Test report

459039-1TRFEMC

Date of issue: February 1, 2022

Applicant:

Blues Inc.

Product:

PCI notebook card with WI-FI

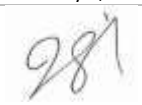
Model:	Variant(s):
NOTE-WIFI 1.2	N/A

Specifications:

- FCC 47 CFR Part 15, Subpart B – Verification
- ICES-003 Issue 7: 2020

Lab and test locations

Company name	Nemko USA Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
State	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
FCC Site Number	Test Firm Registration Number: 392943; Designation Number: US5058
ISED Test Site	2040B-3

Tested by	Greg Woelke, EMC Test Engineer
Reviewed by	James Cunningham, EMC/MIL/WL Supervisor
Review date	February 1, 2022
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart B – Verification	Title 47: Telecommunication; Part 15—Radio Frequency Devices
ICES-003 Issue 7: 2020	Information Technology Equipment (including Digital Apparatus)

1.2 Exclusions

None.

1.3 Statement of compliance

Testing was performed against all relevant requirements of the test standard(s).

Results obtained indicate that the product under test complies in full with the tested requirements.

The test results relate only to the item(s) tested.

See "Section 2 Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Issue Date	Details of changes made to test report
459039-1TRFEMC	February 1, 2022	Original report issued

Section 2 Summary of test results

2.1 Sample information

Receipt date	1/24/2022
Nemko sample ID number	459039

2.2 Testing period

Test start date	1/27/2022
Test end date	1/27/2022

2.3 Emissions test results

Table 2.3-1: *FCC 47 CFR Part 15, Subpart B and ICES-003 Issue 7 results*

Standard	Clause	Test description	Verdict
FCC 47 CFR Part 15, Subpart B	§15.109	Radiated emissions limits [1]	Pass
FCC 47 CFR Part 15, Subpart B	§15.107	Conducted emissions limits (AC mains) [1]	Pass [2]
ICES-003 Issue 7	6.1	AC power line conducted emissions limits [1]	Pass [2]
ICES-003 Issue 7	6.2	Radiated emissions limits [1]	Pass

Notes: [1] Product classification B
[2] The EUT is DC powered

Section 3 Equipment under test (EUT) details

3.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

3.2 Applicant

Company name	Blues Inc.
Address	50 Harbor Street
City	Manchester
State	MA
Postal/Zip code	01944
Country	USA

3.3 Manufacturer

Company name	Microtronics Technology Sdn. Bhd
Address	10 & 10A Jalan Bayu
City	Johor Bahru
State	Johor
Postal/Zip code	81200
Country	Malaysia

3.4 EUT information

Product name	PCI notebook card with WI-FI
Model	NOTE-WIFI 1.2
Variant(s)	N/A
Serial number	N/A
Part number	N/A
Power requirements	EUT was USB powered (5 Vdc)
Description/theory of operation	The EUT is a WiFi network co-processor module
Operational frequencies	38.4 MHz reference clock
Software details	None provided

3.5 EUT exercise and monitoring details

EUT description of the methods used to exercise the EUT and all relevant ports:

- EUT was tested in Stand-by mode

3.6 EUT setup details

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
EUT has no sub-assemblies				

Table 3.6-2: *EUT interface ports*

Description	Qty.
USB	1

Table 3.6-3: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
USB power adaptor	Samsung	EP-TA10JWE	RT2G91Ds/b-e	n/a

Table 3.6-4: *Inter-connection cables*

Cable description	From	To	Length (m)
USB	EUT	USB power adaptor	

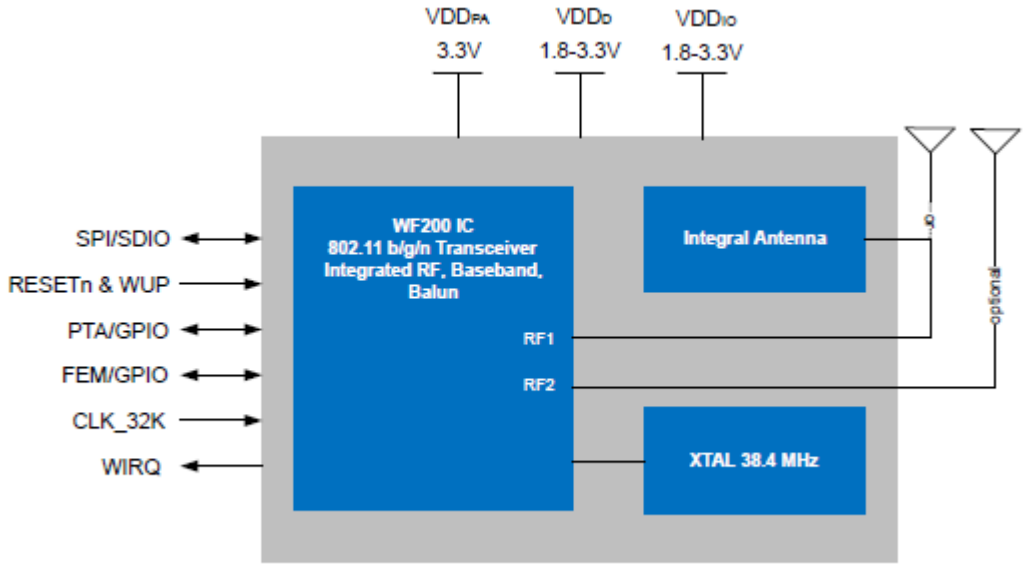

Figure 3.6-1: Test setup diagram

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

None.

4.2 Technical judgement

None.

4.3 Deviations from laboratory test procedures

None.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics, and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty calculations*

Measurement		**U_{cispr} dB**	**U_{lab} dB**
Conducted disturbance at AC mains and other port power using a V-AMN	9 kHz to 150 kHz	3.8	2.9
	150 kHz to 30 MHz	3.4	2.3
Conducted disturbance at telecommunication port using AAN	150 kHz to 30 MHz	5.0	4.3
Conducted disturbance at telecommunication port using CVP	150 kHz to 30 MHz	3.9	2.9
Conducted disturbance at telecommunication port using CP	150 kHz to 30 MHz	2.9	1.4
Conducted disturbance at telecommunication port using CP and CVP	150 kHz to 30 MHz	4.0	3.1
Radiated disturbance (electric field strength in a SAC)	30 MHz to 1 GHz	6.3	5.5
Radiated disturbance (electric field strength in a FAR)	1 GHz to 6 GHz	5.2	4.7
Radiated disturbance (electric field strength in a FAR)	6 GHz to 18 GHz	5.5	5.0

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

V-AMN: V type artificial mains network
AAN: Asymmetric artificial network
CP: Current probe
CVP: Capacitive voltage probe
SAC: Semi-anechoic chamber
FAR: Fully anechoic room

Section 7 Terms and definitions

7.1 Product classification definitions

7.1.1 Title 47: Telecommunication – Part 15 – Radio Frequency devices, Subpart A – General

Class A digital device	A digital device that is marketed for use in a commercial, industrial, or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.
Class B digital device	A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business, and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

7.1.2 ICES-003 – Equipment classification

Class B ITE	Limits of radio noise for ITE for residential operation.
Class A ITE	Limits of radio noise for ITE for non-residential operation.
Conditions	Only ITE intended strictly for non-residential use in commercial, industrial, or business environments, and whose design or other characteristics strongly preclude the possibility of its use in a residential environment, shall be permitted to comply with the less stringent Class A limits. All ITE that cannot meet the conditions for Class A operation shall comply with the Class B limits. The ITE shall comply with both the power line – conducted and the radiated emissions limits within the same Class, with no intermixing.

7.2 General definitions

7.2.1 Title 47: Telecommunication – Part 15-Radio Frequency devices, Subpart A – General

Digital device (Previously defined as a computing device)	An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. A radio frequency device that is specifically subject to an emanation requirement in any other FCC Rule part or an intentional radiator subject to subpart C of this part that contains a digital device is not subject to the standards for digital devices, provided the digital device is used only to enable operation of the radio frequency device and the digital device does not control additional functions or capabilities. Note: Computer terminals and peripherals that are intended to be connected to a computer are digital devices.

7.2.2 ICES-003

Information technology equipment (including Digital Apparatus)	Information Technology Equipment (ITE) is defined as devices or systems that use digital techniques for purposes such as data processing and computation. ITE is any unintentional radiator (device or system) that generates and/or uses timing signals or pulses having a rate of at least 9 kHz and employs digital techniques for purposes such as computation, display, data processing and storage, and control.

Section 8 Testing data

8.1 Radiated emissions

8.1.1 References and limits

- FCC 47 CFR Part 15, Subpart B: §15.109
- ICES-003: §3.2.2
- Test method: ANSI C63.4-2014

Table 8.1-1: *Requirements as per for radiated emissions for Class A*

Facility	Frequency range [MHz]	Measurement		limits
		Distance [m]	Detector type/ bandwidth	[dBµV/m]
FCC Part 15 Subpart B				
SAC	30–88	3	Quasi peak/120 kHz	49.5
	88–216			54.0
	216–960			56.9
	960–1000			60.0
FAR	>1000	3	Linear average/1 MHz	60.0
			Peak/1 MHz	80.0
SAC	30–88	10	Quasi peak/120 kHz	39.0
	88–216			43.5
	216–960			46.4
	960–1000			49.5
ICES-003				
SAC	30–88	3	Quasi peak/120 kHz	50.0
	88–216			54.0
	216–230			56.9
	230–960			57.0
	960–1000			60.0
FAR	>1000	3	Linear average/1 MHz	60.0
			Peak/1 MHz	80.0
SAC	30–88	10	Quasi peak/120 kHz	40.0
	88–216			43.5
	216–230			46.4
	230–960			47.0
	960–1000			49.5

Table 8.1-2: *Requirements as per for radiated emissions for Class B*

Facility	Frequency range [MHz]	Measurement		limits
		Distance [m]	Detector type/ bandwidth	[dBµV/m]
FCC Part 15 Subpart B				
SAC	30–88	3	Quasi peak/120 kHz	40.0
	88–216			43.5
	216–960			46.0
	960–1000			54.0
FAR	>1000	3	Linear average/1 MHz	54.0
			Peak/1 MHz	74.0
SAC	30–88	10	Quasi peak/120 kHz	29.5
	88–216			33.1
	216–960			35.6
	960–1000			43.5
ICES-003				
SAC	30–88	3	Quasi peak/120 kHz	40.0
	88–216			43.5
	216–230			46.0
	230–960			47.0
	960–1000			54.0
FAR	>1000	3	Linear average/1 MHz	54.0
			Peak/1 MHz	74.0
SAC	30–88	10	Quasi peak/120 kHz	30.0
	88–216			33.1
	216–230			35.6
	230–960			37.0
	960–1000			43.5

Notes: Where there is a step in the applicable limit, the lower value was applied at the transition frequency.

8.1.2 Test summary

Verdict	Pass		
Test date	January 27, 2022	Temperature	20 °C
Test engineer	Greg Woelke, EMC Test Engineer	Air pressure	1011 mbar
Test location	☒ 10m semi anechoic chamber ☐ 3m semi anechoic chamber ☐ Other:	Relative humidity	39 %

8.1.3 Notes

The spectral plots within this section have been corrected with all relevant transducer factors.

