Amber Helm Development L.C.

92723 Michigan Hwy-152 Sister Lakes, Michigan 49047 USA Tel: 888-847-8027

EMC Test Report

PBS9-WR2008TX Issued: April 17, 2020

regarding

USA: CFR Title 47, Part 15.247 (Emissions) ISED RSS-247v2 Canada: (Emissions)

for



GNMOD090004

Category: BLE Lock Module

Judgments: 15.247/RSS-247v2 Compliant Transmitter Testing Completed: April 14, 2020



Prepared for:

PassiveBolt, Inc.

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Revision History

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r0 r1		April 17, 2020 June 2, 2020	Initial Draft. Include AC Mains cond.	J. Brunett 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 May 2030.

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

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

1.7 Endorsements

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

1.8 Test Location

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

Table 1: Test Site List.						
Description	Location	Quality Num.				
OATS (3 meter)	3615 E Grand River Rd., Williamston, Michigan 48895	OATSC				

1.9 Traceability and Equipment Used

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

Table 2: Equipment List.

Description	Manufacturer/Model	\mathbf{SN}	Quality Num.	Cal/Ver By / Date Due
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2020
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2020
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Jul-2020
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jul-2020
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2021
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2020
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD / Jul-2020
LISN	Solar / 8012-50-R-24-BNC	970917	LISNB	AHD / March-2021

Date: April 17, 2020

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of PassiveBolt, Inc. 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 PassiveBolt, Inc. GNMOD090004 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	ISED RSS-247v2			

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 Unli- censed Wireless Devices"
TP0102RA	"AHD Internal Document TP0102 - Radiated Emissions Test Procedure"
TP0106RC	"AHD Internal Document TP0106 - Emissions Measurement Procedures (above 40 GHz)"
ISED Canada	"The Measurement of Occupied Bandwidth"
ICES-003; Issue 6 (2016)	"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 BLE radio module for use in electronic door locks. The EUT is approximately $5.6 \ge 13.5 \ge 1.5$ cm in dimension, and is depicted in Figure 1. It is powered by 6 VDC host chassis alkaline batteries. This device is intended to be installed by the manufacturer in their own electronic door locks. Table 3 outlines provider declared EUT specifications.

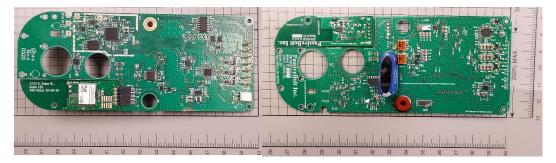


Figure 1: Photos of EUT.

Table 3:	EUT	Declarations.
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General Declarations	
Equipment Type:	BLE Lock Module
Country of Origin:	USA
Nominal Supply:	6 VDC
Oper. Temp Range:	Not Declared
Frequency Range:	2402 - 2480 MHz
Antenna Dimension:	Not Declared
Antenna Type:	Dipole, Patch
Antenna Gain:	3 dBi (patch, dipole)
Number of Channels:	40
Channel Spacing:	2 MHz
Alignment Range:	Not Declared
Type of Modulation:	GFSK (1, 2MBps)
United States	
FCC ID Number:	2AV6C-GNMOD090004
Classification:	DTS
Canada	
IC Number:	26054-GNMOD090004
Classification:	Spread Spectrum Device (2400-2483.5MHz)

3.1.1 EUT Configuration

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

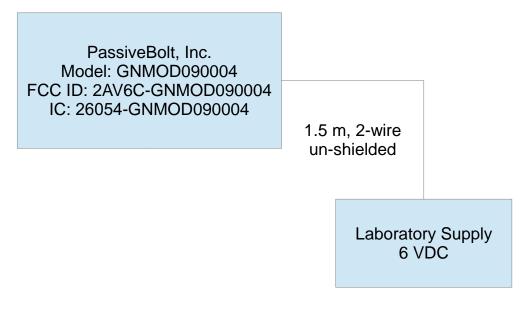


Figure 2: EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT is capable of operating as a BLE control module for use in host door lock devices manufactured only by PassiveBolt, Inc. The EUT includes 3 BLE ports, each individually switched from the single onboard BLE radio. Host devices must be evaluated by the manufacturer following FCC KDB 996369 guidelines. In addition to its BLE radio functionality, the EUT is also tested herein when co-located with a pre-certified ZigBee transceiver (FCC ID: XFF-CSB04PA1X, IC: 8365A-CSB04PA1X). Only a single BLE port can operate at one time. Full digital spurious emissions, including worst case spurious from the pre-certified Zigbee radio, are reported herein. Both the integral BLE and the Zigbee module are capable of simultaneous transmission, and were both set to actively transmit while the EUT was fully tested.

3.1.3 Variants

There is only a single electrical version of the EUT, as tested.

3.1.4 Test Samples

Two samples of the EUT were provided for testing, both capable of CW and modulated transmission of the BLE radio via a mobile application using the BLE link. Mobile application also allowed for activation of the co-located precertified ZigBee transceiver.

3.1.5 Functional Exerciser

Normal operating EUT functionality was verified by observation of transmitted signal. Access keycards were provided to place the EUT into CW transmitting modes as well as for normal access testing.

3.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory. Pretesting on the samples provided indicated that the worst case configuration for emissions was with the dipole antenna populated on the BLE ports and at the 1 MBps modulation rate, for both harmonic and digital spurious emissions.

3.1.7 Production Intent

The EUT appears to be a production ready sample.

3.1.8 Declared Exemptions and Additional Product Notes

This testing is performed on the EUT as a module, intended for installation into other host products manufactured by PassiveBolt, Inc.. It is the manufacturer's responsibility to verify that all end (host) products into which this module is installed are fully compliant. EUT was tested with two distinct antennas, a 3 dBi Patch antenna (PassiveBolt PN: GN.MOD.9.1.1.4) and a 3 dBi Dipole antenna (PassiveBolt PN: W177970AS14).

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.

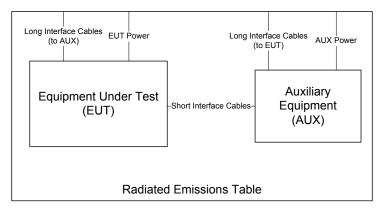


Figure 3: Radiated Emissions Diagram of the EUT.

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° 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 $dB\mu V/m$ 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).

AC Port Conducted Spurious For this device, AC power line conducted emissions are measured in our screen room. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.4 / CISPR 22 are employed. Alternatively, an on-table layout more representative of actual use may be employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 6.

