



Design. Create. Certify. *Connect.*

W66 N220 Commerce Court • Cedarburg, WI 53012 • USA

Phone: 262.375.4400 • Fax: 262.375.4248

www.lsr.com



ENGINEERING TEST REPORT # 314228
LSR Job #: C-2007

Compliance Testing of:

NDE

Test Date(s):

8/14/2014 8/19/2014

8/15/2014 8/27/2014

8/18/2014

Prepared For:

Allegion
Attn: Ryan Kincaid
11819 North Pennsylvania Street
Carmel, IN 46032

This Test Report is issued under the Authority of:

Michael Hintzke, EMC Engineer

Signature:

Date: 9/12/2014

Test Report Reviewed by:
Khairul Aidi Zainal, Senior EMC Engineer

Signature:

Date: 9/12/2014

Tested by:
Michael Hintzke, EMC Engineer

Signature:

Date: 9/12/2014

Table of Contents

EXHIBIT 1.	INTRODUCTION.....	4
1.1	SCOPE.....	4
1.2	NORMATIVE REFERENCES	5
1.3	LS RESEARCH, LLC TEST FACILITY	6
1.4	LOCATION OF TESTING	6
1.5	TEST EQUIPMENT UTILIZED	6
EXHIBIT 2.	PERFORMANCE ASSESSMENT.....	7
2.1	CLIENT INFORMATION.....	7
2.2	EQUIPMENT UNDER TEST (EUT) INFORMATION	7
2.3	ASSOCIATED ANTENNA DESCRIPTION	7
2.4	EUT’S TECHNICAL SPECIFICATIONS	8
2.5	PRODUCT DESCRIPTION.....	9
EXHIBIT 3.	EUT OPERATING CONDITIONS & CONFIGURATION.....	10
3.1	CLIMATE TEST CONDITIONS	10
3.2	APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS	10
3.3	MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES 10	
3.4	DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS	10
EXHIBIT 4.	DECLARATION OF CONFORMITY	11
EXHIBIT 5.	RADIATED EMISSIONS TEST FOR TRANSMIT AND RECEIVE.....	12
5.1	TEST SETUP	12
5.2	TEST PROCEDURE.....	12
5.3	TEST EQUIPMENT UTILIZED	13
5.4	TEST RESULTS	13
5.5	CALCULATION OF RADIATED EMISSIONS LIMITS.....	14
5.6	RADIATED EMISSIONS DATA CHART	15
5.7	TEST SETUP PHOTO(S) – RADIATED EMISSIONS TEST	16
EXHIBIT 6.	FREQUENCY TOLERANCE.....	20
6.1	LIMITS.....	20
6.2	METHOD OF MEASUREMENTS	20
6.3	TEST DATA.....	20

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 2 of 36

EXHIBIT 7. OCCUPIED BANDWIDTH	21
7.1 LIMITS	21
7.2 METHOD OF MEASUREMENTS	21
7.3 TEST DATA	21
7.4 SCREEN CAPTURES - 99% BANDWIDTH	21
EXHIBIT 8. CO-LOCATED EMISSIONS	22
8.1 TEST SETUP	22
8.2 TEST PROCEDURE	22
8.3 TEST EQUIPMENT UTILIZED	23
8.4 CO-LOCATION RADIATED EMISSIONS	23
8.4.1 TRANSMIT MODE	23
8.4.2 RECEIVE MODE	30
APPENDIX A. INSTRUMENT LIST	34
APPENDIX B. TEST STANDARDS: CURRENT PUBLICATION DATES	35
APPENDIX C. UNCERTAINTY STATEMENTS	36

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 3 of 36

EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.225
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Intentional Radiators for Operation in the Band 13.110-14.010 MHz

References:	FCC Part 15, Subpart C, Section 15.109
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for a Digital Device or an Unintentional Radiator

References:	RSS 210 Annex 2
Title:	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I equipment.
Purpose of Test:	To gain IC Certification Authorization for Low-Power License-Exempt Transmitters.

References:	RSS GEN
Title:	General requirements and Information for the Certification of Radio communication Equipment.
Purpose of Test:	To gain IC Certification Authorization for Low-Power License-Exempt Transmitters.

Test Procedures:	Radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
-------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 4 of 36

1.2 NORMATIVE REFERENCES

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2014	Code of Federal Regulations - Telecommunications
RSS 210 Annex 2	2010	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I equipment.
RSS GEN	2010	General requirements and information for the certification of Radio communication Equipment.
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-1-1	2010-01 A1: 2010-06 COR1: 2010	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 5 of 36

1.3 LS RESEARCH, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted. Accreditation status can be verified at A2LA’s web site: www.a2la2.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- FCC Listed Semi-Anechoic Chamber

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated by an ISO 17025 accredited calibration laboratory, traceable to the SI standard.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 6 of 36

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	Allegion
Address:	11819 North Pennsylvania Street Carmel, IN 46032
Contact Person:	Ryan Kincaid
Contact Phone:	(317) 810-3362
Contact Email:	ryan.kincaid@allegion.com

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	NDE
Model Number:	NDE
Serial Number:	Engineering Sample

2.3 ASSOCIATED ANTENNA DESCRIPTION

PCB Trace(s)

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 7 of 36

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	13.56 MHz
RF Power in Watts (Near-field measurement at 3 meters)	0.0000000771Watts
Conducted Output Power (in dBm)	N/A
EIRP (in mW)	N/A
Field Strength at 3 meters	54.1 dB μ V/m
Occupied Bandwidth (99% BW)	2.311 kHz
Type of Modulation	Frequency, Phase and Amplitude Modulated (selectable)
Emission Designator	2K31A1D
Transmitter Spurious (worst case) at 3 meters	62.82dB μ V/m at 10 kHz
Receiver Spurious (worst case) at 3 meters	Refer to transmitter since EUT transmit and receives at the same time.
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Microprocessor Model # (if applicable)	CLRC66302HN
EUT will be operated under FCC/IC Rule	CFR 47 part 15.225 RSS 210
Antenna Information:	
a) Antenna Type	coil/ PCB
b) Detachable/Non-Detachable	Non-detachable
c) Antenna Gain (in dBi)	Not available
Modular Filing	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Portable or Mobile?	Mobile

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 8 of 36

2.5 PRODUCT DESCRIPTION

The Schlage® NDE Series wireless lock with ENGAGE™ technology is designed to be easy to connect, manage, and use. Developed specifically for facilities that want to upgrade to electronic credentials for improved security and efficiency, it is ideal for interior office doors, common area doors, and sensitive storage spaces with a cylindrical door prep. NDE Series wireless locks simplify installation by combining the lock, credential reader, door position sensor and request-to-exit switch all in one unit. NDE Series wireless locks utilize the standard ND cylindrical door prep. They can be installed in minutes with only a Phillips screwdriver; no need to install additional components, drill holes or run wires to each opening.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 9 of 36

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATION.

