

Nebraska Center for Excellence in Electronics
4740 Discovery Drive
Lincoln, NE 68521
Phone: 402-472-5880
Fax: 402-472-5881



FCC Test Report

Company: Novation Wireless
5743 Corsa Way
Westlake Village, CA 91362

Contact: Tim McCarthy

Product: nLock - Wireless Lockset

FCC ID: U4NNSERIES

Test Report No: R091206-30-02A

APPROVED BY: Doug Kramer
Senior Test Engineer

A handwritten signature in black ink, appearing to read "Doug Kramer", written over a horizontal line.

DATE: 24 May 2007
Total Pages: 38

The Nebraska Center for Excellence in Electronics (NCEE) authorizes the above named company to reproduce this report provided it is reproduced in its entirety for use by the company's employees only. Any use that a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. NCEE accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report applies only to the items tested. NCEE is a FCC and Industry Canada registered lab. FCC #100875, IC #4294



Table of Contents

1.0 Summary of test results

- 1.1 Test Results
- 1.2 Test Methods
 - 1.2.1 Conducted Emissions
 - 1.2.2 Radiated Emissions
- 1.3 Reason for Revision

2.0 Description

- 2.1 Equipment under test
- 2.2 Laboratory description
- 2.3 Description of test modes
- 2.4 Applied standards
- 2.5 Description of support units
- 2.6 Configuration of system under test

3.0 Test equipment used

4.0 Detailed Results

- 4.1 Unique antenna requirement
- 4.2 Radiated Emissions
- 4.3 Conducted AC Mains Emissions
- 4.4 Bandwidth
- 4.5 Maximum peak output power
- 4.6 Bandedges
- 4.7 Power Spectral Density

Appendix A – Test photos

Appendix B – Sample calculation

Appendix C – RF exposure evaluation

Appendix D – Table of figures

1.0 Summary of test results**1.1 Test Results**

The EUT has been tested according to the following specifications:

APPLIED STANDARDS: FCC Part 15, Subpart C			
Standard Section	Test Type and Limit	Result	Remark
15.203	Unique Antenna Requirement	Pass	PCB Antenna
15.207	Conducted Emissions	N/A	EUT has no connection to AC mains supply network.
15.209	Radiated Emissions	Pass	Meets the requirement of the limit.
15.247(a)(1)	Minimum 6dB Bandwidth, Limit: Min. 500kHz	Pass	Meets the requirement of the limit.
15.247(b)	Maximum Peak Output Power, Limit: Max. 30.0dBm	Pass	Meets the requirement of the limit.
15.247(c)	Transmitter Radiated Emissions, Limit: Table 15.209	Pass	Meets the requirement of the limit.
15.247(c)	Band Edge Measurement, Limit: 20dB less than the peak value of fundamental frequency	Pass	Meets the requirement of the limit.
15.247(d)	Power Spectral Density, Limit: Max. 8dBm	Pass	Meets the requirement of the limit.

1.2 Test Methods

1.2.1 Conducted AC Emissions

The EUT has no connection to the AC mains supply network and therefore conducted AC emissions are not applicable.

1.2.2 Radiated Emissions

Compliance to 47 CFR Parts 15.209 and 15.247 was tested in accordance with the methods of ANSI/IEEE C63.4: 2003. Several configurations were examined and the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to find the angles of maximum emissions and the receiving antenna was moved from 1m to 4m in both vertical and horizontal positions. The EUT was tested while sitting both vertically and horizontally. The horizontal configuration produced the highest emissions, and that position was used for all radiated testing. All measurements were taken at a distance of 3m from the EUT for Part 15.209 intentional radiator measurements, and 3m for 15.247 measurements of the fundamental frequency in the 902MHz to 928MHz band and subsequent harmonics.

1.3 Reason for Revision

1.3.1

Page 16 has been modified to display correct data for the margins.

1.3.2

A note has been added to page 5, section 2.1 to specify that the EUT is a DTS system and was tested as such.

1.3.3

Page 6, Section 2.6 has been modified to state that the EUT was tested with the RF ID card reader inactive, and that the report is not intended to represent operation with the RF ID active.

1.3.4

Page 5, section 2.1 was modified to state that the channel selection of the EUT is an automatic function, and not available to the user.

2.0 Description**2.1 Equipment under test**

The Equipment Under Test (EUT) was a nLock Wireless Lockset from Novation Wireless and it is designed for us with the nHUB Wireless Access Hub. The EUT utilizes digital modulation scheme. The EUT was therefore test under part 15.247 of the rules as a digitally modulated system.

The Wireless Lockset contains no radio adjustments. The channel selection is controlled automatically by the EUT and the nHUB.

EUT Received Date: March 13 2007

EUT Tested Dates: March 21 – March 27, 2007

PRODUCT	Wireless Lockset
MODEL	nLock
POWER SUPPLY	4 AA batteries, 6V _{DC}
MODULATION TYPE	QFSK
RADIO TECHNOLOGY	Half-duplex RF Link
FREQUENCY RANGE	902MHz – 928MHz
NUMBER OF CHANNELS	32
MAX OUTPUT POWER	6.18dBm
ANTENNA TYPE	Internal
DATA CABLE	None
I/O PORTS	None
ASSOCIATED DEVICES	None

NOTE:

1. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility, which is a FCC and IC registered lab. This site has been fully described in previously submitted reports. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of $45 \pm 4\%$

Temperature of $20 \pm 3^\circ$ Celsius

2.3 Description of test modes

Channel	Frequency
0	902.971
16	915.000
31	926.277

2.4 Applied standards

The EUT is a digital transmission system operating between 902 MHz and 928 MHz. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247) using ANSI/IEEE C63.4: 2003

All test items have been performed and recorded as per the above standards.

