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

CERTIFICATION TEST REPORT

FOR

CDRDB RADIO 3

MODEL NUMBER: AP-8533 (RADIO 3)

FCC ID: UZ7CDRDB
IC: 109AN-CDRDB

REPORT NUMBER: 15U22444-E5V1

ISSUE DATE: FEBRUARY 19, 2016

Prepared for
ZEBRA TECHNOLOGIES CORP.
6480 VIA DEL ORO DR.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	02/19/15	Initial Issue	C. Cheung

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ZEBRA TECHNOLOGIES CORP.
6480 VIA DEL ORO DR.
SAN JOSE, CA 95119, U.S.A.

EUT DESCRIPTION: CDRDB RADIO3

MODEL: AP-8533 (RADIO 3)

SERIAL NUMBER: 15285522200194

DATE TESTED: JANUARY 11, 2016 – JANUARY 26, 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.

Approved & Released For
UL Verification Services Inc. By:

CONAN CHEUNG
PROJECT LEAD
UL Verification Services Inc.

Tested By:

HENRY LAU
EMC ENGINEER
UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the DFS portion of FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, KDB 905462 D02 and D03, ANSI C63.10-2013, RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services, Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

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5. DYNAMIC FREQUENCY SELECTION

5.1. OVERVIEW

5.1.1. LIMITS

INDUSTRY CANADA

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

RSS-247 Issue 1

Note: For the band 5600–5650 MHz, no operation is permitted.

Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.

FCC

§15.407 (h), FCC KDB 905462 D02 “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION” and KDB 905462 D03 “U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY”.

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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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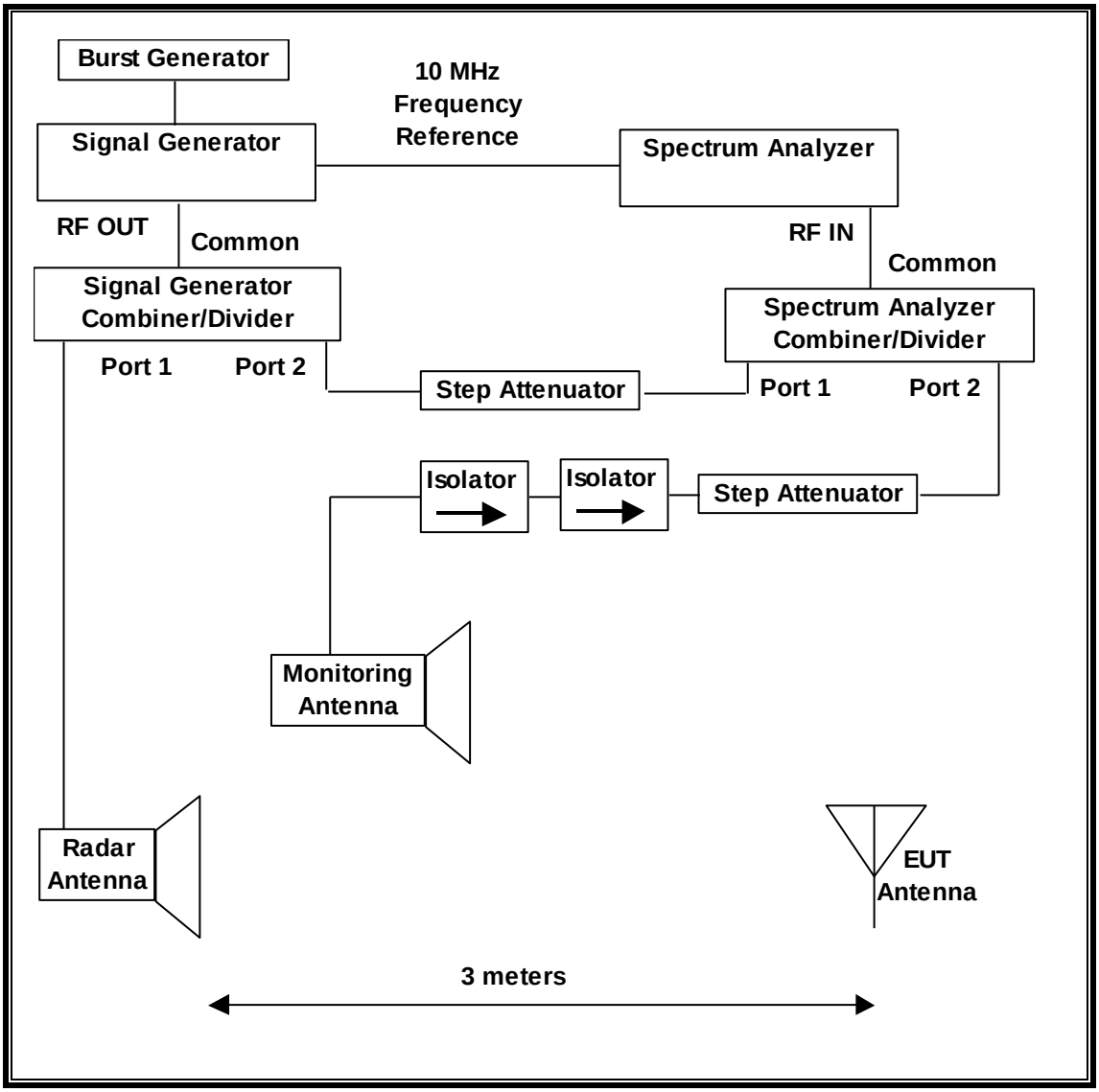
5.1.2. TEST AND MEASUREMENT SYSTEM

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	02/17/16
Arbitrary Waveform Generator	Agilent / HP	33220A	MY44037572	04/08/16

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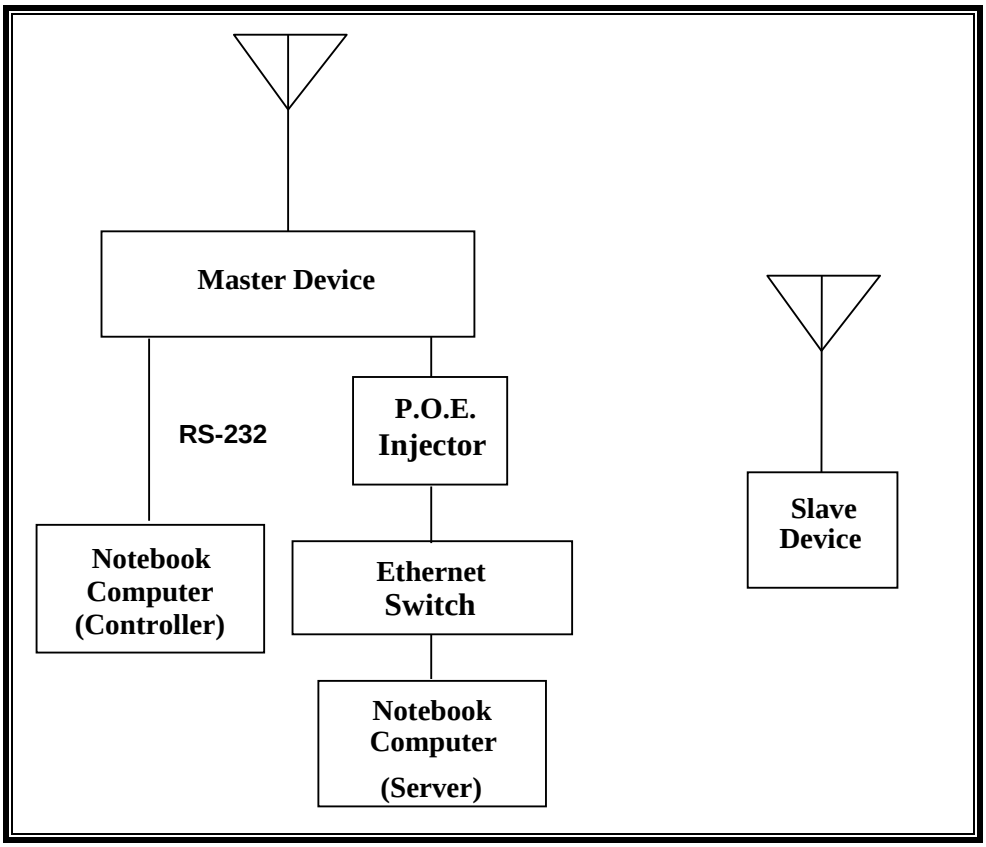
5.1.3. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP

CONFIGURATION 1: 20 MHz and 40 MHz CHANNEL BANDWIDTH



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**
Gigabit P.O.E. Injector	Motorola	PD-7001G	D083164410001A4A01	DoC
Notebook PC (Server)	HP	Elitebook 8470p	CNU251B4RR	DoC
AC Adapter (Server PC)	Lite On Technology	PA-1900-32HT	WBGTK0A1RYQ6IO	DoC
Notebook PC (Controller)	HP	Elitebook 8460p	CNU2032CKJ	DoC
AC Adapter (Controller PC)	Lite On Technology	PA-1650-32HU	WCNXA0C3U3SEGF	DoC
Notebook PC (Slave)	HP	Elitebook 8470p	CNU25193C2	PD962205ANH
AC Adapter (Slave PC)	Lite On Technology	PA-1650-32HU	WCNXA0C4L3QDDL	DoC
Ethernet Switch	D-Link	DGS-100BG	AB202C2006577	DoC
AC Adapter (Switch)	D-Link	AMS47-0501000FU	12020317793	DoC

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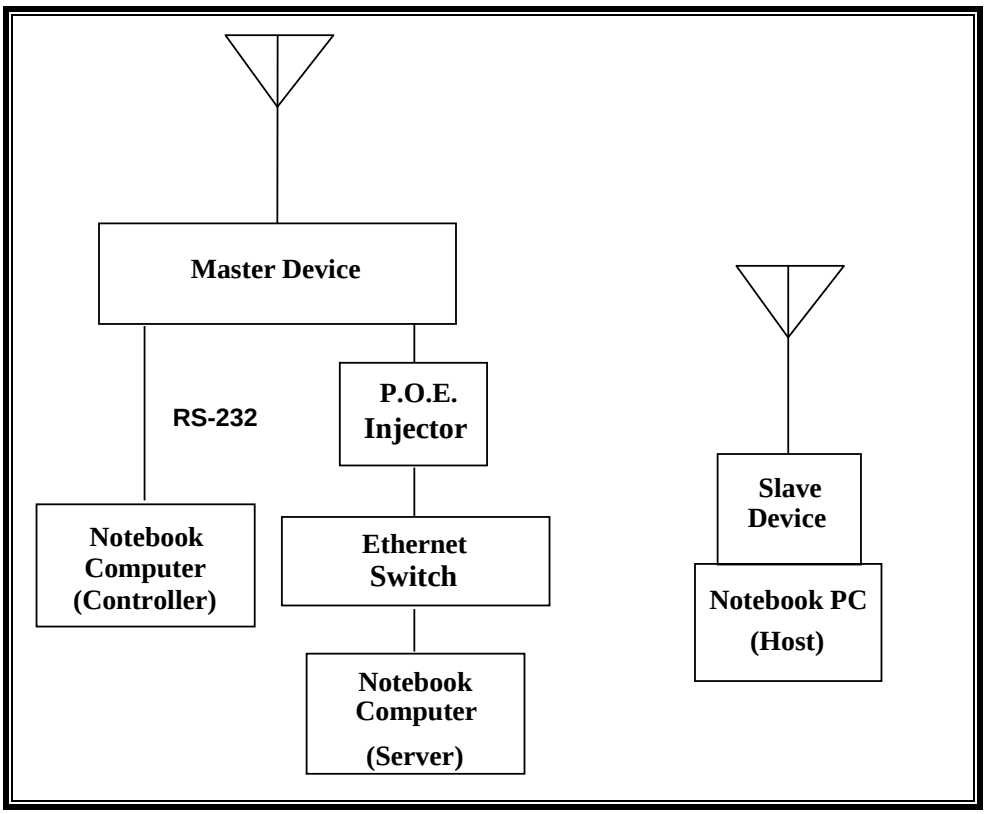
CONFIGURATION 2: 80 MHz CHANNEL BANDWIDTH



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**
Gigabit P.O.E. Injector	Motorola	PD-7001G	D083164410001A4A01	DoC
Notebook PC (Server)	HP	Elitebook 8470p	CNU251B4RR	DoC
AC Adapter (Server PC)	Lite On Technology	PA-1900-32HT	WBGTK0A1RYQ6IO	DoC
Notebook PC (Controller)	HP	Elitebook 8460p	CNU2032CKJ	DoC
AC Adapter (Controller PC)	Lite On Technology	PA-1650-32HU	WCNXA0C3U3SEGF	DoC
802.11ac USB Converter (Slave)	Cisco	AE6000	12R10602307395	Q87-AE6000
Notebook PC (Slave Host)	HP	Elitebook 8470p	CNU25193C2	PD962205ANH
AC Adapter (Host PC)	Lite On Technology	PA-1650-32HU	WCNXA0C4L3QDDL	DoC
Ethernet Switch	D-Link	DGS-100BG	AB202C2006577	DoC
AC Adapter (Switch)	D-Link	AMS47-0501000FU	12020317793	DoC

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5.1.4. DESCRIPTION OF EUT

For FCC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

For IC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding the 5600-5650 MHz range.

The EUT is a Master Device.

The EUT can be configured as a Master Device or a Slave Device without Radar Detection.

The highest power level within these bands is 29.99dBm EIRP in the 5250-5350 MHz band and 29.99dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 5.9dBi in the 5250-5350 MHz band and 5.9dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 5.4dBi in the 5250-5350 MHz band and 5.4dBi in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 5.9dBi.

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, each connected to an antenna to perform radiated tests.

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

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

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

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

The software installed in the EUT is AP8533 version 5.8.3.0-232839X.

UNIFORM CHANNEL SPREADING

This function is not required per KDB 905462.

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5.2. RESULTS FOR 20 MHz BANDWIDTH

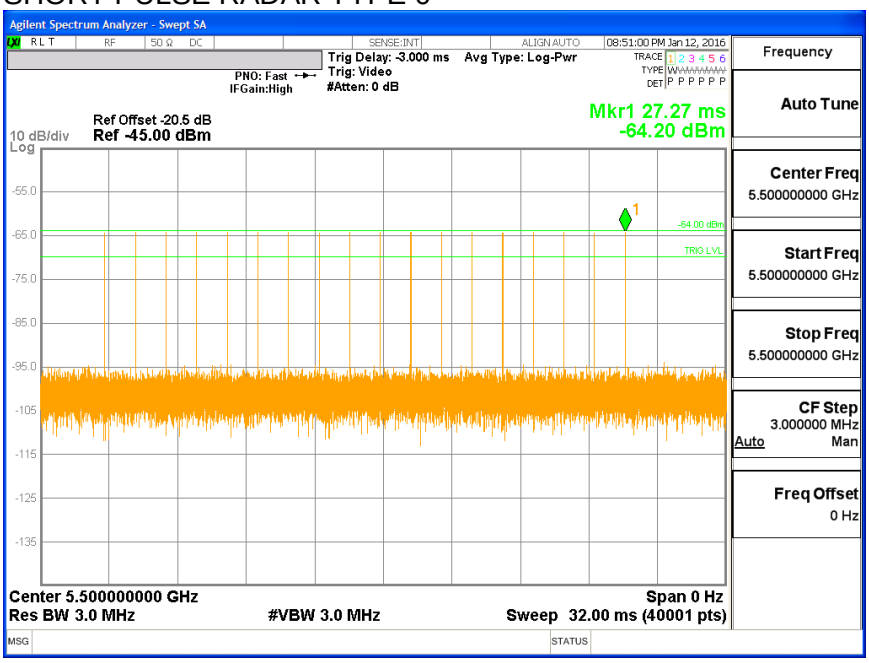
5.2.1. TEST CHANNEL

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

5.2.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

SHORT PULSE RADAR TYPE 0



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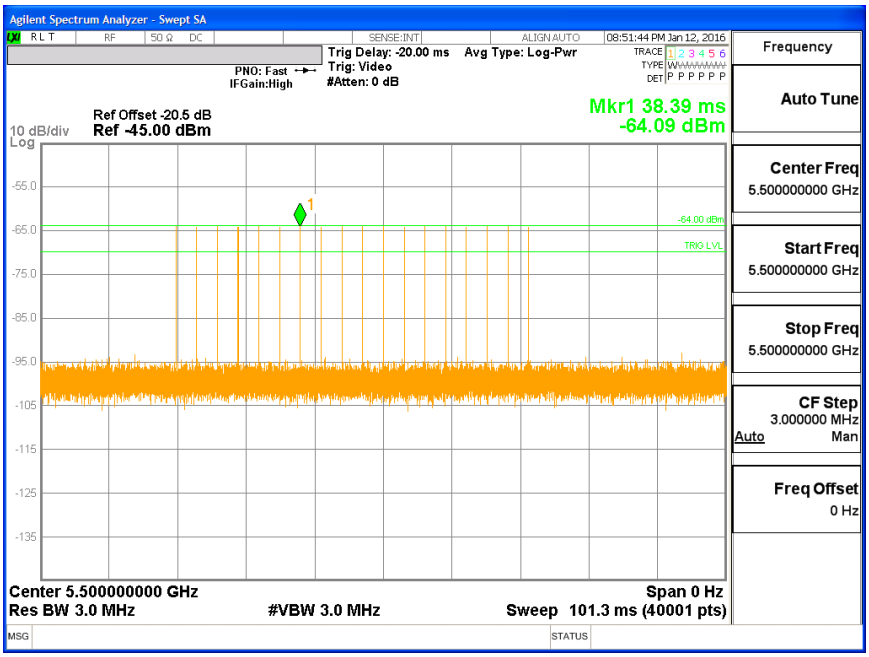
SAMPLE OF RADAR TYPE 1



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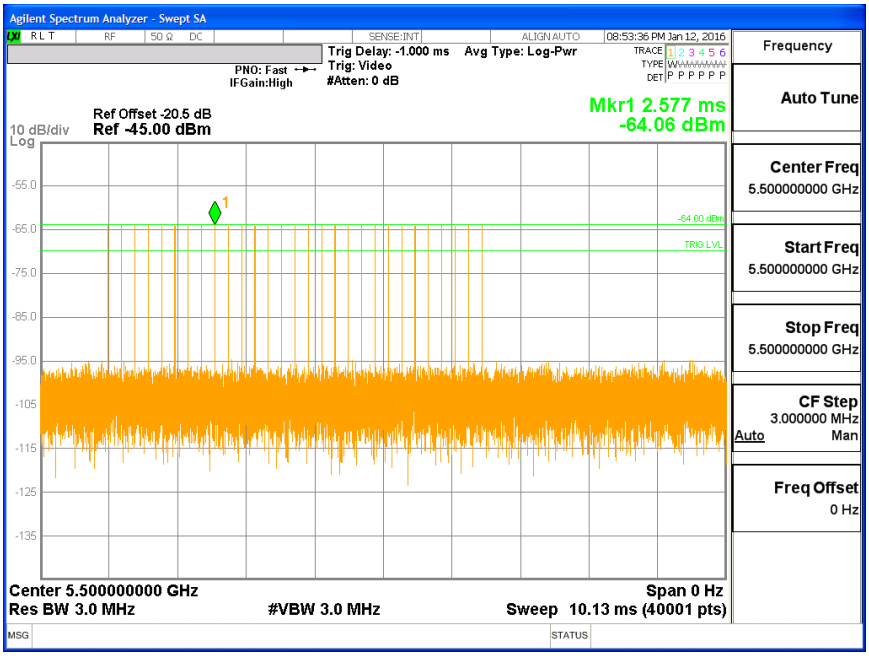
SAMPLE OF RADAR TYPE 2



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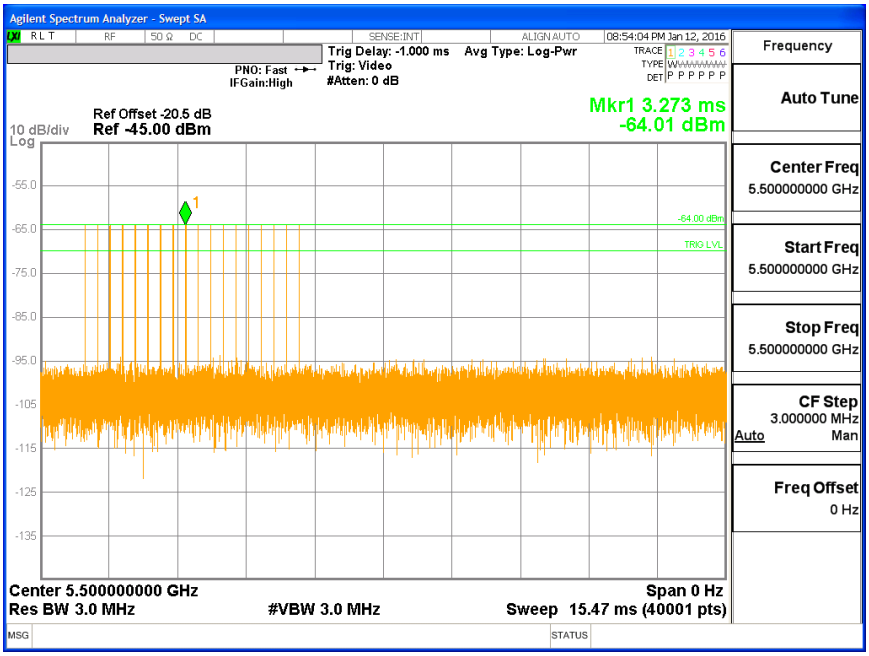
SAMPLE OF RADAR TYPE 3



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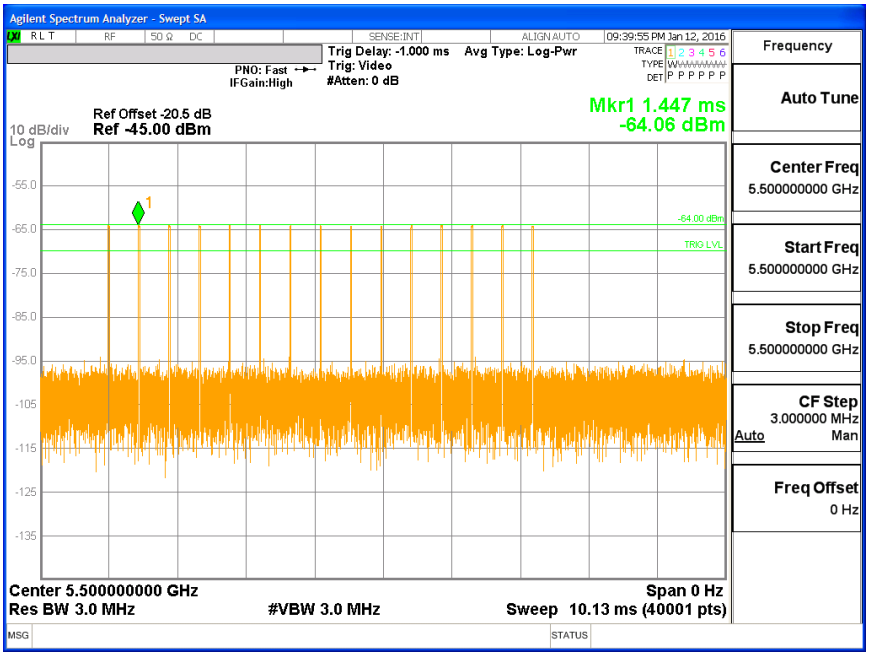
SAMPLE OF RADAR TYPE 4



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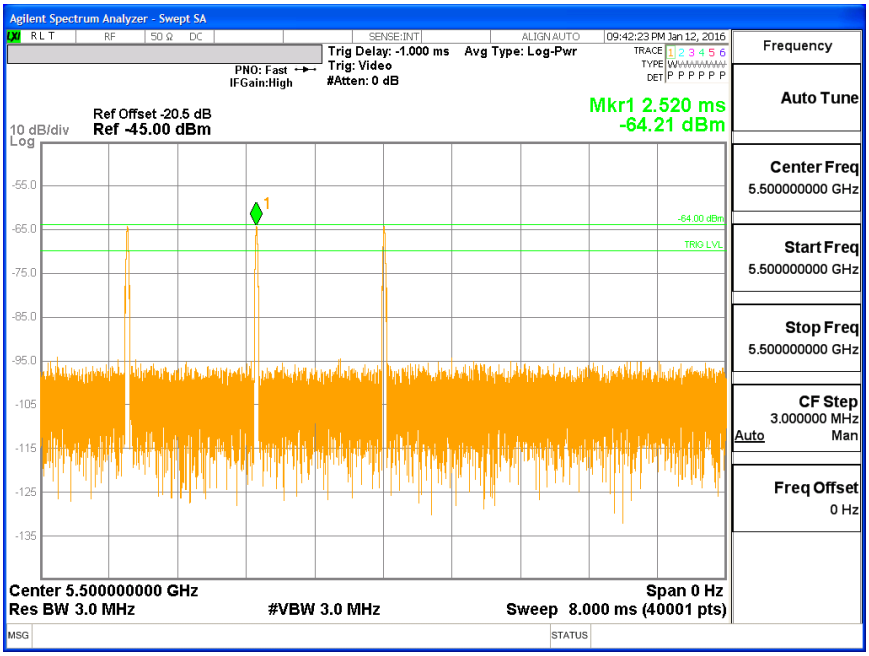
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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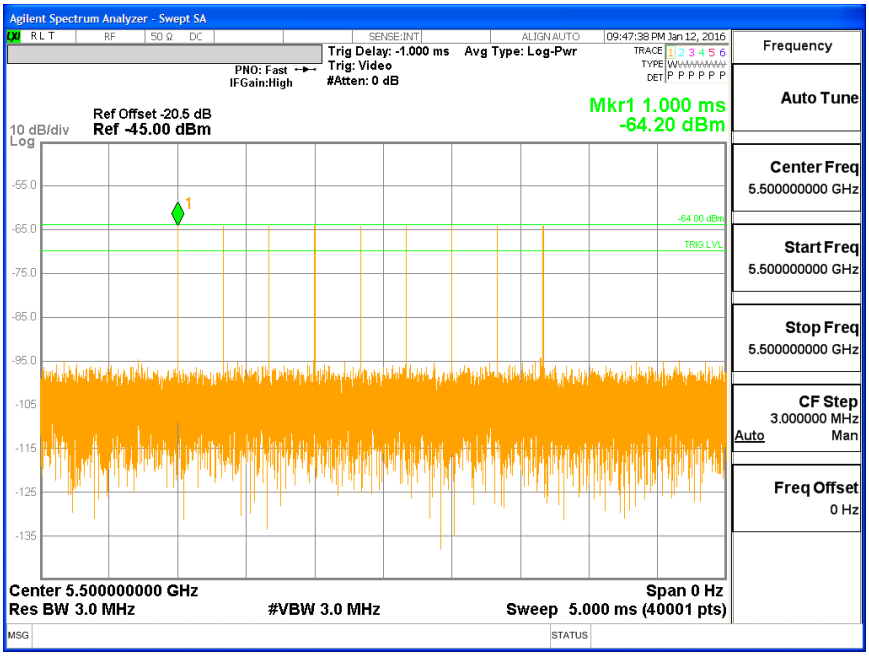
SINGLE BURST OF RADAR TYPE 6



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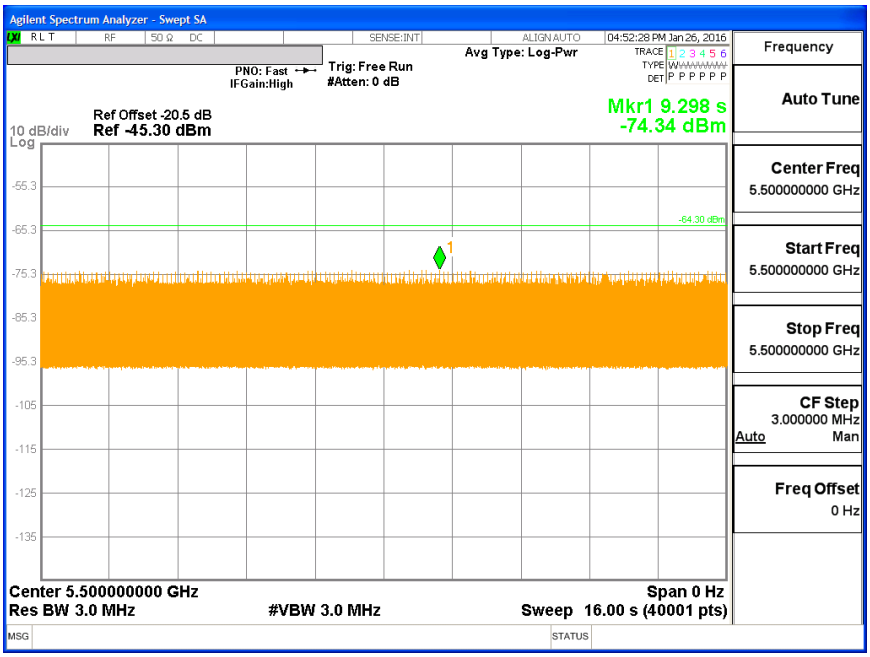
TRAFFIC

TRAFFIC



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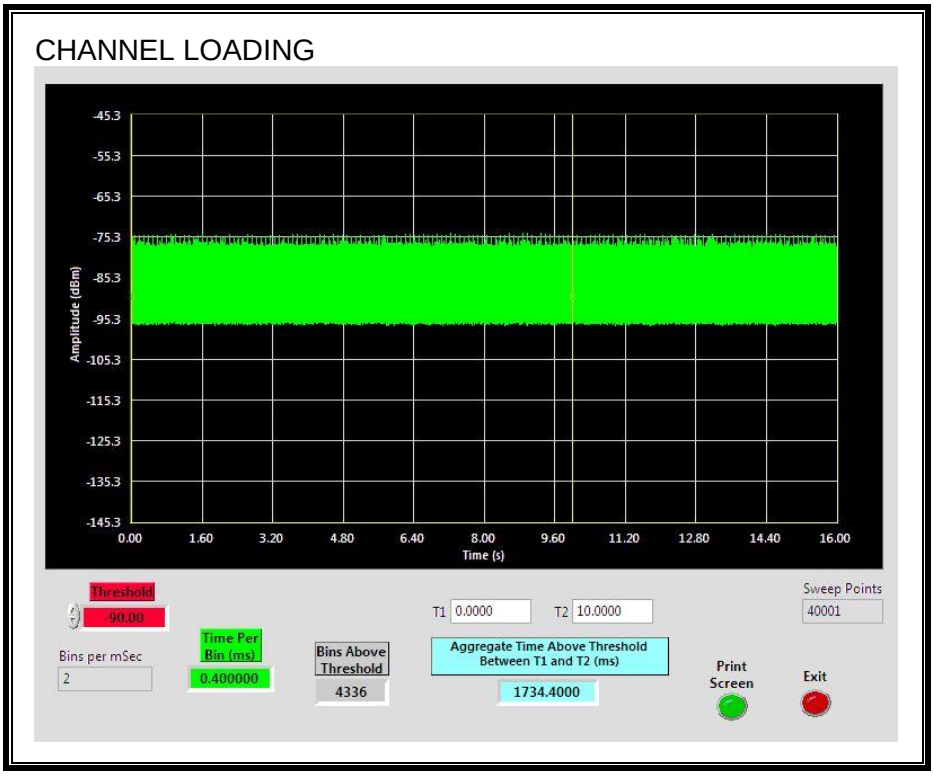
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 17.344%

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5.2.1. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5500 MHz and commence a CAC period. The time to the re-initialization of traffic was measured as the time required for the EUT to complete the CAC period.

PROCEDURE FOR TIMING OF RADAR BURST

A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5500 MHz and commence a CAC period. A radar signal was triggered within 0 to 6 seconds after the beginning of the CAC period and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5500 MHz and commence a CAC period. A radar signal was triggered within 54 to 60 seconds after the beginning of the CAC period and transmissions on the channel were monitored on the spectrum analyzer.

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QUANTITATIVE RESULTS BASED UPON SPECTRUM ANALYZER PLOTS

No Radar Triggered

Beginning of CAC (sec)	Timing of Start of Traffic (sec)	CAC Period Time (sec)
0	64.7	64.7

Radar Near Beginning of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	1.020	1.020

Radar Near End of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	58.88	58.88

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QUANTITATIVE RESULTS BASED ON LOG FILE TIME STAMPS

No Radar Triggered

Beginning of CAC (hh:mm:ss)	End of CAC (hh:mm:ss)	CAC Time (hh:mm:ss)
3:57:38	3:58:42	0:01:04

Radar Near Beginning of CAC

Beginning of CAC (hh:mm:ss)	Radar Detected (hh:mm:ss)	Radar Relative to Start of CAC (hh:mm:ss)
4:03:49	4:03:50	0:00:01

Radar Near End of CAC

Beginning of CAC (hh:mm:ss)	Radar Detected (hh:mm:ss)	Radar Relative to Start of CAC (hh:mm:ss)
4:14:18	4:15:16	0:00:58

If a radar signal is detected during the channel availability check then the PC controlling the EUT displays a message stating that radar was detected.

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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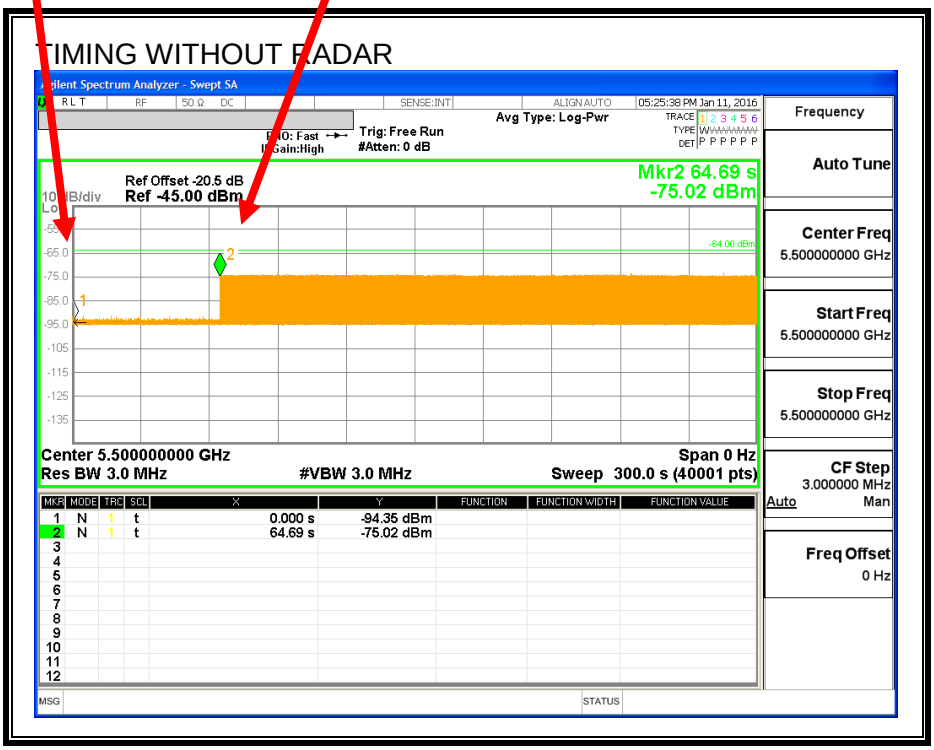
TIMING WITHOUT RADAR DURING CAC

Command to
Switch Channels
Start of CAC

End of CAC



Transmissions begin on channel after completion of the CAC period.

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Log File of CAC Timing Without Radar

Jan 11 03:57:38 2016: DOT11: %%%%>dfs:DFS
evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor
(dfs.c:415)
Jan 11 **03:57:38** 2016: DOT11: %%%%>dfs:DFS
evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor
(dfs.c:415)
Jan 11 **03:58:42** 2016: DOT11: %%%%>dfs:DFS
evt=in_srvc_monitor,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled
(dfs.c:415)

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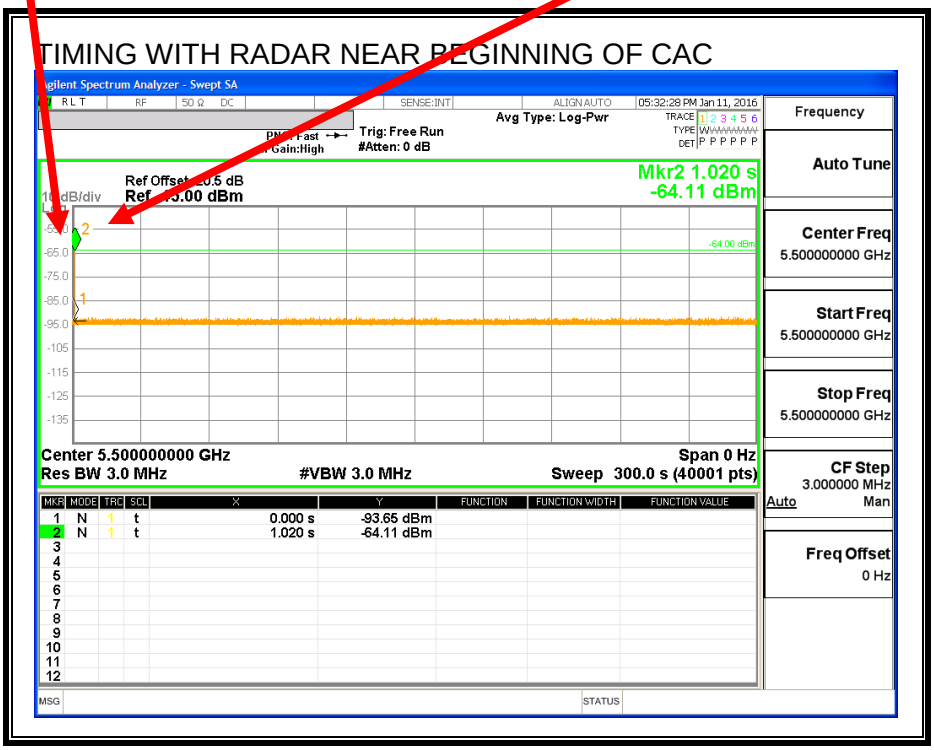
TIMING WITH RADAR NEAR BEGINNING OF CAC

Command to
Switch Channels
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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Log File of Radar at the Beginning of CAC

Jan 11 04:03:49 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 **04:03:49** 2016: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 04:03:50 2016: KERN: WL1: DFS: UNCLASSIFIED ########## radar detected on channel 100 ########## min_pw=23, subband_result=1, AT 300MS.
Jan 11 04:03:50 2016: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 100.
Jan 11 04:03:50 2016: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Jan 11 04:03:50 2016: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Jan 11 04:03:50 2016: DOT11: dfs:Starting resume timer (dfs.c:282)
Jan 11 04:03:50 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=153,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 04:03:50 2016: DOT11: dfs:DFS: driver's ch:153, rim's channel:100, bcmko_next_dfs_chan=153 (dfs.c:335)
Jan 11 04:03:50 2016: DOT11: dfs:DFS: rim's curren_ch=153, new next channel=44, telling dataplane. (dfs.c:343)
Jan 11 04:03:50 2016: DOT11: dfs:DFS_Validate_Power max 36 prtl: 30 (dfs.c:104)
Jan 11 **04:03:50** 2016: ap8533-0700B4 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 20 freq 5500 MHz

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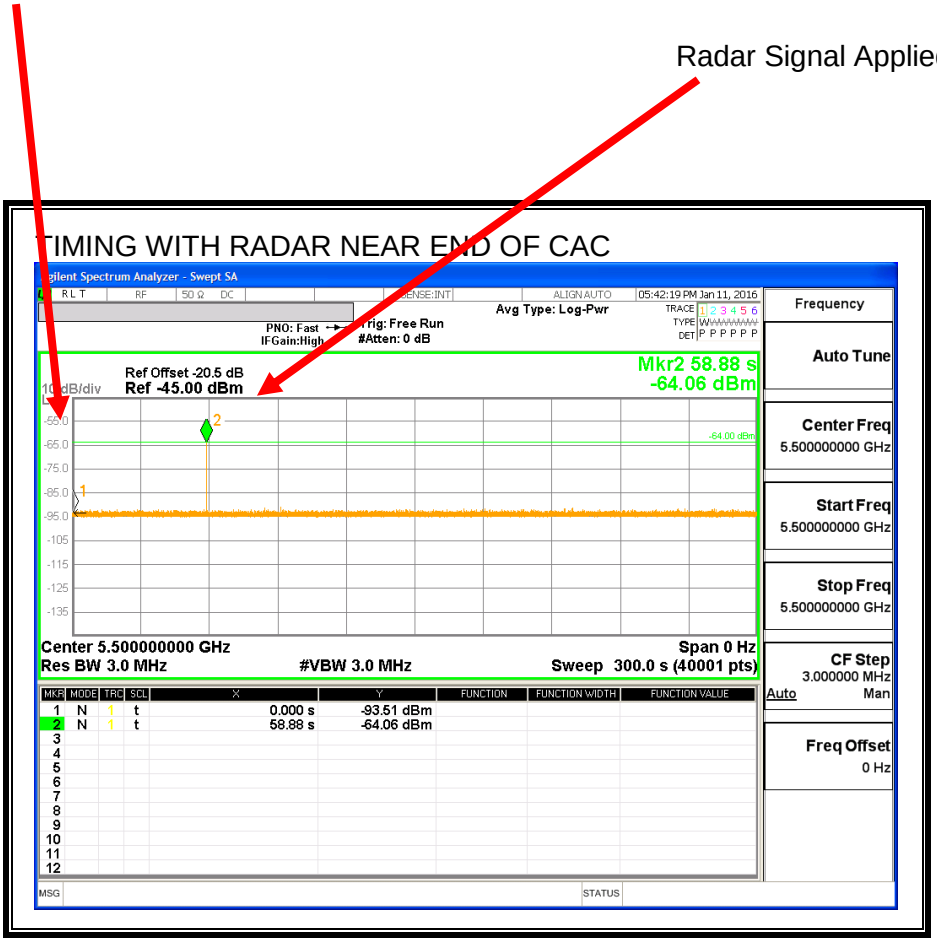
TIMING WITH RADAR NEAR END OF CAC

