Test Report Issued Under the Responsibility of:

ITC ENGINEERING SERVICES, INC.

FCC CFR Title 47 Part E15.407	
Report Reference No. ..... :	20151015-01R-7 Glasses_DFS
Date of Issue .....:	1/15/2016
Total Number of Pages.....:	15
Testing Laboratory..... :	ITC Engineering Services, Inc.
Address .....:	9959 Calaveras Road, Box 543, Sunol CA 94586
Applicant's Name ..... :	Osterhout Design Group
Address .....:	153 Townsend Street, Suite 570, San Francisco, CA USA 94107
Contact.....:	Mr. Brian Donnelly
Phone .....:	415-644-4000
Fax .....:	415-644-4039
Test Specification Standard ..... :	FCC CFR Title 47 Part 15.407 **KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02.** KDB 789033 D02 General UNII Test Procedures New Rules v01
Test Procedure .....:	**KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02.**
Judgment .....:	Complies as tested
Test Item Description ..... :	802.11 b/g/n, Bluetooth 4.1 Smart, 802.11n 5GHz (BW 20MHz), GPS/GLONASS Enabled Augmentation Eyewear
Manufacturer Logo .....:	
Manufacturer .....:	Osterhout Design Group
Model/Type Reference .....:	R-7 Glasses
RF Operating Frequency Bands .....:	2.402 - 2.48 GHz, 5.18 - 5.240 GHz, 5.260 – 5.320 GHz, 5.500 – 5.700 GHz, 5.745 – 5.825 GHz (only BW20MHz for 5 GHz wifi)

Table of Contents

TABLE OF FIGURES 6
LIST OF TABLES 8
1 DOCUMENTATION 4
1.1 Testing Location 4
1.2 Declaration/Disclaimer 4
1.3 Revision History 4
01/14/16 4
Tested Channel Move Time, Close Time and Non Occupancy 4
1.4 Condition of EUT 4
1.5 General Description of EUT 5
1.6 Operational Description of EUT 5
1.7 List of Applicant Peripherals/ Supporting Equipment Used During Test 5
1.8 General Test Remarks 6
1.9 Summary of Tests 6
1.10 Measurement Uncertainty 6
1.11 Test Setup Photos 7
2 NON-OCCUPANCY PER FCC PART 15.407 AND KDB 905462 D02 V01R02 8
2.1 Administrative andEnvironmental Details 8
2.2 Test Equipment 8
2.3 Test Set up Photo 8
2.4 Limits/Requirements 8
2.5 Test Description and Procedure 8
2.6 Non-Occupancy Test Data 9
2.7 Non-Occupancy Plots 10
3 CHANNEL CLOSING TIME PER FCC PART 15.407 AND KDB905462 D02 V01R02 11
3.1 Administrative and Environmental Details 11
3.2 Test Equipment 11
3.3 Test Set up Photo 11
3.4 Limits/Requirements 11
3.5 Test Description and Procedure 11
3.6 Channel Closing Time Test Data 11
3.7 Channel Closing Time Plots 12
4 CHANNEL MOVE TIME PER FCC PART 15.407 AND KDB905462 D02 V01R02 13
4.1 Administrative and Environmental Details 13
4.2 Test Equipment 13
4.3 Test Set up Photo 13
4.4 Limits/Requirements 13
4.5 Test Description and Procedure 13
4.6 Channel Move Time Test Data 13
4.7 Channel Move Time Plots 14
5 APPENDIX 15
5.1 EUT Technical Specification 15
5.2 EUT Photos- attached in the submittal documents 15

Table of Figures

Figure 1: Conducted Test Setup 7
Figure 2: 4 Port Power Splitter Test Setup 7
Figure3: Setup for DFS Conducted Measurements where the EUT 7
Figure 4: Radar Pulse Type 0 9
Figure 5: U-NII-2A Non-Occupancy (Channel 60) 10
Figure 6: U-NII-2C Non-Occupancy (Channel 100) 10
Figure 7: U-NII-2A Channel Closing Time(Channel 60) 12
Figure 8: U-NII-2C Channel Closing Time (Channel 100) 12
Figure 9: U-NII-2A Channel Move Time (Channel 60) 14
Figure 10: U-NII-2C Channel Move Time(Channel 100) 14

1 DOCUMENTATION

1.1 Testing Location

☒ ITC Testing Laboratory:	:	ITC Engineering Services, Inc.
Testing Location/Address	:	9959 Calaveras Road, PO Box 543, Sunol, CA 94586, USA
Prepared By (Name + Signature)	:	Shane Duncan
Tested By (Name + Signature)	:	Michael Gbadebo, PE
Approved By (Name + Signature)	:	Michael Gbadebo, PE
☐ Manufacturer Facility	:	
Testing Location/Address	:	
Tested By (Name + Signature)	:	
Approved By (+ Signature)	:	
☐ 3rd Party Test Facility	:	
Testing Location/Address	:	
Tested By (Name + Signature)	:	
Approved By (+ Signature)	:	

1.2 Declaration/Disclaimer

It is the manufacturer's responsibility to assure that additional production units of these models are manufactured with identical electrical and mechanical characteristics. This report is the confidential property of the applicant. As a mutual protection to our applicants, the public, and ourselves, extracts from the test report shall not be reproduced except in full without ITC Engineering Service's written approval. The applicant/manufacturer shall not use this report to claim product endorsement by any US Government agency.

1.3 Revision History

01/14/16	Tested Channel Move Time, Close Time and Non Occupancy for both U-NII-2A and U-NII-2C pages 8, 11, 13

1.4 Condition of EUT

Equipment Under Test (EUT) was tested as it was received. For the conducted tests, the internal antenna RF cable connector is disconnected from the PCB and a suitable patch cable to the spectrum analyzer is used. The EUT WiFi is software controllable by means of a laptop and a USB connection.

1.5 General Description of EUT

Product	R-7 Glasses
Model No.	N/A
Power Supply	Internal rechargeable Lithium Polymer battery, 1300 mAH (2)
I/O Ports	Custom magnetic USB / charging receptacle
Operating Frequency Range	2.402- 2.48 GHz, 5.18- 5.825 GHz
802.11 b/g/n	
FCC ID	2ADCMR7
Modulation Type	CCK, BPSK, QPSK, 16-QAM, 64-QAM
Modulation Technology	b: DSSS; g: DSSS, OFDM; n: OFDM
Transfer Rate	b: 1-11 Mbps, g: 6-54 Mbps, n: 7.2-72.2 Mbps (20 MHz channel)
Number of Channels	11
Maximum Output Power	+20dBm
Bluetooth 4.1 Smart	
FCC ID	2ADCMR7
Modulation Type	GFSK (1 Mbps)
Modulation Technology	FHSS, AFH
Transfer Rate	1 Mbps
Number of Channels	40
Maximum Output Power	0 dBm typ.
802.11n (5 GHz , BW 20 MHz)	
FCC ID	2ADCMR7
Modulation Type	CCK, BPSK, QPSK, 16-QAM, 64-QAM
Modulation Technology	n: OFDM
Transfer Rate	n: 7.2-72.2 Mbps (BW 20 MHz only)
Number of Channels	45
Maximum Output Power	+11 to +16 dBm typ.
Antenna	
Antenna Type	Chip antenna
Antenna Gain, Peak	1.5
Radiation Pattern	Omni-directional

1.6 Operational Description of EUT

The R-7 Smart Glasses offers immersive 3D HD viewing of stored or streaming video content, with stereo audio, in a static setting, or in a head orientation tracking augmented vision mode.
For 5 GHz bands, The EUT operates under 802.11n BW 20 MHz only.

1.7 List of Applicant Peripherals/ Supporting Equipment Used During Test

Description	Manufacturer	Model Name	Serial Number
Laptop	Apple	MacBook Pro	N/A*
AC Adapter	Apple	N/A*	N/A*
WiFi Master AP	Juniper	WLA322	N/A

*N/A- Not Applicable

1.8 General Test Remarks

The EUT was operated under the following conditions during the testing:

☐	Standby	☐	Test Program (H – Pattern)
☐	Test Program (Color Bar)	☐	Test Program (Applicant Specific)
☐	TV/VCR Signal Input	☐	Signal Generator Input
☐	Continuous Audio Tone (1kHz)	☐	Cycled Audio Tone (1kHz)
☐	Printer/Parallel Function	☐	Modem/Serial Function
☐	Serpentine Program with I/O	☐	Serpentine Program without I/O
☐	Practice Operation	☐	Normal Operating Mode
☐	Essential Operation (Functional Safety)	☐	Continuous Unmonitored Operation
☒	Continuous Monitored Operation	☐	Non-Continuous Operation

The requirements according to the technical regulations are:

☒	Met	☐	Not Met

The Equipment Under Test does:

☒	Fulfill the general approval requirements	☐	Not fulfill the general approval requirements

1.9 Summary of Tests

ITC Engineering Services, Inc. as an independent testing laboratory, declares that the equipment specified above was tested to the requirements of:

Section of FCC Title 47 CFR	Test Description	Result
15.407 and KDB 905462 D02 v01r02	Non-Occupancy	Passed
15.407 and KDB 905462 D02 v01r02	Channel Move Time	Passed
15.407 and KDB 905462 D02 v01r02	Channel Close Time	Passed

Note : This EUT is a client device without radar detection capability.
This EUT operates under 802.11n BW 20MHz mode only.

1.10 Measurement Uncertainty

The measurement of uncertainty levels were estimated based on calculation in accordance with TR 100-028-1. Using the value k = 2 for expanded uncertainty, this provides a 95% level of confidence.

	Measurement Method	Calculated Uncertainty (dB)
1	RF Conducted	± 1.5

1.11 Test Setup Photos

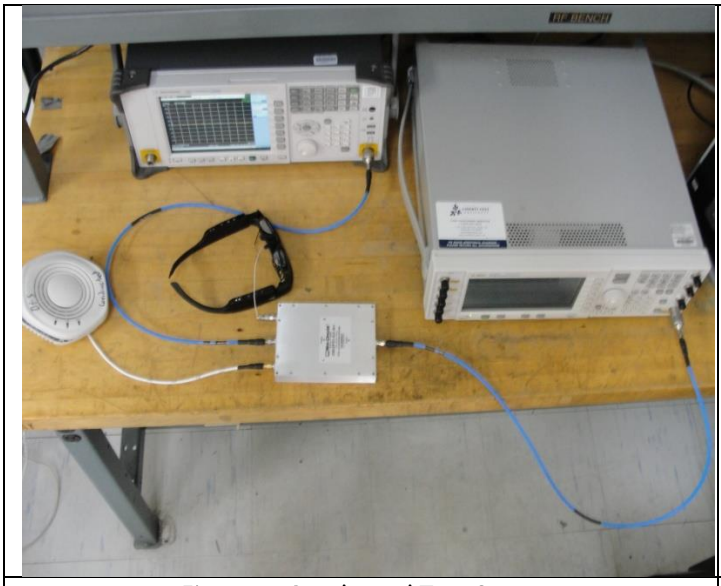

Figure 1: Conducted Test Setup

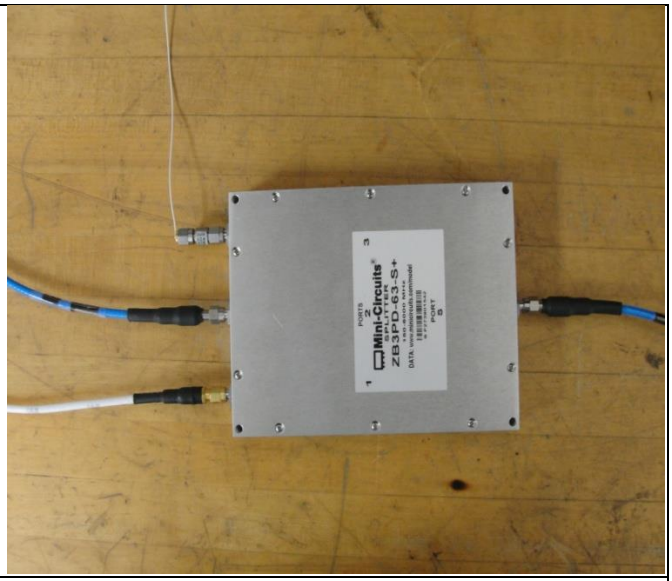

Figure 2: 4 Port Power Splitter Test Setup

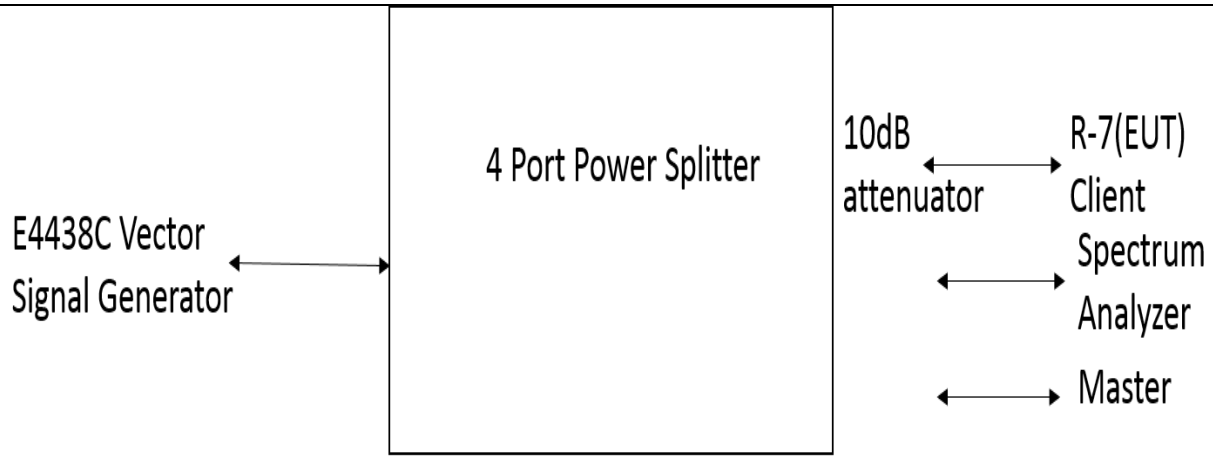

Figure3: Setup for DFS Conducted Measurements where the EUT is the Client without radar detection capability

2 Non-Occupancy Per FCC Part 15.407 and KDB 905462 D02 v01r02

2.1 Administrative andEnvironmental Details

Site Used:	EMC LAB 2A
Test Date:	12/5/15, 1/13/16
Test Engineer:	Michael Gbadebo
Temperature	20°C
Humidity:	47%

2.2 Test Equipment

Equipment Description	Mfg.	Model #	Serial #	Cal. Due Date	Cal. Interval
EMC Analyzer	Agilent	E7402A	MY45112375	7/16/16	2 yr
Vector Signal Generator	Agilent	E4438C	MY47271103	10/12/17	2 yr
Spectrum Analyzer	Rhode & Schwarz	FSU 20Hz-8Ghz	200235	9/25/16	1 yr
4 port power splitter	Mini-circuits	ZB-3PD-63-S+	SF273901542	NA*	NA
Desktop PC	HP	PJ518AAR	CNY44003QK	NA*	NA
Mouse	Microsoft	Optical USB	X802382	NA*	NA
10dB attenuator	Weinschel Corp	3330-10	B9029	NA*	NA

*NA- Not Applicable

2.3 Test Set up Photo

Refer to Figures 1,2,3.

2.4 Limits/Requirements

EUT as a client device is monitored for more than 30 minutes following the channel close/move time to verify no transmissions resume on this Channel.

2.5 Test Description and Procedure

The EUT is a client device without radar detection capability. The master access point allowed the client to operate at 5.3 and 5.5 GHz. The master was connected to a 4 port power splitter with the client (R-7 EUT), as long as the vector signal generator(radar waveforms), and the spectrum analyzer. A 10dB attenuator was connected to the glasses. The analyzer was set to zero-span in order to monitor the EUT for DFS testing after injecting type 0 radar bursts Into the masterdevice .

Pulse Radar Test Waveforms

Radar Type	Pulse Width(µsec)	PRI (µsec)	Number of Pulses
0	1	1428	18

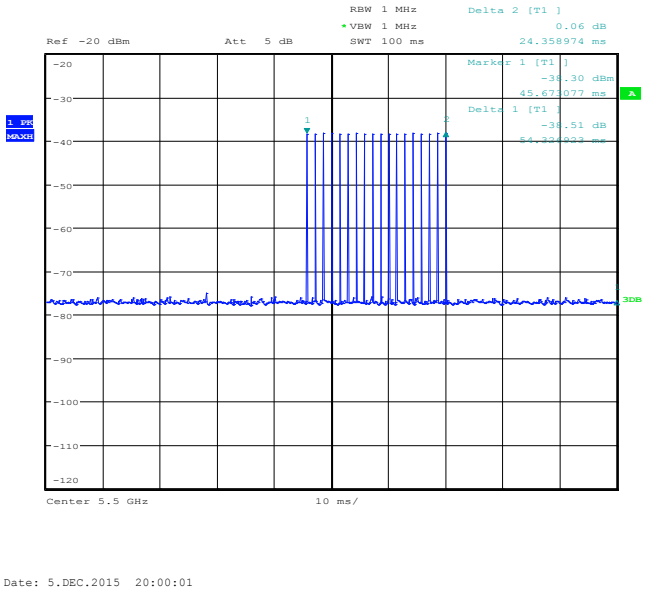

Figure 4: Radar Pulse Type 0

2.6 Non-Occupancy Test Data

U-NII-2A Non-Occupancy Measurement	Requirement Value	Result
>30 minutes	> 30 minutes	Pass

U-NII-2C Non-Occupancy Measurement	Requirement Value	Result
>30 minutes	> 30 minutes	Pass

2.7 Non-Occupancy Plots

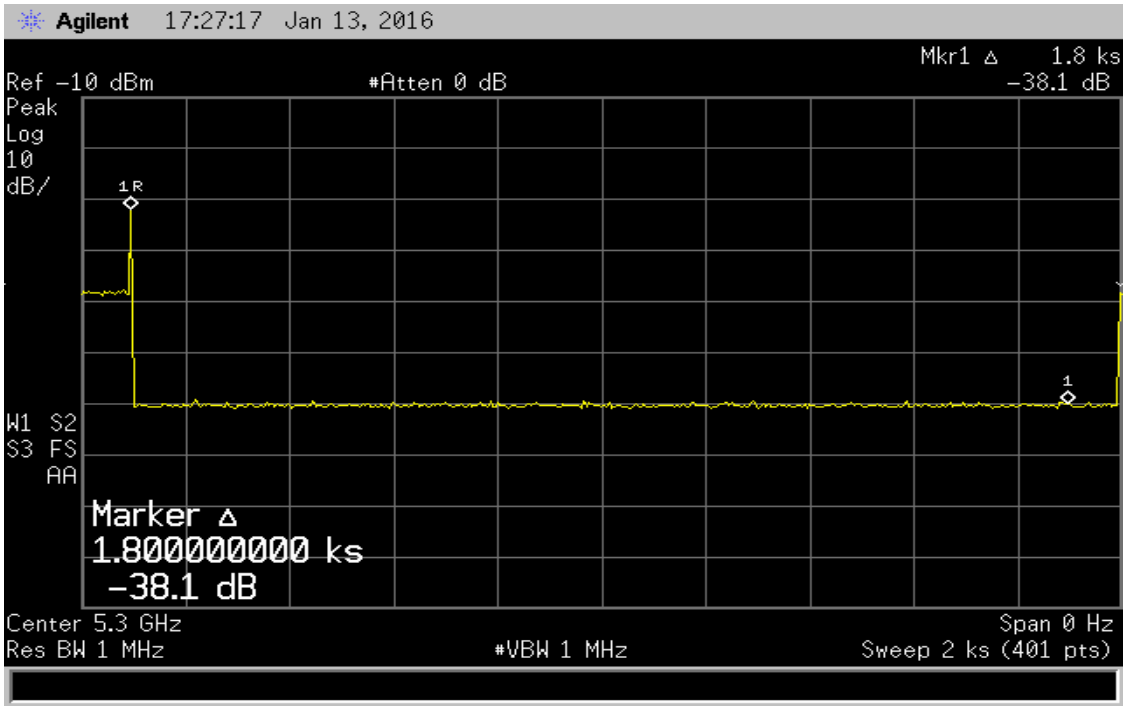

Figure 5: U-NII-2A Non-Occupancy (Channel 60)

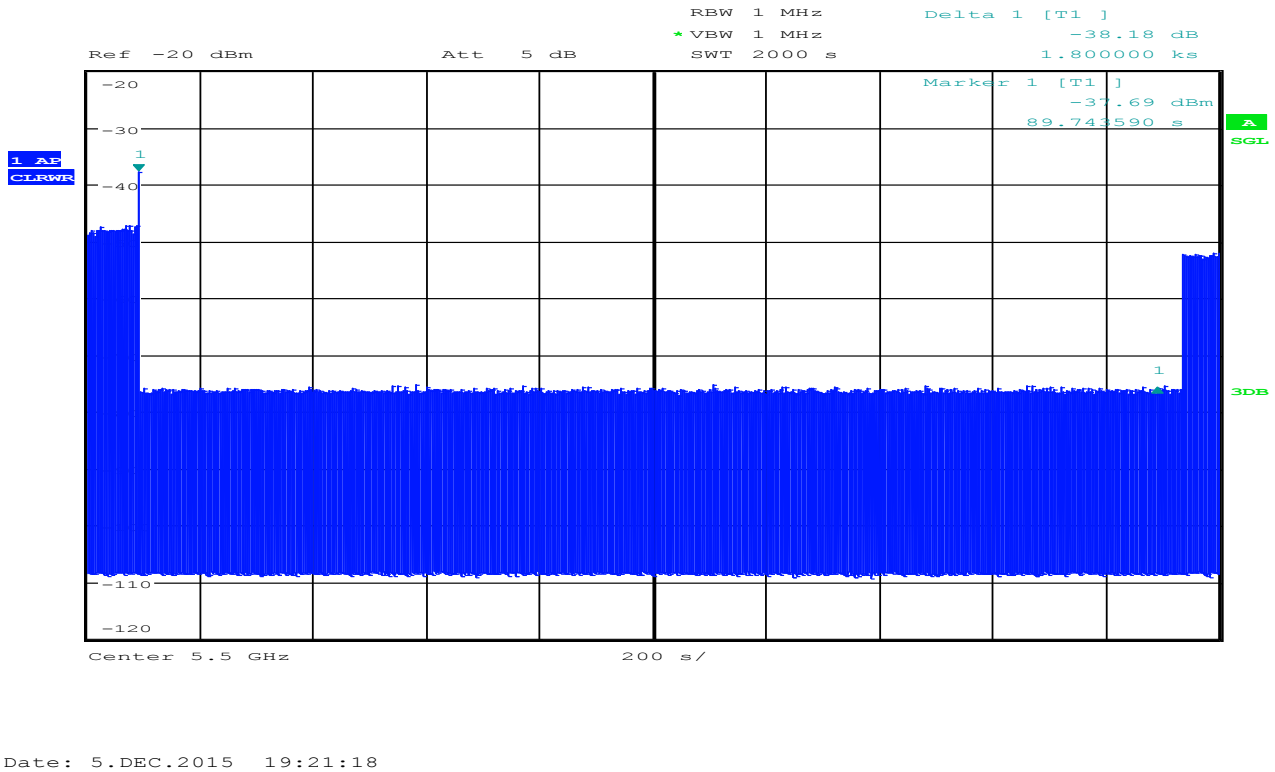

Figure 6: U-NII-2C Non-Occupancy (Channel 100)

3 Channel Closing Time Per FCC part 15.407 and KDB905462 D02 v01r02

3.1 Administrative and Environmental Details

Site Used:	EMC LAB 2A
Test Date:	12/5/15, 1/13/16
Test Engineer:	Michael Gbadebo
Temperature	20°C
Humidity:	47%

3.2 Test Equipment

Equipment Description	Mfg.	Model #	Serial #	Cal. Due Date	Cal. Interval
EMC Analyzer	Agilent	E7402A	MY45112375	7/16/16	2 yr
Vector Signal Generator	Agilent	E4438C	MY47271103	10/12/17	2 yr
Spectrum Analyzer	Rhode & Schwarz	FSU 20Hz-8Ghz	200235	9/25/16	1 yr
4 port power splitter	Mini-circuits	ZB-3PD-63-S+	SF273901542	NA*	NA
Desktop PC	HP	PJ518AAR	CNY44003QK	NA*	NA
Mouse	Microsoft	Optical USB	X802382	NA*	NA
10dB attenuator	Weinschel Corp	3330-10	B9029	NA*	NA

*NA- Not Applicable

3.3 Test Set up Photo

Refer to Figures 1,2,3.

3.4 Limits/Requirements

After Master AP is injected with a radar signal, EUT as a client must stop operating on that channel within 260 ms , the measurement timing begins at the end of the Radar Type 0 burst.

3.5 Test Description and Procedure

A Type 0radar signal was injected into the Master associated with the EUT.The test system was set-up to capture all transmission data for EUT events. The test equipment time stamps all captured events with respect to T1 (zero time indicating the start of the measurements sequence) followed by the radar type 0 burst period.

Radar Type 0 burst period: 25.704 ms

Channel Closing Transmission Time starts immediately after the last radar pulse is injected.
The EUT needs to demonstrate closing transmissions on the channel once a DFS radar pulse is injected into the Master AP.

3.6 Channel Closing Time Test Data

U-NII-2A Channel Closing Time Measurement	Requirement Value	Result
20ms	<260 ms	Pass

U-NII-2C Channel Closing Time Measurement	Requirement Value	Result
40ms	<260 ms	Pass

Note : After the Type 0 radar burst was injected into the Master, the EUT as a client shut down .

3.7 Channel Closing Time Plots

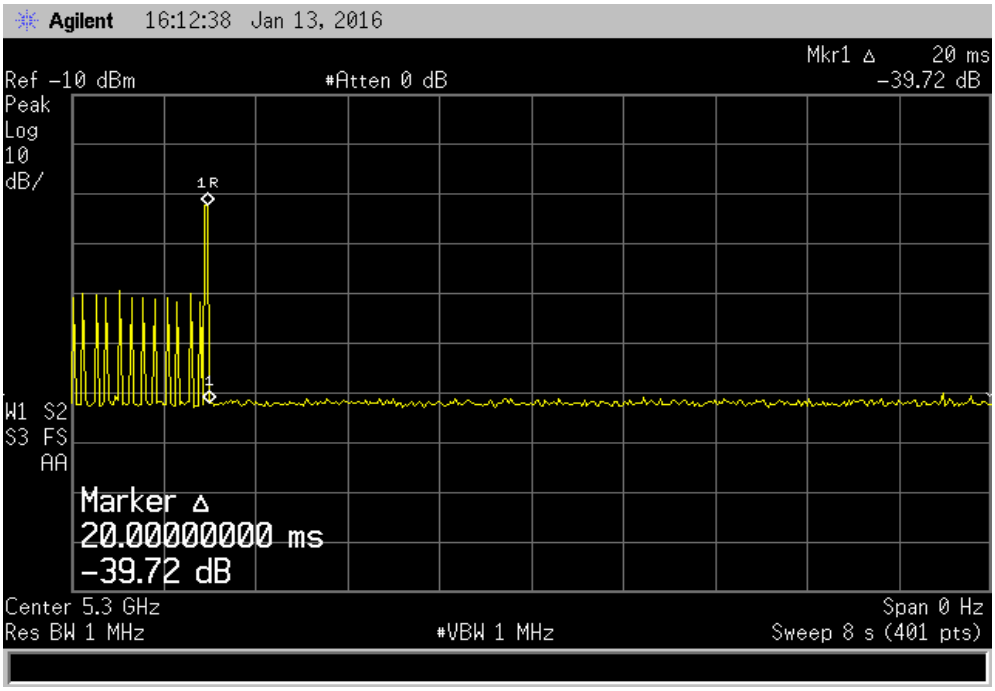

Figure 7: U-NII-2A Channel Closing Time(Channel 60)

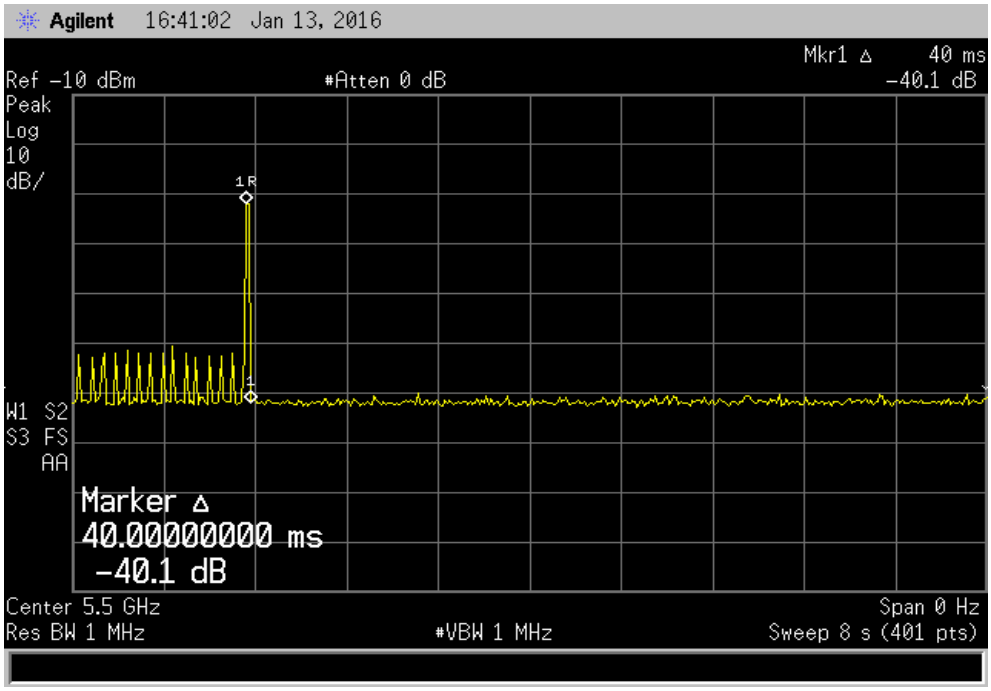

Figure 8: U-NII-2C Channel Closing Time
(Channel 100 Shown)

4 Channel Move Time Per FCC part 15.407 and KDB905462 D02 v01r02

4.1 Administrative and Environmental Details

Site Used:	EMC LAB 2A
Test Date:	12/5/15, 1/13/16
Test Engineer:	Michael Gbadebo
Temperature	20°C
Humidity:	47%

4.2 Test Equipment

Equipment Description	Mfg.	Model #	Serial #	Cal. Due Date	Cal. Interval
EMC Analyzer	Agilent	E7402A	MY45112375	7/16/16	2 yr
Vector Signal Generator	Agilent	E4438C	MY47271103	10/12/17	2 yr
Spectrum Analyzer	Rhode & Schwarz	FSU 20Hz-8Ghz	200235	9/25/16	1 yr
4 port power splitter	Mini-circuits	ZB-3PD-63-S+	SF273901542	NA*	NA
Desktop PC	HP	PJ518AAR	CNY44003QK	NA*	NA
Mouse	Microsoft	Optical USB	X802382	NA*	NA
10dB attenuator	Weinschel Corp	3330-10	B9029	NA*	NA

*NA- Not Applicable

4.3 Test Set up Photo

Refer to Figures 1,2,3.

4.4 Limits/Requirements

After Master AP is injected to a radar signal, EUT as a client must move channel or shut down within 10 seconds , measurement timing begins at the end of the Radar Type 0 burst.

4.5 Test Description and Procedure

A Type 0radar signal was injected to the Master associated with the EUT.The test system was set-up to capture all transmission and beacon for EUT events. The test equipment time stamps all captured events with respect to T1 (zero time indicating the start of the measurements sequence) at the end of the radar type 0 burst , and a 10 second period was monitored.

Radar Type 0 burst period: 25.704 ms.

4.6 Channel Move Time Test Data

U-NII-2A Channel Move Time Measurement	Requirement Value	Result
75 ms	< 10 s	Pass

U-NII-2C Channel Move Time Measurement	Requirement Value	Result
48.1 ms	< 10 s	Pass

Note : After the Type 0 radar burst was injected into the Master, this EUT as a client shut down .

4.7 Channel Move Time Plots

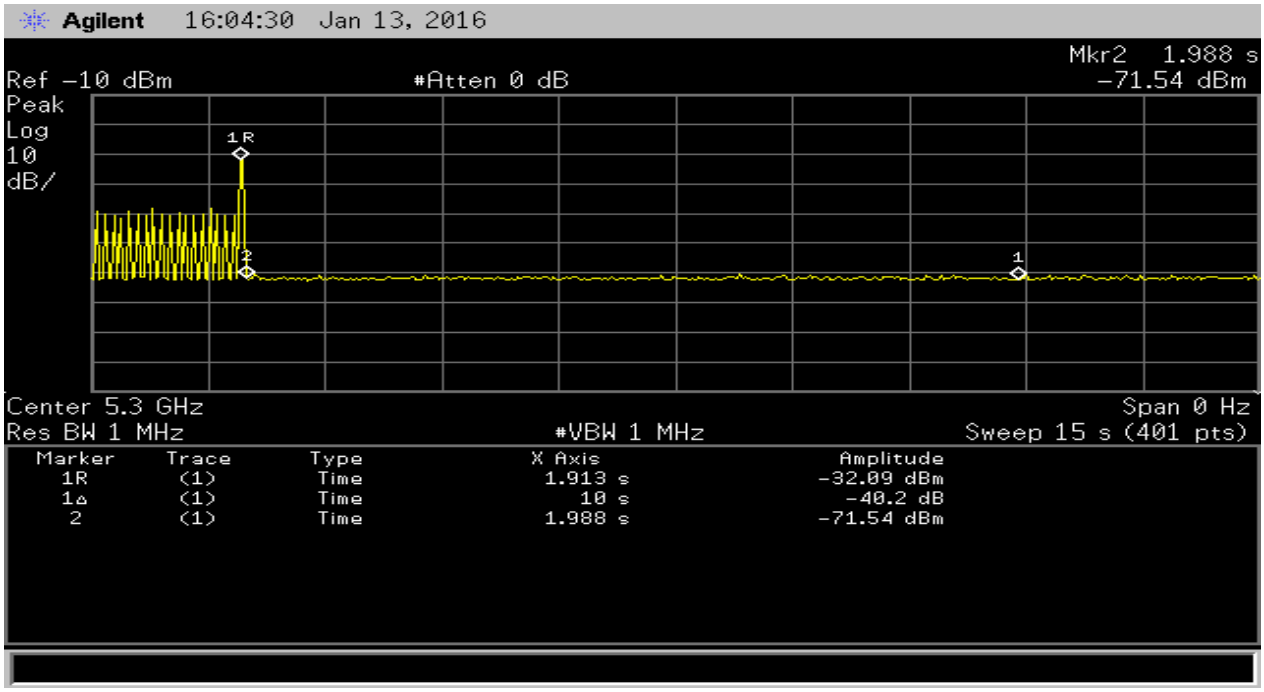

Figure 9: U-NII-2A Channel Move Time(Channel 60)

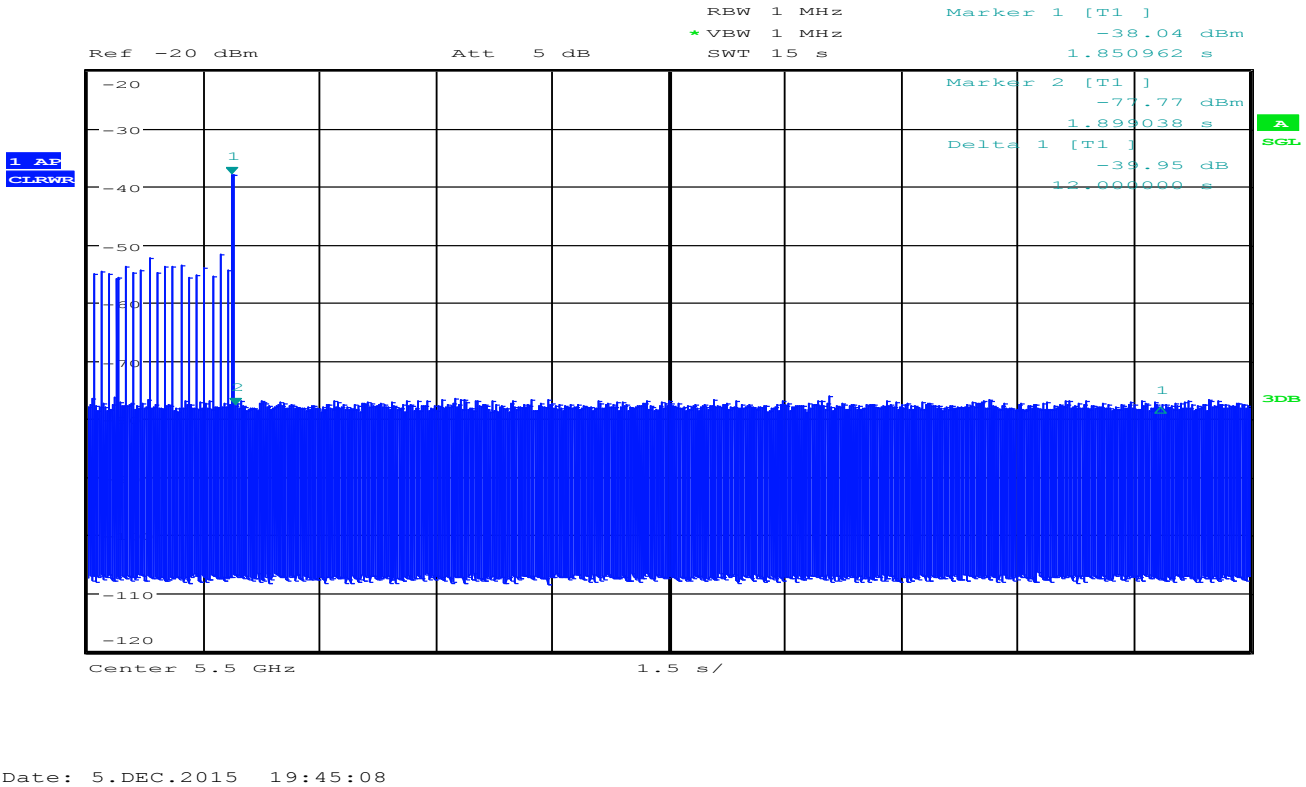

Figure 10: U-NII-2C Channel Move Time(Channel 100)

5 APPENDIX

5.1 EUT Technical Specification

Manufacturer:	Osterhout Design Group		
General Description:	The R-7 Smart Glasses offers immersive 3D HD viewing of stored or streaming video content, with stereo audio, in a static setting, or in a head orientation tracking augmented vision mode.		
EUT Name:	Smart Glasses	**Model:**	R-7
Dimensions:	19cm x 14cm x 4.5cm	**Serial Number:**	R7-P12
Operating Frequency:	2.402 - 2.48 GHz, 5.18 - 5.240 GHz, 5.260 – 5.320 GHz, 5.500 – 5.700 GHz, 5.745 – 5.825 GHz (only 802.11n 20 MHz BW for5 GHz wifi)	**Power Cord Type:**	☐ Shielded ☒ Un-Shielded

5.2 EUT Photos- attached in the submittal documents