5500	Yes
3	5499	Yes
4	5502	Yes
5	5499	Yes
6	5504	Yes
7	5494	Yes
8	5493	No
9	5505	Yes
10	5506	Yes
11	5498	Yes
12	5503	Yes
13	5505	Yes
14	5497	Yes
15	5503	Yes
16	5496	Yes
17	5499	Yes
18	5505	Yes
19	5498	Yes
20	5499	Yes
21	5500	Yes
22	5502	Yes
23	5506	Yes
24	5497	Yes
25	5498	Yes
26	5504	Yes
27	5499	Yes
28	5505	Yes
29	5494	Yes
30	5504	Yes

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

TYPE 6 DETECTION PROBABILITY

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

Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	324	5490	3	Yes
2	799	5491	2	Yes
3	1274	5492	6	Yes
4	1749	5493	7	Yes
5	2224	5494	6	Yes
6	2699	5495	2	Yes
7	3174	5496	3	Yes
8	3649	5497	4	Yes
9	4124	5498	4	Yes
10	4599	5499	3	Yes
11	5074	5500	3	Yes
12	5549	5501	2	Yes
13	6024	5502	4	Yes
14	6499	5503	5	Yes
15	6974	5504	4	Yes
16	7449	5505	4	Yes
17	7924	5506	1	Yes
18	8399	5507	3	Yes
19	8874	5508	6	Yes
20	9349	5509	4	Yes
21	9824	5510	3	Yes
22	10299	5490	5	Yes
23	10774	5491	5	Yes
24	11249	5492	5	Yes
25	11724	5493	4	Yes
26	12199	5494	4	Yes
27	12674	5495	4	Yes
28	13149	5496	3	Yes
29	13624	5497	3	Yes
30	14099	5498	4	Yes
31	14574	5499	4	Yes
32	15049	5500	6	Yes
33	15524	5501	4	Yes
34	15999	5502	4	Yes
35	16474	5503	6	Yes
36	16949	5504	3	Yes
37	17424	5505	4	Yes
38	17899	5506	1	Yes
39	18374	5507	2	Yes
40	18849	5508	6	Yes
41	19324	5509	3	Yes
42	19799	5510	5	Yes

4.3. RESULTS FOR 40 MHz BANDWIDTH

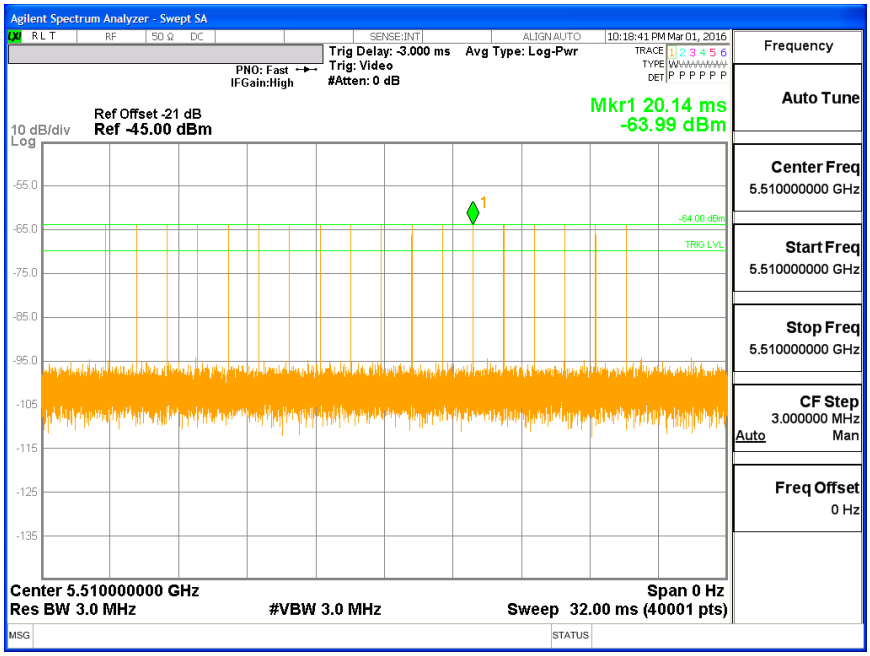
4.3.1. TEST CHANNEL

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

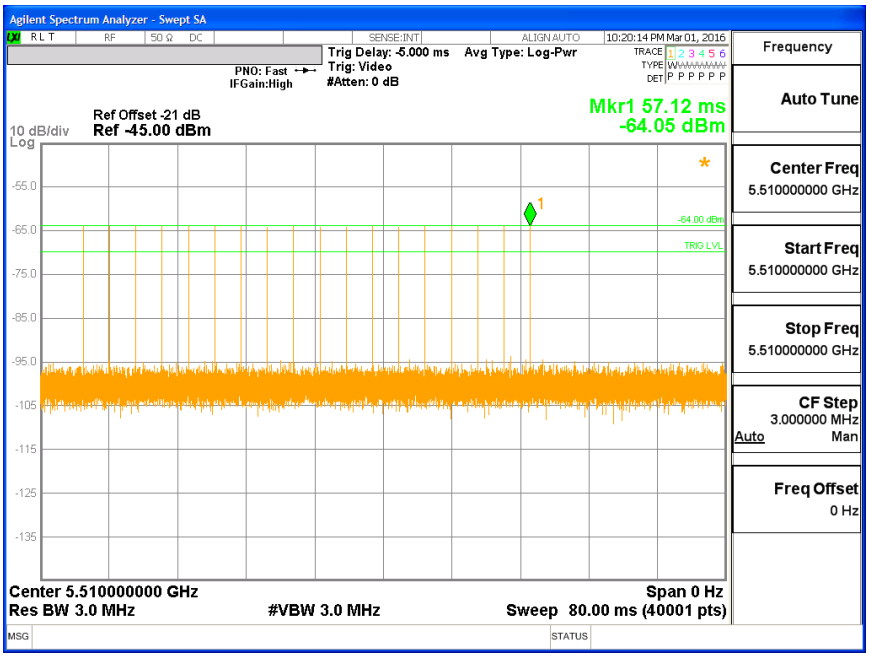
4.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

