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EMC/EMI Test Report

Tested Product:

4K2USB3

representative of HD2USB3

Test Report TR-0599498_R3

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REVISION HISTORY

Revision	Description	Date
0	Initial Release	2021-12-09
1	EUT's name modification	2022-05-16
2	Declaration of manufacturer added (4K2USB3 is representative of HD2USB3)	2022-09-09
3	Updated ICES-003 standard	2023-08-25

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1 INTRODUCTION

This test report describes EMC tests on the product 4K2USB3:

- 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:

- EN55032 (2015) A11 (2020) – *Electromagnetic compatibility of multimedia equipment - Emission requirements*
- EN55035 (2017) A11 (2020) – *Electromagnetic compatibility of multimedia equipment – Immunity requirements*

As per manufacturer declaration, there is no mechanical and electrical differences between 4K2USB3 and HD2USB3. HD2USB3 is a limited features edition of the 4K2USB3.

All qualification tests will be performed on 4K2USB3, which is considered a representative of HD2USB3 product.

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
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

3 PROJECT DATES

RECEPTION DATE(S)
(yyyy-mm-dd)

2021-12-06 (LABCEM#3287)

TESTS DATE(S)
(yyyy-mm-dd)

From 2021-12-06 to 2021-12-07 (LABCEM#3287)

4 DESCRIPTION OF EQUIPMENT UNDER TEST

4.1 EUT

TYPE:	Toggle Switch for video streaming
PRODUCT NAME:	4K2USB3
MANUFACTURER:	Inogeni
LABCEM NUMBER:	LABCEM#3287
PART NUMBER:	4K2USB3
SERIAL NUMBER:	4KM131143
VOLTAGE RATING:	USB Powered
EUT SIZE:	Width = 8cm Height = 2cm Depth = 7cm
FIRMWARE:	8.39
HIGHEST INTERNAL FREQUENCY:	333MHz



Photo 1: EUT



Photo 2: EUT – S/N

4.2 Support Equipment

EUT was exercised with support equipment supplied by client.



Photo 3: Support Equipment – Laptop



Photo 4: Support Equipment – HDMI Pattern Generator

4.3 EUT Setup Diagram

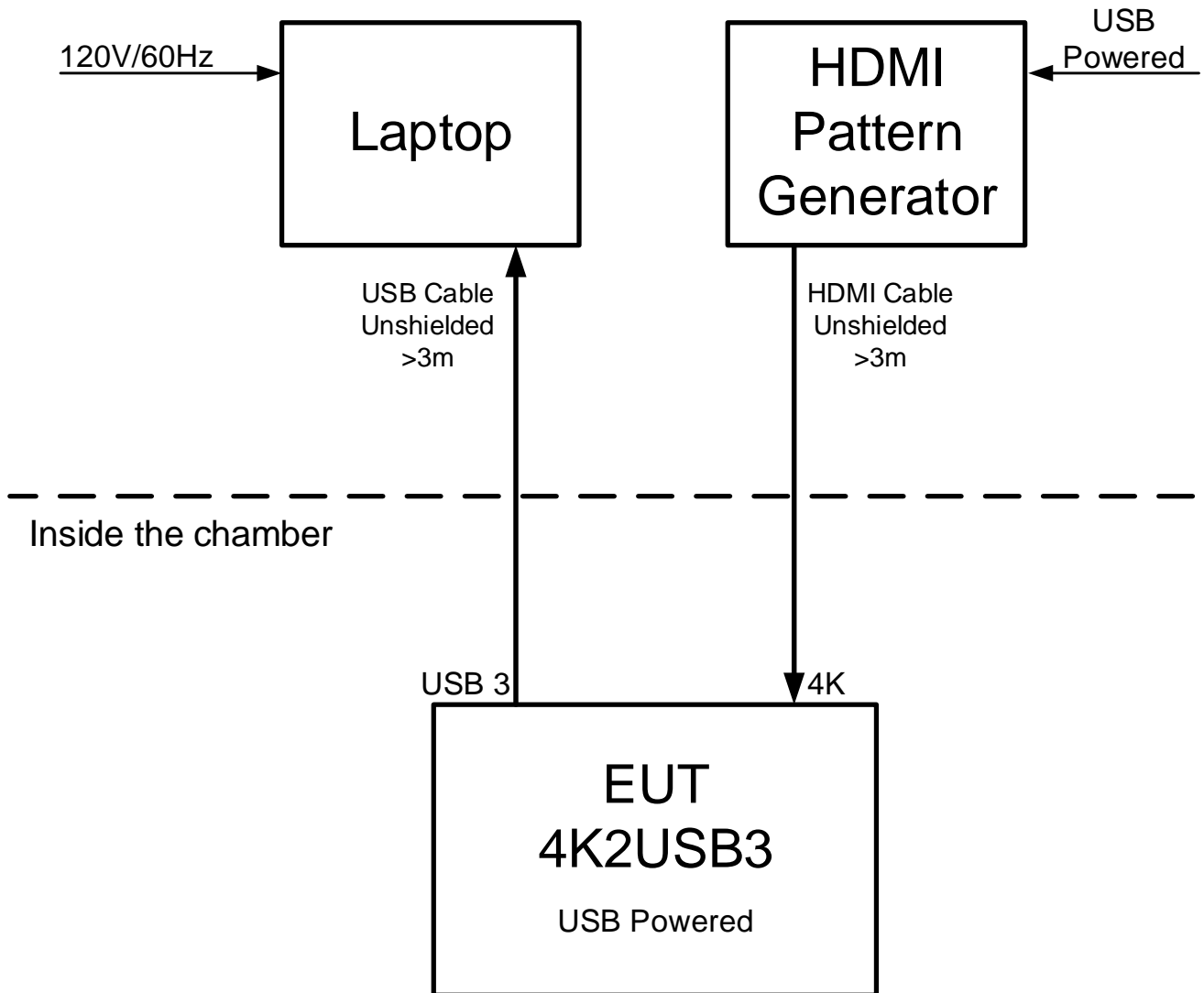
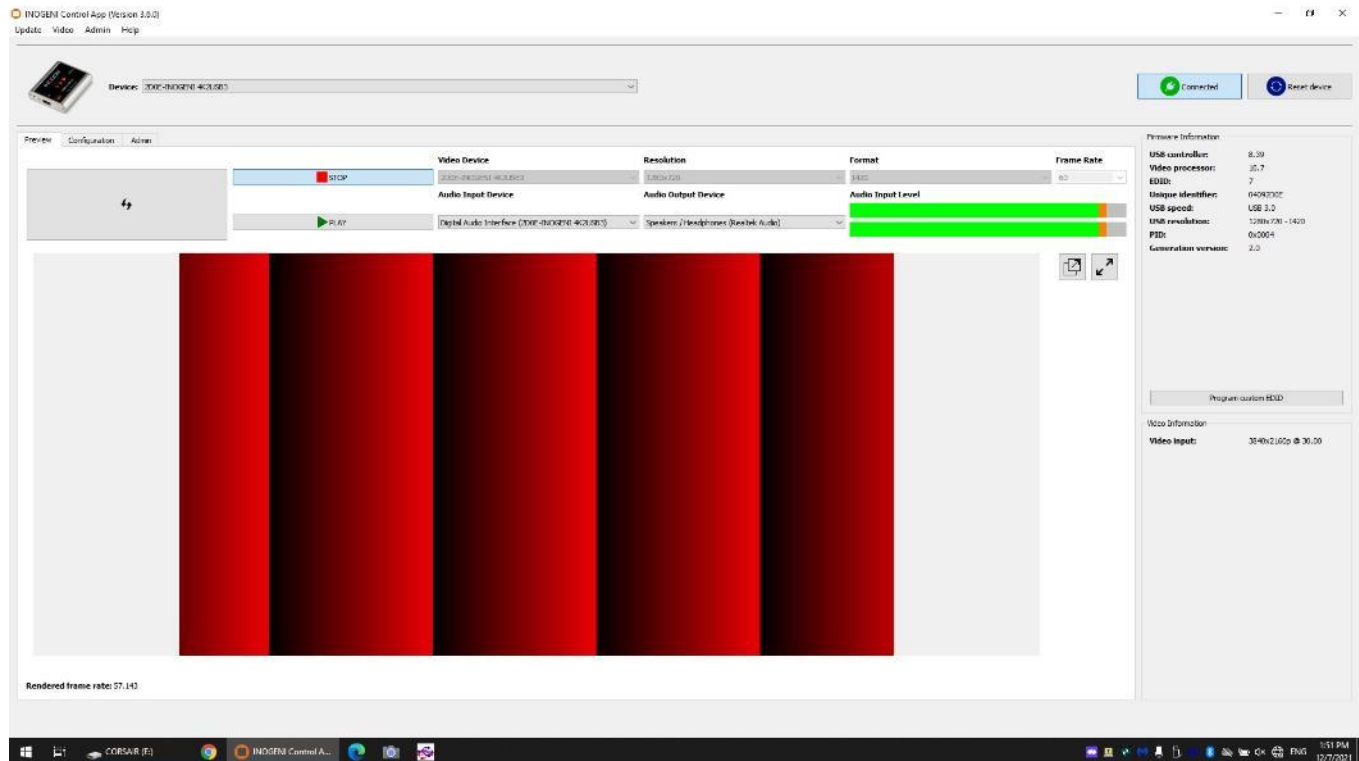


Figure 1: EUT Setup Diagram

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, HD). 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 and the Rendered Frame Rate on the software.

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 Rendered Frame Rate has to be higher than 30 frames per second.

The performance criteria for the evaluation of the immunity test results are defined by EN55035 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 (dB μ V) =	Value Reading at the EMI receiver (dB μ V) + Correction Factor (dB)
Correction Factor (dB) =	LISN Attenuation (dB) + Cable Loss (dB) – Amplifier Gain (dB) + Attenuator (dB)
Margin (dB) =	Conducted Emission Level (dB μ V) – Limit Value (dB μ V)

Table 1: Example of Conducted Emissions Margin Calculation

Radiated Emission Level (dB μ V/m) =	Value reading at the EMI receiver (dB μ V) + Antenna Factor (dB/m) + Correction Factor (dB)
Correction Factor (dB) =	Cable Loss (dB) – Amplifier Gain (dB) + Attenuator (dB)
Margin (dB) =	Radiated Emission Level (dB μ V/m) – Limit Value (dB μ V/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 (2020) subpart B	Test NOT APPLICABLE. EUT powered from an USB cable.			
Radiated Emissions FCC part 15 (2020) subpart B	Class A 30MHz-2GHz	N/A	4KM131143	Pass
Conducted Emissions ICES-003 Issue 7 (2020)	Test NOT APPLICABLE. EUT powered from an USB cable.			
Radiated Emissions ICES-003 Issue 7 (2020)	Class A 30MHz-2GHz	N/A	4KM131143	Pass
Conducted Emissions EN55032 (2015) A11 (2020)	Test NOT APPLICABLE, EUT powered from an USB cable.			
Radiated Emissions EN55032 (2015) A11 (2020)	Class A 30MHz-2GHz	N/A	4KM131143	Pass
Harmonic Current Emission Limits IEC61000-3-2 (2018)	Test NOT APPLICABLE. EUT powered from an USB cable.			
Voltage Fluctuations and Flicker Limitations IEC61000-3-3 (2013) A1 (2017)	Test NOT APPLICABLE. EUT powered from an USB cable.			
Electrostatic Discharge Immunity IEC61000-4-2 (2008)	Contact: $\pm 4\text{kV}$ Air: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$	B	4KM131143	Pass
Radiated Electromagnetic Field Immunity IEC61000-4-3 (2020)	80MHz-1000MHz: 3V/m Discrete Frequencies, 3V/m 1800MHz, 2600MHz 3500MHz, 5000MHz	A	4KM131143	Pass
Electrical Fast Transient Immunity IEC61000-4-4 (2012)	Power: N/A I/O Ports: $\pm 0.5\text{kV}$ / 5kHz Communication Ports: N/A	B	4KM131143	Pass
Surge Immunity IEC61000-4-5 (2014) A1 (2017) EN61000-4-5 (2014) A1 (2017)	Test NOT APPLICABLE. EUT powered from an USB cable.			
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields IEC61000-4-6 (2013)	Power: N/A I/O Ports: 3V Communication Ports: N/A	A	4KM131143	Pass
Power Frequency Magnetic Field Immunity IEC61000-4-8 (2009)	Continuous Field: 1A/m / 50Hz & 60Hz	A	4KM131143	Pass
Voltage Dips, Short Interruptions and Voltage Variation Immunity on AC Input IEC61000-4-11 (2004) A1 (2017)	Test NOT APPLICABLE. EUT powered from an USB cable.			

Table 4: Test Summary

10 EMISSIONS TESTS**10.1 Radiated Emissions****10.1.1 Test Details**

REFERENCE STANDARD	ANSI C63.4 (2014) EN55032 (2015) A11 (2020)
SPECIFICATIONS	
Limit	FCC part 15 subpart B (2020) class A ICES-003 Issue 7 (2020) class A EN55032 (2015) A11 (2020) class A
Frequency Range	30MHz – 1GHz (EN55032 / FCC / ICES-003) 1GHz - 2GHz (EN55032 / FCC / ICES-003)
Measurement Distance	3m
Installation	Table-top equipment
EUT	
Identification	4K2USB3
Voltage Input	USB Powered
TEST INFO	
Test Date (yyyy-mm-dd)	2021-12-06
Temperature °C (For Info Only)	23.8°C
Relative humidity % (For Info Only)	21.4%
Atmospheric pressure kPa (For Info Only)	100.4kPa
Operator	Jean Cadotte
Client Witness	Denis Alain (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)
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 v3.21.0.22	N/A	N/A	N/A
Rohde&Schwarz	EMI receiver	ESW44	101905	12	2022-01-27
Schaffner	Bilog antenna	CBL6112D	22617	24	2023-06-28
TESEQ	Horn antenna	BHA9118	33053	24	2022-10-21
Ampical	Amplifier 1GHz-18GHz	AMP1G18-30-N/PSU	121212	12	2022-01-15

Table 5: Radiated Emissions – Test Equipment

10.1.3 Test Results

Frequency (MHz)	Quasi-Peak Limit extrapolated at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/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 6: Radiated Emissions – Test Results – FCC Part 15 Subpart B / ICES-003 Class A

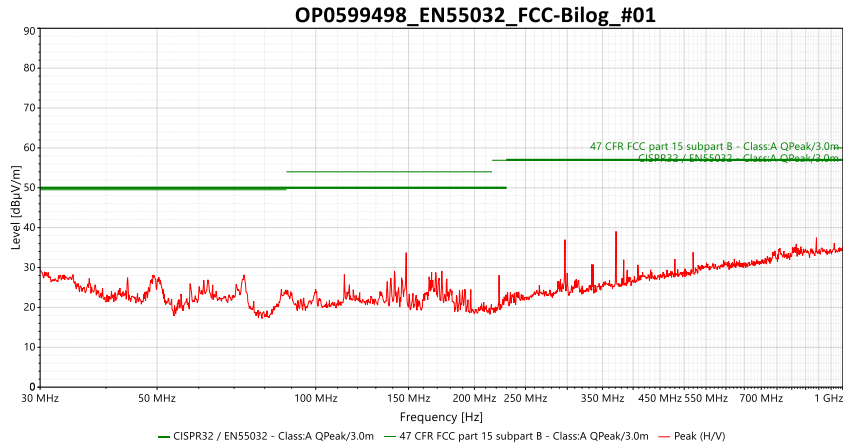
Frequency (MHz)	Quasi-Peak Limit extrapolated at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Results
30 – 230	50	-	-	Pass
230 – 1000	57	-	-	
1000 – 2000	-	56	76	Pass

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.

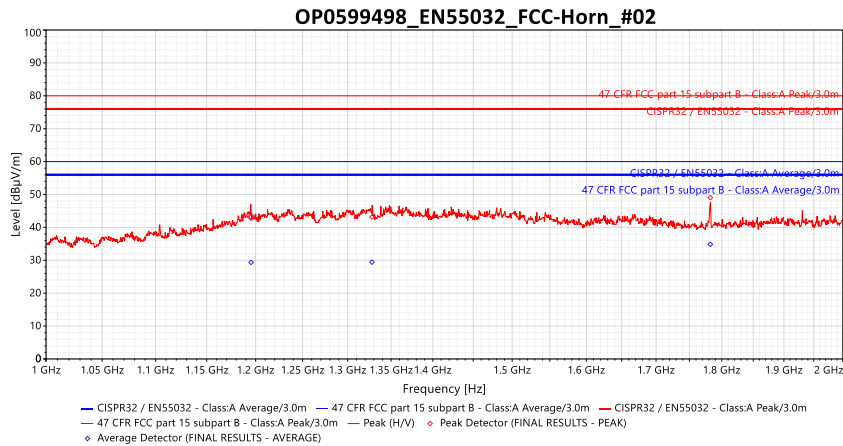
Table 7: Radiated Emissions – Test Results – EN 55032 Class A

10.1.4 Test Data

See APPENDIX A for data files.



Graph 1: Radiated Emissions 30MHz-1GHz



Graph 2: Radiated Emissions 1GHz-2GHz

Frequency (MHz)	Detector	Level (dB μ V/m)	Limit (dB μ V/m)	Bandwidth (kHz)	Measurement Time(s)	Margin (dB)
30-1000 Note 1	Quasi-Peak	-	-	120	15	-
1782.1	Average	34.865	60.00	1000	15	25.135

Note 1: No significant emission was noted

Table 8: Radiated Emissions – Lowest Margin according to FCC Part 15 Subpart B / ICES-003

Frequency (MHz)	Detector	Level (dB μ V/m)	Limit (dB μ V/m)	Bandwidth (kHz)	Measurement Time(s)	Margin (dB)
30-1000 Note 1	Quasi-Peak	-	-	120	15	-
1782.1	Average	34.865	56	1000	15	21.135

Note 1: No significant emission was noted

Table 9: Radiated Emissions – Lowest Margin according to EN55032



Photo 5: Radiated Emissions – Test Setup



Photo 6: Radiated Emissions – Test Setup 30MHz-1GHz

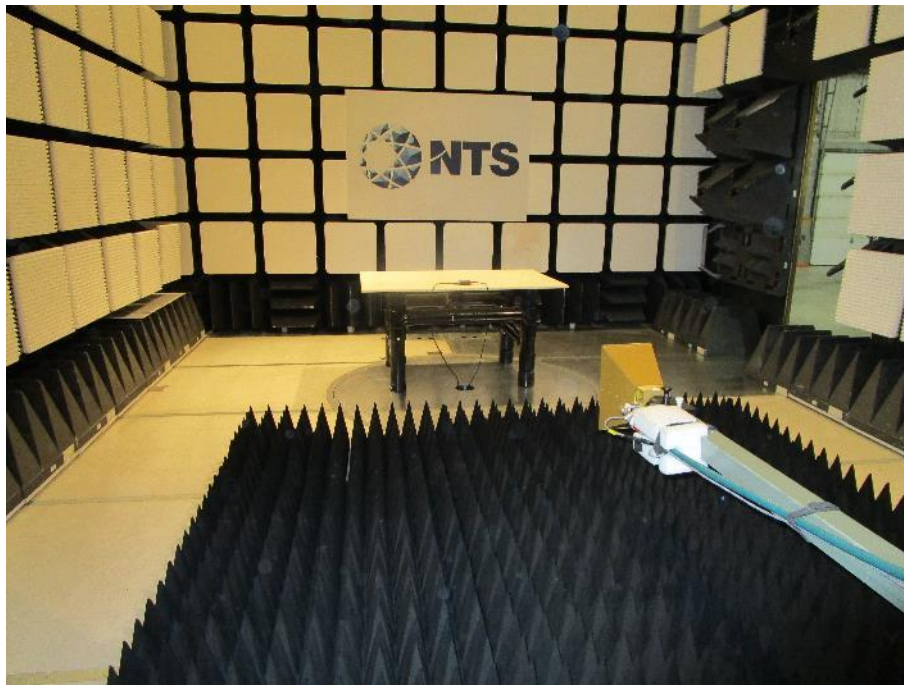


Photo 7: Radiated Emissions – Test Setup 1GHz-2GHz

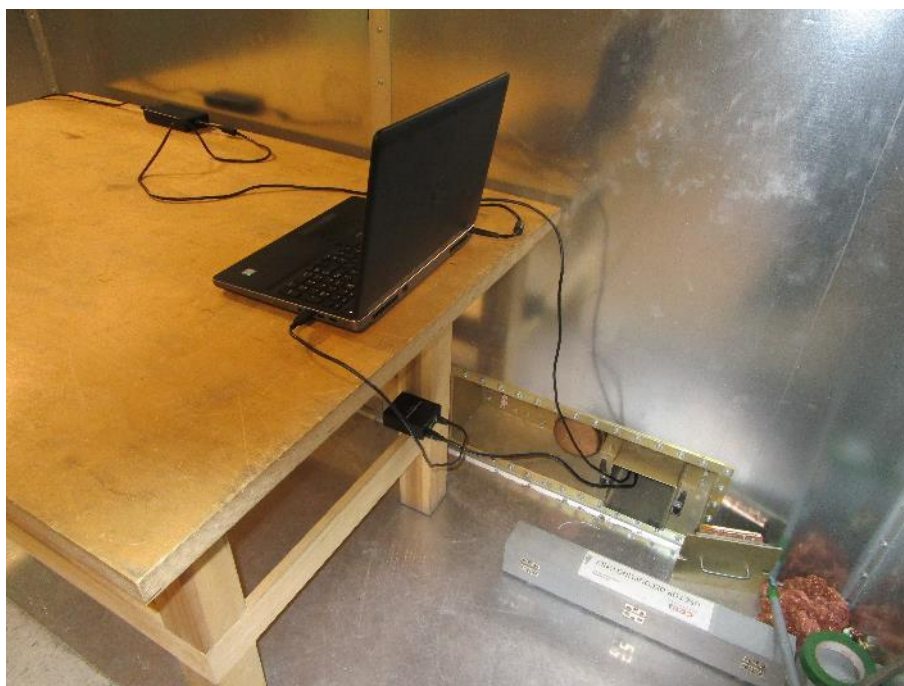


Photo 8: Radiated Emissions – Support Equipment

10.1.5 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.

11 IMMUNITY TESTS**11.1 Electrostatic Discharge Immunity****11.1.1 Test Details**

REFERENCE STANDARD	IEC61000-4-2 (2008)
---------------------------	---------------------

SPECIFICATIONS	
Test Level	Contact: $\pm 4\text{kV}$ Air: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$
Installation	Table-top equipment
Ungrounded Equipment	YES

PERFORMANCE CRITERION	B
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EUT	
Identification	4K2USB3
Voltage Input	USB Powered

TEST INFO	
Test Date (yyyy-mm-dd)	2021-12-06
Temperature Min 15°C – Max 35°C	25.8°C
Relative Humidity Min 30% - Max 60%	45.0%
Atmospheric Pressure Min 86kPa – Max 106kPa	100.4kPa
Operator	Jean Cadotte
Client Witness	Denis Alain (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	2076	12	2022-08-18
EMC-Partner	Relay Module	ESD3000RM32	1822	12	2022-08-18
EMC-Partner	Discharge Network 150pF/330Ohms	ESD3000DN1	1777	12	2022-08-18

Table 10: 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	No event	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.

Table 11: ESD – Test Results – Indirect Discharges

ESD Point	ESD Type	Test Level (kV)	Number	Time Interval (s)	Generator Perpendicular	Comments	Results
C1, C2, C4	Contact	±4	10+ / 10-	1	YES	Note 1	Pass
C3, C5, C6, C7, C8, C9, C10	Contact	±4	10+ / 10-	1	YES	No event	Pass
A1, A2	Air	±2, ±4, ±8	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: Self-recoverable degradation: For a few times, the picture was lost during a split of a second. This test result is considered as a Pass according to performance criteria defined in section 5

Table 12: ESD – Test Results – Direct Discharges

11.1.4 Test Data



Photo 9: ESD – Test Setup

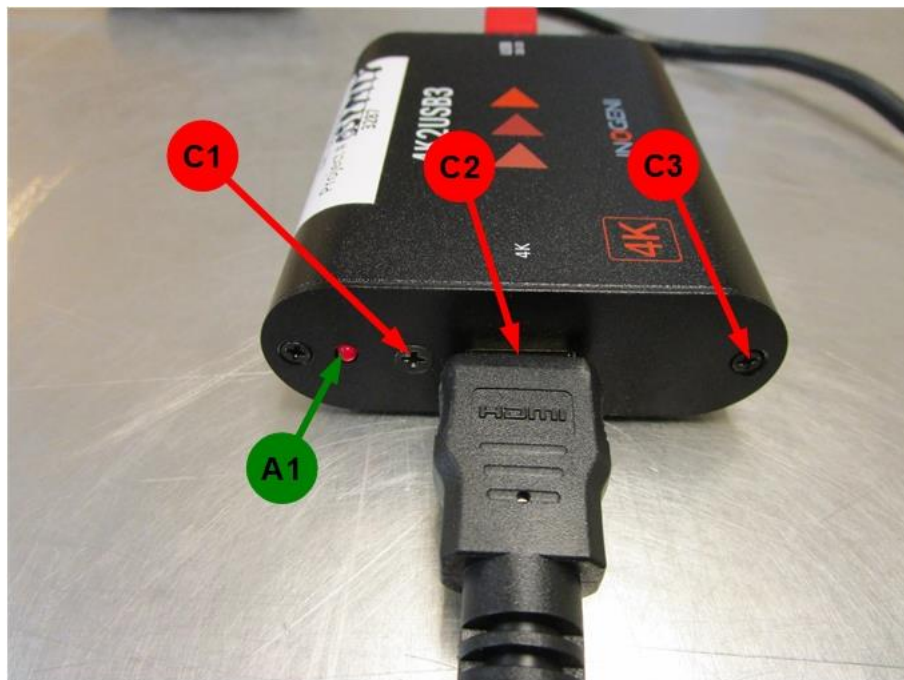


Photo 10: ESD – Location of Discharge Points #1

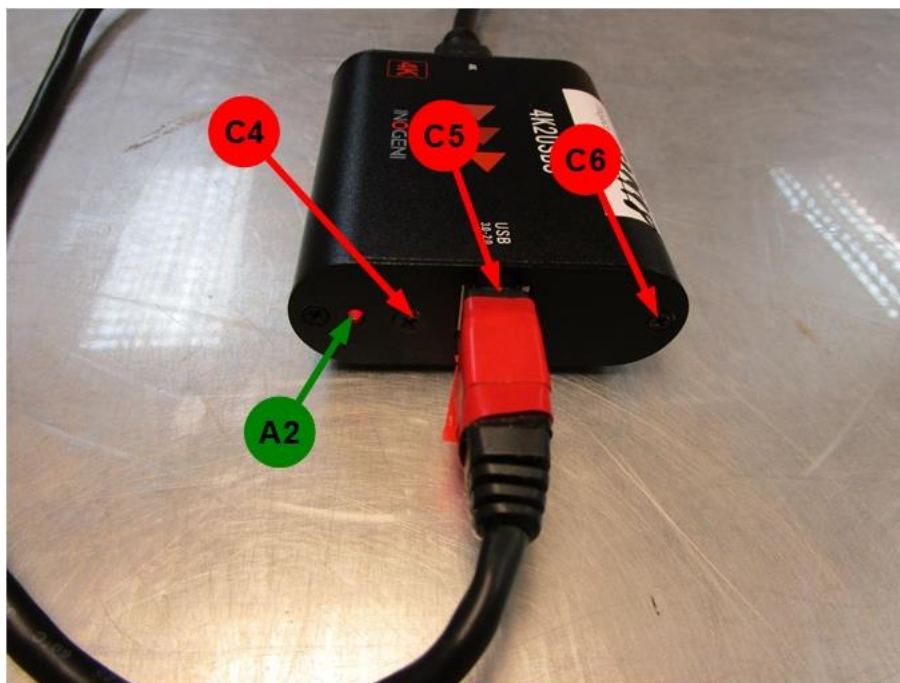


Photo 11: ESD – Location of Discharge Points #2

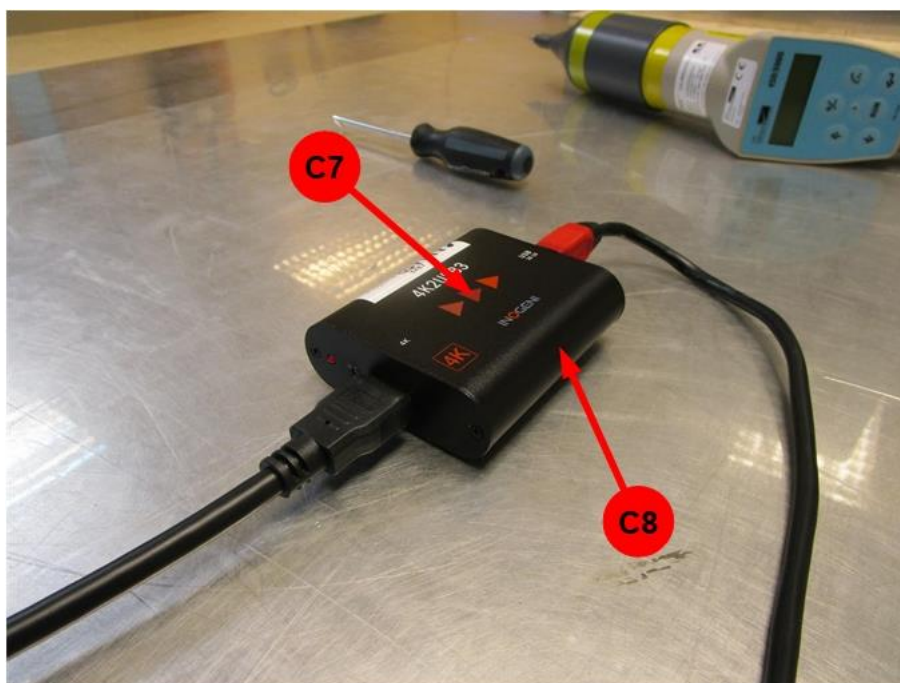


Photo 12: ESD – Location of Discharge Points #3

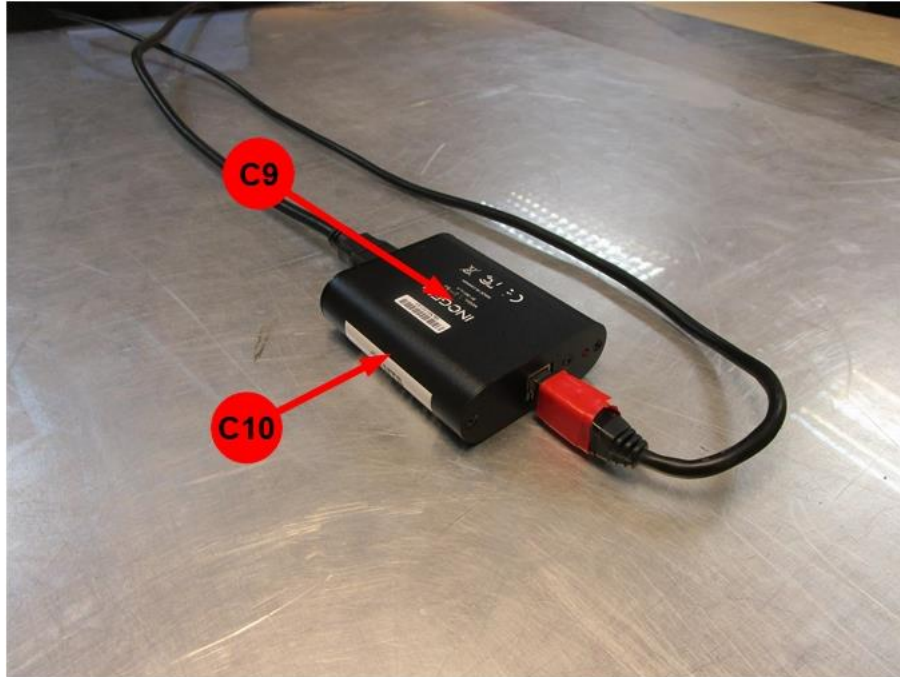


Photo 13: ESD – Location of Discharge Points #4

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	IEC61000-4-3 (2020)	
SPECIFICATIONS		
TEST	#1	
Frequency Range	80MHz-1000MHz	
Test Level	3V/m	
Test Distance	2m	
Uniformity Field Area	1.5m x 1.5m	
Modulation	AM 80% / 1kHz	
Frequency Step	1%	
Dwell Time	0.5s	
TEST	#2	#3
Frequencies	1800MHz, 2600MHz	3500MHz, 5000MHz
Test Level	3V/m	1V/m
Test Distance	2m	2.7m
Uniformity Field Area	1.5m x 1.5m	1.5m x 1.5m
Modulation	AM 80% / 1kHz	
Dwell Time	10s	
Illuminated Face	6	
Installation	Table-top equipment	
PERFORMANCE CRITERION	A	

EUT	
Identification	4K2USB3
Voltage Input	USB Powered

TEST INFO	
Test Date (yyyy-mm-dd)	2021-12-07
Temperature °C (For Info Only)	23.3°C
Relative humidity % (For Info Only)	21.2%
Atmospheric pressure kPa (For Info Only)	100.5kPa
Operator	Jean Cadotte
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 v3.21.0.22	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	2022-11-01
Werlatone	Directional coupler (0.8GHz-3GHz)	C6721-10	98746	12	2022-11-01
Agilent	Directional coupler (2GHz-18GHz)	773D	MY28390533	12	2022-11-01
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	2022-01-06
LABCEM	RF Uniformity Field 1GHz-3GHz (18V/m)	N/A	N/A	12	2022-01-06
LABCEM	RF Uniformity Field 3GHz-6GHz (9V/m)	N/A	N/A	12	2022-01-08

Table 13: 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 Note1	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event Note1	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	No event Note1	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	Pass
	1800, 2600	3	AM / 1kHz	Horizontal Vertical	No event	Pass
	3500, 5000	3	AM / 1kHz	Horizontal Vertical	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: 1m of cable was exposed to the electromagnetic field						

Table 14: Radiated EM Field – Test Results

11.2.4 Test Data



Photo 14: Radiated EM Field – Test setup – Front



Photo 15: Radiated EM Field – Test setup – Right



Photo 16: Radiated EM Field – Test setup – Rear



Photo 17: Radiated EM Field – Test setup – Left



Photo 18: Radiated EM Field – Test setup – Top



Photo 19: Radiated EM Field – Test setup – Bottom



Photo 20: 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	IEC61000-4-4 (2012)
SPECIFICATIONS	
Test Level	Power Ports: N/A I/O Ports: $\pm 0.5\text{kV}$ Communication Ports: N/A
Repetition Frequency	5kHz
Installation	Table-top equipment
PERFORMANCE CRITERION	B
EUT	
Identification	4K2USB3
Voltage Input	USB Powered
TEST INFO	
Test Date (yyyy-mm-dd)	2021-12-06
Temperature °C (For Info Only)	26.5°C
Relative humidity % (For Info Only)	23.9%
Atmospheric pressure kPa (For Info Only)	100.4kPa
Operator	Jean Cadotte
Client Witness	Denis Alain (Inogeni)

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 15: 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
USB Cable	±0.5	Capacitive clamp	5	60	No event	Pass
HDMI Cable	±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.

Table 16: EFT – Test Results

11.3.4 Test Data

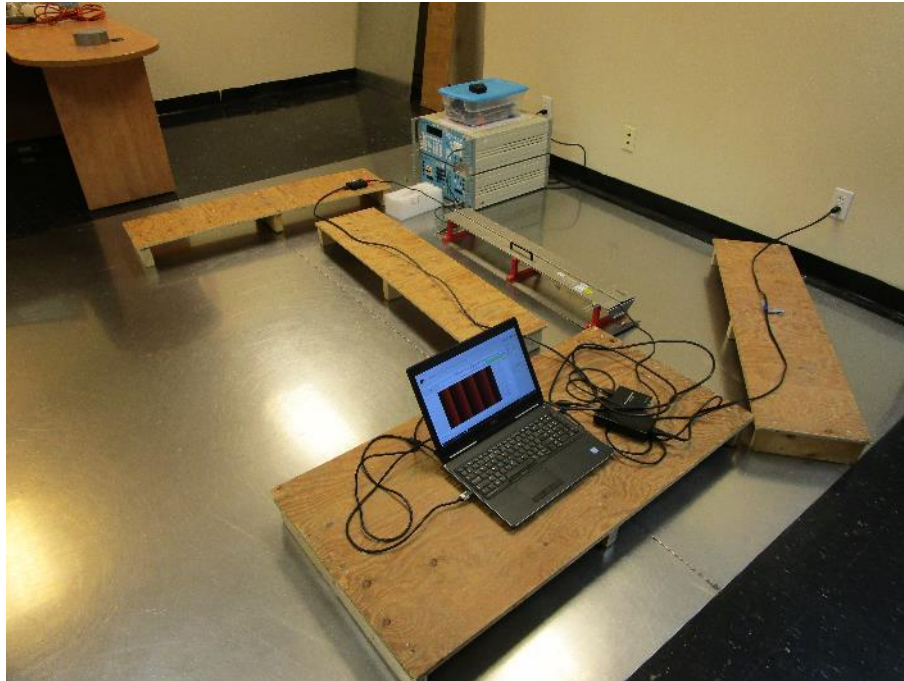


Photo 21: EFT – Test Setup

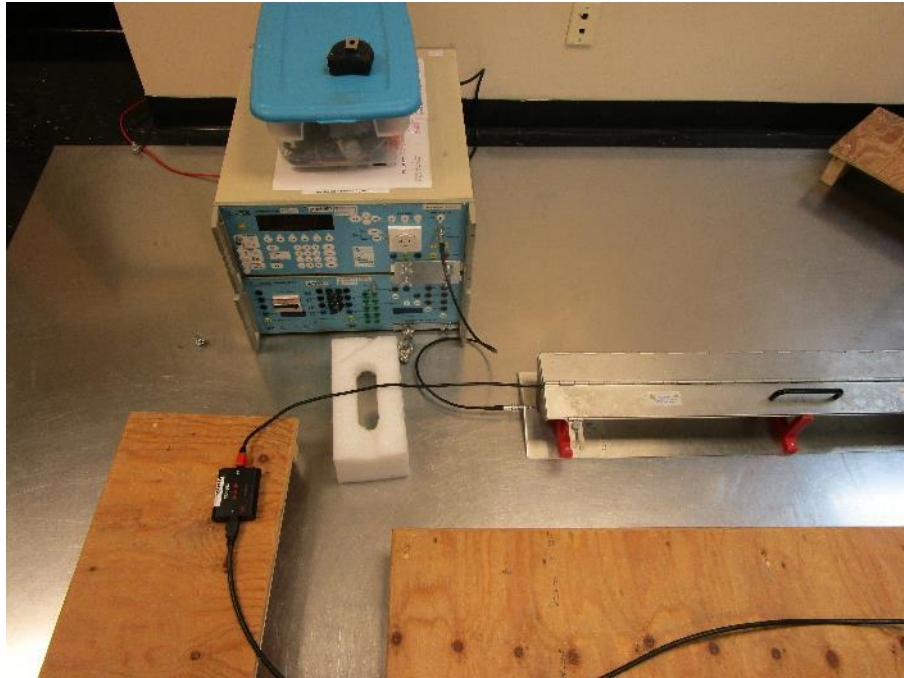


Photo 22: EFT – Test Setup – Capacitive Clamp – USB Cable

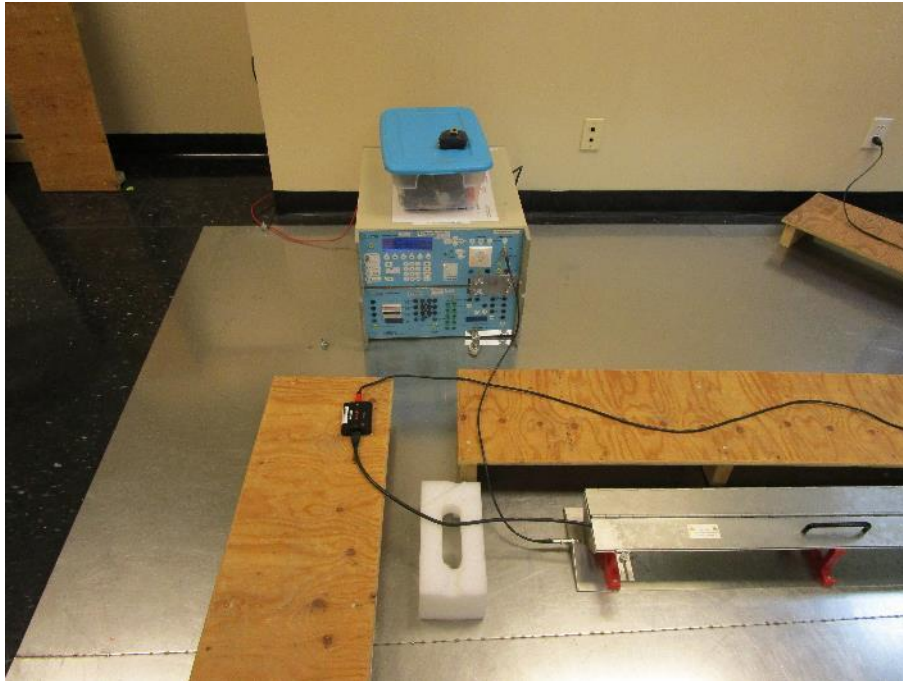


Photo 23: EFT – Test Setup – Capacitive Clamp – HDMI Cable

11.3.5 Test Method

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

11.4 Conducted Disturbances Immunity

11.4.1 Test Details

REFERENCE STANDARD	IEC61000-4-6 (2013)
SPECIFICATIONS	
Test level	Power: N/A 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	4K2USB3
Voltage Input	USB Powered
TEST INFO	
Test Date (yyyy-mm-dd)	2021-12-06
Temperature °C (For Info Only)	23.8°C
Relative humidity % (For Info Only)	21.4%
Atmospheric pressure kPa (For Info Only)	100.4kPa
Operator	Jean Cadotte
Client Witness	Denis Alain (Inogeni)

11.4.2 Test Equipment

Manufacturer	Description	Model	Serial No	Calibration Cycle (month)	Next Calibration (y-m-d)
NEXIO	Software	BAT-EMC v3.21.0.22	N/A	N/A	N/A
TESEQ	Conducted Immunity Test Generator	NSG 4070B-75	34302	12	2022-08-19
TESEQ	CDN M2/M3	CDN M016	34597	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	34759	NCR	NCR
Pasternack	6dB Fixed Attenuator	PE7385-6	LABCEM# 0256	VERIF	VERIF
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 17: Conducted Disturbances – Test Equipment

