ION Digital LLP

MICRA-D

EMC Directive Compliance Test Report

per

FCC CFR47 Part 15/B Subpart 15.231

Revision 0.1

November 12, 2008

Approval		
Checked By:	Parminder Singh, EMC Eng.	Date

Protocol Data Systems Inc, EMC Lab,
Abbotsford BC, Canada.
SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612
FCC O.A.T.S. Registration Number 96437
Industry Canada O.A.T.S. Registration Number IC3384

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Section I: Report of Measurements Testing Information

General Information

Applicant Company Name	ION Digital LLP
Address	#3-3033 King George Hwy.
	Surrey,BC V4P 1B8
	Phone: 800-407-4389
	Fax 800-407-4465
	Contact Person: Dean Schebel
	Email: dean.schebel@ion-digital.com
Product Name	Intrusion Detector Sensor – Plungger Plastic with wire Antenna
FCC ID#	XxxMICRA-DB
Applicable Standard	FCC Part 15.231, ANSI C63.4:2003; Part 15.207, 15.209
Test Results	Pass
Related Report/s Approval	ION Digital 03330 Rev 0.1.pdf
Statement of Compliance	This equipment has been tested in accordance with the standards indentified in the referenced test report. To the best of our knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. – Signature on Front Cover Page.

Equipment Under Test Specification

Manufacturer	ION Digital LLP
Product Description	Intrusion Detector Sensor – Plungger Plastic with wire Antenna
FCC ID	XxxMICRA-DB
Model Number	MICRA-DB
Name	Intrusion Detector Sensor
Operating Frequency	433.93MHz
Emission Designator	DXX
EUT Power Source	3Vdc Coin Cell Battery
Test Item	Production Unit
Type of Equipment	Fixed
Antennas	Wire Antenna
Antenna Connector	permanently attached
Test Voltage	3Vdc Coin Cell Battery

Test Environment

Test Facility	Protocol Data Systems Inc.
	28945 McTavish Road
	Abbotsford, BC V4X 2E7
	Phone: 604-607-0012
	Fax: 604-607-0019
	Email: info@protocol-emc.com
	Website: www.protocol-emc.com
Test Facility ID's	SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612
	FCC O.A.T.S. Registration Number 96437
	Industry Canada O.A.T.S. Registration Number IC3384
Date Tested	10September08
Tested By	David Johanson

Test Setup

Test Supporting Equipment	None required
Test Conditions	Temperature and Humidity: 25°C, 54%
Test Exercise e.g. software description, test signal, etc.	The EUT was set for continuous transmit mode of operation. It only has 1 frequency. The options were for a CW and modulated frequency.
Deviation from Standard/s	No deviation from Standard
Modification to the EUT	No modifications was made.

Test Equipment List

EMISSION				
Manufacturer	**Model**	**Equipment Description**	**Serial No.**	**Next Cal**
HP	85650A	CDN Quasi-Peak Adapter	2043A00240	18/09/09
HP	85662A	Spectrum Analyzer Display	2318A05184	18/09/09
HP	8566B	Spectrum Analyzer RF Section	2241A02102	18/09/09
HP	85685A	RF-Preselector	3107A01222	18/09/09
Solar	8012-50-R-24	LISN	863092	28/09/08
EMCO	CPA-30	Ant Log Periodic 200-1000MHZ	563	05/12/08
EMCO	3110B	Ant Biconical 20-300MHz	9401-1850	05/12/08
EMCO	3115	DGR Horn At. 1-18GHzMHz	3429	15/12/08
AH Systems	SAS-200/550-1	Active Monopole Antenna	631	08/05/09
EMCO	6502	Active Loop Antenna	9002-2489	28/02/09
Rhientech	Custom	Antenna Mast	N/A	N/A
Protocol EMC	Custom	Turntable	N/A	N/A

Measurement Uncertainty

Parameter	**Uncertainty**
Radio Frequency	±1 x 10-5
Total RF power, conducted	±1,5 dB
RF power density, conducted	±3 dB
Spurious emissions, conducted	±3 dB
All emissions, radiated	±3 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

Section II: Report of Measurements Test Procedure

Radiation Interference:

The measurement was made per ANSI C63.4-2003 using an Agilent model 8566B spectrum analyzer, a model 85685A Preselector, a model 85650A quasi-peak adapter, and the appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100kHz with an appropriate sweep speed and the video bandwidth was 300kHz up to 1GHz and 1MHz with a VBW greater than or equal to the RBW above 1GHz. When an emission was found, the table was rotated to produce the maximum, signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The EUT was re-positioned to produce the highest emission level. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

Formula of Conversion Factors:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBμV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ACF	+CL	= FS
330	20 dBμV	+10.36 dB	+0.5	= 30.86 dBμV/m @ 3m

Where the field strength was too low to get an accurate reading at the required distance of 3meters, the Antenna was moved closer to 1 meter. The resulting measurement was distance corrected for 3 meters by using the formula:

(1 meter result) – (20Log(measured distance/required distance)) = (3 meter result)

Example:

1 meter result + distance correction = 3 meter result

54.5 dBμV + -9.54dB = 45 dBμV

Power Line Conducted Interference:

The procedure used was ANSI C63.4-2003 using a 50μH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30MHz. The measurement was performed on an Open Air Test Site at 0.8meters above the horizontal groundplane.

Occupied Bandwidth:

A sample of the transmitter output detected by an antenna was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to 10dB per division.

ANSI C63.4-2003 Measurement Procedures:

The EUT was placed in a horizontal orientation, laying flat, on top of a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.m side). The table used for radiated measurements is capable of continuous rotation.
When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

Due to the construction of the EUT, the EUT was also placed in a vertical orientation and rotated on its axis and the emissions were maximized again to identify the highest emission level.

Frequencies less than 1GHz were measured using the Quasi-Peak receiver. Frequencies equal to and greater than 1GHz were measured using the Average receiver

Section III: Report of Measurements to Radiation Interference

Rules Part No.: Pt 15.231, Pt 15.209

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) μV/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μV/m @ 30 meters
1705 to 30 MHZ	29.54 dBμV/m @ 30 meters
30 – 88	40.0 dBμV/m @ 3 meters
80 – 216	43.5 dBμV/m @ 3 meters
216 - 960	46.0 dBμV/m @ 3 meters
Above 960	54.0 dBμV/m @ 3 meters
Part 15.231	
280-470	71.5 to 81.94 dBμV/m @ 3 meters - Average
Above 470	81.94dBμV/m @ 3 meters - Average
Spurious Emissions 280-470	51.48-61.94 dBμV/m @ 3 meters - Average
Spurious Emissions above 470	61.94 dBμV/m @ 3 meters - Average

Test Data: Fundamental as per Part 15.231

Emission Frequency MHz	Antenna Polarity V/H	Field Strength Peak dBμV/m	Field Strength Avg dBμV/m	Limit dBμV/m	Margin dB
433.9215	V	89.8	57.7	79.9	22.2
867.861	V	51.1	36.0	61.94	25.9
1301.796	V	46.0	34.3	61.94	27.6
1735.760	V	45.4	33.1	61.94	28.8

No other emissions or Harmonics were detected. The spectrum was checked to the tenth harmonic.

Section IV: Report of Maximum Permissible Exposure

Rules Part No.: Pt 1.1310 and 2.1091

Requirements: General Population/Uncontrolled Exposure : 1mW/cm^2

Calculation:

$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$

S = Power Density
P = Power at Antenna Terminal
G = Gain of the Transmit Antenna
EIRP = Effective Isotropic Radiated power
r = Measurement Distance

EIRP Measurement at 3m at 1MHz RBW (peak) = 89.8 dBuV
Conversion to dBm (dBuV – 107) = -17.20 dBm at 300 cm
Conversion to 20cm (-17.2 + (20log (300/20)) = +6.32 dBm at 20 cm
Conversion to mW EIRP ($10^{(6.32/10)}$) = 4.28mW EIRP at 20cm
Power Density = $\frac{4.28}{4\pi(20)^2}$ = 0.000852 mW/ cm^2 at 20cm

Recommendations: Based on these worst case calculations the EUT is well below the maximum permissible exposure limit of 1mW/cm^2 at 20cm.

Section V: Report of Measurements to Periodic Operation

Rules Part No.: Pt 15.231. (a)

Requirements: The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
(3) Periodic transmissions at regular predetermined intervals are not permitted However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition
(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section,provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

Test Data:

This product is designed as an alarm which will transmit only when activated. The total transmission time during an alarm state is 26.1msec and is contained in the following plot. Refer to the User Manual for additional details.

Section VI: 20dB Bandwidth Testing

Rules Part No.: Pt 15.231(c)

Requirement

As per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

20dB bandwidth limit = Fundamental * 0.25%

= 433.92MHz * 0.25%

= 1084.8 KHz

Test Result: As per below figure 2, 20 db Band Width is 588 KHz which is not wider than 0.25% of the center frequency(1084.8) for the test equipment.

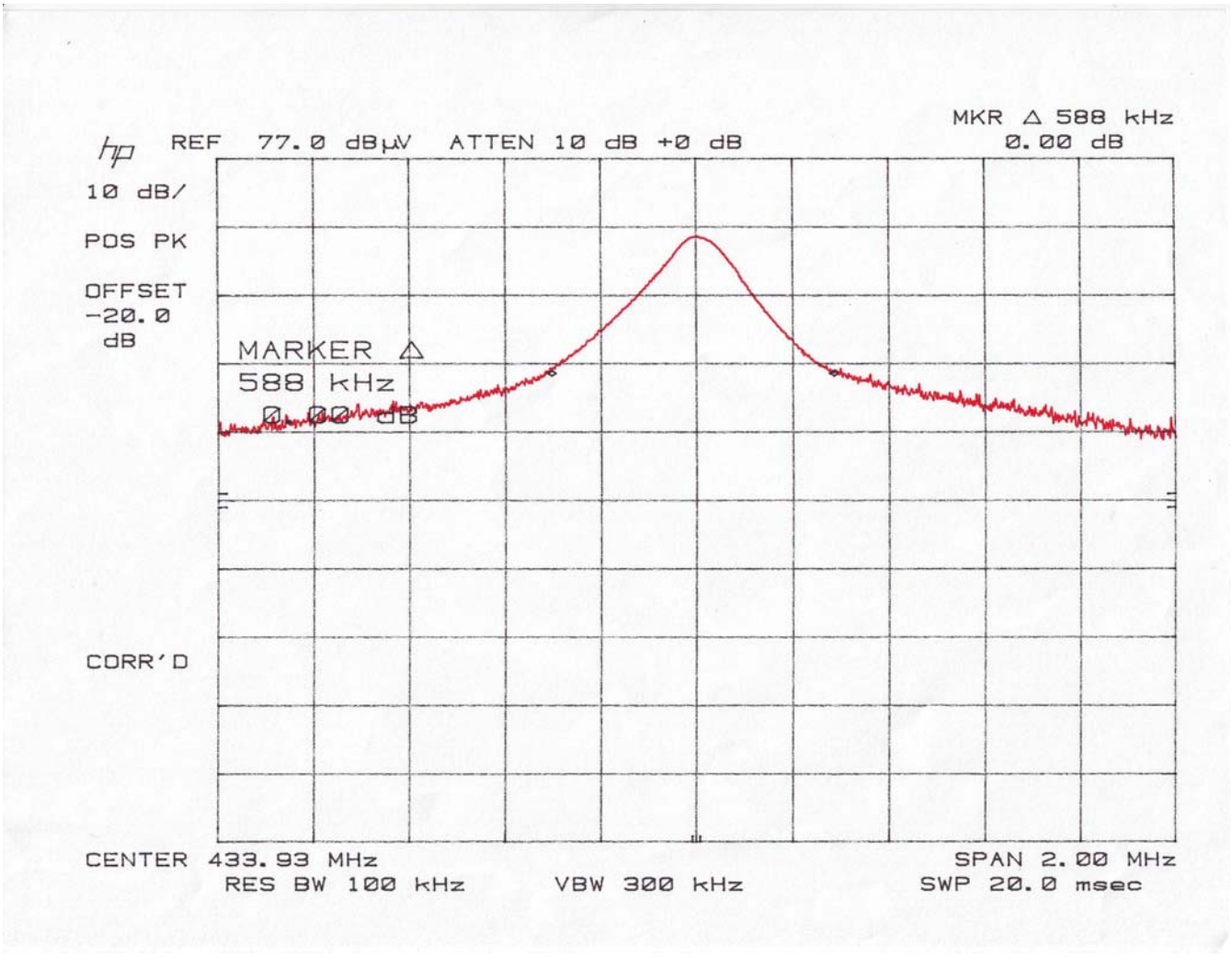


Figure2: 20 db Bandwidth

Section VII: Measurement for Duty Cycle

Rules Part No.: 15.231

Calculations:

Duty cycle= [T(on)/T(on)+T(off)]*100
T(on) = Time period when tranmission is on.
T(Off) = Time Period when transmission is off.

Test Data: As per above Figure 1 T(on)=26.1 msec and Figure 3 shows T(off) = 278 msec

Duty cycle= [26.1/26.1+278]*100= 8.9%

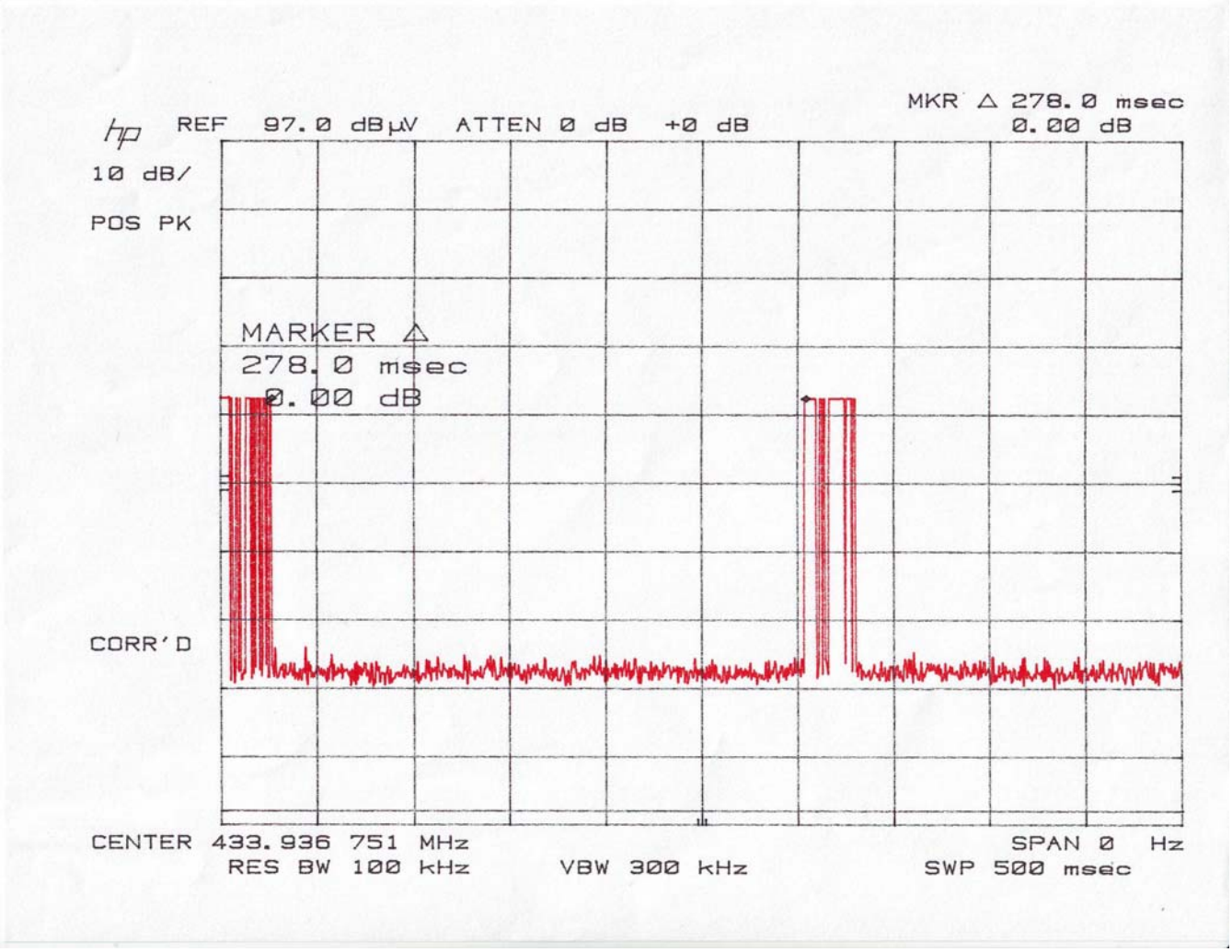


Figure 3: Off Time Duty Cycle Characterstics

off

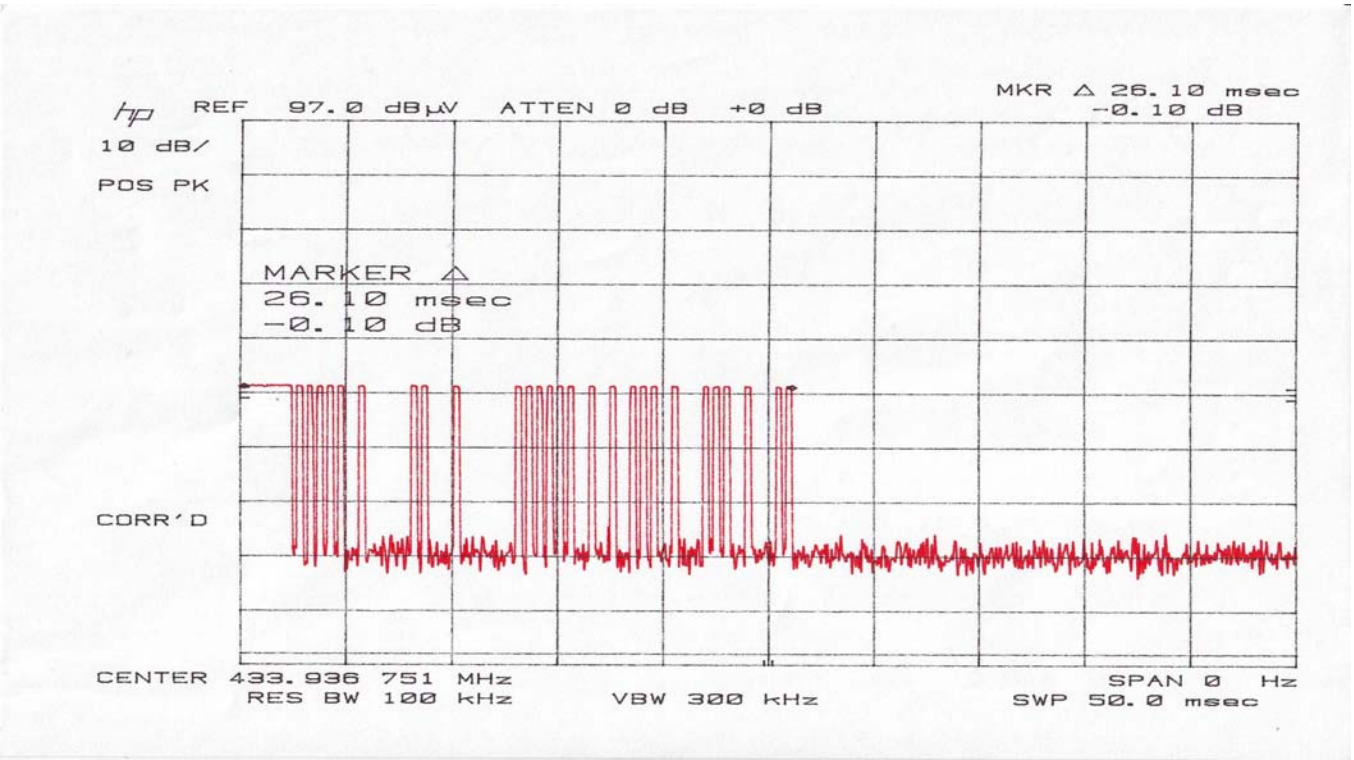


Figure 4: On Time Duty Cycle Characterstics

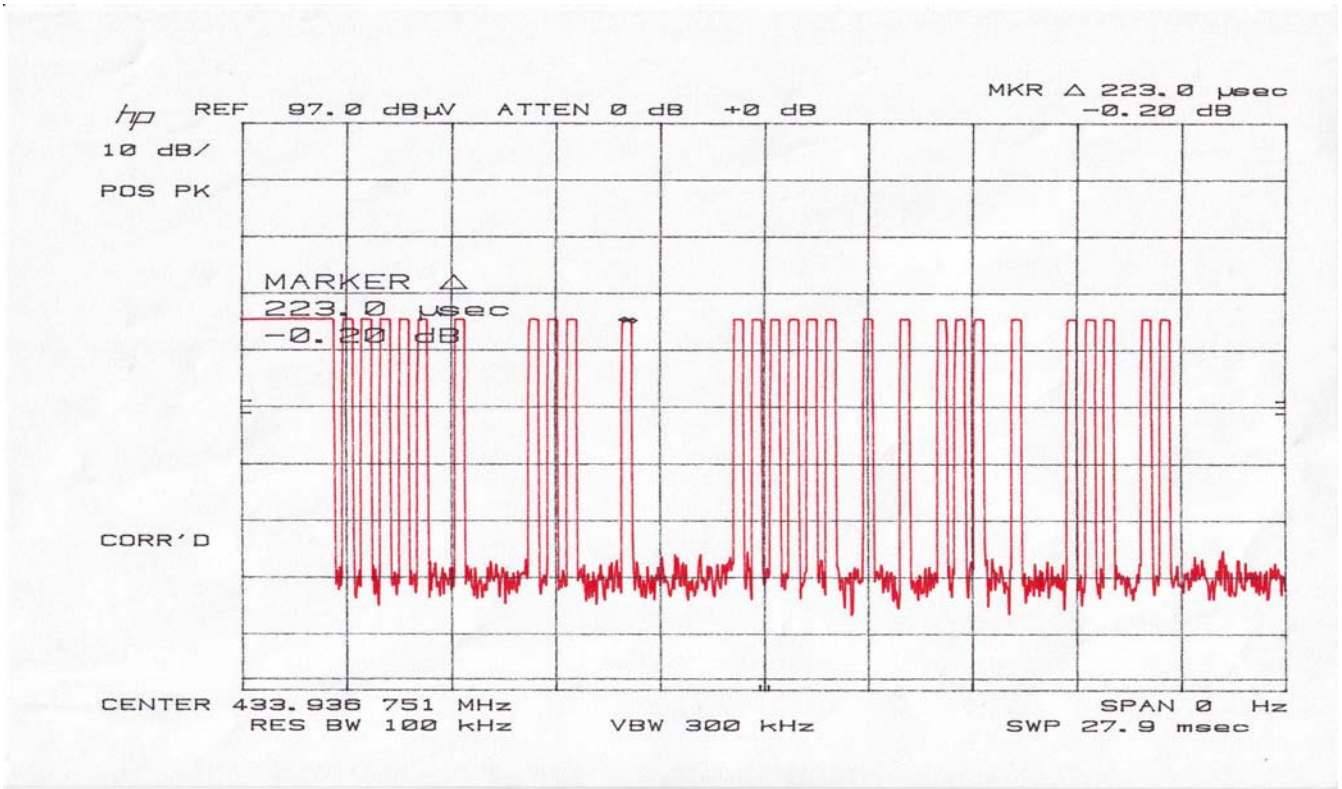


Figure 5: Duty Cycle Characterstics

Section VIII: Report of Measurements to Power Line Conducted Interference

Rules Part No.: Pt 15.207

Requirements:

Frequency MHz	Quasi Peak Limits dBµV	Average Limits dBµV
0.15 – 0.5	66 – 56	56 –46
0.5 – 5.0	56	46
5.0 – 30	60	50

Test Data: Not applicable for this product since it is battery operated

Appendix A: ION DIGITAL LLP MICRA-D

Duty Cycle Correction factor

On a change of state, 4 identical packets are transmitted at random intervals. The time interval between each packet varies between 100 – 800 ms. Each packet begins with an "ON" pulse of 5 milliseconds, which is then followed by 48 bits transmitted as PWM-ASK.

Bits are 500 microseconds long, and are transmitted as follows:

0: OFF (no transmission) for 500 microseconds

1: OFF (no transmission) for 250 microseconds, followed by ON for 250 microseconds.

If we take the worst case scenario of a packet transmission of all 1's, then our total ON time would be :

Packet Time ON = 5mS + 48*0.25mS = 17.0 mS

Thus, for every 100 ms, we are transmitting for less than 17 ms of that time period. Therefore our duty cycle correction factor (in the worst case 100mSec period) is

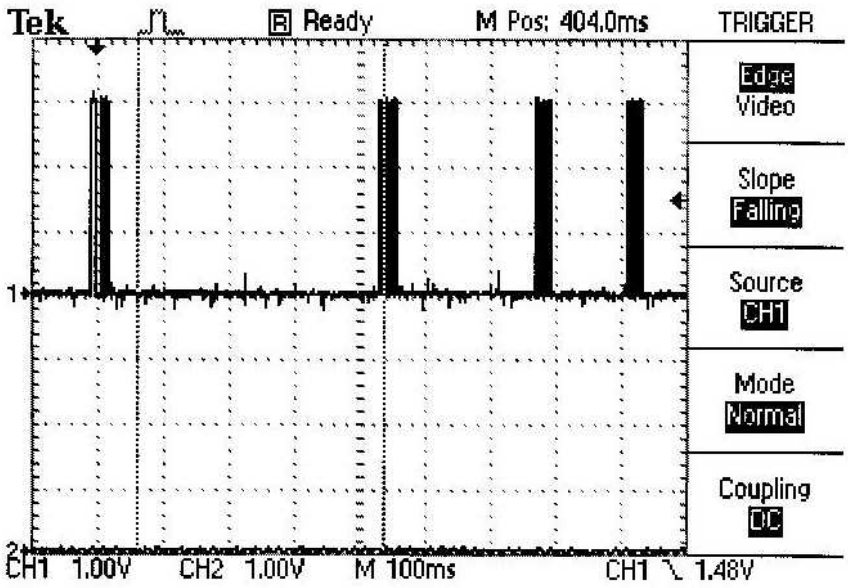
DUTY CYCLE CORRECTION FACTOR (dB) = 20*Log(0.17) = 15.4 dB

Transmission Time Duration from Trigger Point to End of Transmission

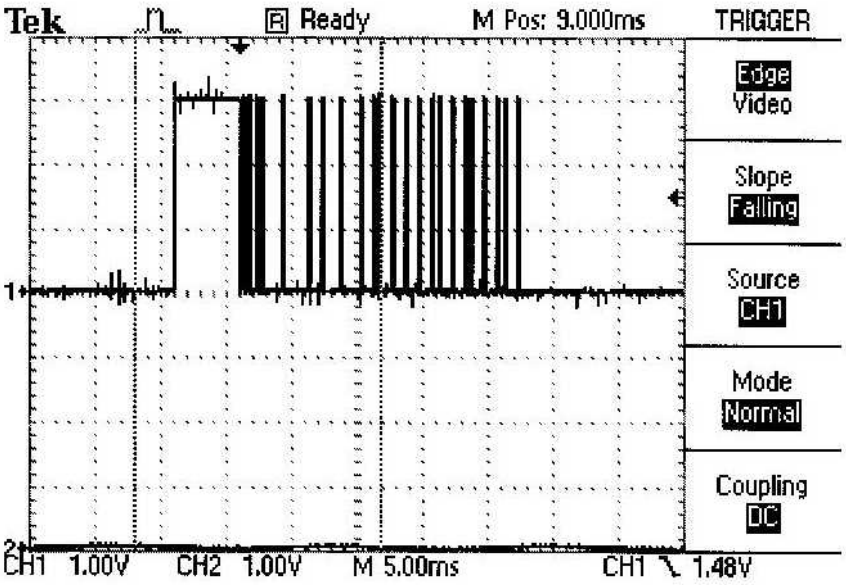
The processor samples the reed switch approximately once per second. After detecting a change of state, it constructs the packet (1mS), then enables the VCO on the transmitter to power up (10mS), but does not transmit during that time. Then 4 packets (29 mS each) are sent, with a random timeout between them (100mS – 800mS). Therefore the total duration time from when the device is triggered, to when transmission is completed and turned off (worst case) is 3.527 seconds.

0.000s	Trigger Point
1.000s	Microprocessor sample time (worst case)
0.011s (worst case)	Microprocessor setup time for packet construction and transmitter warmup
0.029s	Packet 1
0.800s	worst case delay 1 between packets (no transmission)
0.029s	Packet 2
0.800s	worst case delay 2 between packets (no transmission)
0.029s	Packet 3
0.800s	worst case delay 3 between packets (no transmission)
0.029s	Packet 4
3.527s	Total worst case duration from when device is triggered to transmission completed/off.

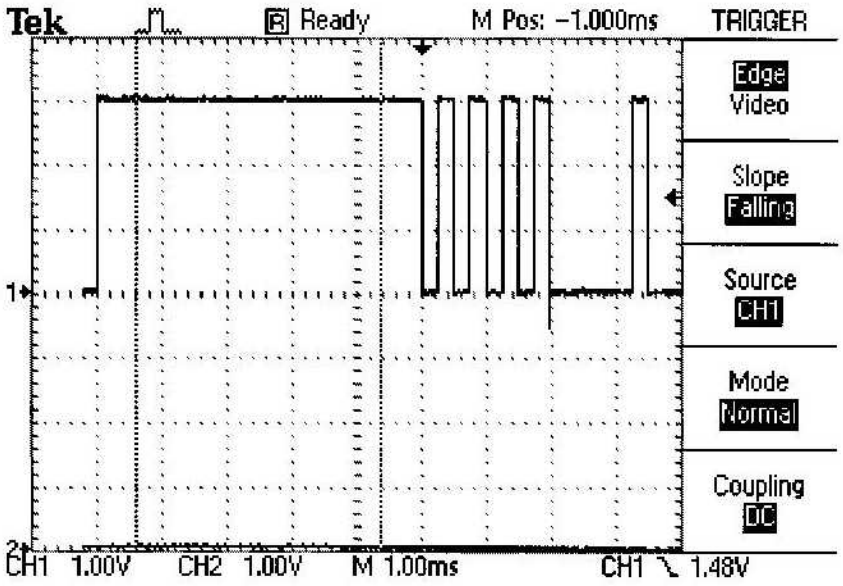
Plot 1: Transmitted Data Packets, 100ms/div



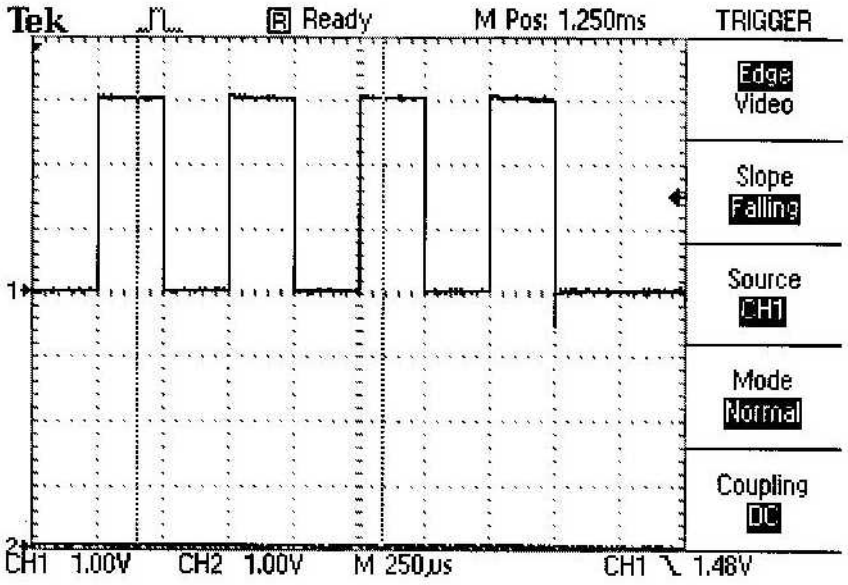
Plot 2: Transmitted Data Packet, 5.0 ms/div



Plot 3: Transmitted Data Packet, 1 ms/div



Plot 4: Transmitted Data Packet, 250 us/div



Appendix B: Report of Measurements EUT Photos

Test Setup of EUT Front View

Conducted Emisssions Test Setup