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

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER: MR84-HW

FCC ID: UDX-60043010
IC: 6961A-60043010

REPORT NUMBER: 16U23317-E2V1

ISSUE DATE: AUGUST 29, 2016

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

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/29/16	Initial Issue	C. 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: 802.11 a/b/g/n/ac WIRELESS ACCESS POINT

MODEL: MR84-HW

SERIAL NUMBER: Q2EK-EKNY-AWFZ

DATE TESTED: MAY 11 – MAY 12, 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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UL Verification Services Inc.

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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%.

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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:

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”.

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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.		

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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.

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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

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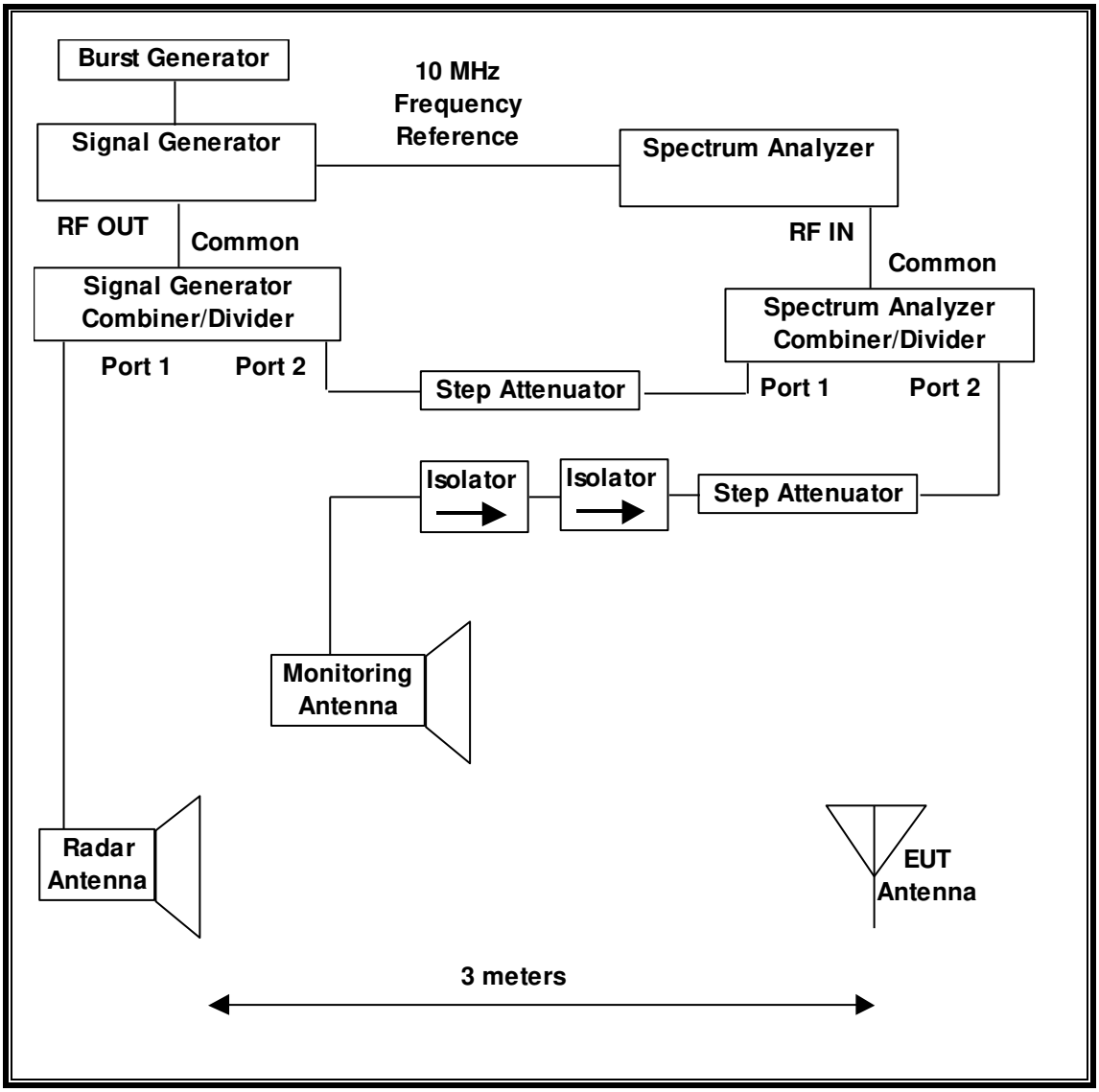
4.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



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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.

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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	03/11/17
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/11/17

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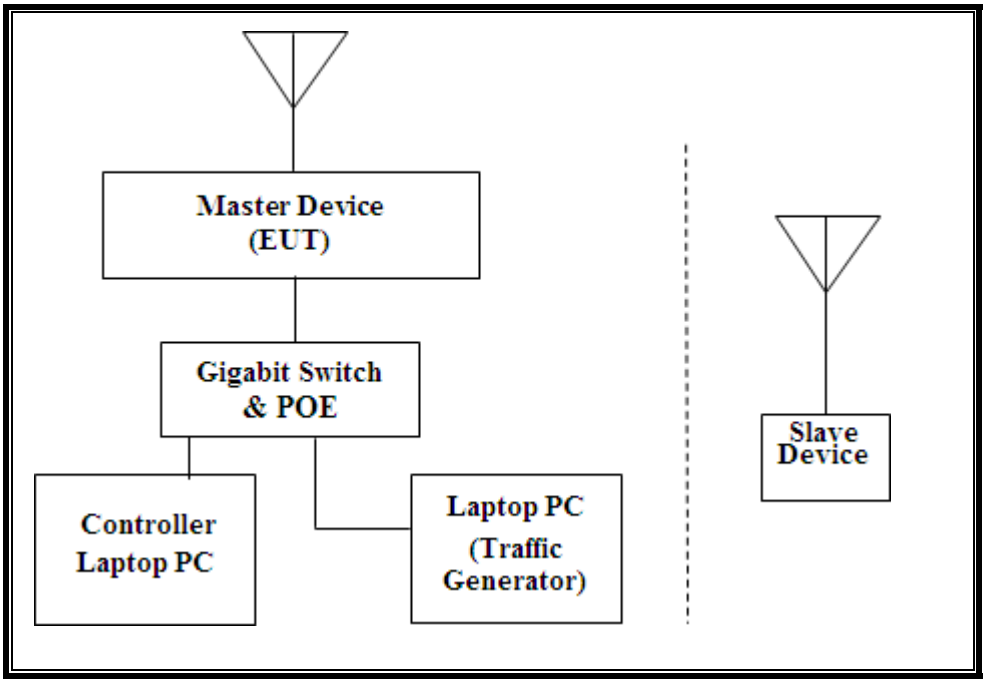
4.1.3. SETUP OF EUT

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)	Apple	A1502	C02NT1VTG3QR	QDS-BRCM1069
AC Adapter (Controller)	Apple	A1435	D39433601B4FTC0A1	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

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4.1.4. 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 29.97 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 11.5 dBi in the 5250-5350 MHz band and in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 6.3 dBi in the 5250-5350 MHz band and in the 5470-5725 MHz band.

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

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

WLAN traffic that meets or exceeds the minimum required loading was generated by transferring a data stream from the Master Device to the Slave Device using iPerf 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 24-201463

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

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4.2. RESULTS FOR 20 MHz BANDWIDTH

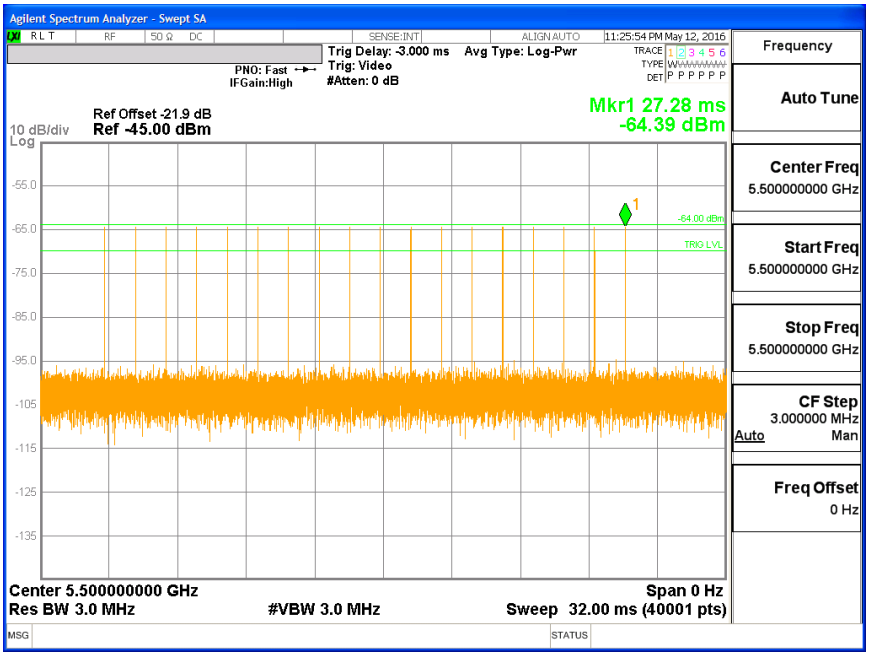
4.2.1. TEST CHANNEL

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



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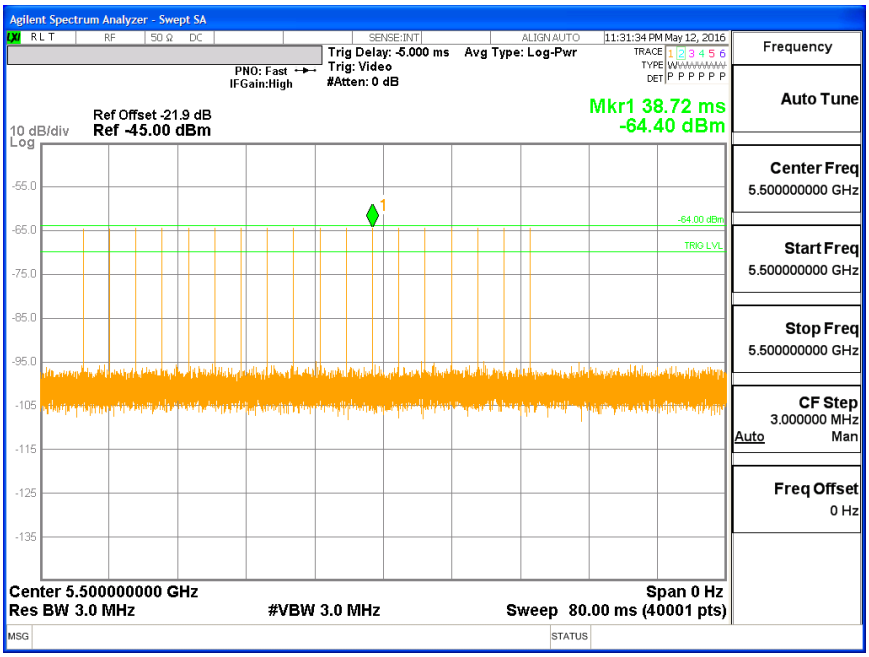
SAMPLE OF RADAR TYPE 1



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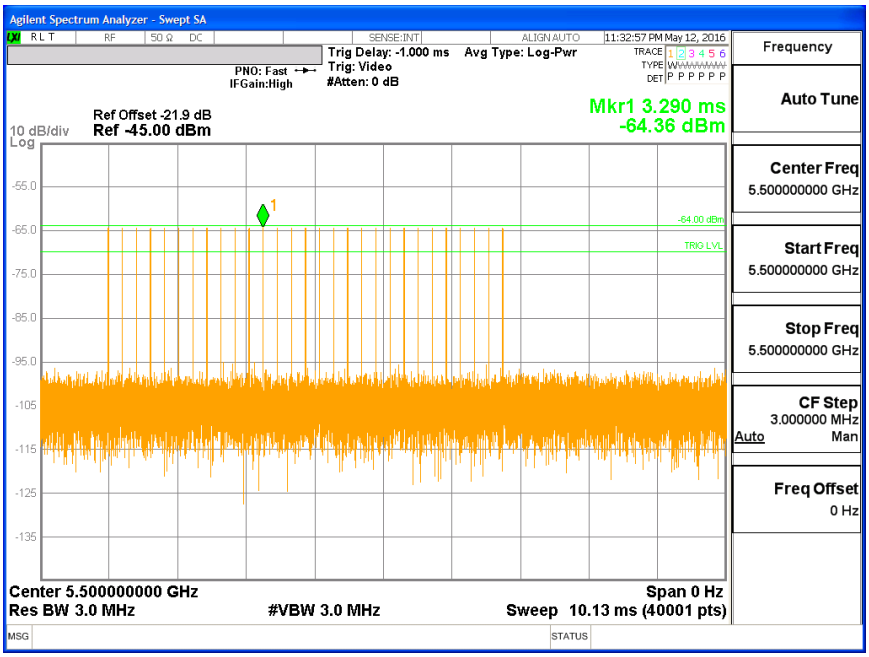
SAMPLE OF RADAR TYPE 2



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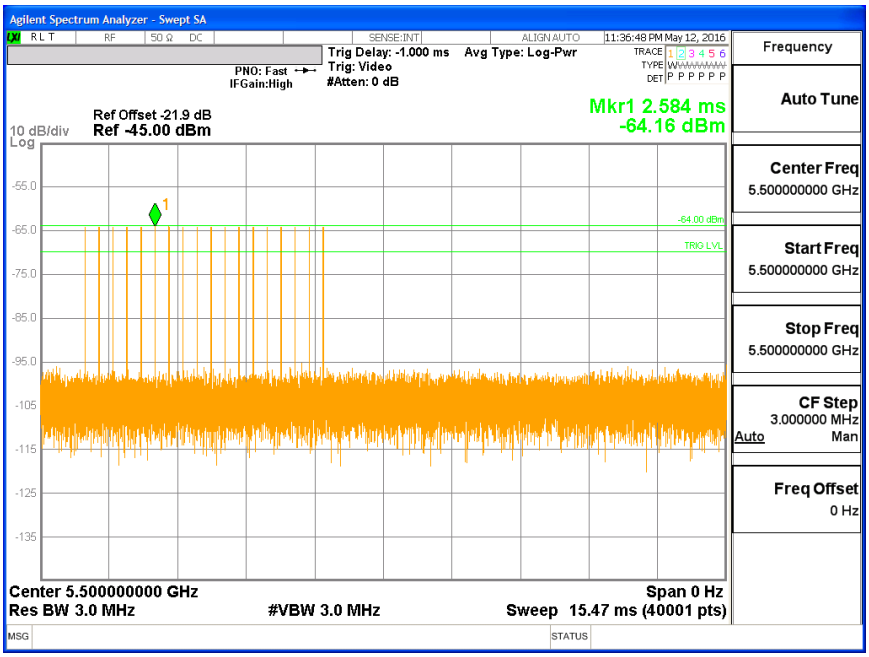
SAMPLE OF RADAR TYPE 3



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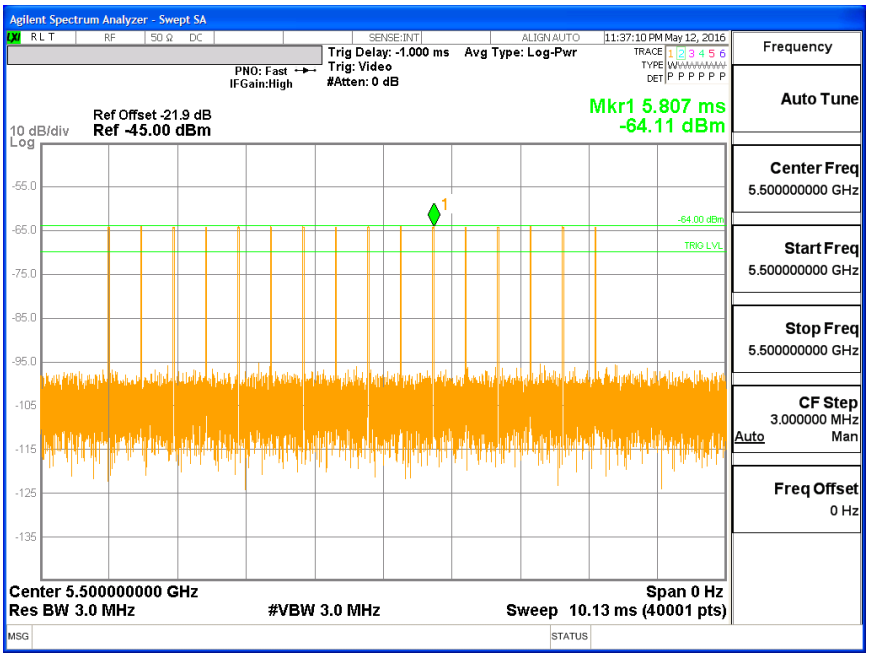
SAMPLE OF RADAR TYPE 4



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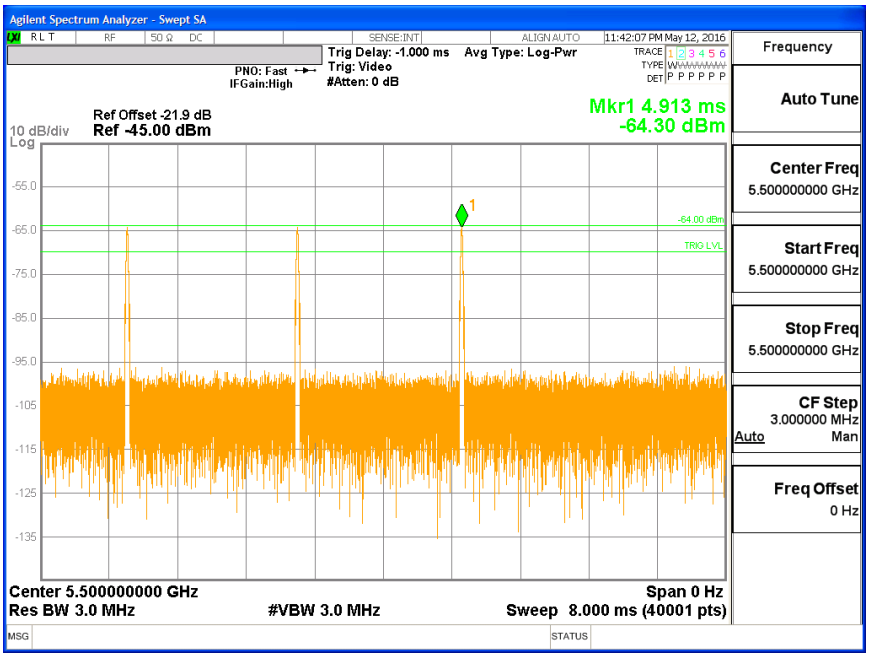
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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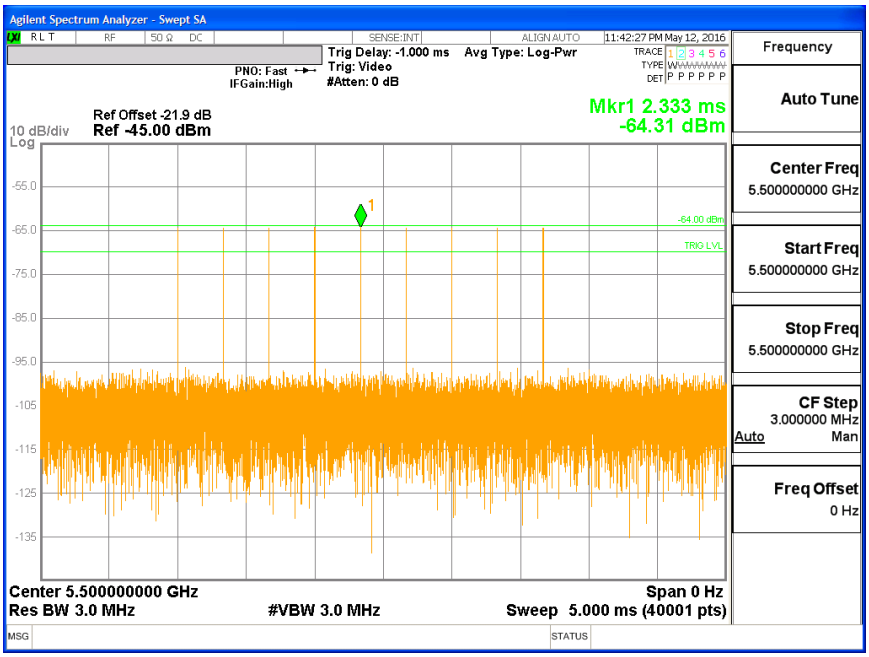
SINGLE BURST OF RADAR TYPE 6



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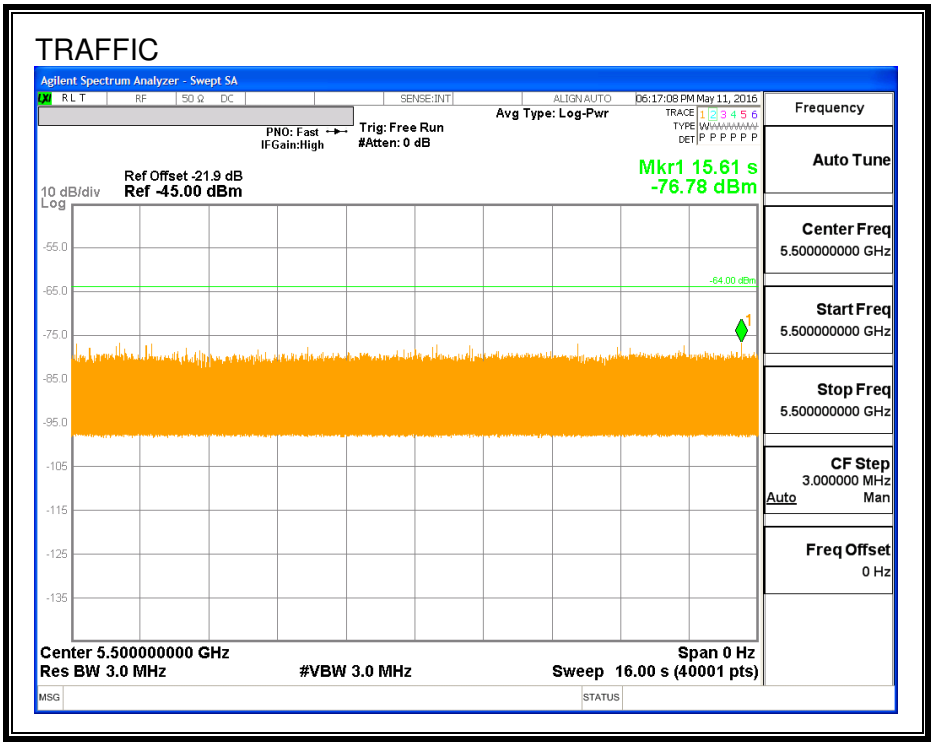
TRAFFIC



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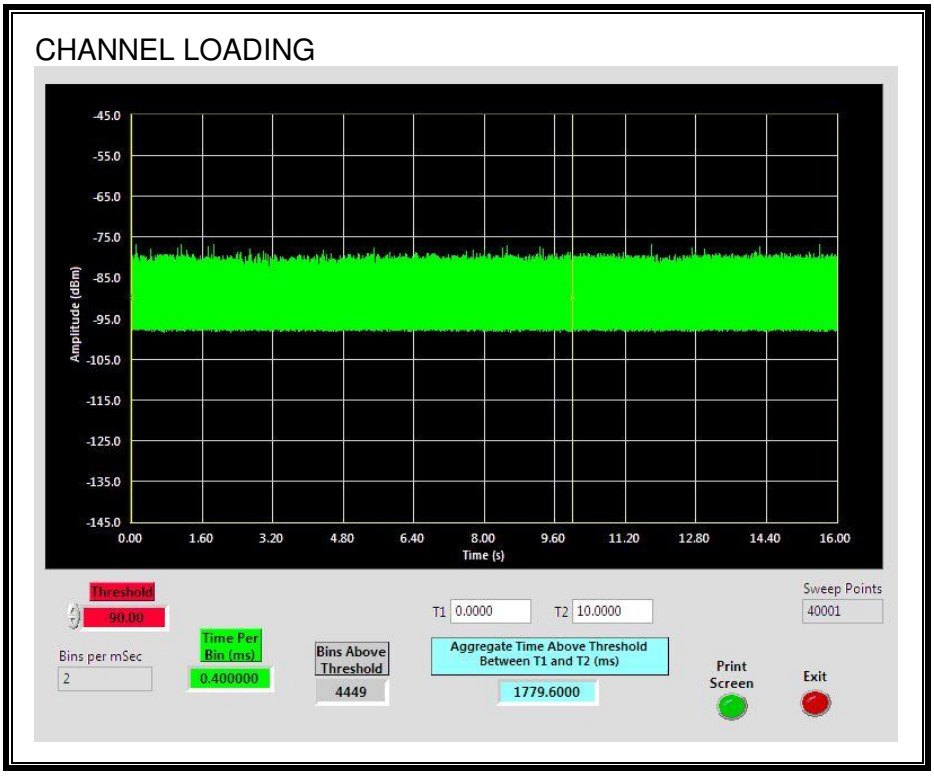
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.796%

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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.

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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)
30.1	183.6	153.5	93.5

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)
29.94	124.4	94.5	1.0

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.51	182.9	152.4	58.9

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

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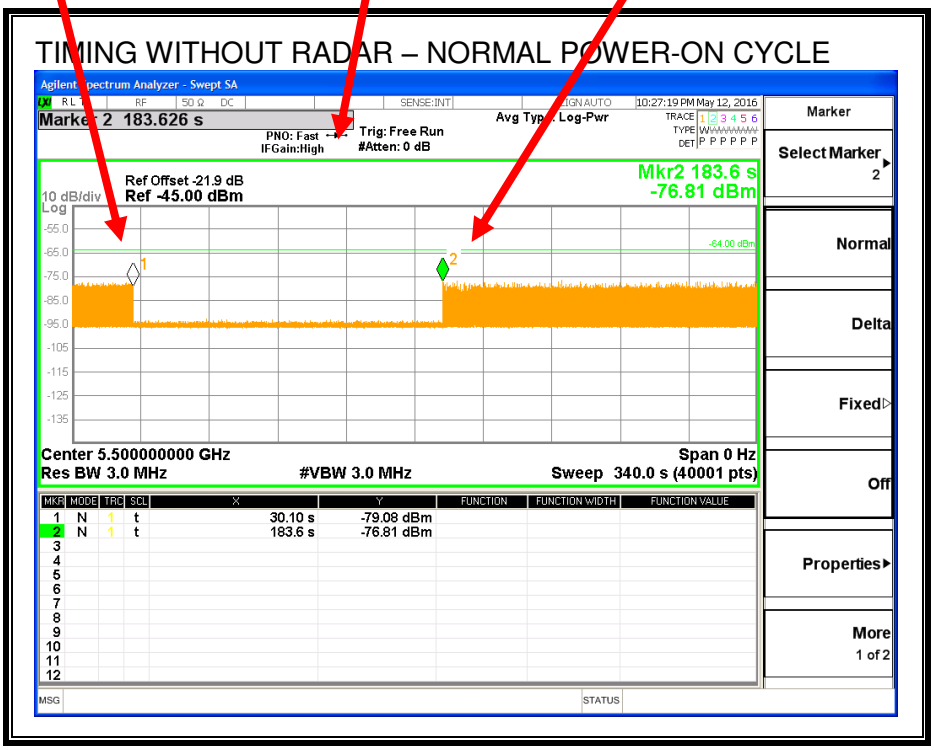
TIMING WITHOUT RADAR DURING CAC

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.

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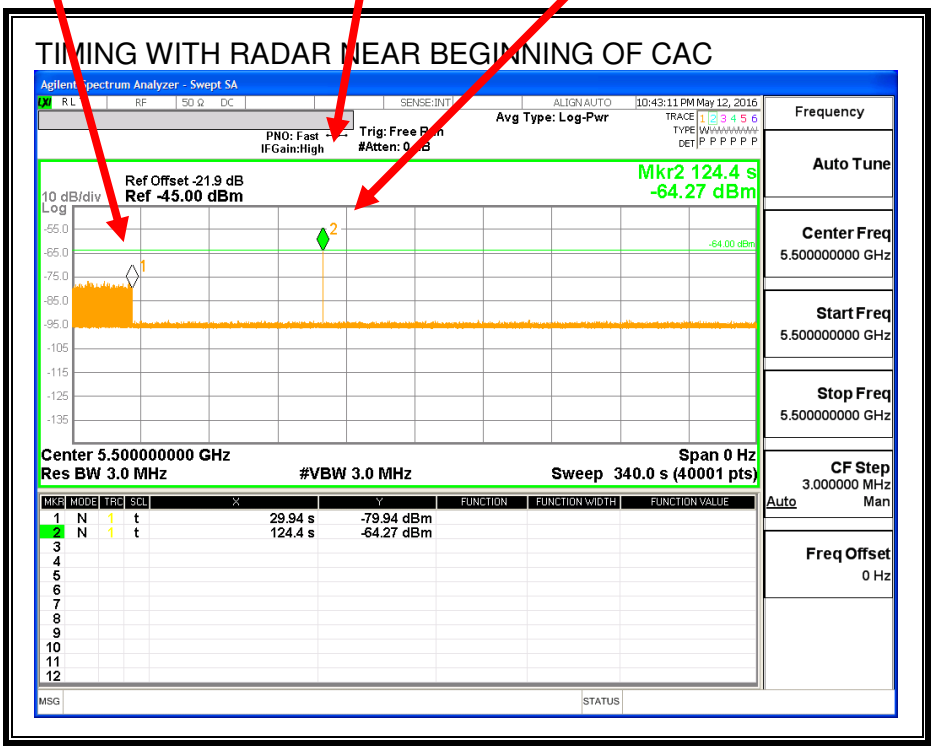
TIMING WITH RADAR NEAR BEGINNING OF CAC

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.

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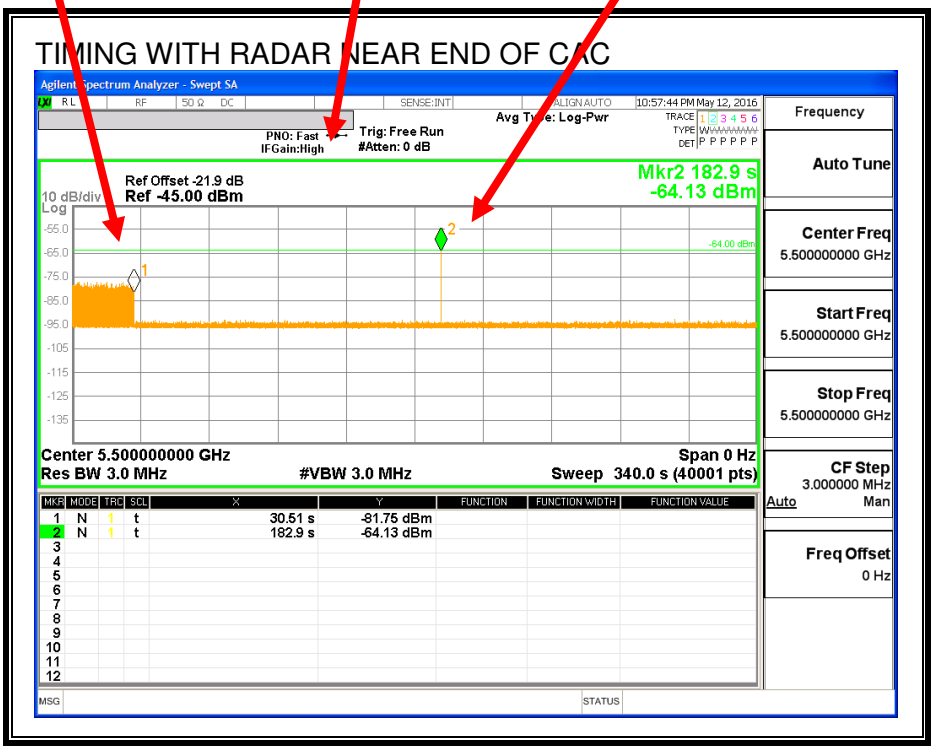
TIMING WITH RADAR NEAR END OF CAC

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.

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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)
0.000	10

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

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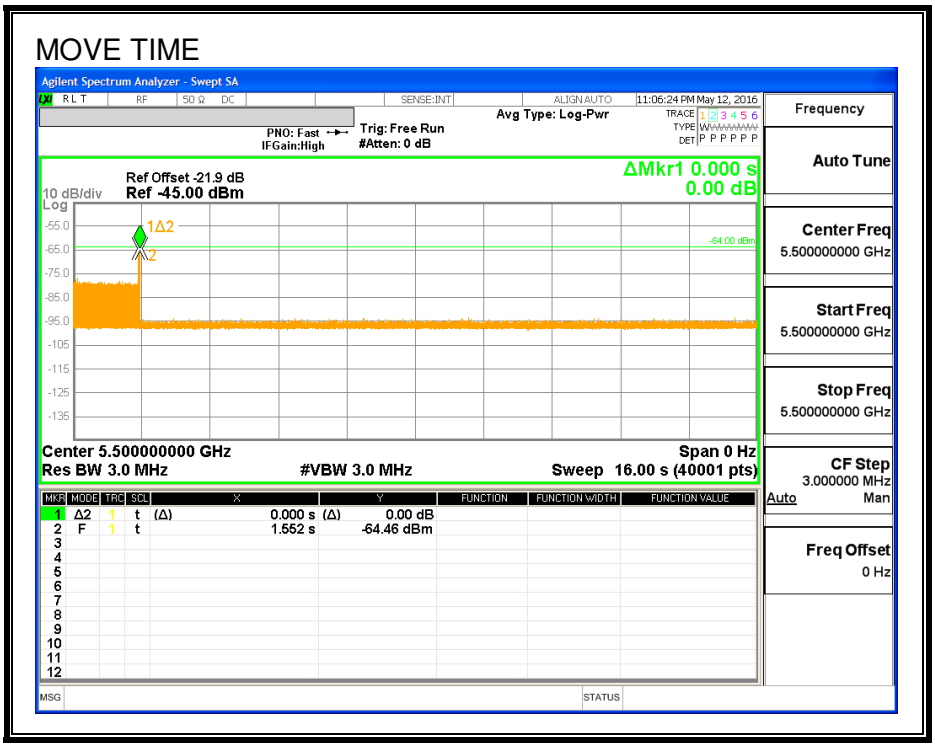
MOVE TIME



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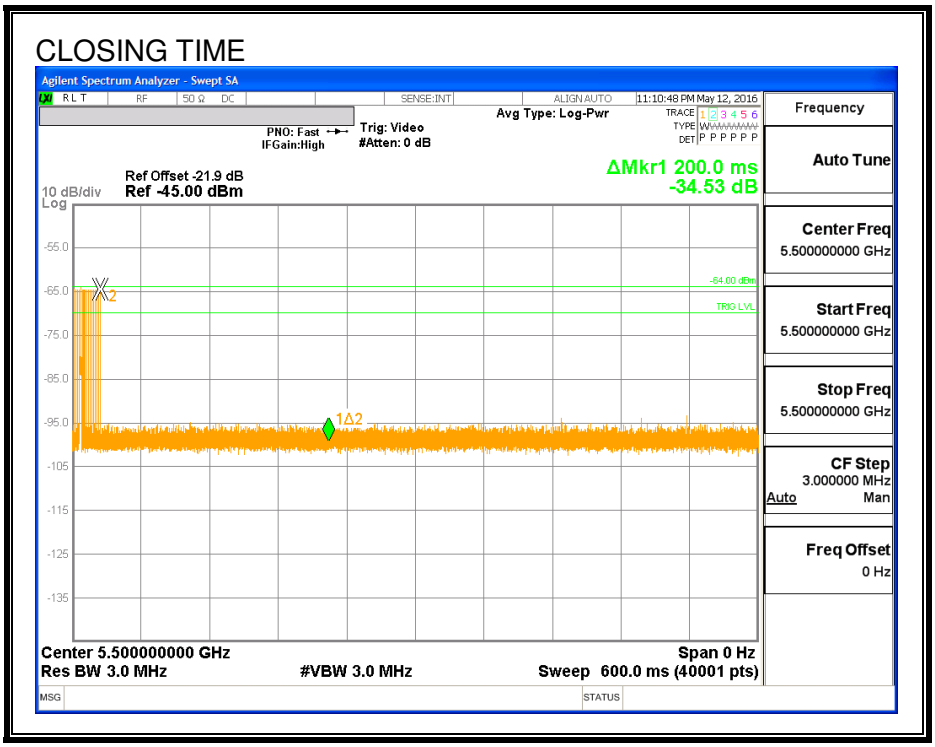
CHANNEL CLOSING TIME



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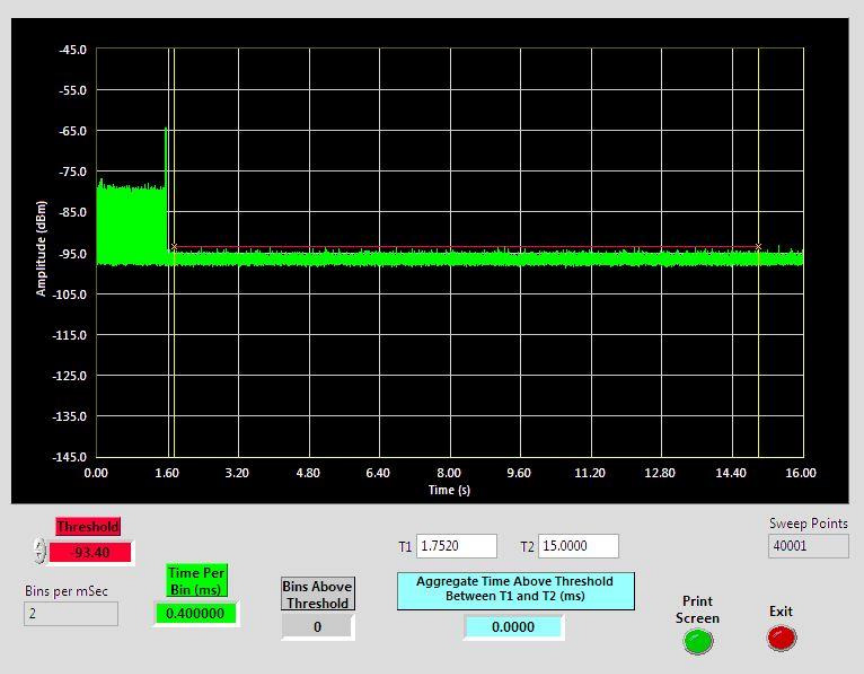
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME



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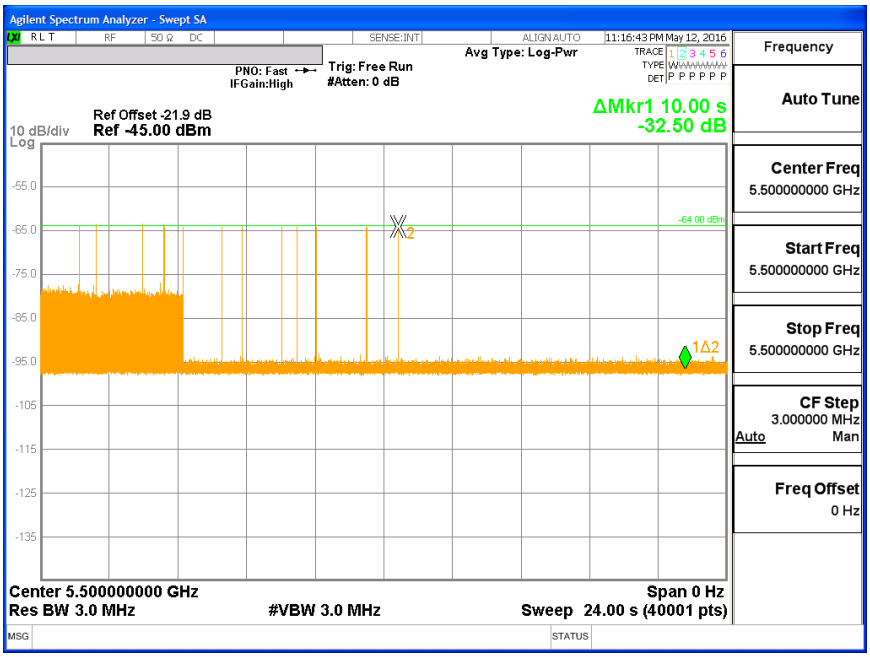
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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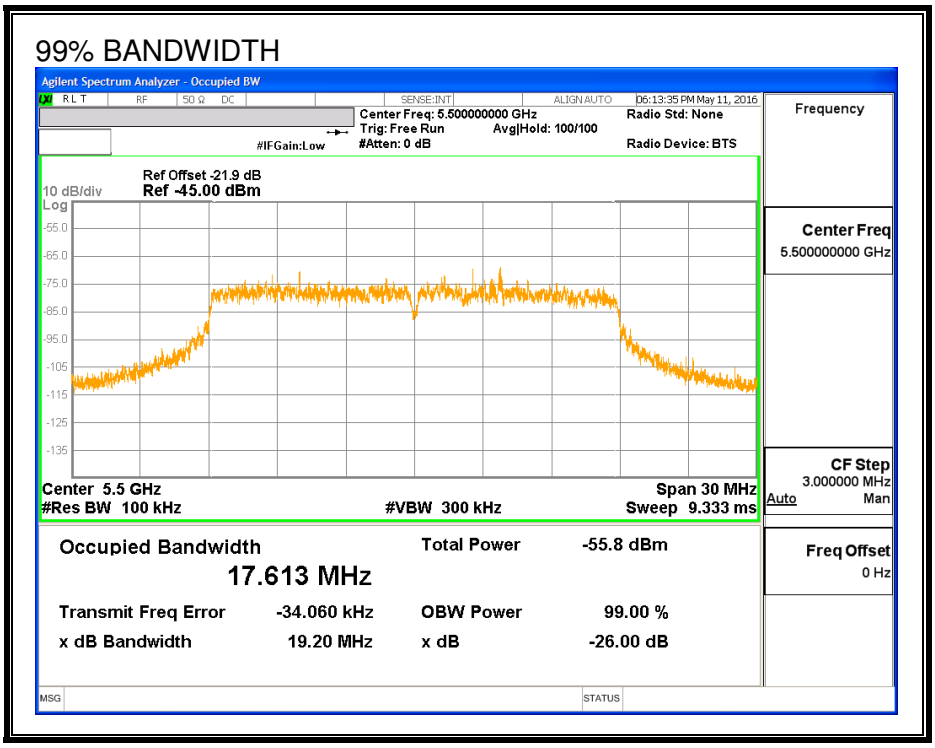
4.2.6. DETECTION BANDWIDTH

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	17.613	113.6	100

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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	FH
5511	10	0	0	

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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	96.67	60	Pass	5490	5510		
FCC Short Pulse Type 3	30	90.00	60	Pass	5490	5510		
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5510		
Aggregate		93.33	80	Pass				
FCC Long Pulse Type 5	30	93.33	80	Pass	5490	5510	5492	5508
FCC Hopping Type 6	42	100.00	70	Pass	5490	5510		

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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	918	58	A	5500	Yes
1003	1	638	83	A	5500	Yes
1004	1	758	70	A	5500	Yes
1005	1	738	72	A	5500	Yes
1006	1	878	61	A	5500	Yes
1007	1	858	62	A	5500	Yes
1008	1	818	65	A	5500	Yes
1009	1	838	63	A	5500	Yes
1010	1	658	81	A	5500	Yes
1011	1	898	59	A	5500	Yes
1012	1	558	95	A	5500	Yes
1013	1	518	102	A	5500	Yes
1014	1	778	68	A	5500	Yes
1015	1	678	78	A	5500	Yes
1016	1	2488	22	B	5500	Yes
1017	1	1378	39	B	5500	Yes
1018	1	1270	42	B	5500	Yes
1019	1	2838	19	B	5500	Yes
1020	1	2858	19	B	5500	Yes
1021	1	2008	27	B	5500	Yes
1022	1	964	55	B	5500	Yes
1023	1	1596	34	B	5500	Yes
1024	1	681	78	B	5500	Yes
1025	1	1443	37	B	5500	Yes
1026	1	2902	19	B	5500	Yes
1027	1	1052	51	B	5500	Yes
1028	1	1705	31	B	5500	Yes
1029	1	1661	32	B	5500	Yes
1030	1	1423	38	B	5500	Yes

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TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.5	208	29	5500	Yes
2002	4.7	169	24	5500	Yes
2003	1.5	163	23	5500	Yes
2004	4	172	29	5500	No
2005	3.2	170	25	5500	Yes
2006	3.9	183	25	5500	Yes
2007	1.1	228	25	5500	Yes
2008	4.3	165	28	5500	Yes
2009	3.9	176	25	5500	Yes
2010	5	197	28	5500	Yes
2011	2.9	212	26	5500	Yes
2012	2.4	200	26	5500	Yes
2013	4.6	219	28	5500	Yes
2014	4.2	211	25	5500	Yes
2015	2.5	197	24	5500	Yes
2016	4.6	192	28	5500	Yes
2017	1.2	182	27	5500	Yes
2018	3.4	225	29	5500	Yes
2019	4.3	181	25	5500	Yes
2020	2.7	228	27	5500	Yes
2021	1.9	188	23	5500	Yes
2022	2.6	158	29	5500	Yes
2023	2	203	26	5500	Yes
2024	3	220	26	5500	Yes
2025	2.6	150	23	5500	Yes
2026	1.8	172	26	5500	Yes
2027	1.6	187	27	5500	Yes
2028	1.1	174	24	5500	Yes
2029	3.3	194	26	5500	Yes
2030	2.9	185	23	5500	Yes

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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	8	316	18	5500	Yes
3002	7.9	303	17	5500	Yes
3003	8.7	271	17	5500	Yes
3004	6.4	404	16	5500	Yes
3005	7.5	266	16	5500	Yes
3006	8.2	412	16	5500	Yes
3007	9.6	288	18	5500	Yes
3008	5.4	446	17	5500	Yes
3009	9.7	335	16	5500	Yes
3010	5.9	271	16	5500	Yes
3011	5.3	423	18	5500	No
3012	9.5	489	16	5500	Yes
3013	9.3	286	17	5500	Yes
3014	8.6	498	18	5500	Yes
3015	6.2	307	16	5500	Yes
3016	5.8	281	18	5500	Yes
3017	6.4	487	17	5500	Yes
3018	6.2	357	18	5500	Yes
3019	7.1	324	16	5500	Yes
3020	9.9	324	18	5500	Yes
3021	5.9	438	18	5500	Yes
3022	6.6	333	18	5500	Yes
3023	8	460	17	5500	Yes
3024	8.9	367	17	5500	No
3025	8.1	389	18	5500	Yes
3026	9.3	442	18	5500	Yes
3027	8.8	344	17	5500	Yes
3028	7.9	292	18	5500	Yes
3029	7.6	457	16	5500	No
3030	7	419	17	5500	Yes

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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	19.3	479	16	5500	Yes
4002	13.8	335	14	5500	Yes
4003	19.7	408	13	5500	Yes
4004	14.7	277	14	5500	Yes
4005	11	496	13	5500	Yes
4006	16.6	378	14	5500	Yes
4007	18.7	359	13	5500	Yes
4008	10	253	13	5500	No
4009	12.7	380	12	5500	Yes
4010	14.6	421	12	5500	Yes
4011	13	309	14	5500	Yes
4012	15.5	363	14	5500	Yes
4013	14.4	264	14	5500	Yes
4014	12.6	464	14	5500	Yes
4015	12.1	378	15	5500	Yes
4016	10.8	339	13	5500	No
4017	16.1	282	14	5500	Yes
4018	10.6	256	15	5500	Yes
4019	16.5	329	16	5500	Yes
4020	11.5	449	12	5500	No
4021	17.9	417	16	5500	Yes
4022	13.4	299	12	5500	Yes
4023	10.8	279	12	5500	Yes
4024	16.9	425	16	5500	Yes
4025	19.6	301	16	5500	Yes
4026	11.4	342	15	5500	Yes
4027	20	481	13	5500	No
4028	12.3	284	12	5500	Yes
4029	11.2	436	13	5500	Yes
4030	19.5	384	13	5500	Yes

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TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5

Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5500	Yes
2	5503	Yes
3	5495	Yes
4	5499	Yes
5	5501	Yes
6	5505	Yes
7	5500	Yes
8	5505	Yes
9	5507	Yes
10	5503	Yes
11	5493	Yes
12	5502	Yes
13	5498	Yes
14	5497	Yes
15	5503	Yes
16	5504	Yes
17	5493	No
18	5495	Yes
19	5498	Yes
20	5493	No
21	5496	Yes
22	5504	Yes
23	5496	Yes
24	5507	Yes
25	5499	Yes
26	5504	Yes
27	5493	Yes
28	5503	Yes
29	5501	Yes
30	5505	Yes

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

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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	98	5490	2	Yes
2	573	5491	5	Yes
3	1048	5492	4	Yes
4	1523	5493	2	Yes
5	1998	5494	4	Yes
6	2473	5495	7	Yes
7	2948	5496	6	Yes
8	3423	5497	1	Yes
9	3898	5498	3	Yes
10	4373	5499	4	Yes
11	4848	5500	6	Yes
12	5323	5501	6	Yes
13	5798	5502	3	Yes
14	6273	5503	7	Yes
15	6748	5504	4	Yes
16	7223	5505	2	Yes
17	7698	5506	3	Yes
18	8173	5507	4	Yes
19	8648	5508	3	Yes
20	9123	5509	3	Yes
21	9598	5510	7	Yes
22	10073	5490	4	Yes
23	10548	5491	2	Yes
24	11023	5492	6	Yes
25	11498	5493	4	Yes
26	11973	5494	11	Yes
27	12448	5495	3	Yes
28	12923	5496	7	Yes
29	13398	5497	8	Yes
30	13873	5498	2	Yes
31	14348	5499	4	Yes
32	14823	5500	3	Yes
33	15298	5501	4	Yes
34	15773	5502	3	Yes
35	16248	5503	1	Yes
36	16723	5504	6	Yes
37	17198	5505	5	Yes
38	17673	5506	4	Yes
39	18148	5507	7	Yes
40	18623	5508	5	Yes
41	19098	5509	5	Yes
42	19573	5510	2	Yes

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4.3. RESULTS FOR 40 MHz BANDWIDTH

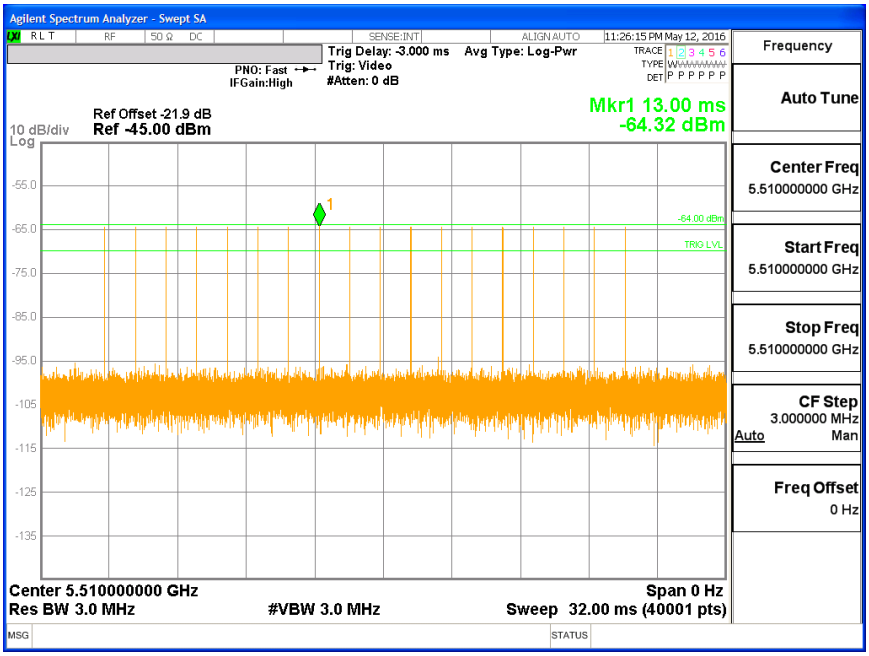
4.3.1. TEST CHANNEL

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



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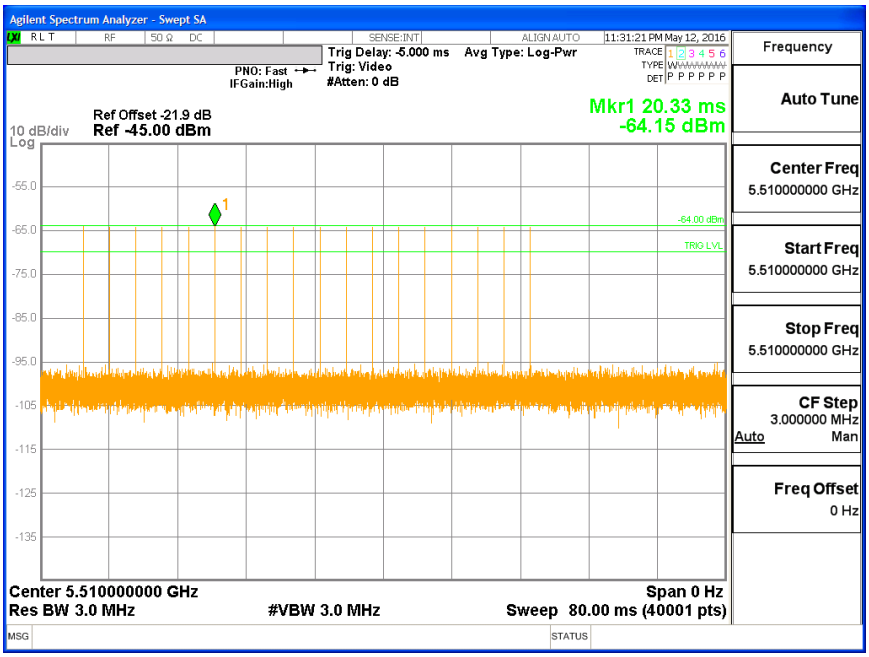
SAMPLE OF RADAR TYPE 1



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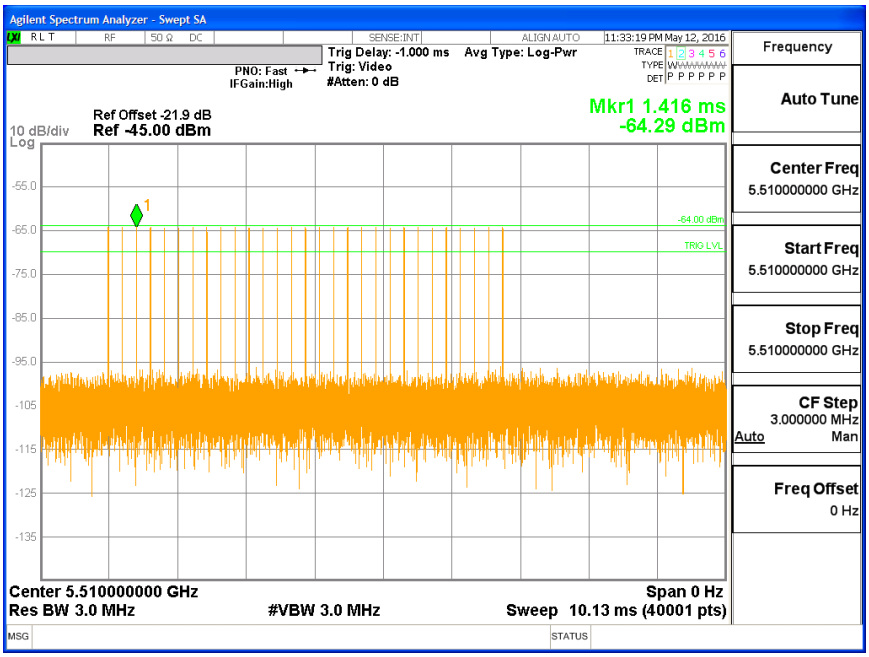
SAMPLE OF RADAR TYPE 2



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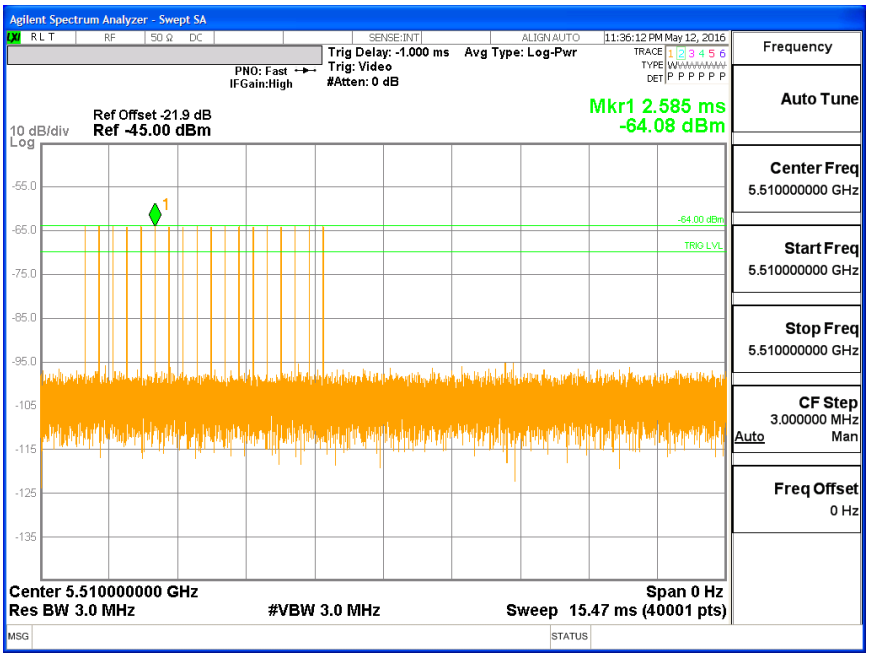
SAMPLE OF RADAR TYPE 3



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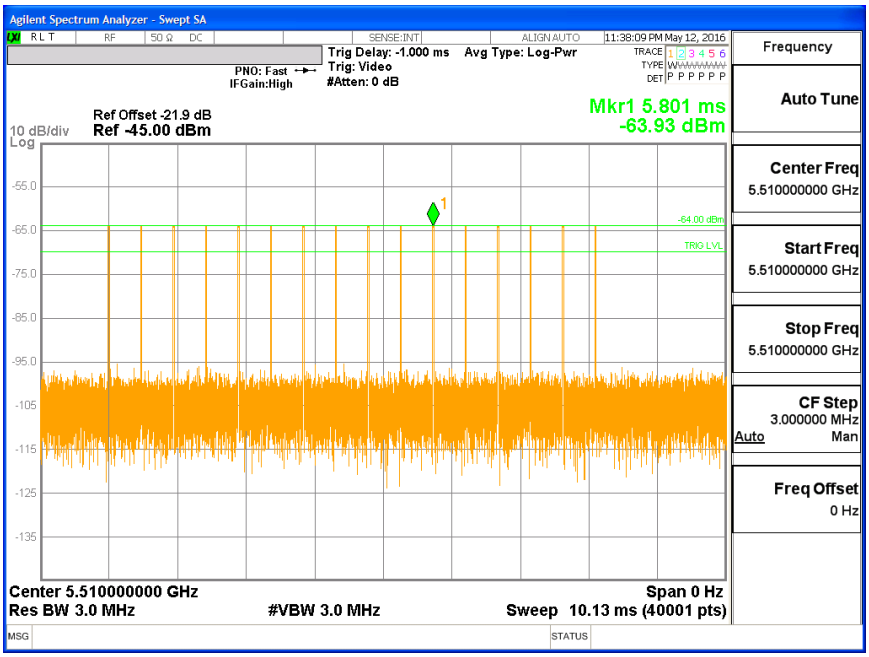
SAMPLE OF RADAR TYPE 4



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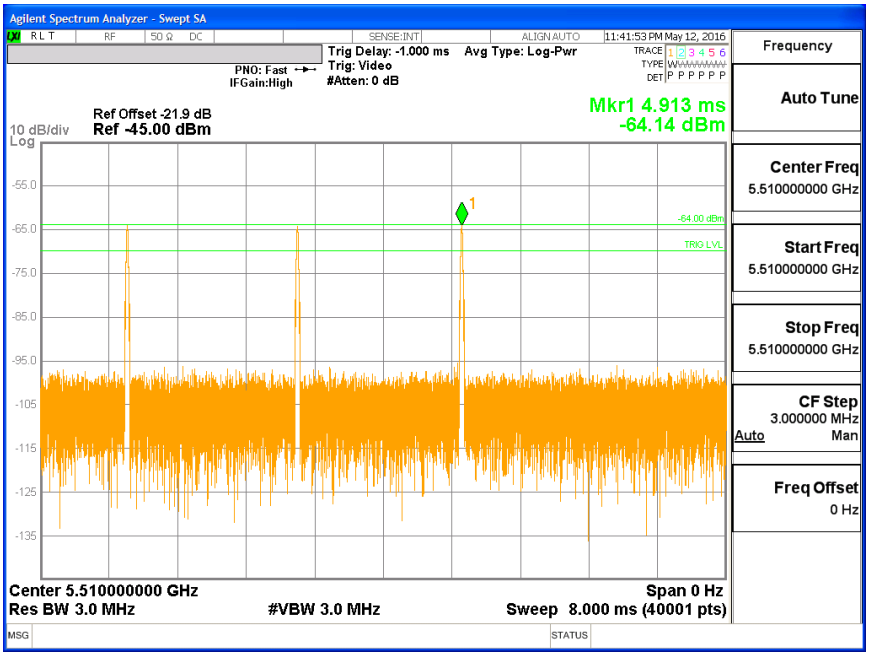
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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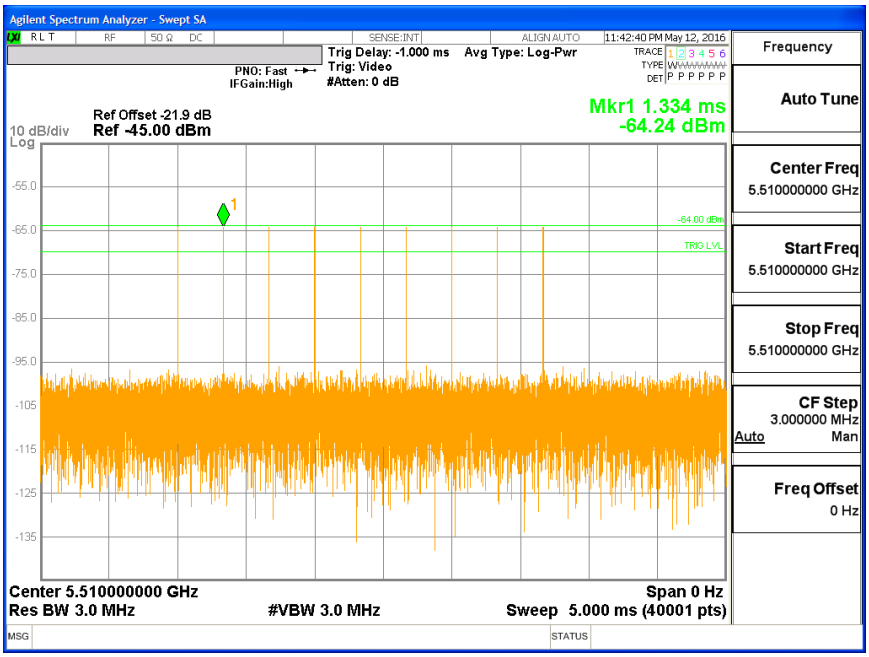
SINGLE BURST OF RADAR TYPE 6



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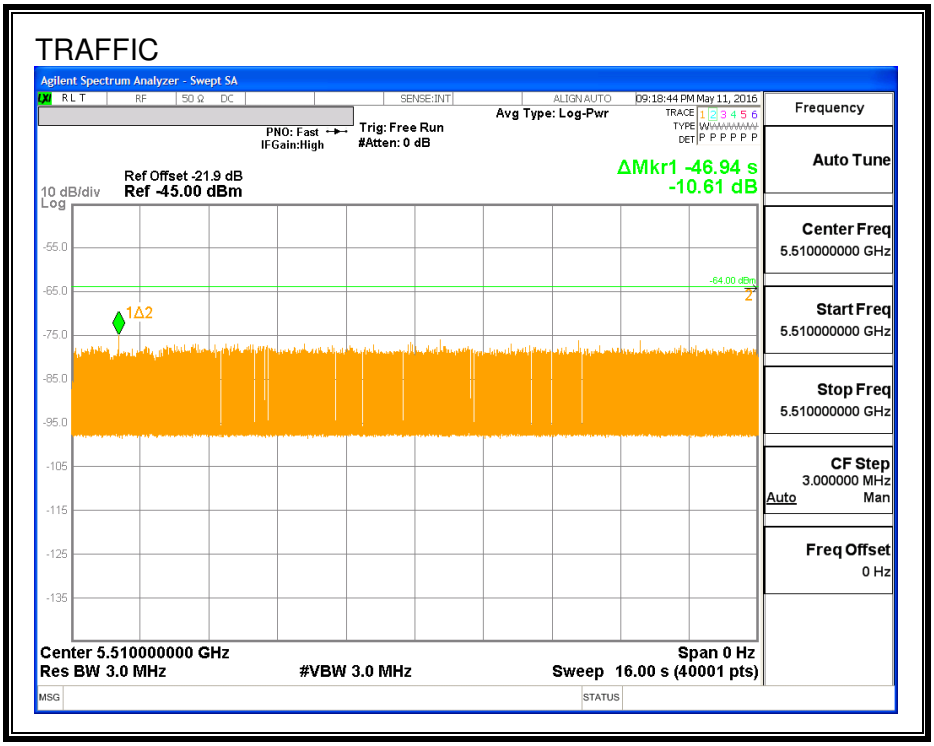
TRAFFIC



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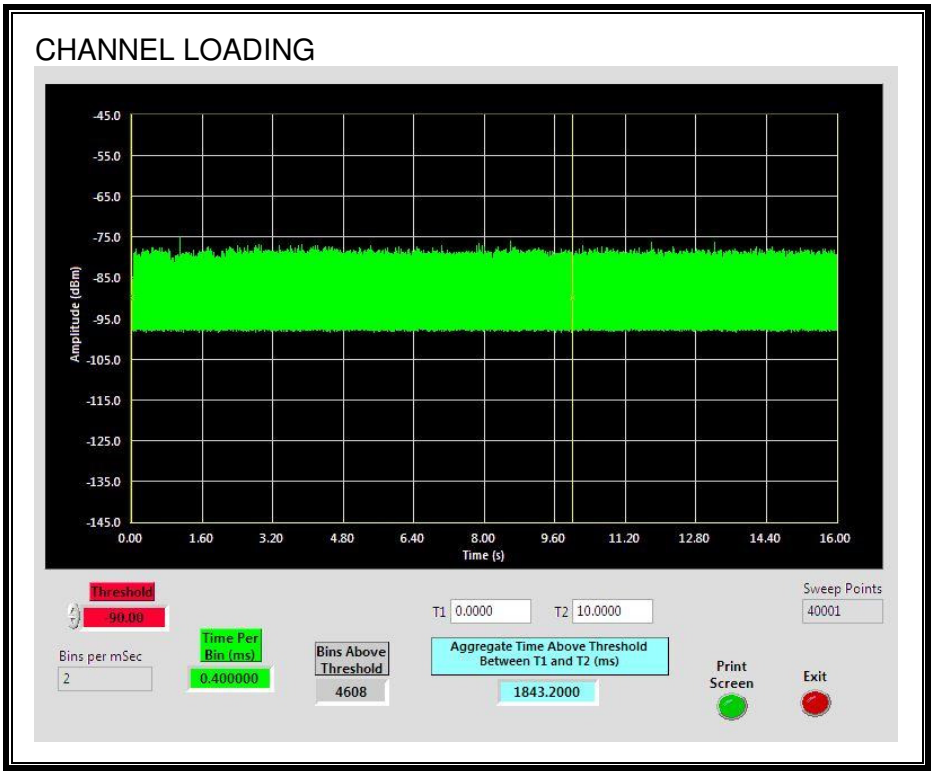
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.432%

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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.

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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)
30.17	183.7	153.5	93.5

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.05	124.4	94.4	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)
30.21	182.4	152.2	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

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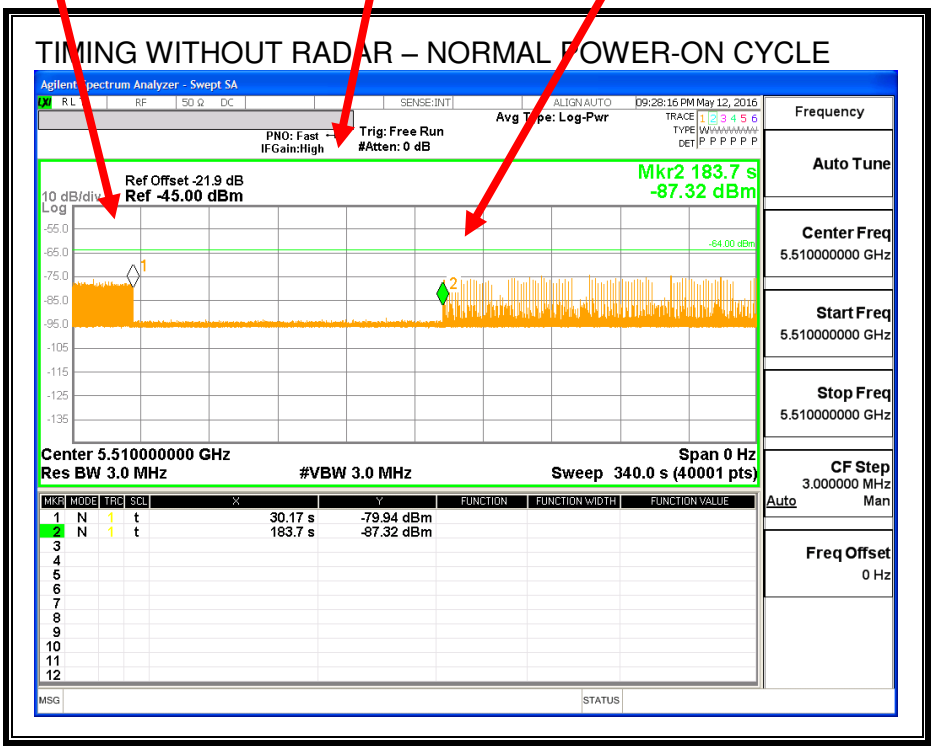
TIMING WITHOUT RADAR DURING CAC

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.

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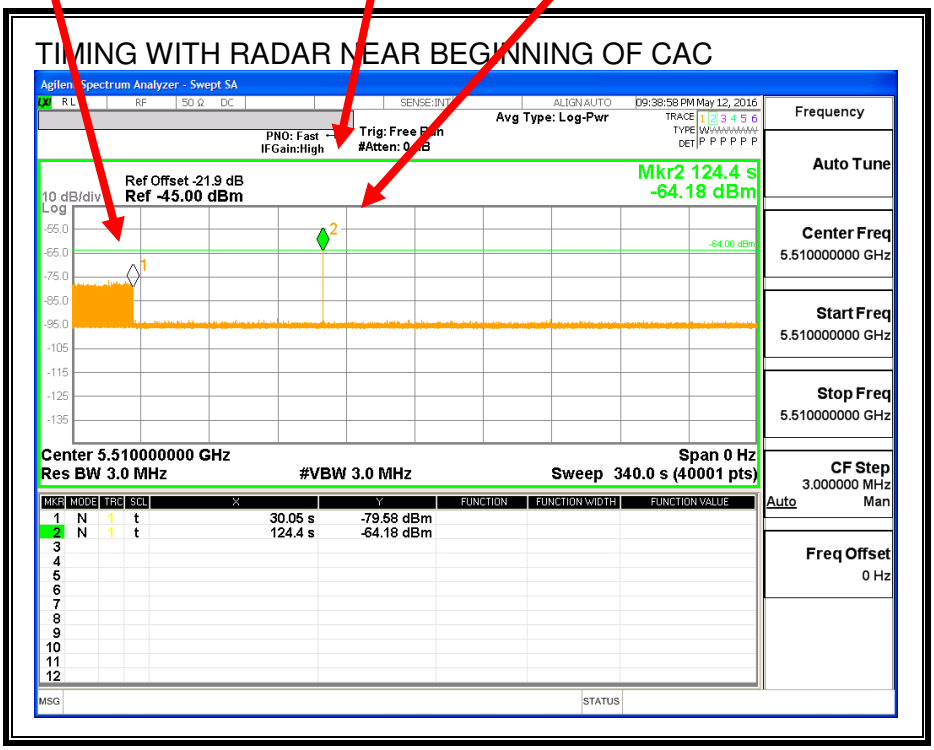
TIMING WITH RADAR NEAR BEGINNING OF CAC

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.

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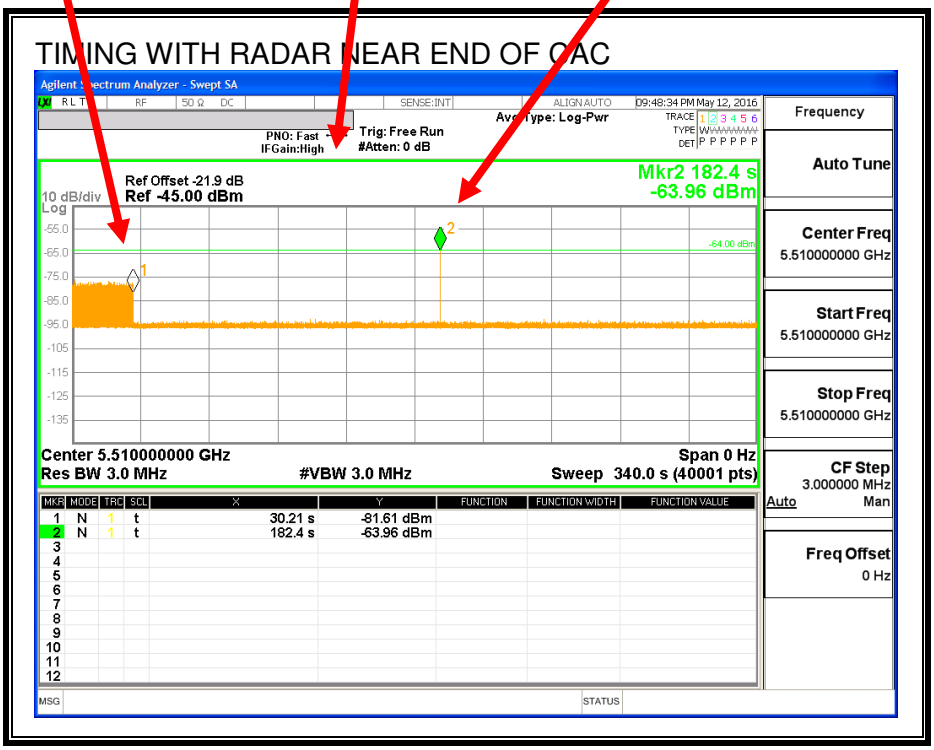
TIMING WITH RADAR NEAR END OF CAC

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.

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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)
0.000	10

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

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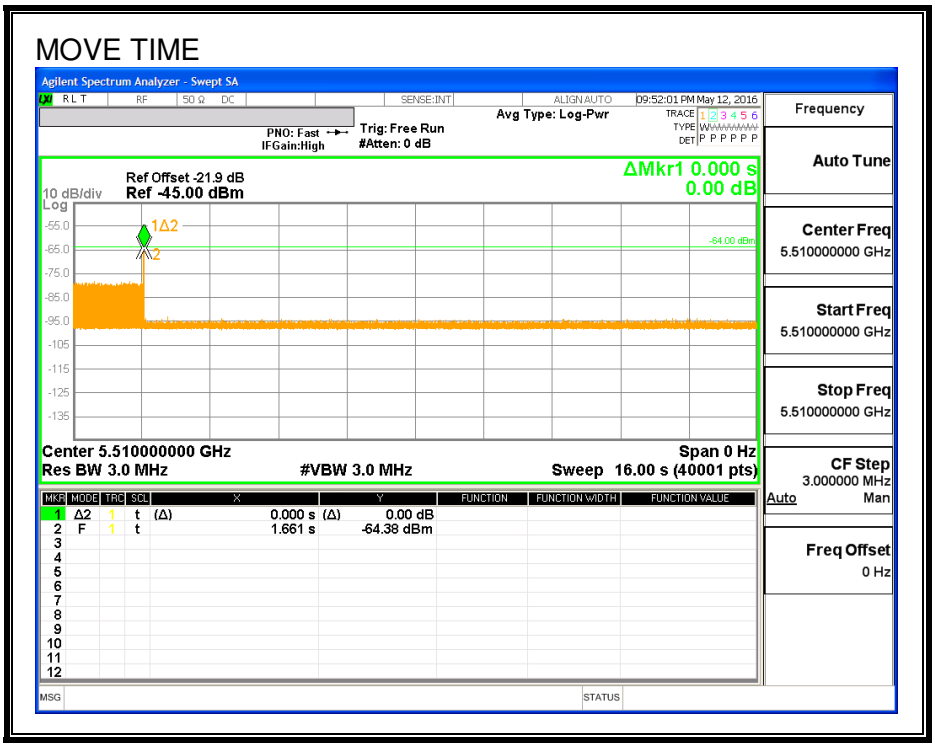
MOVE TIME



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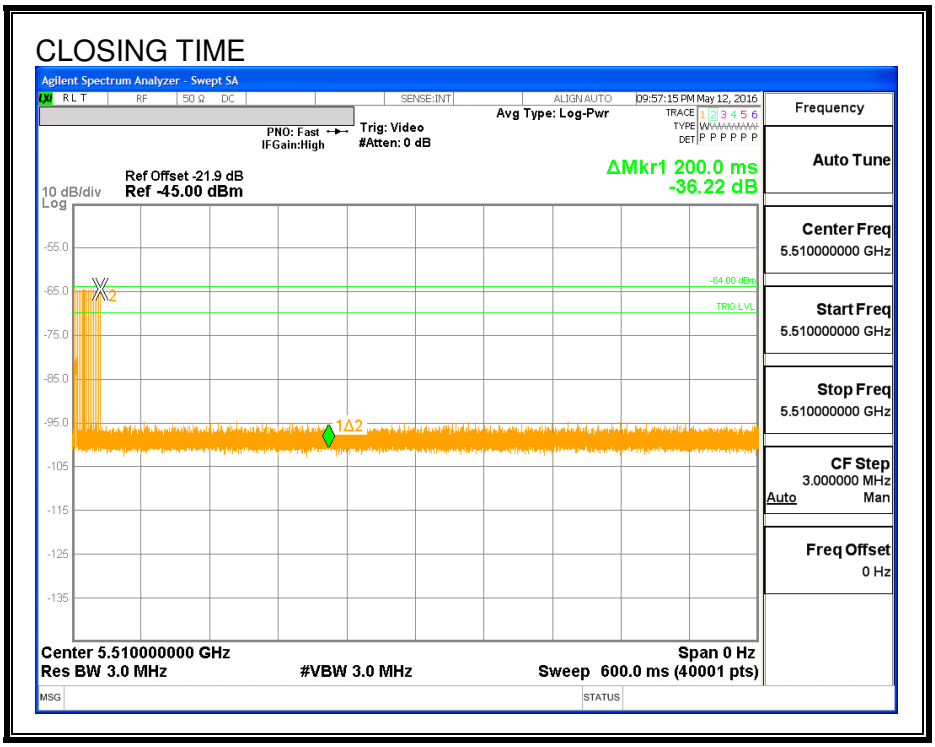
CHANNEL CLOSING TIME



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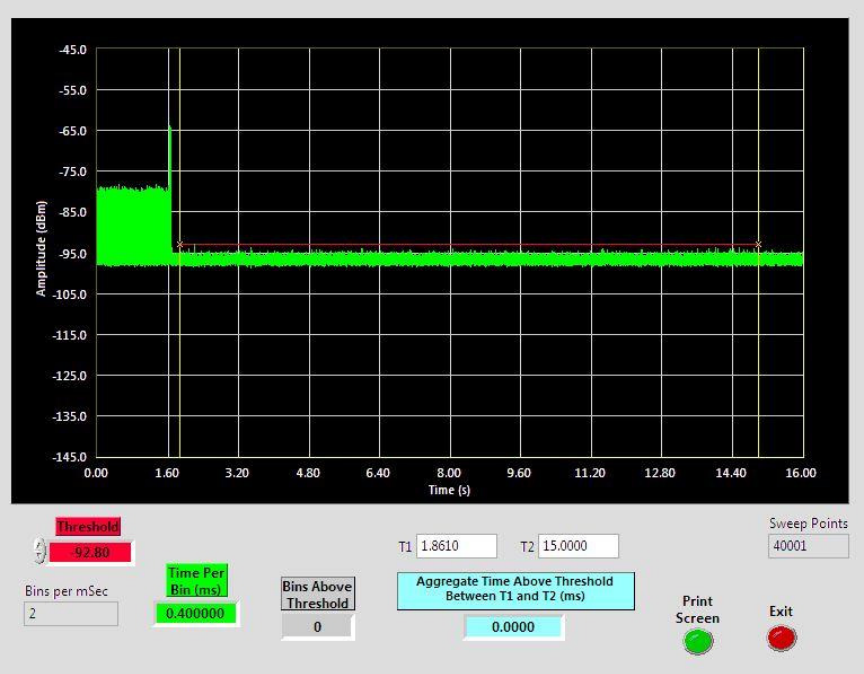
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME



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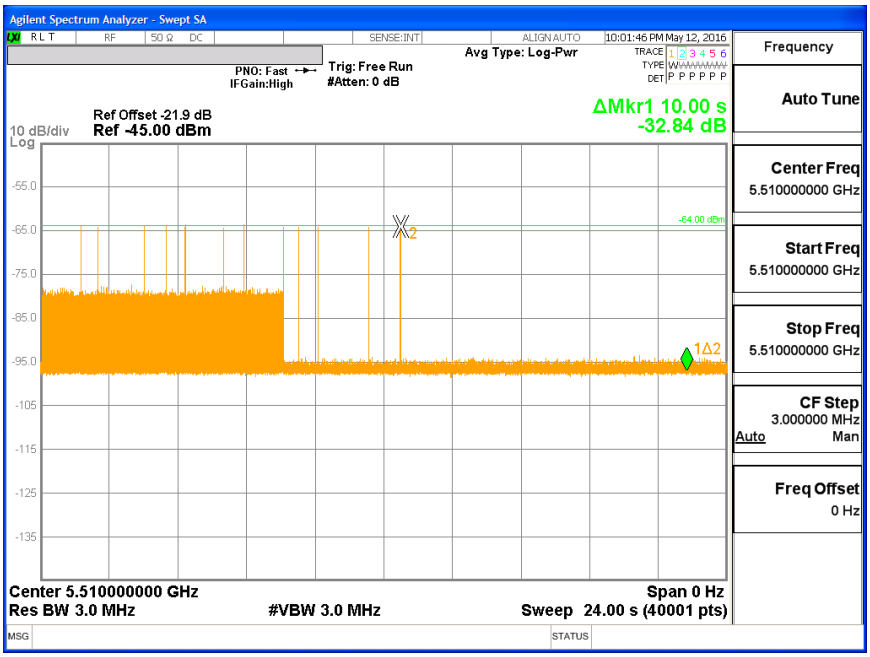
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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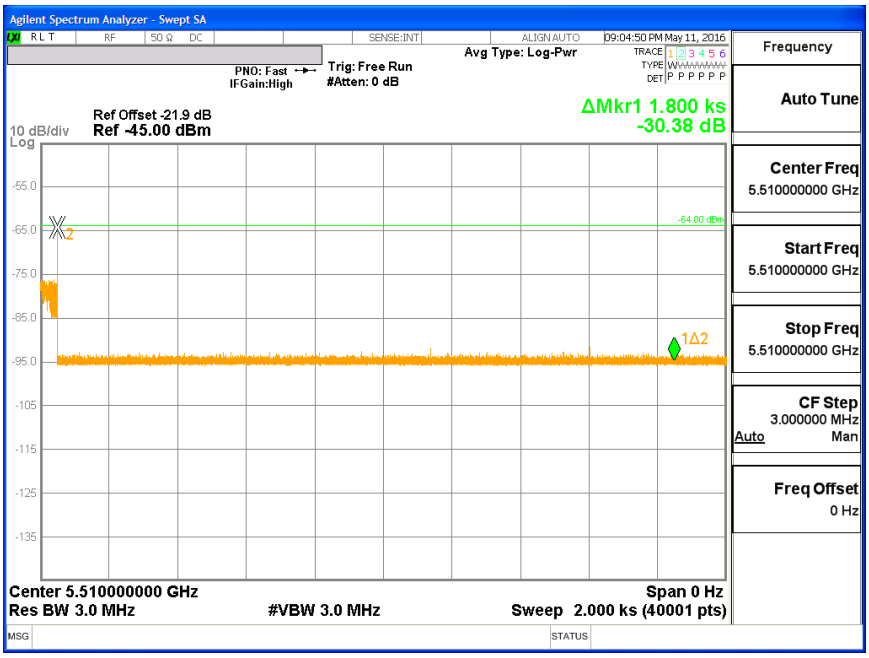
4.3.1. NON-OCCUPANCY PERIOD

RESULTS

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

NON-OCCUPANCY PERIOD



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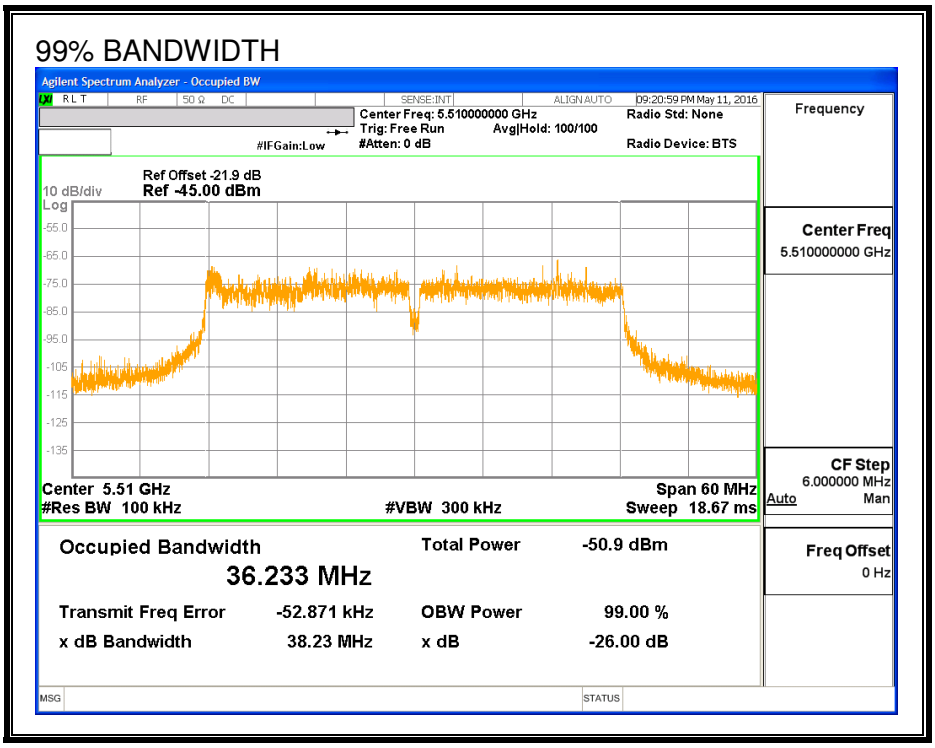
4.3.2. DETECTION BANDWIDTH

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	36.233	110.4	100

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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	

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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	96.67	60	Pass	5490	5530		
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5530		
FCC Short Pulse Type 3	30	93.33	60	Pass	5490	5530		
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5530		
Aggregate		94.17	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		

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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	918	58	A	5510	Yes
1003	1	638	83	A	5510	Yes
1004	1	758	70	A	5510	Yes
1005	1	738	72	A	5510	Yes
1006	1	878	61	A	5510	Yes
1007	1	858	62	A	5510	Yes
1008	1	818	65	A	5510	Yes
1009	1	838	63	A	5510	Yes
1010	1	658	81	A	5510	Yes
1011	1	898	59	A	5510	Yes
1012	1	558	95	A	5510	Yes
1013	1	518	102	A	5510	Yes
1014	1	778	68	A	5510	Yes
1015	1	678	78	A	5510	Yes
1016	1	2488	22	B	5510	Yes
1017	1	1378	39	B	5510	Yes
1018	1	1270	42	B	5510	Yes
1019	1	2838	19	B	5510	Yes
1020	1	2858	19	B	5510	Yes
1021	1	2008	27	B	5510	Yes
1022	1	964	55	B	5510	No
1023	1	1596	34	B	5510	Yes
1024	1	681	78	B	5510	Yes
1025	1	1443	37	B	5510	Yes
1026	1	2902	19	B	5510	Yes
1027	1	1052	51	B	5510	Yes
1028	1	1705	31	B	5510	Yes
1029	1	1661	32	B	5510	Yes
1030	1	1423	38	B	5510	Yes

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TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.5	208	29	5510	Yes
2002	4.7	169	24	5510	Yes
2003	1.5	163	23	5510	Yes
2004	4	172	29	5510	Yes
2005	3.2	170	25	5510	Yes
2006	3.9	183	25	5510	No
2007	1.1	228	25	5510	No
2008	4.3	165	28	5510	Yes
2009	3.9	176	25	5510	Yes
2010	5	197	28	5510	Yes
2011	2.9	212	26	5510	Yes
2012	2.4	200	26	5510	Yes
2013	4.6	219	28	5510	Yes
2014	4.2	211	25	5510	Yes
2015	2.5	197	24	5510	Yes
2016	4.6	192	28	5510	Yes
2017	1.2	182	27	5510	Yes
2018	3.4	225	29	5510	Yes
2019	4.3	181	25	5510	Yes
2020	2.7	228	27	5510	Yes
2021	1.9	188	23	5510	Yes
2022	2.6	158	29	5510	Yes
2023	2	203	26	5510	Yes
2024	3	220	26	5510	Yes
2025	2.6	150	23	5510	Yes
2026	1.8	172	26	5510	Yes
2027	1.6	187	27	5510	Yes
2028	1.1	174	24	5510	Yes
2029	3.3	194	26	5510	Yes
2030	2.9	185	23	5510	Yes

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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	8	316	18	5510	Yes
3002	7.9	303	17	5510	Yes
3003	8.7	271	17	5510	Yes
3004	6.4	404	16	5510	Yes
3005	7.5	266	16	5510	No
3006	8.2	412	16	5510	Yes
3007	9.6	288	18	5510	Yes
3008	5.4	446	17	5510	Yes
3009	9.7	335	16	5510	Yes
3010	5.9	271	16	5510	Yes
3011	5.3	423	18	5510	Yes
3012	9.5	489	16	5510	Yes
3013	9.3	286	17	5510	Yes
3014	8.6	498	18	5510	Yes
3015	6.2	307	16	5510	No
3016	5.8	281	18	5510	Yes
3017	6.4	487	17	5510	Yes
3018	6.2	357	18	5510	Yes
3019	7.1	324	16	5510	Yes
3020	9.9	324	18	5510	Yes
3021	5.9	438	18	5510	Yes
3022	6.6	333	18	5510	Yes
3023	8	460	17	5510	Yes
3024	8.9	367	17	5510	Yes
3025	8.1	389	18	5510	Yes
3026	9.3	442	18	5510	Yes
3027	8.8	344	17	5510	Yes
3028	7.9	292	18	5510	Yes
3029	7.6	457	16	5510	Yes
3030	7	419	17	5510	Yes

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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	19.3	479	16	5510	Yes
4002	13.8	335	14	5510	Yes
4003	19.7	408	13	5510	Yes
4004	14.7	277	14	5510	Yes
4005	11	496	13	5510	Yes
4006	16.6	378	14	5510	Yes
4007	18.7	359	13	5510	Yes
4008	10	253	13	5510	Yes
4009	12.7	380	12	5510	Yes
4010	14.6	421	12	5510	Yes
4011	13	309	14	5510	No
4012	15.5	363	14	5510	Yes
4013	14.4	264	14	5510	Yes
4014	12.6	464	14	5510	Yes
4015	12.1	378	15	5510	Yes
4016	10.8	339	13	5510	Yes
4017	16.1	282	14	5510	Yes
4018	10.6	256	15	5510	Yes
4019	16.5	329	16	5510	Yes
4020	11.5	449	12	5510	Yes
4021	17.9	417	16	5510	Yes
4022	13.4	299	12	5510	Yes
4023	10.8	279	12	5510	Yes
4024	16.9	425	16	5510	Yes
4025	19.6	301	16	5510	Yes
4026	11.4	342	15	5510	Yes
4027	20	481	13	5510	Yes
4028	12.3	284	12	5510	Yes
4029	11.2	436	13	5510	Yes
4030	19.5	384	13	5510	No

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TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5

Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5503	Yes
2	5514	Yes
3	5507	Yes
4	5522	Yes
5	5505	Yes
6	5520	Yes
7	5520	Yes
8	5519	Yes
9	5496	Yes
10	5504	Yes
11	5513	Yes
12	5519	Yes
13	5515	Yes
14	5502	Yes
15	5503	Yes
16	5505	Yes
17	5520	Yes
18	5510	Yes
19	5506	Yes
20	5521	Yes
21	5496	Yes
22	5516	Yes
23	5515	Yes
24	5502	Yes
25	5514	Yes
26	5512	Yes
27	5498	Yes
28	5523	Yes
29	5514	Yes
30	5499	Yes

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

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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	58	5490	9	Yes
2	533	5491	7	Yes
3	1008	5492	6	Yes
4	1483	5493	12	Yes
5	1958	5494	13	Yes
6	2433	5495	8	Yes
7	2908	5496	7	Yes
8	3383	5497	7	Yes
9	3858	5498	10	Yes
10	4333	5499	8	Yes
11	4808	5500	9	Yes
12	5283	5501	8	Yes
13	5758	5502	9	Yes
14	6233	5503	11	Yes
15	6708	5504	8	Yes
16	7183	5505	8	Yes
17	7658	5506	9	Yes
18	8133	5507	6	Yes
19	8608	5508	5	Yes
20	9083	5509	12	Yes
21	9558	5510	10	Yes
22	10033	5511	9	Yes
23	10508	5512	6	Yes
24	10983	5513	6	Yes
25	11458	5514	8	Yes
26	11933	5515	11	Yes
27	12408	5516	8	Yes
28	12883	5517	8	Yes
29	13358	5518	15	Yes
30	13833	5519	7	Yes
31	14308	5520	10	Yes
32	14783	5521	6	Yes
33	15258	5522	11	Yes
34	15733	5523	8	Yes
35	16208	5524	10	Yes
36	16683	5525	6	Yes
37	17158	5526	9	Yes
38	17633	5527	10	Yes
39	18108	5528	8	Yes
40	18583	5529	9	Yes
41	19058	5530	7	Yes

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4.4. RESULTS FOR 80 MHz BANDWIDTH

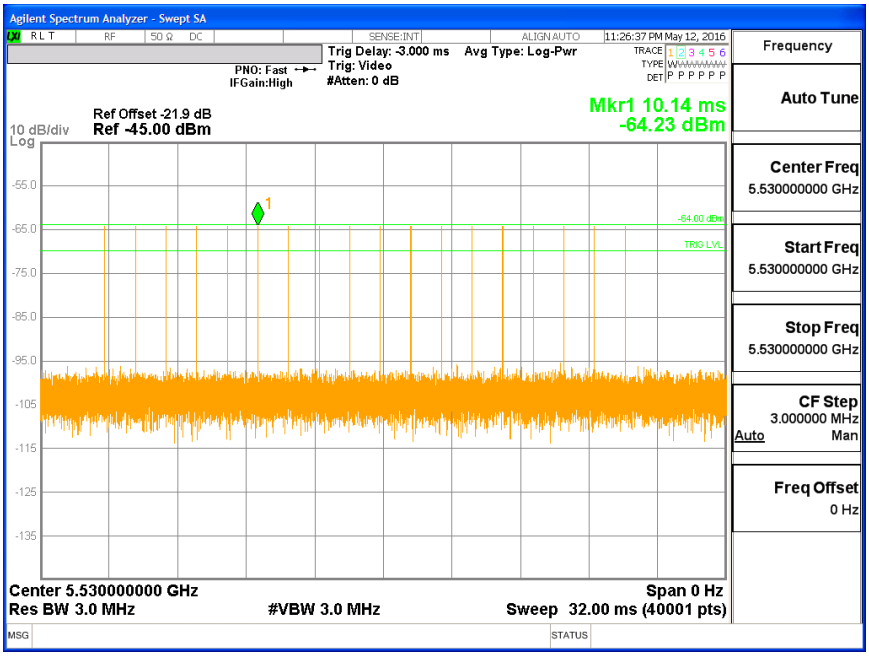
4.4.1. TEST CHANNEL

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



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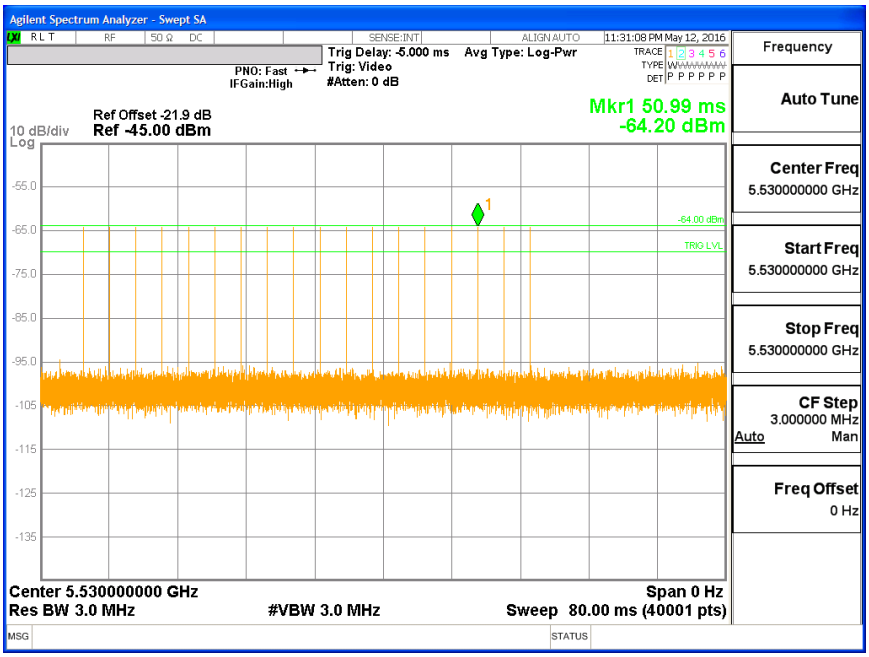
SAMPLE OF RADAR TYPE 1



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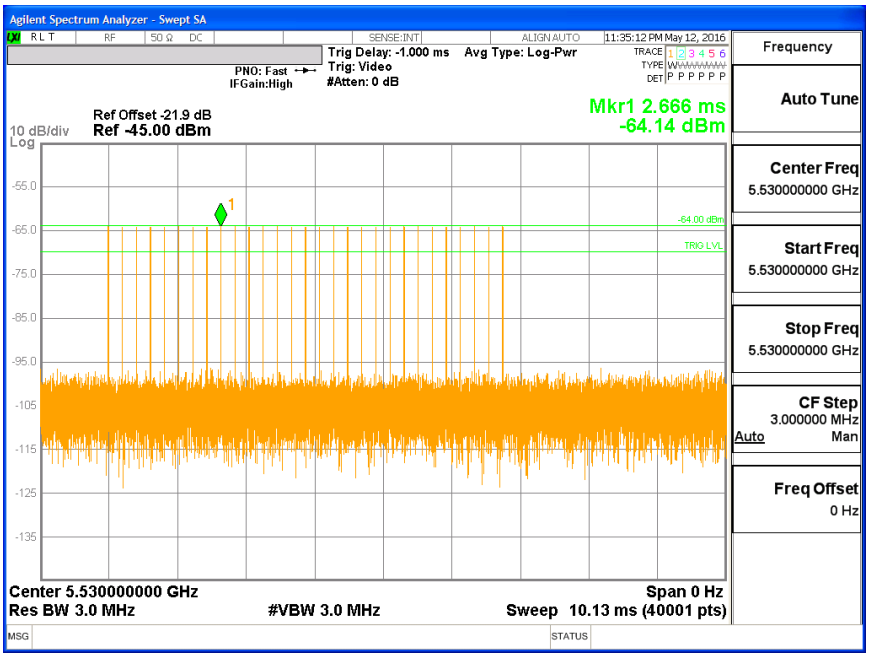
SAMPLE OF RADAR TYPE 2



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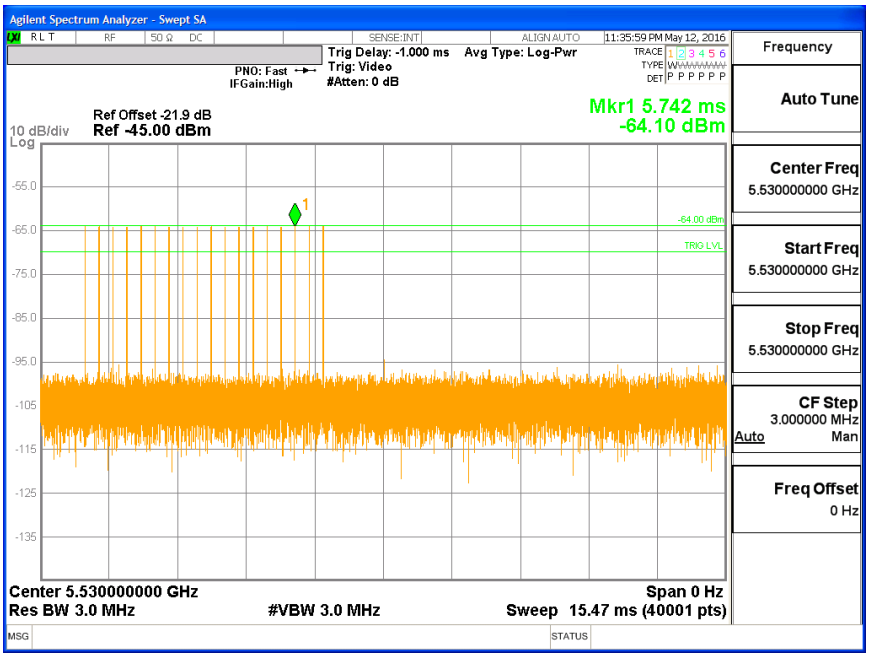
SAMPLE OF RADAR TYPE 3



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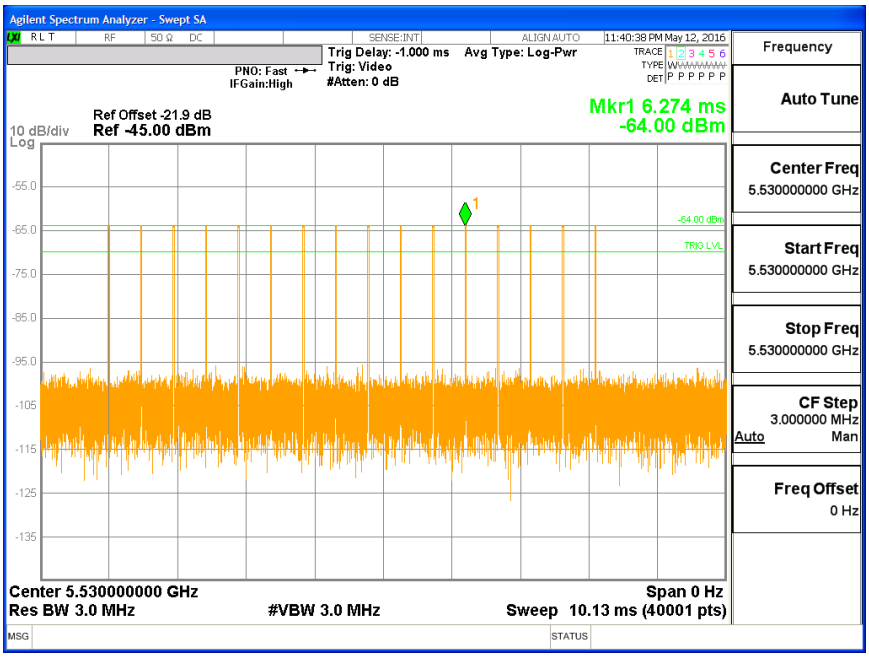
SAMPLE OF RADAR TYPE 4



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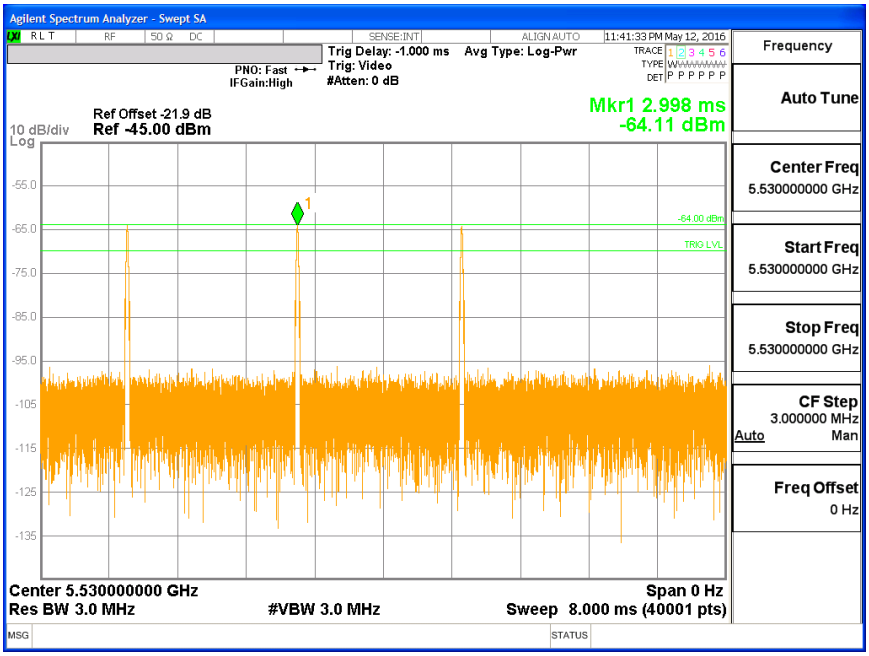
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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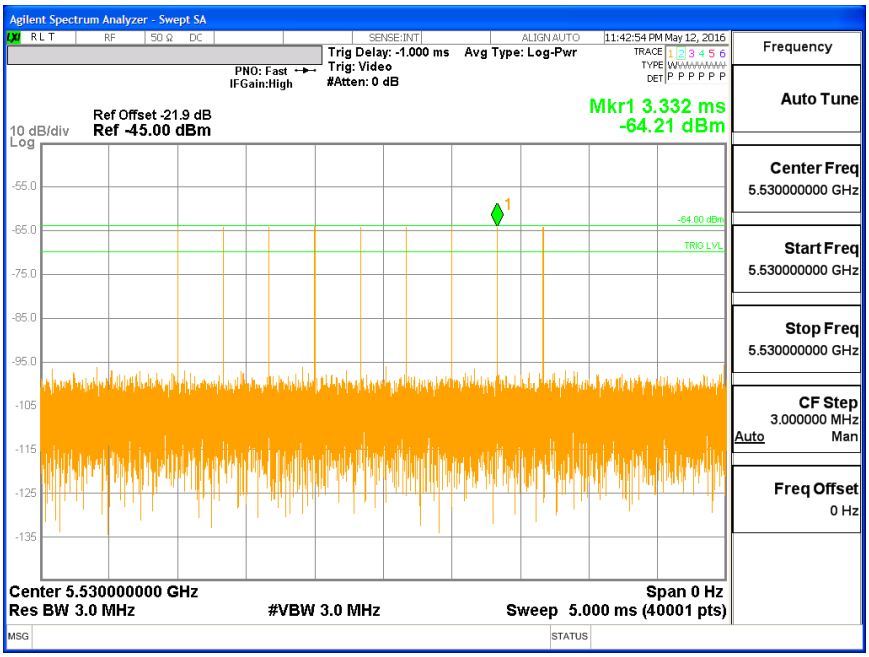
SINGLE BURST OF RADAR TYPE 6



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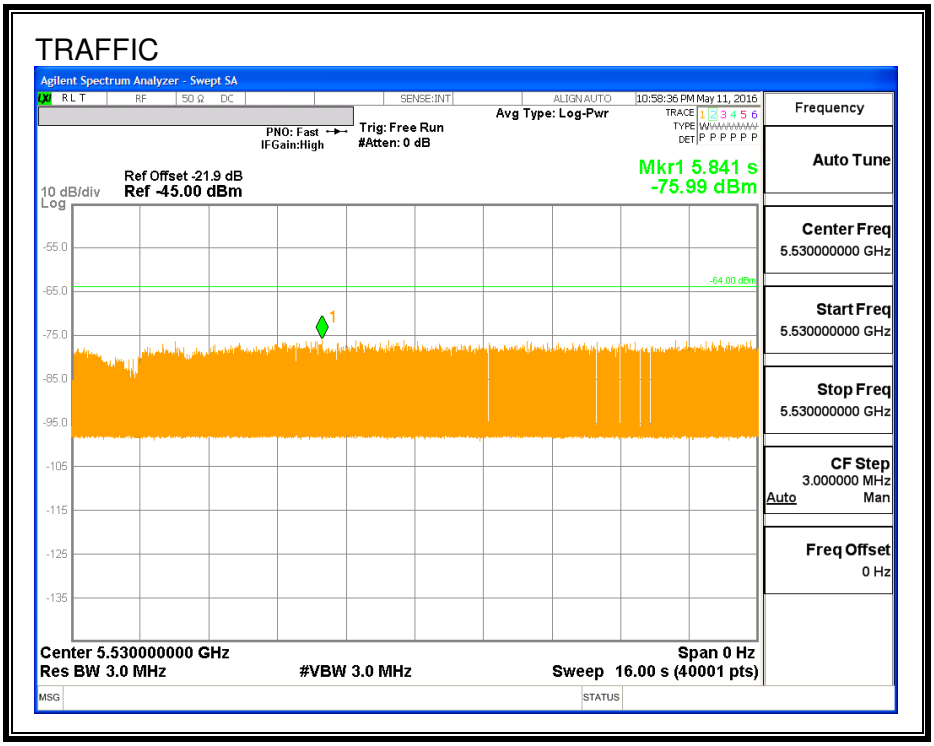
TRAFFIC



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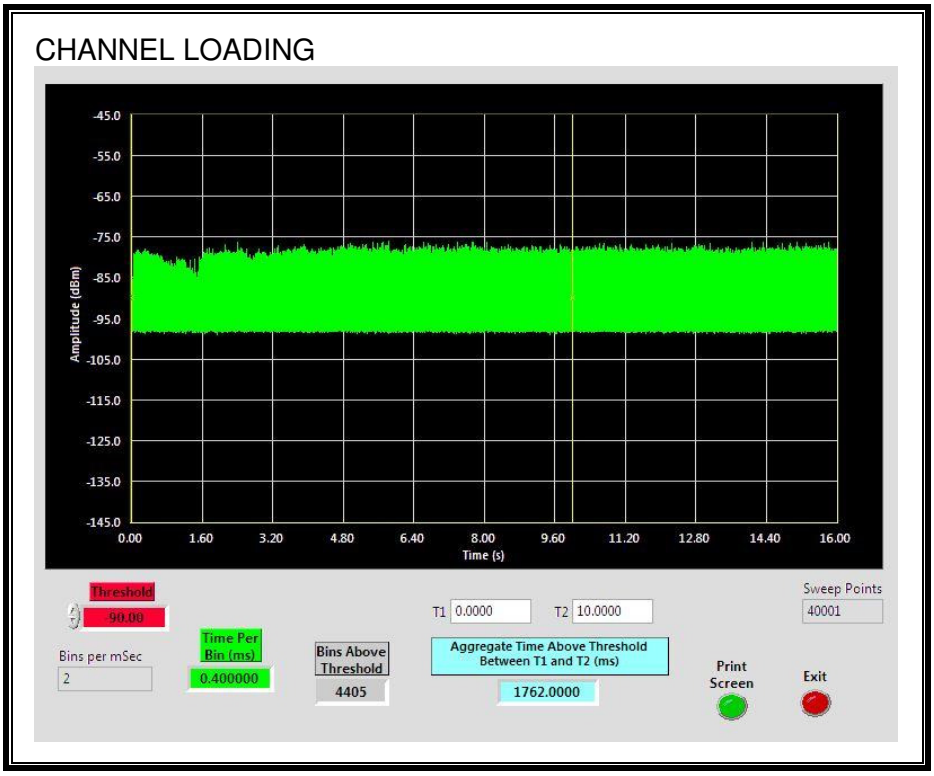
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.62%

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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.

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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)
30.2	185.5	155.3	95.3

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.13	126.4	96.3	1.0

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.06	184.4	154.3	59.0

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

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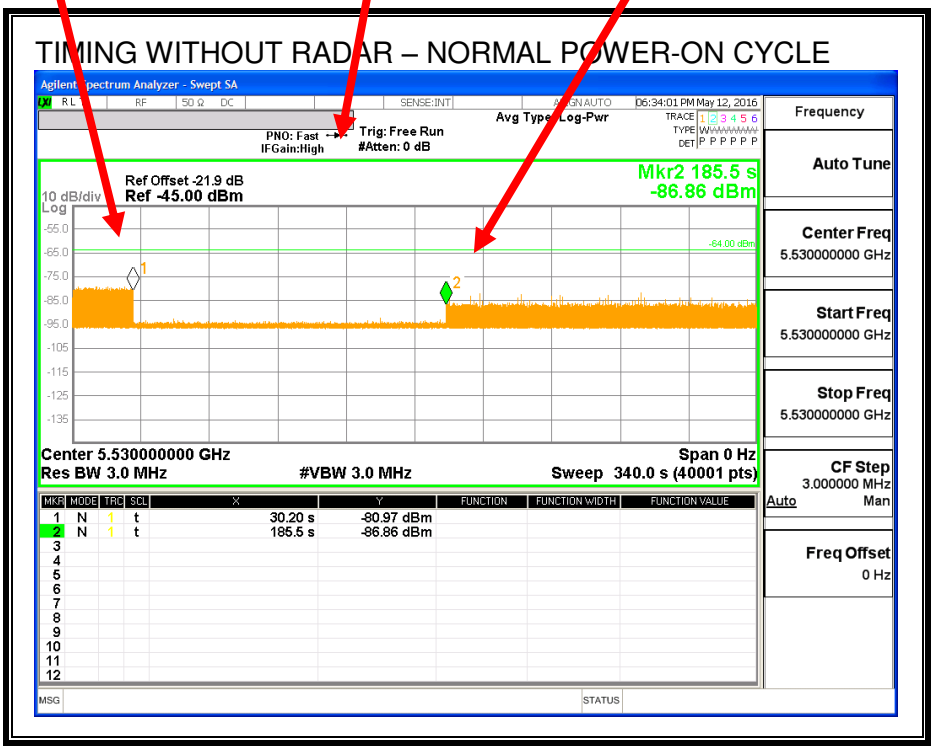
TIMING WITHOUT RADAR DURING CAC

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.

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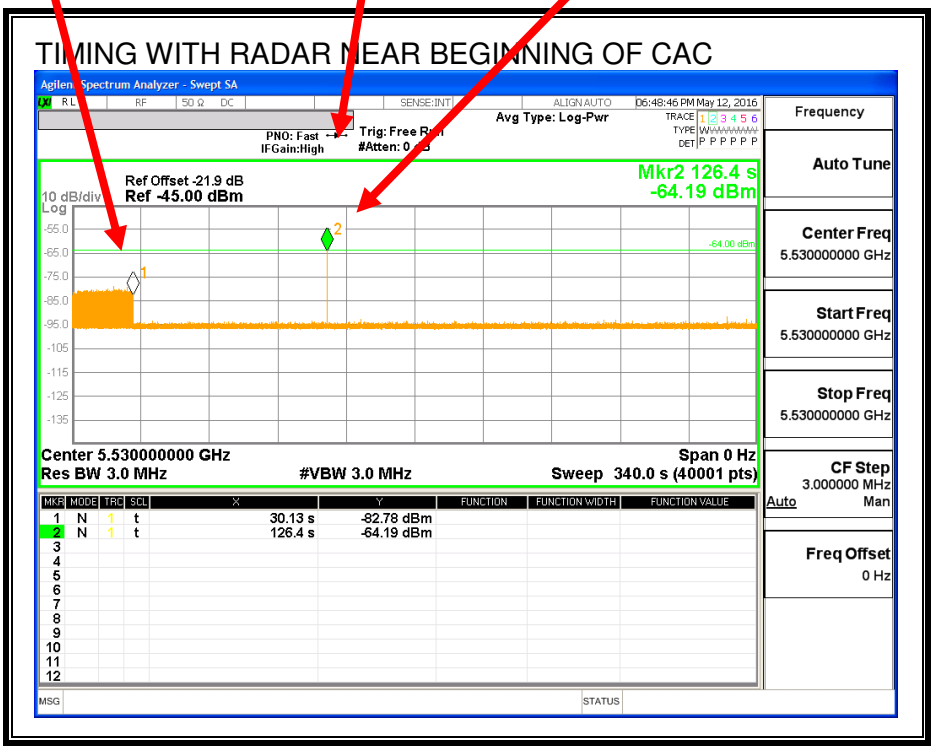
TIMING WITH RADAR NEAR BEGINNING OF CAC

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.

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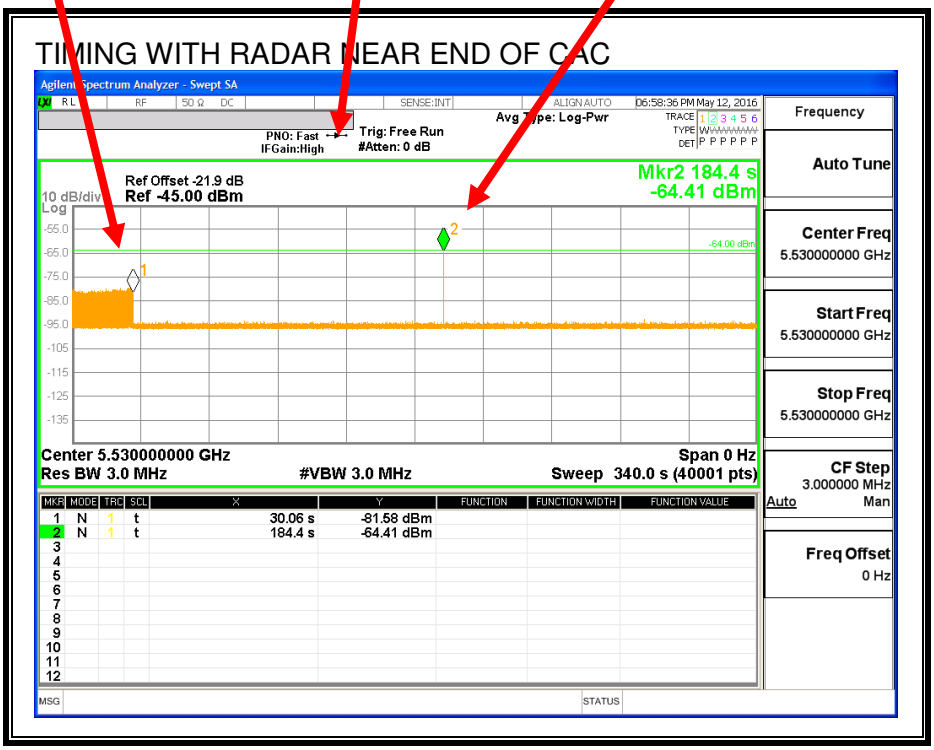
TIMING WITH RADAR NEAR END OF CAC

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.

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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

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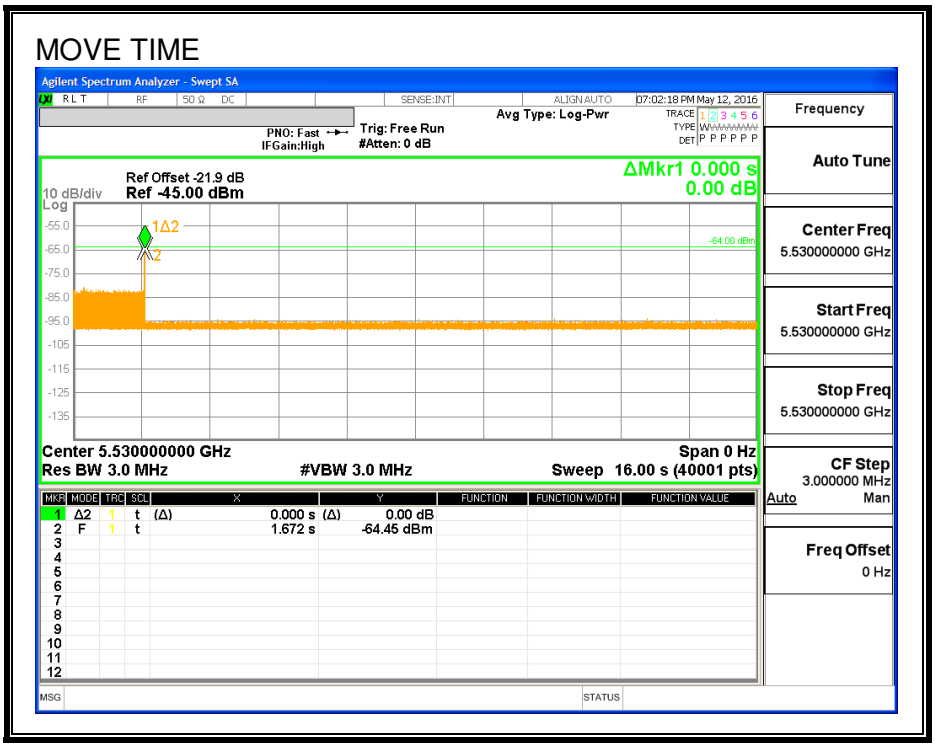
MOVE TIME



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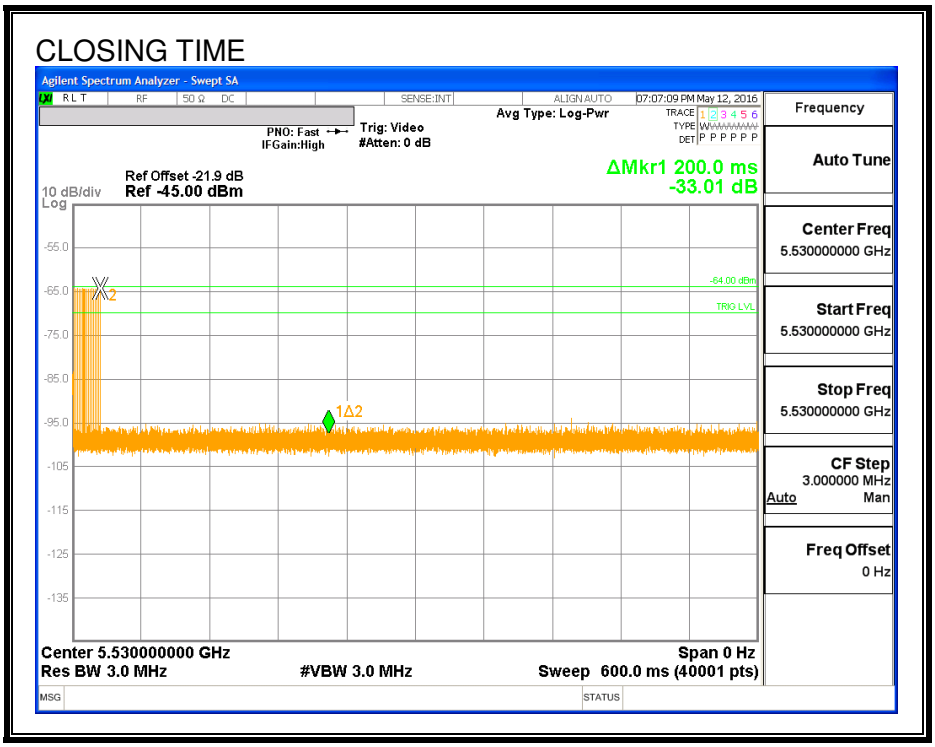
CHANNEL CLOSING TIME



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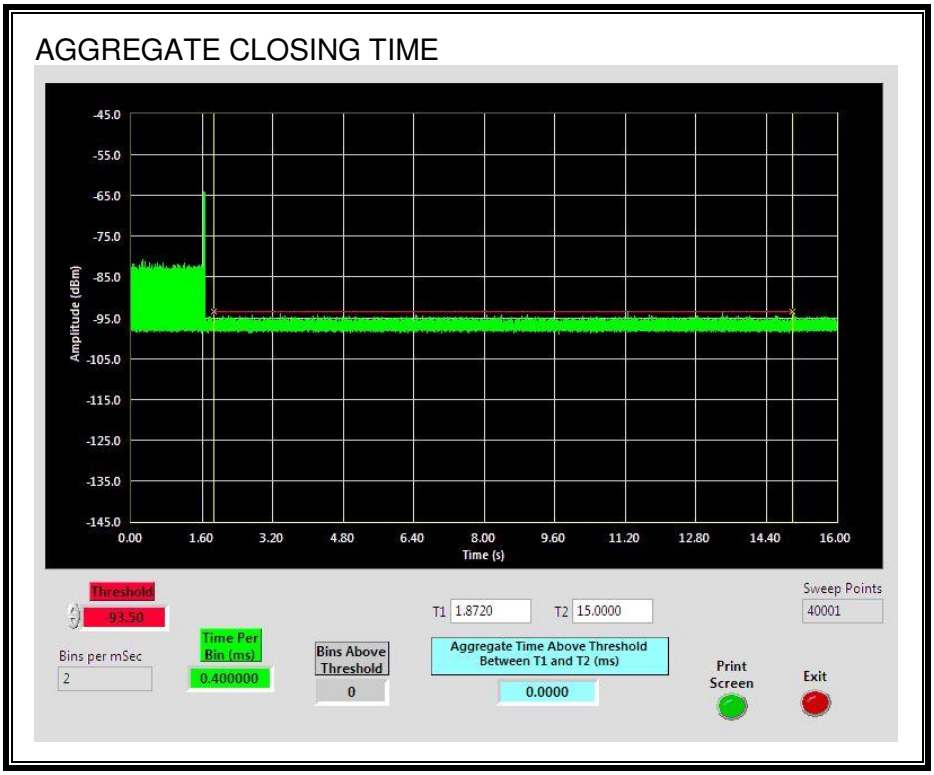
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.



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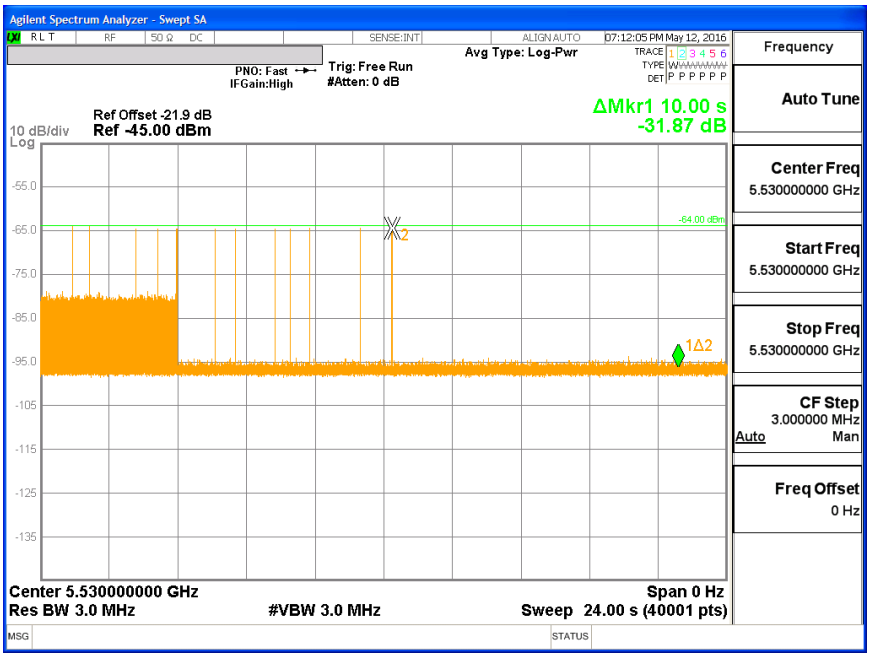
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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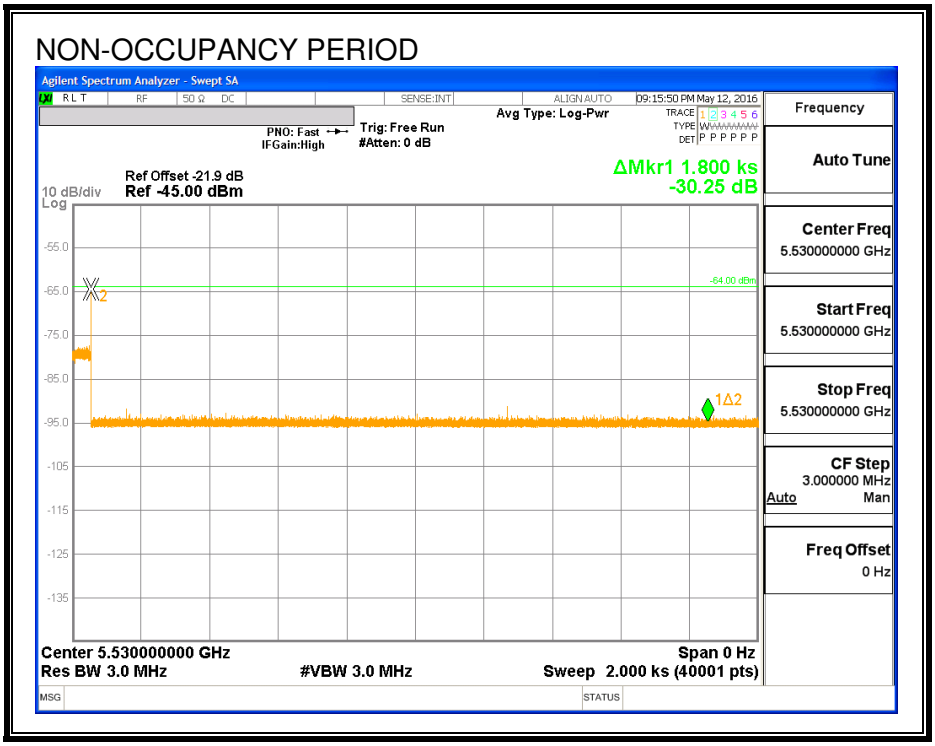
4.4.1. NON-OCCUPANCY PERIOD

RESULTS

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



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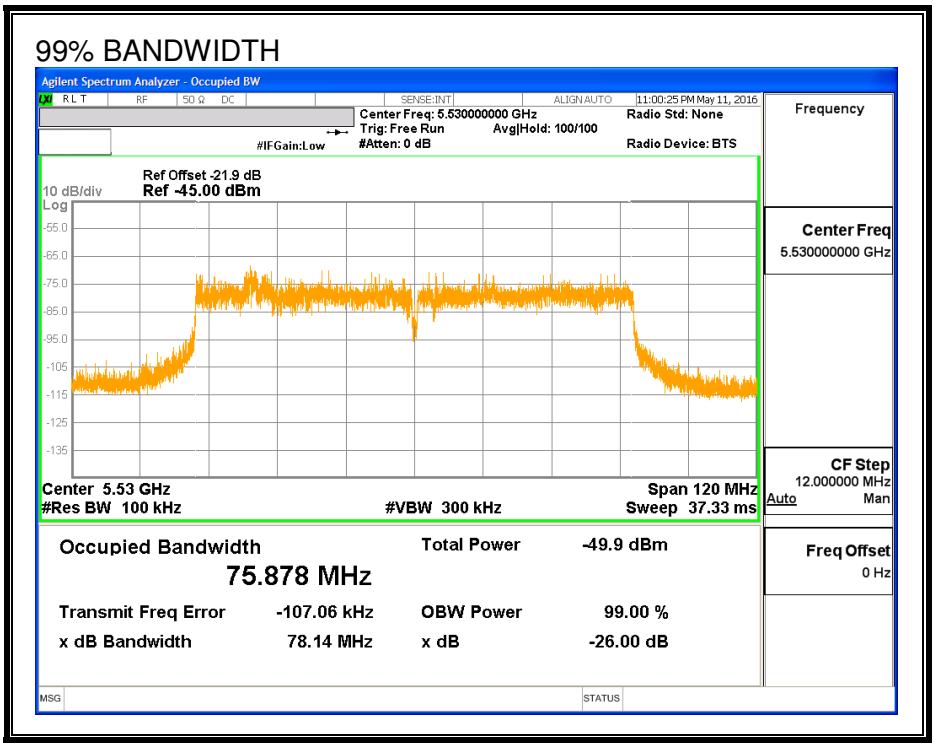
4.4.2. DETECTION BANDWIDTH

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	75.878	105.4	100

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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	30	27	90	
5560	10	10	100	
5565	10	10	100	
5570	10	10	100	FH
5571	10	0	0	

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4.4.3. 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	73.33	60	Pass	5490	5570		
FCC Short Pulse Type 3	30	80.00	60	Pass	5490	5570		
FCC Short Pulse Type 4	30	83.33	60	Pass	5490	5570		
Aggregate		84.17	80	Pass				
FCC Long Pulse Type 5	30	100.00	80	Pass	5490	5530	5494	5526
FCC Hopping Type 6	81	100.00	70	Pass	5490	5570		

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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	918	58	A	5530	Yes
1003	1	638	83	A	5530	Yes
1004	1	758	70	A	5530	Yes
1005	1	738	72	A	5530	Yes
1006	1	878	61	A	5530	Yes
1007	1	858	62	A	5530	Yes
1008	1	818	65	A	5530	Yes
1009	1	838	63	A	5530	Yes
1010	1	658	81	A	5530	Yes
1011	1	898	59	A	5530	Yes
1012	1	558	95	A	5530	Yes
1013	1	518	102	A	5530	Yes
1014	1	778	68	A	5530	Yes
1015	1	678	78	A	5530	Yes
1016	1	2488	22	B	5530	Yes
1017	1	1378	39	B	5530	Yes
1018	1	1270	42	B	5530	Yes
1019	1	2838	19	B	5530	Yes
1020	1	2858	19	B	5530	Yes
1021	1	2008	27	B	5530	Yes
1022	1	964	55	B	5530	Yes
1023	1	1596	34	B	5530	Yes
1024	1	681	78	B	5530	Yes
1025	1	1443	37	B	5530	Yes
1026	1	2902	19	B	5530	Yes
1027	1	1052	51	B	5530	Yes
1028	1	1705	31	B	5530	Yes
1029	1	1661	32	B	5530	Yes
1030	1	1423	38	B	5530	Yes

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TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2

Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Frequency (MHz)	Successful Detection (Yes/No)
2001	2.5	208	29	5530	Yes
2002	4.7	169	24	5530	No
2003	1.5	163	23	5530	Yes
2004	4	172	29	5530	No
2005	3.2	170	25	5530	No
2006	3.9	183	25	5530	Yes
2007	1.1	228	25	5530	Yes
2008	4.3	165	28	5530	Yes
2009	3.9	176	25	5530	No
2010	5	197	28	5530	No
2011	2.9	212	26	5530	Yes
2012	2.4	200	26	5530	Yes
2013	4.6	219	28	5530	No
2014	4.2	211	25	5530	Yes
2015	2.5	197	24	5530	Yes
2016	4.6	192	28	5530	Yes
2017	1.2	182	27	5530	Yes
2018	3.4	225	29	5530	No
2019	4.3	181	25	5530	Yes
2020	2.7	228	27	5530	Yes
2021	1.9	188	23	5530	Yes
2022	2.6	158	29	5530	Yes
2023	2	203	26	5530	Yes
2024	3	220	26	5530	Yes
2025	2.6	150	23	5530	Yes
2026	1.8	172	26	5530	Yes
2027	1.6	187	27	5530	Yes
2028	1.1	174	24	5530	No
2029	3.3	194	26	5530	Yes
2030	2.9	185	23	5530	Yes

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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	8	316	18	5530	Yes
3002	7.9	303	17	5530	Yes
3003	8.7	271	17	5530	No
3004	6.4	404	16	5530	Yes
3005	7.5	266	16	5530	Yes
3006	8.2	412	16	5530	Yes
3007	9.6	288	18	5530	Yes
3008	5.4	446	17	5530	No
3009	9.7	335	16	5530	Yes
3010	5.9	271	16	5530	No
3011	5.3	423	18	5530	No
3012	9.5	489	16	5530	Yes
3013	9.3	286	17	5530	Yes
3014	8.6	498	18	5530	Yes
3015	6.2	307	16	5530	Yes
3016	5.8	281	18	5530	Yes
3017	6.4	487	17	5530	Yes
3018	6.2	357	18	5530	Yes
3019	7.1	324	16	5530	No
3020	9.9	324	18	5530	Yes
3021	5.9	438	18	5530	Yes
3022	6.6	333	18	5530	No
3023	8	460	17	5530	Yes
3024	8.9	367	17	5530	Yes
3025	8.1	389	18	5530	Yes
3026	9.3	442	18	5530	Yes
3027	8.8	344	17	5530	Yes
3028	7.9	292	18	5530	Yes
3029	7.6	457	16	5530	Yes
3030	7	419	17	5530	Yes

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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	19.3	479	16	5530	Yes
4002	13.8	335	14	5530	Yes
4003	19.7	408	13	5530	No
4004	14.7	277	14	5530	Yes
4005	11	496	13	5530	Yes
4006	16.6	378	14	5530	Yes
4007	18.7	359	13	5530	Yes
4008	10	253	13	5530	Yes
4009	12.7	380	12	5530	No
4010	14.6	421	12	5530	No
4011	13	309	14	5530	Yes
4012	15.5	363	14	5530	Yes
4013	14.4	264	14	5530	Yes
4014	12.6	464	14	5530	Yes
4015	12.1	378	15	5530	Yes
4016	10.8	339	13	5530	Yes
4017	16.1	282	14	5530	Yes
4018	10.6	256	15	5530	Yes
4019	16.5	329	16	5530	Yes
4020	11.5	449	12	5530	Yes
4021	17.9	417	16	5530	Yes
4022	13.4	299	12	5530	Yes
4023	10.8	279	12	5530	Yes
4024	16.9	425	16	5530	Yes
4025	19.6	301	16	5530	Yes
4026	11.4	342	15	5530	Yes
4027	20	481	13	5530	Yes
4028	12.3	284	12	5530	No
4029	11.2	436	13	5530	No
4030	19.5	384	13	5530	Yes

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TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5

Trial	Frequency (MHz)	Successful Detection (Yes/No)
1	5496	Yes
2	5519	Yes
3	5503	Yes
4	5503	Yes
5	5523	Yes
6	5505	Yes
7	5523	Yes
8	5507	Yes
9	5526	Yes
10	5503	Yes
11	5521	Yes
12	5510	Yes
13	5511	Yes
14	5499	Yes
15	5500	Yes
16	5504	Yes
17	5502	Yes
18	5512	Yes
19	5524	Yes
20	5524	Yes
21	5510	Yes
22	5501	Yes
23	5505	Yes
24	5506	Yes
25	5516	Yes
26	5498	Yes
27	5511	Yes
28	5516	Yes
29	5497	Yes
30	5513	Yes

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

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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	52	5490	18	Yes
2	527	5491	18	Yes
3	1002	5492	17	Yes
4	1477	5493	20	Yes
5	1952	5494	23	Yes
6	2427	5495	17	Yes
7	2902	5496	17	Yes
8	3377	5497	21	Yes
9	3852	5498	21	Yes
10	4327	5499	13	Yes
11	4802	5500	18	Yes
12	5277	5501	18	Yes
13	5752	5502	21	Yes
14	6227	5503	23	Yes
15	6702	5504	12	Yes
16	7177	5505	16	Yes
17	7652	5506	15	Yes
18	8127	5507	18	Yes
19	8602	5508	12	Yes
20	9077	5509	16	Yes
21	9552	5510	19	Yes
22	10027	5511	19	Yes
23	10502	5512	15	Yes
24	10977	5513	16	Yes
25	11452	5514	18	Yes
26	11927	5515	16	Yes
27	12402	5516	14	Yes
28	12877	5517	18	Yes
29	13352	5518	25	Yes
30	13827	5519	16	Yes
31	14302	5520	14	Yes
32	14777	5521	14	Yes
33	15252	5522	19	Yes
34	15727	5523	20	Yes
35	16202	5524	16	Yes
36	16677	5525	16	Yes
37	17152	5526	19	Yes
38	17627	5527	17	Yes
39	18102	5528	15	Yes

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TYPE 6 DETECTION PROBABILITY (CONTINUED)

40	18577	5529	19	Yes
41	19052	5530	13	Yes
42	19527	5531	19	Yes
43	20002	5532	13	Yes
44	20477	5533	23	Yes
45	20952	5534	19	Yes
46	21427	5535	18	Yes
47	21902	5536	22	Yes
48	22377	5537	9	Yes
49	22852	5538	16	Yes
50	23327	5539	18	Yes
51	23802	5540	21	Yes
52	24277	5541	24	Yes
53	24752	5542	17	Yes
54	25227	5543	14	Yes
55	25702	5544	14	Yes
56	26177	5545	15	Yes
57	26652	5546	15	Yes
58	27127	5547	18	Yes
59	27602	5548	16	Yes
60	28077	5549	14	Yes
61	28552	5550	15	Yes
62	29027	5551	12	Yes
63	29502	5552	19	Yes
64	29977	5553	17	Yes
65	30452	5554	14	Yes
66	30927	5555	14	Yes
67	31402	5556	23	Yes
68	31877	5557	17	Yes
69	32352	5558	15	Yes
70	32827	5559	12	Yes
71	33302	5560	16	Yes
72	33777	5561	19	Yes
73	34252	5562	18	Yes
74	34727	5563	10	Yes
75	35202	5564	15	Yes
76	35677	5565	13	Yes
77	36152	5566	16	Yes
78	36627	5567	16	Yes
79	37102	5568	19	Yes
80	37577	5569	17	Yes
81	38052	5570	17	Yes

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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.

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