



**FCC CFR47 PART 15 SUBPART E
CLASS 2 PERMISSIVE CHANGE TEST REPORT**

FOR

802.11a/b/g/n PCIExpress Minicard

MODEL: AR5BXB72

FCC ID: PPD-AR5BXB72

REPORT NUMBER: 07U11416-1

ISSUE DATE: APRIL 24, 2008

Prepared for
**ATHEROS COMMUNICATIONS, INC.
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, U.S.A.**

Prepared by
**COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	5/14/08	Initial Issue	M. Heckrotte

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	5
4.2. <i>MEASUREMENT UNCERTAINTY</i>	5
5. DYNAMIC FREQUENCY SELECTION	6
5.1. <i>OVERVIEW</i>	6
5.1.1. <i>LIMITS</i>	6
5.1.2. <i>TEST AND MEASUREMENT SYSTEM</i>	9
5.1.3. <i>SETUP OF EUT</i>	12
5.1.4. <i>DESCRIPTION OF EUT</i>	13
5.2. <i>RESULTS FOR 20 MHz BANDWIDTH</i>	14
5.2.1. <i>TEST CHANNEL</i>	14
5.2.2. <i>PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC</i>	14
5.2.3. <i>MOVE AND CLOSING TIME</i>	16
5.2.3. <i>SLAVE NON-OCCUPANCY</i>	20
5.3. <i>RESULTS FOR 40 MHz BANDWIDTH</i>	22
5.3.1. <i>TEST CHANNEL</i>	22
5.3.2. <i>PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC</i>	22
5.3.3. <i>MOVE AND CLOSING TIME</i>	24
5.3.4. <i>SLAVE NON-OCCUPANCY</i>	28
6. SETUP PHOTOS	30

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ATHEROS COMMUNICATIONS, INC.
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, U.S.A.

EUT DESCRIPTION: 802.11a/b/g/n PCIExpress Minicard

MODEL: AR5BXB72

SERIAL NUMBER: Prototype

DATE TESTED: NOVEMBER 28, 2007

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
DFS Portion of CFR 47 Part 15 Subpart E	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All expressions of Pass/Fail in this report are opinions expressed by CCS based on interpretations of the 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 By:



MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

Tested By:



YOBİ ZHOU
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 15 and FCC MO&O 06-96.

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
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

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

5. DYNAMIC FREQUENCY SELECTION

5.1. OVERVIEW

5.1.1. LIMITS

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES 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 *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

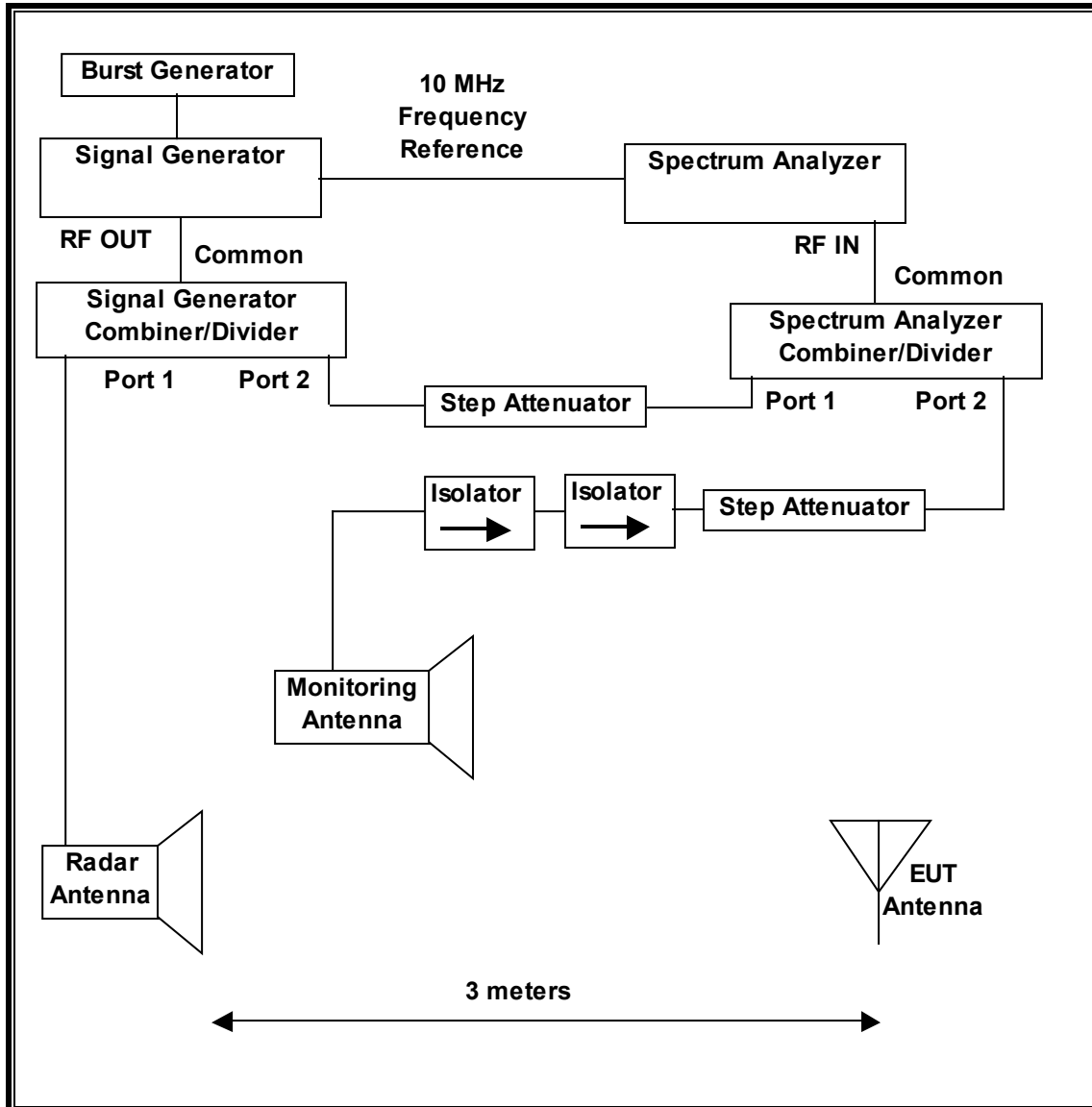
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

