MEASUREMENT AND TECHNICAL REPORT ON THE GILBARCO INCORPORATED LOW FREQUENCY MAT READER SYSTEM RADIO FREQUENCY IDENTIFICATION DEVICE

Southwest Research Institute
6220 Culebra Road
San Antonio, Texas 78228-0510

Project 10.04897.01.002
Report Number EMCR 02/024

Prepared for:

Gilbarco Incorporated
7300 West Friendly Avenue
P.O. Box 22087
Greensboro, NC 27420-2087

Prepared by:
David A. Carmony

May 2002

The results of this test report apply only to the specific samples tested. If the manufacturer extends the test results to apply to other samples of the same model, or from the same lot or batch, the manufacturer should ensure the additional samples are manufactured using identical electrical and mechanical components.

ACCREDITED
1110-01

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May 2002

Reviewed by:	**Approved by:**
Ismael Martinez, Jr.	**James J. Polonis**
Sr. Engineering Technologist	**Manager**
Electromagnetic Compatibility Research Section	**Electromagnetic Compatibility Research Section**
Communications Engineering Department	**Communications Engineering Department**

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1.0 GENERAL INFORMATION

1.1 Product Description

The Gilbarco Incorporated Low Frequency (LF) Mat Reader System (Part # C00016-XXX) is a Radio Frequency Identification Device (RFID) that allows customers wishing to purchase products to interface directly with a Point-Of-Sale terminal via a handheld battery-less transponder (tag). The handheld tags (Texas Instruments Part # RI-TRP-Series) are carried by the user. The LF Mat Reader transmits at 134.2 kHz, which provides energy to a handheld tag. The handheld tags contain a unique and secure ID code so each customer can be identified by their individually registered tag. The low frequency antennas of the system create magnetic charge-up fields, known as "read-zones". As soon as a tag enters the "read-zone" (the magnetic charge-up field created by the antenna) the reader receives the unique ID code.

The transmitter portion of the LF Mat Reader operates at 134.2 kHz and is subject to FCC Part 15, Subpart C, "Intentional Radiator"; paragraphs 15.207 and 15.209. The digital electronics portion of the LF Mat Reader is subject to FCC Part 15, Subpart B, "Unintentional Radiator", paragraph 15.109, under the Class A limits and as such, the LF Mat Reader is incorporated into an application that is subject to Class A limits.

Attachment 1 contains a detailed technical description and functionality of the LF Mat Reader and its components. Photographs of the LF Mat Reader are provided in Appendix D.

1.2 Related Grants

A handheld battery-less transponder (Texas Instruments RI-TRP-Series key ring tag) was used to demonstrate operation of the LF Mat Reader during testing. The microreader module (Texas Instruments part No. RI-STU-MRD1) which provides the 134.2 kHz fundamental emission is a component of the LF Mat Reader and has previously received certification under FCC ID: A92MICRO.

1.3 Tested System Details

The Gilbarco LF Mat Reader System is mounted into an application such as a Point-Of-Sale terminal counter or other similar retail/industrial applications. The system includes one Mat Reader Interface Board (M01803), one Mat Reader Assembly (MR01003GXXX), which includes one 134.2 kHz low 'Q' printed circuit board antenna (M02497A001), a 2700Hz, 90dB beeper and one LCD shutter. The system also includes a 120 VAC to +12VDC LPS Wall Mounted Transformer for input power. The 134.2 kHz transmit signal originates on the MicroReader located on the LF Mat Reader Interface Board and travels via the M01872A002 cable to the antenna where it is intentionally radiated. These components are assembled per the drawings in Attachment 4. The LF Mat Reader System operates from 120VAC converted to +12VDC using a step-down transformer. The +12VDC is then converted to +26VDC and +5VDC by means of switching power supply circuits located on the LF Mat Reader Interface Board. The system functional block diagram is located in Attachment 1.

TABLE 1.1
LOW FREQUENCY MAT READER COMPONENTS

Component Description	Gilbarco Part Number	Texas Instruments Part Number
LF Mat Reader Interface Board (1)	M01803A001	NA
MicroReader (1) (one per M01803)	Q13551-01	RI-STU-MRD1
LF Mat Reader Antenna/Beeper Board	M02497A001	NA
+12VDC Wall Mounted Power Supply	M01878B001	NA

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4-1992, and the limits prescribed in CFR 47, FCC 15.207, 15.109, and 15.209. Radiated testing was performed at an antenna-to-EUT distance of 3, 10, 20, and 30 meters. The Gilbarco Low Frequency Mat Reader was signature scanned for radiated emissions in a semi-anechoic chamber. The OATS testing was performed with the LF Mat Reader antenna in a horizontal position for tests above 30 MHz, and a vertical position for tests below 30 MHz.

1.5 Test Facility

The Open Area Test Site (OATS) and the Radiated/Conducted Measurement Facility used to collect data are located at Southwest Research Institute, 6220 Culebra Road, San Antonio, Texas. Details concerning the test site and measurement facility are found in a letter from SwRI to the FCC dated April 30, 2001, which is on file with the FCC Laboratory Division in Columbia, Maryland. On May 30, 2001, the FCC approved the sites for the purpose of providing test results for submission with equipment authorization applications under the Commission's Equipment Authorization Program.

2.0 PRODUCT LABELING

2.1 FCC ID Label

The FCC ID label is shown in the drawing in Attachment 3.

2.2 Location of Label on EUT

The location of the label is shown in the drawing in Attachment 3.

2.3 Supplemental Information to be in the Reader Manual

In addition to reiteration of required information as on intentional radiator, in keeping with sections 15.21 and 15.105 of the FCC rules, the manual supplied with the Gilbarco Low Frequency Mat Reader will also include the following admonitions:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference; in which case, the user will be required to correct the interference at his own expense.

NO MODIFICATIONS: Modifications to this device shall not be made without the written consent of Gilbarco Incorporated. Unauthorized modifications may void the authority granted under Federal Communications Commission Rules permitting the operation of this device.

3.0 SYSTEM TEST CONFIGURATION

3.1 Justification

Radiated tests were performed on the Gilbarco LF Mat Reader intentional radiator from 110 kHz to 30 MHz for the highest fundamental and harmonics. Three polarizations of the receive loop antenna were used. Radiated tests were performed up to 1 GHz for spurious emissions related to the digital electronics portion of the unit. Both vertical and horizontal polarizations of the receive dipoles were tested. Radiated signature scans were made at 3 meters in a shielded anechoic chamber.

Conducted tests were performed on the AC power of the Gilbarco LF Mat Reader from 450 kHz to 30 MHz.

3.2 EUT Exercise

The LF Mat Reader is powered by 120VAC. A handheld battery-less transponder (Texas Instruments RI-TRP-Series key ring tag) was used to demonstrate operation of the LF Mat Reader during testing. For radiated tests of the digital electronics, the 134.2 kHz microreader transmitter was disabled by removing jumper JP22 on the Low Frequency Mat Reader Interface Board.

3.3 Special Accessories

A ferrite bead (Fair-Rite p/n 0444164181) was placed around the four cables that exit the LF Mat Reader Interface Board to reduce the radiated emissions around 200 MHz. The placement of the bead is shown in the photographs in Appendix D.

3.4 Equipment Modification

The ferrite bead described in paragraph 3.3 was installed during radiated emissions testing. The LF Mat Reader actually met the FCC Class A radiated emission requirement without the bead installed. The added ferrite bead dropped the emission at 196.660 MHz (Vertical) from 1.4 dB under the limit to 6.2 dB under the limit.

3.5 Configuration of Tested System

Refer to Section 4.0 for a block diagram of the tested configuration.

4.0 BLOCK DIAGRAM OF THE GILBARCO LOW FREQUENCY MAT READER SYSTEM

A block diagram of the Gilbarco Low Frequency Mat Reader System is provided in Attachment 1.

5.0 CONDUCTED AND RADIATED MEASUREMENT PHOTOS

Refer to Appendix E for photographs of the conducted and radiated test setups.

6.0 CONDUCTED EMISSION DATA

6.1 Conducted Measurement Data

The LF Mat Reader was tested for conducted emissions. The initial step in collecting conducted data was to perform a spectrum analyzer peak scan of the measurement range to determine worse case. A computer-controlled spectrum analyzer was used to produce a peak measurement data plot. Quasi-peak measurements were made on signals that were close to or above the paragraph 15.207 limit. The worse case emission levels are provided in Table 6.1. Appendix A contains conducted emission measurement plots.

TABLE 6.1
WORST CASE CONDUCTED EMISSION LEVELS

Judgment: EUT Passed By 1.6 dB			
FREQUENCY	**MEASURED LEVEL (dBuV)**		**LIMIT (dBuV)**
	HOT	**NEUTRAL**	
516.8kHz		46.3[1]	48
773.1 kHz		46.2[1]	48
497.7 kHz		45.5[1]	48
747.6 kHz		45.5[1]	48
514.7 kHz	46.4[1]		48
497.7 kHz	46[1]		48
773.1 kHz	45.3[1]		48

[1] Readings are quasi-peak measurements made with a spectrum analyzer.

6.2 Conducted Test Instrumentation

The test instrumentation used to make conducted measurements is given in Appendix C.

7.0 RADIATED EMISSION DATA

The LF Mat Reader was tested for radiated emissions. The data below are the corrected highest level electromagnetic emission measurements taken from the radiated data sheets provided in Appendix B. The data sheets include the emission frequencies and the corrected level. An explanation of the field strength calculation is given in paragraph 7.3.

7.1 Radiated Measurement Data

Measurements were made of the fundamental frequency of 134.2 kHz at 20 meters (the fundamental could not be detected at 30 meters). Additionally, the spectrum was investigated for harmonics and spurious emissions to 30 MHz at either 20 or 30 meters. No harmonics of the fundamental emission were detected. No spurious emissions were detected below 30 MHz. The receive loop antenna was placed in three polarizations for the testing below 30 MHz. Scans were performed starting at 110 kHz to verify that neither the fundamental emission, nor any harmonic emission was in the 90-110 kHz restricted band. The measurement level of the fundamental is shown in Table 7.1.

TABLE 7.1
MEASUREMENT OF FUNDAMENTAL FREQUENCY

Judgment: EUT Passed by 26.6 dB							
Frequency	**Receive Antenna Polarization**	**Corrected Level dB(uV/m)**		**Limit @ 20 Meters[1] dB(uV/m)**		**dB Under Limit**	
		Peak	**Average**	**Peak**	**Average**	**Peak**	**Average**
134.2 kHz	Parallel to EUT	53.1	42.1	92	72	38.9	29.9
134.2 kHz	Perpendicular to EUT	48.8	45.4	92	72	43.2	26.6
134.2 kHz	Parallel to Ground	50.9	45.2	92	72	41.1	26.8

[1] Measurements were made at a distance of 20 meters. The fundamental could not be detected at a 30-meter distance. A 40dB per decade roll-off was used to adjust the limit for the 20-meter distance.

The spectrum from 30 MHz to 1000 MHz was investigated for spurious emissions. The worse case spurious emission levels, taken from the data sheets in Appendix B, are given in Table 7.2. Plots of the peak signature scans are provided in Appendix B.

TABLE 7.2
MEASUREMENT OF SPURIOUS EMISSIONS

Judgment EUT passed by 5.7 dB			
Frequency & Antenna Polarization	**Corrected Level [1] dB(uV/m)**	**Limit[2] dB(uV/m)**	**dB under limit**
108.161 MHz Vertical	35.6	43.5	7.9
118.000 MHz Vertical	36.5	43.5	7.0
127.828 MHz Vertical	35.5	43.5	8.0
186.827 MHz Vertical	37.8	43.5	5.7
196.660 MHz Vertical	37.3	43.5	6.2[3]
206.495 MHz Vertical	38.9	43.5	4.6

[1] All readings are quasi-peak manual measurements made with a receiver.
[2] These emissions are related to the digital electronics and are compared to the 15.109 Class A limit.
[3] This emission was 1.4 dB under the 15.109 Class A limit without the ferrite bead installed around the four cables that exit the LF Mat Reader Interface Board. Refer to paragraphs 3.3 and 3.4.

The frequency stability of the LF Mat Reader fundamental emission was verified by varying the AC input voltage between 85% and 115% of the nominal 120 VAC. The frequency of the fundamental emission changed by a maximum of 60 Hz.

7.2 Test Instrumentation for Radiated Measurements

Radiated scans were made at an open area test site (OATS) and in an RF semi-anechoic chamber 28' long x 16' wide x 16' high with its interior lined on the ceiling and four walls with pyramidal absorber material up to four feet in length. Measurements were made with a spectrum analyzer and a quasi-peak adapter in the anechoic chamber and with a receiver at the OATS. The list of test instrumentation used to perform the testing is shown in Appendix C.

7.3 Field Strength Calculation

The field strength was calculated by adding the antenna factor and cable factor, and subtracting the amplifier gain (when used) from the measured reading. The basic equation with a sample calculation is provided below:

FS = RA + AF + CF - AG

Where	FS	=	Field Strength
	RA	=	Receiver Amplitude
	AF	=	Antenna Factor
	CF	=	Cable Attenuation
	AG	=	Amplifier Gain

For example, reducing the first row of the enclosed radiated data sheet on page 24 (33.953 MHz):

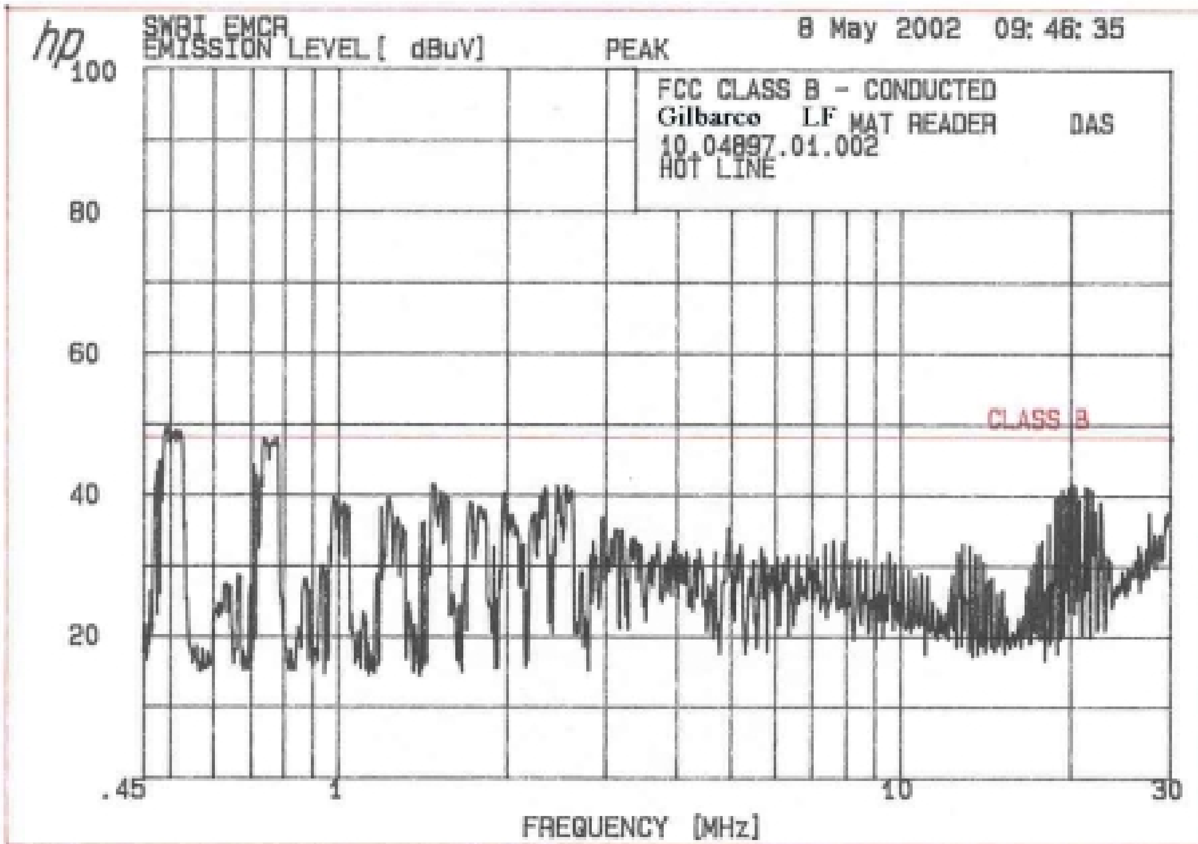
	7.2 dB(uV)
	10.6 dB(1/m)
	2.3 dB (CF/AG FACTOR)
FS =	20.1 dB(uV/m)

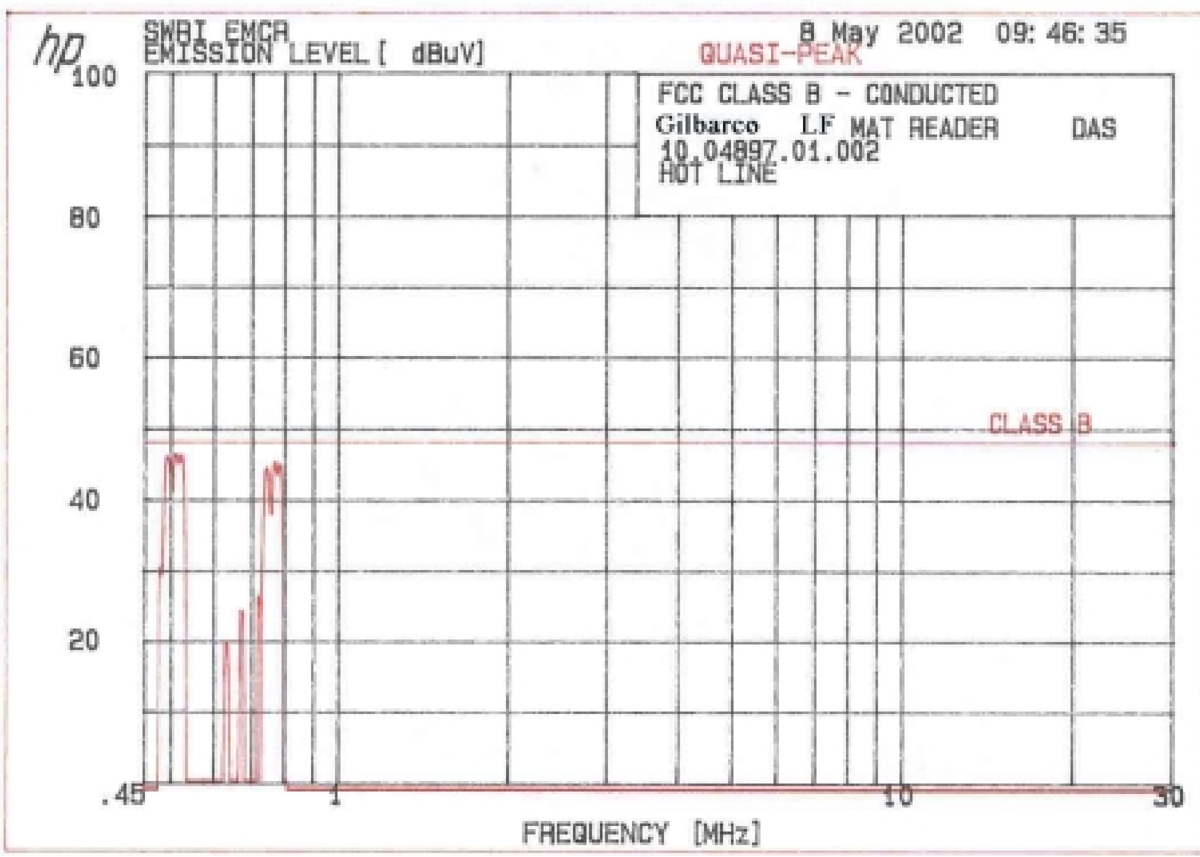
To convert the dB(uV/m) value to its corresponding level in uV/m is as follows:

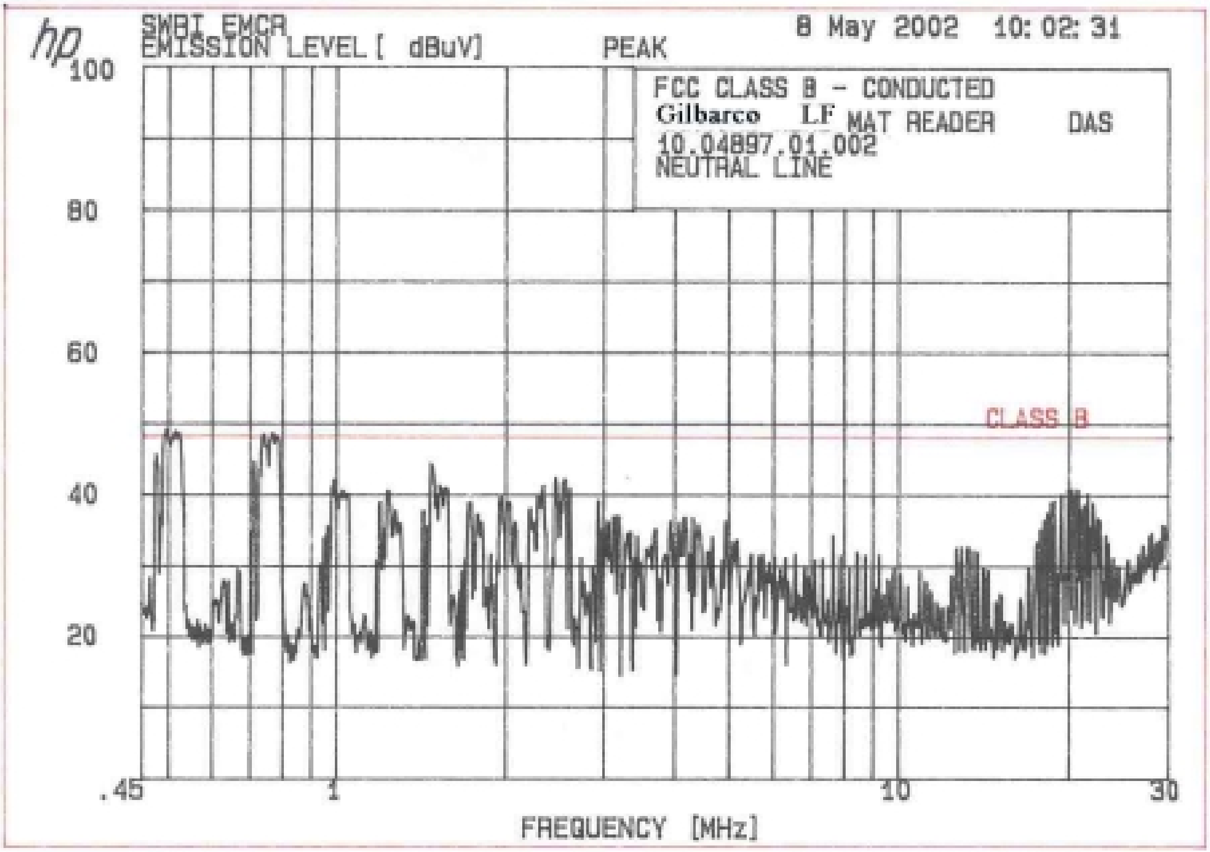
Level in uV/m Common Antilogarithm [(20.1 dBuV/m)/20] = 10.12 uV/m

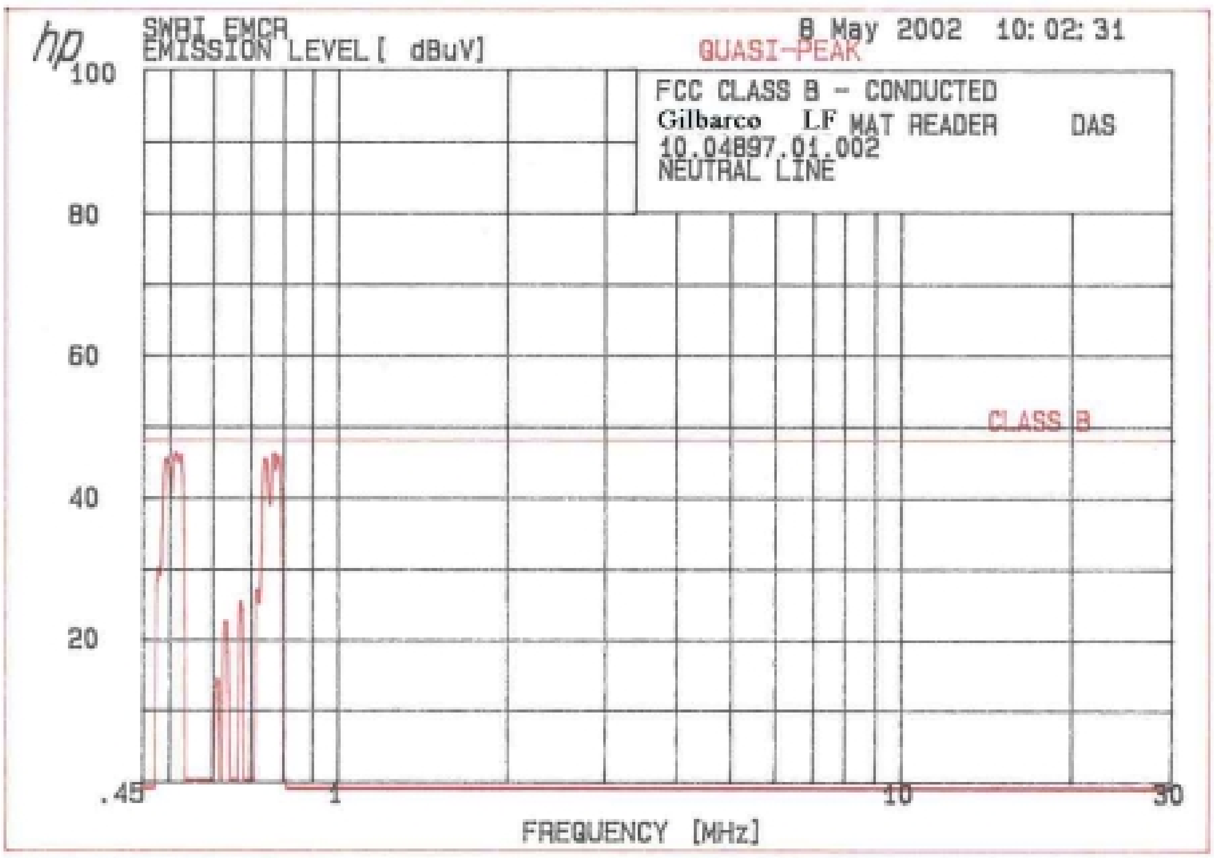
APPENDIX A

CONDUCTED MEASUREMENT PLOTS


hp
SWRI EMCR
EMISSION LEVEL [dBuV]
PEAK
8 May 2002 09: 46: 35
FCC CLASS B - CONDUCTED
Gilbarco LF MAT READER DAS
10.04897.01.002
HOT LINE
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

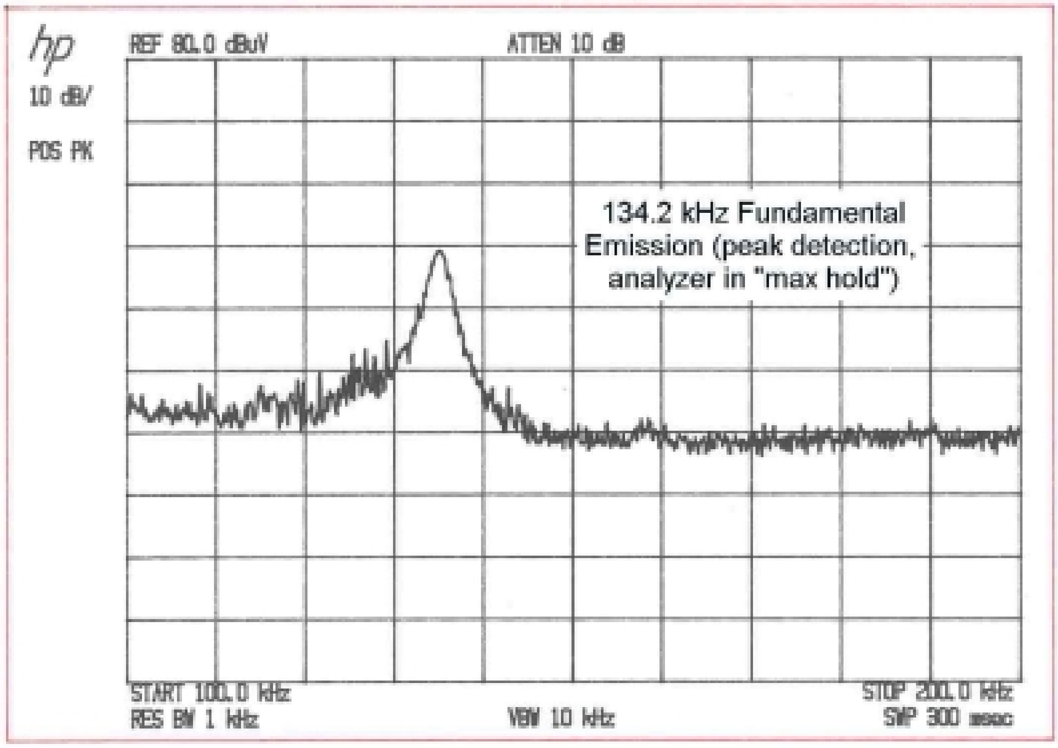

hp
SWRI EMCR
EMISSION LEVEL [dBuV]
QUASI-PEAK
8 May 2002 09: 46: 35
FCC CLASS B - CONDUCTED
Gilbarco LF MAT READER DAS
10.04897.01.002
HOT LINE
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

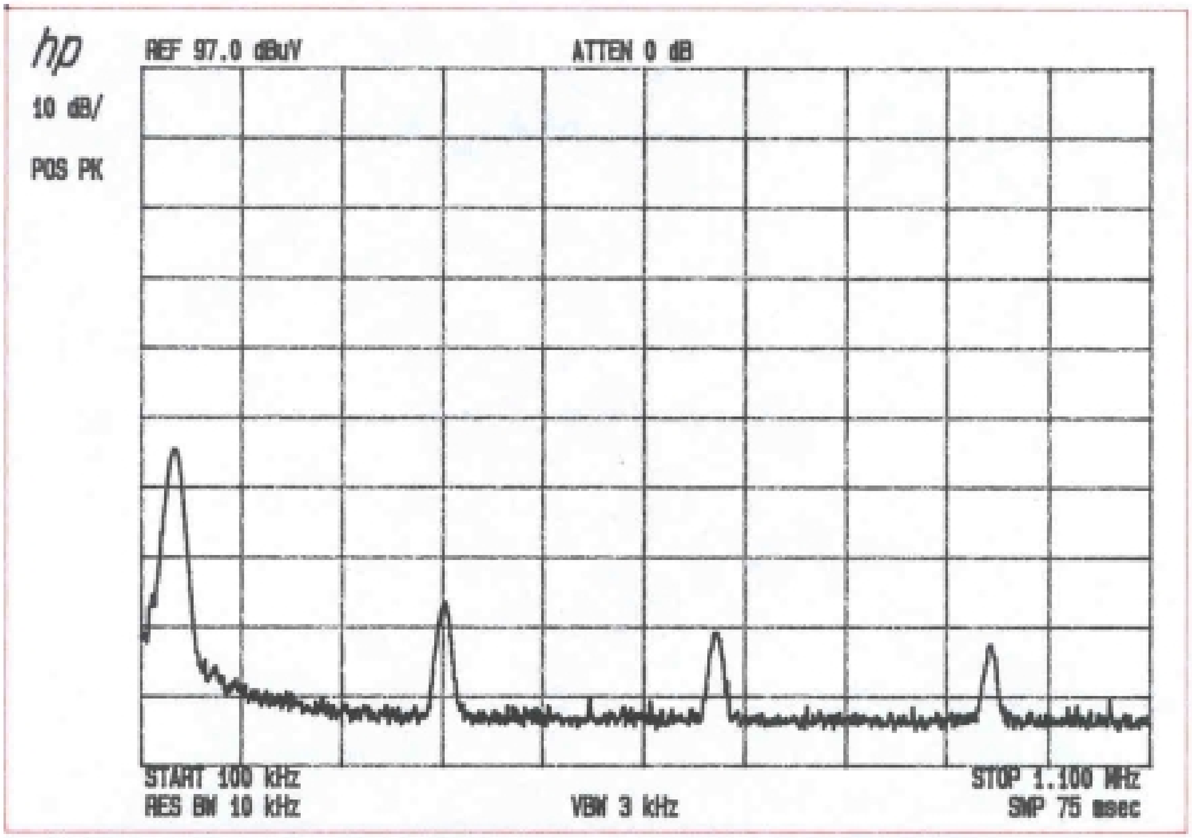

hp
SWRI EMCR
EMISSION LEVEL [dBuV]
PEAK
8 May 2002 10:02:31
FCC CLASS B - CONDUCTED
Gilbarco LF MAT READER DAS
10.04897.01.002
NEUTRAL LINE
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

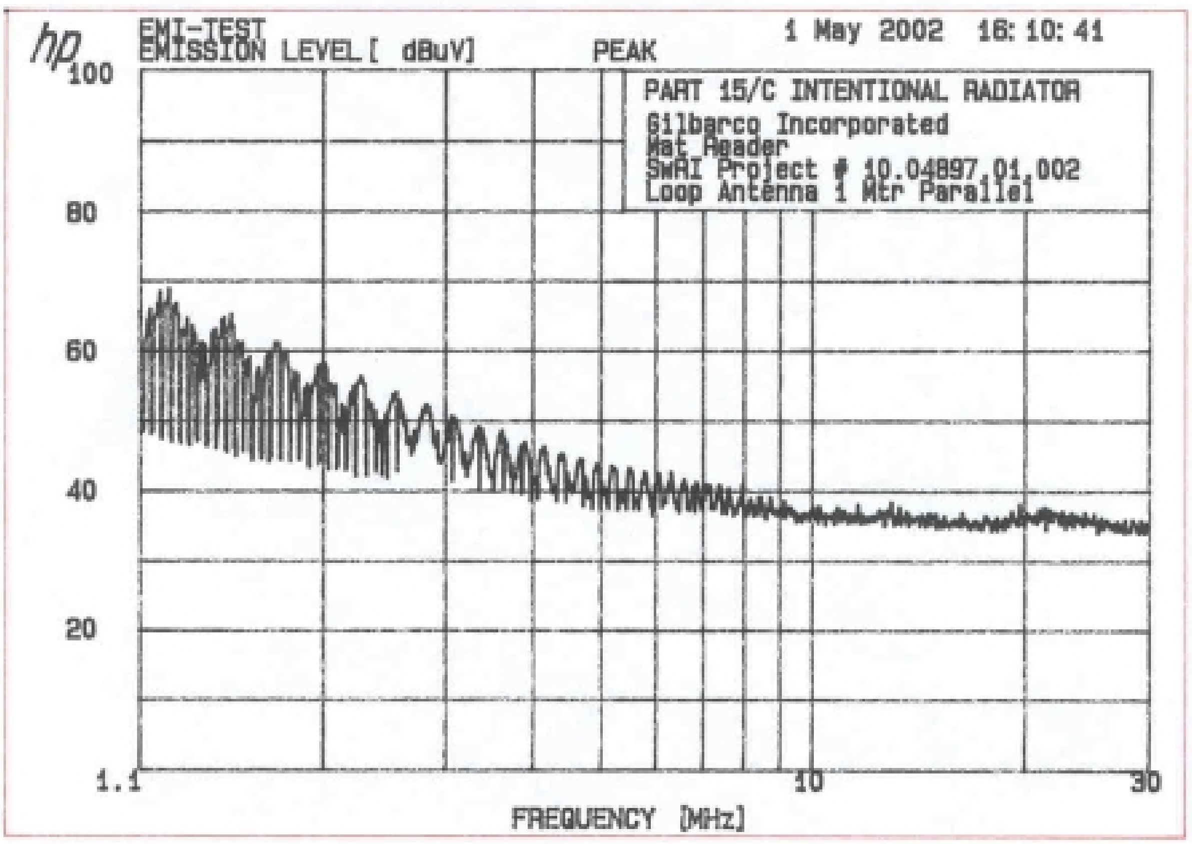

hp
SWRI EMCR
EMISSION LEVEL [dBuV]
QUASI-PEAK
8 May 2002 10:02:31
FCC CLASS B - CONDUCTED
Gilbarco LF MAT READER DAS
10.04897.01.002
NEUTRAL LINE
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

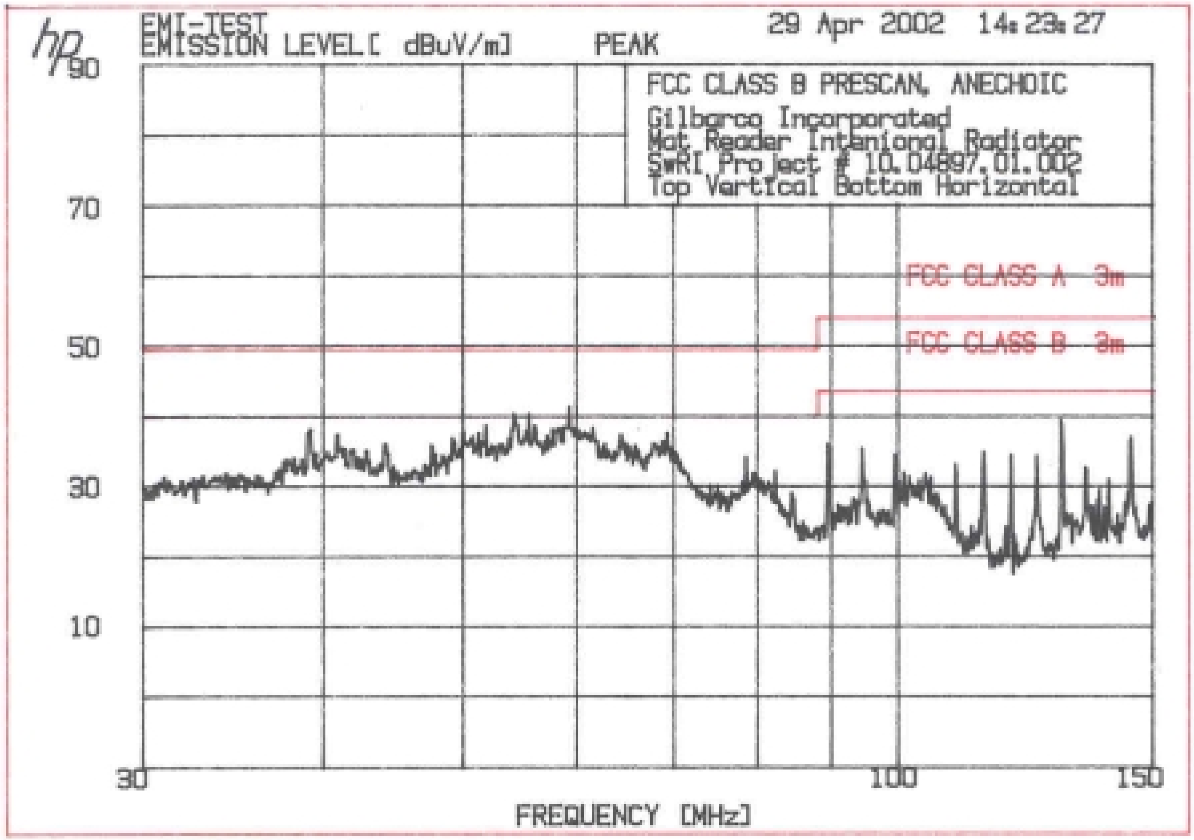
APPENDIX B

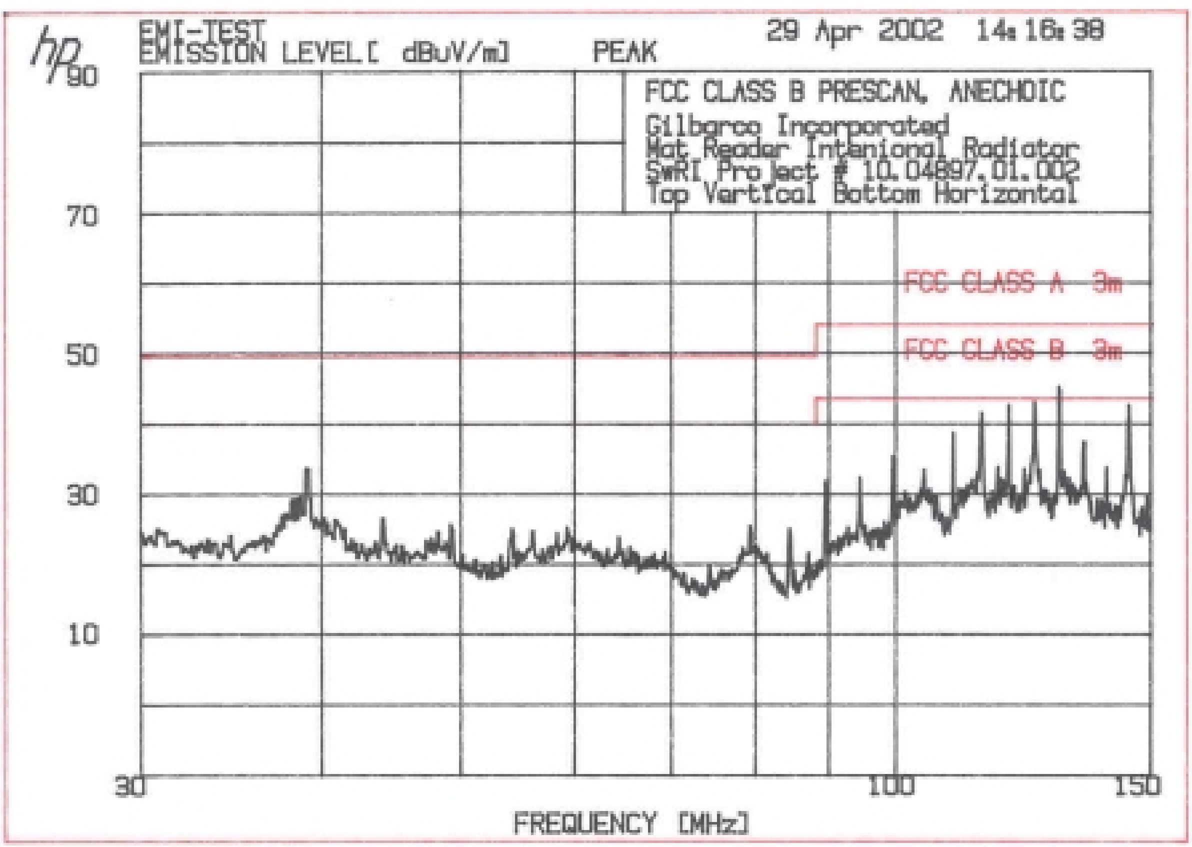
RADIATED SIGNATURE SCAN PLOTS AND OATS DATA SHEETS

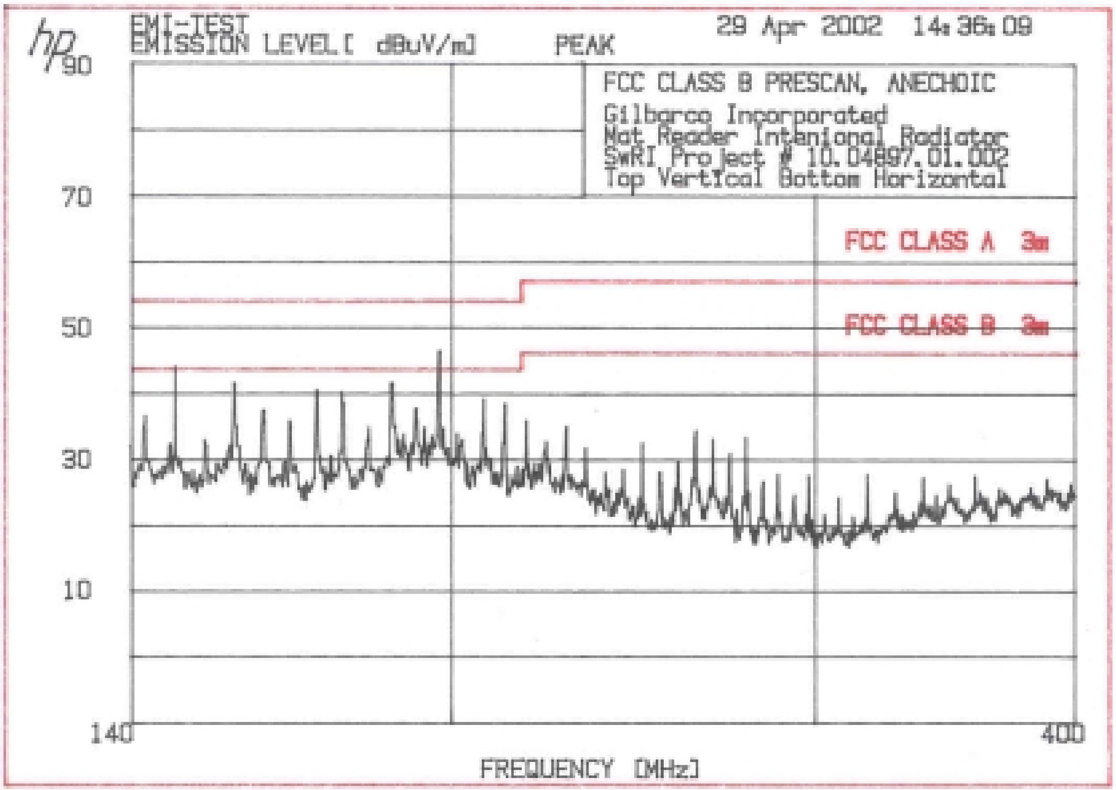

hp
REF 80.0 dBuV
ATTEN 10 dB
10 dB/
POS PK
134.2 kHz Fundamental
Emission (peak detection,
analyzer in "max hold")
START 100.0 kHz
RES BW 1 kHz
VBW 10 kHz
STOP 200.0 kHz
SWP 300 msec

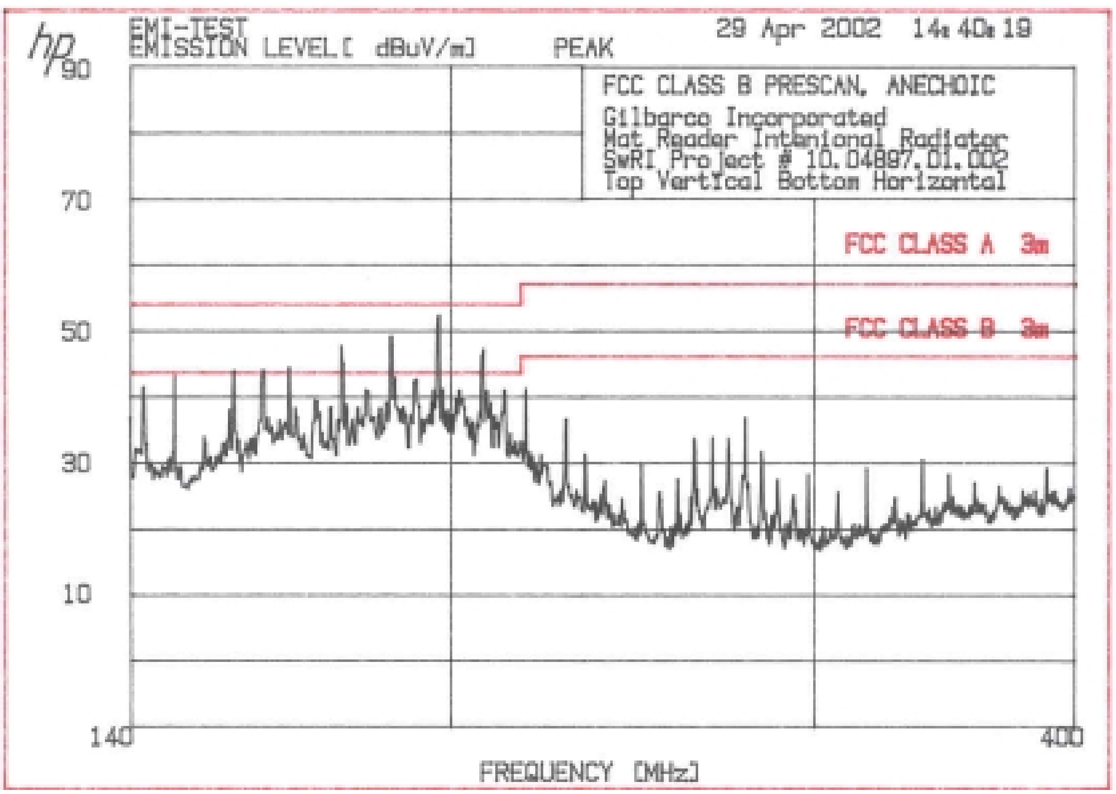

hp
REF 97.0 dBuV
ATTEN 0 dB
10 dB/
POS PK
START 100 kHz
RES BW 10 kHz
VBW 3 kHz
STOP 1.100 MHz
SWP 75 msec

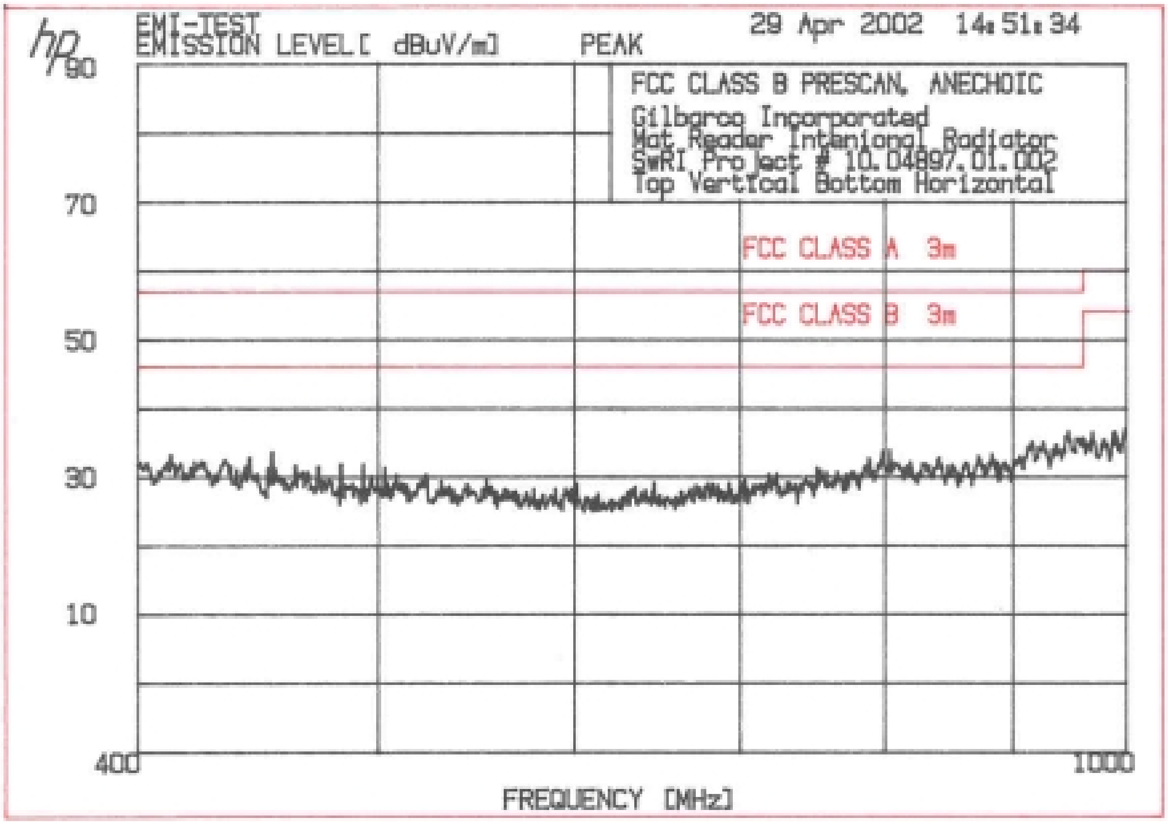

hp
EMI-TEST
EMISSION LEVEL [dBuV]
PEAK
1 May 2002 16: 10: 41
PART 15/C INTENTIONAL RADIATOR
Gilbarco Incorporated
Mat Reader
SWRI Project # 10.04897.01.002
Loop Antenna 1 Mtr Parallel
100
80
60
40
20
1.1
10
30
FREQUENCY [MHz]

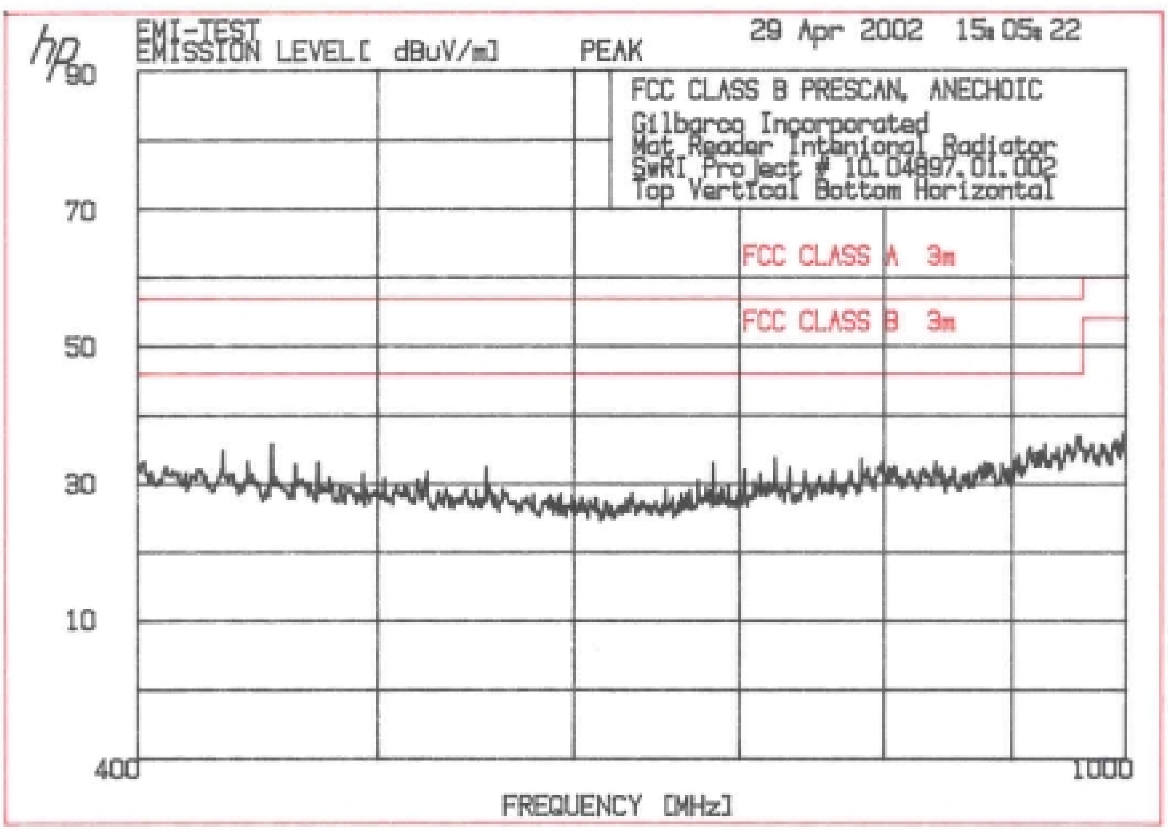

EMI-TEST
EMISSION LEVEL[dBuV/m] PEAK
29 Apr 2002 14:23:27
FCC CLASS B PRESCAN, ANECHOIC
Gilbarco Incorporated
Mat Reader Intenional Radiator
SwRI Project # 10.04897.01.002
Top Vertical Bottom Horizontal
FCC CLASS A 3m
FCC CLASS B 3m
90
70
50
30
10
30
100
150
FREQUENCY [MHz]


EMI-TEST
EMISSION LEVEL[dBuV/m] PEAK
29 Apr 2002 14:16:38
FCC CLASS B PRESCAN, ANECHOIC
Gilbarco Incorporated
Mat Reader Intenional Radiator
SwRI Project # 10.04897.01.002
Top Vertical Bottom Horizontal
FCC CLASS A 3m
FCC CLASS B 3m
90
70
50
30
10
30
100
150
FREQUENCY [MHz]


EMI-TEST
EMISSION LEVEL [dBuV/m] PEAK
29 Apr 2002 14:36:09
FCC CLASS B PRESCAN, ANECHOIC
Gilbarco Incorporated
Nat Reader Intenional Radiator
SwRI Project # 10.04897.01.002
Top Vertical Bottom Horizontal
FCC CLASS A 3m
FCC CLASS B 3m
90
70
50
30
10
140
400
FREQUENCY [MHz]


EMI-TEST
EMISSION LEVEL [dBuV/m] PEAK
29 Apr 2002 14:40:19
FCC CLASS B PRESCAN, ANECHOIC
Gilbarco Incorporated
Nat Reader Intenional Radiator
SwRI Project # 10.04897.01.002
Top Vertical Bottom Horizontal
FCC CLASS A 3m
FCC CLASS B 3m
90
70
50
30
10
140
400
FREQUENCY [MHz]


EMI-TEST
EMISSION LEVEL [dBuV/m] PEAK
29 Apr 2002 14:51:34
FCC CLASS B PRESCAN, ANECHOIC
Gilbarco Incorporated
Mat Reader Intenional Radiator
SwRI Project # 10.04897.01.002
Top Vertical Bottom Horizontal
FCC CLASS A 3m
FCC CLASS B 3m
90
70
50
30
10
400
1000
FREQUENCY [MHz]


EMI-TEST
EMISSION LEVEL [dBuV/m] PEAK
29 Apr 2002 15:05:22
FCC CLASS B PRESCAN, ANECHOIC
Gilbarco Incorporated
Mat Reader Intenional Radiator
SwRI Project # 10.04897.01.002
Top Vertical Bottom Horizontal
FCC CLASS A 3m
FCC CLASS B 3m
90
70
50
30
10
400
1000
FREQUENCY [MHz]

SwRI Open Area Test Site Radiated Emissions v2_2

Device Under Test:	Mat Reader Intentional Radiator	**Project Number:**	10.04897.01.002
Date / Time:	4/30/02 8:45	**Detection Method:**	Pk & Avg & QP
Test Standard (primary limit):	FCC, Part 15 (30m, 15.209 intentional radiator)	**Test Receiver:**	Rohde&Schwarz ESS EMI sn: DE31157
Test Standard (optional limit):	none	**Antenna:**	EMCO 6512 Loop Antenna
Test Sponsor:	Gilbarco	**EUT Mode:**	Powered
Test Technician:	Charles Hale		
Temp.(°F)/Humidity(%):			

Polarization abreviations:
Pg = parallel to ground
Par = parallel to device under test
Per = perpendicular to device under test

FREQ MHz	Orient. θ°	Antenna I.D.	Antenna Pol.	Antenna Ht(m)	Antenna Dis(m)	UnCorr'd Level (dBuV)	Correction Factors (dB) Ant	Correction Factors (dB) Cable	Corr'd Level (dBuV/m)	Primary Limit (dBuV/m)	Optional Limit (dBuV/m)	Margin (Primary) (dB)	Comments (** denotes a measurement above the primary limit) Note: Cable factor includes preamplifier gain at frequencies above 200 MHz.
0.134	0		Par	1.00	20	-13.0	65.7	0.4	53.1	92.0		-38.9	Peak
0.134	0		Par	1.00	20	-24.0	65.7	0.4	42.1	72.0		-29.9	Average
0.110	0		Par	1.00	20	-30.7	65.9	0.4	35.6	73.8		-38.2	Average Ambient
0.110	0		Par	1.00	20	-17.4	65.9	0.4	48.9	93.8		-44.9	Peak Ambient
0.134	0		Per	1.00	20	-17.3	65.7	0.4	48.8	92.0		-43.2	Peak
0.134	0		Per	1.00	20	-20.7	65.7	0.4	45.4	72.0		-26.6	Average
0.110	0		Per	1.00	20	-19.5	65.9	0.4	46.8	73.8		-27.0	Average Ambient
0.110	0		Per	1.00	20	-15.4	65.9	0.4	50.9	93.8		-42.9	Peak Ambient
0.134	0		Pg	1.00	20	-15.2	65.7	0.4	50.9	92.0		-41.1	Peak
0.134	0		Pg	1.00	20	-20.9	65.7	0.4	45.2	72.0		-26.8	Average
0.110	0		Pg	1.00	20	-23.0	65.9	0.4	43.3	73.8		-30.5	Average Ambient
0.110	0		Pg	1.00	20	-17.5	65.9	0.4	48.8	93.8		-45.0	Peak Ambient
0.403	0		Par	1.00	30	-15.3	54.0	0.4	39.1	75.0		-35.9	Peak Ambient
0.403	0		Par	1.00	30	-34.0	54.0	0.4	20.4	55.0		-34.6	Average Ambient
0.455	0		Par	1.00	30	-34.0	54.0	0.4	20.4	54.4		-34.0	Average Ambient
0.455	0		Par	1.00	30	-17.5	54.0	0.4	36.9	74.4		-37.5	Peak Ambient
3.000	0		Par	1.00	30	-15.0	39.2	0.4	24.6	29.5		-4.9	QP
30.000	0		Par	1.00	30	-16.3	33.8	0.4	17.9	29.5		-11.6	QP
0.403	0		Per	1.00	30	-15.0	54.0	0.4	39.4	75.0		-35.6	Peak Ambient
0.403	0		Per	1.00	30	-33.7	54.0	0.4	20.7	55.0		-34.3	Average Ambient
0.455	0		Per	1.00	30	-33.8	54.0	0.4	20.6	54.4		-33.8	Average Ambient
0.455	0		Per	1.00	30	-13.0	54.0	0.4	41.4	74.4		-33.0	Peak Ambient
3.000	0		Per	1.00	30	-16.6	39.2	0.4	23.0	29.5		-6.5	QP
30.000	0		Per	1.00	30	-16.4	33.8	0.4	17.8	29.5		-11.7	QP
0.403	0		Pg	1.00	30	-15.1	54.0	0.4	39.3	75.0		-35.7	Peak Ambient
0.403	0		Pg	1.00	30	-33.5	54.0	0.4	20.9	55.0		-34.1	Average Ambient
0.455	0		Pg	1.00	30	-33.9	54.0	0.4	20.5	54.4		-33.9	Peak Ambient
0.455	0		Pg	1.00	30	-17.1	54.0	0.4	37.3	74.4		-37.1	Average Ambient
3.000	0		Pg	1.00	30	-17.5	39.2	0.4	22.1	29.5		-7.4	Qp
30.000	0		Pg	1.00	30	-16.1	33.8	0.4	18.1	29.5		-11.4	QP

SwRI Open Area Test Site Radiated Emissions v2_2

Device Under Test: Mat Reader Intentional Radiator
Date / Time: 4/30/02 8:45
Test Standard(primary limit): FCC Class A, Part 15 (10 m radiated)
Test Standard(optional limit): CISPR 11 or 22A (10 m radiated)
Test Sponsor: Gilbarco
Test Technician: Charles Hale
Temp.(°F)/Humidity(%): 85/67

Project Number: 10.04897.01.002
Detection Method: QP
EUT Mode: Powered
Test Receiver: Rohde&Schwarz ESS EMI sn: DE31157
Antenna: 5: T2 sn:L174 (primary)
7: T3 sn:L108 (primary)
10: BICON 3104 sn:2107

FREQ MHz	Orient. θ°	Antenna I.D.	Antenna Pol.	Antenna Ht(m)	Antenna Dis(m)	UnCorr'd Level (dBuV)	Correction Factors (dB) Ant	Correction Factors (dB) Cable	Corr'd Level (dBuV/m)	Primary Limit (dBuV/m)	Optional Limit (dBuV/m)	Margin (Primary) (dB)	Comments (** denotes a measurement above the primary limit) Note: Cable factor includes preamplifier gain at frequencies above 200 MHz.
33.953	34	10	V	1.00	10	7.2	10.6	2.3	20.1	39.0	40.0	-18.9	
39.332	362	10	V	1.00	10	9.9	11.0	2.5	23.4	39.0	40.0	-15.6	
49.162	-1	10	V	1.00	10	7.9	10.8	3.0	21.6	39.0	40.0	-17.4	
108.161	184	10	V	1.00	10	18.1	12.7	4.8	35.6	43.5	40.0	-7.9	Digital
113.038	252	10	V	1.00	10	17.1	12.7	4.9	34.8	43.5	40.0	-8.7	Digital
118.000	0	10	V	1.00	10	19.0	12.5	5.0	36.5	43.5	40.0	-7.0	Digital
122.871	360	10	V	1.00	10	13.8	12.3	5.1	31.2	43.5	40.0	-12.3	Digital
127.828	0	10	V	1.00	10	18.2	12.1	5.2	35.5	43.5	40.0	-8.0	Digital
167.162	354	10	V	1.00	10	7.4	15.7	6.2	29.2	43.5	40.0	-14.3	
186.827	-3	10	V	1.00	10	14.3	16.8	6.7	37.8	43.5	40.0	-5.7	Digital
196.660	237	10	V	1.00	10	13.9	16.5	6.9	37.3	43.5	40.0	-6.2	Digital; level with ferrite installed on cables
196.660	237	10	V	1.00	10	18.7	16.5	6.9	42.1	43.5	40.0	-1.4	Digital; level with no ferrite on cables
108.165	128	10	H	4.00	10	4.5	12.7	4.8	22.0	43.5	40.0	-21.5	
113.035	281	10	H	4.00	10	5.5	12.7	4.9	23.2	43.5	40.0	-20.3	
118.000	280	10	H	4.00	10	9.1	12.5	5.0	26.6	43.5	40.0	-16.9	
127.831	288	10	H	4.00	10	10.8	12.1	5.2	28.1	43.5	40.0	-15.4	
147.497	263	10	H	4.00	10	10.8	12.8	5.7	29.3	43.5	40.0	-14.2	
157.330	260	10	H	4.00	10	11.3	14.2	5.9	31.3	43.5	40.0	-12.2	Digital
196.661	108	10	H	4.00	10	11.6	16.5	6.9	35.0	43.5	40.0	-8.5	Digital
206.495	274	5	V	1.00	10	41.2	18.6	-20.9	38.9	43.5	40.0	-4.6	Digital
216.330	314	5	V	1.73	10	34.1	20.5	-20.7	33.9	46.5	40.0	-12.6	Digital
226.161	0	5	V	0.99	10	30.3	20.4	-20.5	30.1	46.5	40.0	-16.4	
350.000	0	5	H	2.28	10	12.6	21.5	-18.3	15.7	46.5	47.0	-30.8	Ambient
550.000	0	7	V	1.27	10	12.3	24.2	-15.2	21.3	46.5	47.0	-25.2	Ambient
900.000	0	7	V	1.27	10	11.7	33.8	-12.7	32.7	46.5	47.0	-13.8	Ambient
535.000	0	7	H	3.02	10	11.7	24.5	-15.4	20.9	46.5	47.0	-25.6	Ambient
900.000	0	7	H	3.02	10	9.6	33.8	-12.7	30.6	46.5	47.0	-15.9	Ambient

APPENDIX C

TEST INSTRUMENTATION

EQUIPMENT USE REPORT

MANUFACTURER	MODEL NO.	DESCRIPTION	SERIAL NO.	CAL DATE
CONDUCTED EMISSIONS				
HP	85650A	Quasi-Peak Adapter	2043A00254	03 Nov 02
HP	8568B	Spectrum Analyzer	2415A00464	14 May 02
Micron	-	Computer	-	NCR
SwRI	---	3 dB Transient Suppressor	L-3	Verified
HP	85685A	Preselector	2510A00123	13 Sep 02
Rhode & Schwarz	ESH2-Z5	LISN	881362/017	04 May 03
ANECHOIC CHAMBER				
Hewlett Packard	8568B	Spectrum Analyzer	2140A01685	02 May 02
Hewlett Packard	85650A	Quasi-Peak Adapter	2043A00213	02 May 02
SwRI	UTC10-221-1	Pre-Amp	9112SN15	Verified
HP	Plotter	7470A	2308A23706	NCR
HP	Printer	890C	-	NCR
-	Computer	-	C100-66	NCR
EMCO	3301B	Rod Antenna	4413	28 Jun 02
EMCO	6512	Loop Antenna	0001-1265	10 Aug 02
EMCO	3121-DB2	Dipole Antenna	148	Verified
EMCO	3121-DB3	Dipole Antenna	148	Verified
EMCO	3121-DB4	Dipole Antenna	1097	Verified
OATS				
Rhode & Schwarz	ESS	EMI Test Receiver	848588/003	23 Jul 02
SwRI	200M-1GHz	OATS Pre-Amp	14-82-020	Verified
EMCO	3104	Biconical Antenna	2107	18 Sep 02
Empire	DM-105-T2	Dipole Antenna	L-000174	31 May 02
Empire	DM-105-T3	Dipole Antenna	L-000108	31 May 02
EMCO	6512	Loop Antenna	0001-1265	10 Aug 02
VOLTAGE VARIATION				
HP	8568B	Spectrum Analyzer	2415A00464	14 May 02
EMCO	6512	Loop Antenna	0001-1265	10 Aug 02
Behlman	150-C	AC Power Source	14-3-374A	Verified
HP	3300A	Function Generator	619-01232	Verified
Fluke	187	True RMS Multimeter	80900084	26 Apr 03

NCR = No Calibration Required

APPENDIX D

PHOTOS OF TESTED EUT

The photos of the tested EUT are in the electronic file “Appendix D Photos of Tested EUT.jpg”

APPENDIX E

PHOTOS OF TEST SETUPS

The test setup photos are in the electronic file “Appendix E Test Setup Photos.jpg”

ATTACHMENT 1

FUNCTIONAL DESCRIPTION AND BLOCK DIAGRAM

ATTACHMENT 2

INSTALLATION INSTRUCTIONS

ATTACHMENT 3

FCC ID LABEL

ATTACHMENT 4

SCHEMATICS