2.5 Description of support units

None

2.6 Configuration of system under test

The EUT was tested while continuously transmitting, and 3 frequencies were examined. One frequency was the lowest possible transmitting frequency and one the highest. The third was in the middle of the operating range. The EUT was also tested in receive mode where noted. The test mode was provided by the manufacturer and was intended to provide continuous transmission. It was powered by a 4 AA batteries (6 V_{DC}).

The EUT includes a built-in RF ID card reader. This card reader was not active during testing, and the results included in this test are not intended to include the operation of this device when it is active. It cannot be activated by the user, only by the manufacturer.

3.0 Test equipment used

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE
Rohde & Schwarz Test Receiver	ESIB26	100037	15-Aug-2006
EMCO Biconilog Antenna	3142B	1647	29-Jan-2007
EMCO Horn Antenna	3115	6416	29-Jan-2007
Preamplifier	TR-PR18	082001/003	6-Dec-2006
Rohde & Schwarz LISN	ESH3-Z5	100023	24-May-2006

4.0 Detailed results

4.1 Unique antenna requirement

4.1.1 Standard applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

4.1.2 Antenna description

The antenna is internal to the EUT and is not user replaceable.

4.2 Radiated emissions

4.2.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH ($\mu\text{V/m}$)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = $20 * \log * \text{Emission level } (\mu\text{V/m})$.
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

4.2.2 Test procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.
- d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.
- e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for peak and average detectors at frequencies above 1GHz.
3. The angles and antenna heights/polarities were adjusted to produce the highest emissions for all measurements above 1GHz.

4.2.3 Deviations from test standard

No deviation.

4.2.4 Test setup

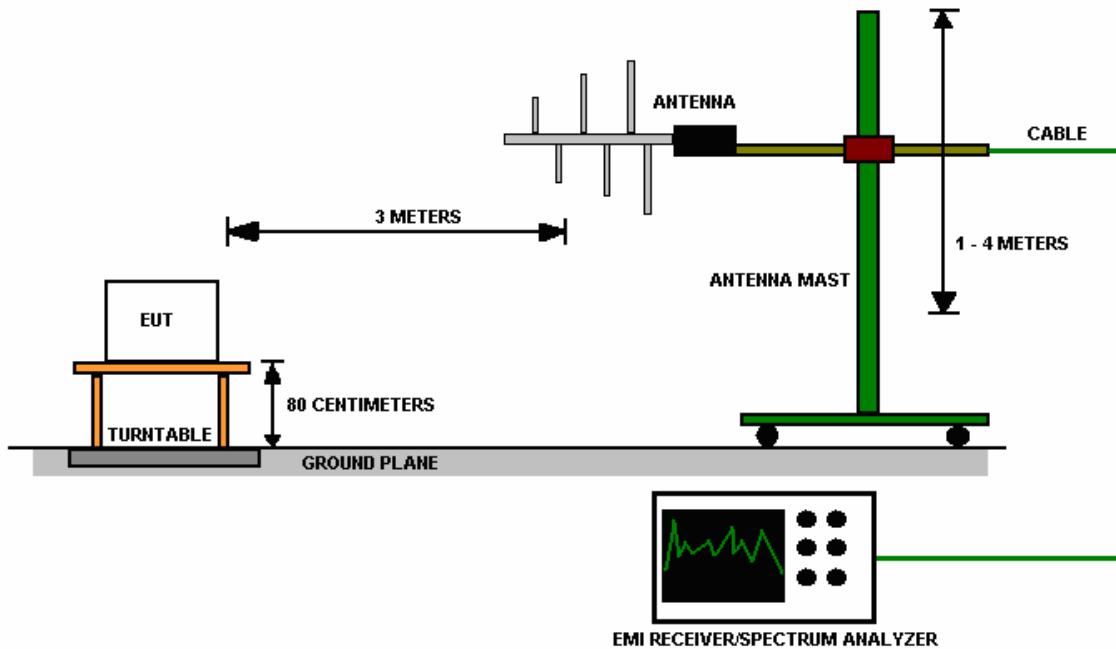


Figure 1 - Radiated Emissions Test Setup

For the actual test configuration, please refer to Appendix A for photographs of the test configuration.

4.2.5 EUT operating conditions

The EUT was powered by 4 AA batteries and had no auxiliary devices, so it was tested by itself. The EUT was set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range. A 40 cm wire was attached to the remote open switch and hung from the EUT towards the ground plane.

4.2.6 Test results

EUT	Wireless Lockset	Model	nLock
MODE	Channel 0	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency	Level	Angle	Height	Pol.
MHz	dBμV/m	deg	cm	
902.0441	31.11	352	200	VER
902.1042	31.11	276	200	VER
902.1643	31.26	148	200	HOR
902.2244	31.8	162	100	VER
902.2846	30.61	359	100	VER
902.3447	31.5	304	100	HOR
902.4048	31.26	205	100	HOR
902.4649	36.55	184	200	HOR
902.5251	30.64	61	200	VER
902.5852	48.50	69	100	HOR
902.6453	64.42	185	100	VER
902.7054	41.38	200	100	HOR
902.7655	30.16	93	200	HOR
902.8257	31.76	226	200	HOR
902.8858	31.84	85	200	HOR
903.006	33.48	340	100	VER
903.1864	31.67	195	200	VER
903.2465	31.82	240	200	VER
903.3066	31.03	9	100	HOR
903.3667	30.74	139	100	HOR
903.4269	31.17	157	200	VER
903.487	31.33	231	100	HOR

REMARKS:

1. Emission level (dBμV/m) = Raw Value (dBμV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.

EUT	Wireless Lockset	Model	nLock
MODE	Channel 16	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency MHz	Level dBμV/m	Angle deg	Height cm	Pol.
913.9479	31.54	146	100	HOR
914.008	31.39	360	200	HOR
914.0681	35.96	12	100	VER
914.1283	32.94	309	200	HOR
914.1884	38.42	66	200	VER
914.2485	40.32	234	200	HOR
914.3086	32.6	360	200	HOR
914.3687	31.31	317	100	HOR
914.4289	30.97	356	200	HOR
914.489	31.43	255	100	VER
914.5491	30.77	325	200	HOR
914.6092	35.34	296	200	HOR
914.6693	31.27	172	200	VER
914.7295	31.33	273	100	VER
914.7896	32.29	149	100	HOR
914.8497	65.04	296	200	HOR
914.9098	31.1	199	200	HOR
914.9699	41.36	50	200	HOR
915.0301	38.44	348	200	HOR
915.0902	30.95	87	200	VER
915.1503	55.11	123	100	VER
915.2104	31.79	170	200	VER
915.2705	32.08	273	200	VER
915.3307	45.33	296	200	HOR
915.3908	31.85	40	200	VER
915.4509	30.43	173	200	HOR
915.511	32.75	309	200	HOR

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.

EUT	Wireless Lockset	Model	nLock
MODE	Channel 31	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Quasi-peak Measurements

Frequency	Level	Angle	Height	Pol.
MHz	dBμV/m	deg	cm	
925.6112	37.9	44	100	HOR
925.6713	31.49	341	200	HOR
925.7315	66.49	40	200	HOR
925.7916	30.74	139	100	VER
925.8517	32.88	222	100	VER
925.9118	31.39	87	200	VER
925.9719	31.15	349	200	VER
926.0321	50.89	322	100	HOR
926.0922	32.31	263	200	HOR
926.1523	31.13	317	100	VER
926.2124	61.83	97	100	VER
926.2725	39.66	195	100	VER
926.3327	41.19	118	200	HOR
926.3928	33.91	351	200	HOR
926.4529	69.12	322	100	HOR
926.513	31.37	40	200	VER
926.5731	31.01	88	200	HOR
926.6333	31.37	210	100	HOR
926.6934	39.28	322	100	HOR
926.7535	31.68	150	200	HOR
926.8136	31.17	49	100	HOR
926.8737	31.63	117	100	VER

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. *Radiated limits do not apply within the 902MHz to 928MHz band.

EUT	Wireless Lockset	Model	nLock
MODE	Receive	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Average Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dB μ V/m	dB μ V/m	dB	cm	deg	
2380.000000	20.21	53.9	33.7	150.0	229	HORI
5841.000000	29.95	53.9	23.9	249.0	19	VERT
6158.500000	26.62	53.9	27.3	393.0	205	VERT
9072.500000	34.87	53.9	19.0	330.0	204	HORI

Peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dB μ V/m	dB μ V/m	dB	cm	deg	
2380.000000	33.73	53.9	20.2	150.0	229	HORI
5841.000000	43.03	53.9	10.9	249.0	19	VERT
6158.500000	40.10	53.9	13.8	393.0	205	VERT
9072.500000	48.20	53.9	5.7	330.0	204	HORI

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	Wireless Lockset	Model	nLock
MODE	Channel 0	FREQUENCY RANGE	1MHz – 10GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Radiated Emissions Average and Peak Data

Frequency	Average	Limit	Margin	Peak	Limit	Margin
MHz	dB μ V/m	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
1805.942	38.1	54.0	15.90	49.1	74.0	24.9
2708.913	41.1	54.0	12.9	53.3	74.0	20.7
3611.884	42.4	54.0	11.74	54.2	74.0	19.8
4514.855	44.2	54.0	10.00	56.3	74.0	17.7
5417.826	48.3	54.0	5.54	60.3	74.0	13.7

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	Wireless Lockset	Model	nLock
MODE	Channel 16	FREQUENCY RANGE	1MHz – 10GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Radiated Emissions Average and Peak Data

Frequency	Average	Limit	Margin	Peak	Limit	Margin
MHz	dB μ V/m	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
1805.942	39.0	54.0	15.0	49.2	74.0	24.8
2708.913	41.6	54.0	12.4	53.9	74.0	20.1
3611.884	44.3	54.0	9.7	56.2	74.0	17.8
4514.855	44.3	54.0	9.7	56.8	74.0	17.2
5417.826	49.1	54.0	4.9	62.3	74.0	11.7

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	Wireless Lockset	Model	nLock
MODE	Channel 31	FREQUENCY RANGE	1MHz – 10GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Radiated Emissions Average and Peak Data

Frequency	Average	Limit	Margin	Peak	Limit	Margin
MHz	dB μ V/m	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
1805.942	39.7	54.0	14.3	50.6	74.0	23.4
2708.913	40.7	54.0	13.3	52.7	74.0	21.3
3611.884	42.7	54.0	11.3	55.7	74.0	18.3
4514.855	44.4	54.0	9.6	56.8	74.0	17.2
5417.826	49.7	54.0	4.3	62.4	74.0	11.6

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	Wireless Lockset	Model	nLock
MODE	Receive	FREQUENCY RANGE	1MHz – 10GHz
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C	TECHNICIAN	NJohnson

Average Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dB μ V/m	dB μ V/m	dB	cm	deg	
2380.000000	20.21	54.0	33.8	150.0	229	HORI
5841.000000	29.95	54.0	24.0	249.0	19	VERT
6158.500000	26.62	54.0	27.4	393.0	205	VERT
9072.500000	34.87	54.0	19.1	330.0	204	HORI

Peak Measurements

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dB μ V/m	dB μ V/m	dB	cm	deg	
2380.000000	33.73	74.0	30.3	150.0	229	HORI
5841.000000	43.03	74.0	31.0	249.0	19	VERT
6158.500000	40.10	74.0	33.9	393.0	205	VERT
9072.500000	48.20	74.0	25.8	330.0	204	HORI

REMARKS:

1. Emission level (dB μ V/m) = Raw Value (dB μ V) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

4.3 Bandwidth

4.4.1 Limits of bandwidth measurements

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.4.2 Test procedures

The bandwidth was measured at a 3m distance by spectrum analyzer with 100 kHz RBW and 1 MHz VBW. The 6 dB bandwidth is defined as the bandwidth of which is higher than peak power minus 6dB.

4.4.3 Deviations from test standard

No deviation.

4.4.4 Test setup

See section 4.2

4.4.5 EUT operating conditions

The EUT was powered by 4 AA batteries and had no auxiliary devices, so it was tested by itself. The EUT was set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

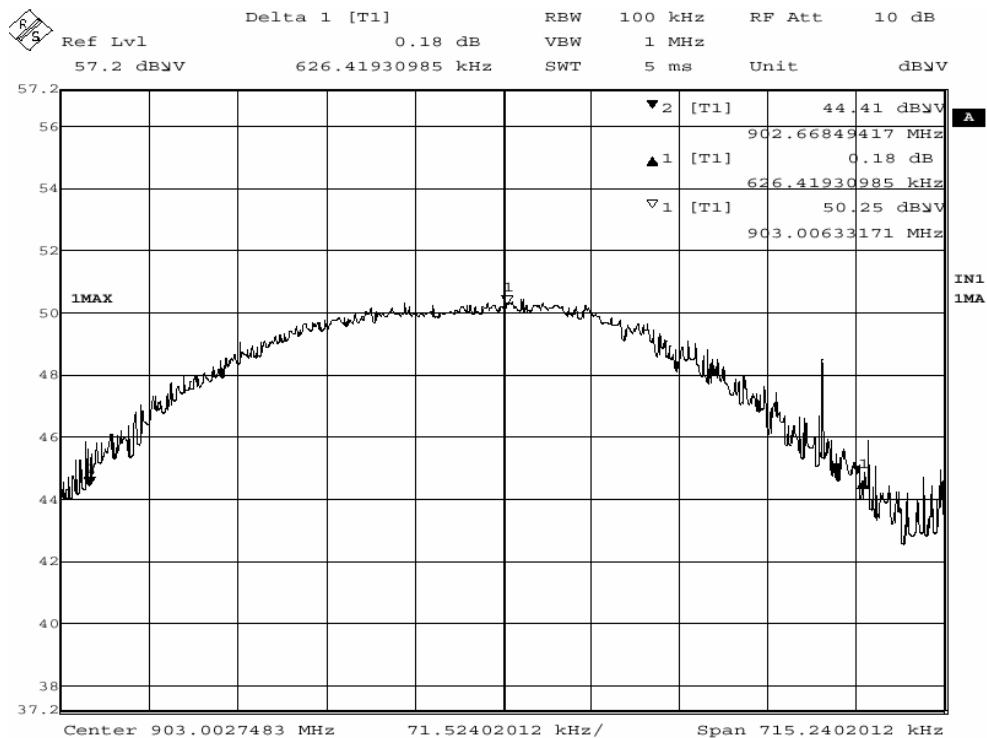
4.4.6 Test results

EUT	Wireless Lockset	MODEL	nLock
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C
TECHNICIAN	NJohnson	MODE	Continuous Transmit

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BW (kHz)	6dB Minimum LIMIT (kHz)	RESULT
0	902.668	626.419	500.00	PASS
16	914.920	676.540	500.00	PASS
31	926.206	611.752	500.00	PASS

REMARKS:

None

**Figure 2 - 6dB Bandwidth, Channel 0**

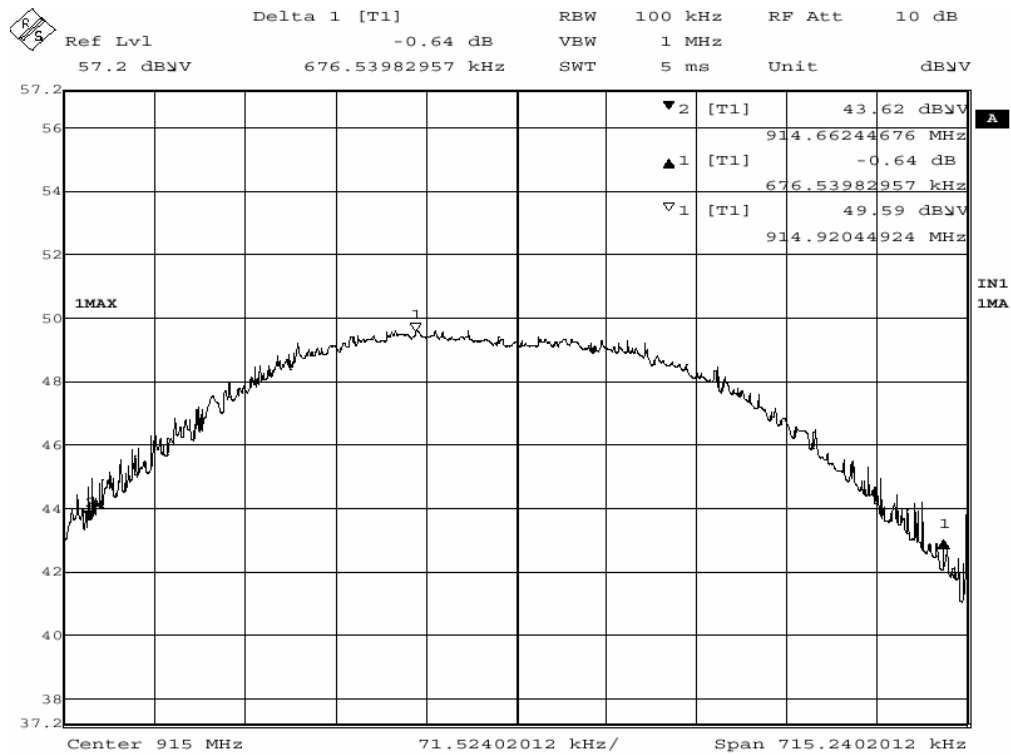


Figure 3 - 6dB Bandwidth, Channel 16

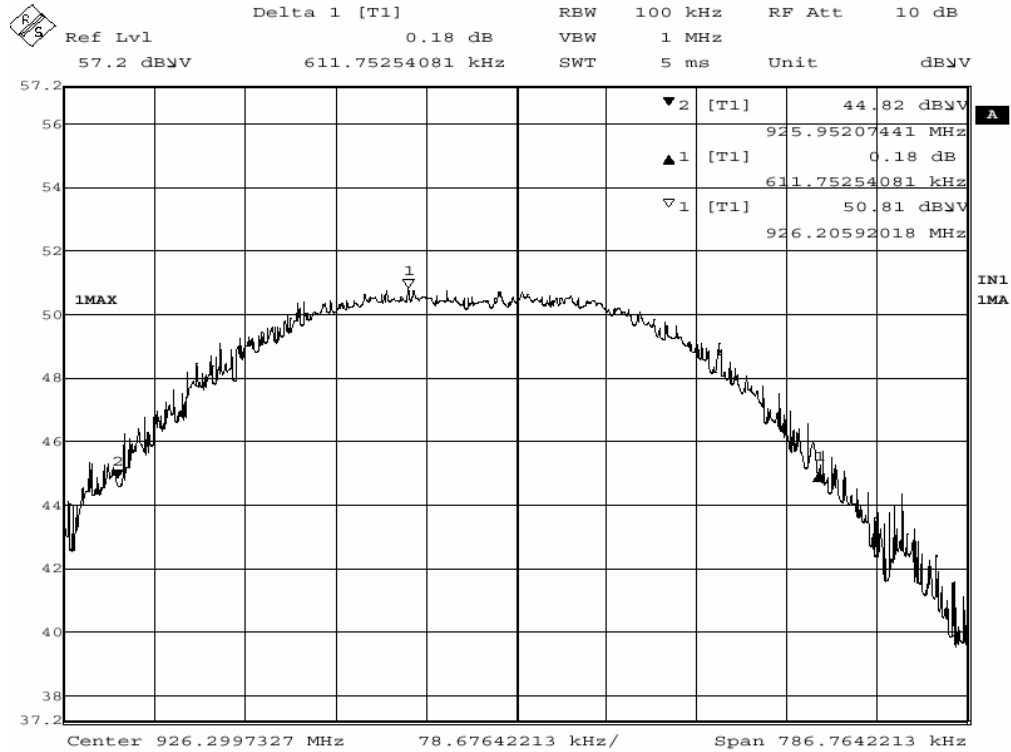


Figure 4 - 6dB Bandwidth, Channel 31

4.4 Maximum peak output power

4.5.1 Limits of power measurements

The maximum peak output power allowed is 30.0dBm (1W).

4.5.2 Test procedures

1. Because the EUT contained no means for direct connection to the antenna port, measurements were made at a 3m distance and the output power was calculated using 0dBi as the gain of the transmitting antenna.
2. The resolution bandwidth was set to 10MHz and the video bandwidth was set to 10MHz to capture the maximum amount of signal. The analyzer used a peak detector in max hold mode. This represented the maximum output power.

4.5.3 Deviations from test standard

No deviation.

4.5.4 Test setup

See section 4.2

4.5.5 EUT operating conditions

The EUT was powered by 4 AA batteries and had no auxiliary devices, so it was tested by itself. The EUT was set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.5.6 Test results**Maximum peak output power**

EUT	Wireless Lockset	MODEL	nLock
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C
TECHNICIAN	NJohnson	MODE	Continuous transmit

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	RESULT
0	902.777	6.18	30.0	PASS
16	914.803	5.80	30.0	PASS
31	926.091	5.45	30.0	PASS

REMARKS:

Because measurements directly from the antenna port were not possible, the measurements were made at a 3m test and the power was calculated using a 0dBi antenna as the transmitting antenna.

4.5 Bandedges

4.6.1 Limits of bandedge measurements

For emissions outside of the allowed band of operation (902MHz – 928MHz), the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

4.6.2 Test procedures

The EUT was tested in the same method as described in section 4.2 - *Radiated emissions*. The EUT was oriented as to produce the maximum emission levels. The resolution bandwidth was set to 120kHz and the EMI receiver was used to scan from the bandedge to the fundamental frequency with a quasi-peak detector. The highest emissions level beyond the bandedge was measured and recorded. If the out of band emissions do not fall within a restricted band from 15.205, then it is required that the out of band emission be 20dB below that of the fundamental emission level. If the out of band emission falls with a restricted band from 15.205, then it is required that the emission be below the limits from 15.209.

4.6.3 Deviations from test standard

No deviation.

4.6.4 Test setup

See 4.2.4

4.6.5 EUT operating conditions

The EUT was powered by 4 AA batteries and had no auxiliary devices, so it was tested by itself. The EUT was set to transmit continuously on the lowest frequency channel and highest frequency channel to examine field strength levels outside of the 902 – 928MHz operational band.

4.6.6 Test results

EUT	Wireless Lockset	MODEL	nLock
INPUT POWER (SYSTEM)	4 AA Batteries 6 V _{DC}	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C
TECHNICIAN	NJohnson	MODE	Continuous transmit

Highest Out of Band Emissions

CHANNEL	Band edge/Measurement Frequency (MHz)	Edge QP Level	Delta	Limit (dBc)	Result
0	902 MHz	36.54	25.83	20	PASS
32	928 MHz	36.66	28.57	20	PASS

NOTE:

Results from 4.2 present this as the worse case scenario. The measurements above are corrected. For corrected measurements of the fundamental peak, see section 4.2. The table above is intended to show the delta only.

4.7 Power Spectral Density

4.6.1 Power spectral density measurements

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.6.2 Test procedures

Because the EUT contained no means for direct connection to the antenna port, measurements were made at a 3m distance and the output power was calculated using 0dBi as the gain of the transmitting antenna. The spectrum analyzer was set to 3 kHz RBW and 30 kHz VBW, the sweep time was 500s. The power spectral density was measured and recorded at the frequency with the highest emission. The sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

4.6.3 Deviations from test standard

No deviation.

4.6.4 Test setup

See section 4.2

4.6.5 EUT operating conditions

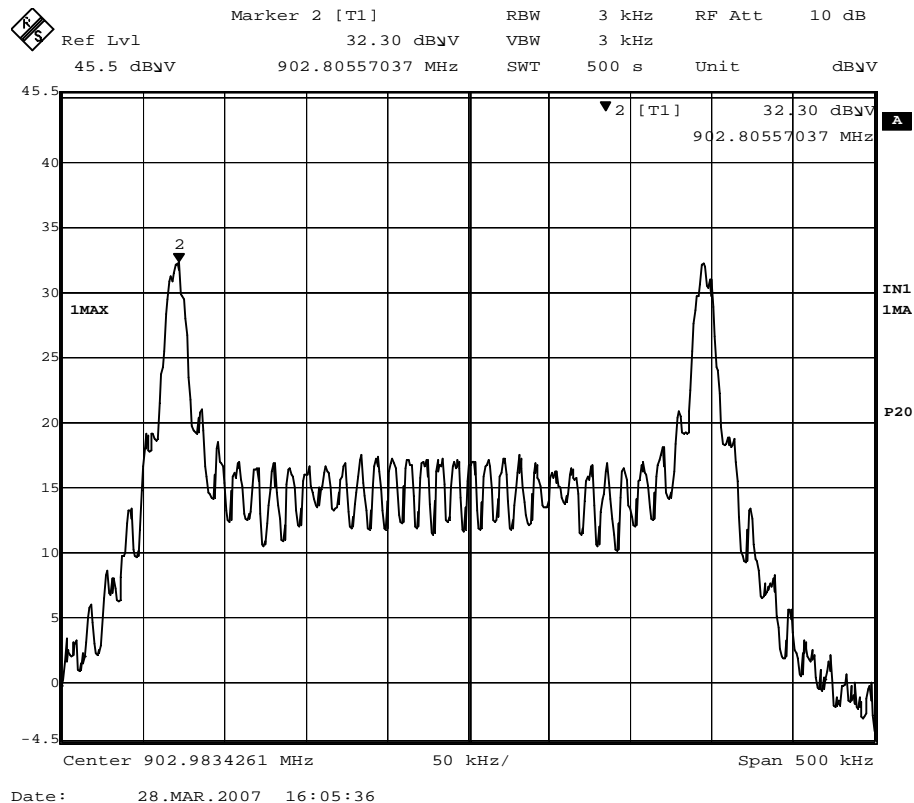
The EUT was programmed to operate at frequency at the lowest frequency and the highest frequency of its operational band and one frequency in the middle. It was powered by a 9VDC power supply and tested in the upright position with each of two antenna options.

EUT	Wireless Lockset	MODEL	nLock
INPUT POWER (SYSTEM)	5V _{DC}	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3°C
TECHNICIAN	NJohnson	MODE	Continuous transmit

Power Spectral Density

CHANNEL	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN # KHz BW (dBm)	MAXIMUM POWER LIMIT (dBm)	RESULT
0	902.806	0.34	8.00	PASS
16	914.832	0.54	8.00	PASS
31	926.110	-0.03	8.00	PASS

Note: Because direct conducted measurements from the antenna port were not possible, measurements were made at a 3m distance and the conducted power was calculated using an antenna gain of 0dBi.

**Figure 5 - PSD Measurement, Channel 0**

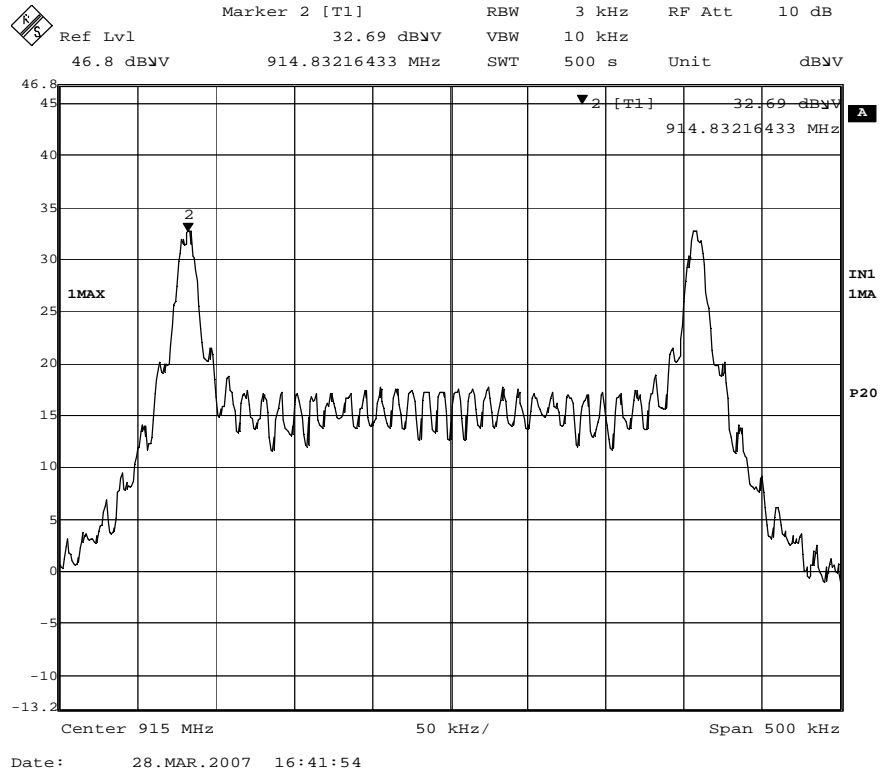


Figure 6 - PSD Measurement, Channel 16

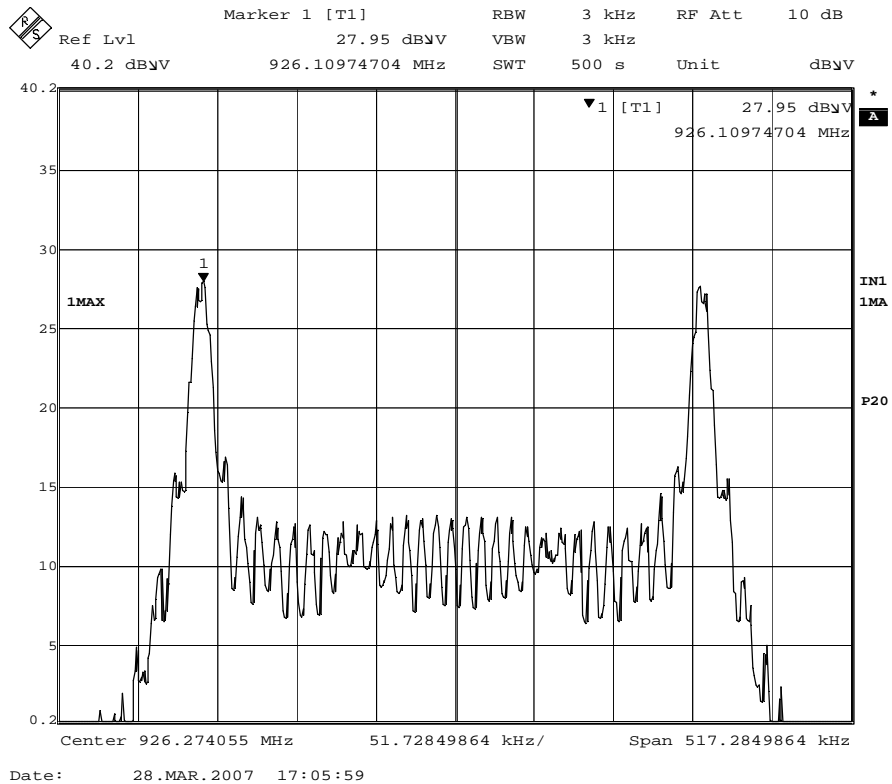


Figure 7 - PSD Measurement, Channel 31

Appendix A: Test Photos



Figure 8 - Radiated Emissions Test Setup



Figure 9 - Radiated Emissions Test Setup

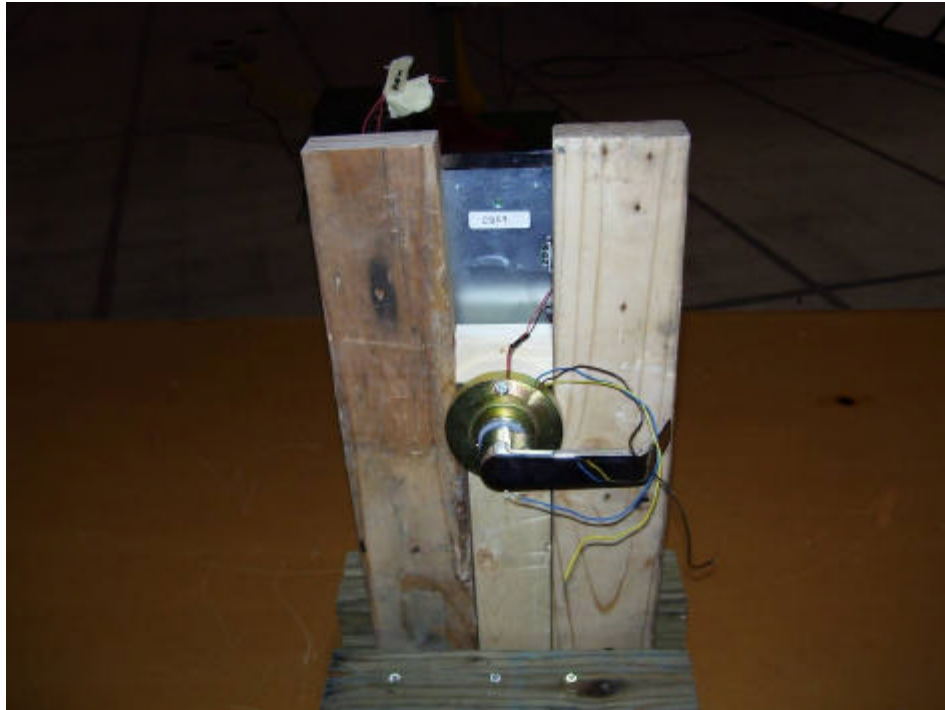


Figure 10 - Radiated Emissions Test Setup

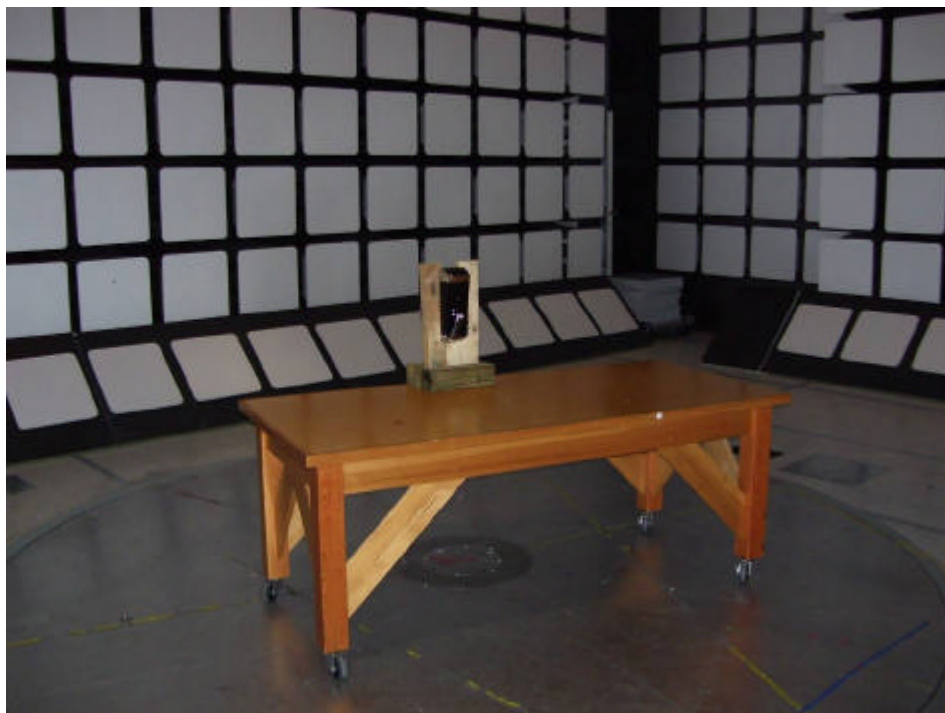


Figure 11 - Radiated Emissions Test Setup

Appendix B: Sample Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF - (-CF + AG) + AV$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dB μ V is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dB μ V/m.

$$FS = 55 + 12 - (-1.1 + 20) + 0 = 48.1 \text{ dB}\mu\text{V/m}$$

The 48.1 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(48.1 \text{ dB}\mu\text{V/m})/20] = 254.1 \mu\text{V/m}$$

AV is calculated by the taking the $20 \cdot \log(T_{\text{on}}/100)$ where T_{on} is the maximum transmission time in any 100ms window.

Appendix C: RF Exposure Evaluation

FCC ID: U4NNCLASS
RF Exposure Statement for U4NNSERIES:**Notice in Installation Manual:**

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 0.66cm (.26 inches) between the radiator and your body.

RF Exposure Calculations:

The following information provides the minimum separation distances for the two major antenna types used in this system.

Directional Antenna:

The antenna is internal to the EUT and has a gain of at most 0dBi. The minimum separation distance is calculated from **FCC OET 65 Appendix B, Table 1B** Guidelines for General Population/Uncontrolled Exposure. This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain. The exposure limit for a transmitter operating at 902.78 MHz is found in mW/cm² using the equations $f/1200$. Since the operating frequency for channel 0 produced the lowest limit, that limit will be used in calculation. ($902.78/1200 = 0.75\text{mW/cm}^2$)

$$S = (P_o * G) / (4 * \pi * r^2) \text{ or } r = \text{SQRT} [(P_o * G) / (4 * \pi * S)]$$

Where $S = 0.75 \text{ mW/cm}^2$ for 902.78 MHz

Where $P_o = 4.15 \text{ mW}$ (Peak RF, 6.18dBm)

Where $G = 1$ (numeric equivalent to 0dBi antenna gain with 0.0 dB cable loss)

Where r = Minimum Safe Distance from antenna (cm)

For $P_o = 4.15\text{mW}$, $r = 0.66\text{cm}$ (.26 inches)

For a distance $[r]$ of 20cm from this antenna, the field density $S = 0.064 \text{ mW/cm}^2$

Notes:

1. The minimum safe distance is based on a conservative “worst case” prediction, i.e. using the formula shown above and no duty factor. In practice the minimum distance will be much shorter. (Ref. 2)
2. The minimum safe distance has been calculated for the maximum allowed Power Density (S) limit of 0.75 mW/cm^2 for the frequency 902.78 MHz for uncontrolled environments (Ref. 2).

References:

1. FCC Part 15, sub-clause 15.247 (b) (4) (i)
2. FCC OET Bulletin 65, Edition 97-01
3. FCC Supplement C to OET Bulletin 65, edition 01-01

Appendix D: Table of Figures

Figure	Page Number
Figure 1 - Radiated Emissions Test Setup	11
Figure 2 - 6dB Bandwidth, Channel 0	21
Figure 3 - 6dB Bandwidth, Channel 16	22
Figure 4 - 6dB Bandwidth, Channel 31	22
Figure 5 - PSD Measurement, Channel 0.....	28
Figure 6 - PSD Measurement, Channel 16.....	29
Figure 7 - PSD Measurement, Channel 31	29
Figure 8 - Radiated Emissions Test Setup	31
Figure 9 - Radiated Emissions Test Setup	31
Figure 10 - Radiated Emissions Test Setup.....	32
Figure 11 - Radiated Emissions Test Setup.....	32