Nemko USA, Inc.

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TEST REPORT

PER RCTA/D0-160G

FOR THE
DS1921G-F5#, DS1922L-F5#, DS1925L-F5#
DATA LOGGERS

PREPARED FOR
Maxim Integrated Products
14460 MAXIM DRIVE
DALLAS, TX 75244 USA

REVISION 1

PREPARED ON JULY 11, 2016

REPORT NUMBER 2016 07313140 RTCA R1

PROJECT NUMBER: 313140

QUOTE NUMBER: Q102104018

DOCUMENT HISTORY

REVISION	DATE	COMMENTS
0	July 11, 2016	Prepared By: Lan Sayasane
0	June 26, 2007	Released By: Jim Morris
1	July 19, 2007	Correct Model # Jim Morris

NOTE: Nemko USA, Inc. hereby makes the following statements so as to conform to the Requirements of EN 17025 "General Criteria For the Operation Of Test Laboratories":

- The units described in this report were received at Nemko USA, Inc.'s facilities on July 8, 2016. Testing was performed on July 11, 2016.
- The Test Results reported herein apply only to the Unit actually tested, and to substantially identical Units.

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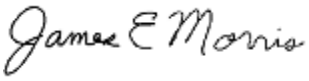
CERTIFICATION

The compatibility testing and this report have been prepared by Nemko USA, Inc., an independent electromagnetic compatibility consulting and test laboratory. Testing was performed Per test methods described in RCTA/DO-160G.

I certify the data evaluation and equipment configuration herein to be a true and accurate representation of the sample's immunity and emission characteristics, as of the test date(s), and for the design of the test sample utilized to compile this report.



James Morris
EMC and Wireless Manager
Nemko USA, Inc., 2210 Faraday Avenue, Suite 150
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1. ADMINISTRATIVE DATA AND TEST SUMMARY

1.1 Administrative Data

CLIENT: **Maxim Integrated Products**

CONTACT: Stewart Merkel

DATE (S) OF TEST: July 11, 2016

EQUIPMENT UNDER TEST (): Data Loggers
Part Number: DS1921G-F5#, DS1922L-F5#, DS1925L-F5#
Serial Number 165EA5, 38C201, 008CFB
Condition Upon Receipt Acceptable

TEST SPECIFICATIONS: Radio Frequency Emissions and Electromagnetic Immunity tests in accordance with the requirements of RCTA/DO-160G.

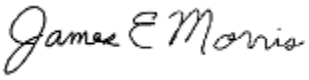
Emission Tests				
Test Method	**Requirement**	**Description**	**Frequency Range**	**Limit**
21.5	RCTA/DO-160G	Radiated RF Emissions	100 MHz – 6000 MHz	Category H

1.2 Test Summary

1.3 Emissions Test Summary

Specification	*Frequency Range*	*Compliance Status*
Section 21.5	100 MHz – 6000 MHz	**Compliant**

Refer to the test results section for further details.



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2. SYSTEM CONFIGURATION

2.1 System Components and Power Cables

None

2.2 Device Interconnection and I/O Cables

None

2.3 Design Modifications for Compliance

None

3. TEST SITE INFORMATION

The test site is located at:

NEMKO USA, Inc.

2210 Faraday Ave., Suite 150

Carlsbad, CA 92008

NEMKO USA is NVLAP certified. The NVLAP Certification is included in Appendix C of this document. The site is physically located 18 miles Northwest of downtown San Diego. The general area is a valley 1.5 miles east of the Pacific Ocean. The EMI testing was under the guidance of National Association of Radio and Telecommunication Engineers (NARTE) personnel.

3.1 Ground Plane

The emissions and susceptibility portions of the testing was performed on a ground plane. The ground plane consisted of a 8’ x 3’ x 1/8” thick copper plate mounted on a wooden bench and is connected to the ground rod via a copper bus bar 2’ wide and 0.25" thick. The DC bonding resistance between the ground plane and ground was less than 2.5mΩ. The Unit Under Test (UUT) and LISNs were bonded to the ground plane.

3.2 Anechoic Chamber

The radiated and conducted emissions tests were conducted inside a semi anechoic chamber which measures 20' x 12' x 10'. Carbon-loaded cones provide RF dissipation. Radiated susceptibility tests were conducted inside a semi anechoic chamber which measures 20' x 12' x 10’. Power capability of the chamber includes 50 amps at 100VDC, 30 amps per phase of 120 VAC at 400 Hz, and 50 amps of up to 250 VAC at up to 60 Hz.

3.3 Detection System

The automated detection system used in emission testing consist of a spectrum Analyzer controlled by a computer. Preamplifiers used where necessary and where they are used an appropriate notation is made in the relevant section of the report. Commercially available EMI measurement software Total Integrated Laboratory Environment (TILE) was used in the performance of these measurements. In this software package, the bandwidths and measurement times are user-selectable, and the bandwidths and sweep times were per the requirements of RTCA/DO-160G.

3.4 Test Equipment

NEMKO USA, Inc. operates a comprehensive Periodic Calibration Program in order to ensure the validity of all test data. NEMKO USA’s Periodic Calibration Program is fully compliant to the requirements of NVLAP Policy Guide PG-1-1988, ANSI/NCSL Z540-1 (1994), ISO 10012-1 (1993-05-01), ISO Standard 17025, ISO-9000 and EN 45001. NEMKO USA, Inc.’s calibration program therefore meets or exceeds the US national commercial and military requirements [N.B. ANSI/NCSL Z540-1 (1994) replaces MIL-STD-45662A].

Specifically, all of NEMKO USA's *primary reference standard devices* (e.g. vector voltmeters, multimeters, attenuators and terminations, RF power meters and their detector heads, oscilloscope mainframes and plug-ins, spectrum analyzers, RF preselectors, quasi-peak adapters, interference analyzers, impulse generators, signal generators and pulse/function generators, field-strength meters and their detector heads, etc.) and certain *secondary standard devices* are periodically recalibrated by:

- A NEMKO USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Standard 17025-accredited as a calibration laboratories by NIST; or,
- A NEMKO USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Standard 17025-accredited as a calibration laboratory by another accreditation body (such as A2LA) that is mutually recognized by NIST; or,
- A manufacturer of Measurement and Test Equipment (M&TE), if the manufacturer uses NIST-traceable standards and is ISO Standard 17025-accredited as calibration laboratory either by NIST or by another accreditation body (such as A2LA) that is mutually recognized by NIST; or
- A manufacturer of M&TE (or by a NEMKO USA-approved independent third party metrology laboratory) that is not ISO Standard 17025-accredited. (In these cases, NEMKO USA conducts an annual audit of the manufacturer or metrology laboratory for the purposes of proving traceability to NIST, ensuring that adequate and repeatable calibration procedures are being applied, and verifying conformity with the other requirements of ISO Standard 17025).

In all cases, the entity performing the Calibration is required to furnish NEMKO USA with a calibration test report and/or certificate of calibration, and a "calibration sticker" on each item of M&TE that is successfully calibrated.

Calibration intervals are normally one year, except when the manufacture advises a shorter interval or if US Government directives or client requirements demand a shorter interval. Items of instrumentation/related equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit), are sidelined pending repair and recalibration. (Repairs are carried out either in-house [if minor] or by a NEMKO USA-approved independent [third party] metrology laboratory, or by the manufacturer of the item of M&TE).

Each antenna used for radiated emissions testing is calibrated annually by either a NIST (or A2LA) ISO Standard 17025-Accredited third-party Antenna Calibration Laboratory or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory.

4. Description of UUT Set-up and Modes of Operation

4.1 Test Specifics

The equipment lists for each EMI/EMC test is contained in the EMI test Sections 5.2.4. Serial numbers, calibration due dates, and equipment used were recorded at test time. Instrumentation calibrations are traceable to the National Institute of Standards and Technology.

A PC computer external to the test room was used in conjunction with the RTS version A for testing. The PC used to simulate actual communications was used to also verify the signal integrity during the evaluation.
Functional performance tests on the UUT were performed prior to each test performed. These established the base line parameters and verified the proper UUT operation. During the actual testing the communications was monitored to verify normal UUT operation.

4.2 Modes of Operation during EMC Testing

During the EMI/EMC evaluation the unit will continuously operate for 12 hours. The configuration were set according: DS1921G -> Every 1 minute (Max Rate), DS1922L -> Every 11 seconds, Resolution 0.0625 (4096 samples up to 12.5 hours), DS1925L -> Every 300 seconds, Resolution 0.0625 (Datasheet sheet recommended lower limit is every 5 minutes or 300 seconds).

4.3 Figure and Picture of actual test Set-up

Figure 4.3-1 UUT Test Setup

5. Bonding and Emission Control

5.1 Bonding Test

5.1.1 Bonding Test Method

Per RTCA/DO-160G the bonding between the UUT, LISN's and ground plane were measured and verified to be less than 2.5 milli ohms.

Test Dates: July 11, 2016

Test Results: Passed

5.1.2 Bonding Data Sheets

Customer:	**Maxim Integrated Products**
Job order:	313140
Test Engineer:	Lan Sayasane
Date:	July 11, 2016
Standard:	RTCA/DO-160G
Remarks:	Section 21.5 – Radiated RF Emissions

From Location	To Location	Measured mΩ	Limit mΩ	Pass (√)	Remarks
Table Ground Plane	Ground Strap	0.02	2.5	√	

5.1.3 Bonding Photographs

5.1.4 Bonding Equipment List

Asset No.:	Description:	Company:	Model Number:	Serial Number:	Date Cal:	Cal Due Date:
D1851	Milliohm Meter	Extech	380560	DA4017	12/30/2015	12/30/2016

5.2 Radiated RF Emissions

5.2.1 Radiated RF Emissions Test Method

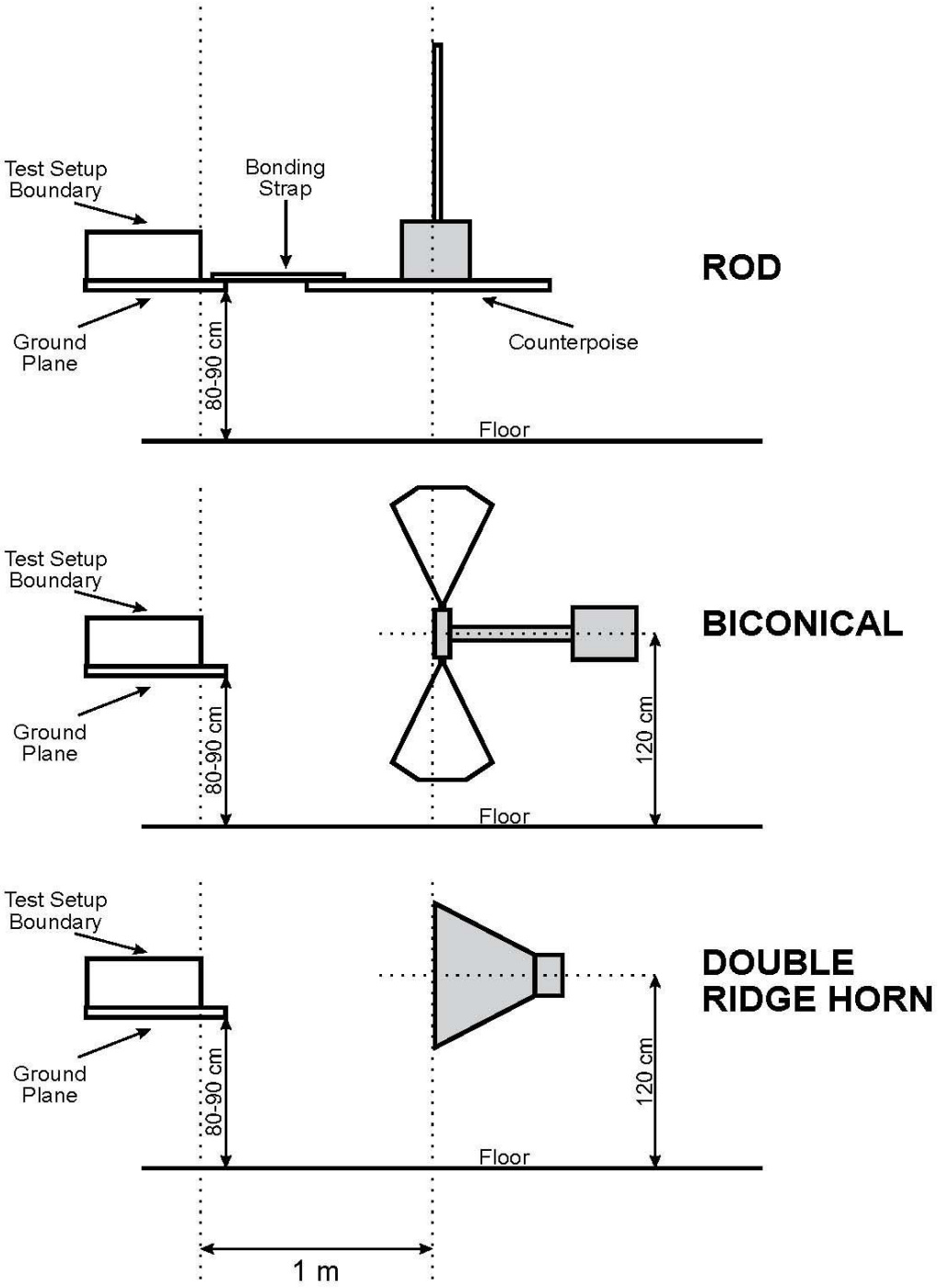
The purpose of this test was to measure the electric field radiated emissions produced by the UUT and associated cabling and to determine whether these emissions are in compliance with the requirements of RTCA/DO-160G.

The UUT configured as shown in Figure 4.3.1 inside the anechoic chamber. The field-measuring antenna was placed inside the chamber and connected via coaxial cable through the bulkhead panel to the detection system located outside the chamber. The detection system consisted of a Spectrum Analyzer controlled by a Computer. A number of antennas were used to cover the frequency range required in this test.

The operation of the UUT was verified. Measurements were then performed of the radiated electric field emissions produced by the UUT. The data was reduced and plotted together with the applicable limit. The Limit is per RTCA/DO-160G, Figure 21-9: Maximum Level of Radiated RF Interference – Category H.

Test Results: The UUT passed the radiated emissions testing as demonstrated in the plots below.

Figure 5.1-1 Test Configuration



5.2.2 Radiated RF Emissions Test Data

Figure 5.1-2: 100 MHz – 200 MHz - Vertical

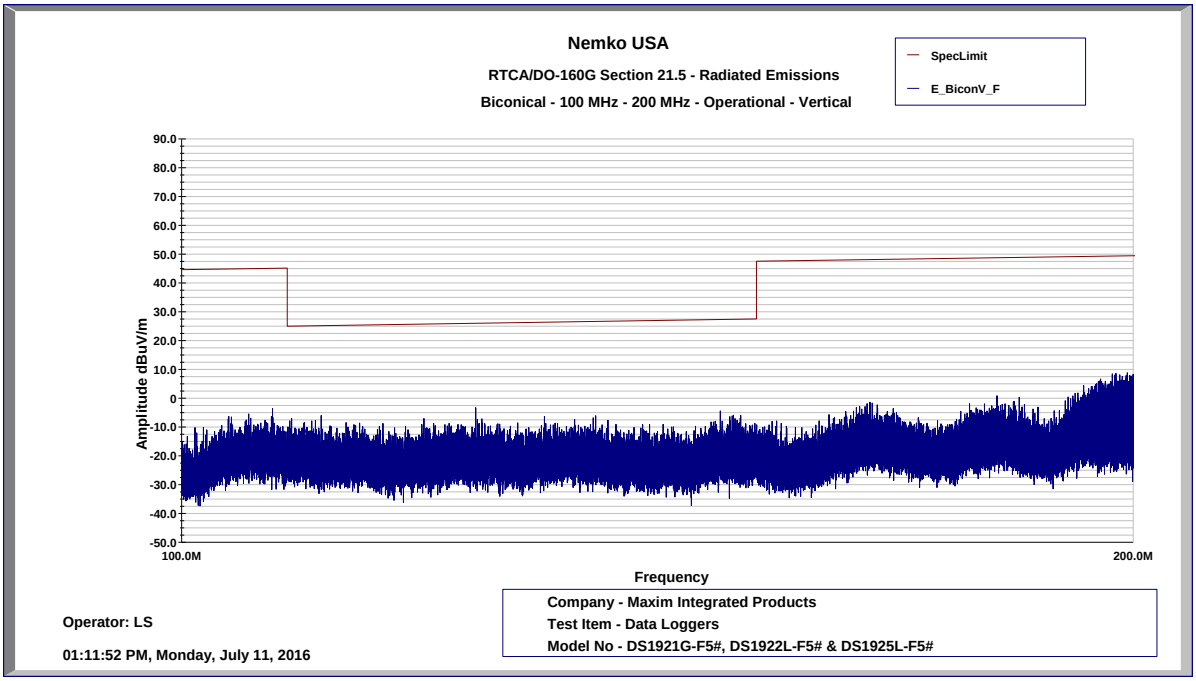


Figure 5.1-3: 100 MHz – 200 MHz - Horizontal

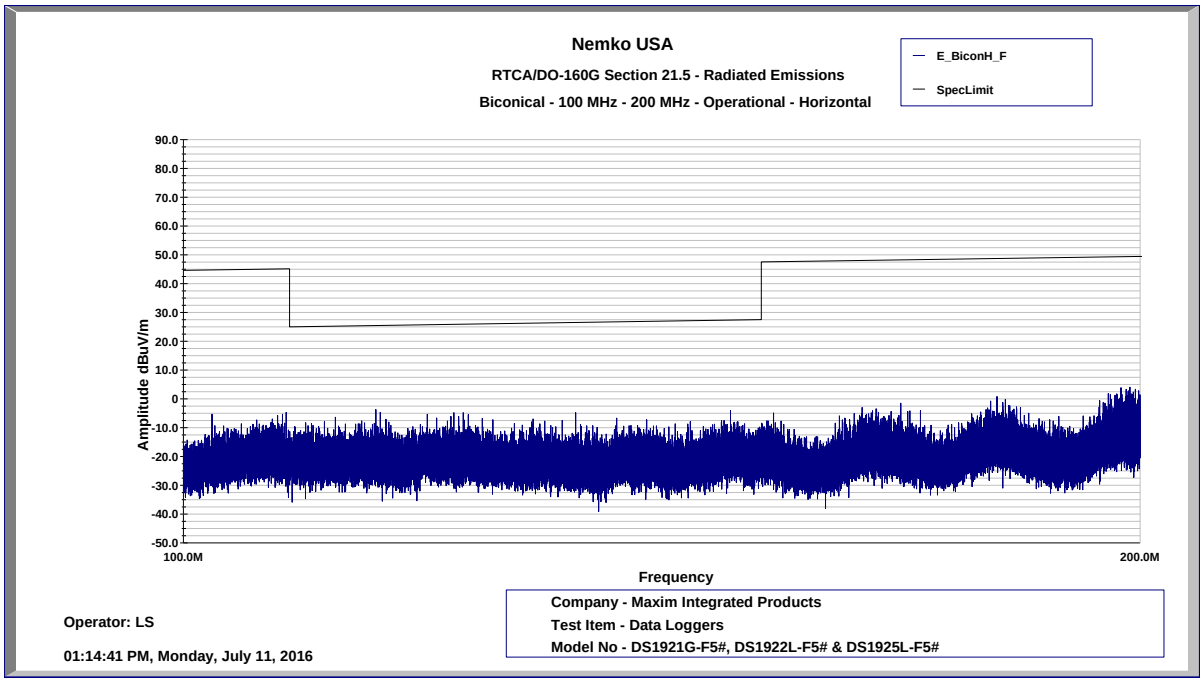


Figure 5.1-4: 200 MHz – 960 MHz - Vertical

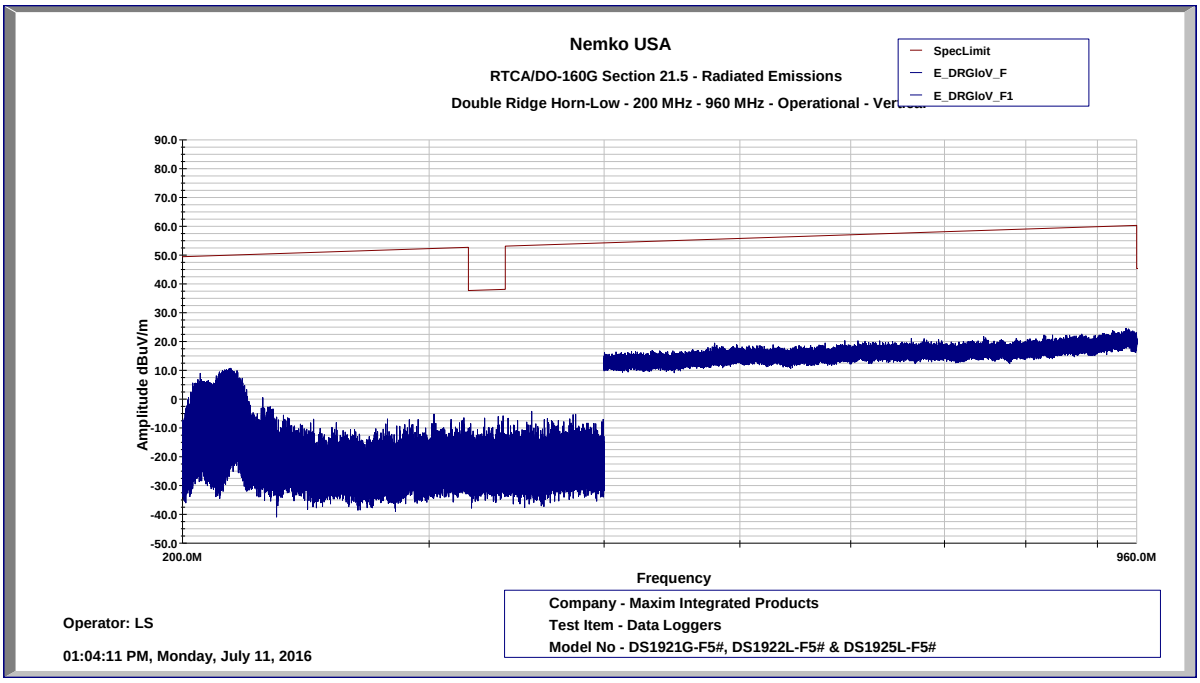


Figure 5.1-5: 200 MHz – 960 MHz - Horizontal

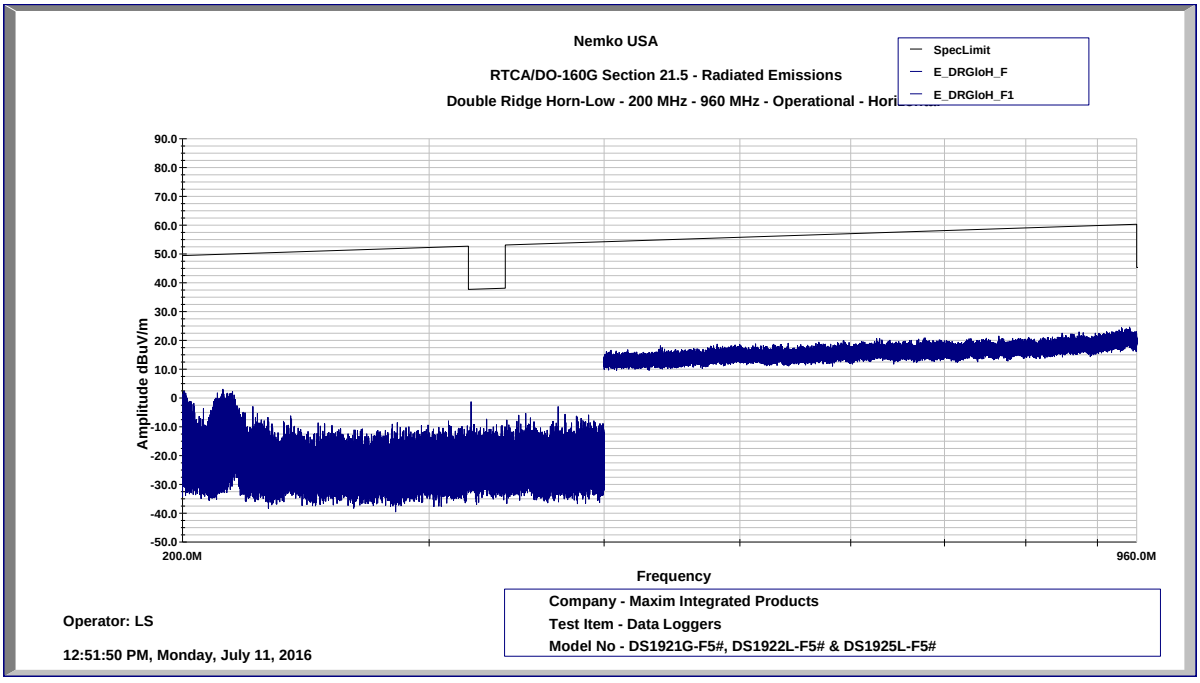


Figure 5.1-6: 960 MHz – 6000 MHz - Vertical

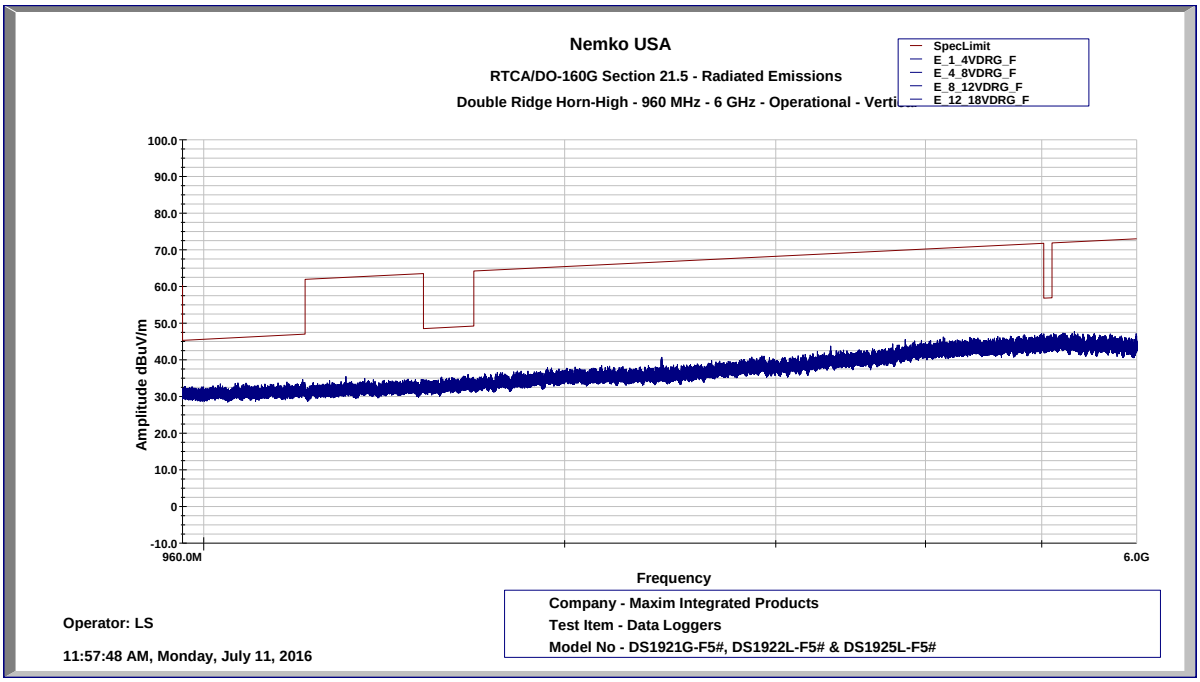
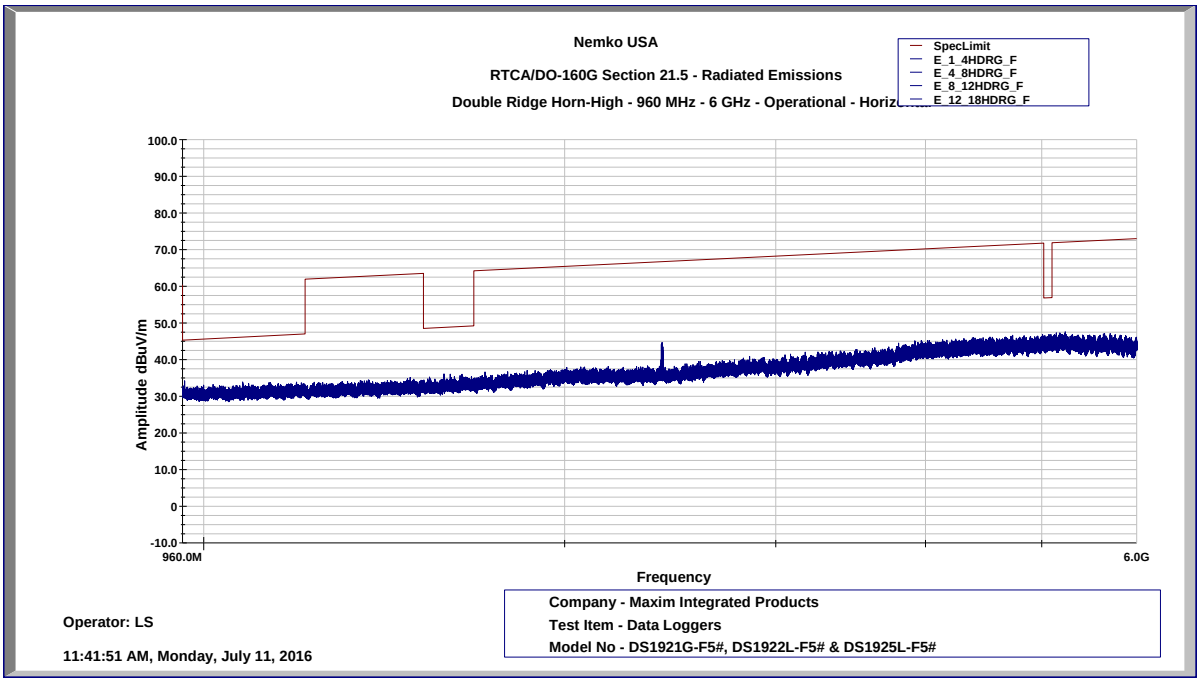


Figure 5.1-7: 960 MHz – 6000 MHz - Horizontal



5.2.3 Radiated RF Emissions Photographs

Figure 5.1-8: 100 MHz to 200 MHz – Vertical

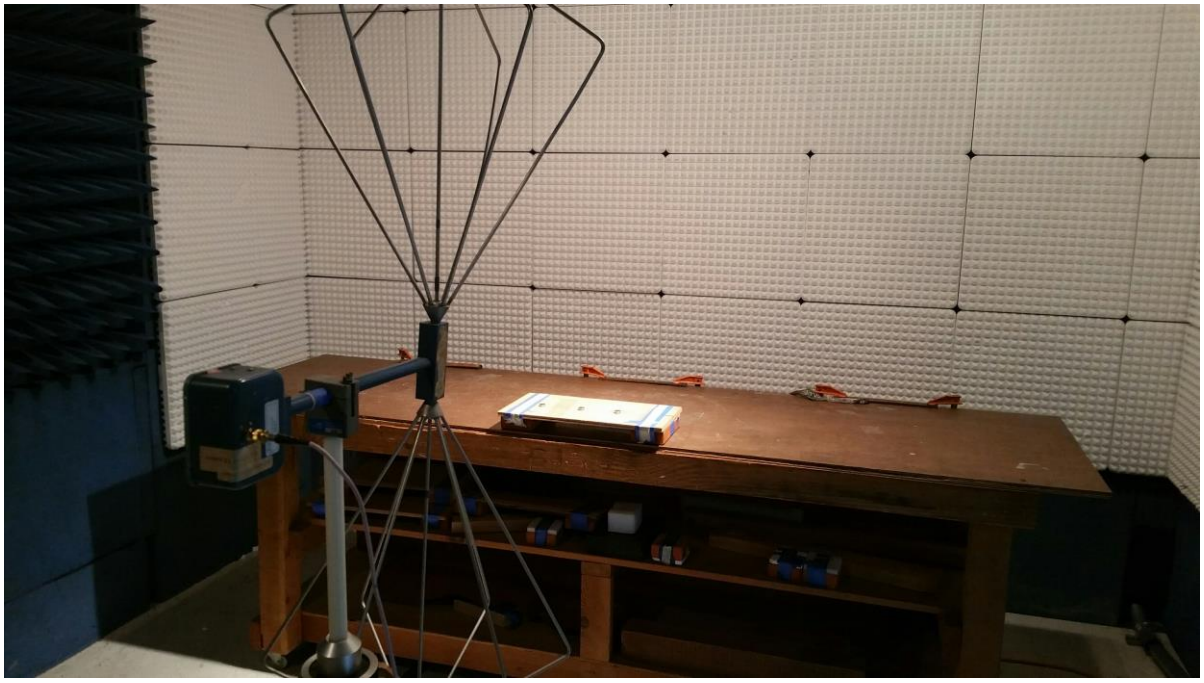


Figure 5.1-9: 100 MHz to 200 MHz – Horizontal

Figure 5.1-10: 200 MHz to 960 MHz – Vertical

Figure 5.1-11: 200 MHz to 960 MHz – Horizontal

Figure 5.1-12: 960 MHz to 6000 MHz – Vertical

Figure 5.1-13: 960 MHz to 6000 MHz – Horizontal

5.2.4 Radiated RF Emissions Test Equipment List

Asset No.:	Description:	Company:	Model Number:	Serial Number:	Last Cal.	Cal due
E1064	Spectrum Analyzer	Agilent	E4440A	US42221762	2/15/2016	2/15/2017
E1029	Pre-amplifier	A.H. Systems, Inc.	PAM-0118	343	9/9/2016	9/9/2016
827	Pre-amplifier	Com-Power	PA-103	161032	3/8/2016	3/8/2017
117	Antenna, Biconical	Electro-Metrics	BIA-25	2611	3/22/2016	3/22/2017
E1014	Antenna, Dual Ridge	A.H.Systems, Inc.	SAS-570	174	12/12/2015	12/12/2016
752	Antenna, DRG Horn	EMCO	3115	9609-4943	4/5/2016	4/5/2017

APPENDIX A – Calibration Program

Nemko USA, Inc.'s Test Equipment & Facilities Calibration Program

Nemko USA, Inc. operates a comprehensive Periodic Calibration Program in order to ensure the validity of all test data. Nemko USA's Periodic Calibration Program is fully compliant to the requirements of NVLAP Policy Guide PG-1-1988, ANSI/NCSL Z540-1 (1994), ISO 10012-1 (1993-05-01), ISO Standard 17025, ISO-9000 and EN 45001. Nemko USA, Inc.'s calibrations program therefore meets or exceed the US national commercial and military requirements [N.B. ANSI/NCSL Z540-1 (1994) replaces MIL-STD-45662A].

Specifically, all of Nemko USA's *primary reference standard devices* (e.g. vector voltmeters, multimeters, attenuators and terminations, RF power meters and their detector heads, oscilloscope mainframes and plug-ins, spectrum analyzers, RF preselectors, quasi-peak adapters, interference analyzers, impulse generators, signal generators and pulse/function generators, field-strength meters and their detector heads, etc.) and certain *secondary standard devices* (e.g. RF Preamplifiers used in CISPR 11/22 and FCC Part 15/18 tests) are periodically recalibrated by:

- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Standard 17025-accredited as a calibration laboratories by NIST; or,
- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Standard 17025-accredited as a calibration laboratory by another accreditation body (such as A2LA) that is mutually recognized by NIST; or,
- A manufacturer of Measurement and Test Equipment (M&TE), if the manufacturer uses NIST-traceable standards and is ISO Standard 17025-accredited as calibration laboratory either by NIST or by another accreditation body (such as A2LA) that is mutually recognized by NIST; or
- A manufacturer of M&TE (or by a Nemko USA-approved independent third party metrology laboratory) that is not ISO Standard 17025-accredited. (In these cases, Nemko USA conducts an annual audit of the manufacturer or metrology laboratory for the purposes of proving traceability to NIST, ensuring that adequate and repeatable calibration procedures are being applied, and verifying conformity with the other requirements of ISO Standard 17025).

In all cases, the entity performing the Calibration is required to furnish Nemko USA with a calibration test report and/or certificate of calibration, and a "calibration sticker" on each item of M&TE that is successfully calibrated.

Calibration intervals are normally one year, except when the manufacture advises a shorter interval (e.g. the HP 8568B Spectrum Analyzer is recalibrated every six months) or if US Government directives or client requirements demand a shorter interval. Items of instrumentation/related equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit), are sidelined pending repair and recalibration. (Repairs are carried out either in-house [if minor] or by a Nemko USA-approved independent [third party] metrology laboratory, or by the manufacturer of the item of M&TE).

Each antenna used for CISPR 11 and CISPR 22 and FCC Part 15 and Part 18 radiated emissions testing (and for testing to the equivalent European Norms) is calibrated annually by either a NIST (or A2LA) ISO Standard 17025-Accredited third-party Antenna Calibration Laboratory or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory. The antenna calibrations are performed using the methods specified in Annex G.5 of CISPR 16-1(1993) or ANSI C63.5-1991, including the "Three-Antenna Method". Certain other kinds of antennas (e.g. magnetic-shielded loop antennas) are calibrated annually by either a NIST (or A2LA) ISO Standard 17025-accredited third-party antenna calibration laboratory, or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory using the procedures specified in the latest version of SAE ARP-958.

In accordance with FCC and other regulations, Nemko USA recalibrates its suite of antennas used for radiated emissions tests on an annual basis. These calibrations are performed as a precursor to the FCC-required annual revalidation of the Normalized Site Attenuation properties of Nemko USA's Open Area Test Site. Nemko USA, Inc. uses the procedures given in both Subclause 16.6 and Annex G.2 of CISPR 16-1 (1993), and, ANSI C63.4-1992 when performing the normalized site attenuation measurements.