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RESULTS OF REPACKAGING THE CROSLEY-AVCO MODEL 183114 COMMAND RECEIVER

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GREENBELT, MD.

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RESULTS OF REPACKAGING THE CROSLEY-AVCO MODEL 183114 COMMAND RECEIVER

BY

David S. Hepler

AND

C. Raymond Somerlock

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I. INTRODUCTION

The Crosley-Avco command receiver model 183114 was originally developed for the S-15 Gamma Ray Satellite under the supervision of Marshall Space Flight Center. Unfortunately, the round package configuration used, while suitable for the particular application, is somewhat awkward for general purpose satellite use. Although the unit is a good design with proven performance, its package design has somewhat limited its widespread use.

To help correct this problem, a contract was let to repackage this receiver. The basic design is the same as previously used. Some of the components, of course, were changed to facilitate the repackaging in the smaller configuration. This report is an evaluation of this new version of the Avco command receiver (Model 184003).

II. SPECIFICATIONS

The specifications for the repackaged receiver are (with some improvements) similar to those that were laid out in the report on the original S-15 command receiver.[1] Briefly, they are:

Electrical

Frequency: 100 - 150 mc, fixed tuned

Input Z: 50 ohms ± 20%

6 db bandwidth: 36 kc, ± 10%

60 db Bandwidth: 100 kc; + 10%, -50%

Image rejection: ≥ 80 db

Spurious frequency rejection: ≥60 db

Local oscillator stability: ±2 kc over the temperature range

Audio output capability: 50 mw into 500 ohm load

Supply voltage: +12 volts ± 10%

Standby current: less than 10 ma

Operate current: less than 20 ma

Minimum sensitivity for operation of Avco decoder: -101 dbm, 75% modulation

Minimum RF overload level for decoder dropout: -7 dbm, 75% modulation

[1] H.K. Lowery, Command Receiver for Gamma Ray Satellite (S-15), Technical Publication MTP-G&C-60-12, Marshall Space Flight Center, December 1960.

Mechanical

Size: 3 - 1/2" x 5"

Weight: approximately 15 ozs.

Vibration: Figure 1

Acceleration: 100G, thrust and two transverse axes for 5 minutes each.

Vacuum: $\leq 10^{-5}$ mm of Hg for 24 hours at 35°C

Temperature range: -20°C to +70°C

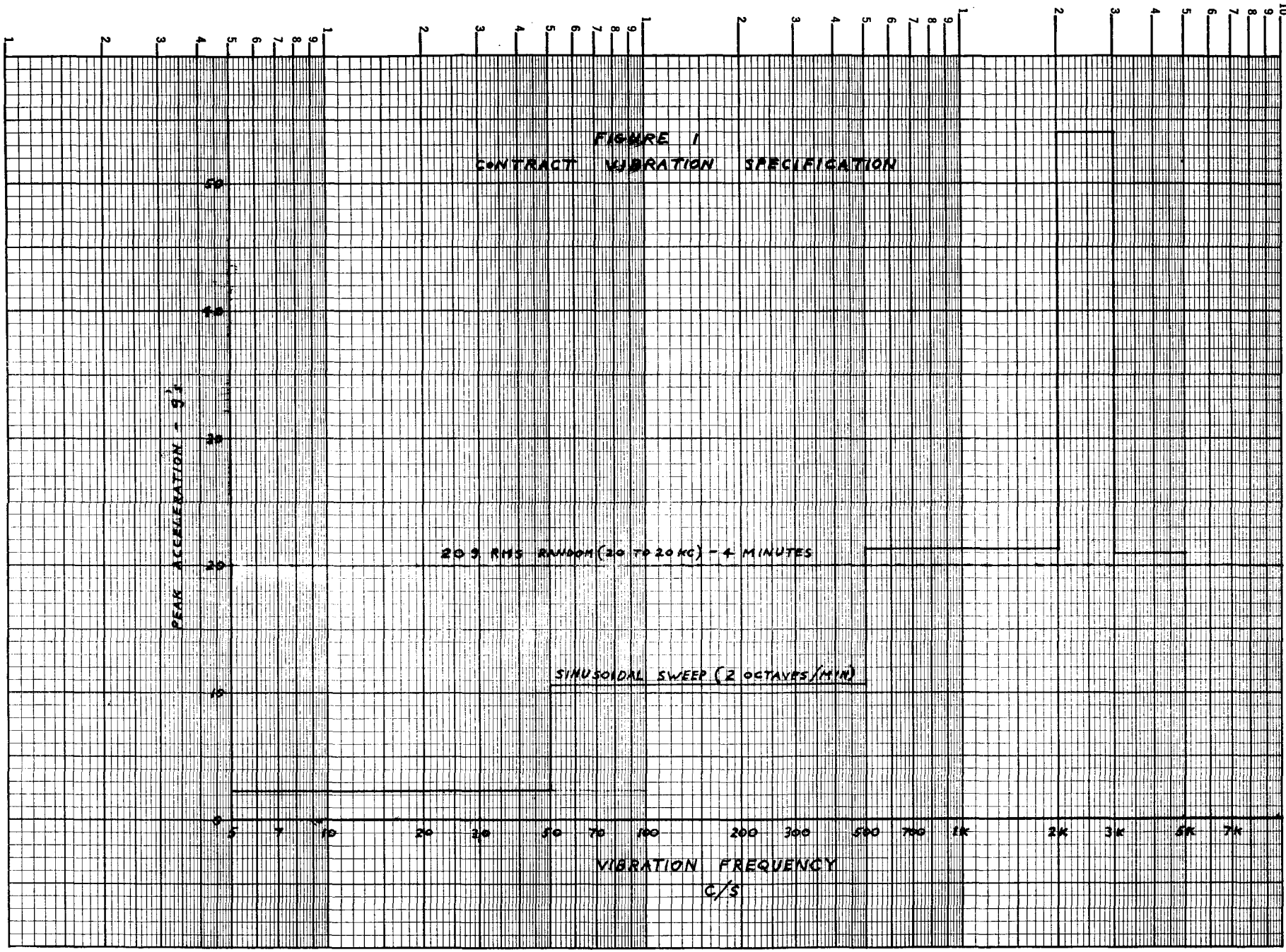


FIGURE 1
CONTRACT VIBRATION SPECIFICATION
PEAK ACCELERATION - g's
50
40
30
20
10
0
20 g RMS RANDOM (20 TO 20 KC) - 4 MINUTES
SINUSOIDAL SWEEP (2 OCTAVES/MIN)
5
7
10
20
30
50
70
100
200
300
500
700
1K
2K
3K
5K
7K
VIBRATION FREQUENCY
C/S

III. TESTING PROCEDURE

Sensitivity and AGC

For measuring the receiver sensitivity, the set-up shown in figure 2 was used. The receiver audio output was loaded with 500 ohms, and the RMS output voltage was plotted versus RF input voltage, with the Hewlett-Packard 608D signal generator being modulated with a 3 kc tone. The sensitivity was defined as that RF input voltage that produced a 3.1 volt RMS audio output with 80% modulation of the signal generator. The signal plus noise-to-noise ratio was also determined at each point by measuring the output noise level with the modulation removed and comparing it with the output measured under modulated conditions.

Bandwidth

The same setup (figure 2) was used for this test as was used for the sensitivity measurements except that the signal generator was unmodulated and the AGC check point voltage was measured with a digital voltmeter. The unmodulated RF input to the receiver was set to a level just high enough to make the AGC function. The voltage at the AGC checkpoint was recorded with the frequency of the signal generator set to the middle of the pass-band. Then the frequency of the signal generator was varied in incremental steps and the input voltage adjusted to bring the AGC voltage back to its recorded value. The change in required RF input level is then the relative change in sensitivity for that frequency. A similar technique was used to check for spurious and image responses.

Audio frequency response

The frequency response of the detector and the audio frequency amplifier stages were also measured with the setup in figure 2. In this test, the R-f input voltage was set to an arbitrary value well above the noise level. The frequency of the audio oscillator supplying the modulation was then varied in steps and the receiver detected audio output was plotted for these frequencies.

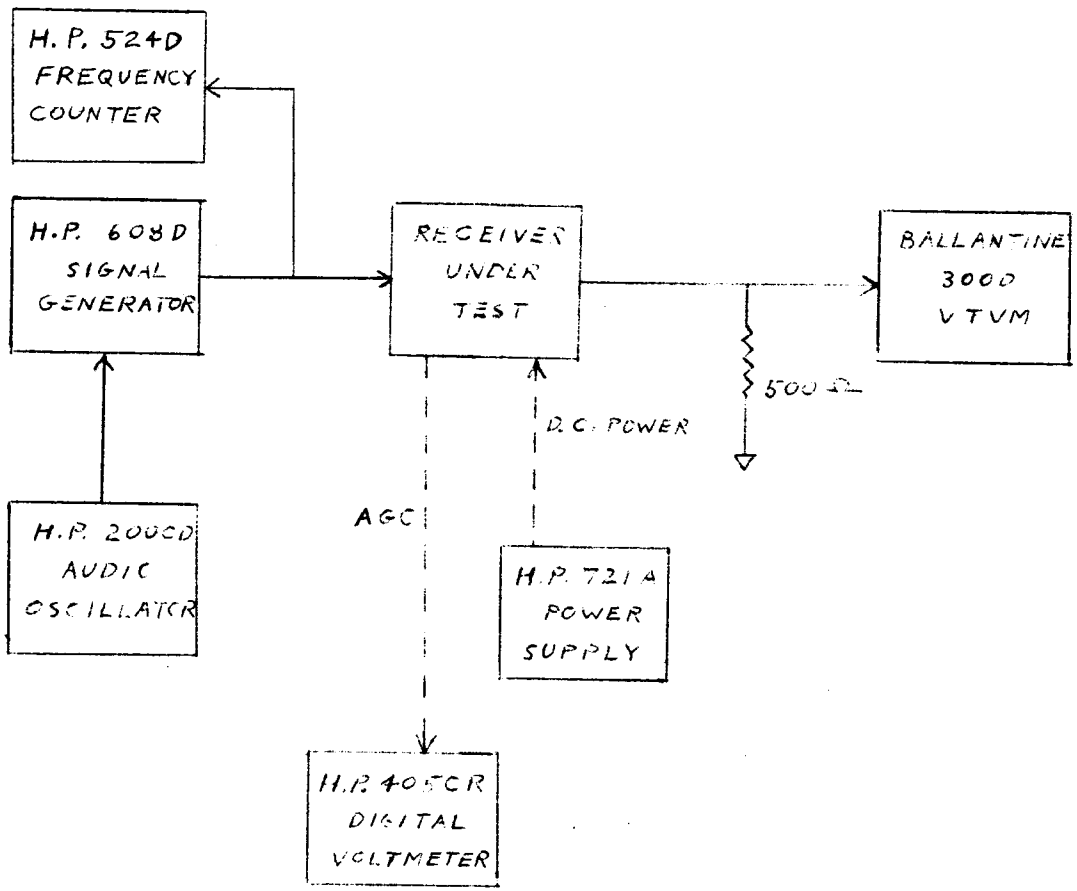
Temperature

Tests that were performed at other than room temperature were made with the receiver inside a Delta model 060A temperature chamber using liquid CO_2 for cooling. Sufficient time was allowed at each temperature setting for the receiver to stabilize at that setting.

Vibration

Vibration tests were made under power by Goddard's Test and Evaluation Division using the specification shown in figure 3. This test was a typical one for the Thor-Delta vehicle and was slightly more severe at certain frequencies than the requirements originally laid down.

FIGURE 2 - RECEIVER TEST SET-UP



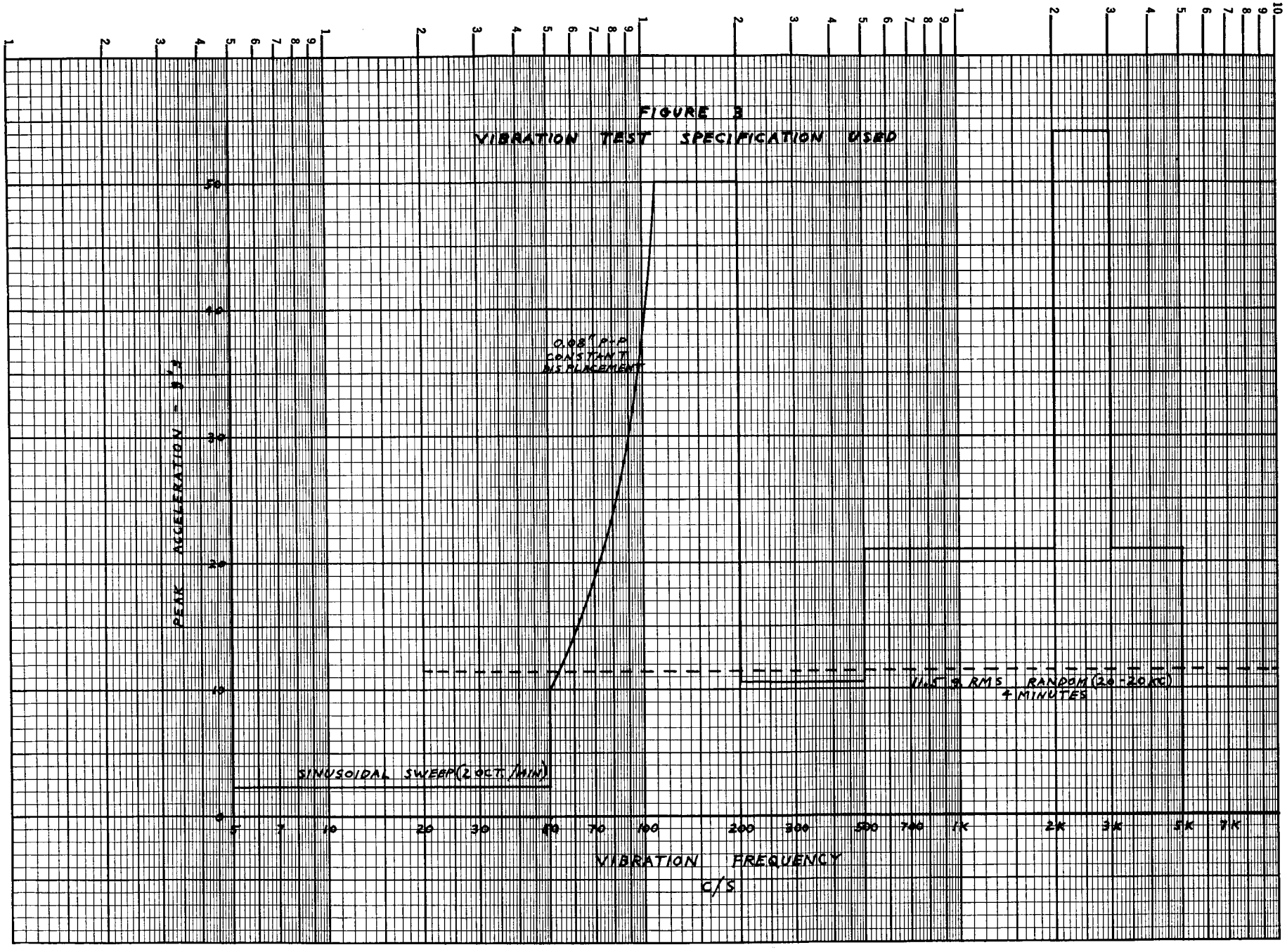


FIGURE 3
VIBRATION TEST SPECIFICATION USED

IV PERFORMANCE

Sensitivity and AGC

Measured curves of the detected output from the receiver plotted against the r-f input levels are shown in figure 4 for 80% and 20% modulation. The sensitivity is arbitrarily defined as that RF input required to produce 12.5 mw (3.1 volts RMS) of audio output with 80% modulation. A decoder can be set to trip reliably at this level and it will then not trip under any conditions with 20% modulation. This condition reduces the possibility of accidental commands. Figure 5 shows how the AGC curve is effected by a ±10% change in supply voltage. Figure 6 illustrates the way in which the signal-plus-noise-to-noise ratio depends on the RF input voltage. No significant spurious responses were found.

I.F. Bandwidth

The IF bandwidth of the receiver is determined by the crystal filter. All other RF and IF tuned circuits are broad enough that they have negligible effect on the overall bandwidth. Use of a crystal filter insures a stable bandpass that is essentially unaffected by AGC, temperature, and supply voltage variations. Steep skirts on the bandpass plot are another benefit from the crystal filter, yielding a $\frac{60 \text{ db}}{6 \text{ db}}$ form factor that is approximately 3:1. A plot of the receiver bandpass is shown in figure 7.

Audio Bandwidth

The frequency response of the audio frequency circuits is plotted in figure 8. The lower and upper -3 db points on the curve are at 800 cps and 10 kc respectively. Since the maximum

usable modulation frequency is approximately 10 kc, and the I.F. bandwidth is 36 kc, the IF passband has an extra 8 kc of bandwidth on each side of center frequency to allow for drift of the receiver local oscillator and command transmitter, and for doppler shift.

Temperature effects

The effect of temperature on the sensitivity of the receiver is shown in figure 9. The sensitivity varies about 4 db over the range -20°C to +70°C. The DC power drain is also somewhat a function of temperature and is plotted in figure 10 for conditions of no signal, and for 500 μv input with 80% modulation. With a 100% modulated signal input, the power requirement increases slightly over that shown in figure 10, reaching a maximum of 19 ma at +70°C.

The effect of temperature on the center frequency of the receiver is not easily measured since the frequency drift is small compared to the bandwidth and the local oscillator cannot be conveniently measured directly. The drift does appear to be within the range specified.

Mechanical Construction

The construction of the receiver package is illustrated in figures 11 through 17. The unit is composed of individual modules, most of which use a "cordwood" type of packaging. The printed circuit boards for these modules are good quality fiberglass, and each module is potted separately in "eccofoam" (made by Emerson and Cummings) before they are soldered into the circuit.

The exceptions to this construction technique are the McCoy crystal filter, the RF filter assembly, and the power connector module.

Shielding for the modules is provided by soldering foil shields directly to the printed circuit interconnection card. The units are then completely shielded between the foil shields and the ground plane on the interconnection card. The shields have a thin insulating layer of transparent material on the inside and an insulating strip is put on the top and bottom of the modules to prevent shorts to the components or boards.

The modules are both screwed and glued to the bottom cover of the package. This cover (and the top cover) are laminated metal sheets that are supposed to have a low mechanical "Q" and therefore suppress vibration resonance. The body of the case is cast aluminum. Spacers of a flexible material are glued to the top of the module shielding and are compressed by the top cover to prevent the unit from moving within the case.

Components

Good quality components seem to have been used throughout, as can be seen from the parts list (figure 19). The inductors and broad band IF transformers are wound on toroidal cores. The RF coils have air cores and are made of heavy wire. JFD piston trimmer capacitors are used for tuning adjustments.

