LS RESEARCH, LLC
Wireless Product Development

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ENGINEERING TEST REPORT # TR 314378 D
LSR Job #: C-2204

Compliance Testing of:
A500 Talkman

Test Date(s):
June 2, 2015

Prepared For:
Vocollect, Inc.
703 Rodi Road
Pittsburgh, PA 15235

This Test Report is issued under the Authority of: Adam Alger, EMC Engineer

Signature: Date: 7-1-15

Test Report Reviewed by:	**Report by:**
Tom Smith, VP EMC Test Services	Adam Alger, EMC Engineer
Signature: Date: 7-1-15	Signature: Date: 6-30-15

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LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industrie Canada Industry Canada

Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A
On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

1.0 Summary of Test Report

In June 2015 the EUT, A500, was tested and MEETS the following requirements:

Operation in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands

FCC Rule Part	IC Standard	Test Description	Measurement Procedure	Test Result
15.407 (h)(2)	RSS-247 Section 6.3	Dynamic Frequency Selection	FCC KDB 905462 D02	Pass*
15.407 (h)(2)(ii)	RSS-247 Section 6.3	Channel Availability Check Time	FCC KDB 905462 D02	N/A*
15.407 (h)(2)(iii)	RSS-247 Section 6.3	Channel Move Time	FCC KDB 905462 D02	Pass
15.407 (h)(2)(iv)	RSS-247 Section 6.3	Non-Occupancy period	FCC KDB 905462 D02	Pass

* The EUT is a client only device

2.0 Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.
LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

3.0 Client Information

Manufacturer Name:	Vocollect, Inc.
Address:	703 Rodi Road Pittsburg, PA 15235
Contact Person:	Brian Sutton

3.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	A500 Talkman
Model Number:	TAP802-01
Serial Number:	Eng. Sample
FCC ID:	MQO-TAP802-01
IC:	2570A-TAP80201

3.2 Product Description

802.11 a/n device using HT20 channels

3.3 Modifications Incorporated In the EUT for Compliance Purposes

None noted at time of test

3.4 Deviations & Exclusions from Test Specifications

None noted at time of test

3.5 Additional Information

EUT connected to AP in normal mode of operation. FTP utilized for channel loading.

4.0 Conditions of Test

Environmental:

Temperature: 20-25º C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

Mains Voltage: N/A
Battery Voltage: 3.7 V

5.0 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

6.0 Conformance Summary

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Subpart E Part and RSS-247 DFS requirements.

<u>If some emissions are seen to be within 3 dB of their respective limits</u>:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Appendix A – Test Equipment

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 28-Apr-2015 Type Test: Radiated and RF Conducted Job #: C-2204

Prepared By: Adam Alger Customer: Vocollect Quote #: 314378

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	44GHz EXA Spectrum Analyzer	Agilent	N9010A	MY53400296	12/11/2014	12/11/2015	Active Calibration
2	CC 000314C	Vector Signal Generator	Agilent	E4438C	US 41469143	4/29/2015	4/29/2017	Active Calibration
3	EE 960093	Power Splitter/Combiner 1-10 GHz	mini-circuits	ZFSC-2-10G	SF702900616	2/17/2015	2/17/2016	Active Calibration
4	EE 960094	Power Splitter/Combiner 1-10 GHz	mini-circuits	ZFSC-2-10G	SF441900526	2/17/2015	2/17/2016	Active Calibration
5	CC000710C	Oscilloscope	Agilent	MSO8104A	MY45001068	N/A	N/A	System
6	CC000259C	Arbitary Wavefrom Generator	Agilent	33250	US40000583	N/A	N/A	System

Description	Manufacturer	Model Number	Serial Number
Access point with DFS (FCC ID: LDK102061 and LDK 102062)	CISCO	AIR-AP 1252AG-AK9	FTX154590DB