Command to
Switch Channels
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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Log File of Radar at the End of CAC

Jan 11 04:14:18 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 **04:14:18** 2016: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 04:15:16 2016: KERN: WL1: DFS: UNCLASSIFIED ########## radar detected on channel 100 ########## min_pw=29, subband_result=1, AT 54300MS.
Jan 11 04:15:16 2016: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 100.
Jan 11 04:15:16 2016: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Jan 11 04:15:16 2016: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Jan 11 04:15:16 2016: DOT11: dfs:Starting resume timer (dfs.c:282)
Jan 11 04:15:16 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 04:15:16 2016: DOT11: dfs:DFS: driver's ch:48, rim's channel:100, bcmko_next_dfs_chan=48 (dfs.c:335)
Jan 11 04:15:16 2016: DOT11: dfs:DFS: rim's curren_ch=48, new next channel=165, telling dataplane. (dfs.c:343)
Jan 11 04:15:16 2016: DOT11: dfs:DFS_Validate_Power max 36 prtl: 30 (dfs.c:104)
Jan 11 04:15:16 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 04:15:16 2016: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Jan 11 04:15:16 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 04:15:16 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Jan 11 **04:15:16** 2016: ap8533-0700B4 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 20 freq 5500 MHz

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5.2.2. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

5.2.3. 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)
0.579	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
3.2	60

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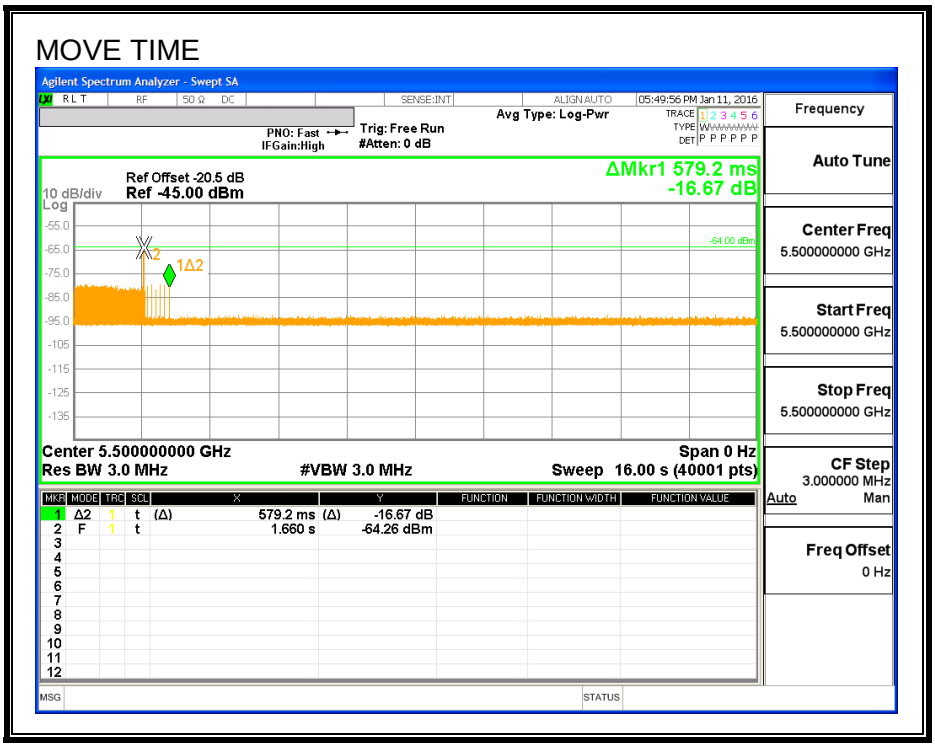
MOVE TIME



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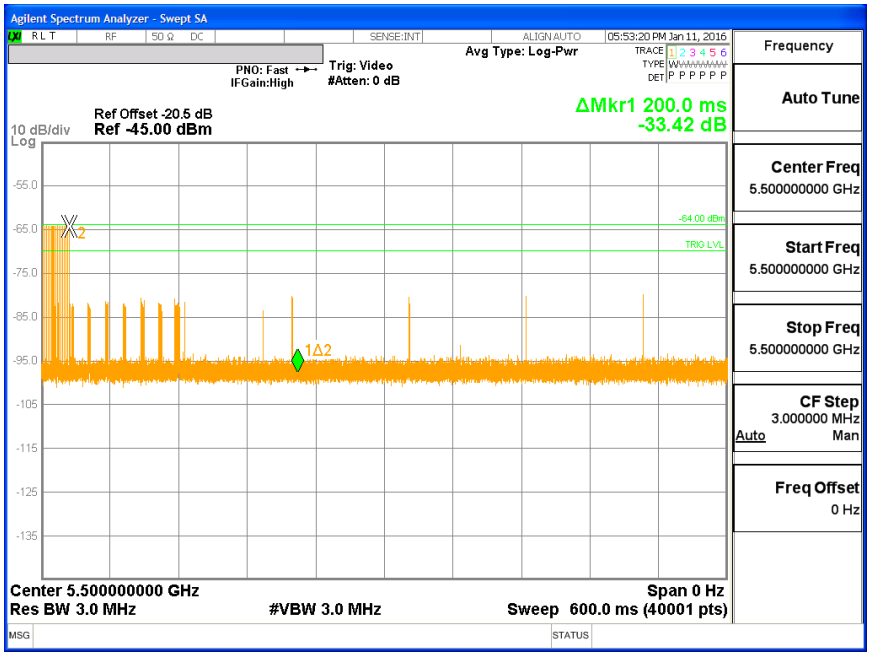
CHANNEL CLOSING TIME

CLOSING TIME



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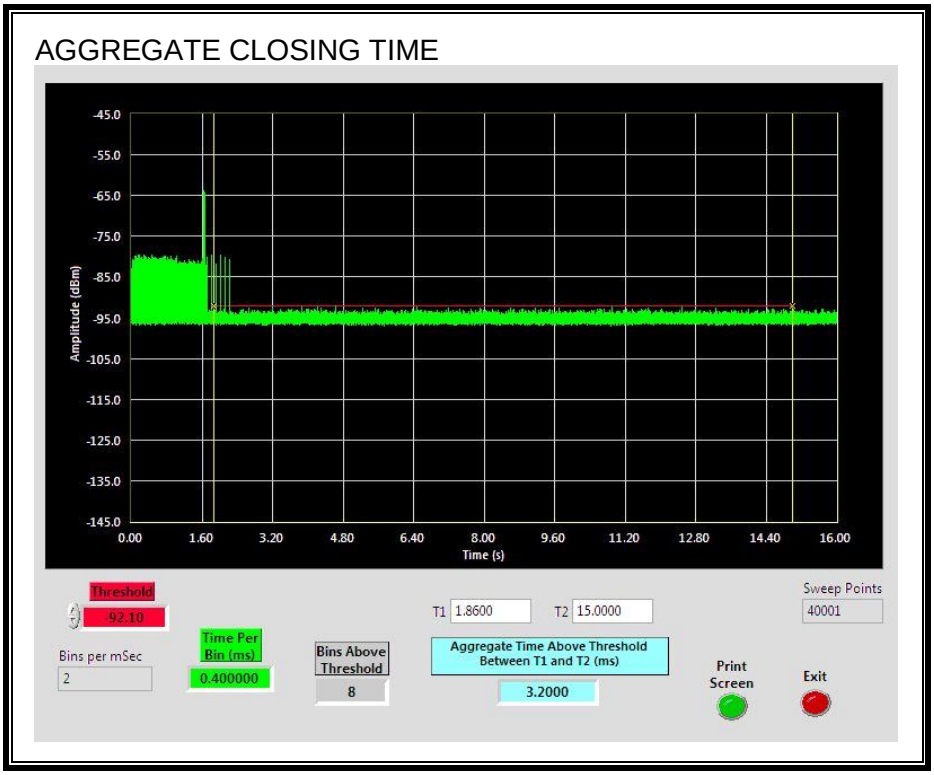
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



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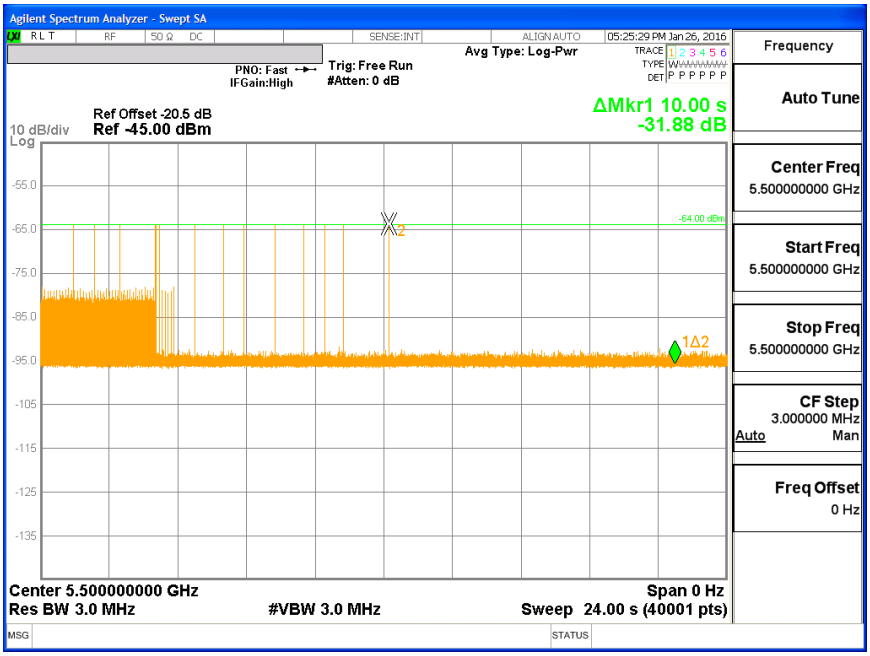
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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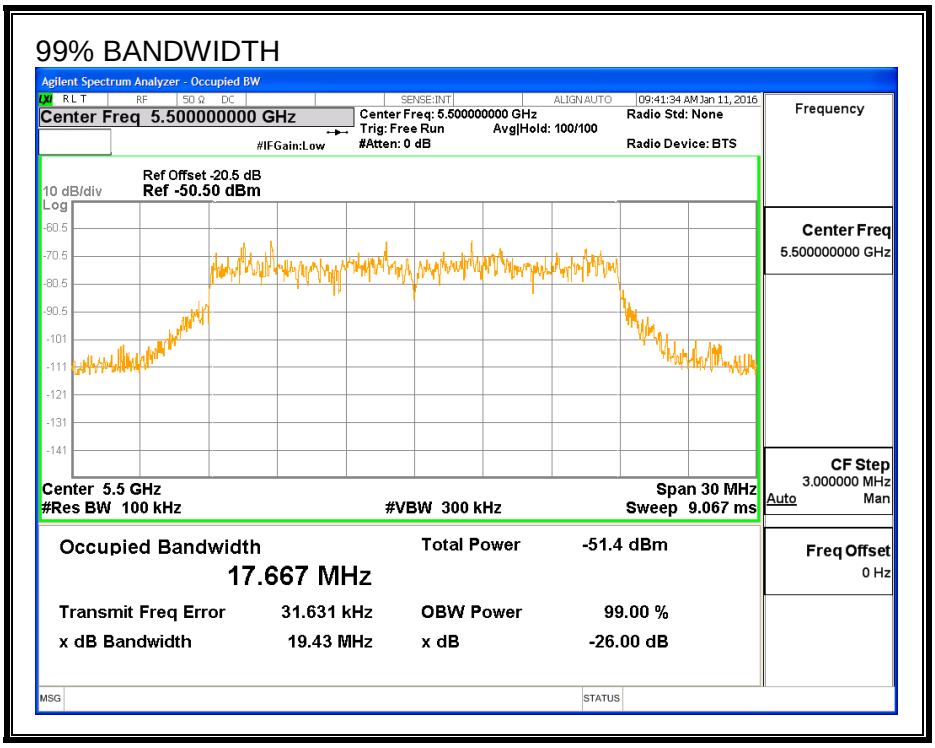
5.2.4. DETECTION BANDWIDTH

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	17.667	113.2	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
5490	10	10	100	FL
5495	10	10	100	
5500	10	9	90	
5505	10	10	100	
5510	10	10	100	FH

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5.2.5. 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	93.33	60	Pass	5490	5510		
FCC Short Pulse Type 2	30	100.00	60	Pass	5490	5510		
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5510		
FCC Short Pulse Type 4	30	86.67	60	Pass	5490	5510		
Aggregate		95.00	80	Pass				
FCC Long Pulse Type 5	30	86.67	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	No
1002	1	638	83	A	5500	Yes
1003	1	618	86	A	5500	Yes
1004	1	758	70	A	5500	Yes
1005	1	738	72	A	5500	Yes
1006	1	698	76	A	5500	Yes
1007	1	558	95	A	5500	Yes
1008	1	538	99	A	5500	Yes
1009	1	578	92	A	5500	Yes
1010	1	818	65	A	5500	Yes
1011	1	658	81	A	5500	Yes
1012	1	918	58	A	5500	Yes
1013	1	598	89	A	5500	Yes
1014	1	878	61	A	5500	Yes
1015	1	938	57	A	5500	Yes
1016	1	1483	36	B	5500	Yes
1017	1	1116	48	B	5500	Yes
1018	1	1071	50	B	5500	Yes
1019	1	2028	27	B	5500	Yes
1020	1	810	66	B	5500	Yes
1021	1	2378	23	B	5500	Yes
1022	1	2398	23	B	5500	Yes
1023	1	2901	19	B	5500	Yes
1024	1	3051	18	B	5500	Yes
1025	1	1136	47	B	5500	Yes
1026	1	2769	20	B	5500	No
1027	1	983	54	B	5500	Yes
1028	1	1551	35	B	5500	Yes
1029	1	2443	22	B	5500	Yes
1030	1	592	90	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	1.9	197	29	5500	Yes
2002	4.2	159	23	5500	Yes
2003	1	153	23	5500	Yes
2004	3.5	162	28	5500	Yes
2005	2.6	160	25	5500	Yes
2006	3.4	173	24	5500	Yes
2007	4.7	218	24	5500	Yes
2008	3.8	155	27	5500	Yes
2009	3.3	166	24	5500	Yes
2010	4.5	187	27	5500	Yes
2011	2.4	202	25	5500	Yes
2012	1.9	190	26	5500	Yes
2013	4	209	27	5500	Yes
2014	3.7	201	24	5500	Yes
2015	2	186	23	5500	Yes
2016	4.1	182	27	5500	Yes
2017	4.7	172	26	5500	Yes
2018	2.9	215	28	5500	Yes
2019	3.8	171	24	5500	Yes
2020	2.2	218	26	5500	Yes
2021	1.3	177	29	5500	Yes
2022	2.1	229	29	5500	Yes
2023	1.5	193	25	5500	Yes
2024	2.5	210	25	5500	Yes
2025	2	221	29	5500	Yes
2026	1.3	161	25	5500	Yes
2027	1.1	177	26	5500	Yes
2028	4.7	164	23	5500	Yes
2029	2.7	184	25	5500	Yes
2030	2.4	175	29	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	7.4	284	18	5500	Yes
3002	7.2	271	17	5500	Yes
3003	8.1	490	16	5500	Yes
3004	5.8	372	16	5500	Yes
3005	6.9	486	18	5500	Yes
3006	7.6	381	16	5500	Yes
3007	8.9	257	18	5500	Yes
3008	9.9	415	17	5500	Yes
3009	9.1	304	16	5500	Yes
3010	5.2	491	18	5500	Yes
3011	9.8	392	17	5500	Yes
3012	8.9	458	16	5500	Yes
3013	8.6	254	16	5500	Yes
3014	8	467	18	5500	Yes
3015	5.6	276	16	5500	Yes
3016	5.2	250	17	5500	Yes
3017	5.7	456	17	5500	Yes
3018	5.6	325	17	5500	Yes
3019	6.4	293	18	5500	Yes
3020	9.3	293	18	5500	Yes
3021	5.3	407	17	5500	Yes
3022	6	302	18	5500	Yes
3023	7.3	428	17	5500	Yes
3024	8.3	336	16	5500	Yes
3025	7.5	357	18	5500	Yes
3026	8.7	411	18	5500	Yes
3027	8.2	312	16	5500	Yes
3028	7.3	261	18	5500	Yes
3029	7	426	18	5500	Yes
3030	6.4	387	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	18.1	447	15	5500	Yes
4002	12.6	304	13	5500	Yes
4003	18.4	377	12	5500	Yes
4004	13.4	497	13	5500	Yes
4005	19.8	465	12	5500	Yes
4006	15.3	347	13	5500	No
4007	17.5	327	13	5500	Yes
4008	18.9	473	12	5500	Yes
4009	11.4	349	12	5500	Yes
4010	13.3	390	16	5500	Yes
4011	11.8	278	14	5500	Yes
4012	14.2	332	13	5500	Yes
4013	13.2	484	14	5500	Yes
4014	11.4	433	14	5500	No
4015	10.8	346	15	5500	Yes
4016	19.6	308	12	5500	No
4017	14.9	250	13	5500	Yes
4018	19.5	475	14	5500	No
4019	15.2	297	15	5500	Yes
4020	10.2	417	16	5500	Yes
4021	16.6	385	16	5500	Yes
4022	12.1	267	12	5500	Yes
4023	19.6	499	16	5500	Yes
4024	15.7	394	15	5500	Yes
4025	18.3	269	15	5500	Yes
4026	10.1	310	14	5500	Yes
4027	18.7	450	12	5500	Yes
4028	11	252	12	5500	Yes
4029	10	404	12	5500	Yes
4030	18.3	353	12	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	5498	No
2	5501	No
3	5495	Yes
4	5499	No
5	5504	Yes
6	5494	Yes
7	5502	Yes
8	5506	Yes
9	5498	Yes
10	5503	Yes
11	5503	Yes
12	5493	Yes
13	5493	Yes
14	5504	Yes
15	5507	Yes
16	5503	Yes
17	5499	Yes
18	5501	Yes
19	5495	Yes
20	5505	Yes
21	5499	Yes
22	5502	Yes
23	5497	Yes
24	5504	No
25	5503	Yes
26	5497	Yes
27	5508	Yes
28	5507	Yes
29	5494	Yes
30	5500	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	63	5490	5	Yes
2	538	5491	5	Yes
3	1013	5492	5	Yes
4	1488	5493	6	Yes
5	1963	5494	4	Yes
6	2438	5495	6	Yes
7	2913	5496	6	Yes
8	3388	5497	2	Yes
9	3863	5498	5	Yes
10	4338	5499	4	Yes
11	4813	5500	6	Yes
12	5288	5501	5	Yes
13	5763	5502	3	Yes
14	6238	5503	7	Yes
15	6713	5504	4	Yes
16	7188	5505	4	Yes
17	7663	5506	5	Yes
18	8138	5507	2	Yes
19	8613	5508	4	Yes
20	9088	5509	5	Yes
21	9563	5510	6	Yes
22	10038	5490	5	Yes
23	10513	5491	1	Yes
24	10988	5492	4	Yes
25	11463	5493	6	Yes
26	11938	5494	9	Yes
27	12413	5495	3	Yes
28	12888	5496	4	Yes
29	13363	5497	6	Yes
30	13838	5498	2	Yes
31	14313	5499	7	Yes
32	14788	5500	2	Yes
33	15263	5501	5	Yes
34	15738	5502	4	Yes
35	16213	5503	3	Yes
36	16688	5504	4	Yes
37	17163	5505	3	Yes
38	17638	5506	4	Yes
39	18113	5507	4	Yes
40	18588	5508	4	Yes
41	19063	5509	2	Yes
42	19538	5510	4	Yes

