EMC TEST REPORT – 386571-2R1TRFEMC

Applicant:

ESKI Inc.

Product name:

WASH

Model:

WASH 3.5

Model Variant:

WASH 3.0

FCC ID:

2ADS4WASH

Specifications:

- FCC 47 CFR Part 15, Subpart B – Verification

Date of issue: December 18, 2020

Yong Huang, Wireless/EMC Specialist
Tested by

Signature

Lab and test locations

Company name	Nemko Canada Inc.	
Facilities	**Montréal site:** **292 Labrosse Avenue** **Pointe-Claire, Québec** **Canada** **H9R 5L8** **Tel: +1 514 694 2684** **Fax: +1 514 694 3528**	
Test site registration	**Organization**	**Recognition numbers and location**
	FCC/ISED	CA2040 (Ottawa/Almonte); CA2041 (Montreal); CA0101 (Cambridge)
Website	www.nemko.com	

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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

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

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant(after modification).

Testing was performed against all relevant requirements of the test standard except as noted in section 1.2 above. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	April 6, 2020	Original report issued
R1TRF	December 18, 2020	Updated as per TCB feedback

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

The following modifications were performed by client:
This picture shows the modification for the WASH 3.5 (final version). Previously there was one small Ferrite per cable on the DMX cable (2 in total) with no turn and 1 big Ferrite per cable on the POWER cable (2 in total). They were changed for 4 bigs Ferrites: 74271221 from Würth Elektronik. And there is a loop for the input and output of the DMX cable (see images below).

2.2 Technical judgment

This report is for C2PCpurpose, as per requested by TCB, referring to original assessment of report 369141-1R1TRFEMC.
Test sample was as provided by client, EUT's emissions was found to be below the limit after modification mentioned in section 2.1 above.

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	30 % – 60 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

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.

3.2 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 4 Measurement uncertainty

4.1 Uncertainty of measurement

Nemko Canada 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 4.1-1: *Measurement uncertainty calculations*

Measurement		U_{cispr} dB	U_{lab} dB			
			Ottawa	Montreal	Cambridge	Almonte
Conducted disturbance at AC mains and other port power using a V-AMN	(9 kHz to 150 kHz)	3.8	2.9	2.8	2.8	N/A
	(150 kHz to 30 MHz)	3.4	2.3	2.2	2.2	N/A
Conducted disturbance at telecommunication port using AAN	(150 kHz to 30 MHz)	5.0	4.3	4.3	4.3	N/A
Conducted disturbance at telecommunication port using CVP	(150 kHz to 30 MHz)	3.9	2.9	2.8	2.8	N/A
Conducted disturbance at telecommunication port using CP	(150 kHz to 30 MHz)	2.9	1.4	1.1	1.1	N/A
Conducted disturbance at telecommunication port using CP and CVP	(150 kHz to 30 MHz)	4.0	3.1	3.0	3.0	N/A
Disturbance power	(30 MHz to 300 MHz)	4.0	3.7	3.7	3.7	N/A
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1 GHz)	6.3	5.7	5.5	5.5	5.5
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2	4.8	5.1	4.8	N/A
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5	5.1	5.0	4.7	N/A

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

Section 5 Summary of test results

5.1 Testing location

Test location (s)	Montreal

5.2 Testing period

Test start date	November 5, 2019
Test end date	November 8, 2019

5.3 Sample information

Receipt date	November 5, 2019
Nemko sample ID number	1

5.4 North America test results

Table 5.4-1: *Result summary for emissions*

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

Notes: [1] Product classification A
[2] The EUT is AC powered

Section 6 Information provided by the applicant

6.1 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 contained 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.

6.2 Applicant

Company name	ESKI Inc.
Address	103 rue Louvain Ouest Montreal, Quebec Canada H2N 1A3

6.3 Manufacturer

Company name	ESKI Inc.
Address	103 rue Louvain Ouest Montreal, Quebec Canada H2N 1A3

6.4 EUT information

Product name	WASH
FCC ID	2ADS4WASH
Model	WASH 3.5
Model variant	WASH 3.0
Serial number	CF-W026
Power requirements	100-240 V_{AC}, 50/60 Hz
Description/theory of operation	Infrared transmitter that controls PIXMOB luminous objects wirelessly; similarly to a LED flood light it is controllable by a lighting board through DMX.
Operational frequencies	8 MHz, 20 MHz
Software details	Firmware version 1.8.9

6.5 EUT setup details

6.5.1 EUT Exercise and monitoring

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

- Send continuous DMX commands to light up wristbands (blue bumps) via wash tester program and an ENTTEC USB to DMX adapter.

EUT setup/configuration rationale:

- The EUT setup in a configuration that was expected to produce the highest amplitude emissions relative to the limit and that satisfy normal operation/installation practice by the end user.
- The type and construction of cables used in the measurement set-up were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
  - The following deviations were:
  - None
- The EUT was setup in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local AE and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
  - The following deviations were:
  - None

EUT monitoring method:

- A wristband was used to confirm it was operating when the wristband would light up. IR operation was also observed via remote monitor.

6.5 EUT setup details, continued

6.5.2 EUT test configuration

Table 6.5-1: *EUT sub assemblies*

Description	Brand name	Model, Part number, Serial number, Revision level
WASH	PIXMOB	MN: WASH 3.5, SN: CF-W026

Table 6.5-2: *EUT interface ports*

Description	Qty.
SP 21 (AC Mains) Port – IN	1
SP 21 (AC Mains) Port - OUT	1
XLR (DMX) Port - IN	1
XLR (DMX) Port – OUT	1

Table 6.5-3: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
Laptop Computer	Apple	MN: MacBook Air, SN: C02SW00HH3QF
DMX512/RDM to USB 2.0 Interface	ENTTEC	MN: DMXUSB PRO, SN: 2159076

Table 6.5-4: *Inter-connection cables*

Cable description	From	To	Length (m)
XLR Cable	XLR (DMX) Port - IN	DMX512/RDM to USB 2.0 Interface	10
3 Conductor AC Power Cable	SP 21 (AC Mains) Port – IN	AC Source	2
XLR Cable	XLR (DMX) Port – OUT	Un-terminated	1
3 Conductor AC Power Cable	SP 21 (AC Mains) Port - OUT	Un-terminated	1

3.5 EUT setup details, continued

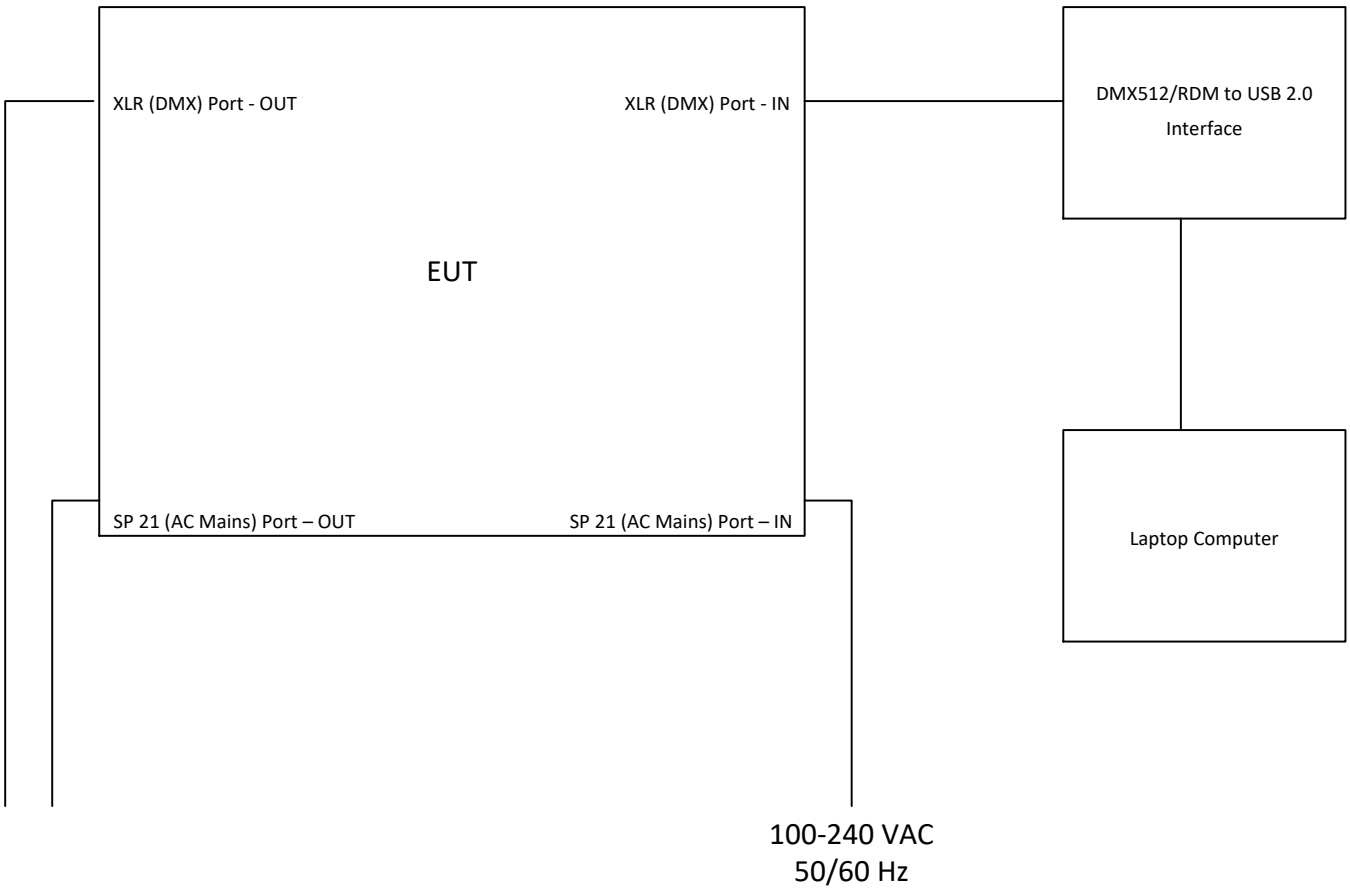

Figure 6.5-1: *block diagram*

Section 7 Terms and definitions

7.1 Product classifications definitions

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

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 definitions

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 – Definitions

Information technology equipment (ITE)	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: Clause §15.109 (Test method ANSI C63.4:2014)
- ICES-003: Section 6.2

Table 8.1-1: *Requirements as per FCC Part 15 Subpart B and ICES-003 for radiated emissions for Class A*

Frequency range [MHz]	Measurement		limits
	Distance [m]	Detector type/ bandwidth	[dBµV/m]
30–88	10	Quasi Peak/120 kHz	39.0
88–216			43.5
216–960			46.4
960–1000			49.5
30–88	3	Quasi Peak/120 kHz	49.5
88–216			54.0
216–960			56.9
960–1000			60.0
>1000	10	Linear average/1 MHz	49.5
		Peak/1 MHz	69.5
>1000	3	Linear average/1 MHz	60.0
		Peak/1 MHz	80.0

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

Table 8.1-2: *Requirements as per FCC Part 15 Subpart B and ICES-003 for radiated emissions for Class B*

Frequency range [MHz]	Measurement		limits
	Distance [m]	Detector type/ bandwidth	[dBµV/m]
30–88	10	Quasi Peak/120 kHz	29.5
88–216			33.1
216–960			35.6
960–1000			43.5
30–88	3	Quasi Peak/120 kHz	40.0
88–216			43.5
216–960			46.0
960–1000			54.0
>1000	10	Linear average/1 MHz	43.6
		Peak/1 MHz	63.6
>1000	3	Linear average/1 MHz	54.0
		Peak/1 MHz	74.0

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

8.1.2 Test summary

Verdict	Pass		
Tested by	Yong Huang	Test date	November 5 to 8, 2019

8.1.3 Notes

- The spectral plots within this section are a summation of a vertical and horizontal scans. The spectral scans have been corrected with the associated applicable transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally; where less than 6 measurements per detector has been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- The spectrum was scanned to 1 GHz according to the EUT highest digital operating frequency.

Table 8.1-3: *Maximum frequency test range based on highest digital operating frequency*

Highest internal frequency [F_X]	Highest measured frequency
$F_X \leq 108$ MHz	1 GHz
108 MHz < $F_X \leq 500$ MHz	2 GHz
500 MHz < $F_X \leq 1$ GHz	5 GHz
$F_X > 1$ GHz	5 × F_X up to a maximum of 40 GHz

Notes: Highest internal frequency [F_X] – highest fundamental frequency generated or used within the EUT or highest frequency at which it operates. This includes frequencies which are solely used within an integrated circuit.
For FM and TV broadcast receivers F_X is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

8.1.4 Setup details

Port under test	Enclosure Port
EUT power input during test	120 V_{AC}, 60 Hz
EUT setup configuration	Table top
Test facility	Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings.

Resolution bandwidth	Measurements below 1 GHz: 120 kHz, Measurements above 1 GHz: 1 MHz
Video bandwidth	Measurements below 1 GHz: 300 kHz, Measurements above 1 GHz:3 MHz
Detector mode	Measurements below 1 GHz: Peak (Preview), Quasi-peak (Final) Measurements above 1GHz: Peak (Preview), Peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms

Table 8.1-4: *Radiated emissions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber (Emissions)	TDK	SAC-3	FA002532e	2 year	January 10, 2020
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Three phase power system	TESEQ	ProfLine 2115-400	FA002516	1 year	May 20, 2020
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	December 6, 2019
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	January 3, 2020

Notes: NCR - no calibration required

Table 8.1-5: *Radiated emissions test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

8.1.5 Test data

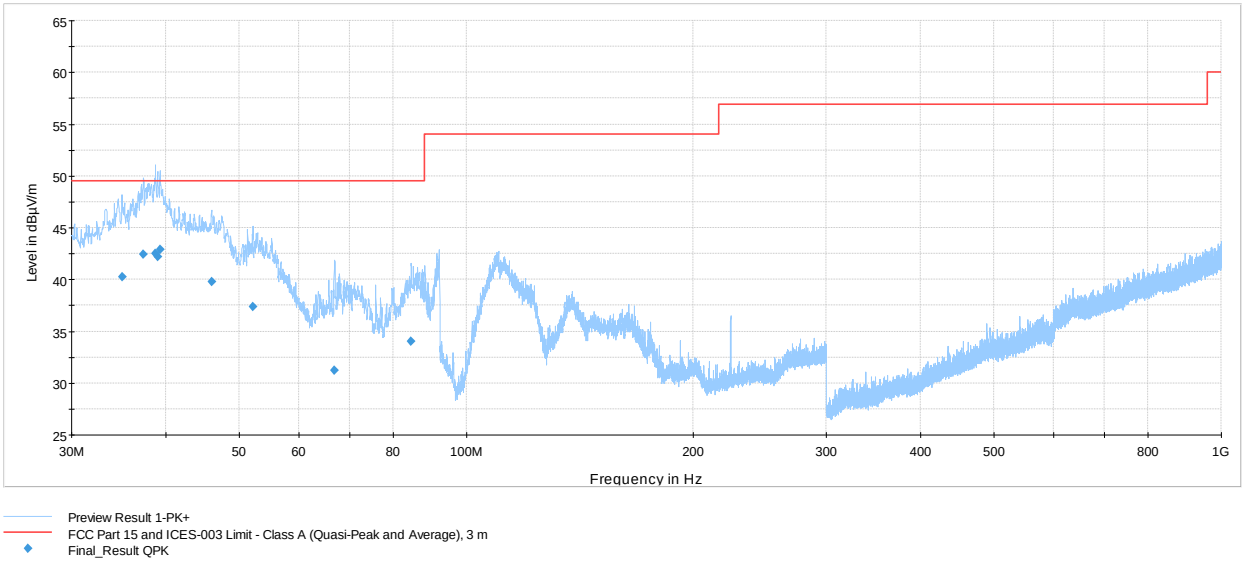

Figure 8.1-1: *Radiated emissions spectral plot (30 to 1000 MHz)*

8.1.5 Test data, continued

Table 8.1-6: *Radiated emissions results*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	Quasi-Peak limit [3] (dBµV/m)	Quasi-Peak margin (dB)	Correction factor[2] (dB)
35.010	40.3	49.5	9.2	22.4
37.380	42.4	49.5	7.1	20.6
38.730	42.5	49.5	7.0	19.6
39.000	42.2	49.5	7.3	19.4
39.270	42.9	49.5	6.6	19.2
45.990	39.8	49.5	9.7	14.7
52.170	37.4	49.5	12.1	12.4
66.930	31.2	49.5	18.3	13.0
84.540	34.1	49.5	15.4	12.4

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (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.

Sample calculation: 37.5 dBµV/m (field strength) = 21.3 dBµV (receiver reading) + 16.2 dB (Correction factor)

8.1.6 Setup photos

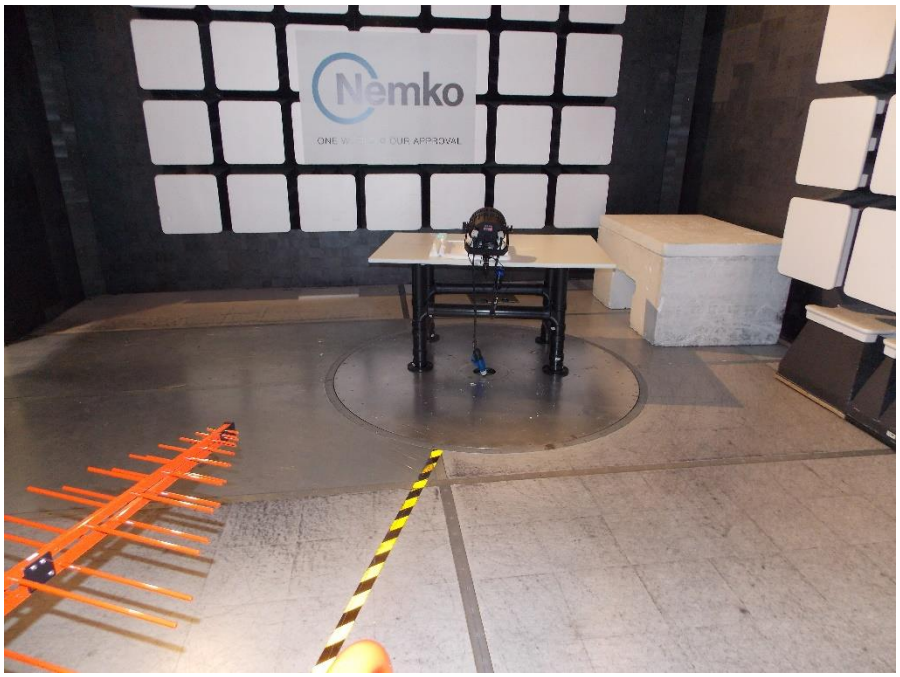

Figure 8.1-2: *Radiated emissions setup photo – below 1 GHz*

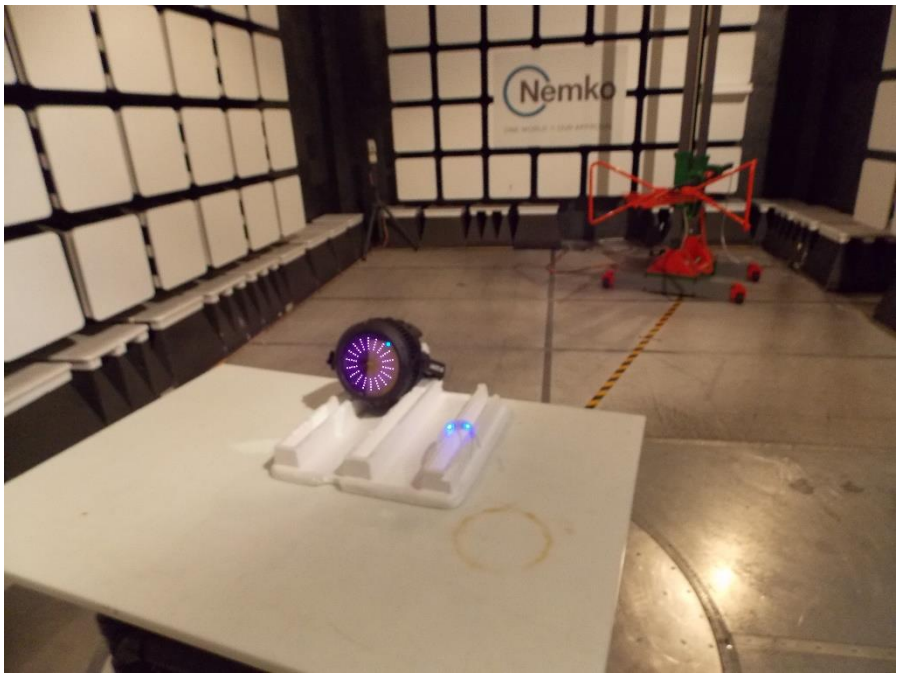

Figure 8.1-3: *Radiated emissions setup photo – below 1 GHz*

8.2 Conducted emissions – from AC mains power ports

8.2.1 References and limits

– FCC 47 CFR Part 15, Subpart B: Clause §15.107 (Test method ANSI C63.4:2014)
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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
0.5–30			73
0.15–0.5	AMN	CAverage/9 kHz	66
0.5–30			60

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

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	66–56
0.5–5			56
5–30			60
0.15–0.5	AMN	CAverage/9 kHz	56–46
0.5–5			46
5–30			50

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

8.2.2 Test summary

Verdict	Pass		
Tested by	Yong Huang	Test date	November 8, 2019

8.2.3 Notes

- The spectral plots within this section have been corrected with applicable transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally; where less than 6 measurements per detector has been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- Equipment with a DC power port powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment and was tested with a power converter. Where the power converter was provided by the manufacturer, the provided converter was used.

8.2.4 Setup details

Port under test – Coupling device	AC Mains – Artificial Mains Network (AMN)
EUT power input during test	120 V_{AC}, 60 Hz
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview), Quasi-peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms (Preview), 160 ms (Final)

Table 8.2-3: *Conducted emissions – from AC mains power ports equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	December 6, 2019
Three phase power system	TESEQ	ProfLine 2115-400	FA002516	1 year	May 20, 2020
LISN	Rohde & Schwarz	ENV216	FA002514	1 year	January 23, 2020

Notes: None

Table 8.2-4: *Conducted emissions – from AC mains power ports test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

8.2.5 Test data

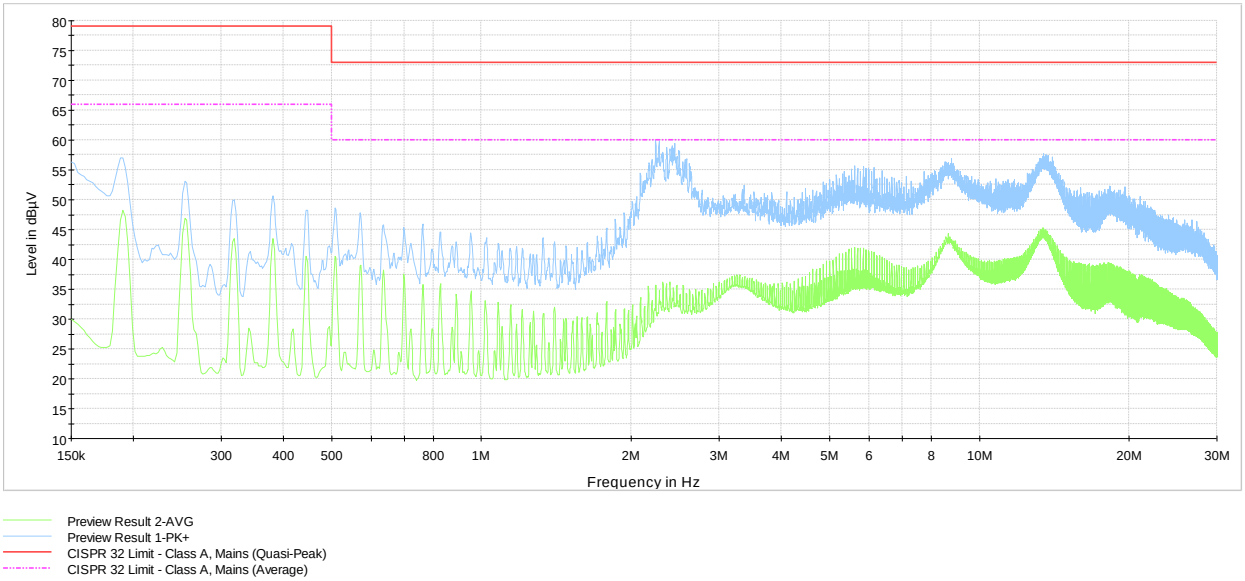

Figure 8.2-1: *Conducted emissions – from AC mains power ports spectral plot on phase line*

8.2.5 Test data, continued

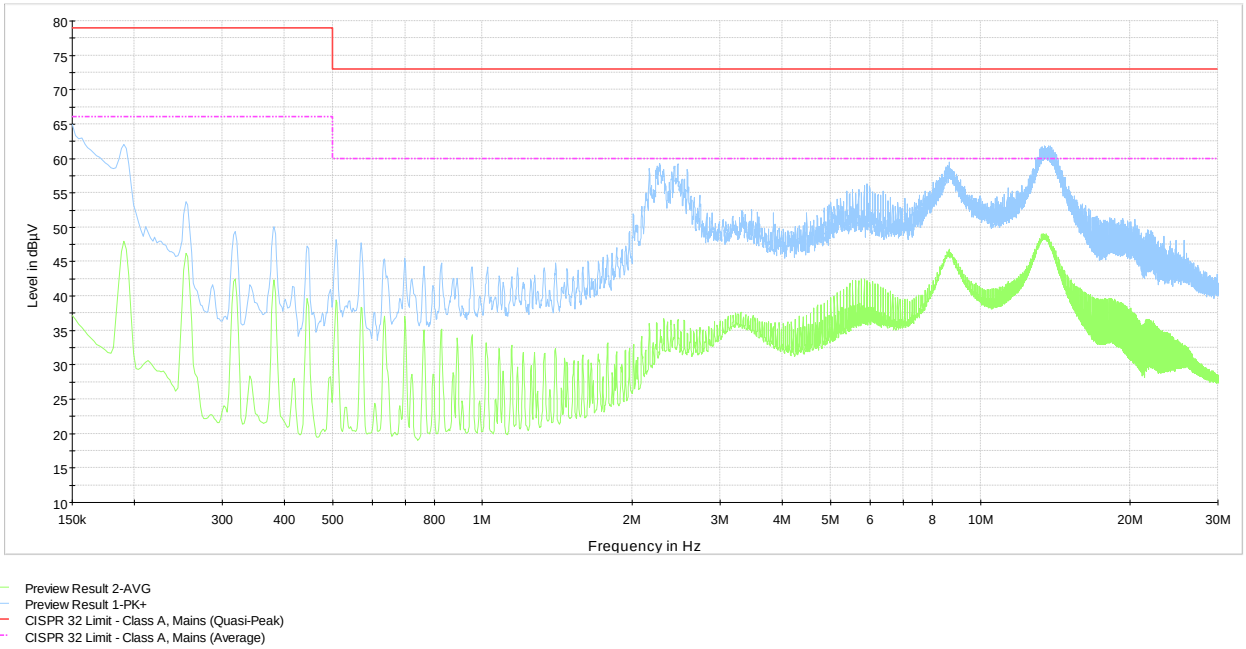

Figure 8.2-2: *Conducted emissions – from AC mains power ports spectral plot on neutral line*

8.2.6 Setup photos

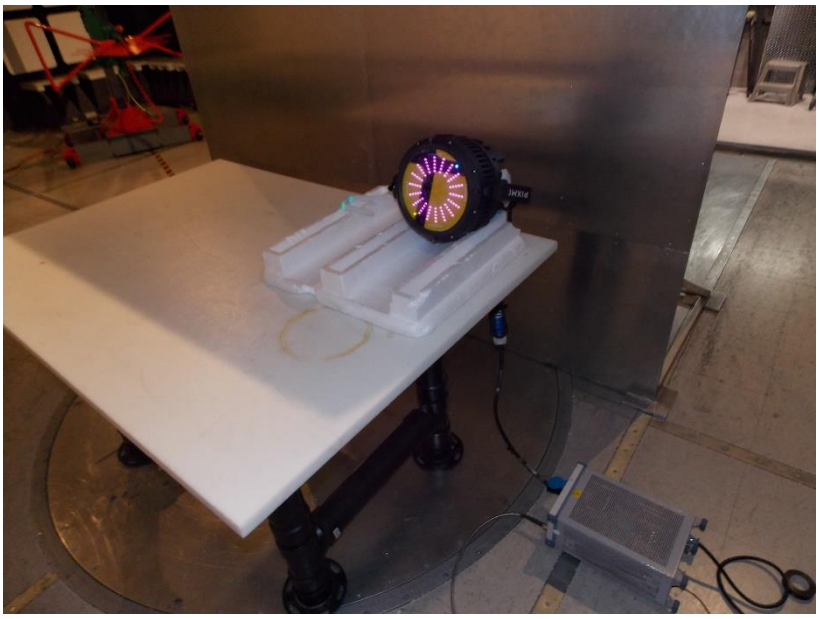

Figure 8.2-3: *Conducted emissions – from AC mains power ports setup photo*

Figure 8.2-4: *Conducted emissions – from AC mains power ports setup photo*

Section 9 EUT photos

9.1 External photos

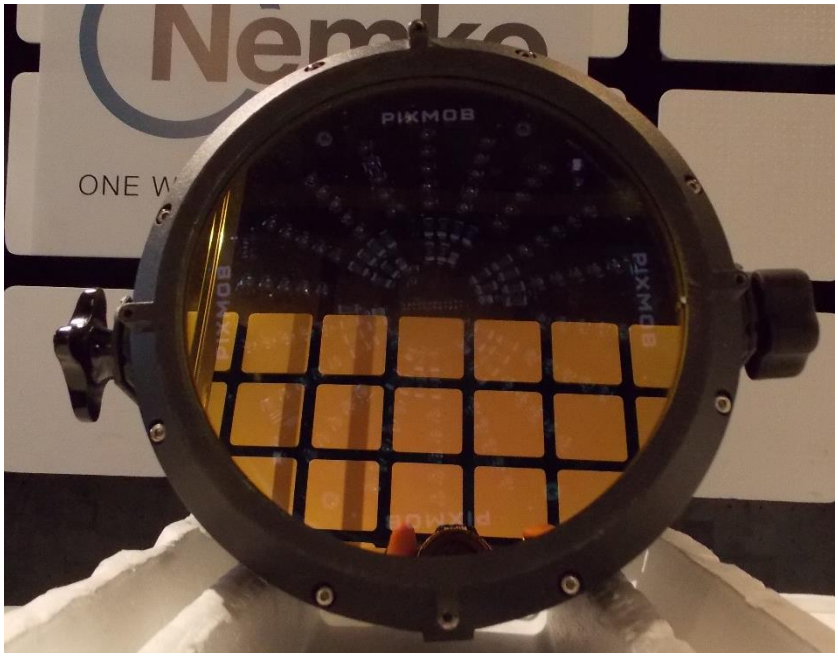

Figure 9.1-1: *Front view photo*

Figure 9.1-2: *Rear view photo*

Figure 9.1-3: *Side view photo*

Figure 9.1-4: *Side view photo*

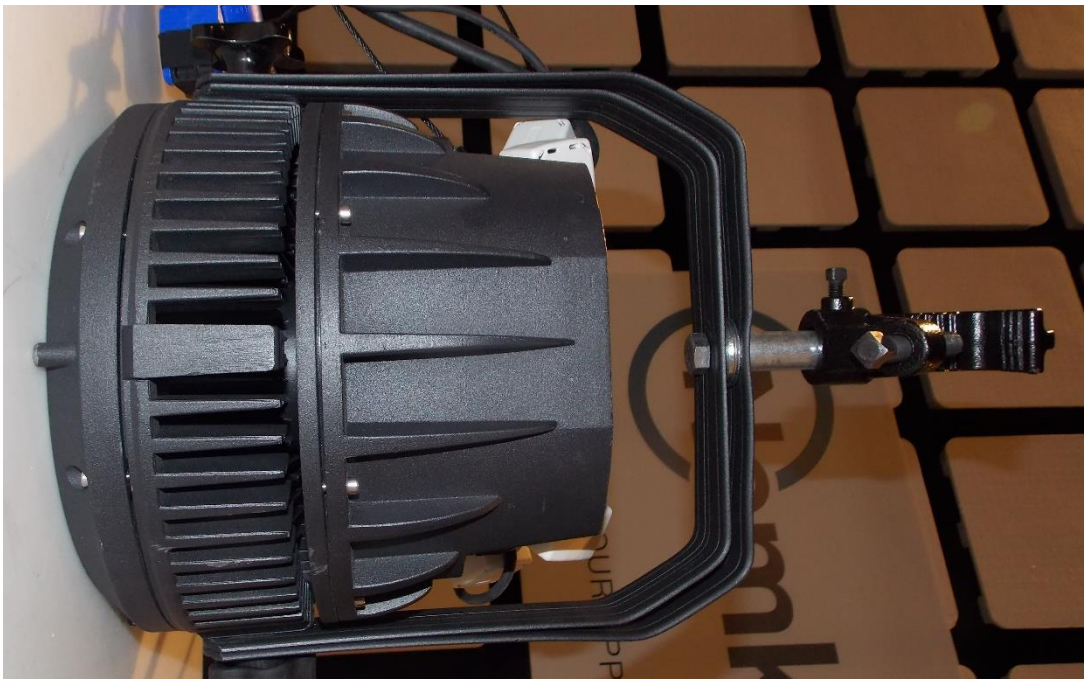

Figure 9.1-5: *Top view photo*

Figure 9.1-6: *Bottom view photo*

Figure 9.1-7: *label view photo*

End of the test report