

EMC Test Report

Project Number: 3758116

Report Number: 3758116EMC01

Revision Level: 1

Client: Digital Dream Labs, LLC, Inc.

Equipment Under Test: Ludos Gameboard

Model Name: Puzzlets

Model Number: DDLPT001

FCC ID: 2ACUO-DDLPT001

IC ID: 12227A-DDLPT001

Applicable Standards: FCC Part 15 Subpart C, § 15.209

RSS-210, Issue 8, December 2010

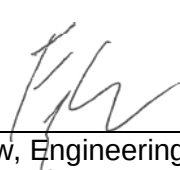
ANSI C63.10: 2013

RSS-GEN, Issue 4, November 2014

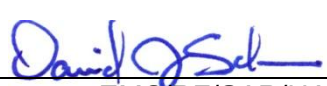
Report issued on: 22 July 2015

Test Result: Compliant

Tested by:


Fendy Liauw, Engineering Technician

Reviewed by:


David Schramm, EMC/RF/SAR/HAC Manager

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or Testing done by SGS International Electrical Approvals in connection with distribution or use of the product described in this report must be approved by SGS international Electrical Approvals in writing.

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1 Summary of Test Results

Basic Standards	Test Result
Emissions Testing	
FCC Part 15, Subpart C, 15.209 / RSS-Gen S7.2.5 - Radiated Emissions	Compliant
FCC Part 15, Subpart C, 15.207 / RSS-Gen S7.2.4 - Conducted Emissions	Compliant

1.1 Modifications Required to Compliance

None

2 General Information

2.1 Client Information

Name: Digital Dream Labs, LLC, Inc.
Address: 6024 Broad Street, Suite 2R
City, State, Zip, Country: Pittsburgh, PA 15206

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

2.3 General Information of EUT

Type of Product: Ludos Gameboard
Model Name: Puzzlets
Model Number: DDLPT001
FCC ID: 2ACUO-DDLPT001
Frequency Range: 2402 to 2480 MHz
Data Modes: Bluetooth LE
Antenna: Integral / PCB

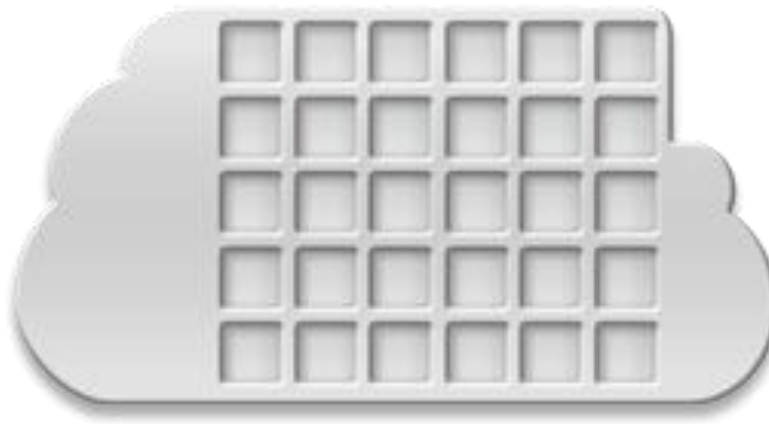
Rated Voltage: 3.7 VDC Internal Li-Ion
Battery

Sample Received Date: 20 May 2015
Dates of testing: 20 – 27 May 2015

2.4 Operating Modes and Conditions

The Cloud Board contained thirty RFID interfaces. Software was provided that allowed control of which RFID antenna was being used at a given time. Pretesting was performed to determine which RFID interface provided the worst-case emissions and final measurements were recorded using that antenna.

2.5 EUT Connection Block Diagram



2.6 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Digital Dream Labs, LLC	Ludos Gameboard	DDLPT001	Not Labeled

3 Occupied Bandwidth

3.1 Test Result

Test Description	Basic Standards	Test Result
99% Bandwidth	RSS-GEN 4.6.1	Reported

3.2 Test Method

The 99% occupied bandwidth measurement function of the spectrum analyzer was employed.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.1 °C

