ENGINEERING TEST REPORT

SITRANS LR250
Model No.: 7ML5431-xxxxx-xxHx

FCC ID: NJA-LR250DE

Applicant: **Siemens Milltronics Process Instruments Inc.**
1954 Technology Drive, P.O. Box 4225
Peterborough, Ontario
Canada, K9J 7B1

In Accordance With

FEDERAL COMMUNICATIONS COMMISSION (FCC)
PART 15, SUBPART C, SEC. 15.209
Low Power Transmitter
Operating at frequency of 25.00 GHz

UltraTech's File No.: MIL-397FCC15C

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: February 19, 2009	
Report Prepared by: Dharmajit Solanki Issued Date: February 19, 2009	Tested by: Hung Trinh Test Dates: December 13 & January 19, 2009

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.209
Title	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Low Power Transmitter operating at frequency of 24.82 GHz.
Test Procedures	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	Commercial, light industry & heavy industry

1.2. RELATED SUBMITAL(S)/GRANT(S)

None

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2008	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 (modified) EN 55022	2005 2006	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement
CISPR 16-2-3	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Radiated disturbance measurement

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT:	
Name:	Siemens Milltronics Process Instruments Inc.
Address:	1954 Technology Drive, P.O. Box 4225 Peterborough, Ontario Canada, K9J 7B1
Contact Person:	Mr. Thoai Bui Phone #: 705 740 7005 Email Address: thoai.bui@siemens.com

MANUFACTURER:	
Name:	Siemens Milltronics Process Instruments Inc.
Address:	1954 Technology Drive, P.O. Box 4225 Peterborough, Ontario Canada, K9J 7B1
Contact Person:	Mr. Thoai Bui Phone #: 705 740 7009 Email Address: thoai.bui@siemens.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

Brand Name	Siemens Milltronics Process Instruments Inc.
Product Name	SITRANS LR250
Models Name or Number	7ML5431-xxxxx-xxHx
EUT Configuration Tested	SITRANS LR250 with 4” flange and 4” horn antenna
Type of Equipment	Pulsed Tank Level Probing Radar (TLPR)
Oscillators’ Frequencies	1.2kHz, 2.2 kHz, 32.768kHz, 92kHz, 460kHz, 10MHz & 25GHz
CPU’s Frequencies	625kHz & 5.0MHz
Operating Temperature Range	-40 to +80 ^{O}C
Input Power Supply Type	DC P/S: 24 VDC
Primary User Functions	Tank Level Probing Radar installed in closed metallic tanks or reinforced concrete tanks, or similar enclosure structures made of comparable attenuating material

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Tank level Probing Radar Base Station (Fixed use in metal or concrete tanks)
Intended Operating Environment:	Commercial, light industry & heavy industry
RF Output Power Rating:	No RF signal shall be leaking outside the metal or concrete tank
Operating Frequency Range:	24.2 to 25.7 GHz
Modulation Types:	Short RF Pulses
Method of Frequency Generation:	Crystal
Duty Cycle:	0.046%
Emission Designation:	2G18P3N
Antennas:	Flange process connection (List all of configurations): • 2", 4" & 6" flange Horn antenna with (List all of configurations): • 1.5" horn maximum antenna gain: 17 dBi • 2" horn maximum antenna gain: 19 dBi • 3" horn maximum antenna gain: 22 dBi • 4" horn maximum antenna gain: 23 dBi
Operating Temperature:	-40 to +80 ^{o}C

RECEIVER	
Operating Frequency Range:	24.2 to 25.7 GHz

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Analog O/P and 2-wire communication such as HART, PA or FF	#1 (L1,+), 2 (L2, -)	Terminal block	Non-shielded
		Housing grounded	Ground lug	Non-shielded

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	24 VDC nominal

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

The SIRANS LR250 operates as in normal operation, transmitting and receiving continuously during tests.

