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AWLTKEY-WR2431TXA
Issued: **December 20, 2024**

UWB Test Report

regarding

USA: CFR Title 47, Part 15.519 (Emissions)
Canada: ISED RSS-220 i1+A1 (Emissions)

for

47723029

Category: UWB Transceiver

Judgments:
Aligns with FCC Part 15.519, ISED RSS-220
Testing Completed: November 21, 2024

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Allegion, PLC

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Date of Issue: December 20, 2024

Revision History

Rev. No.	Date	Details	Revised By
r0	December 20, 2024	Initial Release.	J. Nantz
r1	January 21, 2025	Clarify 100ms vs 2ms per manuf. spec.	J. Brunett
r2	February 14, 2025	Minor corrections.	J. Nantz
r3	March 5, 2025	Add normal op. duty detail.	J. Brunett
r4	April 11, 2025	Add GNSS spur plots.	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 January 2035.

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

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 1.8.0 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1.8.0 Test Site List.

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

1.9 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 1.9.0 . 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. All equipment is evaluated on a cycle no greater than 12 months following laboratory validation procedures and is calibrated following manufacturer recommended intervals.

Table 1.9.0 Equipment List.

Description	Manufacturer/Model	SN	Quality Num.	Cal/Ver By / Date Due
Spectrum Analyzer	R & S / FSV30	101660	RSFSV3001	RS / Apr-2025
EMI Receiver	R & S / ESW26	101313	RSESW2601	RS / Dec-2025
Spectrum Analyzer	R & S / FSW67	103233	RSFSW67	RS / Sept-2025
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Sept-2025
3.5-3.5MM Coax	Coax / Coax	001	CAB019-BLU	AHD / March-2025
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jul-2025
6dB Attenuator	Pasternack / PE7087-6	1	ATTEN01	AHD / On-Use
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2025
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2025
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2025
L-Band Horn	SA / NRL Std.	-1	HRNL01	AHD / On Use
C-Band Horn	SA / NRL Std.	-2	HRNC002	AHD / On Use
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD / On Use
Ka-Band Horn	JEF / NRL Std.	002	HRNKA002	AHD / On Use

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 47723029 for compliance to:

Country/Region/Manu.	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 15.519
Canada	ISED Canada	ISED RSS-220 i1+A1

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 C63.10:2020	"American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
WR-ITP0102RA	"AHD Internal Document - Radiated Emissions Test Method"
WR-ITP0101LC	"AHD Internal Document - Conducted Emissions Test Method"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The EUT is a key free access control module. The EUT is approximately 10 x 7 x 2 cm max. in dimension, and is depicted in Figure 3.1.0 . It is powered by 3.3 Vdc external battery power. This product is used as an access reader to enable key free door access. Table 3.1.0 outlines provider declared EUT specifications.

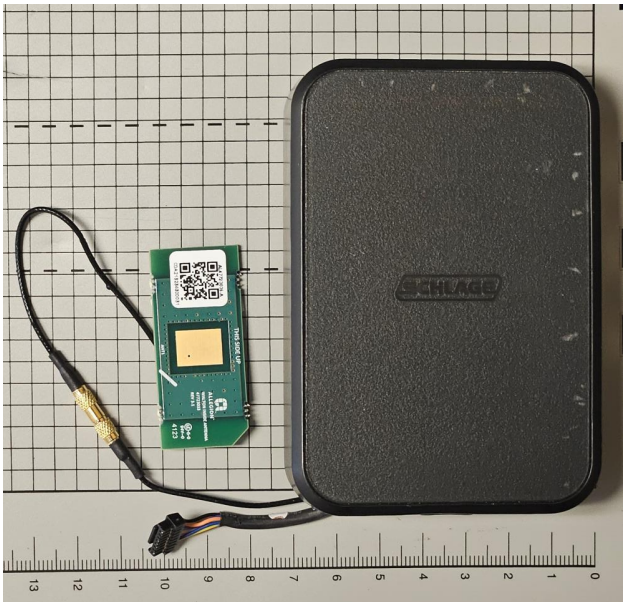


Figure 3.1.0 Photos of EUT.

Table 3.1.0 EUT Declarations.

General Declarations	
Equipment Type:	UWB Transceiver
Country of Origin:	USA
Nominal Supply:	3.3 Vdc
Oper. Temp Range:	Not Declared
Frequency Range:	6198 – 6779 and 7682 – 8268 MHz
Antenna Dimension:	2 cm
Antenna Type:	PCB Patch
Antenna Gain:	Integral
Number of Channels:	2
Channel Spacing:	1.5 GHz
Alignment Range:	Not Declared
Type of Modulation:	PPM

United States	
FCC ID Number:	XPB-SENSEPRO1
Classification:	UWB

Canada	
IC Number:	8053B-SENSEPRO1
Classification:	Ultra-Wideband (UWB) Device

3.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 3.1.1 .

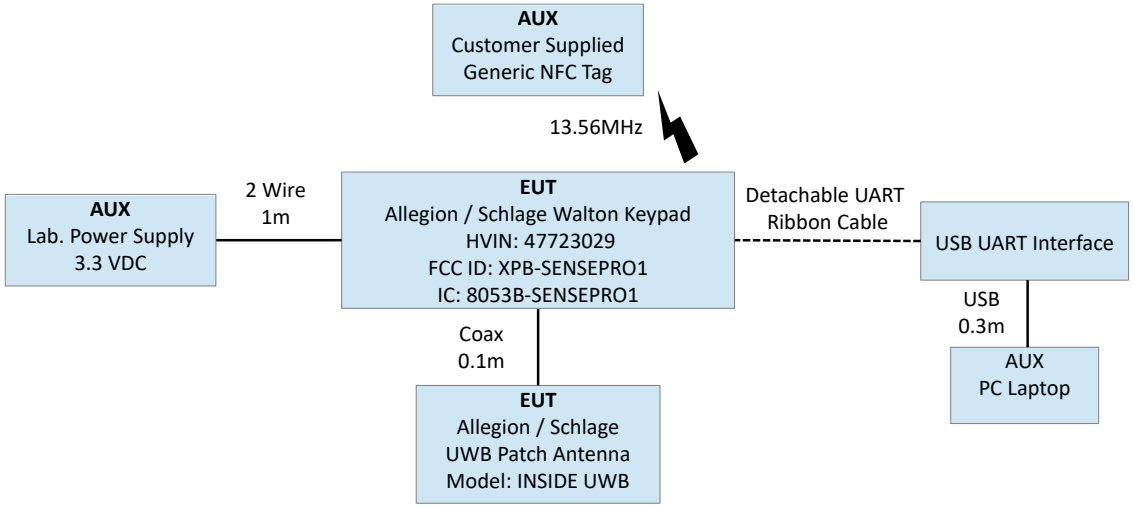


Figure 3.1.1 EUT Test Configuration Diagram.

3.1.2 Modes of Operation

This device operates as a UWB transceiver that conforms to the CCC/FiRa Consortium protocol and is used to determine distance to a paired mobile device via time of flight (ToF) information. The EUT first monitors for a paired device using BLE radio RSSI measurements (addressed in another test report). Once a distance threshold is reached the EUT transitions to UWB ranging to accurately measure proximity. Finally, UWB ranging will timeout or stop at a set distance threshold. The EUT includes a single onboard UWB radio with three PCB patch antennas: onboard ANT1 (capable of TX or RX), onboard ANT2 and off-board ANT3 (each only capable of UWB RX). ANT3 is intended to be integrated on the interior side of the door when completing a lockset assembly. This product is capable of operating on either of two UWB channels: Channel 5 (CF 6500 MHz) or Channel 9 (CF 8000 MHz) and two possible operating modes: SP0 operation (122us pulse every 192 ms in production) and SP3 (141us pulse every 192 ms in production). The EUT was placed into its maximum (worst case) transmission pulse length for each mode and channel and set for a 2ms ranging cycle to make testing easier.

3.1.3 Variants

There is only a single version of the EUT.

3.1.4 Test Samples

Two samples of the EUT were provided for testing: SN: DV3 and SN: KEY1. Both samples were capable of operating on either of two UWB channels: Channel 5 and 9, and two operating modes: SP0 and SP3. Channel selection and operating mode configuration was achieved via a PC serial UART interface that could be attached and then detached from the EUT during testing. The computer application software utilized was TeraTerm version 5.3 and the EUT application FW version tested was 00.25.944994.

3.1.5 Functional Exerciser

EUT functionality was verified by observation of transmitted signal.

3.1.6 Modifications Made

To meet the regulatory requirements the output power settings were limited as follows: Channel 5 SP0 mode = 54, SP3 mode = 40 and Channel 9 SP0 mode = 68, SP3 mode = 50. The manufacturer will implement these levels in firmware.

3.1.7 Production Intent

The EUT appears to be a production ready sample.

3.1.8 Declared Exemptions and Additional Product Notes

In addition to its UWB radio functionality, the EUT is also co-located with an onboard NFC radio (addressed in AHD Report No. AWLTKEY-WR2431TXC) and an onboard BLE radio (addressed in AHD Report No. AWLTKEY-WR2431TXB). The integral BLE + UWB + NFC radios are all capable of simultaneous transmission. Intermodulation products are evaluated in AHD Report No. AWLTKEY-WR2431TXB. Furthermore, the EUT may be co-located with the manufacturer's radio device placed on the interior side of the door (FCC ID: XPB-SENSEPRO2, IC: 8053B-SENSEPRO2), and is evaluated for multi-transmitter co-location with Spurious digital emissions in AHD Report No. AWLTKEY-WR2431TXD.

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 4.1.1 . 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.

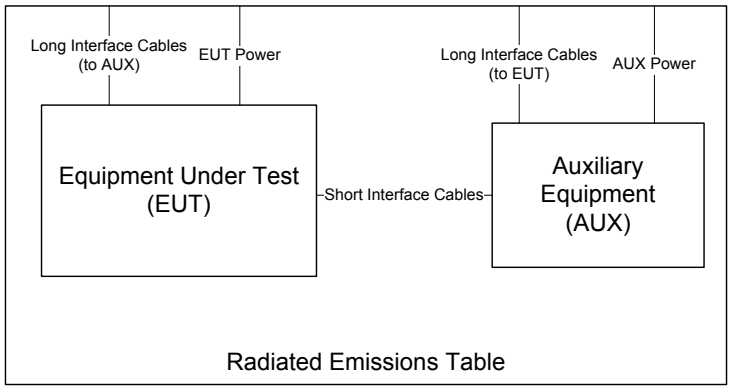


Figure 4.1.1 Radiated Emissions Diagram of the EUT.

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 regulation. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, 10cm diameter single-axis broadband probes meeting the requirements of ISED RSS-102.NS.MEAS are employed. Measurements are repeated and summed over three axes, and the entire frequency range is measured with and without the EUT transmitting.

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 4.1.1 .

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.

When microwave measurements are made at a range different than the regulatory distance or made at close-range to improve receiver sensitivity, the reading is corrected back to the regulatory distance. This is done using a 20 dB/decade field behavior as dictated by the test procedures. When measurements are made in the near-field, the near-field/far-field boundary (N/F) is reported. It is computed as

$$N/F = 2D^2/\lambda$$

where D is the maximum dimension of the transmitter or receive antenna, and λ is the wavelength at the measurement frequency. Typically for high frequency measurements the receive antenna is connected to test receiver / analyzer through an external mixer. In this case, cable loss, IF amplifier gain, and mixer conversion losses are corrected for in the data table, or directly in the analyzer.

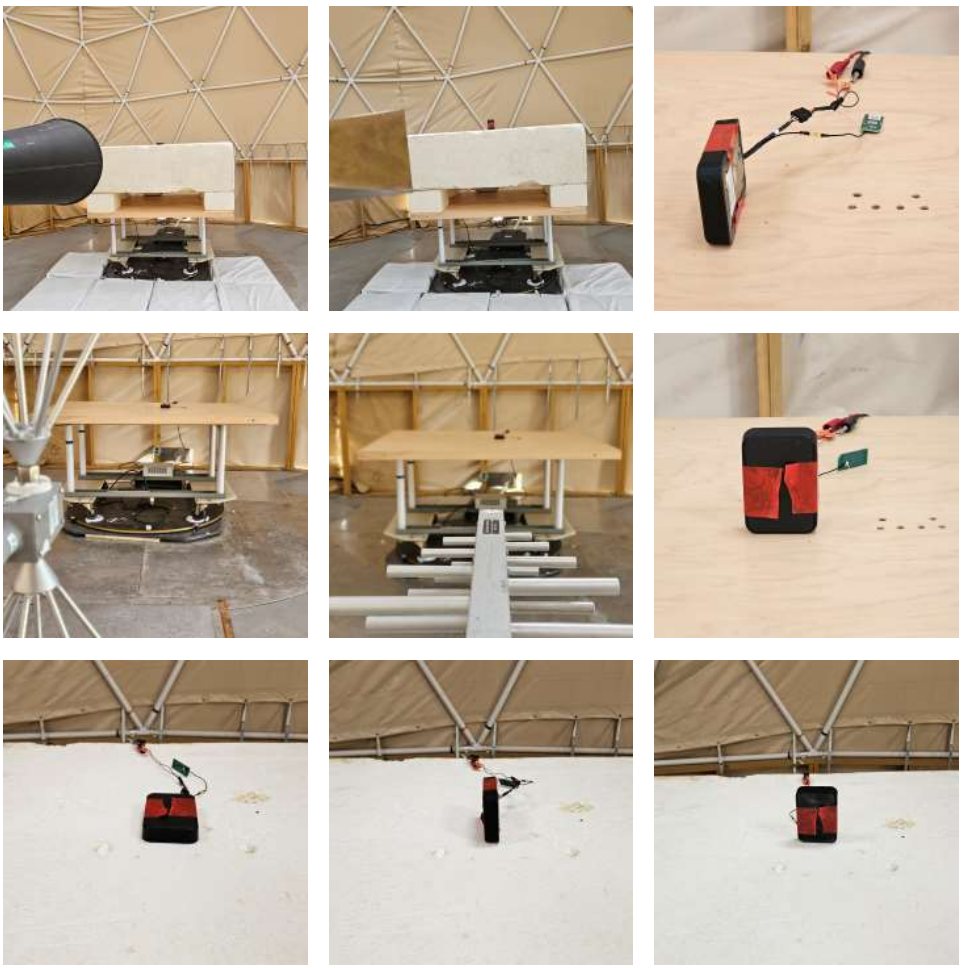


Figure 4.1.1 Radiated Emissions Test Setup Photograph(s).

4.1.2 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 ±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 Fundamental Emission Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 4.2.1 .

Table 4.2.1 Pulsed Emission Characteristics (Duty Cycle).

Frequency Range	**Det**	**IFBW**	**VBW**	**Test Date:**	27-Feb-24
f > 1 000 MHz	Pk	10 MHz	10 MHz	**Test Engineer:**	J. Nantz
				EUT	Allegion 47723029
				Meas. Distance:	60 cm

Pulsed Operation / Duty Cycle									
#	Transmit Mode	Plot/Figure	Voltage (V)	Oper. Freq (MHz)	Cycle Time (ms)	Pulse Length (ms)	Duty (%)	Notes	Exposure Duty Correction*** (dB)
1	SP0, test mode	4.2.1(i)	3.3	6500.0	2.000	0.122	6.11		12.1
2	SP3, test mode	4.2.1(i)	3.3	6500.0	2.000	0.141	7.04		11.5
3	SP0, test mode	4.2.1(ii)	3.3	8000.0	2.000	0.122	6.10		12.1
4	SP3, test mode	4.2.1(ii)	3.3	8000.0	2.000	0.141	7.04		11.5
5	Nominal Normal Op	4.2.1(iii)	3.3	8000.0	192.000	0.141	0.07		31.3
6		NOTE: In normal operating mode, the EUT is observed to turn off almost immediately after loss of paired connection.							

*** Worst-case Exposure duty cycle correction (due to burst-modulated carrier) computed as 10*Log(Pulse Length / Min Cycle-Time).

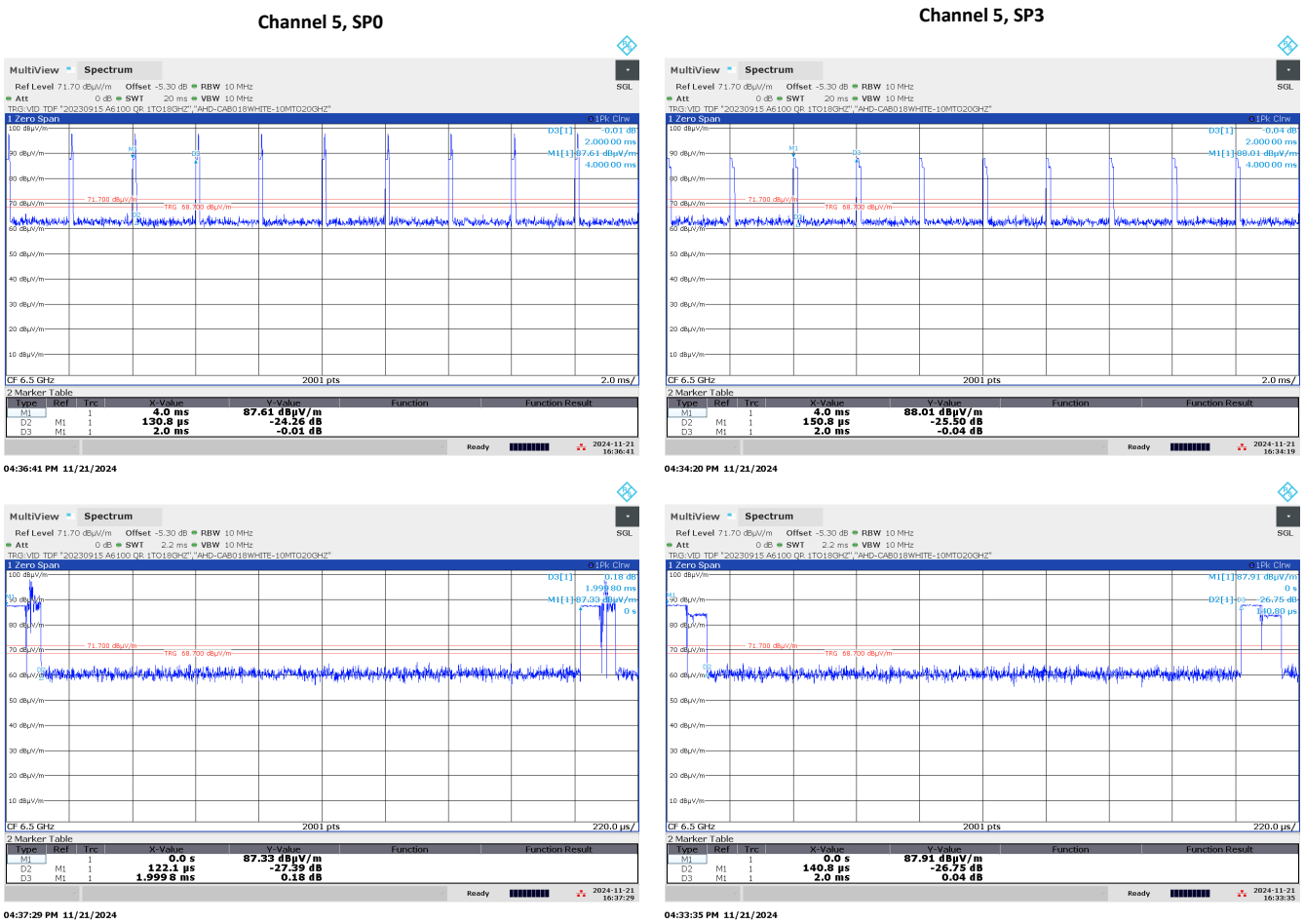
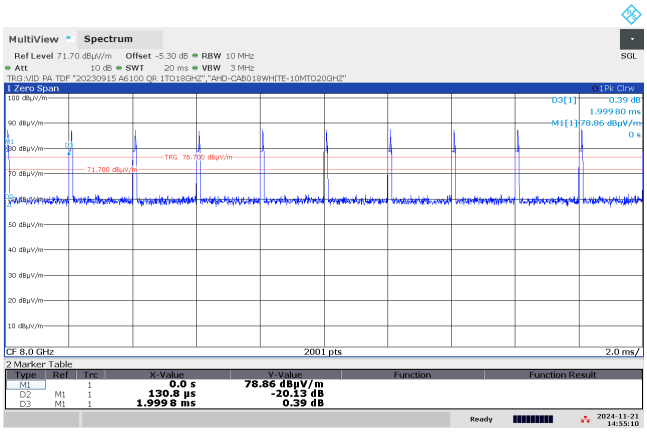


Figure 4.2.1 (i) Example Pulsed Emission Characteristics (Duty Cycle).

Channel 9, SP0



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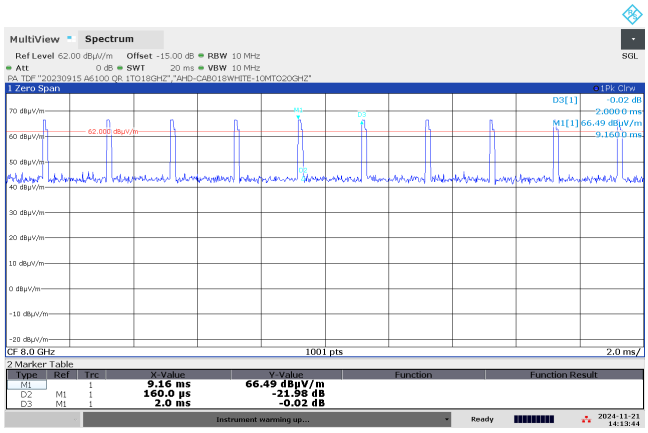
Channel 9, SP3



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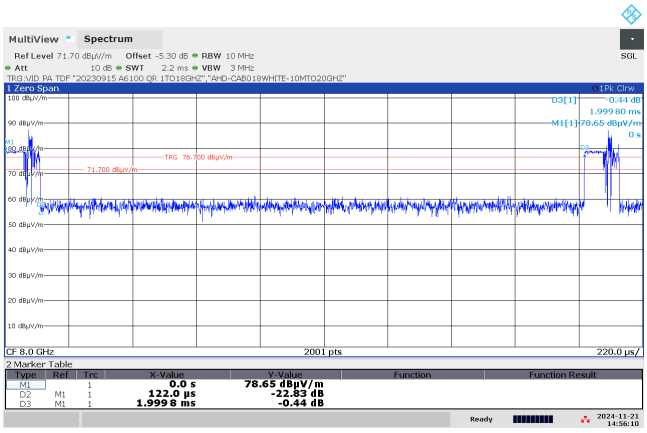

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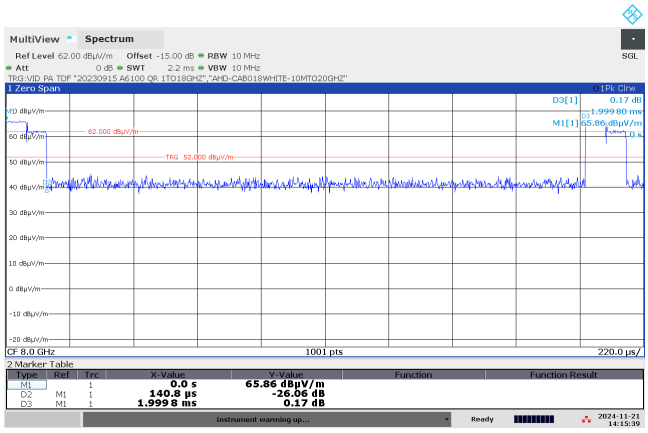

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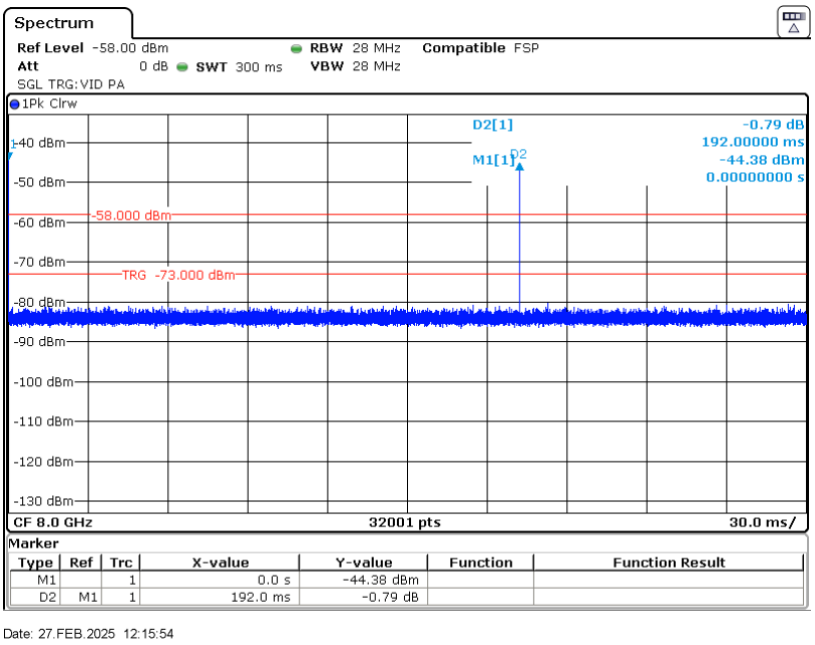
Figure 4.2.1 (ii) Example Pulsed Emission Characteristics (Duty Cycle).

During an active UWB ranging session between the EUT and a Phone, the UWB chipset employs to the CCC/FiRa Ranging Interval specification as computed from the CCC/FiRa required Default Time Hopping Sequence for a value of N = 2. The following plot demonstrates a typical N=2 ranging cycle transmission.



The following plot shows that the EUT UWB transmission stops almost immediately after a loss of connectivity. The loss of paired connectivity can result either from a loss of UWB pairing in the CCC/FiRa protocol, or because of a loss of BLE connection between the EUT and the Phone.

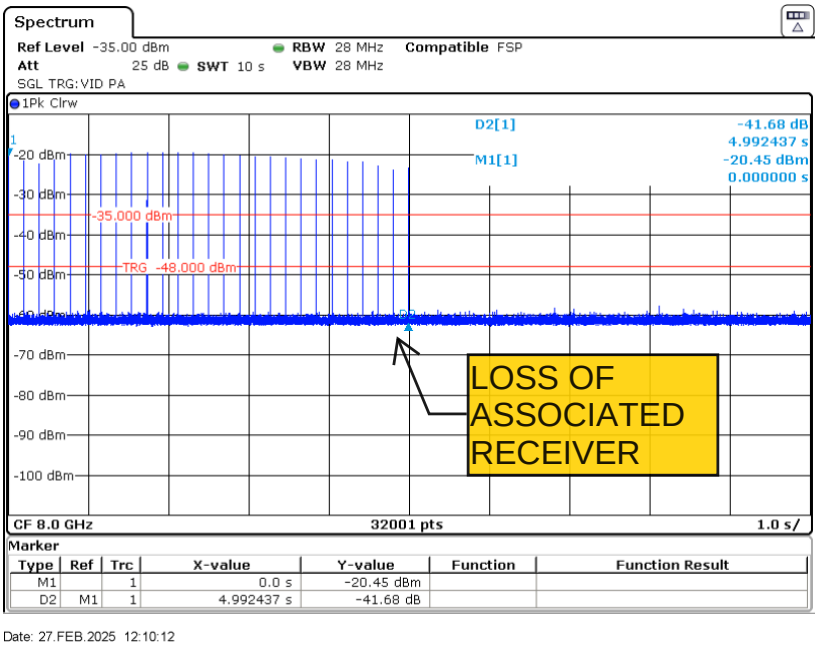


Figure 4.2.1 (iii) Example Pulsed Emission Characteristics (Duty Cycle).

4.2.2 Fundamental Emission Bandwidth

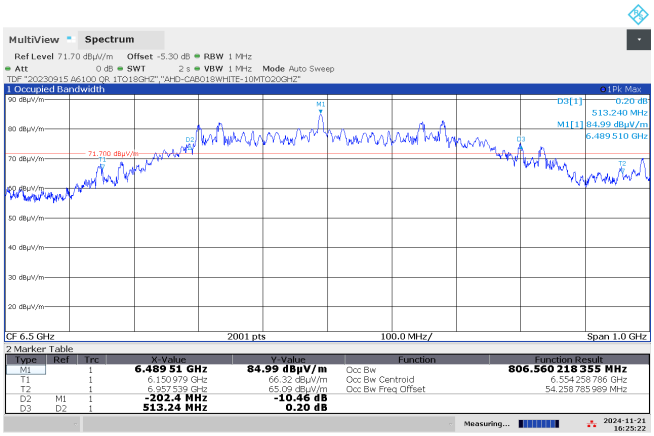
Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available frame length and minimum frame spacing. Radiated emissions are recorded following the test procedures listed in Section 2.1. The 20 dB EBW is measured as the max-held peak-detected signal when the IF bandwidth is greater than or equal to 1% of the receiver span. For complex modulations other than ASK and FSK, the 99% emission bandwidth per IC test procedures has a different result, and is also separately reported.The results of EBW testing are summarized in Table 4.2.2 . Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 4.2.2 .

Table 4.2.2 Intentional Emission Bandwidth.

Frequency Range	**Det**	**IFBW**	**VBW**	**Span**	**Test Date:**	26-Sep-24
f > 1 000 MHz	Pk	1 MHz	3 MHz	1 GHz	**Test Engineer:**	J. Nantz
					EUT	Allegion 47723029
					Meas. Distance:	60 cm

Occupied Bandwidth											
Transmit Mode	Voltage (V)	Oper. Freq (MHz)	99% OBW (MHz)	10 dB EBW (MHz)	10 dB EBW Limit (MHz)	fL (MHz)	fL Limit (MHz)	fH (MHz)	fH Limit (MHz)	fmax (MHz)	Pass/Fail
Normal PPM - SP0	3.3	6500.0	806.6	513.2	500.0	6287.1	3100.0	6800.4	10600.0	6489.5	Pass
Normal PPM - SP3	3.3	6500.0	722.7	613.2	500.0	6188.7	3100.0	6801.8	10600.0	6396.1	Pass
Normal PPM - SP0	3.3	8000.0	805.0	505.8	500.0	7793.6	3100.0	8299.4	10600.0	7986.5	Pass
Normal PPM - SP3	3.3	8000.0	719.2	603.9	500.0	7682.3	3100.0	8286.2	10600.0	7956.5	Pass

Channel 5, SP0



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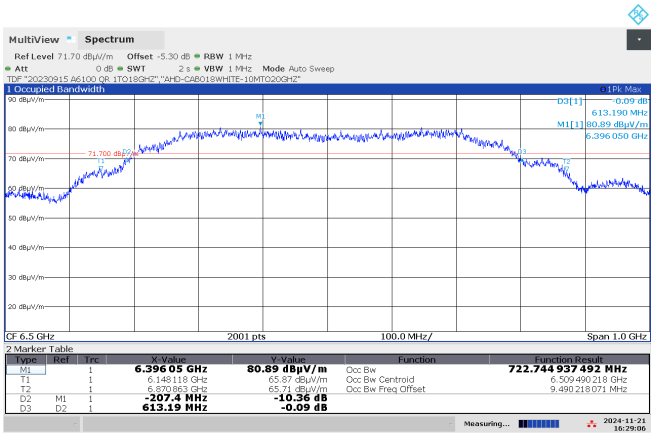
Channel 5, SP3



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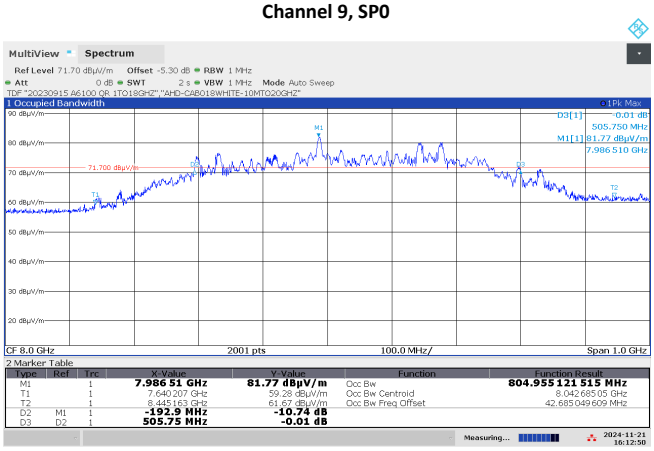
Channel 9, SP0



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Channel 9, SP3

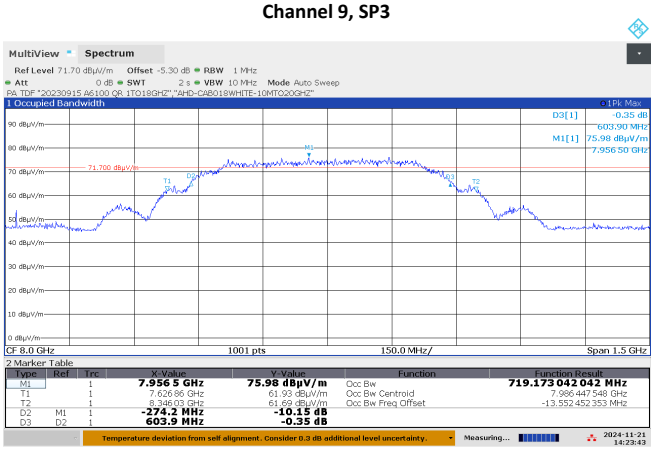

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Figure 4.2.2 Example Intentional Emission Bandwidth.

