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Test report

289364-1TRFEMC

Date of issue: August 12, 2016

Applicant:

Cryopak

Product:

xTagDisplay

Model:

xTagDisplay

Specifications:

- FCC 47 CFR Part 15, Subpart B – Verification
- ICES-003 Issue 5 August 2012

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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 Canada's ISO/IEC 17025 accreditation.

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Table of Contents

Table of Contents **3**
Section 1 Report summary **4**
1.1 Test specifications 4
1.2 Exclusions 4
1.3 Statement of compliance 4
1.4 Test report revision history 4
Section 2 Summary of test results **5**
2.1 North America test results 5
Section 3 Equipment under test (EUT) details **6**
3.1 Applicant/Manufacturer 6
3.2 Sample information 6
3.3 EUT information 6
3.4 EUT exercise and monitoring details 6
3.5 EUT setup details 7
Section 4 Engineering considerations **8**
4.1 Modifications incorporated in the EUT 8
4.2 Technical judgment 8
4.3 Deviations from laboratory tests procedures 8
Section 5 Test conditions **9**
5.1 Atmospheric conditions 9
5.2 Power supply range 9
Section 6 Measurement uncertainty **10**
6.1 Uncertainty of measurement 10
Section 7 Terms and definitions **11**
7.1 Product classifications definitions 11
7.2 General definitions 12
Section 8 Testing data **13**
8.1 Radiated disturbance 13
8.2 Conducted disturbance at mains port 19
Section 9 EUT photos **23**
9.1 External photos 23

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 5 August 2012	Information Technology Equipment (ITE) – Limits and methods of measurement

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. 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 #	Details of changes made to test report
TRF	Original report issued

Section 2 Summary of test results

2.1 North America test results

Table 2.1-1: *FCC 47 CFR Part 15, Subpart B and ICES-003 Issue 5 results*

Test description	Verdict
Radiated disturbance [1]	Pass
Conducted disturbance at mains port	Pass

Notes: [1] Product classification A

Section 3 Equipment under test (EUT) details

3.1 Applicant/Manufacturer

Company name	Cryopak Verification Technologies
Address	11000 Boulevard Parkway
City	Anjou
Province/State	QC
Postal/Zip code	H1J 1R6
Country	Canada

3.2 Sample information

Receipt date	June 22, 2015
Nemko sample ID number	133001281

3.3 EUT information

Product name	xTagDisplay
Model	xTagDisplay
Serial number	1615
Power requirements	3.7 V_{DC} 1.85A/H, Li-ion Polymer
Description/theory of operation	Wireless / wired temperature and humidity sensor
Operational frequencies	Processor : 18.432 MHz RTC : 32.768 MHz Ethernet :25 MHz
Software details	Proprietary software

3.4 EUT exercise and monitoring details

The EUT was monitoring the external sensors and passing Ethernet traffic

3.5 EUT setup details

Table 3.5-1: *EUT interface ports*

Description	Qty.
6 pin Sensor cable	1
USB cable	1
Ethernet	1
6 Pin Sensor cable	1

Table 3.5-2: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
Power supply	V-INFINITY	EPS120050	–	–
Sensor	–	–	08000003F5F86328	–
Sensor	–	–	0C0000024E848928	–

Table 3.5-3: *Inter-connection cables*

Cable description	From	To	Length (m)
6 pin Sensor cable	EUT	Sensor	0.3
USB cable	EUT	Open	1
Ethernet	EUT	Laptop	2
6 Pin Sensor cable	EUT	Sensor	0.3

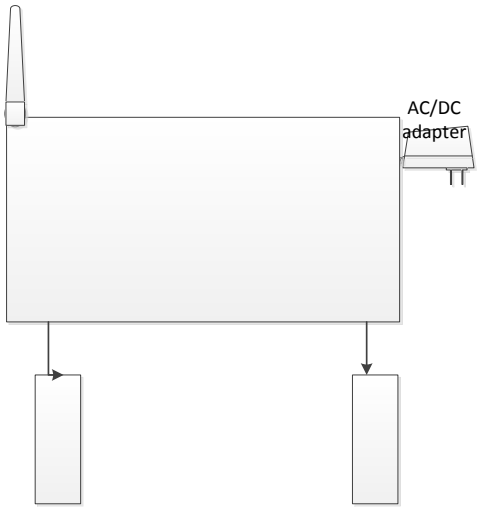


Figure 3.5-1: *Setup diagram*

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

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 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 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7 Terms and definitions

7.1 Product classifications 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

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.

7.2.1 ICES-003

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 disturbance

8.1.1 References

CISPR 22 and ANSI C63.4-2003

8.1.2 Test summary

Verdict	Pass		
Test date	June 23, 2015	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Test location	Ottawa	Relative humidity	41 %

8.1.3 Notes

None

8.1.4 Setup details

EUT setup configuration	Table top
Test facility	3 m 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 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (preview measurement); Quasi-peak (final measurement)
Trace mode	Max Hold
Measurement time	100 ms (preview measurement); 1000 ms (final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (preview); Peak and Average (final)
Trace mode	Max Hold
Measurement time	100 ms (preview); 1000 ms (final)

8.1.4 Setup details, continued

Table 8.1-1: *Radiated disturbance equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Feb. 25/16
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/16
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 12/16
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 01/16
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	May 05/16
50 Ω coax cable	C.C.A.	None	FA002555	1 year	May 05/16
50 Ω coax cable	Huber + Suhner	None	FA002074	1 year	May 05/16

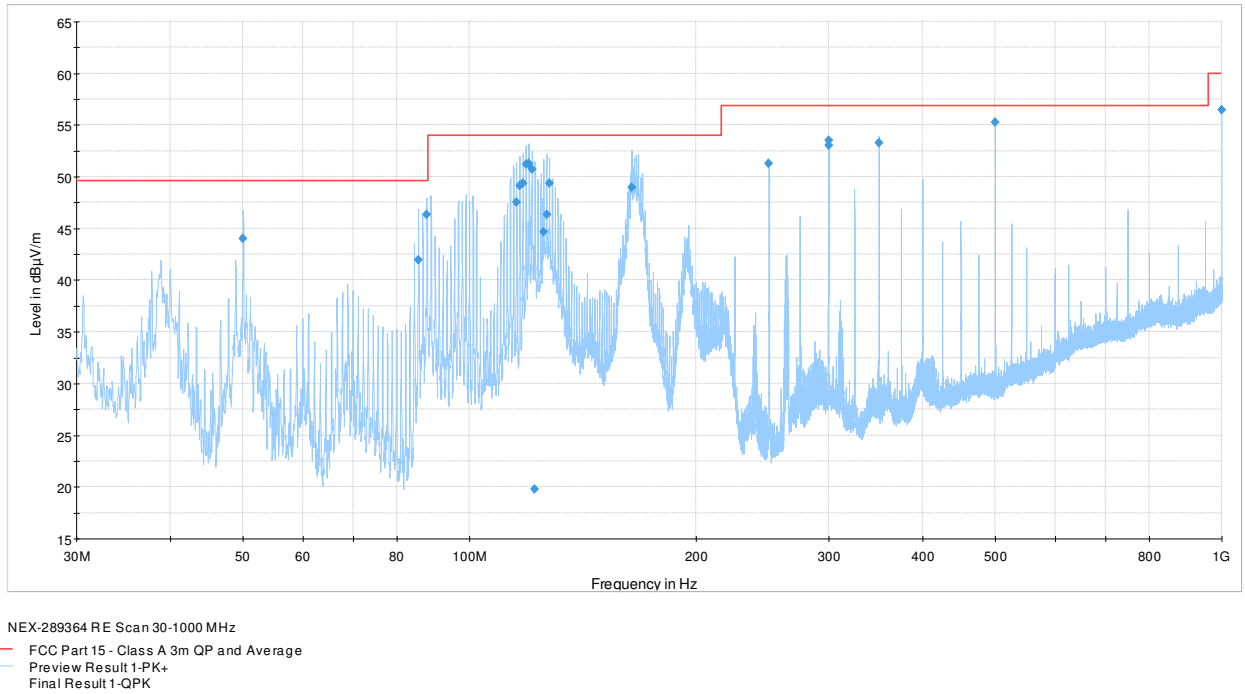
Notes: NCR - no calibration required

Table 8.1-2: *Radiated disturbance test software details*

Manufacturer of Software	Details
Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 8.53.0

Notes: None

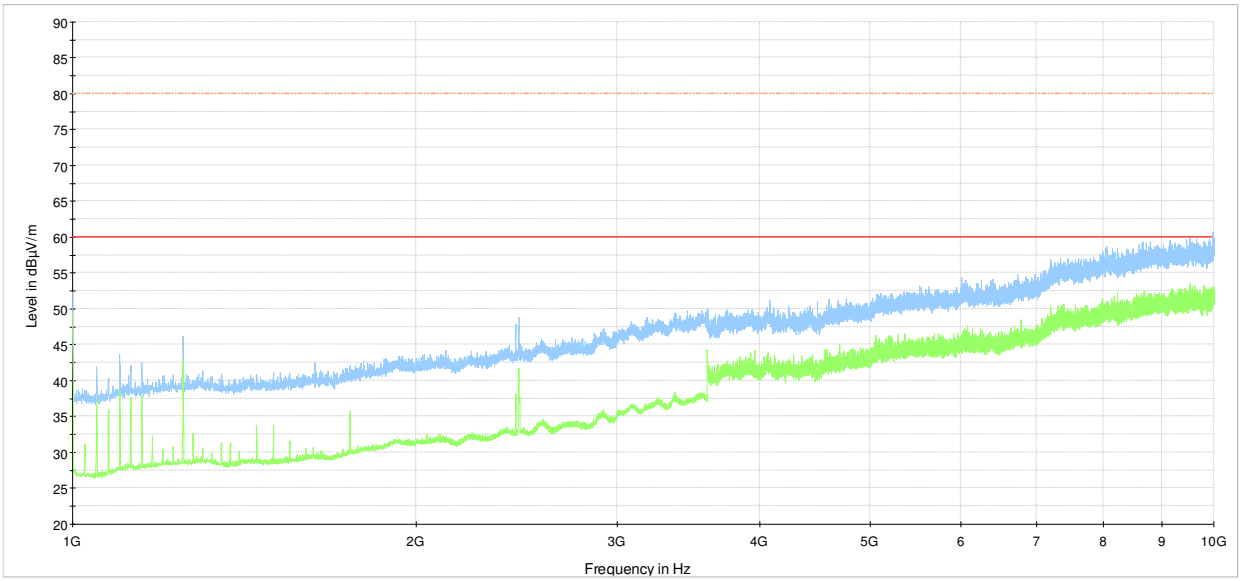
8.1.5 Test data



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

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

8.1.5 Test data, continued



NEX-289364 RE Scan 1-10 GHz
FCC Part 15 - Class A 3m QP and Average
FCC Part 15 - Class A 3m Peak above 1GHz
Preview Result 1-PK+
Preview Result 2-AVG

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.1-2: *Radiated disturbance spectral plot (1 to 10 GHz)*

8.1.5 Test data, continued

Table 8.1-3: *Radiated disturbance (Quasi-Peak) results*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor[2] (dB)	Margin (dB)	3 m Quasi-Peak limit [3] (dBµV/m)
FCC and ICES-003									
500.01	55.3	1000	120	164.0	H	125.0	21.0	1.6	56.9
119.91	51.3	1000	120	106.0	V	153.0	15.6	2.7	54.0
118.80	51.2	1000	120	109.0	V	160.0	15.5	2.8	54.0
120.99	50.7	1000	120	268.0	H	204.0	15.7	3.3	54.0
87.72	46.3	1000	120	126.0	V	65.0	9.1	3.3	49.6
300.00	53.5	1000	120	100.0	H	57.0	16.9	3.4	56.9
1000.00	56.4	1000	120	100.0	H	131.0	28.4	3.6	60.0
350.01	53.2	1000	120	100.0	H	75.0	18.0	3.7	56.9
300.00	53.0	1000	120	99.9	H	56.0	16.9	3.9	56.9
127.68	49.4	1000	120	100.0	V	183.0	15.8	4.6	54.0
117.69	49.4	1000	120	100.0	V	152.0	15.4	4.6	54.0
116.58	49.1	1000	120	100.0	V	173.0	15.4	4.9	54.0
164.28	49.0	1000	120	104.0	V	2.0	14.2	5.0	54.0
49.98	44.1	1000	120	99.9	V	166.0	9.5	5.5	49.6
249.99	51.3	1000	120	118.0	H	69.0	14.6	5.6	56.9
115.47	47.5	1000	120	105.1	V	277.0	15.2	6.5	54.0
126.60	46.3	1000	120	100.0	V	211.0	15.8	7.7	54.0
85.50	41.9	1000	120	124.0	V	266.0	9.1	7.7	49.6

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
Sample calculation: 55.3 dBµV/m (field strength) = 24.3 dBµV (receiver reading) +21.0 dB (Correction factor)

8.1.6 Setup photos

Figure 8.1-3: *Radiated disturbance setup photo*

Figure 8.1-4: *Radiated disturbance setup photo*

8.2 Conducted disturbance at mains port

8.2.1 References

CISPR 22 and ANSI C63.4-2003

8.2.2 Test summary

Verdict	Pass		
Test date	June 23, 2015	Temperature	22 °C
Test engineer	Kevin Rose	Air pressure	1005 mbar
Test location	Ottawa	Relative humidity	41 %

8.2.3 Notes

None

8.2.4 Setup details

Port under test	AC Mains
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above 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 measurement); Quasi-peak and Average (final measurement)
Trace mode	Max Hold
Measurement time	100 ms (preview measurement); 1000 ms (final measurement)

Table 8.2-1: *Conducted disturbance at mains port equipment list*

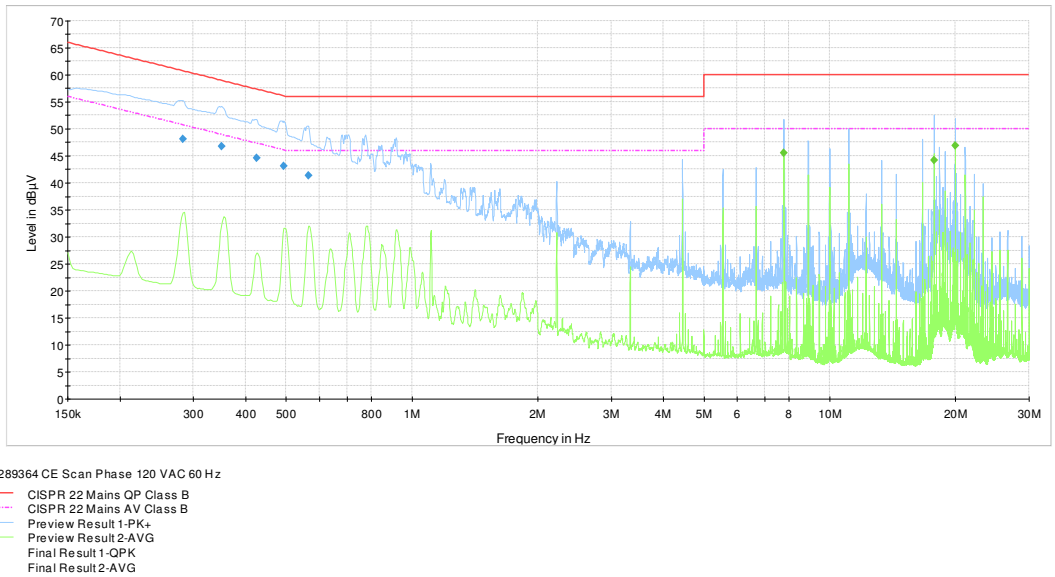
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/16
LISN	Rohde & Schwarz	ENV216	FA002023	1 year	Jan. 09/16
50 Ω coax cable	C.C.A.	None	FA002556	1 year	May 05/16

Table 8.2-2: *Conducted disturbance at mains port test software details*

Manufacturer of Software	Details
Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 8.53.0

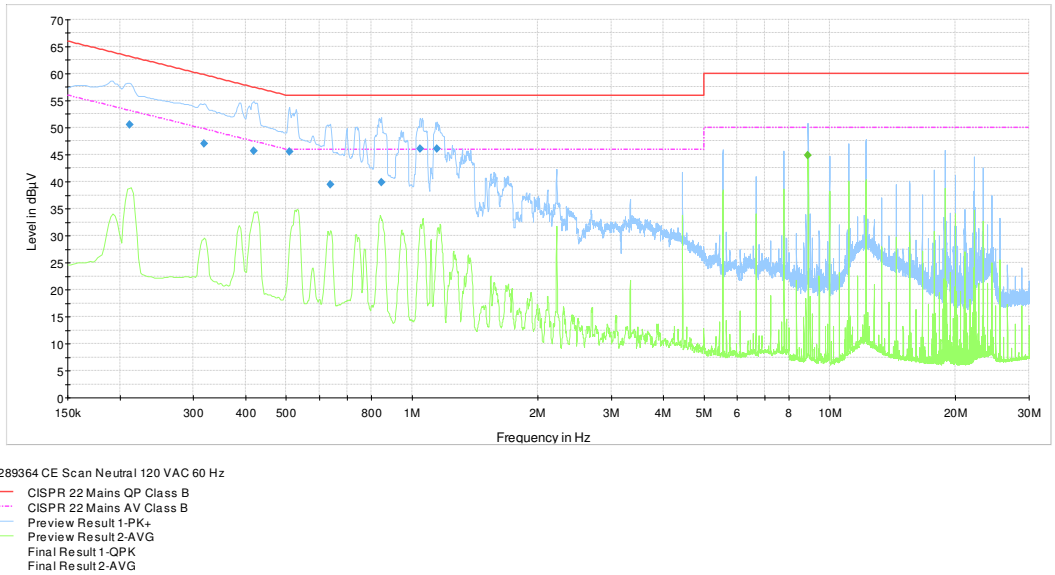
Notes: None

8.2.5 Test data



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-1: *Conducted disturbance at mains port spectral plot on phase line*



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.2-2: *Conducted disturbance at mains port spectral plot on neutral line*

8.2.5 Test data, continued

Table 8.2-3: *Conducted disturbance at mains port (Quasi-Peak) results for AC Mains*

Frequency (MHz)	Quasi-Peak result[1] (dBµV)	Measurement time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction factor[2] (dB)	Margin (dB)	Quasi-Peak limit (dBµV)
0.282750	48.1	1000	9	On	L1	9.9	12.6	60.7
0.350250	46.7	1000	9	On	L1	10.1	12.2	59.0
0.424500	44.6	1000	9	On	L1	10.1	12.8	57.4
0.494250	43.1	1000	9	On	L1	10.2	13.0	56.1
0.566250	41.4	1000	9	On	L1	10.1	14.6	56.0
0.210750	50.5	1000	9	On	N	9.9	12.7	63.2
0.318750	47.0	1000	9	On	N	10.0	12.7	59.7
0.417750	45.7	1000	9	On	N	10.1	11.8	57.5
0.510000	45.6	1000	9	On	N	10.1	10.4	56.0
0.638250	39.5	1000	9	On	N	10.1	16.5	56.0
0.845250	39.9	1000	9	On	N	10.0	16.1	56.0
1.045500	46.1	1000	9	On	N	10.0	9.9	56.0
1.146750	46.1	1000	9	On	N	10.0	9.9	56.0

Notes: [1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Sample calculation: 48.1 dBµV (result) = 35.5 dBµV (receiver reading) + 12.6 dB (Correction factor)

Table 8.2-4: *Conducted disturbance at mains port (Average) results for AC Mains*

Frequency (MHz)	Average result[1] (dBµV)	Measurement time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction factor[2] (dB)	Margin (dB)	Average limit (dBµV)
7.770750	45.5	1000	9	On	L1	10.2	4.5	50.0
17.764750	44.2	1000	9	On	L1	10.5	5.8	50.0
19.983250	46.9	1000	9	On	L1	10.5	3.1	50.0
8.880000	44.8	1000	9	On	N	10.3	5.2	50.0

Notes: [1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Sample calculation: 45.5 dBµV (result) = 35.3 dBµV (receiver reading) + 10.2 dB (Correction factor)