SITRANS LR250 (EUT) is Radar level measurement device, it powered up by 24VDC current loop/2-wire communication such as HART, PA or FF. The product is used for industrial level monitoring of liquids, solids and slurries material in a "continuous monitored operation". It operated by transmitting a series of radar pulses 25GHz from its antenna and the same antenna will receive the reflection signals from the surface of the material. The radar signal traveling time between the transmitting and receiving will be processed and converted to the distance. This distance is used as a basis for display of material level; an external 2-wire communication such as HART, PA or FF of a PC may also be used to communicate this information.

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

- Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

- Test Configuration #1 – Metal tank: Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site has been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049-1). Last Date of Site Calibration: May 17, 2007.

- Test Configuration #2 – Concrete tank: Radiated Emissions were performed at St. Mary's Cement plant located in Ontario, Canada

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.203	Antenna Requirement	Yes. Permanently attached antenna or Professional Installation
15.209 & 15.205	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes
15.115(c)	20 dB Bandwidth	Yes
15.107(a) & 15.207(a)	Power Line Conducted Emissions Measurements (Transmit & Receive)	Yes
15.109(a), Class B	Radiated Emissions from Digital Devices (Unintentional)	Yes
The associated Radio Receiver operating in 25 GHz is exempted from FCC's authorization.		

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and ULTR-P001-2004.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 5 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

5.4. POWERLINE CONDUCTED EMISSIONS @ FCC PART 15, SUBPARTS B & C, PARA.15.107(A) & 15.207

5.4.1. Limits

The equipment shall meet the limits of the following table:

	CLASS B LIMITS		
Test Frequency Range (MHz)	**Quasi-Peak (dBμV)**	**Average* (dBμV)**	**Measuring Bandwidth**
0.15 to 0.5	66 to 56*	56 to 46*	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 to 5	56	46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
5 to 30	60	50	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average

* Decreasing linearly with logarithm of frequency

5.4.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

5.4.3. Test Equipment List

Test Instruments	**Manufacturer**	**Model No.**	**Serial No.**	**Frequency Range**
EMI Receiver System/Spectrum Analyzer with built-in Amplifier	Hewlett Packard	HP 8546A	3520A00248	9KHz-5.6GHz, 50 Ohms
Transient Limiter	Hewlett Packard	11947A	*310701998*	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	*89071531*	9 kHz – 200 MHz 50 Ohms / 50 μH
12'x16'x12' RF Shielded Chamber	RF Shielding	N/A	N/A	N/A

5.4.4. Photographs of Test Setup

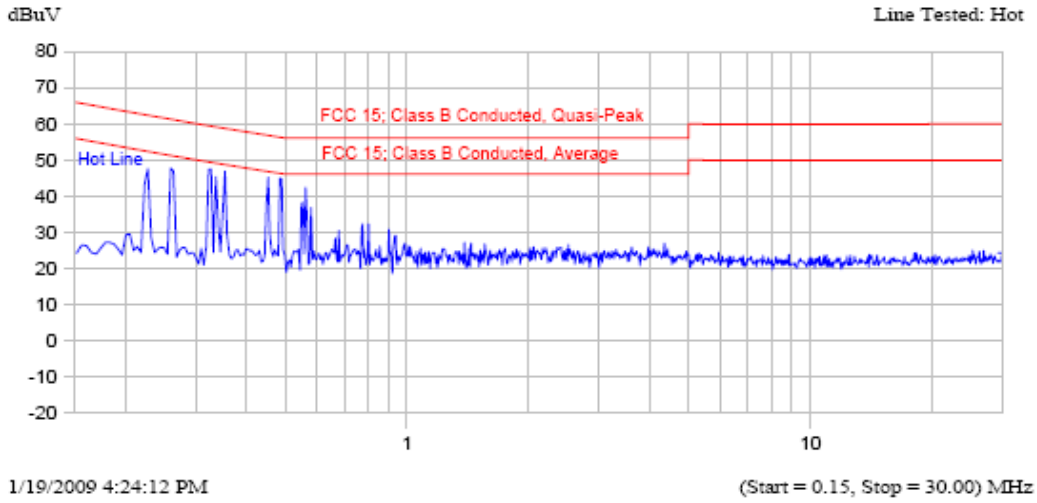
Refer to the Photographs # 1 & 2 in Annex 1 for setup and arrangement of equipment under tests and its ancillary equipment.

5.4.5. Test DATA

The conducted emissions at DC Input Pots comply with FCC 15.207. Please refer to Plots # 1 and 2 below:

UltraTech Group of Labs		Plot #1: DC POWER LINE CONDUCTED EMISSIONS MEASUREMENT PLOT			
Applicant:	Siemens Milltronic Inc.	Detector:[X] PEAK [X] QUASI-PEAK [X] AVERAGE		Temp: 23 °C	Humidity: 20%
Product:	SITRANS LR250 Hart EEx-de	Line Tested: Positive	Line Voltage: 24 V DC	Test Tech: Satish	Test Date: 19rd Jan 2009

Current Graph



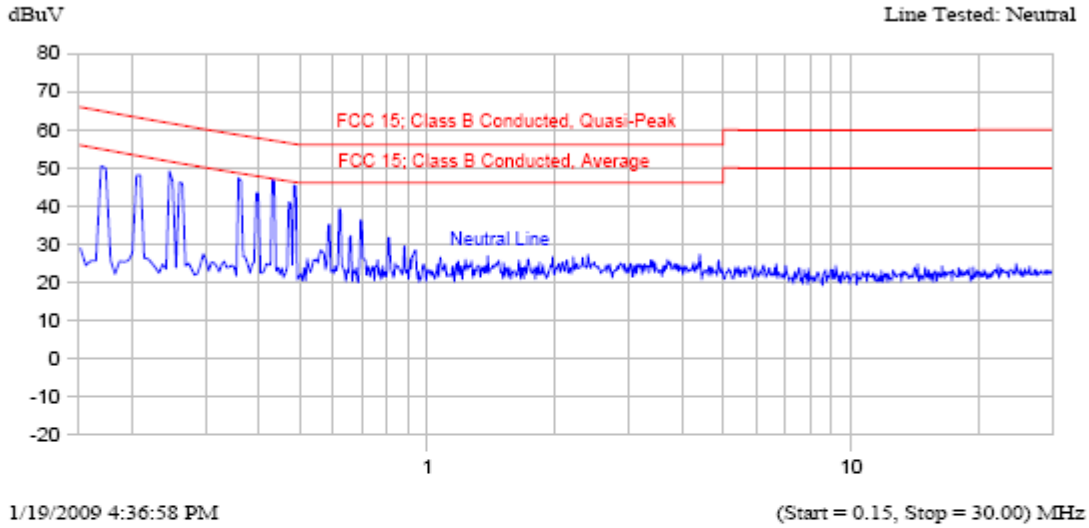
Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.237	48.0	41.9	-20.3	15.0	-37.2	Hot Line
0.249	47.8	41.8	-20.0	15.0	-36.8	Hot Line
0.328	47.0	40.6	-18.9	15.1	-34.4	Hot Line
0.352	47.0	40.4	-18.5	13.6	-35.3	Hot Line
0.356	46.8	40.4	-18.5	14.2	-34.6	Hot Line
0.435	46.5	39.4	-17.8	13.6	-33.5	Hot Line
0.467	46.3	38.7	-17.8	14.2	-32.4	Hot Line
0.551	42.4	35.0	-21.0	14.3	-31.7	Hot Line
0.586	41.4	33.0	-23.0	14.2	-31.8	Hot Line

- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

UltraTech Group of Labs		**Plot #2: DC POWER LINE CONDUCTED EMISSIONS MEASUREMENT PLOT**			
Applicant:	Siemens Milltronic Inc.	Detector:[X] PEAK [X] QUASI-PEAK [X] AVERAGE		Temp: 23 °C	Humidity: 20%
Product:	SITRANS LR250	Line Tested: Neutral	Line Voltage: 24 V DC	Test Tech: Satish	Test Date: 19rd Jan 2009

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.157	51.6	44.8	-20.9	16.5	-39.1	Neutral Line
0.206	50.3	43.2	-20.1	14.6	-38.7	Neutral Line
0.240	49.3	42.4	-19.7	14.9	-37.2	Neutral Line
0.259	49.1	42.1	-19.4	13.8	-37.7	Neutral Line
0.350	48.1	40.8	-18.1	13.6	-35.4	Neutral Line
0.394	47.6	40.5	-17.5	12.3	-35.7	Neutral Line
0.425	49.3	39.9	-17.5	14.5	-32.9	Neutral Line
0.470	46.7	38.6	-18.0	10.8	-35.7	Neutral Line
0.613	42.0	31.5	-24.5	14.4	-31.6	Neutral Line
0.699	36.0	27.6	-28.4	15.1	-30.9	Neutral Line

5.5. TRANSMITTER SPURIOUS EMISSIONS (RADIATED @ 3 METERS), FCC CFR 47, PARA. 15.209 & 15.205

5.5.1. Limits

The fundamental frequency shall not fall within any restricted frequency band specified in 15.205
All transmitter rf emissions shall not exceed the general radiated emission limits specified in @ 15.209(a).

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 – 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 – 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 – 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 – 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 – 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 – 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 – 156.9	2200 - 2300	9000 - 9200	

FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.5.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For 9 kHz $\leq$ frequencies $\leq$ 150 kHz: RBW = 1 KHz, VBW $\geq$ 1 KHz, SWEEP=AUTO.
- For 150 MHz $\leq$ frequencies $\leq$ 30 MHz: RBW = 10 KHz, VBW $\geq$ 10 KHz, SWEEP=AUTO.
- For 30 MHz $\leq$ frequencies $\leq$ 1 GHz: RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.
- For frequencies $\geq$ 1 GHz: RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.
- If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

5.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Microwave Amplifier	Hewlett Packard	HP 83051A	3332A00471	1 GHz to 50 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3160-09	1007	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	1001	26.5 GHz – 40 GHz
Waveguide	CMT	RA42-K_F-5B-C	910074-004	18 GHz – 26.5 GHz
Waveguide	CMT	RA28-K_F-4B-C	920311-001	26.5 GHz – 40 GHz
Horn Antenna & Mixer	OML	WR-19	U30625-1	40 –60 GHz
Horn Antenna & Mixer	OML	E-Band	E30625-1	60 – 90 GHz
Horn Antenna & Mixer	OML	WR-08	F30625-1	90 –140 GHz

5.5.4. Photographs of Test Setup

Refer to the Photographs #3 to #7 in Annex 1 for setup and arrangement of equipment under tests and its ancillary equipment.

5.5.5. Test Data

Note: SITRANS LR250, Model 7ML5431-xxxxx-xxHx with 4" horn antenna (maximum gain: 23 dBi)

5.5.5.1. Test Configuration #1: The LR250 was mounted on top of a Metal Tank and secured to this metal tank using metal screws and nuts as instructed by the manufacturer.

FREQUENCY	RF PEAK LEVEL (dBuV/m)	RF QP/AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT @ 3M 15.209 (dBuV/m)	MARGIN (dB)	PASS/ FAIL	Distance (m)
30 MHz to 1 GHz	Note (1)	Note (1)	H and V	40 to 54	N/A	PASS	3
1 to 100 GHz	Note (2)	Note (2)	H and V	54.00	N/A	PASS	3, 1 & 0.5

Notes:
1. The PEAK emissions were scanned 30 MHz to 1 GHz at 3 meter. No rf emissions were found from the DUT.
2. The PEAK emissions were scanned from 1 GHz to 100 GHz at 3, 1 and 0.5 meters. No rf signal was found when the E-Field was search at the separation distance of 3m, 1m and 0.5 meters from the device under test and receiving antenna.

5.5.5.2. Test Configuration #2: The LR250 was mounted on top of a Concrete Tank at St. Mary Cement Co.

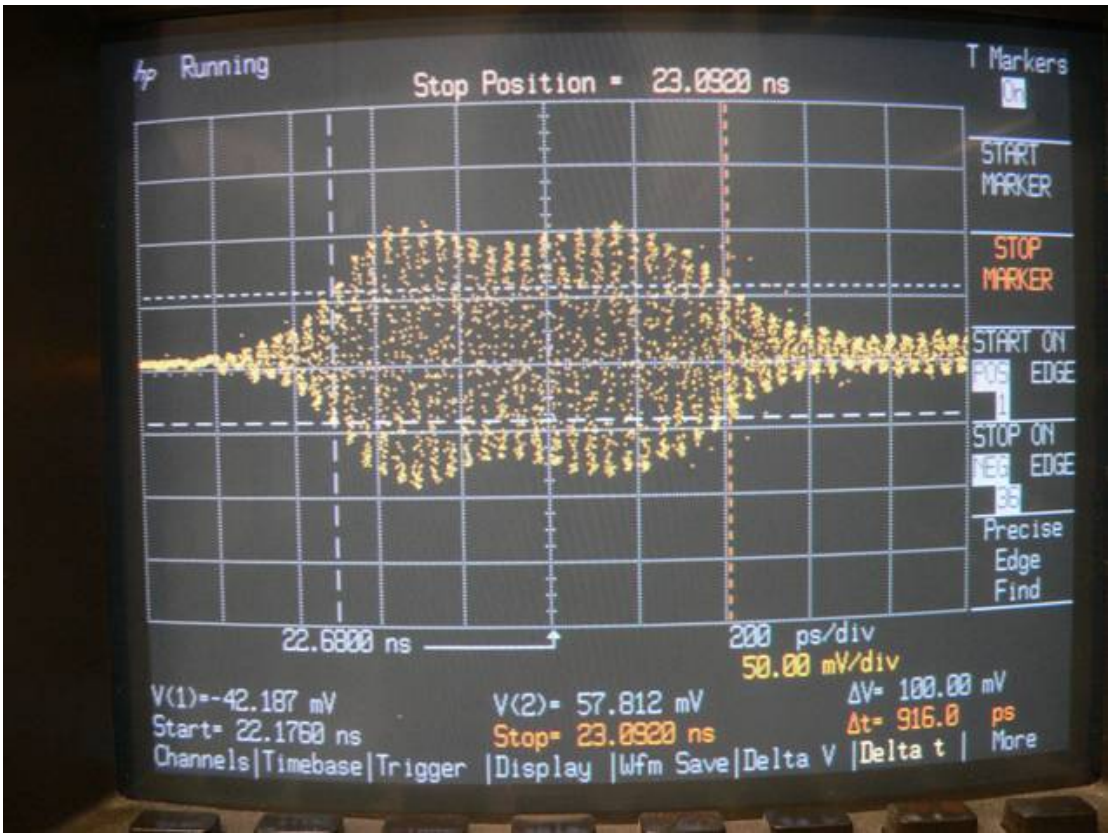
Please refer to the attached test record conducted at St. Mary Cement CO (CF silo), 400 Waverley Road South, Bowmanville, Ontario, Canada L1C 3K3 for details of measurements.

LR250EEx de - Duty cycle

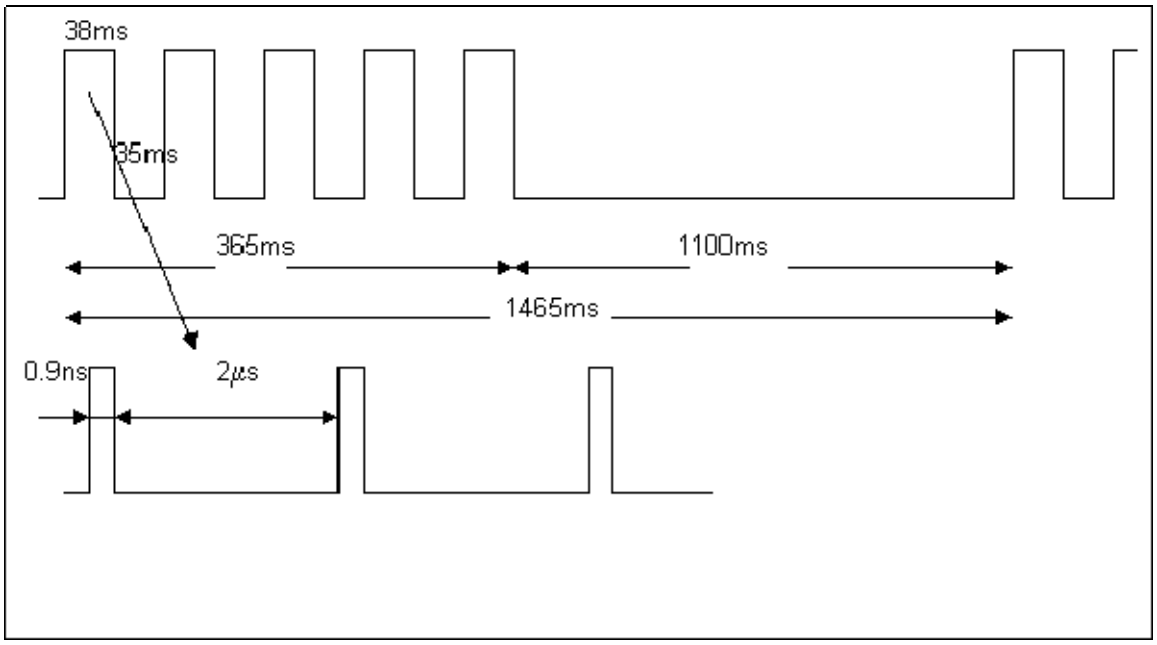
Due to energy constraints LR250EEx de is using a complex modulation, in which the unit is switched ON/OFF as a function of available energy.

When enough energy is available the unit is in default mode and works as follows: Five trains of pulses are sent to the target, each train lasting 38ms with the interval between trains being 35ms. After sending these five trains the radar switches OFF for 1.1s. When there is not enough energy some train pulses may be shortened, the time between train pulses may be increased and the OFF time may increase. The available energy depends on the way the unit is set-up and the distance to the target.

Each train consists in 0.916ns pulses separated by 2µs intervals (500 kHz pulse repetition frequency)



Pulse width = 0.916ns measured with sampling scope



The default behaviour will produce the highest duty cycle.

It is the ratio between the pulse width (0.916ns) and the period of the pulses (2µs) that have the main contribution to the duty cycle

Considering this timing the total duty cycle is:

a) Measured over a full measurement cycle
Duty Cycle = 0.916ns/2µs * 38ms/ (38ms + 35ms) * 365ms/ (365ms + 1100ms) = $5.94*10^{-5}$

b) Measured over the pulse period
Duty Cycle = 0.916ns/2µs = $45.8*10^{-5}$

5.6. 20 DB OCCUPIED BANDWIDTH @ FCC 15.215(C)

5.6.1. Limits

The rf spectrum shall not stay in the restricted band specified in FCC 15.205

5.6.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.4 & ANSI C63.4

The transmitter output was coupled to the spectrum analyzer and the bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63.4, Sec. 13.1.6.2

5.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer

5.6.4. Test Data

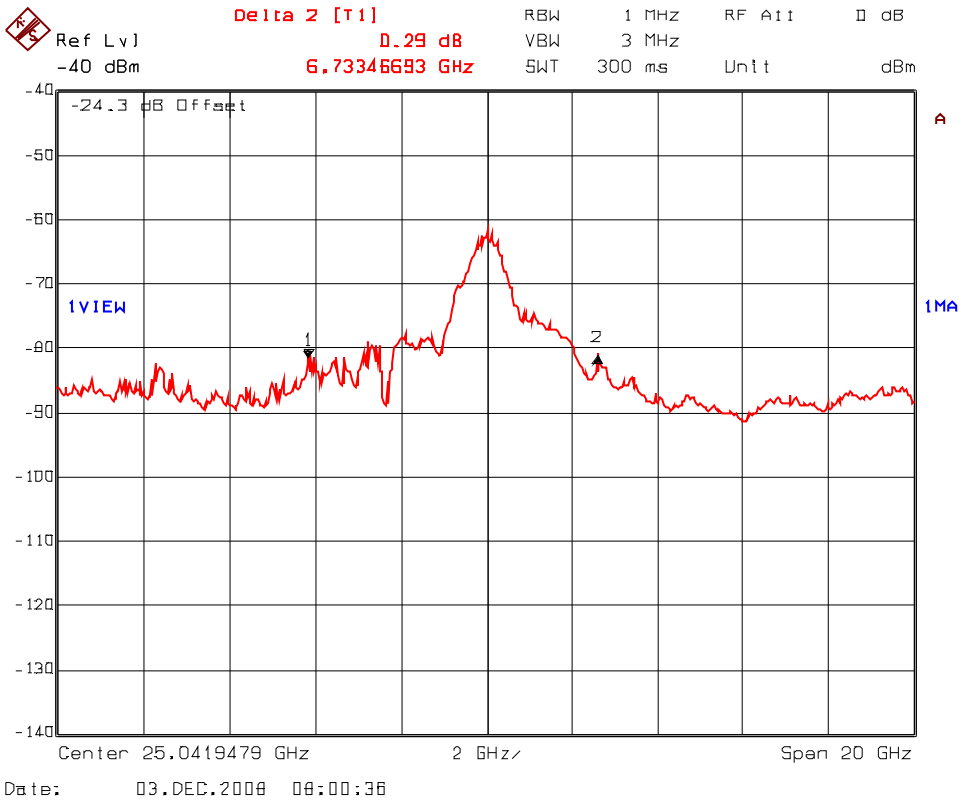
- **Test Sample: SITRANS LR250, Model 7ML5431-xxxxx-xxHx with 4" horn antenna (maximum gain: 23 dBi)**

CHANNEL FREQUENCY (GHz)	20 dB BANDWIDTH (GHz)	MAXIMUM LIMIT (kHz)	PASS/FAIL
25.04	6.734	N/A	N/A

Note: The above measurement is only to full fill the FCC's requirements. The actual bandwidth for pulse desensitizing signal is calculated as below:

BW = 2/(pulse width) = 2/0.916 nS = 2.18 GHz

Plot: 20 dB Bandwidth



5.7. RADIATED EMISSIONS FROM CLASS B UNINTENTIONAL RADIATORS (DIGITAL DEVICES) @ FCC 15.109(A)

5.7.1. Limits

The equipment shall meet the limits of the following table:

Test Frequency Range (MHz)	Class B Limits @3 m (dBμV/m)	EMI Detector Used	Measuring Bandwidth (kHz)
30 – 88	40.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
88 – 216	43.5	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
216 – 960	46.0	Quasi-Peak	RBW = 120 kHz, VBW ≥ 120 kHz
Above 960	54.0	Average	RBW = 1 MHz, VBW = 10 Hz

5.7.2. Method of Measurements

Refer to Ultratech Test Procedures ULTR-P001-2004 & ANSI C63.4 for method of measurements.

The spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 -1000	5000
Above 1000	5^{th} harmonic of the highest frequency or 40 GHz, whichever is lower

5.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Microwave Amplifier	Hewlett Packard	HP 83017A	311600661	1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

5.7.4. Test Data

The emissions were scanned from 30 MHz to 40 GHz at 3 Meters distance and all emissions less than 20 dB below the limits were recorded.

FREQUENCY (MHz)	RF LEVEL (dBuV/m)	DETECTOR USED (PEAK/QP)	ANTENNA PLANE (H/V)	LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
47.5	33.7	QP	V	40.0	-6.3	PASS
47.5	25.6	PEAK	H	40.0	-14.4	PASS
84.1	31.5	PEAK	V	40.0	-8.5	PASS
84.1	19.6	PEAK	H	40.0	-20.4	PASS
116.0	28.8	PEAK	V	43.5	-14.7	PASS
116.0	18.4	PEAK	H	43.5	-25.1	PASS

EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	±1.5	±1.5
LISN coupling specification	Rectangular	±1.5	±1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	±0.3	±0.5
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8$(9 kHz) 0.2 (30 MHz) Uncertainty limits $20\text{Log}(1\pm\Gamma_1\Gamma_R)$	U-Shaped	±0.2	±0.3
System repeatability	Std. deviation	±0.2	±0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	±1.25	±1.30
Expanded uncertainty U	Normal (k=2)	±2.50	±2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30$ dB

$U = 2u_c(y) = \pm 2.6$ dB

- *All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1\pm\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

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