Amber Helm Development L.C.
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EMC Test Report

ZWAVEP-WR1801
Issued: **August 10, 2018**

regarding

USA: CFR Title 47, Part 15.249 (Emissions)
Canada: IC RSS-210/GENe (Emissions)

for

BE468ZP, BE469ZP

Category: Electronic Door Lock

Judgements:
FCC 15.249, ISED RSS-210 Compliant
Testing Completed: August 8, 2018

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Allegion, PLC

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Date of Issue: August 10, 2018

Revision History

Rev. No.	Date	Details	Revised By
r0	August 10, 2018	Initial Release.	J. Brunett
r1	August 31, 2018	Data table limit corrections.	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 2028.

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.	Last Cal By / Date Due
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2019
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2019
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Sept-2018
BNC-BNC Coax	WRTL / RG58/U	001	CAB002-BLACK	AHD / Sept-2018
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURPLE	AHD / Sept-2018
Spectrum Analyzer	Rohde & Schwarz / FSV30	101660	RSFSV30001	RS / Apr-2019
Quad Ridge Horn	Singer / A6100	C35200	HQR2TO18S01	Keysight / Aug-2019

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The ultimate 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 BE468ZP, BE469ZP for compliance to:

Country/Region	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 15.249
Canada	ISED Canada	IC RSS-210/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 (USA)	"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 6 (2016)	"Information Technology Equipment (ITE) Limits and methods of measuremen"

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 23 x 8 x 6 cm in dimension, and is depicted in Figure 1. It is powered by 6 VDC alkaline batteries. This product is used as an electronic entry door latch with Zwave+ Radio Interface. 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:**	USA
Nominal Supply:	6 VDC	**Oper. Temp Range:**	not declared
Frequency Range:	908.4 and 916 MHz	**Antenna Dimension:**	Integral
Antenna Type:	Integral	**Antenna Gain:**	Not Declared
Number of Channels:	2	**Channel Spacing:**	Not Applicable
Alignment Range:	Not Declared	**Type of Modulation:**	FSK
United States			
FCC ID Number:	XPB-ZWPLUS	**Classification:**	DSC
Canada			
IC Number:	8053B-ZWPLUS	**Classification:**	Low Power Device (902-928 MHz)

3.1.1 EUT Configuration

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

3.1.2 Modes of Operation

The EUT is capable of operating as a Zwave+ enabled lock at either 908.4 MHz or 916.0 MHz as a single channel Zwave transceiver with data rates of 9 kbps, 40 kbps, and 100 kbps. Both channels and all modulation rates are tested herein on the most populated BE469ZP variant and for both sets of escucheon faceplates.

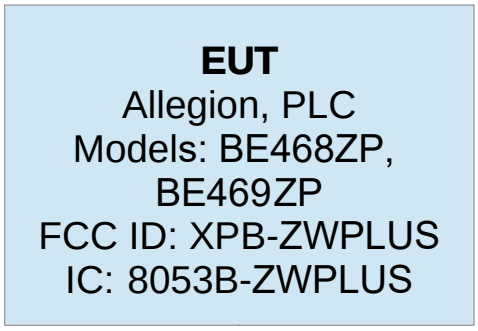


Figure 2: EUT Test Configuration Diagram.

3.1.3 Variants

There are two models of the EUT, a fully populated version (model BE469ZP) and a variant with digital buzzer and accelerometer functionality depopulated (model BE468ZP). Both models employ identical RF electronics and PCBs.

3.1.4 Test Samples

Two samples of the EUT were provided for emissions testing, both radiated samples. The EUT can employ two different escutcheon faceplates, both of which were provided for testing. To place the EUT into CW and CM modes on the EUT's two operating channels, a serial UART interface cable was provided and interfaced via a laboratory PC terminal program. This interface was then disconnected during testing.

3.1.5 Functional Exerciser

EUT functionality was confirmed by observation of transmitted signal.

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 fundamental emissions limits the manufacturer decreased the maximum power setting on the Zwave chipset to a level of 0x11. Manufacturer states the EUT will be sold only with this firmware encoded power setting.

3.1.7 Production Intent

The EUT appears to be a production ready sample.

3.1.8 Declared Exemptions and Additional Product Notes

None.

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.

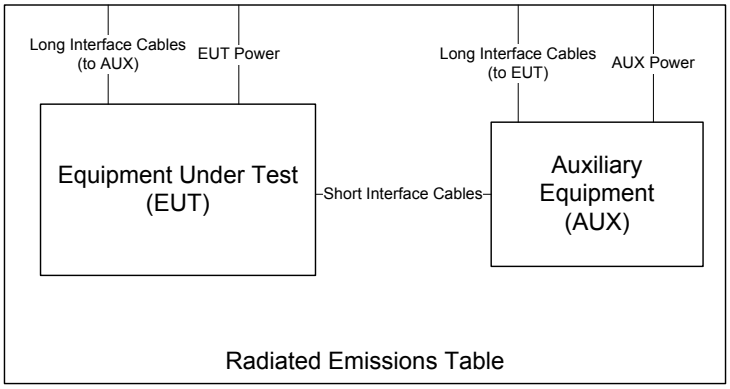


Figure 3: Radiated Emissions Diagram of the EUT.

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.

Where regulations call for substitution method measurements, the EUT is replaced by a substitution antenna if field strength measurements indicate the emission is close to the regulatory limit. This antenna is co-polarized with the test antenna and tuned (when necessary) to the emission frequency, after which the test antenna height is again optimized. The substitution antenna's signal level is adjusted such that its emission is equal to the level measured from the EUT. The signal level applied to the substitution antenna is then recorded. Effective isotropic radiated power (EIRP) and effective radiated power (ERP) in dBm are formulated from

$$EIRP = P_T - G_A = ERP + 2.16, \tag{1}$$

where P_T is the power applied to substitution antenna in dBm, including correction for cable loss, and G_A is the substitution antenna gain, in dBi.

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

4.1.2 Conducted Emissions Test Setup and Procedures

Battery Power Conducted Spurious 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 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

Test Setup & Procedure The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Duty cycle is reported for all relevant modes of operation. The test equipment employed includes RSFSV30001, LOGEMCO01.

Measurement Results The details and results of testing the EUT are summarized in Table 4. Plots showing the measurements made to obtain these values are provided in Figure 5.

Table 4: Fundamental Emission Pulsed Operation.

Detector	Span	IF Bandwidth	Video Bandwidth
Pk	0	1 MHz	3 MHz

Test Date:	18-Jan-18
Test Engineer:	Joseph Brunett
EUT:	BE469
EUT Mode:	Modulated
Meas. Distance:	10 cm

FCC/IC

#	Frequency (MHz)	EUT Test Mode*	Overall Transmission: Min. Repetition Rate (sec)	Overall Transmission: Max. No. of Frames	Overall Transmission: Total Transmission Length (sec)	Internal Frame Characteristics: Max. Frame Length (ms)	Internal Frame Characteristics: Min. Frame Period (ms)	Internal Frame Characteristics: Frame Encoding	Computed Duty Cycle (%)	Computed Duty Cycle (dB)
4	908.4	Cont. Mod.	-	-	inf.	inf.	-	EUT capable of continuous FSK/GFSK transmission.	100.0	0.0
4	916	Cont. Mod.	-	-	inf.	inf.	-	EUT capable of continuous FSK/GFSK transmission.	100.0	0.0

Example Calculation: Worst Case FSK Duty (%) = 100 %

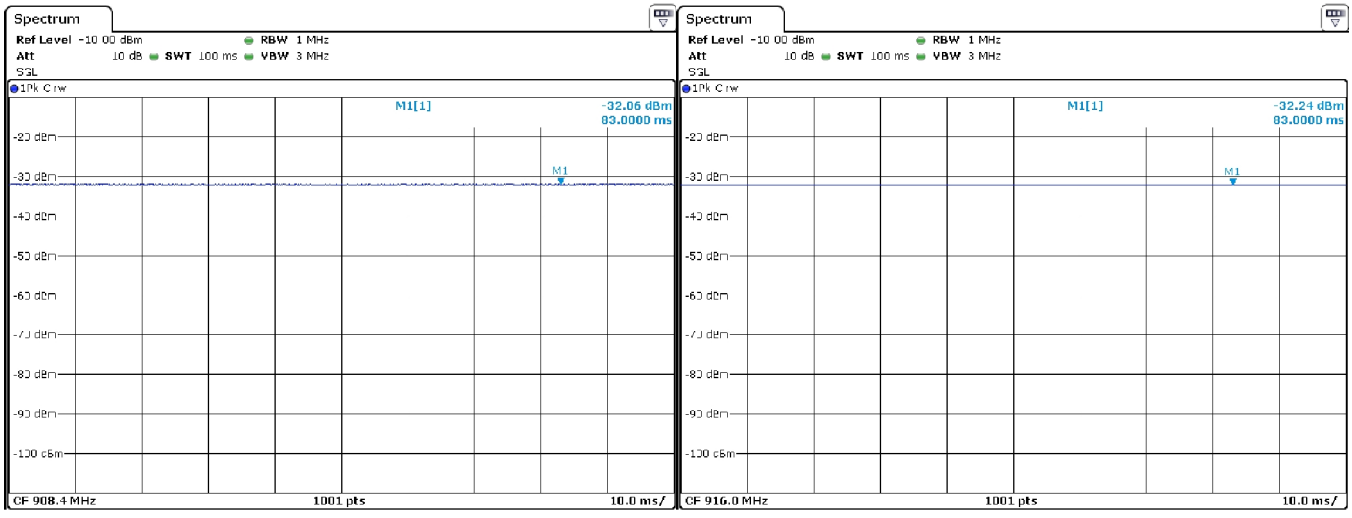


Figure 5: Fundamental Emission Pulsed Operation.

4.2.2 Fundamental Emission Bandwidth

Test Setup & Procedure The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. 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. 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 reported. The test equipment employed includes RSFSV30001, LOGEMCO01.

Measurement Results The details and results of testing the EUT are summarized in Table 5. Plots showing the measurements made to obtain these values are provided in Figure 6.

Table 5: Fundamental Emission Bandwidth.

Detector	IF Bandwidth	Video Bandwidth
Pk	10 kHz	30 kHz

Test Date:	22-Jul-18
Test Engineer:	Joseph Brunett
EUT:	BE469
EUT Mode:	Modulated
Meas. Distance:	10 cm

							FCC/IC
#	Modulation	Center Frequency (MHz)	20 dB EBW (MHz)	99% OBW (MHz)			
1	FSK, 9kbps	908.4	0.085	0.081			
2	FSK, 40kbps	908.4	0.101	0.093			
3	GFSK, 100 kbps	908.4	0.129	0.115			
4	FSK, 9kbps	916.0	0.097	0.089			
5	FSK, 40kbps	916.0	0.101	0.093			
6	GFSK, 100 kbps	916.0	0.129	0.114			

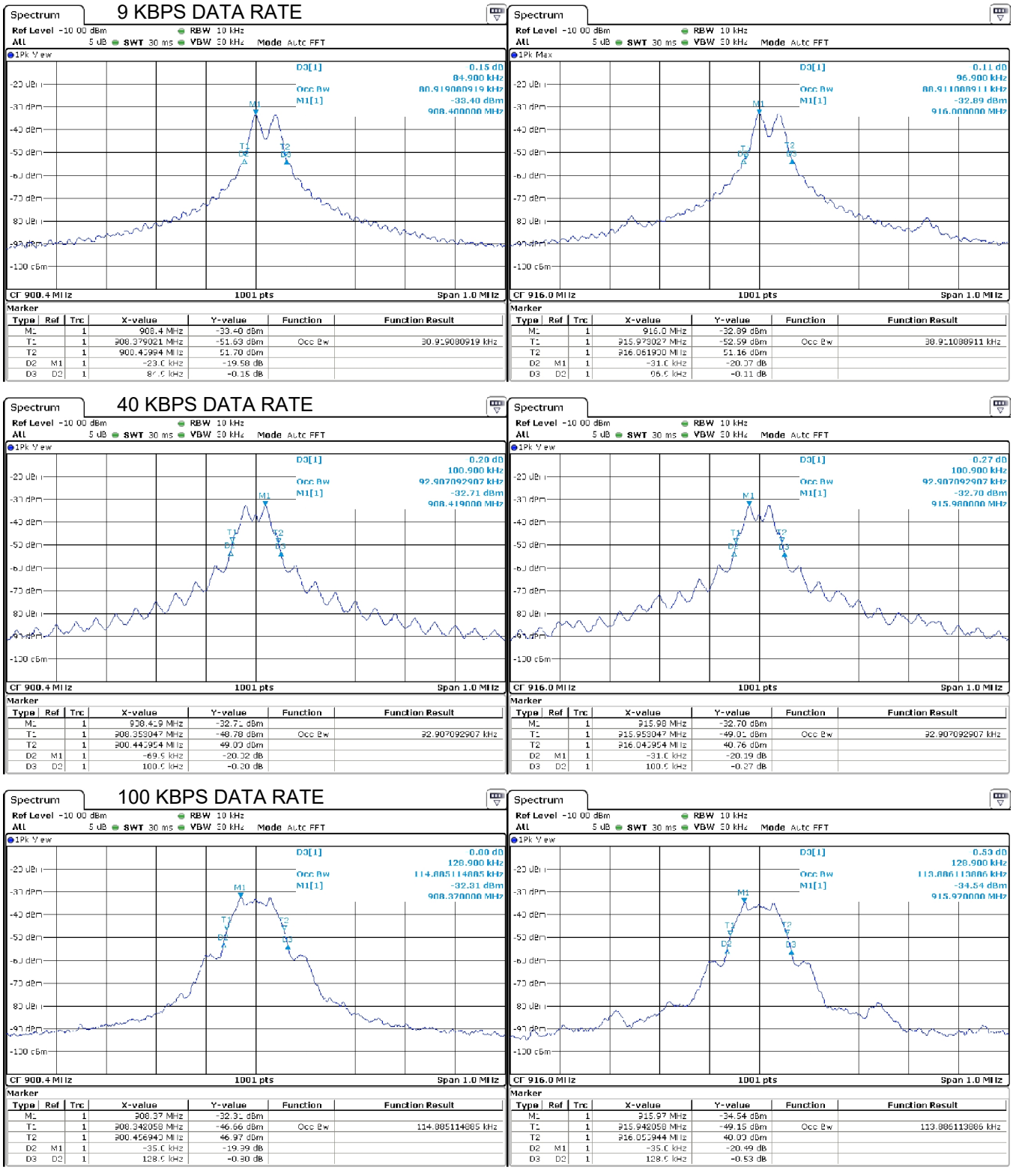


Figure 6: Fundamental Emission Bandwidth.

4.2.3 Fundamental Emission Field Strength

Test Setup & Procedure The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Fundamental emissions are measured at the regulatory distance on our OATS. The test equipment employed includes RSFSV30001, LOGEMCO01.

Measurement Results The details and results of testing the EUT are summarized in Table 6.

Table 6: Fundamental Emission Field Strength.

EUT Modes: a1 BE469 908.4 MHz – CW (Century Escutcheon)
a2 BE469 916 MHz – CW (Century Escutcheon)
Test Date: 07/18/18 a3 BE469 908.4 MHz – CW (Camelot Escutcheon)
Test Engineer: J. Brunett a4 BE469 916 MHz – CW (Camelot Escutcheon)

	Frequency		Site						EUT			Test Antenna				Cable	Receiver				Field Strength @ DR						EIRP		Details
	Start	Stop	Temp.	Table	MR	DR	N/F	CF									Rx Power		Bandwidth		Qpk			Qpk					
R0			C	Angle					Mode	Volt.	Dim	Pol.	Ant.	Dim.	Ka	Kg	Pk	Avg	RBW	VBW	Meas.	Limit		Meas.	Limit		Calc.	Limit	Pass
			RH						see				Height									USA	CAN		USA	CAN			Fail
	MHz	MHz	%	deg	m			dB	table	(V)	cm	H/V	m	cm	dB/m	dB	dBuV/m		MHz		dBuV/m						dBm		dB
R1	SETUP		OATSC						BE468			LOGEMCO01					RSFSV30001				NOTES: WORST EUT ORIENTATION (HPOL: SIDE, VPOL: END)								
R2	908.4	908.4	29/58	0.0	3.0	3.0		0.0	a1	3.0	8.0	H	1.0	100.0	22.7	-7.0			0.12	0.30	89.3	94.0	94.0	89.3	94.0	94.0	-5.9		4.7
R3	908.4	908.4	29/58	45.0	3.0	3.0		0.0	a1	3.0	8.0	V	1.2	100.0	22.7	-7.0			0.12	0.30	93.2	94.0	94.0	93.2	94.0	94.0	-2.0		0.8
R4	SETUP		OATSC						BE468			LOGEMCO01					RSFSV30001				NOTES: WORST EUT ORIENTATION (HPOL: SIDE, VPOL: END)								
R5	916.0	916.0	29/58	0.0	3.0	3.0		0.0	a1	3.0	8.0	H	1.0	100.0	22.8	-7.1			0.12	0.30	88.3	94.0	94.0	88.3	94.0	94.0	-6.9		5.7
R6	916.0	916.0	29/58	45.0	3.0	3.0		0.0	a1	3.0	8.0	V	1.2	100.0	22.8	-7.1			0.12	0.30	93.7	94.0	94.0	93.7	94.0	94.0	-1.5		**0.3**
R7	SETUP		OATSC						B469			LOGEMCO01					RSFSV30001				NOTES: WORST EUT ORIENTATION (HPOL: SIDE, VPOL: END)								
R8	908.4	908.4	29/58	0.0	3.0	3.0		0.0	a1	3.0	8.0	H	1.0	100.0	22.7	-7.0			0.12	0.30	90.0	94.0	94.0	90.0	94.0	94.0	-5.2		4.0
R9	908.4	908.4	29/58	45.0	3.0	3.0		0.0	a1	3.0	8.0	V	1.2	100.0	22.7	-7.0			0.12	0.30	89.2	94.0	94.0	89.2	94.0	94.0	-6.0		4.8
R10	SETUP		OATSC						B469			LOGEMCO01					RSFSV30001				NOTES: WORST EUT ORIENTATION (HPOL: SIDE, VPOL: END)								
R11	916.0	916.0	29/58	0.0	3.0	3.0		0.0	a1	3.0	8.0	H	1.0	100.0	22.8	-7.1			0.12	0.30	89.3	94.0	94.0	89.3	94.0	94.0	-5.9		4.7
R12	916.0	916.0	29/58	45.0	3.0	3.0		0.0	a1	3.0	8.0	V	1.2	100.0	22.8	-7.1			0.12	0.30	93.2	94.0	94.0	93.2	94.0	94.0	-2.0		0.8
R13																													
R14																													
R15																													
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29

(ROW)	(COLUMN)	NOTE:
R0	C5	MR is Measurement Range, which is reduced from DR to achieve necessary SNR.
R0	C6	DR is the regulatory Desired Range measurement distance.
R0	C7	N/F is Near-Field / Far-Field distance computed for max of EUT Antenna Dimension (C10) and Test Antenna dimension (C12), where applicable.
R0	C8	CF is computed using a 20 dB/decade Decay Rate.
R0	C18/19	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.

4.3 Unintentional Emissions

4.3.1 Transmit Chain Spurious Emissions

Test Setup & Procedure The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Spurious radiated emissions measurements are performed to 10 times the highest fundamental operating frequency. The test equipment employed includes RSFSV30001, LOGEMCO01, HQR2TO18S01, HRNK01.

Measurement Results The details and results of testing the EUT are summarized in Table 7.

Table 7: Transmit Chain Spurious Emissions.

EUT Modes: a1 BE469 908.4 MHz – CM (9kbps)
a2 BE469 916 MHz – CM (9kbps)
Test Date: 07/21/18 a3
Test Engineer: J. Brunett a4

	Frequency		Site						EUT			Test Antenna				Cable	Receiver				Field Strength @ DR							EIRP		Details
	Start	Stop	Temp. C RH	Table Angle	MR	DR	N/F	CF	Mode see table	Volt.	Dim	Pol.	Ant. Height	Dim.	Ka	Kg	Rx Power Pk	Rx Power Avg	Bandwidth RBW	Bandwidth VBW	Pk Meas.	Pk Limit USA	Pk Limit CAN	Qpk or Avg Meas.	Qpk or Avg Limit USA	Qpk or Avg Limit CAN		Calc.	Limit	
R0																														Pass Fail
	MHz	MHz	%	deg	m			dB	table	(V)	cm	H/V	m	cm	dB/m	dB	dBuV/m		MHz		dBuV/m							dBm		dB
R1	SETUP		OATSC						BE468			LOGEMCO01					RSFSV30001				NOTES:									
R2	890.0	902.0	29/58	0.0	3.0	3.0		0.0	a1	3.0	8.0	H	1.0	100.0	22.6	-7.0			0.12	0.30	34.4	46.0	46.0	34.4	46.0	46.0				11.6
R3	890.0	902.0	29/58	45.0	3.0	3.0		0.0	a1	3.0	8.0	V	1.2	100.0	22.6	-7.0			0.12	0.30	38.3	46.0	46.0	38.3	46.0	46.0				7.7
R4	928.0	940.0	29/58	0.0	3.0	3.0		0.0	a1	3.0	8.0	H	1.0	100.0	23.1	-7.2			0.12	0.30	29.9	46.0	46.0	29.9	46.0	46.0				16.2
R5	928.0	940.0	29/58	45.0	3.0	3.0		0.0	a1	3.0	8.0	V	1.2	100.0	23.1	-7.2			0.12	0.30	35.3	46.0	46.0	35.3	46.0	46.0				10.8
R6	SETUP		OATSC						BE468			HQR2TO18S01					RSFSV30001				NOTES: max all orientations of EUT									
R7	1816.8	1816.8	29/58	max all	3.0	3.0	0.3	0.0	a1	3.0	4.0	H/V	max all	15.0	30.2	-4.3			1.00	3.00	43.4	74.0	74.0	43.2	54.0	54.0				10.7
R8	2725.2	2725.2	29/58	max all	3.0	3.0	0.4	0.0	a1	3.0	8.0	H/V	max all	15.0	30.2	-5.4			1.00	3.00	45.6	74.0	74.0	45.6	54.0	54.0				8.4
R9	3633.6	3633.6	29/58	max all	3.0	3.0	0.5	0.0	a1	3.0	8.0	H/V	max all	15.0	31.5	-6.2			1.00	3.00	46.6	74.0	74.0	46.3	54.0	54.0				7.6
R10	4542.0	4542.0	29/58	max all	3.0	3.0	0.7	0.0	a1	3.0	8.0	H/V	max all	15.0	32.3	-6.8			1.00	3.00	50.9	74.0	74.0	50.8	54.0	54.0				3.2
R11	5450.4	5450.4	29/58	max all	3.0	3.0	0.8	0.0	a1	3.0	8.0	H/V	max all	15.0	32.6	-7.4			1.00	3.00	50.4	74.0	74.0	50.1	54.0	54.0				3.9
R12	6358.8	6358.8	29/58	max all	3.0	3.0	1.0	0.0	a1	3.0	8.0	H/V	max all	15.0	33.0	-8.0			1.00	3.00	53.0	74.0	74.0	52.4	54.0	54.0				**1.6**
R13	7267.2	7267.2	29/58	max all	3.0	3.0	1.1	0.0	a1	3.0	8.0	H/V	max all	15.0	33.5	-8.6			1.00	3.00	53.0	74.0	74.0	52.0	54.0	54.0				1.9
R14	8175.6	8175.6	29/58	max all	4.0	4.0	1.2	0.0	a1	3.0	8.0	H/V	max all	15.0	34.1	-9.3			1.00	3.00	51.6	74.0	74.0	50.7	54.0	54.0				3.3
R15	9084.0	9084.0	29/58	max all	5.0	5.0	1.4	0.0	a1	4.0	8.0	H/V	max all	15.0	34.7	-9.9			1.00	3.00	52.0	74.0	74.0	51.0	54.0	54.0				2.9
R16																														
R17	SETUP		OATSC						BE468			LOGEMCO01					RSFSV30001				NOTES: max all orientations of EUT									
R18	890.0	902.0	29/58	0.0	3.0	3.0		0.0	a2	3.0	8.0	H	1.0	100.0	22.6	-7.0			0.12	0.30	33.5	46.0	46.0	33.5	46.0	46.0				12.5
R19	890.0	902.0	29/58	45.0	3.0	3.0		0.0	a2	3.0	8.0	V	1.0	100.0	22.6	-7.0			0.12	0.30	38.9	46.0	46.0	38.9	46.0	46.0				7.1
R20	928.0	940.0	29/58	0.0	3.0	3.0		0.0	a2	3.0	8.0	H	1.2	100.0	23.1	-7.2			0.12	0.30	32.5	46.0	46.0	32.5	46.0	46.0				13.5
R21	928.0	940.0	29/58	45.0	3.0	3.0		0.0	a2	3.0	8.0	V	1.2	100.0	23.1	-7.2			0.12	0.30	31.7	46.0	46.0	31.7	46.0	46.0				14.3
R22	SETUP		OATSC						BE468			HQR2TO18S01					RSFSV30001				NOTES: max all orientations of EUT									
R23	1832.0	1832.0	29/58	max all	3.0	3.0	0.3	0.0	a2	3.0	4.0	H/V	max all	15.0	30.1	-4.3	-93.4		1.00	3.00	44.7	74.0	74.0	44.7	54.0	54.0				9.3
R24	2748.0	2748.0	29/58	max all	3.0	3.0	0.4	0.0	a2	3.0	8.0	H/V	max all	15.0	30.3	-5.4	-92.2		1.00	3.00	46.2	74.0	74.0	46.1	54.0	54.0				7.9
R25	3664.0	3664.0	29/58	max all	3.0	3.0	0.5	0.0	a2	3.0	8.0	H/V	max all	15.0	31.5	-6.2	-91.1		1.00	3.00	47.9	74.0	74.0	47.6	54.0	54.0				6.4
R26	4580.0	4580.0	29/58	max all	3.0	3.0	0.7	0.0	a2	3.0	8.0	H/V	max all	15.0	32.3	-6.9	-90.5		1.00	3.00	51.7	74.0	74.0	51.6	54.0	54.0				2.3
R27	5496.0	5496.0	29/58	max all	3.0	3.0	0.8	0.0	a2	3.0	8.0	H/V	max all	15.0	32.6	-7.5	-89.7		1.00	3.00	49.7	74.0	74.0	49.3	54.0	54.0				4.7
R28	6412.0	6412.0	29/58	max all	3.0	3.0	1.0	0.0	a2	3.0	8.0	H/V	max all	15.0	33.0	-8.1	-85.7		1.00	3.00	52.9	74.0	74.0	52.3	54.0	54.0				1.7
R29	7328.0	7328.0	29/58	max all	3.0	3.0	1.1	0.0	a2	3.0	8.0	H/V	max all	15.0	33.5	-8.7	-96.4		1.00	3.00	51.9	74.0	74.0	50.9	54.0	54.0				3.1
R30	8244.0	8244.0	29/58	max all	4.0	4.0	1.2	0.0	a2	3.0	8.0	H/V	max all	15.0	34.2	-9.3	-97.6		1.00	3.00	52.2	74.0	74.0	51.3	54.0	54.0				2.7
R31	9160.0	9160.0	29/58	max all	5.0	5.0	1.4	0.0	a2	4.0	8.0	H/V	max all	15.0	34.8	-10.0	-96.9		1.00	3.00	53.0	74.0	74.0	52.0	54.0	54.0				2.0
R32																														
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	

(ROW)	(COLUMN)	NOTE:
R0	C5	MR is Measurement Range, which is reduced from DR to achieve necessary SNR.
R0	C6	DR is the regulatory Desired Range measurement distance.
R0	C7	N/F is Near-Field / Far-Field distance computed for max of EUT Antenna Dimension (C10) and Test Antenna dimension (C12), where applicable.
R0	C8	CF is computed using a 20 dB/decade Decay Rate.
R0	C18/19	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.

4.3.2 General Radiated Spurious

The results for the measurement of general spurious emissions (emissions arising from digital circuitry) at the nominal voltage and temperature are provided in Table 8. Radiation from digital components are measured up to 1000 MHz or to the highest frequency required by the applied standards, whichever is greater.

Table 8: Radiated Digital Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Date:**	15-Jul-18
f > 1 000 MHz	Pk	1 MHz	3 MHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Avg	1 MHz	3 MHz	**EUT:**	BE469
				EUT Mode:	Active
				Meas. Distance:	3 meters

Digital Spurious Emissions FCC/IC + CE(CISPR)

	Test	Antenna		Pr (Pwr Rx.)				E-Field @ 3m		FCC/IC Class B		CE Class B		FCC/IC Class A		CE Class A		
	Freq.	Type	Test	Pk	QPk/Avg	Ka	Kg	Pk	QPk/Avg	E3lim	Pass	E3lim	Pass	E3lim	Pass	E3lim	Pass	
#	MHz	Used	Pol.	dBm	dBm*	dB/m	dB	dBµV/m	dBµV/m	dBµV/m	dB	dBµV/m	dB	dBµV/m	dB	dBµV/m	dB	Comments
1	45.1	BICEMCO01	H			-1.9	-1.2	29.9		40.0	10.1	40.5	10.6	49.5	19.6	50.5	20.6	background
2	45.1	BICEMCO01	V			-1.9	-1.2	30.3		40.0	9.7	40.5	10.2	49.5	19.2	50.5	20.2	background
3	77.3	BICEMCO01	H			2.0	-1.6	30.1		40.0	9.9	40.5	10.4	49.5	19.4	50.5	20.4	
4	77.3	BICEMCO01	V			2.0	-1.6	28.8		40.0	11.2	40.5	11.7	49.5	20.7	50.5	21.7	
5	115.3	BICEMCO01	H			5.6	-2.0	30.1		43.5	13.4	40.5	10.4	54.0	23.9	50.5	20.4	background
6	115.3	BICEMCO01	V			5.6	-2.0	34.3		43.5	9.2	40.5	6.2	54.0	19.7	50.5	16.2	background
7	180.2	BICEMCO01	H			9.7	-2.6	32.9		43.5	10.6	40.5	7.6	54.0	21.1	50.5	17.6	background
8	180.2	BICEMCO01	V			9.7	-2.6	28.7		43.5	14.8	40.5	11.8	54.0	25.3	50.5	21.8	background
9	220.0	BICEMCO01	H			11.4	-3.0	36.7		46.0	9.3	40.5	3.8	56.9	20.2	50.5	13.8	background
10	220.0	BICEMCO01	V			11.4	-3.0	38.0		46.0	8.0	40.5	2.5	56.9	18.9	50.5	12.5	background
11	305.9	LOGEMCO01	H			13.9	-3.7	32.1		46.0	13.9	47.5	15.4	56.9	24.8	57.5	25.4	background
12	305.9	LOGEMCO01	V			13.9	-3.7	29.8		46.0	16.2	47.5	17.7	56.9	27.1	57.5	27.7	background
13	472.7	LOGEMCO01	H			17.0	-4.8	27.8		46.0	18.2	47.5	19.7	56.9	29.1	57.5	29.7	background
14	472.7	LOGEMCO01	V			17.0	-4.8	29.0		46.0	17.0	47.5	18.5	56.9	27.9	57.5	28.5	background
15	642.5	LOGEMCO01	H			19.6	-5.8	31.9		46.0	14.1	47.5	15.6	56.9	25.0	57.5	25.6	background
16	642.5	LOGEMCO01	V			19.6	-5.8	36.7		46.0	9.3	47.5	10.8	56.9	20.2	57.5	20.8	background
17	703.3	LOGEMCO01	H			20.4	-6.1	38.6		46.0	7.4	47.5	8.9	56.9	18.3	57.5	18.9	background
18	703.3	LOGEMCO01	V			20.4	-6.1	40.0		46.0	**6.0**	47.5	7.5	56.9	16.9	57.5	17.5	background
19																		
20																		
21																		
22																		
23																		
24																		
25																		

*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.

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 ($30 - 200\,\text{MHz}$)	$\pm 4.0\,\text{dB}$
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

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200129-0

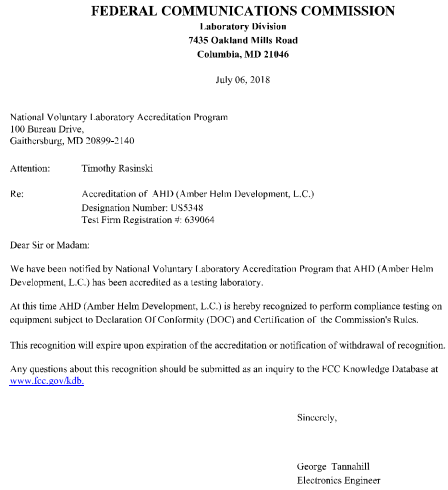
AHD (Amber Helm Development, L.C.)
Sister Lakes, MI

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 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISC-ILAC-IAF Communique dated January 2009).

2018-07-02 through 2019-06-30
For the National Voluntary Laboratory Accreditation Program


FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

July 06, 2018

National Voluntary Laboratory Accreditation Program
100 Bureau Drive,
Gaithersburg, MD 20899-2140

Attention: Timothy Rasinski

Re: Accreditation of AHD (Amber Helm Development, L.C.)
Designation Number: US5348
Test Firm Registration #: 639064

Dear Sir or Madam:

We have been notified by National Voluntary Laboratory Accreditation Program that AHD (Amber Helm Development, L.C.) has been accredited as a testing laboratory.

At this time AHD (Amber Helm Development, L.C.) is hereby recognized to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification of the Commission's Rules.

This recognition will expire upon expiration of the accreditation or notification of withdrawal of recognition.

Any questions about this recognition should be submitted as an inquiry to the FCC Knowledge Database at www.fcc.gov/kdb.

Sincerely,

George Tannahill
Electronics Engineer

Figure 7: Accreditation Documents