Relative Humidity: 49.9 %

3.4 Test Equipment

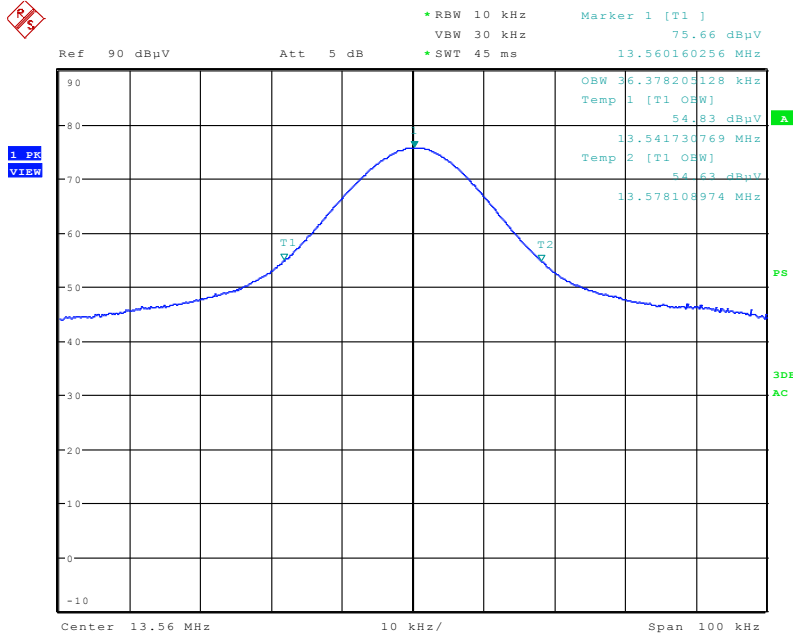
Test Date: 27-May-2015

Tech: FL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
LOOP (ACTIVE)	6502	EMCO	B085752	24-Jun-2015

Note: The calibration period equipment is 1 year.

3.5 Test Data



Date: 27.MAY.2015 09:33:28

Occupied Bandwidth = 36.38kHz

4 Radiated Emissions

4.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Emissions	FCC Part 15, Subpart C ANSI C63.4:2009	Compliant

4.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak and Average detector above 1GHz. The receivers resolution bandwidth was set to 1kHz for measurements taken below 150kHz, 9kHz for in the 150kHz to 30MHz range, 120 kHz in the 30MHz to 1GHz frequency range, and 1MHz for measurements of 1GHz and higher. For testing below 30MHz, a loop antenna was employed, and peak scans were taken with the loop open towards the EUT (Co-Axial) and with the loop in-line with the EUT (Co-Planar). Above 30MHz, a biconilog antenna was used and measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Radiated emissions limits

Frequency Range (MHz)	Limits (uV/m) Quasi-Peak or Average	Measurement Distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note: Limits were converted to dBuV/m using the equation $20 \cdot \text{LOG}(x)$. Additionally, for measurements below 30MHz, the limits were adjusted to a distance of 3m using a 40dB/decade correction per §15.31(f)(2)

Example: at 20MHz, the limit is expressed as 30uV/m at 30m

$$20 \cdot \log(30) = 29.5 \text{ dBuV/m}$$

30 to 3 meters is a single decade, so $29.5 + 40 = 69.5 \text{ dBuV/m}$

4.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 22.4 °C

Relative Humidity: 48.7 %

Atmospheric Pressure: 97.67 kPa

4.4 Test Equipment

Test Date: 21-May-2015

Tech: FL

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
ANTENNA, BILOG	JB6	SUNOL	B079690	7-Oct-2015
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079711	4-Aug-2015
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079713	4-Aug-2015
RF CABLE	SF106	HUBER&SUHNER	B085892	5-Aug-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2016
LOOP (ACTIVE)	6502	EMCO	B085752	24-Jun-2015

