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

CERTIFICATION TEST REPORT

FOR

802.11ac MU-MIMO, TRI-RADIO, EXT. ANT, 2XGE-US

MODEL NUMBER: CDR5G

FCC ID: UZ7CDR5G
IC: 109AN-CDR5G

REPORT NUMBER: 15U22444-E3V1

ISSUE DATE: FEBRUARY 19, 2016

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	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: 802.11ac MU-MIMO, TRI-RADIO, EXT. ANT, 2XGE-US

MODEL: CDR5G

SERIAL NUMBER: 15285522200194

DATE TESTED: DECEMBER 11 to 17, 2015

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

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

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

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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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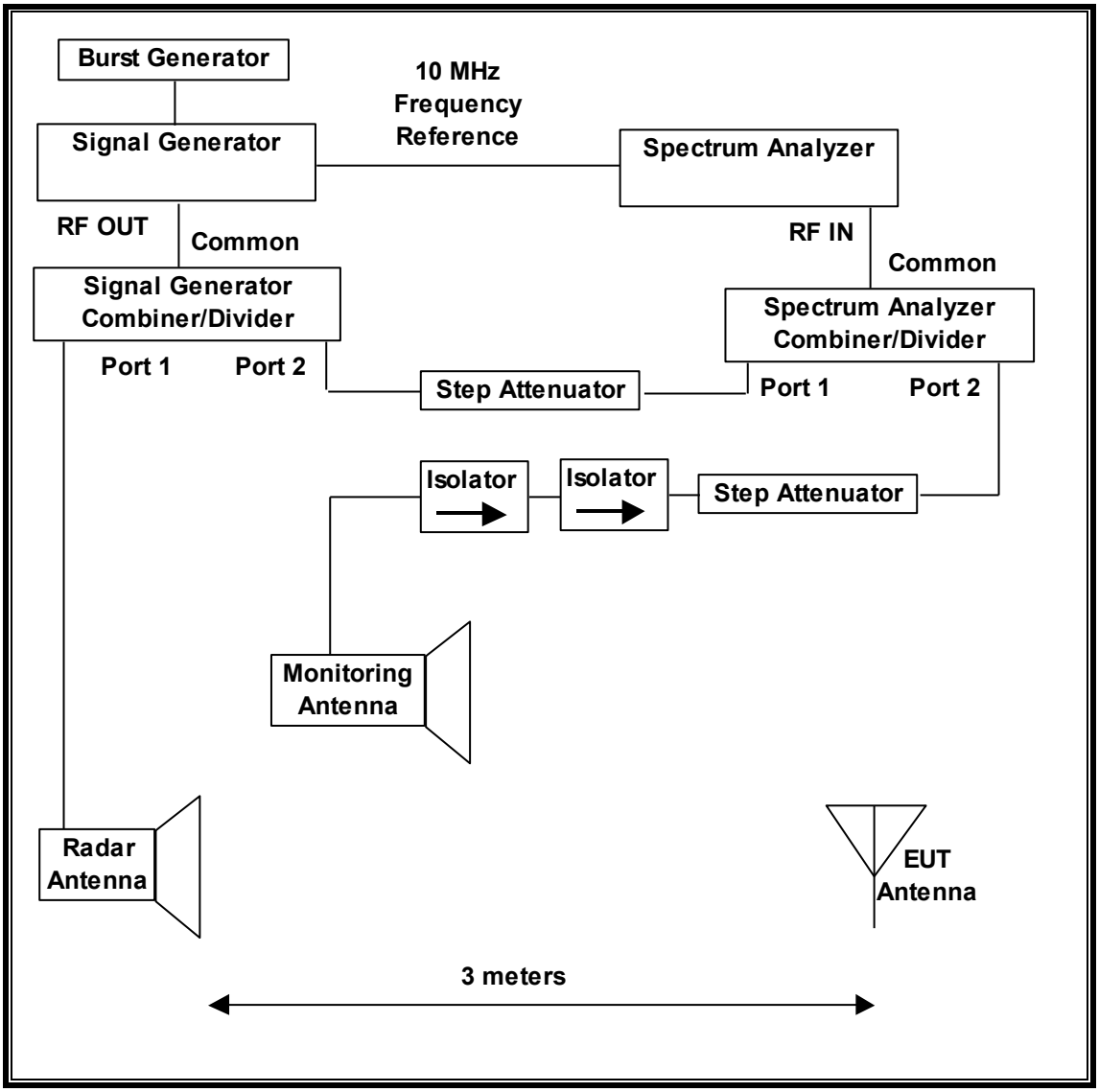
5.1.2. TEST AND MEASUREMENT SYSTEM

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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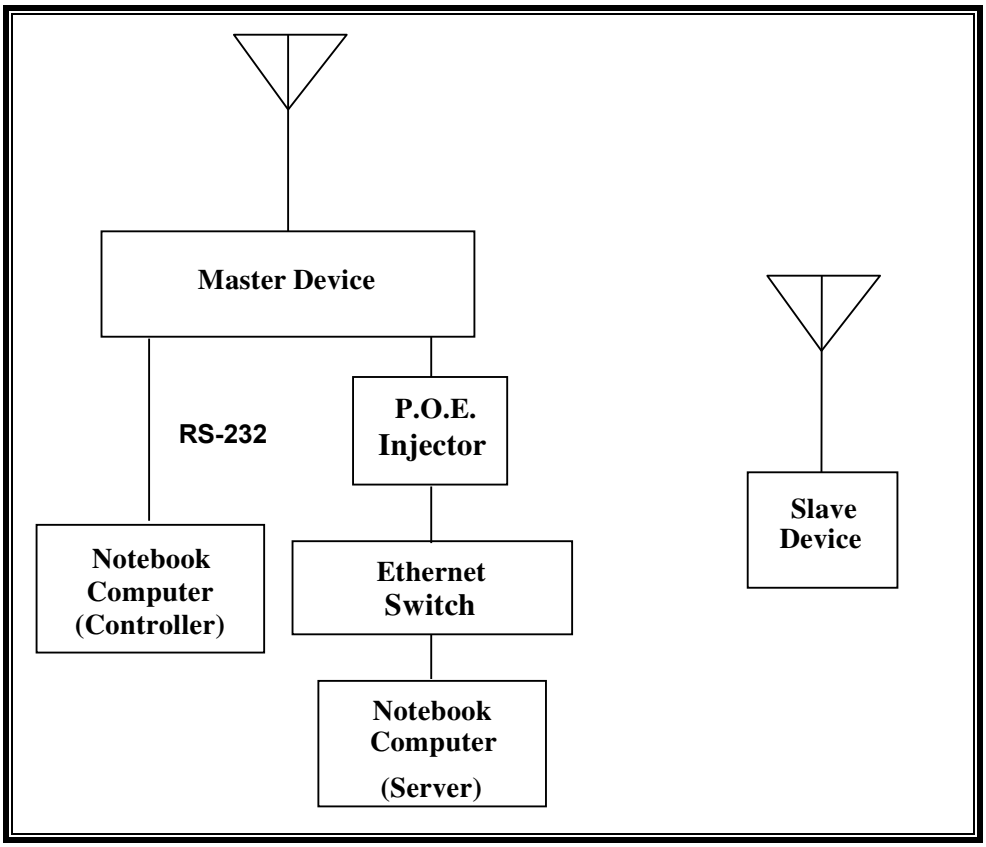
5.1.3. SETUP OF EUT

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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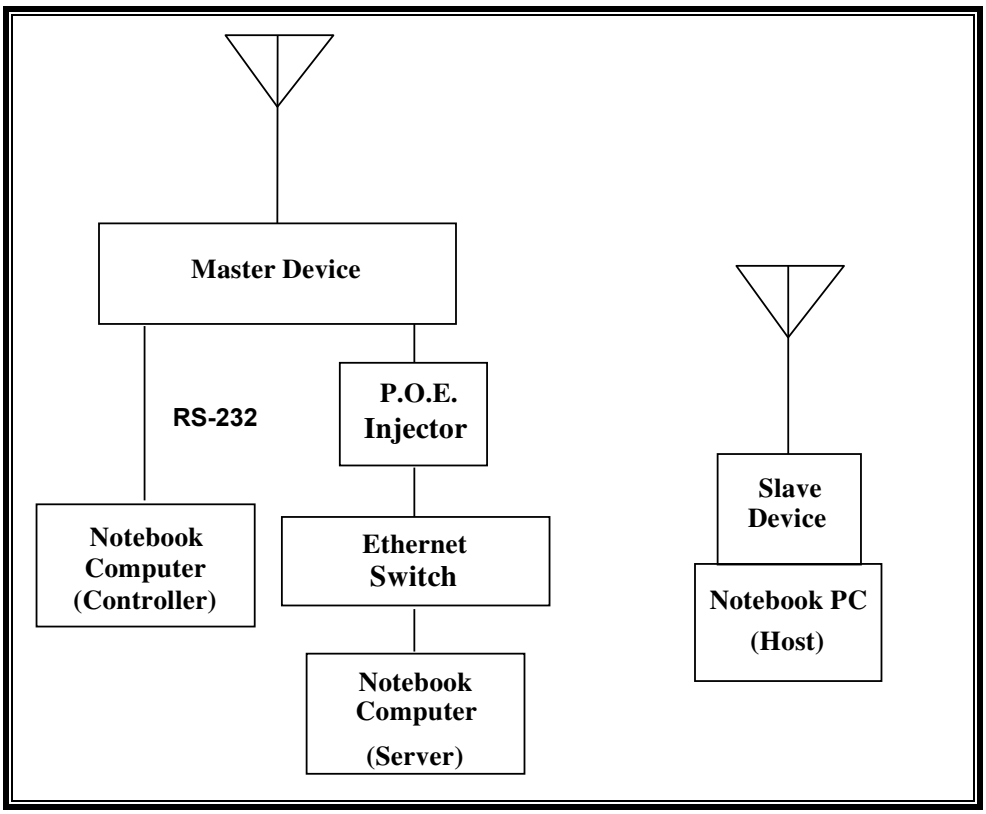
CONFIGURATION 2: 80 MHz CHANNEL BANDWIDTH



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 30 dBm EIRP in the 5250-5350 MHz band and 30 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 10 dBi in the 5250-5350 MHz band and 10 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 2 dBi in the 5250-5350 MHz band and 2 dBi 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, each connected to an antenna to perform radiated tests.

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 CDR5G 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

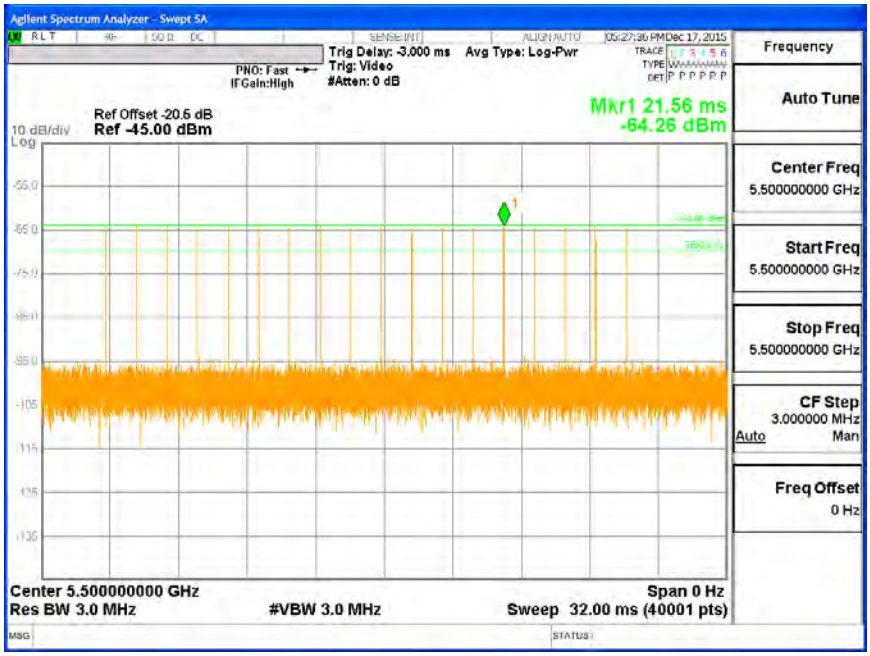
5.2.1. TEST CHANNEL

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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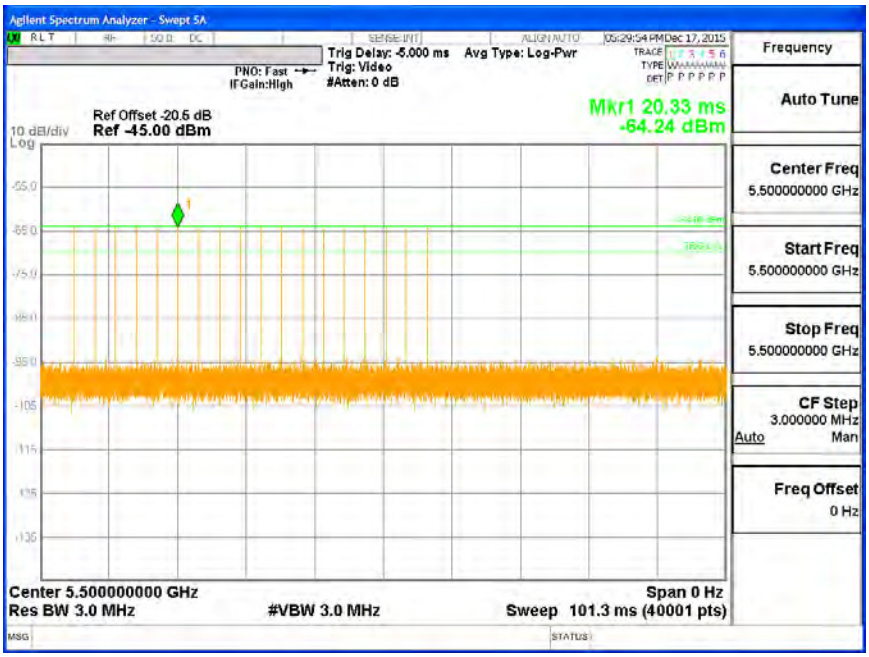
SAMPLE OF RADAR TYPE 1



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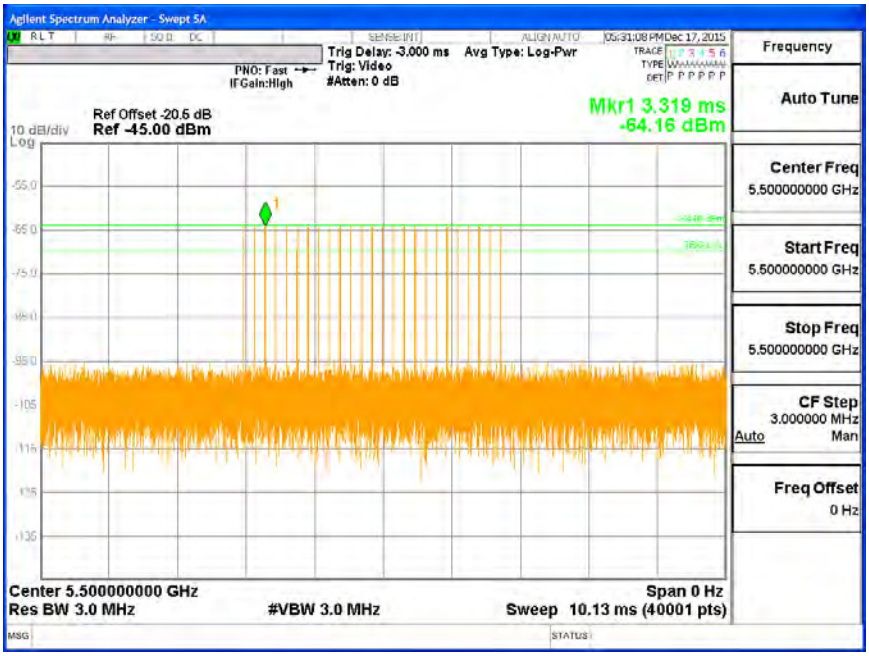
SAMPLE OF RADAR TYPE 2



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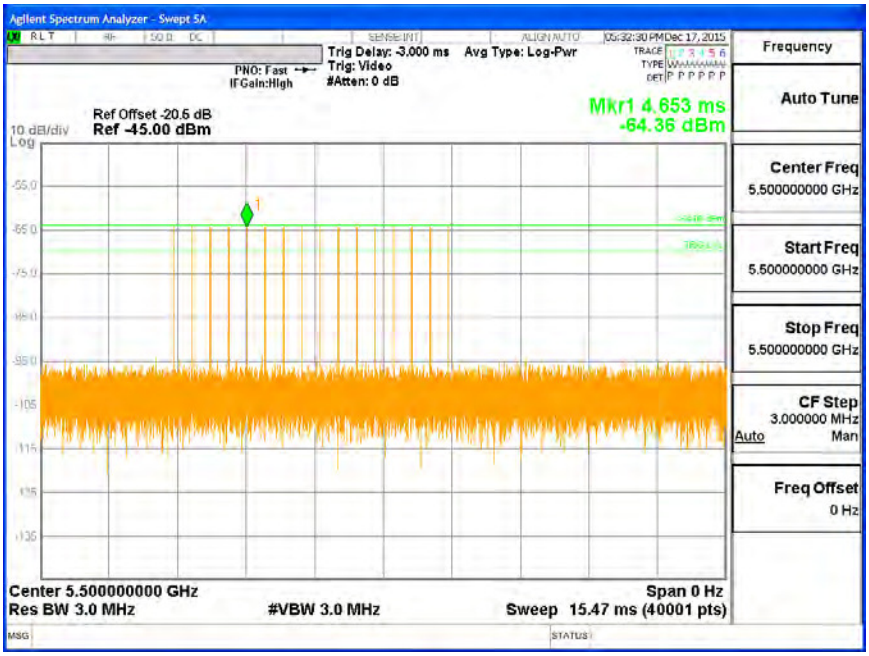
SAMPLE OF RADAR TYPE 3