8.1.4 Setup details

Port under test	Enclosure port
EUT power input during test	
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:
Measuring distance	☐ 10m ☒ 3m ☐ Other:
Antenna height variation	1 – 4 m
Turn table position	0 – 360°
Measurement details	Preview measurements were performed with the receiver in continuous scan or sweep mode. Emissions detected within 6 dB or above limit (minimum of 6 frequencies) were maximized by rotating the EUT and adjusting the antenna height and polarization. At the position of maximum emission, the signal was measured with the appropriate detector against the corresponding limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Detector mode	Peak (Preview measurement) Peak and Average (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 5000 ms (Peak and Average final measurement)

Table 8.1-3: *Radiated emissions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1131	2 Yr	3/1/2022
Antenna, DRG Horn	ETS Lindgren	3117-PA	E1139	1 Yr	4/19/2022
Pre Amp as part of DRG Horn	ETS Lindgren	3117-PA	Part of E1139	1 Yr	4/19/2022
Antenna, Bilog	Schaffner-Chase	CBL 6111C	1480	2 Yr	10/28/2022

Notes: N/A – not applicable
NCR – no calibration required
VOU – verify on use

Table 8.1-4: *Radiated emissions test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.60.15

Notes: None

8.1.5 Test data

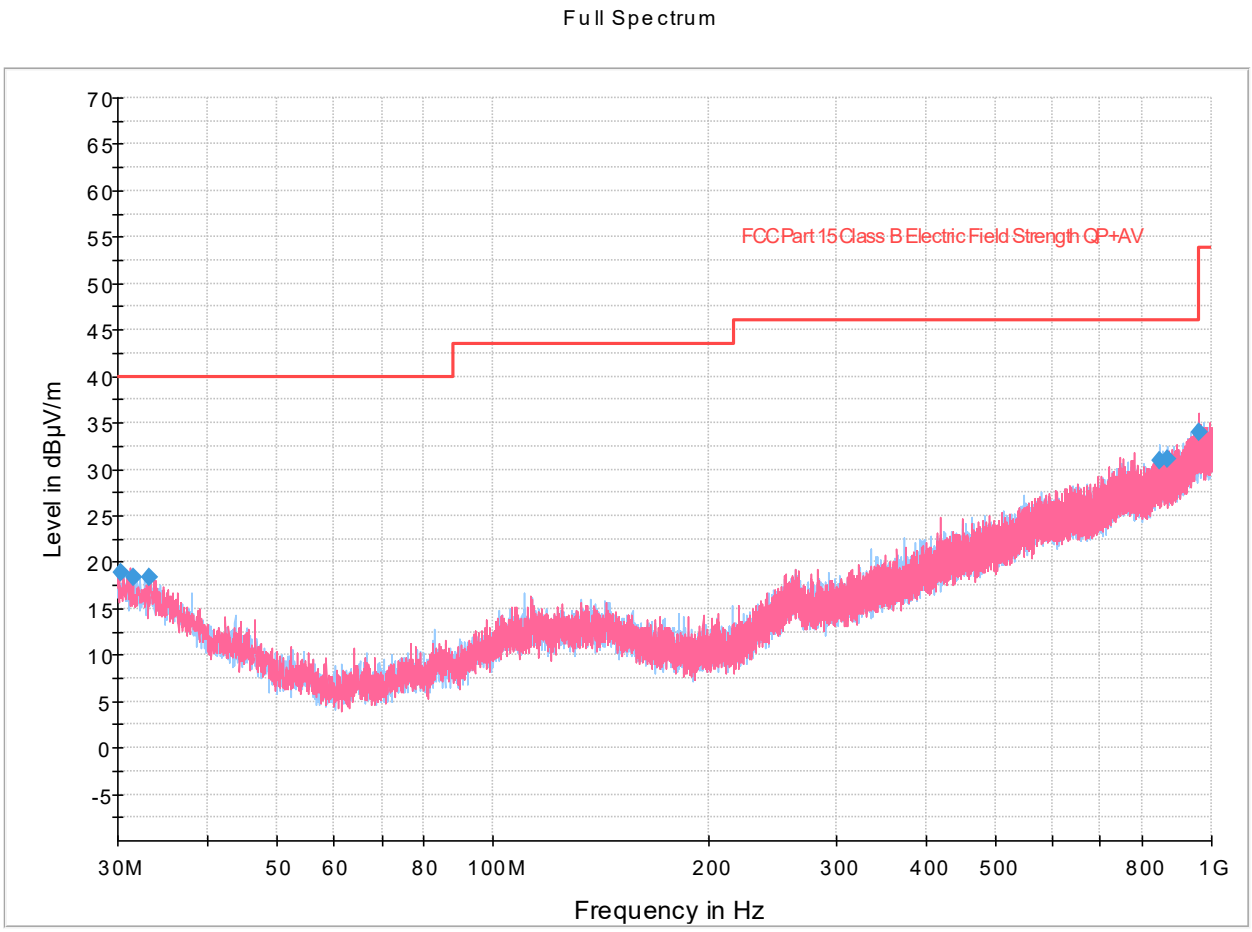

Figure 8.1-1: *Radiated emissions spectral plot (30 MHz - 1 GHz)*

Table 8.1-5*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.320000	18.82	40.00	21.18	5000.0	120.000	129.0	H	0.0	24.9
31.484000	18.32	40.00	21.68	5000.0	120.000	171.0	V	131.0	24.2
33.225667	18.35	40.00	21.65	5000.0	120.000	262.0	V	104.0	23.2
845.505333	30.89	46.00	15.11	5000.0	120.000	139.0	H	301.0	33.5
867.525333	31.05	46.00	14.95	5000.0	120.000	156.0	H	35.0	33.6
958.609000	33.98	46.00	12.02	5000.0	120.000	301.0	V	104.0	36.2

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

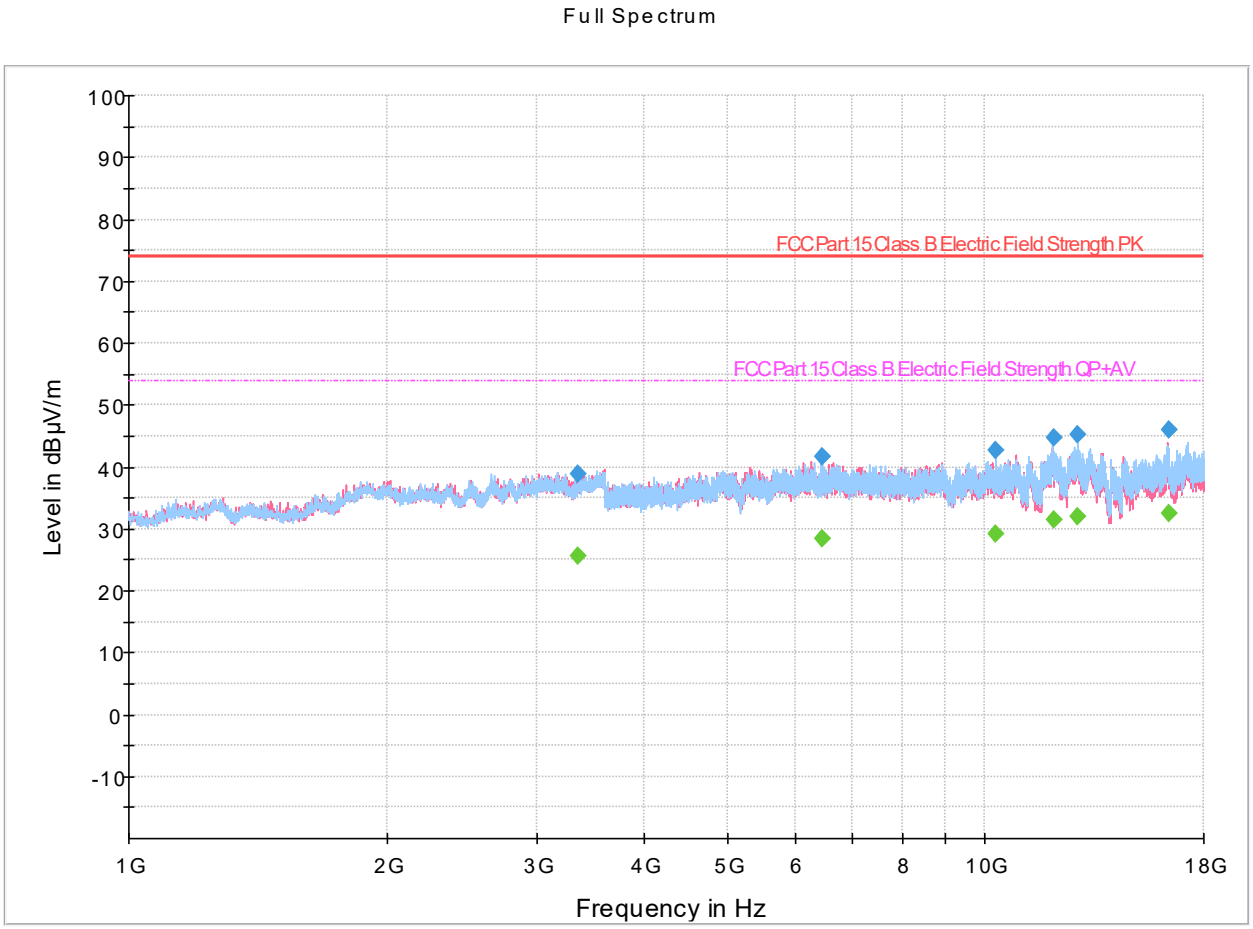

Figure 8.1-2: *Radiated emissions spectral plot (1 GHz - 18 GHz)*

Table 8.1-6*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3341.750000	---	25.60	53.90	28.30	5000.0	1000.000	345.0	V	338.0	-7.8
3341.750000	38.80	---	73.90	35.10	5000.0	1000.000	345.0	V	338.0	-7.8
6450.950000	---	28.48	53.90	25.42	5000.0	1000.000	119.0	V	314.0	-1.0
6450.950000	41.58	---	73.90	32.32	5000.0	1000.000	119.0	V	314.0	-1.0
10289.000000	42.72	---	73.90	31.18	5000.0	1000.000	279.0	H	229.0	1.2
10289.000000	---	29.14	53.90	24.76	5000.0	1000.000	279.0	H	229.0	1.2
12010.400000	44.66	---	73.90	29.24	5000.0	1000.000	132.0	H	146.0	3.8
12010.400000	---	31.35	53.90	22.55	5000.0	1000.000	132.0	H	146.0	3.8
12809.450000	---	31.97	53.90	21.93	5000.0	1000.000	279.0	H	188.0	6.3
12809.450000	45.26	---	73.90	28.64	5000.0	1000.000	279.0	H	188.0	6.3
16369.450000	---	32.41	53.90	21.49	5000.0	1000.000	238.0	V	22.0	8.0
16369.450000	46.09	---	73.90	27.81	5000.0	1000.000	238.0	V	22.0	8.0