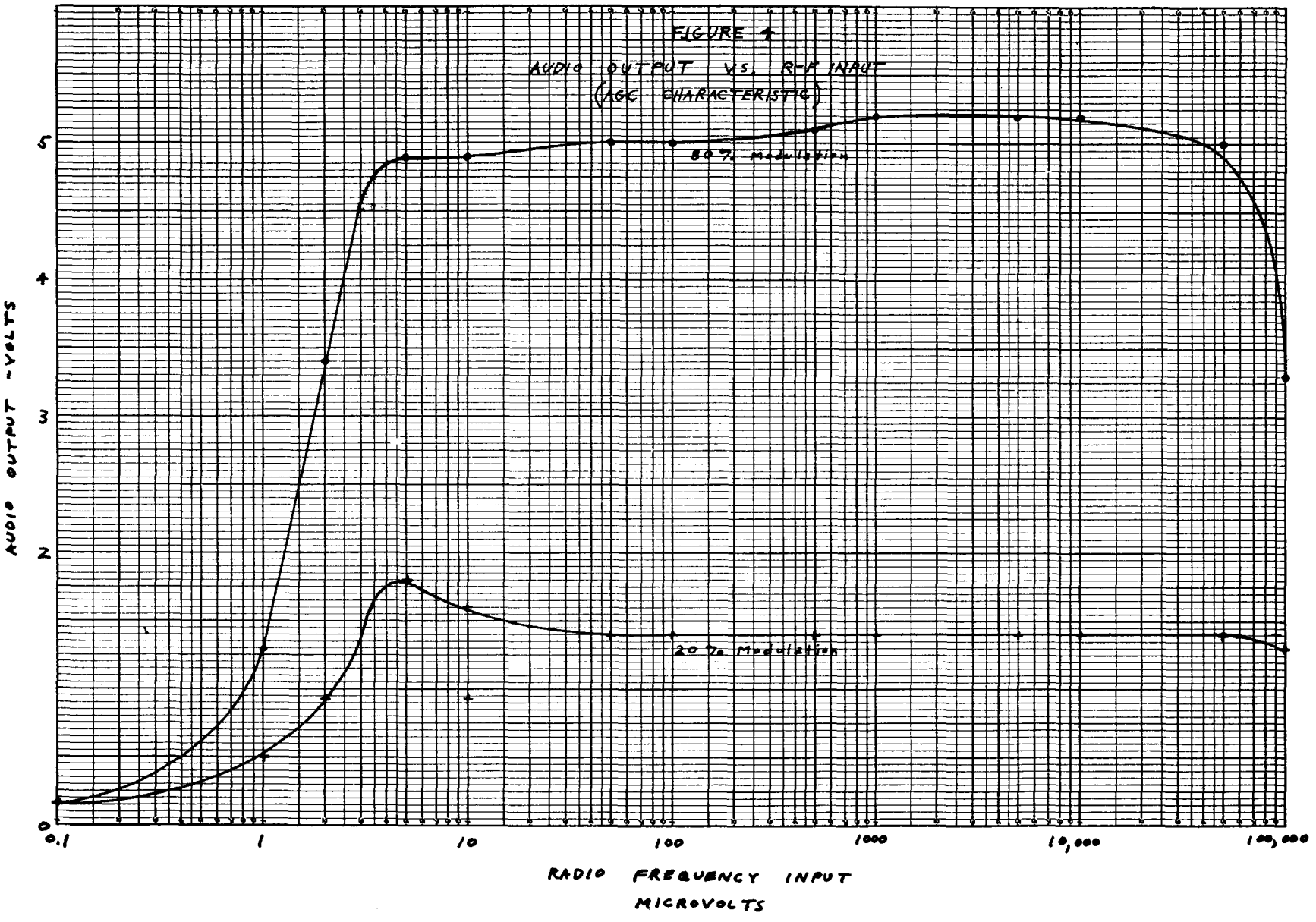


FIGURE 4
AUDIO OUTPUT VS. R-F INPUT
(AGC CHARACTERISTIC)
80% Modulation
20% Modulation
AUDIO OUTPUT - VOLTS
0
2
3
4
5
0.1
1
10
100
1000
10,000
100,000
RADIO FREQUENCY INPUT
MICROVOLTS

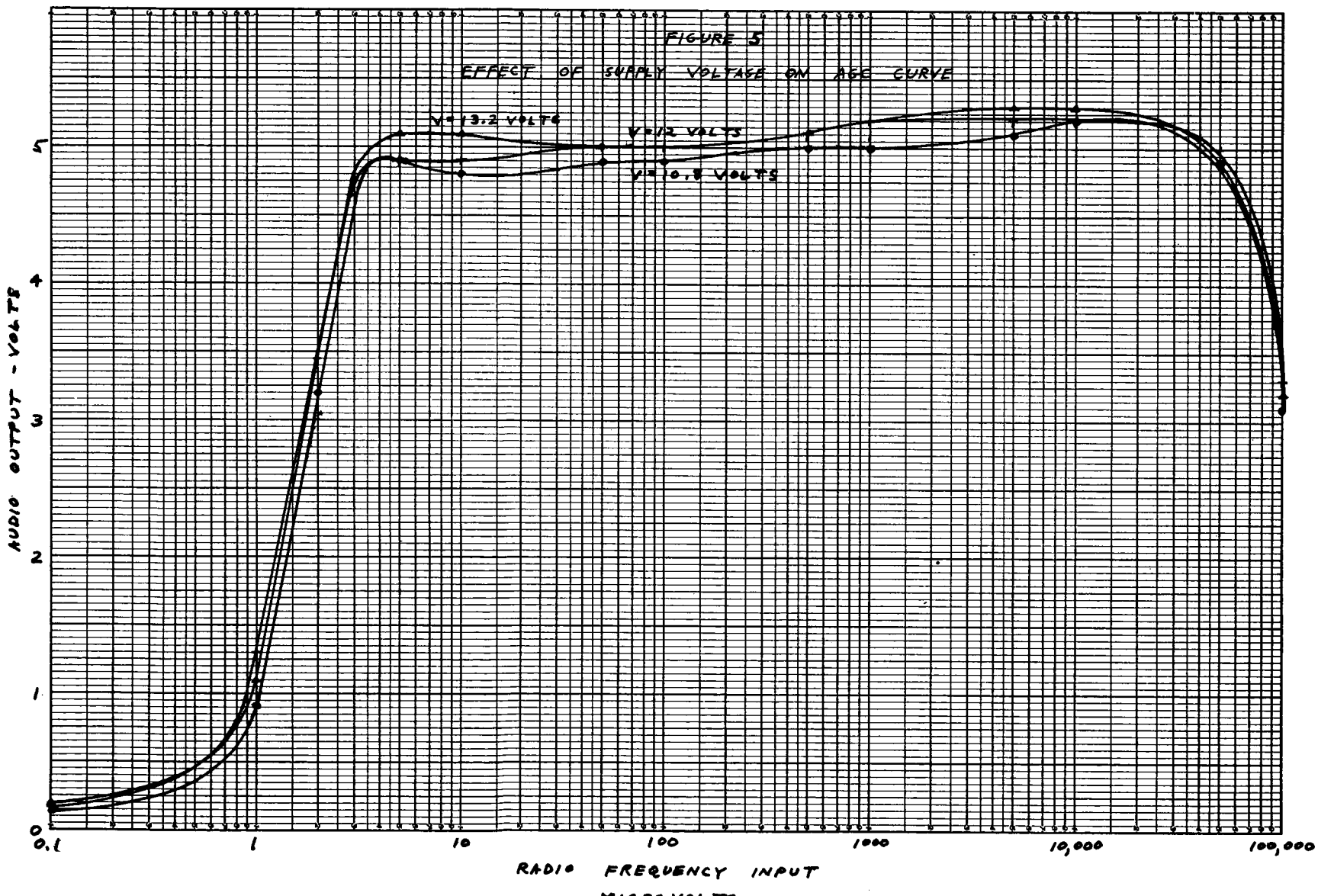


FIGURE 5
EFFECT OF SUPPLY VOLTAGE ON AGC CURVE
V=13.2 VOLTS
V=12 VOLTS
V=10.8 VOLTS
AUDIO OUTPUT - VOLTS
0
1
2
3
4
5
0.1
1
10
100
1000
10,000
100,000
RADIO FREQUENCY INPUT
MICROVOLTS

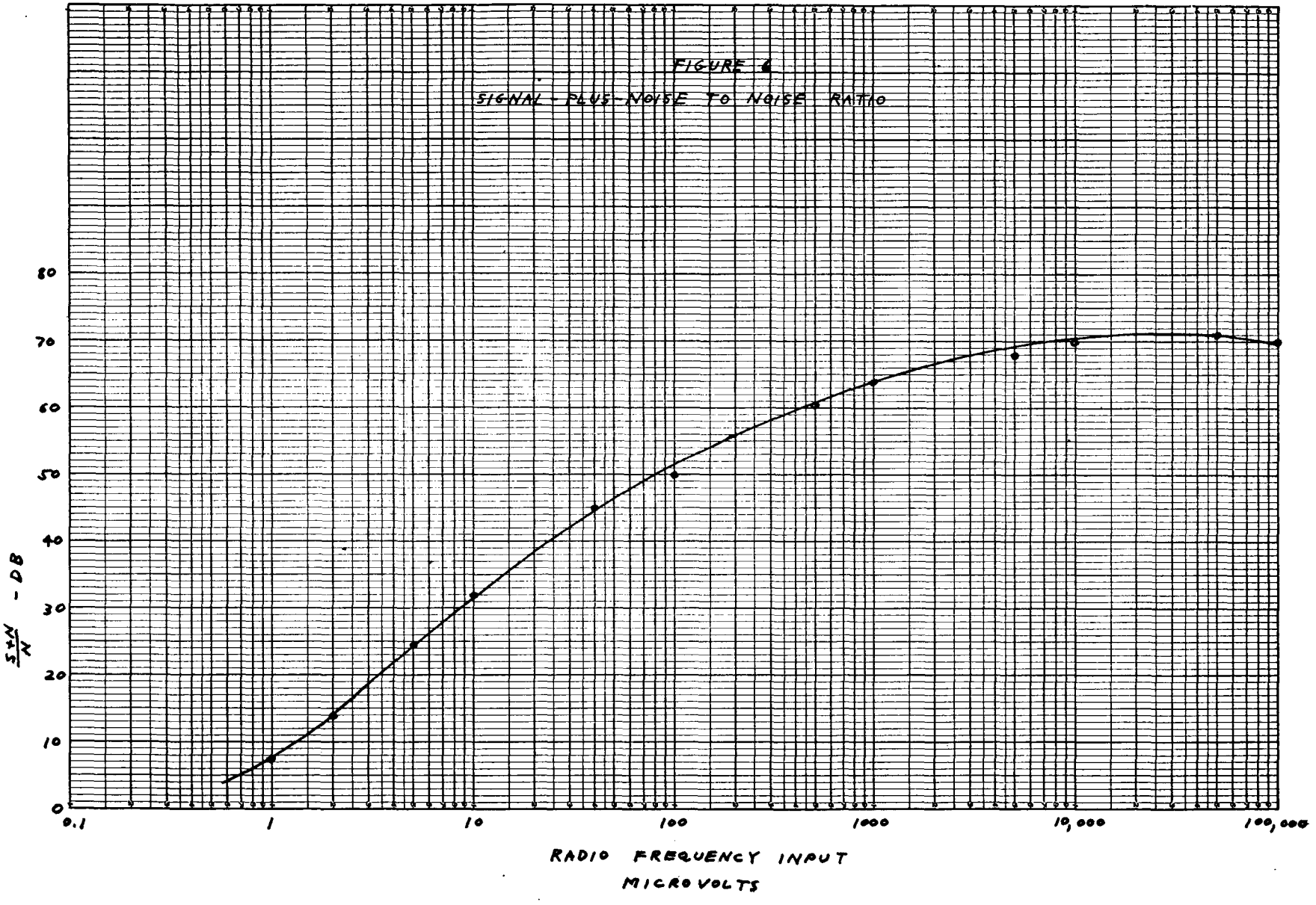


FIGURE 6
SIGNAL - PLUS - NOISE TO NOISE RATIO
S+N/N - DB
0
10
20
30
40
50
60
70
80
0.1
1
10
100
1000
10,000
100,000
RADIO FREQUENCY INPUT
MICROVOLTS

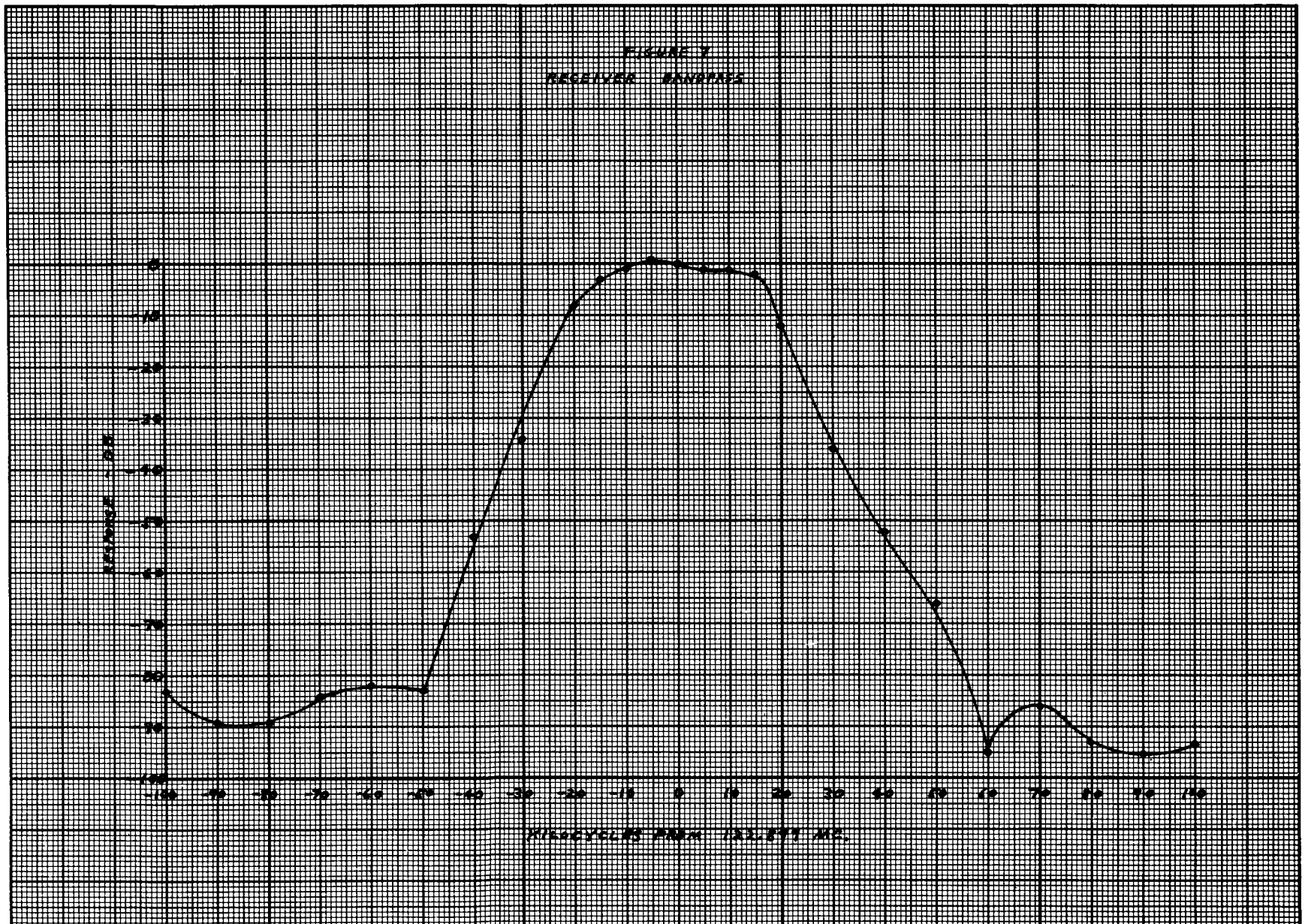


FIGURE 7
RECEIVER BANDPASS

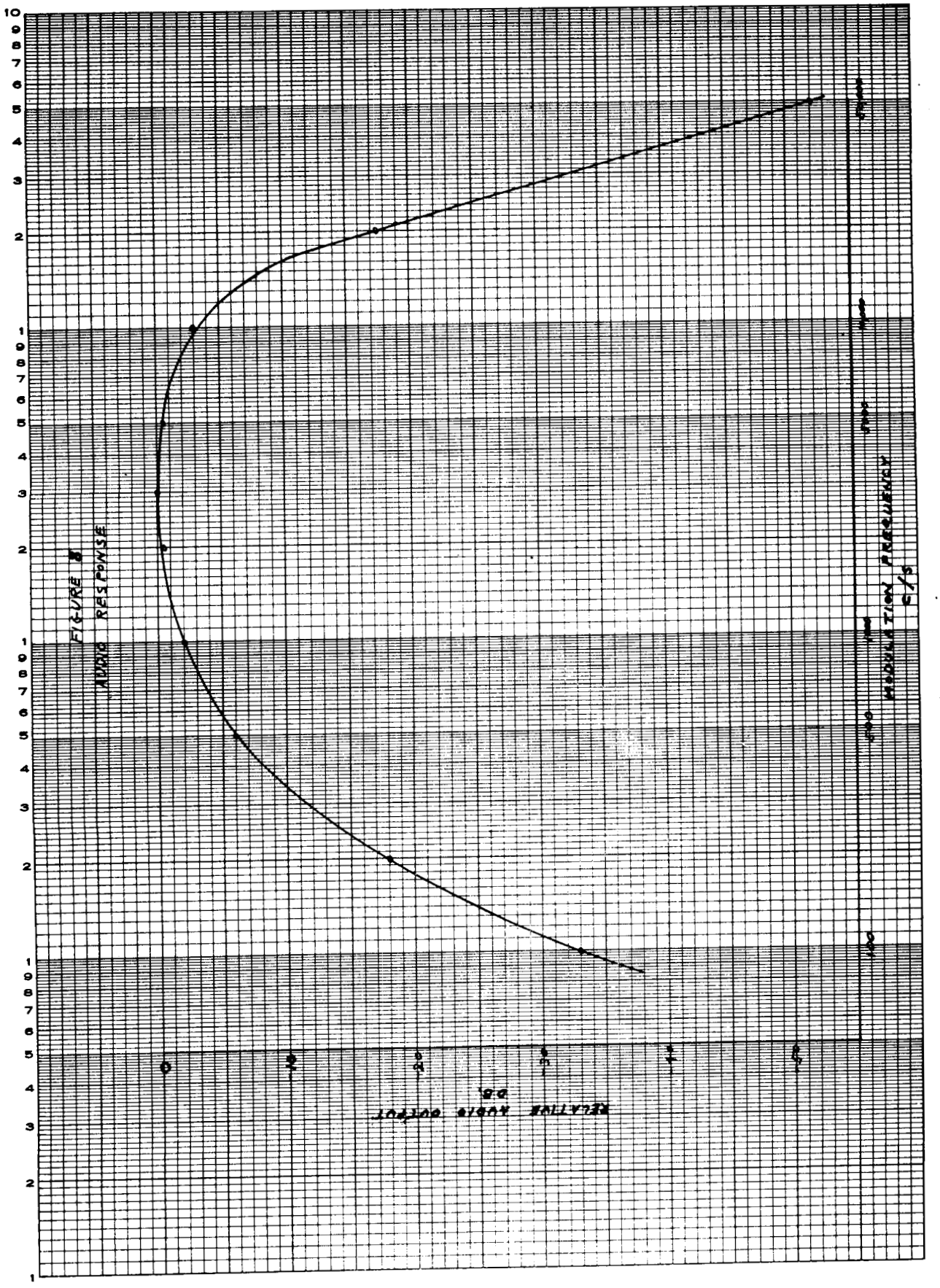


FIGURE 8
AUDIO RESPONSE
RELATIVE AUDIO OUTPUT
DB.
MODULATION FREQUENCY
C/S

FIGURE 7

EFFECT OF TEMPERATURE ON RECEIVER SENSITIVITY

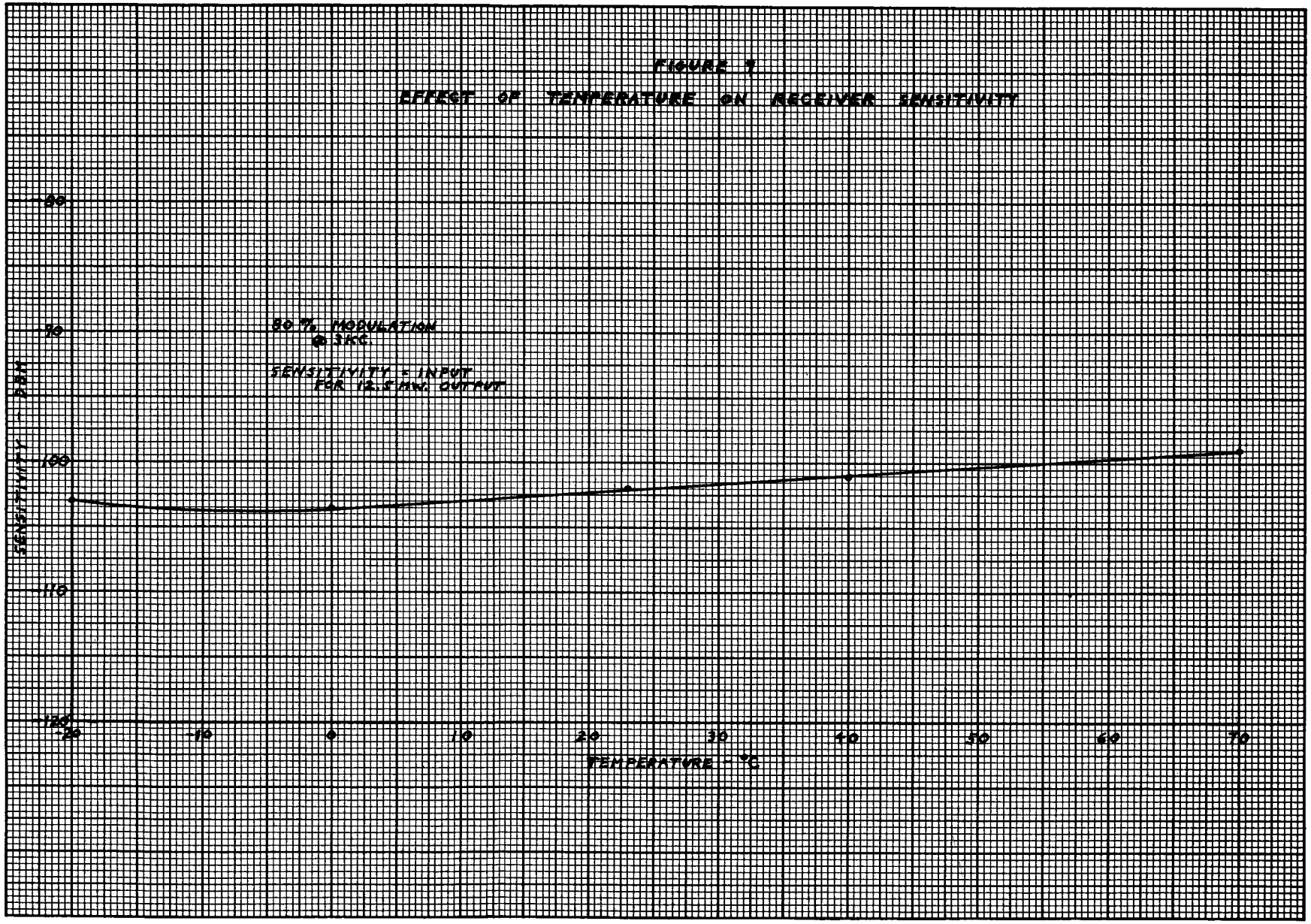
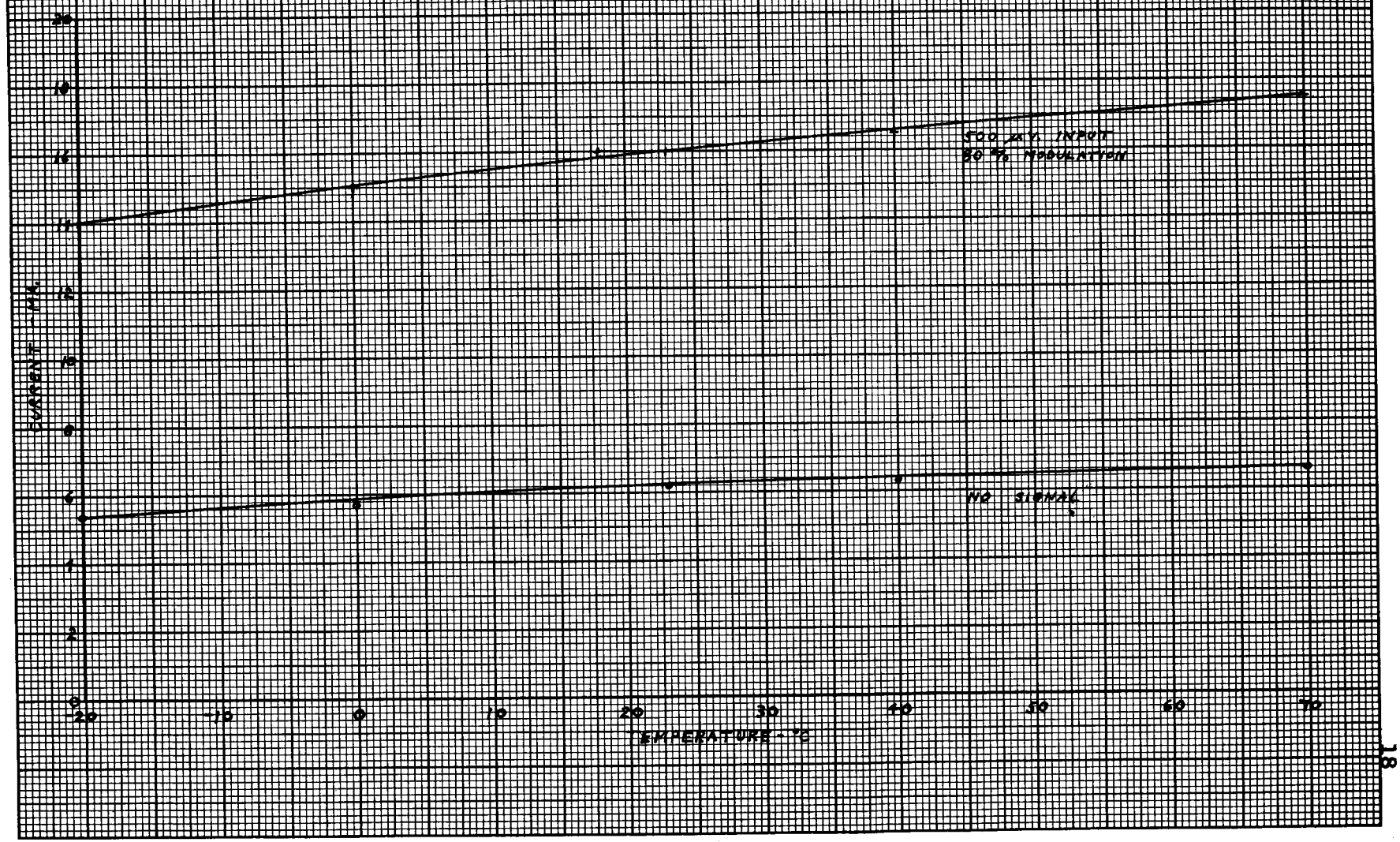


FIGURE 10

EFFECT OF TEMPERATURE ON POWER REQUIREMENTS



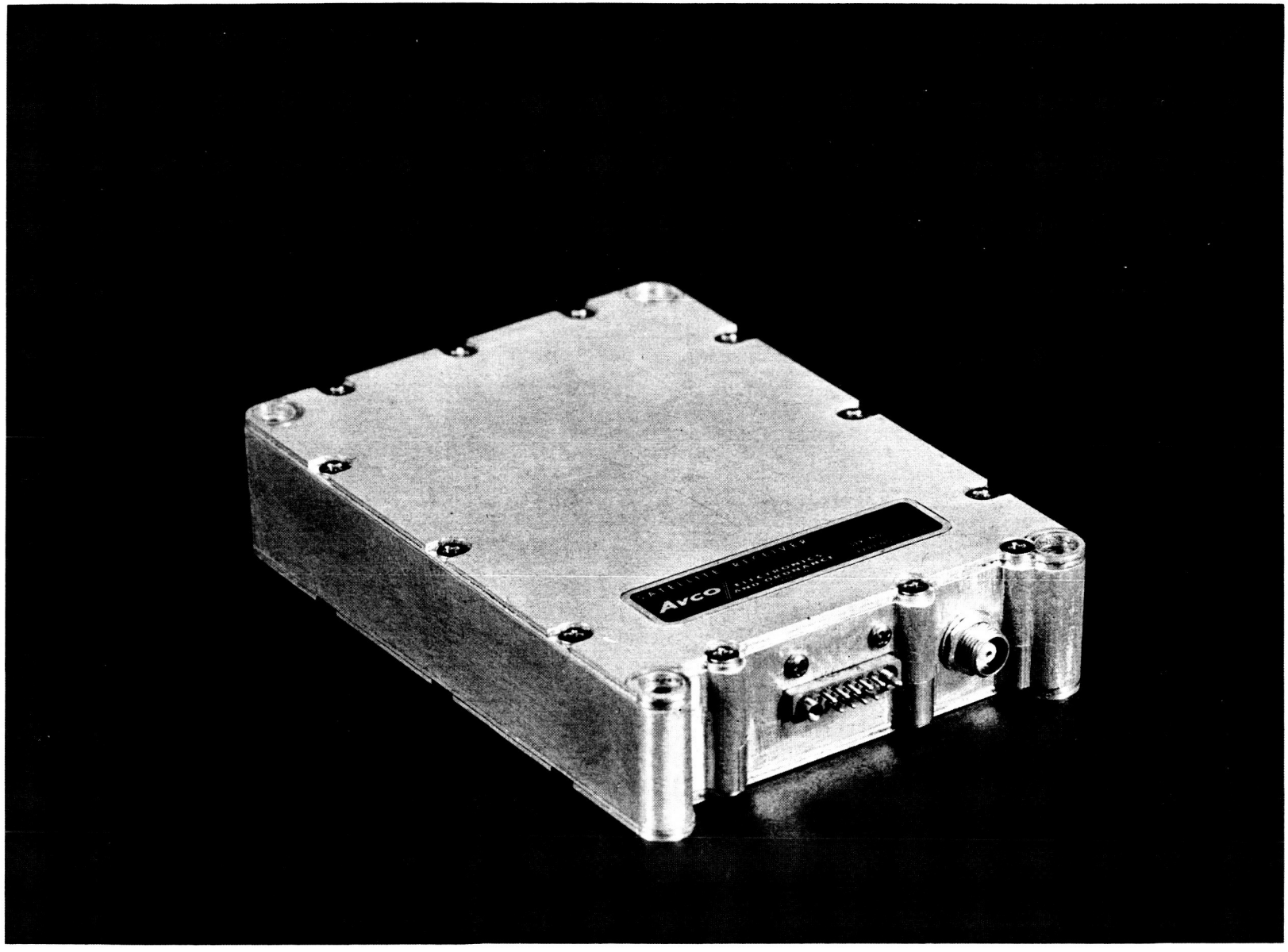


FIGURE 11 - COMPLETE RECEIVER

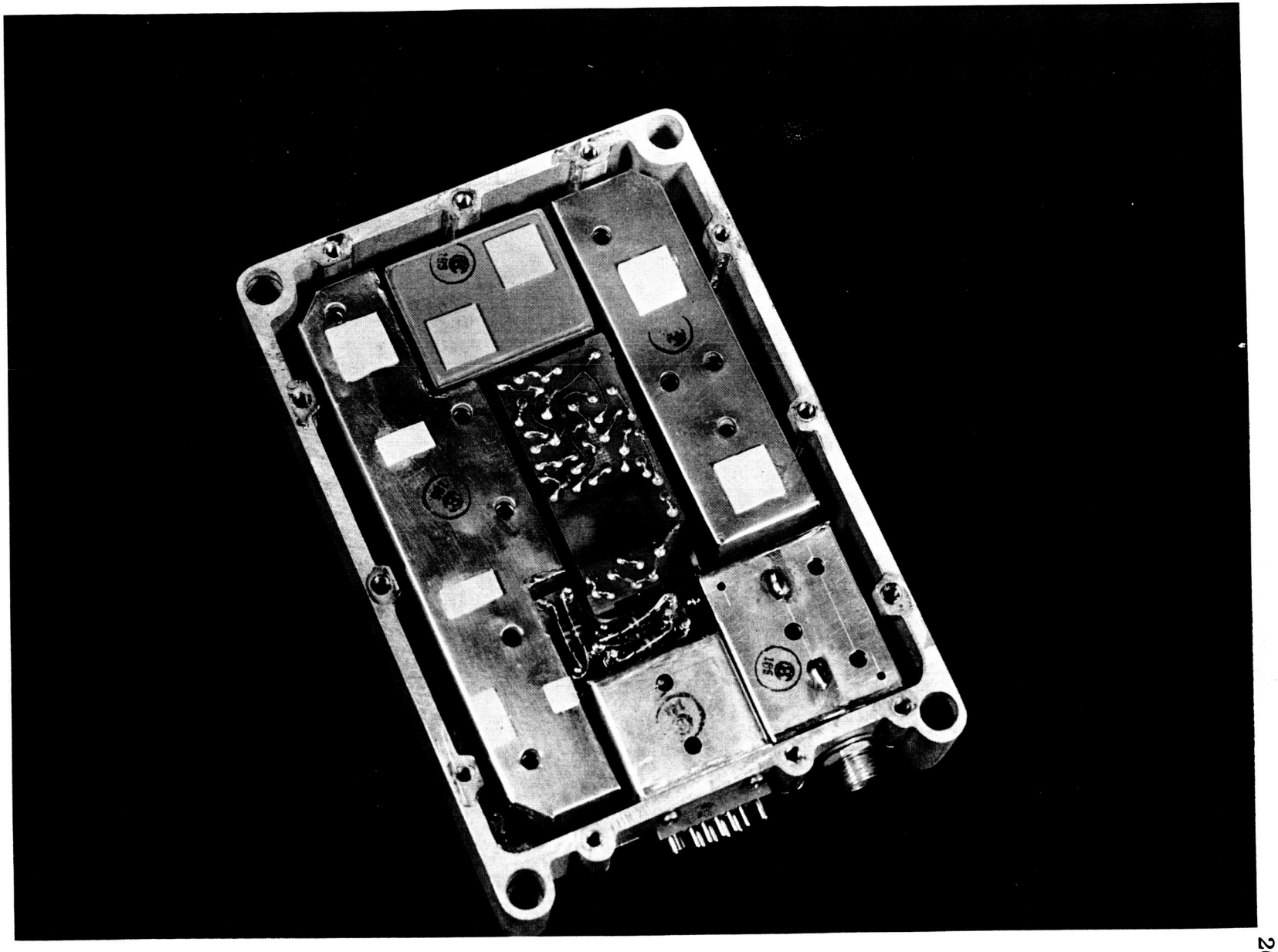


FIGURE 12 - RECEIVER WITH TOP COVER REMOVED

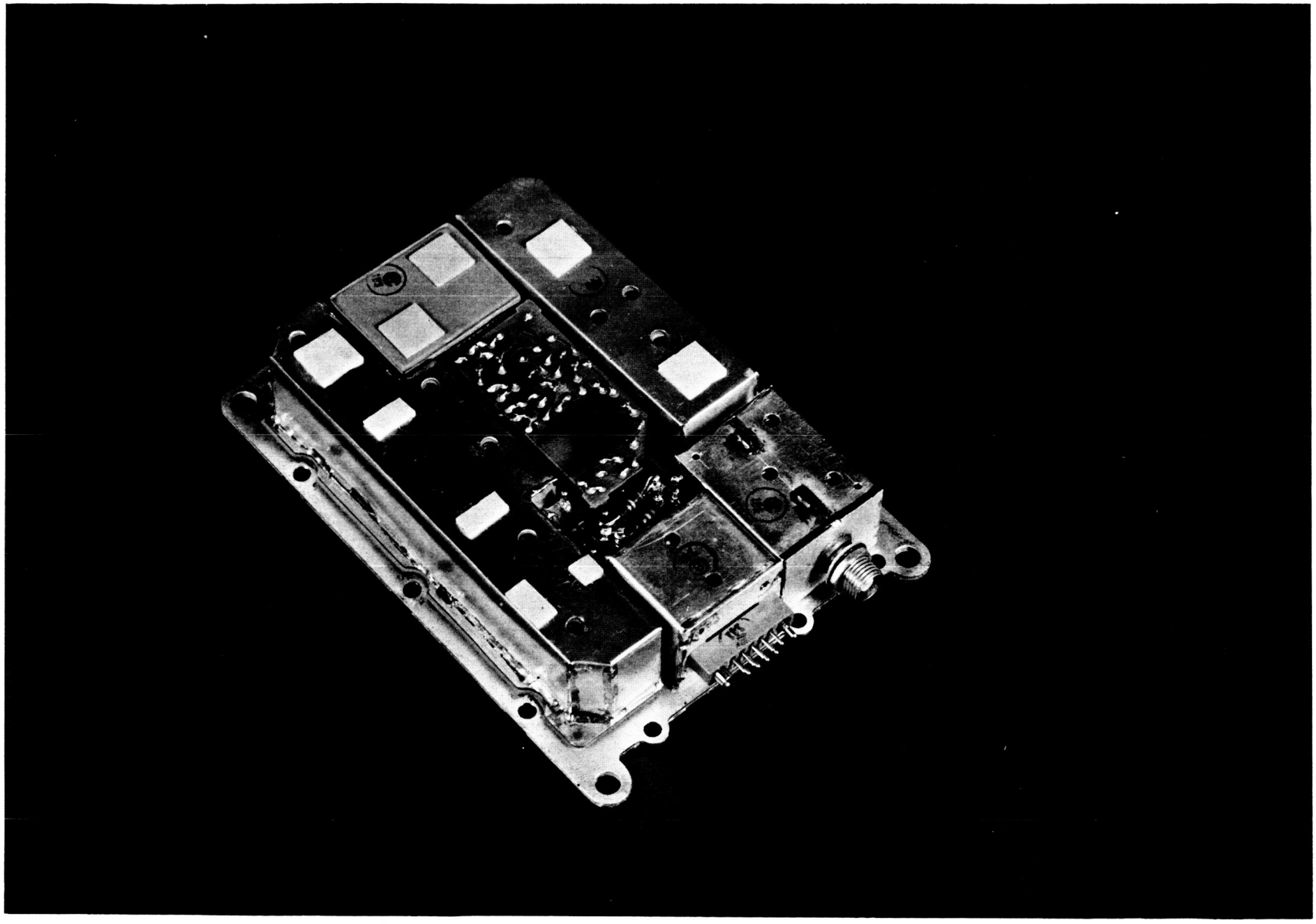


FIGURE 13 - RECEIVER WITH CASE REMOVED

