



Nemko Test Report: 27965RUS1

Applicant: Wavetronix LLC
380 South Technology Ct.
Lindon, UT 84042
USA

**Equipment Under Test:
(E.U.T.)** SS225

FCC ID: PCB-SS225

In Accordance With: **FCC Part 15, Subpart C, 15.249**
Operation within the bands 902-928 MHz,
2400-2483.5 MHz, 5725-5875 MHz, and
24.0-24.25 GHz.

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

TESTED BY:

David Light, Senior Wireless Engineer

DATE: 17 July 2009

APPROVED BY:

Tom Tidwell, Telecom Direct

DATE: 21 July 2009

Total Number of Pages: 14

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Section 1. Summary Of Test Results

Manufacturer: Wavetronox LLC

Model No.: SS225

Serial No.: U010000021

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15.249. All tests were conducted using measurement procedure ANSI C63.4-2003. Radiated Emissions were made on an open area test site.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See "Summary of Test Data".



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Nemko USA, Inc.

CFR 47, PART 15, SUBPART C, Paragraph 15.249

Operation within the bands 902-928 MHz,
2400-2483.5 MHz, 5725-5875 MHz,
and 24.0-24.25 GHz.

EQUIPMENT: SS225

PROJECT NO.:27965RUS1

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Conducted Emissions	15.207	Complies
Radiated Emissions	15.249	Complies

Footnotes:

Section 2. General Equipment Specification

Frequency Range: 24.0 to 24.25 GHz

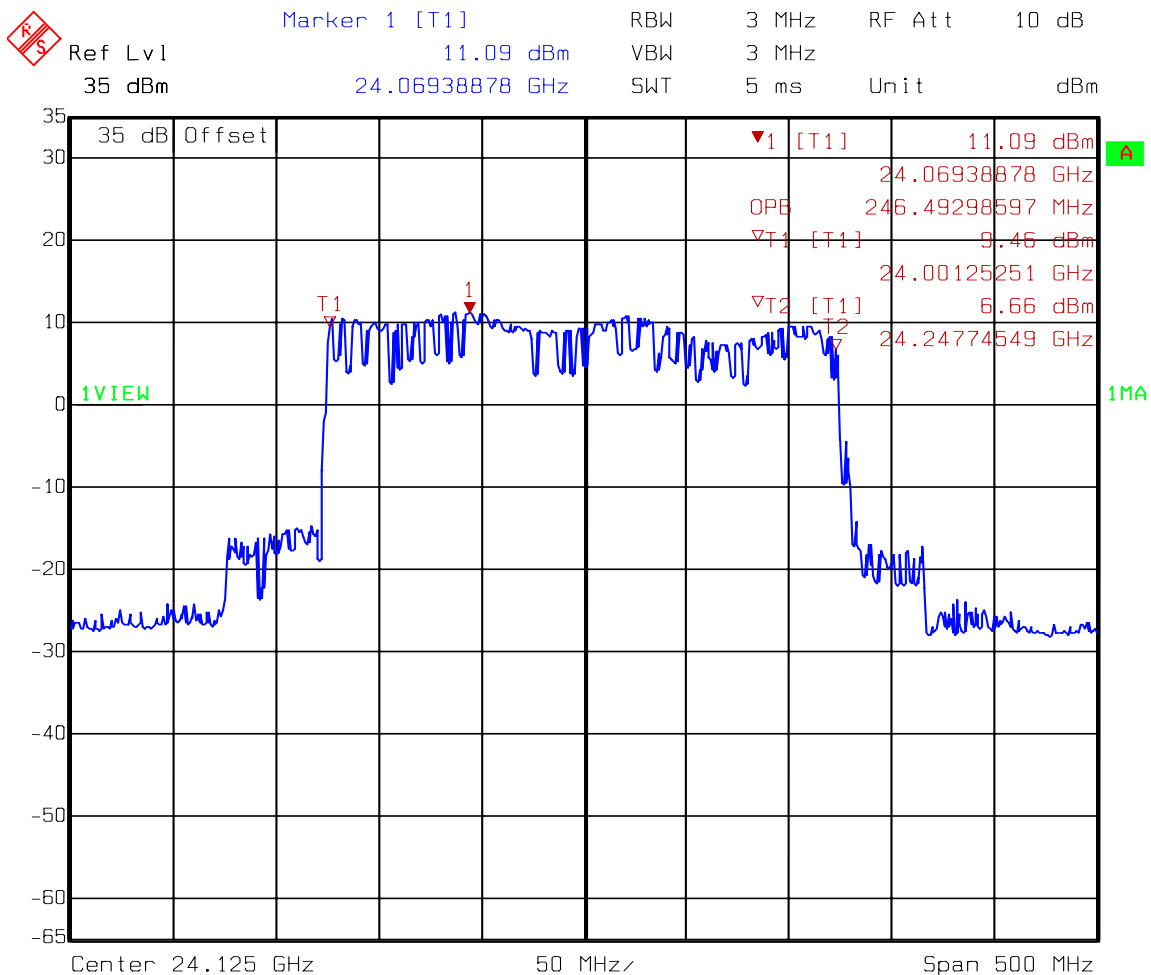
Operating Frequency(ies) of Sample: 24.0008 to 24.2492 GHz

Type of Emission: FMCW

Emission Designator: 249MF0N

Integral Antenna **Yes** **No**

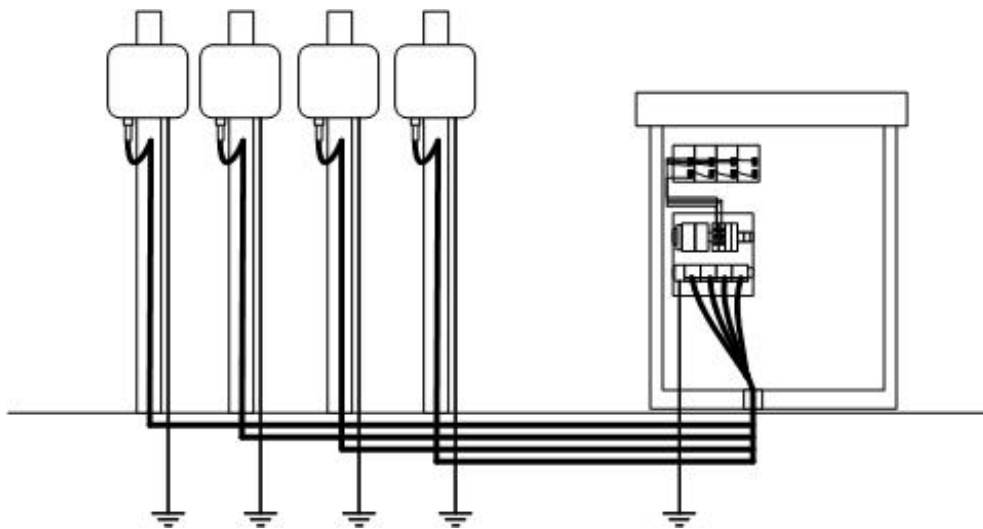
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99% Occupied Bandwidth

Date: 17.JUL.2009 14:21:46

Description of E.U.T.

The Wavetronix SmartSensor 225 Matrix™ traffic sensor is a stop bar presence detector designed for use at signalized intersections (see Figure I-1). The SmartSensor Matrix detects vehicle demand through the use of a 24.125 GHz (K band) operating radio frequency. Classified as a Frequency Modulated Continuous Wave (FMCW) radar, the SmartSensor Matrix detects and reports vehicle presence in as many as 10 lanes simultaneously.

System Diagram

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207

TESTED BY: David Light

DATE: 25 May 2009

Minimum Standard: §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Quasi-peak	Limit (dBmV) Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Results: Complies .**Measurement Data:** See attached table.**Method of Measurement: (Procedure ANSI C63.4-2003)**

Measurements were made using a spectrum analyzer with 10 kHz RBW, Peak Detector. Any emissions that are close to the limit are measured using a test receiver with 10 kHz bandwidth, CISPR Quasi-Peak Detector.

Test Data – Powerline Conducted Emissions

Line 1						
Frequency kHz	EN55022 B QP LIMIT	EN55022 B AVG LIMIT	AVG Meas	AVG Margin	QP Meas	QP Margin
155.44	65.85	55.85	41.25	-14.60	50.82	-15.02
163.29	65.62	55.62	46.43	-9.19	50.29	-15.33
189.29	64.88	54.88	46.96	-7.91	48.20	-16.68
209.14	64.31	54.31	39.10	-15.21	42.91	-21.40
223.02	63.91	53.91	29.92	-24.00	40.69	-23.22
234.26	63.59	53.59	32.23	-21.37	38.99	-24.61
246.34	63.25	53.25	27.74	-25.51	38.09	-25.16
368.45	59.76	49.76	48.53	-1.23	49.39	-10.37
Line 2						
Frequency	EN55022 B QP Limit	EN55022 B AVG Limit	AVG Meas	AVG Margin	QP Meas	QP Margin
150.01	66.00	56.00	49.32	-6.68	53.93	-12.07
159.65	65.72	55.72	44.77	-10.96	51.63	-14.10
162.40	65.65	55.65	44.53	-11.12	52.08	-13.57
175.45	65.27	55.27	55.12	-0.15	56.16	-9.11
193.57	64.76	54.76	45.72	-9.04	49.49	-15.27
204.85	64.43	54.43	40.65	-13.78	45.77	-18.66
208.30	64.33	54.33	40.16	-14.17	45.26	-19.07
216.83	64.09	54.09	30.29	-23.80	43.94	-20.15
229.39	63.73	53.73	31.36	-22.37	43.22	-20.51
365.94	59.83	49.83	49.64	-0.19	51.50	-8.33

Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.249
TESTED BY: David Light	DATE: 17 July 2009

Minimum Standard: Para no. 15.249

(a) The field strengths shall not exceed the following:

Carrier (MHz)	Field Strength (mV/m)	Field Strength (dB μ V)	Harmonic (μ V/m)	Harmonic (dB μ V)
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54
24000-24250	250	108	2500	68

(b) Field strength limits are specified at a distance of 3 metres.

(c) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limits of 15.209 whichever is the less attenuation.

(d) ...for frequencies above 1000 MHz, the above field strength limits are based on average limits. 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 condition of modulation.

Test Results: Complies

Measurement Data: See attached table.

Test Data - Radiated Emissions

Meas. Freq. (GHz)	Ant. Pol. (H/V)	Atten. (dB)	Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. limit (dBuV/m)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
											1 meter
24.1	H	0	63.3	40.4	4.5	0.0	108.2	137.5	-29.3	Pass	Peak
24.1	V	0	78.5	40.5	4.5	0.0	123.5	137.5	-14.0	Pass	Peak
24.1	H	0	49.7	40.4	4.5	0.0	94.6	117.5	-22.9	Pass	Average
24.1	V	0	64.9	40.5	4.5	0.0	109.9	117.5	-7.6	Pass	Average

Limits in the table above are at 1 meter. The limits are adjusted from the 3 meter limit by adding a factor of 9.5 dB from the formula:

$$20 \log(1/3) = -9.5 \text{ dB}$$

Peak limit is Avg. limit + 20 dB as described in 15.249(d).

Analyzer Settings:

Peak Readings: RBW = 1 MHz, VBW = 10 MHz, Peak detector

Average Readings: RBW = 1 MHz, VBW = 10 MHz, Average detector

The measurement was integrated over 250 MHz channel bandwidth to achieve the fundamental field strength.

There were no emissions detected above the carrier. The spectrum was searched from 30 MHz to 100 GHz. All emissions detected within 20 dB of the specification limit are reported per 15.31(o).

Section 5. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/27/09	02/28/11
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/31/09
1763	Bilog Antenna	Schaffner CBL 6111D	22926	11/04/08	11/04/09
1783	Cable	Nemko? 0	0	06/12/08	06/12/09
1767	MI Test Receiver 20Hz - 26.5 GHz - 150 - +30 dBm LC	ROHDE & SCHWARZ ESIB26	837491/0002	09/20/07	09/20/09
1785	Preamplifier	A.H. SYSTEMS PAM-0126	143	04/06/09	04/06/10
984	HORN ANTENNA	MILLITECH NONE	NONE	CNR	N/A
985	HORN ANTENNA	MILLITECH NONE	NONE	CNR	N/A
986	HARMONIC MIXER	Hewlett Packard 11970V	2521A01222	01/00/00	N/A
987	HARMONIC MIXER	Hewlett Packard 5356D	2521A00583	01/00/00	N/A
988	HARMONIC MIXER	Hewlett Packard 11970A	2332A01929	01/00/00	N/A
989	HARMONIC MIXER	Hewlett Packard 11970U	2332A00116	01/00/00	N/A
990	HORN ANTENNA	MILLITECH NONE	NONE	CNR	N/A
991	Horn antenna	EMCO 3160-10	9704-1049	CNR	N/A
992	Horn antenna	EMCO 3160-09	9705-1079	CNR	N/A
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/31/09
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	05/28/08	05/29/10
1258	LISN .15mhz-30mhz	EMCO 3825/2	1305	07/22/08	07/22/09
1039	CABLE, 8.5m	Nemko USA, Inc. RG223	N/A	06/10/08	06/10/09

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CFR 47, PART 15, SUBPART C, Paragraph 15.249

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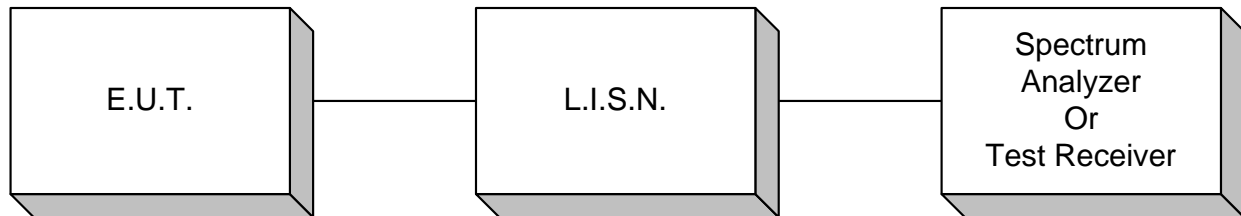
EQUIPMENT: SS225

PROJECT NO.:27965RUS1

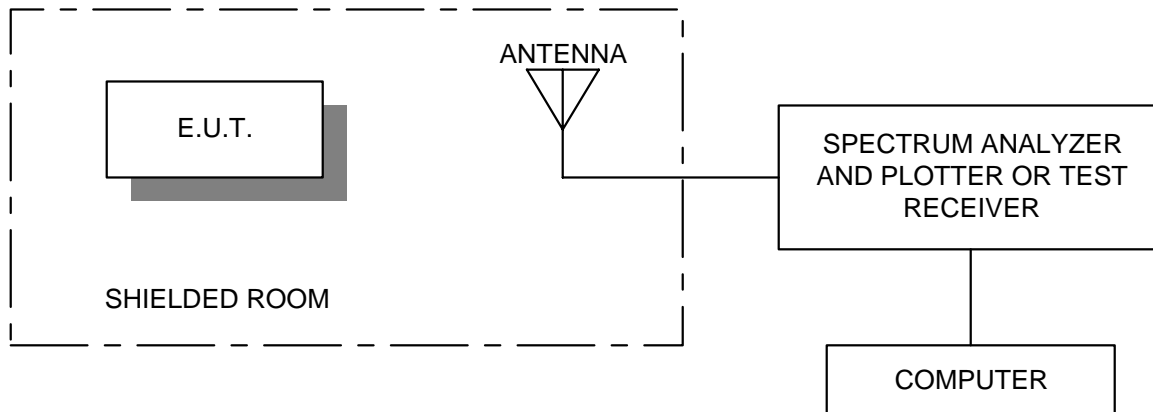
ANNEX A

TEST DIAGRAMS

Conducted Emissions



Radiated Prescan



Test Site For Radiated Emissions