8.2.6 Setup photos

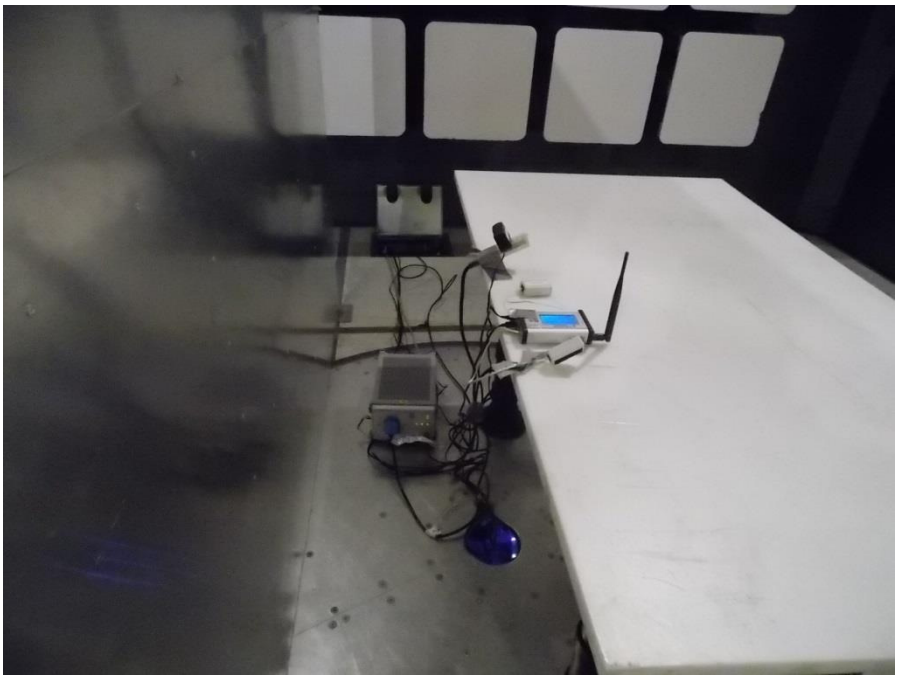


Figure 8.2-3: *Conducted disturbance at mains port setup photo*

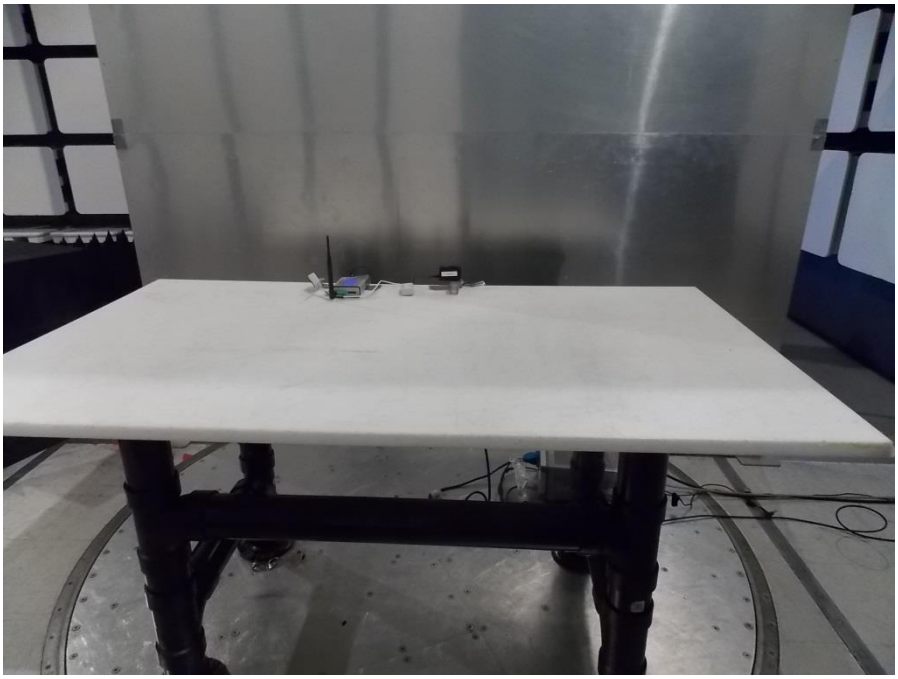


Figure 8.2-4: *Conducted disturbance at mains port setup photo*

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*