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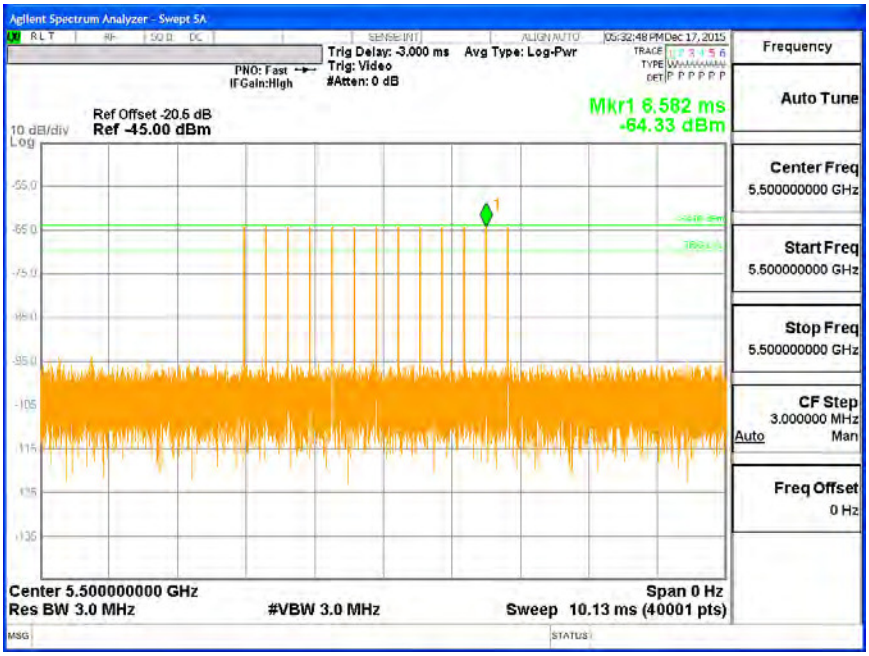
SAMPLE OF RADAR TYPE 4



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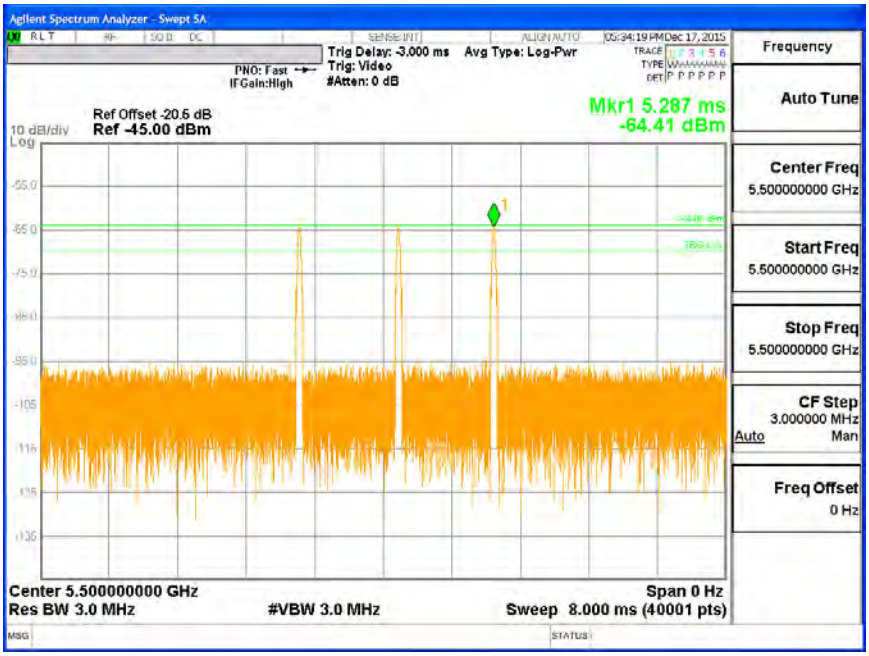
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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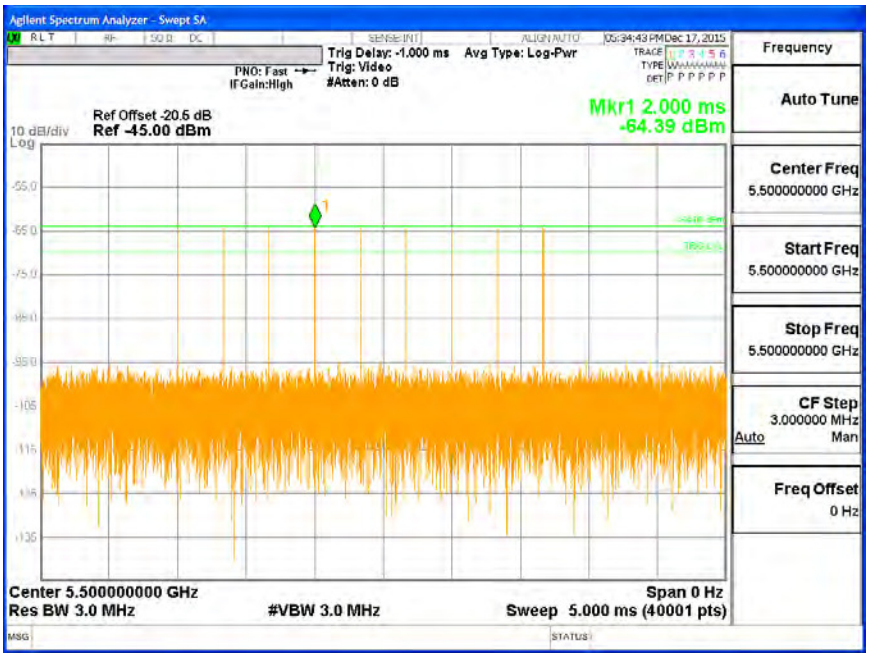
SINGLE BURST OF RADAR TYPE 6



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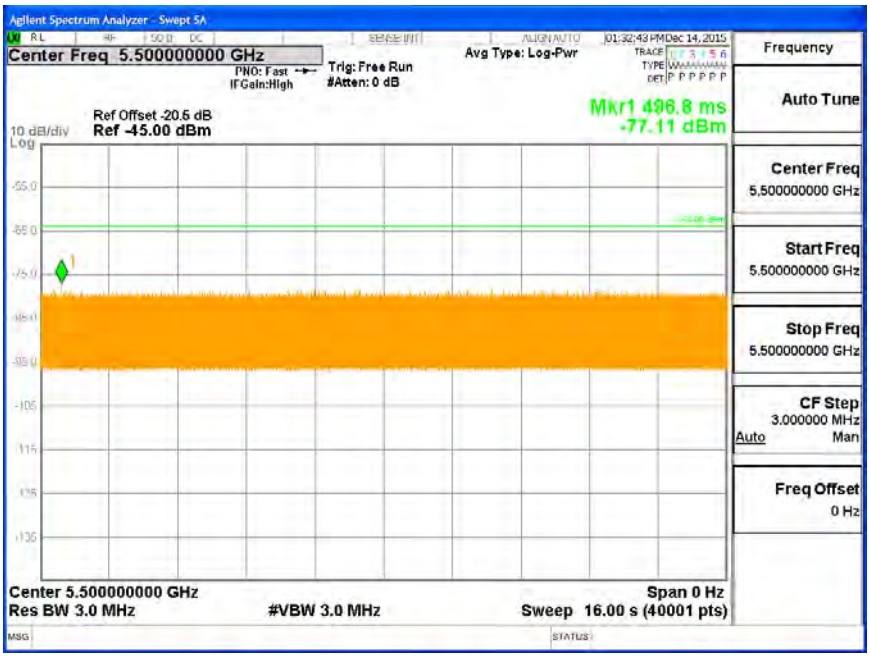
TRAFFIC

TRAFFIC



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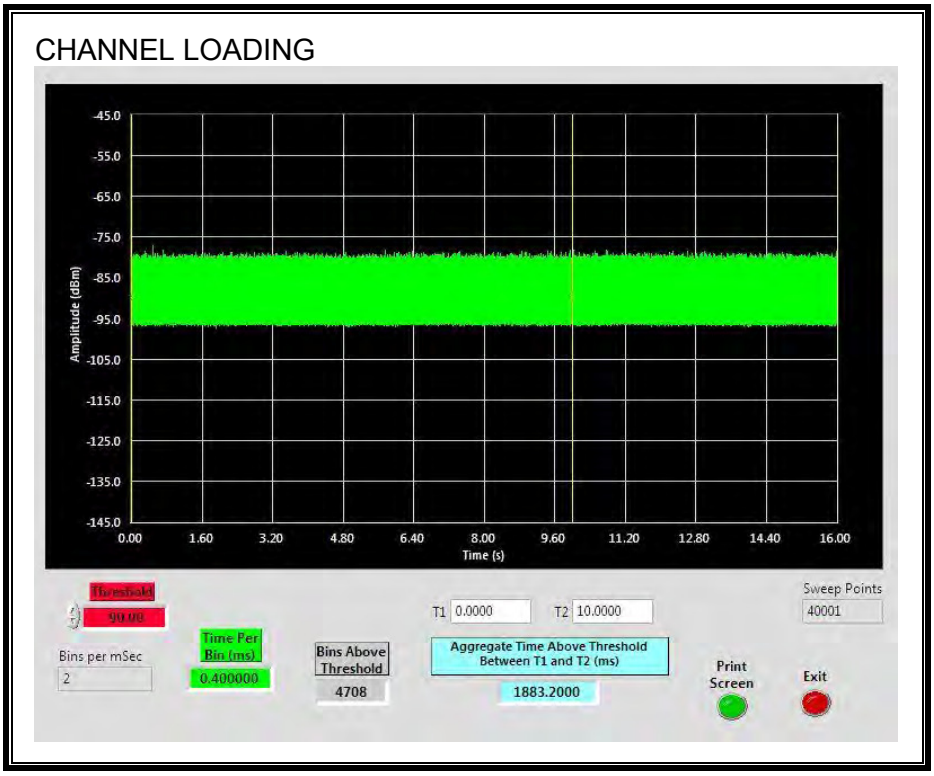
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.83%

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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	64.9	64.9

Radar Near Beginning of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	1.238	1.238

Radar Near End of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	59.42	59.42

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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)
15:02:09	15:03:13	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)
15:23:14	15:23:14	0:00:00

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)
15:34:14	15:35:12	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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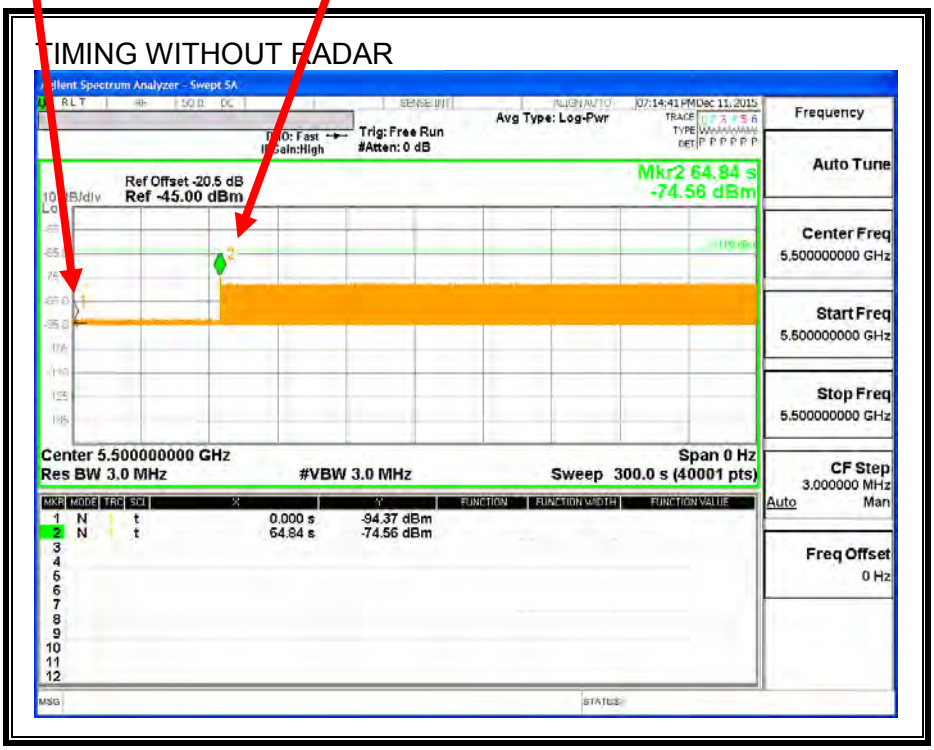
TIMING WITHOUT RADAR DURING CAC

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

Nov 14 15:02:09 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **15:02:09** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **15:03:13** 2015: 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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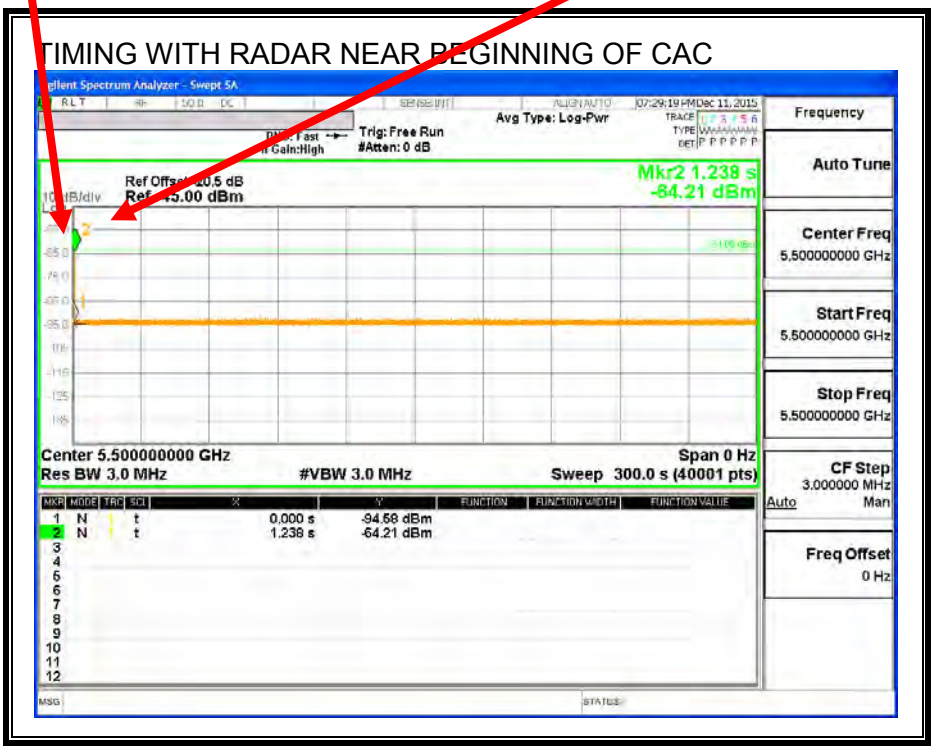
TIMING WITH RADAR NEAR BEGINNING OF CAC

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

Nov 14 15:23:14 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Nov 14 **15:23:14** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Nov 14 15:23:14 2015: KERN: WL1: DFS: ETSI_1 ########## radar detected on channel 100 ########## min_pw=32, subband_result=1, AT 450MS.
Nov 14 15:23:14 2015: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 100.
Nov 14 15:23:14 2015: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Nov 14 15:23:14 2015: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Nov 14 15:23:14 2015: DOT11: dfs:Starting resume timer (dfs.c:282)
Nov 14 15:23:14 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:23:14 2015: DOT11: dfs:DFS: driver's ch:48, rim's channel:100, bcmko_next_dfs_chan=48 (dfs.c:335)
Nov 14 15:23:14 2015: DOT11: dfs:DFS: rim's curren_ch=48, new next channel=44, telling dataplane. (dfs.c:343)
Nov 14 15:23:14 2015: DOT11: dfs:DFS_Validate_Power max 23 prtl: 23 (dfs.c:104)
Nov 14 15:23:14 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:23:14 2015: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Nov 14 15:23:14 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:23:14 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Nov 14 **15:23:14** 2015: 06FA10 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 20 freq 5500 MHz

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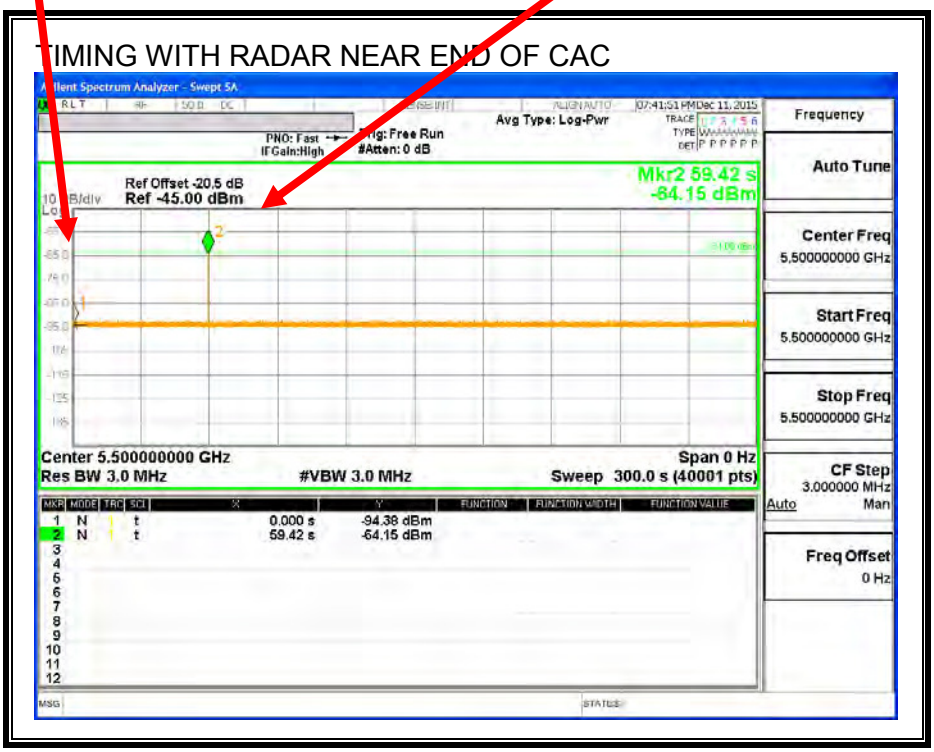
TIMING WITH RADAR NEAR END OF CAC

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

Nov 14 15:34:14 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **15:34:14** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:35:12 2015: KERN: WL1: DFS: ETSI_1 ########## radar detected on channel 100 ########## min_pw=32, subband_result=1, AT 55050MS.
Nov 14 15:35:12 2015: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 100.
Nov 14 15:35:12 2015: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Nov 14 15:35:12 2015: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Nov 14 15:35:12 2015: DOT11: dfs:Starting resume timer (dfs.c:282)
Nov 14 15:35:12 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=36,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:35:12 2015: DOT11: dfs:DFS: driver's ch:36, rim's channel:100, bcmko_next_dfs_chan=36 (dfs.c:335)
Nov 14 15:35:12 2015: DOT11: dfs:DFS: rim's curren_ch=36, new next channel=40, telling dataplane. (dfs.c:343)
Nov 14 15:35:12 2015: DOT11: dfs:DFS_Validate_Power max 23 prtl: 23 (dfs.c:104)
Nov 14 15:35:12 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=36,ridx=1,curCh=36,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:35:12 2015: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Nov 14 15:35:12 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=36,ridx=1,curCh=36,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 15:35:12 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=36,ridx=1,curCh=36,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Nov 14 **15:35:12** 2015: ap8533-06FA10 : %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.

