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EMC/EMI Test Report

Tested Product:

4KX-PLUS

representative of 4KXUSB3

Test Report TR-0599499_R1

Prepared for: **INOGENI Inc.**
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Date: 2022.11.01 17:02:31 -04'00'

A2LA ACCREDITED
CERT #214.48

REVISION HISTORY

Revision	Description	Date
0	Initial Release	2022-02-08
1	Declaration of manufacturer added (4KX-PLUS is representative of 4K2USB3)	2022-11-01

TABLE OF CONTENTS

TABLE OF APPENDICES

LIST OF TABLES

LIST OF CAPTURES

LIST OF FIGURES

LIST OF PHOTOS

LIST OF GRAPHS

1 INTRODUCTION

This test report describes EMC tests on the product 4KX-PLUS:

- in compliance with electromagnetic compatibility directive 2014/30/EU as part of the requirements leading to the CE marking
- in compliance with FCC part 15 subpart B
- in compliance with ICES-003

The essential requirements of the directive 2014/30/EU are covered by the following harmonized standards:

- EN 55032 (2015) A11 (2020) – *Electromagnetic compatibility of multimedia equipment - Emission requirements*
- EN 55035 (2017) A11 (2020) – *Electromagnetic compatibility of multimedia equipment – Immunity requirements*

As per manufacturer declaration, the qualification tests on 4KX-PLUS are also representative of 4KXUSB3 compliance (APPENDIX E).

2 ACRONYMS

EMC: ElectroMagnetic Compatibility
EUT: Equipment Under Test
S/N: Serial Number
N/A: Not Applicable / Not Available
NCR: No Calibration Required
VERIF: Internal Verification of Equipment Characteristics
AC: Alternating Current
DC: Direct Current
PSU: Power Supply Unit
AE: Auxiliary Equipment
QTP: Qualification Test Procedure.
LISN: Line Impedance Stabilisation Network
AM: Amplitude Modulation
CDN: Coupling/Decoupling Network
EM Clamp: Electromagnetic Clamp
I/O: Inputs/Outputs
PE: Protective Earth
HCP: Horizontal Coupling Plane
VCP: Vertical Coupling Plane
ESD: Electrostatic Discharge
EFT: Electrical Fast Transient
Pst: short-term flicker
Plt: long-term flicker
Un: Nominal Voltage

3 PROJECT DATES

RECEPTION DATE(S) (yyyy-mm-dd)	2022-01-28 (LABCEM#3064)
TESTS DATE(S) (yyyy-mm-dd)	From 2022-01-28 to 2022-02-03 (LABCEM#3064)

4 DESCRIPTION OF EQUIPMENT UNDER TEST

4.1 EUT

TYPE:	Toggle Switch for video streaming
PRODUCT NAME:	4KX-PLUS
MANUFACTURER:	INOGENI
LABCEM NUMBER:	LABCEM#3064
PART NUMBER:	4KX-PLUS
SERIAL NUMBER:	4P21500679
VOLTAGE RATING:	120-230Vac 50/60Hz
EXTERNAL PSU INFO:	Manufacturer: CUI INC Model: SMI5-5-V-138 Input Voltage: 100-240v Output Voltage:50/60Hz
EUT SIZE:	Width = 10cm Height = 3cm Depth = 6cm
FIRMWARE:	1.31
HIGHEST INTERNAL FREQUENCY:	330MHz

Photo 1: EUT

Photo 2: EUT – S/N

Photo 3: PSU

12

Photo 4: PSU – S/N

4.2 Support Equipment

EUT was exercised with support equipment supplied by client.

Photo 5: Support Equipment – 4K HDMI Signal Generator

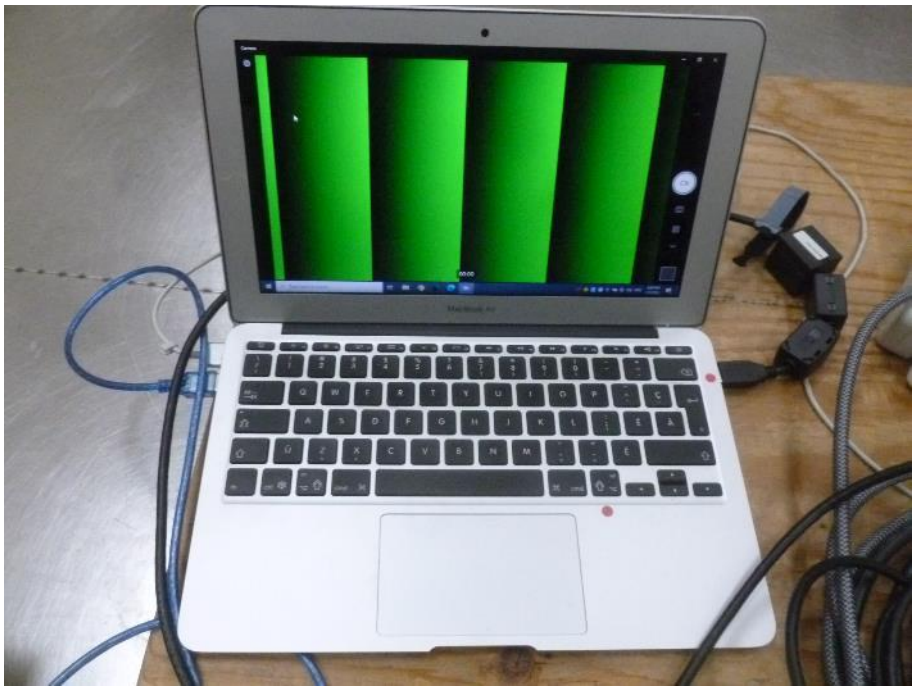


Photo 6: Support Equipment – Laptop

Photo 7: Support Equipment – 4K screen

4.3 EUT Setup Diagram

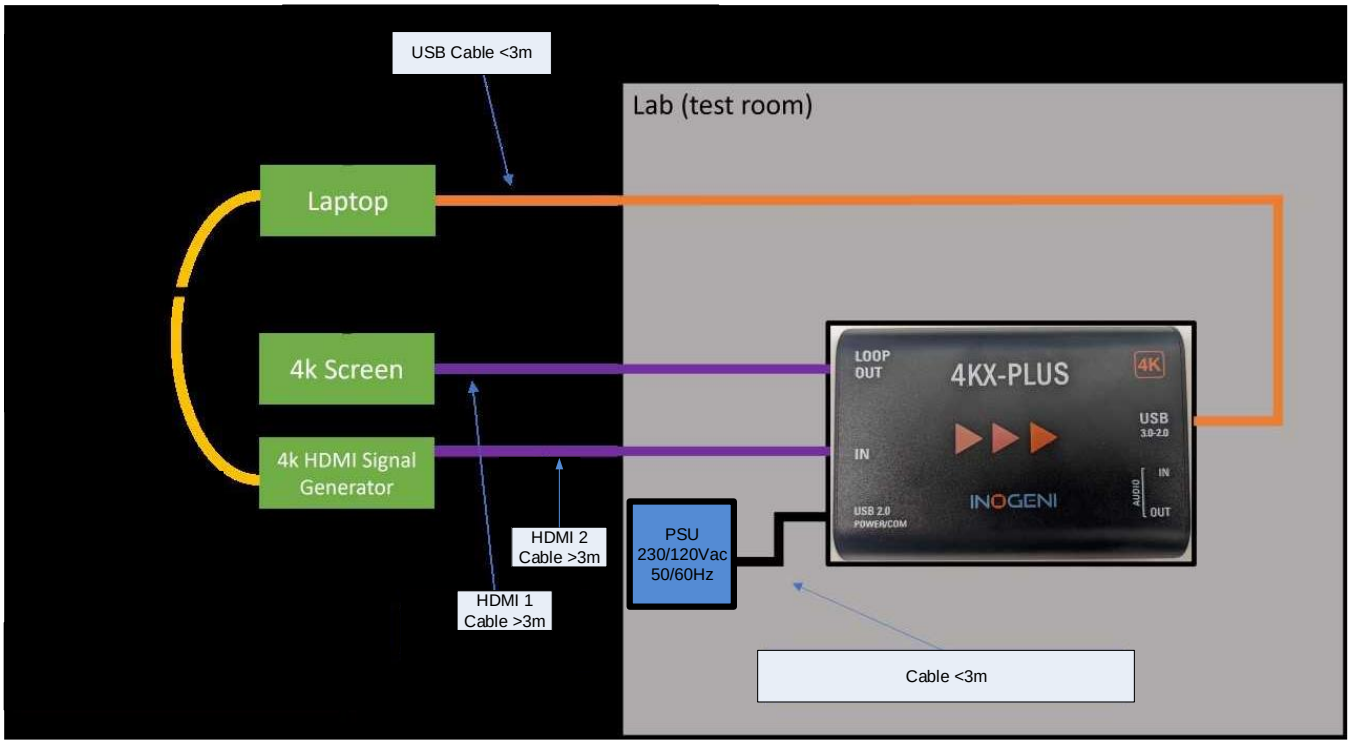
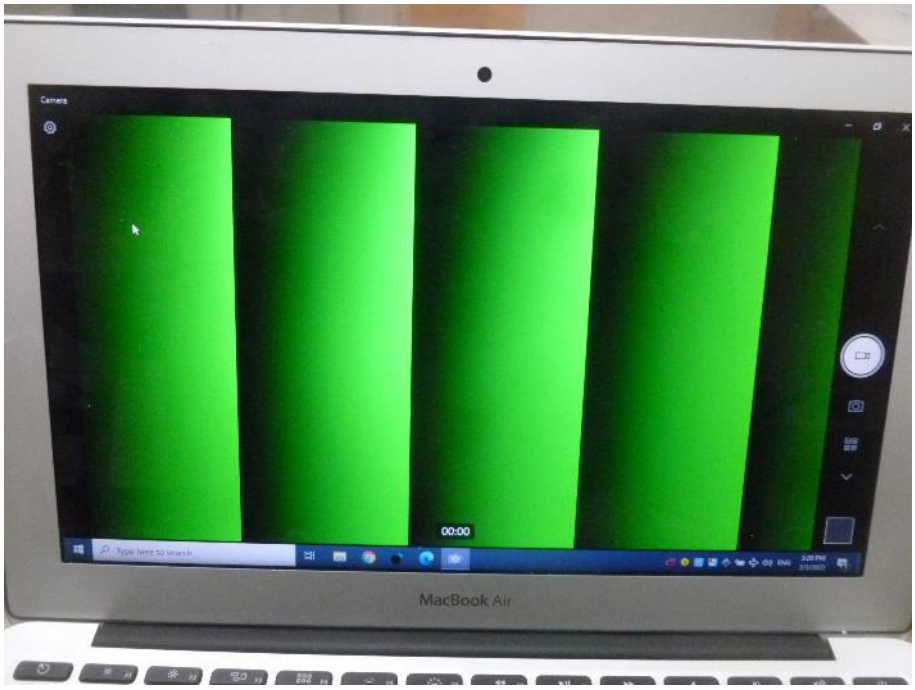


Figure 1: EUT Setup Diagram

4.4 Mode of Operation

During the tests, the EUT forwards the data received from the HDMI Pattern Generator (HDMI, 4K30) to the laptop (USB) and the 4K screen. The frame rate is set to 60Hz.



Capture 1: Client Software

4.5 Method of Monitoring

During the tests, the EUT was monitored by observing the picture on the 4K Screen and Laptop.

5 PERFORMANCE CRITERIA

During the tests, EUT shall operate normally, and the pattern displayed on the software has to be updated smoothly, without cuts in the streaming

The performance criteria for the evaluation of the immunity test results are defined by EN 55035 standard (Electromagnetic compatibility of multimedia equipment – Immunity requirements).

Performance criterion A: The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B: During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.

After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C: Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

6 CALCULATION OF THE COMPLIANCE MARGIN

Conducted Emission Level (dBµV) =	Value Reading at the EMI receiver (dBµV) + Correction Factor (dB)
Correction Factor (dB) =	LISN Attenuation (dB) + Cable Loss (dB) – Amplifier Gain (dB) + Attenuator (dB)
Margin (dB) =	Conducted Emission Level (dBµV) – Limit Value (dBµV)

Table 1: Example of Conducted Emissions Margin Calculation

Radiated Emission Level (dBµV/m) =	Value reading at the EMI receiver (dBµV) + Antenna Factor (dB/m) + Correction Factor (dB)
Correction Factor (dB) =	Cable Loss (dB) – Amplifier Gain (dB) + Attenuator (dB)
Margin (dB) =	Radiated Emission Level (dBµV/m) – Limit Value (dBµV/m)

Table 2: Example of Radiated Emissions Margin Calculation

7 MEASUREMENT UNCERTAINTIES

All measurements under compliance testing, involve certain levels of uncertainties based on test equipment and facilities. The measurement uncertainties of National Technical Systems Canada Inc. (U_{LAB}) were calculated according to CISPR16-4-2 standard and were lower than the maximum allowed by the standard (U_{CISPR}). Therefore, the measurement uncertainties need not to be considered for compliance.

The following table presents uncertainty calculation for emission measurements as requested by ANSI C63.4 (2014):

Test	Expanded Uncertainty with k=2 Coverage Factor (95% Confidence Level)
Conducted Emissions with LISN (9kHz-150kHz)	± 3.77 dB
Conducted Emissions with LISN (150kHz-30MHz)	± 3.33 dB
Radiated Emissions (30MHz-1GHz)	± 5.87 dB
Radiated Emissions (1GHz-18GHz)	± 5.10 dB

Table 3: Measurement Uncertainties

All other calculations of uncertainties evaluation are available upon request.

8 ENGINEERING COMMENTS

8.1 Modifications incorporated in the EUT

No modification was performed on the EUT during testing.

8.2 Deviations from the standards and/or laboratory tests procedure

No deviation from standards and/or test laboratory procedure was performed during testing.

9 TEST SUMMARY

The following table lists all tests called by the harmonized standards indicated in the test report introduction.

Test Name Standards	Test Specifications	Minimum Performance Criterion Required	EUT Serial Number	Results
Conducted Emissions FCC part 15 subpart B (2021)	Class A / 150kHz-30MHz	N/A	4P21500679	Pass
Radiated Emissions FCC part 15 subpart B (2021)	Class A 30MHz-2GHz	N/A	4P21500679	Pass
Conducted Emissions ICES-003 (2016) + Update (2019)	Class A / 150kHz-30MHz	N/A	4P21500679	Pass
Radiated Emissions ICES-003 (2016) + Update (2019)	Class A / 30MHz-2GHz	N/A	4P21500679	Pass
Conducted Emissions EN 55032 (2015) A11 (2020)	Class A / B 150kHz-30MHz	N/A	4P21500679	Pass
Radiated Emissions EN 55032 (2015) A11 (2020)	Class A 30MHz-2GHz	N/A	4P21500679	Pass
Harmonic Current Emission Limits EN IEC 61000-3-2 (2019)	Class A	N/A	4P21500679	Pass
Voltage Fluctuations and Flicker Limitations EN 61000-3-3 (2013) A1 (2019)	Observation period for P_{st}: 10 min Observation period for P_{lt}: 120 min	N/A	4P21500679	Pass
Electrostatic Discharge Immunity IEC 61000-4-2 (2008)	Contact: ±4kV Air: ±2kV, ±4kV, ±8kV	B	4P21500679	Pass
Radiated Electromagnetic Field Immunity IEC 61000-4-3 (2020)	80MHz-1000MHz: 3V/m Discrete Frequencies: 1800MHz, 2600MHz 3500MHz, 5000MHz	A	4P21500679	Pass
Electrical Fast Transient Immunity IEC 61000-4-4 (2012)	Power: ±1kV / 5kHz I/O Ports: ±0.5kV / 5kHz Communication Ports: ±0.5kV	B	4P21500679	Pass
Surge Immunity IEC 61000-4-5 (2014) A1 (2017)	Power: ±2kV L-PE / ±1kV L-L I/O Ports: N/A Communication Ports: N/A	B	4P21500679	Pass
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields IEC 61000-4-6 (2013)	Power: 3V I/O Ports: 3V Communication Ports: 3V	A	4P21500679	Pass

Test Name Standards	Test Specifications	Minimum Performance Criterion Required	EUT Serial Number	Results
Power Frequency Magnetic Field Immunity IEC 61000-4-8 (2009)	Continuous Field: 1A/m / 50Hz & 60Hz	A	4P21500679	Pass
Voltage Dips, Short Interruptions and Voltage Variation Immunity on AC Input IEC 61000-4-11 (2020)	Voltage dips: 0%Un during half cycle 0%Un during 1 cycle 70%Un during 25 cycles (at 50Hz) 70%Un during 30 cycles (at 60Hz) Short interruptions: 0%Un during 250 cycles(at 50Hz) 0%Un during 300 cycles (at 60Hz)	B B C C C C	4P21500679	Pass

Table 4: Test Summary

10 EMISSIONS TESTS

10.1 Conducted Emissions

10.1.1 Test Details

REFERENCE STANDARD	ANSI C63.4 (2014) CISPR 32 (2015) / EN 55032 (2015) A11 (2020)

SPECIFICATIONS	
Limit	FCC part 15 subpart B (2021) class A ICES-003 (2016) Update (2019) class A EN 55032 (2015) A11 (2020) class A
Frequency Range	150kHz – 30MHz
Installation	Table-top equipment

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz 120V/60Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2022-01-28
Temperature °C (For Info Only)	21.9°C
Relative humidity % (For Info Only)	10.8%
Atmospheric pressure kPa (For Info Only)	102.5kPa
Operator	Lyes Rahni
Client Witness	Donatien Crémet (INOGENI)

10.1.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TDK	Emission Anechoic Chamber	16706-1	5412	24	2022-09-04 (NSA) 2023-01-07 (SVSWR)
NEXIO	Software	BAT-EMC v3.21.0.26	N/A	N/A	N/A
Rohde&Schwarz	EMI receiver	ESW44	101905	12	2023-01-19
NARDA	LISN	PMM L2-16B	000WX20801	12	2022-06-25

Table 5: Conducted Emissions – Test Equipment

10.1.3 Test Results

Tested Line	Frequency (MHz)	Average Limit (dBµV)	Quasi-Peak Limit (dBµV)	Results
Power – Phase (230V/50Hz)	0.150 – 0.50	66	79	Pass
	0.50 – 30	60	73	
Power – Neutral (230V/50Hz)	0.150 – 0.50	66	79	Pass
	0.50 – 30	60	73	
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client.				

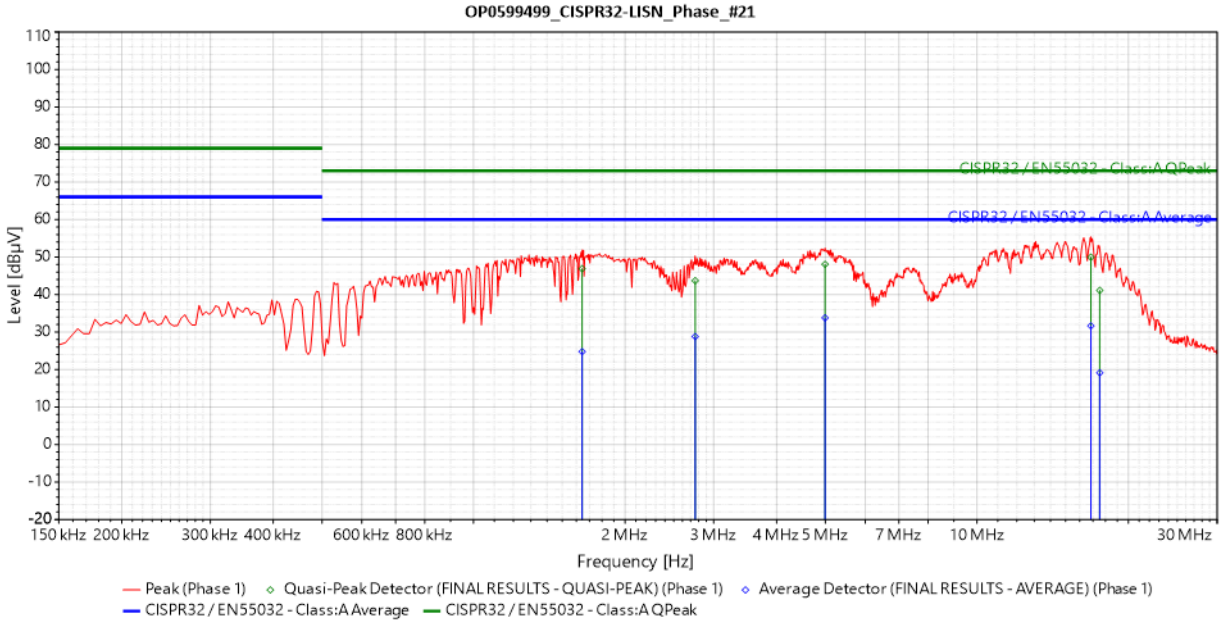
Table 6: Conducted Emissions – Test Results – EN55032 Class A

Tested Line	Frequency (MHz)	Average Limit (dBµV)	Quasi-Peak Limit (dBµV)	Results
Power – Phase (120V/60Hz)	0.150 – 0.50	66	79	Pass
	0.50 – 30	60	73	
Power – Neutral (120V/60Hz)	0.150 – 0.50	66	79	Pass
	0.50 – 30	60	73	
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client.				

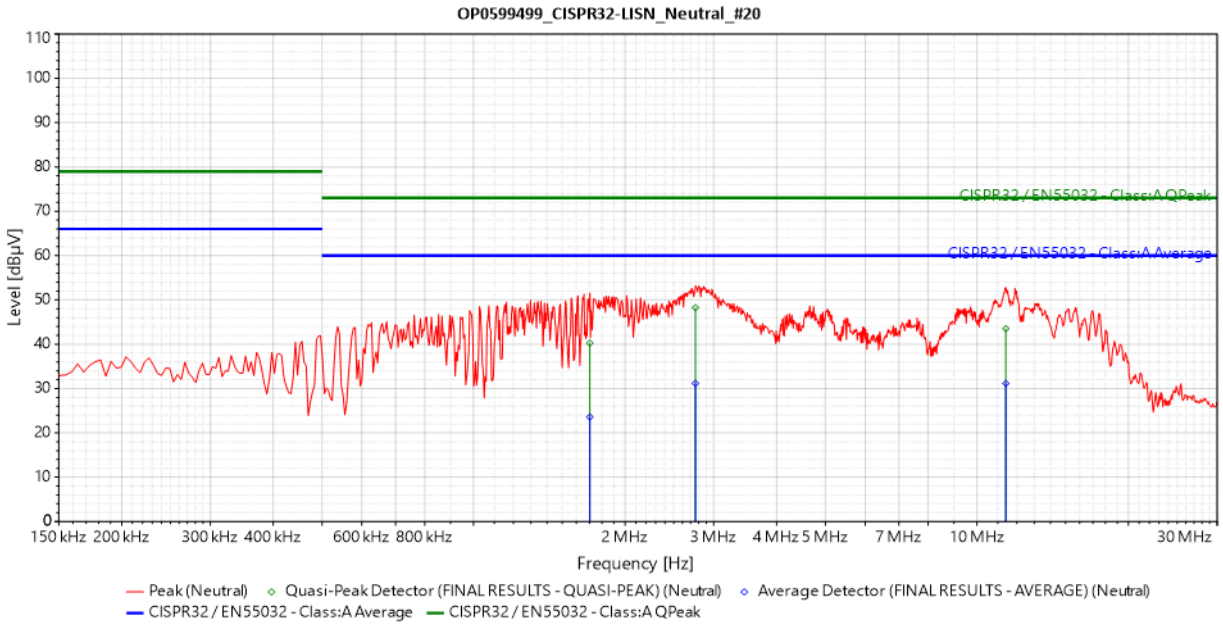
Table 7: Conducted Emissions – Test Results – FCC Part 15 Subpart B / ICES-003 Class A

10.1.4 Test Data

See APPENDIX A for data files.



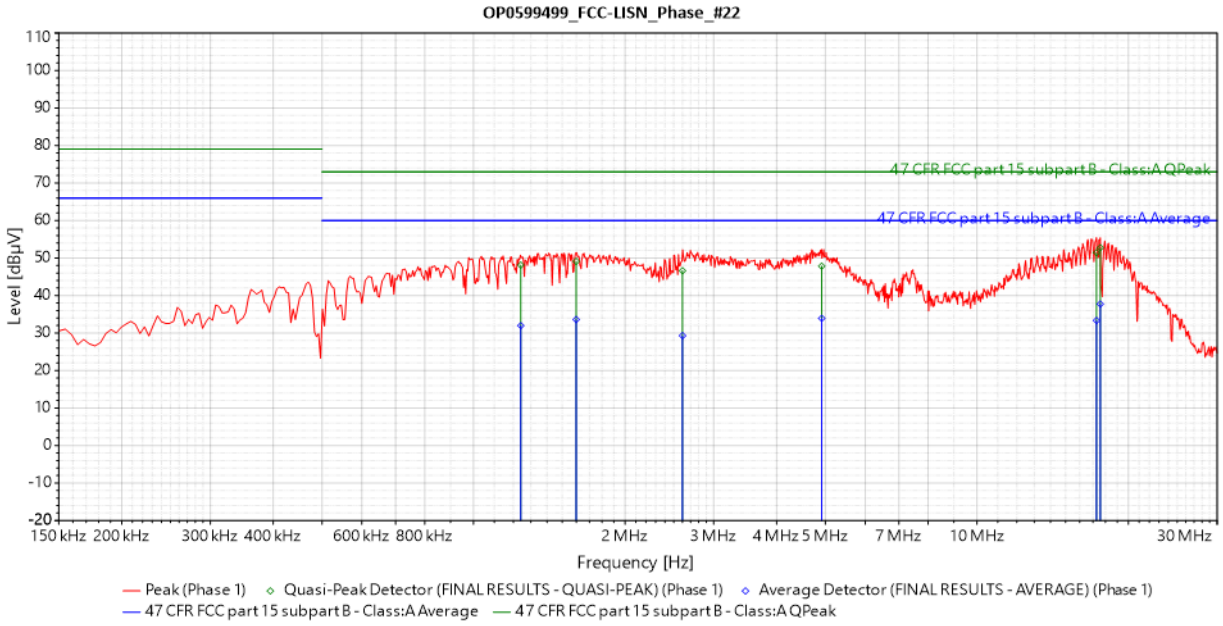
Graph 1: Conducted Emissions – EN55032 – Power – Phase



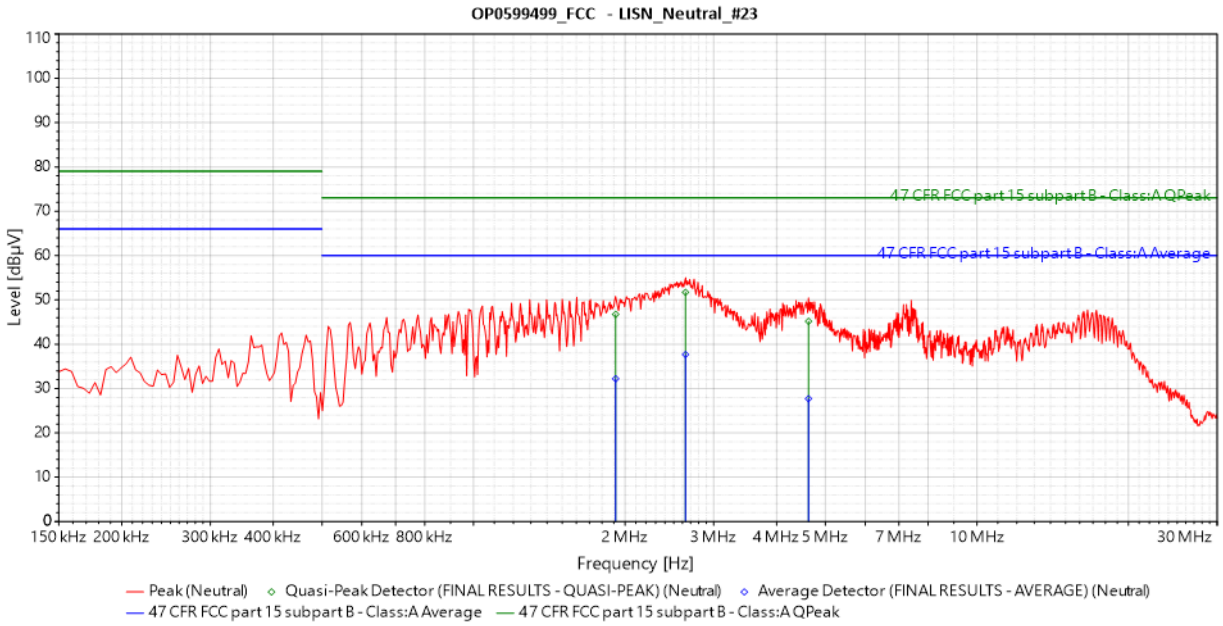
Graph 2: Conducted Emissions – EN55032 – Power – Neutral

Tested Line	Frequency (MHz)	Detector	Level (dBµV)	Limit (dBµV)	Bandwidth (kHz)	Measurement Time (s)	Margin
Power – Phase (230V/50Hz)	16.83	Q-Peak	49.95	73.00	9 kHz	15	23.04
Power – Neutral (230V/50Hz)	2.75	Q-Peak	48.23	73.00	9 kHz	15	24.76

Table 8: Conducted Emissions – Lowest Margin according to EN55032



Graph 3: Conducted Emissions – FCC part 15 Subpart B – Power – Phase



Graph 4: Conducted Emissions – FCC part 15 Subpart B – Power – Neutral

Tested Line	Frequency (MHz)	Detector	Level (dBµV)	Limit (dBµV)	Bandwidth (kHz)	Measurement Time (s)	Margin
Power – Phase (120V/60Hz)	17.58	Q-Peak	52.76	73.00	9 kHz	15	20.23
Power – Neutral (120V/60Hz)	2.63	Q-Peak	51.72	73.00	9 kHz	15	21.27

Table 9: Conducted Emissions – Lowest Margin according to FCC Part 15 Subpart B / ICES-003

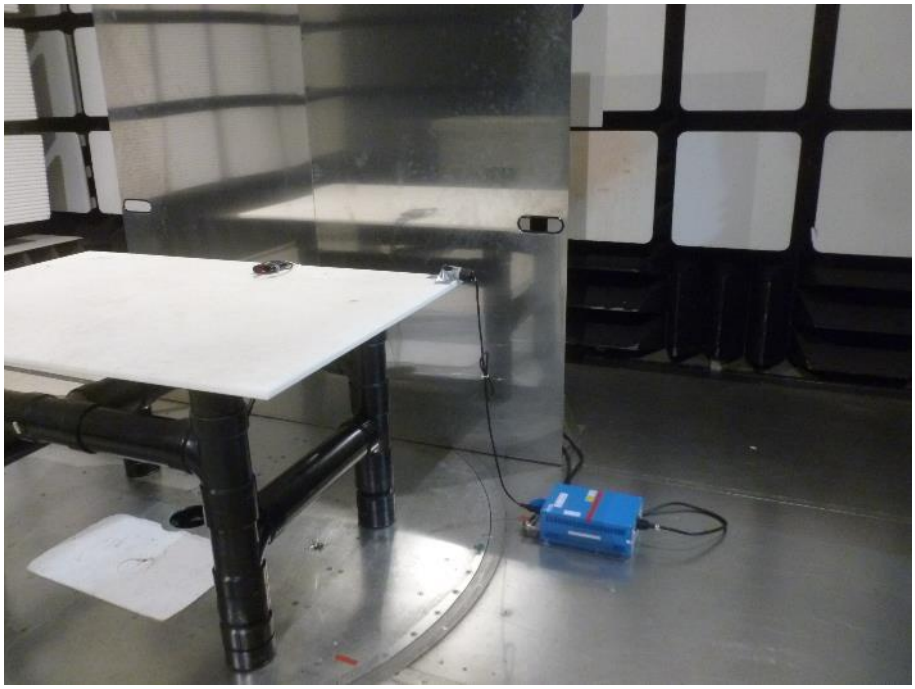


Photo 8: Conducted Emissions – Test Setup

10.1.5 Test Method

Conducted emissions were performed using the procedures of the reference standard.

Once the configuration or mode of operation causing the highest emission level (worst case) was determined, a scan was performed with the Peak detector in the frequency range specified by the reference standard.
Frequencies where level was above the limit or within 20dB of the limit were recorded. The level at these frequencies was measured with the detector specified by the limit.

10.2 Radiated Emissions

10.2.1 Test Details

REFERENCE STANDARD	ANSI C63.4 (2014) EN 55032 (2015) A11 (2020)

SPECIFICATIONS	
Limit	FCC part 15 subpart B (2021) class A ICES-003 (2016) + Update (2019) class A EN 55032 (2015) A11 (2020) class A
Frequency Range	30MHz – 1GHz 1GHz - 2GHz
Measurement Distance	3m
Installation	Table-top equipment

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz

TEST INFO		
Test Date (yyyy-mm-dd)	2022-01-28	2022-02-02
Temperature °C (For Info Only)	21.9°C	23.6°C
Relative humidity % (For Info Only)	10.8%	15.4%
Atmospheric pressure kPa (For Info Only)	102.5kPa	102.4kPa
Operator	Lyes Rahni	Lyes Rahni
Client Witness	Donatien Crémet (INOGENI)	No witness

10.2.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TDK	Emission Anechoic Chamber	16706-1	5412	24	2022-09-04 (NSA) 2023-01-07 (SVSWR)
Sunol Sciences Corporation	Antenna Positioning Tower	TLT2	LABCEM #0181	N.C.R.	N.C.R.
Sunol Sciences Corporation	Flush Mount Turntable	FM2011VS/2022VS	LABCEM #0182	N.C.R.	N.C.R.
Sunol Sciences Corporation	System Controller	SC110V	LABCEM #0183	N.C.R.	N.C.R.
NEXIO	Software	BAT-EMC v3.21.0.26	N/A	N/A	N/A
Rohde&Schwarz	EMI receiver	ESW44	101905	12	2023-01-19
Schaffner	Bilog antenna	CBL6112D	22617	24	2023-06-28
TESEQ	Horn antenna	BHA9118	33053	24	2022-10-21
Amplical	Amplifier 1GHz-18GHz	AMP1G18-30-N/PSU	121212	12	2022-12-22

Table 10: Radiated Emissions – Test Equipment

10.2.3 Test Results

Frequency (MHz)	Quasi-Peak Limit extrapolated at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Results
30 – 230	50	-	-	Pass
230 – 1000	57	-	-	
1000 – 2000	-	56	76	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client.				

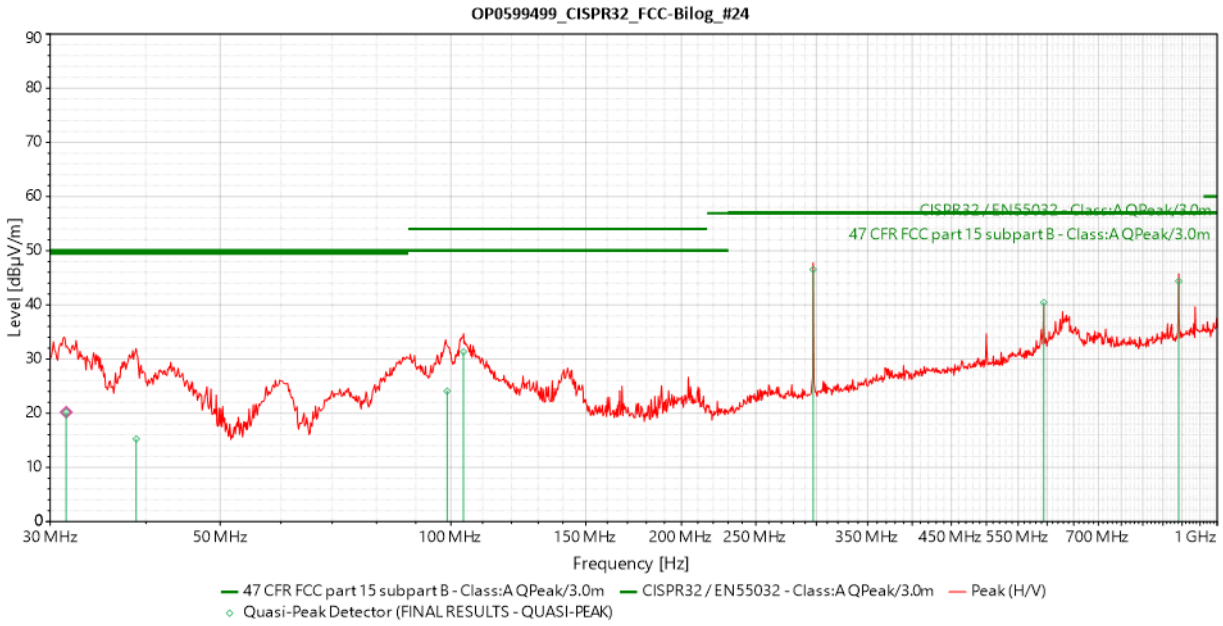
Table 11: Radiated Emissions – Test Results – CISPR 32 Class A

Frequency (MHz)	Quasi-Peak Limit extrapolated at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Results
30 – 88	49.5	-	-	Pass
88 – 216	54.0	-	-	
216 – 960	56.9	-	-	
960 – 1000	60.0	-	-	
1000 – 2000	-	60	80	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client.				

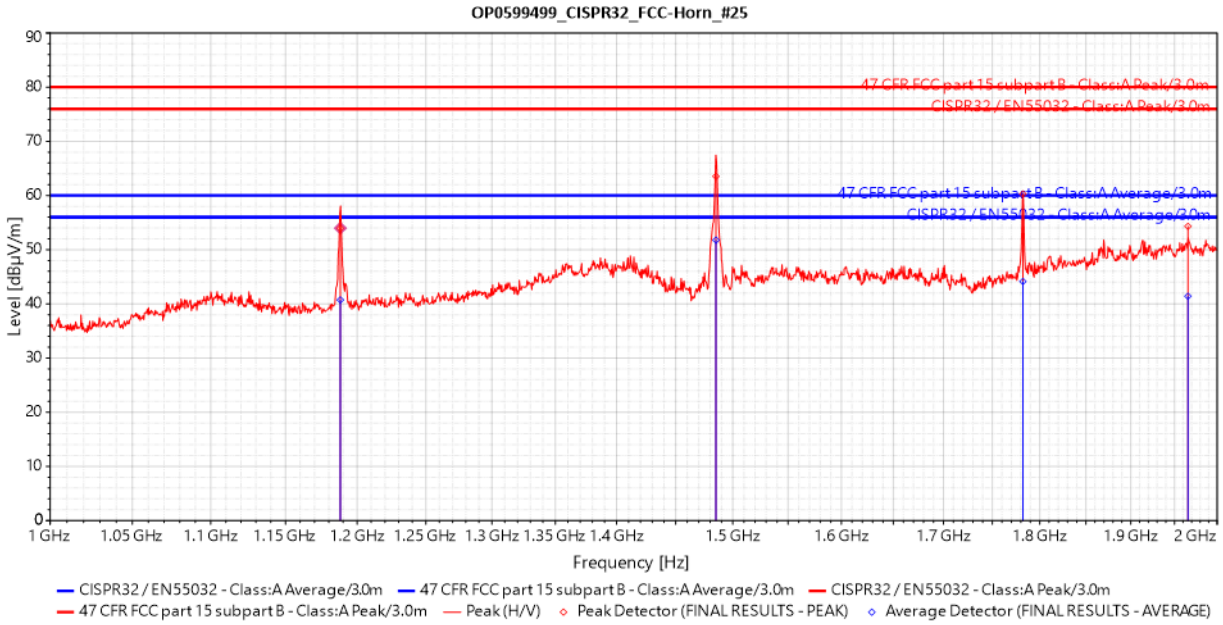
Table 12: Radiated Emissions – Test Results – FCC Part 15 Subpart B / ICES-003 Class A

10.2.4 Test Data

See APPENDIX B for data files.



Graph 5: Radiated Emissions 30MHz-1GHz



Graph 6: Radiated Emissions 1GHz-2GHz

Frequency (MHz)	Detector	Level (dBµV/m)	Limit (dBµV/m)	Bandwidth (kHz)	Measurement Time(s)	Margin (dB)
297.01	Quasi-Peak	46.52	57.00	120	15	10.47
1485.08	Average	51.76	56.00	1000	15	4.23

Table 13: Radiated Emissions – Lowest Margin according to EN55032

Frequency (MHz)	Detector	Level (dBµV/m)	Limit (dBµV/m)	Bandwidth (kHz)	Measurement Time(s)	Margin (dB)
297.01	Quasi-Peak	55.38	56.90	120	15	10.37
1485.08	Average	51.76	60	1000	15	8.24

Table 14: Radiated Emissions – Lowest Margin according to FCC Part 15 Subpart B / ICES-003

Photo 9: Radiated Emissions – Test Setup

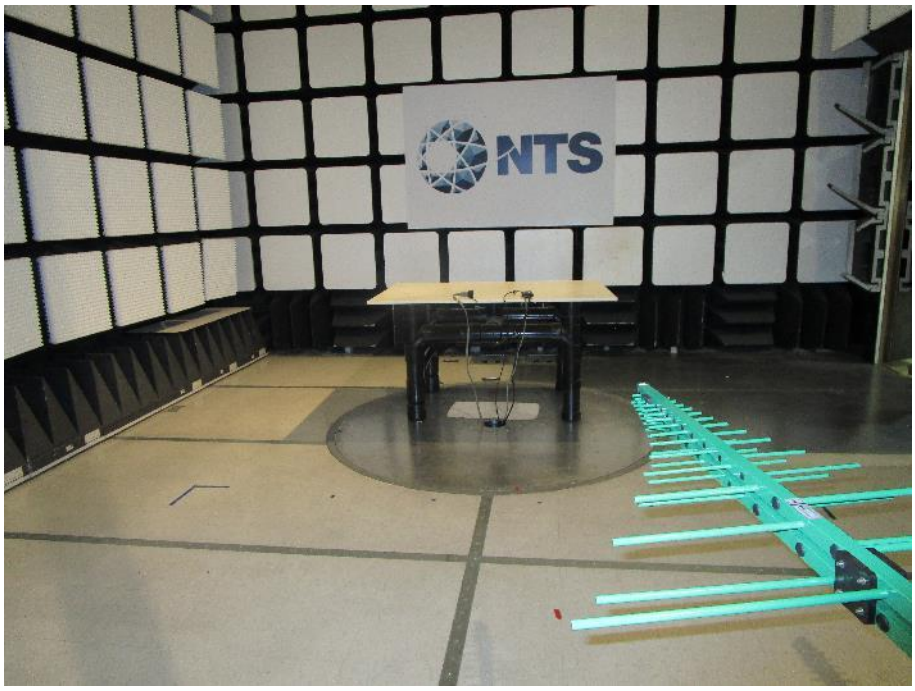


Photo 10: Radiated Emissions – Test Setup 30MHz-1GHz

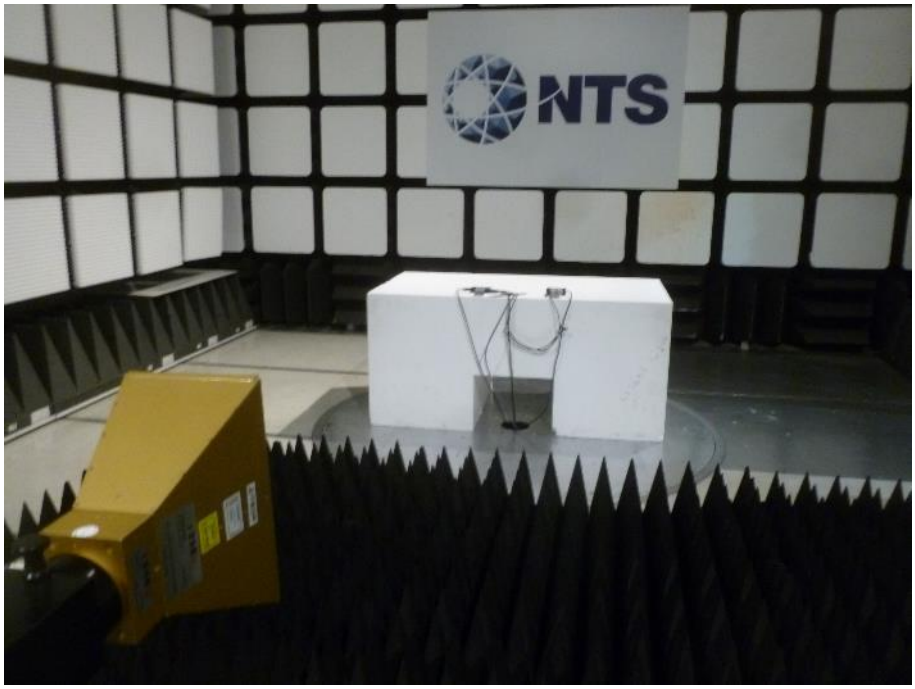


Photo 11: Radiated Emissions – Test Setup 1GHz-2GHz

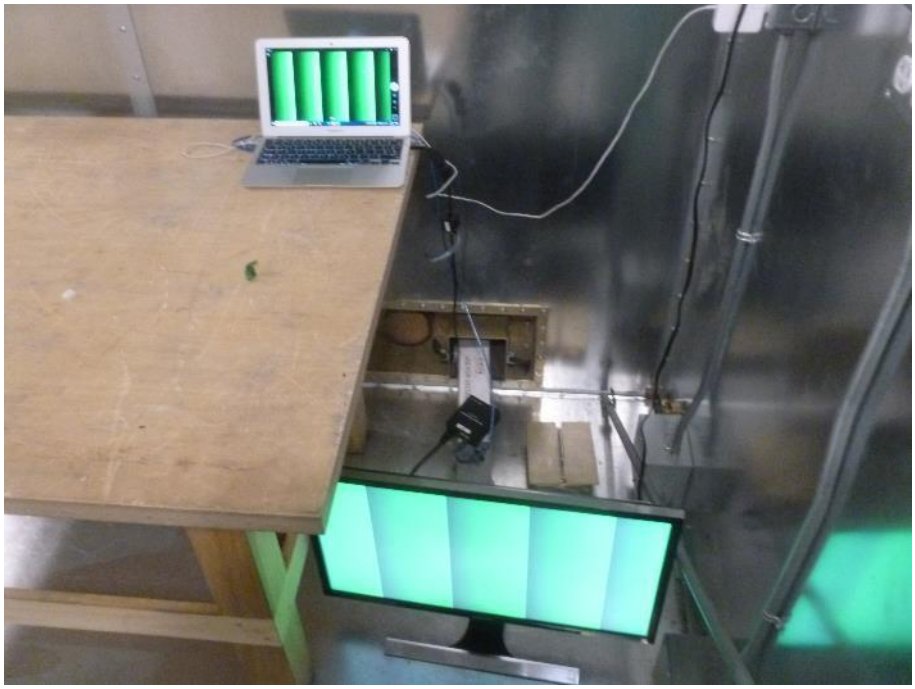


Photo 12: Radiated Emissions – Support Equipment

10.2.5 Test Method

Radiated emissions were performed using the procedures of the reference standard.

Once the configuration or mode of operation causing the highest emission level (worst case) was determined, spectral previews were performed with the Peak detector in the frequency range specified by the reference standard.
Frequencies where level was above the limit or within 10 dB of the limit were recorded. The level at these frequencies was maximized and measured with the detector specified by the limit.

10.3 Harmonic Current Emissions

10.3.1 Test Details

REFERENCE STANDARD	EN 61000-3-2 (2019)
SPECIFICATIONS	
Limit	Class A
EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz
TEST INFO	
Test Date (yyyy-mm-dd)	2022-02-02
Temperature °C (For Info Only)	23.6°C
Relative humidity % (For Info Only)	15.4%
Atmospheric pressure kPa (For Info Only)	102.4kPa
Operator	Lyes Rahni
Client Witness	No witness

10.3.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TESEQ	Software	Win2100 v4.9	N/A	N/A	N/A
TESEQ	AC-DC Power source	NSG 1007	1232A04499 (NSG 1007)	12	2022-09-14

Table 15: Harmonic Current Emissions – Test Equipment

10.3.3 Test Results

Class A ☒	Class B ☐	Class C ☐	Class D ☐

Class A:
Equipment not specified as belonging to Class B, C or D shall be considered as Class A equipment.

- balanced three-phase equipment;
- household appliances, excluding those specified as belonging to Class B, C or D;
- vacuum cleaners;
- high pressure cleaners;
- tools, excluding portable tools;
- independent phase control dimmers;
- audio equipment;
- professional luminaires for stage lighting and studios.

NOTE 1 Equipment that can be shown to have a significant effect on the supply system may be reclassified in a future of this document, taking into account the following factors:
– number of pieces of equipment in use;
– duration of use;
– simultaneity of use;
– power consumption;
– harmonic spectrum, including phase.

Class B:

- portable tools;
- arc welding equipment which is not professional equipment.

Class C:

- lighting equipment.

Class D:
Equipment having a specified power according to 6.3.2 less than or equal to 600 W, of the following types:

- personal computers and personal computer monitors;
- television receivers;
- refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

NOTE 2 Class D limits are reserved for equipment that, by virtue of the factors listed in note 1, can be shown to have a pronounced effect on the public electricity supply system.

*Starting and stopping
When a piece of equipment is brought into operation or is taken out of operation, manually or automatically, harmonic currents and power are not taken into account for the first 10 s following the switching event.
The equipment under test shall not be in stand-by mode (see 3.14) for more than 10 % of any observation period.

Table 16: Harmonic Current Emissions – Classification of Equipment

Tested Line	Limit	Observation Time (min)	Results
Power (230V/50Hz)	Class A	10	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client.			

Table 17: Harmonic Current Emissions – Test Results

10.3.4 Test Data

See APPENDIX C for data files

Photo 13: Harmonic Current Emissions – Test Setup

10.3.5 Test Method

Harmonic current emissions measurements were performed using the procedures of the reference standard.

10.4 Voltage Fluctuations and Flicker Measurements

10.4.1 Test Details

REFERENCE STANDARD	EN 61000-3-3 (2013) A1 (2019)

SPECIFICATIONS	
P_{st} Observation Period	10 min
P_{lt} Observation Period	120 min

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz
Manual Switching	NO

TEST INFO		
Test Date (yyyy-mm-dd)	2022-02-02	2022-02-03
Temperature °C (For Info Only)	23.6°C	23.1°C
Relative humidity % (For Info Only)	15.4%	19.1%
Atmospheric pressure kPa (For Info Only)	102.4kPa	102.4kPa
Operator	Lyes Rahni	Lyes Rahni
Client Witness	No witness	No witness

10.4.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TESEQ	Software	Win2100 v4.9	N/A	N/A	N/A
TESEQ	AC-DC Power source	NSG 1007	1232A04499 (NSG 1007)	12	2022-09-14
TESEQ	Lumped impedance	CCN 1000-1	1232A04499 (CCN 1000-1)	12	2022-09-14

Table 18: Voltage Fluctuations and Flicker Measurements – Test Equipment

10.4.3 Test Results

Parameters	Limit	Results
Short-term flicker value: P_{st}	1.0	Pass
Long-term flicker value: P_{lt}	0.65	Pass
Voltage change for more than 500ms: d(t)	3.3%	Pass
Relative steady state voltage change: dc	3.3%	Pass
Maximum relative voltage change: d_{max}	4%	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client.		

Table 19: Voltage Fluctuations and Flicker Measurements – Test Results

10.4.4 Test Data

See APPENDIX D for data files

Test setup was identical to harmonic current emissions measurements.

10.4.5 Test Method

Voltage fluctuations and flicker measurements were performed using the procedures of the reference standard.

11 IMMUNITY TESTS

11.1 Electrostatic Discharge Immunity

11.1.1 Test Details

REFERENCE STANDARD	IEC 61000-4-2 (2008)

SPECIFICATIONS	
Test Level	Contact: ±4kV Air: ±2kV, ±4kV, ±8kV
Installation	Table-top equipment
Ungrounded Equipment	YES

PERFORMANCE CRITERION	B

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2022-01-31
Temperature Min 15°C – Max 35°C	25.24°C
Relative Humidity Min 30% - Max 60%	36.42%
Atmospheric Pressure Min 86kPa – Max 106kPa	102.5kPa
Operator	Lyes Rahni
Client Witness	Donatien Crémet (Inogeni)

11.1.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
Vaisala	Thermo-Hygrometer	MI70/HMP77	H4610004/JO430012	24	2023-08-13
EMC-Partner	Discharge Generator	ESD3000	1550	18	2023-04-06
EMC-Partner	Relay Module	ESD3000RM32	1892	18	2023-04-06
EMC-Partner	Discharge Network 150pF/330Ohms	ESD3000DN1	1551	18	2023-04-06

Table 20: ESD – Test Equipment

11.1.3 Test Results

Coupling Plane	Position	Polarity Test Level (kV)	Number	Time Interval (s)	Generator Perpendicular	Comments	Results
HCP	Front	±4	10+ / 10-	1	YES	No event	Pass
VCP	Front	±4	10+ / 10-	1	YES	No event	Pass
	Right	±4	10+ / 10-	1	YES	No event	Pass
	Rear	±4	10+ / 10-	1	YES	Note 1	Pass
	Left	±4	10+ / 10-	1	YES	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.							
Note 1: Due to cables, VCP was placed at 15cm from EUT (the standard distance is 10cm).							

Table 21: ESD – Test Results – Indirect Discharges – 4KX-PLUS

Coupling Plane	Position	Polarity Test Level (kV)	Number	Time Interval (s)	Generator Perpendicular	Comments	Results
HCP	Front	±4	10+ / 10-	1	YES	No event	Pass
VCP	Front	±4	10+ / 10-	1	YES	No event	Pass
	Right	±4	10+ / 10-	1	YES	No event	Pass
	Rear	±4	10+ / 10-	1	YES	Note 1	Pass
	Left	±4	10+ / 10-	1	YES	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.							
Note 1: Due to cables, VCP was placed at 15cm from EUT (the standard distance is 10cm).							

Table 22: ESD – Test Results – Indirect Discharges – PSU

ESD Point	ESD Type	Test Level (kV)	Number	Time Interval (s)	Generator Perpendicular	Comments	Results
C1;C2;C4; C6;C7;C9;C10	Contact	±4	10+ / 10-	1	YES	No event	Pass
C3;C5;C8	Contact	±4	10+ / 10-	1	YES	Note 1	Pass
NONE	Air	±2, ±4, ±8	10+ / 10-	1	N/A	Note 2	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.							
Note 1: Self-recoverable degradation – Laptop's signal was lost with each discharge on the EUT it became normal at the end of the perturbations. Note 2: After discharge points research, no possible air discharge was found on the EUT.							

Table 23: ESD – Test Results – Direct Discharges – 4KX-PLUS

ESD Point	ESD Type	Test Level (kV)	Number	Time Interval (s)	Generator Perpendicular	Comments	Results
C11	Contact	±4	10+ / 10-	1	YES	Note 1	Pass
NONE	Air	±2, ±4, ±8	10+ / 10-	1	N/A	Note 2	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.							
Note 1: Self-recoverable degradation – Laptop's signal was lost with each discharge on the EUT it became normal at the end of the perturbations. Note 2: After discharge points research, no possible air discharge was found on the EUT.							

Table 24: ESD – Test Results – Direct Discharges – PSU

11.1.4 Test Data

Photo 14: ESD – Test Setup – 4KX-PLUS

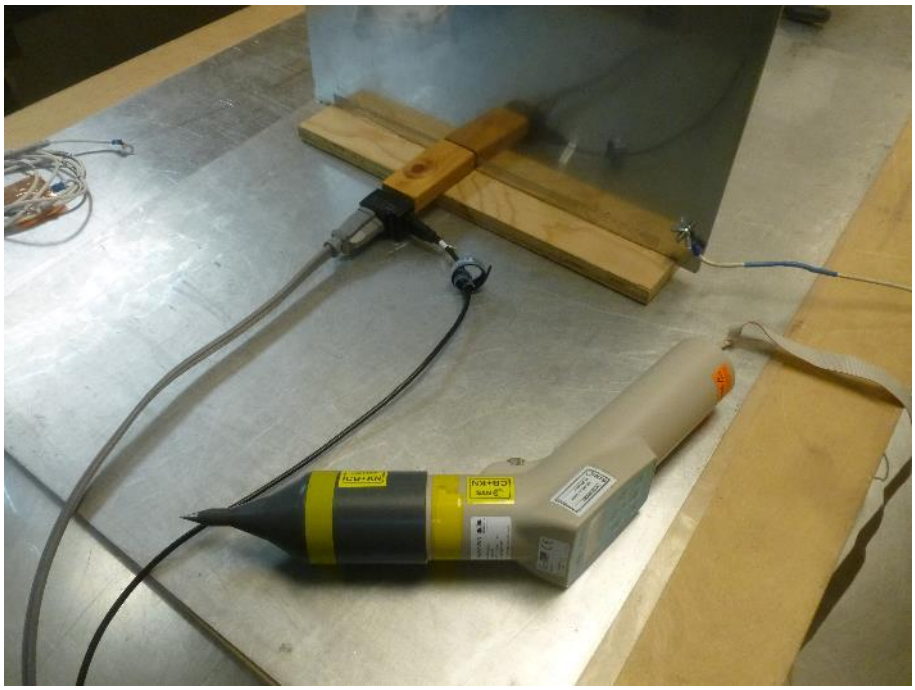


Photo 15: ESD – Test Setup – PSU

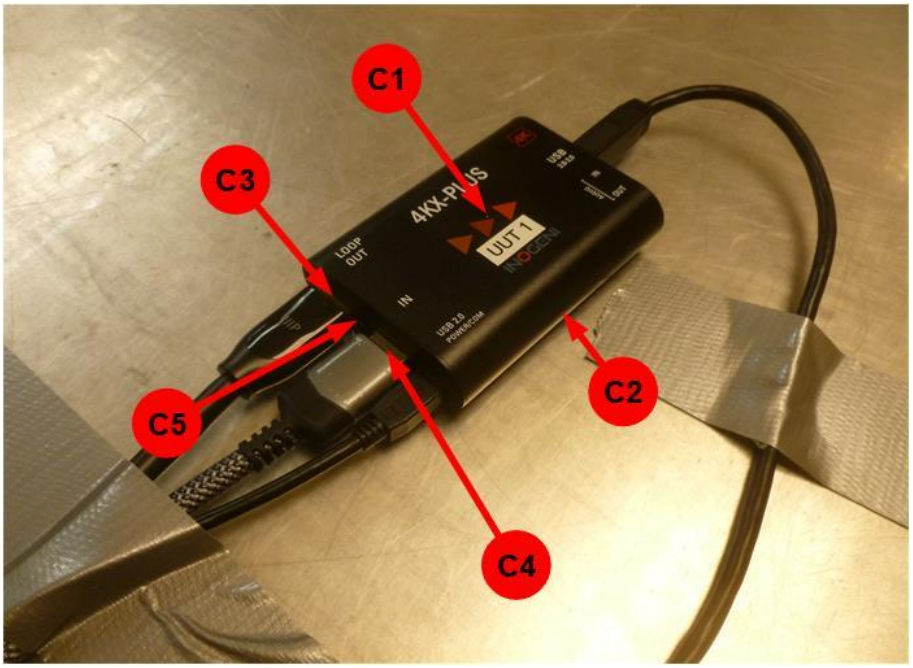


Photo 16: ESD – Location of Discharge Points – 4KX-PLUS #1

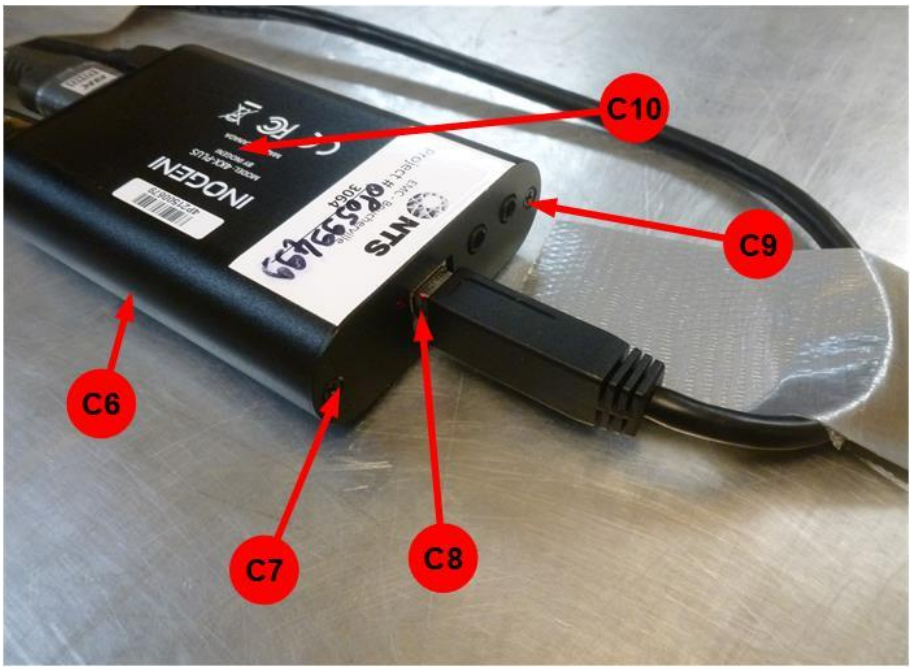


Photo 17: ESD – Location of Discharge Points – 4KX-PLUS #2

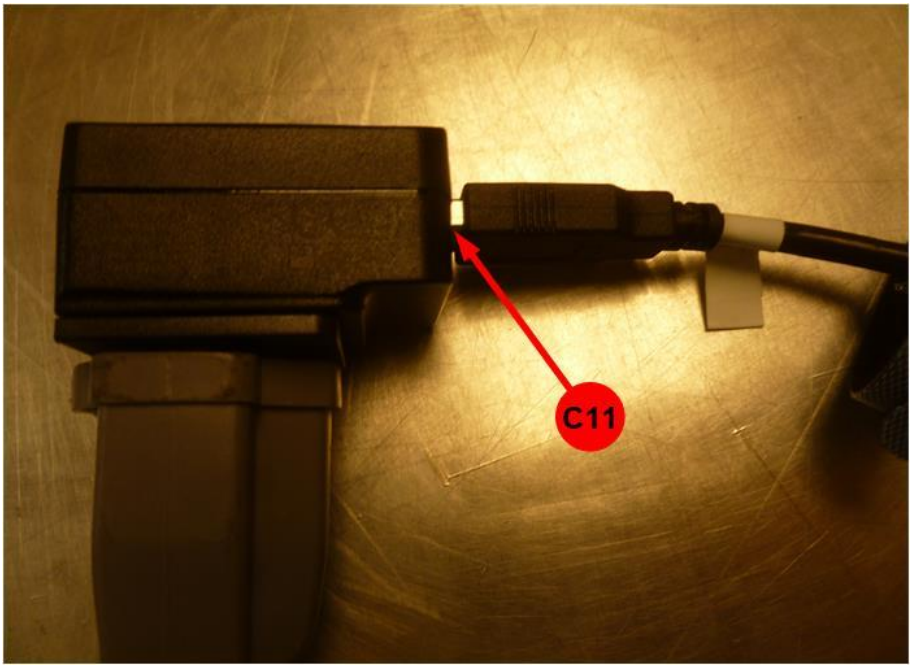


Photo 18: ESD – Location of Discharge Points – PSU

11.1.5 Test Method

Electrostatic discharge immunity tests were performed using the procedures of the reference standard.

Application of direct discharges was applied to points and surfaces of EUT which are accessible to person during normal use. If contact discharge cannot be applied, the air discharge method shall be performed.

Application of indirect discharges was applied to the horizontal coupling plane (0.1m from the front of EUT) and to vertical coupling plane (VCP is positioned at 0.1m from EUT in order to illuminate the four faces of EUT).

11.2 Radiated Electromagnetic Field Immunity

11.2.1 Test Details

REFERENCE STANDARD	IEC 61000-4-3 (2020)

SPECIFICATIONS			
TEST	#1	#2	#3
Frequency Range	80MHz-1000MHz	1800MHz, 2600MHz	3500MHz, 5000MHz
Test Level	3V/m	3V/m	3V/m
Test Distance	2m	2m	2.7m
Uniformity Field Area	1.5m x 1.5m	1.5m x 1.5m	1.5m x 1.5m
Modulation	AM 80% / 1kHz	AM 80% / 1kHz	AM 80% / 1kHz
Frequency Step	1%	N/A	N/A
Dwell Time	0.5s	10s	10s
Illuminated Face	6		
Installation	Table-top equipment		

PERFORMANCE CRITERION	A

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2021-02-01
Temperature °C (For Info Only)	23.4°C
Relative humidity % (For Info Only)	10.1%
Atmospheric pressure kPa (For Info Only)	102.5kPa
Operator	Lyes Rahni
Client Witness	No witness

11.2.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TDK	Immunity Anechoic Chamber	16706-2	5712	N/A	N/A
NEXIO	Software	BAT-EMC v3.21.0.26	N/A	N/A	N/A
TESEQ	Signal generator	ITS 6006	33007	12	2022-08-02
Werlatone	Directional coupler (80MHz-1GHz)	C3908-10	98552	12	2022-12-22
Werlatone	Directional coupler (0.8GHz-3GHz)	C6721-10	98746	12	2022-12-22
Agilent	Directional coupler (2GHz-18GHz)	773D	MY28390533	12	2022-12-22
TESEQ	Power meter	PM 6006	72804	12	2022-08-05
TESEQ	Power meter	PM 6006	72805	12	2022-08-05
TESEQ	Power meter	PM 6006	77352	12	2022-08-05
TESEQ	Power meter	PM 6006	77353	12	2022-08-05
TESEQ	RF amplifier (80MHz-1GHz)	CBA 1G-500	T44193	VERIF	VERIF
TESEQ	RF amplifier (800MHz-3GHz)	CBA 3G-180	T44194	VERIF	VERIF
IFI	RF Amplifier (1GHz-6GHz)	S62-50	Q1539-0113	VERIF	VERIF
Schwarzbeck	Antenna	STLP 9128 D special	9128DS 025	VERIF	VERIF
Com-Power	Horn Antenna	AH-118	071324	24	2022-08-13
Narda	Electric Field Probe	PMM EP601	711WX80868	12	2022-04-28
LABCEM	RF Uniformity Field 80MHz-1GHz (36V/m)	N/A	N/A	12	2022-12-27
LABCEM	RF Uniformity Field 1GHz-3GHz (18V/m)	N/A	N/A	12	2022-12-27
LABCEM	RF Uniformity Field 3GHz-6GHz (9V/m)	N/A	N/A	12	2022-12-29

Table 25: Radiated EM Field – Test Equipment

11.2.3 Test Results

Illuminated Face	Frequencies (MHz)	Test Level (V/m)	Modulation	Polarization	Comments	Results
Front	80 - 1000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
Right	80 - 1000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
Rear	80 - 1000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event	Pass

Left	80 - 1000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
Top	80 - 1000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event	Pass
Bottom	80 - 1000	3	AM / 1kHz	Horizontal Vertical	No event Note1	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event Note1	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event Note1	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.						
Note 1: 1m of cable was exposed to the electromagnetic field						

Table 26: Radiated EM Field – Test Results

11.2.4 Test Data

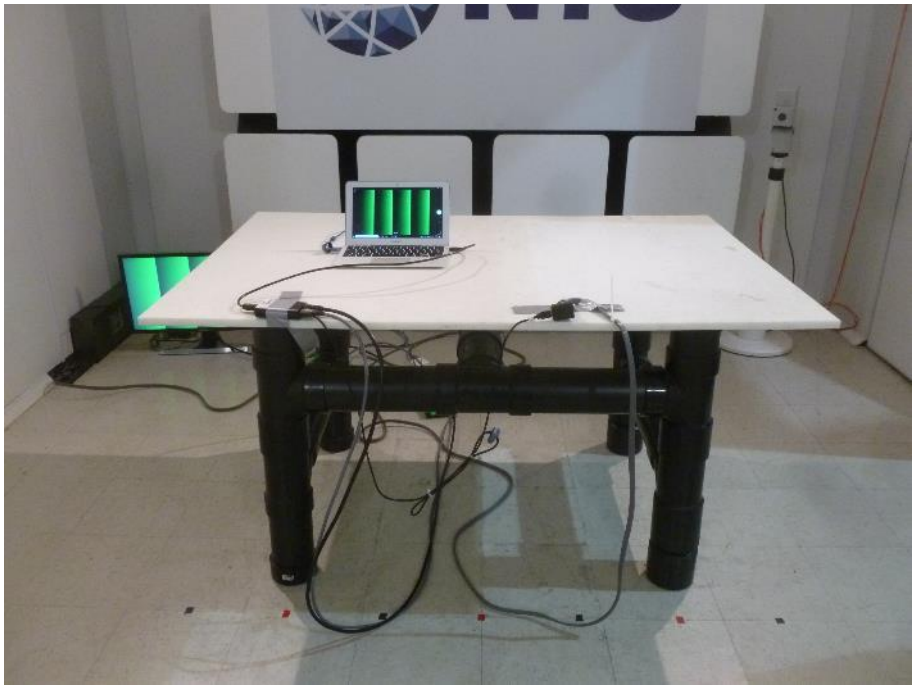


Photo 19: Radiated EM Field – Test setup – Front

Photo 20: Radiated EM Field – Test setup – Right

Photo 21: Radiated EM Field – Test setup – Rear

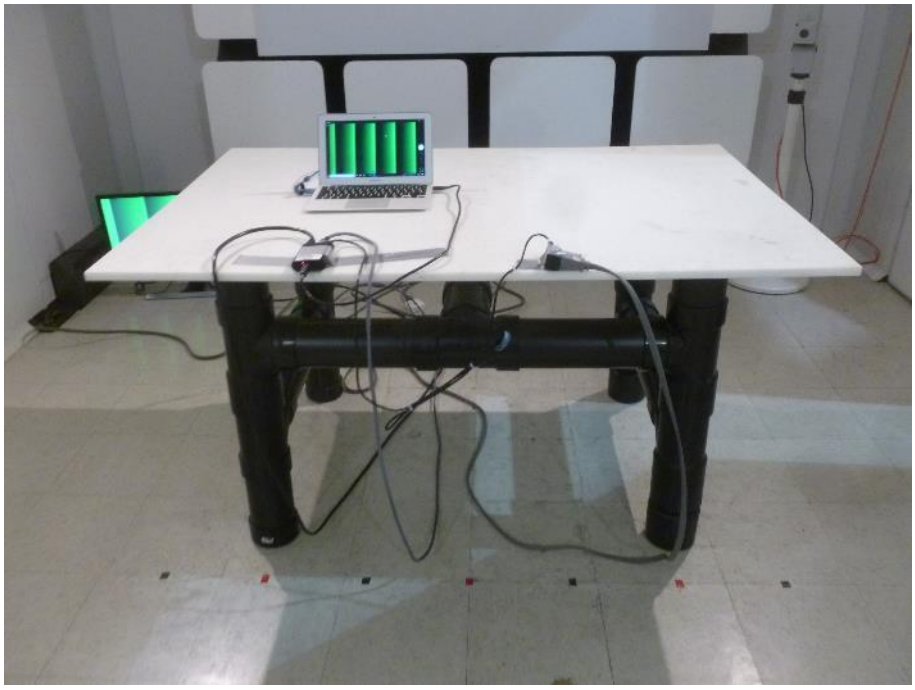


Photo 22: Radiated EM Field – Test setup – Left

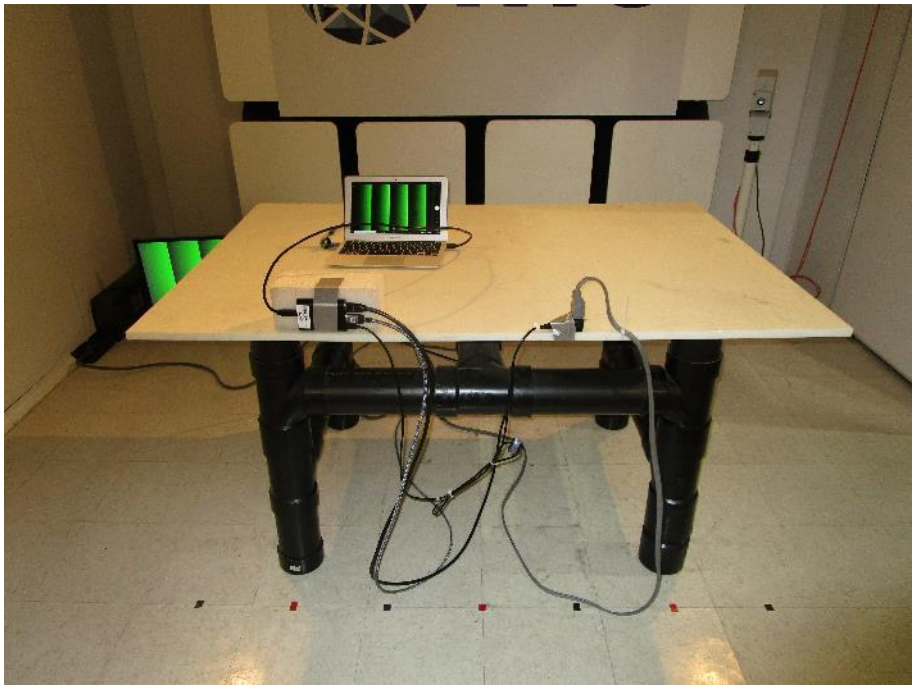


Photo 23: Radiated EM Field – Test setup – Top

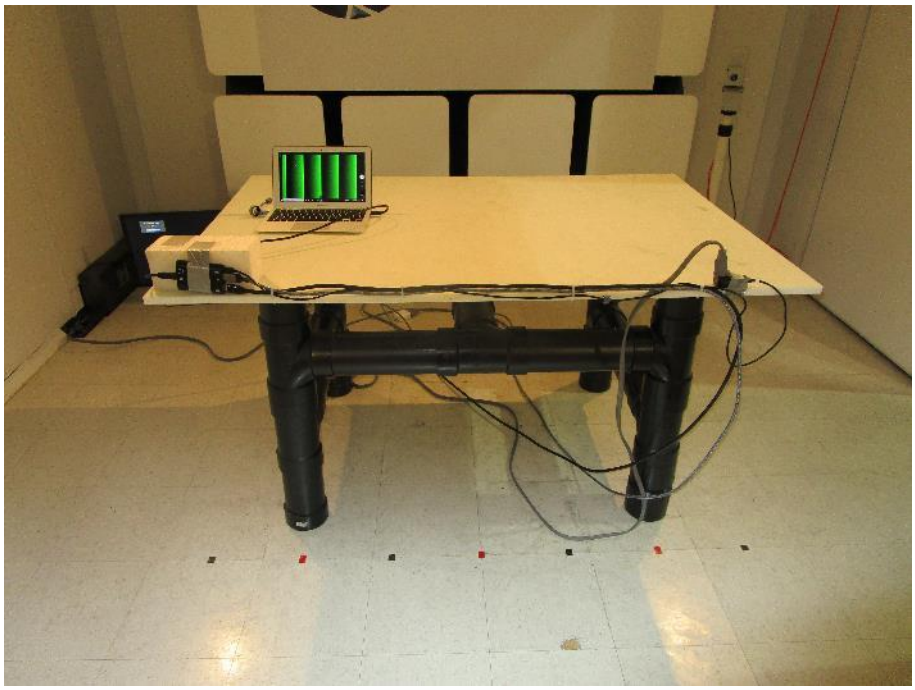


Photo 24: Radiated EM Field – Test setup – Bottom

Photo 25: Radiated EM Field – Test setup – >3GHz

11.2.5 Test Method

Radiated field immunity tests were performed using the procedures of the reference standard.

11.3 Electrical Fast Transient Immunity

11.3.1 Test Details

REFERENCE STANDARD	IEC 61000-4-4 (2012)

SPECIFICATIONS	
Test Level	Power Ports: ±1kV I/O Ports: ±0.5kV Communication Ports: N/A
Repetition Frequency	5kHz
Installation	Table-top equipment

PERFORMANCE CRITERION	B

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2022-02-03
Temperature °C (For Info Only)	23.1°C
Relative humidity % (For Info Only)	19.1%
Atmospheric pressure kPa (For Info Only)	102.4kPa
Operator	Lyes Rahni
Client Witness	No witness

11.3.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TESEQ	Software	Win3000 v1.3.2	N/A	N/A	N/A
TESEQ	Multifunction generator	NSG 3040	1918	12	2022-09-08
TESEQ	EFT Clamp	CDN 3425	1730	VERIF	VERIF

Table 27: EFT – Test Equipment

11.3.3 Test Results

Tested Line	Polarity Test level (kV)	Coupling Method	Repetition Frequency (kHz)	Test Duration By Polarity (s)	Comments	Results
L, N	±1	CDN	5	60	Note 1	Pass
HDMI 1	±0.5	Capacitive clamp	5	60	Note 1	Pass
HDMI 2	±0.5	Capacitive clamp	5	60	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.						
Note 1: Self-recoverable degradation The streaming signal on the laptop and screen were lost, during the perturbation and returned to normal when the perturbation finished. This test result is considered as a Pass according to performance criteria defined in section 5						

Table 28: EFT – Test Results

11.3.4 Test Data

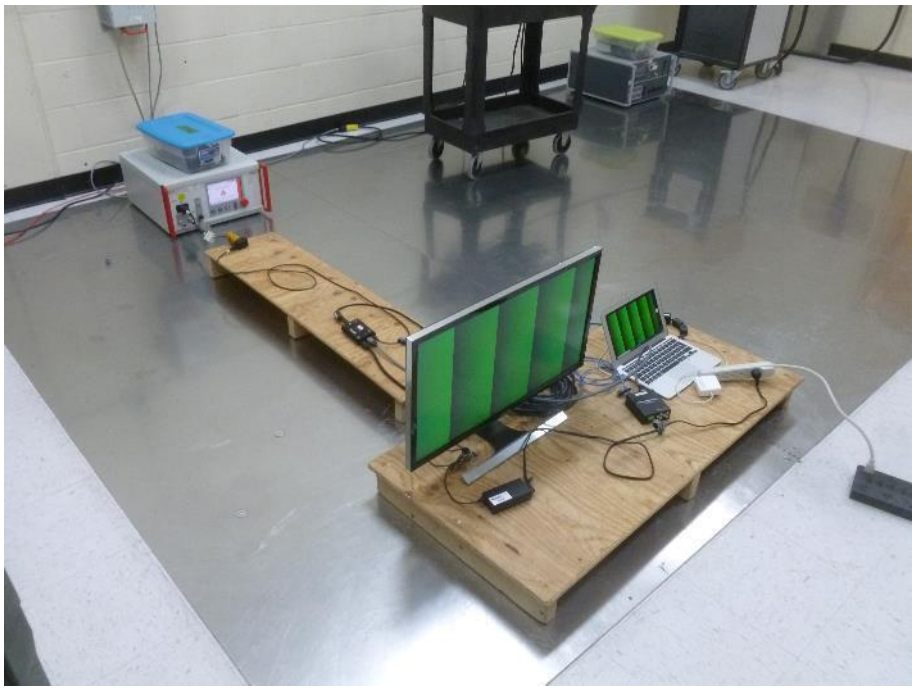


Photo 26: EFT – Test Setup

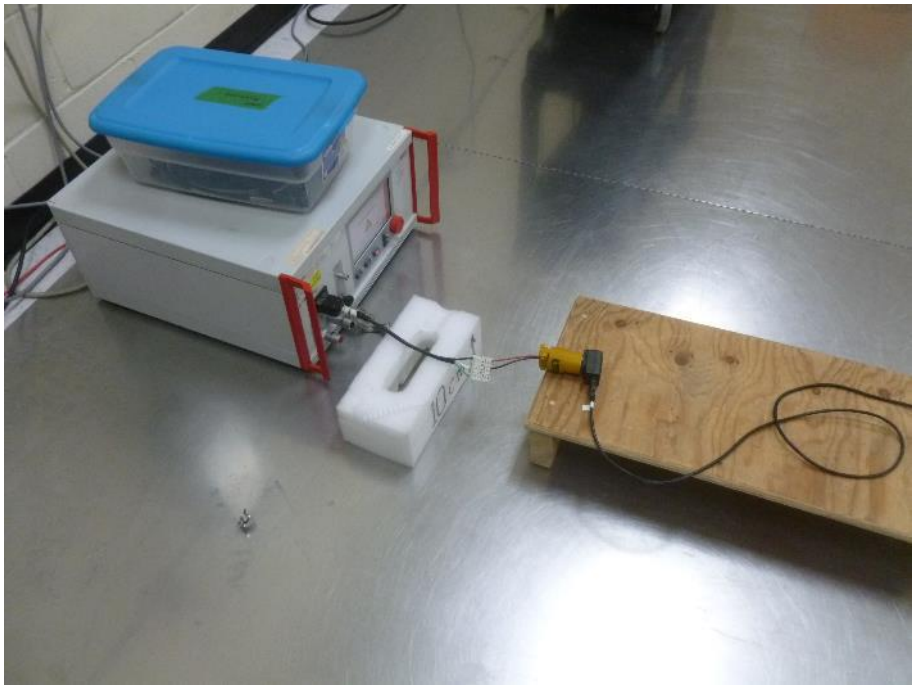


Photo 27: EFT – Test Setup – CDN – Power

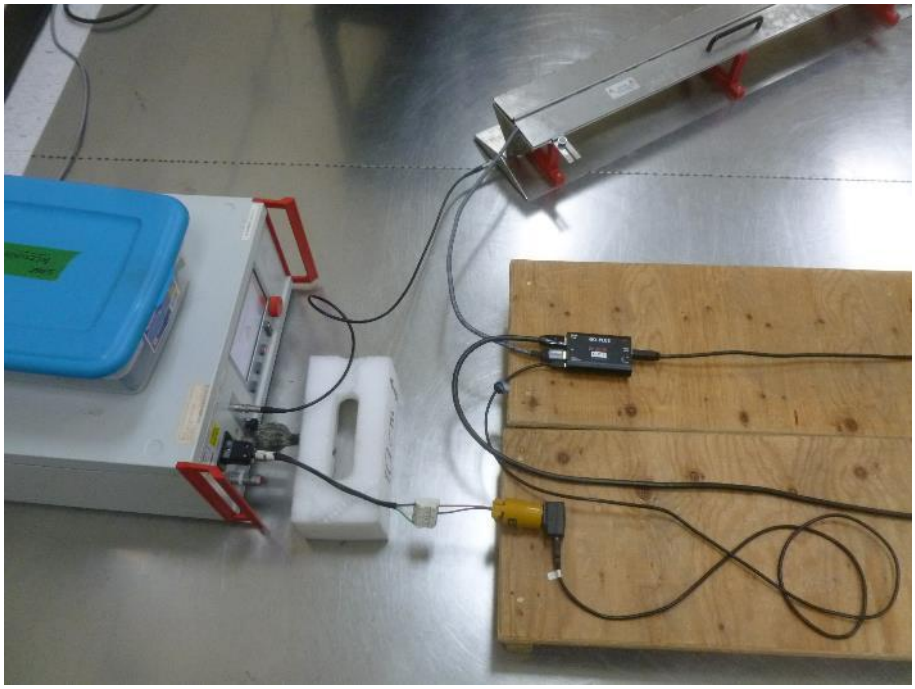


Photo 28: EFT – Test Setup – Capacitive Clamp – HDMI 1

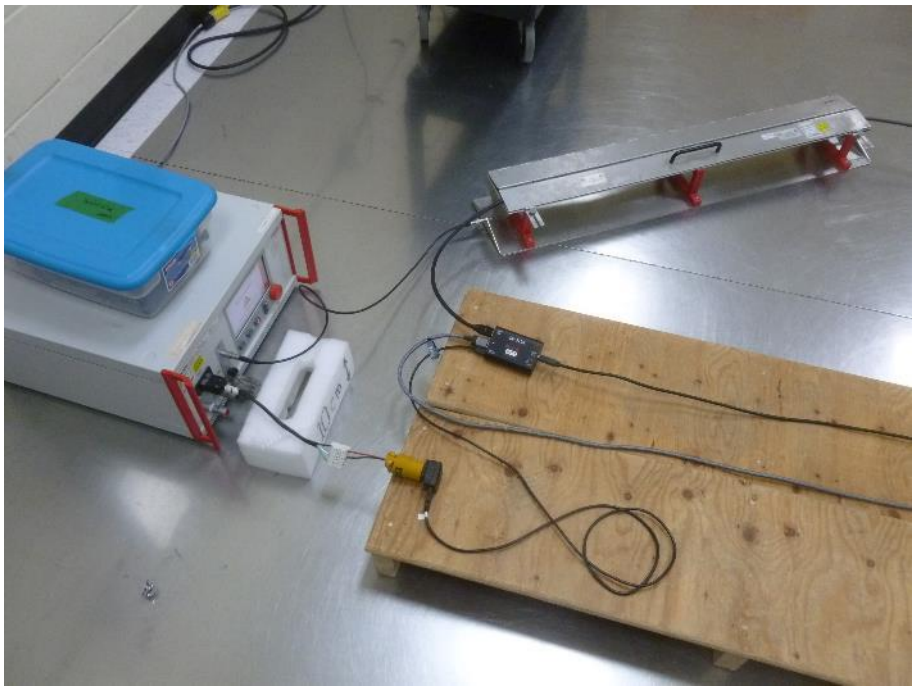


Photo 29: EFT – Test Setup – Capacitive Clamp – HDMI 2

11.3.5 Test Method

Electrical fast transient immunity tests were performed using the procedures of the reference standard.

11.4 Surge Immunity

11.4.1 Test Details

REFERENCE STANDARD	IEC 61000-4-5 (2014) A1 (2017)

SPECIFICATIONS	
1.2/50µs Waveform	Open-Circuit Voltage: 1.2µs/50µs Short-Circuit Current: 8µs/20µs
Test level	Power: ±2kV L-PE / ±1kV L-L I/O Ports: N/A Communication Ports: N/A

PERFORMANCE CRITERION	B

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2022-02-03
Temperature °C (For Info Only)	23.1°C
Relative humidity % (For Info Only)	19.1%
Atmospheric pressure kPa (For Info Only)	102.4kPa
Operator	Lyes Rahni
Client Witness	No witness

11.4.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TESEQ	Software	Win3000 v1.3.2	N/A	N/A	N/A
TESEQ	Multifunction generator	NSG 3040	1918	12	2022-09-08

Table 29: Surge – Test Equipment

11.4.3 Test Results

Application		Polarity Test Level (kV)	Additional Impedance	Number	Interval (s)	Phase Shifting (°)	Comments	Results
between	and							
L	N	+0.5 +1	0Ω	5+	30	90	No event	Pass
L	N	-0.5 -1	0Ω	5-	30	270	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.								
Note 1: EUT without PE, no L vs PE test performed								

Table 30: 1.2/50µs Surge – Test Results – Power Ports

11.4.4 Test Data

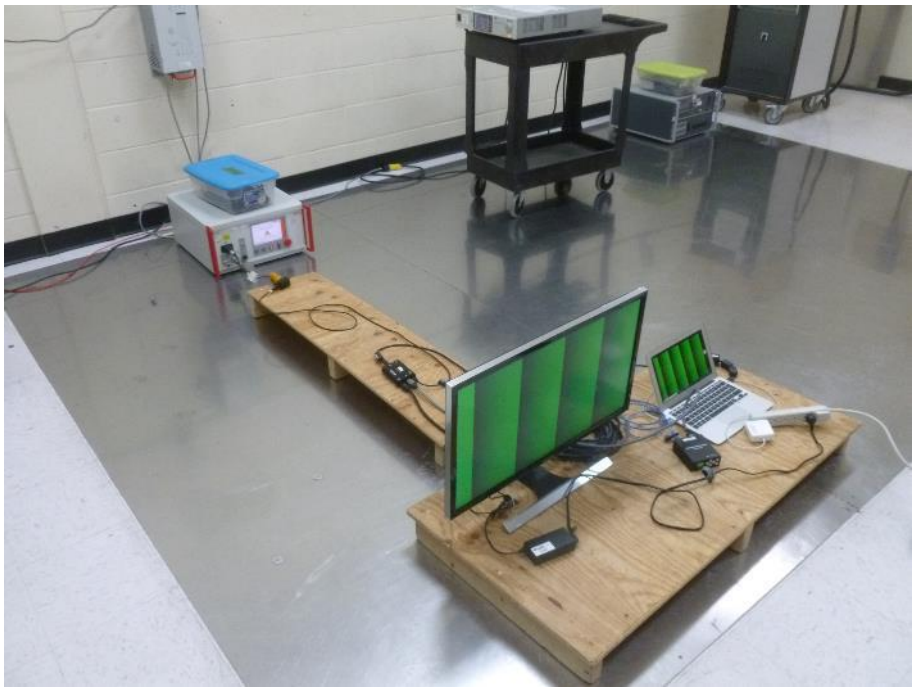


Photo 30: 1.2/50µs Surge – Test Setup – Power Ports

11.4.5 Test Method

Surge immunity tests were performed using the procedures of the reference standard.

11.5 Conducted Disturbances Immunity

11.5.1 Test Details

REFERENCE STANDARD	IEC 61000-4-6 (2013)

SPECIFICATIONS	
Test level	Power: 3Vrms I/O Ports: 3Vrms Communication Ports: N/A
Frequency Range	150kHz-80MHz
Modulation	AM: 80% / 1kHz
Frequency Step	1%
Dwell Time	0.5s

PERFORMANCE CRITERION	A

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2022-02-02
Temperature °C (For Info Only)	23.6°C
Relative humidity % (For Info Only)	15.4%
Atmospheric pressure kPa (For Info Only)	102.4kPa
Operator	Lyes Rahni
Client Witness	No witness

11.5.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
NEXIO	Software	BAT-EMC v3.21.0.26	N/A	N/A	N/A
TESEQ	Conducted Immunity Test Generator	NSG 4070B-75	34302	12	2022-08-19
TESEQ	CDN M2	CDN M216	32740	24	2022-09-24
TESEQ	EM Clamp	KEMZ 801A	33460	24	2022-09-22
TESEQ	RF Current Clamp	MD 4070	33320	24	2022-09-18
TESEQ	Attenuation Clamp	KEMA 801A	33174	NCR	NCR
Pasternack	6dB Fixed Attenuator	PE7385-6	LABCEM #0256	VERIF	VERIF
LABCEM	Laboratory 3 - Conducted Voltage Immunity Calibration CDN-M2 - CI Injection Cable	N/A	N/A	12	2022-09-07
LABCEM	Laboratory 3 - Conducted Voltage Immunity Calibration EM Clamp (sn:33460) - CI Injection Cable + CI Monitoring Cable	N/A	N/A	12	2022-09-07

Table 31: Conducted Disturbances – Test Equipment

11.5.3 Test Results

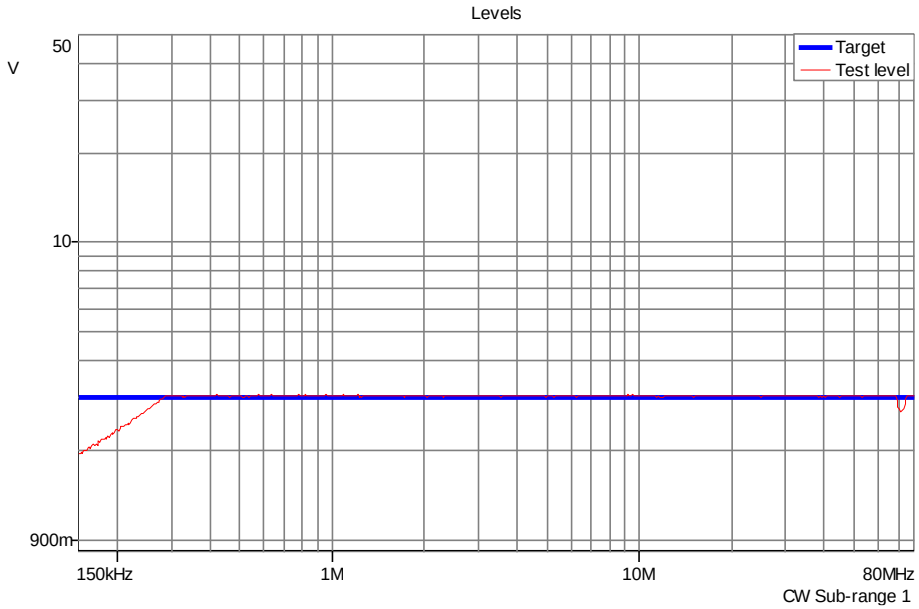
Tested Line	Coupling Method	Frequency (MHz)	Test Level (V)	Modulation	Comments	Results
Power (230Vac/50Hz)	CDN-M2	0.150 - 80	3 Note1	AM / 1kHz	No event	Pass
HDMI1	EM Clamp	0.150 - 80	3 Note1	AM / 1kHz	No event	Pass
HDMI2	EM Clamp	0.150 - 80	3 Note1	AM / 1kHz	No event	Pass

The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.

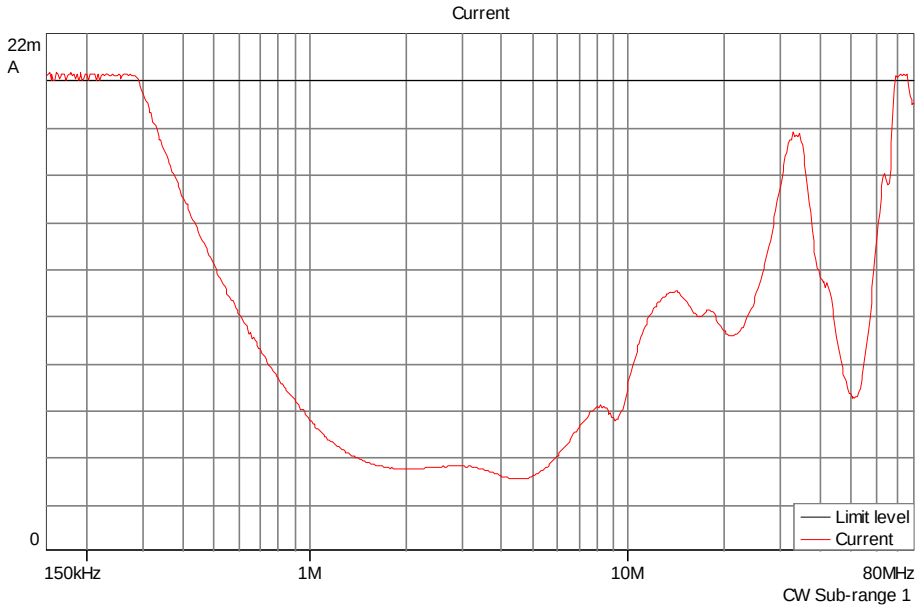
Note1: Test was performed at 3Vrms at all frequency range instead of:
-3Vrms to1Vrms between 10 MHz and 30MHz
-1Vrms between 30MHz and 80MHz

Table 32: Conducted Disturbances – Test Results

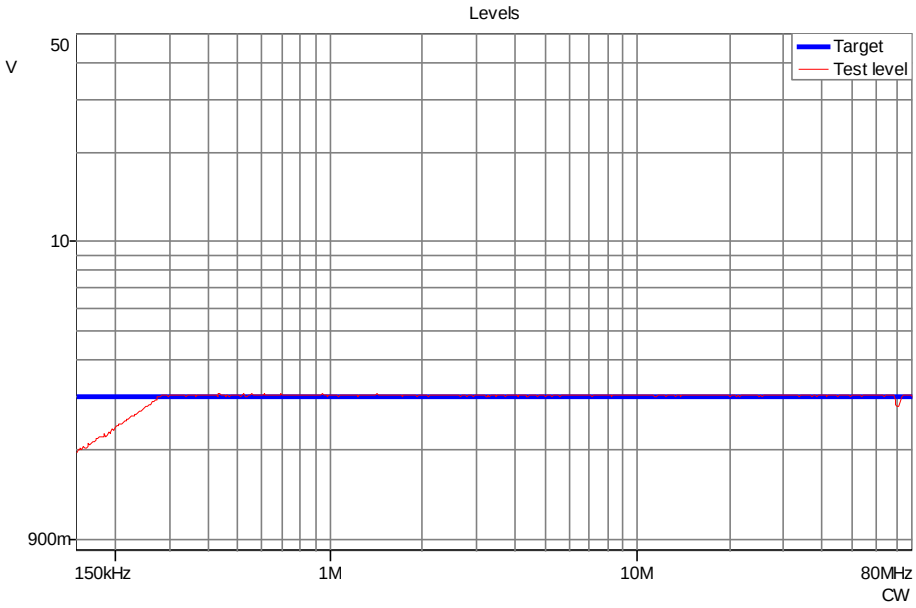
11.5.4 Test Data



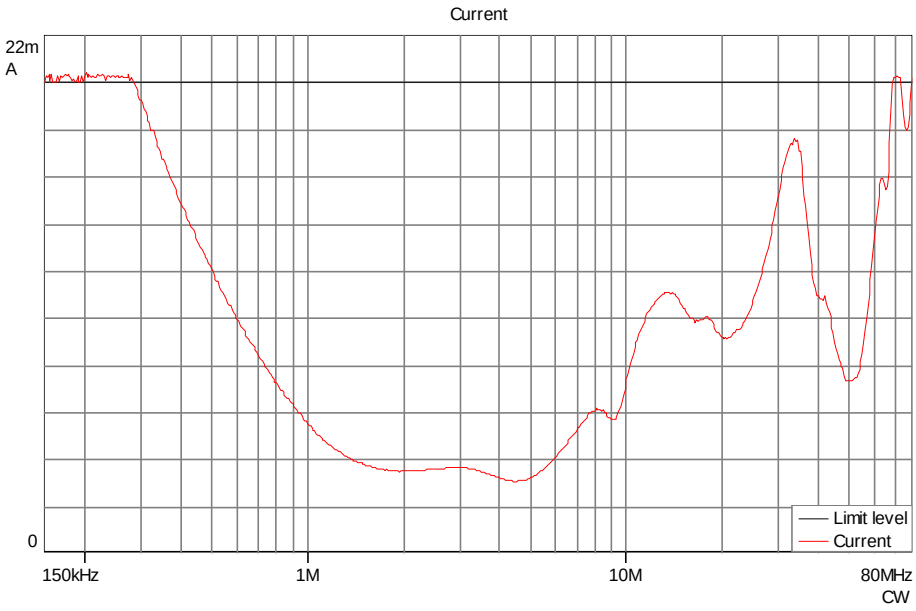
Graph 7: Conducted Disturbances – Voltage Level – EM Clamp – HDMI1



Graph 8: Conducted Disturbances – Current Measurements – EM Clamp – HDMI1



Graph 9: Conducted Disturbances – Voltage Level – EM Clamp – HDMI2



Graph 10: Conducted Disturbances – Current Measurements – EM Clamp – HDMI2

Photo 31: Conducted Disturbances – Test Setup

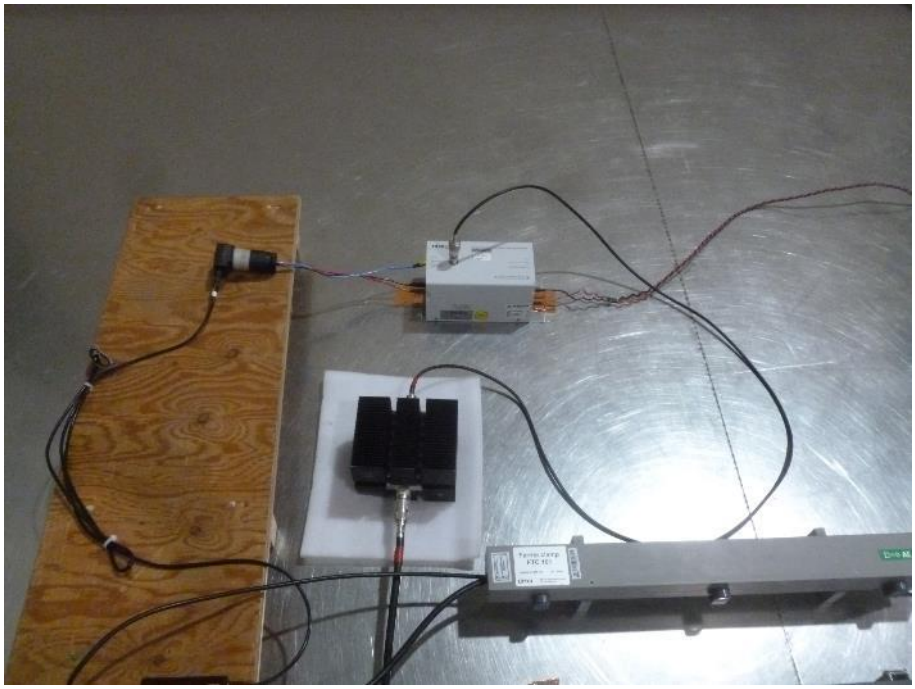


Photo 32: Conducted Disturbances – Test Setup – CDN – Power

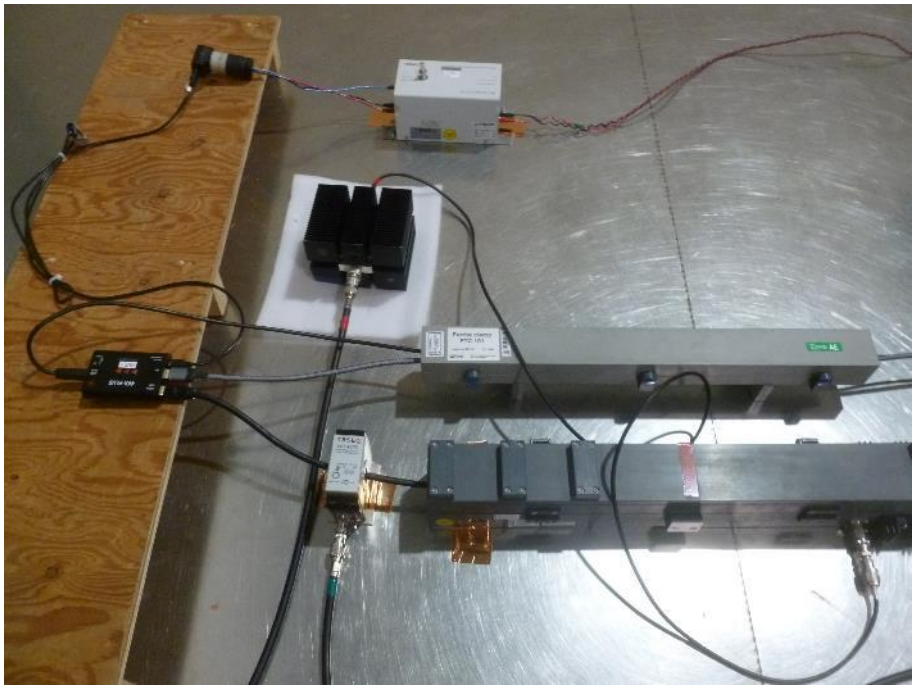


Photo 33: Conducted Disturbances – Test Setup – EM Clamp – HDMI1

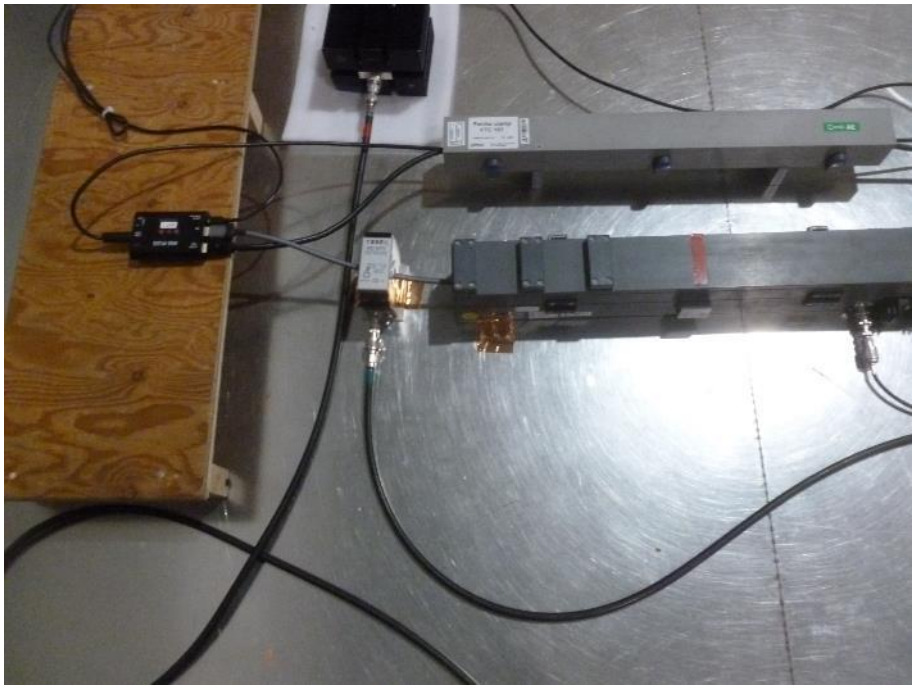


Photo 34: Conducted Disturbances – Test Setup – EM Clamp – HDMI2

11.5.5 Test Method

Conducted Disturbances immunity tests were performed using the procedures of the reference standard.

11.6 Power Frequency Magnetic Field Immunity

11.6.1 Test Details

REFERENCE STANDARD	IEC 61000-4-8 (2009)

SPECIFICATIONS	
Test Level	Continuous field: 1A/m (60s)
Frequency	50Hz / 60Hz
Induction Coil	1m x 1m

PERFORMANCE CRITERION	A

EUT	
Identification	4KX-PLUS
Voltage Input	230V/50Hz 120V/60Hz

TEST INFO	
Test Date (yyyy-mm-dd)	2022-02-02
Temperature °C (For Info Only)	23.6°C
Relative humidity % (For Info Only)	15.4%
Atmospheric pressure kPa (For Info Only)	102.4kPa
Operator	Lyes Rahni
Client Witness	No witness

11.6.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TESEQ	Software	Win2120 v6.0 BETA	N/A	N/A	N/A
TESEQ	AC-DC Power source	NSG 1007	1232A04499 (NSG 1007)	12	2022-09-14
TESEQ	Magnetic coil interface	INA 2141	1417	NCR	NCR
TESEQ	Magnetic coil	INA 703	1978	VERIF	VERIF
Fluke	Digital Clamp Meter	353	21950072	12	2022-05-27
F.W. Bell	ELF Meter	4190	1237005	24	2022-10-08

Table 33: Magnetic Field – Test Equipment

11.6.3 Test Results

Position	Frequency (Hz)	Test Level (A/m)	Test Duration (s)	Comments	Results
1	50	1	60	No event	Pass
2	50	1	60	No event	Pass
3	50	1	60	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.					

Table 34: Magnetic Field – Test Results – RKX-PLUS – 230V/50Hz

Position	Frequency (Hz)	Test Level (A/m)	Test Duration (s)	Comments	Results
1	60	1	60	No event	Pass
2	60	1	60	No event	Pass
3	60	1	60	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.					

Table 35: Magnetic Field – Test Results – RKX-PLUS – 120V/60Hz

Position	Frequency (Hz)	Test Level (A/m)	Test Duration (s)	Comments	Results
1	50	1	60	No event	Pass
2	50	1	60	No event	Pass
3	50	1	60	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.					

Table 36: Magnetic Field – Test Results – PSU – 230V/50Hz

Position	Frequency (Hz)	Test Level (A/m)	Test Duration (s)	Comments	Results
1	60	1	60	No event	Pass
2	60	1	60	No event	Pass
3	60	1	60	No event	Pass
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.					

Table 37: Magnetic Field – Test Results – PSU – 120V/60Hz

11.6.4 Test Data

Photo 35: Magnetic Field – Test Setup – RKX-PLUS – Position #1

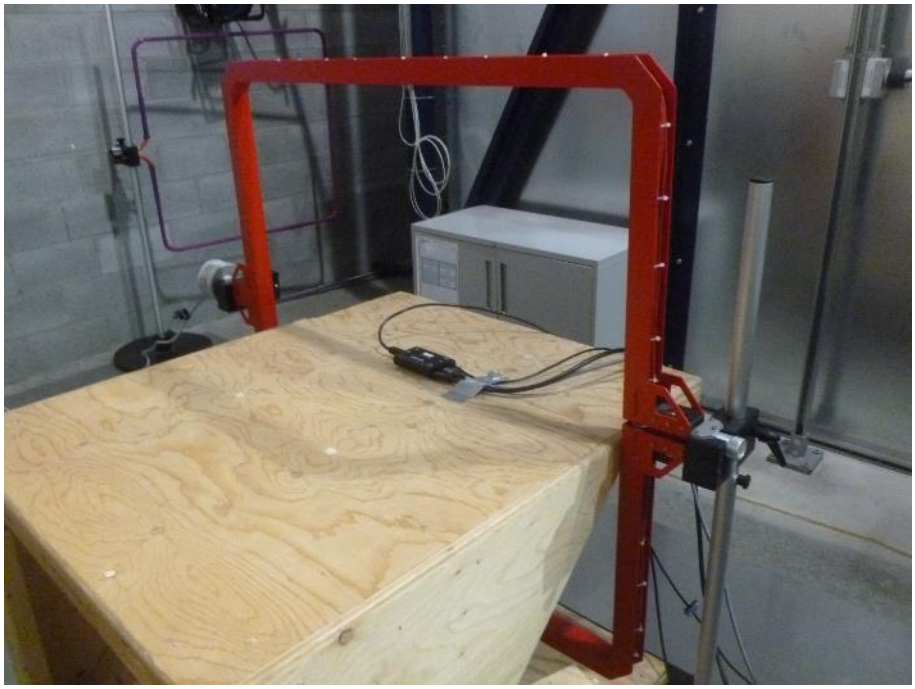


Photo 36: Magnetic Field – Test Setup – RKX-PLUS – Position #2

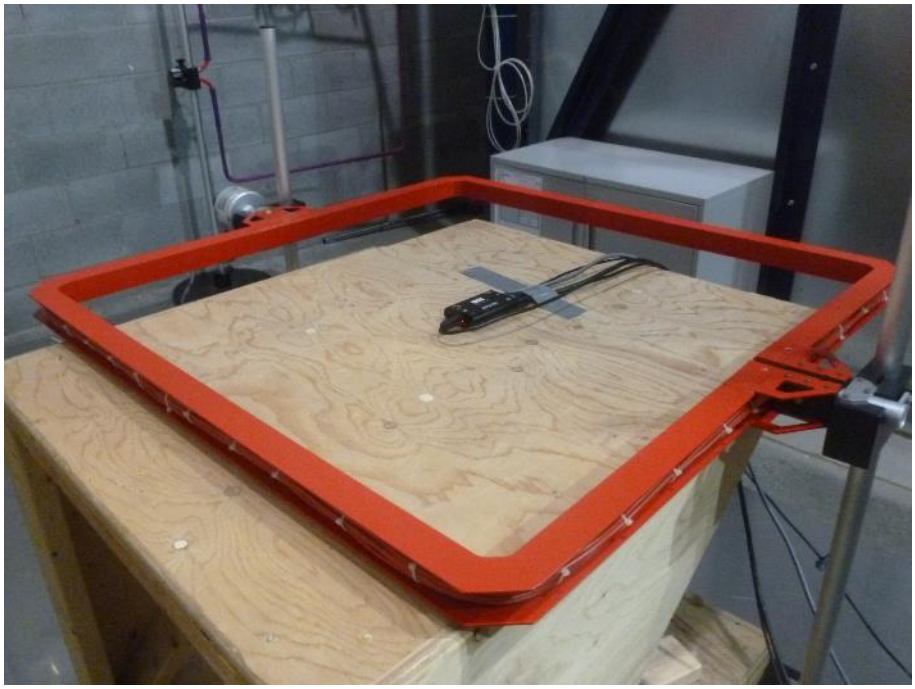


Photo 37: Magnetic Field – Test Setup – RKX-PLUS – Position #3

Photo 38: Magnetic Field – Test Setup – PSU – Position #1

Photo 39: Magnetic Field – Test Setup – PSU – Position #2

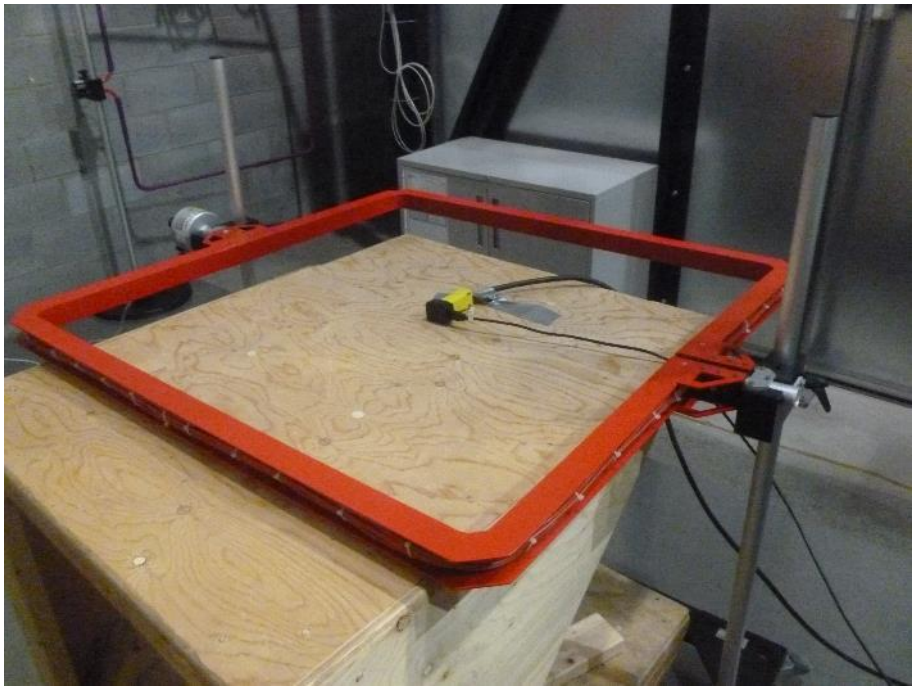


Photo 40: Magnetic Field – Test Setup – PSU – Position #3

11.6.5 Test Method

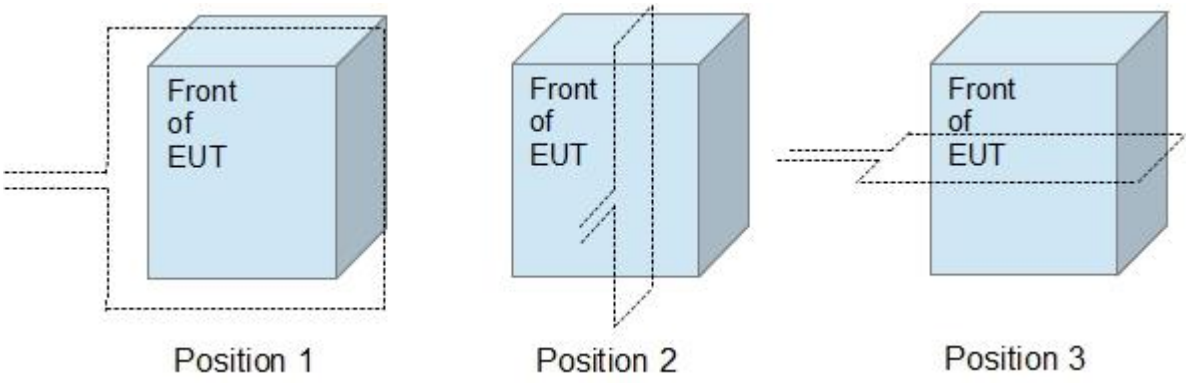


Figure 2: Magnetic Field – Position of Induction Coil

Power frequency field magnetic immunity tests were performed using the procedures of the reference standard.

11.7 Voltage Dips, Short Interruptions and Voltage Variation Immunity on AC input

11.7.1 Test Details

REFERENCE STANDARD	IEC 61000-4-11 (2020)
SPECIFICATIONS	
Voltage Dips	0%Un: ½ cycle 0%Un: 1 cycle 70%Un: 25 cycles 70%Un: 30 cycles
Short Interruptions	0%Un: 250 cycles 0%Un: 300 cycles
PERFORMANCE CRITERION	0%Un / ½ cycle: B 0%Un / 1 cycle: B 70%Un / 25 cycles: C 70%Un / 30 cycles: C 0%Un / 250 cycles: C 0%Un / 300 cycles: C
EUT	
Identification	4KX-PLUS
Voltage Input	240V/50Hz 100V/60Hz
TEST INFO	
Test Date (yyyy-mm-dd)	2022-02-03
Temperature °C (For Info Only)	23.1°C
Relative humidity % (For Info Only)	19.1%
Atmospheric pressure kPa (For Info Only)	102.4kPa
Operator	Lyes Rahni
Client Witness	No witness

11.7.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
TESEQ	Software	Win3000 v1.3.2	N/A	N/A	N/A
TESEQ	Multifunction generator	NSG 3040	1918	12	2022-09-08
TESEQ	Step transformer	INA 6502	190	12	2022-09-08

Table 38: Voltage Variations on AC Input – Test Equipment

11.7.3 Test Results

Tested line	Test Level (% Un)	Duration (Cycle)	Number	Interval (s)	Phase Shifting (°)	Comments	Results
Power (240V/50Hz)	0	1/2	3	10	0	No event	Pass
	0	1	3	10	0	No event	Pass
	70	25	3	10	0	No event	Pass
	0	250	3	10	0	Note 1	Pass
Power (100V/60Hz)	0	1/2	3	10	0	No event	Pass
	0	1	3	10	0	Note 1	Pass
	70	30	3	10	0	No event	Pass
	0	300	3	10	0	Note 1	Pass4
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.							
Note 1: Self-recoverable degradation – The streaming signal on laptop and screen were lost during the interruption and returned to normal when the perturbation finished. This test result is considered as a Pass according to performance criteria defined in section 5.							

Table 39: Voltage Variations on AC Input – Test Results

11.7.4 Test Data

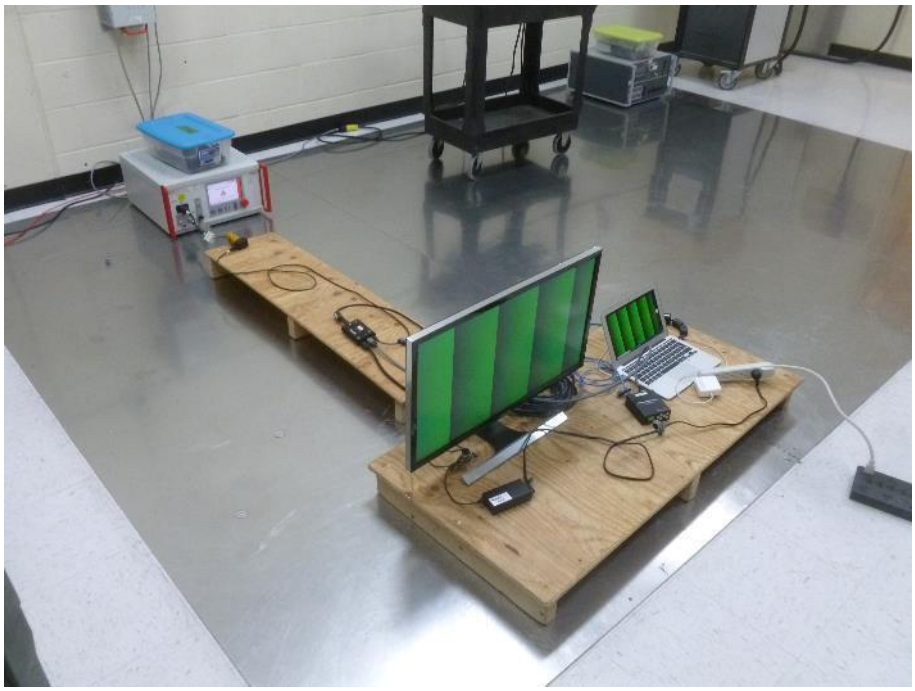


Photo 41: Voltage Variations on AC Input – Test Setup

11.7.5 Test Method

Voltage dips, short interruptions and voltage variation on AC Input immunity tests were performed using the procedures of the reference standard.

APPENDIX A
CONDUCTED EMISSIONS

CONDUCTED EMISSIONS - VOLTAGE

Project: *OP0599499* ***Customer:*** *Inogeni*

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: 4KX-PLUS
Manufacturer: Inogeni
Hardware Version:
Software Version:

CONDUCTED EMISSIONS MEASUREMENT: *OP0599499_CISPR32-LISN_Neutral_#20*

Test Location: Anechoic chamber
Test Date: 2022-01-28 2:40:53 PM
Operator(s): Lyes Rahni
Test Standard: CISPR32 / Class A
Power: 230V/50Hz
Tested Line: Neutral
Operating Mode: PSU CUI INK
Comments:

TEST PARAMETERS		TEST EQUIPMENT USED
Frequency Range 150 kHz - 30 MHz	Bandwidth 9 kHz	LF#1+LF#2 LISN : PMM L2-16B#20801-red Rohde & Schwarz : ESW44

FINAL RESULTS - QUASI-PEAK

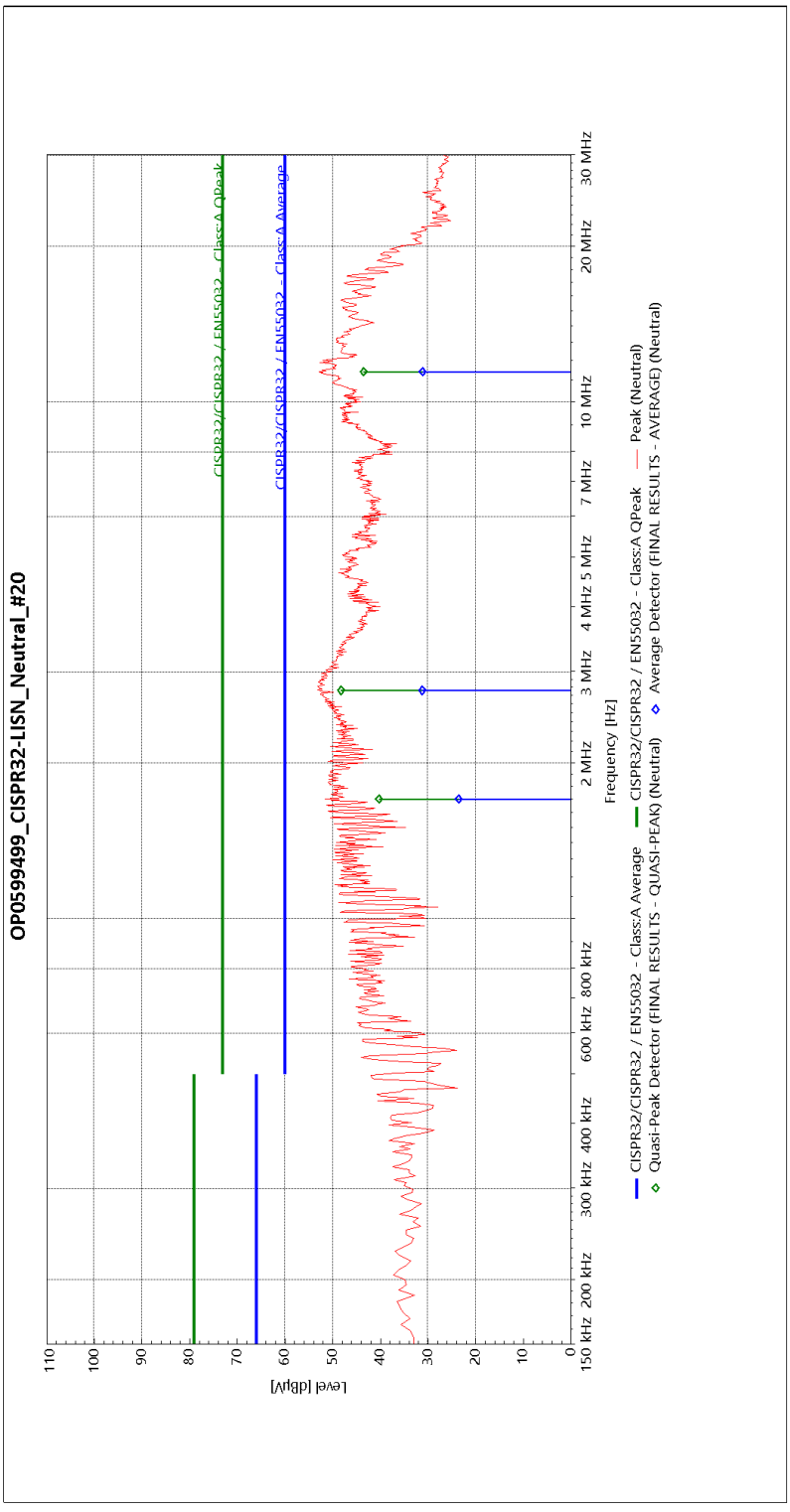
Frequency	SR #	Quasi-Peak Detector (dBµV)	Quasi-Peak Limit (dBµV)	Margin (dB)	Correction (dB)
1.702153 MHz	1	40.254	73	32.746	0.27
2.759301 MHz	1	48.235	73	24.765	0.303
11.413505 MHz	1	43.508	73	29.492	0.532

FINAL RESULTS - AVERAGE

Frequency	SR #	Average Detector (dBµV)	Average Limit (dBµV)	Margin (dB)	Correction (dB)
1.702153 MHz	1	23.591	60	36.409	0.27
2.759301 MHz	1	31.175	60	28.825	0.303
11.413505 MHz	1	31.145	60	28.855	0.532

PR / OP0599499_CISPR32-LISN_Neutral_#20

CONDUCTED EMISSIONS - VOLTAGE
page 2 / 2



PR / OP0599499_CISPR32-LISN_Neutral_#20

CONDUCTED EMISSIONS - VOLTAGE

Project: *OP0599499* ***Customer:*** *Inogeni*

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: 4KX-PLUS
Manufacturer: Inogeni
Hardware Version:
Software Version:

CONDUCTED EMISSIONS MEASUREMENT: *OP0599499_CISPR32-LISN_Phase_#21*

Test Location: Anechoic chamber
Test Date: 2022-01-28 2:56:24 PM
Operator(s): Lyes Rahni
Test Standard: CISPR32 / Class A
Power: 230V/50Hz
Tested Line: Phase
Operating Mode:
Comments:

TEST PARAMETERS		TEST EQUIPMENT USED
Frequency Range 150 kHz - 30 MHz	Bandwidth 9 kHz	LF#1+LF#2 LISN : PMM L2-16B#20801-red Rohde & Schwarz : ESW44

FINAL RESULTS - QUASI-PEAK

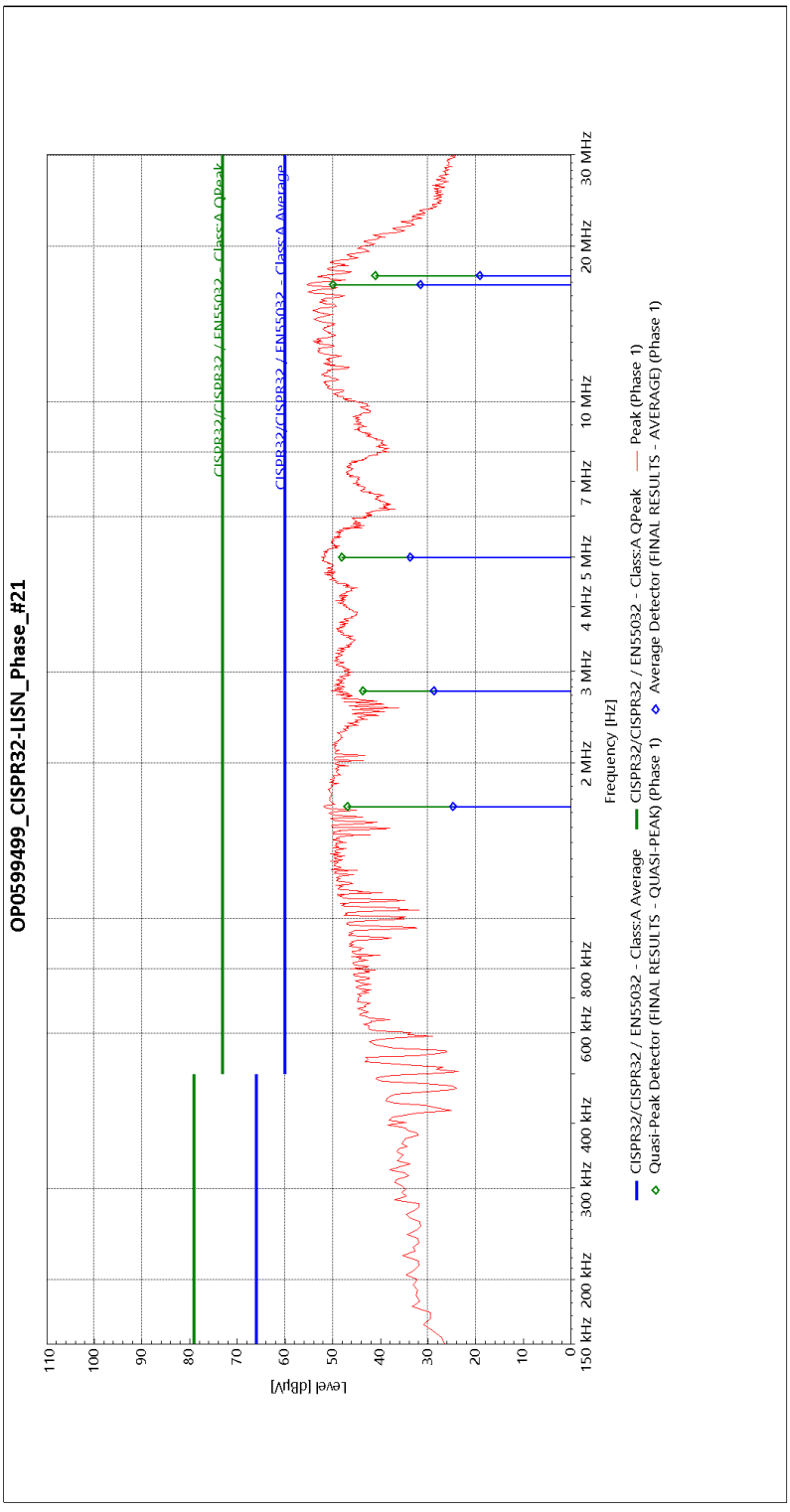
Frequency	SR #	Quasi-Peak Detector (dBµV)	Quasi-Peak Limit (dBµV)	Margin (dB)	Correction (dB)
1.643197 MHz	1	46.892	73	26.108	0.268
2.756247 MHz	1	43.678	73	29.322	0.308
4.991829 MHz	1	48.061	73	24.939	0.388
16.837528 MHz	1	49.958	73	23.042	0.871
17.540421 MHz	1	41.103	73	31.897	0.895

FINAL RESULTS - AVERAGE

Frequency	SR #	Average Detector (dBµV)	Average Limit (dBµV)	Margin (dB)	Correction (dB)
1.643197 MHz	1	24.781	60	35.219	0.268
2.756247 MHz	1	28.798	60	31.202	0.308
4.991829 MHz	1	33.771	60	26.229	0.388
16.837528 MHz	1	31.633	60	28.367	0.871
17.540421 MHz	1	19.134	60	40.866	0.895

PR / OP0599499_CISPR32-LISN_Phase_#21

CONDUCTED EMISSIONS - VOLTAGE
page 2 / 2



PR / OP0599499_CISPR32-LISN_Phase_#21

CONDUCTED EMISSIONS - VOLTAGE

Project: *OP0599499* ***Customer:*** *Inogeni*

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: 4KX-PLUS
Manufacturer: Inogeni
Hardware Version:
Software Version:

CONDUCTED EMISSIONS MEASUREMENT: *OP0599499_FCC-LISN_Phase_#22*

Test Location: Anechoic chamber
Test Date: 2022-01-28 3:08:39 PM
Operator(s): Lyes Rahni
Test Standard: FCC 15 Subpart B / Class A
Power: 120V/60Hz
Tested Line: Phase
Operating Mode:
Comments:

TEST PARAMETERS		TEST EQUIPMENT USED
Frequency Range 150 kHz - 30 MHz	Bandwidth 9 kHz	LF#1+LF#2 LISN : PMM L2-16B#20801-red Rohde & Schwarz : ESW44

FINAL RESULTS - QUASI-PEAK

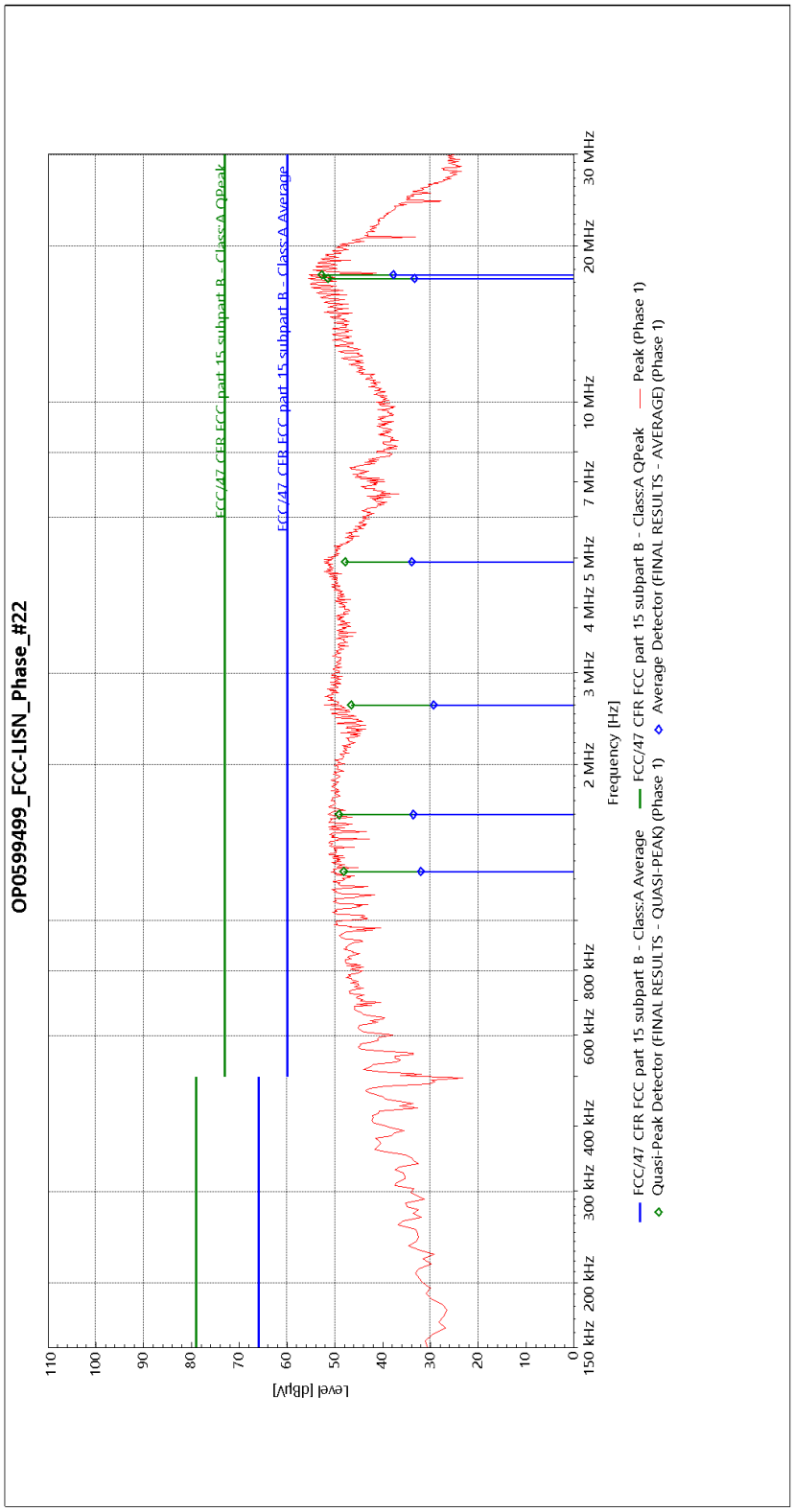
Frequency	SR #	Quasi-Peak Detector (dBµV)	Quasi-Peak Limit (dBµV)	Margin (dB)	Correction (dB)
1.241171 MHz	1	48.124	73	24.876	0.253
1.599159 MHz	1	49.12	73	23.88	0.267
2.600718 MHz	1	46.618	73	26.382	0.302
4.915543 MHz	1	47.833	73	25.167	0.385
17.275564 MHz	1	51.438	73	21.562	0.886
17.58262 MHz	1	52.769	73	20.231	0.897

FINAL RESULTS - AVERAGE

Frequency	SR #	Average Detector (dBµV)	Average Limit (dBµV)	Margin (dB)	Correction (dB)
1.241171 MHz	1	31.968	60	28.032	0.253
1.599159 MHz	1	33.615	60	26.385	0.267
2.600718 MHz	1	29.293	60	30.707	0.302
4.915543 MHz	1	33.921	60	26.079	0.385
17.275564 MHz	1	33.355	60	26.645	0.886
17.58262 MHz	1	37.729	60	22.271	0.897

PR / OP0599499_FCC-LISN_Phase_#22

CONDUCTED EMISSIONS - VOLTAGE
page 2 / 2



PR / OP0599499_FCC-LISN_Phase_#22

CONDUCTED EMISSIONS - VOLTAGE

Project: *OP0599499* ***Customer:*** *Inogeni*

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: 4KX-PLUS
Manufacturer: Inogeni
Hardware Version:
Software Version:

CONDUCTED EMISSIONS MEASUREMENT: *OP0599499_FCC - LISN_Neutral_#23*

Test Location: Anechoic chamber
Test Date: 2022-01-28 3:18:09 PM
Operator(s): Lyes Rahni
Test Standard: FCC 15 Subpart B / Class A
Power: 120V/60Hz
Tested Line: Neutral
Operating Mode: PSU CUI INK
Comments:

TEST PARAMETERS		TEST EQUIPMENT USED
Frequency Range 150 kHz - 30 MHz	Bandwidth 9 kHz	LF#1+LF#2 LISN : PMM L2-16B#20801-red Rohde & Schwarz : ESW44

FINAL RESULTS - QUASI-PEAK

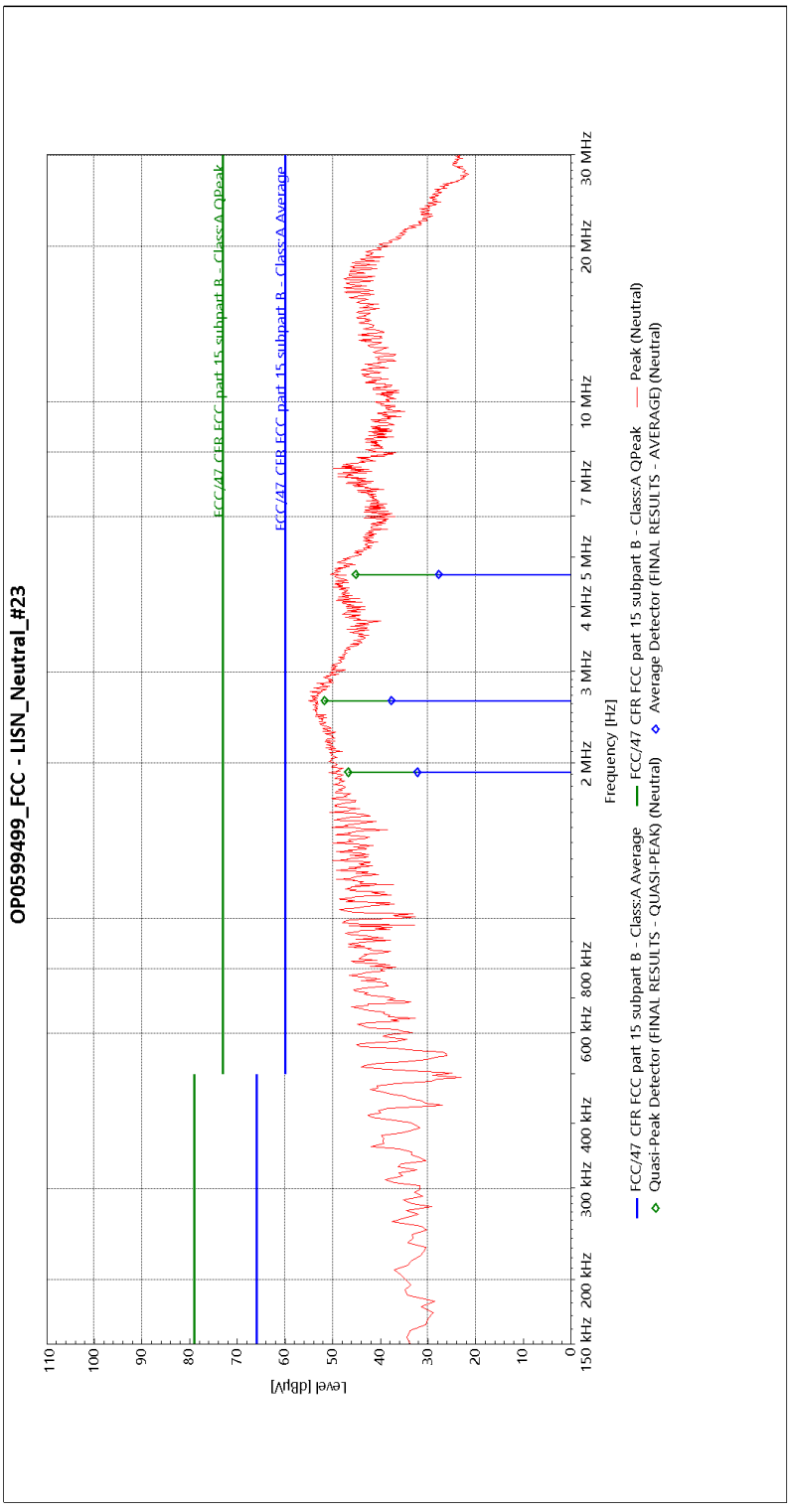
Frequency	SR #	Quasi-Peak Detector (dBµV)	Quasi-Peak Limit (dBµV)	Margin (dB)	Correction (dB)
1.915402 MHz	1	46.741	73	26.259	0.276
2.636872 MHz	1	51.725	73	21.275	0.301
4.628484 MHz	1	45.166	73	27.834	0.357

FINAL RESULTS - AVERAGE

Frequency	SR #	Average Detector (dBµV)	Average Limit (dBµV)	Margin (dB)	Correction (dB)
1.915402 MHz	1	32.21	60	27.79	0.276
2.636872 MHz	1	37.684	60	22.316	0.301
4.628484 MHz	1	27.722	60	32.278	0.357

PR / OP0599499_FCC - LISN_Neutral_#23

CONDUCTED EMISSIONS - VOLTAGE
page 2 / 2



PR / OP0599499_FCC - LISN_Neutral_#23

APPENDIX B
RADIATED EMISSIONS

RADIATED EMISSIONS – ELECTRIC FIELD

Project: *OP0599499* ***Customer:*** *Inogeni*

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: 4KX-PLUS
Manufacturer: Inogeni
Hardware Version:
Software Version:

RADIATED EMISSIONS MEASUREMENT: *OP0599499_CISPR32_FCC-Bilog_#24*

Test Location: Anechoic chamber
Test Date: 2022-01-28 4:15:33 PM
Operator(s): Lyes Rahni
Test Standard: CISPR32 / FCC part 15 subpart B / Class A
Power: 230V/50Hz
Operating Mode:
Comments:

TEST PARAMETERS

Frequency Range	Bandwidth	Test Distance
30 MHz - 1 GHz	120 kHz	3 m

TEST EQUIPMENT USED

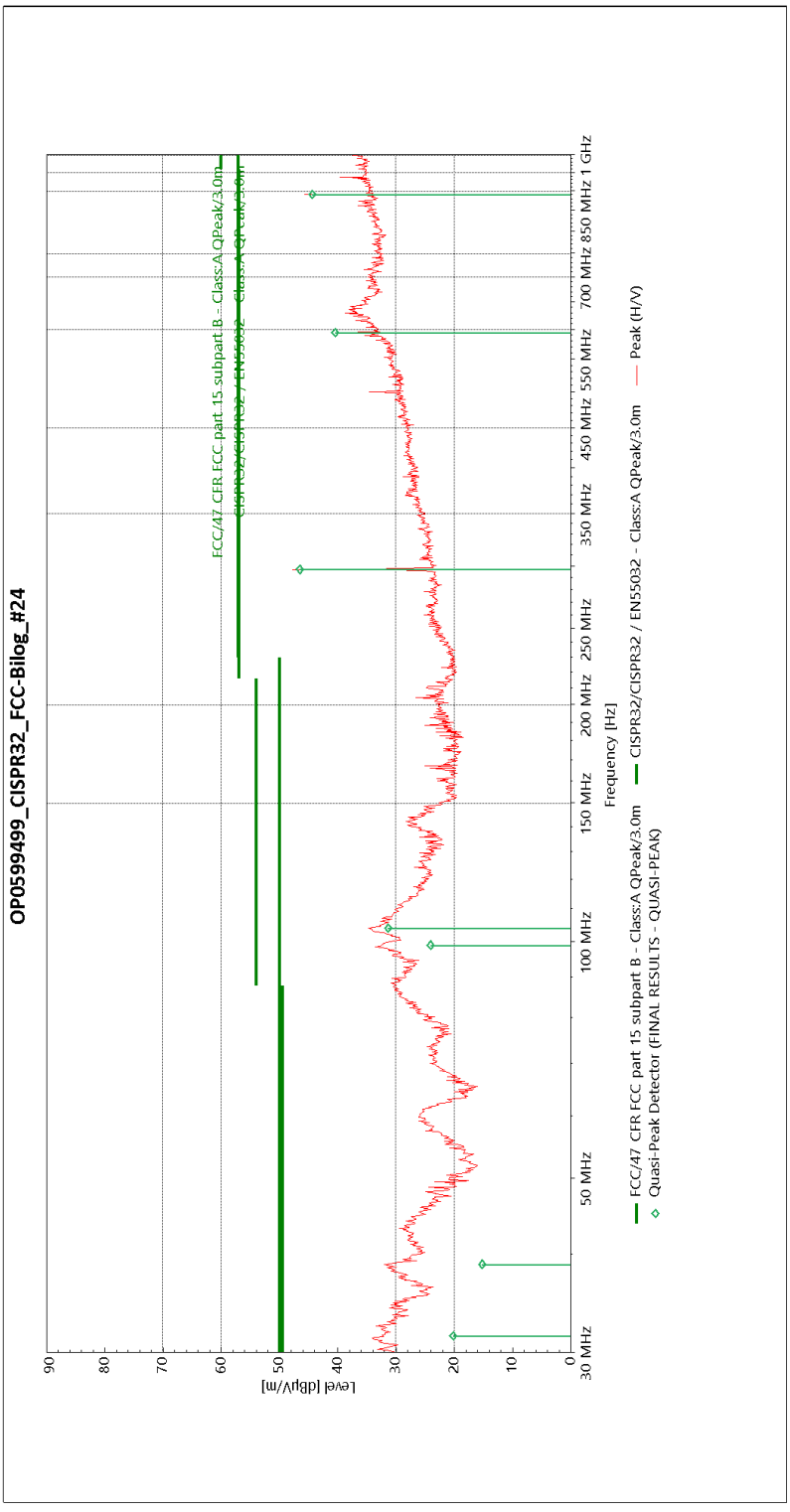
Antenna Mast : SUNOL
Bilog Antenna + 6dB : Schaffner CBL6112D#22617
HF#1 + HF#2
Rohde & Schwarz : ESW44
Turntable : SUNOL

FINAL RESULTS - QUASI-PEAK

Frequency	SR #	Quasi-Peak Detector (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)	Polarization	Azimuth (degree)	Height (m)	Correction (dB)
31.476148 MHz	1	20.183	50	29.817	Vertical	360	1	24.119
38.852177 MHz	1	15.236	50	34.764	Vertical	54.5	1.588	20.209
98.891698 MHz	1	24.069	50	25.931	Vertical	360	1.829	17.557
103.856016 MHz	1	31.333	50	18.667	Vertical	42.75	1.111	18.293
297.016479 MHz	1	46.529	57	10.471	Horizontal	7.75	1.11	20.689
594.0344 MHz	1	40.448	57	16.552	Vertical	246.75	1	27
891.050689 MHz	1	44.349	57	12.651	Horizontal	214.5	1.111	29.45

PR / OP0599499_CISPR32_FCC-Bilog_#24

RADIATED EMISSIONS – ELECTRIC FIELD
page 2 / 2



PR / OP0599499_CISPR32_FCC-Bilog_#24

RADIATED EMISSIONS – ELECTRIC FIELD

Project: *OP0599499* ***Customer:*** *Inogeni*

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: 4KX-PLUS
Manufacturer: Inogeni
Hardware Version:
Software Version:

RADIATED EMISSIONS MEASUREMENT: *OP0599499_CISPR32_FCC-Horn_#25*

Test Location: Anechoic chamber
Test Date: 2022-02-02 9:38:09 AM
Operator(s): Lyes Rahni
Test Standard: CISPR32 / FCC part 15 subpart B / Class A
Power: 230V/50Hz
Operating Mode:
Comments:

TEST PARAMETERS

Frequency Range	Bandwidth	Test Distance
1 GHz - 2 GHz	1 MHz	3 m

TEST EQUIPMENT USED

Antenna Mast : SUNOL
HF#1+HF#2 + HF-LNA + 3dB
Horn Antenna : TESEQ BHA9118
Rohde & Schwarz : ESW44
Turntable : SUNOL

FINAL RESULTS - PEAK

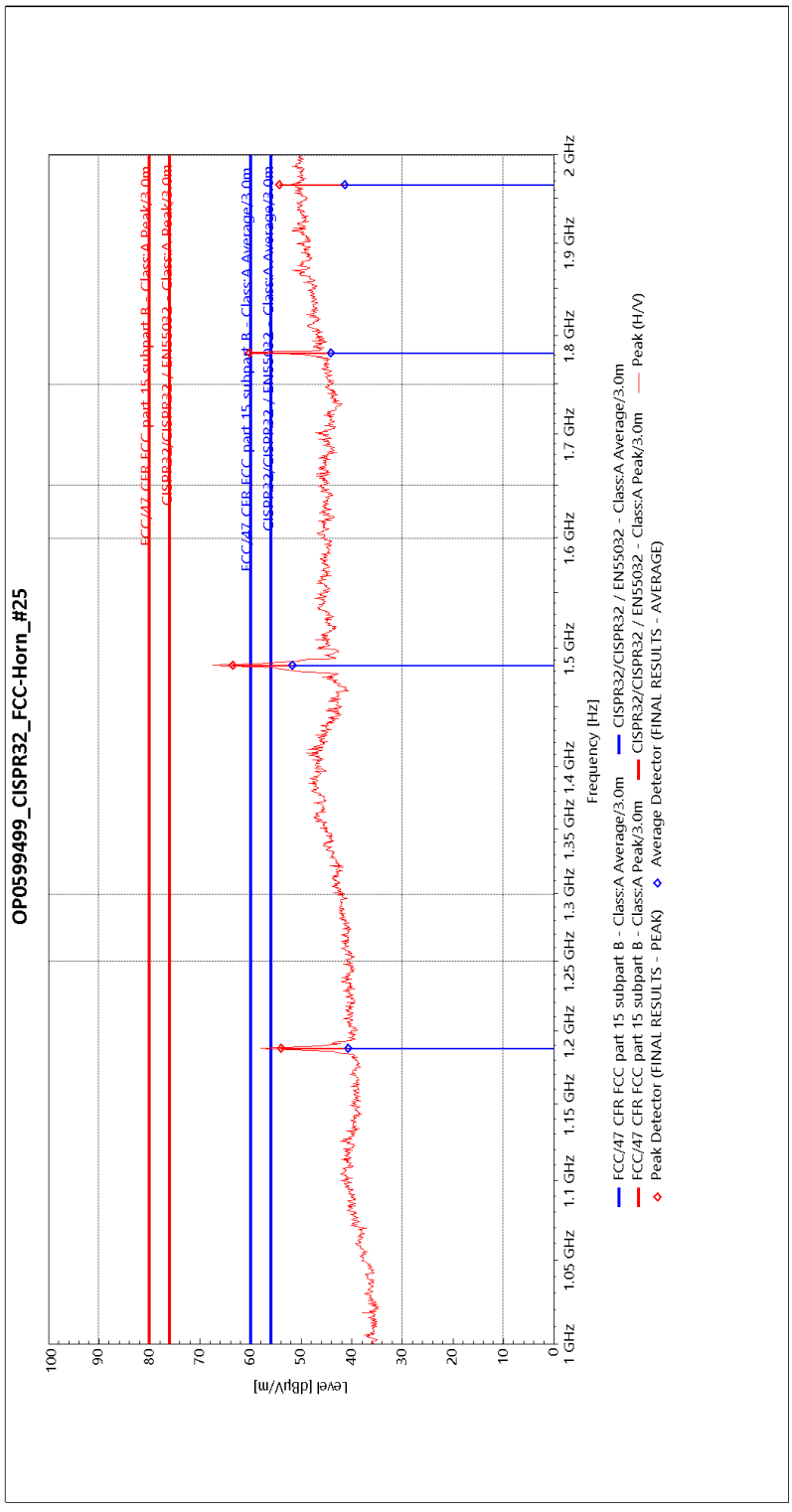
Frequency	SR #	Peak Detector (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Polarization	Azimuth (degree)	Height (m)	Correction (dB)
1.188067248 GHz	1	53.971	76	22.029	Vertical	17.75	3.505	-13.31
1.485085449 GHz	1	63.531	76	12.469	Vertical	337.5	2.372	-13.298
1.782100817 GHz	1	60.278	76	15.722	Horizontal	130.25	3.14	-12.05
1.965631445 GHz	1	54.313	76	21.687	Horizontal	56.25	2.793	-10.833

FINAL RESULTS - AVERAGE

Frequency	SR #	Average Detector (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Polarization	Azimuth (degree)	Height (m)	Correction (dB)
1.188067248 GHz	1	40.727	56	15.273	Vertical	17.75	3.505	-13.31
1.485085449 GHz	1	51.761	56	4.239	Vertical	337.5	2.372	-13.298
1.782100817 GHz	1	44.132	56	11.868	Horizontal	130.25	3.14	-12.05
1.965631445 GHz	1	41.408	56	14.592	Horizontal	56.25	2.793	-10.833

PR / OP0599499_CISPR32_FCC-Horn_#25

RADIATED EMISSIONS – ELECTRIC FIELD
page 2 / 2



PR / OP0599499_CISPR32_FCC-Horn_#25

APPENDIX C
HARMONIC CURRENT EMISSIONS LIMITS

Teseq Profline
4542 Luterbach, Switzerland

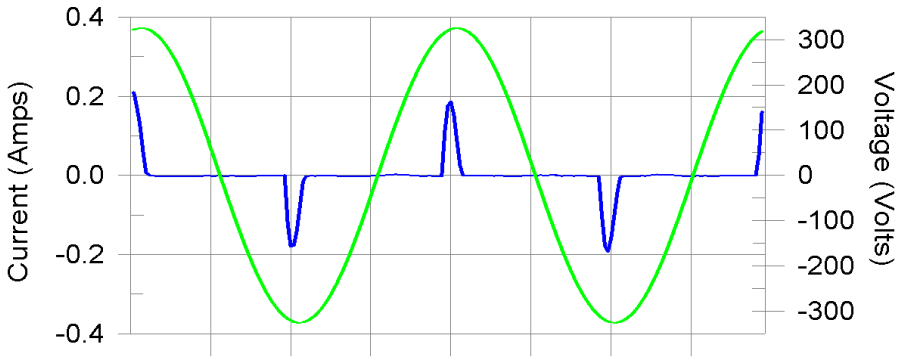
2/7/2022
3:45 PM

Harmonics – Class-A per Ed. 4.0 (2014)(Run time)

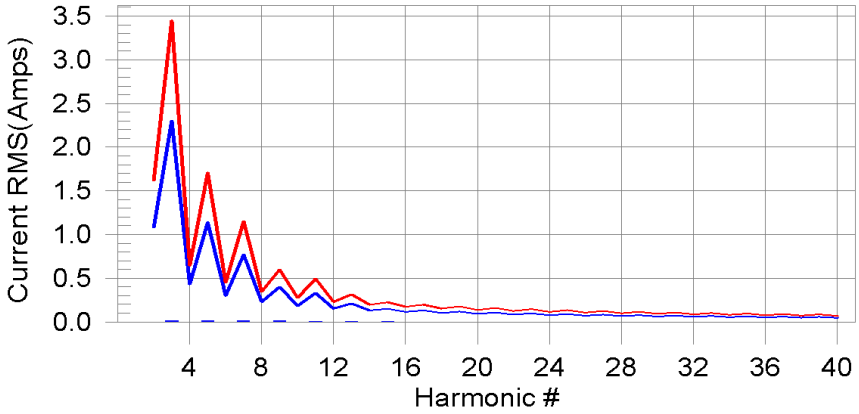
EUT: 4KX-PLUS **Tested by: Lyes Rahni**
Test category: Class-A per Ed. 4.0 (2014) (European limits) **Test Margin: 100**
Test date: 2/3/2022 **Start time: 4:31:43 AM** **End time: 4:42:04 AM**
Test duration (min): 10 **Data file name: H-000027.cts_data**
Comment: OP0599499
Customer: Inogeni

Test Result: Pass **Source qualification: Normal**

Current & voltage waveforms



Harmonics and Class A limit line **European Limits**



Test result: Pass Worst harmonic was #15 with 3.9% of the limit.

Teseq Profline
4542 Luterbach, Switzerland

2/7/2022
3:45 PM

Current Test Result Summary (Run time)

EUT: 4KX-PLUS **Tested by: Lyes Rahni**
Test category: Class-A per Ed. 4.0 (2014) (European limits) **Test Margin: 100**
Test date: 2/3/2022 **Start time: 4:31:43 AM** **End time: 4:42:04 AM**
Test duration (min): 10 **Data file name: H-000027.cts_data**
Comment: OP0599499
Customer: Inogeni

Test Result: Pass **Source qualification: Normal**
THC(A): 0.042 **I-THD(%): 202.0** **POHC(A): 0.000** **POHC Limit(A): 0.251**

Highest parameter values during test:

V_RMS (Volts):	230.47	Frequency(Hz):	50.00
I_Peak (Amps):	0.211	I_RMS (Amps):	0.047
I_Fund (Amps):	0.021	Crest Factor:	4.516
Power (Watts):	4.7	Power Factor:	0.439

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.000	1.080	N/A	0.000	1.620	N/A	Pass
3	0.020	2.300	0.9	0.020	3.450	0.6	Pass
4	0.000	0.430	N/A	0.000	0.645	N/A	Pass
5	0.019	1.140	1.6	0.019	1.710	1.1	Pass
6	0.000	0.300	N/A	0.001	0.450	N/A	Pass
7	0.017	0.770	2.2	0.017	1.155	1.5	Pass
8	0.000	0.230	N/A	0.000	0.345	N/A	Pass
9	0.015	0.400	3.8	0.015	0.600	2.6	Pass
10	0.000	0.184	N/A	0.000	0.276	N/A	Pass
11	0.013	0.330	4.0	0.013	0.495	2.7	Pass
12	0.000	0.153	N/A	0.000	0.230	N/A	Pass
13	0.011	0.210	5.2	0.011	0.315	3.5	Pass
14	0.000	0.131	N/A	0.000	0.197	N/A	Pass
15	0.009	0.150	5.8	0.009	0.225	3.9	Pass
16	0.000	0.115	N/A	0.000	0.173	N/A	Pass
17	0.007	0.132	4.9	0.007	0.198	3.3	Pass
18	0.000	0.102	N/A	0.000	0.153	N/A	Pass
19	0.005	0.118	N/A	0.005	0.178	N/A	Pass
20	0.000	0.092	N/A	0.000	0.138	N/A	Pass
21	0.003	0.107	N/A	0.003	0.161	N/A	Pass
22	0.000	0.084	N/A	0.000	0.125	N/A	Pass
23	0.002	0.098	N/A	0.002	0.147	N/A	Pass
24	0.000	0.077	N/A	0.000	0.115	N/A	Pass
25	0.002	0.090	N/A	0.002	0.135	N/A	Pass
26	0.000	0.071	N/A	0.000	0.107	N/A	Pass
27	0.002	0.083	N/A	0.002	0.125	N/A	Pass
28	0.000	0.066	N/A	0.000	0.099	N/A	Pass
29	0.002	0.078	N/A	0.002	0.116	N/A	Pass
30	0.000	0.061	N/A	0.000	0.092	N/A	Pass
31	0.002	0.073	N/A	0.002	0.109	N/A	Pass
32	0.000	0.058	N/A	0.000	0.086	N/A	Pass
33	0.002	0.068	N/A	0.002	0.102	N/A	Pass
34	0.000	0.054	N/A	0.000	0.081	N/A	Pass
35	0.001	0.064	N/A	0.001	0.096	N/A	Pass
36	0.000	0.051	N/A	0.000	0.077	N/A	Pass
37	0.001	0.061	N/A	0.001	0.091	N/A	Pass
38	0.000	0.048	N/A	0.000	0.073	N/A	Pass
39	0.001	0.058	N/A	0.001	0.087	N/A	Pass
40	0.000	0.046	N/A	0.000	0.069	N/A	Pass

Teseq Profline
4542 Luterbach, Switzerland

2/7/2022
3:45 PM

Voltage Source Verification Data (Run time)

EUT: 4KX-PLUS **Tested by: Lyes Rahni**
Test category: Class-A per Ed. 4.0 (2014) (European limits) **Test Margin: 100**
Test date: 2/3/2022 **Start time: 4:31:43 AM** **End time: 4:42:04 AM**
Test duration (min): 10 **Data file name: H-000027.cts_data**
Comment: OP0599499
Customer: Inogeni

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	230.47	Frequency(Hz):	50.00
I_Peak (Amps):	0.211	I_RMS (Amps):	0.047
I_Fund (Amps):	0.021	Crest Factor:	4.516
Power (Watts):	4.7	Power Factor:	0.439

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.025	0.461	5.53	OK
3	0.410	2.074	19.77	OK
4	0.027	0.461	5.91	OK
5	0.040	0.922	4.32	OK
6	0.028	0.461	6.03	OK
7	0.024	0.691	3.42	OK
8	0.007	0.461	1.54	OK
9	0.021	0.461	4.58	OK
10	0.007	0.461	1.56	OK
11	0.013	0.230	5.60	OK
12	0.012	0.230	5.05	OK
13	0.009	0.230	3.84	OK
14	0.004	0.230	1.67	OK
15	0.006	0.230	2.51	OK
16	0.012	0.230	5.05	OK
17	0.006	0.230	2.56	OK
18	0.015	0.230	6.66	OK
19	0.006	0.230	2.53	OK
20	0.013	0.230	5.51	OK
21	0.007	0.230	3.06	OK
22	0.003	0.230	1.41	OK
23	0.003	0.230	1.22	OK
24	0.003	0.230	1.31	OK
25	0.002	0.230	1.02	OK
26	0.002	0.230	0.84	OK
27	0.006	0.230	2.77	OK
28	0.002	0.230	0.69	OK
29	0.004	0.230	1.55	OK
30	0.003	0.230	1.21	OK
31	0.003	0.230	1.45	OK
32	0.001	0.230	0.54	OK
33	0.003	0.230	1.33	OK
34	0.001	0.230	0.52	OK
35	0.004	0.230	1.64	OK
36	0.002	0.230	0.86	OK
37	0.005	0.230	2.02	OK
38	0.002	0.230	0.84	OK
39	0.004	0.230	1.75	OK
40	0.005	0.230	2.15	OK

APPENDIX D
VOLTAGE FLUCTUATIONS AND FLICKER LIMITATIONS

Teseq Profline
4542 Luterbach, Switzerland

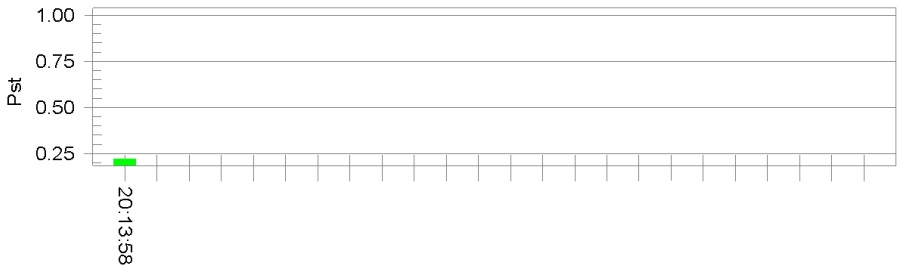
2/7/2022
3:46 PM

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

EUT: 4KX-PLUS **Tested by: Lyes Rahni**
Test category: All parameters (European limits) **Test Margin: 100**
Test date: 2/3/2022 **Start time: 8:03:28 PM** **End time: 8:13:59 PM**
Test duration (min): 10 **Data file name: F-000031.cts_data**
Comment: Flickers Pst
Customer: OP0599499 Inogeni

Test Result: Pass **Status: Test Completed**

Pst and limit line **European Limits**



Plt and limit line

Parameter values recorded during the test:

Vrms at the end of test (Volt):	**230.41**			
Highest dt (%):	**0.00**	**Test limit (%):**	**N/A**	**N/A**
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.03**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.224**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.098**	**Test limit:**	**0.650**	**Pass**

Teseq AG Win2100 V4.9.0 Page 1 of 1

Teseq Profline
4542 Luterbach, Switzerland

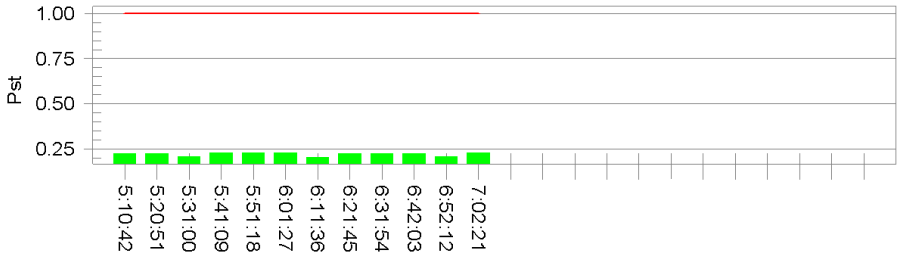
2/7/2022
3:46 PM

Flicker Test Summary per EN/IEC61000-3-3 Ed. 3.0 (2013) (Run time)

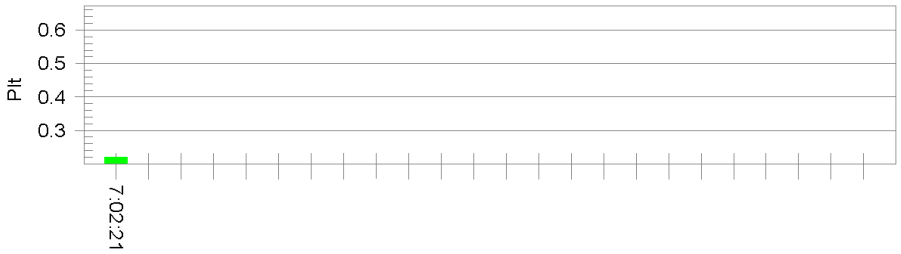
EUT: 4KX-PLUS **Tested by: Lyes Rahni**
Test category: All parameters (European limits) **Test Margin: 100**
Test date: 2/3/2022 **Start time: 5:00:12 AM** **End time: 7:02:23 AM**
Test duration (min): 120 **Data file name: F-000030.cts_data**
Comment: Flickers Plt
Customer: OP0599499 Inogeni

Test Result: Pass **Status: Test Completed**

Pst and limit line **European Limits**



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt):	**230.43**			
Highest dt (%):	**0.00**	**Test limit (%):**	**N/A**	**N/A**
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.09**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.229**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.222**	**Test limit:**	**0.650**	**Pass**

Teseq AG Win2100 V4.9.0 Page 1 of 1

APPENDIX E
CLIENT DOCUMENTATION

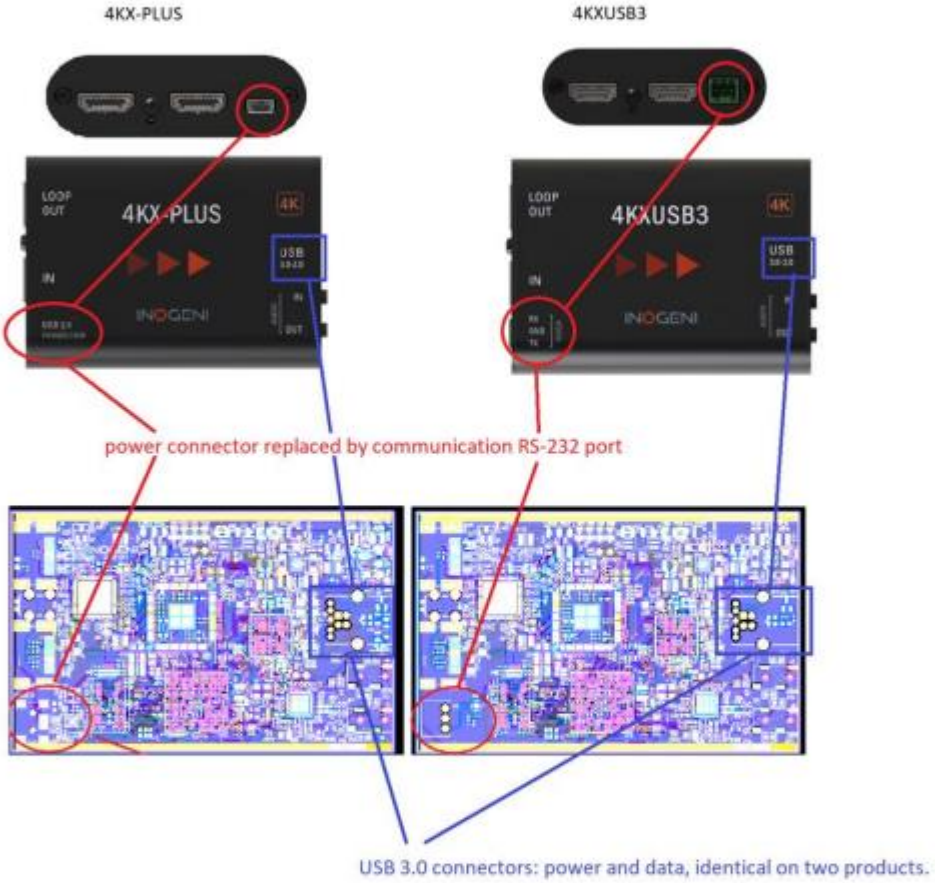
The following documentation was provided by manufacturer for internal information.
NTS Canada did not verify and so does not take the responsibility of this information.

Difference between 4KX-PLUS and 4KXUSB3

2 differences :

1 – The mini-USB power connector, on the 4KX-PLUS, is replaced by a RS-232 communication port, on the 4KXUSB3. See RED circles in the drawing.

2 – The pcbs are identical, except for that small area in RED for the above.



Considering:

- that the RS-232 communication is very low frequency (9600 bauds)
- that the circuit is in an isolated area on the pcb
- that the maximum RS232 cable length is limited at 3m

We consider that the EMC qualification of 4KXUSB3 is representative of 4KX-PLUS EMC compliance.

Gilles Chouinard – 25 oct 2022

END OF TEST REPORT