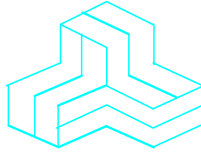


ENGINEERING TEST REPORT



Harmony 891
MODEL NO.: C-RE4A

FCC ID: TOB-ZM3102E

Applicant:

Logitech Inc. - Canada
2355 Skymark Avenue, Suite 100
Mississauga, ON
Canada L4W 4Y6

Tested in Accordance With

FCC Part 15, Subpart C, Section 15.249
Low Power Transmitters
Operating in the Frequency Band 902 - 928 MHz

UltraTech's File No.: LOG-108AF15C249

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: May 27, 2008



Report Prepared by: Dan Huynh

Tested by: Mr. Hung Trinh, EMC/RFI Technician

Issued Date: May 27, 2008

Test Dates: March 23 & May 20, 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.*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com



0685



31040/SIT



C-1376



Approved Test Facility
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, Section 15.249
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Low Power Licensed-Exempt Transmitters operating in the Frequency Band 902 - 928 MHz.
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:	Residential

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

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2007	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	2006 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:	Logitech Inc.
Address:	2355 Skymark Avenue, Suite 100 Mississauga, ON Canada L4W 4Y6
Contact Person:	Mr. Balasundaram Elamaran Phone #: 905-366-6390 Fax #: 905-273-9789 Email Address: bala_elamaran@logitech.com

MANUFACTURER	
Name:	Logitech Technology (Suzhou) Co. Ltd
Address:	No. 3 Song Shan Road, New District Suzhou City, China
Contact Person:	Mr. Winter Fang Phone #: 886-3-612-2031 Fax #: N/A Email Address: winter_fang@logitech.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:	Logitech Inc. - Canada
Product Name:	Harmony 891
Model Name or Number:	C-RE4A
Serial Number:	Test Sample
Type of Equipment:	Low Power Transceiver
Input Power Supply Type:	+ 8V DC from AC Adapter
Primary User Functions of EUT:	RF wireless extender for audio or video equipment.

2.3. EUT’S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Mobile
Intended Operating Environment:	[x] Commercial, industrial or business environment [x] Residential environment
Power Supply Requirement:	8 V DC
RF Output Power Rating:	86.15 dBµV/m Peak at 3m distance
Operating Frequency Range:	908.42 MHz
RF Output Impedance:	50 Ohms
20 dB Bandwidth:	70.94 kHz
Modulation Type:	FSK
Emission Designation:	F1D
Oscillator Frequencies:	32 MHz
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Goodboard Electronic(SuZhou)co., LTD Type: PCB Trace Antenna Model: N/A Frequency Range: 903.42 – 913.42 MHz In/Out Impedance: 50 Ohms Gain: 4dBi

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	USB	1	USB mini B 5 pin	Shielded
2	1/8” Mini Jack	4	Plug-in Jack	Non-shielded
3	DC Input	1	Plug-in Jack	Non-shielded

2.5. ANCILLARY EQUIPMENT

Ancillary Equipment # 1	
Description:	PC
Brand name:	HP
Model Name or Number:	HP Workstation XW
Serial Number:	2UA63108C5
Cable Length & Type:	≥ 3 m, Shielded
Connected to EUT’s Port:	USB

Ancillary Equipment # 2	
Description:	Headset
Brand name:	Generic
Model Name or Number:	N/A
Serial Number:	N/A
Cable Length & Type:	≤ 3 m, Non-shielded

Ancillary Equipment # 3	
Description:	Keyboard
Brand name:	Chicony Electronics Co. Ltd.
Model Name or Number:	KB-9885
Serial Number:	0209209959B
Cable Length & Type:	≤ 3 m, Shielded

Ancillary Equipment # 4	
Description:	Mouse
Brand name:	Microsoft
Model Name or Number:	X8000472-105
Serial Number:	55250 576-2785562-0
Cable Length & Type:	≤ 3 m, Shielded

Ancillary Equipment # 5	
Description:	Microphones
Brand name:	Generic
Model Name or Number:	N/A
Serial Number:	N/A
Cable Length & Type:	≤ 3 m, Non-shielded

