EMC / EMI Test Report

As per

2015 VVSG Volume I; Version 1.1
Sub-paragraphs 4.1.2.5 to 4.1.2.12
2015 VVSG Volume II; Version 1.1
Sub-paragraph 4.8

Emissions & Immunity

on the

Image Cast Evolution

Issued by:

TÜV SÜD Canada Inc.
11 Gordon Collins Dr,
Gormley, ON, L0H 1G0
Canada
Ph: (905) 883-7255

Testing produced for

See Appendix A for full client & EUT details.

Marty McLear,
Project Engineer

Reviewed by:

Sanjiv Vyas,
Project Engineer

Industry Canada
Registration # 6844A-3

Testing Laboratory
Certificate #2955.02

R-4023, G-506
C-4498, T-1246

Registration # CA6844

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of the **Image Cast Evolution**, Model: **PCOS-410A** herein referred to as EUT (Equipment Under Test). The EUT was tested for emissions and immunity compliance against the following standards:

2015 VVSG Volume I; Version 1.1

2015 VVSG Volume II; Version 1.1

Power line conducted emissions, radiated emissions, harmonics emissions, flicker emissions, and immunity testing was evaluated on the EUT. Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

For a more detailed list of the standards and the revision used, see the "Applicable Standards, Specifications and Methods" section of this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.

Summary

The results contained in this report relate only to the item(s) tested.

Equipment Under Test (EUT)	**Image Cast Evolution** Model: **PCOS-410A**
EUT passed all tests performed	Yes
Testing conducted by	Marty McLear

For testing dates, see 'Testing Environmental Conditions and Dates'.

Test Results Summary

Standard/ Method	Description	Criteria	Class / Level	Result
2015 VVSG Vol. I, Ver. 1.1	Power Line Conducted Emissions	N/A	Class B	Pass
2015 VVSG Vol. I, Ver. 1.1	Radiated Emissions	N/A	Class B	Pass
2015 VVSG Vol. I, Ver. 1.1	Electrical Power Disturbance	Normal Operation & No Data Loss	Various	Pass
2015 VVSG Vol. I, Ver. 1.1	Electrical Fast Transient	Normal Operation & No Data Loss	±2kV - Mains	Pass
2015 VVSG Vol. I, Ver. 1.1	Lightning Surge	Normal Operation & No Data Loss	±2kV Line - Line ±2kV Line - Ground	Pass
2015 VVSG Vol. I, Ver. 1.1	Electrostatic Disruption	Normal Operation & No Data Loss	±8kV Contact ±15kV Air	Pass
2015 VVSG Vol. I, Ver. 1.1	Electromagnetic Susceptibility	Normal Operation & No Data Loss	10 V/m, 80 MHz – 1 GHz	Pass
2015 VVSG Vol. I, Ver. 1.1	Conducted RF Immunity	Normal Operation & No Data Loss	10 Vrms, 150 kHz – 80 MHz	Pass
2015 VVSG Vol. I, Ver. 1.1	Magnetic Fields Immunity	Normal Operation & No Data Loss	30 A/m	Pass
Overall Result				**Pass**

If the product as tested complies with the specification or requirement, the EUT is deemed to comply and is issued a 'PASS' grade. If not, 'FAIL' grade is issued.

Notes, Justifications, or Deviations

The following justifications for tests not performed or deviations from the above listed specifications apply:

No Electrical Fast Transients or Conducted RF Immunity tests were performed on any of the I/O cables of the EUTs. All cables are less than 3m.

The manufacturer presented the EUT representative of the main function(s) performed in the application for which it is intended. During measurement, the EUT is operational with a reprehensive working load and program to demonstrate typical operating conditions.

Modifications to the EUT were implemented during immunity testing to pass Electrical Fast Transients / Bursts, 2015 VVSG Volume I; Version 1.0 limits. Refer to Appendix A - Modifications for Compliance.

The EUT includes an external power supply converter.
Manufacturer: FranMar
Model: STD-19063

A later revision of the standard may have been substituted in place of the previous dated referenced revision. The year of the specification used is listed under applicable standards. Using the later revision accomplishes the goal of ensuring compliance to the intent of the previous specification, while allowing the laboratory to incorporate the extensions and clarifications made available by a later revision.

Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)
Margin = 50dBµV/m – (50dBµV + 10dB + 2.5dB – 20dB)
Margin = 7.5 dB (pass)

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)
Margin = 73.0dBµV – (50dBµV + 10dB + 2.5dB + 0.5dB)
Margin = 10.0 dB (pass)

Milligauss to A/m Conversion (Magnetic Immunity)

1A/m = 12.57 mG
3A/m = 3*12.57 = 37.7 mG

Applicable Standards, Specifications and Methods

ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
2015 VVSG Volume I; Version 1.1	
2015 VVSG Volume II; Version 1.1	United States Election Assistance Commission – Voluntary Voting System Guidelines – Version 1.1 Volume I
CISPR 16-2-3:2010/A2:2014	Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 2-3: Methods of Measurement of Disturbances and Immunity - Radiated Disturbance Measurements
IEC 61000-4-2:2008 EN 61000-4-2:2009	Testing and Measurement Techniques - Electrostatic Discharge Immunity Test
IEC/EN 61000-4-3:2006/ A2:2010	Testing and Measurement Techniques - Radiated, Radio-Frequency, Electromagnetic Field Immunity Test
IEC/EN 61000-4-4:2004	Testing and Measurement Techniques - Electrical Fast Transient/Burst Immunity Test
IEC 61000-4-5:2005 EN 61000-4-5:2006	Testing and Measurement Techniques - Surge Immunity Test
IEC 61000-4-6:2008 EN 61000-4-6:2009	Testing and Measurement Techniques - Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields
IEC 61000-4-8:2009 EN 61000-4-8:2010	Testing and Measurement Techniques - Power Frequency Magnetic Field Immunity Test
IEC/EN 61000-4-11:2004	Testing and Measurement Techniques - Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests
ISO 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

Document Revision Status

Revision 0	March 13, 2019 Initial Release

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AM – Amplitude Modulation
CDN – Coupling Decoupling Network
EFT – Electrical Fast Transients
ESD – Electro-Static Discharge
HCP – Horizontal Coupling Plane
VCP – Vertical Coupling Plane
LISN – Line Impedance Stabilization Network
NCR – No Calibration Required
NSA – Normalized Site Attenuation
N/A – Not Applicable
RF – Radio Frequency

AE – Associated Equipment. Equipment needed to exercise and/or monitor the operation of the EUT.

Class A Device – A device that is marketed for use in a commercial, industrial or business environment. A 'Class A' device should not be marketed for use by the general public. A 'Class A' device should contain a warning notice in the user manual stating that it could cause radio interference. For example: "**Warning**: Operation of this equipment in a residential environment could cause radio interference."

Class B Device – A device that is marketed for use in a residential environment and may also be used in a commercial, business or industrial environments. NOTE: A residential environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10m of the device concerned.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment. Has a primary function of entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer.

Antenna Port – Port, other than a broadcast receiver tuner port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.

Broadcast Receiver Tuner Port – Port intended for the reception of a modulated RF signal carrying terrestrial, satellite and/or cable transmissions of audio and/or video broadcast and similar services.

Optical Fiber Port – Port at which an optical fiber is connected to an equipment.

Signal/Control Port – Port intended for the interconnection of components of a EUT, or between a EUT and local AE and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it).
(Examples include: RS-232, USB, HDMI, Fire Wire)

Wired Network Port – Point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network.
(Examples include: CATV, PSTN, ISDN, xDSL, LAN and similar networks)

EMC Test Plan – An EMC test plan established prior to testing. See 'Appendix A – EUT & Client Provided Details'.

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Toronto, Ontario. The testing lab has a calibrated 3m semi-anechoic chamber which allows measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane if applicable.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Industry Canada (IC, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-4023, G-506, C-4498, and T-1246). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc. is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing:

Date	Test	Initials	Temperature (ºC)	Humidity (%)	Pressure (kPa)
February 15, 2019	Power Line Conducted Emissions	MM	20.8	24.3	99.5
February 14, 2019	Radiated Emissions	MM	20.1	17.6	101.4
February 20, 2019	Electrostatic Disruption	MM	21.3	53.1	103.1
February 15, 2019	Electromagnetic Susceptibility	MM	20.8	24.3	99.5
February 19, 2019	Electrical Fast Transient	MM	18.7	20.2	103.5
February 19, 2019	Lightning Surge	MM	18.7	20.2	103.5
February 19, 2019	Conducted RF Immunity	MM	18.7	20.2	103.5
February 20, 2019	Magnetic Fields Immunity	MM	20.3	19.7	103.1
February 15, 2019	Electrical Power Disturbance 4.1.2.5 a, b, c	MM	20.8	24.3	99.5
February 20, 2019	Electrical Power Disturbance 4.1.2.5 e	MM	20.3	19.7	103.1

Detailed Test Result Section

Power Line Conducted Emissions – 4.1.2.9

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard and measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The method is as defined in ANSI C63.4. The limits are as defined in FCC Part 15 Section 15.107:

CLASS B

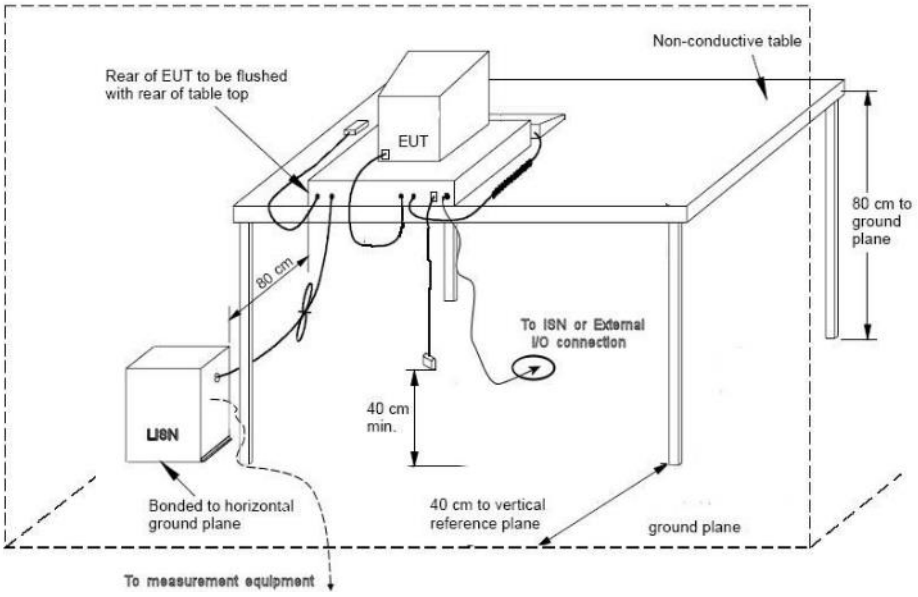
Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	56 to 46* dBµV	150 kHz – 500 kHz	66 to 56* dBµV
500 kHz – 5 MHz	46 dBµV	500 kHz – 5 MHz	56 dBµV
5 MHz – 30 MHz	50 dBµV	5 MHz – 30 MHz	60 dBµV

* Decreases linearly with the logarithm of the frequency

Both Quasi-Peak and Average limits are applicable, and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

Based on ANSI C63.4 Section 4.2, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Typical Setup Diagram