Appendix B – Test Data
B.1 – DFS

Manufacturer	Vocollect, Inc.
Test Location	LS Research, LLC
Rule Part	FCC Subpart E IC RSS-247
General Measurement Procedure	Client without Radar Detection Requirements Prior to Use of a Channel 1. Non-Occupancy Period minimum 30 minutes Client without Radar Detection Requirements During Normal Operation 1. Channel Closing Time 200 ms + an aggregate of 60 ms over remaining 10 second period using Radar Type 0 starting at beginning of Channel move time plus any additional control signals not counting quiet periods during the remaining 10 second period. 2. Channel Move Time 10 seconds using Radar Type 0 Radar Type 0 Pulse width = 1 µsec PRI = 1428 µsec Number of Pulses = 18
General Description of Measurement	Conducted Setup for Client with injection at the Master (Section 7.2.2) (see setup photo exhibit) Radar Test Signal Generator = Arbitrary Waveform Generator + Signal Generator with Ext pulse input EUT Setup to connect to DFS_Master AP and perform FTP for channel loading. Computer connected via Ethernet port to master side to setup file transfer to client device.

7.2.2 Setup for Client with injection at the Master

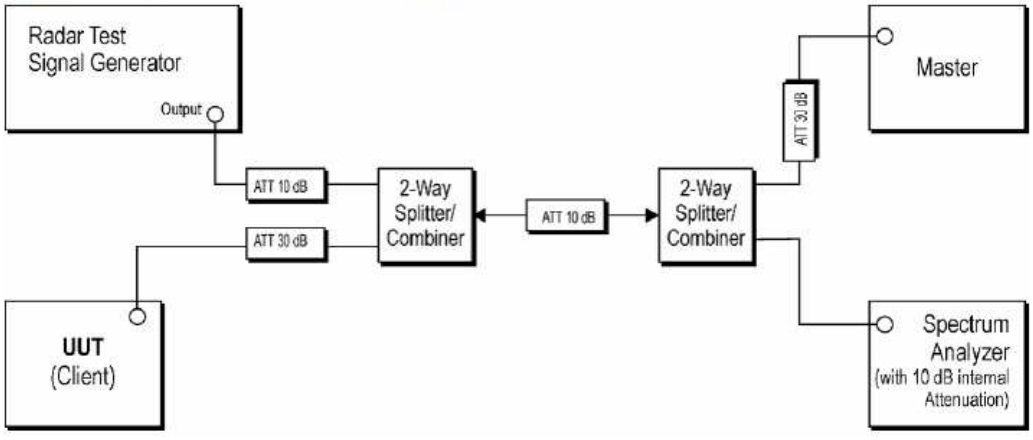
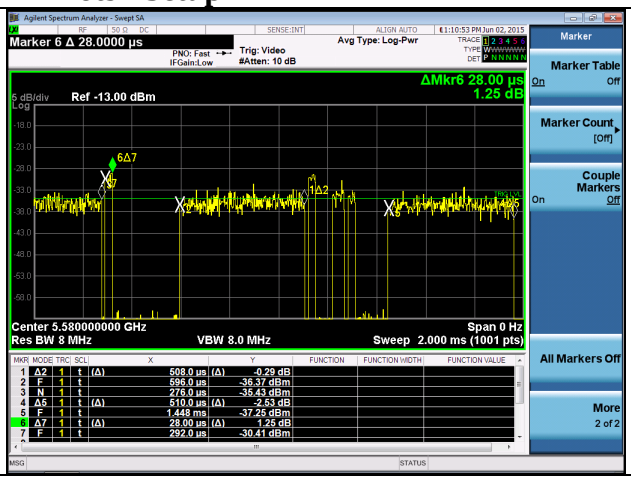
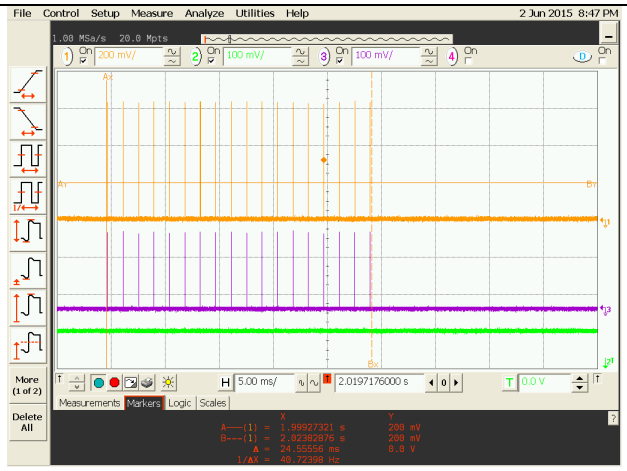