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5.3. RESULTS FOR 40 MHz BANDWIDTH

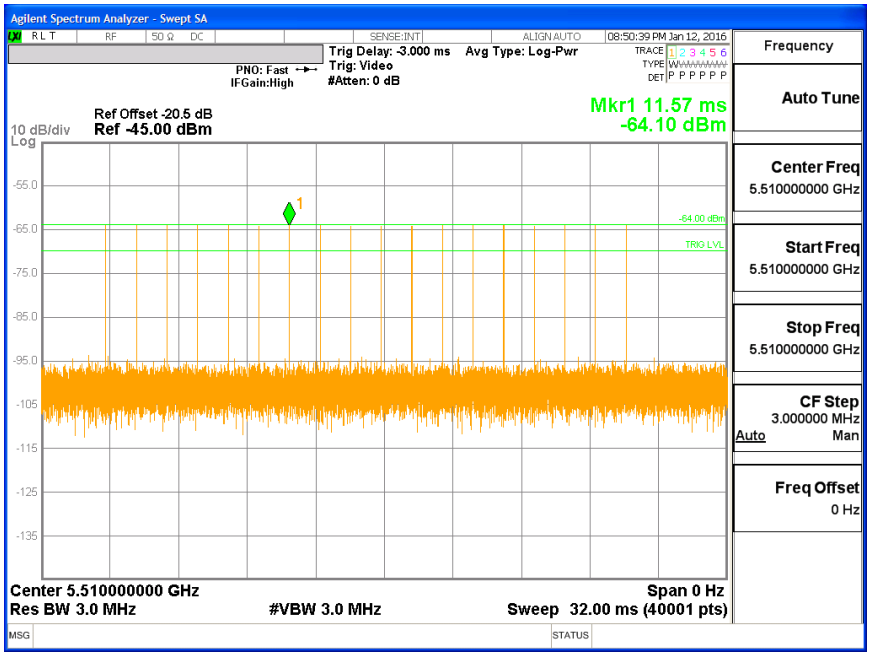
5.3.1. TEST CHANNEL

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

5.3.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

SHORT PULSE RADAR TYPE 0



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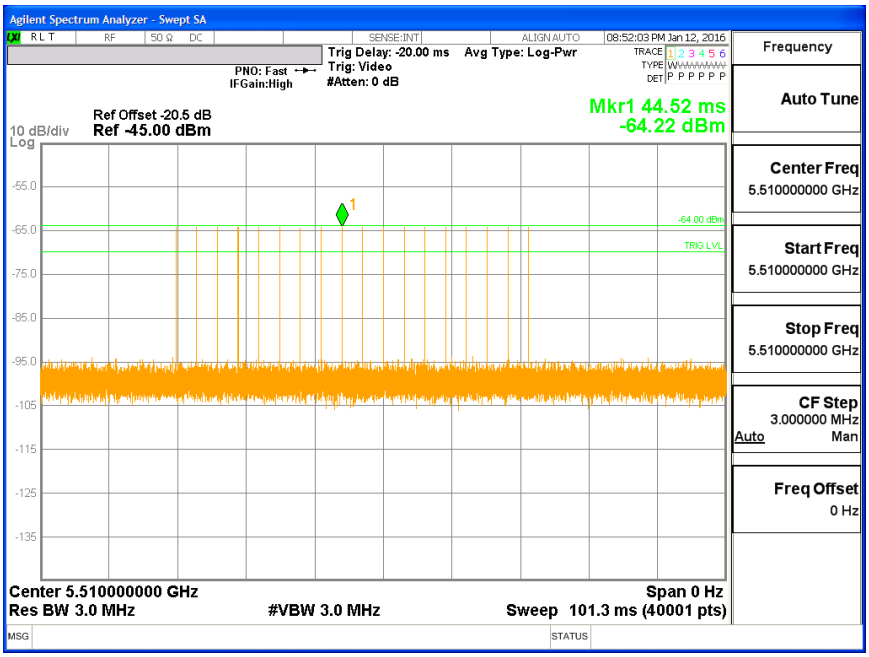
SAMPLE OF RADAR TYPE 1



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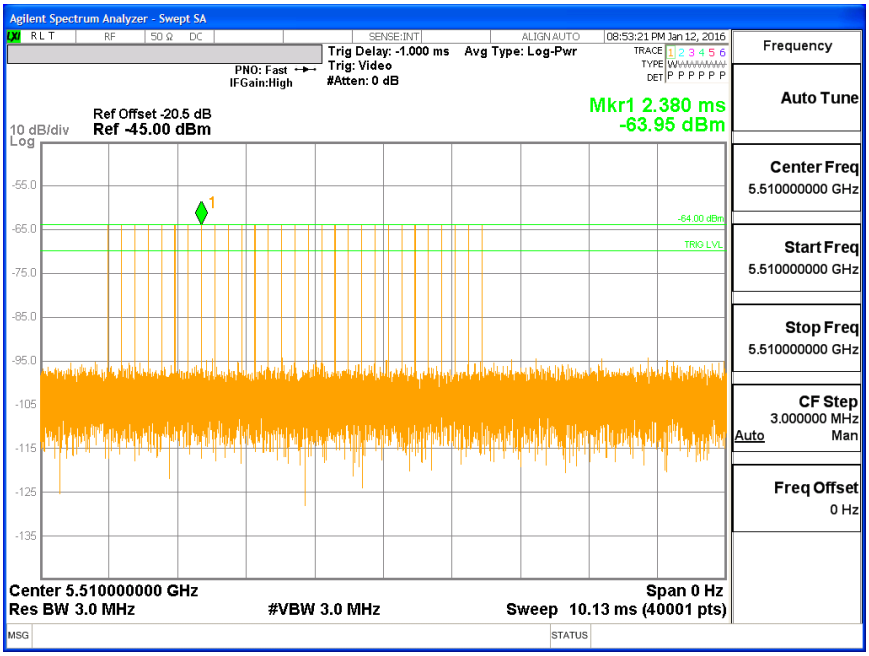
SAMPLE OF RADAR TYPE 2



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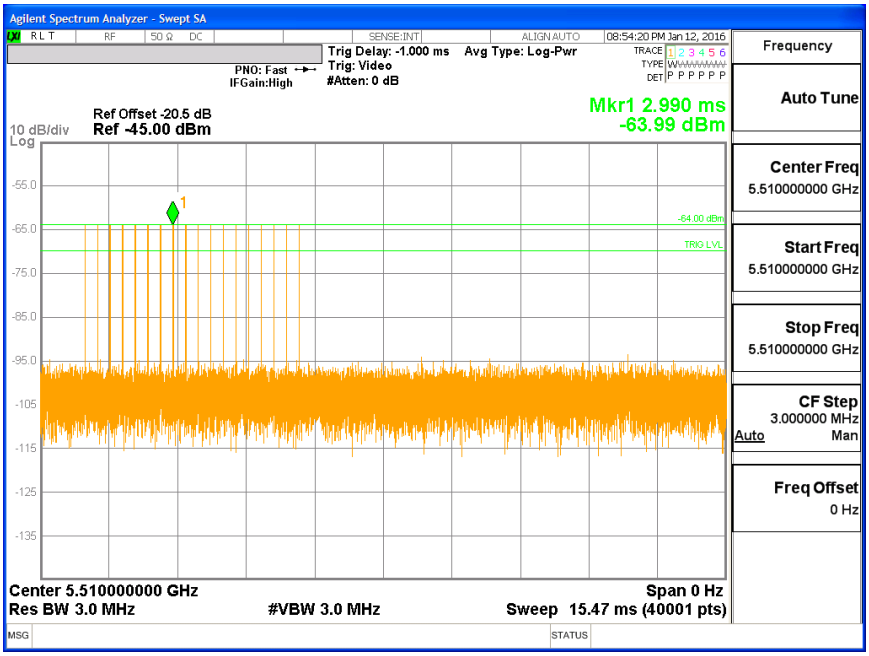
SAMPLE OF RADAR TYPE 3



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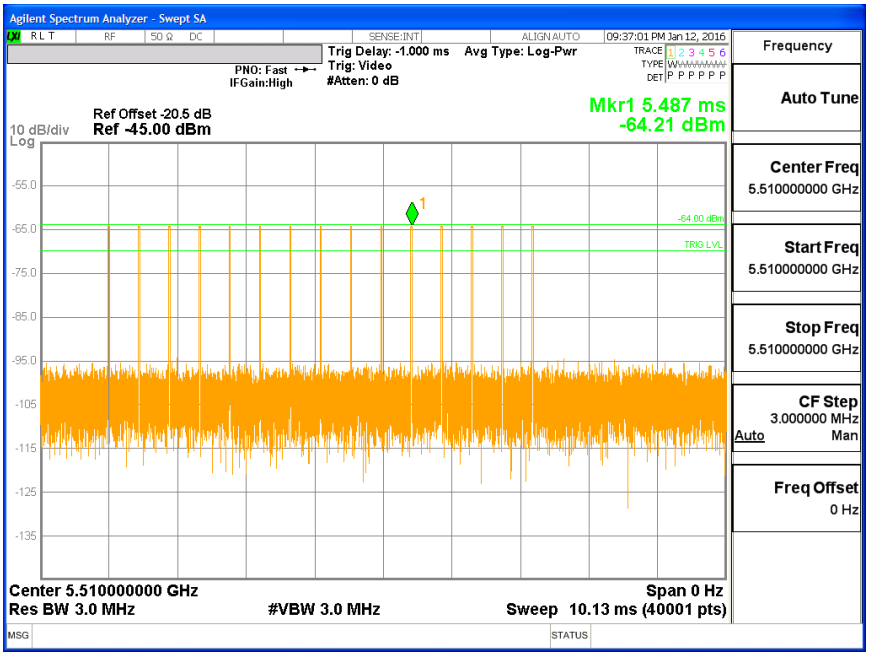
SAMPLE OF RADAR TYPE 4



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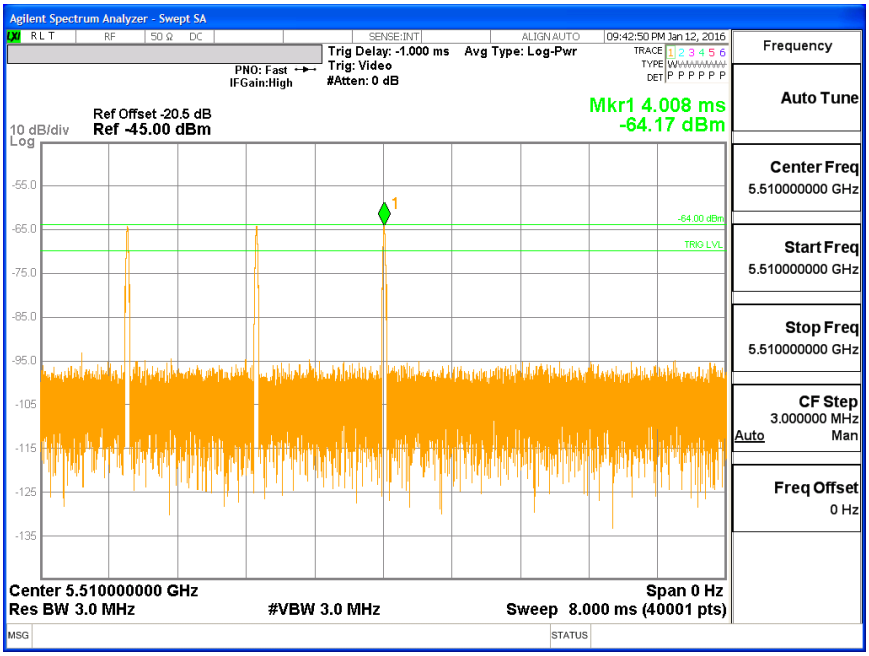
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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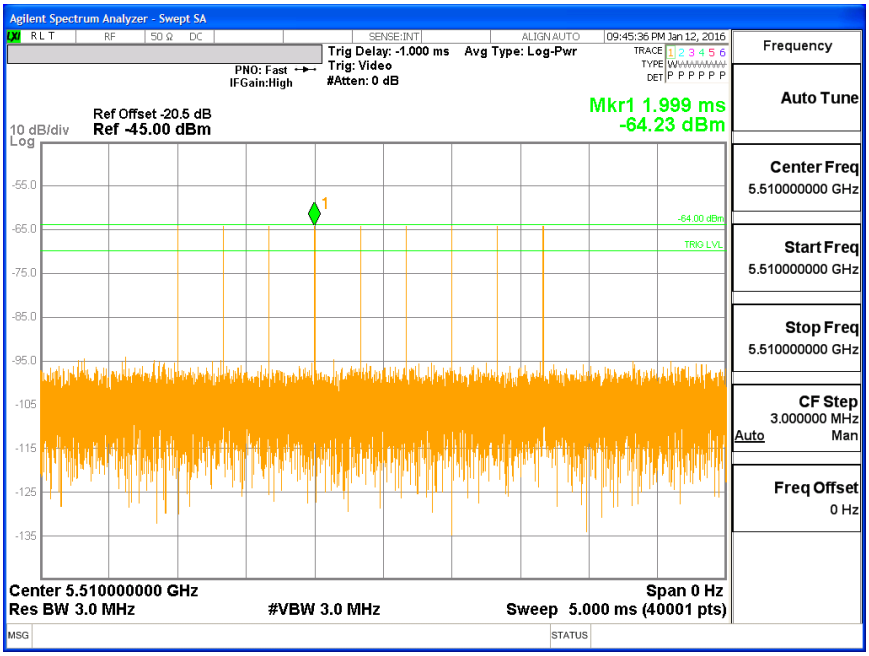
SINGLE BURST OF RADAR TYPE 6



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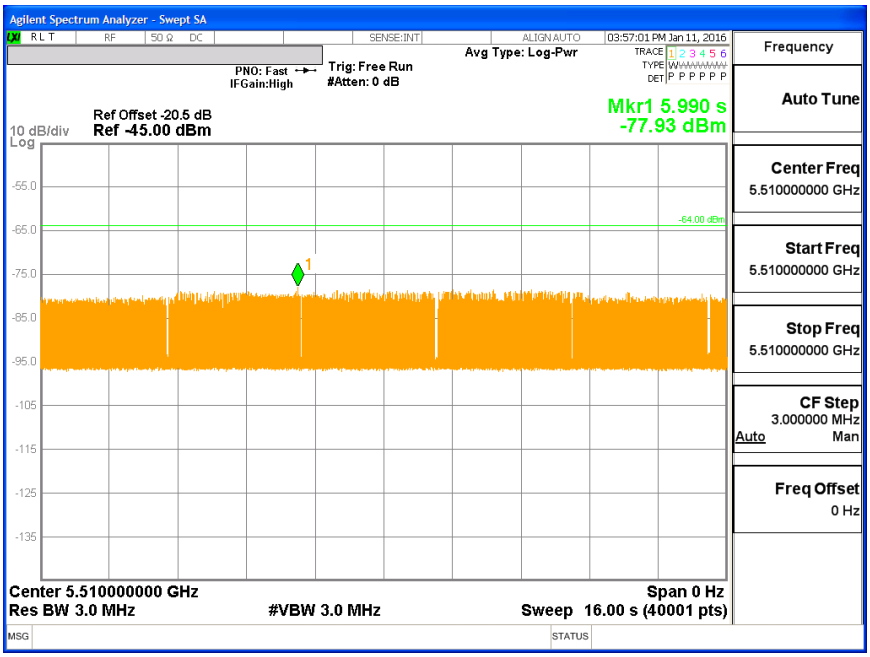
TRAFFIC

TRAFFIC



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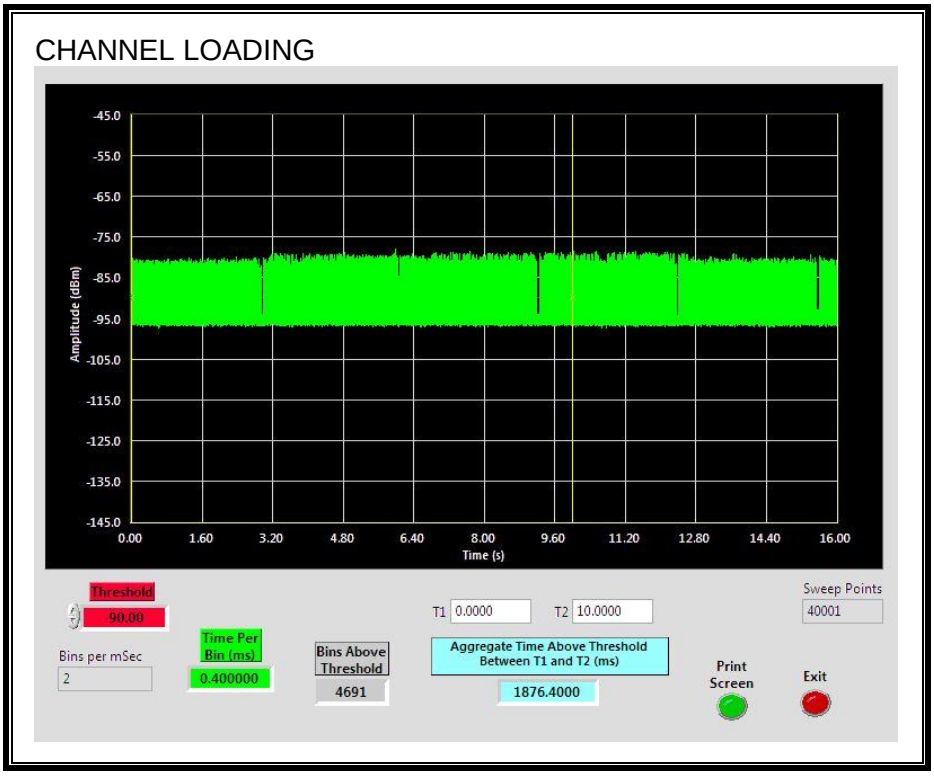
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.764%

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5.3.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5510 MHz and commence a CAC period. The time to the re-initialization of traffic was measured as the time required for the EUT to complete the CAC period.

PROCEDURE FOR TIMING OF RADAR BURST

A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5510 MHz and commence a CAC period. A radar signal was triggered within 0 to 6 seconds after the beginning of the CAC period and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5510 MHz and commence a CAC period. A radar signal was triggered within 54 to 60 seconds after the beginning of the CAC period and transmissions on the channel were monitored on the spectrum analyzer.

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QUANTITATIVE RESULTS BASED UPON SPECTRUM ANALYZER PLOTS

No Radar Triggered

Beginning of CAC (sec)	Timing of Start of Traffic (sec)	CAC Period Time (sec)
0	65.0	65.0

Radar Near Beginning of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	1.005	1.005

Radar Near End of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	58.40	58.40

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QUANTITATIVE RESULTS BASED ON LOG FILE TIME STAMPS

No Radar Triggered

Beginning of CAC (hh:mm:ss)	End of CAC (hh:mm:ss)	CAC Time (hh:mm:ss)
3:11:44	3:12:49	0:01:05

Radar Near Beginning of CAC

Beginning of CAC (hh:mm:ss)	Radar Detected (hh:mm:ss)	Radar Relative to Start of CAC (hh:mm:ss)
3:22:00	3:22:01	0:00:01

Radar Near End of CAC

Beginning of CAC (hh:mm:ss)	Radar Detected (hh:mm:ss)	Radar Relative to Start of CAC (hh:mm:ss)
3:34:04	3:35:03	0:00:59

If a radar signal is detected during the channel availability check then the PC controlling the EUT displays a message stating that radar was detected.

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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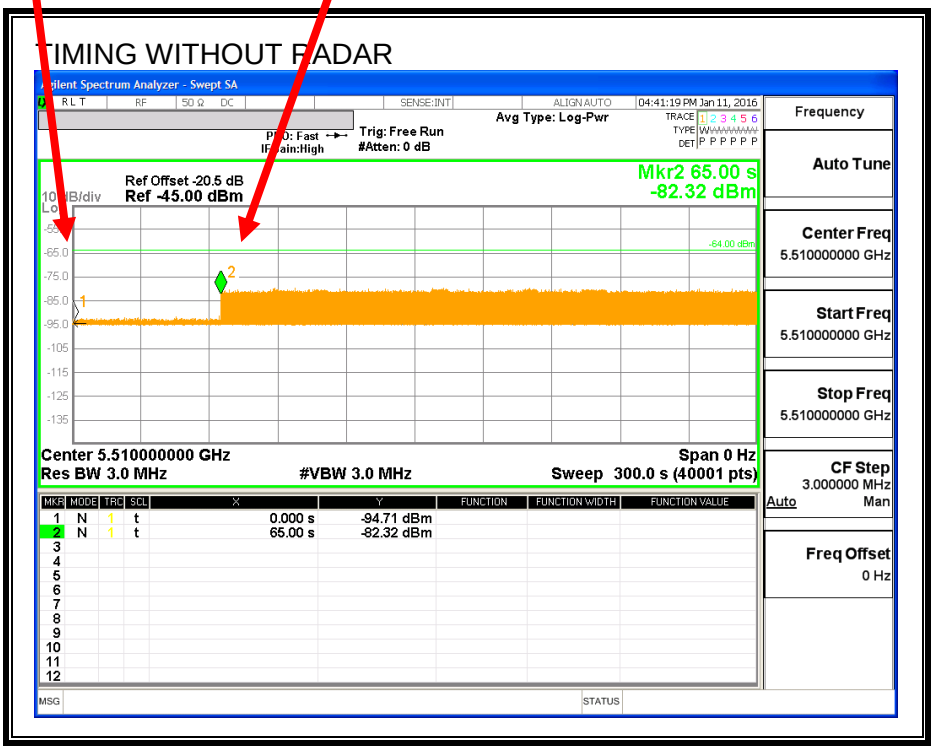
TIMING WITHOUT RADAR DURING CAC

Command to
Switch Channels
Start of CAC

End of CAC



Transmissions begin on channel after completion of the CAC period.

