# TEST REPORT

**Report Number: 102833450MPK-001**
**Project Number: G102833450**
**January 25, 2017**

**Testing performed on the**
**Proxess Electronic Cylindrical Lock**
**Model Number: PX101C**

**FCC ID: 2AKUZPX101C**

**to**
**FCC Part 15 Subpart C (15.225)**
**Industry Canada RSS-210 Issue 9**
**FCC Part 15, Subpart B**
**Industry Canada ICES-003**

**For**

**Proxess LLC**

| Test Performed by: | Test Authorized by: |
|---|---|
| Intertek | Proxess LLC |
| 1365 Adams Court | Tower 1, Colorado Center |
| Menlo Park, CA 94025 USA | 2000 S. Colorado Blvd – Suite 7300 |
| | Denver, CO 80222 USA |

Prepared by: _____ **Date:** January 25, 2017
Aaron Chang

Reviewed by: _____ **Date:** January 25, 2017
Krishna Vemuri

# Report No. 102833450MPK-001

| | |
|---|---|
| **Equipment Under Test**: | Proxess Electronic Cylindrical Lock |
| **Trade Name**: | Proxess LLC |
| **Model:** | PX101C |
| **Serial Number:** | 121520160001 |
| | |
| **Applicant**: | Proxess LLC |
| **Contact**: | Mr. Jon Torre |
| **Address**: | Tower 1, Colorado Center<br>2000 S. Colorado Blvd – Suite 7300<br>Denver, CO 80222 |
| **Country** | USA |
| | |
| **Tel. number**: | (203) 506-4886 |
| **Email**: | jon.torre@proxess.com |
| | |
| **Applicable Regulation**: | FCC Part 15 Subpart C (15.225)<br>Industry Canada RSS-210 Issue 9<br>FCC Part 15, Subpart B<br>Industry Canada ICES-003 |
| **Test Site Location:** | ITS – Site 1<br>1365 Adams Drive<br>Menlo Park, CA 94025 USA |
| **Date of Test**: | January 3 – 6, 2017 |

***We attest to the accuracy of this report:***

Aaron Chang
Project Engineer

Krishna K Vemuri
Engineering Team Lead

## TABLE OF CONTENTS

## 1.0 Summary of Tests

| TEST | REFERENCE FCC 15.225 | REFERENCE RSS-210 | RESULTS |
|---|---|---|---|
| Field Strength of Fundamental | 15.225(a) | B.6 | Complies |
| Radiated Emissions Outside the band | 15.225(b), 15.225(c), 15.225(d), 15.209 | B.6 | Complies |
| Frequency Tolerance of the Carrier | 15.225(e) | B.6 | Complies |
| Line Conducted Emissions | 15.207 | RSS-GEN | Not Applicable[2] |
| Occupied Bandwidth | 15.215 | RSS-GEN | Complies |
| Radiated Emissions from Digital Parts | 15.109 | ICES-003 | Complies |
| Conducted Emissions from Digital Parts | 15.107 | ICES-003 | Not Applicable[2] |
| Antenna requirement | 15.203 | RSS-GEN | Complies[1] |

1 EUT utilizes an internal Antenna.
2 EUT is battery operated.

## 2.0 General Description

2.1 Product Description

The Proxess Electronic Cylindrical Lock is an RFID enabled Grade 1 cylindrical lock set that grants access upon correctly reading a 13.56MHz credential. A pin and tumbler lock set is provided as a backup method for entry.

**Overview of the EUT**

| | | |
|---|---|---|
| **Applicant name & address** | Proxess LLC<br>Tower 1, Colorado Center<br>2000 S. Colorado Blvd – Suite 7300<br>Denver, CO 80222 USA | |
| **Contact info / Email** | Mr. Jon Torre / jon.torre@proxess.com | |
| **Equipment under Test (EUT)** | **Models Number** | **Serial Number** |
| | PX101C | 121520160001 |
| **FCC Identifier** | 2AKUZPX101C | |
| **Operating Frequency** | 13.56MHz | |
| **Number of Channels** | 1 | |
| **Type of Modulation** | ASK | |
| **Operating Temperature** | -20°C to +50°C | |
| **Antenna Type** | Internal PCB Antenna | |

**EUT receive date:** January 03, 2017
**EUT receive condition:** The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.
**Test start date:** January 03, 2017
**Test completion date:** January 06, 2017
The test results in this report pertain only to the item tested.
.

## 2.2 Related Submittal(s) Grants

None

## 2.3 Test Methodology

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10-2013 & ANSI C63.4-2014. Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in the "Data Sheet" of this report.

## 2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

## 2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

| Measurement | Expanded Uncertainty (k=2) | | |
|---|---|---|---|
| | 0.15 MHz – 1 GHz | 1 GHz – 2.5 GHz | > 2.5 GHz |
| RF Power and Power Density – antenna conducted | - | 0.7 dB | - |
| Unwanted emissions - antenna conducted | 1.1 dB | 1.3 dB | 1.9 dB |
| Bandwidth – antenna conducted | - | 30 Hz | - |

| Measurement | Expanded Uncertainty (k=2) | | |
|---|---|---|---|
| | 0.15 MHz – 30MHz | 30 MHz – 1 GHz | 1 GHz – 18 GHz |
| Radiated emissions | - | 4.7 | 5.1 dB |
| AC mains conducted emissions | 2.1 dB | - | - |

## 3.0 System Test Configuration

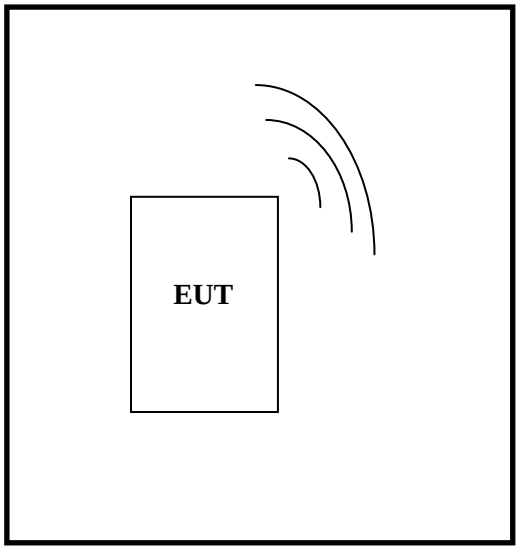
### 3.1 Support Equipment and description

No System Support Equipment or Cables were used for testing.

### 3.2 Block Diagram of Test Setup

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.

**Block diagram for Proxess Electronic Cylindrical Lock**



## 3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is programmed to transmit full power. The highest clock frequency used in the EUT is 2.4GHz; Radiated Emissions was tested up to 18GHz for FCC Part 15 Subpart B.

## 3.4 Software Exercise Program

None.

## 3.5 Mode of Operation during test

The EUT was constantly broadcasting a 13.56 MHz signal. When the EUT recognized a correct 13.56 MHz credential, it would unlock the cylindrical lock.

## 3.6 Modifications required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance.

## 3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

## 4.0 Measurement Results

4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

4.1.1 Requirements

FCC Rules 15.225, 15.209

a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.

b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were made at 10 meters. Data results below are corrected for distance back to 30 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below above 30 MHz were made at 3 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.
Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz
9 kHz or greater for 150kHz to 30 MHz
120 kHz or greater for 30MHz to 1000 MHz
For those frequencies quasi-peak detector applies

Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

FS = RA + AF + CF – AG – DCF

Where FS = Field Strength in dB (μV/m)

RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

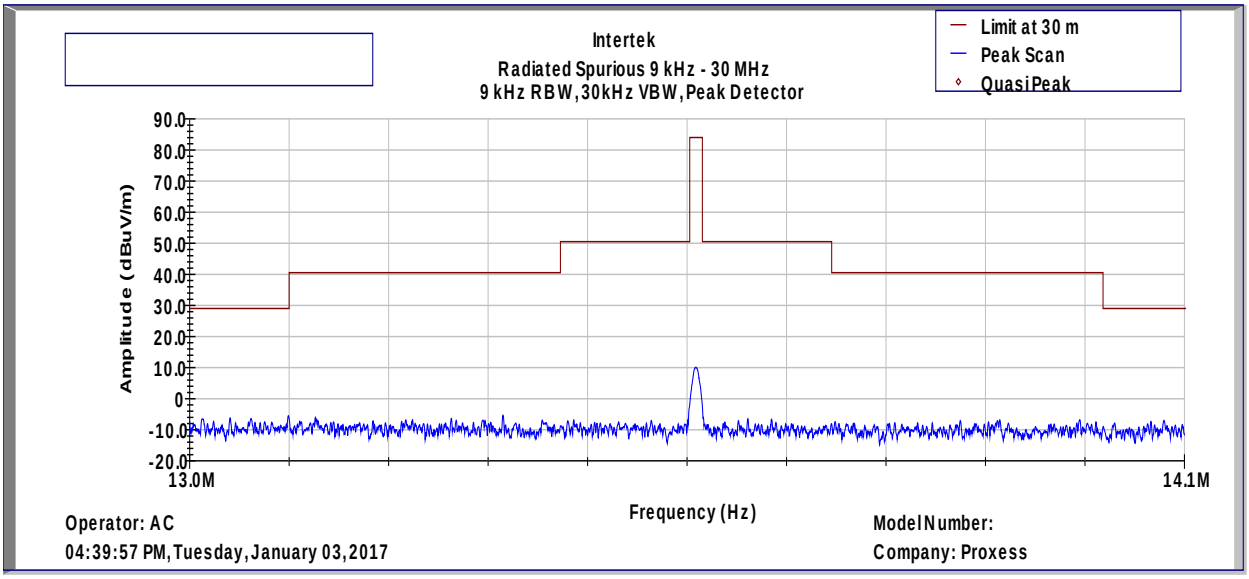
Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Result 15.225 (a)(b)(c)

The data below shows the significant emission frequencies, the limit and the margin of compliance. Note: Parallel and perpendicular orientation of loop antenna was verified. Worst case data presented below.

**Radiated emissions at fundamental frequency of Proxess Electronic Cylindrical Lock**

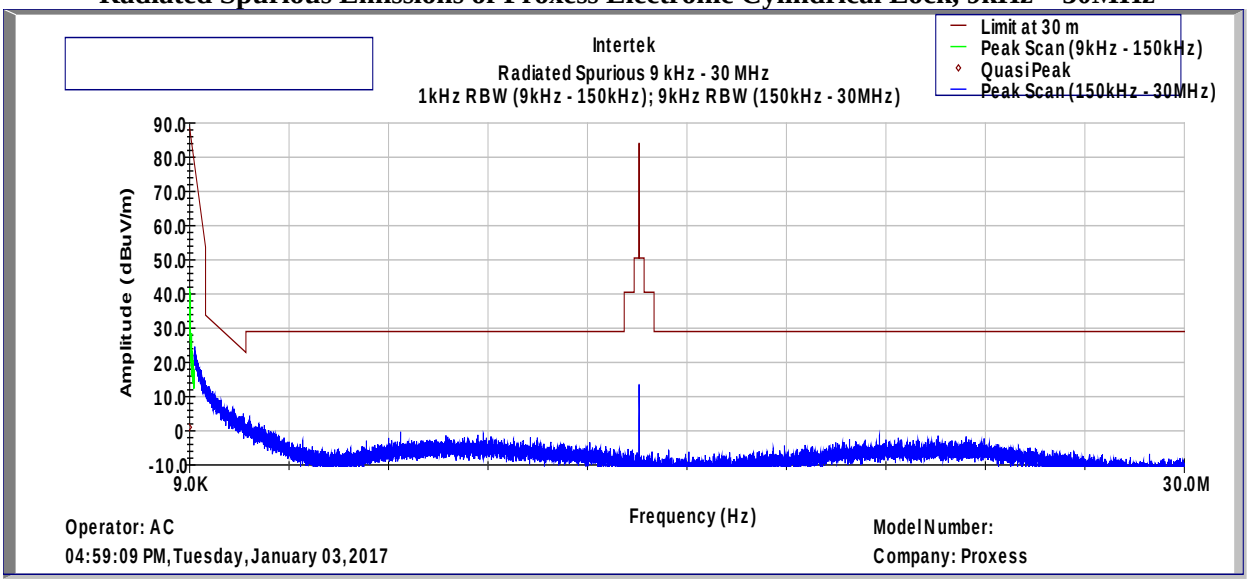
| Frequency | Peak FS | Limit@30m | Margin | RA@10m | CF | AG | DCF | AF |
|---|---|---|---|---|---|---|---|---|
| (MHz) | dB(uV/m) | dB(uV/m) | dB | dB(uV) | dB | dB | dB | dB(1/m) |
| 13.56 | 9.8 | 84 | -74.2 | 25.6 | 0.4 | 32.1 | -19.1 | 35 |



4.1.4 Test Result 15.225 (d)

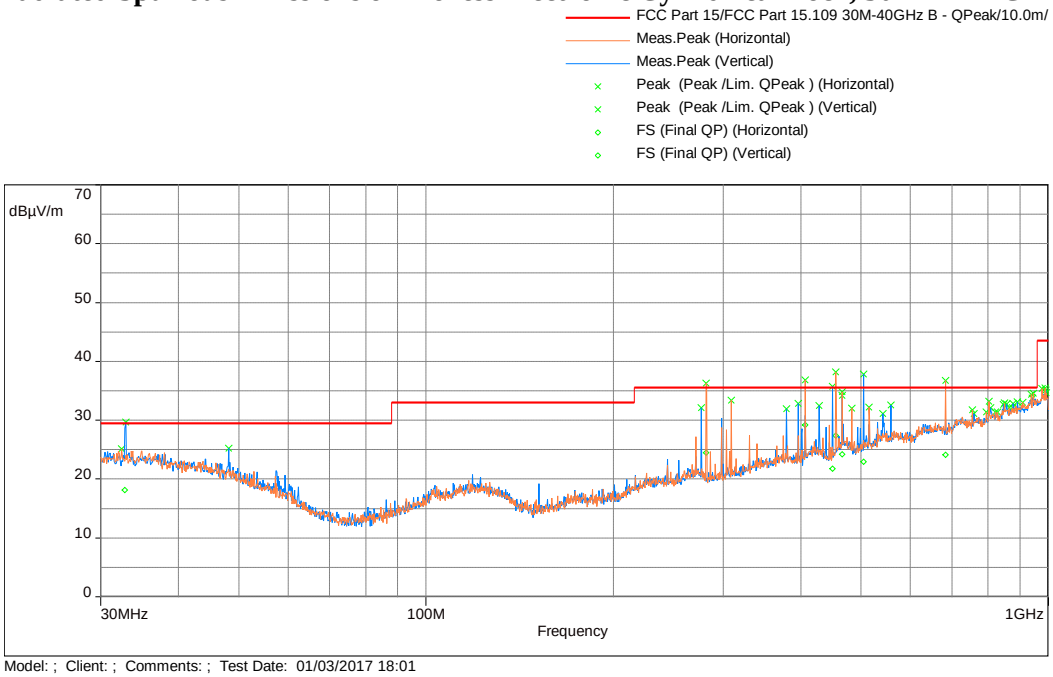
**Radiated Spurious Emissions 9 kHz to 10th Harmonic of Fundamental Transmitter (135.6MHz)**

**Radiated Spurious Emissions of Proxess Electronic Cylindrical Lock, 9kHz – 30MHz**



4.1.4 Test Result 15.225 (d) (Continued)

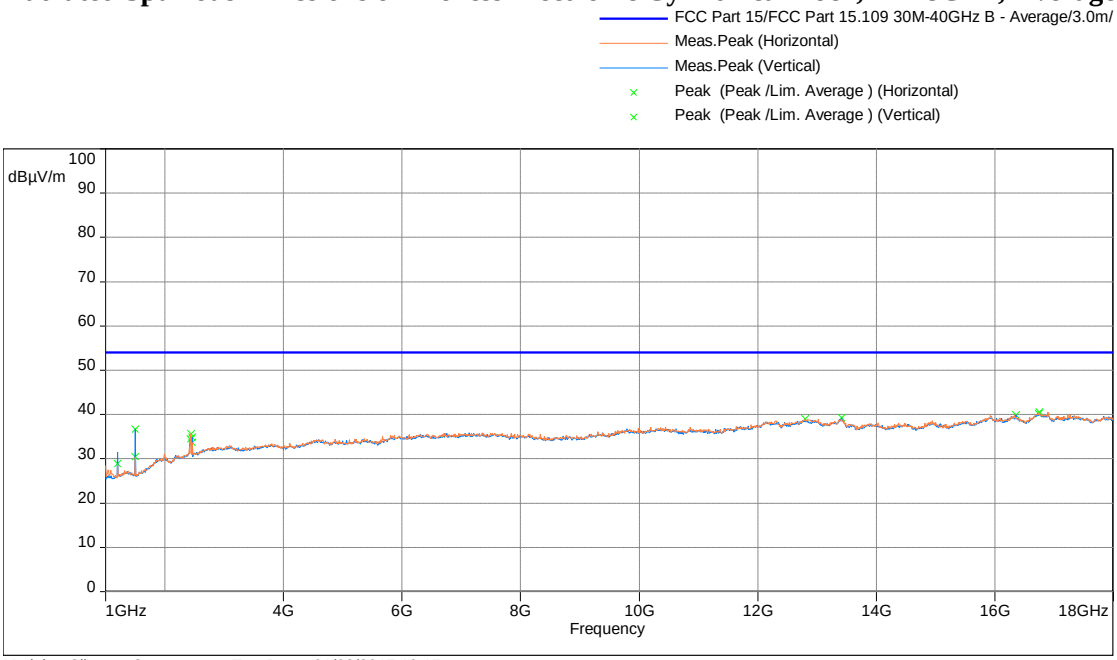
**Radiated Spurious Emissions of Proxess Electronic Cylindrical Lock, 30MHz – 1GHz**




| Frequency | FS | Limit | Margin | Azimuth | Height | Polarity | RA | Correction |
|---|---|---|---|---|---|---|---|---|
| MHz | dBµV/m | (dBµV/m) | dB | deg | m | | dBµV | dB |
| 282.054 | 24.5 | 36 | -11.5 | 109 | 2.51 | Horizontal | 31.91 | -7.41 |
| 406.808 | 29.24 | 36 | -6.76 | 272.25 | 1.84 | Horizontal | 33.1 | -3.87 |
| 455.626 | 27.36 | 36 | -8.64 | 226.25 | 1.71 | Horizontal | 30.47 | -3.11 |
| 466.489 | 24.21 | 36 | -11.79 | 223 | 1.69 | Horizontal | 26.15 | -1.94 |
| 683.443 | 24.13 | 36 | -11.87 | 184.25 | 1.2 | Horizontal | 24.1 | 0.03 |
| 32.793 | 18.13 | 30 | -11.87 | 318.5 | 3.88 | Vertical | 22.09 | -4 |
| 450.209 | 21.74 | 36 | -14.26 | 0 | 3.72 | Vertical | 25.51 | -3.76 |
| 504.445 | 22.91 | 36 | -13.09 | 30.25 | 2.62 | Vertical | 25.23 | -2.32 |

4.1.4 Test Result 15.225 (d) (Continued)

**Radiated Spurious Emissions of Proxess Electronic Cylindrical Lock, 1 - 18GHz, Average**

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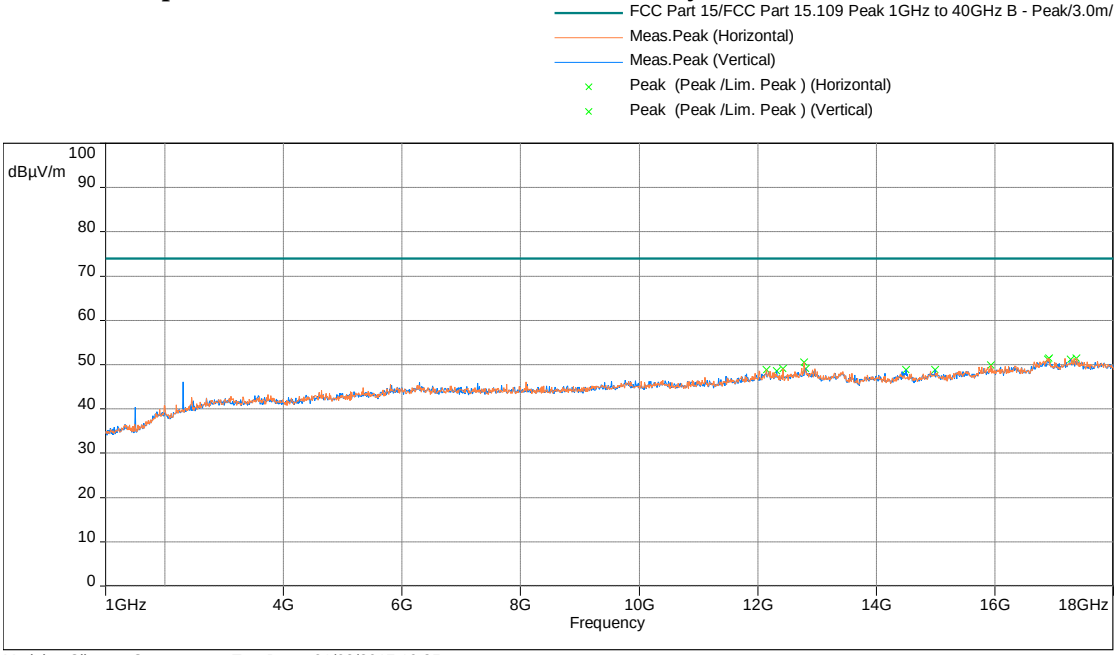
**Radiated Spurious Emissions of Proxess Electronic Cylindrical Lock, 1 - 18GHz, Peak**

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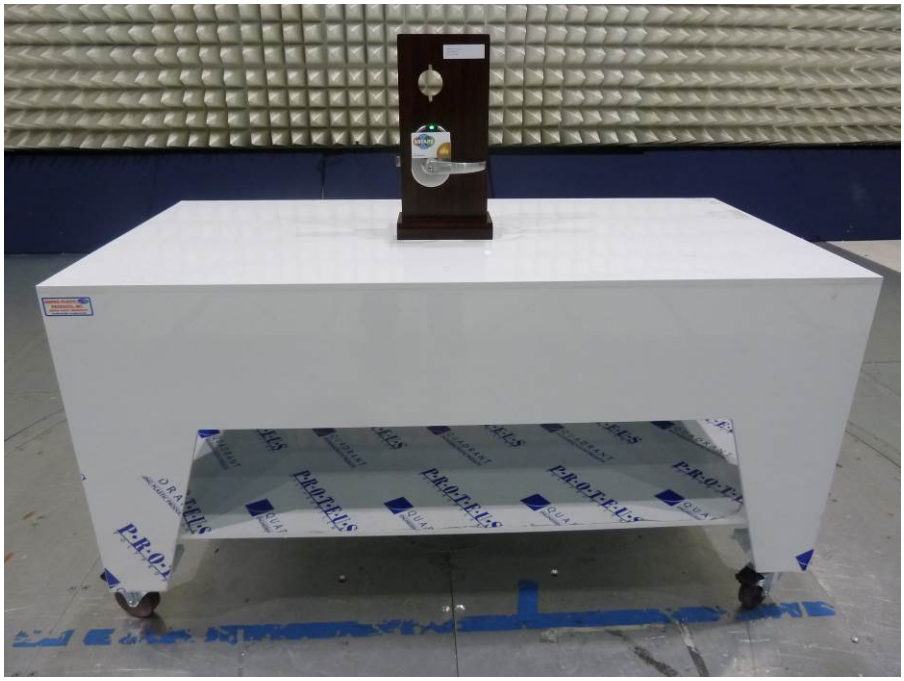
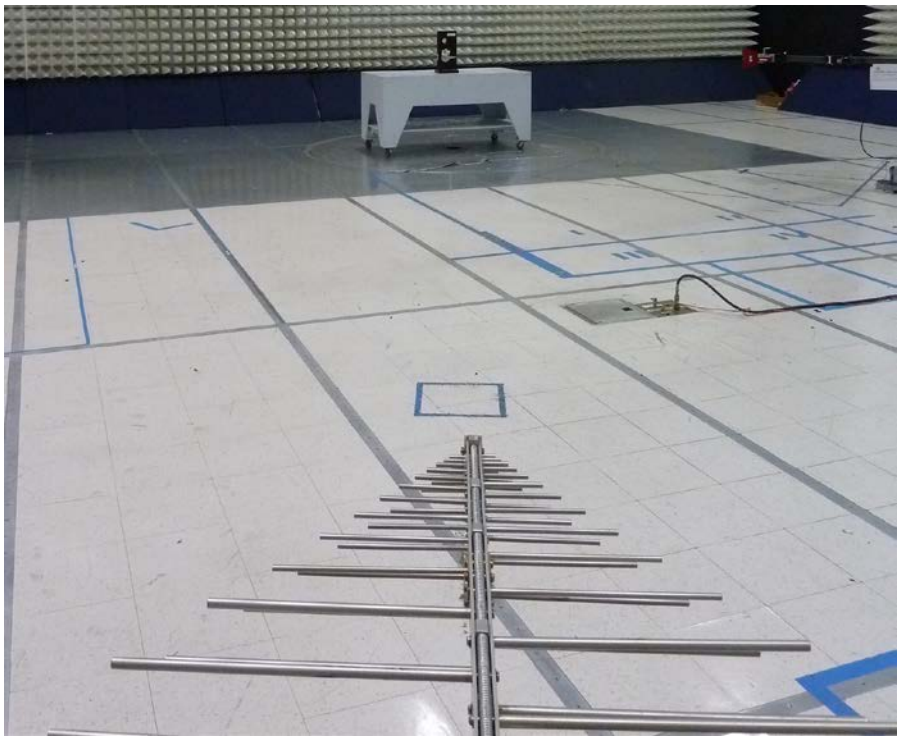
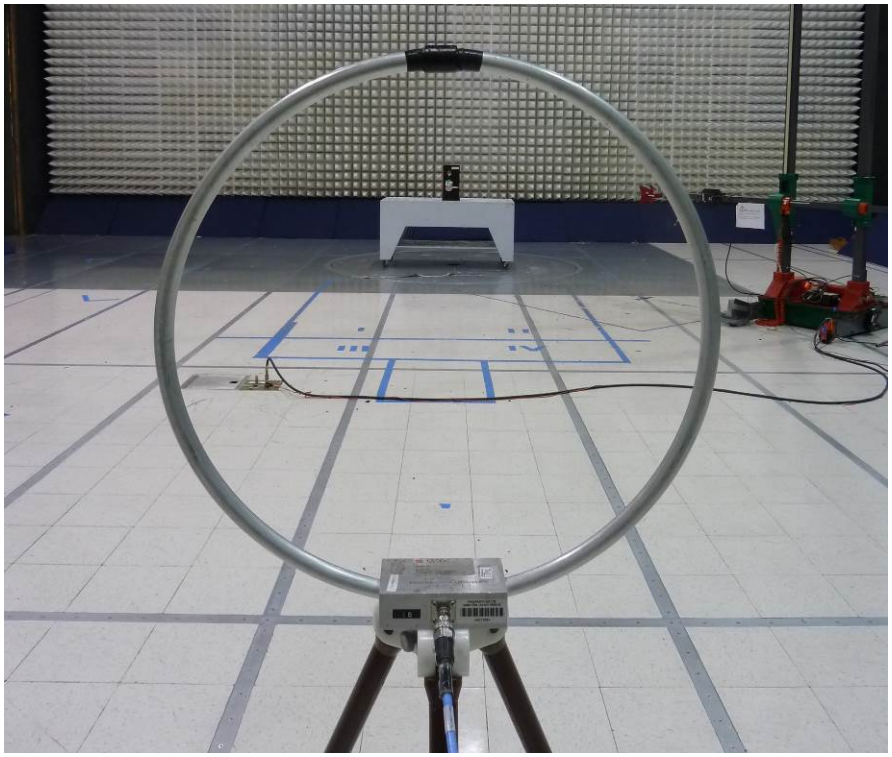
4.1.5 Test Configuration Photographs

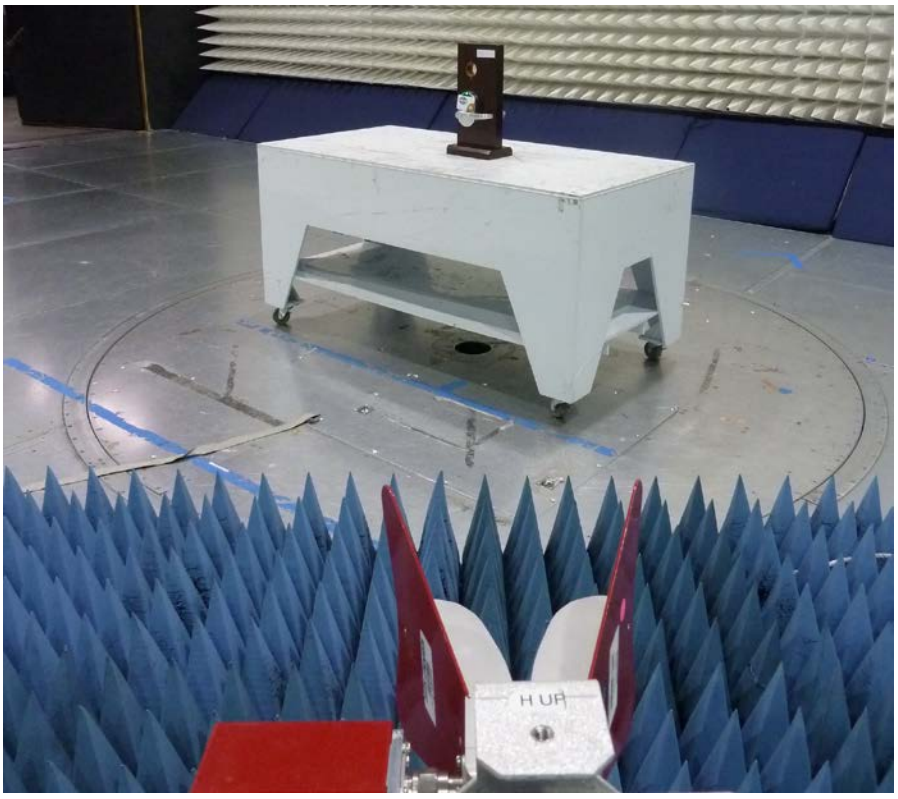
**The following photographs show the testing configurations used.**





4.1.5 Test Configuration Photographs (Continued)





## 4.2 Frequency Tolerance

### 4.2.1 Requirement

FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 4.2.2 Procedure

The EUT was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded.

4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13560000 Hz

| Proxess Electronic Cylindrical Lock | | | | |
|---|---|---|---|---|
| **Voltage (DC)** | **Temperature ( C )** | **Measured Frequency (Hz)** | **Deviation from Reference (Hz)** | **Deviation (%)** |
| 3 | -20 | 13558968 | 965 | 0.007117 |
| 3 | -10 | 13559932 | 1 | 0.000007 |
| 3 | 0 | 13559933 | 0 | 0.000000 |
| 3 | 10 | 13559933 | 0 | 0.000000 |
| 3 | 20 | 13559933 | 0 | 0.000000 |
| 3 | 30 | 13559910 | 23 | 0.000170 |
| 3 | 40 | 13559888 | 45 | 0.000332 |
| 3 | 50 | 13559865 | 68 | 0.000501 |

Nominal Frequency @ 20C, 3VDC: 13559933 Hz

## 4.3 Occupied Bandwidth
FCC 15.215

### 4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

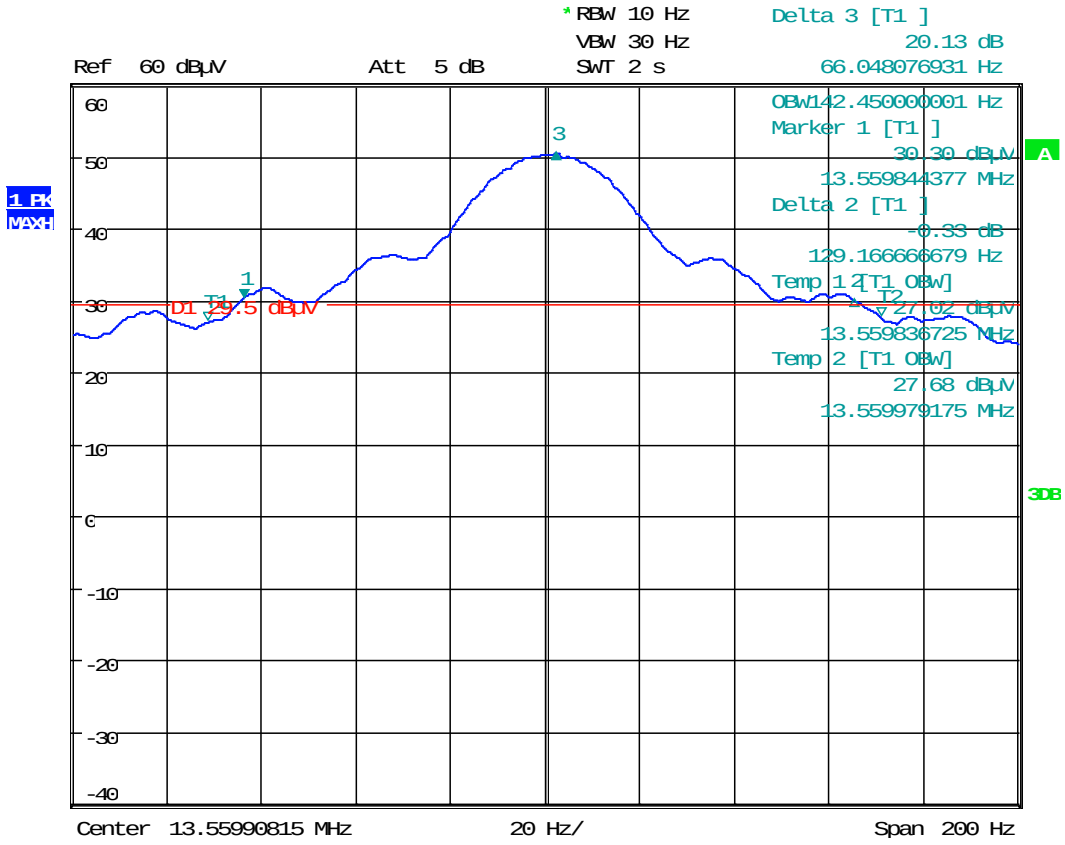
### 4.3.2 Procedure

The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10: 2013, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

4.3.3 Test Results

| EUT | Frequency (MHz) | 20-dB Channel Bandwidth (Hz) | 99% Channel Bandwidth (Hz) |
|---|---|---|---|
| Proxess Electronic Cylindrical Lock | 13.56 | 129.2 | 142.5 |



## 4.4 AC Line Conducted Emission
FCC Rule 15.207, FCC 15.107

### 4.4.1 Requirement

| Frequency Band MHz | Class B Limit dB(μV) | | Class A Limit dB(μV) | |
|---|---|---|---|---|
| | Quasi-Peak | Average | Quasi-Peak | Average |
| 0.15-0.50 | 66 to 56 * | 56 to 46 * | 79 | 66 |
| 0.50-5.00 | 56 | 46 | 73 | 60 |
| 5.00-30.00 | 60 | 50 | 73 | 60 |

*Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.*

### 4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207 outside the transmitter fundamental emissions band. After, the EUT antenna is removed from the EUT and only the fundamental emission band was measured to show that the fundamental emission band is in compliance with the 15.207 limits.

Equipment setup for conducted disturbance tests followed.

### 4.4.3 Test Result

Not Applicable. EUT is Battery powered only.

4.5 Radiated Emissions on Digital Parts and Receiver
FCC Ref: 15.109, ICES 003, RSS Gen

4.5.1 Test Limit

***Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES 003*, RSS GEN***

| **Frequency (MHz)** | **Class A at 10m dB(μV/m)** | **Class B at 3m dB(μV/m)** |
|---|---|---|
| 30-88 | 39 | 40.0 |
| 88-216 | 43.5 | 43.5 |
| 216-960 | 46.4 | 46.0 |
| Above 960 | 49.5 | 54.0 |

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.5.2 Procedures

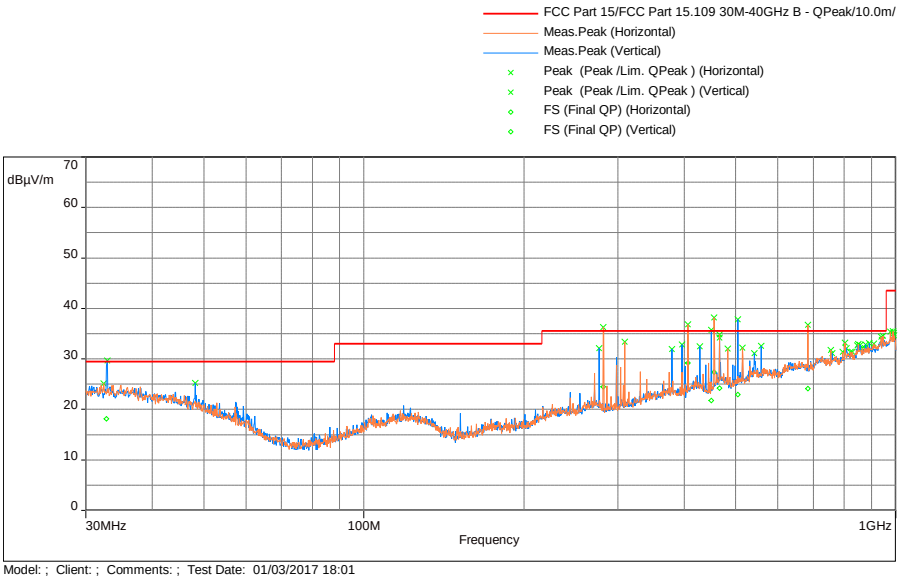
Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

4.5.3 Test Results

Radiated emission measurements were performed from 30 MHz to 18000 MHz. The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.5.3 Test Results (Continued)

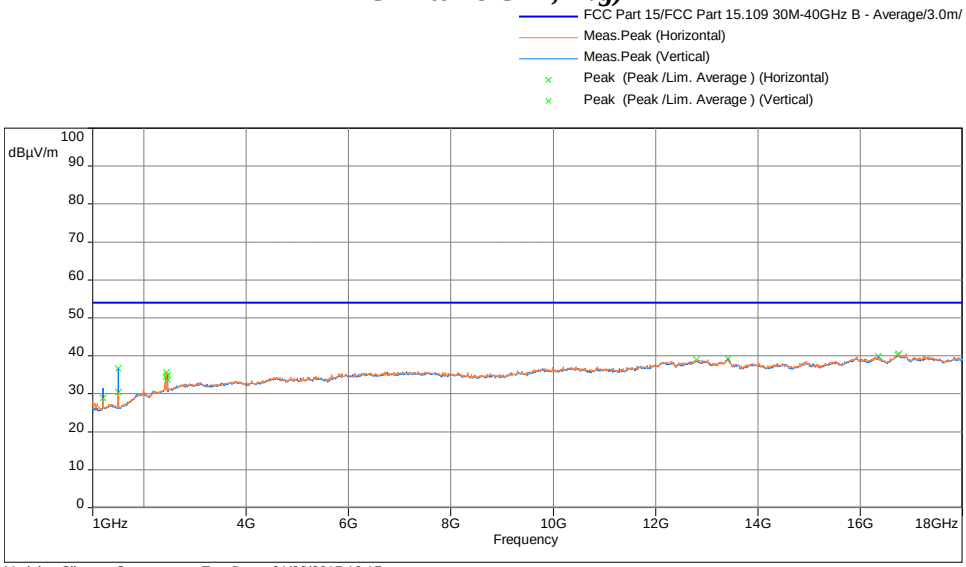
***Proxess Electronic Cylindrical Lock (FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz)***




| Frequency | FS | Limit | Margin | Azimuth | Height | Polarity | RA | Correction |
|---|---|---|---|---|---|---|---|---|
| MHz | dBµV/m | (dBµV/m) | dB | deg | m | | dBµV | dB |
| 282.054 | 24.5 | 36 | -11.5 | 109 | 2.51 | Horizontal | 31.91 | -7.41 |
| 406.808 | 29.24 | 36 | -6.76 | 272.25 | 1.84 | Horizontal | 33.1 | -3.87 |
| 455.626 | 27.36 | 36 | -8.64 | 226.25 | 1.71 | Horizontal | 30.47 | -3.11 |
| 466.489 | 24.21 | 36 | -11.79 | 223 | 1.69 | Horizontal | 26.15 | -1.94 |
| 683.443 | 24.13 | 36 | -11.87 | 184.25 | 1.2 | Horizontal | 24.1 | 0.03 |
| 32.793 | 18.13 | 30 | -11.87 | 318.5 | 3.88 | Vertical | 22.09 | -4 |
| 450.209 | 21.74 | 36 | -14.26 | 0 | 3.72 | Vertical | 25.51 | -3.76 |
| 504.445 | 22.91 | 36 | -13.09 | 30.25 | 2.62 | Vertical | 25.23 | -2.32 |

4.5.3 Test Results (Continued)

***Proxess Electronic Cylindrical Lock (FCC Part 15 Subpart B Radiated Disturbance, 1 GHz to 18 GHz, Avg)***

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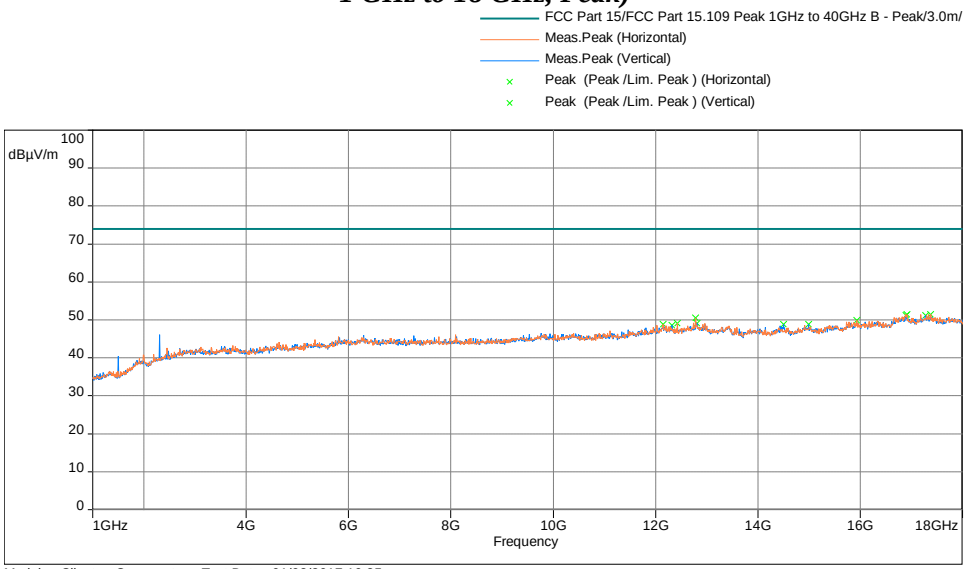
***Proxess Electronic Cylindrical Lock (FCC Part 15 Subpart B Radiated Disturbance, 1 GHz to 18 GHz, Peak)***

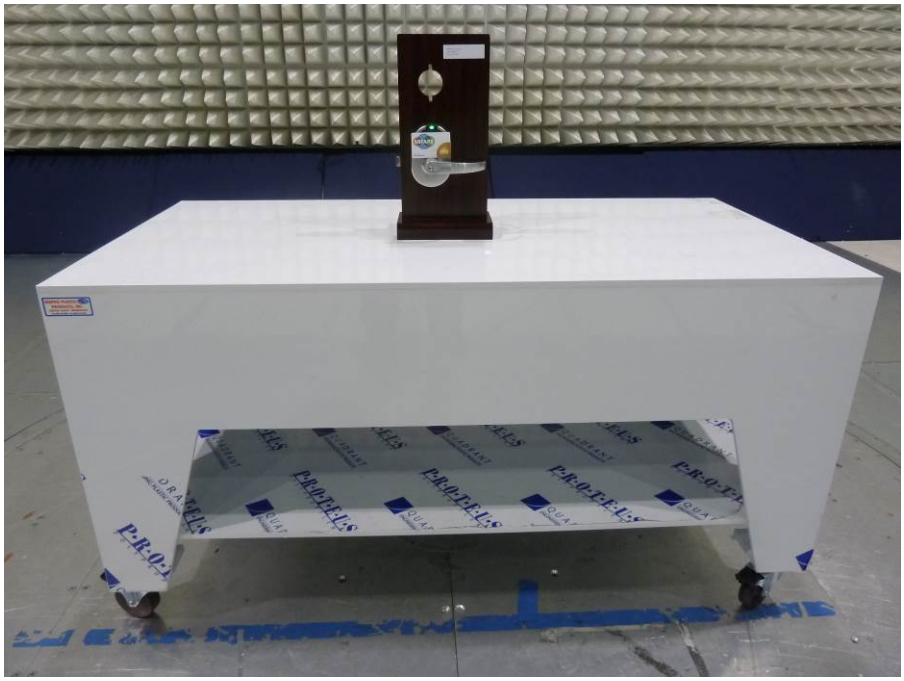



Model: ; Client: ; Comments: ; Test Date: 01/03/2017 19:35

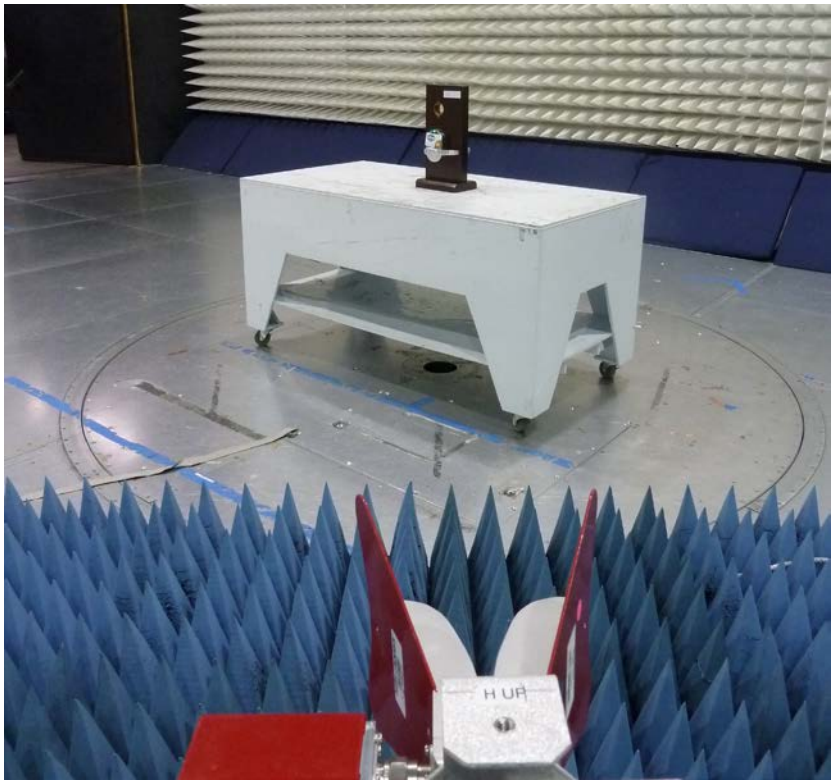
| | |
|---|---|
| **Result for Proxess Electronic Cylindrical Lock** | **Complies** by 6.76 dB to FCC Part 15, Subpart B |

4.5.4 Test Configuration Photographs

**The following photographs show the testing configurations used.**



4.5.4 Test Configuration Photographs (Continued)



## 5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

| Equipment | Manufacturer | Model/Type | Serial No. | Calibration Interval | Cal Due |
|---|---|---|---|---|---|
| EMI Receiver | Rohde and Schwarz | ESU | ITS 01375 | 12 | 07/07/17 |
| BI-Log Antenna | Antenna Research | LPB-2513 | ITS 00355 | 12 | 09/09/17 |
| Pre-Amplifier | Sonoma Instrument | 310N | ITS 00415 | 12 | 03/04/17 |
| Horn Antenna | ETS Lindgren | 3117-PA | ITS 01365 | 12 | 08/09/17 |
| Environmental Test Chamber | ESPEC | BTX-475 | ITS 01435 | 12 | 09/06/17 |
| Ant-Passive Loop | EMCO | 6512 | ITS 001598 | 12 | 09/13/17 |

* Calibration performed by ITS prior to the test. # Calibration not required

Software used for emission compliance testing utilized the following:

| Name | Manufacturer | Version | Template/Profile |
|---|---|---|---|
| Tile | Quantum Change | 3.4.K.22 | 225 9kHz to 30Mhz (Parallel).TIL<br>225 9kHz to 30Mhz (Perpendicular).TIL<br>225 MASK (Parallel).TIL<br>225 MASK (Perpendicular).TIL |
| BAT-EMC | Nexio | 3.16.0.44 | Proxess 1-3-2017.bpp |

## 6.0 Document History

| Revision/ Job Number | Writer Initials | Reviewer Initials | Date | Change |
|---|---|---|---|---|
| 1.0 / G102833450 | AC | KV | January 25, 2017 | Original document |