Ancillary Equipment # 6	
Description:	Monitor
Brand name:	IBM
Model Name or Number:	6547-CAN
Serial Number:	23-cc293
Cable Length & Type:	≤ 3 m, Shielded

Ancillary Equipment # 7	
Description:	Harmony 890 Remote Control
Brand name:	Logitech
Model Name or Number:	R-RG7
Serial Number:	N/A
Cable Length & Type:	N/A

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:	+ 8V DC from AC adapter

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	EUT was configured to transmit continuously for emissions measurements.
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals:	
Frequency Band(s):	908.42 MHz
Test Frequency(ies):	908.42 MHz
Transmitter Wanted Output Test Signals:	
<ul style="list-style-type: none"> • RF Power Output (measured maximum output power): • Normal Test Modulation: • Modulating signal source: 	<p>86.15 dBμV/m Peak at 3m distance</p> <p>FSK</p> <p>Internal</p>

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 Site No.: 2049A-3, Expiry Date: May 17, 2009).

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.107(a) & 15.207	Power Line Conducted Emissions	Yes
--	20 dB Bandwidth	Yes
15.249(a), 15.209, 15.205	Transmitter Radiated Emissions, Harmonic 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 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 6 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. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

RF wireless extender for audio or video equipment.

5.5. POWER LINE CONDUCTED EMISSIONS [47 CFR15.107(a) & 15.207]

5.5.1. Limits

The equipment shall meet the limits of the following table:

Test Frequency Range (MHz)	Class B Limits		Measuring Bandwidth
	Quasi-Peak (dBµV)	Average (dBµV)	
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.

5.5.2. Method of Measurements

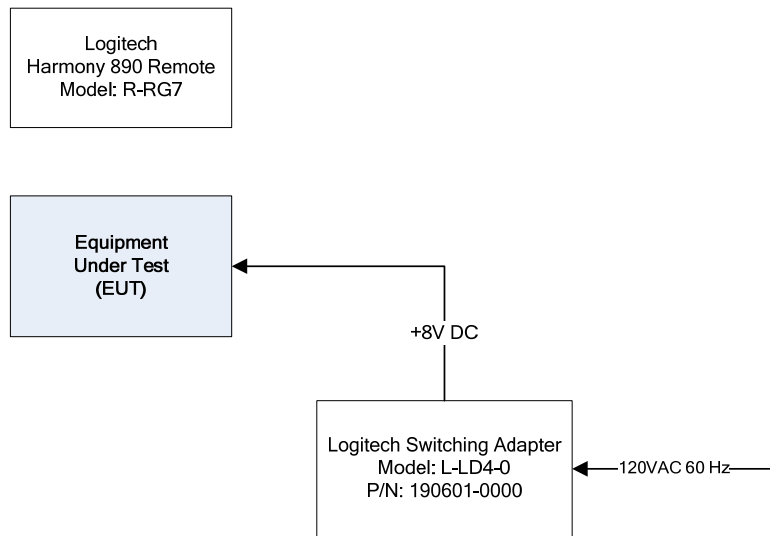
Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

5.5.3. Test Equipment List

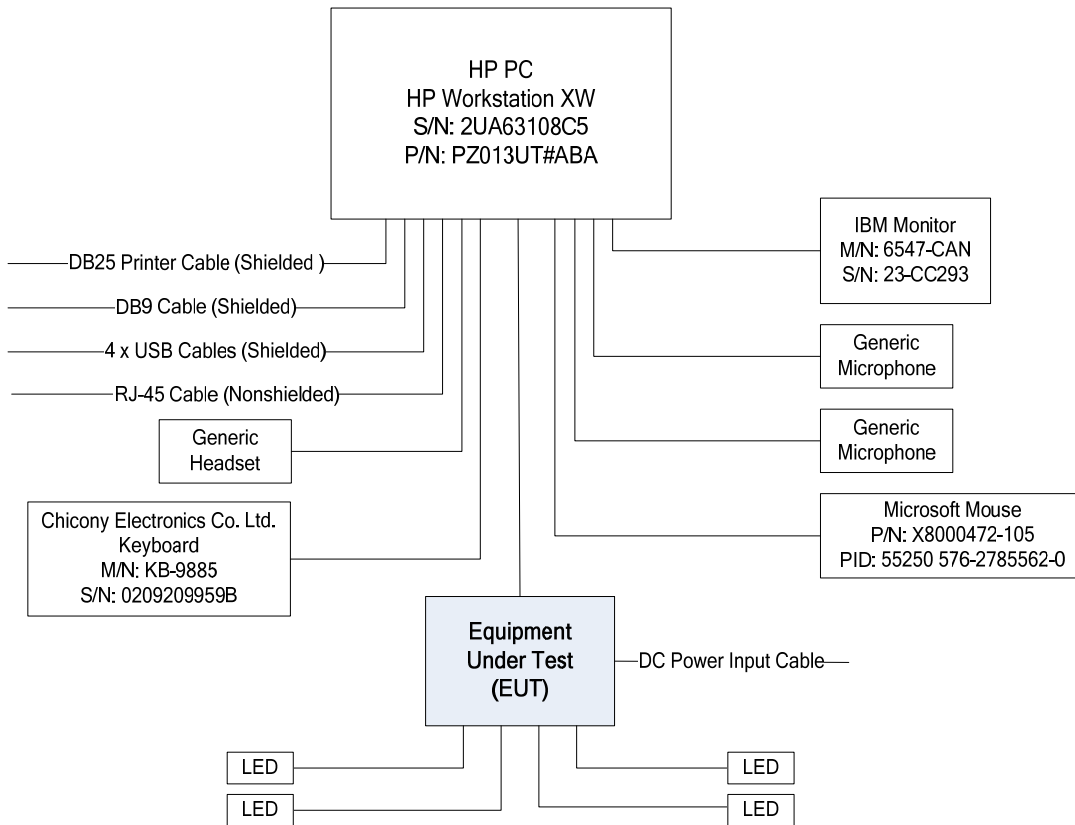
Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 µH
24'x16'x8' RF Shielded Chamber	RF Shielding	--	--	--

5.5.4. Test Arrangement

Test Configuration 1: EUT plugged to outlet with Harmony 890 remote



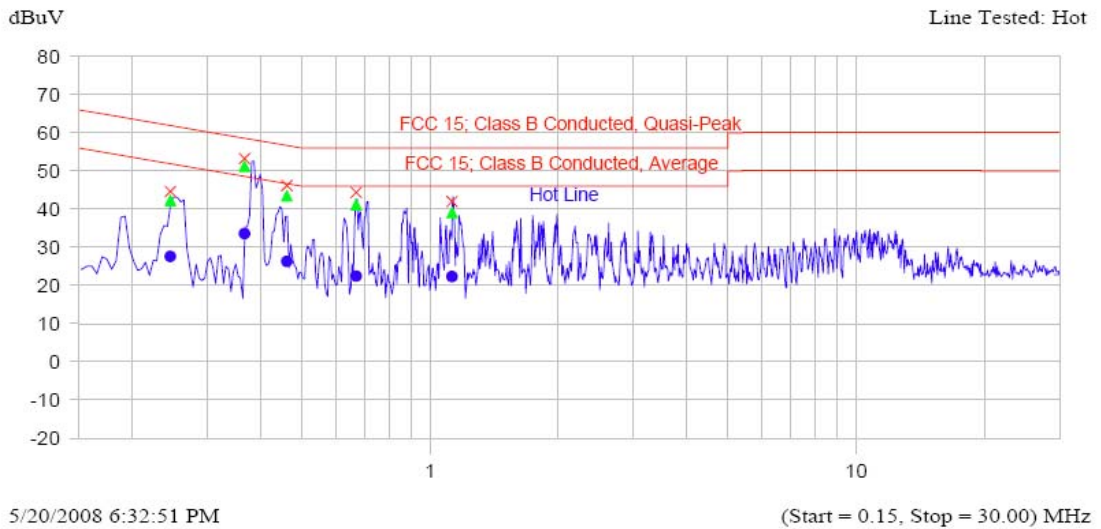
Test Configuration 2: EUT connected to PC; no power connection



5.5.5. Test Data

Plot 5.5.5.1 Power Line Conducted Emissions
 Test Configuration 1: EUT plugged to outlet with Harmony 890 remote
 Line Voltage: 120 VAC 60 Hz
 Line Tested: Hot

Current Graph

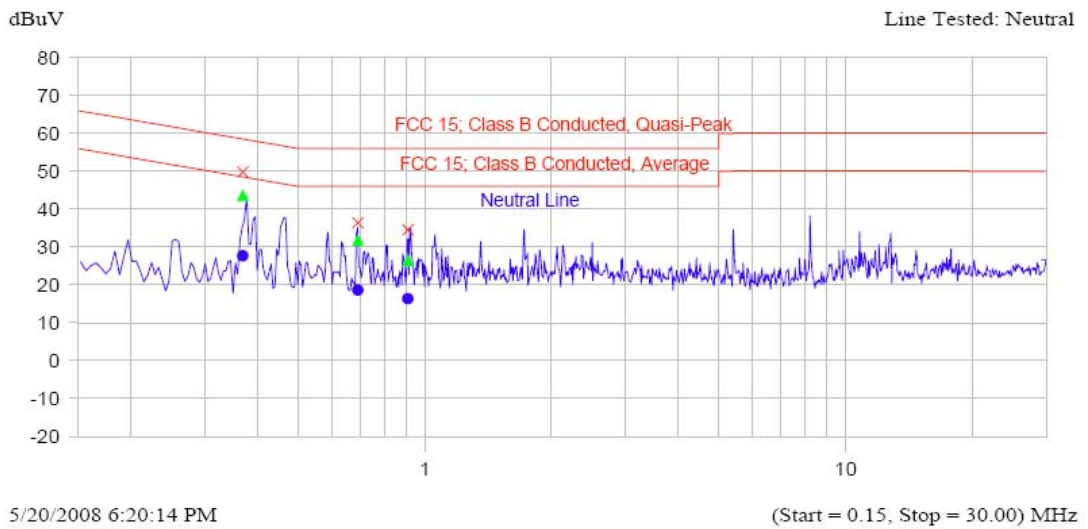


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.246	44.6	42.3	-20.9	27.6	-25.6	Hot Line
0.367	53.3	51.2	-8.5	33.6	-16.2	Hot Line
0.461	46.2	43.5	-13.6	26.3	-20.8	Hot Line
0.671	44.4	41.2	-14.8	22.4	-23.6	Hot Line
1.126	42.0	39.1	-16.9	22.3	-23.7	Hot Line

Plot 5.5.5.2 Power Line Conducted Emissions
 Test Configuration 1: EUT plugged to outlet with Harmony 890 remote
 Line Voltage: 120 VAC 60 Hz
 Line Tested: Neutral

Current Graph

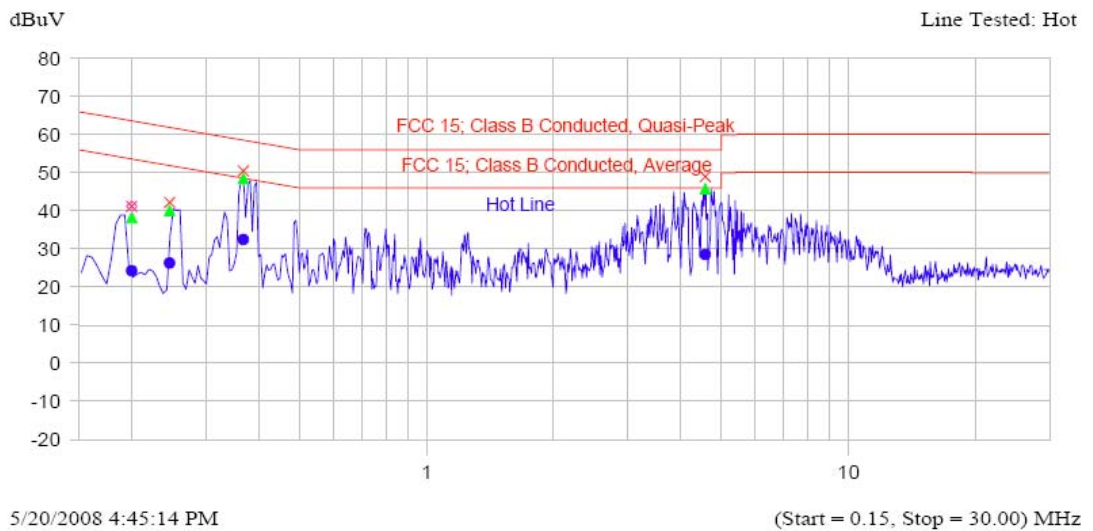


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.369	49.8	43.6	-16.1	27.7	-22.0	Neutral Line
0.693	36.4	31.8	-24.2	18.7	-27.3	Neutral Line
0.911	34.5	26.4	-29.6	16.3	-29.7	Neutral Line

Plot 5.5.5.3 Power Line Conducted Emissions
 Test Configuration 2: EUT connected to PC; no power connection
 Line Voltage: 120 VAC 60 Hz
 Line Tested: Hot

Current Graph

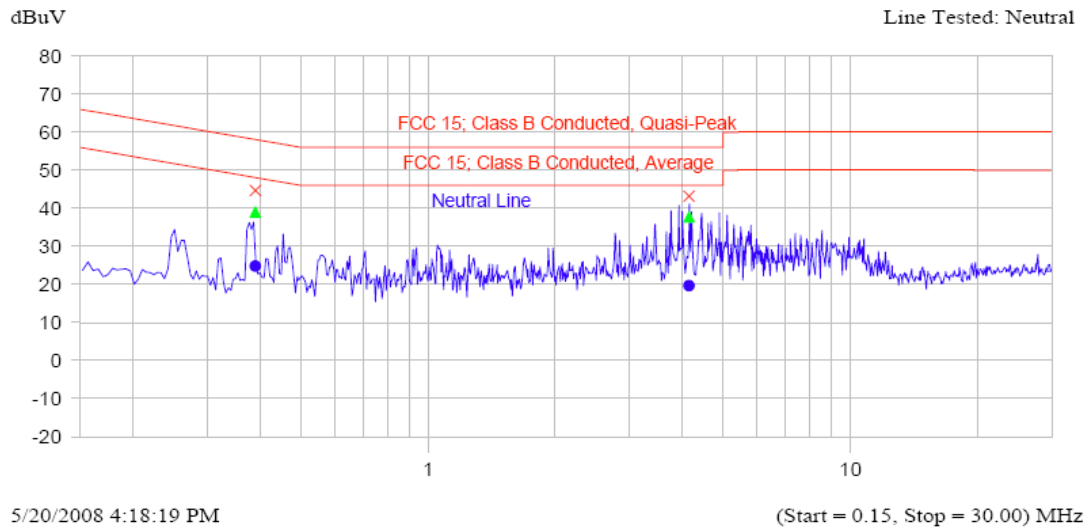


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.200	41.2	38.3	-26.3	24.3	-30.3	Hot Line
0.246	42.2	40.1	-23.1	26.3	-26.9	Hot Line
0.367	50.5	48.5	-11.2	32.4	-17.3	Hot Line
4.581	49.0	45.8	-10.2	28.5	-17.5	Hot Line

Plot 5.5.5.4 Power Line Conducted Emissions
 Test Configuration 2: EUT connected to PC; no power connection
 Line Voltage: 120 VAC 60 Hz
 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
0.390	44.7	39.0	-20.1	24.8	-24.3	Neutral Line
4.148	43.2	37.8	-18.2	19.7	-26.3	Neutral Line

5.6. 20 dB BANDWIDTH

5.6.1. Limits

The fundamental emission must be in the authorized bandwidth.

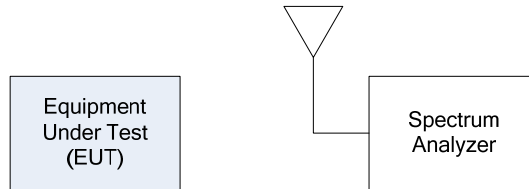
5.6.2. Method of Measurements

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna 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

5.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz
Biconilog antenna	EMCO	3142C	34792	26 - 3000 MHz
RF Amplifier	Hewlett Packard	8447F	2944A04098	0.1 - 1300 MHz
RF Amplifier	Hewlett Packard	8449B	3008A00769	1 – 26.5 GHz

5.6.4. Test Arrangement

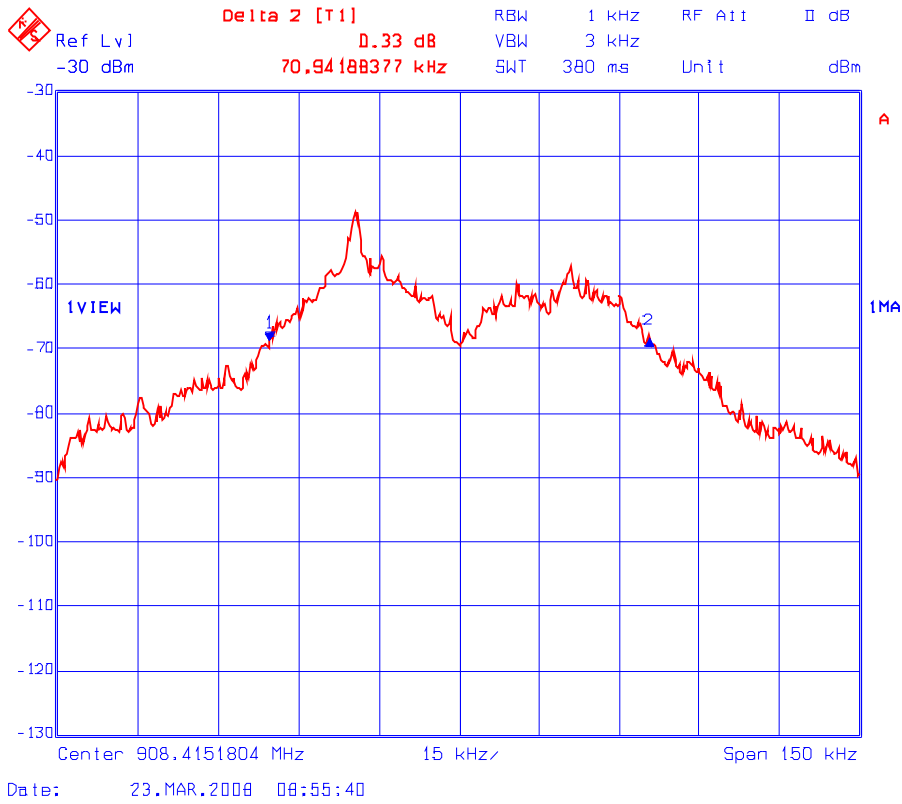


5.6.5. Test Data

Frequency (MHz)	20 dB Bandwidth (kHz)
908.42	70.94

See the following plot for details.

Plot 5.6.5.1 20 dB Bandwidth
Test Frequency: 908.42 MHz



5.7. FUNDAMENTAL FIELD STRENGTH AND HARMONIC EMISSIONS (RADIATED @ 3m) [47 CFR 15.249(a), 15.209 & 15.205]

5.7.1. Limits

(a) The Field Strength of emissions from intentional radiators operated within 902 - 928 MHz band shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m)	Field Strength of Harmonics (µV/m)
902 - 928 MHz	50	500

(c) Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

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

**FCC 47 CFR 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 47 CFR 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

Frequency (MHz)	Field Strength Limits (µV/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

5.7.2. Method of Measurements

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

5.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz - 40 GHz
RF Amplifier	Hewlett Packard	8447F	2944A04098	0.1 - 1300 MHz
RF Amplifier	Hewlett Packard	8449B	3008A00769	1 - 26.5 GHz
Biconilog antenna	EMCO	3142C	34792	26 - 3000 MHz
Horn Antenna	EMCO	3155	6570	1 - 18 GHz

5.7.4. Test Data

The emissions were scanned from 30 MHz to 10 GHz and all significant emissions were recorded.

Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dBµV/m)	Field Strength Limit of § 15.209 (dBµV/m)	Margin (dB)
908.42	82.68	--	V	94.0	--	-11.3
908.42	86.15	--	H	94.0	--	-7.8
1816.84	41.15	30.66	V	54.0	54.0	-23.3
1816.84	40.14	31.31	H	54.0	54.0	-22.7
2725.26	42.63	31.18	V	54.0	54.0	-22.8
2725.26	41.34	30.06	H	54.0	54.0	-23.9
3633.68	43.22	31.73	V	54.0	54.0	-22.2
3633.68	42.49	30.36	H	54.0	54.0	-23.6

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 $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ 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:

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

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

6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (\pm 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:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$