

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 |

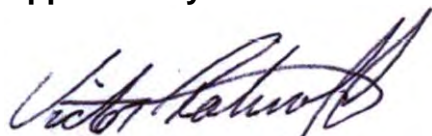
Results

| 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

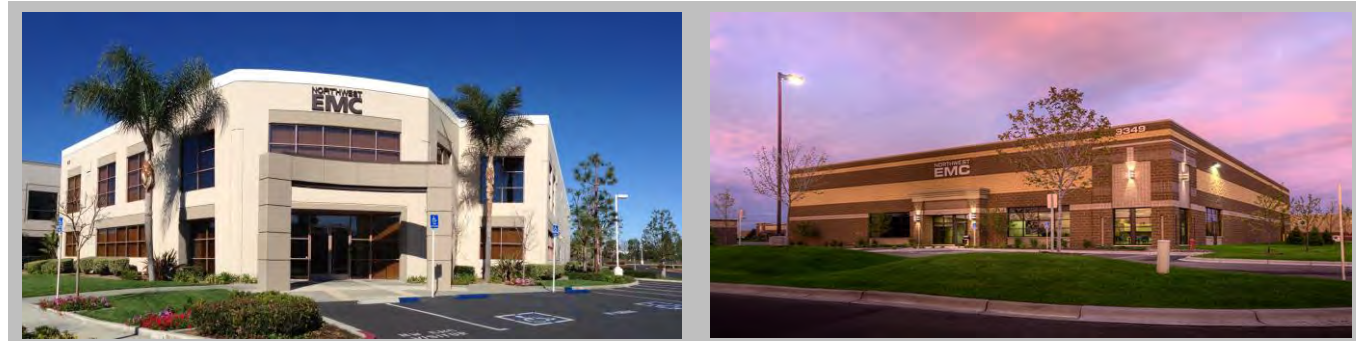
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement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

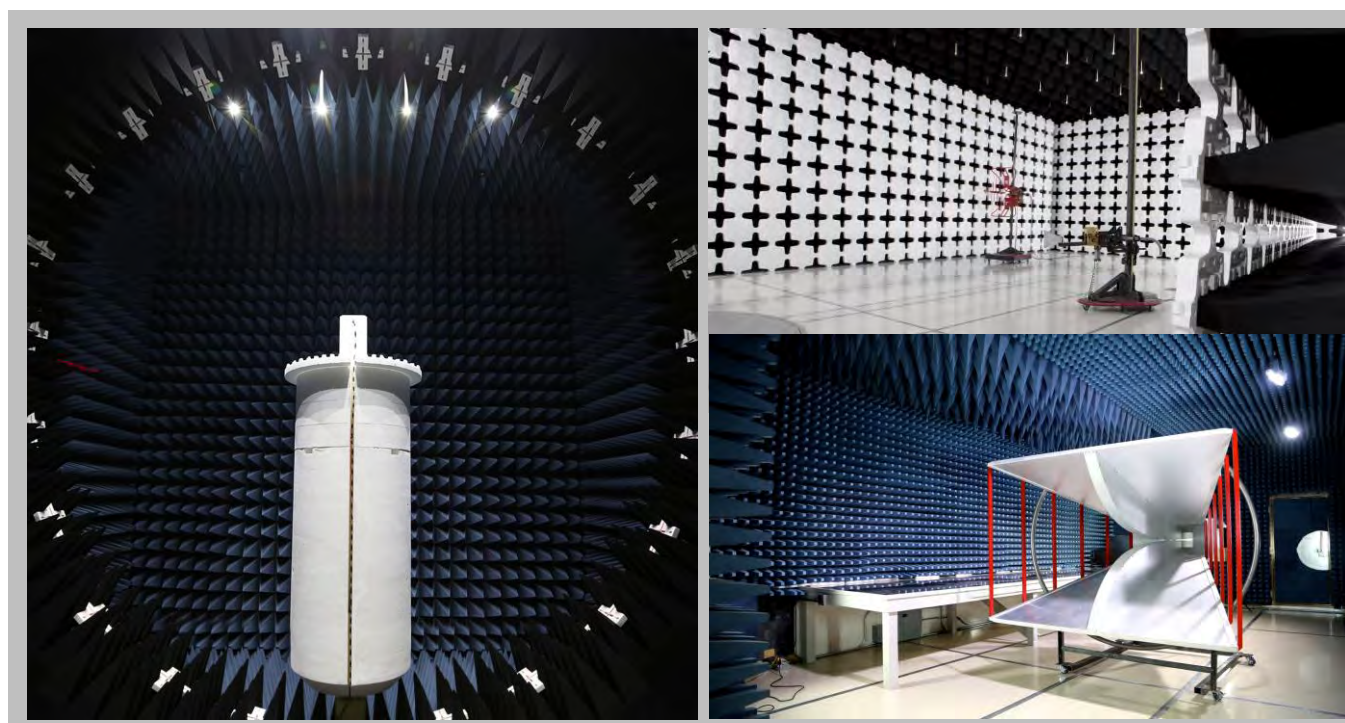
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

| 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 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: | 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

IVWA0002 - 5

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) | BW (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.

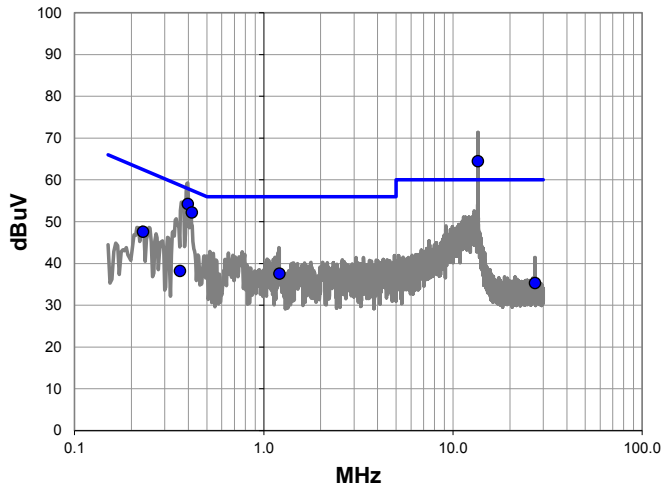
In the event that the operating frequency of 13.56 MHz is causing the product to fail the FCC 15.207 limits, the following guidance can be used:

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.

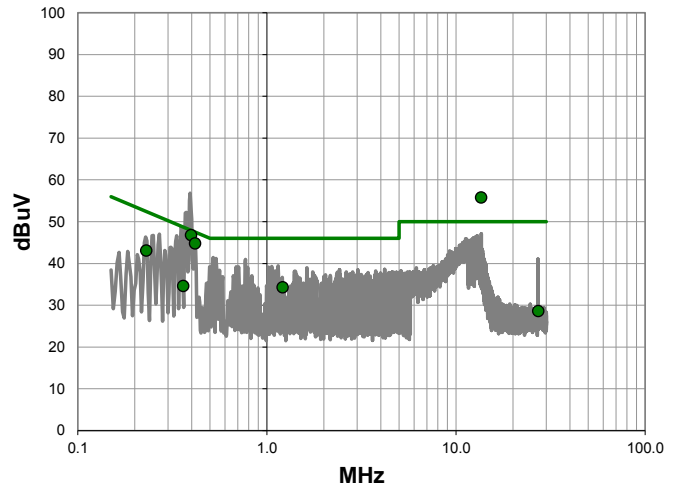
| | | | | | |
|-----------------|---|-------------------|-----------|---|-----------------|
| Work Order: | IVWA0002 | Date: | 01/27/16 |  | |
| Project: | None | Temperature: | 19.5 °C | | |
| Job Site: | OC06 | Humidity: | 36.2% RH | | |
| Serial Number: | 1000022 | Barometric Pres.: | 1024 mbar | 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

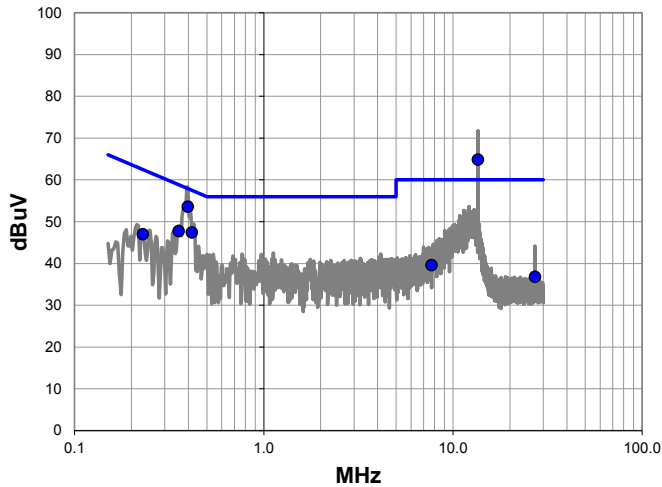
| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Compared to Spec. (dB) |
|------------|------------------|-------------|-----------------|--------------------|------------------------|
| 13.560 | 35.1 | 20.7 | 55.8 | 50.0 | 5.8 |
| 0.396 | 26.8 | 20.0 | 46.8 | 47.9 | -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. | | | | |

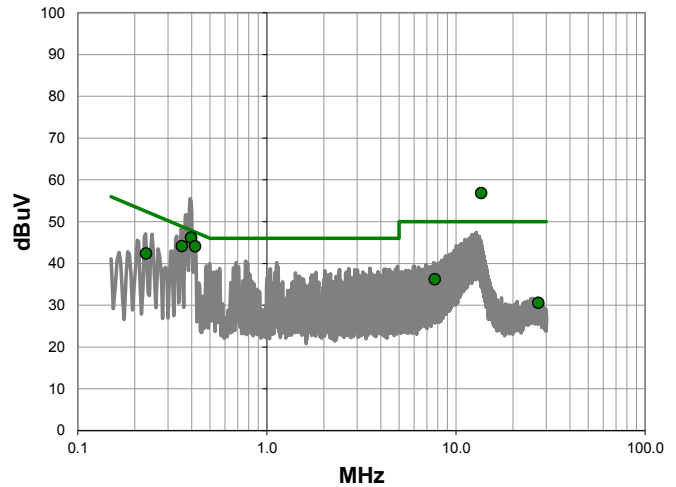
| Test Specifications | Test Method |
|---------------------|------------------|
| FCC 15.207:2016 | ANSI C63.10:2013 |

| 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

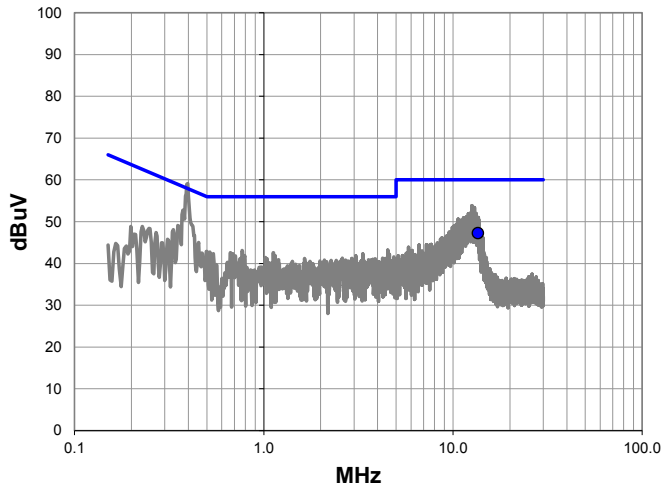
| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Compared to Spec. (dB) |
|------------|------------------|-------------|-----------------|--------------------|------------------------|
| 13.561 | 36.2 | 20.7 | 56.9 | 50.0 | 6.9 |
| 0.396 | 26.2 | 20.0 | 46.2 | 47.9 | -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. | | | | |

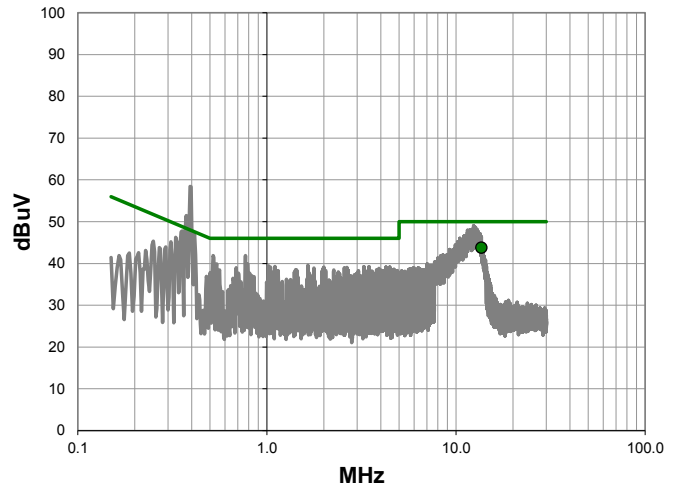
| | |
|---------------------|------------------|
| Test Specifications | Test Method |
| FCC 15.207:2016 | ANSI C63.10:2013 |

| | | | | | | | |
|-------|----|-------|-----------|-------------------|---|---------|------|
| Run # | 12 | Line: | High Line | Ext. Attenuation: | 0 | Results | Pass |
|-------|----|-------|-----------|-------------------|---|---------|------|

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

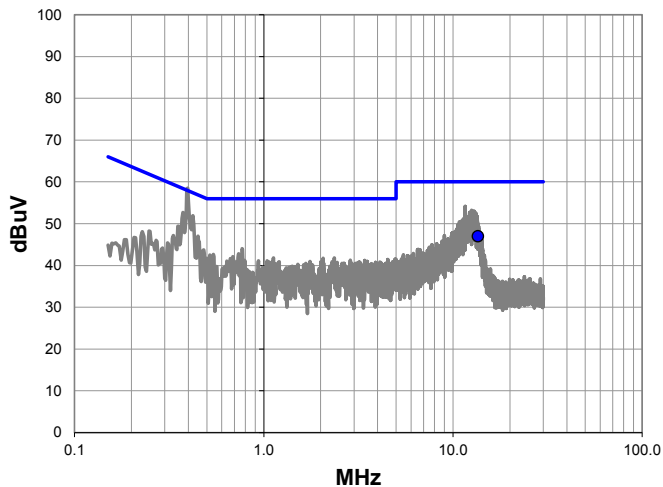
| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Compared to Spec. (dB) |
|------------|------------------|-------------|-----------------|--------------------|------------------------|
| 13.564 | 23.1 | 20.7 | 43.8 | 50.0 | -6.2 |

| | | | | | |
|-----------------|--|-------------------|-----------|---|-----------------|
| 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. | | | | |

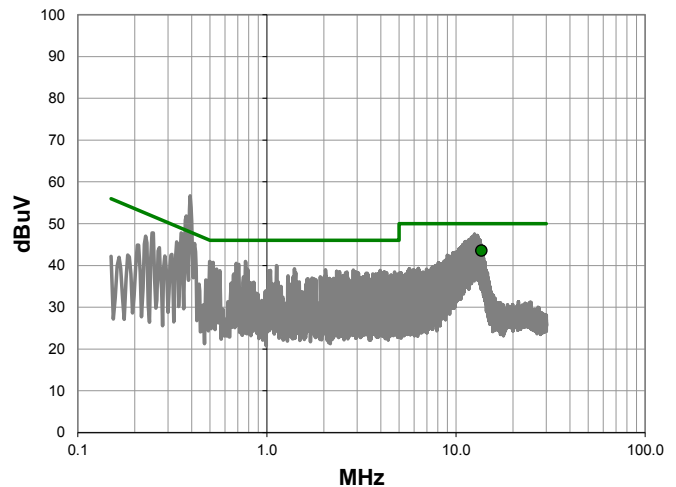
| Test Specifications | Test Method |
|---------------------|------------------|
| FCC 15.207:2016 | ANSI C63.10:2013 |

| 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

IVWA0002 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency 12.71 MHz

Stop Frequency 14.41 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 |
|------------------------------|---------------|----------------------|-----|------------|----------|
| 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.



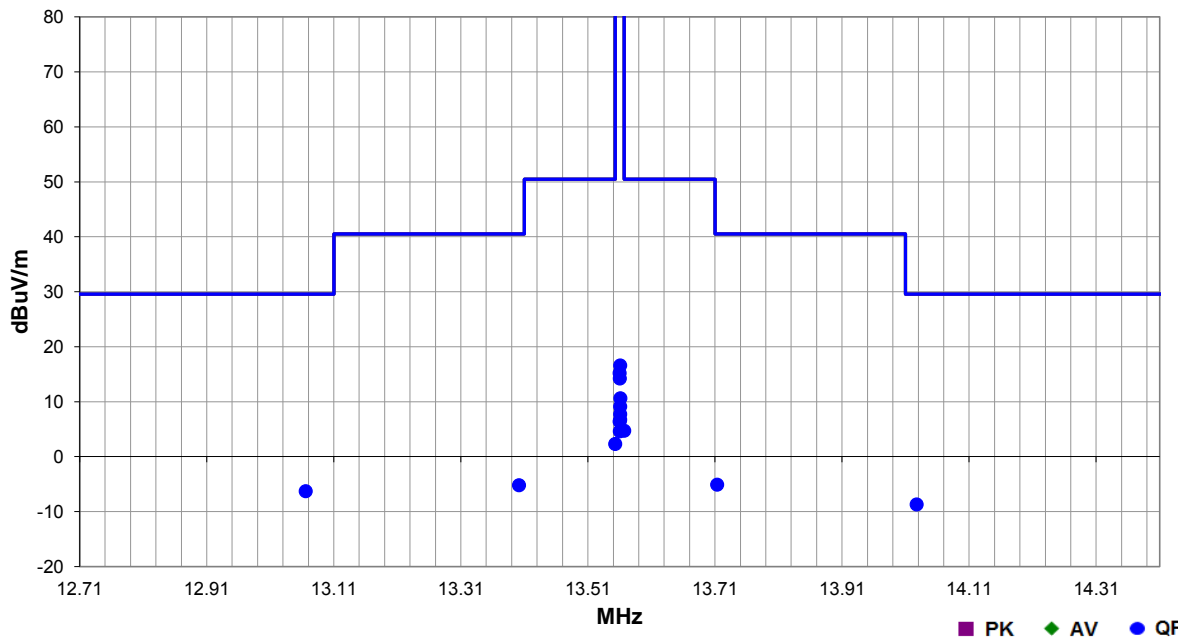
FIELD STRENGTH OF FUNDAMENTAL

PSA-ESCI 2015.07.01
EmiR5 2015.11.06

| | | | | |
|-----------------|---------------------------------------|-------------------|-----------|--|
| 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 |

| | | | | | | | |
|-------|---|-------------------|---|-------------------|------|---------|------|
| Run # | 4 | Test Distance (m) | 3 | Antenna Height(s) | 1(m) | Results | Pass |
|-------|---|-------------------|---|-------------------|------|---------|------|



| 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 | Par 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 |

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

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.

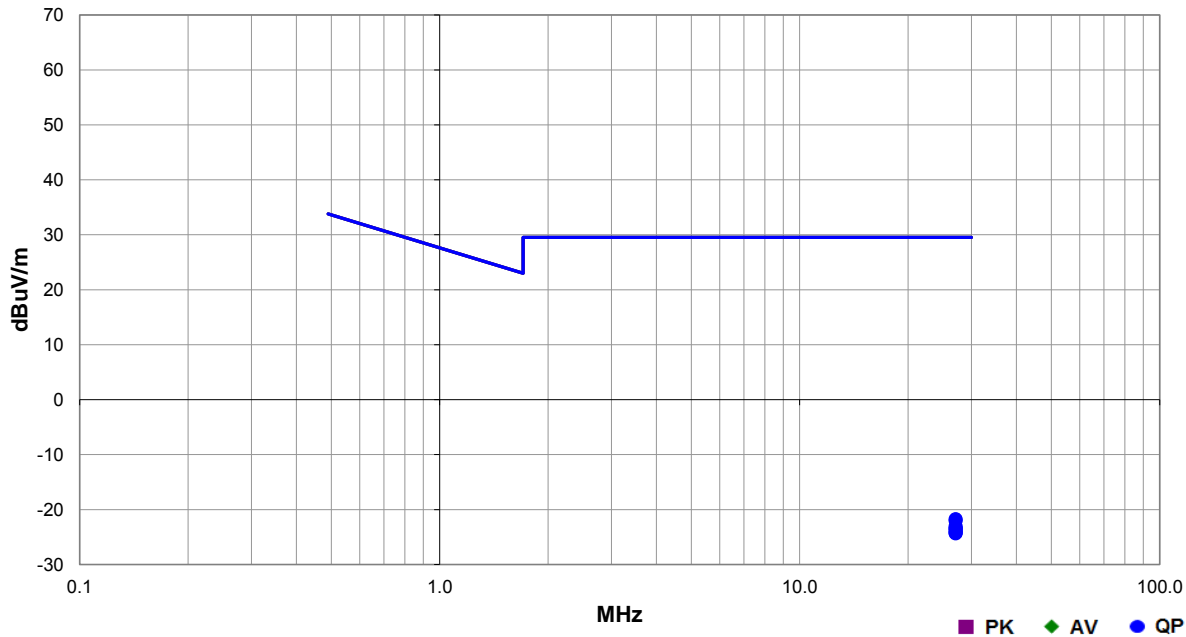
As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of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

FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz

| | | | | |
|-----------------|---------------------------------------|-------------------|-----------|--|
| 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 |

| | | | | | | | |
|-------|---|-------------------|---|-------------------|-----------|---------|------|
| Run # | 6 | Test Distance (m) | 3 | Antenna Height(s) | 1 to 4(m) | Results | Pass |
|-------|---|-------------------|---|-------------------|-----------|---------|------|



| 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.

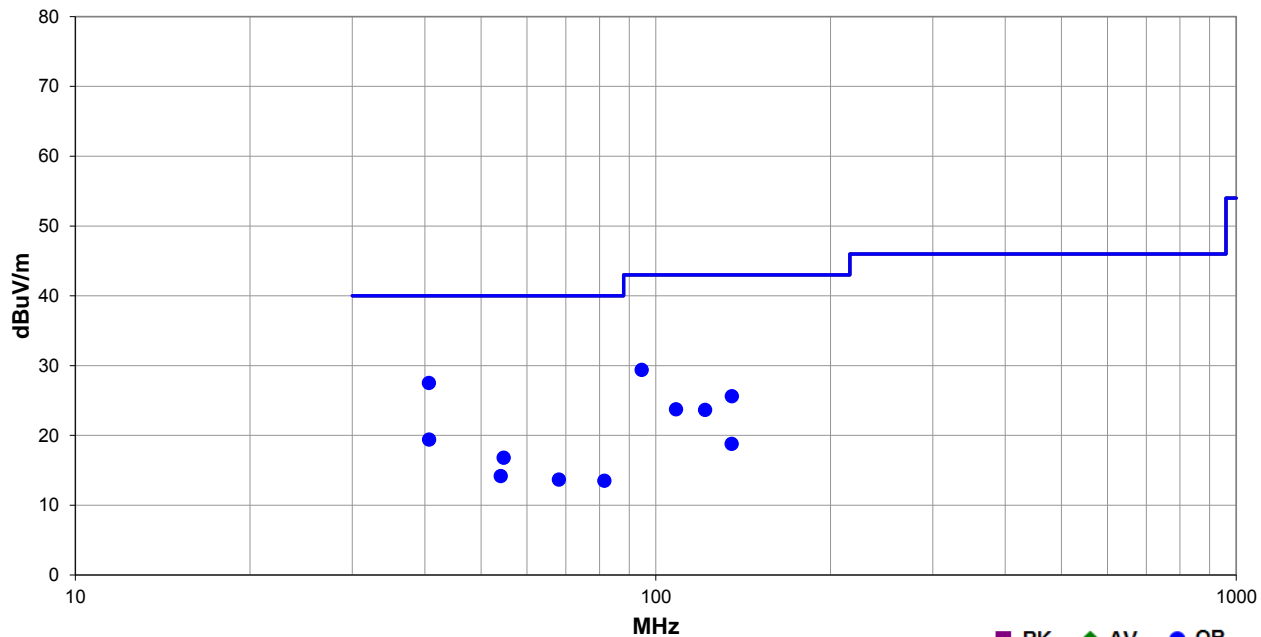
While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009).

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz

| | | | | |
|------------------------|---------------------------------------|--------------------------|-----------|--|
| 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 | | | |
| 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 |

| Run # | 8 | Test Distance (m) | 3 | Antenna Height(s) | 1 to 4(m) | Results | Pass |
|-------|---|-------------------|---|-------------------|-----------|---------|------|
|-------|---|-------------------|---|-------------------|-----------|---------|------|



| 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.

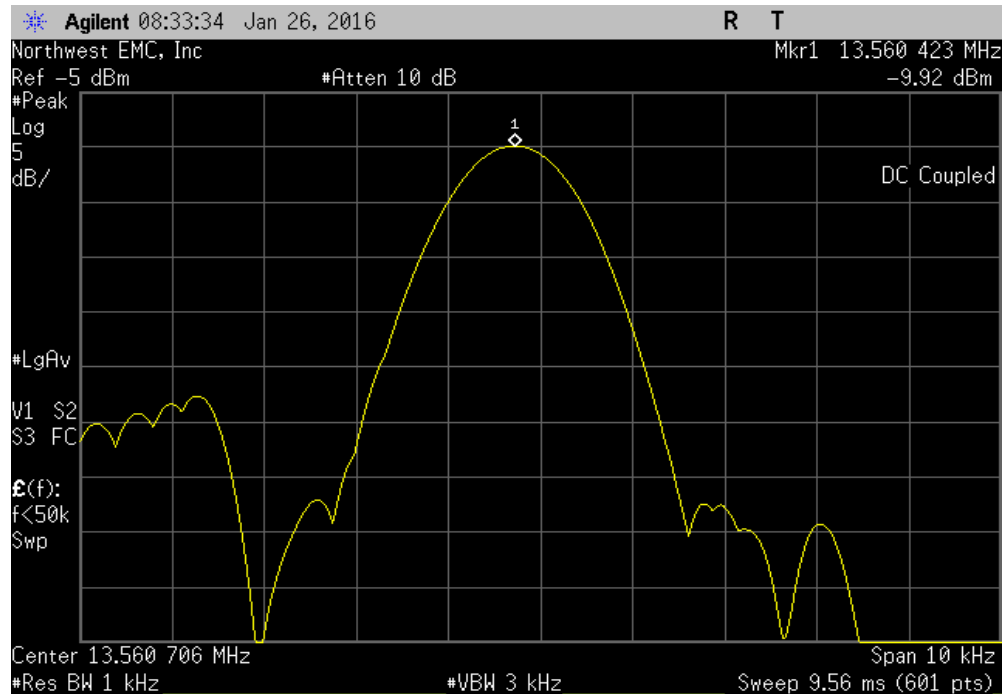
The measurement was made with a direct connection between the EUT antenna port and the test equipment. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

FREQUENCY STABILITY

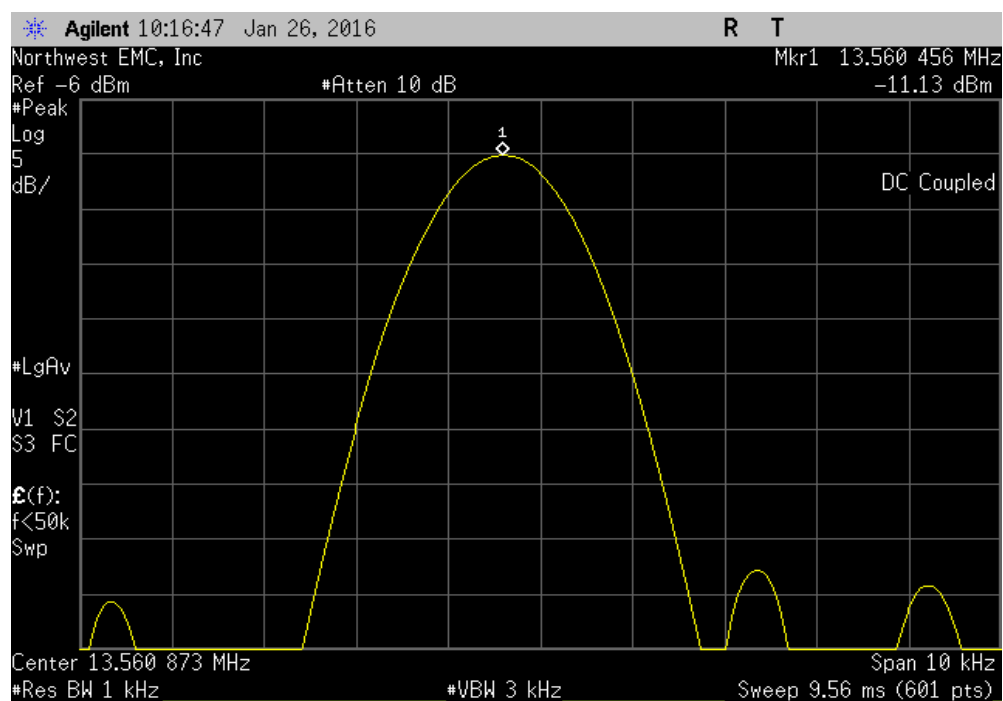
| | | | |
|---|--------------------------------|---|----------------------|
| EUT: Model 400 w/RFID | | Work Order: IVWA0002 | |
| Serial Number: 1000021 | | Date: 01/26/16 | |
| Customer: ivWatch, LLC | | Temperature: 19.5°C | |
| Attendees: Matthew Alley | | Humidity: 39% | |
| Project: None | | Barometric 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 | 13.560423 | 13.56 |
| | Extreme Temperature, 0°C | 13.560456 | 13.56 |
| | Extreme Temperature, +10°C | 13.560440 | 13.56 |
| | Extreme Temperature, +20°C | 13.560406 | 13.56 |
| | Extreme Temperature, +30°C | 13.560356 | 13.56 |
| | Extreme Temperature, +40°C | 13.560323 | 13.56 |
| | Extreme Temperature, +50°C | 13.560289 | 13.56 |
| | Extreme Voltage, +15% | 13.560406 | 13.56 |
| | Extreme Voltage, -15% | 13.560404 | 13.56 |

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 | |

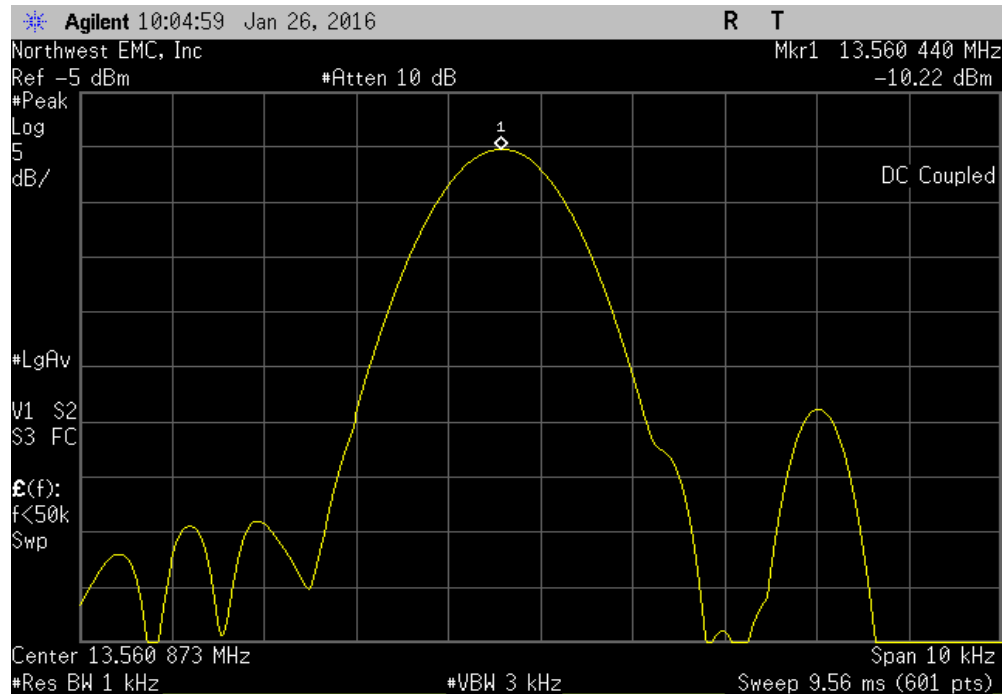


| RFID 13.56MHz, Extreme Temperature, 0°C | | | | | | |
|---|----------------------|----------------------|-----------|-----------|---------|--|
| | Measured Value (MHz) | Assigned Value (MHz) | Error (%) | Limit (%) | Results | |
| | 13.560456 | 13.56 | -0.0034 | ±0.01 | Pass | |

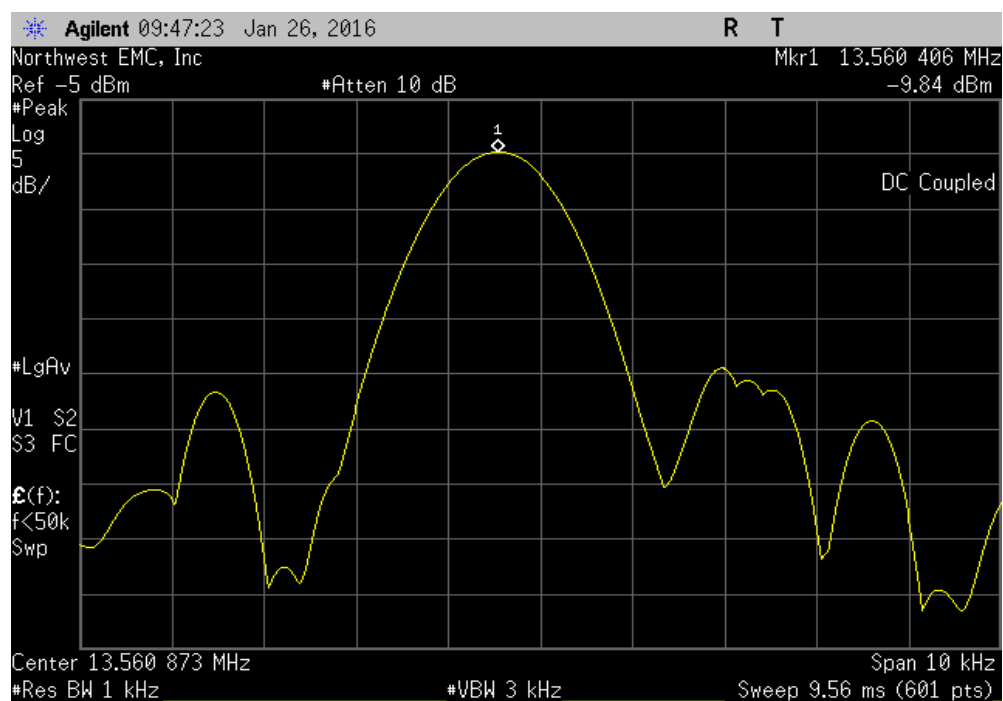


FREQUENCY STABILITY

| 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 | |

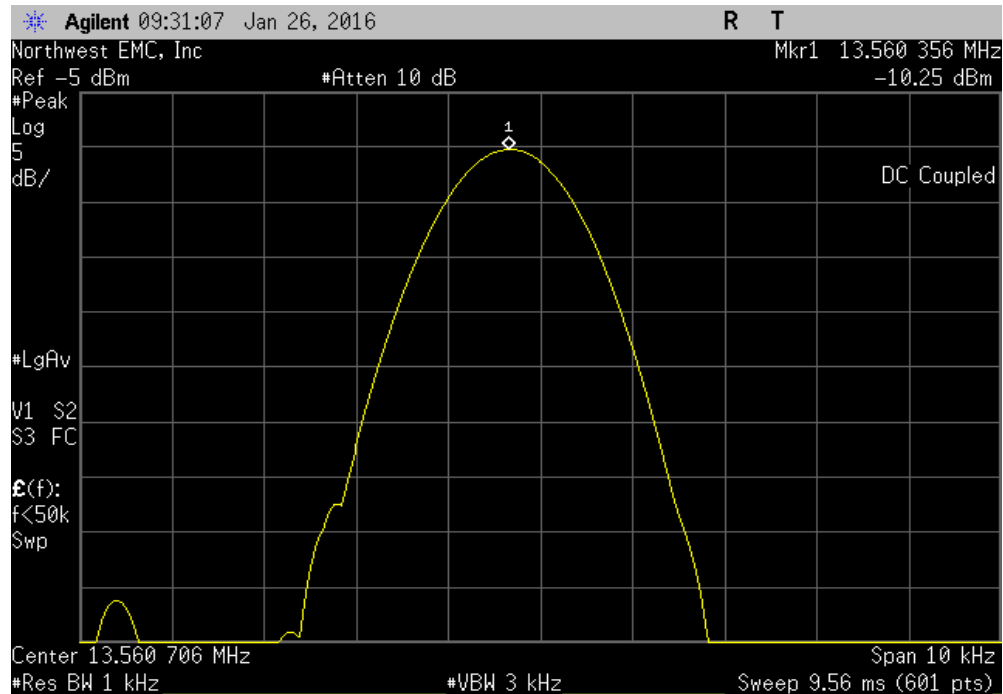


| RFID 13.56MHz, Extreme Temperature, +20°C | | | | | | |
|---|----------------------|----------------------|-----------|-----------|---------|--|
| | Measured Value (MHz) | Assigned Value (MHz) | Error (%) | Limit (%) | Results | |
| | 13.560406 | 13.56 | -0.0030 | ±0.01 | Pass | |

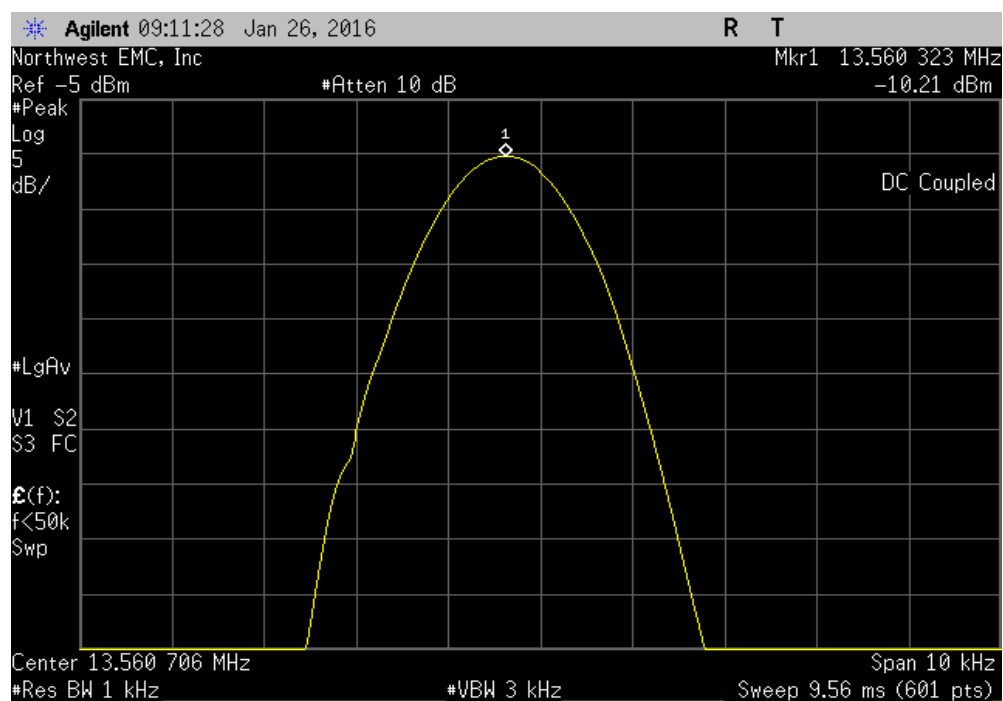


FREQUENCY STABILITY

| 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 | |

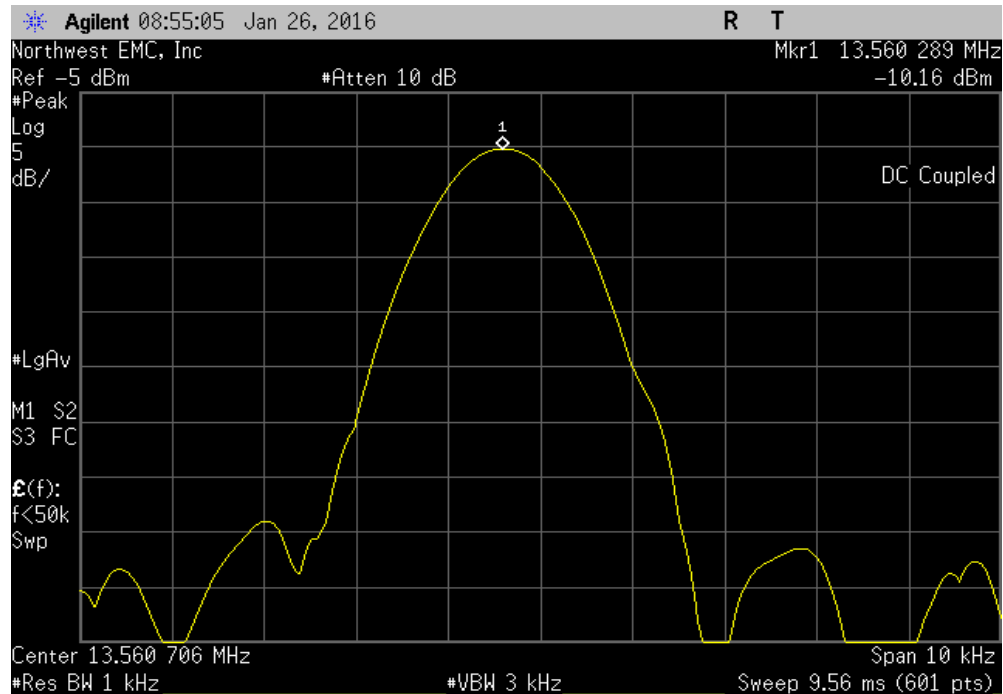


| RFID 13.56MHz, Extreme Temperature, +40°C | | | | | | |
|---|----------------------|----------------------|-----------|-----------|---------|--|
| | Measured Value (MHz) | Assigned Value (MHz) | Error (%) | Limit (%) | Results | |
| | 13.560323 | 13.56 | -0.0024 | ±0.01 | Pass | |

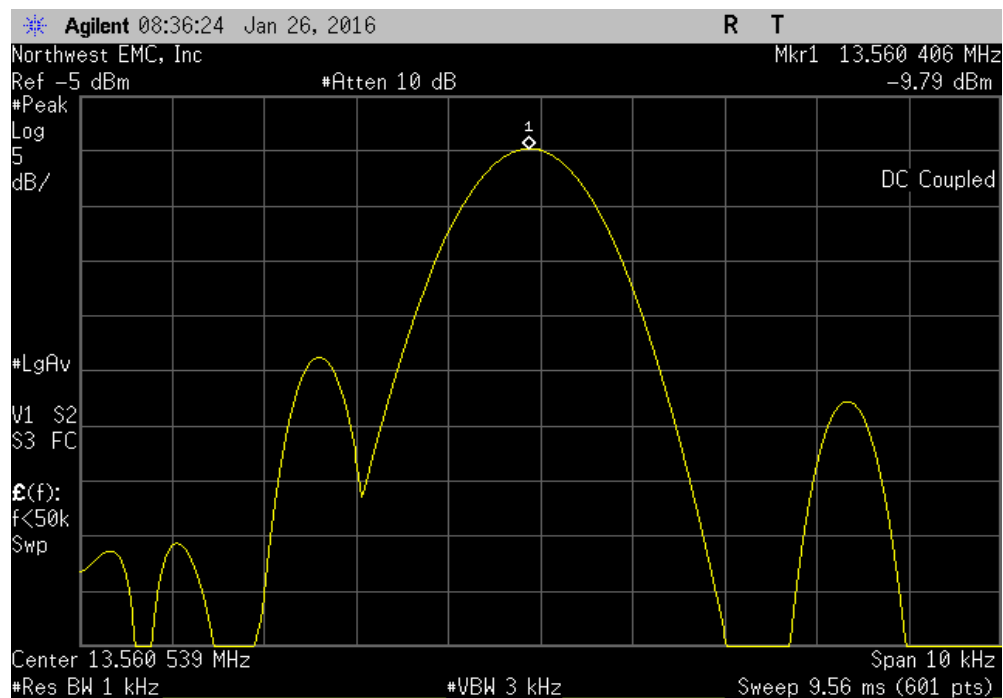


FREQUENCY STABILITY

| 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 | |