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Log File of CAC Timing Without Radar

Jan 11 **03:11:44** 2016: DOT11: %%%%>dfs:DFS
evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk
(dfs.c:415)
Jan 11 03:11:44 2016: DOT11: %%%%>dfs:DFS
evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk
(dfs.c:415)
Jan 11 **03:12:49** 2016: DOT11: %%%%>dfs:DFS
evt=in_srvc_monitor,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled
(dfs.c:415)

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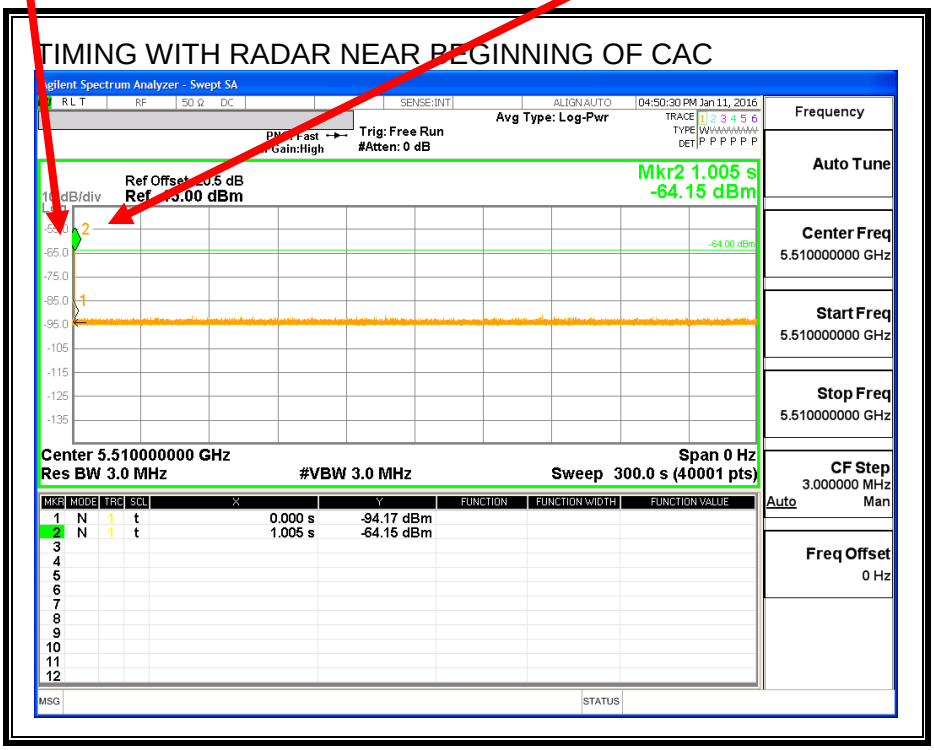
TIMING WITH RADAR NEAR BEGINNING OF CAC

Command to
Switch Channels
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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Log File of Radar at the Beginning of CAC

Jan 11 03:22:00 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 **03:22:00** 2016: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 03:22:01 2016: KERN: WL1: DFS: UNCLASSIFIED ########## radar detected on channel 100l ########## min_pw=27, subband_result=3, AT 300MS.
Jan 11 03:22:01 2016: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 102.
Jan 11 03:22:01 2016: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Jan 11 03:22:01 2016: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Jan 11 03:22:01 2016: DOT11: dfs:Starting resume timer (dfs.c:282)
Jan 11 03:22:01 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=165,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:22:01 2016: DOT11: dfs:DFS: driver's ch:165, rim's channel:100, bcmko_next_dfs_chan=165 (dfs.c:335)
Jan 11 03:22:01 2016: DOT11: dfs:DFS: rim's curren_ch=165, new next channel=48, telling dataplane. (dfs.c:343)
Jan 11 03:22:01 2016: DOT11: dfs:DFS_Validate_Power max 36 prtl: 30 (dfs.c:104)
Jan 11 03:22:01 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=165,ridx=1,curCh=165,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:22:01 2016: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Jan 11 03:22:01 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=165,ridx=1,curCh=165,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:22:01 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=165,ridx=1,curCh=165,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Jan 11 **03:22:01** 2016: ap8533-0700B4 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 40 freq 5500 MHz

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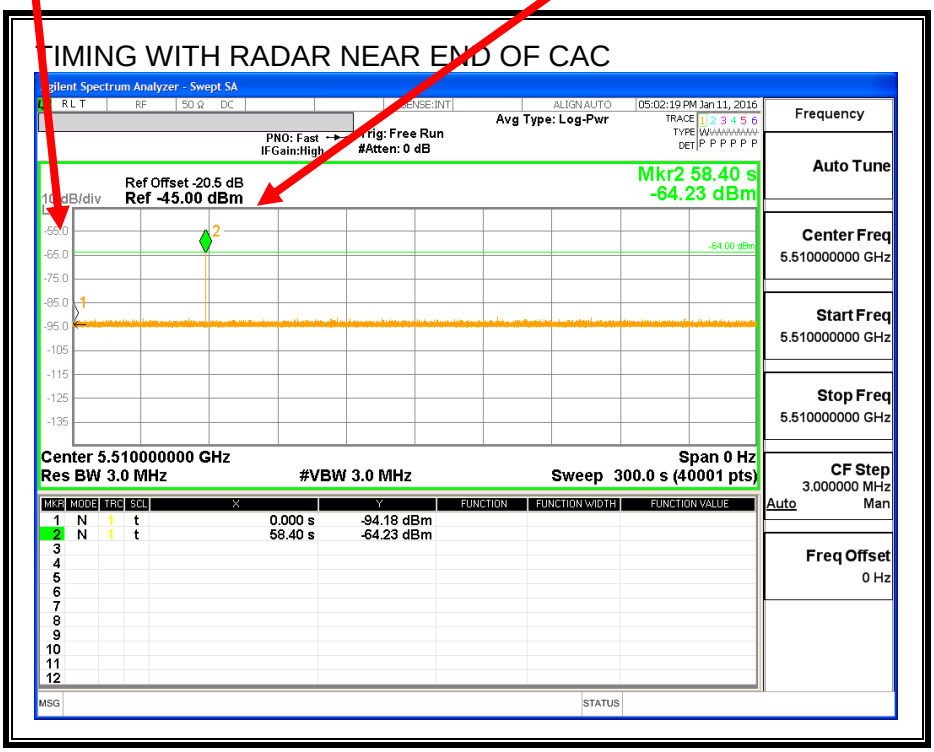
TIMING WITH RADAR NEAR END OF CAC

Command to
Switch Channels
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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Log File of Radar at the End of CAC

Jan 11 03:34:04 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 **03:34:04** 2016: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:35:03 2016: KERN: WL1: DFS: UNCLASSIFIED ########## radar detected on channel 100l ########## min_pw=22, subband_result=3, AT 54300MS.
Jan 11 03:35:03 2016: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 102.
Jan 11 03:35:03 2016: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Jan 11 03:35:03 2016: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Jan 11 03:35:03 2016: DOT11: dfs:Starting resume timer (dfs.c:282)
Jan 11 03:35:03 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=44,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:35:03 2016: DOT11: dfs:DFS: driver's ch:44, rim's channel:100, bcmko_next_dfs_chan=44 (dfs.c:335)
Jan 11 03:35:03 2016: DOT11: dfs:DFS: rim's curren_ch=44, new next channel=153, telling dataplane. (dfs.c:343)
Jan 11 03:35:03 2016: DOT11: dfs:DFS_Validate_Power max 36 prtl: 30 (dfs.c:104)
Jan 11 03:35:03 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=44,ridx=1,curCh=44,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:35:03 2016: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Jan 11 03:35:03 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=44,ridx=1,curCh=44,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 03:35:03 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=44,ridx=1,curCh=44,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Jan 11 **03:35:03** 2016: ap8533-0700B4 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 40 freq 5500 MHz

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5.3.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

5.3.5. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

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

RESULTS

Channel Move Time (sec)	Limit (sec)
0.622	10

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

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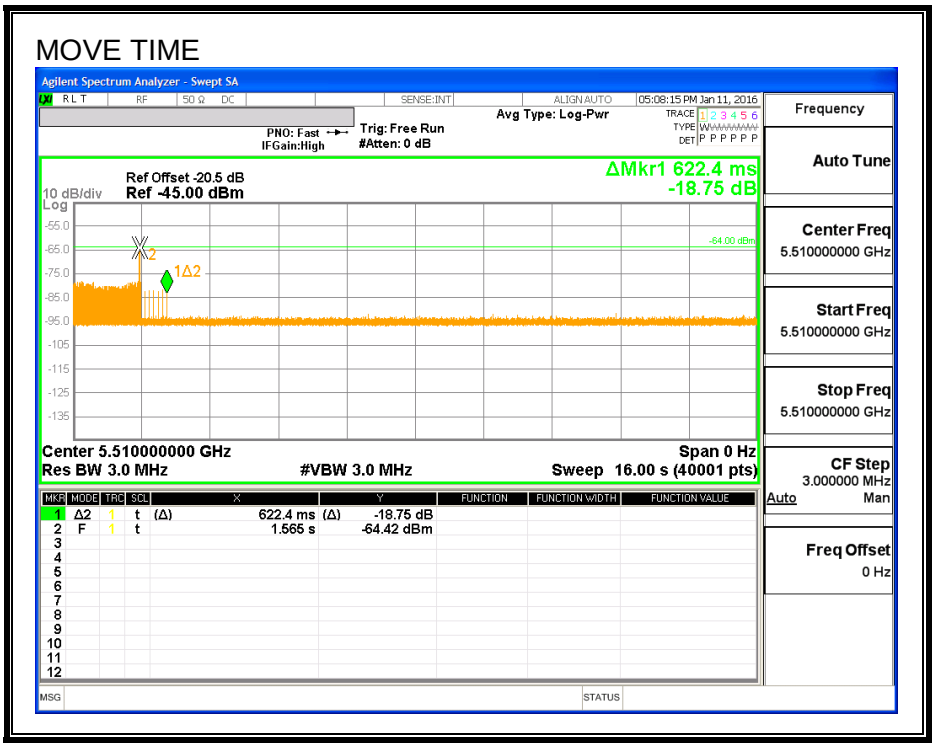
MOVE TIME



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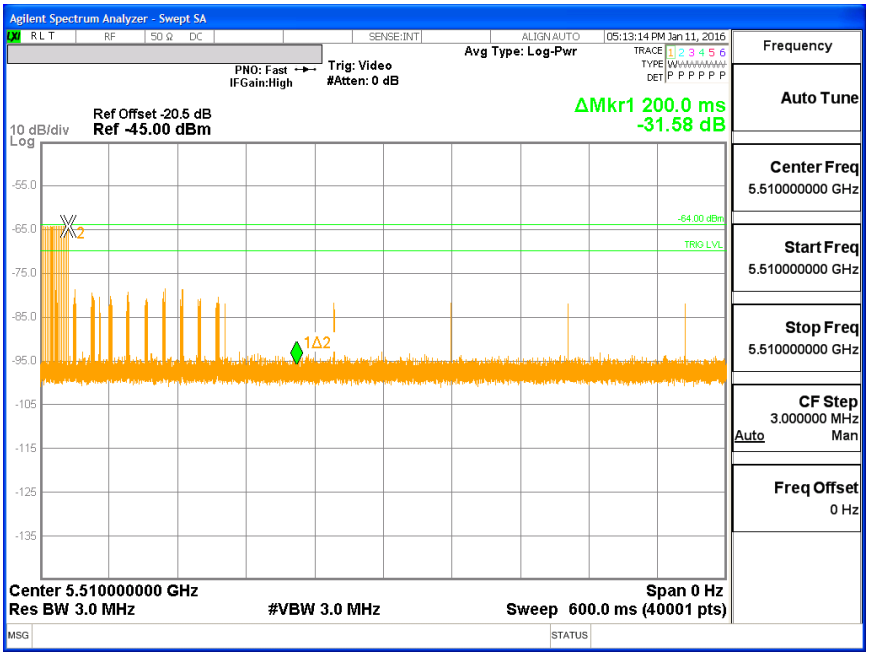
CHANNEL CLOSING TIME

CLOSING TIME



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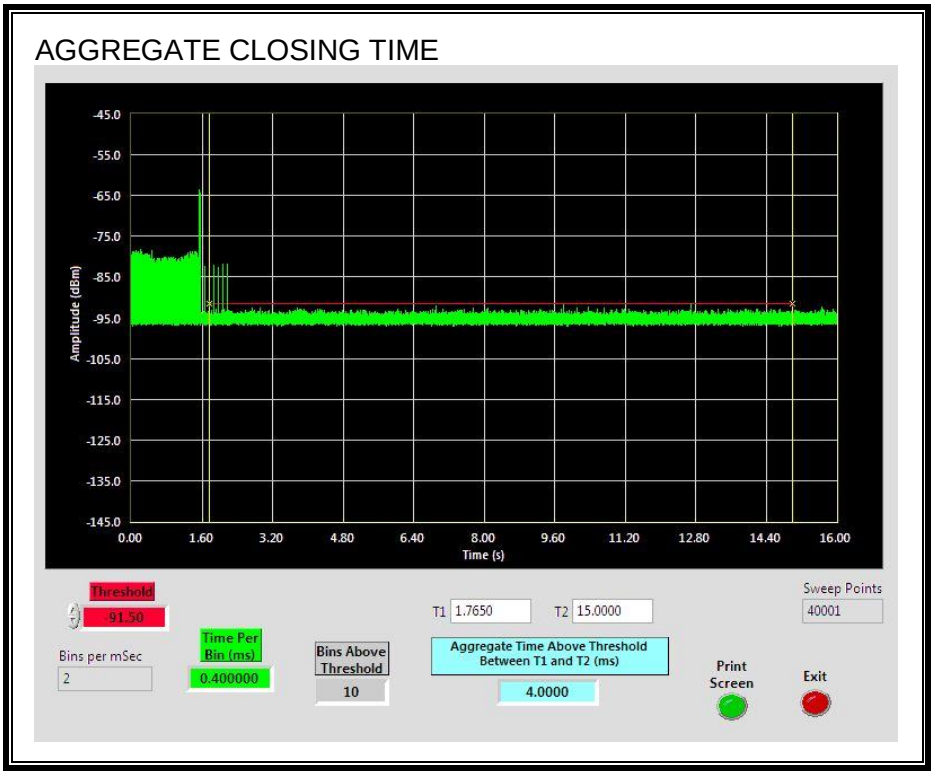
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.



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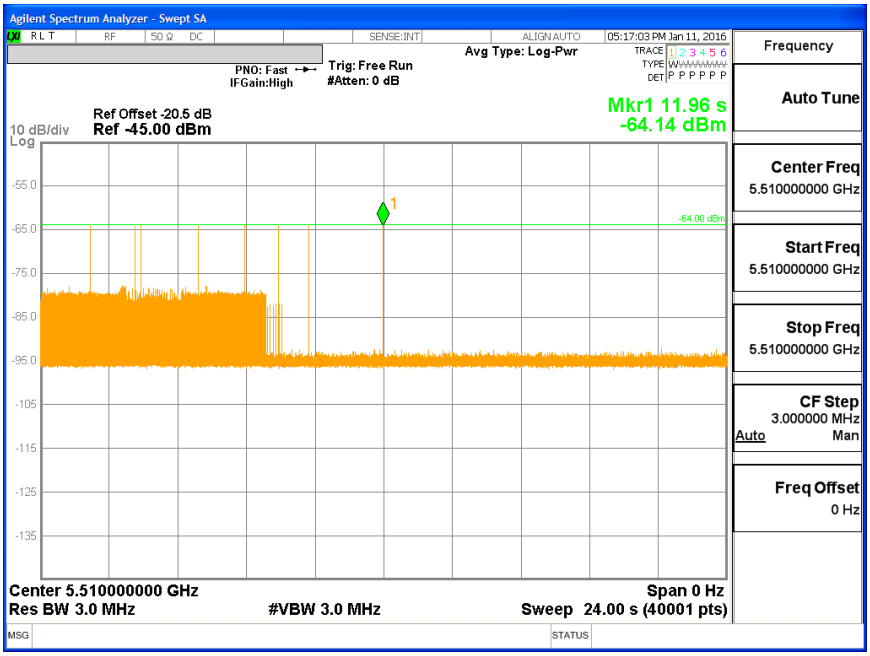
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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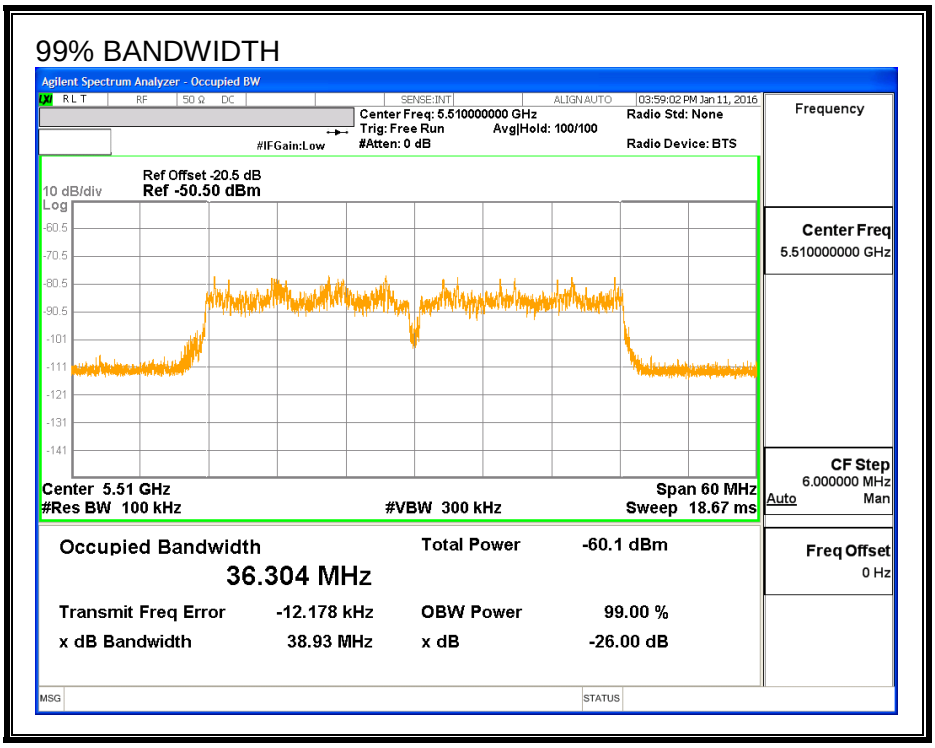
5.3.6. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5490	5530	40	36.304	110.2	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	9	90	
5525	10	10	100	
5530	10	10	100	FH
5531	10	0	0	

