

NORTHWEST EMC

ZOLL Medical Corp.

X Series

FCC 15.407:2016

802.11an SISO Radio

Report # LGPD0171.2



NVLAP Lab Code: 200881-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

CERTIFICATE OF TEST

Last Date of Test: March 23, 2016
ZOLL Medical Corp.
Model: X Series

Radio Equipment Testing

Standards

Specification	Method
FCC 15.407:2016	905462 D02 UNII DFS Compliance Procedures New Rules v01r02

Results

Method Clause	Test Description	Applied	Results	Comments
KDB 905462 -7.7	Channel Loading/Channel Utilization	Yes	Pass	
KDB 905462 -7.8.1	Detection Bandwidth	No	N/A	Not required if EUT does not support DFS Bands or device is a "Client".
KDB 905462 -7.8.2	Channel Availability Check	No	N/A	Not required if EUT does not support DFS Bands or device is a "Client".
KDB 905462 -7.8.3	Move Time	Yes	Pass	
KDB 905462 -7.8.3	Closing Time	Yes	Pass	
KDB 905462 -7.8.3	Non Occupancy Period	Yes	Pass	
KDB 905462 -7.8.4	Statistical Performance	No	N/A	Not required if EUT does not support DFS Bands or device is a "Client".

Deviations From Test Standards

None

Approved By:



Jeremiah Darden, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

Revision Number		Description	Date	Page Number
00		None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

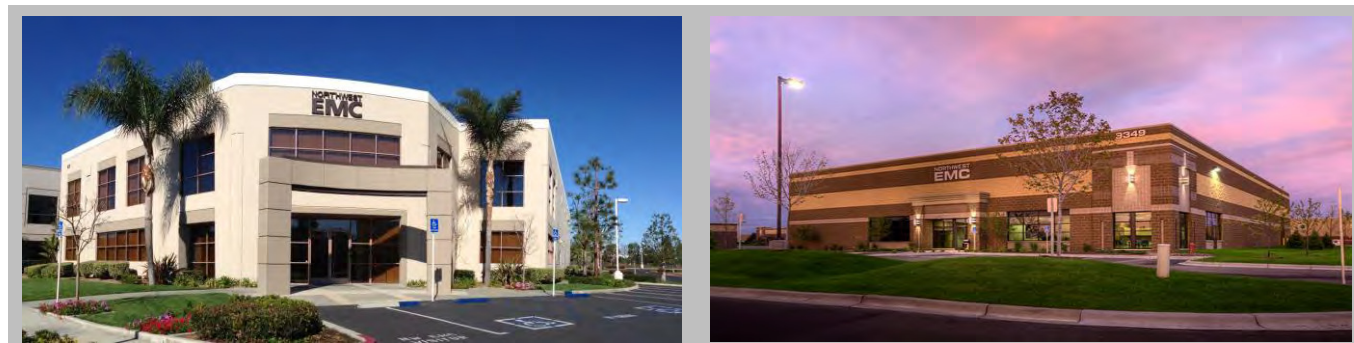
MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

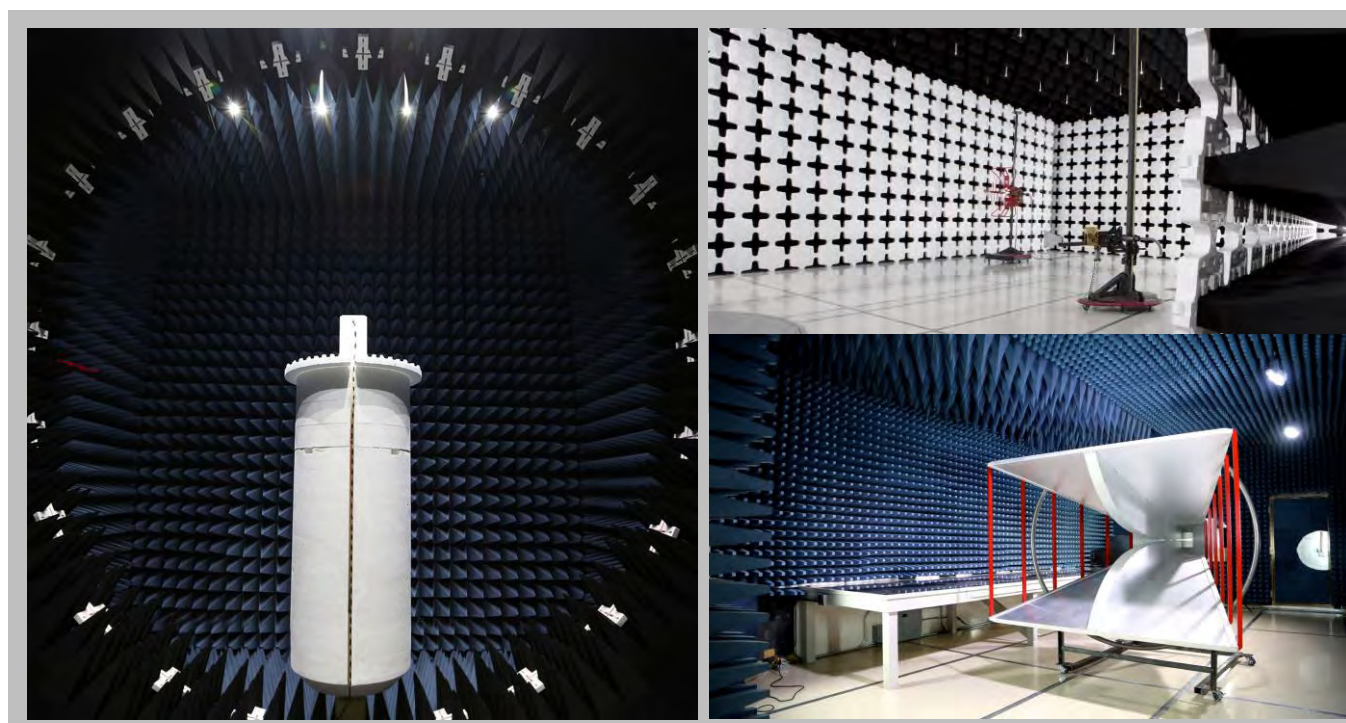
For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>
<http://gsi.nist.gov/global/docs/cabs/designations.html>

FACILITIES



California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Industry Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	ZOLL Medical Corp.
Address:	269 Mill Road
City, State, Zip:	Chelmsford, MA 01824
Test Requested By:	Adam Ford with Logic PD
Model:	X Series
First Date of Test:	March 23, 2016
Last Date of Test:	March 23, 2016
Receipt Date of Samples:	February 23, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Information Provided by the Party Requesting the Test

List all antenna assemblies and their corresponding gains.

1. 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.
2. 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.
 - a. Indicate the calibrated conducted DFS Detection Threshold level.
 - b. For devices with adjustable output power, list the output power range and the maximum EIRP for each antenna assembly.
 - c. 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.
3. Antenna gain measurement verification for tested antenna.
 - a. Describe procedure
 - b. Describe the antenna configuration and how it is mounted
 - c. 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.

The EUT has one 50 ohm antenna port for 2.4 GHz Wi-Fi that is shared with Bluetooth and one 50 ohm antenna port for 5 GHz Wi-Fi. All DFS testing was done on the 5 GHz port. The 5 GHz antenna is a ¼ wave monopole with the following gains: 2.2 dBi at 5320 MHz, 2.4 dBi at 5500 MHz, 2.7 dBi at 5700 MHz

Functional Description of the EUT (Equipment Under Test):

802.11abgn SISO operating with 20 MHz Channel Bandwidth.

The operating modes (Master and/or Client) of the U-NII device.

Client device with no ad-hoc capability.

For Client devices, indicate whether or not it has DFS Radar detection capabilities.

The client device does not have radar detection capabilities.

System architectures, data rates, U-NII Channel bandwidths.

1. 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.

The client device (EUT) employs IP based system architecture. 20 MHz Channel Bandwidth only.

PRODUCT DESCRIPTION

Applicable only to devices with Radar detection capabilities: The time required for the Master Device or Client Device (with radar detection) to complete its power-on cycle.

Power on Cycle is approximately 30 seconds

Hardware, Firmware, and OS Versions:

Linux 3.0

Wlcore firmware 6.3.10.0.139

The operating frequency band(s) of the equipment.

5150 – 5250 MHz, 5250 - 5350 MHz (DFS Band), 5470 - 5725 MHz (DFS Band), 5725 – 5850 MHz

List the highest and the lowest possible power level (equivalent isotropic radiated power (EIRP) of the equipment.

High: 19.4 dBm, Low: 14.7 dBm

Test sequences or messages that should be used for communication between Master and Client Devices, which are used for loading the Channel.

1. 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.
2. For frame based systems with fixed talk/listen ratio, set the ratio to 45%/55% and stream the test file from the Master to the Client.
3. For other system architectures, supply appropriate Channel loading methodology.

lperf is an IP based performance measurement. It can stream data from one device to another.

It can also adjust the amount load placed on the network.

Transmit Power Control description.

This device does not exceed 27dBm EIRP, so no transmit power control is implemented

Applicable only to devices with Radar detection capabilities: Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user.

N/A (No radar detection capabilities)

Applicable only to Master devices: Uniform Channel Spreading requirement for Master Devices. For Master Devices, indicate how the master provides, on aggregate, uniform Channel loading of the spectrum across all Channels.

N/A (client only)

For Client devices, indicate the FCC (and IC) identifier for the Master U-NII Device that is used with it for DFS testing.

Cisco Access Point, TIV. FCC ID for the 5 GHz Radio is LDK102061. IC: 2461B-102061. Model number AIR-AP1252AG-A-K9, S/N:FTX143290HA.

CONFIGURATIONS

Configuration LGPD0171- 1

Software/Firmware Running during test					
Description				Version	
TeraTerm				Unknown	

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
X Series (Radio Module)	ZOLL Medical Corp.	ZOL02-0301R-A	1023259

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC Adapter (Laptop)	Dell	DA180PM111	CN-074X5J-48661-15V-0WZ1-A00
AC/DC Adapter (Test Laptop)	Lenovo	95P1156	None
Laptop	Dell	Latitude	Unknown
Test Laptop	Lenovo	ThinkPad	Unknown

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable (Laptop)	No	1.0m	No	AC Mains	AC Adapter
AC Power Cable (Test Laptop)	Unknown	1.5m	No	AC Mains	AC Adapter
DC Cable (Laptop)	No	1m	No	AC Adapter	Laptop
Ethernet	No	1.5m	No	Access Point	Laptop
Serial Cable	Yes	1.8m	No	Laptop	Zoll Dev Board

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2/23/2016	Channel Loading/Channel Utilization	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	2/23/2016	Move Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	2/23/2016	Closing Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	2/23/2016	Non Occupancy Period	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

Overview

For a Client Device without DFS, the Channel Move Time and Channel Closing Transmission Time requirements are verified with one Short Pulse Radar and one Long Pulse Radar. Non-occupancy period can be confirmed with either short or long pulses.

Channel Closing Transmission Time: The total duration of transmissions, consisting of data signals and the aggregate of control signals, by a U-NII device during the Channel Move Time.

Channel Move Time: The time to cease all transmissions on the current Channel upon detection of a Radar Waveform above the DFS Detection Threshold. A Client Device will not transmit before having received appropriate control signals from a Master Device. A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

Non-Occupancy Period: Time during which both the client and master device shall not make any transmissions on a channel after a radar signal was detected on that channel. It should at least the minimum requirements but it can be more.

Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirement for devices with multiple bandwidth modes	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using widest BW mode available for the link
All other tests	Any single BW mode	Not required

Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

INTRODUCTION & CLIENT DEVICE DFS CONFORMANCE

DFS Detection Thresholds for Master or Client Devices Incorporating DFS

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP $\geq$ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 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. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

DFS Response Requirement Values

Parameter	Value
Non-occupancy	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. (See Notes 1 and 2).
U-NII Detection Bandwidth	Minimum 100% of the UNII 99% transmission power bandwidth. (See Note 3).
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: 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 a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

INTRODUCTION & CLIENT DEVICE DFS CONFORMANCE

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A	(See KDB section 6.1)	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
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

Long Pulse Radar Test Waveforms

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

Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

Setting the Test Signal Level

The radar test signal level is set at the Master Device, or the Client Device with In-Service Monitoring, as appropriate for the particular test. This device is known as the Radar Detection Device (RDD). The RDD consists of the applicable device and the device antenna assembly that has the lowest antenna assembly gain of all available antenna assemblies. Depending on the UUT, the following configurations exist:

- When the Master Device is the UUT, the Master Device is the RDD.
- When a Client Device without Radar Detection is the UUT, the Master Device is the RDD.
- When a Client Device with Radar Detection is the UUT, and is tested for response to the Master Device detections, the Master Device is the RDD.
- When a Client Device with Radar Detection is the UUT, and is tested for independent response to detections by the Client Device, the Client Device is the RDD.

A spectrum analyzer is used to establish the test signal level for each radar type. During this process, there are no transmissions by either the Master Device or Client Device. The spectrum analyzer is switched to the zero span (time domain) mode at the frequency of the Radar Waveform generator. The peak detector function of the spectrum analyzer is utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) are set to at least 3 MHz.

The signal generator amplitude and/or step attenuators are set so that the power level measured at the spectrum analyzer is equal to the DFS Detection Threshold that is required for the tests. The signal generator and attenuator settings are recorded for use during the test.

Data demonstrating that the test signal level is correctly set for each radar type (0-6) will be recorded and reported.

CHANNEL LOADING UTILIZATION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Attenuator	Aeroflex/Weinschel	3053	RKM	NCR	0
Generator - Signal	Benchforge Manufacturing	Colt	TIP	NCR	0
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	0
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	0
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	NCR	0
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	NCR	0
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	5/10/2015	12
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	0

TEST DESCRIPTION

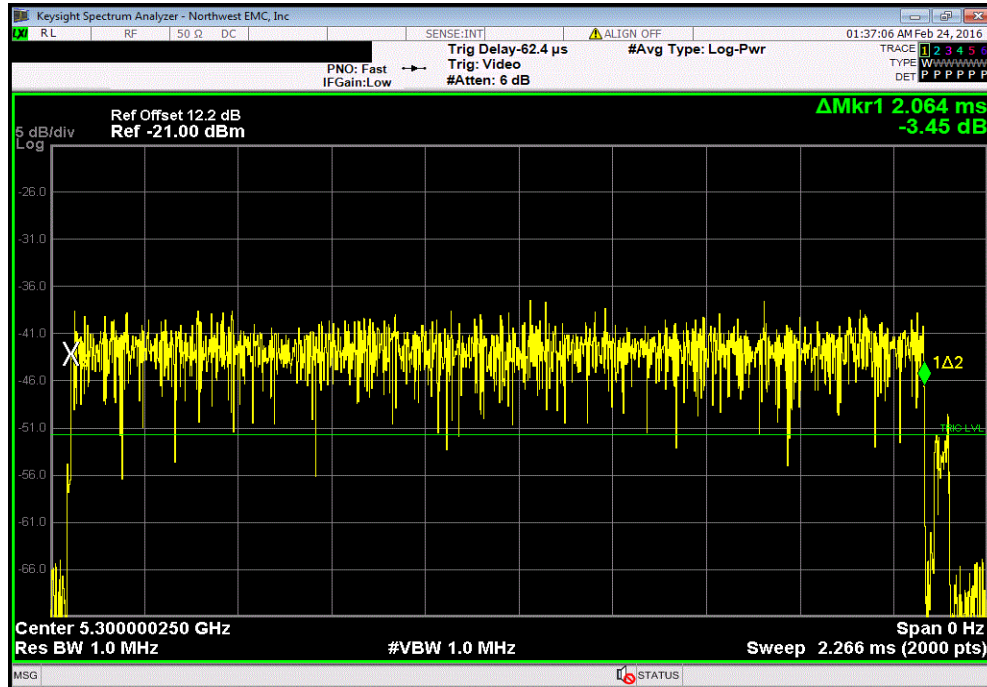
The master and client were connected using the conducted method described in the FCC KDB procedure via a series of splitters and attenuators which allows the radar signals to be injected and monitored. Where required, an approved Media file was streamed through the master and client or an alternative method to load the channel may be used instead. Channel loading requirements were verified. Configuration of the master and client devices were then monitored using the spectrum analyzer.

CHANNEL LOADING UTILIZATION

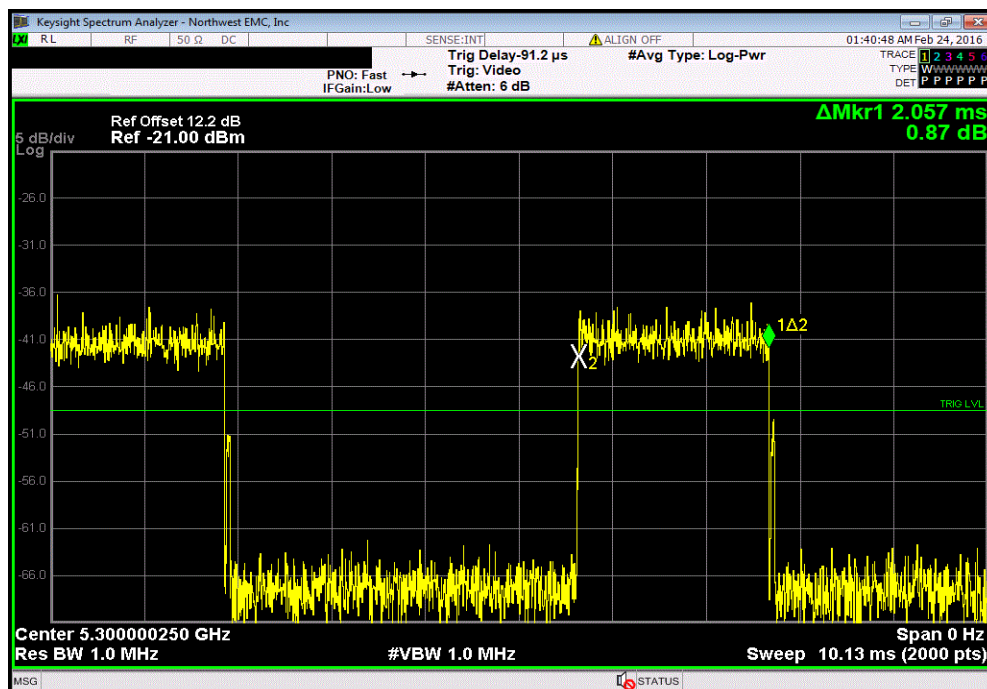
EUT: X Series		Work Order: LGPD0171	
Serial Number: 1023259		Date: 02/23/16	
Customer: ZOLL Medical Corp.		Temperature: 22°C	
Attendees: None		Humidity: 27%	
Project: None		Barometric Pres.: 985.4	
Tested by: Jared Ison	Power: 15 VDC	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 15.407:2016		Test Method	
		KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02	
COMMENTS			
EUT continuously transferring data via iperf. Data load set to 2 Mbps.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Pulse Width (ms)	Ch. Loading (%)
		Limit (%)	Result
Channel 60, 5300 MHz			
802.11(a) 6 Mbps			
	2ms Sweep	N/A	N/A
	10ms Sweep	2.057	37
	25ms Sweep	2.055	37
	100ms Sweep	2.053	37
	10s Sweep	N/A	N/A
		> 17	Pass
		> 17	Pass
		> 17	Pass
		> 17	Pass
		> 17	Pass

CHANNEL LOADING UTILIZATION

Channel 60, 5300 MHz, 802.11(a) 6 Mbps, 2ms Sweep						
	Pulse Width	Ch. Loading	Limit	Result		
	(ms)	(%)	(%)			
	N/A	N/A	> 17	Pass		

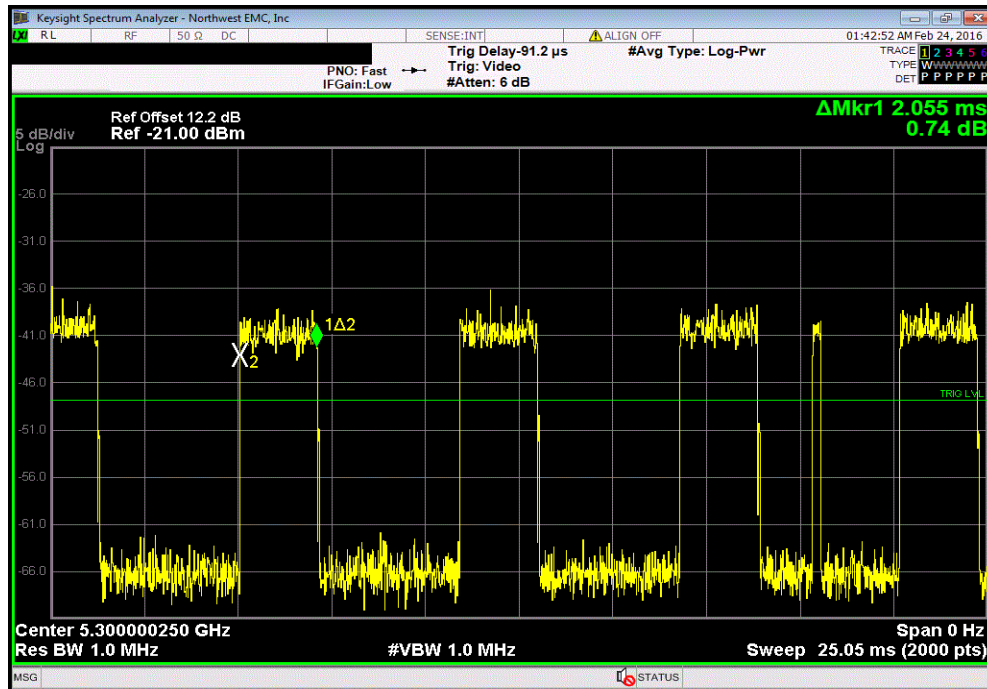


Channel 60, 5300 MHz, 802.11(a) 6 Mbps, 10ms Sweep						
	Pulse Width	Ch. Loading	Limit	Result		
	(ms)	(%)	(%)			
	2.057	37	> 17	Pass		

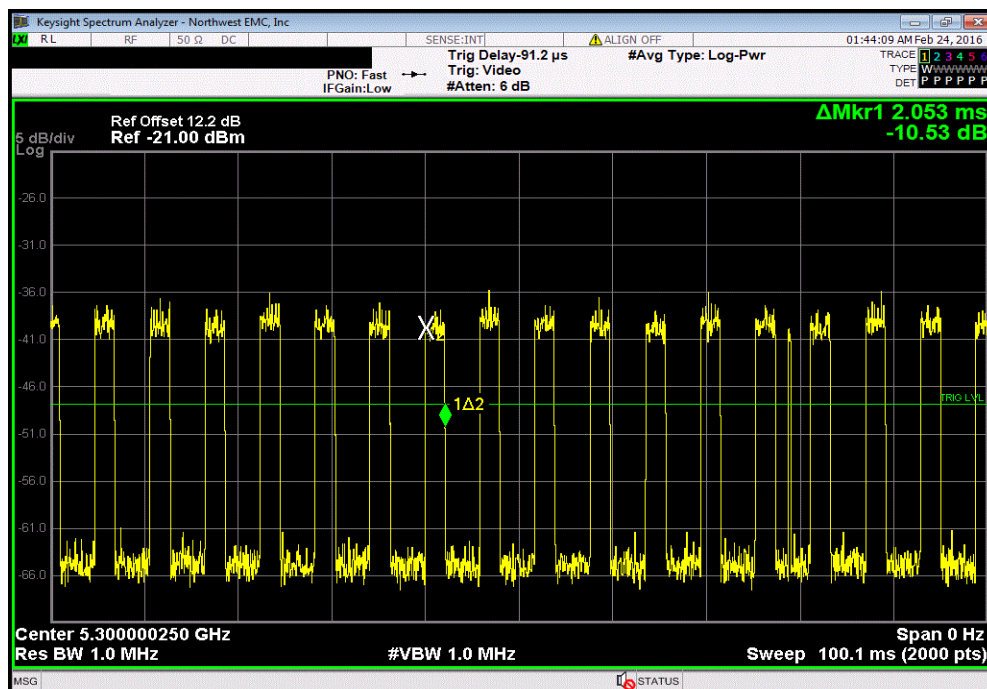


CHANNEL LOADING UTILIZATION

Channel 60, 5300 MHz, 802.11(a) 6 Mbps, 25ms Sweep						
	Pulse Width (ms)	Ch. Loading (%)	Limit (%)	Result		
	2.055	37	> 17	Pass		

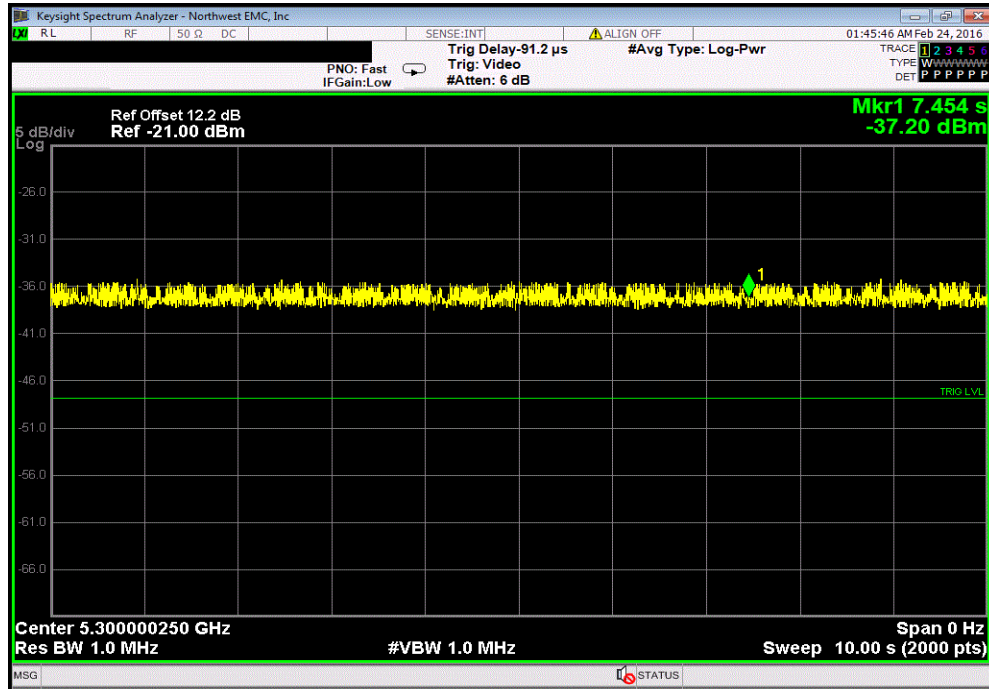


Channel 60, 5300 MHz, 802.11(a) 6 Mbps, 100ms Sweep						
	Pulse Width (ms)	Ch. Loading (%)	Limit (%)	Result		
	2.053	37	> 17	Pass		



CHANNEL LOADING UTILIZATION

Channel 60, 5300 MHz, 802.11(a) 6 Mbps, 10s Sweep						
	Pulse Width (ms)	Ch. Loading (%)	Limit (%)	Result		
	N/A	N/A	> 17	Pass		



MOVE TIME

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	0
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	0
Generator - Signal	Benchforge Manufacturing	Colt	TIP	NCR	0
Attenuator	Aeroflex/Weinschel	3053	RKN	NCR	0
Attenuator	Aeroflex/Weinschel	3053	RKM	NCR	0
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	5/10/2015	12
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	0
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	NCR	0
Current Shunt	Ohmite	TGHGCR0750FE	IAG	4/27/2015	12
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	NCR	0

TEST DESCRIPTION

The master and client were connected using the conducted method described in the FCC KDB procedure via a series of splitters and attenuators which allows the radar signals to be injected and monitored. For master devices, the detection level was set prior to testing by temporarily replacing the master device with the analyzer and setting the power level according to Table 3 and Section 7.5. Where required, an approved Media file was streamed between the master and client or an alternative method to load the channel may be used instead. Channel loading requirements were also verified prior to testing. Configuration and status of the master and client devices were then monitored using the spectrum analyzer. The Move Time test was performed by starting a transmission between the master and client device, and then injecting the appropriate radar signals and making sure both the master and client device vacate the DFS channel within the time specified by the standard.

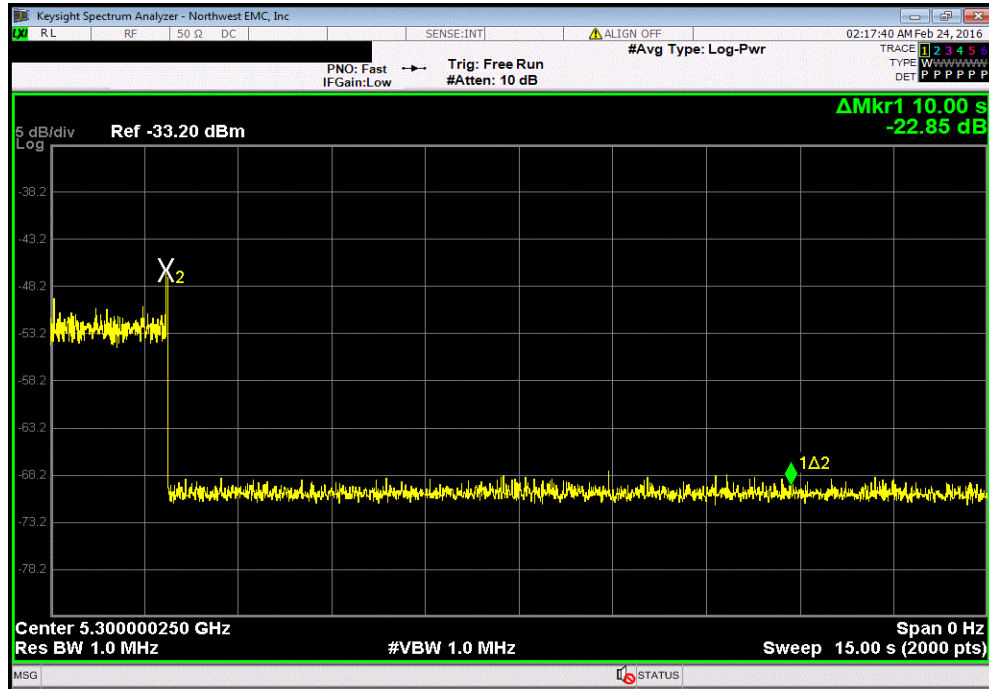
MOVE TIME

EUT: X Series		Work Order: LGPD0171	
Serial Number: 1023259		Date: 02/23/16	
Customer: ZOLL Medical Corp.		Temperature: 22°C	
Attendees: None		Humidity: 27%	
Project: None		Barometric Pres.: 985.4	
Tested by: Jared Ison	Power: 15 VDC	Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.407:2016		KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02	
COMMENTS			
EUT continuously transferring data via iperf. Data load set to 2 Mbps.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit Result
Channel 60, 5300 MHz			
802.11(a) 6 Mbps			
Radar Type 0		See Graph	< 10s Pass
Channel 112, 5560 MHz			
802.11(a) 6 Mbps			
Radar Type 0		See Graph	< 10s Pass

MOVE TIME

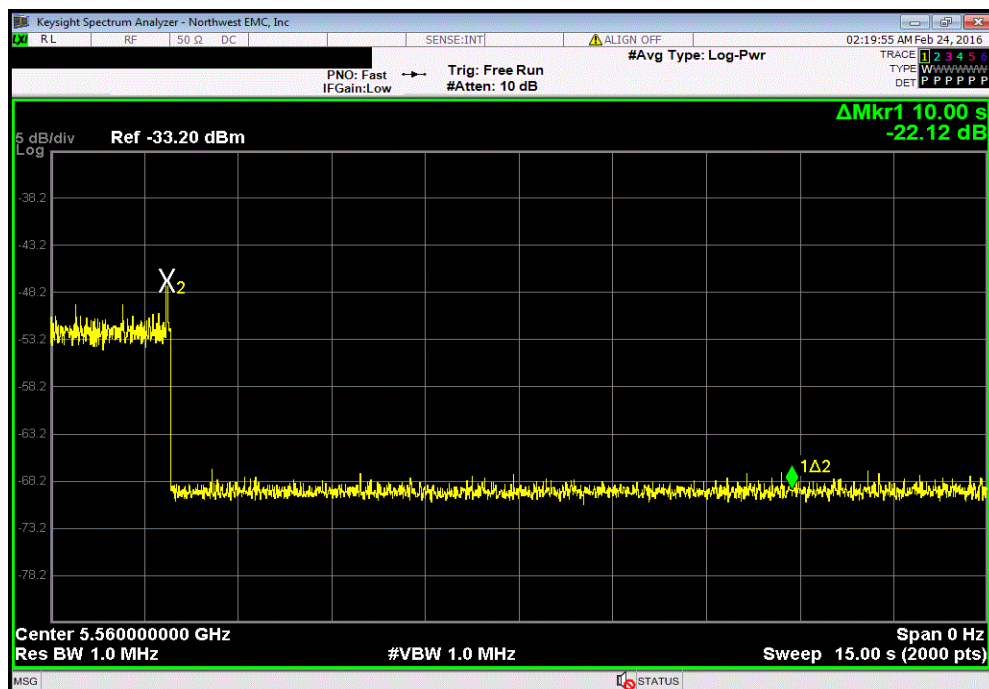
Channel 60, 5300 MHz, 802.11(a) 6 Mbps, Radar Type 0

Value	Limit	Result
See Graph	< 10s	Pass



Channel 112, 5560 MHz, 802.11(a) 6 Mbps, Radar Type 0

Value	Limit	Result
See Graph	< 10s	Pass



CLOSING TIME

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36
Generator - Signal	Benchforge Manufacturing	Colt	TIP	NCR	0
Attenuator	Aeroflex/Weinschel	3053	RKN	NCR	0
Attenuator	Aeroflex/Weinschel	3053	RKM	NCR	0
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	NCR	0
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	NCR	0
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	5/10/2015	12
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	0
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	0
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	0

TEST DESCRIPTION

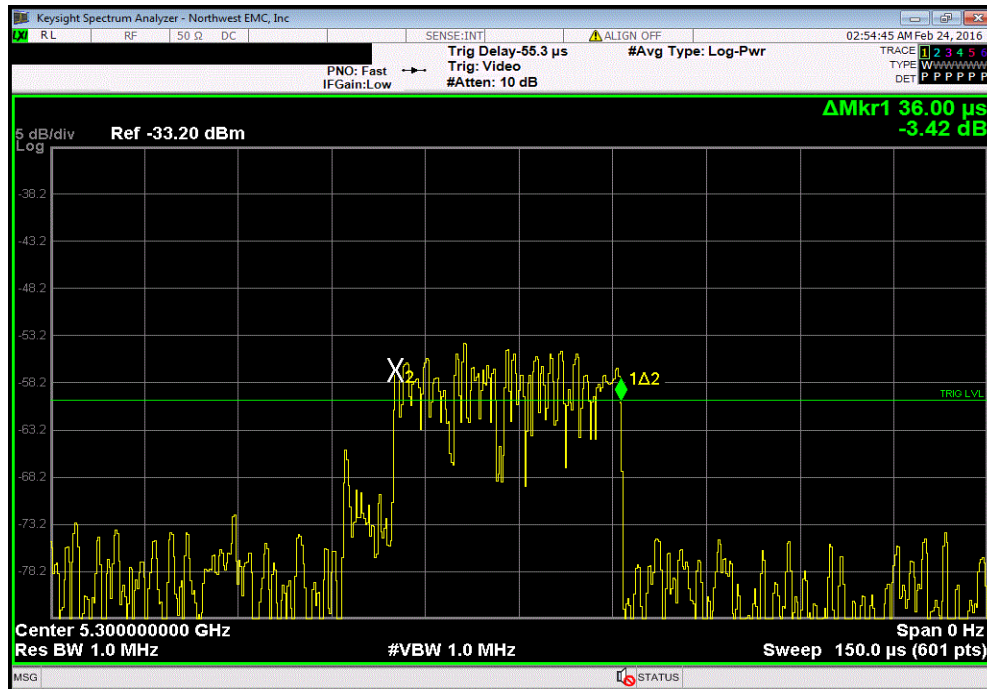
The master and client were connected using the conducted method described in the FCC KDB procedure via a series of splitters and attenuators which allows the radar signals to be injected and monitored. For master devices, the detection level was set prior to testing by temporarily replacing the master device with the analyzer and setting the power level according to Table 3 and Section 7.5. Where required, an approved Media file was streamed through the master and client or an alternative method to load the channel may be used instead. Channel loading requirements were also verified prior to testing. Configuration and status of the master and client devices were then monitored using the spectrum analyzer. The Closing Time test was performed by starting a transmission between the master and client device, and then injecting the appropriate radar signals. All transmission signals between the master and client in the first 200mS are allowed. After this time period, the number of transmissions signals are counted and multiplied by the pulse width value(s). This aggregate is then added to the 200mS allowance for the final value and compared to the specified limit.

CLOSING TIME

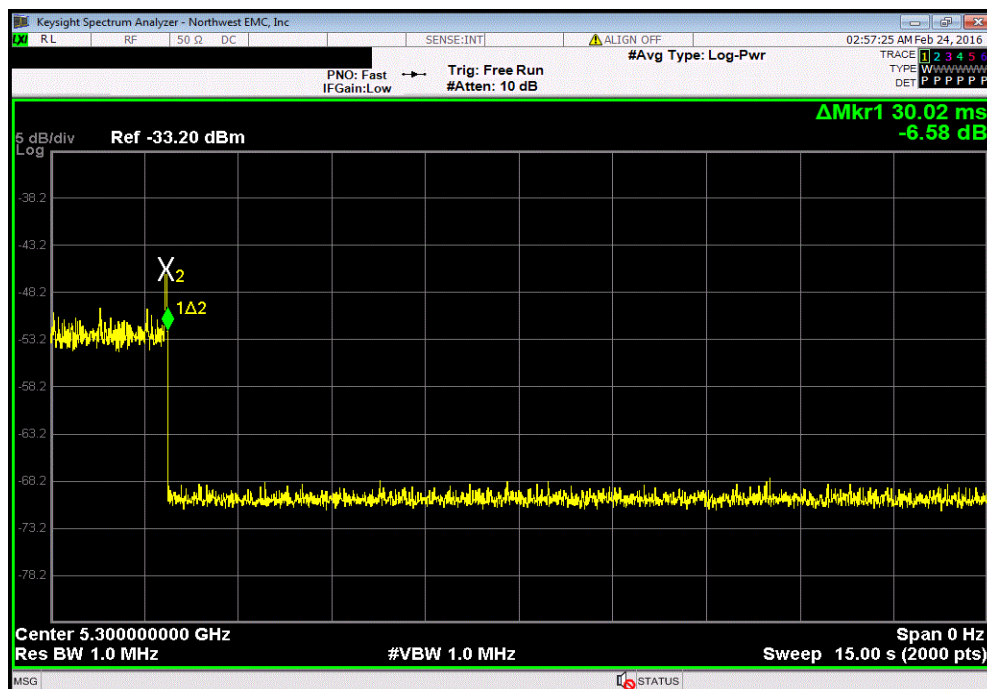
EUT: X Series		Work Order: LGPD0171			
Serial Number: 1023259		Date: 02/23/16			
Customer: ZOLL Medical Corp.		Temperature: 22°C			
Attendees: None		Humidity: 27%			
Project: None		Barometric Pres.: 985.4			
Tested by: Jared Ison	Power: 15 VDC	Job Site: MN08			
TEST SPECIFICATIONS		Test Method			
FCC 15.407:2016		KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02			
COMMENTS					
EUT continuously transferring data via iperf. Data load set to 2 Mbps.					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature 			
		Pulse Width (ms)	Closing Time (ms)	Limit (ms)	Result
Channel 60, 5300 MHz					
802.11(a) 6 Mbps					
Radar Type 0					
Control Signal Pulse Width		0.036	N/A	N/A	N/A
Closing Time		N/A	30.02	200	Pass
Channel 112, 5560 MHz					
802.11(a) 6 Mbps					
Radar Type 0					
Control Signal Pulse Width		0.03625	N/A	N/A	N/A
Closing Time		N/A	22.51	200	Pass

CLOSING TIME

Channel 60, 5300 MHz, 802.11(a) 6 Mbps, Radar Type 0, Control Signal Pulse Width						
	Pulse Width (ms)	Closing Time (ms)	Limit (ms)	Result		
	0.036	N/A	N/A	N/A		

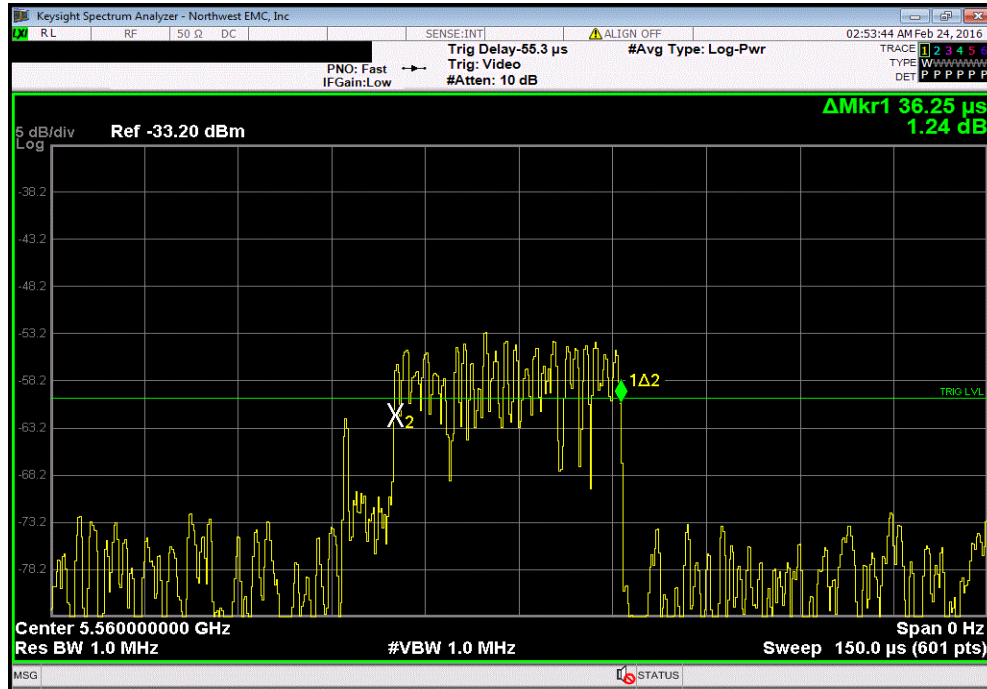


Channel 60, 5300 MHz, 802.11(a) 6 Mbps, Radar Type 0, Closing Time						
	Pulse Width (ms)	Closing Time (ms)	Limit (ms)	Result		
	N/A	30.02	200	Pass		

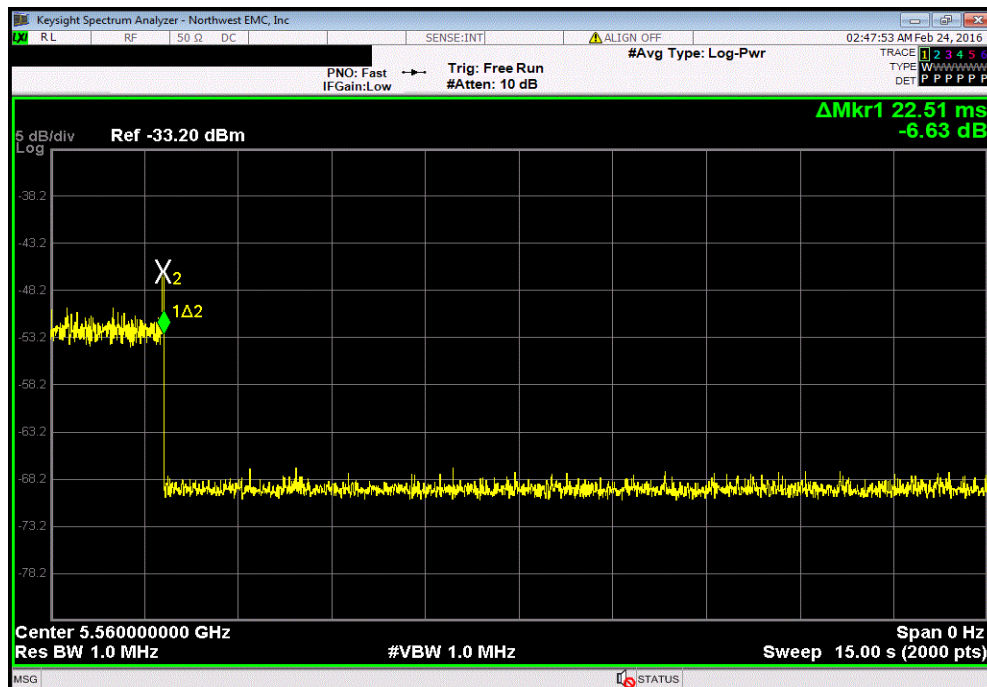


CLOSING TIME

Channel 112, 5560 MHz, 802.11(a) 6 Mbps, Radar Type 0, Control Signal Pulse Width						
	Pulse Width (ms)	Closing Time (ms)	Limit (ms)	Result		
	0.03625	N/A	N/A	N/A		



Channel 112, 5560 MHz, 802.11(a) 6 Mbps, Radar Type 0, Closing Time						
	Pulse Width (ms)	Closing Time (ms)	Limit (ms)	Result		
	N/A	22.51	200	Pass		



NON OCCUPANCY PERIOD

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	5/10/2015	12
Generator - Signal	Benchforge Manufacturing	Colt	TIP	NCR	0
Attenuator	S.M. Electronics	SA26B-20	RFW	3/10/2015	12
Block - DC	Fairview Microwave	SD3379	AMI	9/18/2015	12
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	9/18/2015	12
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAF	NCR	0
Power Divider/Combiner	Fairview Microwave	MP0208-2	IAE	NCR	0
Attenuator	Aeroflex/Weinschel	3053	RKN	NCR	0
Attenuator	Aeroflex/Weinschel	3053	RKM	NCR	0
Meter - Multimeter	Fluke	117/EFSP	MLR	5/27/2015	36
Power Supply - DC	EZ Digital Co., Ltd.	GP-4030D	TQK	NCR	0
Power Supply	Cisco	AIR-PWR-SPLY1	TIVA	NCR	0
Access Point	Cisco	AIR-AP1252AG-A-K9	TIV	NCR	0
Generator - Signal	Agilent	N5183A	TIK	10/17/2014	36

TEST DESCRIPTION

The master and client were connected using the conducted method described in the FCC KDB procedure via a series of splitters and attenuators which allows the communication and injected radar signals to be monitored simultaneously. The spectrum analyzer was configured to sweep the frequency for at least 30 minutes. The appropriate radar signal was injected and the channel was monitored to make sure the master and client devices vacated the channel and did not use it again for a period of time equal to or greater than 30 minutes.

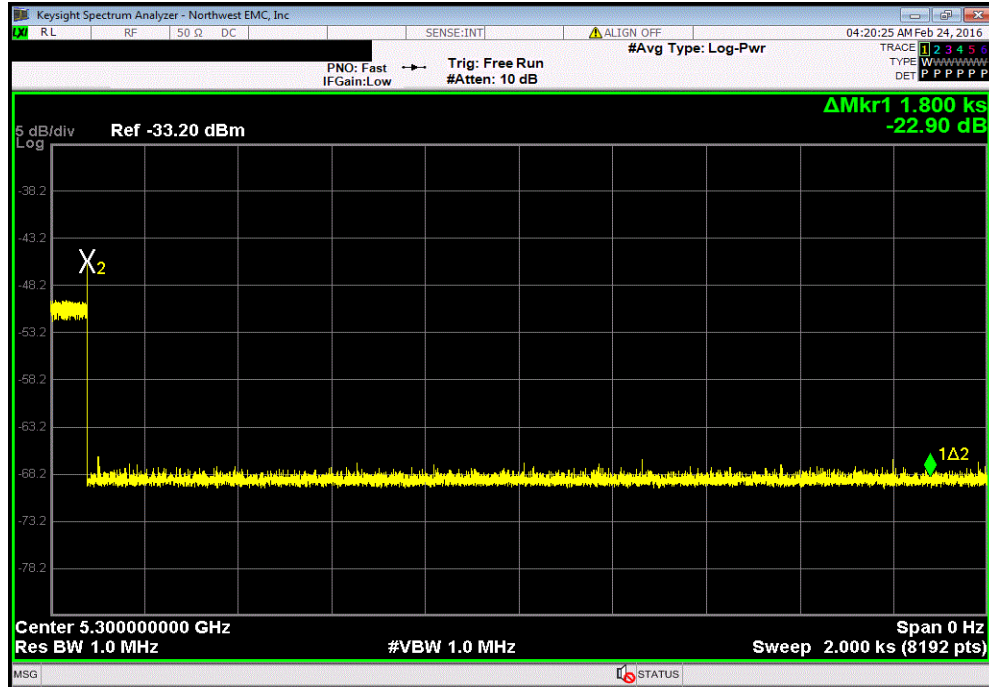
NON OCCUPANCY PERIOD

EUT: X Series		Work Order: LGPD0171	
Serial Number: 1023259		Date: 02/23/16	
Customer: ZOLL Medical Corp.		Temperature: 22°C	
Attendees: None		Humidity: 27%	
Project: None		Barometric Pres.: 985.4	
Tested by: Jared Ison	Power: 15 VDC	Job Site: MN08	
TEST SPECIFICATIONS			
FCC 15.407:2016		Test Method	
		KDB 905462 D02 UNII DFS Compliance Procedures New Rules v01r02	
COMMENTS			
EUT continuously transferring data via iperf. Data load set to 2 Mbps.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature 	
		Value	Limit
Channel 60, 5300 MHz			
802.11(a) 6 Mbps			
30 minute Non Occupancy Period		> 30 min	≥ 30 min
			Pass
Channel 112, 5560 MHz			
802.11(a) 6 Mbps			
30 minute Non Occupancy Period		> 30 min	≥ 30 min
			Pass

NON OCCUPANCY PERIOD

Channel 60, 5300 MHz, 802.11(a) 6 Mbps, 30 minute Non Occupancy Period

				Value	Limit	Result
				> 30 min	≥ 30 min	Pass



Channel 112, 5560 MHz, 802.11(a) 6 Mbps, 30 minute Non Occupancy Period

				Value	Limit	Result
				> 30 min	≥ 30 min	Pass