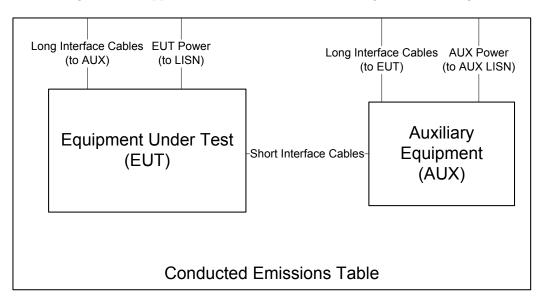


Figure 6: Conducted Emissions Setup Diagram of the EUT.

Conducted emissions are measured and recorded for each AC mains power source over the spectrum 0.15 MHz to 30 MHz for both the ungrounded (HI/PHASE) and grounded (LO/GND) conductors with the EUT placed in its highest current draw operating mode(s). The test receiver is set to peak-hold mode in order to record the peak emissions throughout the course of functional operation. Only if an emission exceeds or is near the limit are quasi-peak and average detection applied. Photographs of the test setup employed are depicted in Figure 7.



Figure 7: Conducted Emissions Test Setup Photograph(s).

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

4.1.3 Power Supply Variation

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

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

4.2 Intentional Emissions

4.2.1 Duty and Transmission Cycle, Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 4. Plots showing the measurements made to obtain these values are provided in Figure 8.

Table 4: Pulsed Emission Characteristics (Duty Cycle).

Frequency Range f > 1 000 MHz				IFBW 3 MHz	VBW 10 MHz		Test Date: est Engineer: EUT as. Distance:	1
			Pulsed O	peration / D	uty Cycle			
Transmit Mada	Symbol Rate	Data Rate	Voltage	Oper. Freq	Tx Cycle Time*	On-Time*	Duty Cycle	Power Duty Correction
Transmit Mode	(Msym/s)	(Mbps)	(V)	(MHz)	(ms)	(ms)	(%)	(dB)
CM	-	-	3.0	2440.0	-	-	-	0.0

* Duty cycle is not applied for demonstrating compliance for this device. Only peak data is used to demonstrate compliance.

-50 dBm

-60 d8m

-70 dBm

-80 d8m

CF 2.44 G

Spectrun				PS - CO	NT TX				Spectrun									
	10.00 dBm		👄 RBW							10.00 dBm			W 3 MHz					
Att	30 dB	SWT 1	s 🖷 VBW	10 MHz					Att	30 dB	SWT 10	10 ms 👄 VB	W 10 MHz					
SGL PIPk Cirw						SGL												
JIPK CHW		1	1	1	1		1		OTAK CUM		1	1	1	1	1	1		
0 dBm									0 dBm									
				_														
-10 dBm									-10 d8m									
-10 000									-10 000									
-20 d8m									-20 dBm									
-30 d8m	TH -29.885	dBm							-30 d8m	TH -29.885	dBm							
-40 d8m									-40 d8m									
-50 dBm									-50 dBm									
60 IQ									60 IO									
-60 d8m									-60 d8m									
-70 dBm									-70 dBm									
-80 d8m				-					-80 d8m									
CF 2.44 GH	lz			100	l pts			100.0 ms/	CF 2.44 GH	IZ			100	1 pts				10.0 ms/
Att	10.00 dBm		2 MBF		NT TX				Att	10.00 dBm		e RB 10 ms e VB	W 3 MHz W 10 MHz					Ţ
SGL 1Pk Cirw									SGL									
ALCK OF W									ALK OUN			1						
0 dBm									0 dBm									
-10 d8m									-10 dBm									
10 0011									10 0011									
												1						
-20 dBm									-20 dBm									
-30 d8m	TH -29.885	dBm					-		-30 d8m	TH -29.885	dBm							
-40 d8m			-						-40 d8m			-						
		1					1				1	1	1		1	1		

Figure 8: Pulsed Emission Characteristics (Duty Cycle).

100.0 ms/

-50 dBn

-60 d8m

-70 dBm

-80 dBm

CF 2.44 G

1001 pts

1001 pts

10.0 ms/

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 9.

Table 5: Intentional Emission Bandwidth.

Frequency Range f > 1 000 MHz			Det Pk	IFBW 30 kHz	VBW 1 MHz			Test Date: Test Engineer: EUT Meas. Distance:	04/05/20 Joseph Brunett PassiveBolt S9 Contucted
				(Occupied Ban	dwidth			
Transmit Mode	Port*	Data Rate	Voltage	Oper. Freq	6 dB BW	6 dB BW Limit	99% OBW	20 dB BW	Pass/Fail
Transmit Mode		(Mbps)	(V)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)	
				2402.0	0.602	0.500	1.046	1.208	Pass
CM 1 Mbps	А	1.0	3.0	2440.0	0.646	0.500	1.052	1.208	Pass
				2480.0	0.621	0.500	1.058	1.211	Pass
				2402.0	1.165	0.500	2.116	1.208	Pass
CM 2 Mbps	А	2.0	3.0	2440.0	1.268	0.500	2.079	1.208	Pass
-				2480.0	1.202	0.500	2.131	1.211	Pass

* OBW was observed to be the same for all three BLE tx ports.

Spectrum	ΓE	BLE - 1	MBPS	5 - CH0	- OBW				Spectrum		BLE - 2	MBP	S - CH) - OB	W			ſ
Ref Level 20.0 Att		SWT 2 n	e RBW	30 kHz 200 kHz M	ode Sweep				Ref Level 2 Att		SWT 2 ms	RBW VBW 3		lode Swee	ep			
1Pk Max					D3[1]			-0.13 dB	●1Pk View				1		D3[1]			-0.02
0 dBm								601.70 kHz	10 dBm									.16540 M
d8m				M1	Occ Bw M1[1]			-0.53 dBm	0 d8m			N	11		Осс Вм M1[1]			441779 M -0.37 d
				h	mones	1	2.401	176010 GHz				D2	former	www	P ³	1	2.40	151520 0
.0 dBm			J.		M M T2				-10 dBm		T1 76	M				₩ 22		
20 dBm			r			<u> </u>			-20 d8m		ſ					- M		
30 d8m	~~~	\sim				$\left \right\rangle$	www		-30 d8m	ma						- \	m	
10 dBm 📝	للمر	\sim				\perp	Why.		-40 dBm							<u> </u>	Var a co	m n
io dem								\sim	r≸o dam									
50 dBm									-60 d8m									
70 dBm									-70 dBm				-					
F 2.402 GHz				2001	pts		Spa	an 3.0 MHz	CF 2.402 GF	Iz			200:	Lots			Spa	an 5.0 Mi
arker									Marker									
Type Ref T M1	1	2.40176		-0.53 dB		Fun	tion Result	t	Type Ref M1	Trc 1	2.401515		<u>Y-value</u> -0.37 dB		iction	Fun	ction Resul	lt
T1 T2	1	2.401481	26 GHz	-15.04 dB -15.02 dB	m Occ Bw		1.0464	76762 MHz	T1 T2	1	2.4009455 2.4030619	3 GHz	-16.27 dE -17.96 dE	βm	Occ Bw		2.1164	441779 MH
D2 M1	1	-7	0.5 kHz	-5.94 0	iB				D2 M1	1	-122.	4 kHz	-6.02	dB				
D3 D2	1	60	1.7 kHz	-0.13 c	iB				D3 D2	1	1.1654	1 MHz	-0.02	dB				
Spectrum			MRDO	CU10	9 - OBW				Spectrum		BLE - 2	MDD	с. <u>с</u> ц.	10 0	D\\/			(
Ref Level 20.0	00 dBm		🖷 RBW	30 kHz				(Δ	Ref Level 2	0.00 dBm		😑 RBW	50 kHz					(
Att 1Pk Max	35 dB	SWT 2 n	s 🖷 VBW	200 kHz M	ode Sweep				Att	35 dB	SWT 2 ms	e vbw :	200 kHz N	lode Swee	ep			
The Wex					D3[1]			-0.23 dB	OTEK AIRM						D3[1]			-0.01
0 dBm					Occ Bw			646.20 kHz	10 dBm					<u> </u>	Occ Bw			26840 M 960520 M
d8m-				M1	M1[1]			-0.63 dBm	0 d8m			P	11		M1[1]			-1.63 d
			C C	m	mon and a second	1	2.439	976160 GHz				DZ-N	m	mm	MD3	1	2.43	951770 0
LO dBm			TI MA		MAN NT2				-10 dBm			N			and	WY.		
20 d8m			ŕ			4			-20 d8m							- May		
30 d8m	m	$m \neq$				\rightarrow	m.		-30 d8m	m			-			- 7		
40 d8m	~~	\sim				- W	"hy		-40 dBm	a want	1						m	m.
								Low	-50 dBm-		~							1 .
50 d8m									-60 d8m									
70 dBm									-70 dBm									-
F 2.44 GHz				2001	nte			an 3.0 MHz	CF 2.44 GH:				200	Inte			En	an 5.0 Mi
arker				2001	pts		эрс	11 3.0 14112	Marker				200.	r prs			300	un 3.0 M
Type Ref T M1	1 1	2.4397f	B 16 GHz	<u>Y-value</u> -0.63 dB	Function	Fun	tion Result	t	Type Ref M1	Trc 1	2.439517		Y-value -1.63 dB		nction	Fun	ction Resul	lt
T1	1	2.439476	26 GHz	-15.14 dB	m Occ Bw		1.0524	73763 MHz	T1	1	2.4389630	2 GHz	-16.31 dB	3m	Occ Bw		2.076	896052 MH
T2 D2 M1	1		1.0 kHz	-15.83 dB -6.45 c	iB				T2 D2 M1		2.4410419 -159.	4 kHz	-16.58 dB -6.30	dB				
D3 D2	1	64	6.2 kHz	-0.23 (IB				D3 D2	1	1.2684	1 MHz	-0.01	dB				
pectrum									Spectrum		BLE - 2	MBP	S - CH	39 - O	BW			(
Ref Level 20.0					9 - OBW				Ref Level 2	0.00 dBm		e RBW						(
Att	35 dB	SWT 2 r	ns 👄 VBW	200 kHz 🛛 M	ode Sweep				Att		SWT 2 ms	VBW	200 kHz N	lode Swe	ер			
1Pk Max				1	D3[1]			-0.01 dB	●1Pk Max				1		D3[1]			0.33
.0 dBm					Occ Bw			620.70 kHz 70765 MHz	10 dBm						Occ Bw			20190 M 434283 M
d8m				M1	10000			-0.79 dBm	0 d8m			P	11		M1[1]			-1.03 di
				m	MI[1]	1	2.479	975860 GHz				02~	\sim	m	- Parma	1	2.47	952020 0
LO dBm			T1 www		- Whyte				-10 dBm		T1	source and				V-T2		
20 d8m			r -			h			-20 dBm		1					- N		
30 dBm	m	$m \neq$				\mathbb{R}	m		-30 dBm	m						+	m	
40 dBm /	N	\sim					- N		-40 øem	N.	\bigvee		L				press of	ww
50 dBm								himme	-50 dBm-									- · · ·
50 d8m									-60 d8m									1
70 dBm									-70 dBm									
F 0 40 011-				0000	ntc			0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	CE 0 40 C				0000	Into				
F 2.48 GHz arker				2001	pts		Spa	an 3.0 MHz	CF 2.48 GH: Marker				200:	ιpts			Spa	an 5.0 M
	ire (X-valu		Y-value	Function	Fun	tion Result	t	Type Ref	Trc 1	X-value 2.479520	2 CU-	Y-value -1.03 de		nction	Fun	ction Resul	lt
Type Ref T		0 47071																
Type Ref T M1 T1	1	2.47975 2.479476	76 GHz	-0.79 dB -15.86 dB	m Occ Bw		1.0584	70765 MHz	T1	1	2.4789355	3 GHz	-16.26 dB	3m	Occ Bw		2,1314	434283 MF
ype Ref T M1	1	2.479476	76 GHz		m Occ Bw		1.0584	70765 MHz		1	2.4789355 2.4810669 -162.	3 GHz 7 GHz		am am	Occ Bw		2.1314	434283 MI

Figure 9: Intentional Emission Bandwidth.

4.2.3 Effective Isotropic Radiated Power

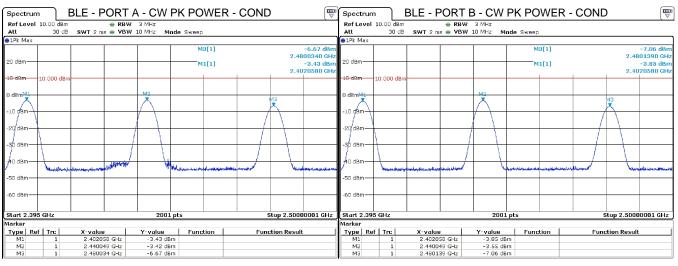
The EUT's radiated power is computed from antenna port conducted power measurements and the gain of the EUT antenna(s). Where the EUT is not sold with an antenna connector, a modified product has been provided including such. Peak conducted output power was measured directly from the EUT at the port where the antenna attaches. The test receiver bandwidth was set to be greater than the measured emission bandwidth of the EUT to capture the true peak. Antenna gain is either provided directly by the antenna manufacturer or measured by comparison between calculated EIRP and conducted output power. Table 6 details the results of these measurements. Plots showing conducted measurements made are depicted in Figure 10.