3.1 CLIMATE TEST CONDITIONS

Temperature:	71° Fahrenheit
Humidity:	30%
Pressure:	741 mmHg

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC/IC Paragraph	Test Requirements	Compliance (yes/no)
FCC: 15.225(a) IC : RSS 210 2.5	Maximum RF Output Power	Yes
FCC: 15.225(d) FCC: 15.209(c) IC : RSS 210 2.5	Maximum RF Spurious Emissions	Yes
FCC: 15.109 FCC: 15.205 IC : RSS 210 2.5	Transmitter General Radiated Emissions	Yes
FCC: 2.1049 IC: RSS GEN 4.6	Occupied Bandwidth	Yes
FCC: 15.109(a) IC : RSS 210 2.5	Un-Intentional Radiated Emissions	Yes
FCC 15.225(e)	Frequency Tolerance	Yes

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None **Yes (explain below)**

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

None **Yes (explain below)**

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 10 of 36

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to **MEET** the requirements as described within the specification of FCC Title 47, CFR Part 15.225, and Industry Canada RSS-210 for a Low-Power License-Exempt Transmitters, as well as the specification of FCC Title 47, CFR Part 15.109 and Industry Canada RSS-210 for non-intentional radiators.

The EUT was found to MEET the requirements of FCC Title 47, CFR Parts 15.247 and 15.209 when co-location functionality was tested with the simultaneous operation of WLAN and Bluetooth modules within the EUT.

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 11 of 36

EXHIBIT 5. RADIATED EMISSIONS TEST FOR TRANSMIT AND RECEIVE

5.1 TEST SETUP

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN, and ANSI C63.4. The NDE device, henceforth referred to as the EUT, was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber.

The EUT operates on a single channel at 13.56 MHz.

For the test, the EUT was in normal configuration where it continuously looks for a badge. Measurements were performed at a 3m separation to identify the emissions below 30MHz.

5.2 TEST PROCEDURE

Radiated RF measurements were performed at a separation distance of 3 meters on the EUT in a Semi-Anechoic, FCC listed Chamber. The frequency range from 10 kHz to 1000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. A Biconical Antenna was used to measure emissions from 30 MHz to 200 MHz and a Log Periodic Dipole Array Antenna was used to measure emissions from 200 MHz to 1000 MHz. For emissions below 30 MHz, an active loop antenna was used. The loop antenna was set at a height of 1m above the conducting ground plane and it was rotated about its vertical and horizontal axes (while utilizing the turntable to rotate the EUT) in order to measure the maximum radiated RF emissions. The maximum radiated RF emissions above 30MHz were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities and rotating the EUT using the turntable.

The receiver was operated with the resolution bandwidth set at 200 Hz for measurements between 9kHz and 150kHz, 9kHz for measurements between 150kHz and 30MHz and 120kHz for measurements between 30MHz and 1000 MHz.

Due to the nature of the device, while in normal operation, the emissions of the transmitter and receiver can be measured simultaneously. The graphs and data represented in this report are that of both TRANSMIT and RECEIVE modes.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 12 of 36

5.3 TEST EQUIPMENT UTILIZED

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with resolution bandwidths as prescribed in ANSI C63.4.

5.4 TEST RESULTS

The EUT was found to **MEET** the Radiated Emissions requirements of FCC Part 15.225 and RSS 210 for a Low-Power License-Exempt transmitter.

The EUT was found to **MEET** the Radiated Emissions requirements of FCC Part 15.109 and RSS Gen for Unintentional Radiators.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 13 of 36

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

Transmitter Limits

The maximum peak output power of an intentional radiator within the band 13.553-13.567 MHz, as specified in FCC Part 15.225 shall not exceed 15,848 microvolts/meter at 30 meters. This limit is calculated in a formula as described below.

Sample calculation(s) for the Fundamental Emission of a transmitter within the band 13.553-13.567 MHz::

A transmitter operating at a fundamental frequency of 13.56 MHz, the emission limit at a 30 meter separation, expressed in decibels, is calculated as follows:

$$20 \log_{10} (15,848) = 84 \text{ dB}\mu\text{V/m}$$

The above emissions limit at a 3 meter separation may be extrapolated by the addition of 40 dB/decade per 47CFR 15.31(f)(2) is calculated as follows:

$$84 \text{ dB}\mu\text{V/m} + 40 \log_{10} (30/3) = 124 \text{ dB}\mu\text{V/m}$$

The harmonic and spurious RF emissions, with appropriate receiver bandwidths, as specified in FCC Part 15.209 and RSS 210, shall be below the measured power of the desired signal, and must also meet the requirements described in RSS GEN where applicable.

Any emissions appearing outside the 13.110-14.010 MHz band shall not exceed the limits of FCC Part 15.209. The following table depicts the general radiated emission limits in FCC Part 15.209. These limits were applied to the fundamental emission of the intentional radiator as well as all other significant spurious signals.

Frequency (MHz)	Limit $\mu\text{V/m}$	Limit (dB $\mu\text{V/m}$)	Measurement Distance (m)
0.009-0.490	2400/F (kHz)	Note 1	300
0.490-1.705	24000/F (kHz)		30
1.705-30.0	30		30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
960-24,000	500	54.0	3

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 14 of 36

5.6 RADIATED EMISSIONS DATA CHART

Manufacturer:	Allegion				
Date(s) of Test:	8/18/14, 8/19/14				
Project Engineer:	Michael Hintzke				
Test Engineer(s):	Michael Hintzke; Peter Feilen				
Voltage:	6VDC (4-AA batteries)				
Operation Mode:	Simultaneous transmit and receive				
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %				
EUT Power:		Single Phase 120VAC		3 Phase ___ VAC	
	√	Battery		Other:	
EUT Placement:	√	80cm non-conductive table		10cm Spacers	
EUT Test Location:		5 Meter Semi-Anechoic FCC Listed Chamber	√	3 Meter Semi-Anechoic FCC Listed Chamber	
Measurements:		Pre-Compliance		Preliminary	√ Final
Detectors Used:	√	Peak	√	Quasi-Peak	√ Average

Fundamental measurements:

3 meter measurements

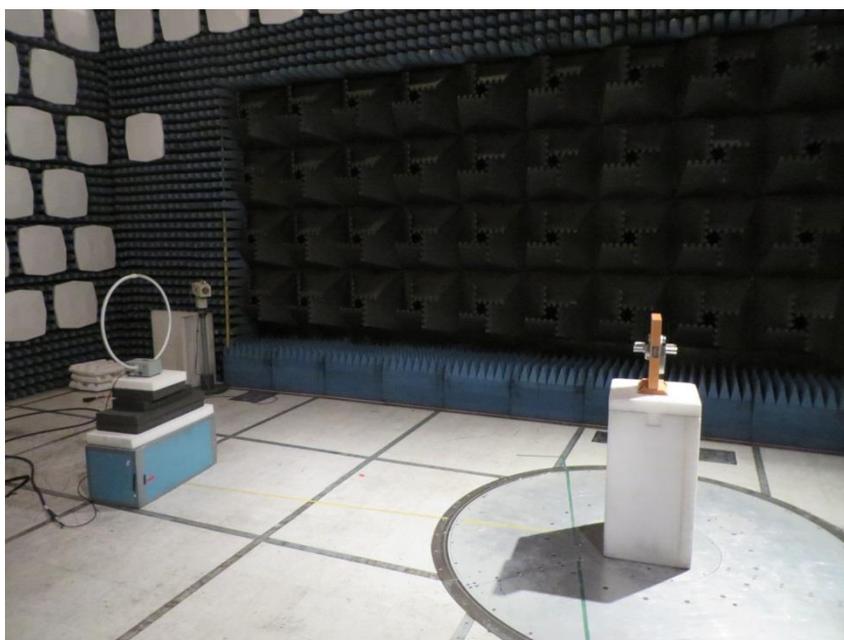
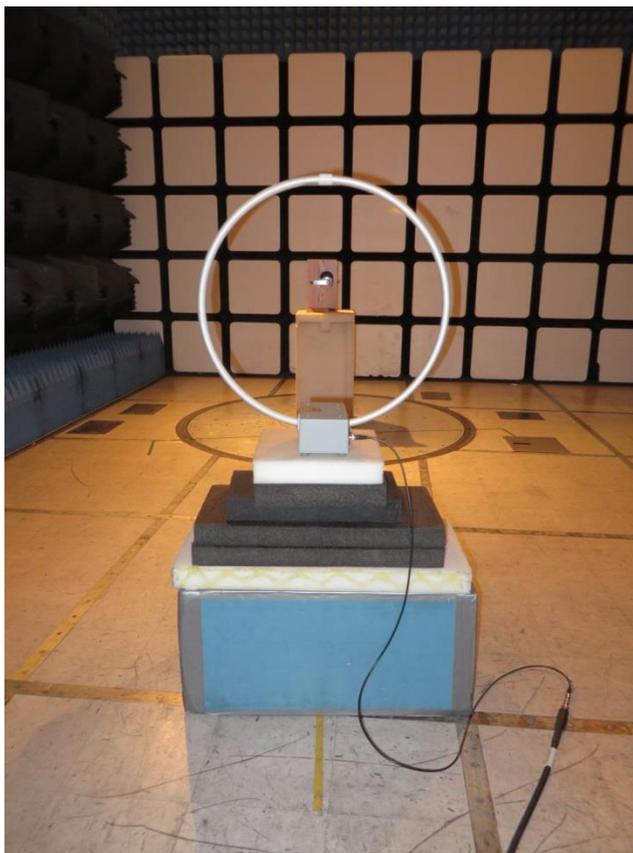
Frequency MHz	Antenna	EUT	Height (m)	Azimuth (0° - 360°)	Peak (dBuV/m)	QP (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)
13.56	H	V	1.00	0	54.1	53.9	124.0	70.1
13.56	V	V	1.00	345	44.7	44.4	124.0	79.6

Note:

1. Limit compared against peak detector reading since the EUT not transmitting continuously.

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 15 of 36

5.7 TEST SETUP PHOTO(S) – RADIATED EMISSIONS TEST



Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 16 of 36

5.8 SCREEN CAPTURES - RADIATED EMISSIONS TESTING

These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak or Average detector function is utilized when measuring frequencies below 1 GHz.

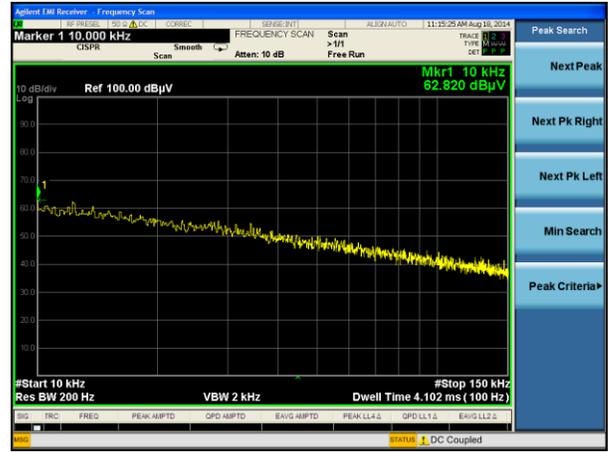
The signature scans shown here are from worst-case emissions with the sense antenna in either vertical or horizontal polarity for worst case presentations.

The scans shown below represent the EUT operating simultaneously in both transmit and receive modes.

9 kHz to 150 kHz, at 3m



Horizontal Polarity



Vertical Polarity

150 kHz to 490 kHz, at 3m



Horizontal Polarity



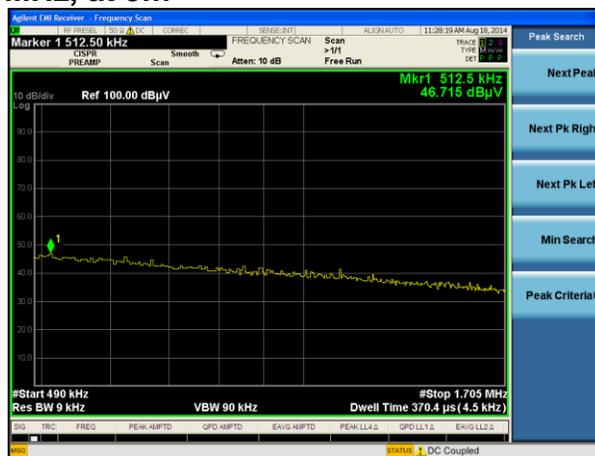
Vertical Polarity

Prepared For: Allegion	Model #: NDE Series	LS Research, LLC
EUT: NDE	Serial Number: Engineering Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 17 of 36

490 kHz to 1.705 MHz, at 3m

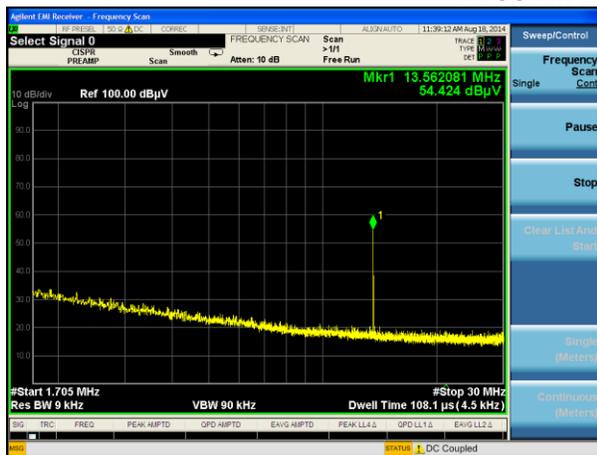


Horizontal Polarity

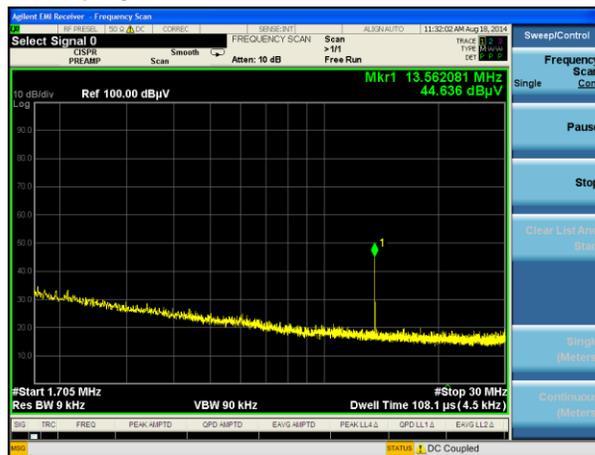


Vertical Polarity

1.705 MHz to 30 MHz at 3m



Horizontal Polarity



Vertical Polarity

30 MHz to 200 MHz at 3m



Horizontal Polarity



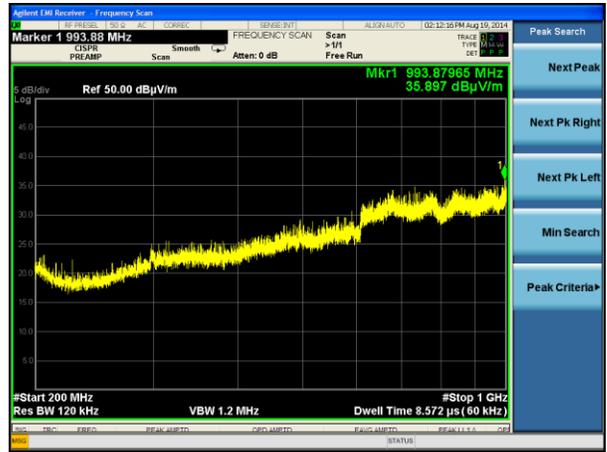
Vertical Polarity

Prepared For: Allegion	Model #:	LS Research, LLC
EUT: NDE	Serial Number:	Template: 15.209
Report #:314228	13.56 MHz Report	Page 18 of 36

200 MHz to 1000 MHz at 3m



Horizontal Polarity



Vertical Polarity

EXHIBIT 6. FREQUENCY TOLERANCE

6.1 LIMITS

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 normal supply voltage from 85% to 115%.

6.2 METHOD OF MEASUREMENTS

The EUT was placed in a portable temperature chamber. The carrier emission was measured at normal supply voltage with new batteries over a temperature variation of -20 degrees to +50 degrees C with a spectrum analyzer with resolution bandwidth = video bandwidth = 1 kHz using the peak search function.

The EUT was placed in a portable temperature chamber. The carrier emission was measured at $\pm 15\%$ of the primary supply voltage. This measurement was performed at both room temperature and over a temperature variation of -20 degrees to +50 degrees C.

6.3 TEST DATA

Carrier Frequency = 13.56 MHz

13.56 MHz - 0.01%	13.56 MHz + 0.01%
13558644 Hz	13561356 Hz

Carrier Frequency @ -20°C	Carrier Frequency @ +50°C
13560580 Hz	13560510 Hz

VDC	Temperature		
	+22°C	+50°C	-20°C
5.1	13560710 Hz	13560670 Hz	13560770 Hz
6.0	13560710 Hz	13560670 Hz	13560770 Hz
6.9	13560710 Hz	13560670 Hz	13560770 Hz

Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 20 of 36

EXHIBIT 7. OCCUPIED BANDWIDTH

7.1 LIMITS

There is no limit. Measurement of the 99% bandwidth is required by Industry Canada per RSS GEN.

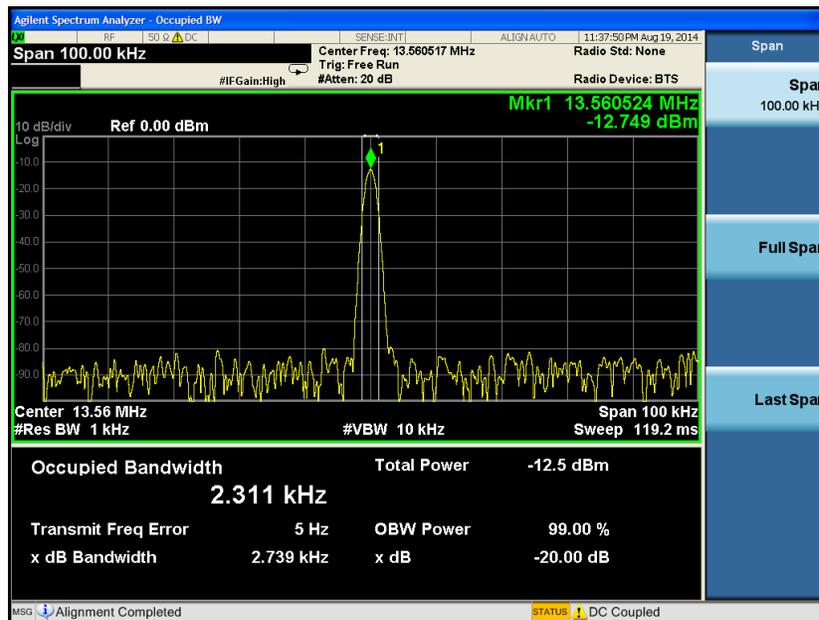
7.2 METHOD OF MEASUREMENTS

The transmitter output was placed in normal operation mode. The bandwidth of the fundamental frequency was measured via radiated measurement using the Spectrum Analyzer bandwidth measurement function.

7.3 TEST DATA

Center Frequency (MHz)	Measured 99%. BW (Hz)
13.56	2311

7.4 SCREEN CAPTURES - 99% BANDWIDTH



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 21 of 36

EXHIBIT 8. CO-LOCATED EMISSIONS

8.1 TEST SETUP

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN, and ANSI C63.4. The NDE device, henceforth referred to as the EUT, was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 3-meter diameter turntable inside a 5 meter Semi-Anechoic, FCC listed Chamber. The EUT was tested in two setups:

The EUT operates on a single channel at 13.56 MHz.

For the test, the EUT was in normal configuration where it continuously looks for a badge. Measurements were performed at a 3m separation to identify the emissions below 30MHz.

8.2 TEST PROCEDURE

Radiated RF measurements were performed at a separation distance of 3 meters on the EUT in a Semi-Anechoic, FCC listed Chamber. The frequency range from 10 kHz to 1000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. A Biconical Antenna was used to measure emissions from 30 MHz to 200 MHz, and a Log Periodic Antenna was used to measure emissions from 200 MHz to 1000 MHz, a Double Ridge Horn Antenna was used to measure emissions from 1 GHz to 18 GHz and a Standard Gain Horn was used to measure emissions from 18 GHz to 26 GHz. For emissions below 30 MHz, an active loop antenna was used. The loop antenna was set at a height of 1m above the conducting ground plane and it was rotated about its vertical and horizontal axes (while utilizing the turntable to rotate the EUT) in order to measure the maximum radiated RF emissions. The maximum radiated RF emissions above 30MHz were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities and rotating the EUT using the turntable.

The receiver was operated with the resolution bandwidth set at 200 Hz for measurements between 9kHz and 150kHz, 9kHz for measurements between 150kHz and 30MHz, 120kHz for measurements between 30MHz and 1000 MHz and 1 MHz for measurements greater than 1000 MHz.

Due to the nature of the EUT, the 125 kHz, 13.56 MHz, 802.11a/b/g and Bluetooth transmitters may operate simultaneously. The following graphs in this report represent the co-location of each radio operating concurrently.

Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 22 of 36

8.3 TEST EQUIPMENT UTILIZED

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with resolution bandwidths as prescribed in ANSI C63.4.

8.4 CO-LOCATION RADIATED EMISSIONS

The EUT was found to **MEET** the Radiated Emissions requirements of FCC Part 15.209 and RSS 210 for a Low-Power License-Exempt transmitter.

8.4.1 TRANSMIT MODE

9 kHz to 150 kHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 23 of 36

150 kHz to 490 kHz

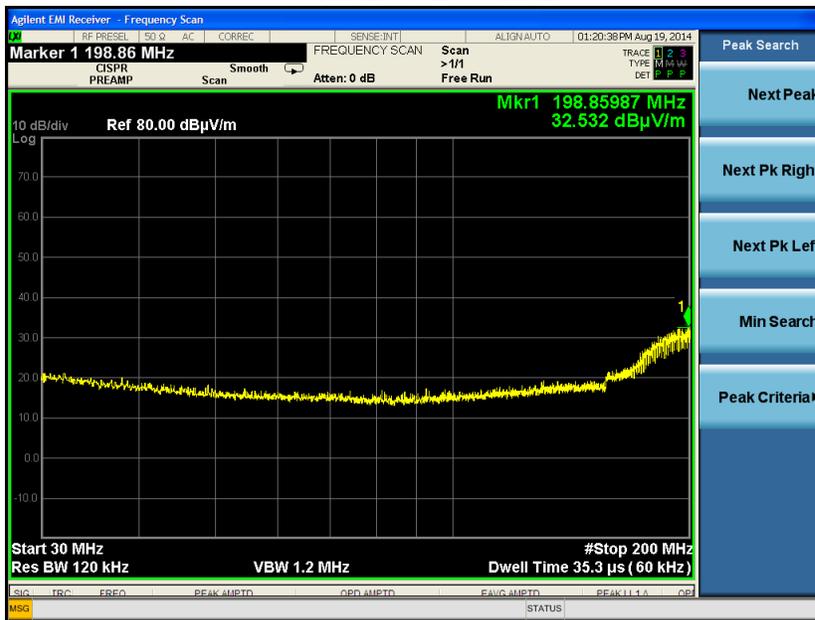


490 kHz to 30 MHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 24 of 36

30 MHz to 200 MHz

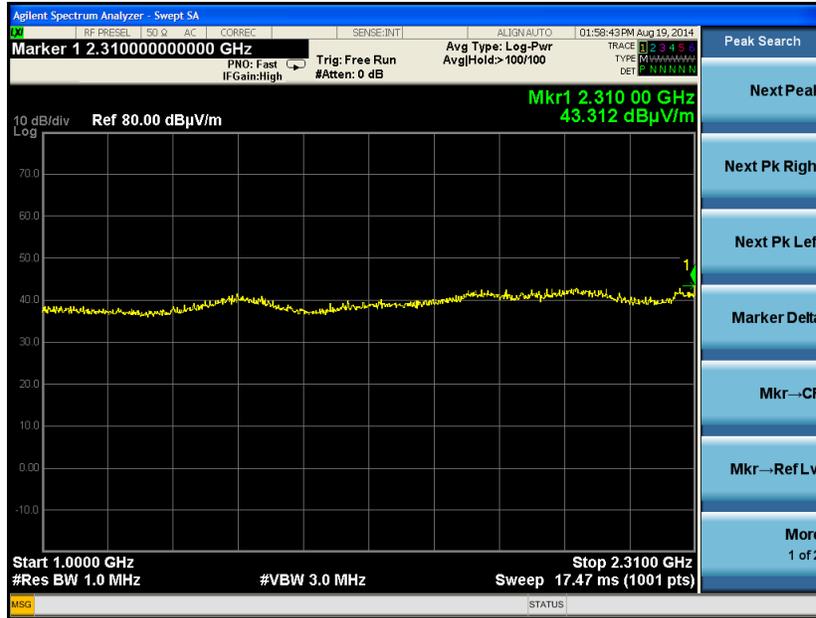


200 MHz to 1000 MHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 25 of 36

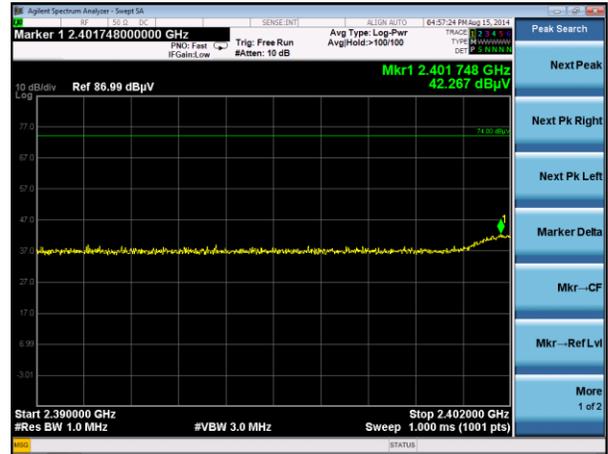
1000 MHz to 2310 MHz



2310 MHz to 2402 MHz



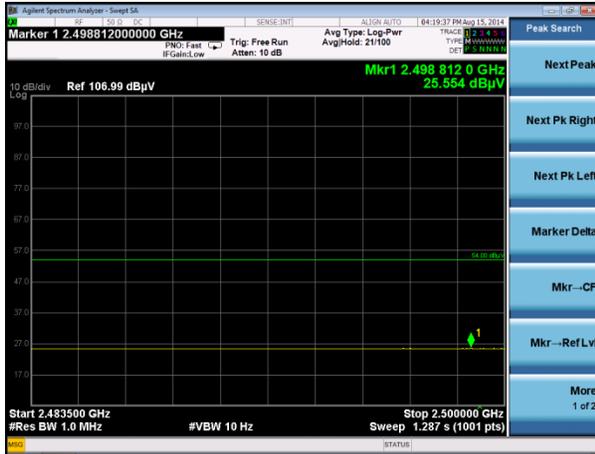
Lower Band Edge - Average



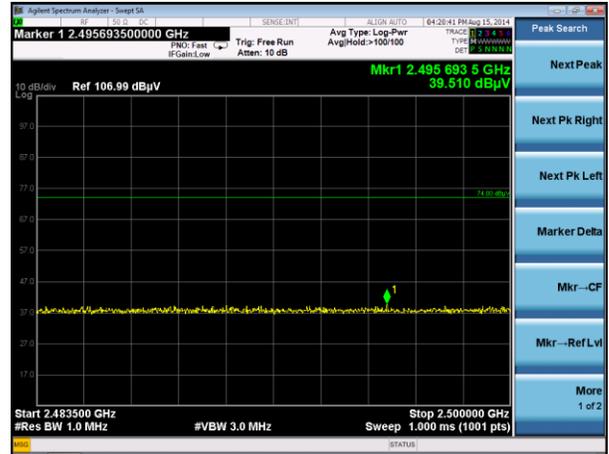
Lower Band Edge - Peak

Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 26 of 36

2483.5 MHz to 2500 MHz

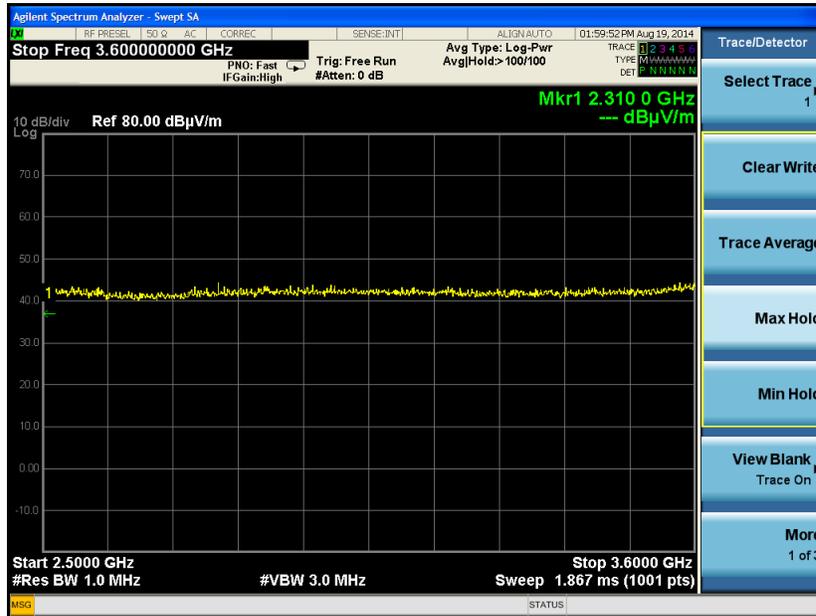


Upper Band Edge - Average



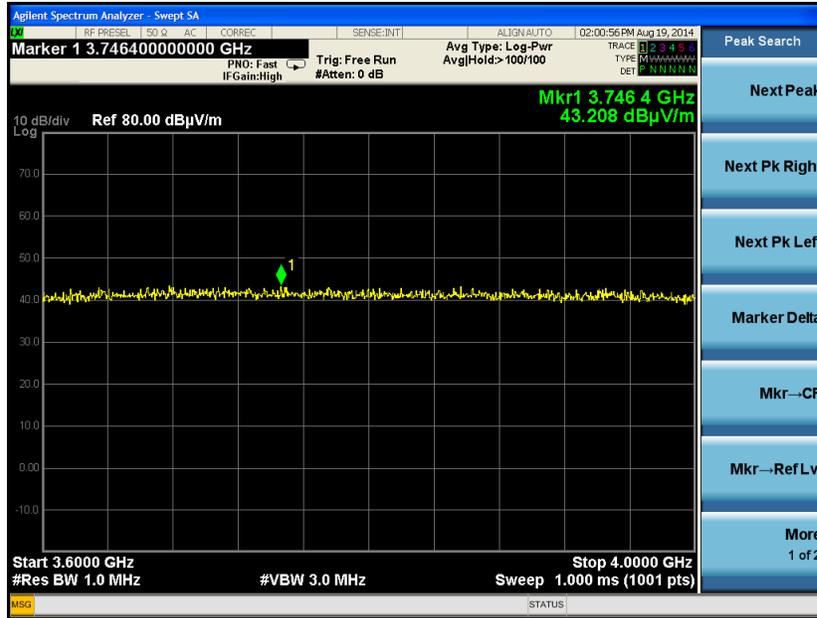
Upper Band Edge - Peak

2500 MHz to 3600 MHz

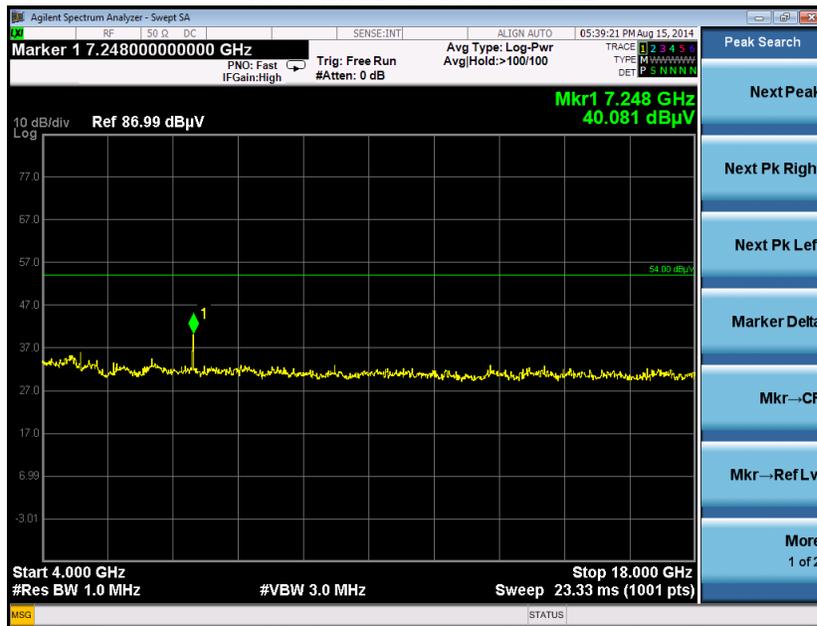


Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 27 of 36

3600 MHz to 4000 MHz

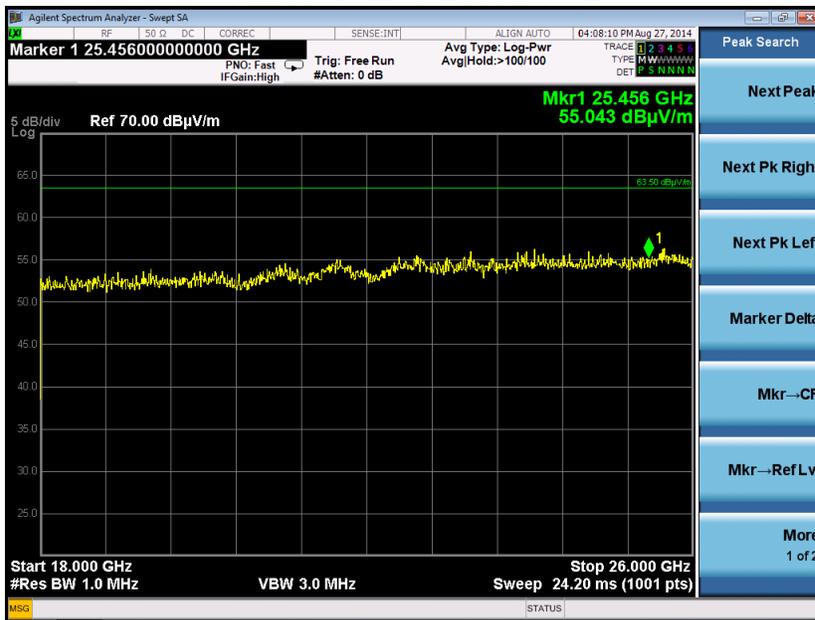


4000 MHz to 18000 MHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 28 of 36

18000 MHz to 26000 MHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 29 of 36

8.4.2 RECEIVE MODE

9 kHz to 150 kHz

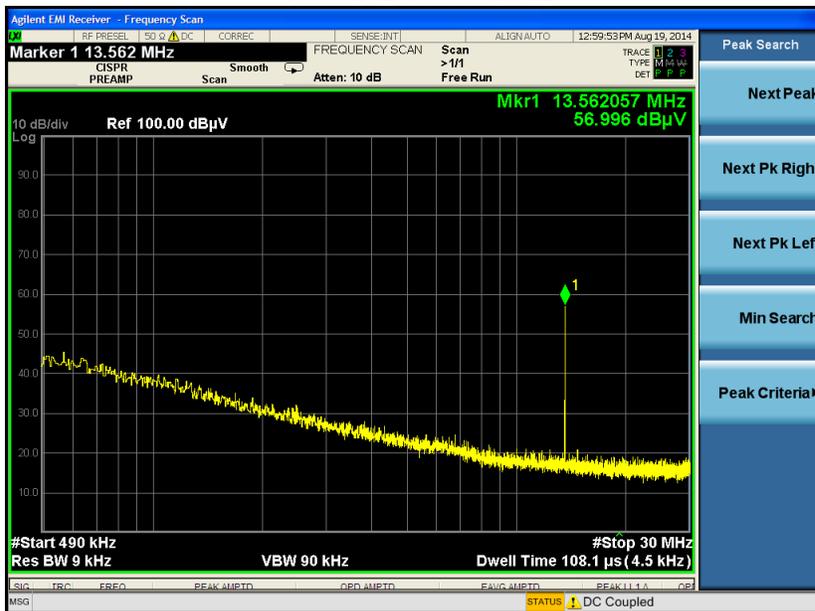


150 kHz to 490 kHz

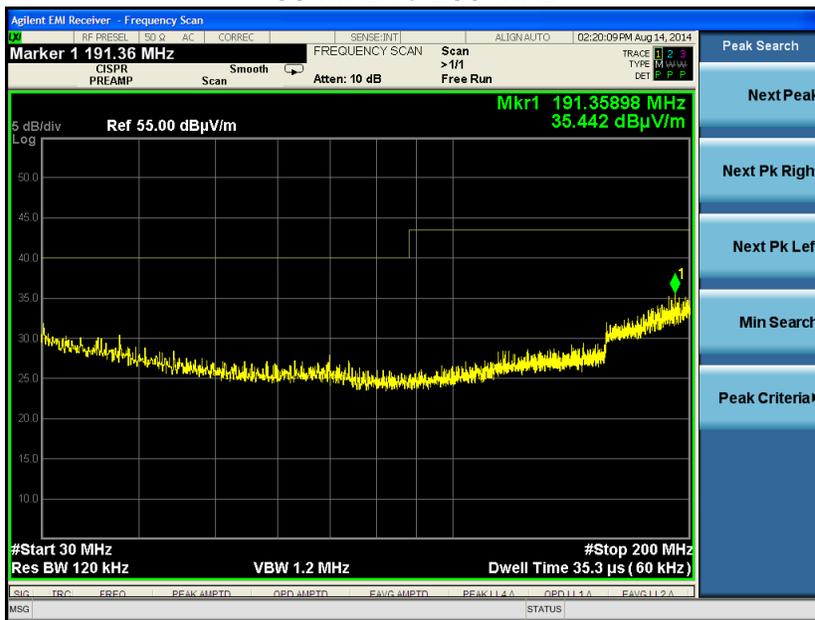


Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 30 of 36

490 kHz to 30 MHz



30 MHz to 200 MHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 31 of 36

200 MHz to 1000 MHz



1000 MHz to 6000 MHz



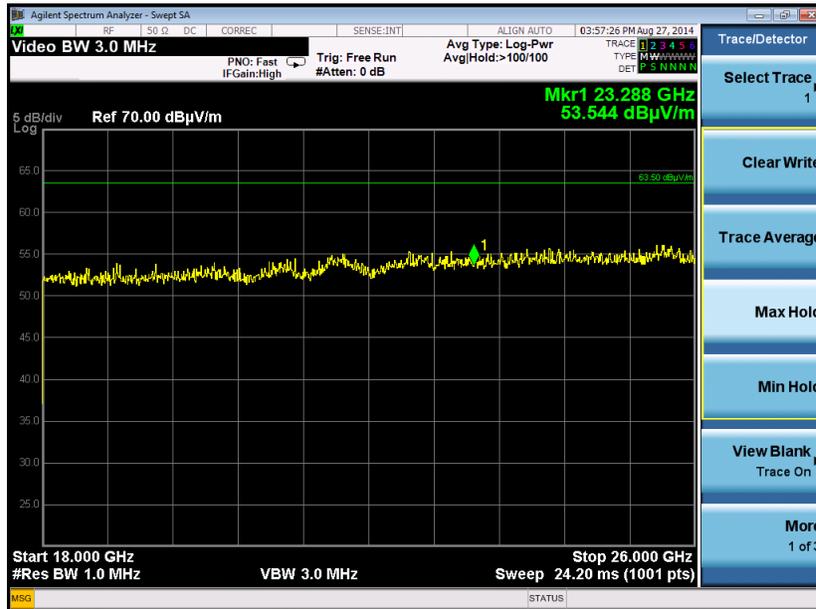
Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 32 of 36

6000 MHz to 18000 MHz



Reduced Bandwidth

18000 MHz to 26000 MHz



Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 33 of 36

APPENDIX A. INSTRUMENT LIST



Date : 15-Aug-2014 Type Test : Radiated Emissions Job # : C-2007

Prepared By: Mike Hintzke Customer : Allegion Quote # : 314228

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	1119/2013	1119/2014	Active Calibration
2	AA 960150	Biconical Antenna	ETS	3110B	0003-3346	1119/2014	1119/2015	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	1119/2014	1119/2015	Active Calibration
4	AA 960006	Active Loop Antenna	EMCO	6502	9205-2753	9/27/2013	9/27/2015	Active Calibration
5	EE 960087	44GHz EXA Spectrum Analyzer	Agilent	N9010A	MY53400296	10/27/2013	10/27/2014	Active Calibration
6	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	6/20/2014	6/20/2015	Active Calibration
7	EE 960159	0.8 - 21GHz LNA	Mini-Circuits	ZVA-213X-S+	740411007	6/20/2014	6/20/2015	Active Calibration
8	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMCO	WLA622-4 / 3160-09	123001	8/20/2014	8/20/2015	Active Calibration
9	AA 960143	Phaseflex	Gore	EKD0D01048.0	5546519	6/14/2013	6/14/2015	Active Calibration
10	AA 960144	Phaseflex	Gore	EKD0D010720	5800373	Verification	Verification	System

Project Engineer:

Quality Assurance:

Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 34 of 36

APPENDIX B. TEST STANDARDS: CURRENT PUBLICATION DATES

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
ANSI C63.10	2009		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2014		
RSS GEN	2010		
RSS 210	2010		

Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 35 of 36

APPENDIX C. UNCERTAINTY STATEMENTS.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

<i>Measurement Type</i>	<i>Particular Configuration</i>	<i>Uncertainty Values</i>
<i>Radiated Emissions</i>	<i>3 – Meter chamber, Biconical Antenna</i>	<i>4.82 dB</i>
<i>Radiated Emissions</i>	<i>3-Meter Chamber, Log Periodic Antenna</i>	<i>4.88 dB</i>
<i>Radiated Emissions</i>	<i>3-Meter Chamber, Horn Antenna</i>	<i>4.85 dB</i>
<i>Radiated Emissions</i>	<i>10-Meter OATS, Biconical Antenna</i>	<i>4.32 dB</i>
<i>Radiated Emissions</i>	<i>10-Meter OATS, Log Periodic Antenna</i>	<i>3.63 dB</i>
<i>Absolute Conducted Emissions</i>	<i>Agilent PSA/ESA Series</i>	<i>1.38 dB</i>
<i>AC Line Conducted Emissions</i>	<i>Shielded Room/EMCO LISN</i>	<i>3.20 dB</i>
<i>Radiated Immunity</i>	<i>3 Volts/Meter in 3-Meter Chamber</i>	<i>2.05 Volts/Meter</i>
<i>Conducted Immunity</i>	<i>3 Volts level</i>	<i>2.33 V</i>
<i>EFT Burst, Surge, VDI</i>	<i>230 VAC</i>	<i>54.4 V</i>
<i>ESD Immunity</i>	<i>Discharge at 15kV</i>	<i>3200 V</i>
<i>Temperature/Humidity</i>	<i>Thermo-hygrometer</i>	<i>0.64° / 2.88 %RH</i>

Prepared For: Allegion	Model #: NDE	LS Research, LLC
EUT: NDE	Serial Number: Engineerig Sample	Template: 15.209
Report #:314228	13.56 MHz Report	Page 36 of 36