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

# CERTIFICATION TEST REPORT

**FOR**

**DIGITAL WIRELESS AUDIO CLIENT DEVICE (SILVERTON)**

**MODEL NUMBER: 444-2196H**

**FCC ID: UA9300**
**IC: 9129A-300**

**REPORT NUMBER: 10U13441-2**

**ISSUE DATE: DECEMBER 06, 2010**

*Prepared for*
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NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 12/06/10 | Initial Issue | M.Heckrotte |

# TABLE OF CONTENTS

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Summit Semiconductor LLC
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**EUT DESCRIPTION:** DIGITAL WIRELESS AUDIO CLIENT DEVICE (SILVERTON)

**MODEL:** 444-2196H

**SERIAL NUMBER:** 02EA1200008D

**DATE TESTED:** DECEMBER 06, 2010

| 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 (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 CCS By:

MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

Tested By:

DOUG ANDERSON
EMC ENGINEER
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, and KDB 437887 as it applies to the Master Device used to support testing of the EUT Slave Device.

# 3. FACILITIES AND ACCREDITATION

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

UL 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. 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 |

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 |
|---|---|
| *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:<br>For the Short pulse radar Test Signals this instant is the end of the *Burst*.<br>For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.<br>For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.<br>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**

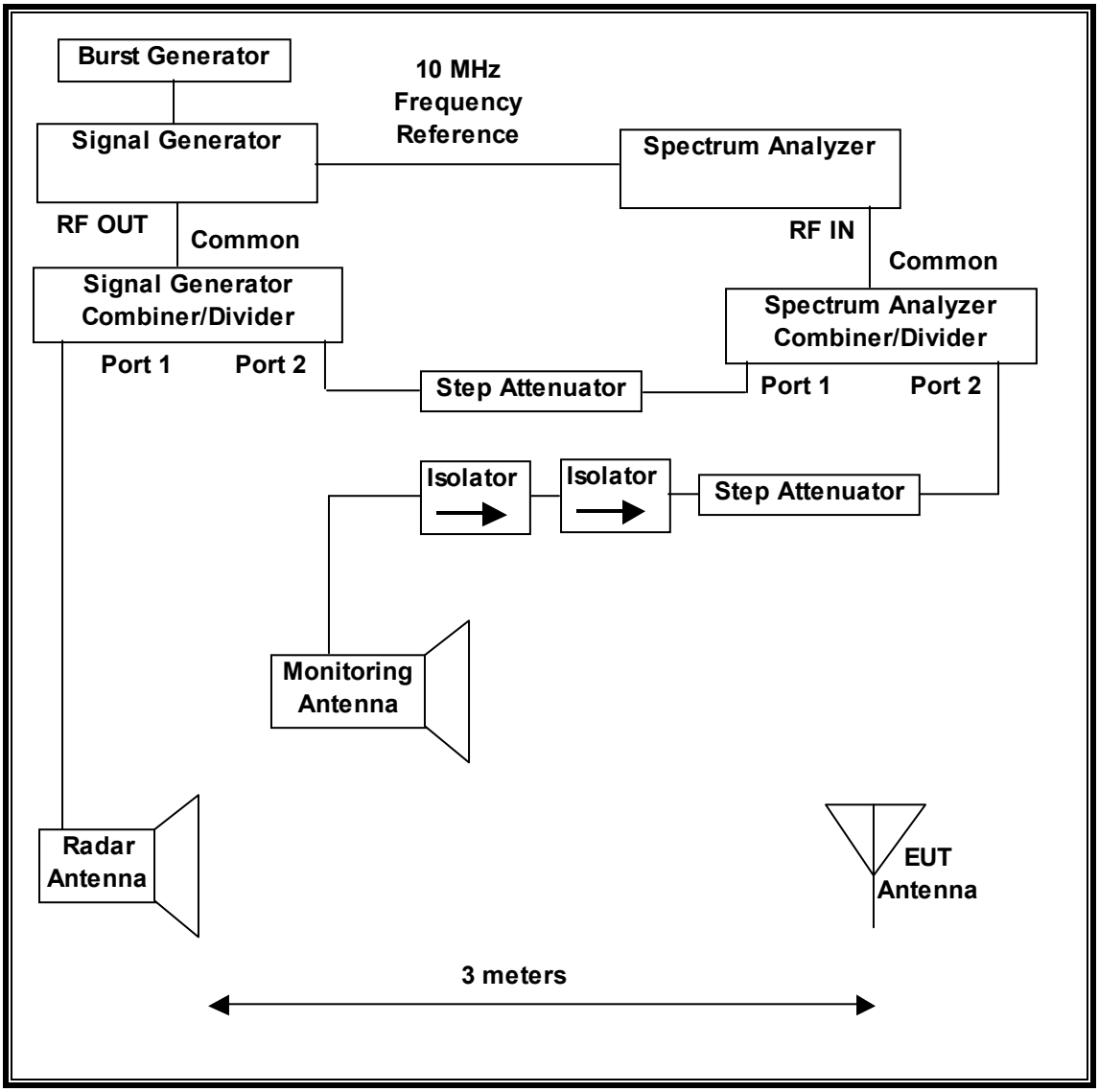
| Radar Waveform | Bursts | Pulses per Burst | Pulse Width (µsec) | Chirp Width (MHz) | PRI (µsec) | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|---|---|
| 5 | 8-20 | 1-3 | 50-100 | 5-20 | 1000-2000 | 80% | 30 |

**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 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 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.

## 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.

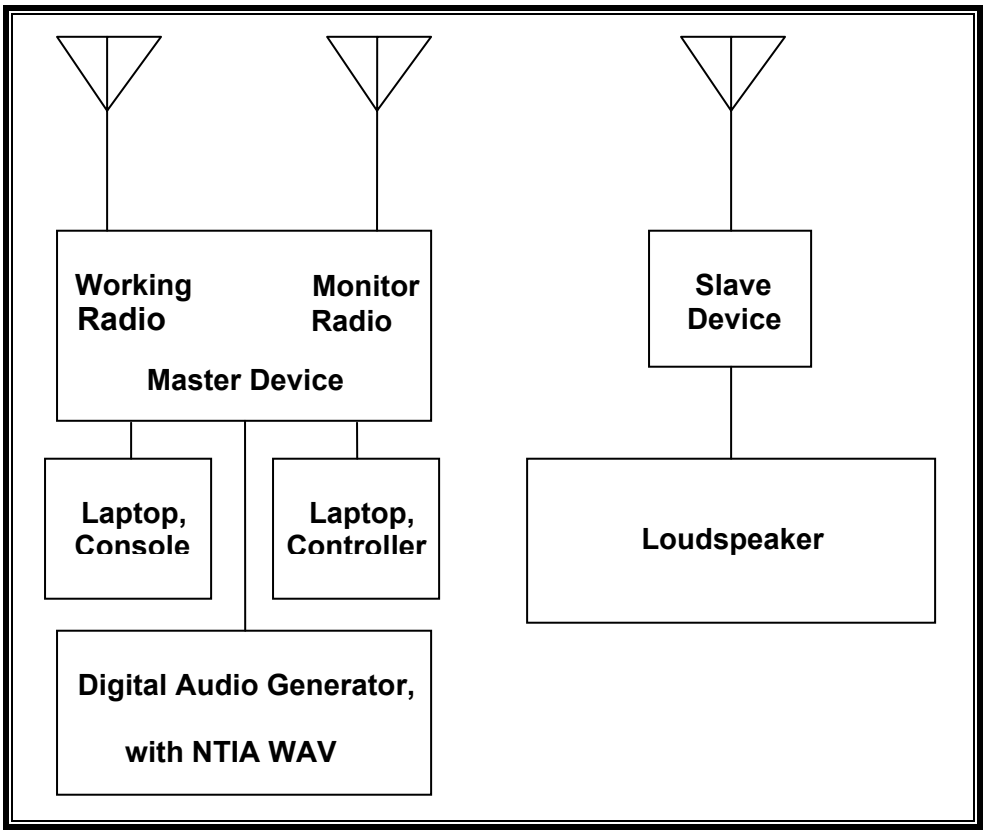
## TEST AND MEASUREMENT EQUIPMENT

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, 44 GHz | Agilent / HP | E4446A | C00996 | 10/29/11 |
| Vector signal generator, 20GHz | Agilent / HP | E8267C | C01066 | 02/12/12 |

### 5.1.3. SETUP OF EUT

**RADIATED METHOD EUT TEST SETUP**




The orientation of the Master Device is set up and maintained in accordance with KDB 437887 during the entire test.

## 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** |
| Summit FS848 Master Module (Wheeler 2.04) | Summit Semiconductor | 444-2203 | 02EA00000289 | UA9100 |
| AC Adapter (Master Module) | Danyang Chenyang Tech Electron Co., Ltd. | CYSB15-120125 | 02116 | DoC |
| Notebook PC (Console) | Dell | PP04X | 17911087201 | DoC |
| AC Adapter (Console PC) | Delta Electronics | DA90PS0-00 | CN-0XD757-48661-63I-5CFI | DoC |
| Notebook PC (Controller) | Dell | PP18L | 34220464525 | DoC |
| AC Adapter (Controller PC) | Delta Electronics | DA90PS1-00 | CN-0MM545-48661-84G-7U4R | DoC |
| Digital Audio Signal Generator | NTI | G2D-DEMZV-C1 | 02117 | N/A |
| AC Adapter (Audio S/G) | Jameco | DDU075110 | 02115 | N/A |
| Loudspeaker | Audiosource | N/A | 01012 | N/A |

## 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 power level within these bands is 10 dBm EIRP. The only antenna assembly utilized with the EUT has a gain of 3.7 dBi. Four identical antennas are utilized to meet diversity requirements. The EUT uses one transmitter/receiver chain, connected to an antenna to perform radiated tests. TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes a proprietary frame-based architecture. One nominal channel bandwidth, 20 MHz, is implemented. Three network frame rates are implemented, corresponding to audio sampling rates of 32, 44.1 and 48 kHz.

Traffic is generated by streaming the audio file “5_GHz_Audio_Test_file.WAV” from the Master to the Slave. This WAV file is based on a 44.1 kHz sampling rate. The digital audio signal generator is used to convert the sampling rate to generate audio at any of the three sampling rates.

The software installed in the EUT is Hood version 0018.

**MANUFACTURER’S STATEMENT REGARDING UNIFORM CHANNEL SPREADING**

Not applicable.

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

The Master Device is a Summit Semiconductor FS848 Master Module (Wheeler), FCC ID: UA9100. The minimum antenna gain for the Master Device is 2.2 dBi.

The software installed in the Master Device is DFS version 1.0.

The worst-case network frame rate with respect to the talk/listen ratio is with an audio sampling rate of 48 kHz.

The rated output power of the Master Device is < 23dBm (EIRP). Therefore the required interference threshold level is –62 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is -62 + 1 = -61 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

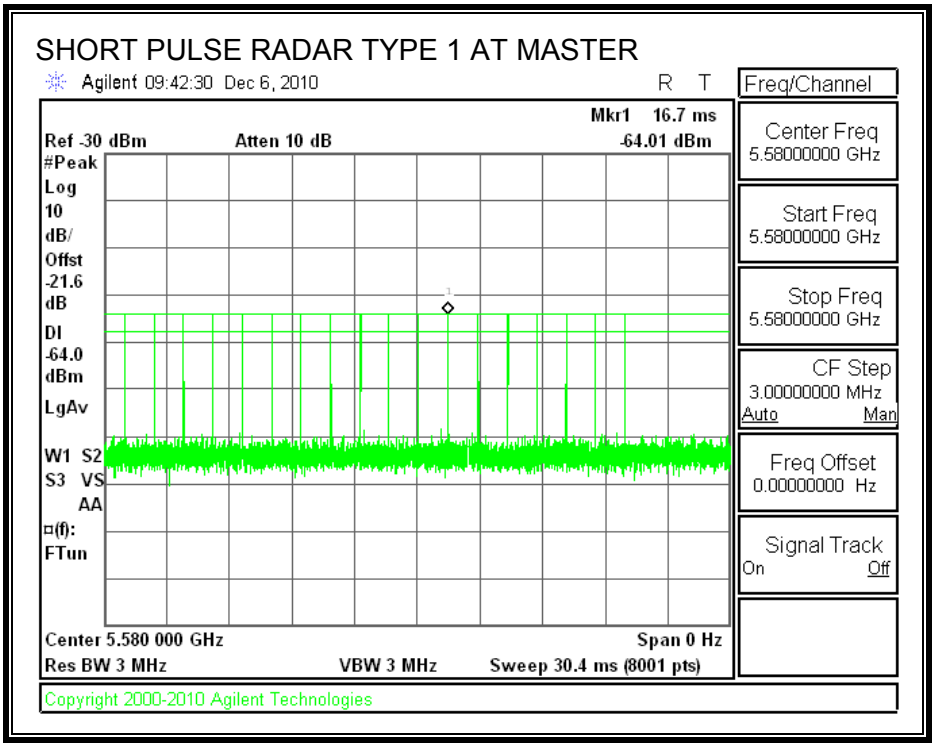
### 5.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5580 MHz.

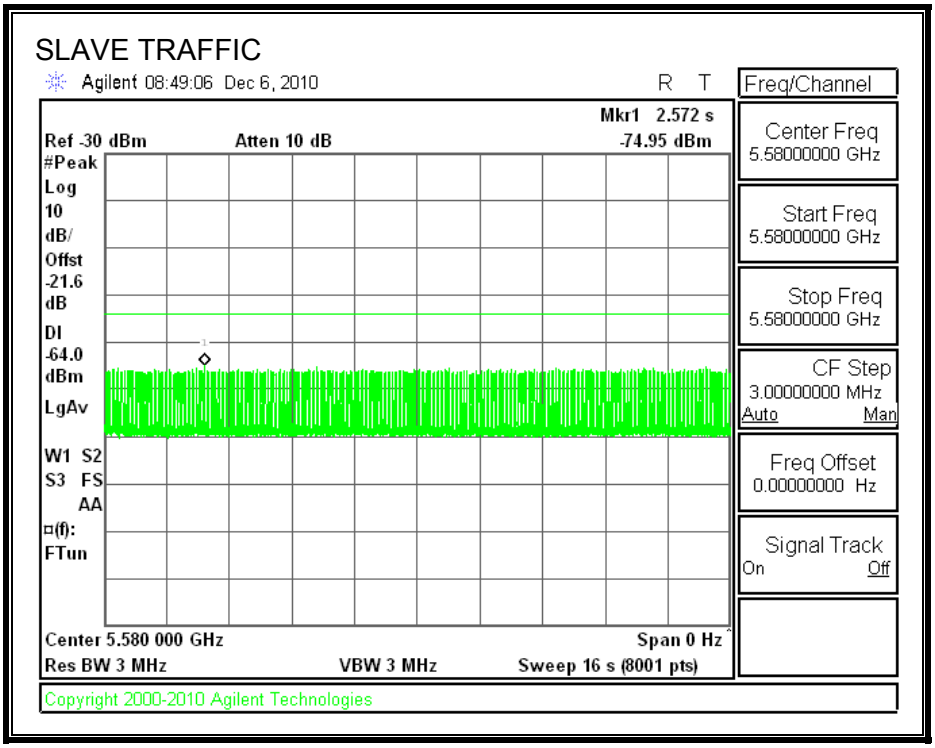
All tests were performed at the worst-case sampling rate of 48 kHz.

### 5.2.2. RADAR WAVEFORM AND TRAFFIC

**RADAR WAVEFORM**



**TRAFFIC**



### 5.2.3. OVERLAPPING CHANNEL TESTS

**RESULTS**

These tests are not applicable.

### 5.2.4. 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).

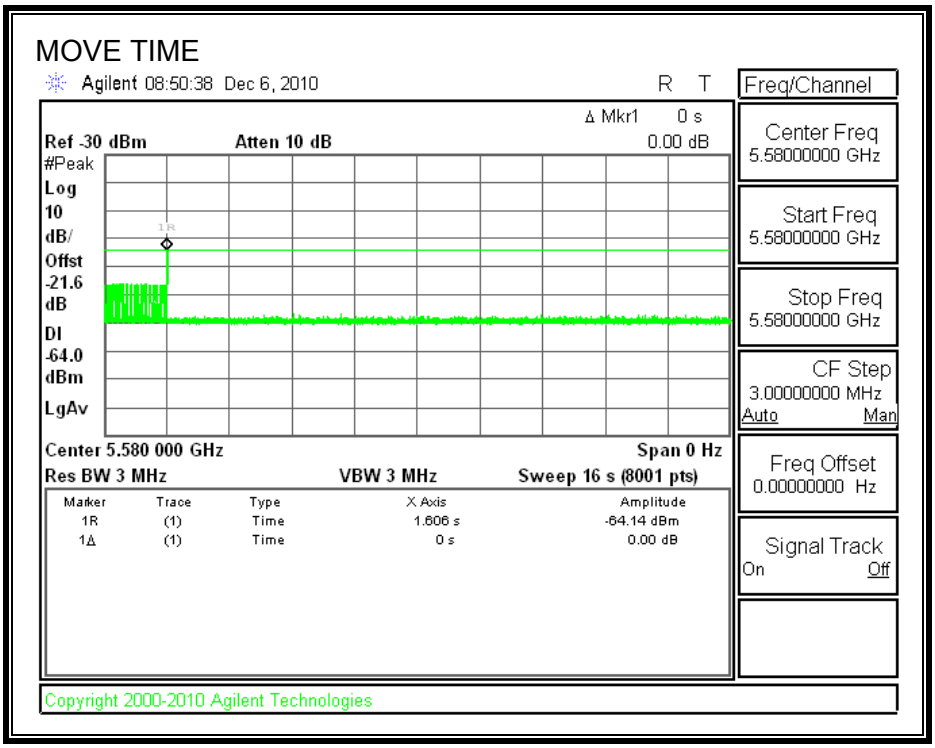
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

**RESULTS**

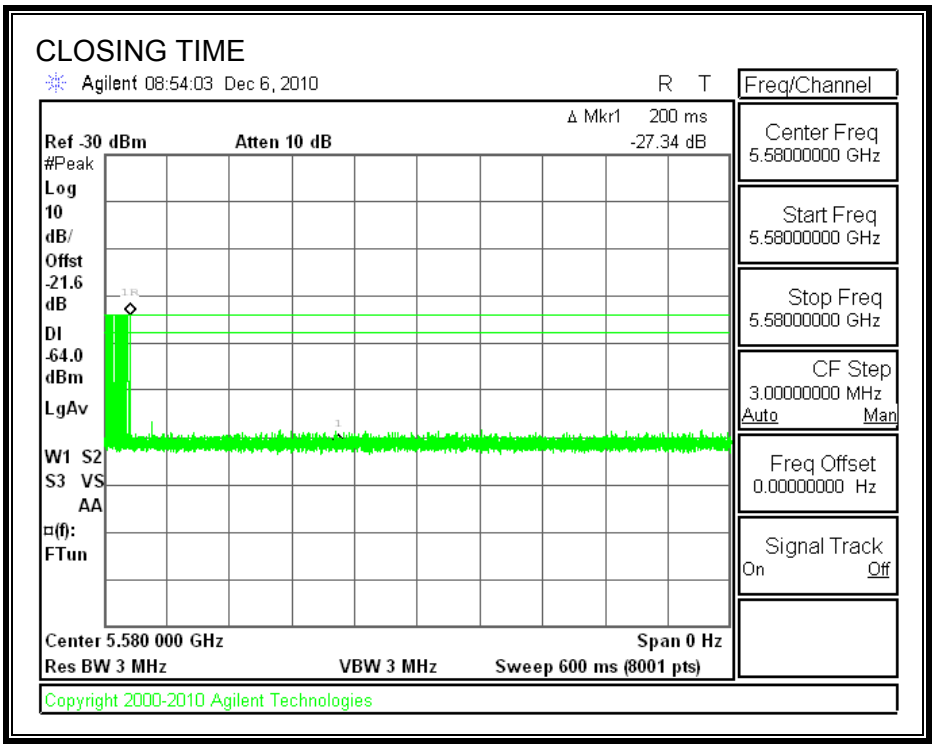
| Agency | Channel Move Time (sec) | Limit (sec) |
|---|---|---|
| FCC / IC | 0.000 | 10 |

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

**MOVE TIME**

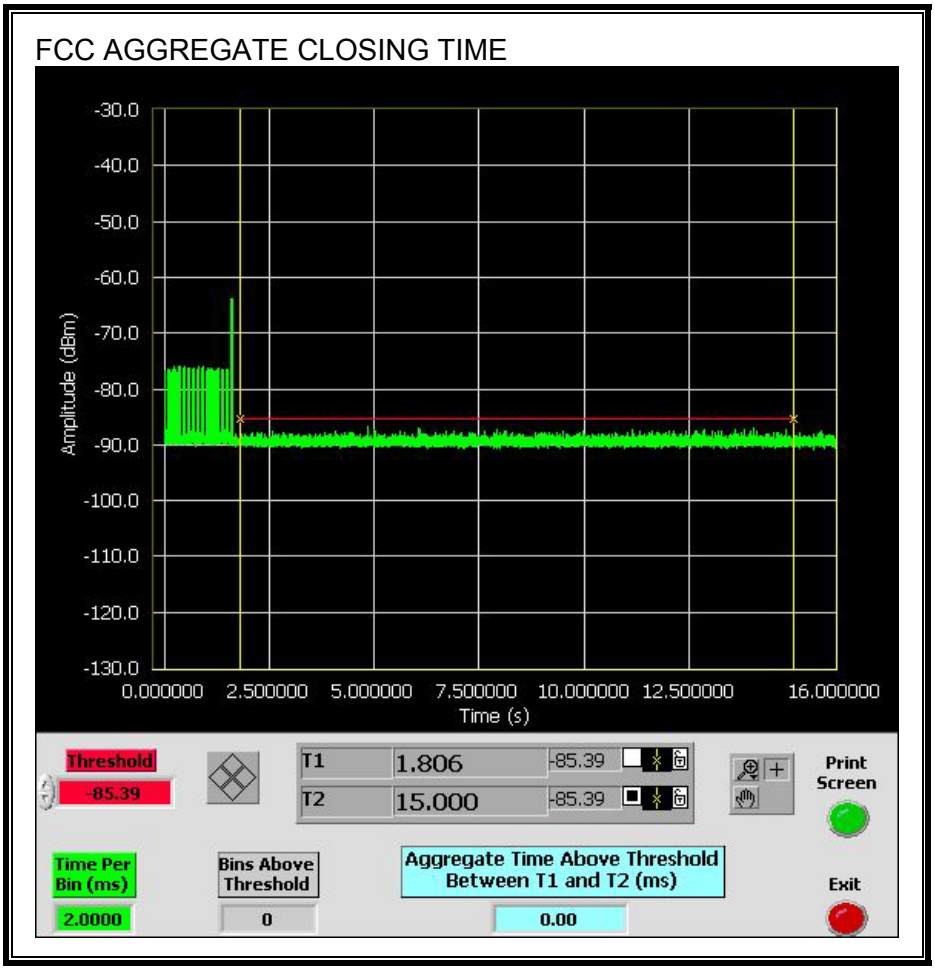


**CHANNEL CLOSING TIME**

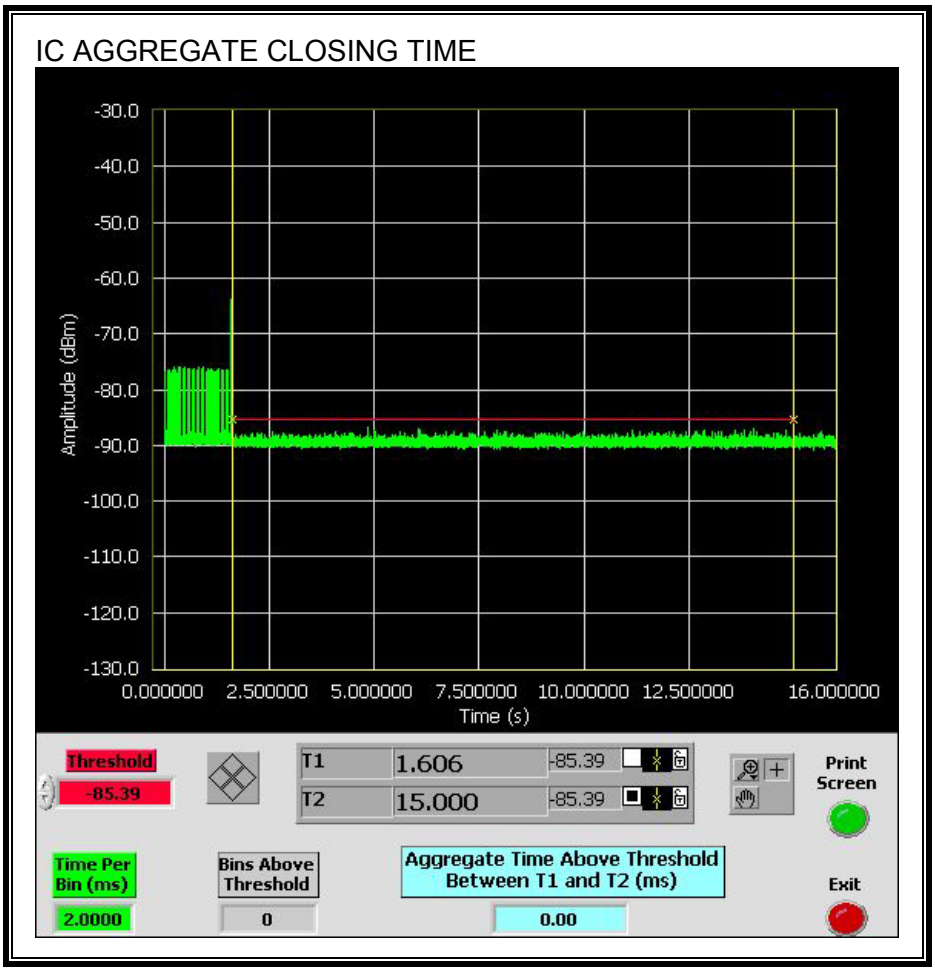


**AGGREGATE CHANNEL CLOSING TRANSMISSION TIME**

No transmissions are observed during the FCC aggregate monitoring period.



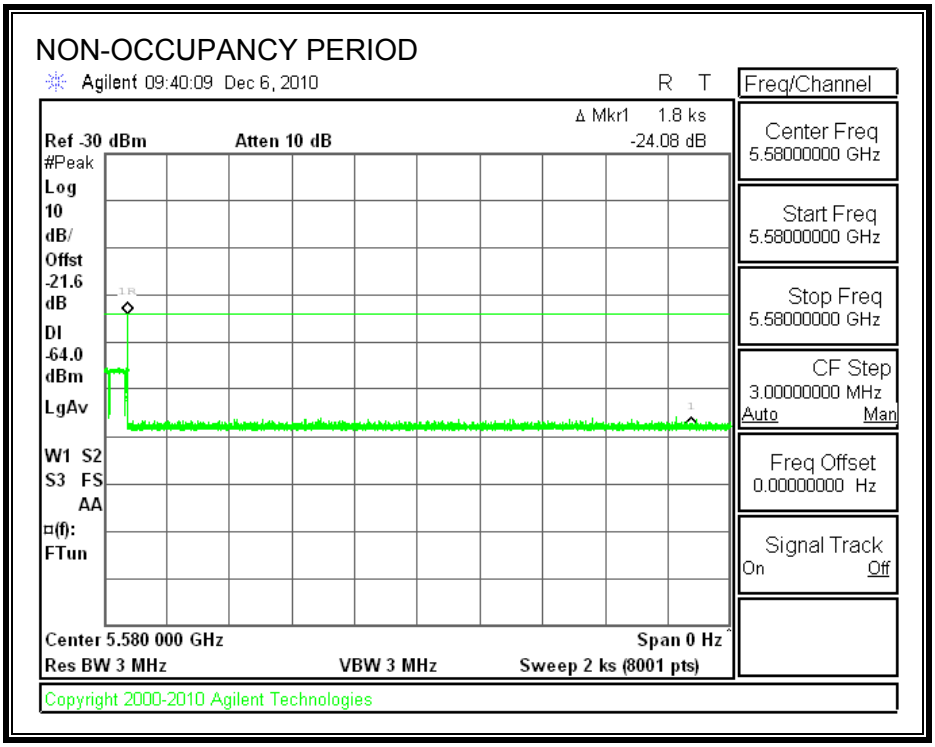
No transmissions are observed during the IC aggregate monitoring period.



### 5.2.5. NON-OCCUPANCY PERIOD

**RESULTS**

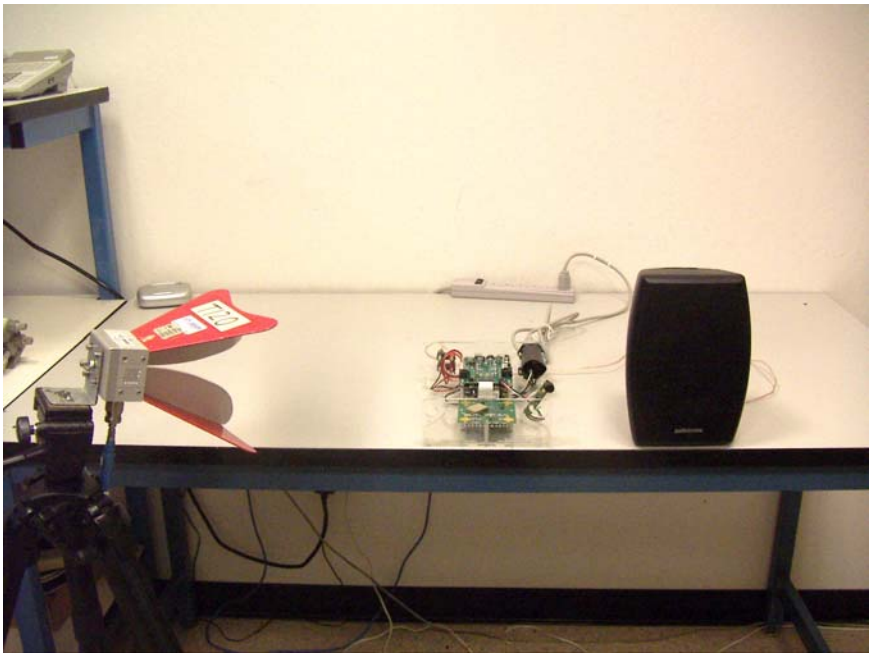
No EUT transmissions were observed on the test channel during the 30-minute observation time.



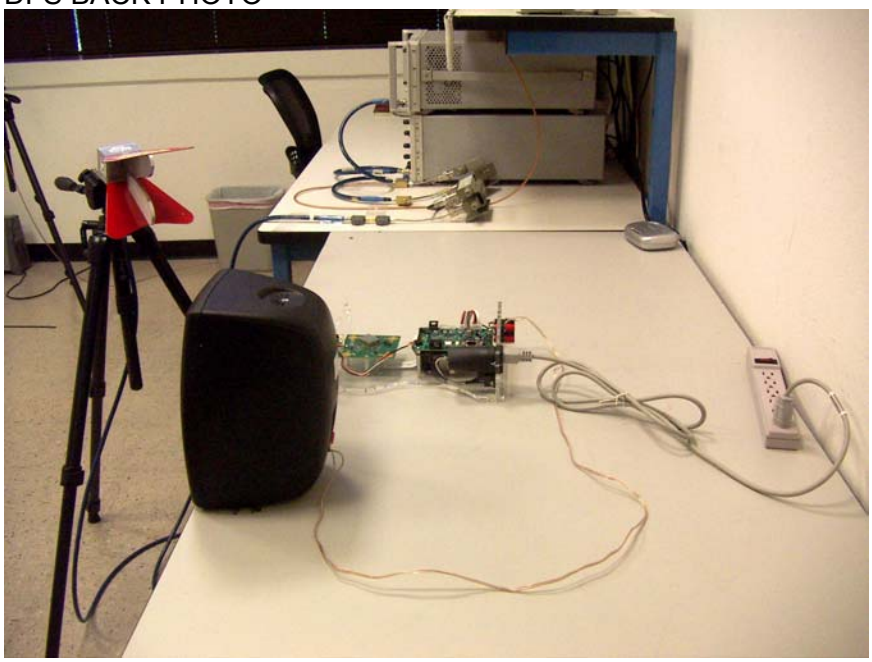
# 6. SETUP PHOTOS

**DYNAMIC FREQUENCY SELECTION MEASUREMENT SETUP**

DFS FRONT PHOTO



DFS BACK PHOTO



# END OF REPORT