

NORTHWEST EMC

ivWatch, LLC

Model 400 w/RFID

FCC 15.207:2016

FCC 15.225:2016

13.56 MHz RFID

Report # IVWA0002.1



NVLAP Lab Code: 200676-0

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. This Report may only be duplicated in its entirety

CERTIFICATE OF TEST

Last Date of Test: January 27, 2016
ivWatch, LLC
Model: Model 400 w/RFID

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2016	ANSI C63.10:2013
FCC 15.225:2016	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.4	Field Strength of Fundamental	Yes	Pass	
6.4	Field Strength of Spurious Emissions Less Than 30 MHz	Yes	Pass	
6.5	Field Strength of Spurious Emissions Greater Than 30 MHz	Yes	Pass	
6.8	Frequency Stability	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Victor Ratinoff, 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 Conformity Assessment Body (CAB) under the EMC directive and 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>

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

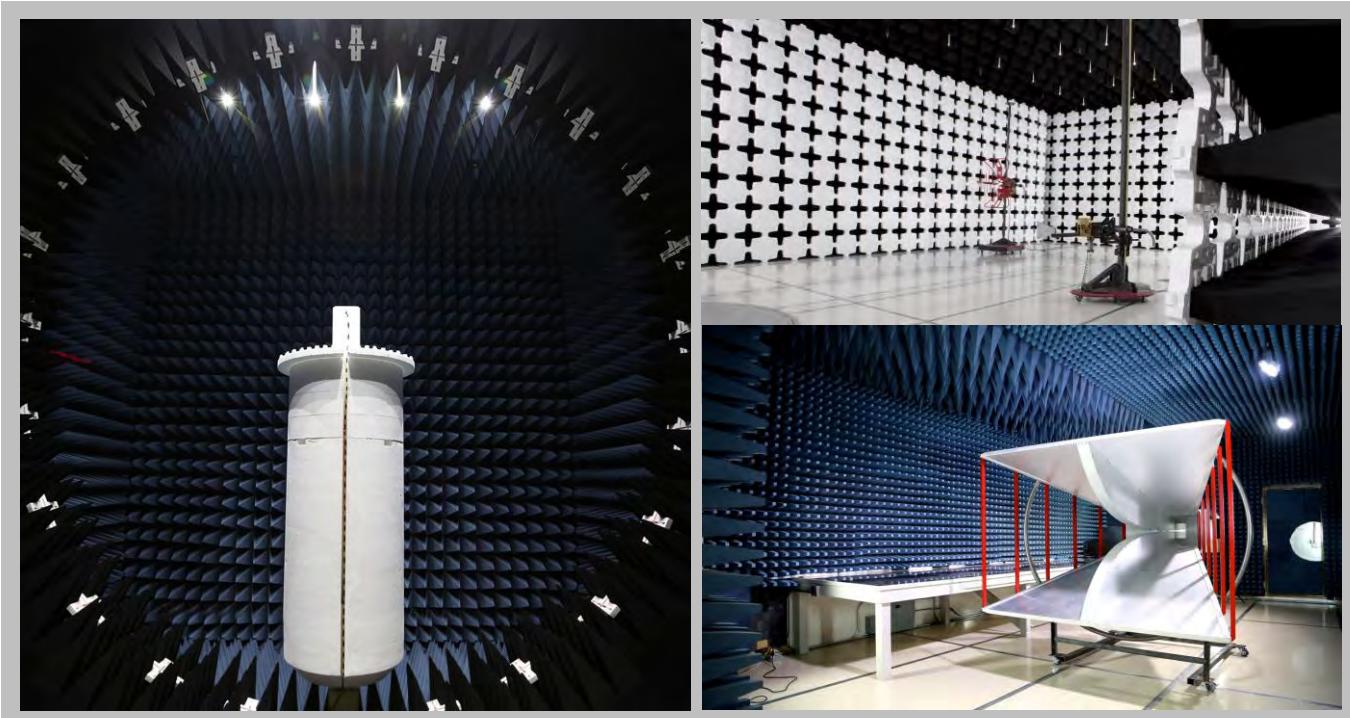
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

FACILITIES



California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	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/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	ivWatch, LLC
Address:	1100 Exploration Way, Suite 209
City, State, Zip:	Hampton, VA 23666
Test Requested By:	Jason Naramore
Model:	Model 400 w/RFID
First Date of Test:	January 25, 2016
Last Date of Test:	January 27, 2016
Receipt Date of Samples:	January 25, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
IV Patient monitor with 13.56 MHz RFID
Testing Objective:
To demonstrate compliance of the radio FCC Part 15.225 for a system level approval.

CONFIGURATIONS

Configuration IVWA0002- 5

Software/Firmware Running during test	
Description	Version
RFID Software	MANU-351

EUT				
Description	Manufacturer	Model/Part Number	Serial Number	
IV Infiltration Detection Monitor	ivWatch, LLC	Model 400/AE-1001000	1000022	

Peripherals in test setup boundary				
Description	Manufacturer	Model/Part Number	Serial Number	
AC/DC Adapter	SL Power and Ault	MENB1030A1241F03	None	
Fiber Cable Sensor	ivWatch, LLC	CC-1000002	10292015-0002	
USB Flash Drive	ScanDisk	SDCZ60-008G	BI120323458B	

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power	No	2.8m	No	AC/DC Adapter	AC Mains
DC Power	No	1.7m	No	IV Infiltration Detection Monitor	AC/DC Adapter

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	1/26/2016	Field Strength of Fundamental	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	1/26/2016	Field Strength of Spurious Emissions less than 30 MHz	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	1/26/2016	Frequency Stability	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	1/27/2016	Field Strength of Spurious Emissions greater than 30 MHz	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.
5	1/27/2016	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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.

MODES OF OPERATION

Continuously Transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

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SAMPLE CALCULATIONS

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable - Conducted Cable Assembly	Northwest EMC	OCP, HFP, AWC	OCPA	4/10/2015	12 mo
LISN	Solar Electronics	9252-50-24-BNC	LIA	3/4/2015	12 mo
Receiver	Rohde & Schwarz	ESCI	ARG	6/1/2015	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	BWI (kHz)
0.15 - 30.0	1.0
30.0 - 400.0	10.0
400.0 - 1000.0	100.0
1000.0 - 6000.0	1000.0

TEST DESCRIPTION

The EUT will be powered either directly or indirectly from the AC power line. Therefore, conducted emissions measurements were made on the AC input of the EUT, or on the AC input of the device used to power the EUT.

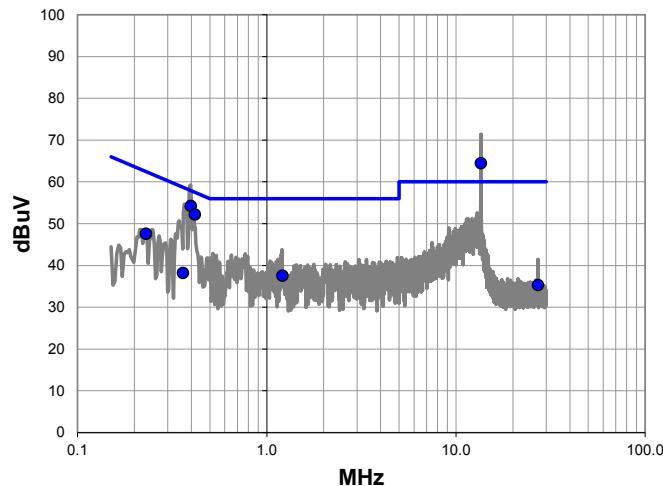
The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.10-2009.

In the event that the operating frequency of 13.56 MHz is causing the product to fail the FCC 15.207 limits, the following guidance can be used:

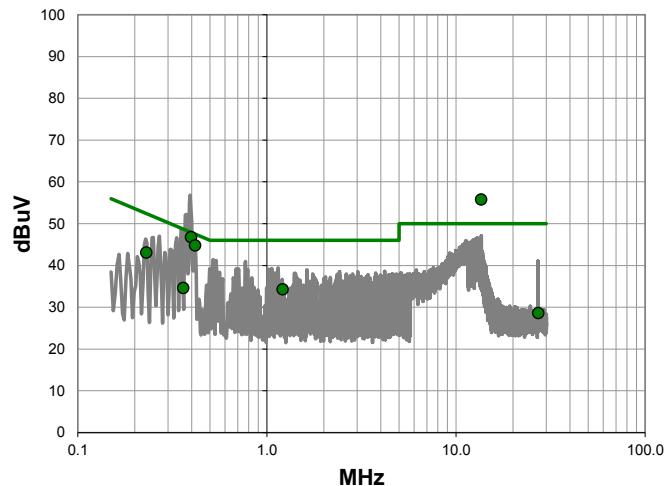
Per the FCC Guidance, the FCC will accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions. (1) First, perform the AC line conducted tests with the antenna attached to make sure the device complies with the 15.207 limits outside the transmitter's fundamental emission band, and then retest with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. (2) For the second portion of these tests, only the fundamental emission band of the transmitter needs to be retested.

Work Order:	IVWA0002	Date:	01/27/16		
Project:	None	Temperature:	19.5 °C		
Job Site:	OC06	Humidity:	36.2% RH		
Serial Number:	1000022	Barometric Pres.:	1024 mbar	Tested by: Johnny Candelas	
EUT:	Model 400 w/RFID				
Configuration:	5				
Customer:	ivWatch, LLC				
Attendees:	Matthew Alley				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuously Transmitting at 13.56MHz				
Deviations:	None				
Comments:	EUT running RFID Test Software. EUT with antenna connected, showing fundamental emission at 13.56MHz.				
Test Specifications		Test Method			
FCC 15.207:2016		ANSI C63.10:2013			
46.8	10	Line: High Line	Ext. Attenuation:	0	Results: Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



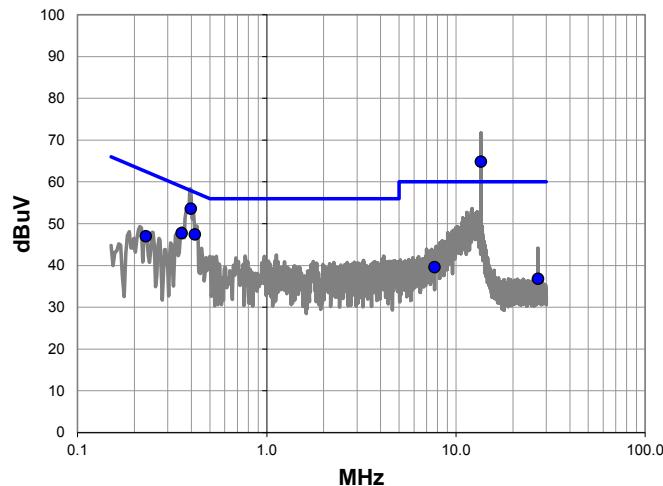
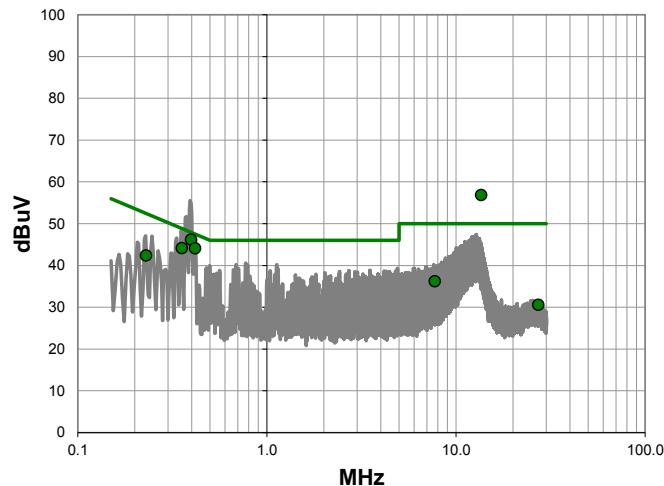
Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.560	43.8	20.7	64.5	60.0	4.5
0.396	34.2	20.0	54.2	57.9	-3.7
0.416	32.2	20.0	52.2	57.5	-5.3
0.230	27.5	20.1	47.6	62.5	-14.8
1.210	17.5	20.1	37.6	56.0	-18.4
0.360	18.2	20.1	38.3	58.7	-20.5
27.121	13.5	21.8	35.3	60.0	-24.7

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.560	35.1	20.7	55.8	50.0	5.8
0.396	26.8	20.0	46.8	47.9	-1.1
0.416	24.8	20.0	44.8	47.5	-2.7
0.230	23.0	20.1	43.1	52.5	-9.3
1.210	14.2	20.1	34.3	46.0	-11.7
0.360	14.6	20.1	34.7	48.7	-14.1
27.121	6.8	21.8	28.6	50.0	-21.4

Work Order:	IVWA0002	Date:	01/27/16		
Project:	None	Temperature:	19.5 °C		
Job Site:	OC06	Humidity:	36.2% RH		
Serial Number:	1000022	Barometric Pres.:	1024 mbar	Tested by: Johnny Candelas	
EUT:	Model 400 w/RFID				
Configuration:	5				
Customer:	ivWatch, LLC				
Attendees:	Matthew Alley				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuously Transmitting at 13.56MHz				
Deviations:	None				
Comments:	EUT running RFID Test Software. EUT with antenna connected, showing fundamental emission at 13.56MHz.				
Test Specifications		Test Method			
FCC 15.207:2016		ANSI C63.10:2013			
Run #	11	Line:	Neutral	Ext. Attenuation:	0
				Results	Pass

Quasi Peak Data - vs - Quasi Peak Limit

Average Data - vs - Average Limit

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.561	44.2	20.7	64.9	60.0	4.9
0.396	33.6	20.0	53.6	57.9	-4.3
0.417	27.4	20.0	47.4	57.5	-10.1
0.355	27.7	20.1	47.8	58.8	-11.1
0.229	26.9	20.1	47.0	62.5	-15.5
7.698	19.2	20.4	39.6	60.0	-20.4
27.121	15.0	21.8	36.8	60.0	-23.2

Average Data - vs - Average Limit

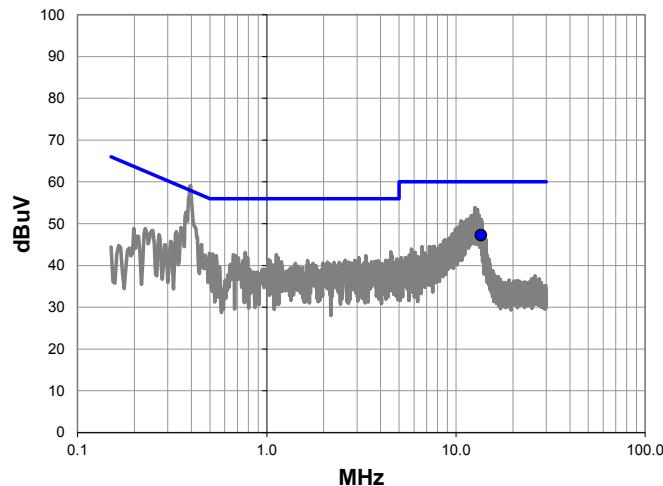
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.561	36.2	20.7	56.9	50.0	6.9
0.396	26.2	20.0	46.2	47.9	-1.7
0.417	24.1	20.0	44.1	47.5	-3.4
0.355	24.1	20.1	44.2	48.8	-4.7
0.229	22.3	20.1	42.4	52.5	-10.1
7.698	15.8	20.4	36.2	50.0	-13.8
27.121	8.8	21.8	30.6	50.0	-19.4

Work Order:	IVWA0002	Date:	01/27/16	
Project:	None	Temperature:	19.5 °C	
Job Site:	OC06	Humidity:	36.2% RH	
Serial Number:	1000022	Barometric Pres.:	1024 mbar	Tested by: Johnny Candelas
EUT:	Model 400 w/RFID			
Configuration:	5			
Customer:	ivWatch, LLC			
Attendees:	Matthew Alley			
EUT Power:	110VAC/60Hz			
Operating Mode:	Continuously Transmitting at 13.56MHz			
Deviations:	None			
Comments:	EUT running RFID Test Software. EUT with antenna terminated with dummy load.			

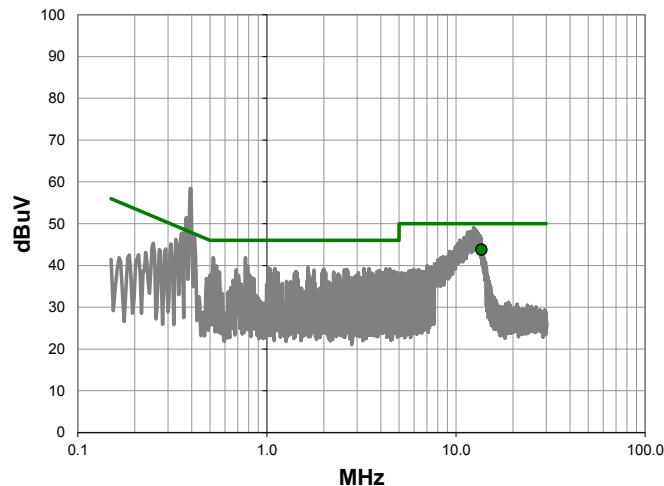
Test Specifications	Test Method
FCC 15.207:2016	ANSI C63.10:2013

Run #	12	Line:	High Line	Ext. Attenuation:	0	Results	Pass
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Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

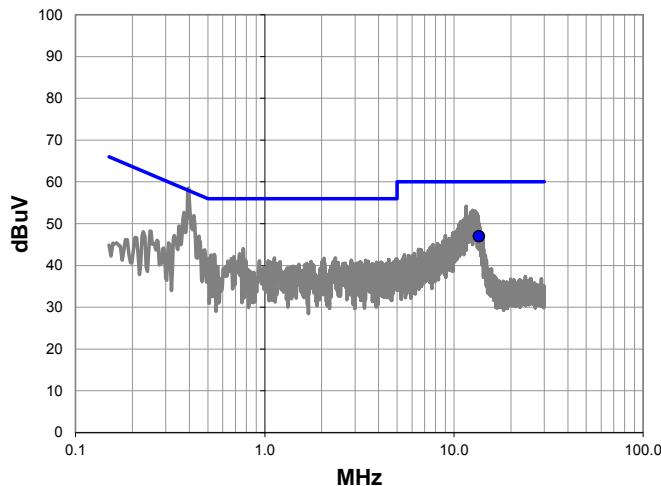
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.564	26.6	20.7	47.3	60.0	-12.7

Average Data - vs - Average Limit

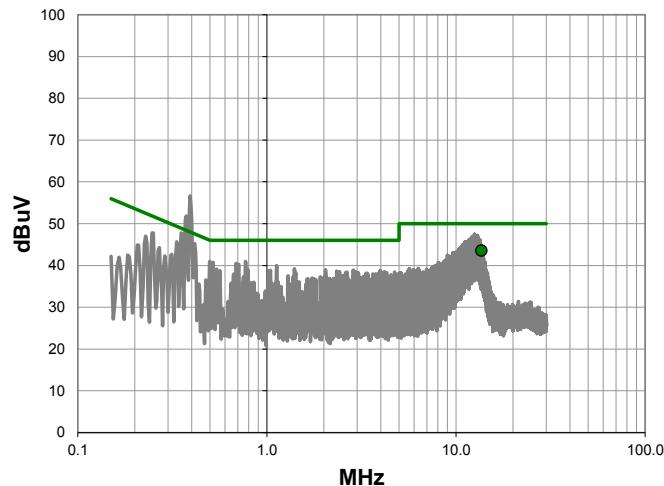
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.564	23.1	20.7	43.8	50.0	-6.2

Work Order:	IVWA0002	Date:	01/27/16	
Project:	None	Temperature:	19.5 °C	
Job Site:	OC06	Humidity:	36.2% RH	
Serial Number:	1000022	Barometric Pres.:	1024 mbar	Tested by: Johnny Candelas
EUT:	Model 400 w/RFID			
Configuration:	5			
Customer:	ivWatch, LLC			
Attendees:	Matthew Alley			
EUT Power:	110VAC/60Hz			
Operating Mode:	Continuously Transmitting at 13.56MHz			
Deviations:	None			
Comments:	EUT running RFID Test Software. EUT with antenna terminated with dummy load.			
Test Specifications		Test Method		
FCC 15.207:2016		ANSI C63.10:2013		
Run #	13	Line:	Neutral	Ext. Attenuation:
				0
				Results
				Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.566	26.3	20.7	47.0	60.0	-13.0

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.566	22.9	20.7	43.6	50.0	-6.4

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Continuously Transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

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FREQUENCY RANGE INVESTIGATED

Start Frequency	12.71 MHz	Stop Frequency	14.41 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	Northwest EMC	10kHz-1GHz RE Cables	OCH	3/4/2015	12 mo
Antenna	EMCO	6502	AZB	8/14/2015	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	12 mo

TEST DESCRIPTION

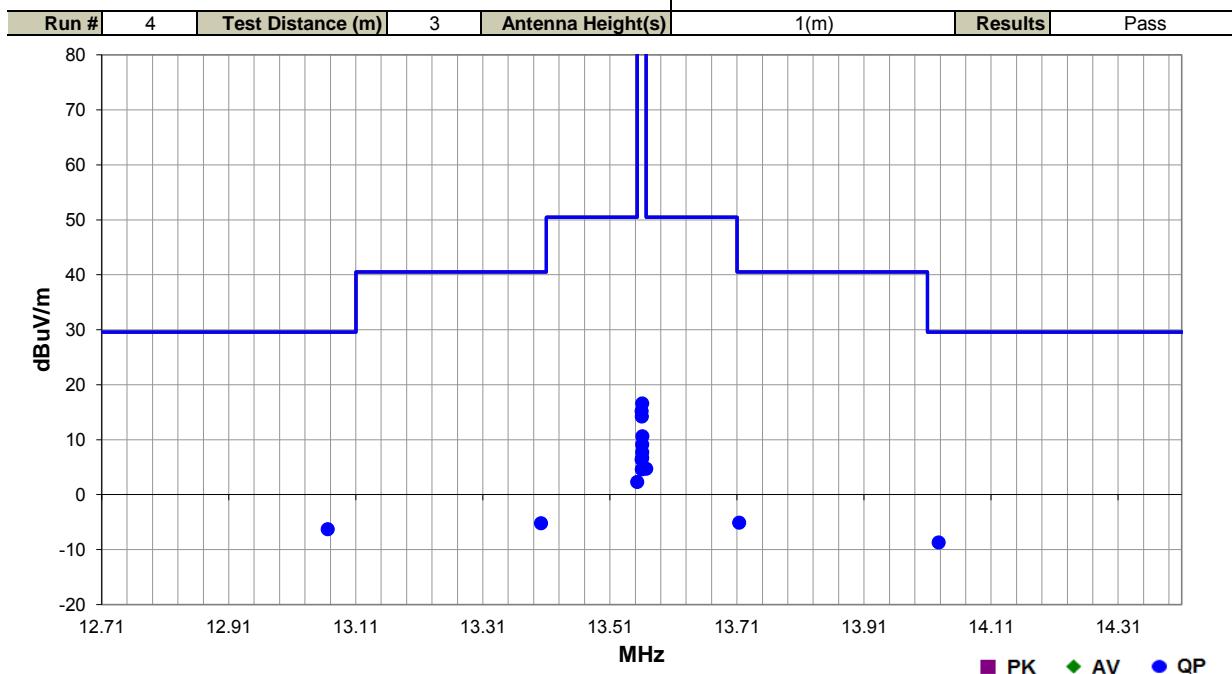
The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

While scanning, fundamental carrier from the EUT was maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal planes, the EUT and/or associated antenna is positioned in 3 orthogonal planes (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

Work Order:	IVWA0002	Date:	01/26/16	 Tested by: Johnny Candelas
Project:	None	Temperature:	19.7 °C	
Job Site:	OC10	Humidity:	38.6% RH	
Serial Number:	1000022	Barometric Pres.:	1024 mbar	
EUT:	Model 400 w/RFID			
Configuration:	5			
Customer:	ivWatch, LLC			
Attendees:	Matthew Alley			
EUT Power:	110VAC/60Hz			
Operating Mode:	Continuously Transmitting at 13.56MHz			
Deviations:	None			
Comments:	EUT running RFID Test Software			

Test Specifications	Test Method
FCC 15.225:2016	ANSI C63.10:2013



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
13.066	22.6	11.1	1.0	98.0	3.0	0.0	Par to GND	QP	-40.0	-6.3	29.5	-35.8	EUT Horizontal
14.028	20.2	11.1	1.6	73.0	3.0	0.0	Par to GND	QP	-40.0	-8.7	29.5	-38.2	EUT Horizontal
13.713	23.8	11.1	1.0	103.0	3.0	0.0	Par to GND	QP	-40.0	-5.1	40.5	-45.6	EUT Horizontal
13.402	23.7	11.1	1.0	148.0	3.0	0.0	Par to GND	QP	-40.0	-5.2	40.5	-45.7	EUT Horizontal
13.567	33.6	11.1	1.0	87.0	3.0	0.0	Par to GND	QP	-40.0	4.7	50.5	-45.8	EUT Horizontal
13.553	31.2	11.1	1.0	99.0	3.0	0.0	Par to GND	QP	-40.0	2.3	50.5	-48.2	EUT Horizontal
13.561	45.5	11.1	1.0	86.0	3.0	0.0	Par to GND	QP	-40.0	16.6	84.0	-67.4	EUT Horizontal
13.560	44.1	11.1	1.0	60.0	3.0	0.0	Par to GND	QP	-40.0	15.2	84.0	-68.8	EUT on Side
13.560	43.1	11.1	1.0	92.0	3.0	0.0	Par to GND	QP	-40.0	14.2	84.0	-69.8	EUT Vertical
13.561	39.5	11.1	1.0	127.0	3.0	0.0	Perp to EUT	QP	-40.0	10.6	84.0	-73.4	EUT Horizontal
13.561	38.0	11.1	1.0	172.0	3.0	0.0	Perp to EUT	QP	-40.0	9.1	84.0	-74.9	EUT on Side
13.561	36.6	11.1	1.0	160.0	3.0	0.0	Perp to EUT	QP	-40.0	7.7	84.0	-76.3	EUT Vertical
13.561	35.6	11.1	1.0	132.0	3.0	0.0	Perp to EUT	QP	-40.0	6.7	84.0	-77.3	EUT Horizontal
13.560	35.3	11.1	1.0	114.0	3.0	0.0	Par to EUT	QP	-40.0	6.4	84.0	-77.6	EUT on Side
13.560	33.5	11.1	1.0	126.0	3.0	0.0	Par to EUT	QP	-40.0	4.6	84.0	-79.4	EUT Vertical

FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Continuously Transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

IVWA0002 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	10 kHz	Stop Frequency	30 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	Northwest EMC	10kHz-1GHz RE Cables	OCH	3/4/2015	12 mo
Antenna	EMCO	6502	AZB	8/14/2015	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	12 mo

TEST DESCRIPTION

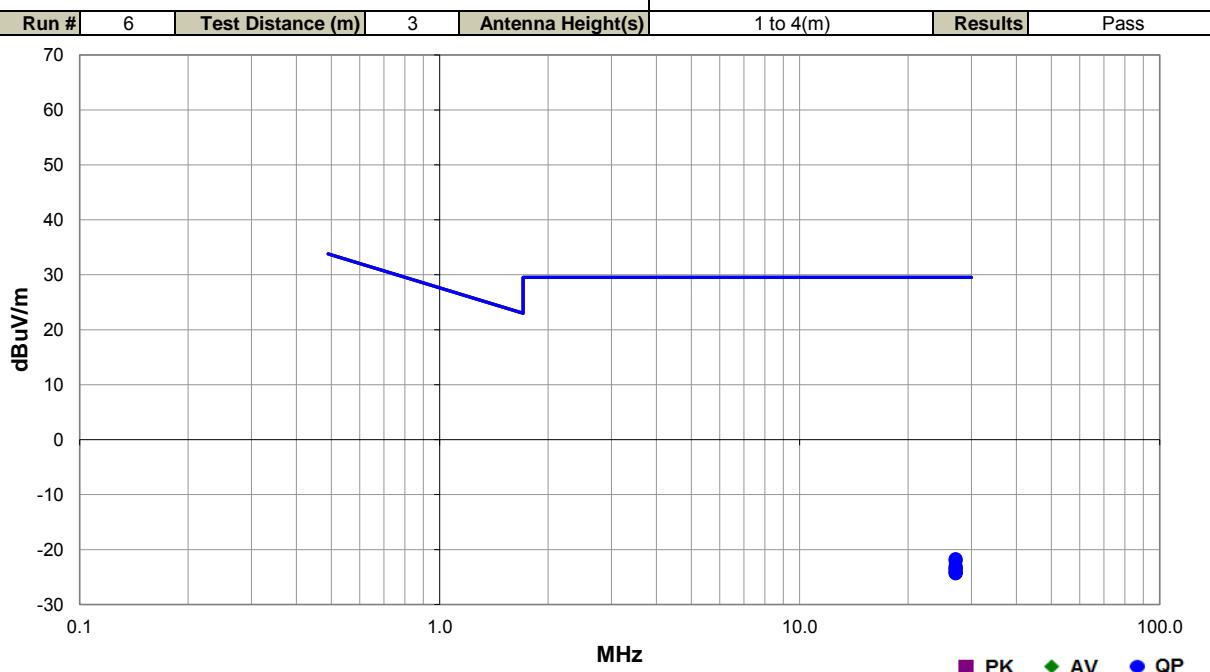
The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal planes, the EUT and/or associated antenna is positioned in 3 orthogonal planes (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

Work Order:	IVWA0002	Date:	01/26/16		
Project:	None	Temperature:	19.7 °C		
Job Site:	OC10	Humidity:	38.6% RH		
Serial Number:	1000022	Barometric Pres.:	1024 mbar		
EUT:	Model 400 w/RFID				
Configuration:	5				
Customer:	ivWatch, LLC				
Attendees:	Matthew Alley				
EUT Power:	110VAC/60Hz				
Operating Mode:	Continuously Transmitting at 13.56MHz				
Deviations:	None				
Comments:	EUT running RFID Test Software				

Test Specifications	Test Method
FCC 15.225:2016	ANSI C63.10:2013



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
27.121	9.0	9.3	1.0	316.0	3.0	0.0	Par to GND	QP	-40.0	-21.7	29.5	-51.3	EUT on Side
27.122	8.7	9.3	1.0	43.0	3.0	0.0	Par to GND	QP	-40.0	-22.0	29.5	-51.6	EUT Horizontal
27.120	7.7	9.3	1.0	287.0	3.0	0.0	Par to EUT	QP	-40.0	-23.0	29.5	-52.6	EUT on Side
27.121	7.3	9.3	1.0	166.0	3.0	0.0	Perp to EUT	QP	-40.0	-23.4	29.5	-53.0	EUT Horizontal
27.121	7.3	9.3	1.0	39.0	3.0	0.0	Par to GND	QP	-40.0	-23.4	29.5	-53.0	EUT Vertical
27.121	7.0	9.3	1.0	138.0	3.0	0.0	Perp to EUT	QP	-40.0	-23.7	29.5	-53.3	EUT on Side
27.121	6.7	9.3	1.0	44.0	3.0	0.0	Par to EUT	QP	-40.0	-24.0	29.5	-53.6	EUT Horizontal
27.121	6.5	9.3	1.0	38.0	3.0	0.0	Perp to EUT	QP	-40.0	-24.2	29.5	-53.8	EUT Vertical
27.122	6.4	9.3	1.0	163.0	3.0	0.0	Par to EUT	QP	-40.0	-24.3	29.5	-53.9	EUT Vertical

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Continuously Transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

IVWA0002 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency | 30 MHz | Stop Frequency | 140 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna	Solar Electronics	7334-1	AOC	6/10/2014	36 mo
Antenna - Biconilog	EMCO	3142B	AXK	10/6/2014	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079	AOO	3/5/2015	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	11/19/2015	12 mo

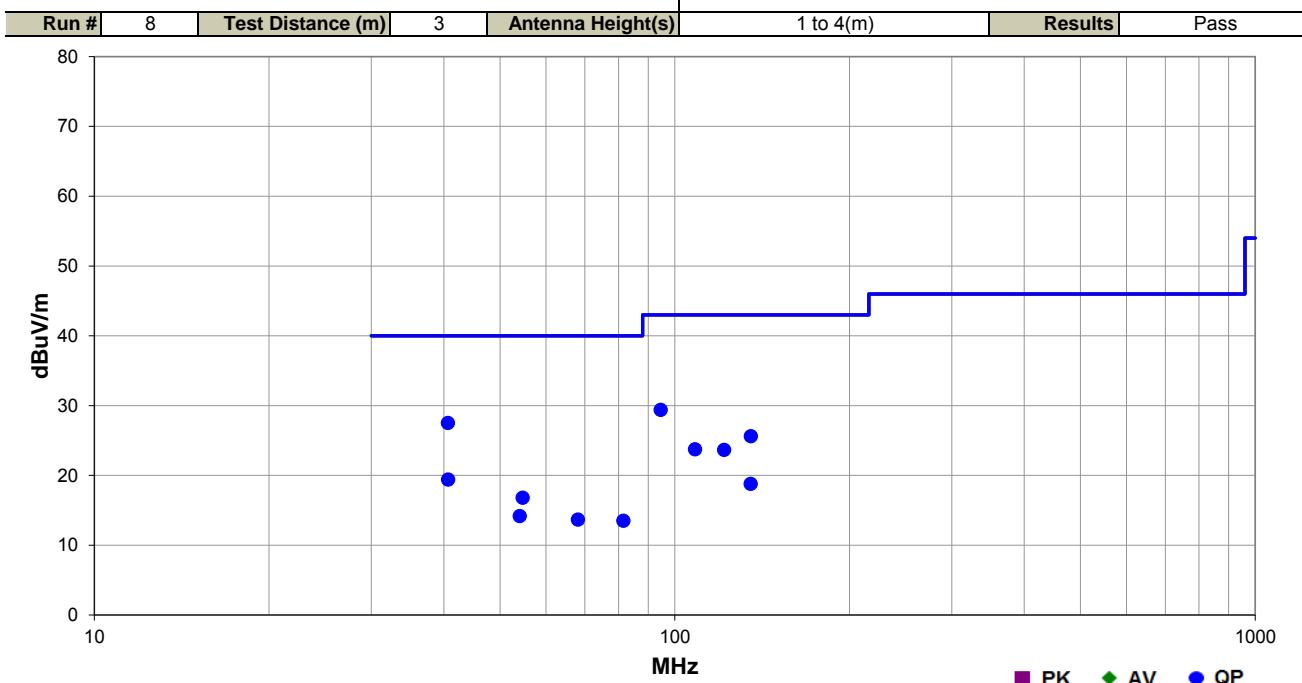
TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting while set at the operating channel.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009).

Work Order:	IVWA0002	Date:	01/27/16	
Project:	None	Temperature:	19.2 °C	
Job Site:	OC10	Humidity:	36.1% RH	
Serial Number:	1000022	Barometric Pres.:	1024 mbar	
EUT:	Model 400 w/RFID		Tested by:	Johnny Candelas
Configuration:	5			
Customer:	ivWatch, LLC			
Attendees:	Matthew Alley			
EUT Power:	110VAC/60Hz			
Operating Mode:	Continuously Transmitting at 13.56MHz			
Deviations:	None			
Comments:	EUT running RFID Test Software			

Test Specifications	Test Method
FCC 15.225:2016	ANSI C63.10:2013



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
40.658	30.8	-3.3	1.0	102.0	3.0	0.0	Vert	QP	0.0	27.5	40.0	-12.5	EUT Horizontal
94.523	36.5	-7.1	1.0	69.0	3.0	0.0	Vert	QP	0.0	29.4	43.0	-13.6	EUT Horizontal
135.174	33.5	-7.9	2.3	105.0	3.0	0.0	Horz	QP	0.0	25.6	43.0	-17.4	EUT Horizontal
108.389	30.7	-7.0	1.0	180.0	3.0	0.0	Vert	QP	0.0	23.7	43.0	-19.3	EUT Horizontal
121.566	31.4	-7.7	1.6	199.0	3.0	0.0	Vert	QP	0.0	23.7	43.0	-19.3	EUT Horizontal
40.685	22.7	-3.3	2.4	225.0	3.0	0.0	Horz	QP	0.0	19.4	40.0	-20.6	EUT Horizontal
54.691	24.2	-7.4	1.0	78.0	3.0	0.0	Vert	QP	0.0	16.8	40.0	-23.2	EUT Horizontal
135.136	26.7	-7.9	1.0	189.0	3.0	0.0	Vert	QP	0.0	18.8	43.0	-24.2	EUT Horizontal
54.037	21.5	-7.3	1.0	16.0	3.0	0.0	Horz	QP	0.0	14.2	40.0	-25.8	EUT Horizontal
68.088	21.8	-8.1	1.0	290.0	3.0	0.0	Horz	QP	0.0	13.7	40.0	-26.3	EUT Horizontal
81.533	21.8	-8.3	1.0	220.0	3.0	0.0	Horz	QP	0.0	13.5	40.0	-26.5	EUT Horizontal

FREQUENCY STABILITY

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)
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPHS-32-3.5-SCT/AC	TBE	NCR	0
Thermometer	Omega Engineering, Inc.	HH311	DUC	10/3/2014	36
Generator - Signal	Agilent	E8257D	TGU	2/5/2015	36
Cable	Fairview Microwave	SCA1814-0101-120	OCZ	NCR	0
Attenuator	Fairview Microwave	SA18E-10	TKS	4/8/2015	12
Block - DC	Fairview Microwave	SD3379	AMN	1/7/2016	12
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	7/23/2015	12

TEST DESCRIPTION

Variation of Supply Voltage

The primary supply voltage was varied from 85% to 115% of the nominal voltage. A DC lab supply was used to vary the supply voltage.

Variation of Ambient Temperature

Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (0° to +50° C) and at 10°C intervals.

The measurement was made with a direct connection between the EUT antenna port and the test equipment. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

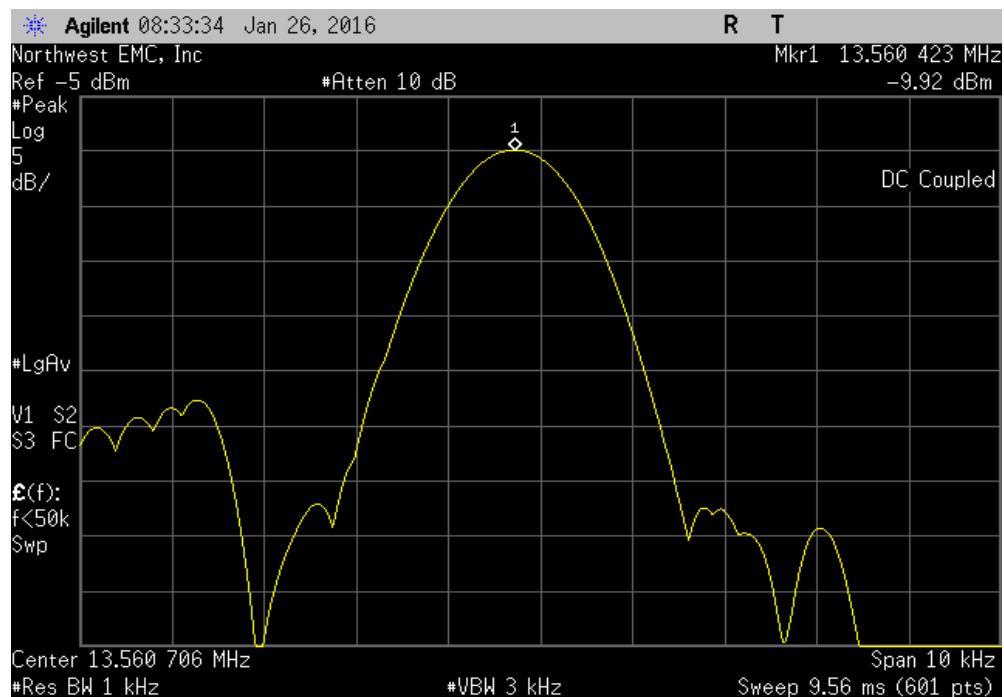
FREQUENCY STABILITY

EUT:	Model 400 w/RFID		Work Order:	IVWA0002			
Serial Number:	1000021		Date:	01/26/16			
Customer:	ivWatch, LLC		Temperature:	19.5°C			
Attendees:	Matthew Alley		Humidity:	39%			
Project:	None		Barometric Pres.:	1023			
Tested by:	Johnny Candelas	Power:	110VAC/60Hz	Job Site:	OC13		
TEST SPECIFICATIONS		Test Method					
FCC 15.225:2016		ANSI C63.10:2013					
COMMENTS							
Continuously Transmitting at 13.56MHz. Operating range of device = +5C to +40C. Transmitter shuts off outside of temperatures tested.							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	5	Signature	Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
RFID 13.56MHz							
Normal Temperature and Voltage Extreme Temperature, 0°C Extreme Temperature, +10°C Extreme Temperature, +20°C Extreme Temperature, +30°C Extreme Temperature, +40°C Extreme Temperature, +50°C Extreme Voltage, +15% Extreme Voltage, -15%							
13.560423 13.56 -0.0031 ±0.01 Pass 13.560456 13.56 -0.0034 ±0.01 Pass 13.560440 13.56 -0.0032 ±0.01 Pass 13.560406 13.56 -0.0030 ±0.01 Pass 13.560356 13.56 -0.0026 ±0.01 Pass 13.560323 13.56 -0.0024 ±0.01 Pass 13.560289 13.56 -0.0021 ±0.01 Pass 13.560406 13.56 -0.0030 ±0.01 Pass 13.560404 13.56 -0.0030 ±0.01 Pass							

FREQUENCY STABILITY

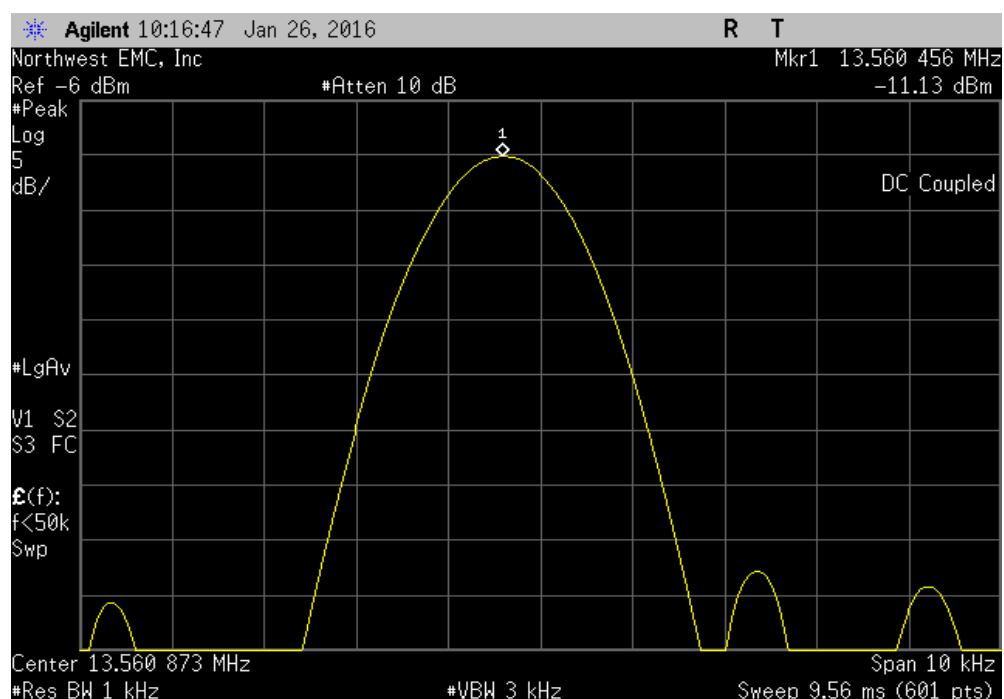
RFID 13.56MHz, Normal Temperature and Voltage

Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560423	13.56	-0.0031	±0.01	Pass



RFID 13.56MHz, Extreme Temperature, 0°C

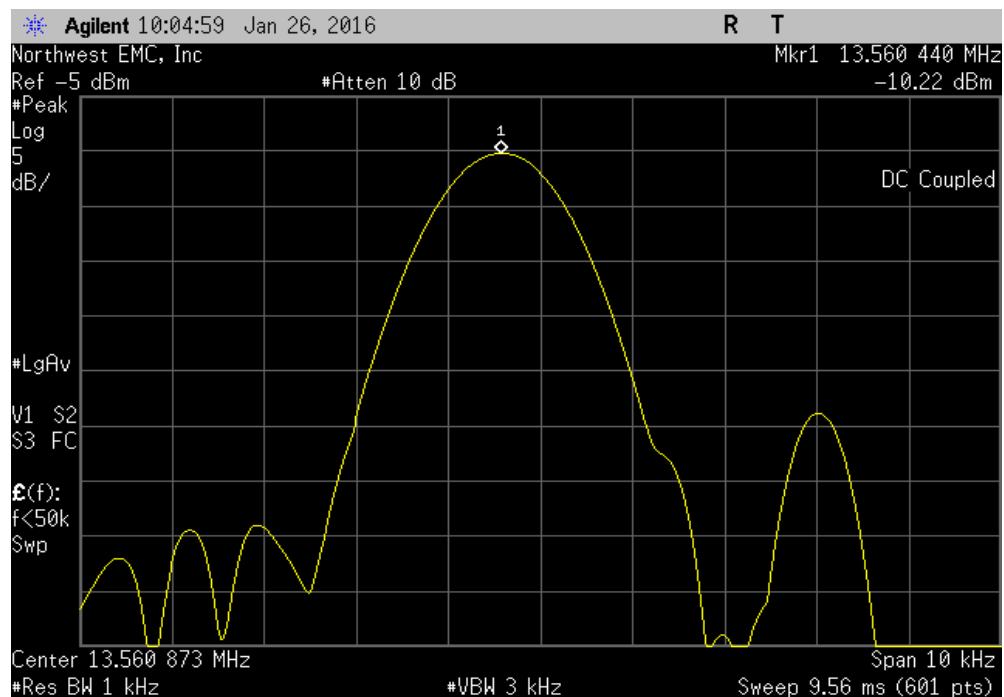
Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560456	13.56	-0.0034	±0.01	Pass



FREQUENCY STABILITY

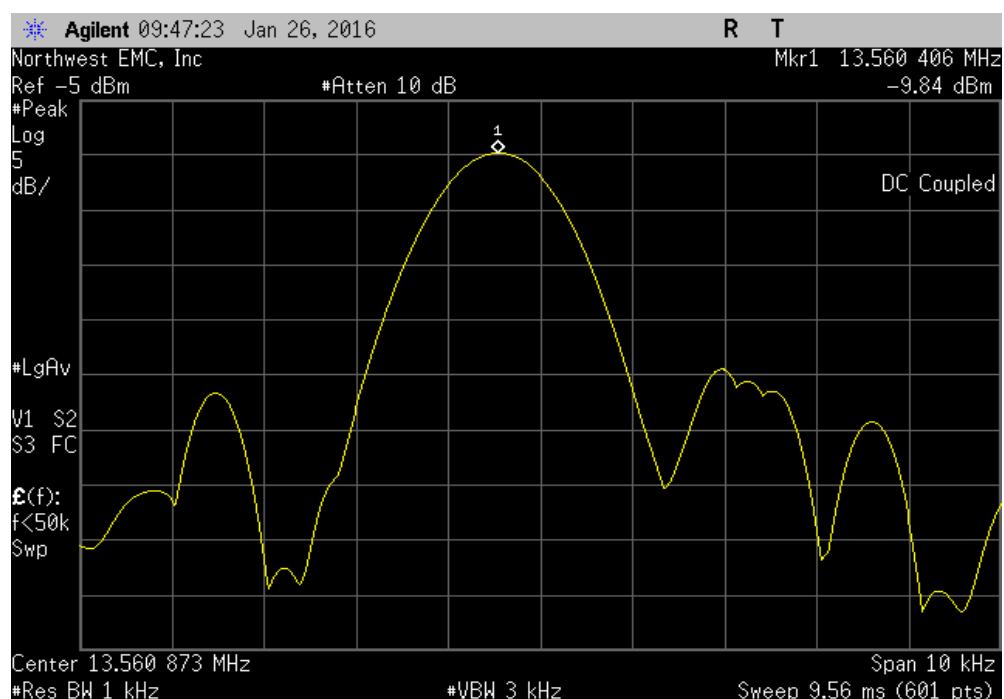
RFID 13.56MHz, Extreme Temperature, +10°C

Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.56044	13.56	-0.0032	±0.01	Pass



RFID 13.56MHz, Extreme Temperature, +20°C

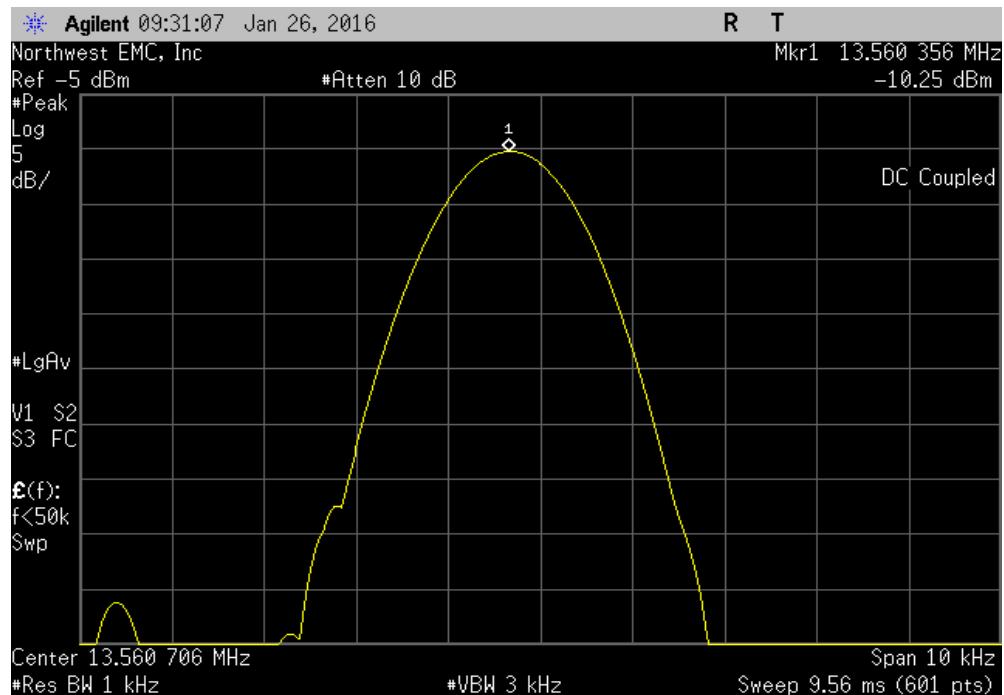
Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560406	13.56	-0.0030	±0.01	Pass



FREQUENCY STABILITY

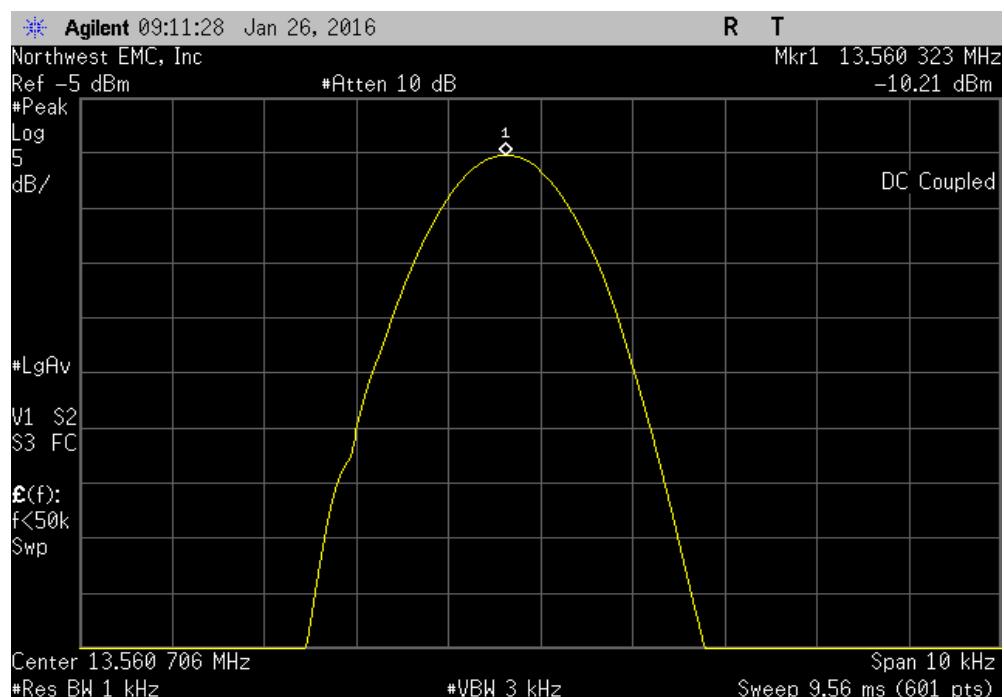
RFID 13.56MHz, Extreme Temperature, +30°C

Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560356	13.56	-0.0026	±0.01	Pass



RFID 13.56MHz, Extreme Temperature, +40°C

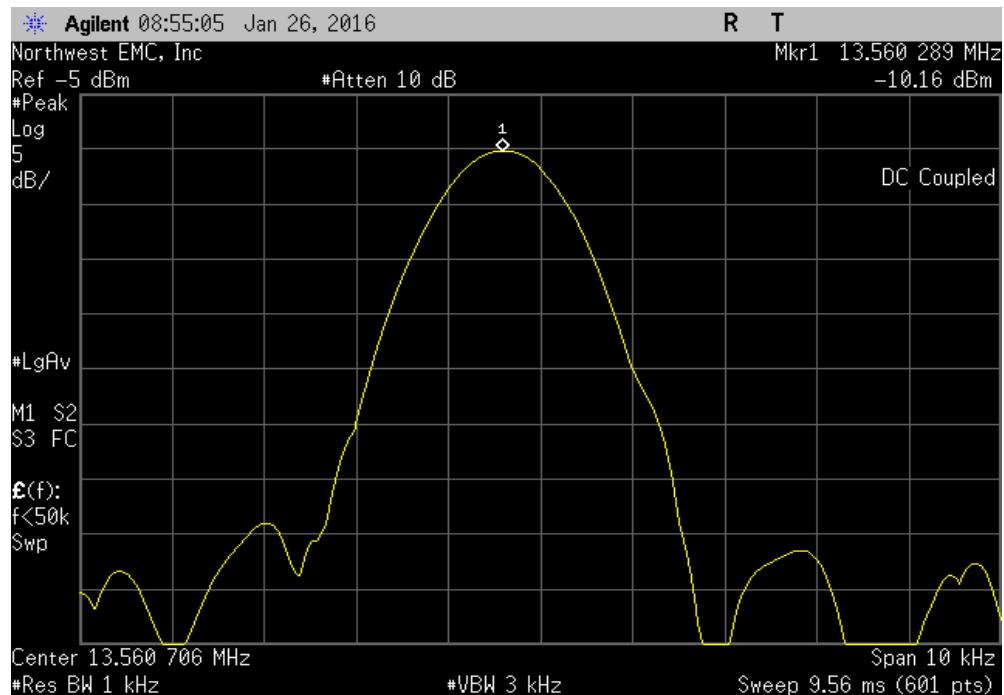
Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560323	13.56	-0.0024	±0.01	Pass



FREQUENCY STABILITY

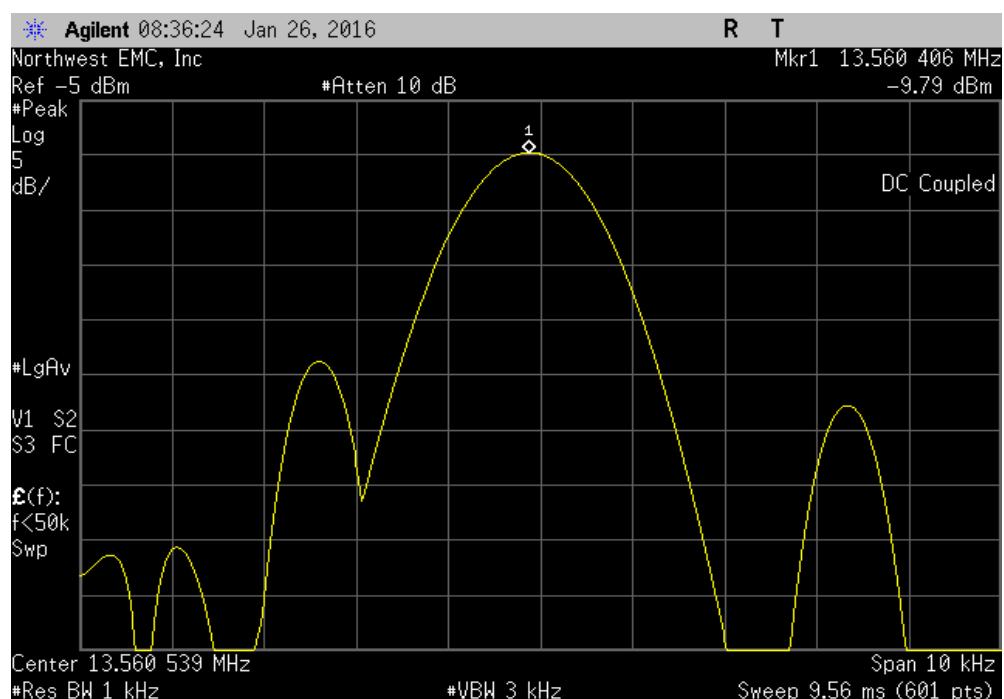
RFID 13.56MHz, Extreme Temperature, +50°C

Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560289	13.56	-0.0021	±0.01	Pass



RFID 13.56MHz, Extreme Voltage, +15%

Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results
13.560406	13.56	-0.0030	±0.01	Pass



FREQUENCY STABILITY

RFID 13.56MHz, Extreme Voltage, -15%					
Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Results	
13.560404	13.56	-0.0030	±0.01	Pass	

