ENGINEERING TEST REPORT

Universal Programmer
Model No.: UP23

FCC ID: PQG-UP23

Applicant:

Lyngsoe Systems Ltd.
5570 Kennedy Road, Unit B
Mississauga, Ontario
Canada L4Z 2A9

In Accordance With
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.209

UltraTech's File No.: LYI-048F15C209

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: January 12, 2009	
Report Prepared by: Dan Huynh Issued Date: January 12, 2009	Tested by: Hung Trinh, EMC/RFI Technician Test Dates: Nov. 29 & Dec. 2, , 2008

- *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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ANSI	FC	VCI	Industry Canada	NVLAP	BSMI	Korea MIC-RRL
0685	31040/SIT	C-1376	46390-2049	200093-0	SL2-IN-E-1119R	2005-82 & 83

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C
Title:	Code of Federal Regulations (CFR), Title 47, Telecommunication - Part 15
Purpose of Test:	To gain FCC Equipment Certification for section 15.209.
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, industrial or business environment

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	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 EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Lyngsoe Systems Ltd.
Address:	5570 Kennedy Road, Unit B Mississauga, Ontario Canada L4Z 2A9
Contact Person:	Donald Ferguson Phone #: 905-501-1533 ext 221 Fax #: 905-501-1538 Email Address: dfe@lyngsoesystems.com

MANUFACTURER	
Name:	Lyngsoe Systems Ltd.
Address:	5570 Kennedy Road, Unit B Mississauga, Ontario Canada L4Z 2A9
Contact Person:	Donald Ferguson Phone #: 905-501-1533 ext 221 Fax #: 905-501-1538 Email Address: dfe@lyngsoesystems.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Lyngsoe Systems Ltd.
Product Name:	Universal Programmer
Model Name or Number:	UP23
Serial Number:	Test sample
Type of Equipment:	Low Power Transceiver
Input Power Supply Type:	from PC via USB port
Primary User Functions of EUT:	For programming RFID Letter and Asset Tags developed by Lyngsoe Systems

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	from PC via USB port
RF Output Power Rating:	58.95 dBµV/m peak at 3m distance
Operating Frequency Range:	125 kHz
Duty Cycle:	n/a
20 dB Bandwidth:	6.08 kHz
Modulation Type:	OOK
Oscillator Frequencies:	20 MHz
Antenna Connector Type:	Integral

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	Power/COM (Data)	1	USB B Plug	Shielded

2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Laptop
Brand Name:	Dell
Model Name or Number:	PP01L
Serial Number:	IF917A00
Cable Length & Type:	<3 m
Connected to EUT's Port:	USB

2.6. TEST SETUP BLOCK DIAGRAM

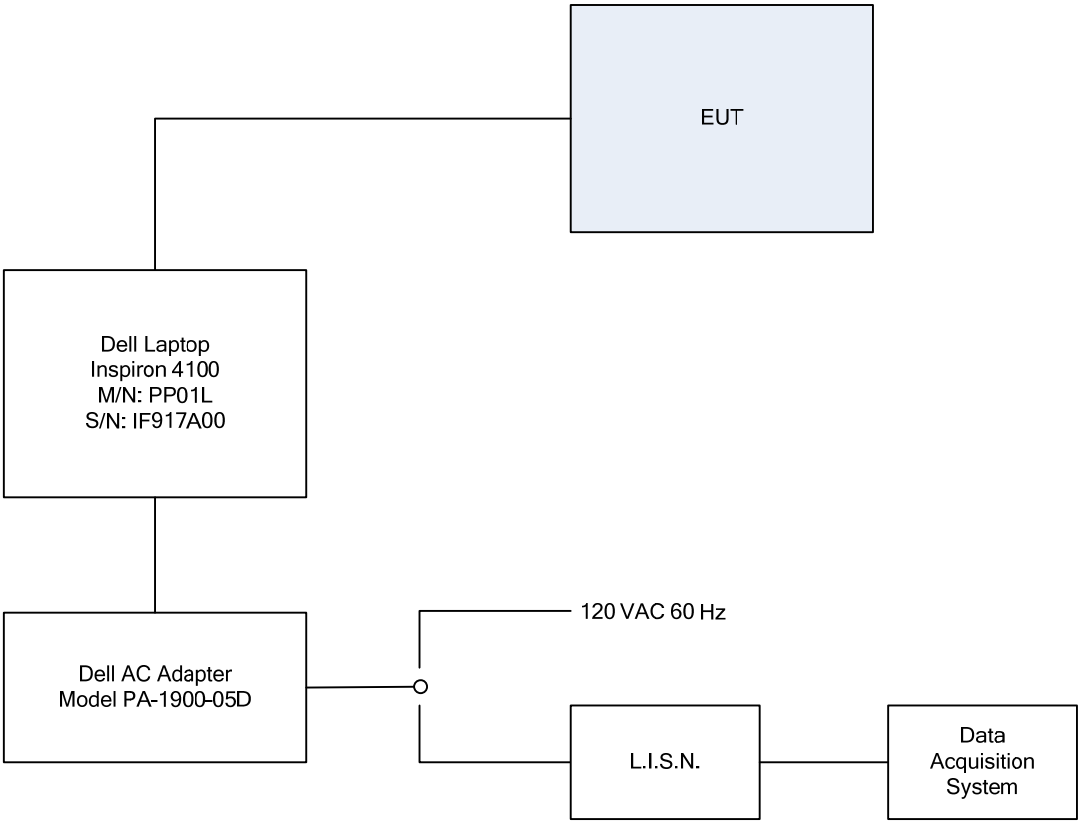


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

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:	from PC via USB Port

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The EUT was configured for continuous transmission for the duration of testing.
Special Test Software:	Tag Communicator Software provided by manufacturer was used to configure the device for testing as applicable.
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals	
Frequency Band(s):	125 kHz
Test Frequency(ies):	125 kHz
RF Power Output:	58.95 dBµV/m peak at 3m distance
Normal Test Modulation:	OOK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- 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 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.: 2049A-3). Expiry Date of Site Calibration: May 17, 2009.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna Requirement	Yes
15.207(a)	AC Powerline Conducted Emissions	Yes
15.209(a)	20 dB Bandwidth	Yes
15.209	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious Emissions	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

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 Ultratech's test procedures 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 7 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. ANTENNA REQUIREMENTS [47 CFR § 15.203]

5.4.1. Requirements

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

N**otes**: This requirement does not apply to carrier current devices operated under the provisions of @ 15.211, 15.213, 15.217, 17.219 or 15.221.

5.4.2. Engineering Analysis

The antenna is an integral part of the EUT; it is soldered onto the radio printed circuit board and located inside the enclosure.

5.5. AC POWERLINE CONDUCTED EMISSION [47 CFR 15.207(a)]

5.5.1. Limit(s)

The equipment shall meet the limits of the following table:

Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..	60 ...……..	50

*Decreases linearly with the logarithm of the frequency

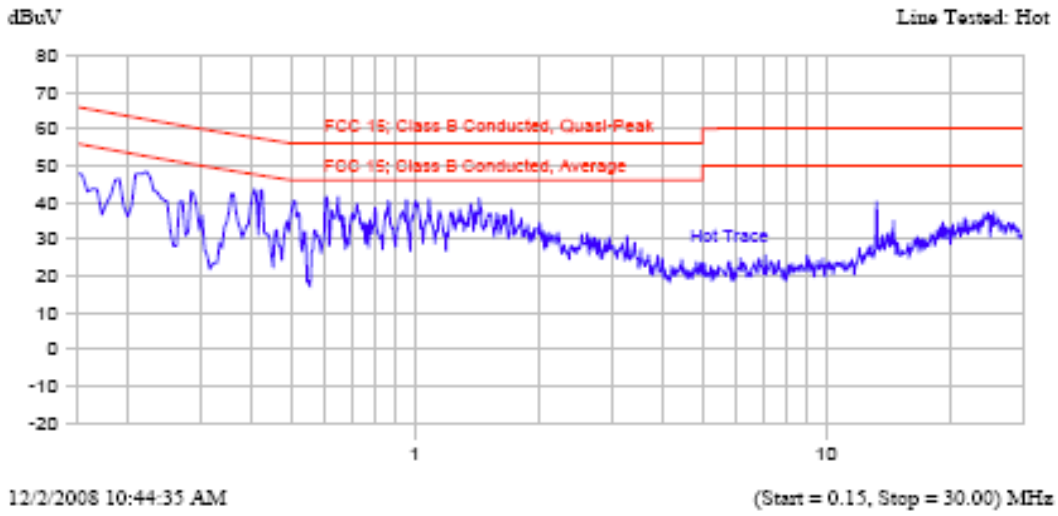
5.5.2. Method of Measurements

Refer to ANSI C63.4.

5.5.3. Test Data

Plot 5.5.3.1
AC Powerline Conducted Emission
Line Voltage: 120VAC 60Hz
Line Tested: Hot

Current Graph

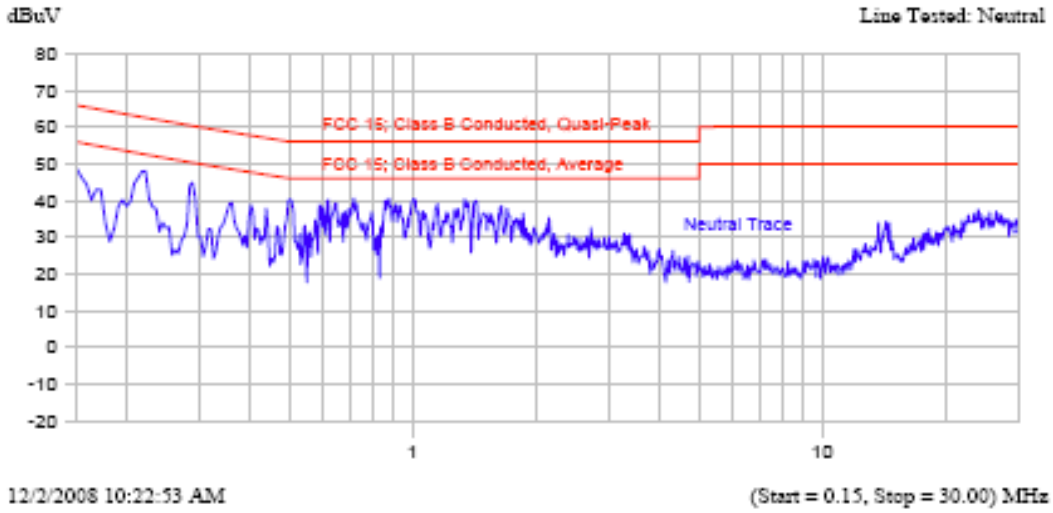


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.195	46.9	43.4	-20.4	30.5	-23.3	Hot Trace
0.219	52.5	49.6	-13.2	46.1	-6.7	Hot Trace
0.285	45.0	42.2	-18.5	34.3	-16.3	Hot Trace
0.406	43.9	41.1	-16.6	24.9	-22.8	Hot Trace
0.600	40.8	38.6	-17.4	24.4	-21.6	Hot Trace
0.644	43.2	38.1	-17.9	32.9	-13.1	Hot Trace
0.865	36.8	36.8	-19.2	33.8	-12.2	Hot Trace
13.247	40.9	37.5	-22.5	17.9	-32.1	Hot Trace

Plot 5.5.3.2
AC Powerline Conducted Emission
Line Voltage: 120VAC 60Hz
Line Tested: Neutral

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.218	52.2	49.0	-13.9	46.4	-6.5	Neutral Trace
0.280	46.4	39.7	-21.1	27.2	-23.6	Neutral Trace
0.495	37.8	37.8	-18.3	17.1	-29.0	Neutral Trace
0.628	40.8	34.2	-21.8	24.1	-21.9	Neutral Trace
0.709	41.7	38.7	-17.3	33.9	-12.1	Neutral Trace
0.874	38.9	31.1	-24.9	23.0	-23.0	Neutral Trace
1.006	41.2	37.1	-18.9	32.8	-13.2	Neutral Trace
1.341	40.3	35.1	-20.9	26.8	-19.2	Neutral Trace

5.6. TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.209 & 15.205]

5.6.1. Limit(s)

(a) The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

47 CFR 15.209(a) General Field Strength Limits

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/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
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.		

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(e) The provisions in Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

5.6.2. Method of Measurements

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

5.6.3. Test Data

Remarks:

- The measuring receiver shall be tuned over the frequency range 9 kHz to 1 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT was initially tested a 10m, signal was not detected at this distance, and test distance was reduced to 3m. The value measured at 3m shall be extrapolated as applicable to compare with limit and measurement distance specified in section 15.209(a).
- Extrapolation factor of 40dB/decade shall be used for frequencies below 30 MHz.

5.6.3.1. Fundamental Emissions

Remarks:

- Field strength limit of the fundamental 125 kHz at 300m distance is 20*log(2400/125) = 25.7 dBµV/m
- For frequency band 0.009- 0.490 MHz, the measured E-Field at 3m (column 2) will be extrapolated to 300m E-Field Level (column 3) using the extrapolation factor of 40*log(3/300) = -80 dB

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Extrapolated E-Field Level @ 300m (dBµV/m)	Antenna Plane (H/V)	§ 15.209 (a) Limits @ 300m (dBµV/m)	Margin (dB)
0.125	55.36	-24.64	V	25.7	-50.34
0.125	58.95	-21.05	H	25.7	-46.75

5.6.3.2. Harmonic/Spurious Emissions

Remarks:

- For frequency band 0.009- 0.490 MHz, the measured E-Field at 3m (column 2) will be extrapolated to 300m E-Field Level (column 3) using the extrapolation factor of 40*log(3/300) = -80 dB
- For frequency bands 0.490-1.705 MHz and 1.705-30.0 MHz, the measured E-Field at 3m (column 2) will be extrapolated to 30m E-Field Level (column 3) using the extrapolation factor of 40*log(3/30) = -40 dB

Frequency (MHz)	Peak E-Field @ 3m (dBµV/m)	Extrapolated E-Field Level (dBµV/m)	Antenna Plane (H/V)	§ 15.209 (a) Limits (dBµV/m)	Margin (dB)
0.009 - 0.490	*	*	H / V	25.7	*
0.490 - 1.705	*	*	H / V	45.7	*
1.705 - 30.0	*	*	H / V	29.5	*
30 - 88	*	*	H / V	40.0	*
88 - 216	*	*	H / V	43.5	*
216 - 960	*	*	H / V	46.0	*
960 - 1000	*	*	H / V	54.0	*

* No emission found.

5.7. 20 dB BANDWIDTH [47 CFR 15.209 (a)]

5.7.1. Limit(s)

Emission bandwidth shall not be located in the restricted bands in 15.205 and the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

5.7.2. Method of Measurements

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4:2003.

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna. The bandwidth of the fundamental frequency was measured with the spectrum analyzer, with the resolution BW set to 1% to 3 % of the approximate emission width and video BW set to 3 times the resolution BW.

5.7.3. Test Data

Channel Frequency (MHz)	20 dB Bandwidth (kHz)
125 kHz	6.08

See the following plot for details.

Plot 5.7.3.1: 20 dB Bandwidth
Fc: 125 kHz

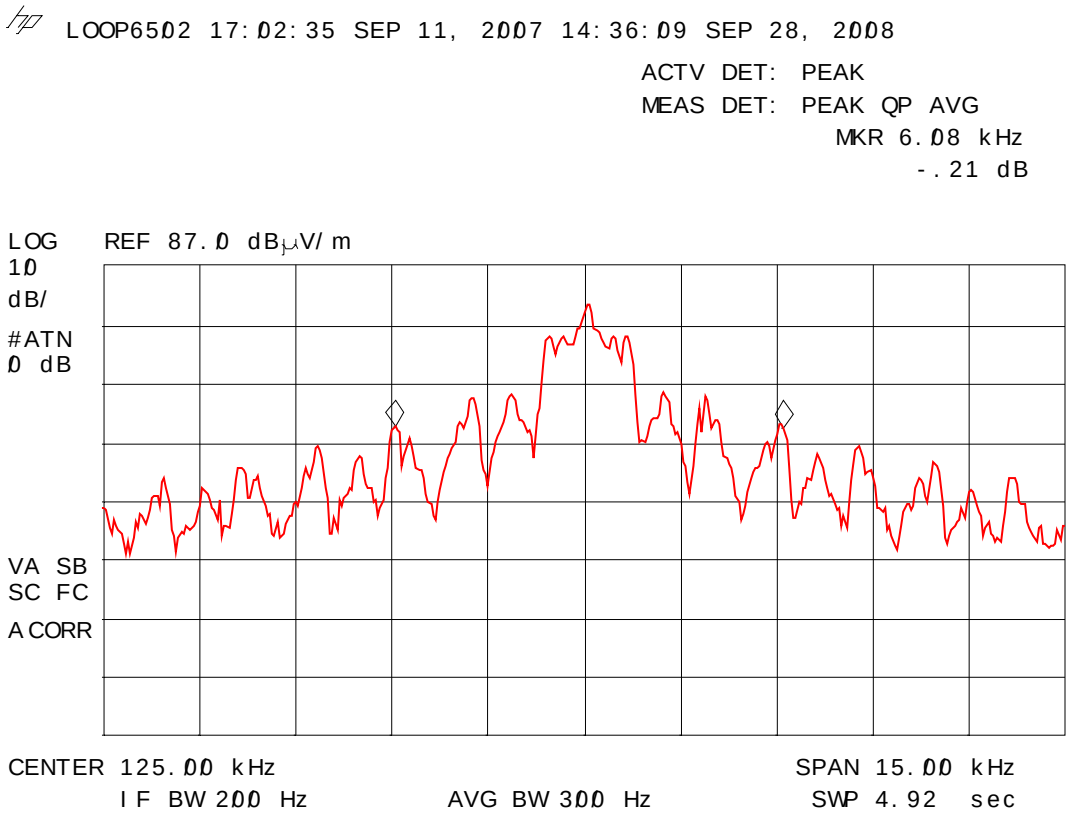


EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Operating Range
EMI-Test Receiver	Rohde & Schwarz	ESU40	100037	20 Hz- 40 GHz Build in amplifier
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz- 40 GHz
Spectrum Analyzer	HP	8593EM	3412A00103	9 kHz – 26.5 GHz
Biconilog Anenna	Emco	3142C	26873	26 – 3000 MHz
Biconilog Anenna	Emco	3142B	1575	26 – 2000 MHz
Horn Antenna	Emco	3115	6570	1 – 18 GHz
Horn Antenna	Emco	3115	5955	1 – 18 GHz
Loop Antenna	Emco	6502	2611	10 kHz – 30 MHz
RF Amplifier	Com-Power	PA-103A	161243	10 MHz – 1000 MHz
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz
High Pass Filter	Mini Circuit	SHP-800	10425	Cut off 433.92 MHz
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
RF Shielded Chamber	Braden Shielding	…	…	…

EXHIBIT 7. MEASUREMENT UNCERTAINTY

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

7.1. 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 Γ_1 = 0.03 LISN VRC Γ_R = 0.8(9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	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

7.2. 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 Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	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