



# GENERAL RESEARCH OF ELECTRONICS, INC.

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Federal Communications Commission  
Authorization and Evaluation Division  
Laboratory Division  
7435 Oakland Mills Road  
Colombia, MD 21046

Ref.: Model 20-496, FCC ID: ADV2000496

This is to clarify that the above equipment is incapable of operating (tuning) or readily being altered by the user to operate, within the frequency bands to the Cellular Radiotelephone Service.

The frequencies in question are deleted from the ROM during manufacture, and cannot be restored through any readily available process or component such as: installation of cuts, jumper wires, resistors, diodes, or plug-in IC's; deletion of such items; or reprogramming via access codes or external devices such as a personal computer.

The receiver is incapable of converting digital cellular transmissions to analog voice audio.

### **Assessing the vulnerability of the receiver to possible modification**

The receive has the possibility of reducing the threshold value to discern transmissions from the Cellular Radiotelephone Service by making modification such as adding jumper wire to the RF band pass filters.

### **Design features that prevent modification of the receiver to receive Cellular Service**

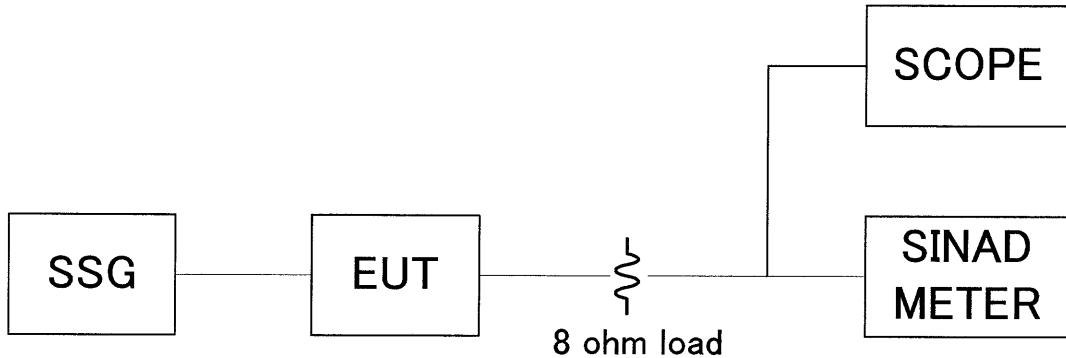
The scanning receiver is designed to prevent any attempt for the user to modify the receiver to receive transmissions from the Cellular Radiotelephone Service by using epoxy to cover the required parts of the RF circuitry including control circuits and band pass filters.

### **Testing method used to determine compliance with the 38 dB rejection ratio**

#### Testing method

The 12 dB SINAD measurement method in the Cellular Radiotelephone Service used for frequencies that the receiver tunes and the signal rejection ratio gained by the measurement.

## Equipment Setup Block Diagram



### Measurement method

Tune the receiver to the received frequency and outputs the receiving frequency from SG to obtain its 12 dB SINAD. Then output the interference frequency to obtain its 12 dB SINAD. The signal rejection ratio is the ratio between these two SSG output levels.

The scanning receiver prevents transmissions more than 38 dB from the Cellular Radiotelephone Service from being received for the following reasons:

1. The image frequencies in the frequency range from 25 MHz to 512 MHz are shown as follows:

$$FR = 25 \text{ to } 54 \text{ MHz, } 108 \text{ to } 174 \text{ MHz, } 216.0025 \text{ to } 225 \text{ MHz, } 406 \text{ to } 512 \text{ MHz}$$

$$\text{IMAGE FREQ.} = FR + 1^{\text{st}} \text{ IF} \times 2$$

$$1^{\text{st}} \text{ IF} = 1^{\text{st}} \text{ Local} - FR$$

$$1^{\text{st}} \text{ Local} = A \times 0.075$$

$$A = (FR + 380.8) / 0.075$$

$$= A.\text{xxx} \text{ (Cut away decimal)}$$

$$(25 \text{ to } 54) + (1^{\text{st}} \text{ IF} \times 2) = 786.5 \text{ to } 815.55 \text{ MHz} \quad \text{IMAGE FREQ.}$$

$$(132.4125 \text{ to } 174) + (1^{\text{st}} \text{ IF} \times 2) = 893.8875 \text{ to } 935.55 \text{ MHz} \quad \text{IMAGE FREQ.}$$

$$(216.0025 \text{ to } 225) + (1^{\text{st}} \text{ IF} \times 2) = 977.5475 \text{ to } 986.55 \text{ MHz} \quad \text{IMAGE FREQ.}$$

$$(406 \text{ to } 512) + (1^{\text{st}} \text{ IF} \times 2) = 1167.5 \text{ to } 1273.6 \text{ MHz} \quad \text{IMAGE FREQ.}$$

These image frequencies are not included within the Cellular Radiotelephone Service Frequency Band except as follows.

$$(108 \text{ to } 132.4875) + (1^{\text{st}} \text{ IF} \times 2) = 869.550 \text{ to } 893.9625 \text{ MHz} \quad \text{IMAGE FREQ.}$$

### Test Results 108 to 132.4875 MHz

Frequency range (MHz)	Cellular frequency range included (MHz)	Received frequency (MHz)	Interference frequency (MHz)	Signal rejection ratio (MHz)	Equation for interference frequency reception (MHz)
108.000 to 132.4875	869.550 to 893.9625	108.000 to 124.000 132.4875	869.550 885.500 893.9625	58 59 60	FR + (IF x 2) = 869.550 FR + (IF x 2) = 885.500 FR + (IF x 2) = 893.9625

The above test results indicate that all the signal rejection ratios for the Cellular Radiotelephone Frequency Service Band are higher than 38 dB.

2. The image frequencies in the frequency range from 806 to 1300 MHz are shown as follows:

$$\text{FR} = 806 \text{ to } 823.9875 \text{ MHz}, 849 \text{ to } 868.9875 \text{ MHz}, 894 \text{ to } 960 \text{ MHz}, 1240 \text{ to } 1300 \text{ MHz}$$

$$\text{IMAGE FREQ.} = \text{FR} - 1^{\text{st}} \text{ IF} \times 2$$

$$1^{\text{st}} \text{ IF} = \text{FR} - 1^{\text{st}} \text{ Local}$$

$$1^{\text{st}} \text{ Local} = A \times 0.075$$

$$A = (\text{FR} - 380.8) / 0.075$$

$$= A.\text{xxx} \text{ (Cut away decimal)}$$

$$(806 \text{ to } 823.9875) - (1^{\text{st}} \text{ IF} \times 2) = 44.35 \text{ to } 62.3625 \text{ MHz} \quad \text{IMAGE FREQ.}$$

$$(849 \text{ to } 868.9875) - (1^{\text{st}} \text{ IF} \times 2) = 87.3 \text{ to } 107.3625 \text{ MHz} \quad \text{IMAGE FREQ.}$$

$$(894 \text{ to } 960) - (1^{\text{st}} \text{ IF} \times 2) = 132.3 \text{ to } 198.3 \text{ MHz} \quad \text{IMAGE FREQ.}$$

$$(1240 \text{ to } 1300) - (1^{\text{st}} \text{ IF} \times 2) = 478.4 \text{ to } 538.4 \text{ MHz} \quad \text{IMAGE FREQ.}$$

These image frequencies are not included within the Cellular Radiotelephone Service Frequency Band.

3. Other rejection results

**Test Results (1)**

Frequency range (MHz)	Cellular frequency range included (MHz)	Received frequency (MHz)	Interference frequency (MHz)	Signal rejection ratio (dB)	Equation for interference frequency reception (MHz)
25.000 to 29.145	836.500 to 848.895	25.000 to 29.145	836.500 to 848.895	70	$1^{\text{st}} \text{ Lo} \times 3 - 1^{\text{st}} \text{ IF} = 836.500$ to $1^{\text{st}} \text{ Lo} \times 3 - 1^{\text{st}} \text{ IF} = 848.895$
35.825 to 44.145	869.075 to 893.895	35.825 to 44.145	869.075 to 893.895	67	$1^{\text{st}} \text{ Lo} \times 3 - 1^{\text{st}} \text{ IF} = 869.075$ $1^{\text{st}} \text{ Lo} \times 3 - 1^{\text{st}} \text{ IF} = 881.500$ $1^{\text{st}} \text{ Lo} \times 3 - 1^{\text{st}} \text{ IF} = 893.895$
221.6025 to 225.000	824.0025 to 830.775	221.6025 to 225.000	824.0025 to 830.775	72	$1^{\text{st}} \text{ Lo} \times 2 - 1^{\text{st}} \text{ IF} = 824.000$ to $1^{\text{st}} \text{ Lo} \times 2 - 1^{\text{st}} \text{ IF} = 830.775$
				71	

$$\begin{aligned}
 1^{\text{st}} \text{ IF} &= 1^{\text{st}} \text{ Local} - \text{FR} \\
 1^{\text{st}} \text{ Local} &= A \times 0.075 \\
 A &= (\text{FR} + 380.8) / 0.075 \\
 &= \text{A.xxx} \text{ (Cut away decimal)}
 \end{aligned}$$