Table 6: Radiated Power Results.

	Frequency Ra f > 1 000 MHz			Det Pk/Avg		Bandwidth 3 MHz				Bandwidth) MHz			Test Date: Test Engineer: EUT: Meas. Distance:	5-Apr-2 J. Brune PassiveBol conducte	tt t S9
			Freq.	Ant.	Ant.	Table Azim.	Ant Height	Ka	Kg	E3(Pk)	EIRP (Pk)	Pout* (Pk)	Ant Gain**	EIRP (Avg) Limit	Pass
#	Mode	Channel	MHz	Used	Pol.	deg	m	dB/m	dB	dBµV/m	dBm	dBm	dBi	dBm	dB
1		L	2402.0	conducted	-	-	-				4	-3.4	3.0	30.0	30.4
2	CW Port 01	М	2440.0	conducted	-	-	-				4	-3.4	3.0	30.0	30.4
3		Н	2480.0	conducted	-	-	-				-3.7	-6.7	3.0	30.0	33.7
4		L	2402.0	conducted	-	-	-				9	-3.9	3.0	30.0	30.9
5	CW Port 02	М	2440.0	conducted	-	-	-				6	-3.6	3.0	30.0	30.6
6		Н	2480.0	conducted	-	-	-				-4.1	-7.1	3.0	30.0	34.1
7		L	2402.0	conducted	-	-	-				8	-3.8	3.0	30.0	30.8
8	CW Port 03	М	2440.0	conducted	-	-	-				5	-3.5	3.0	30.0	30.5
9		Н	2480.0	conducted	-	-	-				-4.1	-7.1	3.0	30.0	34.1
			Freq.	Supply	Ant.	Table Azim.	Ant Height	Ka	Kg	E3(Pk)	EIRP (Pk)	Pout* (Pk)			
#	Mode	Channel	MHz	Voltage	Pol.	deg	m	dB/m	dB	dBµV/m	dBm	dBm			
10			2402.0	6.6	H/V	-	-					-3.4			
11	CW Port 01	L	2402.0	6.0	H/V	-	-					-3.4			
12	C., 101101		2402.0	5.4	H/V	-	-					-3.4			
13															

* Measured conducted from the radio using conducted test sample.

** EUT was provided with two antennas, a PCB dipole antenna (3 dBi) and and a PCB patch antenna (3 dBi). Highest gain included here for computation of EIRP.



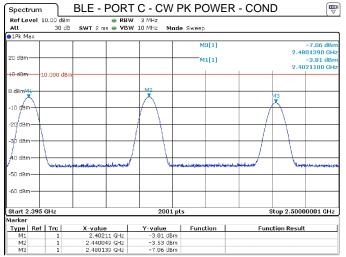


Figure 10: Conducted RF Power Plots

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 11.

Table 7: Power Spectral Density Results.

Frequency Range 2400-2483.5	Detector Pk	IF Bandwidth 3 kHz		Video Bandwidth 10 kHz	Test Date: Test Engineer: EUT: Meas. Distance:	04/05/20 Joseph Brunett PassiveBolt S9 Conducted
						FCC/IC
		Frequency	Ant.	PSDcond (meas)*	PSD Limit	Pass By
Mode	Channel	(MHz)	Used	(dBm/3kHz)	(dBm/3kHz)	(dB)
	L	2402.0	Cond.	-13.7	8.00	21.7
CM 1 Mbps, Port 01	М	2440.0	Cond.	-13.6	8.00	21.6
	Н	2480.0	Cond.	-16.9	8.00	24.9
	L	2402.0	Cond.	-14.2	8.00	22.2
CM 1 Mbps, Port 02	М	2440.0	Cond.	-14.1	8.00	22.1
	Н	2480.0	Cond.	-17.4	8.00	25.4
	L	2402.0	Cond.	-14.1	8.00	22.1
CM 1 Mbps, Port 03	М	2440.0	Cond.	-14.3	8.00	22.3
	Н	2480.0	Cond.	-17.3	8.00	25.3

* PSD measured conducted out the the EUT antenna port following FCC DTS PKPSD procedure.

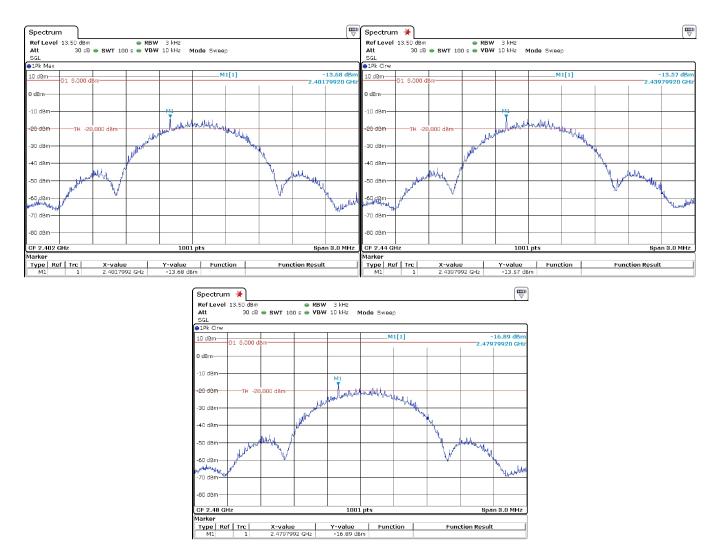


Figure 11: Power Spectral Density Plots.

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.

	25 M	requency R Hz f 10 f > 1000 M	00 MHz	Det Pk/QPk Pk/Avg	IF Band 120 k 1 Ml	Hz	Vid	eo Band 300 kH 3 MHz	Z			Test I	est Date Engineer EUT Mode Distance	J. Brunett PassiveBolt S9 Cont. Modulated, PORT 01, dipole ant
	Freq. Start	Freq. Stop	Ant.	Ant.	Table Azim.	Ant Height	Ka	Kg	E3(Pk)	E3 Pk Lim	E3(Avg)	E3 Avg Lim	Pass	
#	MHz	MHz	Used	Pol.	deg	m	dB/m	dB	dBµV/m	$dB\mu V/m$	$dB\mu V/m$	dBµV/m	dB	Comments
1	Fundament	al Restricte	d Band Edge (Low	Side)										
2	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	48.9	74.0		54.0	5.1	all channels; 1MBps, BLE Only
3	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	47.7	74.0		54.0	6.3	all channels; 2MBps, BLE Only
4	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	57.2	74.0	51.1	54.0	2.9	all channels; 2MBps + ZigBee Active
5	Fundament	al Restricte	d Band Edge (High	n Side)										
6	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	49.2	74.0		54.0	4.8	all channels; 1MBps, BLE Only
7	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	46.9	74.0		54.0	7.1	all channels; 2MBps, BLE Only
8	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	58.3	74.0	52.3	54.0	1.7	all channels; 2MBps + ZigBee Active
9	Harmonic /	Spurious E	missions**											
10	4804.0	4804.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	45.9	74.0		54.0	8.1	Wosrt case - CM 1MBps + ZigBee Active
11	4880.0	4805.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	46.3	74.0		54.0	7.7	Wosrt case - CM 1MBps + ZigBee Active
12	4960.0	4806.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	45.6	74.0		54.0	8.4	Wosrt case - CM 1MBps + ZigBee Active
13	4000.0	6000.0	HQR1TO18S01	H/V	all	all	32.6	-0.6	46.3	74.0		54.0	7.7	Wosrt case - CM 1MBps + ZigBee Active
14	6000.0	8400.0	HQR1TO18S01	H/V	all	all	34.3	-0.8	41.1	74.0		54.0	12.9	max all, CM, noise
15	8400.0	12500.0	HQR1TO18S01	H/V	all	all	35.6	-1.1	42.4	74.0		54.0	11.6	max all, CM, noise
16	12500.0	18000.0	HQR1TO18S01	H/V	all	all	34.2	-1.6	43.6	74.0		54.0	10.4	max all, CM, noise
17	18000.0	26500.0	HRNK01	H/V	all	all	32.0	0.0	41.4	74.0		54.0	12.6	max all, CM, noise
18														
19														
20														
21														
22														

EUT measured in each of Flat, Side, End orientations. Worst case emission from all three orientations reported here.

** No other spurious emissions from the EUT were observed within 20 dB of the regulatory limit.

Table 8(b): Transmit Chain Spurious Emissions.

	Fr	equency R	ange	Det	IF Band	lwidth	Vid	eo Band	width			Т	est Date:	15-Mar-20
	25 MI	Hz f 10	00 MHz	Pk/QPk	120 k	Hz		300 kHz	z			Test I	Engineer:	J. Brunett
	t	$f > 1\ 000\ M$	Hz	Pk/Avg	1 M	Hz		3 MHz					EUT:	PassiveBolt S9
													Mode:	Cont. Modulated, PORT 02, dipole ant
												Meas.	Distance:	3m
														FCC/IC
	Freq. Start	Freq. Stop	Ant.	Ant.	Table Azim.	Ant Height	Ka	Kg	E3(Pk)	E3 Pk Lim	E3(Avg)	E3 Avg Lim	Pass	
#	MHz	MHz	Used	Pol.	deg	m	dB/m	dB	$dB\mu V/m$	dBµV/m	$dB\mu V/m$	dBµV/m	dB	Comments
1	Fundament	al Restricte	d Band Edge (Low	/ Side)										
2	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	47.4	74.0		54.0	6.6	all channels; 1MBps, BLE Only
3	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	46.3	74.0		54.0	7.7	all channels; 2MBps, BLE Only
4	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	55.9	74.0	50.2	54.0	3.8	all channels; 2MBps + ZigBee Active
5	Fundament	al Restricte	d Band Edge (Higł	h Side)										
6	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	48.6	74.0		54.0	5.4	all channels; 1MBps, BLE Only
7	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	47.1	74.0		54.0	6.9	all channels; 2MBps, BLE Only
8	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	57.9	74.0	52.0	54.0	2.0	all channels; 2MBps + ZigBee Active
9	Harmonic /	Spurious E	missions**											
10	4804.0	4804.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	45.9	74.0		54.0	8.1	Wosrt case - CM 1MBps + ZigBee Active
11	4880.0	4805.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	46.3	74.0		54.0	7.7	Wosrt case - CM 1MBps + ZigBee Active
12	4960.0	4806.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	45.6	74.0		54.0	8.4	Wosrt case - CM 1MBps + ZigBee Active
13	4000.0	6000.0	HQR1TO18S01	H/V	all	all	32.6	-0.6	46.3	74.0		54.0	7.7	Wosrt case - CM 1MBps + ZigBee Active
14	6000.0	8400.0	HQR1TO18S01	H/V	all	all	34.3	-0.8	40.9	74.0		54.0	13.1	max all, CM, noise
15	8400.0	12500.0	HQR1TO18S01	H/V	all	all	35.6	-1.1	42.4	74.0		54.0	11.6	max all, CM, noise
16	12500.0	18000.0	HQR1TO18S01	H/V	all	all	34.2	-1.6	44.2	74.0		54.0	9.8	max all, CM, noise
17	18000.0	26500.0	HRNK01	H/V	all	all	32.0	0.0	42.1	74.0		54.0	11.9	max all, CM, noise
18														
19														
20														
21														
22														

EUT measured in each of Flat, Side, End orientations. Worst case emission from all three orientations reported here.

** No other spurious emissions from the EUT were observed within 20 dB of the regulatory limit.

Table 8(c): Transmit Chain Spurious Emissions.

