FCC PART 15, SUBPART B and C
TEST REPORT

for

SENSOR TRANSMITTER MODULE

MODEL: S-1
FCC ID: RY20001

Prepared for

OMNISENSE, LLC
2230 PENINSULA ROAD
OXNARD, CALIFORNIA 93035

Prepared by: REYNALD O. RAMIREZ

Approved by: RUBY A. HALL

COMPATIBLE ELECTRONICS INC.
2337 TROUTDALE DRIVE
AGOURA, CALIFORNIA 91301
(818) 597-0600

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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used to claim product endorsement by NVLAP, NIST or any other agency of the U.S. Government.

Device Tested:	Sensor Transmitter Module Model: S-1 S/N: N/A
Product Description:	See Expository Statement.
Modifications:	The EUT was not modified during the testing.
Manufacturer:	OmniSense, LLC 2230 Peninsula Road Oxnard, California 93035
Test Dates:	June 3 & 4, 2004
Test Specifications:	EMI requirements CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.31, 15.205, 15.209, and 15.247
Test Procedure:	ANSI C63.4: 2001 FCC Public Notice (Document Number: DA 00-705)
Test Deviations:	The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Spurious Radiated RF Emissions, 30 MHz – 1000 MHz	Complies with the **Class B** limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15, Subpart C, section 15.209
2	Spurious Radiated RF Emissions, 10 kHz – 30 MHz and 1000 MHz – 10000 MHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247(c)
3	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 10 kHz – 10 GHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247(c)
4	Emissions produced by the intentional radiator in restricted bands, 10 kHz – 10 GHz	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.205, 15.209(a), and section 15.247 (c)
5	20 dB Bandwidth	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)
6	Peak Power Output	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(1)
7	RF Conducted Antenna Test	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (c)
8	Channel Hopping Separation	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1) and 15.247 (a)(1)(i)
9	Average Time of Occupancy	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i)

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Sensor Transmitter Module, Model: S-1. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 2001. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the Class B specification limits defined by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.31, 15.205, 15.209, and 15.247.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined by CFR Title 47, Part 15, Subpart B.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 2337 Troutdale Drive, Agoura, California 91301.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

OmniSense, LLC

Chris Hoogenboom	President

Compatible Electronics, Inc.

Reynald O. Ramirez	Sr. Test Engineer
Ruby A. Hall	Lab Manager – Agoura Division

2.4 Date Test Sample was Received

The test sample was received on June 3, 2004

2.5 Disposition of the Test Sample

The sample has not been returned to OmniSense, LLC as of the date of this report.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators
ANSI C63.4 2001	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
FCC Title 47, Part 15 Subpart B	FCC Rules - Radio frequency devices (including digital devices) – Unintentional Radiators
FCC Public Notice – DA 00-705	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

The Sensor Transmitter Module, Model: S-1 (EUT) was set up as a stand - alone unit. A 3.6 V_{DC} battery powered the EUT. In this stand alone setup, the EUT was tested in the X, Y and Z axis with no difference in the emissions, therefore for the sake of convenience the EUT was tested in the X axis which allowed for the turning of the table without the EUT tipping over. The EUT was also tested installed in the Gateway product (which was connected to a laptop) as well as the Installer (which was connected to a GPS). The data for the alternate configurations is in appendix E.

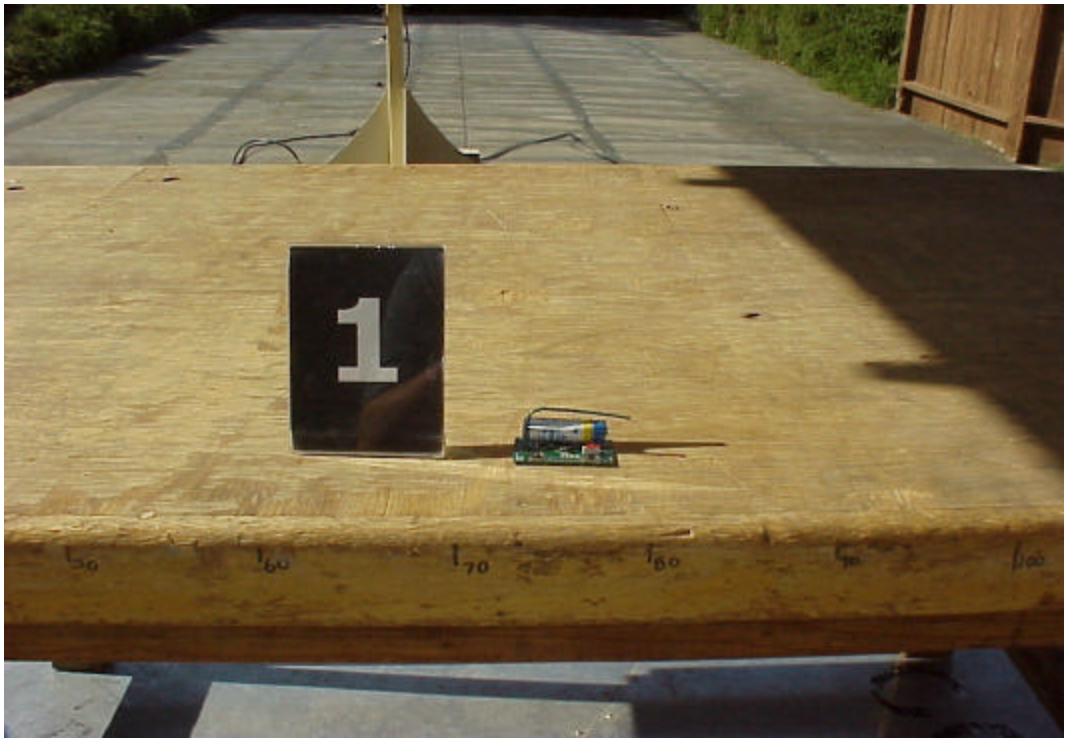
For the intentional radiator and conducted emission portion of the test – The EUT was directly connected to the spectrum analyzer and was in transmitting mode. During the AC conducted emissions test the unit was transmitting in a normal mode of operation. A Laptop with a special program was used to control the channel of the transmitter or to commit the unit to channel hopping mode, depending on the nature of the specific test.

For the unintentional radiator portion of the test – The EUT was placed on the OATS table and was operating in stand by (receive) mode.

For the restricted band emission portion of the test – The EUT was placed on the OATS table and was operating in transmitting mode.

The final radiated as well as the conducted data was taken in the mode above. Please see Appendix E for the data sheets.

4.1.1 Photograph of Test Configuration - EMI



4.1.2 Cable Construction and Termination

Cable 1

This cable was used in the Gateway configuration only. This is a 33-meter, unshielded twisted pair, round, Ethernet cable connecting the EUT to the remotely located laptop computer. The cable has a plastic RJ-45 connector at each end.

Cable 2

This cable was used in the Installer configuration only. This is a 2-meter, unshielded, round, serial cable connecting the EUT to the GPS. The cable has a 4-pin connector at the EUT end and a D-9 connector with a built in ferrite at the GPS end. The cable was bundled to a length of 1 meter.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

#	EQUIPMENT TYPE	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID
1	SENSOR TRANSMITTER MODULE. (EUT)	OMNISENSE, LLC	S-1	N/A	RY20001
	GATEWAY	OMNISENSE, LLC	B-1	N/A	N/A
	AC ADAPTER (GATEWAY)	CUI	DV-0950-B11	N/A	N/A
	LAPTOP PC	TOSHIBA	TECRA 8100	5064913U-3	N/A
	INSTALLER	OMNISENSE, LLC	INSTALLER	5	N/A
	GPS	GARMIN	GPS 76	80280896	N/A

5.2 EMI TEST EQUIPMENT

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Hewlett Packard	8566B	2729A04566	Jan. 16, 2004	Jan. 16, 2005
Quasi-Peak Adapter	Hewlett Packard	85650A	2521A00682	Jan. 16, 2004	Jan. 16, 2005
Preamplifier	Com Power	CPPA-102	01249	Jan. 16, 2004	Jan. 16, 2005
LISN	Com Power	LI-215	12037	Oct. 16, 2003	Oct. 16, 2004
LISN (Accessory)	Com Power	LI-115	02030	Oct. 16, 2003	Oct. 16, 2004
Transient Limiter	Com Power	HZ560	Asset 3549	Jan. 12, 2004	Jan. 12, 2005
Active Loop Antenna	Com Power	AL-130	17067	Mar. 24, 2004	Mar. 24, 2005
Biconical Antenna	Com Power	AB-100	01535	Mar. 05, 2004	Mar. 05, 2005
Log Periodic Antenna	Com Power	AL-100	01116	Jan. 23, 2004	Jan. 23, 2005
Horn Antenna	A.R.A.	DRG-118/A	1015	Nov. 18, 2002	Nov. 18, 2005
Antenna Mast	Com Power	AM-400	N/A	N/A	N/A
High Pass Filter	Microwave Circuits, Inc.	H1G63G01	061703-01R	Feb. 24, 2004	Feb. 24, 2005
Notch Filter	Microwave Circuits, Inc.	NO3915M1	061703-01DC0336	Feb. 24, 2004	Feb. 24, 2005
Turntable	Com Power	TTW-595	N/A	N/A	N/A
Computer	Hewlett Packard	Pavilion 4530	US91912022	N/A	N/A
Printer	Hewlett Packard	C6427B	MY066160TW	N/A	N/A
Conducted Emissions Test Software	Compatible Electronics	SR21	2.3	N/A	N/A
Radiated Emissions Test Software	Compatible Electronics	Vcap1A	3.1	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Transmitter Power

Transmit power is herein defined as the power delivered to a 50 Ohm load at the RF output of the EUT. The test sample had one output power level per channel. They are the following:

CHANNEL	OUTPUT	POWER dBm	ACCURACY
Low	1	8.2	+2/-2 dB
Medium	1	8.6	+2/-2 dB
High	1	8.8	+2/-2 dB

7.2 Channel Number and Frequencies

There are a total of 127 channels. The low channel is at 902.2 MHz and the high channel is at 927.8 MHz. There is a 200 kHz separation between channels.

8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

8.1 RF Emissions

8.1.1 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Com-Power Microwave Preamplifier Model: PA-122 was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps.

The quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets.

The frequencies above 1 GHz were averaged manually by narrowing the video filter down to 10 Hz and setting the sweep time on AUTO on the spectrum analyzer to keep the amplitude reading calibrated.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
10 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 10 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 2001. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst - case (highest emission) configuration of the EUT by the Radiated Emission Manual Test software. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results. The loop antenna was also rotated in the horizontal and vertical axis in order to ensure accurate results.

Radiated Emissions (Spurious and Harmonics) Test (con't)

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance from 10 kHz to 10 GHz to obtain final test data.

The harmonics of the transmitter frequency in the applicable restricted band were also measured utilizing the method mentioned above. See appendix E for datasheets.

8.2 20 dB Bandwidth

The 20 dB Bandwidth was measured using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the EUT. The resolution and video bandwidths were >= 1% of the 20 dB bandwidth.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i). The bandwidth is less than 500 kHz. Please see the data sheets located in Appendix E.

8.3 Peak Output Power

The Peak Output Power was taken using the spectrum analyzer. The bandwidth was measured using a direct connection from the RF out on the EUT. The resolution bandwidth was 1 MHz, and the video bandwidth was 1 MHz.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b)(1). The maximum peak output power is less than 1 watt. Please see the data sheets located in Appendix E.

8.4 RF Antenna Conducted Test

The RF antenna conducted test was taken using the spectrum analyzer. The RF antenna conducted test was measured using a direct connection from the RF out on the EUT into the input of the analyzer. The resolution bandwidth was 100 kHz, and the video bandwidth 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (c). The RF power that is produced by the intentional radiator is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Please see the data sheets located in Appendix E.

8.5 RF Band Edges

The RF band edges were taken at the edges of the spectrum (902 MHz when the EUT was on the low channel and 928 MHz when the EUT was on the high channel) using the spectrum analyzer. The 100 kHz bandwidth outside the frequency band was at least 20 dB below from the spectrum analyzer to the spec limit. The EUT was tested in the mode which is the 100 kHz bandwidth of the highest level. A data sheet is also included, which compares the reading worst case.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (c). The RF power at the band edges at 902 MHz and 928 MHz meet the limits of section 15.209. Please see the data sheets located in Appendix E.

8.6 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the spectrum analyzer. The EUT was operating in its normal operating mode. The resolution bandwidth was 300 kHz, and the video bandwidth 300 kHz. The frequency span was wide enough to include the peaks of two adjacent channels.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1) and 15.247 (a)(1)(i). The Channel Hopping Separation is greater than the 20 dB bandwidth. Please see the data sheets located in Appendix D.

8.7 Number of Hopping Frequencies

The Channel Hopping Separation Test was measured using the spectrum analyzer. The EUT was operating in its normal operating mode. The resolution bandwidth was 10 kHz, and the video bandwidth 10 kHz. The frequency span was not wide enough to include all of the peaks in the frequency band of operation therefore the plot only shows a snapshot of the spectrum which illustrates 51 hopping frequencies.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1) and 15.247 (a)(1)(i). The actual number of hopping frequencies is 127. Please see the data sheets located in Appendix E.

8.8 Average Time of Occupancy Test

The Average Time of Occupancy Test was measured using the spectrum analyzer. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz with a sweep time of 500 msec to determine the time for each transmission. The EUT was tested in channel hopping mode.

The dwell time for one frequency was 68.5 msec. In a 20 second period, the number of frequency transmissions that appear are 1. Therefore, if you multiply the dwell time for one frequency transmission with the number of transmissions in a 20 second period, you should have the time of occupancy in a 20 second period.

0.0685 seconds x 1 = 0.0685 seconds

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (a)(1)(i). The EUT does not transmit for more than 400 msec during a 20 second period on any frequency. Please see the data sheets located in Appendix E.

9. CONCLUSIONS

The Sensor Transmitter Module, Model: S-1 meets all of the specification limits defined in FCC Title 47, Part 15, Subpart C, sections 15.31, 15.205, 15.209, and 15.247.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined in CFR Title 47, Part 15, Subpart B.