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ALGDCB-WR2425USB
Issued: September 7, 2024

Specific Host Test Report

regarding

USA: CFR Title 47, Part 15.247 (Emissions)

for



Digital Operator

Category: Specific Host

Judgments:

FCC 15.247 Compliant

Testing Completed: September 7, 2024



Prepared for:

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Revision History

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r0	September 7, 2024	Initial Release.	J. Brunett
r1	September 28, 2024	Add band edge data.	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 October 2034.

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 1.8.0 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
EMI Receiver	R & S / ESW26	101313	RSESW2601	RS / Nov-2024
Spectrum Analyzer	R & S / FSV30	101660	RSFSV3001	RS / Apr-2025
Power Meter	R & S / NRP50S	101087	RSNRP50	RS / Nov-2024
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / March-2025
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jul-2025
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
K-Band Horn	JEF / NRL Std.	001	HRNK01	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 Digital Operator for compliance to:

Country/Region/Manu.	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.247
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”	
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 door opener hosting a pre-certified radio module. The EUT is approximately (see photos) in dimension, and is depicted in Figure 3.1.0 . It is powered by 120 Vac mains power. This product is used as an motorized door opener to enable hands free access to a doorway. 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:	Specific Host
Country of Origin:	Not Declared
Nominal Supply:	120 Vac
Oper. Temp Range:	Not Declared
Frequency Range:	2402 – 2480 MHz
Antenna Dimension:	Integral
Antenna Type:	Integral
Antenna Gain:	0 dBi (meas.)
Number of Channels:	40
Channel Spacing:	2 MHz
Alignment Range:	Not Declared
Type of Modulation:	GFSK
United States	
FCC ID Number:	XPB-47334317
Classification:	DTS

3.1.1 EUT Configuration

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

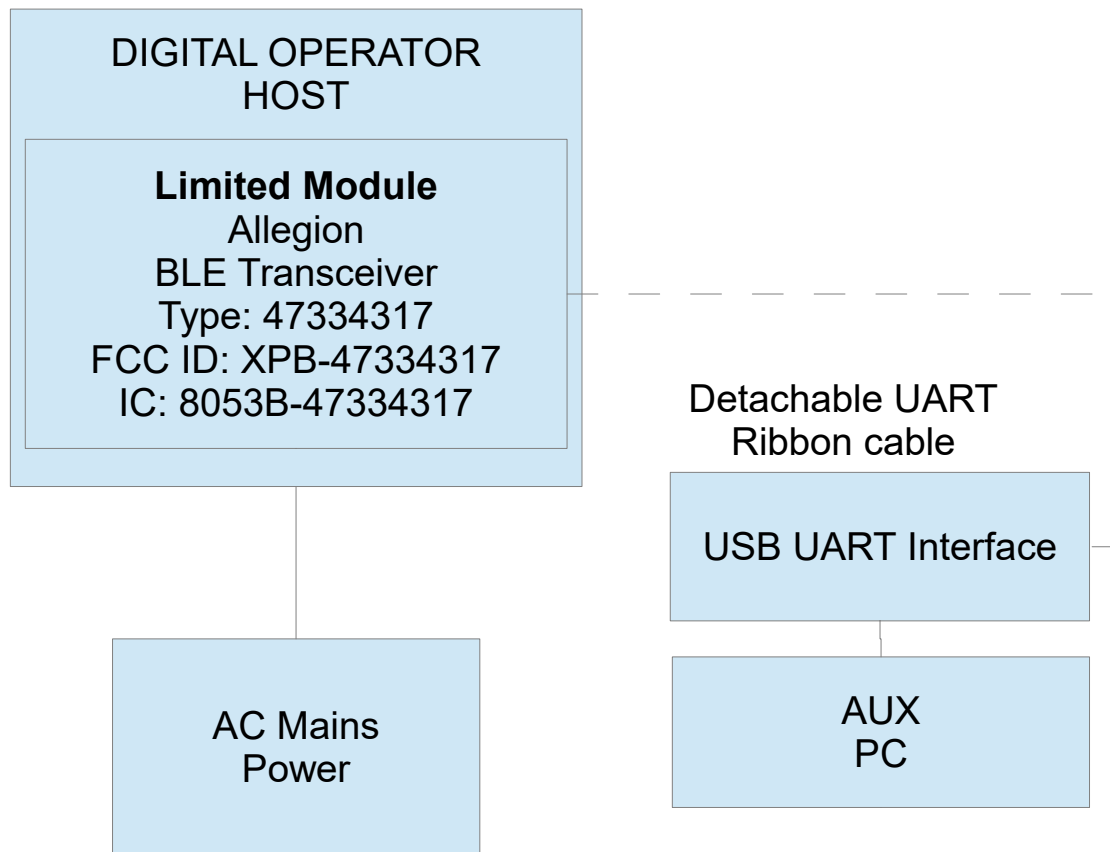


Figure 3.1.1 EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT is capable of operating in BLE 500kBps (LR), 1 MBps, and 2 MBps modes. Test samples were placed into the operating states detailed in the attached test plan using a PC serial UART interface that was attached and then detached from the EUT during testing. The EUT was placed into maximum possible transmission on-time and measured in line with DTS guidelines.

3.1.3 Variants

There are two variants of the EUT, including a Long Black and a Silver Short variant, both of which are tested herein.

3.1.4 Test Samples

Two variant samples of the EUT were provided for testing. Each sample is populated with the pre-certified XPB-47334317 module capable of both normal or forced transmission for testing via a removable UART interface. Test data is provided demonstrating compliance for both samples following the XPB-47334317 module's Specific Host Test Plan included here in Annex A.

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.

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 populated with a limited modular certified radio which is evaluated for a specific host as detailed herein following the test plan as instructed in the module's FCC certification documents. Each EUT is also subject to conducted ac mains terminal and radiated spurious emissions evaluation completed separately via manufacturer SDoC.

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.

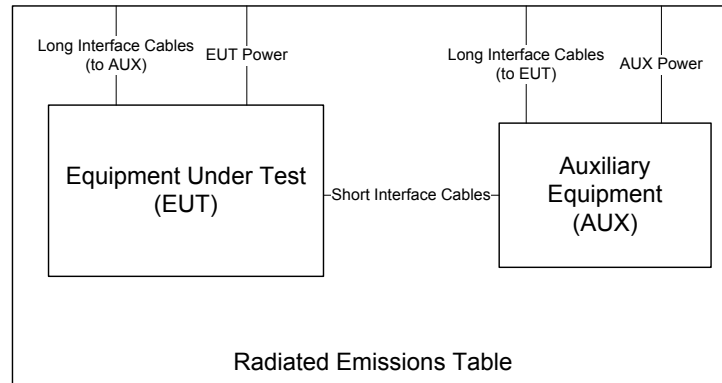


Figure 4.1.1 Radiated Emissions Diagram of the EUT.

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 ISSED SPR-002 section 5.2 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° 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.

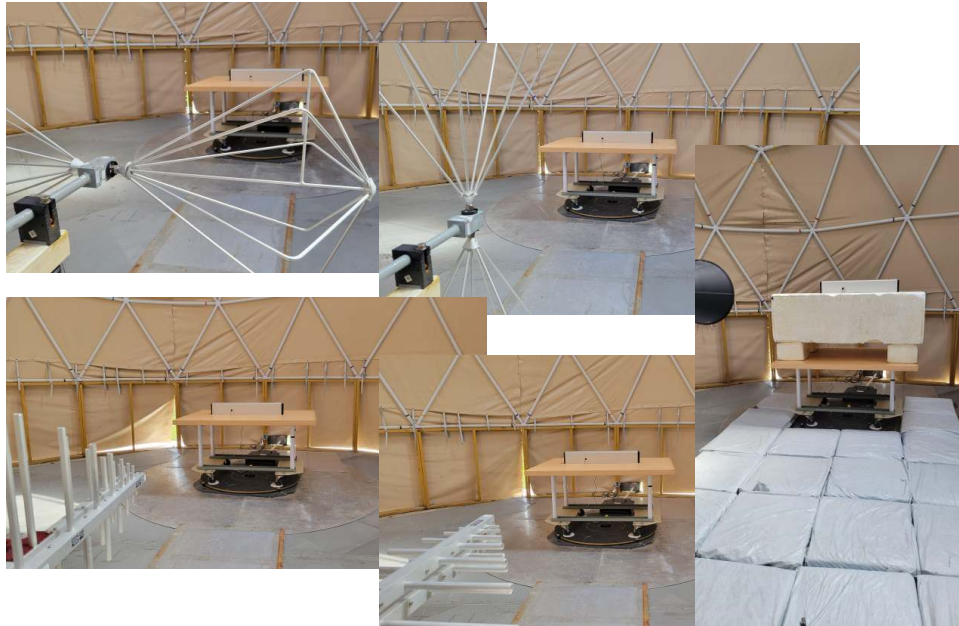


Figure 4.1.1 (i) Radiated Emissions Test Setup Photograph(s).