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)
0.684	10

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

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MOVE TIME

MOVE TIME

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CHANNEL CLOSING TIME

CLOSING TIME

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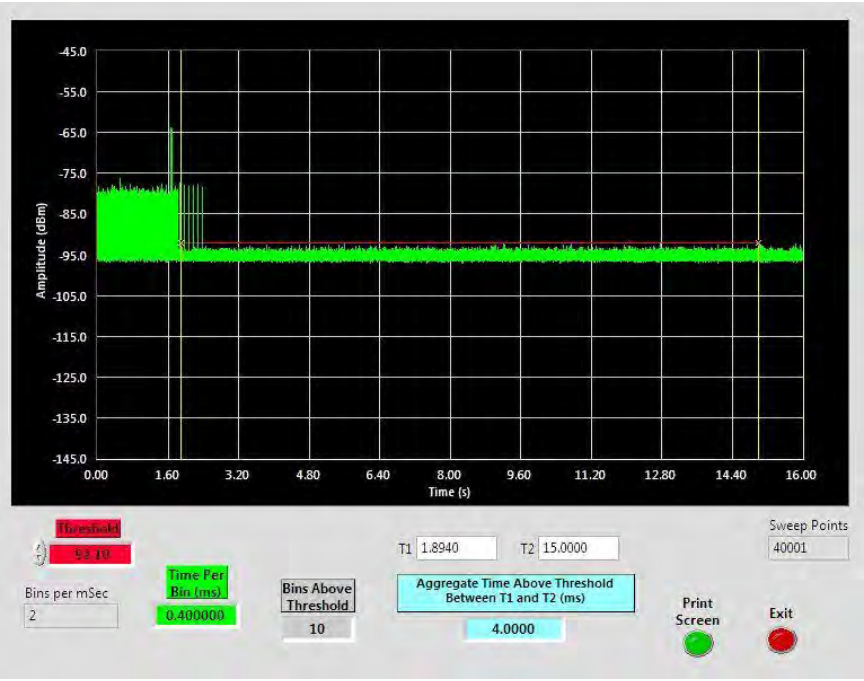
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME



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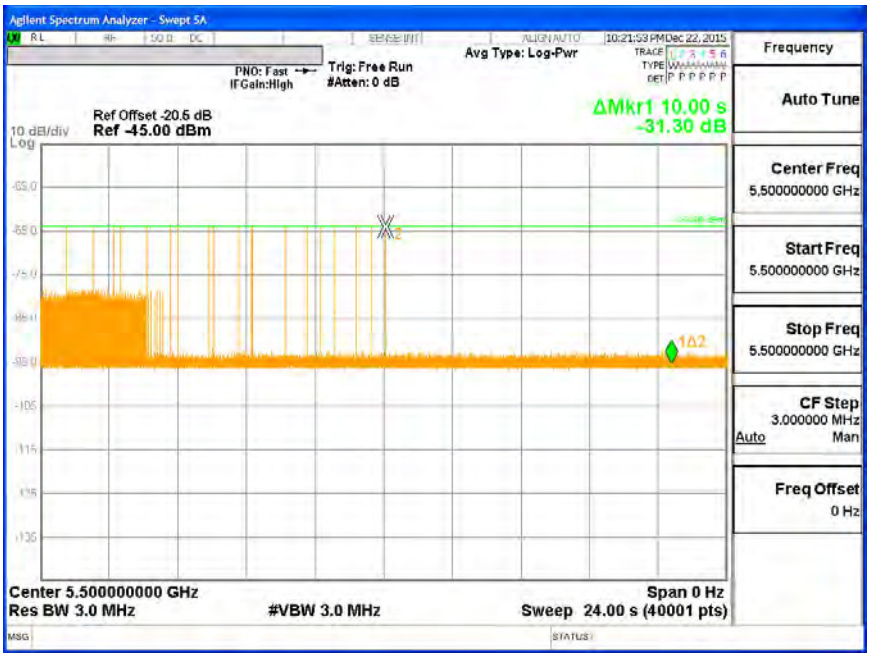
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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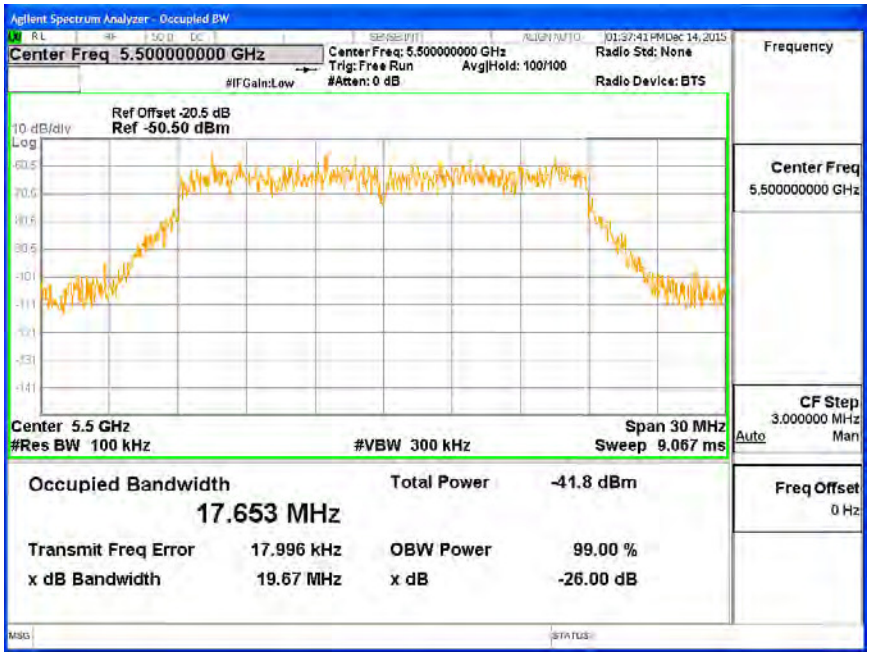
5.2.4. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH

99% 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	17.653	113.3	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	
5506	10	9	90	
5507	10	10	100	
5508	10	9	90	
5509	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	93.33	60	Pass	5490	5510		
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5510		
FCC Short Pulse Type 4	30	96.67	60	Pass	5490	5510		
Aggregate		95.83	80	Pass				
FCC Long Pulse Type 5	30	96.67	80	Pass	5490	5510	5492	5508
FCC Hopping Type 6	42	95.24	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	798	67	A	5500	Yes
1003	1	678	78	A	5500	Yes
1004	1	638	83	A	5500	Yes
1005	1	578	92	A	5500	Yes
1006	1	738	72	A	5500	Yes
1007	1	558	95	A	5500	Yes
1008	1	538	99	A	5500	Yes
1009	1	658	81	A	5500	Yes
1010	1	918	58	A	5500	Yes
1011	1	878	61	A	5500	Yes
1012	1	858	62	A	5500	Yes
1013	1	818	65	A	5500	Yes
1014	1	938	57	A	5500	Yes
1015	1	898	59	A	5500	Yes
1016	1	1085	49	B	5500	Yes
1017	1	1041	51	B	5500	Yes
1018	1	803	66	B	5500	Yes
1019	1	888	60	B	5500	Yes
1020	1	779	68	B	5500	Yes
1021	1	2347	23	B	5500	Yes
1022	1	848	63	B	5500	Yes
1023	1	1351	40	B	5500	Yes
1024	1	2855	19	B	5500	No
1025	1	2134	25	B	5500	Yes
1026	1	1219	44	B	5500	Yes
1027	1	1981	27	B	5500	Yes
1028	1	2549	21	B	5500	Yes
1029	1	892	60	B	5500	Yes
1030	1	1590	34	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	4	158	25	5500	Yes
2002	2.2	201	27	5500	Yes
2003	3.1	195	26	5500	Yes
2004	1.5	204	25	5500	Yes
2005	4.7	202	28	5500	Yes
2006	1.4	215	27	5500	Yes
2007	2.7	179	27	5500	Yes
2008	1.8	196	23	5500	Yes
2009	1.3	207	28	5500	Yes
2010	2.5	229	24	5500	Yes
2011	4.5	163	28	5500	Yes
2012	4	150	29	5500	Yes
2013	2	170	24	5500	Yes
2014	1.7	161	28	5500	Yes
2015	4.1	228	26	5500	Yes
2016	2.1	224	24	5500	No
2017	2.7	213	23	5500	Yes
2018	5	175	25	5500	Yes
2019	1.8	212	28	5500	Yes
2020	4.3	178	23	5500	No
2021	3.4	219	26	5500	Yes
2022	4.2	189	25	5500	Yes
2023	3.6	153	29	5500	Yes
2024	4.6	170	28	5500	Yes
2025	4.1	182	25	5500	Yes
2026	3.4	203	29	5500	Yes
2027	3.2	218	23	5500	Yes
2028	2.7	206	27	5500	Yes
2029	4.8	225	28	5500	Yes
2030	4.5	217	26	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	10	413	16	5500	Yes
3002	9.8	400	18	5500	Yes
3003	5.6	368	18	5500	Yes
3004	8.4	250	17	5500	Yes
3005	9.5	364	17	5500	Yes
3006	5.1	259	18	5500	Yes
3007	6.4	385	16	5500	Yes
3008	7.4	293	16	5500	Yes
3009	6.6	432	17	5500	Yes
3010	7.8	368	17	5500	Yes
3011	7.3	269	16	5500	Yes
3012	6.4	336	17	5500	Yes
3013	6.1	383	18	5500	Yes
3014	5.5	344	16	5500	Yes
3015	8.2	404	17	5500	Yes
3016	7.8	379	16	5500	Yes
3017	8.4	334	18	5500	Yes
3018	8.2	454	16	5500	Yes
3019	9.1	422	17	5500	Yes
3020	6.8	422	16	5500	Yes
3021	7.9	284	16	5500	Yes
3022	8.6	430	17	5500	Yes
3023	9.9	306	18	5500	Yes
3024	5.8	464	18	5500	Yes
3025	5	486	16	5500	Yes
3026	6.2	289	16	5500	Yes
3027	5.7	441	18	5500	Yes
3028	9.9	390	16	5500	Yes
3029	9.6	304	17	5500	Yes
3030	9	265	18	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	13.2	325	13	5500	No
4002	17.7	433	16	5500	Yes
4003	13.5	254	15	5500	Yes
4004	18.6	375	15	5500	Yes
4005	14.9	342	15	5500	Yes
4006	10.4	475	16	5500	Yes
4007	12.6	456	15	5500	Yes
4008	13.9	351	15	5500	Yes
4009	16.6	477	14	5500	Yes
4010	18.5	267	14	5500	Yes
4011	17	407	16	5500	Yes
4012	19.4	460	16	5500	Yes
4013	18.3	362	16	5500	Yes
4014	16.5	310	16	5500	Yes
4015	16	475	12	5500	Yes
4016	14.7	437	15	5500	Yes
4017	10	379	16	5500	Yes
4018	14.6	353	12	5500	Yes
4019	10.3	426	13	5500	Yes
4020	15.4	295	14	5500	Yes
4021	11.7	263	13	5500	Yes
4022	17.3	396	14	5500	Yes
4023	14.7	377	14	5500	Yes
4024	10.7	271	13	5500	Yes
4025	13.4	398	13	5500	Yes
4026	15.3	439	12	5500	Yes
4027	13.8	327	15	5500	Yes
4028	16.2	381	14	5500	Yes
4029	15.1	282	15	5500	Yes
4030	13.3	482	15	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	5505	Yes
2	5506	Yes
3	5504	Yes
4	5504	Yes
5	5499	Yes
6	5493	Yes
7	5494	Yes
8	5496	Yes
9	5494	Yes
10	5501	Yes
11	5508	Yes
12	5499	Yes
13	5506	Yes
14	5501	Yes
15	5503	Yes
16	5505	Yes
17	5492	Yes
18	5495	Yes
19	5501	Yes
20	5493	Yes
21	5501	Yes
22	5497	Yes
23	5500	Yes
24	5493	Yes
25	5497	No
26	5496	Yes
27	5506	Yes
28	5494	Yes
29	5493	Yes
30	5507	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	362	5490	1	No
2	837	5491	2	Yes
3	1312	5492	8	Yes
4	1787	5493	7	Yes
5	2262	5494	6	Yes
6	2737	5495	1	Yes
7	3687	5496	4	Yes
8	4162	5497	4	Yes
9	4637	5498	3	Yes
10	5112	5499	2	Yes
11	5587	5500	1	Yes
12	6062	5501	5	Yes
13	6537	5502	4	Yes
14	7012	5503	3	Yes
15	7487	5504	4	Yes
16	7962	5505	2	Yes
17	8437	5506	4	Yes
18	8912	5507	6	Yes
19	9387	5508	6	Yes
20	9862	5509	4	Yes
21	10337	5510	5	No
22	10812	5490	6	Yes
23	11287	5491	5	Yes
24	11762	5492	3	Yes
25	12237	5493	2	Yes
26	12712	5494	5	Yes
27	13187	5495	3	Yes
28	13662	5496	1	Yes
29	14137	5497	7	Yes
30	14612	5498	4	Yes
31	15087	5499	6	Yes
32	15562	5500	3	Yes
33	16037	5501	4	Yes
34	16512	5502	10	Yes
35	16987	5503	6	Yes
36	17462	5504	3	Yes
37	17937	5505	2	Yes
38	18412	5506	5	Yes
39	19362	5507	3	Yes
40	19837	5508	6	Yes
41	20312	5509	2	Yes
42	20787	5510	2	Yes

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5.3. RESULTS FOR 40 MHz BANDWIDTH

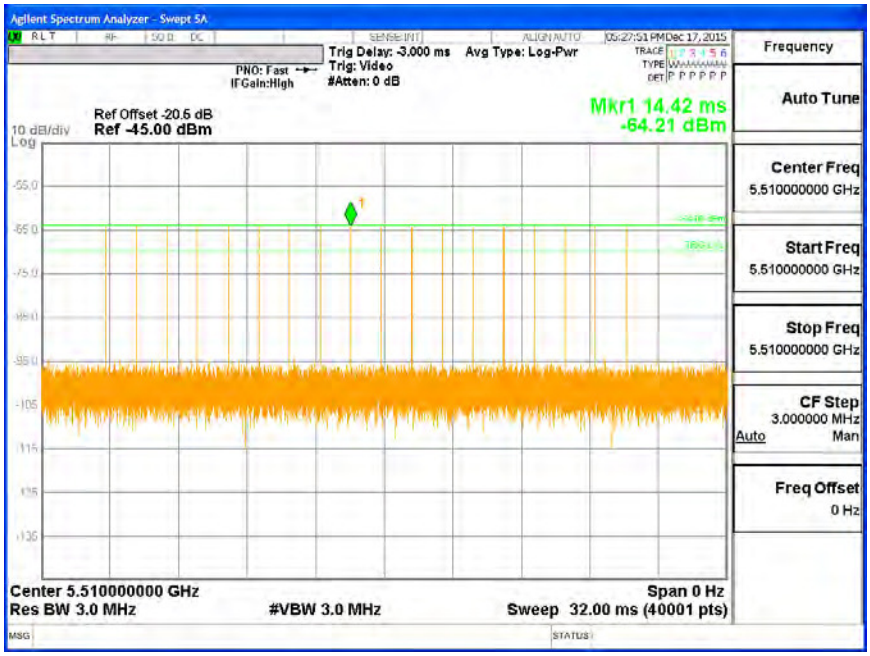
5.3.1. TEST CHANNEL

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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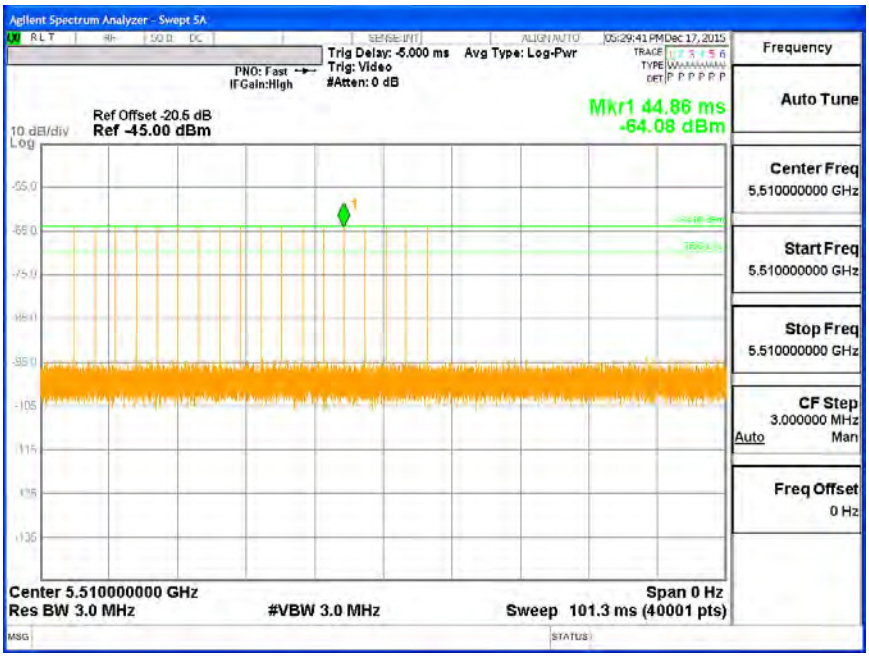
SAMPLE OF RADAR TYPE 1



