



Canada

EMC / EMI Test Report

As per

**CISPR 32:2015 /
EN 55032:2015,
CISPR 24:2010/EN 55024:2010,
FCC Part 15 Subpart B:2015 &
ICES-003:2016**

Emissions & Immunity for

Multimedia Class B Equipment
on the

BBBWL-SC-562

Issued by:

TÜV SÜD Canada Inc.
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Testing produced for



See Appendix A for full client &
EUT details.

Jandrew Gonzales,
Project Engineer



Testing Laboratory
Certificate #2955.02



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



Registration #
CA6844

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



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Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Report Scope

This report addresses the EMC verification testing and test results of the **BBBWL-SC-562**, herein referred to as EUT (Equipment Under Test). The EUT was tested for emissions and immunity compliance against the following standards:

EN 55032:2015/CISPR 32:2015

EN 55024:2010/CISPR 24:2010

FCC Part 15 Subpart B:2015

ICES-003:2016

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.

Client	GHI Electronics	 Canada
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Summary

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

Equipment Under Test (EUT)	BBBWL-SC-562
EUT passed all tests performed	Yes
Testing conducted by	Jandrew Gonzales

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

Client	GHI Electronics	 Canada
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Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Results Summary

Standard/ Method	Description	Criteria	Class / Level	Result
EN 55032/ CISPR 32 FCC 15 - ICES 003	Power Line Conducted Emissions	N/A	Class B	Pass
EN 55032/ CISPR 32	Asymmetric Mode Conducted Emissions	N/A	Class B	N/A
EN 55032/ CISPR 32 FCC 15 - ICES 003	Radiated Emissions	N/A	Class B	Pass
EN 61000-3-2	Power Line Harmonic Emissions	N/A	Class A	Pass
EN 61000-3-3	Flicker Emissions	N/A	--	Pass
EN 55024/ EN 61000-4-2	Electro-Static Discharge	B	±4kV Contact ±8kV Air	Pass
EN 55024/ EN 61000-4-3	Radiated Field Immunity	A	3 V/m, 80 MHz – 1 GHz	Pass
EN 55024/ EN 61000-4-4	Electrical Fast Transients (Bursts)	B	±1kV - Mains ±0.5kV - I/O	Pass
EN 55024/ EN 61000-4-5	Surge Immunity	B	±1kV Line - Line ±2kV Line - Ground	N/A
EN 55024/ EN 61000-4-6	Conducted RF Immunity	A	3 Vrms, 150 kHz – 80 MHz	Pass
EN 55024/ EN 61000-4-8	Power Frequency Magnetic Field	A	1 A/m (3 A/m Tested)	Pass
EN 55024/ EN 61000-4-11	Voltage Dips and Interrupts	B/C	Various	N/A
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.

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Notes, Justifications, or Deviations

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

No asymmetric mode conducted emissions test was evaluated on the EUT as no lines on the EUT meet the definition of wired network port, optical fibre port with metallic shield, antenna port or broadcast receiver tuner port given in this report.

Client has stated that this equipment is consider a ‘DC’ device and that the EUT will not have an AC to DC power supply as part of their system. They have provided an AC to DC power supply to power on the EUT to perform conducted emissions, harmonics and flicker tests. Statements of recommended power supplies will be made by the manufacturer in their documentation.

Power Supply Part#: Sunpower PSU40A-1

Ferrites were added to the EUT cables during the Radiated Emissions test. They were added to eliminate the emissions from the Auxiliary Equipment and not from the EUT. The ferrites are spaced far enough to not affect the EUT emissions.

Client has indicated that the EUT / PCB will be ESD Sensitive and will label ESD Sensitive markings on the silk screen of the PCB.

The following tests are omitted from this report as the EUT is powered by DC. It does not connect to AC or DC mains and its power cable does not connect to other outdoor cables:

- EN 61000-4-5 (Surge Immunity)
- EN 61000-4-11 (Voltage Dips and Interrupts)

The following tests are included using the representative power supply:

- EN 61000-3-2 (Harmonic Emissions)
- EN 61000-3-3 (Voltage Fluctuations & Flicker)

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.

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Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)

Margin = 50dB μ V/m – (50dB μ V + 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 = 73.0dB μ V – (50dB μ V + 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

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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
CFR47 FCC Part 15 Subpart B:2015	Code of Federal Regulations - Radio Frequency Devices
ICES-003, Issue 6 2016	Information Technology Equipment (ITE) - Limits and Methods of Measurement
EN55032:2015/ CISPR32:2015	Electromagnetic Compatibility of Multimedia Equipment – Emission Requirements
EN55024:2010/ CISPR24:2010	Information Technology Equipment - Immunity Characteristics - Limits and Methods of Measurement
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/EN 61000-3-2:2014	Limits for Harmonic Current Emissions (equipment input current \leq 16A per phase)
IEC/EN 61000-3-3:2013	Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low-Voltage Supply Systems, for equipment with rated current \leq 16A per phase and not subject to conditional connection.
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

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Document Revision Status

Revision 1 October 3, 2016
Initial Release

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Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Definitions and Acronyms

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

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

AM – Amplitude Modulation

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 the following warning in its user manual: "**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.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

NSA – Normalized Site Attenuation

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Signal/Control Port – Port intended for the interconnection of components of an EUT, or between an 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)

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.

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

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.

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)

RF – Radio Frequency

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

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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 an 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.

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Testing Environmental Conditions and Dates

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

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
September 30, 2016	Power Line Conducted Emissions	JG	21 – 24	40 – 51	98.0 – 102.0
N/A	Asymmetric Mode Conducted Emissions	N/A	21 – 24	40 – 51	98.0 – 102.0
September 20, 2016	Radiated Emissions	JG	21 – 24	40 – 51	98.0 – 102.0
September 30, 2016	Harmonic Emissions	N/A	21 – 24	40 – 51	98.0 – 102.0
September 30, 2016	Flicker Emissions	N/A	21 – 24	40 – 51	98.0 – 102.0
September 23, 2016	Electro-Static Discharge	JG	21 – 24	40 – 51	98.0 – 102.0
September 26, 2016	Radiated Field Immunity	JG	21 – 24	40 – 51	98.0 – 102.0
September 23, 2016	Electrical Fast Transients	JG	21 – 24	40 – 51	98.0 – 102.0
N/A	Surge Immunity	N/A	21 – 24	40 – 51	98.0 – 102.0
September 23, 2016	Conducted RF Immunity	JG	21 – 24	40 – 51	98.0 – 102.0
September 23, 2016	Power Frequency Magnetic Field	JG	21 – 24	40 – 51	98.0 – 102.0
N/A	Dips and Interrupts	N/A	21 – 24	40 – 51	98.0 – 102.0

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Detailed Test Result Section

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Power Line Conducted Emissions

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 limits and method are as defined in CISPR 32, EN55032, 47 CFR FCC Part 15 Section 15.107, and ICES-003 Issue 6 Section 6.1.

CLASS B

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

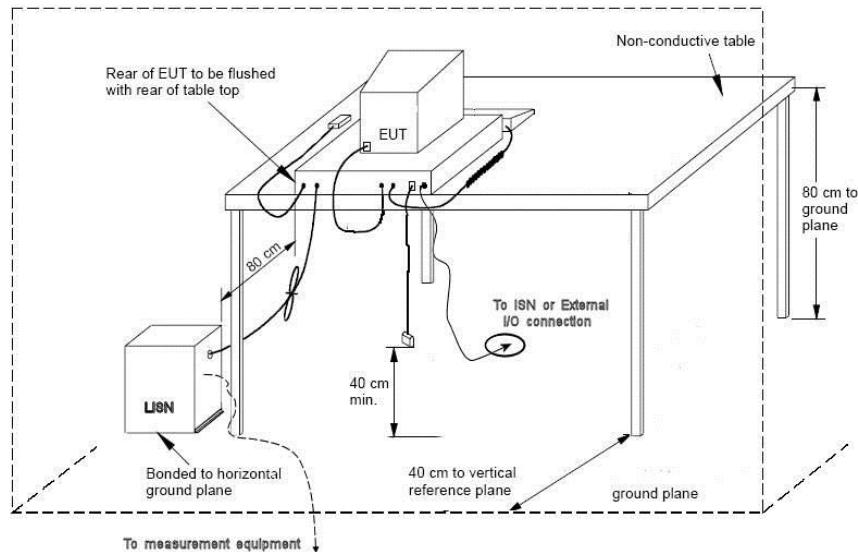
* Decreases linearly with the logarithm of the frequency

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 and CISPR 32 Annex C.3, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

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Typical Setup Diagram



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 2.91\text{dB}$ with a 'k=2' coverage factor and a 95% confidence level.

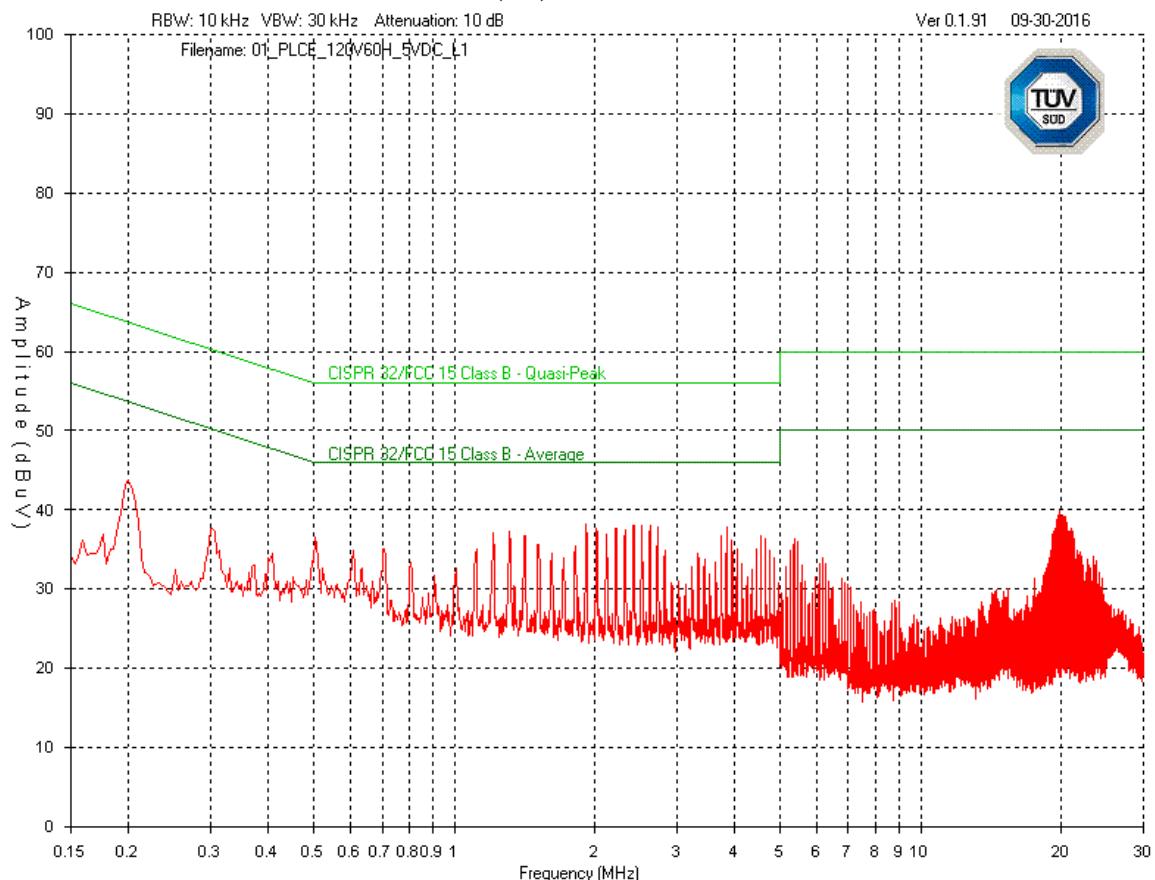
Preliminary Graphs

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.

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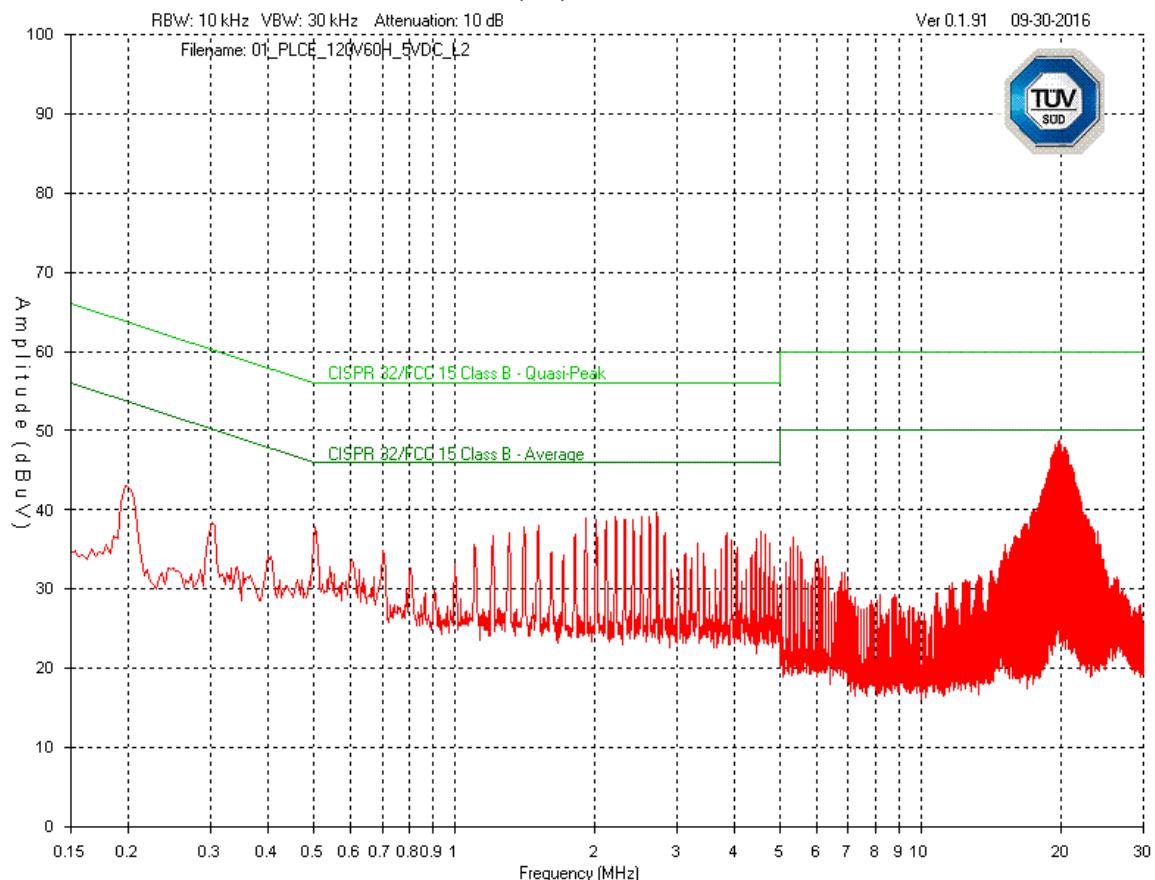
Line (L1) – 120Vac 60Hz



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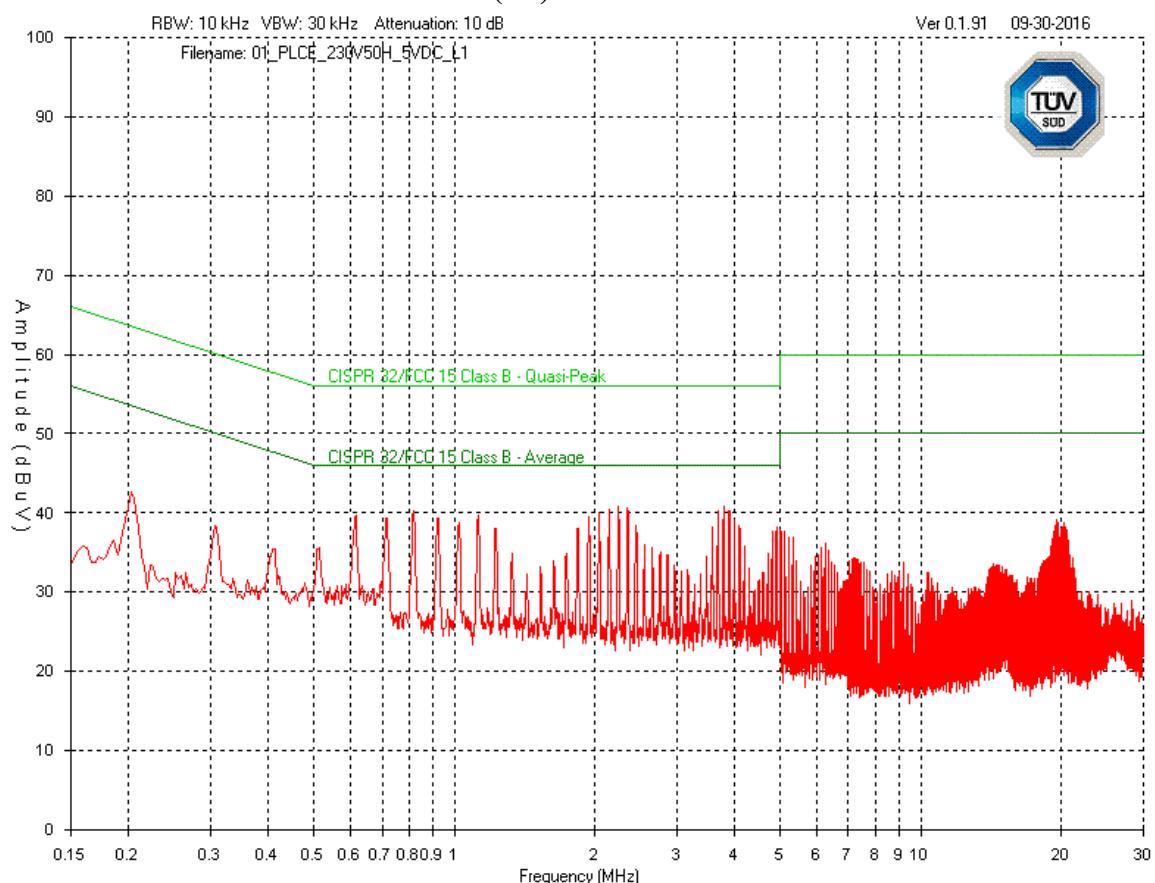
Neutral (L2) – 120Vac 60Hz



