

**Amber Helm Development L.C.**

92723 Michigan Hwy-152

Sister Lakes, Michigan 49047 USA

Tel: 888-847-8027

**ASMLVR-WR2201A**

Issued: February 14, 2022

# DTS Test Report

regarding

**USA: CFR Title 47, Part 15.247 (Emissions)**  
**Canada: IC RSS-247/GENe (Emissions)**

for



## FE789WB, FE789WBC

**Category: Electronic Door Lock**

Judgments:

**FCC 15.247, ISSED RSS-247v2 Compliant**

Testing Completed: February 14, 2022



Prepared for:

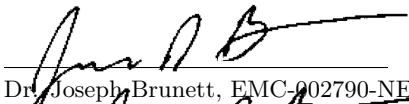
## Allegion, PLC

11819 North Pennsylvania Street, Carmel Indiana 46032 USA

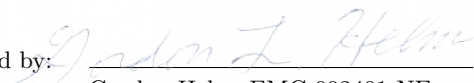
Phone: +1 (317) 810-3362, Fax: +1 (317) 810-3193

Contact: Ryan Kincaid, ryan.kincaid@allegion.com

Data Recorded by:

  
Dr. Joseph Brunnett, EMC-002790-NE

Reviewed by:

  
Gordon Helm, EMC-002401-NE

Prepared by:

Dr. Joseph Brunnett, EMC-002790-NE

Date of Issue: February 14, 2022

## Revision History

Rev. No.	Date	Details	Revised By
r0	February 14, 2022	Initial Release.	J. Brunett
r1	February 24, 2022	Typo Corrections.	J. Brunett
r2	March 4, 2022	Tx Spur Ant Gain adj.	J. Brunett

## Contents

<b>Revision History</b>	<b>2</b>
<b>Table of Contents</b>	<b>2</b>
<b>1 Test Report Scope and Limitations</b>	<b>5</b>
1.1 Laboratory Authorization . . . . .	5
1.2 Report Retention . . . . .	5
1.3 Subcontracted Testing . . . . .	5
1.4 Test Data . . . . .	5
1.5 Limitation of Results . . . . .	5
1.6 Copyright . . . . .	5
1.7 Endorsements . . . . .	5
1.8 Test Location . . . . .	6
1.9 Traceability and Equipment Used . . . . .	6
<b>2 Test Specifications and Procedures</b>	<b>7</b>
2.1 Test Specification and General Procedures . . . . .	7
<b>3 Configuration and Identification of the Equipment Under Test</b>	<b>8</b>
3.1 Description and Declarations . . . . .	8
3.1.1 EUT Configuration . . . . .	9
3.1.2 Modes of Operation . . . . .	9
3.1.3 Variants . . . . .	9
3.1.4 Test Samples . . . . .	9
3.1.5 Functional Exerciser . . . . .	9
3.1.6 Modifications Made . . . . .	9
3.1.7 Production Intent . . . . .	10
3.1.8 Declared Exemptions and Additional Product Notes . . . . .	10
<b>4 Emissions</b>	<b>11</b>
4.1 General Test Procedures . . . . .	11
4.1.1 Radiated Test Setup and Procedures . . . . .	11
4.1.2 Conducted Emissions Test Setup and Procedures . . . . .	13
4.1.3 Power Supply Variation . . . . .	13
4.2 Intentional Emissions . . . . .	14
4.2.1 Duty and Transmission Cycle, Pulsed Operation . . . . .	14
4.2.2 Fundamental Emission Bandwidth . . . . .	15
4.2.3 Effective Isotropic Radiated Power . . . . .	17
4.2.4 Power Spectral Density . . . . .	18
4.3 Unintentional Emissions . . . . .	20
4.3.1 Transmit Chain Radiated Spurious Emissions . . . . .	20
4.3.2 Relative Transmit Chain Spurious Emissions . . . . .	23
4.3.3 Radiated Digital Spurious . . . . .	24

## **5 Measurement Uncertainty and Accreditation Documents**

**25**

## List of Tables

1	Test Site List. . . . .	6
2	Equipment List. . . . .	6
3	EUT Declarations. . . . .	8
4	Pulsed Emission Characteristics (Duty Cycle). . . . .	14
5	Intentional Emission Bandwidth. . . . .	15
6	Radiated Power Results. . . . .	17
7	Power Spectral Density Results. . . . .	18
8	Transmit Chain Spurious Emissions. . . . .	20
8	Transmit Chain Spurious Emissions. . . . .	21
8	Transmit Chain Spurious Emissions. . . . .	21
8	Transmit Chain Spurious Emissions. . . . .	22
8	Transmit Chain Spurious Emissions. . . . .	22
9	Measurement Uncertainty. . . . .	25

## List of Figures

1	Photos of EUT. . . . .	8
2	EUT Test Configuration Diagram. . . . .	9
3	Radiated Emissions Diagram of the EUT. . . . .	11
4	Radiated Emissions Test Setup Photograph(s). . . . .	12
5	Conducted RF Test Setup Photograph(s). . . . .	13
6	Pulsed Emission Characteristics (Duty Cycle). . . . .	14
7	Example Intentional Emission Bandwidth Plots. . . . .	16
8	Power Spectral Density Plots. . . . .	19
9	Conducted Transmitter Emissions Measured. . . . .	23
10	Accreditation Documents . . . . .	25

## **1 Test Report Scope and Limitations**

### **1.1 Laboratory Authorization**

Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: US5348 and US5356) and with ISED Canada, Ottawa, ON (File Ref. No: 3161A and 24249). Amber Helm Development L.C. holds accreditation under NVLAP Lab Code 200129-0.

### **1.2 Report Retention**

For equipment verified to comply with the regulations herein, the manufacturer is obliged to retain this report with the product records for the life of the product, and no less than ten years. A copy of this Report will remain on file with this laboratory until March 2032.

### **1.3 Subcontracted Testing**

This report does not contain data produced under subcontract.

### **1.4 Test Data**

This test report contains data included within the laboratory's scope of accreditation. Any data in this report that is not covered under the laboratory's scope is clearly identified.

### **1.5 Limitation of Results**

The test results contained in this report relate only to the item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require reevaluation.

### **1.6 Copyright**

This report shall not be reproduced, except in full, without the written approval of Amber Helm Development L.C.

### **1.7 Endorsements**

This report shall not be used to claim product endorsement by any accrediting, regulatory, or governmental agency.

## 1.8 Test Location

The EUT was fully tested by **Amber Helm Development L.C.**, headquartered at 92723 Michigan Hwy-152, Sister Lakes, Michigan 49047 USA. Table 1 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1: Test Site List.

Description	Location	Quality Num.
OATS (3 meter)	3615 E Grand River Rd., Williamston, Michigan 48895	OATSC

## 1.9 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 2. The quality system employed at Amber Helm Development L.C. has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 2: Equipment List.