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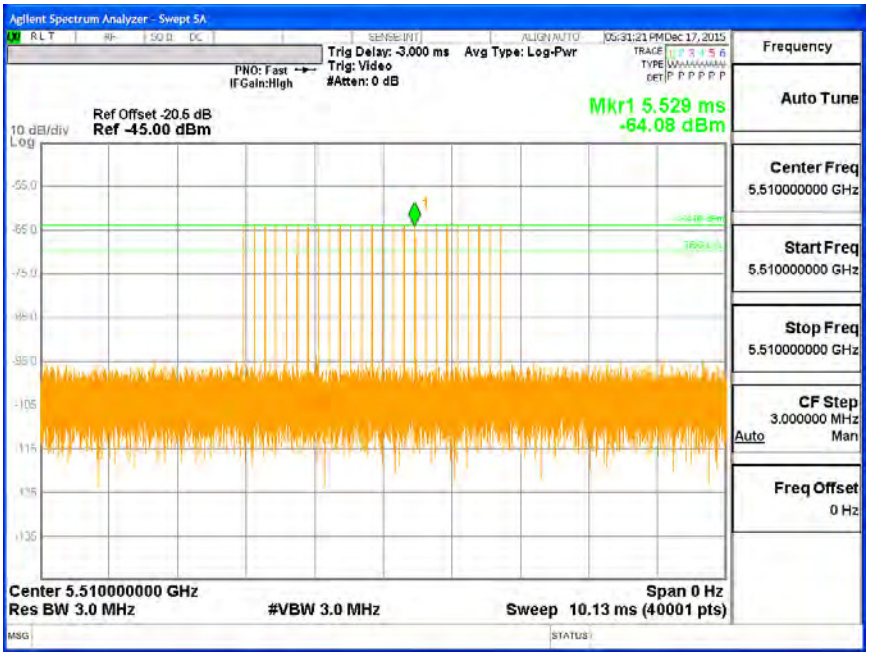
SAMPLE OF RADAR TYPE 2



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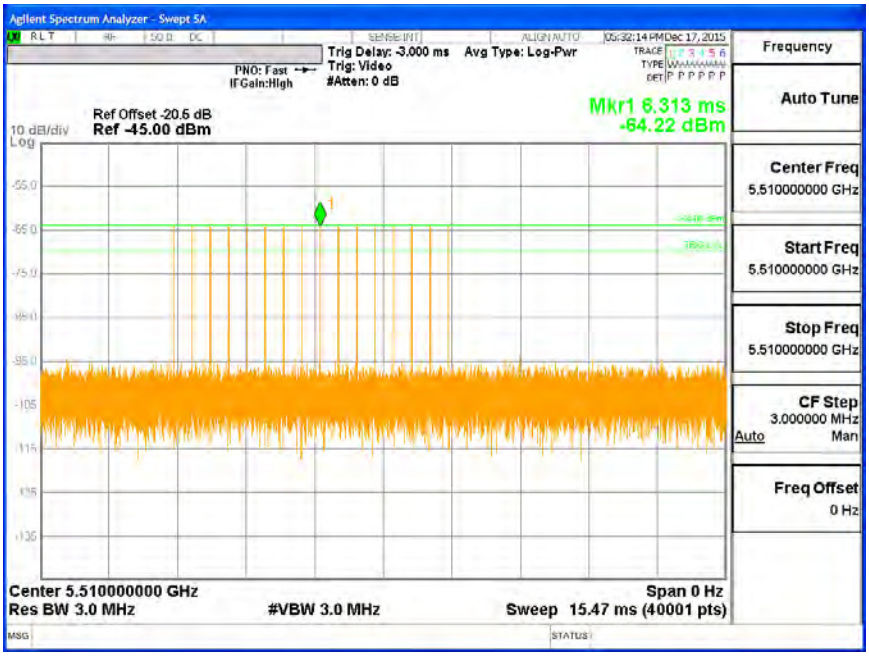
SAMPLE OF RADAR TYPE 3



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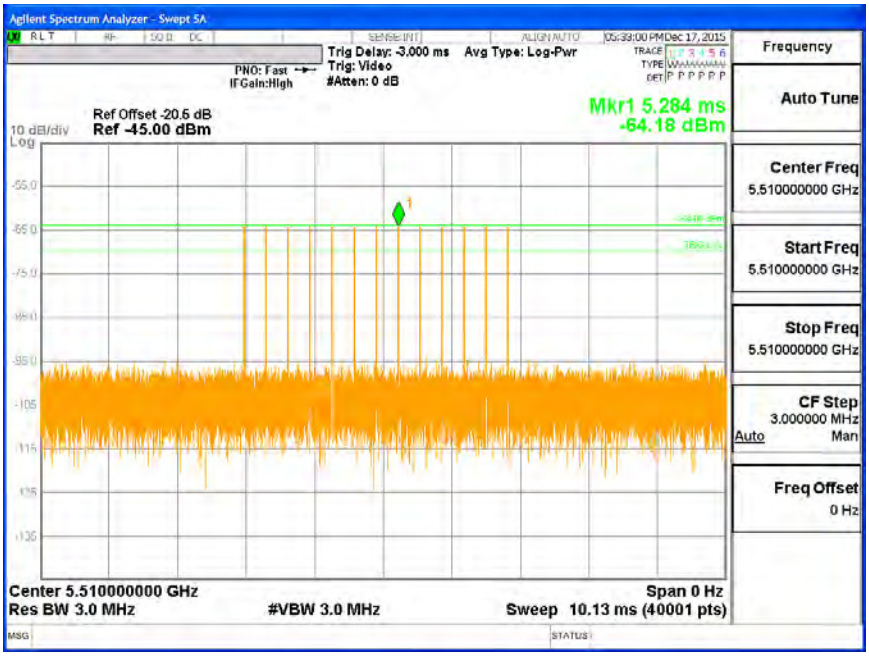
SAMPLE OF RADAR TYPE 4



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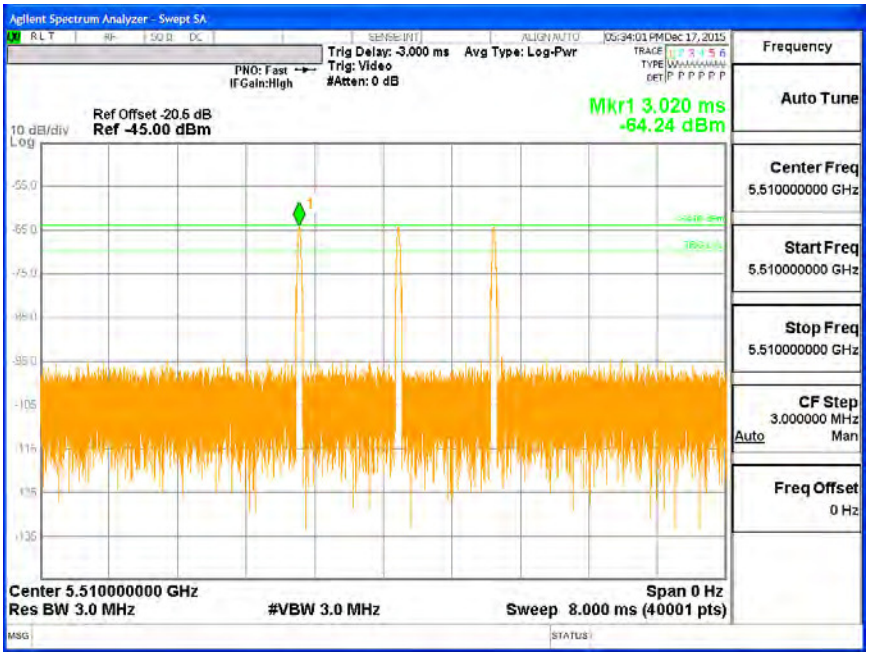
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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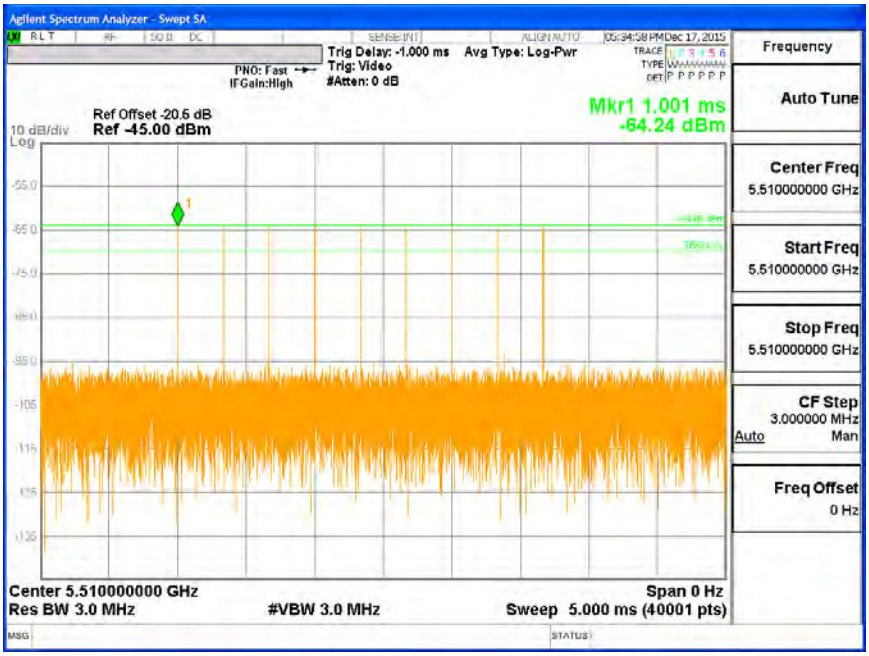
SINGLE BURST OF RADAR TYPE 6



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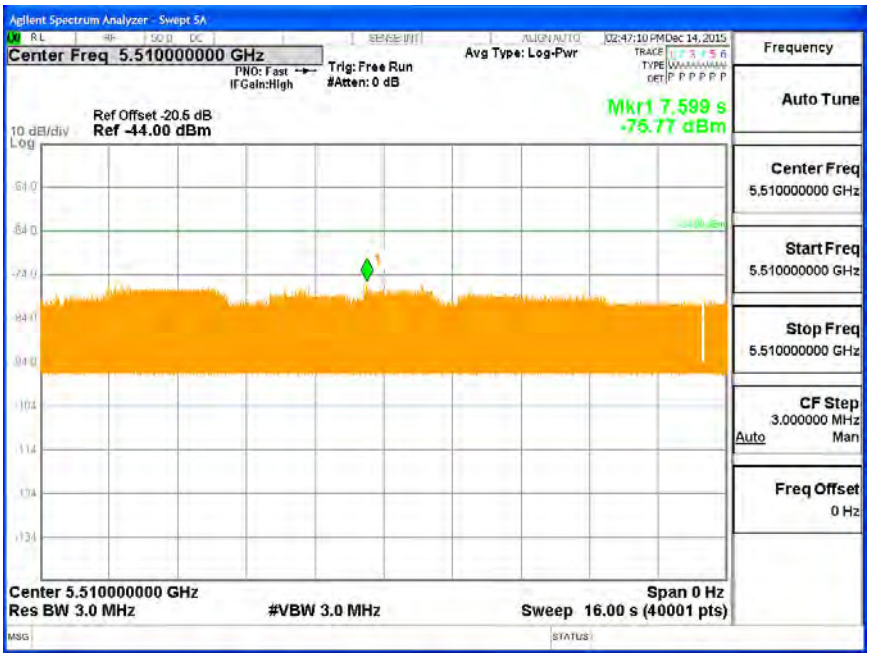
TRAFFIC

TRAFFIC



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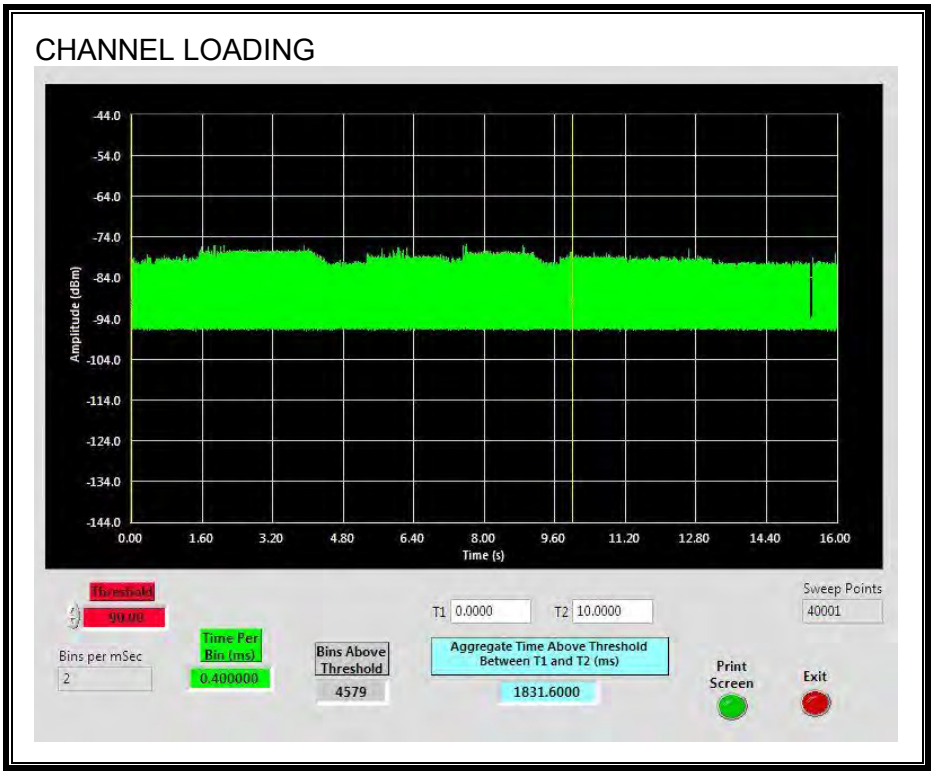
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.31%

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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	64.8	64.8

Radar Near Beginning of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	1.238	1.238

Radar Near End of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	59.42	59.42

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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)
16:48:24	16:49:28	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)
16:59:46	16:59:46	0:00:00

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)
17:09:25	17:10:23	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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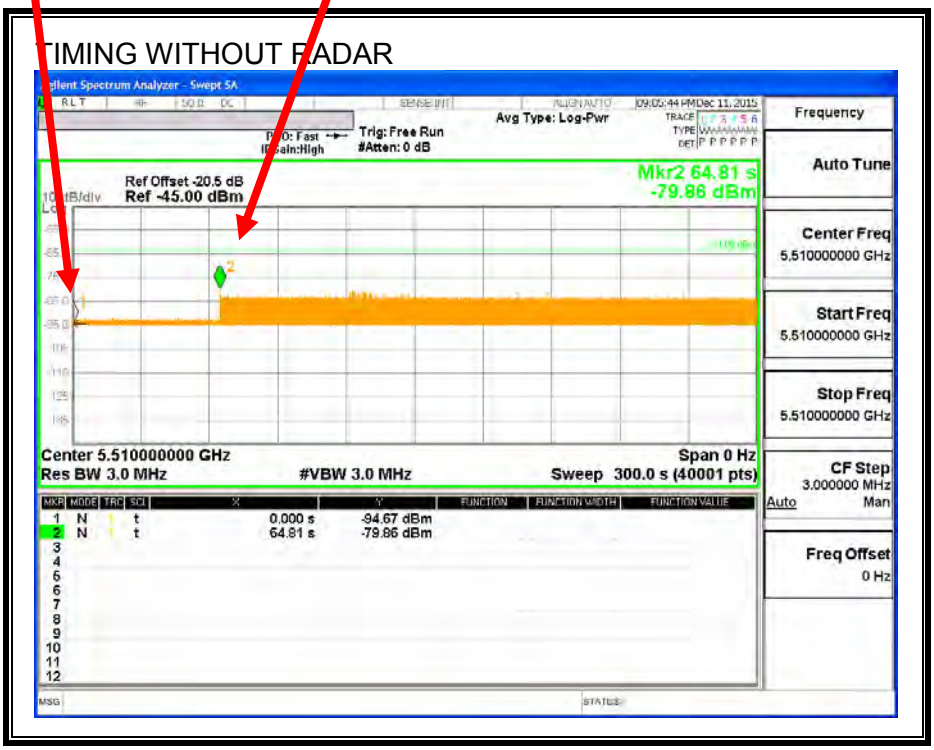
TIMING WITHOUT RADAR DURING CAC

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

Nov 14 16:48:24 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **16:48:24** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **16:49:28** 2015: 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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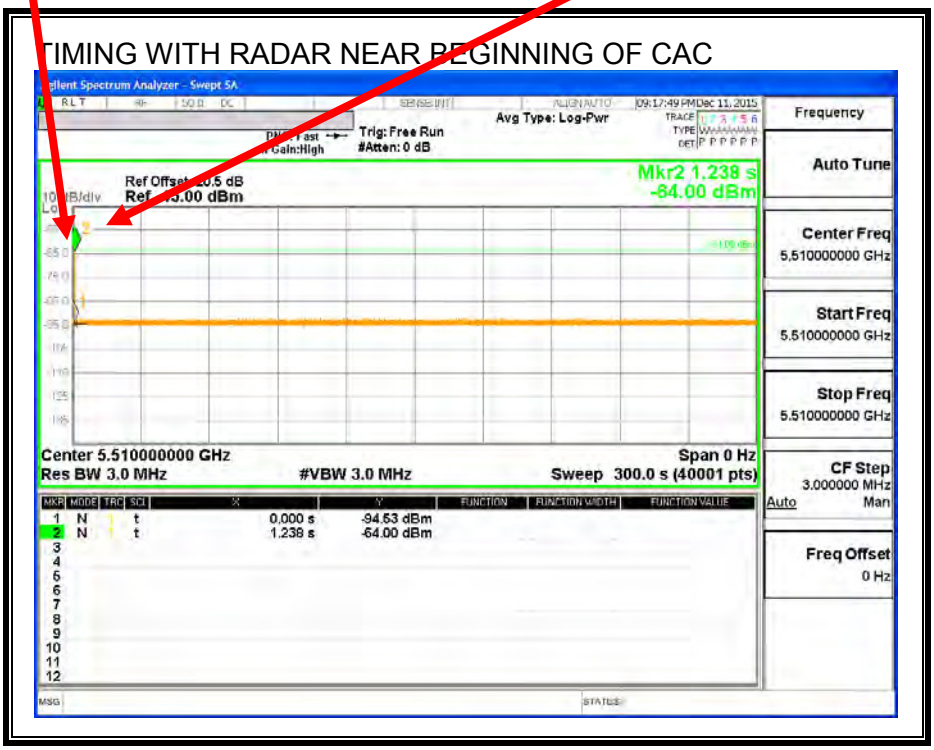
TIMING WITH RADAR NEAR BEGINNING OF CAC

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

Nov 14 16:59:46 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **16:59:46** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 16:59:46 2015: KERN: WL1: DFS: ETSI_1 ########## radar detected on channel 100l ########## min_pw=31, subband_result=3, AT 450MS.
Nov 14 16:59:46 2015: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 102.
Nov 14 16:59:46 2015: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Nov 14 16:59:46 2015: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Nov 14 16:59:46 2015: DOT11: dfs:Starting resume timer (dfs.c:282)
Nov 14 16:59:46 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 16:59:46 2015: DOT11: dfs:DFS: driver's ch:48, rim's channel:100, bcmko_next_dfs_chan=48 (dfs.c:335)
Nov 14 16:59:46 2015: DOT11: dfs:DFS: rim's curren_ch=48, new next channel=36, telling dataplane. (dfs.c:343)
Nov 14 16:59:46 2015: DOT11: dfs:DFS_Validate_Power max 23 prtl: 23 (dfs.c:104)
Nov 14 16:59:46 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 16:59:46 2015: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Nov 14 16:59:46 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 16:59:46 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Nov 14 **16:59:46** 2015: ap8533-06FA10 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 40 freq 5500 MHz

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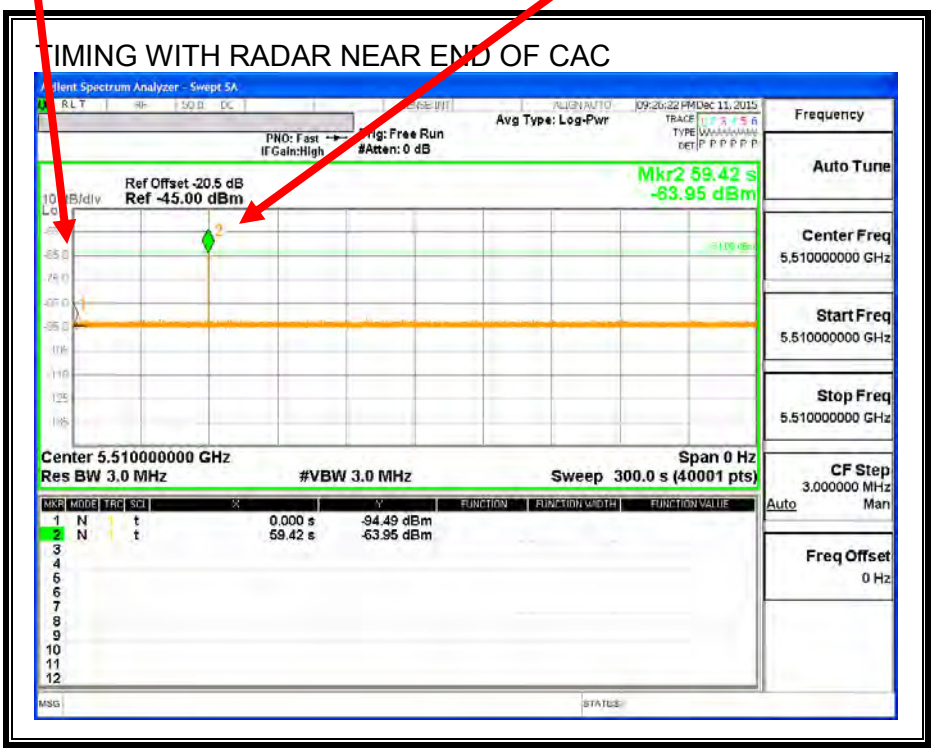
TIMING WITH RADAR NEAR END OF CAC

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

Nov 14 17:09:25 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **17:09:25** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 17:10:23 2015: KERN: WL1: DFS: ETSI_1 ########## radar detected on channel 100l ########## min_pw=33, subband_result=3, AT 54900MS.
Nov 14 17:10:23 2015: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 102.
Nov 14 17:10:23 2015: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Nov 14 17:10:23 2015: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Nov 14 17:10:23 2015: DOT11: dfs:Starting resume timer (dfs.c:282)
Nov 14 17:10:23 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 17:10:23 2015: DOT11: dfs:DFS: driver's ch:48, rim's channel:100, bcmko_next_dfs_chan=48 (dfs.c:335)
Nov 14 17:10:23 2015: DOT11: dfs:DFS: rim's curren_ch=48, new next channel=44, telling dataplane. (dfs.c:343)
Nov 14 17:10:23 2015: DOT11: dfs:DFS_Validate_Power max 23 prtl: 23 (dfs.c:104)
Nov 14 17:10:23 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 17:10:23 2015: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Nov 14 17:10:23 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 17:10:23 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=48,ridx=1,curCh=48,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Nov 14 **17:10:23** 2015: ap8533-06FA10 : %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.

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)
0.675	10

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

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MOVE TIME

MOVE TIME

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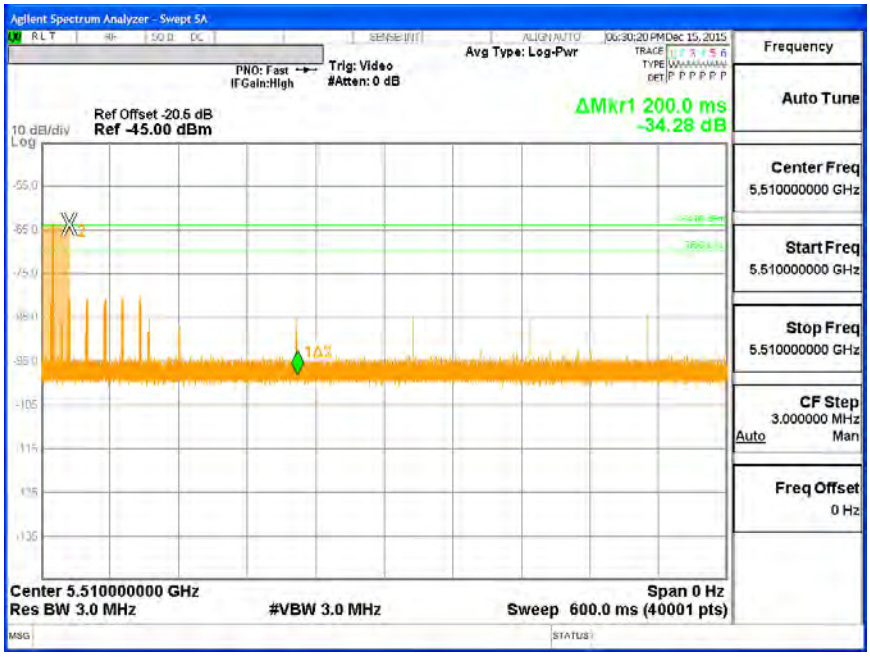
CHANNEL CLOSING TIME

CLOSING TIME



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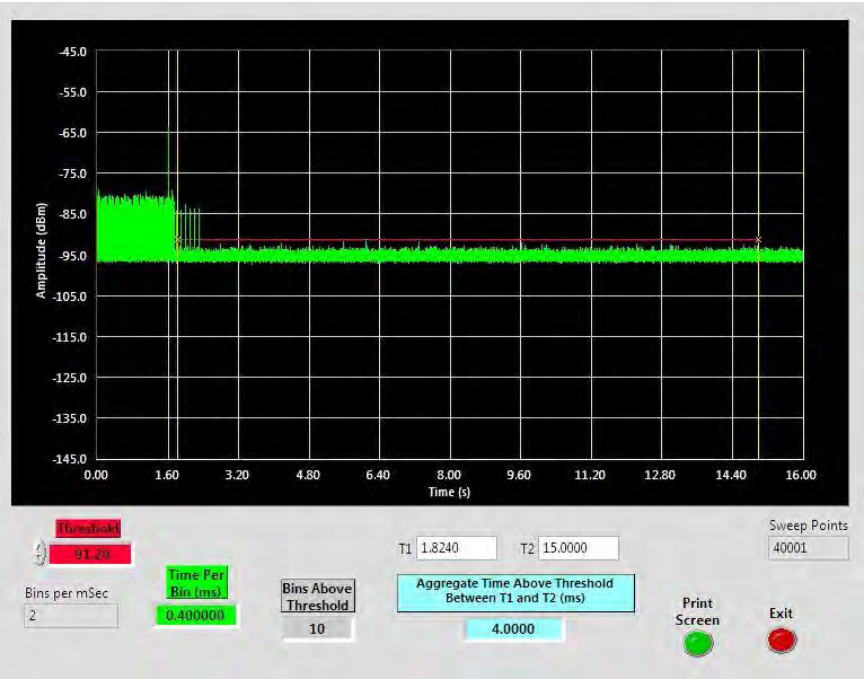
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

Only intermittent transmissions are observed during the aggregate monitoring period.

AGGREGATE CLOSING TIME



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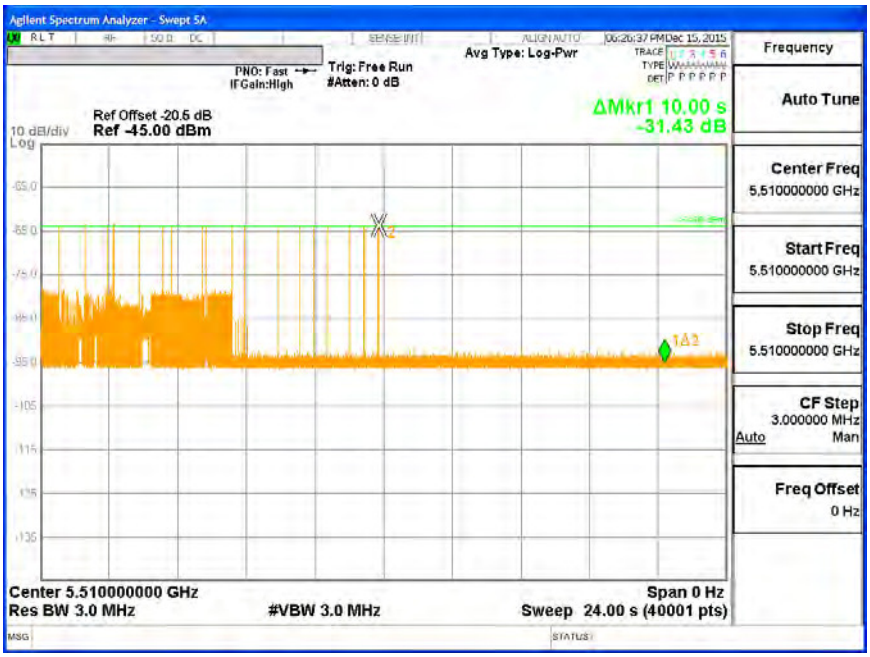
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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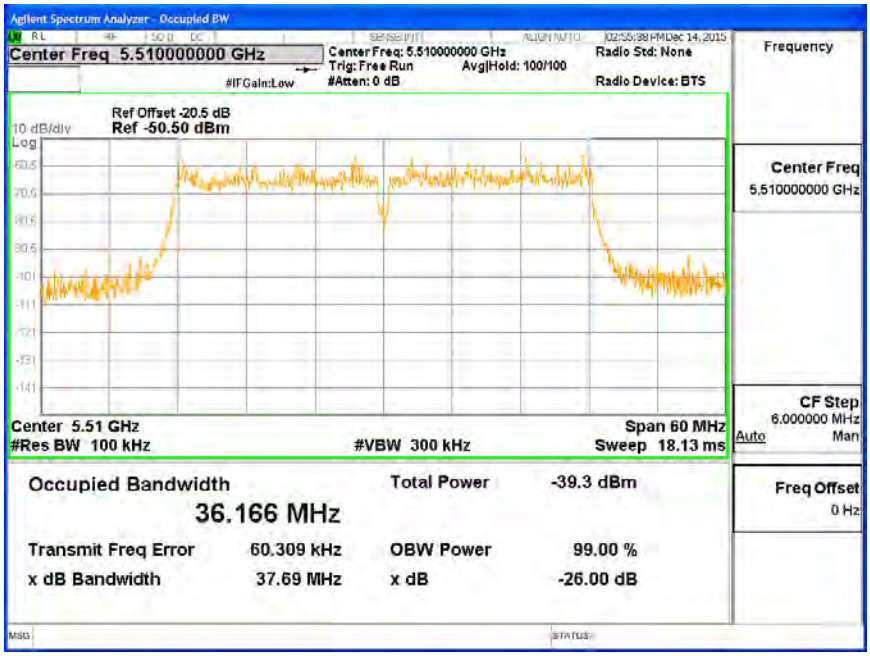
5.3.1. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH

99% 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	36.166	110.6	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
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

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5.3.2. 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	100.00	60	Pass	5490	5530		
FCC Short Pulse Type 3	30	100.00	60	Pass	5490	5530		
FCC Short Pulse Type 4	30	93.33	60	Pass	5490	5530		
Aggregate		97.50	80	Pass				
FCC Long Pulse Type 5	30	93.33	80	Pass	5490	5530	5494	5526
FCC Hopping Type 6	41	97.56	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	798	67	A	5510	Yes
1003	1	678	78	A	5510	Yes
1004	1	638	83	A	5510	Yes
1005	1	578	92	A	5510	Yes
1006	1	738	72	A	5510	Yes
1007	1	558	95	A	5510	Yes
1008	1	538	99	A	5510	Yes
1009	1	658	81	A	5510	Yes
1010	1	918	58	A	5510	Yes
1011	1	878	61	A	5510	Yes
1012	1	858	62	A	5510	Yes
1013	1	818	65	A	5510	Yes
1014	1	938	57	A	5510	Yes
1015	1	898	59	A	5510	Yes
1016	1	1085	49	B	5510	Yes
1017	1	1041	51	B	5510	Yes
1018	1	803	66	B	5510	Yes
1019	1	888	60	B	5510	Yes
1020	1	779	68	B	5510	Yes
1021	1	2347	23	B	5510	Yes
1022	1	848	63	B	5510	Yes
1023	1	1351	40	B	5510	Yes
1024	1	2855	19	B	5510	Yes
1025	1	2134	25	B	5510	Yes
1026	1	1219	44	B	5510	Yes
1027	1	1981	27	B	5510	Yes
1028	1	2549	21	B	5510	Yes
1029	1	892	60	B	5510	Yes
1030	1	1590	34	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	4	158	25	5510	Yes
2002	2.2	201	27	5510	Yes
2003	3.1	195	26	5510	Yes
2004	1.5	204	25	5510	Yes
2005	4.7	202	28	5510	Yes
2006	1.4	215	27	5510	Yes
2007	2.7	179	27	5510	Yes
2008	1.8	196	23	5510	Yes
2009	1.3	207	28	5510	Yes
2010	2.5	229	24	5510	Yes
2011	4.5	163	28	5510	Yes
2012	4	150	29	5510	Yes
2013	2	170	24	5510	Yes
2014	1.7	161	28	5510	Yes
2015	4.1	228	26	5510	Yes
2016	2.1	224	24	5510	Yes
2017	2.7	213	23	5510	Yes
2018	5	175	25	5510	Yes
2019	1.8	212	28	5510	Yes
2020	4.3	178	23	5510	Yes
2021	3.4	219	26	5510	Yes
2022	4.2	189	25	5510	Yes
2023	3.6	153	29	5510	Yes
2024	4.6	170	28	5510	Yes
2025	4.1	182	25	5510	Yes
2026	3.4	203	29	5510	Yes
2027	3.2	218	23	5510	Yes
2028	2.7	206	27	5510	Yes
2029	4.8	225	28	5510	Yes
2030	4.5	217	26	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	10	413	16	5510	Yes
3002	9.8	400	18	5510	Yes
3003	5.6	368	18	5510	Yes
3004	8.4	250	17	5510	Yes
3005	9.5	364	17	5510	Yes
3006	5.1	259	18	5510	Yes
3007	6.4	385	16	5510	Yes
3008	7.4	293	16	5510	Yes
3009	6.6	432	17	5510	Yes
3010	7.8	368	17	5510	Yes
3011	7.3	269	16	5510	Yes
3012	6.4	336	17	5510	Yes
3013	6.1	383	18	5510	Yes
3014	5.5	344	16	5510	Yes
3015	8.2	404	17	5510	Yes
3016	7.8	379	16	5510	Yes
3017	8.4	334	18	5510	Yes
3018	8.2	454	16	5510	Yes
3019	9.1	422	17	5510	Yes
3020	6.8	422	16	5510	Yes
3021	7.9	284	16	5510	Yes
3022	8.6	430	17	5510	Yes
3023	9.9	306	18	5510	Yes
3024	5.8	464	18	5510	Yes
3025	5	486	16	5510	Yes
3026	6.2	289	16	5510	Yes
3027	5.7	441	18	5510	Yes
3028	9.9	390	16	5510	Yes
3029	9.6	304	17	5510	Yes
3030	9	265	18	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	13.2	325	13	5510	Yes
4002	17.7	433	16	5510	Yes
4003	13.5	254	15	5510	Yes
4004	18.6	375	15	5510	Yes
4005	14.9	342	15	5510	Yes
4006	10.4	475	16	5510	Yes
4007	12.6	456	15	5510	Yes
4008	13.9	351	15	5510	Yes
4009	16.6	477	14	5510	Yes
4010	18.5	267	14	5510	No
4011	17	407	16	5510	Yes
4012	19.4	460	16	5510	Yes
4013	18.3	362	16	5510	Yes
4014	16.5	310	16	5510	Yes
4015	16	475	12	5510	No
4016	14.7	437	15	5510	Yes
4017	10	379	16	5510	Yes
4018	14.6	353	12	5510	Yes
4019	10.3	426	13	5510	Yes
4020	15.4	295	14	5510	Yes
4021	11.7	263	13	5510	Yes
4022	17.3	396	14	5510	Yes
4023	14.7	377	14	5510	Yes
4024	10.7	271	13	5510	Yes
4025	13.4	398	13	5510	Yes
4026	15.3	439	12	5510	Yes
4027	13.8	327	15	5510	Yes
4028	16.2	381	14	5510	Yes
4029	15.1	282	15	5510	Yes
4030	13.3	482	15	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	5505	No
2	5511	Yes
3	5513	No
4	5517	Yes
5	5496	Yes
6	5498	Yes
7	5510	Yes
8	5507	Yes
9	5504	Yes
10	5520	Yes
11	5502	Yes
12	5494	Yes
13	5501	Yes
14	5505	Yes
15	5505	Yes
16	5502	Yes
17	5509	Yes
18	5522	Yes
19	5505	Yes
20	5519	Yes
21	5506	Yes
22	5511	Yes
23	5498	Yes
24	5505	Yes
25	5494	Yes
26	5498	Yes
27	5495	Yes
28	5524	Yes
29	5501	Yes
30	5522	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	34	5490	12	Yes
2	509	5491	8	Yes
3	984	5492	7	Yes
4	1459	5493	11	Yes
5	1934	5494	18	Yes
6	2409	5495	8	Yes
7	2884	5496	5	Yes
8	3359	5497	8	Yes
9	3834	5498	10	Yes
10	4309	5499	8	Yes
11	4784	5500	8	Yes
12	5259	5501	8	Yes
13	5734	5502	6	Yes
14	6209	5503	13	Yes
15	6684	5504	8	Yes
16	7159	5505	8	Yes
17	7634	5506	13	Yes
18	8109	5507	4	Yes
19	8584	5508	5	No
20	9059	5509	11	Yes
21	9534	5510	11	Yes
22	10009	5511	9	Yes
23	10484	5512	7	Yes
24	10959	5513	9	Yes
25	11434	5514	9	Yes
26	11909	5515	8	Yes
27	12384	5516	8	Yes
28	12859	5517	8	Yes
29	13334	5518	13	Yes
30	13809	5519	6	Yes
31	14284	5520	9	Yes
32	14759	5521	6	Yes
33	15234	5522	9	Yes
34	15709	5523	9	Yes
35	16184	5524	9	Yes
36	16659	5525	7	Yes
37	17134	5526	11	Yes
38	17609	5527	12	Yes
39	18084	5528	9	Yes
40	18559	5529	7	Yes
41	19034	5530	4	Yes

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5.4. RESULTS FOR 80 MHz BANDWIDTH

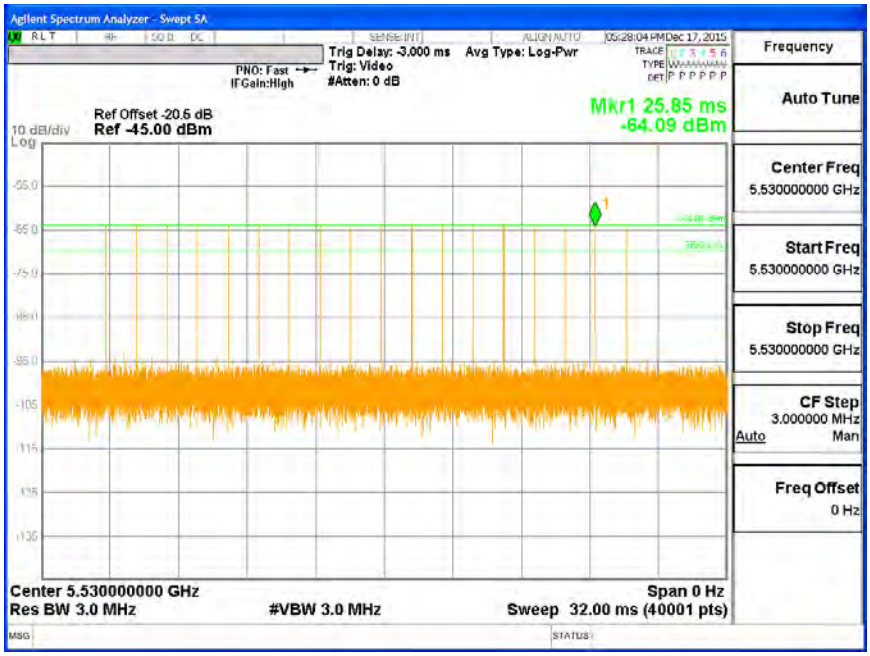
5.4.1. TEST CHANNEL

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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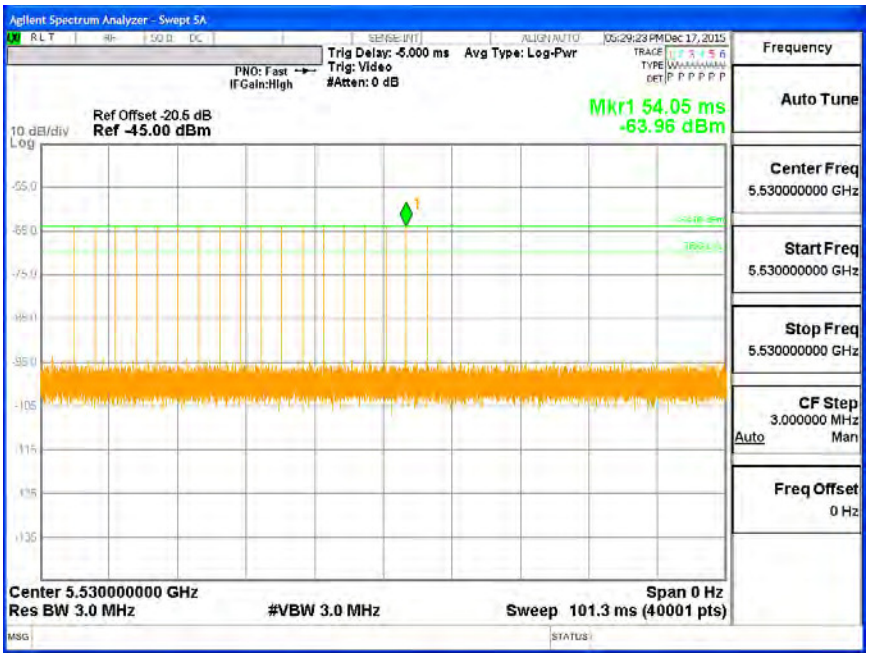
SAMPLE OF RADAR TYPE 1



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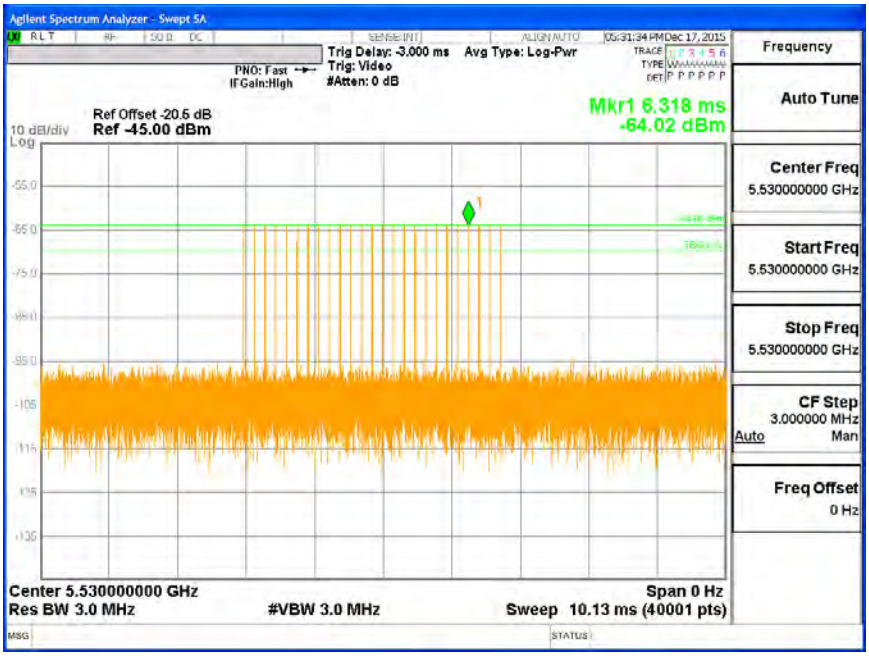
SAMPLE OF RADAR TYPE 2



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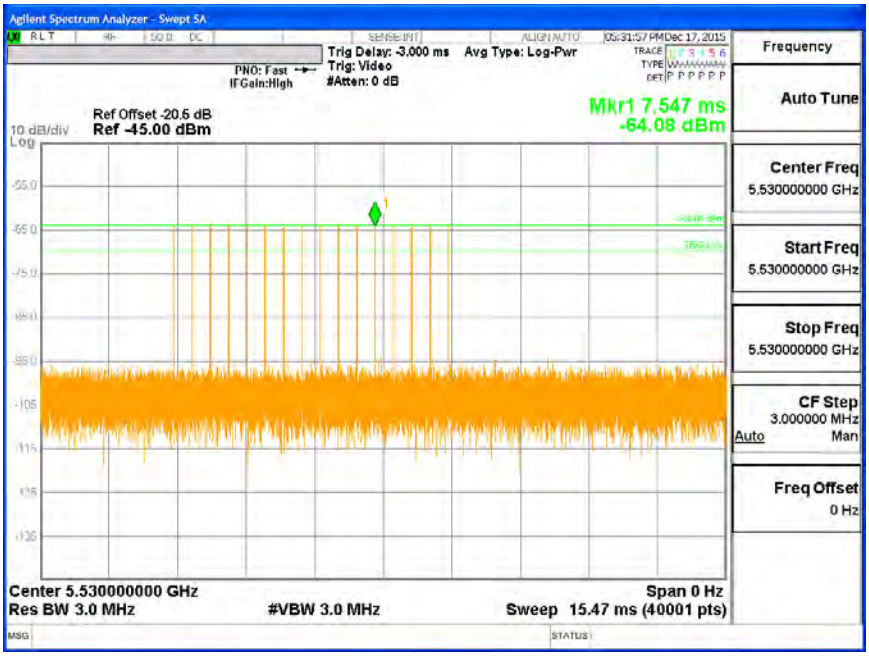
SAMPLE OF RADAR TYPE 3



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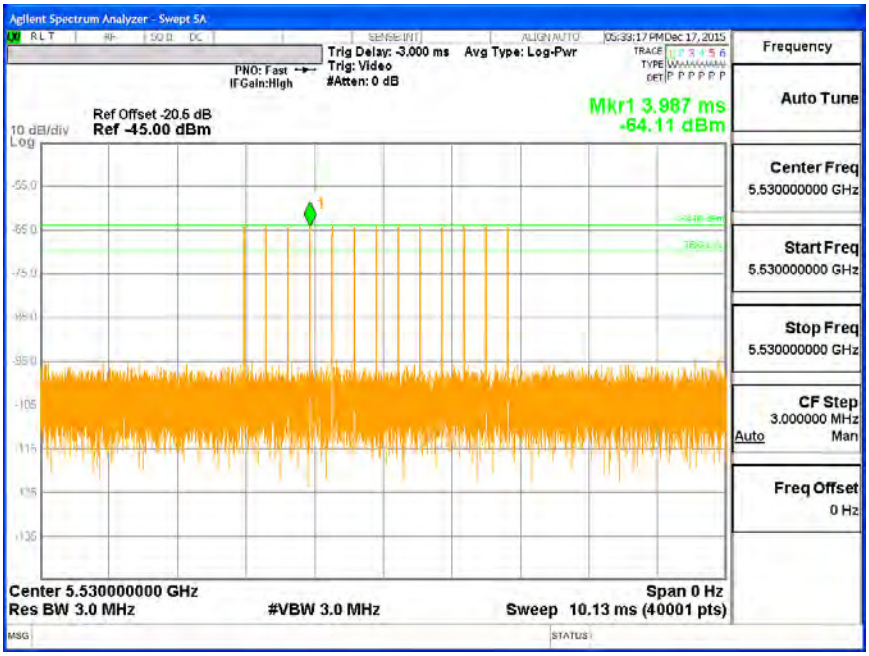
SAMPLE OF RADAR TYPE 4



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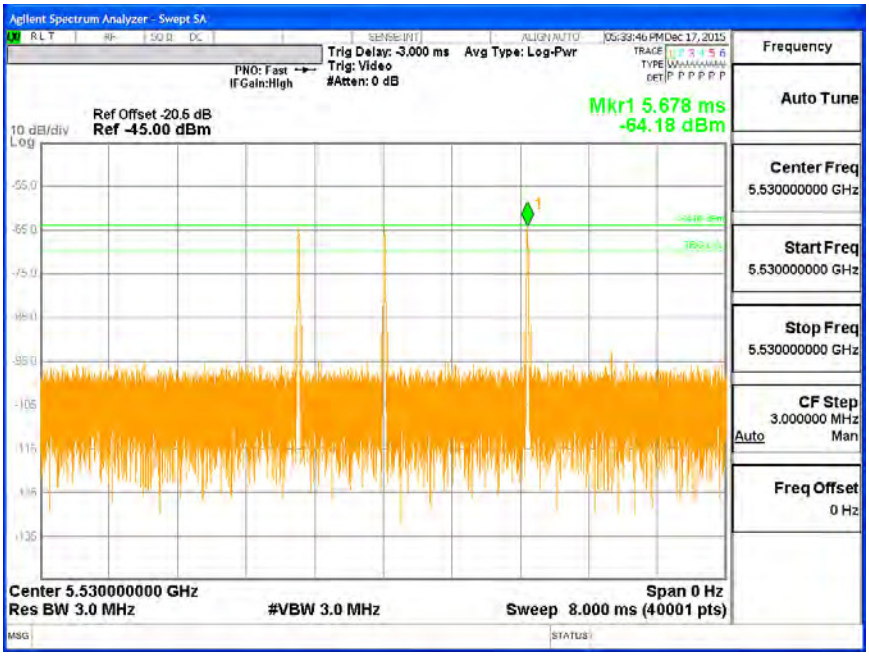
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



