# Amber Helm Development L.C.

92723 Michigan Hwy-152 Sister Lakes, Michigan 49047 USA Tel: 888-847-8027 DOAOE-WR2309TX Issued: May 25, 2023

# **EMC** Test Report

regarding

USA: CFR Title 47, Part 15.255 (Emissions) Canada: ISED RSS-210 Issue 10 (Emissions)

for



# OA1b

### Category: Field Disturbance Sensor

Judgments: FCC 15.255 and ISED RSS-210v10 Compliant Testing Completed: May 16, 2023



Prepared for:

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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 March 2033.

#### 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 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.

		Equipment Lis	0.	
Description	Manufacturer/Model	$\mathbf{SN}$	Quality Num.	Cal/Ver By / Date Due
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2024
Spec. Analyzer 70GHz	Anritsu / MS2760A	1705006	ANMS2760A1	ANR / Sept-2023
Pk/Avg Pwr Mtr	BK Prec. / RFP3008	620C22101	BKPM300801	BK / Mar-2024
LISN	Solar / 8012-50-R-24-BNC	970917	LISNB	AHD / February-2024
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Sept-2023
Harmonic Mixer	VDI / SAX 063	US54250105	MIX50TO7501	AHD / On-use
Harmonic Mixer	VDI / SAX 108	A30316	MIX60TO9001	AHD / On-use
Harmonic Mixer	Hewlett Packard / $11970W$	2521A00179	MIX70TO11001	AHD / On-use
Harmonic Mixer	Pacific mmWave / GMA	26	MIX110TO23001	PMP / On-use
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight / Aug-2023
Log Periodic Antenna	EMCO / 3146	9305 - 3614	LOGEMCO01	Keysight / Aug-2023
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2024
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD / Jul-2023
Ka-Band Horn	JEF / NRL Std.	001	HRNKA001	AHD / Jul-2024
U-Band Horn	Cust. Micro. / HO19R	-	HRNU01	Cust.M. / On-Use
E-Band Horn	Flann / 26240-25-1030B	250901	HRNE01	Flann / On-Use
W-Band Horn	Cust. Micro. / HO10R	-	HRNW01	Cust.M. / On-Use
D/G-Band Horn	Cust. Micro. / $\mathrm{HO5R}$	-	HRNG01	Cust.M. / On-Use

#### Table 2: Equipment List.

### 2 Test Specifications and Procedures

#### 2.1 Test Specification and General Procedures

The goal of Density 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 Density Inc. OA1b for compliance to:

Country/Region	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.255
Canada	ISED Canada	ISED RSS-210 Issue 10

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"
ICES-003; Issue 7 (2020)	"Information Technology Equipment (ITE) - Limits and methods of measurement"

# 3 Configuration and Identification of the Equipment Under Test

#### 3.1 Description and Declarations

The EUT is an indoor field disturbance sensor. The EUT is approximately 13 x 13 x 3 cm in dimension, and is depicted in Figure 1. It is powered by 36-58 VDC power-over-ethernet (PoE). In use, this device is permanently affixed by professional installers to the ceiling or above the door in a commercial room or office. Table 3 outlines provider declared EUT specifications.



Figure 1: Photos of EUT.

Table 3:	EUT	Declarations.
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General Declarations	
Equipment Type:	Field Disturbance Sensor
Country of Origin:	USA
Nominal Supply:	36-58 VDC
Oper. Temp Range:	$0^{\circ}$ C to $+35^{\circ}$ C (manuf. declared)
Frequency Range:	60  to  62.5  GHz
Antenna Dimension:	6cm
Antenna Type:	integral patch arrays
Antenna Gain:	$5 \text{ dBi } (\max)$
Number of Channels:	1
Channel Spacing:	Not Applicable
Alignment Range:	Not Declared
Type of Modulation:	FMCW
United States	
FCC ID Number:	2AYY6OA002
Classification:	DXX
Canada	
IC Number:	26986-OA002
Classification:	Radar

#### 3.1.1 EUT Configuration

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

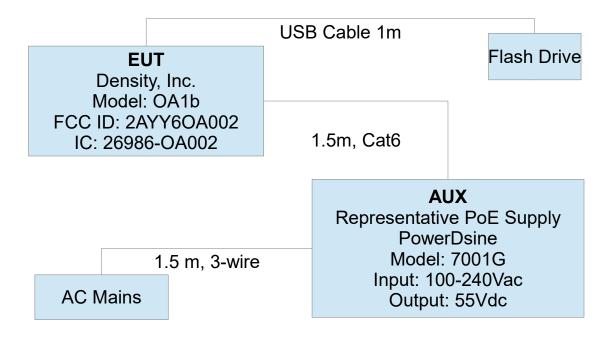


Figure 2: EUT Test Configuration Diagram.

#### 3.1.2 Modes of Operation

The EUT employs two modes of operation, the original OA mode FMCW chirp across the 61.0-61.5 GHz band and a new lower power OE mode FMCW chirp across the 60.3-62.2 GHz band.

#### 3.1.3 Variants

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

### 3.1.4 Test Samples

Two normal operating samples (SN: H3FYS002 and SN: H3GBH030) were provided for testing, along with a third sample for photos.

### 3.1.5 Functional Exerciser

Normal operating EUT functionality was verified prior to testing by observation of the emissions spectrum.

#### 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 professionally installed only in commercial environments and connects over ethernet as a commercial PC peripheral. Testing inline with the product as a PC Peripheral is addressed through manufacturer SDoC. Additionally, as narrow pulses arise when an the FMCW signal chirps past a receiver tuned frequency, the test lab has taken care to ensure we measure peak emissions only when the radar is either placed into CW mode or when the signal "Dwells" at a single frequency for an extended period of time to avoid errors due to pulse desensitization of the test receiver.

#### 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.

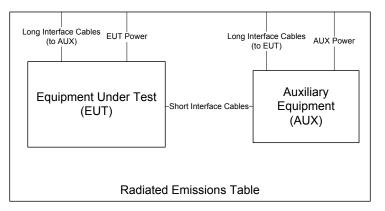


Figure 3: Radiated Emissions Diagram of the EUT.

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 regulation. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, 10cm diameter single-axis broadband probes meeting the requirements of ISED 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  $360^{\circ}$  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  $4 \times 5$  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.

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.

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

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

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

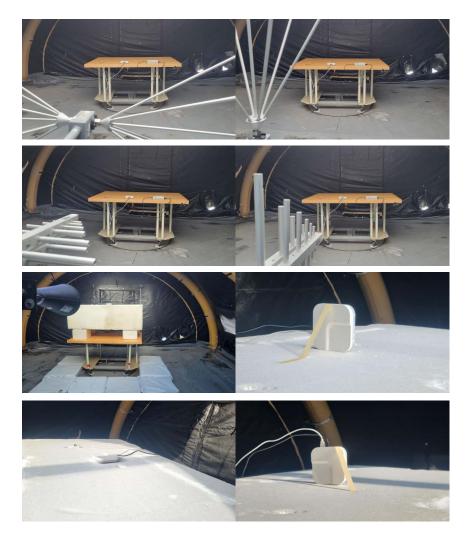


Figure 4: Radiated Emissions Test Setup Photograph(s).

#### 4.1.2 Conducted Emissions Test Setup and Procedures

**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 5.

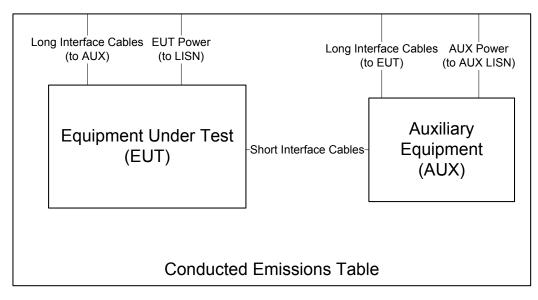


Figure 5: Conducted Emissions Setup Diagram of the EUT.

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 6.



Figure 6: Conducted Emissions Test Setup Photograph(s).

#### 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 of this EUT, measurements of the worst-case radiated emissions are performed with the supply voltage varied by no less than 85% and 115% of the nominal rated value for devices connecting to AC power mains.

#### 4.2 Intentional Emissions

#### 4.2.1 Fundamental Emission Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 4. Plots showing the measurements made to obtain these values are provided in Figure 7.

#### Table 4: Pulsed Emission Characteristics (Duty Cycle).

Det	IF Bandwidth	Video Bandwidth	Test Date:	15-May-23
SA Pk	10 MHz	10 MHz	Test Engineer:	J. Brunett
Pwr Mtr Pk	100 Ms/s	165 MHz	EUT	Density OA1b
			Meas. Distance:	3 m

					FMC	W Details – Exposu	re Duty C	Cycle .				
R0	Transmit Mode	Voltage	Test Frequency	Total Cycle Time	FMCW On- Time	BPSK Ant Duty	Chirp Period	CHIRP BW	Single Chirp On-Time	Chirps / FMCW On-Time	Total On-Time / Total Cycle Time	Power Duty Factor
		(V)	(GHz)	(ms)	(ms)	(dB)	(us)	(MHz)	(us)	(#)	(%)	(dB)
R1	OA	PoE	61.250	200.0	153.08		226	475.0	30	677	10.160	-9.9
R2	OE	PoE	61.200	62.5	26.60		139	2136.0	48	191	14.697	-8.3
#	C1	C2	C3	C4	C5	C6	C8	C9	C10	C11	C12	C13
	(ROW)	(CC	DLUMN)	NOTE:								
	R0		C3	Worst-case f	frequency sel	lected at center of op	perating ba	and.				
	R0		C4	Total Period	of the repeat	ted set of FMCW cl	nirps.					
	R0		C5	Time in which	ch the FMCV	V chirp is repetitive	ly sweepir	ıg.				
	R0		C6	Not applicab	ole – EUT do	es not BPSK betwe	en antenna	arrays.				
	R0		C8	Period of ind	lividual FMC	CW chirps within the	e FMCW	On-Time				
	R0		C10	Total On-tim	e of a single	FMCW chirp measu	ired via pe	ak power	detector / Osc	illocope, Video Ba	ndwidth = 165 MHz.	
	R0		C11	Calc Chirps	/ On-Time =	FMCW On-Time /	Chirp Peri	od				
	R0		C12	Total On-Tir	ne / Total Cy	cle Time = (Total	Chirps x S	ingle Chi	rp On-Time) /	Total Cycle Time		