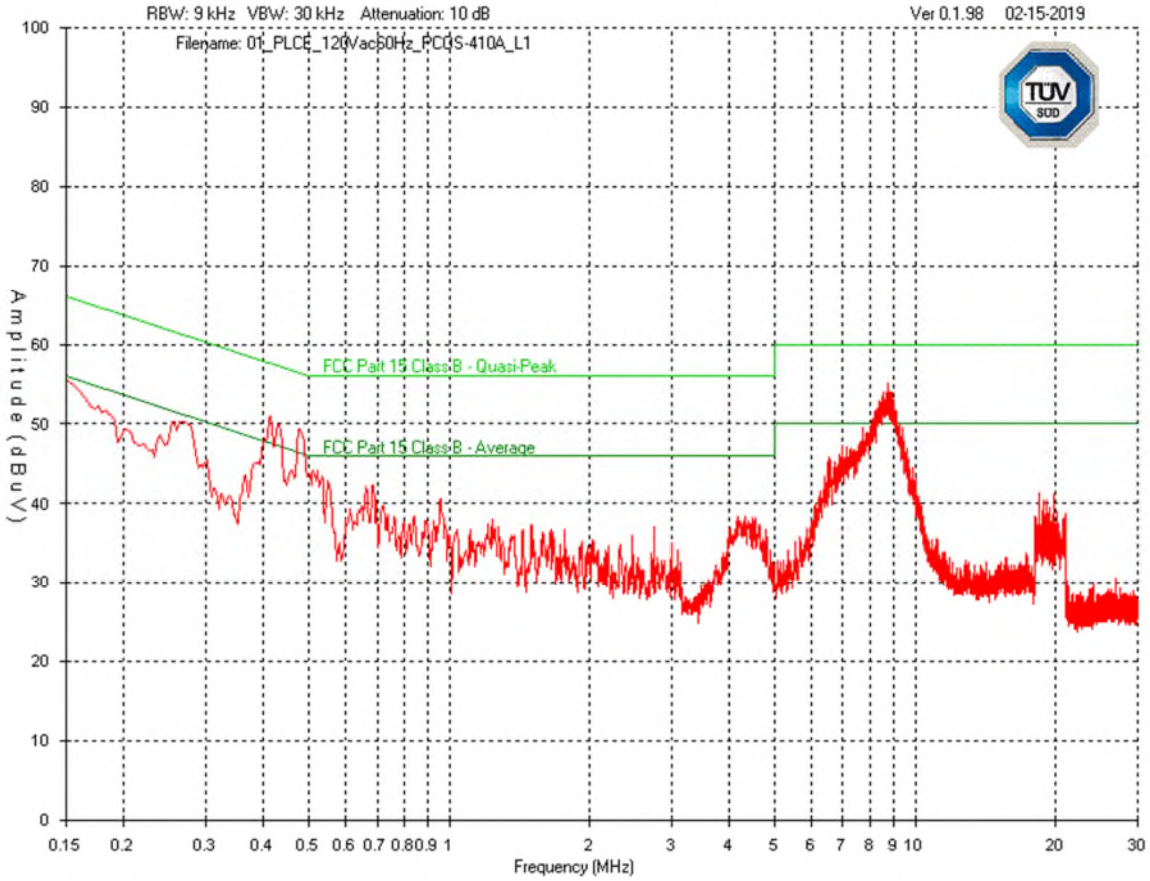


Measurement Uncertainty

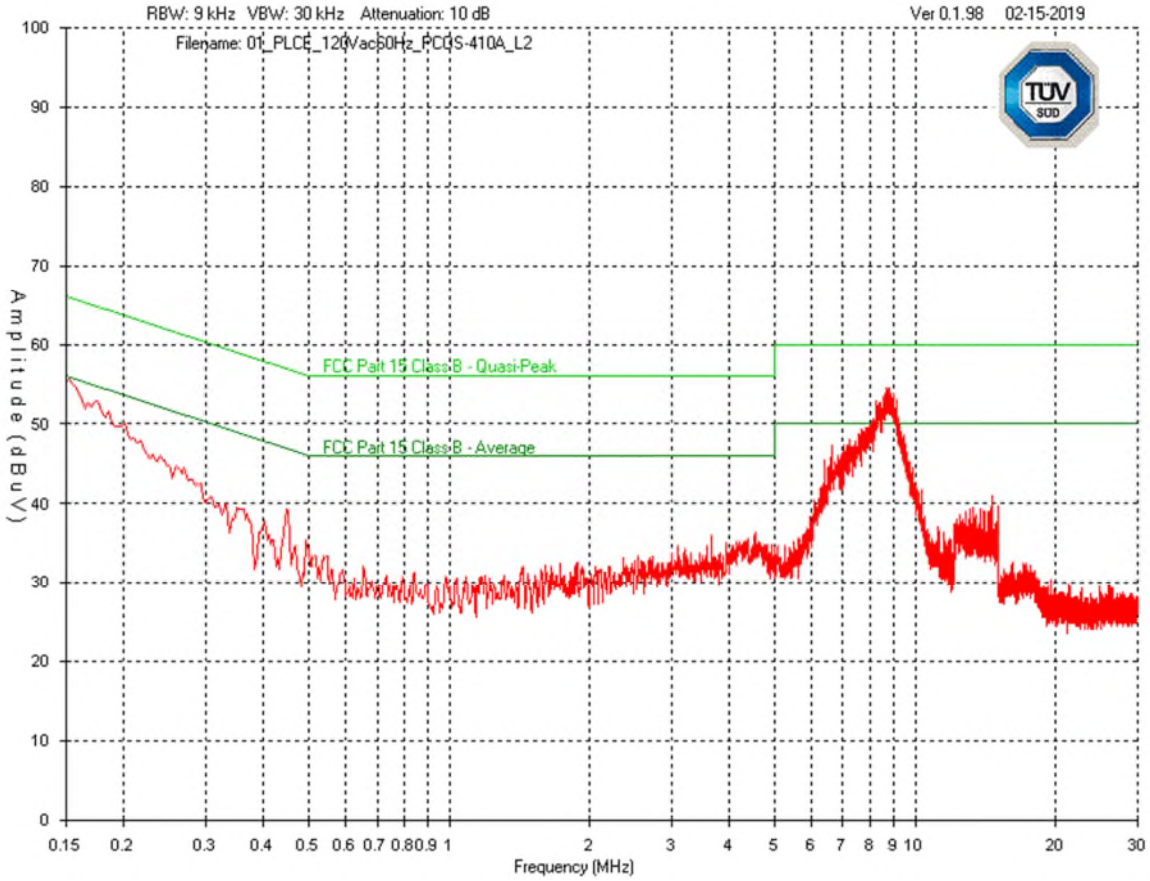
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±2.73dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.



Line (L1) – 120Vac 60Hz



Neutral (L2) – 120Vac 60Hz

Final Measurements

Product Category			Class B								
EUT			Image Cast Evolution								
Supply			**120Vac 60Hz**								
Frequency (MHz)	**Detector**	**Received Signal (dBµV)**	**Atten Factor (dB)**	**Cable Factor (dB)**	**LISN Factor (dB)**	**Level (dBµV)**	**QP Limit (dBµV)**	**AVG Limit (dBµV)**	**QP Margin (dB)**	**AVG Margin (dB)**	**Pass/ Fail**
Line											
8.744	QP	41.4	10	0.1	0.0	51.5	60.0	--	8.5	--	Pass
8.744	AVG	34.7	10	0.1	0.0	44.8	--	50.0	--	5.2	Pass
0.413	AVG	29.1	10	0.1	0.0	39.2	--	47.6	--	8.4	Pass
0.478	AVG	28.7	10	0.1	0.0	38.8	--	46.4	--	7.6	Pass
0.153	AVG	17.1	10	0.0	0.1	27.2	--	55.8	--	28.6	Pass
0.684	AVG	18.8	10	0.1	0.0	28.9	--	46.0	--	17.1	Pass
0.959	AVG	16.2	10	0.1	0.0	26.3	--	46.0	--	19.7	Pass
Neutral											
8.786	QP	39.3	10	0.1	0.0	49.4	60.0	--	10.6	--	Pass
8.786	AVG	31.8	10	0.1	0.0	41.9	--	50.0	--	8.1	Pass
0.153	AVG	16.4	10	0.0	0.1	26.5	--	55.8	--	29.3	Pass
0.449	PEAK	29.3	10	0.1	0.0	39.4	56.9	46.9	17.5	7.5	Pass
14.591	PEAK	30.8	10	0.1	0.1	41.0	60.0	50.0	19.0	9.0	Pass
3.663	PEAK	25.9	10	0.1	0.0	36.0	56.0	46.0	20.0	10.0	Pass

Average and Quasi-Peak Emissions Table

Note:
Peak = Peak measurement
AVG = Average measurement
QP = Quasi-Peak measurement

See 'Appendix B – EUT, Peripherals and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Dec. 27, 2017	Dec. 27, 2019	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Jan. 10, 2018	Jan. 10, 2020	GEMC 302
RF Cable 3m	LMR-400-3M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 276
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	NCR	NCR	GEMC 223
Emissions Software	0.1.98	TUV SUD Canada, Inc.	NCR	NCR	GEMC 58

FCC_ICES003_CE_Rev1

Radiated Emissions – 4.1.2.9

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard and measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limit(s)

The method is as defined in ANSI C63.4:2014. The limits are as defined in FCC Part 15 Section 15.109:

CLASS B

FCC Part 15, Subpart B Limits - 30MHz – 1GHz

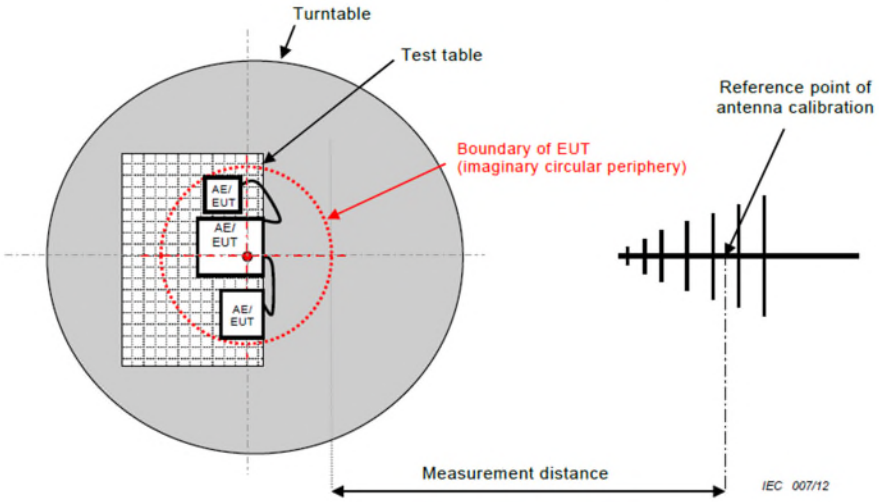
Frequency Range[a]	Quasi-Peak Limits - 3m[b]
30 MHz – 88 MHz	40 dBµV/m
88 MHz – 216 MHz	43.5 dBµV/m
216 MHz – 960 GHz	46 dBµV/m
960 MHz – 1 GHz	54 dBµV/m

Frequency Range[a]	Average Limit - 3m[c]	Peak Limit - 3m[d]
1 GHz and Up	54 dBµV/m	74 dBµV/m

[a]The frequency range scanned is in accordance to FCC Part 15 Section 15.33(b).
[b]Limit is with a resolution bandwidth of 120 kHz, a video bandwidth at least three times greater than the resolution bandwidth, and using a Quasi-Peak detector.
[c]Limit is with a resolution bandwidth of 1 MHz and using an Average detector.
[d]Limit is with a resolution bandwidth of 1 MHz, a video bandwidth at least three times greater than the resolution bandwidth, and using a Peak detector.

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

Typical Radiated Emissions Setup



Note: In accordance with FCC Part 15, section 15.31(f)(1), testing was performed at a 3 meter test distance and an extrapolation factor, if applicable, of 20 dB/decade was applied. For example, an extrapolation of 10m to 3m is 20log(10/3) = 10.5 dB.