	25 MI	requency R: Hz f 10 f > 1000 M	00 MHz	Det Pk/QPk Pk/Avg	IF Band 120 k 1 Ml	Hz	Vid	eo Band 300 kH 3 MHz	z			Test I	est Date: Engineer: EUT: Mode: Distance:	J. Brunett PassiveBolt S9 Cont. Modulated, PORT 03, dipole ant
	Freq. Start	Freq. Stop	Ant.	Ant.	Table Azim.	Ant Height	Ka	Kg	E3(Pk)	E3 Pk Lim	E3(Avg)	E3 Avg Lim	Pass	
#	MHz	MHz	Used	Pol.	deg	m	dB/m	dB	$dB\mu V\!/\!m$	$dB\mu V/m$	$dB\mu V\!/\!m$	$dB\mu V/m$	dB	Comments
1	Fundament	al Restricted	d Band Edge (Low	Side)										
2	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	47.2	74.0		54.0	6.8	all channels; 1MBps, BLE Only
3	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	46.8	74.0		54.0	7.2	all channels; 2MBps, BLE Only
4	2390.0	2390.0	HQR1TO18S01	H/V	0	1.5	30.5	-0.3	54.9	74.0	50.2	54.0	3.8	all channels; 2MBps + ZigBee Active
5	Fundament	al Restricted	d Band Edge (High	n Side)										
6	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	48.9	74.0		54.0	5.1	all channels; 1MBps, BLE Only
7	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	48.1	74.0		54.0	5.9	all channels; 2MBps, BLE Only
8	2483.5	2483.5	HQR1TO18S01	H/V	0	1.5	30.8	-0.3	58.2	74.0	52.1	54.0	1.9	all channels; 2MBps + ZigBee Active
9	Harmonic /	Spurious E	missions**											
10	4804.0	4804.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	45.6	74.0		54.0	8.4	Wosrt case - CM 1MBps + ZigBee Active
11	4880.0	4805.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	45.9	74.0		54.0	8.1	Wosrt case - CM 1MBps + ZigBee Active
12	4960.0	4806.0	HQR1TO18S01	H/V	all	1.5	32.3	-0.5	46.3	74.0		54.0	7.7	Wosrt case - CM 1MBps + ZigBee Active
13	4000.0	6000.0	HQR1TO18S01	H/V	all	all	32.6	-0.6	46.3	74.0		54.0	7.7	Wosrt case - CM 1MBps + ZigBee Active
14	6000.0	8400.0	HQR1TO18S01	H/V	all	all	34.3	-0.8	42.9	74.0		54.0	11.1	max all, CM, noise
15	8400.0	12500.0	HQR1TO18S01	H/V	all	all	35.6	-1.1	43.7	74.0		54.0	10.3	max all, CM, noise
16	12500.0	18000.0	HQR1TO18S01	H/V	all	all	34.2	-1.6	44.3	74.0		54.0	9.7	max all, CM, noise
17	18000.0	26500.0	HRNK01	H/V	all	all	32.0	0.0	42.9	74.0		54.0	11.1	max all, CM, noise
18														
19														
20														
21														
22														

EUT measured in each of Flat, Side, End orientations. Worst case emission from all three orientations reported here.

** No other spurious emissions from the EUT were observed within 20 dB of the regulatory limit.

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 12 below.

Spectrum			ND - 1 MBPS) 🕮
· _					• [⊽
Ref Level 10.00 c	dBm Comp	atible FSP Mode	e Auto Sweep		
Limit Check		PASS			
0 dBhine SPURIO	US LINE ABS	PASS			
-10 dBm					
-20 dBm					
_SPURIOUS_LINE_AB	BS_				
-40 dBm					
-50 dBm					
-60.dProven	and the second	المتطب فحافظ ستبهد فروحان			
-DI UNIPATRA ANTI	the second se	and the second secon	and the second se		
-70 dBm					
-80 dBm					
CF 12.515 GHz		810	106 pts	S	oan 24.97 GHz
Spurious Emission			Froguesses	Bower the 1	41 in-14
2.400 GHz	Range Up 2.484 GHz	RBW 100.000 kHz	Erequency 2.40213 GHz	-5.05 dBm	<u>ΔLimit</u> -13.05 dB
2.400 GHz	2.484 GHz	100.000 kHz	2.44008 GHz	-6.46 dBm	-14.46 dB
2.500 GHz	10.000 GHz	100.000 kHz	6.78548 GHz	-51.89 dBm	-28.39 dB
2.500 GHz	10.000 GHz	100.000 kHz	6.49629 GHz	-53.34 dBm	-29.84 dB
10.000 GHz	17.500 GHz	100.000 kHz	16.82338 GHz	-51.16 dBm	-27.66 dB
10.000 GHz	17.500 GHz	100.000 kHz	16.42109 GHz	-51.87 dBm	-28.37 dB
17.500 GHz	25.000 GHz	100.000 kHz	18,56181 GHz	-52.29 dBm	-28.79 dB
17.500 GHz	25.000 GHz	100.000 kHz	18.59121 GHz	-52.42 dBm	-28.92 dB
17.500 GHz Spectrum Ref Level 10.00 d	BLE - PC	ORT B - CO	18.59121 GHz ND - 1 MBPS Auto Sweep		
17.500 GHz Spectrum Ref Level 10.00 c	BLE - PC	ORT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 d 1 Max Limit check	BLE - PC	ORT B - CO	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dBhine SPURIO	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dBhine aPURIO	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 01 Max Limit check 0 dBhine BPURIO -10 dBm -20 dBm -20 dBm	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Umit theck 0 dbhine SPURIO -10 dBm -20 dBm -30 dBm	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Unit theck 0 dBhine PURIO -10 dBm -20 dBm	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dehine pPURIO -10 d8m -20 d8m -30 d8m -40 d8m -50	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Umit check 0 dBhine apuRIO -10 dBm -20 dBm -30 dBm -40 dBm	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c Max Limit check 0 d8hine PURIO -10 d8m -20 d8m -30 d8m -40 d8m -50 d	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dbhine pPURIO -10 d8m -20 d8m -30 d8m -50 d8m -50 d8m -50 d8m	BLE - PC	DRT B - CO Datible FSP Mode	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Unit check 0 dbhine sPURIO -10 dBm -20 dBm -30 dBm -30 dBm -40 dBm -50 dBm -50 dBm -50 dBm -60,dBm -60,dBm -70 dBm -80 d	BLE - PC	DRTB-CO patible FSP Mode PASS PASS	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dehine pPURIO -10 d8m -20 d8m -20 d8m -50 d8m -50 d8m -50 d8m -50 d8m -50 d8m -60 d8m -60 d8m -70	BLE - PC	DRTB-CO patible FSP Mode PASS PASS	ND - 1 MBPS		
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dbhine pPURIO -10 dBm -20 dBm -20 dBm -50 dB	BLE - PC IBM Comp PUS LINE ABS BS_ BS_ BS_ BS_ BS_ BS_ BS_ B	DRT B - CO patible FSP Mode PASS PASS PASS PASS PASS PASS PASS PAS	ND - 1 MBPS	100K SPUR	2 (₩
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dehine pPURIO -10 d8m -20 d8m -20 d8m -50 d8m -50 d8m -50 d8m -50 d8m -50 d8m -60 d8m -70 d8m -80	BLE - PC	DRTB-CO patible FSP Mode PASS PAS	ND - 1 MBPS	100K SPUF	2
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Imit check 0 dBm - -10 dBm - -20 dBm - -30 dBm - -50 dBm - -60 gBm - -70 dBm - -60 gBm - -70 dBm - -70 dBm - -70 dBm - -80 dBm - -70 dBm - -80 dBm - -70 dBm - -80 dBm - -20 dBm - -80 dBm - </td <td>BLE - PC</td> <td>DRTB-CO patible FSP Mode PASS PASS PASS PASS PASS PASS PASS PAS</td> <td>ND - 1 MBPS Auto Sweep Auto Sweep</td> <td>100K SPUR</td> <td>2</td>	BLE - PC	DRTB-CO patible FSP Mode PASS PASS PASS PASS PASS PASS PASS PAS	ND - 1 MBPS Auto Sweep	100K SPUR	2
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dbhine -20 dbm -20 dbm -30 dbm -30 dbm -40 dbm -50, dbm -60, dbm -70 dbm -80 dbm -80 dbm -20 dbm -20 dbm -30 dbm -50 dbm -60, dbm te ut ut -70 dbm -80 dbm -80 dbm -20 dbm -2.400 GHz -2.400 GHz -2.500 GHz	BLE - PC JBM Comp PUS LINE ABS BS_ BS_ BS_ Comp	PASS PASS PASS PASS PASS PASS PASS PASS	ND - 1 MBPS	100K SPUR	2
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dbhine PURIO -10 dbm -20 dbm -20 dbm -30 dbm -40 dbm -50 dbm -60,dbm -60,dbm -70 dbm -80 dbm -20	BLE - PC	PABS PABS PABS <td>ND - 1 MBPS</td> <td>100K SPUR</td> <td>2</td>	ND - 1 MBPS	100K SPUR	2
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Umit check 0 dBhine PURIO -10 dBm -20 dBm -20 dBm -40 dBm -50 dBm -50 dBm -50 dBm -50 dBm -50 dBm -50 dBm -70 dBm -70 dBm -2.100 GHz 2.400 GHz 2.400 GHz 2.500 GHz 10.000 GHz	BLE - PC JBM Comp US LINE ABS BS_ BS_ CAUSE C	DRTB - CO patible FSP Mode PASS P	ND - 1 MBPS Auto Sweep	100K SPUR	2
17.500 GHz Spectrum Ref Level 10.00 c 1 Max Limit check 0 dehine pPURIO -10 d8m -20 d8m -20 d8m -50 d8m -50 d8m -50 d8m -50 d8m -50 d8m -60 d8m -80	BLE - PC	PABS PABS PABS <td>ND - 1 MBPS</td> <td>100K SPUR</td> <td>Commentation (Commentation (C</td>	ND - 1 MBPS	100K SPUR	Commentation (Commentation (C

Figure 12(a): Conducted Transmitter Emissions Measured.

Spectrum		DRT C - CC	ND - 1 MBPS	100K SPLI	२ 🖫
Ref Level 10.00 (e Auto Sweep		• (*
1 Max	•		1		
Limit Check		PASS			
o dehi <mark>ne spuric</mark>	US LINE ABS	PASS			
-10 dBm					
-20 dBm-					
SPURIOUS_LINE_A	BS_				
40 d8m					
-50 dBm				-	
60.d8m					
CF 12.515 GHz		810)06 pts	S	pan 24.97 GHz
purious Emissior	าร				
Range Low	Range Up	RBW	Frequency	Power Abs	∆Limit
2.400 GHz	2.484 GHz	100.000 kHz	2.43983 GHz	-5.24 dBm	-13.24 dB
2.400 GHz	2.484 GHz	100.000 kHz	2.40179 GHz	-5.25 dBm	-13.25 dB
2.500 GHz	10.000 GHz	100.000 kHz	6.23080 GHz	-53.10 dBm	-29.60 dB
2.500 GHz	10.000 GHz	100.000 kHz	6.68648 GHz	-53.33 dBm	-29.83 dB
10.000 GHz	17.500 GHz	100.000 kHz	16.80088 GHz	-51.95 dBm	-28.45 dB
10.000 GHz	17.500 GHz	100.000 kHz	15.90781 GHz	-52.28 dBm	-28.78 dB
17.500 GHz	25.000 GHz	100.000 kHz	19.02199 GHz	-52.19 dBm	-28.69 dB
17.500 GHz	25.000 GHz	100.000 kHz	18.91549 GHz	-52.49 dBm	-28.99 dB

Figure 12(b): Conducted Transmitter Emissions Measured.

4.3.3 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 9. Radiation from digital components are measured up to 1000 MHz or to the highest frequency required by the applied standards, whichever is greater.

Table 9: Radiated Digital Spurious Emissions.

Freq	uency Range	I	Det		IF Ban	dwidth	1 1	/ideo Bandwid	th		1	est Date:			15-Ma	r-20	
25 MHz	f 1 000 MHz	Pk/	QPk		120	kHz		300 kHz			Test	Engineer:			J. Bru	nett	
f >	1 000 MHz	1	Pk		1 N	4Hz		3 MHz				EUT:			PassiveB	olt S9	
f >	1 000 MHz	A	vg		1 N	4Hz		10kHz			EU	JT Mode:	A	Active. Po	ort 01 Wors	st Case.	Dipole Ant
			0								Meas	Distance:			3 met		1
												Distancei			5 110		
				Di	igital S	purious	Emissions										CC/IC + CE(CISPR
Test			Ant	Table				eld @ 3m**	FCC/IC	Class B	CE C	ass B	FCC/IC 0	Class A	CE Cla	iss A	
Freq		Test	Ht.	Angle	Ka	Kg	Pk	QPk/Avg	E3lim	Pass	E3lim	Pass	E3lim	Pass	E3lim	Pass	
# MH:		Pol.	m	deg	dB/m	dB	$dB\mu V/m$	dBµV/m	dBµV/m	dB	$dB\mu V/m$	dB	dBµV/m	dB	dBµV/m	dB	Comments
1 82.1	BICEMCO01	Н	1.2	90.0	9.5	5	32.8		40.0	7.2	40.5	7.7	49.5	16.7	50.5	17.7	
2 82.1	BICEMCO01	V	1.0	90.0	9.5	5	27.1		40.0	12.9	40.5	13.4	49.5	22.4	50.5	23.4	
3 125.4		Н	max all	max all	11.9	6	33.8		43.5	9.7	40.5	6.7	54.0	20.2	50.5	16.7	background
4 125.4		Н	max all	max all	11.9	6	30.9		43.5	12.6	40.5	9.6	54.0	23.1	50.5	19.6	background
5 186.		Н	max all	max all	14.6	8	38.9		43.5	4.6	40.5	1.6	54.0	15.1	50.5	11.6	background
6 186.		v	max all	max all	14.6	8	36.2		43.5	7.3	40.5	4.3	54.0	17.8	50.5	14.3	background
7 190.		Н	max all	max all	14.9	8	37.2		43.5	6.3	40.5	3.3	54.0	16.8	50.5	13.3	background
8 190.		V	max all	max all	14.9	8	36.7		43.5	6.8	40.5	3.8	54.0	17.3	50.5	13.8	background
9 231.		Н	max all	max all	11.9	-3.1	38.9		46.0	7.1	47.5	8.6	56.9	18.0	57.5	18.6	background
10 231.		V	max all	max all	11.9	-3.1	39.9		46.0	6.1	47.5	7.6	56.9	17.0	57.5	17.6	background
11 293.		Н	max all	max all	13.6	-3.6	40.6		46.0	5.4	47.5	6.9	56.9	16.3	57.5	16.9	background
12 293.		V	max all	max all	13.6	-3.6	41.7		46.0	4.3	47.5	5.8	56.9	15.2	57.5	15.8	background
13 361.		Н	max all	max all	15.0	-4.1	41.2		46.0	4.8	47.5	6.3	56.9	15.7	57.5	16.3	background
14 361.		V	max all	max all	15.0	-4.1	38.2		46.0	7.8	47.5	9.3	56.9	18.7	57.5	19.3	background
15 440.		Н	max all	max all	16.4	-4.6	39.8		46.0	6.2	47.5	7.7	56.9	17.1	57.5	17.7	background
16 440.		V	max all	max all	16.4	-4.6	38.2		46.0	7.8	47.5	9.3	56.9	18.7	57.5	19.3	background
17 551.		Н	max all	max all	18.3	-5.3	41.9		46.0	4.1	47.5	5.6	56.9	15.0	57.5	15.6	background
18 763.		Н	max all	max all	21.1	-6.4	38.7		46.0	7.3	47.5	8.8	56.9	18.2	57.5	18.8	background
19 763.		V	max all	max all	21.1	-6.4	33.9		46.0	12.1	47.5	13.6	56.9	23.0	57.5	23.6	background
20 993.		Н	max all	max all	24.0	-7.4	34.7		54.0	19.3	47.5	12.8	60.0	25.3	57.5	22.8	background
21 993.	D LOGEMCO01	V	max all	max all	24.0	-7.4	35.8		54.0	18.2	47.5	11.7	60.0	24.2	57.5	21.7	background
22										_							
23																	
24 25																	
26																	
27	tion below 1 GHz, A	L	I														

*When E-field is reported directly from Spectrum Analyzer, Antenna Factors and Cable losses are included directly in SA settings.

4.3.4 Conducted Emissions Test Results - AC Power Port(s)

The results of emissions from the EUT's AC mains power port(s) are reported in Table 10.

Table 10: AC Mains Power Conducted Emissions Results.

Spectrum 🔆	AC MA	AINS - L	1 CON	D EMIS	SIONS	Spe	ctrun	n	AC N	IAINS -	L2 COI	ND EMIS	SSION	S 📰
Ref Level 50.00 Att TDF DC 1Pk Maxe2Pk Ma:	0 dB SWT 72		CISPR) 9 kHz 100 kHz	Mode Auto Sw	еер	 Att TDF 	DC		dBµV 0 dB SWT 72		CISPR) 9 kHz 100 kHz	Mode Auto Sw	еер	
1/k Maxwell Ma	18 <u>1</u> V	1 MHz	(hju): more deal	M4[2] M1[3]	9.45 dBy 1.2220 M 15.75 dBy 20.3773 M 20.3773 M	Z 70 d8 Z FCC15 60 d8 FCC15 50 d8 40 d8 30 d8 20 d8	UV-BOPK. UV-BAVG UV-UV-UV-UV-UV-UV-UV-UV-UV-UV-UV-UV-UV-U	50:500.	dBuv		ารางใปประหาศุรรณ	M4[2] M1[3]	Line function of the second	13.23 ماليلان 169 - Khi 1-5.0 dbyV 20.0032 MHz 20.0032 MHz 20.0032 MHz 20.0032 MHz
-10 dBµV Start 150.0 kHz			1001 pts		Stop 30.0 MH;	-10 di Start	ΒμV 150.	0 kHz			1001 pts			Stop 30.0 MHz
EMI Measuremen	Marker								t Marker					
Type Ref Trace	Frequency	Level	Final Test	ΔLimit	Final Result		Ref	Trace	Frequency	Level	Final Test	∆Limit	F	inal Result
N1 3 N2 2	20.3773 MHz	15.75 dBµV	Quasi Peak	-51.68 d8 ,	8.32 dBpV	N1	-	3	28.0032 MHz	14.20 dBµV	Quasi Peak	-49.75 dB ,		10.25 dBµV
N2 2 N3 3	20.3773 MHz 1.2226 MHz	15.75 dBµV 9.45 dBµV	Average Quasi Peak	,-47.81 dB	2.19 dBps	N2 N3	-	2	28.0032 MHz 169.4 kHz	14.20 d8µV 13.23 d8µV	Average Overage	,-45.65 dB -55.08 dB ,		4.35 dBµV 9.89 dBµV
N4 2	1.2226 MHz	9.45 dBµV 9.45 dBµV	Average			N3 N4	-	3	169.4 KHz 169.4 kHz	13.23 dBµV 13.23 dBµV	Quasi Peak Average			9.89 dBµV 3.00 dBµV
2	1.2226 MHZ	9.45 08µV	Average					2	109.4 KHZ	10.23 d8µV	Average	,-51.97 dB		3.00 GBHV

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 11: Measurement Uncertainty.

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

^{\dagger}Ref: CISPR 16-4-2:2011+A1:2014

United States Department of Commerce National Institute of Standards and Technology	Gordon Helm EMC-002401-NE Rented For the second sec
NVLAP LAB CODE: 200129-0	The second se
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.	Joseph Brunett
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 ISO-LAC-IAF Communique dated January 2009).	MARE
2019-06-28 through 2020-06-30 Effective Dates For the National Voluntary Laboratory Accreditation Program	PATIFIED ENGINER

Figure 13: Accreditation Documents