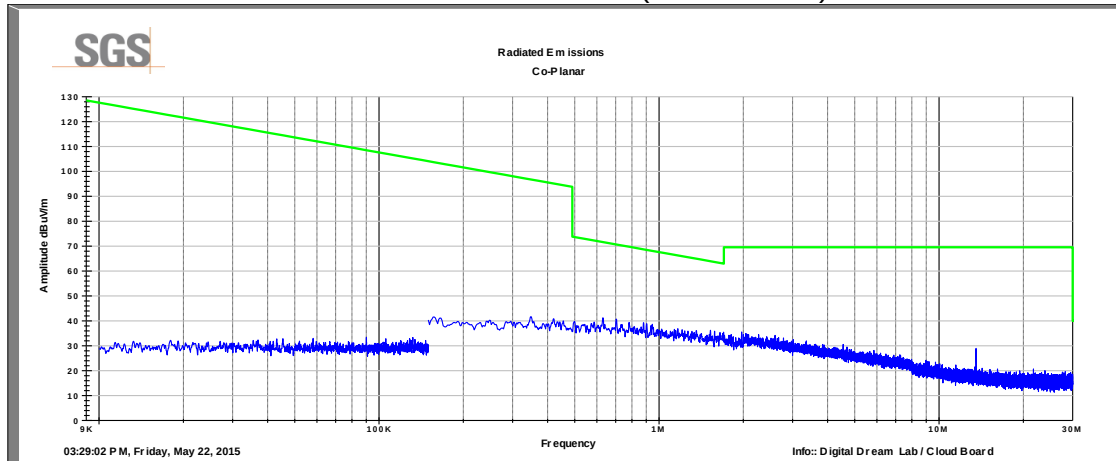
Note: The calibration period equipment is 1 year.

Software:

"Radiated Emissions" TILE! profile dated 15 Oct 2011

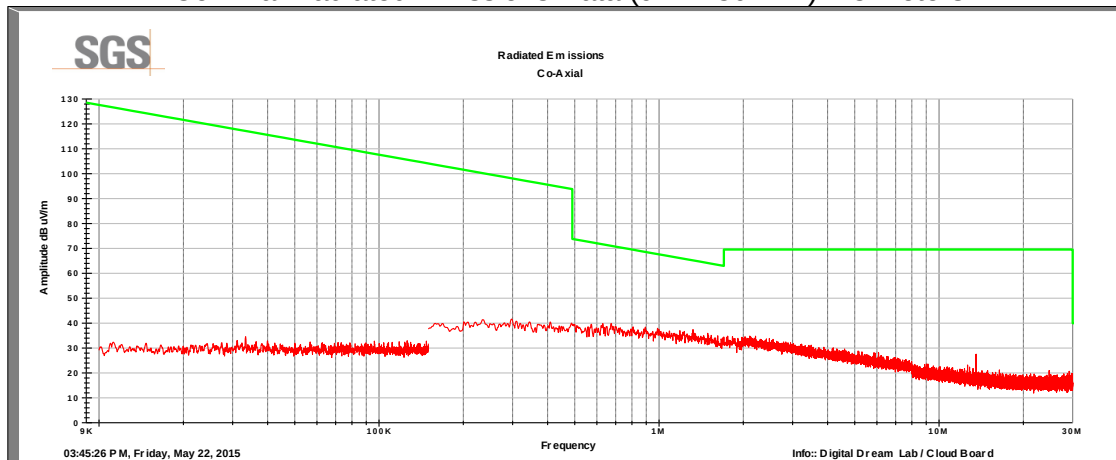
4.5 Test Data

Co-Planar Radiated Emissions Data (9kHz-30MHz) – 3 meters



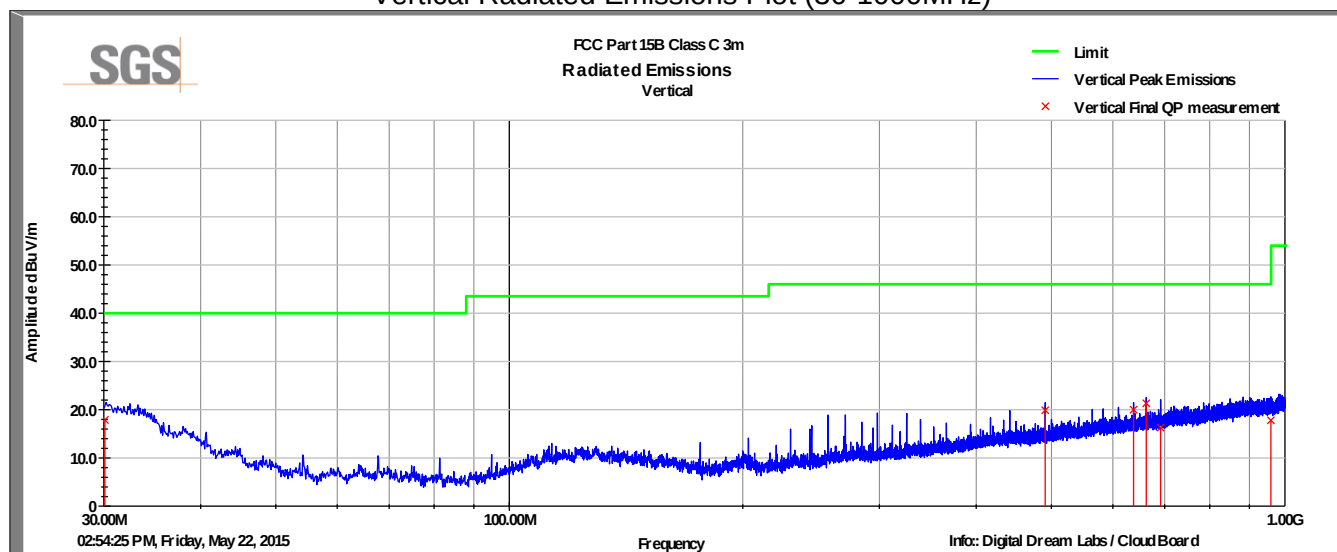
Frequency MHz	Raw QP (dBuV)	Polarity (CA/CP)	AF (dBS/m)	CL (dB)	Dist Conv (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.56	24.0	CP	10.8	0.3	0.0	29.5	69.5	-40.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

Co-Axial Radiated Emissions Data (9kHz-30MHz) – 3 meters



Frequency MHz	Raw QP (dBuV)	Polarity (CA/CP)	AF (dBS/m)	CL (dB)	Dist Conv (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.56	22.4	CA	10.8	0.3	0.0	28.5	69.5	-41.0
QP Value = Level + AF + CL - Amp								
Margin = QP Value - Limit								

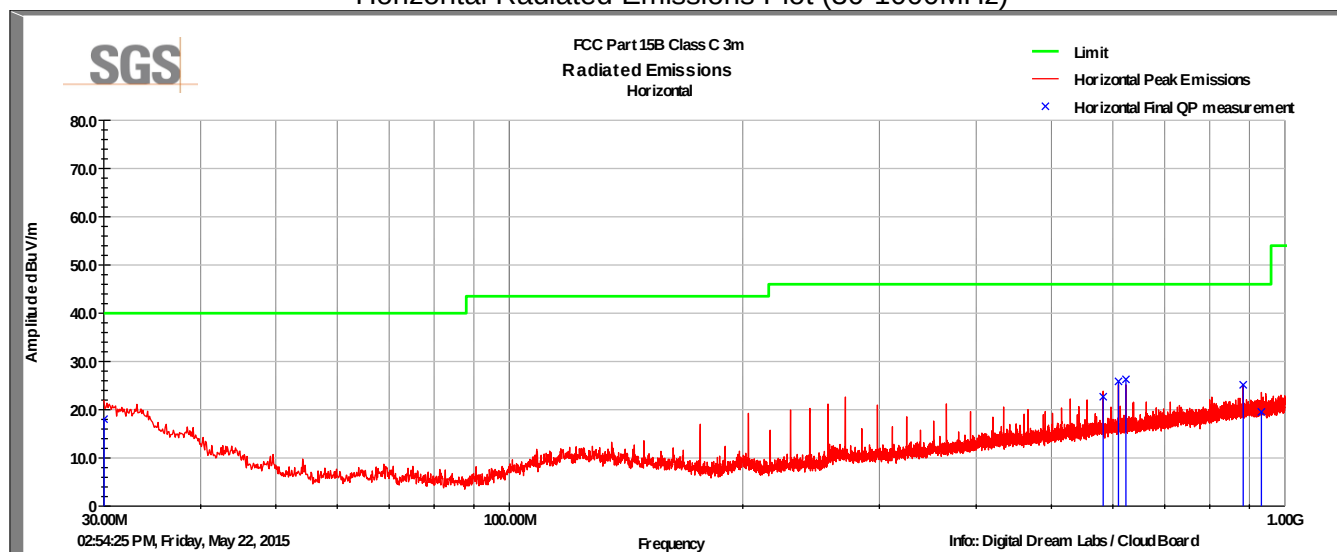
Vertical Radiated Emissions Plot (30-1000MHz)



Vertical Radiated Emissions Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.09	27.7	V	50.0	316.0	21.9	0.2	32.0	17.9	40.0	-22.1
490.90	33.8	V	274.0	323.0	18.1	1.1	33.1	19.9	46.0	-26.1
638.18	31.6	V	25.0	332.0	20.2	1.3	33.1	20.0	46.0	-26.0
662.73	32.6	V	117.0	279.0	20.5	1.3	33.1	21.3	46.0	-24.7
691.56	27.2	V	221.0	187.0	20.8	1.3	33.1	16.3	46.0	-29.7
959.37	25.8	V	270.0	129.0	23.4	1.6	32.9	17.8	46.0	-28.2
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

Horizontal Radiated Emissions Plot (30-1000MHz)



Horizontal Radiated Emissions Data (30-1000MHz)

Frequency MHz	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.02	27.8	H	320.0	243.0	22.0	0.2	32.0	18.0	40.0	-22.0
583.08	35.2	H	152.0	158.0	19.4	1.2	33.1	22.7	46.0	-23.3
610.20	37.9	H	125.0	158.0	19.8	1.2	33.1	25.9	46.0	-20.1
623.76	38.2	H	135.0	149.0	19.9	1.3	33.1	26.3	46.0	-19.7
883.62	33.8	H	5.0	297.0	22.8	1.5	33.0	25.1	46.0	-20.9
932.68	27.7	H	140.0	130.0	23.2	1.6	32.9	19.5	46.0	-26.5
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

5 Conducted Emissions

5.1 Test Result

Test Description	Basic Standards	Test Result
Conducted Emissions, Class B	FCC Part 15, Subpart B ANSI C63.4:2009	Compliant

5.2 Test Method

With the receivers resolution bandwidth was set to 9 kHz the initial preliminary exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) using a max hold mode incorporating a Peak detector and Average detector and using the TILE! software. The final test data was measured using a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBuV)		Class B Limits (dBuV)	
	FCC	CISPR	FCC	CISPR
0.15 to 0.5 MHz	Avg 66 QP 79		Avg 56 to 46 QP 66 to 56	
0.5 to 5 MHz	Avg 60 QP 73		Avg 46 Pk 56	
5 to 30 MHz	Avg 60 QP 73		Avg 50 Pk 60	

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.4°C

Relative Humidity: 48.7%

Atmospheric Pressure: 97.67 kPa

5.4 Test Equipment

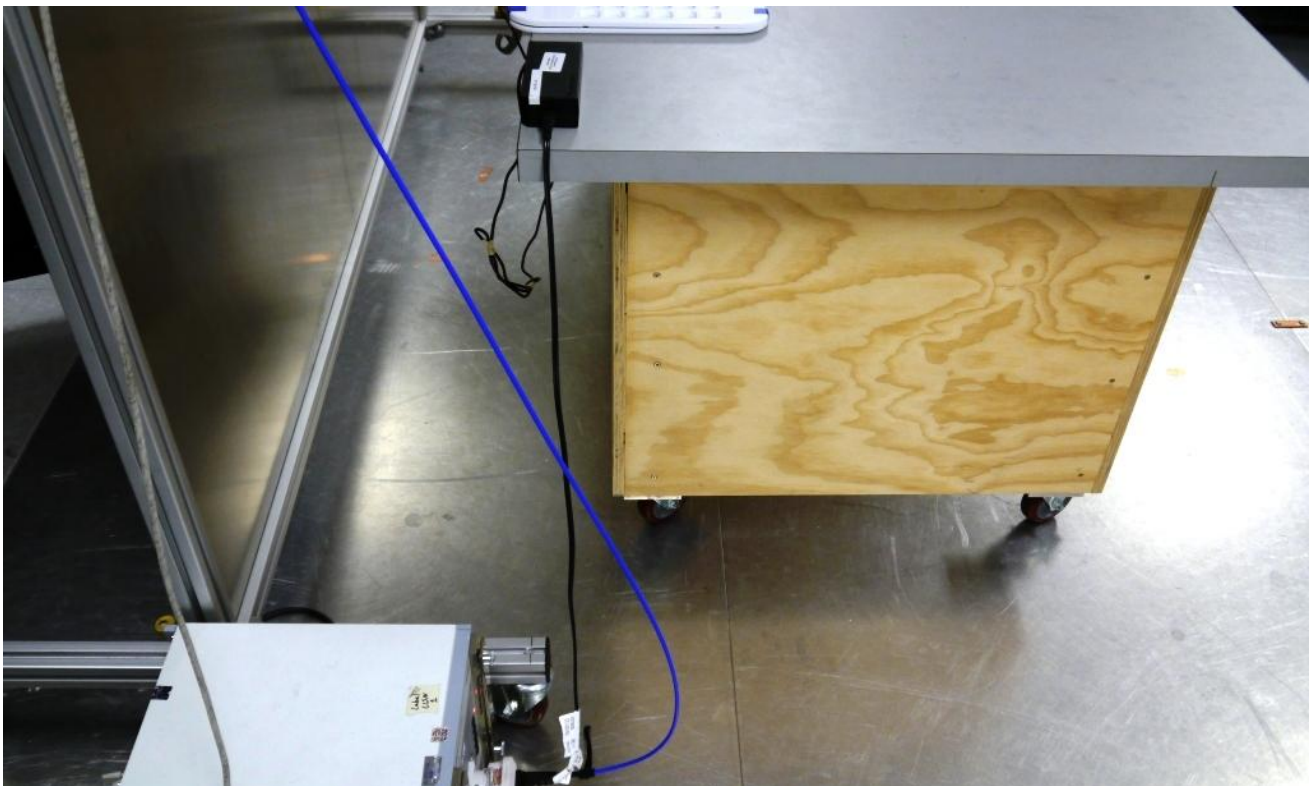
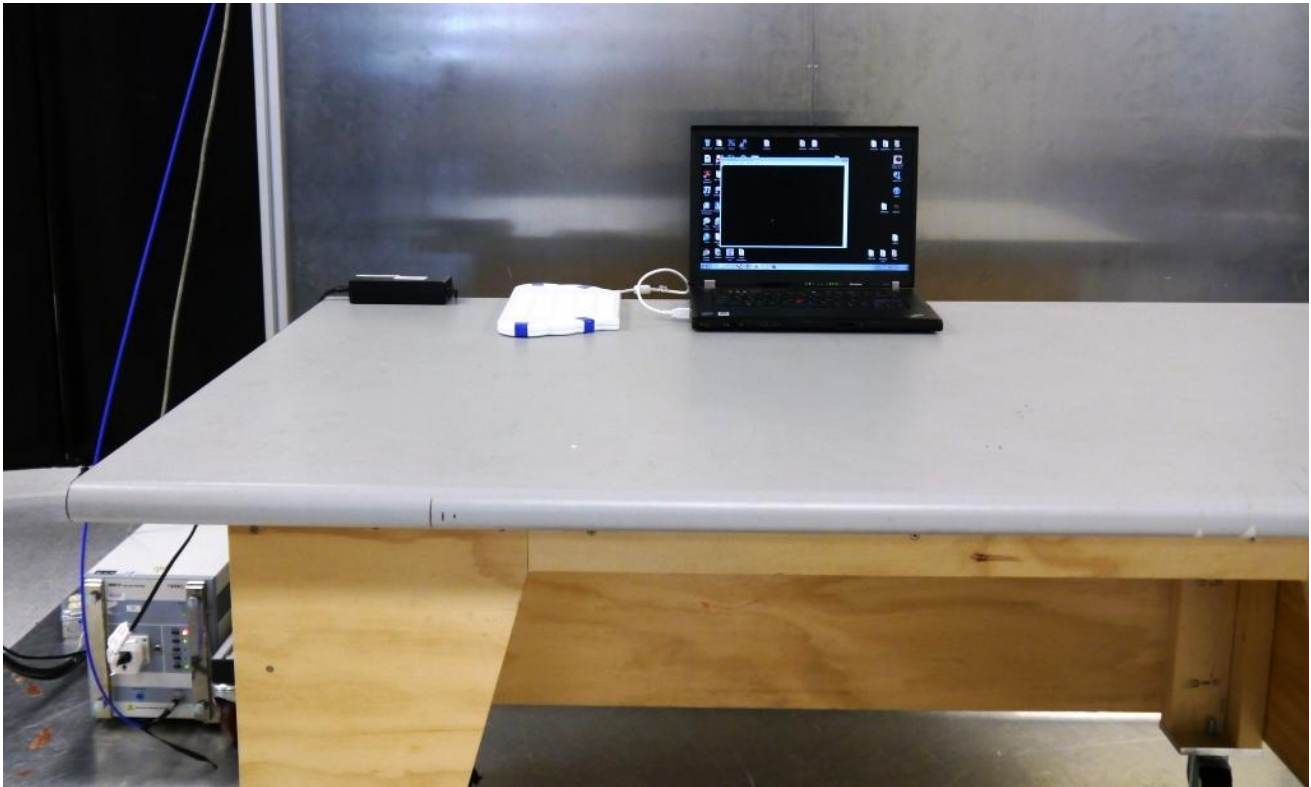
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
TWO-LINE V-NETWORK	NNB 51	TESEQ	B085882	23-Sep-2015
COAXIAL CABLE	CBL-25FT-NMNM	Mini-Circuit	B094941	5-Aug-2015
EMI TEST RECEIVER	ESU08	ROHDE & SCHWARZ	B085759	26-Jun-2015

