

11 Radiated Emissions (Digital parts and Receiver)

11.1 Method

Tests are performed in accordance with FCC Part 15B, ISSED ICES-003.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	5.0 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.9 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.1 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in dB μ V/m
 RA = Receiver Amplitude (including preamplifier) in dB μ V
 CF = Cable Attenuation Factor in dB
 AF = Antenna Factor in dB
 AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μ V
 NF = Net Reading in dB μ V

Example:

$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$
 $UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$

Alternately, when BAT-EMC Emission Software is used, the "Level" includes all losses and gains and is compared directly in the "Margin" column to the "Limit". The "Correction" includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the "Level" column.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DS42'	Weather Station Vantage Vue	Davis	6250	MS191212003	02/24/2021	02/24/2022
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/07/2020	05/07/2021
PRE11'	50dB gain pre-amp	Pasternack	PRE11	PRE11	09/21/2020	09/21/2021
145108'	Receiver	Rhode & Schwarz	ESIB40	100209	06/08/2020	06/08/2021
HS002'	Pre-amp to under floor cable	Huber & Suhner	SucoFlex 106A	HS002	11/25/2020	11/25/2021
145-406'	10m Track A In-floor Cable #1	Huber + Suhner	sucoflex 160-19220mm	001	07/13/2020	07/13/2021
IW001'	Receiver to floor cable	Insulated Wire	2801-NPS	001	10/07/2020	10/07/2021
IW006'	Pre-amp to antenna cable	Insulated Wire	2800-NPS	IW006	11/25/2020	11/25/2021
PRE12'	Pre-amp, 1-18GHz	Com-Power	PAM-118A	18040117	12/07/2020	12/07/2021
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	08/03/2020	08/03/2021
145-414'	3m Track A cables	Huber + Suhner	3m Track A cables	multiple	06/25/2020	06/25/2021

Software Utilized:

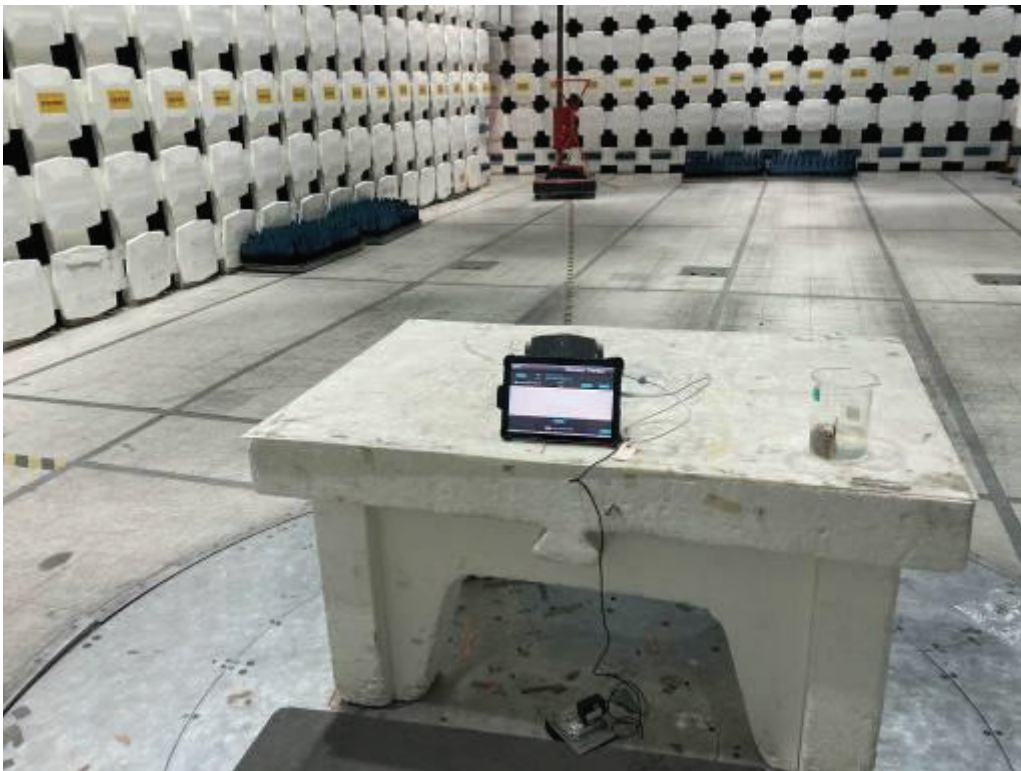
Name	Manufacturer	Version
BAT-EMC	Nexio	3.18.0.16 (10M)

