



Nemko Test Report: 23305RUS1Rev1

Applicant: Sensonix
15755 32nd Avenue North
Plymouth, MN 55447

**Equipment Under Test:
(E.U.T.)** DX80

FCC Identifier: TGUDX80

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Frequency Hopping Transmitters

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

TESTED BY:

A handwritten signature in black ink, appearing to read 'David Light', written over a horizontal line.

David Light, Senior Wireless Engineer

DATE: 17 November 2008

APPROVED BY:

A handwritten signature in black ink, appearing to read 'P. H. M.', written over a horizontal line.

DATE: 18 November, 2008

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Section 1. Summary of Test Results

Manufacturer: Sensonix
Model No.: DX80
Serial No.: None
FCC Identifier: TGUDX80

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 15.247 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-2003. 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

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. [All tests were performed radiated.](#)

See "Summary of Test Data".



NVLAP LAB CODE: 100426-0

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dB μ V	NA
Channel Separation	15.247(a)(1)	Greater of 25 kHz or 20 dB Bandwidth	Not tested
Pseudorandom Hopping Algorithm	15.247(a)(1)		Not tested
Time of Occupancy	15.247(a)(1)(ii)	≤ 0.4 sec in 30 sec	Not tested
20 dB Occupied Bandwidth	15.247(a)(1)	≤ 1 MHz	Not tested
Peak Power Output	15.247(b)	1 Watt	Not tested
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc	Not tested
Spurious Emissions (Radiated)	15.247(c)	Table 15.209(a)	Complies

Footnotes:

Reasoning for Class II change: Adding helical monopole antenna (1.7 dBi) to existing grant.

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

General Equipment Information

Frequency Band:	902.5 to 927.5 MHz
Standard Test Voltage:	4.5 Vdc
Number of Channels:	27
Channel Spacing:	500 kHz
User Frequency Adjustment:	Not adjustable by user. Algorithm controls hopping sequence.

Section 3. Spurious Emissions

NAME OF TEST: Spurious Emissions	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE: 17 November 2008

Test Results: Complies.

Analyzer Settings: RBW 1 MHz/VBW 1 MHz, Peak detector

Equipment Used: 1464-1484-1485-1016-791-1763

Measurement Uncertainty: +/- 3.6 dB

Test Data – Radiated Emissions

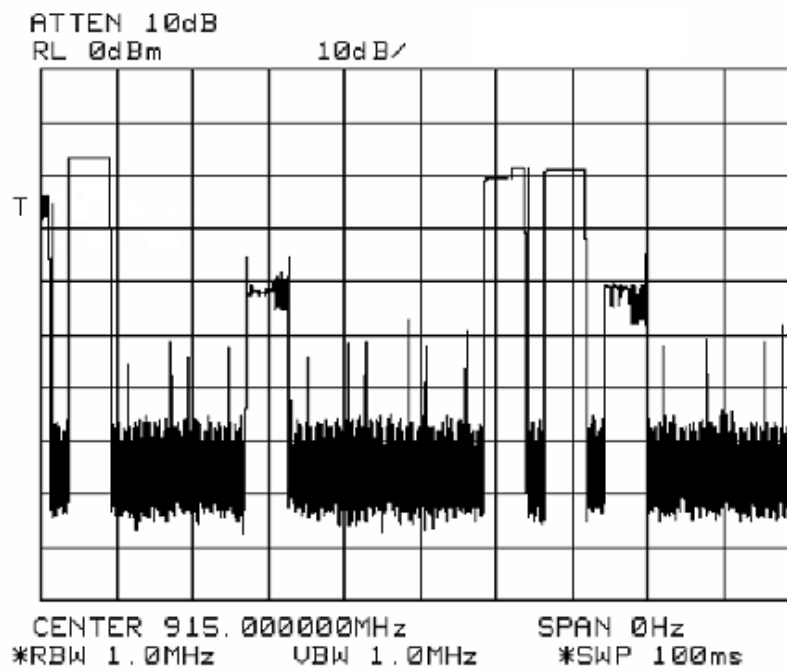
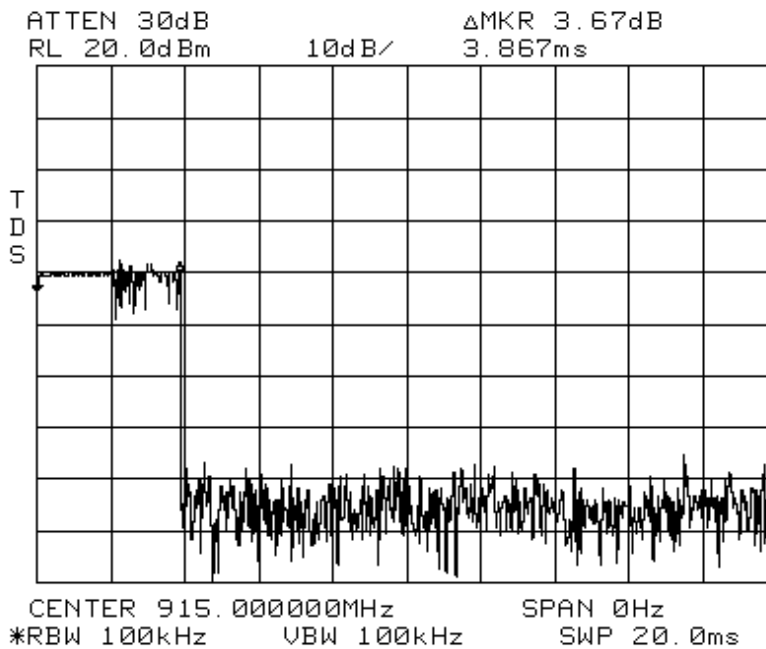
Freq MHz	Rdng dBμV	Cable dB	Cable dB	Pre-A Duty Cycle dB	Horn dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
2745.0 Peak	52.3	+0.8	+2.9	-32.7 0.0	+29.4	+0.0	52.7	74.0	-21.3	Vert
2745.0 Average	52.3	+0.8	+2.9	-32.7 -18.7	+29.4	+0.0	34.0	54.0	-20.0	Vert
2782.5 Peak	55.2	+0.8	+2.9	-32.7 0.0	+29.4	+0.0	55.6	74.0	-18.4	Vert
2782.5 Average	55.2	+0.8	+2.9	-32.7 -18.7	+29.4	+0.0	36.9	54.0	-17.1	Vert
6492.5 Peak	41.8	+1.3	+4.0	-31.1 0.0	+35.2	+0.0	51.2	74.0	-22.8	Vert
6492.5 Average	41.8	+1.3	+4.0	-31.1 -18.7	+35.2	+0.0	32.5	54.0	-21.5	Vert
2782.5 Peak	51.5	+0.8	+2.9	-32.7 0.0	+29.4	+0.0	51.9	74.0	-22.1	Horiz
2782.5 Average	51.5	+0.8	+2.9	-32.7 -18.7	+29.4	+0.0	33.2	54.0	-20.8	Horiz

Corrected reading (dBμV/m) = Reading (dBμV) + Path Loss (dB) + Duty Cycle (dB)

The device was tested on three channels (902.5, 915 and 927.5 MHz).

The spectrum was searched from 30 MHz to 10 GHz. All emissions are reported.

Test Data – Duty Cycle



$$3.867 * 3 = 11.601$$

$$20 \log (11.601/100) = -18.7 \text{ dB}$$

Test Setup Photo



The device was tested stand-alone (outside of enclosure). The ribbon cable, seen in the photo, supplies power from the external power adapter to the module.

Section 4. Antenna Gain and Pattern

NAME OF TEST: Antenna Gain and Pattern	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE: 17 November 2008

Test Results:

Complies.

Analyzer Settings:

RBW 100 kHz/VBW 300 kHz, Peak detector

Equipment Used: 1464-1484-1485-1016-791-1763

Peak Antenna Gain at 915 MHz: +1.7 dBi

See data following.

EIRP Substitution MethodPage 1 of 1

Job No.: 23305 Sensorix Date: 17 Nov. 2008
 Specification: None specified Temperature(°C): 21
 Tested By: David Light Relative Humidity(%) 37
 E.U.T.: Sensorix custom helical monopole antenna
 Configuration: Mounted on DX80 radio PCB with SMA input connector.

Complete X
 Preliminary _____

Sample No: 1
 Location: AC 1 RBW: 1 MHz
 Detector Type: Peak VBW: 1 MHz Measurement Distance: 3 m

Test Equipment Used

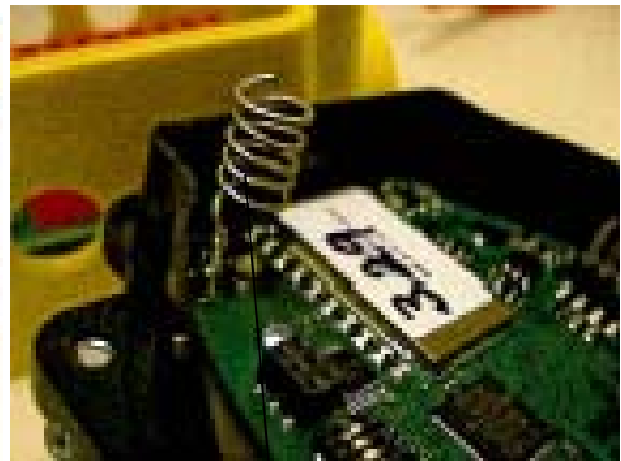
Antenna: 1763 Directional Coupler: _____
 Pre-Amp: _____ Cable #1: 1484
 Filter: _____ Cable #2: 1485
 Receiver: 1464 Cable #3: _____
 Attenuator #1: _____ Cable #4: _____
 Attenuator #2: _____ Mixer: _____
 Additional equipment used: _____
 Measurement Uncertainty: +/-3.6 dB

Frequency (MHz)	Meter Reading (dBm)	Substitution Level (dBm)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarity	Comments
										Input 0 dBm
915	-34.1	-4.1		0	5.8	1.7			H	Azimuth 240 deg.
915	-39.1	-8.6		0	5.8	-2.8			V	

Notes: _____

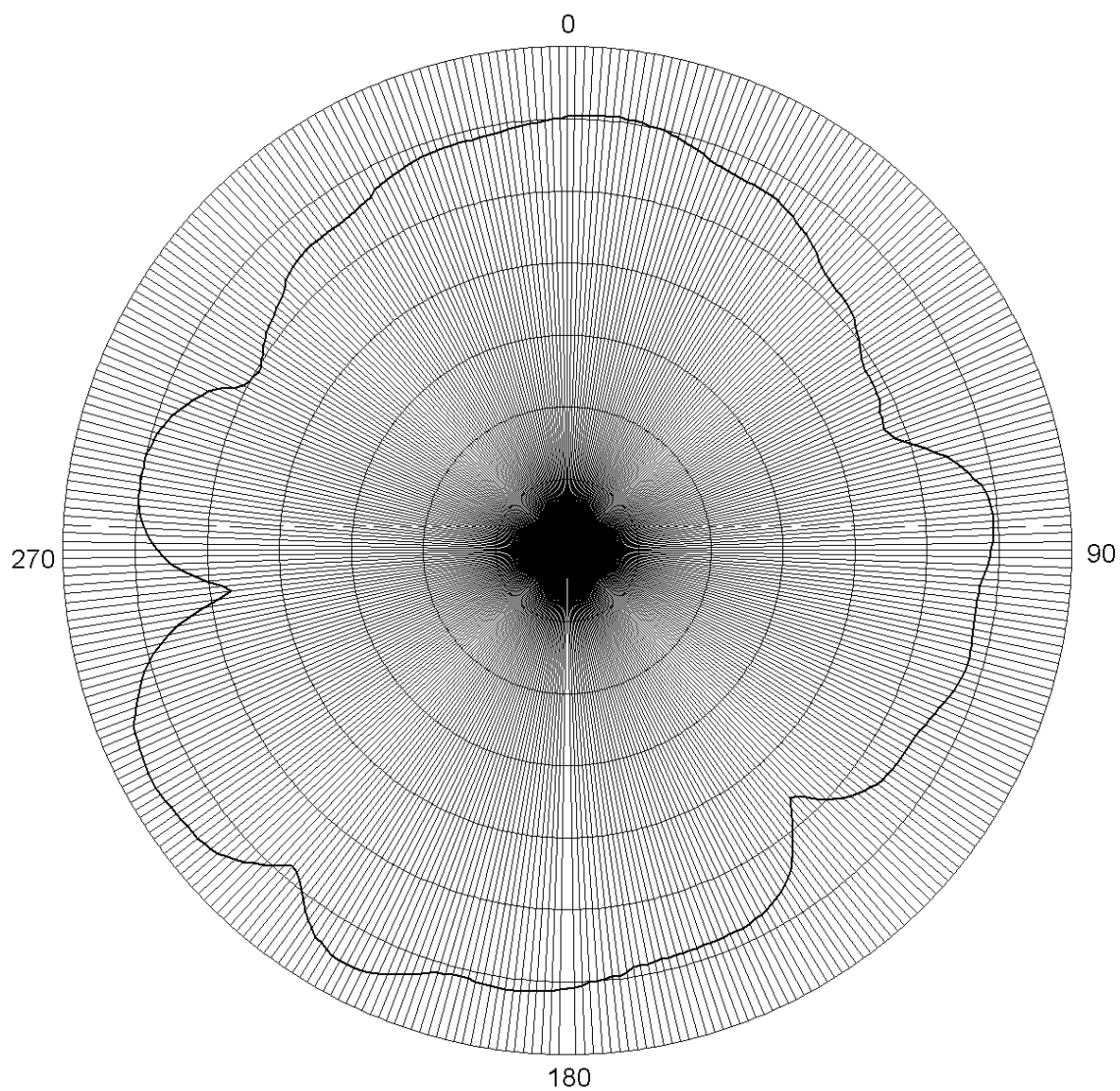


SMA connector for
gain and pattern
testing



Helical
antenna

Antenna Pattern



Y Axis: 0 dB to 70 dB in 10 deg. increments

Section 5. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/24/07	01/24/09
1484	Cable	Storm PR90-010-072	N/A	05/07/08	05/07/09
1485	Cable	Storm PR90-010-216	N/A	05/07/08	05/07/09
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/07/08	05/07/09
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/07/08	05/07/09
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/30/09
1763	Bilog Antenna	Schaffner CBL 6111D	22926	11/04/08	11/04/09

ANNEX A - TEST DETAILS

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(c)

Minimum Standard:

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	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	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions