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

8.1.6 Setup photos

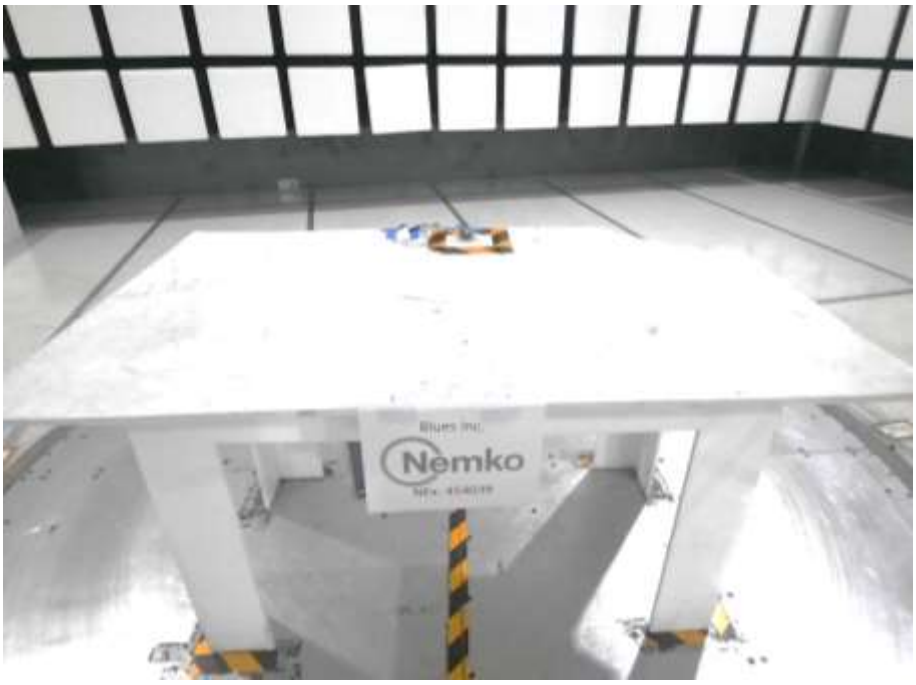

Figure 8.1-3: *Radiated emissions setup photo – below 1 GHz*

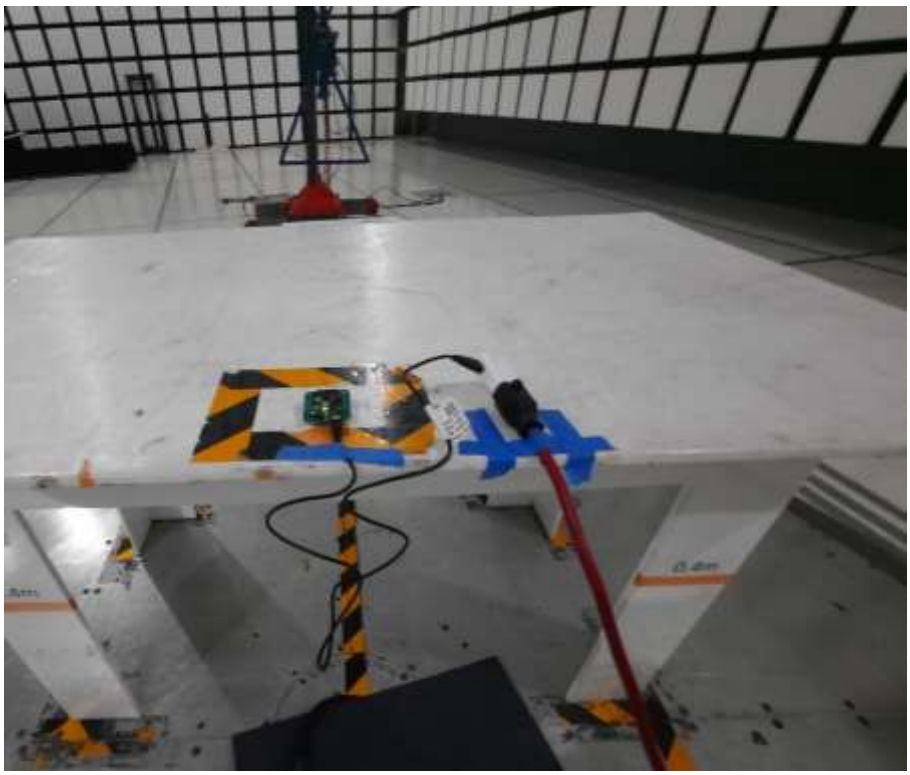

Figure 8.1-4: *Radiated emissions setup photo – below 1 GHz*

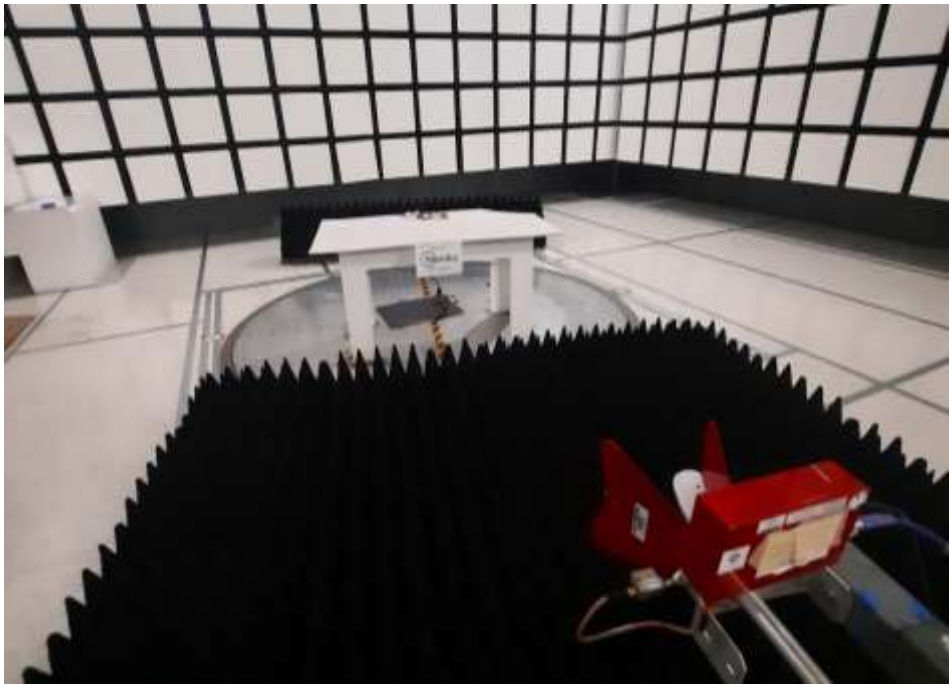

Figure 8.1-5: *Radiated emissions setup photo – above 1 GHz*

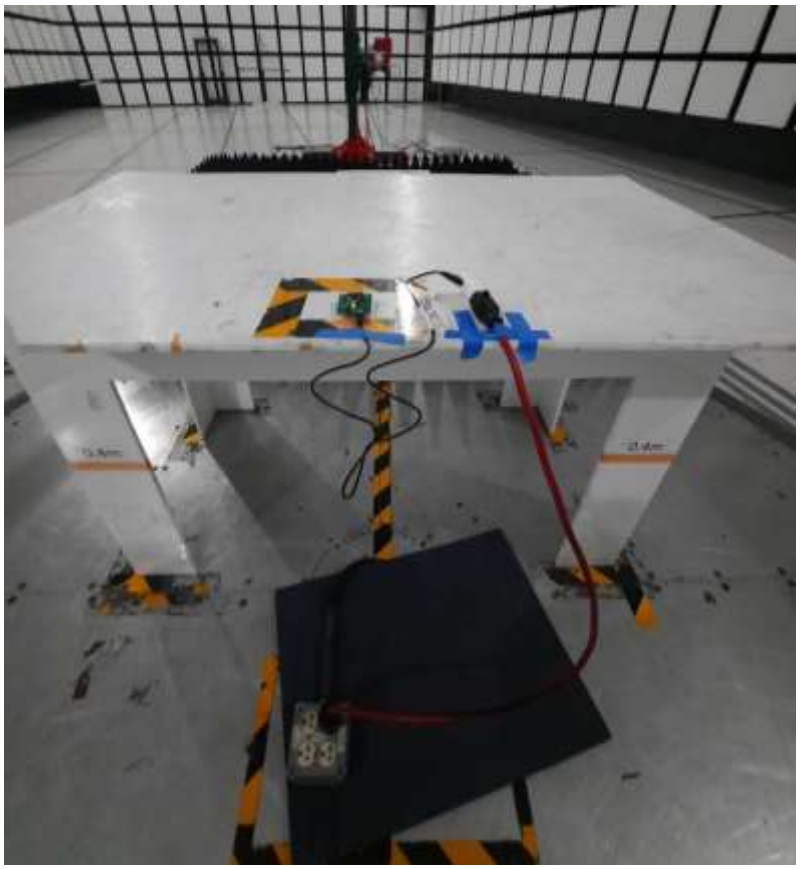

Figure 8.1-6: *Radiated emissions setup photo – above 1 GHz*

8.2 Conducted emissions from AC mains ports

8.2.1 References and limits

- FCC 47 CFR Part 15, Subpart B: §15.107
- ICES-003: §3.2.1
- Test method: ANSI C63.4-2014

Table 8.2-1: *Requirements for conducted emissions from the AC mains power ports for Class A*

Frequency range [MHz]	Measurement		Limits
	Coupling device	Detector type/ bandwidth	[dBµV]
0.15–0.5	AMN	Quasi peak/9 kHz	79.0
0.5–30			73.0
0.15–0.5	AMN	Average/9 kHz	66.0
0.5–30			60.0

Table 8.2-2: *Requirements for conducted emissions from the AC mains power ports for Class B*

Frequency range [MHz]	Measurement		Limits
	Coupling device	Detector type/ bandwidth	[dBµV]
0.15–0.5	AMN	Quasi peak/9 kHz	66.0–56.0
0.5–5			56.0
5–30			60.0
0.15–0.5	AMN	Average/9 kHz	56.0–46.0
0.5–5			46.0
5–30			50.0

Notes: The lower limit shall apply at the transition frequency.

8.2.2 Test summary

Verdict	Pass		
Test date	January 27, 2022	Temperature	20 °C
Test engineer	Greg Woelke, EMC Test Engineer	Air pressure	1011 mbar
Test location	☒ Ground plane ☐ Other:	Relative humidity	39 %

8.2.3 Notes

The spectral plots within this section have been corrected with all relevant transducer factors.

Equipment with a DC power port powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment and tested with a power converter. Where the manufacturer provided the power converter, the supplied converter was used.

8.2.4 Setup details

Port under test – Coupling device	USB Power Adaptor – Artificial Mains Network (AMN)
EUT power input during test	
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Selected emissions were re-measured with the appropriate detector(s) against the correlating limit(s) and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Detector mode	– Peak and Average (Preview measurement) – Quasi-peak and Average (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 5000 ms (Quasi-peak and Average final measurement)

Table 8.2-3: *Conducted emissions from AC mains port equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver	Rohde & Schwarz	ESCI 7	E1026	2 Yr	2/24/2023
LISN	Rohde & Schwarz	ENV216	E1019	1 Yr	9/20/2022
Transient Limiter (10 dB pad)	Hewlett Packard	11947A	681	1 Yr	2/11/2022

Notes: N/A – not applicable
NCR – no calibration required
VOU – verify on use

Table 8.2-4: *Conducted emissions from AC mains port test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.60.15

Notes: None

8.2.5 Test data

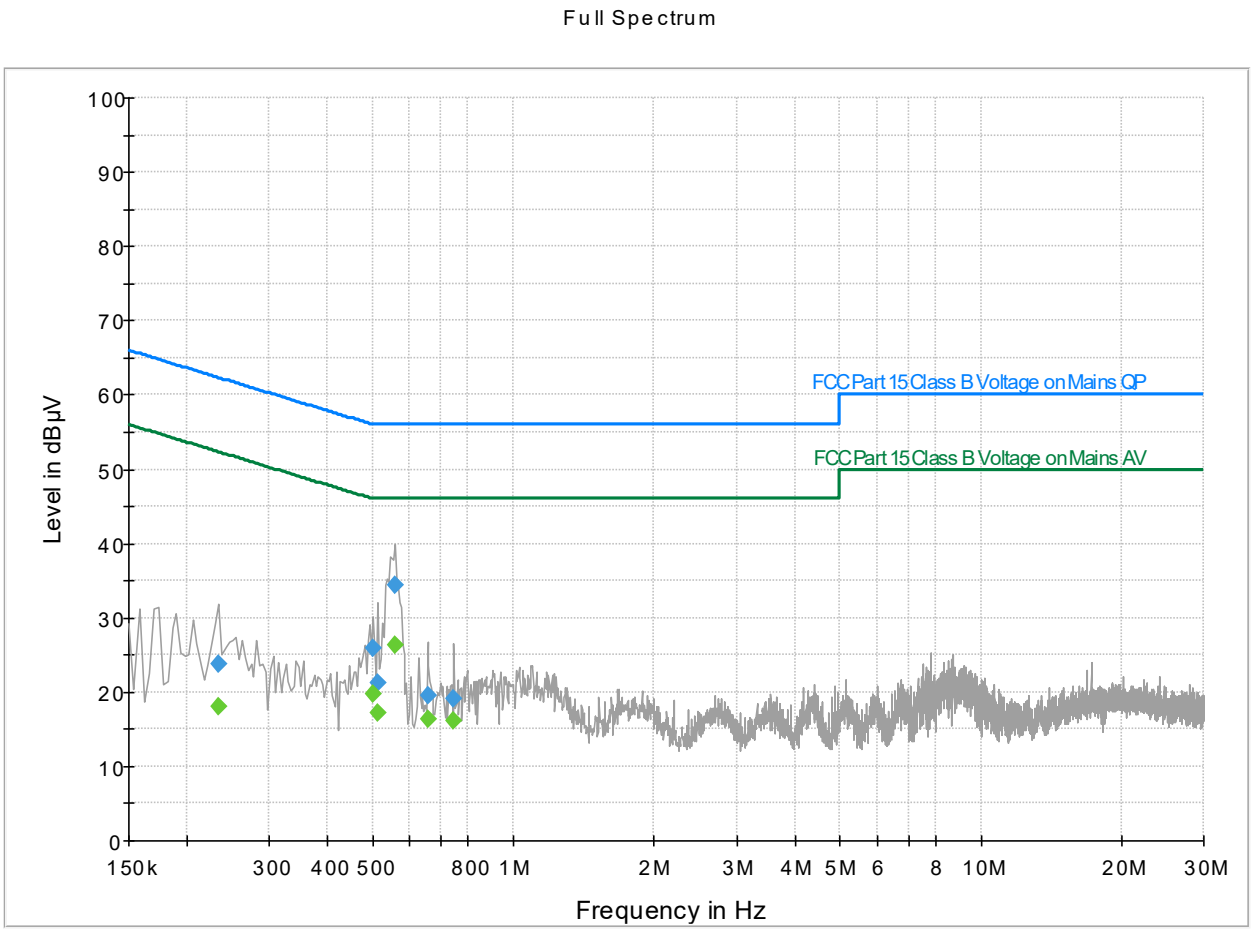

Figure 8.2-1: *Conducted emissions at mains port spectral plot (150 kHz - 30 MHz)*

Table 8.2-5*: Conducted emissions at mains port results*

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.234000	23.86	---	62.31	38.45	5000.0	9.000	N	ON	19.5
0.234000	---	17.94	52.31	34.36	5000.0	9.000	N	ON	19.5
0.502000	25.91	---	56.00	30.09	5000.0	9.000	L1	ON	19.4
0.502000	---	19.78	46.00	26.22	5000.0	9.000	L1	ON	19.4
0.510000	21.34	---	56.00	34.66	5000.0	9.000	L1	ON	19.4
0.510000	---	17.18	46.00	28.82	5000.0	9.000	L1	ON	19.4
0.558000	34.43	---	56.00	21.57	5000.0	9.000	L1	ON	19.4
0.558000	---	26.24	46.00	19.76	5000.0	9.000	L1	ON	19.4
0.654000	19.64	---	56.00	36.36	5000.0	9.000	L1	ON	19.4
0.654000	---	16.41	46.00	29.59	5000.0	9.000	L1	ON	19.4
0.746000	19.20	---	56.00	36.80	5000.0	9.000	L1	ON	19.4
0.746000	---	16.04	46.00	29.96	5000.0	9.000	L1	ON	19.4

Notes: [1] Result (dBµV) = receiver analyzer value (dBµV) + correction factor (dB).
[2] Correction factors = LISN factor IL (dB) + cable loss (dB) + transient limiter (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

8.2.6 Setup photos

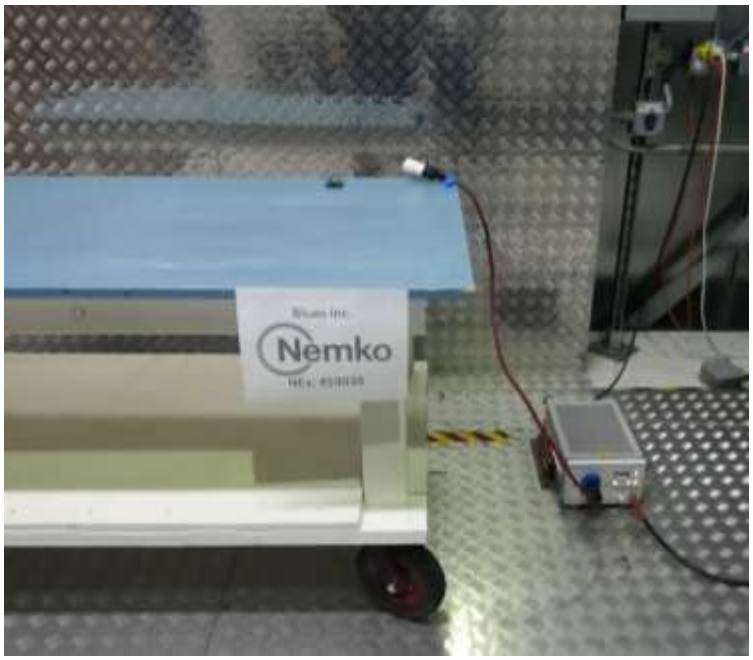

Figure 8.2-2: *Conducted emissions from AC mains power ports setup photo*

Figure 8.2-3: *Conducted emissions – from AC mains power ports setup photo*

Section 9 EUT photos

9.1 External photos

Figure 9.1-1: *Front view photo*

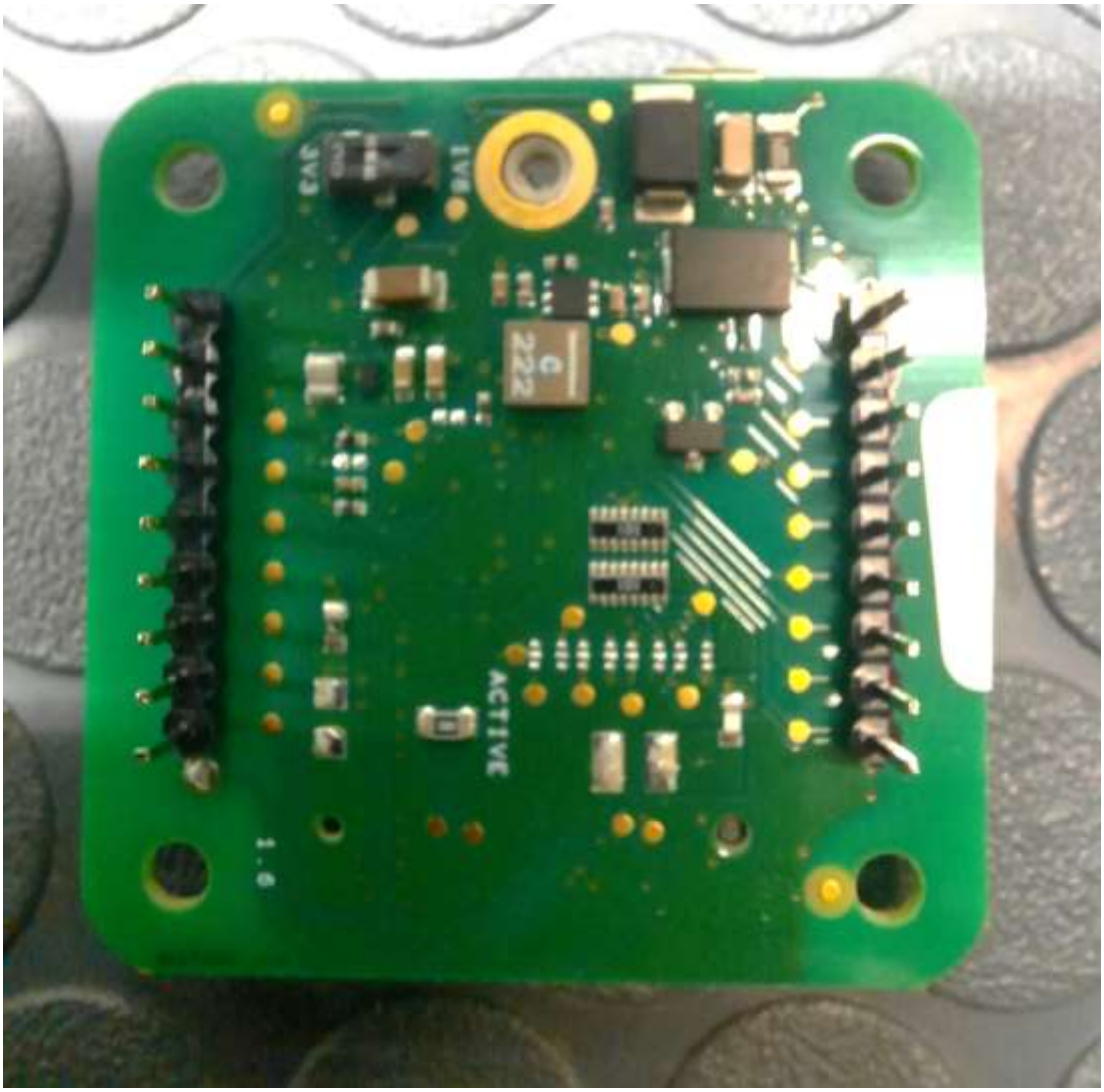

Figure 9.1-2: *Rear view photo*

End of test report