# TEST REPORT

**Report Number: 30481231**
**Project Number: 3048123**
**Report Date: September 10, 2003**
**Date of testing: September 8 to 25, 2003**

Testing performed on the
**Scanning Receiver**
**Model: 20-515**
**FCC ID: ADV2000515**
to
**FCC Part 15 Class B**
for
**General Research of Electronics, Inc.**

A2LA Certificate Number: 1755-01

**Test Performed by:**
Intertek
1365 Adams Court
Menlo Park, CA 94025

**Test Authorized by:**
General Research of Electronics, Inc.
Shiba NO.3 Amerex Bldg.
No. 12-17 Mita 3-Chome, Minato-Ku
Tokyo 108-0073, Japan

**Prepared by:** Bruce Gordon **Date:** 09/15/03

**Reviewed by:** David Chernomordik **Date:** 09/15/03

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# 1.0 General Description

## 1.1 Product Description

The Equipment under Test (EUT) is VHF/UHF Programmable AM/FM-Digital Trunking Handheld Scanning Receiver PRO-96 CAT. NO. 20-515.
Please refer to the attached specifications sheets in Appendix A for more details.

A pre-production version of the sample was received on September 8, 2003 in good condition. As declared by the Applicant, it is identical to production units.

## 1.2 Related Submittal(s) Grants

This is a single 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 radiated measurements were performed in a semi-anechoic chamber. 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 test site and conducted measurement facility used to collect the radiated data is Site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

1.5 Summary of Test Results

**Model: 20-515**
**FCC ID: ADV2000515**

| TEST | REFERENCE | RESULTS |
|---|---|---|
| Radiated Emission | 15.109 | Complies |
| AC Line Conducted Emission | 15.107 | Complies |
| Antenna Conducted Emission | 15.111 | Complies |
| FCC Part 15. 121 Requirement | 15.121 | Complies * |

* See File "Report for FCC Rule Part 15.121"

## 2.0 System Test Configuration

### 2.1 Justification

The EUT is available with two antennas. A Short antenna and a Long antenna. Tests for Radiated Emissions were performed on both antennas. The Long antenna had the worst case emissions and this data is included in this test report.

The tests were performed according to the test procedure as outlined in CFR47 Part 15.31 and in ANSI C63.4.

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 placed on top of a non-conductive table. If the EUT attaches to peripherals, they are connected and operational (as typical as possible).

For radiated emission measurements, 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. 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

The unit was 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

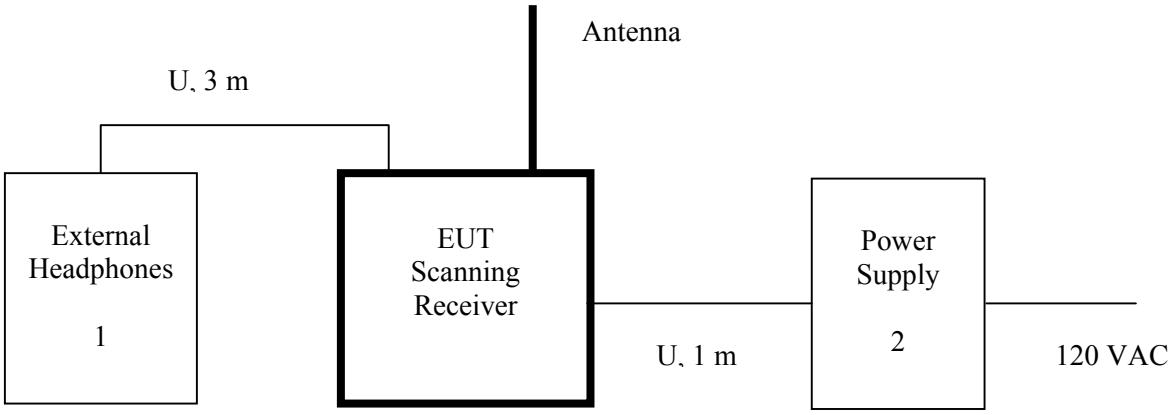
The EUT was tested in two modes and the worst-case emission was recorded:

Test Mode 1: The EUT was set to constantly receive at a particular frequency (1 near the top, 1 near the middle, and 1 near the bottom of each band).
Test Mode 2: The EUT was set to constantly scan and receive a particular band.

2.4 Support Equipment List and Description

| Item # | Description | Model No. | Serial No. |
|---|---|---|---|
| 1 | Headphone | LT-100 | none |
| 2 | BK Precision | 1630 | 146-02817 |

2.5 Equipment Setup Block Diagram




2.6 Equipment Modification

Any modifications installed previous to testing by GRE will be incorporated in each production model sold/leased in the United States.

Intertek Testing Services installed no modifications.

## 3.0 Emission Test Results

AC line conducted emission measurements were performed from 0.15 MHz to 30 MHz. Analyzer resolution is 10 kHz or greater.

Radiated emission measurements and antenna conducted emission measurements were performed from 30 MHz to 5000 MHz. Analyzer resolution is 100 kHz or greater for frequencies from 30 MHz to 1000 MHz, 1 MHz - for frequencies above 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 dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(1/m)
AG = Amplifier Gain in dB
DF = Distance Factor in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.

RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
DF = 0 dB
FS = 52 +7.4 +1.6 –29.0 + 0 = 32 dB(μV/m)
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

3.2 Radiated Emission Data

| | |
|---|---|
| **Tested By:** | Bruce Gordon |
| **Test Date:** | September 8, 2003 |

| | | |
|---|---|---|
| **Temperature** | **(°C)** | 22 $^0$C |
| **Relative Humidity** | **(%)** | 57 % |

The results on the following page(s) were obtained when the device was tested in the condition described in Sections 2 and 3. Measurements on LO frequencies were performed when the EUT was setup in receiving mode on particular channel. In addition, scans from 30 MHz to 5 GHz were performed when the EUT was setup in receiving mode on the middle channel to measure emissions from the digital parts.

| | |
|---|---|
| **Results:** | **Complies** by 8.1 dB at 479.17 MHz<br>(Tuned frequency 860 MHz) |

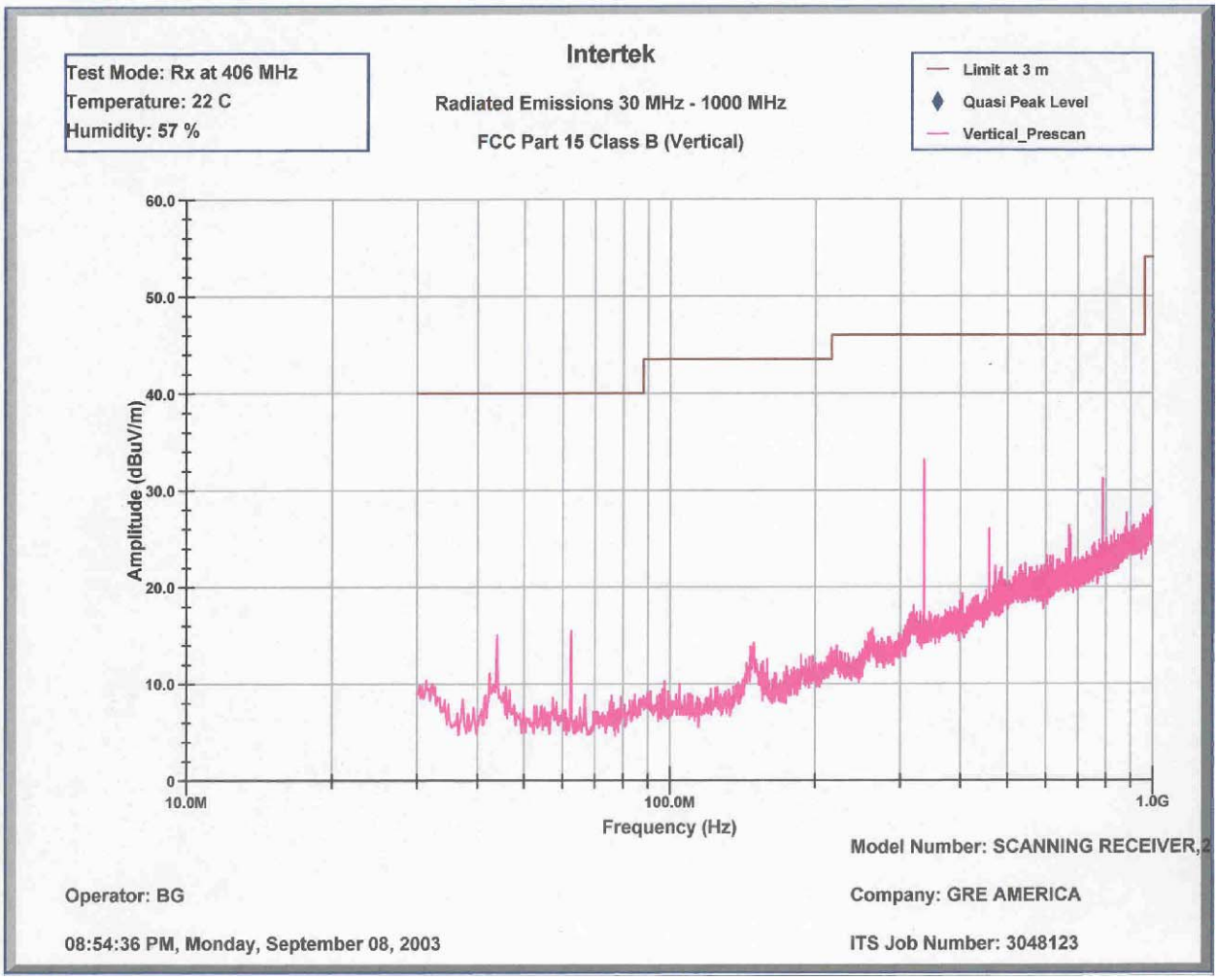
All other emissions are at least 10 dB below the limit.

