



Nemko Test Report: 28293RUS1

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

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

FCC Identifier: TGUDX80

Industry Canada Identifier: 7044A-DX8009

In Accordance With: **FCC Part 15, Subpart C, 15.247 and IC RSS-210**
Frequency Hopping Transmitters

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

TESTED BY: 

David Light, Senior Wireless Engineer

DATE: 18 June 2009

APPROVED BY: 

Tom Tidwell, Telecom Direct

DATE: 22 June 2009

Total Number of Pages: 24

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Section 1. Summary of Test Results

Manufacturer: Sen sonic, Inc.

Model No.: DX80

Serial No.: None

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 and Industry Canada RSS-210, Issue 7 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 and Industry Canada.



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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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a) / RSS-Gen 7.2.2	Not tested
Channel Separation	15.247(a)(1) / RSS-210 A8.1(c)	Complies
Time of Occupancy	15.247(a)(1) / RSS-210 A8.1(c)	Complies
20 dB Occupied Bandwidth	15.247(a)(1) / RSS-210 A8.1(c)	Complies
Peak Power Output	15.247(b) RSS-210 A8.4(1)	Not tested
Spurious Emissions (Antenna Conducted)	15.247(d) / RSS-210 A8.5	Complies
Spurious Emissions (Radiated)	15.247(d) / RSS-210 A8.5	Not tested
Receiver Spurious Emissions	RSS-Gen 7.2.3	Not tested

Footnotes:

Changes are all firmware based, no physical changes

–Reduce channel spacing to 400 kHz (down from 500 kHz)

–Increase ON time to as much as 62.5 ms on a given frequency

–Increase total number of channels available to as many as 64

--Increased frequency range from 902.5 – 927.5 MHz to 902.4 to 927.6 MHz

Section 2. Equipment Under Test (E.U.T.)**General Equipment Information**

Frequency Band: 902 – 928 MHz
 2400 – 2483.5 MHz
 5725 – 5850 MHz

Operating Frequency Range: 902.4 to 927.6 MHz

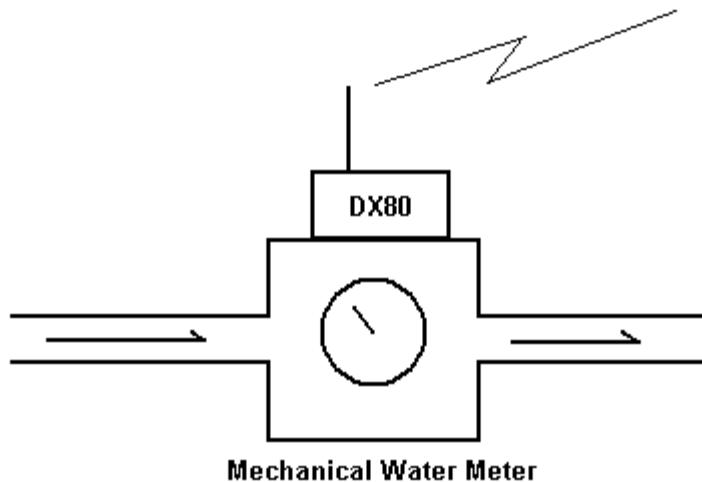
Number of Channels: 64 maximum

Channel Spacing: 400 kHz

User Frequency Adjustment: Software controlled

Description of EUT

The DX80 is a TDMA frequency hopping transmitter used to transmit water meter data. The EUT can be configured with an integral antenna, a 1/2 wave dipole or a 1/4 wave dipole with reverse gender SMA connector.

System Diagram

Section 3. Channel Separation

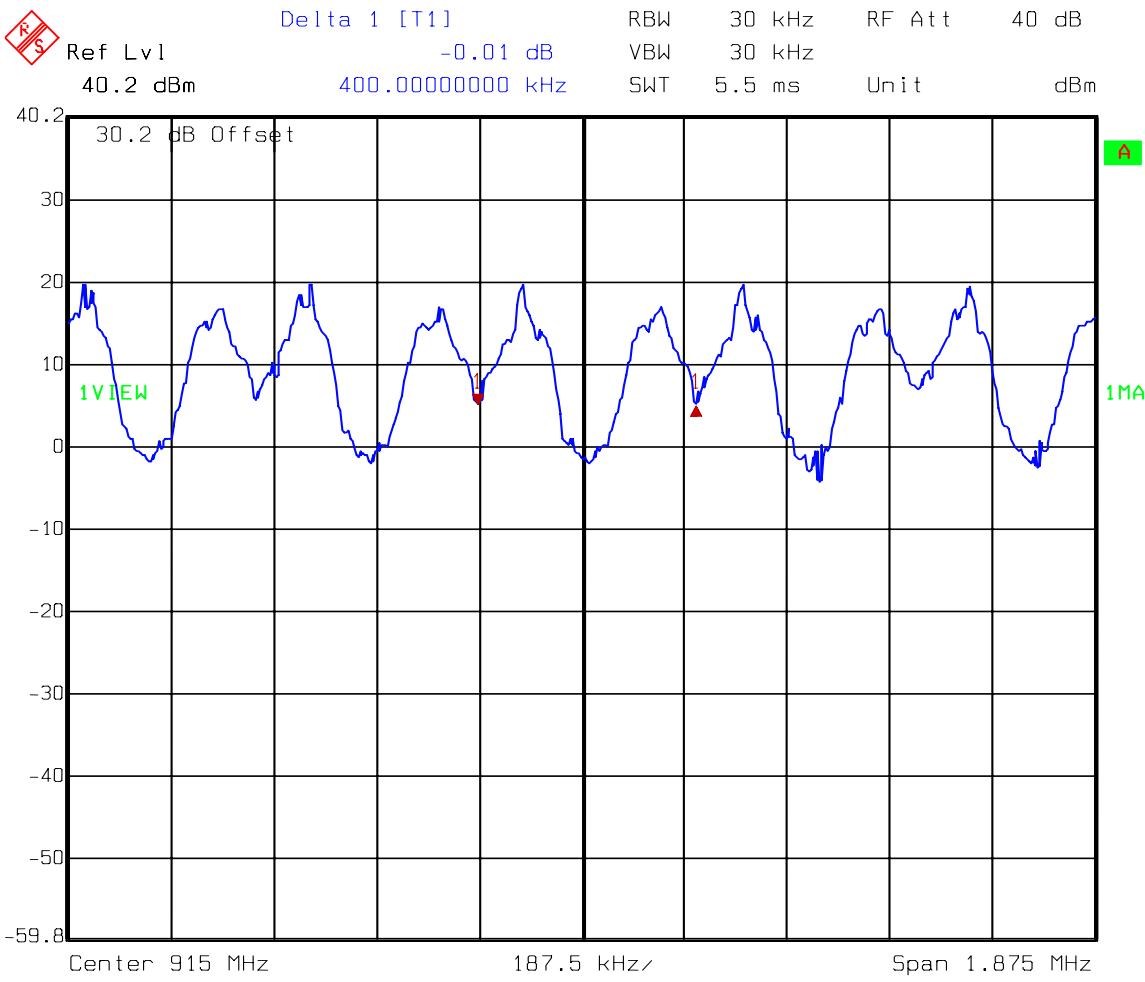
NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 18 June 2009

Test Results: Complies.**Measurement Data:** See 20 dB BW plot

Measured 20 dB bandwidth: 323 kHz
Channel Separation: 400 kHz

Equipment Used: 1036-1082-1472-1469**Measurement Uncertainty:** 1×10^{-7} ppm**Temperature:** 22 °C**Relative Humidity:** 35 %

Test Data – Channel Separation



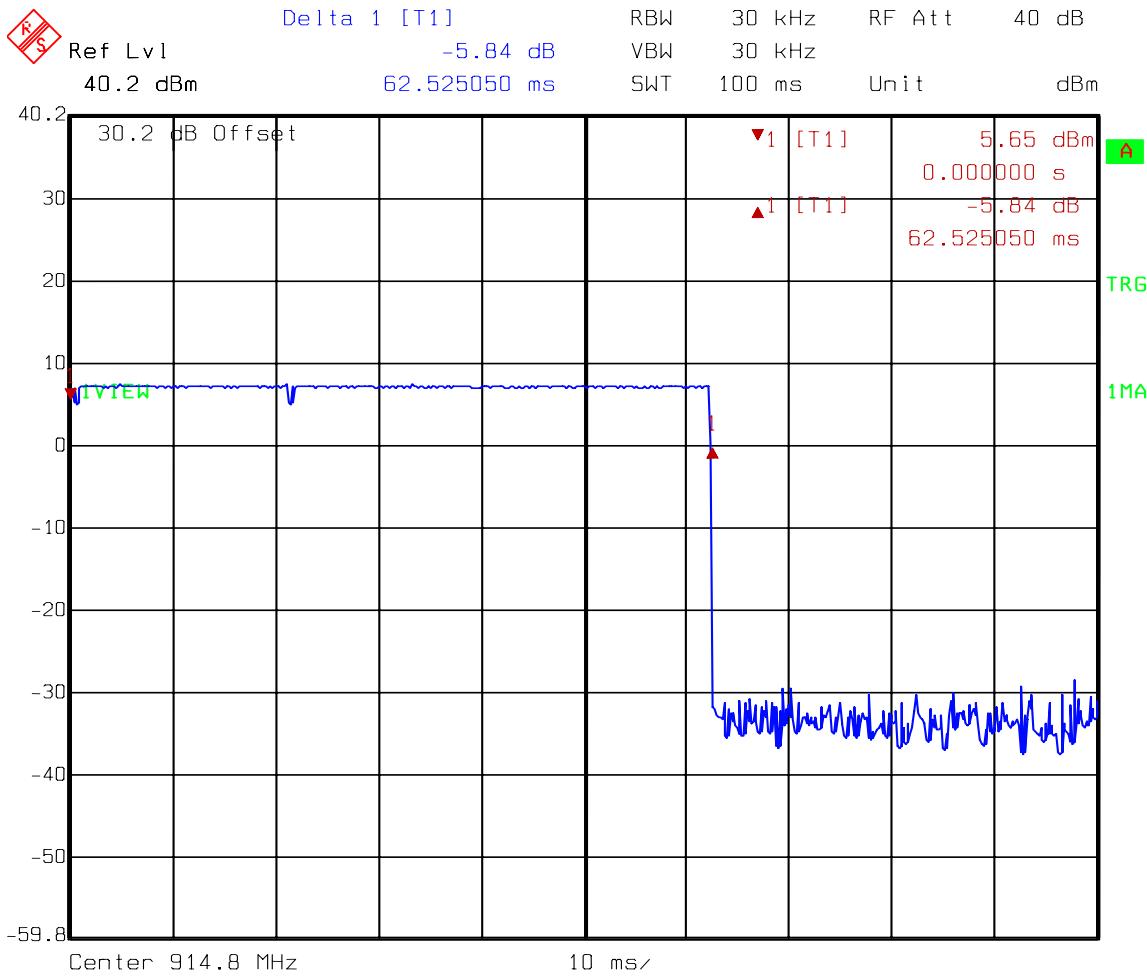
Section 4. Time of Occupancy

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 18 June 2009

Test Results: Complies.**Measurement Data:**

Maximum Dwell Time On Any Channel: 62.5 mS

Equipment Used: 1036-1082-1472-1469**Measurement Uncertainty:** 1X10⁻⁷ ppm**Temperature:** 22 °C**Relative Humidity:** 35 %

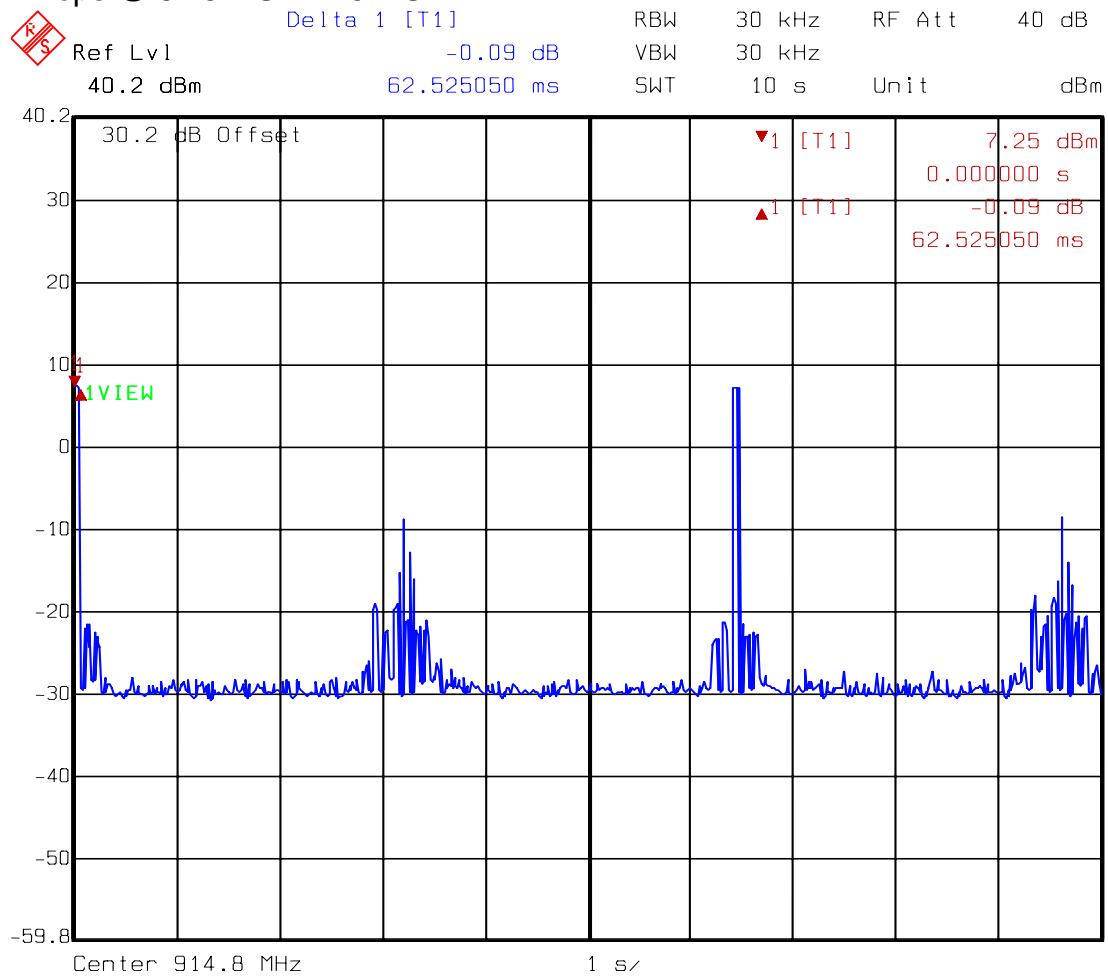
Test Data – Time of Occupancy**Pulse Width**

Test Data – Time of Occupancy

64 Channels

10 second sweep

2 hops @ 62.5 mS = 125 mS



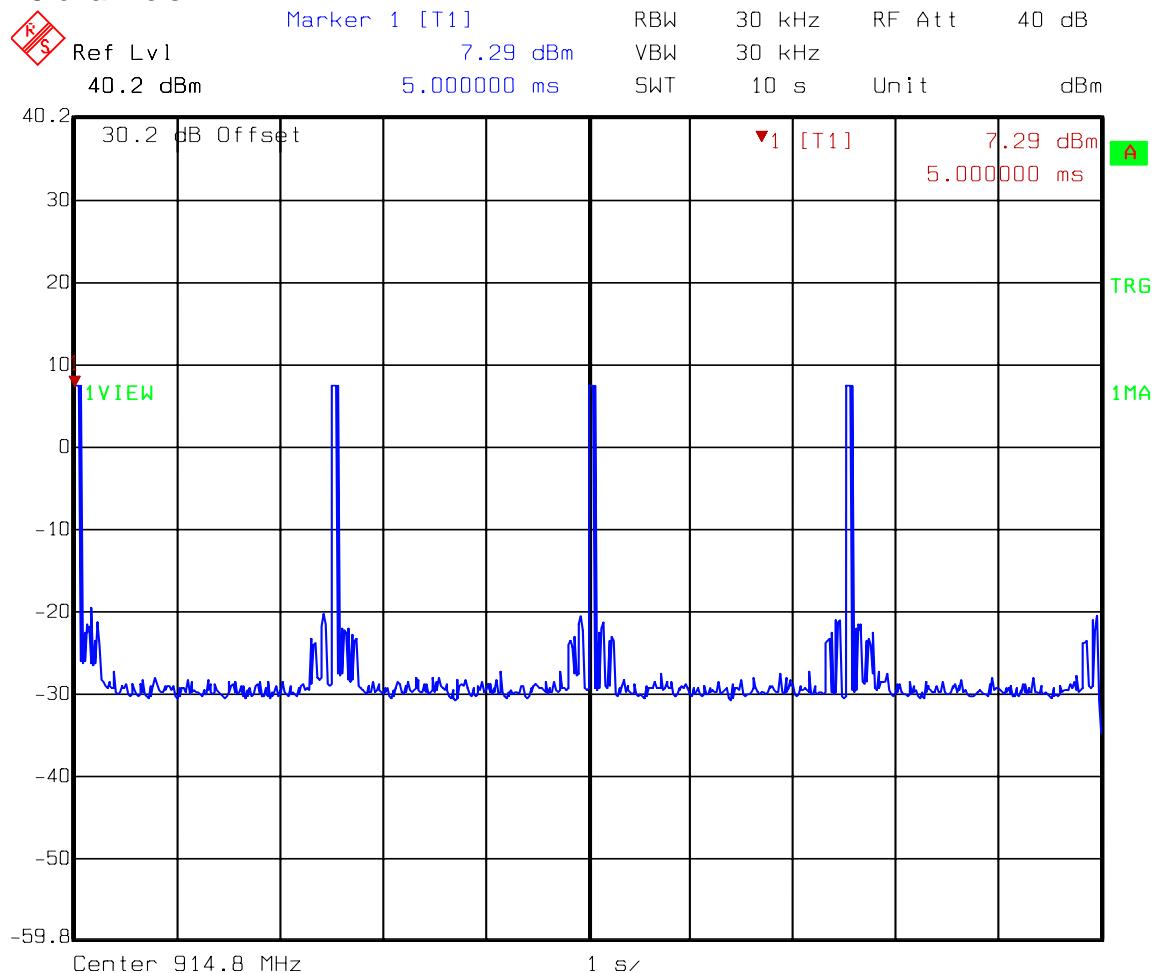
Date: 18.JUN.2009 09:07:55

Test Data – Time of Occupancy

10 second sweep

4 hops @ 62.5 mS = 250 mS

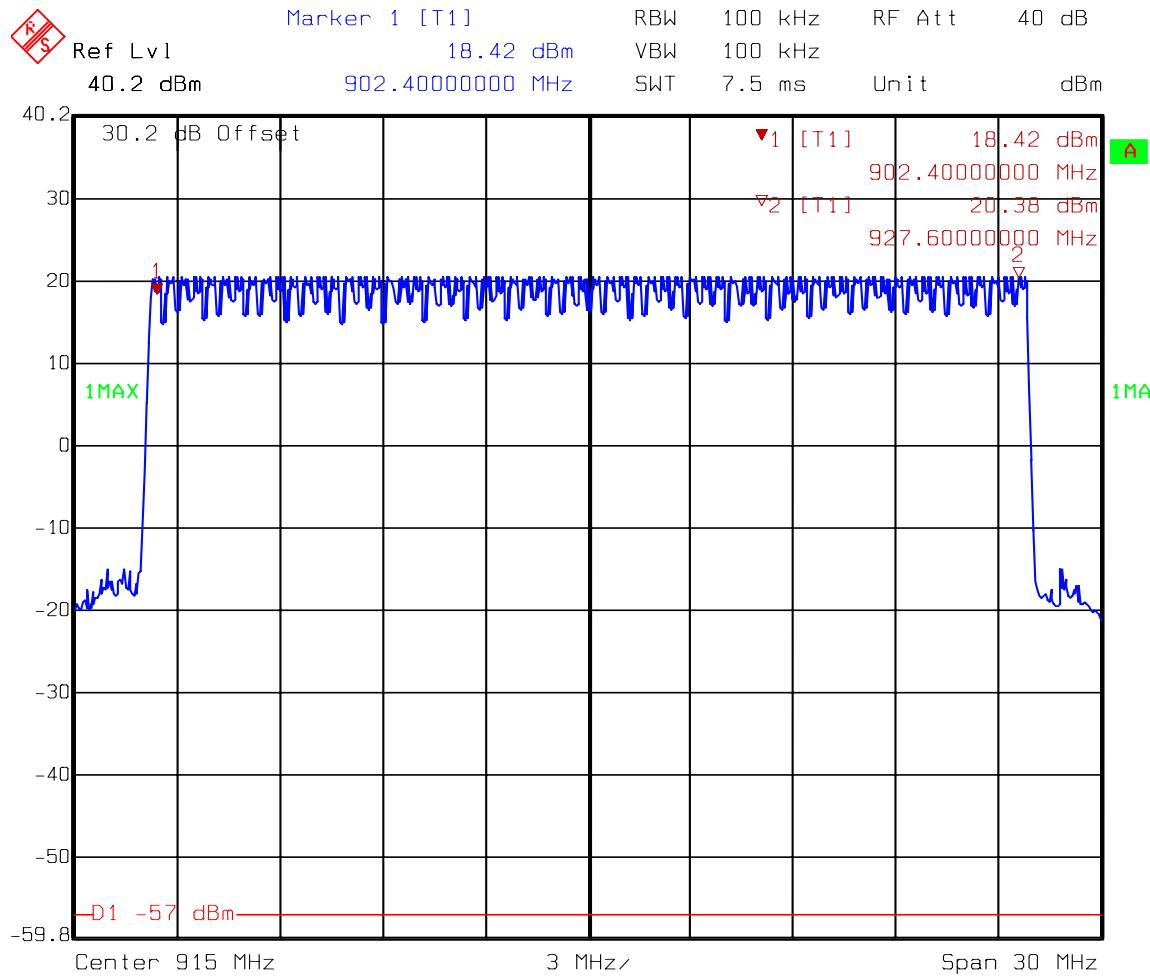
25 channels



Date: 18.JUN.2009 09:00:14

Test Data – Time of Occupancy

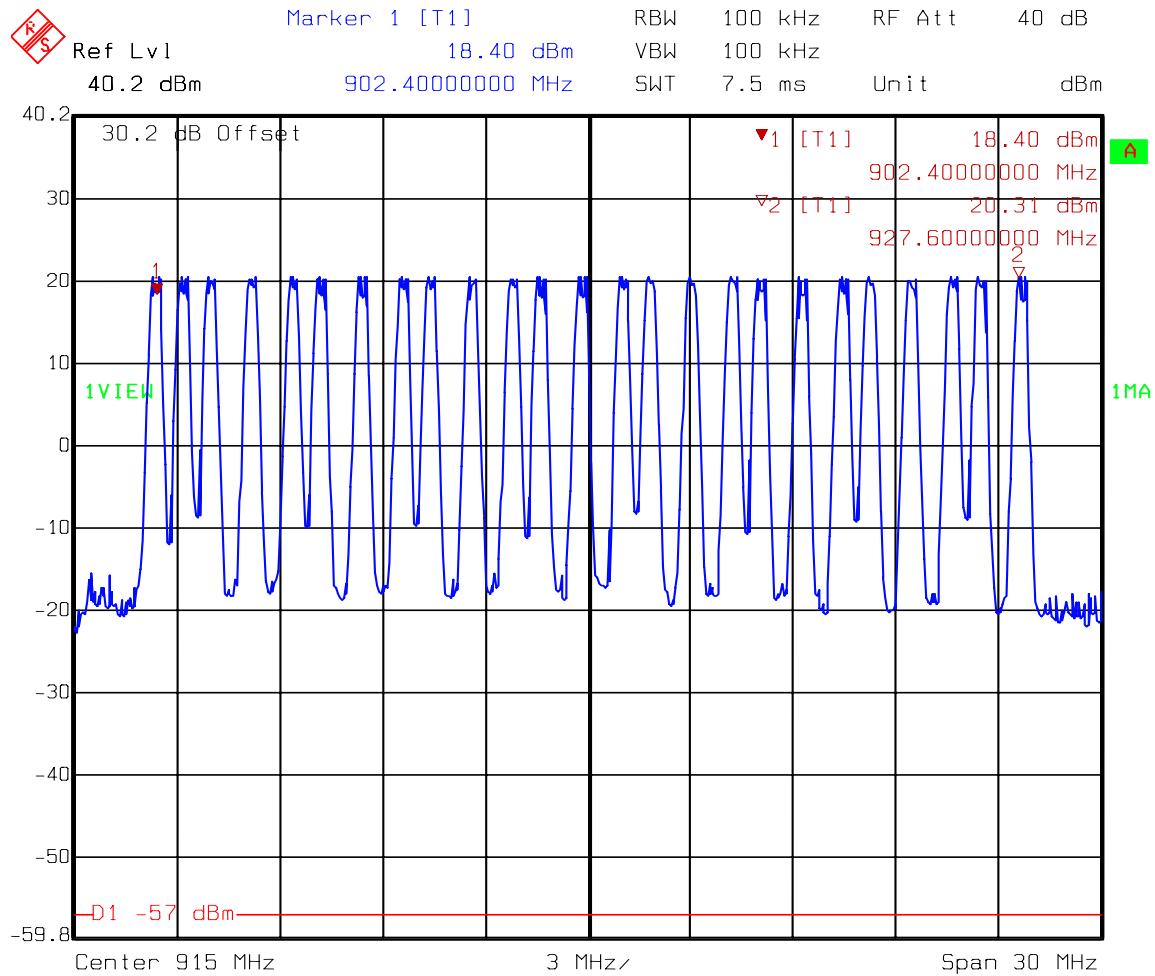
64 channels



Date: 18.JUN.2009 09:59:40

Test Data – Time of Occupancy

25 channels



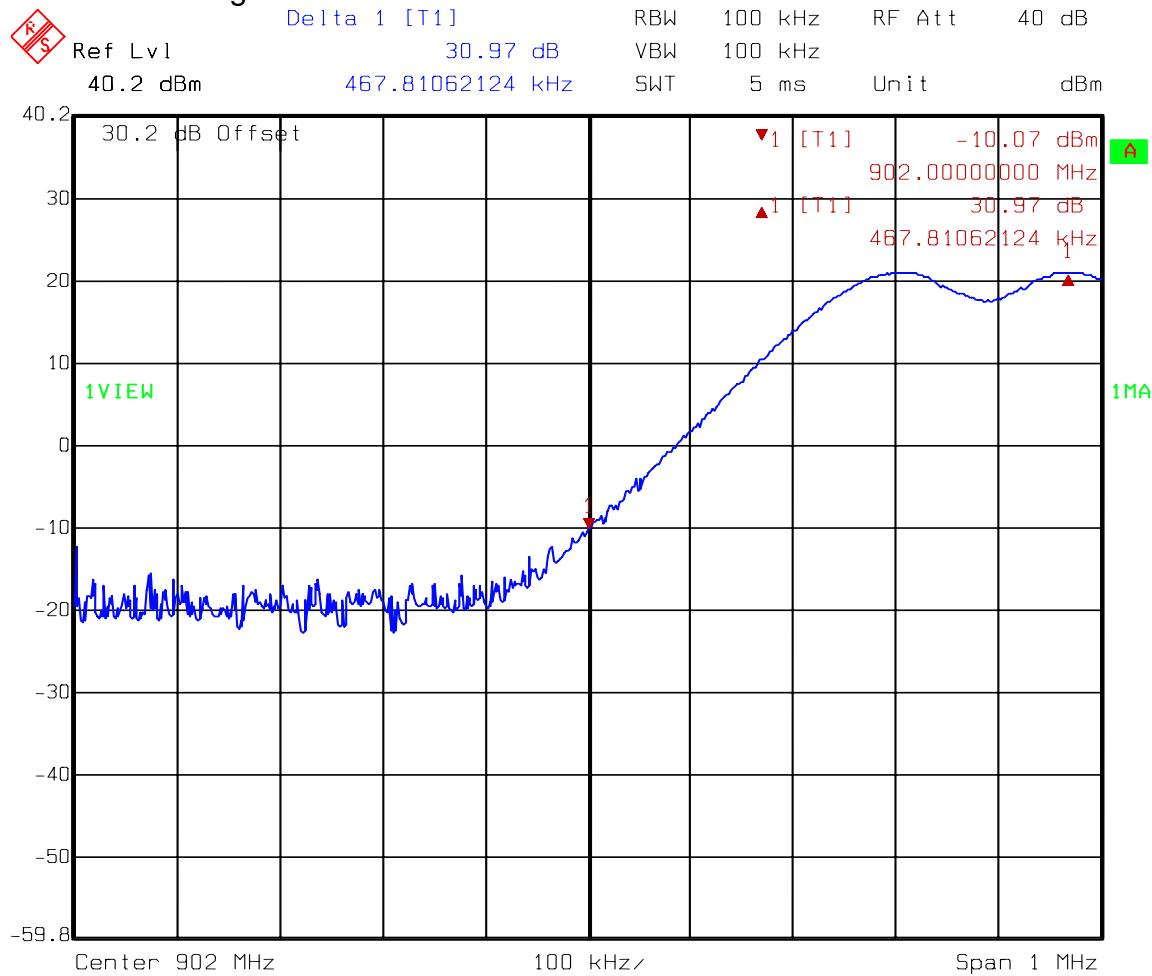
Date: 18.JUN.2009 10:00:27

Section 5. Spurious Emissions (Antenna Conducted)

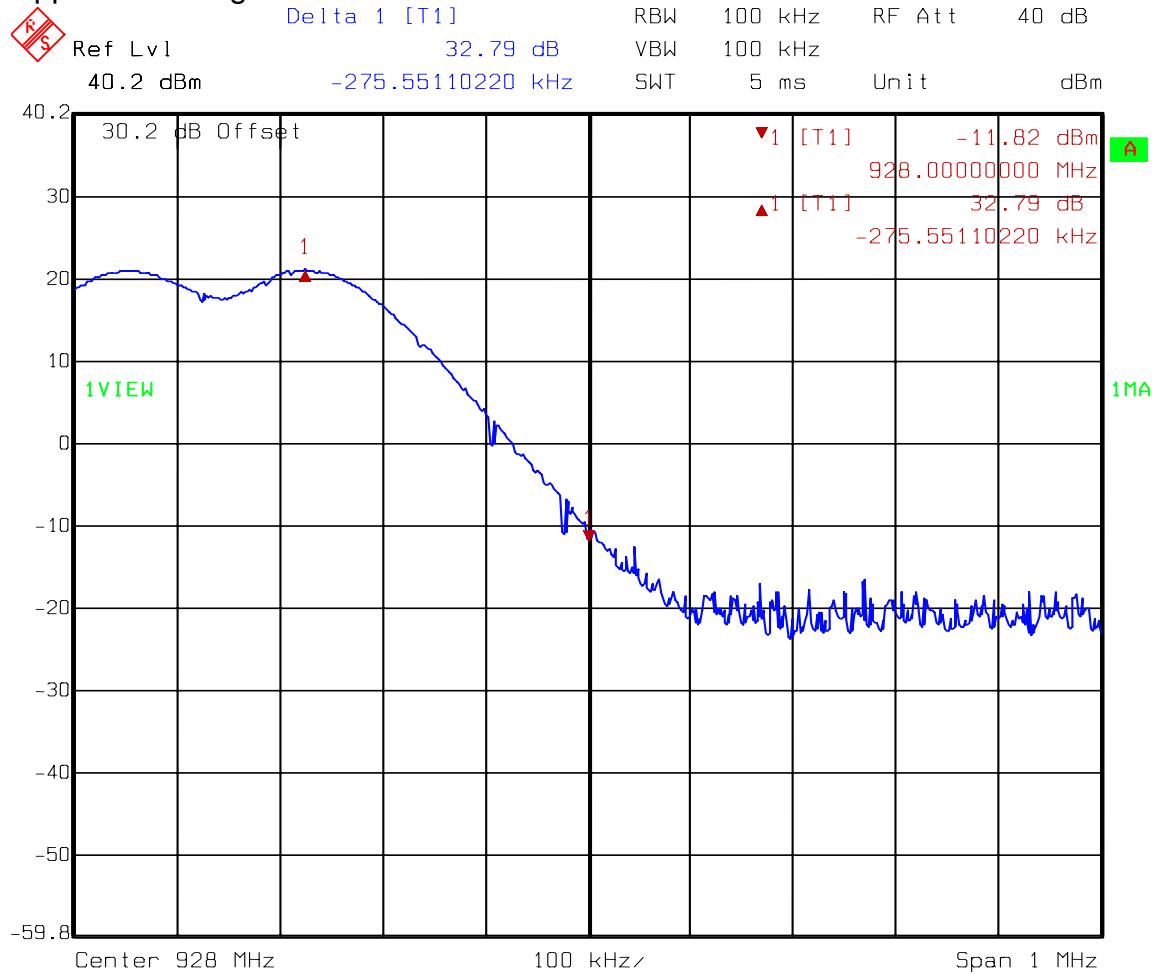
NAME OF TEST: Spurious Emissions (Antenna Conducted) PARA. NO.: 15.247(d)

TESTED BY: David Light DATE: 18 June 2009

Test Results: Complies. Upper and lower band edge data is presented to demonstrate compliance with wider frequency band.**Measurement Data:** See attached plots.**Equipment Used:** 1036-1082-1472-1469**Measurement Uncertainty:** 1X10⁻⁷ ppm**Temperature:** 22 °C**Relative Humidity:** 35 %

Test Data – Spurious Emissions at Antenna Terminals**Lower Band Edge**

Date: 18.JUN.2009 08:46:57

Test Data – Spurious Emissions at Antenna Terminals**Upper Band Edge**

Section 6. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	01/19/09	01/20/11
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A

Nemko USA, Inc.

EQUIPMENT: DX80

FCC PART 15, SUBPART C and RSS-210

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

PROJECT NO.:28293RUS1

ANNEX A - TEST DETAILS

NAME OF TEST: Channel Separation

PARA. NO.: 15.247(a)(1)

Minimum Standard:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

NAME OF TEST: Time of Occupancy

PARA. NO.: 15.247(a)(1)

Minimum Standard:

Frequency Band (MHz)	20 dB Bandwidth	No. of Hopping Channels	Average Time of Occupancy
902 - 928	<250 kHz	50	=<0.4 sec. in 20 sec.
902 - 928	=>250 kHz	25	=<0.4 sec. in 10 sec.
2400 - 2483.5	-----	75	=<0.4 sec. in 0.4 seconds multiplied by the number of hopping channels employed.
5725 - 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: 1 MHz

VBW: = RBW

Span: 0 Hz

LOG dB/div.: 10 dB

Sweep: Sufficient to see one hop time sequence.

Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

$(30 \text{ sec.} / 0.001 \text{ sec.}) / 75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in 30 sec.}$

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 15.247(d)
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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 (μ 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

Method Of Measurement:

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ : Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ : Peak of highest spurious level above center frequency.

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

Nemko USA, Inc.

EQUIPMENT: DX80

FCC PART 15, SUBPART C and RSS-210

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

PROJECT NO.:28293RUS1

ANNEX B - TEST DIAGRAMS

Antenna Conducted Tests