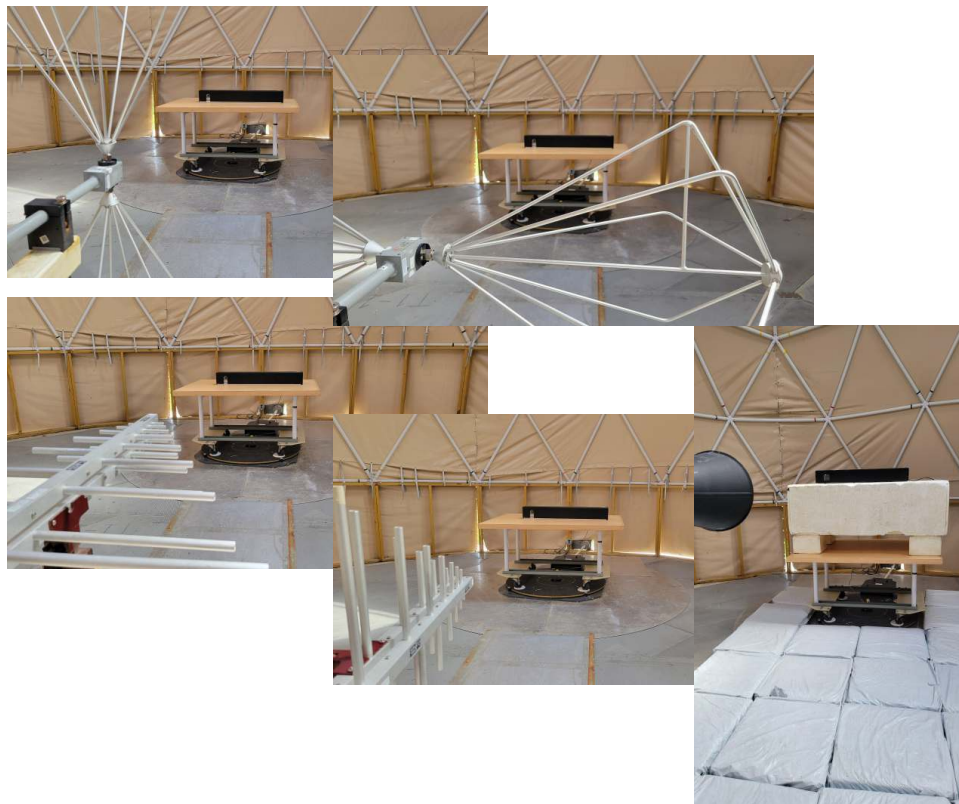


Figure 4.1.1 (ii) Radiated Emissions Test Setup Photograph(s).

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.

4.2 Intentional Emissions

4.2.1 Fundamental Emission Pulsed Operation (PREVIOUSLY TESTED)

This device was previously tested as detailed in the report(s) to which this document in an addendum (AHD, LC Test Report No. ALGDCB-WR2238US).

4.2.2 Fundamental Emission Occupied Bandwidth (PREVIOUSLY TESTED)

This device was previously tested as detailed in the report(s) to which this document in an addendum (AHD, LC Test Report No. ALGDCB-WR2238US).

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.

Test Date: 17-Aug-24
Test Engineer: Joseph Brunett
EUT: Allegion Digital Operator
Meas. Distance: Conducted from Module

#	Mode	Channel	Freq. MHz	Host Supply V	Pout (Pk) dBm	Fundamental Power				
						Mode	Channel	Freq. MHz	Host Supply V	Pout (Pk) dBm
R1	Large DO Black (500 kBps)	19	2440.0	140.0	8.6	Small DO Silver (500 kBps)	19	2440.0	140.0	8.6
R2		19	2440.0	130.0	8.7		19	2440.0	130.0	8.6
R3		19	2440.0	120.0	8.6		19	2440.0	120.0	8.6
R4		19	2440.0	100.0	8.6		19	2440.0	100.0	8.6
R5		19	2440.0	90.0	8.6		19	2440.0	90.0	8.6
R6		19	2440.0	80.0	8.6		19	2440.0	80.0	8.5
R7		19	2440.0	70.0	OFF		19	2440.0	70.0	OFF
R22										
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10

(ROW)

(COLUMN)

NOTES

Host is battery operated from 4 x AA alkaline batteries. Laboratory supply used to adjust voltage over all possible extremes.

ALL

C4

ALL

C5, C10

Measured conducted per DTS Guidance 558074 D01 v5 r02 / ANSI C63.10 11.9.1.3 (PKPM1)

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		Test Date:				16-Aug-24			
30 >= f > 1000 MHz		Pk/QPk		100 kHz		300 kHz		Test Engineer:				J. Brunett			
f < 1000 MHz		Pk/Avg		1 MHz		3 MHz		EUT:				Digital Operator Large Host			
								Meas. Distance:				3 m			
Transmitter Spurious in Restricted Bands														FCC 15.109/209 Class B Limits	
	Mode	Frequency		Test System				Electric Field @ 3m				Pass	Comments		
R0		Start MHz	Stop MHz	Antenna QN	Pol. dBm	Ka dBi	Kg dB	Duty Corr. dB	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Qpk/Avg. dBuV/m	Limit Qpk dBuV/m		dB	
R1	BLE 500kbps	30	88	BICEMCO01	H/V	13.3	-0.3	0.0	32.9		26.5	40	13.5	CH 39, background	
R2	BLE 500kbps	88	216	BICEMCO02	H/V	7.8	-0.5	0.0	34.4		27.3	43	15.7	CH 39, background	
R3	BLE 500kbps	216	1000	LOGEMCO01	H/V	11.3	-0.9	0.0	35.8		29.9	46	16.1	CH 39, background	
R4															
R5	Fundamental Restricted Band Edge (Low Side)														
R6	BLE 2 MBps	2390.0	2390.0	HQR1TO18S01	H/V	21.5	-0.3	0.0	40.2	74.0	34.3	54.0	19.7	CH0	
R7	Fundamental Restricted Band Edge (High Side)														
R8	BLE 2 MBps	2483.5	2483.5	HQR1TO18S01	H/V	21.5	-0.3	0.0	44.5	74.0	38.0	54.0	16.0	CH39	
R9															
R10	BLE 500kbps	4960.0	4960.0	HQR1TO18S01	H/V	24.6	-0.5	0.0	44.3	74.0	35.9	54.0	18.1	CH39	
R11	BLE 500kbps	1000.0	4000.0	HQR1TO18S01	H/V	21.5	-0.2	0.0	44.6	74.0	38.9	54.0	15.1	CH39	
R12	BLE 500kbps	4000.0	6000.0	HQR1TO18S01	H/V	24.9	-0.4	0.0	44.3	74.0	35.9	54.0	18.1	CH39	
R13	BLE 500kbps	7440.0	7440.0	HQR1TO18S01	H/V	25.3	-0.7	0.0	28.9	74.0	22.5	54.0	31.5	CH39, noise floor	
R14	BLE 500kbps	6000.0	8400.0	HQR1TO18S01	H/V	27.1	-0.6	0.0	26.8	74.0	18.2	54.0	35.8	CH39, noise floor	
R15	BLE 500kbps	8400.0	12500.0	HQR1TO18S01	H/V	32.0	-0.8	0.0	28.0	74.0	21.5	54.0	32.5	CH39, noise floor	
R16	BLE 500kbps	12500.0	18000.0	HQR1TO18S01	H/V	35.4	-1.1	0.0	43.7	74.0	35.2	54.0	18.8	CH39, noise floor	
R17	BLE 500kbps	18000.0	26500.0	HRNK001	H/V	33.7	0.0	0.0	45.3	74.0	39.8	54.0	14.2	CH39, noise floor	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	
(ROW)		(COLUMN)		NOTES											
ALL		C9, C11		Radiated measurements were made in line with ANSI C63-10-2013 section 11.12.1. Antenna and cable factors are included in reported SA data.											

Table 4.3.1 (ii) Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth	Test Date:	16-Aug-24
30 >= f > 1000 MHz	Pk/QPk	100 kHz	300 kHz	Test Engineer:	J. Brunett
f < 1000 MHz	Pk/Avg	1 MHz	3 MHz	EUT:	Digital Operator Large Host
				Meas. Distance:	3 m

Transmitter Spurious in Restricted Bands														FCC 15.109/209 Class B Limits	
R0	Mode	Frequency		Test System				Electric Field @ 3m				Pass	Comments		
		Start MHz	Stop MHz	Antenna QN	Pol. dBm	Ka dBi	Kg dB	Duty Corr. dB	Meas. Pk dBuV/m	Limit Pk dBuV/m	Meas. Qpk/Avg. dBuV/m			Limit Qpk dBuV/m	
R1	BLE 500kbps	30	88	BICEMCO01	H/V	13.3	-0.3	0.0	33.8		28.2	40	11.8	CH 39, background	
R2	BLE 500kbps	88	216	BICEMCO02	H/V	7.8	-0.5	0.0	35.0		28.5	43	14.5	CH 39, background	
R3	BLE 500kbps	216	1000	LOGEMCO01	H/V	11.3	-0.9	0.0	36.8		29.9	46	16.1	CH 39, background	
R4															
R5	Fundamental Restricted Band Edge (Low Side)														
R6	BLE 2 MBps	2390.0	2390.0	HQR1TO18S01	H/V	21.5	-0.3	0.0	41.2	74.0	32.4	54.0	21.6	CH0	
R7	Fundamental Restricted Band Edge (High Side)														
R8	BLE 2 MBps	2483.5	2483.5	HQR1TO18S01	H/V	21.5	-0.3	0.0	43.9	74.0	33.7	54.0	20.3	CH39	
R9															
R10	BLE 500kbps	4960.0	4960.0	HQR1TO18S01	H/V	24.6	-0.5	0.0	43.2	74.0	33.9	54.0	20.1	CH39	
R11	BLE 500kbps	1000.0	4000.0	HQR1TO18S01	H/V	21.5	-0.2	0.0	46.7	74.0	37.0	54.0	17.0	CH39	
R12	BLE 500kbps	4000.0	6000.0	HQR1TO18S01	H/V	24.9	-0.4	0.0	43.2	74.0	33.9	54.0	20.1	CH39	
R13	BLE 500kbps	7440.0	7440.0	HQR1TO18S01	H/V	25.3	-0.7	0.0	29.4	74.0	20.4	54.0	33.6	CH39, noise floor	
R14	BLE 500kbps	6000.0	8400.0	HQR1TO18S01	H/V	27.1	-0.6	0.0	27.8	74.0	19.4	54.0	34.6	CH39, noise floor	
R15	BLE 500kbps	8400.0	12500.0	HQR1TO18S01	H/V	32.0	-0.8	0.0	28.1	74.0	20.3	54.0	33.7	CH39, noise floor	
R16	BLE 500kbps	12500.0	18000.0	HQR1TO18S01	H/V	35.4	-1.1	0.0	45.6	74.0	34.9	54.0	19.1	CH39, noise floor	
R17	BLE 500kbps	18000.0	26500.0	HRNK001	H/V	33.7	0.0	0.0	47.7	74.0	39.0	54.0	15.0	CH39, noise floor	
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	

(ROW)
ALL(COLUMN)
C9, C11

NOTES

Radiated measurements were made in line with ANSI C63-10-2013 section 11.12.1. Antenna and cable factors are included in reported SA data.

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

[†]Ref: CISPR 16-4-2:2011+A1:2014



Figure 5.0.0 Accreditation Documents

6 ANNEX A - Test Plan

Allegion Limited Module Host Integration Test Plan

Objective:

The objective of this integration test plan is to confirm that each host in which this module is employed remains compliant with all applicable FCC regulations.

Scope:

This module does not employ (1) an integral EMC shield or (2) internal voltage regulation, and thus its use is limited for use by this manufacturer. In addition, this integration test plan must be followed by this manufacturer for each Specific Host (SH) in which this module is used.

A Specific Host is classified as a series or set of similar models having the same form factor, physical size, component layout and construction. A Permissive Change (PC) authorization is required for every unique SH.

Test Plan:

For each product (SH w/ module), Allegion must ensure the product is tested and test data retained for demonstrating ongoing emissions compliance. The following table of module configurations must be tested, and data retained. These configurations have been selected as worst-case scenarios based on the module's stand-alone test report and general testing required for a host product per 996369 D04 Module Integration Guide v02.

REGULATION	TEST CHANNELS	TEST MODULATION	TEST PROCEDURE (C63.10)	EMISSION TYPE	MODULE REPORT REFERENCE
15.247	0, 39	BLE, 2 Mbps	BAND EDGE SPURIOUS	RADIATED	PAGE 24
15.247	19	BLE, 500 kbps	OUTPUT PWR VS. HOST SUPPLY VOLTAGE	CONDUCTED	PAGE 18
15.109/209*	39(BLE)	BLE, 500 kbps	SPURIOUS EMISSIONS (30MHZ - 26.5 GHZ)	RADIATED	PAGE 25

* NOTE: HOST DIGITAL ELECTRONICS MUST BE FULLY ACTIVE DURING THIS TESTING IN LINE WITH SDOC EMISSIONS COMPLIANCE TESTING REQUIREMENTS.

Furthermore, if this product incorporates any other radio module, the manufacturer must ensure that all additional equipment authorization and testing for technical requirements not covered by the current module's grant be met. This module may only be co-located with other modules listed on it's authorization grant. The incorporation of any other radio module will require further testing and regulatory approval.

Following FCC authorized laboratory guidance, a C2PC will be required for each SH dissimilar from those already approved, including any additional equipment authorization and testing for technical requirements not covered by the module grant. The module manufacturer is reminded that this product is not authorized for use in portable products without further addressing RF exposure requirements.