Description	Manufacturer/Model	SN	Quality Num.	Cal/Ver By / Date Due
Spectrum Analyzer	R & S / FSW26	101873	RSFSW2601	RS / Sept-2022
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2023
Pk Pwr Telecom	Anritsu / MT8870A	6201282278	ANMT8870A	AHD / On-use
Power Meter	R & S / NRP50S	101087	RSNRP50	RS / Nov-2022
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Mar-2022
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jul-2022
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2023
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2023
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2022
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD / Jul-2022

## 2 Test Specifications and Procedures

### 2.1 Test Specification and General Procedures

The goal of Allegion, PLC is to demonstrate that the Equipment Under Test (EUT) complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Allegion, PLC FE789WB, FE789WBC for compliance to:

Country/Region	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.247
Canada	ISED Canada	IC RSS-247/GENe

It has been determined that the equipment under test is subject to the rules and directives above at the date of this testing. In conjunction with these rules and directives, the following specifications and procedures are followed herein to demonstrate compliance (in whole or in part) with these regulations.

ANSI C63.4:2014	"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
ANSI C63.10:2013	"American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
TP0102RA	"AHD Internal Document TP0102 - Radiated Emissions Test Procedure"
ISED Canada	"The Measurement of Occupied Bandwidth"
ICES-003; Issue 7 (2020)	"Information Technology Equipment (ITE) - Limits and methods of measurement"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The EUT is wireless enabled electronic door lock. The EUT is approximately 10 x 15 x 5 cm in dimension, and is depicted in Figure 1. It is powered by 6 VDC alkaline AA batteries. This product is used as an electronic entry door latch with WLAN and BLE. Table 3 outlines provider declared EUT specifications.

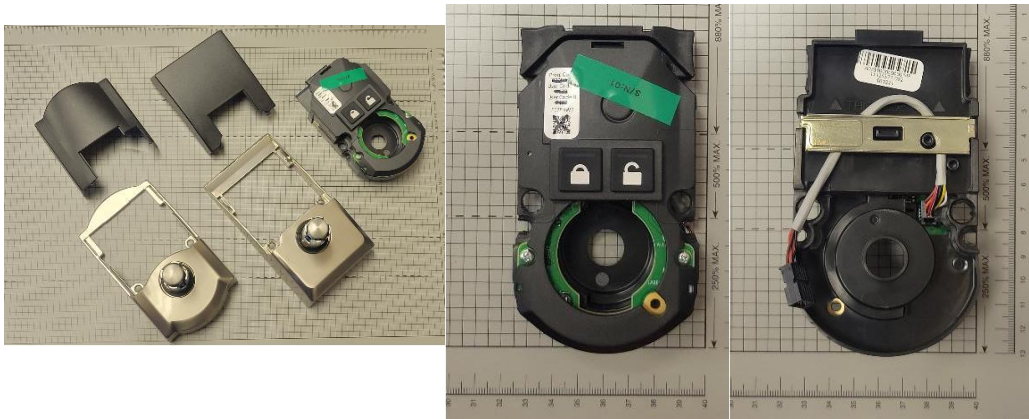


Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations	
Equipment Type:	Electronic Door Lock
Country of Origin:	Not Declared
Nominal Supply:	6 VDC
Oper. Temp Range:	Not Declared
Frequency Range:	2400 – 2483.5 MHz
Antenna Dimension:	Integral
Antenna Type:	PCB Trace
Antenna Gain:	-2.0 dBi (meas.)
Number of Channels:	11(WLAN), 40(BLE)
Channel Spacing:	5 MHz(WLAN), 1 MHz(BLE)
Alignment Range:	Not Declared
Type of Modulation:	GFSK, OFDM
United States	
FCC ID Number:	XPB-SMLEVER
Classification:	DTS
Canada	
IC Number:	8053B-SMLEVER
Classification:	Spread Spectrum (24002483.5 MHz)



### 3.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

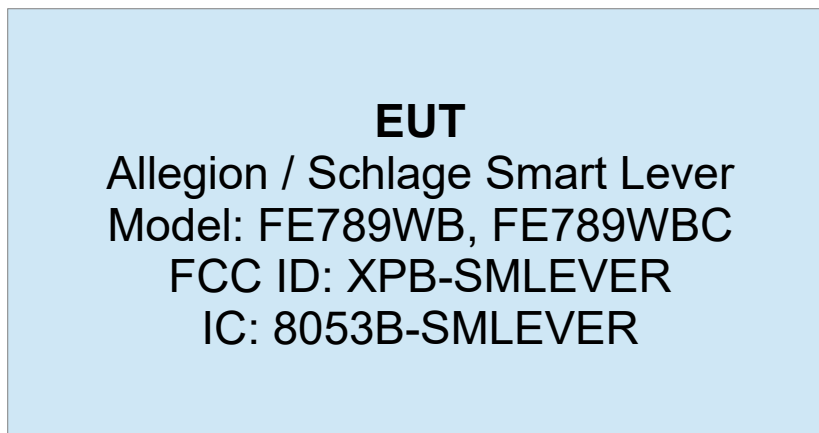


Figure 2: EUT Test Configuration Diagram.

### 3.1.2 Modes of Operation

The EUT is capable of operating in 802.11 b, g, n(20) SISO, and BLE modes. Test samples were placed into worst-case operating states (highest data rate, highest operating power that may be employed in each mode) using a PC serial UART interface that could be attached and detached from the EUT interface board. The EUT was placed into maximum possible transmission on-time and measured in line with DTS guidelines. Worst case emissions are observed when the EUT is tested in the absence of the metal chassis (escutcheons), as would be the case if future plastic chassis are introduced.

### 3.1.3 Variants

There is only a single version of the EUT, which currently may employ two different styles of escutcheon

### 3.1.4 Test Samples

Three samples of the EUT were provided for emissions testing, two normal radiated samples and one sample with u.fl. connectors populated to allow for conducted RF port measurements. The EUT can employ interchangeable escutcheons (faceplates), two of which were tested along with the EUT in the absence of the housing.

### 3.1.5 Functional Exerciser

Normal functionality was confirmed by measurement of transmitted signals.

### 3.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory. However, in order to bring the device into compliance with band edge and inter-modulation spurious emissions, the manufacturer chose to have the maximum power setting on the WLAN chipset reduced from the maximum power setting level (0) down to a power setting level of (3). All products manufactured will be set with WLAN power setting level no greater than level (3).

**3.1.7 Production Intent**

The EUT appears to be a production ready sample.

**3.1.8 Declared Exemptions and Additional Product Notes**

The EUT is subject to compliance as part of a full lock set, which includes digital spurious emissions associated with the attached touch keypad via end-product SDoC evaluation completed separately.

## 4 Emissions

### 4.1 General Test Procedures

#### 4.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first pre-scanned in our screen room. Spectrum and modulation characteristics of all emissions are recorded. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.8 are employed. After pre-scan, emission measurements are made on the test site of record. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in relevant test standards are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3. All intentionally radiating elements that are not fixed-mounted in use are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. If the EUT is fixed-mounted in use, measurements are made with the device oriented in the manner consistent with installation and then emissions are recorded. If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied.

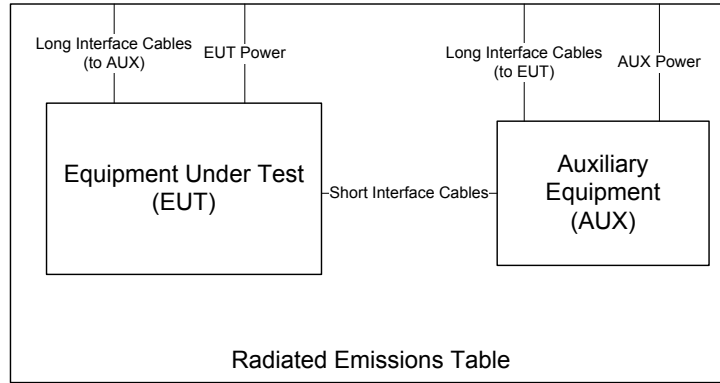


Figure 3: Radiated Emissions Diagram of the EUT.

For devices with intentional emissions below 30 MHz, a shielded loop antenna and/or E-field and H-Field broadband probes are used depending on the regulations. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, the broadband probes employed are 10cm diameter single-axis shielded transducers and measurements are repeated and summed over three axes.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through  $360^\circ$  in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Emissions above 1 GHz are characterized using standard gain or broadband ridge-horn antennas on our OATS with a  $4 \times 5$  m rectangle of ECCOSORB absorber covering the OATS ground screen and a 1.5m table height. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced. Photographs of the test setup employed are depicted in Figure 4.

Where regulations allow for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to  $\text{dB}\mu\text{V}/\text{m}$  at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where  $P_R$  is the power recorded on spectrum analyzer, in dBm,  $K_A$  is the test antenna factor in dB/m,  $K_G$  is the combined pre-amplifier gain and cable loss in dB,  $K_E$  is duty correction factor (when applicable) in dB, and  $C_F$  is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is computed, it is computed as

$$\text{EIRP}(\text{dBm}) = E_{3m}(\text{dB}\mu\text{V}/\text{m}) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.



Figure 4: Radiated Emissions Test Setup Photograph(s).

#### 4.1.2 Conducted Emissions Test Setup and Procedures

**Transmit Antenna Port Conducted Emissions** At least one sample EUT supplied for testing was provided with a  $50\Omega$  antenna port. Conducted transmit chain emissions measurements (where applicable) are made by connecting the EUT antenna port directly to the test receiver port. Photographs of the test setup employed are depicted in Figure 5.

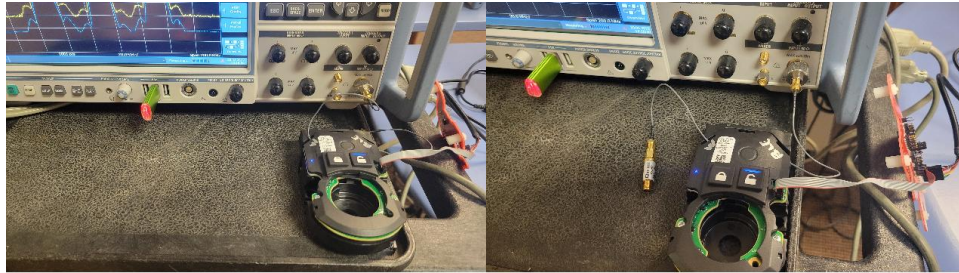


Figure 5: Conducted RF Test Setup Photograph(s).

The EUT is not subject to measurement of power line conducted emissions as it is powered solely by its internal battery.

#### 4.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case the EUT is designed for operation from a battery power source, the extreme test voltages are evaluated over the range specified in the test standard; no less than  $\pm 10\%$  of the nominal battery voltage declared by the manufacturer. For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

## 4.2 Intentional Emissions

### 4.2.1 Duty and Transmission Cycle, Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 4. Plots showing the measurements made to obtain these values are provided in Figure 6.

Table 4: Pulsed Emission Characteristics (Duty Cycle).

Test Date: 14-Feb-22  
 Test Engineer: Joseph Brunett  
 EUT: Allegion FE789W(C)  
 Meas. Distance: Conducted

Test Mode Pulsed Operation / Average Measurement Duty Cycle								
#	Mode	Data Rate Mbps	Voltage V	Oper. Freq MHz	Pulse Length	Pulse Period	Duty Cycle %	Power Correction dB
R1	BLE	1.0	6.0	2440.0	407.650	625.750	65	1.86
R2	802.11b	11.0	6.0	2437.0	11.895	12.315	97	0.15
R3	802.11g	54.0	6.0	2437.0	1.976	2.022	98	0.10
R4	802.11n(20)	65.0	6.0	2437.0	1.835	2.076	88	0.54
#	C1	C3	C4	C5	C6	C7	C8	C9

\* Duty Cycle is measured in line with DTS guidance 558074 D01 v5 r02 section 6(b) for averaging only over full-power transmission pulses.

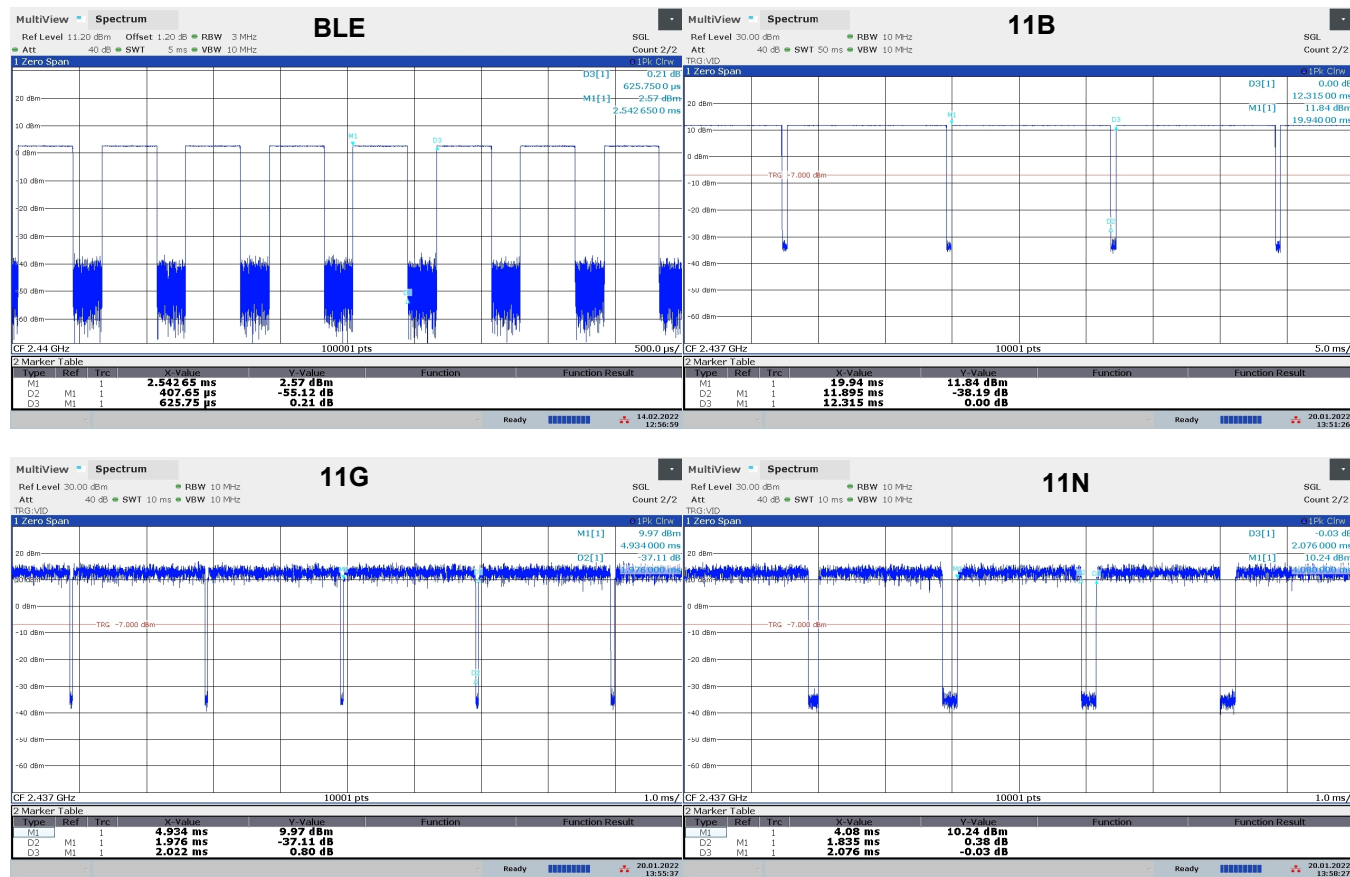


Figure 6: Pulsed Emission Characteristics (Duty Cycle).

#### 4.2.2 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available packet length and minimum packet spacing. Radiated emissions are recorded following the test procedures listed in Section 2.1. The 6 dB bandwidth is measured for the lowest, middle, and highest channels available. The 99% emission bandwidth per IC test procedures is also reported. The results of this testing are summarized in Table 5. Plots showing measurements employed obtain the emission bandwidths reported are provided in Figure 7.

Table 5: Intentional Emission Bandwidth.

**Test Date:** 1/20/22, 2/24/22  
**Test Engineer:** Joseph Brunett  
**EUT:** Allegion FE789W(C)  
**Meas. Distance:** Conducted

#	Transmit Mode	Data Rate (Mbps)	Voltage (V)	Oper. Freq (MHz)	Occupied Bandwidth			Pass/Fail
					DTS 6 dB BW (MHz)	DTS 6 dB BW Limit (MHz)	99% OBW (MHz)	
R1	BLE	1.0	6.0	2402.0	0.68	0.50	1.08	Pass
R2				2440.0	0.69	0.50	1.05	Pass
R3				2480.0	0.72	0.50	1.07	Pass
R4	802.11b	11.0	6.0	2412.0	8.21	0.50	14.21	Pass
R5				2437.0	7.67	0.50	14.58	Pass
R6				2462.0	8.18	0.50	14.29	Pass
R7	802.11g	54.0	6.0	2412.0	16.57	0.50	16.72	Pass
R8				2437.0	16.51	0.50	17.07	Pass
R9				2462.0	16.42	0.50	16.93	Pass
R10	802.11n(20)	65.0	6.0	2412.0	17.59	0.50	17.84	Pass
R11				2437.0	17.83	0.50	18.48	Pass
R12				2462.0	17.74	0.50	17.96	Pass
#	C1	C2	C3	C4	C5	C6	C7	C8

ROW

COLUMN

NOTE

(R1-R12)

(C5)

DTS Bandwidth measured with RBW = 100 kHz per ANSI C63.10 11.8.1

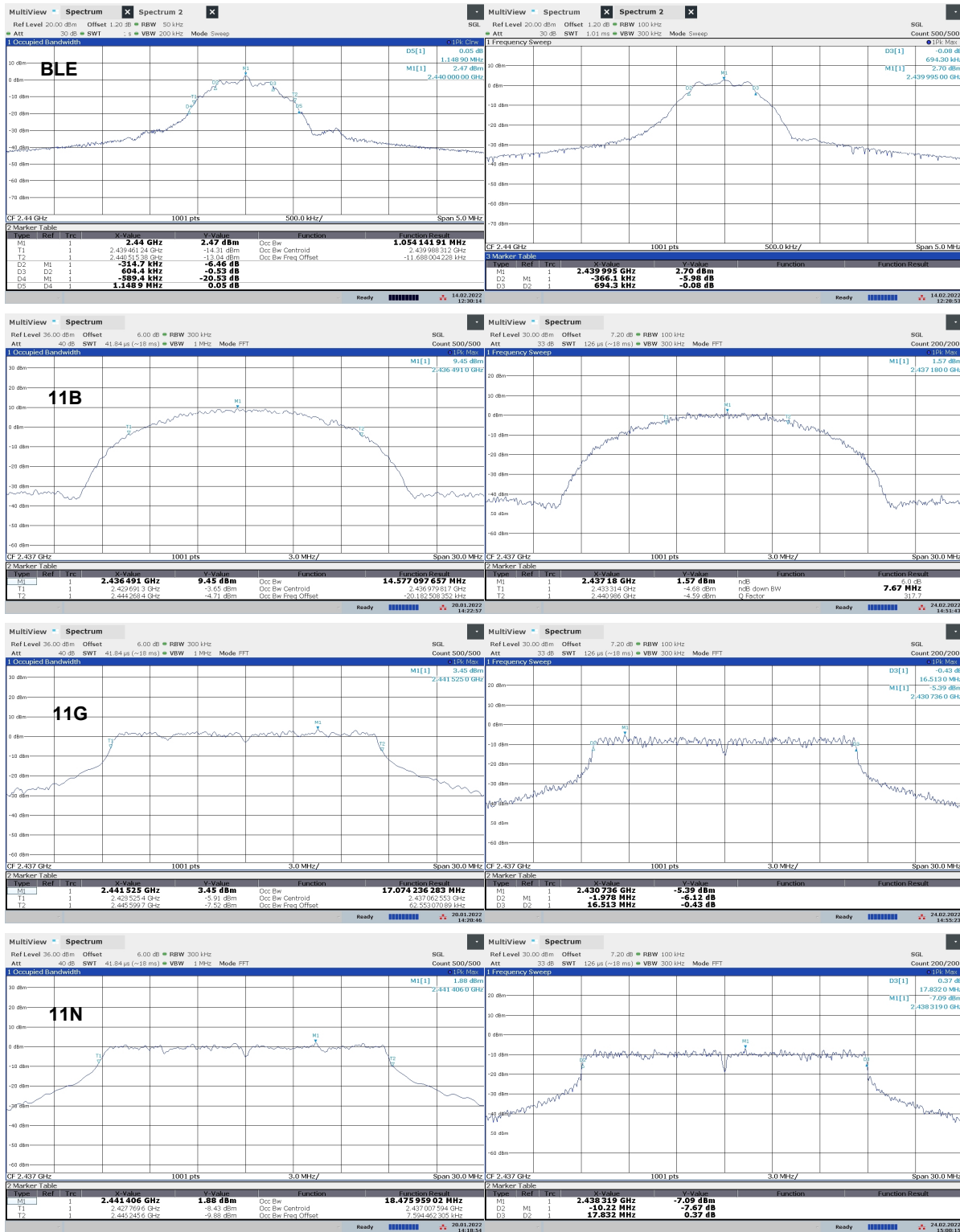


Figure 7: Example Intentional Emission Bandwidth Plots.



### 4.2.3 Effective Isotropic Radiated Power

The EUT's radiated power is computed from antenna port conducted power measurements and the gain of the EUT antenna(s). Where the EUT is not sold with an antenna connector, a modified product has been provided including such. The results of this testing are summarized in Table 6.

Table 6: Radiated Power Results.

**Test Date:** 24-Feb-22  
**Test Engineer:** Joseph Brunett  
**EUT:** Allegion FE789W(C)  
**Meas. Distance:** Conducted

#	Mode	Channel	Fundamental Power						EIRP (Avg) dBm	EIRP (Avg) Limit dBm	Pass dB	Comments
			Freq. MHz	Pout (Pk)** dBm	Pout (Avg)* dBm	Duty dB	Pout (Avg) + Duty dBm	Ant Gain*** dBi				
R4	BLE	0	2402.0	3.3	1.3	1.9	3.1	-2.0	1.1	36.0	34.9	
R5		19	2440.0	3.0	1.1	1.9	2.9	-2.0	.9	36.0	35.1	
R6		39	2480.0	2.9	0.9	1.9	2.8	-2.0	.8	36.0	35.2	
R4	802.11B	1	2412.0		13.89	0.15	14.0	-2.0	12.0	36.0	24.0	
R5		6	2437.0		11.19	0.15	11.3	-2.0	9.3	36.0	26.7	
R6		11	2462.0		13.73	0.15	13.9	-2.0	11.9	36.0	24.1	
R7	802.11G	1	2412.0		8.32	0.10	8.4	-2.0	6.4	36.0	29.6	
R8		6	2437.0		10.10	0.10	10.2	-2.0	8.2	36.0	27.8	
R9		11	2462.0		8.16	0.10	8.3	-2.0	6.3	36.0	29.7	
R10	802.11N(20)	1	2412.0		7.93	0.54	8.5	-2.0	6.5	36.0	29.5	
R11		6	2437.0		9.85	0.54	10.4	-2.0	8.4	36.0	27.6	
R12		11	2462.0		7.86	0.54	8.4	-2.0	6.4	36.0	29.6	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12

\* Measured conducted from radio conducted sample. Avg Power measured per DTS Guidance 558074 D01 v5 r02 Section 8.3.2.2 / ANSI C63.10 11.9.2.3.1 (AVGPM)

\*\* Measured conducted from radio conducted sample. Pk Power measured per DTS Guidance 558074 D01 v5 r02 Section 8.3.1.1 / ANSI C63.10 11.9.1.1 (RBW>DTS)

\*\*\* Maximum Antenna Gain as measured from 3 m free-space measurements in CW mode.

#### 4.2.4 Power Spectral Density

For this test, the EUT was attached directly to the test receiver. Following FCC DTS measurement procedures, the emission spectrum is first scanned for maximum spectral peaks, the span and receiver bandwidth are then reduced until the power spectral density is measured in the prescribed receiver bandwidth. The results of this testing are summarized in Table 7. Plots showing how these measurements were made are depicted in Figure 8.

Table 7: Power Spectral Density Results.

<b>Frequency Range</b>	<b>Detector</b>	<b>IF Bandwidth</b>	<b>Video Bandwidth</b>	<b>Test Date:</b>	20-Jan-22
2400-2483.5	Pk	3 kHz	10 kHz	<b>Test Engineer:</b>	Joseph Brunett
				<b>EUT:</b>	Allegion FE789W(C)
				<b>Meas. Distance:</b>	Conducted

3kHz Power Spectral Density							
#	Mode	Channel	Frequency (MHz)	Ant. Used	PSDcond (meas)* (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass By (dB)
R1	BLE	0	2402.0	Cond.	-12.2	8.00	20.2
R2		19	2440.0	Cond.	-12.6	8.00	20.6
R3		39	2480.0	Cond.	-10.4	8.00	18.4
R4	802.11b	1	2412.0	Cond.	-9.8	8.00	17.8
R5		6	2437.0	Cond.	-9.8	8.00	17.8
R6		11	2462.0	Cond.	-9.9	8.00	17.9
R7	802.11g	1	2412.0	Cond.	-16.5	8.00	24.5
R8		6	2437.0	Cond.	-15.9	8.00	23.9
R9		11	2462.0	Cond.	-17.7	8.00	25.7
R10	802.11n(20)	1	2412.0	Cond.	-17.1	8.00	25.1
R11		6	2437.0	Cond.	-14.9	8.00	22.9
R12		11	2462.0	Cond.	-15.9	8.00	23.9
#	C1	C2	C3	C4	C5	C6	C7

\* PSD measured conducted following DTS guidance 558074 D01 v5 r02 8.4 / ANSI C63.10 11.10 PKPSD procedure.

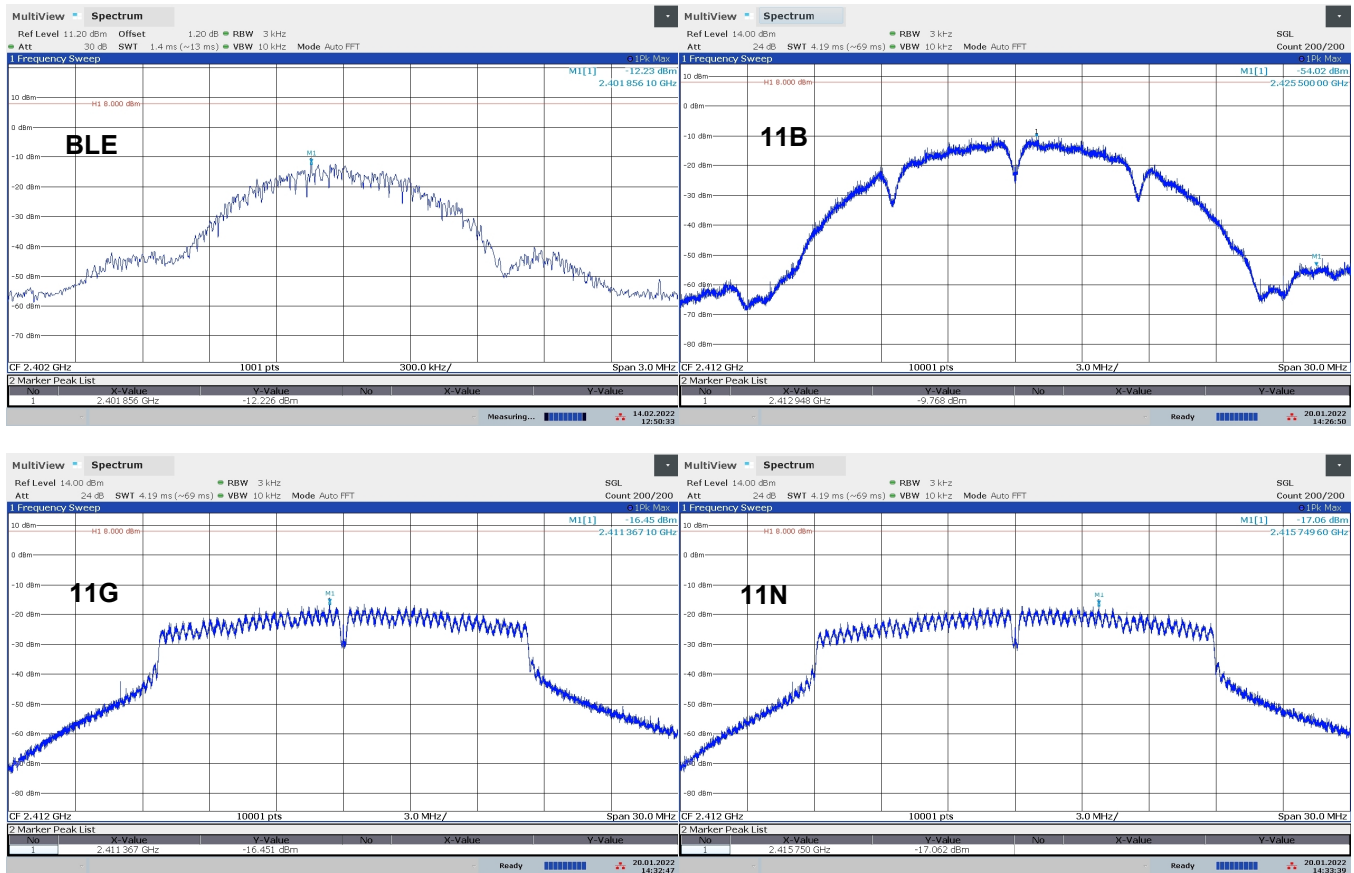


Figure 8: Power Spectral Density Plots.

### 4.3 Unintentional Emissions

#### 4.3.1 Transmit Chain Radiated Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 8. Measurements are performed to 10 times the highest fundamental operating frequency.

Table 8(a): Transmit Chain Spurious Emissions.

Frequency Range		Det		IF Bandwidth		Video Bandwidth		Test Date:					20-Jan-22	
30 >= f > 1000 MHz		Pk/QPk		100 kHz		300 kHz		Test Engineer:					J. Brunett	
f < 1000 MHz		Pk/Avg		1 MHz		3 MHz		EUT:					Allegion FE789W(C)	
								Meas. Distance:					Conducted	

Transmitter Spurious in Restricted Bands															FCC/IC
#	Mode	Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass	Comments	
		Start MHz	Stop MHz	Pk dBm	Qpk/Avg dBm	Gain dBi		Factor dB	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Qpk/Avg dBuV/m	Limit Qpk/Avg dBuV/m	dB		
R1	Fundamental Restricted Band Edge (Low Side)														
R2	BLE	2390.0	2390.0	-33.5	-62.4	2.0	0.0	1.9	63.7	74.0	36.7	54.0	10.3	max all - L,M,H channels	
R3	Fundamental Restricted Band Edge (High Side)														
R4	BLE	2483.5	2483.5	-24.6	-58.5	2.0	0.0	1.9	72.6	74.0	40.6	54.0	1.4	max all - L,M,H channels	
R5															
R6	BLE	30	88	-96.2		2.0	6.0	1.9	7.0			40	33.0	max L,M,H channels or noise	
R7	BLE	88	216	-94.8		2.0	6.0	1.9	8.4			43	34.6	max L,M,H channels or noise	
R8	BLE	216	1000	-93.2		2.0	6.0	1.9	10.0			46	36.0	max L,M,H channels or noise	
R9	BLE	4804.0	4804.0	-48.6		2.0	0.0	1.9	48.6	74.0	48.6	54.0	5.4	max all - L channel	
R10	BLE	4880.0	4880.0	-48.8		2.0	0.0	1.9	48.4	74.0	48.4	54.0	5.6	max all - M channel	
R11	BLE	4960.0	4960.0	-47.5		2.0	0.0	1.9	49.7	74.0	49.7	54.0	4.3	max all - H channel	
R12	BLE	7319.7	7319.7	-67.1		2.0	0.0	1.9	30.1	74.0	30.1	54.0	23.9	max all - L,M,H channels	
R13	BLE	1000.0	4000.0	-60.3		2.0	0.0	1.9	36.9	74.0	36.9	54.0	17.1	max L,M,H channels or noise	
R14	BLE	4000.0	6000.0	-47.5		2.0	0.0	1.9	49.7	74.0	49.7	54.0	4.3	max L,M,H channels or noise	
R15	BLE	6000.0	8400.0	-67.1		2.0	0.0	1.9	30.1	74.0	30.1	54.0	23.9	max L,M,H channels or noise	
R16	BLE	8400.0	12500.0	-68.4		2.0	0.0	1.9	28.8	74.0	28.8	54.0	25.2	max L,M,H channels or noise	
R17	BLE	12500.0	26000.0	-70.3		2.0	0.0	1.9	26.9	74.0	26.9	54.0	27.1	max L,M,H channels or noise	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	

\* Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12

\*\* Measured according to ANSI C63-10-2013 section 6.10.5.2

\*\*\* Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)

\*\*\* Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

Table 8(b): Transmit Chain Spurious Emissions.

<b>Frequency Range</b>	<b>Det</b>	<b>IF Bandwidth</b>	<b>Video Bandwidth</b>	<b>Test Date:</b>	1/20/2022, 2/28/2022
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz	<b>Test Engineer:</b>	J. Brunett
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz	<b>EUT:</b>	Allegion FE789W(C)
				<b>Meas. Distance:</b>	Conducted

Transmitter Spurious in Restricted Bands														FCC/IC
#	Mode	Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass	Comments
		Start MHz	Stop MHz	Pk dBm	Qpk/Avg dBm	Gain dBi		Factor dB	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Qpk/Avg dBuV/m	Limit Qpk/Avg dBuV/m	dB	
R1	Fundamental Restricted Band Edge (Low Side)													
R2	802.11B	2390.0	2390.0	-55.9	-61.4	2.0	0.0	0.2	41.3	74.0	36.0	54.0	18.0	max all - L,M,H channels
R3	Fundamental Restricted Band Edge (High Side)													
R4	802.11B	2483.5	2483.5	-57.9	-60.0	2.0	0.0	0.2	39.3	74.0	37.4	54.0	16.6	max all - L,M,H channels
R5														
R6	802.11B	30	88	-96.3		2.0	6.0	0.2	6.9			40	33.1	
R7	802.11B	88	216	-94.2		2.0	6.0	0.2	9.0			43	34.0	
R8	802.11B	216	1000	-93.8		2.0	6.0	0.2	9.4			46	36.6	
R9														
R10	NOTE: LO/Spur measured radiated to confirm compliance, as integral antenna < 2 dBi in 4 GHz band													
R11	802.11B	4102.3	4102.3				0.0	0.2	55.7	74.0	45.6	54.0	8.4	LO / Spur (Radiated)
R12														
R13	802.11B	4923.7	4923.7	-58.2		2.0	0.0	0.2	39.0	74.0		54.0	54.0	max all - L,M,H channels
R14	802.11B	7313.2	7313.2	-75.2		2.0	0.0	0.2	22.0	74.0		54.0	54.0	max all - L,M,H channels
R15	802.11B	9029.1	9029.1	-77.3		2.0	0.0	0.2	19.9	74.0		54.0	54.0	max all - L,M,H channels
R16	802.11B	1000.0	4000.0	-76.2		2.0	0.0	0.2	21.0	74.0		54.0	53.0	max L,M,H channels or noise
R17	802.11B	4000.0	6000.0			2.0	0.0	0.2	55.7	74.0	45.6	54.0	8.4	max L,M,H channels or noise
R18	802.11B	6000.0	8400.0	-75.2		2.0	0.0	0.2	22.0	74.0		54.0	54.0	max L,M,H channels or noise
R19	802.11B	8400.0	12500.0	-77.3		2.0	0.0	0.2	19.9	74.0		54.0	54.0	max L,M,H channels or noise
R20	802.11B	12500.0	26000.0	-71.0		2.0	0.0	0.2	26.2	74.0		54.0	54.0	max L,M,H channels or noise
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

\* Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12

\*\* Measured according to ANSI C63-10-2013 section 6.10.5.2

\*\*\* Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)

\*\*\* Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

Table 8(c): Transmit Chain Spurious Emissions.

<b>Frequency Range</b>	<b>Det</b>	<b>IF Bandwidth</b>	<b>Video Bandwidth</b>	<b>Test Date:</b>	20-Jan-22
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz	<b>Test Engineer:</b>	J. Brunett
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz	<b>EUT:</b>	Allegion FE789W(C)
				<b>Meas. Distance:</b>	Conducted

Transmitter Spurious in Restricted Bands														FCC/IC
#	Mode	Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass	Comments
		Start MHz	Stop MHz	Pk dBm	Qpk/Avg dBm	Gain dBi		Factor dB	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Qpk/Avg dBuV/m	Limit Qpk/Avg dBuV/m	dB	
R1	Fundamental Restricted Band Edge (Low Side)													
R2	802.11G	2390.0	2390.0	-55.8	-61.6	2.0	0.0	0.1	41.4	74.0	35.8	54.0	18.2	max all - L,M,H channels
R3	Fundamental Restricted Band Edge (High Side)													
R4	802.11G	2483.5	2483.5	-55.1	-61.3	2.0	0.0	0.1	42.1	74.0	36.1	54.0	17.9	max all - L,M,H channels
R5														
R6	802.11G	30	88	-91.3		2.0	6.0	0.1	11.9			40	28.1	
R7	802.11G	88	216	-93.9		2.0	6.0	0.1	9.3			43	33.7	
R8	802.11G	216	1000	-95.2		2.0	6.0	0.1	8.0			46	38.0	
R9	802.11G	4065.7	4065.7	-38.1	-58.2	2.0	0.0	0.1	59.1	74.0	39.2	54.0	14.8	LO / Spur
R10	802.11G	4928.9	4928.9	-76.1		2.0	0.0	0.1	21.1	74.0		54.0	32.9	max all - L,M,H channels
R11	802.11G	7313.2	7313.2	-75.2		2.0	0.0	0.1	22.0	74.0		54.0	32.0	max all - L,M,H channels
R12	802.11G	9029.1	9029.1	-77.3		2.0	0.0	0.1	19.9	74.0		54.0	34.1	max all - L,M,H channels
R13	802.11G	1000.0	4000.0	-76.2		2.0	0.0	0.1	21.0	74.0		54.0	33.0	max L,M,H channels or noise
R14	802.11G	4000.0	6000.0	-38.1	-58.2	2.0	0.0	0.1	59.1	74.0	39.2	54.0	14.8	max L,M,H channels or noise
R15	802.11G	6000.0	8400.0	-75.2		2.0	0.0	0.1	22.0	74.0		54.0	32.0	max L,M,H channels or noise
R16	802.11G	8400.0	12500.0	-77.3		2.0	0.0	0.1	19.9	74.0		54.0	34.1	max L,M,H channels or noise
R17	802.11G	12500.0	26000.0	-71.0		2.0	0.0	0.1	26.2	74.0		54.0	27.8	max L,M,H channels or noise
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

\* Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12

\*\* Measured according to ANSI C63-10-2013 section 6.10.5.2

\*\*\* Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)

\*\*\* Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

Table 8(d): Transmit Chain Spurious Emissions.

<b>Frequency Range</b>	<b>Det</b>	<b>IF Bandwidth</b>	<b>Video Bandwidth</b>	<b>Test Date:</b>	20-Jan-22
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz	<b>Test Engineer:</b>	J. Brunett
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz	<b>EUT:</b>	Allegion FE789W(C)
				<b>Meas. Distance:</b>	Conducted

Transmitter Spurious in Restricted Bands														FCC/IC	
	Mode	Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass		
#		Start MHz	Stop MHz	Pk dBm	Qpk/Avg dBm	Gain dBi	dB	Factor dB	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Qpk/Avg dBuV/m	Limit Qpk/Avg dBuV/m	dB	Comments	
R1	Fundamental	Restricted Band Edge (Low Side)													
R2	802.11N(20)	2390.0	2390.0	-57.5	-67.7	2.0	0.0	0.5	39.7	74.0	30.1	54.0	23.9	max all - L,M,H channels	
R3	Fundamental	Restricted Band Edge (High Side)													
R4	802.11N(20)	2483.5	2483.5	-59.4	-66.7	2.0	0.0	0.5	37.8	74.0	31.1	54.0	22.9	max all - L,M,H channels	
R5															
R6	802.11N(20)	30	88	-89.2		2.0	6.0	0.5	14.0			40	26.0		
R7	802.11N(20)	88	216	-89.0		2.0	6.0	0.5	14.2			43	28.8		
R8	802.11N(20)	216	1000	-85.1		2.0	6.0	0.5	18.1			46	27.9		
R9	802.11N(20)	4023.9	4068.6	-39.1	-59.3	2.0	0.0	0.5	58.1	74.0	38.5	54.0	15.5	LO / Spur	
R10	802.11N(20)	4063.9	4925.7	-75.3		2.0	0.0	0.5	21.9	74.0		54.0	32.1	max all - L,M,H channels	
R11	802.11N(20)	7313.2	7390.1	-75.5		2.0	0.0	0.5	21.7	74.0		54.0	32.3	max all - L,M,H channels	
R12	802.11N(20)	9029.1	9022.5	-77.9		2.0	0.0	0.5	19.3	74.0		54.0	34.7	max all - L,M,H channels	
R13	802.11N(20)	1000.0	4000.0	-73.5		2.0	0.0	0.5	23.7	74.0		54.0	30.3	max L,M,H channels or noise	
R14	802.11N(20)	4000.0	6000.0	-39.1	-59.3	2.0	0.0	0.5	58.1	74.0	38.5	54.0	15.5	max L,M,H channels or noise	
R15	802.11N(20)	6000.0	8400.0	-75.5		2.0	0.0	0.5	21.7	74.0		54.0	32.3	max L,M,H channels or noise	
R16	802.11N(20)	8400.0	12500.0	-77.9		2.0	0.0	0.5	19.3	74.0		54.0	34.7	max L,M,H channels or noise	
R17	802.11N(20)	12500.0	26000.0	-71.0		2.0	0.0	0.5	26.2	74.0		54.0	27.8	max L,M,H channels or noise	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	

\* Conducted measurements were made in line with DTS guidance 558074 D01 v5 r02 sections 8.5, 8.6, 8.7 / ANSI C63.10 11.10, 11.11, 11.12

\*\* Measured according to ANSI C63.10-2013 section 6.10.5.2

\*\*\* Ground Reflection Factor as described in ANSI C63.10-2013 section 11.12.2.2 (c)

\*\*\* Computed according to ANSI C63.10-2013 section 11.12.2.2 (e)

Table 8(e): Transmit Chain Spurious Emissions.

<b>Frequency Range</b>	<b>Det</b>	<b>IF Bandwidth</b>	<b>Video Bandwidth</b>	<b>Test Date:</b>	24-Feb-22
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz	<b>Test Engineer:</b>	J. Brunett
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz	<b>EUT:</b>	Allegion FE789W(C)
				<b>Meas. Distance:</b>	3 m, Radiated

Simultaneous Transmitter - Inter-modulation Measurements															FCC/IC
#	Mode	Frequency		OATS Table		Test Antenna				Electric Field @ 3m				Pass	Comments
		Start MHz	Stop MHz	Ht m	Angle deg	QN	Pol H/V	Ka dBm	Kg dBm	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Avg dBuV/m	Limit Avg dBuV/m	dB	
R1	Intermod - Restricted Band (Low Side / High Side)														
R2	802.11b + BLE	2369.2	2369.2	1.5	.0	HQR1TO18S01	H/V	32.0	-0.3	59.3	74.0	48.7	54.0	5.3	L,M,H channels, both
R3	802.11b + BLE	2502.0	2502.0	1.5	.0	HQR1TO18S01	H/V	33.0	-0.3	65.4	74.0	51.1	54.0	2.9	L,M,H channels, both
R4	Intermod - Restricted Band (Low Side / High Side)														
R5	802.11g + BLE	2369.2	2369.2	1.5	.0	HQR1TO18S01	H/V	32.0	-0.3	60.2	74.0	47.2	54.0	6.8	L,M,H channels, both
R6	802.11g + BLE	2502.0	2502.0	1.5	.0	HQR1TO18S01	H/V	33.0	-0.3	64.3	74.0	50.3	54.0	3.7	L,M,H channels, both
R7	Intermod - Restricted Band (Low Side / High Side)														
R8	802.11n + BLE	2369.2	2369.2	1.5	.0	HQR1TO18S01	H/V	32.0	-0.3	57.1	74.0	46.9	54.0	7.1	L,M,H channels, both
R9	802.11n + BLE	2502.0	2502.0	1.5	.0	HQR1TO18S01	H/V	33.0	-0.3	64.0	74.0	50.1	54.0	3.9	L,M,H channels, both
R10															
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	

### 4.3.2 Relative Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions relative to the fundamental in a 100 kHz receiver bandwidth (at the nominal voltage and temperature) are provided in Figure 9 below.

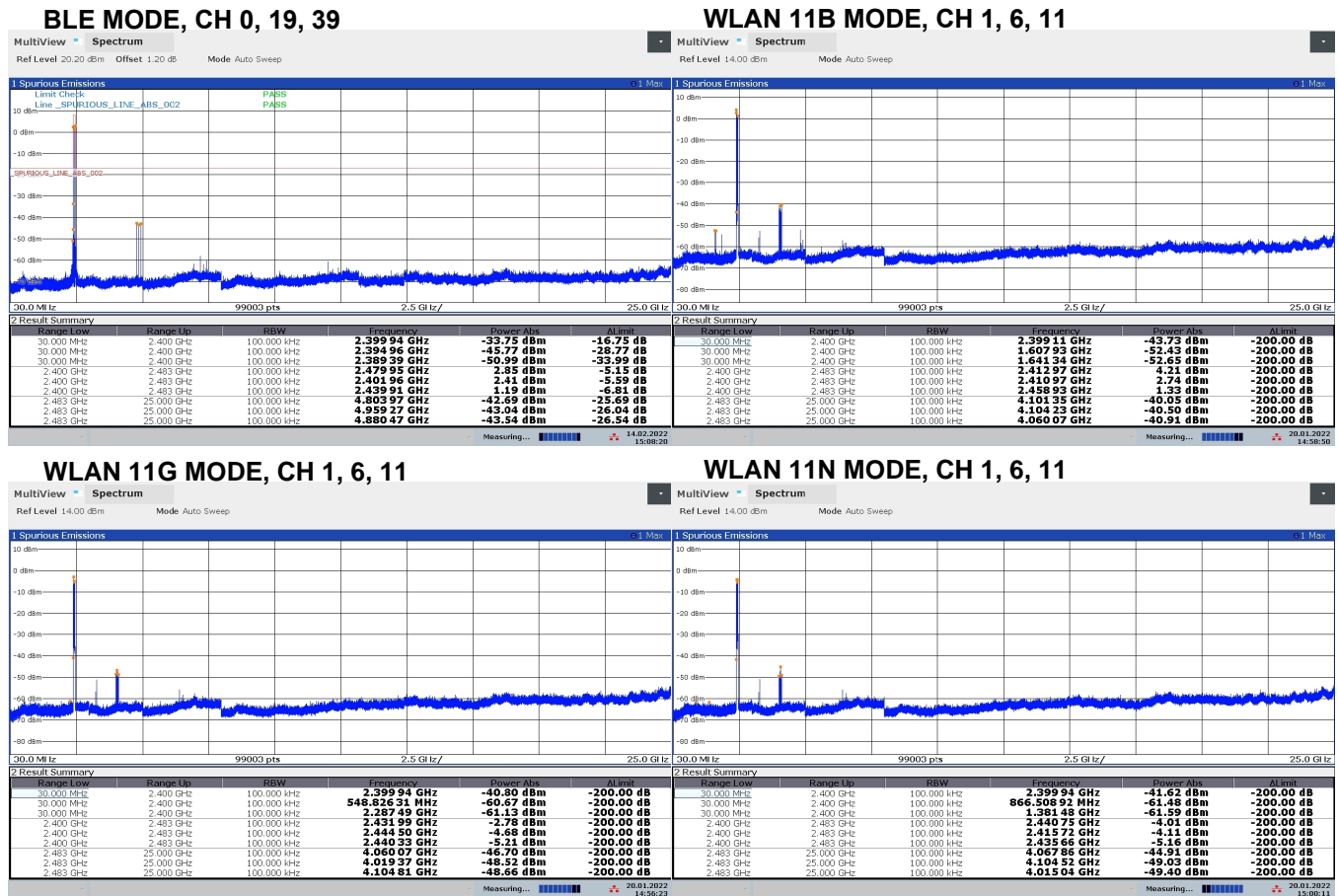


Figure 9: Conducted Transmitter Emissions Measured.

#### **4.3.3 Radiated Digital Spurious**

The results for the measurement of digital spurious emissions are not reported herein as all digital emissions were greater than 20 dB below the regulatory limit. Radiation from digital components was measured to 1 GHz, or to five times the maximum digital component operating frequency, whichever is greater.



## 5 Measurement Uncertainty and Accreditation Documents

The maximum values of measurement uncertainty for the laboratory test equipment and facilities associated with each test are given in the table below. This uncertainty is computed for a 95.45% confidence level based on a coverage factor of  $k = 2$ .

Table 9: Measurement Uncertainty.

Measured Parameter	Measurement Uncertainty <sup>†</sup>
Radio Frequency	$\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS - 1))/2 + 1 \text{ Hz})$
Conducted Emm. Amplitude	$\pm 1.9 \text{ dB}$
Radiated Emm. Amplitude ( $f < 30 \text{ MHz}$ )	$\pm 3.1 \text{ dB}$
Radiated Emm. Amplitude (30 – 200 MHz)	$\pm 4.0 \text{ dB}$
Radiated Emm. Amplitude (200 – 1000 MHz)	$\pm 5.2 \text{ dB}$
Radiated Emm. Amplitude ( $f > 1000 \text{ MHz}$ )	$\pm 3.7 \text{ dB}$

<sup>†</sup>Ref: CISPR 16-4-2:2011+A1:2014



Figure 10: Accreditation Documents