Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15, RSS-210 and ANSI C63.10

On

Grid Alignment Radio

DRXGA185

Prepared for:

Carestream Health Inc.

150 Verona St

Rochester NY, 14608

Prepared by:

TUV Rheinland of North America, Inc.

Auftraggeber: *Client:*	Carestream Health Inc. 150 Verona St Rochester NY, 14608	Ronald Cain 585-627-8321 / 585-477-2718 ronald.cain@carestreamhealth.com	
Bezeichnung: *Identification:*	Grid Alignment Radio	**Serien-Nr.:** *Serial No.*	prototype
Gegenstand der Prüfung: *Test item:*	DRXGA185	**Prüfdatum:** *Date tested:*	08/16/2013
Prüfort: *Testing location:*	TUV Rheinland of North America 336 Initiative Drive Rochester, NY 14624 U.S.A.		
Prüfgrundlage: *Test specification:*	Emissions: FCC Part 15.209(a), RSS-210 Issue 8 & RSS-GEN Issue 3, ANSI C63.10 RSS-210 Issue 8, RSS-GEN Issue 3 FCC Part 15.205 & RSS-GEN Issue 3, FCC Part 15.203 RSS-210 Issue 8 & RSS-GEN Issue 3, RSS-GEN Issue 3		
Prüfergebnis: *Test Result*	**Der vorstehend beschriebene Prüfgegenstand wurde geprüft und entspricht oben genannter Prüfgrundlage. The above product was found to be Compliant to the above test standard(s)**		

geprüft / *tested by:* Randall Masline	***reviewed by:*** Cecil Gittens
Randall E Masline 26 August 2013 *Date* *Name* *Signature*	Cecil Gittens 26 August 2013 ***Date*** ***Name*** ***Signature***
Sonstiges : *Other Aspects:*	**None**
Abkürzungen: OK, Pass, Compliant, Complies = entspricht Prüfgrundlage Fail, Not Compliant, Does not Comply = entspricht nicht Prüfgrundlage N/A = nicht anwendbar	Abbreviations: OK, Pass, Compliant, Complies = passed Fail, Not Compliant, Does Not Comply = failed N/A = not applicable

		Industry Canada	**VCCI**	**BSMI**
US5253	**Testing Cert.# 3331.04**	**3466C-1**	**A-0037**	**SL2-IN-E-050R**

Revisions

Date mm/dd/yy	Name	Page Number of Change	Describe Change

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15, RSS-210 and ANSI C63.10, based on the results of testing performed on 08/16/2013 on the Grid Alignment Radio, Model No. DRXGA185, manufactured by Carestream Health Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 *Summary of Test Results*

Applicant	Carestream Health Inc. 150 Verona St Rochester NY, 14608	**Tel**	585-627-8321	**Contact**	Ronald Cain
		Fax	585-477-2718	**e-mail**	ronald.cain@carestreamhealth.com

Description	Grid Alignment Radio	**Model Number**	DRXGA185
Serial Number	prototype	**Test Voltage/Freq.**	120VAC/60Hz
Test Date Completed:	08/16/2013	**Test Engineer**	Randall Masline

Standards	Description	Severity Level or Limit	Measurement	Test Result
RSS-210 Issue 8	Industry Canada - Low-power License-exempt Radiocommunication Devices	See called out basic standards below	See Below	**Complies**
ANSI C63.10	American National Standard for Unlicensed Wireless Devices	See called out basic standards below	See Below	**Complies**
RSS-GEN Issue 3	General Requirements and information for the certification of radio apparatus	See called out basic standards below	See Below	**Complies**
FCC Part 15.209(a), RSS-210 Issue 8 & RSS-GEN Issue 3	Radiated Emissions	30 - 1000 MHz		**Complies**
FCC Part 15.207(a) RSS-210 Issue 8 & RSS-GEN Issue 3	Conducted Emissions	150 kHz - 30 MHz	Limit	**Complies**
FCC Part 15.205 & RSS-GEN Issue 3	Restricted Bands			**Complies**
FCC Part 15.203 RSS-210 Issue 8 & RSS-GEN Issue 3	Antenna Requirements			**Complies**
RSS-GEN Issue 3	99% Bandwidth			**Complies**

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at, 336 Initiative Drive, Rochester, NY 14624-6217 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90575). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 ILAC/A2LA

This is a program which is administered under the auspices of A2LA. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Certificate Number: 3331.04). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 VCCI

VCCI Accredited test lab. Registration numbers A-0037, R-3673, C-4113, C-4114, C-4115, T-1158, T-1159 G429.

2.1.4 Industry Canada

(Registration No.: 3466C-1) The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2009.

2.1.5 BSMI

Registration No.: SL2-IN-E-050R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

2.1.6 Korea

Recognized by Radio Research Agency as an accredited Conformity Assessment Body (CAB) under the terms of Phase I of the APEC TEL.

2.1.7 Test Software

- Agilent MXE Receiver A.10.04
  (The installed EMC software in the MXE has p/n N6141A-2FP and version 1.3.50510.18099)
- CIGUI 32 Version 1.4 for California Instruments AC power source
- HP software E7415A Version A.01.45
- National Instruments "Measurement & Automation Employer" Version 4.6.2f1
- Rohde & Schwarz EMI Measurement software ES-K1 V1.71 ServicePack2
- Schaffner NSG 2025 Win 2025 Version 5.0
- Schaffner NSG 2050 Win 2050 Version 6.0
- TILE version 3.4.K.28
- Voltech PM 6000 Firmware 1.21.07RC2, Software IEC61000-3 for PM6000 Release 1.15.07RC1

2.2 Measurement Uncertainty

Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	4.57 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.62 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

General

☐	The estimated combined standard uncertainty for ESD immunity measurements is ± 0.43%.
☐	The estimated combined standard uncertainty for radiated immunity measurements is ± 2.0dB.
☐	The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 6.0%.
☐	The estimated combined standard uncertainty for surge immunity measurements is ± 5.0%.
☐	The estimated combined standard uncertainty for conducted immunity measurements is ± 2.0 dB.
☐	The estimated combined standard uncertainty for power frequency magnetic field immunity measurements is ± 2.57%.
☐	The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 4.89%.
☒	The estimated combined standard uncertainty for radiated emissions measurements is ± 4.6 dB.
☐	The estimated combined standard uncertainty for conducted emissions measurements is ± 2.6 dB.
☐	The estimated combined standard uncertainty for harmonic current ± 7.27% and flicker measurements is ± 3.87%.

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Ref.	Serial #	Last Cal dd/mm/yy	Next Cal dd/mm/yy	Test
Radiated Emissions							
Horn	EMCO	3115	C025	9512-4630	20-Jul-12	20-Jul-13	RE
Horn	EMCO	3115	C031	9812-5635	23-Mar 12	23-Mar 14	RE
BiLog	Chase	CBL6111	C041	1170	12-Sept-12	12-Sept-14	RE
Analyzer w RF Filter Section 85460A	HP	8546A		3325A00134	11-Sept-12	11-Sept-13	RE
Receiver (20Hz-40GHz)	Rohde & Schwarz	ESI(B) 40	C320	839283/005	13-Sept-12	13-Sept-13	RE
Multimeter	Fluke	83	C437	48162892	13-Sept-12	13-Sept-13	RE
Amplifier 1 - 18GHz	Rohde & Schwarz	TS-PR18	C439	122002/001	7-Nov-11	7-Nov-13	RE
BiLog	Chase	CBL6111B	C448	2081	22-Feb-12	22-Feb-14	RE
Receiver	Agilent	N9038A	C325	MY52130004	1-May-12	1-May 13	RE
Pressure/Temperature/RH	Extech	SD700	C482	Q668892	3-Oct-12	3-Oct-13	RE
Conducted Emissions							
LISN	Schwarzbeck	8121	C111	131	21-Jan-13	21-Jan-14	CE
Analyzer w RF Filter Section 85460A	HP	8546A		3325A00134	11-Sept-12	11-Sept-13	CE
Multimeter	Fluke	87	C405	49050672	13-Sept-12	13-Sept-13	CE
General Laboratory Equipment							
Multimeter	Fluke	87	C445	59890224	13-Sept-12	13-Sept-13	
Multimeter	Fluke	8062A	C452	4715199	13-Sept-12	13-Sept-13	
Pressure/Temperature/RH	Extech	SD700	C481	Q668884	3-Oct-12	3-Oct-13	

Note: CE = Conducted Emissions, CI= Conducted Immunity, DP=Disturbance Power, EFT=Electrical Fast Transients, ESD = Electrostatic Discharge, FLI=Flicker, HAR=Harmonics, MF=Magnetic Field Immunity, RE=Radiated Emissions, RI=Radiated Immunity, SI=Surge Immunity, VDSI=Voltage Dips and Short Interruptions

3 Product Information

3.1 Product Description

See Section Appendix A

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

3.3 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report.

4 Emissions

4.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	08/15/2013	
Standard	FCC Part 15.209(a), RSS-210 Issue 8 & RSS-GEN Issue 3						
Product Model	DRXGA185			**Serial#**	prototype		
Configuration	See test plan for details						
Test Set-up	Tested on 10m O.A.T.S. at 3 m distance placed on turn-table, see test plans for details						
EUT Powered By	120VAC/60Hz	**Temp**	24ºC	**Humidity**	54%	**Pressure**	1013mbar
Frequency Range	30 - 1000 MHz @ 3m						
Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Randall Masline		

4.1.2 Test Procedure(s)

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.10 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 30 - 1000 MHz was investigated for radiated emissions.

Radiated emission testing was first performed at a distance of 3 meters in the semi-anechoic chamber in order to identify the specific frequencies for which these measurements will be made on the 10 m OATS. At a 3m distance.

4.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

4.1.4 Final Test

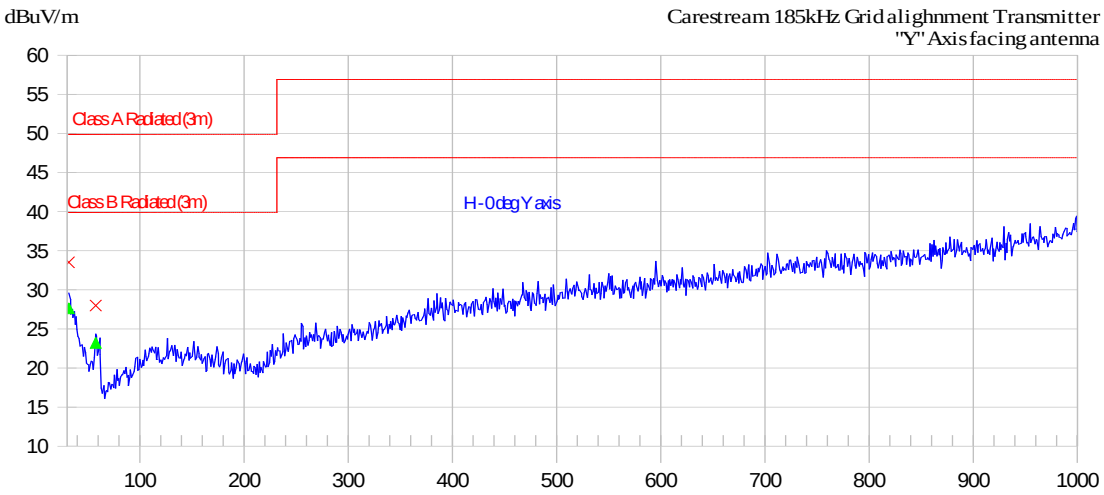
All final radiated emissions measurements were below (in compliance) the limits.

Radiated Emission Graphs

NOTES:

Radiated Emissions
Vertical / Horizontal

H - 0 deg

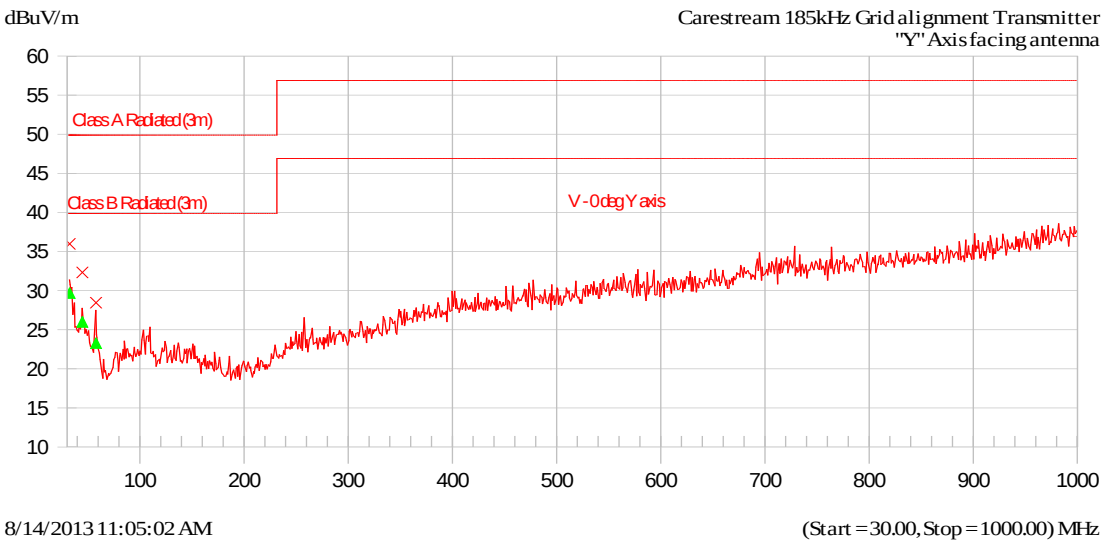


Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
30.002	33.6	27.7	-12.3	-22.3	H - 0 deg Y axis
56.099	28.1	23.3	-16.7	-26.7	H - 0 deg Y axis

NOTES:

Radiated Emissions
Vertical / Horizontal

V - 0 deg

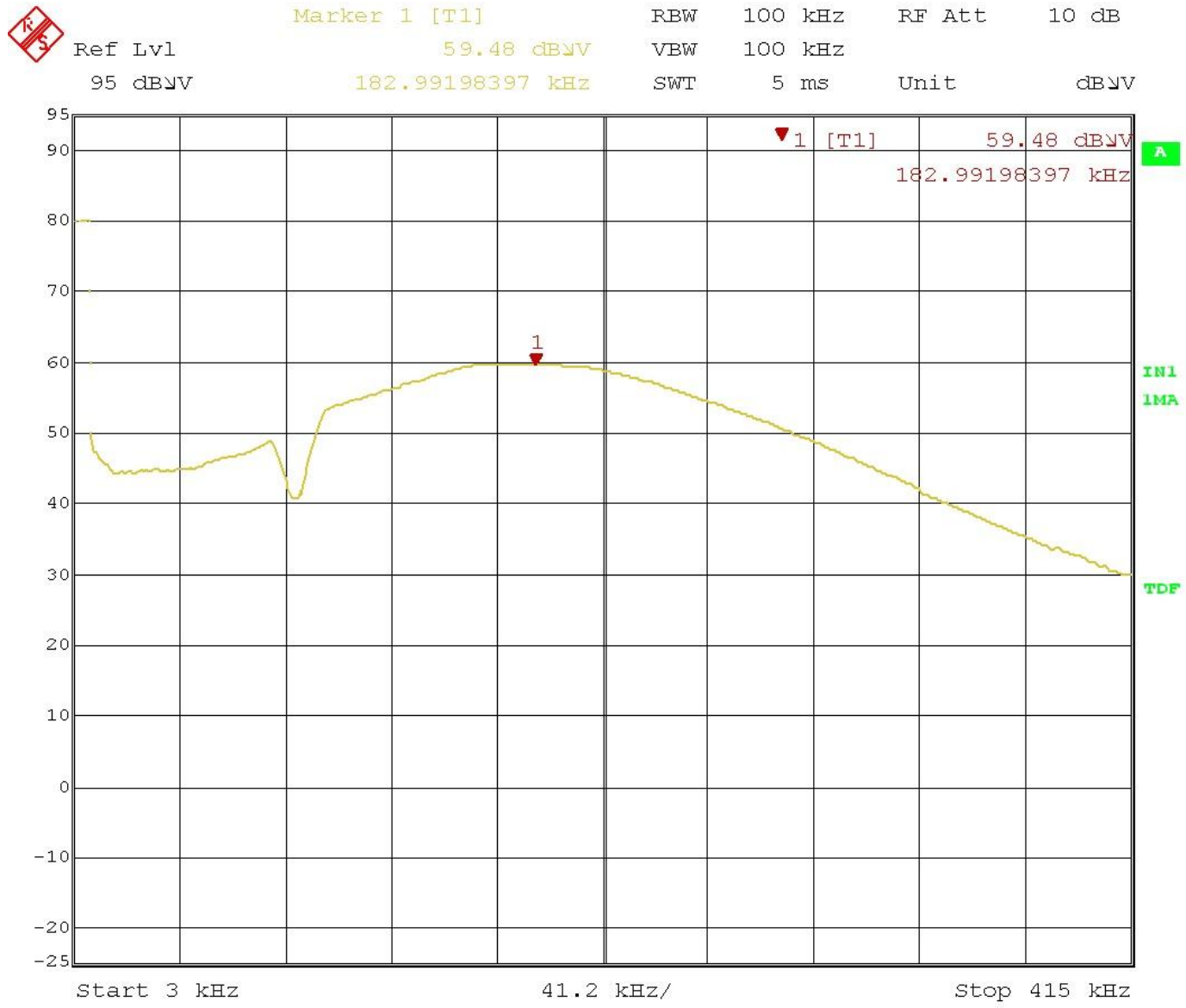


Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
30.932	36.1	29.8	-10.2	-20.2	V - 0 deg Y axis
43.107	32.4	26.1	-13.9	-23.9	V - 0 deg Y axis
56.160	28.6	23.4	-16.6	-26.6	V - 0 deg Y axis

NOTES:

Radiated Emissions 3kHz – 415 kHz

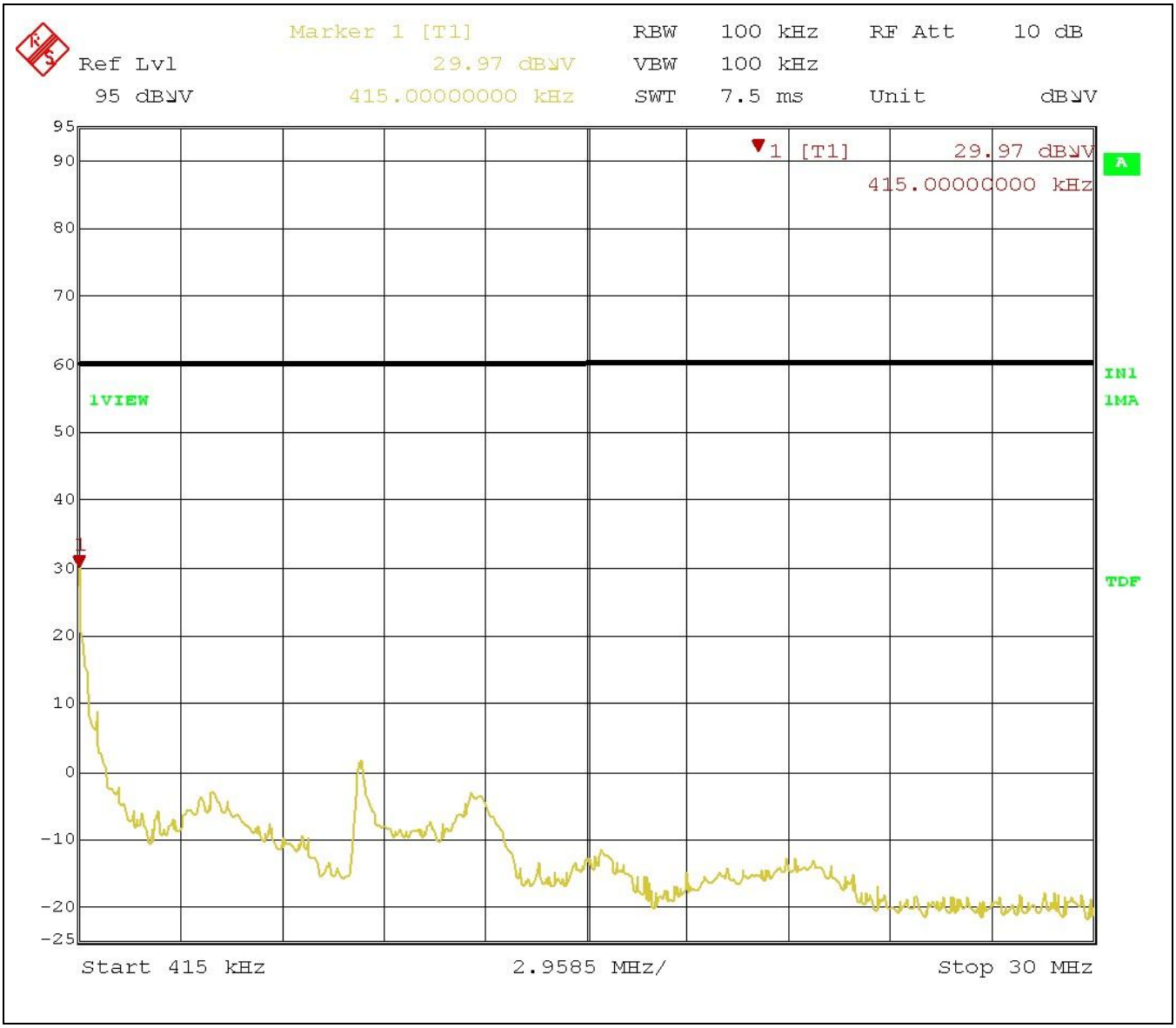
Vertical



NOTES:

Radiated Emissions 415 kHZ – 30 MHz

Vertical / Horizontal



4.1.5 Field Strength

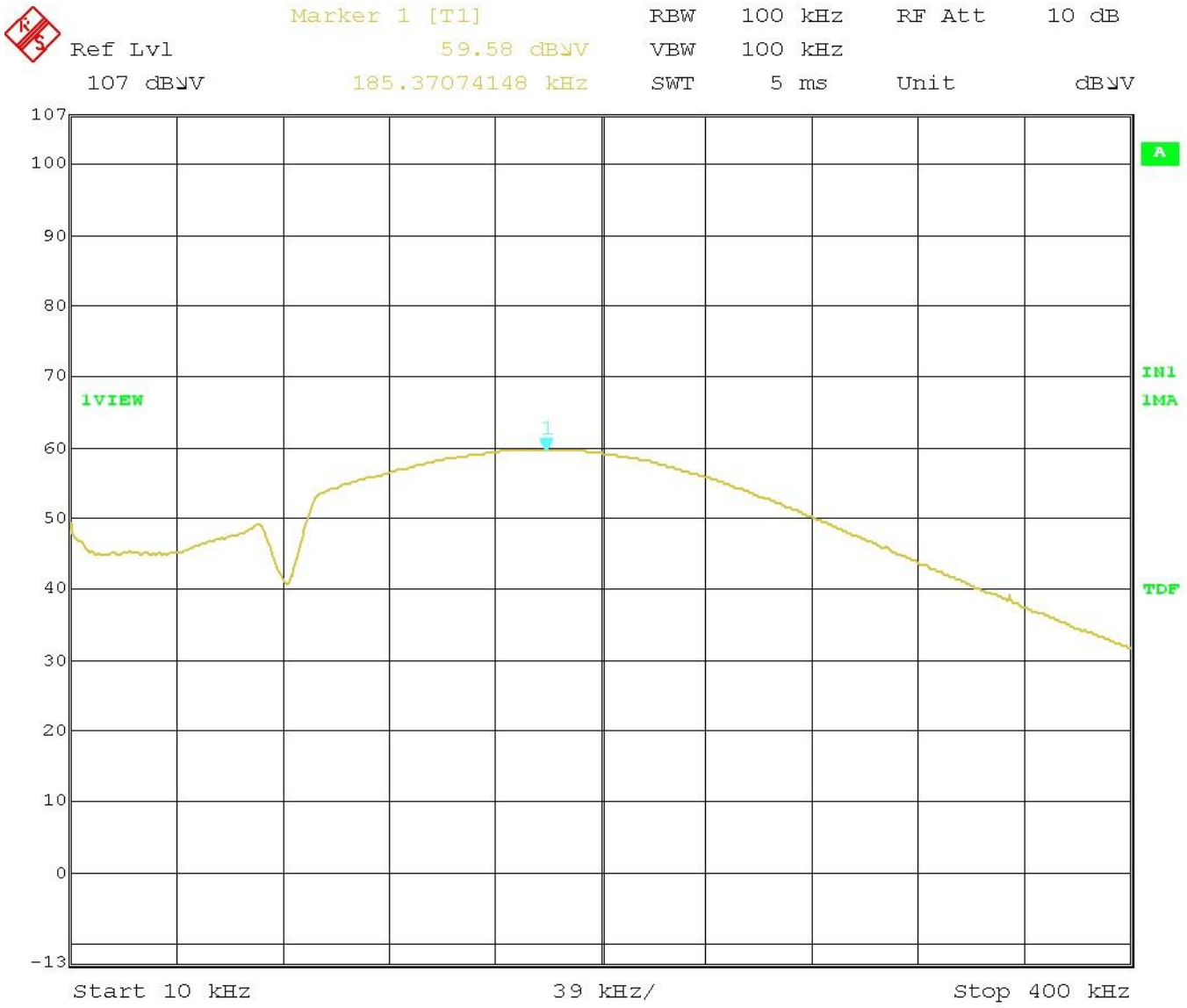


Figure 1 – Field strength with loop antenna in Perpendicular axis

Taken at 1 meter distance

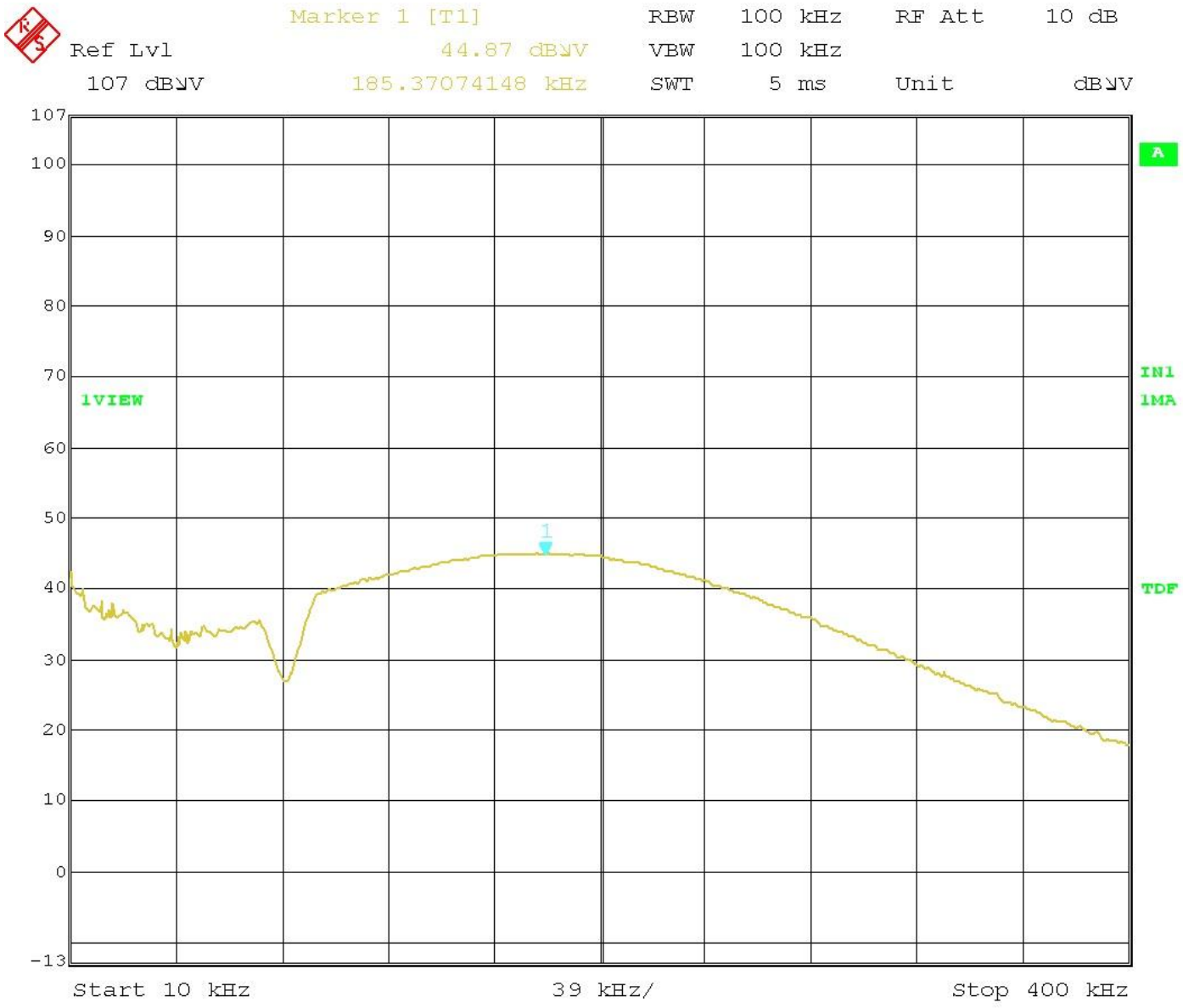


Figure 2 – Field strength with loop antenna in Parallel axis

Taken at 1 meter distance

4.1.6 Final Tabulated Data

The 15.209 Limits for an intentional radiator operating at 319 kHz are 2400/F(kHz)

2400/319 = 7.59 microvolts/meter at 300m or 21.04 dBuV at 300m

To extrapolate the field strength from 300m to 3m where the field strength could be measured, measurements were taken at 2 distances according to FCC Part 15.31(e)(2)

The extrapolation factor is 32.96 dB per decade at 2 decades from 300m down to 3 m testing distance. 21.05 dBuV + 65.92 dB = 86.97 dBuV/m Limit from 9 kHz to 490 kHz

The Average field strength of the EUT at 100% duty cycle at 3 meters is 42.2 dBuV/m and the limit is 86.97 dBuV/m

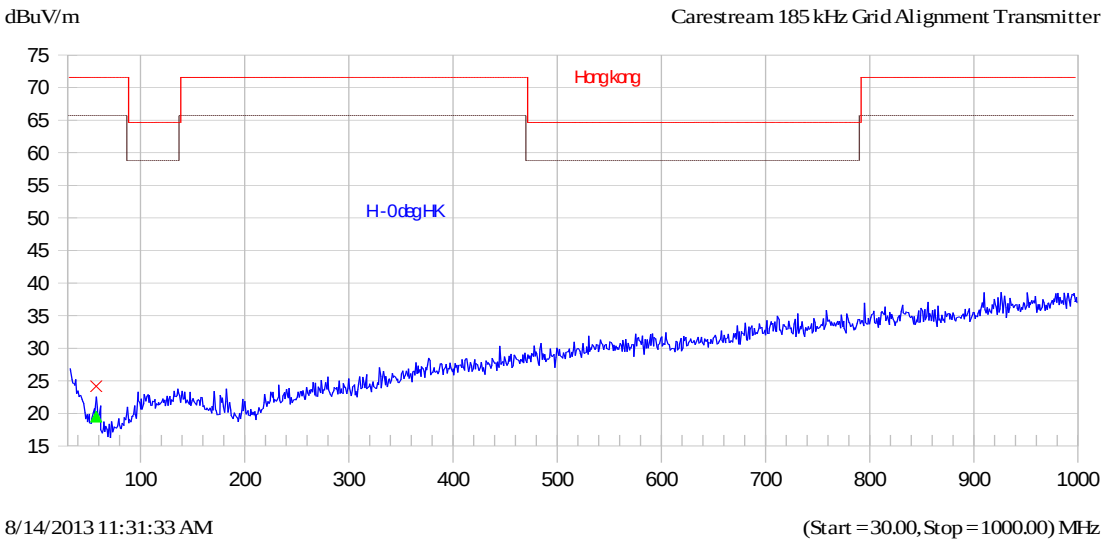
The AC input was varied from 85% to 115% with no change in field strength.

Distance (m)	Peak (dBuV)	Extrapolated Limit	Result
1	59.58	-	-
3	42.2	86.97 dBuV/m	**Complies**

Table 1 – Extrapolation for 15.209 Limits

Radiated Emissions Using Hong Kong Limits

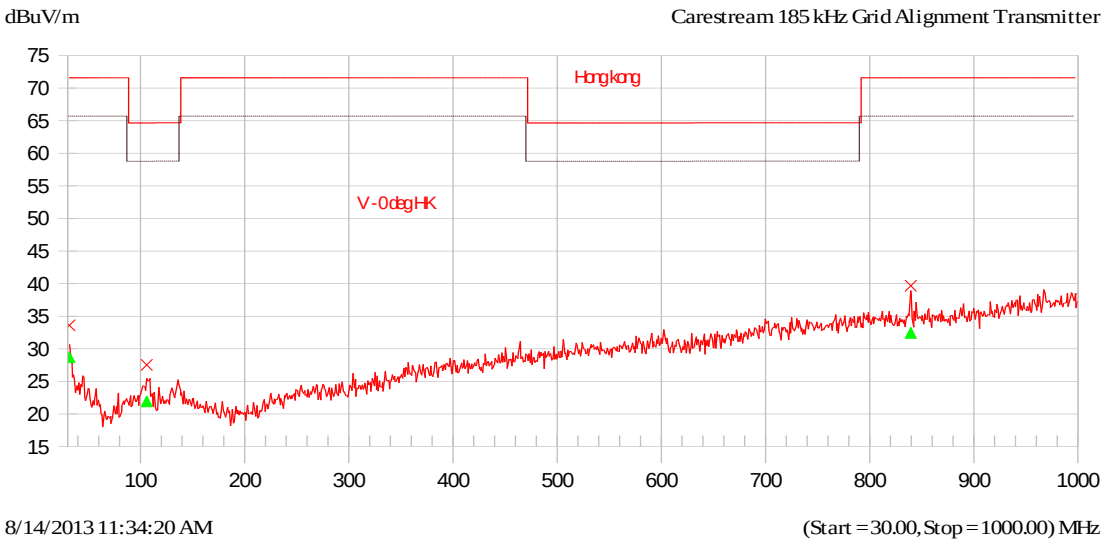
H - 0 deg HK



Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
55.908	24.3	19.6	0.0	0.0	H - 0 deg HK

Figure 3 - Spurious Emissions at 3 m with Hong Kong Limits

V - 0 deg HK



Frequency MHz	Peak dBuV/m	QP dBuV/m	Class B-QP dB	Class A-QP dB	Trace Name
30.125	33.7	28.8	0.0	0.0	V - 0 deg HK
104.341	27.7	22.1	0.0	0.0	V - 0 deg HK
837.700	39.8	32.6	0.0	0.0	V - 0 deg HK

Figure 4 - Spurious Emissions at 3 m with Hong Kong Limits

4.2 Conducted Emissions

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

4.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	8/15/2013	
Standard	FCC Part 15.207(a) RSS-210 Issue 8 & RSS-GEN Issue 3						
Product Model	GA			**Serial#**	Prototype		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room EUT placed on table see test plans for details						
EUT Powered By	120VAC/60Hz	**Temp**	22º C	**Humidity**	43%	**Pressure**	1016mbar
Frequency Range	150 kHz - 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Randall Masline				

4.2.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of EN55022 & ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Further conducted emission tests were performed per the procedures stated in the other emissions standards listed in this report.

The frequency range from **150 kHz - 30 MHz** was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

4.2.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

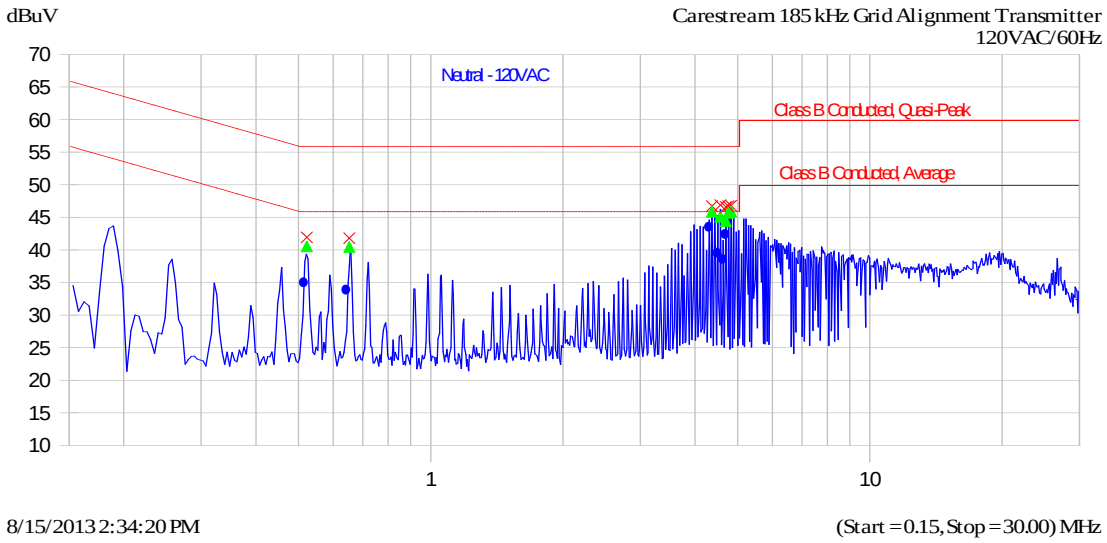
4.2.5 Final Graphs

NOTES:

Conducted Emissions @ 120V/60Hz

Neutral

Neutral - 120VAC



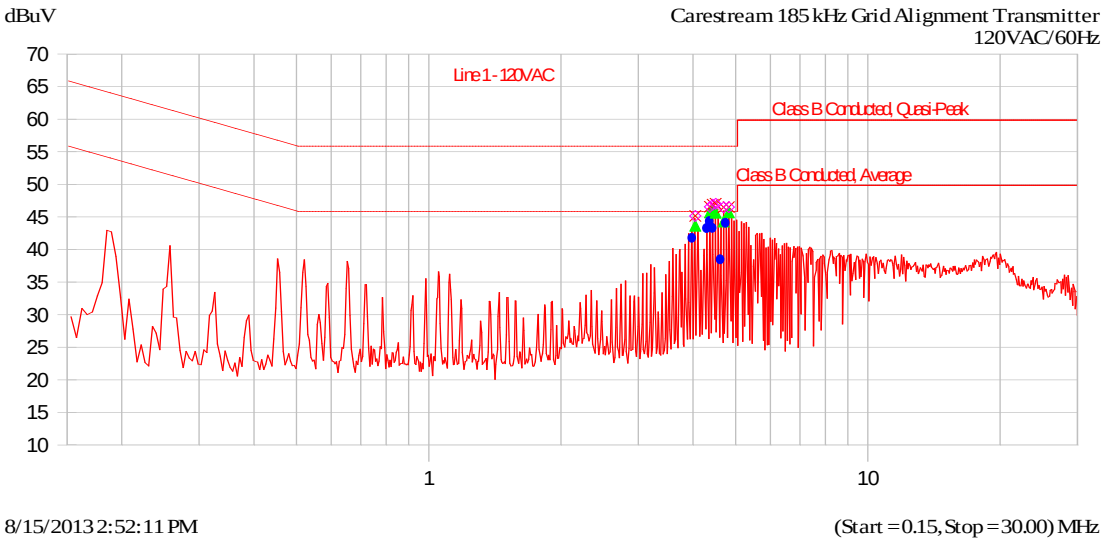
Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Transducer Correction dB	Cable Correction dB
0.518	42.0	40.7	-15.3	34.9	-11.1	0.0	10.2
0.647	41.9	40.6	-15.4	33.8	-12.2	0.0	10.3
4.332	46.8	46.0	-10.0	43.4	-2.6	0.1	10.6
4.785	46.9	46.0	-10.0	44.2	-1.8	0.1	10.7
4.526	47.0	45.2	-10.8	39.4	-6.6	0.1	10.6
4.653	46.7	44.5	-11.5	38.5	-7.5	0.1	10.6
4.719	46.8	45.8	-10.2	42.3	-3.7	0.1	10.7

NOTES:

Conducted Emissions @ 120V/60Hz

Line

Line 1 - 120VAC



Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Transducer Correction dB	Cable Correction dB
4.007	45.3	43.8	-12.2	41.7	-4.3	0.1	10.6
4.329	46.7	45.8	-10.2	43.2	-2.8	0.1	10.6
4.393	47.0	46.1	-9.9	44.2	-1.8	0.1	10.6
4.458	47.2	45.8	-10.2	43.2	-2.8	0.1	10.6
4.652	46.6	44.4	-11.6	38.4	-7.6	0.1	10.6
4.781	46.6	45.8	-10.2	44.0	-2.0	0.1	10.7

4.3 Restricted Bands of Operation

In accordance with 47 CFR Part 15.407(b)(7) Intentional radiators need to comply with the provisions of 47 CFR Part 15.205. The results of these measurements can be found in section 4.1

.

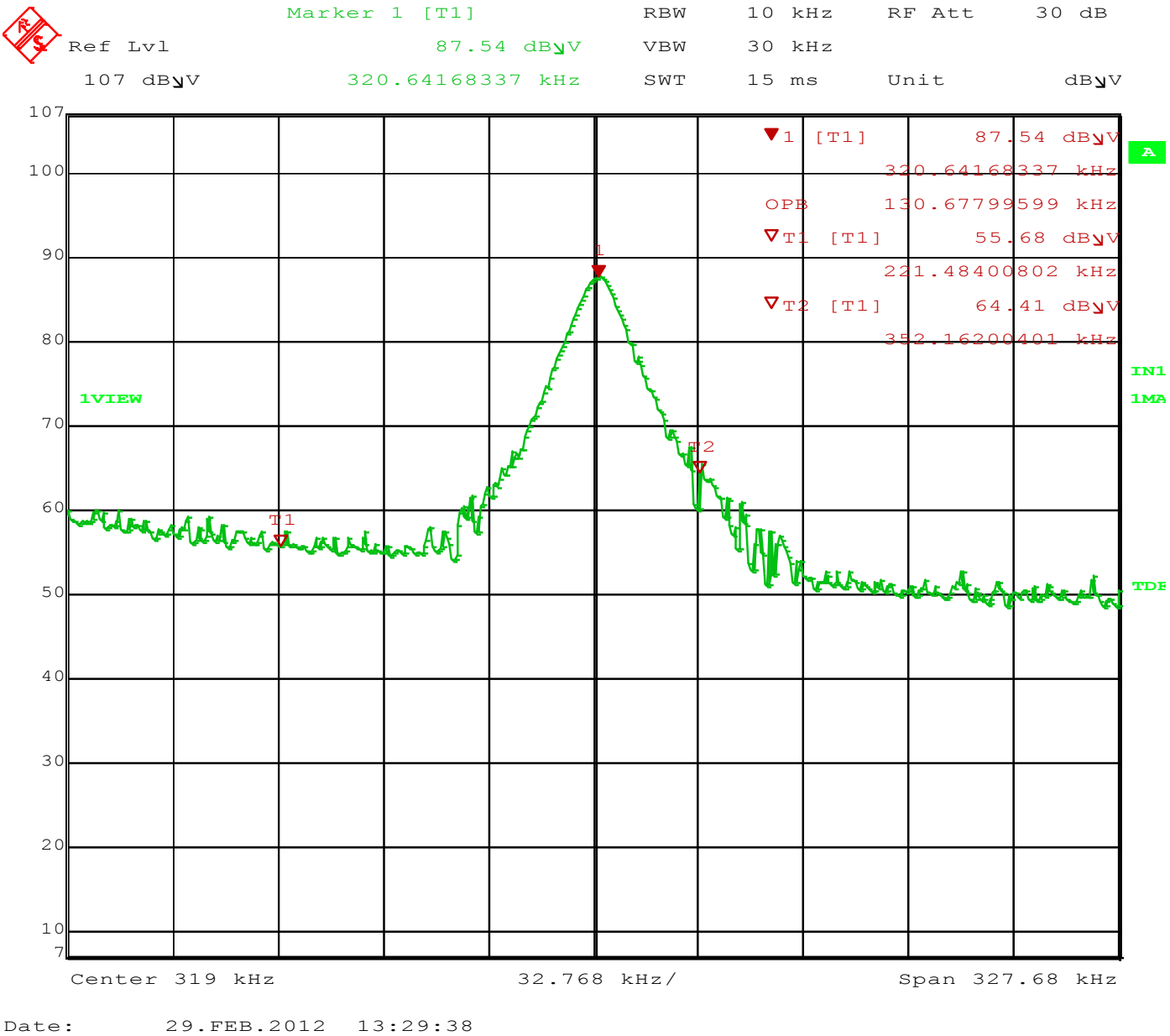
4.4 Antenna Requirements

In accordance with 47 CFR Part 15.203 an intentional radiator shall be designed to ensure that no antenna other then that furnished by the responsible party shall be used with the device.

The EUT uses mounted coils for antenna elements and are soldered to the main PCB.

4.5 99% Bandwidth

In accordance with Industry Canada's RSS-210 Issue 8 Annex 9.2(1)



Plot 1– 99% Bandwidth = 130.677 kHz

Appendix A

5 Test Plan

This test report is intended to follow this test plan outlined here in unless other wise stated in this here report. The following test plan will give details on product information, standards to be used, test set ups and refer to TUV test procedures. The test procedures will give the steps to be taken when performing the stated test. The product information below came via client, product manual, product itself and or the internet.

5.1 General Information

Client	Carestream Health Inc.
Address	150 Verona St
Address	Rochester NY, 14608
Contact Person	Ronald Cain
Telephone	585-627-8321
Fax	585-477-2718
e-mail	ronald.cain@carestreamhealth.com

5.2 Model(s) Name

DRXGA185

5.3 Type of Product

Grid Alignment Radio

5.4 EUT Electrical Powered Information

5.4.1 Electrical Power Type

☒	**AC**	☐	**DC**	☐	**Batteries**	☐	**Host -**

5.5 Electrical Support Equipment

Type	Manufacture	Model	Connected To
none			