TEST REPORT

Report Number: 30642571
Project Number: 3064257
August 21, 2004

Testing performed on the
Scanning Receiver
Model Number: 20-496 (Pro-2096)
FCC ID:ADV2000496
to

FCC Part 15, Subpart B
ICES 003

CLASS: B
For
General Research of Electronics, Inc.

A2LA Certificate Number: 1755-01

Test Performed by:	Test Authorized by:
Intertek	General Research of Electronics, Inc.
1365 Adams Court	SHIBA N0.3 AMEREX BLDG.
Menlo Park, CA 94025	No. 12-17 MITA 3-CHOME, MINATO-KU
	Tokyo 108-0073, Japan

Prepared by: _____ **Date:** August 21, 2004
Bruce Gordon

Reviewed by: _____ **Date:** August 22, 2004
Ollie Moyrong

CERTIFICATION OF COMPLIANCE
Report No. 30642571

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below.

Equipment Under Test:	Scannong Receiver
Trade Name:	General Research of Electronics, Inc.
Model No.:	20-496 (Pro-2096)
Serial No.:	Several
Applicant:	General Research of Electronics, Inc.
Contact:	Mr. Kiyoshi Wakui
Address:	SHIBA N0.3 AMEREX BLDG. No. 12-17 MITA 3-CHOME, MINATO-KU Tokyo, 108-0073
Country	Japan
Tel. number:	+813-5439-3611
Fax number:	+813-5439-3644
Applicable Regulation:	FCC Part 15, Subpart B Industry Canada ICES-003
Equipment Class:	Class B
Date of Test:	August 20, 2004

We attest to the accuracy of this report:

Bruce Gordon
Test Engineer

Ollie Moyrong
EMC Manager

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1.0 General Description

1.1 Product Description

The Equipment under Test (EUT) is VHF/UHF Programmable AM/FM-9600 BPS Digital Trunking Handheld Scanning Receiver PRO-2096 CAT. NO. 20-496.
Please refer to the attached specifications sheets in Appendix A for more details.

A pre-production version of the sample was received on August 19, 2004 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: 20-526
FCC ID: ADV2000526

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 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:

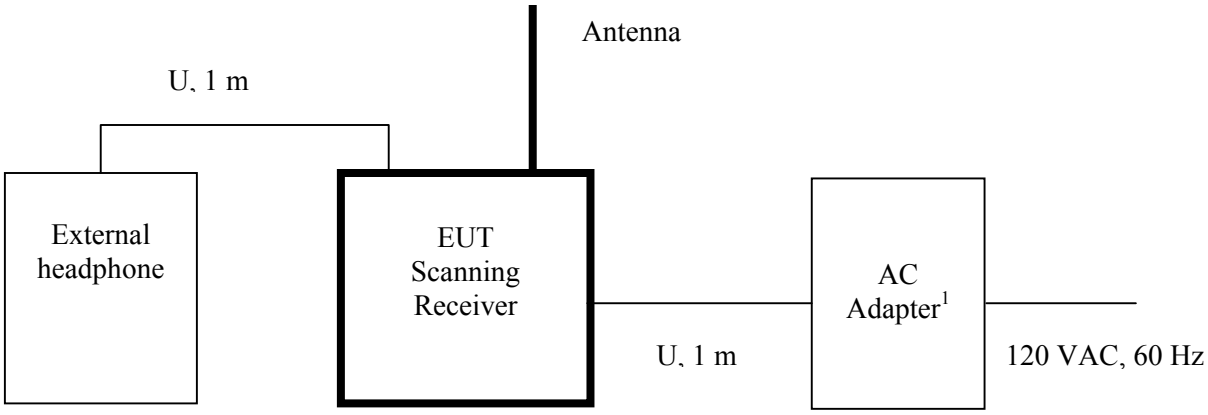
Test Mode 1: The EUT was set to constantly receive at the low, middle and high channels of each band.

Test Mode 2: The EUT was set to constantly scan a particular band.

2.4 Support Equipment List and Description

Item #	Description	Model No.	Serial No.
1	External headphone	Avid	Not Labeled

2.5 Equipment Setup Block Diagram



[1] The AC adapter is manufactured by RadioShack®, Part number JOD(M)-48-A641

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.

Preliminary tests were performed to determine the worst-case emission with the EUT tuned to the low, middle and high channels of each band. From these preliminary measurements the EUT was tuned to the frequency with the highest emission and the final scan was performed using the automated test software.

The same procedure was used to determine the worst-case emission level with the EUT setup in scanning mode for each band.

The final recorded data reflects the worst-case result.

A sample calculation, 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

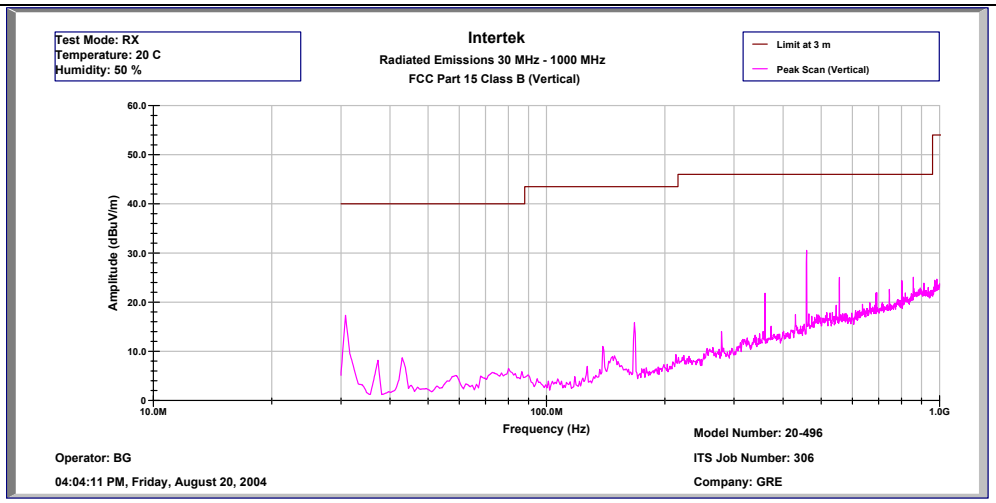
Tested By:	Bruce Gordon
Test Date:	August 20, 2003

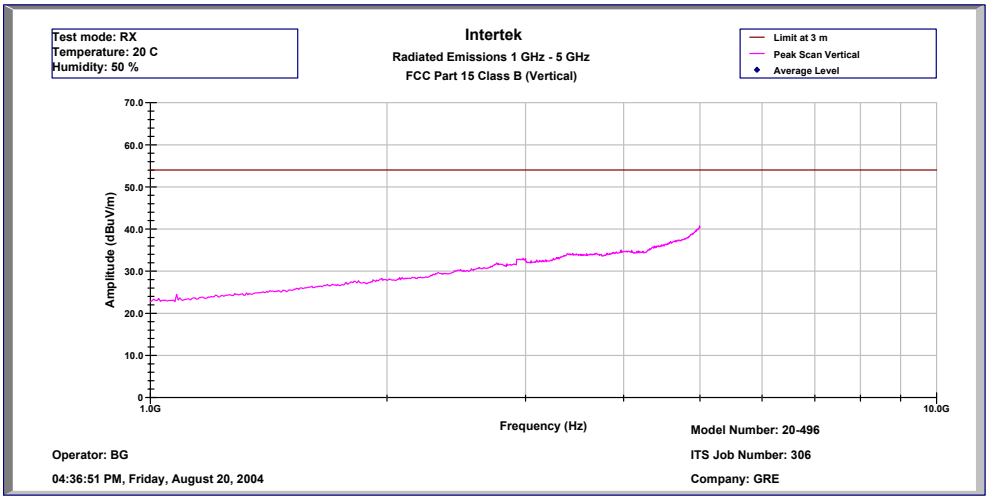
Temperature	**(°C)**	20^0C
Relative Humidity	**(%)**	50%

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 15.6 dB at 857.73 MHz

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





Intertek

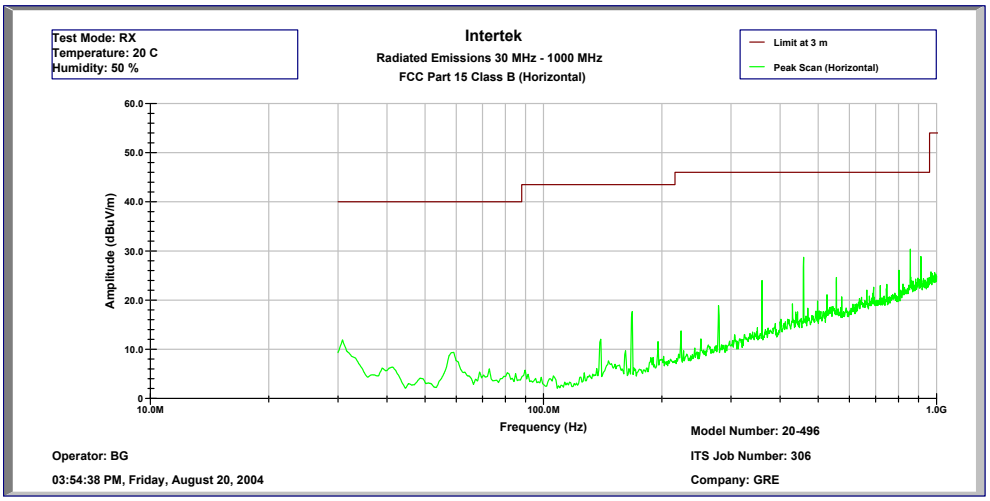
Radiated Emissions 30 MHz – 5000 MHz

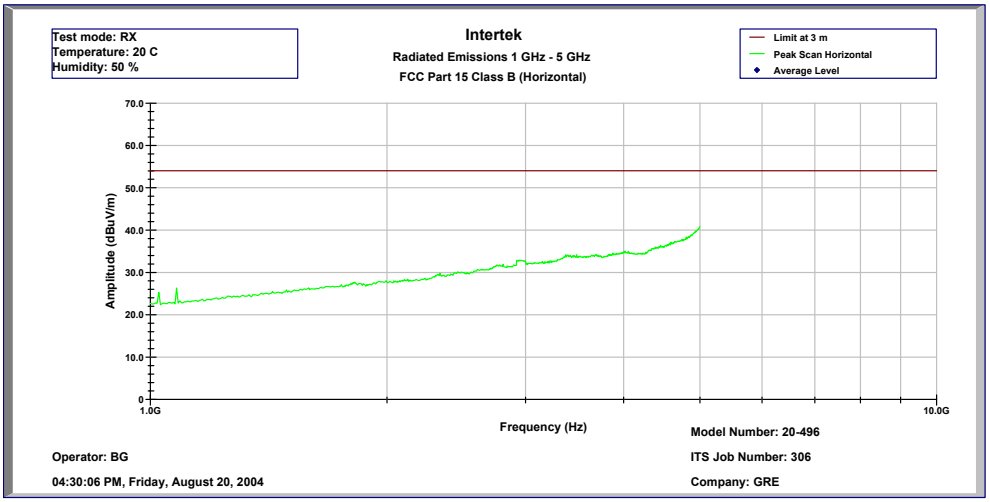
FCC Class B (Vertical)

EUT Model Number: 20-496	**ITS Job Number:** 306
Company: GRE	**Tst Date:** August 20, 2004
Operator: BG	

Frequency	Pk FS	Limit@3m	Margin	RA	CF	AG	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
37.28	8.1	40.0	-31.9	30.0	3.8	32.4	6.7
42.93	8.7	40.0	-31.3	28.7	3.9	32.4	8.5
167.42	15.8	43.5	-27.7	34.2	4.8	32.3	9.1
359.80	21.8	46.0	-24.2	33.2	5.8	32.3	15
556.23	25.0	46.0	-21.0	31.9	6.6	32.5	18.9
857.73	25.1	46.0	-20.9	27.6	7.8	32.2	21.8

Test Mode: Normal	**Temperature:** 20 C	**Humidity:** 50%





Intertek

Radiated Emissions 30 MHz – 5000 MHz

FCC Class B (Horizontal)

EUT Model Number: 20-496	**ITS Job Number:** 306
Company: GRE	**Tst Date:** August 20, 2004
Operator: BG	

Frequency	Pk FS	Limit@3m	Margin	RA	AG	CF	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
168.23	17.7	43.5	-25.8	36.4	32.3	4.8	8.8
359.80	24.0	46.0	-22.0	35.1	32.3	5.8	15.3
459.23	28.7	46.0	-17.3	36.9	32.3	6.2	17.9
556.23	24.6	46.0	-21.4	30.5	32.5	6.6	19.9
802.77	26.1	46.0	-19.9	29.3	32.4	7.3	21.9
857.73	30.4	46.0	-15.6	31.6	32.2	7.8	23.1
912.70	28.9	46.0	-17.1	29.3	31.9	7.9	23.5

Test Mode: Normal	**Temperature:** 20 C	**Humidity:** 50%

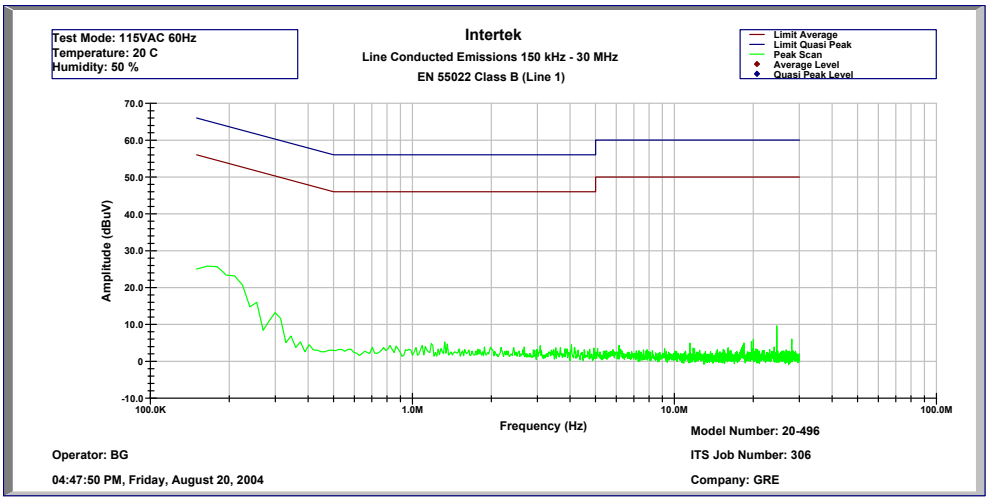
3.3 AC Line Conducted Emission Data

Tested By:	Bruce Gordon
Test Date:	August 20, 2004

Temperature	**(°C)**	20.0^0C
Relative Humidity	**(%)**	50%

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 more than 15 dB


Test Mode: 115VAC 60Hz
Temperature: 20 C
Humidity: 50 %
Intertek
Line Conducted Emissions 150 kHz - 30 MHz
EN 55022 Class B (Line 1)
Limit Average
Limit Quasi Peak
Peak Scan
Average Level
Quasi Peak Level
Amplitude (dBuV)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
100.0K
1.0M
10.0M
100.0M
Frequency (Hz)
Model Number: 20-496
ITS Job Number: 306
Company: GRE
Operator: BG
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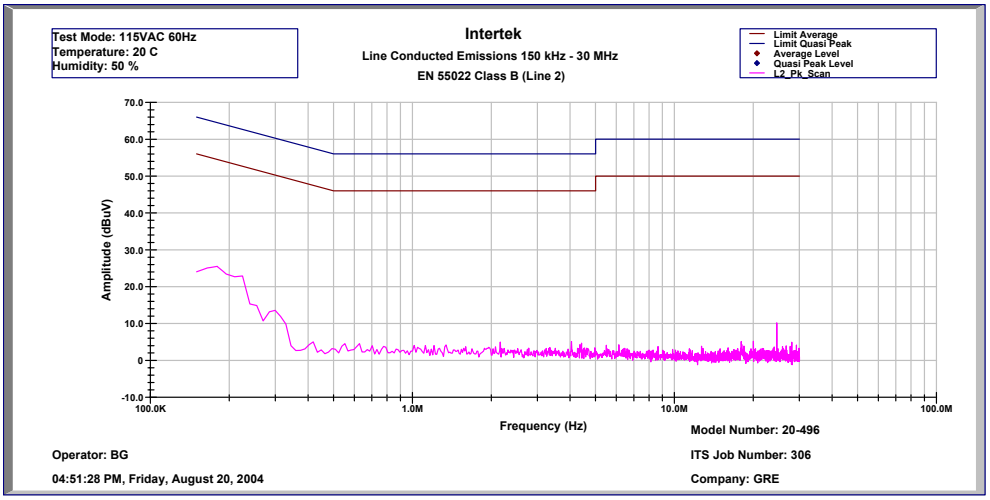

Test Mode: 115VAC 60Hz
Temperature: 20 C
Humidity: 50 %
Intertek
Line Conducted Emissions 150 kHz - 30 MHz
EN 55022 Class B (Line 2)
Limit Average
Limit Quasi Peak
Average Level
Quasi Peak Level
L2_Pk_Scan
Amplitude (dBuV)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
100.0K
1.0M
10.0M
100.0M
Frequency (Hz)
Model Number: 20-496
ITS Job Number: 306
Company: GRE
Operator: BG
04:51:28 PM, Friday, August 20, 2004

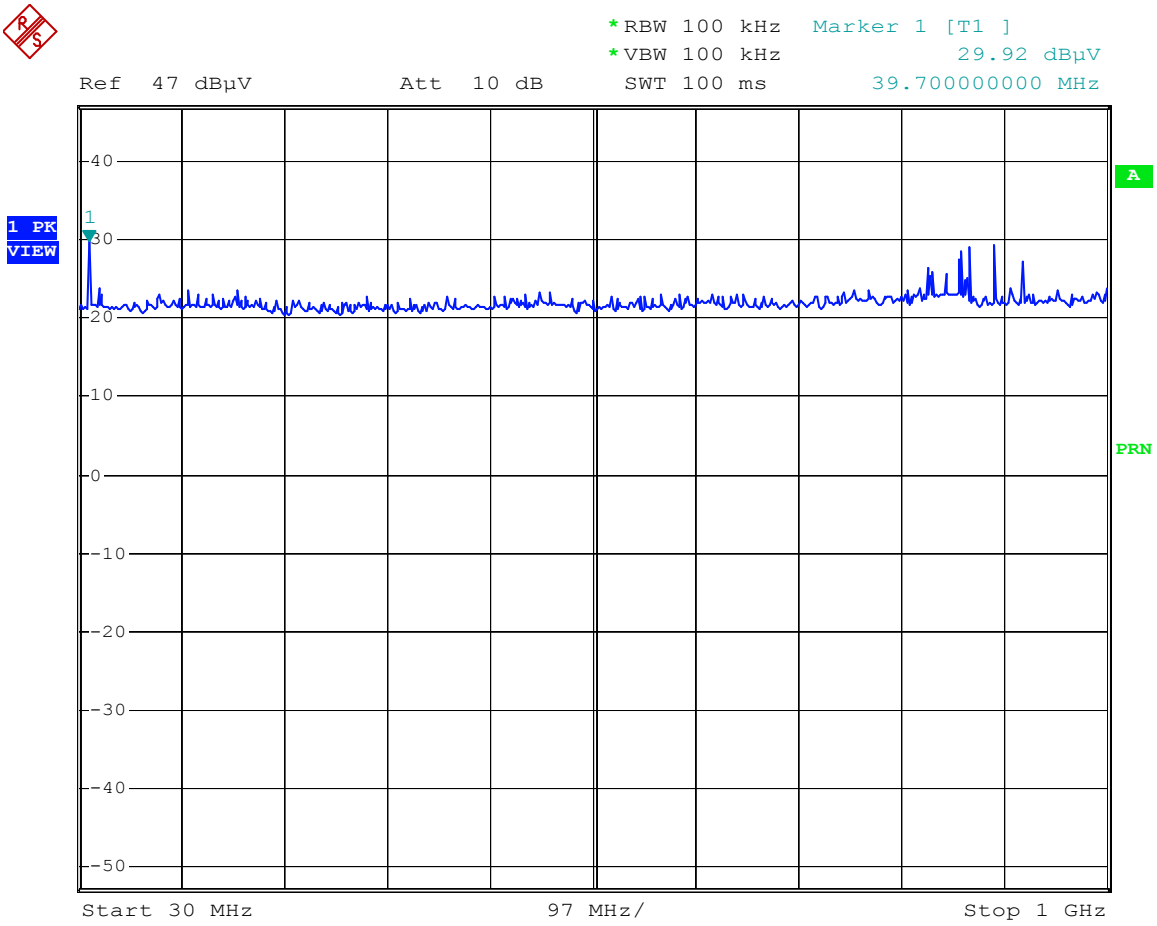
3.4 Antenna Conducted Emission Data

Tested By:	Bruce Gordon
Test Date:	August 20, 2004

Temperature	**(°C)**	20^0C
Relative Humidity	**(%)**	50%

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 7.68 dB at 3.08 GHz



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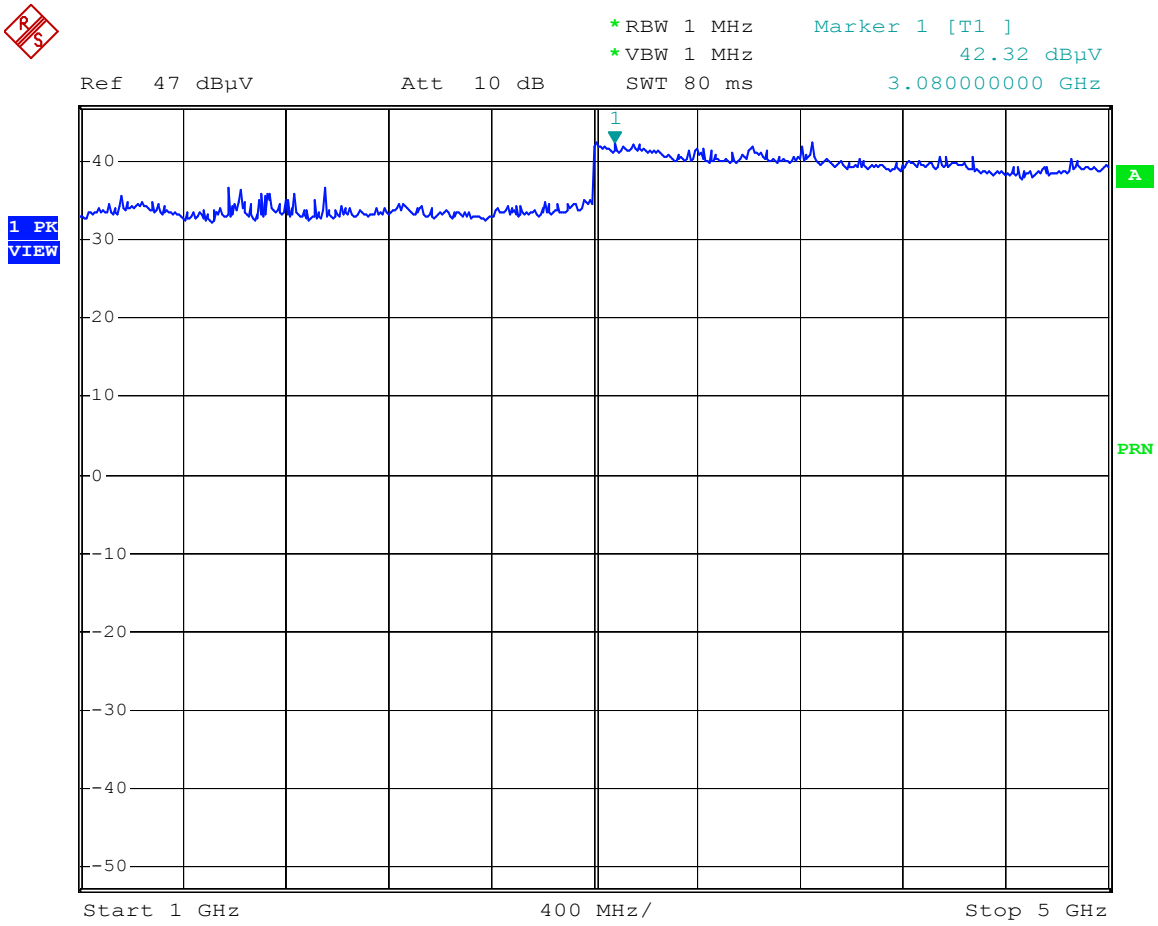

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4.0 List of Test Equipment

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

Test Equipment List

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
BI-Log Antenna	EMCO	3143	9509-1160	12	10/1/04
Horn Antenna	EMCO	3115	8812-3049	12	4/14/05
Pre-Amplifier	Sonoma Inst.	310	185634	12	10/08/04
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	9/06/04
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	9/08/04
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	9/08/04
EMI Receiver	Rhode-Schwarz	FSP	1093.4495.40	12	2/04/05
LISN	FCC	FCC-LISN-50-50-M-H	2011	12	2/10/05

Appendix A

GRE GENERAL RESEARCH OF ELECTRONICS, INC.

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

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

Date: JUL. 30, 2004
Reference No. 04003

SPECIFICATIONS

SUBJECT: 5,500 CHANNEL FREQUENCY MEMORIES WITH 16,500 ID MEMORIES, VHF/UHF PROGRAMMABLE AM/ FM-DIGITAL TRUNKING SCANNING RECEIVER
PRO-2096 CAT. NO. 20-496

1. GENERAL

1.1 Programmable channel : 500 channels (50 channels x 10 banks)
1,500 ID memories (30 location x 5 sub-banks x 10 banks)
11 in 1 V-Scanner (500 channels x 11 folders with 1,500 channels x 11 folders)
Total 5,500 channel frequency memories plus 16,500 ID memories
6 service search
1 limit search bank
1 priority channel
7 WX frequencies
WX alert and SAME receiving with 10 FIPS (Federal Information Processing Standard) area code memories

1.2 Receiving mode : AM, FM/APCO-25 Digital modulation, CTCSS, DCS, Motorola trunking/APCO-25 3,600 and 9,600 BPS Digital trunking, EDACS (GE/Ericsson/M/A-COM) trunking

1.3 Receiving system : Triple conversion PLL superheterodyne

1st IF 380.72750 MHz – 380.86875 MHz

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

– Continued –

PRODUCT DEVELOPMENT & MANUFACTURING

GENERAL RESEARCH OF ELECTRONICS, INC. Ref. No. 04003

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

2nd IF 21.4 MHz: The 2nd Local OSC frequency employs lower side of 1st IF.

3rd IF 455 kHz : The 3rd Local OSC frequency employs lower side of 2nd IF.

1.4 Frequency range :

Freq.	Step	Mode (Default)
25.000 – 27.995 MHz	5 kHz	AM
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
216.0025 – 221.9975 MHz	5 kHz	FM
222.000 – 225.000 MHz	5 kHz	FM
406.000 – 512.000 MHz	6.25 kHz	FM
806.000 – 960.000 MHz	6.25 kHz	FM
1240.000 – 1300.000 MHz	6.25 kHz	FM

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

GENERAL RESEARCH OF ELECTRONICS, INC. Ref. No. 04003

1.5	Preprogrammed band search	:	Marine CB FRS/GMRS/MURS Fire/Police Aircraft Ham
1.6	WX frequencies	:	162.400, 162.425, 162.450, 162.475, 162.500, 162.525, 162.550 MHz
1.7	Scanning rate	:	60 channels/sec.
1.8	Search rate	:	75 steps/sec.
1.9	Display	:	LED back-lighted LCD with 12 characters 4 lines
1.10	Zeromatic	:	Activates during search mode
1.11	Audio output	:	1.8 Watts
1.12	Speaker	:	Built-in 77 mm 8 Ohms dynamic speaker
1.13	Operating voltage	:	DC 13.8 Volts
1.14	Dimension	:	Approx. 185 (W) x 135 (D) x 55 (H) mm
1.15	Weight	:	Approx. 790 g without outer cabinet and accessories
1.16	Accessory	:	Telescopic antenna, Owner's manual, Sleeve, Handle bracket AC adapter and Outer cabinet
1.17	Memory backup	:	No battery back-up required, EEPROM and Flash memory used
1.18	Drop test	:	In Gift-Box, Height 76 cm

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GENERAL RESEARCH OF ELECTRONICS, INC. Ref. No. 04003

2. ELECTRICAL

Standard Test Condition

(1)	Power source voltage	:	13.8 Volts DC
(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 m Watts
(9)	Audio output load	:	8 Ohm resistive load

				Nominal	Limit
2.1	Frequency range	:	VHF Low		25 – 54 MHz
			VHF Aircraft		108 – 136.9875 MHz
			VHF High		137 – 174 MHz
					216.0025 – 225.000 MHz
			UHF Low		406 – 512 MHz
			UHF High		806 – 960 MHz
					1240 – 1300 MHz

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

2.2	Sensitivity	:	VHF Low	0.3 μV	1 μV
	FM: (S+N)/N = 20 dB		VHF Aircraft	0.3 μV	1 μV
	Dev.: 3 kHz at 1 kHz		VHF High	0.5 μV	2 μV
			UHF Low/T	0.5 μV	2 μV
			UHF High 806 – 960 MHz	0.7 μV	3 μV
			1240 – 1300 MHz	0.7 μV	4 μV
	AM: (S+N)/N = 20 dB	:	VHF Low	1 μV	3 μV
	Mod.: 60% at 1 kHz		VHF Aircraft	1 μV	3 μV
			VHF High	1.5 μV	5 μV
			UHF Low/T	2 μV	6 μV
			UHF High 806 – 960 MHz	2 μV	6 μV
			1240 – 1300 MHz	3 μV	12 μV

GENERAL RESEARCH OF ELECTRONICS, INC. Ref. No. 04003

			Nominal	Limit
2.3	Data decode sensitivity			
	CT : CTCSS 350 Hz Dev. at 41, 174, 450, 860 MHz		1 μV	3 μV
	DC : DCS 350 Hz Dev. at 41, 174, 450, 860 MHz		1 μV	3 μV
	ED : ED (GE/Ericsson/M/A-COM) 4 kHz Dev. at 174, 450, 860 MHz		1 μV	4 μV
	MO (Voice channel) : MO (Motorola) 350 Hz Dev. at 174, 450, 860 MHz		0.5 μV	3 μV
	MO (Control channel) : MO (Motorola) 4 kHz Dev. at 174, 450, 860 MHz		1 μV	4 μV
	WX Alert 1050 Hz tone : 3 kHz Dev. at 162.4 MHz		0.3 μV	1 μV
	WX SAME : 4 kHz Dev. at 162.4 MHz		0.5 μV	2 μV
2.4	WX alert tone decode range : 4 kHz Dev. 2 μV at 162.400 MHz		1050 ±25 Hz	±40 Hz
2.5	WX alert tone checking time : 4 kHz Dev. 2 μV at 162.400 MHz		2.2 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. :		80 dBSPL	70 dBSPL
2.7	Image ratio 1st IF image	: VHF Low at 41 MHz	60 dB	50 dB
		VHF Aircraft at 124 MHz	60 dB	50 dB
		VHF High at 174 MHz	50 dB	35 dB
		UHF Low/T at 450 MHz	55 dB	45 dB
		UHF High at 860 MHz	90 dB	80 dB
		1270 MHz	50 dB	35 dB
	2nd IF image	: VHF High at 174 MHz	50 dB	40 dB

GENERAL RESEARCH OF ELECTRONICS, INC. Ref. No. 04003

			Nominal	Limit
2.8	Attenuator	: VHF Low	20 dB	17 – 24 dB
		VHF Aircraft	20 dB	17 – 24 dB
		VHF High	20 dB	17 – 24 dB
		UHF Low	15 dB	10 – 20 dB
		UHF High	13 dB	8 – 18 dB
2.9	Squelch sensitivity (Band center)			
	Threshold	: AM/FM	0.5 μV	2 μV
	Tight: (S+N)/N	: AM	20 dB	10 dB
		FM	25 dB	15 dB
2.10	Selectivity			
	AM 25 – 27.995 MHz	: -6 dB	±5 kHz	±7 kHz
		-50 dB	±6 kHz	±10 kHz
	Other frequency	: -6 dB	±8 kHz	±12 kHz
		-50 dB	±14 kHz	±17.5 kHz
2.11	Spurious rejection (Except Primary image)	: VHF High at 174 MHz	40 dB	30 dB
2.12	IF rejection	: 380.8 MHz at 174 MHz	60 dB	40 dB
		21.4 MHz at 174 MHz	100 dB	80 dB
2.13	Acceptable radio frequency displacement at EIA RS-204D	:	±6 kHz	±3 kHz
2.14	Signal to noise ratio	: 25 – 54 MHz	40 dB	30 dB
	AM/FM	108 – 136.9875 MHz	40 dB	30 dB
	RF: 100 μV	137 – 174 MHz	40 dB	30 dB
	Dev.: 3 kHz at 1 kHz	216.0025 – 225 MHz	40 dB	30 dB
	Mod. 60% at 1 kHz	406 – 512 MHz	35 dB	25 dB
		806 – 960 MHz	35 dB	25 Db
		1240 – 1300 MHz	35 dB	25 dB
2.15	Residual noise Vol. min. and Squelched	:	2 mV	5 mV
2.16	Scanning rate without trunking:		60 ch/sec.	33 – 66 ch/sec.

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GENERAL RESEARCH OF ELECTRONICS, INC. Ref. No. 04003