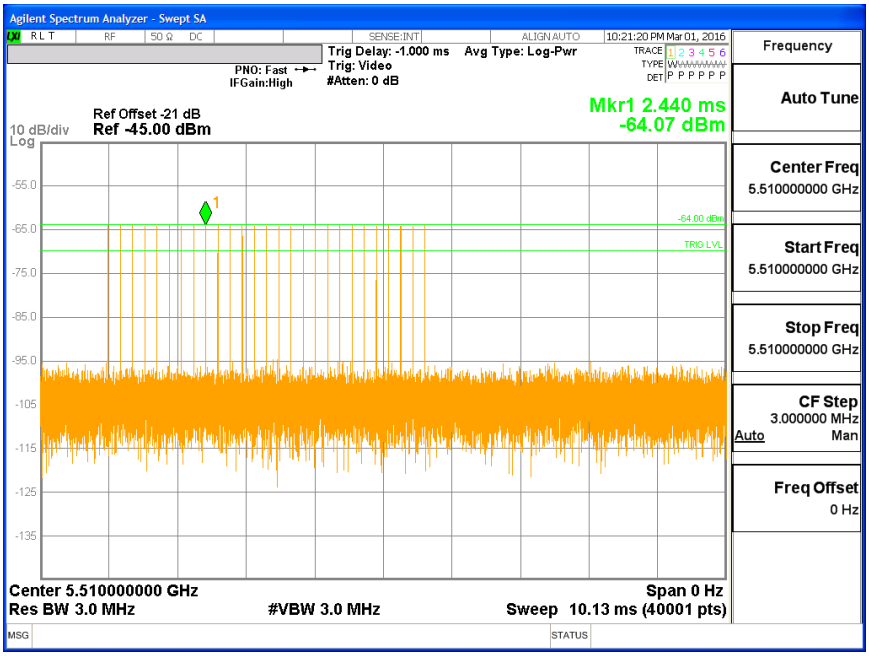
SHORT PULSE RADAR TYPE 0



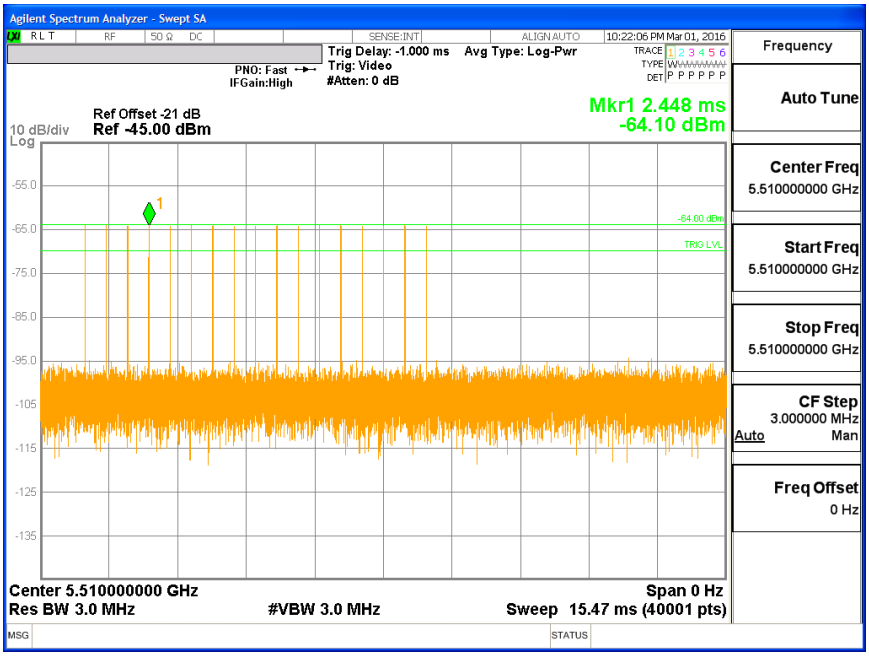
SAMPLE OF RADAR TYPE 1



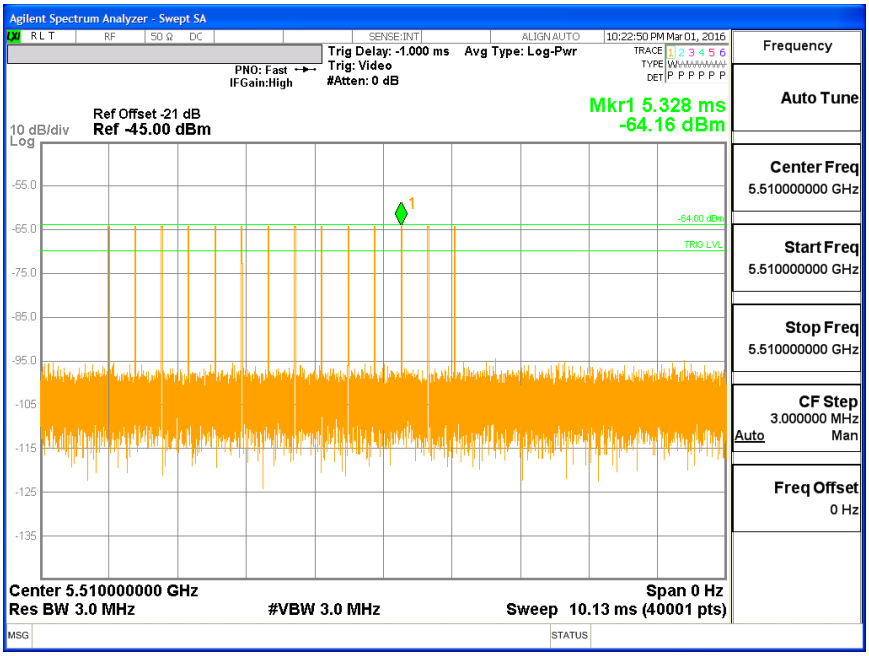
SAMPLE OF RADAR TYPE 2



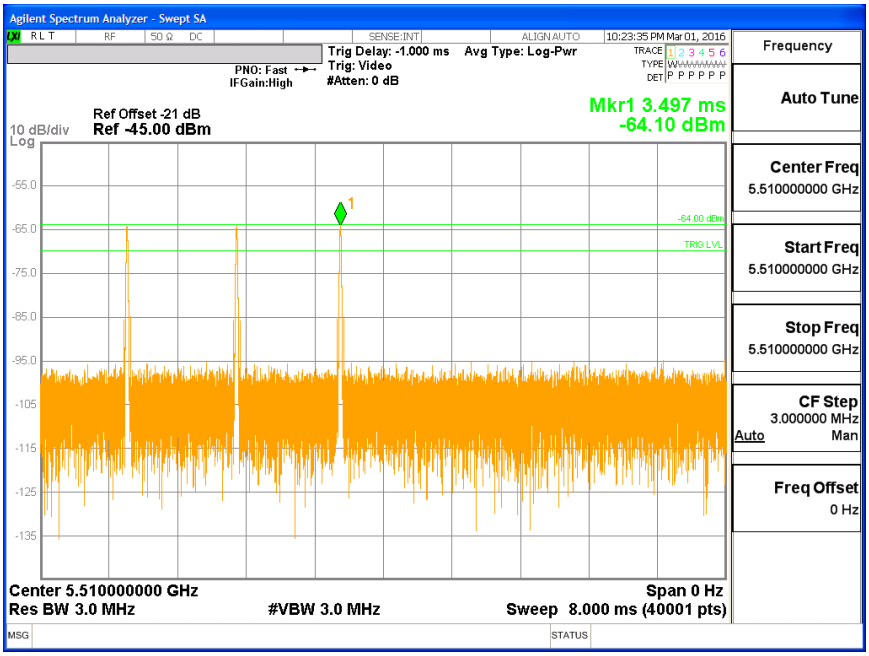
SAMPLE OF RADAR TYPE 3



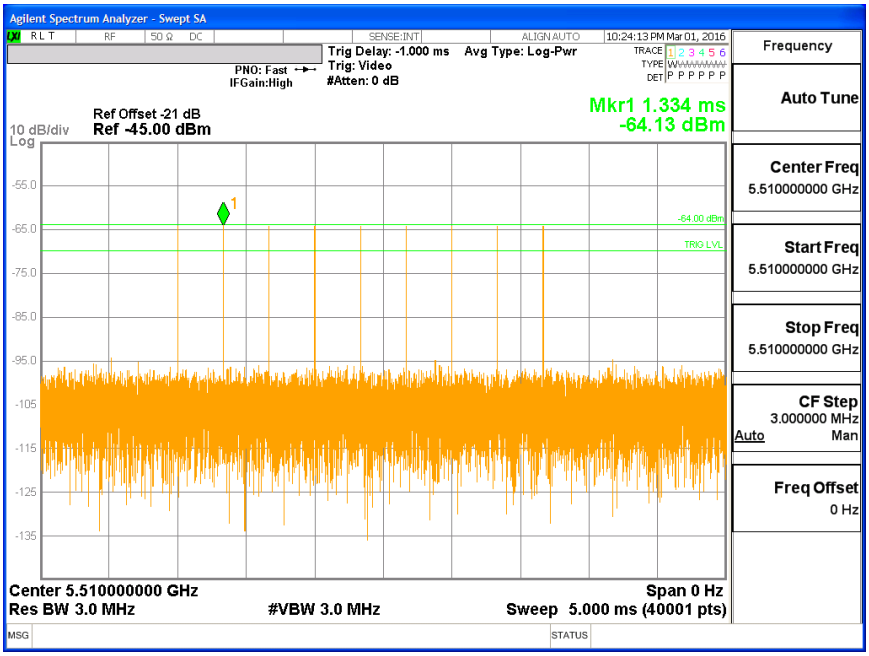
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

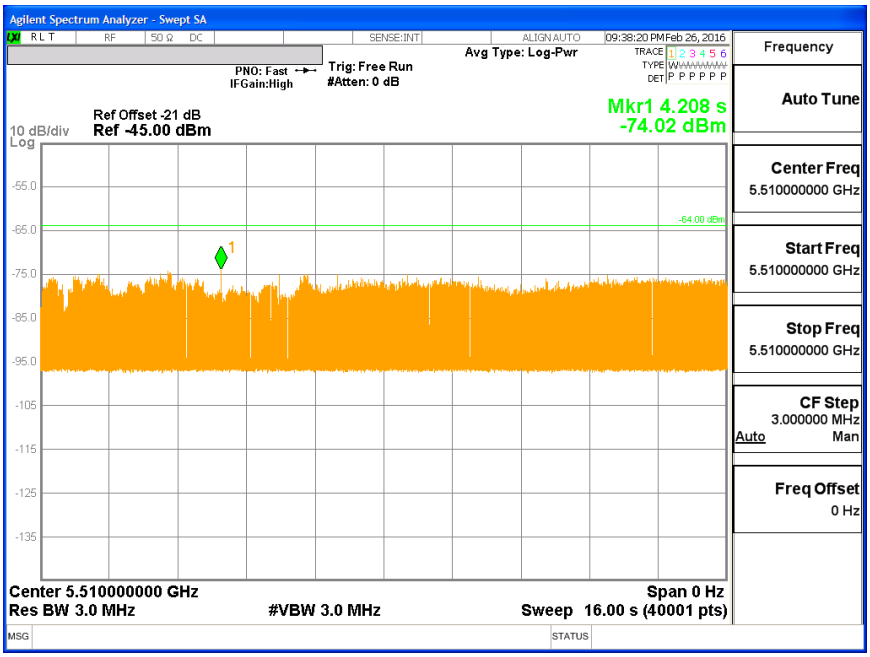


SINGLE BURST OF RADAR TYPE 6

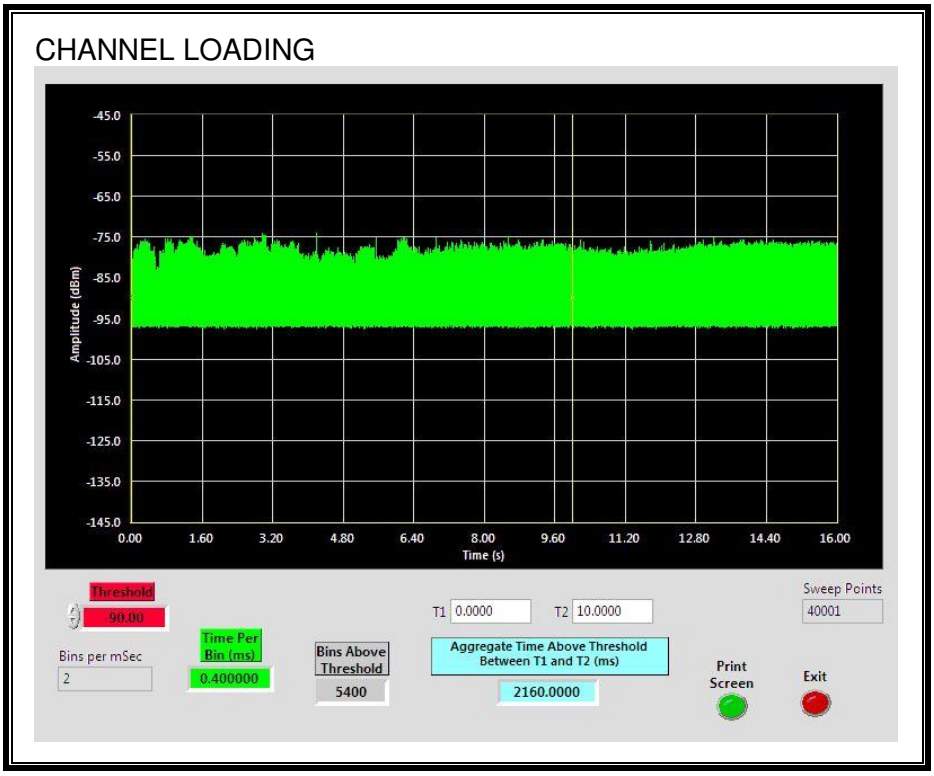


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 21.6%

4.3.3. 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)
29.98	185.9	155.9	95.9

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)
30.44	127.3	96.9	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)
30.12	184.4	154.3	58.4

QUALITATIVE RESULTS

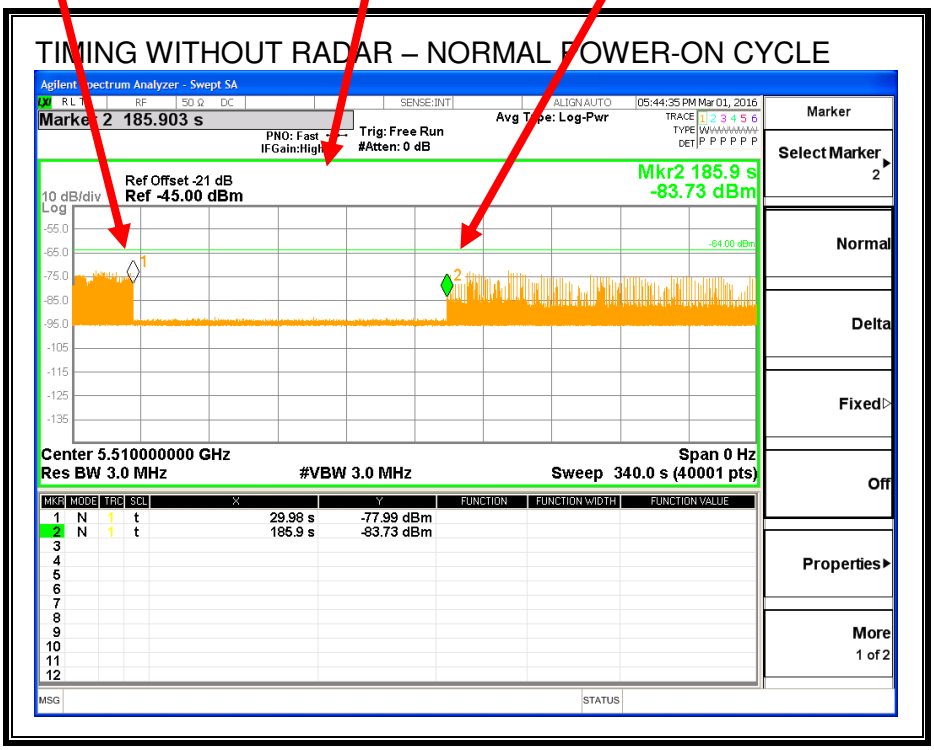
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



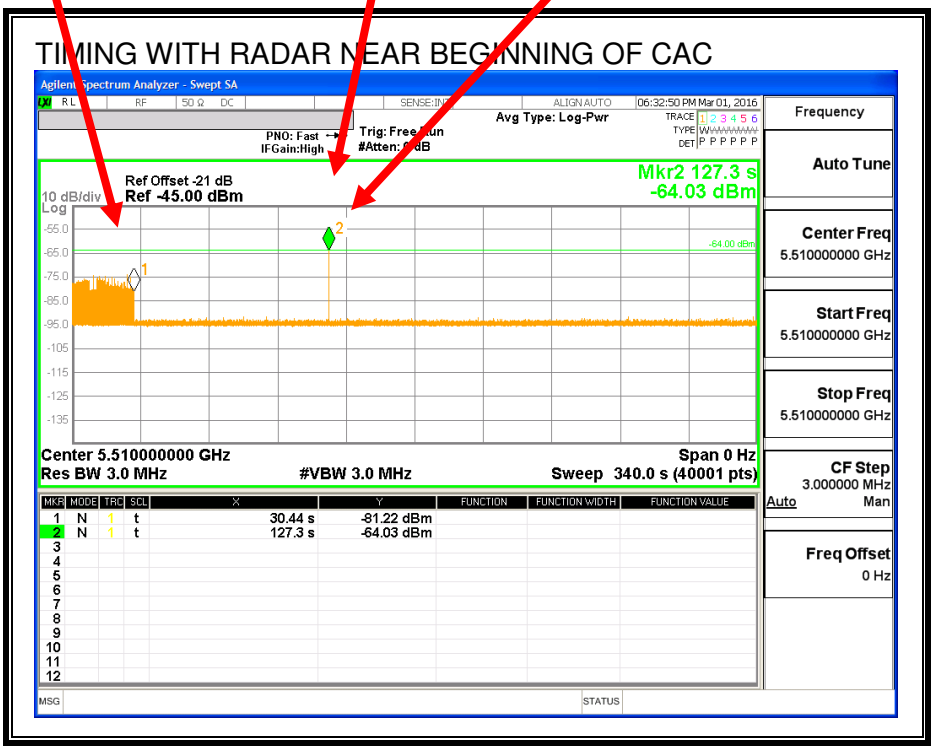
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



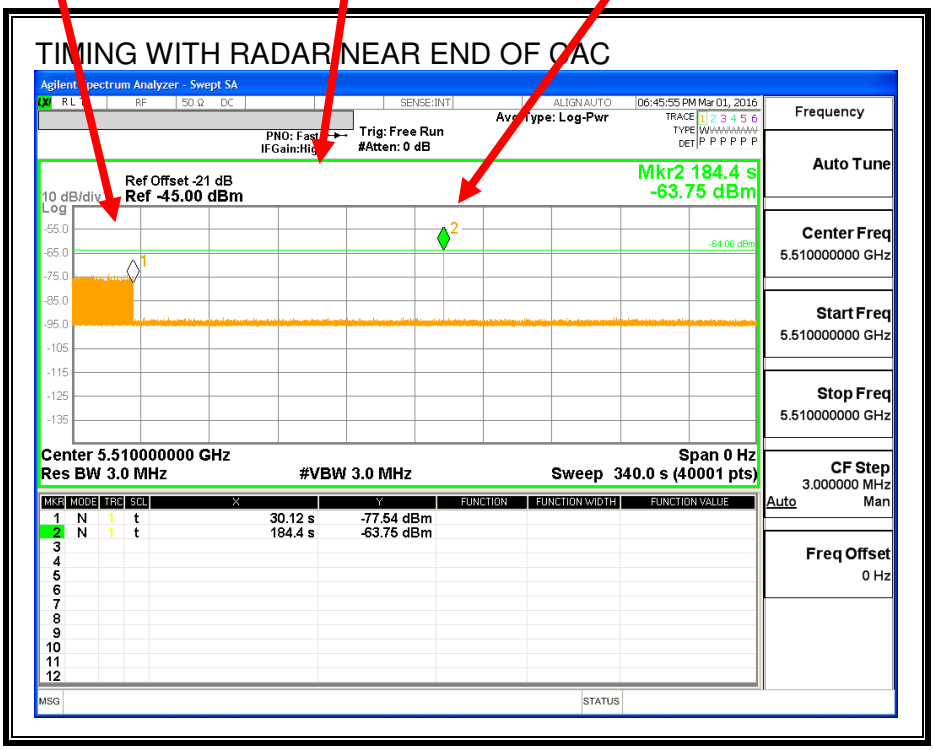
No EUT transmissions were observed after the radar signal.

TIMING WITH RADAR NEAR END OF CAC

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

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

4.3.1. 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.

4.3.2. 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)

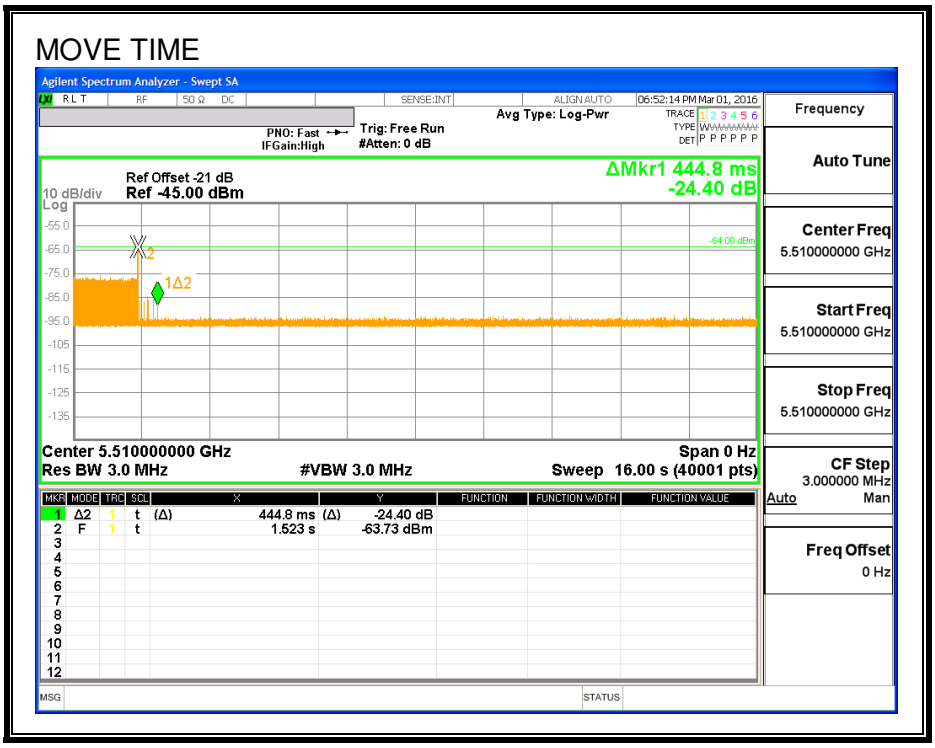
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.445	10

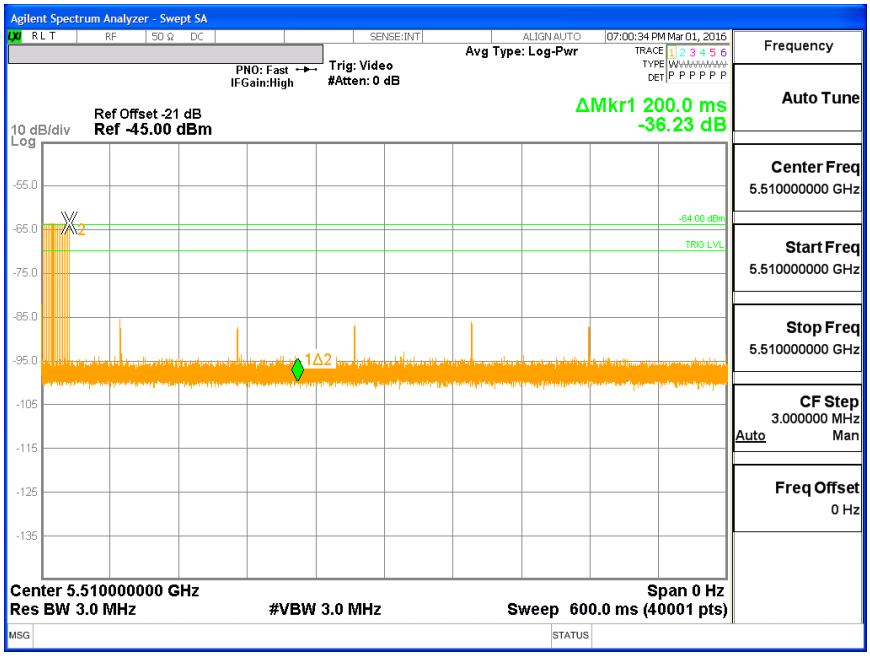
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
4.4	60

MOVE TIME



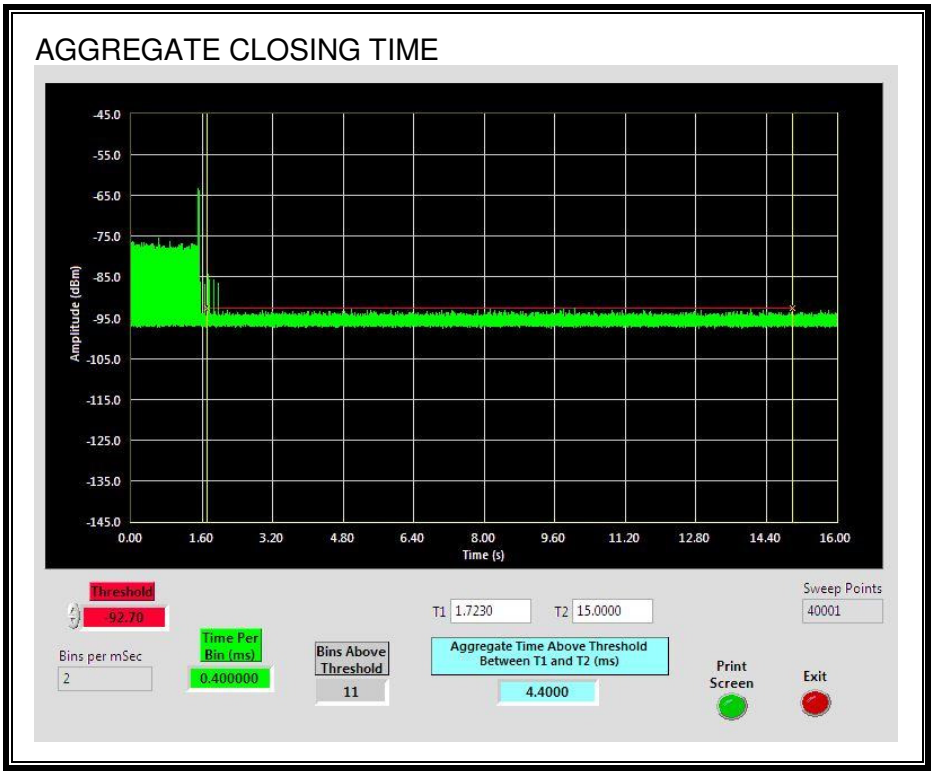
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

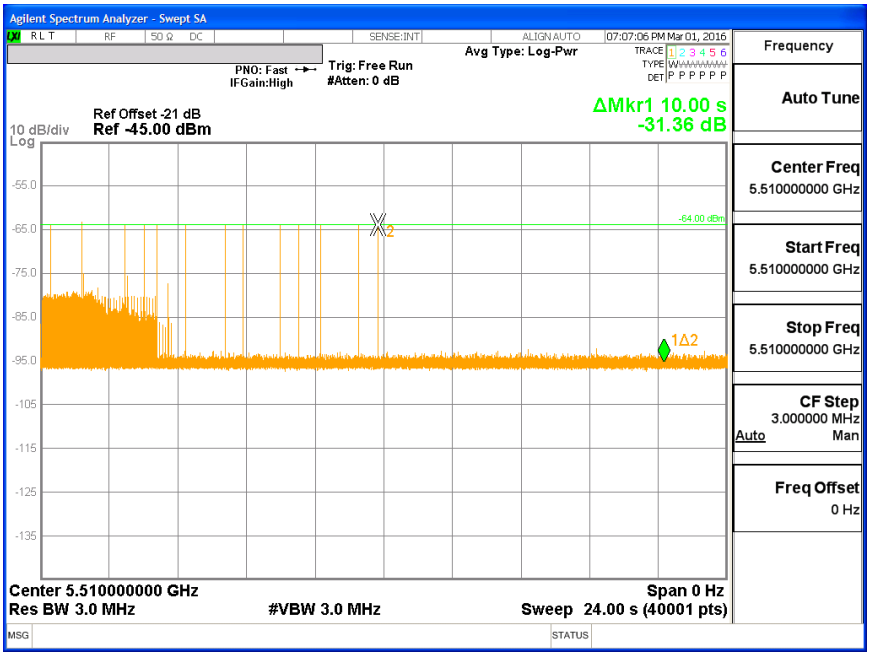
Only intermittent transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR

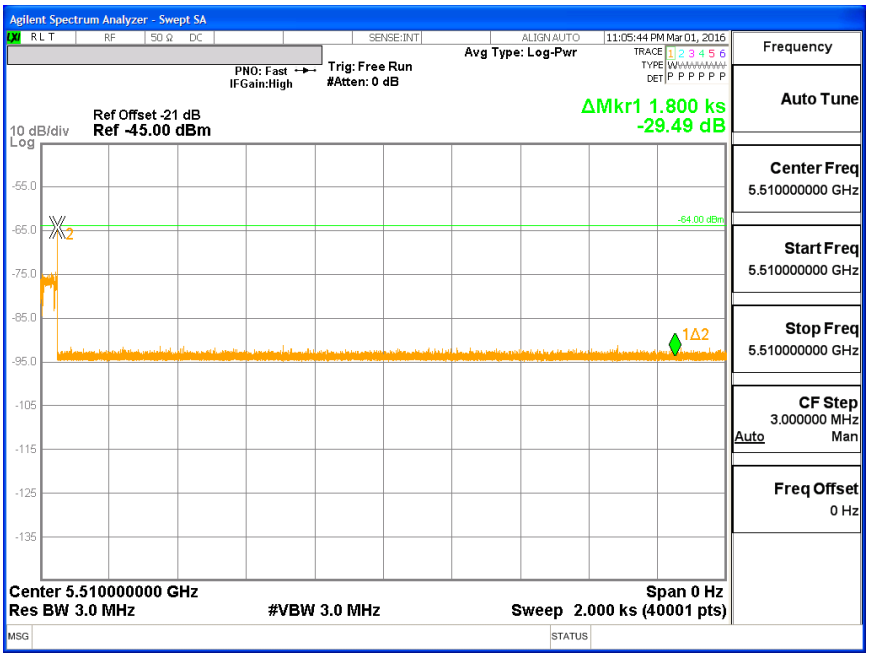


4.3.1. NON-OCCUPANCY PERIOD

RESULTS

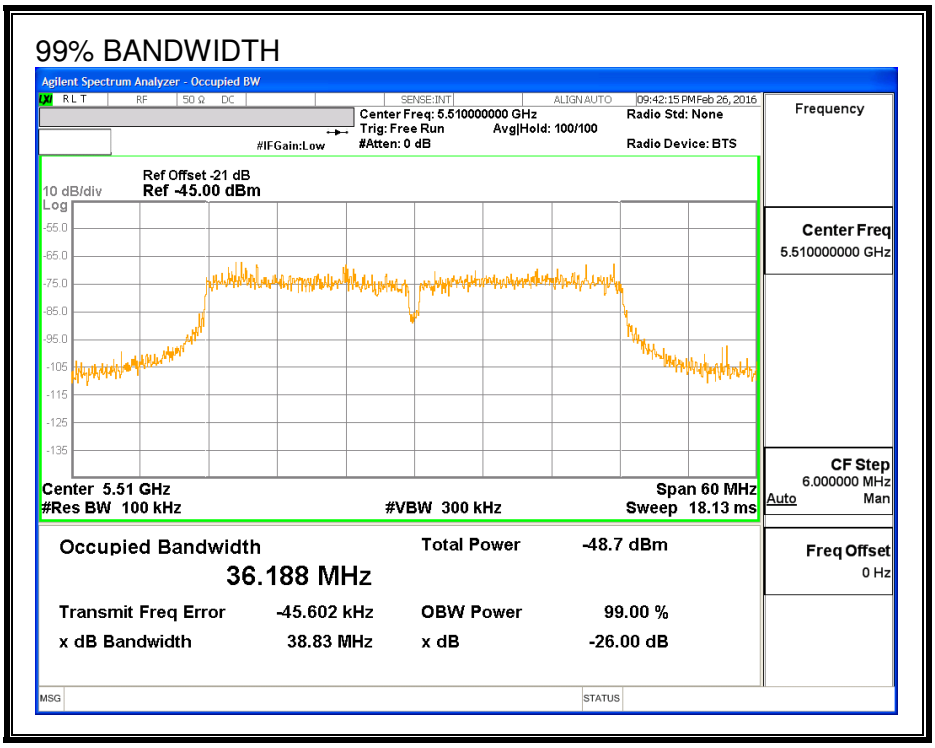
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



4.3.2. 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	36.188	110.5	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	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	FH
5531	10	0	0	

4.3.3. 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	93.33	60	Pass	5490	5530		
FCC Short Pulse Type 3	30	83.33	60	Pass	5490	5530		
FCC Short Pulse Type 4	30	80.00	60	Pass	5490	5530		
Aggregate		89.17	80	Pass				
FCC 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	598	89	A	5510	Yes
1003	1	578	92	A	5510	Yes
1004	1	858	62	A	5510	Yes
1005	1	658	81	A	5510	Yes
1006	1	938	57	A	5510	Yes
1007	1	758	70	A	5510	Yes
1008	1	638	83	A	5510	Yes
1009	1	918	58	A	5510	Yes
1010	1	618	86	A	5510	Yes
1011	1	718	74	A	5510	Yes
1012	1	538	99	A	5510	Yes
1013	1	518	102	A	5510	Yes
1014	1	878	61	A	5510	Yes
1015	1	838	63	A	5510	Yes
1016	1	1458	37	B	5510	Yes
1017	1	1479	36	B	5510	Yes
1018	1	629	84	B	5510	Yes
1019	1	2132	25	B	5510	Yes
1020	1	2765	20	B	5510	Yes
1021	1	1850	29	B	5510	Yes
1022	1	2612	21	B	5510	Yes
1023	1	1826	29	B	5510	Yes
1024	1	1523	35	B	5510	Yes
1025	1	2221	24	B	5510	Yes
1026	1	694	77	B	5510	Yes
1027	1	2874	19	B	5510	Yes
1028	1	2830	19	B	5510	Yes
1029	1	2591	21	B	5510	Yes
1030	1	2677	20	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	1	180	27	5510	Yes
2002	3.3	223	29	5510	Yes
2003	4.2	216	28	5510	Yes
2004	2.6	226	27	5510	Yes
2005	1.7	223	23	5510	Yes
2006	2.5	156	29	5510	Yes
2007	3.8	201	29	5510	Yes
2008	2.9	218	25	5510	Yes
2009	2.4	229	29	5510	Yes
2010	3.6	169	26	5510	Yes
2011	1.5	185	23	5510	Yes
2012	1	172	24	5510	Yes
2013	3.1	192	25	5510	Yes
2014	2.8	183	23	5510	Yes
2015	1.1	169	28	5510	Yes
2016	3.2	165	26	5510	Yes
2017	3.9	154	25	5510	Yes
2018	2	197	26	5510	Yes
2019	2.9	153	29	5510	Yes
2020	1.3	200	25	5510	Yes
2021	4.6	160	28	5510	Yes
2022	1.2	211	27	5510	Yes
2023	4.7	175	24	5510	Yes
2024	1.6	192	23	5510	No
2025	1.2	203	27	5510	Yes
2026	4.5	225	24	5510	Yes
2027	4.3	159	25	5510	No
2028	3.8	228	29	5510	Yes
2029	1.9	166	23	5510	Yes
2030	1.5	158	28	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	6.2	481	17	5510	Yes
3002	6.1	468	16	5510	Yes
3003	6.9	435	16	5510	Yes
3004	9.8	317	18	5510	Yes
3005	5.8	431	18	5510	Yes
3006	6.5	326	18	5510	Yes
3007	7.8	453	17	5510	Yes
3008	8.8	360	16	5510	Yes
3009	8	500	18	5510	Yes
3010	9.2	436	18	5510	Yes
3011	8.7	337	17	5510	No
3012	7.8	403	18	5510	Yes
3013	7.5	451	16	5510	Yes
3014	6.9	412	17	5510	Yes
3015	9.6	472	18	5510	Yes
3016	9.2	446	17	5510	Yes
3017	9.7	401	16	5510	Yes
3018	9.6	271	17	5510	Yes
3019	5.3	489	18	5510	No
3020	8.2	489	17	5510	Yes
3021	9.3	352	17	5510	Yes
3022	10	498	17	5510	Yes
3023	6.2	373	16	5510	No
3024	7.2	281	16	5510	Yes
3025	6.4	303	17	5510	Yes
3026	7.6	356	17	5510	No
3027	7.1	258	16	5510	Yes
3028	6.2	457	17	5510	Yes
3029	5.9	371	18	5510	Yes
3030	5.2	333	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	15.9	393	14	5510	No
4002	10.4	500	12	5510	Yes
4003	16.2	322	16	5510	Yes
4004	11.2	442	12	5510	Yes
4005	17.6	410	16	5510	Yes
4006	13.1	292	12	5510	Yes
4007	15.3	273	12	5510	Yes
4008	16.7	418	16	5510	Yes
4009	19.3	294	16	5510	Yes
4010	11.1	335	15	5510	Yes
4011	19.7	474	13	5510	Yes
4012	12	277	12	5510	Yes
4013	11	429	13	5510	Yes
4014	19.3	378	13	5510	No
4015	18.7	292	13	5510	Yes
4016	17.4	253	16	5510	Yes
4017	12.7	446	12	5510	No
4018	17.3	421	13	5510	Yes
4019	13	493	14	5510	No
4020	18.1	363	15	5510	No
4021	14.4	331	14	5510	Yes
4022	20	464	16	5510	Yes
4023	17.4	444	15	5510	Yes
4024	13.5	339	14	5510	Yes
4025	16.1	466	14	5510	Yes
4026	18	255	13	5510	Yes
4027	16.5	395	16	5510	Yes
4028	18.9	449	16	5510	Yes
4029	17.9	350	16	5510	No
4030	16.1	298	16	5510	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5498	Yes
2	5508	Yes
3	5505	Yes
4	5504	Yes
5	5501	Yes
6	5511	Yes
7	5513	Yes
8	5517	Yes
9	5520	Yes
10	5499	Yes
11	5500	Yes
12	5521	Yes
13	5497	Yes
14	5525	Yes
15	5510	Yes
16	5504	Yes
17	5516	Yes
18	5507	Yes
19	5518	Yes
20	5508	Yes
21	5511	Yes
22	5522	Yes
23	5525	Yes
24	5517	Yes
25	5521	Yes
26	5497	Yes
27	5503	Yes
28	5520	Yes
29	5499	Yes
30	5510	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	307	5490	9	Yes
2	782	5491	5	Yes
3	1257	5492	12	Yes
4	1732	5493	7	Yes
5	2207	5494	7	Yes
6	2682	5495	7	Yes
7	3157	5496	9	Yes
8	3632	5497	8	Yes
9	4107	5498	8	Yes
10	4582	5499	2	Yes
11	5057	5500	4	Yes
12	5532	5501	9	Yes
13	6007	5502	7	Yes
14	6482	5503	6	Yes
15	6957	5504	11	Yes
16	7432	5505	8	Yes
17	7907	5506	7	Yes
18	8382	5507	7	Yes
19	8857	5508	12	Yes
20	9332	5509	11	Yes
21	9807	5510	8	Yes
22	10282	5511	8	Yes
23	10757	5512	8	Yes
24	11232	5513	11	Yes
25	11707	5514	5	Yes
26	12182	5515	9	Yes
27	12657	5516	11	Yes
28	13132	5517	7	Yes
29	13607	5518	7	Yes
30	14082	5519	10	Yes
31	14557	5520	7	Yes
32	15032	5521	10	Yes
33	15507	5522	9	Yes
34	15982	5523	8	Yes
35	16457	5524	11	Yes
36	16932	5525	5	Yes
37	17407	5526	8	Yes
38	17882	5527	8	Yes
39	18357	5528	7	Yes
40	18832	5529	7	Yes
41	19307	5530	10	Yes