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

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 Frequency 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 set to display 8001 bins on the horizontal axis. The time-domain resolution is 2 msec / bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. 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 horn antenna is set up with its main beam oriented directly toward the radar test generator antenna at a 3-meter distance (this is the same location at which the EUT will be placed during the test). The spectrum analyzer is connected to this horn antenna via a coaxial cable, with the reference level offset set equal to the horn antenna assembly gain (horn antenna gain – coaxial cable loss). A 50-ohm load is connected to each unused port of the test system. 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 amplitude is measured and the difference from -64 dBm is calculated. The Reference Level Offset of the spectrum analyzer is adjusted 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.

The signal generator is set to produce a radar waveform, a burst is triggered manually and the level on the spectrum analyzer is observed. The amplitude of the signal generator is adjusted as required so that the peak level of the waveform is at a displayed level equal to specified interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established 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. The video test file is streamed to generate WLAN traffic. The WLAN traffic, as displayed on the spectrum analyzer, is confirmed to be at a lower amplitude than the radar detection threshold, and the displayed traffic is confirmed to be only from the EUT and not from the support device associated with the EUT.

If different settings of the Step Attenuators are required to meet the above conditions, a new System Calibration is performed for the new Step Attenuator settings.

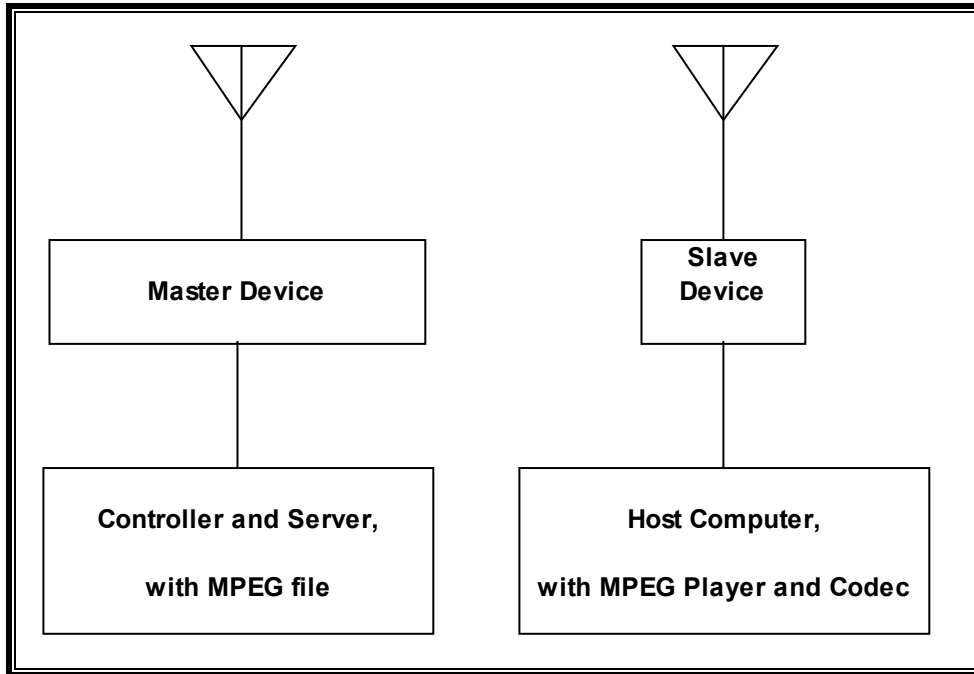
TEST AND MEASUREMENT EQUIPMENT

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	MY45300064	3/18/2008
Vector Signal Generator 250kHz-20GHz	Agilent / HP	E8267C	US43320336	12/2/2007
High Speed Digital I/O Card	National Instruments	PCI-6534	HA1612845	1/16/2008

5.1.3. SETUP OF EUT

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

The following support equipment was utilized for the DFS tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	IBM	08K8204	11S08K8204Z1ZAC85AJ1MT	DoC
Laptop	IBM	T43	L3-AB1AT	DoC
AC Adapter	IBM	92P1107	11S92P1107Z1ZACT5972BT	DoC
Laptop	IBM	T60p	ZZ-8D115	DoC

5.1.4. DESCRIPTION OF EUT

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

The EUT is a Slave Device without radar detection.

The highest gain antenna assembly utilized with the EUT has a gain of 6.2 dBi in the 5250-5350 MHz band and 5.34 dBi in the 5470-5725 MHz band. The highest gain antenna assembly utilized with the EUT has an effective 802.11a legacy mode gain of 9.21 dBi in the 5250-5350 MHz band and 8.35 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of -2.0 dBi in the 5250-5350 MHz band and -1.2 dBi in the 5470-5725 MHz band.

The highest combined power level within these bands for the 802.11n mode is 26.68 dBm EIRP in the 5250-5350 MHz band and 26.02 dBm EIRP in the 5470-5725 MHz band. The highest combined power level within these bands for the 802.11a legacy mode is 26.98 dBm EIRP in the 5250-5350 MHz band and 26.86 dBm EIRP in the 5470-5725 MHz band.

The EUT uses two transmitter/receiver chains and, optionally, one receive only chain, connected to two or three 50-ohm coaxial antenna ports as applicable to satisfy MIMO operational requirements.

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 802.11a/n architecture. Two nominal channel bandwidths are implemented: 20 MHz and 40 MHz.

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

The Master Device is an Atheros Access Point, FCC ID: PPD-AR5BMB82. The DFS software installed in the Master Device is revision 4.0.0. The minimum antenna gain for the Master Device is 0 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level 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.

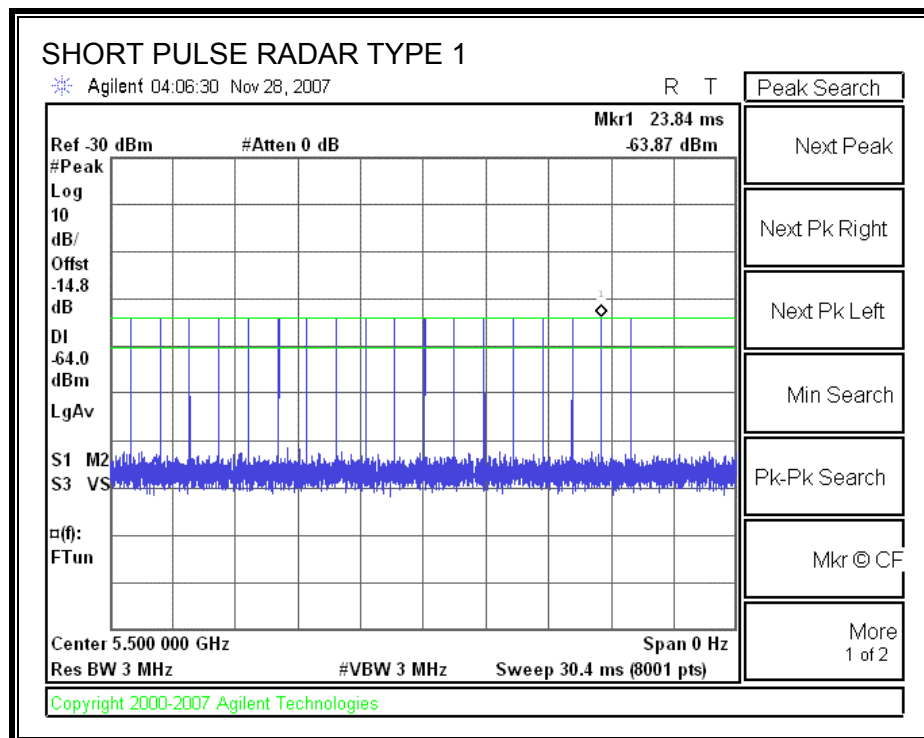
5.2. RESULTS FOR 20 MHz BANDWIDTH

5.2.1. TEST CHANNEL

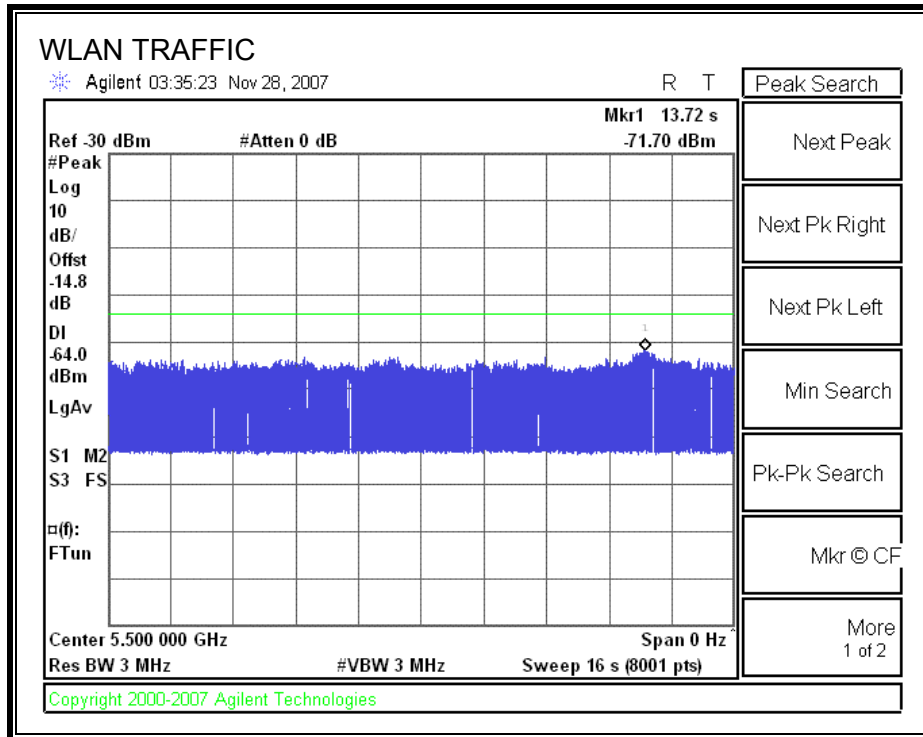
All tests were performed at a channel center frequency of 5500 MHz. Measurements were performed using conducted test methods.

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)

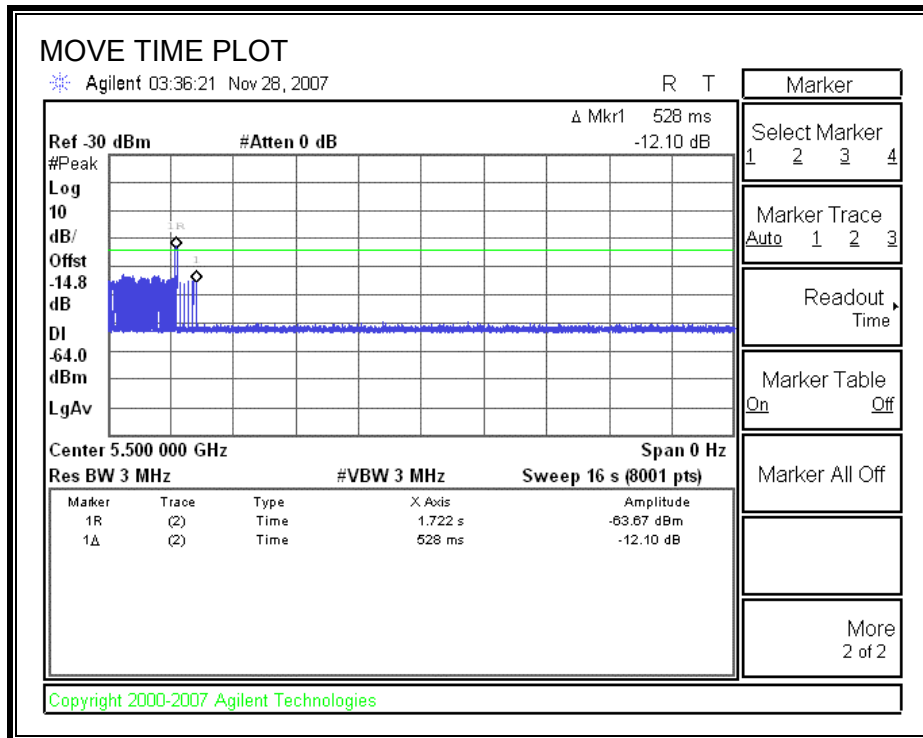
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

