



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: Line 6 Digital Wireless Inc.

Model: G10T

Description: 2400-2483.5MHz Guitar Transmitter

Serial Number: N/A

FCC ID: UOB-G10T

IC: 6768A-G10T

To

FCC Part 15.247

IC RSS-247

Date of Issue: October 21, 2015

On the behalf of the applicant:

Line 6 Digital Wireless Inc.
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Attention of:

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Alex Macon
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 25, 2015	Alex Macon	Original Document
2.0	September 17, 2015	Amanda Reed	Added IC ID to report
3.0	October 21, 2015	Amanda Reed	Updated title & added IC standard on cover page



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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (mbar)
20.6 – 21.7	36.7 – 41.2	968.7 – 972.4

EUT Description

Model: G10T

Description: 2400-2483.5MHz Guitar Transmitter

Firmware: N/A

Software: N/A

Serial Number: N/A

Additional Information: None

EUT Operation during Tests

The EUT was placed into a test mode provided by the OEM

Accessories: None

Cables: None

Modifications: None

15.203: Antenna Requirement:

- ☒ The antenna is permanently attached to the EUT
- ☐ The antenna uses a unique coupling
- ☐ The EUT must be professionally installed
- ☐ The antenna requirement does not apply



Test Reports Summary

FCC 15.247 Specification	Test Name	Pass, Fail, N/A	Comments
15.203	Antenna Requirements	Pass	
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Power line Conducted Emissions	N/A	EUT cannot transmit when batteries are charging

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63.10-2009	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2009	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories
KDB 558074 D01 v03r03	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

Conducted Output Power

Engineer: Alex Macon

Test Date: 8/24/2015

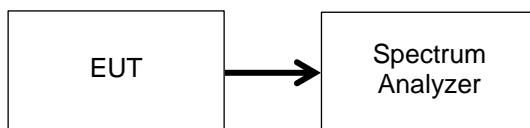
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 1-5% of the OBW, not to exceed 1MHz
 VBW $\geq 3 \times$ RBW
 RMS Detector
 Number of points in sweep $\geq 2 \times$ span / RBW
 Trace average at least 100 traces in power averaging mode
 Sweep = auto
 Span = $1.5 \times$ EBW

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The RF output power was measured using the spectrum analyzer's channel power function

Test Setup



Transmitter Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	1.65	1 W (30 dBm)	Pass
2442	3.25	1 W (30 dBm)	Pass
2478	1.33	1 W (30 dBm)	Pass

See Annex A for test data

Conducted RF Measurements (15.209)**Engineer:** Alex Macon**Test Date:** 8/28/2015**Test Procedure**

Antenna-port conducted measurements were performed as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands for 15.209.

The following offsets were added to the measurements:

The maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level

A maximum ground reflection factor to the EIRP level, 6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz.

The following equations were used to determine the field strength from the conducted values.

$E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and $d = 3\text{m}$

$E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] + 95.2$, for $d = 3$ meters.

The Spectrum Analyzer was set to the following:

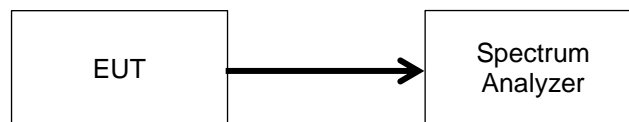
The Spectrum Analyzer was set to the following for emissions > 1000 MHz:

- a. RBW = 1 MHz
- b. VBW ≥ 3 MHz
- c. Detector = Peak.
- d. Sweep time = auto
- e. Trace mode = max hold
 - 1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
- f. RBW = 1 MHz
- g. VBW $\leq \text{RBW}/100$ (i.e., 10 kHz) but not less than 10 Hz

For emissions below 1000 MHz the Spectrum Analyzer settings were as follows:

- a. RBW = 100 kHz
- b. VBW ≥ 300 kHz
- c. Detector = Peak
- d. Sweep time = auto
- e. Trace mode = max hold

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was investigated.

