Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15C

On

Rex2 Family of Power Meters

ILC24-I

Elster Solutions, LLC
208 South Rogers Lane
Raleigh, NC 27610

Prepared by:

TUV Rheinland of North America, Inc.

Client:	Elster Solutions, LLC 208 South Rogers Lane Raleigh, NC 27610	John Holt 919-250-5557 / 919-250-5486 john.holt@us.elster.com

Identification:	Rex2 Family of Power Meters	***Serial No.:***	1056
Test item:	ILC24-I	***Date tested:***	02 February 2010
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.	Tel: (919) 554-3668 Fax: (919) 554-3542	
Test specification:	**Emissions:** FCC Part 15, Subpart C FCC Part 15.207(a) FCC Parts 15.205, 15.209, 15.215(c) FCC Part 15.247, FCC Part 15.247(a)(1), FCC Part 15.247(a)(1)(i), FCC Part 15.247(b)(2), FCC Part 15.247(g), FCC Part 15.247(h), FCC Parts 15.109(a) and FCC Part 15.107(a)		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		

tested by: Michael Moranha	***reviewed by:*** Robert Richards
Michael Moranha 2010.02.24 08:26:25 -05'00' 24 February 2010 ***Signature***	Digitally signed by Bob Richards Date: 2010.02.24 08:30:08 -05'00' 24 February 2010 ***Signature***

Other Aspects:	**None**

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

90552 and 100881	**NVLAP Lab Code (200094-0)**	**Industry Canada** **IC-2932H**

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15C based on the results of testing performed on 02 February 2010 on the Rex2 Family of Power Meters, Model No. ILC24-I, manufactured by Elster Solutions, LLC. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 *Summary of Test Results*

Applicant	Elster Solutions, LLC 208 South Rogers Lane Raleigh, NC 27610	**Tel**	919-250-5557	**Contact**	John Holt
		Fax	919-250-5486	**e-mail**	john.holt@us.elster.com

Description	Rex2 Family of Power Meters	**Model Number**	ILC24-I
Serial Number	1056	**Test Voltage/Freq.**	120VAC / 60Hz
Test Date Completed:	02 February 2010	**Test Engineer**	Michael Moranha

Standards	Description	Severity Level or Limit	Criteria	Test Result
FCC Part 15, Subpart C Standard	Radio Frequency Devices-Subpart C: Intentional Radiators	See called out basic standards below	See Below	**Complies**
FCC Parts 15.205, 15.209, 15.215(c)	Radiated Emissions EUT in Transmit Mode	Below limit of sections 15.205, 15.209(a) and 15.215(c)	Below Limit	Complies
FCC Part 15.207(a)	Conducted Emissions on Mains EUT in Transmit Mode	Below limit of section 15.207(a)	Below Limit	Complies
FCC Part 15.247	Operation within the band 902-928 MHz	See called out basic standards below	Below Limit	Complies
FCC Part 15.247(a)(1)(i)	Occupied Bandwidth	Contained within the Frequency Band 20dB ≤ 500 kHz 99% BW ≤ 500 kHz	Below Limit	Complies
FCC Part 15.247(a)(1)(i)	Channel Seperation	15,848 µV/m at 30m 84 dBµV/m at 30m	Below Limit	Complies
FCC Part 15.247(a)(1)	Pseudorandom Hoppong Algorithm	25 hopping channels when the BW ≥ 250kHz	Below Limit	Complies
FCC Part 15.247(b)(2)	Transmitter Output Power	Shall not exceed 0.25 Watts	Below Limit	Complies
FCC Part 15.247(g)	Frequency Hopping Spread Spectrum (FHSS) Systems	Description of Hopping System	Below Limit	Complies
FCC Part 15.247(h)	Incorporation of Intelligence within a FHSS System	Not Applicable: EUT does not incorporate hopping intelligence	NA	Complies
FCC Parts 15.109(a)	Radiated Emissions while EUT in Receive Mode	Below limit of section 15.109(a) Class B	Below Limit	Complies
FCC Part 15.107(a)	Conducted Emissions EUT in Receive Mode	Below limit of section 15.107(a) Class B	Below Limit	Complies

2 Laboratory Information

2.1 Accreditations and Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab code: 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: IC-2932H The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2009.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174, R-1679, C-1790 and C-1791).

2.1.5 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	3.3 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.18 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated and Conducted RF Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	23-Jan-09	23-Jan-10
Antenna Horn 1-18GHz	EMCO	3115	5770	16-Jun-08	16-Jun-10
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	29-Jun-09	29-Jun-10
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	04-Dec-09	04-Dec-10
Cable, Coax	Andrew	FSJ1-50A	003	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	030	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	045	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	049	14-Dec-09	14-Dec-10
1.5 GHz High Pass Filter	Bonn Electronik	BHF 1500	025155	26-Jan-09	26-Jan-10
Conducted Emissions (AC/DC and Signal I/O)					
LISN 15-18 (NSLK 8126)	Schwarzbeck Mess-Electronik	NSLK 8126	003885	02-Feb-09	02-Feb-10
Transient Limiter	Schaffner	CFL-9206	1649	09-Dec-09	09-Dec-10
Transient Limiter	Schaffner	CFL-9206	1630	10-Dec-09	10-Dec-10
Receiver, EMI	Rohde & Schwarz	ESH3	860905/005	24-Aug-09	24-Aug-10
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	04-Dec-09	04-Dec-10
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	26-May-09	26-May-10
Cable, Coax	Pasternack	RG-223	051	09-Dec-09	09-Dec-10
General Laboratory Equipment					
Meter, Temp/Humid/Barom	Fisher	02-400	01	28--Dec-09	28--Dec-10
Meter, Temp/Humidity	Dickson Company	TH550	6215304	19-Mar-09	19-Mar-11
Attenuator	Pasternack	PE7015-20	NA	22-Jan-09	22-Jan-10

3 Product Information

3.1 Product Description

The Equipment Under Test is the Internal LAN Controller 2 (ILC24-I) for which Limited Modular Approval is being sought. The ILC24-I is typically installed in one of several varieties of host meter of which there are two primary types; the A3 Alpha Node and the A3 Alpha Collector. Variations of collectors and nodes are formed by their configuration of option boards and antenna type. The information provided in the following table lists a representative sample of configurations. The options included do not change the ILC2 module and are considered equivalent styles. The following meters will be tested and the worst-case meter will be used to file the FCC report.

Table 1 – EUT Designation

EUT	Model Name	Elster Style Number
#0551 - A3 Collector, form 2S, w/relay board, external antenna	ILC24-I	ZDC304P8000
#0551 - A3 Collector, form 2S, w/relay board, internal antenna	ILC24-I	ZDC304P8000

In addition to the internal antenna normally supplied with the A3 Collector [containing the ILC24-I module], there are two different models of external antenna that may be used as shown in table 4. The remote mount model offers a 3db gain option and the local mount model has the option for use with or without a metal ground plane mounting. Elster will supply the highest gain version of the remote mount antenna and the ground plane version of the local mount antenna.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

4 Spurious Emissions

4.1 Spurious Emissions Outside the band

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either RF conducted or radiated measurements. Conducted antenna port measurements are provided below to show that the EUT meets these requirements at the band edges.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	18, 19 January 2010	
Standard	FCC Parts 15.205, 15.209, 15.215 and RSS-210						
Product Model	ILC24-I			**Serial#**	1056		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	120VAC / 60Hz	**Temp**	74 ºF	**Humidity**	36%	**Pressure**	1000 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Michael Moranha		

4.1.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

4.1.4 Final Test

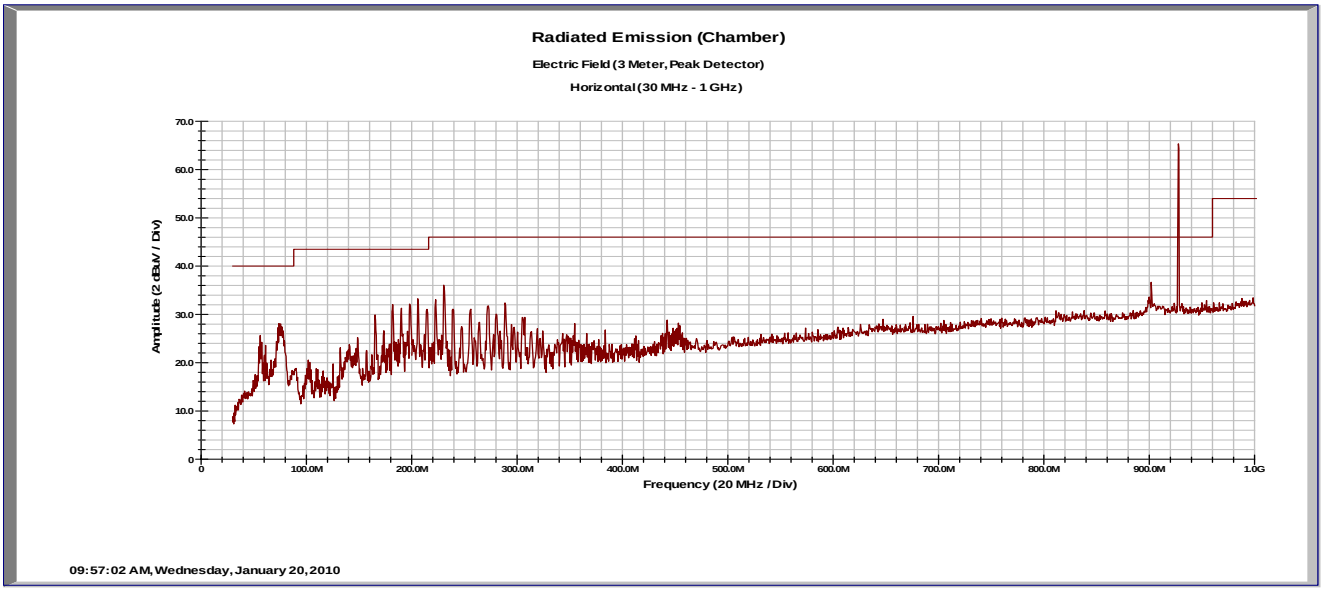
All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst–case emissions are shown below. All other emissions on the other investigated channels are on file at TUV Rheinland.

4.1.4.1 Emissions Outside the Frequency Band

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either RF conducted or radiated measurements. Conducted antenna port measurements are provided below to show that the EUT meets these requirements at the band edges.

Radiated Emissions – External Antenna – WORST CASE
Horizontal Ch 63



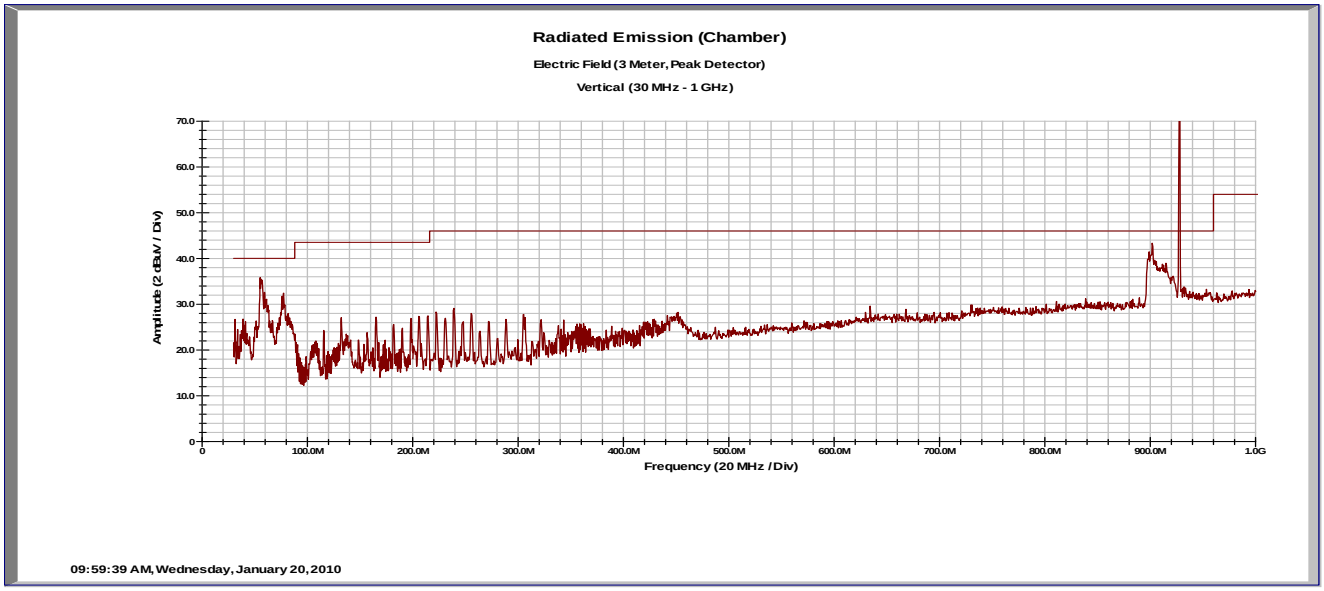
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
927.60	H	1	140	76.56	0.00	3.43	22.80	102.79	46.00	56.79
927.60	H	1	140	82.36	0.00	3.43	22.80	108.59	46.00	62.59
927.60	H	1	140	82.61	0.00	3.43	22.80	108.84	46.00	62.84

Notes: The Plot was taken with a notch filter tuned at the fundamental frequency
Except for the fundamental frequency, a notch filter was used for all measurements Using the QP detector.

The Fundamental frequency was measured without the notch filter and used the **Pk**, **QP** and **Av** detectors.
These values are used as the reference level (-20dBc) for the harmonic measurements, not in a restricted band.

Radiated Emissions – External Antenna – WORST CASE

Vertical Ch 63



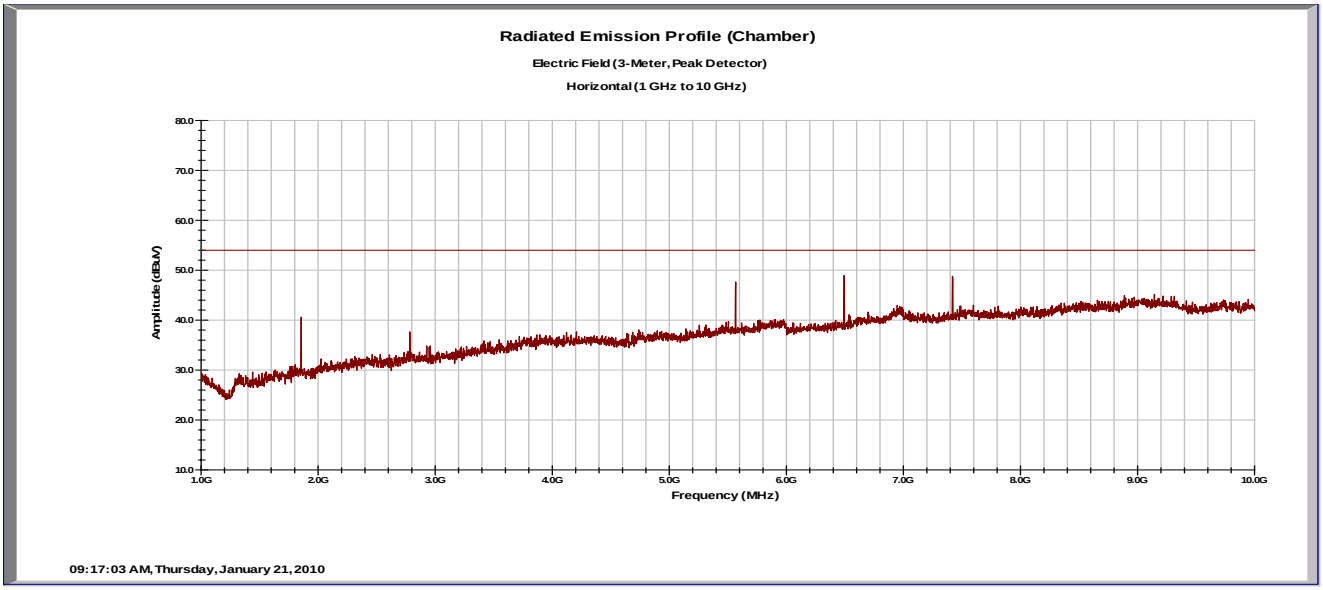
Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
55.21	V	1	88	20.81	0.00	0.79	9.49	31.09	40.00	-8.91
77.35	V	1.8	219	20.69	0.00	0.93	6.61	28.23	40.00	-11.77
901.83	V	1.6	255	15.88	0.00	3.35	22.17	41.41	46.00	-4.59
927.60	V	1.1	164	89.26	0.00	3.43	22.60	115.29	N/A	N/A
927.60	V	1.1	164	95.09	0.00	3.43	22.60	121.12	N/A	N/A
927.60	V	1.1	164	95.28	0.00	3.43	22.60	121.31	N/A	N/A

Notes: The Plot was taken with a notch filter tuned at the fundamental frequency
Except for the fundamental frequency, a notch filter was used for all measurements Using the QP detector.

The Fundamental frequency was measured without the notch filter and used the **Pk**, **QP** and **Av** detectors.
These values are used as the reference level (-20dBc) for the harmonic measurements, not in a restricted band.

Radiated Emissions – Internal Antenna – WORST CASE

Horizontal CH 63

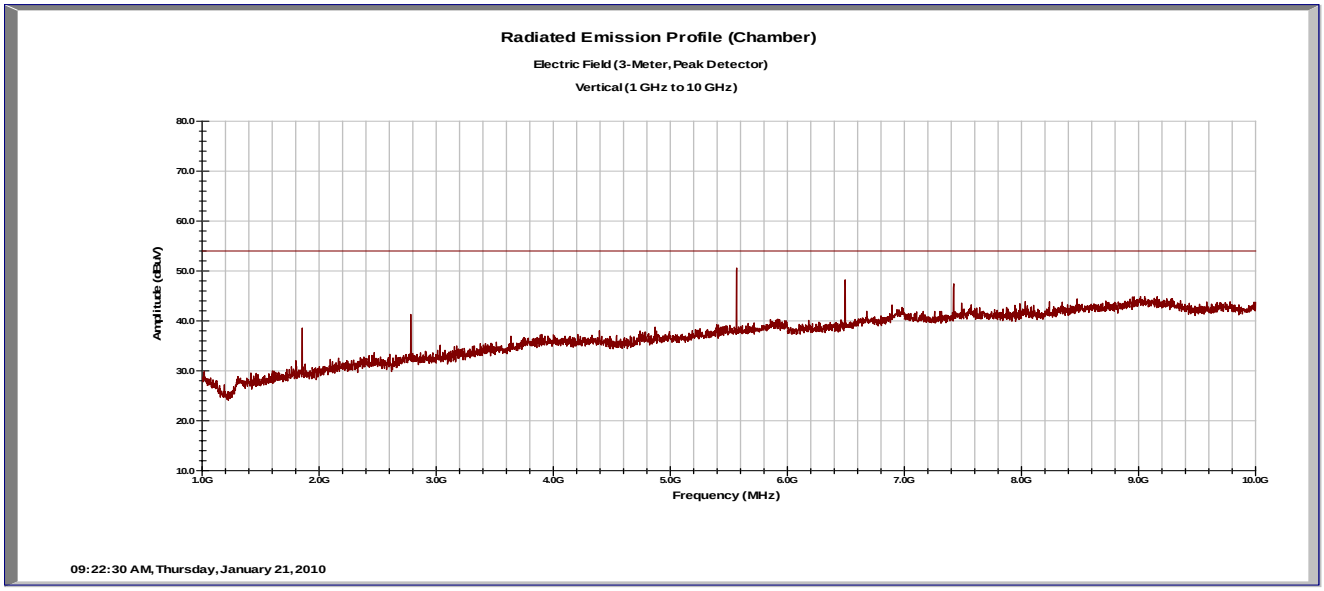


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1855.20	H	1	312	37.31	35.70	6.41	27.09	35.10	54.00	-18.90
5565.60	H	1	328	30.58	35.21	11.85	33.97	41.19	54.00	-12.81
6493.20	H	1	260	28.44	35.29	13.56	34.20	40.92	54.00	-13.08
9276.00	H	1	0	20.95	35.86	15.63	37.68	38.39	54.00	-15.61
1855.20	H	1	312	46.32	35.70	6.41	27.09	44.11	74.00	-29.89
5565.60	H	1	328	40.75	35.21	11.85	33.97	51.36	74.00	-22.64
6493.20	H	1	260	41.11	35.29	13.56	34.20	53.59	74.00	-20.41
9276.00	H	1	0	34.40	35.86	15.63	37.68	51.84	74.00	-22.16

Notes: Notes: CH 63 – 927.6 MHz High Pass Filter used
Emissions shown in shown in Blue are using the Peak Detector and Green are using the Average Detector
Emissions outside the Restricted Bands are shown.
Emissions Inside the Restricted Bands are shown below
All harmonic emissions (including Peak) are below the limits of part 15.209

Radiated Emissions – Internal Antenna – WORST CASE

Vertical CH 63



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1855.20	V	1	165	35.16	35.70	6.41	27.13	33.00	54.00	-21.00
5565.60	V	1	29	33.33	35.21	11.85	34.03	44.01	54.00	-9.99
6493.20	V	1	282	28.04	35.29	13.56	34.29	40.61	54.00	-13.39
9276.00	V	1	0	20.95	35.86	15.63	37.75	38.47	54.00	-15.53
1855.20	V	1	165	45.06	35.70	6.41	27.13	42.90	74.00	-31.10
5565.60	V	1	29	42.70	35.21	11.85	34.03	53.38	74.00	-20.62
6493.20	V	1	282	40.99	35.29	13.56	34.29	53.56	74.00	-20.44
9276.00	V	1	0	33.74	35.86	15.63	37.75	51.26	74.00	-22.74

Notes: CH 63 – 927.6 MHz High Pass Filter used
Emissions shown in shown in Blue are using the Peak Detector and Green are using the Average Detector
Emissions outside the Restricted Bands are shown.
Emissions Inside the Restricted Bands are shown below
All harmonic emissions (including Peak) are below the limits of part 15.209

Radiated Emissions in Restricted Bands – WORST CASE

ILC24-I with External Antenna

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
CH 63: PK										
2782.80	H	1.1	70	42.31	35.55	8.03	28.72	43.51	74.00	-30.49
3710.40	H	1.1	324	38.90	35.34	9.39	32.21	45.16	74.00	-28.84
4638.00	H	1	255	36.23	35.52	10.74	32.31	43.76	74.00	-30.24
7420.80	H	1	279	37.93	35.47	15.02	36.66	54.14	74.00	-19.86
8348.40	H	1.2	0	34.12	35.62	15.35	37.10	50.94	74.00	-23.06
CH 63: AV										
2782.80	H	1.1	70	31.69	35.55	8.03	28.72	32.89	54.00	-21.11
3710.40	H	1.1	324	26.15	35.34	9.39	32.21	32.41	54.00	-21.59
4638.00	H	1	255	22.95	35.52	10.74	32.31	30.48	54.00	-23.52
7420.80	H	1	279	26.88	35.47	15.02	36.66	43.09	54.00	-10.91
8348.40	H	1.2	0	21.24	35.62	15.35	37.10	38.06	54.00	-15.94
CH 63: PK										
2782.80	V	1	292	43.48	35.55	8.03	28.98	44.95	74.00	-29.05
3710.40	V	1.2	54	38.55	35.34	9.39	32.23	44.84	74.00	-29.16
4638.00	V	1	78	37.30	35.52	10.74	32.51	45.03	74.00	-28.97
7420.80	V	1.6	80	38.55	35.47	15.02	36.68	54.78	74.00	-19.22
8348.40	V	1.2	0	34.12	35.62	15.35	37.05	50.89	74.00	-23.11
CH 63: AV										
2782.80	V	1	292	33.66	35.55	8.03	28.98	35.13	54.00	-18.87
3710.40	V	1.2	25.6	38.55	35.34	9.39	32.23	44.84	54.00	-9.16
4638.00	V	1	78	25.04	35.52	10.74	32.51	32.77	54.00	-21.23
7420.80	V	1.6	80	27.64	35.47	15.02	36.68	43.87	54.00	-10.13
8348.40	V	1.2	0	21.27	35.62	15.35	37.05	38.04	54.00	-15.96

Notes: CH 63 – 927.6 MHz
High Pass Filter used
Highlighted emission is worst case

4.1 Conducted Emissions in Transmit mode

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	22 January 2010	
Standard	FCC Part 15.207(a)						
Product Model	ILC24-I			**Serial#**	1056		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	120VAC / 60 Hz	**Temp**	73º F	**Humidity**	25%	**Pressure**	1011 mbar
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Michael Moranha				

4.1.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 150 kHz – 30 MHz was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.1.3 Deviations

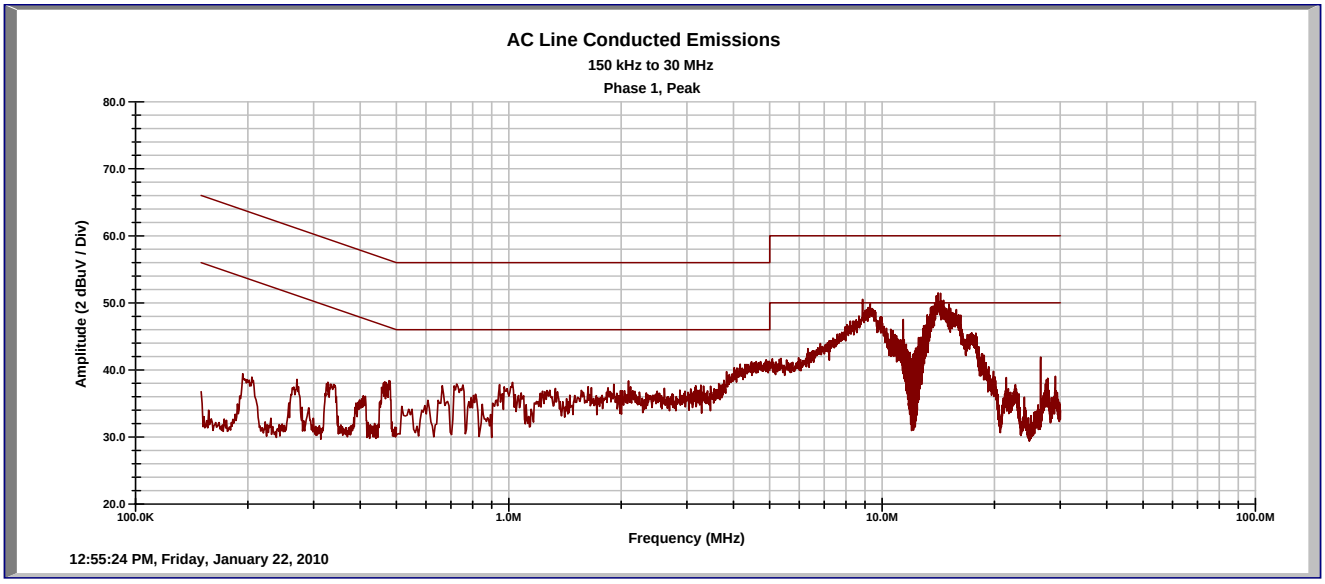
There were no deviations from the test methodology listed in the test plan for the conducted emission test.

4.1.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

4.1.5 Final Graphs and Tabulated Data

Conducted Emissions @ 120V/60Hz
Line 1

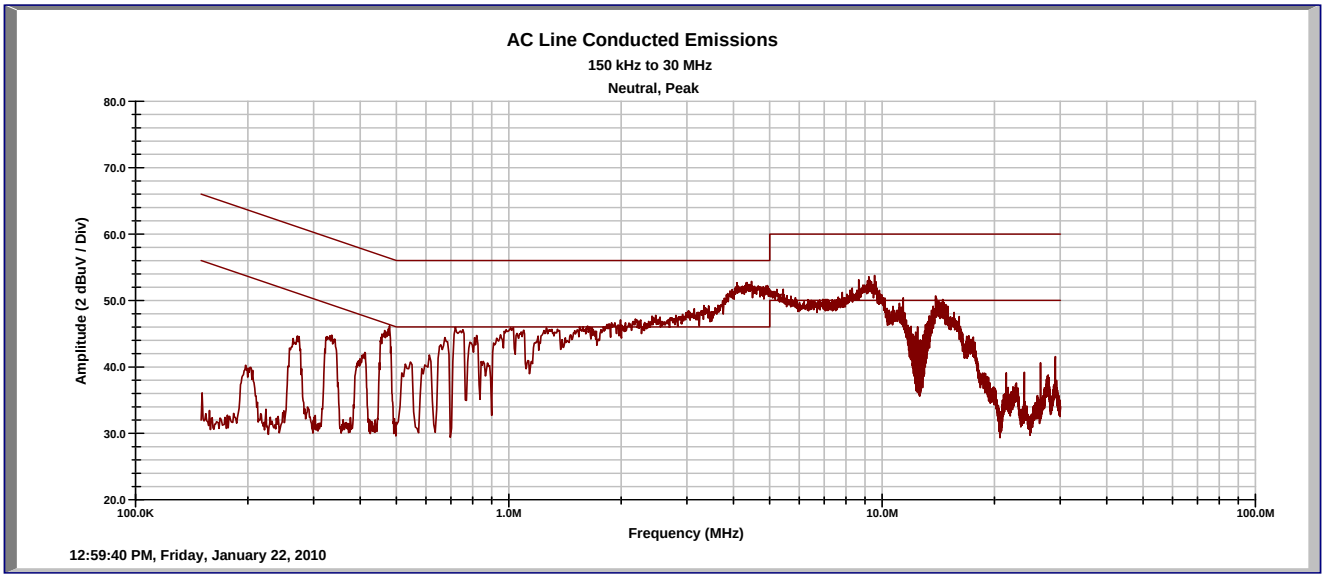


Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)

Notes: Worst case emissions are on the Neutral, see below.

Conducted Emissions @ 120V/60Hz

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.47	N	32.59	22.50	0.04	0.15	56.51	46.51	-23.73	-23.82
0.65	N	29.30	17.47	0.05	0.17	56.00	46.00	-26.48	-28.31
0.94	N	31.73	18.52	0.05	0.19	56.00	46.00	-24.03	-27.24
4.75	N	36.60	24.41	0.15	0.24	56.00	46.00	-19.01	-21.20
8.99	N	33.25	22.33	0.23	0.20	60.00	50.00	-26.32	-27.24
14.17	N	34.91	28.27	0.26	0.11	60.00	50.00	-24.72	-21.36

Notes:

4.2 Frequency Hopping Spread Spectrum (FHSS) Systems FCC Part 15.247(g)

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

In constant transmit mode, the Rex2 Meter sends a packet nominally every 97.3 ms with a delay of 8 to 16 ms between packets. Each packet is sent on the next channel determined by the pseudo-random hop table. When presented with a continuous data stream, the EUT adheres to the 0.4 second dwell time for each 10 second window requirement. The EUT always distributes its transmissions across all 25 channels, and does not re-use a channel again until a transmission has occurred on each of the other 24 channels.

4.3 Incorporation of Intelligence within a FHSS System FCC Part 15.247(h)

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The EUT does not incorporate intelligence relating to the hopping pattern as described above. Rather, the EUT always distributes its transmissions across the same 25 channels. A channel is not re-used until a transmission has occurred on each of the other 24 channels.

5 Antenna Port Conducted Emissions

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2009, RSP-100 Issue 9. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

5.1 Band Edge

5.1.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	22 January 2010	
Standard	FCC Part 15.247(a)(1)(i), RSS 210 A8.1						
Product Model	ILC24-I		**Serial#**	1056			
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Michael Moranha		

5.1.2 Test Procedure

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

5.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.1.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

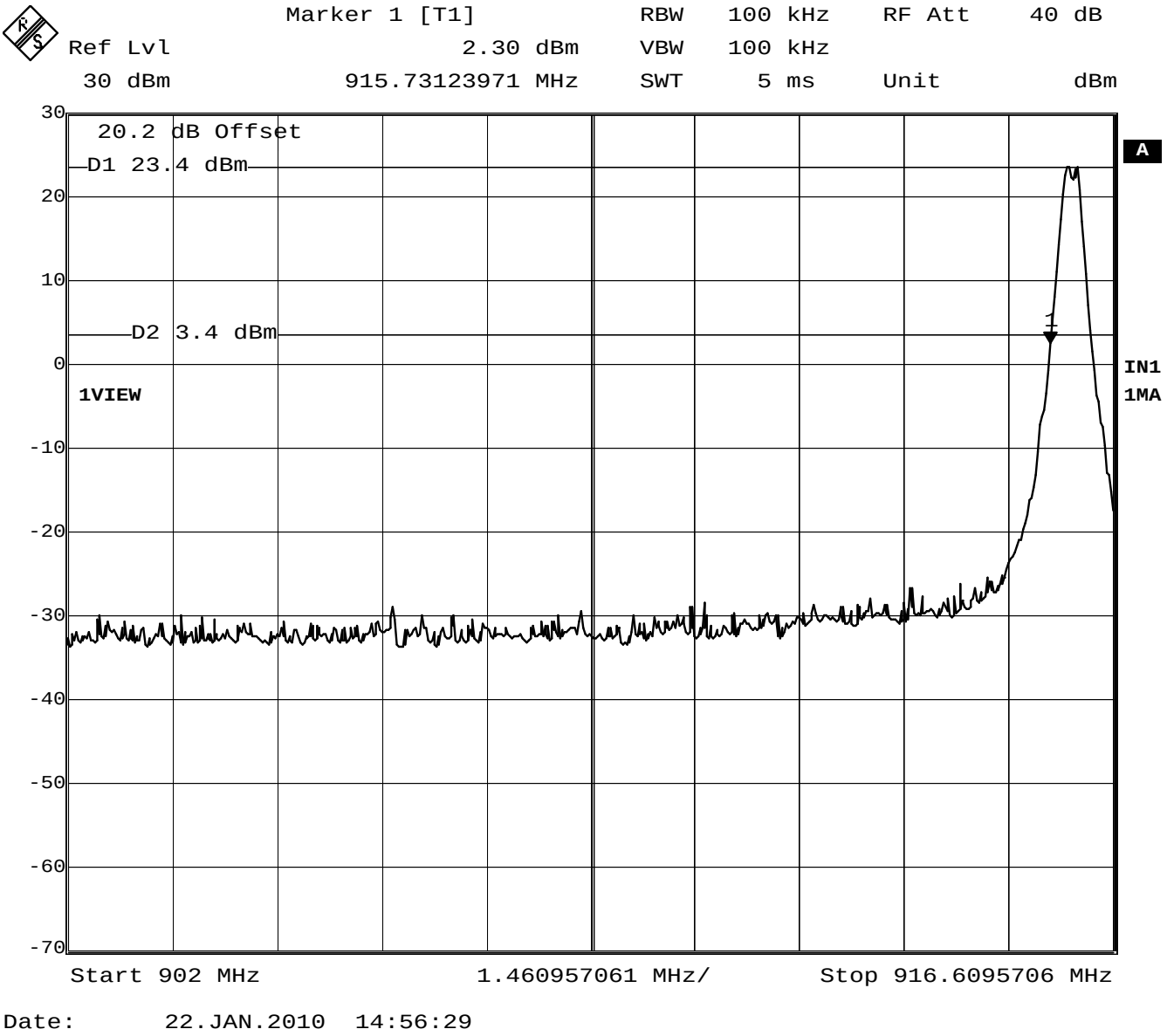


Figure 1: Lower Band Edge Measurement

Note: Band Edge is at 902 MHz

Channel Frequency is 902.8 MHz, The 20dB down point is at 915.73 MHz. The EUT is compliant with the rules.

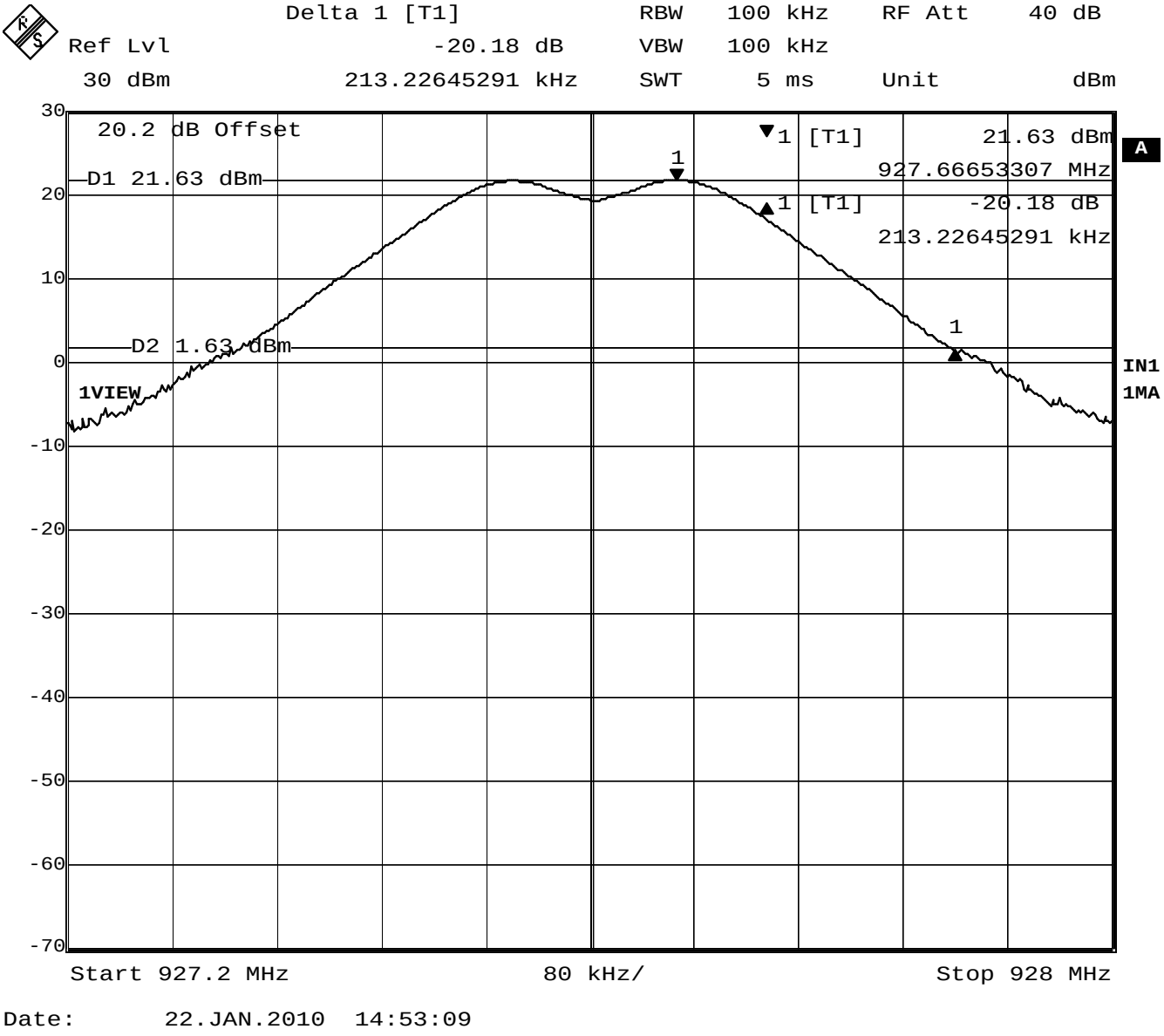


Figure 2: Upper Band Edge Measurement

Note: Band edge is at 928 MHz

Channel 63 Frequency is 927.6 MHz. The EUT is compliant with the rules.

5.2 Channel Separation

5.2.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	22 January 2010
Standard	FCC Part 15.247(a)(1)(i), RSS 210 A8.1						
Product Model	ILC24-I			**Serial#**	1056		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Michael Moranha		

5.2.2 Test Procedure

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.

Maximum allowed 20dB Bandwidth = 500 kHz

Channel Separation = 25 kHz Min. or the 20 dB bandwidth of the hopping channel, whichever is greater

The channel separation is greater than the measured maximum 20 dB bandwidth. Therefore the EUT is compliant with this section.

5.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.2.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

5.2.5 Final Data

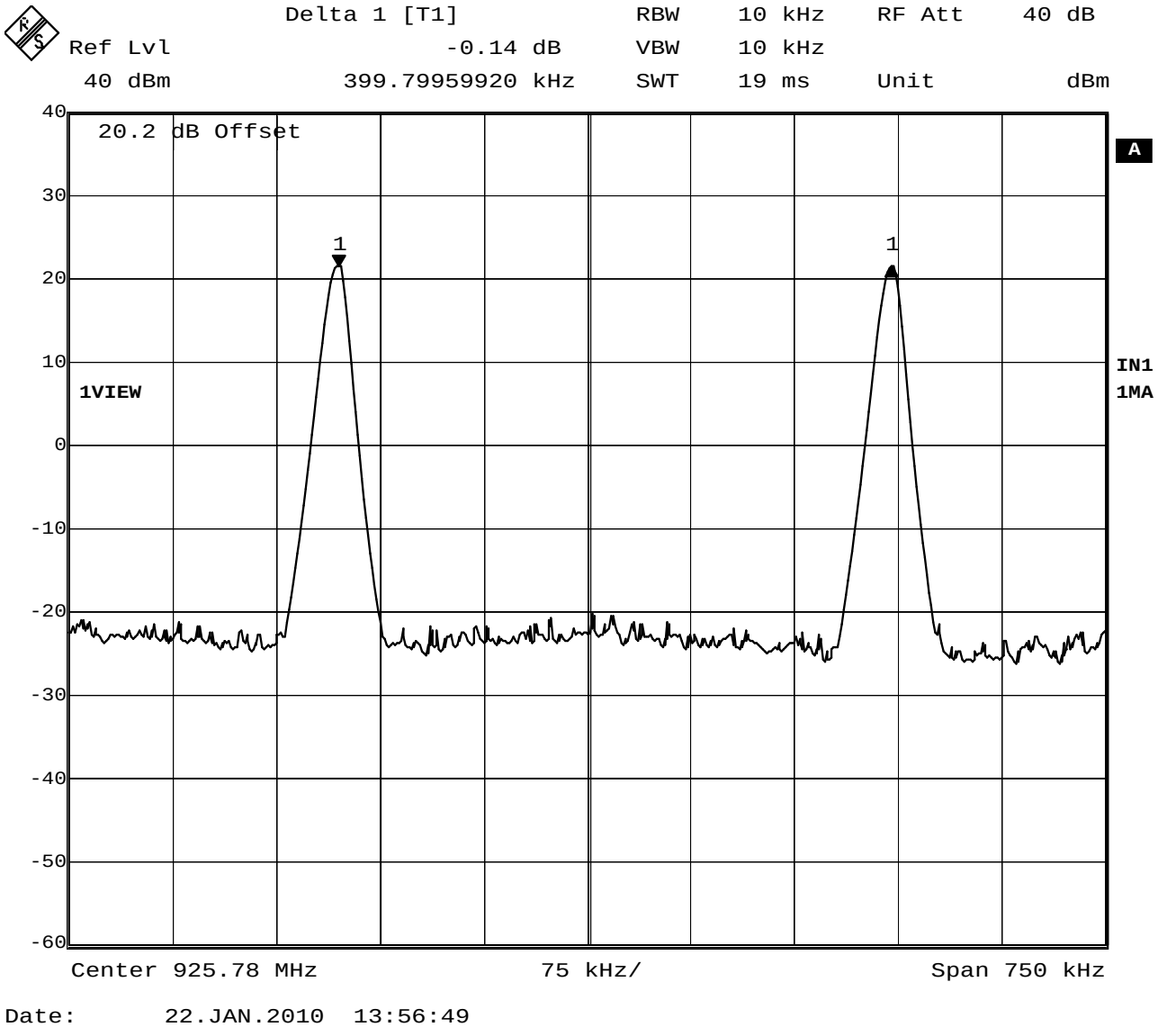


Figure 3: Channel Separation = 400 kHz

Spectrum Analyzer Parameters:
RBW=10kHz
Span=750kHz
VBW= 10kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

5.3 Pseudorandom Hopping Algorithm

5.3.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	22 January 2010
Standard	FCC Part 15.247(a)(1)(i) and RSS-210, A8.1						
Product Model	ILC24-I			**Serial#**	1056		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Michael Moranha		

5.3.2 Test Procedure

The channel bandwidth for this system is greater than 250 kHz. Therefore the system must use at least 25 channels that are selected at the system hopping rate, 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.

In constant transmit mode, the Rex2 Meter would send a packet every 97.3 ms with a delay of 8 to 16 ms between packets. Each packet is sent on the next channel determined by the pseudo-random hop sequence given in the operation description

5.3.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.3.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

5.3.5 Final Data

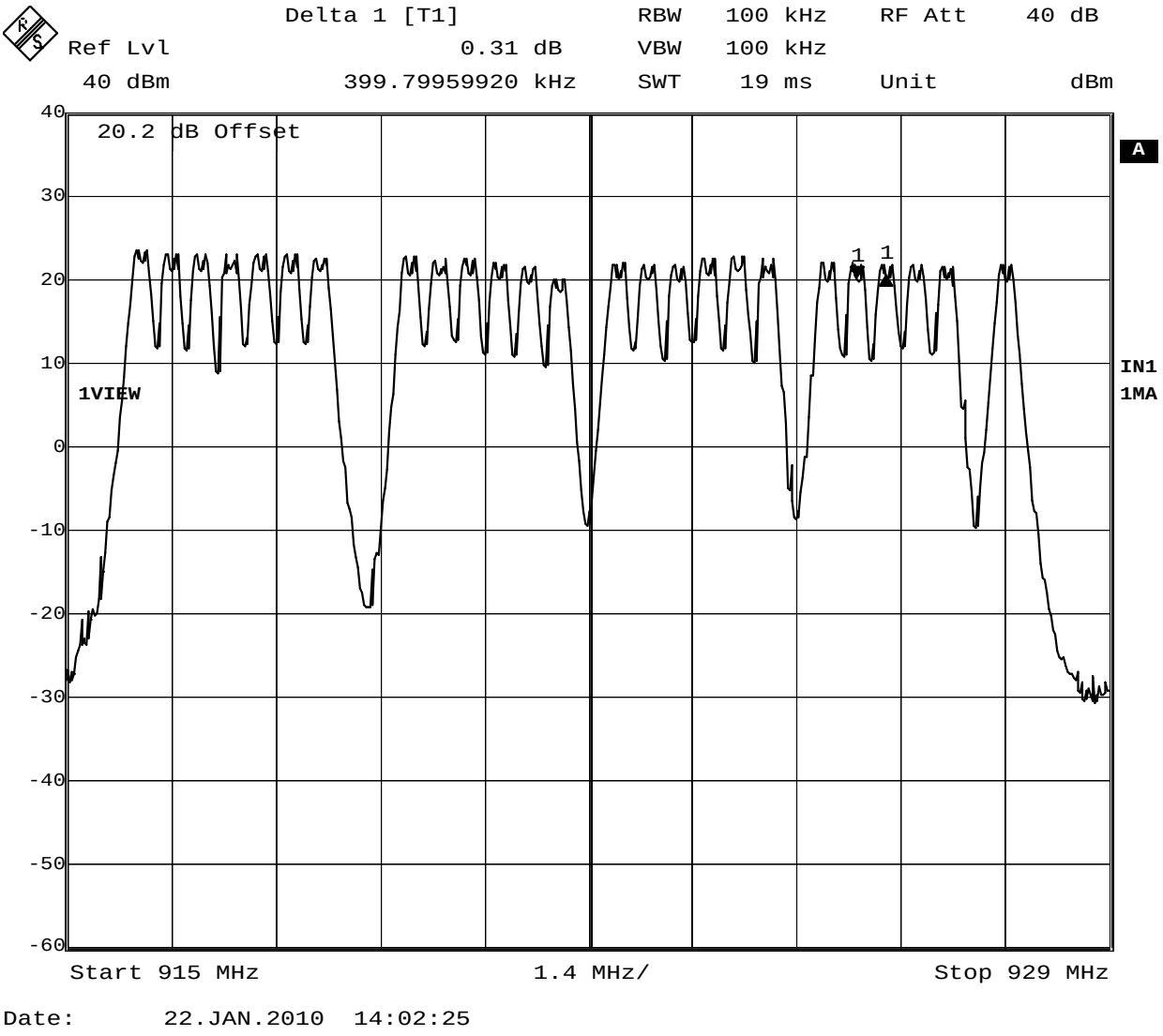


Figure 4: Plot of hopping Channels 915-928 MHz

Spectrum Analyzer Parameters:
RBW=100kHz
Span=14MHz
VBW= 100kHz
LOG dB/div.= 10dB
Sweep = Auto
Detector = sample detector, max hold

Time of Occupancy FCC Part 15.247(a)(1)(i)

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
902.4-927.6	=>250 kHz	25	=<0.4 sec. In 10 sec.

There were 2 hops at 81.48 milliseconds per hop for any 10 sec. Period. Time of occupancy equals number of hops multiplied by the duration of one hop.

Time of Occupancy limit = 0.400 seconds in any 10 second period.
Calculated Time of Occupancy = 0.084 seconds x 2 = 0.168 seconds in any 10 second period

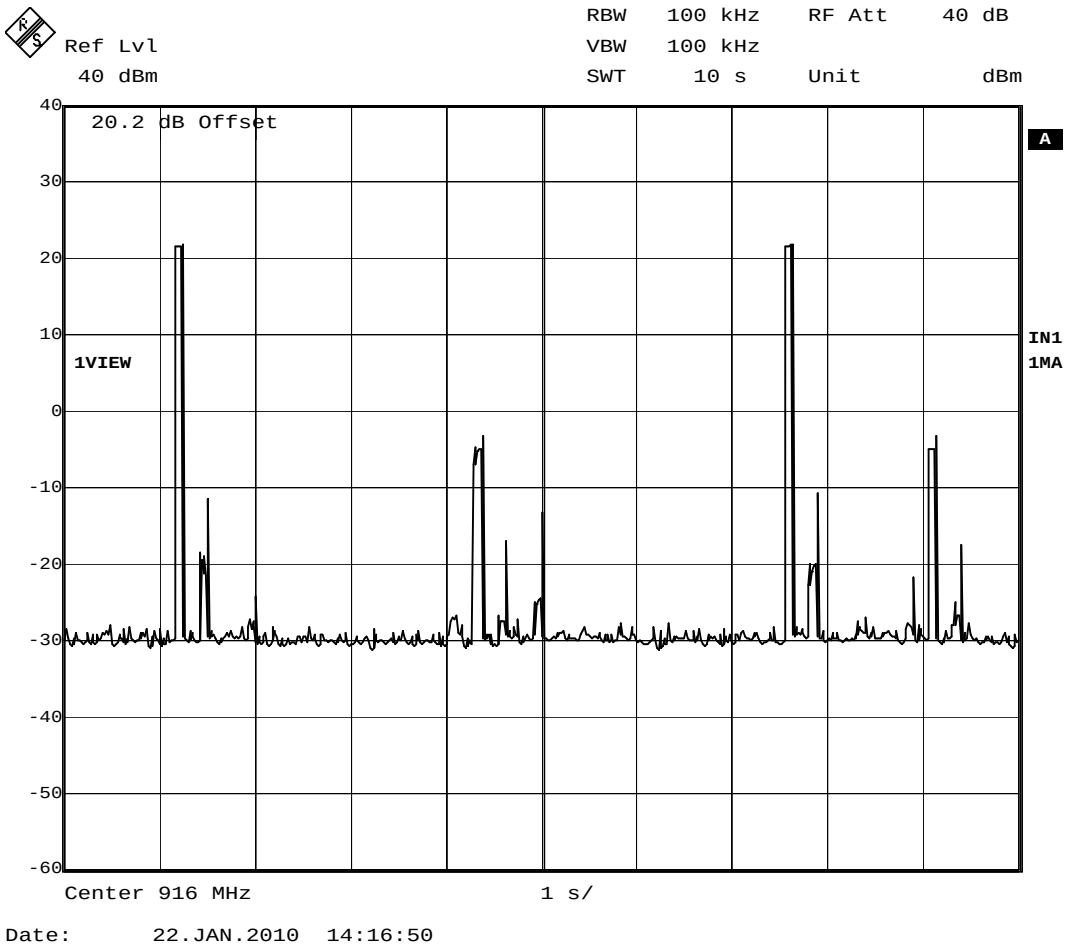


Figure 5: 10 second sweep of 916.0 MHz

Note: The on-channel traces are the two highest peaks.

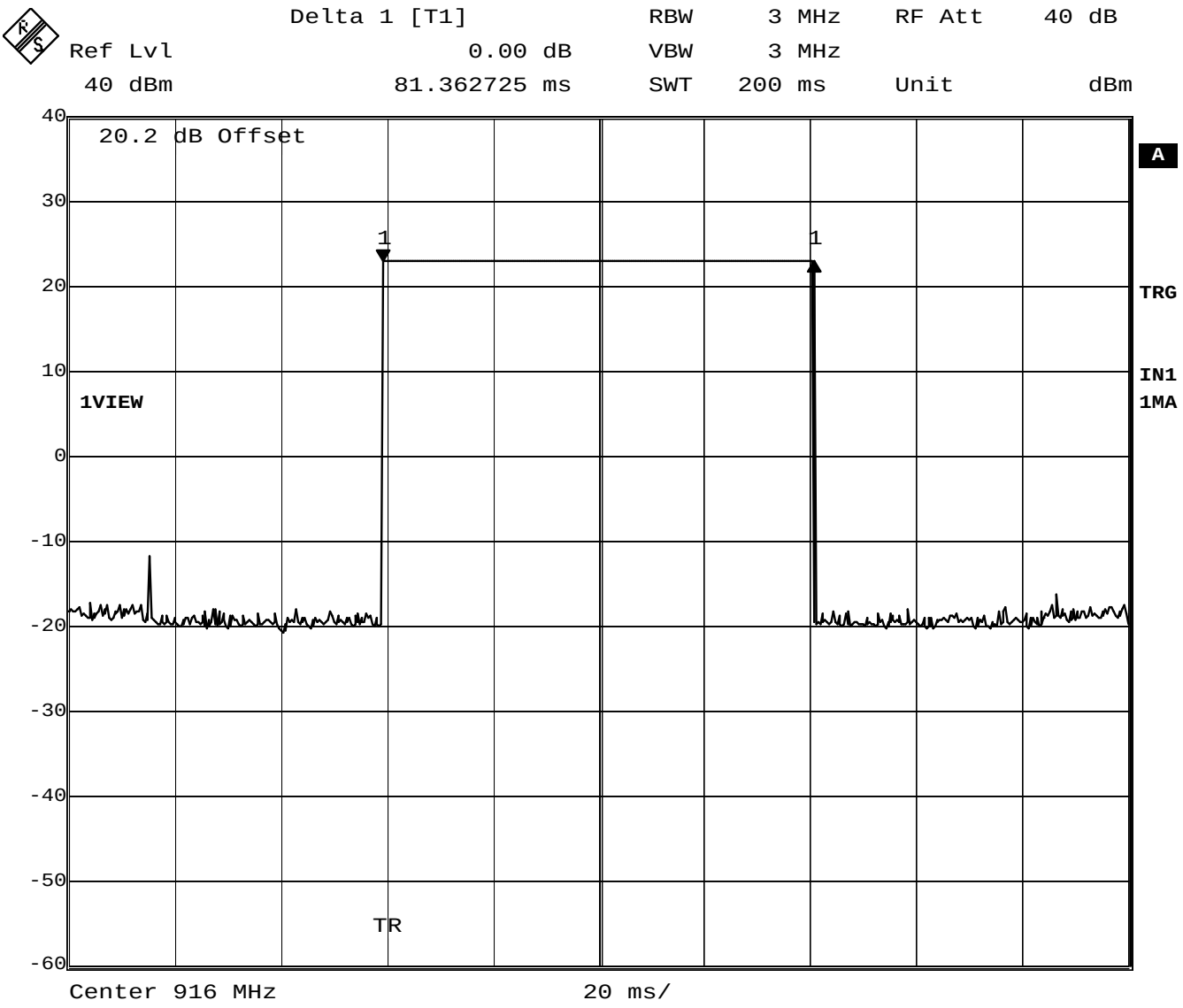


Figure 6: Measurement of 1 hop at 902.8 MHz

Time on Frequency = 81.36ms

Spectrum Analyzer Parameters:
RBW=1MHz
Span=zero
VBW= 3MHz
LOG dB/div.= 10dB
Sweep = 200 ms
Detector = sample detector, max hold

5.4 Occupied Bandwidth

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

5.4.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	22 January 2010
Standard	FCC Part 15.247(a)(1)(i)						
Product Model	ILC24-I			**Serial#**	1056		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Michael Moranha		

5.4.2 Test Procedure

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.

Maximum allowed 20dB Bandwidth = 500 kHz

Channel Separation = 25 kHz Min. or the 20 dB bandwidth of the hopping channel, whichever is greater

The channel separation is greater than the measured maximum 20 dB bandwidth. Therefore the EUT is compliant with this section.

5.4.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

5.4.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

5.4.5 Final Data

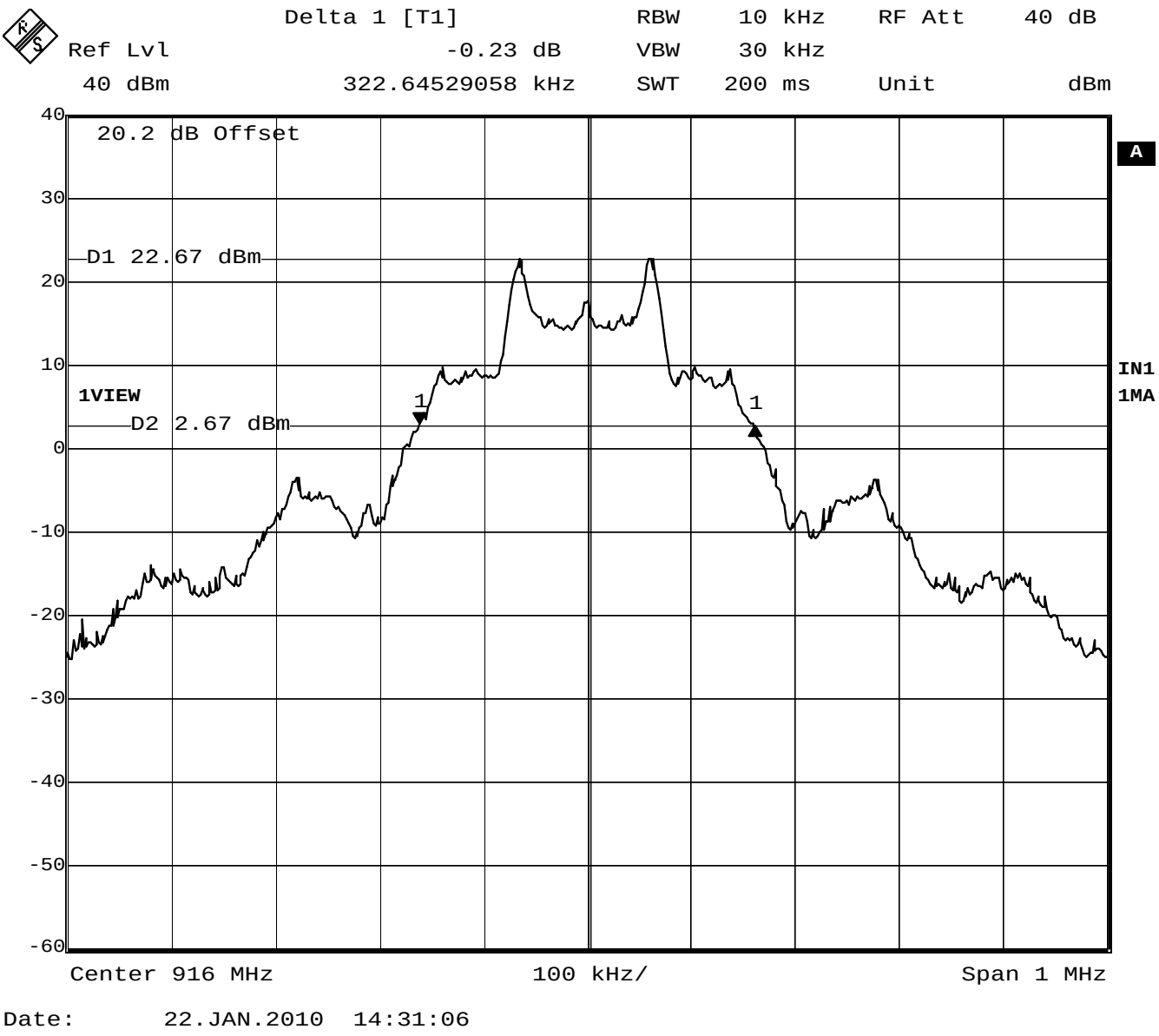


Figure 7: Occupied Bandwidth

Note: The above plot is the worst case.

***BW = 320.6 KHZ**

5.5 Peak Output Power

The maximum peak output power of the intentional radiator shall not exceed 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels. (Conducted Measurement)

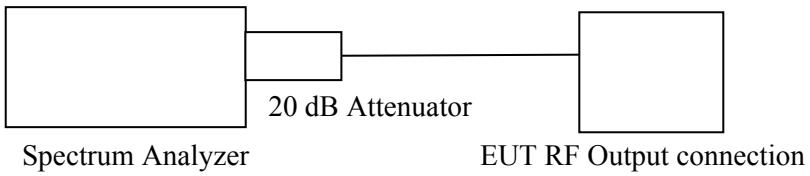
5.5.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	22 January 2010
Standard	FCC Part 15.247(b)(2) and RSS-210 A8.4(1)						
Product Model	ILC24-I			**Serial#**	1056		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Michael Moranha		

5.5.2 Test Procedure

The peak output power was measured at CH01, CH34, CH48, and at CH63. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The cable loss and the attenuator was measured and added in the reference level offset in the spectrum analyzer. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was equal to the resolution bandwidth.

Test Setup:



5.5.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Surge Immunity test.

5.5.4 Final Test

The EUT met the performance criteria requirement as specified in the test plan of this report and in the standards.

5.5.5 Final Data - Peak Power Output

CH34: 916.0 MHz = 0.204 Watts = 130.09 dBµV

CH48: 921.6 MHz = 0.092 Watts = 126.62 dBµV

CH63: 927.6 MHz = 0.136 Watts = 128.32 dBµV

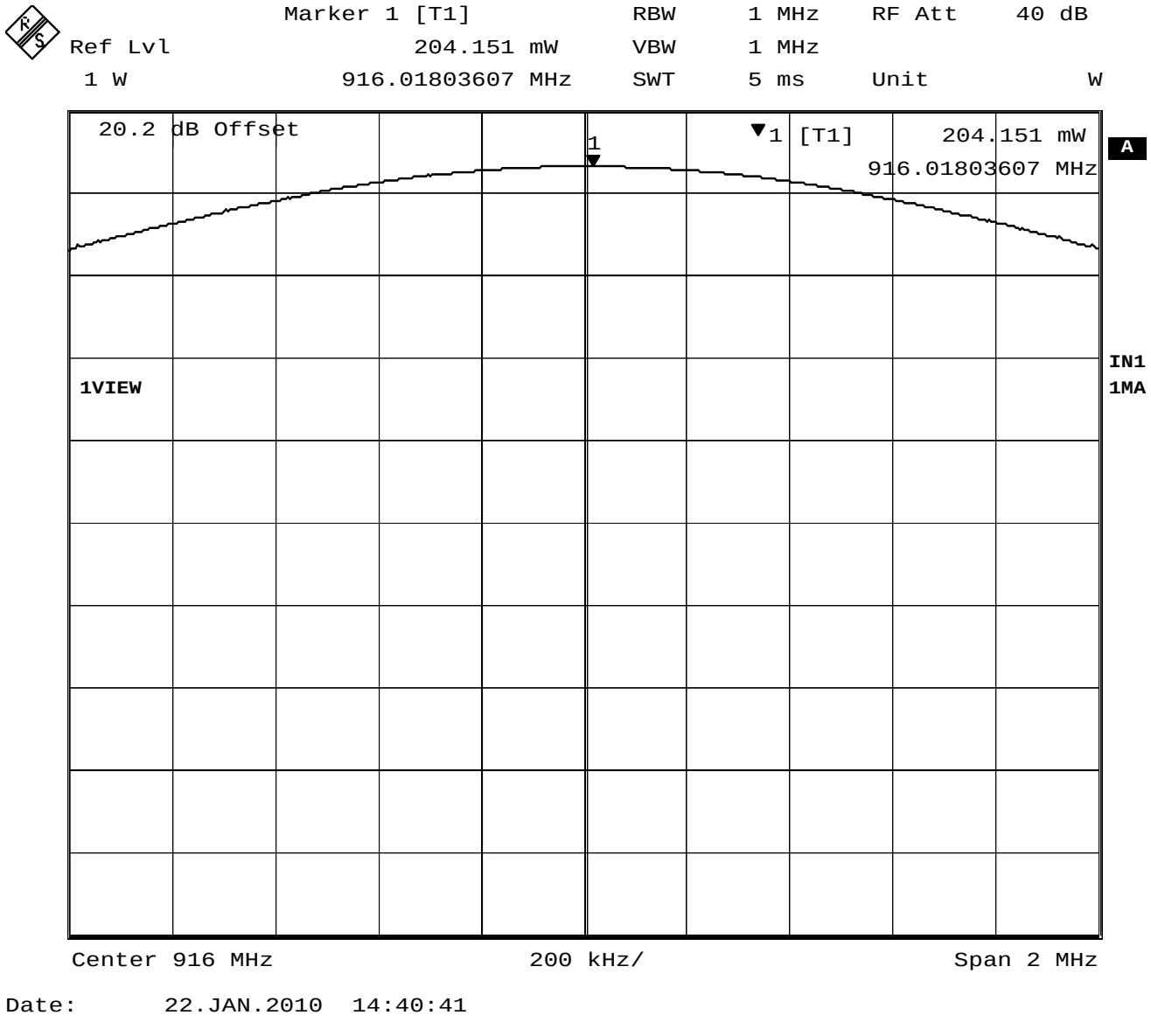


Figure 8: CH 34 (916.0 MHz) Peak Output Power

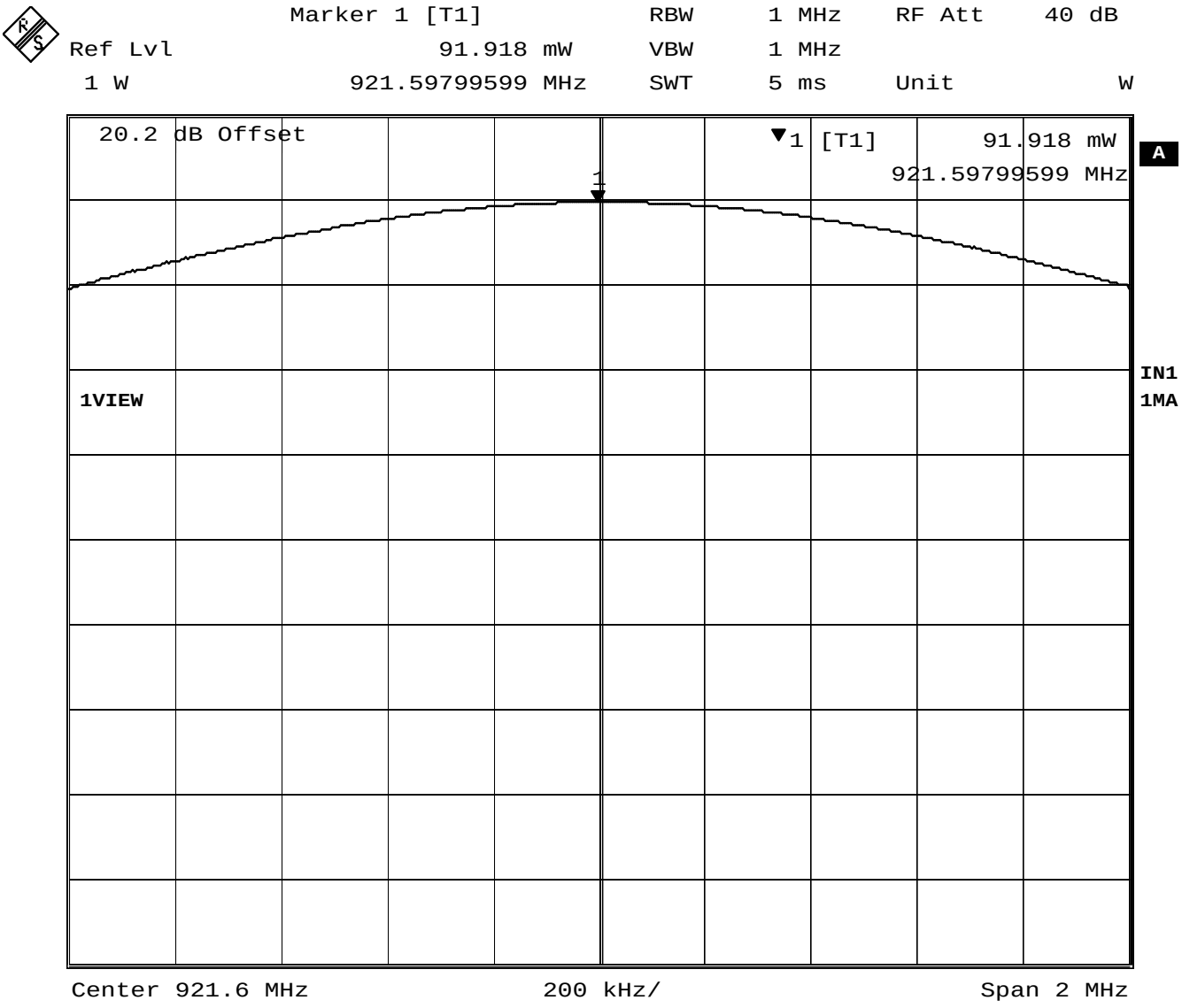


Figure 9: CH 48 (921.6 MHz) Peak Output Power

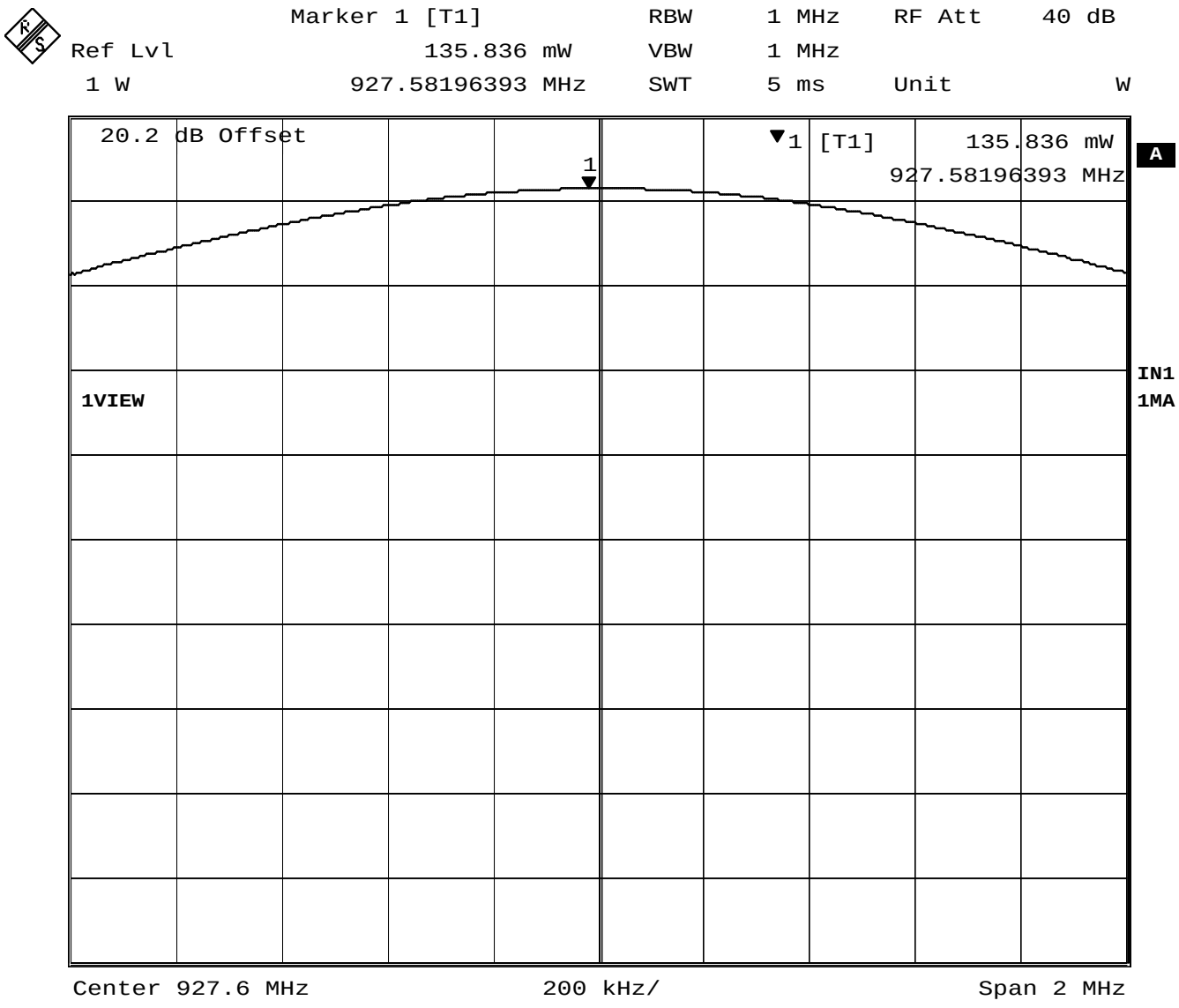


Figure 10: CH 63 (926.7 MHz) Peak Output Power

Antenna Gain

The antenna gain data was supplied separately with the following results provided:

Results

Internal Antenna

Freq.	Peak (dBi)
(GHz)	
0.902 – 0.928	5.64

External Antennas

Though the ILC24-I module is normally supplied with an integral printed circuit antenna, it may be used with two different models of external antenna as shown in the table 5. The remote mount model offers a 3db gain option and the local mount model has the option for use with or without a metal ground plane mounting.

Approved External Antennas

Antenna	Mount	Gain
PCTEL(MAXRAD) MFB9150 Unity Gain Fiberglass Omnidirectional	Remote	2.15 dBi
PCTEL(MAXRAD) MFB9153 3dB Fiberglass Omnidirectional	Remote	5.15 dBi
Antenex TRA9023P(NP)* [white body] 3dB Gain Antenex TRAB9023P(NP)* [black body] 3dB Gain	Local	3.00 dBi

- Note the "NP" designation specifies the NGP variation that can be used without a metal ground plane. It is equivalent with respect to gain and pattern, to the "P" model that does require a metal ground plane.
- Refer to the Technical Description document for more details

6 Emissions in Receive Mode.

6.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

6.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	22 January 2010	
Standard	FCC Parts 15.109(a)						
Product Model	ILC24-I		**Serial#**	1056			
Configuration	See test plan for details						
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane on a turn-table. See test plans for details						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Frequency Range	30 MHz to 5 GHz @ 3m						
Perf. Criteria	(Below Limit)		**Perf. Verification**	Readings Under Limit			
Mod. to EUT	None		**Test Performed By**	Michael Moranha			

6.1.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.4:2003 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 30 MHz to 5 GHz was investigated for radiated emissions.

Radiated emission testing was performed at a distance of 3 meters in a 5 meter semi-anechoic chamber.

6.1.3 Deviations

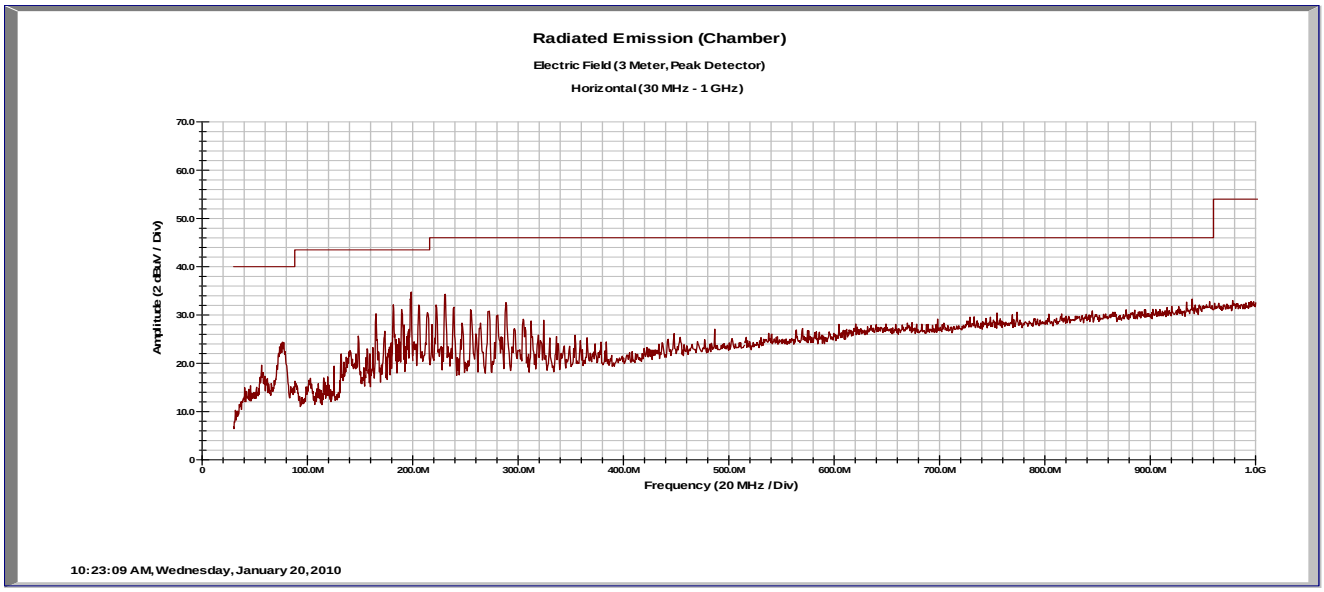
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

6.1.4 Final Test

All final radiated emissions measurements were below (in compliance) the limits.

6.1.5 Final Graphs and Tabulated Data

Radiated Emissions – External Antenna
Horizontal

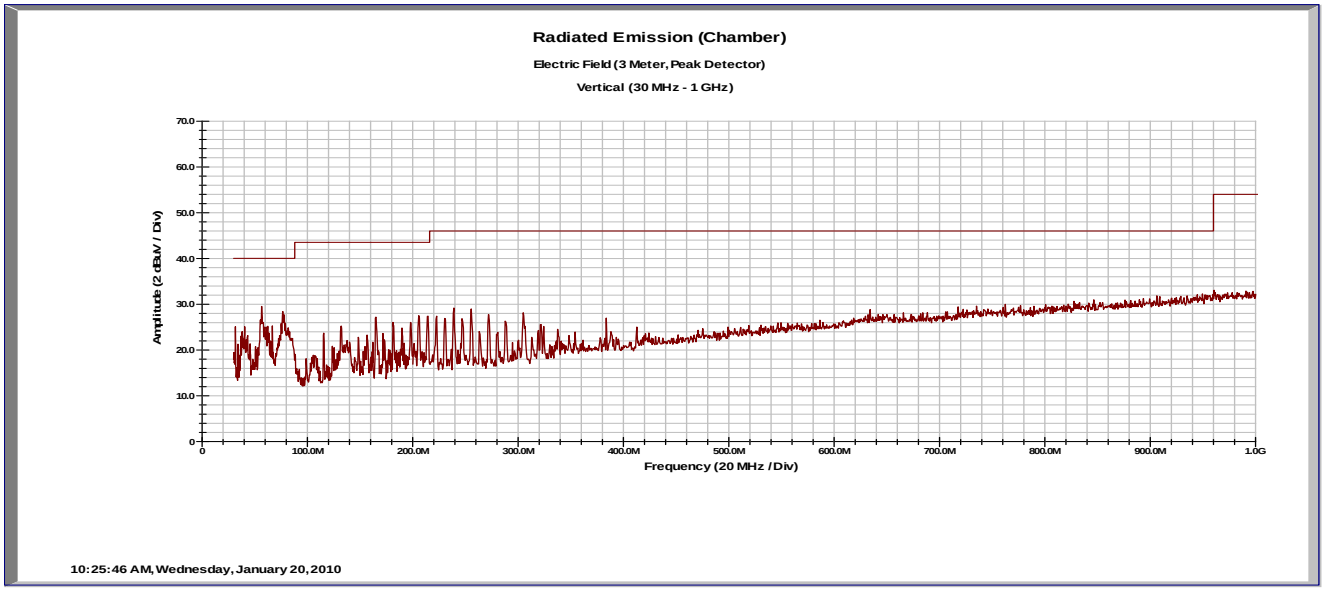


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
77.70	H	1.5	46	15.01	0.00	0.94	7.66	23.61	40.00	-16.39
198.60	H	1.2	320	19.04	0.00	1.51	10.26	30.81	40.00	-9.19
230.00	H	1	289	17.83	0.00	1.63	10.70	30.16	40.00	-9.84
288.37	H	1	0	16.53	0.00	1.84	12.93	31.30	47.00	-15.70

Notes:

Radiated Emissions – External Antenna

Vertical

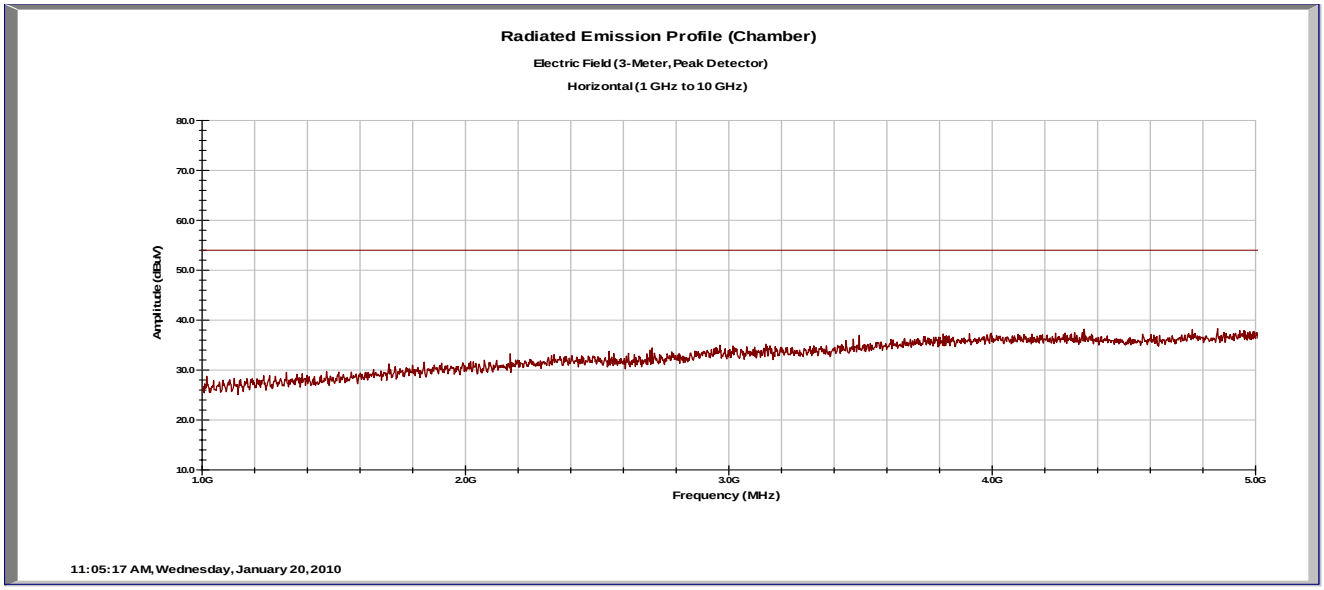


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
31.88	V	1	345	17.08	0.00	0.60	5.30	22.98	40.00	-17.02
56.50	V	1	28	14.09	0.00	0.80	9.41	24.30	40.00	-15.70
76.56	V	1	233	15.63	0.00	0.93	6.64	23.20	40.00	-16.80
164.90	V	1	154	16.35	0.00	1.38	8.69	26.42	43.50	-17.08
239.10	V	1	256	13.24	0.00	1.67	12.24	27.14	46.00	-18.86
383.70	V	1	0	0.02	0.00	2.11	14.87	17.01	46.00	-28.99

Notes: All emissions were below the noise floor of the receiver, or more than 20 dB below the limit

Radiated Emissions – External Antenna

Horizontal

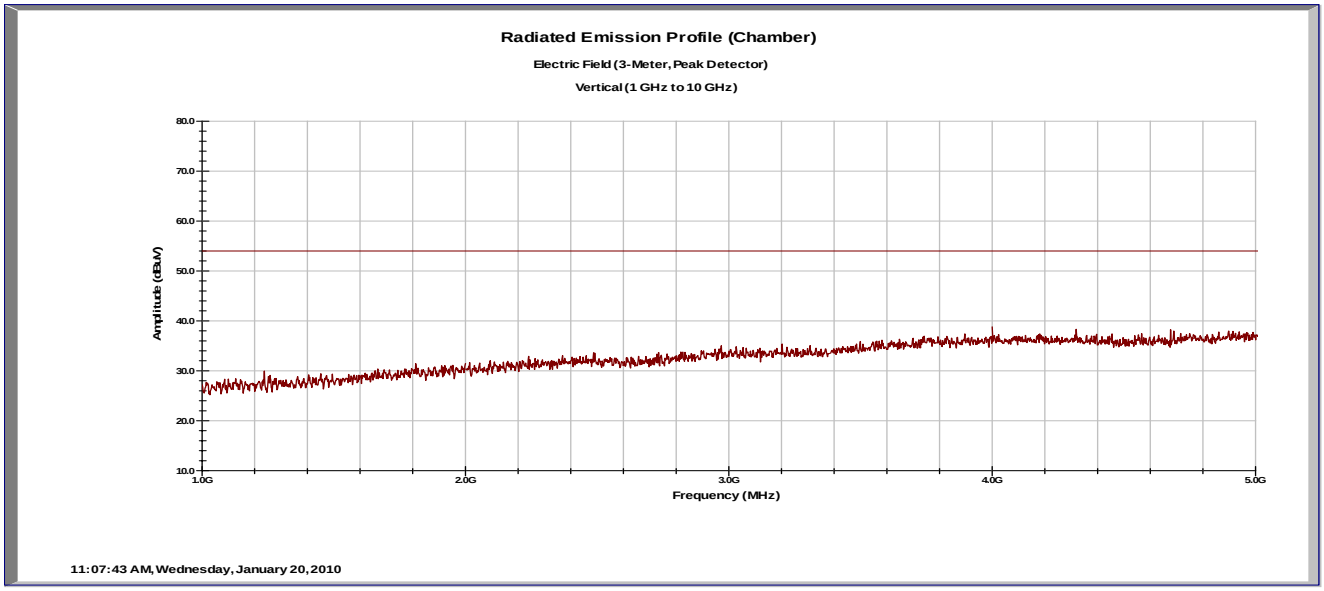


Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Notes: All emissions were below the noise floor of the receiver, or more than 20 dB below the limit

Radiated Emissions – External Antenna

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Notes:

6.2 Conducted Emissions

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other near by electronic equipment.

6.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	22 January 2010	
Standard	FCC Part 15.107(a)						
Product Model	ILC24-I			**Serial#**	1056		
Configuration	See test plan for details						
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	120VAC / 60Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010mbar
Frequency Range	150 kHz to 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Michael Moranha				

6.2.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 150 kHz to 30 MHz was investigated for conducted emissions.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

6.2.3 Deviations

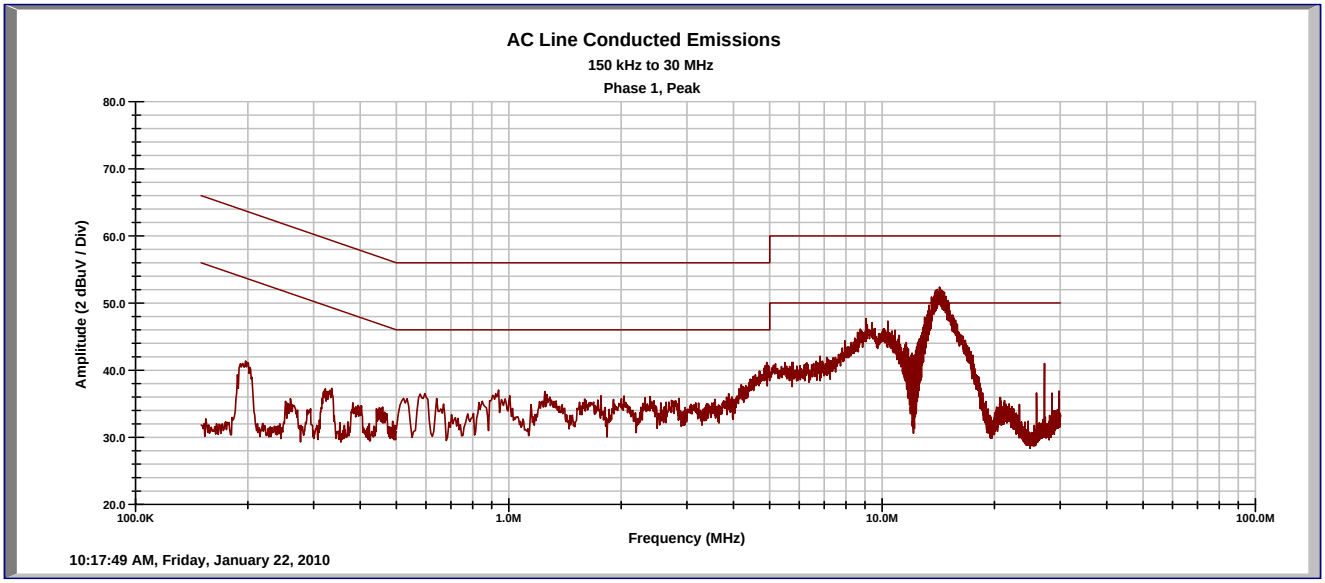
There were no deviations from the test methodology listed in the test plan for the conducted emission test.

6.2.4 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

6.2.5 Final Graphs and Tabulated Data

Conducted Emissions @ 120V/60Hz
Line 1

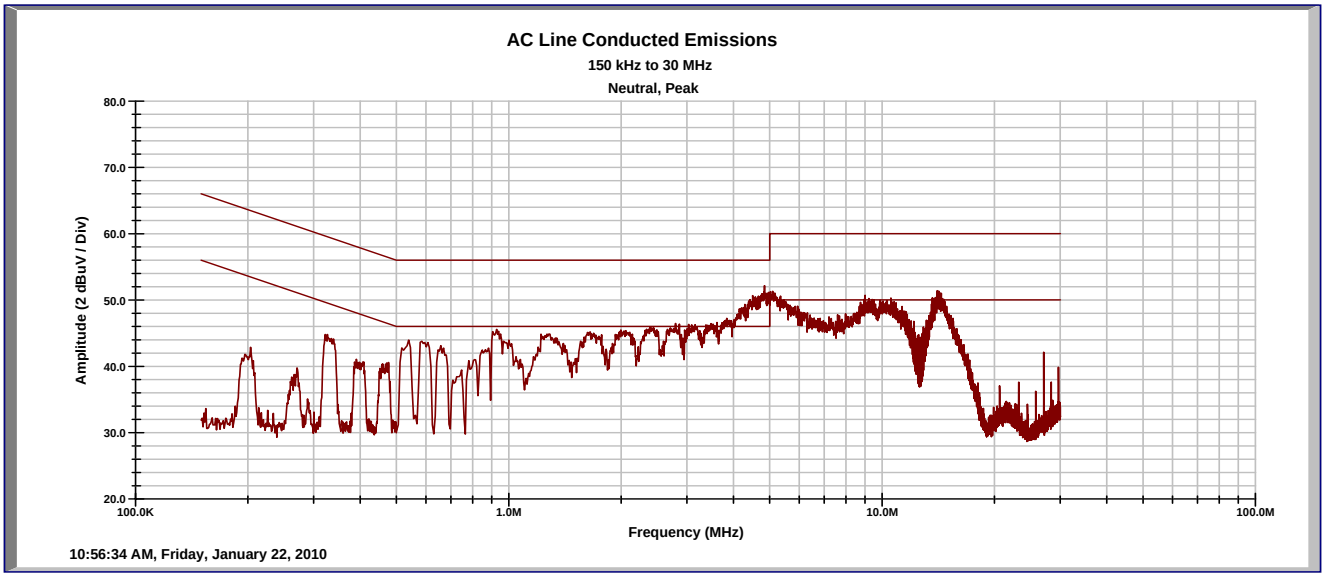


Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.20	1	24.95	14.83	0.03	10.03	63.61	53.61	-28.60	-28.72
0.34	1	22.75	14.88	0.03	9.99	59.20	49.20	-26.43	-24.30
0.94	1	21.67	11.33	0.05	9.91	56.00	46.00	-24.37	-24.71
4.98	1	24.41	14.44	0.15	9.90	56.00	46.00	-21.54	-21.51
9.00	1	33.55	30.26	0.23	9.98	60.00	50.00	-16.24	-9.53
14.22	1	35.01	27.78	0.26	10.08	60.00	50.00	-14.64	-11.87

Notes:

Conducted Emissions @ 120V/60Hz

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi (dBuV)	Ave (dBuV)	Loss (dB)	T Limiter (dB)	Limit (dBuV)	Limit (dBuV)	Margin (dB)	Margin (dB)
0.21	N	29.02	22.30	0.03	0.10	63.21	53.21	-34.06	-30.78
0.58	N	30.98	17.80	0.04	0.17	56.00	46.00	-24.81	-27.99
0.91	N	31.74	15.55	0.05	0.19	56.00	46.00	-24.02	-30.21
4.72	N	36.01	23.89	0.14	0.24	56.00	46.00	-19.61	-21.73
10.30	N	35.63	30.48	0.22	0.20	60.00	50.00	-23.95	-19.10
14.19	N	35.82	29.67	0.26	0.11	60.00	50.00	-23.81	-19.96

Notes: