TEST REPORT

0.0 Summary of Test Results

Radio Shack, A Division of Tandy Corporation - Model: 20-423 (PRO-2017)
FCC ID: AAO2000423

TEST	REFERENCE	RESULTS
Radiated Emission	15.109	Complies
Conducted Emission	15.107	Complies

We attest to the accuracy of this report:

Barry Smith
Test Engineer

David Chernomordik
EMC Site Manager

1.0 General Description

1.1 Product Description

The General Research of Electronics, Inc. Model No.: 20-423 (PRO-2017) is a scanning receiver used to listen to police and fire departments, ambulance services, government agencies, private companies, amateur radio services, aircraft and military operations.

Please refer to the attached users manual for more details.

A pre-production version of the sample was received on October 22, 1999 in good condition.

1.2 Related Submittal(s) Grants

This is an Application for Certification of a scanning receiver.

1.3 Test Methodology

Both AC mains line-conducted (if applicable) and radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Section"** of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is Site 1. This test facility and site measurement data have been fully placed on file with the FCC.

GRE GENERAL RESEARCH OF ELECTRONICS, INC.

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SHIBA NO.3 AMEREX BLDG.
3-12-17 MITA, MINATO-KU
TOKYO, JAPAN

Tokyo: AUG. 20, 1999

Reference No. 99013

SPECIFICATION

SUBJECT : VHF/UHF DIRECT ENTRY PROGRAMMABLE AM/FM SCANNER
PRO-2017 CAT. NO. 20-423 (USA and CANADA MODELS)

1. GENERAL

-1 Programmable channel : 10 bank 20 channel (200 channel) memory banks
4 pre-programmed band search
Direct search
20 monitor channels
50 frequency-skip memories in search mode
200 channels lock-out in scan mode
7 WX pre-programmed frequencies with 1050Hz alert system
1 Priority channel

-2 Receiving system : PLL synthesizer dual-conversion superheterodyne
1st IF 10.7MHz: The 1st Local OSC frequency for VHF Lo and AIR Band employs upper side of receiving frequency range.
: The 1st Local OSC frequency for VHF Hi and UHF Low Band employs lower side of receiving frequency range.
2nd IF 455kHz : The 2nd Local OSC frequency employs lower side of 1st IF.

-3 Wire programming : PC to Earphone Jack

-4 Frequency range :

Freq.	Step	Mode
29.0000 ~ 54.0000MHz	5.0kHz	FM
108.0000 ~ 136.9875MHz	12.5kHz	AM
137.0000 ~ 174.0000MHz	5.0kHz	FM
380.0000 ~ 512.0000MHz	12.5kHz	FM

-5 Pre-programmed band search : Fire/Police (FD/PD)
Ham
Air
Marine

- cont'd -

-6	WX 7 Frequencies with alert function	:	162.400, 162.425, 162.450, 162.475, 162.500, 162.525, 162.550MHz
-7	Scanning rate	:	25 channels/sec.
-8	Search rate	:	50 steps/sec.
-9	Display	:	LCD w/backlighting
-10	Speaker	:	Built-in 77mm 8 ohms dynamic speaker
-11	Audio output	:	1.0W
-12	Operating voltage and power consumption	:	120V AC, 60Hz 8W use: AC-DC adaptor
-13	Dimension	:	Approx. 210 (W) x 175 (D) x 52 (H) mm
-14	Weight	:	Approx. 680g
-15	Accessory	:	Telescopic-antenna, UL/CSA listed AC-DC adaptor and Owner's manual
-16	Memory backup	:	Capacitor

2. ELECTRICAL

				Nominal	Limit
-1	Frequency range	:	VHF Low		29- 54MHz
			AIR		108-136.9875MHz
			VHF High		137-174MHz
			UHF Low		380-512MHz
-2	Sensitivity (S+N)/N=20dB DEV.: 3kHz at 1kHz MOD.: 60% at 1kHz	:	VHF Low	0.5μV	1μV
			AIR	1μV	3μV
			VHF High	0.5μV	2μV
			UHF Low	0.7μV	3μV
-3	Tone decode sensitivity 1050Hz 4kHz dev. at 162.400MHz	:	WX Alert	0.5μV	2μV
-4	Image ratio	:	All band		Not specified
-5	Squelch sensitivity (Band center)				
	Threshold	:	FM and AM	0.5μV	2μV
	Tight: (S+N)/N	:	FM	25dB	15dB
		:	AM	20dB	10dB