Test Setup

See Annex B for test data

Radiated Spurious Emissions

Engineer: Alex Macon

Test Date: 8/24/2015

Test Procedure Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

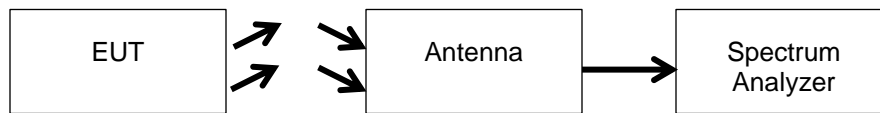
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

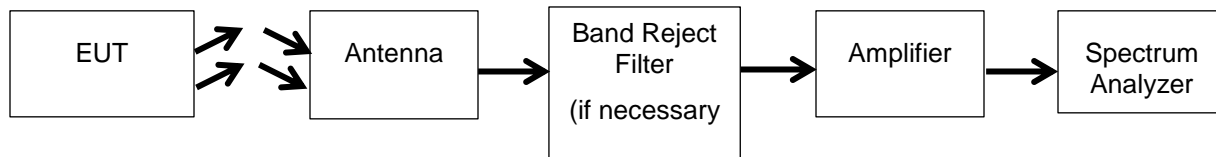
Test Setup



Test Procedure for Radiated Spurious Emissions above 1 GHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

Test Setup



See Annex C for Test Data

Conducted Spurious Emissions

Engineer: Alex Macon

Test Date: 8/24/2015

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Peak Detector

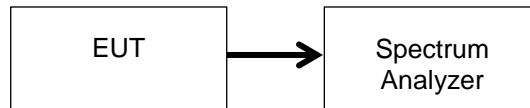
Trace mode = max hold

Sweep = auto couple

Frequency Range = 30MHz – 10th Harmonic of the fundamental

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The trace was allowed to stabilize. All emissions were investigated to insure they were attenuated from the peak fundamental by at least 20dB. If the average power levels were measured then the out-of-band emissions needed to be attenuated by 30dB. In addition emissions were investigated at the band edges to insure all out-of-band emissions were attenuated 20 or 30dB as necessary.

Test Setup



See Annex D for test data



DTS Bandwidth

Engineer: Alex Macon

Test Date: 8/24/2015

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Peak Detector

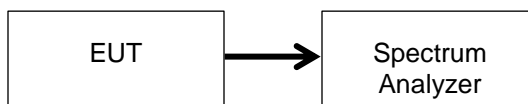
Trace mode = max hold

Sweep = auto couple

Span = $1.5 \times$ EBW

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. The maximum width of the emission that was determined by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that were attenuated by 6db and this value was used to determine the width of the carrier. Alternatively the spectrum analyzer's automatic bandwidth capability was used.

Test Setup



6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (KHz)	Specification Limit (kHz)	Result
2402	721.6	≥ 500	Pass
2442	757.5	≥ 500	Pass
2478	715.4	≥ 500	Pass

99% Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (MHz)	Result
2402	1.08	Pass
2442	1.06	Pass
2478	1.07	Pass

See Annex E for test data

Transmitter Power Spectral Density (PSD)

Engineer: Alex Macon

Test Date: 8/24/2015

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

DTS channel center frequency

Span 1.5 x DTS bandwidth

RBW = 3 kHz \leq RBW \leq 100 kHz

VBW \geq 3 x RBW

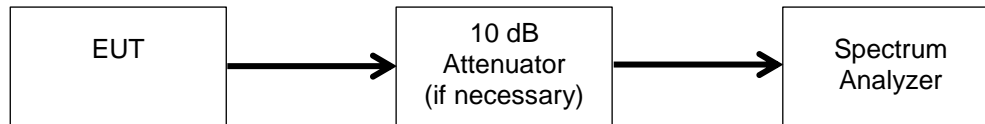
Peak Detector

Sweep time = auto couple

Trace mode = max hold

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. Once the trace has stabilize the peak marker was used to determine the peak power spectral density.

Test Setup



PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-4.666	8	Pass
2442	-3.096	8	Pass
2478	0.002	8	Pass

See Annex F for test data



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	2/26/15	2/26/16
Preamplifier	HP	8447D	i00055	NCR	NCR
Horn Antenna	EMCO	3116	i00085	NCR	NCR
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	5/8/14	5/8/16
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/9/12	4/9/2016
Spectrum Analyzer	Agilent	E4407B	i00331	6/13/14	6/13/16
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
EMI Analyzer	Agilent	E7405A	i00379	2/5/15	2/5/16
Standard Gain Horn Kit	Pacific Millimeter Products	Mixer Mdl: MD1A 60 – 90 GHz Horn Mdl: EM 90 – 140 GHz Horn Mdl: FM	i00394	NCR	NCR
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	11/26/15
Spectrum Analyzer	Agilent	E4440A	S/N:MY46180566	3/20/15	12/1/16

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT