Electrolux Home Products

Application
For Certification
User Interface with Transmitter

FCC ID: ABMELU81A

April 28, 2004

ACCREDITED
CERT NO: 1427.01

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1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the Electrolux Home Products *User Interface with Transmitter* for Certification under FCC Part 15, Subpart C.
There are no other simultaneous applications.
The Receiver portion will be verified under Declaration of Conformity.

1.2 Product Description

User Interface with Transmitter is a RF transmitter operating in 915MHz. The intended use of the *User Interface with Transmitter* is to generate and transmit a RF signal with freezer status data to receiver. *User Interface with Transmitter* powered at 5VDC.

Antenna Description:

Integrated antenna

Sample Submitted: April 8, 2004
Test Work Started: April 8, 2004
Test Work Completed: April 12, 2004

1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2000. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on March 2003 submitted to FCC. Please reference the site registration number: 90706, dated April 18, 2003.

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

N/A

2.2 EUT Setup

For simplicity of testing, the transmitter was wired to transmit continuously and tested with no plastic enclosure. The freezer Electronic Control Unit including the Power Supply (ECU) was assembled on the test fixture to provide data and 5VDC for the *User Interface with Transmitter*.

2.3 EUT Exercising Software

N/A

2.4 Special Accessories

There are no special accessories necessary for compliance of these products.

2.5 Equipment Modification

No modifications were installed during the testing.

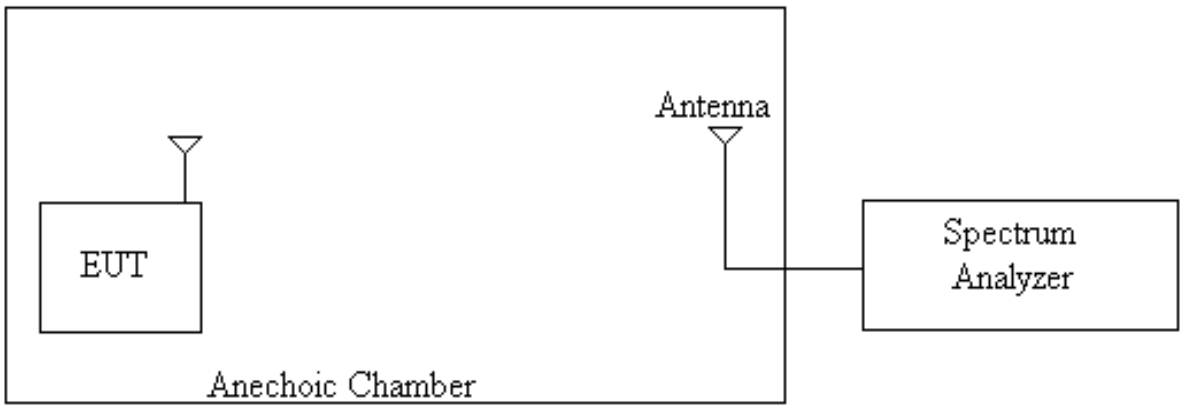
2.6 Support Equipment List and Description

Freezer Electronic Control Unit including the Power Supply (ECU) assembled on the test fixture by Electrolux Home Products.

2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.
The EUT was powered at 5VDC from the Electronic Control Unit Power Supply (ECU).

Field Strength Measurements



3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

47 CFR 15.249(a)(b)	Field Strength of Fundamental
47 CFR 15.249(a)(b), 15.205	Field Strength of Harmonics
47 CFR 15.249(c), 15.209	Out of Band Spurious Emissions
	Bandwidth of Emissions
47 CFR 15.207	Line Conducted Emissions

Note: A Conducted emissions testing was performed for the Electronic Control Unit Power Supply, which provides 5VDC power for the transmitter.

3.1 Field Strength of Fundamental and Harmonics Emissions, FCC 15.249(a)

Field Strength of Fundamental at 914.99MHz.

The EUT complies with the Standard requirements for Fundamental Emissions with minimum margin 1.9dB for Fundamental Emissions.

The Table 3-1-1 shows the Field Strength of Fundamental Radiation.

Note: Correction Factor in the Table includes the Antenna Factor and Cable Loss.

Radiated Emissions of Fundamental **Date:** 04-12-2004

Company: Electrolux Home Products
Model: User Interface with Transmitter
Test Engineer: Norman Shpilsher
Special Info:
Standard: FCC Part 15.249(a)
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a CISPR Quasi-peak detector

Table # 3-1-1

Frequency	Antenna			QP reading	Total QP	QP Limit	Margin	Comments
MHz	Polarity	Hts(cm)	Factor(dB1/m)	dBµV	dBµV/m	dBµV/m	dB	
914.99	V	100	25.1	63.4	88.5	94.0	-5.5	
914.99	H	141	25.1	67.0	92.1	94.0	-1.9	

Comments:

3.2 Field Strength of Harmonics Emissions, FCC 15.249(a), 15.205

Field Strength of Harmonics Emissions measurements were made up to 10th harmonic.

The EUT complies with the Standard requirements for Harmonics Emissions with minimum margin 5.3dB.

The Table 3-2-1 and Graphs 3-2-1 and 3-2-2 show the Field Strength Harmonics Emissions.

Note: Emission level shown on the Graph includes the Antenna Factor, Cable Loss; Pre-amplifier gain also included (for measurements above 1GHz). Total Factor in the Table includes all above factors.

Harmonics and Spurious Radiated Emissions **Date:** 04-12-2004

Company: Electrolux Home Products
Model: User Interface with Transmitter
Test Engineer: Norman Shpilsher
Special Info:
Standard: FCC Part 15.249(a)
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a Peak detector

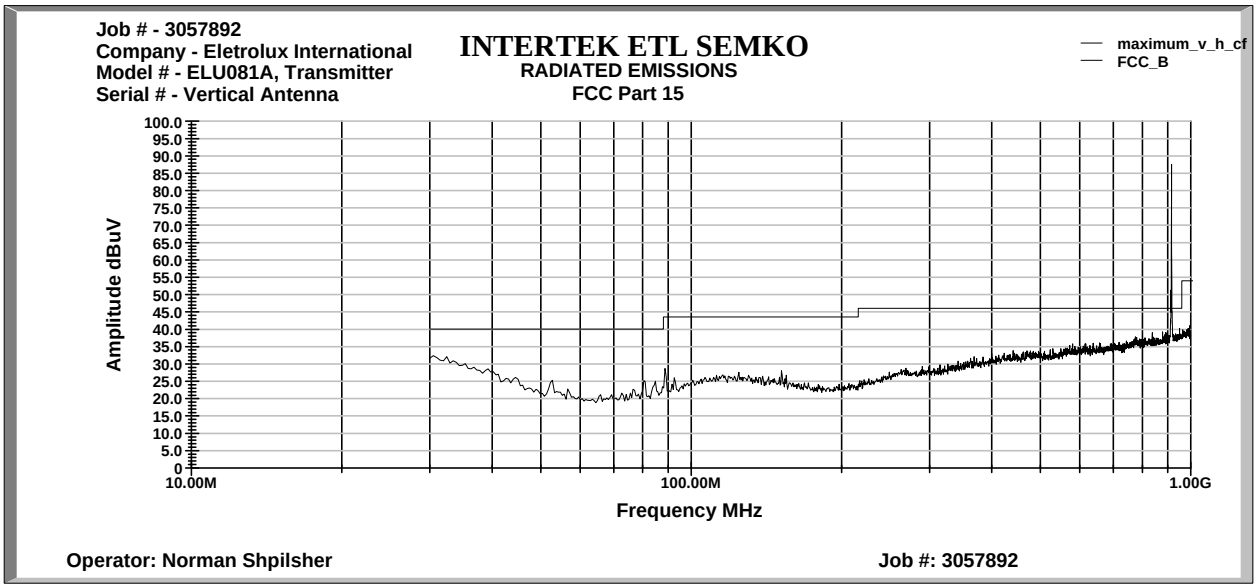
Table # 3-2-1

Frequency	Antenna		Total Factor	Peak reading	Total at 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dBµV	dBµV/m	dBµV/m	dB	
4530.50	V	121	7.8	39.1	46.9	54.0	-7.1	
5272.10	V	115	9.1	39.6	48.7	54.0	-5.3	
2444.90	H	100	-0.3	39.9	39.7	54.0	-14.3	
2.695.3	H	100	0.8	39.2	39.9	54.0	-14.0	
4253.20	H	105	7.2	37.2	44.4	54.0	-9.6	
4636.60	H	117	8.0	36.2	44.2	54.0	-9.8	
5032.90	H	100	8.8	36.4	45.2	54.0	-8.8	
5392.00	H	100	9.3	36.2	45.5	54.0	-8.5	

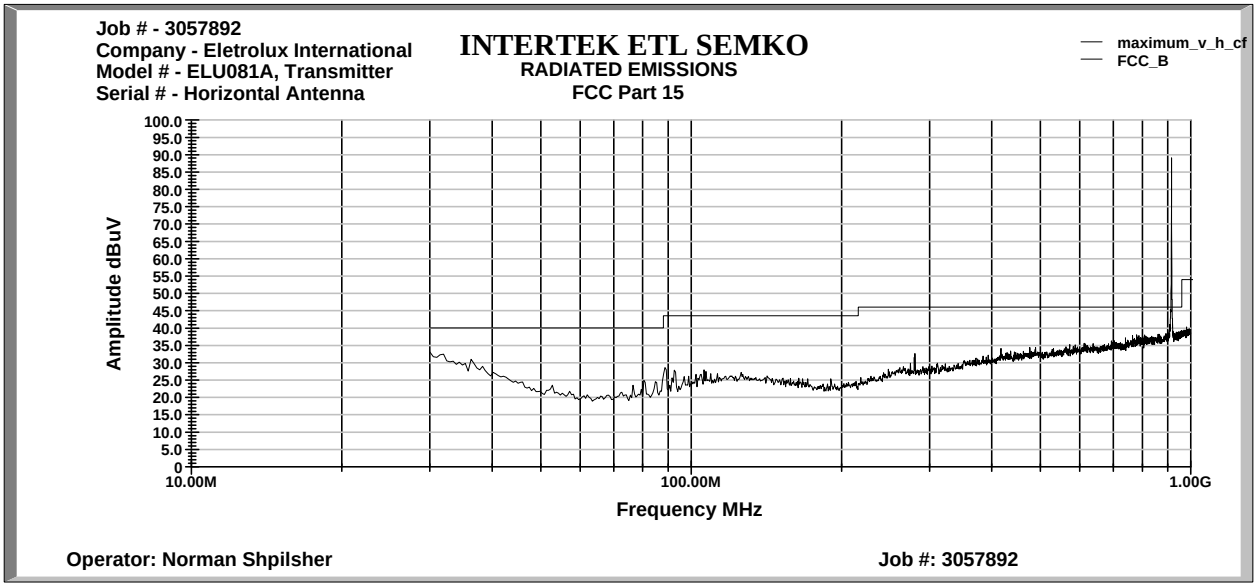
Comments:

Graph # 3-2-1
Harmonics and Spurious Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

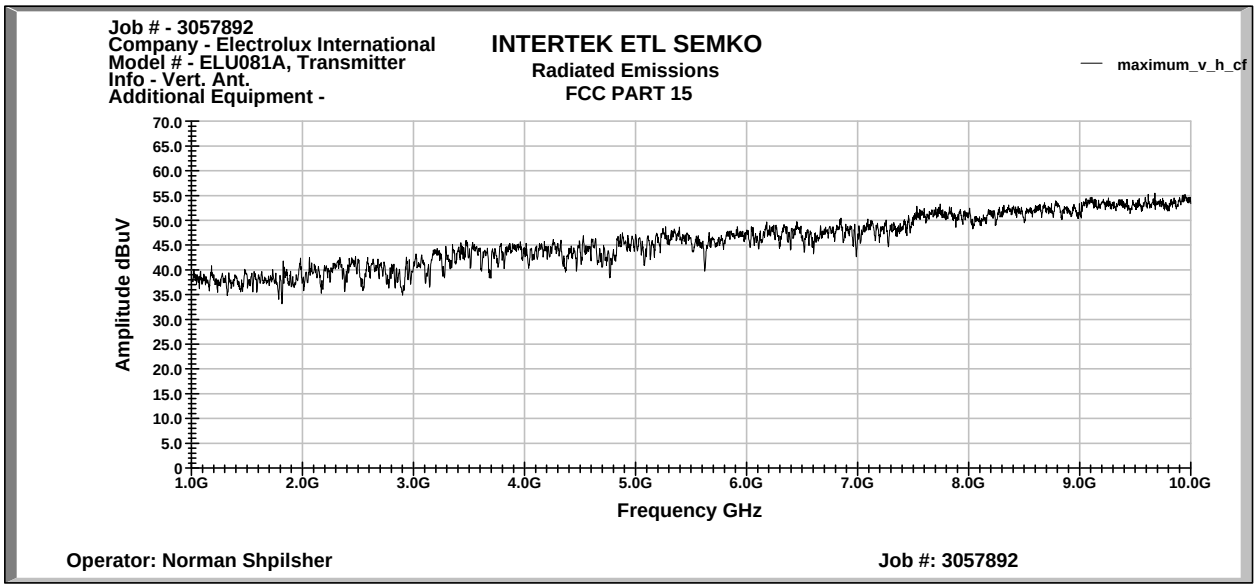


Horizontal Antenna Polarization

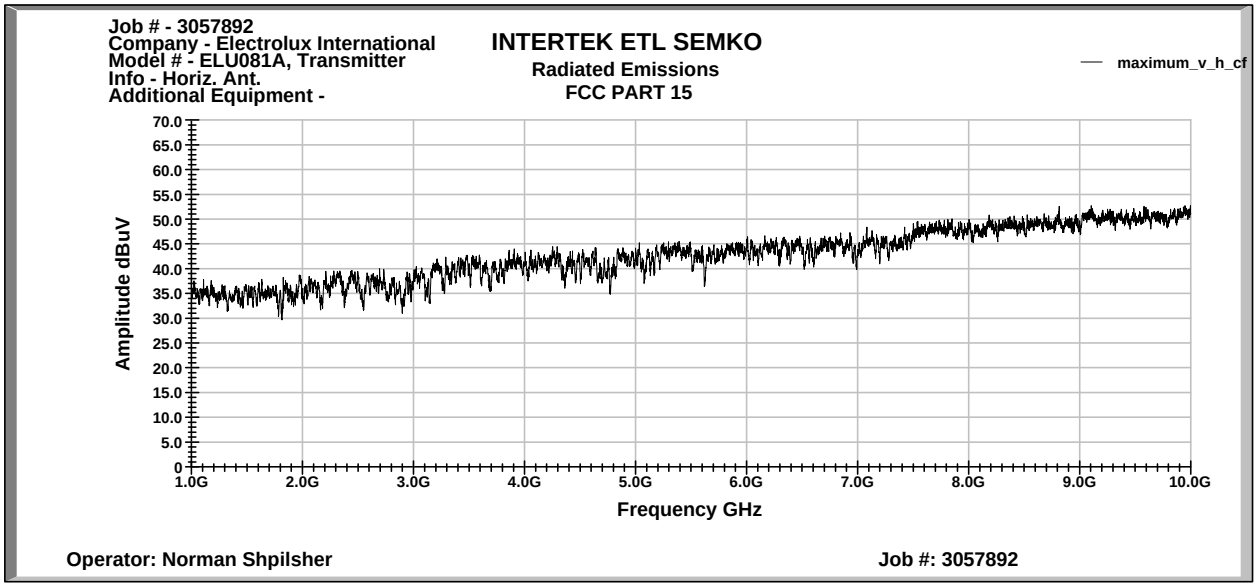


Graph # 3-2-2
Harmonics and Spurious Emissions from 1GHz to 10GHz

Vertical Antenna Polarization



Horizontal Antenna Polarization



3.3 Out of Band Spurious Emissions, FCC 15.249(c), 15.209

Out-of-band measurements were made for frequencies:
902MHz
928MHz.

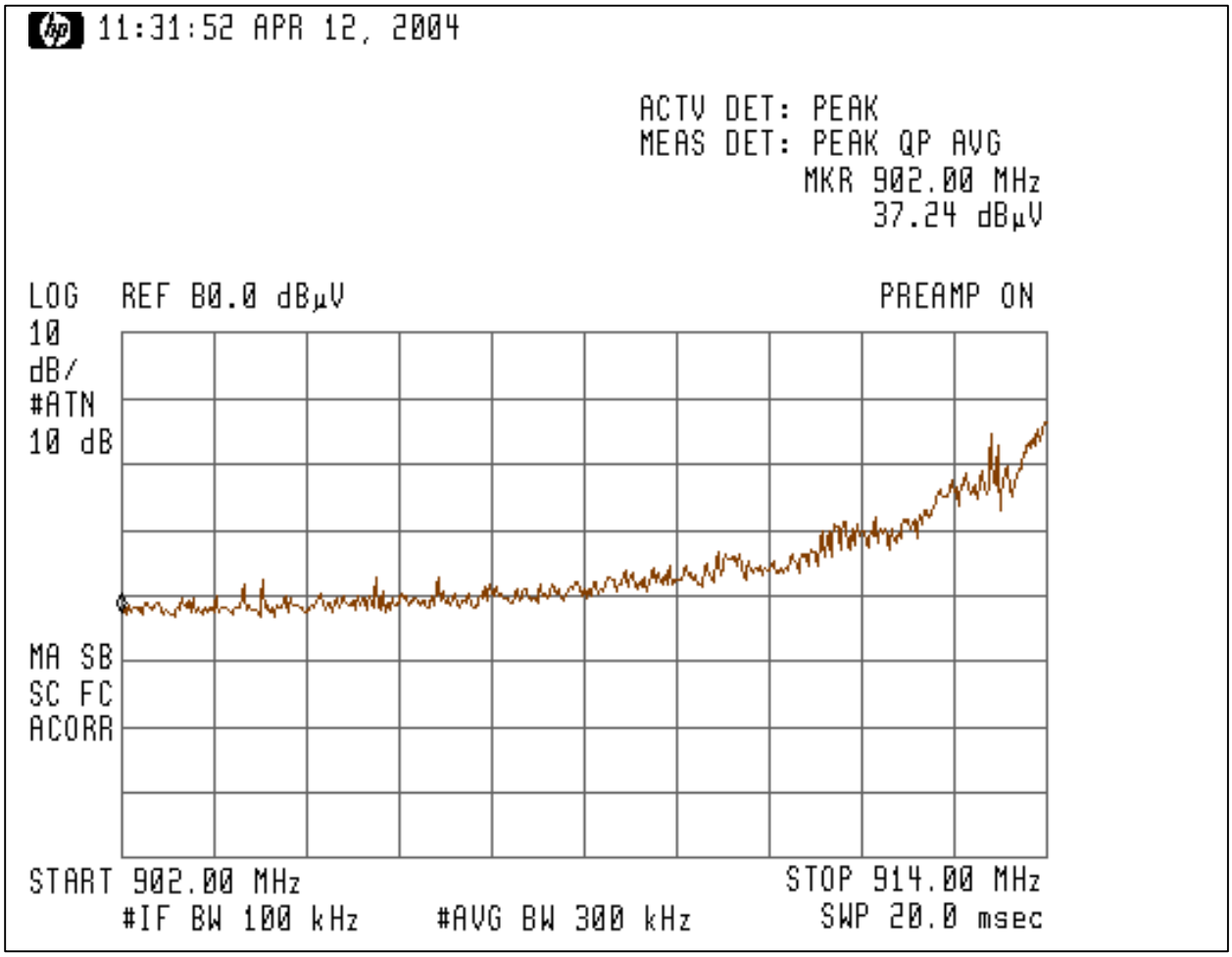
Output frequencies of the EUT was 915MHz

The EUT complies with the Standard requirements Out of Band Spurious Emissions for Section 15.209 as well as for Section 15.249(c).

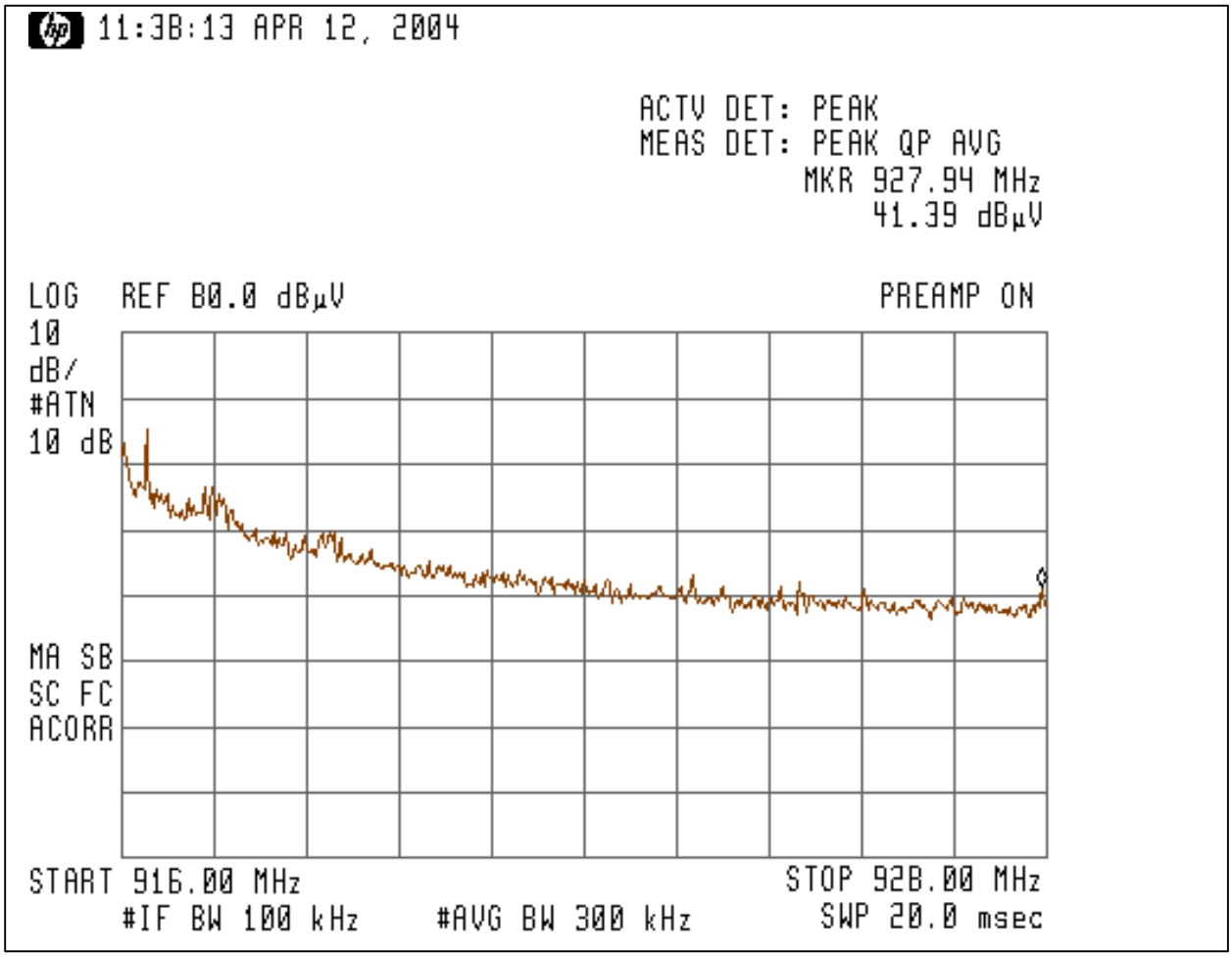
The Graph 3-3-1 shows the Out of Band Spurious Emissions at 902MHz.
The Graph 3-3-2 shows the Out of Band Spurious Emissions at 928MHz.

Note: Emission level shown in the Graphs includes the Antenna Factor and Cable Loss. No Pre-amplifier was used during measurements.

Graph # 3-3-1
Out of Band Emissions at 902MHz



Graph # 3-3-2
Out of Band Emissions at 928MHz



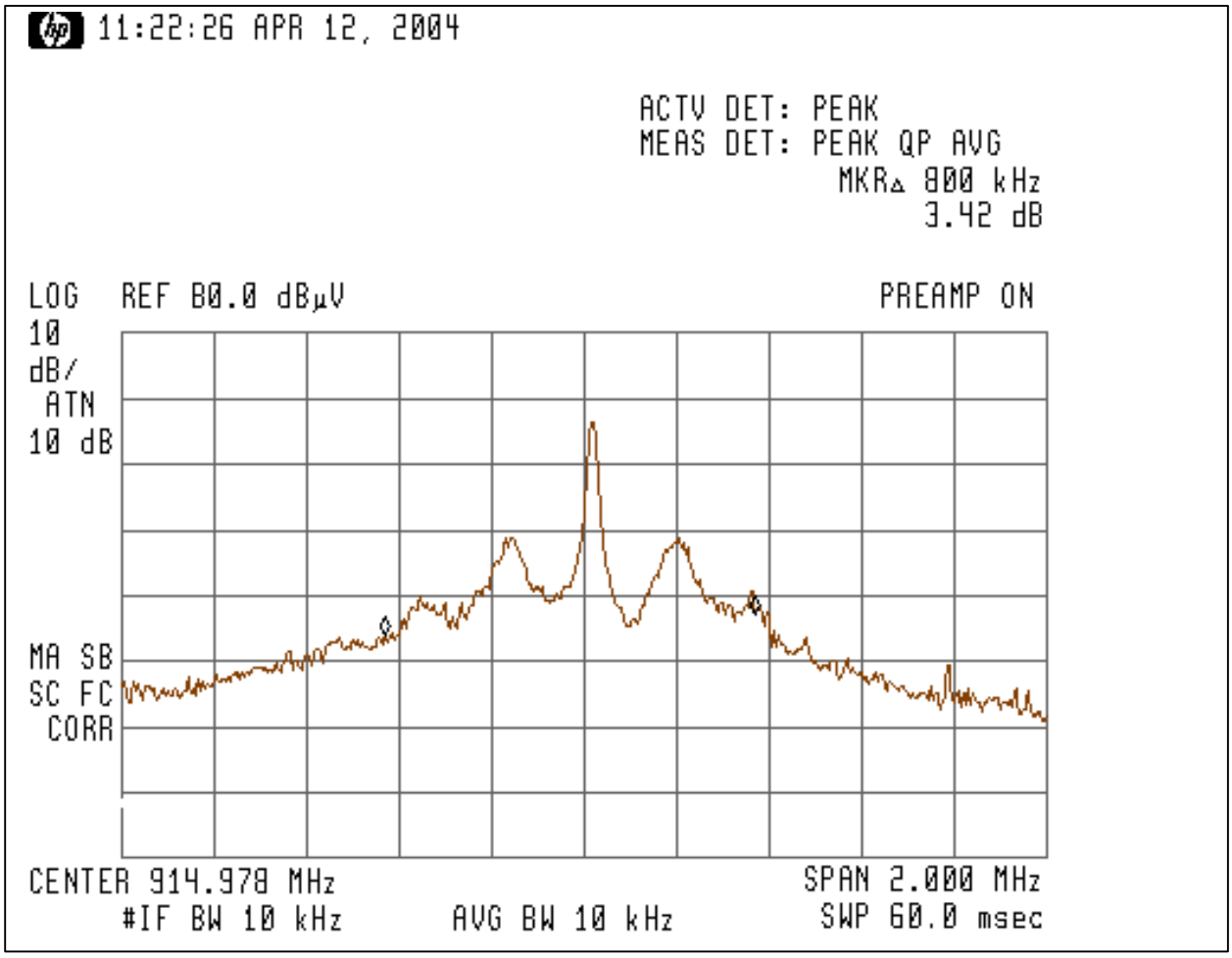
3.4 Bandwidth of Emissions

Bandwidth of Emissions measurements was made for frequency of 915MHz.

Bandwidth of Emissions for Base Unit at 99% power was measured at 800kHz.

The Graphs 3-4-1 below shows the Bandwidth of Emissions.

Graph # 3-4-1



3.5 Line Conducted Emissions, FCC 15.207

Line Conducted Emissions testing was performed in frequency range from 150kHz to 30MHz. The dimmer function of the Repeater was disabled during testing (See Section 2.1)

The Table 3-5-1 and Graph 3-5-1 show the Line Conducted Emissions.

Conducted Emissions **Date:** 4/8/2004

Company: Electrolux Home Products

Model: Freezer Controller and user interface

Test Engineer: Troy Ihle

Standard: FCC Part 15.207

Note: The table shows the worst case conducted emissions

All measurements were taken using a CISPR Quasi-peak detector

Table # 3-5-1

Line 1

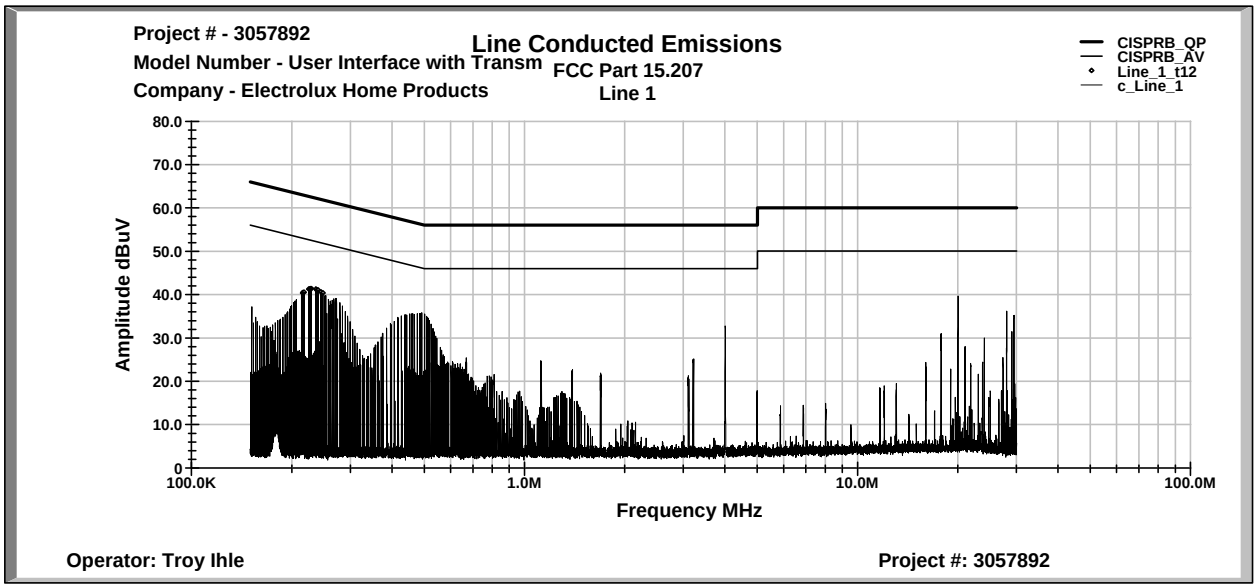
Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
220.98 KHz	33.2	4.5	64.0	54.0	-30.8	-49.5
222.04 KHz	33.4	4.2	63.9	53.9	-30.6	-49.8
224.16 KHz	33.6	4.9	63.9	53.9	-30.3	-49.0
230.22 KHz	33.8	4.6	63.7	53.7	-29.9	-49.1
230.25 KHz	33.7	5.1	63.7	53.7	-30.0	-48.6
230.89 KHz	33.8	4.7	63.7	53.7	-29.9	-49.0
230.95 KHz	33.7	5.0	63.7	53.7	-30.0	-48.7
231.97 KHz	33.7	4.7	63.7	53.7	-30.0	-49.0
233.74 KHz	33.6	5.1	63.6	53.6	-30.0	-48.5
233.89 KHz	33.6	5.5	63.6	53.6	-30.0	-48.2
237.89 KHz	33.6	5.4	63.5	53.5	-29.9	-48.1
241.28 KHz	33.4	5.0	63.4	53.4	-30.0	-48.4

Line 2

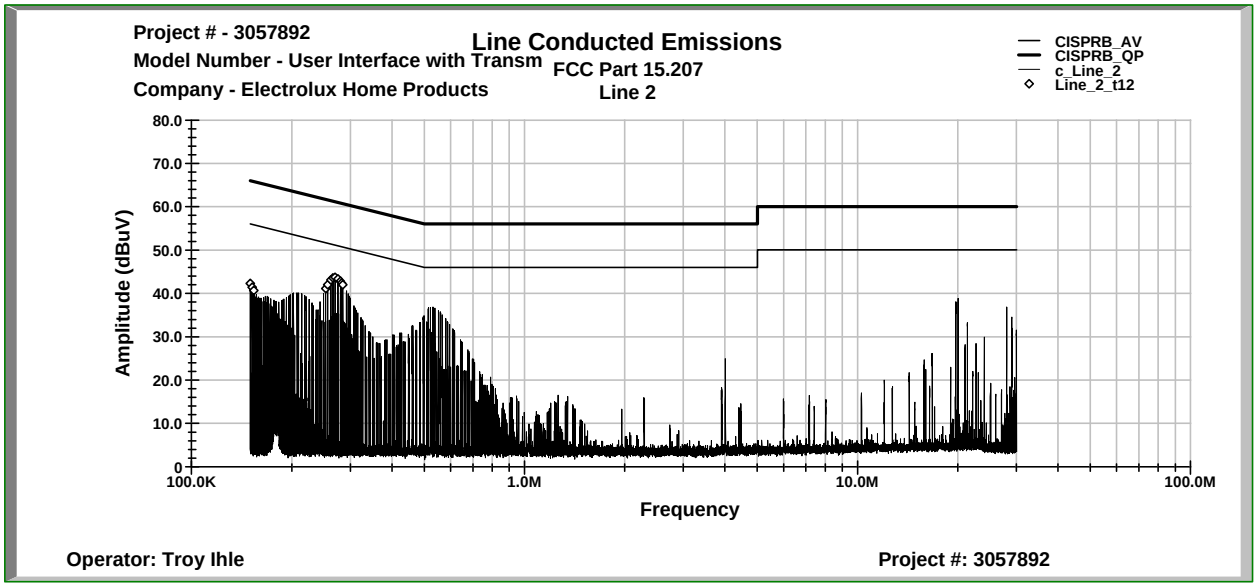
Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
150.0 KHz	36.9	7.1	66.0	56.0	-29.1	-48.9
150.05 KHz	36.9	7.3	66.0	56.0	-29.1	-48.7
150.21 KHz	36.7	6.8	66.0	56.0	-29.3	-49.2
259.52 KHz	34.9	4.6	62.9	52.9	-27.9	-48.3
263.76 KHz	35.7	5.8	62.8	52.8	-27.0	-46.9
269.1 KHz	36.2	5.4	62.6	52.6	-26.4	-47.2
269.6 KHz	36.1	5.3	62.6	52.6	-26.4	-47.3
269.61 KHz	36.2	5.3	62.6	52.6	-26.4	-47.3
270.58 KHz	36.2	5.2	62.6	52.6	-26.4	-47.3
272.46 KHz	36.1	6.0	62.5	52.5	-26.4	-46.6
274.5 KHz	36.0	5.9	62.4	52.4	-26.5	-46.6
276.94 KHz	35.7	5.3	62.4	52.4	-26.7	-47.0

Graph # 3-5-1
Line Conducted Emissions

Line 1



Line 2



3.6 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.7.

Conducted Emissions

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector.

3.7 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

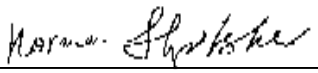
RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Norman Shpilsher
Sr. EMC Engineer
Intertek ETL SEMKO

Signature



Date: April 28, 2004

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers and Test Software

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
HP85462A Receiver RF Section	3325A00106	08/03	08/04	X
HP85460A RF Filter Section	3330A00109	08/03	08/04	X
HP85462A Receiver RF Section	3549A00306	01/04	01/05	
HP85460A RF Filter Section	3448A00276	01/04	01/05	
Advantest Spectrum Analyzer R3271A	55050084	06/03	06/04	X
TILE! Instrument Control System	ver. 3.2 X	N/A	N/A	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	01/04	01/05	X
Schaffner-Chase Bicono-Log Antenna	2630	06/03	06/04	
EMCO Horn Antenna 3115	9507-4513	12/03	12/04	
EMCO Horn Antenna 3115	6579	01/04	01/05	X

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
FCC LISN-2	316	01/04	01/05	X
FCC-LISN-50-25-2	2014	06/03	06/04	