			Nominal	Limit
2.17	Search rate (Receiving mode FM)	: at 162.25 – 164.25 MHz	75 steps/sec.	60 – 85 steps/sec.
2.18	Scan and Search delay time	:	2 sec.	1 – 3 sec.
2.19	Audio output (T.H.D. 10 %)	: RF input: 100 μV at 174 MHz		
	8 Ohms R Load, 1 kHz		1.5 Watts	1.0 Watt
2.20	T.H.D. at 50 m Watt	: RF input: 100 μV at 174 MHz	1 %	5 %
2.21	Audio max. power	: RF input: 100 μV at 174 MHz		
	8 Ohm internal speaker		1.8 Watts	1.3 Watts
	32 Ohm at headphone mono/stereo (each phone)		19m/14m Watts	28m/28m Watts
2.22	Audio frequency response at –6 dB	: RF input: 100 μV at 174 MHz	300 Hz 2.0 kHz	200 – 400 Hz 1.5 – 3.0 kHz
2.23	Intermediate frequency	: 1st 380.72750 – 380.86875 MHz 2nd 21.4 MHz 3rd 455 kHz		
2.24	Current drain at 13.8 Volts 8 Ohm internal speaker at 174 MHz	: Vol. Max. Squelch	450 mA 200 mA	550 mA 250 mA
2.25	Current drain AC adapter GA-04D-1100 8 Ohm internal speaker at 174 MHz	: Vol. Max. Squelch	100 mA AC 60 mA AC	120 mA AC 70 mA AC
2.26	Birdies and step frequency when search	: Under discussion		
2.27	Filters	: Saw filter for 380.8 MHz (1st IF), Monolithic crystal filter for 21.4 MHz (2nd IF) and Ceramic filters for 455 kHz (3rd IF)		
2.28	Antenna impedance	: 50 Ohms		

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2.29 Temperature range : Test to specification between: +18°C – +35°C
Operate (Need not meet spec.): -20°C – +60°C

3. OPERATING CONTROLS AND CONNECTIONS

3.1 Volume control with power switch

3.2 Squelch control

3.3 Keyboard (30 keys): FUNCtion, PROG, WX, TRUNK, MANual, PRI, TUNE, TEXT, ATT, PAUSE, MODE, ▲, ▼, DIM, SCAN, SRCH, L/OUT, ENT, CLEAR, 1, ABC/2, DEF/3, GHI/4, JKL/5, MNO/6, PQRS/7, TUV/8, WXYZ/9, 0, • and DELAY

3.4 LCD display: 12 characters and 4 lines
Frequency, Mode, ch, Bank, ... Etc.

3.5 BNC type antenna connector

3.6 Earphone jack (D = 3.5 mm stereo)

3.7 External power jack

3.8 PC Interface and Clone jack (D = 35 mm mono)

3.9 Reset switch

4. FEATURES

4.1 The scanner can receiving Phase 1 APCO-25 C4FM/IMBE digital voice modulation

4.2 10 bank and 500 channel memories for trunking bank and channel combined with conventional mode

4.3 Scan both trunking and conventional channels at same time

4.4 V-Scanner Folders – Eleven 500 channel virtual scanner folders, total 5, 500 channels

4.5 1,500 ID memories in 10 ID banks, 5 sub-ID memories in each bank and each sub-ID memory has 30 ID locations. (V-Scanner Folders, Total 16,500 ID memories)

4.6 The scanner can receive Motorola APCO-25 digital trunking system of 3,600 and 9,600 BPS CC.

4.7 The scanner can receive Motorola VHF and UHF (Type I/IIi) trunking system.

4.8 The scanner can receive VHF and UHF EDACS trunking system.

4.9 The scanner can receive CTCSS and DCS data.

4.10 Alphanumeric data entry and display

4.11 Clone the memory to other unit (Use 20-289 PC cable)

4.12 Pre-programmed Marine, CB, FRS/GMRS/MURS, Fire/Police, Aircraft, Ham and Weather frequencies

4.13 WX alert (1050 Hz tone) and SAME (Specific Area Message Encoding) system receive

4.14 Attenuator control (Normal attenuator and Global attenuator)

4.15 Frequency tune mode (Frequency ▲ or ▼)

4.16 "Zeromatic" tuning system

4.17 Change the direction at the searching by ▲ (up) or ▼ (down)

4.18 60 channels/sec. Scanning rate and 75 steps/sec. Searching rate

4.19 2 second scan and search delay

4.20 Manual selection for channel

4.21 Scan mode [Cleared channels (000.000 freq.) are not scan.]

4.22 Deleting a frequency from a channel

4.23 1 limit search bank

4.24 Key lock for safety

4.25 Key tone and alert tone

4.26 12 characters and 4 lines dot matrix LCD (Indicate channel numbers, Frequency, ID number and the data on the LCD)

4.27 LCD and keyboard backlighting with dimmer switch

4.28 LCD contrast control

4.29 Regulated DC power supply circuit

4.30 Built-in dynamic speaker

4.31 Crystal filter for 2nd IF and Ceramic filters for 3rd IF section

4.32 50 lock out frequencies per search bank, Fire/Police, Aircraft, Ham, Limit search (Totaling 200 frequencies.)

4.33 Frequency lock-out review

4.34 Channel lock-out and channel lock-out review

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 X'tal (MHz)
VHF Low	5.0	25.0000 – 54.0000	A = (FR + 380.800)/0.075	2nd Local = 1st IF – 21.4	20.9450
VHF High	12.5	108.0000 – 136.9875	= A.xxx (Cut away decimal)	2nd Local = 1st IF – 21.4	20.9450
	5.0	137.0000 – 150.7750	1st Local = A x 0.075	2nd Local = 1st IF – 21.4	20.9450
	7.5	150.7825 – 150.8125	1st IF = 1st Local – FR	2nd Local = 1st IF – 21.4025	20.9475
	7.5	150.8150 – 154.4525		2nd Local = 1st IF – 21.4	20.9450
	7.5	154.45625 – 154.47875		2nd Local = 1st IF – 21.4	20.9450
	7.5	154.4825 – 154.5050		2nd Local = 1st IF – 21.4	20.9450
	5.0	154.5100 – 154.5250		2nd Local = 1st IF – 21.4	20.9450
	6.25	154.52750 – 154.54625		2nd Local = 1st IF – 21.3975	20.9425
	7.5	154.5475 – 154.6075		2nd Local = 1st IF – 21.4025	20.9475
	5.0	154.6100 – 154.6550		2nd Local = 1st IF – 21.4	20.9450
	7.5	154.6575 – 156.2475		2nd Local = 1st IF – 21.3975	20.9425
	5.0	156.2500 – 157.4750		2nd Local = 1st IF – 21.4	20.9450
	7.5	157.4775 – 161.5650		2nd Local = 1st IF – 21.3975	20.9425
	5.0	161.5700 – 173.2000		2nd Local = 1st IF – 21.4	20.9450
	6.25	173.20375 – 173.22250		2nd Local = 1st IF – 21.4025	20.9475
	6.25	173.22500 – 173.38750		2nd Local = 1st IF – 21.4	20.9450
	6.25	173.39000 – 173.41500		2nd Local = 1st IF – 21.3975	20.9425
	5.0	173.4200 – 174.0000		2nd Local = 1st IF – 21.4	20.9450
	5.0	216.0025 – 221.9975		2nd Local = 1st IF – 21.4025	20.9475
	5.0	222.0000 – 225.0000		2nd Local = 1st IF – 21.4	20.9450
UHF Low	6.25	406.0000 – 512.0000		2nd Local = 1st IF – 21.4	20.9450
UHF High	6.25	806.0000 – 823.9875	A = (FR – 380.800)/0.075	2nd Local = 1st IF – 21.4	20.9450
	6.25	849.0000 – 868.9875	= A.xxx (Cut away decimal)	2nd Local = 1st IF – 21.4	20.9450
	6.25	894.0000 – 960.0000	1st Local = A x 0.075	2nd Local = 1st IF – 21.4	20.9450
	6.25	1240.0000 – 1300.0000	1st IF = FR – 1st Local	2nd Local = 1st IF – 21.4	20.9450

RF DENOTES Frequency received

IF FREQUENCY

1st IF: 380.7300 – 380.850 MHz

2nd IF: 21.3975 MHz/21.4000 MHz/21.4025 MHz

3rd IF: 455 kHz

-3 Example

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 X' TAL (MHz)
VHF Low	5.0	25.0000	A : 5410.666 = (25.0000 + 380.800) / 0.075 = 5410.666 (Cut away decimal) 1st Local : 405.750 =5410 x 0.075 1st IF : 380.750 = 405.750 – 25.0000	359.350 = 380.750 – 21.4	20.9450
		40.0000	5610.666 = (40.0000 + 380.800) / 0.075 = 5610.666 (Cut away decimal) 420.750 =5610 x 0.075 380.750 = 420.750 – 40.0000	359.350 = 380.750 – 21.4	20.9450
		54.0000	5797.333 = (54.0000 + 380.800) / 0.075 = 5797.333 (Cut away decimal) 434.775 =5797 x 0.075 380.775 = 434.775 – 54.0000	359.375 = 380.775 – 21.4	20.9450
VHF High	12.5	108.0000	6517.333 = (108.0000 + 380.800) / 0.075 = 6517.333 (Cut away decimal) 488.775 =6517 x 0.075 380.775 = 488.775 – 108.0000	359.375 = 380.775 – 21.4	20.9450
	6.25	154.5275	7137.7 = (154.5275 + 380.800) / 0.075 = 7137.7 (Cut away decimal) 535.275 =7137 x 0.075 380.7475 = 535.275 – 154.5275	359.350 = 380.7475 – 21.3975	20.9425
	5.0	174.0000	7397.333 = (174.0000 + 380.800) / 0.075 = 7397.333 (Cut away decimal) 554.775 = 7397 x 0.075 380.775 = 554.775 – 174.0000	359.375 = 380.775 – 21.4	20.9450
	5.0	216.0025	7957.366 = (216.0025 + 380.800) / 0.075 = 7957.366 (Cut away decimal) 596.775 = 7957 x 0.075 380.7725 = 596.775 – 216.0025	359.370 = 380.7725 – 21.4025	20.9475
	5.0	225.0000	8077.333 = (225.0000 + 380.800) / 0.075 = 8077.333 (Cut away decimal) 605.775 =8077 x 0.075 380.775 = 605.775 – 225.0000	359.375 = 380.775 – 21.4	20.9450

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 X' TAL (MHz)
UHF Low	6.25	406.0000	10490.666 = (406.0000 + 380.800) / 0.075 = 10490.666 (Cut away decimal) 786.750 =10490 x 0.075 380.750 = 786.750 – 406.0000	359.350 = 380.750 – 21.4	20.9450
		446.0000	11024.000 = (446.0000 + 380.800) / 0.075 = 11024.000 (Cut away decimal) 826.800 =11024 x 0.075 380.800 = 826.800 – 446.0000	359.400 = 380.800 – 21.4	20.9450
		512.0000	11904.000 = (512.0000 + 380.800) / 0.075 = 11904.000 (Cut away decimal) 892.800 =11904 x 0.075 380.800 = 892.800 – 512.0000	359.400 = 380.800 – 21.4	20.9450
UHF High	6.25	806.0000	5669.333 = (806.0000 – 380.800) / 0.075 = 5669.333 (Cut away decimal) 425.175 =5669 x 0.075 380.825 = 806.000 – 425.175	359.425 = 380.825 – 21.4	20.9450
		860.0000	6389.333 = (860.0000 – 380.800) / 0.075 = 6389.333 (Cut away decimal) 479.175 =6389 x 0.075 380.825 = 860.000 – 479.175	359.425 = 380.825 – 21.4	20.9450
		960.0000	7722.666 = (960.0000 – 380.800) / 0.075 = 7722.666 (Cut away decimal) 579.150 =7722 x 0.075 380.850 = 806.000 – 579.150	359.450 = 380.850 – 21.4	20.9450
		12400.0000	11456.000 = (1240.0000 – 380.800) / 0.075 = 11456.000 (Cut away decimal) 859.200 =11456 x 0.075 380.800 = 1240.000 – 859.200	359.400 = 380.800 – 21.4	20.9450
		1300.0000	12256.000 = (1300.0000 – 380.800) / 0.075 = 12256.000 (Cut away decimal) 919.200 =12256 x 0.075 380.800 = 1300.000 – 919.200	359.400 = 380.800 – 21.4	20.9450