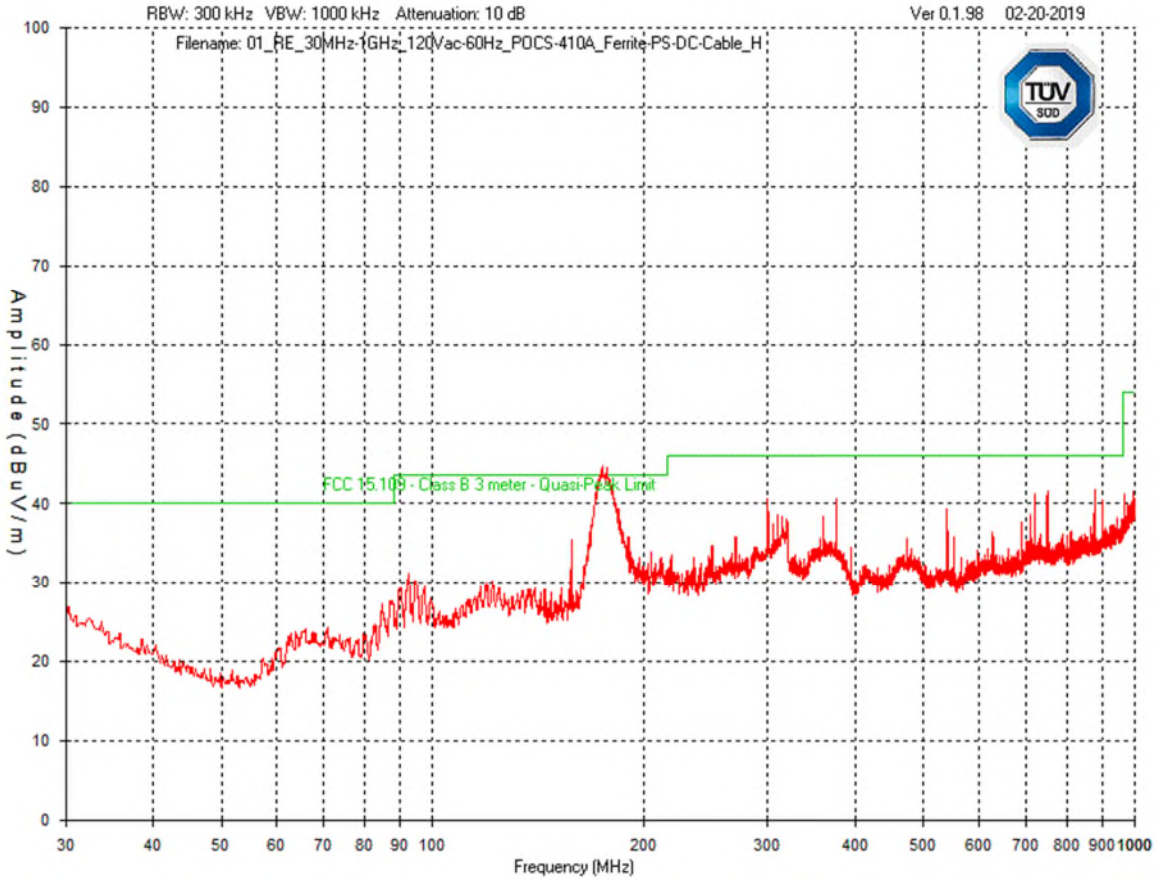
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±5.04dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

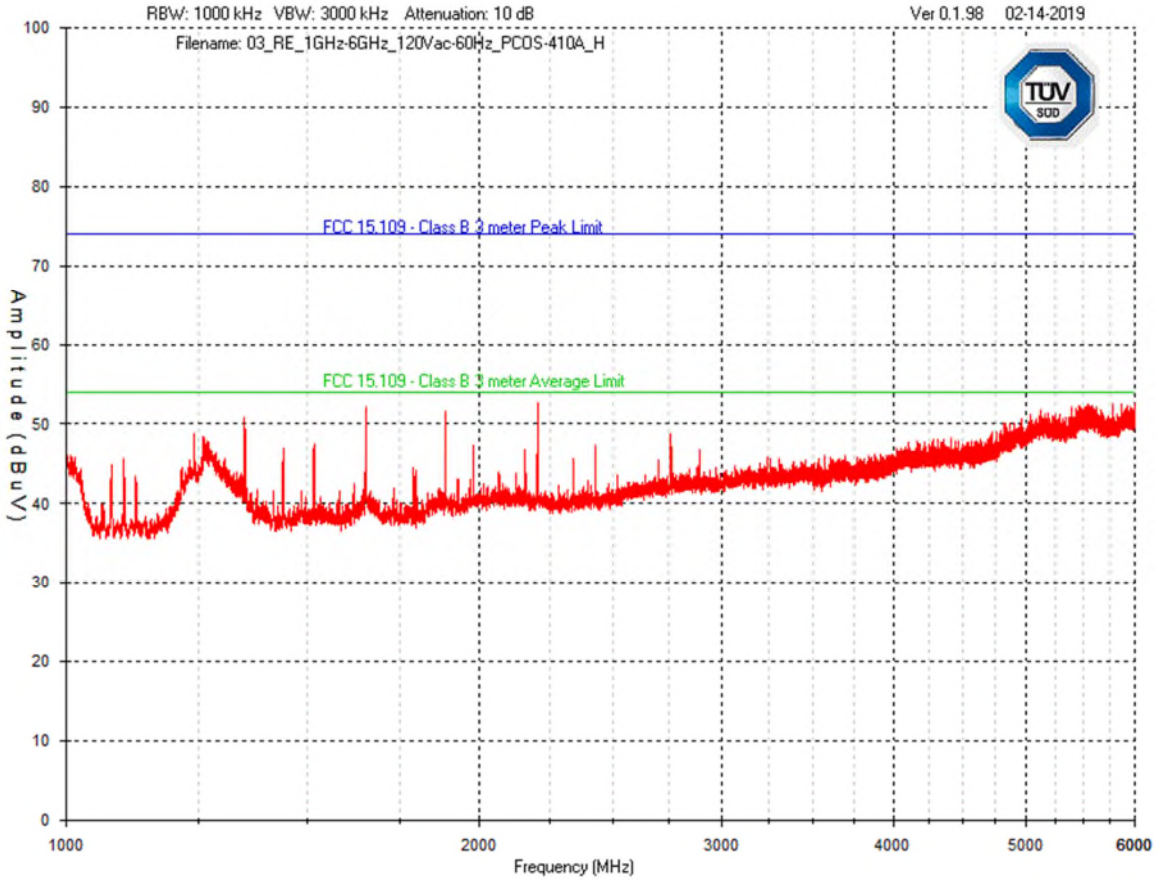
Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

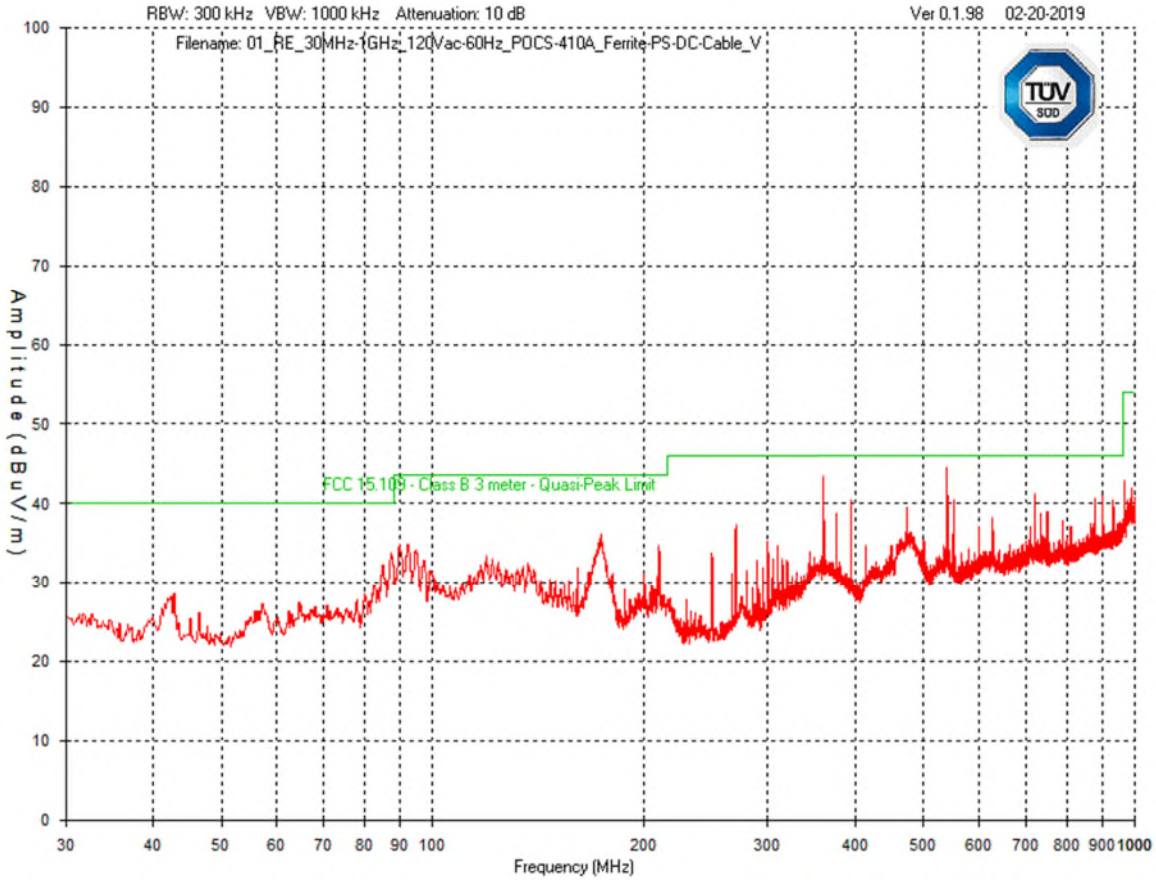
In accordance with FCC Part 15, Subpart B, Section 15.33, the device was scanned to a minimum of a 1 GHz. For devices containing clocks higher than 108 MHz, they were scanned above 1 GHz to meet the requirements of FCC Part 15, Section 15.33.



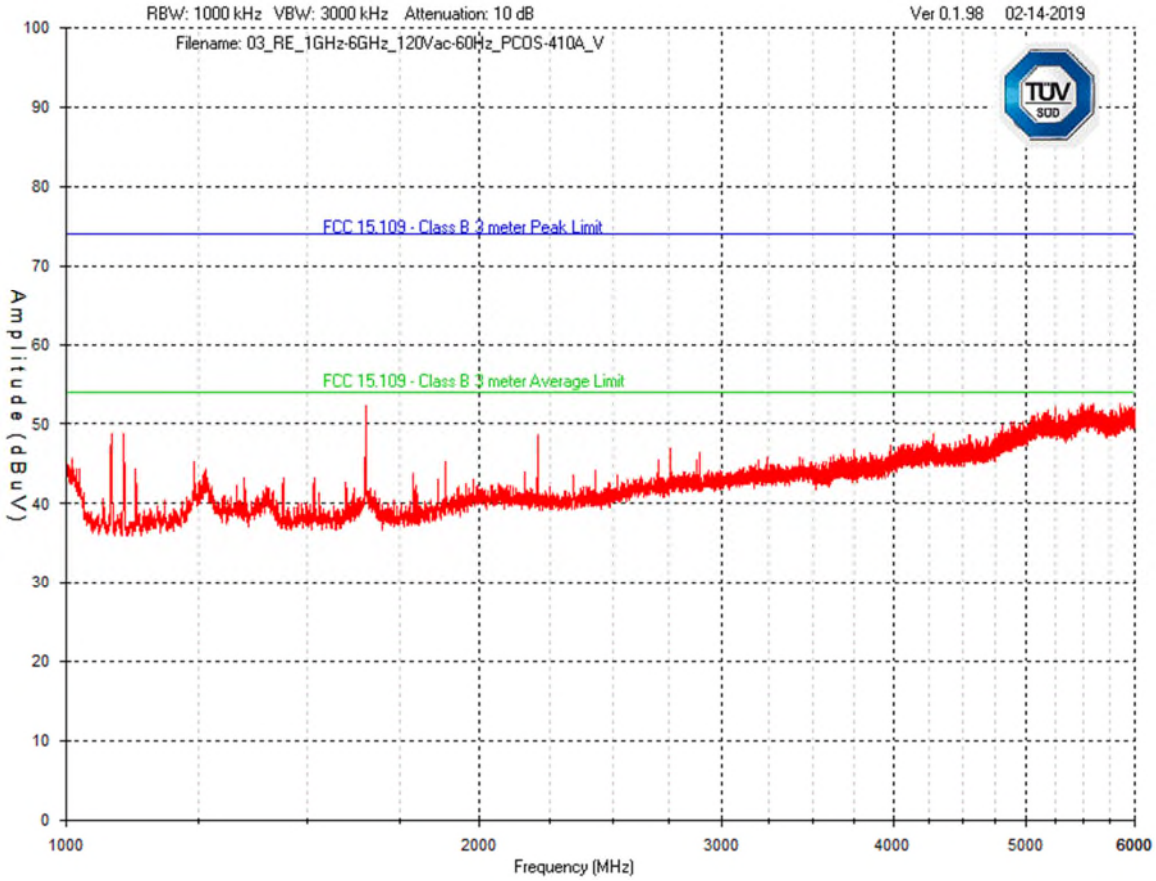
Horizontal – 120Vac 60Hz – 30MHz - 1GHz



Horizontal – 120Vac 60Hz – 1GHz - 6GHz



Vertical – 120Vac 60Hz – 30MHz - 1GHz



Vertical – 120Vac 60Hz – 1GHz - 6GHz

Final Measurements

The worst case measurement as listed in the table below appeared at a horizontal antenna height of 115 cm and a table azimuth of 210 degrees, as pictured in Appendix B.

Product Category			Class B							
Supply			**120Vac 60Hz**							
Frequency (MHz)	**Detector**	**Received Signal (dBµV)**	**Antenna Factor (dB/m)**	**Atten Factor (dB)**	**Cable Factor (dB)**	**Pre-Amp (dB)**	**Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dB)**	**Pass/ Fail**
Horizontal Antenna Polarization										
174.43	QP	51.1	9.6	6	0.8	-33.7	33.8	43.5	9.7	Pass
875.26	QP	42.7	23.0	6	2.2	-32.5	41.4	46.0	4.6	Pass
750.03	QP	42.9	22.0	6	2.1	-33.0	40.0	46.0	6.0	Pass
720.16	QP	41.8	22.1	6	2.0	-33.1	38.8	46.0	7.2	Pass
375.13	QP	49.9	16.3	6	1.3	-33.5	40.0	46.0	6.0	Pass
300.05	QP	47.3	12.8	6	1.2	-33.6	33.7	46.0	12.3	Pass
2205.58	AVG	47.4	28.4	0	3.4	-34.2	45.0	54.0	9.0	Pass
1653.78	AVG	56.5	25.8	0	2.9	-34.8	50.4	54.0	3.6	Pass
1890.27	AVG	50.6	27.2	0	3.0	-34.4	46.4	54.0	7.6	Pass
1350.04	AVG	51.9	25.5	0	2.6	-35.1	44.9	54.0	9.1	Pass
1241.18	AVG	42.0	25.2	0	2.5	-35.6	34.1	54.0	19.9	Pass
2756.76	AVG	43.0	29.6	0	3.8	-33.4	43.0	54.0	11.0	Pass
Vertical										
540.03	QP	45.8	19.7	6	1.6	-33.3	39.8	46.0	6.2	Pass
360.09	QP	47.6	15.9	6	1.2	-33.5	37.2	46.0	8.8	Pass
719.86	QP	28.2	22.1	6	2.0	-33.1	25.2	46.0	20.8	Pass
900.38	QP	32.5	23.7	6	2.2	-32.4	32.0	46.0	14.0	Pass
875.36	QP	38.7	23.0	6	2.2	-32.5	37.4	46.0	8.6	Pass
393.85	QP	49.2	16.3	6	1.4	-33.5	39.4	46.0	6.6	Pass
551.18	QP	44.1	19.4	6	1.6	-33.3	37.8	46.0	8.2	Pass
1653.47	AVG	51.7	25.8	0	2.9	-34.8	45.6	54.0	8.4	Pass
1079.77	AVG	49.9	24.6	0	2.7	-36.2	41.0	54.0	13.0	Pass
1102.92	AVG	48.8	24.7	0	2.7	-36.1	40.1	54.0	13.9	Pass
2205.89	AVG	37.1	28.4	0	3.4	-34.2	34.7	54.0	19.3	Pass

Quasi-Peak and Average Emissions Table

Note:
Peak = Peak measurement
QP = Quasi-Peak measurement
AVG = Average measurement

See 'Appendix B – EUT, Peripherals, and Test Setup Photos' for photos showing the test set-up for the highest radiated emission.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 12, 2018	Jan. 12, 2020	GEMC 233
BiLog Antenna	3142-C	ETS	Feb. 22, 2017	Feb. 22, 2019	GEMC 137
Horn Antenna 1 – 18 GHz	AH-118	Com-Power Corporation	July 12, 2017	July 12, 2019	GEMC 214
Attenuator 6 dB	612-6-1	Meca Electronics, Inc	NCR	NCR	GEMC 286
Pre-Amp	LNA-1450	RF Bay Inc.	Oct. 18, 2018	Oct. 11, 2020	GEMC 221
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Nov. 15, 2017	Nov. 15, 2019	GEMC 189
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	NCR	NCR	GEMC 271
Emissions Software	0.1.98	TUV SUD Canada, Inc.	NCR	NCR	GEMC 58

Electrical Power Disturbance – 4.1.2.5

Purpose

An AC powered device may be subjected to voltage dips, short interruptions or other voltage variations in the power line. Such conditions are mainly caused by faults or changes in the network due to sudden large changes in load, or when a brown out or a black out condition occurs. These voltage dips can also occur with power supplies that are not well regulated such as emergency diesel AC generators. This test simulates the occurrence of these conditions and subjects the EUT to this phenomenon.

Application Level Requirements

This test is performed in accordance with the methodology defined in IEC 61000-4-11. As per VVSG 1.0 (2005) Vol. 1, the following dip and interruption levels apply:

Voltage Dip Level	Duration	Duration @ 60Hz [Cycles]
30% (36 Vac)	0.01s	0.6
60% (72 Vac)	0.1s / 1.0s	6 / 60
100% (120 Vac)	0.5	300

Voltage Surge Level	Duration	Duration @ 60Hz [Cycles]
85% (102 Vac)	4 hours	14400
115% (138 Vac)	4 hours	14400

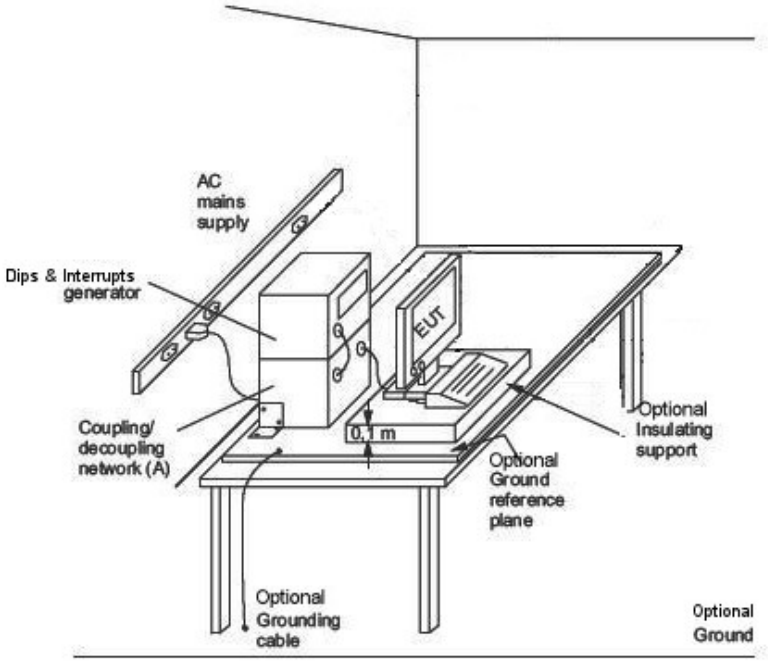
Surges of +15% line variations of nominal line voltage and electrical power increases of 7.5% and reductions of 12.5% of nominal specified power supply for a period of up to four hours at each level.

The voltage level in brackets is the residual voltage of the voltage dip applied and presumes a normal operating voltage of 120 Vac and a frequency of 60Hz.

The test is carried out at phase angles of 0º, 90º, and 270º of the AC with 5 repetitions applied at each of the dips and interrupts listed in the table above.

No disruption of normal operation or loss of data is applied to this test.

Typical Test Setup



Application Level Accuracy

As per IEC 61000-4-11, the voltage must be ±5% of the voltage stated to be applied. The frequency must be kept within ±2% of the stated frequency.

Test Results

The EUTs passed the requirements. The EUTs met the criteria's listed above in the application level requirements.

No anomalies were observed for the surges and no disruption to operation or data loss occurred.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Immunity Generator	EMC Pro Plus	Keytek Thermo Corp.	Feb. 6, 2019	Feb. 6, 2021	GEMC 188
Immunity Software	CEWare 32 V4.1	Thermo Fisher Scientific	NCR	NCR	GEMC 182
Variac	PWRSTA 3PN126	Powerstat	NCR	NCR	GEMC 6032

IEC61000-4-11_DipsImmunity-C24_Rev3

Electrical Fast Transients / Bursts – 4.1.2.6

Purpose

Electrical Fast Transients is a series of bursts consisting of a number of fast transients, which in a typical application environment, can be coupled into the supply and onto the I/O lines of the EUT. These transient signals usually arise from nearby switching circuitry such as a light switch, relay bounces, electric motor noise, interruption of inductive loads, etc. This test is to verify that the EUT is immune to such transient disturbances based on the applicable test levels. This test, however, does not guarantee that the EUT will not experience higher level burst impulses during its operation, which may cause the EUT to fail.

Application Level Requirement

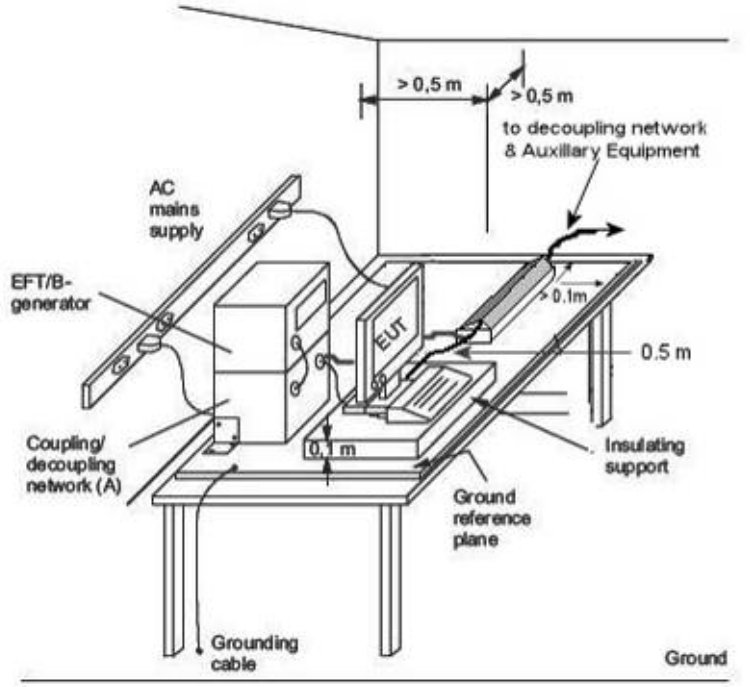
This test is performed in accordance with the methodology defined in IEC 61000-4-4. The voltage waveform applied has the following characteristics:

- Pulse rise time: 5ns ± 30%
- Pulse duration (to 50% value): 50ns ± 30%
- Pulse repetition frequency 100kHz
- Burst duration should be 15ms ± 20%
- Burst period should be 300ms ± 20%

Bursts are applied for 1 minute each at the positive and the negative polarity to the mains power input (common mode) and to each applicable I/O line.

A test level of ±2kV is applied to the power supply port(s) via a coupling and decoupling network and ±1kV to each applicable I/O line via a Capacitive Coupling Clamp. No disruption of normal operation or loss of data is to occur during the performance of this test.

Typical Test Setup



Application Level Accuracy

As per IEC 61000-4-4, the test level is specified as being within ±10% into a 50Ω load and ±20% into a 1000Ω load.

Test Results

The EUT's second USB monitor experienced a shutdown during the test and did not self-recover. The manufacturer installed a ferrite on the USB to pass the test. Refer to Appendix A - Modifications for Compliance. No additional anomalies were observed.

After the ferrite install on the USB cable, the EUT passed the requirements. The EUT met Criteria B as defined in "Appendix A – EUT & Client Provided Details".

Test Voltage	Repetition Rate	Coupling Lines	Result
±2kV	100kHz	L – N – PE	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Immunity Generator	EMC Pro Plus	Keytek Thermo Corp.	Feb. 6, 2019	Feb. 6, 2021	GEMC 188
Immunity Software	CEWare 32 V4.1	Thermo Fisher Scientific	NCR	NCR	GEMC 182

IEC61000-4-4_EFTB_Rev4

Lightning Surge – 4.1.2.7

Purpose

Surge occurs when a high energy disturbance takes place on the power lines, or less frequently, I/O lines and can cause significant temporary increase in current and/or voltage. These disturbances can arise during a nearby lightning strike, circuit trips, short-circuits on the same power line that the equipment is connected to, etc. The sudden rise in voltage over a very short period of time could cause damage to the components of the EUT and this test assesses the immunity of the EUT to such transient waves. This test differs from Electrical Fast Transients / Bursts in that this waveform, characterized by the rapid increase of current and/or voltage followed by a slower decrease, has a longer wave duration that could allow damage to the EUT. This test does not guarantee that the EUT will not be exposed to a higher level of surge energy during its operation, which may cause the EUT to fail. This test also does not ensure operation of the EUT in the presence of direct lightning effects.

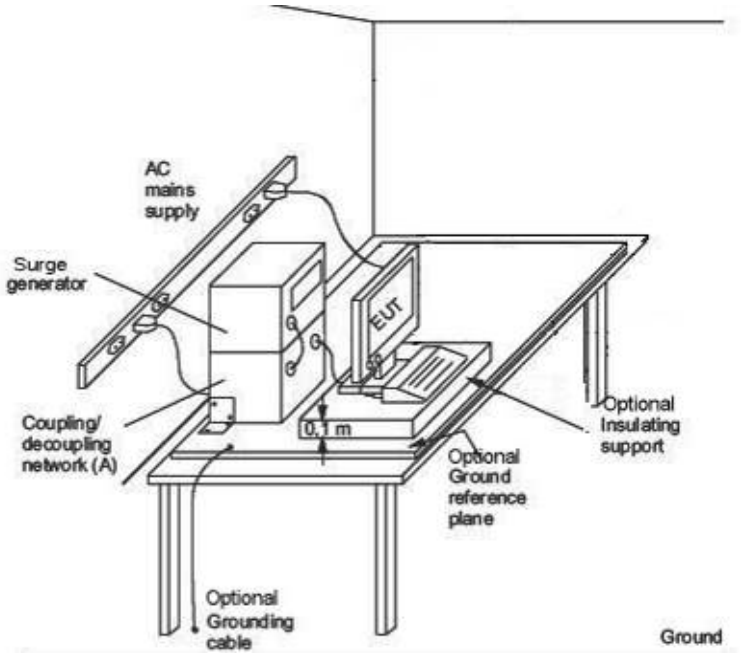
Application Level Requirement

This test is performed in accordance with the methodology defined in IEC 61000-4-5. Surges are simulated using a waveform generator and the characteristics of the waveform generated are as follows:

- Rise time of 1.2µs and wave duration of 50µs (to 50% value) into an open circuit.
- Rise time of 8µs and wave duration of 20µs (to 50% value) into a short circuit.
- Dwell time of 60 seconds between each surge.
- 5 surges in the positive and 5 surges in the negative polarity.
- For AC systems, the surge pulses are applied at 0º, 90º, 180º and 270º.
- For AC systems, Line to Ground is performed at the same amount as the Line to Line voltage.

For AC mains supply, a test level of ±2kV Line to Line and ±2kV Line to Ground is applied to the power supply port(s) via a coupling and decoupling network. Lower test levels are evaluated first before applying the required test level. No disruption of normal operation or data loss is allowed as applied to this test.

Typical Test Setup



Application Level Accuracy

As per IEC 61000-4-5, the level is specified as being within ±10% for open circuit voltage calibration or ±10% for short circuit current calibration. The EUTs input impedance, or whether Line – PE or Line – Line is being performed, combined with the calibrated generators output impedance, will affect the timing and voltage/current of the waveform applied to the EUT.

Test Results

The EUT passed the requirements. The EUT did not encounter any deviation from normal operation or data loss.

Test Voltages	Phase Angles	Number of Surges	Coupling Lines	Result
±0.5kV, ±1kV, ±2kV	0°, 90°, 180°, 270°	5 per polarity	L – PE	Pass
±0.5kV, ±1kV, ±2kV	0°, 90°, 180°, 270	5 per polarity	N – PE	Pass
±0.5kV, ±1kV, ±2kV	0°, 90°, 180°, 270°	5 per polarity	L – N	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Immunity Generator	EMC Pro Plus	Keytek Thermo Corp.	Feb. 6, 2019	Feb. 6, 2021	GEMC 188
Immunity Software	CEWare 32 V4.1	Thermo Fisher Scientific	NCR	NCR	GEMC 182

IEC61000-4-5_Surge_Rev4

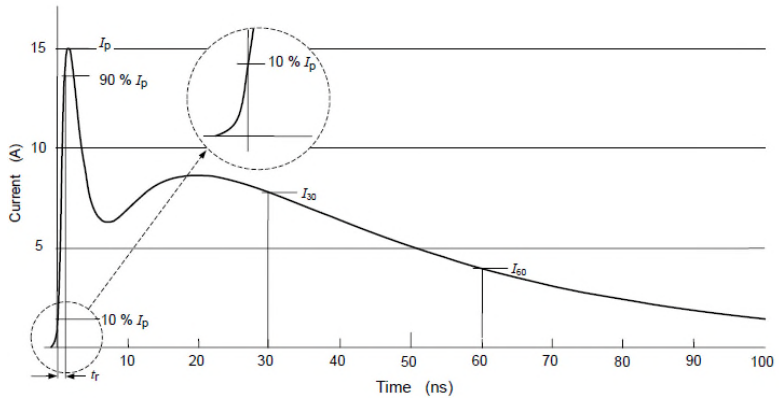
Electrostatic Disruption – 4.1.2.8

Purpose

The purpose of this immunity test is to apply a static electricity discharge from the operator to the EUT or create a nearby discharge field. An example of this discharge can be seen in low humidity conditions when a person touches an object and creates a small spark. This spark could potentially be harmful to the operation of the EUT. The contact method, with related reduced voltages, has been shown to be roughly equivalent to air discharges in severity and due to its reproducibility, contact is the preferred test method. Air discharge is used where contact discharge cannot be applied since the discharge point is significantly insulated and the insulation cannot be easily broken through. This test ensures a minimum level of immunity which is likely to occur in a normal usage environment. This test does not guarantee that the EUT will not be exposed to higher discharge levels which could cause it to fail.

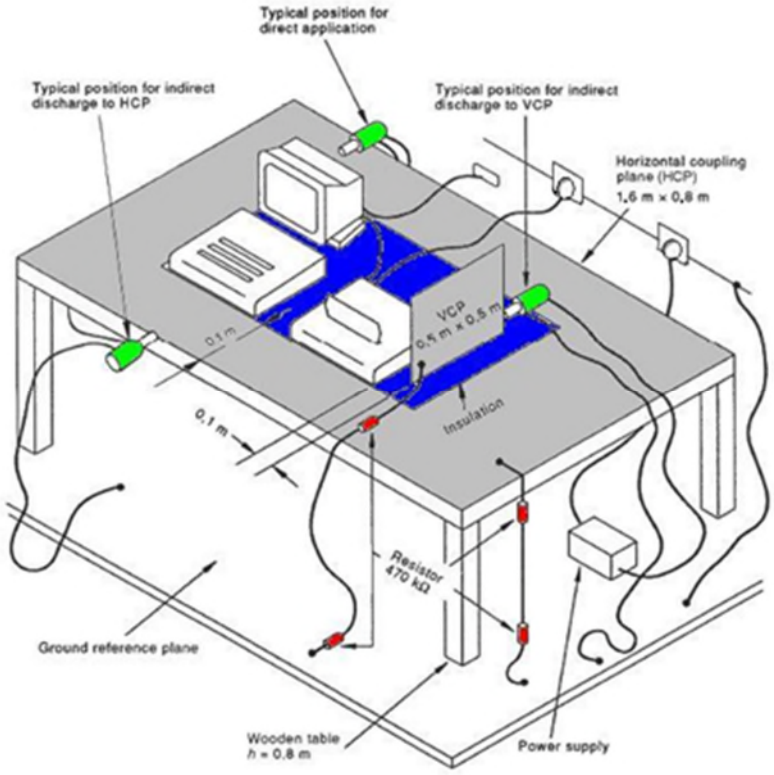
Application Level Requirement

This test is performed in accordance with the methodology defined in IEC 61000-4-2. Ten hits in the positive and negative polarity are applied at each defined discharge point on the EUT. These are called direct discharges, regardless of contact or air being applied. Horizontal Coupling Plane (HCP) and Vertical Coupling Plane (VCP) discharges are also applied and these are called indirect discharges. A typical test setup representation is shown on the following page. A photograph of the actual test setup is shown in Appendix B. See the results table under Test Results for the actual EUT discharge points.



A level of ±8kV contact or ±15kV air, where applicable, is applied to each defined discharge point. For air discharge testing, the test is applied at the lower test levels first. No disruption to normal operation or loss of data is applied to this test. However, all anomalies, if any, are noted.

Typical ESD Setup



Application Level Accuracy

Contact discharge: ±15% for the first peak current, ±5% for the output voltage and ±25% for the rise time as measured at the discharge electrode tip of ESD generator.

Test Results

The EUTs passed the requirements. The EUTs encountered no disruption of normal operation and no loss of data. No anomalies were observed.

Location	Test Voltage	Discharge Type	Pass / Fail
1. HCP	±2kV, ±4kV, ±8kV	Contact	Pass
2. VCP	±2kV, ±4kV, ±8kV	Contact	Pass
3. Front enclosure screw – left	±2kV, ±4kV, ±8kV	Contact	Pass
4. Front enclosure screw – right	±2kV, ±4kV, ±8kV	Contact	Pass
5. Front security tab – left	±2kV, ±4kV, ±8kV	Contact	Pass
6. Front security tab – right	±2kV, ±4kV, ±8kV	Contact	Pass
7. Security FOB outer shell	±2kV, ±4kV, ±8kV	Contact	Pass
8. LCD Touch Screen – center	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
9. AUX LCD Touch Screen – center	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
10. AUX LCD Touch Screen – stand	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
11. AUX LCD Touch Screen – rear	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
12. Enclosure – ballot entry seam	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
13. Enclosure button – Cast	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
14. Enclosure button – Return	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
15. Enclosure – top upper left	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
16. Enclosure – top upper right	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
17. Enclosure – top upper center	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
18. Controller – buttons	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
19. Headphone jack	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)

20. AC Power supply enclosure – top	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
21. AC Power supply enclosure – back	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
22. AC Power supply – cable	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
23. DC power cable – entry	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass
24. RJ-45 cable	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)
25. USB cable	±2kV, ±4kV, ±8kV, ±15kV	Air	Pass (No Discharge)

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
ESD Simulator	NSG 437	Teseq	Jun. 28, 2017	Jun. 28, 2019	GEMC 130
ESD HCP	80CM x 160CM	TUV SUD Canada, Inc	NCR	NCR	GEMC 50
ESD VCP	50CM x 50CM	TUV SUD Canada, Inc	NCR	NCR	GEMC 51
ESD 470K A	2x470kΩ 100CM	TUV SUD Canada, Inc	NCR	NCR	GEMC 52
ESD 470K B	2x470kΩ 100CM	TUV SUD Canada, Inc	NCR	NCR	GEMC 53

IEC61000-4-2_ESD_Rev4

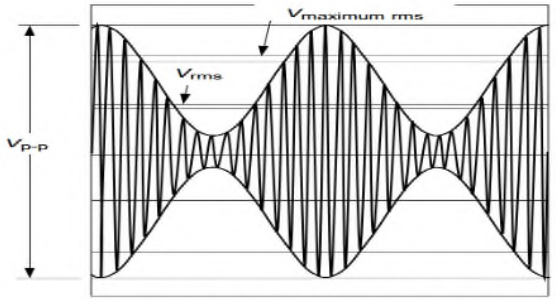
Electromagnetic Susceptibility – 4.1.2.10

Purpose

The EUT will likely be exposed to intentional sources of electromagnetic radiation during its regular application. Sources of such radiation can be cellular phones, FM radio, television, remote car alarms, garage door openers, and other broadcast transmissions. These sources of radiation are licensed or certified for broadcast and therefore, the EUT should be immune to their RF energy. This test assesses the immunity of the EUT to the applicable field strength test level. This test, however, does not guarantee that the EUT will not be exposed to higher level fields during its operation, which may cause it to fail.