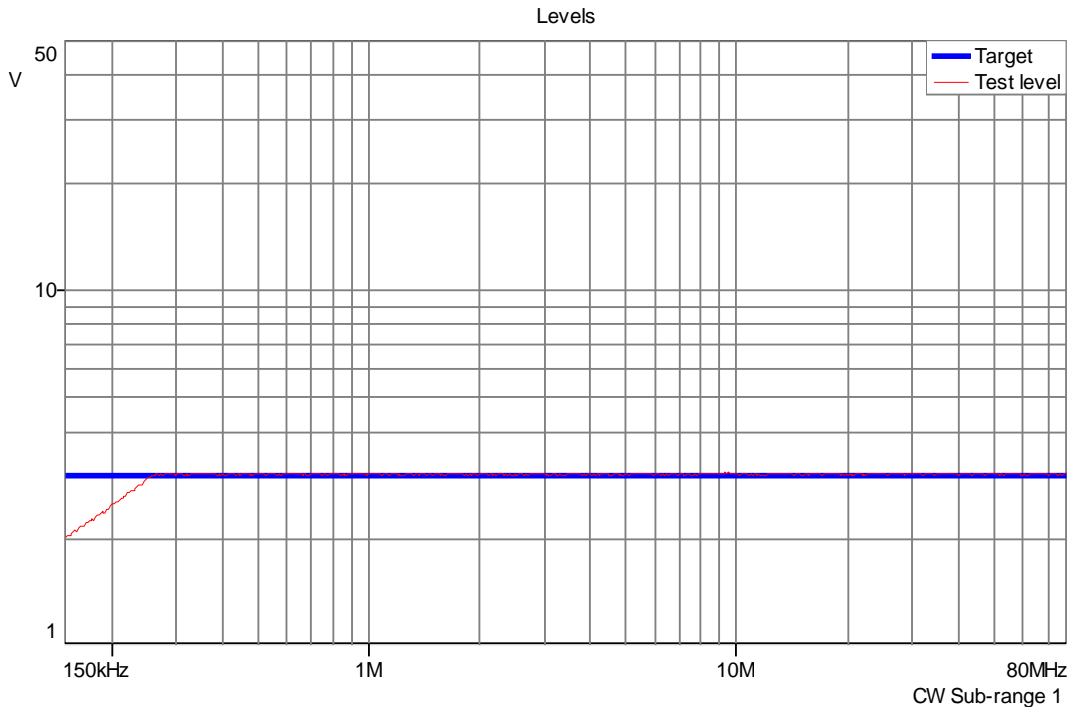
11.4.3 Test Results

Tested Line	Coupling Method	Frequency (MHz)	Test Level (V)	Modulation	Comments	Results
USB Cable	EM Clamp	0.150 - 80	3	AM / 1kHz	No event	Pass
HDMI Cable	EM Clamp	0.150 - 80	3	AM / 1kHz	No event	Pass

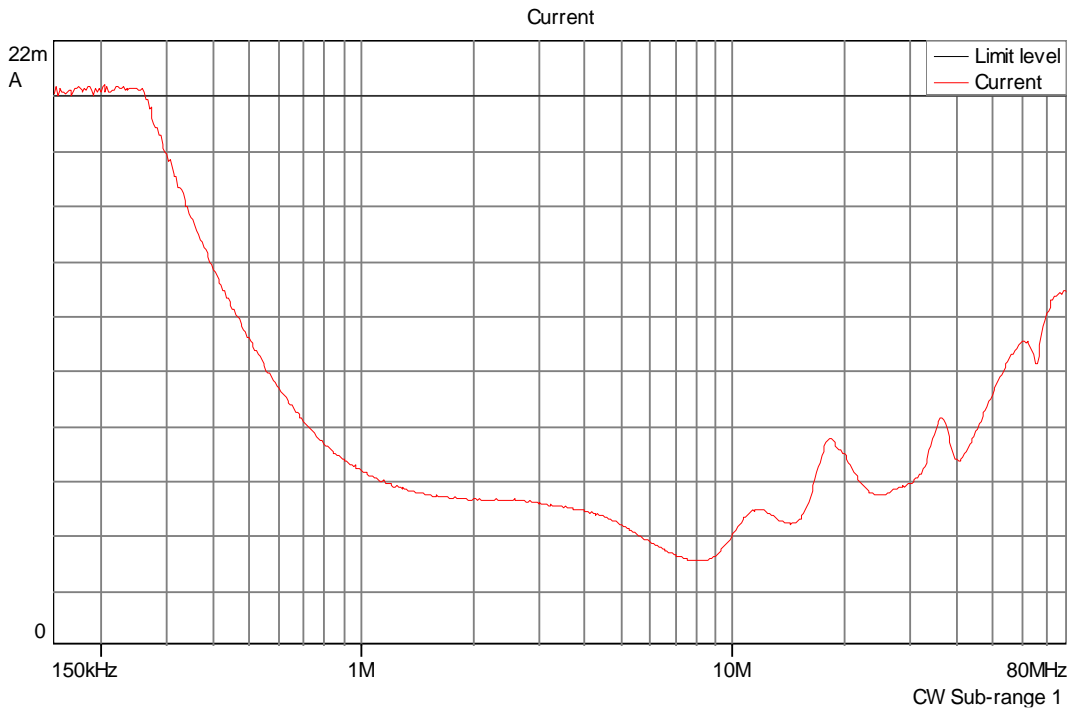
The decision rule used to determine the test results is based on the limits stated in the test standard and the functional requirement provided by the client. See section 5 for further detail.

Table 18: Conducted Disturbances – Test Results – EM Clamp

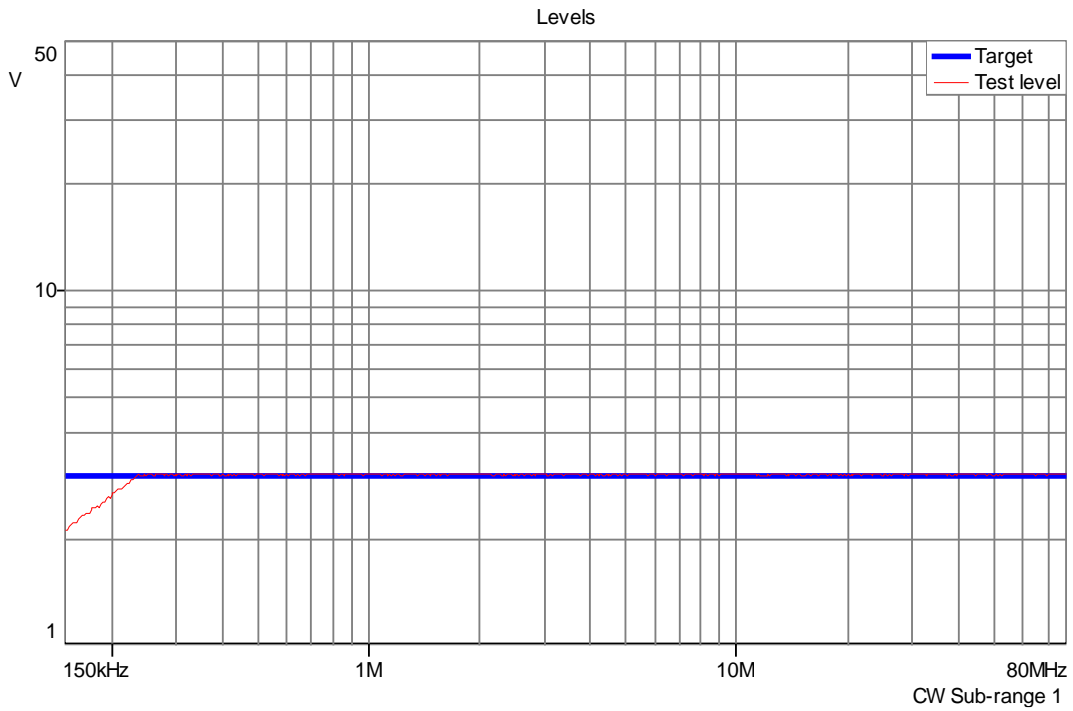
11.4.4 Test Data



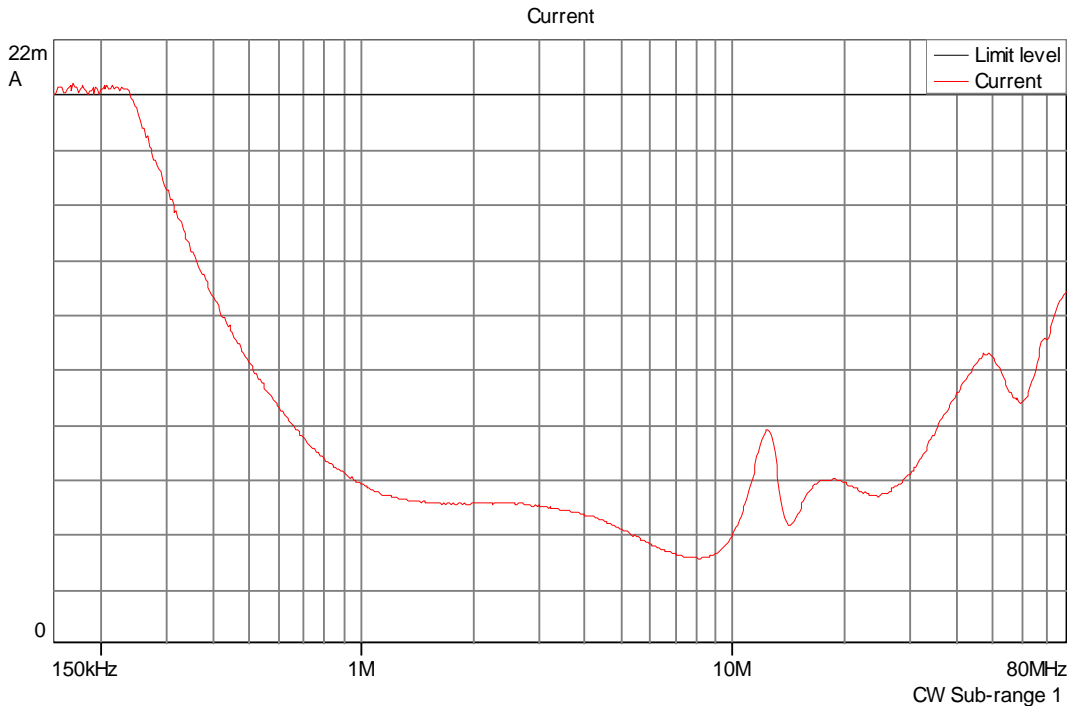
Graph 3: Conducted Disturbances – Voltage Level – EM Clamp – USB Cable



Graph 4: Conducted Disturbances – Current Measurements – EM Clamp – USB Cable



Graph 5: Conducted Disturbances – Voltage Level – EM Clamp – HDMI Cable



Graph 6: Conducted Disturbances – Current Measurements – EM Clamp – HDMI Cable



Photo 24: Conducted Disturbances – Test Setup



Photo 25: Conducted Disturbances – Test Setup – CDN – USB Cable

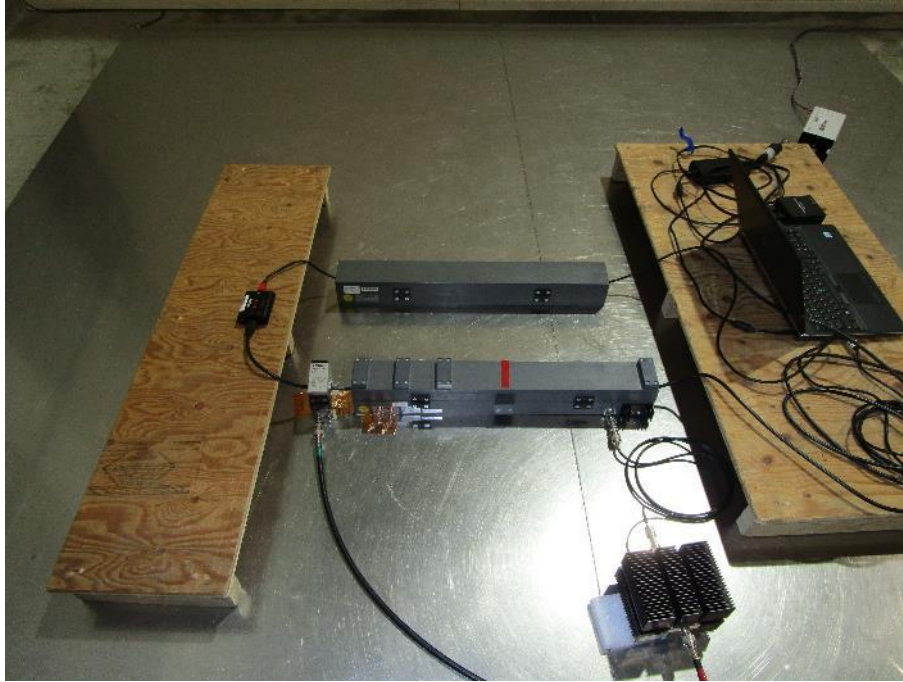


Photo 26: Conducted Disturbances – Test Setup – EM Clamp – HDMI Cable

11.4.5 Test Method

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

11.5 Power Frequency Magnetic Field Immunity

11.5.1 Test Details

REFERENCE STANDARD	IEC61000-4-8 (2009)
SPECIFICATIONS	
Test Level	Continuous field: 1A/m (60s)
Frequency	50Hz / 60Hz
Induction Coil	1m x 1m
PERFORMANCE CRITERION	A
EUT	
Identification	4K2USB3
Voltage Input	USB Powered
TEST INFO	
Test Date (yyyy-mm-dd)	2021-12-06
Temperature °C (For Info Only)	23.3°C
Relative humidity % (For Info Only)	26.1%
Atmospheric pressure kPa (For Info Only)	100.4kPa
Operator	Jean Cadotte
Client Witness	Denis Alain (Inogeni)

11.5.2 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 19: Magnetic Field – Test Equipment

11.5.3 Test Results

Position	Frequency (Hz)	Test Level (A/m)	Test Duration (s)	Comments	Results
1	50	1	60	No event	Pass
	60	1	60	No event	Pass
2	50	1	60	No event	Pass
	60	1	60	No event	Pass
3	50	1	60	No event	Pass
	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 20: Magnetic Field – Test Results

11.5.4 Test Data

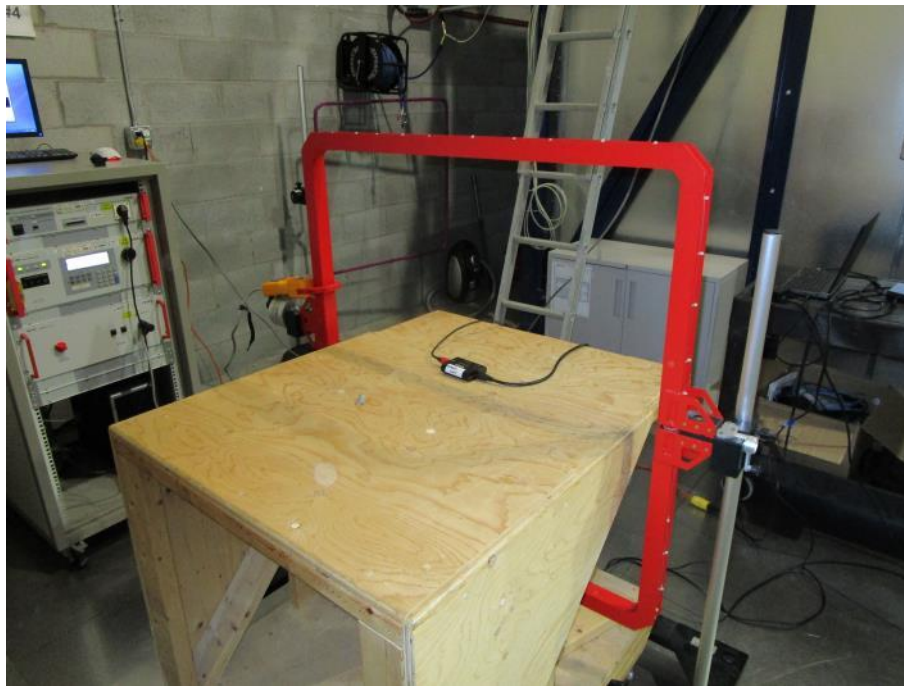


Photo 27: Magnetic Field – Test Setup – Position #1



Photo 28: Magnetic Field – Test Setup – Position #2

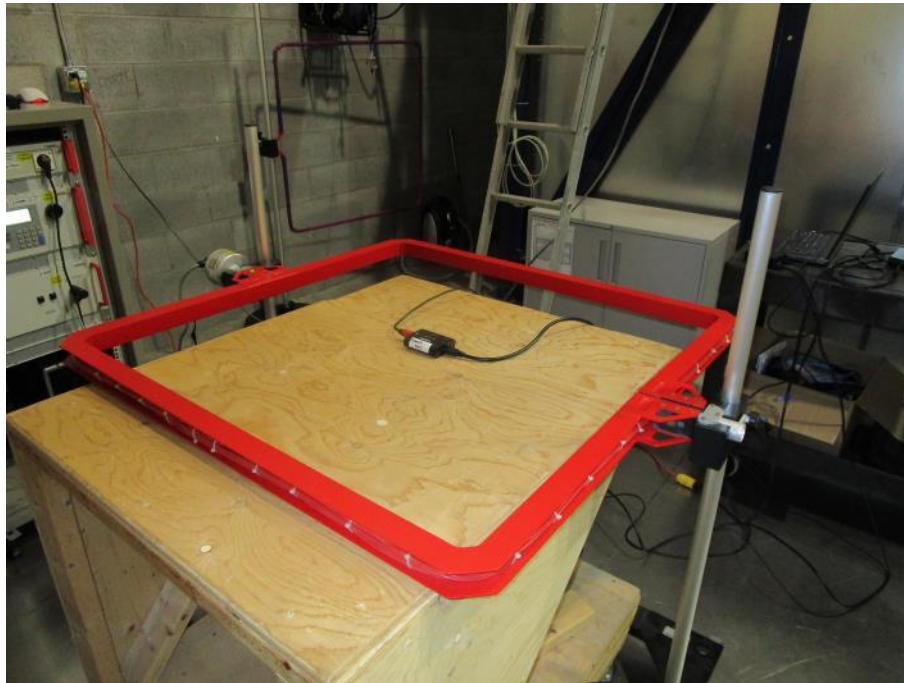


Photo 29: Magnetic Field – Test Setup – Position #3

11.5.5 Test Method

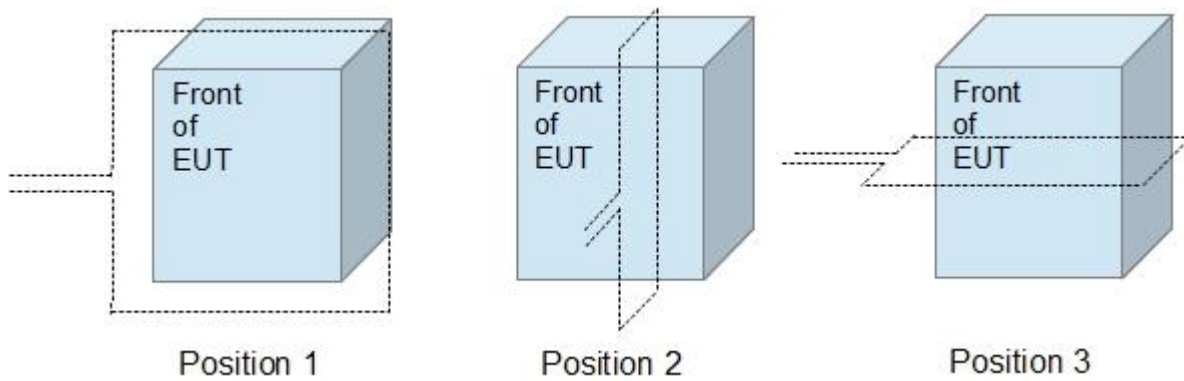


Figure 2: Magnetic Field – Position of Induction Coil

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

**APPENDIX A
RADIATED EMISSIONS**



RADIATED EMISSIONS – ELECTRIC FIELD
page 1 / 2

Project: OP0599498

Customer: Inogeni

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: Toggle Switch 4K2USB3
 Manufacturer: Inogeni
 Hardware Version:
 Software Version:

RADIATED EMISSIONS MEASUREMENT: OP0599498_EN55032_FCC-Bilog_#01

Test Location: Anechoic chamber
 Test Date: 2021-12-06 10:04:06 AM
 Operator(s): Jean Cadotte
 Test Standard: EN55032 / FCC part 15 subpart B / Class A
 Power: USB Powered
 Operating Mode:
 Comments:

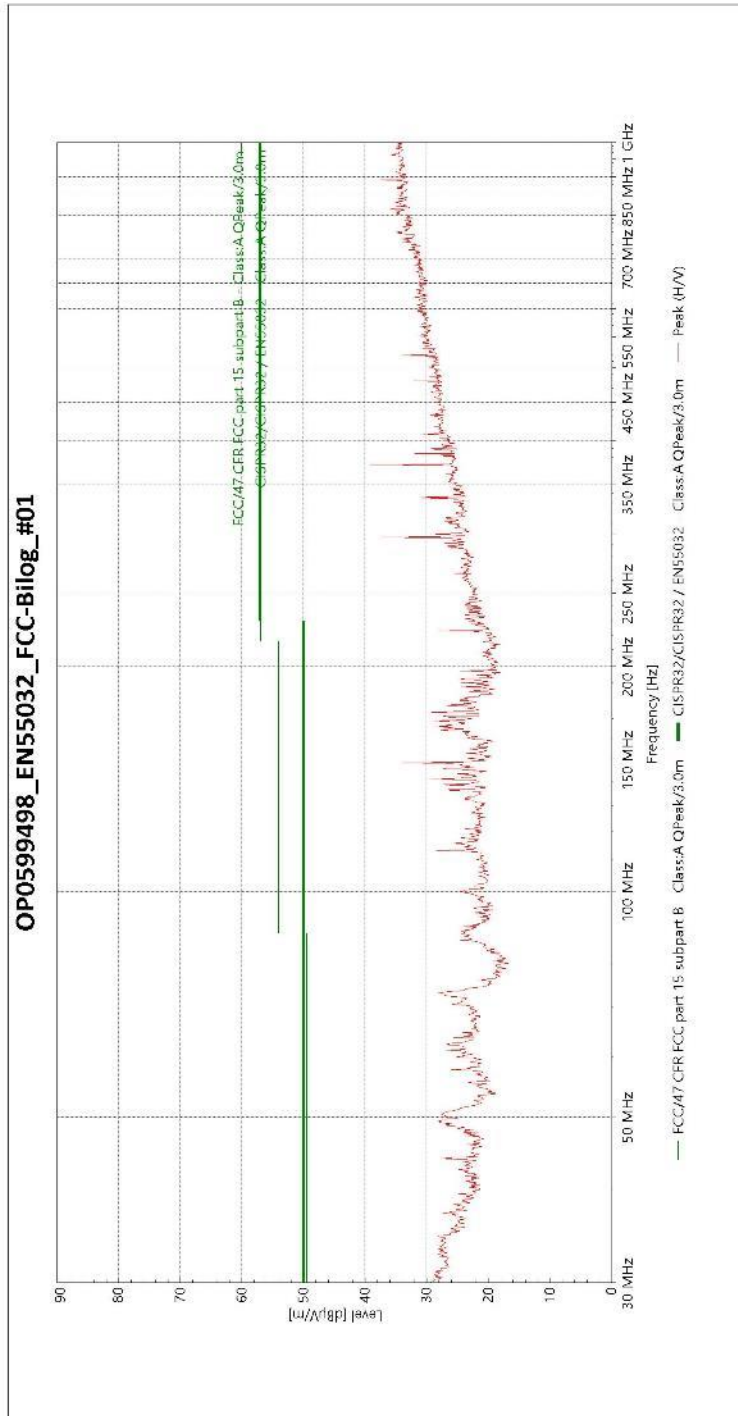
TEST PARAMETERS

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

PR / OP0599498_EN55032_FCC-Bilog_#01



FR / OP0599498_EN55032_FCC-Bilog_#01



RADIATED EMISSIONS – ELECTRIC FIELD
page 1 / 2

Project: OP0599498 **Customer:** Inogeni

DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

Equipment: Toggle Switch 4K2USB3
 Manufacturer: Inogeni
 Hardware Version:
 Software Version:

RADIATED EMISSIONS MEASUREMENT: OP0599498_EN55032_FCC-Horn_#02

Test Location: Anechoic chamber
 Test Date: 2021-12-06 10:57:57 AM
 Operator(s): Jean Cadotte
 Test Standard: EN55032 / FCC part 15 subpart B / Class A
 Power: USB Powered
 Operating Mode:
 Comments:

TEST PARAMETERS

Frequency Range: 1 GHz - 2 GHz
 Bandwidth: 1 MHz
 Test Distance: 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)
1.195225012 GHz	1	43.216	76	32.784	Vertical	19	2.384	-13.772
1.32771853 GHz	1	43.152	76	32.848	Horizontal	349	2.058	-13.654
1.782105505 GHz	1	49.016	76	26.984	Horizontal	218.75	1.014	-12.74

FINAL RESULTS - AVERAGE

Frequency	SR #	Average Detector (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Polarization	Azimuth (degree)	Height (m)	Correction (dB)
1.195225012 GHz	1	29.357	56	26.643	Vertical	19	2.384	-13.772
1.32771853 GHz	1	29.434	56	26.566	Horizontal	349	2.058	-13.654
1.782105505 GHz	1	34.865	56	21.135	Horizontal	218.75	1.014	-12.74

PR / OP0599498_EN55032_FCC-Horn_#02





OP0599498_EN55032_FCC-Horn_#02