4.4. RESULTS FOR 80 MHz BANDWIDTH

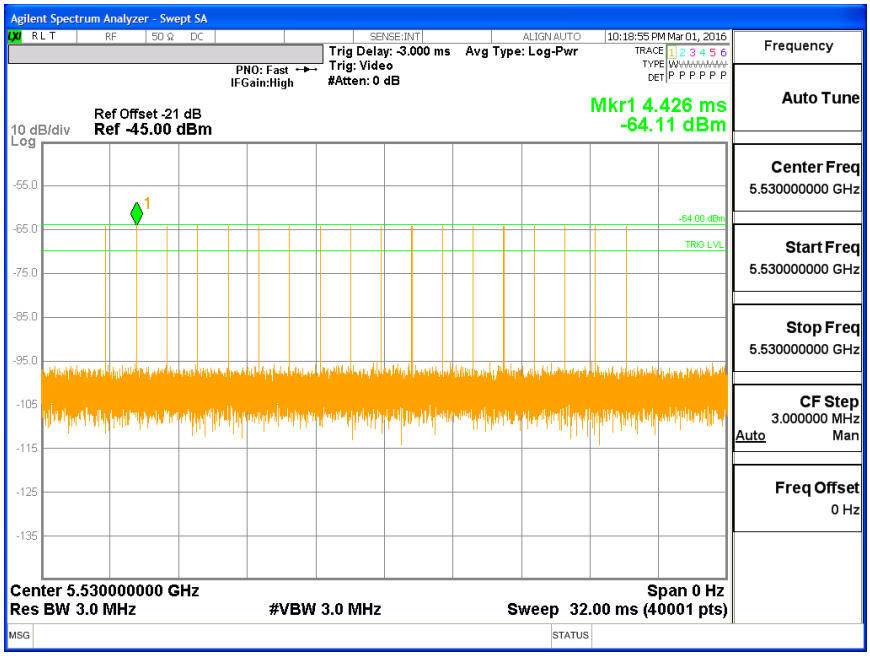
4.4.1. TEST CHANNEL

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

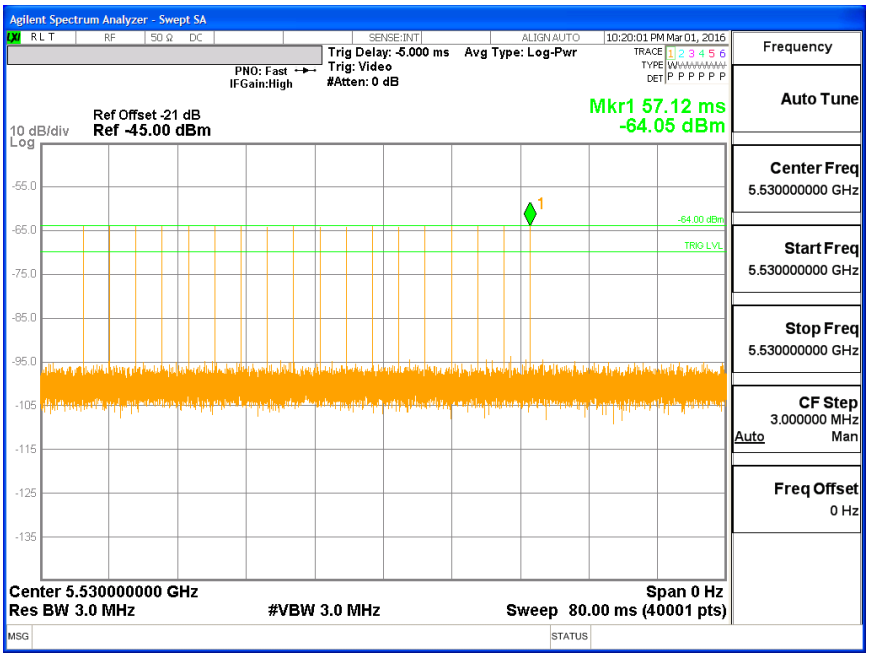
4.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