**Test Results (2)**

Frequency range (MHz)	Cellular frequency range included (MHz)	Received frequency (MHz)	Interference frequency (MHz)	Signal rejection ratio (dB)	Equation for interference frequency reception (MHz)
849.000 to 859.6875	838.300 to 848.9875	849.000 to 859.6875	838.300 to 848.9875	80	$\{(\text{FR} \times 2) - 2^{\text{nd}} \text{ IF}\} / 2 = 838.300$ to $\{(\text{FR} \times 2) - 2^{\text{nd}} \text{ IF}\} / 2 = 838.9875$
866.800 to 868.9875	824.000 to 826.1875	866.800 to 868.9875	824.000 to 826.1875	48	$\text{FR} + (2^{\text{nd}} \text{ IF} \times 2) = 824.000$ to $\text{FR} + (2^{\text{nd}} \text{ IF} \times 2) = 826.1875$
894.000 to 904.6875	883.300 to 893.9875	894.000 to 904.6875	883.300 to 893.9875	79	$\{(\text{FR} \times 2) - 2^{\text{nd}} \text{ IF}\} / 2 = 883.300$ to $\{(\text{FR} \times 2) - 2^{\text{nd}} \text{ IF}\} / 2 = 893.9875$
911.800 to 936.7875	869.000 to 893.9875	911.800 to 936.7875	869.000 to 893.9875	49	$\text{FR} + (2^{\text{nd}} \text{ IF} \times 2) = 869.000$ $\text{FR} + (2^{\text{nd}} \text{ IF} \times 2) = 877.200$ $\text{FR} + (2^{\text{nd}} \text{ IF} \times 2) = 893.9875$
				50	

The above test results indicate that all the signal rejection ratios for the Cellular Radiotelephone Service Frequency Band are higher than 38 dB.

## LOCAL OSC FREQUENCY CALCULATION

Receiving band (FR step)	Freq. step (kHz)	Receiving freq. FR (MHz)	1 <sup>st</sup> Local PLL 1/ VCO 1 or VCO 2 (MHz)	2 <sup>nd</sup> Local PLL 2/VCO 3 (MHz)	3 <sup>rd</sup> Local X'tal (MHz)
VHF Low	5.0	25.0000 – 54.0000	A = (FR + 380.800)/0.075	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
VHF High	12.5	108.0000 – 136.9875	= A.xxx (Cut away decimal)	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	5.0	137.0000 – 150.7750	1 <sup>st</sup> Local = A x 0.075	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	7.5	150.7825 – 150.8125	1 <sup>st</sup> IF = 1 <sup>st</sup> Local – FR	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4025	20.9475
	7.5	150.8150 – 154.4525		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	7.5	154.45625 – 154.47875		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	7.5	154.4825 – 154.5050		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	5.0	154.5100 – 154.5250		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	6.25	154.52750 – 154.54625		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.3975	20.9425
	7.5	154.5475 – 154.6075		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4025	20.9475
	5.0	154.6100 – 154.6550		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	7.5	154.6575 – 156.2475		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.3975	20.9425
	5.0	156.2500 – 157.4750		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	7.5	157.4775 – 161.5650		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.3975	20.9425
	5.0	161.5700 – 173.2000		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	6.25	173.20375 – 173.22250		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4025	20.9475
	6.25	173.22500 – 173.38750		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	6.25	173.39000 – 173.41500		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.3975	20.9425
	5.0	173.4200 – 174.0000		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	5.0	216.0025 – 221.9975		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4025	20.9475
	5.0	222.0000 – 225.0000		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
UHF Low	6.25	406.0000 – 512.0000		2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
UHF High	6.25	806.0000 – 823.9875	A = (FR – 380.800)/0.075	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	6.25	849.0000 – 868.9875	= A.xxx (Cut away decimal)	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	6.25	894.0000 – 960.0000	1 <sup>st</sup> Local = A x 0.075	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450
	6.25	1240.0000 – 1300.0000	1 <sup>st</sup> IF = FR – 1 <sup>st</sup> Local	2 <sup>nd</sup> Local = 1 <sup>st</sup> IF – 21.4	20.9450

RF DENOTES Frequency received

IF FREQUENCY

1<sup>st</sup> IF: 380.7300 – 380.850 MHz

2<sup>nd</sup> IF: 21.3975 MHz/21.4000 MHz/21.4025 MHz

3<sup>rd</sup> IF: 455 kHz

## **Label Requirement**

The scanning receiver has a label affixed to the product shown on the attached drawing of the model label, which reads as follows:

WARNING: MODIFICATION OF THIS DEVICE TO RECEIVE CELLULAR  
RADIOTELEPHONE SERVICE SIGNALS IS PROHIBITED UNDER FCC RULES AND  
FEDERAL LAW.

Based on the above, we hereby attest that the equipment in question complies fully with the provisions of §15.121 of FCC Rules.



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M. Ishizuka, Chief Engineer