Nemko Test Report:	1L0615RUS2
Applicant:	Wavetronix 5314 North 250 West Suite # 110 Provo, Utah 84604
Equipment Under Test: **(E.U.T.)**	SmartSensor 105
In Accordance With:	**FCC Part 15, Subpart C** For Operation Within The Bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, 24075-24175 MHz Intentional Radiators Used As Field Disturbance Sensors Excluding Perimeter Protection Systems
Tested By:	Nemko Dallas Inc. 802 N. Kealy Ave Lewisville, TX 75057
Authorized By:	 David Light, Wireless Lab Supervisor
Date:	15 February 2002
Total Number of Pages:	20

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Section 1. Summary of Test Results

Manufacturer: Wavetronics

Model No.: 105

Sample No.: S01

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 Part 15, Subpart C, Paragraph 15.245. All tests were conducted using measurement procedure ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

F	D	S

Equipment Code

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".

NVLAP LAB CODE: 100351-0

TESTED BY: Lance Walker DATE: 2/13/2002

Summary Of Test Data

Name of Test	Paragraph Number	Results
Radiated Emissions	15.231(b)	Complies
Powerline Conducted Emissions	15.207	N/A

Footnotes:

The device is DC powered. The power supply was varied +/-15% from nominal (12 Vdc) to determine the effect on rf emission levels. There was no noticeable effect.

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Range: 10.5-10.55 GHz

Supply Power Requirement: 12 Vdc

Description of E.U.T.

The SmartSensor 105 is designed as a Field Disturbance Sensor to operate in the 10.50 GHz to 10.55 GHz band. The end user has no control over the RF set up of the device, but may adjust mounting height and angle to achieve optimum performance.

Modifications Incorporated in E.U.T.

Not Applicable

Section 3. Equipment Configuration

Equipment Configuration List:

Item	Description	Model No.	Serial.	Rev.
(A)	SmartSensor	105		
(B)				
(C)				
(D)				
(E)				
(F)				
(G)				

Inter-connection Cables:

Item	Description	Length (m)
(1)	Power cable	Approx 2m
(2)		
(3)		
(4)		
(5)		
(6)		
(7)		
(8)		

Section 4. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.245
TESTED BY: Lance Walker	DATE: 2/13/2002

Minimum Standard: See Annex B

Test Results: Complies

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Radiated Emissions

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Job No.:	L0615R	Date:	2/13/02
Specification:	CFR 47, Part 15	Temperature(°C):	22
Tested By:	Lance Walker	Relative Humidity(%)	50
E.U.T.:	10 GHz FDS		
Configuration:	normal		
Sample Number:			
Location:	AC 3	RBW:	1 MHz
Detector Type:	Peak	VBW:	1 MHz

Test Equipment Used

Antenna:	1034	Directional Coupler:	#N/A
Pre-Amp:	1016	Cable #1:	1484
Filter:	#N/A	Cable #2:	1485
Receiver:	1464	Cable #3:	1046
Attenuator #1	#N/A	Cable #4:	1083
Attenuator #2:	#N/A	Mixer:	986

Additional equipment used: 0984, 0985, 0990, 0991, 0989, 0986, 0987, 0988, 0983, 1629, 1628

Measurement Uncertainty: +/- 1.7 dB

Frequency (GHz)	Peak Meter Reading (dBuV)	Average Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Peak Corrected Reading (dBuV/m)	Average Corrected Reading (dBuV/m)	Comment
10.528 H	73.2	N/A	38.3	6.8	0.0	118.3	N/A	Limit 137.5 dBuV/m@1M
10.528 V	49.5	N/A	38.3	6.8	0.0	94.6	N/A	Limit 137.5 dBuV/m@1M
21.056 H	66.7	37.8	40.3	8.3	50.2	65.1	29.1	111.5 dBuV/m@20cm
21.056 V	67	37.8	40.3	8.3	50.2	65.4	29.1	111.5 dBuV/m@20cm
31.584 H	63.1	41.3	43.5	12	35.3	83.3	54.4	Limit 101.0 dBuV/m@20cm
31.584 V	63.1	41.3	43.5	12	35.3	83.3	54.4	Limit 101.0 dBuV/m@20cm
41.112 H	37.9		39.7	0	0.0	77.6		Noise Floor, Same Limit
41.112 V	37.9		39.7	0	0.0	77.6		Noise Floor, Same Limit
52.640 H	36.1		41.8	0	0.0	77.9		Noise Floor, Same Limit
52.640 V	36.1		41.8	0	0.0	77.9		Noise Floor, Same Limit
63.168 H	46.4		42.7	0	0.0	89.1		Noise Floor, Same Limit
63.168 V	46.4		42.7	0	0.0	89.1		Noise Floor, Same Limit
73.696 H	46.2		43.5	0	0.0	89.7		Noise Floor, Same Limit
73.696 V	46.2		43.5	0	0.0	89.7		Noise Floor, Same Limit
84.224 H	51.3		45.6	0	0.0	96.9		Noise Floor, Same Limit
84.224 V	51.3		45.6	0	0.0	96.9		Noise Floor, Same Limit
94.752 H	53.2		46.3	0	0.0	99.5		Noise Floor, Same Limit
94.752 V	53.2		46.3	0	0.0	99.5		Noise Floor, Same Limit

Notes: Average readings were taken using 10 Hz VBW, average was noise floor from 21.056 GHz and up

Unit was tested at +/- 15% Voltage with no effect on carrier power.

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Nemko Dallas, Inc.

Data Plot — 20 dB BW

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Job No.:	1L0615R	Date:	2/15/2002
Specification:	FCC Part 15.247	Temperature(°C):	22
Tested By:	Lance Walker	Relative Humidity(%)	35
E.U.T.:	10 GHz FDS		
Configuration:	Normal Transmit		
Sample Number:	S01		
Location:	Lab 2	RBW:	100 kHz
Detector Type:	Peak	VBW:	100 kHz

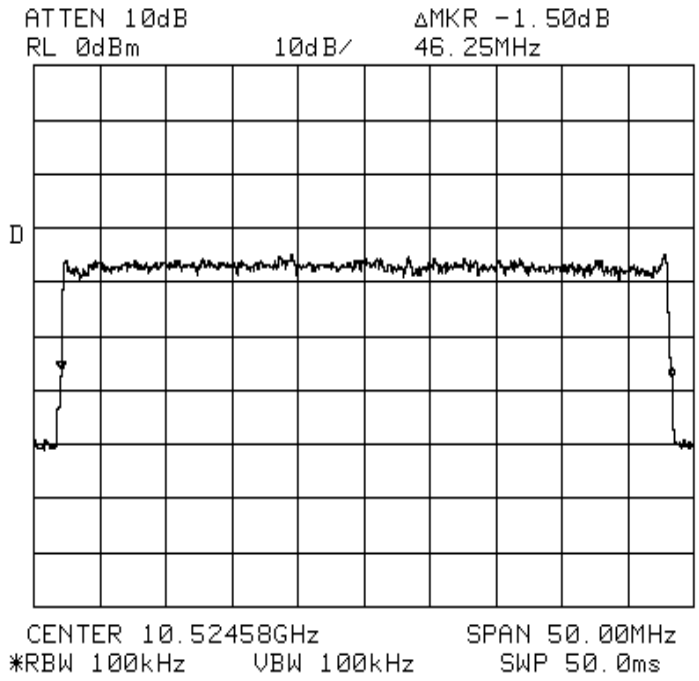
Measurement Distance: N/A m

Test Equipment Used

Antenna:	993	Directional Coupler:	
Pre-Amp:		Cable #1:	1045
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:

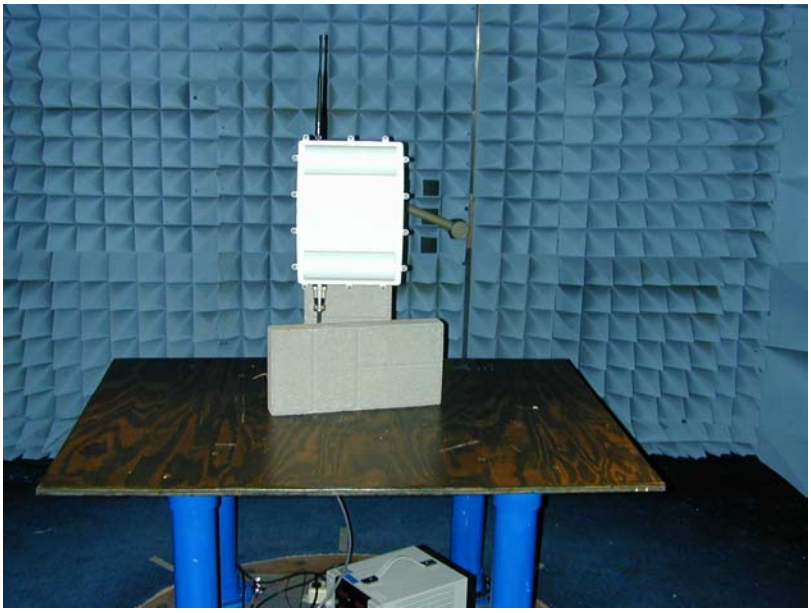
Measurement Uncertainty: +/-1.7 dB



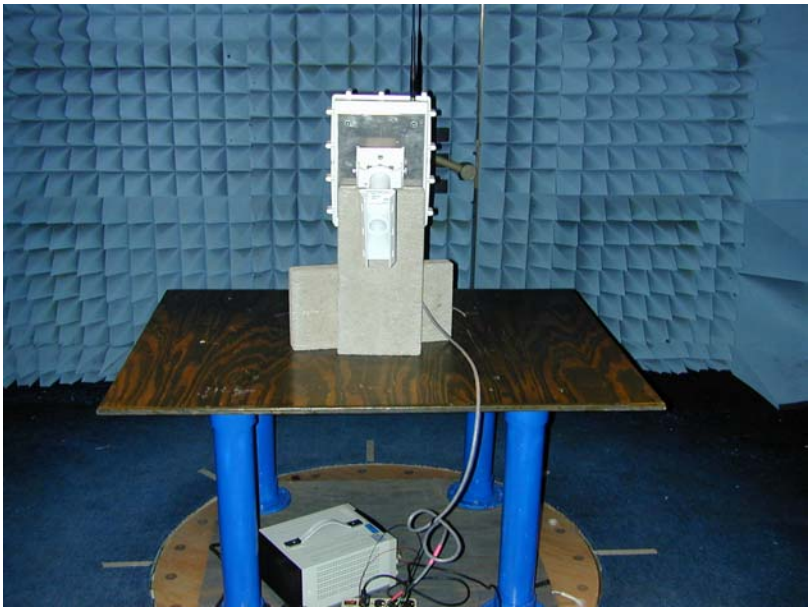
Notes:

Radiated Photographs (Worst Case Configuration)

FRONT VIEW



REAR VIEW



Section 5. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207
TESTED BY:	DATE:

Minimum Standard:

Frequency(MHz)	Maximum Powerline Conducted RF Voltage	
	μV	dBμV
0.45 - 30.0	250	48

Test Results: Complies/Does Not Comply. See attached graphs and table.

Test Data: See attached table and graphs.

Method Of Measurement: (Procedure ANSI C63.4-1992)

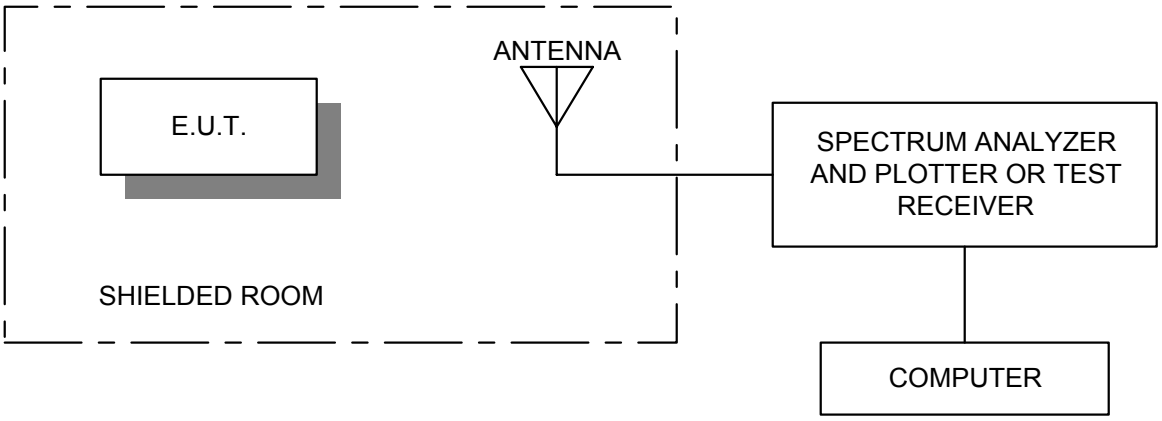
Measurements were made using a spectrum analyzer with 10 kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 10 kHz bandwidth, CISPR Quasi-Peak detector.

Broadband emissions are identified by switching the receiver detector function from Quasi-Peak to Average. If the amplitude of the emission drops by 6 dB or more then the emission is classified as broadband and the Quasi-Peak level is reduced by a factor of 13 dB.

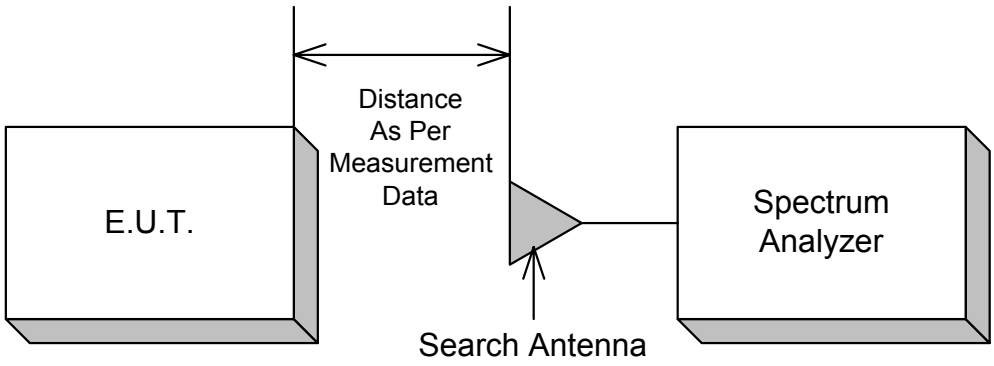
All emissions within 10 dB of limit have been recorded.

Section 6. Block Diagrams

Radiated Fundamental measurement



Measurement Setup for Harmonic Emissions



Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01
993	Horn antenna	A.H. Systems SAS-200/571	XXX	01/08/02
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01
984	HORN ANTENNA	MILLITECH NONE	NONE	CNR
983	PRE-AMP, 18-40 GHz	KTL BB1	1	01/25/01
990	HORN ANTENNA	MILLITECH NONE	NONE	CNR
991	Horn antenna	EMCO 3160-10	9704-1049	CNR
989	HARMONIC MIXER	Hewlett Packard 11970U	2332A00116	01/00/00
986	HARMONIC MIXER	Hewlett Packard 11970V	2521A01222	01/00/00
987	HARMONIC MIXER	Hewlett Packard 5356D	2521A00583	01/00/00
988	HARMONIC MIXER	Hewlett Packard 11970A	2332A01929	01/00/00
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	06/01/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01
1046	Flex cable 1m	Astrolab Inc. 32022-2-29094K-1M	N/A	01/29/01
986	HARMONIC MIXER	Hewlett Packard 11970V	2521A01222	01/00/00
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU
1628	CABLE, 6 ft	MEGAPHASE TM26 S1S5 72	N/A	CBU

RESTRICTED BANDS

Section A Restricted Bands of Operation

(a) Except as shown in paragraph (d) of this section , only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.49 - 0.51	16.69475-16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425-16.80475	960-1240	7.25-7.75
3.020 - 3.026	25.5-25.67	1300-1427	8.025-8.5
4.125 - 4.128	37.5-38.25	1435-1626.6	9.0-9.2
4.17725 - 4.17775	73-74.6	1645.5-1646.5	9.3-9.5
4.20725 - 4.20775	74.8-75.2	1660-1710	10.6-12.7
6.215 - 6.218	108-121.94	1718.8-1722.2	13.25-13.4
6.31175 - 6.31225	123-138	2220-2300	14.47-14.5
8.291 - 8.294	149.9-150.05	2310-2390	15.35-16.2
8.362 - 8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625 - 8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425 - 8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29 - 12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975 - 12.52025	240-285	3345.8-3358	36.43-36.5
12.57675 - 12.57725	322-335.4	3600-4400	Above 38.6
13.36 - 13.41			

RADIATED EMISSION LIMITS

Radiated Emission Limits

§15.245 Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz and 24075-24175 MHz.

(a) Operation under the provision of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength Of Fundamental (millivolts/meter)	Field Strength of Harmonics (millitvolts/meter)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For field disturbance sensors designed for use only within a building or to open building doors, 25 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands fully comply with the limits given in §15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment; vehicles such as fork-lifts that are intended primarily for use indoors or for very specialized operations. Or railroad locomotives, railroad cars and other equipment which travel on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g. putting a vehicle in reverse gear, activating a turn signal, etc.).

§15.245, continued

(2) Field strength limits are specified at a distance of 3 meters.

(3) 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 emission limits in §15.209, whichever is the lesser attenuation.

(4) The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

§15.209 Radiated Emission Limits, General Requirements

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (millivolts/meter)	Measurement Distance (meters)
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