11.3 Results:

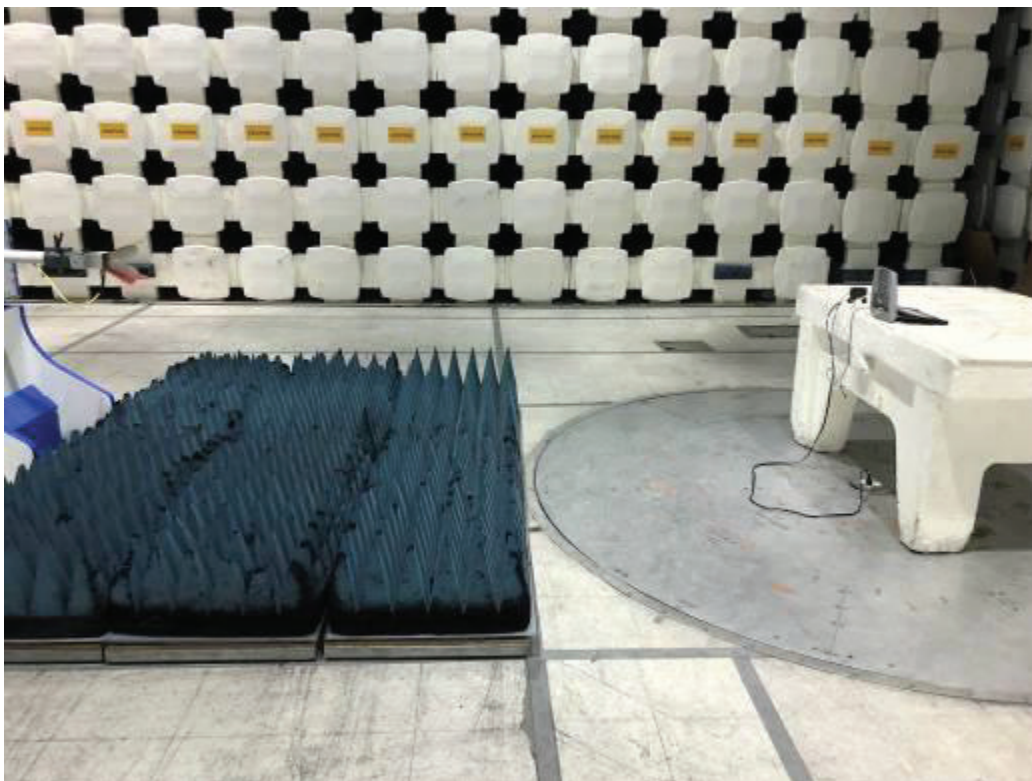
The sample tested was found to Comply.

11.4 Setup Photographs:

Test Setup Below 1 GHz at 10 meters



Test Setup Above 1 GHz at 3 meters



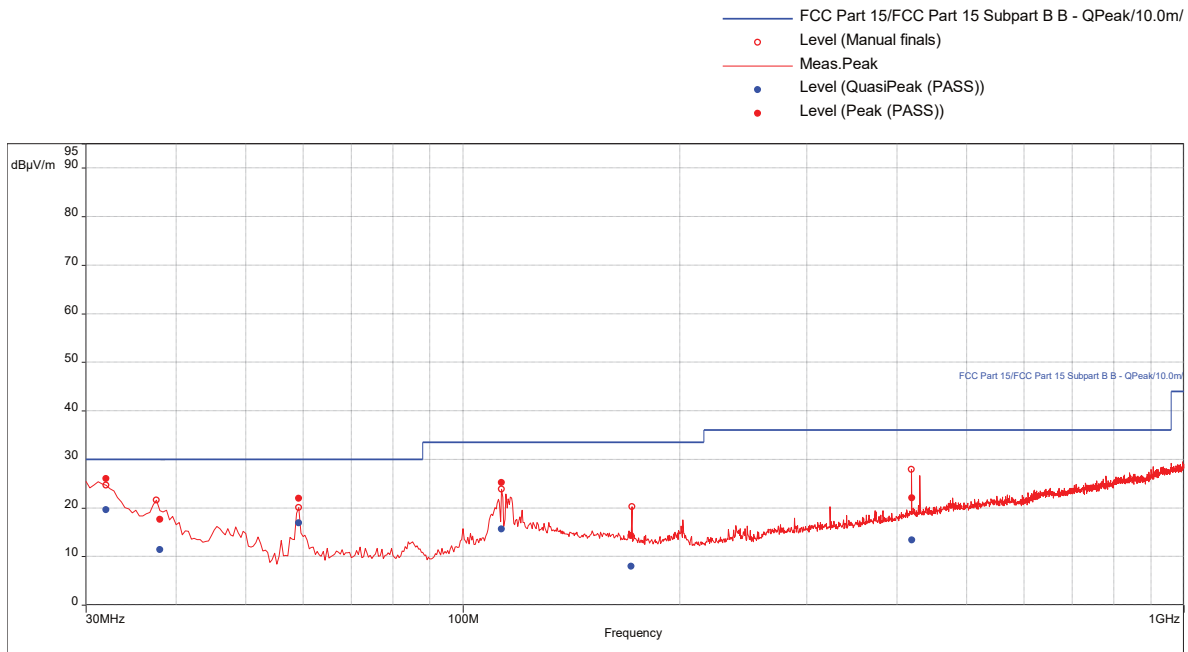
11.5 Plots/Data:

30-1000 MHz

Test Information:

Date and Time	3/21/2021 10:46:05 AM
Client and Project Number	CVRX_G104584704
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	18%
Atmospheric Pressure	1002 mB
Comments	RE 30-1000MHz 120VAC 60Hz FCC

Graph:



Results:

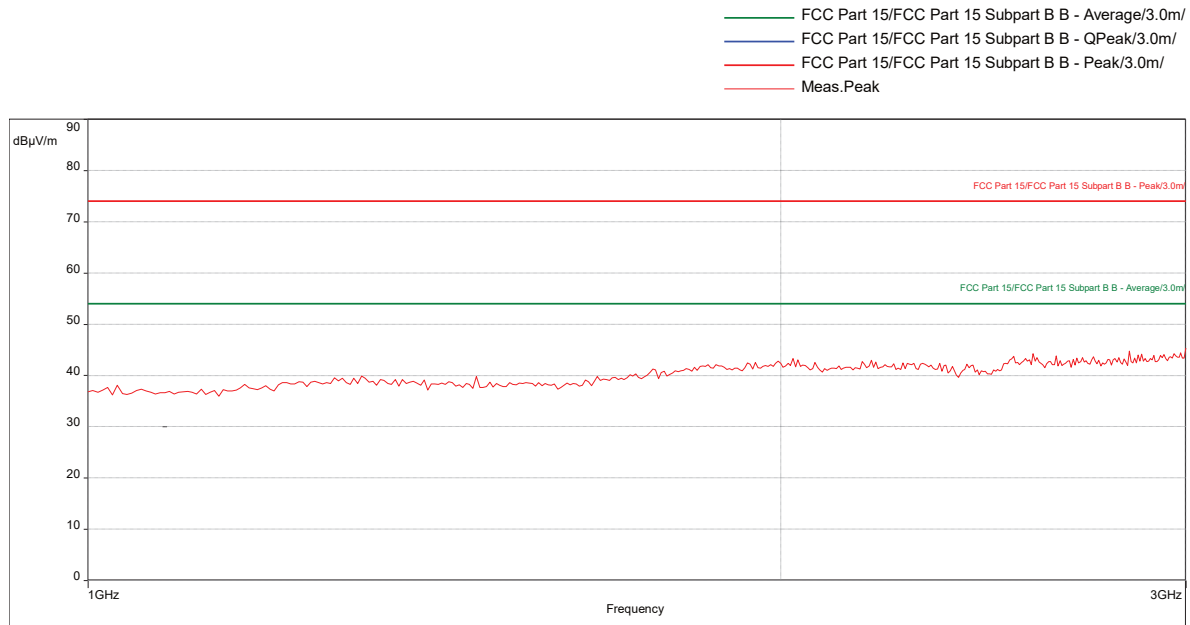
QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
32	19.64	30.00	-10.36	25.00	3.11	Vertical	120000.00	-13.71
37.82105263	11.36	30.00	-18.64	0.00	2.64	Vertical	120000.00	-18.09
59.13684211	16.89	30.00	-13.11	17.00	1.51	Vertical	120000.00	-25.86
113.3578947	15.66	33.50	-17.84	320.00	2.23	Vertical	120000.00	-19.53
171.2526316	7.98	33.50	-25.52	261.00	3.86	Vertical	120000.00	-20.76
419.5473684	13.34	36.00	-22.66	144.00	1.00	Vertical	120000.00	-15.07

1 - 3 GHz

Test Information:

Date and Time	4/4/2021 12:30:57 PM
Client and Project Number	CVRX_G104584704
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	18%
Atmospheric Pressure	1002 mB
Comments	RE 1 to 3 GHz_120VAC 60Hz_Mode 2_normal mode

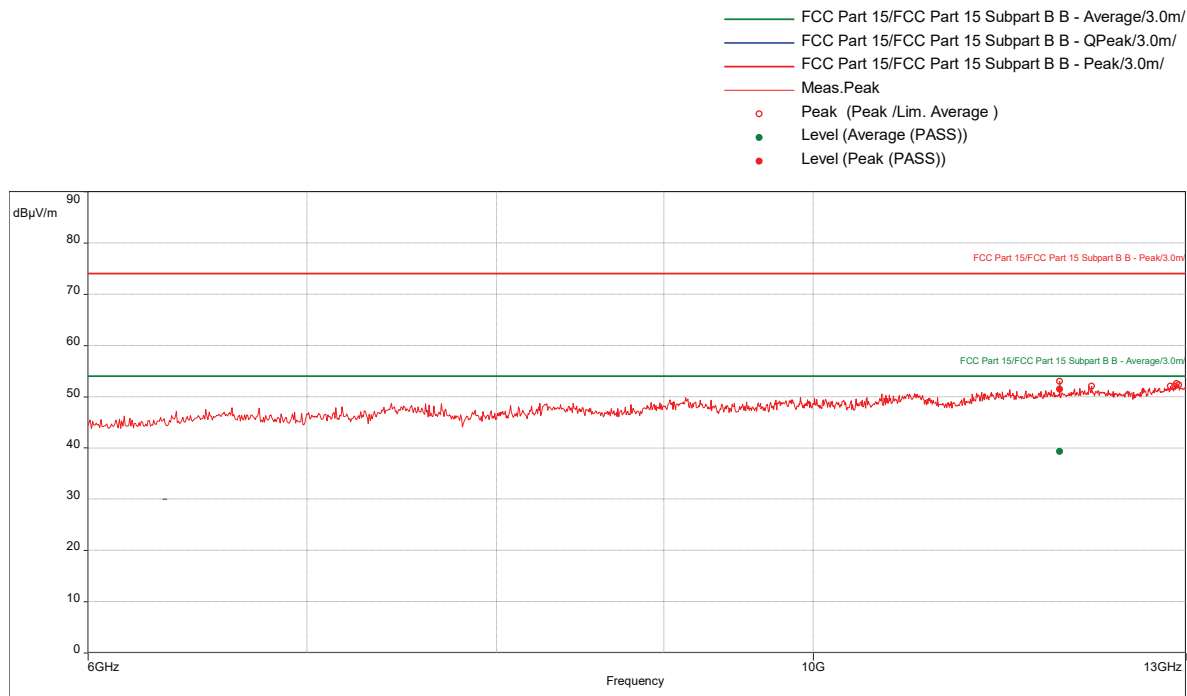
Graph:**Results:** No emissions were detected.

3 – 13 GHz

Test Information:

Date and Time	4/4/2021 12:20:23 PM
Client and Project Number	CVRX_G104584704
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	18%
Atmospheric Pressure	1002 mB
Comments	RE 6 to 13 GHz_120VAC 60Hz_Mode 2_normal mode

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
11896.84211	51.41	74.00	-22.59	328.00	2.30	Vertical	1000000.00	0.62

Average (PASS) (1)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
11896.84211	39.28	54.00	-14.72	328.00	2.30	Vertical	1000000.00	0.62

Intertek

Report Number: 104584704BOX-015

Issued: 05/13/2021

Test Personnel: Vathana Ven *VSV*
Supervising/Reviewing
Engineer:
(Where Applicable) Kouma Sinn *KPS*
FCC Part 15B
Product Standard: ISED ICES-003
Input Voltage: 120VAC 60Hz
Pretest Verification w/
BB Source: **Yes**

Test Date: 03/21/2021, 04/04/2021

Limit Applied: Class B

Ambient Temperature: 21 °C

Relative Humidity: 18 %

Atmospheric Pressure: 1002 mbars

Deviations, Additions, or Exclusions: None