DFS Portion of FCC CFR47 PART 15 SUBPART E
DFS Portion of INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

BreezeMax Extreme, 802.16e 5 GHz U-NII Base Station Radio

MODEL NUMBER: XTRM-BS-1DIV-5.4-90

FCC ID: LKT-EXTR-50

IC: 2514A-EXTR50

REPORT NUMBER: 09U12441-1

ISSUE DATE: APRIL 16, 2009

Prepared for
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TEL AVIV
69710, ISRAEL

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	04/16/09	Initial Issue	M. Heckrotte

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ALVARION, LTD.
21A BARZEL STREET
69710, ISRAEL

EUT DESCRIPTION: BreezeMax Extreme, 802.16e 5 GHz U-NII Base Station Radio

MODEL: XTRM-BS-1DIV-5.4-90

SERIAL NUMBER: 02159

DATE TESTED: MARCH 27 to APRIL 06, 2009

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
DFS Portion of CFR 47 Part 15 Subpart E	Pass
DFS Portion of INDUSTRY CANADA RSS-210 Issue 7 Annex 9	Pass

Compliance Certification Services, Inc. (CCS) 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 CCS based on interpretations and/or observations of test results. 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

Tested By:

DOUGLAS ANDERSON
EMC TECHNICIAN
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 15, FCC 06-96, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

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

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

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

5. DYNAMIC FREQUENCY SELECTION

5.1. OVERVIEW

5.1.1. LIMITS

INDUSTRY CANADA

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 7 A9.4 (b) (ii) **Channel Availability Check Time:** …

Additional requirements for the band 5600-5650 MHz: Until further notice, devices subject to this Section shall not be capable of transmitting in the band 5600-5650 MHz, so that Environment Canada weather radars operating in this band are protected.

RSS-210 Issue 7 A9.4 (b) (iv) **Channel closing time:** the maximum channel closing time is 260 ms.

FCC

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

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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
Uniform Spreading	Yes	Not required	Not required

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

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 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.	

Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows: For the Short pulse radar Test Signals this instant is the end of the *Burst*. For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated. For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. 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 channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.	

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
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

Table 6 – Long Pulse Radar Test Signal

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

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

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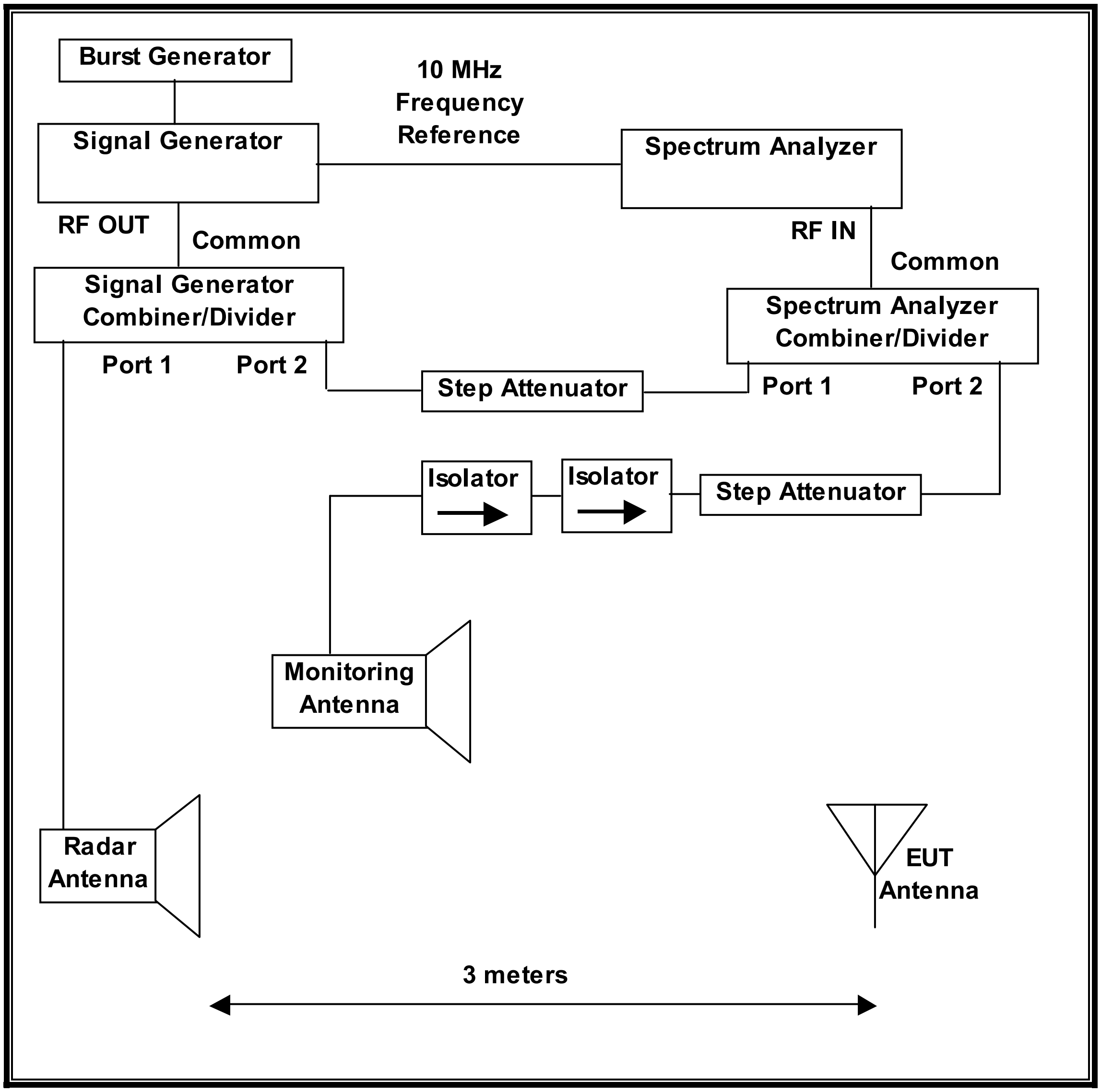
5.1.2. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM



SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 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 Freqeuncy Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. 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 analyer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. Measure the amplitude and calculate the difference from –64 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference.

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.

Set the signal generator to produce a radar waveform, trigger a burst manually and measure the level on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

Establish a link between the Master and Slave, adjusting the distance between the units as needed to provide a suitable received level at the Master and Slave devices. Stream the video test file to generate WLAN traffic. Confirm that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold. For Master Device testing confirm that the displayed traffic does not include Slave Device traffic. For Slave Device testing confirm that the displayed traffic does not include Master Device traffic.

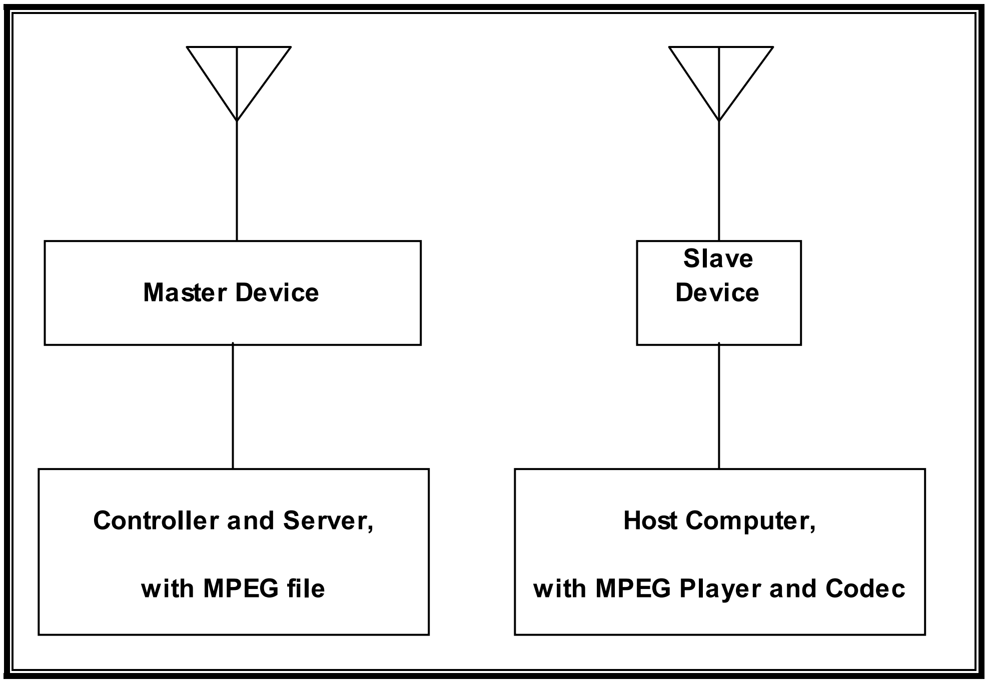
TEST AND MEASUREMENT EQUIPMENT

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, 44 GHz	Agilent / HP	E4446A	C00986	02/03/10
Vector signal generator, 20GHz	Agilent / HP	E8267C	C01066	11/16/09
Arbitrary Waveform Generator	Agilent / HP	33220A	C01146	05/05/09

5.1.3. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

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

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC/DC Power Supply (Master EUT)	Mean Well	SP-200-48	RA88057739	DoC
802.16e DTS/U-NII Subscriber Unit (Slave EUT)	Alvarion, Ltd.	XTRM-SU-OD-1D-4.9-UL-A	W847002738	LKT-EXTR-CPE-50
P.O.E. Injector (Slave EUT)	Alvarion, Ltd.	0334B5555	A30443139313	DoC
Notebook PC (Master)	Dell	PP11L	CN-0D4571-48643-51S-0557	DoC
AC Adapter (Master PC)	Dell	ADP-65JB B	CN-OF8834-48661-5CI-6NO3	DoC
Notebook PC (Slave)	Dell	PP11L	CN-0C4708-48643-54F-4144	DoC
AC Adapter (Slave PC)	Lite On Technology	PA-1900-02D	CN-09T215-71615-4BE-4082	DoC
Airport Express Base Station	Apple	A1084	HS43U6GS0V0	BCGA1084
10/100 Fast Ethernet Switch	Netgear	FS105	1D1793704A8A	DoC
AC Adapter (Ethernet Switch)	DVE	DSA-9R-05	3507 HB	DoC

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5.1.4. DESCRIPTION OF EUT

The EUT operates over the 5470-5725 MHz range.

The EUT is a Master Device.

The highest power level is 24.2 dBm EIRP at a bandwidth of 5 MHz and 27.2 dBm EIRP at a bandwidth of 10 MHz in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 17 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 8 dBi in the 5470-5725 MHz band.

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

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 two transmitter/receiver chains, each connected to a 50-ohm coaxial antenna port. The 8 dBi antennas were connected during the test.

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

WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

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

The EUT utilizes the WiMax 802.16e architecture. Two nominal channel bandwidths are implemented: 5 MHz and 10 MHz.

The software installed in the access point is version 1.0.0.65

MANUFACTURER’S STATEMENT REGARDING UNIFORM CHANNEL SPREADING

This statement is in a separate document.

5.2. RESULTS FOR 5 MHz BANDWIDTH

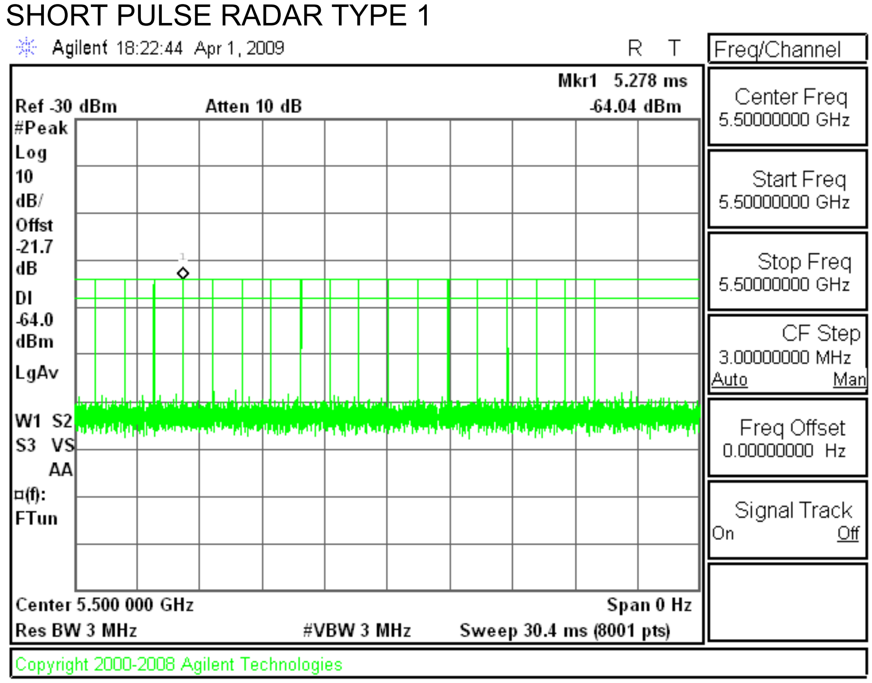
5.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz. Measurements were performed using conducted test methods.

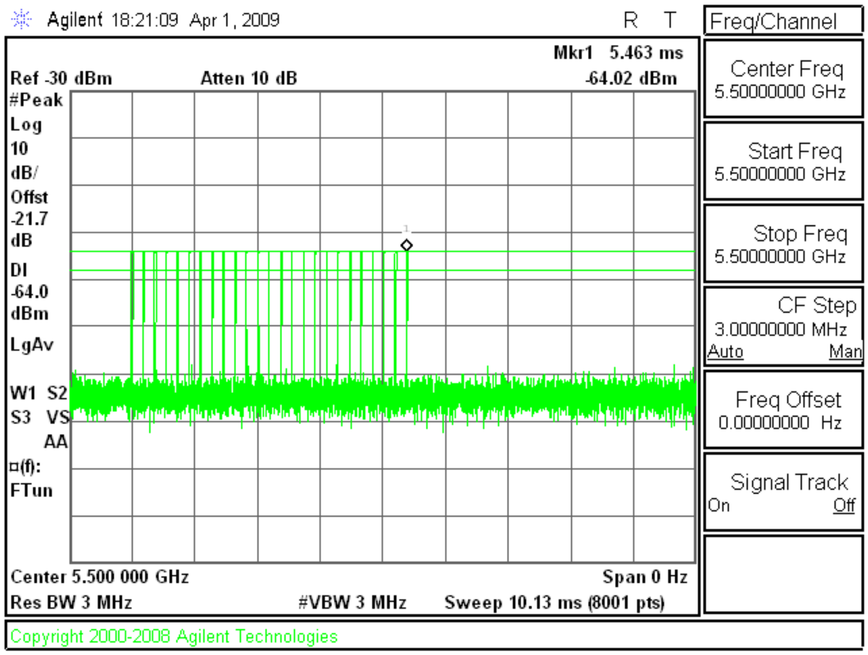
5.2.2. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

PLOTS OF RADAR WAVEFORMS

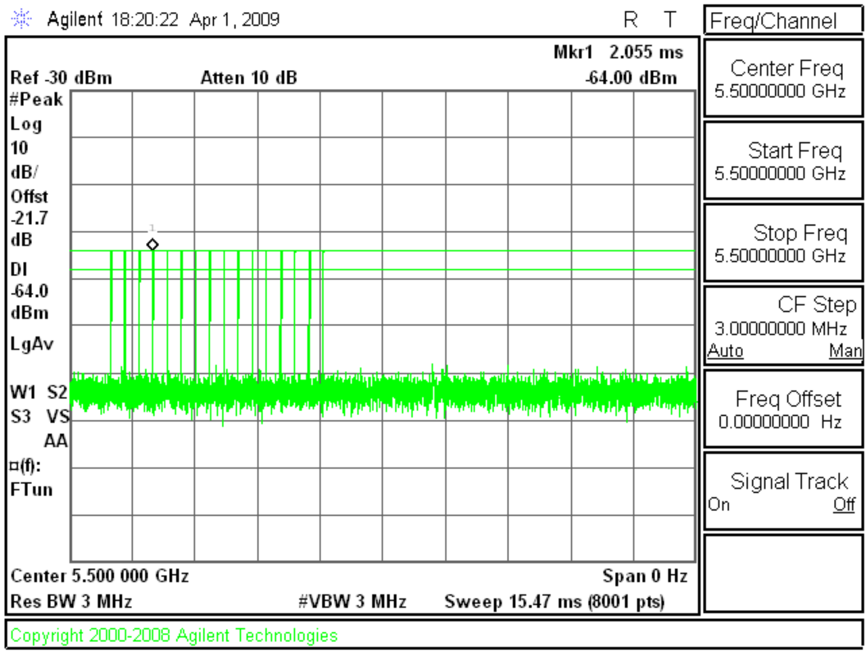
SHORT PULSE RADAR TYPE 1

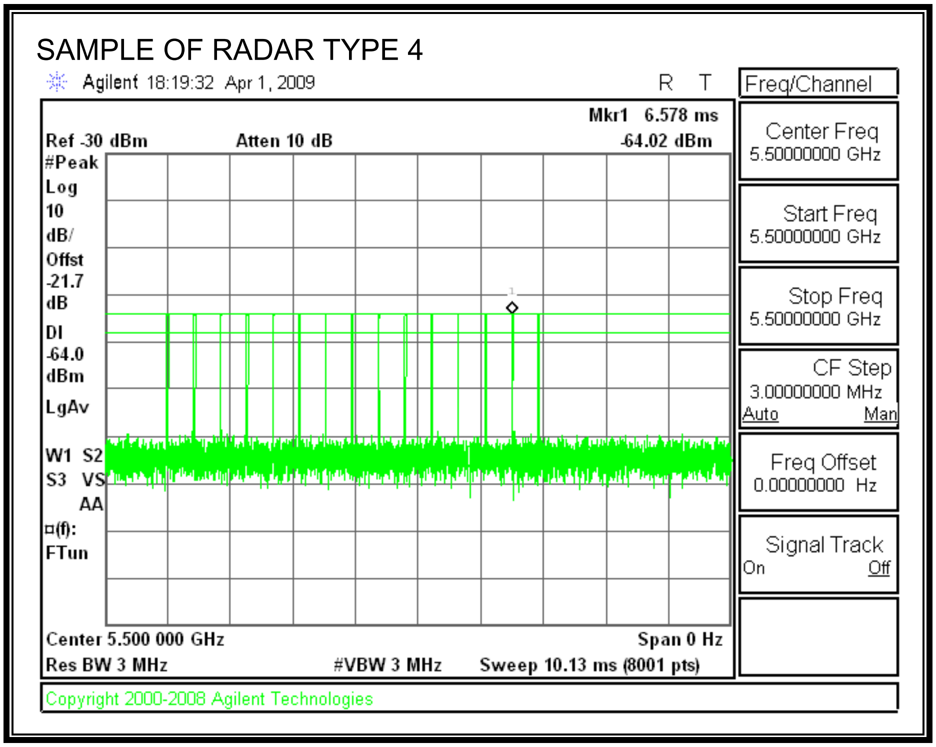


SAMPLE OF RADAR TYPE 2

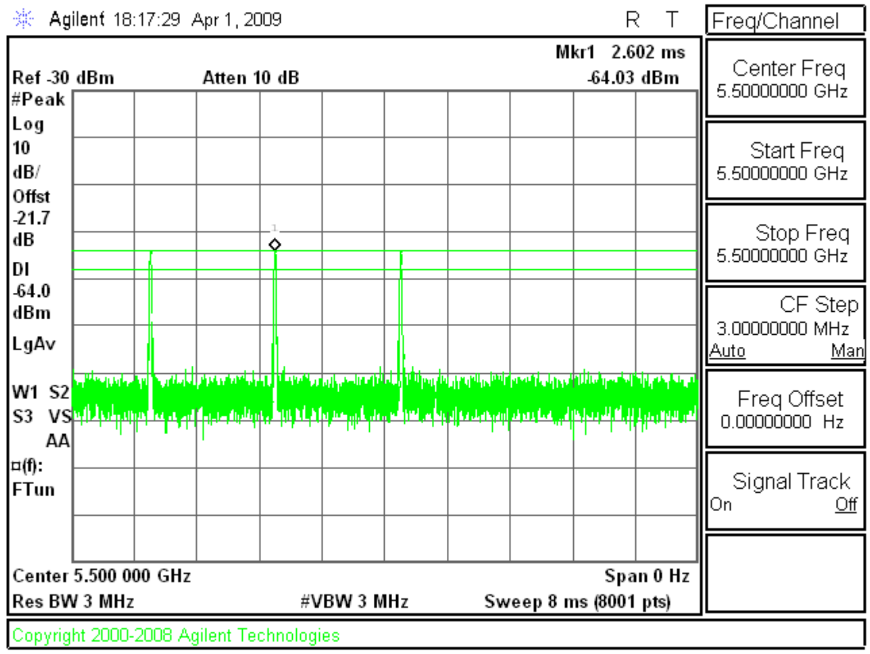


SAMPLE OF RADAR TYPE 3

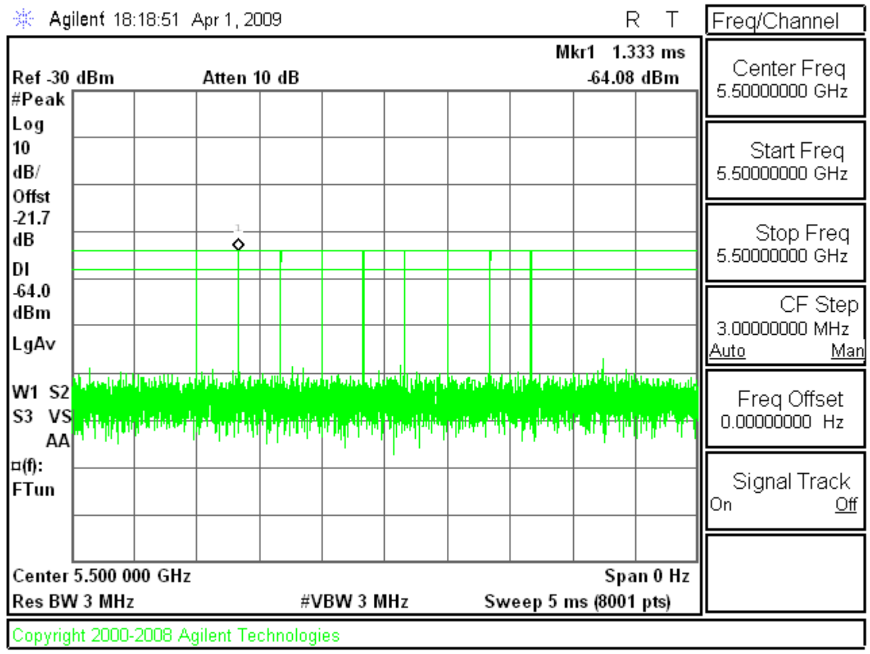



SAMPLE OF RADAR TYPE 4
Agilent 18:19:32 Apr 1, 2009
R T
Freq/Channel
Mkr1 6.578 ms
Ref -30 dBm
Atten 10 dB
-64.02 dBm
#Peak
Log
10
dB/
Offst
-21.7
dB
Dl
-64.0
dBm
LgAv
W1 S2
S3 VS
AA
FTun
Center Freq
5.50000000 GHz
Start Freq
5.50000000 GHz
Stop Freq
5.50000000 GHz
CF Step
3.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Center 5.500 000 GHz
Span 0 Hz
Res BW 3 MHz
#VBW 3 MHz
Sweep 10.13 ms (8001 pts)
Copyright 2000-2008 Agilent Technologies

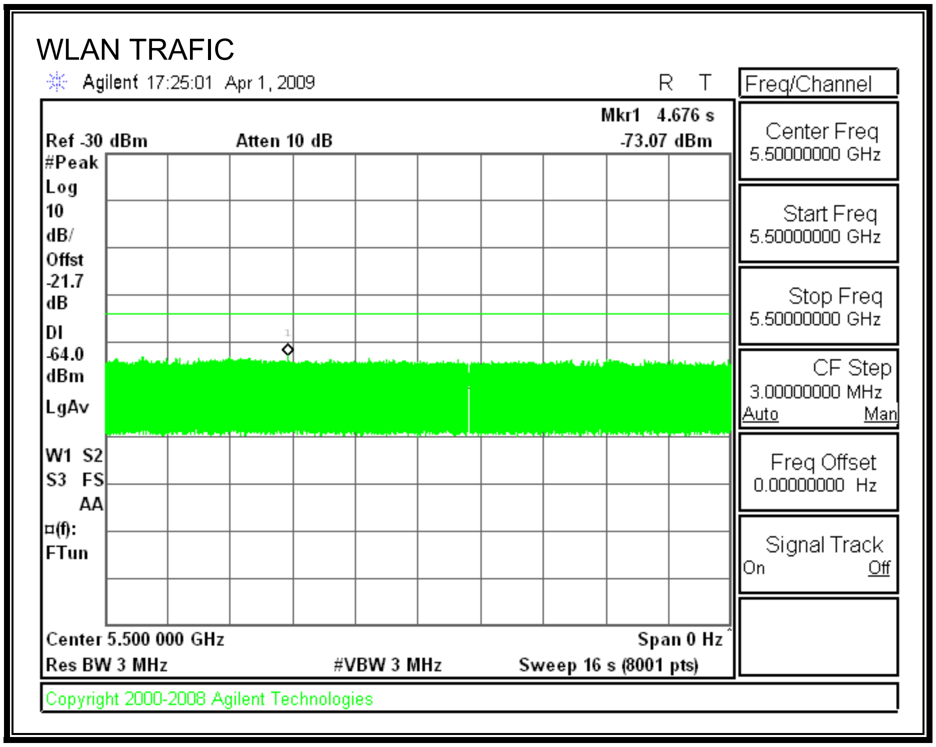
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



SINGLE BURST OF RADAR TYPE 6



PLOT OF WLAN TRAFFIC FROM MASTER



5.2.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
23.67	212.7	189.1	129.1

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
24.9	159.2	134.3	5.2

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
24.12	209.8	185.7	56.6

QUALITATIVE RESULTS

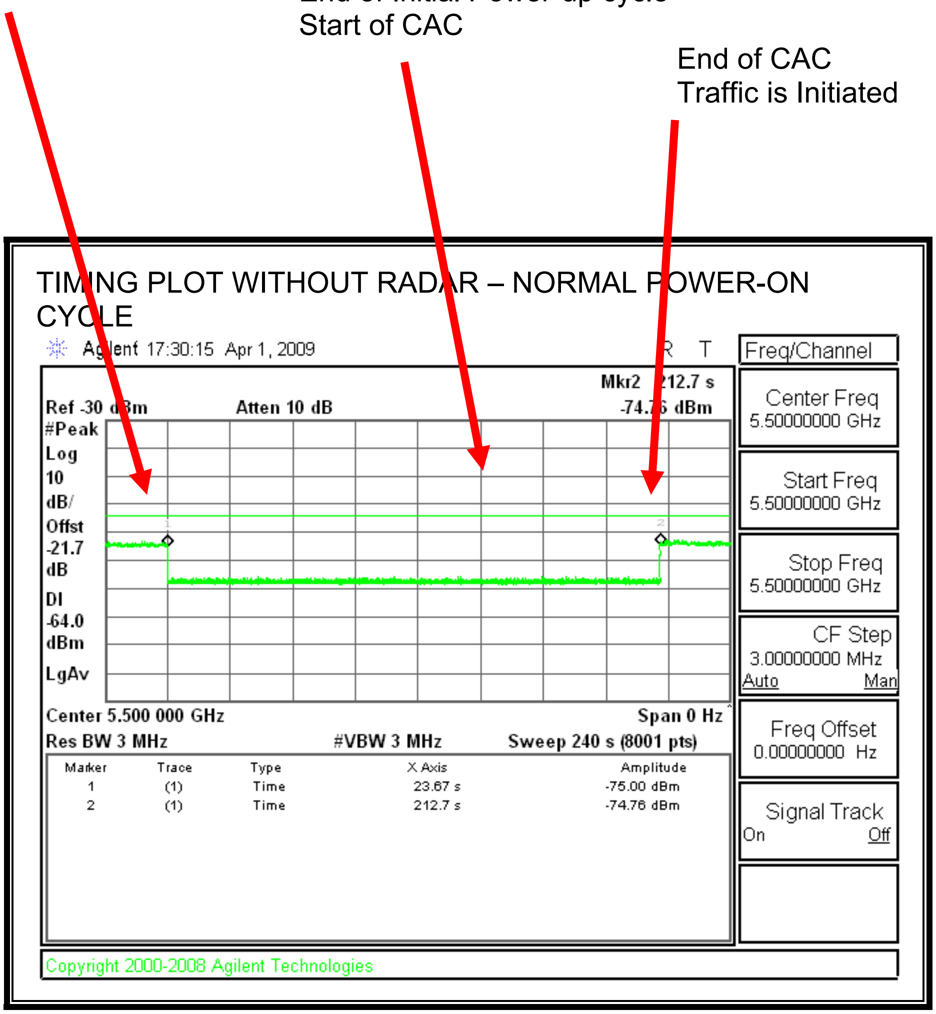
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT indicates radar detected	No transmissions on channel
Within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

