

Report No.: 307625324.001 Page 1 of 65

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.



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Ац	ftraggeber : Client:	Sensor Switch, Inc. 900 Northrop Road Wallingford, CT 06			
Bezeichnung: Identification:	Lighting	Control System	Serien-Nr.: Serial No.	PROTOYPE	
Gegenstand der Prüfung: Test item:	Radio Bı	ridge	Prüfdatum: Date tested:	October 8th -10th	2007
Prüfort: Testing location:	12 Comn Newtowr	einland of North Ame nerce Road a, CT 06470-1607 \$ 200111-0			
Prüfgrundlage: Test specification:	FCC Part	(b)(5) and 1.131	7 (a)(2), FCC Par 15.2 10, FCC Part 15.247 (c	47 (b)(3), FCC Part 15.2d), 15.205, 15.209, FCC Part 15.215 (c)	art 1
Prüfergebnis: Test Result	oben gen		age. The above produ	vurde geprüft und ent act was found to be Con	_
geprüft / tested by:	Dieter Balda	amus	kontrolliert / re	viewed by: Bruce Fagley	
16 July 2008 Datum Date Sonstiges:	Name Name	Unterschrift Signature	16 July 2008 Datum Date None	Name Untersch Name Signature	
	pliant, Does not Con	entspricht Prüfgrundlage mply = entspricht nicht	Abbreviations: OK, Pa	ass, Compliant, Complies = passed of Compliant, Does Not Comply = fail not applicable	ed
F©		NV	ثوها	Industry Canad	a
US5112 2001		0111-0 3466D-1			



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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 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.



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1.3	Sum	m	ary of Test Results						
			itch, Inc.	Tel	(203) 263	5-2842	Contact	William J F	assbender
Applicant			rop Road rd, CT 06492	Fax	(203) 263	5-1565	email	fozzy@sens	orswitch.com
Type of Equip	ment	L	ighting Control System	Model Numbe	er	Radio	Bridge		
Standar	ds		Description	S	Severity L	evel or I	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	Part 15.247 (a) (2) Spectrum Bandwith of a Direct Sequence Spread Spectrum System South		Limit	Complies					
FCC Part 15.247	C Part 15.247 (b) (3) Maximum Output Power 1 Watt (30dBm)		Limit	Complies					
FCC Part 15.247 and 1.1310			Limit	Complies					
FCC Part 15.247 15.205, 15.209	Part 15.247 (c), 05, 15.209 Radiated Spurious Emissions -20dBc, 15.205 (a), 15.209 (a)		-20dBc, 15.205 (a), 15.209 (a)		Limit	Complies			
FCC Part 15.247 (d) Tra		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 B		20dB Bandwith	20dB Contained within the Frequency Band			Within Limit	Complies		



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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 ± 1.4 dB.

The estimated combined standard uncertainty for radiated emissions measurements is \pm 1.6 dB.

The estimated combined standard uncertainty for conducted emissions measurements is \pm 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.



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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



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Figure 1 – Photo of EUT (Transmitter)

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product endorsement by TUV Rheinland, NVLAP or any agency of the United States Government.



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Figure 2 – Photo of EUT (Receiver)



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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)					11/07/20	007
Standard	FCC Part 15.247 (a) (2)						
Product Model	Radio Bridge			Serial#	Protoyp	ne e	
Configuration	See test plan for deta	See test plan for details					
Test Set-up	Tested @ 3m on O.	Tested @ 3m on O.A.T.S. placed on turn-table, see test plans for details					
EUT Powered By	AC/DC Adapter & Batteries	Temp	22°C	Humidity	45%	Pressure	998mbar
Frequency Range	2.405 GHz - 2.480 GHz @ 3m						
Perf. Criteria	500kHz. (Below Limit) Perf. Verification					gs Under L	imit
Mod. to EUT	None		Test Perfe	ormed By	Dieter I	Baldamus	

4.1.2 Test Procedure

Spectrum Bandwidth was performed using the Conducted method. 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 Spectrum Bandwidth testing the lowest middle and highest channels.

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental was measured using 100kHz RBW and a VBW=100kHz. The 6dB bandwidth was measured and recorded.

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.



Report No.:		307625324.001	Page 12 of 65
	ry of Final Data		
NOTES:		Spectrum Bandwidth Low Frequency	
[例] 13:56:31 N MFR: SENS MARKER △ -1.65 MHz .86 dB		L: RADIO BRIDGE ACTV DET: PEAK MEAS DET: PEAK MKRA	
LOG REF 13.0	dBm		PREAMP ON
MA SB SC FC ACORR CENTER 2.40443 #JF BW 10			10.00 MHz 20.0 msec
9124 Bicon 3146 Log Per 3106 Horn	ANTE 3109 Bicon 3115 Horn CBL6112B Bilog	NNA/COUPLER: CBL6140 X-Wing JB3 Bilog NSLK 8126 LISN	☐ NNB-4/63TL LISN ☐ NNB-4/200X LISN ☐ MDS-21 Clamp
MEAS TYPE: Radiated Prescan Radiated Final Conducted Disturbance Power Other	POLARIZATION: Vertical Horizontal Line Neutral NA	DISTANCE: 3 Meter 10 Meter Meter NA	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other



		rrecisely hight.	
Report No.:	30	07625324.001	Page 13 of 65
	· · · · · · · · · · · · · · · · · · ·		1.190 10 11.00
NOTES:	C	neetwym Dandwidth	
		pectrum Bandwidth	
		Middle Frequency	
(Ap) 14:34:41	NDV 07, 2007 NSOR SWITCH MODEL:	00010 001000	
Mt K: St	NSDR SMITCH MODEL:	: RADIO BRIDGE	25
MARKER	Δ	ACTV DET: PEAK	ACC
-1.80 M	Hz	MEAS DET: PEAK	
-,02 de		MKR△	-1.80 MHz
			02 dB
LDG REF 13.	0 dBm		PREAMP DN
10	S S S		N N
dB/			
NTA	N _m		
50 dB		<u> </u>	
20 20	- 		
	- J	\ \	
	1 / 1		<u> </u>
MA SB	\sim		
SC FC	m OV	Ma	
CORR	NV	VM	<u> </u>
M	V	1 1 1	man
83			
CENTER 2.480	50 GHz	SPAN	20.00 MHz
	100 kHz #AUG BW :		20.0 msec
10 m.m. (m.m.)			
	ANTEN	NA/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 NA	Factory Floor
Other	NA Neutral		Other
Onici	11/14		



			Frecisely Hight.		
Re	port No.:		307625324.001		Page 14 of 65
110	port rion		001 02002 1100 1		7 ago 7 7 07 00
NOTES:			C4 D1-		
			Spectrum Bandy		
			High Frequer	ncy	
L					
(A) 14	1:50:24 N	IOV 07, 2007			
<u>حبت</u>					
	MARKER		ACTU DE	T: PEAK	
	2.48135 (3Hz		T: PEAK OP AVG	
	83.48 dB)			MKR 2.48135 GH	17
	00,70 00)	u v		63.48 dBu	
				22, 2 00,	
LDG I	REF 122.4	7 dR11			
100 I	ייםם ו	יעסט ש			
qB/	8	88			20
AIN	80 80	9) 9)	strong rem (s)	s) s) s)	
40 qB			Na line		
ן סטישר			y my want		
	0 0	- 		0 0	
			b		12
		7	1	the last	
MA SB	so (so)	My /	V	100	
SC FC	m	1 4		VInh	
CORR	m/			V	~
021.11	V				
-	8	60 80	69 69	0 0 0	
CENTER	2.48000	, сп-		SPAN 10.00 MH	1-
100,000,000,000,000,000,000	#]F BW 10		3 BW 100 kHz	SWP 20.0 mse	
,	יר אם זר א	עט אחע #ח∨	צעא שמד אם כ	SWI CE.E IIISE	۵۵.
			AIDENIA /COURT PR		
			NTENNA/COUPLER		- 4/20mz
9124 Bicon		3109 Bicon	CBL6140	_	B-4/63TL LISN
3146 Log P		3115 Horn	☐ JB3 Bilog		B-4/200X LISN
3106 Horn		CBL6112B Bilo	g NSLK 812	26 LISN	OS–21 Clamp
MEAS TYP	E:	POLARIZATIO	N: DISTANCI	E: LOCA	ATION:
Radiated P		Vertical	3 Meter		TS
Radiated F		Horizontal	10 Meter	=	ni-Anechoic
Conducted		Line	Met	=	elded Room
Disturbance		Neutral	NA NA		etory Floor
Other_	C I UWEI	NA	I INA		her
		L INA		OI	1161



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4.1.6 Tabulated Test Data

Radiated Emissions	Measure	ments				
Standard:	47 CFR 15	.247 (a) (2)			Date:	11/7/2007
Device Tested:	Sensor Sw	itch - Radio Brid	dge		File:	07110701- 6dB Bandwith.xls
				Minimum		
				Limit □□		
				(Average		
				+		
				Correction		
	Freq	6dB Bandwith	Minimum Limit	Factors -		
Meas #	(MHz)	(MHz)	(MHz)	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 Balo	lamus				
TUV Rheinland of North A	merica, Inc.	12 Commerce	Road Newt	own, CT 06	6470 Tel:(203) 4	426-0888 Fax: (203) 426-4009

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product endorsement by TUV Rheinland, NVLAP or any agency of the United States Government.



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4.1.7 Photos

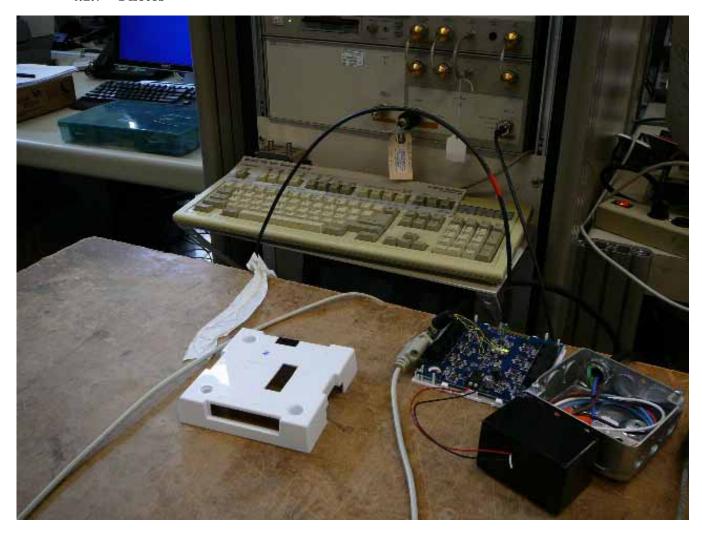


Figure 3 – Spectrum Bandwidth Test Setup



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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)						07/0/200)7
Standard	FCC Part 15.247 (a) (2	2)						
Product Model	Radio Bridge				Serial#	Prote	руре	
Configuration	See test plan for details							
Test Set-up	Tested in shielded room EUT placed on table see test plans for details						s for details	
EUT Powered By	AC/DC Adapter & Batteries	Tem	p	22°C	Humidit	y 45%	Pressure	998mbar
Frequency Range	2.405GHz - 2.480GH	$z \otimes z$	3m					
Perf. Criteria	1 Watt (30dBm) (Below Limit)	I	Perf. Verification			Readings Under Limit		
Mod. to EUT	None	7	Test Performed By			Dieter I	Baldamus	

4.2.2 Test Procedure

Maximum output power test was performed using the conducted method. The measurement was made using a direct connection between the RF transmitter output of the EUT and the spectrum analyzer. The cable loss and antenna factor were added to the measurement. Measurement of the duty yele were also made and used to calculate the average level. 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.

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.



Report No.	:	307625324.001		Page 18 of 65		
	nmary of Final Data	1				
NOTES:		Duty Cycle Measu	rement			
「%an 15:12:0	6 NOV 07, 2007					
MARKER 10.875 -2.15	Δ i msec	ACTV DE MEAS DE	ACTV DET: PEAK MEAS DET: PEAK QP AVG MKRA 10.875 msec -2.15 d <u>B</u>			
LDG REF 13	3.0 dBm		PREAMP DN			
ALN ALV	hund	W	Many			
VA SB SC FC CORR						
MMM	Munyahan	mayor and	CARROLL CO.			
CENTER 2,44 #]F BW		JG BW 100 kHz	SPAN 0 Hz #SWP 15.0 msec			
9124 Bicon 3146 Log Per 3106 Horn	☐ 3109 Bicon ☐ 3115 Horn ☐ CBL6112B Bilog	ANTENNA/COUPLER CBL6140 X-Wing JB3 Bilog NSLK 8126 LISN	NNB-	-4/63TL LISN -4/200X LISN -21 Clamp		
MEAS TYPE: Radiated Prescan Radiated Final Conducted Disturbance	POLARIZATION: Vertical Horizontal Line Neutral	DISTANCE: 3 Meter 10 Meter Meter NA	Shield			
Power Other	□ NA			r		



Report	No.:	307625324.001	Page 19 of 65				
NOTES:	D	uty Cycle Measurement					
<u>(</u> ∰) 15:17	2:40 NOV 07, 2007						
2.0	MARKER A 2.0250 msec -1.75 dB ACTV DET: PEAK MEAS DET: PEAK QP AVG MKRA 2.0250 msec -1.75 dB						
LOG REF 10 dB/	13.0 dBm		PREAMP ON				
ATN	Mund	W	Manuel				
VA SB —— SC FC CORR							
CENTER 2.	#]F BW 100 kHz #AVG BW 100 kHz #SWP 15.0 msec						
ANTENNA/COUPLER:							
9124 Bicon 3146 Log Per 3106 Horn	☐ 3109 Bicon ☐ 3115 Horn ☐ CBL6112B Bilog	CBL6140 X-Wing JB3 Bilog NSLK 8126 LISN	☐ NNB-4/63TL LISN ☐ NNB-4/200X LISN ☐ MDS-21 Clamp				
MEAS TYPE: Radiated Presca Radiated Final Conducted Disturbance Po Other	Wer Horizontal Line Neutral	DISTANCE: 3 Meter 10 Meter Meter NA	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other				



	110	clastry might.				
Report No.:	lo.: 307625324.001 Page 20 of 65					
NOTES:	Maxi	mum Output Power				
		Low Frequency				
[Z] All - 2ll - ll 0	NOV 97 2007					
<u>(</u> ፩፮) 14∶24∶49 ∫ MFR: SEN	SOR SWITCH MODEL:	RADIO BRIDGE				
MARKER		ACTV DET: PEAK				
2,40446		MEAS DET: PEAK I	QP AVG 0446 GHz			
3.77 dBm		ר.ם תתוו	3.77 dBm			
			36.66.3.86			
LDG REF 13.0	dBm	PI	REAMP ON			
qB/		64	N N			
ATN	1/1					
50 dB						

MA SB SC FC						
CORR		- L				
8		81 81 81				
CENTER 2.4054		SPAN 1	0.00 MHz			
#]F BW 1		MHz #SWP	500 msec			
		A/COUPLER:				
9124 Bicon 3146 Log Per	☐ 3109 Bicon ☐ 3115 Horn	CBL6140 X-Wing	NNB-4/63TL LISN			
3106 Horn						
MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:			
Radiated Prescan	Vertical	3 Meter	OATS			
Radiated Final	Horizontal	10 Meter	Semi-Anechoic Shielded Room			
Conducted Disturbance Power	Line Neutral	Meter NA	Shielded Room Factory Floor			
Other	□ NA		Other			



R	eport No.:			7625324.00					Page 21 of 65
NOTES:				kimum Ot Middle Fr					
(A) 1	5:06:35 1	NDV Ø7, 21	ð07						
	MARKER 2.44446 GHz 2.86 dBm ACTV DET: PEAK MEAS DET: PEAK QP AVG MKR 2.44446 GHz 2.86 dBm								
LDG 10	REF 13.0	dBn		s l s	To To		PREA	MP DN	
dB/ ATN 50 dB									
				e) (a)				67	
MA SB SC FC CORP									
CENTE	R 2,44459 #]F BW 1		#AVG BW 3	MHz				MHz msec	
			ANTENN						
9124 Bico 3146 Log 3106 Hor	Per	3109 Bio		□ ЈВЗ	L6140 X- Bilog LK 8126 I	Ü		=	3TL LISN 00X LISN Clamp
	Prescan Final	POLARIZ Vertical Horizon Line Neutral NA		DISTA 3 M 10 M NA				LOCATIO OATS Semi-An Shielded Factory Other	echoic Room



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NOTES:	M	laximum Output Power High Frequency					
MFR: SENSOR SWITCH MODEL: RADIO BRIDGE MARKER ACTV DET: PEAK 2.48050 GHz MEAS DET: PEAK OP AVG C.75 dBm MKR 2.48050 GHz 2.75 dBm							
LOG REF 10 dB/ ATN 50 dB	13.0 dBm	F	PREAMP DN				
MA SB SC FC CORR							
	CENTER 2.48050 GHz SPAN 20.00 MHz #]F BW 1.0 MHz #AVG BW 3 MHz SWP 20.0 msec						
9124 Bicon 3146 Log Per 3106 Horn	ANTEN 3109 Bicon 3115 Horn CBL6112B Bilog	NNA/COUPLER: CBL6140 X-Wing JB3 Bilog NSLK 8126 LISN	NNB-4/63TL LISN NNB-4/200X LISN MDS-21 Clamp				
MEAS TYPE: Radiated Prescar Radiated Final Conducted Disturbance Pow Other	Horizontal Line Neutral	DISTANCE: 3 Meter 10 Meter Meter NA	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other				



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4.2.6 Tabulated Test Data

Radiated Emission	ıs Measu	rements								
Standard:	47 CFR 15	.247(b) (3)		Pres	can/Final:	Final			Date:	11/7/2007
Device Tested:	Sensor Swi	tch - Radio E	Bridge		Distance:	0m, Direct	Measureme	nt	File:	07110707 Max Power.xls
	Freq	Measured Peak	Cable Correction		Antenna	Corrected Measured Average	Peak Limit	Peak	e.i.r.p. Peak	
Meas #	(MHz)	(dBm)	Factor	Duty Cycle	Gain	(dBm)	(30dBm)	(dB) □	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 Bald	amus								
TUV Rheinland of North	America, In	c. 12 Comr	nerce Road	Newtown	, CT 0647	Tel:(20	3) 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



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



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4.3 RF Human Exposure Limits

This test evaluates the RF Human Exposure to prove the safety of radiation harmfulness to human body.

4.3.1 Test Over View

Results	Complies (as tested	l per this	report)		Date	08/10/2	207
Standard	FCC Part 15.247 (b)(5)	and 1.1310	ı				
Product Model	Radio Bridge			Serial#	Protoy	pe	
Configuration	See test plan for deta	See test plan for details					
Test Set-up	Tested in shielded ro	Tested in shielded room EUT placed on table					
EUT Powered By	AC/DC Adapter & Batteries	Temp	22°C	Humidity	45%	Pressure	998mbar
Frequency Range	2.405GHz - 2.480G	Hz @ 3n	1				
Perf. Criteria	1.0 (mW/cm2) (Belo Limit)	ow	Perf. Verification		Readings under Limit		
Mod to EUT	None		Test Perf	ormed By	Dieter Baldamus		

4.3.2 Test Procedure

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Semi-Anechoic Chamber, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula (see section 4.9.6) and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

4.3.3 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)



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LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	Average Time (minutes)				
(A)Limits For Occupational / Control Exposures								
300-1500			F/300	6				
1500-100,000			5	6				
	(B)Limits For General Population / Uncontrolled Exposure							
300-1500			F/1500	6				
1500-100,000			1.0	30				

F = Frequency in MHz

4.3.4 Deviations

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

4.3.5 Antenna Gain

The maximum Gain measured in Semi-Anechoic Chamber is 2.14 dBi or 1.637 (numeric).

4.3.6 Test Results

Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement and the highest gain of the antenna. Limit for MPE (from FCC part 1.1310 table 1) is 1.0 mW/cm² for 2.4-2.483.5 GHz.

Highest Pout is 1.327 mW (1.23dBm), highest antenna gain (in linear scale) is 1.637, and R is 20cm.

 $Pd = (1.327*1.637) / (4*\pi*20^2) = 0.00432 \text{ mW/cm}^2$, which is 0.99568 mW/cm² below to the limit.

Sample Calculation

The Friis transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm₂

Pout = output power to antenna in mW

G = gain of antenna in linear scale

 $\pi \approx 3.1416$

R = distance between observation point and center of the radiator in cm

Ref.: David K. Cheng, Field and Wave Electromagnetics, Second Edition, Page 640, Eq. (11-133).



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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 teste	ed per this re	eport)		Date	10/09/200	7	
Standard	FCC Part 15.247 (c),	15.205, 15.20	9					
Product Model	Radio Bridge			Serial#	Protoy	rpe		
Configuration	See test plan for de	See test plan for details						
Test Set-up	Tested in shielded	Tested in shielded room EUT placed on table						
EUT Powered By	AC/DC Adapter & Batteries	Temp	22°C	Humidity	45%	Pressure	998mbar	
Frequency Range	2.405GHz - 2.480	GHz @ 3m						
Perf. Criteria	-20dBc, 15.205 (a)	, 15.209 (a)	5.209 (a) Perf. Verifica		Readings under Limit			
Mod to EUT	None Test Performed By			Dieter	Baldamus			

4.4.2 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.

4.4.3 Deviations

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

4.4.4 Final Test

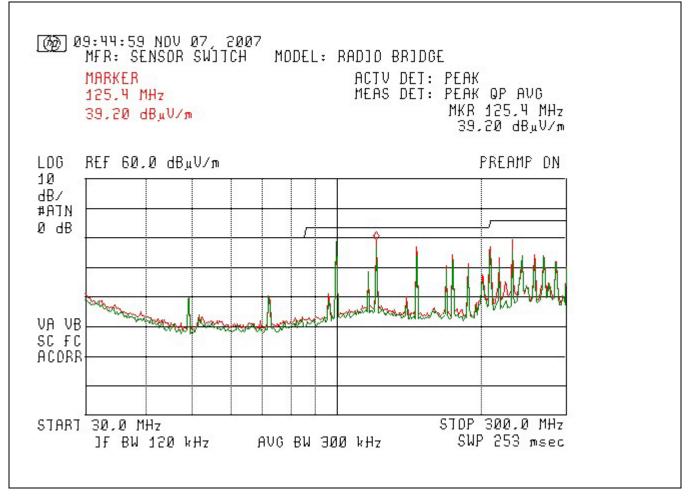
The Radiated Spurious Emissions of the EUT were below the limits specified in the standard.



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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: Radiated Prescan Radiated Final Conducted Disturbance Power Other	POLARIZATION: Vertical Horizontal Line Neutral NA	DISTANCE: 3 Meter 10 Meter Meter NA	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other



Frecisely night.						
Report No.:	307625324.001	Page 29 of 65				
NOTES:	iona Emissiona Busasan					
Kadiated Sp	ourious Emissions Prescan					
(ሕጅ) 09:49:11 NOV 07, 2007						
(፴፮) 09:49:11 NDV 07, 2007 MFR: SENSOR SWJJCH MOD	EL: RAD]O BR]DGE					
MARKER	ACTV DET: PEAK					
301.2 MHz	MEAS DET: PEAK QP					
50.52 dBµV/m	MKR 301 50.52	dBuV/m				
	15.50.5.5	sādāk ses				
LOG REF 60.0 dBuV/m	PRE!	AMP DN				
10 dB/						
#ATN PATN						
Ø dB						
11, 11, 11, 11, 11, 11, 11, 11, 11, 11,		L A				
		A hale				
Marie Park Marie Marie Land Land Land Land	W M M M M M M M M M M M M M M M M M M M					
VA VB						
SC FC						
ACORR						
START 300.0 MHz	STOP 1.00					
]f BW 120 kHz AVG B	W 300 kHz SWP 65	6 msec				
ANTI	ENNA/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:		LOCATION:				
Radiated Prescan Radiated Final Vertical Horizontal	3 Meter 10 Meter	OATS Semi-Anechoic				
Conducted Line	Meter	Shielded Room				
Disturbance Power Neutral	NA	Factory Floor				
Other NA		Other				



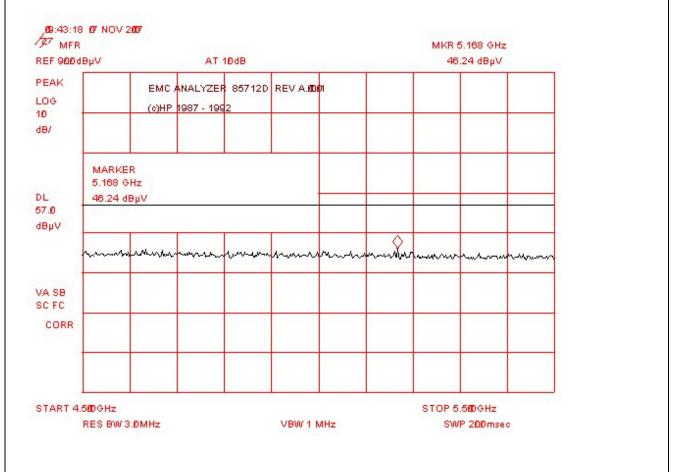
Report No.:	307625324.001	Page 30 of 65						
NOTES:	Radiated Spurious Emissions Prescan	ı						
@ 09:55:54 NOV 0 MFR: SENSOR S MARKER 1.076 GHz 35.60 dBµV/m								
LDG REF 60.0 dBuV 10 dB/ #ATN 0 dB	/m	PREAMP ON						
VA VB SC FC ACORR								
START 1.000 GHz JF BW 1.0 MH	START 1.000 GHz START 1.000 GHz JF BW 1.0 MHz AVG BW 3 MHz SWP 20.0 msec							
ANTENNA/COUPLER:								
3146 Log Per :	□ 9124 Bicon □ 3109 Bicon □ CBL6140 X-Wing □ NNB-4/63TL LISN □ 3146 Log Per □ 3115 Horn □ JB3 Bilog □ NNB-4/200X LISN							
Radiated Prescan Radiated Final Conducted Disturbance Power	ARIZATION: DISTANCE:	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other						



			Precisely Ri	ght.	
Report No.	:		307625324.0	001	Page 31 of 6
OTES:	R	adiated Spur	ious Emiss	ions Prescan	
9 9:36:23 9 7 NOV 2 У мгк REF 900 dBµV	oo r AT 1	ØdB	in in	MKR 2.2217 GH 46.29 dBµ	
PEAK LOG 10 dB/	EMC ANALYZER (c)HP 1987 - 199	85712D REV A.8	io dri		
MARKEI 2.2217 (DL 46.29 dE 57.0 dBµV	3Hz			SRQ 140	
MA VB SC FC CORR	makan kerupatan mentakan terpendan tet	, open som	actor of the same and		in response to the second of the
START 2.0000 GHz	ОМН	VBW 1	MHz	STOP 2.4850/9 Hz SWP 2000 m	
		50.10	NA/COUP	Shortenan	
9124 Bicon 3146 Log Per 3106 Horn		lorn 112B Bilog	☐ JB	3 Bilog LK 8126 LISN	NNB-4/63TL LISN NNB-4/200X LISN MDS-21 Clamp
EAS TYPE: Radiated Prescan Radiated Final Conducted Disturbance Power	Vertice Horizo Line	ontal	⊠ 3 N	Meter Meter	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor



TO, 7771 SSILLITINOUT	Precis	sely Right.					
Report No.:	30762	307625324.001					
NOTES: Radiated Spurious Emissions Prescan							
Radiated Spurious Emissions 1 reseau							
,09:43:18 07 N OV 2 007							
THE MER		MKR 5.168 GHz					
REF 900dBµV	AT 10dB	46.24 dBµV					



