Electromagnetic Compatibility Test Report

Prepared in accordance with

Product Standard:

FCC Part 15: 2007, RSS-210: 2007

on

Lighting Control System

Radio Bridge

Prepared for:

Sensor Switch, Inc.

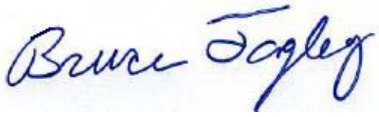
900 Northrop Road

Wallingford, CT 06492

Prepared by:

TUV Rheinland of North America, Inc.

Auftraggeber: *Client:*	Sensor Switch, Inc. 900 Northrop Road Wallingford, CT 06492		
Bezeichnung: ***Identification:***	Lighting Control System	**Serien-Nr.:** *Serial No.*	PROTOYPE
Gegenstand der Prüfung: *Test item:*	Radio Bridge	**Prüfdatum:** *Date tested:*	October 8th -10th 2007
Prüfort: *Testing location:*	TUV Rheinland of North America 12 Commerce Road Newtown, CT 06470-1607 NVLAP # 200111-0		
Prüfgrundlage: *Test specification:*	FCC Part 15: FCC Part 15C Section 15.247 FCC Part 15.247 (a)(2), FCC Par 15.247 (b)(3), FCC Part 15.247 (b)(5) and 1.1310, FCC Part 15.247 (c), 15.205, 15.209, FCC Part 15, FCC Part 15.247 (d), FCC Part 15.215 (b), FCC Part 15.215 (c), RSS-210		
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:* **Dieter Baldamus**	**kontrolliert** / *reviewed by:* **Bruce Fagley**
 24 June 2008 **Datum** *Date* / **Name** *Name* / **Unterschrift** *Signature*	 24 June 2008 **Datum** *Date* / **Name** *Name* / **Unterschrift** *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

FC	NVLAP®	**Industry Canada**
US5112	**200111-0**	**3466D-1**

TABLE OF CONTENTS

1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15C, based on the results of testing performed on October 8th -10th 2007 on the Lighting Control System, Model No. Radio Bridge, manufactured by Sensor Switch, 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	Sensor Switch, Inc. 900 Northrop Road Wallingford, CT 06492	**Tel**	(203) 265-2842	**Contact**	William J Fassbender
		Fax	(203) 265-1565	**email**	fozzy@sensorswitch.com
Type of Equipment	Lighting Control System	**Model Number**	Radio Bridge		

Standards	Description	Severity Level or Limit	Criteria	Test Result
FCC Part 15	Radio Frequency Devices -Part C	See called out basic standards below	See Below	Complies
FCC Part 15.247 (a) (2)	Spectrum Bandwith of a Direct Sequence Spread Spectrum System	500kHz on a 6dB Bandwith, 2.405 GHz - 2.480 GHz	Limit	Complies
FCC Part 15.247 (b) (3)	Maximum Output Power	1 Watt (30dBm)	Limit	Complies
FCC Part 15.247 (b)(5) and 1.1310	RF Human Exposure Limit	1.0 (mW/cm2)	Limit	Complies
FCC Part 15.247 (c), 15.205, 15.209	Radiated Spurious Emissions	-20dBc, 15.205 (a), 15.209 (a)	Limit	Complies
FCC Part 15.247 (d)	Transmitter Power Density	8 dBm/3kHz	Limit	Complies
FCC Part 15.207	Conducted Emissions	15.207 (a)	Limit	Complies
FCC Part 15.215 (b)	Frequency Stability	Containment of 20dB,	Limit	Complies
FCC Part 15.215 (c) RSS-210	20dB Bandwith	20dB Contained within the Frequency Band	Within Limit	Complies

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 12 Commerce Road, Newtown CT 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 US5112). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab code: 200111-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: 3466D-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 C63.4-2003.

2.2 Measurement Uncertainty

General

The estimated combined standard uncertainty for conducted immunity measurements is ± 1.4dB.
The estimated combined standard uncertainty for radiated emissions measurements is ± 1.6 dB.
The estimated combined standard uncertainty for conducted emissions measurements is ± 1.2dB.

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.

3 Product Information

3.1 Product Description

The radio bridge is only one component that is part of a new lighting control system being designed by Sensor Switch, Inc. The name for the newly designed system is called 'nLight'. nLight will typically consist of the following components: SensorView software, at least one gateway, at least one bridge (or two radio bridges), devices for switching lighting loads (nPP-16, nWSD, nCMR, …), devices for detecting occupancy, light levels (nCM, nWV, nCM-ADC, …) and devices for user control (nPOD, nPOD-D, …). SensorView software is a browser based application which will allow clients to customize their buildings lighting needs. The software will have the ability to change device parameters, load profiles, update device firmware, respond to load shedding, and many more selectable options. The gateway provides a method of translating Ethernet packets from SensorView to RS-485 where all nLight devices can communicate. The bridge (or radio bridges) contains eight RS-485 ports. Each port typically represents a lighting zone to which devices can be connected. For example, a private office will typically require one nCMR and one nPOD. An open office area could potentially use five nPP-16 and seven nCM-PDT depending on the overall size and lighting load.

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

Figure 1 – Photo of EUT (Transmitter)

Figure 2 – Photo of EUT (Receiver)

4 Emissions

4.1 Spectrum Bandwidth

This test measures the spectrum bandwidth of the intentional radiator signal generated by the EUT.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	11/07/2007	
Standard	FCC Part 15.247 (a) (2)						
Product Model	Radio Bridge			**Serial#**	Protoype		
Configuration	See test plan for details						
Test Set-up	Tested @ 3m on O.A.T.S. placed on turn-table, see test plans for details						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	2.405 GHz - 2.480 GHz @ 3m						
Perf. Criteria	500kHz. (Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Dieter Baldamus		

4.1.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.4 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 2.405-2.480 GHz was investigated for radiated emissions, testing the lowest middle and highest channels.

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 3m OATS.

4.1.3 Deviations

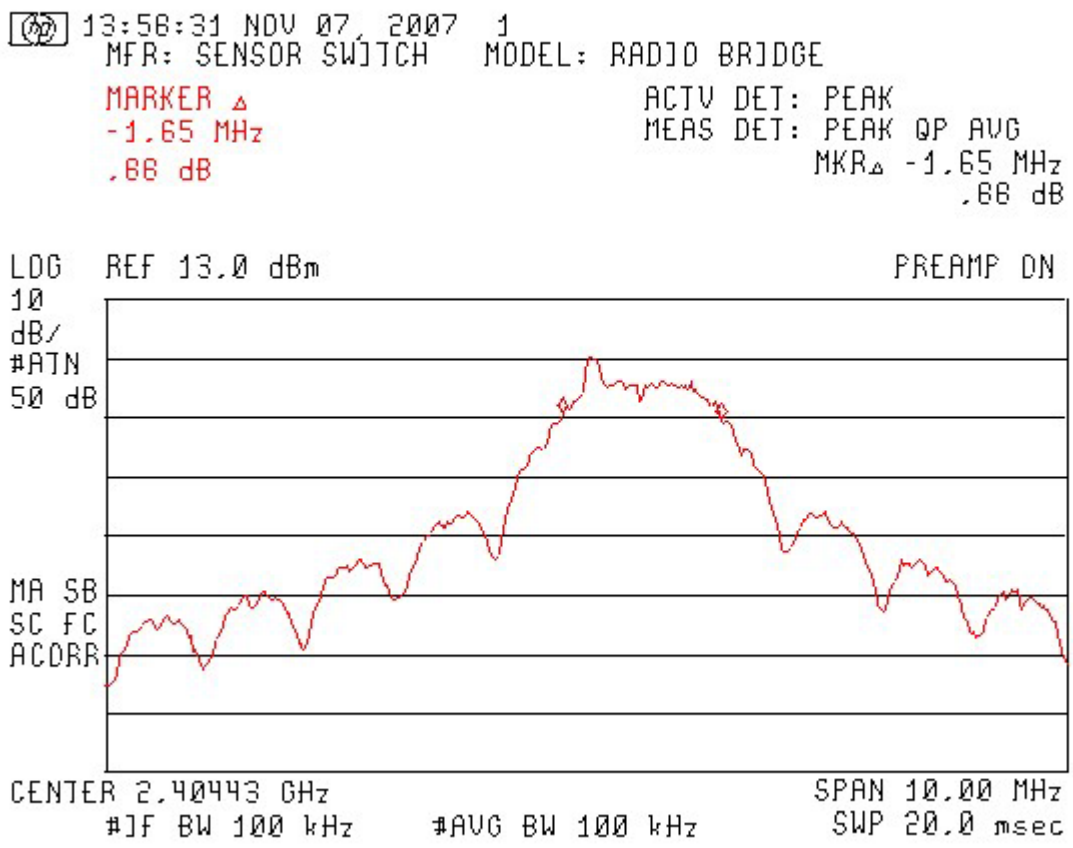
There were no deviations from the test methodology listed in the test plan.

4.1.4 Final Test

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

4.1.5 Summary of Final Data

NOTES:	**Spectrum Bandwidth Low Frequency**

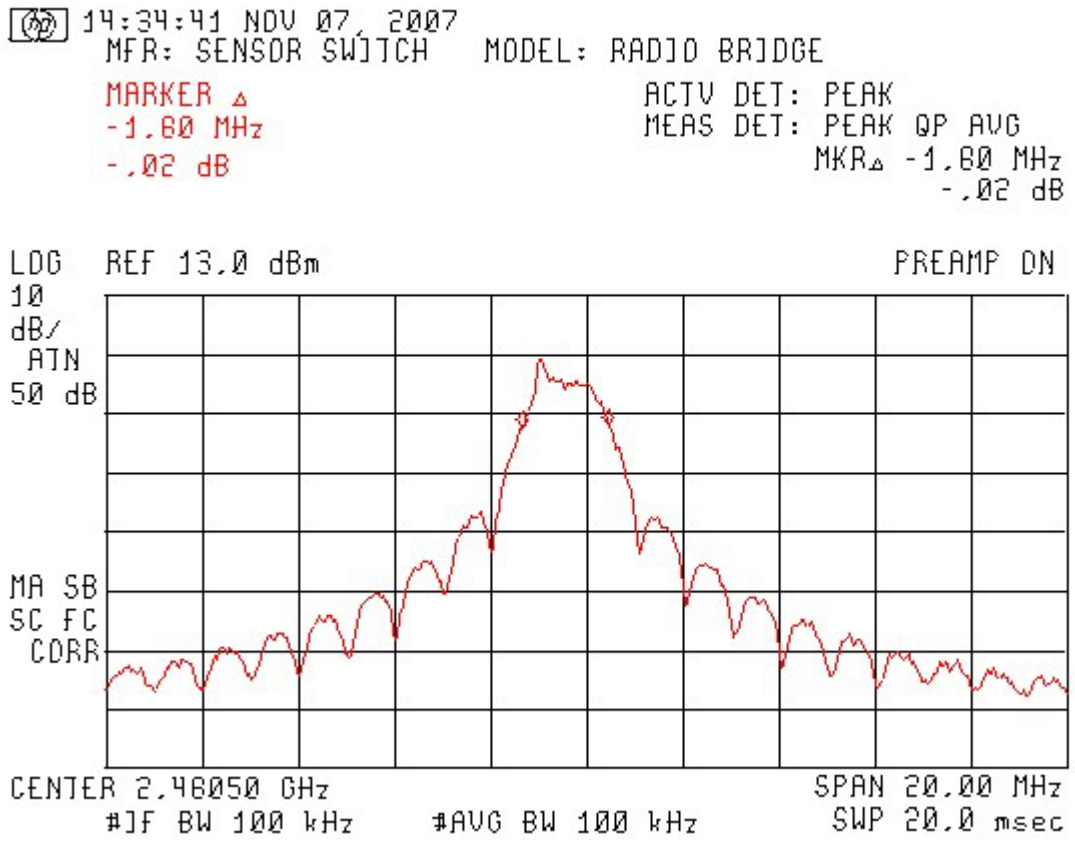


ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:	**Spectrum Bandwidth** **Middle Frequency**

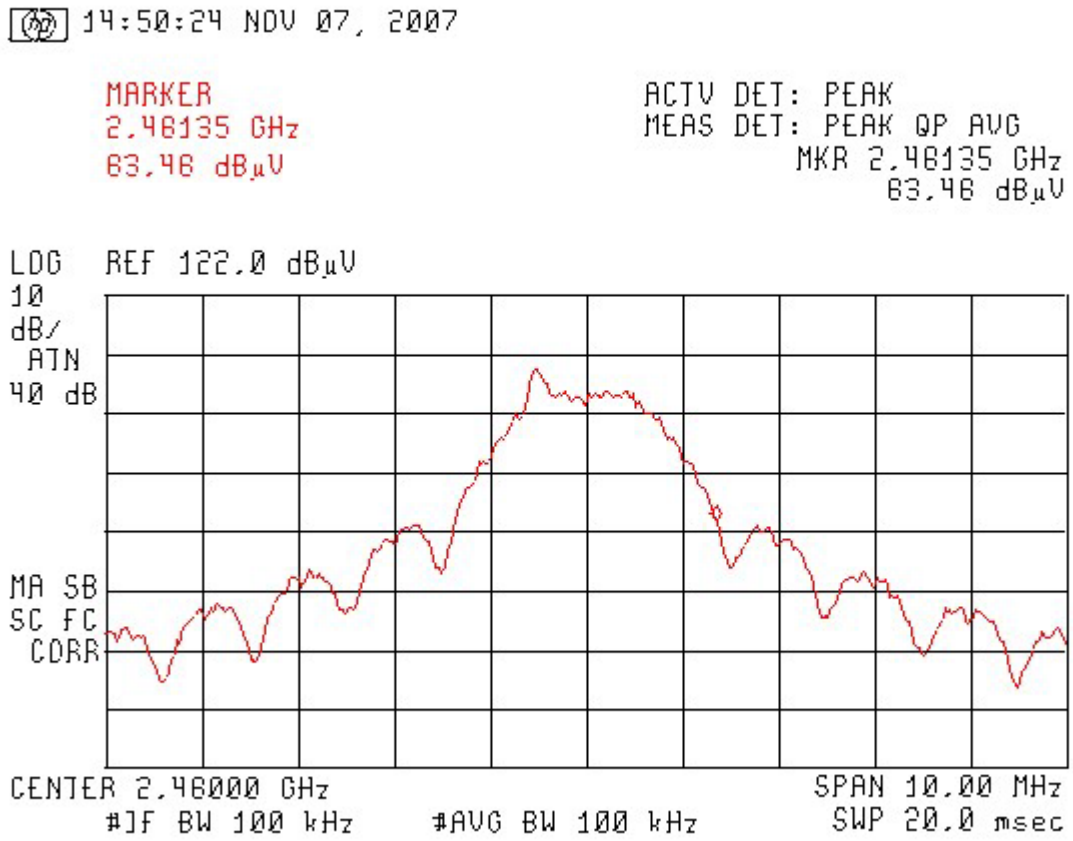


ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:	**Spectrum Bandwidth** **High Frequency**



ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	**POLARIZATION:**	**DISTANCE:**	**LOCATION:**
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

4.1.6 Tabulated Test Data

Radiated Emissions Measurements						
Standard:	47 CFR 15.247 (a) (2)				***Date:***	11/7/2007
Device Tested:	Sensor Switch - Radio Bridge				***File:***	07110701- 6dB Bandwith.xls
Meas #	Freq (MHz)	6dB Bandwith (MHz)	Minimum Limit (MHz)	Minimum Limit □□ (Average + Correction Factors - Limit)	Result	Comment
Channel 1 (2410GHz)	2404.43	1.6500	0.5000	-1.15	**Complied**	
Channel 8 (2450GHz)	2444.60	1.8500	0.5000	-1.35	**Complied**	
Channel 15 (2480GHz)	2480.50	1.8000	0.5000	-1.30	**Complied**	
Tested by:	Dieter Baldamus					
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009						

4.1.7 Photos

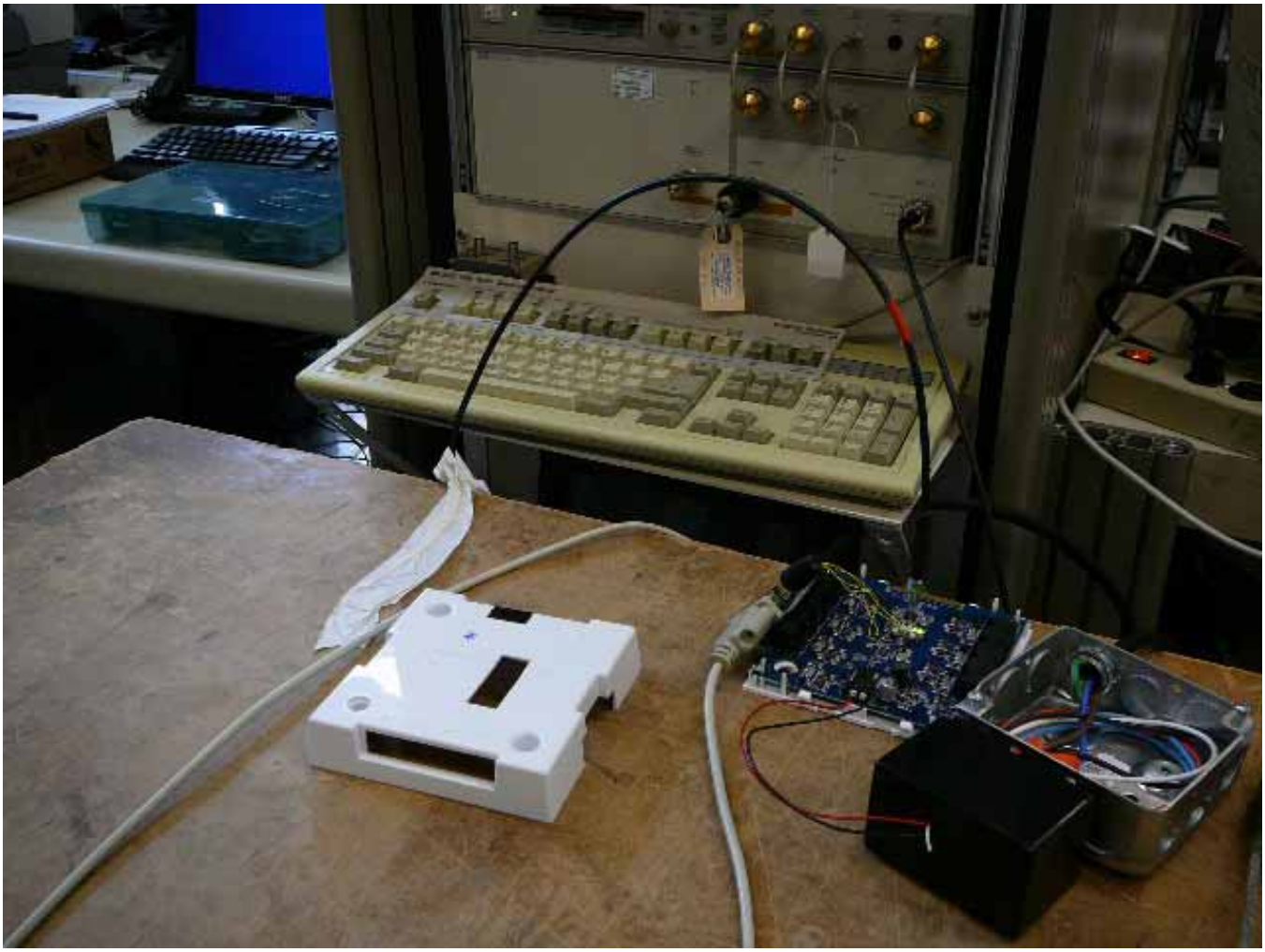


Figure 3 - Radiated Emissions Test Setup (Semi-Anechoic Chamber 2)

4.2 Maximum Output Power

This test measures the radiated electromagnetic levels of the intentional radiator generated by the EUT through the antenna port.

4.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	07/0/2007	
Standard	FCC Part 15.247 (a) (2)						
Product Model	Radio Bridge			**Serial#**	Protoype		
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	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	2.405GHz - 2.480GHz @ 3m						
Perf. Criteria	1 Watt (30dBm) (Bellow Limit)	**Perf. Verification**	Readings Under Limit for L1 and L2				
Mod. to EUT	None	**Test Performed By**	Dieter Baldamus				

4.2.2 Test Procedure

Radiated emissions tests were performed using the procedures of ANSI C63.4 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 2.405-2.480 GHz was investigated for radiated emissions, testing the lowest middle and highest channels.

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 3m OATS.

4.2.3 Deviations

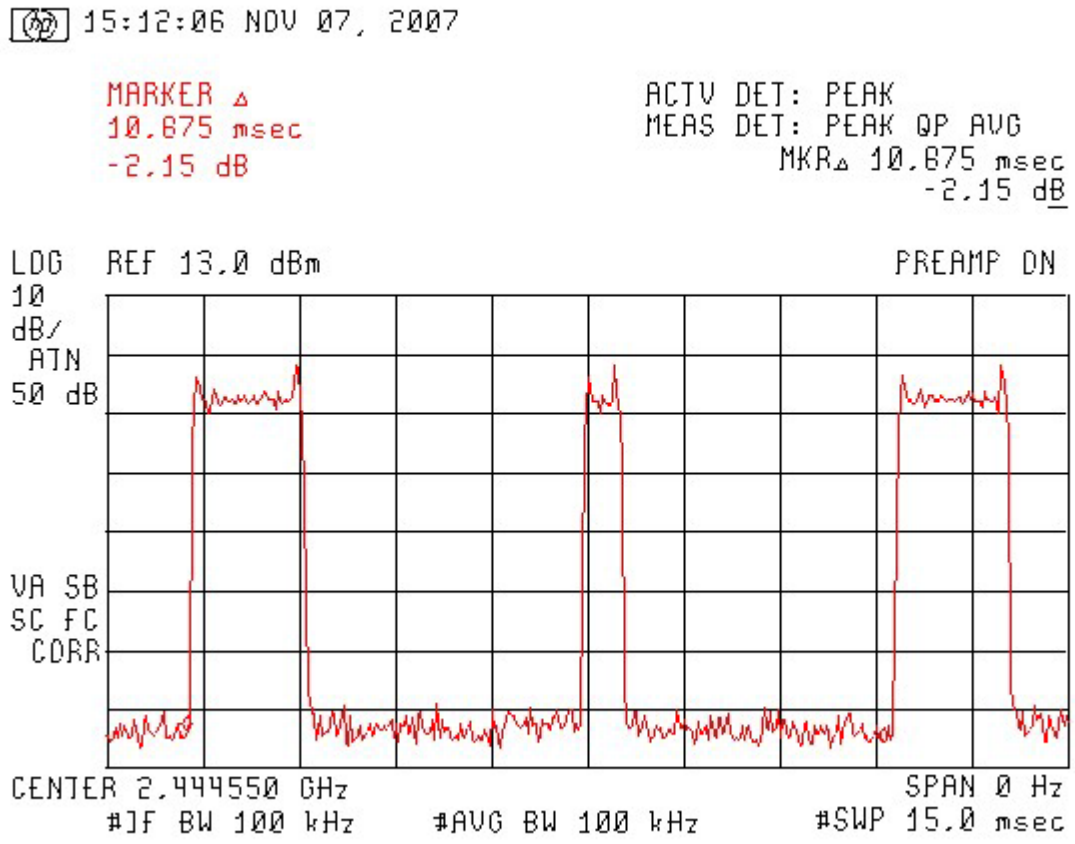
There were no deviations from the test methodology listed in the test plan.

4.2.4 Final Test

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

4.2.5 Summary of Final Data

NOTES:	Duty Cycle Measurement

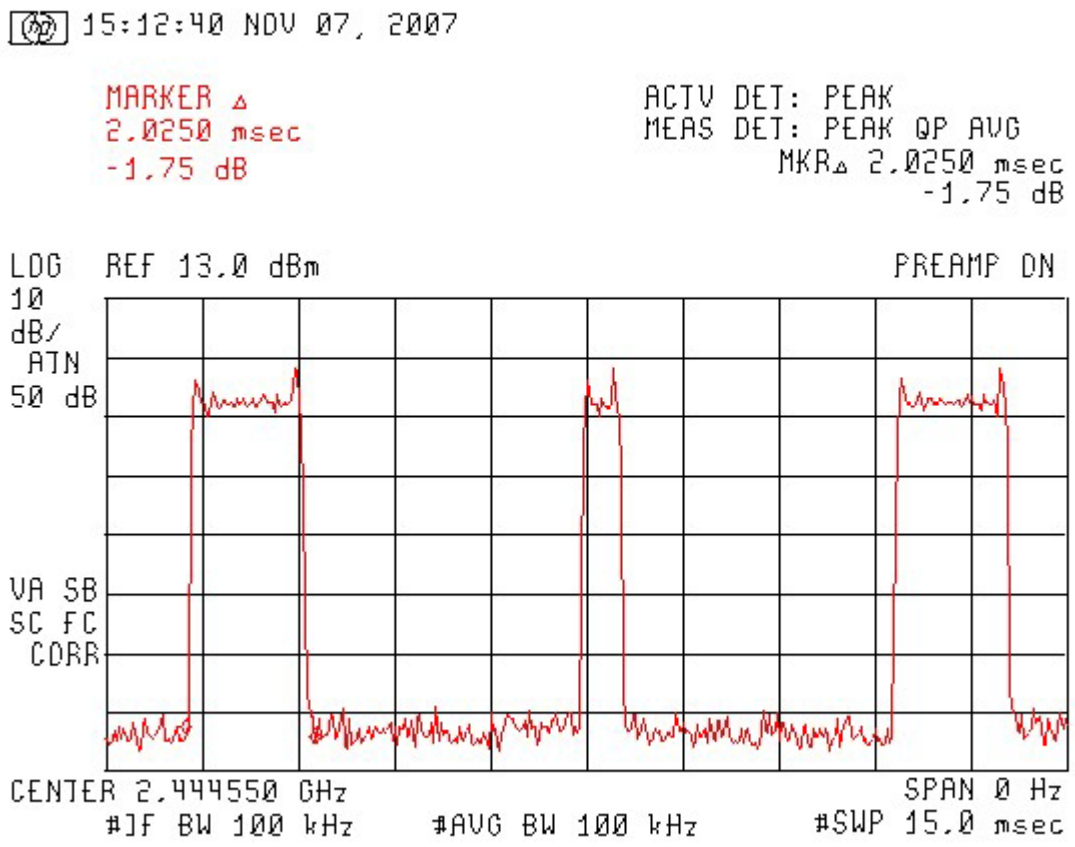


ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:	**Duty Cycle Measurement**

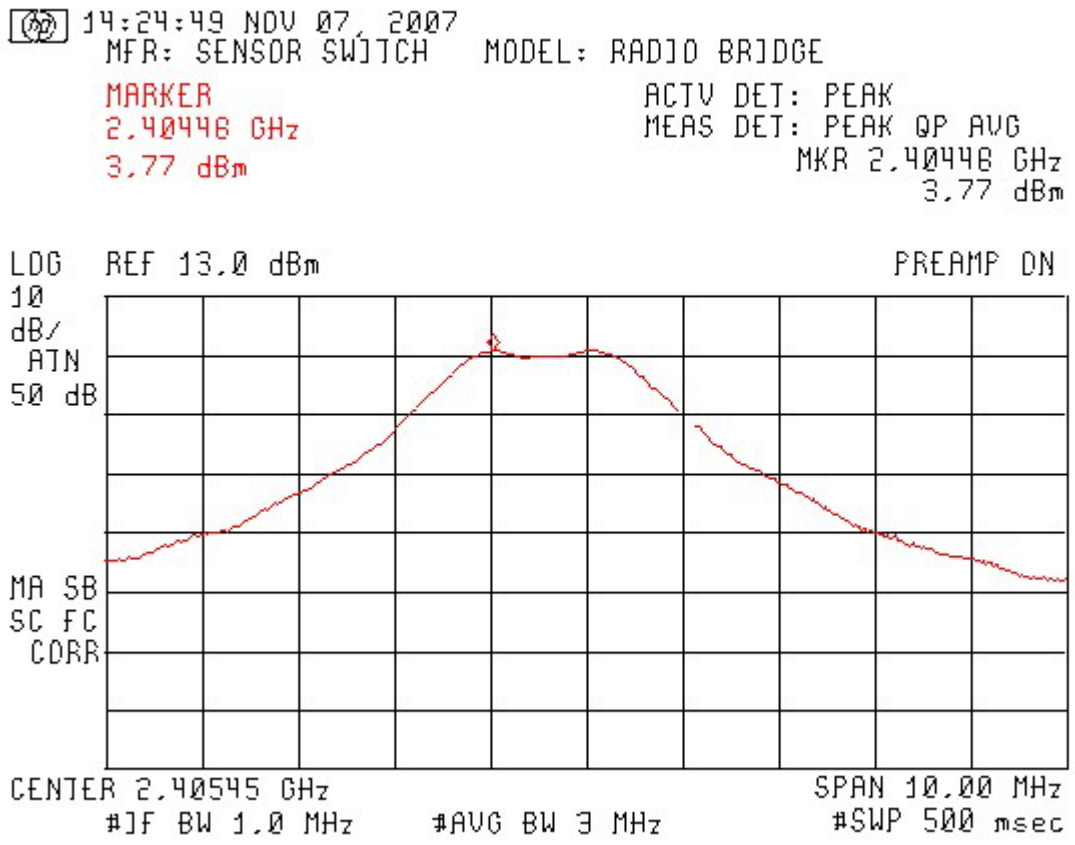


ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:	**Maximum Output Power** **Low Frequency**

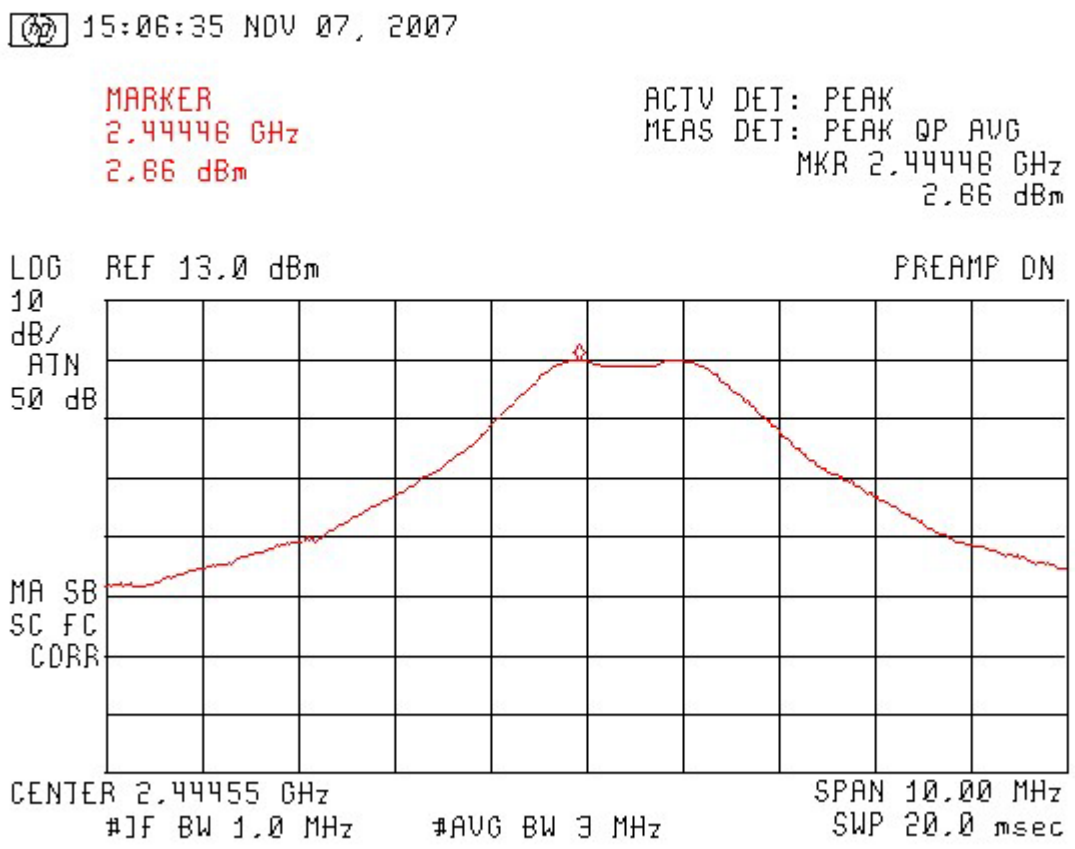


ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	**POLARIZATION:**	**DISTANCE:**	**LOCATION:**
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:	**Maximum Output Power** **Middle Frequency**

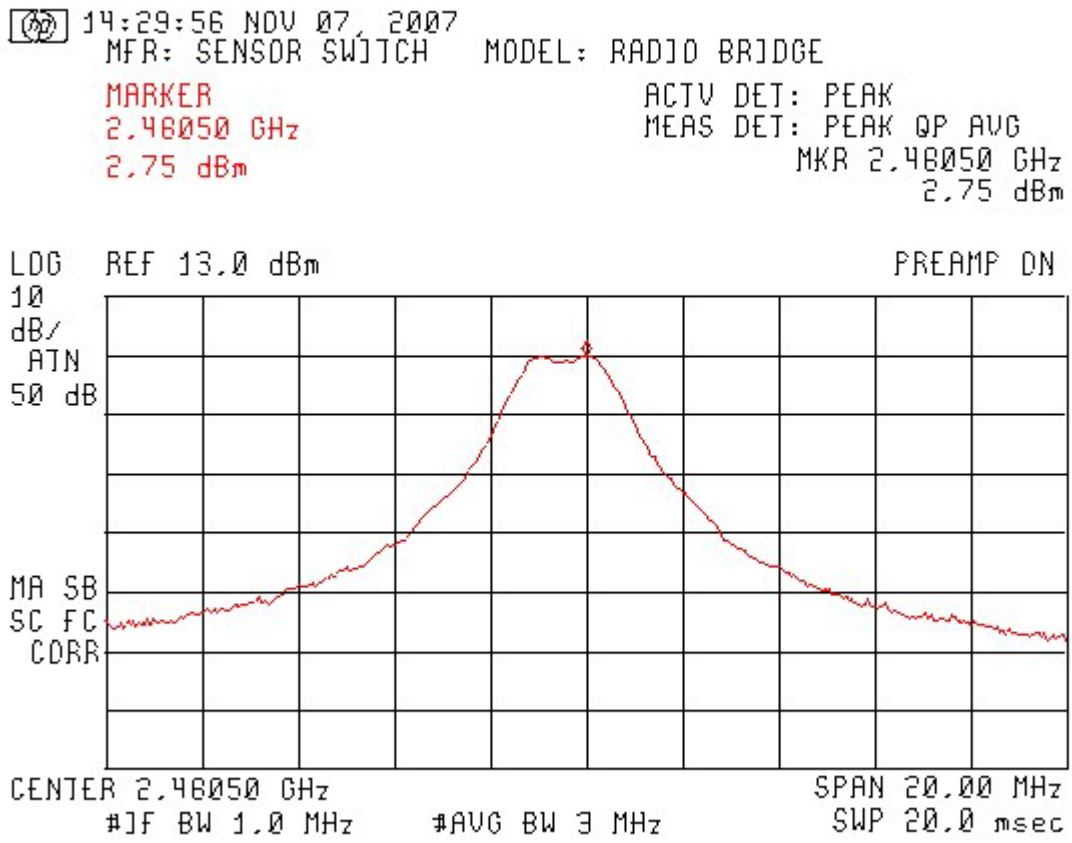


ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	**POLARIZATION:**	**DISTANCE:**	**LOCATION:**
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:	**Maximum Output Power** **High Frequency**



ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	**POLARIZATION:**	**DISTANCE:**	**LOCATION:**
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

4.2.6 Tabulated Test Data

Radiated Emissions Measurements										
Standard:	47 CFR 15.247(b) (3)			**Prescan/Final:**	Final			***Date:***	11/7/2007
Device Tested:	Sensor Switch - Radio Bridge			**Distance:**	0m, Direct Measurement			***File:***	07110707 Max Power.xls
Meas #	Freq (MHz)	Measured Peak (dBm)	Cable Correction Factor	Duty Cycle	Antenna Gain	Corrected Measured Average (dBm)	Peak Limit 1 Watt (30dBm)	Peak (dB □	e.i.r.p. Peak Power (dBm)	Comment
Channel 1 (2.405GHz)	2404.48	3.60	1.00	-5.51	2.14	1.23	30.00	-28.77	**Complied**	
Channel 8 (2.444GHz)	2445.48	2.73	1.00	-5.51	2.14	0.36	30.00	-29.64	**Complied**	
Channel 15 (2.480GHz)	2480.24	2.86	1.00	-5.51	2.14	0.49	30.00	-29.51	**Complied**	
Tested by:	Dieter Baldamus									
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009										

Average Values were calculated based on the duty cycle of the transmission frequency
Measured Duty Cycle is 2.025ms + 0.787ms in 10ms
Duty Cycle = Tx ON/(TxON+TxOFF)
Duty Cycle 28.12%
in dB -5.509847

Average Value = Peak Value (in dBm) - Duty Cycle
Duty Cycle = 10log (0.2812) = -5.50985

Corrected Measured Peak (dBm) = Measured Peak + Correction Factor+ Duty Cycle+ Antenna Gain

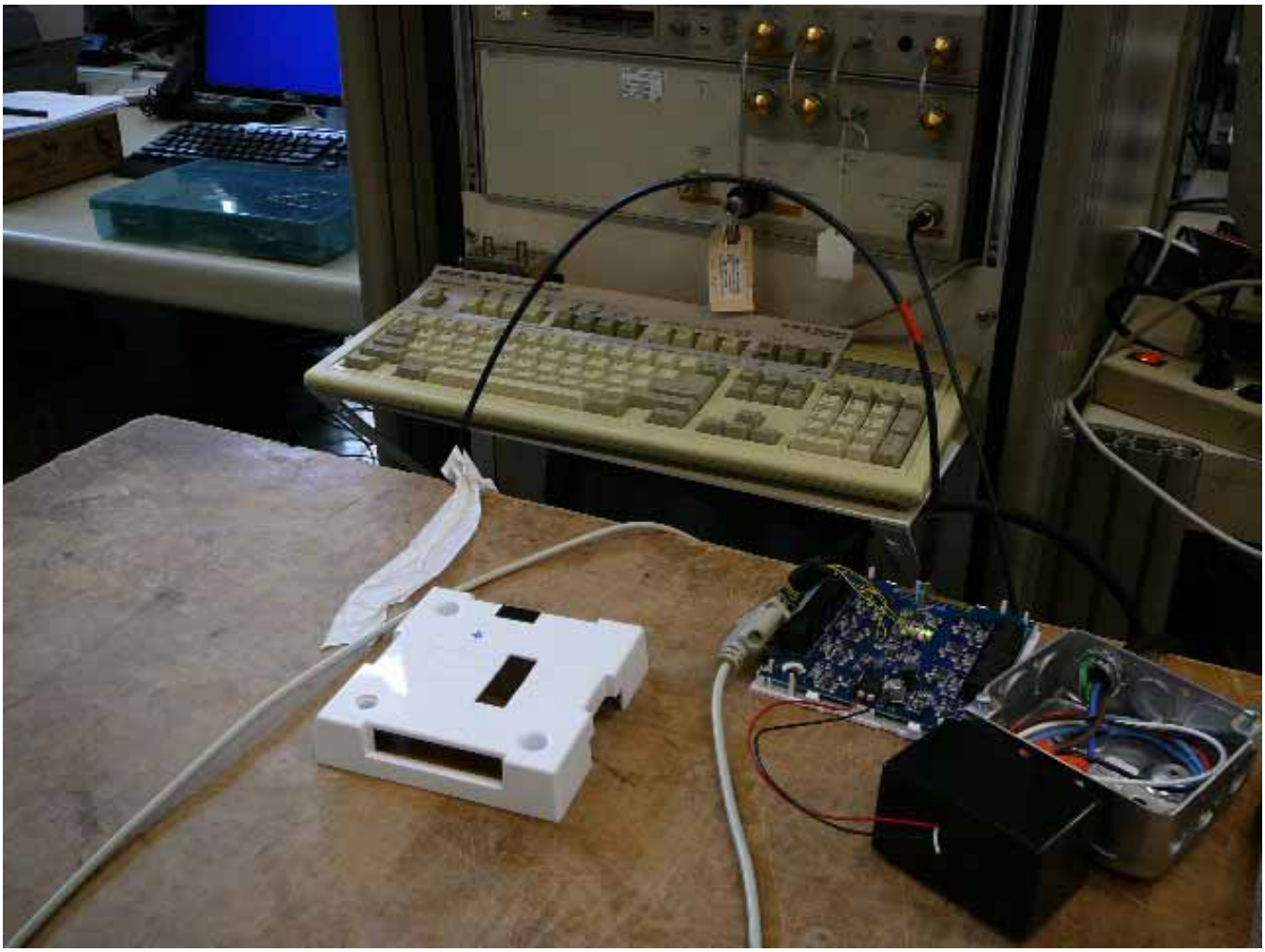


Figure 4 – Maximum Output Power (Semi-Anechoic Chamber 2)

4.3 RF Human Exposure Limits

This test evaluates the potential for the EUT currents to be injected into the public supply system and cause distortion on the AC power lines.

4.3.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	08/10/207	
Standard	FCC Part 15.247 (b)(5) and 1.1310						
Product Model	Radio Bridge			**Serial#**	Protoype		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room EUT placed on table						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	2.405GHz - 2.480GHz @ 3m						
Perf. Criteria	1.0 (mW/cm2) (Bellow Limit)		**Perf. Verification**		Readings under Limit		
Mod to EUT	None		**Test Performed By**		Dieter Baldamus		

4.3.2 Test Procedure

The maximum input power was measured. Then the minimum distance to the radiator was calculated based on the following formula:

$S=PG/4\Pi r^2 = EIRP/4\Pi r^2$ where:

- P: Power Input to the antenna in mW
- EIRP: Equivalent (effective) isotropic radiated power.
- S: power density mW/cm^2 (1.0 according to the maximum permissible exposure limits (MPE) stated in the FCC standard.
- G: Numeric Gain of antenna relative to isotropic radiator
- r: Distance to centre of radiation in cm

$r = \sqrt{PG/4\Pi S}$

4.3.3 Deviations

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

4.3.4 Final Test

The distance of the antenna is greater than the calculated in r. Therefore the FCC radio frequency exposure limits are not exceeded.

4.3.5 Tabulated Test Data

Radiated Emissions Measurements									
Standard:	47 CFR 15.247(b) (5) and 1.1310						***Date:***	11/7/2007	
Device Tested:	Sensro Switch - Radio Bridge						***File:***	07110707 RF Exposure	
Meas #	Freq (MHz)	Measured Peak (dBm)	Cable Correction Factor	Duty Cycle	Total Average EIRP (dBm)	Total Average EIRP (mW)	S Max Exposure Limit (mW2/cm)	Safety Distance (cm)	Comment
Channel 1 (2410GHz)	2404.48	3.60	1.00	-5.51	-0.91	0.81	1.00	0.254	Maximum Safety Distance
Channel 8 (2450GHz)	2445.48	2.73	1.00	-5.51	-1.78	0.66	1.00	0.230	
Channel 15 (2480GHz)	2480.24	2.86	1.00	-5.51	-1.65	0.68	1.00	0.233	
Tested by:	Dieter Baldamus								
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009									

Average Values were calculated based on the duty cycle of the transmission frequency
Measured Duty Cycle is 2.025ms + 0.787ms in 10ms
Duty Cycle = Tx ON/(TxON+TxOFF)
Duty Cycle = 28.12%
in dB = -5.509847

Total Average EIRP = Measured Peak (in dBm) + Cable Correction Factor - Duty Cycle

Safety Distance = vE/(4*¶*S) = vTotal Average EIRP/(4*3.1416*Max Exposure Limit)

4.4 Radiated Spurious Emissions

This test measures the radiated electromagnetic levels of the intentional and unintentional radiator generated by the EUT.

4.4.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	10/09/2007	
Standard	FCC Part 15.247 (c), 15.205, 15.209						
Product Model	Radio Bridge			**Serial#**	Protoype		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room EUT placed on table						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	2.405GHz - 2.480GHz @ 3m						
Perf. Criteria	-20dBc, 15.205 (a), 15.209 (a)			**Perf. Verification**	Readings under Limit		
Mod to EUT	None			**Test Performed By**	Dieter Baldamus		

4.4.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.4 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 2.405-2.480 GHz was investigated for radiated emissions, testing the lowest middle and highest channels.

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 3m OATS.

4.4.3 Deviations

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

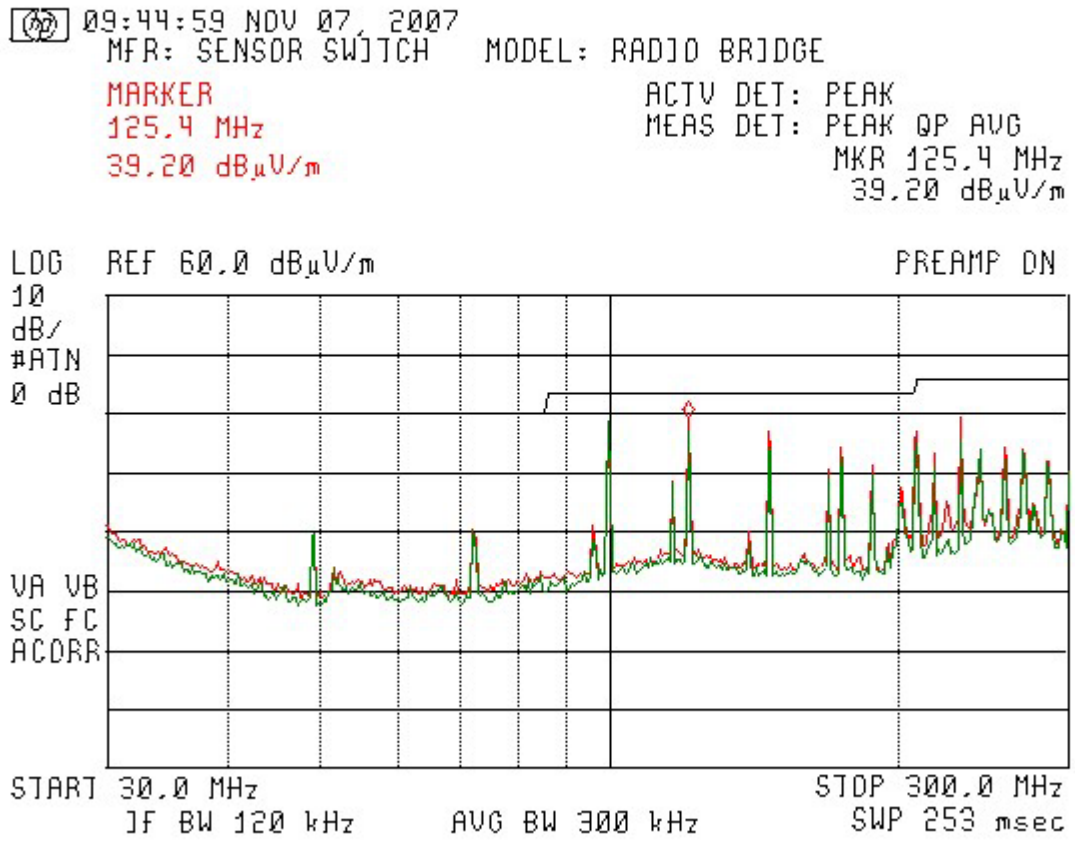
4.4.4 Final Test

The Voltage Fluctuations & Flicker of the EUT were below the limits specified in the standard. The EUT complies with 24dmax requirements for manual switching.

4.4.5 Summary of Final Data

NOTES:

Radiated Emissions Prescan



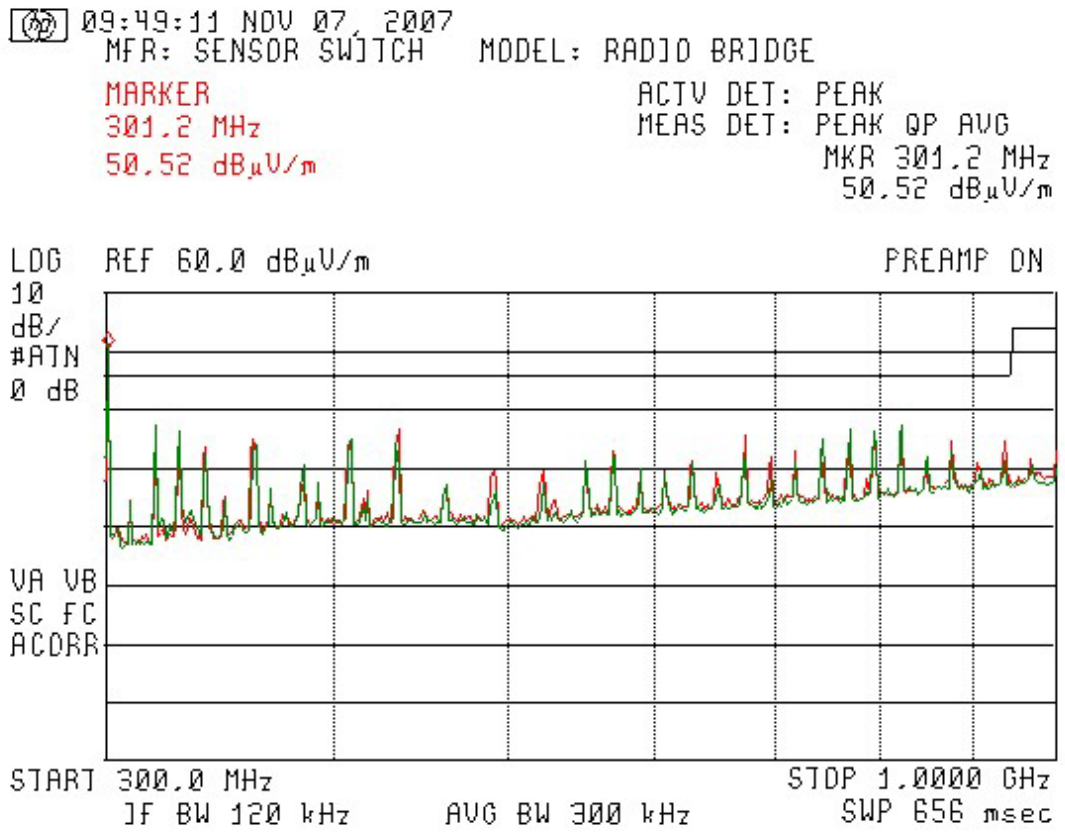
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



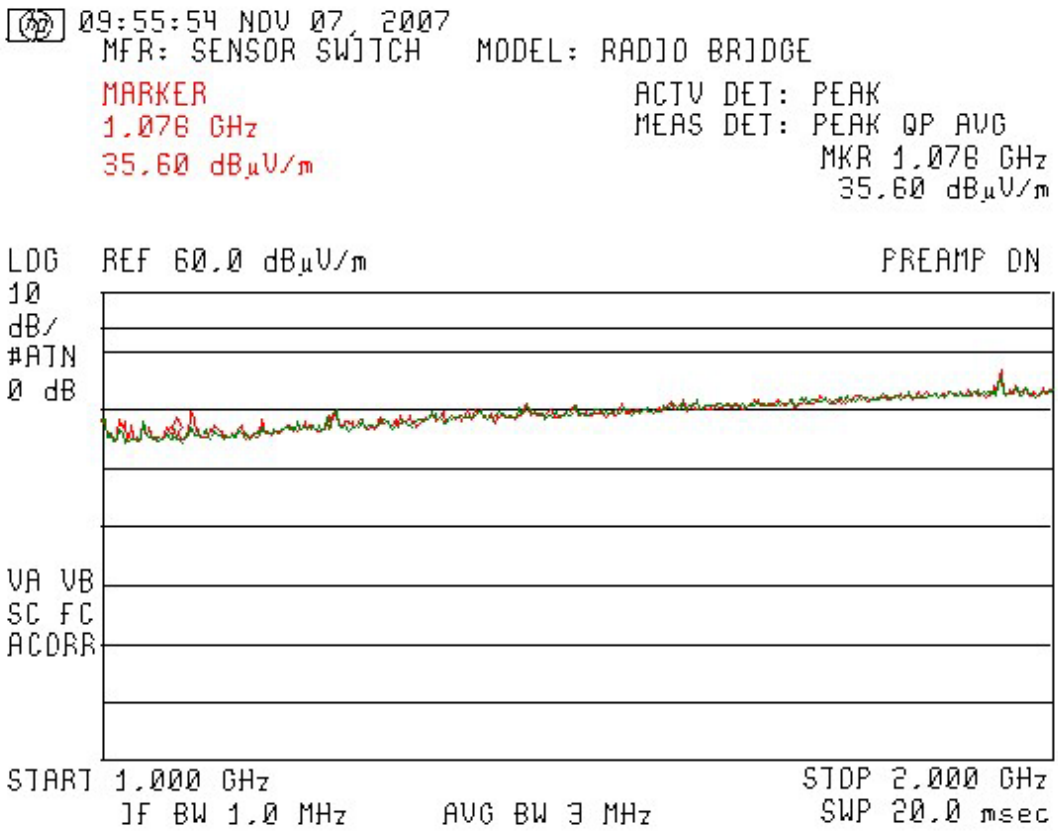
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



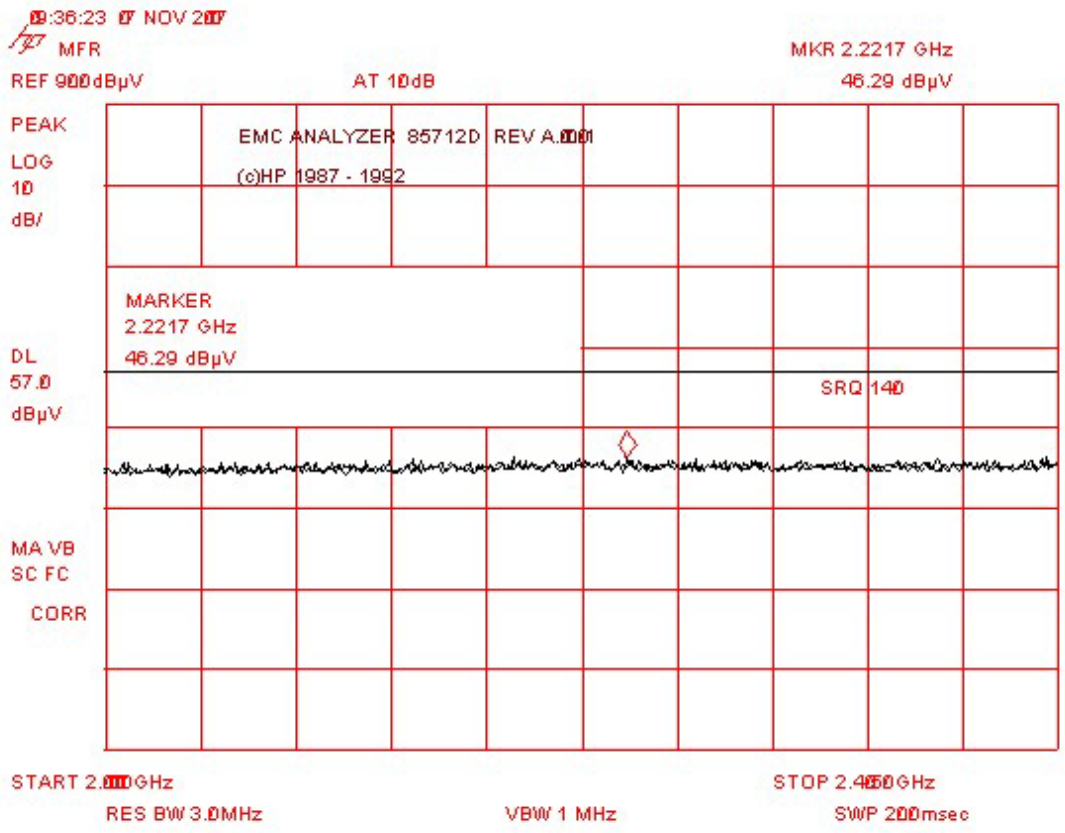
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



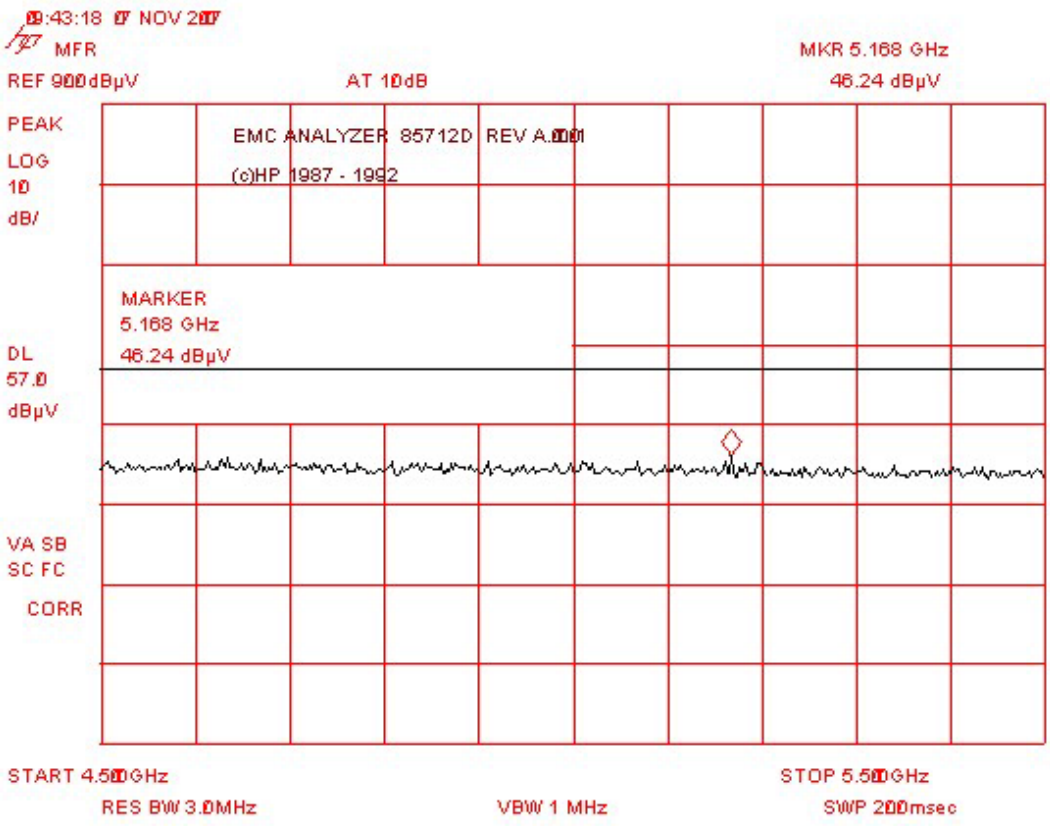
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



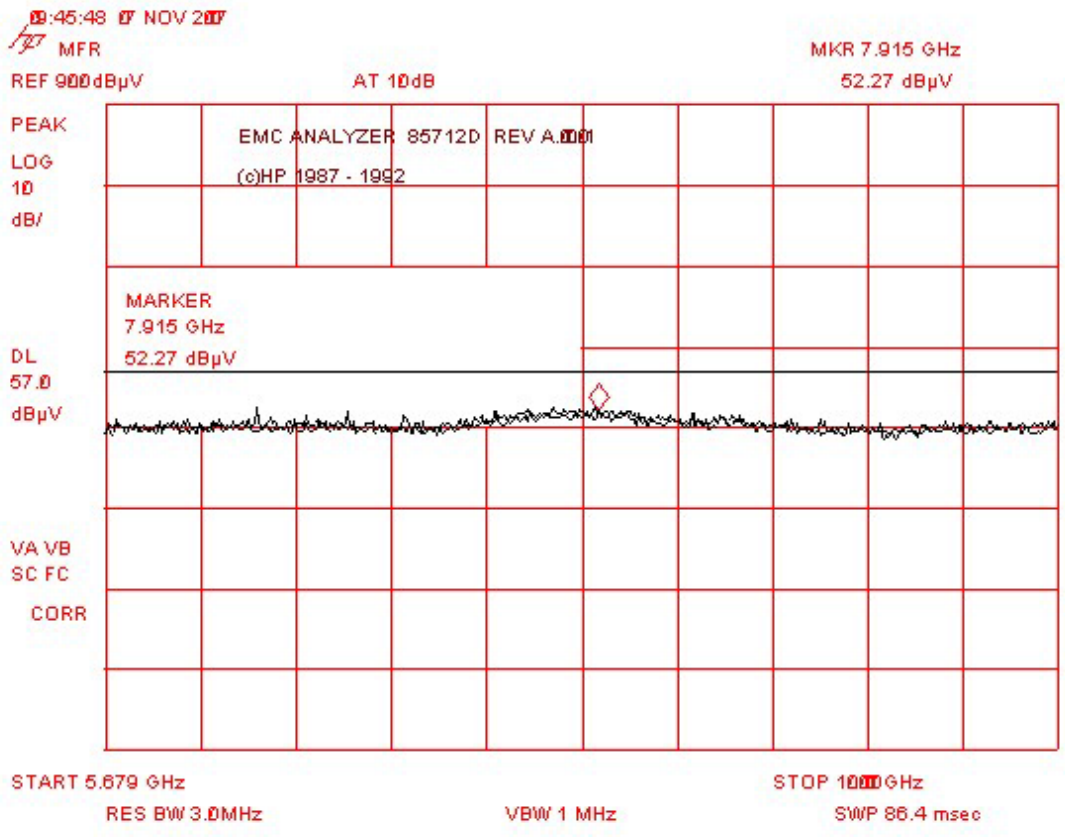
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



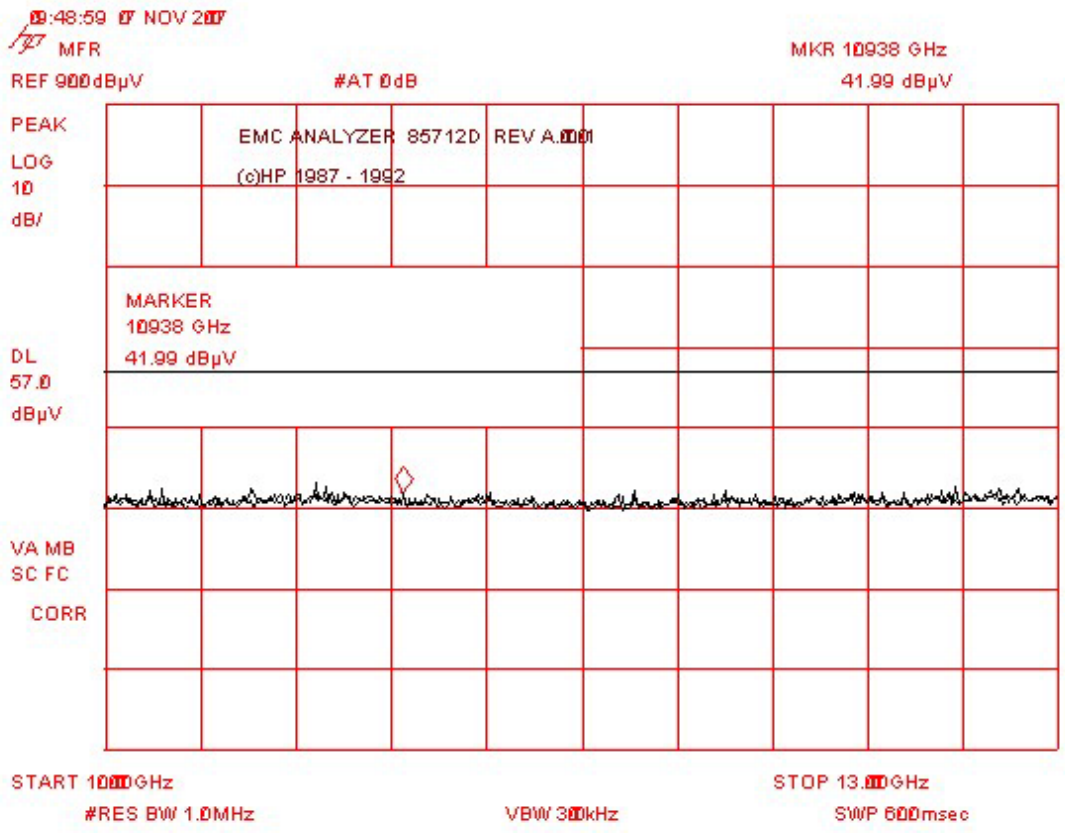
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



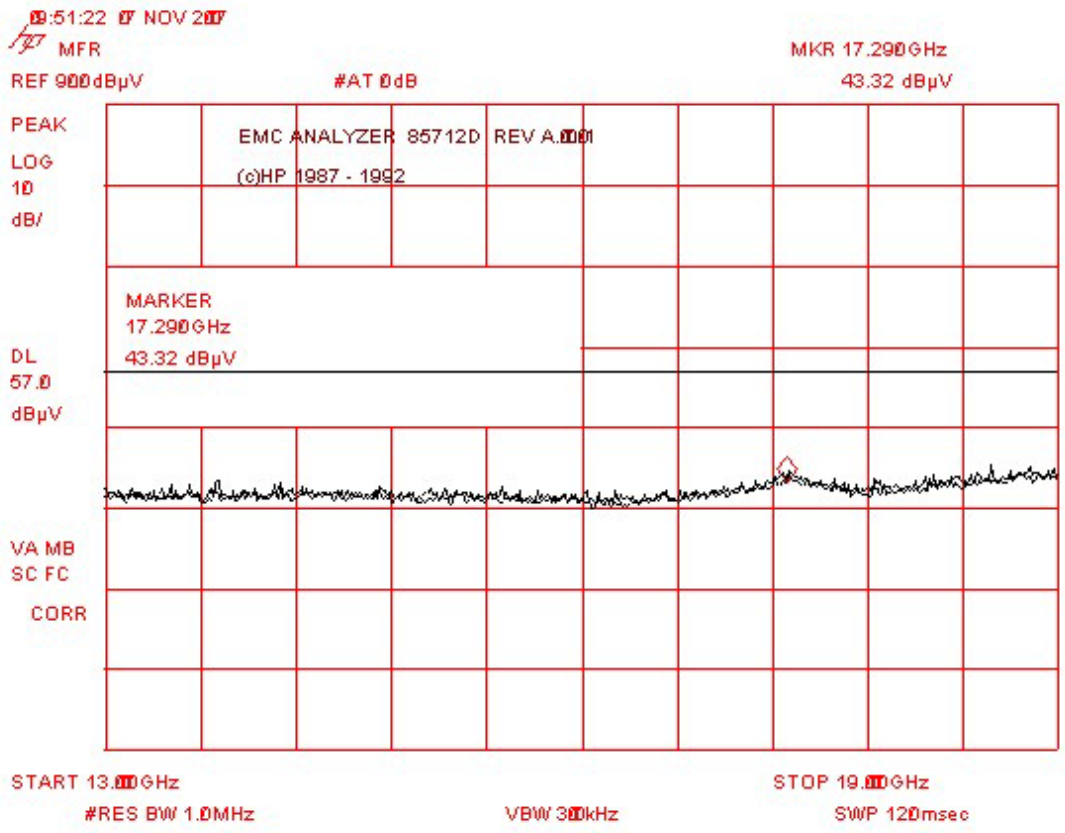
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



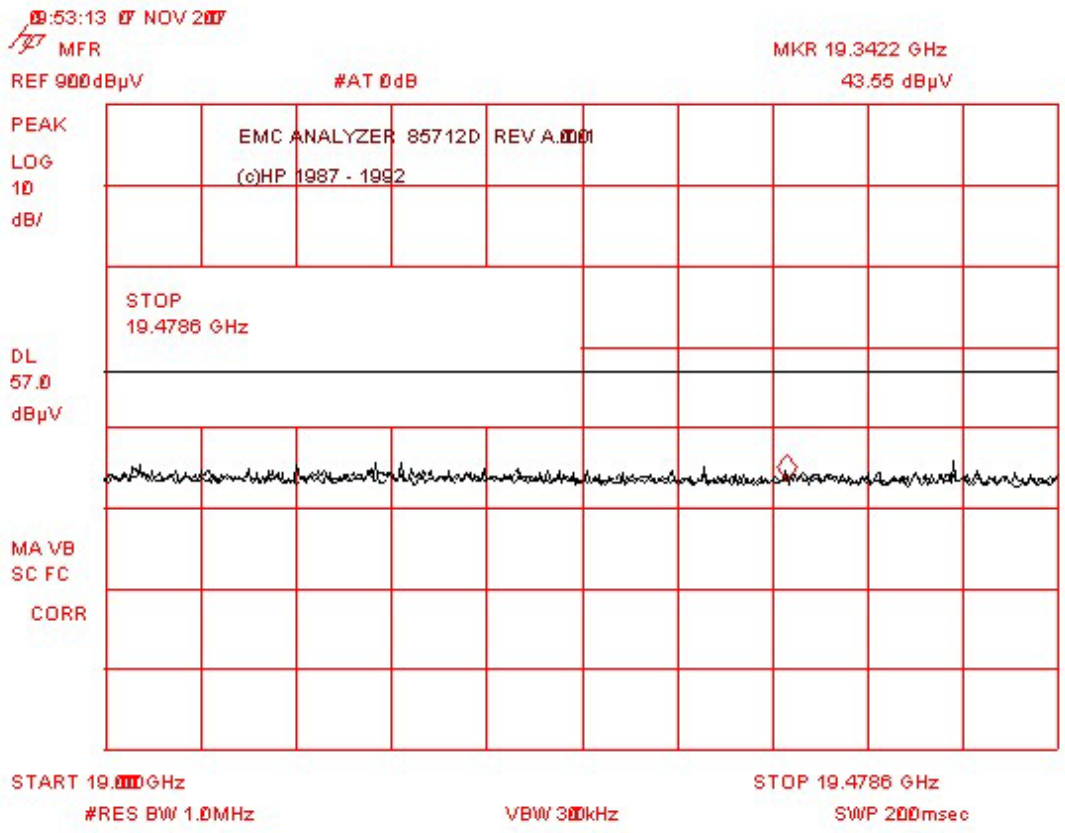
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



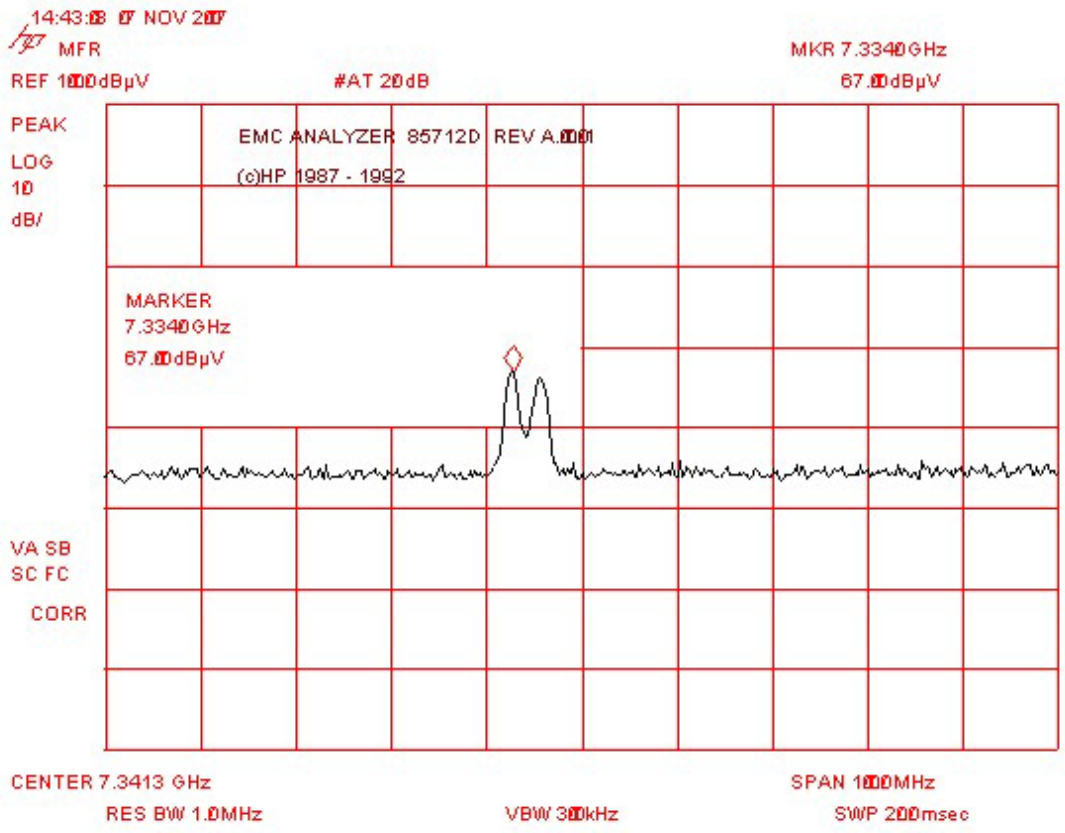
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



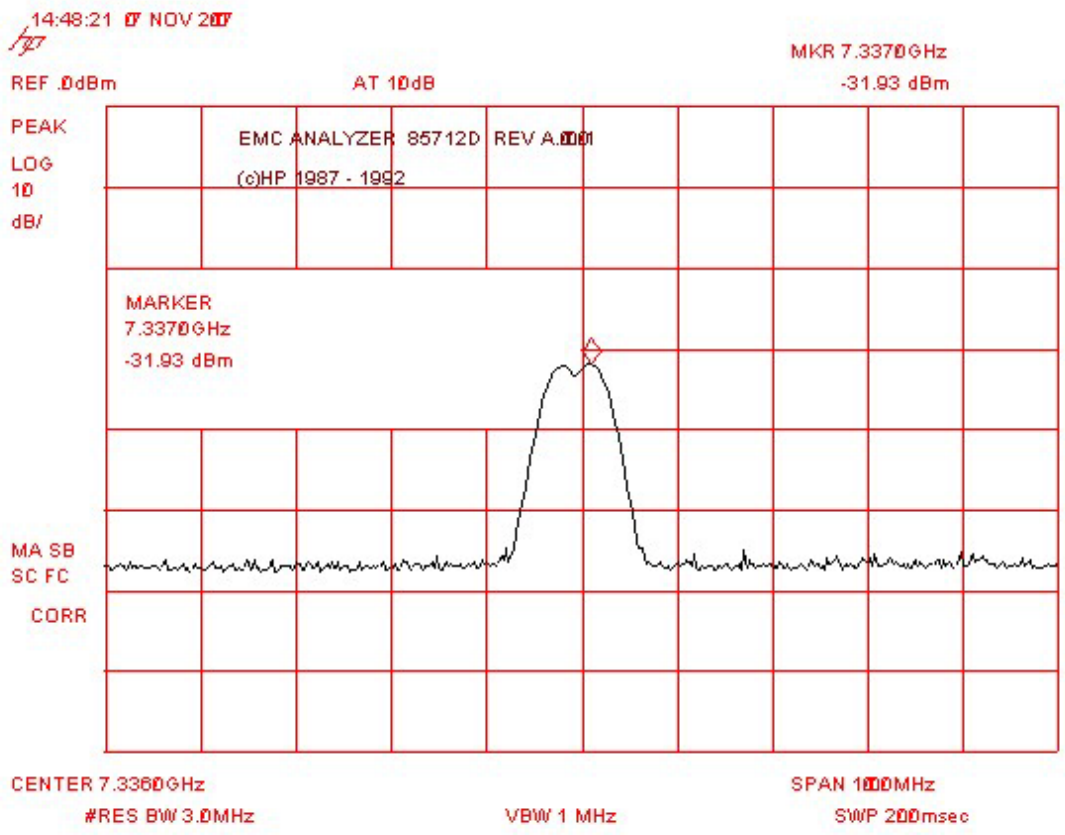
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



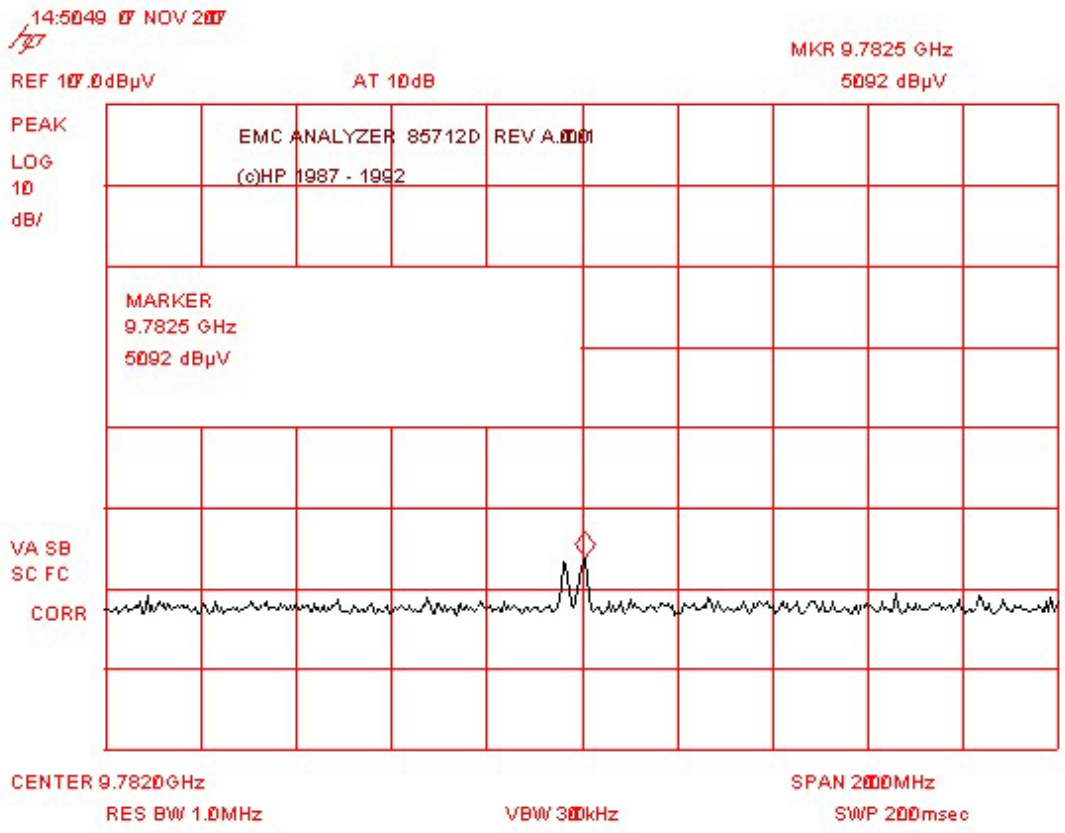
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan

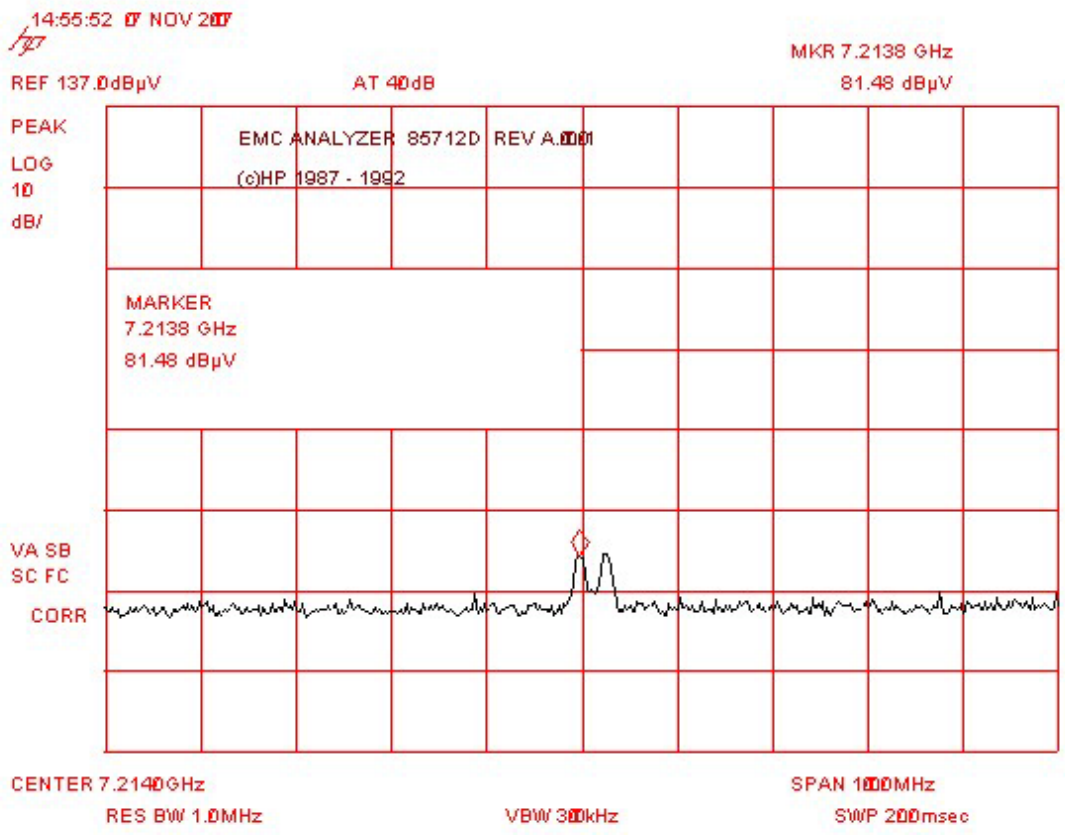


ANTENNA/COUPLER:			
☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Radiated Spurious Emissions Prescan



ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

Tabulated Test Data

Conducted Emission Test						
Standard:	47 CFR 15.247 (c)				***Date:***	7/26/2007
Device Tested:	Sensor Switch - Radio Bridge				***File:***	07110704 S.E. Conducted
Meas #	Freq (GHz)	RF Peak Level (dBµV)	-20dBc Limit (dBm)	Margin H (Average + Correction Factors - Limit)	Result	Comment
Lower Channel						
1	2.4046	109.82				
2	2.4000	64.60	89.82	-25.22	**Complied**	at bandedge
3	4.8091	68.31	89.82	-21.51	**Complied**	2nd Harmonic
4	7.2140	81.48	89.82	-8.34	**Complied**	3rd Harmonic
5	9.7825	56.86	89.82	-32.96	**Complied**	4th Harmonic
Middle Channel						
6	2.4445	109.17				
7	4.8910	63.45	89.17	-25.72	**Complied**	2nd Harmonic
8	7.3369	75.07	89.17	-14.10	**Complied**	3rd Harmonic
9	9.7825	50.10	89.17	-39.07	**Complied**	4th Harmonic
High Channel						
10	2.4805	109.27			**Complied**	
11	2.4835	64.39	89.27	-24.88	**Complied**	at bandedge
12	4.9593	51.94	89.27	-37.33	**Complied**	2nd Harmonic
13	7.4414	71.54	89.27	-17.73	**Complied**	3rd Harmonic
14	9.9186	47.09	89.27	-42.18	**Complied**	4th Harmonic
Tested by:	Dieter Baldamus					
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009						

4.4.6 Photos

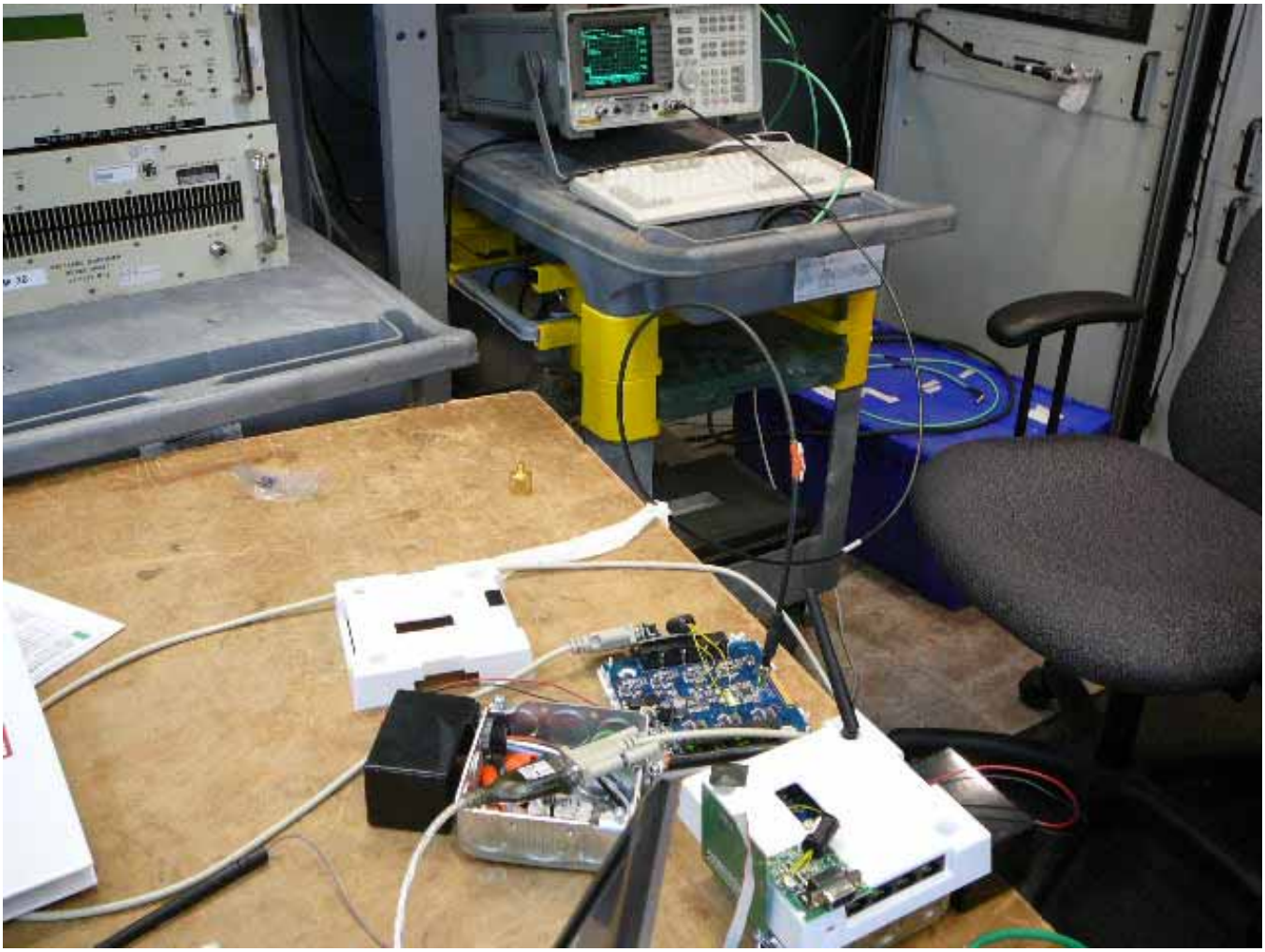


Figure 5 - Radiated Spurious Emissions Test Setup (Semi-Anechoic Chamber 2)

Figure 6 - Radiated Spurious Emissions Test Setup (Radiated Prescan- Semi Anechoic Chamber)

Figure 7 - Radiated Spurious Emissions Test Setup (Radiated Final Test - OATS)

4.5 Transmitter Power Density Spectrum

This test is to evaluate

4.5.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	07/0/2007	
Standard	FCC Part 15.215 (b)						
Product Model	Radio Bridge		**Serial#**	Protoype			
Configuration	See test plan for details						
Test Set-up	Tested in 3m chamber EUT placed on table See test plan for details						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	2.405GHz - 2.480GHz @ 3m						
Perf. Criteria	8dBm in a 3kHz BW		**Perf. Verification**	Readings under Limit			
Mod to EUT	None		**Test Performed By**	Dieter Baldamus			

4.5.2 Test Procedure

The Radiated Power Density was performed using a 1 second interval over a 3kHz bandwidth within each band.

The frequency range from 2.405-2.480 GHz was investigated for radiated emissions, testing the lowest middle and highest channels

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 3m OATS

4.5.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

4.5.4 Final Test

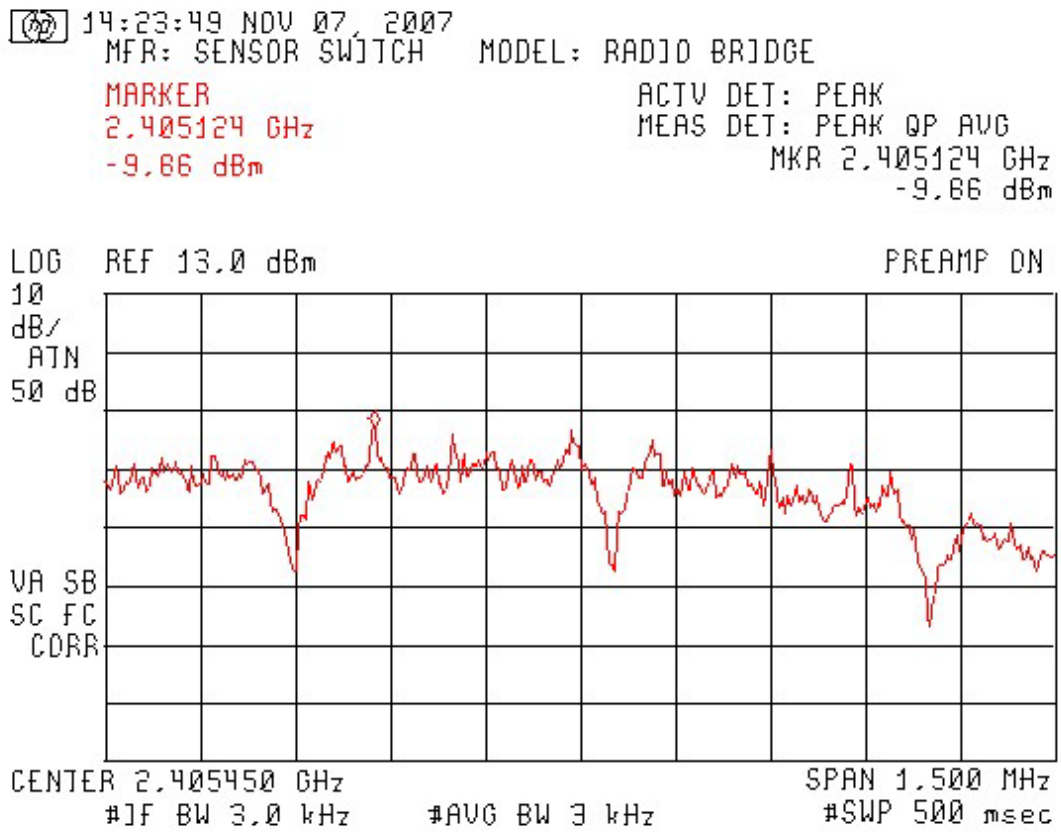
The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.5.5 Test Results

4.5.6 Summary of Final Data

NOTES:

Transmitter Power Density Measurement



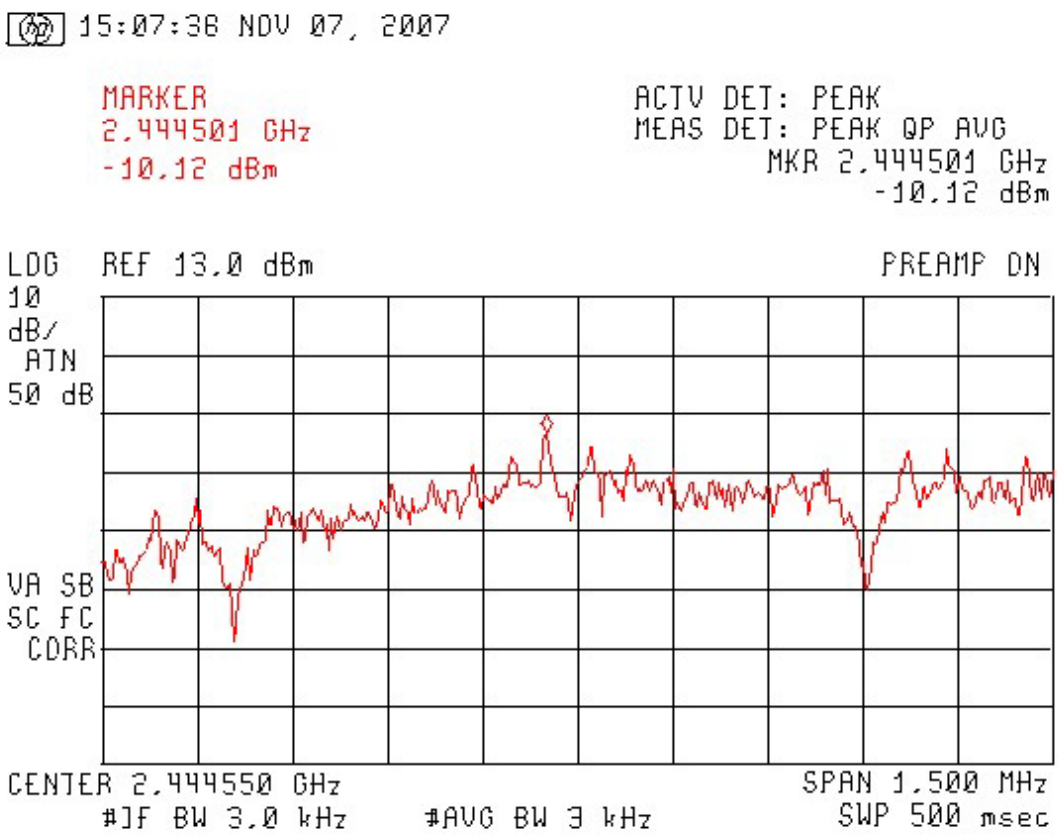
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Transmitter Power Density Measurement



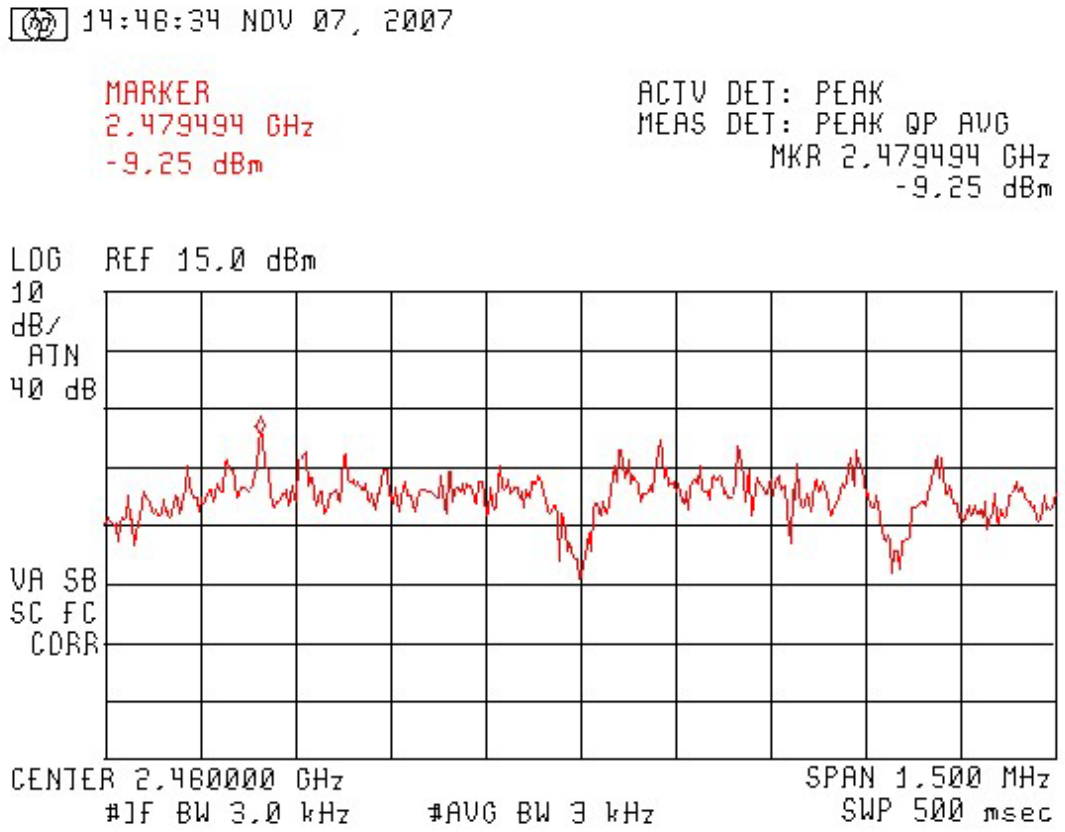
ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

NOTES:

Transmitter Power Density Measurement



ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☒ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☒ Radiated Prescan	☒ Vertical	☒ 3 Meter	☐ OATS
☐ Radiated Final	☒ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☐ Conducted	☐ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☐ Neutral	☐ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

4.5.7 Photos

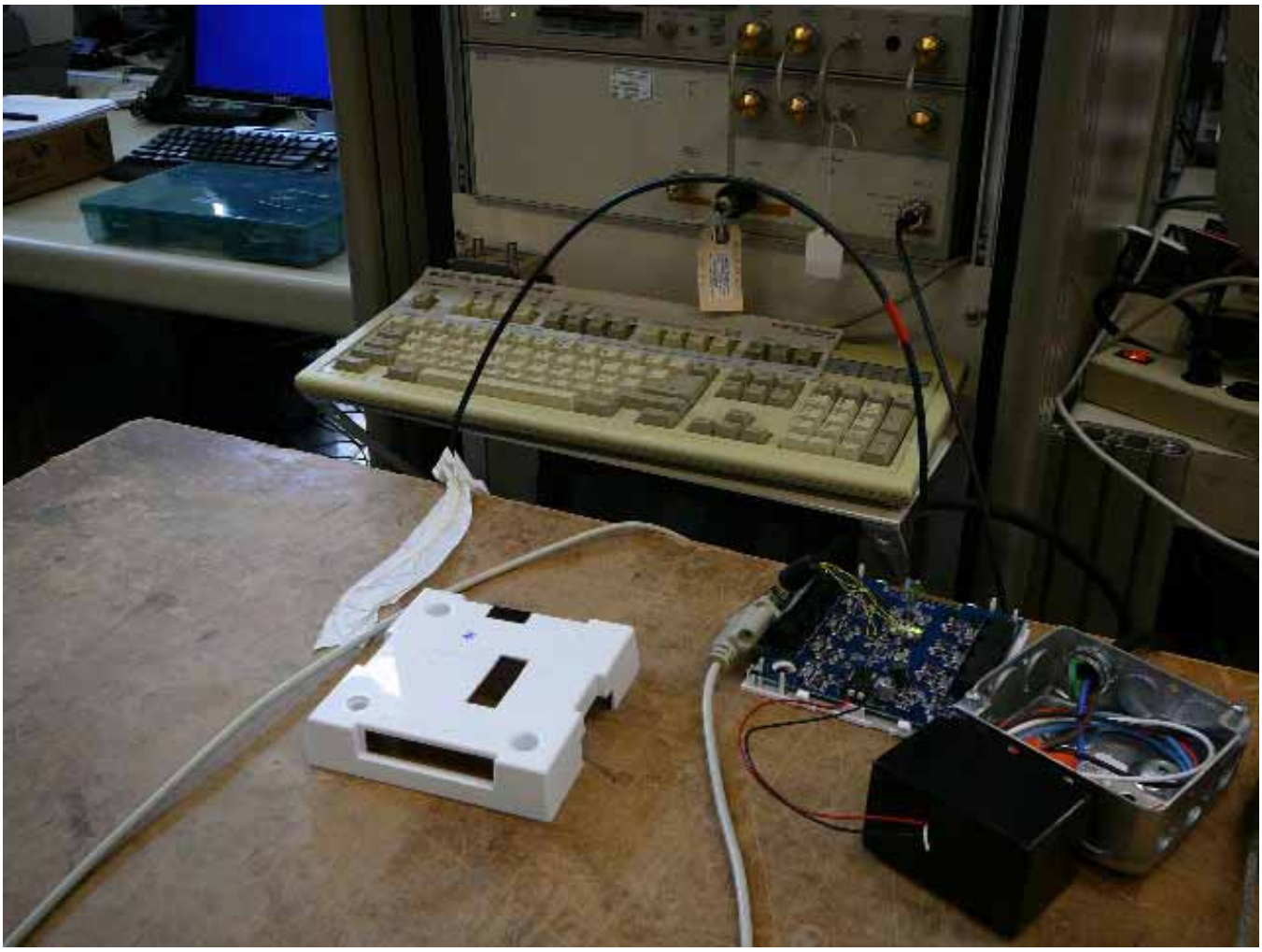


Figure 8 – Transmitter Power Density Spectrum (Semi-Anechoic Chamber 2)

4.6 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.

4.6.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	07/0/2007	
Standard	FCC Part 15.207						
Product Model	Radio Bridge			**Serial#**	Protoype		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room EUT placed on table						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	120V/60Hz, 0150-30MHz						
Perf. Criteria	FCC Part 15.207 (a)	**Perf. Verification**	Readings Under Limit for L1 and L2				
Mod. to EUT	None	**Test Performed By**	Dieter Baldamus				

4.6.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4 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 0.15 to 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.

4.6.3 Deviations

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

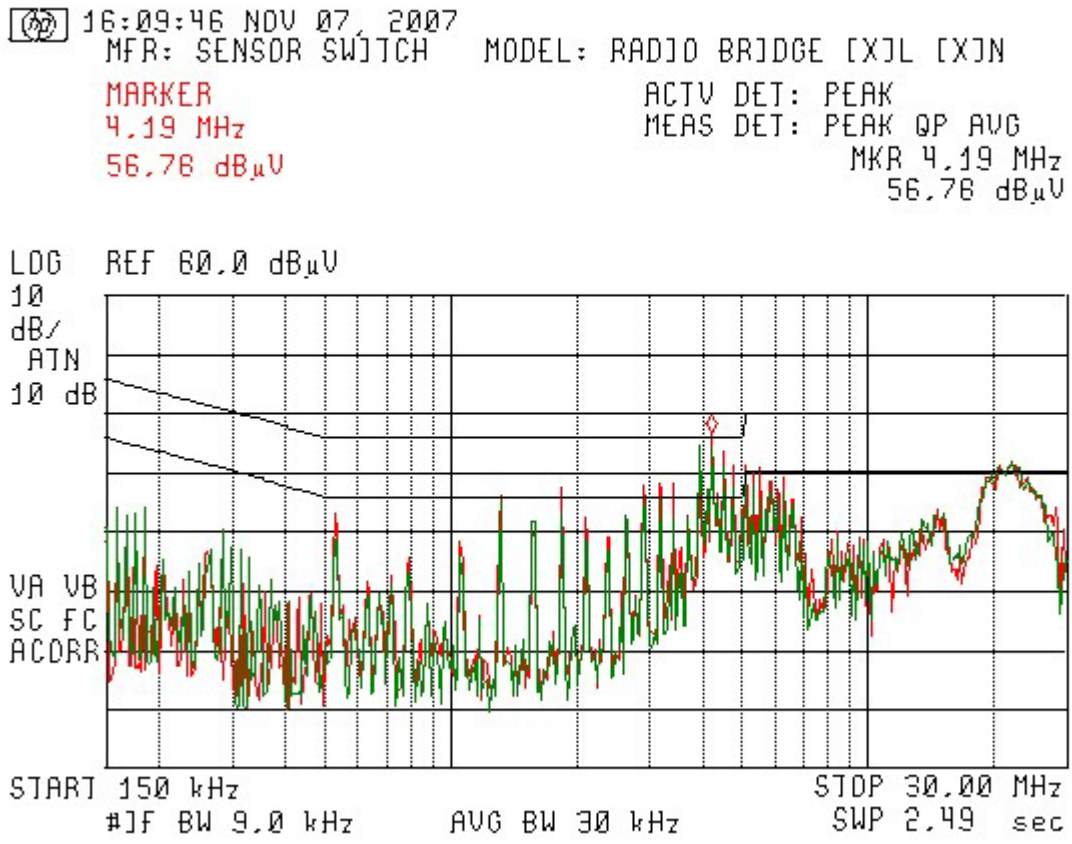
4.6.4 Final Test

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

4.6.5 Final Graph

NOTES:

Conducted Emissions @ 120V/60Hz



ANTENNA/COUPLER:

☐ 9124 Bicon	☐ 3109 Bicon	☐ CBL6140 X-Wing	☐ NNB-4/63TL LISN
☐ 3146 Log Per	☐ 3115 Horn	☐ JB3 Bilog	☐ NNB-4/200X LISN
☐ 3106 Horn	☐ CBL6112B Bilog	☐ NSLK 8126 LISN	☐ MDS–21 Clamp

MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
☐ Radiated Prescan	☐ Vertical	☐ 3 Meter	☐ OATS
☐ Radiated Final	☐ Horizontal	☐ 10 Meter	☐ Semi-Anechoic
☒ Conducted	☒ Line	☐ ____Meter	☒ Shielded Room
☐ Disturbance Power	☒ Neutral	☒ NA	☐ Factory Floor
☐ Other_____	☐ NA		☐ Other_____

4.6.6 Final Tabulated Data at 120V/60Hz

Conducted Emissions Measurements												
Standard:	EN55022:1998, Class B/FCC Part 15.107 (a)									***Date:***	11/9/2007	
Device Tested:	Sensor Switch - Radio Bridge									***File: .xls***	07110902 CE120V.xls	
Voltage:	120V/60Hz											
Signal Num	Freq	Peak Amp	QP Amp	Avg Amp	QP Limit	Avg Limit	Conductor	QP ∪	QP Result	Avg ∪	Average Result	Mode
	MHz	dBuV	dBuV	dBuV	dBuV	dBuV		dB		dB		
1	0.1633	43.45	36.71	23.77	65.29	55.29	Line	-28.58	**Complied**	-31.52	**Complied**	
2	0.2858	37.09	31.35	4.51	60.64	50.64	Line	-29.29	**Complied**	-46.13	**Complied**	
3	0.5039	17.19	9.77	2.53	56.00	46.00	Line	-46.23	**Complied**	-43.47	**Complied**	
4	25.0133	44.17	43.75	43.28	60.00	50.00	Line	-16.25	**Complied**	-6.72	**Complied**	
5	0.1615	40.73	33.93	23.61	65.39	55.39	Neutral	-31.46	**Complied**	-31.78	**Complied**	
6	0.2720	33.87	26.69	8.77	61.06	51.06	Neutral	-34.37	**Complied**	-42.29	**Complied**	
7	13.8424	13.28	8.74	2.33	60.00	50.00	Neutral	-51.26	**Complied**	-47.67	**Complied**	
8	17.8317	13.95	9.02	2.75	60.00	50.00	Neutral	-50.98	**Complied**	-47.25	**Complied**	
9	25.0134	43.54	43.16	42.71	60.00	50.00	Neutral	-16.84	**Complied**	-7.29	**Complied**	
Tested by:	Dieter Baldamus											
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009											CE22_B.xlt Revised 13APR05	

4.6.7 Photos

Figure 9 –Conducted Emissions Test Setup

4.7 Frequency Stability

This test is to evaluate the performance of the EUT when subjected to temperature and voltage changes

4.7.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	10/09/2007	
Standard	FCC Part 15.215						
Product Model	Radio Bridge			**Serial#**	Protoype		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room. See test plans for details						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22ºC	**Humidity**	45%	**Pressure**	998mbar
Frequency Range	2.405 GHZ – 2.480GHz		**Temperature Range**		0°C – 70°C		
Perf. Criteria	Containment of 20dB of frequency range		**Perf. Verification**		Readings under Limit		
Mod to EUT	See section 5.5		**Test Performed By**		Dieter Baldamus		

4.7.2 Test Procedure

EUT was place in a temperature chamber. Frequency and output power level were measured at room temperature. Temperature in the chamber was increased to 70°C and maintained till the EUT reached that temperature. Frequency and level was measured again. EUT was placed into a humidity chamber and temperature was set to 0 °C. Temperature was maintained till the EUT reached that temperature. Frequency and level were measured again.

4.7.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Surge Immunity test.

4.7.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

4.7.5 Summary of Final Test Results

Frequency Stability Test - Temperature Variations						
Standard:	FCC Part 15.225 e)			***Date:***	11/9/2007	
Device Tested:	Radio Bridge			***File:***	07100812 Freq. Stability.xls	
Customer:	Sensor Switch					
Temperature	**Start-up (GHz)**	**2min (GHz)**	**5min (GHz)**	**10min (GHz)**	**Permitted Band Edge in MHz (+/-0.01%)**	**Results**
Low						
0°C	2.4045	2.4045	2.4048	2.4049	2.4000GHz-2.4835GHz	**Complied**
22°C	2.4048	2.4050	2.4049	2.4050	2.4000GHz-2.4835GHz	**Complied**
70°C	2.4049	2.4050	2.4049	2.4050	2.4000GHz-2.4835GHz	**Complied**
Middle						
0°C	2.4445	2.4445	2.4445	2.4446	2.4000GHz-2.4835GHz	**Complied**
22°C	2.4445	2.4445	2.4446	2.4446	2.4000GHz-2.4835GHz	**Complied**
70°C	2.4446	2.4446	2.4446	2.4446	2.4000GHz-2.4835GHz	**Complied**
High						
0°C	2.4805	2.4805	2.4805	2.4805	2.4000GHz-2.4835GHz	**Complied**
22°C	2.4805	2.4805	2.4805	2.4805	2.4000GHz-2.4835GHz	**Complied**
70°C	2.4805	2.4805	2.4805	2.4805	2.4000GHz-2.4835GHz	**Complied**
Tested by:	Dieter Baldamus					
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009						
FCC TempStab.xlt Revised 24APR08						

Frequency Stability Test - Voltage Variations						
Standard:	FCC Part 15.225 e)			***Date:***	6/11/2008	
Device Tested:	DSVII+Turbo			***File:***	08061101 FreqVar.xls	
Customer:	Datastrip					
Temperature	**Start-up (GHz)**	**2min (GHz)**	**5min (GHz)**	**10min (GHz)**	**Permitted Band Edge in MHz (+/-0.01%)**	**Results**
Low						
102 V(85%)	2.4047	2.4047	2.4048	2.4048	2.4000GHz-2.4835GHz	**Complied**
120V (100%)	2.4048	2.4047	2.4048	2.4048	2.4000GHz-2.4835GHz	**Complied**
138V (115%)	2.4047	2.4047	2.4047	2.4047	2.4000GHz-2.4835GHz	**Complied**
Middle						
102 V(85%)	2.4445	2.4445	2.4445	2.4445	2.4000GHz-2.4835GHz	**Complied**
120V (100%)	2.4444	2.4444	2.4444	2.4444	2.4000GHz-2.4835GHz	**Complied**
138V (115%)	2.4445	2.4445	2.4445	2.4445	2.4000GHz-2.4835GHz	**Complied**
High						
102 V(85%)	2.4806	2.4805	2.4804	2.4805	2.4000GHz-2.4835GHz	**Complied**
120V (100%)	2.4805	2.4805	2.4805	2.4805	2.4000GHz-2.4835GHz	**Complied**
138V (115%)	2.4806	2.4805	2.4806	2.4805	2.4000GHz-2.4835GHz	**Complied**
Tested by:	Dieter Baldamus					
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009						
FCC TempStab.xlt Revised 24APR08						

4.7.6 Photos

Figure 10 –Frequency Stability Test Setup – Temperature Chamber at +50°C

Figure 11 –Frequency Stability Test Setup – Humidity Chamber at 0°C

4.8 Band Edge Measurement

This test evaluates the potential for the EUT to cause voltage fluctuation and flicker impressed on the public AC low-voltage system.

4.8.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	05/13/2008	
Standard	FCC Part 215 c)/RSS-210						
Product Model	Radio Bridge			**Serial#**	Protoype		
Configuration	See test plan for details						
Test Set-up	Tested in OATS EUT placed on table See test plan for details						
EUT Powered By	AC/DC Adapter & Batteries	**Temp**	22º C	**Humidity**	45%	**Pressure**	1001mbar
Perf. Criteria	6dB and 99% Band Edge		**Perf. Verification**		Readings within Limit		
Mod to EUT	None		**Test Performed By**		**Error! Reference source not found.**		

4.8.2 Test Procedure

Radiated field strength emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Testing was performed at a distance of 10 meters on the OATS Deviations. Reading were made at 6dB and 99% of the fundamental signal.

4.8.3 Deviations

There were no deviations from the test methodology listed in the test plan for the band edge measurement test.

4.8.4 Final Test

The Band Edge Measurements were within the limits specified in the standard.

4.8.5 Tabulated Test Data

Radiated Emissions Measurements								
Standard:	47 CFR FCC Part 15.215 c)/RSS-210			***PRESCAN or FINAL:***		Final	***Date:***	5/13/2008
Device Tested:	Sensor Switch - Radio Bridge				***Distance:***	10m	***File Name:***	0805301Bandedge.xls
Mode:	Normal Operation							
Mount:	Table Top							
Modifications:	NA							
		Measured Level						
Meas #	TX Band	Peak	-20dB High End (MHz)	+20dB High End (MHz)	99% Measured Bandwith (MHz)	Band (MHz)	Result	Comment
RBW = 9kHz VBW=30kHz								
1	2404.48	3.60	2403.53	2405.31	1.7800	2400-2483.5	**Complied**	
2	2445.48	2.73	2444.52	2446.33	1.8100	2400-2483.6	**Complied**	
3	2480.24	2.86	2479.49	2481.36	1.8700	2400-2483.7	**Complied**	
Tested by:	Dieter Baldamus							
TUV Rheinland of North America, Inc. 12 Commerce Road Newtown, CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009								

4.8.6 Photos

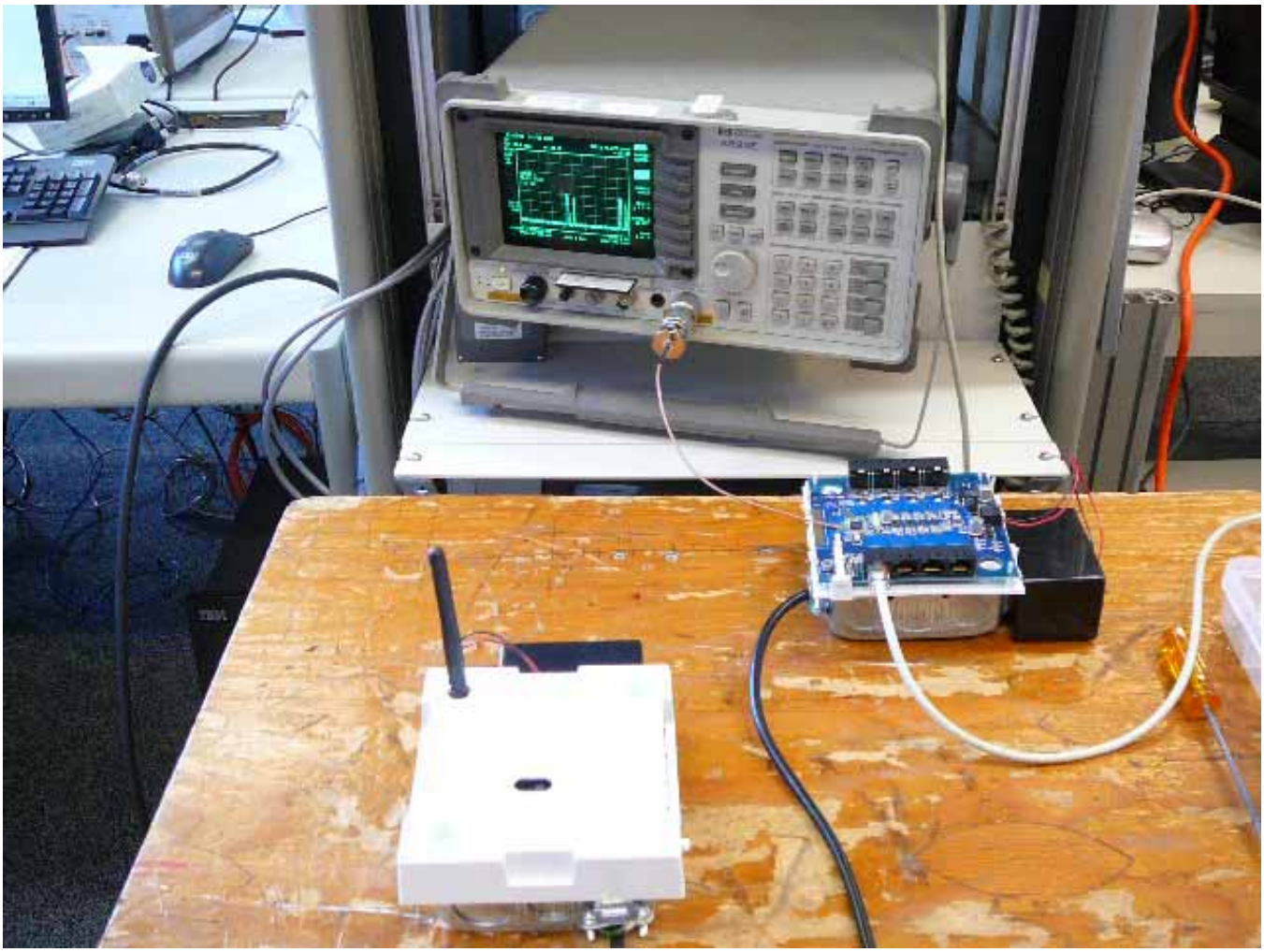


Figure 12 –Frequency Stability Test Setup – Humidity Chamber at 0°C

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	Sensor Switch, Inc.
Address	900 Northrop Road
Address	Wallingford, CT 06492
Contact Person	William J Fassbender
Telephone	(203) 265-2842
Fax	(203) 265-1565
email	fozzy@sensorswitch.com

5.2 Model(s) Name

Radio Bridge

5.3 Type of Product

Lighting Control System

5.4 Equipment Under Test (EUT) Description

The EUT is a wireless foot pedal used for various applications in the industrial environment. The wireless system eliminates the nuisance of wires under foot while invisible waves fill a room with 360° of signal. The EUT consist of a wireless foot pedal transmitter and a receiver; one (the transmitter) used with batteries and one (the receiver) used with an AC/DC adapter. The receiver also sends a signal every second to control de antenna output power of the transmitter.

5.5 Modifications

Software Change to comply with the frequency stability test.

5.6 Product Environment

☐	**Residential**	☐	**Hospital**
☒	**Light Industrial**	☐	**Small Clinic**
☐	**Industrial**	☐	**Doctor's office**
☐	**Other**		

*Check all that apply

5.7 Countries

☒	**USA**
☐	**Taiwan**
☐	**Japan**
☐	**Europe**

*Check all that apply

5.8 Applicable Documents

Standard	Description
FCC Part 15	Rado Frquency Devices -Part C
FCC Part 15.247 (a) (2) RSS-210	Spectrum Bandwith of a Direct Sequence Spread Spectrum System
FCC Part 15.247 (b)	Maximum Output Power
FCC Part 1.1310	RF Human Exposure Limit
FCC Part 15.247 (c), 15.205, 15.209	Radiated Spurious Emissions
FCC Part 15.247 (d)	Transmitter Power Density of a Direct Sequence Spread Spectrum System
FCC Part 15.207	Conducted Emissions
FCC Part 15.215 (b)	Frequency Stability
FCC part 15.215 c), RSS-210	Band Edge Measurement

5.9 General Product Information

Size (Transmitter)	**H**	5cm	**W**	15cm	**L**	15cm
Weight (Transmitter)	0.5		**Fork-Lift Needed**		No	
Notes	None					

5.10 EUT Powered Information

5.10.1 Power Type

☒	**AC**	☒	**DC (From AC./DC Block)**	☐	**Batteries**	☐	**Host -**

5.10.2 Power Information

Name	**Type**	**Voltage**		**Frequency**	**Current**	**Notes**
		min	**max**			
24VDC AC/DC Adapter	Class 1	120VAC	120VAC	60Hz	500mA	
Notes						

5.11 EUT Modes Of operation

The EUT footswitch transmitter has 2 modes of operation. Switch ON or Switch OFF. Both modes were in operation during the test. The receiver was constantly on receiving signals from the footswitch transmitter.

5.12 EUT Configurations

Configuration	Description
Configuration 1	Transmitter was on all the time
Note: all configurations are the same except as noted above	

5.13 EUT Clock/Oscillator Frequencies

☐	**Less than 108MHz**	**FCC – scan up to 1GHz**
☐	**Less than 500MHz**	**FCC – scan up to 2GHz**
☐	**Less than 1000MHz**	**FCC – scan up to 5GHz**
☒	**Greater then 1000MHz**	**FCC – scan up to 5th Harmonic or 40GHz (2.4GHz)**

5.14 Electrical Support Equipment

Type	Manufacture	Model	Connected To
NA	NA	NA	NA

5.15 Non - Electrical Support Equipment

Item	Notes
NA	NA

5.16 EUT Equipment/Cabling Information

EUT Port	Connected To	Location	Cable Type		
			Length	Shielded	Bead
15-24VDC Input	AC/ DC Terminal Block	Tx/ Rx	1.5m	No	No

5.17 EUT Doors

☒	**None**
☐	**For service personnel only**
☐	**Operator will wear ESD strap**
☐	**Other**

5.18 EUT Grounding

☒	**None**
☐	**AC line cord – third wire**
☐	**Via host I/O cable**
☐	**Other**

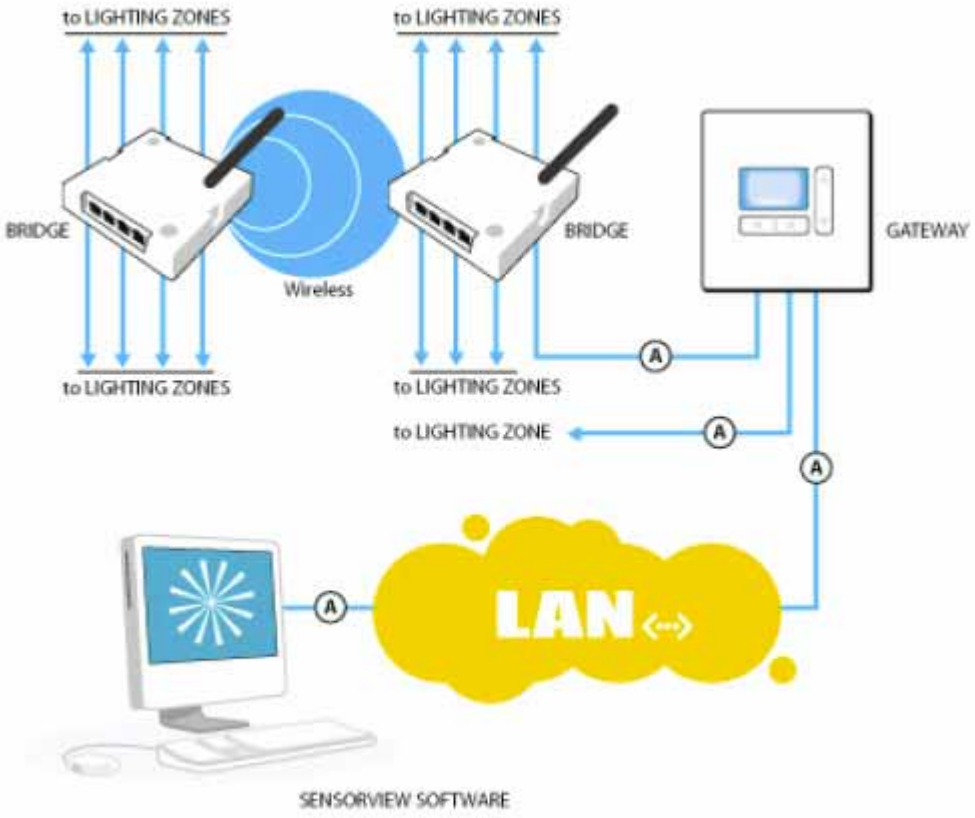
5.19 EUT Test Program

None

5.20 Monitoring of EUT during Testing

During the test a LED in the receiver indicates that the switch of the transmitter is ON. If the LED is off the foot switch is OFF as well.

5.21 EUT Configuration Block Diagram



5.22 Constructional Data Form

TUV Rheinland D-51101 Köln 91 Am Grauen Stein/ Konstantin-Wille-Str. 1	Please submit in duplicate		
	Gen-Ausw-Nr.	Aktenzeichen: 30762324.001 Sensor Switch - Radio Bridge	Anlage-Nr. 1 of 1

EMC/EMV
Constructional Data Form

Item Listing No. & Location in EUT	Component / Sub-Assembly	Part No. & Description	Freq.; Rated ERP/Atten.
1.0	Enclosure	Plastic	NA
2.0	Antenna	AN -A2	2.14dBi

TUV Rheinland Prüfstelle für Gerätesicherheit	Applicant	
Köln, den:	Ort/place:	Datum/date:
(report copy not signed)	(report copy not signed)	
TUV Rheinland Prüfstelle für Gerätesicherheit	(Stempel und Unterschrift des Antragstellers/ stamp and signature of applicant)	