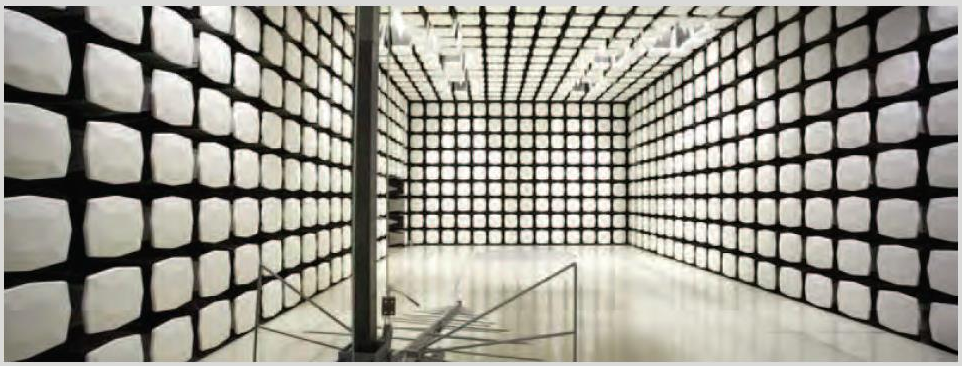
NORTHWEST EMC

# PicoBrew

## Pico S

**FCC 15.207:2016**
**FCC 15.225:2016**
**13.56 MHZ Radio using RFID**

**Report # PIBR0002**



NVLAP TESTING

NVLAP Lab Code: 200629-0

# CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

**Last Date of Test: September 22, 2016**
**PicoBrew**
**Model: Pico S**

## Radio Equipment Testing

### Standards

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

### Results

| Method Clause | Test Description | Applied | Results | Comments |
|---|---|---|---|---|
| 6.2 | AC – 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:

*Rod Munro, 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

NORTHWEST EMC
REV 2014.10.14

| Revision Number | Description | Date | Page Number |
|---|---|---|---|
| 00 | None | | |

# ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.7.25

## 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

**ISED** - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

## 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

# MEASUREMENT UNCERTAINTY

TMU.2015.07.10

## 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 QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. 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.

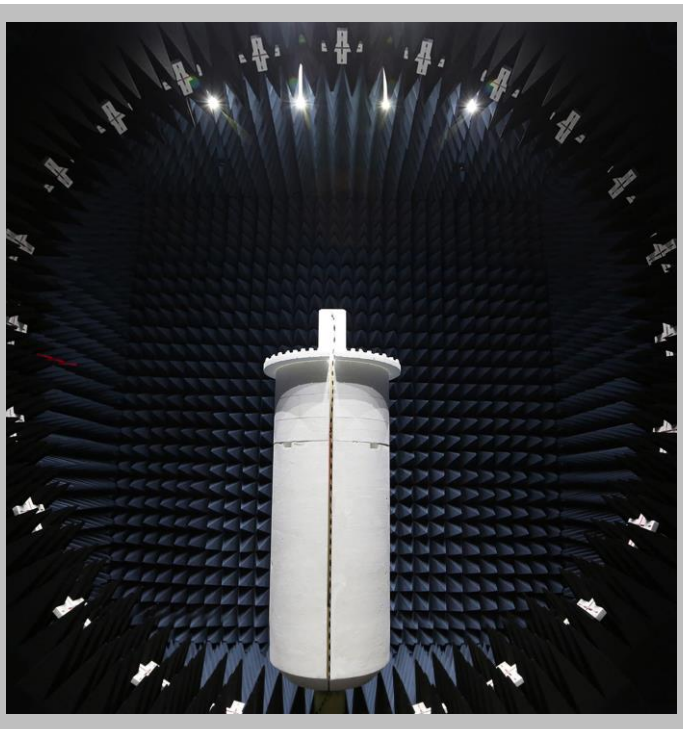
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

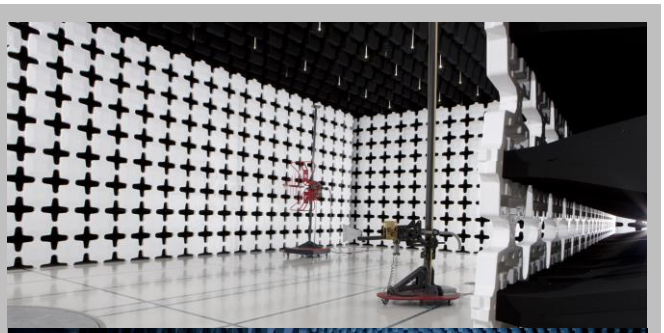
| Test | + MU | - MU |
|---|---|---|
| Frequency Accuracy (Hz) | 0.0007% | -0.0007% |
| Amplitude Accuracy (dB) | 1.2 dB | -1.2 dB |
| Conducted Power (dB) | 0.3 dB | -0.3 dB |
| Radiated Power via Substitution (dB) | 0.7 dB | -0.7 dB |
| Temperature (degrees C) | 0.7°C | -0.7°C |
| Humidity (% RH) | 2.5% RH | -2.5% RH |
| Voltage (AC) | 1.0% | -1.0% |
| Voltage (DC) | 0.7% | -0.7% |
| Field Strength (dB) | 5.0 dB | -5.0 dB |
| AC Powerline Conducted Emissions (dB) | 2.4 dB | -2.4 dB |

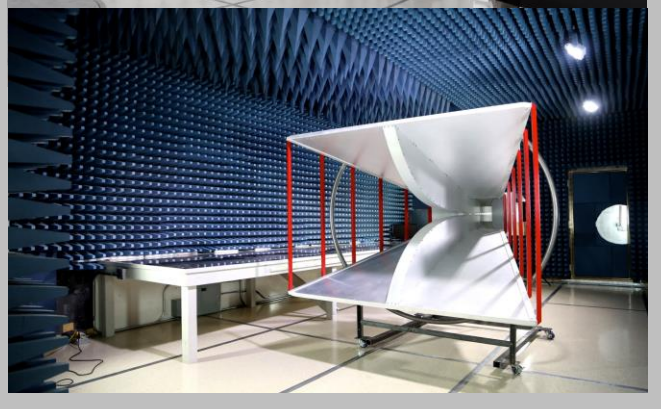
# FACILITIES

REV 2016.7.25

| California | Minnesota | New York | Oregon | Texas | Washington |
|---|---|---|---|---|---|
| Labs OC01-13<br>41 Tesla<br>Irvine, CA 92618<br>(949) 861-8918 | Labs MN01-08, MN10<br>9349 W Broadway Ave.<br>Brooklyn Park, MN 55445<br>(612)-638-5136 | Labs NY01-04<br>4939 Jordan Rd.<br>Elbridge, NY 13060<br>(315) 554-8214 | Labs EV01-12<br>22975 NW Evergreen Pkwy<br>Hillsboro, OR 97124<br>(503) 844-4066 | Labs TX01-09<br>3801 E Plano Pkwy<br>Plano, TX 75074<br>(469) 304-5255 | Labs NC01-05<br>19201 120th Ave NE<br>Bothell, WA 98011<br>(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 |
| **Innovation, Science and Economic Development 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

2014-12-10

## Client and Equipment Under Test (EUT) Information

| | |
|---|---|
| **Company Name:** | PicoBrew |
| **Address:** | 2121 North 35th Street Suite 100 |
| **City, State, Zip:** | Seattle, WA 98103 |
| **Test Requested By:** | Connor Lang |
| **Model:** | Pico S |
| **First Date of Test:** | September 14, 2016 |
| **Last Date of Test:** | September 22, 2016 |
| **Receipt Date of Samples:** | September 14, 2016 |
| **Equipment Design Stage:** | Pre-production |
| **Equipment Condition:** | No Damage |

## Information Provided by the Party Requesting the Test

| **Functional Description of the EUT:** |
|---|
| The Pico S automates the process of brewing craft beer in the home. It does so through the use of circulation pumps, fluid valves, and a steam injector to heat the liquid. Additionally, it is a smart, connected device that reads ingredient packs automatically through the use of a 13.56MHz RFID system, and logs data to the cloud via WiFi. |

| **Testing Objective:** |
|---|
| To demonstrate compliance of the 13.56 MHz RFID radio to FCC Part 15.225 specifications. |

# CONFIGURATIONS

NORTHWEST EMC 2014-12-10

## Configuration PIBR0002- 1

| Software/Firmware Running during test | |
|---|---|
| **Description** | **Version** |
| Test Firmware | 0.0.1 |

| EUT | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model/Part Number** | **Serial Number** |
| Smart Home Brewing Appliance (120VAC) | PicoBrew | 100-001 | PS20160818000047 |

| Cables | | | | | |
|---|---|---|---|---|---|
| **Cable Type** | **Shield** | **Length (m)** | **Ferrite** | **Connection 1** | **Connection 2** |
| AC Cable | No | 1.2m | No | Smart Home Brewing Appliance (120VAC) | AC Mains |

# MODIFICATIONS

NORTHWEST EMC
2014-12-10

## Equipment Modifications

| Item | Date | Test | Modification | Note | Disposition of EUT |
|---|---|---|---|---|---|
| 1 | 9/14/2016 | 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 | 9/14/2016 | 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 | 9/16/2016 | 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. |
| 4 | 9/19/2016 | 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. |
| 5 | 9/22/2016 | AC – Powerline Conducted Emissions | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | Scheduled testing was completed. |

# AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

## TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

## TEST EQUIPMENT

| Description | Manufacturer | Model | ID | Last Cal. | Cal. Due |
|---|---|---|---|---|---|
| LISN | Solar Electronics | 9252-50-R-24-BNC | LIM | 11/3/2015 | 11/3/2016 |
| Receiver | Rohde & Schwarz | ESCI | ARE | 8/8/2016 | 8/8/2017 |
| Cable - Conducted Cable Assembly | Northwest EMC | NC4, HHF, TYL | NC4A | 5/6/2016 | 5/6/2017 |

## MEASUREMENT UNCERTAINTY

| Description | | |
|---|---|---|
| Expanded k=2 | 2.4 dB | -2.4 dB |

## CONFIGURATIONS INVESTIGATED

PIBR0002-1

## MODES INVESTIGATED

RFID, 13.56 MHz
RFID, 13.56 MHz, Antenna port terminated with 50ohm load

# AC – POWERLINE CONDUCTED EMISSIONS

| | | | |
|---|---|---|---|
| EUT: | Pico S | Work Order: | PIBR0002 |
| Serial Number: | PS20160818000047 | Date: | 09/22/2016 |
| Customer: | PicoBrew | Temperature: | 22°C |
| Attendees: | Connor Lang | Relative Humidity: | 45% |
| Customer Project: | None | Bar. Pressure: | 1020 mb |
| Tested By: | Richard Mellroth | Job Site: | NC05 |
| Power: | 110VAC/60Hz | Configuration: | PIBR0002-1 |

## TEST SPECIFICATIONS

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

## TEST PARAMETERS

| | | | | | |
|---|---|---|---|---|---|
| Run #: | 1 | Line: | High Line | Add. Ext. Attenuation (dB): | 0 |

## COMMENTS

None

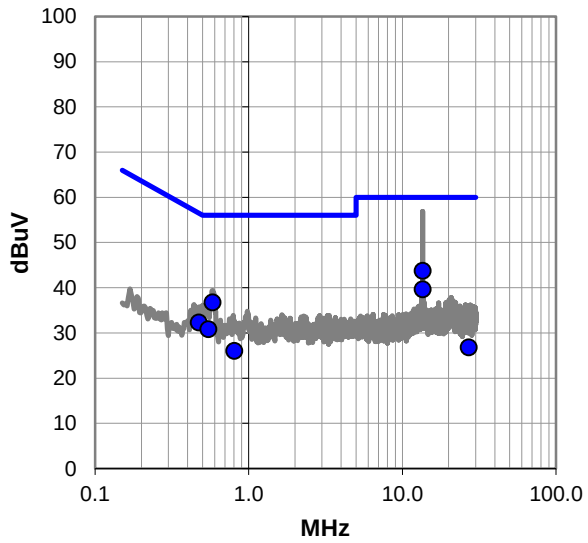
## EUT OPERATING MODES

RFID, 13.56 MHz

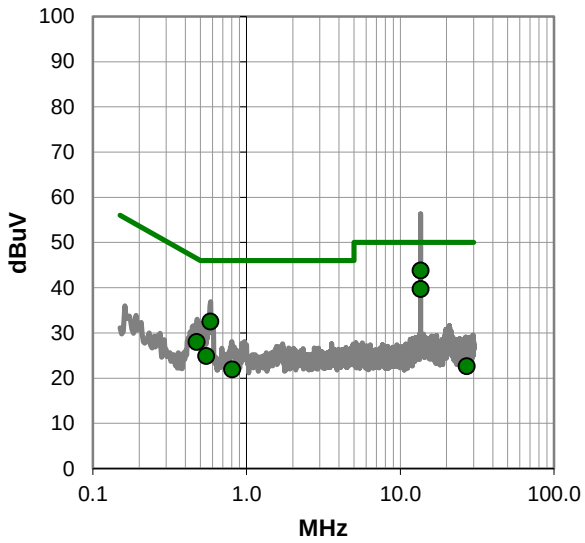
## DEVIATIONS FROM TEST STANDARD

None

**Quasi Peak Data - vs - Quasi Peak Limit**




**Average Data - vs - Average Limit**



# AC – POWERLINE CONDUCTED EMISSIONS

WTD.2016.05.18

## RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.567 | 21.9 | 21.8 | 43.7 | 60.0 | -16.3 |
| 0.582 | 16.1 | 20.6 | 36.7 | 56.0 | -19.3 |
| 13.553 | 17.8 | 21.8 | 39.6 | 60.0 | -20.4 |
| 0.475 | 11.7 | 20.6 | 32.3 | 56.4 | -24.1 |
| 0.547 | 10.2 | 20.6 | 30.8 | 56.0 | -25.2 |
| 0.806 | 5.3 | 20.7 | 26.0 | 56.0 | -30.0 |
| 27.122 | 3.0 | 23.8 | 26.8 | 60.0 | -33.2 |

Average Data - vs - Average Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.567 | 22.0 | 21.8 | 43.8 | 50.0 | -6.2 |
| 13.553 | 17.9 | 21.8 | 39.7 | 50.0 | -10.3 |
| 0.582 | 11.9 | 20.6 | 32.5 | 46.0 | -13.5 |
| 0.475 | 7.4 | 20.6 | 28.0 | 46.4 | -18.4 |
| 0.547 | 4.3 | 20.6 | 24.9 | 46.0 | -21.1 |
| 0.806 | 1.2 | 20.7 | 21.9 | 46.0 | -24.1 |
| 27.122 | -1.2 | 23.8 | 22.6 | 50.0 | -27.4 |

## CONCLUSION

Pass

Tested By

# AC – POWERLINE CONDUCTED EMISSIONS

| | | | |
|---|---|---|---|
| EUT: | Pico S | Work Order: | PIBR0002 |
| Serial Number: | PS20160818000047 | Date: | 09/22/2016 |
| Customer: | PicoBrew | Temperature: | 22°C |
| Attendees: | Connor Lang | Relative Humidity: | 45% |
| Customer Project: | None | Bar. Pressure: | 1020 mb |
| Tested By: | Richard Mellroth | Job Site: | NC05 |
| Power: | 110VAC/60Hz | Configuration: | PIBR0002-1 |

## TEST SPECIFICATIONS

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

## TEST PARAMETERS

| | | | | | |
|---|---|---|---|---|---|
| Run #: | 3 | Line: | Neutral | Add. Ext. Attenuation (dB): | 0 |

## COMMENTS

None

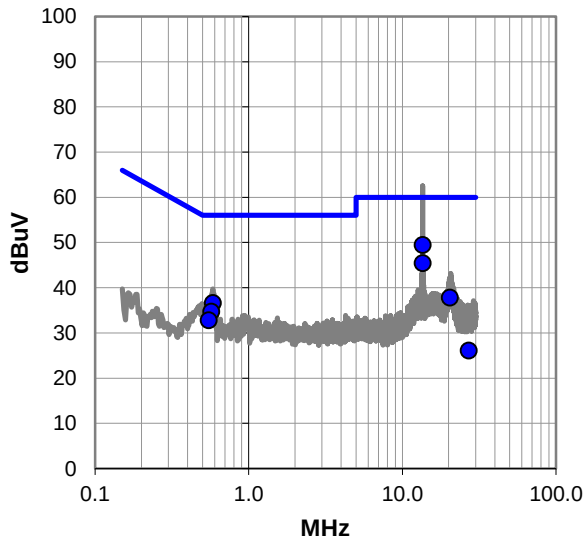
## EUT OPERATING MODES

RFID, 13.56 MHz

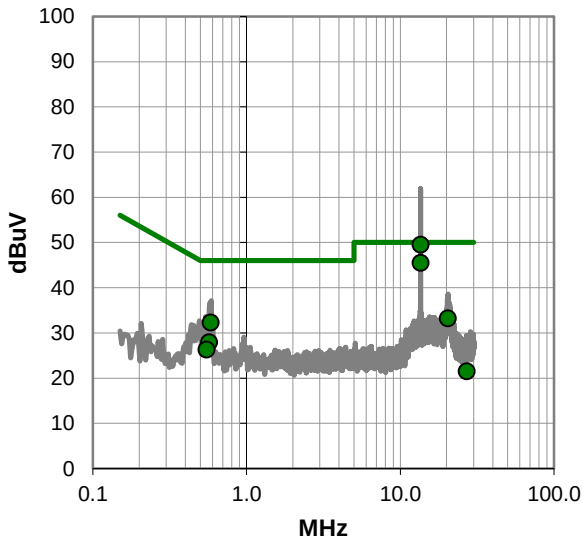
## DEVIATIONS FROM TEST STANDARD

None

**Quasi Peak Data - vs - Quasi Peak Limit**




**Average Data - vs - Average Limit**



# AC – POWERLINE CONDUCTED EMISSIONS

WTD.2016.05.18

## RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.567 | 27.6 | 21.8 | 49.4 | 60.0 | -10.6 |
| 13.553 | 23.6 | 21.8 | 45.4 | 60.0 | -14.6 |
| 0.584 | 16.0 | 20.6 | 36.6 | 56.0 | -19.4 |
| 0.571 | 14.1 | 20.6 | 34.7 | 56.0 | -21.3 |
| 20.410 | 15.1 | 22.7 | 37.8 | 60.0 | -22.2 |
| 0.550 | 12.2 | 20.6 | 32.8 | 56.0 | -23.2 |
| 27.118 | 2.3 | 23.8 | 26.1 | 60.0 | -33.9 |

Average Data - vs - Average Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.567 | 27.7 | 21.8 | 49.5 | 50.0 | -0.5 |
| 13.553 | 23.7 | 21.8 | 45.5 | 50.0 | -4.5 |
| 0.584 | 11.7 | 20.6 | 32.3 | 46.0 | -13.7 |
| 20.410 | 10.5 | 22.7 | 33.2 | 50.0 | -16.8 |
| 0.571 | 7.3 | 20.6 | 27.9 | 46.0 | -18.1 |
| 0.550 | 5.7 | 20.6 | 26.3 | 46.0 | -19.7 |
| 27.118 | -2.3 | 23.8 | 21.5 | 50.0 | -28.5 |

## CONCLUSION

Pass

Tested By

# AC – POWERLINE CONDUCTED EMISSIONS

| | | | |
|---|---|---|---|
| EUT: | Pico S | Work Order: | PIBR0002 |
| Serial Number: | PS20160818000047 | Date: | 09/22/2016 |
| Customer: | PicoBrew | Temperature: | 22°C |
| Attendees: | Connor Lang | Relative Humidity: | 45% |
| Customer Project: | None | Bar. Pressure: | 1020 mb |
| Tested By: | Richard Mellroth | Job Site: | NC05 |
| Power: | 110VAC/60Hz | Configuration: | PIBR0002-1 |

## TEST SPECIFICATIONS

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

## TEST PARAMETERS

| | | | | | |
|---|---|---|---|---|---|
| Run #: | 4 | Line: | Neutral | Add. Ext. Attenuation (dB): | 0 |

## COMMENTS

None

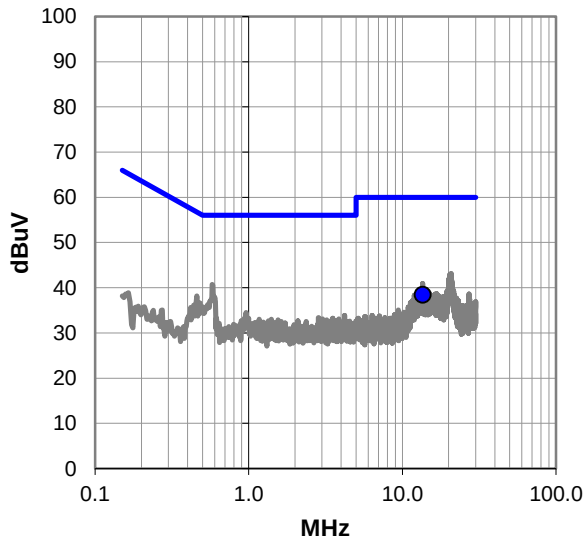
## EUT OPERATING MODES

RFID, 13.56 MHz, Antenna port terminated with 50ohm load

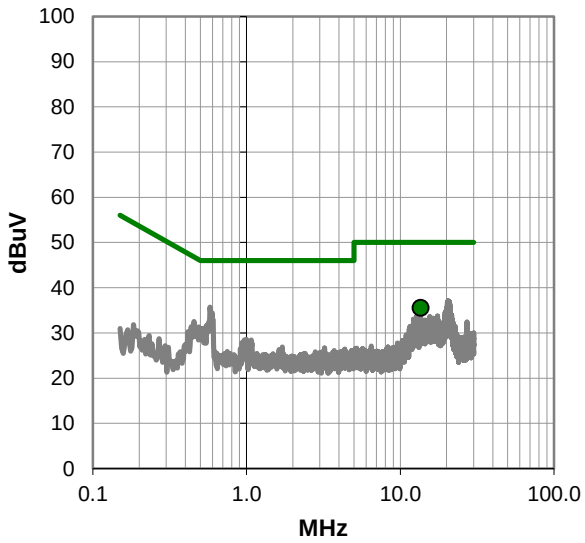
## DEVIATIONS FROM TEST STANDARD

None

**Quasi Peak Data - vs - Quasi Peak Limit**




**Average Data - vs - Average Limit**



# AC – POWERLINE CONDUCTED EMISSIONS

WTD.2016.05.18

## RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.561 | 16.6 | 21.8 | 38.4 | 60.0 | -21.6 |

Average Data - vs - Average Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.561 | 13.7 | 21.8 | 35.5 | 50.0 | -14.5 |

## CONCLUSION

Pass

Tested By

# AC – POWERLINE CONDUCTED EMISSIONS

| | | | |
|---|---|---|---|
| EUT: | Pico S | Work Order: | PIBR0002 |
| Serial Number: | PS20160818000047 | Date: | 09/22/2016 |
| Customer: | PicoBrew | Temperature: | 22°C |
| Attendees: | Connor Lang | Relative Humidity: | 45% |
| Customer Project: | None | Bar. Pressure: | 1020 mb |
| Tested By: | Richard Mellroth | Job Site: | NC05 |
| Power: | 110VAC/60Hz | Configuration: | PIBR0002-1 |

## TEST SPECIFICATIONS

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

## TEST PARAMETERS

| | | | | | |
|---|---|---|---|---|---|
| Run #: | 5 | Line: | High Line | Add. Ext. Attenuation (dB): | 0 |

## COMMENTS

None

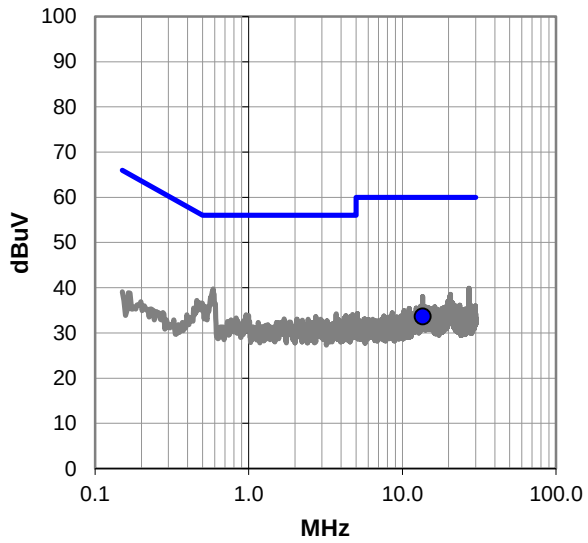
## EUT OPERATING MODES

RFID, 13.56 MHz, Antenna port terminated with 50ohm load

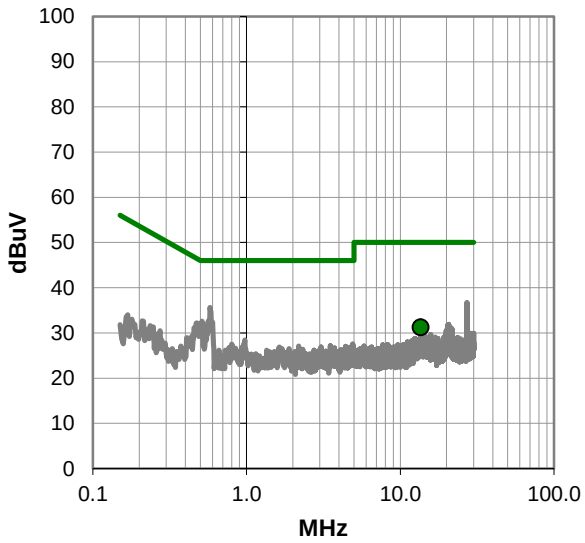
## DEVIATIONS FROM TEST STANDARD

None

**Quasi Peak Data - vs - Quasi Peak Limit**




**Average Data - vs - Average Limit**



# AC – POWERLINE CONDUCTED EMISSIONS

WTD.2016.05.18

## RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.560 | 11.8 | 21.8 | 33.6 | 60.0 | -26.4 |

Average Data - vs - Average Limit

| Freq (MHz) | Amp. (dBuV) | Factor (dB) | Adjusted (dBuV) | Spec. Limit (dBuV) | Margin (dB) |
|---|---|---|---|---|---|
| 13.560 | 9.4 | 21.8 | 31.2 | 50.0 | -18.8 |

## CONCLUSION

Pass

Tested By

# FIELD STRENGTH OF FUNDAMENTAL

PSA-ESCI 2016.07.22

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**

RFID 13.56 MHz.

**POWER SETTINGS INVESTIGATED**

110VAC/60Hz

**CONFIGURATIONS INVESTIGATED**

PIBR0002 - 1

**FREQUENCY RANGE INVESTIGATED**

| | | | |
|---|---|---|---|
| Start Frequency | 9 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 | None | 10m Test Distance Cable | EVL | 5/12/2016 | 12 mo |
| Analyzer - Spectrum Analyzer | Agilent | E4443A | AFB | 5/17/2016 | 12 mo |
| Antenna | EMCO | 6502 | AOA | 7/6/2016 | 24 mo |

**MEASUREMENT BANDWIDTHS**

| Frequency Range (MHz) | Peak Data (kHz) | Quasi-Peak Data (kHz) | Average Data (kHz) |
|---|---|---|---|
| 0.01 - 0.15 | 1.0 | 0.2 | 0.2 |
| 0.15 - 30.0 | 10.0 | 9.0 | 9.0 |
| 30.0 - 1000 | 100.0 | 120.0 | 120.0 |
| Above 1000 | 1000.0 | N/A | 1000.0 |

**TEST DESCRIPTION**

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

The fundamental carrier of the EUT was maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The center of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, 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

NORTHWEST EMC

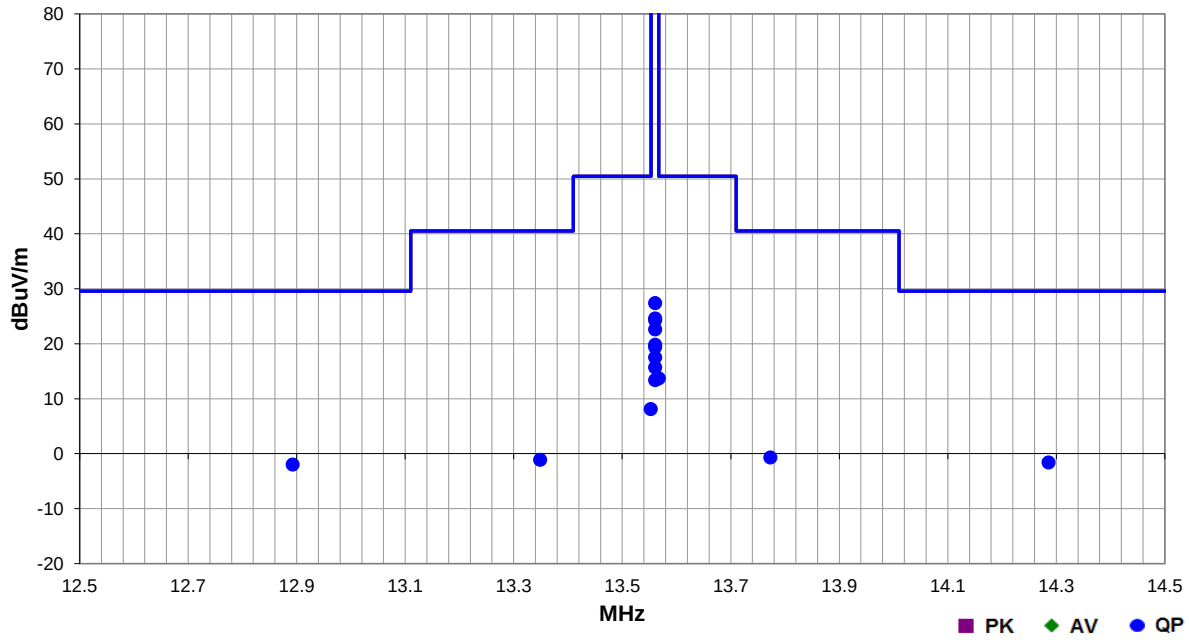
PSA-ESCI 2016.07.22

EmiR5 2016.07.22.1

| | | | | | |
|---|---|---|---|---|---|
| **Work Order:** | PIBR0002 | **Date:** | 09/14/16 | | |
| **Project:** | None | **Temperature:** | 23.4 °C | | |
| **Job Site:** | EV11 | **Humidity:** | 37.6% RH | | |
| **Serial Number:** | PS20160818000047 | **Barometric Pres.:** | 1021 mbar | **Tested by:** | Jared Ison |
| **EUT:** | Pico S | | | | |
| **Configuration:** | 1 | | | | |
| **Customer:** | PicoBrew | | | | |
| **Attendees:** | Connor Lang | | | | |
| **EUT Power:** | 110VAC/60Hz | | | | |
| **Operating Mode:** | RFID 13.56 MHz. | | | | |
| **Deviations:** | None | | | | |
| **Comments:** | None | | | | |

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

| **Run #** | 0 | **Test Distance (m)** | 10 | **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14.286 | 6.4 | 11.1 | 1.0 | 130.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -1.6 | 29.5 | -31.1 | EUT On Side |
| 12.893 | 6.0 | 11.1 | 1.0 | 191.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -2.0 | 29.5 | -31.5 | EUT On Side |
| 13.567 | 21.7 | 11.1 | 1.0 | 158.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | 13.7 | 50.5 | -36.8 | EUT On Side |
| 13.773 | 7.3 | 11.1 | 1.0 | 325.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -0.7 | 40.5 | -41.2 | EUT On Side |
| 13.349 | 6.9 | 11.1 | 1.0 | 226.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -1.1 | 40.5 | -41.6 | EUT On Side |
| 13.553 | 16.1 | 11.1 | 1.0 | 173.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | 8.1 | 50.5 | -42.4 | EUT On Side |
| 13.561 | 35.4 | 11.1 | 1.0 | 178.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | 27.4 | 84.0 | -56.6 | EUT On Side |
| 13.561 | 32.6 | 11.1 | 1.0 | 196.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | 24.6 | 84.0 | -59.4 | EUT Horz |
| 13.561 | 32.3 | 11.1 | 1.0 | 164.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | 24.3 | 84.0 | -59.7 | EUT Vert |
| 13.561 | 30.6 | 11.1 | 1.0 | 161.0 | 10.0 | 0.0 | Para to GND | QP | -19.1 | 22.6 | 84.0 | -61.4 | EUT On Side |
| 13.561 | 27.8 | 11.1 | 1.0 | 217.0 | 10.0 | 0.0 | Para to GND | QP | -19.1 | 19.8 | 84.0 | -64.2 | EUT Horz |
| 13.561 | 27.4 | 11.1 | 1.0 | 184.0 | 10.0 | 0.0 | Para to GND | QP | -19.1 | 19.4 | 84.0 | -64.6 | EUT Vert |
| 13.561 | 25.5 | 11.1 | 1.0 | 291.0 | 10.0 | 0.0 | Para to EUT | QP | -19.1 | 17.5 | 84.0 | -66.5 | EUT On Side |
| 13.561 | 23.7 | 11.1 | 1.0 | 292.0 | 10.0 | 0.0 | Para to EUT | QP | -19.1 | 15.7 | 84.0 | -68.3 | EUT Horz |
| 13.561 | 21.4 | 11.1 | 1.0 | 215.0 | 10.0 | 0.0 | Para to EUT | QP | -19.1 | 13.4 | 84.0 | -70.6 | EUT Vert |

# FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHZ

NORTHWEST EMC

PSA-ESCI 2016.07.22

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**

RFID 13.56 MHz.

**POWER SETTINGS INVESTIGATED**

110VAC/60Hz

**CONFIGURATIONS INVESTIGATED**

PIBR0002 - 1

**FREQUENCY RANGE INVESTIGATED**

| | | | |
|---|---|---|---|
| Start Frequency | 9 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 | None | 10m Test Distance Cable | EVL | 5/12/2016 | 12 mo |
| Antenna | EMCO | 6502 | AOA | 7/6/2016 | 24 mo |
| Analyzer - Spectrum Analyzer | Agilent | E4443A | AFB | 5/17/2016 | 12 mo |

**MEASUREMENT BANDWIDTHS**

| Frequency Range (MHz) | Peak Data (kHz) | Quasi-Peak Data (kHz) | Average Data (kHz) |
|---|---|---|---|
| 0.01 - 0.15 | 1.0 | 0.2 | 0.2 |
| 0.15 - 30.0 | 10.0 | 9.0 | 9.0 |
| 30.0 - 1000 | 100.0 | 120.0 | 120.0 |
| Above 1000 | 1000.0 | N/A | 1000.0 |

**TEST DESCRIPTION**

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

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, 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

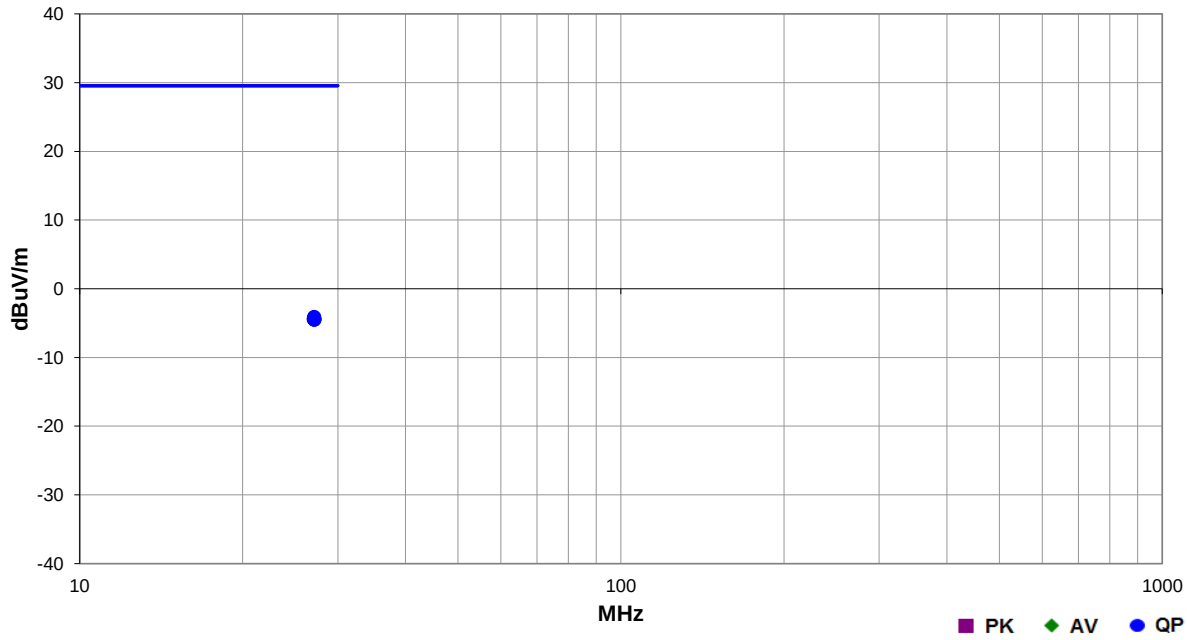
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.07.22.1

| | | | | | |
|---|---|---|---|---|---|
| **Work Order:** | PIBR0002 | **Date:** | 09/14/16 | | |
| **Project:** | None | **Temperature:** | 23 °C | | |
| **Job Site:** | EV11 | **Humidity:** | 40.8% RH | | |
| **Serial Number:** | PS20160818000047 | **Barometric Pres.:** | 1025 mbar | **Tested by:** | Jared Ison |
| **EUT:** | Pico S | | | | |
| **Configuration:** | 1 | | | | |
| **Customer:** | PicoBrew | | | | |
| **Attendees:** | Connor Lang | | | | |
| **EUT Power:** | 110VAC/60Hz | | | | |
| **Operating Mode:** | RFID 13.56 MHz. | | | | |
| **Deviations:** | None | | | | |
| **Comments:** | None | | | | |

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

| **Run #** | 12 | **Test Distance (m)** | 10 | **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27.118 | 5.8 | 9.2 | 2.8 | 65.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -4.1 | 29.5 | -33.6 | EUT On Side |
| 27.121 | 5.7 | 9.2 | 1.0 | 194.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -4.2 | 29.5 | -33.7 | EUT Horz |
| 27.123 | 5.6 | 9.2 | 1.0 | 317.0 | 10.0 | 0.0 | Para to GND | QP | -19.1 | -4.3 | 29.5 | -33.8 | EUT On Side |
| 27.138 | 5.5 | 9.2 | 1.0 | 27.0 | 10.0 | 0.0 | Para to EUT | QP | -19.1 | -4.4 | 29.5 | -33.9 | EUT Vert |
| 27.076 | 5.5 | 9.2 | 1.8 | 235.0 | 10.0 | 0.0 | Perp to GND | QP | -19.1 | -4.4 | 29.5 | -33.9 | EUT Vert |
| 27.063 | 5.5 | 9.2 | 1.0 | 127.0 | 10.0 | 0.0 | Para to GND | QP | -19.1 | -4.4 | 29.5 | -33.9 | EUT Horz |
| 27.144 | 5.4 | 9.2 | 1.0 | 216.0 | 10.0 | 0.0 | Para to EUT | QP | -19.1 | -4.5 | 29.5 | -34.0 | EUT On Side |
| 27.106 | 5.4 | 9.2 | 1.0 | 74.0 | 10.0 | 0.0 | Para to GND | QP | -19.1 | -4.5 | 29.5 | -34.0 | EUT Vert |
| 27.125 | 5.4 | 9.2 | 1.0 | 307.0 | 10.0 | 0.0 | Para to EUT | QP | -19.1 | -4.5 | 29.5 | -34.0 | EUT Horz |

# FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30MHz

PSA-ESCI 2016.07.22

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**

RFID 13.56 MHz

**POWER SETTINGS INVESTIGATED**

110VAC/60Hz

**CONFIGURATIONS INVESTIGATED**

PIBR0002 - 1

**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 |
|---|---|---|---|---|---|
| Analyzer - Spectrum Analyzer | Keysight | N9010A | AFO | 6/8/2016 | 12 mo |
| Cable | Northwest EMC | Bilog Cables | NC1 | 8/3/2016 | 12 mo |
| Amplifier - Pre-Amplifier | Miteq | AM-1616-1000 | PAB | 7/15/2016 | 12 mo |
| Antenna - Biconilog | Teseq | CBL 6141B | AYL | 7/30/2015 | 24 mo |

**MEASUREMENT BANDWIDTHS**

| Frequency Range (MHz) | Peak Data (kHz) | Quasi-Peak Data (kHz) | Average Data (kHz) |
|---|---|---|---|
| 0.01 - 0.15 | 1.0 | 0.2 | 0.2 |
| 0.15 - 30.0 | 10.0 | 9.0 | 9.0 |
| 30.0 - 1000 | 100.0 | 120.0 | 120.0 |
| Above 1000 | 1000.0 | N/A | 1000.0 |

**TEST DESCRIPTION**

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

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

# FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30MHz

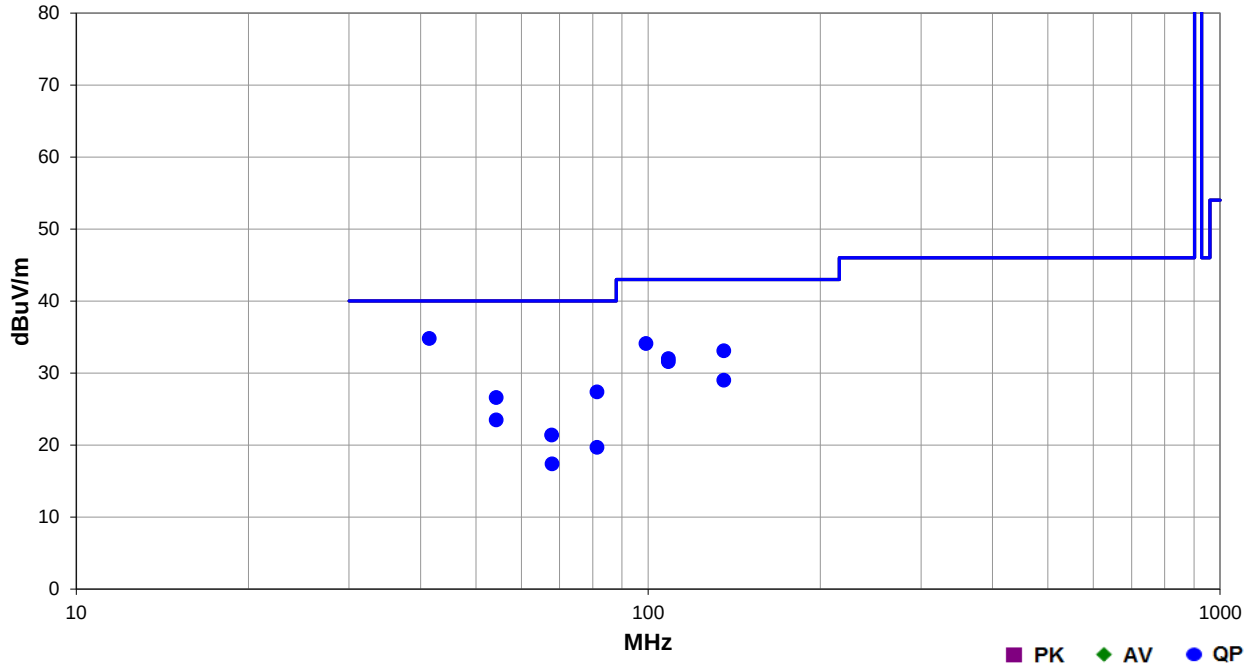
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.07.22.1

| | | | | | |
|---|---|---|---|---|---|
| **Work Order:** | PIBR0002 | **Date:** | 09/16/16 | | |
| **Project:** | None | **Temperature:** | 22 °C | | |
| **Job Site:** | NC01 | **Humidity:** | 46% RH | | |
| **Serial Number:** | PS20160818000047 | **Barometric Pres.:** | 1021 mbar | **Tested by:** | Richard Mellroth |
| **EUT:** | Pico S | | | | |
| **Configuration:** | 1 | | | | |
| **Customer:** | PicoBrew | | | | |
| **Attendees:** | Connor Lang | | | | |
| **EUT Power:** | 110VAC/60Hz | | | | |
| **Operating Mode:** | RFID 13.56 MHz | | | | |
| **Deviations:** | None | | | | |
| **Comments:** | EUT contains water and has only one physical orientation in normal use. Testing performed only in normal operating position. | | | | |

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

| **Run #** | 2 | **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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41.422 | 31.7 | 3.1 | 1.0 | 336.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 34.8 | 40.0 | -5.2 |
| 99.106 | 38.2 | -4.1 | 4.0 | 103.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 34.1 | 43.0 | -8.9 |
| 135.617 | 34.6 | -1.5 | 2.1 | 207.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 33.1 | 43.0 | -9.9 |
| 108.495 | 34.8 | -2.8 | 1.8 | 70.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 32.0 | 43.0 | -11.0 |
| 108.497 | 34.4 | -2.8 | 1.0 | 166.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 31.6 | 43.0 | -11.4 |
| 81.375 | 33.9 | -6.5 | 1.1 | 170.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 27.4 | 40.0 | -12.6 |
| 54.253 | 29.2 | -2.6 | 1.0 | 166.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 26.6 | 40.0 | -13.4 |
| 135.617 | 30.5 | -1.5 | 1.0 | 102.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 29.0 | 43.0 | -14.0 |
| 54.253 | 26.1 | -2.6 | 3.4 | 112.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 23.5 | 40.0 | -16.5 |
| 67.815 | 27.6 | -6.2 | 1.0 | 224.0 | 3.0 | 0.0 | Vert | QP | 0.0 | 21.4 | 40.0 | -18.6 |
| 81.375 | 26.2 | -6.5 | 2.2 | 121.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 19.7 | 40.0 | -20.3 |
| 67.925 | 23.7 | -6.3 | 3.1 | 288.0 | 3.0 | 0.0 | Horz | QP | 0.0 | 17.4 | 40.0 | -22.6 |

# FREQUENCY STABILITY

XMit 2016.05.06

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. | Cal. Due |
|---|---|---|---|---|---|
| Chamber - Temperature/Humidity | Tenney | T6S | TBG | NCR | NCR |
| Meter - Multimeter | Fluke | 111 | MMM | 2/18/2016 | 2/18/2019 |
| Thermometer | Omega Engineering, Inc. | HH311 | DUH | 4/3/2015 | 4/3/2018 |
| Probe - Near Field Set | Com-Power | PS-400 | IPE | NCR | NCR |
| Attenuator | Fairview Microwave | SA4014-20 | TKV | 3/4/2016 | 3/4/2017 |
| Block - DC | Fairview Microwave | SD3379 | AMU | 5/6/2016 | 5/6/2017 |
| Cable | Micro-Coax | UFD150A-1-0720-200200 | NCS | 6/7/2016 | 6/7/2017 |
| Analyzer - Spectrum Analyzer | Agilent | E4446A | AAT | 6/15/2016 | 6/15/2017 |

**TEST DESCRIPTION**

A near-field probe was placed near the transmitter. A low-loss coaxial cable was used to connect the near-field probe to the spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made on the single transmit frequency as called out on the data sheets. Testing was done while the EUT was continuously polling.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage while at ambient temperature. Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range of -20 ° to +50° C and at 10°C intervals.

The requirement of a frequency tolerance of ±0.01% is equivalent to 100 ppm
The formula to check for compliance is:

ppm = (Measured Frequency / Measured Nominal Frequency - 1) * 1,000,000

# FREQUENCY STABILITY

NORTHWEST EMC

XMit 2016.05.06

| | | | | | |
|---|---|---|---|---|---|
| **EUT:** | Pico S | | | **Work Order:** | PIBR0002 |
| **Serial Number:** | PS20160818000047 | | | **Date:** | 09/19/16 |
| **Customer:** | PicoBrew | | | **Temperature:** | 23 °C |
| **Attendees:** | Connor Lang | | | **Humidity:** | 51% RH |
| **Project:** | None | | | **Barometric Pres.:** | 1022 mbar |
| **Tested by:** | Richard Mellroth | **Power:** | 110VAC/60Hz | **Job Site:** | NC02 |

| TEST SPECIFICATIONS | Test Method |
|---|---|
| FCC 15.225:2016 | ANSI C63.10:2013 |
| | |

**COMMENTS**

None

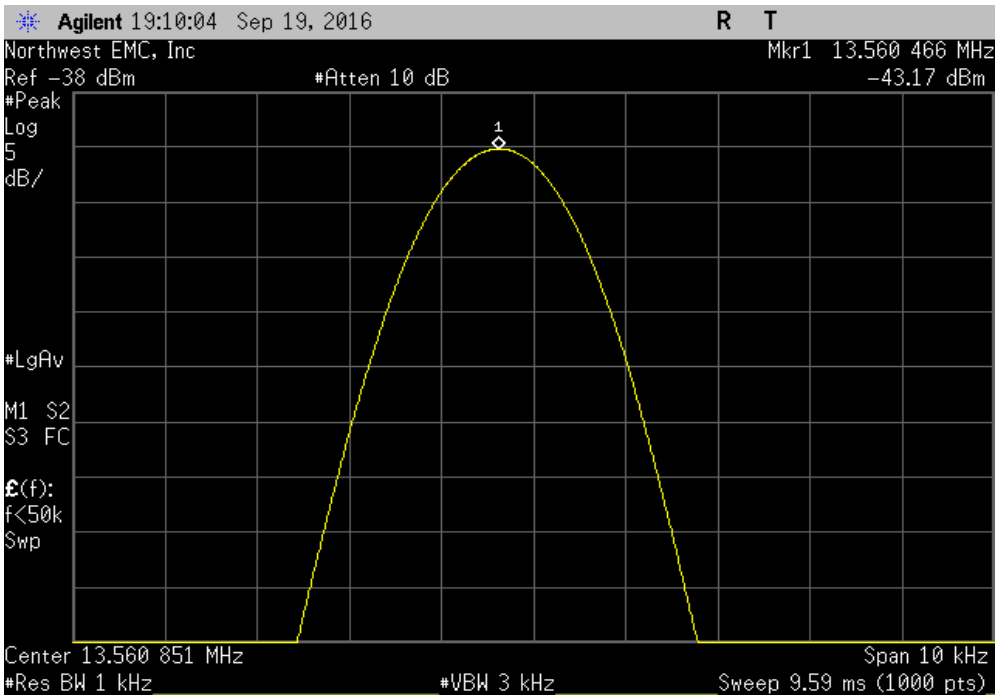
**DEVIATIONS FROM TEST STANDARD**

None

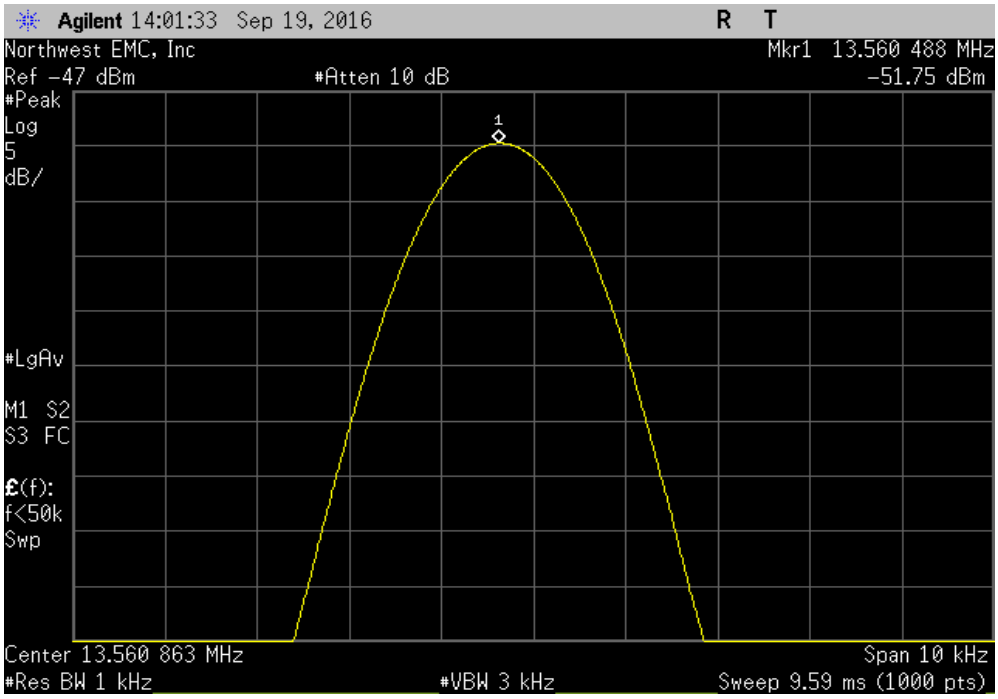
| Configuration # | 1 | Signature |
|---|---|---|

| | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
|---|---|---|---|---|---|
| RFID, 13.56 MHz | | | | | |
| Voltage: 115% | | | | | |
| Startup | 13.560466 | 13.56 | 34.4 | 100 | Pass |
| Voltage: 100% | | | | | |
| Startup | 13.560488 | 13.56 | 36 | 100 | Pass |
| Voltage: 85% | | | | | |
| Startup | 13.560466 | 13.56 | 34.4 | 100 | Pass |
| Temperature: +50° | | | | | |
| Startup | 13.560458 | 13.56 | 33.8 | 100 | Pass |
| After 2 Minutes | 13.560458 | 13.56 | 33.8 | 100 | Pass |
| After 5 Minutes | 13.560449 | 13.56 | 33.1 | 100 | Pass |
| After 10 Minutes | 13.560458 | 13.56 | 33.8 | 100 | Pass |
| Temperature: +40° | | | | | |
| Startup | 13.560468 | 13.56 | 34.5 | 100 | Pass |
| After 2 Minutes | 13.560456 | 13.56 | 33.6 | 100 | Pass |
| After 5 Minutes | 13.560458 | 13.56 | 33.8 | 100 | Pass |
| After 10 Minutes | 13.560456 | 13.56 | 33.6 | 100 | Pass |
| Temperature: +30° | | | | | |
| Startup | 13.560478 | 13.56 | 35.3 | 100 | Pass |
| After 2 Minutes | 13.560478 | 13.56 | 35.3 | 100 | Pass |
| After 5 Minutes | 13.560468 | 13.56 | 34.5 | 100 | Pass |
| After 10 Minutes | 13.560476 | 13.56 | 35.1 | 100 | Pass |
| Temperature: +20° | | | | | |
| Startup | 13.560506 | 13.56 | 37.3 | 100 | Pass |
| After 2 Minutes | 13.560506 | 13.56 | 37.3 | 100 | Pass |
| After 5 Minutes | 13.560506 | 13.56 | 37.3 | 100 | Pass |
| After 10 Minutes | 13.560508 | 13.56 | 37.5 | 100 | Pass |
| Temperature: +10° | | | | | |
| Startup | 13.560515 | 13.56 | 38 | 100 | Pass |
| After 2 Minutes | 13.560518 | 13.56 | 38.2 | 100 | Pass |
| After 5 Minutes | 13.560518 | 13.56 | 38.2 | 100 | Pass |
| After 10 Minutes | 13.560517 | 13.56 | 38.1 | 100 | Pass |
| Temperature: 0° | | | | | |
| Startup | 13.560518 | 13.56 | 38.2 | 100 | Pass |
| After 2 Minutes | 13.560517 | 13.56 | 38.1 | 100 | Pass |
| After 5 Minutes | 13.560516 | 13.56 | 38.1 | 100 | Pass |
| After 10 Minutes | 13.560518 | 13.56 | 38.2 | 100 | Pass |
| Temperature: -10° | | | | | |
| Startup | 13.560498 | 13.56 | 36.7 | 100 | Pass |
| After 2 Minutes | 13.560498 | 13.56 | 36.7 | 100 | Pass |
| After 5 Minutes | 13.560498 | 13.56 | 36.7 | 100 | Pass |
| After 10 Minutes | 13.560498 | 13.56 | 36.7 | 100 | Pass |
| Temperature: -20° | | | | | |
| Startup | 13.560448 | 13.56 | 33 | 100 | Pass |
| After 2 Minutes | 13.560447 | 13.56 | 33 | 100 | Pass |
| After 5 Minutes | 13.560448 | 13.56 | 33 | 100 | Pass |
| After 10 Minutes | 13.560448 | 13.56 | 33 | 100 | Pass |

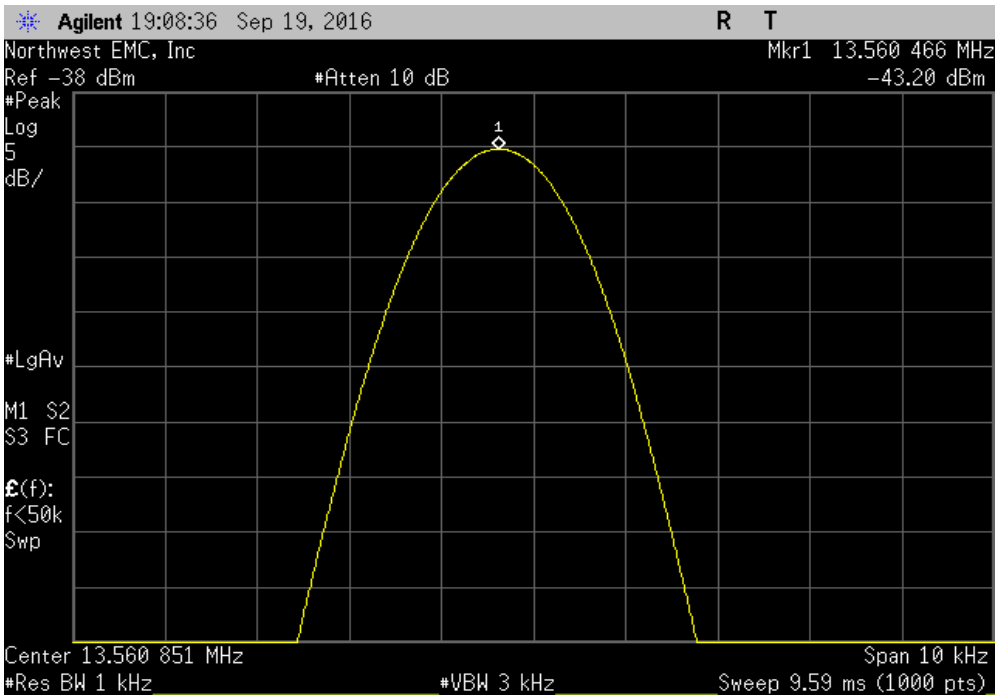
| RFID, 13.56 MHz, Voltage: 115%, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560466 | 13.56 | 34.4 | 100 | Pass |



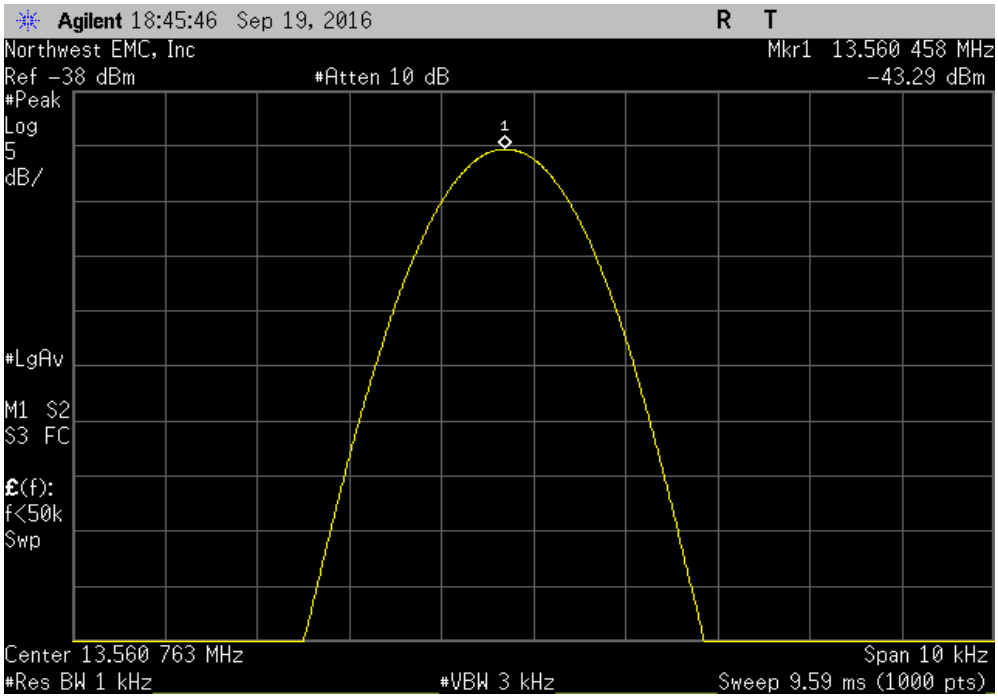

| RFID, 13.56 MHz, Voltage: 100%, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560488 | 13.56 | 36 | 100 | Pass |



| RFID, 13.56 MHz, Voltage: 85%, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560466 | 13.56 | 34.4 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: +50°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560458 | 13.56 | 33.8 | 100 | Pass |



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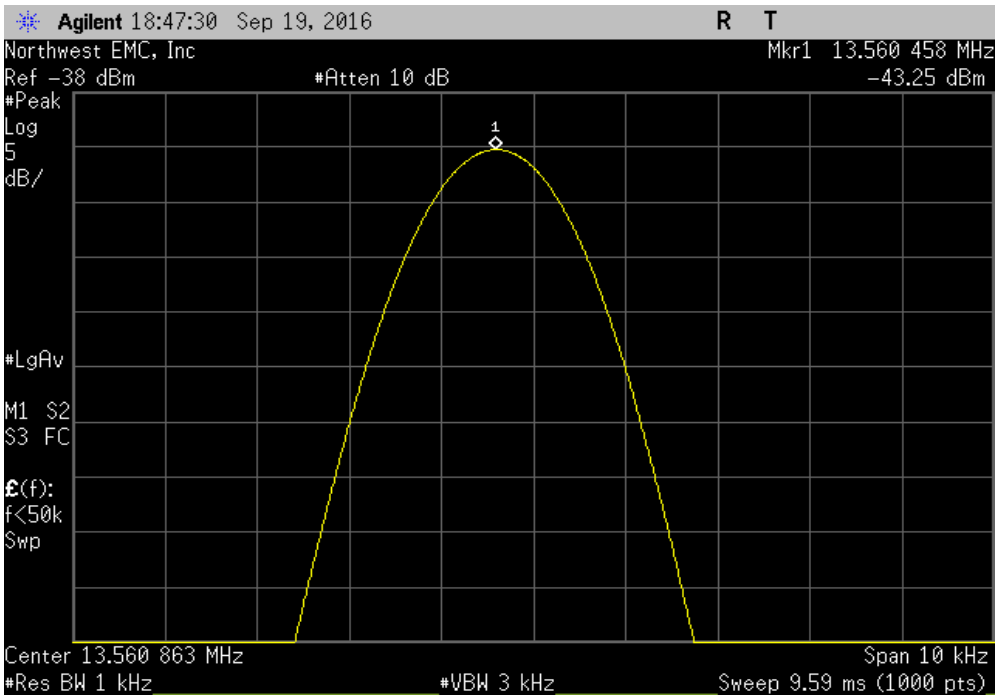
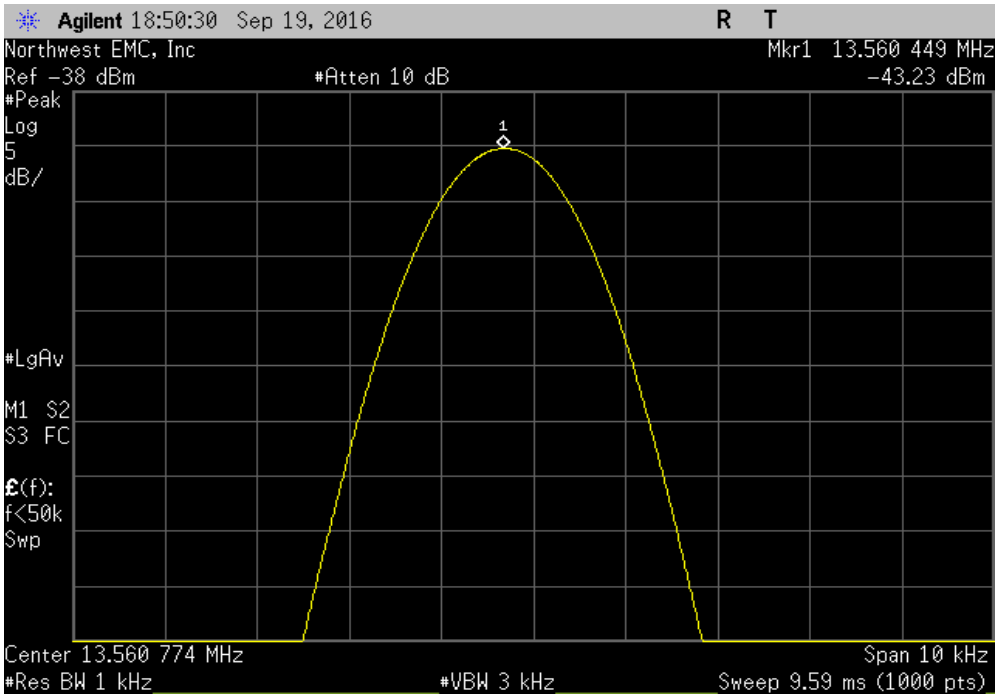
| RFID, 13.56 MHz, Temperature: +50°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560458 | 13.56 | 33.8 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: +50°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560449 | 13.56 | 33.1 | 100 | Pass |



# FREQUENCY STABILITY

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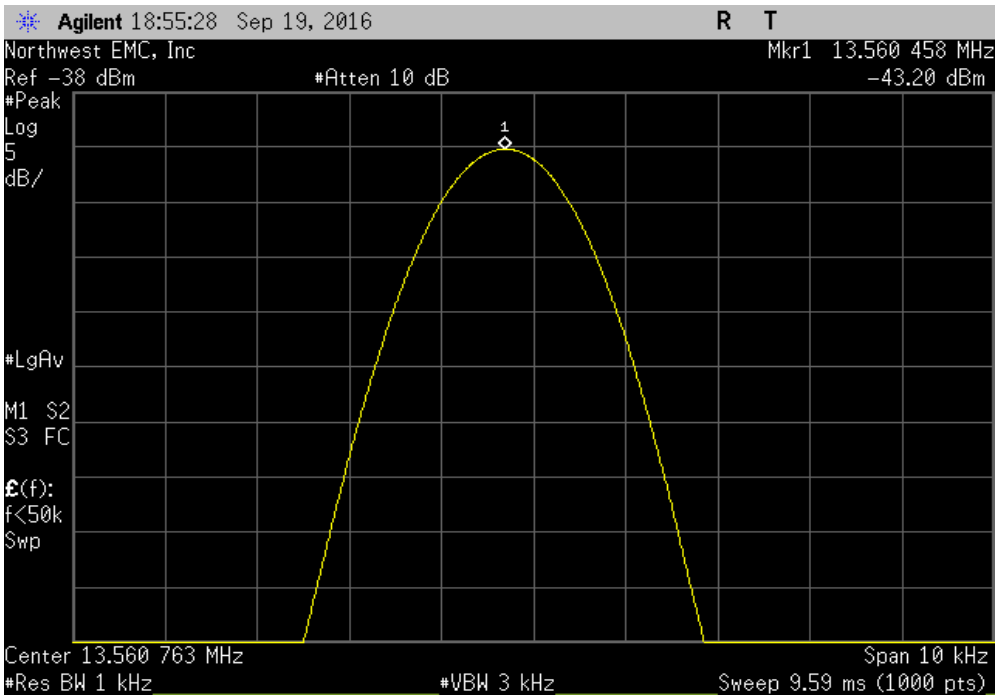
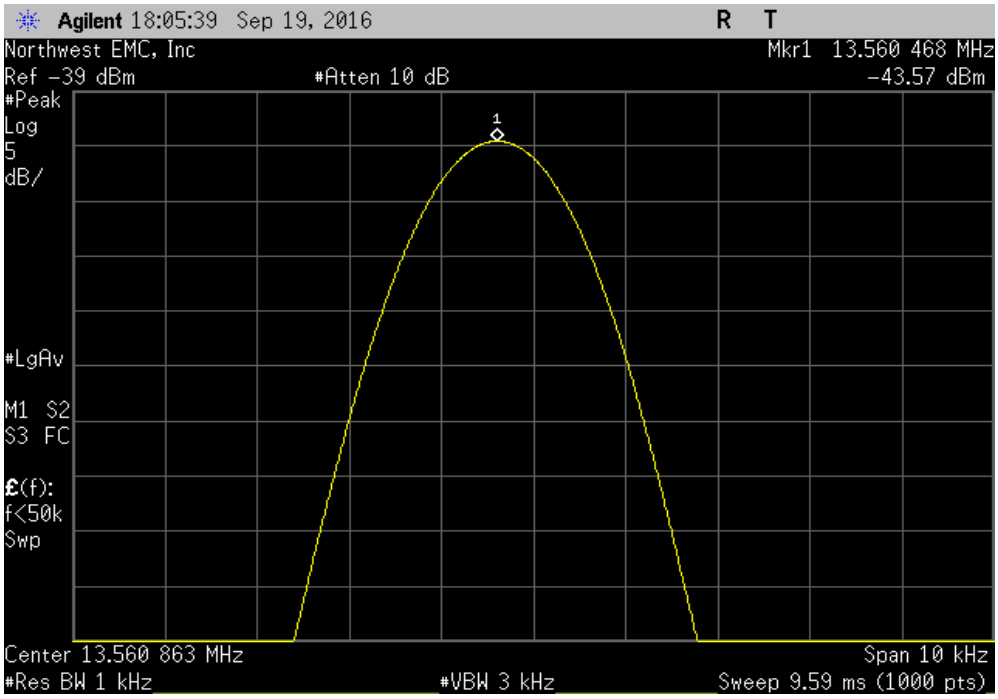
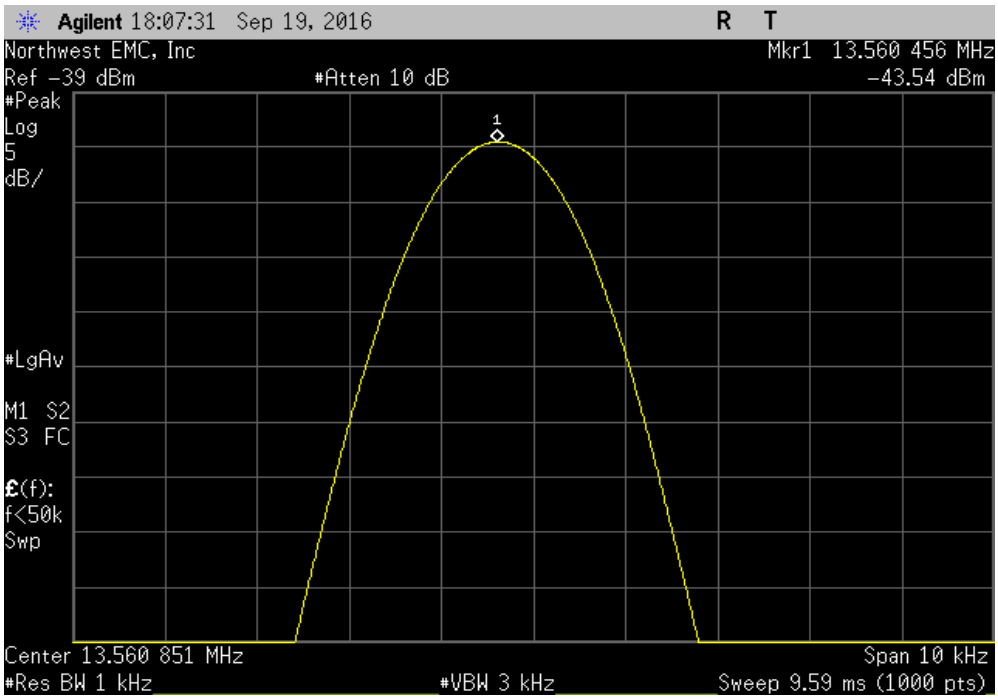
| RFID, 13.56 MHz, Temperature: +50°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560458 | 13.56 | 33.8 | 100 | Pass |



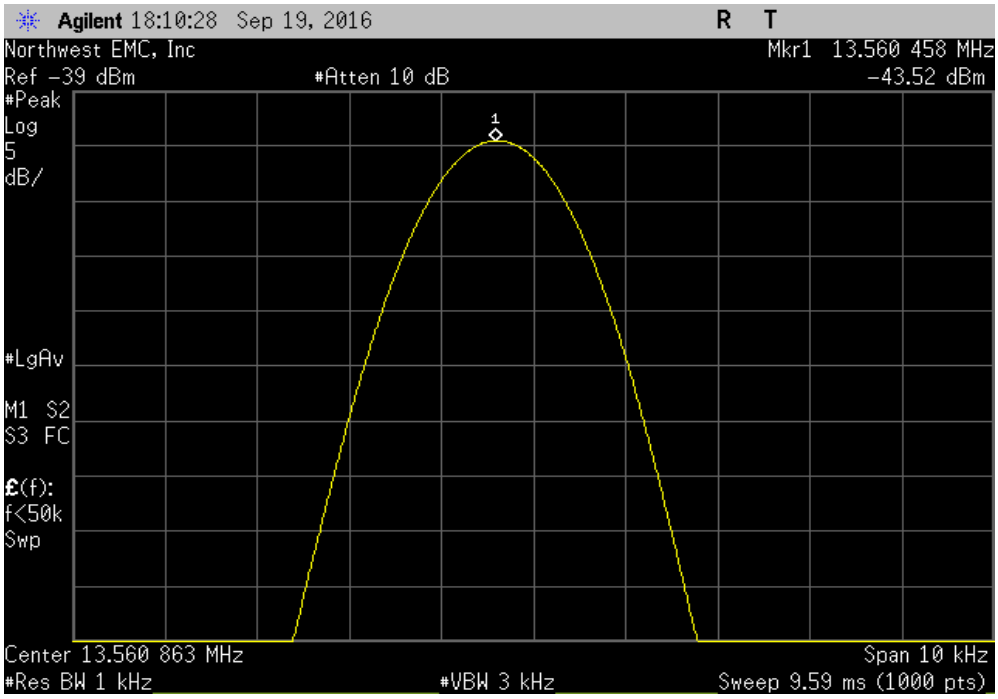

| RFID, 13.56 MHz, Temperature: +40°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560468 | 13.56 | 34.5 | 100 | Pass |



| RFID, 13.56 MHz, Temperature: +40°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560456 | 13.56 | 33.6 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: +40°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560458 | 13.56 | 33.8 | 100 | Pass |



# FREQUENCY STABILITY

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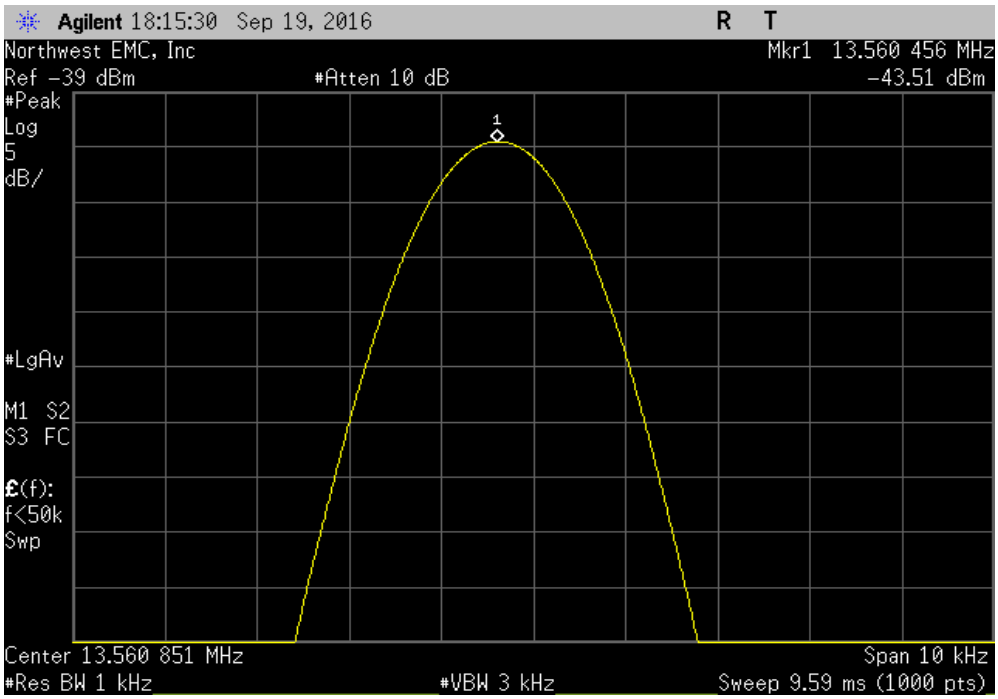
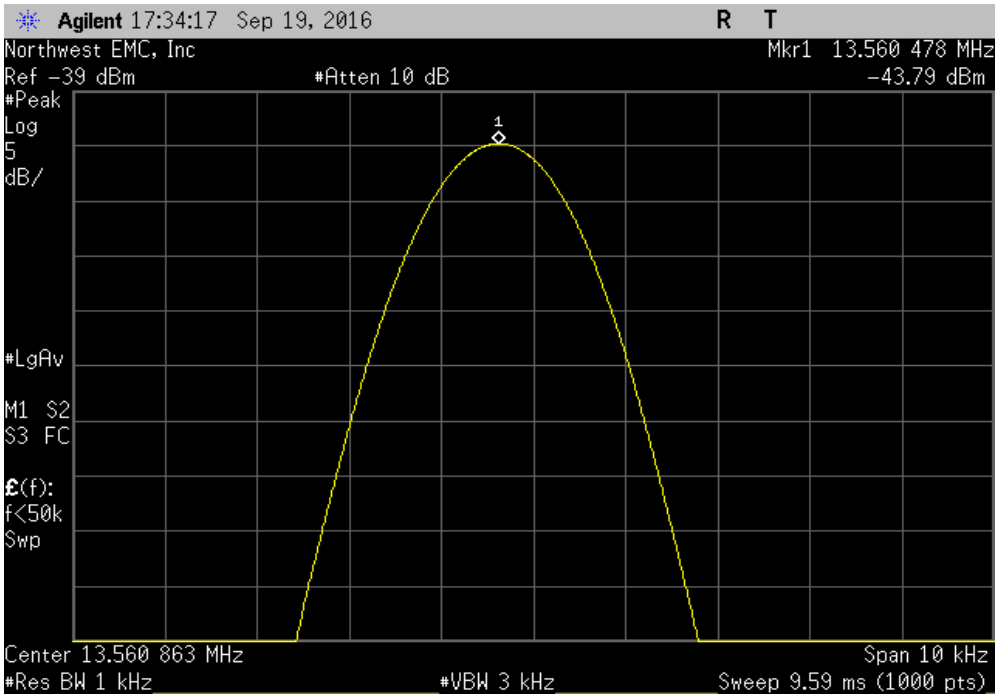
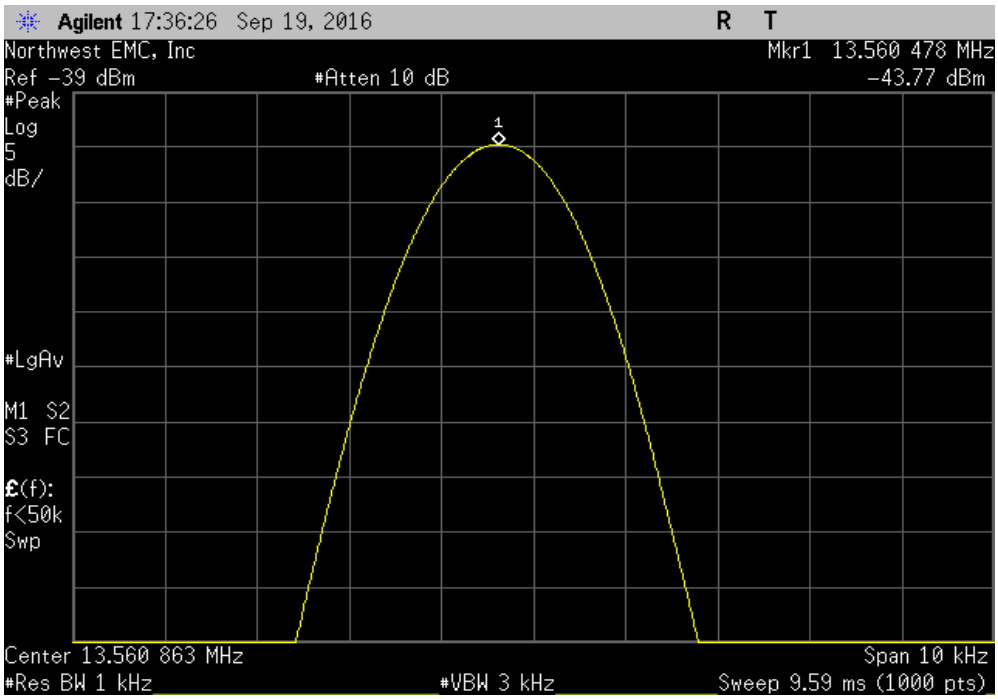
| RFID, 13.56 MHz, Temperature: +40°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560456 | 13.56 | 33.6 | 100 | Pass |



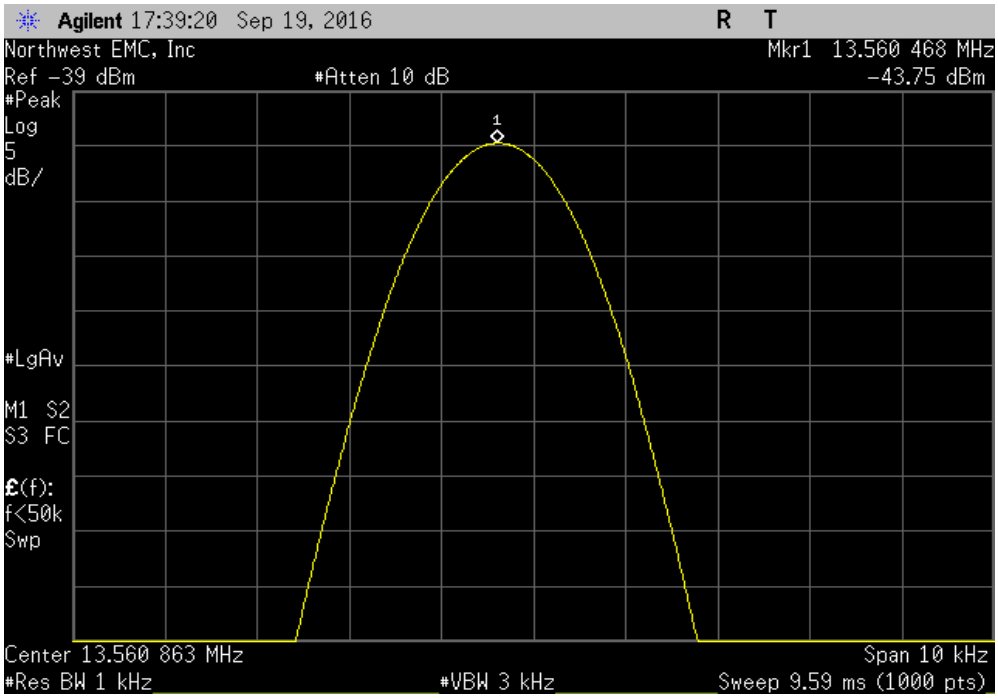

| RFID, 13.56 MHz, Temperature: +30°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560478 | 13.56 | 35.3 | 100 | Pass |



| RFID, 13.56 MHz, Temperature: +30°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560478 | 13.56 | 35.3 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: +30°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560468 | 13.56 | 34.5 | 100 | Pass |



# FREQUENCY STABILITY

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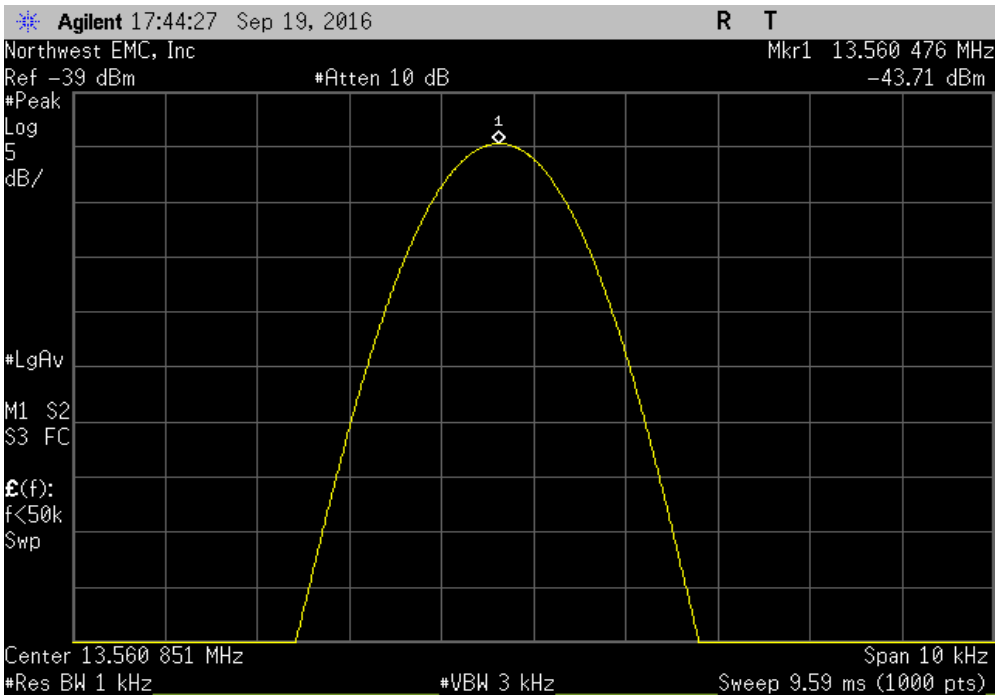
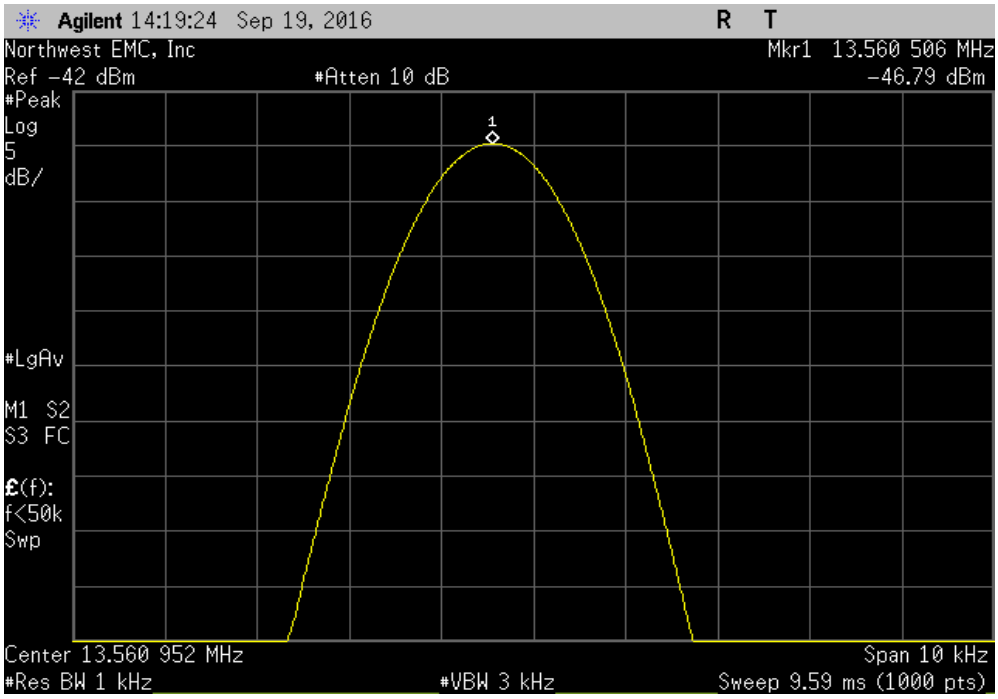
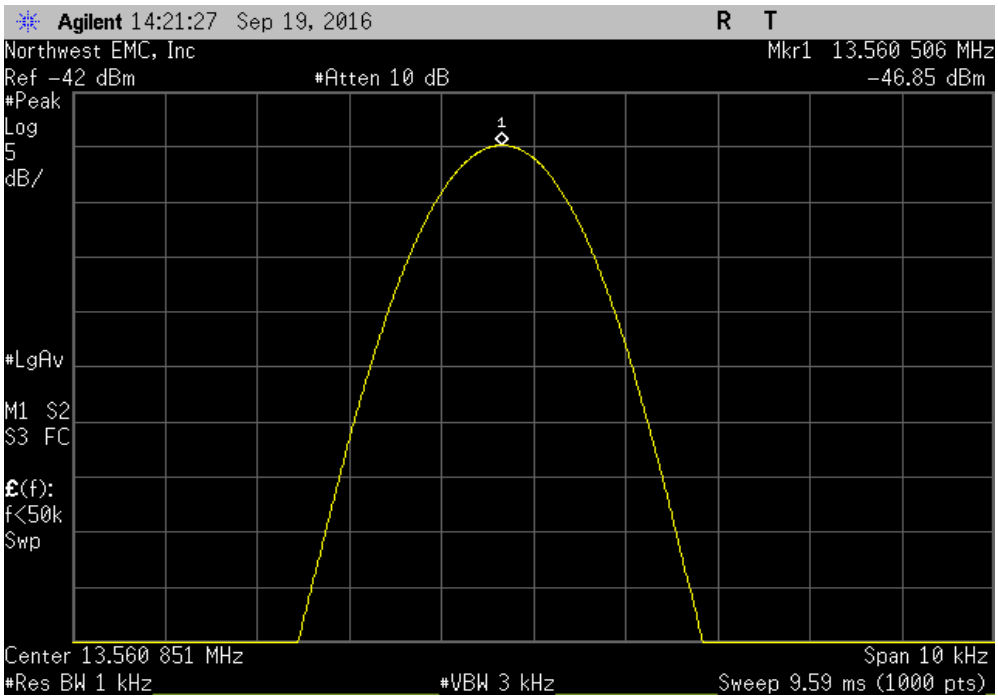
| RFID, 13.56 MHz, Temperature: +30°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560476 | 13.56 | 35.1 | 100 | Pass |



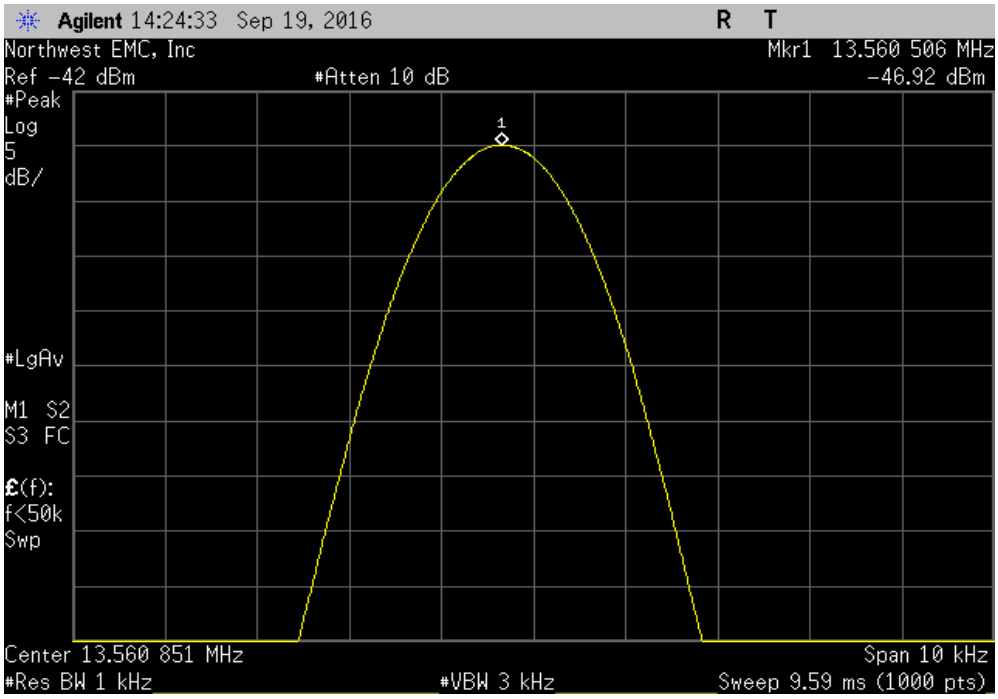

| RFID, 13.56 MHz, Temperature: +20°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560506 | 13.56 | 37.3 | 100 | Pass |



| RFID, 13.56 MHz, Temperature: +20°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560506 | 13.56 | 37.3 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: +20°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560506 | 13.56 | 37.3 | 100 | Pass |



# FREQUENCY STABILITY

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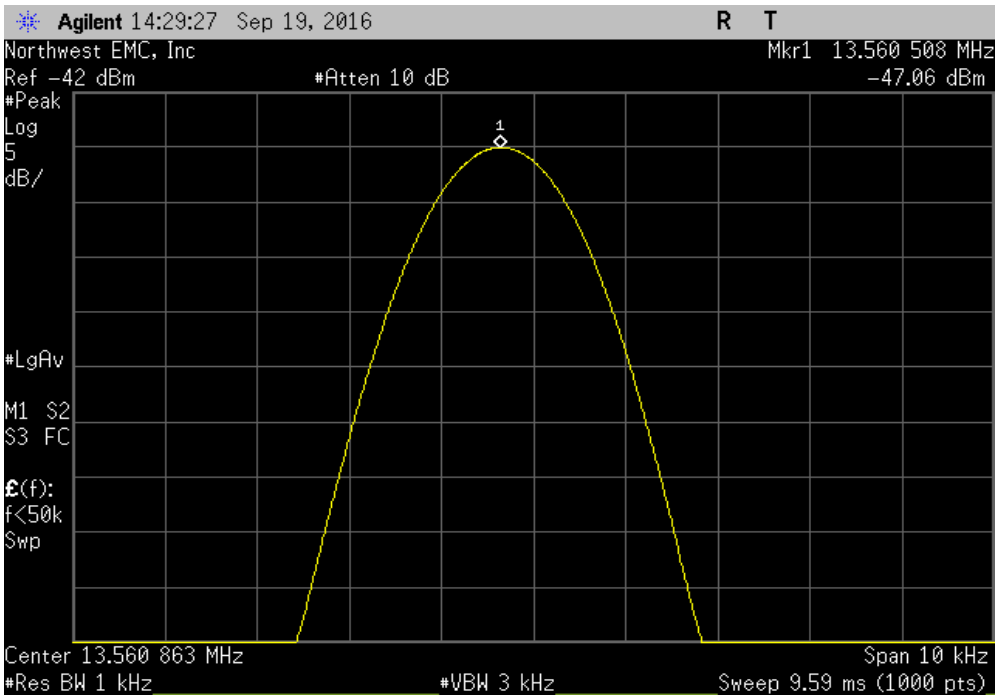
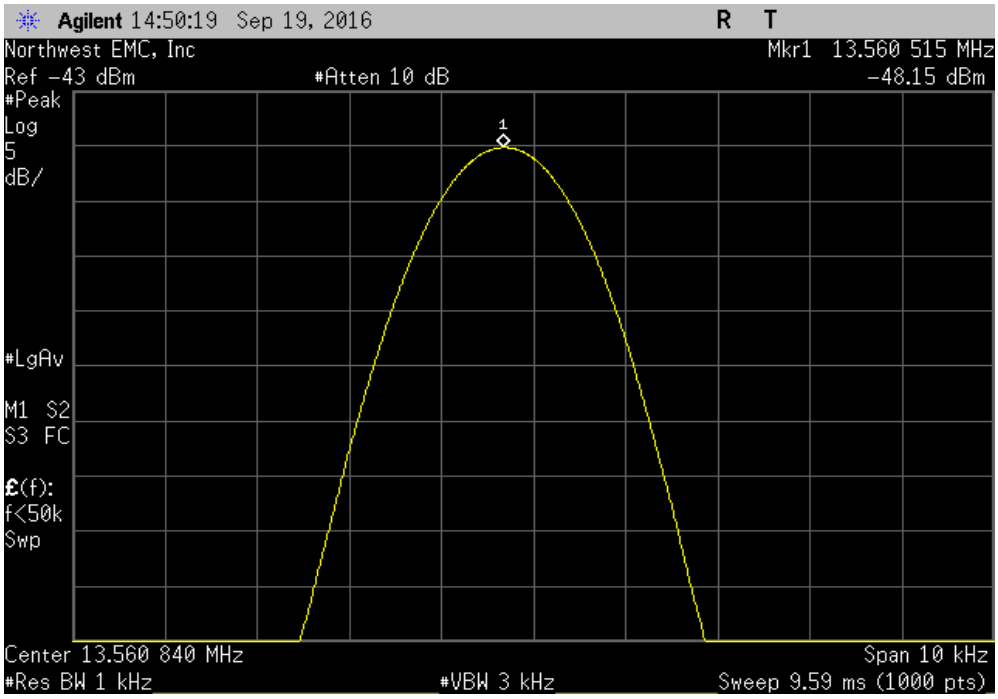
| RFID, 13.56 MHz, Temperature: +20°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560508 | 13.56 | 37.5 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: +10°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560515 | 13.56 | 38 | 100 | Pass |



# FREQUENCY STABILITY

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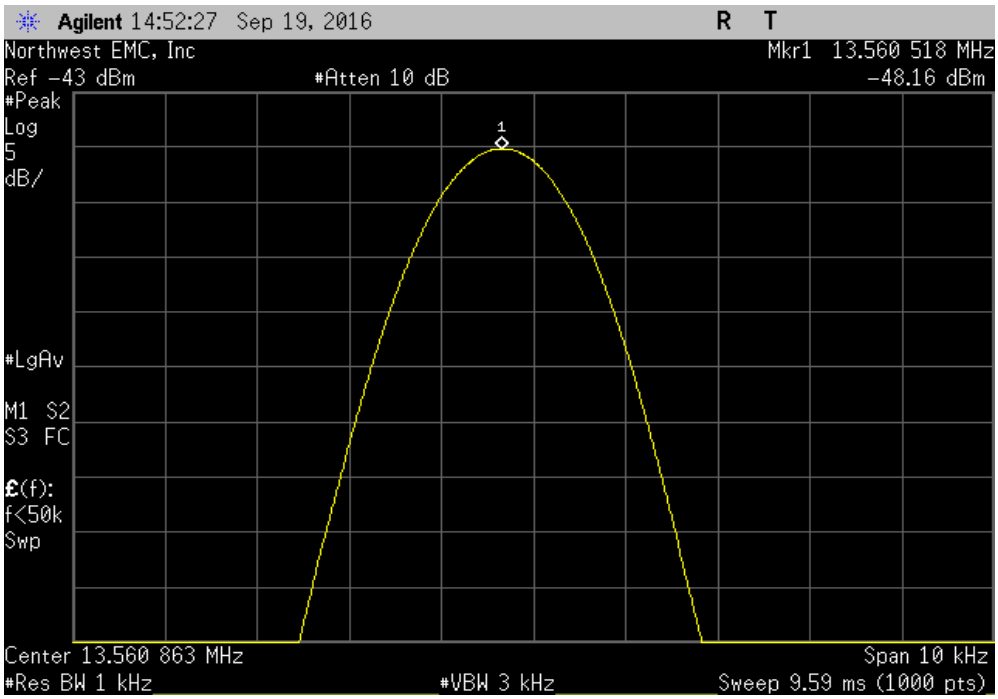
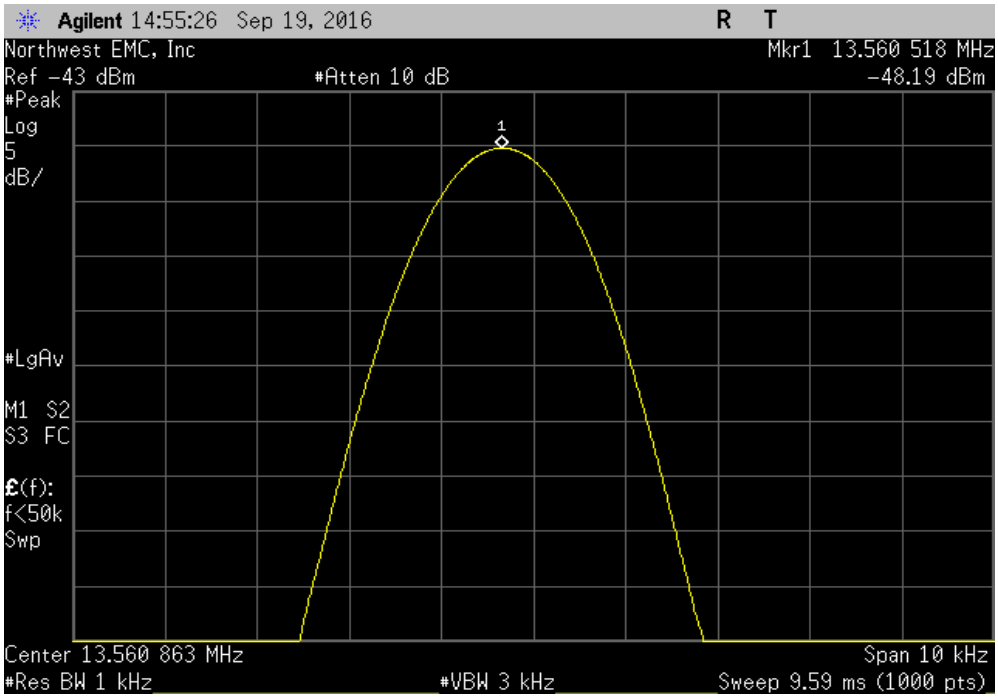
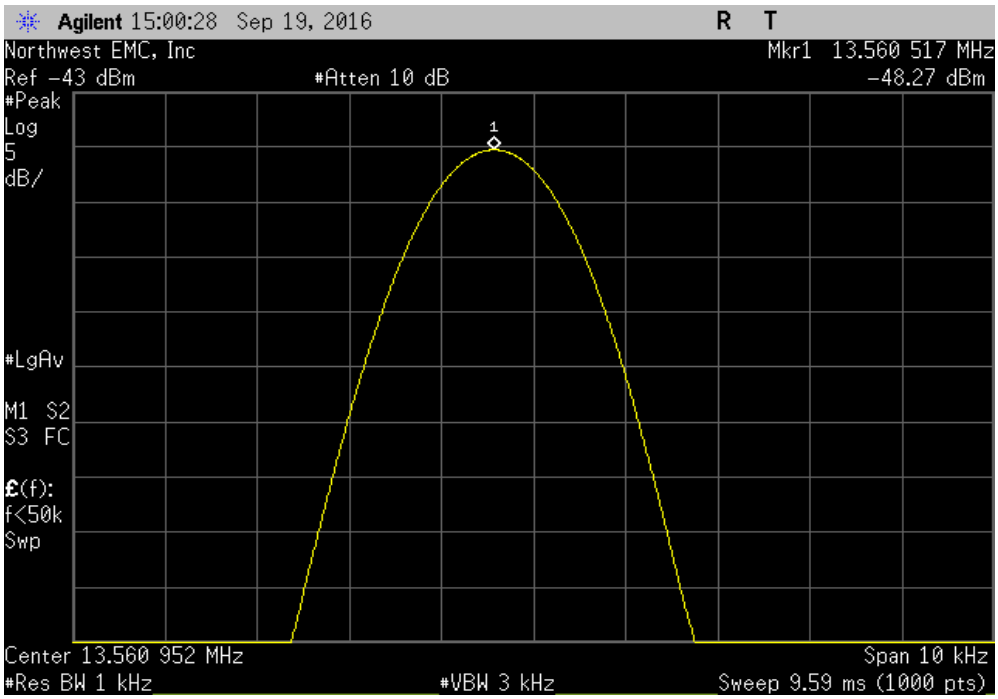
| RFID, 13.56 MHz, Temperature: +10°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560518 | 13.56 | 38.2 | 100 | Pass |



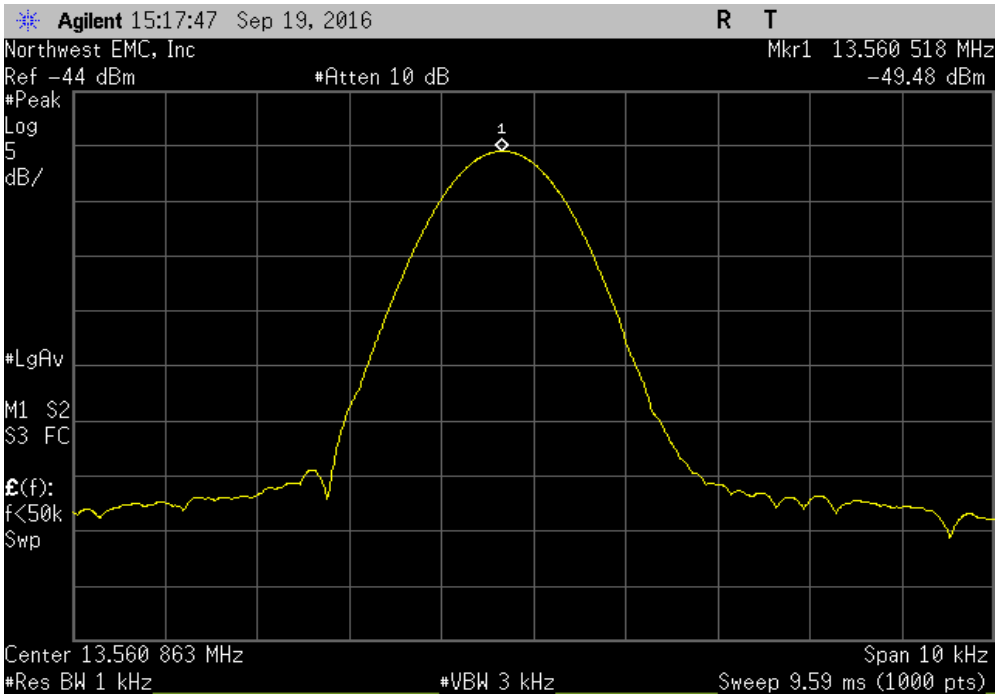

| RFID, 13.56 MHz, Temperature: +10°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560518 | 13.56 | 38.2 | 100 | Pass |



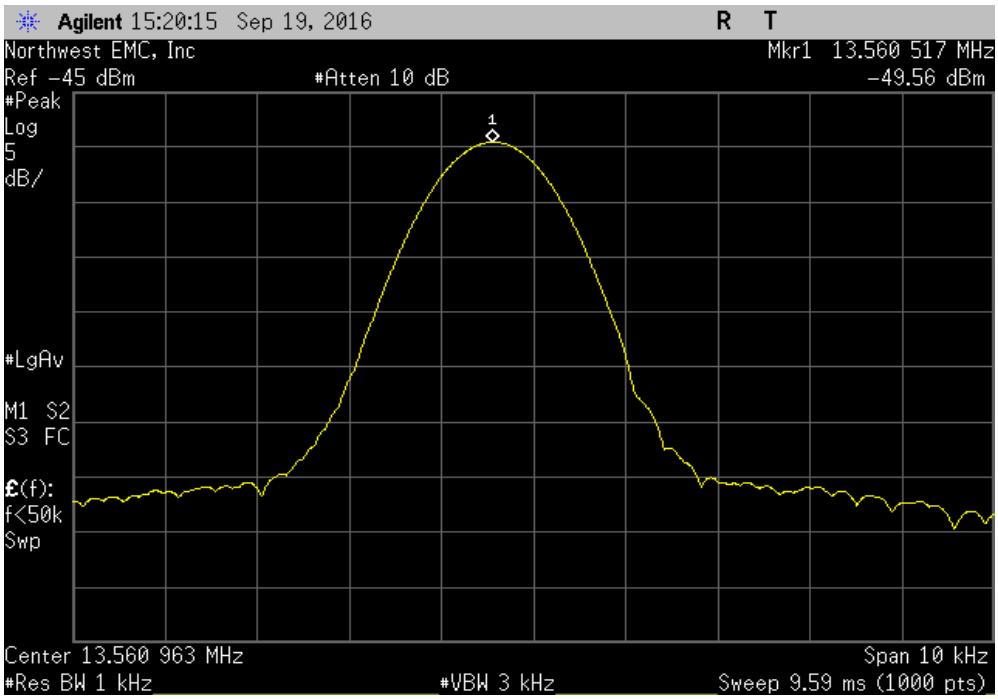
| RFID, 13.56 MHz, Temperature: +10°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560517 | 13.56 | 38.1 | 100 | Pass |



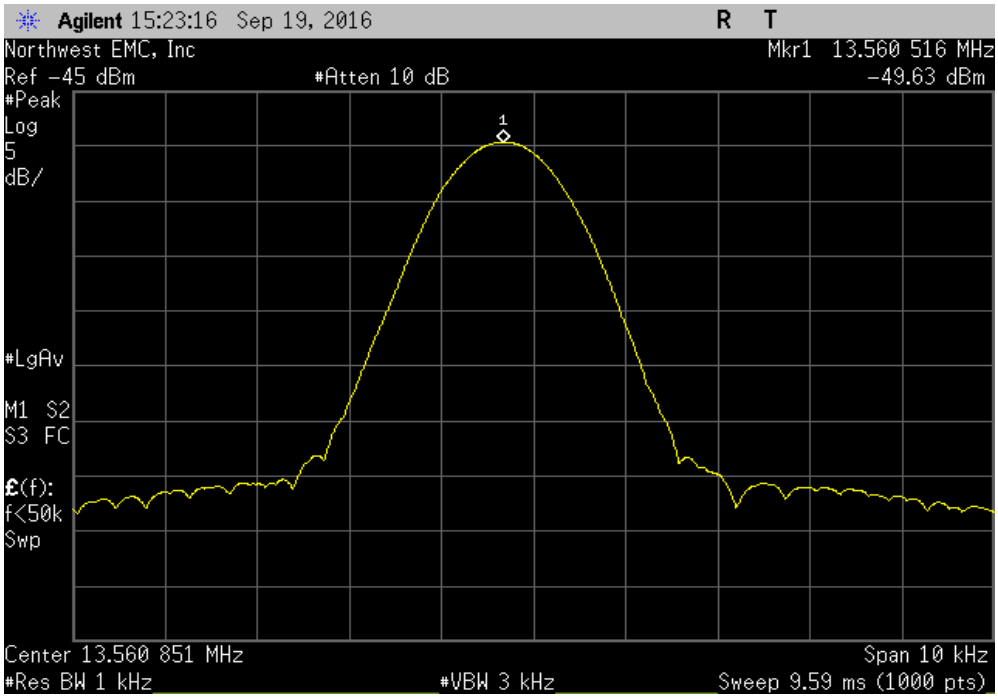

| RFID, 13.56 MHz, Temperature: 0°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560518 | 13.56 | 38.2 | 100 | Pass |



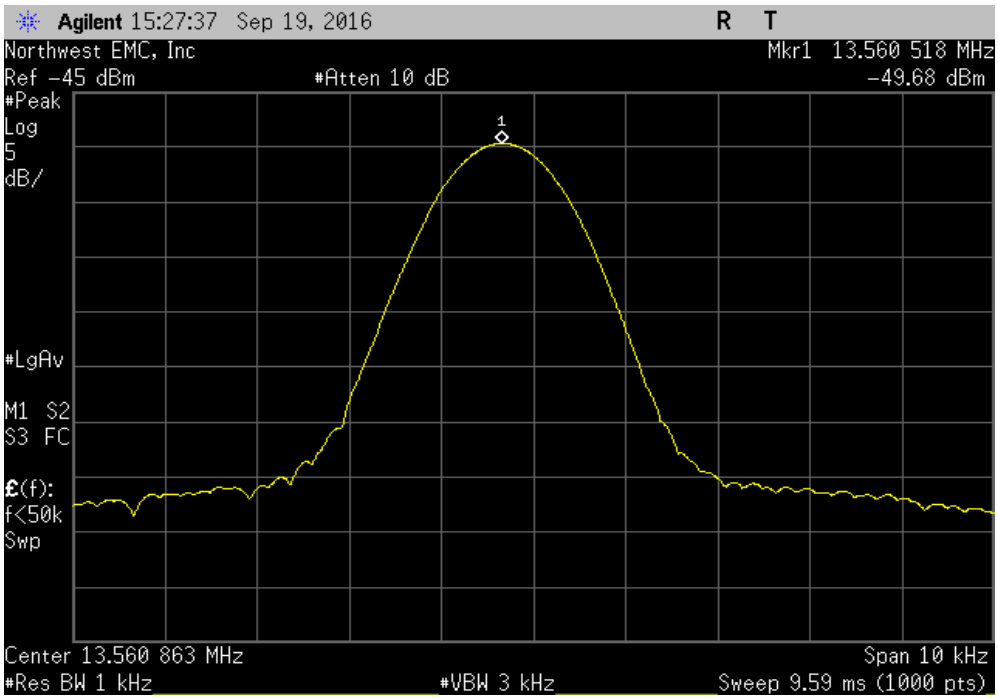
| RFID, 13.56 MHz, Temperature: 0°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560517 | 13.56 | 38.1 | 100 | Pass |



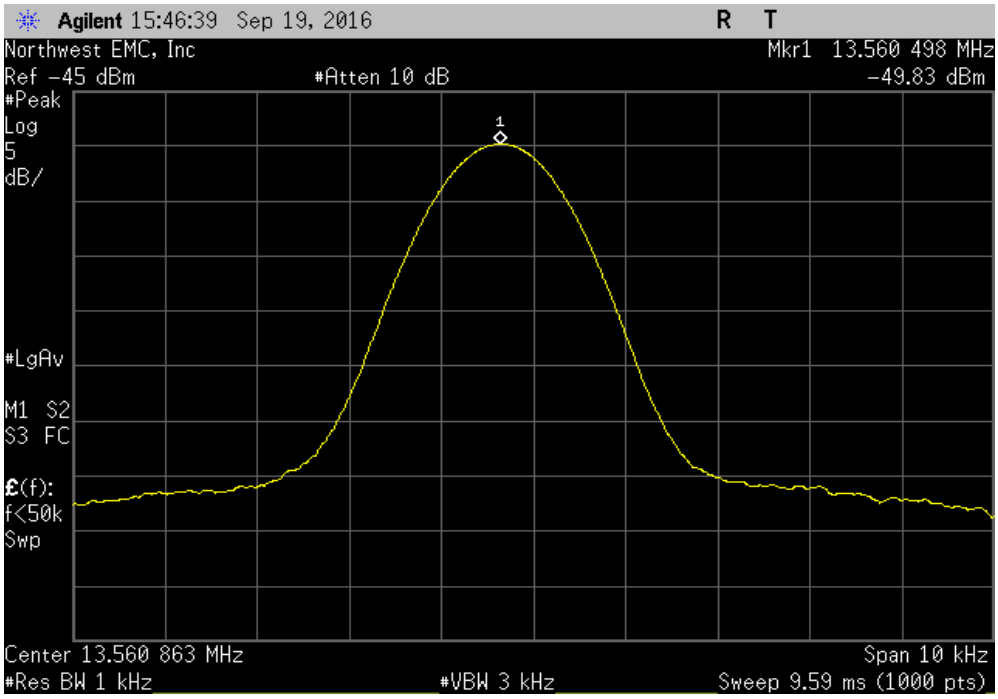

| RFID, 13.56 MHz, Temperature: 0°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560516 | 13.56 | 38.1 | 100 | Pass |



| RFID, 13.56 MHz, Temperature: 0°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560518 | 13.56 | 38.2 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: -10°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560498 | 13.56 | 36.7 | 100 | Pass |



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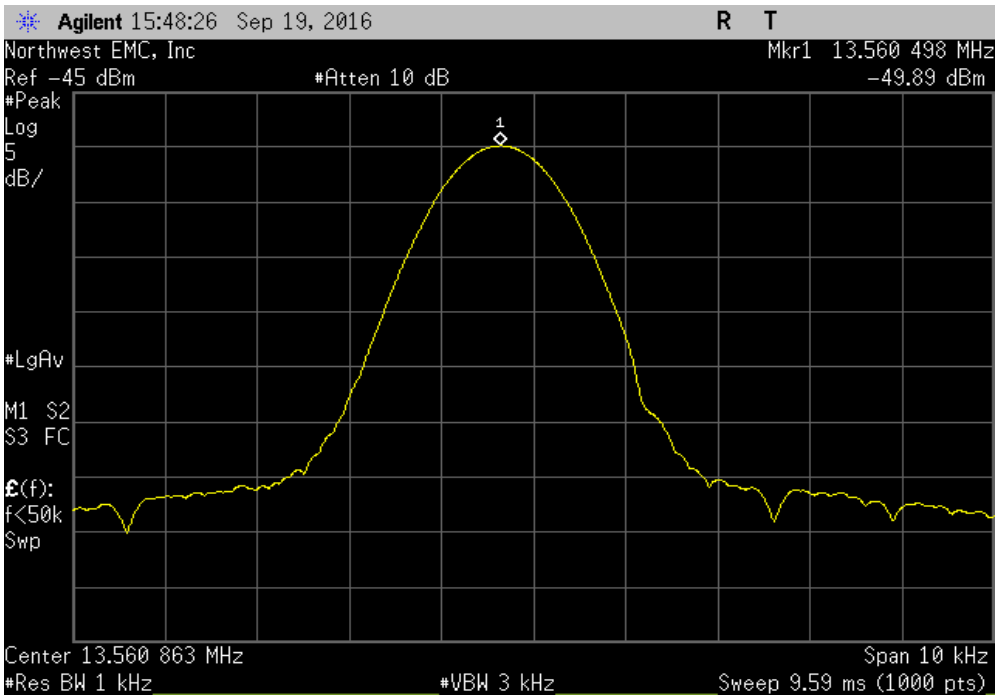
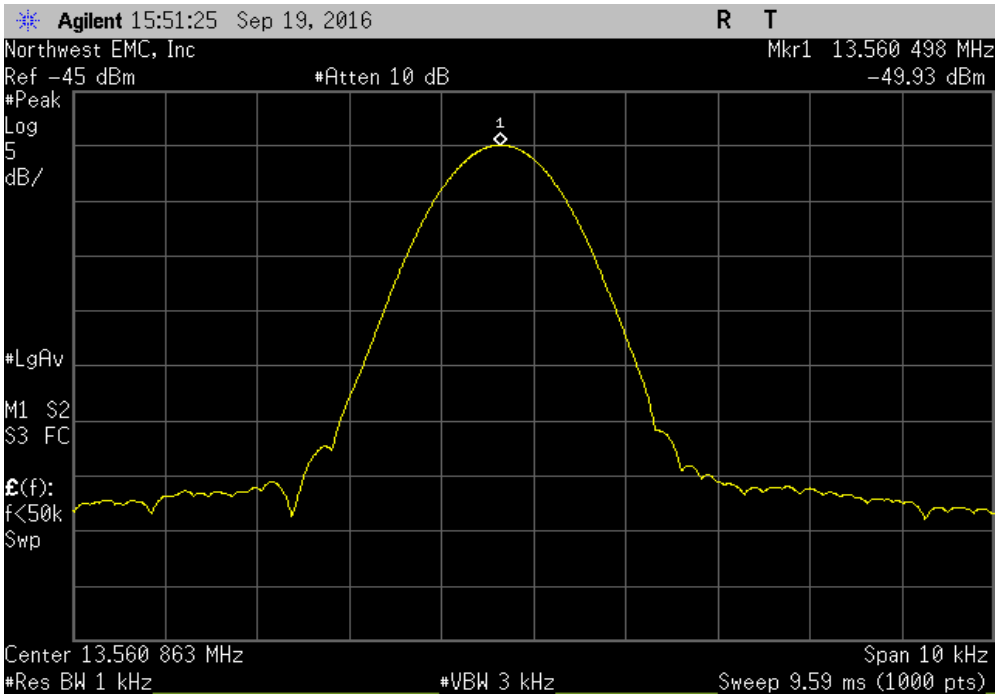
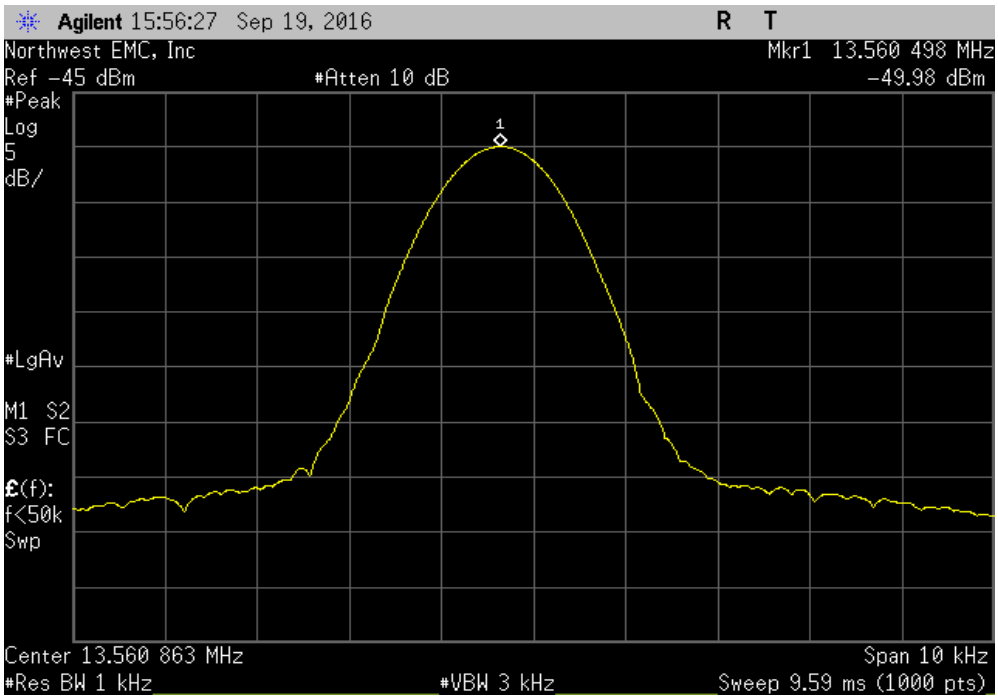
| RFID, 13.56 MHz, Temperature: -10°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560498 | 13.56 | 36.7 | 100 | Pass |



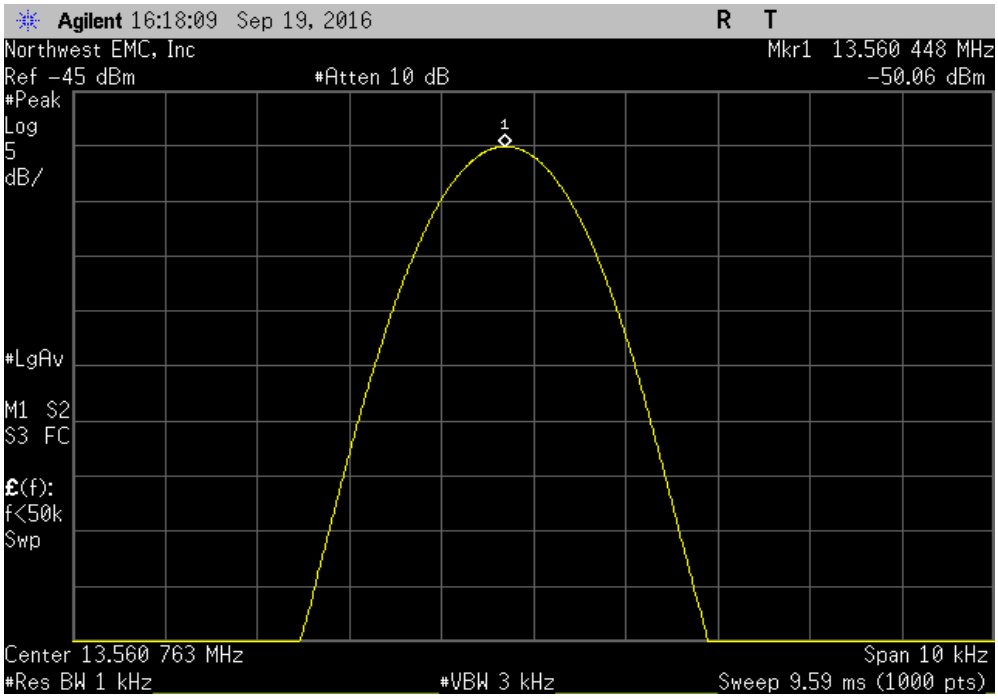

| RFID, 13.56 MHz, Temperature: -10°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560498 | 13.56 | 36.7 | 100 | Pass |



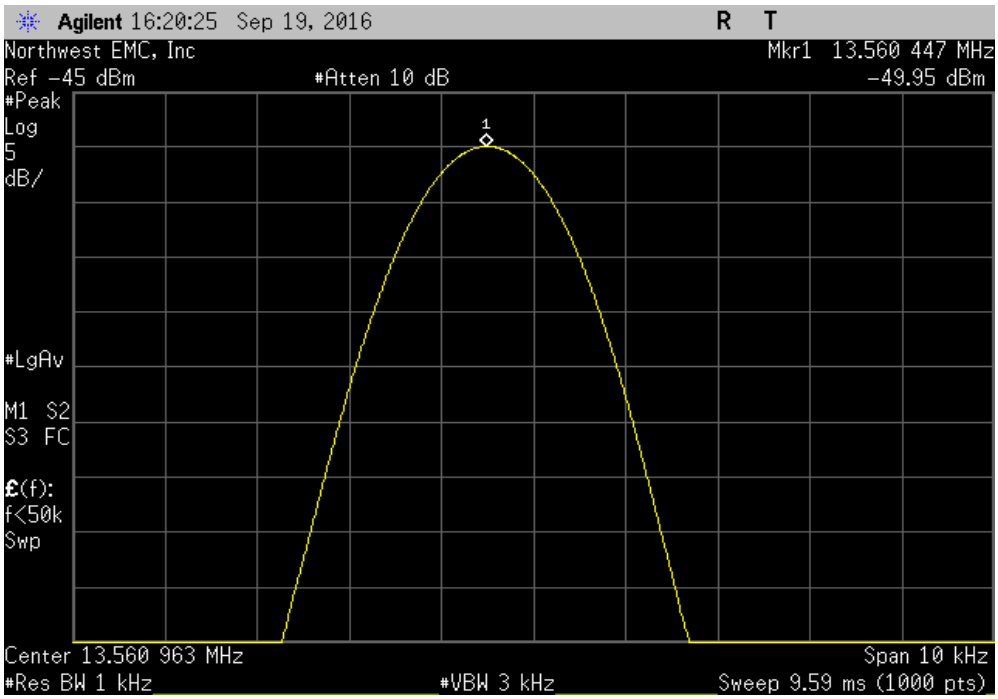
| RFID, 13.56 MHz, Temperature: -10°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560498 | 13.56 | 36.7 | 100 | Pass |



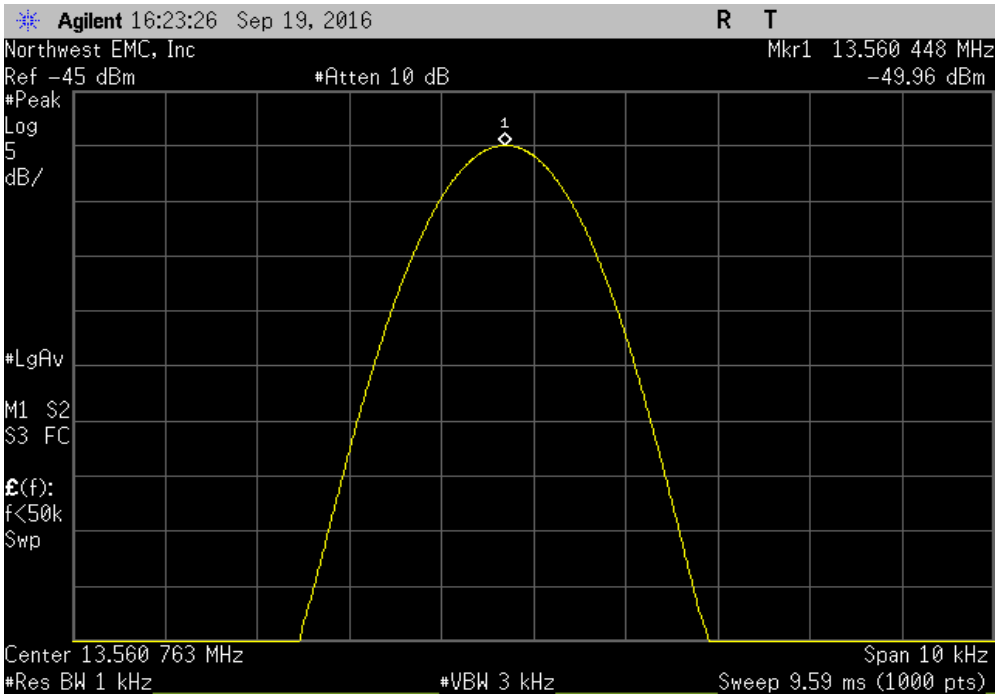

| RFID, 13.56 MHz, Temperature: -20°, Startup | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560448 | 13.56 | 33 | 100 | Pass |



| RFID, 13.56 MHz, Temperature: -20°, After 2 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560447 | 13.56 | 33 | 100 | Pass |




| RFID, 13.56 MHz, Temperature: -20°, After 5 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560448 | 13.56 | 33 | 100 | Pass |



# FREQUENCY STABILITY

XMit 2016.05.06

| RFID, 13.56 MHz, Temperature: -20°, After 10 Minutes | | | | | | |
|---|---|---|---|---|---|---|
| | | Measured Value (MHz) | Assigned Value (MHz) | Error (ppm) | Limit (ppm) | Results |
| | | 13.560448 | 13.56 | 33 | 100 | Pass |