Certification Application Report
FCC Part 15.245

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		Sensys Traffic AB Tel: +46 36 342987 Slottsgatan 14 553 22 Jönköping, Sweden Contact: Patrick Chiocchio	
FCC ID	PBVRS242	**Test Report Date**	May 31, 2013
Platform	N/A	**RTL Work Order #**	2013054
Model	RS242	**RTL Quote #**	QRTL13-054B
American National Standard Institute	ANSI C63.4: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
FCC Classification	FDS: Field Disturbance Sensor		
FCC Rule Part(s)/ Guidance	FCC Rules Part 15.245: Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz (10-01-12)		
Digital Interface Information:	Digital Interface was found to be compliant		

Frequency Range (MHz)	Output Power* (W)	Frequency Tolerance	Emission Designator
24084.48 – 24161.28	N/A	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15 and ANSI C63.4.

Signature: _____ Date: May 31, 2013

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

This is an original FCC certification application report.

Applicable Standards:

- FCC Part 15.245: Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz

1.2 Description of EUT

Equipment Under Test	Sensor
Model	RS242
Power Supply	External 12 VDC
Modulation Type	FMCW
Frequency Range	24084.48 – 24161.28 MHz
Antenna Connector Type	N/A
Antenna Type	Array Antenna

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4-2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for Sensys Traffic AB, Inc., Model: RS242, FCC ID: PBVRS242.

1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), three channels were tested.

2.2 Exercising the EUT

The EUT was supplied with test firmware so that the EUT would continuously transmit during testing. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions.

2.3 Test Result Summary

Table 2-1: Test Result Summary

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.245(b)	Field Strength of Fundamental and Harmonics	Pass
FCC 15.215(c)	20 dB Bandwidth	N/A

2.4 Test System Details

The test samples were received on May 1, 2013. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

Table 2-2: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Radar Sensor	Sensys Traffic AB	RS242	947DA9130000	PBVRS242	10.2m shielded; 1m unshielded	21041
Radar Sensor	Sensys Traffic AB	RS242	3467A9130000	PBVRS242	10.2m shielded; 1m unshielded	20847
Radar Sensor with termination	Sensys Traffic AB	RS242	C32FA9130000	PBVRS242	10.2m shielded; 1m unshielded	20848

