Underwriters Laboratories Inc.
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Melville, New York 11747-3081
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Report of Measurements
of Electromagnetic Compatibility Testing

Test Report File No.	:	**BP7169** Date of issue: February 3, 1999
Applicant	:	Applied Wireless Identifications Group Inc.
Model / Serial No.	:	Sentinal-Prox SR-2400
Product Type	:	Doorframe Proximity Reader
Power Supply	:	5Vdc and 12Vdc
Manufacturer	:	Same as Applicant
License holder	:	Same as Applicant
Address	:	382 Route 59 Section 292
	:	Monsey, NY 10952
Test Result	:	☒ **Positive** ☐ **Negative**
Test Project Number	:	98ME50398
References(s)		
FCC ID:		**XXXSR2400**

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Report Directory

1.0 G E N E R A L - Product Description

The device under test is a Doorframe Proximity Reader which operates at 125kHz and is powered by a dc source. This Radio Frequency Identification (RFID) reader or proximity reader uses radio frequency to identify, locate and track people and objects that carry the appropriate transponders. Proximity reader can work in none line-of-sight situations and in darkness, bright sun light or through dirt, grimes and smudges.

1.1 Device Configuration During Test

The EUT was configured as a stand-alone device. Tests were performed with both a 5Vdc and 12Vdc supply connected to the EUT.

1.1.1 Deviations from ANSI C63.4 Standard Test Set-up

☐ None

☐As described below:

1.2 Device Modifications Necessary for Compliance

☐ N/A

☒ As described below:

The modification to the SR-2400 consists of a resistor R6 100 Ohm in series with the VCC of U3. A small 0402 body style resistor was used directly on the circuit trace.

Environmental conditions in the lab:

	Range
Temperature:	20-25°C
Relative Humidity	30 - 60 %
Atmospheric pressure	680 - 1060 mbar

2.0 EMISSIONS TEST REGULATIONS:

☐	EN 50081-1 /1992		
☐	EN 50081-2 /1993		
☐	EN 55011 / 3.1991	☐ Group 1	☐ Group 2
		☐ Class A	☐ Class B
☐	EN 55013 / 6.1990		
☐	EN 55014 / 2.1987	☐ Household appliances and similar	
		☐ Portable tools	
		☐ Semiconductor devices	
☐	EN 55014 / 12.1993	☐ Household appliances and similar	
		☐ Portable tools	
		☐ Semiconductor devices	
☐	EN 55015 / 1993		
☐	EN 55022 / 4.1987	☐ Class A	☐ Class B
☐	EN 55020 / 1994		
☐	EN60555-2/1987, EN61000-3-2, 1995		
☐	EN60555-3/1987, EN61000-3-3, 1995		
☐	VCCI	☐ Class 1	☐ Class 2
☒	FCC Part, 15, Subpart B	☒ Class A	☐ Class B
☒	FCC Part , 15, Subpart C, Paragraph 15.209.		
☐	FCC Part 18		
☐	CISPR 11 (1990)		
☐	CISPR 14 (1993)		
☐	CISPR 22		
☐	DENTORI		
☐	AS3548		
☐	(OTHER) _____		

2.1 EUT OPERATION MODE - EMISSIONS TESTS:

☐	Standby
☐	Test program (H-Pattern)
☐	Test program (color bar)
☐	Test program (customer specific)
☐	Practice operation
☒	Normal operation Mode: Continuous sense for entry badge.
☒	As per manufacturer's instructions
☐	other

2.1.1 Conducted Emissions Tests:

☐ **Test Applicable** ☒ **Test Not Applicable**

2.1.2 Conducted Click Emissions Tests:

☐ **Test Applicable** ☒ **Test Not Applicable**

2.2.1 Reserved for Future Use

2.2.2 Radiated Emissions Test (10 Meter Semi-Anechoic Chamber):

☒ **Test Applicable** ☐ **Test Not Applicable**

All Data Pages located in Appendix A.

120kHz-30MHz Using Magnetic Loop Antenna
The measurement antenna distance ☒ 3 ☐ 10 meters from the EUT.

30MHz-1000MHz
The measurement antenna distance ☐ 3 ☒ 10 meters from the EUT.

Tests were performed on the transmitter in accordance with the limitations set forth by CFR47 FCC Part 15, Subpart B, Class A, Paragraph 15.209 and tested in accordance with the test procedures and methodologies in ANSI C63.4: 1992.

The EUT was checked throughout the frequency band 120KHz to 100MHz. The transmitter operated at 125KHz. The allowable field strength limits in accordance with 15.209 were applied to the frequency. All other emissions were tested in accordance with the general limitations in 15.209.

From 120KHz to 30MHz, measurements were made at a distance of 3 meters. The limit was adjusted using the 40dB/decade limit extrapolation method.

Test equipment used for final radiated emissions tests:

☒	HP - 8566B	Hewlett-Packard	Spectrum Analyzer	Equipment No.: ME5-589
☒	HP - 85662A	Hewlett-Packard	Analyzer Display	Equipment No.: ME5-590
☒	HP - 85650A	Hewlett-Packard	Quasi-Peak Adapter	Equipment No.: ME5-591
☒	HP - 85685A	Hewlett-Packard	Preselector	Equipment No.: ME5-588
☐	NM- 17/27B	Carnel Labs	Field Intensity Meter	Equipment No.: ME5A-054
☐	CCA7	Carnel Labs	CISPR Quasi-peak Adapter	Equipment No.: ME5A-053
☐	R3261C	Advantest	Spectrum Analyzer	Equipment No.: ME5A-228
☐	R3551	Advantest	Pre-Selector	Equipment No.: ME5A-229

Test Accessories:

☒	6507	EMCO	Active Loop	Equipment No.: ME5A-288
☐	94455-1	Ailtech	Biconnical Antenna	Equipment No.: ME5-439
☐	3146	EMCO	Log Periodic Antenna	Equipment No.: ME5-451
☐	3146	EMCO	Log Periodic Antenna	Equipment No.: ME5-811
☒	3142	EMCO	BiconiLog Antenna	Equipment No.:ME5A-436
☐	3142	EMCO	BiconiLog Antenna	Equipment No.:ME5A-261

2.2.3 RFI Power Measurements:

☐ **Test Applicable** ☒ **Test Not Applicable**

2.2.4 Harmonic Disturbances:

☐ **Test Applicable** ☒ **Test Not Applicable**

2.3 EMISSIONS TEST RESULTS

☐ Conducted Emissions

☐ Voltage(Section 2.1.1)	☐ MET	☐ NOT MET
☐ Current(Section 2.1.1)	☐ MET	☐ NOT MET
☐ Clicks(Section 2.1.2)	☐ MET	☐ NOT MET
☒ Radiated Emissions(Section 2.2.2)	☒ MET	☐ NOT MET
☐ RFI Power(Section 2.2.3)	☐ MET	☐ NOT MET

☐ Harmonic Disturbances

☐ Steady State(Section 2.2.4)	☐ MET	☐ NOT MET
☐ Fluctuating(Section 2.2.4)	☐ MET	☐ NOT MET

The tractability of the measurements contained in this report is achieved by the use of calibrated equipment which is traceable back to NIST.

3.0 IMMUNITY TEST REGULATIONS:

☒ NOT APPLICABLE

☐ EN50082-1:1992

☐ EN50082-2:1995

☐ EN55104 : 1995

☐ FDA - Reviewer Guide

☐ Bellcore GR-1089, Core

☐ IEC 601-1-2

In accordance with:

☐	IEC 801-2,	☐ IEC 1000-4-2	Electrostatic Discharge (ESD)
☐	IEC 801-3,	☐ ENV50140	RF Immunity
☐	IEC 801-4,	☐ IEC 1000-4-4	Electrical Fast Transient (EFT)
☐	IEC 801-5,	☐ IEC 1000-4-5	Surge (Lighting)
☐	IEC 801-6,	☐ ENV50141	Conducted Immunity
☐	IEC 801-11,	☐ IEC 1000-4-11	Voltage Dips and Interruptions

3.1 EUT OPERATION MODE - IMMUNITY TESTS:

☐ Standby
☐ Test program (H-Pattern)
☐ Test program (color bar)
☐ Test program (customer specific)
☐ Practice operation
☐ Normal operating Mode:
☐ As per manufacture's instructions

3.1.1 Electrostatic Discharge (ESD) Test:

☐ **Test Applicable** ☒ **Test Not Applicable**

3.1.2 Radiated Field (RF Immunity) Test:

☐ **Test Applicable** ☒ **Test Not Applicable**

3.1.3 Electrical Fast Transient (EFT)/Burst test:

☐ **Test Applicable** ☒ **Test Not Applicable**

3.1.4 Voltage Surge Test:

☐ **Test Applicable** ☒ **Test Not Applicable**

3.1.5 Conducted Immunity Test:

☐ **Test Applicable** ☒ **Test Not Applicable**

3.1.6 Voltage Dips and Interruptions:

☐ **Test Applicable** ☒ **Test Not Applicable**

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4.0 SUMMARY:

The equipment under test has

☒ met the technical requirements as defined under section(s) ☒2.0 and ☐ 3.0

☐ not met the technical requirements as defined under section(s) ☐ 2.0 and ☐ 3.0.

Test Start Date: 12/8/98

Test Completion Date: 12/29/98

- UNDERWRITERS LABORATORIES, INC. -

Project Engineer

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Engineering Services 3014AMEL

File Number: BP7169
Project Number: 98ME50398
Model Number: Sentinal-Prox SR-2400
FCC ID: XXXSR2400

Issued:February 3, 1999

APPENDIX A

EMISSIONS TEST DATA

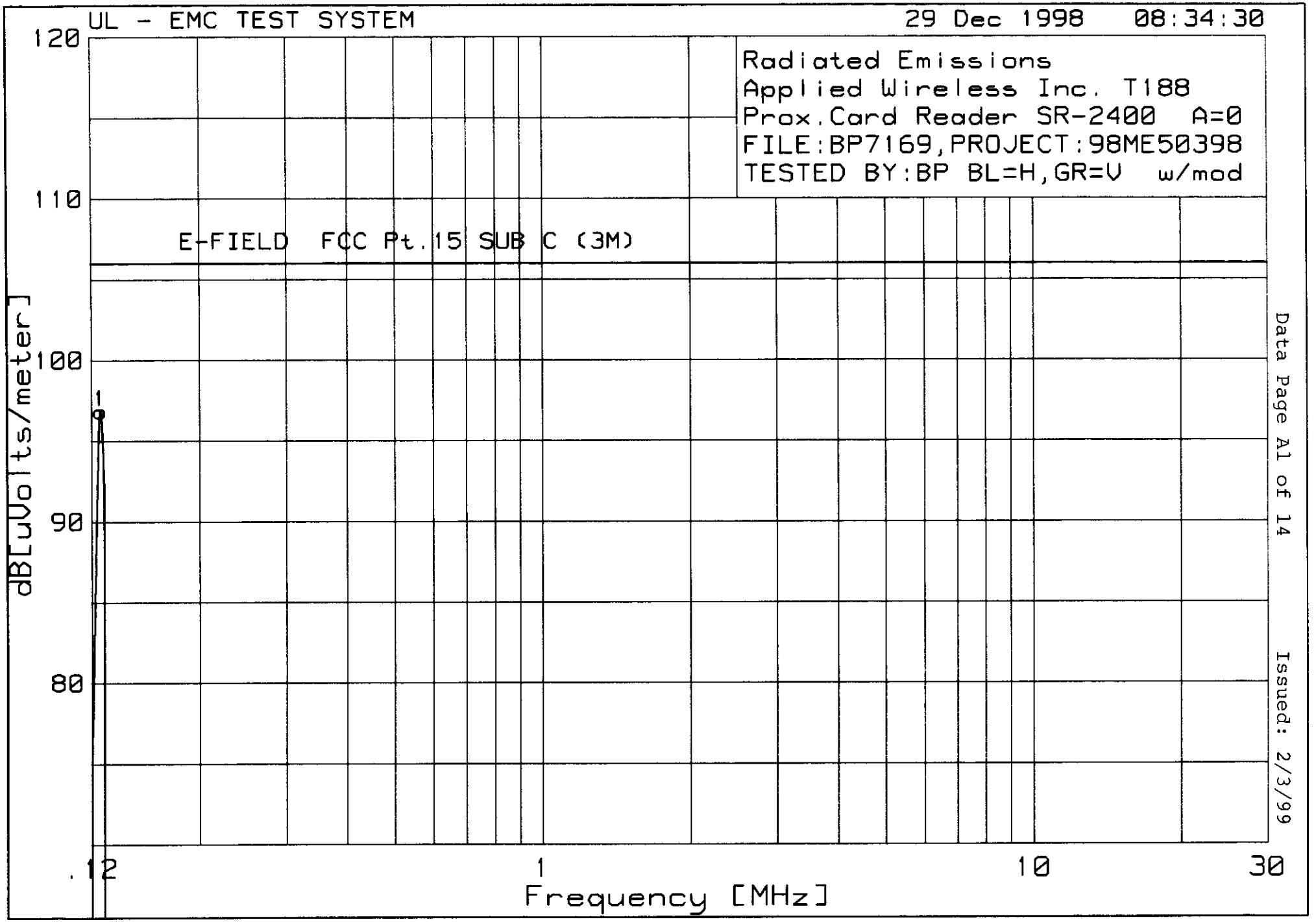
1. ☐ Conducted Emissions ☐ voltage ☐current
   - ☐ Peak traces, Data Pages A___ and/through A___
   - ☐ Quasi-Peak traces, Data Pages A___ and/through A___
   - ☐ Average traces, Data Pages A___ and/through A___

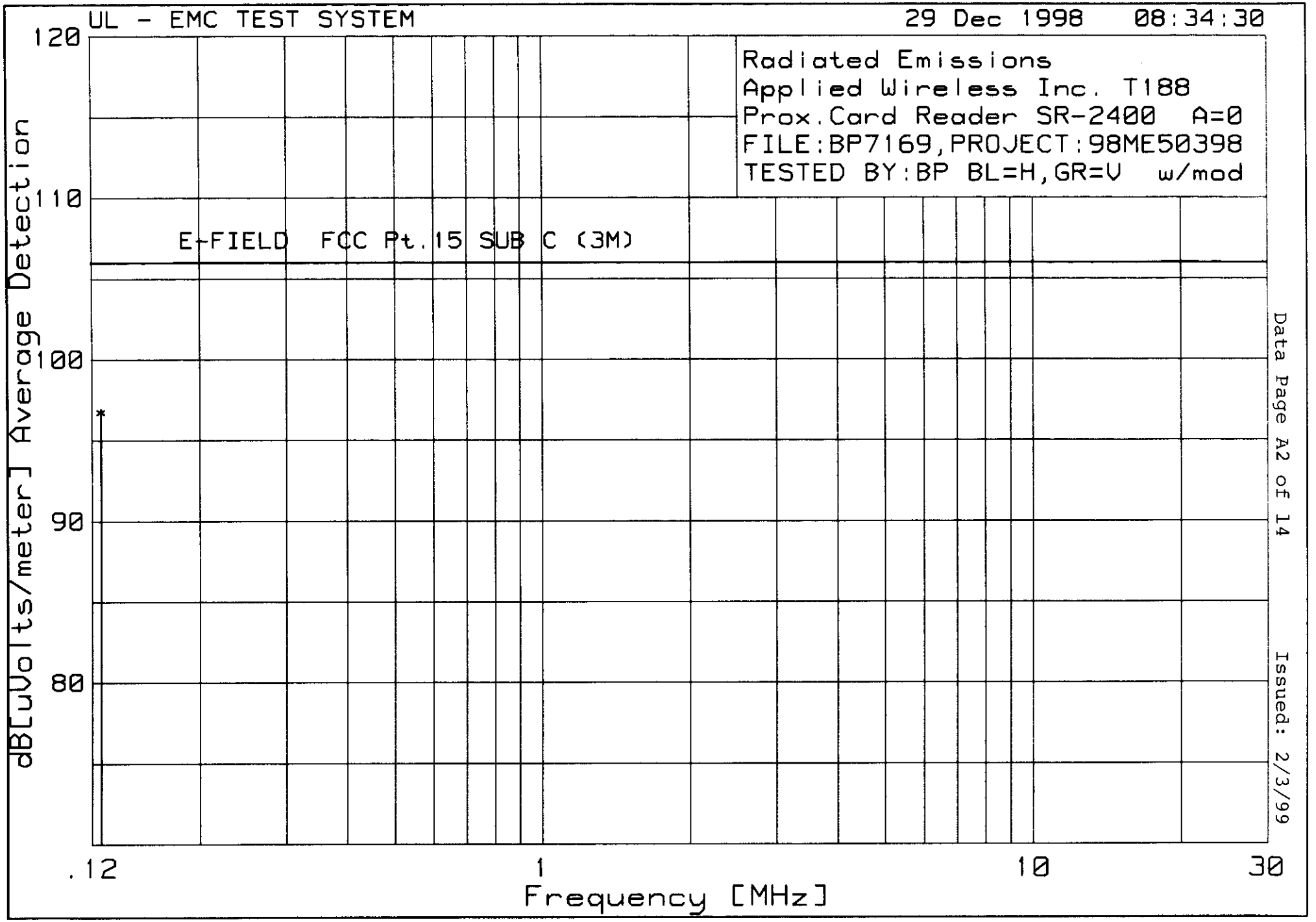
   ☐ Discontinuous Interference (Clicks)
   - ☐ No clicks exceeded the steady state quasi-peak limit
   - ☐ Clicks exceeded the steady state quasi-peak limit. The limit was adjusted to _____dB and no clicks exceeded the adjusted limit.
   - ☐ Clicks exceeded the adjusted limit. See Data Page A___ for details.

2. ☒ Radiated Emissions
   - ☒ Peak traces, Data Pages A1, A4, A7, A10 and A13.
   - ☒ Quasi-Peak Data, Data Page A14.
   - ☒ Average trace data, Data Pages A2, A5, A8 and A11.
   - ☒ Average Data, Data Pages A3, A6, A9 and A12.

3. ☐ RFI Power Measurements
   - ☐ Peak traces, Data Pages A___ and/through A___
   - ☐ Quasi-Peak traces, Data Pages A___ and/through A___
   - ☐ Average Traces, Data Pages A___ and/through A___

4. ☐ Harmonic Disturbances
   - ☐ Steady State Harmonics, Data Pages A___ and/through A___
   - ☐ Fluctuating Harmonics, Data Pages A___ and/through A___
   - ☐ Changing Voltage, Data Pages A___ and/through A___


UL - EMC TEST SYSTEM
29 Dec 1998 08:34:30
Radiated Emissions
Applied Wireless Inc. T188
Prox.Card Reader SR-2400 A=0
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
dB[uVolts/meter]
120
110
100
90
80
.12
1
10
30
Frequency [MHz]
Data Page A1 of 14
Issued: 2/3/99


UL - EMC TEST SYSTEM
29 Dec 1998 08:34:30
Radiated Emissions
Applied Wireless Inc. T188
Prox.Card Reader SR-2400 A=0
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
dB[uVolts/meter] Average Detection
120
110
100
90
80
.12
1
10
30
Frequency [MHz]
Data Page A2 of 14
Issued: 2/3/99

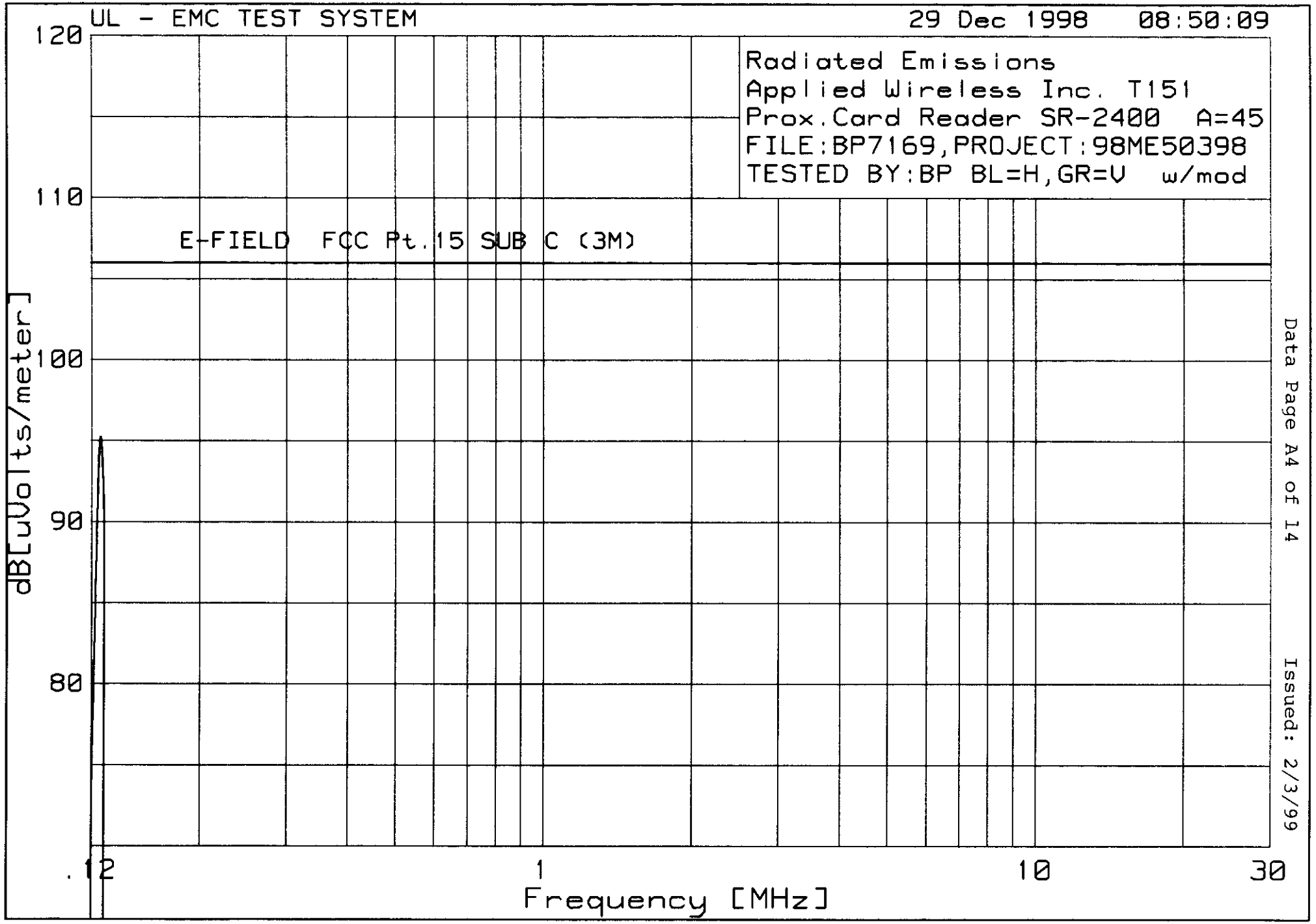
Date Tested: 29 Dec 1998
08:34:30

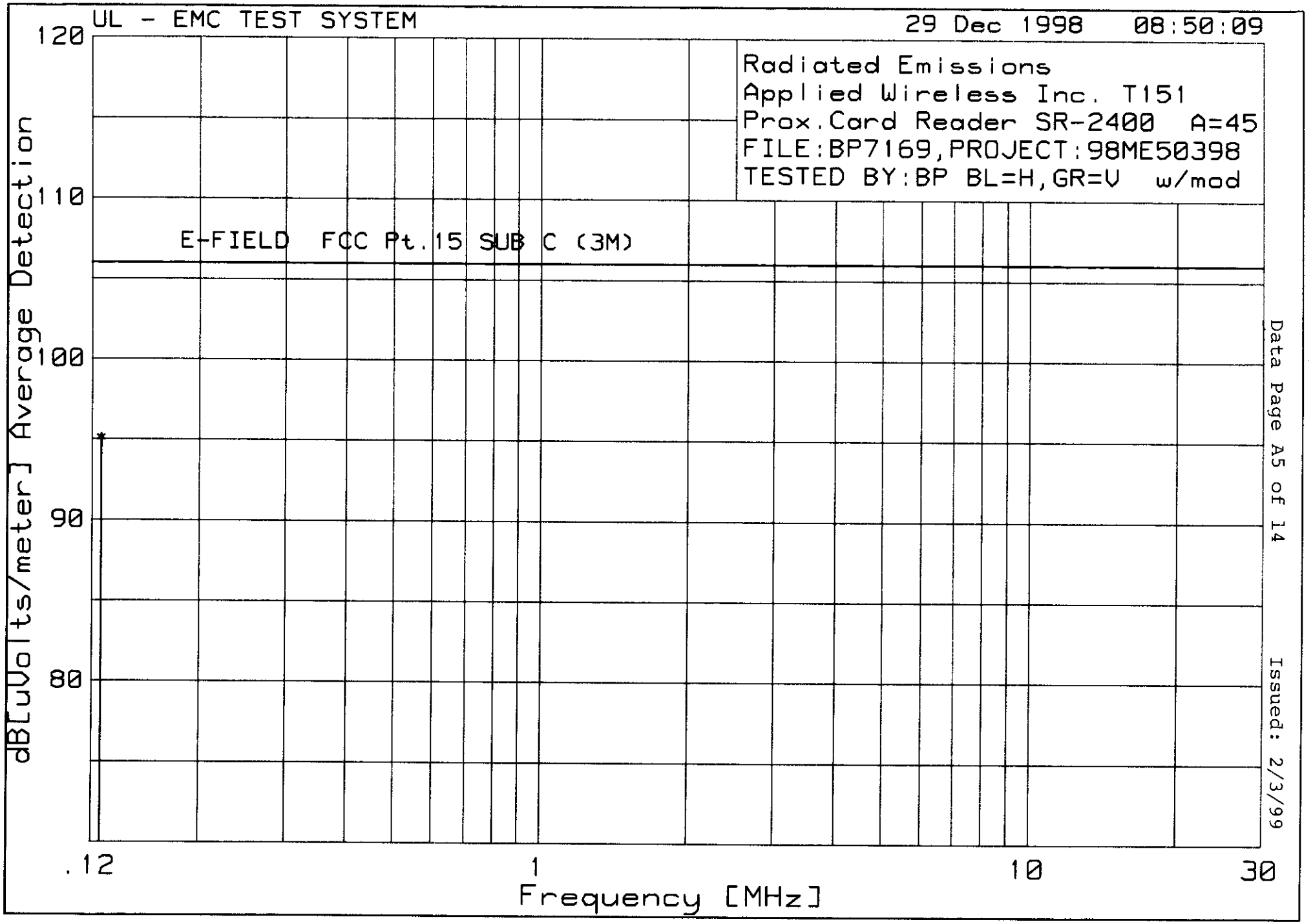
Applied Wireless Inc. T188
Prox.Card Reader SR-2400 A=0
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod

TEST REQUIREMENTS: Radiated Emissions
RECEIVER : Hewlett-Packard Spectum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST FREQUENCY [MHz]	METER READING [dB(uV)]	GAIN/LOSS FACTOR [dB]	TRANSDUCER FACTOR [dB]	LEVEL LIMITS:1	2	3	4
				dB[uVolts/meter]			
.12556	80	.2	16.6	96.8	106	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE


UL - EMC TEST SYSTEM
29 Dec 1998 08:50:09
Radiated Emissions
Applied Wireless Inc. T151
Prox.Card Reader SR-2400 A=45
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
120
110
100
90
80
dB[uVolts/meter]
.12
1
10
30
Frequency [MHz]
Data Page A4 of 14
Issued: 2/3/99


UL - EMC TEST SYSTEM
29 Dec 1998 08:50:09
Radiated Emissions
Applied Wireless Inc. T151
Prox.Card Reader SR-2400 A=45
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
dB[uVolts/meter] Average Detection
120
110
100
90
80
.12
1
10
30
Frequency [MHz]
Data Page A5 of 14
Issued: 2/3/99

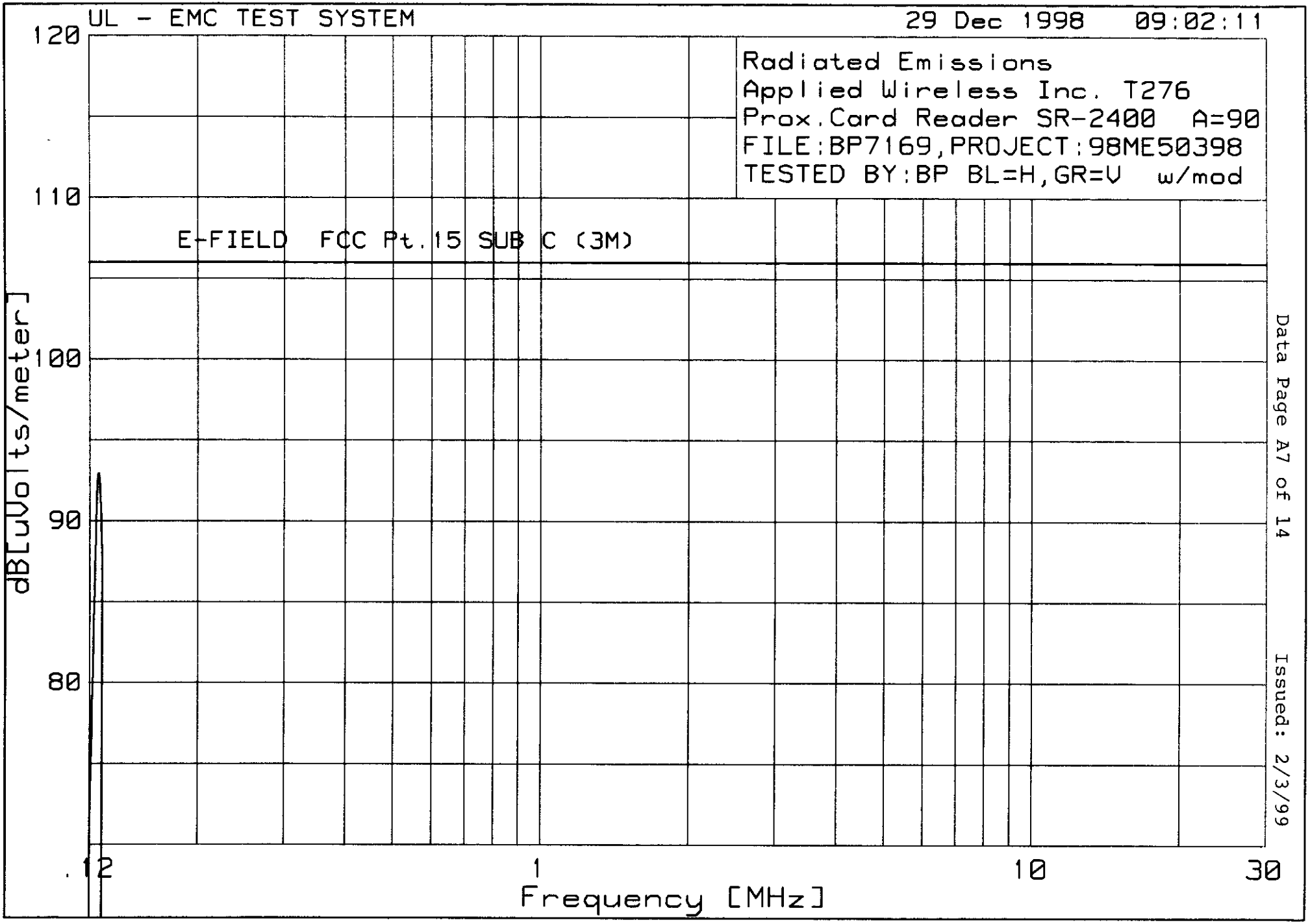
Date Tested: 29 Dec 1998
08:50:09

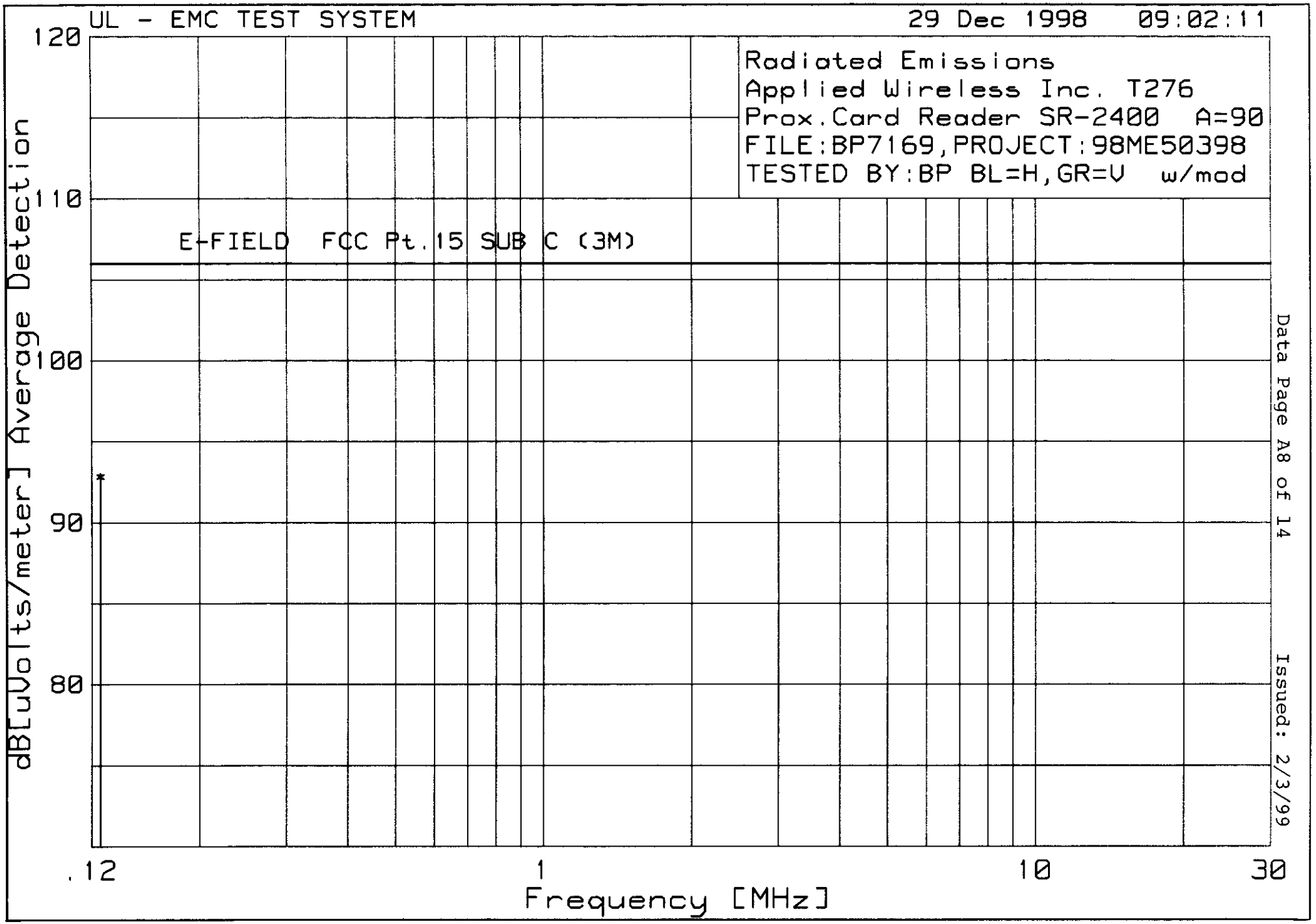
Applied Wireless Inc. T151
Prox.Card Reader SR-2400 A=45
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod

TEST REQUIREMENTS: Radiated Emissions
RECEIVER : Hewlett-Packard Spectum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST FREQUENCY [MHz]	METER READING [dB(uV)]	GAIN/LOSS FACTOR [dB]	TRANSDUCER FACTOR [dB]	LEVEL LIMITS:1	2	3	4	dB[uVolts/meter]
.12552	78.4	.2	16.6	95.2	106	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE


UL - EMC TEST SYSTEM
29 Dec 1998 09:02:11
Radiated Emissions
Applied Wireless Inc. T276
Prox.Card Reader SR-2400 A=90
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
120
110
100
90
80
dB[uVolts/meter]
.12
1
10
30
Frequency [MHz]
Data Page A7 of 14
Issued: 2/3/99


UL - EMC TEST SYSTEM
29 Dec 1998 09:02:11
Radiated Emissions
Applied Wireless Inc. T276
Prox.Card Reader SR-2400 A=90
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
dB[uVolts/meter] Average Detection
120
110
100
90
80
.12
1
10
30
Frequency [MHz]
Data Page A8 of 14
Issued: 2/3/99

UL - EMC TEST SYSTEM

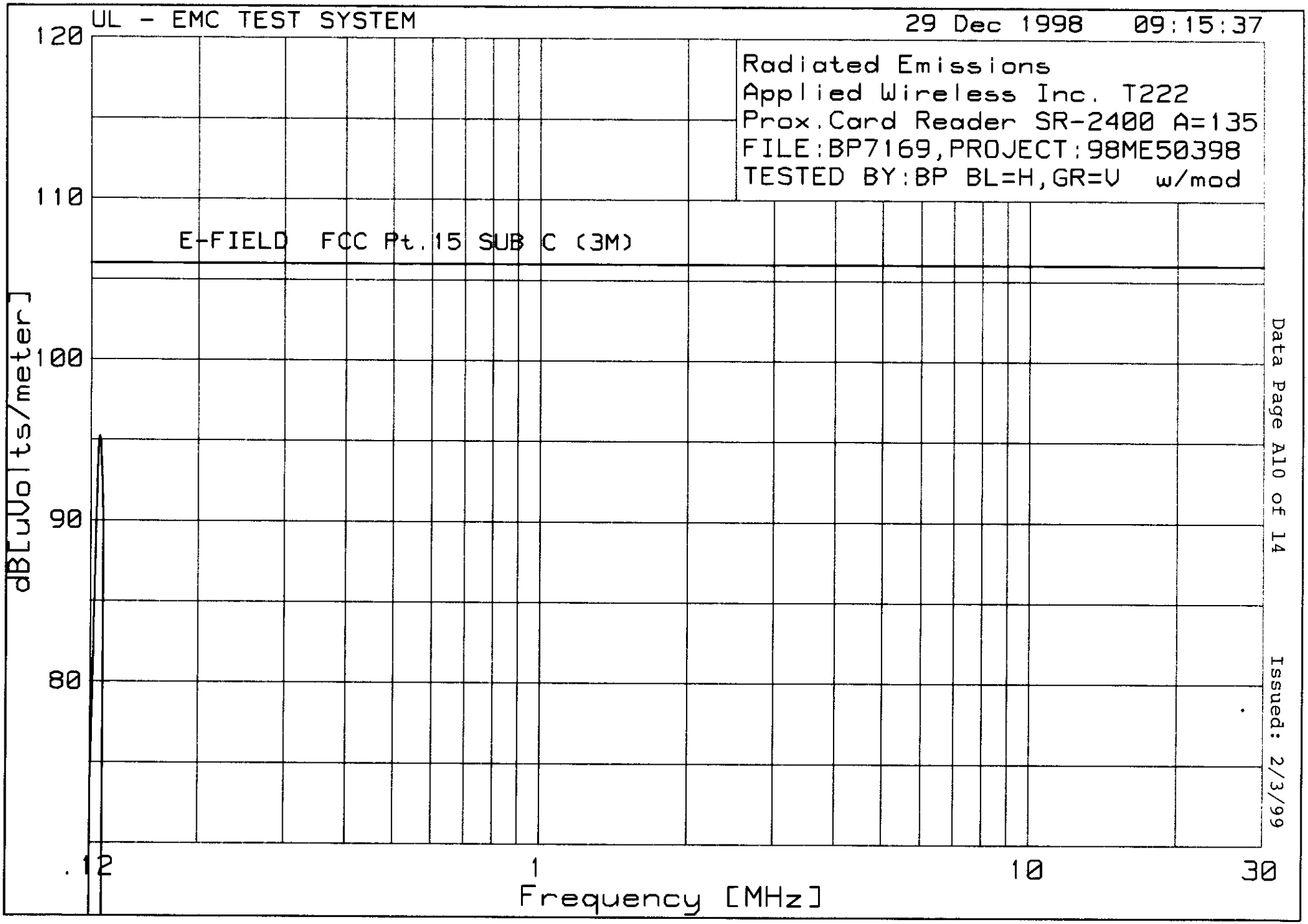
Date Tested: 29 Dec 1998
09:02:11

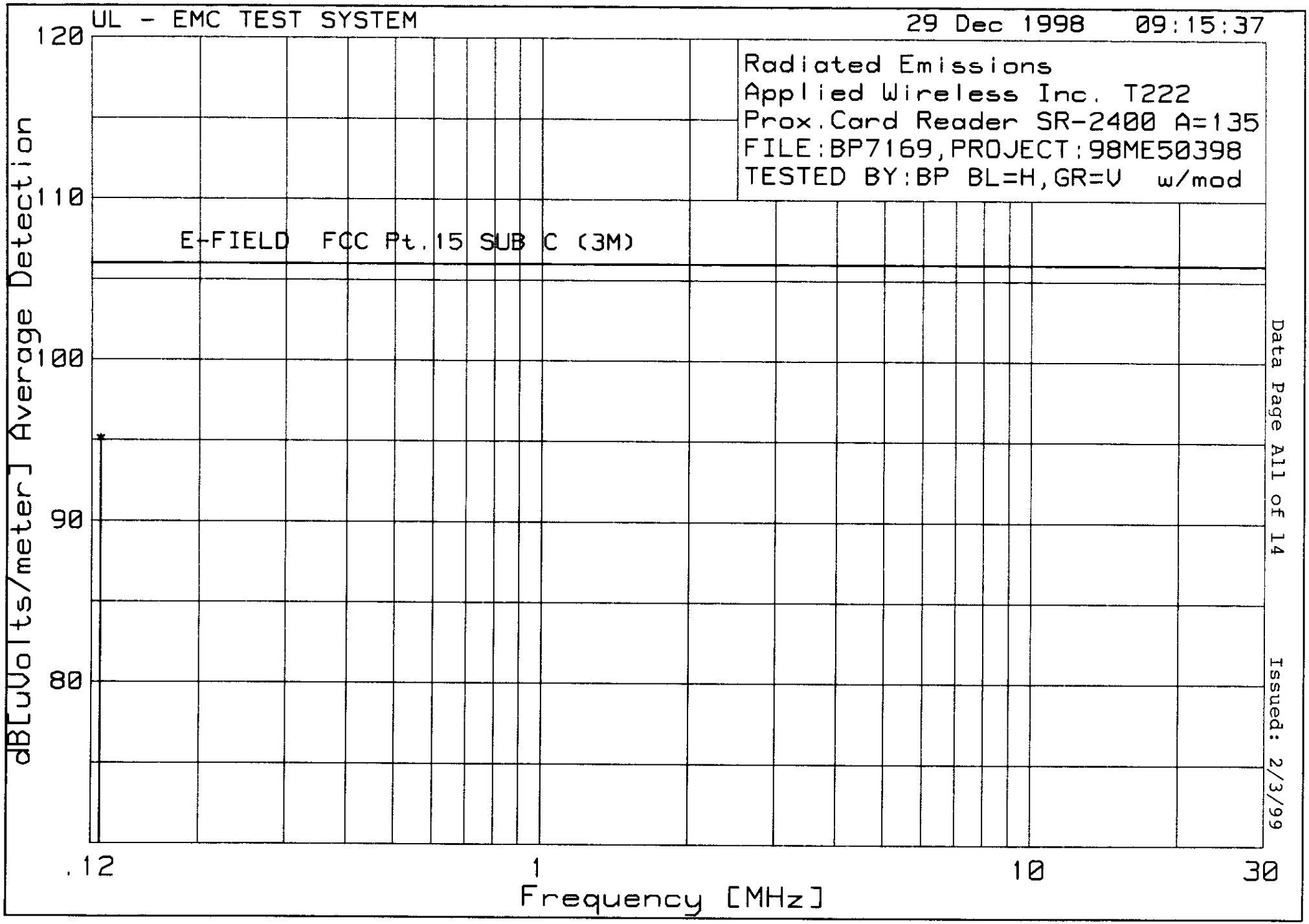
Applied Wireless Inc. T276
Prox.Card Reader SR-2400 A=90
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod

TEST REQUIREMENTS: Radiated Emissions
RECEIVER : Hewlett-Packard Spectum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST FREQUENCY [MHz]	METER READING [dB(uV)]	GAIN/LOSS FACTOR [dB]	TRANSDUCER FACTOR [dB]	LEVEL	LIMITS:1	2	3	4
					dB[uVolts/meter]			
.12539	76.1	.2	16.6	92.9	106	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE


UL - EMC TEST SYSTEM
29 Dec 1998 09:15:37
Radiated Emissions
Applied Wireless Inc. T222
Prox.Card Reader SR-2400 A=135
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
120
110
100
90
80
dB[uVolts/meter]
.12
1
10
30
Frequency [MHz]
Data Page A10 of 14
Issued: 2/3/99


UL - EMC TEST SYSTEM
29 Dec 1998 09:15:37
Radiated Emissions
Applied Wireless Inc. T222
Prox.Card Reader SR-2400 A=135
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
E-FIELD FCC Pt.15 SUB C (3M)
dB[uVolts/meter] Average Detection
120
110
100
90
80
.12
1
10
30
Frequency [MHz]
Data Page All of 14
Issued: 2/3/99

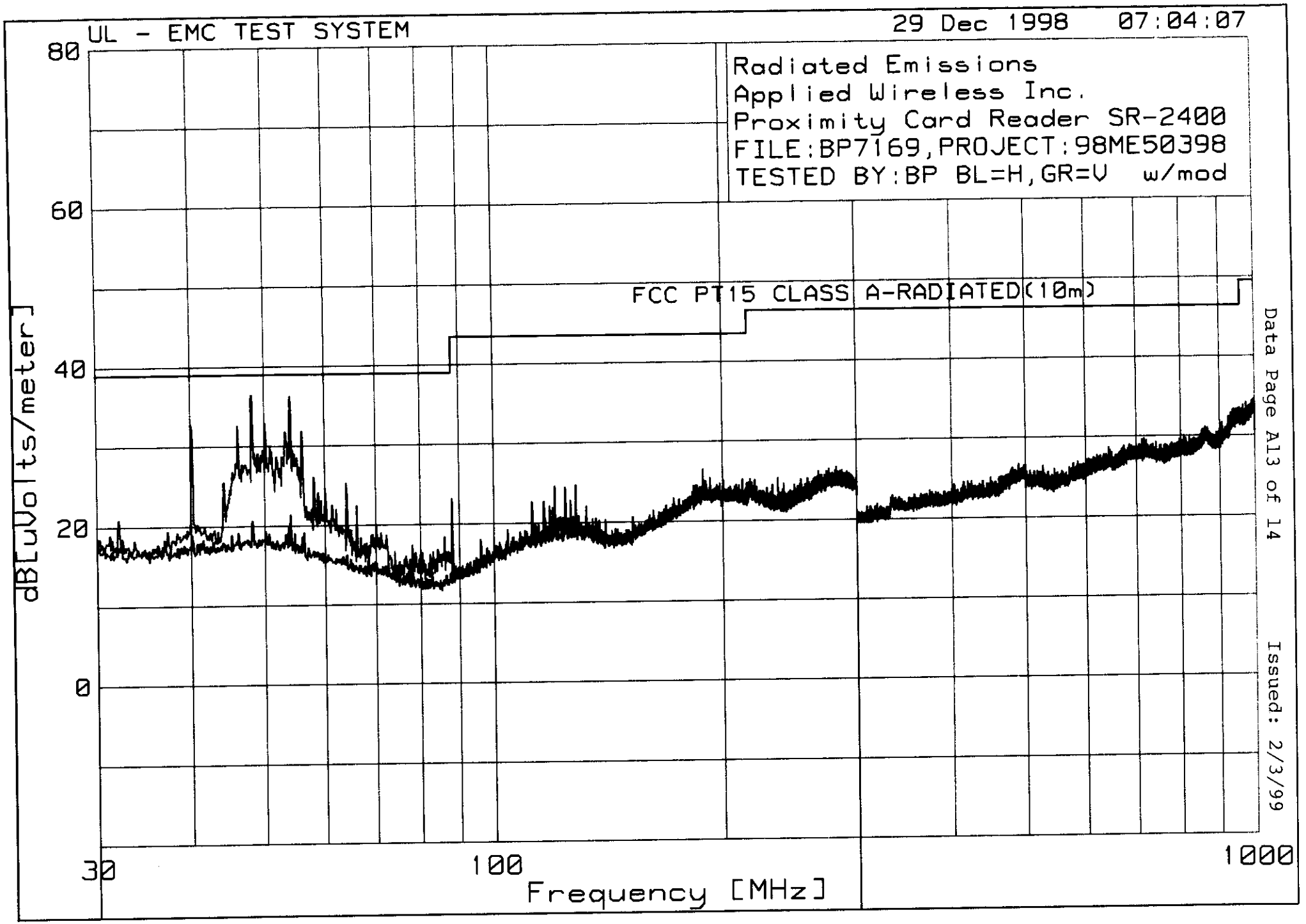
Date Tested: 29 Dec 1998
09:15:37

Applied Wireless Inc. T222
Prox.Card Reader SR-2400 A=135
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod

TEST REQUIREMENTS: Radiated Emissions
RECEIVER : Hewlett-Packard Spectum Analyzer, Model HP8566B
DETECTION MODE : Average
BANDWIDTH : 200Hz for measurements 9kHz to 150kHz
: 10kHz for measurements 150kHz to 30MHz
: 100kHz for measurements above 30MHz

TEST FREQUENCY [MHz]	METER READING [dB(uV)]	GAIN/LOSS FACTOR [dB]	TRANSDUCER FACTOR [dB]	LEVEL	LIMITS:1	2	3	4
					dB[uVolts/meter]			
.12533	78.4	.2	16.6	95.2	106	N/A	N/A	N/A

LIMIT 1 E-FIELD FCC Pt.15 SUB C (3M)
LIMIT 2 NONE
LIMIT 3 NONE
LIMIT 4 NONE


UL - EMC TEST SYSTEM
29 Dec 1998 07:04:07
Radiated Emissions
Applied Wireless Inc.
Proximity Card Reader SR-2400
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod
FCC PT15 CLASS A-RADIATED(10m)
80
60
40
20
0
dB[uVolts/meter]
30
100
1000
Frequency [MHz]
Data Page A13 of 14
Issued: 2/3/99

UL - EMC TEST SYSTEM

Date Tested: 29 Dec 1998
07:04:07

Applied Wireless Inc.
Proximity Card Reader SR-2400
FILE:BP7169,PROJECT:98ME50398
TESTED BY:BP BL=H,GR=V w/mod

DATA POINT [No.]	TEST FREQUENCY [MHz]	METER READING [dB(uV)]	GAIN/LOSS FACTOR [dB]	TRANSDUCER FACTOR [dB]	LEVEL dB[uVolts/meter]	LIMITS:1	2	3	4
1	40.13755	19.7	.3	12.5	32.5	39.0	0.0	0.0	0.0
Azimuth : 311	Height :	250 V		Margin [dB]		-6.5	---	---	---
2	46.14577	19.9	.4	12.7	33.0	39.0	0.0	0.0	0.0
Azimuth : 115	Height :	105 V		Margin [dB]		-6	---	---	---
3	48.15044	23.0	.4	12.8	36.2	39.0	0.0	0.0	0.0
Azimuth : 107	Height :	106 V		Margin [dB]		-2.8	---	---	---
4	50.15022	19.0	.4	12.8	32.2	39.0	0.0	0.0	0.0
Azimuth : 107	Height :	110 V		Margin [dB]		-6.8	---	---	---
5	53.40994	17.4	.4	12.5	30.3	39.0	0.0	0.0	0.0
Azimuth : 126	Height :	121 V		Margin [dB]		-8.7	---	---	---
6	54.16134	22.8	.4	12.4	35.6	39.0	0.0	0.0	0.0
Azimuth : 65	Height :	99 V		Margin [dB]		-3.4	---	---	---
7	56.16112	19.1	.4	12.1	31.6	39.0	0.0	0.0	0.0
Azimuth : 64	Height :	101 V		Margin [dB]		-7.4	---	---	---

H - indicates horizontal antenna polarization.
V - indicates vertical antenna polarization.

LIMIT 1 : FCC PT15 CLASS A-RADIATED(10m)
LIMIT 2 : NONE
LIMIT 3 : NONE
LIMIT 4 : NONE

APPENDIX C

SAMPLE CALCULATIONS

APPENDIX C

Sample Calculations

Radiated Emissions Limit conversion from μV/m to dBμV/m
(limits in accordance with paragraph 15.109)

Radiated Emissions Limit (dBμV/m) = 20*log (μV/m)

Radiated Emissions Limit (dBμV/m) = 20 * log (90)
Radiated Emissions Limit (dBμV/m) = 39.1

Radiated Emissions test data obtained during measurements.

Field Strength (dBμV/m) = Measured field strength(dBμV/m) + Antenna Factor(dB) + Cable Factor(dB)

Field Strength (dBμV/m) = 19.7dBμV/m + 12.5dB + 0.3dB
Field Strength (dBμV/m) = 32.5

Radiated Emissions Limit conversion from μV/m to dBμV/m and 40dB/decade
(limits in accordance with paragraph 15.209)

Radiated Emission Limits; General Requirements

Frequency between 0.009-0.490 MHz 2400/F(kHz) at 300 meters = Field Strength in μV/meter

125kHz 2400/(125) at 300 meters

Radiated emissions at 125 kHz at 300 meters =19.2μV/meter

dBμV/m=20*log(19.2μV/m)

dBμV/m=25.67 at 300meters

40dB/decade

300 meters to 3 meters = 80 dB

Radiated Emissions Limit = dbμV/m + dB

25.66 + 80

105.66 dBμV/m