Note: The calibration period equipment is 1 year.

Software:

“Conducted Emissions” TILE! profile dated 6 Mar 2013

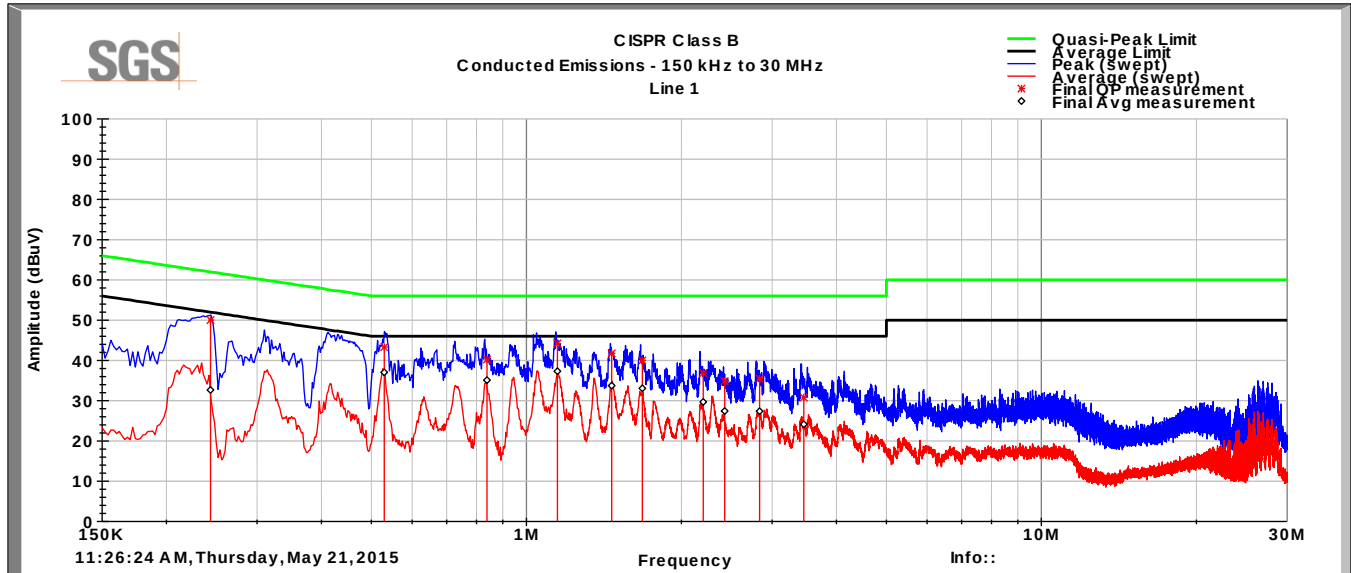
5.5 Test Setup Photographs



5.6 Test Data

Conducted Emissions Plot 150-30MHz

Line 1

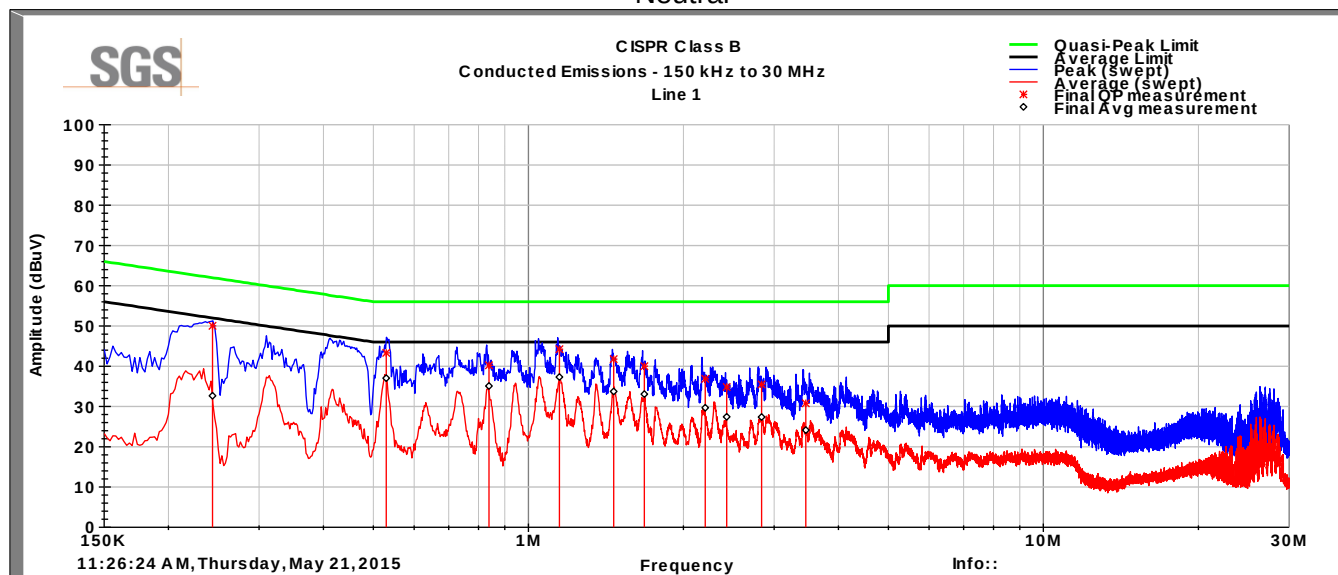


Conducted Emissions Data 150-30MHz

Line 1

Frequency (MHz)	QP Value (dBuV)	QP Limit (dBuV)	Margin (dB)	Avg Value (dBuV)	Avg Limit (dBuV)	Avg Margin (dB)
0.243	50.0	62.0	-11.9	32.6	52.0	-19.3
0.529	43.3	56.0	-12.7	37.0	46.0	-9.0
0.839	40.2	56.0	-15.8	35.1	46.0	-10.9
1.149	44.2	56.0	-11.8	37.3	46.0	-8.7
1.464	41.7	56.0	-14.3	33.7	46.0	-12.3
1.679	40.0	56.0	-16.0	33.1	46.0	-12.9
2.205	36.9	56.0	-19.1	29.7	46.0	-16.3
2.427	34.8	56.0	-21.2	27.4	46.0	-18.6
2.837	35.5	56.0	-20.5	27.4	46.0	-18.6
3.457	30.8	56.0	-25.2	24.1	46.0	-21.9

Conducted Emissions Plot 150-30MHz Neutral



Conducted Emissions Data 150-30MHz Neutral

Frequency (MHz)	QP Value (dBuV)	QP Limit (dBuV)	QP Margin (dB)	Avg Value (dBuV)	Avg Limit (dBuV)	Avg Margin (dB)
0.243	49.3	62.0	-12.7	31.6	52.0	-20.3
0.443	43.2	57.0	-13.9	27.7	47.0	-19.3
0.639	37.1	56.0	-18.9	28.0	46.0	-18.0
0.958	41.0	56.0	-15.0	35.6	46.0	-10.4
1.323	34.6	56.0	-21.4	20.5	46.0	-25.5
1.602	37.8	56.0	-18.2	30.7	46.0	-15.3
1.829	36.0	56.0	-20.0	30.2	46.0	-15.8
2.146	33.8	56.0	-22.2	27.6	46.0	-18.4
2.704	31.2	56.0	-24.8	22.9	46.0	-23.1
3.354	26.9	56.0	-29.1	20.2	46.0	-25.8

6 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	9 June 2015
1	- Updated RSS and ANSI references on cover page - Added FCC and IC ID's to cover page - Added conducted emissions test results. - Added tabular data for fundamental measurement.	22 July 2015