2.5 Configuration of Tested System

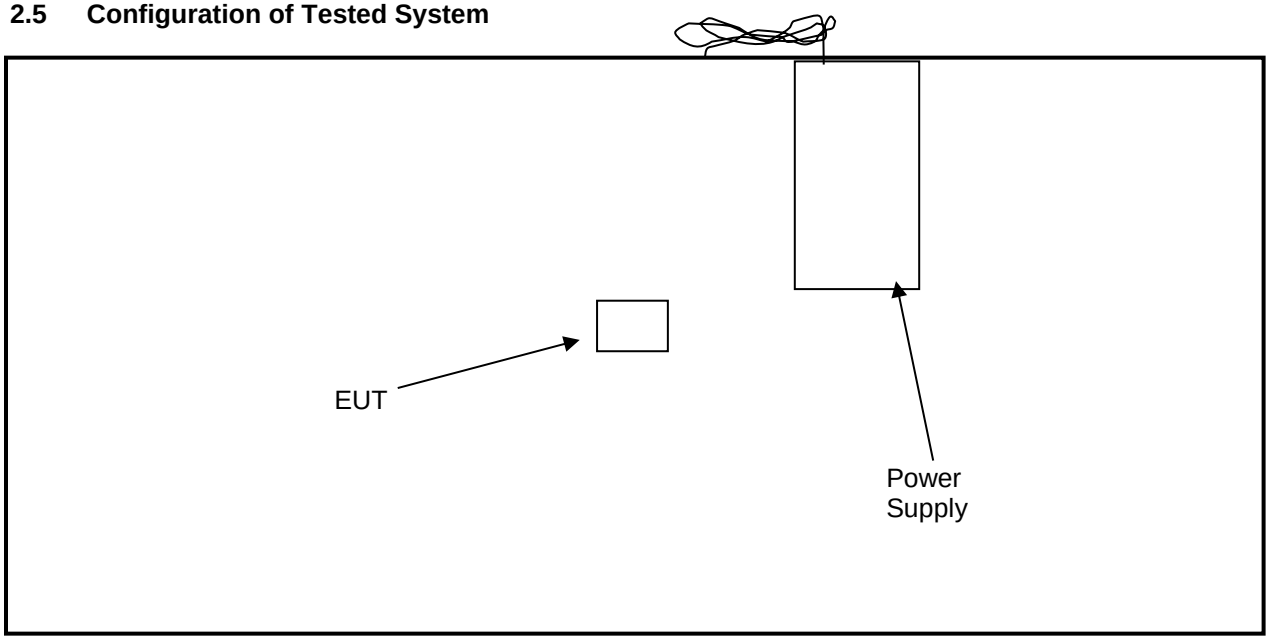


Figure 2-1: Configuration of System Under Test

3 Radiated Emissions – FCC 15.209, 15.245(b)

3.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
10,500 – 10,550 (fundamental)	2,500,000	3
harmonics	25,000	3

As shown in 15.35(b), for frequencies above 1,000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any circumstances of modulation.

3.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to 100 GHz per FCC 15.33(2).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 3-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	10/1/13
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	8/10/13
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	8/20/13
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20’	NA	8/16/13
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/16/13
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/16/13
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz – 6.5 GHz)	3325A00159	9/20/13
900914	Hewlett Packard	8546OA	RF Filter (100 kHz - 6.5 GHz)	3330A00107	9/20/13
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/19/14
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	4/19/14
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	4/19/14
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	4/19/14
901218	EMCO	3160-09	Horn Antenna (18 - 26 GHz)	960281-003	4/19/14
901303	EMCO	3160-10	Horn Antenna (26.5 - 40.0 GHz)	960452-007	6/14/13
901256	ATM	19-443-6R	Horn Antenna (40 - 60 GHz)	8041704-01	4/19/14
900717	Hewlett Packard	11970U	Harmonic Mixer 40 – 60 GHz	2332A01110	10/29/13
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	2/6/14
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	2/6/14
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	2/2/14
900126	Hewlett Packard	11970A	Harmonic Mixer (26 - 40 GHz)	2332A01199	10/29/13
900715	Hewlett Packard	11970V	Harmonic Mixer (50 - 75 GHz)	2521A00512	10/29/13
900712	ATM	15-443-6R	Horn Antenna (50 - 75 GHz)	8051805-1	2/6/14
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	9/20/13
900914	Hewlett Packard	8546OA	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	9/20/13

3.3 Radiated Emissions Test Results

Table 3-2: Radiated Emissions Test Data (Fundamentals)

Emission Frequency (MHz)	Peak Analyzer Detector (dBuV/m)	Average Analyzer Detector (dBuV/m)	Site Correction Factor (dB/m)	Corrected Analyzer Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Limit (dBuV/m)	Average Margin (dB)
24084.596	62.0		51.8	113.8	148.0	-34.2		
24084.596		61.3	51.8	113.1			128.0	-14.9
24115.150	62.7		52.5	115.2	148.0	-32.8		
24115.150		61.8	52.5	114.3			128.0	-13.7
24161.200	62.2		51.8	114.0	148.0	-34.0		
24161.200		61.4	51.8	113.2			128.0	-14.8

3.4 Radiated Emissions Harmonics/Spurious Test Data

Table 3-3: Radiated Emissions Harmonics/Spurious (Low Channel)

