Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
Tel: 888-847-8027

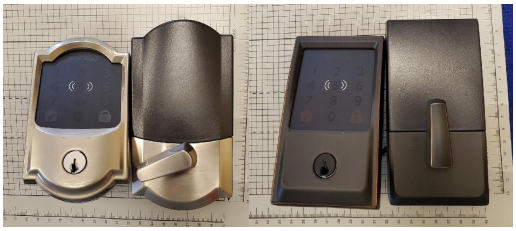
JACK1-WR2117A
Issued: **July 1, 2021**

DTS Test Report

regarding

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

for



BE499WB

Category: Electronic Door Lock

Judgments:
FCC 15.247, ISED RSS-247v2 Compliant
Testing Completed: June 31, 2021

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Allegion, PLC

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Date of Issue: July 1, 2021

Revision History

Rev. No.	Date	Details	Revised By
r0	July 1, 2021	Initial Release.	J. Brunett
r1	July 12, 2021	Correct plots and data.	J. Brunett
r2	July 19, 2021	Update KDB references.	J. Brunett

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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 August 2031.

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 laboratories scope of accreditation.

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

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-2021
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2023
Pk Pwr Telecom	Anritsu / MT8870A	6201282278	ANMT8870A	AHD / Jul-2021
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Oct-2021
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jul-2022
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2021
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2021
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2021
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD / Jul-2021

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 BE499WB 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 15 x 8 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, BLE/Zigbee, and NFC interfaces. Table 3 outlines provider declared EUT specifications.

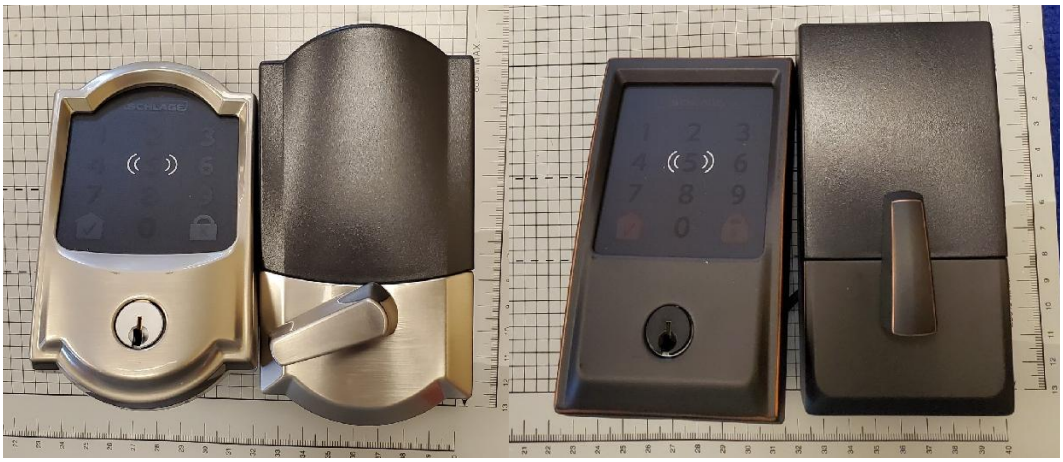


Figure 1: Photos of EUT.

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:	2412 – 2462 MHz
Antenna Dimension:	Integral
Antenna Type:	Trace
Antenna Gain:	2.2 dBi (meas.)
Number of Channels:	11(WLAN)
Channel Spacing:	5 MHz(WLAN)
Alignment Range:	Not Declared
Type of Modulation:	GFSK, OFDM
United States	
FCC ID Number:	XPB-JACKALOPE
Classification:	DTS
Canada	
IC Number:	8053B-JACKALOPE
Classification:	Spread Spectrum (24002483.5 MHz)

3.1.1 EUT Configuration

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

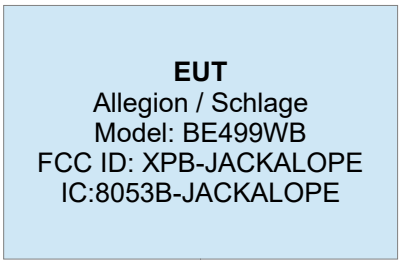


Figure 2: EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT is capable of operating in 802.11 b, g, and n(20) SISO 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 continuous transmission (> 98% on-time) and measured in line with DTS guidelines.

3.1.3 Variants

There is only a single version of the EUT.

3.1.4 Test Samples

Four samples of the EUT were provided for emissions testing, two normal radiated samples and two samples with u.fl. connectors populated to allow for conducted RF port measurements. The EUT can employ two different escutcheon faceplates, both of which are tested along with the EUT.

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 (1). All products manufactured will be set with WLAN power setting level no greater than level (1).

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 also employs an NFC transceiver (which is addressed in detail in a separate test report) and a pre-certified BLE+Zigbee module integrated into the product (FCC ID: QOQMGM12P3 IC: 5123A-MGM12P3). Inter-modulation and co-location concerns relating to both of these other radios when operating simultaneously with this

radio are addressed herein. The EUT is also designed to accommodate an alternate RF SAW filter (to mitigate component shortages). Both filters have been fully tested herein and worst case emissions are reported for both. No significant difference between the two filters was observed.

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.

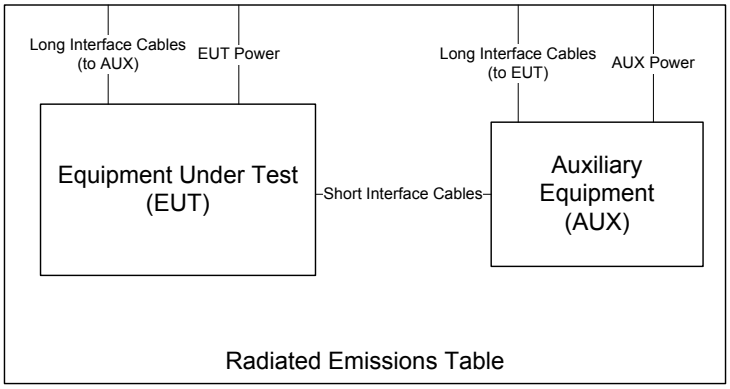


Figure 3: Radiated Emissions Diagram of the EUT.

