



Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel Tel. +972 4628 8001 Fax. +972 4628 8277 E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (DTS)

FOR:

LiveMetric (Medical) S.A. Wristband blood pressure monitor Model:LM1P FCC ID: 2AQVELM1PX

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.



Table of contents

1	Applicant information	3
2	Equipment under test attributes	
3	Manufacturer information	3
4	Test details	
5	Tests summary	4
6	EUT description	5
6.1	General information	5
6.2	Test configuration	5
6.3	Changes made in EUT	5
6.4	EUT test positions	6
6.5	Transmitter characteristics	7
7	Transmitter tests according to 47CFR part 15 subpart C requirements	8
7.1	Minimum 6 dB bandwidth	8
7.2	Peak output power	13
7.3	Field strength of spurious emissions	
7.4	Band edge radiated emissions	
7.5	Maximum power spectral density (PSD)	
7.6	Antenna requirements	
8	APPENDIX A Test equipment and ancillaries used for tests	
9	APPENDIX B Measurement uncertainties	
10	APPENDIX C Test laboratory description	
11	APPENDIX D Specification references	
12	APPENDIX E Test equipment correction factors	
13	APPENDIX F Abbreviations and acronyms	49



1 Applicant information

Client name:	LiveMetric (Medical) S.A.
Address:	40, rue Glesener, Luxembourg L-1630
Telephone:	+1 (330) 285-7222
E-mail:	benita.lanzer@livemetric.com
Contact name:	Mr. Benita Lanzer

2 Equipment under test attributes

Product name:	Wristband blood pressure monitor
Product type:	BLE
Model(s):	LM1P
Serial number:	102-032-07
Hardware version:	A1
Software release:	Rev 1.0
Receipt date	27-Aug-18

3 Manufacturer information

Manufacturer name:	LiveMetric (Medical) S.A.
Address:	40, rue Glesener, Luxembourg L-1630
Telephone:	+1 (330) 285-7222
E-Mail:	benita.lanzer@livemetric.com
Contact name:	Mr. Benita Lanzer

4 Test details

Project ID:	31317
Location:	Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started:	27-Aug-18
Test completed:	29-Nov-18
Test specification(s):	FCC 47CFR part 15 subpart C § 15.247 (DTS)



5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.247(a)2, 6 dB bandwidth	Pass
Section 15.247(b)3, Peak output power	Pass
Section 15.247(d), Radiated spurious emissions	Pass
Section 15.247(d), Band edge emissions	Pass
Section 15.247(e), Peak power density	Pass
Section 15.247(b)5, RF exposure	Pass, the exhibit to the application of certification is provided
Section 15.207(a), Conducted emission	Not required
Section 15.203, Antenna requirement	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	November 29, 2018	RH
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	December 5, 2018	Chu
Approved by:	Mr. K. Zushchyk, Projects & Customer Manager, EMC & Radio	December 24, 2018	X



6 EUT description

6.1 General information

The EUT, model name LM1P, wristband blood pressure monitor, is intended to measure systolic and diastolic blood pressure (BP) and heart rate (HR) in a non-invasive manner.

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during testing.



6.4 EUT test positions

Photograph 6.4.1 EUT in X-axis orthogonal position



Photograph 6.4.2 EUT in Y-axis orthogonal position



Photograph 6.4.3 EUT in Z-axis orthogonal position



6.5 Transmitter characteristics

Туре о	Type of equipment									
Х	Stand-alone (Equipment with or without its own control provisions)									
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)									
	Plug-in card (Equ	ipment ir	ntended for	a variety	of host sy	rstems)				
Intende	ed use	Со	ndition of	use						
	fixed	Alw	/ays at a di	stance m	ore than 2	m from a	all people			
	mobile	Alw	/ays at a di	stance m	ore than 2	0 cm fror	n all people			
Х	portable	Ma	y operate a	at a distar	nce closer	than 20 d	om to human bod	у		
Assign	ed frequency ran	ge		2400-24	83.5 MHz					
Operat	ing frequency rar	ge		2402 – 2	2480 MHz					
Movim	um rotod output n	ower		At trans	mitter 50 G	2 RF outp	out connector	NA		
waxim	um rated output p	ower		Peak ou	itput powe	r		-9.72 dB	m	
				1 X	No					
							continuous varia	ble		
Is trans	smitter output por	wer varia	ble?				stepped variable	e with stepsi	ze dB	
					Yes	minimum	RF power		dBm	
						maximum	n RF power		dBm	
Antenr	a connection									
								wi	th temporary RF connect	tor:
	unique coupling		star	idard con	ard connector		integral	X wi	thout temporary RF con	nector
Antenr	na/s technical cha	racterist	ics							
Type			Manufac	turer		Model I	number		Gain	
Interna			Wurth el	ectronik		SMT			-0.5 dBi	
Transmitter aggregate data rate/s 1 Mbps				os						
Туре о	Type of modulation BLE(GFSK)									
Modulating test signal (baseband) PRBS										
Transn	nitter power sour	e								
Х	Battery	Nomina	I rated vol	tage	3.7 V	DC	Battery type	Li-lon p	olymer battery	
	DC	Nomina	I rated vol	tage						
	AC mains Nominal rated voltage					Frequency				



Test specification:	Section 15.247(a)(2), 6 dB bandwidth				
Test procedure:	ANSI C63.10, Section 11.8.1				
Test mode:	Compliance				
Date(s):	03-Sep-18	verdict.	FA33		
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery		
Remarks:					

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Minimum 6 dB bandwidth

7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
902.0 - 928.0		
2400.0 - 2483.5	6.0	500.0
5725.0 - 5850.0		

* - Modulation envelope reference points provided in terms of attenuation below the peak of modulated carrier.

7.1.2 Test procedure

- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
- 7.1.2.2 The EUT was set to transmit modulated carrier.
- **7.1.2.3** The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

Figure 7.1.1 The 6 dB bandwidth test setup



Test specification:	Section 15.247(a)(2), 6 dB bandwidth			
Test procedure:	ANSI C63.10, Section 11.8.1			
Test mode:	Compliance	Vordiot	DASS	
Date(s):	03-Sep-18	veraici.	FA33	
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery	
Remarks:				

Table 7.1.2 The 6 dB bandwidth test results

ASSIGNED FREQUENCY BAN DETECTOR USED: SWEEP TIME: RESOLUTION BANDWIDTH: VIDEO BANDWIDTH: MODULATION ENVELOPE REF MODULATION: BIT RATE:	2400-2483.5 MHz Peak Auto 100 kHz 300 kHz 6.0 dBc GFSK			
Carrier frequency, MHz	6 dB bandwidth. kHz	Limit. kHz	Margin, kHz	Verdict
2402	510.5	500	10.5	Pass
2442	522.5	500	22.5	Pass
2480	513.5	500	13.5	Pass

Reference numbers of test equipment used

<u>.</u>		 <u>.</u>	<u>.</u>	<u>.</u>	-	<u>.</u>	<u>.</u>
HL 2909	HL 4135						

Full description is given in Appendix A.



Test specification:	Section 15.247(a)(2), 6 dB bandwidth			
Test procedure:	ANSI C63.10, Section 11.8.1			
Test mode:	Compliance	Vordiot	DV66	
Date(s):	03-Sep-18	veruici.	FASS	
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery	
Remarks:				









Test specification:	Section 15.247(a)(2), 6 dB bandwidth			
Test procedure:	ANSI C63.10, Section 11.8.1			
Test mode:	Compliance	Vordiot	DV66	
Date(s):	03-Sep-18	verdict: PASS		
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery	
Remarks:				



Plot 7.1.2 The 6 dB bandwidth test result at mid frequency





Test specification:	Section 15.247(a)(2), 6 dB bandwidth			
Test procedure:	ANSI C63.10, Section 11.8.1			
Test mode:	Compliance	Vordiot	DV66	
Date(s):	03-Sep-18	veruici.	FASS	
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery	
Remarks:				









Test specification:	Section 15.247(b)(3), Peak output power			
Test procedure:	ANSI C63.10, Section 11.9.1.1			
Test mode:	Compliance	Vardiate DASS		
Date(s):	03-Sep-18	verdict.	FA33	
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery	
Remarks:				

7.2 Peak output power

7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

Table 7.2.1	Peak	output	power	limits
	i cun	output	ponci	minus

Assigned frequency	Maximum antenna	Peak outpu	It power*	Equivalent field strength	
range, MHz	gain, dBi	W	dBm	limit @ 3m, dB(µV/m)**	
902.0 - 928.0					
2400.0 - 2483.5	6.0	1.0	30.0	131.2	
5725.0 - 5850.0					

*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;

without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band; by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

**- Equivalent field strength limit was calculated from the peak output power as follows: E=sqrt(30×P×G)/r, where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

7.2.2 Test procedure

- 7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.
- 7.2.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- **7.2.2.3** The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360⁰ and the measuring antenna height was swept in both vertical and horizontal polarizations.
- **7.2.2.4** The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.
- **7.2.2.5** The maximum peak output power was calculated from the field strength of carrier as follows:

 $P = (E \times d)^2 / (30 \times G),$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(μ V/m) - Transmitter antenna gain in dBi – 95.2 dB

7.2.2.6 The worst test results (the lowest margins) were recorded in Table 7.2.2.



Test specification:	Section 15.247(b)(3), Peak output power				
Test procedure:	ANSI C63.10, Section 11.9.1.1				
Test mode:	Compliance	Vordiot	DASS		
Date(s):	03-Sep-18	verdict:	FA33		
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Figure 7.2.1 Setup for carrier field strength measurements



Test specification:	Section 15.247(b)(3), Peak c	Section 15.247(b)(3), Peak output power			
Test procedure:	ANSI C63.10, Section 11.9.1.1				
Test mode:	Compliance	Vordiot	DASS		
Date(s):	03-Sep-18	verdict.	FA33		
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY:	2400-2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	0.8 m
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Double ridged guide
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	1 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
EUT 6 dB BANDWIDTH:	522.5 kHz
RESOLUTION BANDWIDTH:	1 MHz
VIDEO BANDWIDTH:	3 MHz

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402.0000	84.77	Н	1.5	5.0	-0.5	-9.93	10	-20.43	Pass
2442.0000	84.98	Н	1.5	-24.0	-0.5	-9.72	10	-20.22	Pass
2479.9772	77.91	Н	1.5	-33.0	-0.5	-16.79	10	-27.29	Pass

*- EUT front panel refer to 0 degrees position of turntable.

- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$, where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm* = *Field strength in dB(\muV/m)* - *Transmitter antenna gain in dBi* – 95.2 *dB* *- Margin = Peak output power – specification limit.

Reference numbers of test equipment used

HL 3903	HL 4360	HL 5288	HL 5405		

Full description is given in Appendix A.



Test specification:	Section 15.247(b)(3), Peak output power				
Test procedure:	ANSI C63.10, Section 11.9.1.1				
Test mode:	Compliance	Vordiot	DV66		
Date(s):	03-Sep-18	veruici.	FA33		
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery		
Remarks:		·			





Plot 7.2.2 Field strength of carrier at mid frequency





Test specification:	Section 15.247(b)(3), Peak output power				
Test procedure:	ANSI C63.10, Section 11.9.1.1				
Test mode:	Compliance	Vordiot			
Date(s):	03-Sep-18	veruici.	FA33		
Temperature: 23 °C	Relative Humidity: 50 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Plot 7.2.3 Field strength of carrier at high frequency



Test specification:	Section 15.247(d), Radiated spurious emissions			
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1			
Test mode:	Compliance	Vardiate	DV66	
Date(s):	28-Aug-18	verdict.	FA33	
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery	
Remarks:				

7.3 Field strength of spurious emissions

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Frequency, MHz	Field streng	tricted bands,	Attenuation of field strength of spurious versus	
Trequency, IIII	Peak	Quasi Peak	Average	carrier outside restricted bands, dBc***
0.009 - 0.090	148.5 – 128.5	NA	128.5 - 108.5**	
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 - 93.8**	
0.490 – 1.705		73.8 – 63.0**		
1.705 - 30.0*		69.5		20.0
30 – 88	NIA	40.0	NIA	20.0
88 – 216	INA	43.5	NA	
216 – 960		46.0		
960 - 1000		54.0		
1000 – 10 th harmonic	74.0	NA	54.0	

Table 7.3.1 Radiated spurious emissions limits

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

 $Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$

where S_1 and S_2 – standard defined and test distance respectively in meters.

**- The limit decreases linearly with the logarithm of frequency.

*** - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

7.3.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

- **7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.
- **7.3.2.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360⁰ and the measuring antenna was rotated around its vertical axis.
- **7.3.2.3** The worst test results (the lowest margins) were recorded and shown in the associated plots.

7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

- **7.3.3.1** The EUT was set up as shown in Figure 7.3.2, Figure 7.3.3, energized and the performance check was conducted.
- **7.3.3.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360⁰, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.
- 7.3.3.3 The worst test results (the lowest margins) were recorded and shown in the associated plots.



Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate	DV66		
Date(s):	28-Aug-18	verdict.	FA33		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz



Figure 7.3.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz





Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate	DV66		
Date(s):	28-Aug-18	verdict.	FA33		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Figure 7.3.3 Setup for spurious emission field strength measurements above1000 MHz





Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate	DV66		
Date(s):	28-Aug-18	verdict.	FA33		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Table 7.3.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: INVESTIGATED FREQUENCY RANGE: TEST DISTANCE: MODULATION: BIT RATE: DUTY CYCLE: TRANSMITTER OUTPUT POWER SETTINGS: DETECTOR USED: RESOLUTION BANDWIDTH: VIDEO BANDWIDTH: TEST ANTENNA TYPE: 2400-2483.5 MHz 0.009 – 25000 MHz 3 m GFSK 1 Mbps 100 % Maximum Peak 100 kHz 300 kHz Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength of spurious, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(µV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
Low carrier frequency									
7205.8375	52.37	V	1.29	8.0	04 77	32.40	20.0	12.40	Dooo
9270.6000	48.73	Н	2.34	-6.0	04.77	36.04	20.0	16.04	Fd55
Mid carrier fre	equency								
14435.3500	52.29	Н	1.00	-15.0	84.98	32.69	20.0	12.69	Pass
High carrier fr	requency								
14407.9375	52.29	Н	1.00	180.0	77.91	20.52	20.0	0.52	Pass

*- EUT front panel refers to 0 degrees position of turntable.

**- Margin = Attenuation below carrier - specification limit.



Test specification:	Section 15.247(d), Radiated	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1					
Test mode:	Compliance	Vardiate	DV66			
Date(s):	28-Aug-18	verdict.	FA33			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery			
Remarks:						

Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: INVESTIGATED FREQUENCY RANGE: TEST DISTANCE: MODULATION: BIT RATE: DUTY CYCLE: TRANSMITTER OUTPUT POWER SETTINGS: DETECTOR USED: RESOLUTION BANDWIDTH: TEST ANTENNA TYPE: 2400 – 2483.5 MHz 1000 – 25000 MHz 3 m GFSK 1 Mbps 100 % Maximum Peak 1000 kHz Double ridged guide

Frequency	Anteni	na	A = i ma u 4 h	Peak field s	trength(VB	W=3 MHz)	Average	field strength(VBW=10 Hz)	
MHz	Polarization	Height, m	degrees*	Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Verdict
Low carrie	r frequency									
4808.4000	V	1.29	8.0	46.94	74.00	-27.06	46.94	54.00	-7.06	Deee
12558.7875	Н	2.34	-6.0	50.58	74.00	-23.42	50.58	54.00	-3.42	F d 5 5
Mid carrier	frequency									
4883.9125	Н	1.00	9.0	42.69	74.00	-31.31	42.69	54.00	-11.31	
7388.8375	Н	2.08	117.0	46.96	74.00	-27.04	46.96	54.00	-7.04	Pass
12105.9625	V	1.02	-163.0	53.18	74.00	-20.82	53.18	54.00	-0.82	
High carrie	er frequency									
4880.4375	V	3.15	-14.0	43.27	74.00	-30.73	43.27	54.00	-10.73	
7440.5000	Н	1.02	130.0	51.50	74.00	-22.5	51.50	54.00	-2.50	Pass
12139.7625	V	4.00	117.0	53.34	74.00	-20.66	53.34	54.00	-0.66	

*- EUT front panel refers to 0 degrees position of turntable.

**- Margin = Measured field strength - specification limit.



Test specification:	Section 15.247(d), Radiated	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1					
Test mode:	Compliance	Vordiot	DASS			
Date(s):	28-Aug-18	veraici.	FA33			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery			
Remarks:						

Table 7.3.4 Field strength of spurious emissions below 1 GHz within restricted bands

	2400 - 2483 5 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
BIT RATE:	1 Mbps
DUTY CYCLE:	100 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz)
	9.0 kHz (150 kHz – 30 MHz)
	120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth

TEST ANTENNA TYPE:

Active loop (9 kHz - 30 MHz) Biconilog (30 MHz – 1000 MHz)

FREQUENCY HOPPING:

FREQUENCY HOPPING: Disabled								
Frequency, MHz	Peak emission, dB(µV/m)	Qua Measured emission, dB(μV/m)	isi-peak Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Low carrier	frequency							
No emission peaks were found Pass							Pass	
Mid carrier f	requency							
No emission peaks were found							Pass	
High carrier frequency								
No emission peaks were found							Pass	

*- Margin = Measured emission - specification limit.

**- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0446	HL 3903	HL 4360	HL 4933	HL 5288	HL 5405

Full description is given in Appendix A.

Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and	d 11.12.1			
Test mode:	Compliance	Vardiate	DV66		
Date(s):	28-Aug-18	verdict:	FA33		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Table 7.3.5 Restricted bands according to FCC section 15.205

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 – 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Abovo 29 6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	ADOVE 30.0



Test specification:	Section 15.247(d), Radiated spurious emissions					
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1					
Test mode:	Compliance					
Date(s):	28-Aug-18	verdict:	FA33			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery			
Remarks:						

Plot 7.3.1 Radiated emission measurements from 0.009 to 30 MHz at the low, mid, high carrier frequency





Test specification:	Section 15.247(d), Radiated spurious emissions					
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1					
Test mode:	Compliance					
Date(s):	28-Aug-18	verdict:	FA33			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery			
Remarks:						

Plot 7.3.2 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency









Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate	DV66		
Date(s):	28-Aug-18	verdict.	FA33		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Plot 7.3.4 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal



Plot 7.3.5 Radiated emission measurements from 1000 to 3000 MHz at the low carrier frequency

TEST SITE:Semi anechoic chamberTEST DISTANCE:3 mANTENNA POLARIZATION:Vertical and Horizontal





Test specification:	Section 15.247(d), Radiated spurious emissions					
Test procedure:	ANSI C63.10, sections 11.11 an	d 11.12.1				
Test mode:	Compliance	Vordiot	DV66			
Date(s):	28-Aug-18	verdict.	FA33			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery			
Remarks:						

Plot 7.3.6 Radiated emission measurements from 1000 to 3000 MHz at the mid carrier frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal



Plot 7.3.7 Radiated emission measurements from 1000 to 3000 MHz at the high carrier frequency

TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal





Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate	DV66		
Date(s):	28-Aug-18	verdict.	FA33		
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Plot 7.3.8 Radiated emission measurements from 3000 to 18000 MHz at the low carrier frequency









Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate DASS			
Date(s):	28-Aug-18	verdict: PASS			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Plot 7.3.10 Radiated emission measurements from 3000 to 18000 MHz at the high carrier frequency







Date: 28.AUG.2018 12:08:46

Date: 28.AUG.2018 12:38:45



Test specification:	Section 15.247(d), Radiated spurious emissions				
Test procedure:	ANSI C63.10, sections 11.11 and 11.12.1				
Test mode:	Compliance	Vardiate DASS			
Date(s):	28-Aug-18	verdict: PASS			
Temperature: 24 °C	Relative Humidity: 51 %	Air Pressure: hPa	Power: Battery		
Remarks:					

Plot 7.3.12 Radiated emission measurements from 18000 to 25000 MHz at the mid carrier frequency



Date: 28.AUG.2018 12:14:40

Date: 28.AUG.2018 12:35:14

Plot 7.3.13 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency



Date: 28.AUG.2018 12:20:05

Date: 28.AUG.2018 12:28:58

Test specification:	Section 15.247(d), Band edge emissions				
Test procedure:	ANSI C63.10, section 11.13				
Test mode:	Compliance	Vardiate DASS			
Date(s):	22-Nov-18	verdict.	FA33		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery		
Remarks:					

7.4 Band edge radiated emissions

7.4.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.4.1.

Output power	Assigned	Attenuation below	Field strength at 3 m within restricted bands, dB(μV/m)		
	rrequency, MHZ carrier', dBC		Peak	Average	
	902.0 - 928.0				
Peak	2400.0 - 2483.5	20.0	74.0	54.0	
	5725.0 – 5850.0				
Averaged over a time	902.0 – 928.0				
interval	2400.0 - 2483.5	30.0	74.0	54.0	
	5725.0 - 5850.0				

* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

7.4.2 Test procedure

- **7.4.2.1** The EUT was set up as shown in Figure 7.4.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 7.4.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- **7.4.2.3** The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.
- **7.4.2.4** The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- **7.4.2.5** The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.4.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- **7.4.2.6** The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.



Figure 7.4.1 Band edge emission test setup

Test specification:	Section 15.247(d), Band edg	Section 15.247(d), Band edge emissions			
Test procedure:	ANSI C63.10, section 11.13				
Test mode:	Compliance	Vordict	DV66		
Date(s):	22-Nov-18	veruict.	FAGO		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery		
Remarks:					

Table 7.4.2 Band edge emission test results

ASSIGNED FREC DETECTOR USEI MODULATION: BIT RATE: TRANSMITTER O VIDEO BANDWID	QUENCY RANGE: D: PUTPUT POWER SETTINGS: TH:	2400-2 Peak GFSK 1 Mbp Maxim ≥ RBV	2483.5 MHz s uum V	
Frequency, MHz	Band edge emission, Peak, dB(μV/m)	Limit Average, dB(μV/m)	Margin, dB	Verdict
2400 2483 5	42.879 38.027	54	-11.121 -16.973	Pass

*- Margin = Attenuation below carrier – specification limit.

Reference numbers of test equipment used

HL 3903	HL 4360	HL 5288	HL 5405				
- Ill description is given in Annondix A							

Full description is given in Appendix A.



Test specification:	Section 15.247(d), Band edge emissions				
Test procedure:	ANSI C63.10, section 11.13				
Test mode:	Compliance	Vardiet, DASS			
Date(s):	22-Nov-18	verdict.	FA33		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery		
Remarks:					









Test specification:	Section 15.247(d), Peak power density				
Test procedure:	ANSI C63.10 section 11.10				
Test mode:	Compliance	Vardiet: DASS			
Date(s):	22-Nov-18	verdict.	FA33		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery		
Remarks:					

7.5 Maximum power spectral density (PSD)

7.5.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.5.1.

Table	751	Peak	spectral	nower	density	limits
lable	1.5.1	I Can	spectral	power	uchally	mmus

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(µV/m)*
902.0 - 928.0			
2400.0 - 2483.5	3.0	8.0	103.2
5725.0 - 5850.0			

* - Equivalent field strength limit was calculated from the peak spectral power density as follows: E=sqrt(30×P)/r, where P is peak spectral power density and r is antenna to EUT distance in meters.

7.5.2 Test procedure for field strength measurements

- **7.5.2.1** The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- **7.5.2.3** The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360⁰ and the measuring antenna height was swept in both vertical and horizontal polarizations.
- **7.5.2.4** The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.
- 7.5.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G)$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi – 95.2 dB

7.5.2.6 The calculated maximum peak output power was found below the peak spectral power density limit as provided in Table 7.5.2 and associated plots.



Test specification:	Section 15.247(d), Peak power density			
Test procedure:	ANSI C63.10 section 11.10			
Test mode:	Compliance	Vardiet: DASS		
Date(s):	22-Nov-18	verdict.	FA33	
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery	
Remarks:				

Figure 7.5.1 Setup for carrier field strength measurements





Test specification:	Section 15.247(d), Peak power density			
Test procedure:	ANSI C63.10 section 11.10			
Test mode:	Compliance	Vardiate	DV66	
Date(s):	22-Nov-18	verdict:	FA33	
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery	
Remarks:				

Table 7.5.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY:	2400-2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	0.8 m
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Double ridged guide
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	1 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
EUT 6 dB BANDWIDTH:	522.5 kHz
RESOLUTION BANDWIDTH:	1 MHz
VIDEO BANDWIDTH:	3 MHz

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402.0000	84.77	Н	1.5	5.0	-0.5	-9.93	8	-18.43	Pass
2442.0000	84.98	Н	1.5	-24.0	-0.5	-9.72	8	-18.22	Pass
2479.9772	77.91	Н	1.5	-33.0	-0.5	-16.79	8	-27.29	Pass

*- EUT front panel refer to 0 degrees position of turntable.

- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$, where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm* = *Field strength in dB(\muV/m)* - *Transmitter antenna gain in dBi* – 95.2 *dB* *- Margin = Peak output power – specification limit.

Reference numbers of test equipment used

HL 3903	HL 4360	HL 5288	HL 5405			

Full description is given in Appendix A.



Test specification:	Section 15.247(d), Peak power density			
Test procedure:	ANSI C63.10 section 11.10			
Test mode:	Compliance	Vordiot	DV66	
Date(s):	22-Nov-18	verdict.	FA33	
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery	
Remarks:				











Test specification:	Section 15.247(d), Peak power density			
Test procedure:	ANSI C63.10 section 11.10			
Test mode:	Compliance	Vordict	DV66	
Date(s):	22-Nov-18	veruici.	FASS	
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1008 hPa	Power: Battery	
Remarks:				

Plot 7.5.3 Field strength of carrier at high frequency





Test specification:	Section 15.203, Antenna requirements			
Test procedure:	Visual inspection			
Test mode:	Compliance	Vardiate	DVCC	
Date(s):	29-Nov-18	verdict.	FA33	
Temperature: 22 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery	
Remarks:				

7.6 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.6.1.

Table 7.6.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	
The transmitter employs a unique antenna connector	NA	Comply
The transmitter requires professional installation	NA	



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	11-Feb-18	11-Feb-19
2909	Spectrum analyzer, ESA-E, 100 Hz to	Agilent	E4407B	MY414447	27-Mar-18	27-Mar-19
	26.5 GHz	Technologies		62		
3903	Microwave Cable Assembly, 40.0 GHz,	Huber-Suhner	SUCOFLE	1226/2A	07-Feb-18	07-Feb-19
	1.5 m, SMA/SMA		X 102A			
4135	Shield Box	TESCOM CO.,	TC-5916A	5916A000	04-Apr-18	04-Apr-19
		LTD		136		
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde &	ESU40	100322	26-Dec-17	26-Dec-18
		Schwarz				
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power	AHA-118	701046	04-Jan-18	04-Jan-19
		Corporation				
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-	00809	21-Jan-18	21-Jan-19
			8000E			
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11	500023/11	01-Aug-18	01-Aug-19
			N(x2)	8		



9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon	n Labs EMC measurements
--	-------------------------

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: ± 1.7 dB
	12.4 GHz to 40 GHz: ± 2.3 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB
	2.9 GHz to 6.46 GHz: ± 3.5 dB
	6.46 GHz to 13.2 GHz: ± 4.3 dB
	13.2 GHz to 22.0 GHz: ± 5.0 dB
	22.0 GHz to 26.8 GHz: ± 5.5 dB
	26.8 GHz to 40.0 GHz: ± 4.8 dB
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB
	150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance	
Horizontal polarization	Biconilog antenna: ± 5.3 dB
	Biconical antenna: ± 5.0 dB
	Log periodic antenna: ± 5.3 dB
	Double ridged horn antenna: \pm 5.3 dB
Vertical polarization	Biconilog antenna: ± 6.0 dB
	Biconical antenna: ± 5.7 dB
	Log periodic antenna: \pm 6.0 dB
	Double ridged horn antenna: ± 6.0 dB

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.



10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

Address:	P.O. Box 23, Binyamina 3055001, Israel.
Telephone:	+972 4628 8001
Fax:	+972 4628 8277
e-mail:	mail@hermonlabs.com
website:	www.hermonlabs.com

Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

11 APPENDIX D Specification references

FCC 47CFR part 15: 2017	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz



12 APPENDIX E Test equipment correction factors

Antenna factor Active loop antenna Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



Frequency, MHz	Antenna factor, dB/m	
30	14.96	
35	15.33	
40	16.37	
45	17.56	
50	17.95	
60	16.87	
70	13.22	
80	10.56	
90	13.61	
100	15.46	
120	14.03	
140	12.23	
160	12.67	
180	13.34	
200	15.40	
250	16.42	
300	17.28	
400	19.98	
500	21.11	
600	22.90	
700	24.13	
800	25.25	
900	26.35	
1000	27.18	

Antenna factor Trilog antenna Model ALX-8000E, Frankonia, S/N 00809, HL 5288, 30-1000 MHz

The antenna factor shall be added to receiver reading in $dB\mu V$ to obtain field strength in $dB\mu V/m$.



Antenna factor Active Horn Antenna, Com-Power Corporation, model: AHA-118, s/n 701046, HL 4933

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.1
1500	-15.1
2000	-10.9
2500	-11.9
3000	-11.1
3500	-10.6
4000	-8.6
4500	-8.3
5000	-5.9
5500	-5.7
6000	-3.3
6500	-4.0
7000	-2.2
7500	-1.7
8000	1.1
8500	-0.8
9000	-1.5
9500	-0.2

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
10000	1.8
10500	1.0
11000	0.3
11500	-0.5
12000	3.1
12500	1.4
13000	-0.3
13500	-0.4
14000	2.5
14500	2.2
15000	1.9
15500	0.5
16000	2.1
16500	1.2
17000	0.6
17500	3.1
18000	4.2

The antenna factor shall be added to receiver reading in $dB\mu V$ to obtain field strength in $dB\mu V/m$.



Cable loss Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1226/2A HL 3903

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.98
100	0.15	10000	1.86	22000	3.07
500	0.38	10500	1.93	23000	3.13
1000	0.56	11000	1.99	24000	3.21
1500	0.69	11500	2.04	25000	3.26
2000	0.82	12000	2.10	26000	3.48
2500	0.90	12500	2.15	27000	3.44
3000	0.98	13000	2.21	28000	3.53
3500	1.06	13500	2.25	29000	3.59
4000	1.11	14000	2.29	30000	3.66
4500	1.17	14500	2.34	31000	3.70
5000	1.24	15000	2.36	32000	3.79
5500	1.32	15500	2.40	33000	3.88
6000	1.40	16000	2.45	34000	3.94
6500	1.50	16500	2.48	35000	3.91
7000	1.56	17000	2.56	36000	4.05
7500	1.62	17500	2.58	37000	4.22
8000	1.68	18000	2.60	38000	4.25
8500	1.74	19000	2.84	39000	4.27
9000	1.78	20000	2.88	40000	4.33

Report ID: LIVRAD_FCC.31317.docx Date of Issue: 24-Dec-18



Cable loss RF Cable, Huber-Suhner, 18 GHz, 6 m, SF118/11N(x2), S/N 500023/118 HL 5405



Type: Sales no.:

Serial no.: PA no.:

Ring no.: Cable length:

Time:

Date:

1.4

Test length:

Connector 1: Connector 2: Cable: Meas. System:

Inspected by:

Specific Test Report

Frequency Range [GHz]	IL min S21 [dB]	IL min S12 [dB]	RL max S11 [dB]	RL max S22 [dB]
0.040 - 1.836	-1.431	-1.431	-37.037	-37 704
1.836 - 3.632	-2.062	-2.066	-33.573	-32 848
3.632 - 5.428	-2.576	-2.576	-28.548	-29 602
5.428 - 7.224	-3.013	-3.014	-30.738	-32 523
7.224 - 9.020	-3.415	-3.416	-33,728	-32 257
9.020 - 10.816	-3.772	-3.772	-29.302	-30,735
10.816 - 12.612	-4.138	-4.138	-28,768	-26,255
12.612 - 14.408	-4.456	-4.462	-27,109	-26 151
14.408 - 16.204	-4.786	-4.786	-26.056	-27 116
16.204 - 18.000	-5.113	-5.111	-27.762	-28.508



SF118/11N/11N/6000MM 10497130 500023 /118 1956306

6 m

SF_11_N-656 SF_11_N-656 SUCOFLEX_118 N5230C,MY49001834,A.09.42.22

7:04:21 AM 6/6/2018 AZ /111

Start Freq.: Stop Freq.: Meas Points: Source Power: 0.04000 GHz 18.00000 GHz 801 -5 dBm





13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(µV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	around
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μS	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10⁵)
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
S	second
Т	temperature
Tx	transmit
V	volt
WB	wideband

END OF DOCUMENT