Emission Frequency (MHz)	Peak Analyzer Detector (dBuV/m)	Average Analyzer Detector (dBuV/m)	Site Correction Factor (dB/m)	Corrected Analyzer Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Limit (dBuV/m)	Average Margin (dB)
1505.279	51.0		-9.0	42.0	83.1	-41.1		
1505.279		50.1	-9.0	41.1			63.1	-22.0
4515.837	49.7		-2.1	47.6	83.1	-35.5		
4515.837		49.1	-2.1	47.0			63.1	-16.1
6021.171	41.5		-0.5	41.0	83.1	-42.1		
6021.171		38.3	-0.5	37.8			63.1	-25.3
7526.462	49.6		1.0	50.6	83.1	-32.5		
7526.462		48.1	1.0	49.1			63.1	-14.0
9031.724	39.7		6.6	46.3	83.1	-36.8		
9031.724		35.8	6.6	42.4			63.1	-20.7
10537.000	45.4		8.5	53.9	83.1	-29.2		
10537.000		42.8	8.5	51.3			63.1	-11.8
12042.333	46.8		9.7	56.5	83.1	-26.6		
12042.333		45.3	9.7	55.0			63.1	-8.1
48169.192*	29.4		24.0	51.2	108.0	-56.8		
48169.192*		19.3	24.0	40.4			88.0	-47.6
72253.788**	-14.9		23.2	8.3	108.0	-99.7		
72253.788**		-16.8	23.2	6.4			88.0	-81.6

** testing performed at 1m, interpolated to 3m.*
*** testing performed at 0.01m, interpolated to 3m.*

Table 3-4: Radiated Emissions Harmonics/Spurious (Mid Channel)

Emission Frequency (MHz)	Peak Analyzer Detector (dBuV/m)	Average Analyzer Detector (dBuV/m)	Site Correction Factor (dB/m)	Corrected Analyzer Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Limit (dBuV/m)	Average Margin (dB)
1507.228	48.8		-9.1	39.7	84.3	-44.6		
1507.228		47.6	-9.1	38.5			64.3	-25.8
4521.605	47.6		-1.7	45.9	84.3	-38.4		
4521.605		46.8	-1.7	45.1			64.3	-19.2
6028.848	41.2		-0.4	40.8	84.3	-43.5		
6028.848		39.0	-0.4	38.6			64.3	-25.7
7536.051	48.8		1.3	50.1	84.3	-34.2		
7536.051		47.9	1.3	49.2			64.3	-15.1
9043.255	36.5		6.7	43.2	84.3	-41.1		
9043.255		32.0	6.7	38.7			64.3	-25.6
10550.451	41.2		8.7	49.9	84.3	-34.4		
10550.451		39.2	8.7	47.9			64.3	-16.4
12057.709	44.3		9.8	54.1	84.3	-30.2		
12057.709		42.6	9.8	52.4			64.3	-11.9
48230.300*	28.3		24.0	52.3	108.0	-55.7		
48230.300*		22.1	24.0	46.1			88.0	-41.9
72345.830**	-13.8		23.2	9.4	108.0	-98.6		
72345.830**		-14.8	23.2	8.4			88.0	-79.6

** testing performed at 1m, interpolated to 3m.*
*** testing performed at 0.01m, interpolated to 3m.*

Table 3-5: Radiated Emissions Harmonics/Spurious (High Channel)

Emission Frequency (MHz)	Peak Analyzer Detector (dBuV/m)	Average Analyzer Detector (dBuV/m)	Site Correction Factor (dB/m)	Corrected Analyzer Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Limit (dBuV/m)	Average Margin (dB)
1510.066	49.4		-9.4	40.0	83.2	-43.2		
1510.066		47.8	-9.4	38.4			63.2	-24.8
4530.246	45.9		-1.5	44.4	83.2	-38.8		
4530.246		45.1	-1.5	43.6			63.2	-19.6
6040.355	40.9		-0.1	40.8	83.2	-42.4		
6040.355		38.6	-0.1	38.5			63.2	-24.7
7550.445	48.1		1.3	49.4	83.2	-33.8		
7550.445		47.3	1.3	48.6			63.2	-14.6
9060.529	36.5		6.7	43.2	83.2	-40.0		
9060.529		32.9	6.7	39.6			63.2	-23.6
10570.602	41.4		8.4	49.8	83.2	-33.4		
10570.602		40.0	8.4	48.4			63.2	-14.8
12080.715	44.4		9.9	54.3	83.2	-28.9		
12080.715		43.3	9.9	53.2			63.2	-10
48322.400*	30.4		24.0	54.4	108.0	-53.6		
48322.400*		22.2	24.0	46.2			88.0	-41.8
72483.600**	-7.4		23.2	15.8	108.0	-92.2		
72483.600**		-17.9	23.2	5.3			88.0	-82.7

** testing performed at 1m, interpolated to 3m.*
*** testing performed at 0.01m, interpolated to 3m.*

3.5 Radiated Emissions Digital Test Data

Table 3-6: Digital Radiated Emissions Test Data

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
33.800	Qp	H	0	1.5	17.2	-26.0	-8.8	40.0	-48.8	Pass
151.122	Qp	H	0	1.0	17.4	-31.7	-14.3	43.5	-57.8	Pass
278.526	Qp	H	0	1.0	17.2	-28.2	-11.0	46.0	-57.0	Pass
375.802	Qp	H	0	1.0	17.5	-26.1	-8.6	46.0	-54.6	Pass
461.039	Qp	H	0	1.0	17.0	-24.4	-7.4	46.0	-53.4	Pass
608.462	Qp	H	0	1.0	18.3	-22.4	-4.1	46.0	-50.1	Pass

Test Personnel:

Daniel W. Baltzell		May 2-21, 2013
Test Engineer	Signature	Dates of Test

4 AC Conducted Emissions - FCC 15.207

4.1 Test Methodology for Conducted Line Emissions Measurements

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

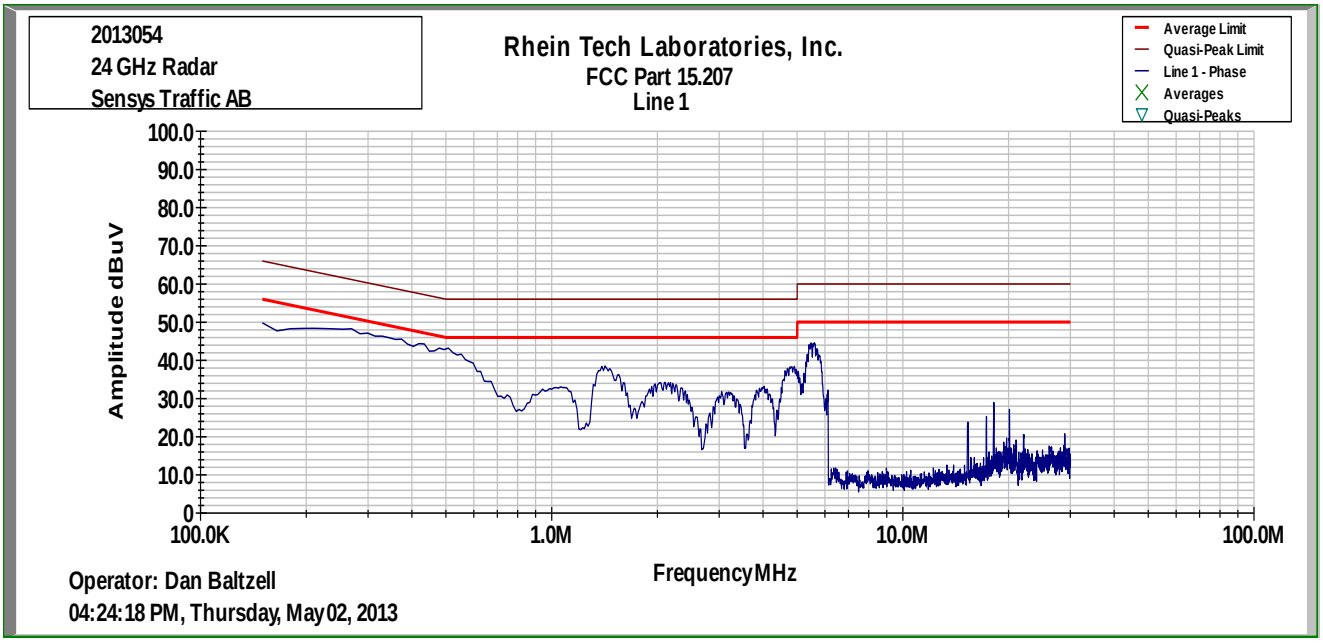
4.2 Conducted Line Emission Test Procedure

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE.

