HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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RADIATED EMISSIONS TEST REPORT

ACCORDING TO: FCC 47CFR part 24E

FOR:

Airspan Networks Inc.
LTE Base Station Radio
Model: AirUnity 588, 3.550-3.700 GHz (B48)
FCC ID: PIDAU588ENB37

Table of contents

1 Applicant information

Client name:	Airspan Networks Inc.
Address:	777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone:	+1 561 893 8670
Fax:	+1 561 893 8671
E-mail:	zlevi@airspan.com
Contact name:	Mr. Zion Levi

2 Equipment under test attributes

Product name:	LTE Base Station Radio
Product type:	Transceiver
Model(s):	AirUnity 588, 3.550-3.700 GHz (B48)
Serial number:	DA5847016A72
Hardware version:	D4
Software release:	SR18.0
Receipt date	09-Nov-22

3 Manufacturer information

Manufacturer name:	Airspan Networks Inc.
Address:	777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone:	+1 561 893 8670
Fax:	+1 561 893 8671
E-Mail:	zlevi@airspan.com
Contact name:	Mr. Zion Levi

4 Test details

Project ID:	49155
Location:	Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test conducted:	29-Mar-23
Test specification(s):	FCC 47CFR part 24E

5 Tests summary

Test	Status
Transmitter characteristics	
Section 24.238, Radiated out of band emission	Pass

The product was approved under FCC ID: PIDAU588ENB37
The relevant test was done to support operation of LTE UE radio module approved by FCC under FCC ID: O2J-AC25 and simultaneously with AirUnity 588, 3.550-3.700 GHz (B48) radio and submit Application for Class II permissive changes certification.
The hardware change was made by adding the FCC approved modules. The appropriate photographs are attached to the Application for certification package.

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. M. Evsuk, test engineer, EMC & Radio	29-Mar-23	
Reviewed by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	01-May-23	
Approved by:	Mr. M. Nikishin, group leader, EMC & Radio	16-May-23	

6 EUT description

6.1 General information

The EUT, Mobile Digital station, AirUnity 3.55-3.7GHz, Band 48, is part of a LTE broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. AirUnity 588 is a combined LTE small cell based backhaul modules approved by FCC under FCC ID: O2J-AC25. The AirUnity's transceiver/receiver (Up to 256 QAM modulation, data rate up to 143 Mbps) equipped with a 10dBi internal antenna. Advanced Antenna Techniques 2x2 MIMO are supported. The maximum RF output power (not including antenna gain) is 22.49 dBm for 10dBi and it can be reduced by software.
Antennas 1/2 is one sector and antennas 3/4 is another sector.
The AiUnity is installed intdoors. The Subscriber transmits and receives traffic to and from the base station respectively. The transceiver provides subscribers with "always-on" Internet, high speed data only, or data and voice (VoIP) services and is configured with a unique base station reference number, preventing the LTE UE from relocating to another subscriber premises without authorization.

Note: The AirUnity equipment defined as Category A CBSD (Citizens Broadband Radio Service Device)
Antennas 1/2 arrange one sector while antenna 1 is cross polarized to antenna 2 and antennas 3/4 arrange another sector while antenna 3 is cross polarized to antenna 4.
The transmitter output signals are completely uncorrelated, antennas 1/2 is one sector and antennas 3/4 is another sector! The sectors are either non overlapping by operation on different frequency channels or by different sectors coverage without overlapping of antenna beams.

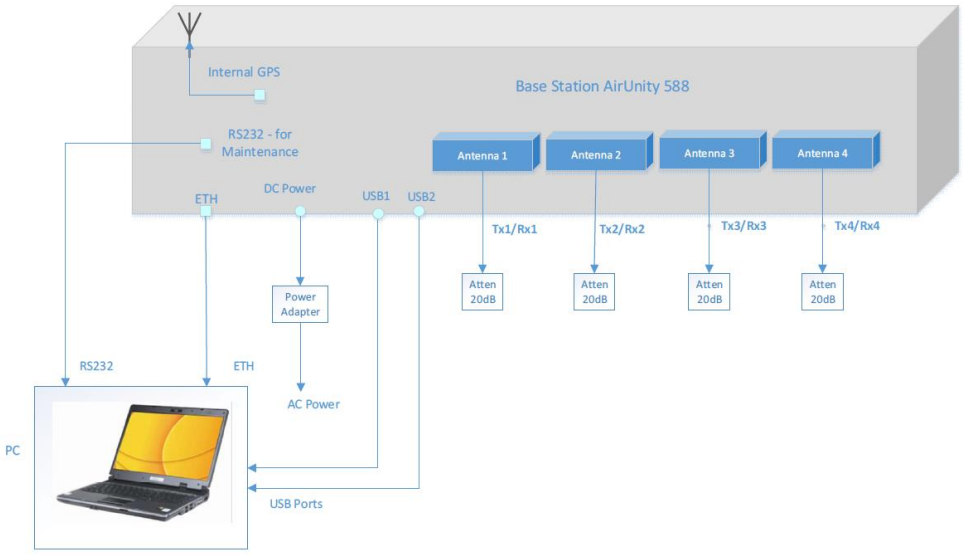
6.2 Ports and lines

Port No.	Name	Type	Cable Max. >3m	Cable Shielded	Qty.	Comments
1	ETH	RG45	>3m	v	1	NA
2	RS232	RG45	>3m	v	1	For maintenance
3	USB port	USB	>3m	-	2	
4	Internal GPS	Int. GPS antenna	NA	NA	1	NA
5	DC power 12VDC	Power	>3m	-	1	

6.3 Ports and lines

Use	Product Type	Manufacturer	Model	Qty.	Serial number
AE	PC	DELL	Latitude E7440	1	3234219878
AE	RF attenuator 20 dB	Mini-circuite	VAT-20+	4	NA
AE	Power adapter	DEE VAN	DSA-60DFE-12	1	NA

6.4 Test configuration



6.5 Changes made in the EUT

No changes were implemented in the EUT during testing.

6.6 Transmitter characteristics

Type of equipment	
V	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)

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
V	mobile	Always at a distance more than 20 cm from all people
	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency range	3550.0 – 3700.0 MHz (B48) Access 1850-1910 MHz (B2) Relay 1710-1755 (B4) Relay 1850-1915 (B25) Relay
Operating frequency (full bands)	3555.0 – 3695.0 MHz 1852.5 – 1907.5 MHz 1712.5 – 1752.5 MHz 1852.5 – 1912.5 MHz
RF channel spacing	10 MHz, 20 MHz 5 MHz, 10 MHz, 15 MHz, 20 MHz 5 MHz, 10 MHz, 15 MHz, 20 MHz 5 MHz, 10 MHz, 15 MHz, 20 MHz
Maximum rated output power	At transmitter 50 Ω RF output connector (per port): 22.49 dBm 26 dBm

Is transmitter output power variable?				
	No			
V	Yes		continuous variable	
		V	stepped variable with step size	0.25 dB
			minimum RF power	-30 dBm
			maximum RF power at antenna connector	dBm

Antenna connection					
unique coupling	**V**	standard connector	Integral	**V**	with temporary RF connector
					without temporary RF connector

Antenna/s technical characteristics

Type	Manufacturer	Model number	Gain
(Access) Internal	Airspan	AN1018-1	10 dBi
(Relay) Internal	Airspan	NA	6.5 dBi

Transmitter aggregate data rate/s, Mbps

Transmitter 26dBc power bandwidth	Type of modulation			
	QPSK	16QAM	64QAM	256QAM
10 MHz	10.7	22.7	47.3	71.5
20 MHz	23.4	45.4	95.0	143.0

Type of multiplexing	TDD
Modulating test signal (baseband)	PRBS
Maximum transmitter duty cycle in normal use	0.74

Transmitter power source

		Nominal rated voltage		Battery type	
	DC	**Nominal rated voltage**			
V	AC mains	**Nominal rated voltage**	100-240VAC	Frequency	50/60Hz

Common power source for transmitter and receiver	**V**	yes	no

Test specification:	Section 24.238, Radiated out of band emission		
Test procedure:	47 CFR, Section 2.1053		
Test mode:	Compliance	Verdict:	PASS
Date(s):	29-Mar-23		
Temperature: 27 ºC	Relative Humidity: 46 %	Air Pressure: 1011 hPa	Power: 110 VAC, 50 Hz
Remarks:			

7 Transmitter tests according to 47CFR part 24E

7.1 Radiated out of band emission measurements at AirUnity 588 and LTE UE module simultaneous transmitting mode

7.1.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	55+10logP** mobile	-13	82.23

* - Excluding the band emission
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:

$$E=sqrt(30\times P\times 1.64)/r,$$

where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

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

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

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

7.1.3.1 The EUT was set up as shown in Figure 7.1.2, energized and the performance check was conducted.

7.1.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.1.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

Test specification:	**Section 24.238, Radiated out of band emission**		
Test procedure:	47 CFR, Section 2.1053		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	29-Mar-23		
Temperature: 27 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1011 hPa	**Power:** 110 VAC, 50 Hz
Remarks:			

Figure 7.1.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

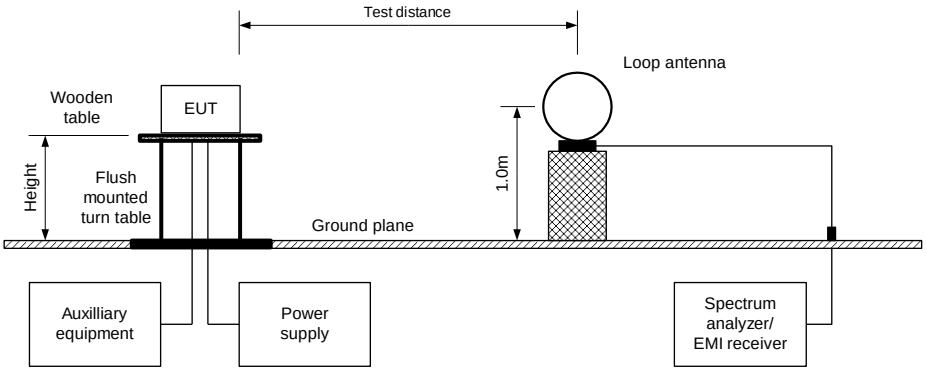
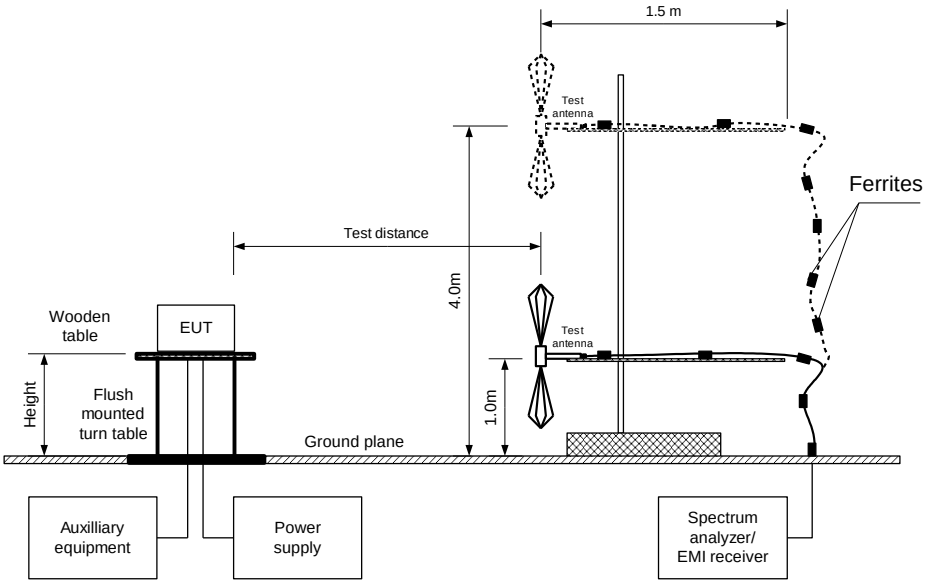
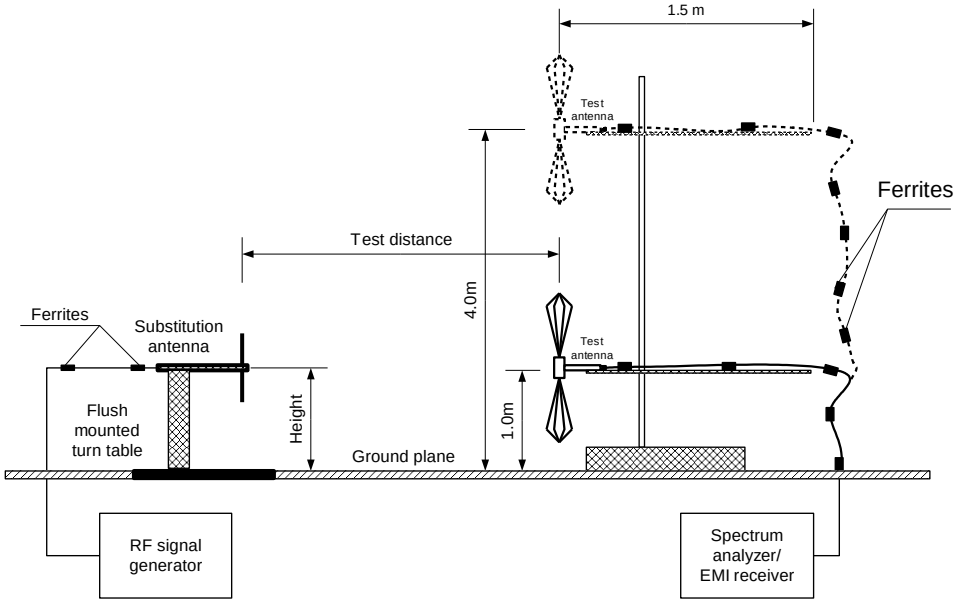


Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 24.238, Radiated out of band emission**		
Test procedure:	47 CFR, Section 2.1053		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	29-Mar-23		
Temperature: 27 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1011 hPa	**Power:** 110 VAC, 50 Hz
Remarks:			

Figure 7.1.3 Setup for substitution ERP measurements of spurious



Test specification:	**Section 24.238, Radiated out of band emission**		
Test procedure:	47 CFR, Section 2.1053		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	29-Mar-23		
Temperature: 27 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1011 hPa	**Power:** 110 VAC, 50 Hz
Remarks:			

Table 7.1.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 1860-1905 MHz (UE module)
3555.0 – 3695.0 MHz (AirUnity 588)
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: 256QAM
OCCUPIED BANDWIDTH 20 MHz (Output power and PSD Worst case)
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Carrier frequencies: 1890 MHz (UE module) 3625 MHz (AirUnity 588)							
217.9	48.0	82.23	-34.23	100	Vertical	1.0	158
301.5	53.9	82.23	-28.33	100	Vertical	1.0	143
375.0	48.9	82.23	-33.33	100	Horizontal	1.0	-119
875.0	42.0	82.23	-40.23	100	Horizontal	1.0	26
3760.2	49.2	82.23	-33.03	100	Horizontal	2.0	-38
3920.0	49.7	82.23	-32.53	100	Vertical	1.5	-107
29000.0	52.8	82.23	-29.53	100	Vertical	1.6	46

*****- Margin = Field strength of spurious – calculated field strength limit.
******- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

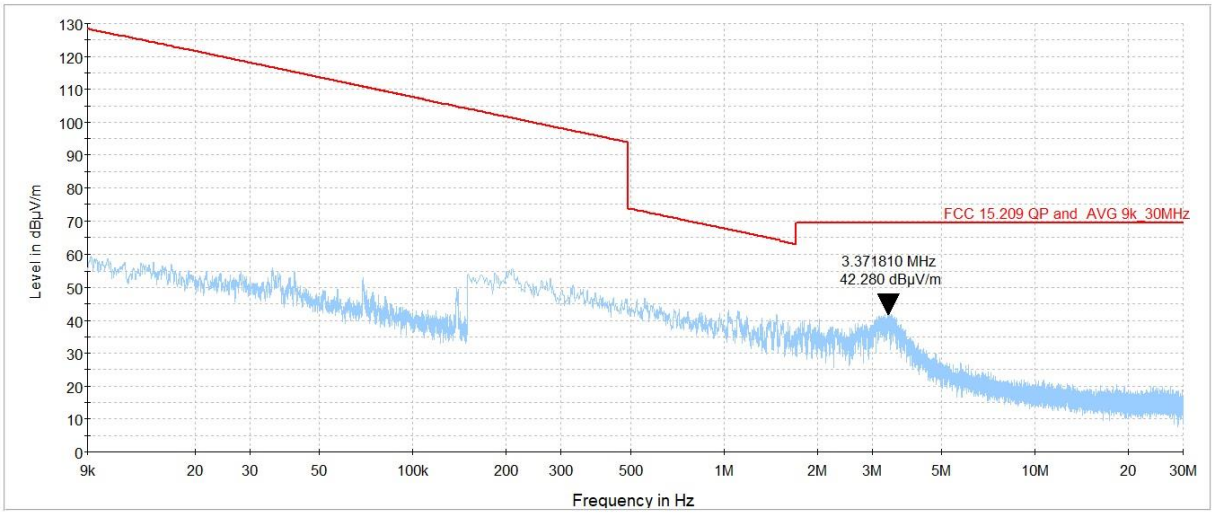
HL 0446	HL 3903	HL 4933	HL 4956	HL 5288	HL 5902	HL 7585	HL5642

Full description is given in Appendix A.

Test specification:	Section 24.238, Radiated out of band emission		
Test procedure:	47 CFR, Section 2.1053		
Test mode:	Compliance	Verdict:	PASS
Date(s):	29-Mar-23		
Temperature: 27 ºC	Relative Humidity: 46 %	Air Pressure: 1011 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.1.1 Radiated emission measurements in 9 kHz - 30 MHz range

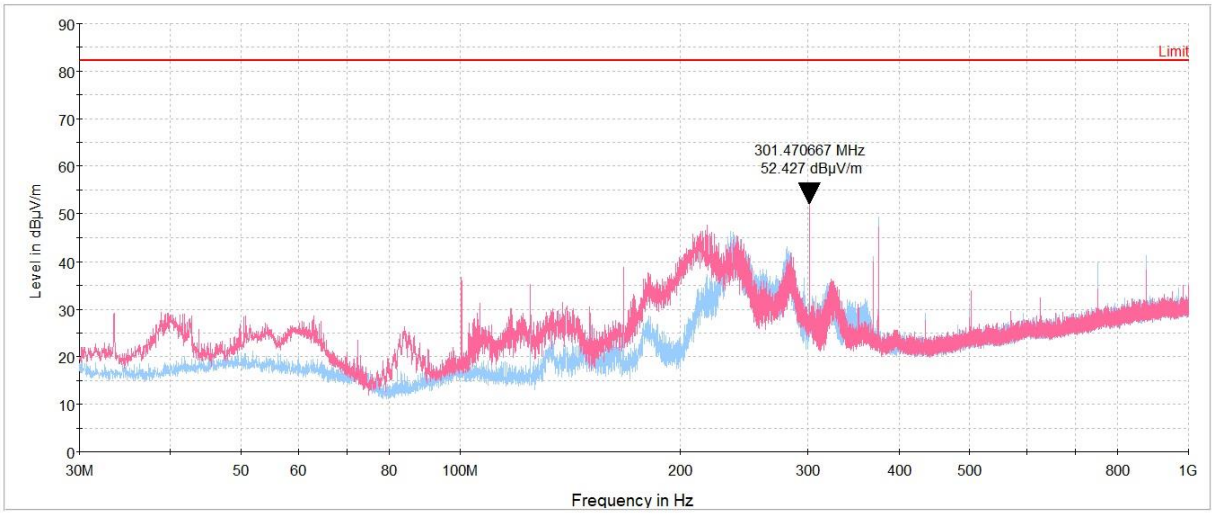
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



*Will be applied limit of 82.23 dB(µV/m)

Plot 7.1.2 Radiated emission measurements in 30 - 1000 MHz range

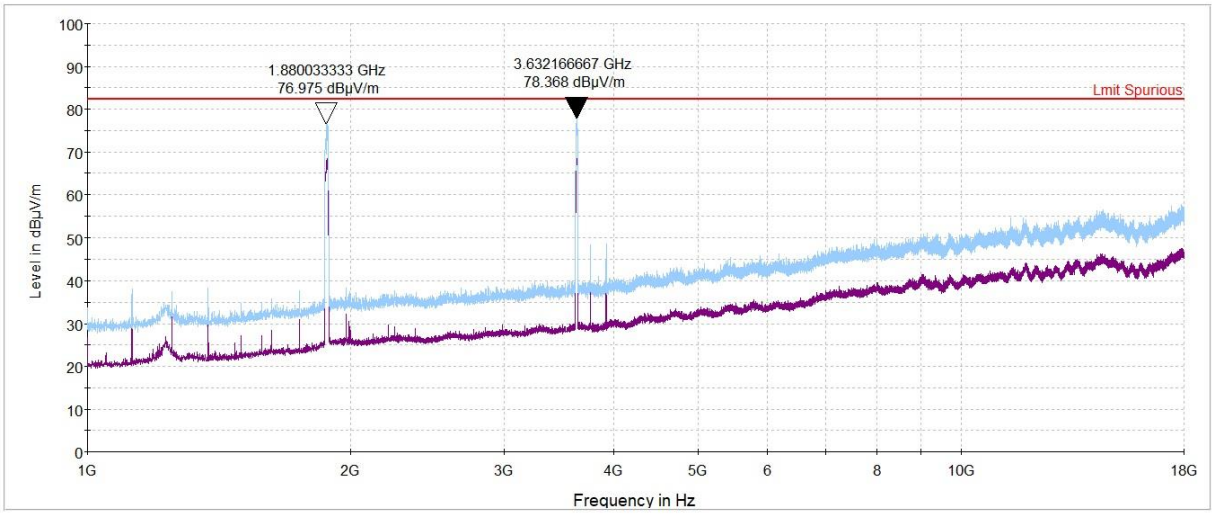
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 24.238, Radiated out of band emission		
Test procedure:	47 CFR, Section 2.1053		
Test mode:	Compliance	Verdict:	PASS
Date(s):	29-Mar-23		
Temperature: 27 ºC	Relative Humidity: 46 %	Air Pressure: 1011 hPa	Power: 110 VAC, 50 Hz
Remarks:			

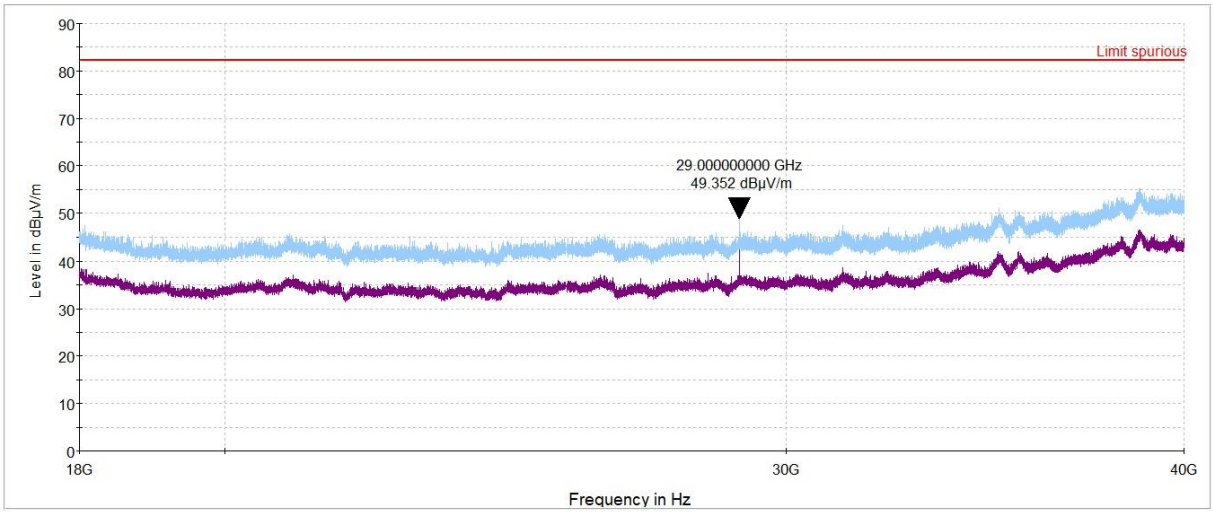
Plot 7.1.3 Radiated emission measurements in 1000 – 18000 MHz range

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



Plot 7.1.4 Radiated emission measurements in 18000 – 40000 MHz range

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



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 (9) kHz - 30 MHz	EMCO	6502	2857	28-Feb-23	28-Feb-24
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	07-Apr-22	07-Apr-23
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	11-Oct-22	11-Oct-23
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-007	29-May-22	29-May-24
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	19-Jan-23	19-Jan-24
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	07-Mar-22	07-Mar-23
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Mar-25
5376	EXA Signal Analyzer, 10 Hz - 32 GHz	Keysight Technologies	N9010B	MY57470404	27-Dec-22	27-Dec-23
5642	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/SMA	Mini Circuits	CBL-6FT-SMSM+	NA	21-Jul-22	21-Jul-23
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000	NA	08-Dec-22	08-Dec-23
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	19-May-22	19-May-23

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 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 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).

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website: www.hermonlabs.com

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

11 APPENDIX D Specification references

47CFR part 24E: 2021	Private land mobile radio services
47CFR part 2: 2021	Frequency allocations and radio treaty matters; general rules and regulations
ANSI/TIA/EIA-603-E:2016	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

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(μV) to convert it into field strength in dB(μV/m).

Antenna factor
Trilog antenna
Model ALX-8000E, Frankonia, S/N 00809, HL 5288, 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
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 dBμV to obtain field strength in dBμV/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 dBμV to obtain field strength in dBμV/m.

Antenna factor
Active Horn Antenna,
Com-Power Corporation, model: AHA-840, s/n 105004, HL 4956

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
18000	2.5
18500	0.5
19000	-1.0
19500	-2.4
20000	-2.5
20500	-2.2
21000	-2.0
21500	-2.7
22000	-3.7
22500	-3.8
23000	-3.7
23500	-5.0
24000	-4.5
24500	-5.0
25000	-4.7
25500	-4.4
26000	-4.3
26500	-5.6
27000	-4.3
27500	-4.9
28000	-5.2
28500	-4.4

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
29000	-2.7
29500	-2.6
30000	-1.4
30500	-1.5
31000	-1.0
31500	-2.6
32000	-3.3
32500	-3.3
33000	-5.1
33500	-5.2
34000	-1.5
34500	-5.4
35000	-3.3
35500	-4.2
36000	-2.8
36500	-2.6
37000	-1.0
38000	1.8
38500	2.8
39000	1.3
39500	1.3
40000	0.3

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

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
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
dBΩ	decibel referred to one Ohm
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
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

END OF DOCUMENT