

Nemko Test Report: 5L0182RUS1

Applicant: Crane Nuclear Inc.
2825 Cobb International Boulevard
Kennesaw, Georgia 30152

Equipment Under Test: ValveWatch 1-51001EX

In Accordance With: FCC Part 15, Subpart C, 15.247
Digital Transmission System Transmitter

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

Authorized By: 
David Light, Senior Wireless Engineer

Date: 9/8/2005

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Section 1. Summary of Test Results

Manufacturer: Crane Nuclear Inc

Model No.: ValveWatch 1-51001EX

Serial No.: 004224-05/010

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 Digital Transmission Systems. 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.

<input checked="" type="checkbox"/>	New Submission	<input type="checkbox"/>	Production Unit
<input type="checkbox"/>	Class II Permissive Change	<input checked="" type="checkbox"/>	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".



NVLAP LAB CODE: 100426-0

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EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 5L0182RUS1

Summary Of Test Data

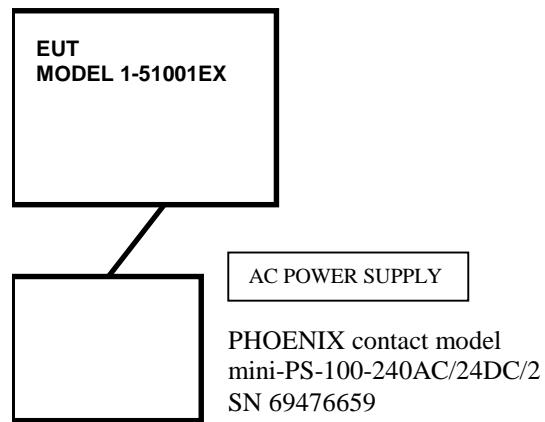
NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	Complies
Maximum Peak Power Output	15.247(b)(1)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	Complies
Spurious Emissions (Restricted Bands)	15.247(c)	Complies
Peak Power Spectral Density	15.247(d)	Complies

Footnotes:

Section 2. Equipment Under Test (E.U.T.)**General Equipment Information****Frequency Band:** 2402 to 2480 MHz**Channel Spacing:** 1 MHZ**User Frequency Adjustment:** Software controlled

Description of EUT

Acquire data remotely from a Local Data Acquisition Unit to a Hub Communications Assembly for data transfer to the ValveWatch Database.

System Diagram

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EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 5L0182RUS1

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Kevin Rose	DATE: 9/06/2005

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

The worst-case emission is 45.1dB_{UV} 0.375MHz on the Hot side of the line.
This is 3.7 dB below the average specification limit of 49dB_{UV}.

Test Data – Powerline Conducted Emissions



Dallas Headquarters:
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Fax: (972) 436-2667

Conducted Emissions Powerline Voltage Measurement											
Complete	<input checked="" type="checkbox"/>		Job # : <u>5L0182E</u>				Test # : <u>CEPV-01</u>				
Preliminary	<input type="checkbox"/>		Page <u>1</u>				of <u>2</u>				
Client Name :	Crane Nuclear Inc										
EUT Name :	ValveWatch										
EUT Model # :	ValveWatch 1-51001ex										
EUT Part # :	ValveWatch 1-51001ex										
EUT Serial # :	5200001										
EUT Config. :	Acquisition Mode										
Specification :	FCC CLASS B										
Transducer # :	545	Temp. (deg. C) :	22	Reference :							
HP Filter # :	968	Humidity (%) :	33	Date :	09/06/05						
Cable 1 # :	1019	EUT Voltage :	115 Vac	Time :	11:00 A.M.						
Cable 2 # :	1116	EUT Frequency :	60 Hz	Staff :	Kevin Rose						
Detector 1 # :	718	Peak Bandwidth:	10kHz	Location :	SR						
Detector 2 # :		QP Bandwidth	9kHz	Photo ID:	5L0182E CEPV-01						
Limiter # :		Avg. Bandwidth	9kHz								
Meas. Freq. Test Point (MHz)	EUT (P, QP, A)	Detector Type (QP, A)	Limit Type (QP, A)	Meter Reading (dBuV)	Path Loss (dB)	Transducer Factor (dB)	Corrected Reading (dBuV)	Spec.limit (dBuV)	CR/SL Diff. (dB)	Pass Fail Unc.	Comment
Q.P.	Avg.										
0.174	H	QP	QP	56.0	0	0.5	56.5	64	54	-7.5	Pass
0.174	H	A	A	48.0	0	0.5	48.5	64	54	-5.5	Pass
0.374	H	QP	QP	49.5	0	0.5	50.0	59	49	-9.0	Pass
0.375	H	A	A	44.6	0	0.5	45.1	59	49	-3.9	Pass
0.4	H	QP	QP	48.0	0	0.5	48.5	57	47	-8.5	Pass
0.4	H	A	A	42.0	0	0.5	42.5	57	47	-4.5	Pass

Date: 09/06/2005 Time: 15:34:06 W/W: FCC B COND [AVE] Test Lead: White Sequence#: 9

White Lead FCC

dBuV/m

150 kHz 1MHz 10MHz 30MHz

FCC B COND [QP]

FCC B COND [AVE]

..\\EMCShare\\AUTOMATE\\DATASHTS\\CEP_Voltage Rev C.xls Document Control #EMC DS EM COND VOLT

Test Data – Powerline Conducted Emissions



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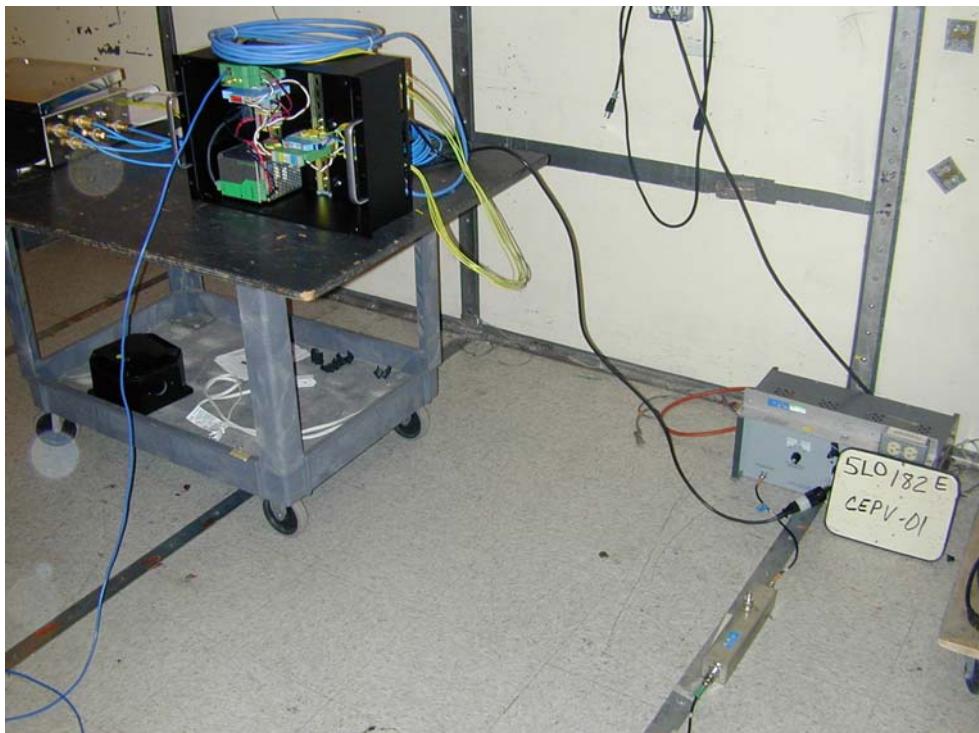
Tel: (972) 436-9600

Fax: (972) 436-2667

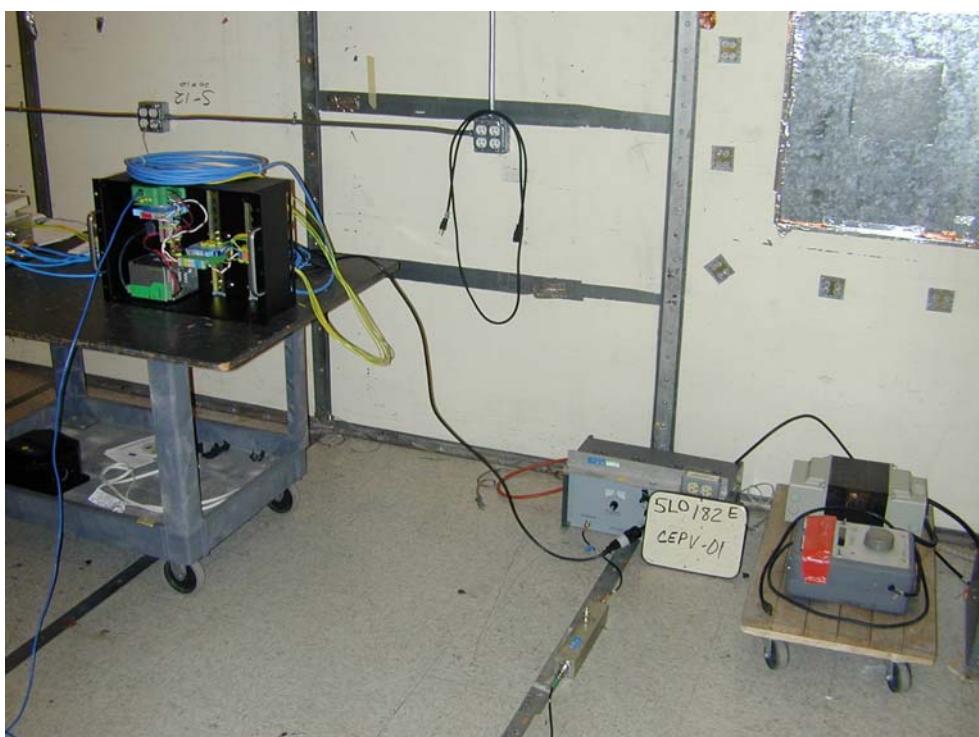
Conducted Emissions Powerline Voltage Measurement												
Complete	<input checked="" type="checkbox"/>		Job # : 5L0182E			Test # : CEPV-01						
Preliminary	<input type="checkbox"/>											
Page <u>2</u> of <u>2</u>												
Client Name :	Crane Nuclear Inc											
EUT Name :	ValveWatch											
EUT Model # :	ValveWatch 1-51001ex											
EUT Part # :	ValveWatch 1-51001ex											
EUT Serial # :	5200001											
EUT Config. :	Acquisition Mode											
Specification :	FCC CLASS B					Reference :						
Meas. Freq. (MHz)	EUT Test Point	Detector Type (P, QP, A)	Limit Type (QP, A)	Meter Reading (dBuV)	Path Loss (dB)	Transducer Factor (dB)	Corrected Reading (dBuV)	Spec. limit (dBuV)		CR/SL Diff. (dB)	Pass Fail Unc.	Comment
								Q.P.	Avg.			
0.174	N	QP	QP	48.2	0.0	0.5	48.5	64.0	54.0	-15.5	Pass	
0.174	N	A	A	45.0	0.0	0.5	45.5	64.0	54.0	-8.5		
0.35	N	QP	QP	48.0	0.0	0.5	48.5	59.0	49.0	-10.5		
0.35	N	A	A	42.0	0.0	0.5	42.5	59.0	49.0	-6.5		
Date: 09/06/2005 Time: 15:23:13 WO#: FCC B COND [AVE] Test Lead: White Sequence#: 8 dB μ V/m White Lead FCC												
..\EMCShare\AUTOMATE\DATASHTS\CEP_Voltage Rev C.xls Document Control #EMC DS EM COND VOLT												

Photos – Powerline Conducted Emissions

Front



Side



Nemko Dallas

EQUIPMENT: ValveWatch

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Digital Transmission Systems
Test Report No.: 5L0182RUS1

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Kevin Rose	DATE: 6/27/05

Test Results: Complies.

Measurement Data: See 6 dB BW plot

Measured 6 dB bandwidth:

Test Data – Occupied Bandwidth

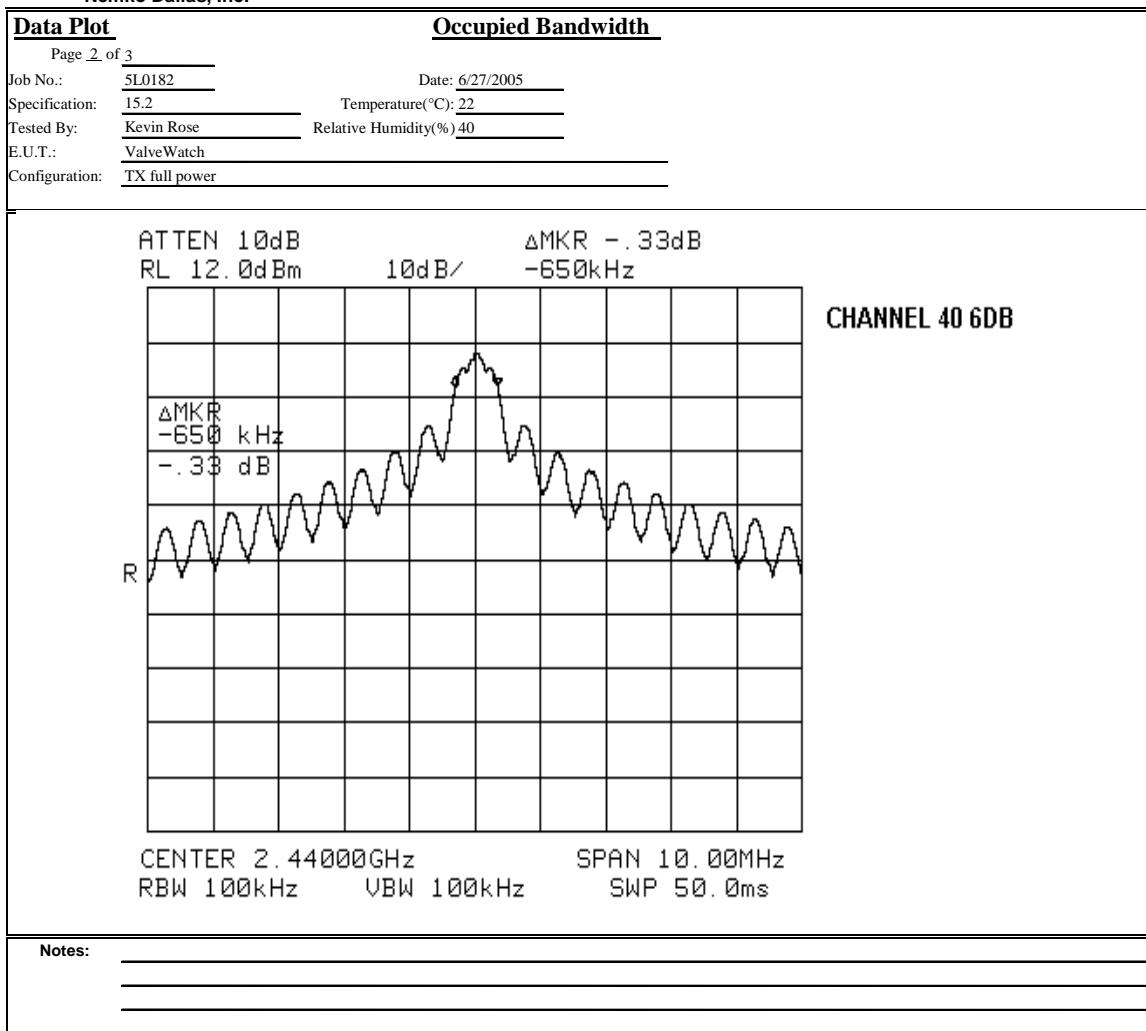
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Data Plot		Occupied Bandwidth	
Page <u>1</u> of <u>3</u>			
Job No.:	5L0182	Date:	6/27/2005
Specification:	15.247	Temperature(°C):	22
Tested By:	Kevin Rose	Relative Humidity(%):	40
E.U.T.:	ValveWatch		
Configuration:	TX full power		
Serial Number:	5200001	RBW:	100 kHz
Location:	Lab 2	VBW:	100 kHz
Detector Type:	Peak		
Test Equipment Used			
Antenna:	Directional Coupler:		
Pre-Amp:	Cable #1:		
Filter:	Cable #2: 1082		
Receiver:	Cable #3:		
Attenuator #1	Cable #4:		
Attenuator #2:	Mixer:		
Additional equipment used:			
Measurement Uncertainty: +/-1x10 ⁻⁷ ppm			
Notes: _____ _____ _____			

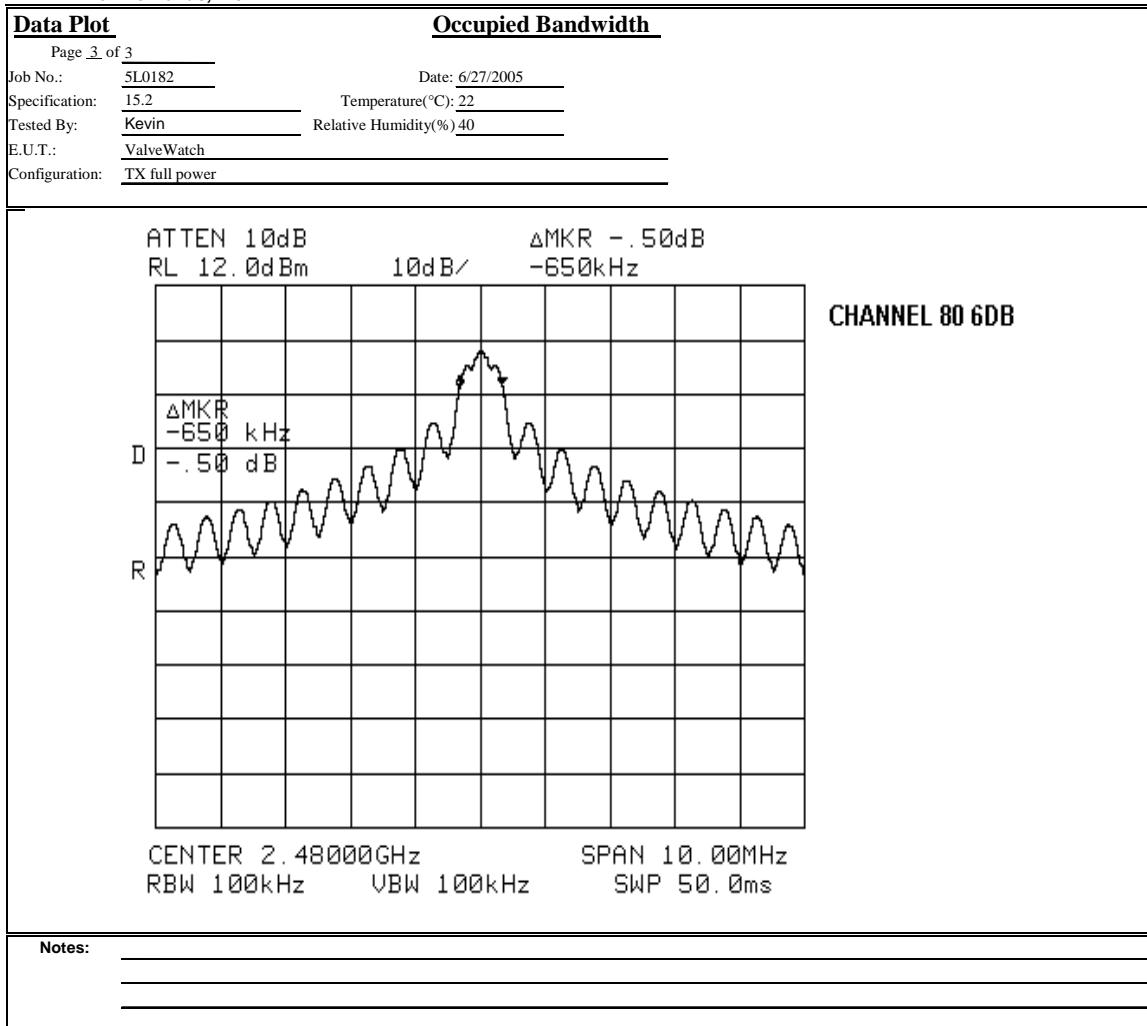
Test Data – Occupied Bandwidth

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Test Data – Occupied Bandwidth

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Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: Kevin Rose	DATE: 6/27/2005

Test Results: Complies.**Measurement Data:** Refer to attached data

The measurement was repeated at +/- 15% of nominal supply voltage with no variation noted: RF conducted power output.

Frequency (MHz)	Mode	Peak Power (dBm) antenna connector	With 6dBi antenna EIRP (dBm)
2402	Tx full	7.7	13.7
2442	Tx full	8.8	14.8
2480	Tx full	8.8	14.8

Test Equipment: 1029-1081-1464

Test Conditions: 22°C
40% RH

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EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 5L0182RUS1

Section 6 Spurious Emissions at Antenna Terminals

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

TESTED BY: Kevin Rose

DATE: 6/27/2005

Test Results: Complies.

Measurement Data: See attached plots.

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot		Spurious Emissions at Antenna Terminals			
Page <u>1</u> of 4				Complete <input checked="" type="checkbox"/> Preliminary: _____	
Job No.:	5L0182	Date:	9/6/2005	RBW:	100 kHz
Specification:	15.247	Temperature(°C):	22	VBW:	100 kHz
Tested By:	Kevin Rose	Relative Humidity(%):	40		
E.U.T.:	ValveWatch				
Configuration:	TX full power				
Serial Number:	3				
Location:	Lab 2	RBW:	100 kHz		
Detector Type:	Peak	VBW:	100 kHz		
Test Equipment Used					
Antenna:	Directional Coupler: _____				
Pre-Amp:	Cable #1: _____				
Filter:	Cable #2: _____				
Receiver:	Cable #3: _____				
Attenuator #1	Cable #4: _____				
Attenuator #2:	Mixer: _____				
Additional equipment used:					
Measurement Uncertainty:	+/-1.7 dB				
Date:	06.SEP.2005 15:22:05				
Notes:	lower bandedge				

Test Data – Spurious Emissions at Antenna Terminals



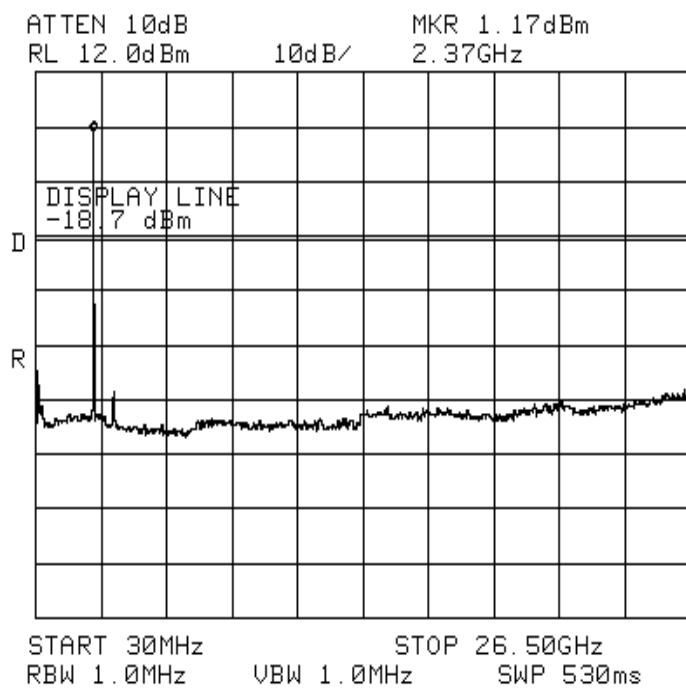
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Data Plot

Spurious Emissions at Antenna Terminals

Page 2 of 4
Job No.: 5L0182 Date: 6/27/2005
Specification: 15.2 Temperature(°C): 22
Tested By: Kevin Rose Relative Humidity(%) 40
E.U.T.: ValveWatch
Configuration: TX full power



CHANNEL 1 SPURIOUS

Notes:

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot **Spurious Emissions at Antenna Terminals**

Page 3 of 4

Job No.: 5L0182 Date: 6/27/2005
 Specification: 15.2 Temperature(°C): 22
 Tested By: Kevin Rose Relative Humidity(%) 40
 E.U.T.: ValveWatch
 Configuration: TX full power

ATTEN 10dB MKR -46.67dBm
 RL 12.0dBm 10dB/ 3.25GHz

CHANNEL 40 SPURIOUS

START 30MHz STOP 26.50GHz
 RBW 1.0MHz VBW 1.0MHz SWP 530ms

Notes: _____

Nemko Dallas

EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 5L0182RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot **Spurious Emissions at Antenna Terminals**

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Job No.: 5L0182 Date: 6/27/2005

Specification: 15.2 Temperature(°C): 22

Tested By: Kevin Rose Relative Humidity(%) 40

E.U.T.: ValveWatch

Configuration: TX full power

ATTEN 10dB MKR -45.00dBm
 RL 12.0dBm 10dB/ 3.29GHz

CHANNEL 80 SPURIOUS

R

MKR
3.29 GHz

-45.00 dBm

START 30MHz STOP 26.50GHz
 RBW 1.0MHz VBW 1.0MHz SWP 530ms

Notes:

Nemko Dallas

EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 5L0182RUS1

Section 7. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.247 (c)
TESTED BY: Kevin Rose	DATE: 6/27/2005

Test Results: Complies.

Spectrum was searched from 9 kHz to the 10th harmonic. No Emissions were detected within 20db of the limit.

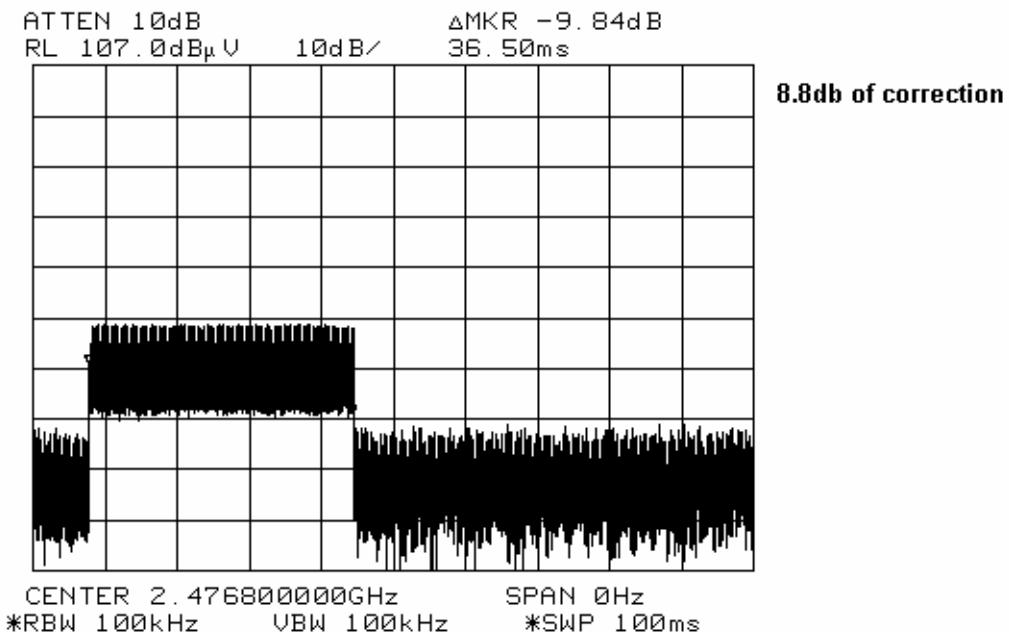
During Radiated test EUT was running at greater than 99.5% on time.

Duty Cycle correction was assessed with typical modulation used during normal operation.

Measurement Data: See attached table.

Duty cycle

(36.5ms/100) log*20=duty cycle



Radiated Emissions

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Radiated EmissionsPage 1 of 1

Job No.: 5L0182R Date: 6/27/2005
 Specification: 15.247/15.205 Temperature(°C): 21
 Tested By: Kevin Rose Relative Humidity(%) 46
 E.U.T.: ValveWatch
 Configuration: TX full power
 Sample Number: 5200001
 Location: AC 3 RBW: 1 MHz
 Detector Type: Peak VBW: 1 MHz

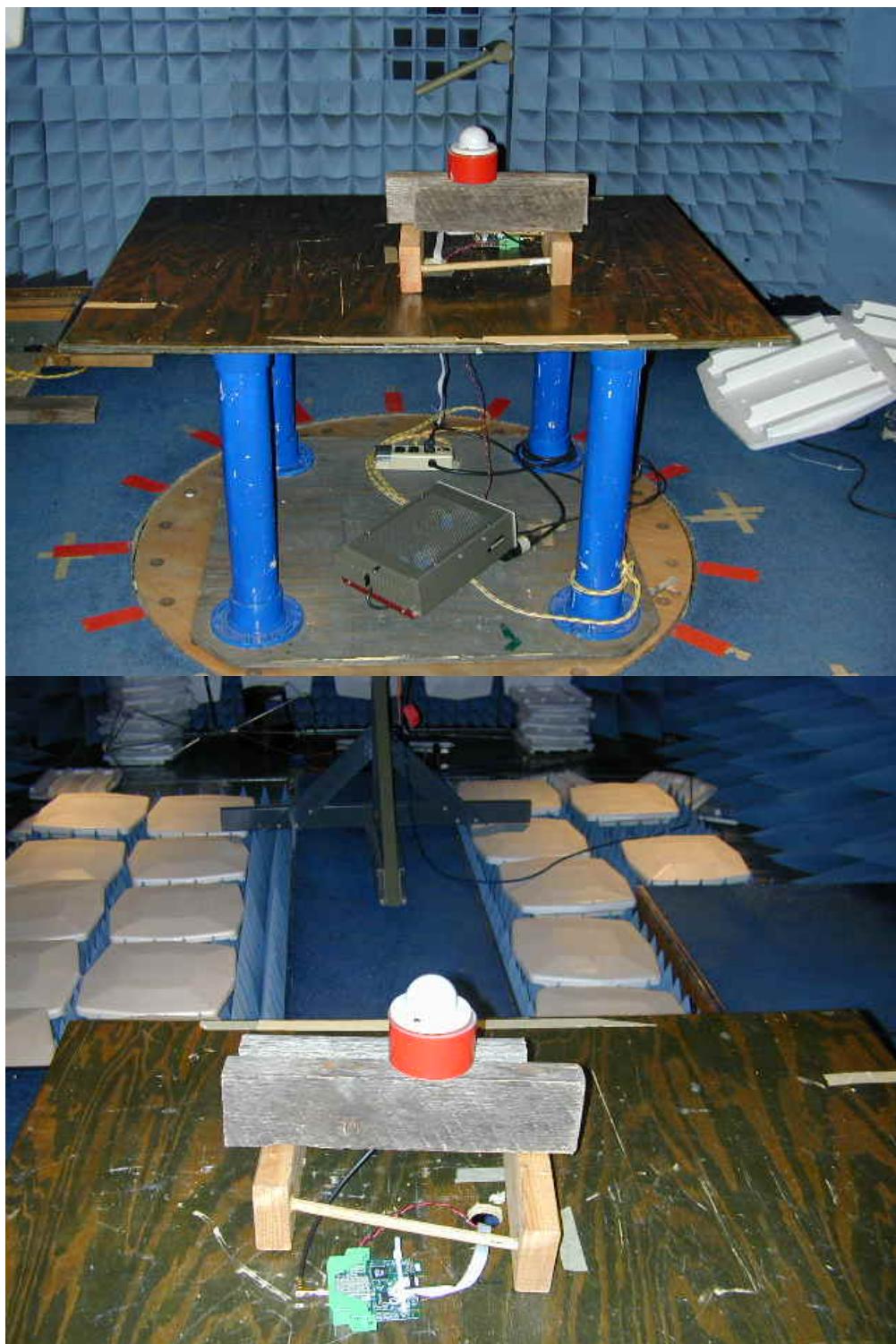
Test Equipment Used

Antenna:	1304	Directional Coupler:	#N/A
Pre-Amp:	1016	Cable #1:	1484
Filter:	#N/A	Cable #2:	1485
Receiver:	1464	Cable #3:	#N/A
Attenuator #1	#N/A	Cable #4:	#N/A
Attenuator #2:	#N/A	Mixer:	#N/A

Measurement Uncertainty: +/- 3.6 dB

Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
								V
2.4835	48.7	28.0	3.1	32.8	47.0	74	54	Peak
2.4835	39.9	28.0	3.1	32.8	38.2	74	54	average 8.8 duty cycle
2.4835	35.3	28.0	3.1	32.8	33.6	74	54	10hz
								H
2.4835	46.8	28.0	3.1	32.8	45.1	74	54	Peak
2.4835	38.0	28.0	3.1	32.8	36.3	74	54	average 8.8 duty cycle
2.4835	35.2	28.0	3.1	32.8	33.5	74	54	10hz

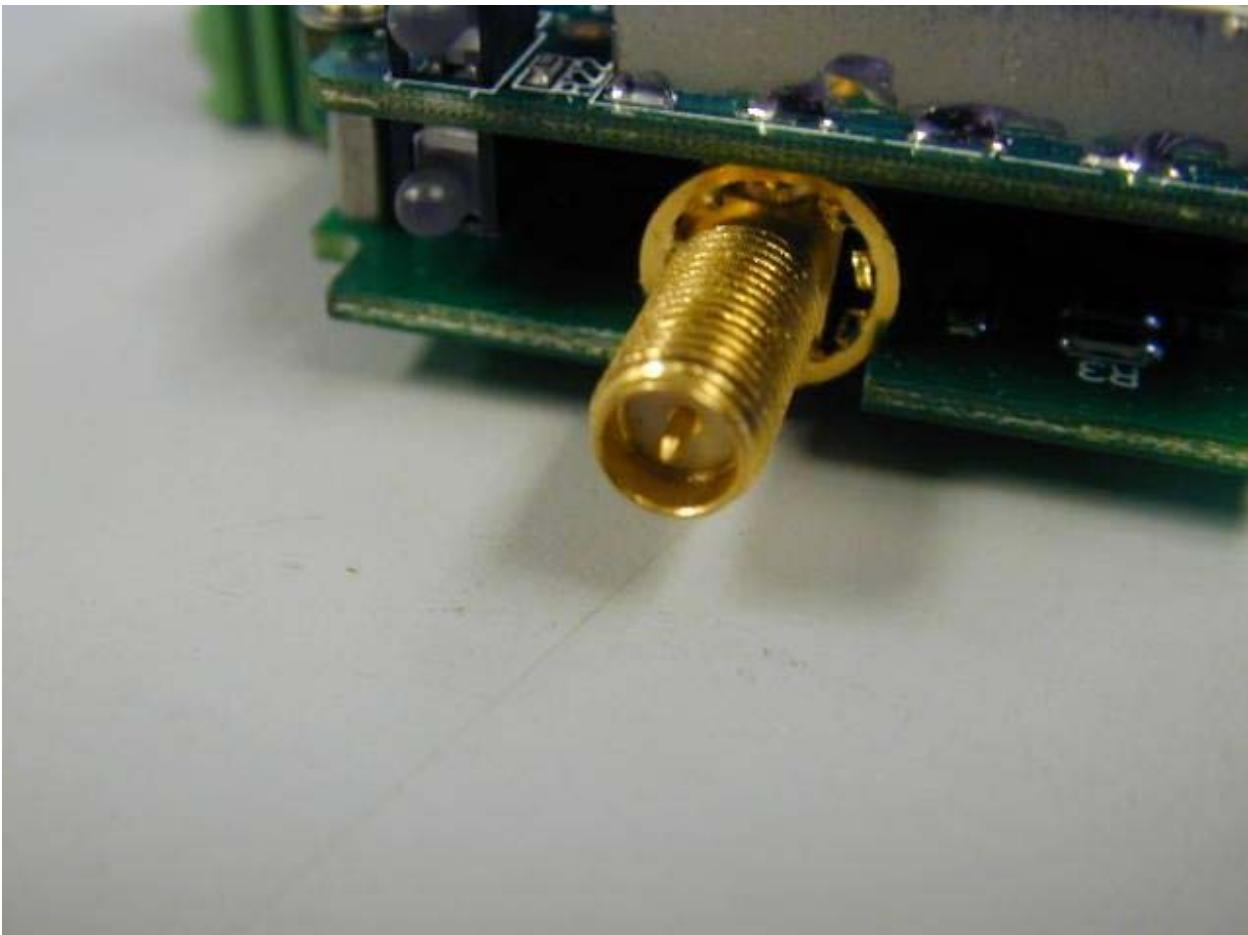
Radiated Photographs



15.203 Antenna connector Requirement

The EUT uses a Reverse Polarity SMA connector

Connector photo



Nemko Dallas

EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
Test Report No.: 5L0182RUS1

Section 8. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: Kevin Rose	DATE: 6/27/2005

Test Results: Complies.

Measurement Data: See attached data..

Peak Power Spectral Density



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Data Plot **Peak Power Spectral Density**

Page 1 of 3

Job No.: 5L0182 Date: 6/27/2005 Complete X
 Specification: 15.247 Temperature(°C): 22 Preliminary: _____
 Tested By: Kevin Rose Relative Humidity(%): 40 _____
 E.U.T.: ValveWatch _____
 Configuration: TX full power _____
 Serial Number: 5200001 _____
 Location: Lab 2 RBW: 3 kHz _____
 Detector Type: Peak VBW: 3 kHz _____

Test Equipment Used

Antenna: _____ Directional Coupler: _____
 Pre-Amp: _____ Cable #1: _____
 Filter: _____ Cable #2: _____
 Receiver: 1464 Cable #3: 1483 _____
 Attenuator #1 1472 Cable #4: _____
 Attenuator #2: 1474 Mixer: _____
 Additional equipment used: _____
 Measurement Uncertainty: $\pm 1 \times 10^{-7}$ ppm

*ATTEN 10dB MKR -9.67dBm
 RL 12.0dBm 10dB/ 2.400963GHz

channel 1 PSD

START 2.400000GHz STOP 2.402000GHz
 *RBW 3.0kHz VBW 3.0kHz *SWP 680sec

Notes: _____

Peak Power Spectral Density



Nemko Dallas, Inc.

Data Plot

Page 2 of 3

Job No.: 5L0182 Date: 6/27/2005

Specification: 15.2 Temperature(°C): 22

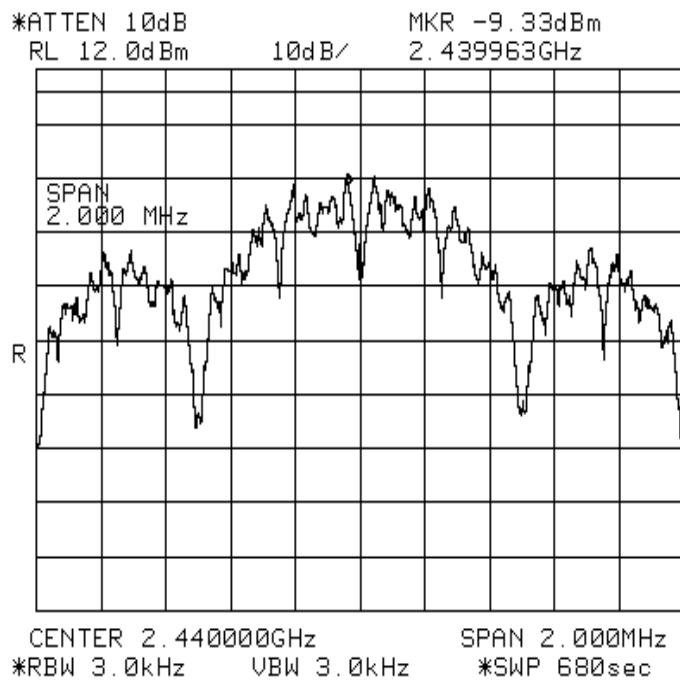
Tested By: Kevin Rose Relative Humidity(%) 40

E.U.T.: ValveWatch

Configuration: TX full power

Peak Power Spectral Density

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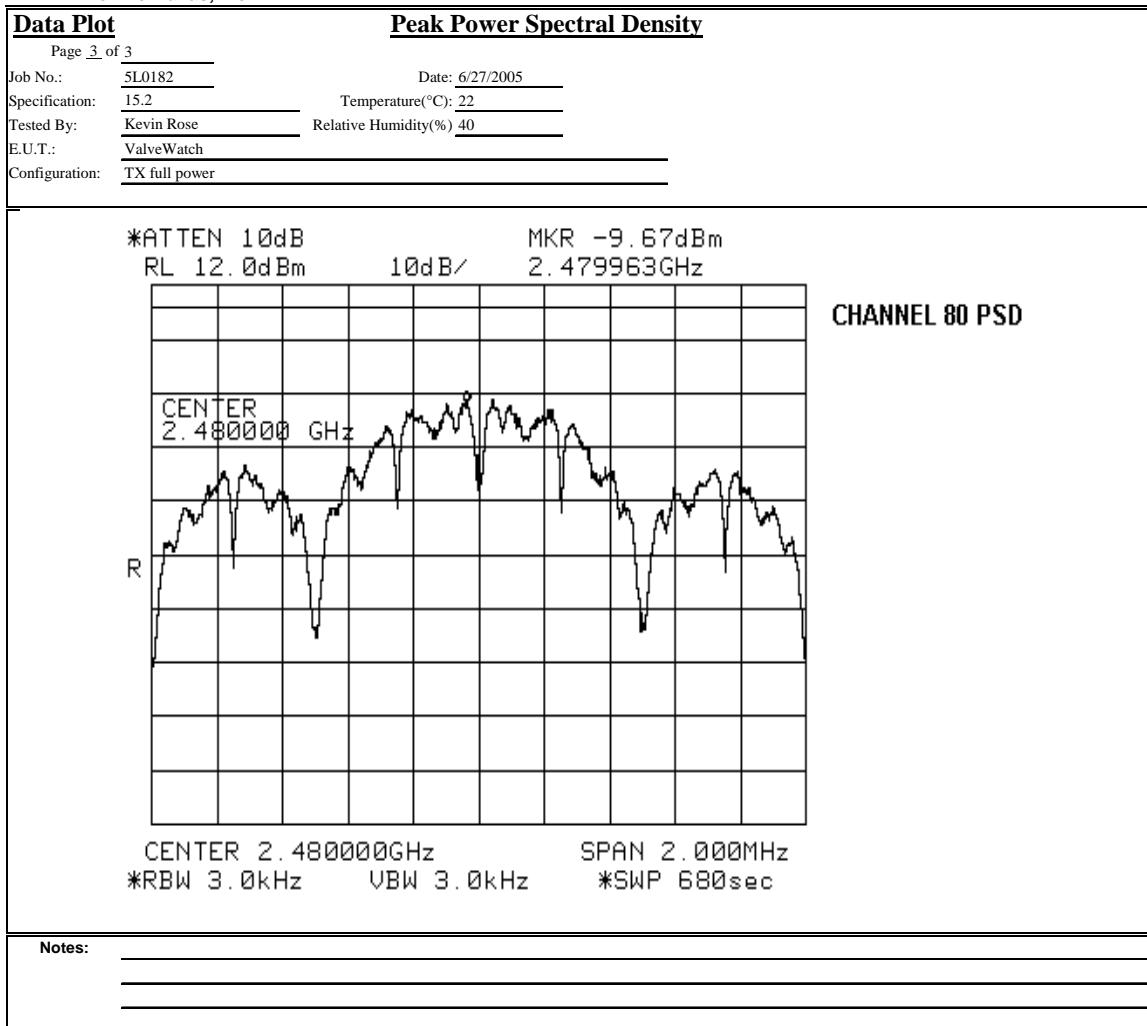


CHANNEL 40 PSD

Notes:

Peak Power Spectral Density

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Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
545	LISN	Schwarz Beck 8120	8120350	09/17/04	09/17/05
1555	Filter high pass 5KHz	Solar Electronics 7930-5.0	933125	04/20/05	04/20/06
1553	CABLE 1m	KTL RG223	N/A	06/09/04	06/09/05
1998	CABLE, 1m	KTL RG223	N/A	06/09/04	06/09/05
1284	Spectrum analyzer display	Hewlett Packard 8566B	1811A00223	01/10/05	01/10/06
966	Receiver	Rohde & Schwartz ESH2	880370/029	09/20/04	09/20/05
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	08/26/04	08/26/05
1029	PEAK POWER METER	HP 8900D	3303U0012	12/23/04	12/22/05
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	12/23/04	12/22/05
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	07/23/04	07/23/05
760	Antenna biconical	Electro Metrics MFC-25	477	06/22/04	06/22/05
791	PREAMP, 25dB	ICC LNA25	398	11/12/04	11/12/05
1083	Cable 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1477	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W5	NONE	CBU	N/A

Nemko Dallas

EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C

Digital Transmission Systems

Test Report No.: 5L0182RUS1

ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions**PARA. NO.:** 15.207(a)**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 Conducted Emission (MHz)	Limit (dBmV)	
	Quasi-peak	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.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

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FCC PART 15, SUBPART C
Digital Transmission Systems
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NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(2)

Minimum Standard: The minimum 6 dB bandwidth shall be at least 500 kHz

NAME OF TEST: Maximum Peak Output Power**PARA. NO.:** 15.247(b)(1)**Minimum Standard:** The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

Substitution Antenna Method for Integral Antennas:

The peak field strength of the carrier is measured in a worst-case configuration with a RBW > 5 times the occupied bandwidth of the transmitted waveform. For cases where the RBW of the test instrument is not sufficient, the power is measured using a peak power meter instead of the spectrum analyzer.

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

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

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EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
Digital Transmission Systems
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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.

NAME OF TEST: Pseudorandom Hopping Algorithm PARA. NO.: 15.247(a)(1)

Minimum Standard: The system shall hop to channel frequencies that are selected from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

NAME OF TEST: Time of Occupancy**PARA. NO.:** 15.247(a)(1)(ii)**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 30 sec.
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 (10, 20, or 30 seconds).

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 sec./.001 sec.)/75 chan. = 400 x 1 msec. = 400 msec. or 0.4 sec. in 30 sec.

Nemko Dallas**EQUIPMENT:** ValveWatch**FCC PART 15, SUBPART C**
Digital Transmission Systems
Test Report No.: 5L0182RUS1**NAME OF TEST:** Occupied Bandwidth**PARA. NO.:** 15.247(a)(2)**Minimum Standard:**

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	1 MHz
5725 – 5850	1 MHz

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 dB bandwidth

LOG dB/div.: 10 dB

Sweep: Auto

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

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NAME OF TEST: RF Exposure

PARA. NO.: 15.247(b)(4)

Minimum Standard: Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

NAME OF TEST: Spurious Emissions(conducted)	PARA. NO.: 15.247(c)
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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 IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.

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 Dallas**EQUIPMENT:** ValveWatch**FCC PART 15, SUBPART C**
Digital Transmission Systems
Test Report No.: 5L0182RUS1**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 (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

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

NAME OF TEST: Transmitter Power Density**PARA. NO.:** 15.247(d)

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement: The spectrum analyzer is set as follows:

RBW: 3 kHz

VBW: >3 kHz

Span: => measured 6 dB bandwidth

Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is $1500/3 = 500$ sec.

LOG dB/div.: 2 dB

Note: For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

For Devices With Integral Antenna:

For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

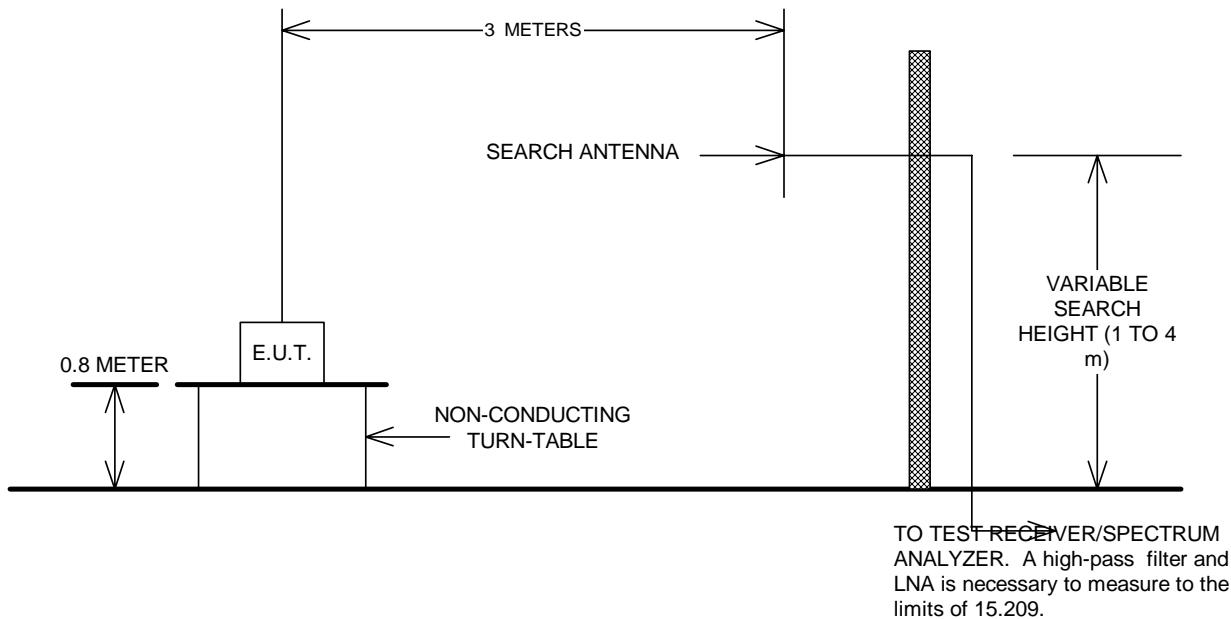
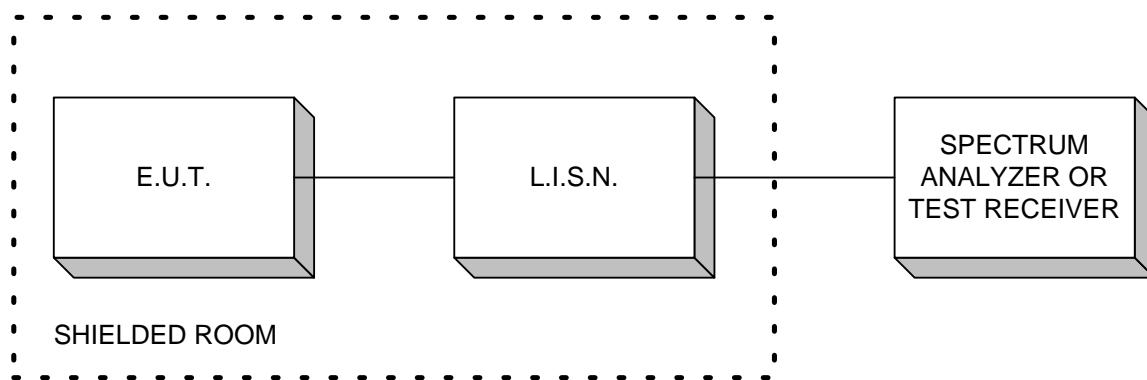
Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

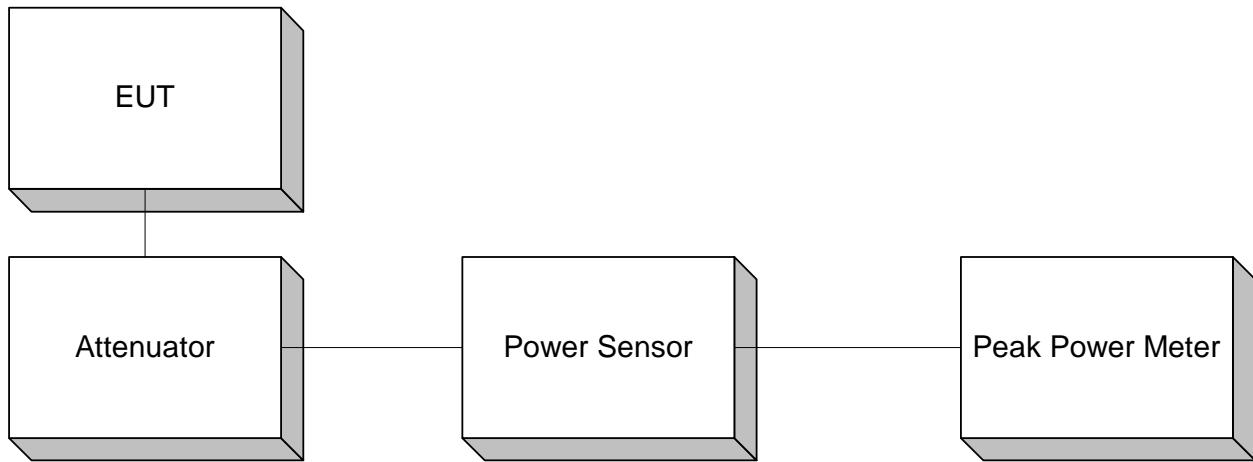
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EQUIPMENT: ValveWatch

FCC PART 15, SUBPART C
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ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions**Conducted Emissions**

Peak Power At Antenna Terminals

**Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)**