TIMING PLOT WITHOUT RADAR DURING CAC

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

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



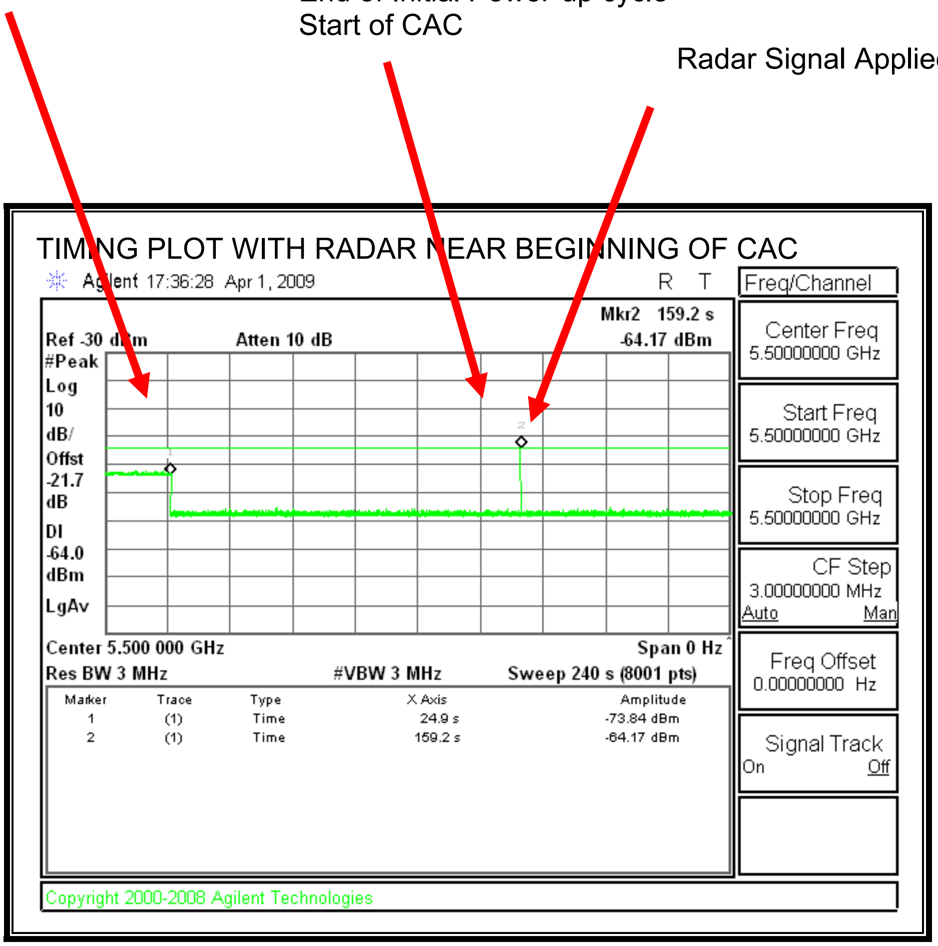
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING PLOT WITH RADAR NEAR BEGINNING OF CAC

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

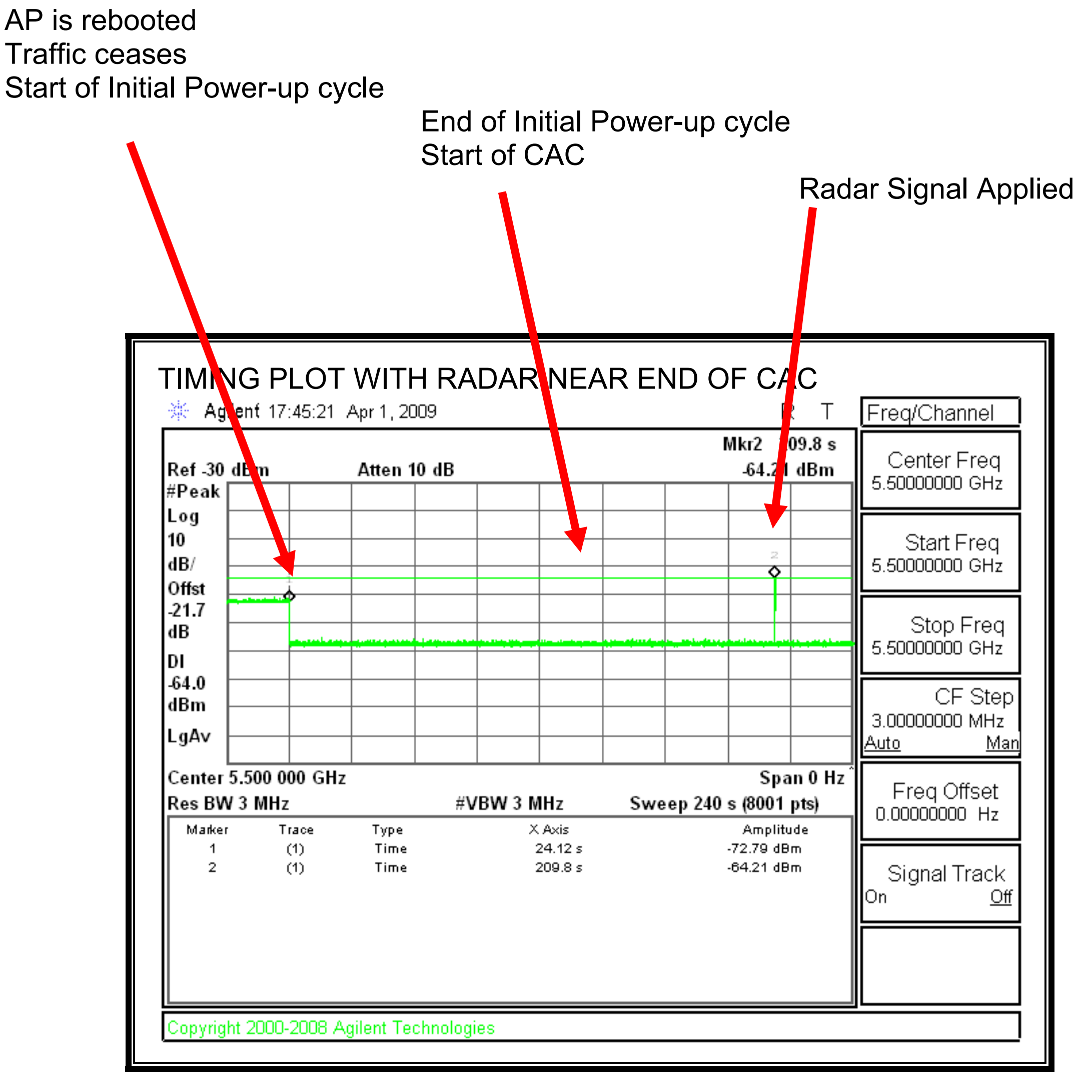
End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

TIMING PLOT WITH RADAR NEAR END OF CAC



No EUT transmissions were observed after the radar signal.

5.2.4. OVERLAPPING CHANNEL TESTS

PROCEDURE

The EUT was set to block all channels except 5497.5MHz, 5500 MHz and 5502.5 MHz, which are overlapping. The active channel was 5500 MHz and the radar test frequency was 5500 MHz.

A link was established on the active channel with the video file streaming.

A radar burst was triggered and a stopwatch timer was started. A second radar burst was triggered approximately 45 seconds after the first. A third radar burst was triggered approximately 45 seconds after the second.

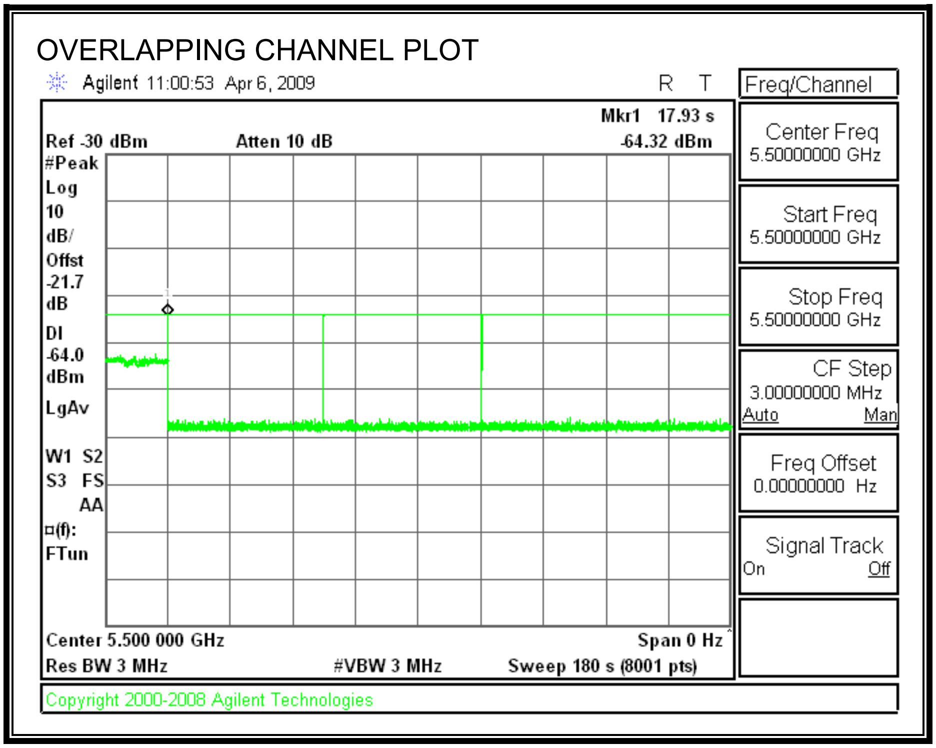
The EUT channel was monitored on the spectrum analyzer during the entire test procedure.

RESULTS

No beacons or traffic was observed on the spectrum analyzer after the first radar burst was transmitted.

TEST RESULTS

No EUT transmissions were observed on the test channels during the observation time.



5.2.5. MOVE AND CLOSING TIME

REPORTING NOTES

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

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

The aggregate channel closing transmission time is calculated as follows:

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

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

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

RESULTS

Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.016	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	12.0	260

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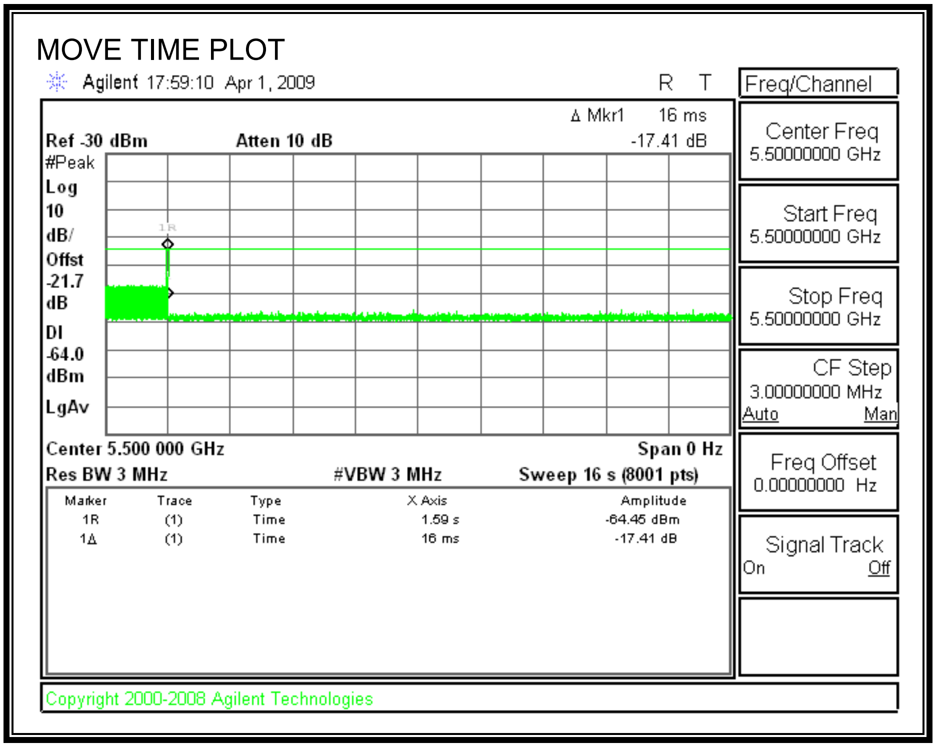
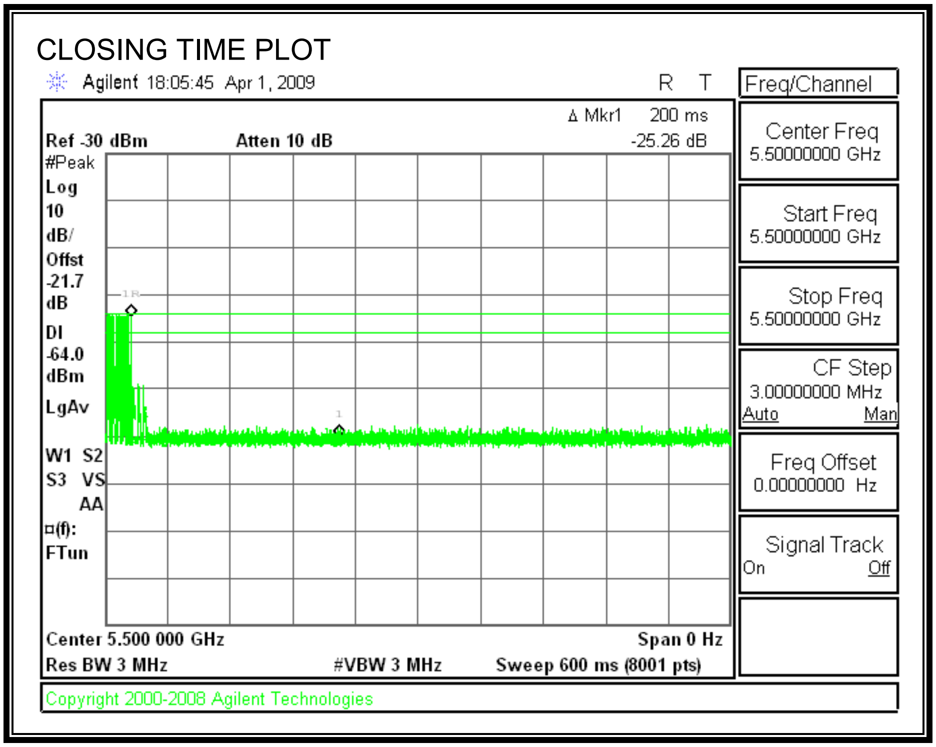
MOVE TIME

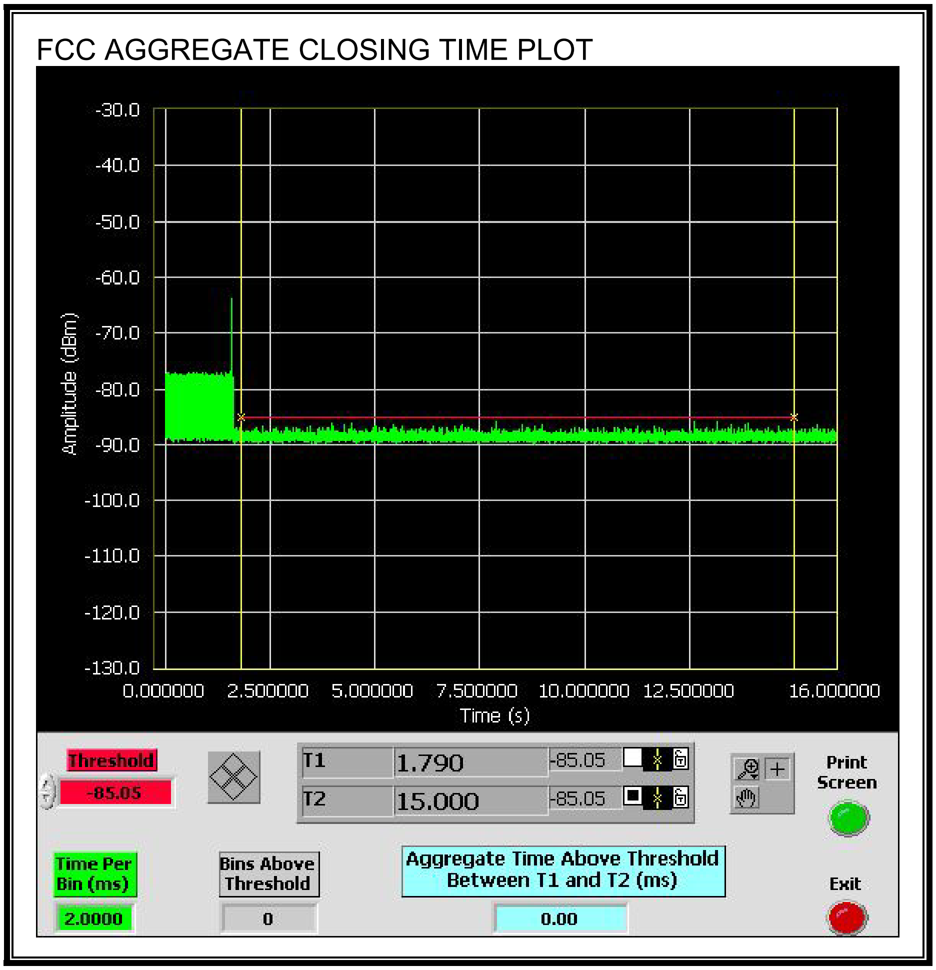

MOVE TIME PLOT
Agilent 17:59:10 Apr 1, 2009
R T
Freq/Channel
Δ Mkr1 16 ms
Ref -30 dBm Atten 10 dB -17.41 dB
#Peak
Log
10
dB/
Offst
-21.7
dB
Dl
-64.0
dBm
LgAv
Center 5.500 000 GHz Span 0 Hz
Res BW 3 MHz #VBW 3 MHz Sweep 16 s (8001 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 1.59 s -64.45 dBm
1Δ (1) Time 16 ms -17.41 dB
Center Freq 5.50000000 GHz
Start Freq 5.50000000 GHz
Stop Freq 5.50000000 GHz
CF Step 3.00000000 MHz Auto Man
Freq Offset 0.00000000 Hz
Signal Track On Off
Copyright 2000-2008 Agilent Technologies

CHANNEL CLOSING TIME

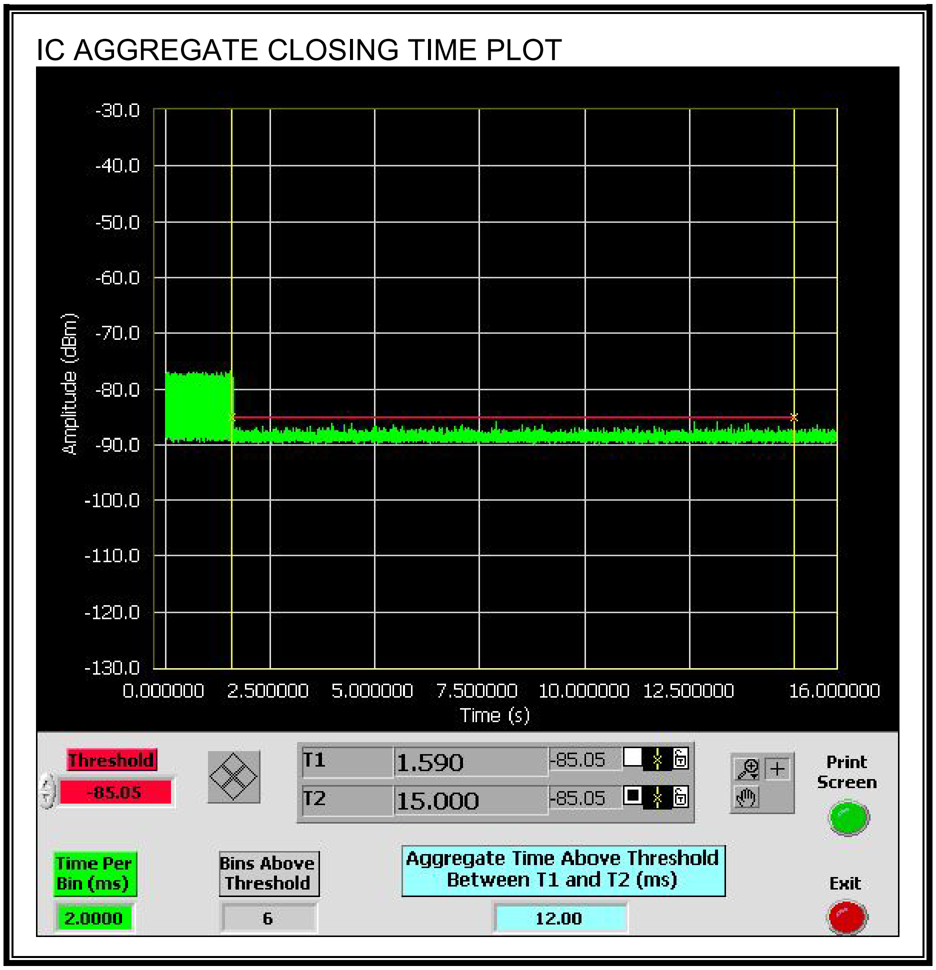


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.

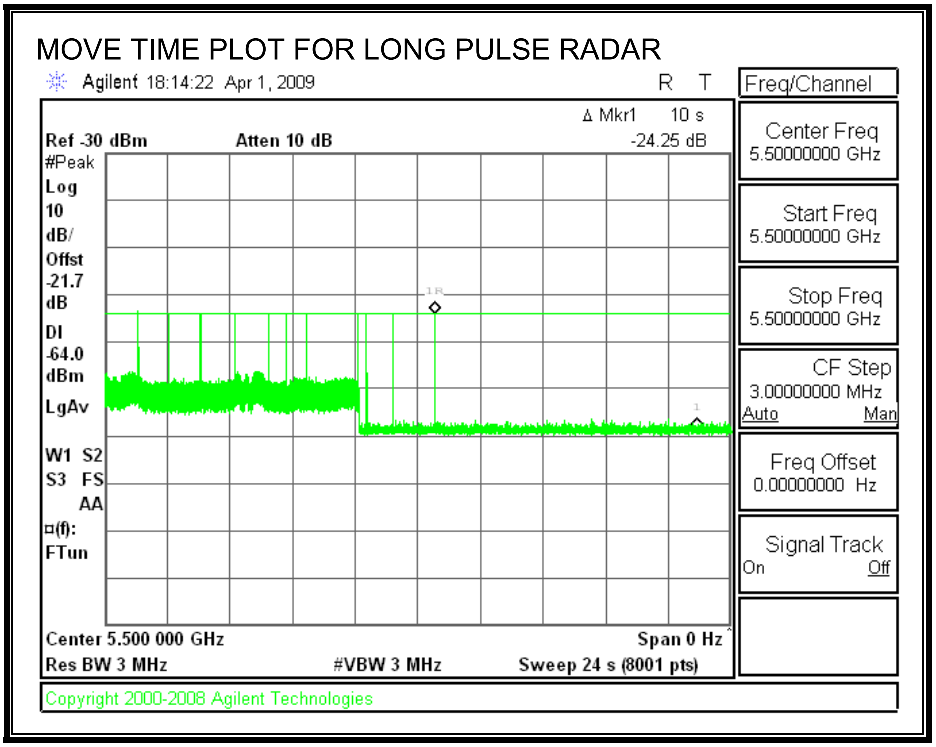


Only intermittent transmissions are observed during the IC aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

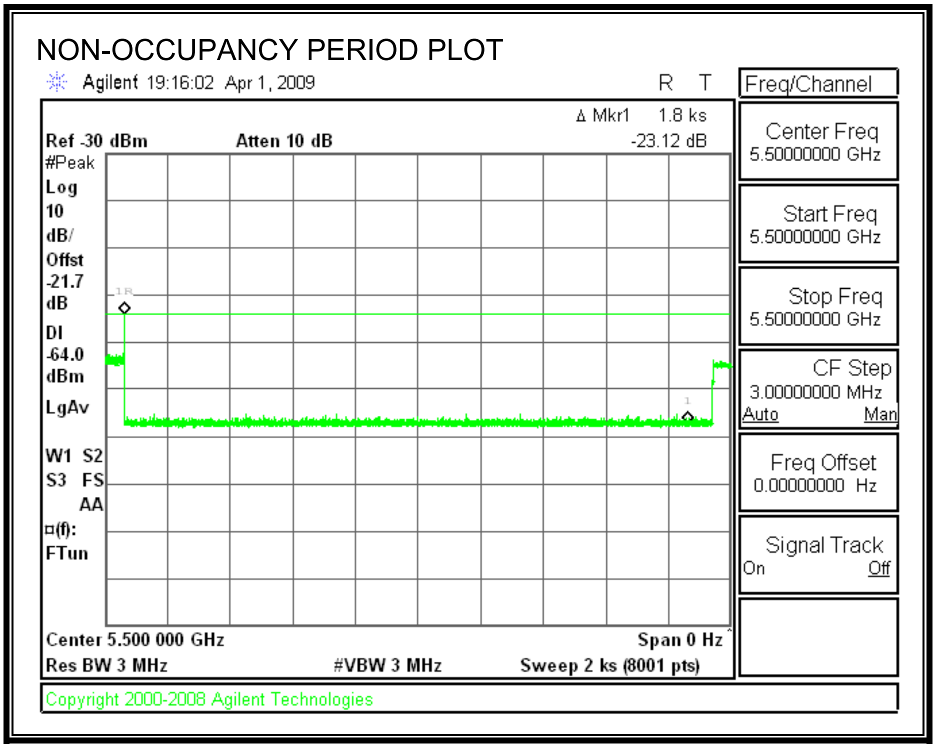
The traffic ceases prior to 10 seconds after the end of the radar waveform.



5.2.6. NON-OCCUPANCY PERIOD

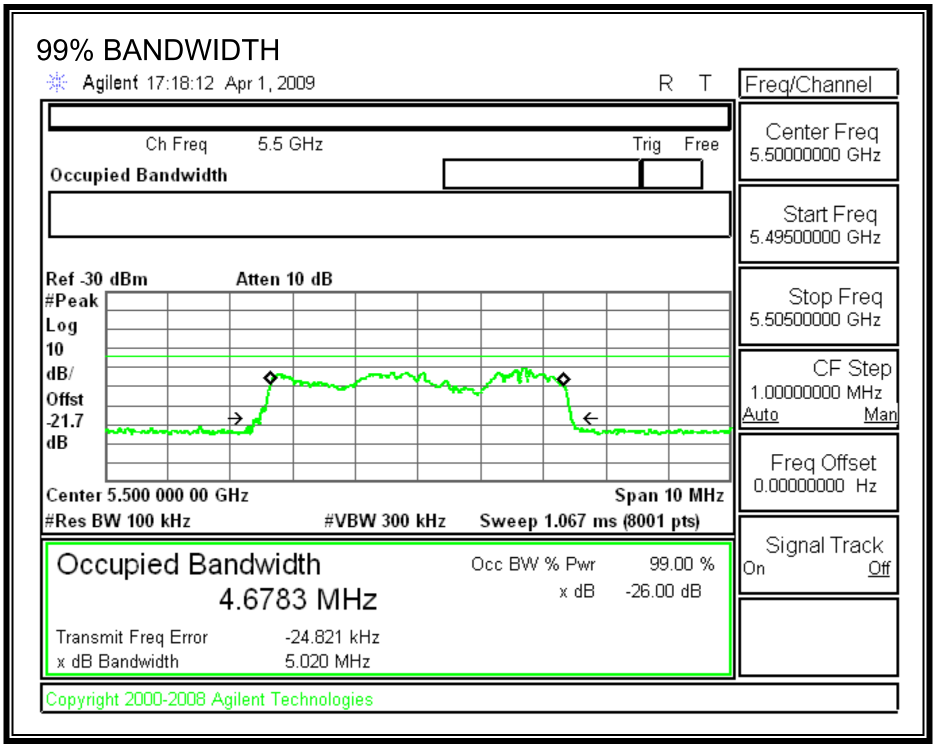
RESULTS

No EUT transmissions were observed on the test channel during the 30-minute observation time. The EUT performed a CAC after the end of the Non-Occupancy period, and reinitiated transmissions.



5.2.7. 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 (%)
5495	5506	11	4.678	235.1	80

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5494	10	1	10	
5495	10	10	100	FL
5496	10	10	100	
5497	10	10	100	
5498	10	10	100	
5499	10	9	90	
5500	10	10	100	
5501	10	10	100	
5502	10	10	100	
5503	10	10	100	
5504	10	10	100	
5505	10	10	100	
5506	10	10	100	FH
5507	10	1	10	

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5.2.8. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary				
Signal Type	**Number of Trials**	**Detection (%)**	**Limit (%)**	**Pass/Fail**
FCC Short Pulse Type 1	30	100.00	60	Pass
FCC Short Pulse Type 2	30	100.00	60	Pass
FCC Short Pulse Type 3	30	100.00	60	Pass
FCC Short Pulse Type 4	30	100.00	60	Pass
Aggregate		100.00	80	Pass
FCC Long Pulse Type 5	30	100.00	80	Pass
FCC Hopping Type 6	39	87.18	70	Pass

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1	
1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	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	Successful Detection (Yes/No)
2001	2.4	180.00	23	Yes
2002	2.6	155.00	23	Yes
2003	1.1	226.00	27	Yes
2004	4.1	165.00	25	Yes
2005	1.8	165.00	28	Yes
2006	1.9	227.00	23	Yes
2007	2.1	224.00	27	Yes
2008	5	183.00	29	Yes
2009	3.1	212.00	29	Yes
2010	3.8	197.00	23	Yes
2011	3.8	228.00	27	Yes
2012	4.9	180.00	29	Yes
2013	1.3	230.00	25	Yes
2014	2.9	215.00	25	Yes
2015	4.4	205.00	28	Yes
2016	2.8	217.00	23	Yes
2017	2.6	167.00	27	Yes
2018	3.9	191.00	29	Yes
2019	1.3	163.00	28	Yes
2020	2.6	208.00	24	Yes
2021	3.1	193.00	29	Yes
2022	2.3	166.00	26	Yes
2023	4.9	194.00	28	Yes
2024	4	197.00	26	Yes
2025	4.6	155.00	27	Yes
2026	1.1	150.00	29	Yes
2027	1.4	220.00	26	Yes
2028	4.2	212.00	28	Yes
2029	1.2	182.00	25	Yes
2030	1.6	178.00	25	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
3001	7.9	401.00	16	Yes
3002	5	485.00	16	Yes
3003	7	402.00	16	Yes
3004	7.9	289.00	17	Yes
3005	7.9	500.00	17	Yes
3006	9	459.00	16	Yes
3007	7.8	496.00	17	Yes
3008	9.2	394.00	16	Yes
3009	7	346.00	17	Yes
3010	6	298.00	16	Yes
3011	7.9	420.00	16	Yes
3012	6.1	343.00	16	Yes
3013	8.4	285.00	16	Yes
3014	8.1	342.00	18	Yes
3015	8.5	251.00	18	Yes
3016	6.9	374.00	18	Yes
3017	6.9	358.00	16	Yes
3018	5.8	472.00	18	Yes
3019	8.7	458.00	18	Yes
3020	10	360.00	16	Yes
3021	5.9	459.00	18	Yes
3022	7	448.00	18	Yes
3023	8.1	354.00	18	Yes
3024	8.2	330.00	18	Yes
3025	8	446.00	16	Yes
3026	8	331.00	17	Yes
3027	8.5	432.00	17	Yes
3028	7	449.00	18	Yes
3029	7.6	259	17	Yes
3030	7.6	351	18	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
4001	18.4	459.00	13	Yes
4002	13.8	296.00	16	Yes
4003	16.4	414.00	12	Yes
4004	10.6	412.00	13	Yes
4005	18.1	323.00	16	Yes
4006	16.9	474.00	14	Yes
4007	13	418.00	13	Yes
4008	12.1	474.00	15	Yes
4009	17.8	412.00	12	Yes
4010	12.2	381.00	16	Yes
4011	18	498.00	14	Yes
4012	11.8	288.00	14	Yes
4013	19.2	275.00	16	Yes
4014	17.7	359.00	15	Yes
4015	14.3	306.00	16	Yes
4016	17.9	341.00	12	Yes
4017	16.2	348.00	12	Yes
4018	18.8	319.00	16	Yes
4019	11.7	361.00	15	Yes
4020	15.2	335.00	16	Yes
4021	13.3	255.00	16	Yes
4022	19.2	331.00	15	Yes
4023	17	260.00	12	Yes
4024	14.8	295.00	12	Yes
4025	18.7	480.00	13	Yes
4026	13.5	256.00	16	Yes
4027	17.3	441.00	13	Yes
4028	14.4	477.00	13	Yes
4029	16.2	369.00	16	Yes
4030	19.4	489.00	13	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

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

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	274	5495	5	Yes
2	749	5496	3	Yes
3	1224	5497	2	Yes
4	1699	5498	4	Yes
5	2174	5499	1	Yes
6	2649	5500	3	Yes
7	3124	5501	3	Yes
8	3599	5502	4	Yes
9	4074	5503	1	Yes
10	4549	5504	3	Yes
11	5024	5505	2	Yes
12	5499	5506	3	Yes
13	5974	5507	3	No
14	6449	5495	3	Yes
15	6924	5496	4	Yes
16	7399	5497	2	Yes
17	7874	5498	1	No
18	9299	5499	3	Yes
19	9774	5500	2	Yes
20	10249	5501	2	Yes
21	10724	5502	4	Yes
22	11199	5503	2	Yes
23	11674	5504	2	Yes
24	12149	5505	2	Yes
25	12624	5506	2	Yes
26	13099	5507	3	No
27	13574	5495	1	Yes
28	14049	5496	4	Yes
29	14524	5497	4	Yes
30	14999	5498	2	Yes
31	15474	5499	3	Yes
32	15949	5500	6	Yes
33	16424	5501	2	Yes
34	16899	5502	3	Yes
35	17374	5503	3	Yes
36	17849	5504	2	Yes
37	18324	5505	2	Yes
38	18799	5506	3	No
39	19274	5507	2	No

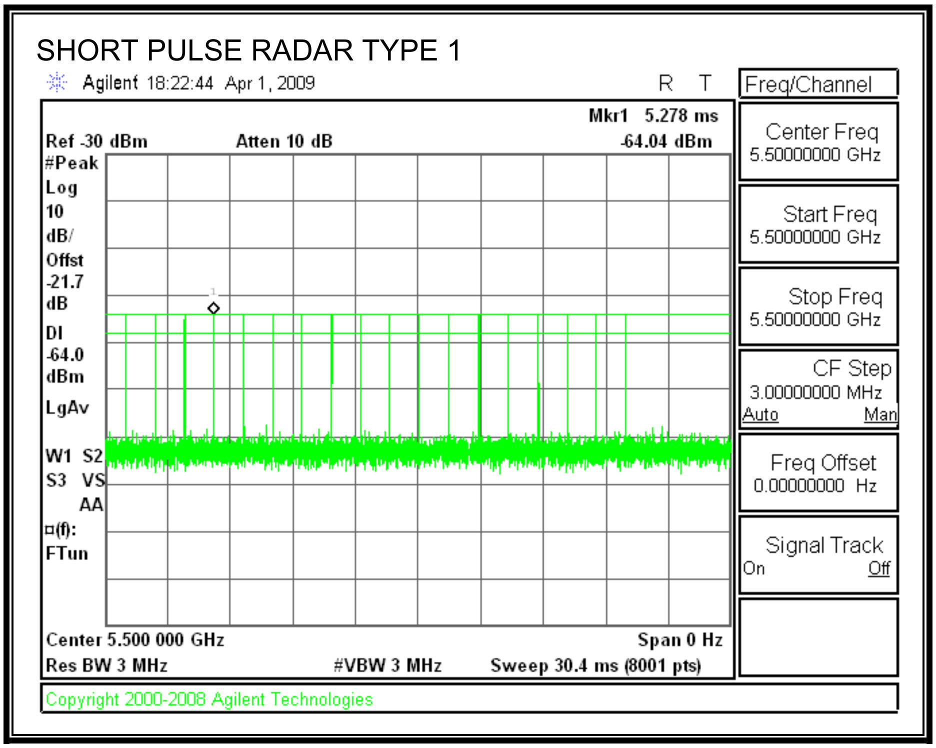
5.3. RESULTS FOR 10 MHz BANDWIDTH

5.3.1. TEST CHANNEL

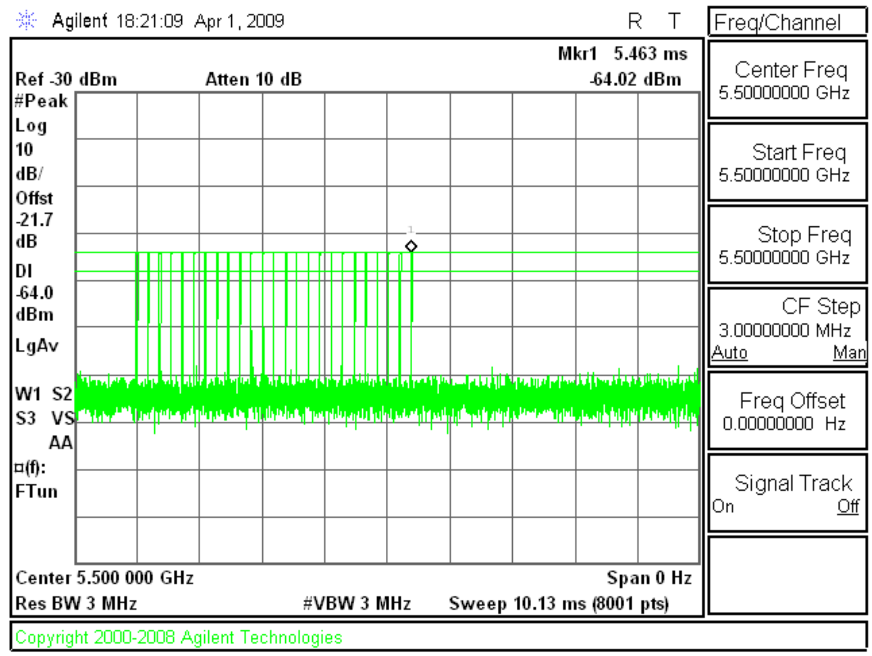
All tests were performed at a channel center frequency of 5500 MHz. Measurements were performed using conducted test methods.

5.3.2. PLOTS OF RADAR WAVEFORMS AND WLAN TRAFFIC

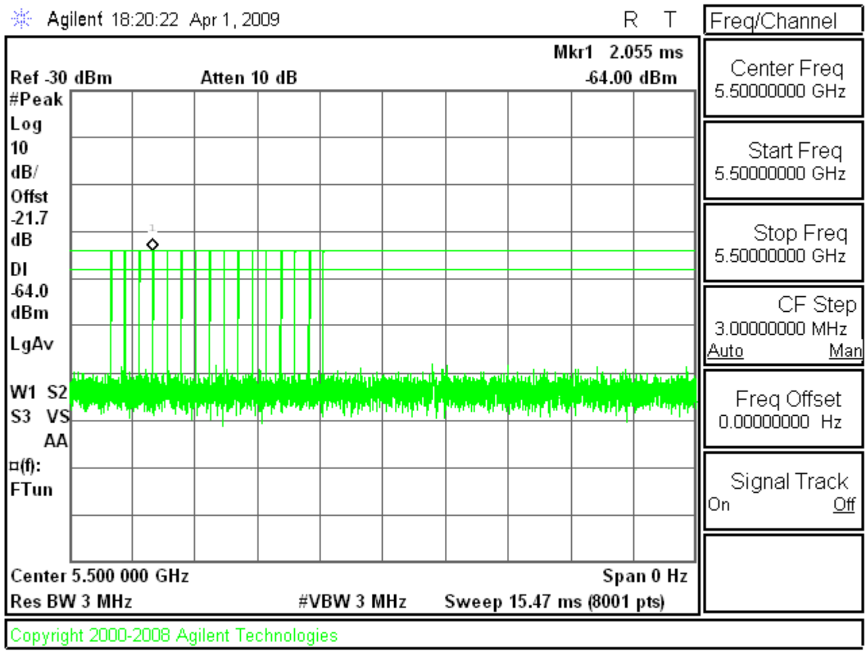
PLOTS OF RADAR WAVEFORMS



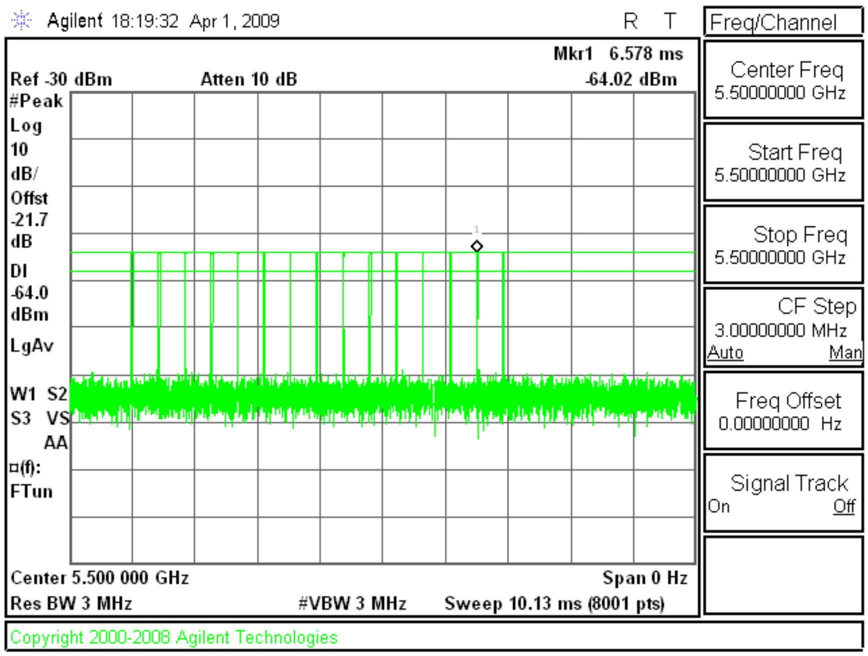
SAMPLE OF RADAR TYPE 2



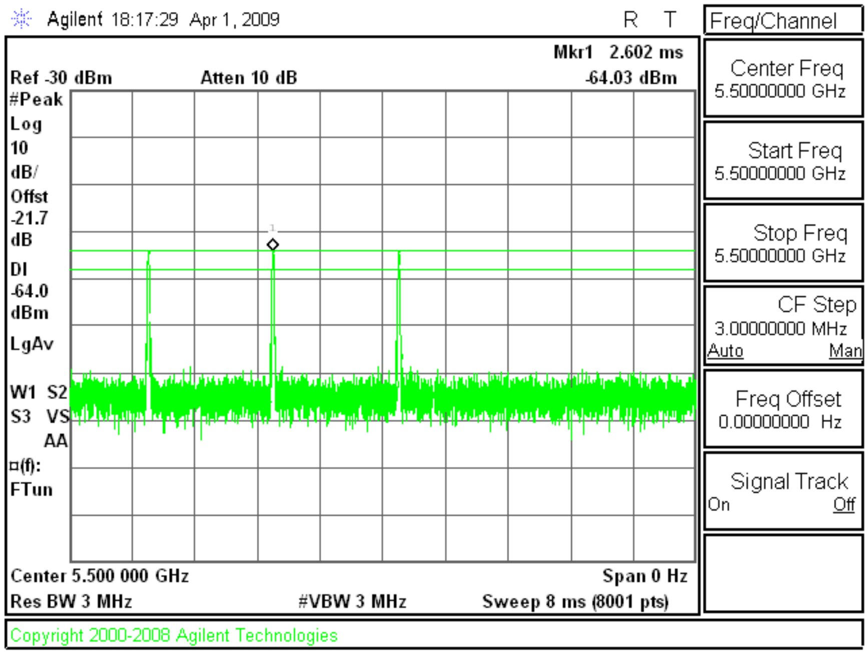
SAMPLE OF RADAR TYPE 3



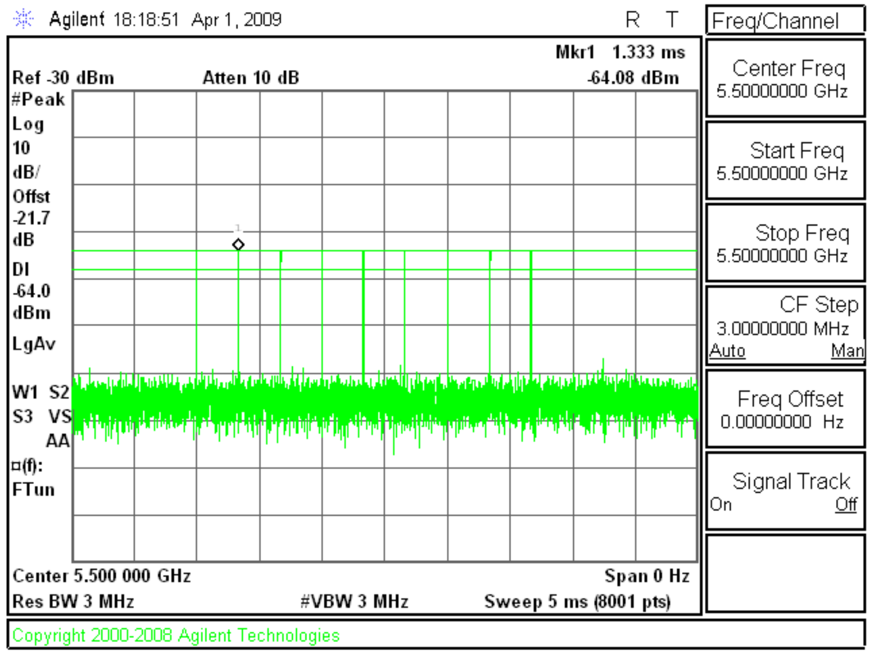
SAMPLE OF RADAR TYPE 4



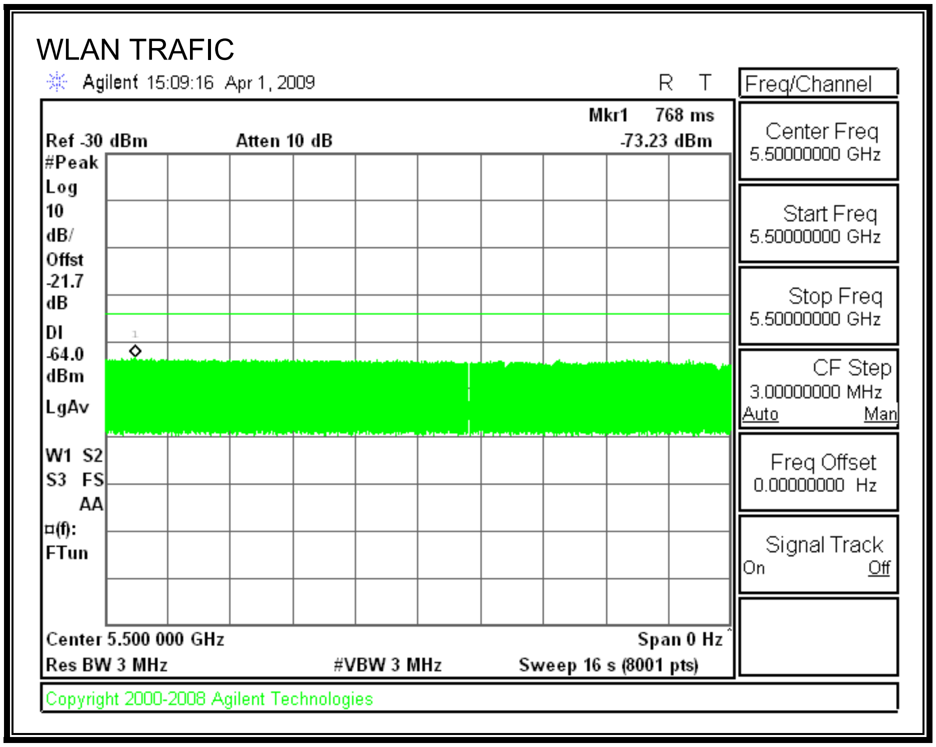
SAMPLE OF SINGLE BURST OF RADAR TYPE 5



SINGLE BURST OF RADAR TYPE 6



PLOT OF WLAN TRAFFIC FROM MASTER



5.3.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

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

PROCEDURE FOR TIMING OF RADAR BURST

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

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

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
23.4	212.6	189.2	129.2

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
23.49	155.8	132.3	3.1

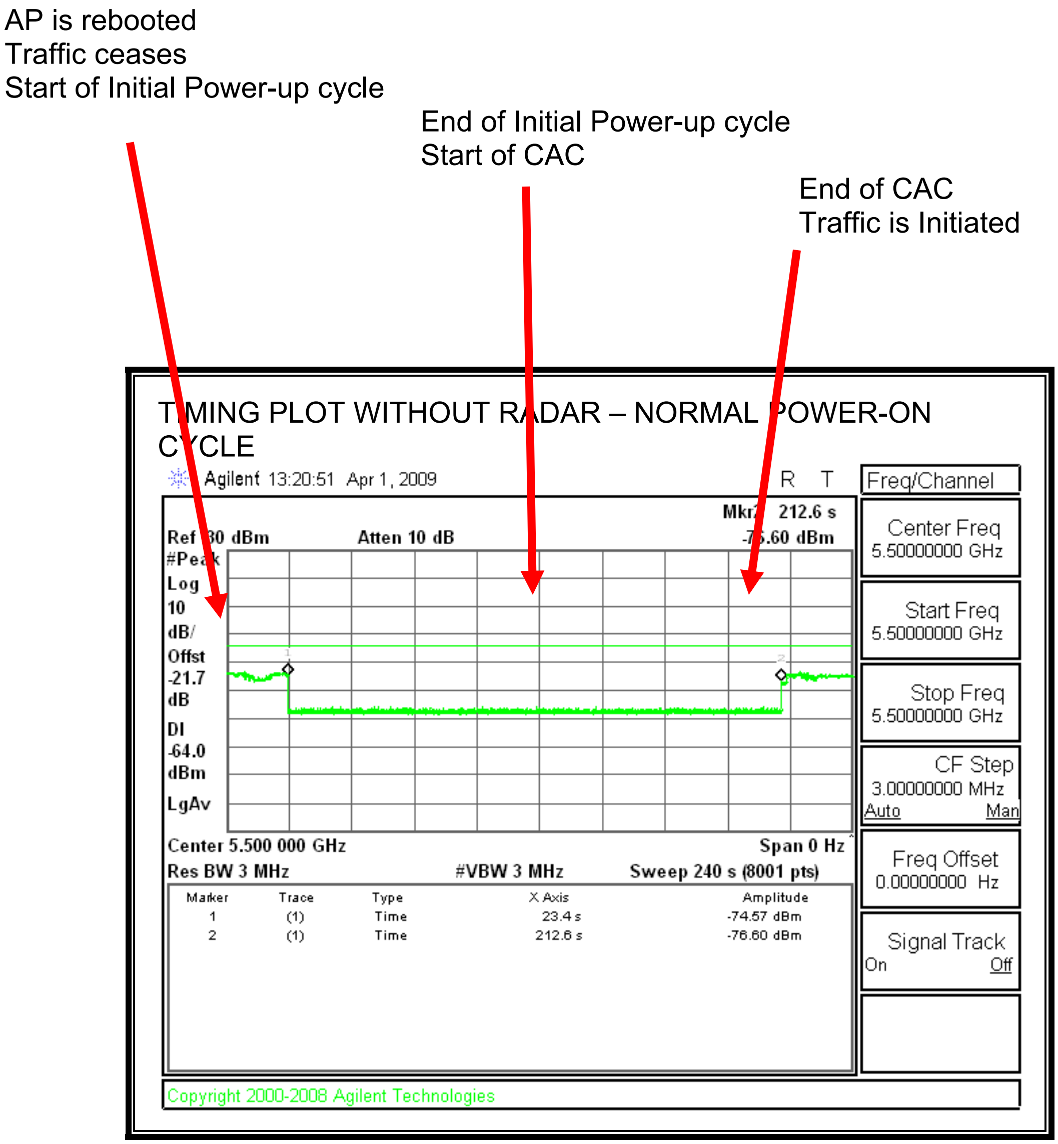
Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
24.06	210.0	185.9	56.7

QUALITATIVE RESULTS

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

TIMING PLOT WITHOUT RADAR DURING CAC



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

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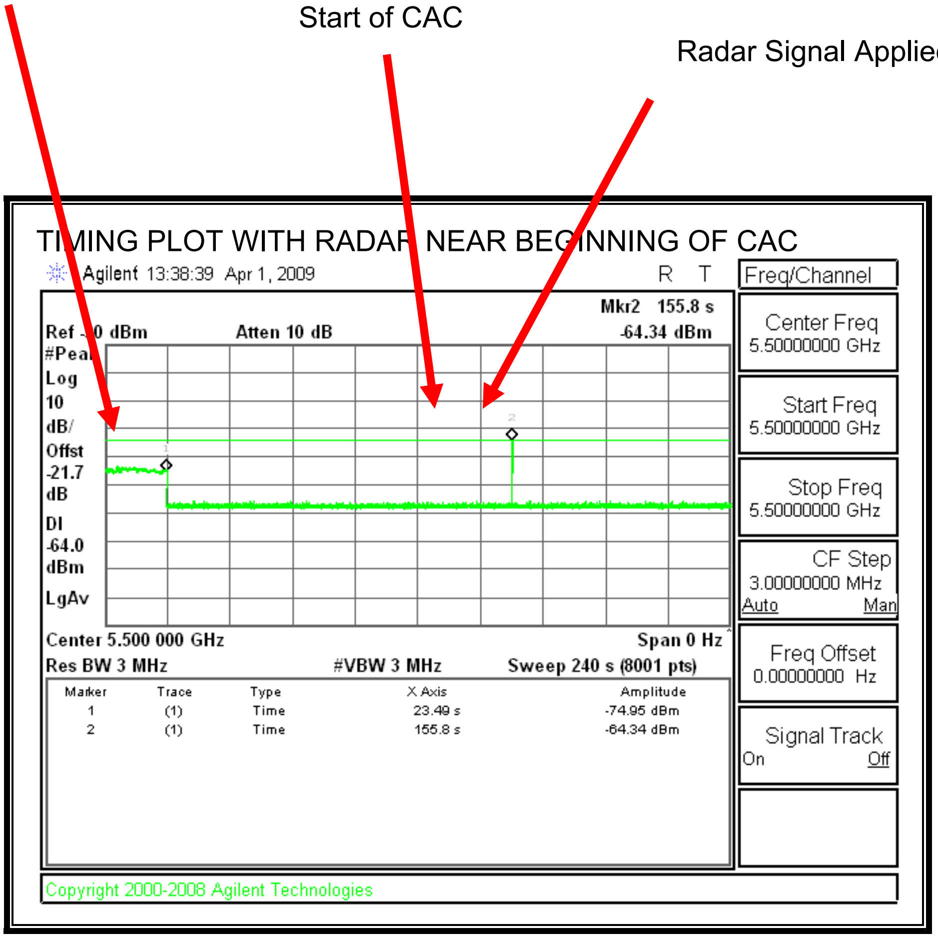
TIMING PLOT WITH RADAR NEAR BEGINNING OF CAC

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

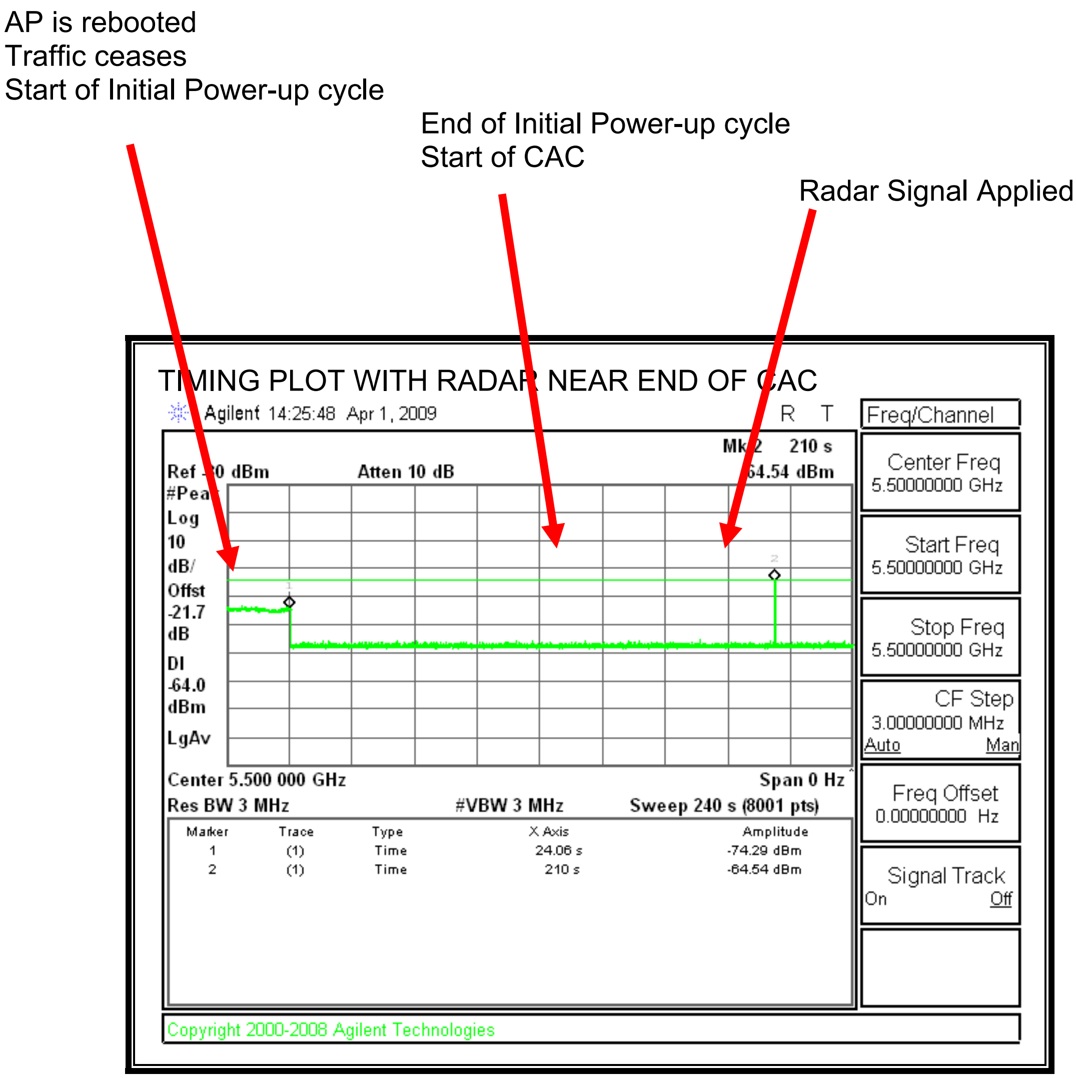
End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

TIMING PLOT WITH RADAR NEAR END OF CAC



No EUT transmissions were observed after the radar signal.

5.3.4. OVERLAPPING CHANNEL TESTS

PROCEDURE

The EUT was set to block all channels except 5495MHz, 5500 MHz and 5505 MHz, which are overlapping. The active channel was 5500 MHz and the radar test frequency was 5500 MHz.

A link was established on the active channel with the video file streaming.

A radar burst was triggered and a stopwatch timer was started. A second radar burst was triggered approximately 45 seconds after the first. A third radar burst was triggered approximately 45 seconds after the second.

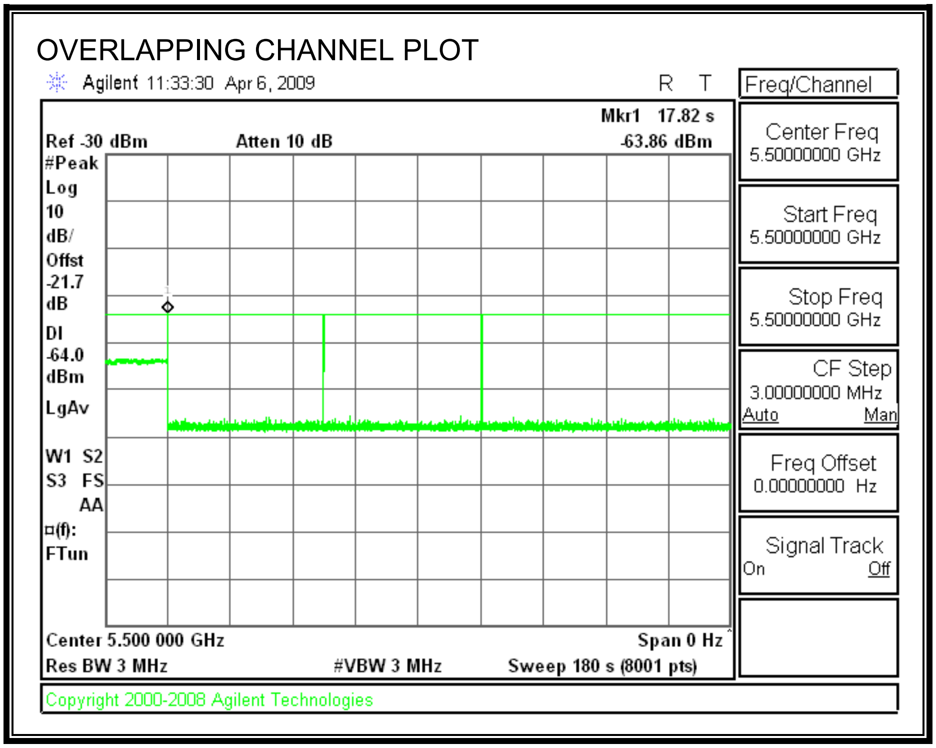
The EUT channel was monitored on the spectrum analyzer during the entire test procedure.

RESULTS

No beacons or traffic were observed on the spectrum analyzer after the first radar burst was transmitted.

TEST RESULTS

No EUT transmissions were observed on the test channels during the observation time.



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 FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

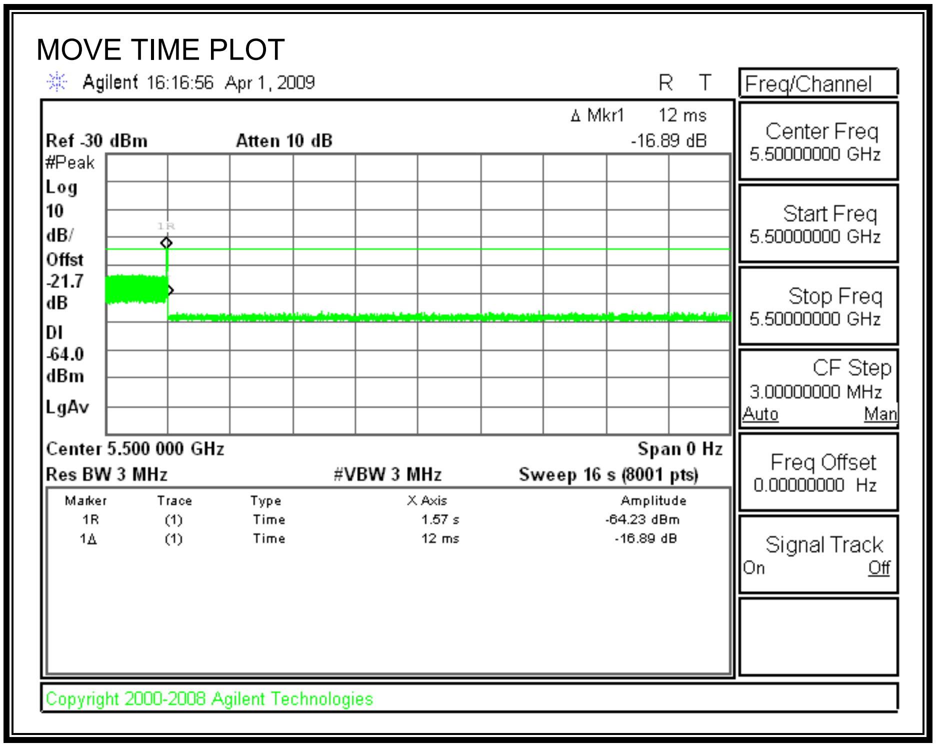
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

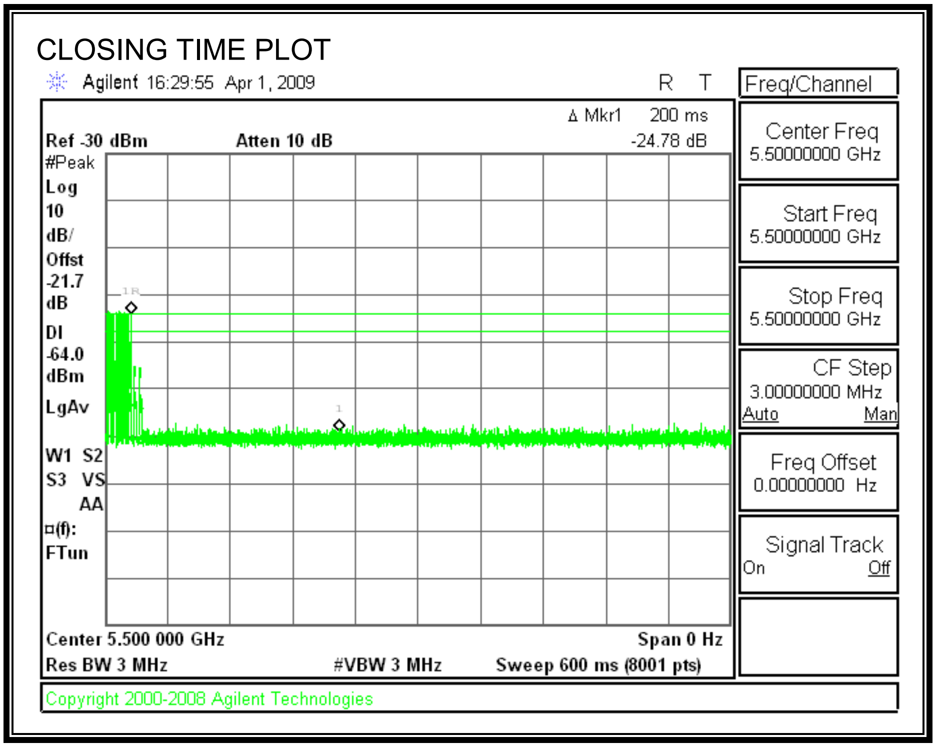
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.012	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	12.0	260

MOVE TIME

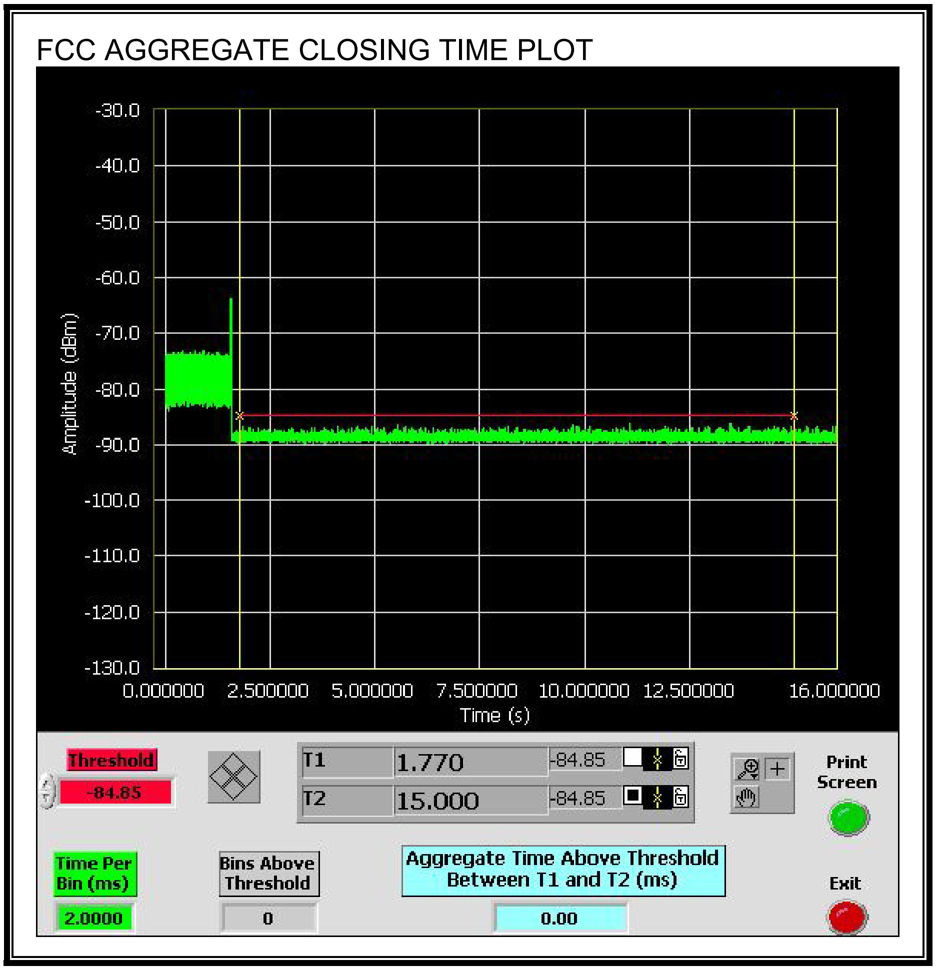

MOVE TIME PLOT
Agilent 16:16:56 Apr 1, 2009
R T
Freq/Channel
Δ Mkr1 12 ms
Ref -30 dBm
Atten 10 dB
-16.89 dB
#Peak
Log
10
dB/
Offst
-21.7
dB
Dl
-64.0
dBm
LgAv
Center 5.500 000 GHz
Span 0 Hz
Res BW 3 MHz
#VBW 3 MHz
Sweep 16 s (8001 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 1.57 s -64.23 dBm
1Δ (1) Time 12 ms -16.89 dB
Center Freq
5.50000000 GHz
Start Freq
5.50000000 GHz
Stop Freq
5.50000000 GHz
CF Step
3.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Copyright 2000-2008 Agilent Technologies

CHANNEL CLOSING TIME

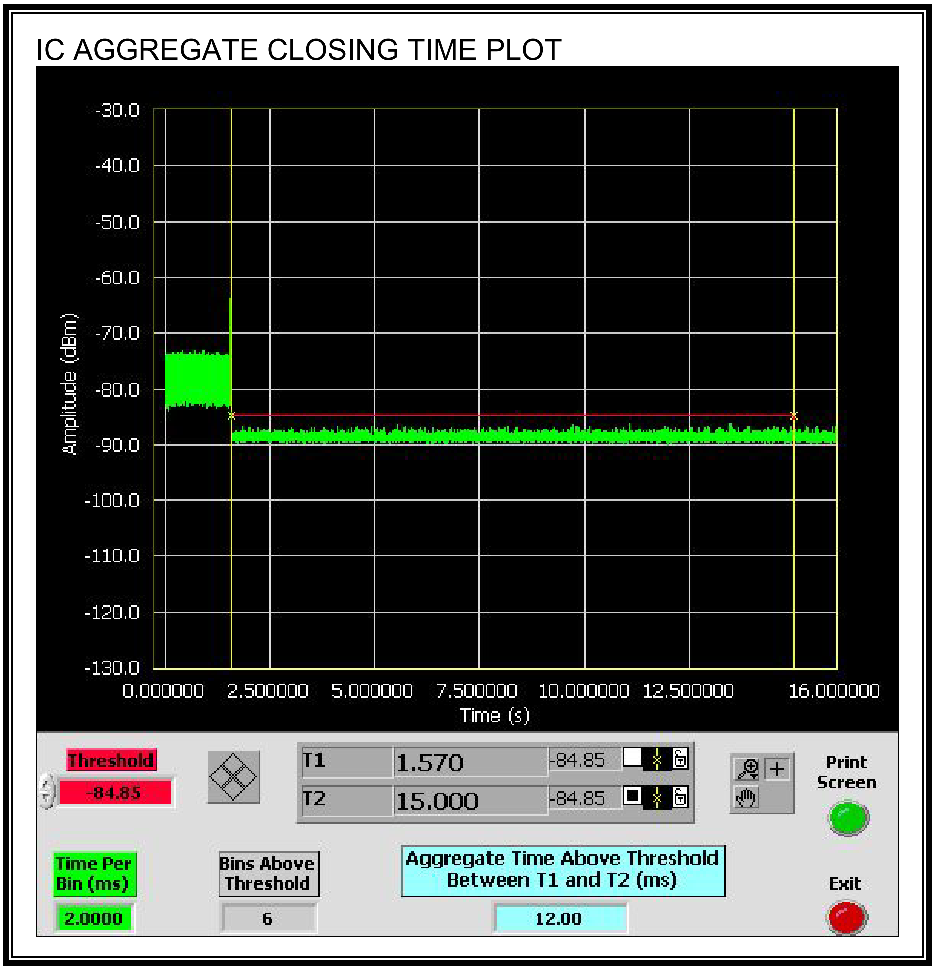


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.

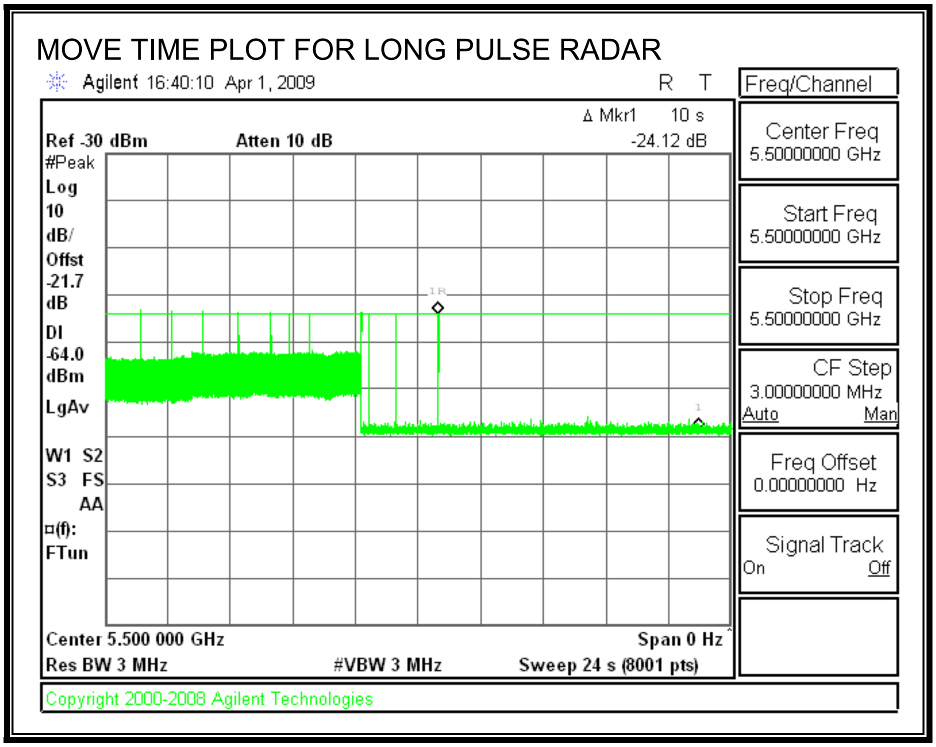


Only intermittent transmissions are observed during the IC aggregate monitoring period.



LONG PULSE CHANNEL MOVE TIME

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

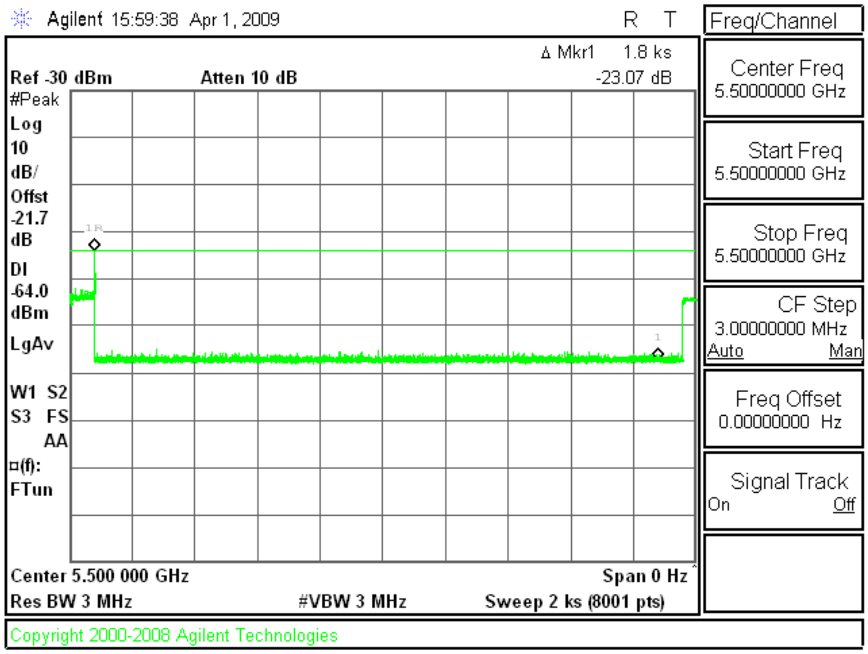


5.3.6. NON-OCCUPANCY PERIOD

RESULTS

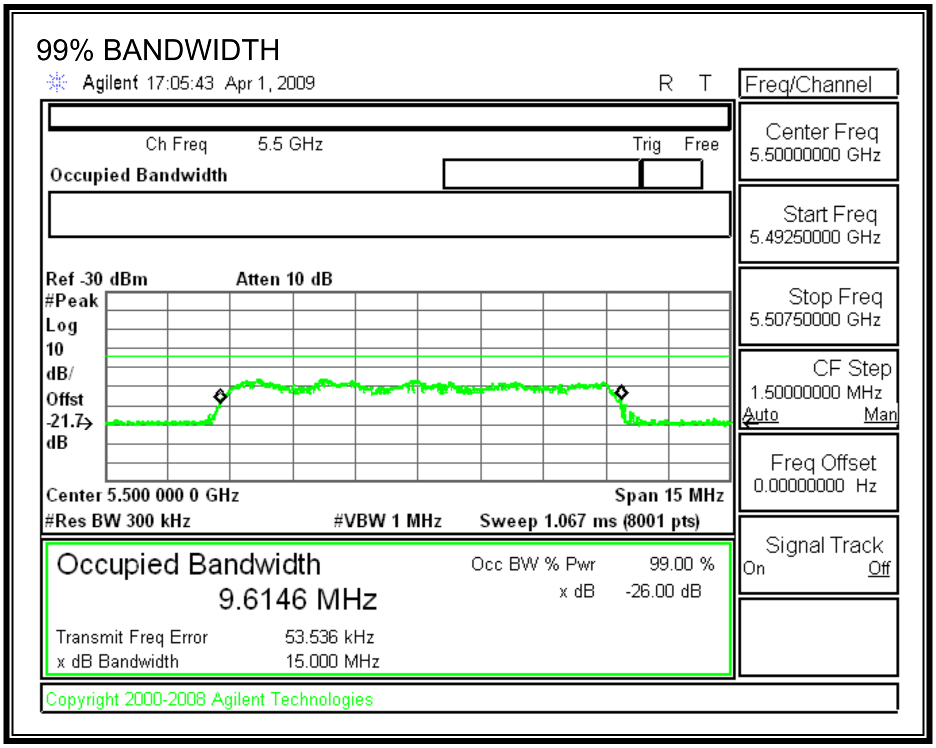
No EUT transmissions were observed on the test channel during the 30-minute observation time. The EUT performed a CAC after the end of the Non-Occupancy period, and reinitiated transmissions.

NON-OCCUPANCY PERIOD PLOT



5.3.7. 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 (%)
5495	**5506**	**11**	**9.615**	**114.4**	**80**

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5494	10	2	20	
5495	10	10	100	FL
5496	10	10	100	
5497	10	10	100	
5498	10	10	100	
5499	10	9	90	
5500	10	10	100	
5501	10	10	100	
5502	10	10	100	
5503	10	10	100	
5504	10	10	100	
5505	10	10	100	
5506	10	10	100	FH
5507	10	2	20	

5.3.8. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary

Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail
FCC Short Pulse Type 1	30	100.00	60	Pass
FCC Short Pulse Type 2	30	100.00	60	Pass
FCC Short Pulse Type 3	30	100.00	60	Pass
FCC Short Pulse Type 4	30	100.00	60	Pass
Aggregate		100.00	80	Pass
FCC Long Pulse Type 5	30	93.33	80	Pass
FCC Hopping Type 6	36	91.67	70	Pass

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	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	Successful Detection (Yes/No)
2001	2.4	180.00	23	Yes
2002	2.6	155.00	23	Yes
2003	1.1	226.00	27	Yes
2004	4.1	165.00	25	Yes
2005	1.8	165.00	28	Yes
2006	1.9	227.00	23	Yes
2007	2.1	224.00	27	Yes
2008	5	183.00	29	Yes
2009	3.1	212.00	29	Yes
2010	3.8	197.00	23	Yes
2011	3.8	228.00	27	Yes
2012	4.9	180.00	29	Yes
2013	1.3	230.00	25	Yes
2014	2.9	215.00	25	Yes
2015	4.4	205.00	28	Yes
2016	2.8	217.00	23	Yes
2017	2.6	167.00	27	Yes
2018	3.9	191.00	29	Yes
2019	1.3	163.00	28	Yes
2020	2.6	208.00	24	Yes
2021	3.1	193.00	29	Yes
2022	2.3	166.00	26	Yes
2023	4.9	194.00	28	Yes
2024	4	197.00	26	Yes
2025	4.6	155.00	27	Yes
2026	1.1	150.00	29	Yes
2027	1.4	220.00	26	Yes
2028	4.2	212.00	28	Yes
2029	1.2	182.00	25	Yes
2030	1.6	178.00	25	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
3001	7.9	401.00	16	Yes
3002	5	485.00	16	Yes
3003	7	402.00	16	Yes
3004	7.9	289.00	17	Yes
3005	7.9	500.00	17	Yes
3006	9	459.00	16	Yes
3007	7.8	496.00	17	Yes
3008	9.2	394.00	16	Yes
3009	7	346.00	17	Yes
3010	6	298.00	16	Yes
3011	7.9	420.00	16	Yes
3012	6.1	343.00	16	Yes
3013	8.4	285.00	16	Yes
3014	8.1	342.00	18	Yes
3015	8.5	251.00	18	Yes
3016	6.9	374.00	18	Yes
3017	6.9	358.00	16	Yes
3018	5.8	472.00	18	Yes
3019	8.7	458.00	18	Yes
3020	10	360.00	16	Yes
3021	5.9	459.00	18	Yes
3022	7	448.00	18	Yes
3023	8.1	354.00	18	Yes
3024	8.2	330.00	18	Yes
3025	8	446.00	16	Yes
3026	8	331.00	17	Yes
3027	8.5	432.00	17	Yes
3028	7	449.00	18	Yes
3029	7.6	259	17	Yes
3030	7.6	351	18	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
4001	18.4	459.00	13	Yes
4002	13.8	296.00	16	Yes
4003	16.4	414.00	12	Yes
4004	10.6	412.00	13	Yes
4005	18.1	323.00	16	Yes
4006	16.9	474.00	14	Yes
4007	13	418.00	13	Yes
4008	12.1	474.00	15	Yes
4009	17.8	412.00	12	Yes
4010	12.2	381.00	16	Yes
4011	18	498.00	14	Yes
4012	11.8	288.00	14	Yes
4013	19.2	275.00	16	Yes
4014	17.7	359.00	15	Yes
4015	14.3	306.00	16	Yes
4016	17.9	341.00	12	Yes
4017	16.2	348.00	12	Yes
4018	18.8	319.00	16	Yes
4019	11.7	361.00	15	Yes
4020	15.2	335.00	16	Yes
4021	13.3	255.00	16	Yes
4022	19.2	331.00	15	Yes
4023	17	260.00	12	Yes
4024	14.8	295.00	12	Yes
4025	18.7	480.00	13	Yes
4026	13.5	256.00	16	Yes
4027	17.3	441.00	13	Yes
4028	14.4	477.00	13	Yes
4029	16.2	369.00	16	Yes
4030	19.4	489.00	13	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5

Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	No
20	Yes
21	Yes
22	Yes
23	No
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

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

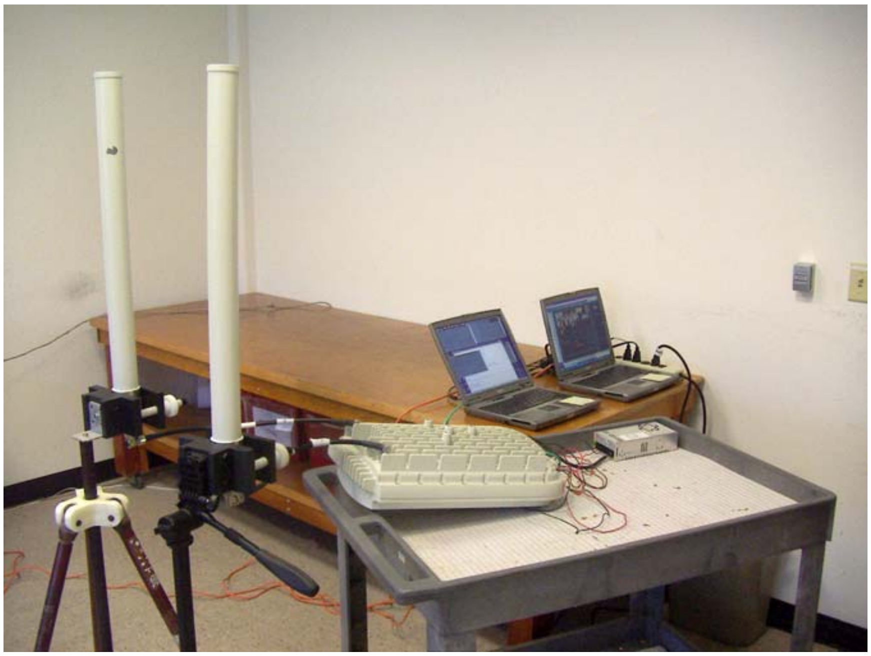
TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	257	5495	5	Yes
2	732	5496	3	Yes
3	1207	5497	2	Yes
4	1682	5498	1	Yes
5	2157	5499	1	No
6	2632	5500	4	Yes
7	3107	5501	3	Yes
8	3582	5502	4	Yes
9	4057	5503	4	Yes
10	5007	5504	2	Yes
11	5482	5505	4	Yes
12	5957	5506	2	Yes
13	6432	5495	2	Yes
14	6907	5496	4	Yes
15	7382	5497	1	Yes
16	7857	5498	1	No
17	8332	5499	1	Yes
18	9282	5500	1	No
19	9757	5501	1	Yes
20	10232	5502	1	Yes
21	10707	5503	4	Yes
22	11182	5504	2	Yes
23	11657	5505	2	Yes
24	12132	5506	2	Yes
25	12607	5495	2	Yes
26	13082	5496	3	Yes
27	13557	5497	1	Yes
28	14032	5498	4	Yes
29	14507	5499	3	Yes
30	14982	5500	2	Yes
31	15457	5501	3	Yes
32	15932	5502	4	Yes
33	16407	5503	3	Yes
34	16882	5504	3	Yes
35	17357	5505	4	Yes
36	17832	5506	2	Yes

6. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP

DFS FRONT PHOTO



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END OF REPORT