				Nominal	Limit
-6	Selectivity	:	-6dB	±10kHz	±14kHz
			-50dB	±18kHz	±25kHz
-7	Spurious rejection (Except Primary image)	:	VHF Low at 40MHz	50dB	30dB
			VHF High at 154MHz	50dB	30dB
			UHF Low	Not specified	
-8	IF rejection	:	10.7MHz at 154MHz	70dB	60dB
-9	Acceptable radio frequency displacement a: EIA RS-204D	:	VHF 154MHz	±6kHz	±3kHz
-10	Signal to noise ratio	:	VHF Low at 40MHz	50dB	39dB
	RF : 100μV		AIR at 124MHz	45dB	30dB
	DEV. : 3kHz at 1kHz		VHF High at 154MHz	45dB	30dB
	MOD. : 60% at 1kHz		UHF at 450MHz	35dB	25dB
-11	Residual noise Vol. min. and Squelched	:	at 154MHz	1mV	3mV
-12	Scanning rate	:		25ch/sec.	22-28ch/sec.
-13	Search rate	:		50 steps/sec.	45-55 steps/sec.
-14	Scan and Search delay time	:		2sec.	1-3sec.
-15	Priority sampling	:		2sec.	1.5-2.5sec.
-16	Priority CH checking time	:			
	WX Frequency			140msec.	200msec.
	Other Frequency			40msec.	50msec.
-17	Audio output (T.H.D. 10%) 8Ω R Load 1kHz	:	RF input : 100μV at 154MHz	0.8W	0.5W
-18	T.H.D. at 0.5 watt output	:	RF input : 100μV at 154MHz	3%	8%
-19	Audio max. power	:	RF input : 100μV at 154MHz		
	8Ω Internal speaker			1.0W	0.8W
	32Ω earphone mon/stereo (each phone)			17/10mW	25mW
-20	Audio frequency response at -6dB	:	RF input : 100μV at 154MHz	300Hz	200Hz-400Hz
				2.0kHz	1.5kHz-3.0kHz
-21	Intermediate frequency	:	1st 10.7MHz		
			2nd 455kHz		

-22	Operating voltage and power consumption	: 120V AC 60Hz	8W	10W
-23	Memory hold time		10 Hours	1 Hour
-24	Birdies and step frequency when search	: Under discussion		
-25	Filter	: Monolithic crystal filter for 10.7MHz and ceramic filter for 455kHz		
-26	Antenna impedance	: 50 ohms		
-27	Temperature range	: Test to specification between: +18°C - +35°C Operate (Need not meet spec.): 0°C - +43°C		

3. OPERATING CONTROL

-1 Volume control
-2 Squelch control
-3 Power switch
-4 Keyboard (22 keys)
-5 LCD indicator:
7 digits frequency with MHz
3 digits memory channel
5 band search
FD/PD
AIR
HAM
MARINE
WX
10 banks indication
Receiver condition
SRCH
SCAN
MAN
PGM
DLY
L/O
PRI
▲ and ▼
M for monitor
-d- for Direct search
-b- for Band search
L-r for Frequency lock-out Review
ALErt for Alert mode
WirEd for wired programming mode
-6 Motorola type antenna connector
-7 12V DC power jack
-8 Reset switch
-9 Earphone/pc jack (D=3.5mm stereo)

4. KEY FUNCTION

BAND
ALERT/PRIority
WX
MANUAL
SCAN
MONitor/CLear
▲ and ▼
ProGraM
Lock-Out ReVieW/Lock-Out
ENTER
Decimal point/DELAY
10 numeric key/bank selector

5. FEATURES

-1 200 channel memories plus 20 monitor memories
-2 200 channels automatic scanning for VHF to UHF band
-3 Pre-programed FIRE/POLICE, AIR, HAM, MRN and WX bands search
-4 QUICK PROGRAM when receive signals up to 200 channels
-5 INTELIGENT SEARCH, 50 frequency-skip memories in search mode
-6 HYPERSCAN, 25 channels/sec. scanning rate and 50 steps/sec. searching rate
-7 "Zeromatic" tuning system
-8 10 digit channel and frequency display with all function indicators
-9 200 channels lock-out in scan mode
-10 Built-in Priority channel
-11 Built-in WX alert system
-12 Built-in wired programming system
-13 Lock/Out ReVieW key to confirm lock out frequency sequentially
-14 20 monitor memory
-15 Change search direction by ▲ (up) or ▼ (down)
-16 2 second scan and search delay
-17 Manual selection for channel
-18 Scan mode [cleared channels (000.000 freq.) do not scan]
-19 Direct search
-20 Program mode
-21 Key tone
-22 LCD backlighting
-23 Duplicate frequency check

GENERAL RESEARCH OF ELECTRONICS, INC.

How to calculate CAT. NO. 20-423 (PRO-2017) OSC Frequency

1. Cat. No. 20-423 (PRO-2017) formula for 1st Local OSC are different due to frequency.

   -1 Receive Freq. at 29MHz - 54MHz (VHF Low Band)

   OSC Freq. (MHz) = Receive Freq. (MHz) + 10.7 (MHz)

   -2 Receive Freq. at 108MHz - 136.9875MHz (AIR Band)

   OSC Freq. (MHz) = Receive Freq. (MHz) + 10.7 (MHz)

   -3 Receive Freq. at 137MHz - 174MHz (VHF Hi Band)

   OSC Freq. (MHz) = Receive Freq. (MHz) - 10.7 (MHz)

   -4 Receive Freq. at 380MHz - 512MHz (UHF Low Band)

   OSC Freq. (MHz) = {Receive Freq. (MHz) - 10.7(MHz)} / 3

2. Example

   -1 Receive Freq. at 29MHz (VHF Low Band)

   OSC Freq. = 29 (MHz) + 10.7 (MHz)
   = 39.7 (MHz)

   -2 Receive Freq. at 108MHz (AIR Band)

   OSC Freq. = 108 (MHz) + 10.7 (MHz)
   = 118.7 (MHz)

   -3 Receive Freq. at 137MHz (VHF Hi Band)

   OSC Freq. = 137 (MHz) - 10.7 (MHz)
   = 126.3 (MHz)

   -4 Receive Freq. at 380MHz (UHF Low Band)

   OSC Freq. = {380 (MHz) - 10.7 (MHz)} / 3
   = 123.1 (MHz)

2.0 System Test Configuration

2.1 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power without modulation.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Detector function is in peak mode. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance if measured at a closer distance.

2.2 EUT Exercising Software

For emissions testing, the units were setup to receive continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

2.3 Mode of Operation

The EUT was tested in two modes and the worst case emission was recorded:

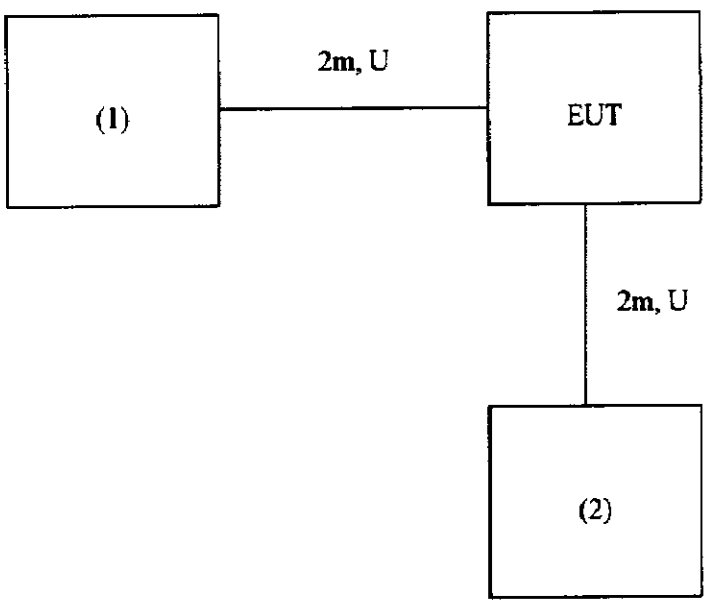
1. EUT was set to constantly receive at a particular frequency.
2. EUT was set to constantly scan and receive a particular band.

2.3 Support Equipment List and Description

a) The FCC ID's for all equipment used in the tested system (included inserted cards, which have grants) are:

Item #	Description	Model No.	Serial No.	FCC ID
1	Sony Speaker	N/A	N/A	N/A
2	Radio Shack DC Power Supply	JOD-41U-02	N/A	N/A

b) Equipment Setup Block Diagram



m: Length in meters
U: Unshielded cable

2.4 Equipment Modification

Any modifications installed previous to testing by Radio Shack, A Division of Tandy Corporation will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services.

3.0 Emission Results

AC line conducted emission measurements were performed from 0.45 MH to 30 MHz. Analyzer resolution is 10 kHz or greater.

Radiated emission measurements were performed from 30 MHz to 5000 MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

3.1 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 reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG + DF

where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
DF = Distance Factor

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF

where FS = Field Strength in dμV/m
RR = RA - AG in dBμV
LF = CF + AF + DF in dB

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

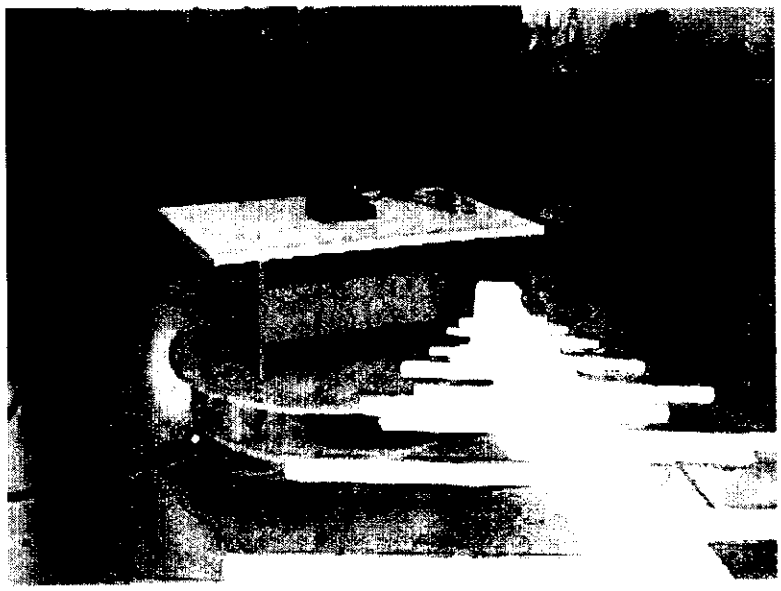
RA = 52.0 dBμV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
FS = RR + LF
FS = 23 + 9 = 32 dBμV/m

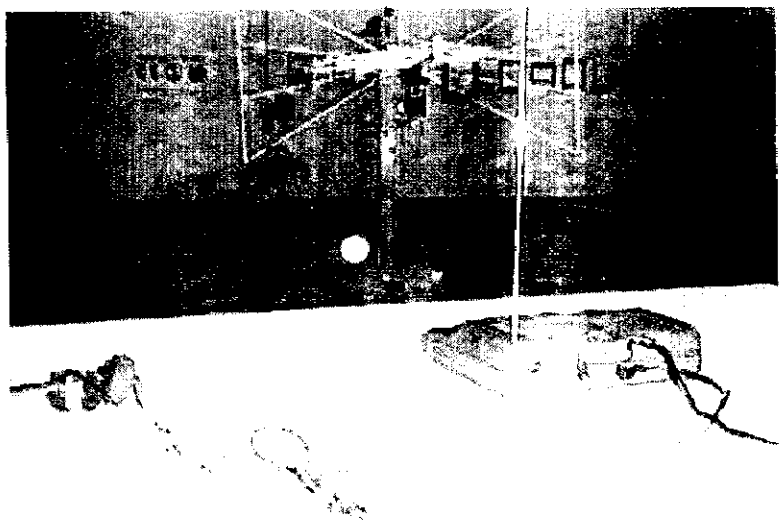
DF = 0 dB
RR = 23.0 dBμV
LF = 9.0 dB

Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

3.2 Radiated Emission Configuration Photograph

Worst Case Radiated Emission
at 143.3 MHz





3.3 Radiated Emission Data

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Judgement: Passed by 8.6 dB at 143.3 MHz

ITS Intertek Testing Services

Radiated Emissions Test Data

Company: GRE	**Model #:** 20-423 (Pro-2017)	**Standard**	**FCC § 15.209**	
EUT: Radio Shack Scanning Receiver	**S/N #:** 000007	**Limits**	3	
Project #: J99027232	**Test Date:** Oct 25, 1999	**Test Distance**	3	meters
Test Mode: Scanning specific frequency, monitoring L.O.	**Engineer:** Barry Smith	**Duty Relaxation**	0	dB

Tuned Frequency	LO Frequency	Reading	Detector	Ant	Amp	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	MHz	dB(uV)	P/AvQ	#	#	H/V	db(1/m)	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
29.000	39.70	34.0	Peak	2	1	V	8.9	25.8	0.7	0.0	17.8	40.0	-22.2
39.500	50.20	41.5	Peak	2	1	V	6.3	26.1	1.0	0.0	22.7	40.0	-17.3
54.000	64.70	37.3	Peak	2	1	V	5.4	25.9	1.1	0.0	17.9	40.0	-22.1
108.000	118.70	41.6	Peak	2	1	V	7.3	25.6	1.4	0.0	24.7	43.5	-18.8
122.500	133.20	44.3	Peak	2	1	V	7.5	24.8	1.4	0.0	28.4	43.5	-15.1
136.975	147.68	44.5	Peak	2	1	V	11.3	26.3	1.5	0.0	31.0	43.5	-12.5
137.000	126.30	49.2	Peak	2	1	V	7.6	25.5	1.4	0.0	32.7	43.5	-10.8
154.000	143.30	49.7	Peak	2	1	V	10.0	26.3	1.5	0.0	34.9	43.5	-8.6
174.000	163.30	45.3	Peak	2	1	V	9.6	25.6	1.7	0.0	31.0	43.5	-12.5
380.000	123.10	41.3	Peak	2	1	V	6.9	25.6	1.4	0.0	24.0	43.5	-19.5
440.000	143.10	40.4	Peak	2	1	V	10.0	26.3	1.5	0.0	25.6	43.5	-17.9
512.000	167.10	46.5	Peak	2	1	V	9.2	25.6	1.7	0.0	31.8	43.5	-11.7

Notes:

a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

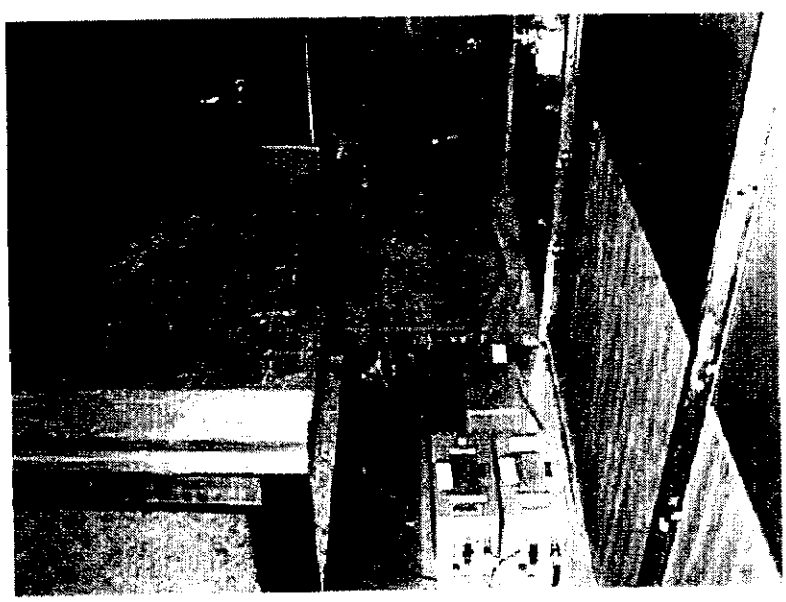
c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