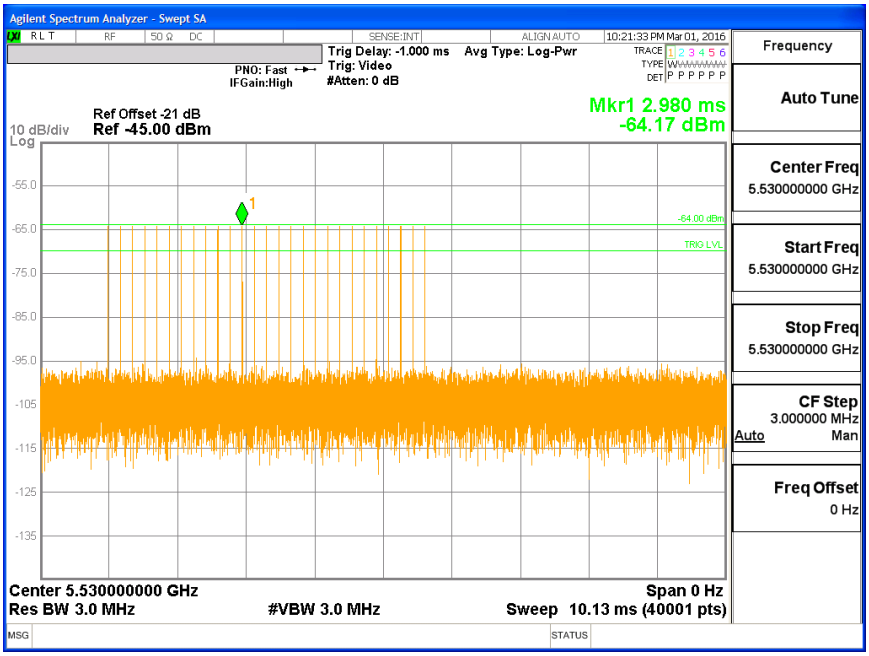
SHORT PULSE RADAR TYPE 0



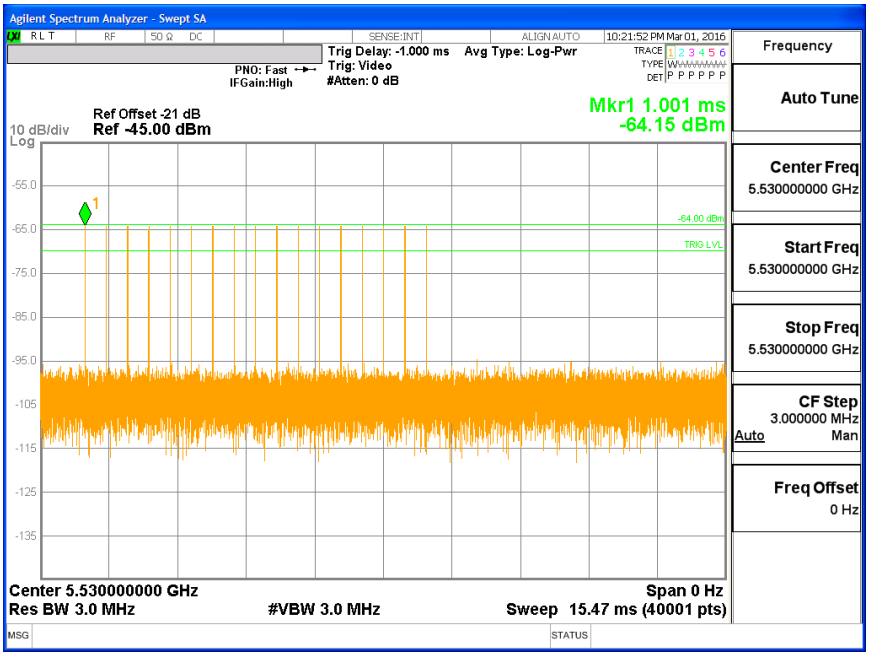
SAMPLE OF RADAR TYPE 1



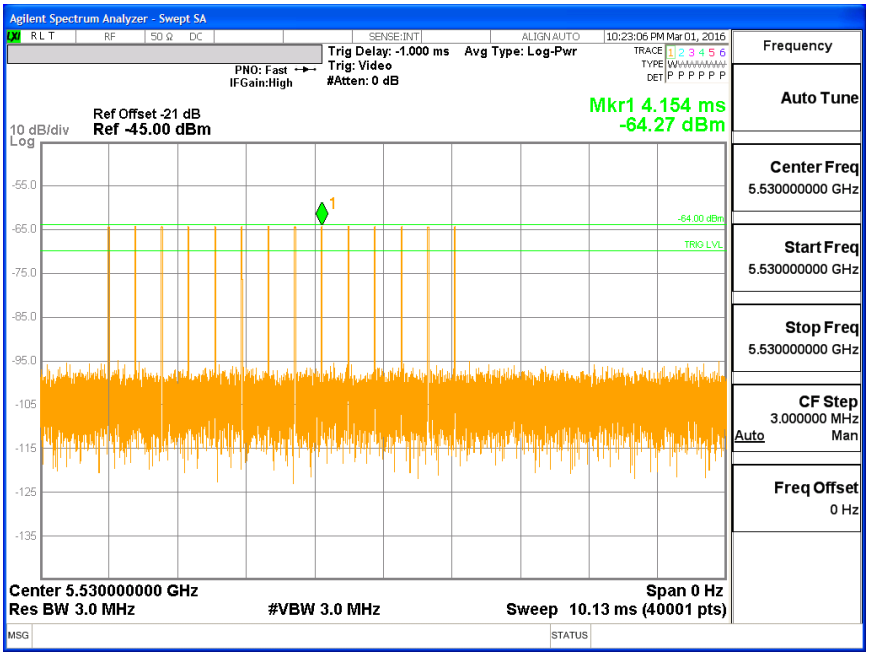
SAMPLE OF RADAR TYPE 2



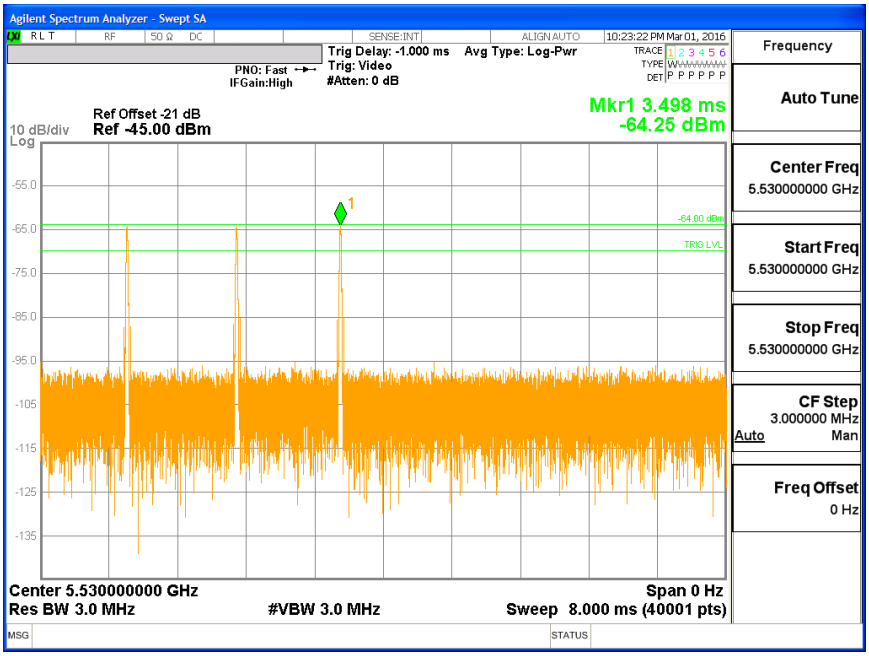
SAMPLE OF RADAR TYPE 3



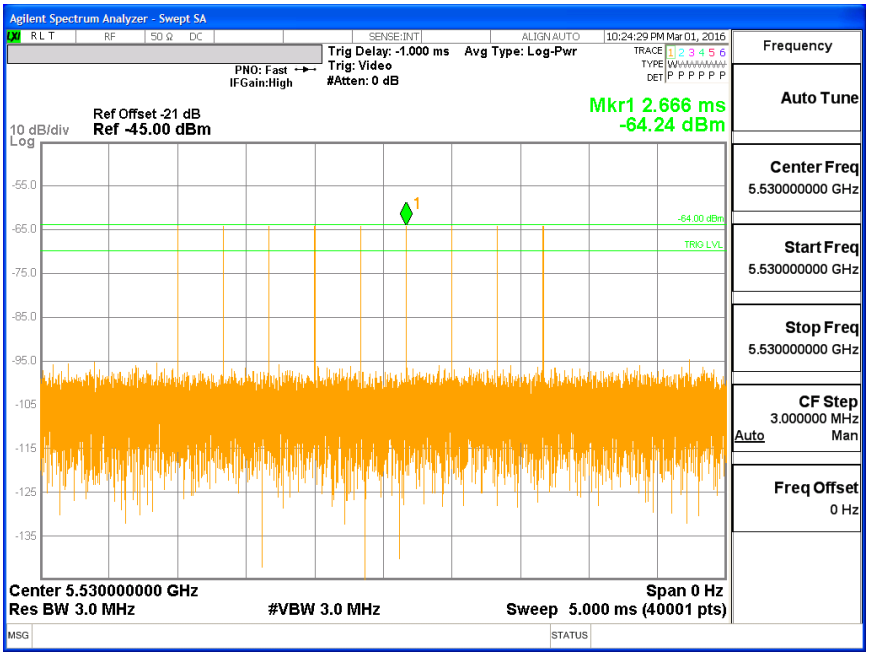
SAMPLE OF RADAR TYPE 4



SAMPLE OF SINGLE BURST OF RADAR TYPE 5

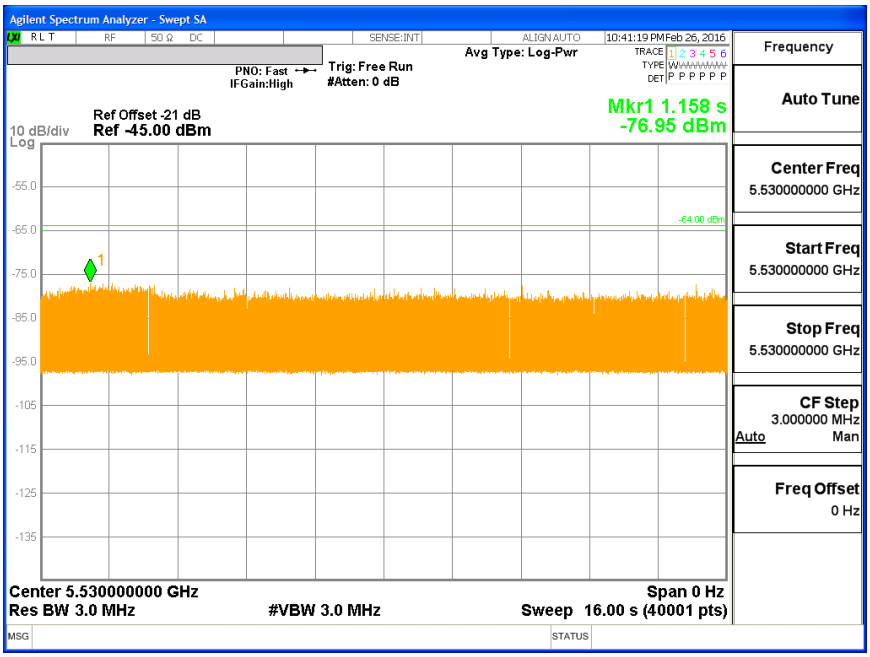


SINGLE BURST OF RADAR TYPE 6

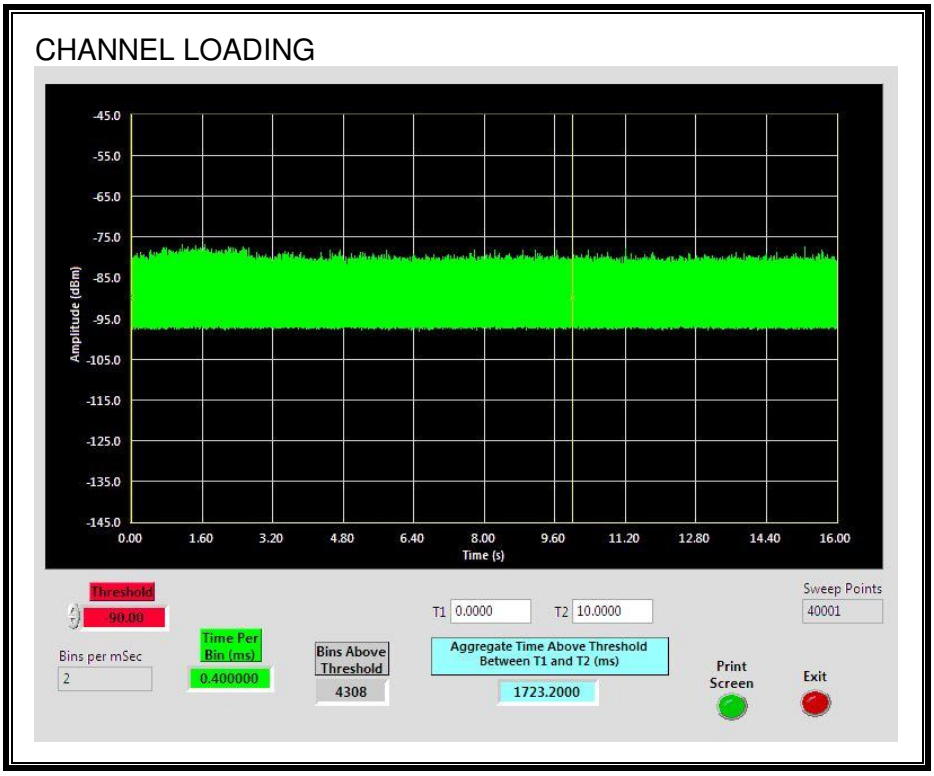


TRAFFIC

TRAFFIC



CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.232%

4.4.1. 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)
30.31	186.7	156.4	96.4

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.25	127.3	97.1	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)
30.22	185.1	154.9	58.5

QUALITATIVE RESULTS

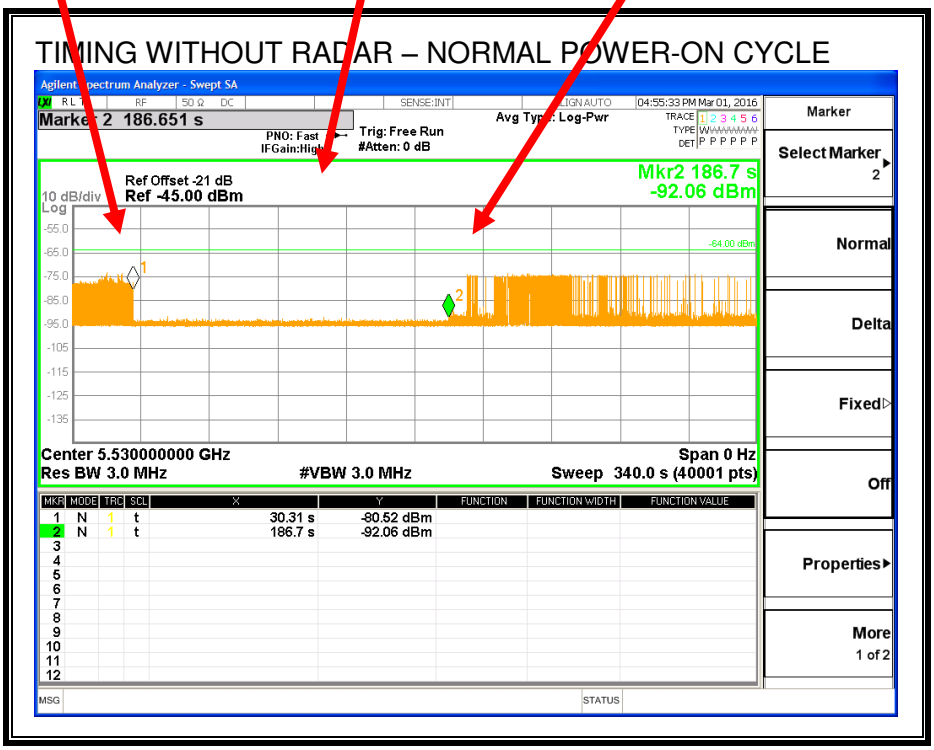
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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



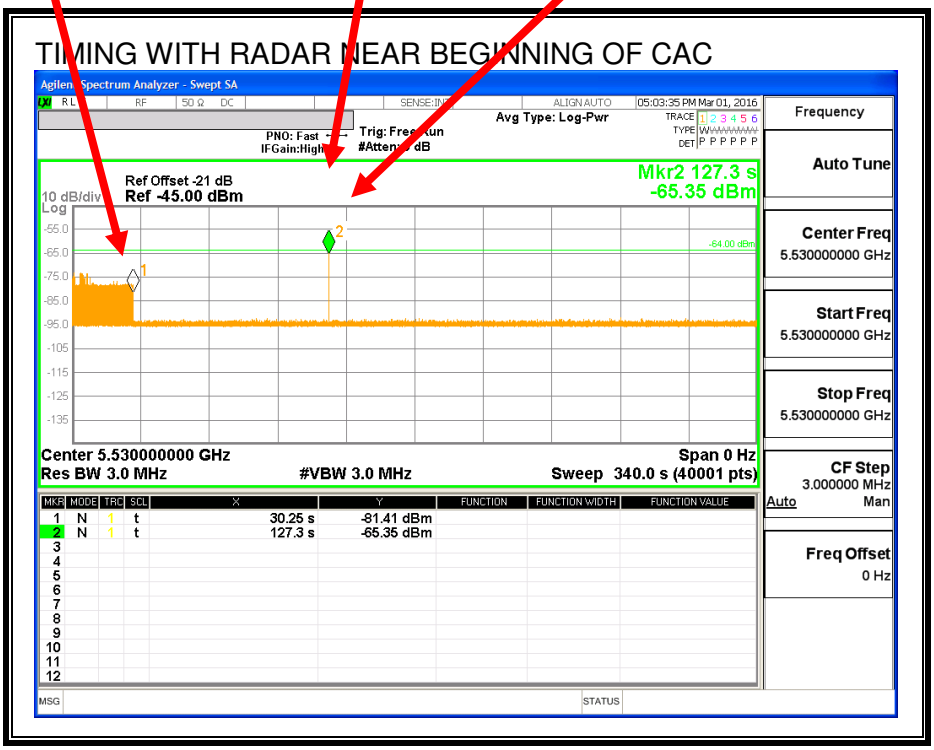
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

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



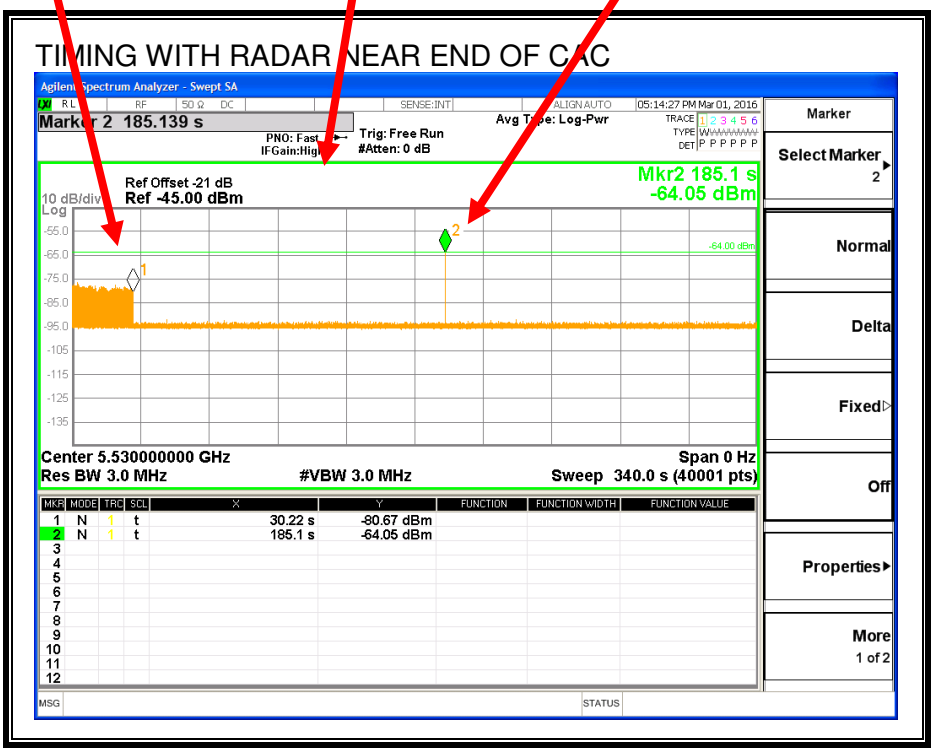
No EUT transmissions were observed after the radar signal.

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.

4.4.2. 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.

4.4.3. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

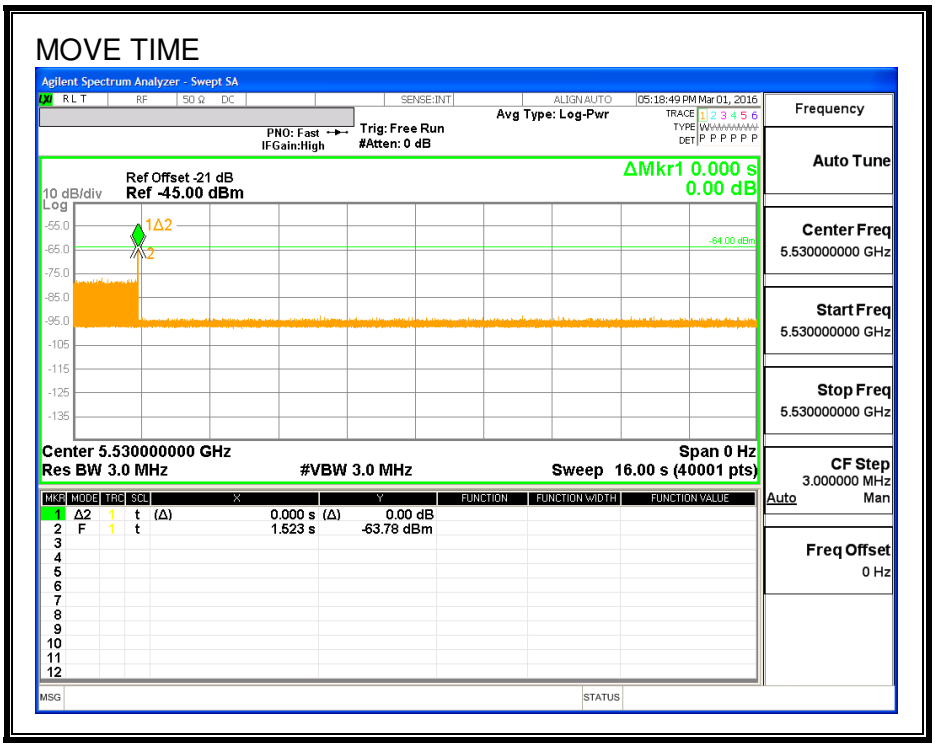
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

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

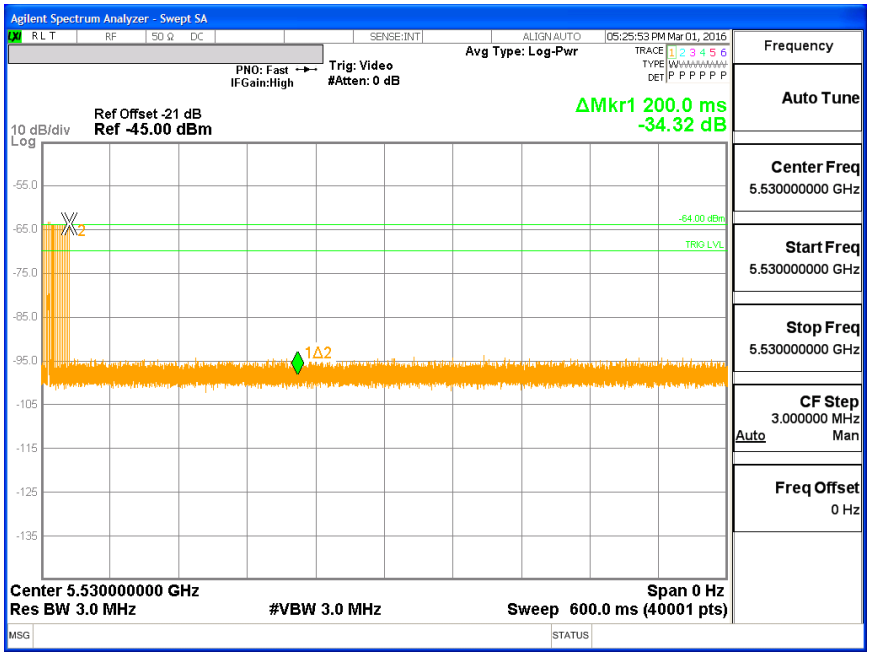
Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60

MOVE TIME



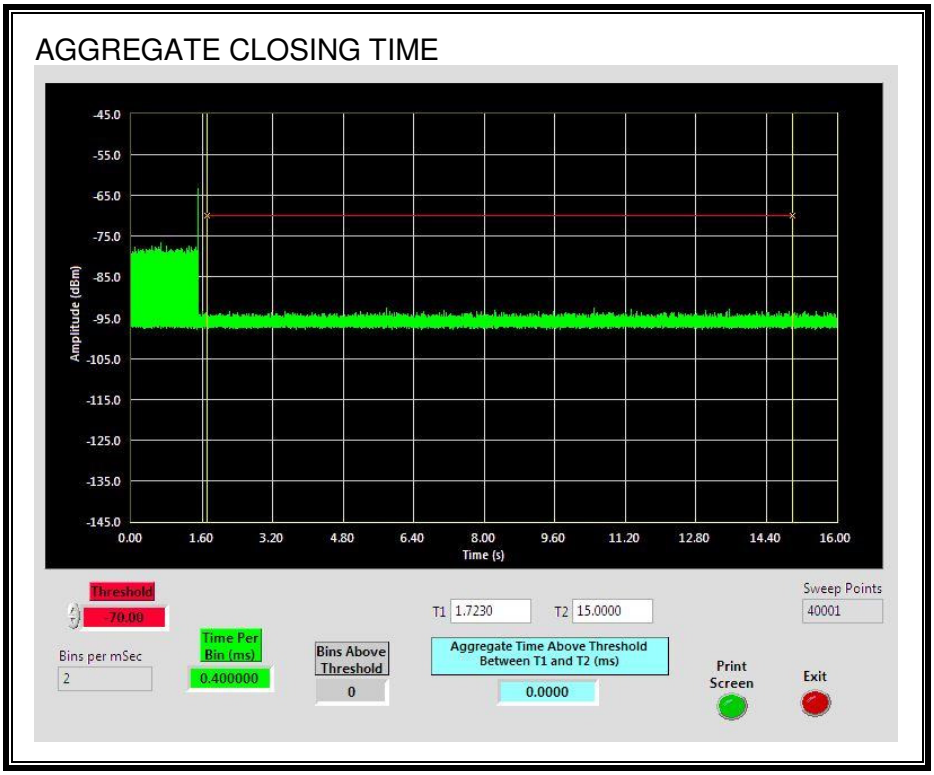
CHANNEL CLOSING TIME

CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

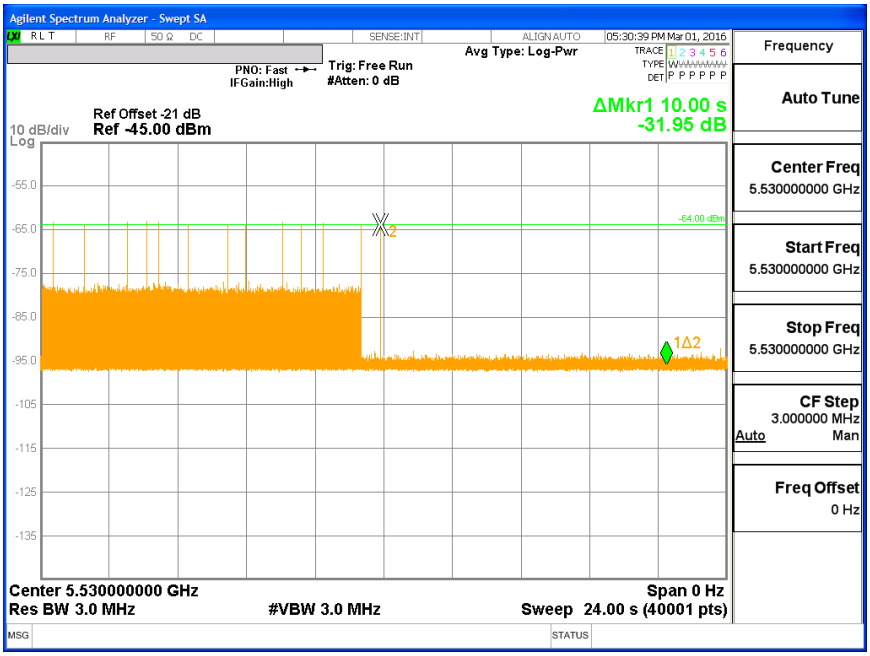
No transmissions are observed during the aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR

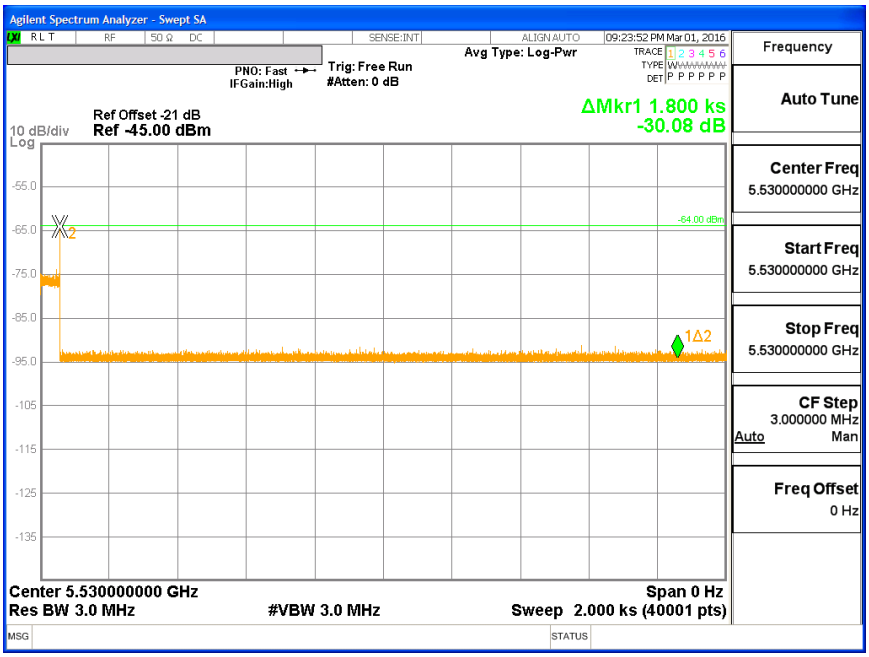


4.4.1. NON-OCCUPANCY PERIOD

RESULTS

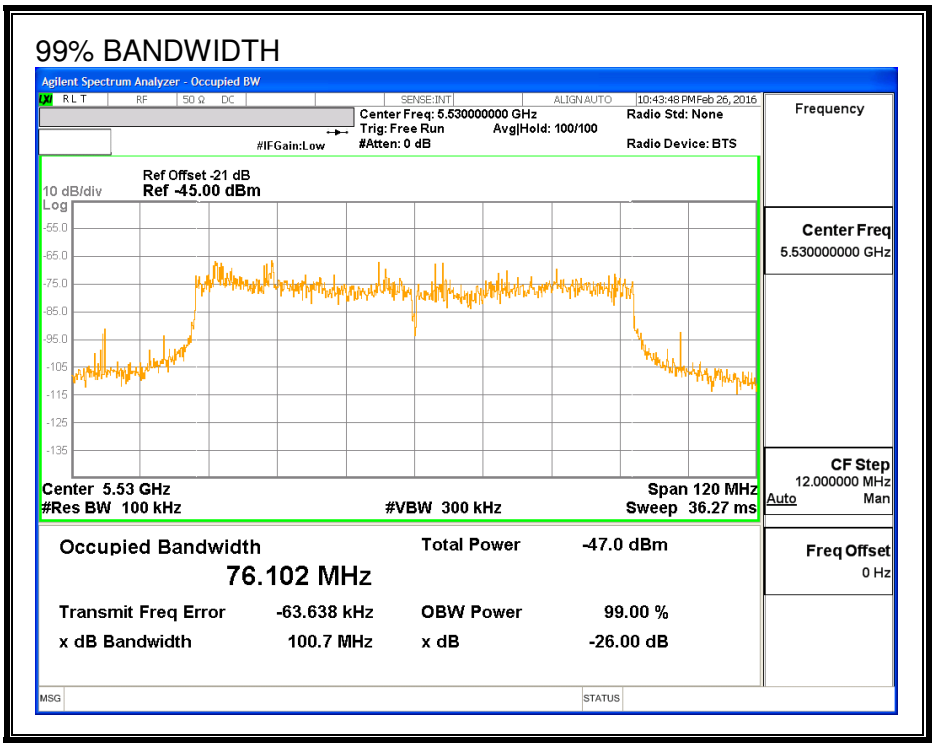
No EUT transmissions were observed on the test channel during the 30-minute observation time.

NON-OCCUPANCY PERIOD



4.4.2. 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	76.102	105.1	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	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	

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	90.00	60	Pass	5490	5570		
FCC Short Pulse Type 3	30	83.33	60	Pass	5490	5570		
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5570		
Aggregate		90.00	80	Pass				
FCC Long Pulse Type 5	30	96.67	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	598	89	A	5530	Yes
1003	1	578	92	A	5530	Yes
1004	1	858	62	A	5530	Yes
1005	1	658	81	A	5530	Yes
1006	1	938	57	A	5530	Yes
1007	1	758	70	A	5530	Yes
1008	1	638	83	A	5530	Yes
1009	1	918	58	A	5530	Yes
1010	1	618	86	A	5530	Yes
1011	1	718	74	A	5530	Yes
1012	1	538	99	A	5530	Yes
1013	1	518	102	A	5530	Yes
1014	1	878	61	A	5530	Yes
1015	1	838	63	A	5530	Yes
1016	1	1458	37	B	5530	Yes
1017	1	1479	36	B	5530	Yes
1018	1	629	84	B	5530	Yes
1019	1	2132	25	B	5530	Yes
1020	1	2765	20	B	5530	Yes
1021	1	1850	29	B	5530	Yes
1022	1	2612	21	B	5530	Yes
1023	1	1826	29	B	5530	Yes
1024	1	1523	35	B	5530	Yes
1025	1	2221	24	B	5530	Yes
1026	1	694	77	B	5530	Yes
1027	1	2874	19	B	5530	Yes
1028	1	2830	19	B	5530	Yes
1029	1	2591	21	B	5530	Yes
1030	1	2677	20	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	1	180	27	5530	Yes
2002	3.3	223	29	5530	Yes
2003	4.2	216	28	5530	Yes
2004	2.6	226	27	5530	Yes
2005	1.7	223	23	5530	Yes
2006	2.5	156	29	5530	Yes
2007	3.8	201	29	5530	Yes
2008	2.9	218	25	5530	Yes
2009	2.4	229	29	5530	Yes
2010	3.6	169	26	5530	Yes
2011	1.5	185	23	5530	Yes
2012	1	172	24	5530	No
2013	3.1	192	25	5530	Yes
2014	2.8	183	23	5530	Yes
2015	1.1	169	28	5530	No
2016	3.2	165	26	5530	No
2017	3.9	154	25	5530	Yes
2018	2	197	26	5530	Yes
2019	2.9	153	29	5530	Yes
2020	1.3	200	25	5530	Yes
2021	4.6	160	28	5530	Yes
2022	1.2	211	27	5530	Yes
2023	4.7	175	24	5530	Yes
2024	1.6	192	23	5530	Yes
2025	1.2	203	27	5530	Yes
2026	4.5	225	24	5530	Yes
2027	4.3	159	25	5530	Yes
2028	3.8	228	29	5530	Yes
2029	1.9	166	23	5530	Yes
2030	1.5	158	28	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	6.2	481	17	5530	No
3002	6.1	468	16	5530	Yes
3003	6.9	435	16	5530	Yes
3004	9.8	317	18	5530	No
3005	5.8	431	18	5530	Yes
3006	6.5	326	18	5530	Yes
3007	7.8	453	17	5530	Yes
3008	8.8	360	16	5530	Yes
3009	8	500	18	5530	Yes
3010	9.2	436	18	5530	Yes
3011	8.7	337	17	5530	Yes
3012	7.8	403	18	5530	Yes
3013	7.5	451	16	5530	Yes
3014	6.9	412	17	5530	Yes
3015	9.6	472	18	5530	Yes
3016	9.2	446	17	5530	Yes
3017	9.7	401	16	5530	Yes
3018	9.6	271	17	5530	Yes
3019	5.3	489	18	5530	No
3020	8.2	489	17	5530	Yes
3021	9.3	352	17	5530	No
3022	10	498	17	5530	Yes
3023	6.2	373	16	5530	Yes
3024	7.2	281	16	5530	Yes
3025	6.4	303	17	5530	Yes
3026	7.6	356	17	5530	Yes
3027	7.1	258	16	5530	Yes
3028	6.2	457	17	5530	Yes
3029	5.9	371	18	5530	Yes
3030	5.2	333	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	15.9	393	14	5530	Yes
4002	10.4	500	12	5530	Yes
4003	16.2	322	16	5530	No
4004	11.2	442	12	5530	Yes
4005	17.6	410	16	5530	No
4006	13.1	292	12	5530	Yes
4007	15.3	273	12	5530	Yes
4008	16.7	418	16	5530	Yes
4009	19.3	294	16	5530	Yes
4010	11.1	335	15	5530	Yes
4011	19.7	474	13	5530	Yes
4012	12	277	12	5530	Yes
4013	11	429	13	5530	Yes
4014	19.3	378	13	5530	No
4015	18.7	292	13	5530	Yes
4016	17.4	253	16	5530	No
4017	12.7	446	12	5530	Yes
4018	17.3	421	13	5530	Yes
4019	13	493	14	5530	Yes
4020	18.1	363	15	5530	Yes
4021	14.4	331	14	5530	Yes
4022	20	464	16	5530	Yes
4023	17.4	444	15	5530	Yes
4024	13.5	339	14	5530	Yes
4025	16.1	466	14	5530	Yes
4026	18	255	13	5530	Yes
4027	16.5	395	16	5530	Yes
4028	18.9	449	16	5530	Yes
4029	17.9	350	16	5530	Yes
4030	16.1	298	16	5530	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5		
Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5559	Yes
2	5547	Yes
3	5511	Yes
4	5519	Yes
5	5510	Yes
6	5502	Yes
7	5535	Yes
8	5498	Yes
9	5522	Yes
10	5522	Yes
11	5514	Yes
12	5525	Yes
13	5517	Yes
14	5561	Yes
15	5543	Yes
16	5510	Yes
17	5535	No
18	5544	Yes
19	5546	Yes
20	5551	Yes
21	5545	Yes
22	5526	Yes
23	5547	Yes
24	5547	Yes
25	5536	Yes
26	5504	Yes
27	5515	Yes
28	5521	Yes
29	5527	Yes
30	5561	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	294	5490	13	Yes
2	769	5491	16	Yes
3	1244	5492	22	Yes
4	1719	5493	18	Yes
5	2194	5494	11	Yes
6	2669	5495	16	Yes
7	3144	5496	12	Yes
8	3619	5497	13	Yes
9	4094	5498	16	Yes
10	4569	5499	9	Yes
11	5044	5500	11	Yes
12	5519	5501	20	Yes
13	5994	5502	17	Yes
14	6469	5503	15	Yes
15	6944	5504	18	Yes
16	7419	5505	18	Yes
17	7894	5506	24	Yes
18	8369	5507	13	Yes
19	8844	5508	19	Yes
20	9319	5509	14	Yes
21	9794	5510	19	Yes
22	10269	5511	16	Yes
23	10744	5512	15	Yes
24	11219	5513	20	Yes
25	11694	5514	14	Yes
26	12169	5515	16	Yes
27	12644	5516	15	Yes
28	13119	5517	15	Yes
29	13594	5518	16	Yes
30	14069	5519	21	Yes
31	14544	5520	14	Yes
32	15019	5521	15	Yes
33	15494	5522	17	Yes
34	15969	5523	16	Yes
35	16444	5524	18	Yes
36	16919	5525	13	Yes
37	17394	5526	12	Yes
38	17869	5527	19	Yes
39	18344	5528	17	Yes

TYPE 6 DETECTION PROBABILITY (CONTINUED)

40	18819	5529	16	Yes
41	19294	5530	19	Yes
42	19769	5531	22	Yes
43	20244	5532	20	Yes
44	20719	5533	20	Yes
45	21194	5534	25	Yes
46	21669	5535	19	Yes
47	22144	5536	19	Yes
48	22619	5537	19	Yes
49	23094	5538	16	Yes
50	23569	5539	16	Yes
51	24044	5540	11	Yes
52	24519	5541	9	Yes
53	24994	5542	13	Yes
54	25469	5543	17	Yes
55	25944	5544	13	Yes
56	26419	5545	14	Yes
57	26894	5546	18	Yes
58	27369	5547	25	Yes
59	27844	5548	18	Yes
60	28319	5549	21	Yes
61	28794	5550	18	Yes
62	29269	5551	17	Yes
63	29744	5552	13	Yes
64	30219	5553	20	Yes
65	30694	5554	15	Yes
66	31169	5555	17	Yes
67	31644	5556	13	Yes
68	32119	5557	24	Yes
69	32594	5558	16	Yes
70	33069	5559	18	Yes
71	33544	5560	24	Yes
72	34019	5561	15	Yes
73	34494	5562	14	Yes
74	34969	5563	23	Yes
75	35444	5564	16	Yes
76	35919	5565	27	Yes
77	36394	5566	18	Yes
78	36869	5567	20	Yes
79	37344	5568	13	Yes
80	37819	5569	15	Yes
81	38294	5570	17	Yes

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.