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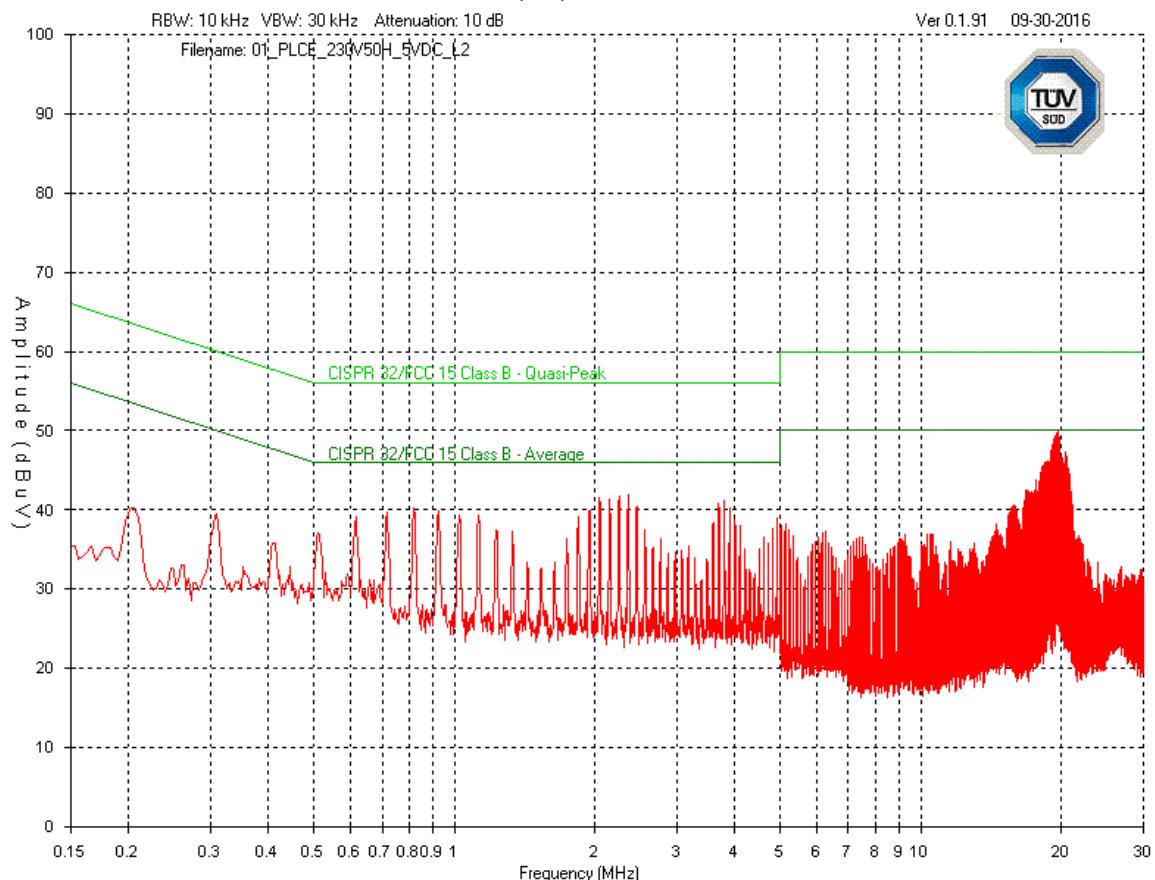


Line (L1) – 230Vac 50Hz



Client	GHI Electronics	
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Neutral (L2) – 230Vac 50Hz



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Final Measurements

Product Category			Class B								
EUT			BBBWL-SC-562								
Supply			120Vac 60Hz - 5Vdc Adapter								
Frequency (MHz)	Detector Peak/Avg/QP	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											
1.921	PEAK	28.1	10.0	0.1	0.0	38.2	56.0	46.0	17.8	7.8	Pass
2.528	PEAK	28.0	10.0	0.1	0.0	38.1	56.0	46.0	17.9	7.9	Pass
2.422	PEAK	28.0	10.0	0.1	0.0	38.1	56.0	46.0	17.9	7.9	Pass
2.631	PEAK	27.8	10.0	0.1	0.0	37.9	56.0	46.0	18.1	8.1	Pass
3.838	PEAK	27.8	10.0	0.1	0.0	37.9	56.0	46.0	18.1	8.1	Pass
2.727	PEAK	27.7	10.0	0.1	0.0	37.8	56.0	46.0	18.2	8.2	Pass
Neutral											
19.889	AVG	34.6	10.0	0.1	0.1	44.8	--	50.0	--	5.2	Pass
19.878	PEAK	38.7	10.0	0.1	0.1	48.9	60.0	--	11.1	--	Pass
20.684	PEAK	36.8	10.0	0.1	0.1	47.0	60.0	50.0	13.0	3.0	Pass
19.068	PEAK	36.3	10.0	0.1	0.1	46.5	60.0	50.0	13.5	3.5	Pass
20.975	PEAK	35.6	10.0	0.1	0.1	45.8	60.0	50.0	14.2	4.2	Pass
18.975	PEAK	35.5	10.0	0.1	0.1	45.7	60.0	50.0	14.3	4.3	Pass
20.786	PEAK	35.3	10.0	0.1	0.1	45.5	60.0	50.0	14.5	4.5	Pass

Average and Quasi-Peak Emissions Table

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Product Category			Class B								
EUT			BBBWL-SC-562								
Supply			230Vac 50Hz - 5Vdc Adapter								
Frequency (MHz)	Detector Peak/Avg/QP	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											
3.785	PEAK	30.8	10.0	0.1	0.0	40.9	56.0	46.0	15.1	5.1	Pass
2.250	PEAK	30.7	10.0	0.1	0.0	40.8	56.0	46.0	15.2	5.2	Pass
2.352	PEAK	30.6	10.0	0.1	0.0	40.7	56.0	46.0	15.3	5.3	Pass
2.147	PEAK	30.4	10.0	0.1	0.0	40.5	56.0	46.0	15.5	5.5	Pass
3.679	PEAK	30.2	10.0	0.1	0.0	40.3	56.0	46.0	15.7	5.7	Pass
3.888	PEAK	30.2	10.0	0.1	0.0	40.3	56.0	46.0	15.7	5.7	Pass
Neutral											
19.727	Avg	38.3	10.0	0.1	0.1	48.5	--	50.0	--	1.5	Pass
19.707	Avg	35.4	10.0	0.1	0.1	45.6	--	50.0	--	4.4	Pass
19.705	PEAK	40.0	10.0	0.1	0.1	50.2	60.0	--	9.8	--	Pass
19.602	PEAK	39.6	10.0	0.1	0.1	49.8	60.0	--	10.2	--	Pass
20.017	PEAK	36.5	10.0	0.1	0.1	46.7	60.0	50.0	13.3	3.3	Pass
20.199	PEAK	36.4	10.0	0.1	0.1	46.6	60.0	50.0	13.4	3.4	Pass
18.783	PEAK	36.0	10.0	0.1	0.1	46.2	60.0	50.0	13.8	3.8	Pass
18.455	PEAK	35.9	10.0	0.1	0.1	46.1	60.0	50.0	13.9	3.9	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.

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Jan. 15, 2015	Jan. 15, 2017	GEMC 65
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 29
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	NCR	NCR	GEMC 223
150kHz High Pass Filter	EZ-25	Rohde & Schwarz	NCR	NCR	GEMC 120
Emissions Software	0.1.91	Global EMC	NCR	NCR	GEMC 58

CISPR32-FCC_PLCE_Rev1

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Radiated Emissions

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.

Limits & Method

The limits and method are as defined in ANSI C63.4 and CISPR 32, EN55032, 47 CFR FCC Part 15 Section 15.109(g), and ICES-003 Issue 6 Section 6.2:

CLASS B

Frequency Range ^a	Quasi-Peak Limits - 10m ^b	Quasi-Peak Limits - 3m ^b
30 MHz – 230 MHz	30 dB μ V/m	40 dB μ V/m
230 MHz – 1 GHz	37 dB μ V/m	47 dB μ V/m

CISPR 32 / EN 55032,

Frequency Range ^a	Average Limit - 3m ^c	Peak Limit - 3m ^d
1 GHz – 3 GHz	50 dB μ V/m	70 dB μ V/m
3 GHz – 6 GHz	54 dB μ V/m	74 dB μ V/m

FCC Part 15 Subpart B,

Frequency Range ^a	Average Limit - 3m ^c	Peak Limit - 3m ^d
1 GHz and Up	54 dB μ V/m	74 dB μ V/m

^aThe frequency range scanned is in accordance to CISPR 32 Table 1 and FCC Part 15 Section 15.33(b).

^bLimit 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.

^cLimit is with a resolution bandwidth of 1 MHz and using an Average detector.

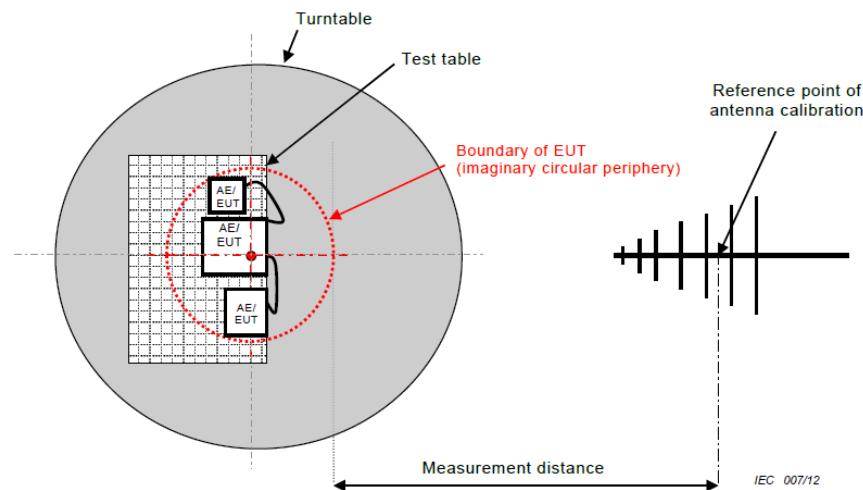
^dLimit is with a resolution bandwidth of 1 MHz, a video bandwidth at least three times greater than the resolution bandwidth, and using a Peak detector.

Based on ANSI C63.4 Section 4.2 and CISPR 32 Annex C.3, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Typical Radiated Emissions Setup



Note: In accordance with CISPR 32 Annex C, testing was performed at a 3 meter test distance.

Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

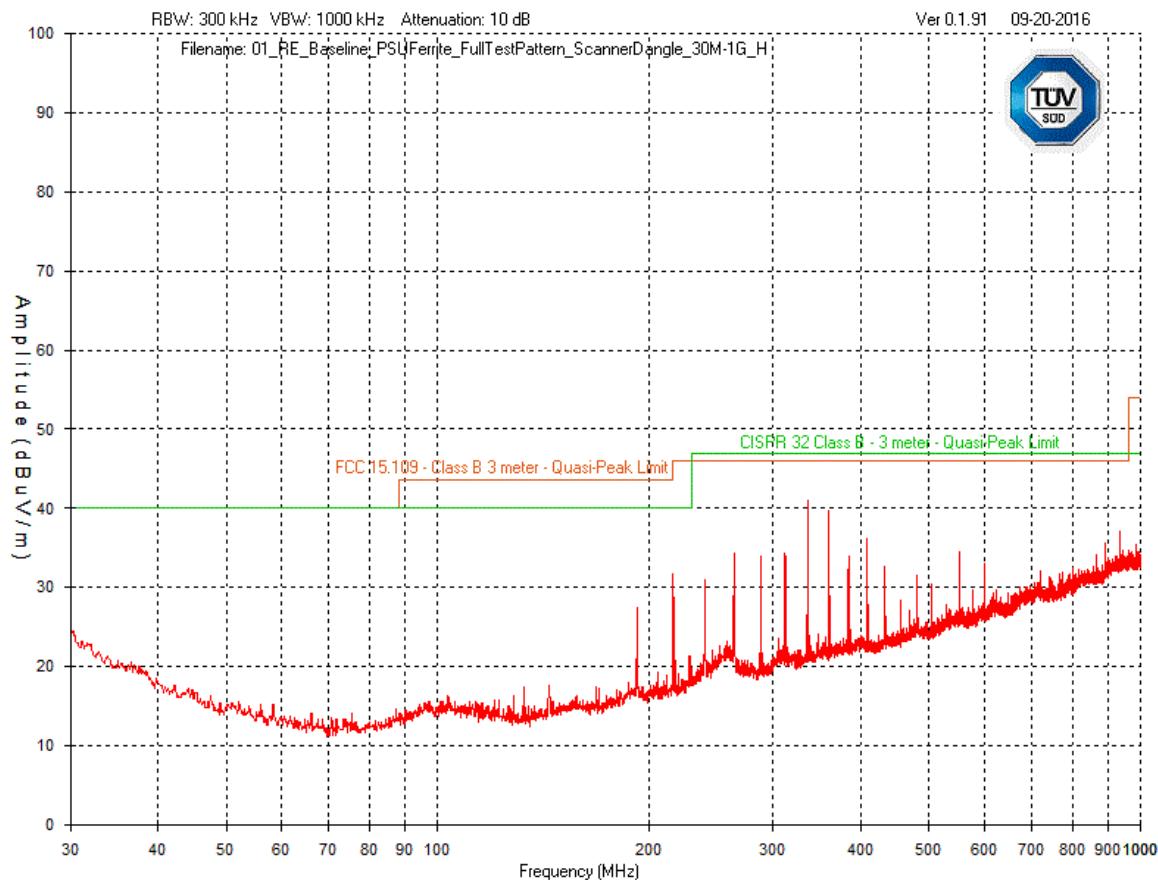
The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement.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

In accordance with FCC Part 15, Subpart A, Section 15.33 and CISPR 32 Table 1, the EUT 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 and CISPR 32.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