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^o 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 4×5 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 dBμV/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

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

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 50Ω 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.

Power supply variation testing was not performed for this device.

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.

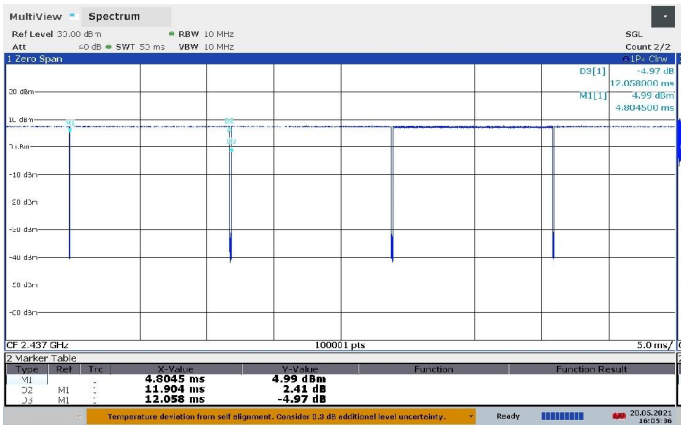
Table 4: Pulsed Emission Characteristics (Duty Cycle).

Test Date: 20-May-21
Test Engineer: Joseph Brunett
EUT Allegion BE499WB
Meas. Distance: Conducted

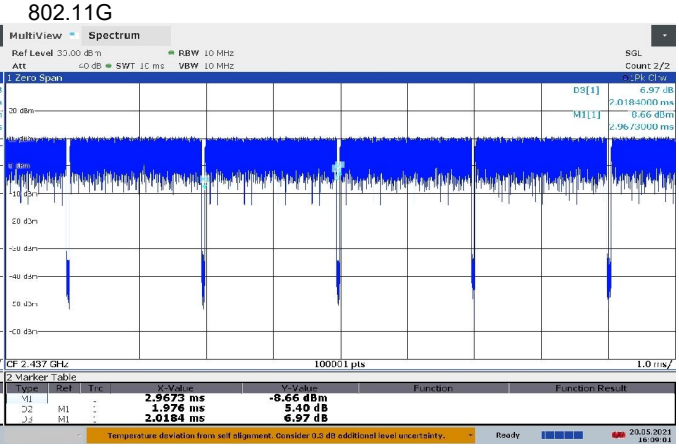
	Test Mode Pulsed Operation / Average Measurement Duty Cycle							
#	Mode	Data Rate Mbps	Voltage V	Oper. Freq MHz	Pulse Length	Pulse Period	Duty Cycle %	Power Duty Correction dB
R1	802.11b	11.0	6.0	2437.0	11.9040	12.0580	99	-
R2	802.11g	54.0	6.0	2437.0	1.9760	2.0184	98	-
R3	802.11n(20)	65.0	6.0	2437.0	1.8440	1.8864	98	-
#	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.

802.11B



802.11G



802.11N(20)

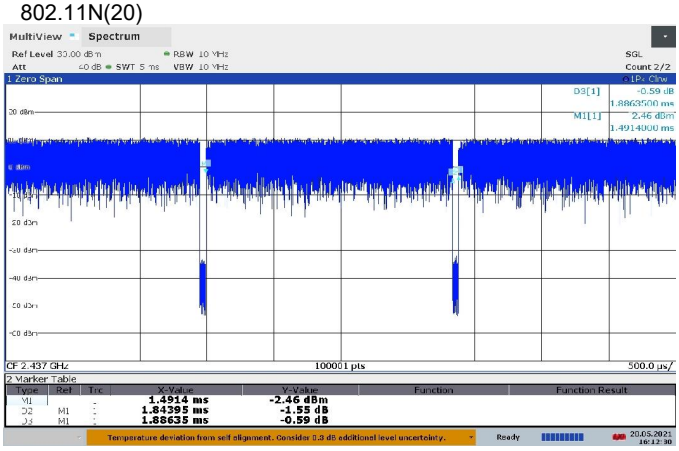


Figure 6: Pulsed Emission Characteristics (Duty Cycle).

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: 12-Jul-21
Test Engineer: Joseph Brunett
EUT Allegion BE499WB
Meas. Distance: Conducted

#	Transmit Mode	Data Rate (Mbps)	Voltage (V)	Occupied Bandwidth: Oper. Freq (MHz)	6 dB BW (MHz)	6 dB BW Limit (MHz)	99% OBW (MHz)	Pass/Fail
R1	802.11b	11.0	6.0	2412.0	9.82	0.50	14.46	Pass
R2				2437.0	9.22	0.50	14.61	Pass
R3				2462.0	9.84	0.50	14.54	Pass
R4	802.11g	54.0	6.0	2412.0	16.39	0.50	16.66	Pass
R5				2437.0	16.37	0.50	17.47	Pass
R6				2462.0	15.79	0.50	16.67	Pass
R7	802.11n(20)	65.0	6.0	2412.0	16.97	0.50	17.91	Pass
R8				2437.0	17.68	0.50	18.47	Pass
R9				2462.0	16.97	0.50	18.04	Pass
#	C1	C2	C3	C4	C5	C6	C7	C8

802.11B

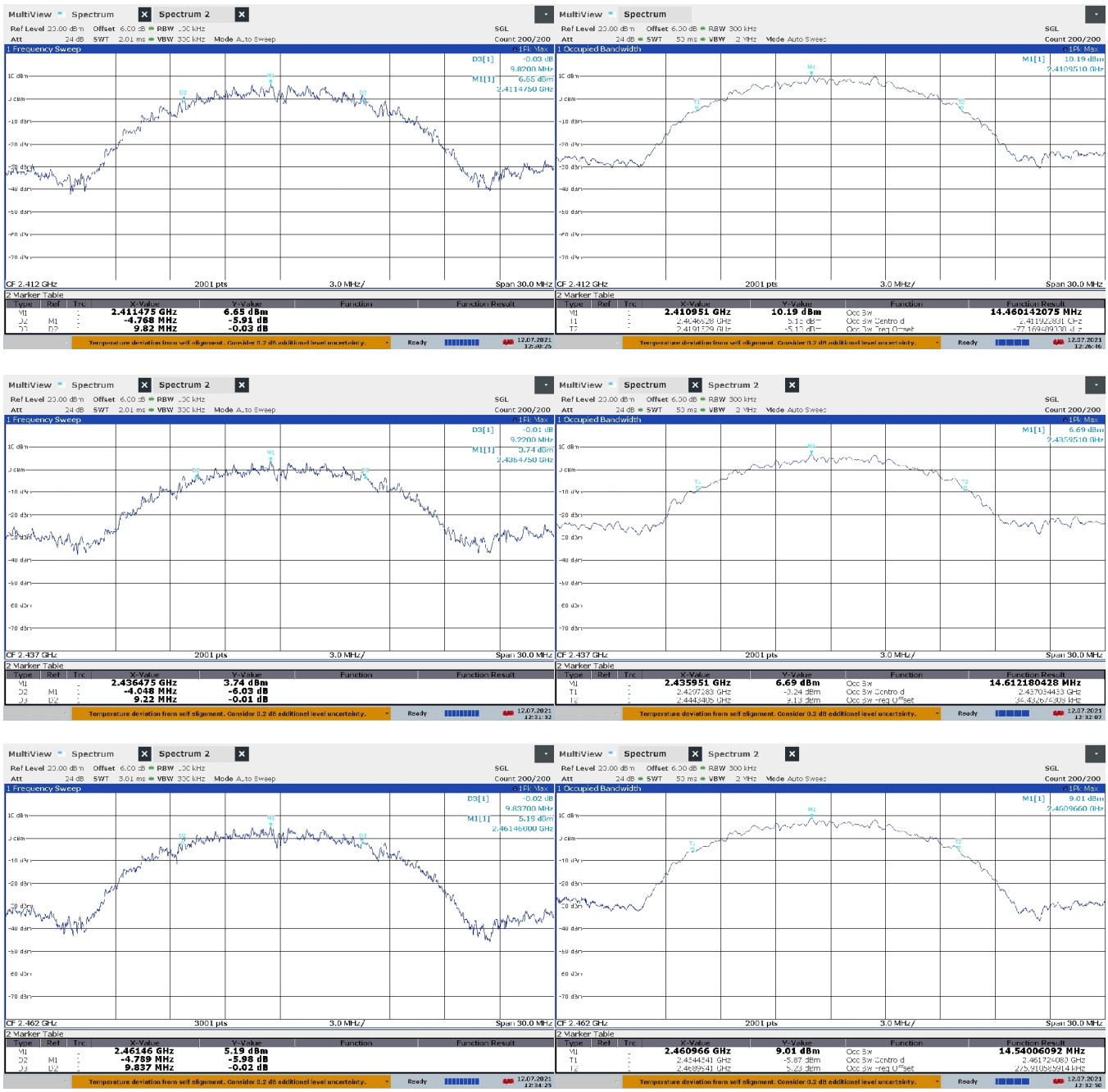


Figure 7(a): Intentional Emission Bandwidth.

802.11G

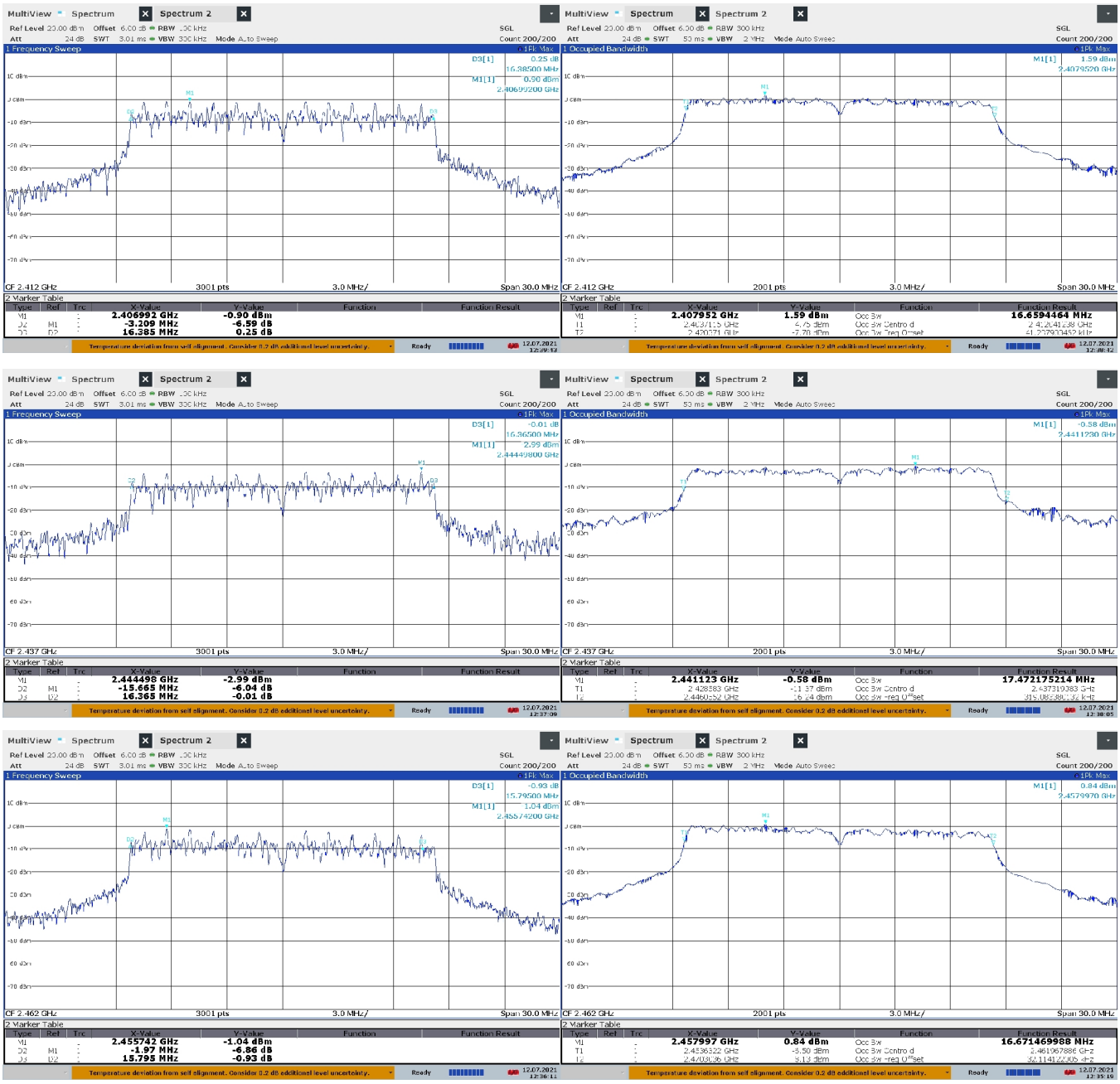


Figure 7(b): Intentional Emission Bandwidth.

802.11N

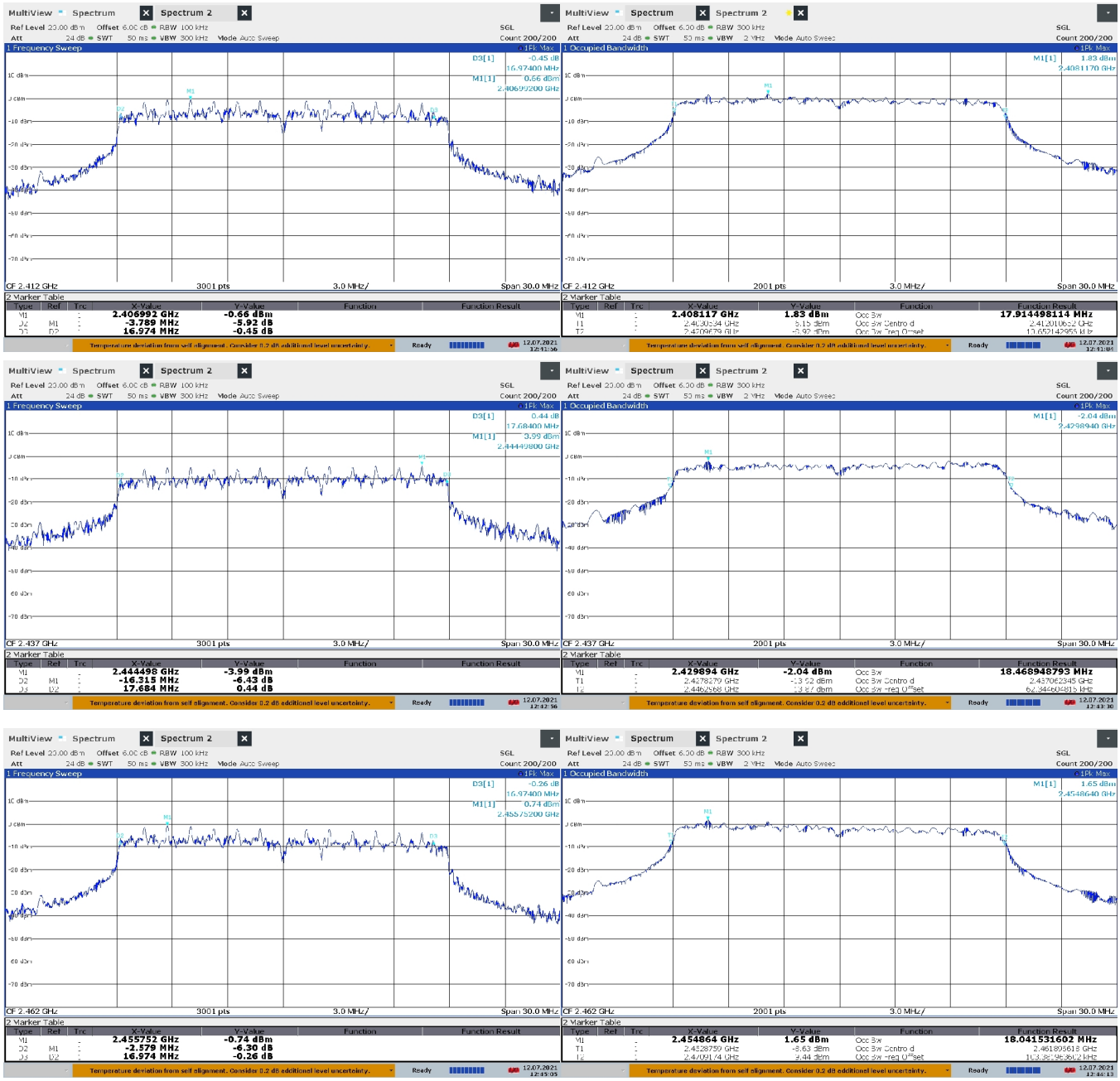


Figure 7(c): Intentional Emission Bandwidth.

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: 23-Apr-21
Test Engineer: Joseph Brunett
EUT: Allegion BE499WB
Meas. Distance: Conducted

	Fundamental Power										
#	Mode	Channel	Freq. MHz	Pout (Pk)** dBm	Duty dB	Pout + Duty dBm	Ant Gain*** dBi	EIRP (Pk) dBm	EIRP (Avg) Limit dBm	Pass dB	Comments
R4	802.11B	1	2412.0	16.6		16.6	2.2	18.8	36.0	17.3	
R5		6	2437.0	14.6		14.6	2.2	16.8	36.0	19.3	
R6		11	2462.0	17.3		17.3	2.2	19.5	36.0	16.6	
R7	802.11G	1	2412.0	18.1		18.1	2.2	20.3	36.0	15.8	
R8		6	2437.0	17.9		17.9	2.2	20.1	36.0	16.0	
R9		11	2462.0	17.7		17.7	2.2	19.9	36.0	16.2	
R10	802.11N(20)	1	2412.0	17.7		17.7	2.2	19.9	36.0	16.2	
R11		6	2437.0	18.2		18.2	2.2	20.4	36.0	**15.7**	
R12		11	2462.0	17.7		17.7	2.2	19.9	36.0	16.2	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11

* Measured conducted from radio conducted sample. Avg Power measured per DTS Guidance 558074 D01 v5 r02 Section 8.3.2.2 / ANSI C63.10 11.9.2.2 (AVGSA-1)
** Measured conducted from radio conducted sample. Pk Power measured per DTS Guidance 558074 D01 v5 r02 Section 8.3.1.3 / ANSI C63.10 11.9.1.3 (PKPM1)
*** Worst Case 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.

Frequency Range	**Detector**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	12-Jul-21
2400-2483.5	Pk	3 kHz	10 kHz	**Test Engineer:**	Joseph Brunett
				EUT:	Allegion BE499WB
				Meas. Distance:	Conducted

3kHz Power Spectral Density							
#	Mode	Channel	Frequency (MHz)	Ant. Used	PSDcond (meas)* (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass By (dB)
R1	802.11b	1	2412.0	Cond.	-12.2	8.00	20.2
R2		6	2437.0	Cond.	-13.7	8.00	21.7
R3		11	2462.0	Cond.	-11.9	8.00	**19.9**
R4	802.11g	1	2412.0	Cond.	-16.4	8.00	24.4
R5		6	2437.0	Cond.	-14.7	8.00	22.7
R6		11	2462.0	Cond.	-17.7	8.00	25.7
R7	802.11n(20)	1	2412.0	Cond.	-16.1	8.00	24.1
R8		6	2437.0	Cond.	-15.3	8.00	23.3
R9		11	2462.0	Cond.	-18.3	8.00	26.3
#	C1	C2	C3	C4	C5	C6	C7

* PSD measured conducted out the EUT antenna port following DTS guidance 558074 D01 v5 r02 PKPSD procedure.

802.11B 802.11G

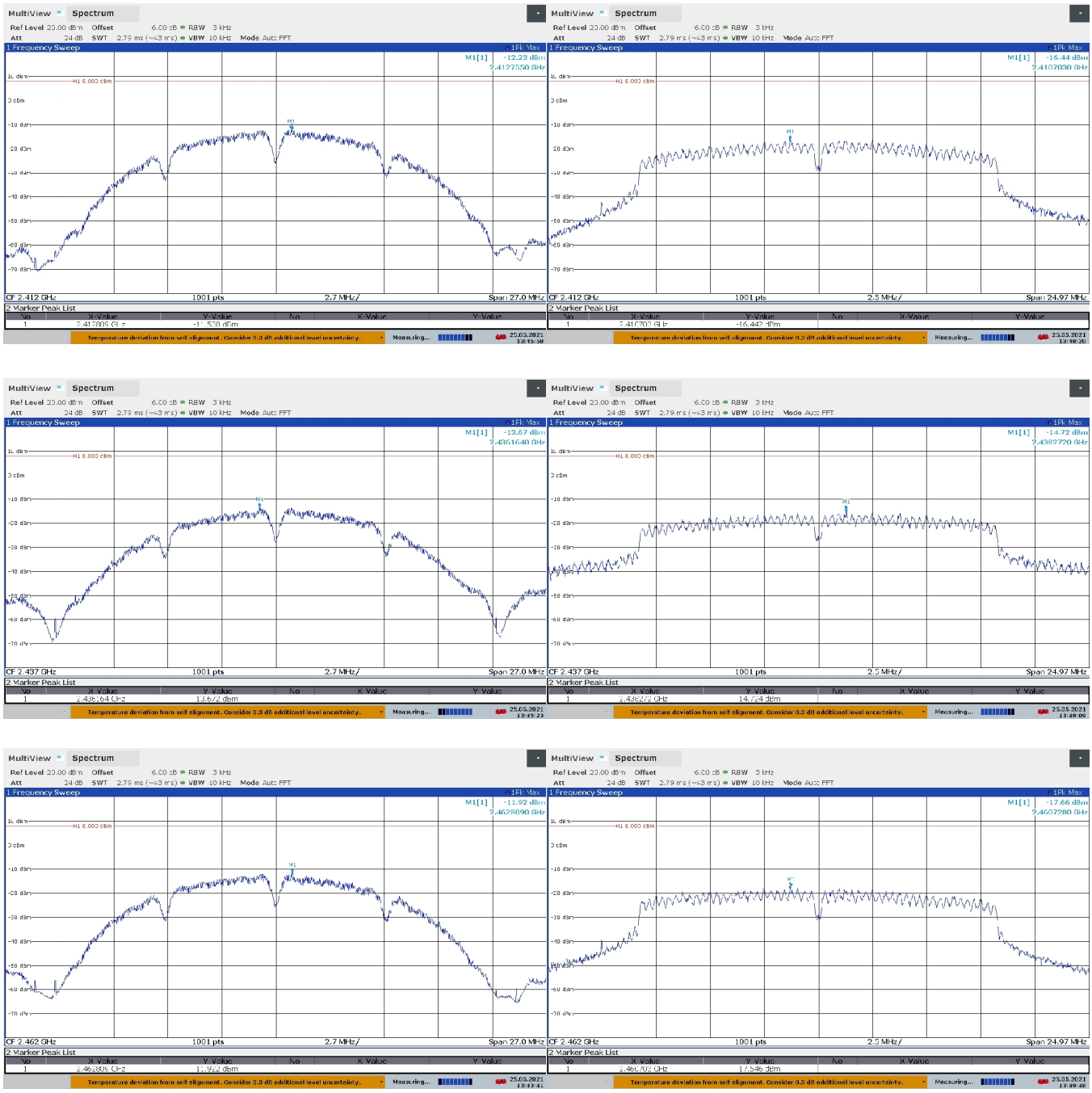
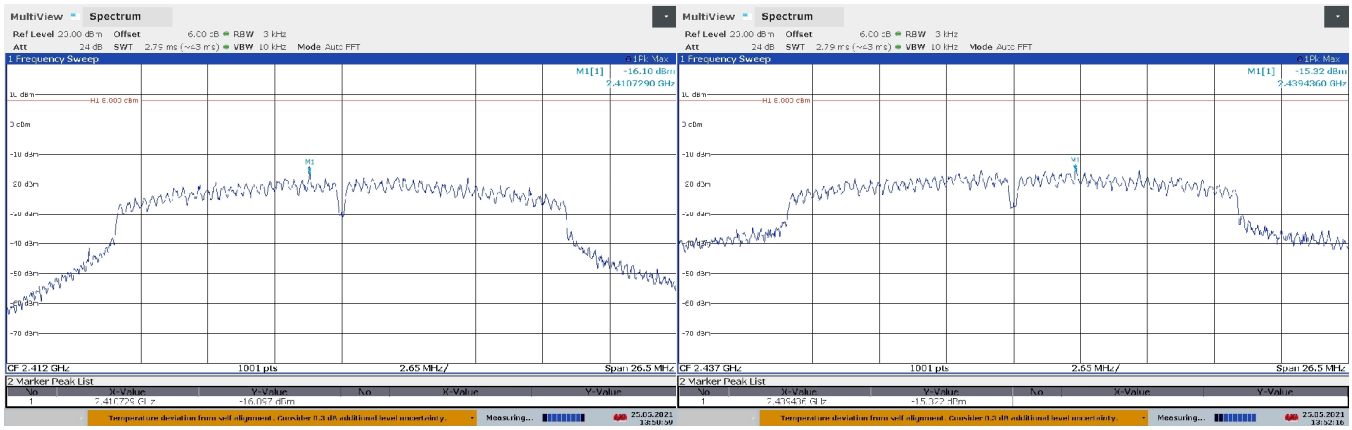


Figure 8(a): Power Spectral Density Plots.

802.11N



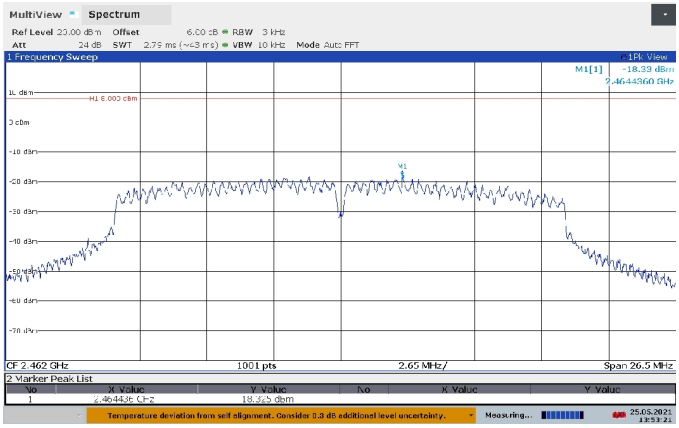


Figure 8(b): Power Spectral Density Plots.

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		
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz	**Test Date:**	24-May-21
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz	**Test Engineer:**	J. Brunett
				EUT:	Allegion BE499WB
				Meas. Distance:	Conducted

Transmitter Spurious in Restricted Bands FCC/IC

		Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass	
	Mode	Start	Stop	Pk	Qpk/Avg	Gain		Factor	Meas. Pk	Limit Pk	Meas. Qpk/Avg	Limit Qpk/Avg		
#		MHz	MHz	dBm	dBm	dBi	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	Comments
R1	Fundamental Restricted Band Edge (Low Side)													
R2	802.11B	2390.0	2390.0	-42.4	-52.1	2.2	0.0	0.0	55.0	74.0	45.4	54.0	8.6	max all - L,M,H channels
R3	Fundamental Restricted Band Edge (High Side)													
R4	802.11B	2483.5	2483.5	-39.3	-49.1	2.2	0.0	0.0	58.1	74.0	48.4	54.0	5.6	max all - L,M,H channels
R5														
R6	802.11B	30	88	-89.2		2.2	6.0	0.0	14.2			40	25.8	
R7	802.11B	88	216	-89.0		2.2	6.0	0.0	14.4			43	28.6	
R8	802.11B	216	1000	-85.1		2.2	6.0	0.0	18.3			46	27.7	
R9	802.11B	4019.2	4019.2	-43.9	-46.9	2.2	0.0	0.0	53.5	74.0	50.6	54.0	**3.4**	LO / Spur
R10	802.11B	4923.7	4923.7	-54.2	-60.2	2.2	0.0	0.0	43.2	74.0	37.3	54.0	16.7	max all - L,M,H channels
R11	802.11B	7387.1	7387.1	-54.2	-60.2	2.2	0.0	0.0	43.2	74.0	37.3	54.0	16.7	max all - L,M,H channels
R12	802.11B	9028.1	9028.1	-54.7	-60.7	2.2	0.0	0.0	42.7	74.0	36.7	54.0	17.3	max all - L,M,H channels
R13	802.11B	1000.0	4000.0	-60.3	-53.4		0.0	0.0	34.9	74.0	41.9	54.0	12.1	max L,M,H channels or noise
R14	802.11B	4000.0	6000.0	-54.2	-60.2	2.2	0.0	0.0	43.2	74.0	37.3	54.0	16.7	max L,M,H channels or noise
R15	802.11B	6000.0	8400.0	-54.2	-60.2	2.2	0.0	0.0	43.2	74.0	37.3	54.0	16.7	max L,M,H channels or noise
R16	802.11B	8400.0	12500.0	-54.7	-60.7	2.2	0.0	0.0	42.7	74.0	36.7	54.0	17.3	max L,M,H channels or noise
R17	802.11B	12500.0	26000.0	-54.3	-64.3	2.2	0.0	0.0	43.1	74.0	33.2	54.0	20.8	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(b): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz

Test Date: 24-May-21
Test Engineer: J. Brunett
EUT: Allegion BE499WB
Meas. Distance: Conducted

Transmitter Spurious in Restricted Bands FCC/IC

	Mode	Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass	
		Start	Stop	Pk	Qpk/Avg	Gain		Factor	Meas. Pk	Limit Pk	Meas. Qpk/Avg	Limit Qpk/Avg		
#		MHz	MHz	dBm	dBm	dBi	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	Comments
R1	Fundamental Restricted Band Edge (Low Side)													
R2	802.11G	2390.0	2390.0	-40.3	-57.6	2.2	0.0	0.0	57.1	74.0	39.9	54.0	14.1	max all - L,M,H channels
R3	Fundamental Restricted Band Edge (High Side)													
R4	802.11G	2483.5	2483.5	-35.7	-54.5	2.2	0.0	0.0	61.7	74.0	43.0	54.0	11.0	max all - L,M,H channels
R5														
R6	802.11G	30	88	-88		2.2	6.0	0.0	15.4			40	24.6	
R7	802.11G	88	216	-89.2		2.2	6.0	0.0	14.2			43	28.8	
R8	802.11G	216	1000	-85.3		2.2	6.0	0.0	18.1			46	27.9	
R9	802.11G	4123.1	4123.1	-45.9	-49.1	2.2	0.0	0.0	51.5	74.0	48.4	54.0	**5.6**	LO / Spur
R10	802.11G	4945.8	4945.8	-60.9	-66.9	2.2	0.0	0.0	36.5	74.0	30.6	54.0	23.4	max all - L,M,H channels
R11	802.11G	7414.6	7414.6	-60.5	-66.5	2.2	0.0	0.0	36.9	74.0	31.0	54.0	23.0	max all - L,M,H channels
R12	802.11G	9064.6	9064.6	-58.6	-64.6	2.2	0.0	0.0	38.8	74.0	32.9	54.0	21.1	max all - L,M,H channels
R13	802.11G	1000.0	4000.0	-59.2	-54.9		0.0	0.0	36.0	74.0	40.4	54.0	13.6	max L,M,H channels or noise
R14	802.11G	4000.0	6000.0	-60.9	-66.9	2.2	0.0	0.0	36.5	74.0	30.6	54.0	23.4	max L,M,H channels or noise
R15	802.11G	6000.0	8400.0	-60.5	-66.5	2.2	0.0	0.0	36.9	74.0	31.0	54.0	23.0	max L,M,H channels or noise
R16	802.11G	8400.0	12500.0	-58.6	-64.6	2.2	0.0	0.0	38.8	74.0	32.9	54.0	21.1	max L,M,H channels or noise
R17	802.11G	12500.0	26000.0	-54.3	-64.3	2.2	0.0	0.0	43.1	74.0	33.2	54.0	20.8	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(c): Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz

Test Date: 24-May-21
Test Engineer: J. Brunett
EUT: Allegion BE499WB
Meas. Distance: Conducted

Transmitter Spurious in Restricted Bands FCC/IC

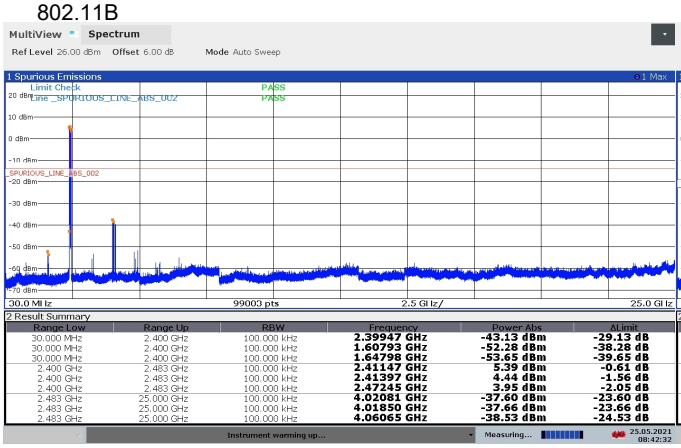
	Mode	Frequency		Output Power		Ant	***GR Factor	Avg Duty	Electric Field @ 3m				Pass	
		Start	Stop	Pk	Qpk/Avg	Gain		Factor	Meas. Pk	Limit Pk	Meas. Qpk/Avg	Limit Qpk/Avg		
#		MHz	MHz	dBm	dBm	dBi	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	Comments
R1	Fundamental Restricted Band Edge (Low Side)													
R2	802.11N(20)	2390.0	2390.0	-35.8	-58.0	2.2	0.0	0.0	61.6	74.0	39.5	54.0	12.4	max all - L,M,H channels
R3	Fundamental Restricted Band Edge (High Side)													
R4	802.11N(20)	2483.5	2483.5	-34.1	-54.5	2.2	0.0	0.0	63.3	74.0	43.0	54.0	10.7	max all - L,M,H channels
R5														
R6	802.11N(20)	30	88	-89.6		2.2	6.0	0.0	13.8			40	26.2	
R7	802.11N(20)	88	216	-88.8		2.2	6.0	0.0	14.6			43	28.4	
R8	802.11N(20)	216	1000	-85.1		2.2	6.0	0.0	18.3			46	27.7	
R9	802.11N(20)	4045.6	4045.6	-45.9	-48.1	2.2	0.0	0.0	51.5	74.0	49.4	54.0	**4.6**	LO / Spur
R10	802.11N(20)	4873.7	4873.7	-62.7	-68.7	2.2	0.0	0.0	34.7	74.0	28.8	54.0	25.2	max all - L,M,H channels
R11	802.11N(20)	7307.2	7307.2	-60.8	-66.8	2.2	0.0	0.0	36.6	74.0	30.7	54.0	23.3	max all - L,M,H channels
R12	802.11N(20)	9029.5	9029.5	-63.8	-69.8	2.2	0.0	0.0	33.6	74.0	27.7	54.0	26.3	max all - L,M,H channels
R13	802.11N(20)	1000.0	4000.0	-60.3	-56.4		0.0	0.0	34.9	74.0	38.9	54.0	15.1	max L,M,H channels or noise
R14	802.11N(20)	4000.0	6000.0	-62.7	-68.7	2.2	0.0	0.0	34.7	74.0	28.8	54.0	25.2	max L,M,H channels or noise
R15	802.11N(20)	6000.0	8400.0	-60.8	-66.8	2.2	0.0	0.0	36.6	74.0	30.7	54.0	23.3	max L,M,H channels or noise
R16	802.11N(20)	8400.0	12500.0	-63.8	-69.8	2.2	0.0	0.0	33.6	74.0	27.7	54.0	26.3	max L,M,H channels or noise
R17	802.11N(20)	12500.0	26000.0	-54.3	-64.3	2.2	0.0	0.0	43.1	74.0	33.2	54.0	20.8	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)

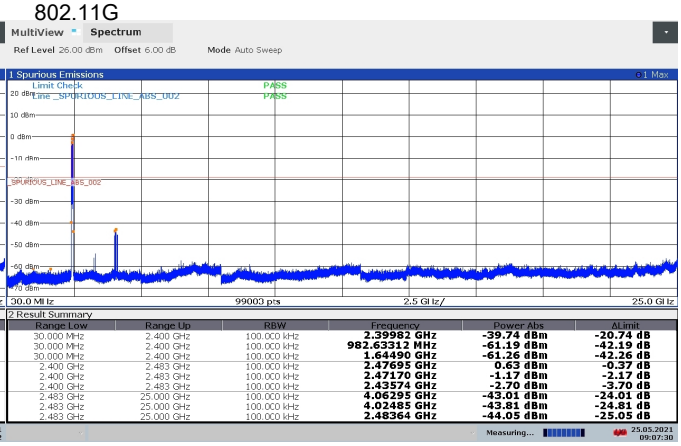
4.3.2 Relative Transmit Chain Spurious Emissions

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.

802.11B



802.11G



802.11N

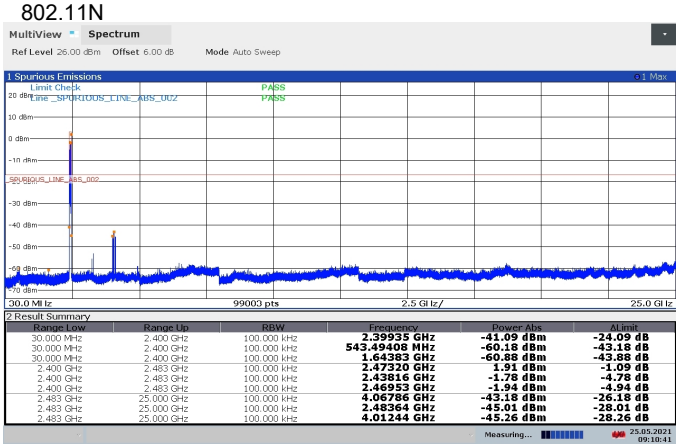


Figure 9: Conducted Transmitter Emissions Measured.

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†
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 ($30 - 200\,\text{MHz}$)	$\pm 4.0\,\text{dB}$
Radiated Emm. Amplitude ($200 - 1000\,\text{MHz}$)	$\pm 5.2\,\text{dB}$
Radiated Emm. Amplitude ($f > 1000\,\text{MHz}$)	$\pm 3.7\,\text{dB}$

†Ref: CISPR 16-4-2:2011+A1:2014


United States Department of Commerce
National Institute of Standards and Technology

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NVLAP LAB CODE: 200129-0

AHD (Amber Helm Development, L.C.)
Sister Lakes, MI

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2020-06-23 through 2021-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

Figure 10: Accreditation Documents