Application Level Requirement

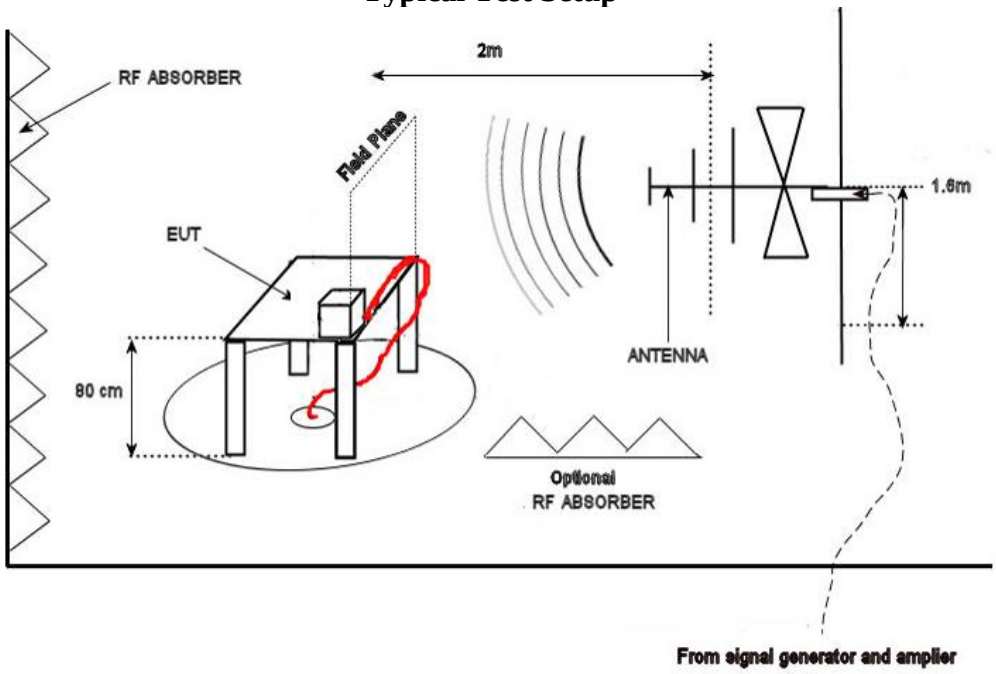
This test is performed in accordance with the methodology defined in IEC 61000-4-3. The immunity test is performed over the frequency range of 80MHz to 1.0GHz. As the frequency range is swept incrementally, the step size used is calculated at 1% of the preceding frequency value, rounded down to the nearest kHz. Known clock frequencies, local oscillators, etc. are analyzed separately, where applicable, and these are defined in "Appendix A – EUT & Client Provided Details". The field uniformity is calibrated at 10V/m and a modulation of 80% AM 1kHz sine wave is applied during the application of the RF energy at each frequency.



Modulated RF-signal 80 % AM

The RF field is applied in both horizontal and vertical antenna polarization and four sides of the EUT are subjected to this RF field. The dwell time used for each frequency is 3 seconds. Forward power is monitored and records are kept on file at TUV SUD Canada Inc. An isotropic field probe is also placed in near proximity of the EUT to verify the application of the RF field. Performance Criteria level A as defined in "Appendix A – EUT & Client Provided Details" is applied to this test.

Typical Test Setup



Application Level Accuracy

As per IEC 61000-4-3, the RF field is specified as 0dB to +6dB for at least 12 of the 16 calibration points. For a 10 V/m field, this allows for the EUT to be subjected to a field of 10 V/m to 20 V/m with at least 75% coverage at this level.

Test Results

The EUTs encountered no disruption of normal operation or data loss. No other anomalies were observed.

Input Voltage and Frequency	120Vac, 60Hz
Frequency Range and Field Strength	80MHz – 1GHz 10V/m (80% AM)
Sweep Step	1% of Fundamental
Dwell Time	3 sec.
Result	**Pass**

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Signal Generator	SMU 200A	Rohde & Schwarz	Dec. 22, 2017	Dec. 22, 2019	GEMC 236
BiLog Antenna	3142-C	ETS	Oct. 19, 2018	Oct. 19, 2020	GEMC 8
Power Amplifier	5225FE	Ophir RF	NCR	NCR	GEMC 298
Field Probe	FL 7018	AR	Oct. 10, 2018	Oct. 10, 2020	GEMC 164
Field Monitor	FM 7004	AR	NCR	NCR	GEMC 13
Power Head	PH 2000	AR	Feb. 1, 2017	Feb. 1, 2019	GEMC 15
Power Meter	PM 2002	AR	Feb. 1, 2017	Feb. 1, 2019	GEMC 16
Immunity Software	V224	TUV SUD Canada, Inc.	NCR	NCR	GEMC 57

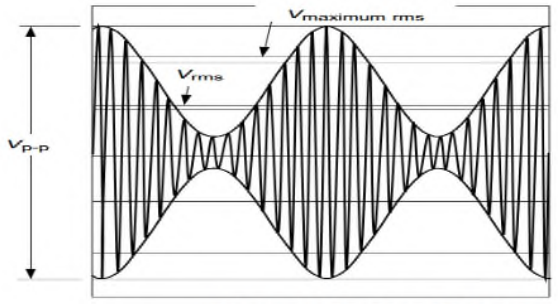
Conducted RF Immunity – 4.1.2.11

Purpose

The EUT will likely be exposed, in some way, to low frequency intentional sources of RF energy during its regular application. Sources of such radiations can be AM radio, shortwave radio, CB transmissions, and other low frequency broadcast transmissions. These sources of radiations are licensed or certified for broadcast and therefore, the EUT should be immune to their RF energy. Due to the properties of radio, the power or I/O lines on the EUT would likely be the passive receiving antenna that induces the disturbance to the EUT. Since this is the main method of coupling at this frequency range, the direct application of the RF energy to the line being tested is used. At this frequency range and level, this method is easier to produce and reproduce in a laboratory environment than subjecting the EUT to an equivalent RF field.

Application Level Requirement

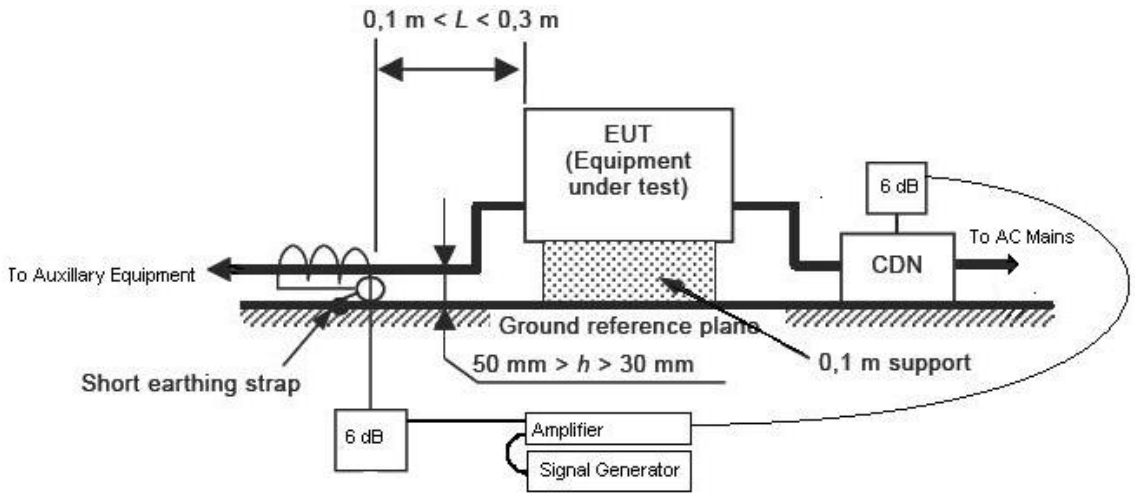
This test is performed in accordance with the methodology defined in IEC 61000-4-6. I/O cables are tested using a bulk current injection probe and power lines are tested using a coupling and decoupling network. The immunity test is performed over the frequency range of 150kHz to 80MHz. As the frequency range is swept incrementally, the step size used is calculated at 1% of the preceding frequency value, rounded down to the nearest kHz. Known clock frequencies, local oscillators, etc. are analyzed separately, where applicable, and these are defined in "Appendix A – EUT & Client Provided Details". The test level is calibrated at 10Vrms and a modulation of 80% AM 1kHz sine wave is applied during the application of the RF energy at each frequency.



Modulated RF-signal 80 % AM

The dwell time used for each frequency is 3 seconds. A current probe is placed between the coupling device and the EUT to verify the application of the RF energy. No disruption to normal operation or data loss allowed is applied to this test.

Typical Test Setup



Application Level Accuracy

As per IEC 61000-4-6, the CDN must meet a common mode impedance $|Z_{CE}| = 150\Omega \pm 20\Omega$ for 150kHz to 26MHz and $|Z_{CE}| = 150\Omega + 60\Omega$ or $150\Omega - 45\Omega$ for 26MHz to 80MHz. During tests using the bulk current injection probe, the impedance of each cable will affect the current injected and therefore, current was monitored. The calibration is performed according to IEC 61000-4-6 which allows for ±2dB.

Test Results

The EUTs passed the requirements. The EUTs met Criteria A as defined in "Appendix A – EUT & Client Provided Details". No anomalies were observed.

Input Voltage and Frequency	120Vac 60Hz
Frequency Range and Signal Strength	150kHz - 80MHz 10Vrms (80% AM)
Sweep Step	1% of Fundamental
Dwell Time	3 sec.
AC Mains	Pass
Result	**Pass**

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Power Line CDN	FCC-801-M3-16A	FCC	Feb. 23, 2018	Feb. 23, 2020	GEMC 138
Power Amplifier	75A250A	AR	NCR	NCR	GEMC 14
Signal Generator	SMY01	Rohde & Schwarz	Feb. 21, 2018	Feb. 21, 2020	GEMC 6330
Power Attenuator 6dB	100-A-FFN-06	Bird	NCR	NCR	GEMC 48
Immunity Software	V223	TUV SUD Canada, Inc	NCR	NCR	GEMC 57

IEC61000-4-6_ConductedImmunity_Rev4

Magnetic Fields Immunity – 4.1.2.12

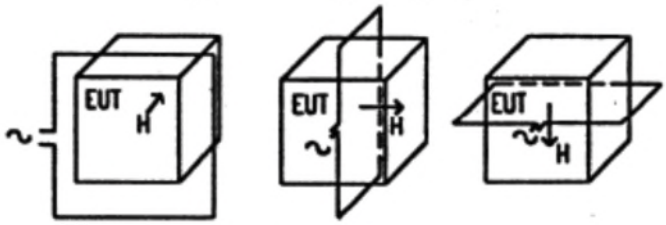
Purpose

A magnetic field with the frequency of the power line is generated around the EUT. In practice, the EUT will be subjected to power frequency magnetic fields from nearby power lines, transformers, or devices such as televisions or monitors. Since the EUT is usually used in conjunction with other electrical equipment, it is subjected to the steady state magnetic fields. These are magnetic fields that the device is exposed to under normal operating conditions. These fields have lower field strengths compared to typical transient magnetic fields.

Application Level Requirement

This test is performed in accordance with the methodology defined in IEC 61000-4-8. Three orthogonal axis of the EUT are subjected to the field within the magnetic loop. The transient magnetic field, if applicable, is tested for 1 minute while the steady state magnetic field is tested for 15 minutes. The frequency applied is 60 Hz. A magnetic field strength of 30 A/m is applied to the EUT in each orthogonal axis. No disruption to normal operation or loss of data is applied to this test.

Typical Setup Diagram



Application Level Accuracy

As per IEC 61000-4-8, the field over the area that the EUT occupies within the loop must be calibrated to be within ±3dB. For a field strength of 3 A/m, this means that the empty calibrated field strength can be between 2.1 A/m and 4.2 A/m over the area that the EUT occupies.

Test Results

The EUT passed the requirements. The EUT did not encounter any disruption of normal operation or loss of data. No anomalies were observed.

When a 60 Hz field was applied, the EUTs were powered at 120 Vac 60 Hz, battery mode and the field strength at 30 A/m.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Magnetic Loop	F-1000-4-8/9/10-L-1M	FCC	NCR	NCR	GEMC 22
Variac	PWRSTA 3PN126	Powerstat	NCR	NCR	GEMC 6032
Clamp Meter	365	Fluke	Nov. 19, 2018	Nov. 19, 2019	GEMC 260

IEC61000-4-8_MagneticImmunity_Rev3

Appendix A – EUT & Client Provided Details

General EUT Description

Client Details	
Organization / Address	Pro V&V 700 Boulevard South Huntsville, Al. 35803
Contact	Michael L. Walker
Phone	256-713-1111
Email	michael.walker@provandv.com
Manufacturer Details (if not same as above)	
Organization / Address	Dominion Voting Systems/215 Spadina Ave, Toronto, ON M5T 2C7
Contact	Aamer Chaudhry
Phone	416.762.8683 x 227
Email	aamer.chaudhry@dominionvoting.com
EUT (Equipment Under Test) Details	
EUT Name	Image Cast Evolution
EUT Model / SN	PCOS-410A
EUT revision	51
Software version	5.5.6.1
Equipment category	Voting Machines
EUT is powered using	AC/DC
Input voltage range(s) (V)	100-240
Frequency range(s) (Hz)	50-60
Rated input current (A)	1.8A
Nominal power consumption (W)	60W
Number of power supplies in EUT	1
Basic EUT functionality description	Voting Ballot Tabulator
Modes of operation	Voting Mode, Tech Mode
EUT setup time (min)	5
Frequency of all clocks present in EUT	CPU Core 533MHz, DDR 266MHz, Video 90MHz, Local Bus 66MHz, PCI 33MHz
I/O cable description Specify length and type	AVS ATI RJ45 3m; AVS Headphones Audio 1/8" 2.5m; AVS Sip&Puff Audio 1/8" 1.5m;

	Power Input Docking Connector extension cable 15cm; Ballot Box Intrusion Switch docking connector extension cable 110cm;
Available connectors on EUT	Serial; 2xCF; USB; Ethernet RJ45, ATI RJ45, Bottom Ballot Box Docking Connector, Aux Power, BMD Lights RJ11
Dimensions of product	L 570mm W 490mm H 180mm
Method of monitoring EUT and description of failure for immunity.	Run voting test, without disruption of normal operation or loss of data.

EUT Functional Description

Voting Ballot Tabulator.

EUT Configuration

Please see Appendix B for a picture of the unit running in normal conditions.

- Cables and earthing were connected as per manufacturer's specification.
- All cables are less than 3m

Operational Setup

Peripheral devices were attached to the EUT for its test operation. However, this report does not represent compliance of these peripheral device(s) in any way.

- Turn on device, enter test mode using voter and admin cards

Modifications for Compliance

The following modifications were made during testing for the sample to achieve compliance with the testing requirements:

A ferrite bead installed on the USB cable which connects to the second USB monitor signal cable. See Appendix B - EUT, Peripherals, and Test Setup Photos.
Wurth Electronik ferrite P/N: 742 712 22

Appendix B – EUT, Peripherals, and Test Setup Photos

Figure 1 – EUT Front Close Up

Figure 2 – EUT Rear Close Up

Figure 3 – EUT Power Supply

Figure 4 – EUT Accessory – ATI control panel & Headphones

Figure 5 – EUT Accessory – Second USB monitor

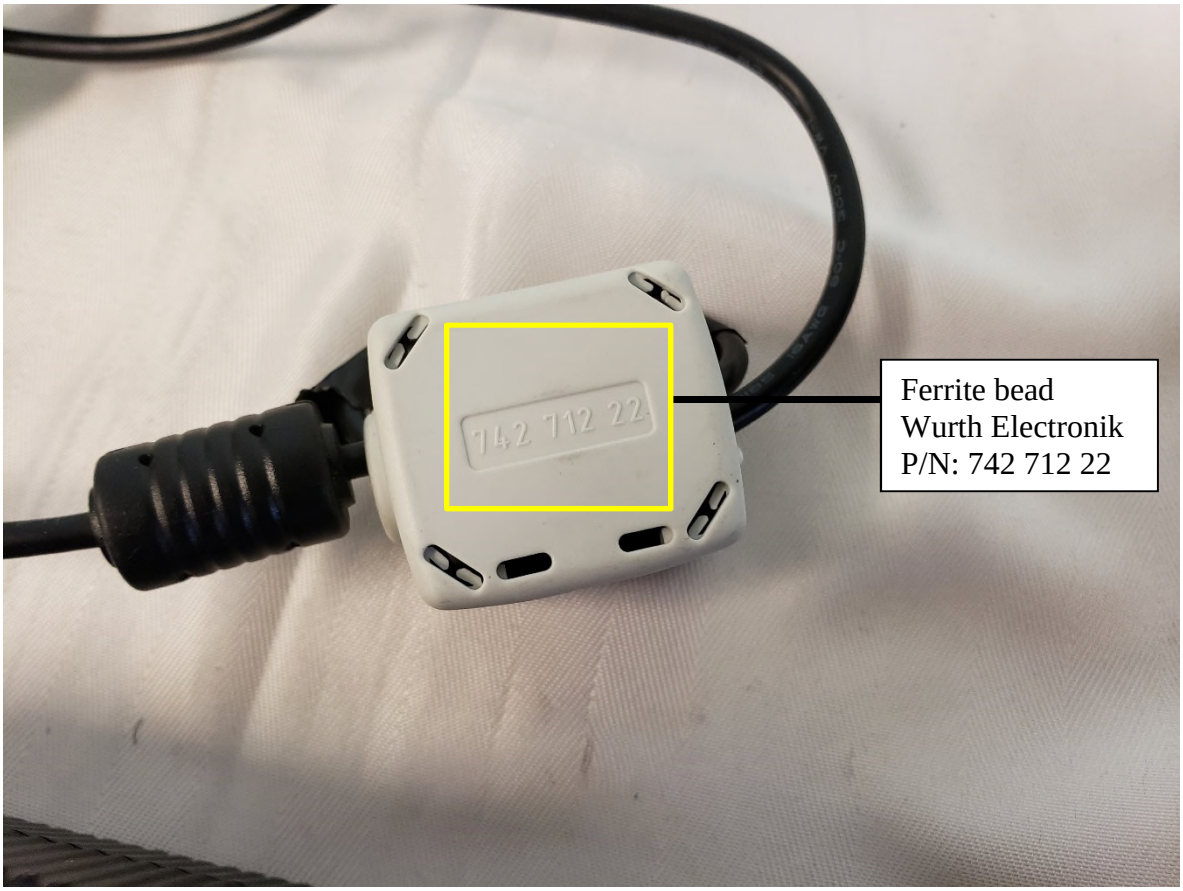


Figure 6 – Ferrite bead installed on second USB monitor cable

Figure 7 – Power Line Conducted Emissions Setup – Photo 1

Figure 8 – Power Line Conducted Emissions Setup – Photo 2

Figure 9 – Radiated Emissions Setup – Photo 1
30MHz – 1GHz

Figure 10 – Radiated Emissions Setup – Photo 2
1GHz – 6GHz

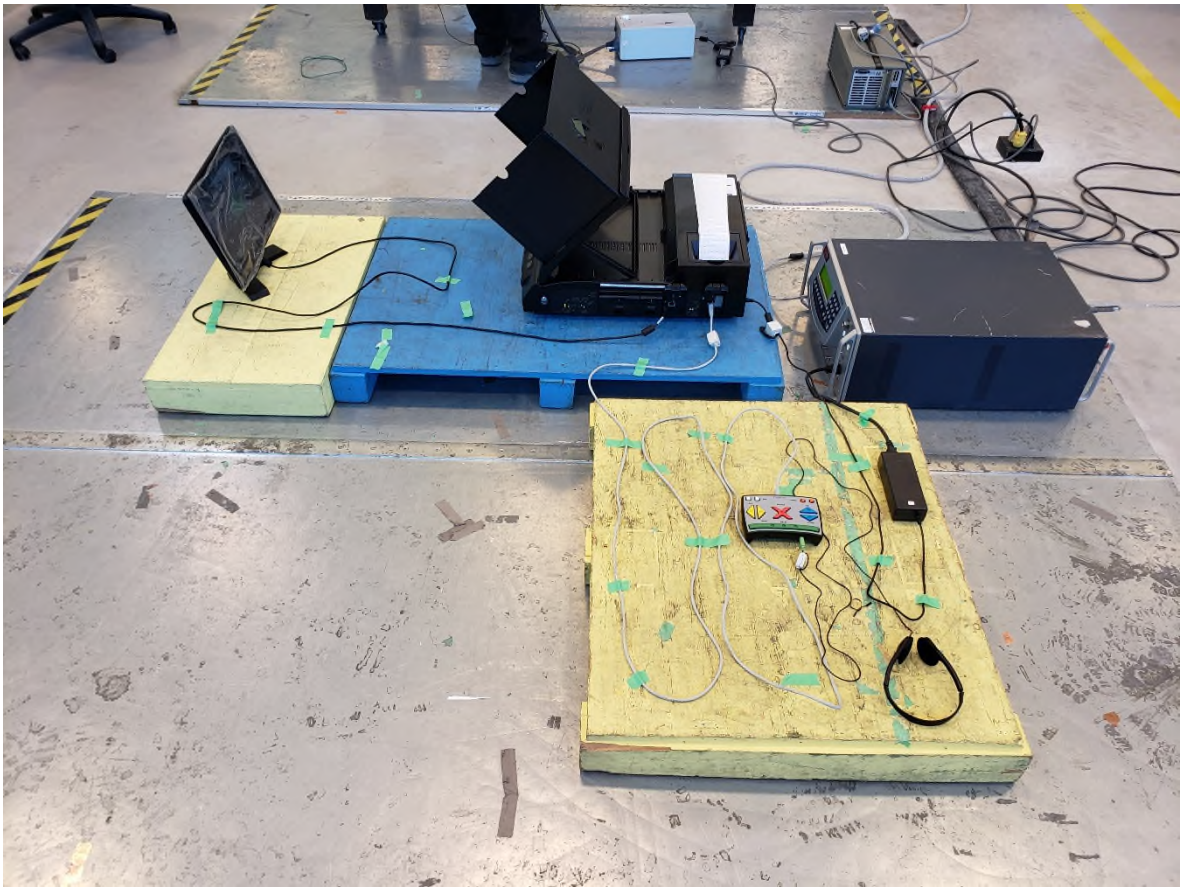


Figure 11 – Electrical Power Disturbance - Dips / Electrical Fast Transient / Lightning Surge

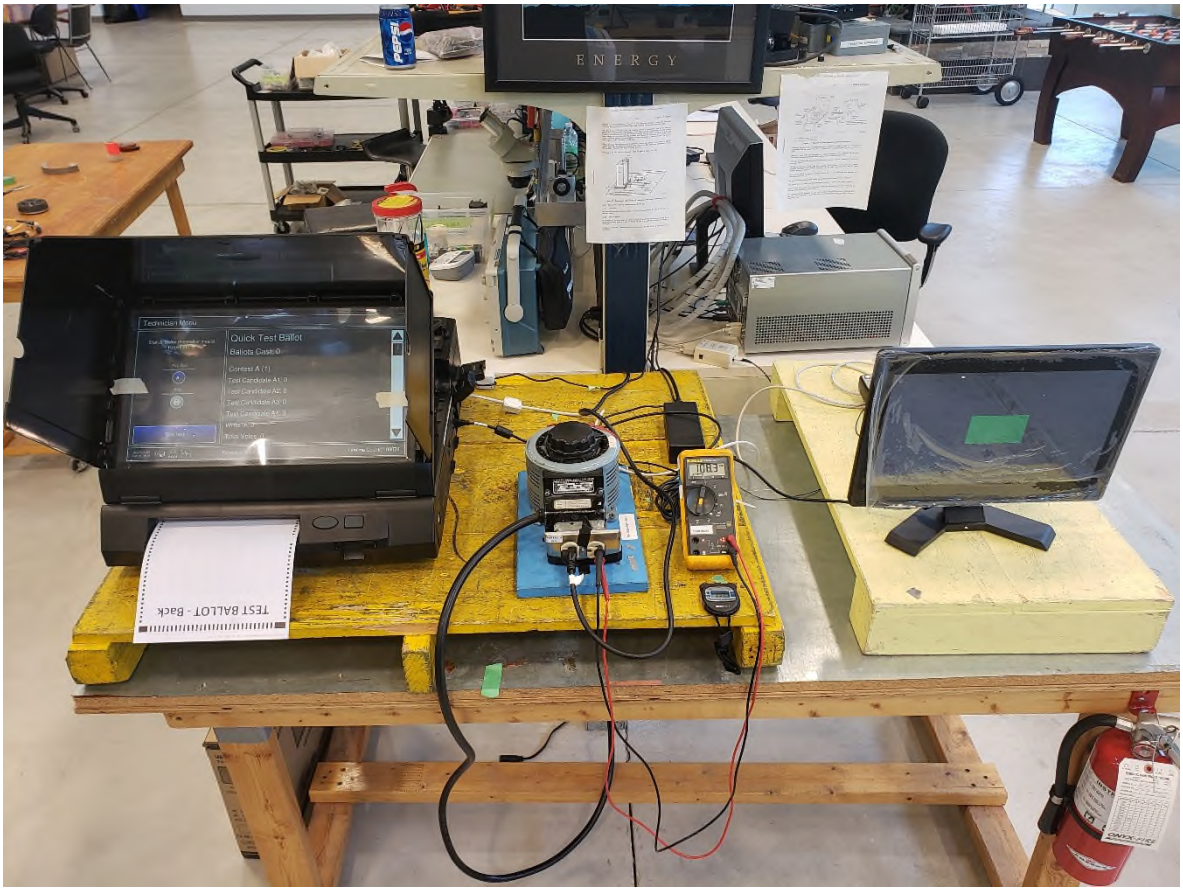


Figure 12 – Electrical Power Disturbance – power increase & reduction

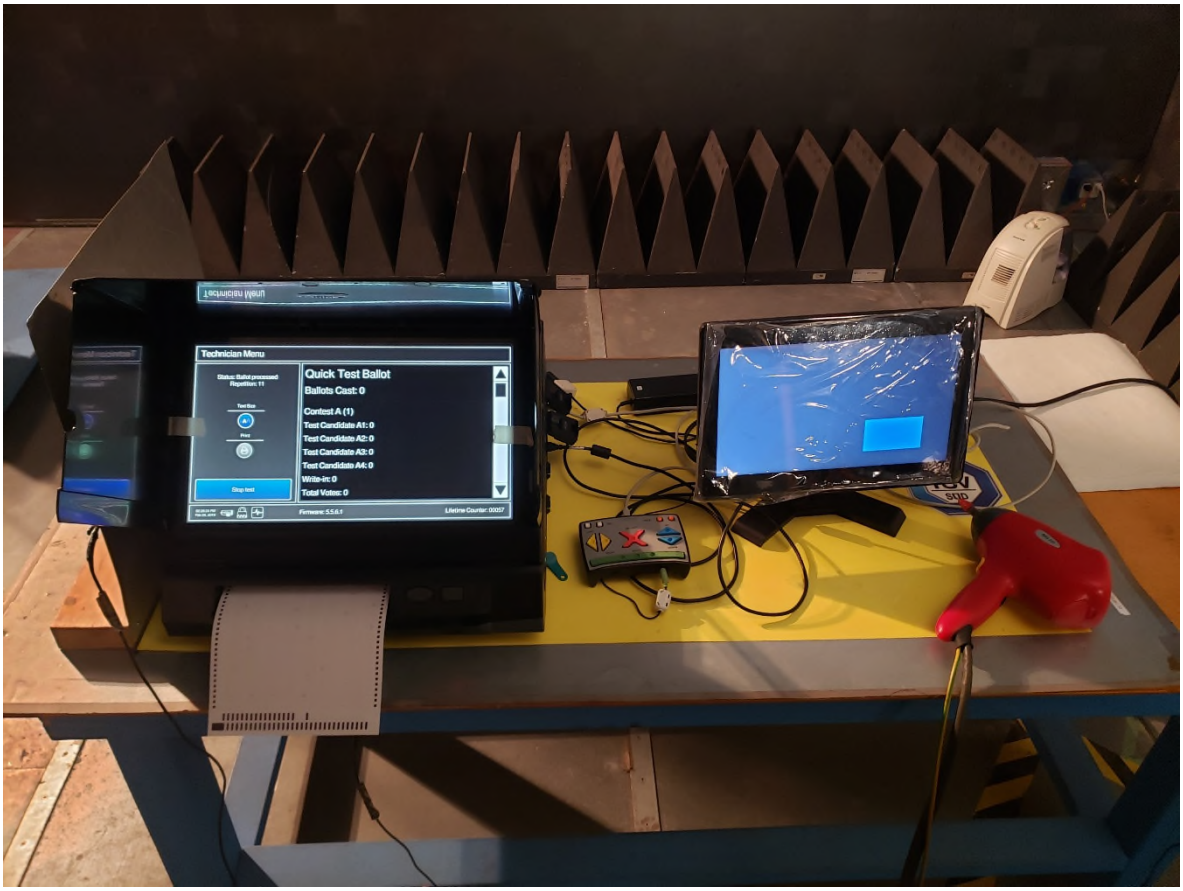


Figure 13 – Electrostatic Disruption Setup

Figure 14 – Electromagnetic Susceptibility Setup

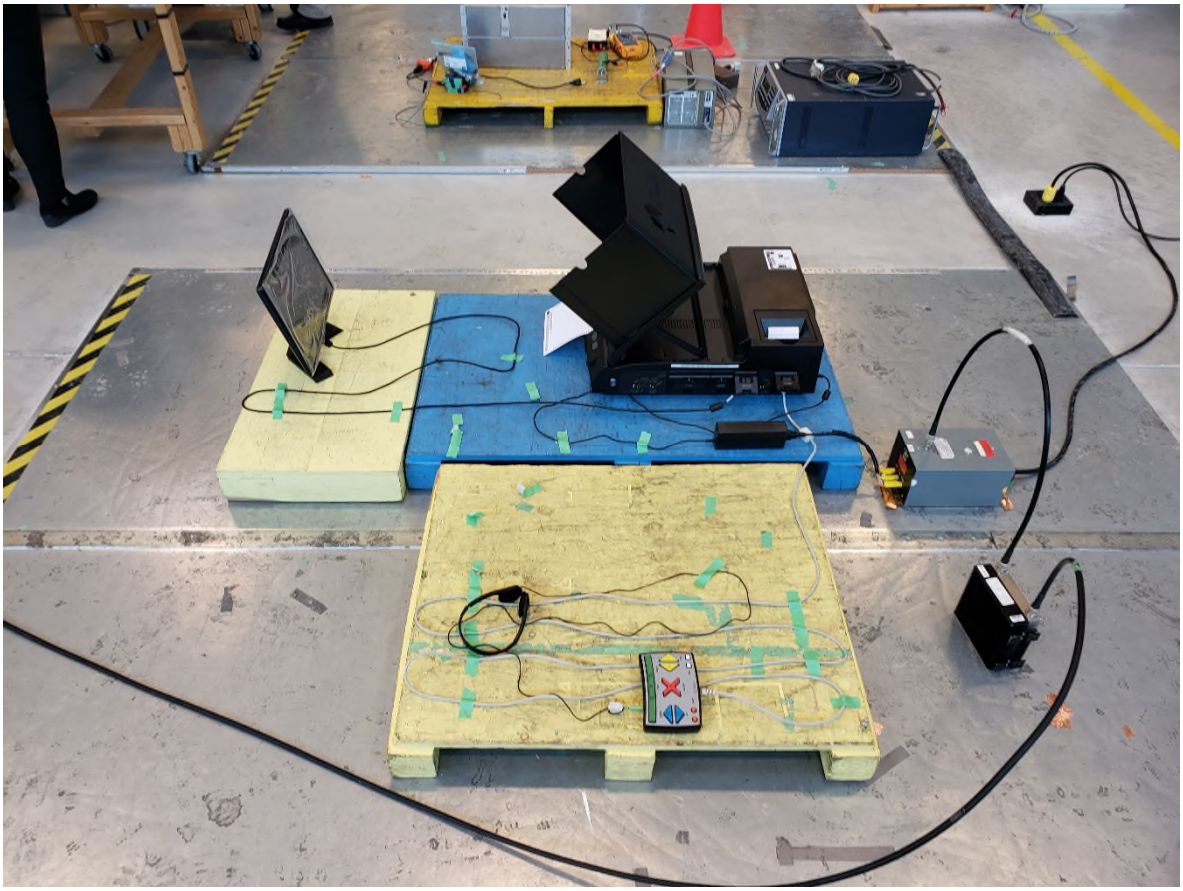


Figure 15 – Conducted RF Immunity Setup

Figure 16 – Magnetic Fields Immunity

Appendix C – Product Marking

Product Marking

Products marketed in the US:
For products that are not intentional radiators and are subject to the 'verification' procedure in the US, according to the FCC, the product shall bear the following statement in a conspicuous location on the device:

> *This device complies with Part 15 of the FCC Rules.*
> *Operation is subject to the following two conditions:*
> *(1) this device may not cause harmful interference, and*
> *(2) this device must accept any interference received, including interference that may cause undesired operation.*

Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified is required to be affixed only to the main control unit.

When the device is so small or for such use that it is not practicable to place the statement specified on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed.

In this case, the following statement may accompany the product:

> *"This device complies with Part 15 of the FCC Rules. See manual for details*"

Also, the FCC identifier or other unique identifier such as a model number and serial number, as appropriate, must be displayed on the device.

Products marketed within Canada:
According to Industry Canada, the following statement shall be permanently affixed to the ITE or displayed electronically and its text must be clearly legible. If the dimensions of the device are too small or if it is not practical to place the label on the device and electronic labeling has not been implemented, the label shall be, upon agreement with Industry Canada, placed in a prominent location in the user manual supplied with the ITE.

> *CAN ICES-3 (*)/NMB-3(*)*

* Insert either "A" or "B" but not both to identify the applicable Class of ITE.