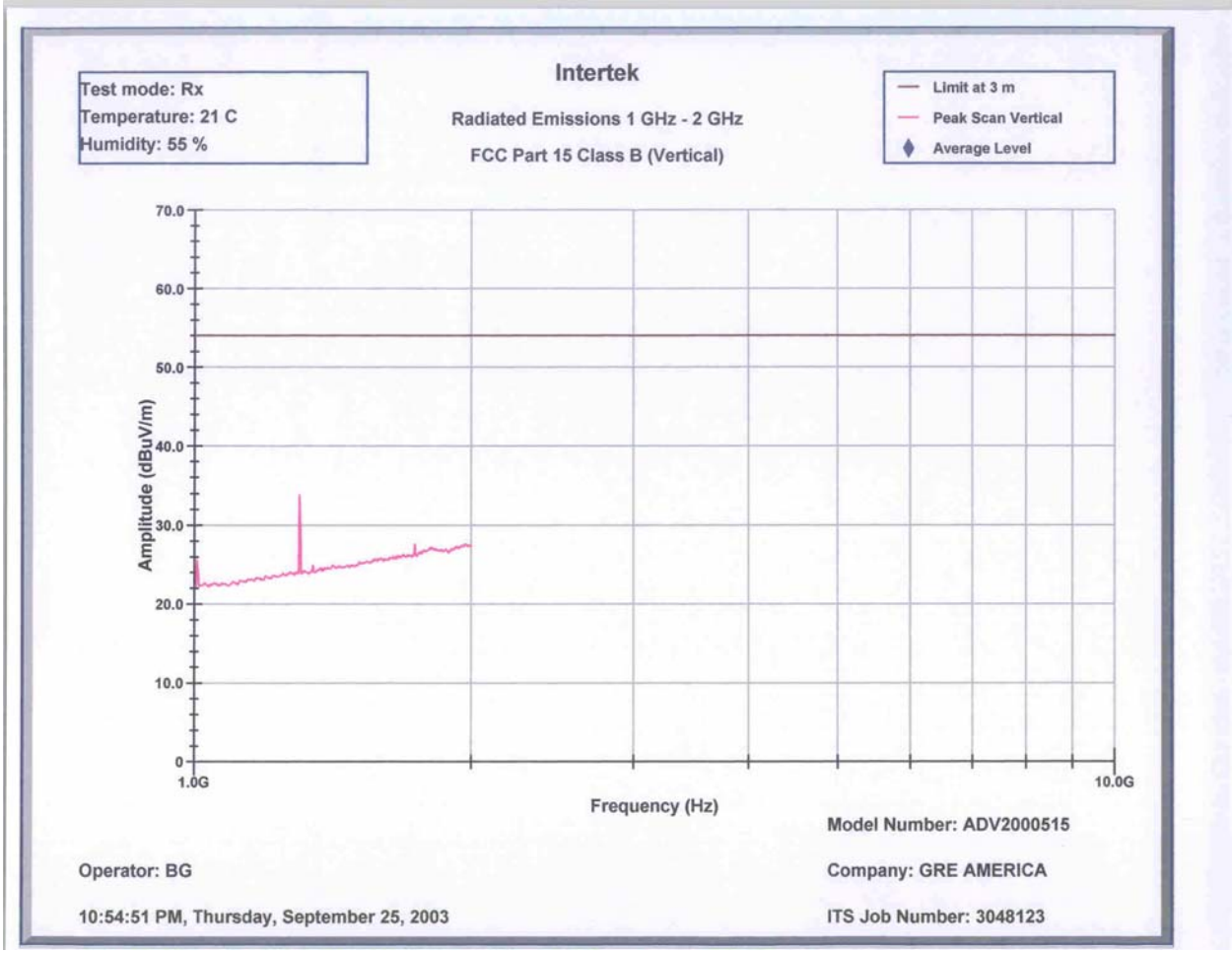
Model: 20-515
Test Mode: Receiving
Test distance: 3 m

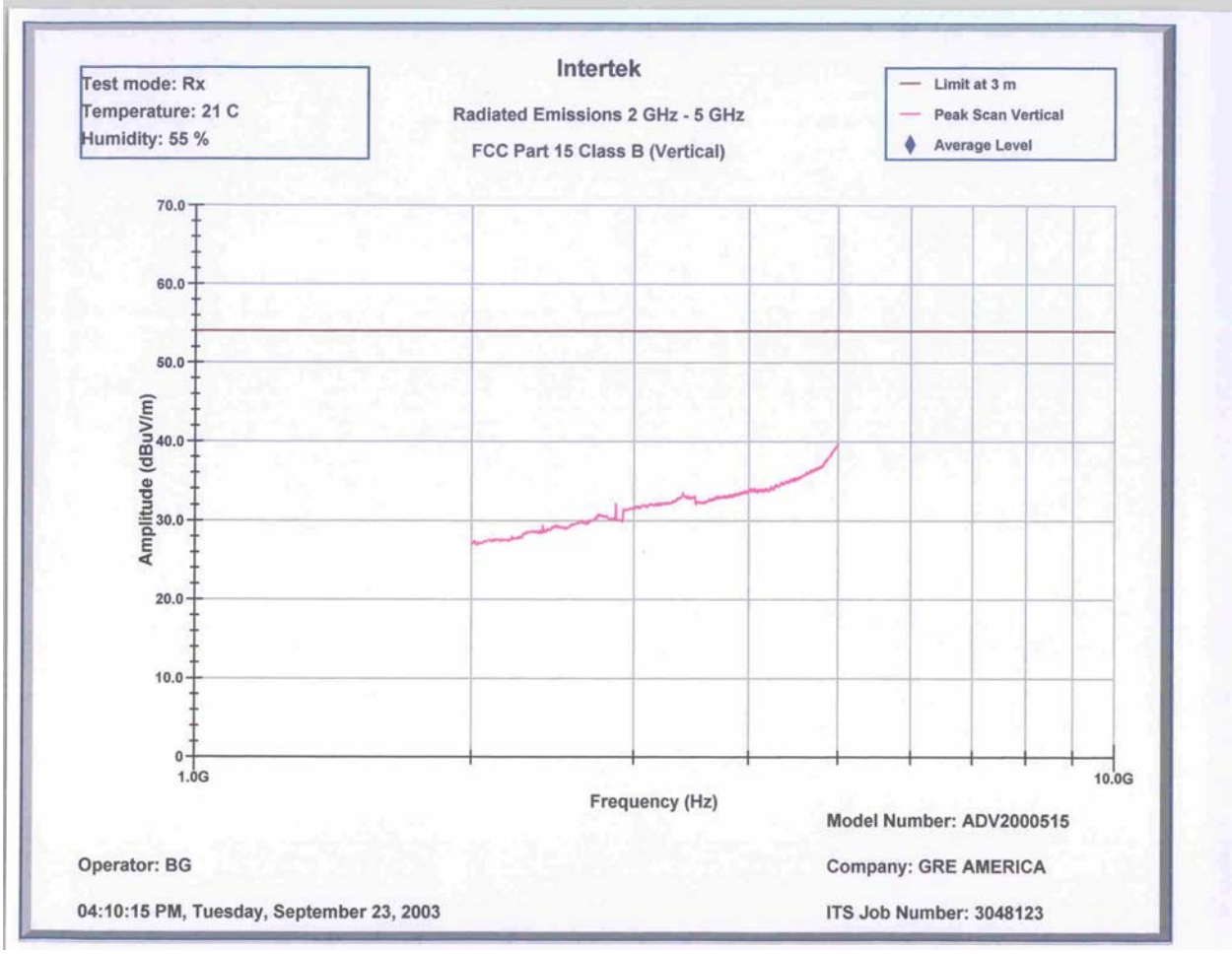
**FCC Part 15.109 Class B Radiated Emissions Data**

| Tuned Frequency | L.O. Frequency | Corected Amplitude | Limit At 3m | Margin | SA Reading | Pre-amplifier Gain | Cable Loss | Antenna Factor | Attn. |
|---|---|---|---|---|---|---|---|---|---|
| MHz | MHz | dB(uV/m) | dB(uV/m) | dB | dB(uV) | dB | dB | dB(1/m) | dB |
| 28.0000 | 408.73 | 36.9 | 46.0 | ***-9.1*** | 48.8 | 32.3 | 1.9 | 15.5 | 3.0 |
| 40.0000 | 421.79 | 37.4 | 46.0 | ***-8.6*** | 48.5 | 32.3 | 1.9 | 16.3 | 3.0 |
| 54.0000 | 434.80 | 37.9 | 46.0 | ***-8.1*** | 48.4 | 32.3 | 1.9 | 16.9 | 3.0 |
| 108.0000 | 488.76 | 37.0 | 46.0 | ***-9.0*** | 46.0 | 32.4 | 2.0 | 18.4 | 3.0 |
| 122.5000 | 503.23 | 37.1 | 46.0 | ***-8.9*** | 46.4 | 32.4 | 2.0 | 18.1 | 3.0 |
| 136.9880 | 517.71 | 36.6 | 46.0 | ***-9.4*** | 45.1 | 32.4 | 2.1 | 18.7 | 3.0 |
| 137.0000 | 517.79 | 36.6 | 46.0 | ***-9.4*** | 45.1 | 32.4 | 2.1 | 18.7 | 3.0 |
| 155.4875 | 536.24 | 35.2 | 46.0 | ***-10.8*** | 43.8 | 32.4 | 2.2 | 18.7 | 3.0 |
| 174.0000 | 554.69 | 35.5 | 46.0 | ***-10.5*** | 43.9 | 32.5 | 2.1 | 18.9 | 3.0 |
| 406.0000 | 786.74 | 36.3 | 46.0 | ***-9.7*** | 41.9 | 32.5 | 2.6 | 21.2 | 3.0 |
| 446.0000 | 839.77 | 34.3 | 46.0 | ***-11.7*** | 39.3 | 32.3 | 2.7 | 21.5 | 3.0 |
| 512.0000 | 892.79 | 34.4 | 46.0 | ***-11.6*** | 38.0 | 32.0 | 2.8 | 22.6 | 3.0 |
| 806.0000 | 425.16 | 34.7 | 46.0 | ***-11.3*** | 45.7 | 32.3 | 1.9 | 16.4 | 3.0 |
| 860.0000 | 479.17 | 37.9 | 46.0 | ***-8.1*** | 47.5 | 32.4 | 1.9 | 17.9 | 3.0 |
| 960.0000 | 579.13 | 35.7 | 46.0 | ***-10.3*** | 44.2 | 32.5 | 2.2 | 18.8 | 3.0 |

Notes:
1. Negative signs (-) in the Margin column signify levels below the limit.
2. All other readings not reported are at least 10 dB below the limit.
3. For LO frequencies calculation, see Appendix B


Intertek
Test Mode: Rx at 406 MHz
Temperature: 22 C
Humidity: 57 %
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (Vertical)
Limit at 3 m
Quasi Peak Level
Vertical_Prescan
Amplitude (dBuV/m)
60.0
50.0
40.0
30.0
20.0
10.0
0
10.0M
100.0M
1.0G
Frequency (Hz)
Model Number: SCANNING RECEIVER,2
Operator: BG
Company: GRE AMERICA
08:54:36 PM, Monday, September 08, 2003
ITS Job Number: 3048123


Test mode: Rx
Temperature: 21 C
Humidity: 55 %
Intertek
Radiated Emissions 1 GHz - 2 GHz
FCC Part 15 Class B (Vertical)
Limit at 3 m
Peak Scan Vertical
Average Level
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
Amplitude (dBuV/m)
1.0G
10.0G
Frequency (Hz)
Model Number: ADV2000515
Operator: BG
Company: GRE AMERICA
10:54:51 PM, Thursday, September 25, 2003
ITS Job Number: 3048123


Intertek
Test mode: Rx
Temperature: 21 C
Humidity: 55 %
Radiated Emissions 2 GHz - 5 GHz
FCC Part 15 Class B (Vertical)
Limit at 3 m
Peak Scan Vertical
Average Level
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
Amplitude (dBuV/m)
1.0G
10.0G
Frequency (Hz)
Model Number: ADV2000515
Company: GRE AMERICA
ITS Job Number: 3048123
Operator: BG
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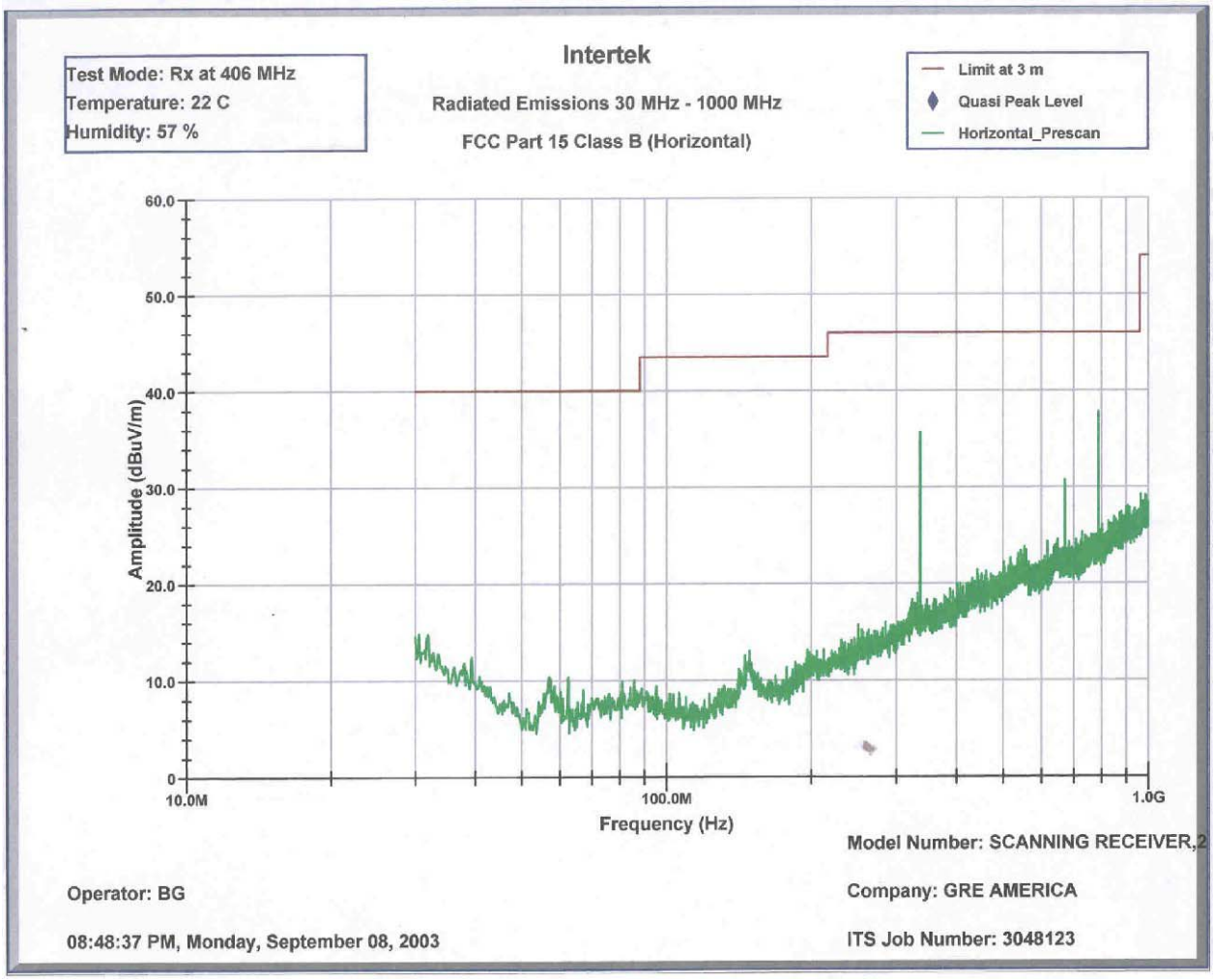
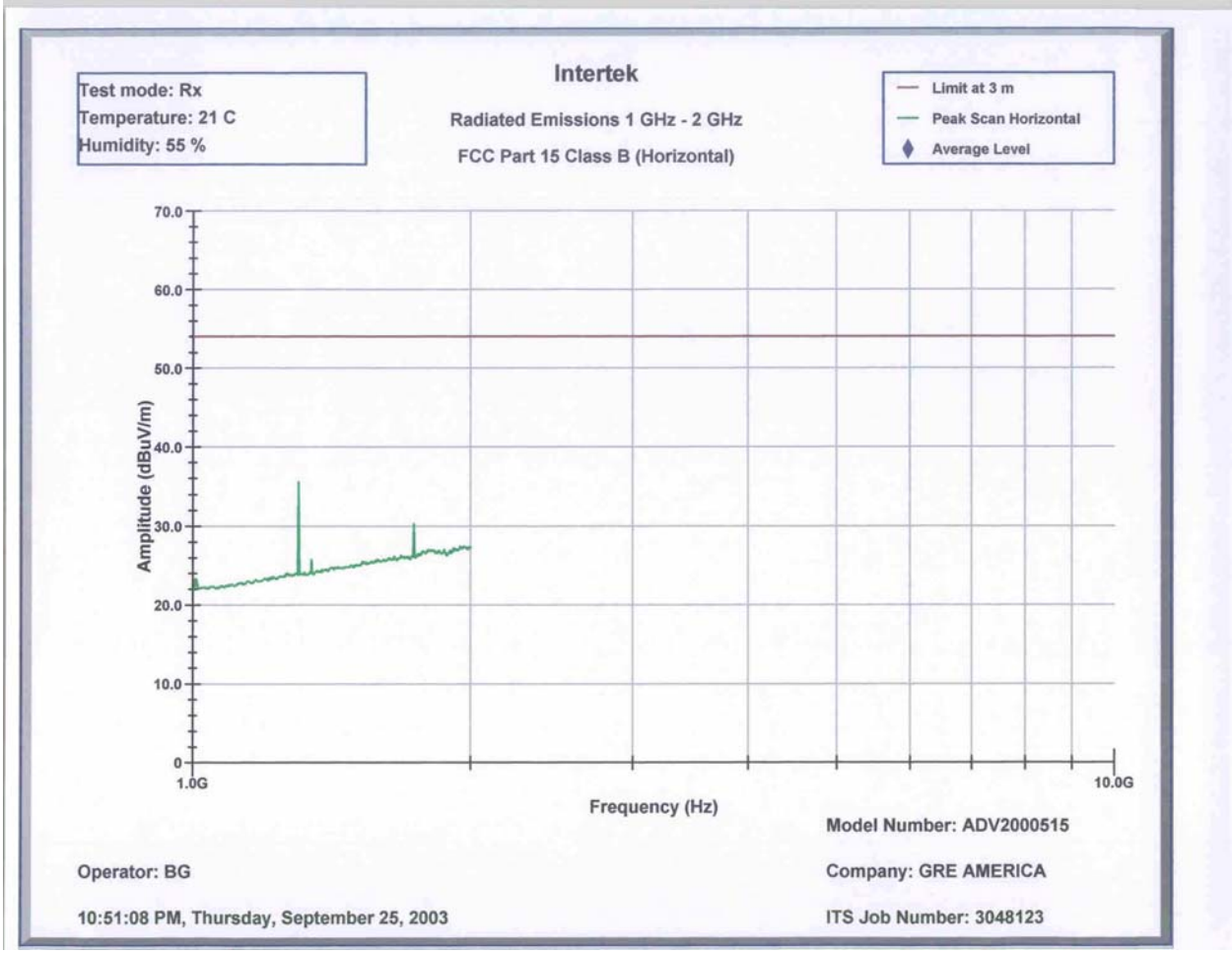
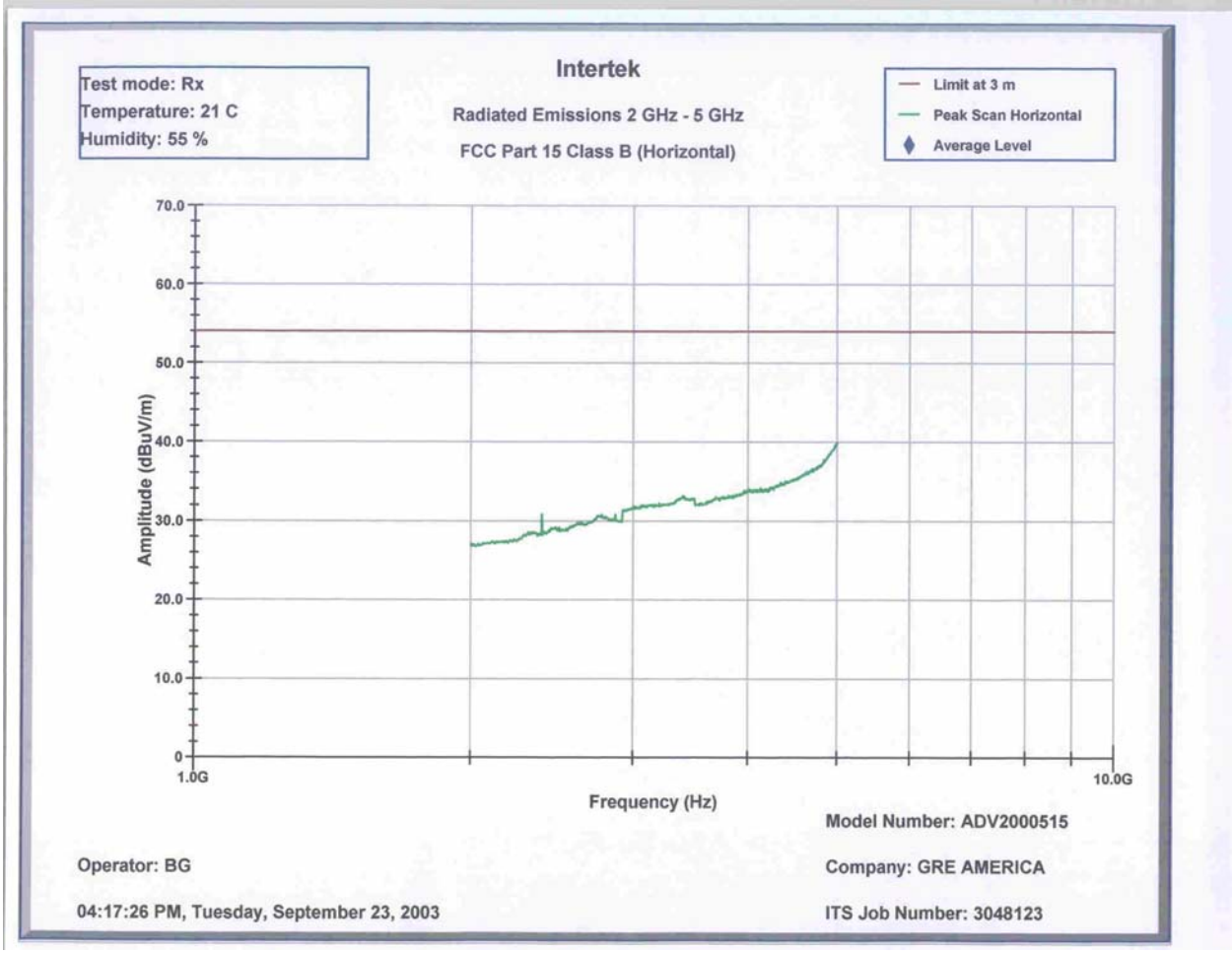

Intertek
Test Mode: Rx at 406 MHz
Temperature: 22 C
Humidity: 57 %
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (Horizontal)
Limit at 3 m
Quasi Peak Level
Horizontal_Prescan
Amplitude (dBuV/m)
60.0
50.0
40.0
30.0
20.0
10.0
0
10.0M
100.0M
1.0G
Frequency (Hz)
Model Number: SCANNING RECEIVER,2
Operator: BG
Company: GRE AMERICA
08:48:37 PM, Monday, September 08, 2003
ITS Job Number: 3048123


Intertek
Test mode: Rx
Temperature: 21 C
Humidity: 55 %
Radiated Emissions 1 GHz - 2 GHz
FCC Part 15 Class B (Horizontal)
Limit at 3 m
Peak Scan Horizontal
Average Level
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
Amplitude (dBuV/m)
1.0G
10.0G
Frequency (Hz)
Model Number: ADV2000515
Company: GRE AMERICA
ITS Job Number: 3048123
Operator: BG
10:51:08 PM, Thursday, September 25, 2003


Intertek
Test mode: Rx
Temperature: 21 C
Humidity: 55 %
Radiated Emissions 2 GHz - 5 GHz
FCC Part 15 Class B (Horizontal)
Limit at 3 m
Peak Scan Horizontal
Average Level
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
Amplitude (dBuV/m)
1.0G
10.0G
Frequency (Hz)
Model Number: ADV2000515
Company: GRE AMERICA
ITS Job Number: 3048123
Operator: BG
04:17:26 PM, Tuesday, September 23, 2003

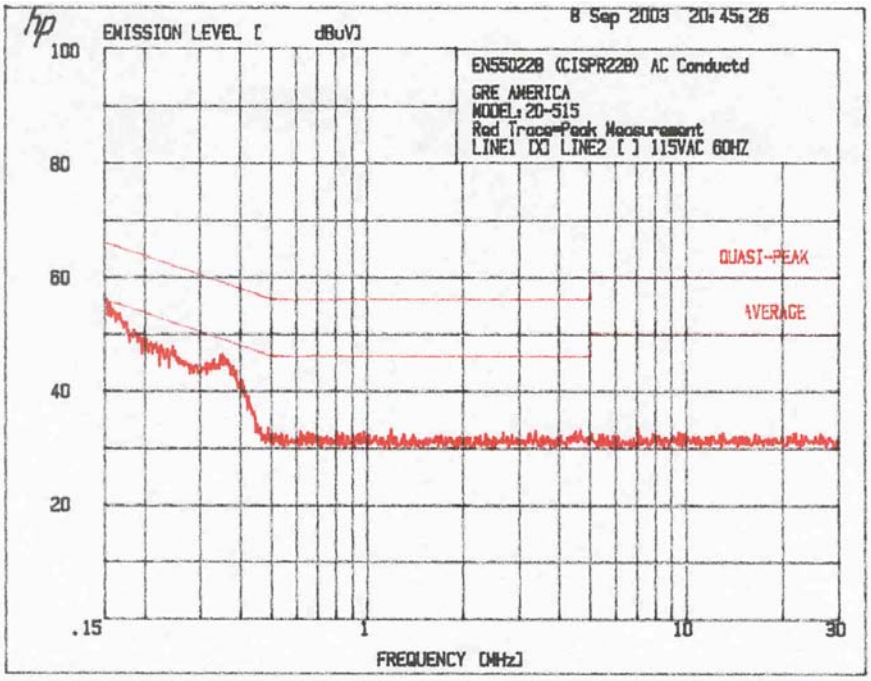
3.3 AC Line Conducted Emission Data

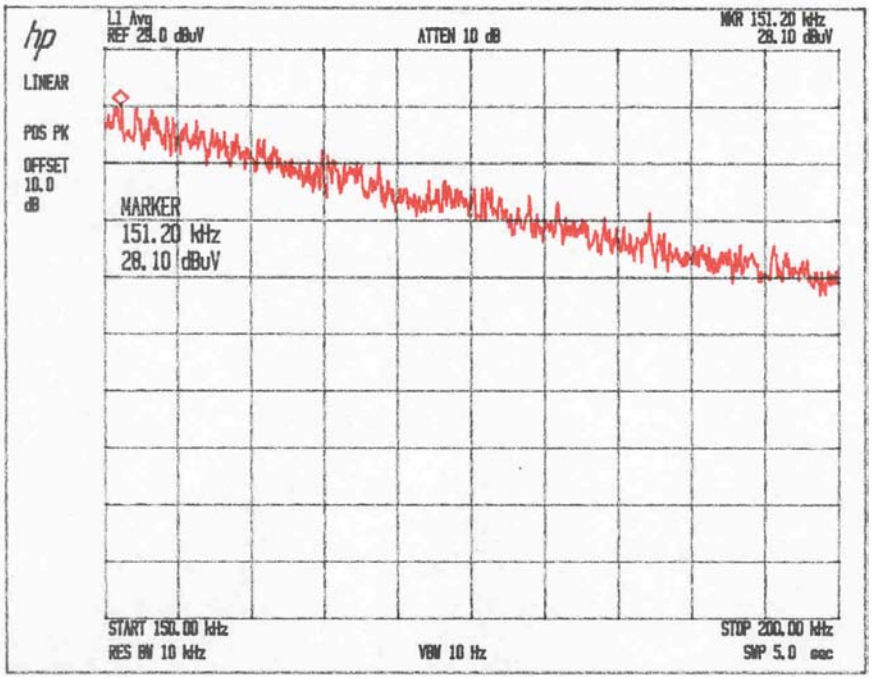
| | |
|---|---|
| **Tested By:** | Bruce Gordon |
| **Test Date:** | September 8, 2003 |

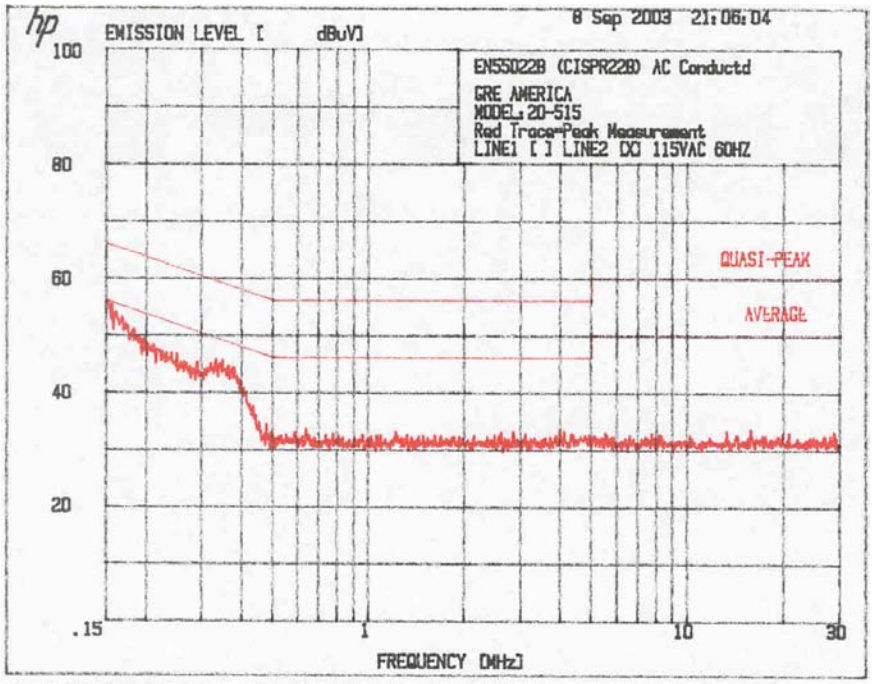
| | | |
|---|---|---|
| **Temperature** | **(°C)** | 22 $^{0}$C |
| **Relative Humidity** | **(%)** | 57 % |

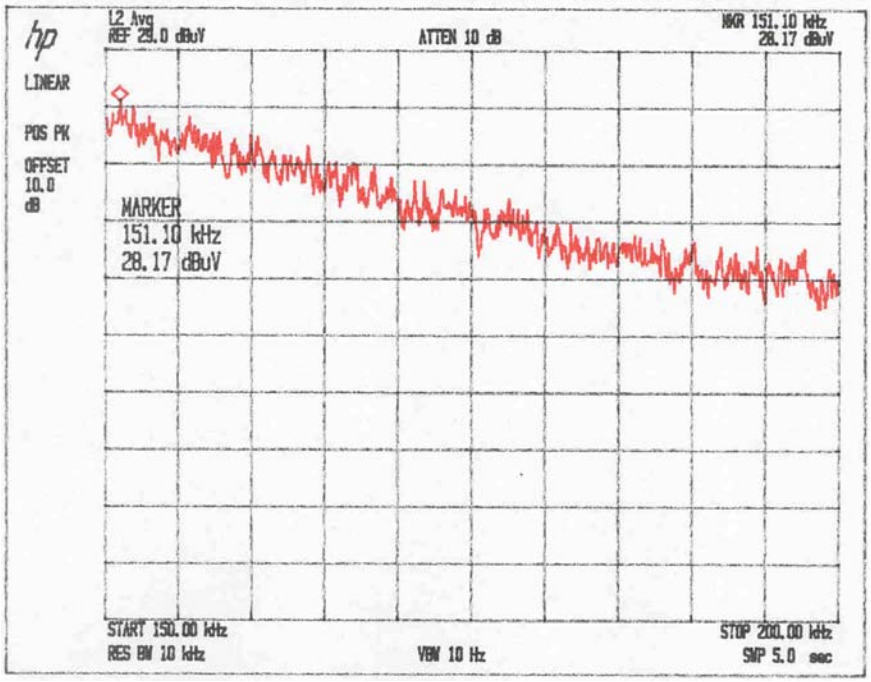
The results on the following page(s) were obtained when the device was tested in the condition described in Sections 2 and 3.

| | |
|---|---|
| **Results:** | **Complies** by 3.7 dB at 355.7 kHz |


EMISSION LEVEL [ dBuV]
8 Sep 2003 20:45:26
EN55022B (CISPR22B) AC Conductd
GRE AMERICA
MODEL: 20-515
Red Trace=Peak Measurement
LINE1 DC LINE2 [ ] 115VAC 60HZ
QUASI-PEAK
AVERAGE
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]


L1 Avg
REF 28.0 dBuV
ATTEN 10 dB
MKR 151.20 kHz
28.10 dBuV
LINEAR
POS PK
OFFSET
10.0
dB
MARKER
151.20 kHz
28.10 dBuV
START 150.00 kHz
RES BW 10 kHz
VBW 10 Hz
STOP 200.00 kHz
SWP 5.0 sec


EMISSION LEVEL [ dBuV]
8 Sep 2003 21:06:04
EN55022B (CISPR22B) AC Conductd
GRE AMERICA
MODEL: 20-515
Red Trace-Peak Measurement
LINE1 [ ] LINE2 DC 115VAC 60HZ
QUASI-PEAK
AVERAGE
100
80
60
40
20
.15
1
10
30
FREQUENCY [MHz]


L2 Avg
REF 28.0 dBuV
ATTEN 10 dB
MKR 151.10 kHz
28.17 dBuV
LINEAR
POS PK
OFFSET
10.0
dB
MARKER
151.10 kHz
28.17 dBuV
START 150.00 kHz
RES BW 10 kHz
VBW 10 Hz
STOP 200.00 kHz
SWP 5.0 sec

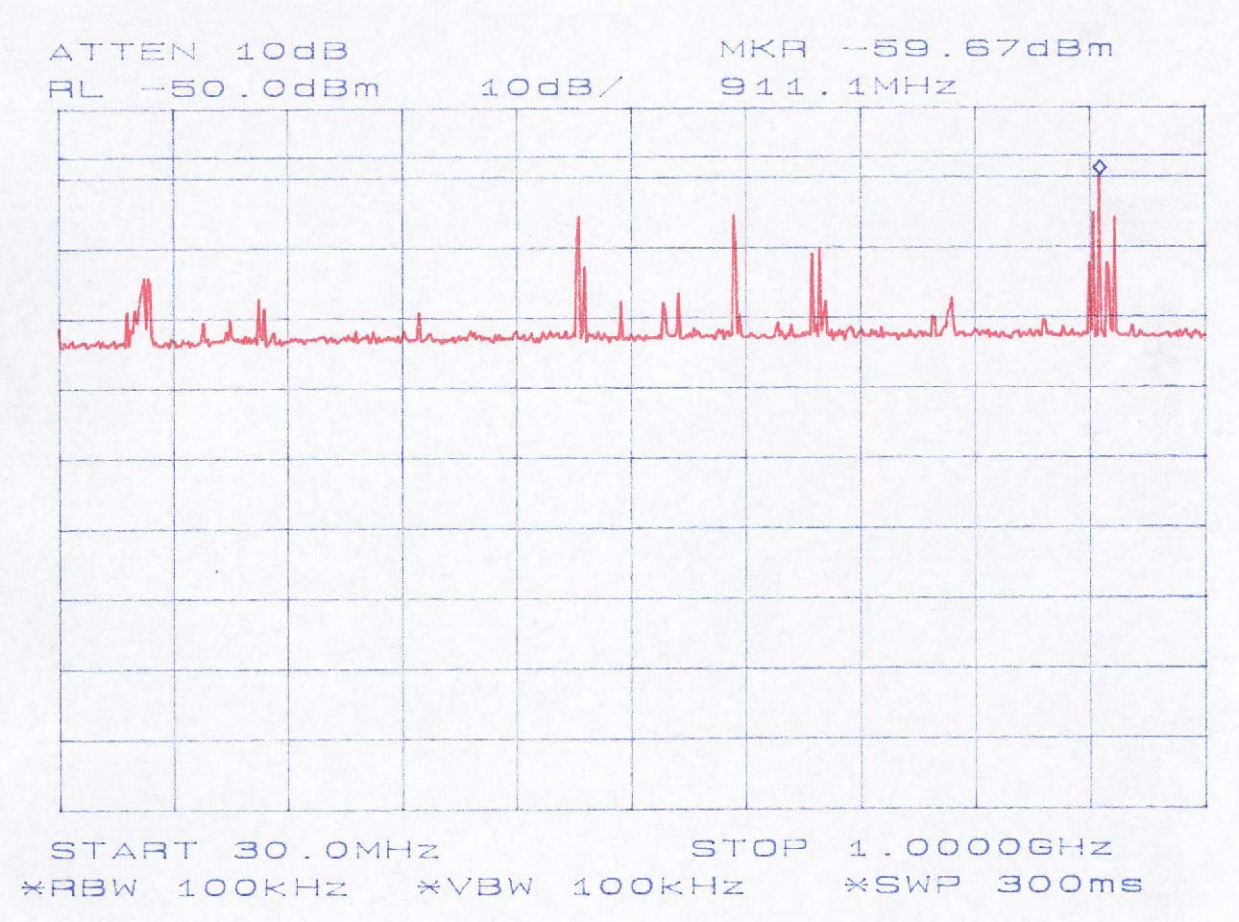
3.4 Antenna Conducted Emission Data

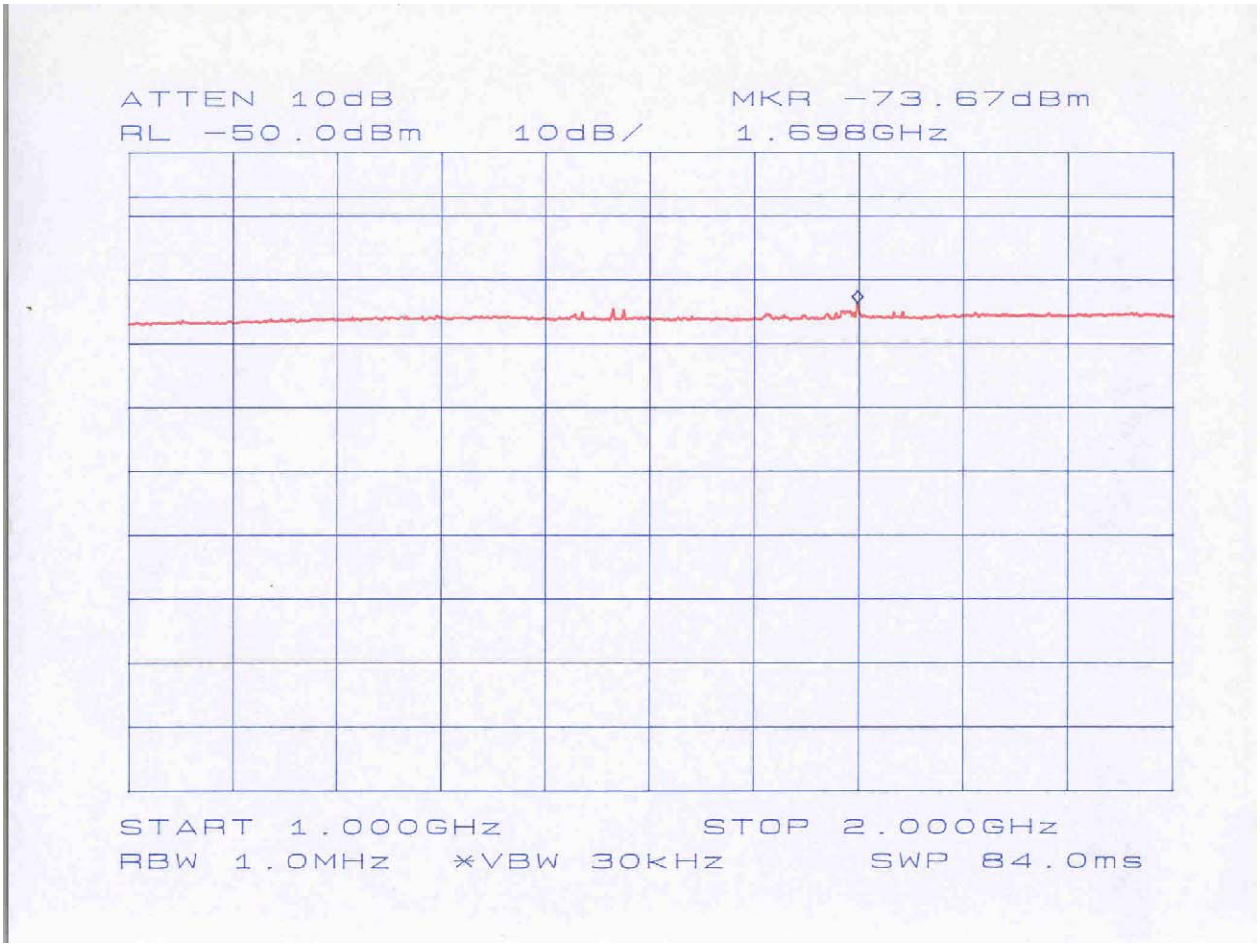
| | |
|---|---|
| **Tested By:** | Bruce Gordon |
| **Test Date:** | September 8, 2003 |

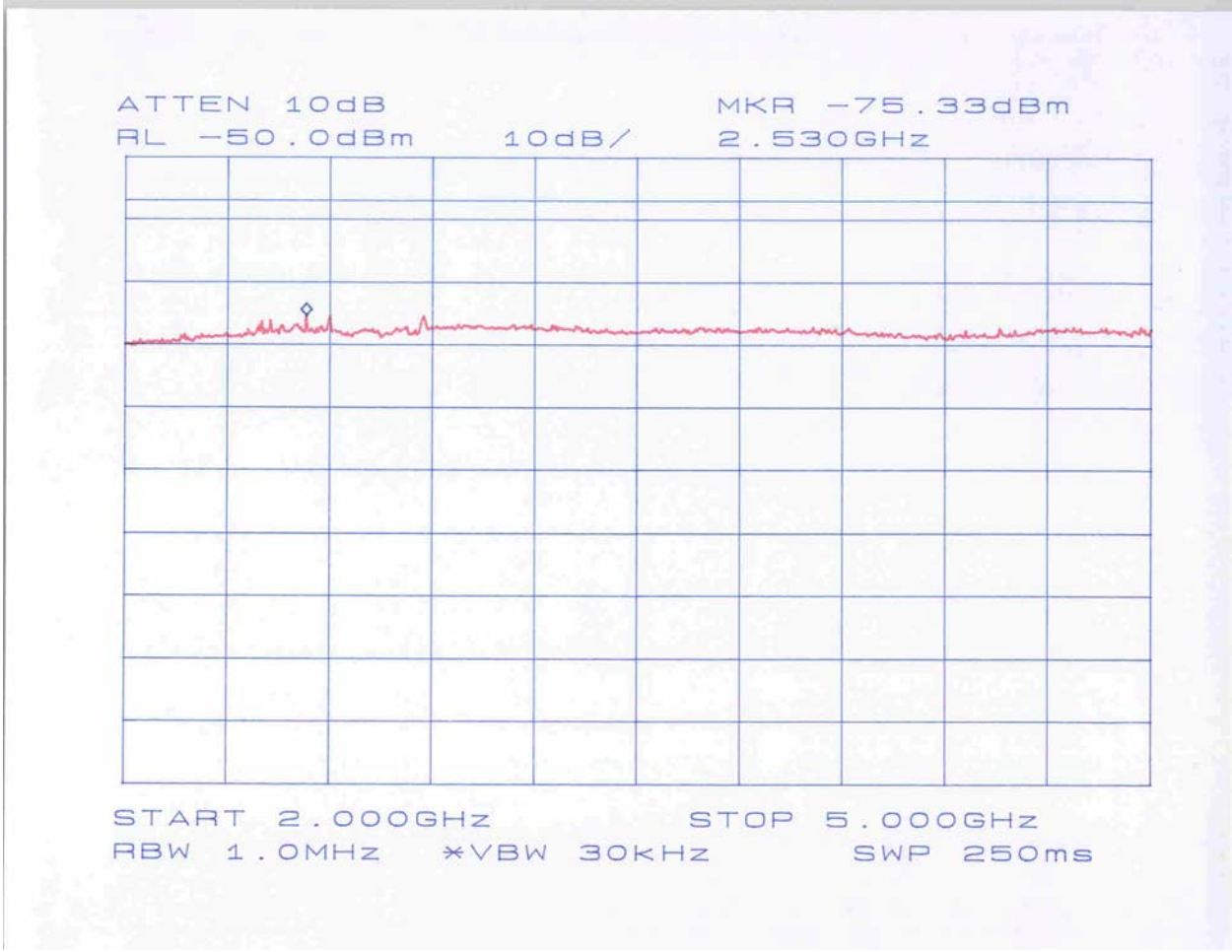
| | | |
|---|---|---|
| **Temperature** | **(°C)** | 22 $^{0}$C |
| **Relative Humidity** | **(%)** | 57 % |

The results on the following page(s) were obtained when the device was tested in the condition described in Sections 2 and 3. Test was performed when the EUT operated in scanning mode. The Spectrum analyzer was setup in MAX HOLD.

| | |
|---|---|
| **Results:** | **Complies** by 2.67 dB at 911.1 MHz |


ATTEN 10dB
MKR -59.67dBm
RL -50.0dBm
10dB/
911.1MHz
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 300ms


ATTEN 10dB
MKR -73.67dBm
RL -50.0dBm
10dB/
1.698GHz
START 1.000GHz
STOP 2.000GHz
RBW 1.0MHz
*VBW 30kHz
SWP 84.0ms


ATTEN 10dB
RL -50.0dBm
10dB/
MKR -75.33dBm
2.530GHz
START 2.000GHz
STOP 5.000GHz
RBW 1.0MHz
*VBW 30kHz
SWP 250ms

## 4.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list.

| Equipment | Manufacturer | Model/Type | Serial # | Cal Int | Cal Due |
|---|---|---|---|---|---|
| BI-Log Antenna | EMCO | 3143 | 9509-1160 | 12 | 9/19/03 |
| Pre-Amplifier | Sonoma Inst. | 310 | 185634 | 12 | 10/30/03 |
| Spectrum Analyzer w/8650 QP Adapter | Hewlett Packard | 8568B | 1912A0053 2521A01021 | 12 | 11/20/03 |
| Spectrum Analyzer w/85650 QP Adapter | Hewlett Packard | 8566B | 2416A00317 2043A00251 | 12 | 10/29/03 |
| LISN | FCC | FCC-LISN-50-50-M-H | 2011 | 12 | 2/08/04 |
| Pulse Limiter | Hewlett Packard | 11947A | 2820A00184 | 12 | 3/5/04 |

**Appendix A**

GRE GENERAL RESEARCH OF ELECTRONICS, INC.

Phone: +813-5439-3611
Fax: +813-5439-3644

SHIBA NO.3 AMEREX BLDG.
No. 12-17 MITA 3-CHOME, MINATO-KU
TOKYO 108-0073, JAPAN

Revised: AUG. 28, 2003
Date: FEB. 10, 2003
Reference No. 03001

## SPECIFICATIONS

SUBJECT: VHF/UHF AM/FM HANDHELD RACE SCANNER PRO-99 CAT. NO. 20-515

### 1. GENERAL

1.1 Programmable channel : 500 channels (50 channels x 10 banks)
6 pre-programmed service searches
1 limit search
50 frequency-skip memories in search mode
500 channels lock-out in scan mode
7 WX pre-programmed frequencies (with 1050 Hz tone alert system)
1 priority channel

1.2 Receiving system : Triple conversion PLL super heterodyne

1st IF 380.8 MHz: The 1st Local OSC frequency for VHF and UHF Low/T band employs upper side of receiving frequency range.

: The 1st Local OSC frequency for UHF High band employs lower side of receiving frequency range.

2nd IF 45 MHz : The 2nd Local OSC frequency employs lower side of 1st IF.

3rd IF 450 kHz : The 3rd Local OSC frequency employs lower side of 2nd IF.

– Continued –

**PRODUCT DEVELOPMENT & MANUFACTURING**

GENERAL RESEARCH OF ELECTRONICS, INC.

REV.: AUG. 28, 2003
REF. NO. 03001

1.3 Frequency range :

| Freq. | Step | Mode |
|---|---|---|
| 28.000 – 54.000 MHz | 5 kHz | FM |
| 108.000 – 136.9875 MHz | 12.5 kHz | AM |
| 137.000 – 150.775 MHz | 5 kHz | FM |
| 150.7825 – 150.8125 MHz | 7.5 kHz | FM |
| 150.8150 – 154.4525 MHz | 7.5 kHz | FM |
| 154.45625 – 154.47875 MHz | 7.5 kHz | FM |
| 154.4825 – 154.5050 MHz | 7.5 kHz | FM |
| 154.5100 – 154.5250 MHz | 5 kHz | FM |
| 154.52750 – 154.54625 MHz | 6.25 kHz | FM |
| 154.5475 – 154.6075 MHz | 7.5 kHz | FM |
| 154.610 – 154.655 MHz | 5 kHz | FM |
| 154.6575 – 156.2475 MHz | 7.5 kHz | FM |
| 156.250 – 157.475 MHz | 5 kHz | FM |
| 157.4775 – 161.5650 MHz | 7.5 kHz | FM |
| 161.570 – 173.200 MHz | 5 kHz | FM |
| 173.20375 – 173.22250 MHz | 6.25 kHz | FM |
| 173.22500 – 173.38750 MHz | 6.25 kHz | FM |
| 173.39000 – 173.41500 MHz | 6.25 kHz | FM |
| 173.4200 – 174.000 MHz | 5 kHz | FM |
| 406.000 – 512.000 MHz | 6.25 kHz | FM |
| 806.000 – 960.000 MHz | 6.25 kHz | FM |

Except cellular band: 824 – 848.9875 MHz and 869 – 893.9875 MHz

1.4 Pre-Programmed service search : Fire/Police (FD/PD)
Ham
Aircraft
Marine (MRN)
Car
FRS/GMRS/MARS

1.5 WX 7 frequencies : 162.400, 162.425, 162.450, 162.475, 162.500, 162.525, 162.550 MHz

1.6 Scanning rate : 50 channels/sec.

1.7 Search rate : 62 steps/sec.

1.8 Display : LED back-lighted LCD with 16 characters 4 lines

1.9 Zeromatic : Activates during search mode

1.10 Audio output (10% THD) : 150m Watts at DC 4.5 Volts (Battery)

1.11 Speaker : Built-in $\phi$28 mm 8 Ohms dynamic speaker

- 2 -

GENERAL RESEARCH OF ELECTRONICS, INC.

REV.: AUG. 28, 2003
REF. NO. 03001

| | | |
|---|---|---|
| 1.12 Operating voltage | : | DC 4.5 Volts "AA" cell x 3 pcs. |
| 1.13 Ext. power and charge voltage: | | DC 6 Volts (regulated)<br>AC Adaptor: 273 – 1758 (6 Volts 300 mA)<br>DC Adaptor: 273 – 1859 (6 Volts) |
| 1.14 Dimension | : | Approx. 67 (W) x 31 (D) x 122 (H) mm |
| 1.15 Weight | : | Approx. 165 g without antenna and batteries |
| 1.16 Accessory | : | Rubber antenna, Stubby antenna, Belt clip, Normal Batt. Holder and Ni-MH Batt. holder |
| 1.17 Memory backup | : | No battery back-up required, EEPROM used |
| 1.18 Drop test | : | In Gift-Box, Height 76 cm<br>Out of Carton, Height 100 cm |

## 2. ELECTRICAL

Standard Test Condition

| | | | |
|---|---|---|---|
| (1) | Power source voltage | : | 4.5 Volts DC (Battery) |
| (2) | Antenna impedance | : | 50 Ohms |
| (3) | Test temperature | : | 18 – 35 degrees C |
| (4) | Standard signal level | : | 100 μV |
| (5) | Modulation frequency | : | 1 kHz |
| (6) | Reference FM deviation | : | 3.0 kHz |
| (7) | Reference AM modulation | : | 60% |
| (8) | Reference audio output | : | 75 mWatts |
| (9) | Audio output load | : | 8 Ohm resistive load |

| | | | Nominal | Limit |
|---|---|---|---|---|
| 2.1 | Frequency range | : | VHF Low | 28 – 54 MHz |
| | | | VHF Aircraft | 108 – 136.9875 MHz |
| | | | VHF High | 137 – 174 MHz |
| | | | UHF Low | 406 – 512 MHz |
| | | | UHF High | 806 – 823.9875 MHz |
| | | | | 849 – 868.9875 MHz |
| | | | | 894 – 960 MHz |

Except cellular band: 824.000 – 848.9875 MHz and 869.000 – 893.9875 MHz

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| | | | | Nominal | Limit |
|---|---|---|---|---|---|
| 2.2 | Sensitivity<br>(S+N)/N = 20 dB<br>Dev.: 3 kHz at 1 kHz<br>Mod.: 60% at 1 kHz | : | VHF Low<br>VHF Aircraft<br>VHF High<br>UHF Low/T<br>UHF High | 0.3 μV<br>0.7 μV<br>0.5 μV<br>0.5 μV<br>0.5 μV | 1 μV<br>3 μV<br>2 μV<br>2 μV<br>2 μV |
| 2.3 | Data decode sensitivity<br>WX alert 1050 Hz tone<br>3 kHz Dev. at 162.4 MHz | : | | 0.3 μV | 1 μV |
| 2.4 | WX alert tone decode range<br>4 kHz Dev. 1 μV at 162.400 MHz | : | | 1050 ±30 Hz | ±40 Hz |
| 2.5 | WX alert tone checking time<br>4 kHz Dev. 1 μV at 162.400 MHz | : | | 3.0 sec. | 2 – 5 sec. |
| | Note: When receiving WX alert in priority operation, the priority sampling time up to 2 sec. is added to this depending on Alert tone transmission timing. | | | | |
| 2.6 | WX alert sound level at 1 ft. | : | | 70 dBSPL | 60 dBSPL |
| 2.7 | CTCSS Data decode sensitivity<br>350 Hz Dev. at 41, 154.6, 450, 860 MHz | : | | 1 μV | 3 μV |
| 2.8 | Image ratio | | | | |
| | 1st IF image | : | VHF Low at 41 MHz<br>41 MHz + (2 x 380.8 MHz) = 802.6 MHz | 40 dB | 30 dB |
| | | | VHF Aircraft at 124 MHz<br>124 MHz + (2 x 380.75 MHz) = 885.5 MHz | 40 dB | 30 dB |
| | | | VHF High at 154.6 MHz<br>154.6 MHz + (2 x 380.75 MHz) =916.1 MHz | 38 dB | 30 dB |
| | | | UHF Low at 450 MHz<br>450 MHz + (2 x 380.775 MHz) = 1211.55 MHz | 56 dB | 40 dB |
| | | | UHF High at 860 MHz<br>860 MHz - (2 x 380.825 MHz) = 98.35 MHz | 49 dB | 40 dB |
| | 2nd IF image | : | VHF High at 154.6 MHz<br>154.6 MHz + (2 x 45 MHz) = 244.6 MHz | 75 dB | 60 dB |

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| | | | | Nominal | Limit |
|---|---|---|---|---|---|
| 2.9 | Squelch sensitivity (Band center) | | | | |
| | Threshold | : | AM/FM | 0.3 μV | 1 μV |
| | Tight: (S+N)/N | : | AM | 20 dB | 10 dB |
| | | | FM | 30 dB | 20 dB |
| 2.10 | Selectivity | : | –6 dB | ±10 kHz | ±14 kHz |
| | | | –50 dB | ±18 kHz | ±25 kHz |
| 2.11 | Spurious rejection (Except Primary image) | : | VHF High at 154.6 MHz | 40 dB | 30 dB |
| 2.12 | IF rejection | : | 380.75 MHz at 154.6 MHz | 75 dB | 50 dB |
| | | | 45 MHz at 154.6 MHz | 70 dB | 50 dB |
| 2.13 | Acceptable radio frequency displacement at EIA RS-204D | : | at 154.6 MHz | ±6 kHz | ±3 kHz |
| 2.14 | Signal to noise ratio | : | 28 – 54 MHz | 40 dB | 30 dB |
| | RF: 100 μV | | 108 – 136.9875 MHz | 40 dB | 30 dB |
| | Dev.: 3 kHz at 1 kHz | | 137 – 174 MHz | 40 dB | 30 dB |
| | Mod. 60% at 1 kHz | | 406 – 512 MHz | 35 dB | 25 dB |
| | | | 806 – 960 MHz | 35 dB | 25 dB |
| 2.15 | Residual noise Vol. min. and Squelched | : | at 154.6 MHz | 0.5 mV | 2 mV |
| 2.16 | Scanning rate | : | at 406 -455 MHz 1MHz steps | 50 ch/sec. | 40 –55 ch/sec. |
| | Note; at worst combination scanning rate | | 17ch/sec. | | |
| 2.17 | Search rate | : | at 162.25 –164.25 MHz | 62 steps/sec. | 40 –70 steps/sec. |
| 2.18 | Scan and Search delay time | : | | 2 sec. | 1 – 3 sec. |
| 2.19 | Priority sampling | : | | 3 sec. | 2.5 – 3.5 sec. |
| 2.20 | Priority CH checking time | : | WX frequency | 78m sec. | 150m sec. |
| | | | Other frequency | 35m sec. | 100m sec. |
| 2.21 | Tone SQ detect time | | | 250m sec | 220 – 280m sec. |
| 2.22 | Audio output(T.H.D. 10 % BTL): RF input: 100 μV at 154.6 MHz | | | | |
| | 8 Ohms R Load, 1 kHz | | | Batt. 4.5 V/Ext. power DC 6 V | |
| | 150m Watts | | | 110m Watts | |
| 2.23 | T.H.D. at 50m Watt | : | RF input: 100 μV at 154.6 MHz | 1 % | 5 % |

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| | | | Nominal | Limit |
|---|---|---|---|---|
| 2.24 | Audio max. power | : RF input: 100 μV at 154.6 MHz | | |
| | 8 Ohm internal speaker | Batt. 4.5 V/Ext. power DC 6 V | 230m Watts | 180m Watts |
| | 32 Ohm at headphone mono/stereo (each phone) | Batt. 4.5 V/Ext. power DC 6 V | 17m/10m Watts | 25m Watts |
| 2.25 | Audio frequency response at –6 dB | : RF input: 100 μV at 154.6 MHz | 300 Hz<br>2 kHz | 200 – 400 Hz<br>1.5 – 3.0 kHz |
| 2.26 | Intermediate frequency | : 1st 380.680 – 380.86875 MHz<br>2nd 45 MHz<br>3rd 450 kHz | | |
| 2.27 | Current drain | : at 154.6 MHz | | |
| | Ext. power 6 V | Vol. Max.<br>Squelch | 240 mA<br>75 mA | 280 mA<br>100 mA |
| | Batt. 4.5 V | Vol. Max.<br>Squelch | 240 mA<br>75 mA | 280 mA<br>100 mA |
| 2.28 | Charging current Ni-MH Battery (1600 mA/h) | | | |
| | 1) AC adapter charging current | : | 150 mA | 120 – 180 mA |
| | Note: This specification is obtained AC 120 V with model 273-1758 without the scanner on after ten hours. | | | |
| | 2) DC adapter (regulated) charging current (at 6 V) | : | 150 mA | 120 – 180 mA |
| | Note: This specification is obtained DC 6 V model 273-1859 without the scanner on after ten hours. | | | |
| 2.29 | Battery life at continuous operation | | | |
| | Alkaline battery (CAT.NO.23-872):<br>Ni-MH battery (CAT.NO.23-528) | | 15 Hours<br>14 Hours | Not specified<br>Not specified |
| | Note: Test condition: EIAJ CP-2905 (1-4-4.1) | | | |
| 2.30 | Birdies and step frequency when search | : Under discussion | | |

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| | | | Nominal | Limit |
|---|---|---|---|---|
| 2.31 | Filters | : | Surface acoustic wave filter for 380.8 MHz (1st IF), Monolithic crystal filter for 45 MHz (2nd IF) and Ceramic filter for 450 kHz (3rd IF) | |
| 2.32 | Antenna impedance | : | 50 Ohms | |
| 2.33 | Temperature range | : | Test to specification between: +18°C – +35°C<br>Operate (Need not meet spec.): -10°C – +60°C | |
| 2.34 | Low BATT indicator | : | 3.3 V | 3 – 3.5 V |
| 2.35 | On-Air programming protocol | : | | |
| | | | Interface: AFSK (Audio Frequency Shift Keying) | |
| | | | Modulation: MSK (Minimum Shift Keying) | |
| | | | Mark frequency: 1200 Hz | |
| | | | Space frequency: 1800 Hz | |
| | | | Data format: Asynchronous | |
| | | | Data length: 8 bit | |
| | | | Parity: None | |
| | | | Stop bit: 2 bit | |
| | | | Baud rate: 1200 | |
| | | | Data direction: One way | |
| 2.36 | On-Air programming data decode sensitivity 3 kHz Dev. at 154.6 MHz | : | 2 μV | 4 μV |

## 3. OPERATING CONTROLS AND CONNECTIONS

3.1 Volume control and Squelch control with power switch

3.2 Keyboard 19 keys (1 is 4 way type key)

3.3 LCD indicator: 16 character 4 lines Frequency, Mode, ch, Bank, ..... Etc.

3.4 BNC type antenna connector

3.5 Earphone jack (D = 3.5 mm stereo)

3.6 PC Interface and Clone Jack (D = 3.5 mm mono)

3.7 External power/charge jack (EIAJ RC-5320A Voltage classification 2) Matched Plug (type –"B")

3.8 Battery compartment

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## 4. KEY FUNCTION

FUNC
Key lock/LIGHT
SCAN (CAR/CH)
MANual
SRCH(PAUSE)
WX (ALERT)
10 numeric key (0 – 9, PRI, DLY, L/OUT, CTCSS)
● (CLEAR)
ENT
4 way type key (▲, ▼, ◀, ▶)

## 5. FEATURES

5.1 16 character 4 lines plus I-cons LCD indicator

5.2 Small in size: 122 x 67 x 31 (H x W x D mm)

5.3 500 channels automatic scanning for VHF to UHF band

5.4 The scanner can receive CTCSS data.

5.5 Pre-programmed Fire/Police, Aircraft, Ham, MRN, CAR, FRS/GMRS/MARS and WX service search

5.6 QUICK PROGRAM when receive signals up to 500 channels

5.7 INTELIGENT SEARCH, 50 frequency-skip memories in search mode

5.8 Easy programming feature for storing car numbers and race drivers

5.9 HYPERSCAN, 50 channels/sec. Scanning rate and 50 steps/sec. searching rate

5.10 "Zeromatic" tuning system

5.11 500 channels lock-out in scan mode

5.12 Built-in priority channel

5.13 Built-in WX alert system

5.14 Built-in on-air programming system

5.15 PC IF programming system

5.16 Lock/Out ReVieW key to confirm lock out frequency sequentially

5.17 Change MENU direction by ▲(up), ▼(down), ◀(left) or ▶(right)

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5.18 2 second scan and search delay

5.19 Manual selection for channel

5.20 Scan mode [Cleared channels (000.000 freq.) do not scan.]

5.21 Program mode

5.22 Key lock for safety

5.23 Key tone

5.24 LCD and Keys (Front) backlighting

5.25 Low battery indicator on LCD

5.26 Built-in power save circuit

5.27 Limit search

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**Appendix B**

## LOCAL OSC FREQUENCY CALCULATION

| Receiving band (FR step) | Freq. step (kHz) | Receiving freq. FR (MHz) | 1st Local PLL 1/ VCO 1 or VCO 2 (MHz) | 2nd Local PLL 2/VCO 3 (MHz) | 3rd Local (MHz) |
|---|---|---|---|---|---|
| VHF Low | 5.0 | 25.0000 – 54.0000 | A = (FR + 380.800)/0.075 | 2nd Local = 1st IF – 45.0 | 45.0 |
| VHF High | 12.5 | 108.0000 – 136.9875 | = A.xxx (Cut away decimal) | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 5.0 | 137.0000 – 150.7750 | 1st Local = A x 0.075 | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 150.7825 – 150.8125 | 1st IF = 1st Local – FR | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 150.8150 – 154.4525 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 154.45625 – 154.47875 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 154.4825 – 154.5050 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 5.0 | 154.5100 – 154.5250 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 6.25 | 154.52750 – 154.54625 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 154.5475 – 154.6075 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 5.0 | 154.6100 – 154.6550 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 154.6575 – 156.2475 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 5.0 | 156.2500 – 157.4750 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 7.5 | 157.4775 – 161.5650 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 5.0 | 161.5700 – 173.2000 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 6.25 | 173.20375 – 173.22250 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 6.25 | 173.22500 – 173.38750 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 6.25 | 173.39000 – 173.41500 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 5.0 | 173.4200 – 174.0000 | A = (FR + 380.700)/0.075 = A.xxx (Cut away decimal) 1st Local = A x 0.075 1st IF = 1st Local – FR | 2nd Local = 1st IF – 45.0 | 45.0 |
| UHF Low | 6.25 | 406.0000 – 512.0000 | A = (FR + 380.800)/0.075 = A.xxx (Cut away decimal) 1st Local = A x 0.075 1st IF = 1st Local – FR | 2nd Local = 1st IF – 45.0 | 45.0 |
| UHF High | 6.25 | 806.0000 – 823.9875 | A = (FR – 380.800)/0.075 = A.xxx (Cut away decimal) 1st Local = A x 0.075 1st IF = FR – 1st Local | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 6.25 | 849.0000 – 868.9875 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | 6.25 | 894.0000 – 960.0000 | | 2nd Local = 1st IF – 45.0 | 45.0 |
| | | | | | |

RF DENOTES Frequency received

IF FREQUENCY 1st IF:380.680 – 380.86875 MHz, 2nd IF:45.0 MHz , 3rd IF:450 kHz