4.2.3 Fundamental Emission

Following the test procedures listed in Section 2.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured along all three axes, including when the EUT loop axes are aligned in the same axis as the test loop and aligned coplanar (in the same plane) with the test loop antenna. Table 4.2.3 details the results of these measurements.

Table 4.2.3 Fundamental Radiated Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
f > 1 000 MHz	Pk/RMS	1 MHz	3 MHz		

Test Date:	19-Nov-24
Test Engineer:	J. Nantz
EUT:	Allegion 47723029
Mode:	CM
Meas. Distance:	3m

	RX BW		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR		EIRP**						FCC/IC
	IFBW	VBW	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	Pk	RMS	MR	DR	N/F	CF	Pk	RMS	Pk	RMS	50 MHz Pk Lim	FCC RMS Lim.	ISED RMS Lim.	Pass	
#	(MHz)	(MHz)	MHz	MHz	Number	H/V	cm	dB/m	dB	dBuV/m		m	m	m	dB	dBuV/m		dBm		dBm	dBm	dBm	dB	Comments
1	**UWB CHANNEL 5, MOD INDEX 0, POWER SETTING 54**																							
2	- PEAK Power (Pk Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max-Held)																							
3	28	10.0	6488.0	6488.0	HQR1TO18S01	H/V	14.0	140.4	17.3			3.0	3.0	0.8	0.0	89.9								
4	50	50.0	6488.0	6488.0	HQR1TO18S01	H/V	14.0	140.4	17.3			3.0	3.0	0.8	0.0			-.3		.0			**0.3**	max all
5	- RMS Power (RMS Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max Held)																							
6	1	3.0	6488.0	6488.0	HQR1TO18S01	H/V	14.0	140.4	17.3			3.0	3.0	0.8	0.0	71.3	49.1		-46.1		-41.3	-41.3	**4.8**	max all
7	**UWB CHANNEL 5, MOD INDEX 3, POWER SETTING 40**																							
8	- PEAK Power (Pk Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max-Held)																							
9	28	28.0	6683.8	6683.8	HQR1TO18S01	H/V	14.0	151.1	17.3			3.0	3.0	0.9	0.0	82.5								
10	50	50.0	6683.8	6683.8	HQR1TO18S01	H/V	14.0	151.1	17.3			3.0	3.0	0.9	0.0			-7.6		.0			**7.6**	max all
11	- RMS Power (RMS Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max Held)																							
12	1	3.0	6683.8	6683.8	HQR1TO18S01	H/V	14.0	151.1	17.3			3.0	3.0	0.9	0.0	69.6	52.8		-42.4		-41.3	-41.3	**1.1**	max all
13																								
14	**UWB CHANNEL 9, MOD INDEX 0, POWER SETTING 68**																							
15	- PEAK Power (Pk Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max-Held)																							
16	28	10.0	7987.0	7987.0	HQR1TO18S01	H/V	14.0	234.6	17.3			3.0	3.0	1.0	0.0	89.9								
17	50	50.0	7987.0	7987.0	HQR1TO18S01	H/V	14.0	234.6	17.3			3.0	3.0	1.0	0.0			-.3		.0			**0.3**	max all
18	- RMS Power (RMS Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max Held)																							
19	1	3.0	7987.0	7987.0	HQR1TO18S01	H/V	14.0	234.6	17.3			3.0	3.0	1.0	0.0	71.6	49.3		-45.9		-41.3	-41.3	**4.6**	max all
20	**UWB CHANNEL 9, MOD INDEX 3, POWER SETTING 50**																							
21	- PEAK Power (Pk Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max-Held)																							
22	28	10.0	8144.9	8144.9	HQR1TO18S01	H/V	14.0	246.2	17.3			3.0	3.0	1.1	0.0	80.5								
23	50	50.0	8144.9	8144.9	HQR1TO18S01	H/V	14.0	246.2	17.3			3.0	3.0	1.1	0.0			-9.7		.0			**9.7**	max all
24	- RMS Power (RMS Detector, 1 GHz Span, 1001 Freq Samples, 1 sec sweep, Max Held)																							
25	1	3.0	8144.9	8144.9	HQR1TO18S01	H/V	14.0	246.2	17.3			3.0	3.0	1.1	0.0	69.2	53.5		-41.7		-41.3	-41.3	**0.4**	max all
26																								
27																								

* CF is computed assuming a 20 dB/decade Decay Rate. DR is the regulatory Desired Range measurement distance. MR is Measurement Range, which is reduced from DR to achieve necessary SNR.

** EIRP is computed from field strength at 3 meter distance.

*** Dimension of antenna is taken to be larger of the test antenna and the EUT antenna; EUT antenna is 3cm in dimension.

EIRP Peak (50 MHz) = EIRP Pk (10 MHz) + 20 Log10(50 Mhz / 28MHz)

4.3 Unintentional Emissions

4.3.1 Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 4.3.1 . Following the test procedures listed in Section 2.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured when the EUT loop axes placed in all three axes, including when they are aligned along the same axis as the test loop antenna and are aligned coplanar with the test loop antenna. For all arrangements, test loop is rotated for maximum field. The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 4.3.1 . Measurements are performed to 10 times the highest fundamental operating frequency.

Table 4.3.1 (i) Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
F < 960 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	26-Sep-24
F > 960 MHz	RMS Detector: 1 GHz Span / 1001 Freq Samples; 1 sec sweep/GHz Span (i.e. 1ms RMS integration time per bin); Max Held			**Test Engineer:**	J. Nantz
	Pk Detector: 1 GHz Span / 1001 Freq Samples; 1 sec sweep/GHz Span (i.e. 1ms RMS integration time per bin); Max Held			**EUT:**	Allegion 47723029
				Mode:	2ms Rep Tx. , CH 5
				Meas. Distance:	As Noted

FCC/IC

	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR*****					E-Field Limit			
#	Temp. (C)	Volt. (V)	Start MHz	Stop MHz	Quality Number	Pol. H/V	Dim. cm	Ka dB/m	Kg dB	Pk dBuV/m	RMS	MR m	DR m	N/F m	CF dB	Pk dBuV/m	Qpk				Pk dBuV/m	Qpk	Pass dB	Comments
1	7	13.4	30.0	88.0	BICEMCO01	H/V	22.0	16.9	35.0			3.0	3.0	0.0	0.0	31.1						40.0	8.9	background, max SP0/SP3
2	7	13.4	88.0	216.0	BICEMCO01	H/V	22.0	16.9	35.0			3.0	3.0	0.1	0.0	29.9						43.5	13.6	background, max SP0/SP3
3	7	13.4	216.0	960.0	LOGEMCO01	H/V	22.0	20.1	29.9			3.0	3.0	0.3	0.0	37.2						46.0	8.8	background, max SP0/SP3
	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR*****		EIRP**						
#	Temp. (C)	Volt. (V)	Start MHz	Stop MHz	Quality Number	Pol. H/V	Dim. cm	Ka dB/m	Kg dB	Pk dBuV/m	RMS	MR m	DR m	N/F m	CF dB	Pk dBuV/m	RMS	Pk dBm	RMS	1MHz Pk Lim dBm	FCC RMS Lim. dBm	ISED RMS Lim. dBm	Pass dB	Comments
4	GPS Restricted Band Emissions																							
5	20	13.4	1164.0	1240.0	HQR1TO18S01	H/V	22.0	25.2	-0.4			0.6	3.0	0.4	14.0	6.9		-88.4			-85.3	-85.3	**3.1**	background, max SP0/SP3
6	20	13.4	1559.0	1610.0	HQR1TO18S01	H/V	22.0	21.9	-0.4			0.6	3.0	0.5	14.0	-7.2		-102.4			-85.3	-85.3	17.1	background, max SP0/SP3
7																								
8	Harmonic / Spurious UWB Emissions																							
9	20	13.4	960.0	1610.0	HQR1TO18S01	H/V	22.0	27.6	19.3			0.6	3.0	0.5	14.0	13.7	6.3	-81.5	-88.9	-34.0	-75.3	-75.3	13.6	background, max SP0/SP3
10	20	13.4	1610.0	1990.0	HQR1TO18S01	H/V	22.0	21.7	19.1			0.6	3.0	0.6	14.0	12.2	0.7	-83.0	-94.5	-34.0	-63.3	-70.0	24.5	background, max SP0/SP3
11	20	13.4	1990.0	3100.0	HQR1TO18S01	H/V	22.0	20.6	18.2			0.6	3.0	1.0	14.0	14.6	5.0	-80.6	-90.2	-34.0	-61.3	-70.0	20.2	background, max SP0/SP3
12	20	13.4	3100.0	4500.0	HQR1TO18S01	H/V	22.0	27.4	18.0			0.6	3.0	1.5	14.0	19.2	8.3	-76.0	-86.9	-34.0	-41.3	-41.3	42.0	max SP0/SP3
13	20	13.4	4500.0	6147.0	HQR1TO18S01	H/V	22.0	57.2	17.3			0.6	3.0	2.0	14.0	47.5	22.5	-47.7	-72.7	-34.0	-41.3	-41.3	13.7	max SP0/SP3
14	20	13.4	6802.0	10600.0	HQR1TO18S01	H/V	15.0	35.3	29.1			0.6	3.0	1.6	14.0	46.8	21.6	-48.4	-73.6	-34.0	-41.3	-41.3	14.4	background, max SP0/SP3
15	20	13.4	10600.0	18000.0	HQR1TO18S01	H/V	15.0	34.3	23.5			0.6	3.0	2.7	14.0	28.1	15.0	-67.1	-80.3	-34.0	-61.3	-61.3	19.0	background, max SP0/SP3
16	20	13.4	18000.0	26500.0	HRNK001	H/V	10.2	33.7	36.5			0.3	3.0	1.8	20.0	32.2	20.1	-63.0	-75.1	-34.0	-61.3	-61.3	13.8	background, max SP0/SP3
17	20	13.4	26500.0	40000.0	HRNKA001	H/V	9.2	37.2	12.5			0.2	3.0	2.3	23.5	40.3	28.7	-54.9	-66.5	-34.0	-61.3	-61.3	**5.2**	background, max SP0/SP3
18																								

* CF is computed assuming a 20 dB/decade Decay Rate. DR is the regulatory Desired Range measurement distance. MR is Measurement Range, which is reduced from DR to achieve necessary SNR.

** EIRP is computed from field strength at 3 meter distance.

*** Dimension of antenna is taken to be larger of the test antenna and the EUT antenna; EUT antenna is 3cm in dimension.

**** ISED Correspondence regarding this particular product permitted use at proposed power rating under RSS-220 Hand-Held Regulations. See correspondence included in this application.

***** When E-field or EIRP is reported directly from Spectrum Analyzer, Antenna Factors and Cable losses are included directly in SA settings and Pr is not reported.

Table 4.3.1 (ii) Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
F < 960 MHz	Pk/QPk	120 kHz	300 kHz
F > 960 MHz	RMS Detector: 1 GHz Span / 1001 Freq Samples; 1 sec sweep/GHz Span (i.e. 1ms RMS integration time per bin); Max Held		
	Pk Detector: 1 GHz Span / 1001 Freq Samples; 1 sec sweep/GHz Span (i.e. 1ms RMS integration time per bin); Max Held		

Test Date:	26-Sep-24
Test Engineer:	J. Nantz
EUT:	Allegion 47723029
Mode:	2ms Rep Tx. , CH 9
Meas. Distance:	As Noted

FCC/IC

	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR*****					E-Field Limit			
	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	Pk	RMS	MR	DR	N/F	CF	Pk	Qpk				Pk	Qpk	Pass	
#	(C)	(V)	MHz	MHz	Number	H/V	cm	dB/m	dB	dBuV/m		m	m	m	dB	dBuV/m					dBuV/m		dB	Comments
1	7	13.4	30.0	88.0	BICEMCO01	H/V	22.0	16.9	35.0			3.0	3.0	0.0	0.0	31.1						40.0	8.9	background, max SP0/SP3
2	7	13.4	88.0	216.0	BICEMCO01	H/V	22.0	16.9	35.0			3.0	3.0	0.1	0.0	29.9						43.5	13.6	background, max SP0/SP3
3	7	13.4	216.0	960.0	LOGEMCO01	H/V	22.0	20.1	29.9			3.0	3.0	0.3	0.0	37.2						46.0	8.8	background, max SP0/SP3
	Env.		Frequency Band		Antenna + Cable***					Rx. Power		Range Correction*				E-Field @ DR*****		EIRP**						
	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	Pk	RMS	MR	DR	N/F	CF	Pk	RMS	Pk	RMS	1MHz Pk Lim	FCC RMS Lim.	ISED RMS Lim.	Pass	
#	(C)	(V)	MHz	MHz	Number	H/V	cm	dB/m	dB	dBuV/m		m	m	m	dB	dBuV/m		dBm		dBm	dBm	dBm	dB	Comments
4	GPS Restricted Band Emissions																							
5	20	13.4	1164.0	1240.0	HQR1TO18S01	H/V	22.0	25.2	-0.4			0.6	3.0	0.4	14.0	-0.4		-95.6			-85.3	-85.3	10.3	max SP0/SP3
6	20	13.4	1559.0	1610.0	HQR1TO18S01	H/V	22.0	21.9	-0.4			0.6	3.0	0.5	14.0	-2.9		-98.1			-85.3	-85.3	12.8	max SP0/SP3
7																								
8	Harmonic / Spurious UWB Emissions																							
9	20	13.4	960.0	1610.0	HQR1TO18S01	H/V	22.0	27.6	19.3			0.6	3.0	0.5	14.0	17.0	3.1	-78.2	-92.1	-34.0	-75.3	-75.3	16.8	background, max SP0/SP3
10	20	13.4	1610.0	1990.0	HQR1TO18S01	H/V	22.0	21.7	19.1			0.6	3.0	0.6	14.0	18.1	2.1	-77.1	-93.1	-34.0	-63.3	-70.0	23.1	background, max SP0/SP3
11	20	13.4	1990.0	3100.0	HQR1TO18S01	H/V	22.0	20.6	18.2			0.6	3.0	1.0	14.0	13.0	4.3	-82.2	-90.9	-34.0	-61.3	-70.0	20.9	background, max SP0/SP3
12	20	13.4	3100.0	4500.0	HQR1TO18S01	H/V	22.0	27.4	18.0			0.6	3.0	1.5	14.0	20.2	8.5	-75.0	-86.7	-34.0	-41.3	-41.3	41.0	max SP0/SP3
13	20	13.4	4500.0	7650.0	HQR1TO18S01	H/V	22.0	57.2	17.3			0.6	3.0	2.5	14.0	45.0	20.3	-50.2	-74.9	-34.0	-41.3	-41.3	16.3	max SP0/SP3
14	20	13.4	8284.0	10600.0	HQR1TO18S01	H/V	15.0	35.3	29.1			0.6	3.0	1.6	14.0	52.6	27.5	-42.6	-67.7	-34.0	-41.3	-41.3	8.6	background, max SP0/SP3
15	20	13.4	10600.0	18000.0	HQR1TO18S01	H/V	15.0	34.3	23.5			0.6	3.0	2.7	14.0	27.8	15.0	-67.4	-80.3	-34.0	-61.3	-61.3	19.0	background, max SP0/SP3
16	20	13.4	18000.0	26500.0	HRNK001	H/V	10.2	33.7	36.5			0.3	3.0	1.8	20.0	32.4	20.1	-62.8	-75.1	-34.0	-61.3	-61.3	13.8	background, max SP0/SP3
17	20	13.4	26500.0	40000.0	HRNKA001	H/V	9.2	37.2	12.5			0.2	3.0	2.3	23.5	40.3	28.6	-54.9	-66.6	-34.0	-61.3	-61.3	**5.3**	background, max SP0/SP3
18																								

* CF is computed assuming a 20 dB/decade Decay Rate. DR is the regulatory Desired Range measurement distance. MR is Measurement Range, which is reduced from DR to achieve necessary SNR.

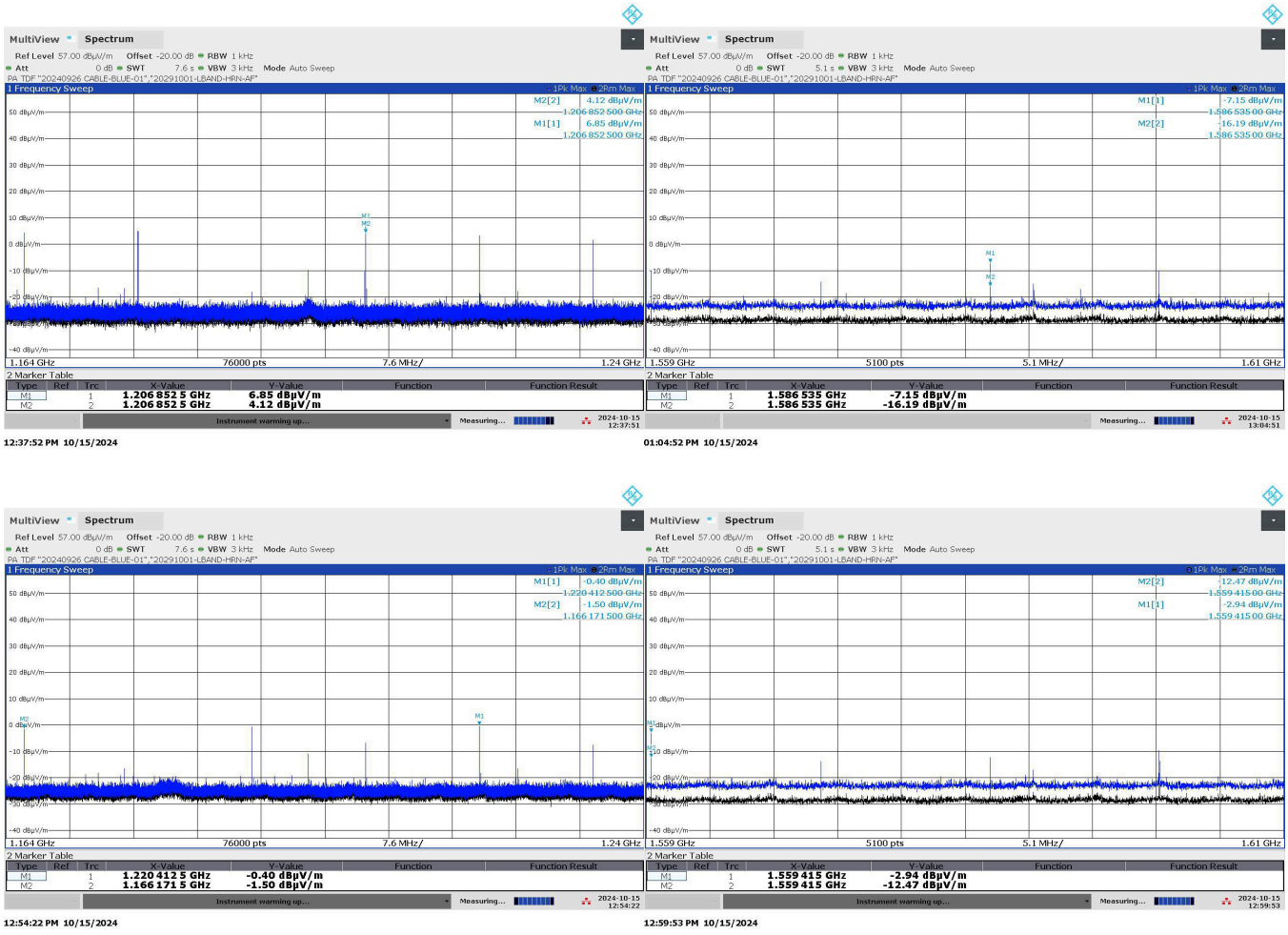
** EIRP is computed from field strength at 3 meter distance.

*** Dimension of antenna is taken to be larger of the test antenna and the EUT antenna; EUT antenna is 3cm in dimension.

**** ISED Correspondence regarding this particular product permitted use at proposed power rating under RSS-220 Hand-Held Regulations. See correspondence included in this application.

***** When E-field or EIRP is reported directly from Spectrum Analyzer, Antenna Factors and Cable losses are included directly in SA settings and Pr is not reported.

Table 4.3.1 (iii) Transmit Chain Spurious Emissions.



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 5.0.0 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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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 on ISO/IEC 17025).

2024-06-13 through 2025-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

Figure 5.0.0 Accreditation Documents