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ef Level 91.00 dBµV/m tt 0 dB L TDF FRQ % Clrw 0 dBµV/m 0 dBµV/m 0 dBµV/m 91.000 dBµV/m		ns <b>- VBW</b> 28	B MHz D2 M3			102.9	-1.13 dB 226.000 µs 6 dBµV/m	Triggered CH1: 10 dl	B/div .9 dBm				/*************************************			
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ef Level 91.00 dBµV/m tt 0 dE L TDF FRQ k Clrw			3 MHz D2				-1.13 dB 226.000 µs	Triggered CH1: 10 dl	B/div .9 dBm	1.2						
efLevel 91.00 dBµV/m tt 0 dB			8 MHz	9F11				Triggered CH1: 10 dl	B/dlv							
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		-						]								
								6								
D2 M1 1 D3 M1 1	154.0 ms 200.0 ms	-38.03 d -0.90 d						M1 D2 M	1 1	21.9 153.0	2 ms 102.1 8 ms	.7 dBµV/m -38.09 dB	1			
M1 1	155.0 ms	109.16 dBµV/i	n		. un			Type Ref		X-value	Y-	value	Function	1	Function R	tesult
	X-value	Y-value	Funct	ion	Fun	ction Result	1	Marker				5001 p				20.0
51.25 GHz ker		1001	pts			1	00.0 ms/	CF 61.25 G	Hz			5001 p	ots			20.0
dBμV/m-								30 dBµV/m-								
								20 db 4/m								
dBµV/m								40.dBµV/m-								
dBµV/m					-			50 abpv/m								
								50 dBµV/m-								
dBµV/m								60 dBµV/m-								
dBµV/m	Filmina	+	hund		Unopen	+ +	useren syl	in all of all land		menter with tensor but	tile win outstation in				de sense de service de service	Danadad
dBµV/m	02							70 dBµV/m-								
dB a c/m								80 dBµV/m-								
dBµV/m																
97.000 dBµV/m								90 dBµV/m-	91.000 dBµV	//m						
dBµV/m	l î							100 dBµV/m	-							
LdBµV/m						1	55.00 <u>0 ms</u>		M1 Managementers	و المراجع ال						153.080
dBµV/m			M	1[1]		109.1	00.000 ms .6 dBuV/m	 110 dBμV/m					D2[1]			21.920
			D3	8[1]			-0.90 dB						M1[1]			102.17 dB
							,	O 1Pk Clrw	14							
k Clrw		BW 28 MHz						Att SGL TDF FF		dB 🥌 SWT	200 ms 👄	<b>VBW</b> 28	MHz			
L TDF FRQ k Clrw	9 👄 SWT 1 s 👄 V	10 10 10 10 10					( <del>_</del>	Ref Level	91.00 dBp	//m Offset	t -6.00 dB 👄	<b>RBW</b> 10	MHz			
L TDF FRQ k Clrw		BW 10 MHz						Spectrum	1							

## OA (ORIGINAL) MODE

Figure 7(a): Example Pulsed Emission Characteristics (Duty Cycle).

Ref Level 91.00	dBµV/m Off	set -6.00 d	3 👄 RBW 1	0 MHz					Ref Leve									
Att	0 dB 👄 SW	T 200 m	s 👄 VBW 2	8 MHz					🖷 Att		0 dB 😑 S	SWT 50	ms 👄 VBW	28 MHz				
GL TDF FRQ									SGL TDF F	RQ								
1Pk Clrw									●1Pk Clrw					_				
				D	3[1]			0.17 dB 62.5038 ms							D2[1]			-22.83 26.55920
ا 10 dBµV/m				M	1[1]			02.3038 ms .32 dBµV/m		l 					-M1[1]			84.94 dBµ\
					1111		00.	58.3762 ms	110 000011	i					outful.			9.41620
00 dBµV/m		-		L		-	-		100 dBµV/n	l								
				1					100 00011	i i								
0 dBpv/m=91.000	dBµV/m	1		-	3				90 dBpV/m-	91.000 dB	uv/m=		_	_				
CARDING THE ACTION OF		- and an or a second second	de la fate	1 1	AND CALIFORNIA DAYS	and Harver		Halphe Armen (More)			a a a a a a a a a a a a a a a a a a a	alana alaha da da	da adaad ma		alalahan dalah	66666644		
								-	80 dBµV/m-									
				1														
			n <b>2</b> 2 222 3	7.04.17	t i		0.0 0		70 dBµV/m·									
) dBµV/m	all a second second second	-	Property and the second	and the state of a	and the particulation	and the second state of the second state		and the second second second	S. Beneficial ad editor	ULL LISLAND	ما بي بي ال		فير ويحملون			111111111111111111111111111111111111111	ton and all all and	a day a plander by de
) ивру/п									60 dBpV/m	CALLAR MARKANIN	de para para de	the second biology and a	departed with the party	and all the second parts	Sector Milesting	a line problem inter	and the second second	and the state of the second second
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o dop vym									50 dBµV/m·									
) dBµV/m																		
									40 dBµV/m·		-	-	-	-	-	-		
) dBµV/m				<u> </u>														
				1					30 dBµV/m-		-	-	-	-	-			
F 61.2 GHz		1	5001	pts	1	1		20.0 ms/										
arker				·					CF 61.2 G	lz			50	D1 pts				5.0 m
vpe   Ref   Trc	X-valu	e	Y-value	Func	tion	Fun	ction Resul	t I	Marker									
M1 1			85.32 dBµV/						Type Re		X-va		Y-value		unction		Function	n Result
D2 M1 1		5992 ms	-21.81						M1	1		9.4162 ms	84.94 dBµ					
D3 M1 1	62.									11 1	21	6.5592 ms	-22.8	B dB				
pectrum Ref Level 91.00		5038 ms set -6.00 d	0.17 ) 3 • RBW 1 s • VBW 2	0 MHz					Triggeree CH1: 10 d	1 B/div				1				
Spectrum Ref Level 91.00 Att SGL TRG: VID TDF	dBµV/m Off 0 dB ⊜ SW	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz					Triggere	1 B/div		2						
pectrum Ref Level 91.00 Att GL TRG: VID TDF	dBµV/m Off 0 dB ⊜ SW	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz	2[1]				Triggeree CH1: 10 d	1 B/div		2						
pectrum Ref Level 91.00 Att GL TRG: VID TDF	dBµV/m Off 0 dB ⊜ SW	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz	2[1]			-1.26 dB 139.200 µs	Triggeree CH1: 10 d	1 B/div		2						
Ref Level 91.00 Att SGL TRG:VID TDF IPK CIrw	dBµV/m Off 0 dB ⊜ SW	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D	2[1]		85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggere CH1: 10 c VCent: -4	1 B/div i6 dBm 1								
Ref Level 91.00 Att SGL TRG:VID TDF IPK CIrw	dBµV/m Off 0 dB ⊜ SW	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D			85.	-1.26 dB 139.200 µs	Triggeree CH1: 10 d	1 B/div			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Ref Level 91.00 Att JPK CIrw 10 dBµV/m	dBµV/m Off 0 dB ⊜ SW	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D			85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggere CH1: 10 c VCent: -4	1 B/div i.6 dBm 1			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- Marine - M Marine - Marine - Marine - Marine - Ma	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			monten
Spectrum           Ref Level 91.00           Att           JEK CIRW           ID dBµV/m           JD dBµV/m	dBµV/m Off 0 dB • SW FRQ	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D			85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggere CH1: 10 c VCent: -4	1 B/div i.6 dBm 1			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			wow
Spectrum           Ref Level 91.00           Att           JEK CIRW           ID dBµV/m           JD dBµV/m	dBµV/m Off 0 dB • SW FRQ	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D	11[1]		85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggere CH1: 10 c VCent: -4	1 B/div i.6 dBm 1			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	wont		mont
Spectrum           Ref Level           SGL TR3: VID TDF           ID dBµV/m           ID dBµV/m           ID dBµV/m           ID dBµV/m           ID dBµV/m	dBµV/m Off 0 dB • SW FRQ	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D	11[1]	22	85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggere CH1: 10 c VCent: -4	1 B/div i.6 dBm 1			mann L		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	M.		
Spectrum           Ref Level           SGL TR3: VID TDF           ID dBµV/m           ID dBµV/m           ID dBµV/m           ID dBµV/m           ID dBµV/m	dBµV/m Off 0 dB • SW FRQ	<b>set</b> -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D	11[1]		85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggere CH1: 10 c VCent: -4	1 B/div i.6 dBm 1					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Month N		
Spectrum           Ref Level 91.00           Att           GL TRG: VID TDF           IPk Clrw           10 dBµV/m           00 dBµV/m           0 dBµV/m           0 dBµV/m	dBµV/m Off 0 dB • SW FRQ dBµV/m	set -6.00 d	3 <b>• RBW</b> 1	0 MHz 8 MHz D	11[1]		85.	-1.26 dB 139.200 µs .76 dBµV/m	Triggeree CH1: 10 c VCent: -4	I B/div 					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			<u> </u>
pectrum           Ref Level 91.00           Att           It RG: VID TDF           JPk Clrw           10 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggere CH1: 10 c VCent: -4	I B/div 								239.31
Spectrum           Ref Level 91.00           Att           GL TRG: VID TDF           IPk Clrw           10 dBµV/m           00 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L6 dBm 1					~~%~			<u> </u>
ipectrum           Ref Level 91.00           Att           ige.rks;viD TDF           igk.clmw           10 dBµV/m           00 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L6 dBm 1				us/Div				<u> </u>
ipectrum           Ref Level 91.00           Att           ssc. TRG:VID TDF           IPk Clrw           00 dBµV/m           00 dBµV/m           91.000           0 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m           1 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D			85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggere CH1: 10 c VCent: -4	B/div L6 dBm 1								<u> </u>
ipectrum           Ref Level 91.00           Att           ssc. TRG:VID TDF           IPk Clrw           00 dBµV/m           00 dBµV/m           91.000           0 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m           0 dBµV/m           1 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L6 dBm 1			50					<u> </u>
Spectrum           Ref Level 91.00           Att           SGL TRG: VID TDF           IPK Clrw           10 dBµV/m           00 dBµV/m           00 dBµV/m           0 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L6 dBm 1			50					<u> </u>
Spectrum           Ref Level 91.00           Att           SGL TRG: VID TDF           1Pk Clrw           10 dBµV/m           10 dBµV/m           10 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50					<u> </u>
Spectrum           Ref Level 91.00           Att           SGL TRG: VID TDF           IPK Clrw           10 dBµV/m           00 dBµV/m           0 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50			Maranta Maranta		<u> </u>
Spectrum           Ref Level 91.00           Att           SGL TRG:VID TDF           JR CHW           00 dBµV/m           0 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz D		1	85.	-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50					<u> </u>
Spectrum           Ref Level 91.00           Att           Irk Clrw           10 dbj.v/m           00 dbj.v/m           0 dbj.v/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	B RBW 1	0 MH2 8 MH2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		1		-1.26 dB 139.200 µs 76 dBµ/ym \$56.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50					<u> </u>
ipectrum           Ref Level 91.00           Att           GL TRS:VID TDF           JR Chevel 91.00           JR Chevel 91.00           0 dBµV/m           F 61.2 CHz	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m (G 71.000 dBµY/	set -6.00 d	3 • RBW 1 5 • VBW 2	0 MH2 8 MH2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		1		-1.26 dB 139.200 µs 76 dBµV/m 556.200 µs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50					<u> </u>
Comparison of the second	dBµV/m Off D dB SW FRQ dBµV/m dBµV/m G 71.000 dBµV/ dBµV/m	set -6.00 d T 1 m	3 RBW 1 5 VBW 2	0 MHz 8 MHz M M M M M M M M M M M M M M M M M M				-1.26 dB 139.200 μs 76 dBµ/m 556.200 μs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50					<u> </u>
Spectrum           Ref Level 91.00 Att           SGL TRG:VID TDF           Jrk Clrw           10 dBµV/m           00 dBµV/m	dBµV/m Off 0 dB SW FRQ dBµV/m dBµV/m cs 71.000 dBµV/ frug hybrid cs 71.000 dBµV/ cs	set -6.00 d T 1 m	3 • RBW 1 5 • VBW 2 1 1 1 1 1 1 1 1 1 1 1 1 1	0 MHz 8 MHz 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9				-1.26 dB 139.200 μs 76 dBµ/m 556.200 μs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div L.6 dBm			50					<u> </u>
Spectrum           Ref Level 91.00           Att           SGL TRG: VID TDF           Ink Cirw           10 dBµV/m           00 dBµV/m           0 dBµV/m	dBµV/m         Off           D dB         SW           FRQ         SW           dBµV/m         G           dQµV/m         G           dQµV/m         G           dQµV/m         G	set -6.00 d T 1 m	3 • RBW 1 5 • VBW 2	0 MHz 8 MHz 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				-1.26 dB 139.200 μs 76 dBµ/m 556.200 μs	Triggeree CH1: 10 c VCent: -4	B/div L.6 dBm 1 1 B/div B/div B/div L.6 dBm 1			50					<u> </u>

Spectrum

OE (ENTRY) MODE

Figure 7(b): Example Pulsed Emission Characteristics (Duty Cycle).

#### 4.2.2 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the worst case test mode. Radiated emissions are recorded following the test procedures listed in Section 2.1. The 99% EBW is measured as the maxheld peak-detected signal when the IF bandwidth is greater than or equal to 1% of the receiver span. The results of EBW testing are summarized in Table 5. Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 8.

#### Table 5: Intentional Emission Bandwidth.

		<b>Det</b> Pk	<b>IF Bandv</b> 1 MH			andwidth MHz			Test Dates est Engineers EUTs eas. Distances	:	27-Apr-23 J. Brunett Density OA1b 3 m
					Oc	cupied Band	width				
R0	Transmit	Channel	Temperature	Voltage	fL	fL Limit	fH	fH Limit	99% OBW	OBW Limit	Notes/Pass/Fail
K0	Mode		(C)	(V)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)	
R1		-	55.0	66.7	61020.9	61000.0	61494.5	61500.0	473.6	500.0	
R2		-	55.0	30.6	61020.9	61000.0	61494.4	61500.0	473.6	500.0	
R3	0.1	-	-20.0	66.7	61024.9	61000.0	61498.5	61500.0	473.6	500.0	
R4	OA	-	-20.0	30.6	61023.7	61000.0	61497.3	61500.0	473.6	500.0	
R5		-	20.0	55.0	61021.2	61000.0	61494.8	61500.0	473.6	500.0	
R6				fL <sub>MIN</sub>	61020.9	fH <sub>MAX</sub>	61498.5	OBW <sub>MAX</sub>	473.6		Pass
R7		-	55.0	66.7	60203.8	57000.0	62340.2	71000.0	2136.4		
R8		-	55.0	30.6	60201.3	57000.0	62337.6	71000.0	2136.4		
R9	OF	-	-20.0	66.7	60205.8	57000.0	62342.2	71000.0	2136.4		
R10	OE	-	-20.0	30.6	60204.6	57000.0	62341.0	71000.0	2136.4		
R11		-	20.0	55.0	60204.5	57000.0	62340.8	71000.0	2136.4		
R12				fL <sub>MIN</sub>	60201.3	fH <sub>MAX</sub>	62342.2	OBW	Pass		
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11

(ROW) (COLUMN) NOTE:

R0 R0 C5/C7 Computed via thermal chamber frequency shift and nominal OBW measurements.

C5/C7 OBW measured with Chirp active, equivalent to measurement with CW set at lowest and highest ends of chirp band.

Spectrum									Spectrun	r )							
Ref Level 9	0.00 dBµV/	'm		RBW 1 MHz					Ref Leve	47.00 dB	JV/m Offset	t -6.00	dB 👄 RBW 5 N	1Hz			`
Att	0 (	dB SV	VT 1 ms 👄	VBW 28 MHz	Mode Auto Swe	∋p			👄 Att		0 dB 👄 SWT	50 (	ms 👄 VBW 28 N	1Hz Mode Au	ito Sweep	Input AC	
TDF FRQ									PA TDF FR	Q							
⊖1Pk Max									●1Pk Max								
					D3[1]			1.01 dB						M1[1]			89.80 dBµV/m
120 dBµV/m-		_		_				478.800 MHz	110 dBµV/m								60.82310 GHz
					Occ Bw			5473526 MHz		l,				Occ Bw		2.1	36363636 GHz
110 dBµV/m-		_		_	M1[1]			1.54 dBµ∀/m		)						_	
1		T	L		1	N#3	61	.492800 GHz	90 dBµV/m-		T1		ML			T2	
100 dBµV/m-		7	mul	In manage			_		90 aBhA/m-							From	
		D.							80 dBuV/m-								
90 dBµV/m 90	.000 dBµV/	m T							oo ubpv/m								
									70 dBuV/m-								
80 dBµV/m										and march and and						here	mannasana
70 dBµV/m		1				1			60 dBuilden				_				
		1					A although to an	maliturenerseration									
60 dBµV/m	monorman	L <sup>a</sup>						medilihananinaninaninani	50 dBµV/m-								
oo abpv/m										47.000 dBµ	/V/m						
50 dBµV/m		_		_					40 dBµV/m-								
40 dBµV/m-				_		F2		_	30 dBµV/m-								
		F1															
CF 61.25 GHz	,			1001	nte		6	pan 1.0 GHz	20 dBµV/m-				-				
Marker	2			1001	pes		5	pun 1.0 unz	CF 61.18 (	GHz			1001 pt	s			Span 3.5 GHz
	* 1	X-va		Y-value	Function	-	nction Res		Marker								
Type Ref M1	1		4928 GHz	101.54 dBuV/r		Fu	nction Resi	ut	Type Re	f Trc	X-value		Y-value	Function		Function Re	sult
T1	1		4928 GHZ 1229 GHz	99.91 dBµV/r			473 526	6473526 MHz	M1	1	60.8231		89.80 dBµV/m				
T2	1		4755 GHz	99.90 dBµV/r			473.320	110020 MHZ	T1	1	60.20448		89.36 dBµV/m	Occ Bw		2.1	36363636 GHz
D2 M1	1		74.5 MHz	-7.81 d					T2	1	62.34084	GHz	86.87 dBµV/m				
D3 D2	1		78.8 MHz	1.01 d					r	T				Measuring			27.04.2023 14:36:31
									<u> </u>								14:36:31 ///

Figure 8: Example Intentional Emission Bandwidth.

#### 4.2.3Fundamental Emission

Following the test procedures listed in Section 2.1, radiated emissions measurements are made on the EUT for both Horizontal and Vertical polarized fields. Table 6 details the results of these measurements.

#### Table 6: Fundamental Radiated Emissions.

			Frequen	cy Range			De	et	IF B	andwi	dth		Vide	o Band	lwidth							Test Date			05/15/23
			25 MHz≤f	≤ 1 000 MH	Iz		Pk/Q	)Pk	12	20 kHz			1	300 kH	Iz						Te	est Engineer			J. Brunett
							Pk (S	SA)	10	) MHz				10 MH	z							EUT		Density OA1b	
							Avg (F	RMS)	1	MHz				3 MH:	z							Mode		(	CW, Chirp
			f > 1 0	00 MHz			Pk (Pw	r Mtr)	10	0 Ms/s	5		1	65 MI	łz						Me	eas. Distance		5	See Table.
		1	Env.	Frequen			ntenna/	Cable			D.		orrect		E3-Field		EI	RP	LIDD	Limit	EUT	Power Ou			
RO	Mode	1	Volt.	Start	Stop	Ant	Pol.	Dim	Ka	Kg		. ~	N/F		Pk		Pk					EUT Po Pk		D D	
RU	Mode	Temp.		MHz	MHz		H/V				NIK	DR			rk dBuV	Avg	РК	Avg JD	РК	Avg			Limit	dB	Commente
		(C)	(V)			QN		cm	dB/m	dB			m	dB		//m		dBm			dBi	dBm			Comments
R1		18	55.0	61021.0	61021.0	HRNV01	H/V	3.0	40.8	6.0	3.0		0.4		107.6		12.4		_	40.0	5.0	7.4	27.0	19.6	CW / Slow Chirp
R2	OA (CW)	18	55.0	61250.0	61250.0	HRNV01	H/V	3.0	40.8	6.0	3.0	3.0	0.4		107.3		12.1	2.2	43.0	40.0	5.0	7.1	27.0	19.9	CW / Slow Chirp
R3		18	55.0	61494.0	61494.0	HRNV01	H/V	3.0	40.8	6.0	3.0	3.0	0.4		107.2		12.0	2.1	43.0	40.0	5.0	7.0	27.0	20.0	CW / Slow Chirp
R4		18	55.0	60205.0	60205.0	HRNV01	H/V	3.0	40.8	6.0	3.0	3.0	0.4		89.2		-6.0	-14.3	10.0		5.0	-11.0	-10.0	1.0	CW / Slow Chirp
R5	OE (CW)	18	55.0	61250.0	61250.0	HRNV01	H/V	3.0	40.8	6.0	3.0	3.0	0.4		88.9		-6.3	-14.6	10.0		5.0	-11.3	-10.0	1.3	CW / Slow Chirp
R6	1	18	55.0	62340.0	62340.0	HRNV01	H/V	3.0	40.8	6.0	3.0	3.0	0.4		89.0		-6.2	-14.5	10.0		5.0	-11.2	-10.0	1.2	CW / Slow Chirp
			Env.	Frequen	cy Band	A	ntenna /	Cable			Ra	inge (	Correct	tion	Pr PWR	MTR	EI	RP	EIRP	Limit	EUT	Power Ou	tput		
R7		Temp.	Volt.	Start	Stop	Ant	Pol.	Dim	Ka	Kg	MR	DR	N/F	CF	Pk	Avg	Pk	Avg	Pk	Avg	Ant. Gain	EUT Po Pk	Limit	Pass By	
		(C)	(V)	MHz	MHz	QN	H/V	cm	dB/m	dB			m	dB	dBi	m	'	dBm		-	dBi	dBm	·	dB	Comments
R8	OA (Chirp)	18	55.0	61000.0	61500.0	HRNV01	H/V	3.0	40.8		3.0	3.0	0.4		-39.0	-49.7	13.6	2.9	43.0	40.0	5.0	8.6	27.0	18.4	Chirp
R9	OE (Chirp)	18	55.0	57000.0	71000.0	HRNV01	H/V	3.0	40.8		3.0	3.0	0.4		-58.5	-68.7	-5.9	-16.1	10.0		5.0	-10.9	-10.0	0.9	Chirp
R10																									
#		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24
		(1	ROW)	(COL	UMN)	NOTE:																			

R0

C10/C11/C12/C13 CF is computed assuming a 20 dB/decade Field Decay Rate. DR is Regulatory Range Distance. MR is Measurement Distance. N/F is near-far boundary.

Pk Field measured via SA per ANSI C63.10:2013 9.10, Pk Pwr measured with broadband Pk power meter per ANSI C63.10:2013 9.11 Avg measured via Broadband Pwr Meter w/ 1see avg window. EIRP/MHz is computed from field strength at 3m distance. EIRP = E3m – 95.2; E3m = 107 + Pr + Ka – Kg: C14 C15

C16 C17

R1-R6 R8.R9

R0

R0 R0

EIRP Avg is computed from EIRP Pk – Power Duty Cycle with Spectrum Analyzer. e.g. 107.6 dBuV/m @ 3m – 95.2 = 12.4 dBm EIRP (R1/C16) – 9.9 dB Duty = 2.5 dBm EIRP Avg (R1,C17) EIRP Avg is measured directly with broadband average power meter. e.g. (107 - -49.7 dBm + 40.8 - 0.0) - 95.2 = 2.9 dBm EIRP (R8/C17) C17

#### 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 7.

#### Table 7: Transmit Chain Spurious Emissions.

		25 N	$\begin{aligned} & f = quency \\ & f   I  Z \le f \le 1 \\ & f > 1 \ 000 \\ & f > 1 \ 000 \end{aligned}$	000 MHz MHz		Pk/ F	et QPk Pk vg	1	Bandwi 120 kH: 1 MHz 1 MHz	z	v	30 3	Bandw 0 kHz MHz MHz MHz	idth									Test I	est Date: Engineer: EUT: Mode: Distance:	J. Brunett Density OA1b OE + OA + CW
														FF	REQ < 40 GH	Z									
	E	nv.	Frequer	cy Band	Ant	enna +	Cable					orrect		E-F	ield @ DR							E-Fi	eld Limit		
R0	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	MR	DR	N/F	CF	Pk	Avg							Pk	Avg	Pass By	
	(C)	(V)	MHz	MHz	Number	H/V	cm	dB/m	dB	m	m	m	dB		lBuV/m							dI	BuV/m	dB	Comments
R1	18	55.0	1000.0	6000.0	HQR1TO18S01	H/V	15.0	33.0	-1.3	3.0	3.0	0.9		44.5	37.2							74.0	54.0	16.8	max all orientations
R2	18	55.0	14400.0	14400.0	HQR1TO18S01	Н	15.0	36.0	-2.5	3.0	3.0	2.2		55.0	53.5							74.0	54.0	0.5	LO SPUR – max all orient
R3	18	55.0	14400.0	14400.0	HQR1TO18S01	V	15.0	36.0	-2.5	3.0	3.0	2.2		54.1	52.5							74.0	54.0	1.5	LO SPUR – max all orient
R4	18	55.0	6000.0	18000.0	HQR1TO18S01	H/V	15.0	34.6	-3.1	3.0	3.0	2.7		55.0	53.5							74.0	54.0	0.5	max all orientations
R5	18	55.0	18000.0	26500.0	HRNK001	H/V	10.2	33.7	40.0	3.0	3.0	1.8		54.4	44.2							74.0	54.0	9.8	max all orientations
R6	18	55.0	28800.0	28800.0	HRNKA01	Н	9.2	36.0	40.0	3.0	3.0	1.6		46.2	44.3							74.0	54.0	9.7	LO SPUR – max all orient
R7	18	55.0	28800.0	28800.0	HRNKA01	V	9.2	36.0	40.0	3.0	3.0	1.6		41.9	40.2							74.0	54.0	13.8	LO SPUR – max all orient
R8	18	55.0	26500.0	40000.0	HRNKA01	H/V	9.2	37.0	40.0	3.0	3.0	2.3		46.2	44.3							74.0	54.0	9.7	max all orientations
R9															FREQ >= 40	GHZ									
	E	nv.	Frequer	cy Band	Ant	enna +	Cable					orrect		E-F	ield @ DR	EI	RP	EIR	P Limit	S @	DR	S Lir	nit @ DR		
R10	Temp.	Volt.	Start	Stop	Quality	Pol.	Dim.	Ka	Kg	MR	DR	N/F	CF	Pk	Avg	Pk	Avg	Pk	Avg	Pk	Avg	Pk	Avg	Pass By	
	(C)	(V)	GHz	GHz	Number	H/V	cm	dB/m	dB	m	m	m	dB	0	lBuV/m	dł	Зm	d	Bm	dBm	/cm2	dB	m/cm2	dB	Comments
R11	18	55.0	40.0	57.0	HRNU001	H/V	4.0	43.5		3.00				53.3	44.2		-51.0			-102.5	-111.5		-70.5	41.0	max all orientations
R12	18	55.0	57.0	61.0	HRNV001	H/V	3.0	40.7		3.00				66.8	48.5	-28.4		13.0	10.0					41.4	OA Mode, max all orientations
R13	18	55.0	61.5	71.0	HRNV001	H/V	3.0	41.0		3.00	3.0	0.4		68.7	50.0	-26.5	-45.2	13.0	10.0					39.5	OA Mode, max all orientations
R14	18	55.0	71.0	90.0	HRNE001	H/V	2.5	42.4		3.00				59.9	52.2	-35.3	-43.0			-95.9	-103.6		-70.5	33.1	max all orientations
R15	18	55.0	90.0	110.0	HRNW001	H/V	2.0	47.0		3.00				61.8	52.9		-42.3				-102.8		-70.5	32.3	max all orientations
R16	18	55.0	110.0	140.0	HRNG001	H/V	1.0	54.0		3.00	3.0	0.1		66.4	55.7	-28.8	-39.5			-89.3	-100.1		-70.5	29.6	max all orientations
R17	18	55.0	140.0	200.0	HRNG001	H/V	1.0	54.0		3.00	3.0	0.1		70.1	60.6	-25.1	-34.6			-85.6	-95.2		-70.5	24.7	max all orientations
R18																									
#	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

(ROW) (COLUMN) NOTE:

R0R9 C10/C11/C12/C13 CF is computed assuming a 20 dB/decade Decay Rate. DR is Regulatory Range Distance. MR is Measurement Distance, reduced as necessary to achieve Rx. sensitivity.

 R0/R9
 C7
 Dimension of antenna is taken to be larger of the test antenna and the DUT antenna; DUT antenna is 6cm in dimension.

 R9
 C16/C17
 EIRP is computed from field strength at 3 meter distance in a 1 MHz RBW/3 MHz VBW.

 R9
 C16/C17
 EIRP is computed from field strength at 3 meter distance in a 1 MHz RB

 R9
 C23
 S @ DR: 90 pW/cm2 = -70.5 dBm/cm2, FCC/ISED Regulatory Limit

R9 C20/C21 Spatial Power Density S @ 3m (dBm/cm^2) = EIRP (dBm) - 10\*log10(4\*pi\*((300cm)^2)) = EIRP (dBm) - 60.5 dB.

#### 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.

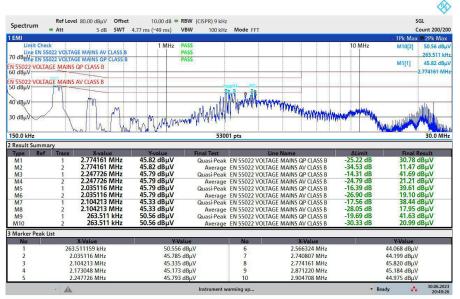
	1			F Bar	ndwidt	t	Video B	Bandwidt	h			Test Date:	22-Jan-23				
25	5 MHz≤	f≤1 000 MHz	Pk/QPk	120	kHz		300	) kHz			Tes	st Engineer:		J. Brune	tt		
	f > 1	000 MHz	Pk	1 N	ИНz		3 1	MHz				EUT:		1b			
	f > 1	000 MHz	Avg/RMS	5 1 1	ИНz		31	MHz			1	EUT Mode:		Active			
			0								Mea	s. Distance:		3 m			
												mperature:		5C			
												l. Humidty:		31%			
											K	a. muninuty.		5170			
			I	Digital	Spurio	ous Emis	sions - RA	DIATED	O(OATS)						FCC/ISED/CI		
	Test	Anteni	na			E	Field @ 31	n**	CISPR32 C	LB (QPk)	FCC/ISED 0	CLB (QPk)	FCC/ISED C	LA (QPk)			
	Freq.	QN	Test	Ka	Kg	Pk	Qpk	Avg	E3lim	Pass	E3lim	Pass	E3lim	Pass			
#	MHz		Pol.	dB/m	dB	dBµV/n	n dBµV/m	dBµV/m	dBµV/m	dB	dBµV/m	dB	dBµV/m	dB	Comments		
1	86.7	BICEMCO01	Н	7.8	5	42	36.5		40.0	3.5	40.0	3.5	49.5	13.0			
2	112.1	BICEMCO01	H	9.3	6	34.6	29.8		40.0	10.2	43.5	13.7	54.0	24.2			
3	137.3	BICEMCO01	Н	11.5	6	35.7	29.4		40.0	10.6	43.5	14.1	54.0	24.6			
4	182.2	BICEMCO01	Н	14.2	8	36.5	28.3		40.0	11.7	43.5	15.2	54.0	25.7			
5	240.0	LOGEMCO01	H	12.1	-1.0	45	42.5		47.0	4.5	46.0	3.5	56.9	14.4			
6	273.3	LOGEMCO01	H	13.1	-1.1	38.3	32.3		47.0	14.7	46.0	13.7	56.9	24.6			
7	348.1	LOGEMCO01	H	14.8	-1.3	33	26.3		47.0	20.7	46.0	19.7	56.9	30.6			
8	407.0	LOGEMCO01	H	15.9	-1.4	34.5	29.2		47.0	17.8	46.0	16.8	56.9	27.7			
9 10	456.0	LOGEMCO01	H	16.7	-1.6	35.8	30.1		47.0	16.9	46.0	15.9	56.9	26.8			
10	86.7	BICEMCO01	V	7.8	5	42.7	36.5		40.0	3.5	40.0	3.5	49.5	13.0			
11	112.1	BICEMCO01 BICEMCO01	V	9.3	5	42.7	36.9		40.0	3.3 3.1	40.0	5.5 6.6	49.3 54.0	13.0			
12	137.3	BICEMCO01 BICEMCO01	V	11.5	6	37.2	30.9		40.0	9.6	43.5	13.1	54.0	23.6			
14	182.2	BICEMCO01	V	14.2	8	34.0	29.3		40.0	10.7	43.5	14.2	54.0	24.7			
15	216.0	LOGEMCO01	v	11.3	9	36.5	30.9		40.0	9.1	43.5	14.2	54.0	23.1			
16	238.0	LOGEMCO01	V	12.1	-1.0	40.2	34.8		47.0	12.2	46.0	11.2	56.9	22.1			
17	273.3	LOGEMCO01	V	13.1	-1.1	31.3	25.2		47.0	21.8	46.0	20.8	56.9	31.7			
18	348.1	LOGEMCO01	V	14.8	-1.3	27.5	21.3		47.0	25.7	46.0	24.7	56.9	35.6			
19	407.0	LOGEMCO01	V	15.9	-1.4	26.4	21.1		47.0	25.9	46.0	24.9	56.9	35.8			
20	456.0	LOGEMCO01	v	16.7	-1.6	30.9	24.7		47.0	22.3	46.0	21.3	56.9	32.2			
20	150.0	LUGLACOUT		10.7	1.0	50.9	2-1./			22.5	10.0	21.5	50.7	52.2			
22																	
22						All other	digital em	rious ami	seion > 20	B below (	lass B emissio	ne Limite					
23 24						All ouler	uigitai spu	nous enn	551011 ~ 20 0	ID DEIOW C	Jass D CHHSSIC	nis Lillins.					
24 25																	
23 26				-													
20																	
28																	
29																	
30																	
31																	
32																	

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

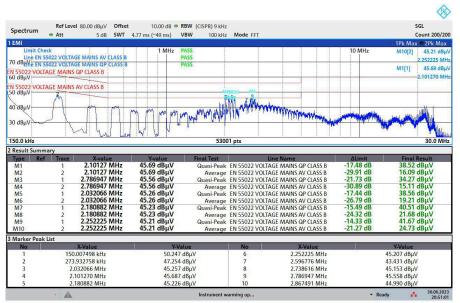
#### 4.3.3 Conducted Emissions Test Results - AC Power Port(s)

The results of emissions from the EUT's AC mains power port(s) are reported in Table 9.

#### Table 9: AC Mains Power Conducted Emissions Results.



20:49:27 30.06.2023



20:51:02 30.06.2023

### 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 10: Measurement Uncertainty.

Measured Parameter	${\bf Measurement} ~ {\bf Uncertainty}^{\dagger}$
Radio Frequency	$\pm (f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS - 1))/2 + 1 \text{ Hz})$
Conducted Emm. Amplitude	$\pm 1.9\mathrm{dB}$
Radiated Emm. Amplitude $(f < 30 \text{ MHz})$	$\pm 3.1\mathrm{dB}$
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 $(f > 1000 \text{ MHz})$	$\pm 3.7\mathrm{dB}$

<sup>†</sup>Ref: CISPR 16-4-2:2011+A1:2014

United States Department of Commerce National Institute of Standards and Technology	Gordon Helm EMC-002401-NE AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
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	Joseph Brunett EMC-002790-NE
This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17028:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009). 2023-06-20 through 2024-06-30 Effective Dates For the National Voluntiary Libboratory Accreditation Program	RANNED ENGINES

Figure 9: Accreditation Documents