ANTENNA/COUPLER:								
9124 Bicon	3109 Bicon	CBL6140 X-Wing	NNB-4/63TL LISN					
3146 Log Per		☐ 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	│	Factory Floor					
Other	□ NA		Other					



		Precisely Right.	
Report No.:		307625324.001	Page 33 of
OTES:	Radiated Spur	ious Emissions Prescan	
09:45:48 07 NOV 2007 /д7 мfR REF 9000 dBµV	AT 10dB	MKR 7.9 52.2	915 GHz 7 dBµV
PEAK LOG 10 dB/	EMC ANALYZER 85712D REV A.I (c)HP 1987 - 1992	100 (pri	
MARKER 7.915 GHz DL 52.27 dBμV 57.0			
	and a spherology in the property was the	South State of the Control of the Co	A CONTRACTOR OF THE CONTRACTOR
SC FC CORR			
START 5.679 GHz RES BW 3.0N	1Hz VBW 1	STOP 10000 MHz SWP	GHz 86.4 msec
	ANTEN	NA/COUPLER:	
9124 Bicon 3146 Log Per 3106 Horn	☐ 3109 Bicon ☐ 3115 Horn ☐ CBL6112B Bilog	☐ CBL6140 X-Wing ☐ JB3 Bilog ☐ NSLK 8126 LISN	☐ NNB-4/63TL LISN ☐ NNB-4/200X LISN ☐ MDS-21 Clamp
EAS TYPE: Radiated Prescan Radiated Final Conducted Disturbance Power	POLARIZATION: Vertical Horizontal Line Neutral	DISTANCE: 3 Meter 10 Meter Meter NA	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor



			Pred	isely Right.		
Report No.:		307625324.001			Page 34 of 6	
OTES:		Radiated	l Spurious	Emissions	Prescan	
Ø:48:59 Ø NOV У МFR REF 900 dBµV		#AT ØdB			MKR 1 <u>0</u> 938 6 41,99 de	
PEAK LOG 10 dB/	EMC ANA (c)HP 1987	LYZER 85712D 7 - 1992	REV A.80001			
МАКК 18938 DL 41.99 57.8 dBµV	GHz					
VA MB SC FC CORR	u annimor de	her constitution of	boath agus agus d	Lane mors between	and the second s	winds and and and and
START 10000 GHz #RES BW	1.0MHz		VBW/300kHz		STOP 13.000 GH; SWP 600	
9124 Bicon			NTENNA/	COUPLER	:: 0 X-Wing	□ NNB-4/63TL LISN
3146 Log Per 3106 Horn EAS TYPE:		3115 Horn CBL6112B Bild LARIZATIO		JB3 Bilo	g 126 LISN	NNB-4/200X LISN MDS-21 Clamp LOCATION:
Radiated Prescan Radiated Final Conducted Disturbance Powe	er \begin{aligned} alig	Vertical Horizontal Line Neutral NA		3 Meter 10 Meter Me	r	OATS Semi-Anechoic Shielded Room Factory Floor Other



10.7771 8	SILA I KUUI		Pred	isely Right.			
Report No.:			307625324.001				Page 35 of 65
NOTES:		Radiated	d Spurious	Emissions	Prescan		
19 :51:22 07 19 7 MFR REF 900 dBp\		#AT ØdB	p - 8p	20	MKR 17.298 43.32 d		
PEAK LOG 10 dB/	1000	ANALYZER 85712D 1987 - 1992	REV A.MON				
1	MARKER 7.2986Hz 13.32 dBµV						
VA MB SC FC CORR	meestad on the second of the	Andrew Control of the State of	pelankeelseen netspeel	industrial and the second	and the common security to the common securit	whenever	
START 13.000 #RES	0GHz S BW 1.0MHz		VBW 3 0 kHz		STOP 19.000GI SWP 12		
70124 D:			NTENNA/	COUPLE			ATEL LYON
9124 Bicon 3146 Log Per 3106 Horn		☐ 3109 Bicon ☐ 3115 Horn ☐ CBL6112B Bild		JB3 Bild	0 X-Wing og 126 LISN	=	3TL LISN 00X LISN Clamp
MEAS TYPE Radiated Pro Radiated Fin Conducted Disturbance Other	escan aal	POLARIZATION Vertical Horizontal Line Neutral NA	ON:	DISTANC 3 Meter 10 Mete Mo NA		LOCATIO OATS Semi-An Shielded Factory Other	echoic Room



10.7791-	SSIEATKUUT		Pred	isely Right.			
Rep	ort No.:		3076	25324.001		Page 36	of 65
NOTES:		Radiated	d Spurious	Emissions I	Prescan		
09:53:13 (F) MFR REF 9000dB	97 NOV 2807 JV	#AT ØdB			МКR 19.3422 GH: 43.55 dBµ		
PEAK LOG 10 dB/		NALYZER 85712D 1987 - 1992	REVA.MOM				
DL 57.0	STOP 19.4786 GHz						
MA VB	a Danie a Constantina de la constantin	hasseness Alvelias survey	- was the grade of the day of	electrocking Americans	Apricamental and the control of the	decention	
SC FC CORR							
START 19.8 #RE	MDGHz S BW 1.0MHz		VBW 300kHz		TOP 19.4786 GHz SWP 200m:		
		A	NTENNA/	COUPLER:	<u> </u>		
9124 Bicon 3146 Log Pe 3106 Horn	er	3109 Bicon 3115 Horn CBL6112B Bild		CBL6140 JB3 Bilog NSLK 81	X-Wing	☐ NNB-4/63TL LISN ☐ NNB-4/200X LISN ☐ MDS-21 Clamp	
MEAS TYPI Radiated Pi Radiated Fi Conducted Disturbance Other	rescan nal	POLARIZATION Vertical Horizontal Line Neutral NA	ON:	DISTANC 3 Meter 10 Meter Meter NA		LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other	



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4.4.6 Tabulated Test Data

Radiated Sp								2222244	F10.1.4.1	F: 1			7/5/000
Standard:	47 CFR 15.3						· · · · ·	PRESCAN		Final		Date:	7/5/200
Device Tested:	Sensor Switch	h, Radio B	ridge with (Cables, 120	VAC / 60 H	Z			Distance:	3.0m		File:	08060702.xls
		IVI	easured Le	Vei			-		Antenna +				-
Meas#	Freq (MHz)	Peak	Quasi- Peak	Average	Quasi- Peak Limit	Peak Limit (- 20dBc)	Average Limit	Minimum Delta	Cable Correction Factor (included in measured levels)	Result	Antenna Polarization	Angle (degrees)	Antenna Heig (m)
RBW=120kHz, \	BW=300kHz												
1	53.8711	44.10	25.65	17.87	39.10			-13.45	7.55	Complied	Vertical	356	1.54
2	63.5000	44.17	33.96	3.98	39.10		1	-5.14	6.27	Complied	Vertical	2	1.25
3	72.0000	33.08	27.74	21.03	39.10			-11.36	6.56	Complied	Vertical	203	1.87
4	75.0000	31.14	26.67	20.48	39.10			-12.43	6.81	Complied	Vertical	357	1.00
5	275.0497	31.03	26.50	25.15	46.40			-19.90	13.22	Complied	Vertical	214	2.24
6	300.0545	48.77	45.70	42.45	46.40			-0.70	14.22	Complied	Vertical	248	2.47
7	638.3527	25.32	18.89	12.11	46.40			-27.51	19.23	Complied	Vertical	NA	NA
8	725.0000	24.82	18.65	12.13	46.40			-27.75	18.8	Complied	Vertical	182	1.85
Radiated Sp	urious Em	issions I	leasuren	nents			1						
Standard:	47 CFR 15.3							PRESCAN	or FINAL:	Final		Date:	7/5/200
Device Tested:	Sensor Switch				VAC / 60 H	Z			Distance:	3.0m		File:	
		,	I						1				
		М	easured Le	vel									
Meas#	Freq (MHz)	Peak	Quasi- Peak	Average	Quasi- Peak Limit	Peak Limit (- 20dBc)	Average Limit	Minimum Delta	Antenna + Cable Correction Factor (included in measured levels)	Result	Antenna Polarization	Angle (degrees)	Antenna Heig
IVICAO II	1 109 (111112)	1 oak	1 our	7 W Grago	Lilling	Zoubo)	Linni	Dona		rtoouit	1 Glanzation	(dogreco)	()
RBW=1MHz, VB	W=1MHz						1						1
1	2405.2177	81.58	80.73	63.08					27.6	Fundamental	Vertical	15	1.00
2	2400.0000	50.86	47.55	36.44		61.58	53.98	-17.54	27.6	Complied	Vertical	10	1.00
3	4809.1000	40.64	38.45	35.11		61.58	53.98	-18.87	12.7*	Complied	Vertical	10	1.10
4	7214.0000	40.45	38.44	35.12		61.58	53.98	-18.86	14.5*	Complied	Vertical	25	1.00
5	2444.5000	82.44	81.55	62.55					27.6	Fundamental	Vertical	32	1.00
6	4891.0000	41.50	38.45	35.44		62.44	53.98	-18.54	12.7*	Complied	Vertical	18	1.00
7	7336.9000	40.80	38.78	34.98		62.44	53.98	-19.00	14.5*	Complied	Vertical	26	1.00
8	2480.4800	82.05	81.54	63.44					27.6	Fundamental	Vertical	355	1.10
9	2485.3000	51.25	48.45	45.55		62.05	53.98	-8.43	12.7*	Complied	Vertical	5	1.00
10	4959.3000	40.89	38.47	35.04		62.05	53.98	-18.94	12.7*	Complied	Vertical	5	1.12
11	7441.4400	41.05	39.05	34.96		62.05	53.98	-19.02	14.5*	Complied	Vertical	356	1.00
										•			
Tested by:	Dieter Baldar	mus											
TUV Rheinland o	of North Amer	ica, Inc. 1	2 Commerc	ce Road	Newtown,	CT 06470	Tel:(203)	426-0888	Fax: (203)	426-4009			

The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TUV Rheinland test mark. This report must not be used by the applicant to claim product endorsement by TUV Rheinland, NVLAP or any agency of the United States Government.



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4.4.7 Photos



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



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Figure 6 - Radiated Spurious Emissions Test Setup (Radiated Final Test - OATS)



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4.5 Transmitter Power Density Spectrum

This test is to evaluate

4.5.1 Test Over View

Results	Complies (as teste	Date	e 0	7/0/20	07				
Standard	FCC Part 15.215 (b)								
Product Model	Radio Bridge				Serial#	Prot	oype		
Configuration	See test plan for de	tails		<u>.</u>					
Test Set-up	Tested in 3m cham	Tested in 3m chamber EUT placed on table See test plan for details							
EUT Powered By	AC/DC Adapter & Batteries	Temp	22°C	Н	umidity	45%	Press	sure	998mbar
Frequency Range	2.405GHz - 2.480	GHz @ 3	m					·	
Perf. Criteria	8dBm in a 3kHz B	8dBm in a 3kHz BW Perf. Verification Readings under Limit							
Mod to EUT	None		Test P	erfo	rmed By	Dieter	Balda	ımus	

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

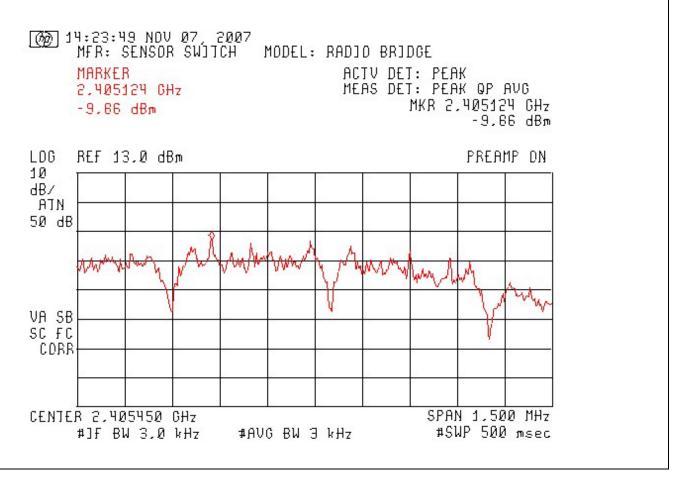
The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.



Daniel Mail	20722504 204	D 14 -f 0F
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4.5.5	Summary	v of Final	Data

NOT	ES:
	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							



ter Power Density Measurement								
MARKER ACTV DET: PEAK PEAK								
	PREAMP ON							
wal programmy	AAM							
V								
	1,500 MHz							
IG BW 3 kHz SW	P 500 msec							
ANTENNA/COUPLER:								
CBL6140 X-Wing JB3 Bilog NSLK 8126 LISN	☐ NNB-4/63TL LISN ☐ NNB-4/200X LISN ☐ MDS-21 Clamp							
ON: DISTANCE: 3 Meter 10 Meter Meter NA	LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor Other							
il	MEAS DET: PEAK MKR 2.1 SPAN JG BW 3 kHz SPAN SW ANTENNA/COUPLER: CBL6140 X-Wing JB3 Bilog NSLK 8126 LISN ION: DISTANCE: 3 Meter 10 Meter Meter							



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NOTES:	Transmitter Power Density Measurement	
MARKER 2.479494 GH -9.25 dBm LOG REF 15.0 dH 10 dB/ ATN 40 dB	ACTV DET: PEAK MEAS DET: PEAK QP AVG MKR 2,479494 GHz -9,25 dBm	
CENTER 2,460000 #JF BW 3.0		
9124 Bicon	ANTENNA/COUPLER: 3109 Bicon CBL6140 X-Wing NNB-4/63TL LISN	
3146 Log Per 3106 Horn	S109 Bicon	
	POLARIZATION: DISTANCE: LOCATION:	
Radiated Prescan Radiated Final Conducted Disturbance Power Other	✓ Vertical ✓ 3 Meter ☐ OATS ☐ Horizontal ☐ 10 Meter ☐ Semi-Anechoic ☐ Line ☐ Meter ☑ Shielded Room ☐ NA ☐ Factory Floor ☐ Other ☐ Other	



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4.5.6 Photos



Figure 7 – Transmitter Power Density Spectrum (Semi-Anechoic Chamber 2)



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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)	er this re	eport)			Date	07/0/2007	7
Standard	FCC Part 15.207							
Product Model	Radio Bridge			Seria	al#	Protoy	/pe	
Configuration	See test plan for detail	S						
Test Set-up	Tested in shielded room	Tested in shielded room EUT placed on table						
EUT Powered By	AC/DC Adapter & Batteries	Temp	22°C	Hun	nidity	45%	Pressure	998mbar
Frequency Range	120V/60Hz, 0150-30N	ИHz						
Perf. Criteria	FCC Part 15.207 (a)	FCC Part 15.207 (a) Perf. Verification Readings Under Limit for L1 and L2						
Mod. to EUT	None	Test P	erformed	l By	Dieter	Baldaı	nus	

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.



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4.6.5 Final (Graph		
NOTES:	Conducted Emi	issions @ 120V/60Hz	
9124 Bicon	ANTENN 3109 Bicon	A/COUPLER: CBL6140 X-Wing	NNB-4/63TL LISN
3146 Log Per 3106 Horn	3115 Horn CBL6112B Bilog	JB3 Bilog NSLK 8126 LISN	NNB-4/200X LISN MDS-21 Clamp
MEAS TYPE:	POLARIZATION:	DISTANCE:	LOCATION:
Radiated Prescan	Vertical	3 Meter	OATS
Radiated Final Conducted	Horizontal Line	10 Meter Meter	Semi-Anechoic Shielded Room
Disturbance Power	Neutral	NA NA	Factory Floor
Other	□ NA		Other



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4.6.6 Final Tabulated Data at 120V/60Hz

Conducted E	missions	Measurem	ents									
Standard:	EN55022:1998, Class B/FCC Part 1			5.107 (a)						Date:	11/9/2007	
Device Tested:	Sensor Sw	itch - Radio Br	idge							File: .xls	07110902 CE120)V.xls
Voltage:	120V/60Hz											
Signal Num	Freq	Peak Amp	QP Amp	Avg Amp	QP Limit	Avg Limit	Conductor	QP U	QP Result	Avg∪	Average Result	Mode
	MHz	dBuV	dBuV	dBuV	dBuV	dBuV		dB		dB	Ŭ	
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 Balo	lamus										
TUV Rheinland	of North Am	erica, Inc. 12	Commerce	Road N	lewtown, C	T 06470	Tel:(203) 4	26-0888 Fa	x: (203) 426-4009		CE22	_B.xlt Revised 13APR05



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4.6.7 Photos

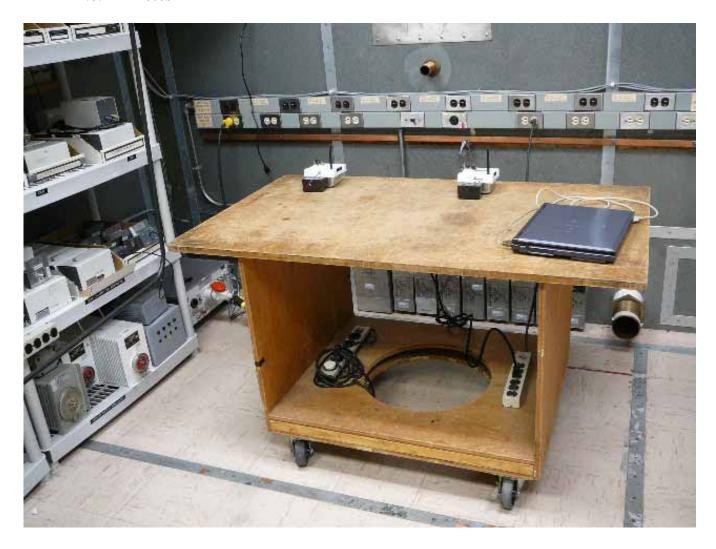


Figure 8 - Conducted Emissions Test Setup



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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 teste	ed per this	Date	10/09/200)7			
Standard	FCC Part 15.215							
Product Model	Radio Bridge			Serial#	Protov	ype		
Configuration	See test plan for de	tails				•		
Test Set-up	•	Tested in shielded room. See test plans for details						
EUT Powered By	AC/DC Adapter & Batteries	Temp	22°C	Humidity	45%	Pressure	998mbar	
Frequency Range	2.405 GHZ – 2.480)GHz	Tempera	ture Range	0°C –	70°C		
Perf. Criteria	Containment of 200 frequency range	dB of	Perf. Verification Readings under Limit			imit		
Mod to EUT	See section 5.5		Test Perf	ormed 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.



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4.7.5 Summary of Final Test Results

	tability Test - Ten	iperature Variati	ons			
Standard:	FCC Part 15.225 e)			Date:		
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℃	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℃	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℃	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	c. 12 Commerce R	oad Newtown, C	T 06470 Tel:(20	3) 426-0888 Fax: (203) 426-4009	

FCC TempStab.xlt Revised 24APR08

Frequency S	tability Test - Volt	age 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
ested by:	Dieter Baldamus					
UV Rheinland	of North America, Inc	c. 12 Commerce Ro	oad Newtown, C	CT 06470 Tel:(203) 426-0888 Fax: (203) 426-4009	
	<u>-</u>		<u> </u>			ECC TempStab xlt Revised 24AP

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4.7.6 Photos



Figure 9 – Frequency Stability Test Setup – Temperature Chamber at +50°C



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Figure 10 – Frequency Stability Test Setup – Humidity Chamber at 0°C



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4.8 Band Edge Measurement

This test evaluates the band edge of the fundamental signal in each of the lowest, middle and highest transmission frequency.

4.8.1 Test Over View

Results	Complies (as tested per this report)				Date	05/13/200	8
Standard	FCC Part 215 c)/RS	SS-210					
Product Model	Radio Bridge Serial#			Protoy	pe		
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	22° C	Humidity	45%	Pressure	1001mbar
Perf. Criteria	6dB and 99% Band Edge		Perf. Verification		Readings within Limit		
Mod to EUT	None	-	Test Performed By		Dieter Baldamus		

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. Readings 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

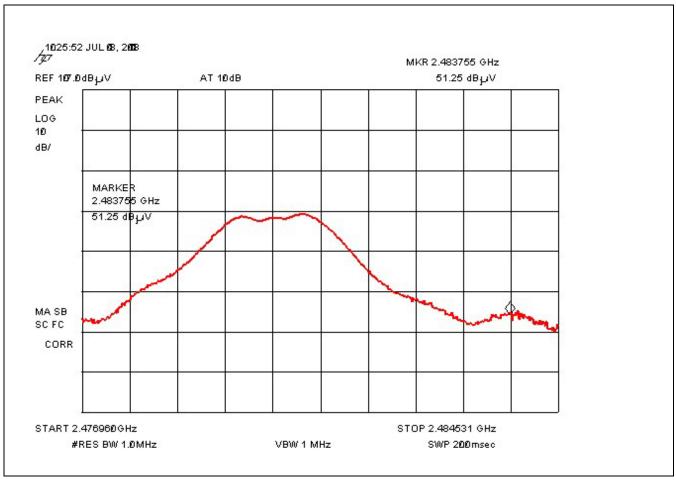
The Band Edge Measurements were within the limits specified in the standard.



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4.8.5 Graphs

NOTES:		
	Band Edge Measurement	
	(Radiated)	



	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 Neutral	□ NA	Factory Floor			
Other	□ NA		Other			



Precisely Right.						
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NOTES:	NOTES: Band Edge Measurement (Radiated)					
12:24:09 JUL 08, 2008 197 REF 97.0dBpV	#AT ØdB	МК	R 2.44000810 GHz 51086 dB µV			
PEAK LOG 10 dB/						
MARKER 2.400080 GHz 5086 dE µV	- Contract to					
MA SB SC FC	Le Ullima de la companya della companya della companya de la companya de la companya della compa					
CORR						
START 2.3995 0 0 GHz #RES BW 1.0 MHz	VE	STOF 9W 1 MHz	° 2.468786 GHz SWP 2010 msec			
9124 Bicon 3146 Log Per 3106 Horn		ΓΕΝΝΑ/COUPLER: CBL6140 M JB3 Bilog NSLK 8126	_	NNB-4/63TL LISN NNB-4/200X LISN MDS-21 Clamp		
MEAS TYPE: Radiated Prescan Radiated Final Conducted Disturbance Power	POLARIZATION Vertical Horizontal Line Neutral	DISTANCE 3 Meter 10 Meter Meter NA		LOCATION: OATS Semi-Anechoic Shielded Room Factory Floor		



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4.8.6 Tabulated Test Data

Radiated Emi	ssions Me	asurement	ts					
Standard:	47 CFR FC	47 CFR FCC Part 15.215 c)/RSS-210		PRESCA	N or FINAL:	Final	Date:	5/13/2008
Device Tested:	Sensor Swit	tch - Radio Br	idge		Distance:	10m	File Name:	0805301Bandedge.xls
Mode:	Normal Ope	eration						
Mount:	Table Top							
Modifications:	NA							
			Measured Leve	el				
					99%			
					Measured			
	1 1		-20dB High	+20dB High	Bandwith			
Meas #	TX Band	Peak	End (MHz)	End (MHz)	(MHz)	Band (MHz)	Result	Comment
RBW = 9kHz VBV	V=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 Balda	amus						
TUV Rheinland of			ommerce Roa	d Newtown	, CT 06470	Tel:(203) 426	6-0888 Fax: (2	203) 426-4009



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4.8.7 Photos

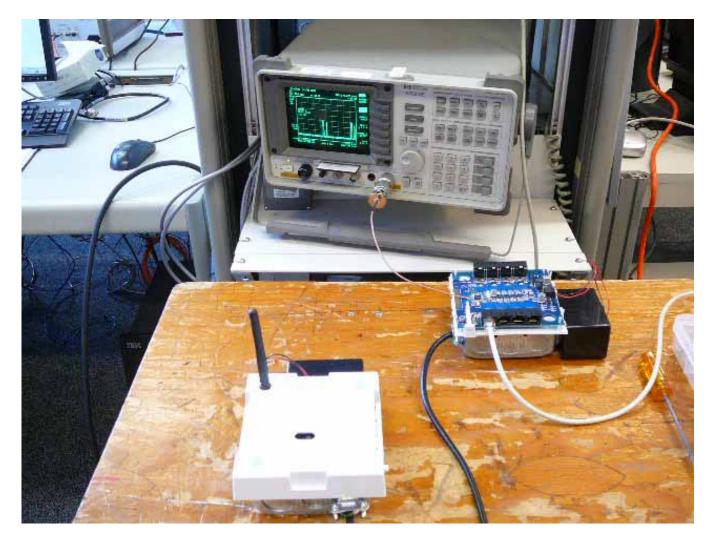


Figure 11 -Bandedge Measurement Test Set-up



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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		



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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	

5.7 Countries

\boxtimes	USA
	Taiwan
	Japan
	Europe

^{*}Check all that apply

^{*}Check all that apply



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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 e), RSS-210	Band Edge Measurement		



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5.9 General Product Information

Size (Transmitter)	Н	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 Block)

5.10.2 Power Information

Name	Туре	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.

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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 5 th Harmonic or 40GHz (2.4GHz)

5.14 Electrical Support Equipment

Туре	Manufacture	Model	Connected To
NA	NA	NA	NA

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Item		7	Notes		
NA	NA	1	Total		
5.16 EUT Equip	oment/Cabling Inf	formation			
EUT Port	Connected To	Location		Cable Type	
			Length	Shielded	Bea
15-24VDC Input	AC/ DC Terminal Block	Tx/ Rx	1.5m	No	No
		1	1		
5.17 EUT Door	rs				
None None					
None For ser	rs vice personnel only or will wear ESD st				

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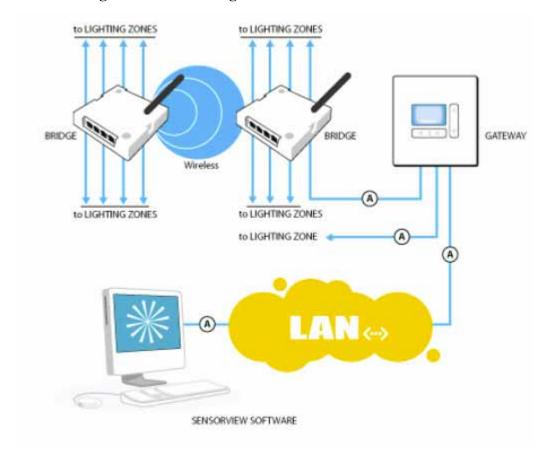
5.19 EUT Test Program

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



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5.22 Constructional Data Form

TUV Rheinland				Please submit in duplicate		
D-51101 Köln 91		Gen-Ausw-Nr.		Aktenzeichen:		Anlage-Nr.
			3076	62324.001 Sensor Switch - Radio Bridge	Rev 2	1 of 1
Am Grauen Stein/						
Konstantin-Wille	-Str. 1			DAGGERAY		
			Cons	EMC/EMV structional Data Form		
Item Listing No. & Location in EUT		Component Sub-Assemb		Part No. & Description	Freq.; ERP/A	
1.0	Enclos	ure		Plastic	N.	A
2.0	Antenr	na		AN -A2	2.14	dBi
TUV Rheinland	Prüfstelle	für Gerätesiche	rheit	Applicant Ort/place: Datum/date:		
Köln, den:				Ort/place: Datu	m/aate:	
(repo	rt copy no	ot signed)		(report copy not signed	l)	
(report copy not signed) TUV Rheinland Prüfstelle für Gerätesicherheit				(Stempel und Unterschrift des Anti- stamp and signature of applie		

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