



DFS Portion of FCC CFR47 PART 15 SUBPART E
DFS Portion of INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

BreezeMax Extreme 802.16e 5 GHz UNII CPE Radio

MODEL NUMBER: XTRM-SU-OD-1D-4.9-UL-A

FCC ID: LKT-EXTR-CPE-50

IC: 2514A-EXTRCPE50

REPORT NUMBER: 09U12441-2

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NVLAP LAB CODE 200065-0

Revision History

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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 UNII CPE Radio

MODEL: XTRM-SU-OD-1D-4.9-UL-A

SERIAL NUMBER: W847002738

DATE TESTED: 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 8 Annex 9	Pass

Compliance Certification Services (UL 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 UL CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:

Tested By:



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UL CCS

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 8.

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".

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
<i>Non-occupancy period</i>	30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds
<i>Channel Closing Transmission Time</i>	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
The instant that the <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> begins is as follows: For the Short pulse radar Test Signals this instant is the end of the <i>Burst</i>. 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

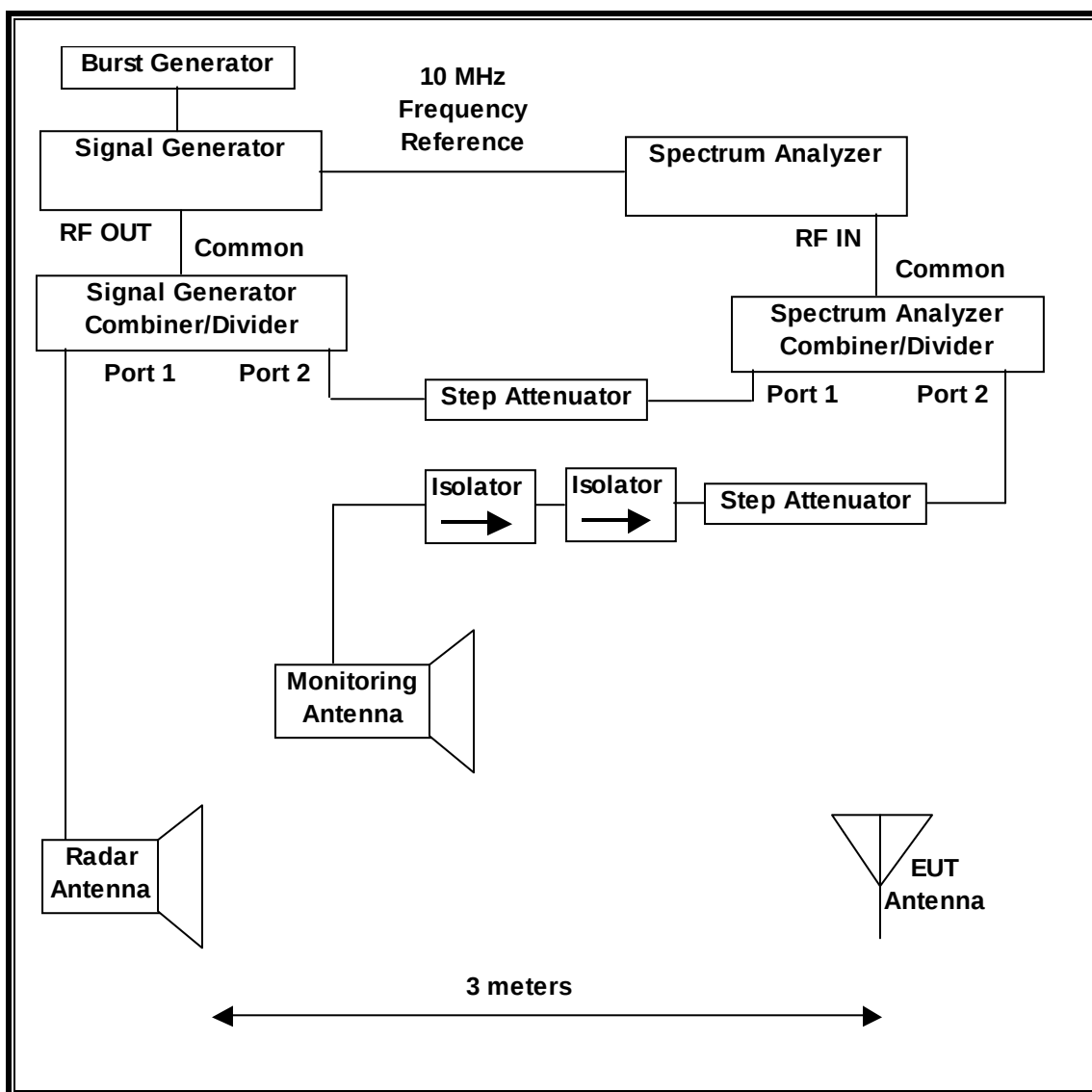
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

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

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 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. 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.

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.

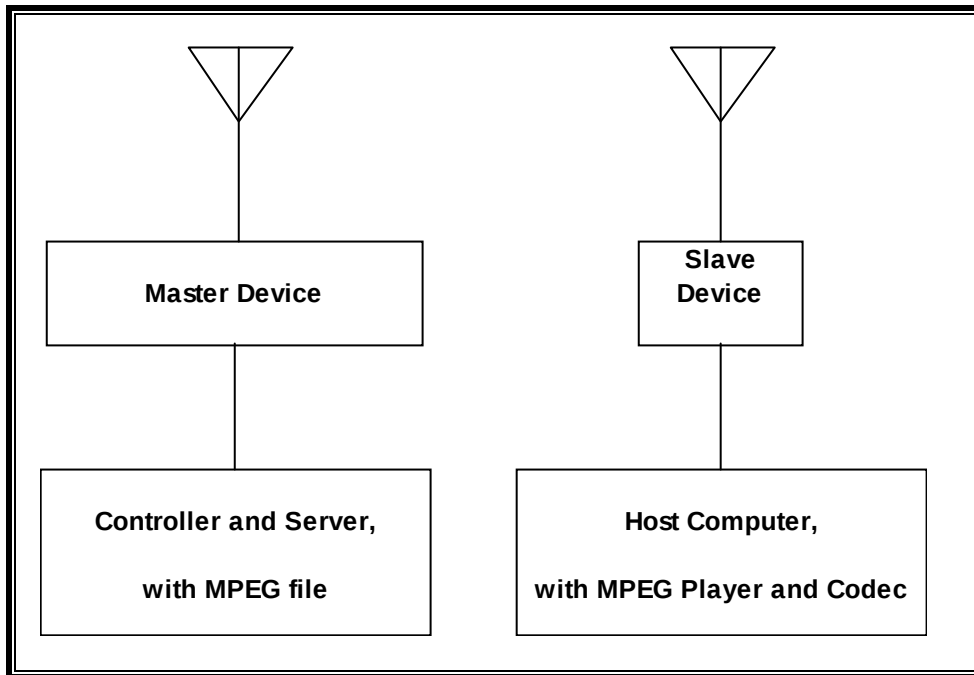
TEST AND MEASUREMENT EQUIPMENT

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

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
BreezeMax Extreme, 802.16e 5 GHz U-NII Base Station Radio (Master Device)	Alvarion, Ltd.	XTRM-BS-1DIV-5.4-90	02322	LKT-EXTR-50
AC/DC Power Supply (Master EUT)	Mean Well	SP-200-48	RA88057739	DoC
P.O.E. Injector (Slave EUT)	Alvarion, Ltd.	0334B5555	A30443139313	DoC
Notebook PC (Host PC for 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 (for Host PC)	Apple	A1084	HS43U6GS0V0	BCGA1084
10/100 Fast Ethernet Switch	Netgear	FS105	1D1793704A8A	DoC
AC Adapter (Ethernet Switch)	DVE	DSA-9R-05	3507 HB	DoC

5.1.4. DESCRIPTION OF EUT

The EUT operates over the 5470-5725 MHz range.

The EUT is a Slave Device without Radar Detection.

The highest power level is 24.18 dBm EIRP at a bandwidth of 5 MHz and 26.9 dBm EIRP at a bandwidth of 10 MHz.

The only antenna assembly utilized with the EUT has a gain of 17 dBi.

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

The EUT uses one transmitter/receiver chain and one receive only chain, each connected to a 17 dBi antenna during the test to perform radiated testing.

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 not required since the maximum EIRP is less than 500 mW (27 dBm).

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

The software installed in the EUT is 1.7.2.5.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is an Alvarion, Ltd. 802.16e Base Station, FCC ID: LKT-EXTR-50. The minimum antenna gain for the Master Device is 8 dBi. The software installed in the master device is version 1.0.0.65.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is -64 dBm. After correction for antenna gain and procedural adjustments, the required conducted 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 margin to the limit.

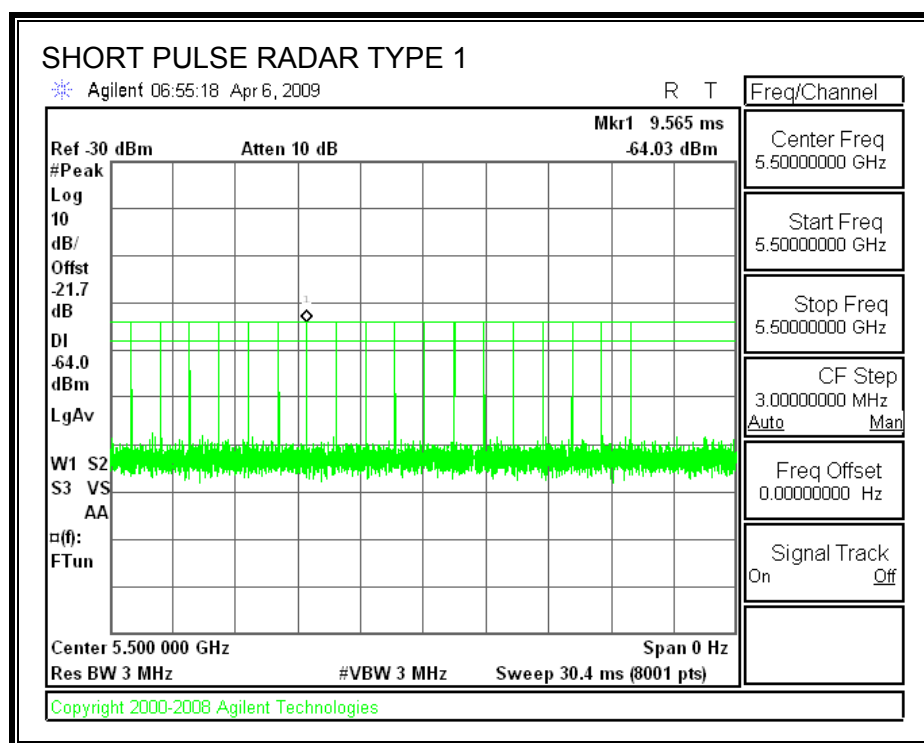
5.2. RESULTS FOR 5 MHz BANDWIDTH

5.2.1. TEST CHANNEL

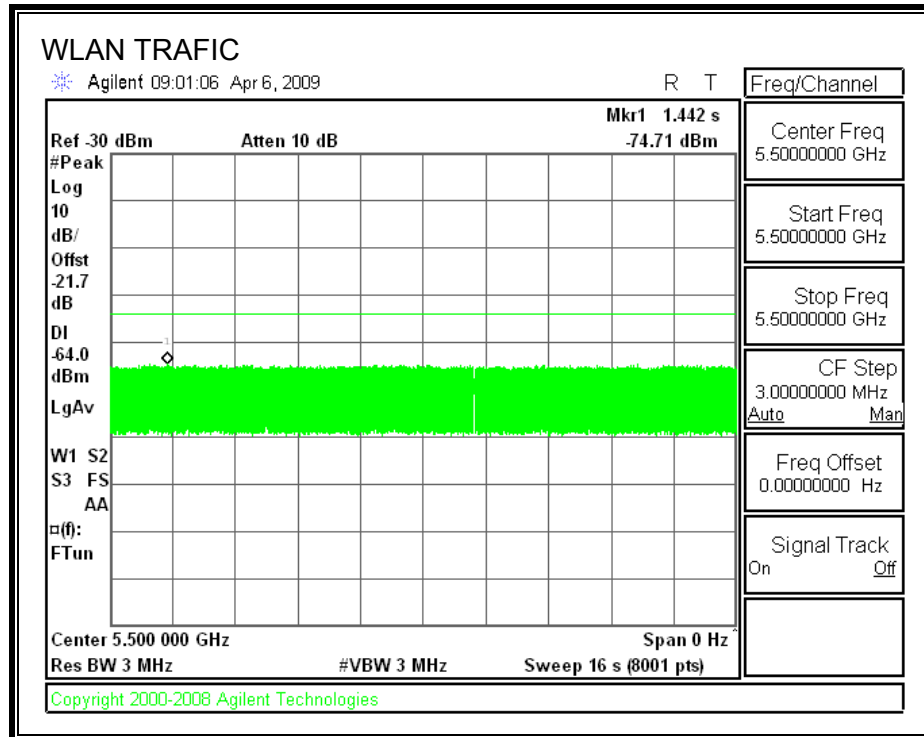
All tests were performed at a channel center frequency of 5500 MHz. Measurements were performed using conducted test methods.

5.2.2. PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC

PLOTS OF RADAR WAVEFORM



PLOT OF WLAN TRAFFIC



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

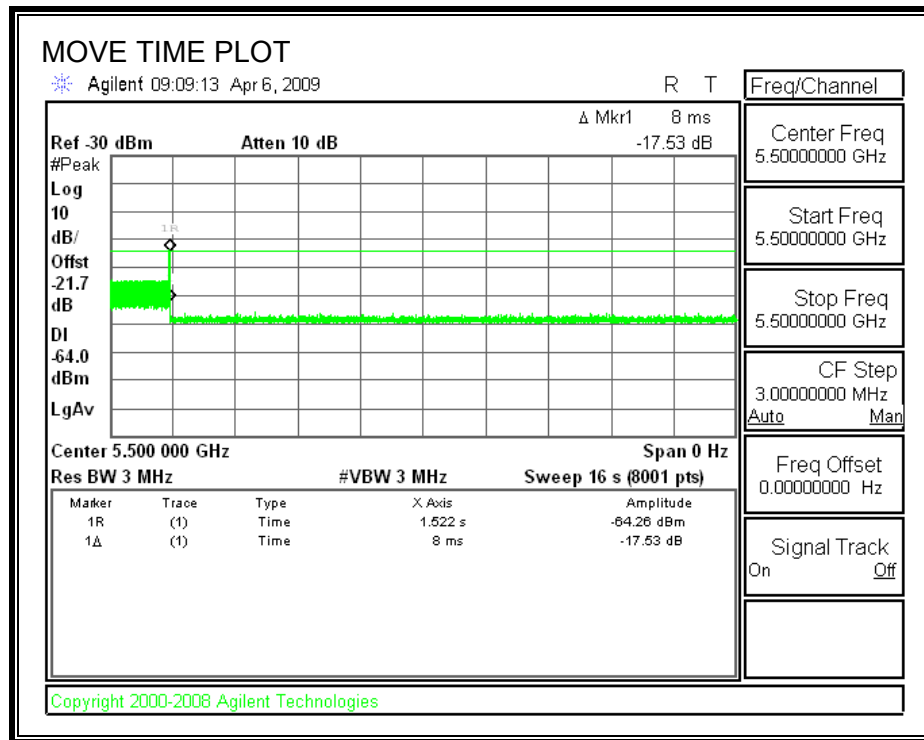
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

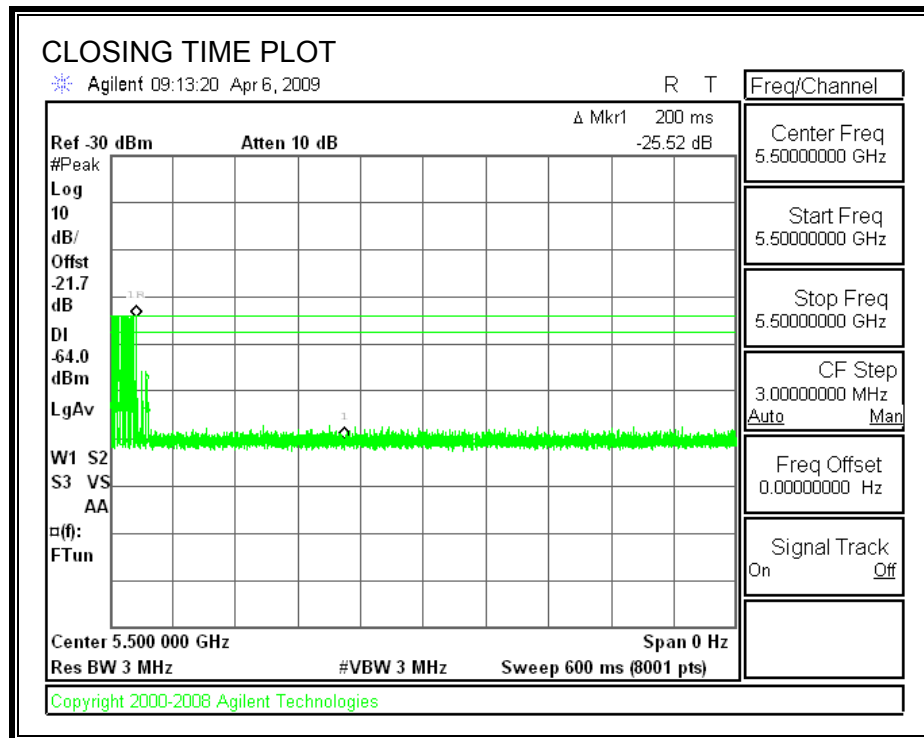
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.008	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	8.0	260

MOVE TIME

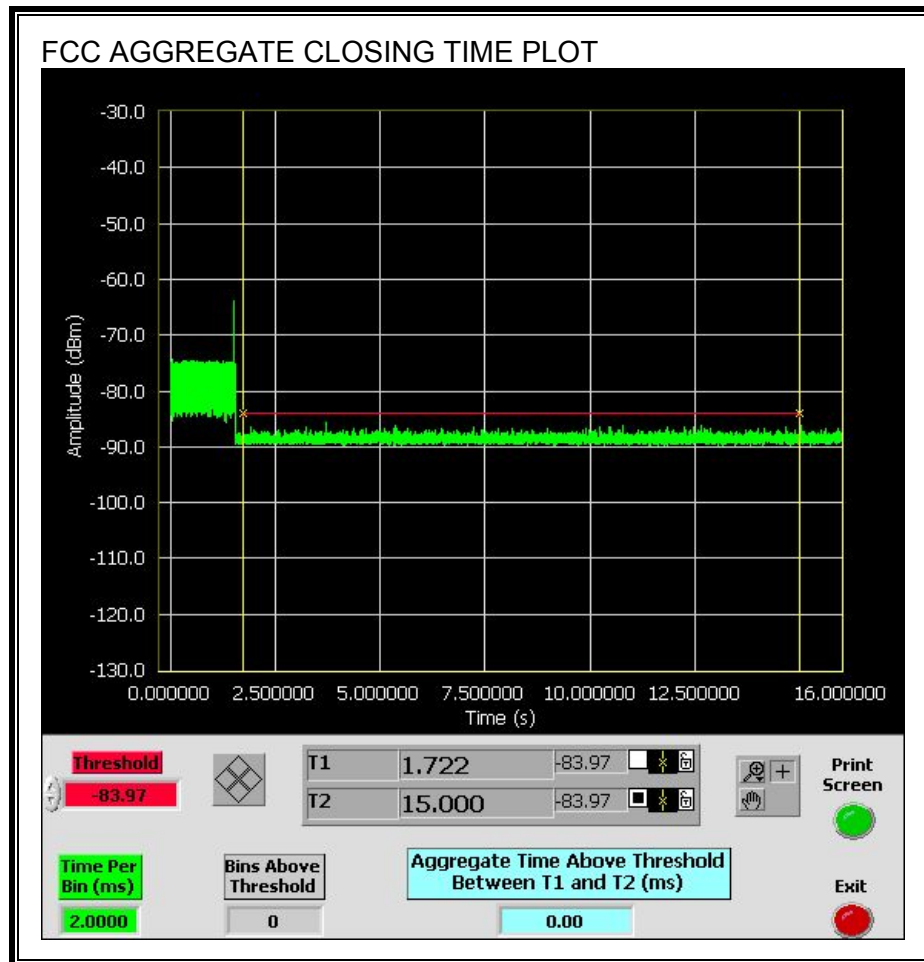


CHANNEL CLOSING TIME

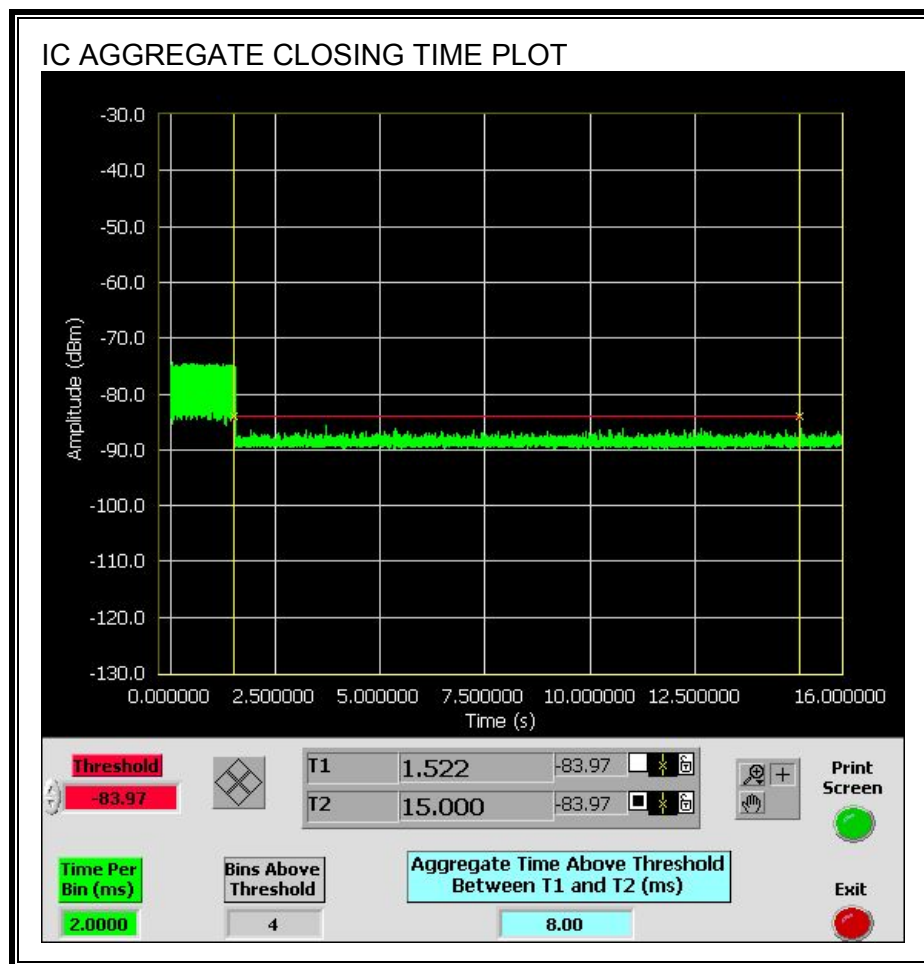


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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



5.2.4. NON-OCCUPANCY

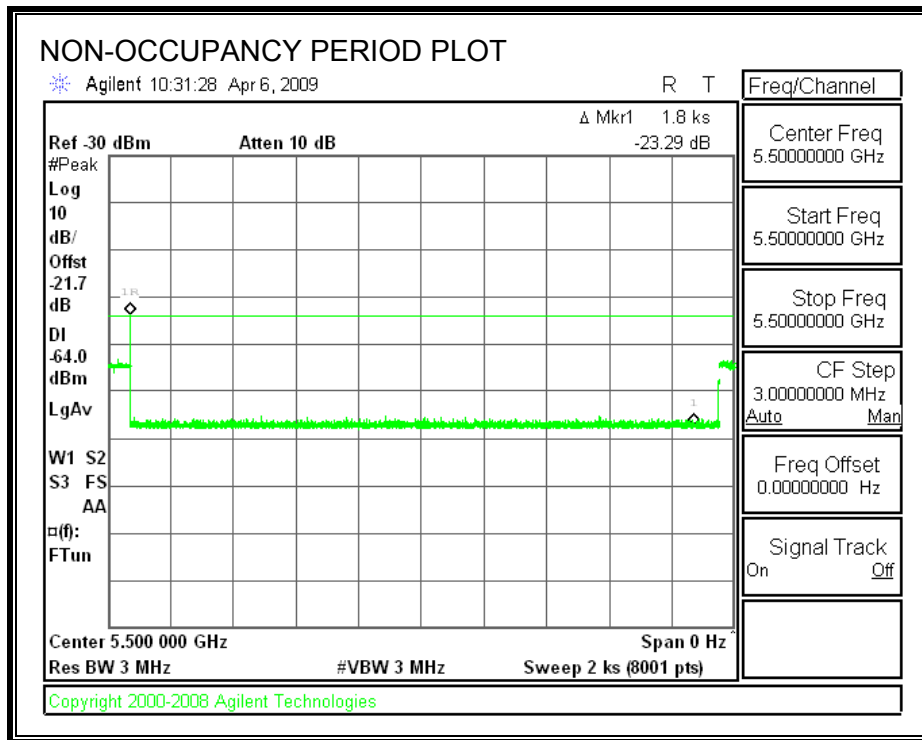
TEST PROCEDURE

The spectrum analyzer is monitoring the emissions from the Slave.

The AP and Slave are linked in a 5 MHz bandwidth mode, with streaming video. The spectrum analyzer trace is started, then the radar is triggered, and the channel is monitored for > 30 minutes.

ASSOCIATED TEST RESULTS

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



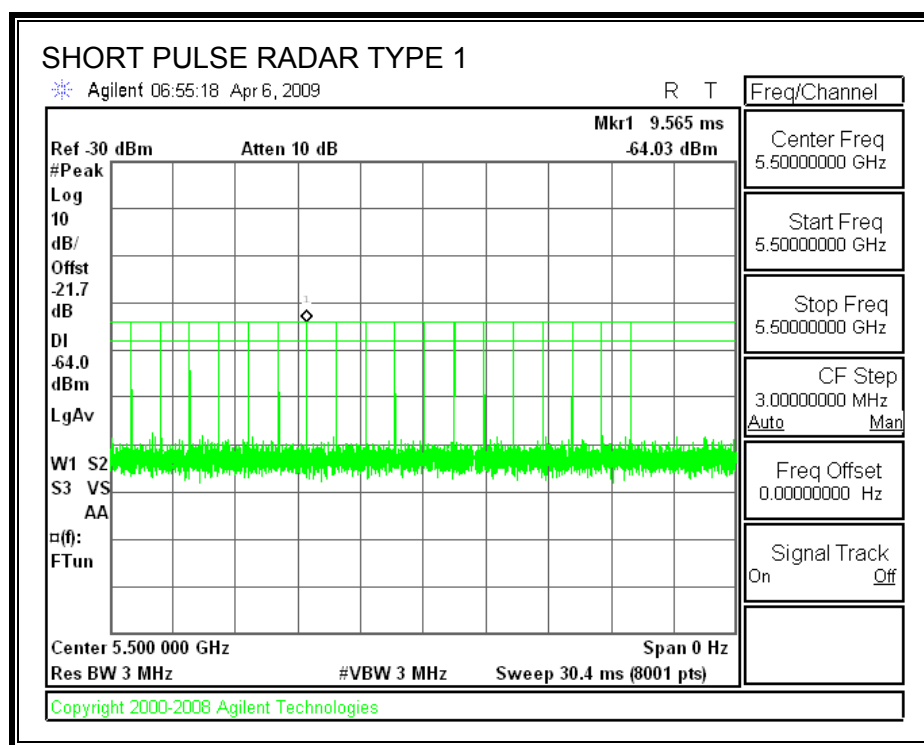
5.3. RESULTS FOR 10 MHz BANDWIDTH

5.3.1. TEST CHANNEL

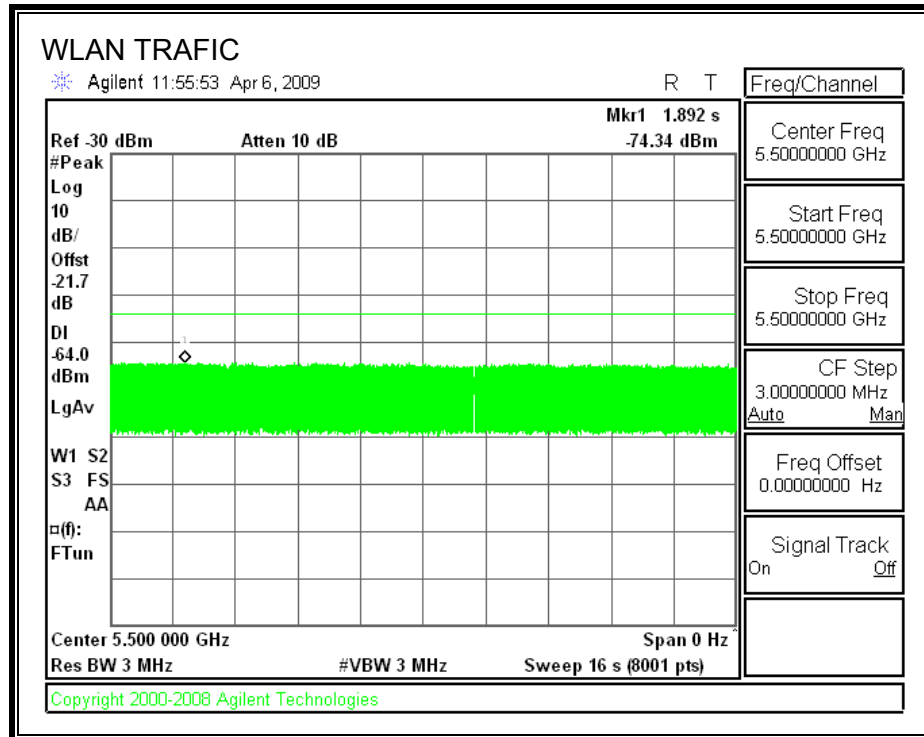
All tests were performed at a channel center frequency of 5500 MHz. Measurements were performed using conducted test methods.

5.3.2. PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC

PLOTS OF RADAR WAVEFORM



PLOT OF WLAN TRAFFIC



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

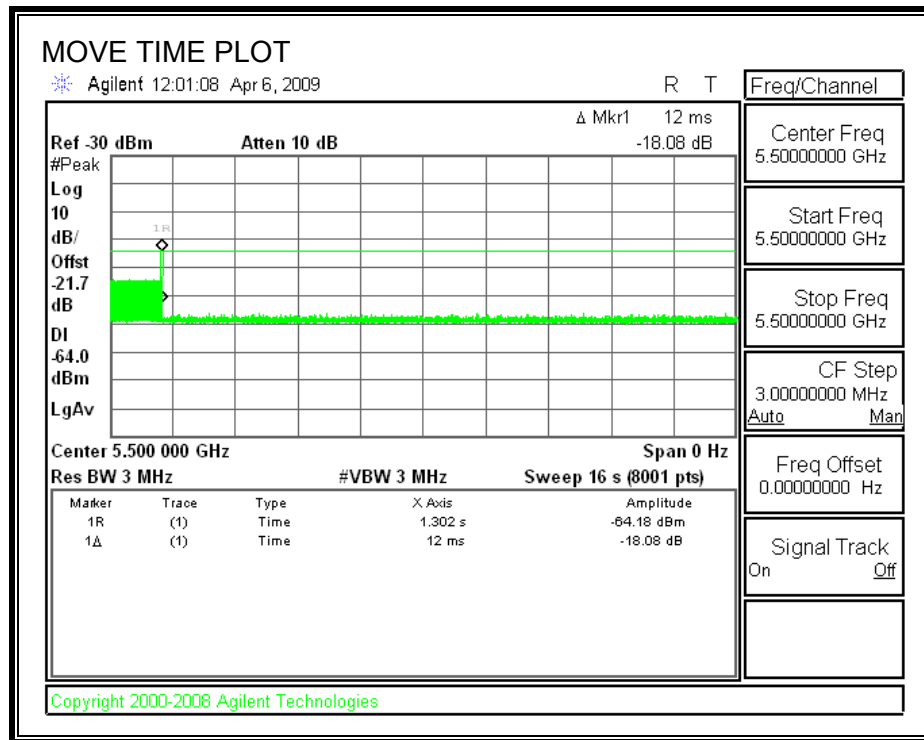
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

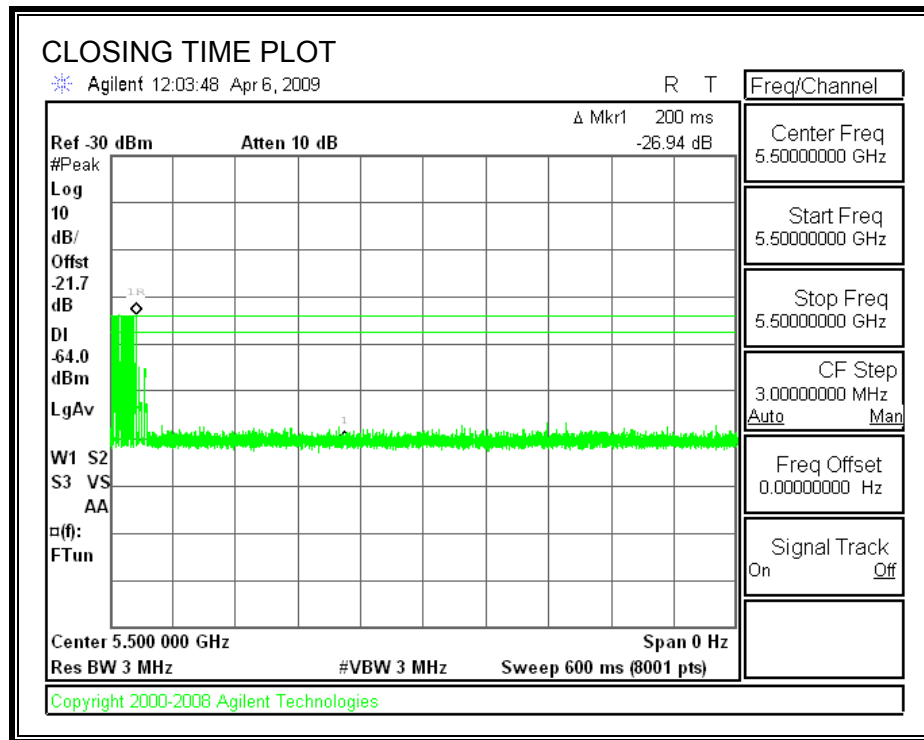
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.012	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	10.0	260

MOVE TIME

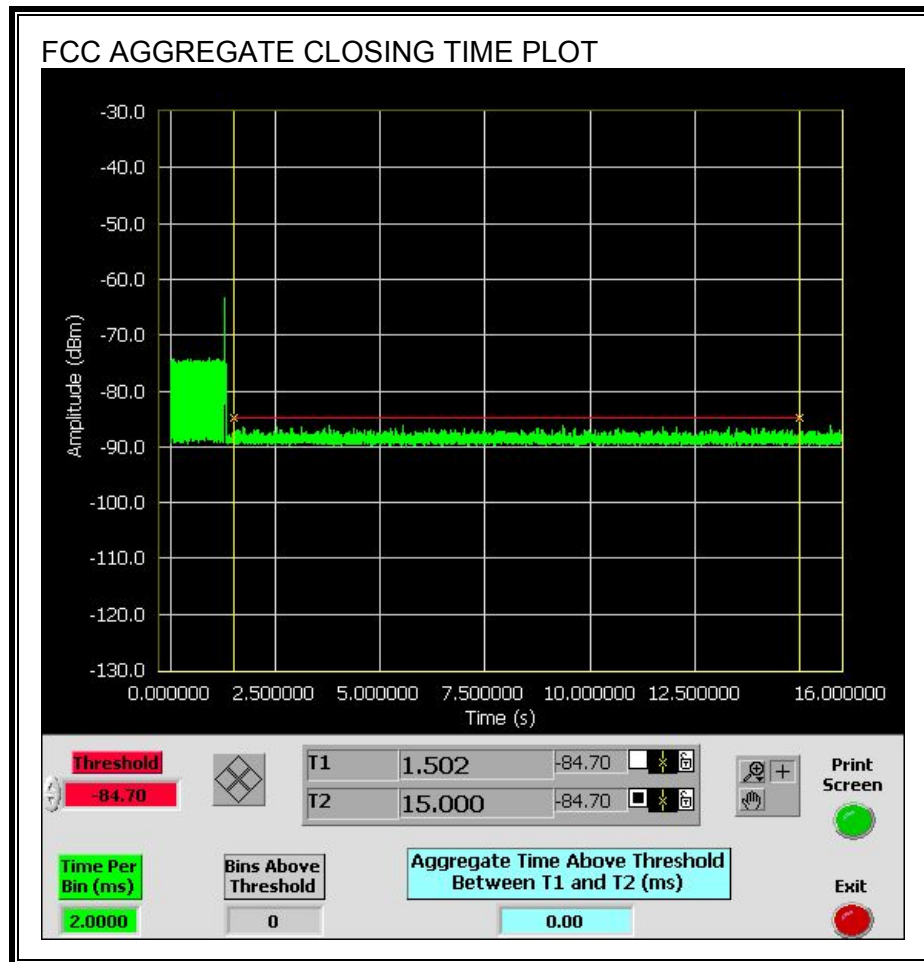


CHANNEL CLOSING TIME

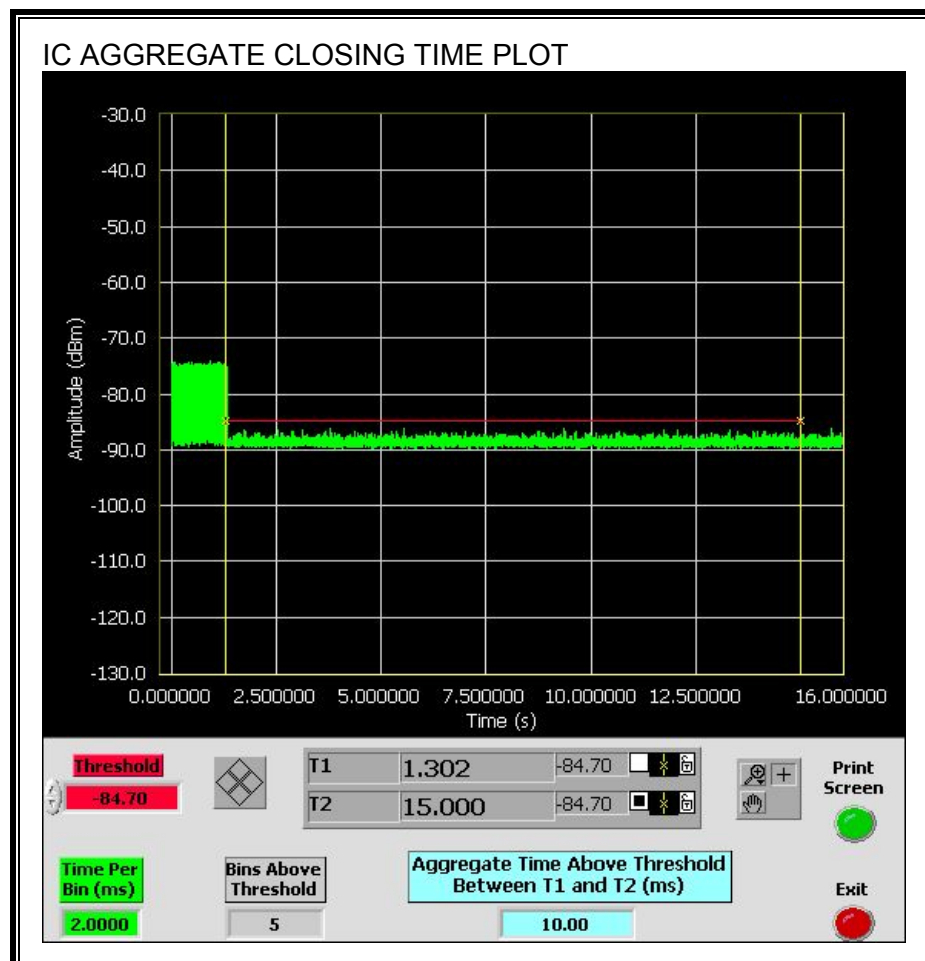


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



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



5.3.4. NON-OCCUPANCY

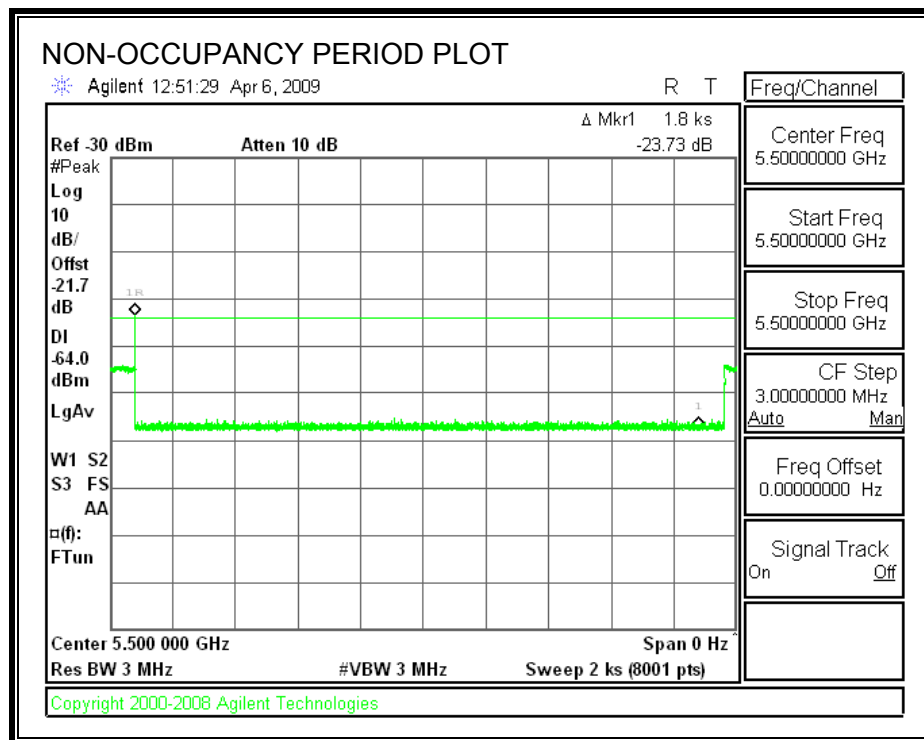
TEST PROCEDURE

The spectrum analyzer is monitoring the emissions from the Slave.

The AP and Slave are linked in a 10 MHz bandwidth mode, with streaming video. The spectrum analyzer trace is started, then the radar is triggered, and the channel is monitored for > 30 minutes.

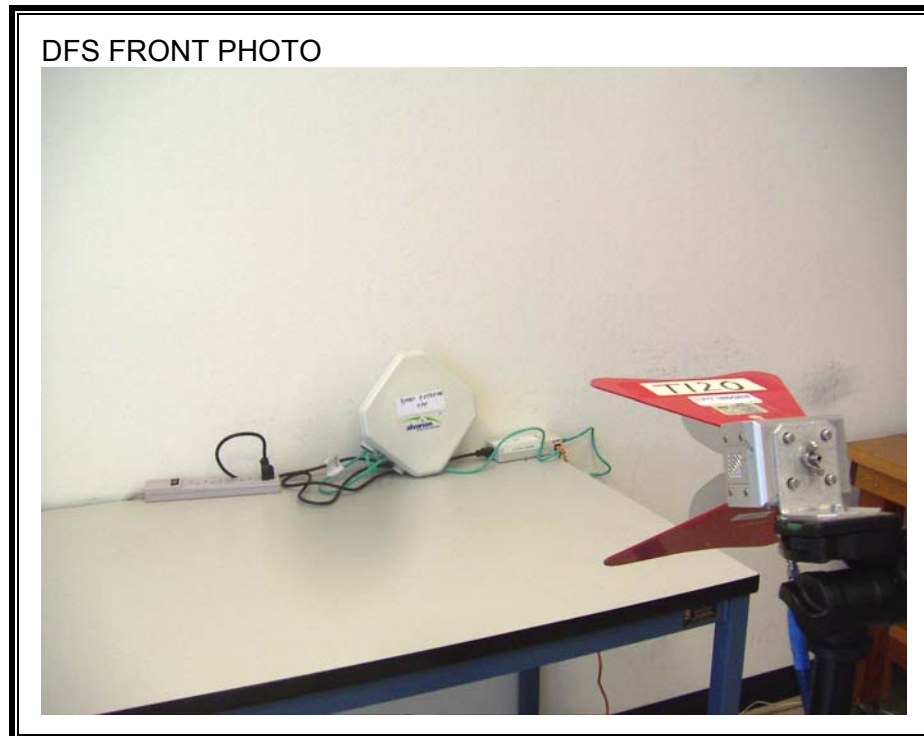
TEST RESULTS

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



6. SETUP PHOTOS

DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP



DFS SIDE PHOTO



PHOTO OF MASTER SUPPORT DEVICE



END OF REPORT