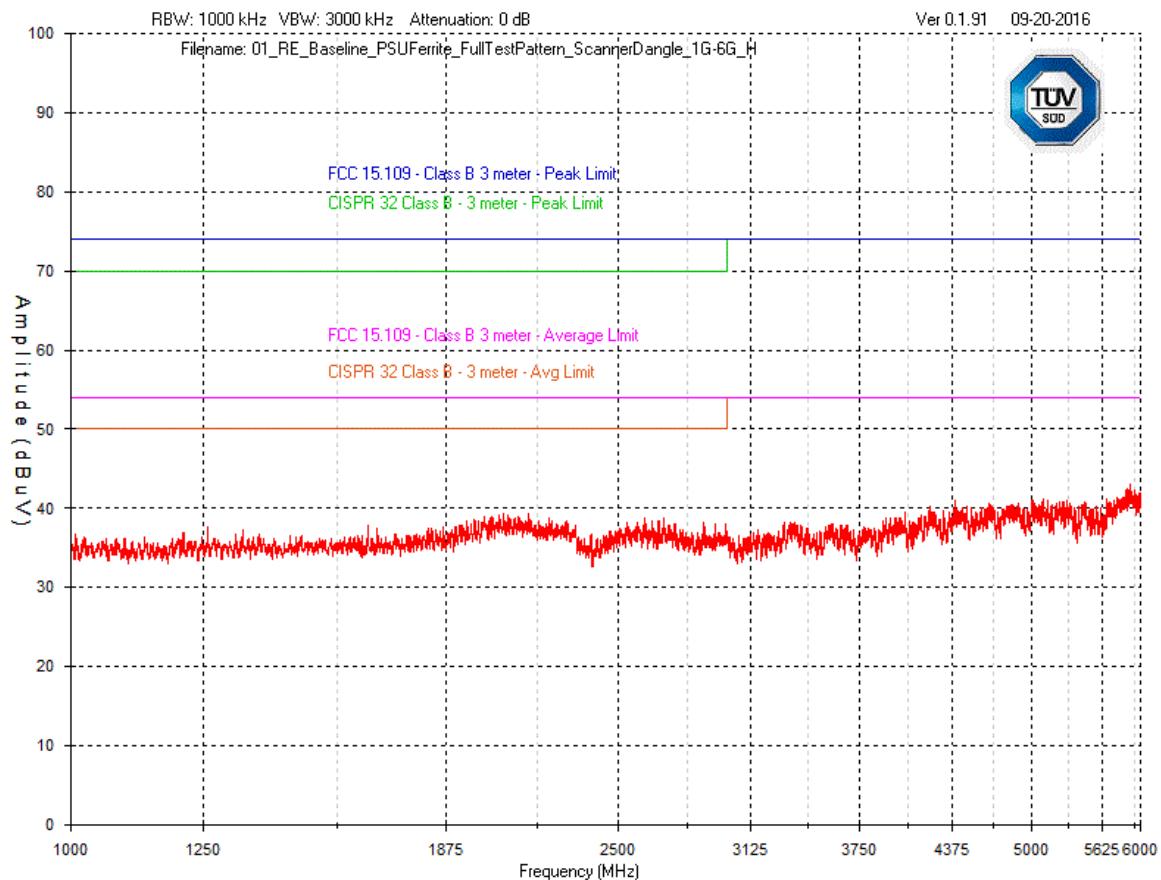


Horizontal – Peak Emissions Graph 5Vdc – 30MHz - 1GHz



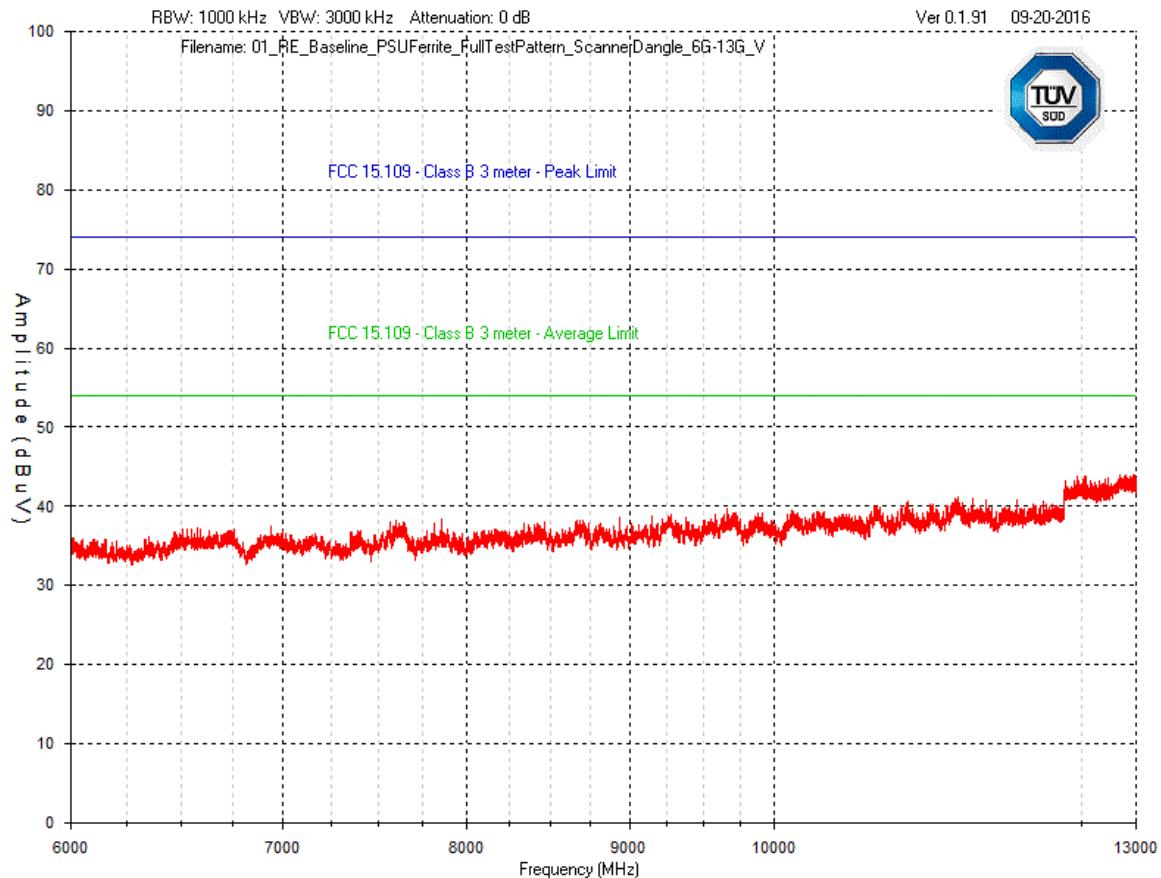
Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Horizontal – Peak Emissions Graph 5Vdc – 1GHz - 6GHz



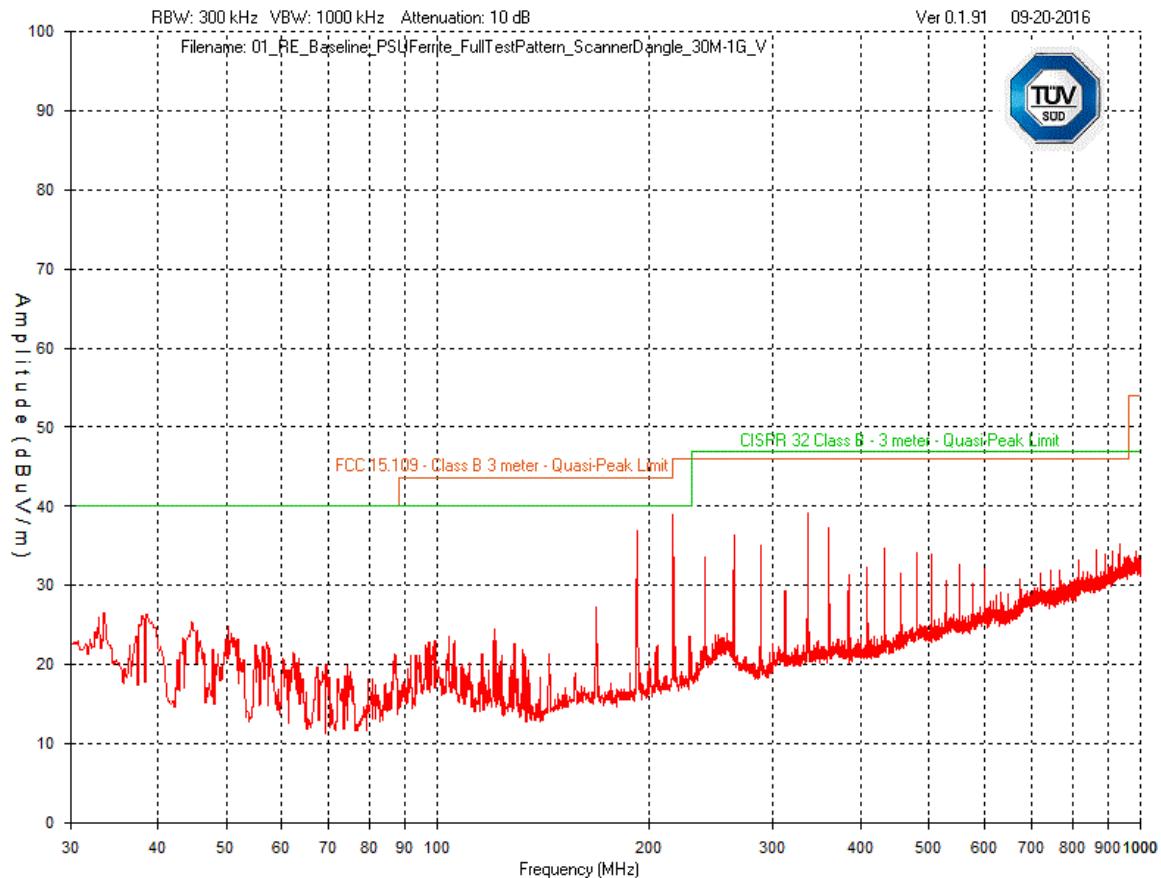
Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Horizontal – Peak Emissions Graph 5Vdc – 6GHz – 13GHz



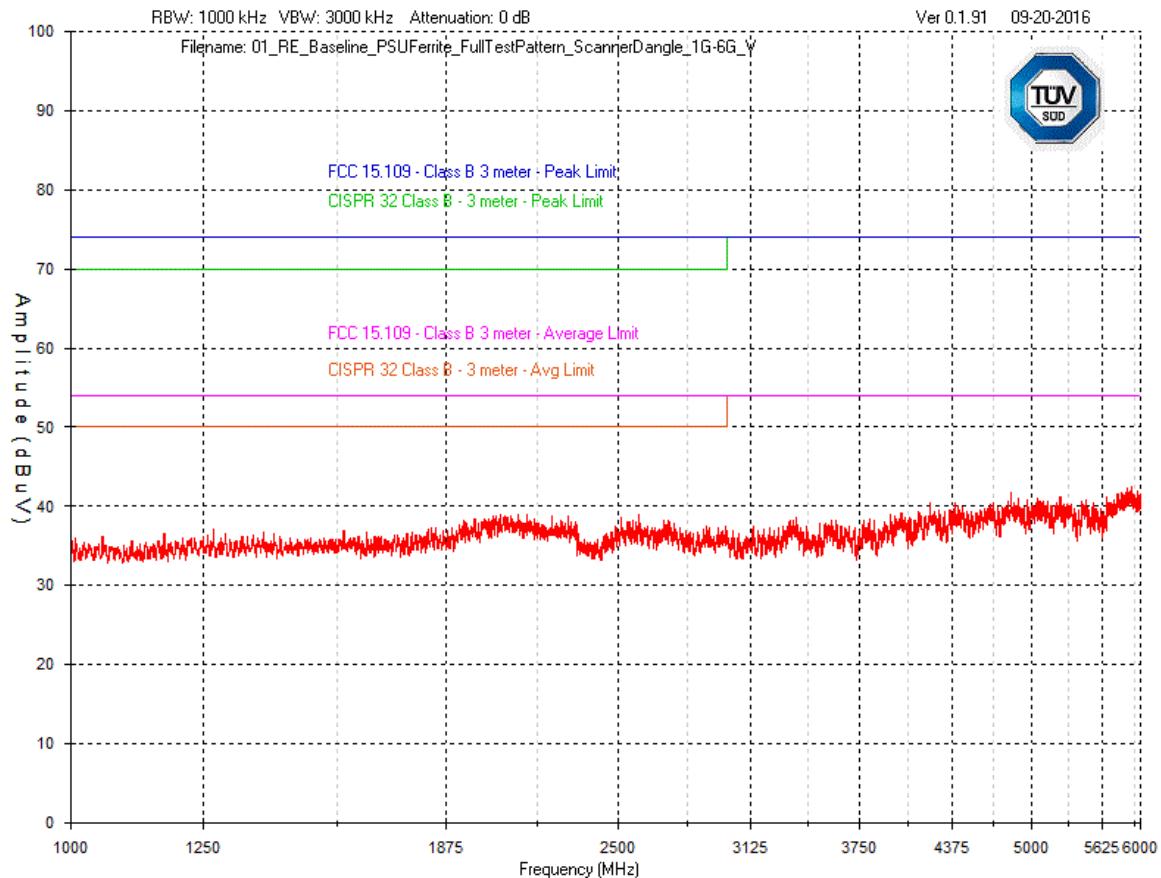
Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Vertical – Peak Emissions Graph
5Vdc – 30MHz - 1GHz



Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

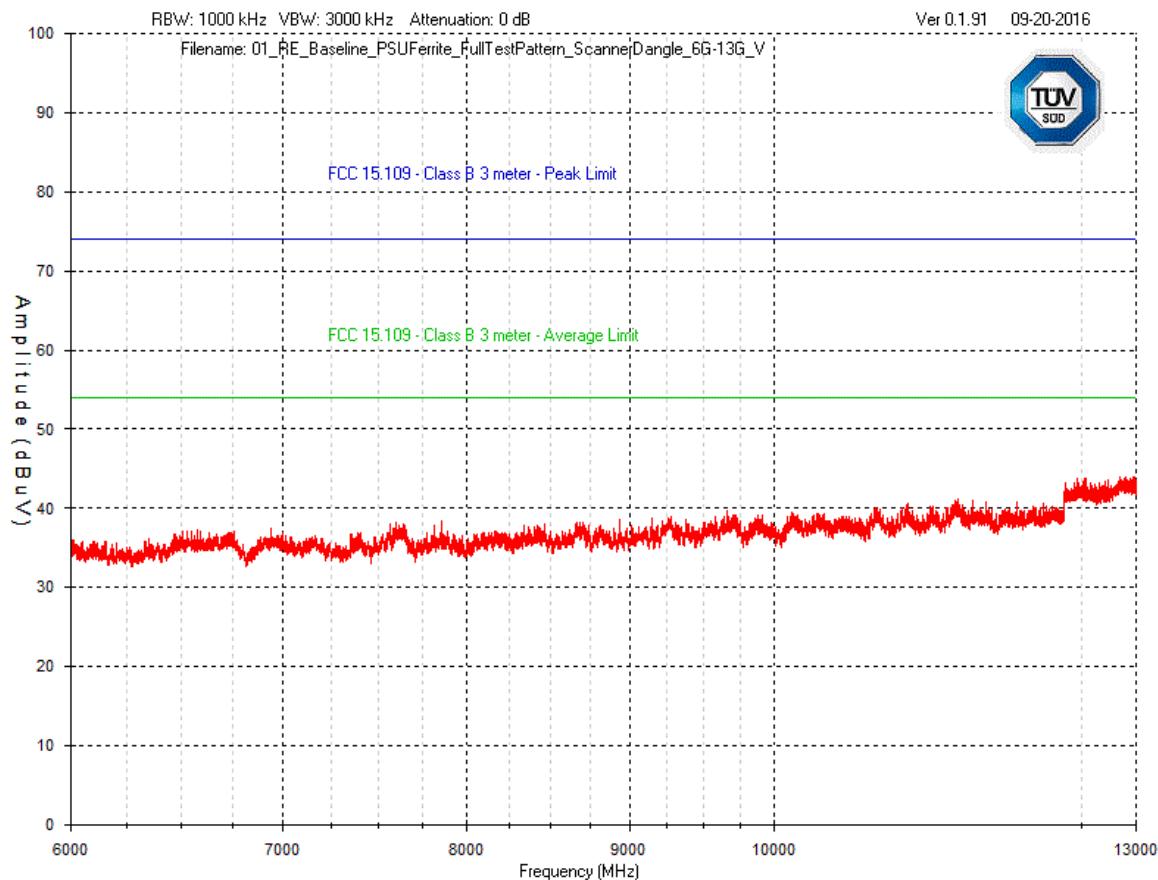
Vertical – Peak Emissions Graph 5Vdc – 1GHz - 6GHz



Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Vertical – Peak Emissions Graph 5Vdc – 6GHz – 13GHz



Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Final Measurements

The worst case measurement as listed in the table below appeared at a vertical antenna height of 130 cm and a table azimuth of 360 degrees, as pictured in Appendix B.

Product Category			FCC 15 Subpart B Class B							
Supply			120Vac 60Hz							
Frequency (MHz)	Detector Peak/QP	Received Signal (dB μ V)	Antenna Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Pre-Amp (dB)	Level (dB μ V/m)	QP Limit (dB μ V/m)	QP Margin (dB)	Pass/Fail
Horizontal Antenna Polarization										
335.84	PEAK	55.6	14.6	3.0	1.4	-33.7	40.9	46.0	5.1	Pass
359.99	PEAK	53.4	15.7	3.0	1.5	-33.9	39.7	46.0	6.3	Pass
216.14	PEAK	50.0	11.2	3.0	1.0	-33.5	31.7	46.0	14.3	Pass
408.11	PEAK	48.9	16.5	3.0	1.6	-33.9	36.1	46.0	9.9	Pass
192.09	PEAK	46.1	10.8	3.0	1.0	-33.4	27.5	43.5	16.0	Pass
551.86	PEAK	43.8	19.6	3.0	1.9	-33.9	34.4	46.0	11.6	Pass
Vertical Antenna Polarization										
216.14	PEAK	57.3	11.1	3.0	1.0	-33.5	38.9	46.0	7.1	Pass
191.99	PEAK	56.1	10.3	3.0	1.0	-33.4	37.0	43.5	6.5	Pass
335.94	PEAK	53.8	14.7	3.0	1.4	-33.7	39.2	46.0	6.8	Pass
359.99	PEAK	51.4	15.2	3.0	1.5	-33.9	37.2	46.0	8.8	Pass
263.87	PEAK	53.1	12.8	3.0	1.1	-33.5	36.5	46.0	9.5	Pass
288.02	PEAK	51.8	12.8	3.0	1.2	-33.6	35.2	46.0	10.8	Pass

Quasi-Peak Emissions Table

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Product Category			CISPR 32 Class B							
Supply			230Vac 50Hz							
Frequency (MHz)	Detector Peak/QP	Received Signal (dB μ V)	Antenna Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Pre-Amp (dB)	Level (dB μ V/m)	QP Limit (dB μ V/m)	QP Margin (dB)	Pass/Fail
Horizontal Antenna Polarization										
335.84	PEAK	55.6	14.6	3.0	1.4	-33.7	40.9	47.0	6.1	Pass
359.99	PEAK	53.4	15.7	3.0	1.5	-33.9	39.7	47.0	7.3	Pass
216.14	PEAK	50.0	11.2	3.0	1.0	-33.5	31.7	40.0	8.3	Pass
408.11	PEAK	48.9	16.5	3.0	1.6	-33.9	36.1	47.0	10.9	Pass
192.09	PEAK	46.1	10.8	3.0	1.0	-33.4	27.5	40.0	12.5	Pass
551.86	PEAK	43.8	19.6	3.0	1.9	-33.9	34.4	47.0	12.6	Pass
Vertical Antenna Polarization										
216.14	PEAK	57.3	11.1	3.0	1.0	-33.5	38.9	40.0	1.1	Pass
191.99	PEAK	56.1	10.3	3.0	1.0	-33.4	37.0	40.0	3.0	Pass
335.94	PEAK	53.8	14.7	3.0	1.4	-33.7	39.2	47.0	7.8	Pass
359.99	PEAK	51.4	15.2	3.0	1.5	-33.9	37.2	47.0	9.8	Pass
263.87	PEAK	53.1	12.8	3.0	1.1	-33.5	36.5	47.0	10.5	Pass
288.02	PEAK	51.8	12.8	3.0	1.2	-33.6	35.2	47.0	11.8	Pass

Quasi-Peak Emissions Table

Note:

Peak = Peak measurement

QP = Quasi-Peak measurement

All peak values are under peak limits where peak limits are defined (> 1GHz).

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

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi-Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
BiLog Antenna	3142-C	ETS	Feb. 10, 2015	Feb. 10, 2017	GEMC 137
Attenuator 3 dB	612-03-1	Meca Electronics, Inc	NCR	NCR	GEMC 222
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Jan 30, 2015	Jan 30, 2017	GEMC 168
Horn Antenna 2 - 18 GHz	WBH218HN	Q-par	Feb. 12, 2016	Feb. 12, 2018	GEMC 6375
Horn Antenna 1 – 18 GHz	AH-118	Com-Power Corporation	July 1, 2015	July 1, 2017	GEMC 214
Pre-Amp 1 - 26.5 GHz	HP 8449B	HP	Nov. 27, 2015	Nov. 27, 2017	GEMC 189
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 27
RF Cable 0.5m	LMR-400-0.5M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 31
Emissions Software	0.1.91	Global EMC	NCR	NCR	GEMC 58

CISPR32-FCC_RE-B_Rev1

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Power Line Harmonics Emissions

Purpose

The purpose of this test is to ensure that the power line harmonic current content generated from the EUT does not exceed the current limits listed as measured from a calibrated power source. This helps protect power line utilities ensure power line quality. Secondly, when current harmonics are generated on one phase of a three-phase system, harmonics may cause overheating of the neutral line. These current limits reduce the chances of that overheating from occurring.

Limits

The limits listed below are as per IEC 61000-3-2 and apply to equipments which are not of the following list:

Portable tool(s); Arc welding equipment; Lighting equipment; Personal computers and personal computer monitors; Televisions or television receivers.

Harmonic Order n (Frequency in Hz)	Maximum Permissible Harmonic Current A
Odd Harmonics	
3 (150 Hz)	2.30
5 (250 Hz)	1.14
7 (350 Hz)	0.77
9 (450 Hz)	0.40
11 (550 Hz)	0.33
13 (650 Hz)	0.21
$15 \leq n \leq 39$ (750 Hz – 1950 Hz)	$0.15 \times (15 / n)$
Even Harmonics	
2 (100 Hz)	1.08
4 (200 Hz)	0.43
6 (300 Hz)	0.30
$8 \leq n \leq 40$	$0.23 \times (8 / n)$

Measurement Accuracy

The stated measurement accuracy from the manufacturer of the measuring and output device is ± 51 mA.

Measurement Results

The graphs shown below are for graphical illustration of the final tabular results. For final measurements in text form, please refer to the tables.

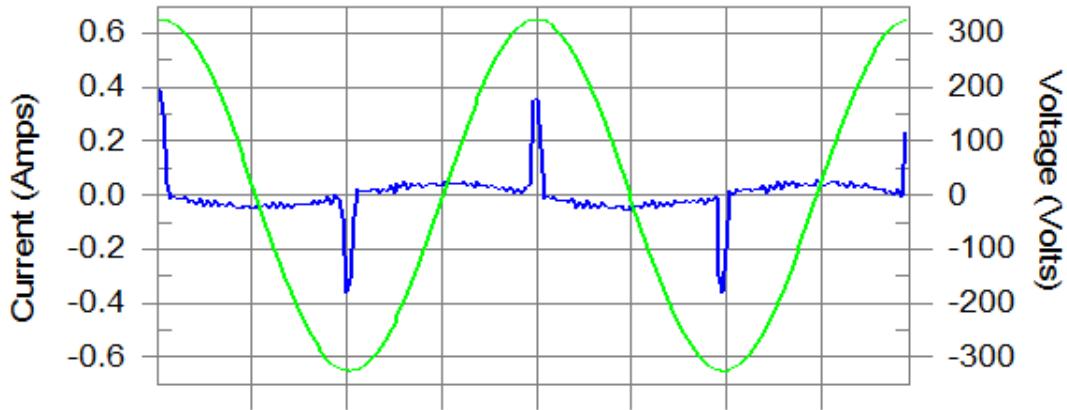
Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

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

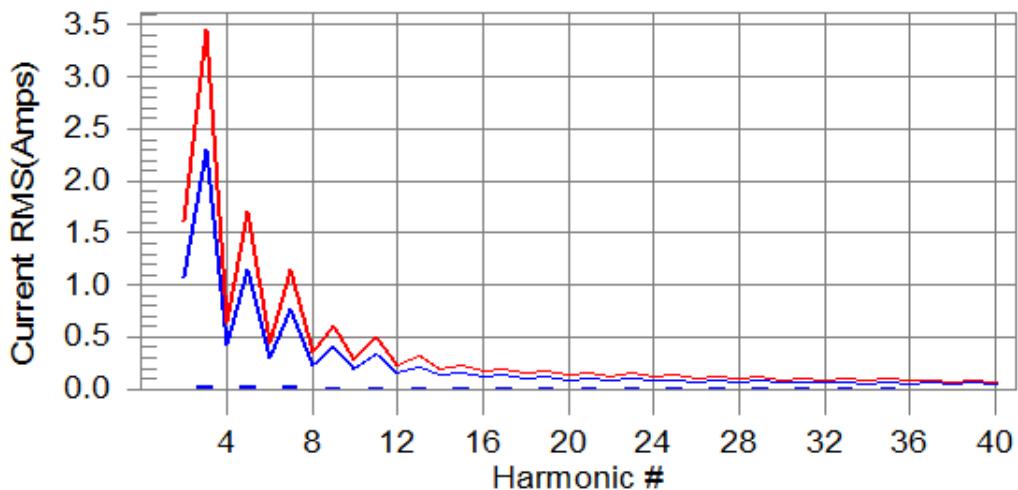
EUT: BBWireless
 Test category: Class-A per Ed. 4.0 (2014) (European limits)
 Test date: 9/30/2016 Start time: 9:05:03 AM End time: 9:15:25 AM
 Test duration (min): 10 Data file name: H-000425.cts_data
 Comment: Representative 5Vdc Power Supply
 Customer: GHI Electronics

Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line European Limits



Test result: Pass Worst harmonic was #19 with 8.7% of the limit.

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Current Test Result Summary (Run time)

EUT: BBWireless

Tested by: JG

Test category: Class-A per Ed. 4.0 (2014) (European limits)

Test Margin: 100

Test date: 9/30/2016

Start time: 9:05:03 AM

End time: 9:15:25 AM

Test duration (min): 10

Data file name: H-000425.cts_data

Comment: Representative 5Vdc Power Supply

Customer: GHI Electronics

Test Result: Pass Source qualification: Normal

THC(A): 0.064 I-THD(%): 166.5 POHC(A): 0.025 POHC Limit(A): 0.251

Highest parameter values during test:

V_RMS (Volts):	230.22	Frequency(Hz):	50.00
I_Peak (Amps):	0.412	I_RMS (Amps):	0.079
I_Fund (Amps):	0.040	Crest Factor:	5.405
Power (Watts):	5.6	Power Factor:	0.313

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.001	1.080	N/A	0.001	1.620	N/A	Pass
3	0.023	2.300	1.0	0.024	3.450	0.7	Pass
4	0.001	0.430	N/A	0.001	0.645	N/A	Pass
5	0.022	1.140	1.9	0.024	1.710	1.4	Pass
6	0.001	0.300	N/A	0.001	0.450	N/A	Pass
7	0.022	0.770	2.8	0.023	1.155	2.0	Pass
8	0.001	0.230	N/A	0.001	0.345	N/A	Pass
9	0.021	0.400	5.2	0.022	0.600	3.7	Pass
10	0.001	0.184	N/A	0.001	0.276	N/A	Pass
11	0.020	0.330	6.0	0.021	0.495	4.2	Pass
12	0.001	0.153	N/A	0.001	0.230	N/A	Pass
13	0.019	0.210	9.0	0.020	0.315	6.3	Pass
14	0.001	0.131	N/A	0.001	0.197	N/A	Pass
15	0.018	0.150	11.7	0.018	0.225	8.2	Pass
16	0.001	0.115	N/A	0.001	0.173	N/A	Pass
17	0.016	0.132	12.4	0.017	0.198	8.6	Pass
18	0.001	0.102	N/A	0.001	0.153	N/A	Pass
19	0.015	0.118	12.6	0.016	0.178	8.7	Pass
20	0.001	0.092	N/A	0.001	0.138	N/A	Pass
21	0.013	0.107	12.6	0.014	0.161	8.7	Pass
22	0.001	0.084	N/A	0.001	0.125	N/A	Pass
23	0.012	0.098	12.3	0.012	0.147	8.5	Pass
24	0.000	0.077	N/A	0.001	0.115	N/A	Pass
25	0.011	0.090	11.7	0.011	0.135	8.1	Pass
26	0.001	0.071	N/A	0.001	0.107	N/A	Pass
27	0.009	0.083	11.0	0.009	0.125	7.6	Pass
28	0.001	0.066	N/A	0.001	0.099	N/A	Pass
29	0.008	0.078	10.0	0.008	0.116	6.9	Pass
30	0.001	0.061	N/A	0.001	0.092	N/A	Pass
31	0.006	0.073	8.8	0.007	0.109	6.1	Pass
32	0.001	0.058	N/A	0.001	0.086	N/A	Pass
33	0.005	0.068	7.5	0.005	0.102	5.3	Pass
34	0.000	0.054	N/A	0.000	0.081	N/A	Pass
35	0.004	0.064	N/A	0.004	0.096	N/A	Pass
36	0.000	0.051	N/A	0.000	0.077	N/A	Pass
37	0.003	0.061	N/A	0.003	0.091	N/A	Pass
38	0.000	0.048	N/A	0.000	0.073	N/A	Pass
39	0.002	0.058	N/A	0.002	0.087	N/A	Pass
40	0.000	0.046	N/A	0.000	0.069	N/A	Pass

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Voltage Source Verification Data (Run time)

EUT: BBWireless **Tested by: JG**
Test category: Class-A per Ed. 4.0 (2014) (European limits) **Test Margin: 100**
Test date: 9/30/2016 **Start time: 9:05:03 AM** **End time: 9:15:25 AM**
Test duration (min): 10 **Data file name: H-000425.cts_data**
Comment: Representative 5Vdc Power Supply
Customer: GHI Electronics

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

Highest parameter values during test:

Voltage (Vrms):	230.22	Frequency(Hz):	50.00
I_Peak (Amps):	0.412	I_RMS (Amps):	0.079
I_Fund (Amps):	0.040	Crest Factor:	5.405
Power (Watts):	5.6	Power Factor:	0.313

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.309	0.460	67.20	OK
3	0.408	2.072	19.70	OK
4	0.109	0.460	23.76	OK
5	0.090	0.921	9.79	OK
6	0.073	0.460	15.85	OK
7	0.063	0.691	9.12	OK
8	0.056	0.460	12.11	OK
9	0.054	0.460	11.77	OK
10	0.048	0.460	10.37	OK
11	0.047	0.230	20.31	OK
12	0.045	0.230	19.33	OK
13	0.020	0.230	8.77	OK
14	0.031	0.230	13.65	OK
15	0.030	0.230	13.10	OK
16	0.030	0.230	13.19	OK
17	0.027	0.230	11.52	OK
18	0.033	0.230	14.26	OK
19	0.026	0.230	11.38	OK
20	0.025	0.230	10.76	OK
21	0.026	0.230	11.20	OK
22	0.020	0.230	8.74	OK
23	0.026	0.230	11.12	OK
24	0.020	0.230	8.85	OK
25	0.017	0.230	7.33	OK
26	0.014	0.230	5.90	OK
27	0.019	0.230	8.27	OK
28	0.014	0.230	5.98	OK
29	0.014	0.230	6.07	OK
30	0.013	0.230	5.76	OK
31	0.018	0.230	7.71	OK
32	0.010	0.230	4.28	OK
33	0.011	0.230	4.72	OK
34	0.011	0.230	4.59	OK
35	0.009	0.230	3.95	OK
36	0.012	0.230	5.00	OK
37	0.010	0.230	4.22	OK
38	0.008	0.230	3.52	OK
39	0.008	0.230	3.45	OK
40	0.007	0.230	3.02	OK

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Flicker Meter	PACS-1	California Instruments	Feb. 4, 2015	Feb. 4, 2017	GEMC 46
AC Power Source	5000 iX	California Instruments	Feb. 4, 2015	Feb. 4, 2017	GEMC 47
California Instruments CTS SW2	CTS 4.0 V4.9	Ametek Programmable Power Division	NCR	NCR	GEMC 184

IEC61000-3-2_Harmonics_Rev3

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Flicker Emissions

Purpose

The purpose of this test is to ensure that the flicker content generated from the EUT does not exceed the limits listed as measured from a calibrated power source. This helps power line utilities ensure power line quality. Secondly, flicker can create an impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates from time to time.

Limits

The limits listed below apply as per IEC 61000-3-3. Note that $Pst = 1.0$ is defined as the human threshold of irritability. This is defined in figure 4 of the previously mentioned standard and is related to number of changes per minute relative to the amount of voltage change induced on the calibrated source impedance.

- The value of Pst shall not be greater than 1.0,
- The value of Plt shall not be greater than 0.65,
- The value of $d(t)$ during a voltage change shall not exceed 3.3% for more than 500ms,
- The relative steady-state voltage change, dc , shall not exceed 3.3%,
- The maximum relative voltage change, d_{max} , shall not exceed 4% (without additional conditions).

Measurement Accuracy

The stated measurement accuracy from the manufacturer of the measuring and output device is:

$Pst \pm 4\%$ of reading for $0.5 < Pst < 20$

$Plt \pm 4\%$ of reading for $0.5 < Plt < 20$

$dc \pm 2\%$ of reading for $d_{max} > 0.1\%$

Measurement Results

The graphs shown below are for graphical illustration of the final tabular results. For final measurements in text form please refer to the table.

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

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

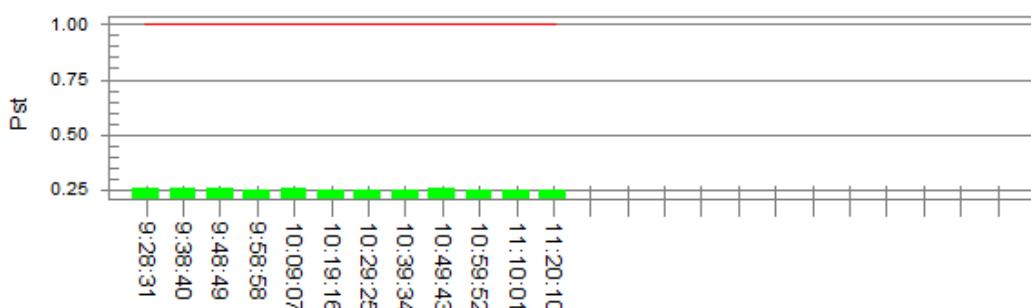
EUT: BBWireless **Tested by: JG**
Test category: All parameters (European limits) **Test Margin: 100**
Test date: 9/30/2016 **Start time: 9:18:01 AM** **End time: 11:21:12 AM**
Test duration (min): 121 **Data file name: F-000426.cts_data**
Comment: Representative 5Vdc Power Supply
Customer: GHI Electronics

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

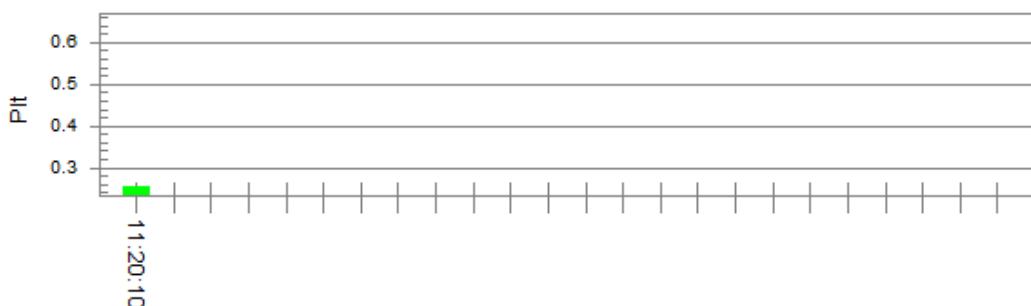
Status: Test Completed

Pst_i and limit line

European Limits



Plt and limit line



Parameter values recorded during the test:

Vrms at the end of test (Volt): 230.17

Vrms at the end of test (VRms):	260.11	Test limit (%):	N/A	N/A
Highest dt (%):	1.03	Test limit (mS):	500.0	Pass
T-max (mS):	0	Test limit (%):	3.30	Pass
Highest dc (%):	0.00	Test limit (%):	4.00	Pass
Highest dmax (%):	-1.03	Test limit (%):	1.000	Pass
Highest Pst (10 min. period):	0.261	Test limit:	0.650	Pass
Highest Plt (2 hr. period):	0.254	Test limit:		

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	 Canada

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Flicker Meter	PACS-1	California Instruments	Feb. 4, 2015	Feb. 4, 2017	GEMC 46
AC Power Source	5000 iX	California Instruments	Feb. 4, 2015	Feb. 4, 2017	GEMC 47
California Instruments CTS SW2	CTS 4.0 V4.9	Ametek Programmable Power Division	NCR	NCR	GEMC 184

IEC61000-3-3_Flicker_Rev3

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Electro-Static Discharge

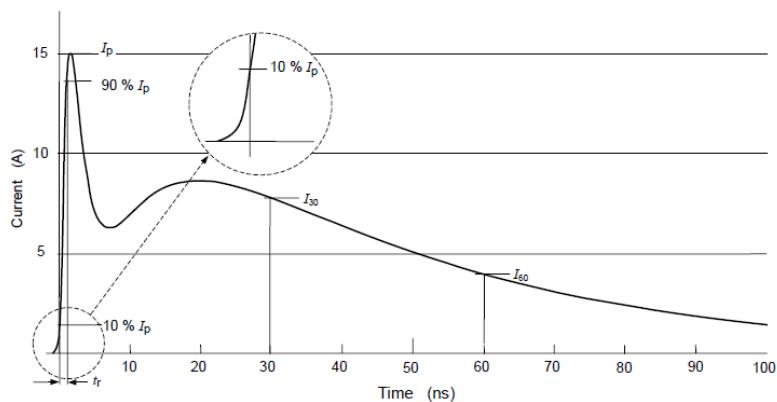
Purpose

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.

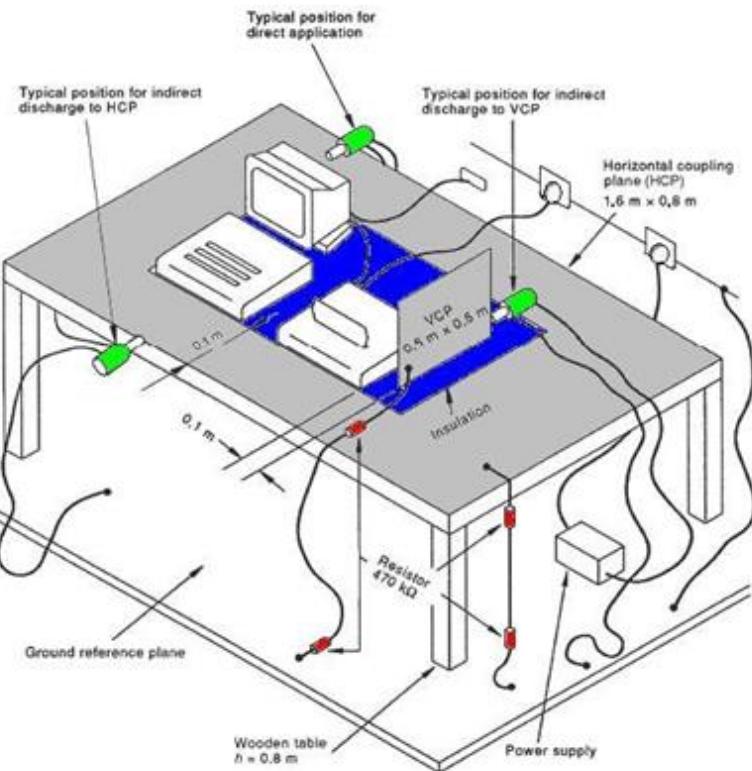


A level of $\pm 4\text{kV}$ contact or $\pm 8\text{kV}$ air, where applicable, is applied to each defined discharge point. For air discharge testing, the test is applied at the lower test levels first. Performance Criteria level B as defined in "Appendix A – EUT & Client Provided Details" is applied to this test. However, all anomalies, if any, are noted.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Typical ESD Setup



Application Level Accuracy

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

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Results

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

Location	Test Voltage	Discharge Type	Pass / Fail
1. HCP	±4kV	Contact	Pass
2. VCP	±4kV	Contact	Pass
3. USB Shell	±4kV	Contact	Pass
4. Power Cable	±2kV, ±4kV, ±8kV	Air Attempted, No Discharge	Pass
5. HDMI Cable	±2kV, ±4kV, ±8kV	Air Attempted, No Discharge	Pass
6. USB Cable	±2kV, ±4kV, ±8kV	Air Attempted, No Discharge	Pass
7. Micro USB Cable	±2kV, ±4kV, ±8kV	Air Attempted, No Discharge	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Minizap ESD Simulator	Minizap	Thermo Electron Corp	Feb. 10, 2015	Feb. 10, 2017	GEMC 1
ESD HCP	80CM x 160CM	Global EMC	NCR	NCR	GEMC 50
ESD VCP	50CM x 50CM	Global EMC	NCR	NCR	GEMC 51
ESD 470K A	2x470kΩ 100CM	Global EMC	NCR	NCR	GEMC 52
ESD 470K B	2x470kΩ 100CM	Global EMC	NCR	NCR	GEMC 53

IEC61000-4-2_ESD_Rev4

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	



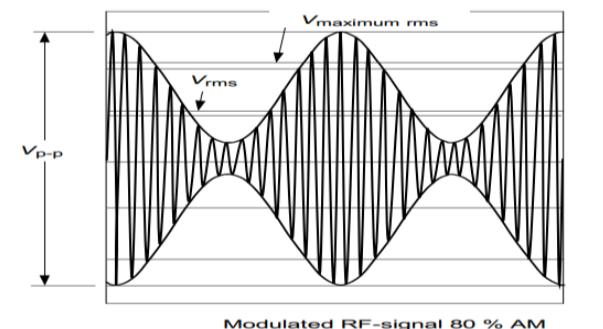
Radiated Field Immunity

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 3V/m and a modulation of 80% AM 1kHz sine wave is applied during the application of the RF energy at each frequency.

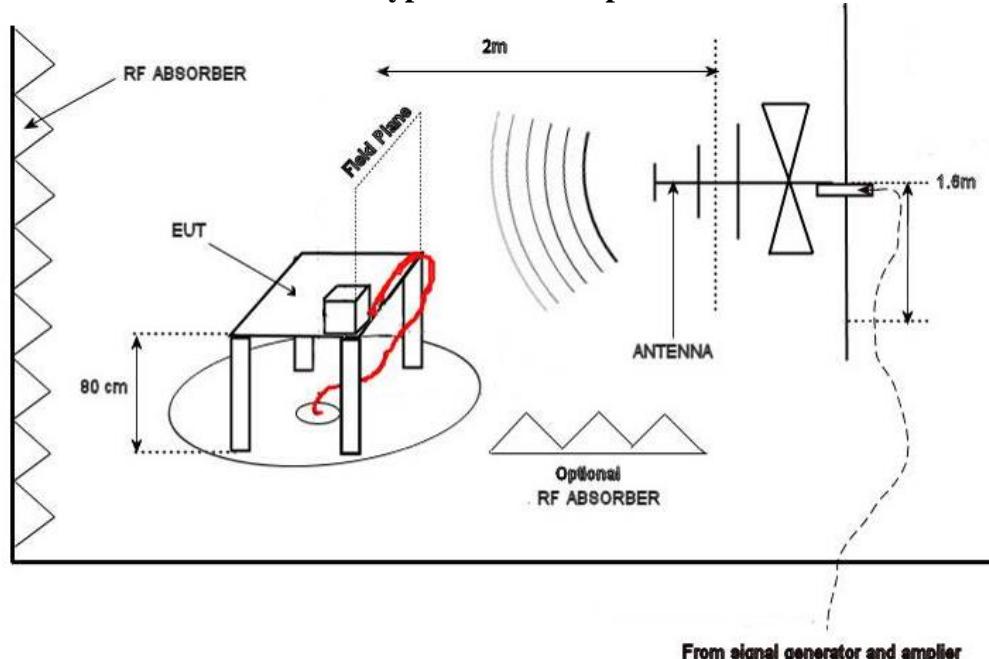


The RF field is applied in both horizontal and vertical antenna polarization and four sides of the EUT are subjected to this RF field. The dwell time used for each frequency is 3 seconds. Forward power is monitored and records are kept on file at TÜV SÜD Canada Inc. An isotropic field probe is also placed 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.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



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.

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Results

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

Input Voltage and Frequency		230Vac 50Hz
Frequency Range and Field Strength		80MHz – 1GHz 3V/m (80% AM)
Sweep Step		1% of Fundamental
Dwell Time		3 sec.
Clock Frequencies Analyzed Separately		
Clock	Frequency Inspected	Dwell Time
DDR Clock	400MHz	60 sec
Processor Clock	1GHz	60 sec
Result	Pass	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Signal Generator	SMHU	Rohde & Schwarz	Jan. 21, 2015	Jan. 21, 2017	GEMC 155
BiLog Antenna	3142-C	ETS	Feb. 10, 2015	Feb. 10, 2017	GEMC 137
Power Amplifier	250W1000B	AR	NCR	NCR	GEMC 192
Field Probe	FL 7006	AR	Dec. 22, 2015	Dec. 22, 2017	GEMC 25
Field Monitor	FM 7004	AR	NCR	NCR	GEMC 13
Power Head	PH 2000	AR	Jan. 22, 2015	Jan. 22, 2017	GEMC 15
Power Meter	PM 2002	AR	Jan. 21, 2015	Jan. 21, 2017	GEMC 16
Immunity Software	V219	Global EMC	NCR	NCR	GEMC 57

IEC61000-4-3_RadiatedImmunity_Rev4

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Electrical Fast Transients / Bursts

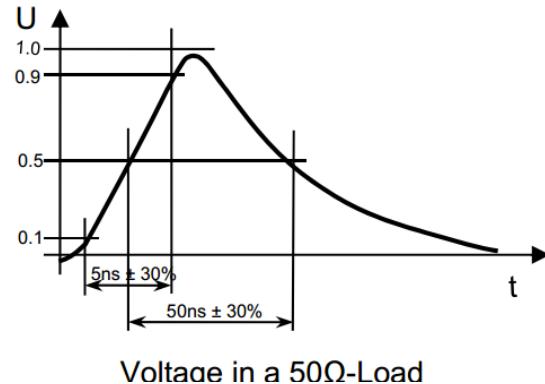
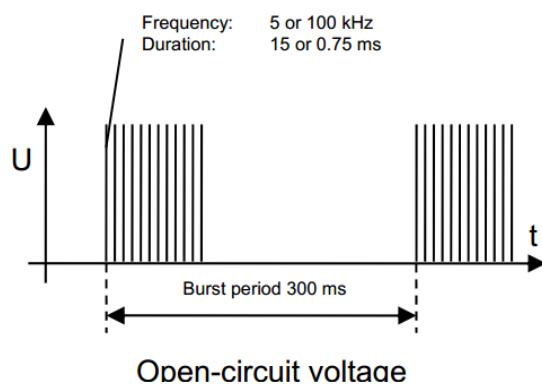
Purpose

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: $5\text{ns} \pm 30\%$
- Pulse duration (to 50% value): $50\text{ns} \pm 30\%$
- Pulse repetition frequency 5kHz (75 pulses per 15ms burst train)
- Burst duration should be $15\text{ms} \pm 20\%$
- Burst period should be $300\text{ms} \pm 20\%$



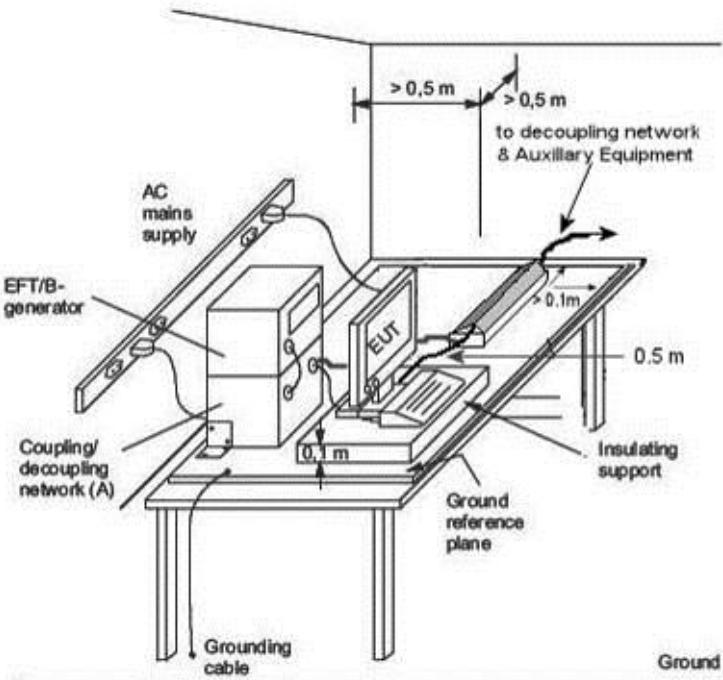
Bursts are applied for 1 minute each at the positive and the negative polarity to the mains power input (common mode) and to each applicable I/O line.

A test level of $\pm 0.5\text{kV}$ is applied to I/O lines via a capacitive coupling clamp and $\pm 1\text{kV}$ is applied to the power supply port(s) via a coupling and decoupling network. Performance Criteria level B as defined in "Appendix A – EUT & Client Provided Details" is applied to this test.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Typical Test Setup



Application Level Accuracy

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

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Results

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

Test Voltage	Repetition Rate	Coupling Lines	Result
±0.5kV	5kHz	DC Power Cable	Pass
±0.5kV	5kHz	Micro USB Cable	Pass
±0.5kV	5kHz	HDMI Cable	Pass
±0.5kV	5kHz	USB Scanner Cable	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Immunity Generator	EMC Pro Plus	Keytek Thermo Corp.	Feb. 10, 2015	Feb. 10, 2017	GEMC 4
Immunity Generator	EMC Pro Plus	Keytek Thermo Corp.	Nov. 17, 2014	Nov. 17, 2016	GEMC 188
CCL Clamp	EMC Pro Plus	Keytek Thermo Corp.	Feb. 10, 2015	Feb. 10, 2017	GEMC 5
Immunity Software	CEWare 32 V4.1	Thermo Fisher Scientific	NCR	NCR	GEMC 182

IEC61000-4-4_EFTB_Rev4

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



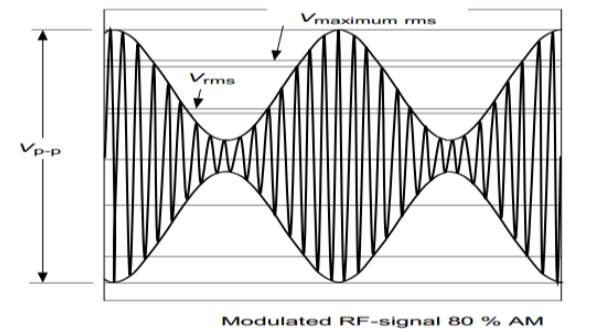
Conducted RF Immunity

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 3Vrms and a modulation of 80% AM 1kHz sine wave is applied during the application of the RF energy at each frequency.

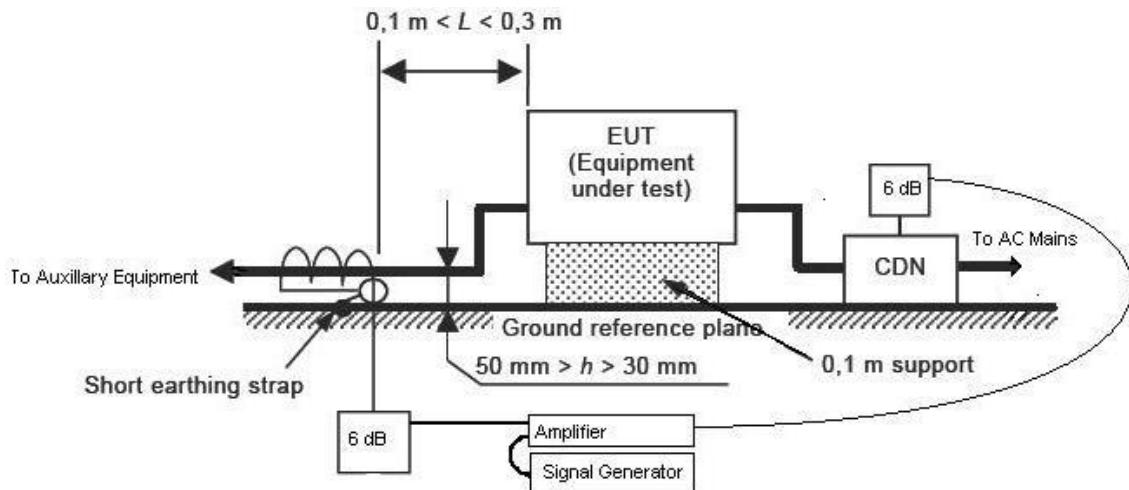


The dwell time used for each frequency is 3 seconds. A current probe is placed between the coupling device and the EUT to verify the application of the RF energy. Performance Criteria level A as defined in "Appendix A – EUT & Client Provided Details" is applied to this test.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



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 $\pm 2\text{dB}$.

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Test Results

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

Input Voltage and Frequency	230Vac 50Hz
Frequency Range and Signal Strength	150kHz - 80MHz 3Vrms (80% AM)
Sweep Step	1% of Fundamental
Dwell Time	3 sec.
DC Cable	Pass
USB Cable	Pass
Micro USB Cable	Pass
HDMI Cable	Pass
USB Scanner Cable	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. 10, 2016	Feb. 10, 2018	GEMC 138
Power Amplifier	75A250A	AR	NCR	NCR	GEMC 14
RF Current Probe	F-33-2	FCC	Jan. 16, 2015	Jan. 16, 2017	GEMC 19
Bulk Current Injection Probe	F-120-9A	FCC	Jan. 19, 2015	Jan. 19, 2017	GEMC 20
Signal Generator	SMHU	Rohde & Schwarz	Jan. 21, 2015	Jan. 21, 2017	GEMC 155
Power Attenuator 6dB	100-A-FFN-06	Bird	NCR	NCR	GEMC 48
Immunity Software	V219	Global EMC	NCR	NCR	GEMC 57

IEC61000-4-6_ConductedImmunity_Rev4

Client	GHI Electronics	
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

Power Frequency Magnetic Field

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.

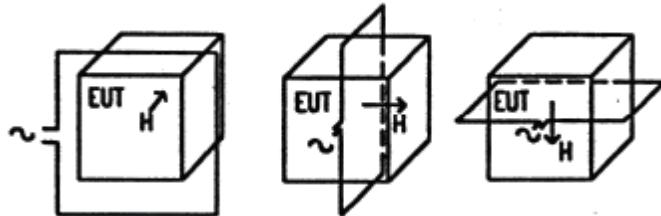
Application Level Requirement

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 frequencies applied are 50 Hz and 60 Hz. A magnetic field strength of 3 A/m is applied to the EUT in each orthogonal axis. Performance Criteria level A as defined in "Appendix A – EUT & Client Provided Details" is applied to this test.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



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 $\pm 3\text{dB}$. 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 met Criteria A as defined in "Appendix A – EUT & Client Provided Details". No anomalies were observed.

When a 50 Hz & 60 Hz power frequency magnetic field was applied to the EUT, it was powered at 5Vdc.

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
Immunity Generator	EMC Pro Plus	KeyTek Thermo Corp.	Feb. 10, 2015	Feb. 10, 2017	GEMC 4
Immunity Software	CEWare 32 V4.1	Thermo Fisher Scientific	NCR	NCR	GEMC 182
Clamp Meter	365	Fluke	Nov. 10, 2015	Nov. 10, 2016	CANE00139

IEC61000-4-8_MagneticImmunity_Rev3

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Appendix A – EUT & Client Provided Details

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

General EUT Description

Client Details	
Organization / Address	GHI Electronics 501 E. Whitcomb Ave. Madison Heights, MI, USA 48071
Contact	Gary Beaver
Phone	+1 248 397 8856
Email	Gary.beaver@ghielectronics.com
EUT (Equipment Under Test) Details	
EUT Name	BBBWL-SC-562
EUT revision	New Product
Software version	1.0
Equipment category	Single Board Computer
EUT is powered using	DC
Input voltage range(s) (V)	5V
Number of power supplies in EUT	3
Transmits RF energy? (describe)	Yes – 2.4GHz wi-fi
Basic EUT functionality description	Development Board
Modes of operation	Running Test Program
Step by step instructions for setup and operation	<ul style="list-style-type: none"> - Connect USB scanner, micro HDMI, micro USB to board - Connect micro HDMI to tv - Turn on TV to HDMI source, plug in DC power to EUT - Wait 1-2 minutes for board boot sequence, hear tone from barcode scanner - Observe colorbar pattern on TV - Shut down LCD TV (for emissions tests – leave LCD TV on for immunity) - Power on LCD TV to ensure that colorbar and moving object is still active
EUT response time (ms)	N/A
EUT setup time (min)	2+ minutes

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

EUT (Equipment Under Test) Details Continued	
Frequency of all clocks present in EUT	32 kHz Oscillator 24 MHz Oscillator 12 MHz generated HDMI audio clock 48 MHz USB clock (internal to OSD3358) 400 MHz DDR clock (internal to OSD3358) 1 GHz Processor clock (internal to OSD3358) 2.4 GHz WiFi clock (internal to WL1835 module)
I/O cable description Specify length and type	3 ft Micro USB cable 30 ft HDMI cable Micro HDMI to HDMI Cable USB Bar Code Scanner
Available connectors on EUT	5Vdc Power Jack Micro USB Connector USB Connector Micro HDMI Connector Micro SD Connector
Peripherals required to exercise EUT Ex. Signal generator	LED TV with HDMI Input (used as a monitor) 5V Power Supply Micro USB Cable USB Bar Code Scanner
Dimensions of product	L 90mm W 60mm H 10mm
Method of monitoring EUT and description of failure for immunity.	EUT will display colorbar pattern with moving object on monitor. Depending on the level of failure: 1 – Device will recover with no interruptions in the monitor display. Mitigation: None 2 – Device will reset and return to color bar pattern with moving object on monitor with no user interaction. Mitigation: None 3 – Device will reset and return to Linux login prompt. Mitigation: Requires re-loading of software 4 – Device will reset and fail to boot. Mitigation: Requires re-flashing of eMMC contents with software image

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



EUT (Equipment Under Test) Details Continued	
Other notes to test lab (URL to product, etc).	Connectors, such as micro-USB, micro-HDMI, etc., are fragile and should be handled delicately when plugging and un-plugging cables. Please try to not put excessive torque on the cables as that could cause a connector to fail.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



EUT Functional Description

A development board,

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.
 - USB Scanner to EUT USB Port
 - Micro HDMI to EUT Micro HDMI port, HDMI to TV
 - Micro USB cable to EUT
 - DC Power Cable

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 TV
- Turn on EUT and wait for Test Pattern to appear on TV

Modifications for Compliance

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

- None. The EUT provided met the requirements without need for modification.

Criteria Description

Performance Criterion A: During and after the test, the equipment shall continue to operate as intended as specified by the manufacturer.

Performance Criterion B: After the test, the equipment shall continue to operate as intended as specified by the manufacturer. During testing, temporary degradation, or loss of function or performance which is self-recovering is allowed.

Performance Criterion C: During testing, temporary degradation, or loss of function or performance which is self-recoverable or restorable by the operation of controls.

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Appendix B – EUT, Peripherals, and Test Setup Photos

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

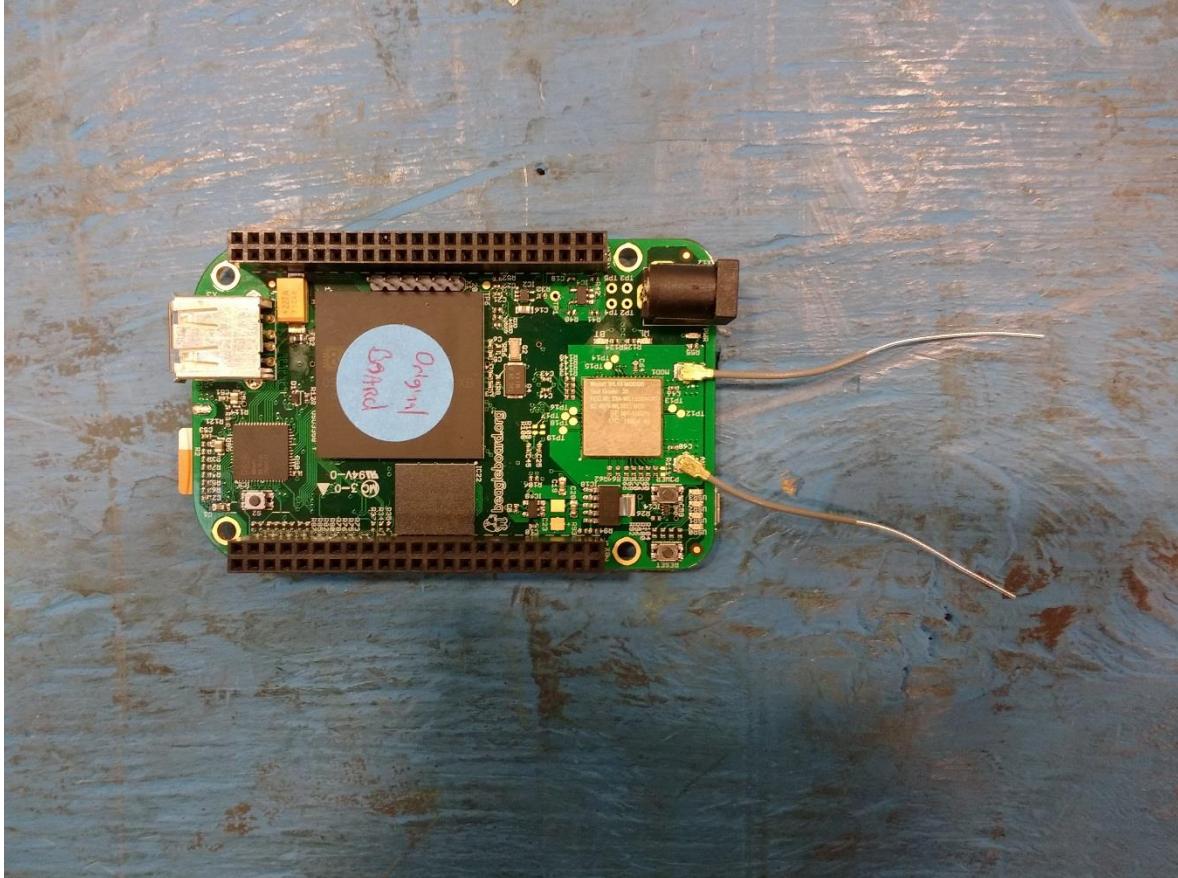


Figure 1 – EUT Close Up – Front

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

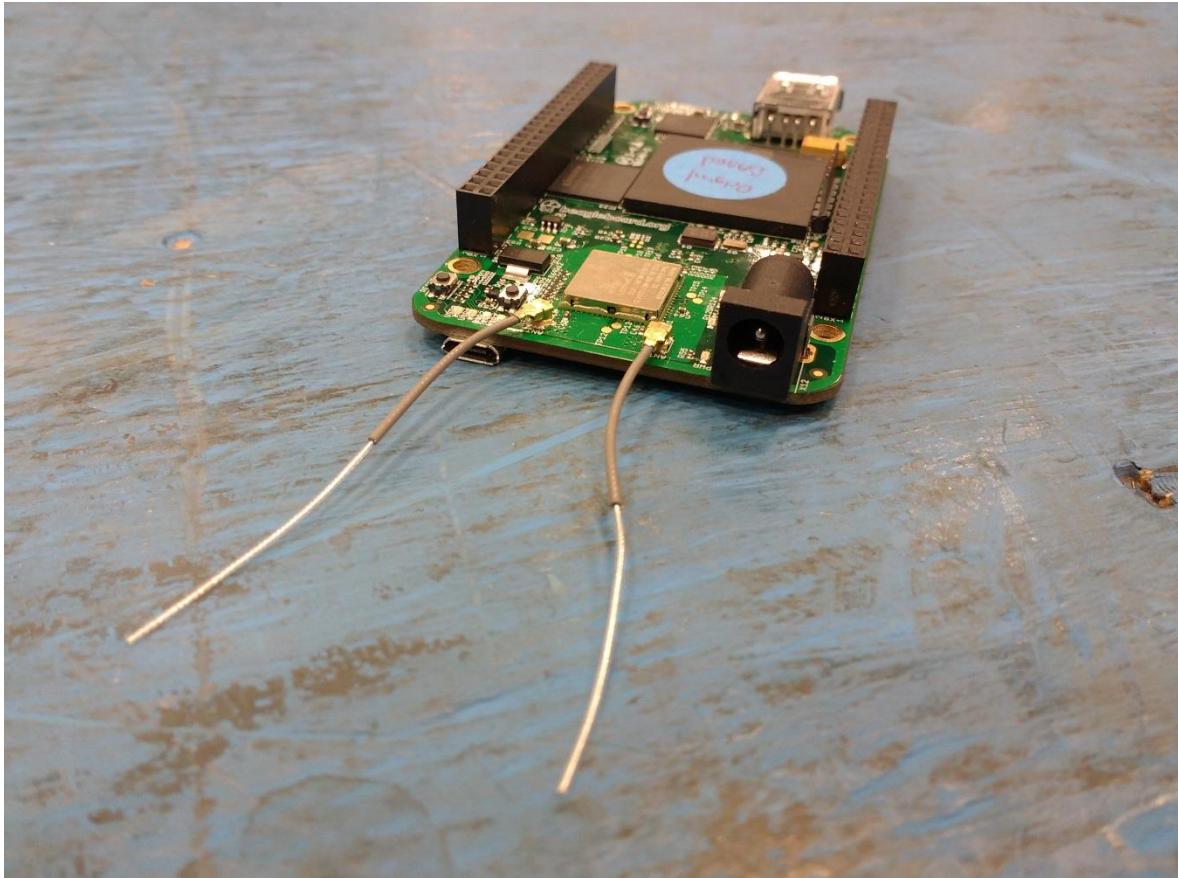


Figure 2 – EUT Close Up – Power Plug / Micro HDMI Port

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Figure 3 – EUT Close Up – Barcode USB / Micro USB & MicroSD Slot

