



UL International EMC Services  
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<http://www.ul.com/emc/>

January 9, 2004

Taylor Company  
Attn: Ms. Mary Dane-Greenhow  
750 N. Blackhawk Blvd.  
Rockton, IL 61702

UL Reference: File MC1656, Project 03NK34728

Subject: EMC Test and Measurement Report for  
Model C903 Slush Freezer

Dear Ms. Greenhow:

We have provided with this letter your EMC Test Report for the above referenced model. The product was determined to comply with the requirements noted in the report.

Please review the attached report and direct any questions or comments to me.

We appreciate your interest in UL's EMC Services, and encourage you to contact us in the future should you need EMC test services. This closes Project 03NK34728.

Best regards,

A handwritten signature in black ink, appearing to read 'Mike Ehas'.

Mike Ehas (Ext 42351)  
EMC Sr. Engineering Associate  
International EMC Services

Reviewed by:

A handwritten signature in black ink, appearing to read 'Jack Steiner'.

Jack Steiner  
Engineering Group Leader  
International EMC Services

# EMC – TEST REPORT

Issue Date: January 9, 2004

## Ö EMISSIONS IMMUNITY

Test Report File No. : MC1656  
 Project No. : 03NK34728  
  
 Model / Type : C903  
 Kind of Product : Slush Freezer  
  
 Applicant : Taylor Company  
 License Holder : Taylor Company  
 Address : 750 N. Blackhawk Blvd.  
           : Rockton, IL 61072  
  
 Manufacturer : Same as Applicant  
               :  
               :  
  
**Test Result : COMPLIANT**

**This report without appendices consists of 12 pages. Appendix A contains test photos, Appendix B contains original test data and Appendix C contains sample calculations.**

**The data contained in this report reflects only the items tested in the configurations and mode of operations described. An attempt has been made to arrange the EUT, with the equipment provided, into a test configuration which maximizes the observed emissions of the EUT while simulating, as close as practical, a typical end-use installation. The photos and data provided in this report document that configuration.**

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**Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062  
 Fax: (847) 272-8864**

# REPORT DIRECTORY

## SECTION    TITLE

### **GENERAL**

- 1.0            General Product Description
- 1.1            Model Differences
- 1.2            Environmental Conditions in Test Lab
- 1.3            Calibration Details of Equipment Used for Measurement
- 1.4            EUT (Equipment Under Test) Configuration
- 1.5            EUT Operating Mode
- 1.6            Device Modifications

### **EMISSIONS**

- 2.0            Emissions Test Regulations
  - Conducted Voltage
  - Radiated Electric Field Emissions
  - Frequency Tolerance / Temperature Variation Measurement
  - Frequency Tolerance / Voltage Variation Measurement
  - Occupied Bandwidth Measurement

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- 3.0            Immunity Test Regulations

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- 4.0            General Remarks
- 4.1            Summary

### **APPENDICIES**

- A            Test Setups (Photos, Diagrams and Drawings)
- B            Test Data
- C            Sample Calculations
- D            Block Diagram of the Measurement System

## 1.0 GENERAL PRODUCT DESCRIPTION

The Equipment Under Test (EUT) a slush freezer for dispensing cold beverages in commercial establishments. The product contains a 13.56 MHz tranceiver (RFID device), to communicate with the beverage container located in the base cabinet as well as to communicate with the customer card function.

### 1.0.1 Equipment Mobility:

Floor Standing

### 1.0.2 Test Voltage and Frequency:

<u>Voltage (V)</u>	<u>Frequency (Hz)</u>
120	60

## 1.1 MODEL DIFFERENCES

**Any other model(s) represented by the models tested in this investigation will be documented by the manufacturer.**

## 1.2 ENVIRONMENTAL CONDITIONS IN TEST LAB

**Temperature: 20-25 °C**  
**Relative Humidity: 30-60% RH**  
**Atmospheric Pressure: 860-1060 mbar**

## 1.3 CALIBRATION OF EQUIPMENT USED FOR MEASUREMENT

**All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less.**

**All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST), therefore, all test data recorded in this report is traceable to NIST.**

#### 1.4 EUT CONFIGURATION(s)

See Appendix A for individual set-up configuration(s). In addition to the EUT, the following peripheral devices and/or cables were connected during the measurement:

Device	Manufacturer	Model	Serial #	FCC ID
N/A				

Cable	Manufacturer	Length	Type	Shield Type	Shield Termination
N/A					

#### 1.5 EUT OPERATING MODE(s)

The equipment under test was operated during the measurements under the following conditions:

Conducted Voltage: The EUT was operated with all functions operational including the compressor, mixing motors and transceiver operational and with the transceiver operational and all other functions at idle.

Radiated Emissions: Measurements between 10 MHz-30 MHz were conducted with all functions operational and with the customer antenna active and cabinet antenna active. Measurements between 30 MHz-1000 MHz were conducted with all functions operational and the customer card antenna active (worst case operation).

Frequency Tolerance: Measurements were conducted with the transceiver board and all associated circuitry mounted to a section of plywood.

#### 1.6 DEVICE MODIFICATIONS

The following modifications were necessary for compliance:

To comply with Conducted Voltage, a 1.0 uF capacitor was placed between line and neutral conductors at the location where the power cord enters the enclosure and a Steward ferrite, p/n 28B1225-100 was placed on the power cord at the same location. The jacket of the power cord was removed and 2-turns of the line, neutral and ground conductors were wrapped on the ferrite core.

To comply with Radiated Emissions a metal enclosure was added to enclose the transceiver printed circuit board. A ferrite was added to the RS232 communication cable, Steward, p/n 28B1225-100 with 4 turns. And a ferrite was added to the customer card antenna cable, TT Electronic, p/n 31V 156 0562 with 4 turns.

## 2.0 EMISSIONS TEST REGULATIONS

**The EUT as a whole was considered to be a Class A device. The transceiver circuitry complies with the limits specified in sections 15.207 and 15.209.**

Emissions testing was performed according to the following regulations:

47 CFR Part 15 Subpart C: 2002 + ANSI C63.4 – 1992

47 CFR Part 15.205(a)

47 CFR Part 15.207(a)

47 CFR Part 15.209(a)(d)

47 CFR Part 15.225(a)(b)(c)

47 CFR Part 15 Subpart B: 2002 + ANSI C63.4 – 1992

47 CFR Part 15.107 (b)

47 CFR Part 15.109 (b)

RSS-210 : 2001

6.2.2 (e) (13.553-13.567 MHz)

Sections 2-5, 6.4, 6.4, 6.6. 7.4, 7.5, 9 -15

## **CONDUCTED VOLTAGE EMISSIONS**

### Test Location

Ground Plane (Test Station 3)

### UL Procedure

3014ANBK-LPG-001

### Test Instruments

#### Spectrum Analyzer / Quasi-peak Adapter

Advantest Model 3261A Spectrum Analyzer No. EMC4089

Last Cal. 01/15/03    Next Cal. 01/15/04

Model R3551 Preselector No. EMC4088

Last Cal. 01/15/04    Next Cal. 01/15/04

#### Line Impedance Stabilization Networks (LISNs)

SOLAR Model 8602-50-TS-50-N    S/N 963903    No. EMC4064

Last Cal. 01/17/03    Next Cal. 01/17/04

SOLAR Model 8602-50-TS-50-N    S/N 963904    No. EMC4065

Last Cal. 01/17/04    Next Cal. 01/17/04

#### Transient Limiter

Electro-Metrics Model: EM-7600-2

No. EMC4224

#### Frequency Range on each line

150kHz to 30 MHz

### Test Results

The requirements are:

MET

### Remarks

See App. B for complete test results.

## **RADIATED ELECTRIC FIELD EMISSIONS, 10kHz to 30MHz**

### Test Location

10 Meter Semi-Anechoic Chamber

### UL Procedure

3014ANBK-LPG-002

### Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector

Hewlett Packard Model 8566B Spectrum Analyzer

Last Cal. 01/15/03    Next Cal. 01/15/04

Model 85650A Quasi-peak Adapter

Last Cal. 01/15/03    Next Cal. 01/15/04

Model 85685A RF Preselector        No. EMC4015

Last Cal. 01/15/03    Next Cal. 01/15/04

### Antennas

Solar Electronics., Loop Sensor, Model 7334-1, s/n 927613, EMC4038

Last Cal. 03/04/03    Next Cal. 03/04/04

### Frequency Range of Measurement

10kHz-30MHz

### Measurement Distance

10 meters

### Antenna Height

1.5 meters to the center of the loop

### Antenna Polarity

Peak scan was conducted with the antenna in the vertical polarity. Final emission (average) measurements were also check in the horizontal polarity. The antenna polarity recording with the highest emission was documented.

### Test Results

The requirements are:

MET

### Remarks

See App. B for complete test results.

**RADIATED ELECTRIC FIELD EMISSIONS, 30MHz to 1000MHz**Test Location

10 Meter Semi-Anechoic Chamber

UL Procedure

3014ANBK-LPG-002

Test InstrumentsSpectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector

Hewlett Packard Model 8566B Spectrum Analyzer

Last Cal. 01/15/03 Next Cal. 01/15/04

Model 85650A Quasi-peak Adapter

Last Cal. 01/15/03 Next Cal. 01/15/04

Model 85685A RF Preselector No. EMC4015

Last Cal. 01/15/03 Next Cal. 01/15/04

Miteq AM-3A-000110-N Preamp No. FCA4003, EMC4016, EMC4151

Antennas

Chase EMC Ltd., Biconical Antenna Model VBA6106A

S/N 1246

Last Cal. 05/25/01 Next Cal. 05/25/02

Chase EMC Ltd., Log Periodic Antenna Model UPA6108

S/N 1120

Last Cal. 05/25/01 Next Cal. 05/25/02

Frequency Range of Measurement

30MHz-1000MHz

Measurement Distance

10 meters

Test Results

The requirements are:

MET

Remarks

See App. B for complete test results.

Preliminary measurements (peak scans) were done by rotating the turntable 360° and at multiple antenna heights (1, 2, 3 and 4 meters).

If necessary, final measurements were conducted using a quasi-peak detector. These emissions were maximized by rotating the turntable 360° and positioning the receive antenna from 1 to 4 meters in height.

**FREQUENCY TOLERANCE / TEMPERATURE VARIATION  
-20 DEGREES C TO +50 DEGREES C**

Test Location

Open lab area

Test Instruments

Frequency Counter

Hewlett-Packard, Model 5386A, s/n 2621A00329, EMC 4087

Last Cal. 01/15/03    Next Cal. 01/15/04

Environmental Chamber

Thermotron, Model SM-32-7800, s/n 32311

Last Cal. 01/15/03    Next Cal. 01/15/04

Antenna

Near field probe

Frequency Range of Measurement

13.56 MHz plus/minus 0.01%

Temperature Range of Measurement

-20 degrees C to +50 degrees C

Test Results

The requirements are:

MET

Remarks

See App. B for complete test results.

**FREQUENCY TOLERANCE / VOLTAGE VARIATION**  
**102Vac, 120Vac, 138Vac**

Test Location

Open lab area

Test Instruments

Frequency Counter

Hewlett-Packard, Model 5386A, s/n 2621A00329, EMC 4087

Last Cal. 01/15/03    Next Cal. 01/15/04

Antenna

Near field probe

Frequency Range of Measurement

13.56 MHz plus/minus 0.01%

Voltage Range of Measurement

102Vac, 120Vac, 138Vac

Test Results

The requirements are:

MET

Remarks

See App. B for complete test results.

## OCCUPIED BANDWIDTH MEASUREMENT

### Test Location

10 Meter Semi-Anechoic Chamber

### UL Procedure

3014ANBK-LPG-002

### Test Instruments

Spectrum Analyzer / Quasi-peak Adapter / Preamplifier / Preselector

Hewlett Packard Model 8566B Spectrum Analyzer

Last Cal. 01/15/03    Next Cal. 01/15/04

Model 85650A Quasi-peak Adapter

Last Cal. 01/15/03    Next Cal. 01/15/04

Model 85685A RF Preselector        No. EMC4015

Last Cal. 01/15/03    Next Cal. 01/15/04

### Antennas

Solar Electronics., Loop Sensor, Model 7334-1, s/n 927613, EMC4038

Last Cal. 03/04/03    Next Cal. 03/04/04

### Frequency Range of Measurement

13.56 MHz

### Measurement Distance

10 meters

### Test Results

The requirements are:

MET

### Remarks

See App. B for complete test results.

### 3.0 IMMUNITY TEST REGULATIONS

**Immunity testing was not required nor performed.**

### 4.0 GENERAL REMARKS

Sample Receipt Date : November 14, 2003

Test Dates

Start : November 20, 2003  
End : January 9, 2004

### 4.1 SUMMARY

The requirements according to the technical regulations are:

MET

Underwriters Laboratories Inc.  
333 Pfingsten Road  
Northbrook, IL 60062 USA

**FCC Site Number: 31040/SIT 1300F2**

Best regards,



Mike Ehas (Ext 42351)  
EMC Sr. Engineering Associate  
International EMC Services

Reviewed by:



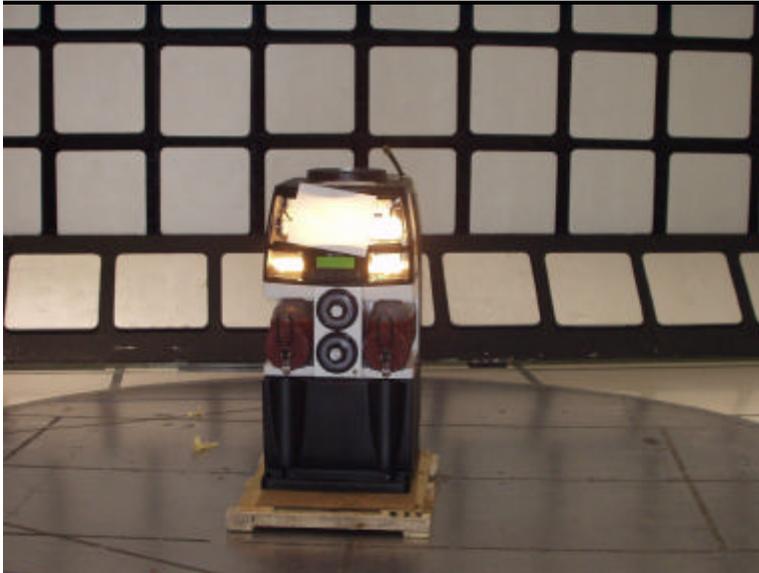
Jack Steiner  
Engineering Group Leader  
International EMC Services

**APPENDIX A**

**PHOTOS**



**Conducted Emissions**  
(Ground Plane 3)



**Radiated Emissions &  
Occupied Band Width**  
(10M Chamber)



**Temperature Stability**  
(Thermotron Chamber) &  
**Voltage Stability**

**APPENDIX B**

**TEST DATA**

**EMISSIONS**

Conducted Voltage  
Radiated Electric Field Emissions  
Frequency Tolerance / Temperature Variation Measurement  
Frequency Tolerance / Voltage Variation Measurement  
Occupied Band Width Measurement



TAYLOR  
 MODEL: C903  
 ALL ACTIVE  
 120V/60Hz  
 LINE

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2	3	4
=====								
Line - L1 .15 - 2MHz								
.17047	62.92qp	9.4	0	72.32+	79	66	64.9	54.9
			Margin [dB]:		-6.68	6.32	7.42	17.42
.15807	64.02qp	9.4	0	73.42+	79	66	65.6	55.6
			Margin [dB]:		-5.58	7.42	7.82	17.82
.16622	63.72qp	9.4	0	73.12+	79	66	65.1	55.1
			Margin [dB]:		-5.88	7.12	8.02	18.02
.22336	58.47qp	9.5	0	67.97+	79	66	62.7	52.7
			Margin [dB]:		-11.03	1.97	5.27	15.27
.25788	50.45qp	9.5	0	59.95	79	66	61.5	51.5
			Margin [dB]:		-19.05	-6.05	-1.55	8.45

qp - Quasi-Peak detector

- LIMIT 1: CISPR CLASS A QUASI-PEAK
- LIMIT 2: CISPR CLASS A AVERAGE
- LIMIT 3: CISPR CLASS B QUASI-PEAK
- LIMIT 4: CISPR CLASS B AVERAGE

TAYLOR  
 MODEL: C903  
 ALL ACTIVE  
 120V/60Hz  
 LINE

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2	3	4
.168	55.27av	9.4	0	64.67+	79	66	65.1	55.1
			Margin [dB]:		-14.33	-1.33	-.43	9.57
.17409	54.34av	9.4	0	63.74+	79	66	64.8	54.8
			Margin [dB]:		-15.26	-2.26	-1.06	8.94
.22655	50.26av	9.5	0	59.76+	79	66	62.6	52.6
			Margin [dB]:		-19.24	-6.24	-2.84	7.16
.27274	49.12av	9.6	0	58.72+	79	66	61	51
			Margin [dB]:		-20.28	-7.28	-2.28	7.72
.33246	44.35av	9.6	0	53.95+	79	66	59.4	49.4
			Margin [dB]:		-25.05	-12.05	-5.45	4.55
.48687	46.46av	9.7	0	56.16+	79	66	56.2	46.2
			Margin [dB]:		-22.84	-9.84	-.04	9.96
.62281	43.46av	9.7	0	53.16+	73	60	56	46
			Margin [dB]:		-19.84	-6.84	-2.84	7.16
.74225	47.22av	9.7	0	56.92+	73	60	56	46
			Margin [dB]:		-16.08	-3.08	.92	10.92
.8993	47.53av	9.8	0	57.33+	73	60	56	46
			Margin [dB]:		-15.67	-2.67	1.33	11.33
1.07484	47.15av	9.8	0	56.95+	73	60	56	46
			Margin [dB]:		-16.05	-3.05	.95	10.95
1.21275	47.54av	9.9	0	57.44+	73	60	56	46
			Margin [dB]:		-15.56	-2.56	1.44	11.44
1.33021	45.17av	9.9	0	55.07+	73	60	56	46
			Margin [dB]:		-17.93	-4.93	-.93	9.07
1.48595	47.82av	9.9	0	57.72+	73	60	56	46
			Margin [dB]:		-15.28	-2.28	1.72	11.72
1.56579	47.66av	9.9	0	57.56+	73	60	56	46
			Margin [dB]:		-15.44	-2.44	1.56	11.56
1.70569	47.45av	9.9	0	57.35+	73	60	56	46
			Margin [dB]:		-15.65	-2.65	1.35	11.35
1.91949	46.7av	9.9	0	56.6+	73	60	56	46
			Margin [dB]:		-16.4	-3.4	.6	10.6
2.0799	46.4av	9.9	0	56.3+	73	60	56	46
			Margin [dB]:		-16.7	-3.7	.3	10.3
2.52934	44.84av	10	0	54.84+	73	60	56	46
			Margin [dB]:		-18.16	-5.16	-1.16	8.84
2.99376	44.29av	10	0	54.29+	73	60	56	46
			Margin [dB]:		-18.71	-5.71	-1.71	8.29
10.52435	48.53av	10.3	0	58.83+	73	60	60	50
			Margin [dB]:		-14.17	-1.17	-1.17	8.83
14.56929	43.54av	10.4	0	53.94+	73	60	60	50
			Margin [dB]:		-19.06	-6.06	-6.06	3.94
17.47066	41.39av	10.5	0	51.89+	73	60	60	50
			Margin [dB]:		-21.11	-8.11	-8.11	1.89

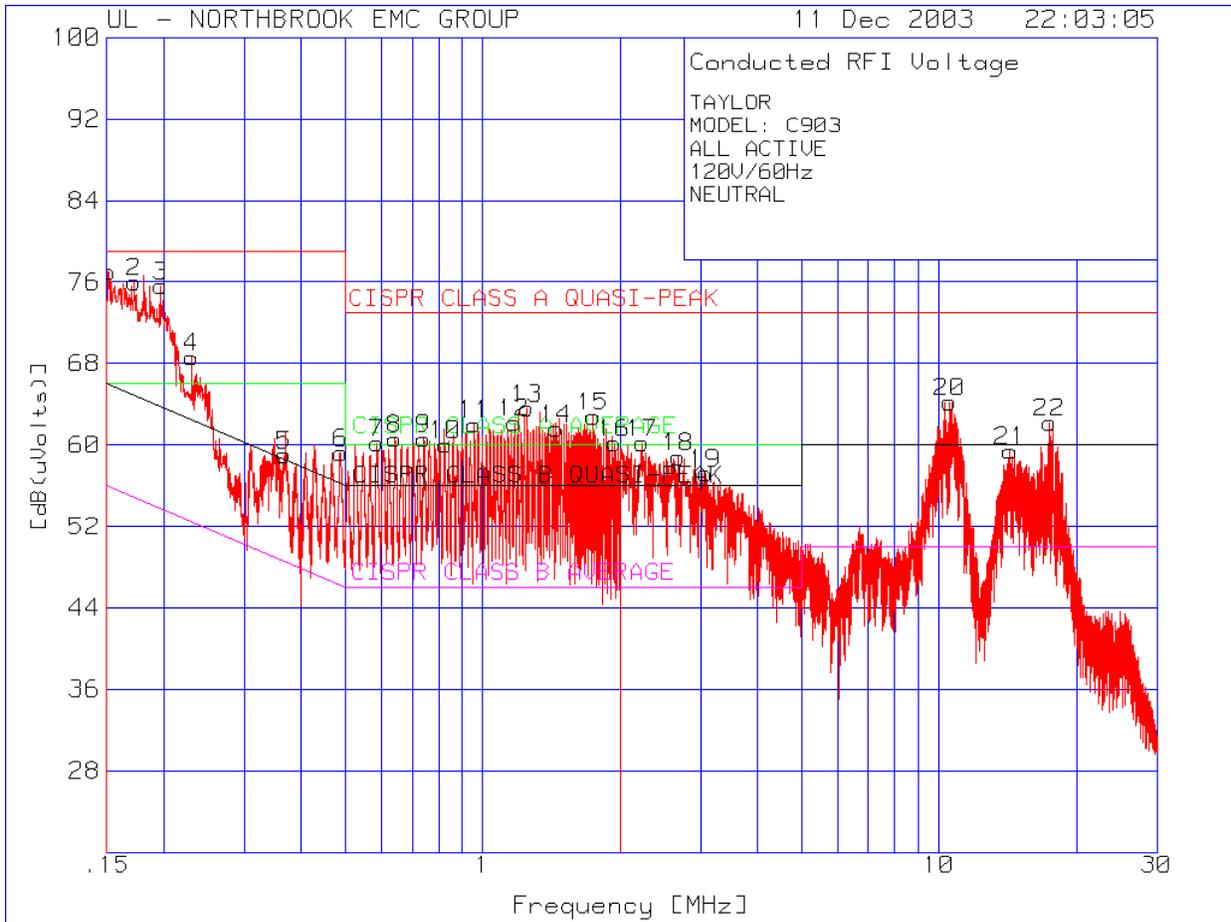
av - Average detector

LIMIT 1: CISPR CLASS A QUASI-PEAK  
 LIMIT 2: CISPR CLASS A AVERAGE  
 LIMIT 3: CISPR CLASS B QUASI-PEAK  
 LIMIT 4: CISPR CLASS B AVERAGE

**UNDERWRITERS LABORATORIES INC.**  
**Conducted Emissions**

Date Tested: December 11, 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Detection Mode** : Quasi-peak (qp) or Peak (pk) or Average (ave)  
**Bandwidth** : 200 Hz for measurements 9 kHz to 150 kHz  
 9 kHz for measurements 150 kHz to 30 MHz  
**Line** : L2



TAYLOR  
 MODEL: C903  
 ALL ACTIVE  
 120V/60Hz  
 NEUTRAL

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2	3	4
=====								
Line - L1 .15 - 2MHz								
.16337	63.57qp	9.4	0	72.97+	79	66	65.3	55.3
			Margin [dB]:		-6.03	6.97	7.67	17.67
.1566	64.17qp	9.4	0	73.57+	79	66	65.6	55.6
			Margin [dB]:		-5.43	7.57	7.97	17.97
.18296	62.15qp	9.5	0	71.65+	79	66	64.4	54.4
			Margin [dB]:		-7.35	5.65	7.25	17.25
.21483	56.65qp	9.5	0	66.15+	79	66	63	53
			Margin [dB]:		-12.85	.15	3.15	13.15
.35285	48.65qp	9.6	0	58.25	79	66	58.9	48.9
			Margin [dB]:		-20.75	-7.75	-.65	9.35
.48864	46.9qp	9.7	0	56.6+	79	66	56.2	46.2
			Margin [dB]:		-22.4	-9.4	.4	10.4

qp - Quasi-Peak detector

LIMIT 1: CISPR CLASS A QUASI-PEAK  
 LIMIT 2: CISPR CLASS A AVERAGE  
 LIMIT 3: CISPR CLASS B QUASI-PEAK  
 LIMIT 4: CISPR CLASS B AVERAGE

TAYLOR  
 MODEL: C903  
 ALL ACTIVE  
 120V/60Hz  
 NEUTRAL

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2	3	4
.168	53.27av	9.4	0	62.67+	79	66	65.1	55.1
			Margin [dB]:		-16.33	-3.33	-2.43	7.57
.17244	53.69av	9.4	0	63.09+	79	66	64.8	54.8
			Margin [dB]:		-15.91	-2.91	-1.71	8.29
.19685	46.91av	9.5	0	56.41+	79	66	63.7	53.7
			Margin [dB]:		-22.59	-9.59	-7.29	2.71
.22985	49.59av	9.5	0	59.09+	79	66	62.5	52.5
			Margin [dB]:		-19.91	-6.91	-3.41	6.59
.3671	46.05av	9.6	0	55.65+	79	66	58.6	48.6
			Margin [dB]:		-23.35	-10.35	-2.95	7.05
.48869	46.15av	9.7	0	55.85+	79	66	56.2	46.2
			Margin [dB]:		-23.15	-10.15	-1.35	9.65
.58586	46.91av	9.7	0	56.61+	73	60	56	46
			Margin [dB]:		-16.39	-3.39	.61	10.61
.64261	47.06av	9.7	0	56.76+	73	60	56	46
			Margin [dB]:		-16.24	-3.24	.76	10.76
.74291	46.81av	9.7	0	56.51+	73	60	56	46
			Margin [dB]:		-16.49	-3.49	.51	10.51
.82771	45.82av	9.8	0	55.62+	73	60	56	46
			Margin [dB]:		-17.38	-4.38	-.38	9.62
.95738	46.98av	9.8	0	56.78+	73	60	56	46
			Margin [dB]:		-16.22	-3.22	.78	10.78
1.17151	47.37av	9.8	0	57.17+	73	60	56	46
			Margin [dB]:		-15.83	-2.83	1.17	11.17
1.25136	47.83av	9.9	0	57.73+	73	60	56	46
			Margin [dB]:		-15.27	-2.27	1.73	11.73
1.44817	47.71av	9.9	0	57.61+	73	60	56	46
			Margin [dB]:		-15.39	-2.39	1.61	11.61
1.74726	45.11av	9.9	0	55.01+	73	60	56	46
			Margin [dB]:		-17.99	-4.99	-.99	9.01
1.94028	46.68av	9.9	0	56.58+	73	60	56	46
			Margin [dB]:		-16.42	-3.42	.58	10.58
2.23471	45.62av	9.9	0	55.52+	73	60	56	46
			Margin [dB]:		-17.48	-4.48	-.48	9.52
2.67915	45.21av	10	0	55.21+	73	60	56	46
			Margin [dB]:		-17.79	-4.79	-.79	9.21
3.07366	44.09av	10	0	54.09+	73	60	56	46
			Margin [dB]:		-18.91	-5.91	-1.91	8.09
10.54682	47.6av	10.3	0	57.9+	73	60	60	50
			Margin [dB]:		-15.1	-2.1	-2.1	7.9
14.31461	43.19av	10.4	0	53.59+	73	60	60	50
			Margin [dB]:		-19.41	-6.41	-6.41	3.59
17.45069	39.86av	10.5	0	50.36+	73	60	60	50
			Margin [dB]:		-22.64	-9.64	-9.64	.36

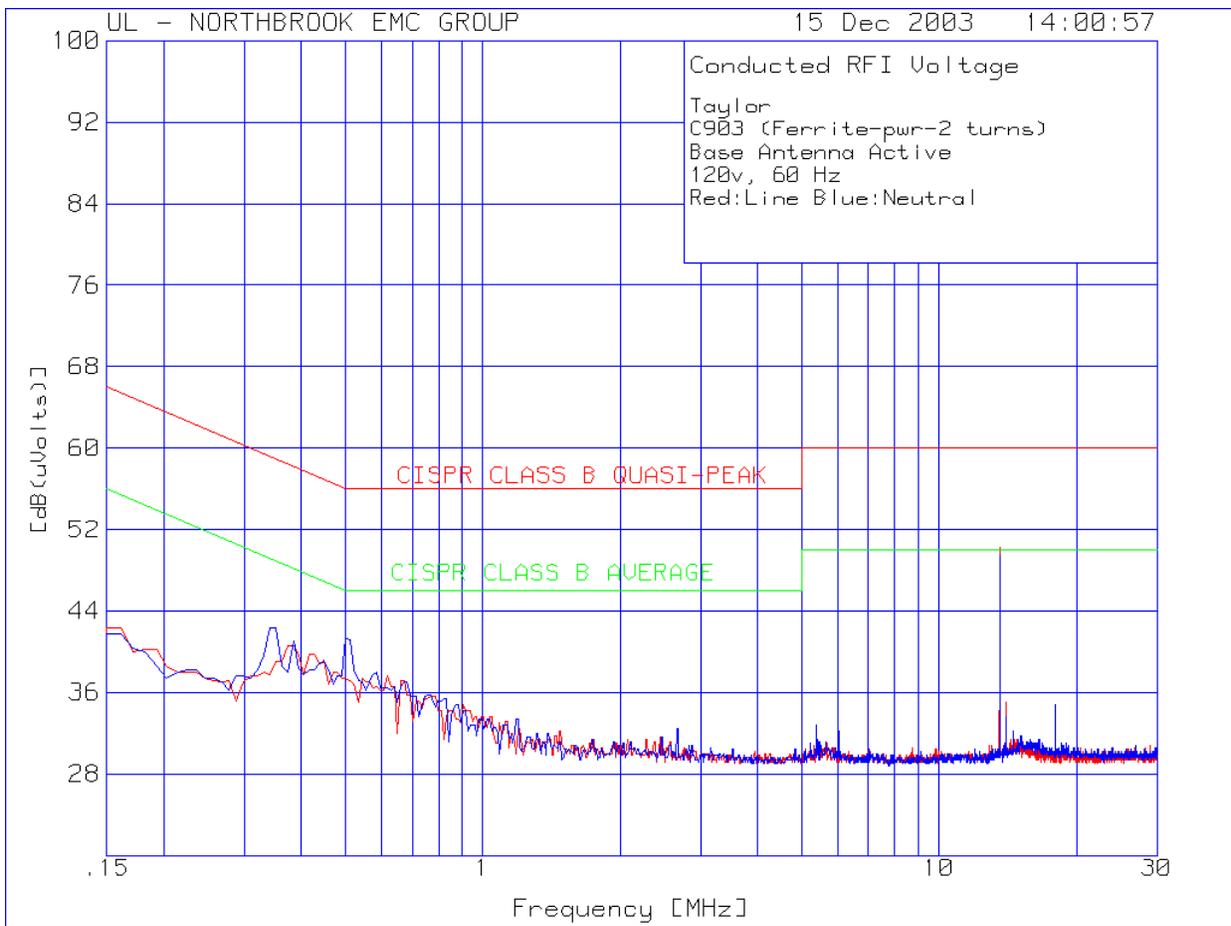
av - Average detector

LIMIT 1: CISPR CLASS A QUASI-PEAK  
 LIMIT 2: CISPR CLASS A AVERAGE  
 LIMIT 3: CISPR CLASS B QUASI-PEAK  
 LIMIT 4: CISPR CLASS B AVERAGE

**UNDERWRITERS LABORATORIES INC.**  
**Conducted Emissions**

Date Tested: 15 December 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Detection Mode** : Quasi-peak (qp) or Peak (pk) or Average (ave)  
**Bandwidth** : 200 Hz for measurements 9 kHz to 150 kHz  
 9 kHz for measurements 150 kHz to 30 MHz  
**Line** : L1 and L2



Taylor  
 C903 (Ferrite-pwr-2 turns)  
 Base Antenna Active  
 120v, 60 Hz  
 Red:Line Blue:Neutral

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2
=====						
Line - L1 .15 - 30MHz						
13.57877	37.8av	10.4	0	48.2	60	50
			Margin [dB]:		-11.8	-1.8
Line - L2 .15 - 30MHz						
13.57877	37.33av	10.4	0	47.73	60	50
			Margin [dB]:		-12.27	-2.27

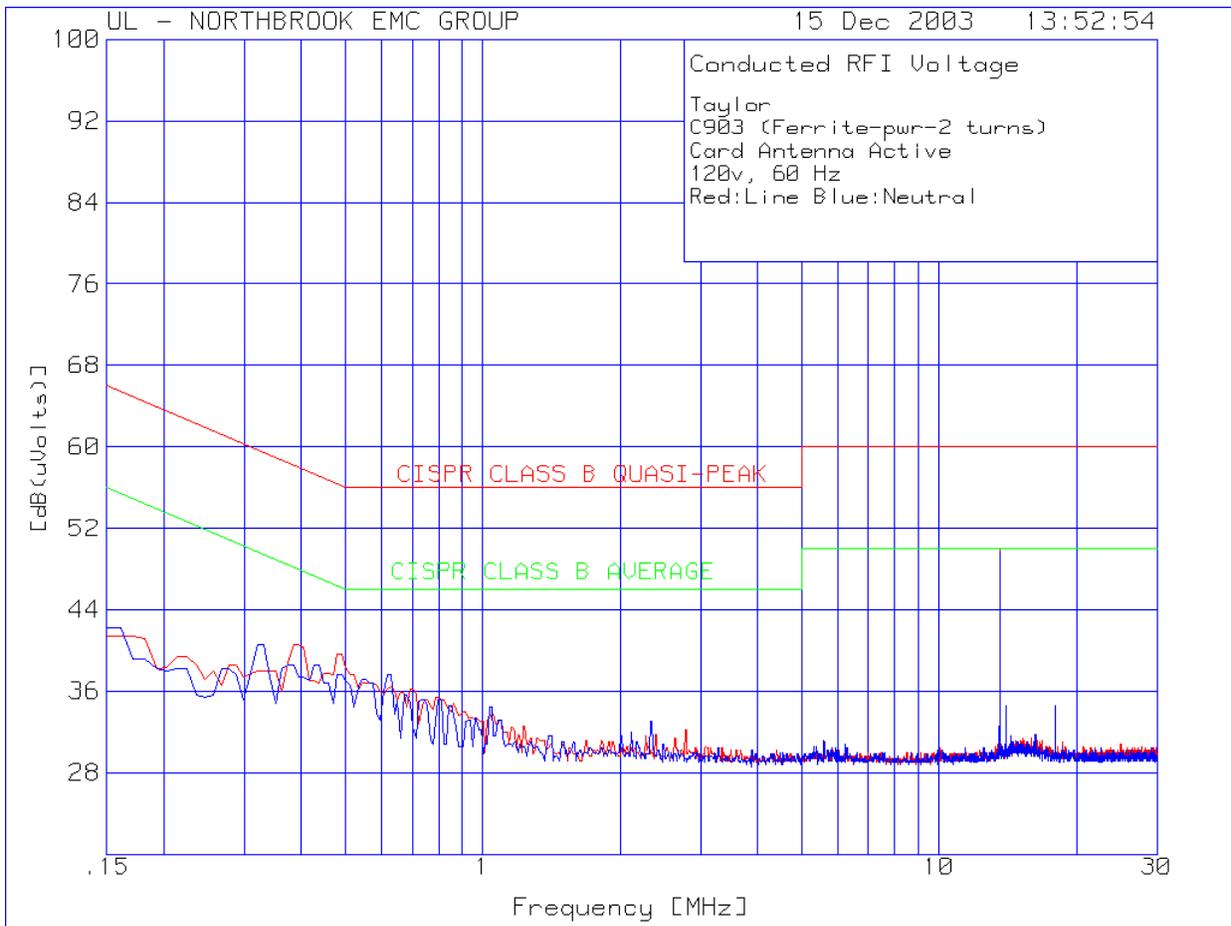
av - Average detector

LIMIT 1: CISPR CLASS B QUASI-PEAK  
 LIMIT 2: CISPR CLASS B AVERAGE

**UNDERWRITERS LABORATORIES INC.**  
**Conducted Emissions**

Date Tested: December 15, 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Detection Mode** : Quasi-peak (qp) or Peak (pk) or Average (ave)  
**Bandwidth** : 200 Hz for measurements 9 kHz to 150 kHz  
 9 kHz for measurements 150 kHz to 30 MHz  
**Line** : L1 and L2



Taylor  
 C903 (Ferrite-pwr-2 turns)  
 Card Antenna Active  
 120v, 60 Hz  
 Red:Line Blue:Neutral

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	2
Frequency	Reading	Factor	Factor	[dB(uVolts)]		
[MHz]	[dB(uV)]	[dB]	[dB]			
=====						
Line - L1	.15 - 30MHz					
13.57877	37.95av	10.4	0	48.35	60	50
			Margin [dB]:		-11.65	-1.65
Line - L2	.15 - 30MHz					
13.57877	37.22av	10.4	0	47.62	60	50
			Margin [dB]:		-12.38	-2.38

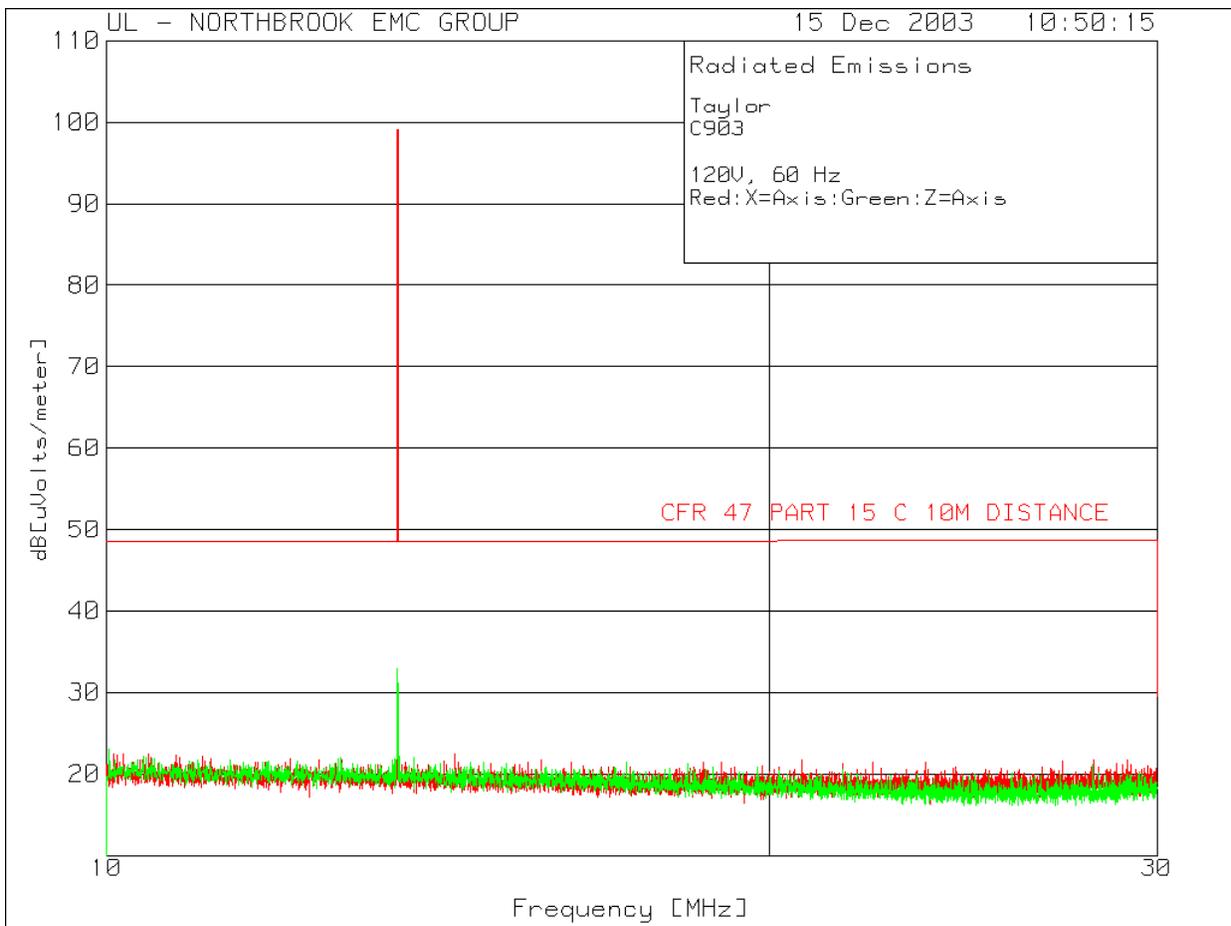
av - Average detector

LIMIT 1: CISPR CLASS B QUASI-PEAK  
 LIMIT 2: CISPR CLASS B AVERAGE

**UNDERWRITERS LABORATORIES INC.**  
**Radiated Emissions**

Date Tested: 03 June 2002

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Detection Mode** : Average (Av)  
**Bandwidth** : 120 kHz  
**Measurement Distance** : 10 meter  
**Antenna Type** : 10 MHz – 30 MHz Loop Sensor



Taylor  
 C903  
 120V, 60 Hz  
 Red:X=Axis:Green:Z=Axis

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====					
Range: 4 10 - 30MHz					
13.5607	21.25 av	.5	11	32.75	99.1
Azimuth: 123		Height:100 Vert		Margin [dB]:	-66.35
13.5607	16.56 av	.5	11	28.06	99.1
Azimuth: 99		Height:100 Vert		Margin [dB]:	-71.04

LIMIT 1: CFR 47 PART 15 C 10M DISTANCE

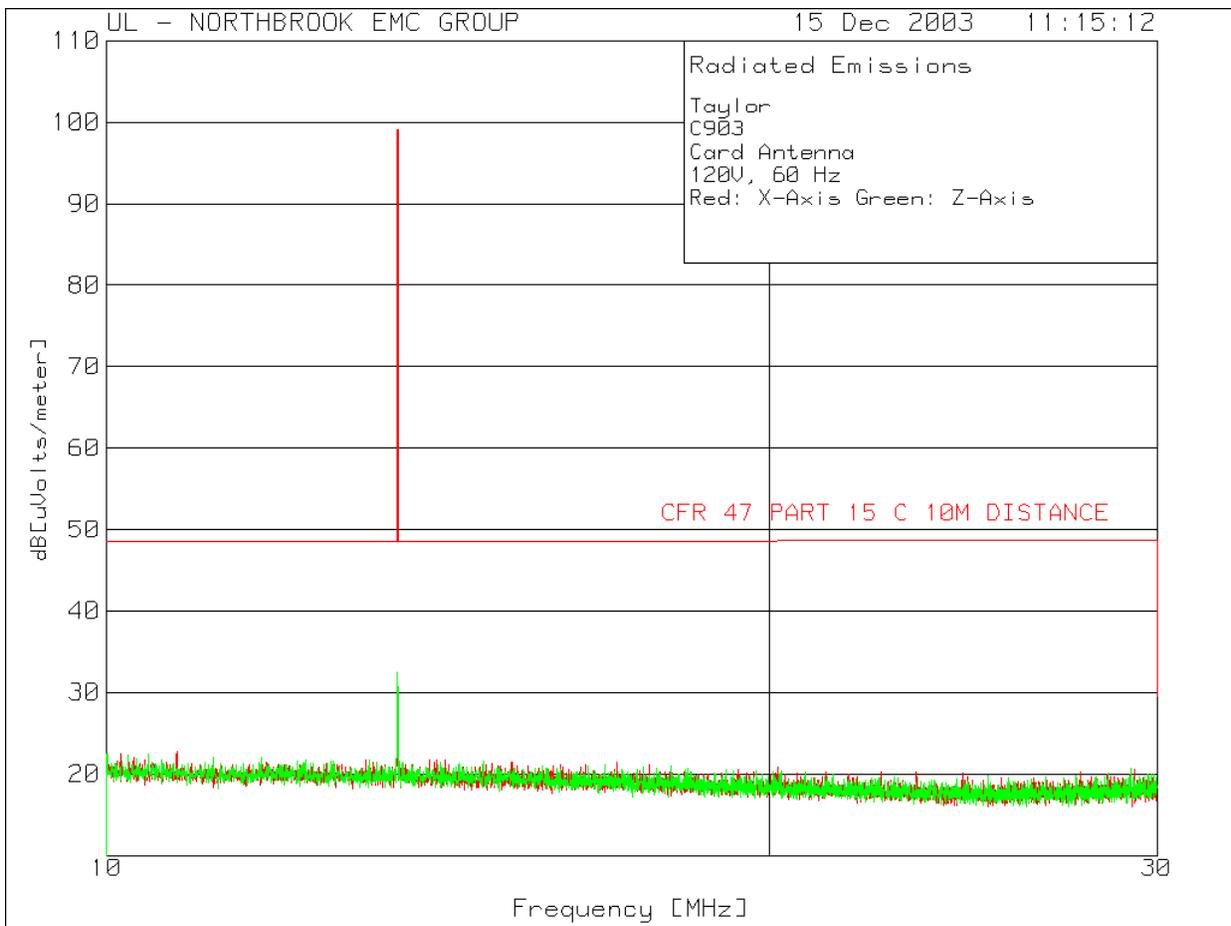
av - Average detector

Industry Canada Limit is 103.1 dBuV @ 10 M The margin of compliance at this limit is 70.35 dBuV

**UNDERWRITERS LABORATORIES INC.**  
**Radiated Emissions**

Date Tested: 03 June 2002

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Detection Mode** : Average (Av)  
**Bandwidth** : 120 kHz  
**Measurement Distance** : 10 meter  
**Antenna Type** : 10 MHz – 30 MHz Loop Sensor



Taylor  
C903  
Card Antenna  
120V, 60 Hz  
Red: X-Axis Green: Z-Axis

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1
=====					
Range: 4 10 - 30MHz					
13.5596	21.52 av	.5	11	33.02	99.1
Azimuth: 159		Height:100 Vert		Margin [dB]:	-66.08
13.5596	17.69 av	.5	11	29.19	99.1
Azimuth: 86		Height:100 Horz		Margin [dB]:	-69.91

LIMIT 1: CFR 47 PART 15 C 10M DISTANCE  
LIMIT 2: NONE  
LIMIT 3: NONE  
LIMIT 4: NONE  
LIMIT 5: NONE  
LIMIT 6: NONE

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector  
avlg - Average log detector

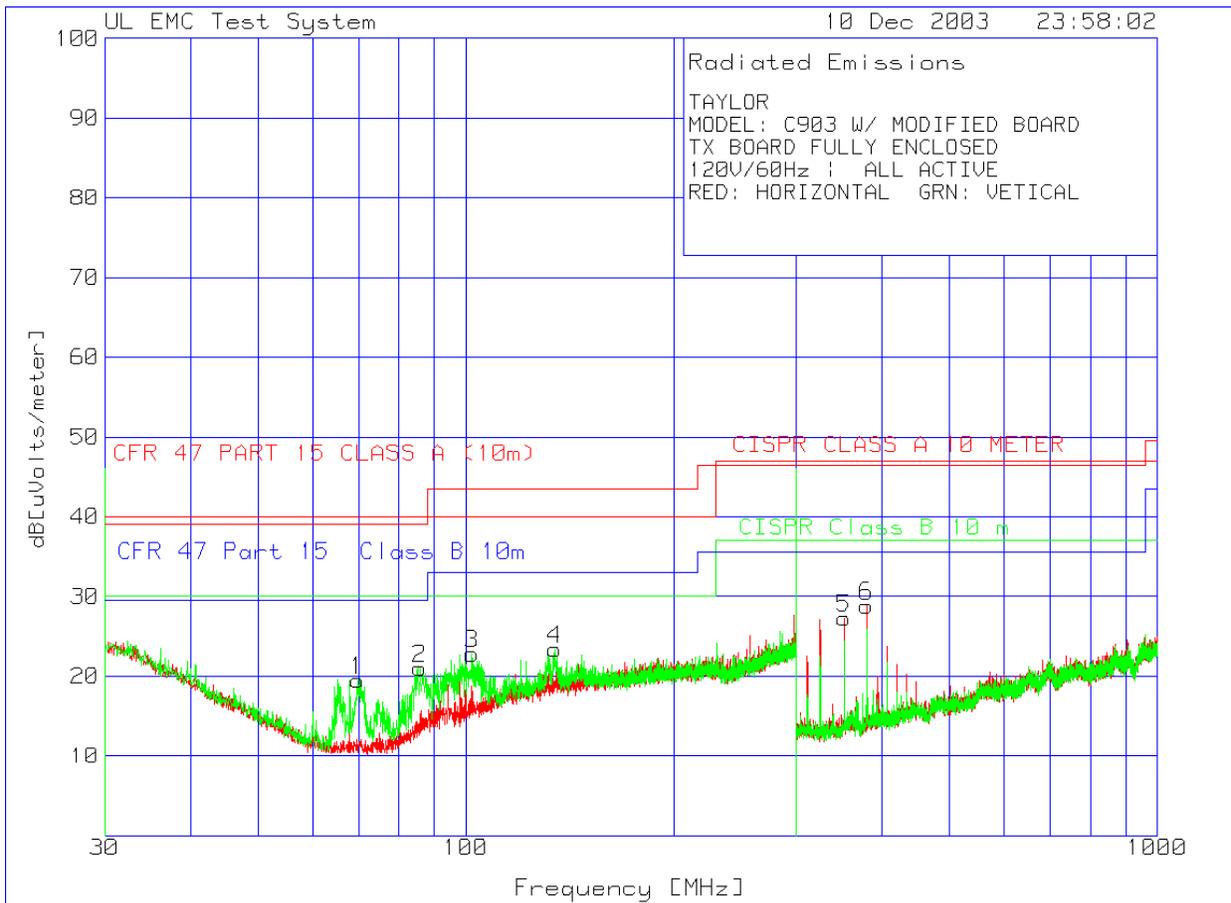
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Industry Canada Limit is 103.1 dBuV @ 10 M The margin of compliance at this limit is 70.08 dBuV

**UNDERWRITERS LABORATORIES INC.**  
**Radiated Emissions**

Date Tested: December 10, 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Detection Mode** : Quasi-peak (qp)  
**Bandwidth** : 120 kHz  
**Measurement Distance** : 3 meters  
**Antenna Type** : 30 - 300 MHz, Biconical  
300 - 1000 MHz, Log-Periodic



TAYLOR  
 MODEL: C903 W/ MODIFIED BOARD  
 TX BOARD FULLY ENCLOSED  
 120V/60Hz | ALL ACTIVE  
 RED: HORIZONTAL GRN: VETICAL

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4	
=====									
Range: 1 30 - 300MHz									
67.7239	38.24 qp	-26.8	6.7	18.14	40	30	39.1	29.6	
Azimuth: 192		Height:244 Vert		Margin [dB]:		-21.86	-11.86	-20.96	-11.46
84.7227	36.03 qp	-26.7	8.4	17.73	40	30	39.1	29.6	
Azimuth: 50		Height:161 Vert		Margin [dB]:		-22.27	-12.27	-21.37	-11.87
111.9302	31.1 qp	-26.5	12.3	16.9	40	30	43.5	33.1	
Azimuth: 119		Height:101 Vert		Margin [dB]:		-23.1	-13.1	-26.6	-16.2
133.982	32.75 qp	-26.6	14.3	20.45	40	30	43.5	33.1	
Azimuth: 219		Height:101 Vert		Margin [dB]:		-19.55	-9.55	-23.05	-12.65
Range: 3 300 - 1000MHz									
352.4985	44.63 qp	-32.6	15.1	27.13	47	37	46.4	35.6	
Azimuth: 50		Height:230 Horz		Margin [dB]:		-19.87	-9.87	-19.27	-8.47
379.6012	46.38 qp	-32.5	15.4	29.28	47	37	46.4	35.6	
Azimuth: 86		Height:208 Horz		Margin [dB]:		-17.72	-7.72	-17.12	-6.32

LIMIT 1: CISPR CLASS A 10 METER  
 LIMIT 2: CISPR Class B 10 m  
 LIMIT 3: CFR 47 PART 15 CLASS A (10m)  
 LIMIT 4: CFR 47 Part 15 Class B 10m

qp - Quasi-Peak detector

**UNDERWRITERS LABORATORIES INC.  
Frequency Tolerance / Temperature Variation Measurement**

Date Tested: January 7, 2004

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart

**Fundamental Frequency = 13.559777 MHz @ 23 °C**

Temperature °C	Frequency MHz	Requirement %	Limit MHz
-20	13.559918	0.01	13.561132 13.558421
-10	13.559913		
0	13.559891		
+10	13.559848		
+20	13.559793		
+30	13.559731		
+40	13.559678		
+50	13.559624		

The Frequency Tolerance / Temperature Variation Measurement was conducted with the transceiver printed circuit board and all associated circuitry and antennas removed from the product and mounted to a section of plywood.

**UNDERWRITERS LABORATORIES INC.**  
**Frequency Tolerance / Voltage Variation Measurement**

Date Tested: December 15, 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart

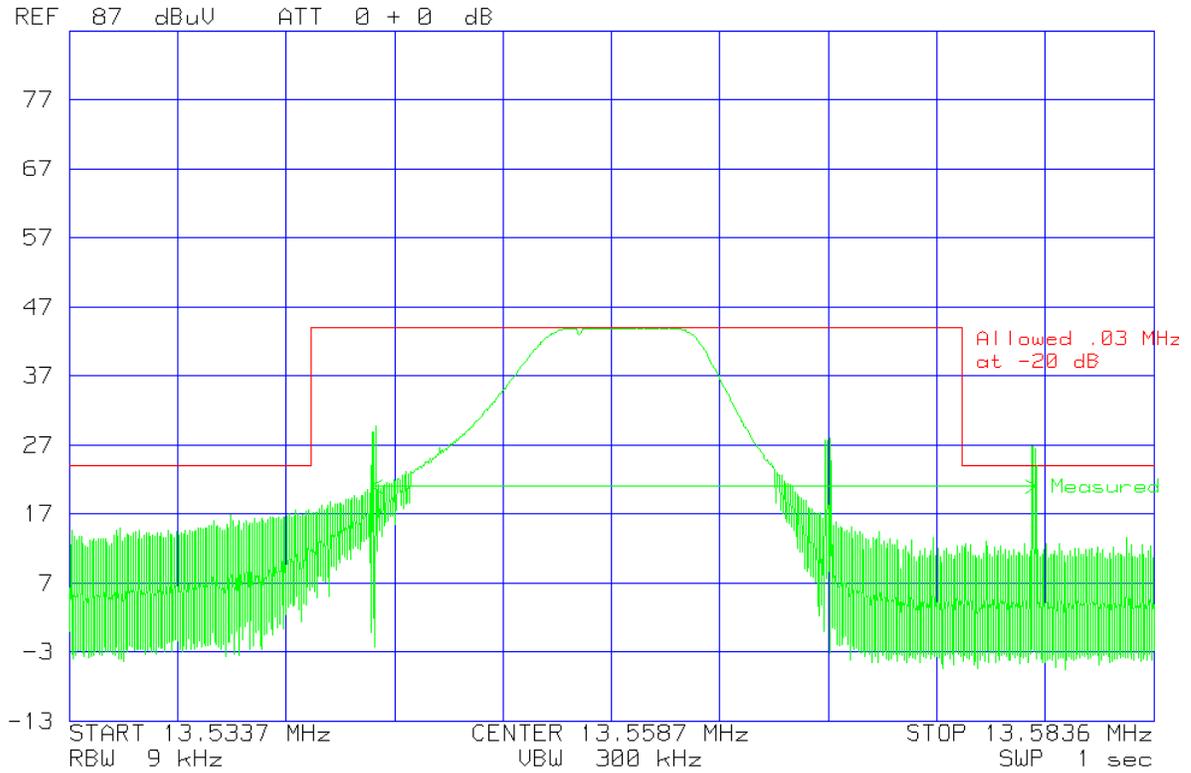
**Fundamental Frequency = 13.56 MHz**

<b>Voltage</b>	<b>Frequency MHz</b>	<b>Requirement %</b>	<b>Limit MHz</b>
<b>102V</b>	<b>13.559501</b>	<b>0.01</b>	<b>13.560901</b> <b>13.558191</b>
<b>120V</b>	<b>13.559547</b>		
<b>138V</b>	<b>13.559596</b>		

**UNDERWRITERS LABORATORIES INC.**  
**Occupied Bandwidth Measurement**

Date Tested: December 15, 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Subpart C  
**Bandwidth** : 120 kHz  
**Measurement Distance** : 10 meter  
**Antenna Type** : 10 kHz – 30 MHz Loop Sensor

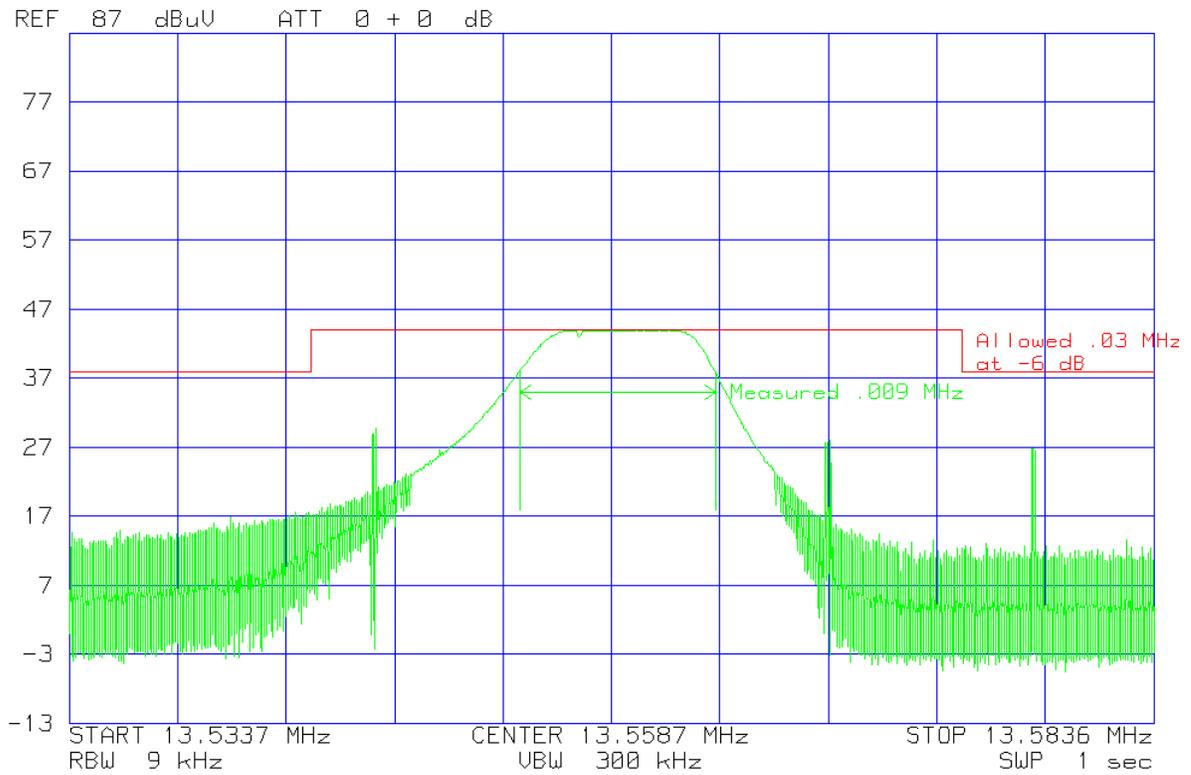


Occupied Bandwidth at 20 dB down is 16.37 kHz

**UNDERWRITERS LABORATORIES INC.**  
**Occupied Bandwidth Measurement**

Date Tested: December 15, 2003

**Manufacturer** : Taylor  
**Equipment Under Test** : C903  
**Requirement** : CFR 47, Part 15, Class B  
**Bandwidth** : 120 kHz  
**Measurement Distance** : 10 meter  
**Antenna Type** : Loop Sensor



Occupied Bandwidth at 6 dB down is 8.9 kHz

**APPENDIX C****Sample Calculations of Field Strengths****Basic Equation:**

The field strength is calculated by adding the Meter Reading, Cable Set Gain/Loss and Transducer (Antenna or LISN) Factor. The basic equation is as follows:

$$FS = MR + GL + TF$$

Where:

FS = Calculated Field Strength in dB(uV)/meter

MR = Meter Reading of receiver amplitude in dB(uV)

GL = Gain/Loss factor of cable set in dB

A negative Gain/Loss indicates signal amplification (gain)

A positive Gain/Loss indicates signal attenuation (loss)

TF = Transducer Factor of antenna or LISN in dB

**Sample Calculation:**

The measured receiver amplitude is 52.7 dB(uV).

The gain/loss factor is -30.2 dB (indicating a preamplifier is included in the cable set).

The transducer factor (antenna factor) is 6.6 dB.

These factors are added ( $52.7 + (-30.2) + 6.6$ ) resulting in a calculated field strength of 29.1 dB(uV)/meter.

## Sample Calculations of Limit

### Basic Equation:

The limit is calculated by using the information in table 15.209 for frequency (MHz), field strength (uV/m) and measurement distance (meters).

### The basic equation for converting uV/m to dBuV/m is as follows:

$$20 \text{ Log (uV/m)} = \text{dBuV/m}$$

Where:

uV/m = micro volts per meter

dBuV/m = decibel micro volts per meter

### The basic equation for converting distance D1 to D2 is as follows:

Less than 30 MHz =  $40 \text{ Log (D1/D2)}$  = correction factor

Greater than 30 MHz =  $20 \text{ Log (D1/D2)}$  = correction factor

### The basic equation for converting the limit is as follows:

$$\text{dBuV @ 30m} + \text{correction factor} = \text{dBuV @ 10 m}$$

### Sample Calculation:

The field strength limit per section 15.225 at 13.56 MHz is 10,000 uV/m at 30 meters. The following calculations were used to determine the limit in dBuV at 10 meters:

#### Distance correction factor:

$$40\text{Log}(30\text{m}/10\text{m}) = 19.08$$

#### Conversion calculation for uV/m to dBuV/m :

$$20\text{Log} (10000 \text{ uV/m}) = 80 \text{ dBuV/m}$$

#### 10 meter limit calculation:

$$80 \text{ dBuV} + 19.08 = 99.08 \text{ dBuV/m @ 10 m}$$