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5.3.7. 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	96.67	60	Pass	5490	5530		
FCC Short Pulse Type 2	30	93.33	60	Pass	5490	5530		
FCC Short Pulse Type 3	30	96.67	60	Pass	5490	5530		
FCC Short Pulse Type 4	30	96.67	60	Pass	5490	5530		
Aggregate		95.83	80	Pass				
FCC Long Pulse Type 5	30	90.00	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	No
1002	1	638	83	A	5510	Yes
1003	1	618	86	A	5510	Yes
1004	1	758	70	A	5510	Yes
1005	1	738	72	A	5510	Yes
1006	1	698	76	A	5510	Yes
1007	1	558	95	A	5510	Yes
1008	1	538	99	A	5510	Yes
1009	1	578	92	A	5510	Yes
1010	1	818	65	A	5510	Yes
1011	1	658	81	A	5510	Yes
1012	1	918	58	A	5510	Yes
1013	1	598	89	A	5510	Yes
1014	1	878	61	A	5510	Yes
1015	1	938	57	A	5510	Yes
1016	1	1483	36	B	5510	Yes
1017	1	1116	48	B	5510	Yes
1018	1	1071	50	B	5510	Yes
1019	1	2028	27	B	5510	Yes
1020	1	810	66	B	5510	Yes
1021	1	2378	23	B	5510	Yes
1022	1	2398	23	B	5510	Yes
1023	1	2901	19	B	5510	Yes
1024	1	3051	18	B	5510	Yes
1025	1	1136	47	B	5510	Yes
1026	1	2769	20	B	5510	Yes
1027	1	983	54	B	5510	Yes
1028	1	1551	35	B	5510	Yes
1029	1	2443	22	B	5510	Yes
1030	1	592	90	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	1.9	197	29	5510	Yes
2002	4.2	159	23	5510	Yes
2003	1	153	23	5510	Yes
2004	3.5	162	28	5510	Yes
2005	2.6	160	25	5510	Yes
2006	3.4	173	24	5510	No
2007	4.7	218	24	5510	Yes
2008	3.8	155	27	5510	Yes
2009	3.3	166	24	5510	Yes
2010	4.5	187	27	5510	Yes
2011	2.4	202	25	5510	Yes
2012	1.9	190	26	5510	Yes
2013	4	209	27	5510	Yes
2014	3.7	201	24	5510	Yes
2015	2	186	23	5510	Yes
2016	4.1	182	27	5510	Yes
2017	4.7	172	26	5510	Yes
2018	2.9	215	28	5510	Yes
2019	3.8	171	24	5510	Yes
2020	2.2	218	26	5510	Yes
2021	1.3	177	29	5510	Yes
2022	2.1	229	29	5510	Yes
2023	1.5	193	25	5510	Yes
2024	2.5	210	25	5510	Yes
2025	2	221	29	5510	Yes
2026	1.3	161	25	5510	Yes
2027	1.1	177	26	5510	Yes
2028	4.7	164	23	5510	Yes
2029	2.7	184	25	5510	Yes
2030	2.4	175	29	5510	No

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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	7.4	284	18	5510	Yes
3002	7.2	271	17	5510	Yes
3003	8.1	490	16	5510	Yes
3004	5.8	372	16	5510	Yes
3005	6.9	486	18	5510	Yes
3006	7.6	381	16	5510	Yes
3007	8.9	257	18	5510	Yes
3008	9.9	415	17	5510	Yes
3009	9.1	304	16	5510	Yes
3010	5.2	491	18	5510	Yes
3011	9.8	392	17	5510	Yes
3012	8.9	458	16	5510	Yes
3013	8.6	254	16	5510	Yes
3014	8	467	18	5510	Yes
3015	5.6	276	16	5510	Yes
3016	5.2	250	17	5510	Yes
3017	5.7	456	17	5510	Yes
3018	5.6	325	17	5510	Yes
3019	6.4	293	18	5510	No
3020	9.3	293	18	5510	Yes
3021	5.3	407	17	5510	Yes
3022	6	302	18	5510	Yes
3023	7.3	428	17	5510	Yes
3024	8.3	336	16	5510	Yes
3025	7.5	357	18	5510	Yes
3026	8.7	411	18	5510	Yes
3027	8.2	312	16	5510	Yes
3028	7.3	261	18	5510	Yes
3029	7	426	18	5510	Yes
3030	6.4	387	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	18.1	447	15	5510	Yes
4002	12.6	304	13	5510	Yes
4003	18.4	377	12	5510	Yes
4004	13.4	497	13	5510	Yes
4005	19.8	465	12	5510	Yes
4006	15.3	347	13	5510	Yes
4007	17.5	327	13	5510	Yes
4008	18.9	473	12	5510	Yes
4009	11.4	349	12	5510	Yes
4010	13.3	390	16	5510	Yes
4011	11.8	278	14	5510	Yes
4012	14.2	332	13	5510	Yes
4013	13.2	484	14	5510	Yes
4014	11.4	433	14	5510	Yes
4015	10.8	346	15	5510	Yes
4016	19.6	308	12	5510	Yes
4017	14.9	250	13	5510	Yes
4018	19.5	475	14	5510	Yes
4019	15.2	297	15	5510	No
4020	10.2	417	16	5510	Yes
4021	16.6	385	16	5510	Yes
4022	12.1	267	12	5510	Yes
4023	19.6	499	16	5510	Yes
4024	15.7	394	15	5510	Yes
4025	18.3	269	15	5510	Yes
4026	10.1	310	14	5510	Yes
4027	18.7	450	12	5510	Yes
4028	11	252	12	5510	Yes
4029	10	404	12	5510	Yes
4030	18.3	353	12	5510	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	5524	No
2	5513	Yes
3	5504	Yes
4	5511	Yes
5	5519	Yes
6	5514	Yes
7	5499	Yes
8	5521	Yes
9	5512	Yes
10	5508	Yes
11	5524	Yes
12	5514	Yes
13	5518	Yes
14	5503	Yes
15	5498	Yes
16	5517	Yes
17	5521	Yes
18	5498	Yes
19	5498	No
20	5524	No
21	5507	Yes
22	5512	Yes
23	5510	Yes
24	5495	Yes
25	5502	Yes
26	5520	Yes
27	5524	Yes
28	5495	Yes
29	5500	Yes
30	5517	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	54	5490	10	Yes
2	529	5491	7	Yes
3	1004	5492	6	Yes
4	1479	5493	12	Yes
5	1954	5494	14	Yes
6	2429	5495	7	Yes
7	2904	5496	7	Yes
8	3379	5497	7	Yes
9	3854	5498	11	Yes
10	4329	5499	8	Yes
11	4804	5500	10	Yes
12	5279	5501	8	Yes
13	5754	5502	9	Yes
14	6229	5503	12	Yes
15	6704	5504	7	Yes
16	7179	5505	9	Yes
17	7654	5506	10	Yes
18	8129	5507	5	Yes
19	8604	5508	6	Yes
20	9079	5509	11	Yes
21	9554	5510	10	Yes
22	10029	5511	9	Yes
23	10504	5512	6	Yes
24	10979	5513	6	Yes
25	11454	5514	8	Yes
26	11929	5515	10	Yes
27	12404	5516	8	Yes
28	12879	5517	9	Yes
29	13354	5518	15	Yes
30	13829	5519	7	Yes
31	14304	5520	9	Yes
32	14779	5521	5	Yes
33	15254	5522	11	Yes
34	15729	5523	9	Yes
35	16204	5524	10	Yes
36	16679	5525	5	Yes
37	17154	5526	9	Yes
38	17629	5527	11	Yes
39	18104	5528	8	Yes
40	18579	5529	9	Yes
41	19054	5530	6	Yes

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5.4. RESULTS FOR 80 MHz BANDWIDTH

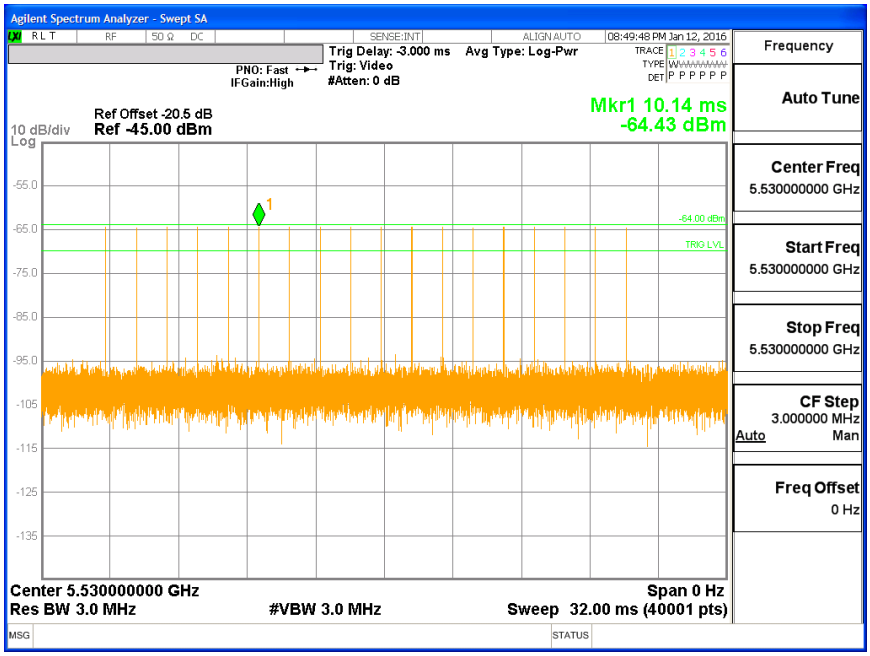
5.4.1. TEST CHANNEL

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

5.4.2. RADAR WAVEFORMS AND TRAFFIC

RADAR WAVEFORMS

SHORT PULSE RADAR TYPE 0



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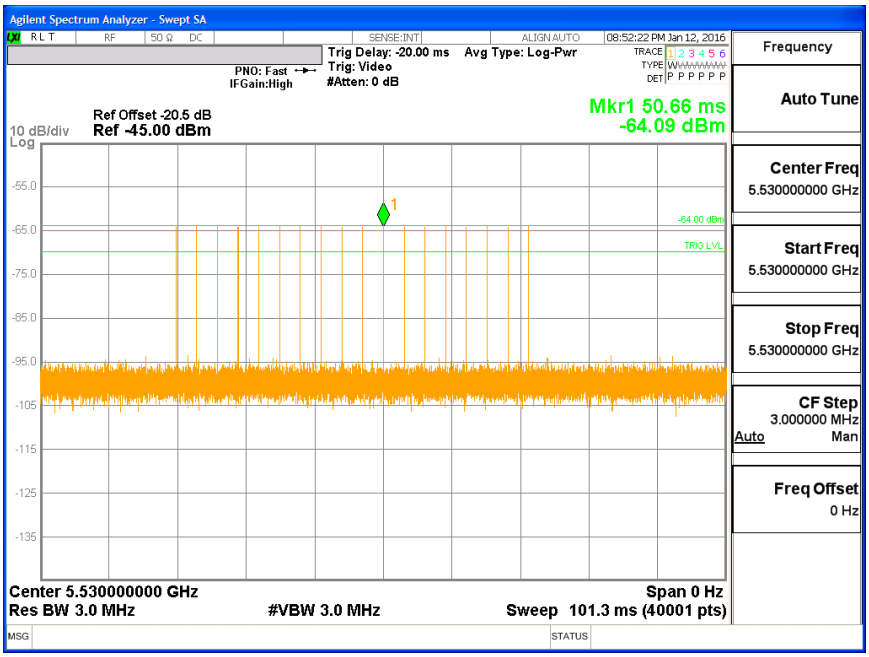
SAMPLE OF RADAR TYPE 1



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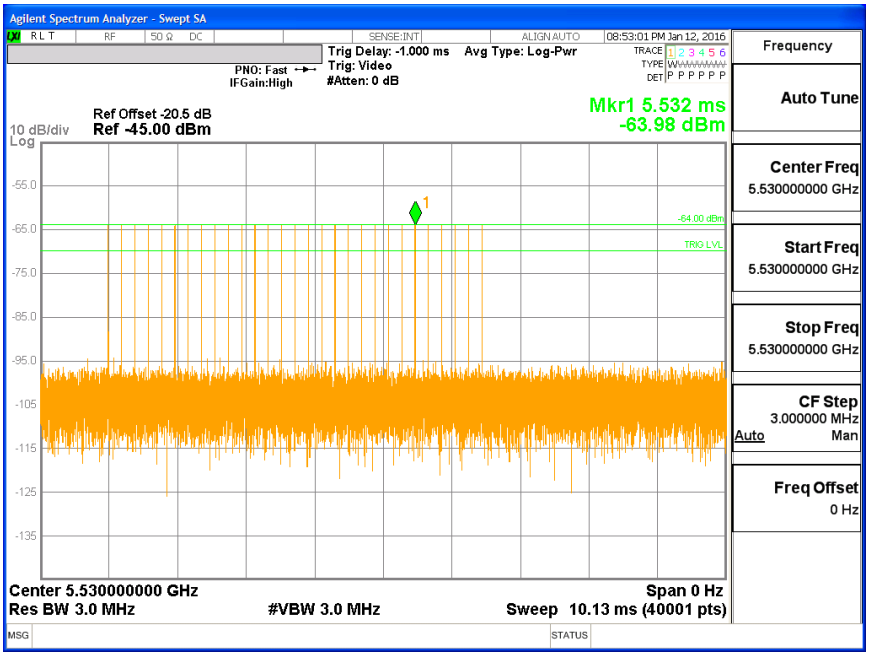
SAMPLE OF RADAR TYPE 2



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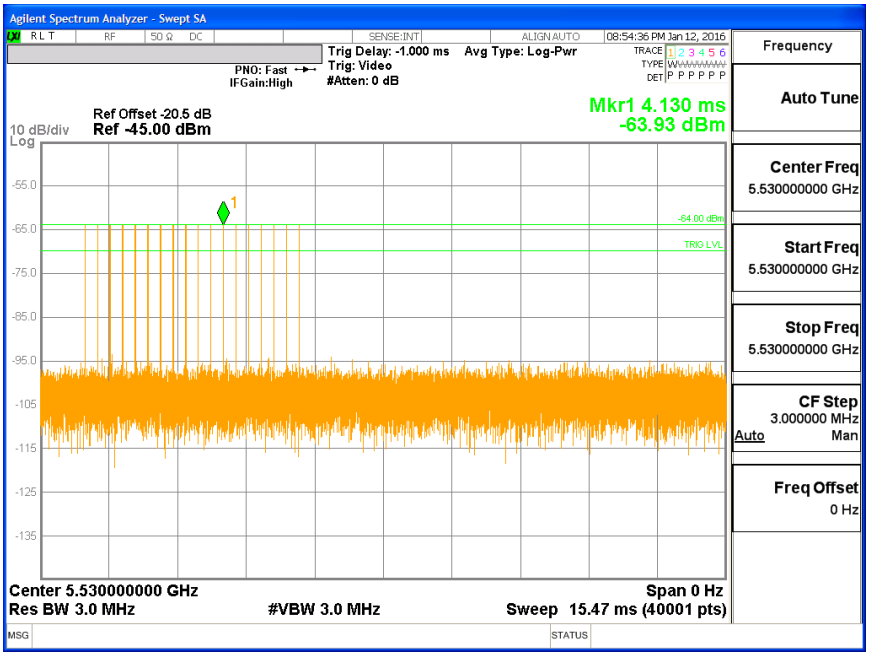
SAMPLE OF RADAR TYPE 3



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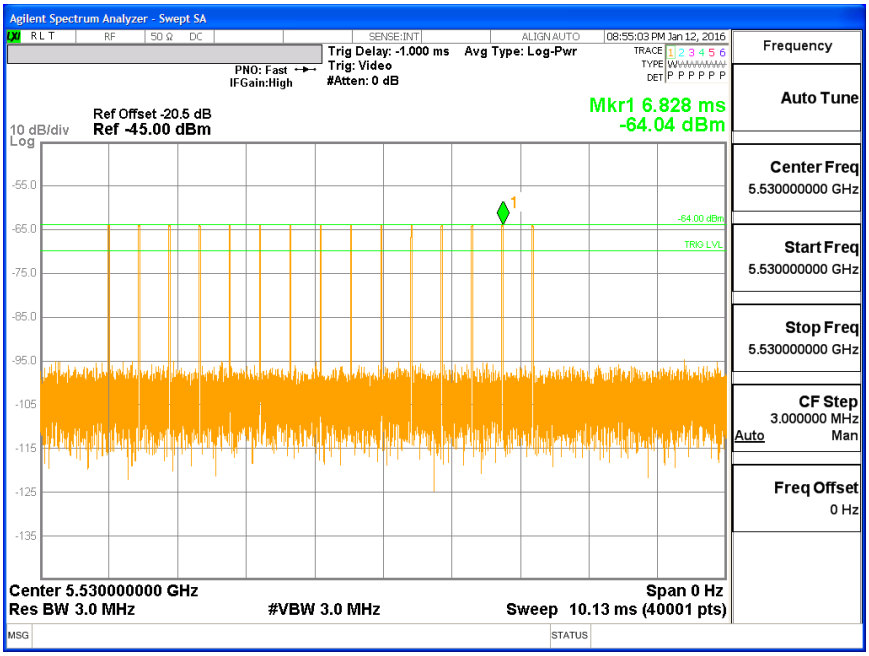
SAMPLE OF RADAR TYPE 4



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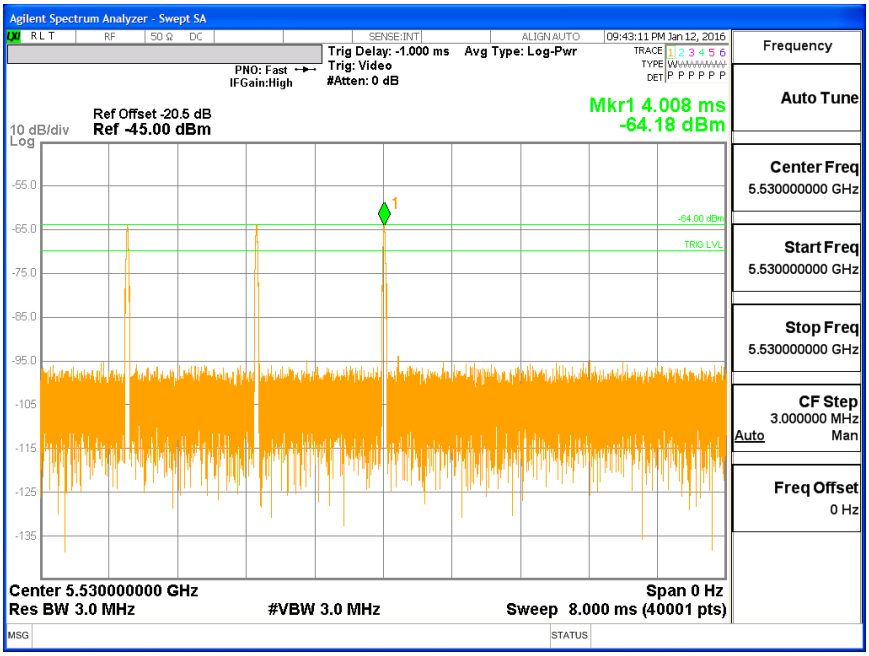
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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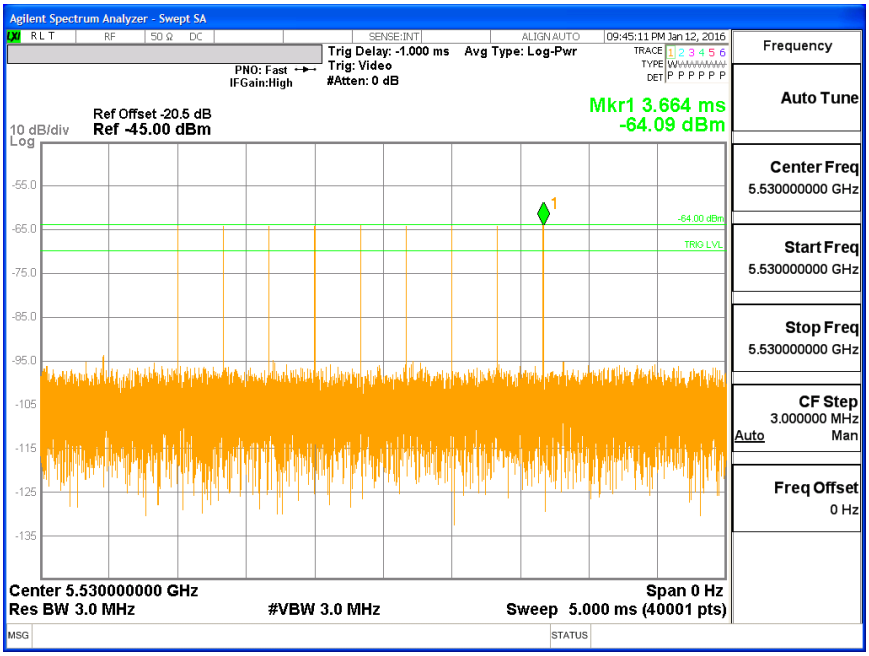
SINGLE BURST OF RADAR TYPE 6



