

Echoflex Solutions Inc.

STM 112C

EMC Directive Compliance Test Report

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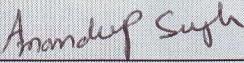
FCC Part 15.231 & IC RSS-210

FCC ID: XMGSTM112C

IC ID: 7256A-STM112C

Revision 1.0

June 3, 2010

Approval		
Checked By:	 Amandeep Singh	June 3, 2010
		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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Index

Section I:	Report of Measurements Testing Information	3
Section II:	Report of Measurements Test Procedure	5
Section III:	Report of Measurements to Radiation Interference.....	6
Section IV:	Report of Maximum Permissible Exposure.....	7
Section V:	Report of Measurements to Periodic Operation	8
Section VIII:	Report of Measurements to Power Line Conducted Interference	12

Section I: Report of Measurements Testing Information

General Information

Applicant Company Name	Echoflex Solutions Inc.
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	Phone: 604-815-0091 Ext 669
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	Contact Person: Kin Leong
	Email: kin@echoflexsolutions.com
Product Name	STM 112C – with wire Antenna
Applicable Standard	FCC Part 15.231, ANSI C63.4:2003; Part 15.207, 15.209
Test Results	Pass
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	Echoflex Solutions Inc.
Product Description	STM 112C – with wire Antenna
FCC ID	XMGSTM112C
IC ID	7256A-STM112C
Model Number	STM 112C – with wire Antenna
Name	Environment Sensor (light, temprature, motion, etc.
Operating Frequency	314.954 MHz
Emission Designator	547KA1D
EUT Power Source	3Vdc Solar Cell Battery
Test Item	Production Unit
Type of Equipment	Fixed
Antennas	Wire Antenna
Antenna Connector	permanently attached
Test Voltage	3Vdc Solar Cell

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	May 26 TH , 2010 to May 30 TH , 2010
Tested By	Amandeep Singh

Test Setup

Test Supporting Equipment	None required
Test Conditions	Temperature and Humidity: 15°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

Manufacturer	Model	Equipment Description	Serial No.	Next Cal
HP	85650A	CDN Quasi-Peak Adapter	2811A01080	12/08/10
HP	85662A	Spectrum Analyzer Display	2152A03569	11/08/10
HP	8566B	Spectrum Analyzer RF Section	2241A02102	11/08/10
HP	85685A	RF-Preselector	3107A01222	11/08/10
EMCO	3146	Ant Log Periodic 200-1000MHZ	9611-4699	08/08/10
EMCO	3110B	Ant Biconical 20-300MHz	9401-1850	08/08/10
EMCO	3115	Horn Antenna 1-18GHz	9403-4251	20/08/10
EMCO	3825/2	LISN	2470	20/07/10
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 FCC Part 15 and IC RSS-210 Issue 6 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 dB μ V) 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:

$$\begin{array}{lllll}
 \text{Freq (MHz)} & \text{Meter Reading} & +\text{ACF} & +\text{CL} & = \text{FS} \\
 330 & 20 \text{ dB}\mu\text{V} & +10.36 \text{ dB} & +0.5 & = 30.86 \text{ dB}\mu\text{V/m} @ 3\text{m}
 \end{array}$$

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:

$$(1 \text{ meter result}) - (20\text{Log}(\text{measured distance}/\text{required distance})) = (3 \text{ meter result})$$

Example:

$$\begin{aligned}
 1 \text{ meter result} + \text{distance correction} &= 3 \text{ meter result} \\
 54.5 \text{ dB}\mu\text{V} + -9.54\text{dB} &= 45 \text{ dB}\mu\text{V}
 \end{aligned}$$

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.

Measurement Procedures(FCC Part 15 and IC RSS-210 Issue 6):

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 Radiated Emissions

Rules Part No.:

FCC Part 15.209, FCC Part 15.231 & IC RSS-210 Issue 6

Frequency	Limits
IC RSS-210 Issue 6- Pt 2.6 Table 2 & 3	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 to 30 MHZ	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 - 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters
IC RSS-210 Issue 6- Pt 2.6 Table 4	
280-470	71.5 to 81.94 dB μ V/m @ 3 meters - Average
Above 470	81.94dB μ V/m @ 3 meters - Average
Spurious Emissions 280-470	51.48-61.94 dB μ V/m @ 3 meters - Average
Spurious Emissions above 470	61.94 dB μ V/m @ 3 meters - Average

Test Data:

Fundamental

Frequency (MHz)	Polarization (V/H)	Measured Value at 3m (dB μ V)	Total Correction Factor (dB)	Corrected Peak(dBuV)	Peak Limit (dB μ V/m)	Peak Margin (dB)	Duty Cycle Correction Factor (dB)	Average Margin dbuV/m
314.952	V	79	16.3	95.3	75.6	19.7	-34.9	-15.2
314.945	H	85.2	16.3	101.5	75.6	25.9	-34.9	-9

Harmonics

Frequency (MHz)	Polarization (V/H)	Measured Value at 3m (dB μ V)	Total Correction Factor (dB)	Corrected Peak(dBuV)	Peak Limit (dB μ V/m)	Peak Margin (dB)	Duty Cycle Correction Factor (dB)	Average Margin dbuV/m
629.913	H	39.2	20.9	60.1	55.6	4.5	-34.9	-30.4
629.928	V	31.2	20.9	52.1	55.6	-3.5	-34.9	-38.4
944.877	H	17.4	26	43.4	55.6	-12.2	-34.9	-47.1
944.883	V	15.6	26	41.6	55.6	-14	-34.9	-48.9
1259.939	H	29.9	1.7	31.6	55.6	-24	-34.9	-58.9
1259.862	V	19.3	1.7	21	55.6	-34.6	-34.9	-69.5
1574.645	H	35	6.3	41.3	55.6	-14.3	-34.9	-49.2
1574.711	V	35.4	6.3	41.7	55.6	-13.9	-34.9	-48.8
1889.884	H	25.9	10.4	36.3	55.6	-19.3	-34.9	-54.2
1889.798	V	10.1	10.4	20.5	55.6	-35.1	-34.9	-70

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/cm²

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

$$\begin{aligned} \text{EIRP Measurement at 3m at 1MHz RBW (peak)} &= 85.20 \text{dBuV} \\ \text{Conversion to dBm (dBuV} - 107) &= -21.8 \text{ dBm at 300 cm} \\ \text{Conversion to 20cm } (-21.8 + (20 \log (300/20)) &= 1.722 \text{ dBm at 20 cm} \\ \text{Conversion to mW EIRP } (10^{\frac{1.722}{10}}) &= 1.487 \text{ mW EIRP at 20cm} \\ \text{Power Density} = \frac{1.487}{4\pi(20)^2} &= 0.000286 \text{ mW/ cm}^2 \text{ at 20cm} \end{aligned}$$

Recommendations:

Based on these worst case calculations the EUT is well below the maximum permissible exposure limit of 1mW/cm² at 20cm.

Section V: Report of Measurements to Periodic Operation

Rules Part No.: IC RSS-210 Issue 6- Annex 1.1

Requirements:

The frequency bands and field strength limits in Tables 1 and 4 are only for the transmission of a control signal such as that used with alarm systems, door openers, remote switches, etc. Radio control of toys or model aircraft, and continuous transmissions, such as voice or video, and data transmissions are not permitted except as provided in 6.1.1(e). The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

The following conditions shall be met to comply with the provisions for momentary operation:

- (1) A manually operated transmitter shall employ a push-to-operate switch and be under manual control at all transmission times. When released, the transmitter shall cease transmission (holdover time of up to 5 seconds is permitted).
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation, i.e. maximum 5 seconds of operation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted, except as provided in 6.1.1(e). However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.
- (4) Intentional radiators employed for radio control purposes during emergencies involving fire, security of goods (e.g. burglar alarm), and safety-of-life, when activated to signal an alarm, may operate during the interval of the alarm condition.

Test Data:

This product is designed as an environmental sensor (light, temperature, motion, etc.) which will transmit only when activated. The total transmission time during the sensing state is 18 msec and is contained in the following plots. Refer to the User Manual for additional details.

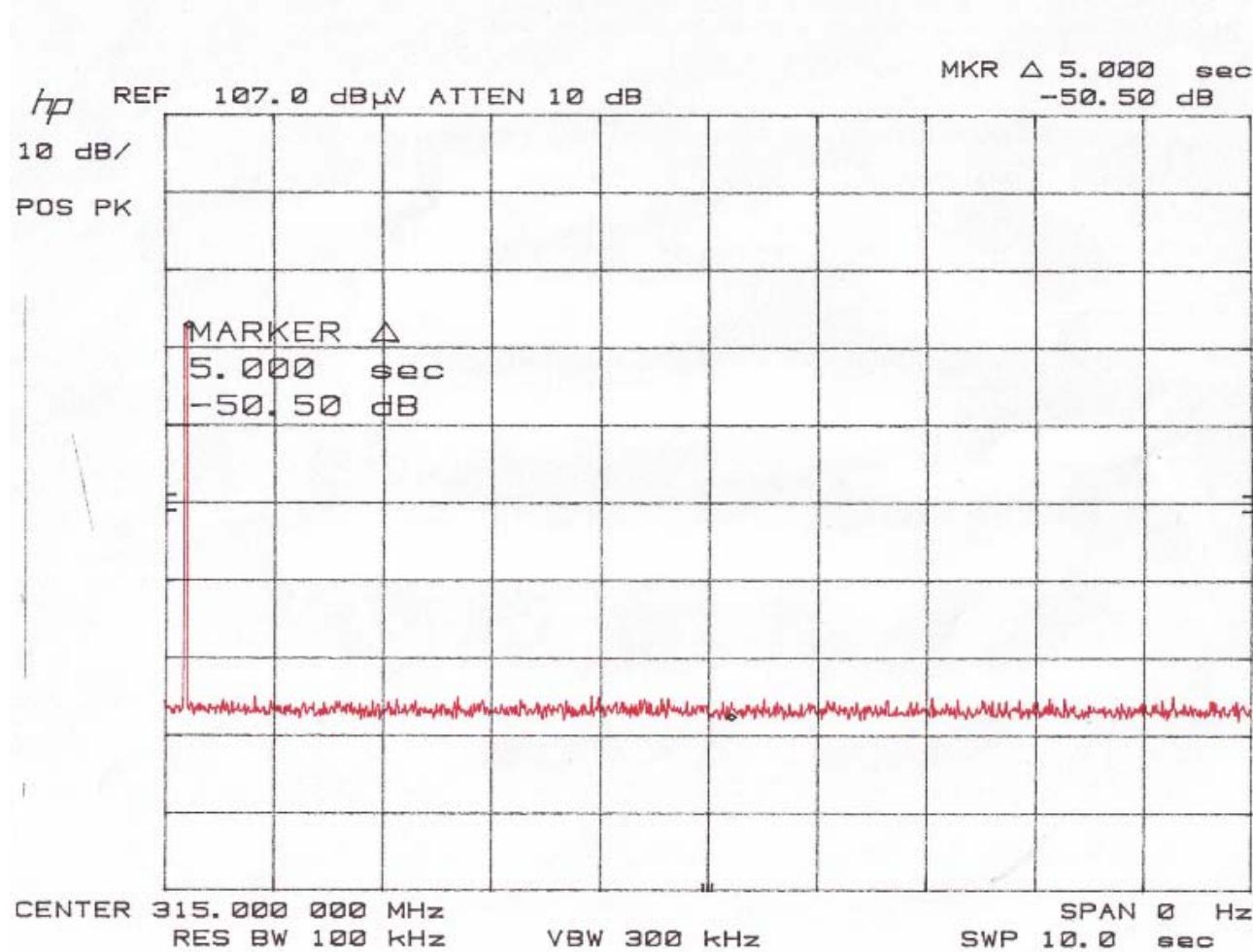


Figure 1: EUT Ceasees Operation after 5s

Section VI: 20dB Bandwidth measurements

Rules Part No.: FCC Part 15.231 & IC RSS-210 Issue 6- Annex A 1.1.3

Requirement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz the emissions shall not be wider than 0.5 of the centre frequency.

$$20\text{dB bandwidth limit} = \text{Fundamental} * 0.25\%$$

$$= 319.51 \text{ MHz} * 0.25\%$$

$$= 798.77 \text{ KHz}$$

Test Result: As shown in Figure 2, 20 db Band Width is 547 kHz which is not wider than 0.25% of the center frequency(798.77 KHz) for the test equipment.

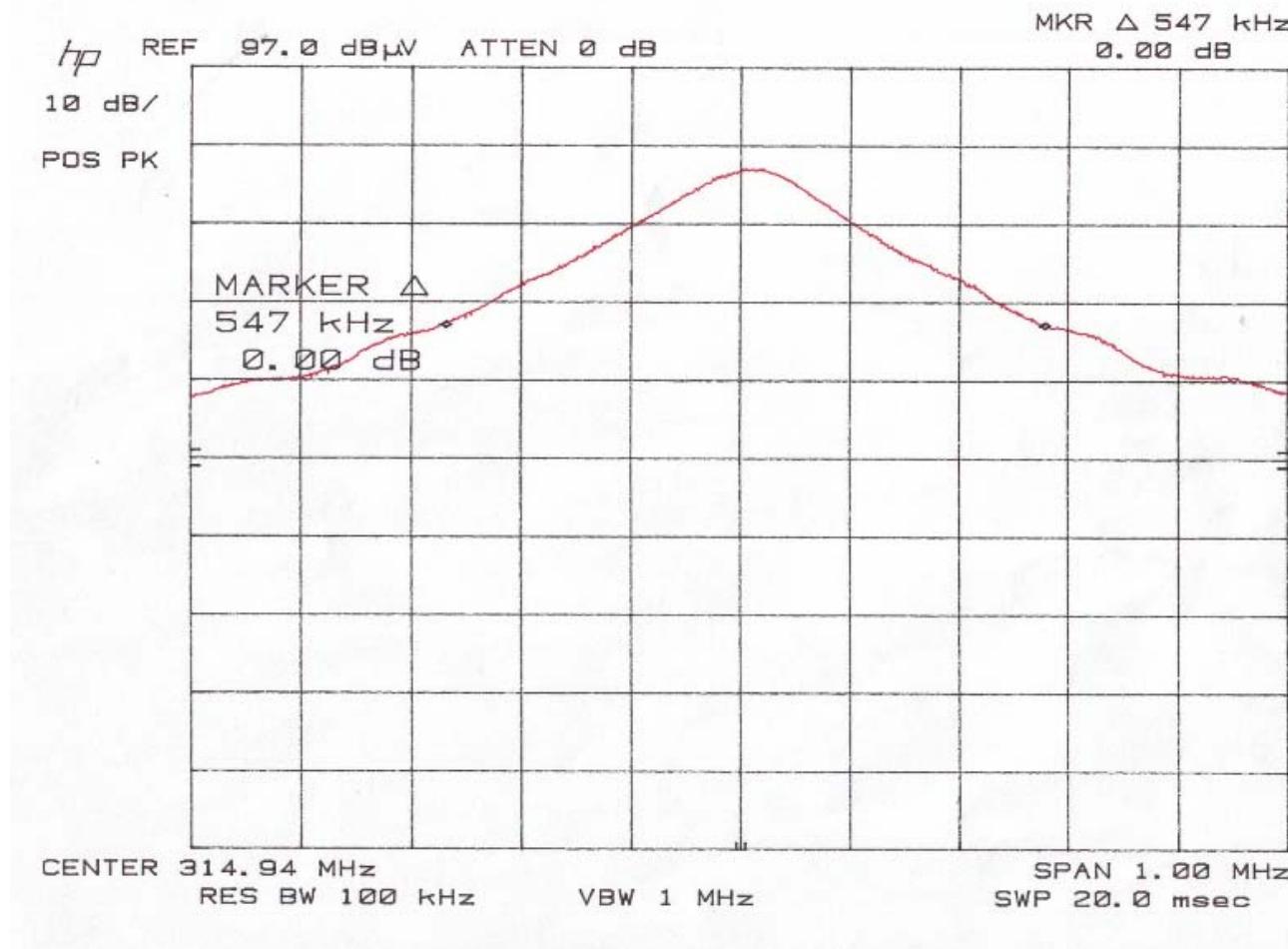


Figure 2: 20dB Bandwidth

Section VII: Measurements for Duty Cycle

Rules Part No.: IC RSS-210 Issue 6

The EUT transmits 3 ASK (OOK) data packets. Each packet lasts 1.2 ms with 50% duty cycle. The EUT is transmitting 0.6 ms during each of the three data packets, for a total of 1.8 ms for each standard transmission, because the standard transmissions occurs at a period longer than 100ms, section 15.35(c) limits the period (for calculating the average) to 100 ms.

Duty Cycle Correction factor = $-20 \log (3*0.6 \text{ ms} / 100 \text{ ms}) = -34.9 \text{ dB}$

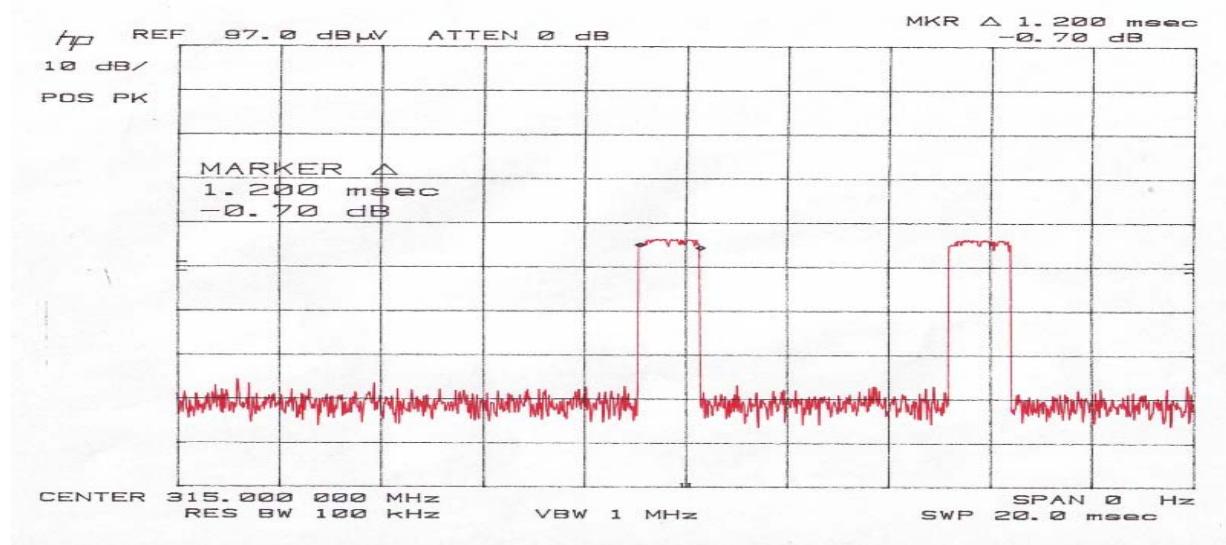


Figure 3: Measurement of Time On/Off

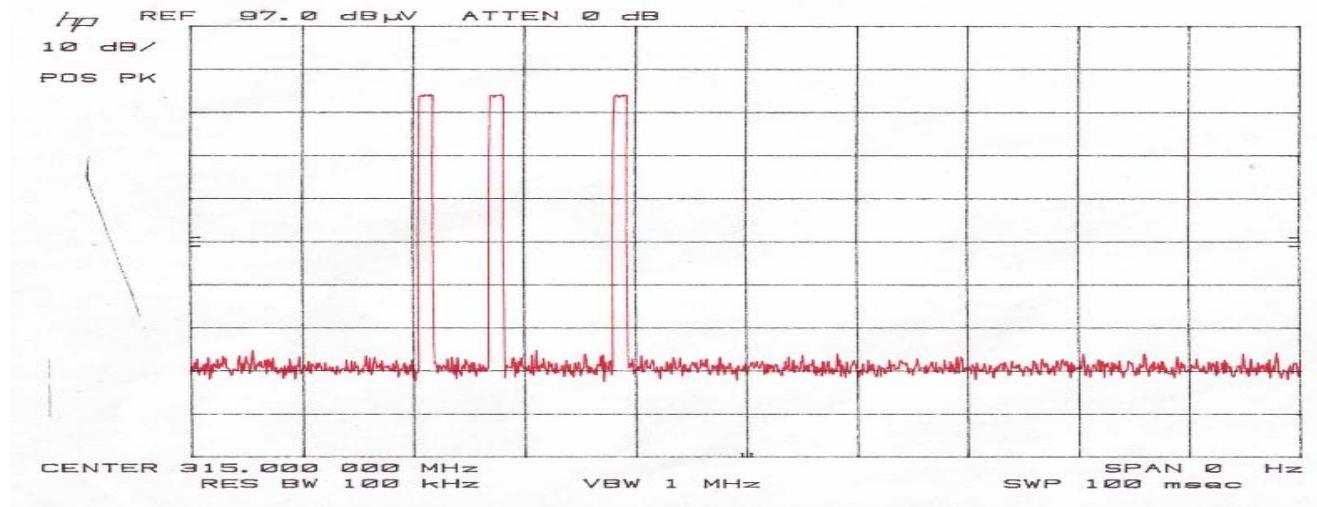


Figure 4: Three Data Packet

Section VIII: Report of Measurements to Power Line Conducted Interference

Rules Part No.: FCC Part 15.207 & IC RSS-210 Issue 6
Requirements:

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

Test Data:

Not applicable, the EUT is battery operated

Appendix A: Report of Measurements EUT Photos



Figure5: Front View of EUT



Figure 6:Test Setup Emissions