3.4 AC conducted Emission Configuration Photograph

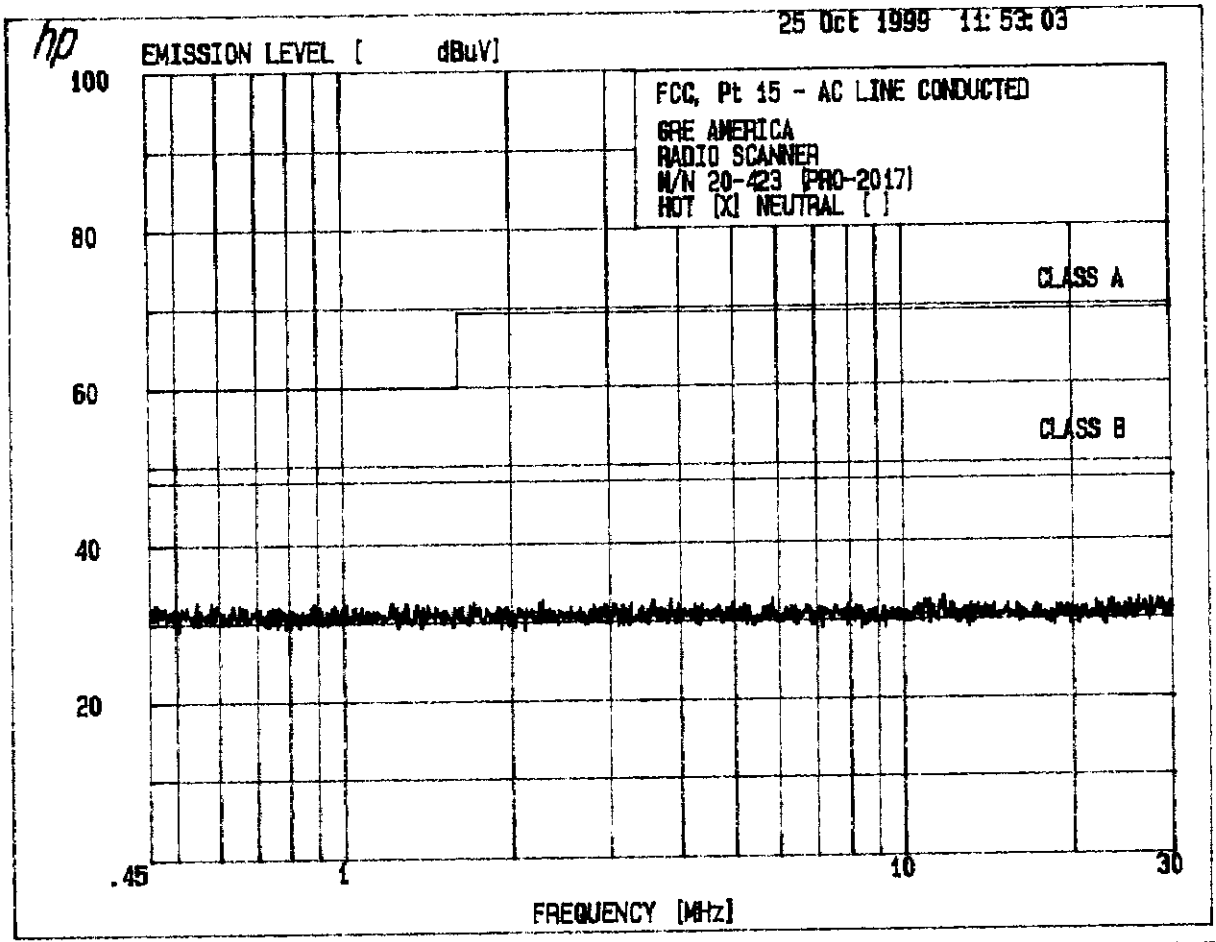
Worst Case Conducted Emission
at 2.15 MHz

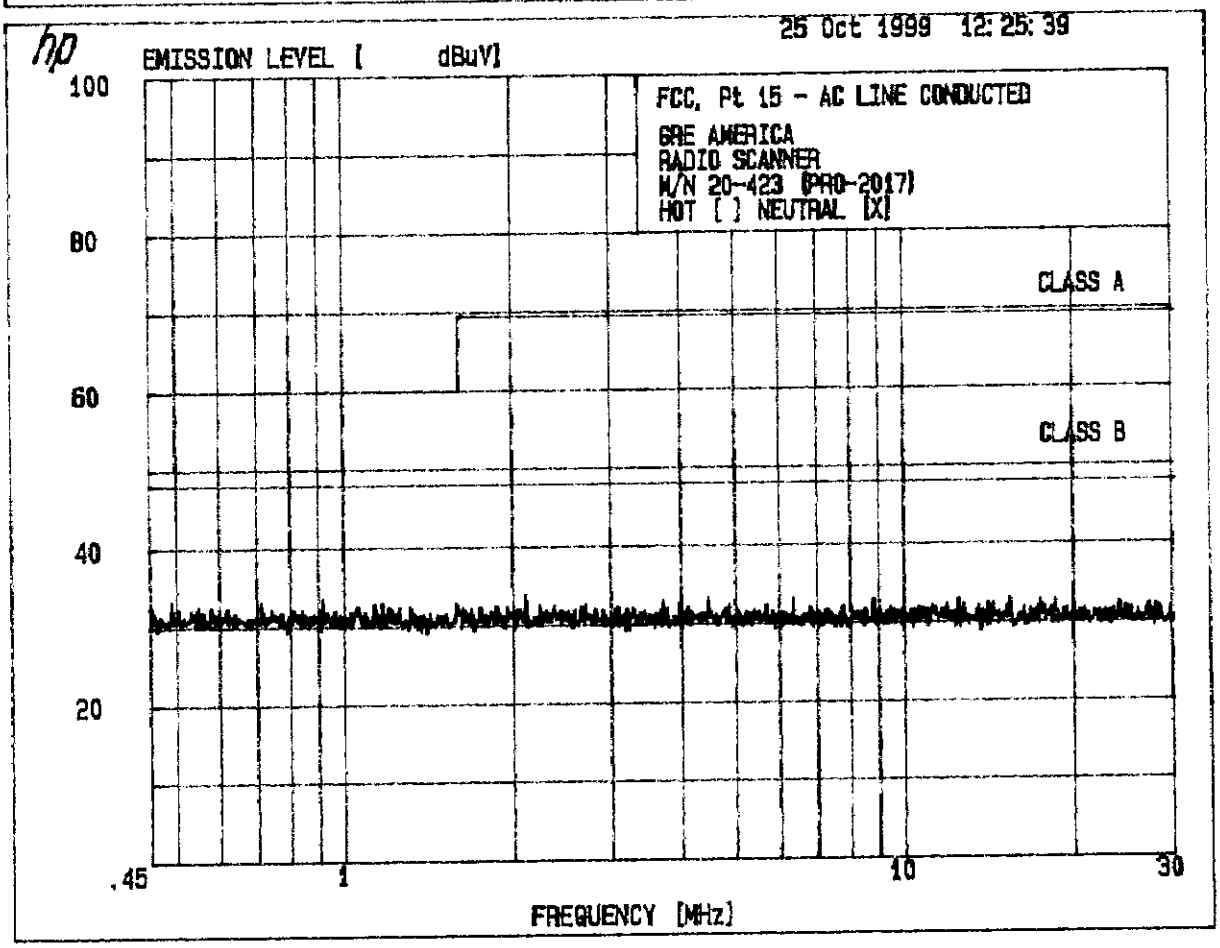


3.5 Conducted Emission Data

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Judgement: Passed by 14.0 dB at 2.15 MHz


25 Oct 1999 11:53:03
EMISSION LEVEL [dBuV]
FCC, Pt 15 - AC LINE CONDUCTED
GRE AMERICA
RADIO SCANNER
M/N 20-423 (PRO-2017)
HOT [X] NEUTRAL [ ]
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]


25 Oct 1999 12:25:39
EMISSION LEVEL [dBuV]
FCC, Pt 15 - AC LINE CONDUCTED
GRE AMERICA
RADIO SCANNER
M/N 20-423 (PRO-2017)
HOT [ ] NEUTRAL [X]
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]