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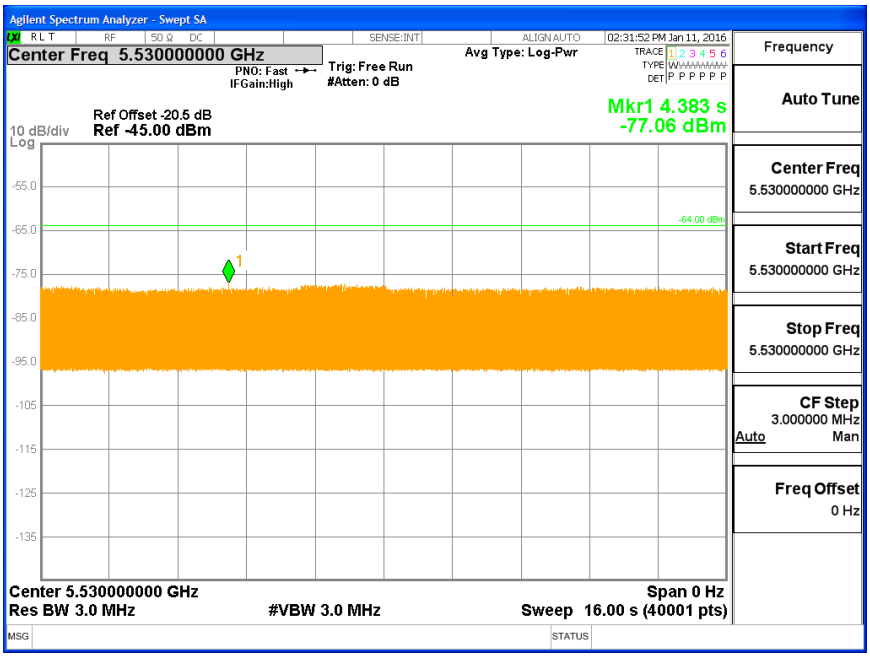
TRAFFIC

TRAFFIC



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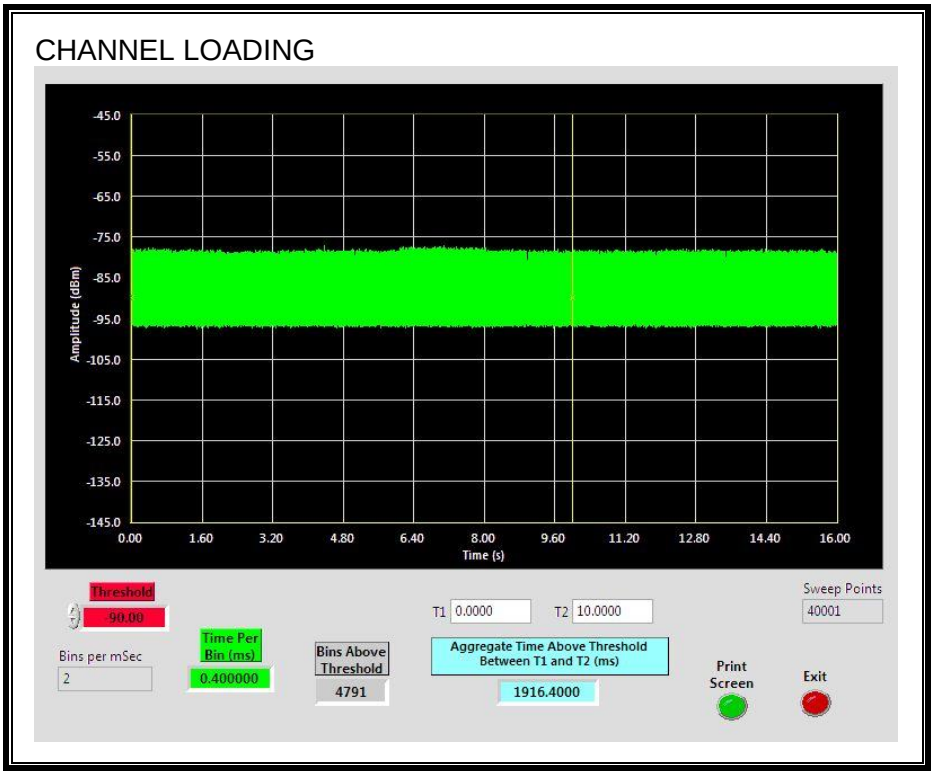
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 19.16%

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5.4.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5530 MHz and commence a CAC period. The time to the re-initialization of traffic was measured as the time required for the EUT to complete the CAC period.

PROCEDURE FOR TIMING OF RADAR BURST

A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5530 MHz and commence a CAC period. A radar signal was triggered within 0 to 6 seconds after the beginning of the CAC period and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. A sweep was started on the spectrum analyzer when a software command was issued to the EUT to change to 5530 MHz and commence a CAC period. A radar signal was triggered within 54 to 60 seconds after the beginning of the CAC period and transmissions on the channel were monitored on the spectrum analyzer.

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QUANTITATIVE RESULTS BASED UPON SPECTRUM ANALYZER PLOTS

No Radar Triggered

Beginning of CAC (sec)	Timing of Start of Traffic (sec)	CAC Period Time (sec)
0	64.0	64.0

Radar Near Beginning of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	0.930	0.930

Radar Near End of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	58.96	58.96

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QUANTITATIVE RESULTS BASED ON LOG FILE TIME STAMPS

No Radar Triggered

Beginning of CAC (hh:mm:ss)	End of CAC (hh:mm:ss)	CAC Time (hh:mm:ss)
4:41:37	4:42:42	0:01:05

Radar Near Beginning of CAC

Beginning of CAC (hh:mm:ss)	Radar Detected (hh:mm:ss)	Radar Relative to Start of CAC (hh:mm:ss)
4:49:17	4:49:18	0:00:01

Radar Near End of CAC

Beginning of CAC (hh:mm:ss)	Radar Detected (hh:mm:ss)	Radar Relative to Start of CAC (hh:mm:ss)
5:00:49	5:01:48	0:00:59

If a radar signal is detected during the channel availability check then the PC controlling the EUT displays a message stating that radar was detected.

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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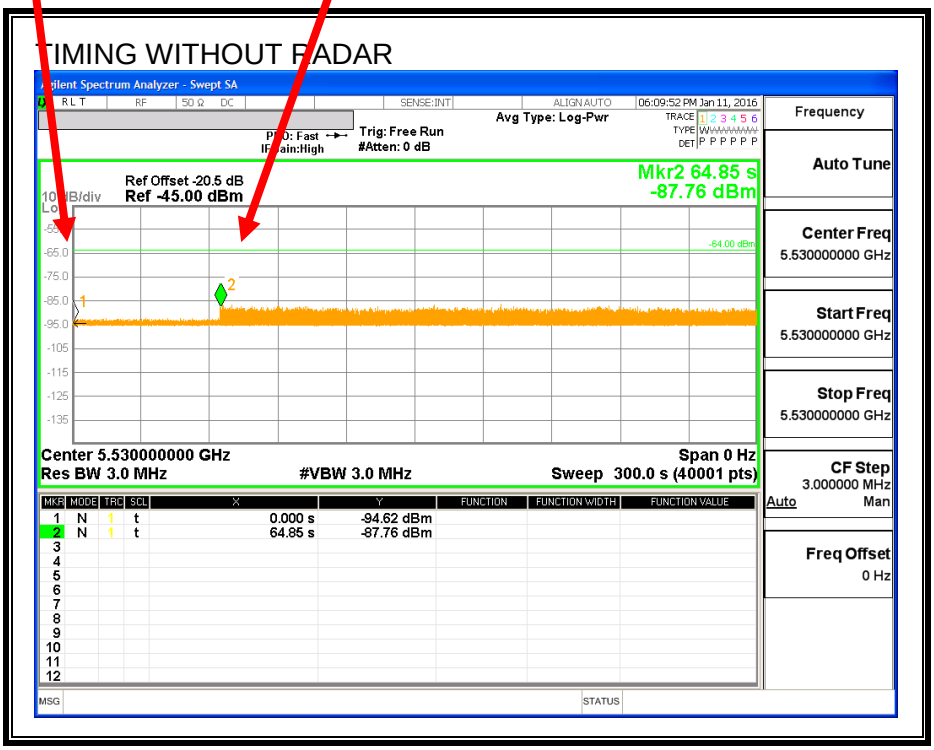
TIMING WITHOUT RADAR DURING CAC

Command to
Switch Channels
Start of CAC

End of CAC



Transmissions begin on channel after completion of the CAC period.

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Log File of CAC Timing Without Radar

Jan 11 04:41:37 2016: DOT11: %%%%>dfs:DFS
evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor
(dfs.c:415)
Jan 11 **04:41:37** 2016: DOT11: %%%%>dfs:DFS
evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor
(dfs.c:415)
Jan 11 **04:42:42** 2016: DOT11: %%%%>dfs:DFS
evt=in_srvc_monitor,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled
(dfs.c:415)

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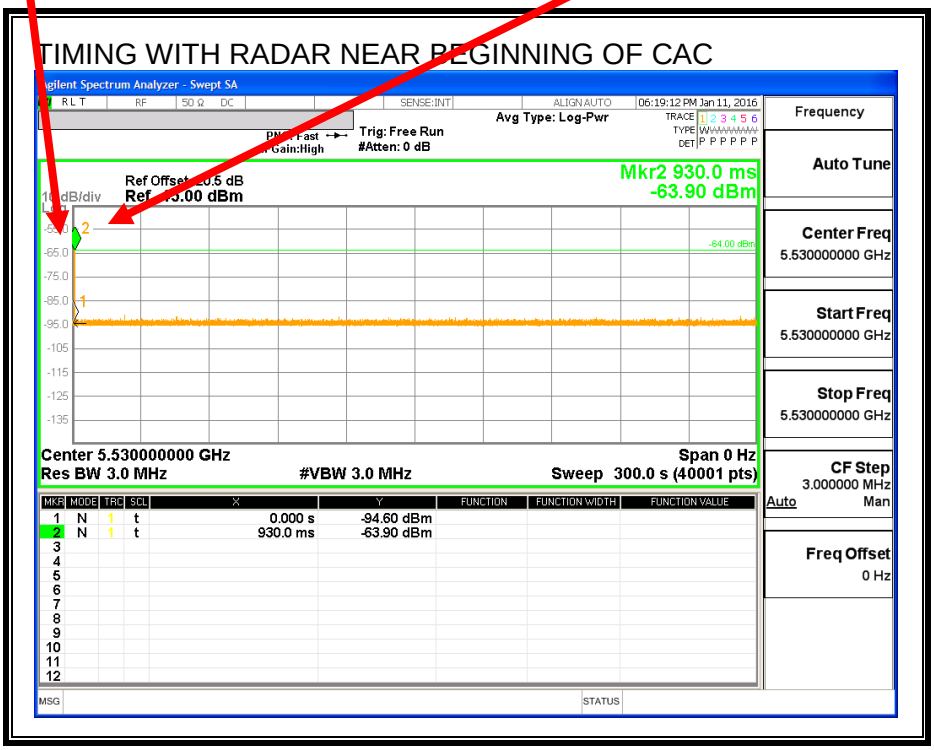
TIMING WITH RADAR NEAR BEGINNING OF CAC

Command to
Switch Channels
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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Log File of Radar at the Beginning of CAC

Jan 11 04:49:17 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 **04:49:17** 2016: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 04:49:18 2016: KERN: WL1: DFS: UNCLASSIFIED ########## radar detected on channel 100/80 ########## min_pw=31, subband_result=6, AT 300MS.
Jan 11 04:49:18 2016: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 106.
Jan 11 04:49:18 2016: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Jan 11 04:49:18 2016: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Jan 11 04:49:18 2016: DOT11: dfs:Starting resume timer (dfs.c:282)
Jan 11 **04:49:18** 2016: ap8533-0700B4 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 80 freq 5500 MHz

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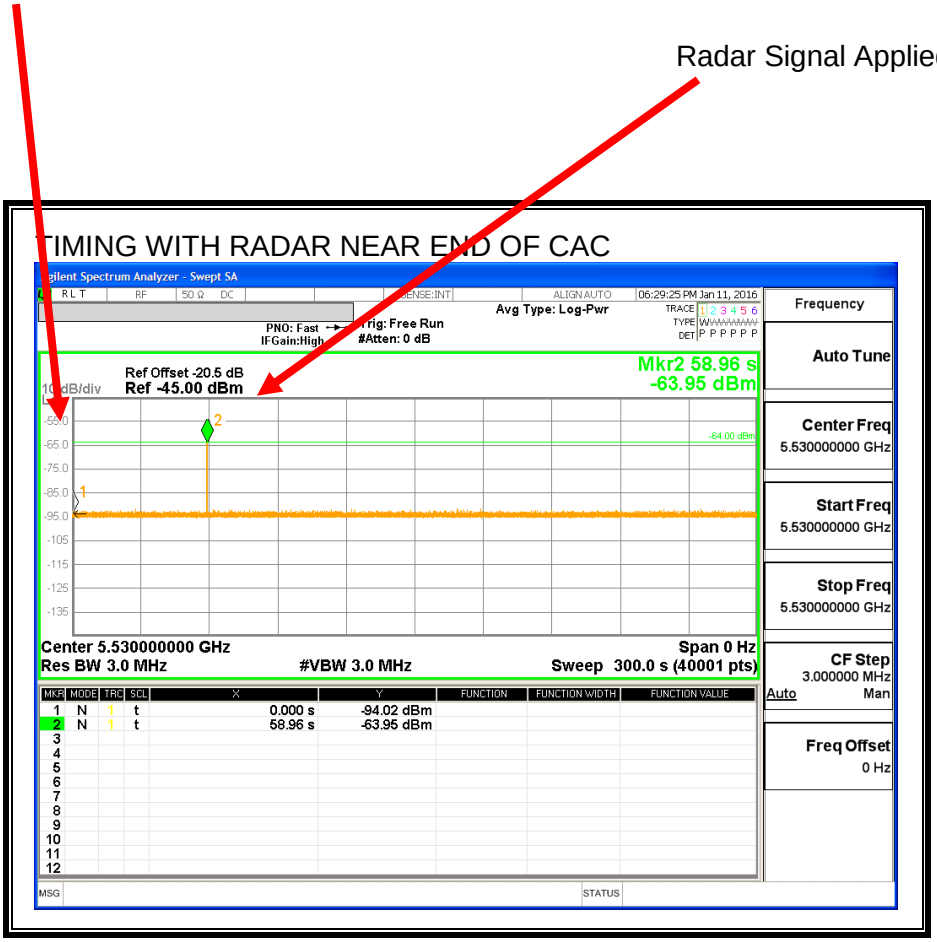
TIMING WITH RADAR NEAR END OF CAC

Command to
Switch Channels
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

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Log File of Radar at the End of CAC

Jan 11 05:00:49 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 **05:00:49** 2016: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Jan 11 05:01:48 2016: KERN: WL1: DFS: UNCLASSIFIED ########## radar detected on channel 100/80 ########## min_pw=31, subband_result=6, AT 54600MS.
Jan 11 05:01:48 2016: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 106.
Jan 11 05:01:48 2016: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Jan 11 05:01:48 2016: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Jan 11 05:01:48 2016: DOT11: dfs:Starting resume timer (dfs.c:282)
Jan 11 05:01:48 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=157,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 05:01:48 2016: DOT11: dfs:DFS: driver's ch:157, rim's channel:100, bcmko_next_dfs_chan=157 (dfs.c:335)
Jan 11 05:01:48 2016: DOT11: dfs:DFS: rim's curren_ch=157, new next channel=161, telling dataplane. (dfs.c:343)
Jan 11 05:01:48 2016: DOT11: dfs:DFS_Validate_Power max 36 prtl: 30 (dfs.c:104)
Jan 11 05:01:48 2016: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=157,ridx=1,curCh=157,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 05:01:48 2016: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Jan 11 05:01:48 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=157,ridx=1,curCh=157,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Jan 11 05:01:48 2016: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=157,ridx=1,curCh=157,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Jan 11 **05:01:48** 2016: ap8533-0700B4 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 80 freq 5500 MHz

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5.4.1. OVERLAPPING CHANNEL TESTS

RESULTS

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

These tests are not applicable.

5.4.2. 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)
0.014	10

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

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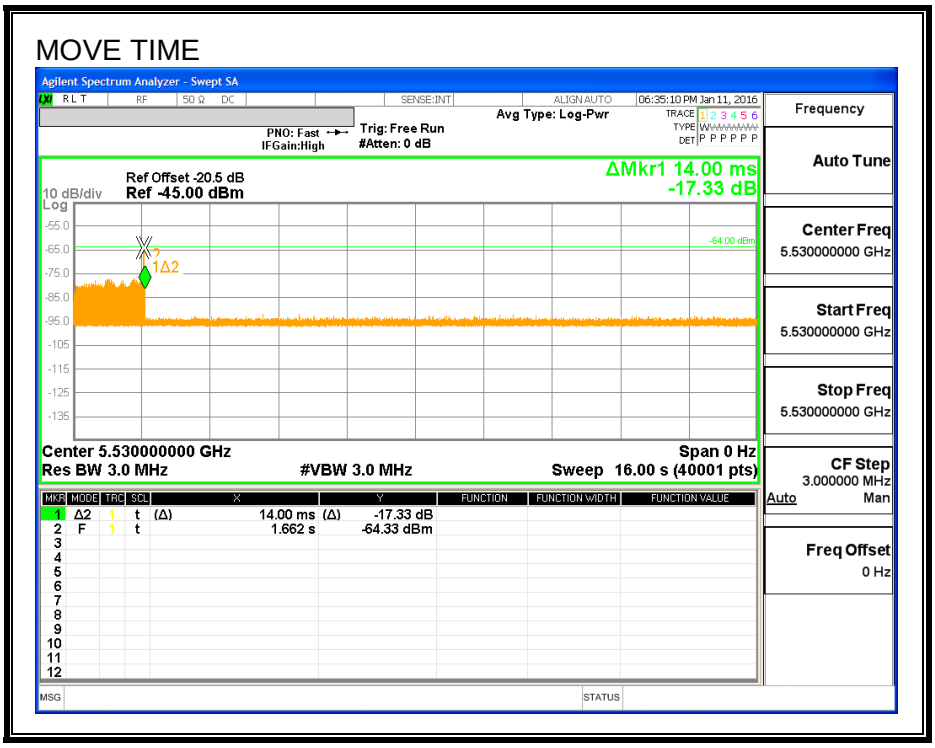
MOVE TIME



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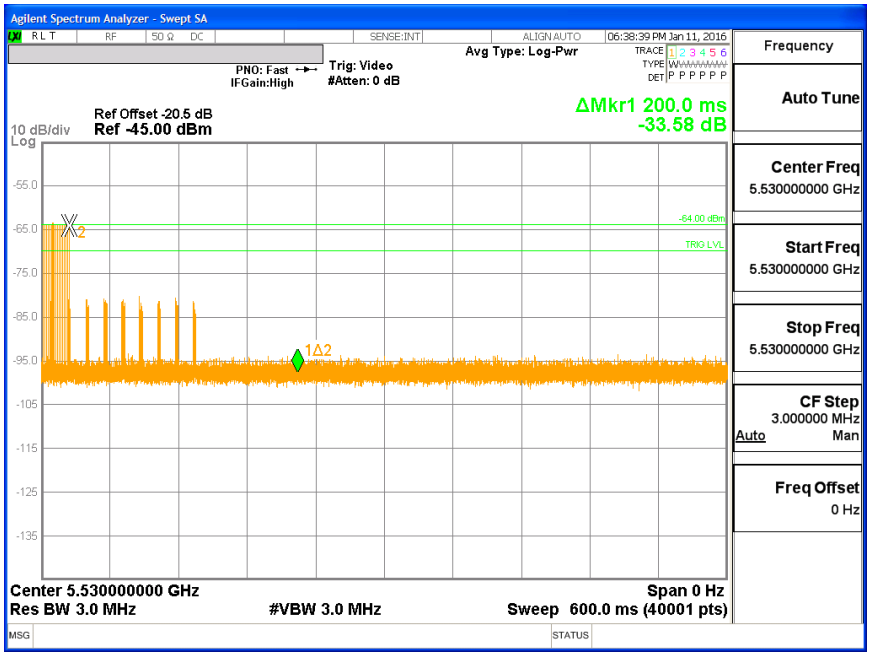
CHANNEL CLOSING TIME

CLOSING TIME



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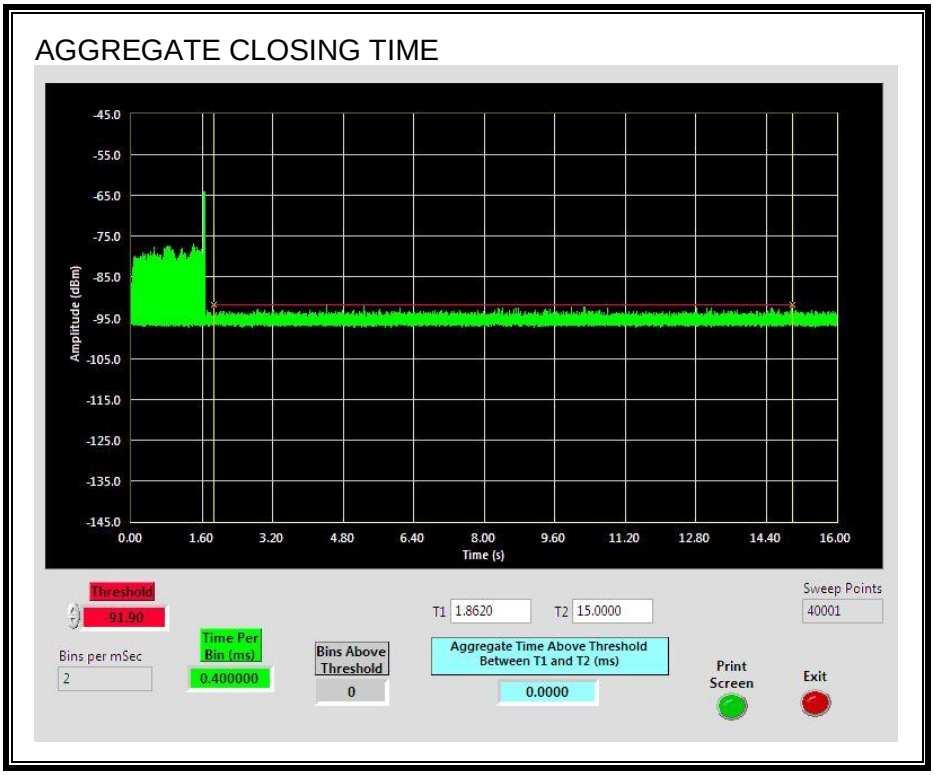
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.