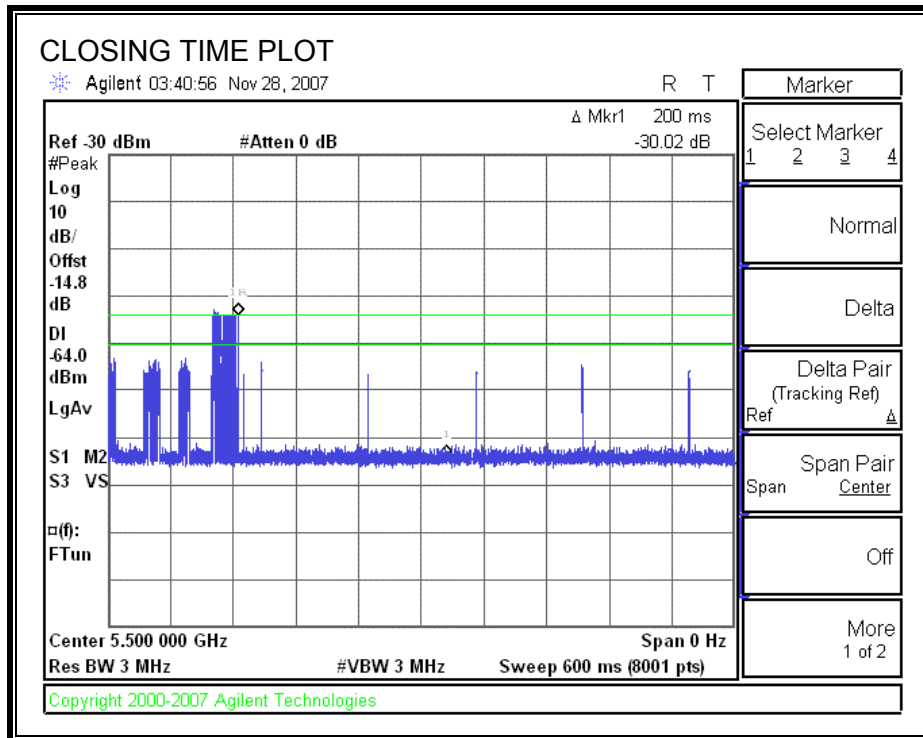
Channel Move Time (sec)	Limit (sec)
0.5	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
10.0	60

MOVE TIME

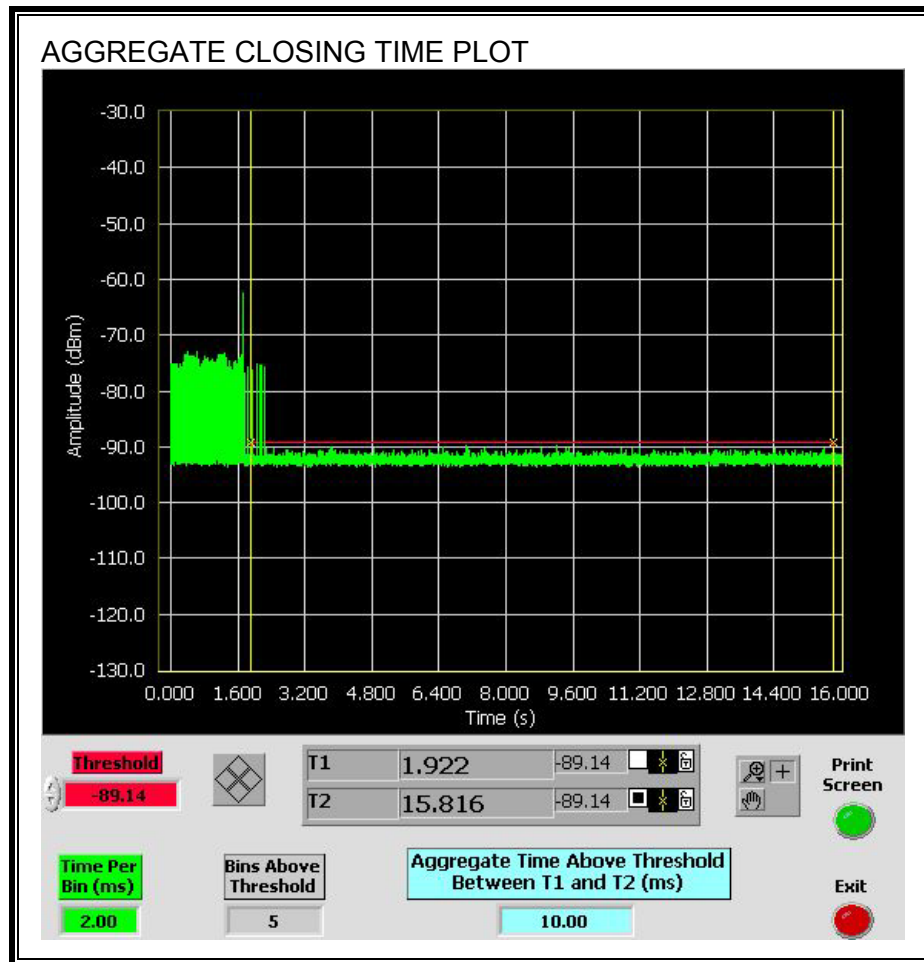


CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

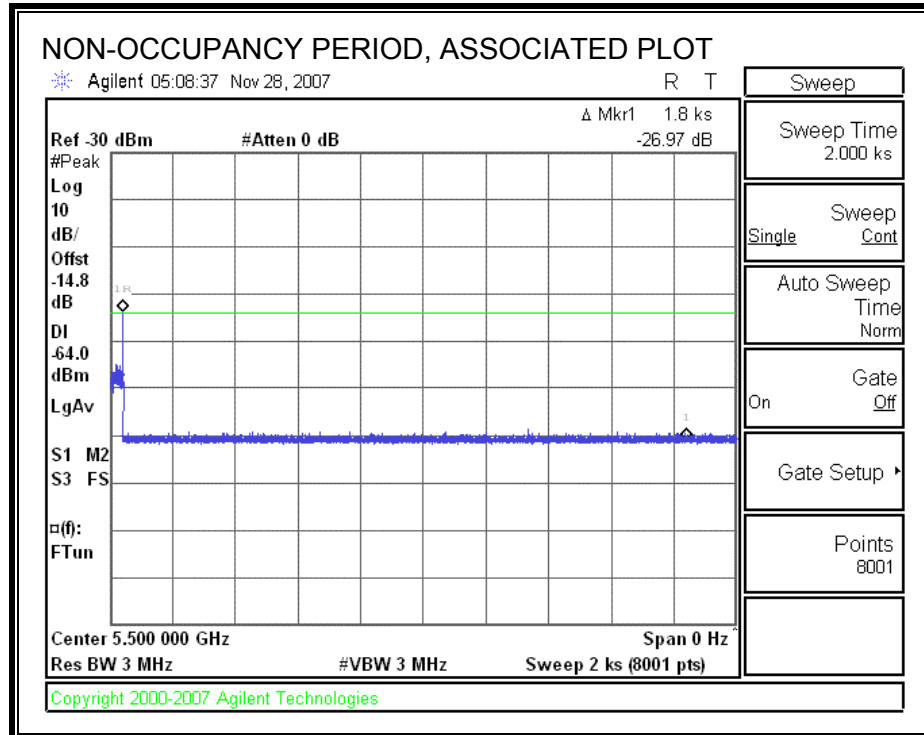
Only intermittent transmissions are observed during the aggregate monitoring period.



SLAVE NON-OCCUPANCY

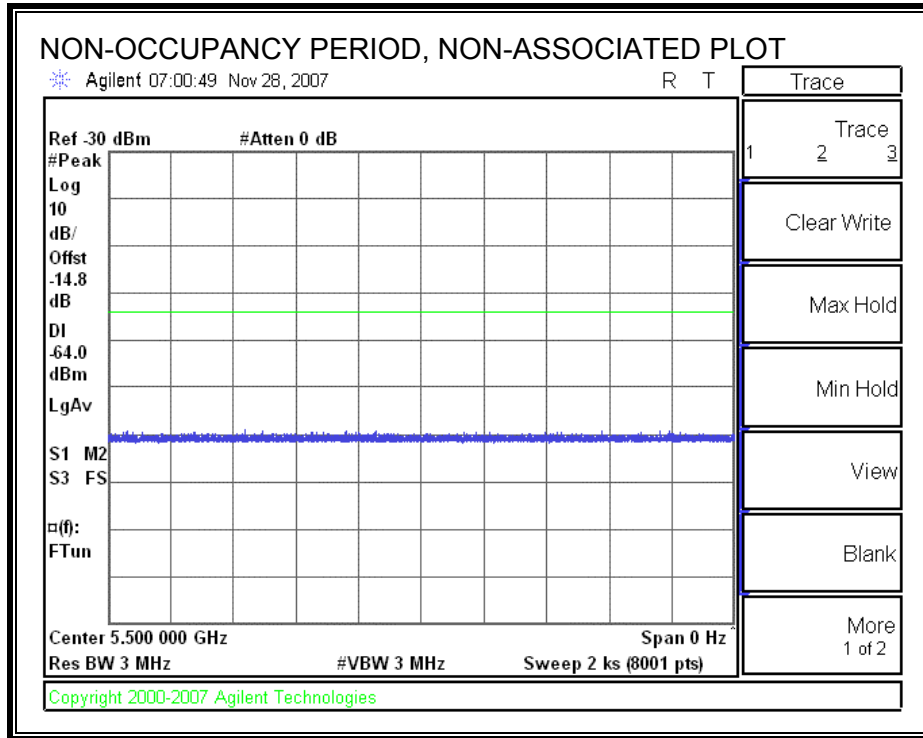
ASSOCIATED TEST RESULTS

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



NON-ASSOCIATED TEST RESULTS

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



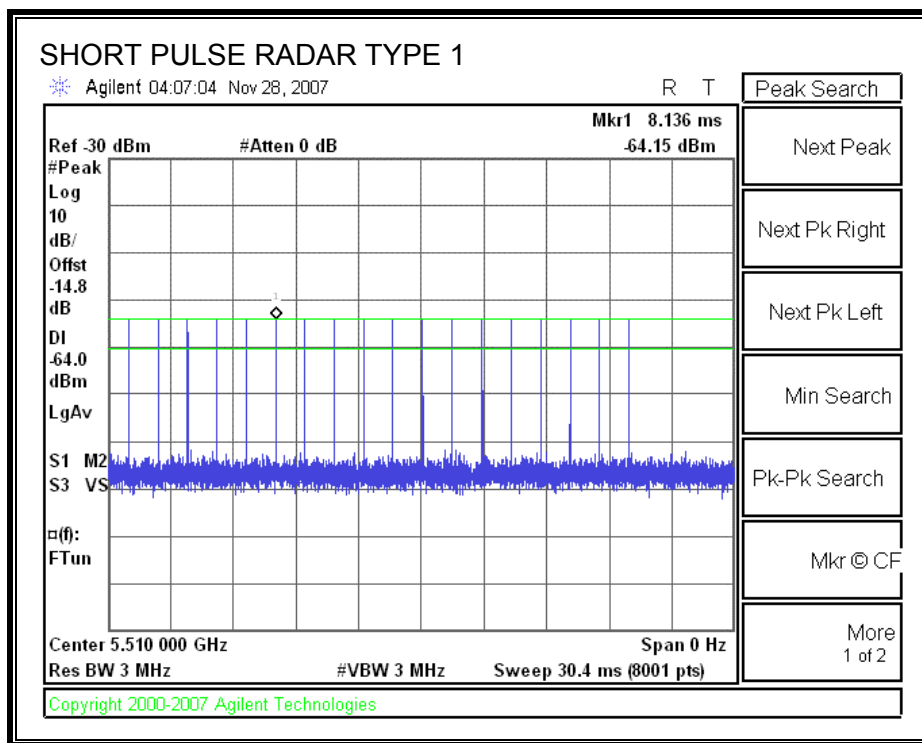
5.3. RESULTS FOR 40 MHz BANDWIDTH\

5.3.1. TEST CHANNEL

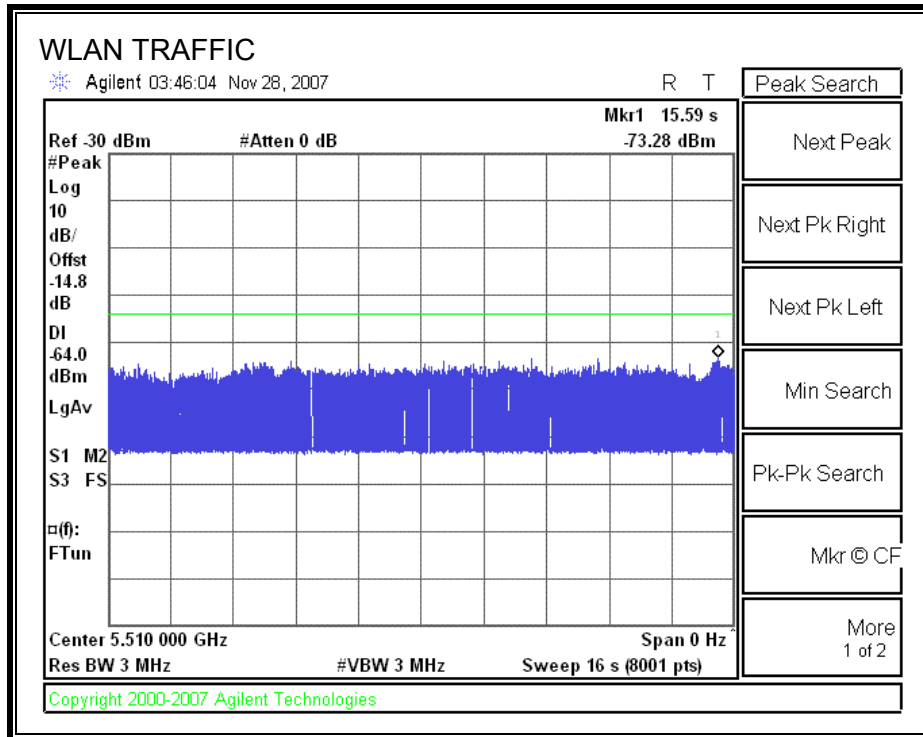
All tests were performed at a channel center frequency of 5510 MHz. Measurements were performed using conducted test methods.

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)

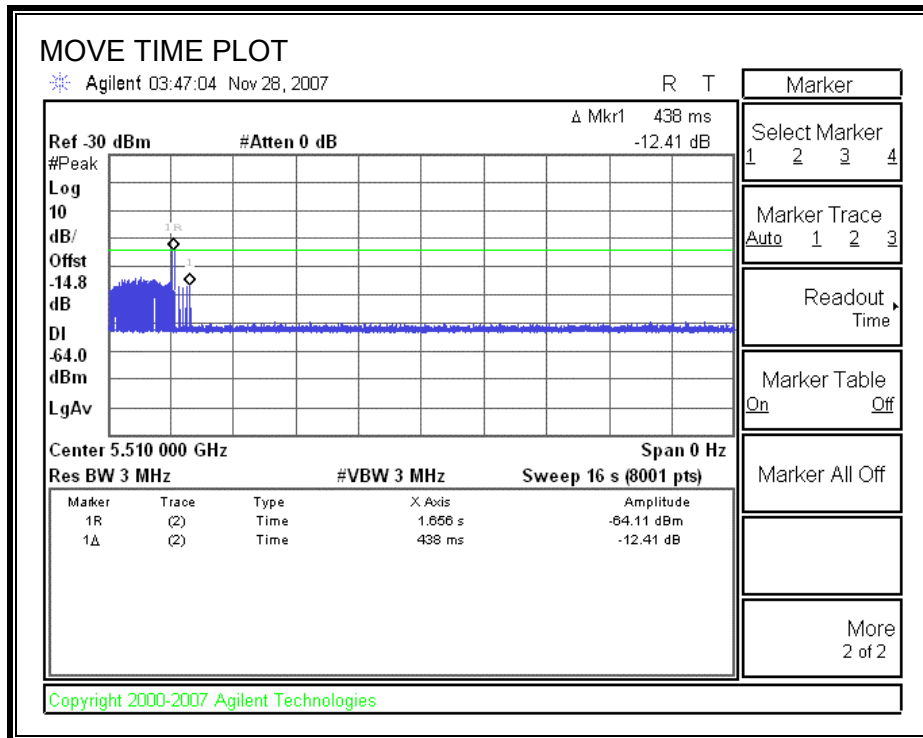
The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

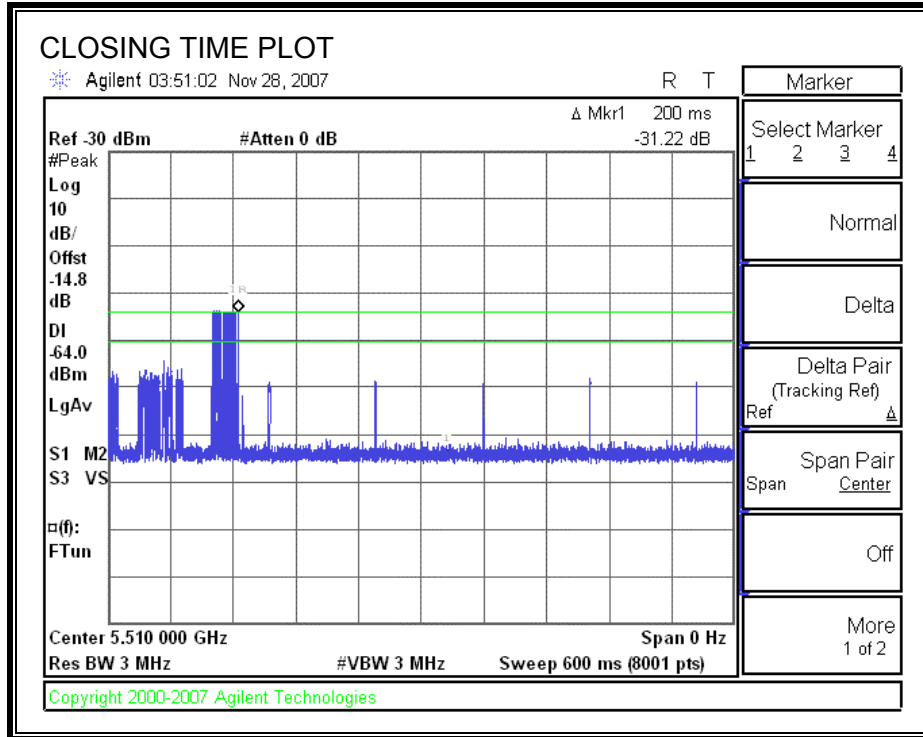
Channel Move Time (sec)	Limit (sec)
0.4	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
6.0	60

MOVE TIME

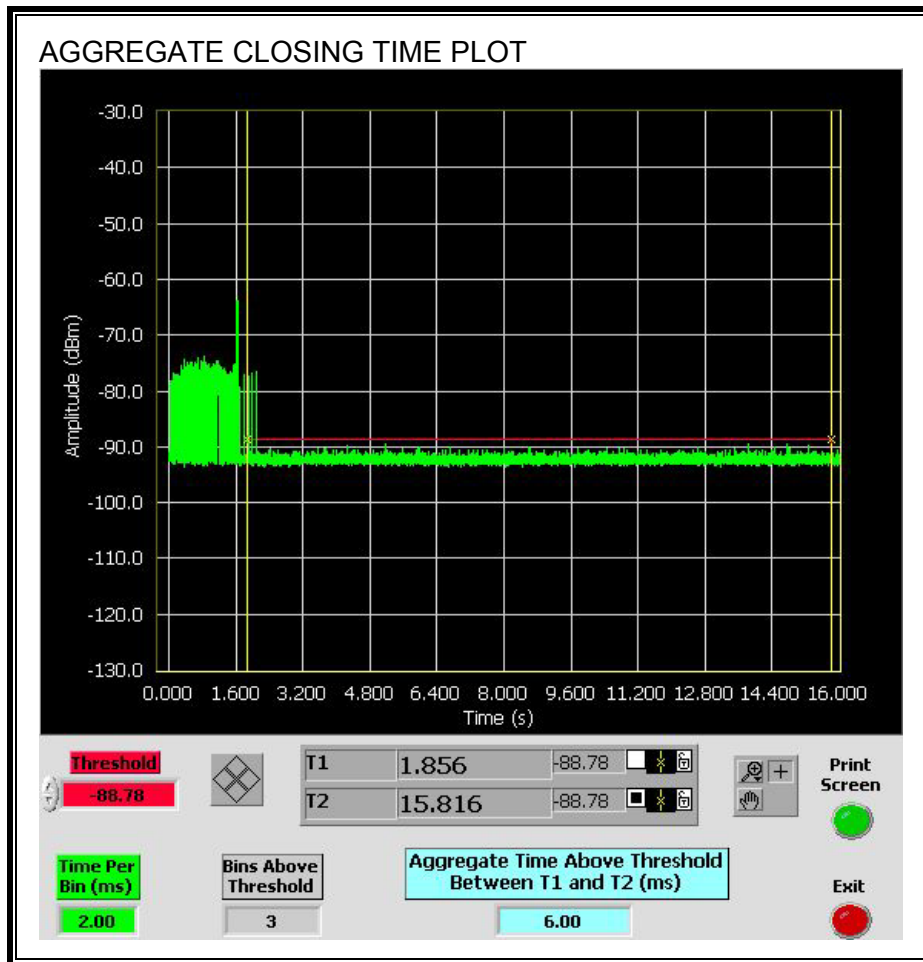


CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

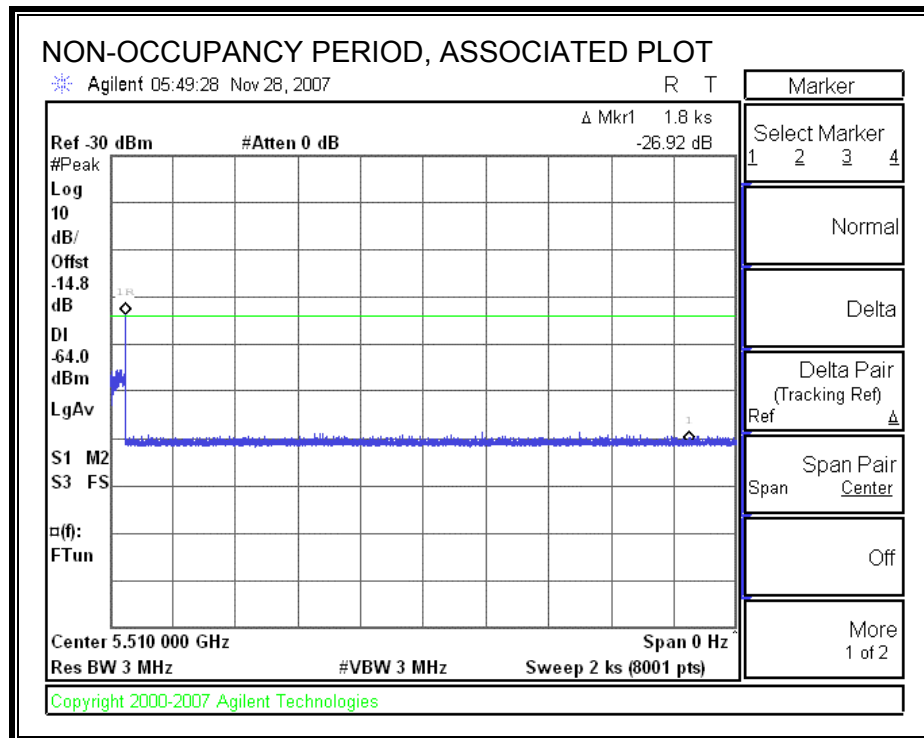
Only intermittent transmissions are observed during the aggregate monitoring period.



5.3.4. SLAVE NON-OCCUPANCY

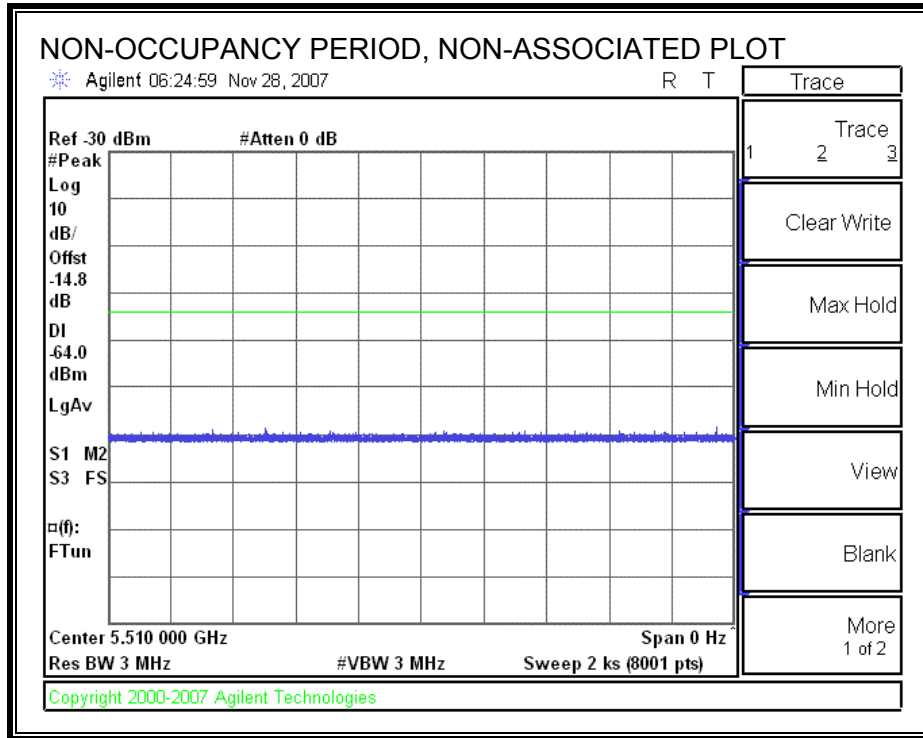
ASSOCIATED TEST RESULTS

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



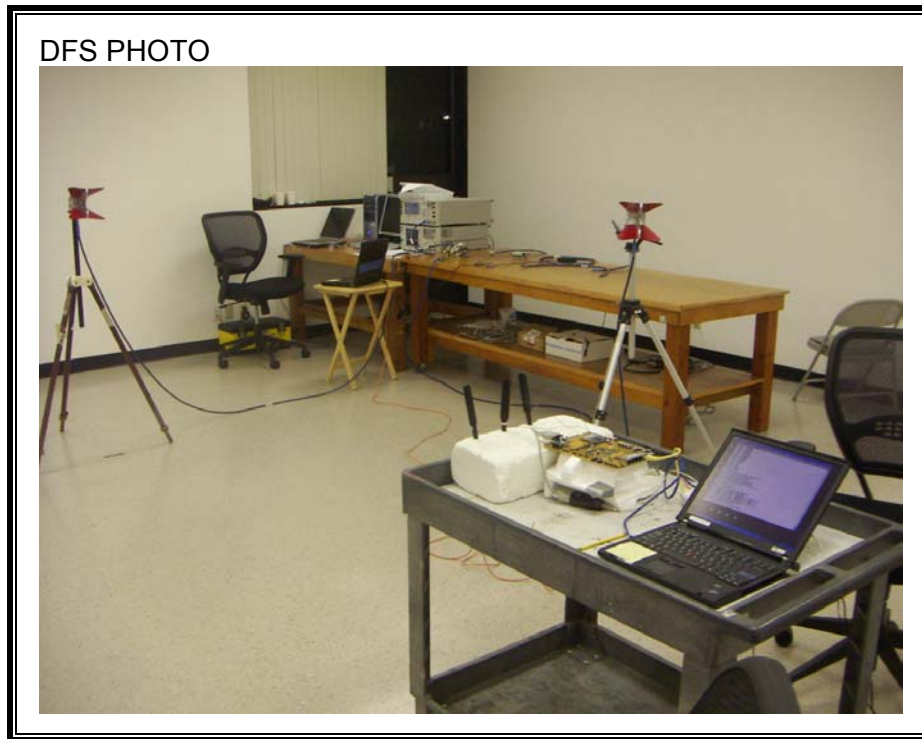
NON-ASSOCIATED TEST RESULTS

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



6. SETUP PHOTOS

DFS MEASUREMENT SETUP



END OF REPORT