

TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231 (e)

FOR:

Given Imaging Ltd.

Bravo Reflux System

Model: Bravo Reflux Capsule

Model number: FGS-0635 and FGS-0636

FCC ID: PHZ-BRAVO100

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.
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1 Applicant information

Client name: Given Imaging Ltd.
Address: P.O. Box 258, Hermon Building, Yoqneam 2069204, Israel
Telephone: +972 4-909 7974
Fax: +972 4-993 8060
E-mail: nir.pnini@medtronic.com
Contact name: Mr. Nir Pnini

2 Equipment under test attributes

Product name: Capsule
Product type: Transmitter
Model: Bravo Reflux Capsule
Model number: FGS-0635, FGS-0636 ^{Note}
Serial number: 677F8
Hardware version: PCA ALT-0271-02 ,PCA-0105-07LF, NVE
Software release: 08.03
Receipt date: 21-May-20

Note: According to manufacturer's declaration provided in Appendix F of the test report, both model numbers are of the same exact Bravo capsule device with only packaging difference. Package of FGS-0636 include 1 unit of Bravo delivery and capsule device while package of FGS-0635 include 5 units same exact to the one in FGS-0636.

3 Manufacturer information

Manufacturer name: Given Imaging Inc.
Address: 15 Hampshire Street, Mansfield, MA, 02048, USA

4 Test details

Project ID: 37724
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 21-May-20
Test completed: 28-Jun-20
Test specification(s): FCC 47CFR part 15, subpart C, §15.231 (e)

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Part 15, Section 231(a) Periodic operation requirements	Pass
FCC Part 15, Section 231(a) Field strength of emissions	Pass
FCC Part 15, Section 231(c) Occupied bandwidth	Pass
FCC Part 15, Section 207 Conducted emission	Not required
FCC Part 15, Section 203 Antenna requirements	Pass

This test report is issued by Hermon Laboratories for certification of Class II permissive changes, provided that the EUT approved under FCC ID: PHZ-BRAVO100 has been modified as specified in the manufacturer's declaration (see Annex G to the test report). All tests were performed again to confirm the identity of the updated version

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:	Mr. I. Zilberstein, test engineer, EMC & Radio	21-May-20 – 28-Jun-20	
Reviewed by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	15-Oct-20	
Approved by:	Mr. S. Samokha, technical manager, EMC & Radio	28-Oct-20	

6 EUT description

Note: The following data in this clause is provided by the customer and represents his sole responsibility

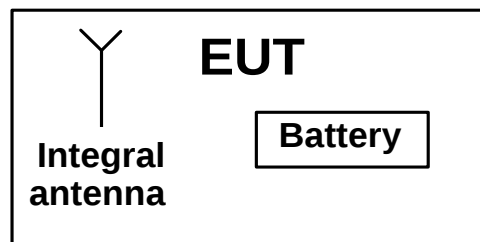
6.1 General information

The EUT, Bravo-Hybrid3 pH probe (capsule), is a transmitter operating at 433.92 MHz, with on/off keying modulation and powered from 3.0V internal battery.

6.2 EUT options/configurations

Number	Operating mode description	Configuration
1	Operation mode	Recorder receives data from the transmitter capsule simulator and saved it

6.3 Test configuration



6.4 Changes made in EUT

No changes were implemented in the EUT during testing.

6.5 Transmitter characteristics

Type of equipment						
X	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 (Equipment intended for a variety of host systems)					
Operating frequencies		433.92 MHz				
Maximum rated output power		At transmitter 50 Ω RF output connector		dBm		
		Field strength at 3 m distance		55.98 dB(μ V/m) -peak 51.55 dB(μ V/m)-average		
Is transmitter output power variable?		X	No			
		Yes	continuous variable			
			stepped variable with stepsize			
			dB			
		minimum RF power				
		maximum RF power				
		dBm				
Antenna connection						
unique coupling		standard connector		X	integral	
				X	with temporary RF connector	
				X	without temporary RF connector	
Antenna/s technical characteristics						
Type		Manufacturer		Model number		
Integral		NA		NA		
Type of modulation		ASK				
Transmitter aggregate data rate/s		1 kbps				
Transmitter power source						
X	Battery	Nominal rated voltage	3 VDC	Battery type	Silver Oxide	
	DC	Nominal rated voltage	VDC			
	AC mains	Nominal rated voltage	VAC			
Common power source for transmitter and receiver						
		X		yes		
				no		



Test specification: FCC Part 15, Section 231(e), Periodic operation requirements			
Test procedure: Supplier declaration		Verdict: PASS	
Test mode: Compliance			
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

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

7.1 Periodic operation requirements

7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- Duration of each transmission shall not be greater than 1 second;
- Silent period between transmissions shall be at least 30 times the duration of the transmission;
- Silent period between transmissions shall be in no case less than 10 seconds.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

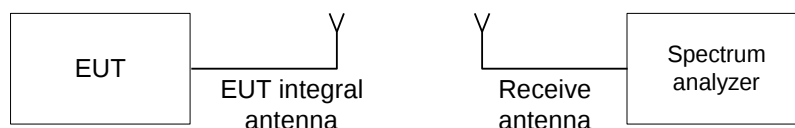
7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in the associated plots. The test results were recorded in Table 7.1.2.

Table 7.1.1 Periodic operation requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted	Supplier declaration	Comply
Duration of each transmission shall not be greater than 1 second	Plot 7.1.1	Comply
Silent period between transmissions shall be at least 30 times the duration of the transmission	Plot 7.1.2	Comply
Silent period between transmissions shall be in no case less than 10 seconds	Plot 7.1.2	Comply

Figure 7.1.1 Setup for transmitter shut down test





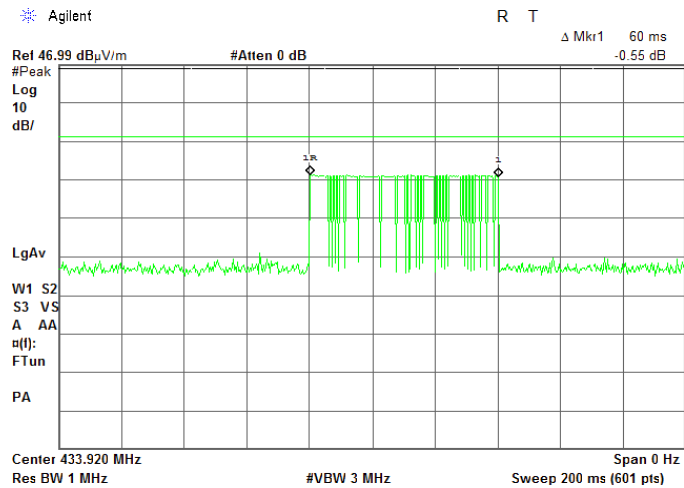
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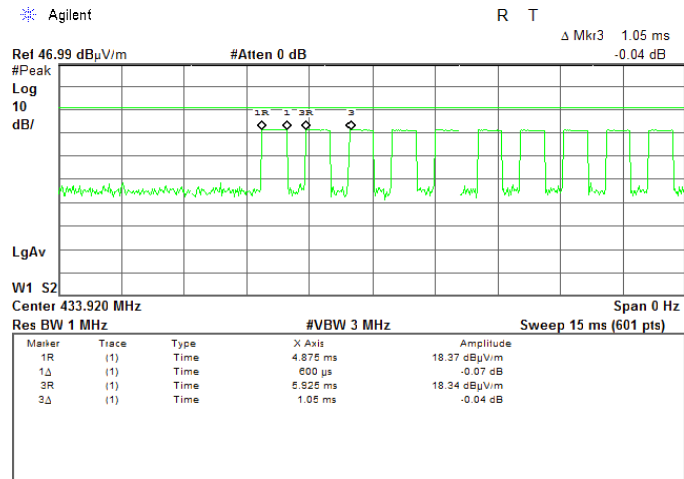
Date of Issue: 28-Oct-20

Test specification: FCC Part 15, Section 231(e), Periodic operation requirements			
Test procedure: Supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Plot 7.1.1 Transmitter pulse duration



$T_{\text{xon duration}} = \text{Pulse duration} * \text{Duty cycle within RF burst} = 60 * 0.57 = 34.28 \text{ ms}$



$\text{Duty cycle within RF burst} = T_{\text{xon}} / T_{\text{xon+off}} = 0.6 / 1.05 = 0.57$



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Test specification: FCC Part 15, Section 231(e), Periodic operation requirements			
Test procedure: Supplier declaration		Verdict: PASS	
Test mode: Compliance			
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Plot 7.1.2 Transmitter pulse period

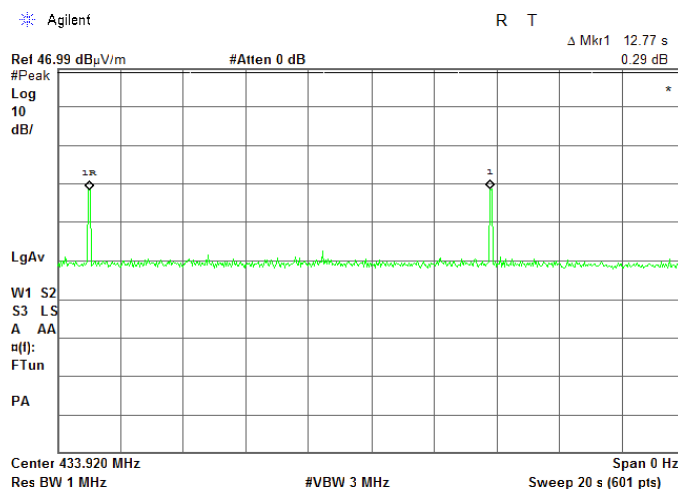


Table 7.1.2 Total duration of transmissions

Burst Duration, ms	Duty cycle within the burst, %	Txon within the burst, ms	Maximum number of transmissions within 1 hour	Total duration within 1 hour, sec	Limit, sec	Margin, sec	Verdict
60.0	57.14	34.28	282	9.666	10.0	-0.334	Pass

Reference numbers of test equipment used

HL 4355							
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Full description is given in Appendix A.



Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

7.2 Field strength of emissions

7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
433.92	92.8	72.8

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	72.8	52.8
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	NA	73.8 – 63.0**	NA		
1.705 – 30.0*		69.5			
30 – 88		40.0			
88 – 216		43.5			
216 – 960		46.0			
960 - 1000		54.0			
Above 1000	74.0	NA	54.0		

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

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

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

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

Note 1: The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: The above 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.



Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

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

7.2.2.1 The EUT was set up as shown in Figure 7.2.1 energized and the performance check was conducted.

7.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.2.2.3 The worst test results (the lowest margins), recorded in Table 7.2.3, Table 7.2.4 and shown in the associated plots.

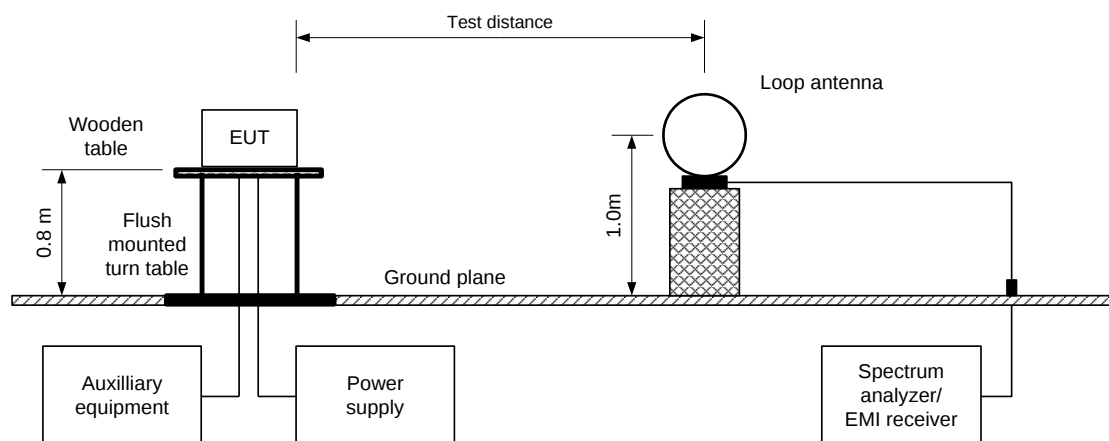
7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, Figure 7.2.3, energized and the performance check was conducted.

7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.2.3.3 The worst test results (the lowest margins), recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz





Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Figure 7.2.2 Setup for spurious emission field strength measurements in 30 -1000 MHz

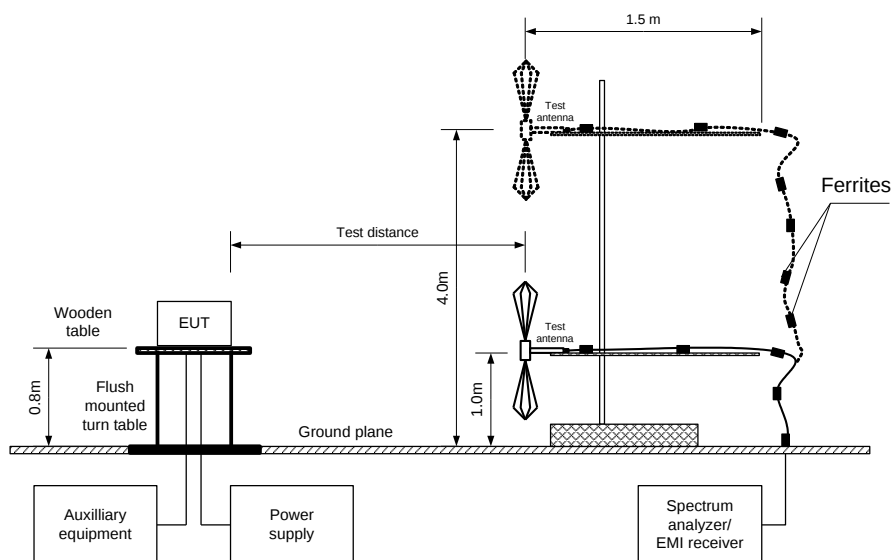
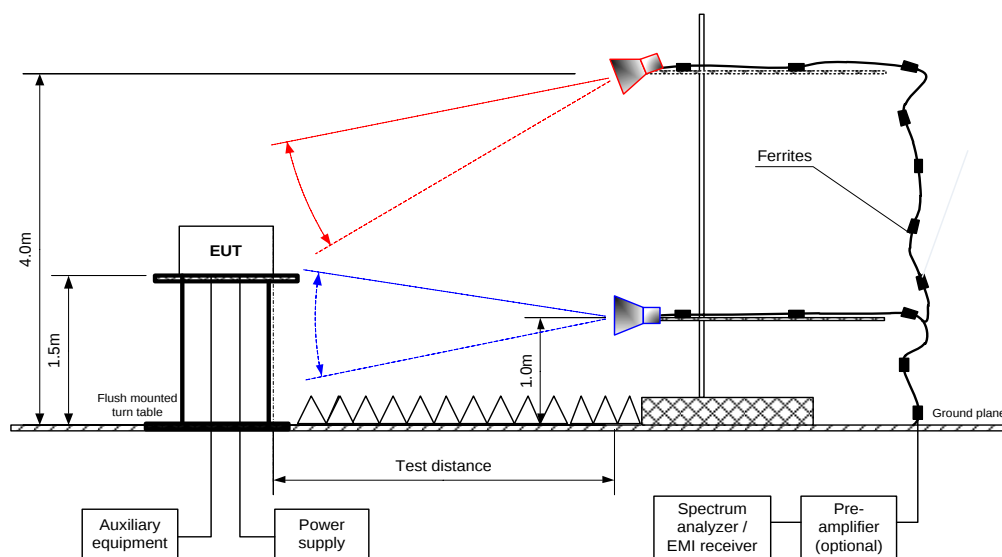


Figure 7.2.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands below 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: ASK
 BIT RATE: 1 kbps
 INVESTIGATED FREQUENCY RANGE: 0.009 – 4500 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 1.0 MHz (above 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)***	Limit, dB(μV/m)	Margin, dB**	
Fundamental emission											
433.896	V	1.04	350	55.98	100.8	-44.82	55.98	51.55	80.8	-29.25	Pass
Spurious emissions											
868.875	V	1.2	0	41.45	80.8	-39.35	41.45	37.02	60.8	-23.78	Pass

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

**- Margin, dB =Measured (calculated) value, dB(μV/m)-Limit, dB(μV/m)

***- Average field strength calculated = Peak field strength measured – Duty cycle factor

Table 7.2.4 Spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical
 MODULATION: ASK
 BIT RATE: 1 kbps
 INVESTIGATED FREQUENCY RANGE: 0.009 – 5000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 1.0 MHz (above 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

Double magda guide (above 2000 MHz)											
F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)***	Limit, dB(μV/m)	Margin, dB**	
No emissions were found											Pass

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

**- Margin, dB =Measured (calculated) value, dB(μV/m)-Limit, dB(μV/m)

***- Average field strength calculated = Peak field strength measured – Duty cycle factor



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Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Table 7.2.5 Average factor calculation

Transmission pulse A during burst		Transmission pulse B during burst		Quantity bursts during 100 msec	Average factor, dB
Duration, ms	Quantity	Duration, ms	Quantity		
60	1	NA	NA	1	-4.43

*- Average factor was calculated as follows
for pulse train shorter than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{\text{Train duration}} \times \text{Number of bursts within pulse train} \right)$$

Table 7.2.6 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m
 EUT POSITION: Typical
 MODULATION: ASK
 BIT RATE: 1 kbps
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 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, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
All signals below limit at least 20 dB								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		
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Full description is given in Appendix A.



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Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Table 7.2.7 Restricted bands according to FCC 15, Section 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	12.290 - 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	16.420 - 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	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	



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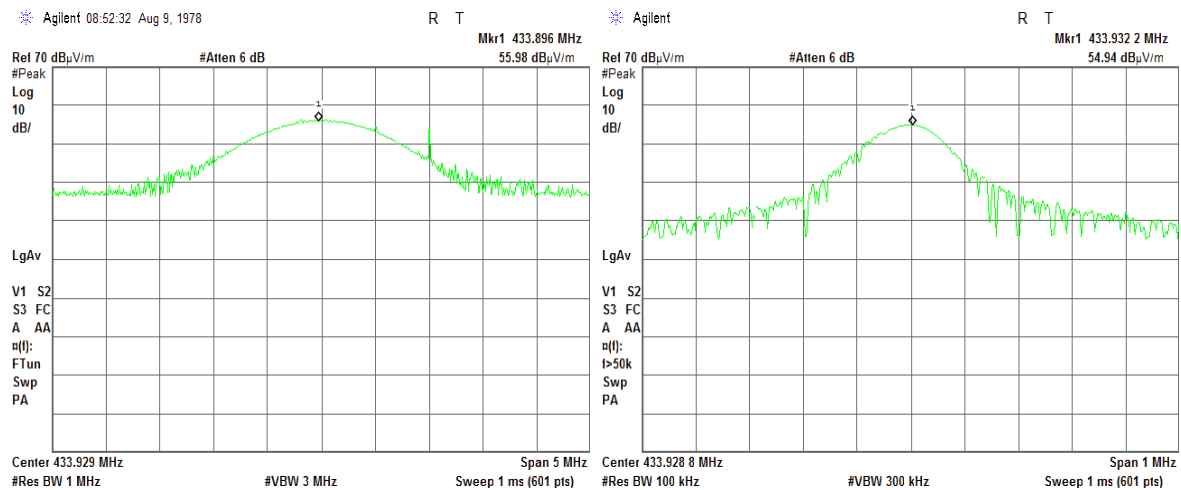
Report ID: GIVRAD_FCC.37724

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Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

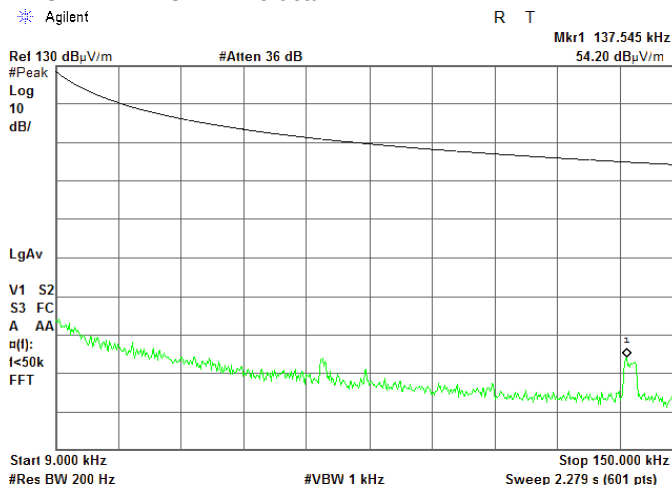
Plot 7.2.1 Radiated emission measurements at the low fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.6 Radiated emission measurements from 9 kHz to 150 kHz

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





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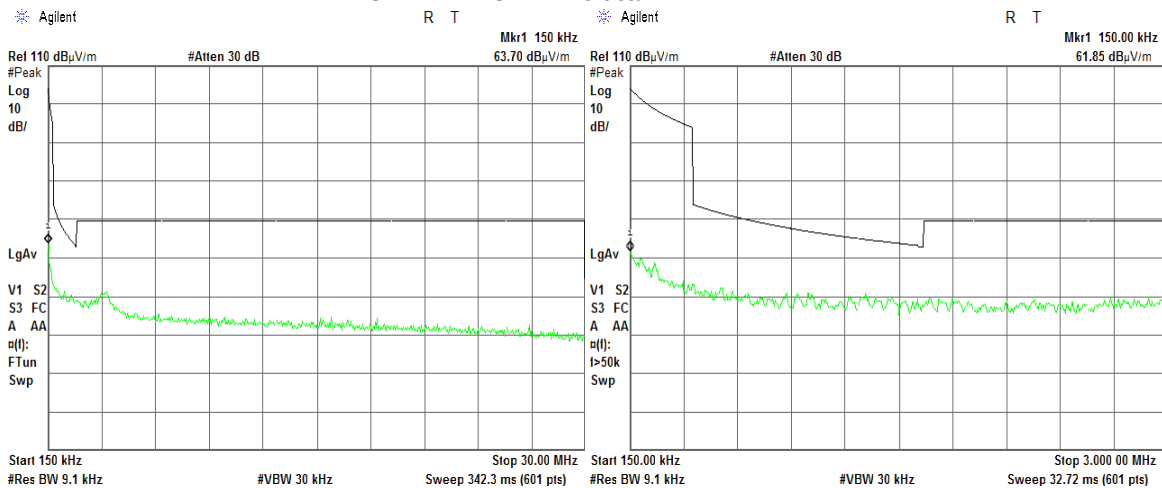
Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Plot 7.2.2 Radiated emission measurements from 150 kHz to 30 MHz

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical



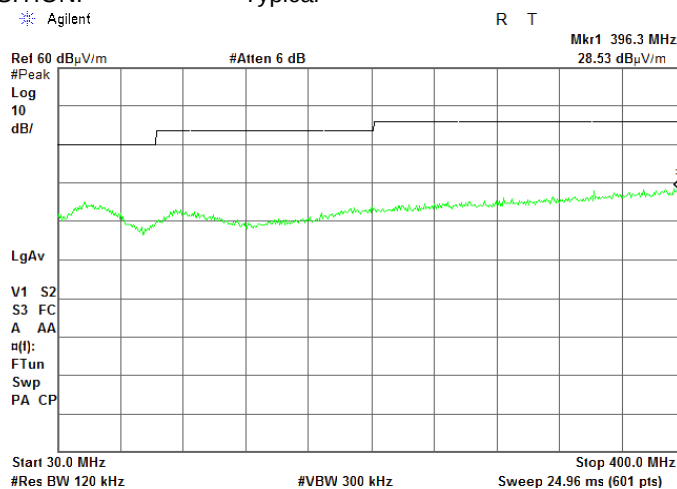
Plot 7.2.3 Radiated emission measurements from 30 to 400 MHz

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical and Horizontal

EUT POSITION: Typical





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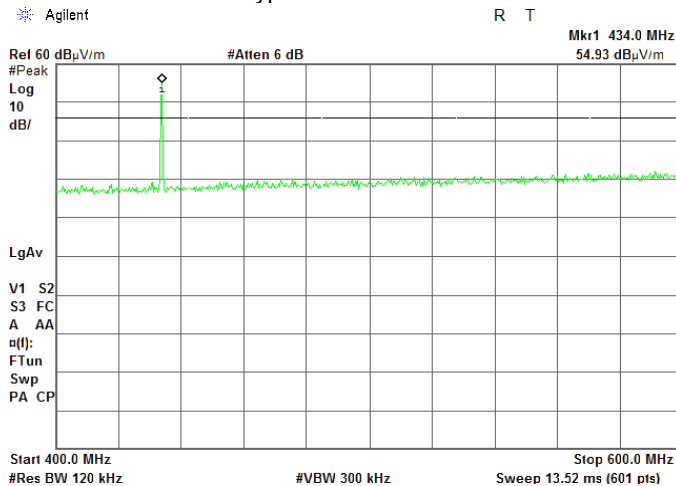
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Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

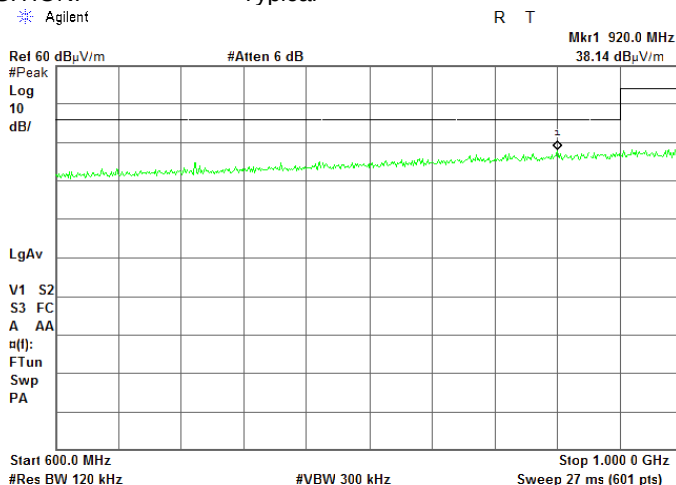
Plot 7.2.4 Radiated emission measurements from 400 to 600 MHz

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



Plot 7.2.5 Radiated emission measurements from 600 to 1000 MHz

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





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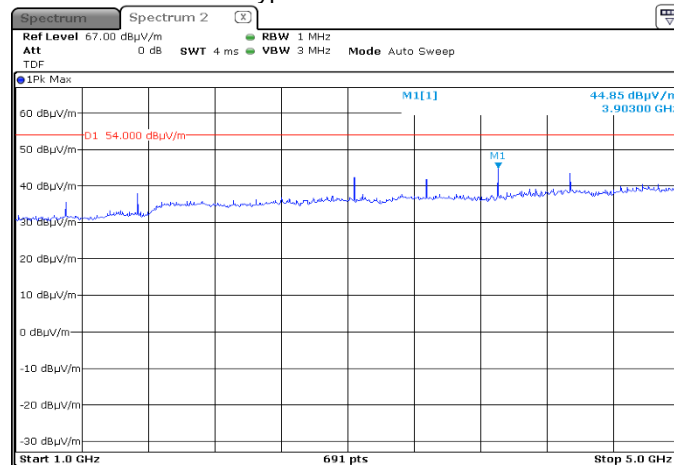
Report ID: GIVRAD_FCC.37724

Date of Issue: 28-Oct-20

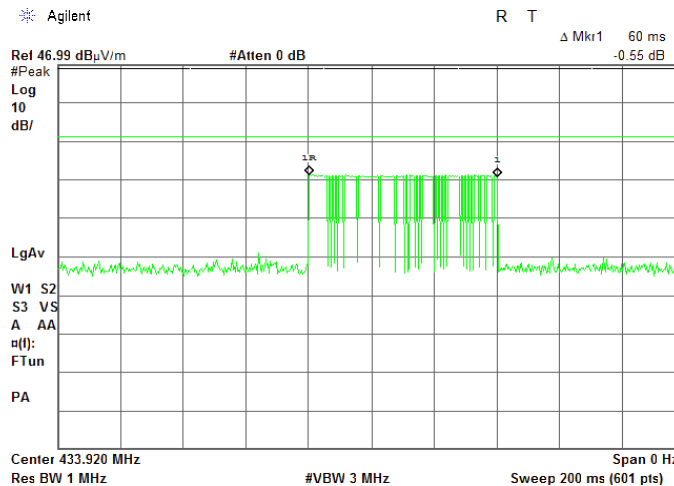
Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Plot 7.2.6 Radiated emission measurements from 1000 to 5000 MHz

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



Plot 7.2.7 Transmitter pulse duration





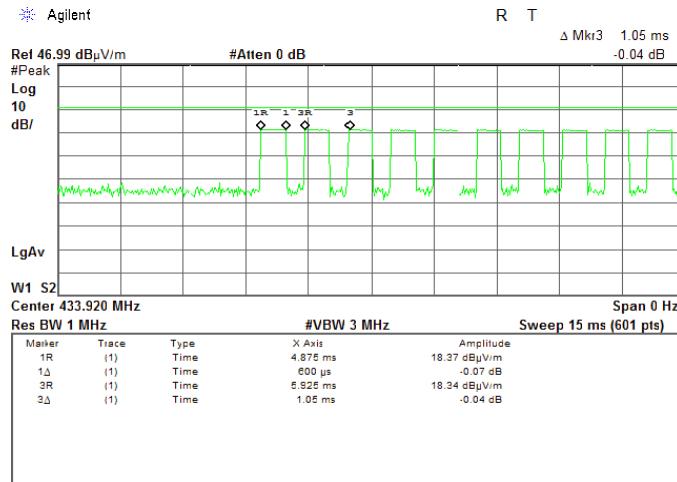
HERMON LABORATORIES

Report ID: GIVRAD_FCC.37724

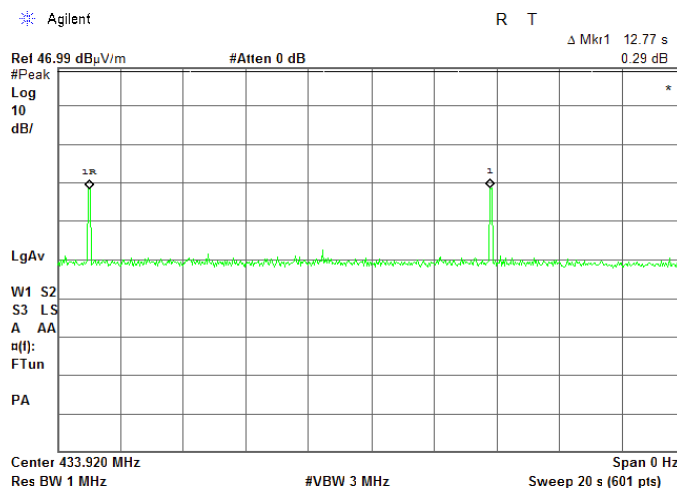
Date of Issue: 28-Oct-20

Test specification: FCC Part 15, Section 231(b), Field strength of emissions			
Test procedure: ANSI C63.10, Section 6.5 / 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jul-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Plot 7.2.8 Transmission pulse duration (Tx ON)



Plot 7.2.9 Transmitter pulse period





Test specification: FCC Part 15, Section 231(c) , Section A1.3, Occupied bandwidth			
Test procedure: ANSI C63.10, Section 6.9.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, % of the carrier frequency
70 - 900	20.0	0.25

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

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

Figure 7.3.1 Occupied bandwidth test setup





Test specification: FCC Part 15, Section 231(c) , Section A1.3, Occupied bandwidth			
Test procedure: ANSI C63.10, Section 6.9.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 03-Jun-20			
Temperature: 24 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 3 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results according to FCC 15.231

DETECTOR USED: Peak hold
 RESOLUTION BANDWIDTH: 1kHz
 VIDEO BANDWIDTH: 3kHz
 MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
 MODULATION: ASK
 BIT RATE: 1 kbps

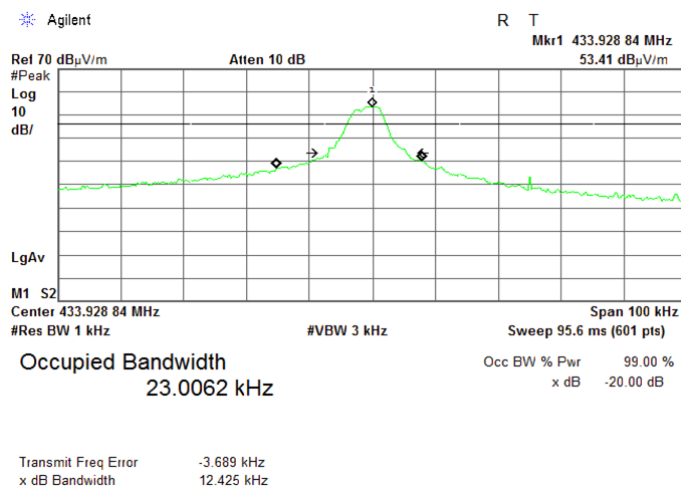
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
433.92	12.45	0.25	1084.8	1072.35	Pass

Reference numbers of test equipment used

HL 3818	HL 3903	HL 5288	HL 5405					
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Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test result





Test specification: FCC Part 15, Section 203, Antenna requirements			
Test procedure: Visual inspection / supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-19			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1007 hPa	Power: 3 VDC
Remarks:			

7.4 Antenna requirements

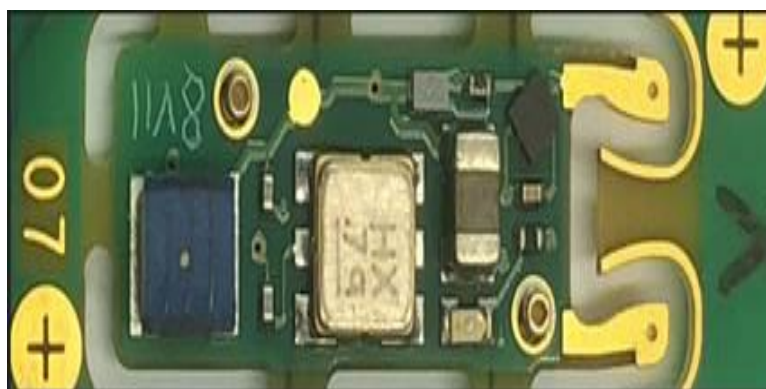
The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed 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 7.4.1.

Table 7.4.1 Antenna requirements

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

Photograph 7.4.1 Antenna assembly



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	25-Jun-20	25-Jun-21
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	24-Feb-20	24-Feb-21
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	27-Apr-20	27-Apr-21
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1225/2A	06-Apr-20	06-Apr-21
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	06-Apr-20	06-Apr-21
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	06-Jan-20	06-Jan-21
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	08-Feb-19	08-Feb-22
5376	EXA Signal Analyzer, 10 Hz - 32 GHz	Keysight Technologies	N9010B	MY57470404	18-Mar-20	18-Mar-21
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11 N(x2)	500023/118	11-Aug-19	11-Aug-20

9 APPENDIX B Test equipment correction factors

HL 0446: Active Loop Antenna
EMCO, model: 6502, s/n 2857

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
10	-33.4	±1.0
20	-37.8	±1.0
50	-40.5	±1.0
75	-41.0	±1.0
100	-41.2	±1.0
150	-41.2	±1.0
250	-41.1	±1.0
500	-41.2	±1.0
750	-41.3	±1.0
1000	-41.3	±1.0

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
2000	-41.4	±1.0
3000	-41.4	±1.0
4000	-41.5	±1.0
5000	-41.5	±1.0
10000	-41.7	±1.0
15000	-42.1	±1.0
20000	-42.7	±1.0
25000	-44.2	±1.0
30000	-45.8	±1.0

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ A/m.

HL 4933: Active Horn Antenna
COM-POWER CORPORATION, model: AHA-118, s/n 701046

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 μ V to obtain field strength in dB μ V/m.

HL 5288: Trilog Antenna
Frankonia, model: ALX-8000E, s/n: 00809
30-1000 MHz

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

Frequency, MHz	Antenna factor, dB/m
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

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

above 1000 MHz

Frequency, MHz	Antenna factor, dB/m
1000	26.9
1100	28.1
1200	28.4
1300	29.6
1400	29.1
1500	30.4
1600	30.7
1700	31.5
1800	32.3
1900	32.6
2000	32.5
2100	32.9
2200	33.5
2300	33.2
2400	33.7
2500	34.6
2600	34.7
2700	34.6
2800	35.0
2900	35.5
3000	36.2
3100	36.8
3200	36.8
3300	37.0
3400	37.5
3500	38.2

Frequency, MHz	Antenna factor, dB/m
3600	38.9
3700	39.4
3800	39.4
3900	39.6
4000	39.7
4100	39.8
4200	40.5
4300	40.9
4400	41.1
4500	41.4
4600	41.3
4700	41.6
4800	41.9
4900	42.3
5000	42.7
5100	43.0
5200	42.9
5300	43.5
5400	43.6
5500	44.3
5600	44.7
5700	45.0
5800	45.0
5900	45.3
6000	45.9

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

HL 5405: RF Cable
Huber-Suhner, model: SF118/11N(x2), s/n: 500023/118
Calibration date: 01-Aug-2018

Set / Applied, MHz	Measured, dB	Uncertainty, dB
0.1	0.01	±0.07
50	0.23	±0.07
100	0.32	±0.07
200	0.45	±0.08
300	0.55	±0.08
400	0.64	±0.08
500	0.71	±0.08
600	0.78	±0.08
700	0.85	±0.08
800	0.91	±0.08
900	0.97	±0.08
1000	1.02	±0.08
1100	1.07	±0.08
1200	1.12	±0.08
1300	1.16	±0.08
1400	1.21	±0.08
1500	1.25	±0.08
1600	1.30	±0.08
1700	1.34	±0.08
1800	1.38	±0.08
1900	1.42	±0.08
2000	1.47	±0.08
2500	1.64	±0.10
3000	1.81	±0.10
3500	1.97	±0.10
4000	2.11	±0.10
4500	2.25	±0.10
5000	2.38	±0.10
5500	2.48	±0.10
6000	2.59	±0.10
6500	2.72	±0.10
7000	2.84	±0.13
7500	2.97	±0.13
8000	3.08	±0.13
8500	3.21	±0.13
9000	3.31	±0.13
9500	3.42	±0.13
10000	3.52	±0.13

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 relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; 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 Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

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.

12 APPENDIX E

Specification references

47CFR part 15: 2019
ANSI C63.10: 2013

Radio Frequency Devices.
American National Standard of Procedures for Compliance Testing of Unlicensed
Wireless Devices

13 APPENDIX F Manufacturer's declaration

Note: The following data in this clause is provided by the customer and represents his sole responsibility.

 Confidential			
Document Title: Bravo Reflux capsule product numbers declaration for EMC + Radio tests	Document No. NA	Version NA	Page 1 of 1

1. Purpose

The purpose of this document is to justify inclusion of the product numbers FGS-0635 and FGS-0636 as EUT in EMC and Radio tests in Hermon Labs, project 37724.

2. Scope

Report IDs:

- GIVRAD_EN.37724
- GIVRAD_FCC.37724
- GIVEMC_37724
- GIVEMC_37724_Ed4

EUT:

- Bravo Reflux capsule delivery device, 1-pk FGS-0636
- Bravo Reflux capsule delivery device, 5-pk FGS-0635

3. Declaration

Both stated product numbers are of the same exact Bravo capsule device with only packaging difference. Package of FGS-0636 include 1 unit of Bravo delivery and capsule device while package of FGS-0635 include 5 units same exact to the one in FGS-0636.

_____	(date)
August 13, 2020	
	(signature)

Nir Pnini	(printed name)

Design Quality Engineer	(position)

14 APPENDIX G Manufacturer's declaration

October 05, 2020

Telefication B.V.
Attn: Dept. FCC TCB
Edisonstraat 12A
6902 PK ZEVENAAR
The Netherlands

Subject: Application for Bravo Reflux Capsule Class II Permissive Change of the product with FCC ID:
PHZ-BRAVO100

Dear Gentlemen,

The following changes were implemented in approved Bravo Reflux Capsule FCC ID: PHZ-BRAVO100 :

1. Replacement of reed switch by a NVE magnetic sensor and electrical switch on capsule PCA.
2. Capsule RF transistor was declared EOL and replaced with a new one with the same parameters.
3. Capacitor Vdd filtering 100 pF was changed to 150 pF.
4. A LED was added on the PCA to indicate capsule's status during the assembly process with no layout change.

No impact in the RF performance of the device after above mentioned changes .

Tim Thomas
VP, Medical and Regulatory Affairs

15 APPENDIX H 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(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	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	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

END OF DOCUMENT