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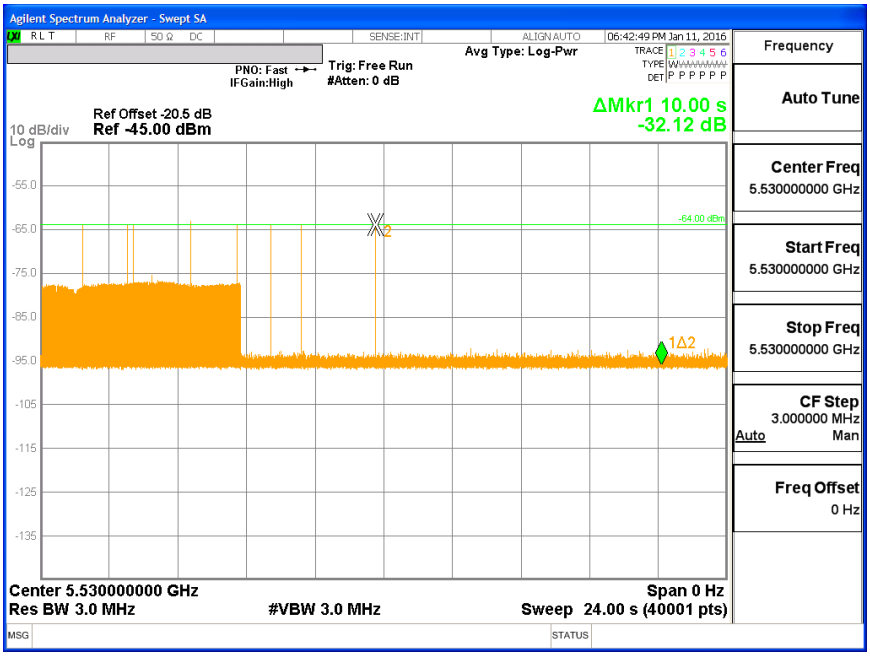
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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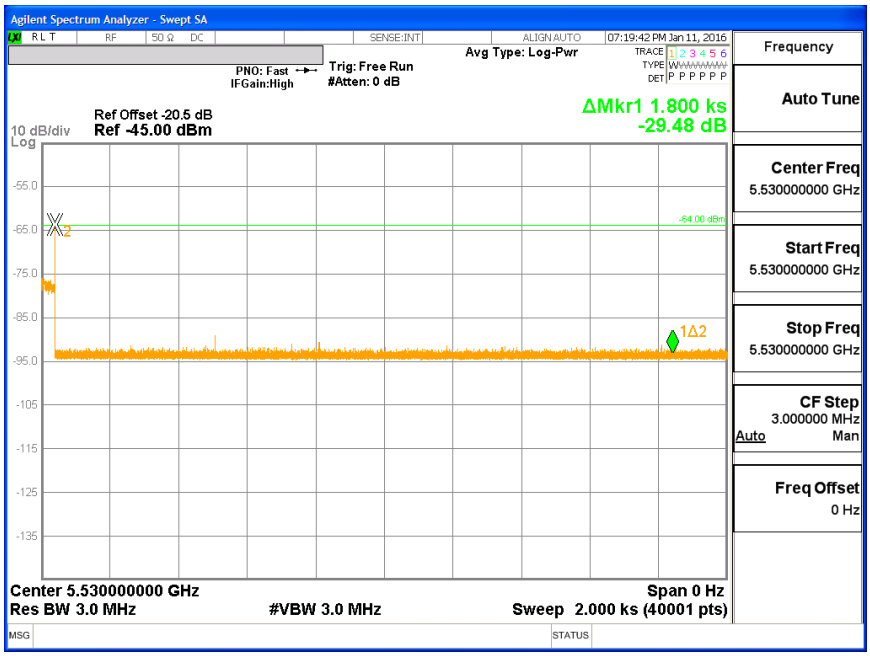
5.4.1. NON-OCCUPANCY PERIOD

RESULTS

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

NON-OCCUPANCY PERIOD



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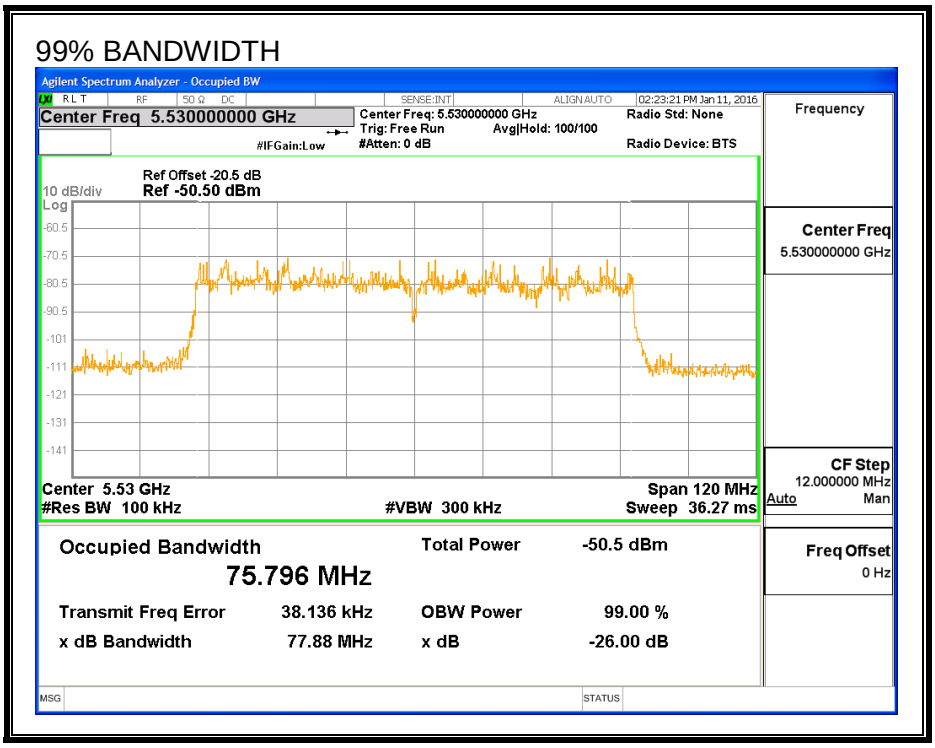
5.4.2. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5491	5569	78	75.796	102.9	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
5491	10	10	100	FL
5492	10	10	100	
5493	10	10	100	
5494	10	10	100	
5495	10	10	100	
5500	10	10	100	
5505	10	10	100	
5510	10	10	100	
5515	10	10	100	
5520	10	10	100	
5525	10	10	100	
5530	10	10	100	
5535	10	10	100	
5540	10	10	100	
5545	10	10	100	
5550	10	10	100	
5555	10	10	100	
5560	10	10	100	
5565	10	10	100	
5566	10	10	100	
5567	10	10	100	
5568	10	10	100	
5569	10	10	100	FH

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5.4.3. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail	Detection Bandwidth		80% of Det BW	
					FL	FH	FL5	FH5
FCC Short Pulse Type 1	30	96.67	60	Pass	5491	5569		
FCC Short Pulse Type 2	30	100.00	60	Pass	5491	5569		
FCC Short Pulse Type 3	30	96.67	60	Pass	5491	5569		
FCC Short Pulse Type 4	30	93.33	60	Pass	5491	5569		
Aggregate		96.67	80	Pass				
FCC Long Pulse Type 5	30	93.33	80	Pass	5491	5569	5499	5561
FCC Hopping Type 6	79	100.00	70	Pass	5491	5569		

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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	No
1002	1	638	83	A	5530	Yes
1003	1	618	86	A	5530	Yes
1004	1	758	70	A	5530	Yes
1005	1	738	72	A	5530	Yes
1006	1	698	76	A	5530	Yes
1007	1	558	95	A	5530	Yes
1008	1	538	99	A	5530	Yes
1009	1	578	92	A	5530	Yes
1010	1	818	65	A	5530	Yes
1011	1	658	81	A	5530	Yes
1012	1	918	58	A	5530	Yes
1013	1	598	89	A	5530	Yes
1014	1	878	61	A	5530	Yes
1015	1	938	57	A	5530	Yes
1016	1	1483	36	B	5530	Yes
1017	1	1116	48	B	5530	Yes
1018	1	1071	50	B	5530	Yes
1019	1	2028	27	B	5530	Yes
1020	1	810	66	B	5530	Yes
1021	1	2378	23	B	5530	Yes
1022	1	2398	23	B	5530	Yes
1023	1	2901	19	B	5530	Yes
1024	1	3051	18	B	5530	Yes
1025	1	1136	47	B	5530	Yes
1026	1	2769	20	B	5530	Yes
1027	1	983	54	B	5530	Yes
1028	1	1551	35	B	5530	Yes
1029	1	2443	22	B	5530	Yes
1030	1	592	90	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	1.9	197	29	5530	Yes
2002	4.2	159	23	5530	Yes
2003	1	153	23	5530	Yes
2004	3.5	162	28	5530	Yes
2005	2.6	160	25	5530	Yes
2006	3.4	173	24	5530	Yes
2007	4.7	218	24	5530	Yes
2008	3.8	155	27	5530	Yes
2009	3.3	166	24	5530	Yes
2010	4.5	187	27	5530	Yes
2011	2.4	202	25	5530	Yes
2012	1.9	190	26	5530	Yes
2013	4	209	27	5530	Yes
2014	3.7	201	24	5530	Yes
2015	2	186	23	5530	Yes
2016	4.1	182	27	5530	Yes
2017	4.7	172	26	5530	Yes
2018	2.9	215	28	5530	Yes
2019	3.8	171	24	5530	Yes
2020	2.2	218	26	5530	Yes
2021	1.3	177	29	5530	Yes
2022	2.1	229	29	5530	Yes
2023	1.5	193	25	5530	Yes
2024	2.5	210	25	5530	Yes
2025	2	221	29	5530	Yes
2026	1.3	161	25	5530	Yes
2027	1.1	177	26	5530	Yes
2028	4.7	164	23	5530	Yes
2029	2.7	184	25	5530	Yes
2030	2.4	175	29	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	7.4	284	18	5530	Yes
3002	7.2	271	17	5530	No
3003	8.1	490	16	5530	Yes
3004	5.8	372	16	5530	Yes
3005	6.9	486	18	5530	Yes
3006	7.6	381	16	5530	Yes
3007	8.9	257	18	5530	Yes
3008	9.9	415	17	5530	Yes
3009	9.1	304	16	5530	Yes
3010	5.2	491	18	5530	Yes
3011	9.8	392	17	5530	Yes
3012	8.9	458	16	5530	Yes
3013	8.6	254	16	5530	Yes
3014	8	467	18	5530	Yes
3015	5.6	276	16	5530	Yes
3016	5.2	250	17	5530	Yes
3017	5.7	456	17	5530	Yes
3018	5.6	325	17	5530	Yes
3019	6.4	293	18	5530	Yes
3020	9.3	293	18	5530	Yes
3021	5.3	407	17	5530	Yes
3022	6	302	18	5530	Yes
3023	7.3	428	17	5530	Yes
3024	8.3	336	16	5530	Yes
3025	7.5	357	18	5530	Yes
3026	8.7	411	18	5530	Yes
3027	8.2	312	16	5530	Yes
3028	7.3	261	18	5530	Yes
3029	7	426	18	5530	Yes
3030	6.4	387	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	18.1	447	15	5530	No
4002	12.6	304	13	5530	Yes
4003	18.4	377	12	5530	Yes
4004	13.4	497	13	5530	Yes
4005	19.8	465	12	5530	Yes
4006	15.3	347	13	5530	Yes
4007	17.5	327	13	5530	Yes
4008	18.9	473	12	5530	Yes
4009	11.4	349	12	5530	Yes
4010	13.3	390	16	5530	Yes
4011	11.8	278	14	5530	Yes
4012	14.2	332	13	5530	Yes
4013	13.2	484	14	5530	Yes
4014	11.4	433	14	5530	Yes
4015	10.8	346	15	5530	Yes
4016	19.6	308	12	5530	Yes
4017	14.9	250	13	5530	Yes
4018	19.5	475	14	5530	Yes
4019	15.2	297	15	5530	Yes
4020	10.2	417	16	5530	Yes
4021	16.6	385	16	5530	Yes
4022	12.1	267	12	5530	Yes
4023	19.6	499	16	5530	Yes
4024	15.7	394	15	5530	Yes
4025	18.3	269	15	5530	No
4026	10.1	310	14	5530	Yes
4027	18.7	450	12	5530	Yes
4028	11	252	12	5530	Yes
4029	10	404	12	5530	Yes
4030	18.3	353	12	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	5513	No
2	5549	Yes
3	5511	Yes
4	5525	Yes
5	5528	Yes
6	5538	Yes
7	5555	Yes
8	5525	Yes
9	5500	Yes
10	5523	Yes
11	5542	Yes
12	5549	Yes
13	5542	Yes
14	5504	Yes
15	5553	No
16	5499	Yes
17	5519	Yes
18	5522	Yes
19	5517	Yes
20	5541	Yes
21	5538	Yes
22	5530	Yes
23	5501	Yes
24	5555	Yes
25	5532	Yes
26	5537	Yes
27	5527	Yes
28	5526	Yes
29	5553	Yes
30	5539	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	355	5491	10	Yes
2	830	5492	14	Yes
3	1305	5493	22	Yes
4	1780	5494	21	Yes
5	2255	5495	18	Yes
6	2730	5496	14	Yes
7	3205	5497	13	Yes
8	3680	5498	8	Yes
9	4155	5499	19	Yes
10	4630	5500	16	Yes
11	5105	5501	13	Yes
12	5580	5502	15	Yes
13	6055	5503	12	Yes
14	6530	5504	19	Yes
15	7005	5505	15	Yes
16	7480	5506	14	Yes
17	7955	5507	12	Yes
18	8430	5508	21	Yes
19	8905	5509	24	Yes
20	9380	5510	13	Yes
21	9855	5511	11	Yes
22	10330	5512	22	Yes
23	10805	5513	20	Yes
24	11280	5514	14	Yes
25	11755	5515	13	Yes
26	12230	5516	14	Yes
27	12705	5517	22	Yes
28	13180	5518	16	Yes
29	13655	5519	10	Yes
30	14130	5520	20	Yes
31	14605	5521	15	Yes
32	15080	5522	14	Yes
33	15555	5523	16	Yes
34	16030	5524	20	Yes
35	16505	5525	18	Yes
36	16980	5526	17	Yes
37	17455	5527	15	Yes
38	17930	5528	17	Yes
39	18405	5529	14	Yes

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TYPE 6 DETECTION PROBABILITY (CONTINUED)

40	18880	5530	17	Yes
41	19355	5531	22	Yes
42	19830	5532	17	Yes
43	20305	5533	14	Yes
44	20780	5534	9	Yes
45	21255	5535	18	Yes
46	21730	5536	17	Yes
47	22205	5537	11	Yes
48	22680	5538	11	Yes
49	23155	5539	13	Yes
50	23630	5540	14	Yes
51	24105	5541	17	Yes
52	24580	5542	17	Yes
53	25055	5543	17	Yes
54	25530	5544	19	Yes
55	26005	5545	18	Yes
56	26480	5546	16	Yes
57	26955	5547	15	Yes
58	27430	5548	16	Yes
59	27905	5549	20	Yes
60	28380	5550	14	Yes
61	28855	5551	16	Yes
62	29330	5552	20	Yes
63	29805	5553	14	Yes
64	30280	5554	16	Yes
65	30755	5555	13	Yes
66	31230	5556	20	Yes
67	31705	5557	17	Yes
68	32180	5558	19	Yes
69	32655	5559	22	Yes
70	33130	5560	19	Yes
71	33605	5561	19	Yes
72	34080	5562	19	Yes
73	34555	5563	15	Yes
74	35030	5564	24	Yes
75	35505	5565	20	Yes
76	35980	5566	23	Yes
77	36455	5567	16	Yes
78	36930	5568	15	Yes
79	37405	5569	18	Yes

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6. BRIDGE MODE RESULTS

Per KDB 905462, Section 5.1 (footnote 1):

Networks Access Points with Bridge and/or MESH modes of operation are permitted to operate in the DFS bands but must employ a DFS function. The functionality of the Bridge mode as specified in §15.403(a) must be validated in the DFS test report. Devices operating as relays must also employ DFS function. The method used to validate the functionality must be documented and validation data must be documented. Bridge mode can be validated by performing a test statistical performance check (Section 7.8.4) on any one of the radar types. This is an abbreviated test to verify DFS functionality. MESH mode operational methodology must be submitted in the application for certification for evaluation by the FCC.

This device does not support Bridge Mode, therefore this test was not performed.

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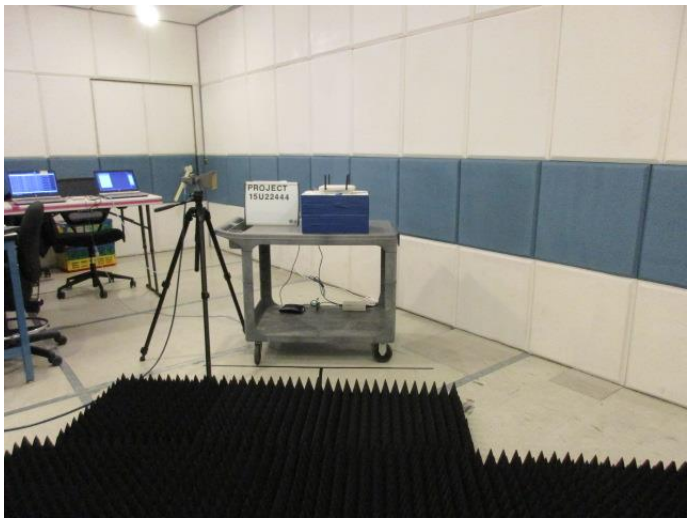
7. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS FRONT PHOTO



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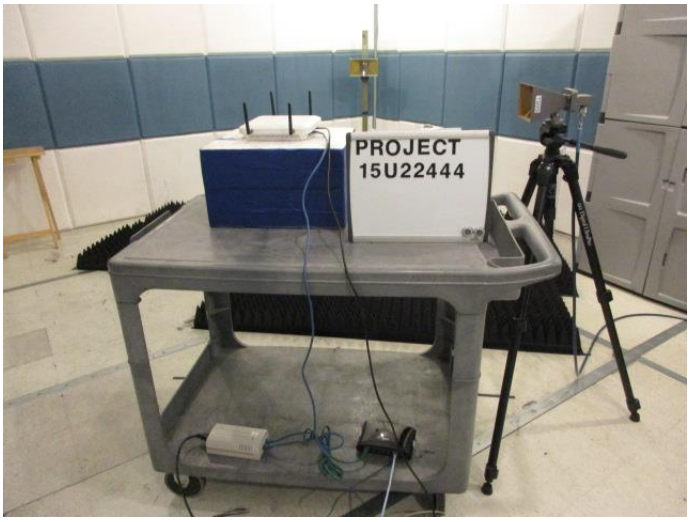
DFS BACK PHOTO



END OF REPORT

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