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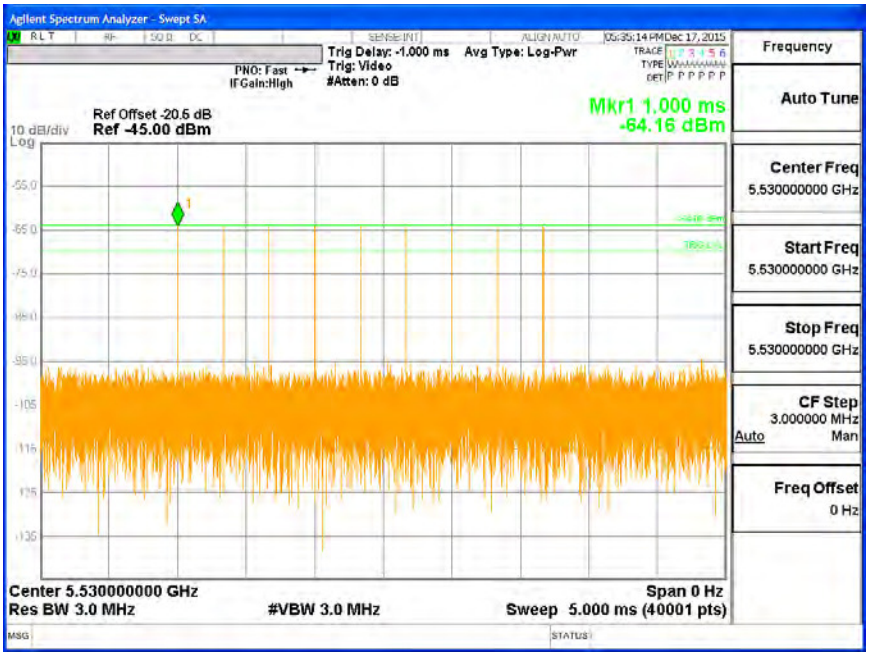
SINGLE BURST OF RADAR TYPE 6



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TRAFFIC

TRAFFIC

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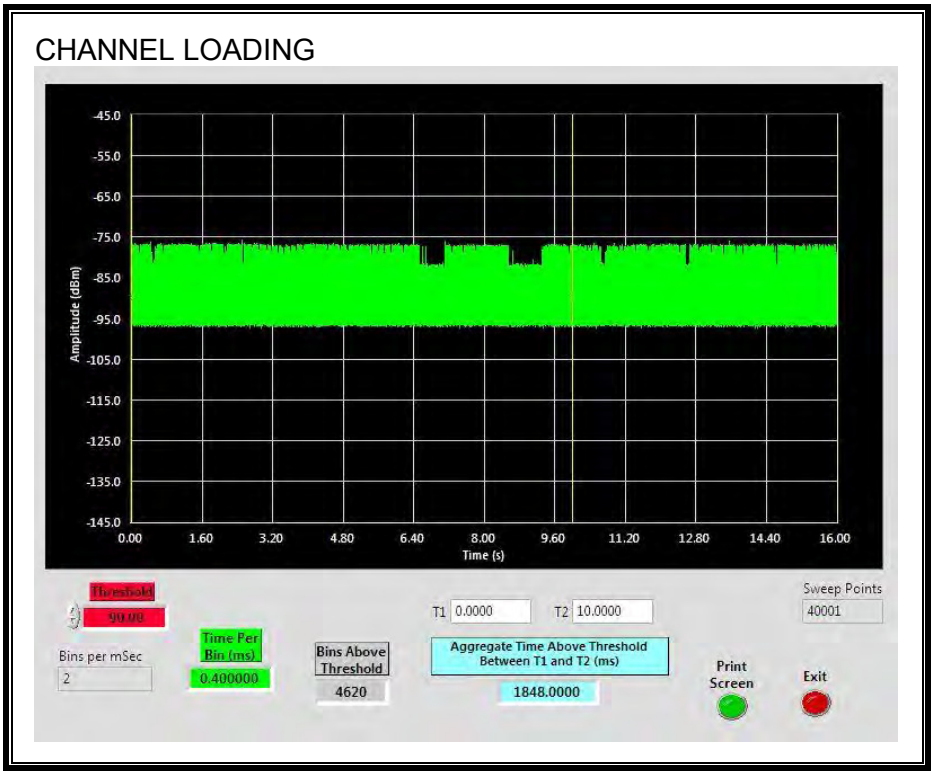
CHANNEL LOADING



The level of traffic loading on the channel by the EUT is 18.48%

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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	64.9	64.9

Radar Near Beginning of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	1.193	1.193

Radar Near End of CAC

Beginning of CAC (sec)	Timing of Radar Burst (sec)	Radar Relative to Start of CAC (sec)
0	59.43	59.43

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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)
18:39:53	18:40:57	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)
18:50:23	18:50:24	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)
18:58:40	18:59:38	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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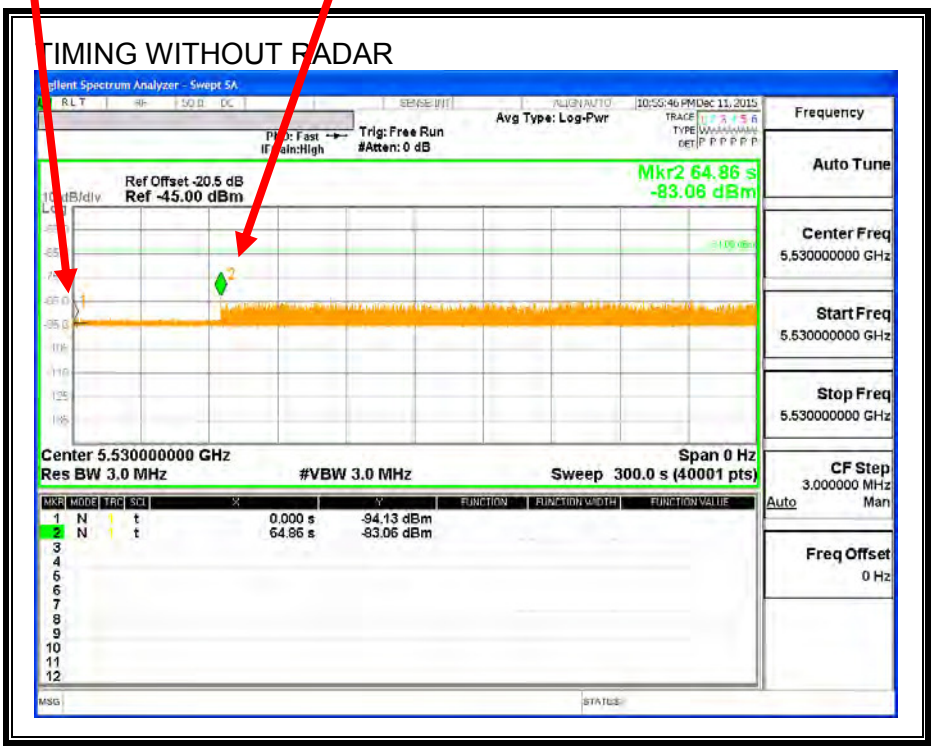
TIMING WITHOUT RADAR DURING CAC

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

Nov 14 18:39:53 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Nov 14 **18:39:53** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=in_srvc_monitor (dfs.c:415)
Nov 14 **18:40:57** 2015: 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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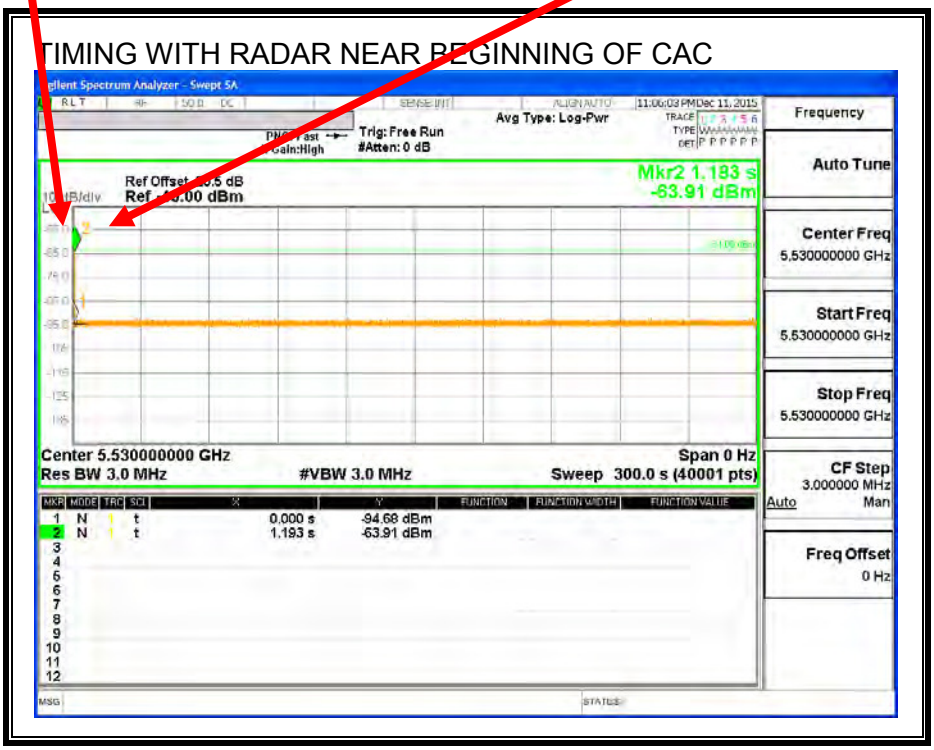
TIMING WITH RADAR NEAR BEGINNING OF CAC

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

Nov 14 18:50:23 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **18:50:23** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_disabled,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 18:50:24 2015: KERN: WL1: DFS: ETSI_1 ########## radar detected on channel 100/80 ########## min_pw=34, subband_result=6, AT 300MS.
Nov 14 18:50:24 2015: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 106.
Nov 14 18:50:24 2015: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_disabled (dfs.c:415)
Nov 14 18:50:24 2015: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Nov 14 18:50:24 2015: DOT11: dfs:Starting resume timer (dfs.c:282)
Nov 14 18:50:24 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=44,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 18:50:24 2015: DOT11: dfs:DFS: driver's ch:44, rim's channel:100, bcmko_next_dfs_chan=44 (dfs.c:335)
Nov 14 18:50:24 2015: DOT11: dfs:DFS: rim's curren_ch=44, new next channel=36, telling dataplane. (dfs.c:343)
Nov 14 18:50:24 2015: DOT11: dfs:DFS_Validate_Power max 23 prtl: 23 (dfs.c:104)
Nov 14 18:50:24 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=44,ridx=1,curCh=44,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 18:50:24 2015: DOT11: dfs:DFS: ignoring duplicate channel change indication (dfs.c:324)
Nov 14 18:50:24 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=44,ridx=1,curCh=44,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 18:50:24 2015: DOT11: %%%%>dfs:DFS evt=dfs_disabled,ch=44,ridx=1,curCh=44,state=dfs_disabled,prev_state=radar_seen (dfs.c:415)
Nov 14 **18:50:24** 2015: ap8533-06FA10 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 80 freq 5500 MHz

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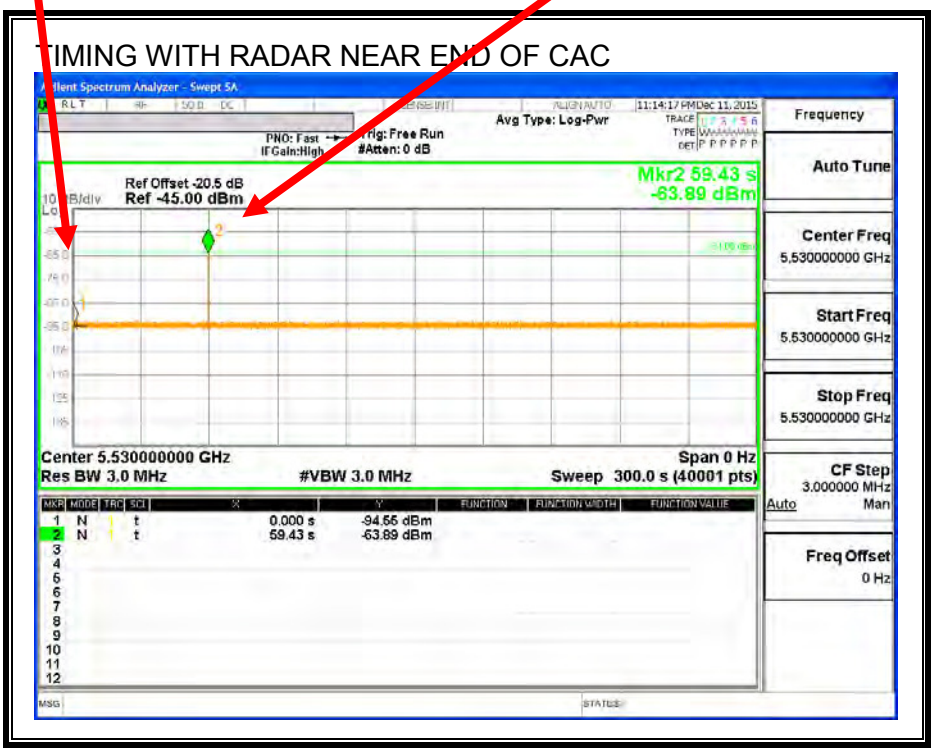
TIMING WITH RADAR NEAR END OF CAC

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

Nov 14 18:58:39 2015: ap8533-06FA10 : %DIAG-6-NEW_LED_STATE: LED state message RADIO_2_52G_LED_ON from module DOT11
Nov 14 **18:58:40** 2015: DOT11: %%%%>dfs:DFS evt=chan_avail_chk,ch=100,ridx=1,curCh=100,state=dfs_idle,prev_state=dfs_idle (dfs.c:415)
Nov 14 18:59:38 2015: KERN: WL1: DFS: ETSI_1 ########## radar detected on channel 100/80 ########## min_pw=33, subband_result=6, AT 53550MS.
Nov 14 18:59:38 2015: KERN: wl1: dfs : state PRE-ISM Channel Availability Check, detected radar in channel 106.
Nov 14 18:59:38 2015: DOT11: %%%%>dfs:DFS evt=radar_seen,ch=100,ridx=1,curCh=100,state=chan_avail_chk,prev_state=dfs_idle (dfs.c:415)
Nov 14 18:59:38 2015: DOT11: %%%%>dfs:Radar reported on channel 100 Freq 5500 MHz by radio_idx 1 (dfs.c:298)
Nov 14 18:59:38 2015: DOT11: dfs:Starting resume timer (dfs.c:282)
Nov 14 18:59:38 2015: DOT11: %%%%>dfs:DFS evt=chan_chngd,ch=36,ridx=1,curCh=100,state=radar_seen,prev_state=chan_avail_chk (dfs.c:415)
Nov 14 **18:59:38** 2015: ap8533-06FA10 : %RADIO-4-RADAR_DETECTED: Radar found on channel 100 width 80 freq 5500 MHz

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5.4.4. OVERLAPPING CHANNEL TESTS

RESULTS

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

5.4.5. 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)
0.137	10

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

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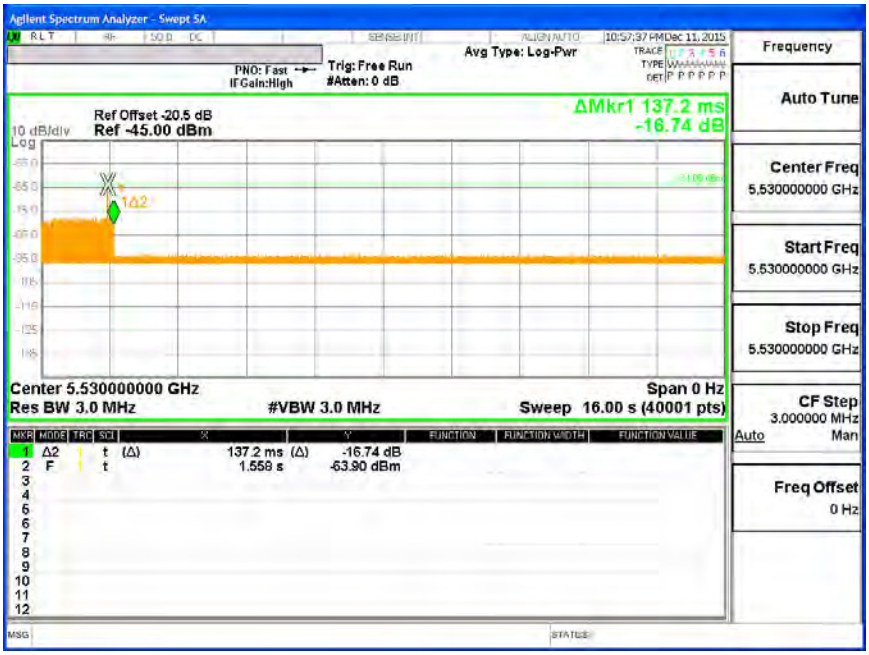
MOVE TIME

MOVE TIME



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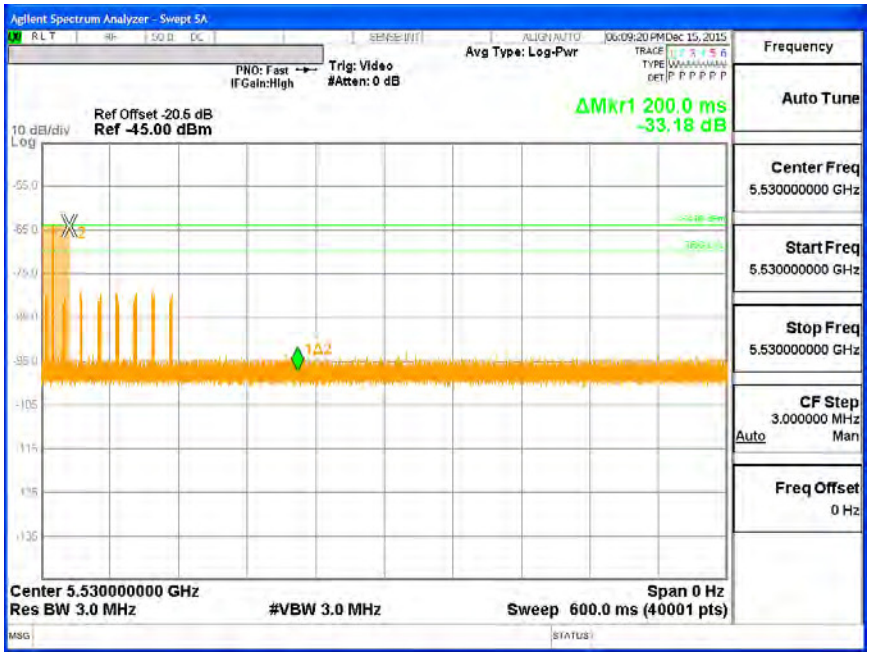
CHANNEL CLOSING TIME

CLOSING TIME



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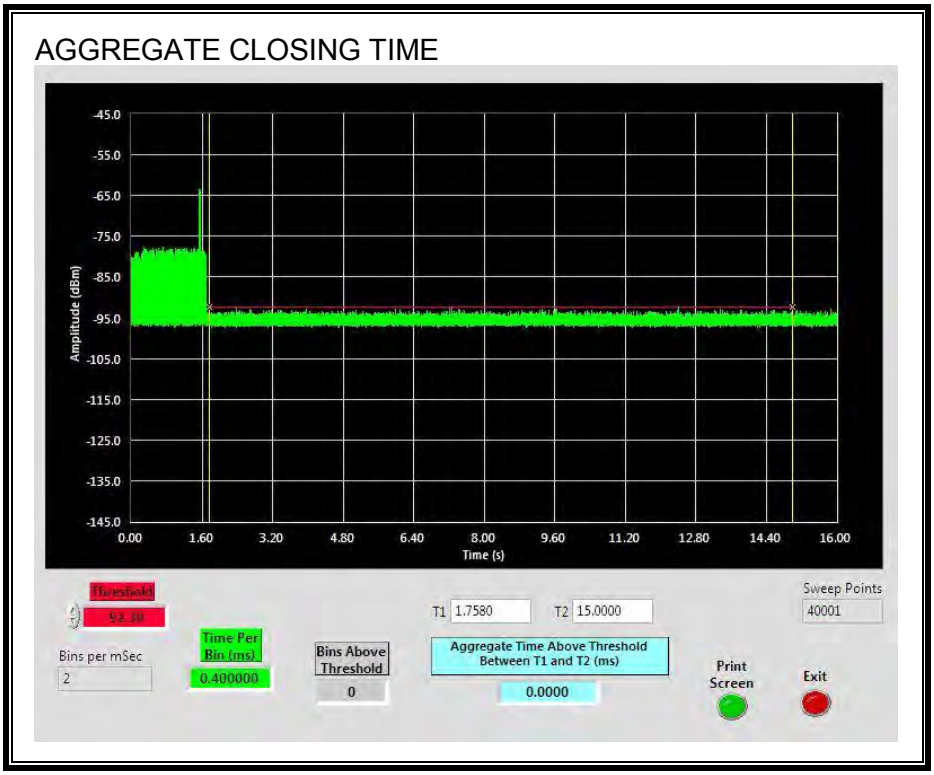
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.



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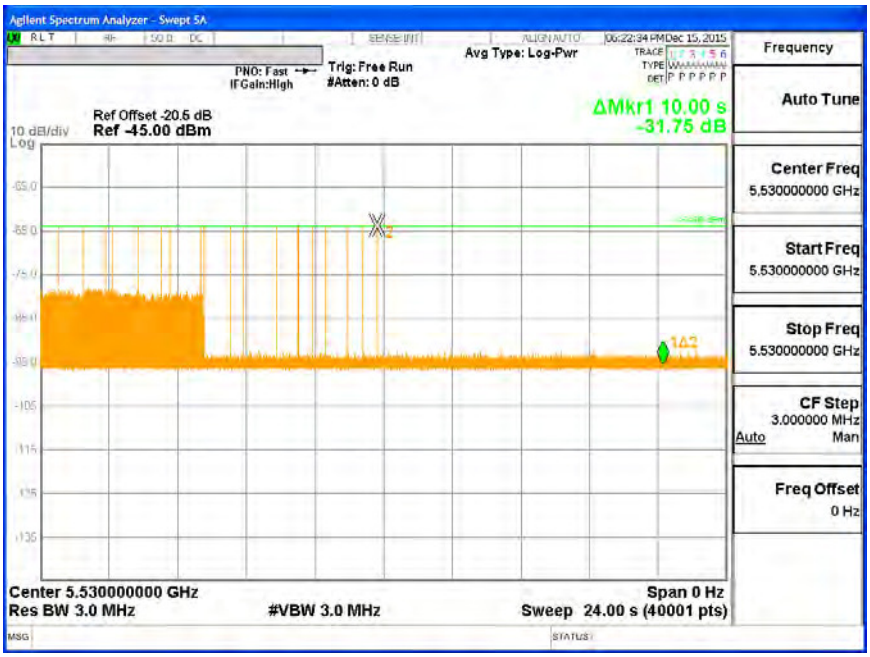
LONG PULSE CHANNEL MOVE TIME

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

MOVE TIME FOR LONG PULSE RADAR



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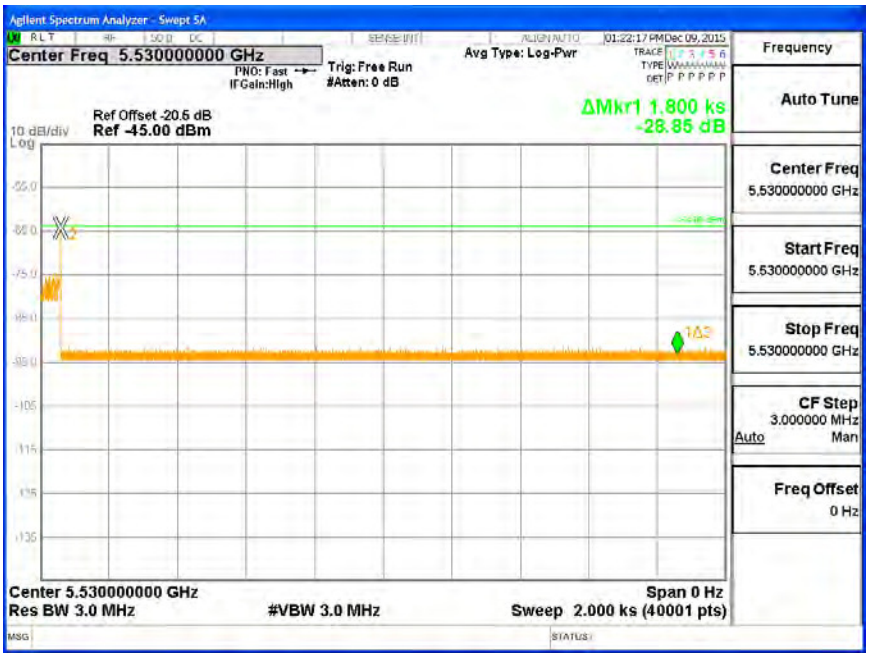
5.4.1. NON-OCCUPANCY PERIOD

RESULTS

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

NON-OCCUPANCY PERIOD



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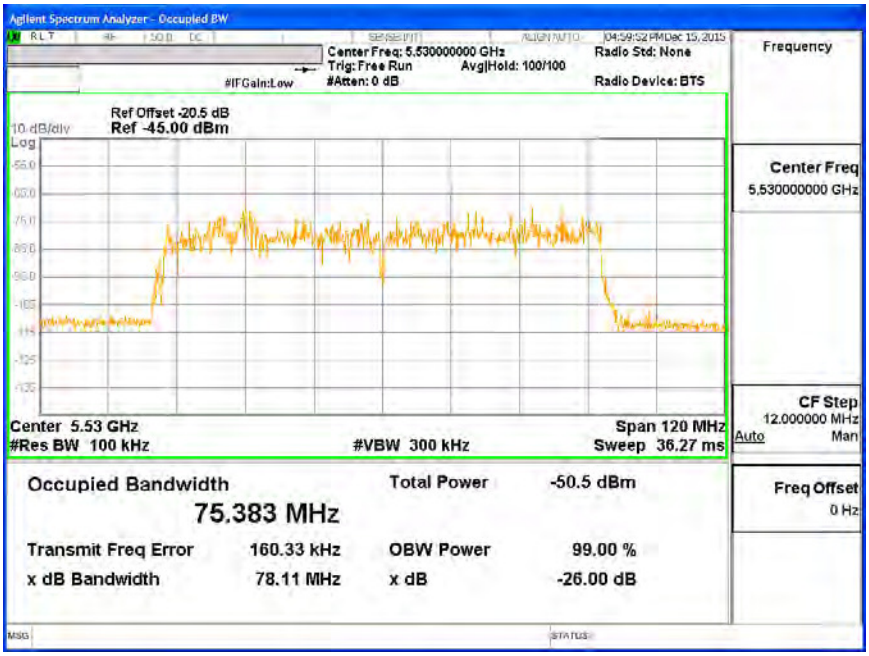
5.4.2. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH

99% BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5492	5569	77	75.383	102.1	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	5	50	
5492	10	10	100	FL
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	9	90	
5525	10	10	100	
5530	10	9	90	
5535	10	9	90	
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
5570	10	0	0	

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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	5492	5569		
FCC Short Pulse Type 2	30	90.00	60	Pass	5492	5569		
FCC Short Pulse Type 3	30	96.67	60	Pass	5492	5569		
FCC Short Pulse Type 4	30	93.33	60	Pass	5492	5569		
Aggregate		94.17	80	Pass				
FCC Long Pulse Type 5	30	96.67	80	Pass	5492	5569	5500	5561
FCC Hopping Type 6	78	100.00	70	Pass	5492	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	798	67	A	5530	Yes
1003	1	678	78	A	5530	Yes
1004	1	638	83	A	5530	Yes
1005	1	578	92	A	5530	Yes
1006	1	738	72	A	5530	Yes
1007	1	558	95	A	5530	Yes
1008	1	538	99	A	5530	Yes
1009	1	658	81	A	5530	Yes
1010	1	918	58	A	5530	Yes
1011	1	878	61	A	5530	Yes
1012	1	858	62	A	5530	Yes
1013	1	818	65	A	5530	Yes
1014	1	938	57	A	5530	Yes
1015	1	898	59	A	5530	Yes
1016	1	1085	49	B	5530	Yes
1017	1	1041	51	B	5530	Yes
1018	1	803	66	B	5530	Yes
1019	1	888	60	B	5530	Yes
1020	1	779	68	B	5530	Yes
1021	1	2347	23	B	5530	Yes
1022	1	848	63	B	5530	Yes
1023	1	1351	40	B	5530	Yes
1024	1	2855	19	B	5530	Yes
1025	1	2134	25	B	5530	Yes
1026	1	1219	44	B	5530	Yes
1027	1	1981	27	B	5530	Yes
1028	1	2549	21	B	5530	Yes
1029	1	892	60	B	5530	Yes
1030	1	1590	34	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	4	158	25	5530	Yes
2002	2.2	201	27	5530	Yes
2003	3.1	195	26	5530	Yes
2004	1.5	204	25	5530	Yes
2005	4.7	202	28	5530	Yes
2006	1.4	215	27	5530	Yes
2007	2.7	179	27	5530	Yes
2008	1.8	196	23	5530	Yes
2009	1.3	207	28	5530	Yes
2010	2.5	229	24	5530	Yes
2011	4.5	163	28	5530	Yes
2012	4	150	29	5530	Yes
2013	2	170	24	5530	Yes
2014	1.7	161	28	5530	Yes
2015	4.1	228	26	5530	Yes
2016	2.1	224	24	5530	Yes
2017	2.7	213	23	5530	Yes
2018	5	175	25	5530	No
2019	1.8	212	28	5530	Yes
2020	4.3	178	23	5530	Yes
2021	3.4	219	26	5530	Yes
2022	4.2	189	25	5530	Yes
2023	3.6	153	29	5530	Yes
2024	4.6	170	28	5530	Yes
2025	4.1	182	25	5530	No
2026	3.4	203	29	5530	Yes
2027	3.2	218	23	5530	Yes
2028	2.7	206	27	5530	Yes
2029	4.8	225	28	5530	Yes
2030	4.5	217	26	5530	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	10	413	16	5530	Yes
3002	9.8	400	18	5530	Yes
3003	5.6	368	18	5530	Yes
3004	8.4	250	17	5530	Yes
3005	9.5	364	17	5530	Yes
3006	5.1	259	18	5530	Yes
3007	6.4	385	16	5530	Yes
3008	7.4	293	16	5530	Yes
3009	6.6	432	17	5530	Yes
3010	7.8	368	17	5530	Yes
3011	7.3	269	16	5530	Yes
3012	6.4	336	17	5530	Yes
3013	6.1	383	18	5530	Yes
3014	5.5	344	16	5530	Yes
3015	8.2	404	17	5530	Yes
3016	7.8	379	16	5530	Yes
3017	8.4	334	18	5530	Yes
3018	8.2	454	16	5530	Yes
3019	9.1	422	17	5530	Yes
3020	6.8	422	16	5530	Yes
3021	7.9	284	16	5530	Yes
3022	8.6	430	17	5530	Yes
3023	9.9	306	18	5530	Yes
3024	5.8	464	18	5530	Yes
3025	5	486	16	5530	Yes
3026	6.2	289	16	5530	No
3027	5.7	441	18	5530	Yes
3028	9.9	390	16	5530	Yes
3029	9.6	304	17	5530	Yes
3030	9	265	18	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	13.2	325	13	5530	Yes
4002	17.7	433	16	5530	Yes
4003	13.5	254	15	5530	Yes
4004	18.6	375	15	5530	Yes
4005	14.9	342	15	5530	Yes
4006	10.4	475	16	5530	Yes
4007	12.6	456	15	5530	Yes
4008	13.9	351	15	5530	Yes
4009	16.6	477	14	5530	Yes
4010	18.5	267	14	5530	Yes
4011	17	407	16	5530	No
4012	19.4	460	16	5530	No
4013	18.3	362	16	5530	Yes
4014	16.5	310	16	5530	Yes
4015	16	475	12	5530	Yes
4016	14.7	437	15	5530	Yes
4017	10	379	16	5530	Yes
4018	14.6	353	12	5530	Yes
4019	10.3	426	13	5530	Yes
4020	15.4	295	14	5530	Yes
4021	11.7	263	13	5530	Yes
4022	17.3	396	14	5530	Yes
4023	14.7	377	14	5530	Yes
4024	10.7	271	13	5530	Yes
4025	13.4	398	13	5530	Yes
4026	15.3	439	12	5530	Yes
4027	13.8	327	15	5530	Yes
4028	16.2	381	14	5530	Yes
4029	15.1	282	15	5530	Yes
4030	13.3	482	15	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	5542	Yes
2	5519	Yes
3	5543	Yes
4	5536	No
5	5500	Yes
6	5505	Yes
7	5538	Yes
8	5507	Yes
9	5534	Yes
10	5518	Yes
11	5534	Yes
12	5516	Yes
13	5541	Yes
14	5541	Yes
15	5548	Yes
16	5515	Yes
17	5544	Yes
18	5515	Yes
19	5531	Yes
20	5541	Yes
21	5504	Yes
22	5549	Yes
23	5519	Yes
24	5554	Yes
25	5529	Yes
26	5523	Yes
27	5548	Yes
28	5517	Yes
29	5505	Yes
30	5506	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	41	5492	17	Yes
2	516	5493	15	Yes
3	991	5494	18	Yes
4	1466	5495	17	Yes
5	1941	5496	25	Yes
6	2416	5497	20	Yes
7	2891	5498	19	Yes
8	3366	5499	21	Yes
9	3841	5500	21	Yes
10	4316	5501	15	Yes
11	4791	5502	14	Yes
12	5266	5503	14	Yes
13	5741	5504	18	Yes
14	6216	5505	23	Yes
15	6691	5506	11	Yes
16	7166	5507	18	Yes
17	7641	5508	17	Yes
18	8116	5509	17	Yes
19	8591	5510	9	Yes
20	9066	5511	13	Yes
21	9541	5512	19	Yes
22	10016	5513	20	Yes
23	10491	5514	13	Yes
24	10966	5515	18	Yes
25	11441	5516	18	Yes
26	11916	5517	16	Yes
27	12391	5518	12	Yes
28	12866	5519	16	Yes
29	13341	5520	26	Yes
30	13816	5521	18	Yes
31	14291	5522	14	Yes
32	14766	5523	14	Yes
33	15241	5524	20	Yes
34	15716	5525	18	Yes
35	16191	5526	13	Yes
36	16666	5527	15	Yes
37	17141	5528	19	Yes
38	17616	5529	17	Yes
39	18091	5530	17	Yes

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TYPE 6 DETECTION PROBABILITY (CONTINUED)

40	18566	5531	17	Yes
41	19041	5532	12	Yes
42	19516	5533	17	Yes
43	19991	5534	10	Yes
44	20466	5535	21	Yes
45	20941	5536	18	Yes
46	21416	5537	16	Yes
47	21891	5538	21	Yes
48	22366	5539	11	Yes
49	22841	5540	16	Yes
50	23316	5541	19	Yes
51	23791	5542	23	Yes
52	24266	5543	24	Yes
53	24741	5544	20	Yes
54	25216	5545	13	Yes
55	25691	5546	13	Yes
56	26166	5547	17	Yes
57	26641	5548	17	Yes
58	27116	5549	19	Yes
59	27591	5550	15	Yes
60	28066	5551	15	Yes
61	28541	5552	13	Yes
62	29016	5553	15	Yes
63	29491	5554	17	Yes
64	29966	5555	17	Yes
65	30441	5556	14	Yes
66	30916	5557	14	Yes
67	31391	5558	20	Yes
68	31866	5559	15	Yes
69	32341	5560	15	Yes
70	32816	5561	14	Yes
71	33291	5562	18	Yes
72	33766	5563	23	Yes
73	34241	5564	17	Yes
74	34716	5565	9	Yes
75	35191	5566	15	Yes
76	35666	5567	11	Yes
77	36141	5568	15	Yes
78	36616	5569	15	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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