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

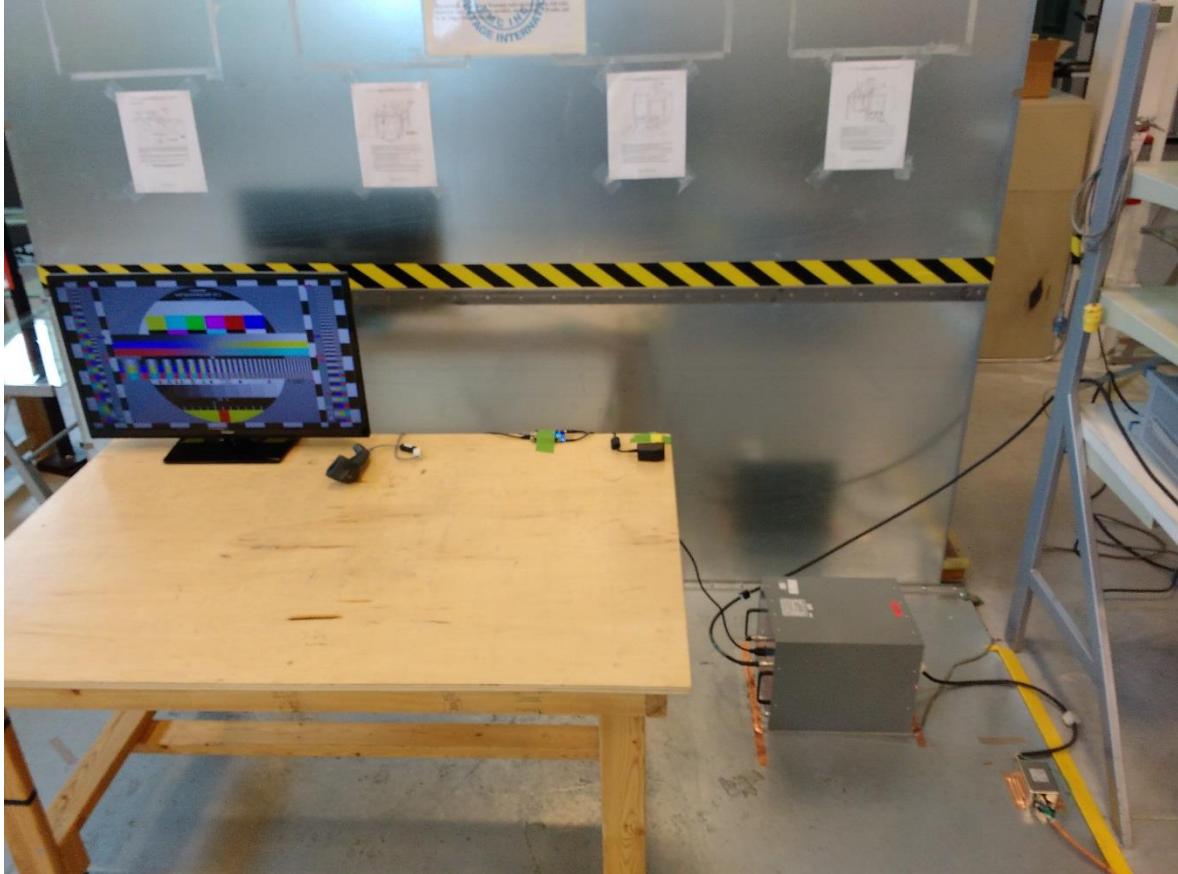


Figure 4 – Power Line Conducted Emissions Setup – Photo 1

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

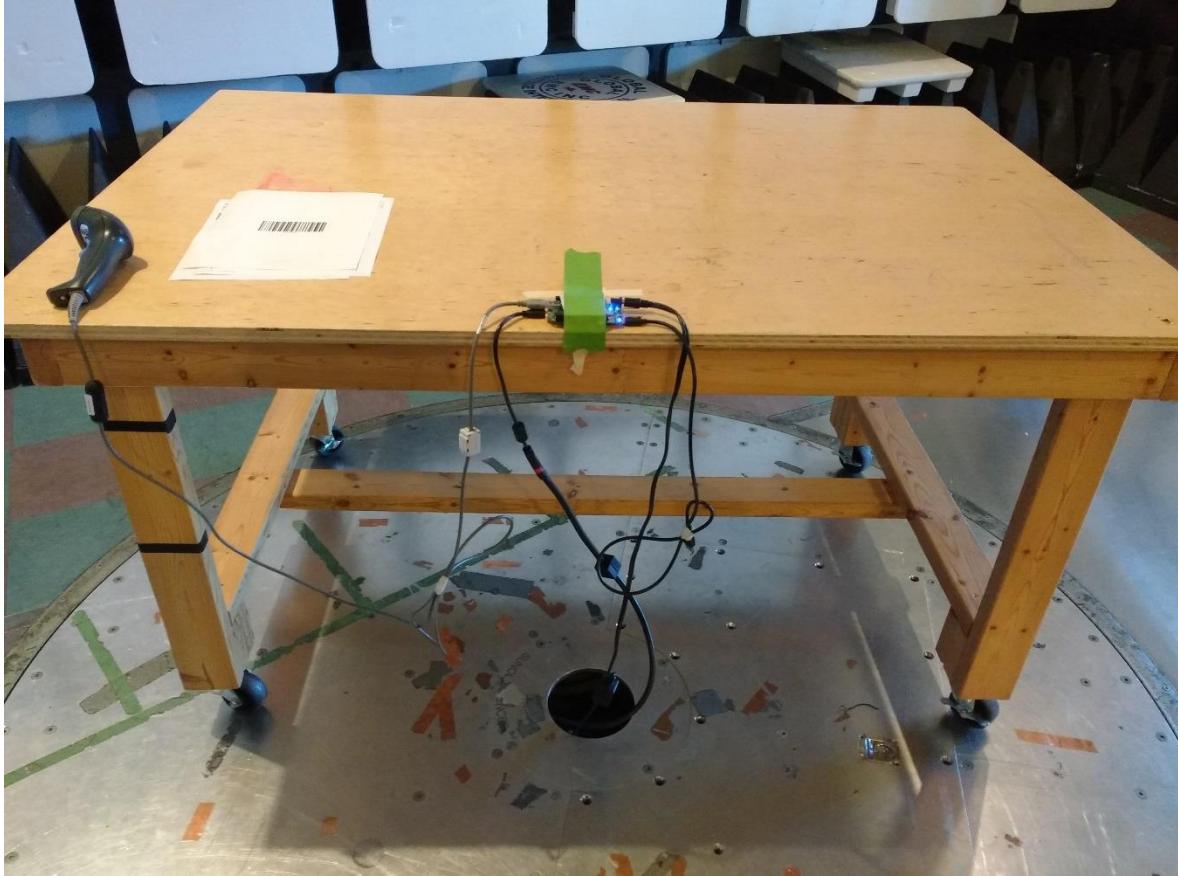


Figure 5 – Radiated Emissions Setup – Photo 1

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	



Figure 6 – Radiated Emissions Setup – Photo 2
30MHz – 1GHz

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	



Figure 7 – Radiated Emissions Setup – Photo 3
1GHz – 2GHz

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

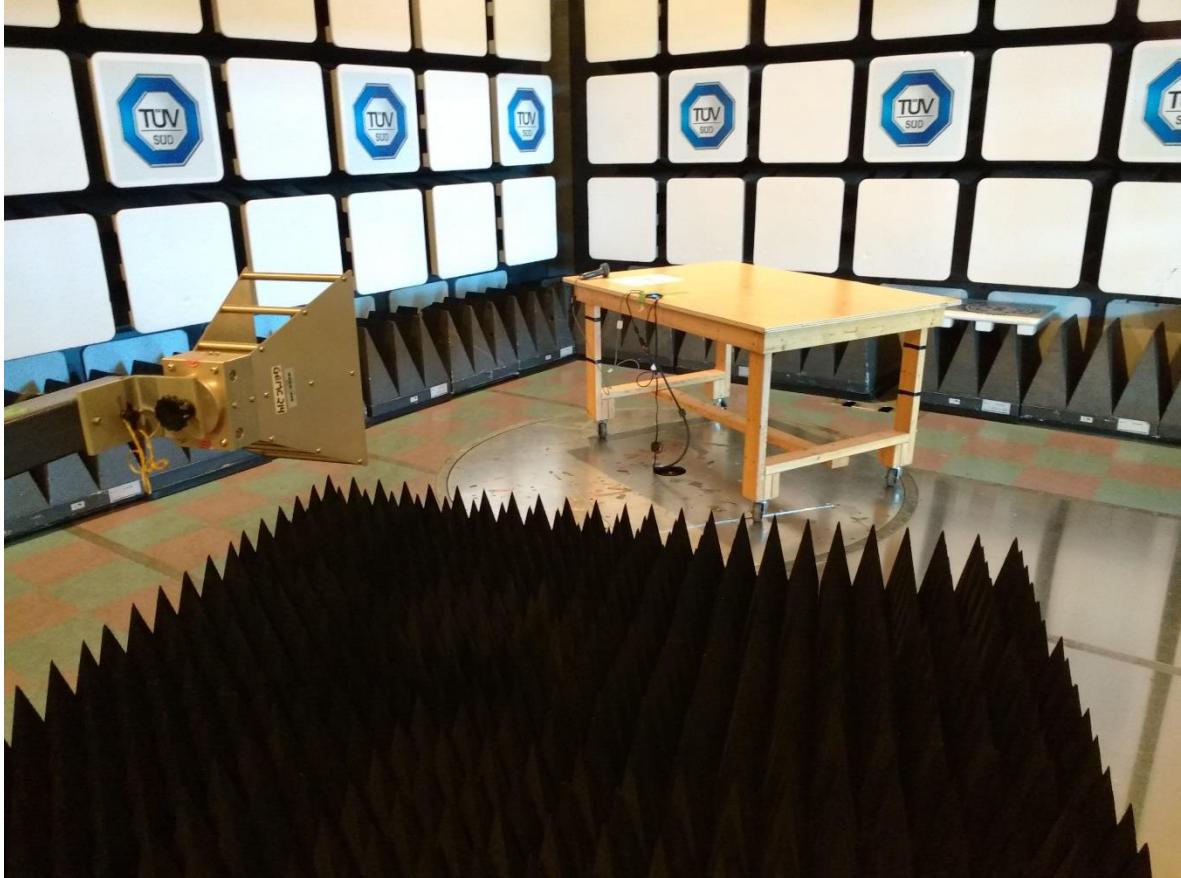


Figure 8 – Radiated Emissions Setup – Photo 4
1GHz - 6GHz

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	



Figure 9 – Radiated Emissions Setup – Photo 5
6GHz - 13GHz

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

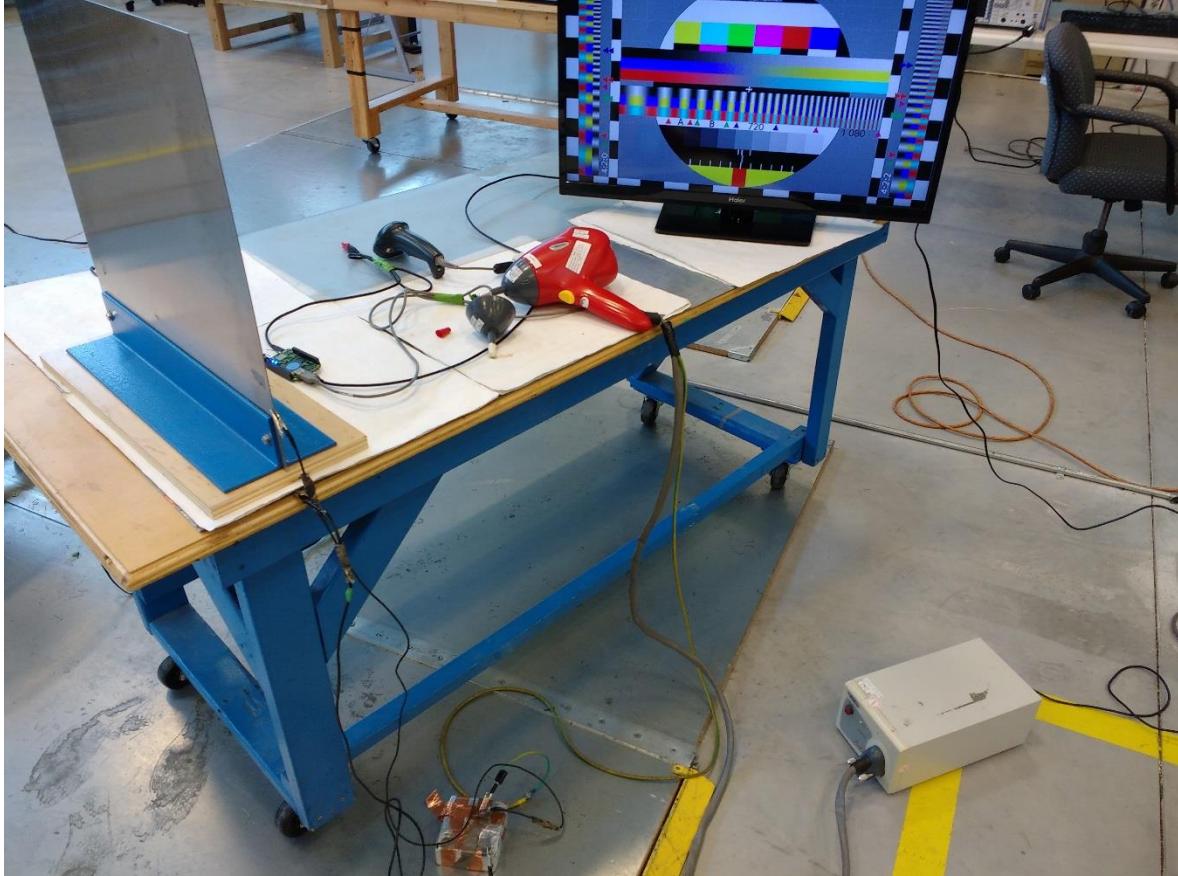


Figure 10 – Electro-Static Discharge Setup

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	



Figure 11 – Radiated Immunity Setup

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

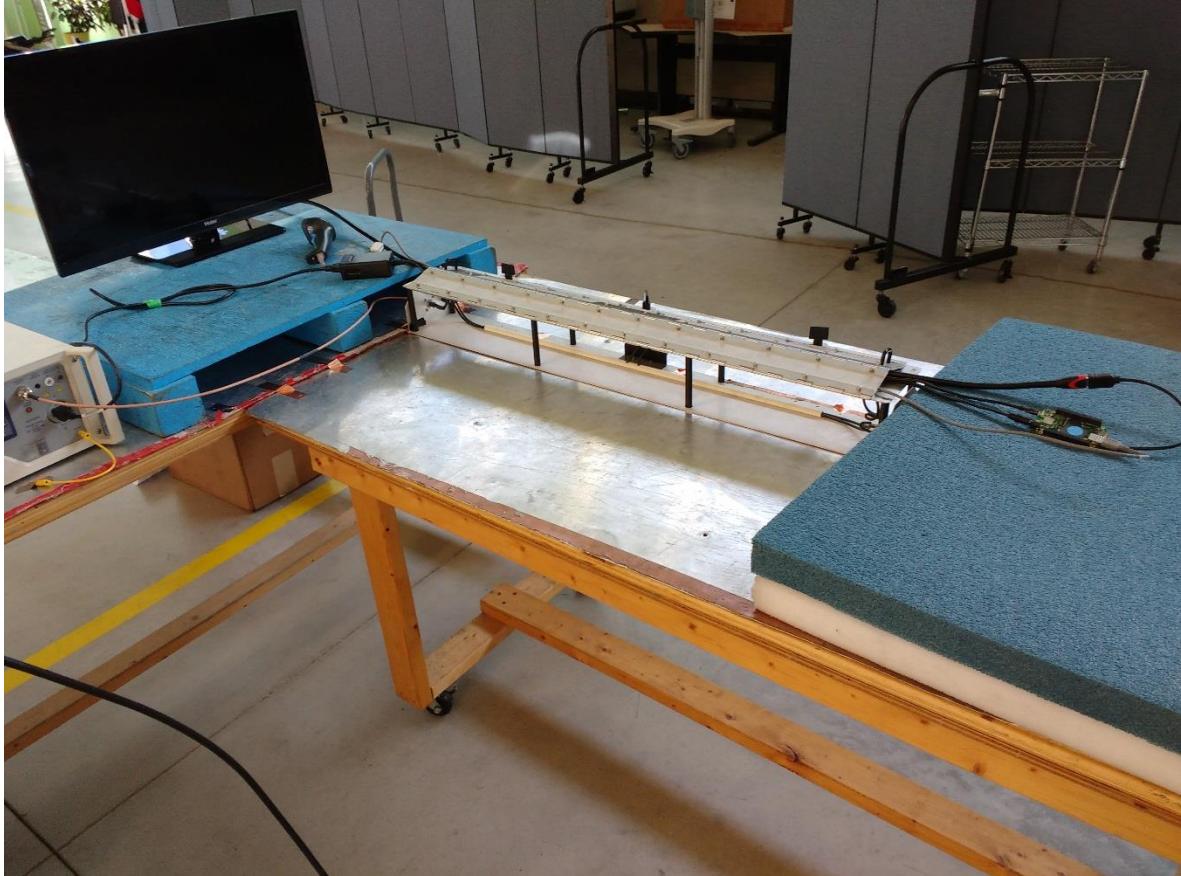


Figure 12 – EFT Setup – Signal/Interconnection/DC Lines

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

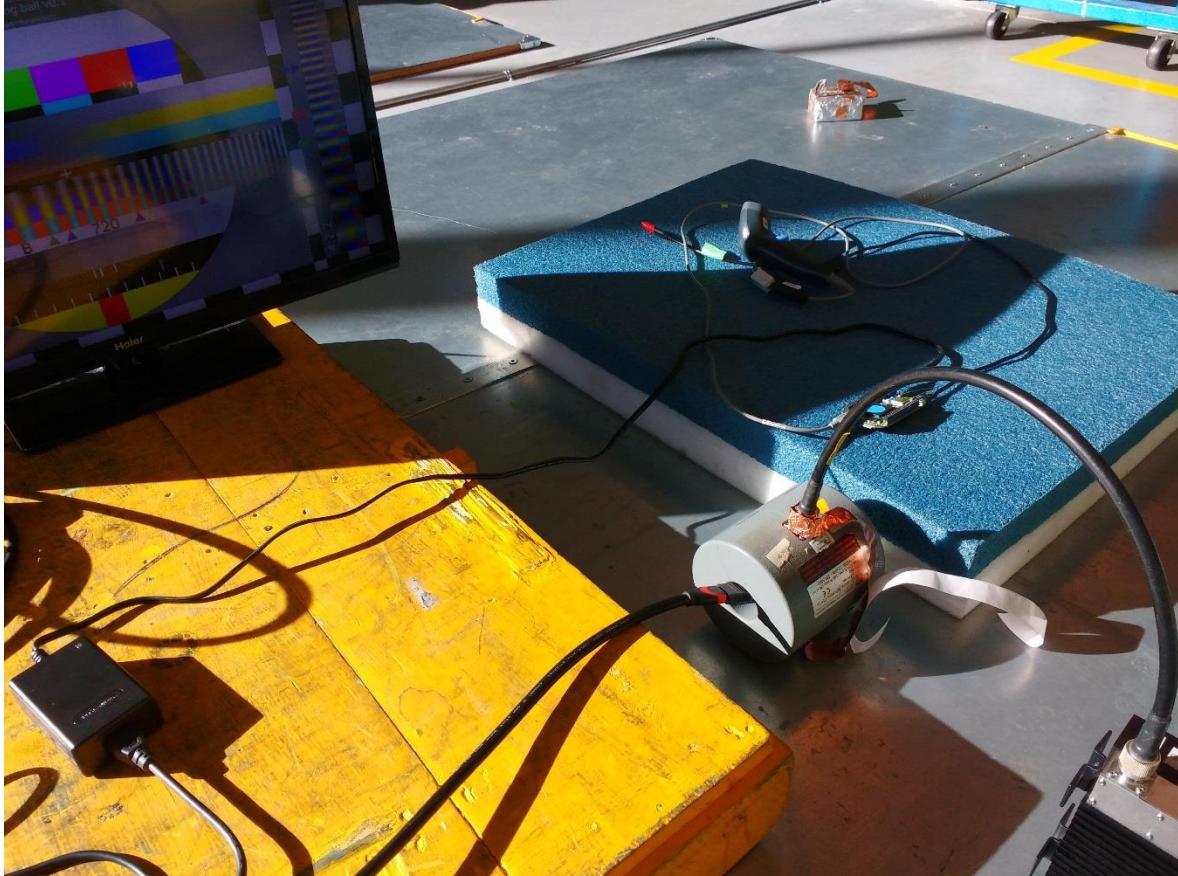


Figure 13 – Conducted Immunity Setup – HDMI Cable – Photo 1

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

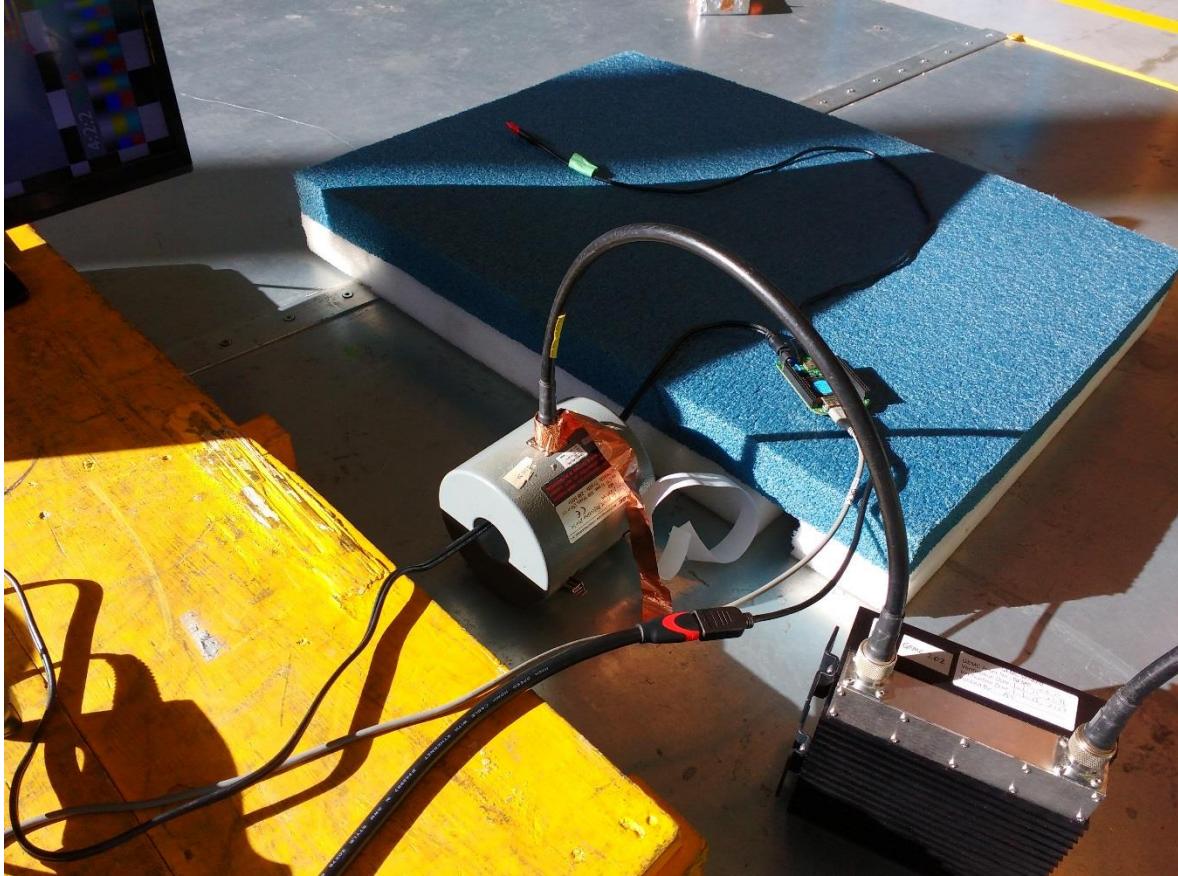


Figure 14 – Conducted Immunity Setup – DC Cable – Photo 2

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

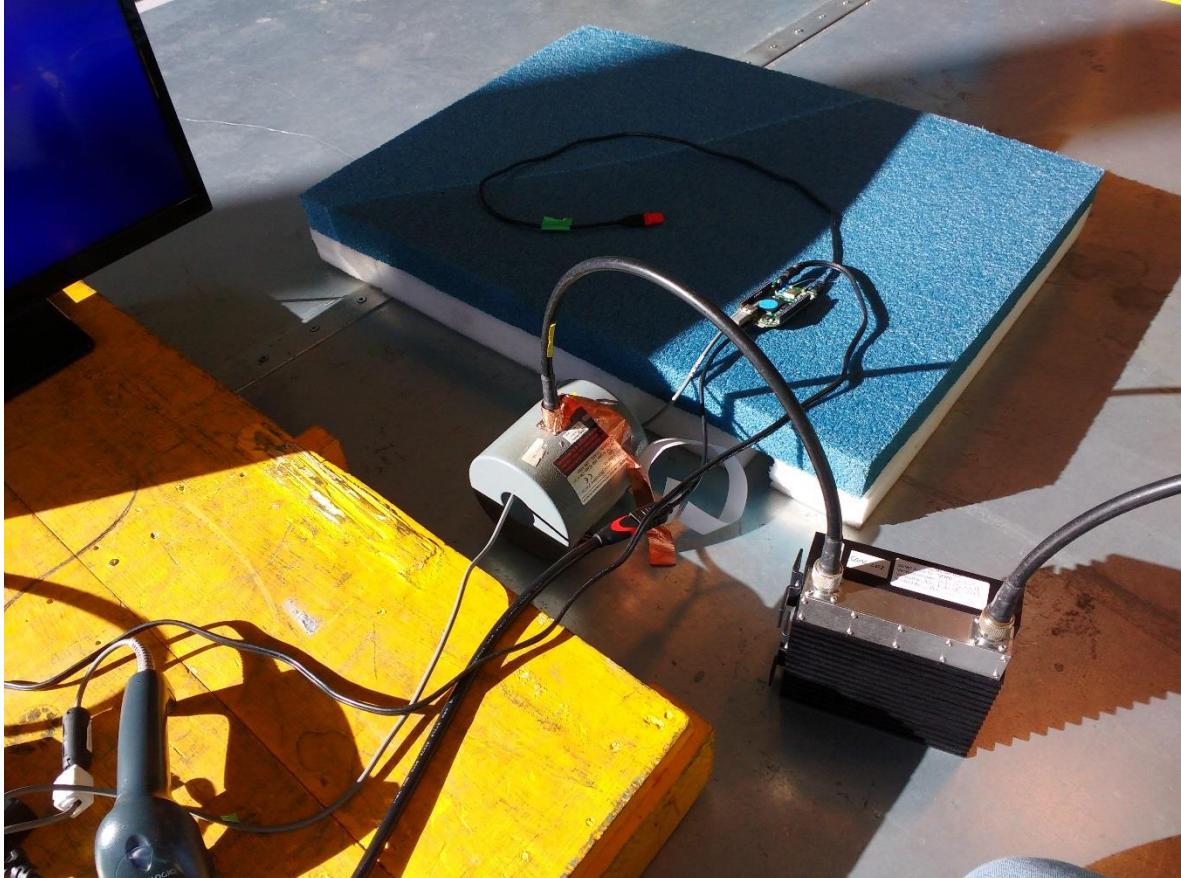


Figure 15 – Conducted Immunity Setup – USB Scanner – Photo 3

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024

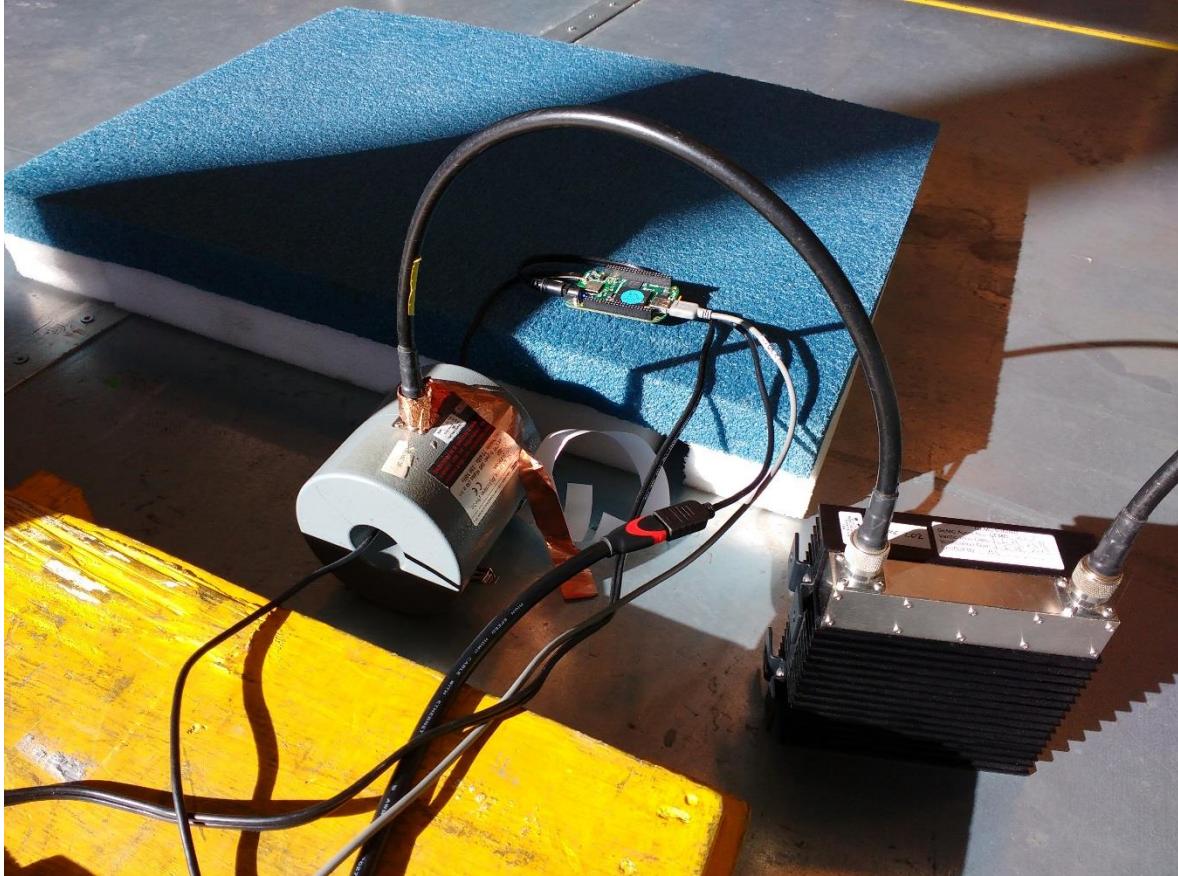


Figure 16 – Conducted Immunity Setup – Micro USB Cable – Photo 4

Client	GHI Electronics	 Canada
Product	BBBWL-SC-562	
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024	

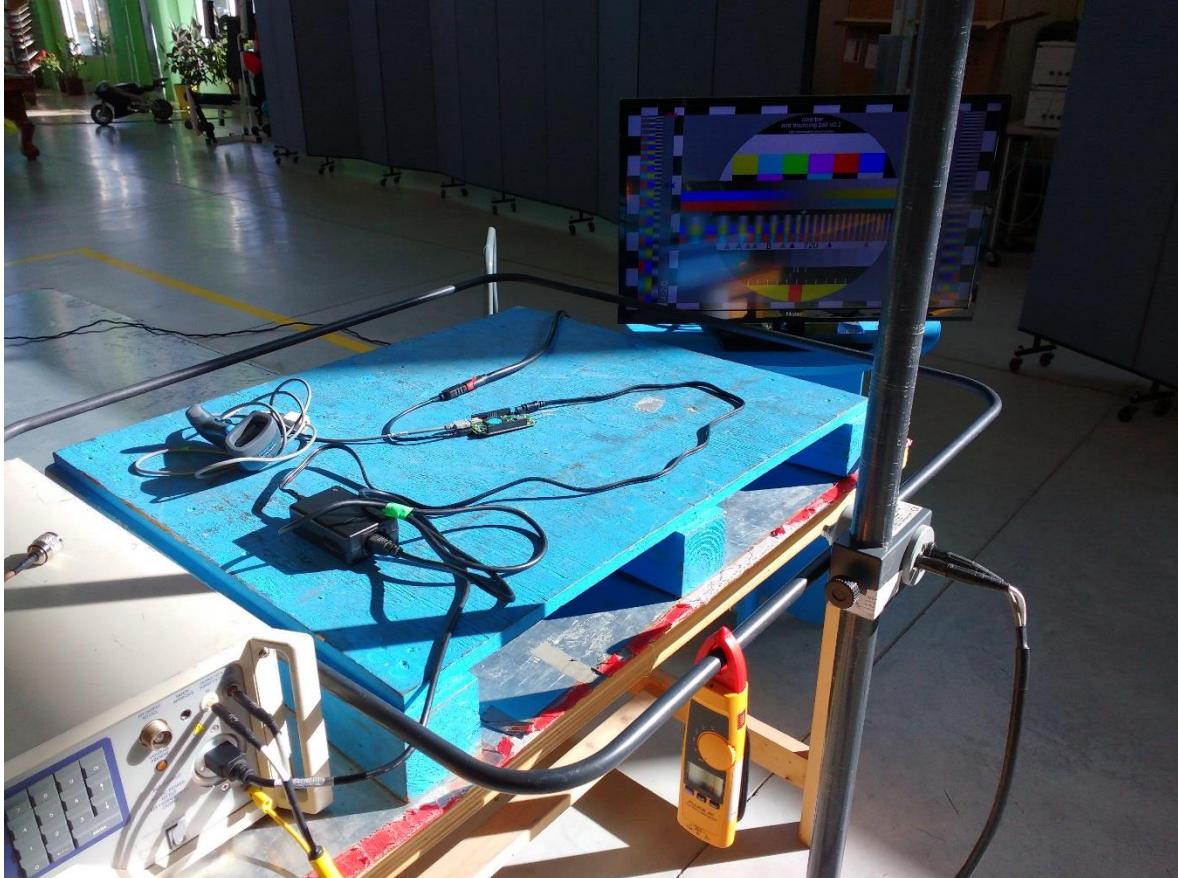


Figure 17 – Power Frequency Magnetic Field Setup

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



Appendix C – Product Marking

Client	GHI Electronics
Product	BBBWL-SC-562
Standard(s)	FCC Part 15 Subpart B / ICES-003 CISPR 32/EN55032 & CISPR 24/EN55024



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.