

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**

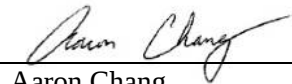
For

Proxess LLC

Test Performed by:
Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Test Authorized by:
Proxess LLC
Tower 1, Colorado Center
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Date: January 25, 2017

Reviewed by:


Krishna Vemuri

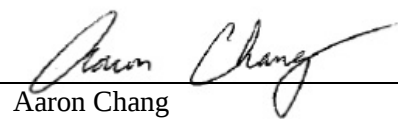
Date: January 25, 2017

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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 2000 S. Colorado Blvd – Suite 7300 Denver, CO 80222
Country	USA
Tel. number:	(203) 506-4886
Email:	jon.torre@proxess.com
Applicable Regulation:	FCC Part 15 Subpart C (15.225) Industry Canada RSS-210 Issue 9 FCC Part 15, Subpart B Industry Canada ICES-003
Test Site Location:	ITS – Site 1 1365 Adams Drive 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

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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 Tower 1, Colorado Center 2000 S. Colorado Blvd – Suite 7300 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.

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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

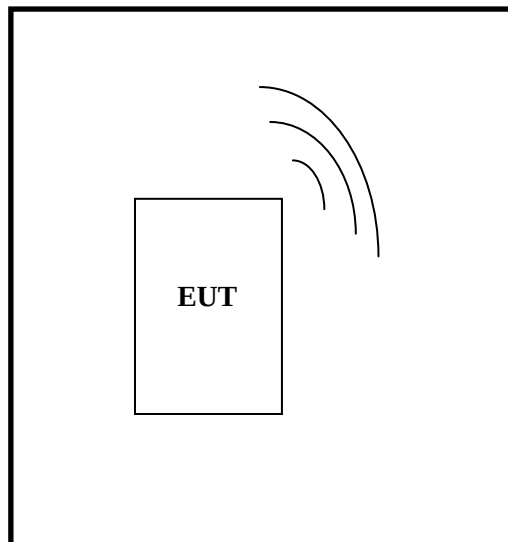
3.1 Support Equipment and description

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	$2400/F(\text{kHz})$	300
0.490-1.705	$24000/F(\text{kHz})$	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 (μ V/m)

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

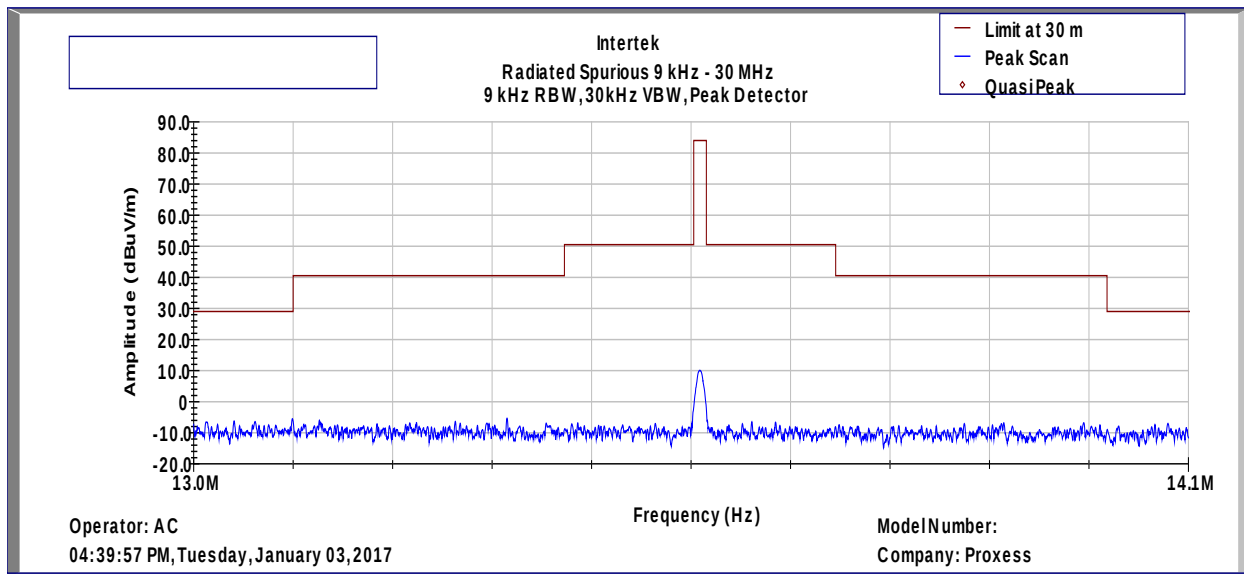
Note: FS was measured with loop antenna below 30MHz

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.

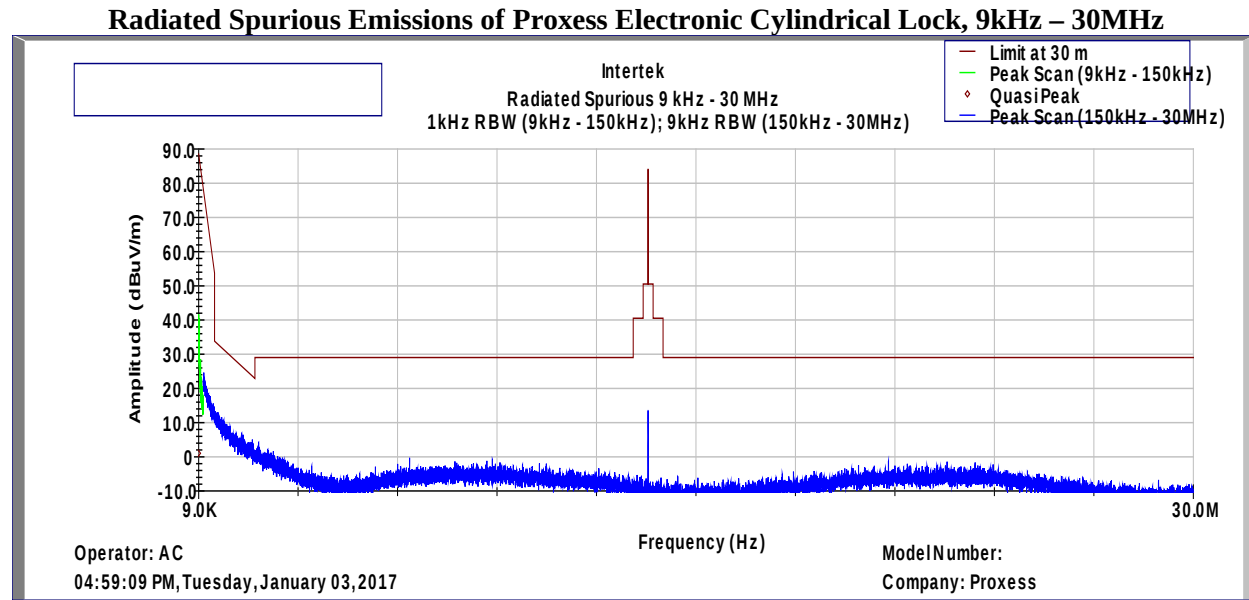
Radiated emissions at fundamental frequency of Proxess Electronic Cylindrical Lock

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



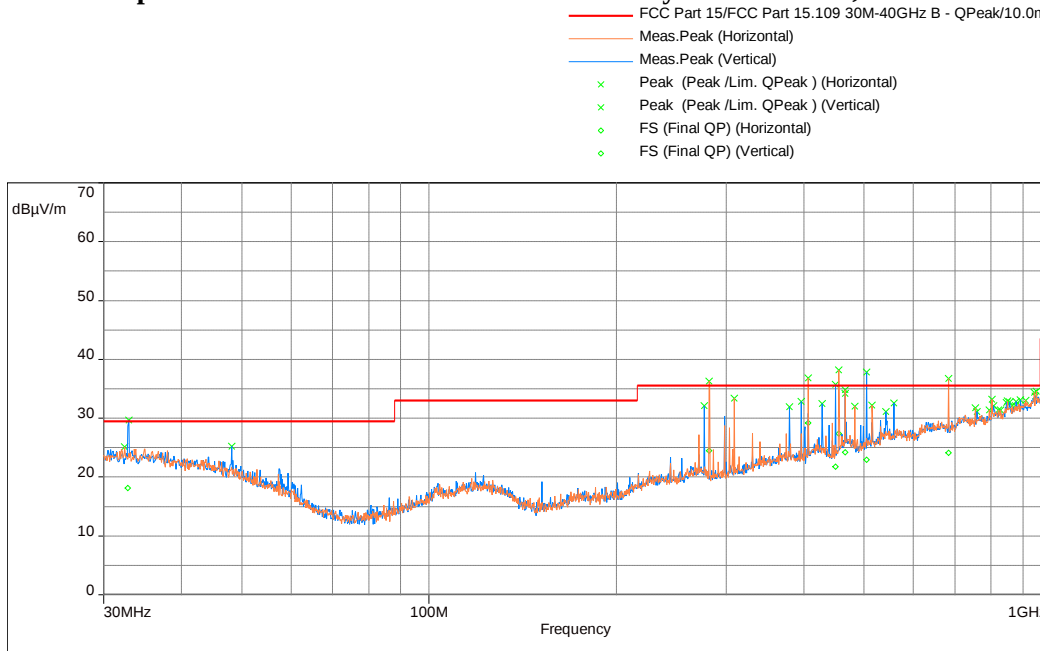
4.1.4 Test Result 15.225 (d)

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



4.1.4 Test Result 15.225 (d) (Continued)

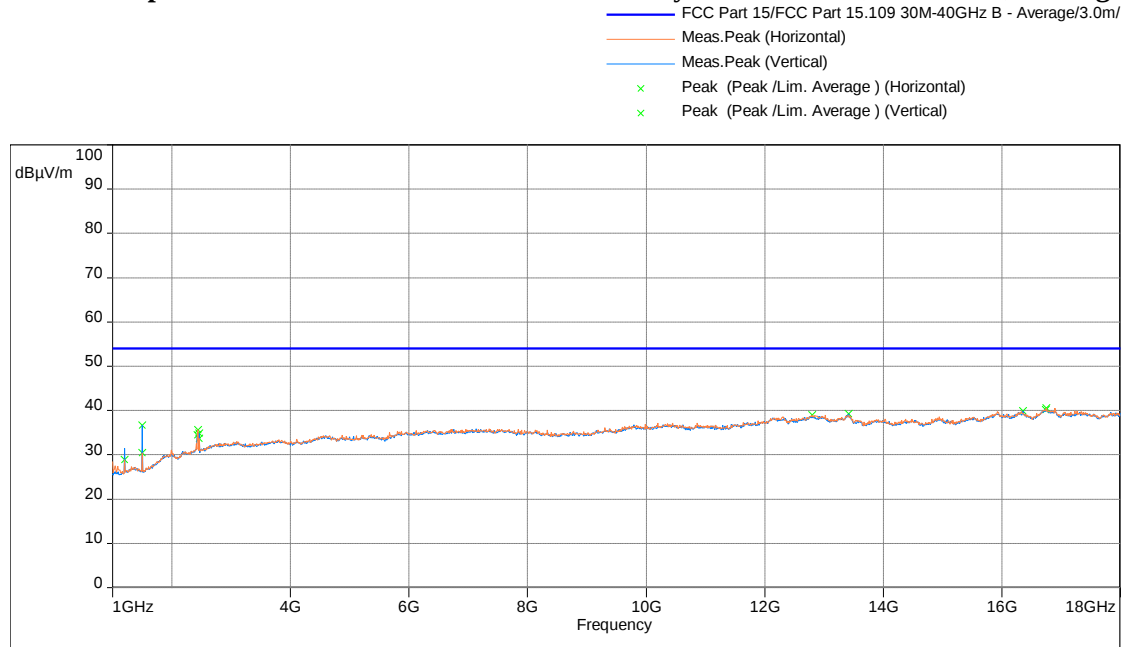
Radiated Spurious Emissions of Proxess Electronic Cylindrical Lock, 30MHz – 1GHz



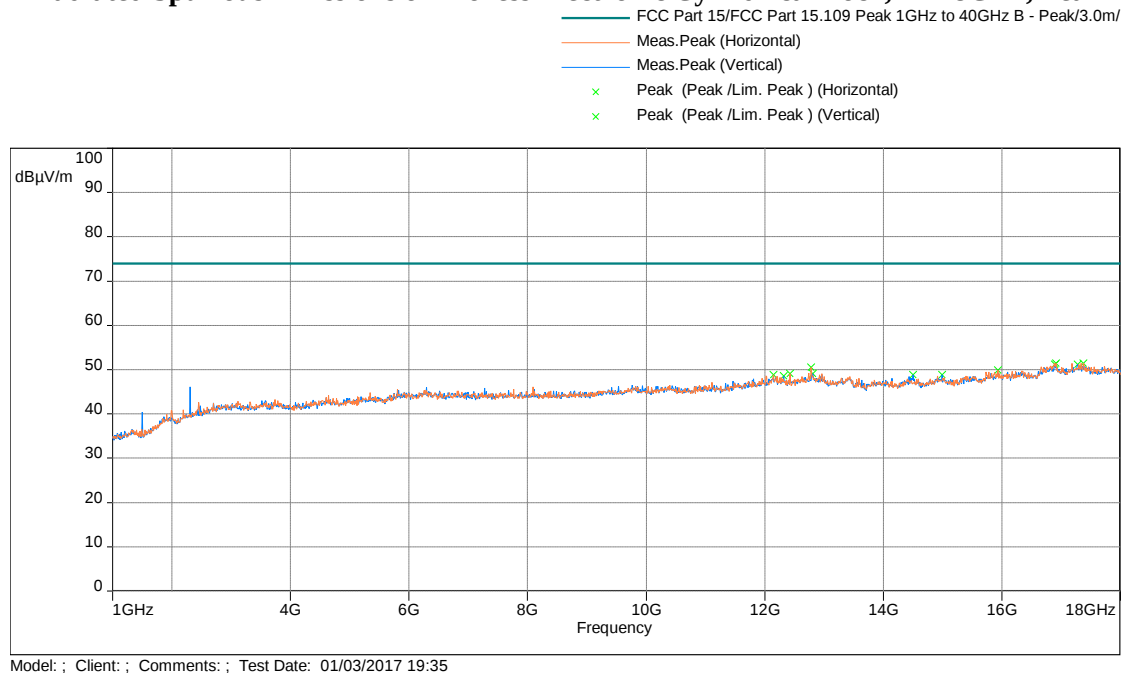
Frequency	FS	Limit	Margin	Azimuth	Height	Polarity	RA	Correction
MHz	dBμV/m	(dBμV/m)	dB	deg	m		dBμV	dB
282.054	24.5	36	-11.5	109	2.51	Horizontal	31.91	-7.41
406.808	29.24	36	-6.76	272.25	1.84	Horizontal	33.1	-3.87
455.626	27.36	36	-8.64	226.25	1.71	Horizontal	30.47	-3.11
466.489	24.21	36	-11.79	223	1.69	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

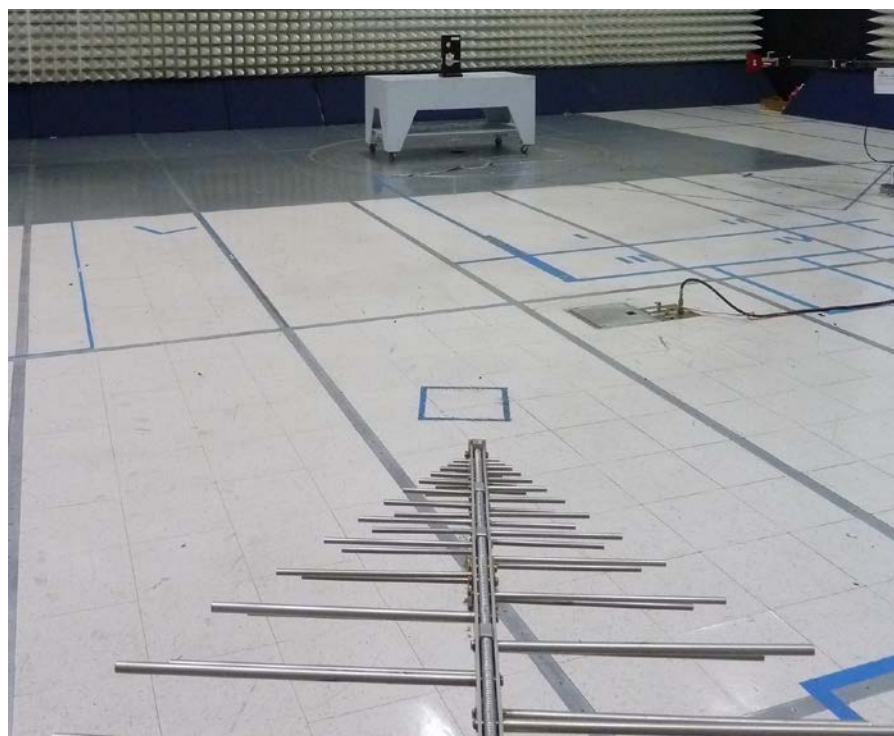
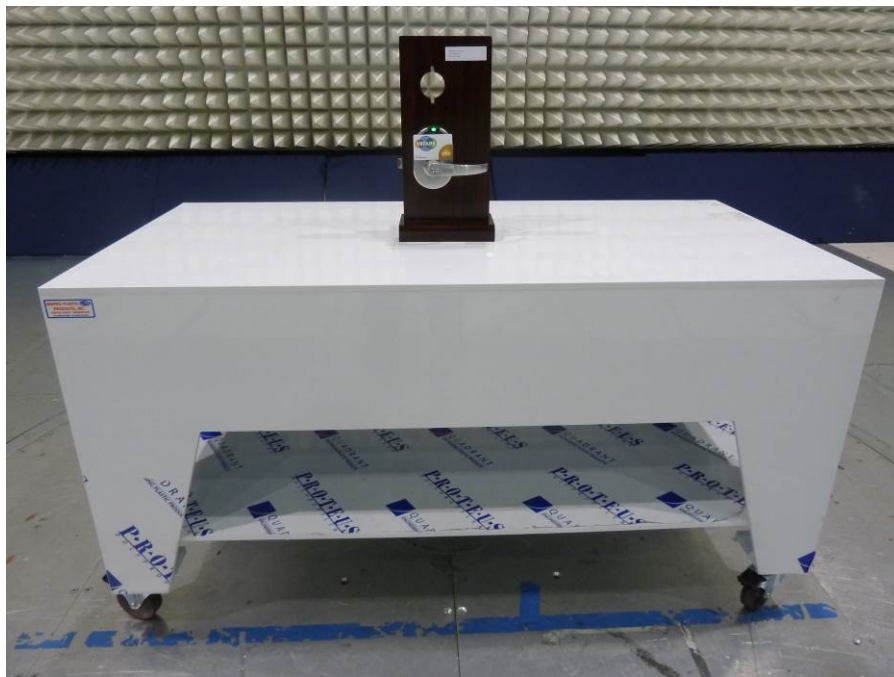


Radiated Spurious Emissions of Proxess Electronic Cylindrical Lock, 1 - 18GHz, Peak

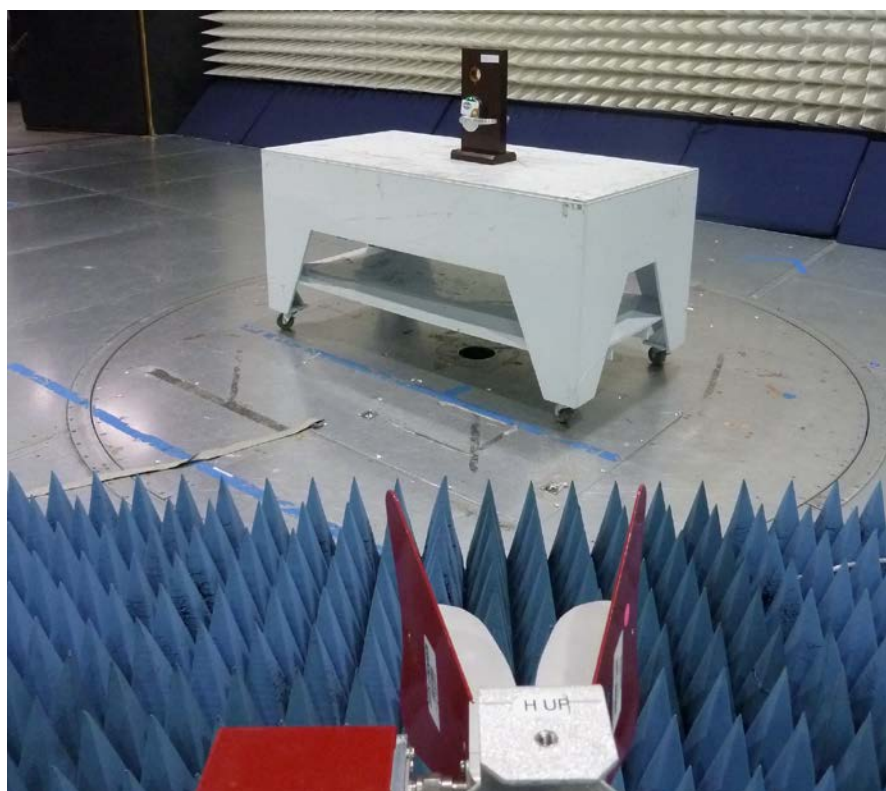
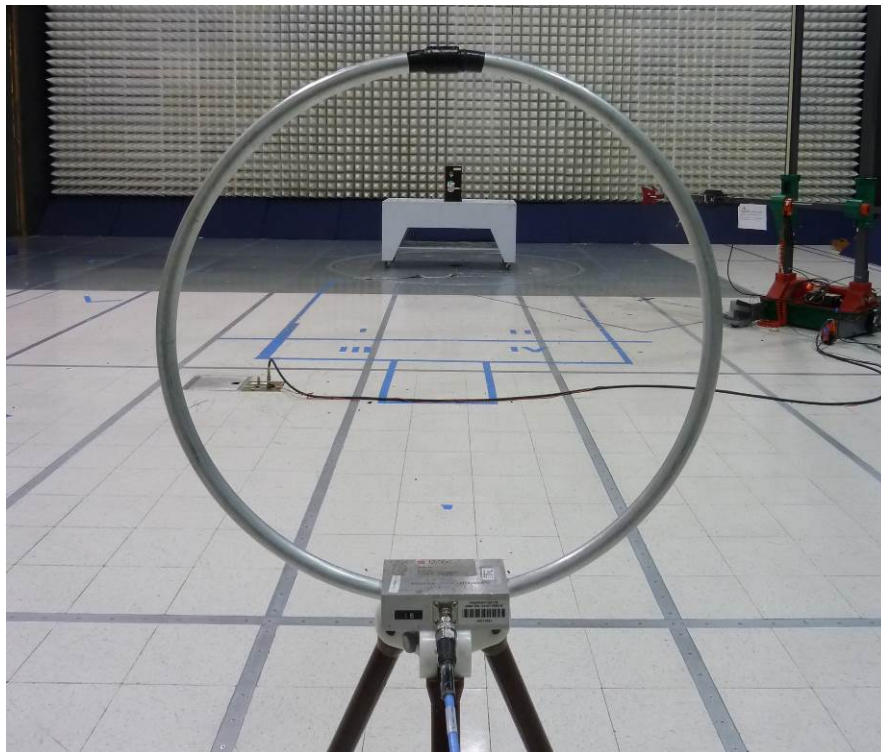


4.1.5 Test Configuration Photographs

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 $\pm 0.01\%$ 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.

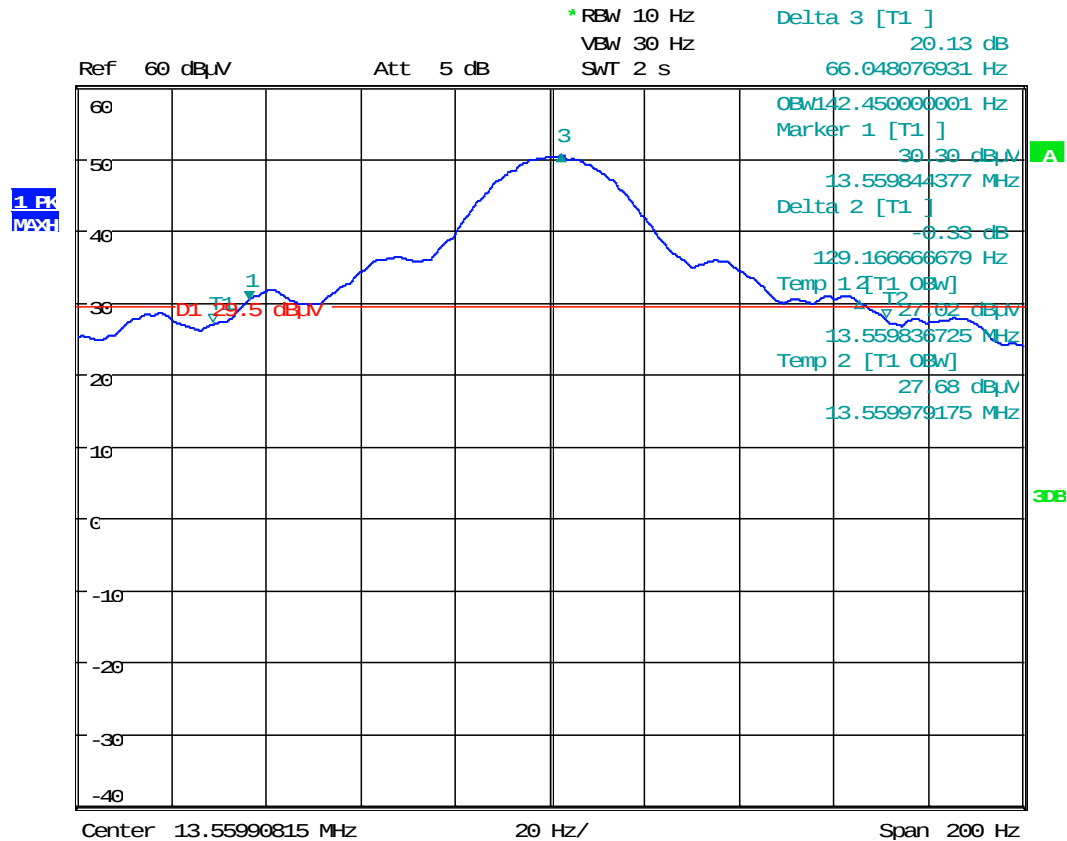
4.3.2 Procedure

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



Date: 6.JAN.2017 15:42:05



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

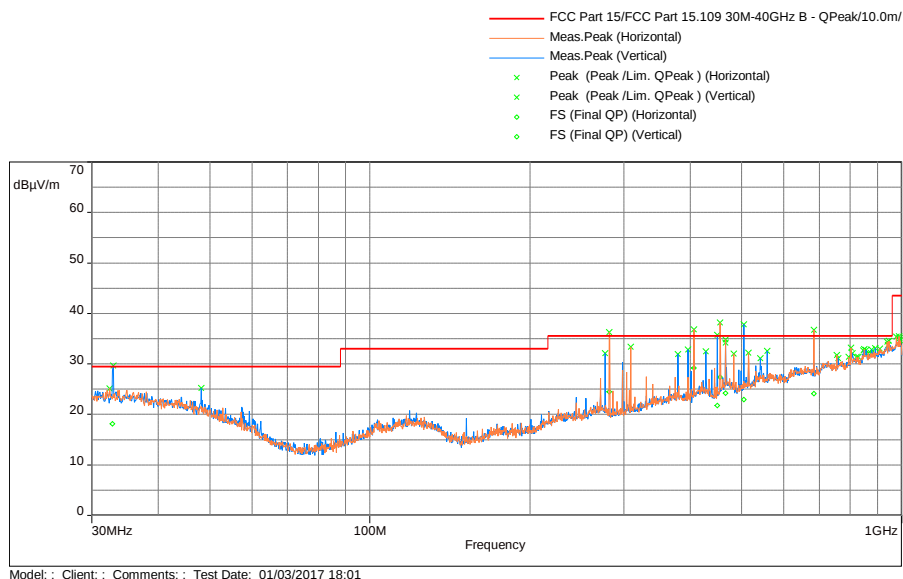
Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

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)

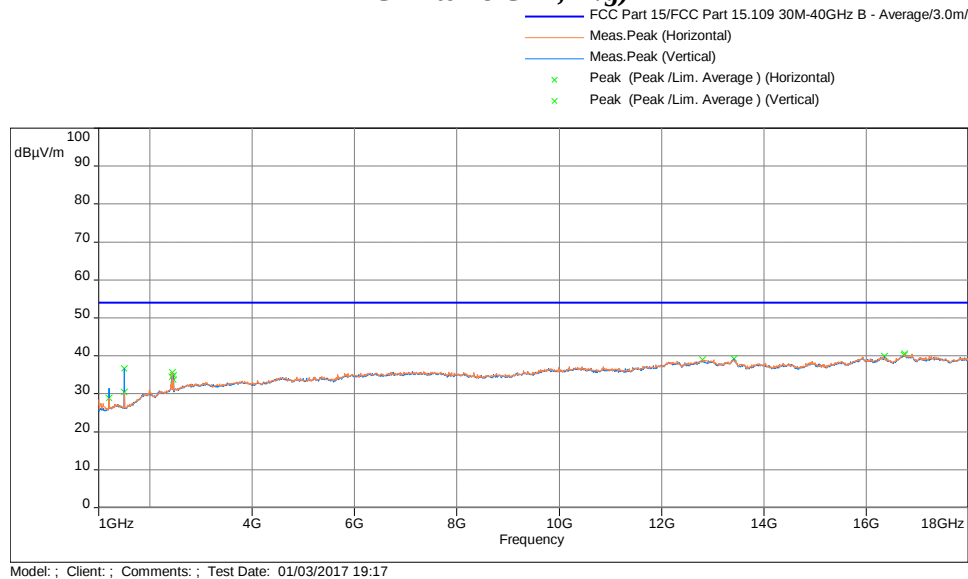
Proxess Electronic Cylindrical Lock (FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz)



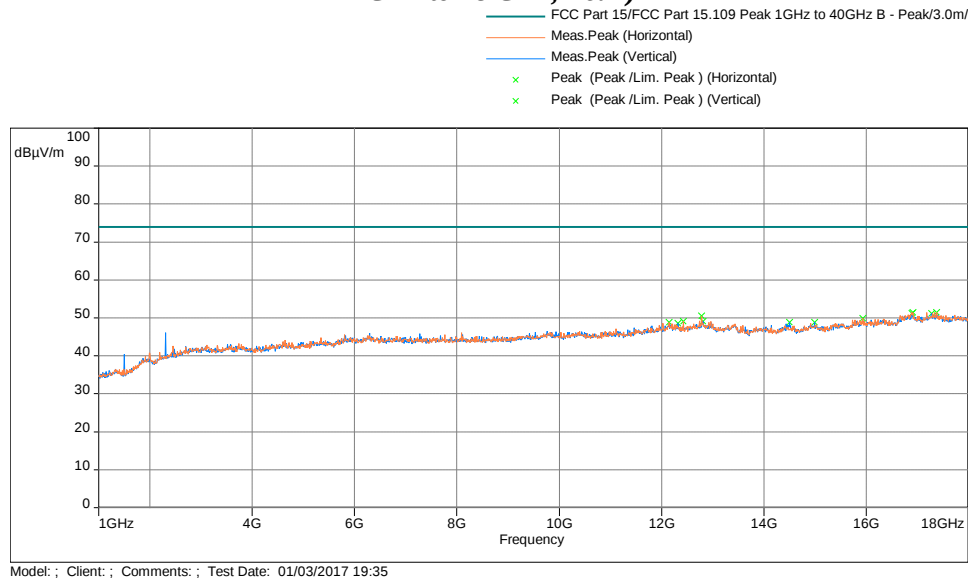
Frequency	FS	Limit	Margin	Azimuth	Height	Polarity	RA	Correction
MHz	dBμV/m	(dBμV/m)	dB	deg	m		dBμV	dB
282.054	24.5	36	-11.5	109	2.51	Horizontal	31.91	-7.41
406.808	29.24	36	-6.76	272.25	1.84	Horizontal	33.1	-3.87
455.626	27.36	36	-8.64	226.25	1.71	Horizontal	30.47	-3.11
466.489	24.21	36	-11.79	223	1.69	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)



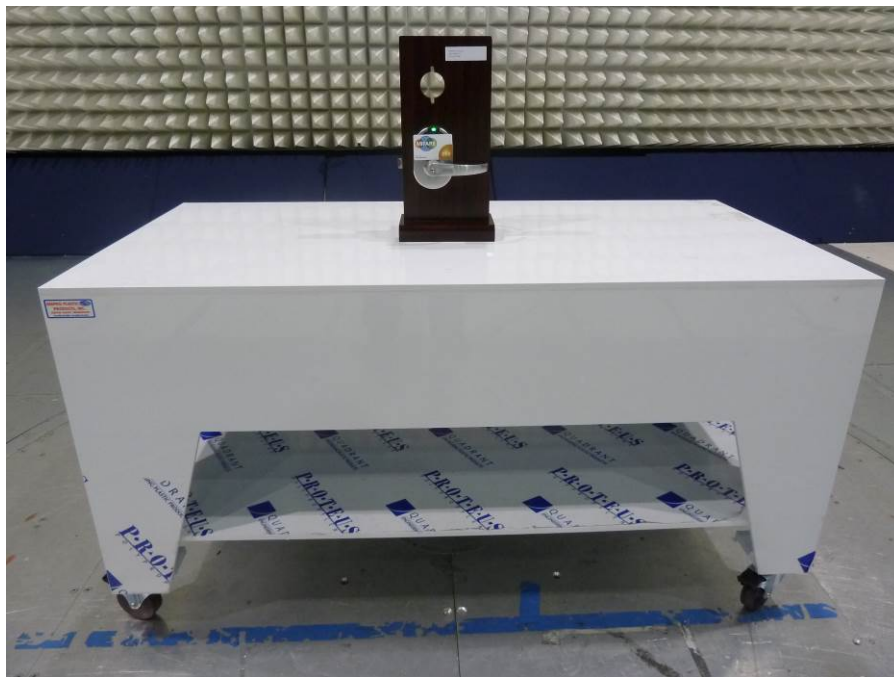
Proxess Electronic Cylindrical Lock (FCC Part 15 Subpart B Radiated Disturbance, 1 GHz to 18 GHz, Peak)



Result for Proxess Electronic Cylindrical Lock Complies by 6.76 dB to FCC Part 15, Subpart B
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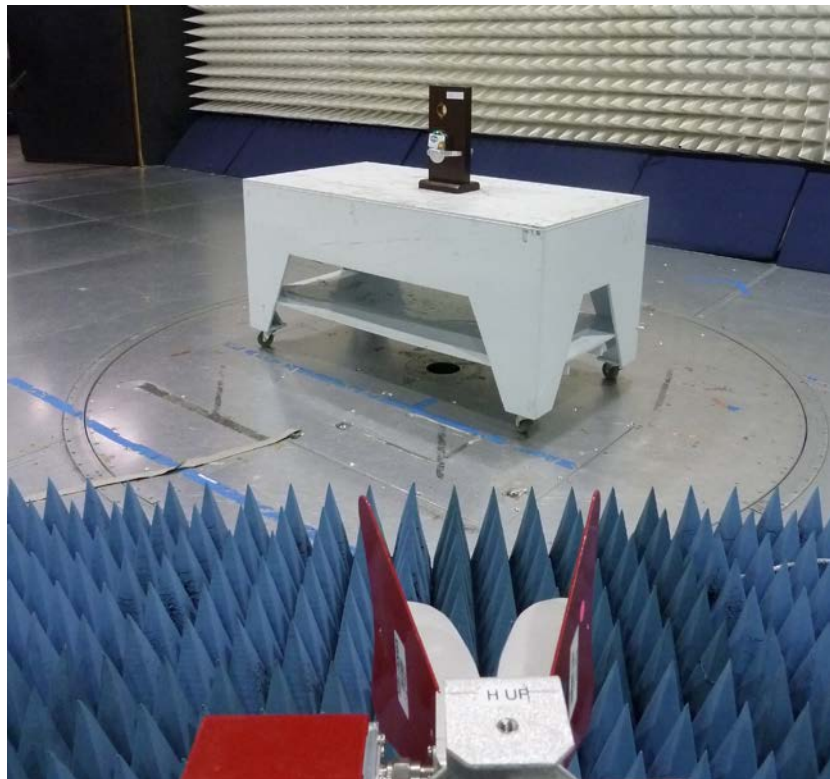
4.5.4 Test Configuration Photographs

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 225 9kHz to 30Mhz (Perpendicular).TIL 225 MASK (Parallel).TIL 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