# Allegion

**TEST REPORT FOR**

## Multi Tech Reader
## Model: MTK15-485

**Tested To The Following Standards:**

**FCC Part 15 Subpart C Section(s)**

**15.207 & 15.209**

**Report No.: 99085-4**

**Date of issue: December 20, 2016**

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

**This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.**

**We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.**

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# ADMINISTRATIVE INFORMATION

## Test Report Information

**REPORT PREPARED FOR:**

Allegion
500 Golden Ridge Road, Bldg 1, Suite 160
Golden CO 80401

REPRESENTATIVE: Bryan Hoff
Customer Reference Number: 4071752

**REPORT PREPARED BY:**

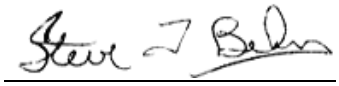
Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 99085

**DATE OF EQUIPMENT RECEIPT:** November 15, 2016
**DATE(S) OF TESTING:** November 15, 2016

## Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



***Steve Behm***
***Director of Quality Assurance & Engineering Services***
***CKC Laboratories, Inc.***

# Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

# Software Versions

| CKC Laboratories Proprietary Software | Version |
|---|---|
| EMITest Emissions | 5.03.02 |

# Site Registration & Accreditation Information

| Location | CB # | TAIWAN | CANADA | FCC | JAPAN |
|---|---|---|---|---|---|
| Mariposa A | US0103 | SL2-IN-E-1147R | 3082A-2 | US1024 | A-0136 |

# SUMMARY OF RESULTS

## Standard / Specification: FCC Part 15 Subpart C - 15.209

| Test Procedure | Description | Modifications | Results |
|---|---|---|---|
| 15.215(c) | Occupied Bandwidth | NA | Pass |
| 15.209 | Field Strength of Fundamental | NA | Pass |
| 15.209 | Field Strength of Spurious Emissions | NA | Pass |
| 15.207 | AC Conducted Emissions | NA | NP |

NA = Not Applicable
NP = CKC Laboratories was not contracted to perform test.

# Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

| Summary of Conditions |
|---|
| No modifications were made during testing. |
| |

**Modifications listed above must be incorporated into all production units.**

# Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

| Summary of Conditions |
|---|
| Since previous testing, the manufacturer has made the following modifications to the EUT.<br>Testing was performed to demonstrate continued compliance with the incorporated modifications.<br><br>1. U1 – NXP CLRC663<br>• Added vias<br>• Moved traces from under the part on inner layer<br>▪ SPI Bus signal<br>2. U3 – NXP P5FD081<br>• Added vias<br>• Moved traces from under the part on inner layer<br>▪ Unused Data line<br>3. U10 Microchip PIC24FJ32GA104<br>• Added vias<br>• Moved traces from under the part on inner layers<br>▪ Keypad Row 1 and Row 4 indicator<br>▪ Keypad LED signal |
| |

# EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 1

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Multi Tech Reader | Allegion | MTK15-485 | 16440004 |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| DC Power Supply | HP | 6205C | 2228A01775 |

## General Product Information:

| Product Information | Manufacturer-Provided Details |
|---|---|
| Equipment Type: | Stand-Alone Equipment |
| Modulation Type: | CW |
| Maximum Duty Cycle: | Not Performed |
| Antenna Type(s) and Gain: | Coil Antenna / .005036m^2 |
| Antenna Connection Type: | Integral |
| Nominal Input Voltage: | 12VDC |
| Firmware / Software used for Test: | X09_14 and X14_14 |

# FCC Part 15 Subpart C

## 15.215(c) Occupied Bandwidth (20dB BW)

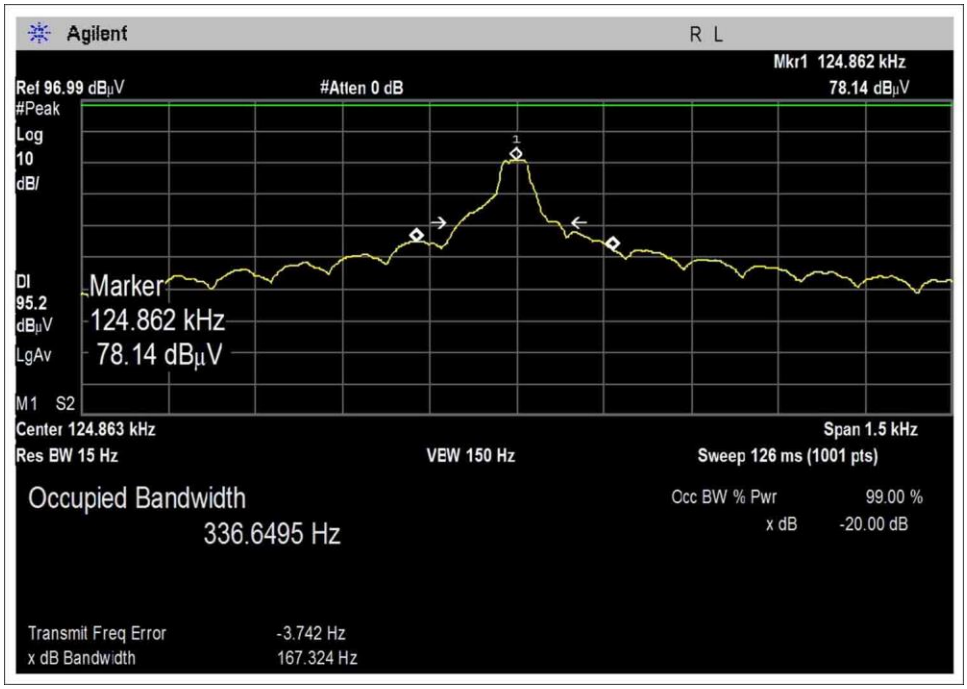
| Test Setup/Conditions | | | |
|---|---|---|---|
| Test Location: | Mariposa Lab A | Test Engineer: | Benny Lovan |
| Test Method: | ANSI C63.10 (2013) | Test Date(s): | 11/15/16 |
| Configuration: | 1 | | |
| Test Setup: | Radiated Emissions Fundamental Measurements (125kHz)<br><br>Modulation: CW<br>Antenna Type: Integral (Proximity Coil)<br>Antenna Gain 0dB Gain<br>Antenna Size: .005036m^2<br><br>The EUT is powered by a DC power supply at 12VDC. The customer declares the EUT standard method of installation is wall mounted in the upright/vertical (Y-axis) orientation.<br>The EUT is setup on an 80cm foam block. It has been programmed to continuously transmit the RFID signal at 125kHz. A card is placed in front of the EUT and it is reading the card continuously. Preliminary measurements indicated that the Y-Axis was worst case. The data presented was taken in the Y-Axis. | | |

| Environmental Conditions | | | |
|---|---|---|---|
| Temperature (ºC) | 20 | Relative Humidity (%): | 38 |

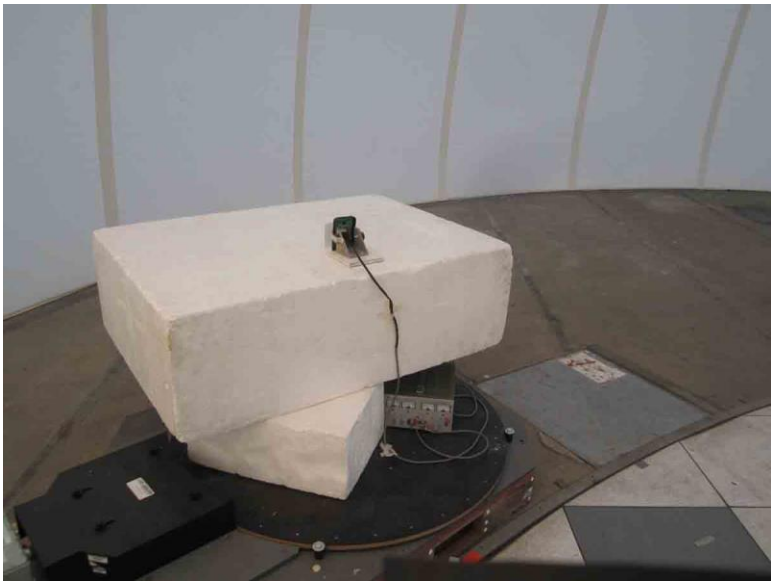
| Test Equipment | | | | | |
|---|---|---|---|---|---|
| Asset# | Description | Manufacturer | Model | Cal Date | Cal Due |
| P06231 | Cable | Andrew | CXTA04A-70 | 3/3/2016 | 3/3/2018 |
| P06847 | Cable | Times Microwave Systems | LMR195-FR-6 | 7/9/2015 | 7/9/2017 |
| P06232 | Cable | Andrew | CXTA04A-35 | 3/3/2016 | 3/3/2018 |
| P06231 | Cable | Andrew | CXTA04A-70 | 3/3/2016 | 3/3/2018 |
| 02668 | Spectrum Analyzer | Agilent | E4446A | 8/26/2016 | 8/26/2017 |
| 00226 | Loop Antenna | EMCO | 6502 | 4/4/2016 | 4/4/2018 |

| Test Data Summary | | | | | |
|---|---|---|---|---|---|
| Frequency (MHz) | **Antenna Port** | **Modulation** | **Measured (kHz)** | **Limit (kHz)** | **Results** |
| 125kHz | Integral | CW | 0.167324 | None | NA |

## Plot



## Test Setup Photos



# 15.209 Field Strength of Fundamental

| Test Data Summary - Voltage Variations | | | | | |
|---|---|---|---|---|---|
| **Frequency (MHz)** | **Modulation / Ant Port** | **$V_{Minimum}$ (dBuV/m)** | **$V_{Nominal}$ (dBuV/m)** | **$V_{Maximum}$ (dBuV/m)** | **Max Deviation from $V_{Nominal}$ (dB)** |
| 0.125 Parallel | CW / Integral Antenna | 9.2 | 9.1 | 8.9 | 0.3 |
| 0.125 Perpendicular | CW / Integral Antenna | -9.3 | -8.5 | -9.3 | 0.8 |
| 0.125 Ground Parallel | CW / Integral Antenna | 4.5 | 4.5 | 5.6 | 1.1 |

Test performed using operational mode with the highest output power, representing worst case. Worst case orientation for this unit was the Y-Axis.

***Parameter Definitions:***

Measurements performed at input voltage according to manufacturer specification.

| Parameter | Value |
|---|---|
| $V_{Nominal}$: | 12VDC |
| $V_{Minimum}$: | 5 VDC |
| $V_{Maximum}$: | 16 VDC |

| Test Data Summary – Radiated Field Strength Measurement | | | | | |
|---|---|---|---|---|---|
| **Frequency (MHz)** | **Modulation** | **Ant. Type** | **Measured (dBuV/m @ 300m)** | **Limit (dBuV/m @ 300m)** | **Results** |
| 0.125 (Parallel) | CW | Integral | 9.1 | ≤25.7 | Pass |
| 0.125 (Perpendicular) | CW | Integral | -8.5 | ≤25.7 | Pass |
| 0.125 (Ground Parallel) | CW | Integral | 4.5 | ≤25.7 | Pass |

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • 209-966-5240 | | |
| Customer: | **Allegion** | | |
| Specification: | **15.209 Radiated Emissions** | | |
| Work Order #: | **99085** | Date: | 11/15/2016 |
| Test Type: | **Radiated Scan** | Time: | 07:15:00 |
| Tested By: | Benny Lovan | Sequence#: | 1 |
| Software: | EMITest 5.03.02 | | |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

Radiated Emissions Fundamental Measurements (125kHz)

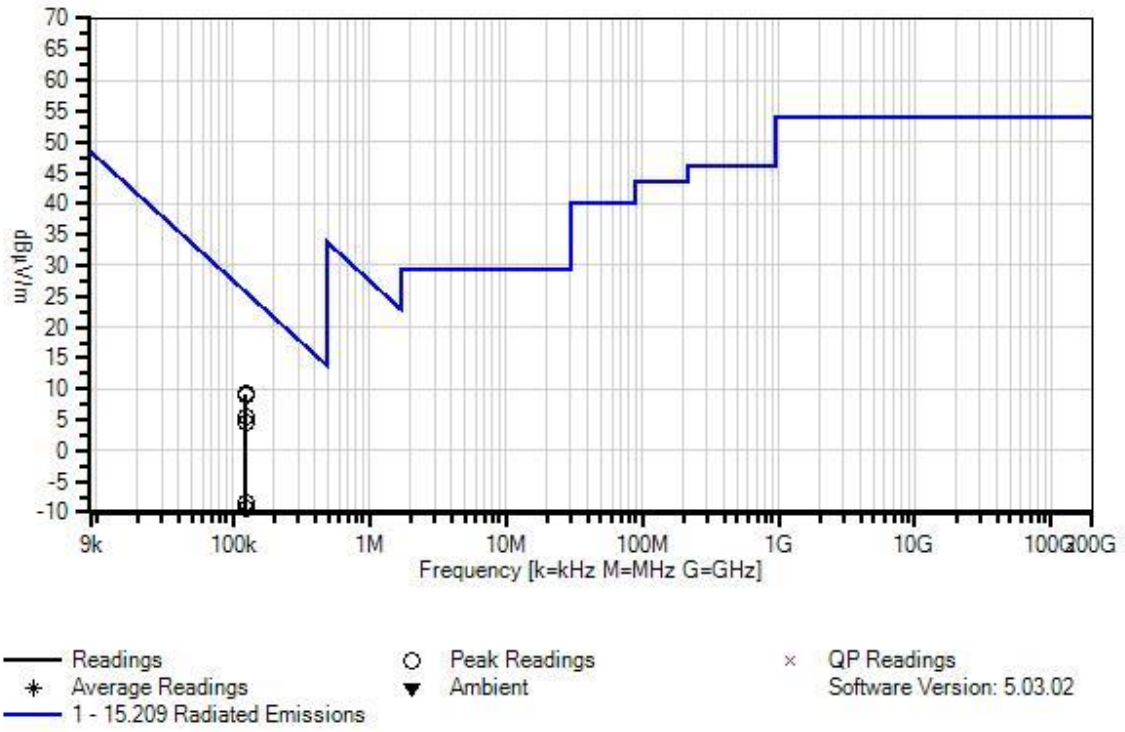
Temperature: 20°C
Humidity:38%
Atmospheric Pressure: 97.6 kPa

Method: ANSI C63.10 2013

Modulation: CW
Antenna Type: Integral (Proximity Coil)
Antenna Gain 0dB Gain
Antenna Size: .005036m^2

The EUT is powered by a DC power supply at 12VDC. The customer declares the EUT standard method of installation is wall mounted in the upright/vertical (Y-axis) orientation.
The EUT is setup on an 80cm foam block. It has been programmed to continuously transmit the RFID signal at 125kHz. A card is placed in front of the EUT and it is reading the card continuously.
Preliminary measurements indicated that the Y-Axis was worst case. The data presented was taken in the Y-Axis.
Voltage variation of 5VDC and 16VDC (Rated Voltages) was performed.

Allegion WO#: 99085 Sequence#: 1 Date: 11/15/2016
15.209 Radiated Emissions Test Distance: 3 Meters Ground Parallel




Readings
Average Readings
1 - 15.209 Radiated Emissions
Peak Readings
Ambient
QP Readings
Software Version: 5.03.02

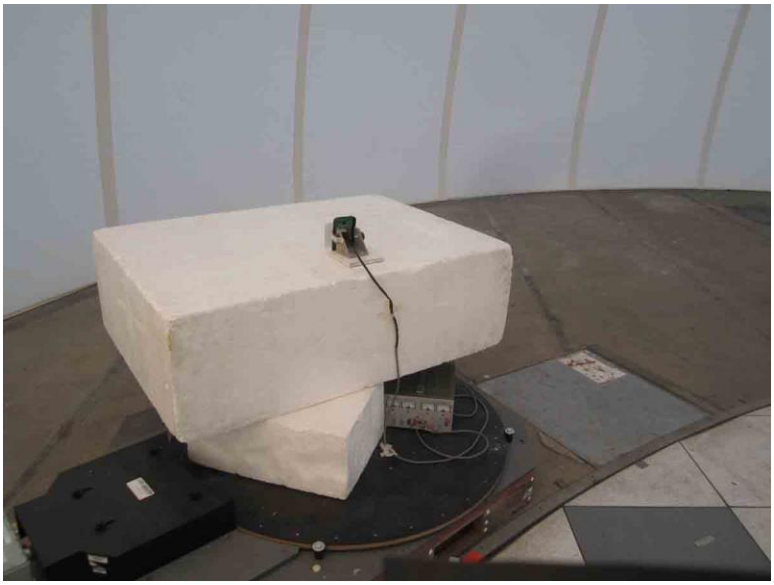
***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00226 | Loop Antenna | 6502 | 4/4/2016 | 4/4/2018 |
| T2 | ANP06232 | Cable | CXTA04A-35 | 3/3/2016 | 3/3/2018 |
| T3 | ANP06231 | Cable | CXTA04A-70 | 3/3/2016 | 3/3/2018 |
| T4 | ANP06847 | Cable | LMR195-FR-6 | 7/9/2015 | 7/9/2017 |
| | 02668 | Spectrum Analyzer | E4446A | 8/26/2016 | 8/26/2017 |

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | T4 dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 124.958k | 78.7 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | 9.2 | 25.7 | -16.5 | Paral |
| | | | | | | | | | 5VDC Voltage VAR | | |
| 2 | 125.032k | 78.6 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | 9.1 | 25.7 | -16.6 | Paral |
| | | | | | | | | | 12VDC Nominal | | |
| 3 | 124.924k | 78.4 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | 8.9 | 25.7 | -16.8 | Paral |
| | | | | | | | | | 16VDC Voltage VAR | | |
| 4 | 124.902k | 75.1 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | 5.6 | 25.7 | -20.1 | Groun |
| | | | | | | | | | 16VDC Voltage VAR | | |
| 5 | 124.990k | 74.0 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | 4.5 | 25.7 | -21.2 | Groun |
| | | | | | | | | | 12VDC Nominal | | |
| 6 | 124.982k | 74.0 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | 4.5 | 25.7 | -21.2 | Groun |
| | | | | | | | | | 5VDC Voltage VAR | | |
| 7 | 125.004k | 61.0 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | -8.5 | 25.7 | -34.2 | Perpe |
| | | | | | | | | | 12VDC Nominal | | |
| 8 | 124.986k | 60.2 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | -9.3 | 25.7 | -35.0 | Perpe |
| | | | | | | | | | 16VDC Voltage VAR | | |
| 9 | 124.980k | 60.2 | +10.5 | +0.0 | +0.0 | +0.0 | -80.0 | -9.3 | 25.7 | -35.0 | Perpe |
| | | | | | | | | | 5VDC Voltage VAR | | |

## Test Setup Photos



# 15.209 Radiated Emissions

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • 209-966-5240 | | |
| Customer: | **Allegion** | | |
| Specification: | **15.209 Radiated Emissions** | | |
| Work Order #: | **99085** | Date: | 11/15/2016 |
| Test Type: | **Radiated Scan** | Time: | 13:14:31 |
| Tested By: | Benny Lovan | Sequence#: | 1 |
| Software: | EMITest 5.03.02 | | |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

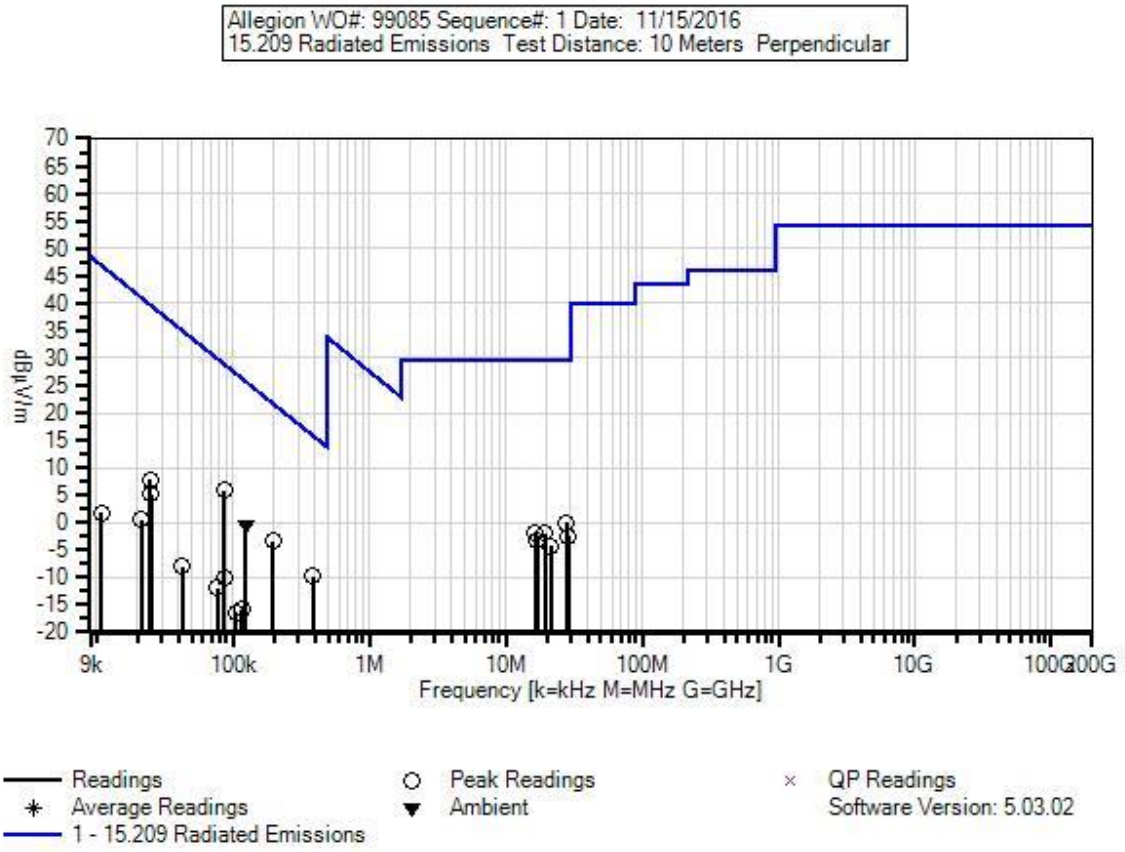
Radiated Emissions Spurious Measurements (9kHz-30MHz)

Temperature: 19°C
Humidity:50%
Atmospheric Pressure: 98.2 kPa

Method: ANSI C63.10 2013

Modulation: CW
Antenna Type: Integral (Proximity Coil)
Antenna Gain 0dB Gain
Antenna Size: .005036m^2

The EUT is powered by a DC power supply at 12VDC. The customer declares the EUT standard method of installation is wall mounted in the upright/vertical (Y-axis) orientation.
The EUT is setup on an 80cm foam block. It has been programmed to continuously transmit the RFID signal at 125kHz. A card is placed in front of the EUT and it is reading the card continuously.
Preliminary measurements indicated that the Y-Axis was worst case. The data presented was taken in the Y-Axis.


Allegion WO#: 99085 Sequence#: 1 Date: 11/15/2016
15.209 Radiated Emissions Test Distance: 10 Meters Perpendicular
dBµV/m
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
9k
100k
1M
10M
100M
1G
10G
100G
Frequency [k=kHz M=MHz G=GHz]
Readings
Average Readings
1 - 15.209 Radiated Emissions
Peak Readings
Ambient
QP Readings
Software Version: 5.03.02

***Test Equipment:***

| ID | Asset #/Serial # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN00226 | Loop Antenna | 6502 | 4/4/2016 | 4/4/2018 |
| T2 | ANP06847 | Cable | LMR195-FR-6 | 7/9/2015 | 7/9/2017 |
| T3 | ANP04249 | Cable | CXTA04A-50 | 3/3/2016 | 3/3/2018 |
| T4 | ANP06230 | Cable | CXTA04A-50 | 3/3/2016 | 3/3/2018 |
| | 02668 | Spectrum Analyzer | E4446A | 8/26/2016 | 8/26/2017 |

***Measurement Data:*** Reading listed by margin. Test Distance: 10 Meters

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | T4 dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 87.065k | 54.5 | +10.3 | +0.0 | +0.1 | +0.0 | -59.1 | 5.8 | 28.8 | -23.0 | Perpe |
| 2 | 198.430k | 45.5 | +10.0 | +0.0 | +0.1 | +0.1 | -59.1 | -3.4 | 21.6 | -25.0 | Paral |
| 3 | 386.000k | 39.3 | +9.8 | +0.0 | +0.1 | +0.1 | -59.1 | -9.8 | 15.9 | -25.7 | Groun |
| 4 | 124.660k | 48.0 | +10.5 | +0.0 | +0.1 | +0.1 | -59.1 | -0.4 | 25.7 | -26.1 | Paral |
| | Ambient | | | | | | | | Fundamental | | |
| 5 | 27.957M | 12.0 | +6.0 | +0.1 | +0.4 | +0.6 | -19.1 | 0.0 | 29.5 | -29.5 | Perpe |
| 6 | 16.539M | 7.1 | +9.1 | +0.1 | +0.3 | +0.5 | -19.1 | -2.0 | 29.5 | -31.5 | Paral |
| 7 | 19.565M | 8.0 | +8.2 | +0.1 | +0.3 | +0.5 | -19.1 | -2.0 | 29.5 | -31.5 | Perpe |
| 8 | 24.755k | 54.3 | +12.6 | +0.0 | +0.0 | +0.1 | -59.1 | 7.9 | 39.7 | -31.8 | Paral |
| 9 | 29.035M | 10.1 | +5.5 | +0.1 | +0.4 | +0.6 | -19.1 | -2.4 | 29.5 | -31.9 | Groun |
| 10 | 17.095M | 6.1 | +8.9 | +0.1 | +0.3 | +0.5 | -19.1 | -3.2 | 29.5 | -32.7 | Perpe |
| 11 | 21.546M | 6.1 | +7.8 | +0.1 | +0.4 | +0.5 | -19.1 | -4.2 | 29.5 | -33.7 | Groun |
| 12 | 25.160k | 51.6 | +12.6 | +0.0 | +0.0 | +0.1 | -59.1 | 5.2 | 39.6 | -34.4 | Perpe |
| 13 | 87.075k | 38.7 | +10.3 | +0.0 | +0.1 | +0.0 | -59.1 | -10.0 | 28.8 | -38.8 | Paral |
| 14 | 21.415k | 46.5 | +13.1 | +0.0 | +0.0 | +0.0 | -59.1 | 0.5 | 41.0 | -40.5 | Paral |
| 15 | 76.600k | 36.6 | +10.5 | +0.0 | +0.1 | +0.0 | -59.1 | -11.9 | 29.9 | -41.8 | Perpe |
| 16 | 116.770k | 32.5 | +10.6 | +0.0 | +0.1 | +0.1 | -59.1 | -15.8 | 26.3 | -42.1 | Paral |
| 17 | 42.930k | 39.9 | +11.2 | +0.0 | +0.0 | +0.0 | -59.1 | -8.0 | 34.9 | -42.9 | Groun |
| 18 | 105.025k | 31.9 | +10.7 | +0.0 | +0.1 | +0.1 | -59.1 | -16.3 | 27.2 | -43.5 | Groun |
| 19 | 10.955k | 45.0 | +15.8 | +0.0 | +0.0 | +0.0 | -59.1 | 1.7 | 46.8 | -45.1 | Groun |

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories Inc. • 5046 Sierra Pines Dr. • Mariposa, CA 95338 • 209-966-5240 | | |
| Customer: | **Allegion** | | |
| Specification: | **15.209 Radiated Emissions** | | |
| Work Order #: | **99085** | Date: | 11/15/2016 |
| Test Type: | **Radiated Scan** | Time: | 13:14:31 |
| Tested By: | Benny Lovan | Sequence#: | 1 |
| Software: | EMITest 5.03.02 | | |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

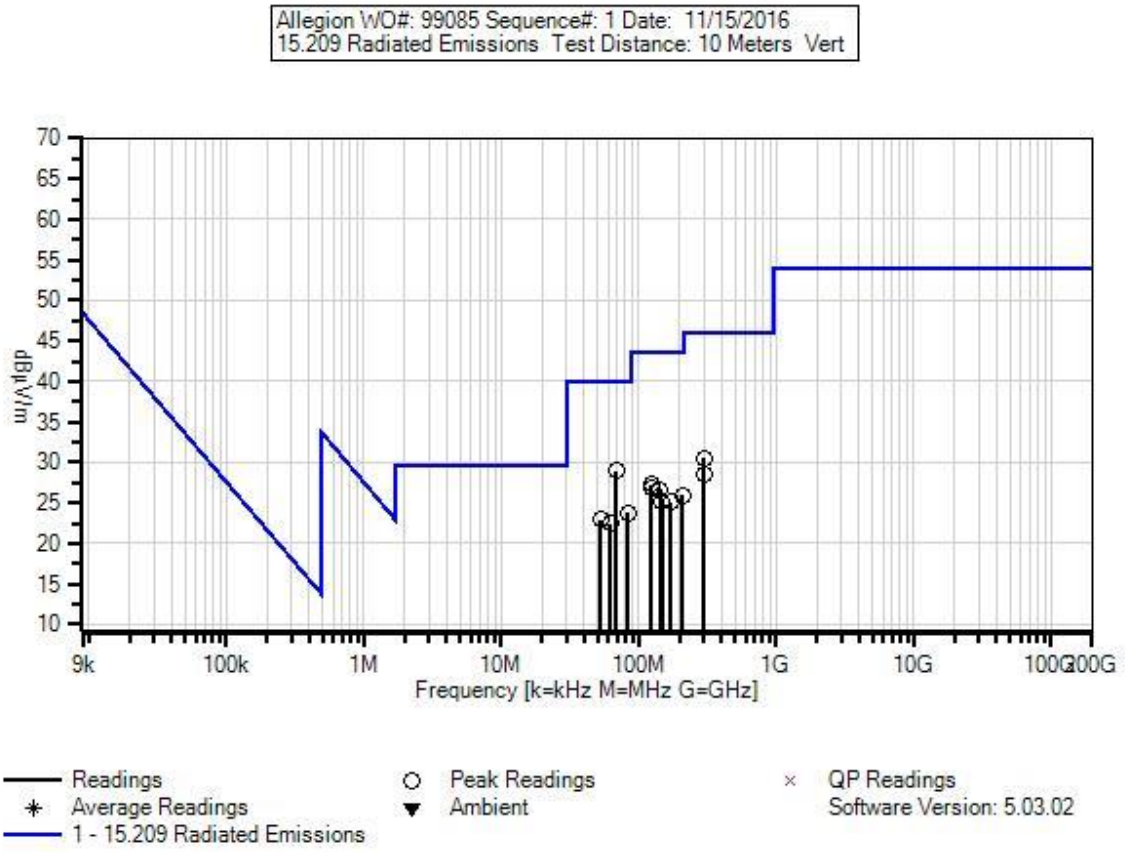
Radiated Emissions Spurious Measurements (30-1000MHz)

Temperature: 19°C
Humidity:50%
Atmospheric Pressure: 98.2 kPa

Method: ANSI C63.10 2013

Modulation: CW
Antenna Type: Integral (Proximity Coil)
Antenna Gain 0dB Gain
Antenna Size: .005036m^2

The EUT is powered by a DC power supply at 12VDC. The customer declares the EUT standard method of installation is wall mounted in the upright/vertical (Y-axis) orientation.
The EUT is setup on an 80cm foam block. It has been programmed to continuously transmit the RFID signal at 125kHz. A card is placed in front of the EUT and it is reading the card continuously.
Preliminary measurements indicated that the Y-Axis was worst case. The data presented was taken in the Y-Axis.


Allegion WO#: 99085 Sequence#: 1 Date: 11/15/2016
15.209 Radiated Emissions Test Distance: 10 Meters Vert
dBuV/m
70
65
60
55
50
45
40
35
30
25
20
15
10
9k
100k
1M
10M
100M
1G
10G
100G
200G
Frequency [k=kHz M=MHz G=GHz]
Readings
Average Readings
1 - 15.209 Radiated Emissions
Peak Readings
Ambient
QP Readings
Software Version: 5.03.02

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP06847 | Cable | LMR195-FR-6 | 7/9/2015 | 7/9/2017 |
| T2 | ANP04249 | Cable | CXTA04A-50 | 3/3/2016 | 3/3/2018 |
| T3 | ANP06230 | Cable | CXTA04A-50 | 3/3/2016 | 3/3/2018 |
| T4 | ANP05656 | Attenuator | PE7004-6 | 12/22/2015 | 12/22/2017 |
| T5 | AN01993 | Biconilog Antenna | CBL6111C | 3/11/2016 | 3/11/2018 |
| T6 | AN00449 | Preamp-Top Amp (dB) | 8447F | 2/18/2016 | 2/18/2018 |
| T7 | ANP06883 | Cable | LMR195-FR-3 | 10/27/2015 | 10/27/2017 |
| | 02668 | Spectrum Analyzer | E4446A | 8/26/2016 | 8/26/2017 |

***Measurement Data:*** Reading listed by margin. Test Distance: 10 Meters

| # | Freq | Rdng | T1<br>T5 | T2<br>T6 | T3<br>T7 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 69.190M | 32.4 | +0.2<br>+0.1 | +1.0<br>+6.0 | +0.7<br>+5.1 | -27.1 | +10.5 | 28.9 | 40.0 | -11.1 | Vert |
| 2 | 297.200M | 22.5 | +0.4<br>+0.3 | +2.1<br>+6.0 | +1.4<br>+13.7 | -26.4 | +10.5 | 30.5 | 46.0 | -15.5 | Vert |
| 3 | 84.190M | 24.0 | +0.2<br>+0.1 | +1.0<br>+6.0 | +0.7<br>+8.3 | -27.1 | +10.5 | 23.7 | 40.0 | -16.3 | Vert |
| 4 | 122.780M | 23.3 | +0.3<br>+0.2 | +1.3<br>+6.0 | +0.9<br>+11.7 | -27.0 | +10.5 | 27.2 | 43.5 | -16.3 | Horiz |
| 5 | 123.501M | 23.0 | +0.3<br>+0.2 | +1.3<br>+6.0 | +0.9<br>+11.7 | -27.0 | +10.5 | 26.9 | 43.5 | -16.6 | Vert |
| 6 | 143.494M | 22.7 | +0.3<br>+0.2 | +1.4<br>+6.0 | +1.0<br>+11.4 | -26.8 | +10.5 | 26.7 | 43.5 | -16.8 | Vert |
| 7 | 52.920M | 24.5 | +0.2<br>+0.1 | +0.8<br>+6.0 | +0.6<br>+7.4 | -27.2 | +10.5 | 22.9 | 40.0 | -17.1 | Horiz |
| 8 | 298.340M | 20.6 | +0.4<br>+0.3 | +2.1<br>+6.0 | +1.4<br>+13.7 | -26.4 | +10.5 | 28.6 | 46.0 | -17.4 | Horiz |
| 9 | 209.200M | 22.6 | +0.3<br>+0.2 | +1.7<br>+6.0 | +1.2<br>+9.9 | -26.4 | +10.5 | 26.0 | 43.5 | -17.5 | Vert |
| 10 | 62.780M | 25.4 | +0.2<br>+0.1 | +0.9<br>+6.0 | +0.7<br>+5.7 | -27.1 | +10.5 | 22.4 | 40.0 | -17.6 | Horiz |
| 11 | 147.780M | 21.4 | +0.3<br>+0.2 | +1.4<br>+6.0 | +1.0<br>+11.2 | -26.8 | +10.5 | 25.2 | 43.5 | -18.3 | Horiz |
| 12 | 172.780M | 22.7 | +0.3<br>+0.2 | +1.5<br>+6.0 | +1.0<br>+9.5 | -26.6 | +10.5 | 25.1 | 43.5 | -18.4 | Horiz |

## Test Setup Photos

# SUPPLEMENTAL INFORMATION

## Measurement Uncertainty

| Uncertainty Value | Parameter |
|---|---|
| 4.73 dB | Radiated Emissions |
| 3.34 dB | Mains Conducted Emissions |
| 3.30 dB | Disturbance Power |

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

## Emissions Test Details

**TESTING PARAMETERS**

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

**CORRECTION FACTORS**

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

| SAMPLE CALCULATIONS | | |
|---|---|---|
| | Meter reading | (dBµV) |
| + | Antenna Factor | (dB/m) |
| + | Cable Loss | (dB) |
| - | Distance Correction | (dB) |
| - | Preamplifier Gain | (dB) |
| = | Corrected Reading | (dBµV/m) |

**TEST INSTRUMENTATION AND ANALYZER SETTINGS**

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE | | | |
|---|---|---|---|
| TEST | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS | 150 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 9 kHz | 150 kHz | 200 Hz |
| RADIATED EMISSIONS | 150 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 30 MHz | 1000 MHz | 120 kHz |
| RADIATED EMISSIONS | 1000 MHz | >1 GHz | 1 MHz |

**SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS**

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret (“^”) was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

**Peak**

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

**Quasi-Peak**

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

**Average**

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.