Figure 3: Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Master

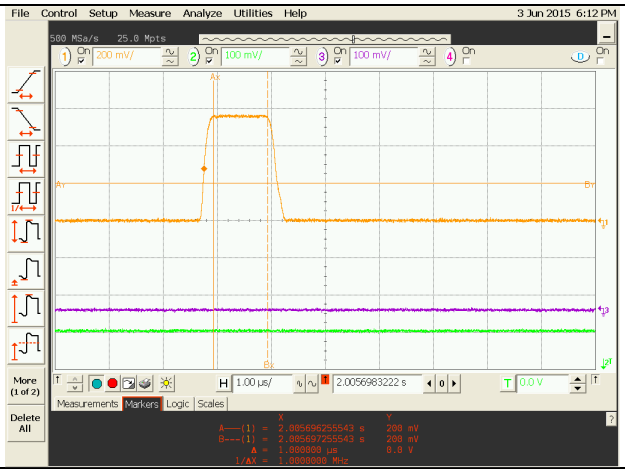
Plots - Setup



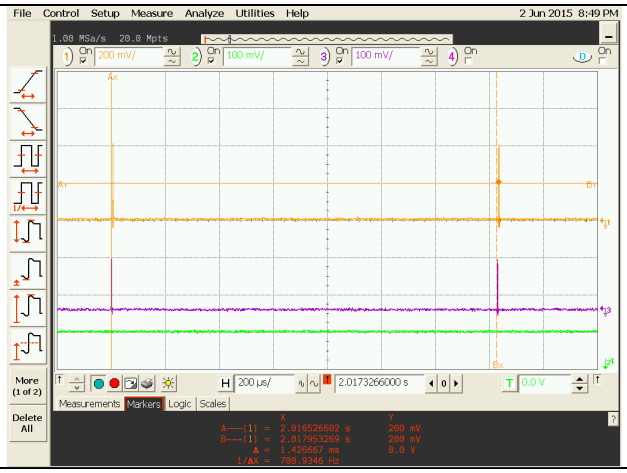
Channel loading > 17% during FTP



Setup of Radar Pulse (18 Pulses)



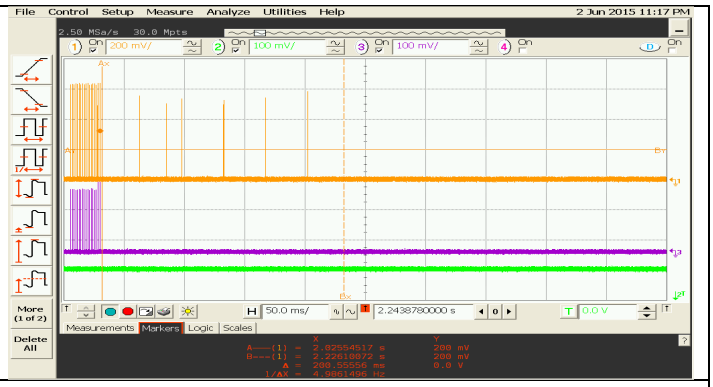
Setup of Radar Pulse (Pulse Width 1 µs)



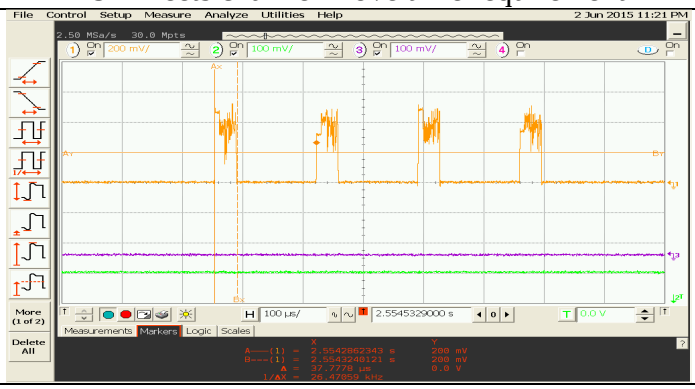
Setup of Radar Pulse (PRI 1.428 ms)

Plots - Performing the test

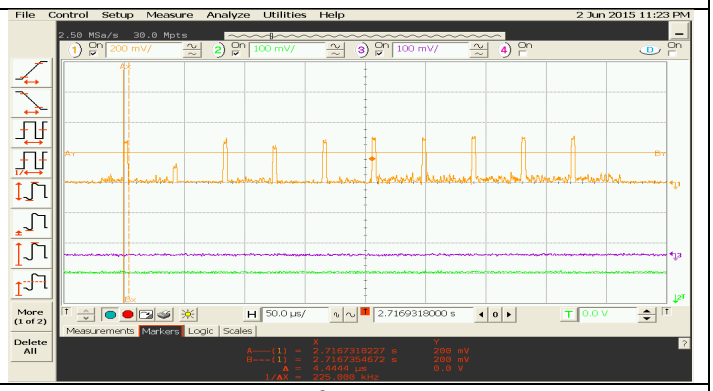
Radar Pulse introduced at 2 seconds
Marker A on last radar pulse
Marker B 10 seconds after marker A
EUT meets channel move time requirement



Showing 200 ms channel closing time



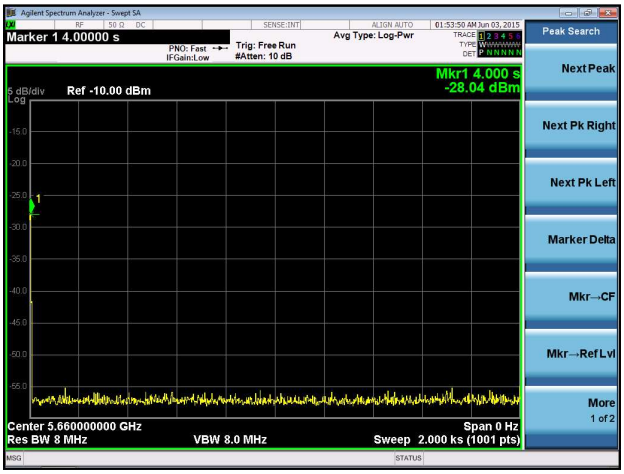
AP Control signals after 200 ms (width type 1)



AP Control signals after 200 ms (width type 2)

AP total control signal on time in window 200 ms to 10 second close time = 1.4079 ms
(7 pulses x 37.7 µs + 260 pulses x 4.4 µs)
Note: No transmissions from client device after initial 200 ms channel closing time.

Non-Occupancy Period



Information as required by KDB 905462 D02 Section 8:

	8.1 Complete description of the U-NII device	
1	The operating frequency range(s) of the equipment.	5260-5320 MHz, 5500-5700 MHz
2	The operating modes (Master and/or Client) of the U-NII device. Bridge modes and MESH modes, as applicable, must be included in the description	Client with no radar detection capability . No bridge or mesh modes
3	For Client devices, indicate whether or not it has radar detection capability and indicate the FCC identifier for the Master U-NII Device that is used with it for DFS testing.	No radar detection capability. Master used with testing FCC ID: LDK102061 and LDK 102062
4	List the highest and the lowest possible power level (equivalent isotropic radiated power (EIRP)) of the equipment.	Highest power = 14.06 dBm @ 5260 MHz ; Lowest power 12.75 dBm @ 5700 MHz ;
5	List all antenna assemblies and their corresponding gains.	5 GHz PIFA with 4.1 dBi peak gain
a	If radiated tests are to be performed, the U-NII Device should be tested with the lowest gain antenna assembly (regardless of antenna type). The report should indicate which antenna assembly was used for the tests. For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.	Not applicable
b	If conducted tests are to be performed, indicate which antenna port/connection was used for the tests and the antenna assembly gain that was used to set the DFS Detection Threshold level during calibration of the test setup.	Not applicable - device client only
i	Indicate the calibrated conducted DFS Detection Threshold level.	Not applicable - device client only
ii	For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.	Power not adjustable - uses 1 antenna (for 5 GHz)
iii	Indicate the antenna connector impedance. Ensure that the measurement instruments match (usually 50 Ohms) or use a minimum loss pad and take into account the conversion loss.	50 ohms
c	Antenna gain measurement verification for tested antenna.	Not applicable - device client only
i	Describe procedure	Not applicable - device client only
ii	Describe the antenna configuration and how it is mounted	Not applicable - device client only
iii	If an antenna cable is supplied with the device, cable loss needs to be taken into account. Indicate the maximum cable length and either measure the gain with this cable or adjust the measured gain accordingly. State the cable loss.	No antenna cable - PIFA antenna with temporary u.fl connection for measurement
6	Test sequences or messages that should be used for communication between Master and Client Devices, which are used for Channel loading.	Device transfers data with no user interface for video. FTP utilized for test.
a	Stream the test file from the Master Device to the Client Device for IP based systems or frame based systems which dynamically allocate the talk/listen ratio.	Device transfers data with no user interface for video. FTP utilized for test.
b	For frame based systems with fixed talk/listen ratio, set the ratio to the worst case (maximum) that is user configurable during this test as specified by the manufacturer and stream the test file from the Master to the Client.	Not applicable
c	For other system architectures, supply appropriate Channel loading methodology.	Not applicable
7	Transmit Power Control description	Not applicable
8	System architectures, data rates, U-NII Channel bandwidths.	
a	Indicate the type(s) of system architecture (e.g. IP based or Frame based) that the U-NII device employs. Each type of unique architecture must be tested.	IP based
9	The time required for the Master Device and/or Client Device to complete its power-on cycle.	Typical 3 seconds
10	Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user.	See software security exhibit
11	The manufacturer is permitted to select the first channel either manually or randomly. The manufacturer may also block DFS channels from use.	Not applicable - device client only

Section 8.2

8.2 Complete description of the Radar Waveform calibration		
1	Description of calibration setup	Not applicable - device client only
a	Block diagram of equipment setup, clearly identifying if a radiated or conducted method was used.	Conducted method
2	Description of calibration procedure	Not applicable - device client only
a	Verify DFS Detection Threshold levels	Not applicable - device client only
i	Indicate DFS Detection Threshold levels used.	Not applicable - device client only
ii	Consider output power range and antenna gain.	Not applicable - device client only
b	For the Short Pulse Radar Types, spectrum analyzer plots of the burst of pulses on the Channel frequency should be provided.	Supplied
c	For the Long Pulse Radar Type, spectrum analyzer plot of a single burst (1-3 pulses) on the Channel frequency should be provided.	Not applicable - device client only
d	Describe method used to generate frequency hopping signal.	Not applicable - device client only
e	The U-NII Detection Bandwidth	Not applicable - device client only
f	For the Frequency Hopping waveform, a spectrum analyzer plot showing 9 pulses on one frequency within the U-NII Detection Bandwidth should be provided.	Not applicable - device client only
g	Verify use of vertical polarization for testing when using a radiated test method.	Not applicable - conducted method
3	When testing a Client Device with radar detection capability, verify that the Client Device is responding independently based on the Client Device's self-detection rather than responding to the Master Device. If required, provide a description of the method used to isolate the client from the transmissions from the Master Device to ensure Client Device self detection of the Radar Waveform.	Device client with no radar detection capability only

Section 8.3

8.3 Complete description of test procedure		
1	Description of deviations to the procedures or equipment described in this document.	No deviations noted
2	Description of DFS test procedure and test setup used to monitor the U-NII device and Radar Waveform transmissions. Provide a block diagram of the signal monitoring equipment setup.	Supplied
a	List of equipment	Supplied
b	Test setup photos	Supplied
3	Description of DFS test procedure and test setup used to generate the Radar Waveforms.	Supplied
a	Block diagram of equipment setup	Supplied
b	List of equipment	Supplied
c	Test setup photos	Supplied
d	For each of the waveforms that were used for each signal type, supply the characteristics (pulse width, pulse repetition interval, number of pulses per burst, modulation).	Supplied - Radar type 0 for client with no radar detection
e	For selecting the waveform parameters from within the bounds of the signal type, describe how they were selected (i.e., manually or randomly).	Radar type 0 setup with arbitrary waveform generator pulse function
f	Channel loading description including data type, timing plots, percentage of channel loading calculation, and protocol.	FTP channel loading - plots supplied
4	The DFS tests are to be performed on U-NII Channel(s). Refer to Table 2 for additional requirements for devices with multiple bandwidth modes.	20 MHz channels only
i	List each Channel frequency that was used for the tests.	5580 and 5660 MHz
ii	Data Sheet showing the U-NII Detection Bandwidth for the Channel(s) used during the test.	Not applicable - device client only
iii	Plot of RF measurement system showing its nominal noise floor in the same bandwidth which is used to perform the Channel Availability Check, initial radar bursts, In-Service Monitoring, and 30 minute Non-Occupancy Period tests.	Supplied
5	Timing plot(s) showing compliance with the Channel Availability Check Time requirement of 60 seconds at start up.	Not applicable - device client only
a	The plot should show the Initial Tpower-up time.	Not applicable - device client only
b	The plot should include the Initial Tpower-up period in addition to 60 second period.	Not applicable - device client only
6	Timing plot(s) showing compliance with the Initial DFS radar detection requirements during the 60 second initial Channel Availability Check at start up.	Not applicable - device client only
a	Plot for DFS radar detection for Radar Waveforms applied 6 seconds after the Initial Tpower-up time period. The minimum length of the plot should be 1.5 minutes after the Tpower-up time period. The plot should show the radar burst at the appropriate time. This test is only required once and Radar Type 0 should be used for the test.	Not applicable - device client only
b	Plot for DFS radar detection for Radar Waveforms applied 6 seconds before end of the 60 second Channel Availability Check Time. The minimum length of the plot should be 1.5 minutes after the Tpower-up time period. The plot should show the radar burst at the appropriate time. This test is only required once and Radar Types 0 should be used for the test.	Not applicable - device client only
c	The minimum time resolution of the plots should be sufficient to show the Radar Waveform bursts (overall, not individual pulses within the burst).	Confirmed

Section 8.3 (cont.)

7	Verification that when the device is "off" that the RF energy emitted is below the FCC rules for unintentional radiators: For the plots of U-NII RF activity versus time, the device is considered to be "off" or not transmitting when intentional U-NII signals (beacons, data packets or transmissions, or control signals) are below the FCC rules for unintentional radiation due to device leakage, oscillator noise, clocks, and other unintentional RF generators.	Confirmed
8	Spectrum Analyzer, VSA, or some other data gathering Instrument plots showing compliance with the Channel Move Time requirements during in the In-Service Monitoring. The plots need to show U-NII device transmissions on the Channel in the form of RF activity on the vertical axis versus time on the horizontal axis. Only one 10 second plot needs to be reported for Radar Type 0. The plot for the Short Pulse Radar Types should start at the end of the radar burst. The Channel Move Time will be calculated based on the plot of Radar Type 0. The plots need to show U-NII device transmissions on the Channel in the form of RF activity on the vertical axis versus time on the horizontal axis. Sufficient resolution should be used.	Supplied
a	The plots and/or data must show the U-NII Device's compliance with the 200 milliseconds limit on data transmission and compliance with the 60 millisecond aggregate limit found in Table 4.	Supplied
b	Indicate the total number of times the test was performed.	Radar type 0 only
c	Indicate a detect/not detect for each waveform within a signal type and the number of failures and the number of successful radar detection times within the time limit. Sample data sheets are shown in Tables 8-11.	Not applicable - device client only
d	Verify compliance with the minimum percentage of successful detection requirements found in Tables 5-7.	Not applicable - device client only
9	Spectrum Analyzer plot(s) showing compliance with the 30 minute Non-Occupancy Period requirement. Only one plot is required. This is a separate test that is performed in addition to the other In-Service Monitoring tests.	Supplied

Appendix C - References

Publication	Year	Title
FCC CFR Parts 0-15	2015	Code of Federal Regulations – Telecommunications
RSS-247 Issue 1	2015	Digital Transmissions Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-GEN Issue 4	2014	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing Unlicensed Wireless Devices
FCC KDB 905462 D02	2014	UNII DFS Compliance Procedures New Rules v01r02

END OF REPORT

Date	Version	Comments	Person
6-30-15	V0	Initial Draft Release	Adam A
7-1-15	V1	Final Release	Adam A
7-23-15	V1a	TCB Comments addressed	Adam A