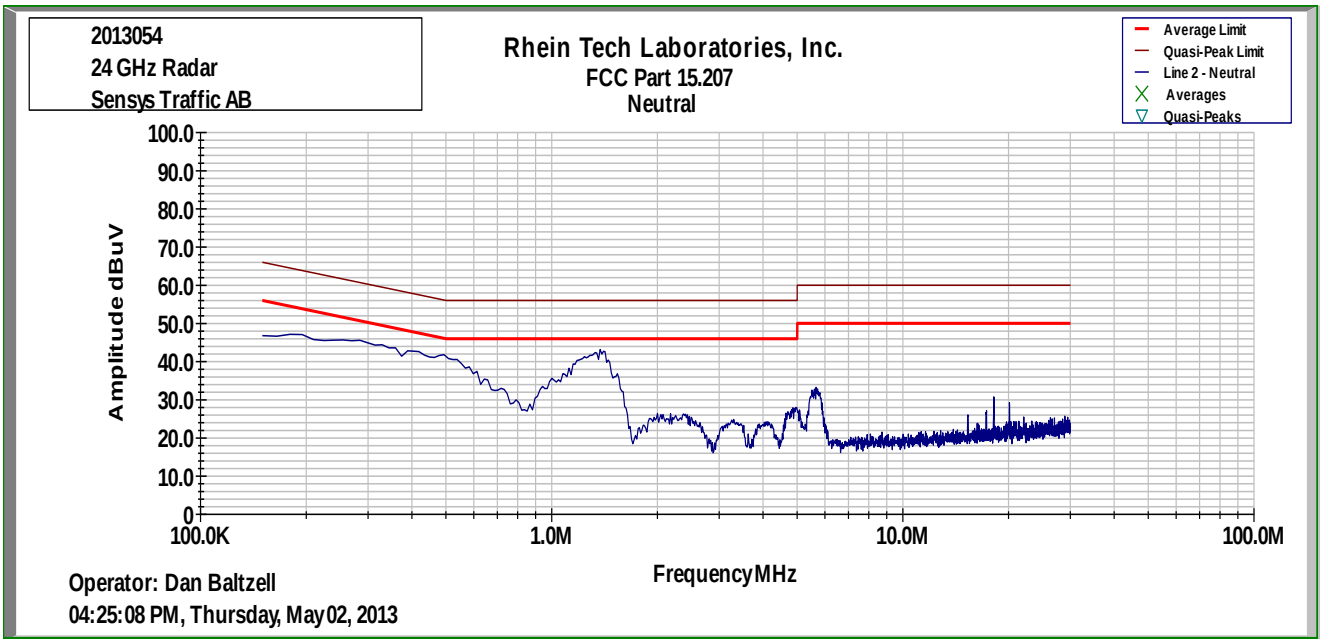
Table 4-1: Conducted Line Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz - 1.5 GHz)	2602A00160	2/17/14
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	2/17/14
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A11239	2/17/14
901082	AFJ International	LS16	16A LISN	16010020081	3/26/14

Plot 4-1: Conducted Emissions (Phase Side); Mode: Transmit



Plot 4-2: Conducted Emissions (Neutral Side); Mode: Transmit



Test Personnel:

Daniel Baltzell	Daniel W. Baltzell	May 2, 2012
Test Engineer	Signature	Date of Test

5 20 dB Bandwidth – FCC 15.215(c)

5.1 20 dB Bandwidth Test Procedure

The 20 dB bandwidths were measured using a 50-ohm spectrum analyzer. The modulated carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was auto and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 1 MHz, and the video bandwidth set to 3 MHz. The table below contains the bandwidth measurement results.

Table 5-1: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14

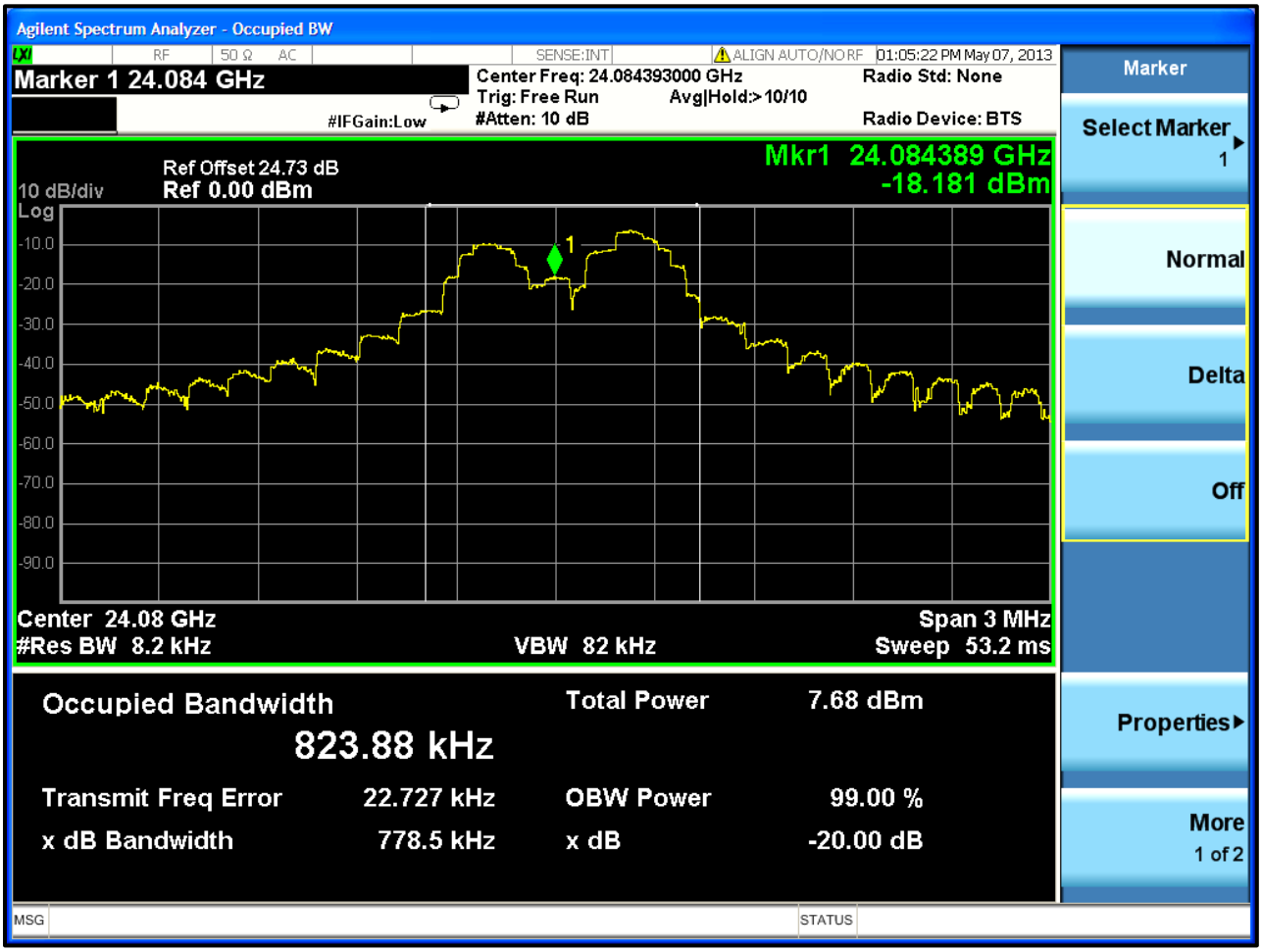
5.2 Bandwidth Test Data

Table 5-2: Bandwidth Test Data

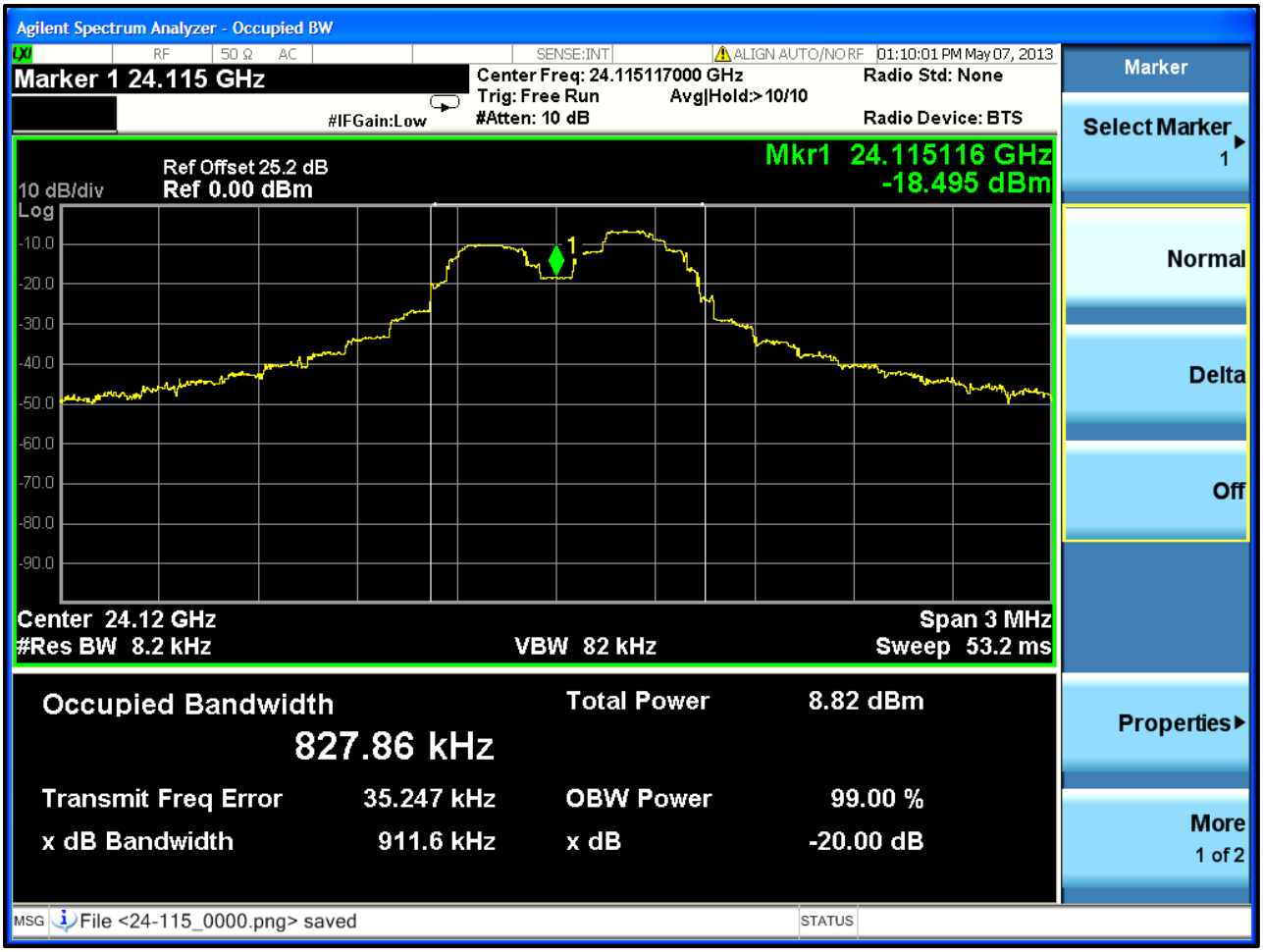
Frequency (GHz)	20 dB Bandwidth (kHz)
24.08448	778.5
24.11520	911.6
24.16128	852.6

5.3 20 dB Bandwidth Plots

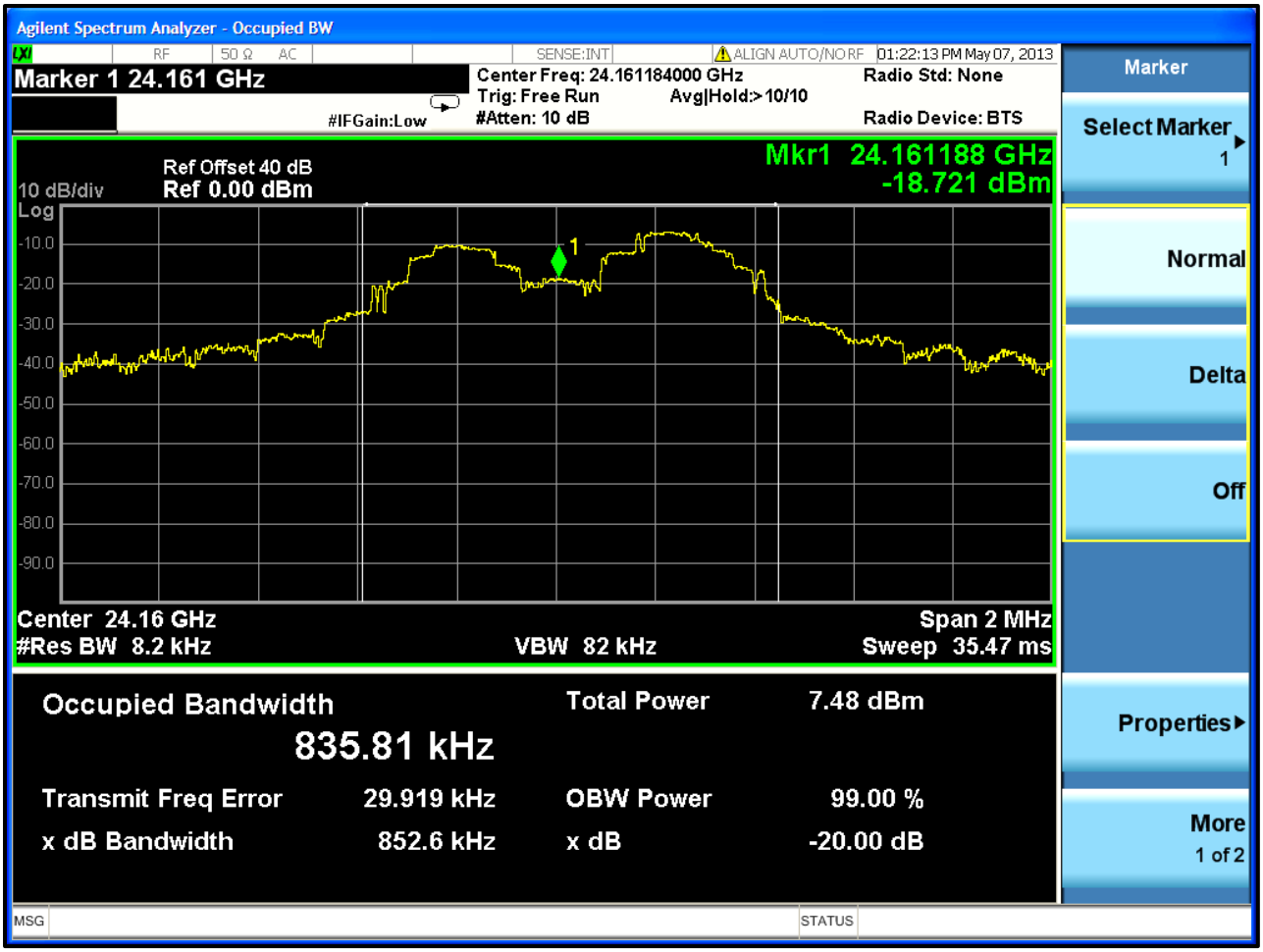
Plot 5-1: 20 dB Bandwidth (24.084 GHz)



Plot 5-2: 20 dB Bandwidth (24.115 GHz)



Plot 5-3: 20 dB Bandwidth (24.161 GHz)



Test Personnel:

Daniel W. Baltzell		May 7, 2013
Test Engineer	Signature	Date of Test

6 Conclusion

The data in this measurement report shows that the EUT as tested, Sensys Traffic AB Radar Sensor, Model RS242, FCC ID: PBVRS242, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations.