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PAC Products Limited

Application
For Certification
PAC Electronic Fence

FCC ID: QGS6252009

August, 2002

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1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the *PAC Electronic Fence* for Certification under Part 15.209
There are no other simultaneous applications.

1.2 Product Description

The *PAC Electronic Fence* is an induction loop fence transmitter FC3 that connects directly to an loop-wire antenna to provide a low frequency signal that activate a dog containment collar unit.

PAC Electronic Fence Antenna

The *PAC Electronic Fence* antenna is a loop-wire antenna (1.5mm^2 multi-cored cable PVC 7/0.53 BS 6491X, or equivalent) into a loop of 1500 yards – 15 to 20 ohms max.

1.3 Test Methodology

Emission measurements were performed according to the procedures specified in **ANSI C63.4 (1992)**. Radiated Emissions measurements were performed in Open Area Test Site and in 3m full size semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All 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., Oakdale, Minnesota. This test facility has been fully described in a report dated on May 2000 submitted to your office. Please reference the Registration number: 90706, dated May 19,2000.

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2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

Radiated Emissions testing in frequency range from 9kHz up to 30MHz was performed in Open Area Test Site with a measurement distance of 30m. An Extrapolation Factor of 60dB/decade was used in the frequency range from 9 to 150kHz. Radiated Emissions testing in the frequency range above 30MHz was performed in 3m full size Anechoic Chamber with a measurement distance of 3m.

2.2 EUT Exercising Software

N/A

2.3 Special Accessories

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

2.4 Equipment Modification

No modifications were installed during the testing.

2.5 Support Equipment List and Description

N/A

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2.6 Test Setup and Test Configuration Block Diagrams

The EUT was setup as tabletop equipment, the EUT transmitting antenna (loop-wire, 300’ length) was connected to the transmitter. The EUT was powered at 120VAC/60Hz through AD41–1200300DU AC Adapter 120VAC/12VDC. The transmitter output power was adjusted to the maximum.

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3.0 EMISSION 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 15.209	Radiated Emissions
47 CFR 15.207	Conducted Emissions

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3.1 Radiated Emissions, FCC 15.209

The Radiated Emissions testing was performed in frequency range from 9kHz to 1GHz.
The transmitter output power was adjusted to the maximum.

Table # 3-1-1 and Graph # 3-1-1 show the Radiated Emissions at frequency range from 9kHz to 30MHz.

Table # 3-1-2 shows the Radiated Emissions at frequency range from 30MHz to 1GHz.

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Radiated Emissions from 9kHz to 30MHz **Date:** 08-26-2002

Company: PAC Products Limited
Model: PAC Electronic Fence
Test Engineer: Norman Shpilsher
Special Info:
Standard: FCC Part 15.209
Note: Measurement distance 30m.
Distance Factor 60dB from 9kHz to 490kHz
The table shows the worst case radiated emissions.
Measurements were taken using a CISPR Quasi-Peak detector from 90 to 110kHz and Peak detector at other frequencies.
Measurements were taken Spectrum Analyzer RBW of 100Hz in frequency range below 150kHz and 10kHz in frequency range above 150kHz.

Table # 3-1-1

Frequency MHz	Reading dBµV	Ant. CF dB(1/m)	Net at 3m dBµV/m	Distance Factor dB	(*)15.209 Limit dBµV/m	Limit at 30m dBµV/m	Margin dB
0.0111	2.25	78.03	80.28	60.00	46.74	106.74	-26.5
0.0149	-0.96	75.56	74.60	60.00	44.14	104.14	-29.5
0.0187	-1.13	73.13	72.00	60.00	42.17	102.17	-30.2
0.0218	-3.50	71.74	68.24	60.00	40.84	100.84	-32.6
0.0339	-3.28	68.30	65.02	60.00	37.00	97.00	-32.0
0.0560	-2.84	63.78	60.94	60.00	32.64	92.64	-31.7
0.0810	-4.15	60.23	56.08	60.00	29.43	89.43	-33.4
0.1270	.4.66	56.76	56.76	60.00	25.53	85.53	-28.8
0.1440	-5.14	55.79	50.65	60.00	24.44	84.44	-33.8

Comments:

1. (*) FCC 15.209 limits given with Average detector at frequencies from 9 to 90kHz and from 110 to 490kHz, at other frequencies the limits given with CISPR Quasi-Peak detector
2. No emissions above floor noise were observed in frequency range above above 150kHz.

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TILE Instrument Control System EMI Measurement Software

Radiated Emissions from 30MHz to 1GHz **Date:** 06-10-2002

Company: PAC Products Limited
Model: PAC Electronic Fence
Test Engineer: Norman Shpilsher
Special Info:
Standard: FCC Part 15.209
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 # 3-1-2

Frequency	Ant. Polarity	Reading dBμV	Total CF dB(1/m)	QP at 3m dBμV/m	QP Limit dBμV/m	Margin dB
47.415 MHz	V	15.9	11.0	26.8	40.0	-13.2
127.12 MHz	V	12.6	13.6	26.2	43.5	-17.3
987.06 MHz	H	13.8	26.2	40.1	54.0	-13.9

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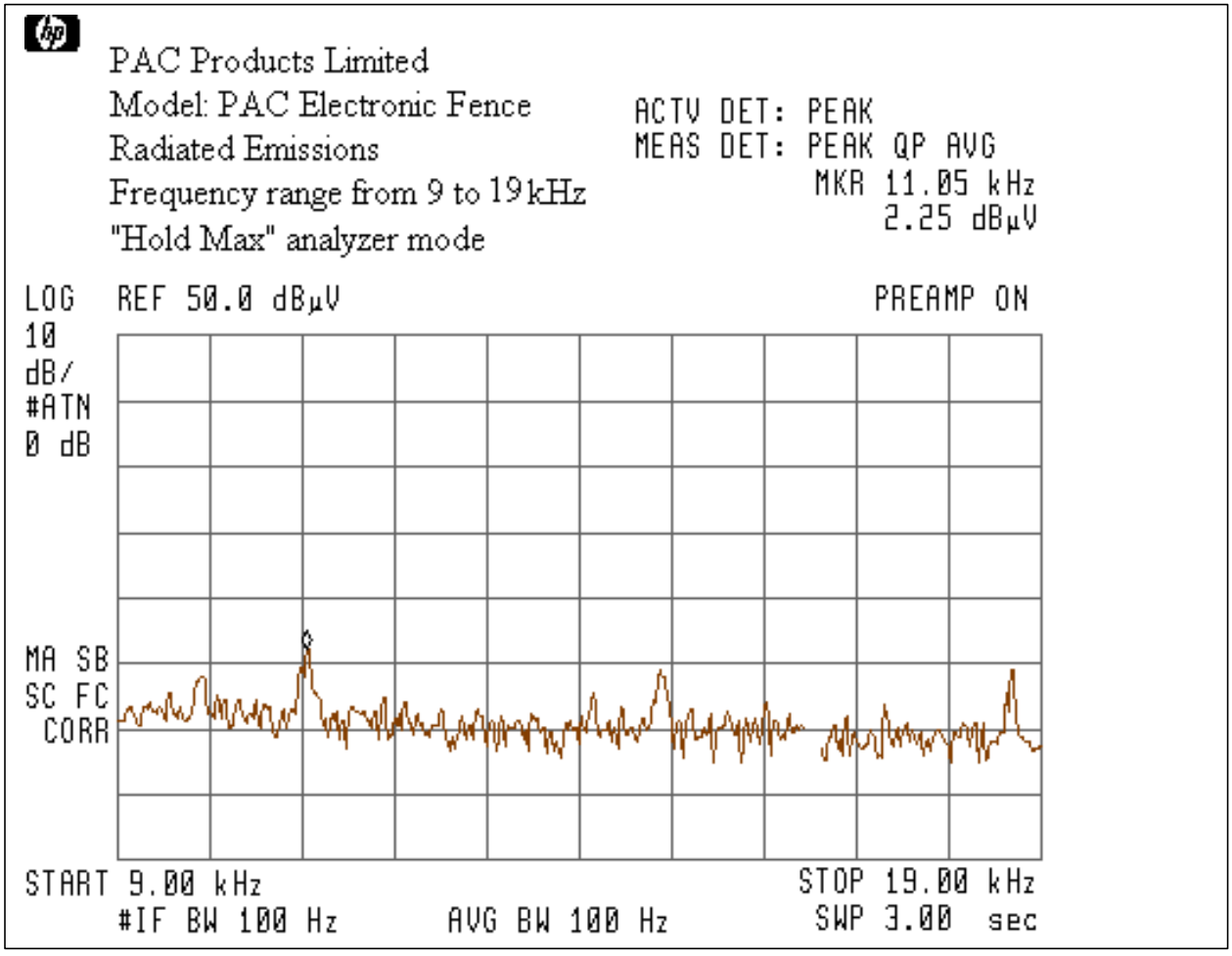
Graph # 3-1-1


PAC Products Limited
Model: PAC Electronic Fence
Radiated Emissions
Frequency range from 9 to 19kHz
"Hold Max" analyzer mode
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 11.05 kHz
2.25 dBµV
LOG
10
dB/
#ATN
0 dB
REF 50.0 dBµV
PREAMP ON
MA SB
SC FC
CORR
START 9.00 kHz
#IF BW 100 Hz
AVG BW 100 Hz
STOP 19.00 kHz
SWP 3.00 sec

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3.2 Conducted Emissions, FCC 15.207

The Conducted Emissions testing was performed in frequency range from 450kHz to 30MHz.
The transmitter output power was adjusted to the maximum and the collar unit was charging to produce the maximum emissions.

Table # 3-2-1 and Graph # 3-2-1show the Conducted Emissions.

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TILE Instrument Control System EMI Measurement Software

Conducted Emissions **Date:** 06-10-2002

Company: PAC Products Limited
Model: PAC Electronic Fence
Test Engineer: Norman Shpilsher
Special Config. Info:
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 # 3-2-1

Line 1

Frequency MHz	QP $dB_{\mu}V$	AVG $dB_{\mu}V$	QP Limit $dB_{\mu}V$	Margin dB
457.37 KHz	33.37	9.09	48.0	-14.6
458.45 KHz	33.21	8.81	48.0	-14.8
459.11 KHz	33.2	9.09	48.0	-14.8
484.87 KHz	31.24	10.97	48.0	-16.7
485.03 KHz	31.25	10.9	48.0	-16.7
490.08 KHz	30.87	8.59	48.0	-17.1
492.06 KHz	30.71	8.37	48.0	-17.3
515.58 KHz	28.64	7.9	48.0	-19.3
517.53 KHz	28.47	8.11	48.0	-19.5
517.79 KHz	28.49	8	48.0	-19.5
518.23 KHz	28.44	8.16	48.0	-19.5
537.16 KHz	27.33	13.37	48.0	-20.6

Line 2

Frequency MHz	QP $dB_{\mu}V$	AVG $dB_{\mu}V$	QP Limit $dB_{\mu}V$	Margin dB
450.49 KHz	32.48	7.76	48.0	-15.5
452.43 KHz	32.24	8.22	48.0	-15.7
463.59 KHz	31.76	8.2	48.0	-16.2
470.35 KHz	31.3	8.67	48.0	-16.7
477.47 KHz	30.89	17.54	48.0	-17.1
477.93 KHz	30.95	17.98	48.0	-17.0
495.72 KHz	29.09	6.8	48.0	-18.9
495.88 KHz	29.15	7.81	48.0	-18.8
502.47 KHz	28.53	7.14	48.0	-19.4
504.7 KHz	28.47	7.34	48.0	-19.5
524.22 KHz	26.86	6.93	48.0	-21.1
528.95 KHz	26.58	7.47	48.0	-21.4

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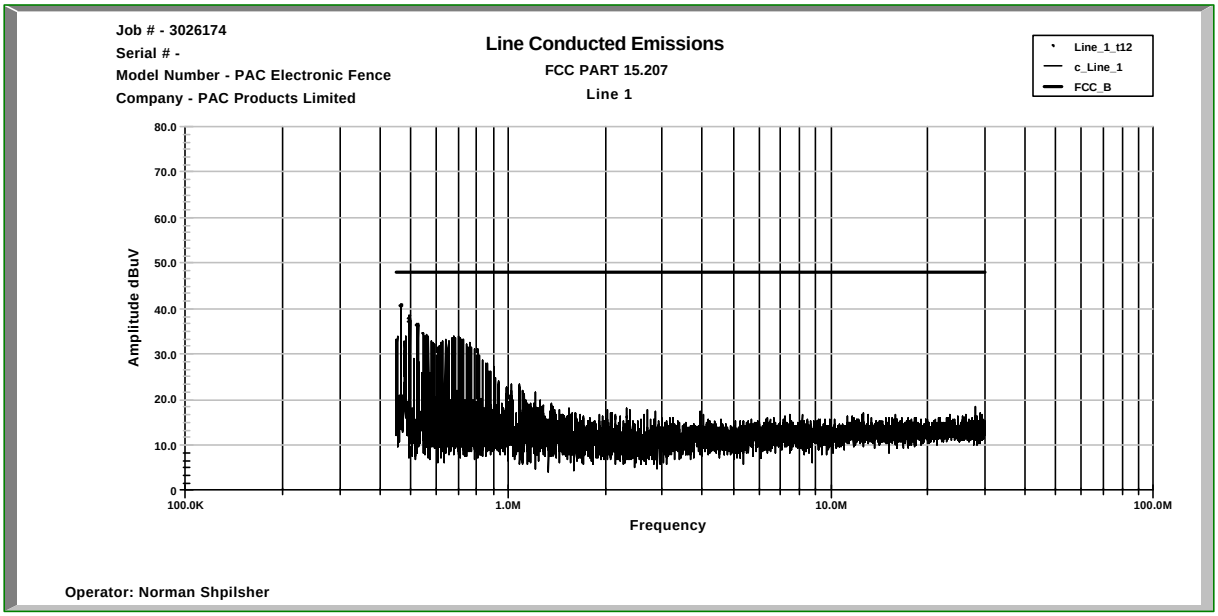
Graph # 3-2-1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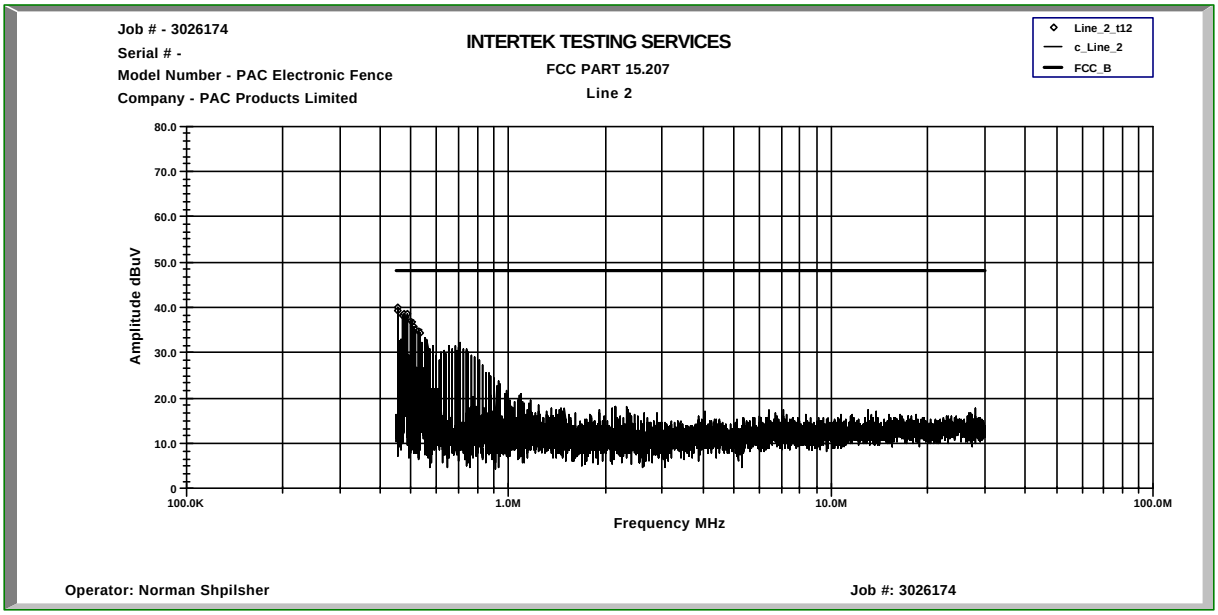
Serial # -
Model Number - PAC Electronic Fence
Company - PAC Products Limited
Line Conducted Emissions
FCC PART 15.207
Line 1
Line_1_t12
c_Line_1
FCC_B
Amplitude dBuV
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
100.0K
1.0M
10.0M
100.0M
Frequency
Operator: Norman Shpilsher


Job # - 3026174
Serial # -
Model Number - PAC Electronic Fence
Company - PAC Products Limited
INTERTEK TESTING SERVICES
FCC PART 15.207
Line 2
Line_2_t12
c_Line_2
FCC_B
Amplitude dBuV
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
100.0K
1.0M
10.0M
100.0M
Frequency MHz
Operator: Norman Shpilsher
Job #: 3026174

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3.3 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane in Open Area Test Site for measurements below 30MHz. For measurements above 30MHz the EUT was placed on a non-conductive table centered on a motorized turntable 0.8m above the ground plane inside the Anechoic Chamber. The loop antenna was used for measurements in frequency range below 30MHz at measurement distance of 30m from the perimeter of the wire circle. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz with measurement distance of 3m. The radiated emissions below 30MHz were maximized by configuring the EUT and by positioning the antenna around the EUT; the center of the loop was 1m above the ground. The radiated emissions above 30MHz 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 3.4.

Conducted Emissions Measurements

Conducted Emissions testing was performed in the Anechoic Chamber. 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 EUT's emissions meet the average limit as measured with the quasi-peak detector.

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3.4 Field Strength Calculation

Calculation of the field strength limits at 11kHz:
Limit at 300m= 20log (2400/F(kHz))
Limit at 300m= 20log (2400/11)
Limit at 300m= 20 log (153.26) = 46.78dBmV/m
Limit at 3m= 46.78 dBmV/m + Distance Factor = 46.78 dBmV/m + 60 dB = 106.78 dBmV/m

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 dBi

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 dBi is subtracted giving field strength of 41.1 dB(μV/m).

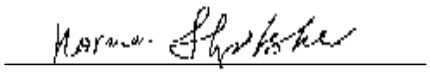
RA = 48.1 dB(μV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dBi
FS = RF + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/m)

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

Tested by:

Norman Shpilsher
EMC Project Engineer
Intertek Testing Services NA, Inc.

Signature



Signature

Date: August 26, 2002

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4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP85462A Receiver RF Section	3325A00106	07/01	07/02	X
HP85460A RF Filter Section	3330A00109	07/01	07/02	X
HP85462A Receiver RF Section	3549A00306	11/01	11/02	X
HP85460A RF Filter Section	3448A00276	11/01	11/02	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Schaffner-Chase Bicono-Log Antenna	2468	11/01	11/02	X
A.H. Systems SAS-200/562B Loop antenna	215	11/01	11/02	X
EMCO Horn antenna 3115	9507-4513	09/01	09/02	
EMCO Horn antenna 3115	6579	12/01	12/02	
EMCO Horn antenna 3116	9904-2423	10/01	10/02	

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
FCC LISN-2	316	01/02	01/03	X
FCC-LISN-50-25-2	2014	04/02	04/03	