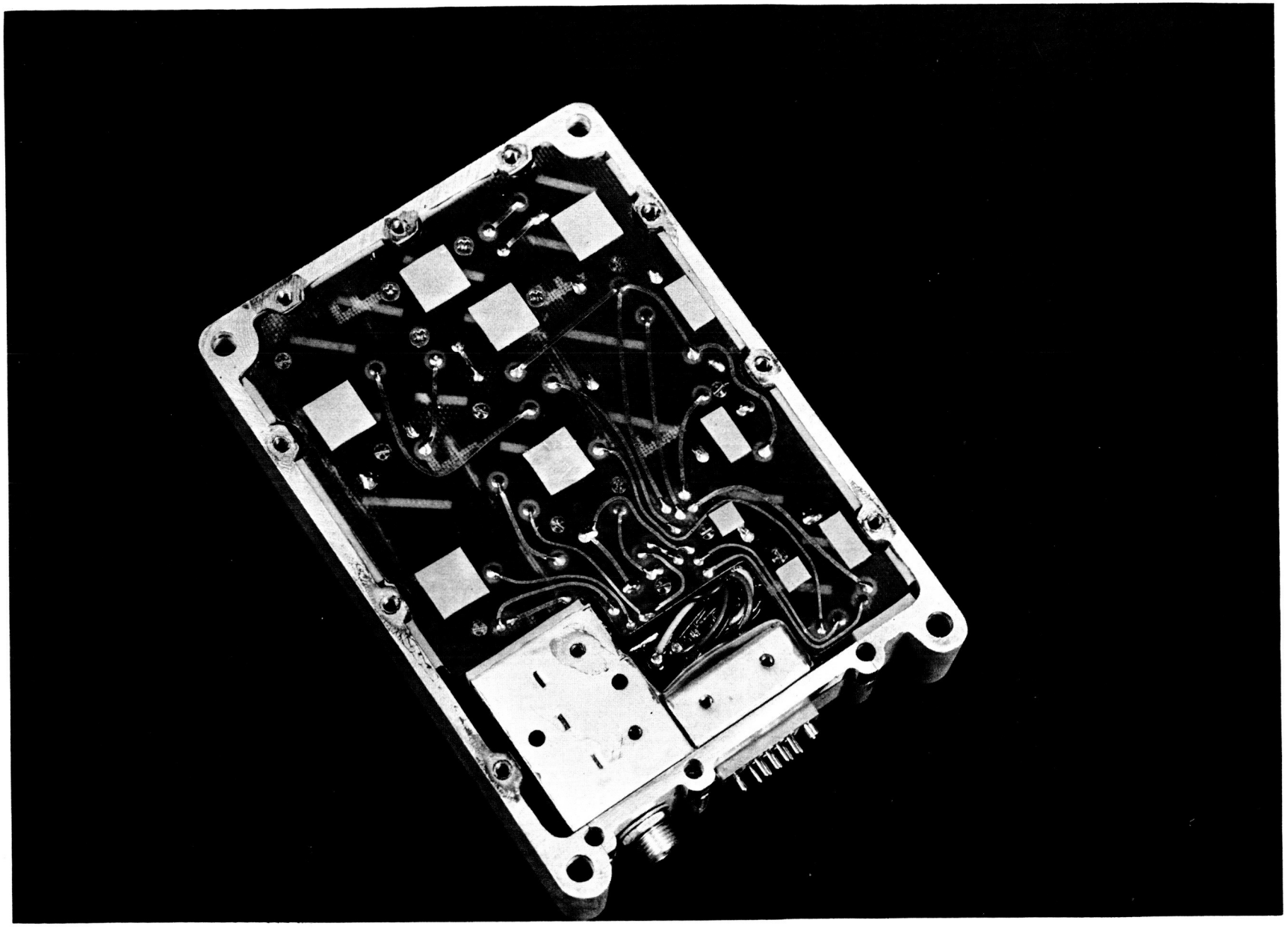


FIGURE 14 - BOTTOM VIEW OF RECEIVER INTERIOR

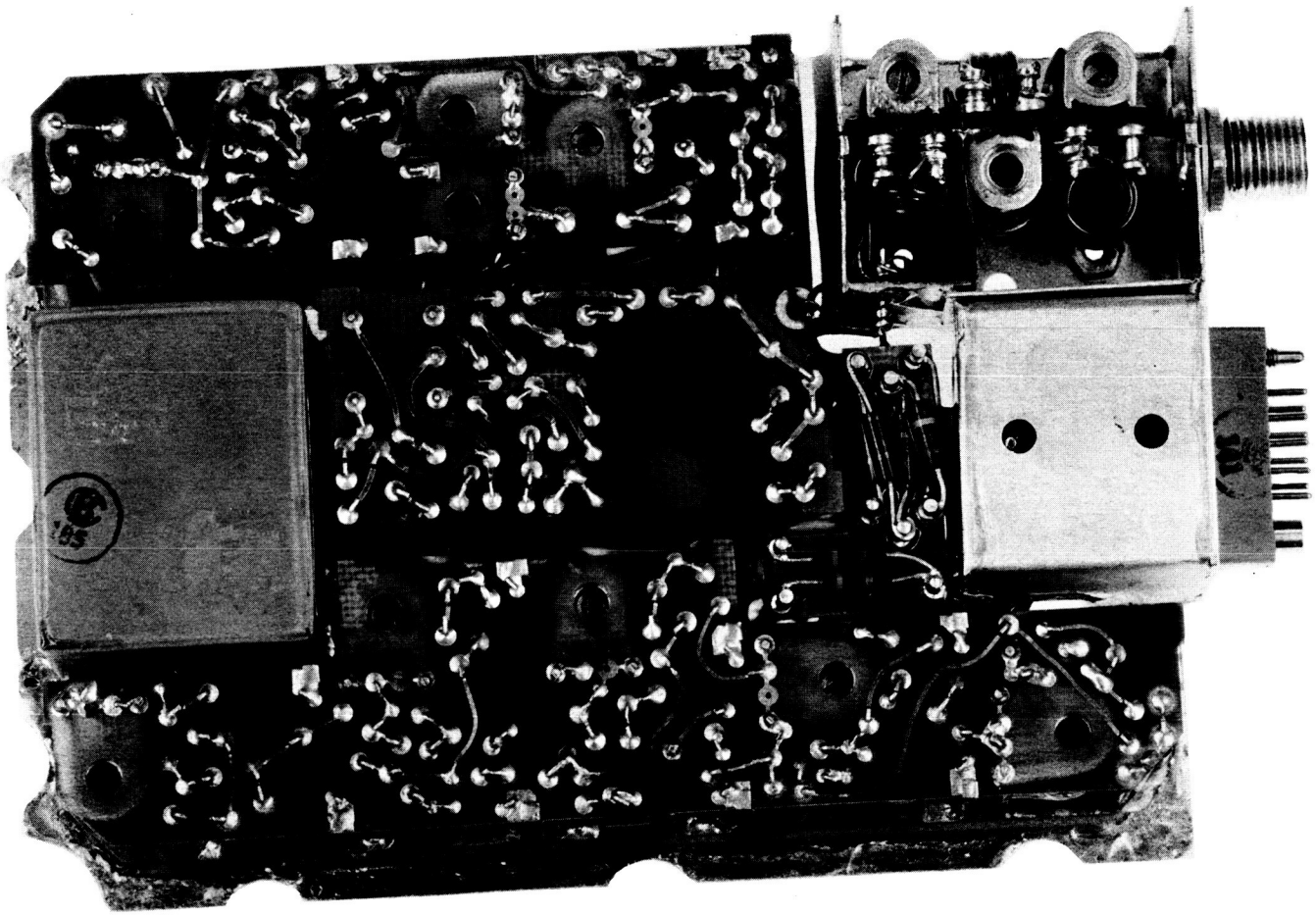


FIGURE 15 - MODULES WITH SHIELDS REMOVED

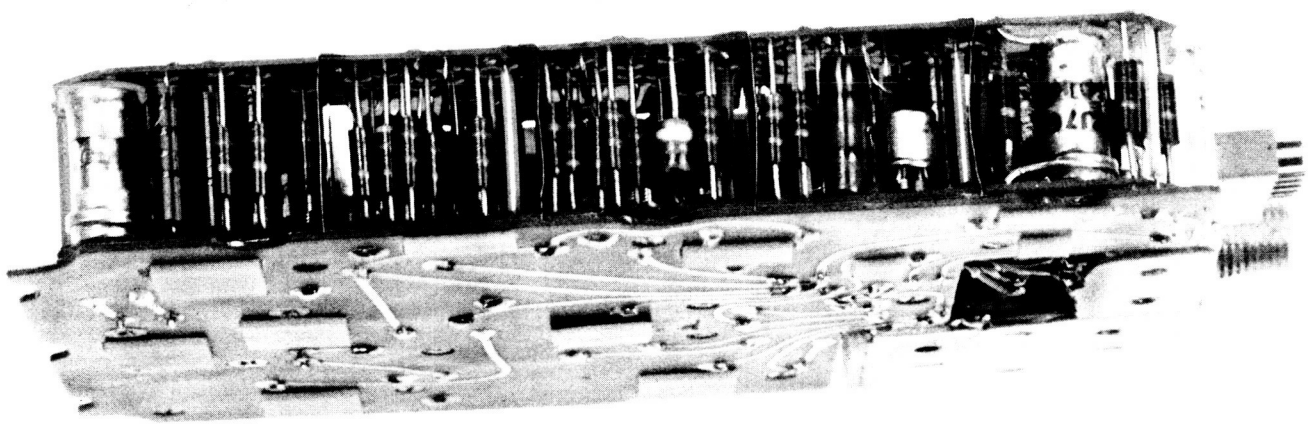


FIGURE 16 - SIDE VIEW OF A MODULE

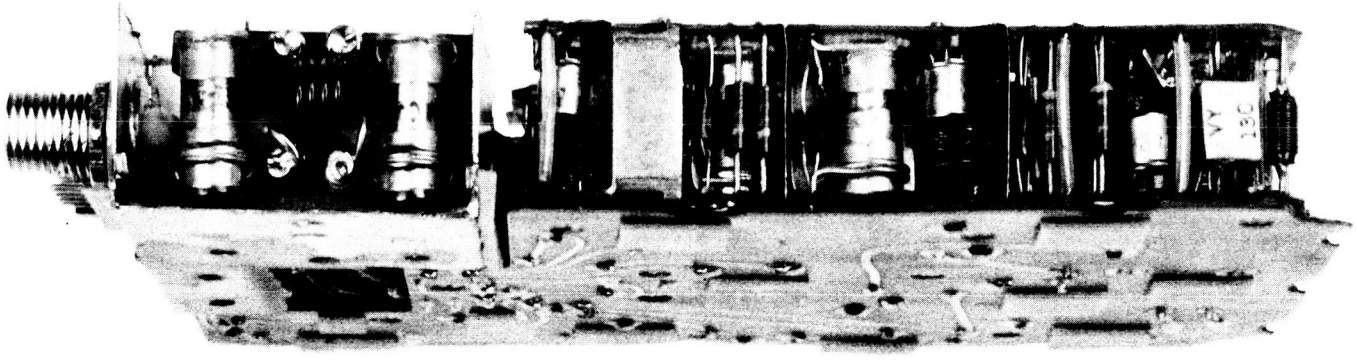
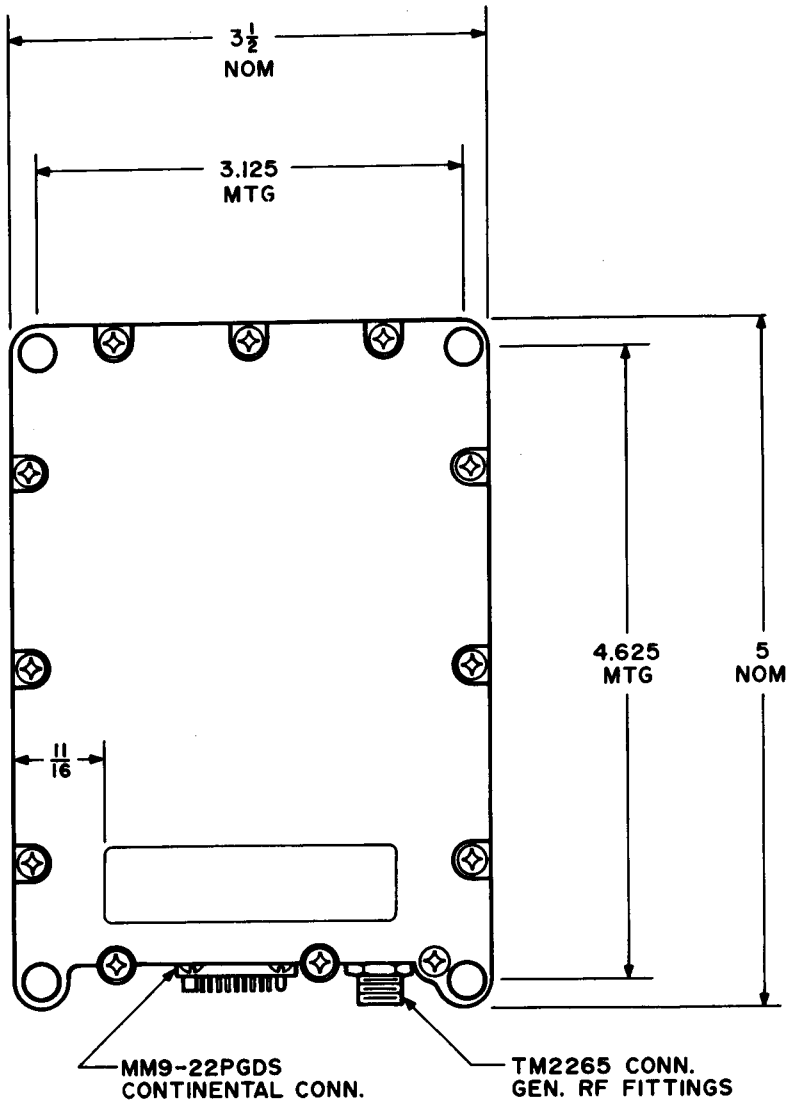


FIGURE 17 - SIDE VIEW OF A MODULE

Figure 18

Drawing of Package



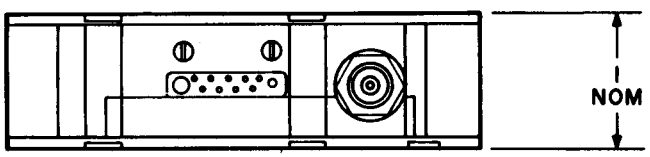


Figure 19A

ASSEMBLY PARTS LIST

ITEM NO.	DWG. ITEM		ISSUE	DESCRIPTION	SIZE	PART NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	INSP.	MAKE OR BUY	MFG. CODE	A/R	NO. REQ.	U/M	QUANITY PER PART	REMARKS
						185058																																
1				RECEIVER ASSEMBLY		184003	*																															
2																																						
3																																						
4				BOARD CIRCUIT ASSY			1	*																														
5																																						
6				CONVERTER MODULE ASSY				1	*																													
7																																						
8				I. F. MODULE ASSY				1		*																												
9																																						
10				AUDIO AMP MODULE ASSY				1			*																											
11																																						
12				PRESELECTOR ASSY			1					*																										
13																																						
14				CONNECTOR ASSY			1						*																									
15																																						
16				TERMINAL BOARD ASSY	B	185061		1						*																								
17				TERMINAL BOARD ASSY	B	185060						1			*																							
18																																						
19				TRANSFORMER ASSY DRIVER							1					*																						
20				TRANSFORMER ASSY OUTPUT							1						*																					
21																																						
22				HEADER ASSY DRIVER	B	185059										1		*																				
23				HEADER ASSY OUTPUT	B	184999											1		*																			
24																																						
25				CASE ASSY	C	185133	1													*																		
26				CASE	D	184814														1																		
27				PLATE-TOP	D	184823	1																															BARRY CONTROLS
28				PLATE-BOTTOM	D	184821	1																															BARRY CONTROLS
29				PLATE-END	C	184838	1																															
30				SCREW MTG	B	184839	4																															
31																																						
32																																						
33				BRACKET-CONNECTOR	C	184817							1																									
34				COVER-BRACKET	B	184818							1																									
35																																						
36				NAMEPLATE	C	185137-5	1																															
37				SCHEMATIC	R	185108																																
38																																						
39				CONNECTOR		MM9-22PGOS							1																									CONTINENTAL CONV
40				RECEPTICAL	B	184475						1																										GRFF
41																																						
42				BOARD CIRCUIT MASTER	-	185051		1																														
43				BOARD CIRCUIT AUDIO	-	185052					1																											
44				BOARD CIRCUIT AUDIO	-	185053					1																											
45				BOARD CIRCUIT CONV	-	185056			1																													
46				BOARD CIRCUIT CONV	-	185057			1																													
47				BOARD CIRCUIT IF	-	185054				1																												
48				BOARD CIRCUIT IF	-	185055				1																												
49																																						
50																																						

C/N NO. DATE																															
ISSUE																															

MAKE OR BUY																															
A/R																															
ISSUE																															

NOTES:

Figure 19B

ASSEMBLY PARTS LIST

ITEM NO.	DUP. ITEM		ISSUE	DESCRIPTION	SIZE	PART NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	INSP.	MAKE OR BUY	MFG. CODE	A/R	NO. REQ.	U/M	QUANITY PER PART	REMARKS
51				CAN CONVERTER	C	184984			1																													
52				CAN IF	C	184985				1																												
53																																						
54																																						
55				INSULATOR PAD	B	185114-1	12																															
56				INSULATOR PAD	B	185114-2	6																															
57				INSULATOR PAD	B	185114-3	4																															
58																																						
59				HOUSING PRESELECTOR	C	184827						1																										
60				COVER PRESELECTOR	C	184828						1																										
61				TERMINAL-HERMET SEAL		AAA-30W-SS						3																										ELECTRICAL INDUSTRIES
62																																						
63				TERMINAL BOARD	B	184976								1																								
64				TERMINAL		X2044A								9																								CAMBRIDGE THER CORP
65																																						
66				TERMINAL BOARD	B	184826									1																							
67				TERMINAL		254-388									12																							PRECISION METAL PROD
68																																						
69				SPACER	B	184977		2																														
70				SPACER	B	184844					1																											
71				SPACER	B	185077			3	3	3																											
72				INSERT	B	184845			3	3	3																											
73				PLUG PRINTED CIRCUIT		3231												5	5																			CAMBRIDGE THER CORP
74																																						
75				HEADER SHELL OUTPUT	B	184837													1																			
76				HEADER SHELL DRIVER	B	184836												1																				
77																																						
78				SHELL EPOXY		M5-1-450-E										1																						WELLS ELECTRONICS
79				SHELL EPOXY		M5-2-500-E											1																					WELLS ELECTRONICS
80																																						
81				TRANSFORMER DRIVER	C	185088										1																						
82				TRANSFORMER OUTPUT	C	185089											1																					
83																																						
84																																						
85				SHIELD PRESELECTOR	B	184975						1																										
86				SHIELD CONVERTER	B	184974			1																													
87				SHIELD CONVERTER	B	184846			1																													
88				SHIELD CONVERTER	B	184847			1																													
89				SHIELD IF	B	184973-1				1																												
90				SHIELD IF	B	184973-2				1																												
91				SHIELD IF	B	184973-3				1																												
92				SHIELD IF	B	184973-4				1																												
93				SCREW 4 - 40 x 5/8 FLAT HD		AN507C440R10	3																															3 - 29/25
94				SCREW 4 - 40 x 1/4 FLAT HEAD		AN507C440R4	21																															12 - 28/25 9 - 27/25
95				SCREW 0 - 80 x 3/16 FLAT HEAD		ANS10CO3		13																														3-6/4 3-8/4 3-10/4 4-16/69/4
96				SCREW 2 - 56 x 1/4 FLAT HD		MS35200-3	4																															4 - 102/4
97				SCREW 2-56 x 3/16 FLAT HD		MS35200-2		4																														2 - 14/28 2 - 12/28
98				SCREW 2 - 56 x 1/4 FLAT HD		MS35126-3	2																															2 - 14/25
99																																						
100				WASHER FLAT #4		AN960C4L		4																														

C/N NO. DATE
ISSUE

MAKE OR BUY
A/R
ISSUE

NOTES:

Figure 19C

ASSEMBLY PARTS LIST

ITEM NO.	DUP. ITEM		ISSUE	DESCRIPTION	SIZE	PART NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	INSP.	MAKE OR BUY	MFG. CODE	A/R	NO. REQ.	U/M	QUANITY PER PART	REMARKS
101				CRYSTAL	C	184286			1																												SEE DRAWING
102				CRYSTAL FILTER	C	184587		1																													SEE DRAWING
103																																					
104																																					
105				CAPACITOR FEED THRU	B	185071							9																								ALLEN BRADLEY
106				CAPACITOR TRIMMER		VCJ761			4	5		3																									JFD ELECTRONICS
107				CAPACITOR .01 uf		MC80V103AM			4	14	3																										AEROVOX
108				CAPACITOR .001 uf AXIAL LEAD		VK26CW102M				3																											VITRAMON INC
109				CAPACITOR .001 uf RADIAL LEAD		VK21CW102M				4	1																										VITRAMON INC
110				CAPACITOR .47 uf		150D474X0035A2				1	1																										SPRAGUE
111				CAPACITOR .82 Pf		JM0.82 PF ± 5%				2																											JEFFERS
112				CAPACITOR 1.5 Pf		JM1.5 Pf ± 5%				1																											JEFFERS
113				CAPACITOR 150 Pf		VK26CW151			8	1		2																									VITRAMON INC
114																																					
115																																					
116																																					
117				CAPACITOR		JM1.2 PF 5%						2																									
118				CAPACITOR 6.8 uf		150D685X0035B2					2																										SPRAGUE
119																																					
120																																					
121				CAPACITOR 22 PF		VY13C220J			1																												VITRAMON
122				CAPACITOR 82 Pf		VY13C820J			1																												VITRAMON
123																																					
124				CAPACITOR 0.25 uf		CR89W254AM					1																										AEROVOX
125				CAPACITOR 1 uf		150D105X0035A2					1																										SPRAGUE
126																																					
127																																					
128																																					
129				REGULATOR-SILICON	C	185084					1																										SEE DRAWING
130				DIODE V27	C	184520				4																											SEE DRAWING
131				DIODE		PD311				2																											PSI
132				DIODE	C	184798				1	2																										SEE DRAWING
133				DIODE		PC-116			1																												PSI
134																																					
135																																					
136																																					
137																																					
138				TRANSISTOR		2N917			3	4																											FAIRCHILD
139				TRANSISTOR		FM1613				1																											FAIRCHILD
140				TRANSISTOR		2N910					1																										FAIRCHILD
141				TRANSISTOR		FM910					3																										FAIRCHILD
142																																					
143				PAD-TRANSISTOR		A10091 DAP			3	5	4																										MILTON ROSS METAL PROD
144				TRANSFORMER IF INTERSTAGE	C	185080				1																											
145				TRANSFORMER RF	B	183962-2			1																												
146				TRANSFORMER OSCILLATOR	B	183961-2			1																												
147				TRANSFORMER MIXER	C	185083			1																												
148				TRANSFORMER IF INPUT	C	185082				1																											
149				TRANSFORMER IF OUTPUT	C	185081				1																											
150				TRANSFORMER IF AGC	B	183958				2																											

C/N NO. DATE

ISSUE

MAKE OR BUY

A/R

ISSUE

NOTES:

Figure 19D

ASSEMBLY PARTS LIST

ITEM NO.	DUP. ITEM		ISSUE	DESCRIPTION	SIZE	PART NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	INSP.	MAKE OR BUY	MFG. CODE	A/R	NO. REQ.	U/M	QUANITY PER PART	REMARKS
151				RESISTOR 15 Ω		RCO7GF150J					1																											
152				RESISTOR 18 Ω		RCO7GF180J				1																												
153				RESISTOR 22 Ω		RCO7GF220J					2																											
154				RESISTOR 100 Ω		RCO7GF101J					2																											
155				RESISTOR 180 Ω		RCO7GF181J				4																												
156				RESISTOR 220 Ω		RCO7GF221J			1																													
157				RESISTOR 1K		RCO7GF102J			1	2	2																											
158				RESISTOR 1.8K		RCO7GF182J				4																												
159				RESISTOR 2.2K		RCO7GF222J			1		1																											
160				RESISTOR 3.3K		RCO7GF332J				1																												
161				RESISTOR 4.7K		RCO7GF472J					1																											
162				RESISTOR 6.8K		RGO7GF682J			3																													
163				RESISTOR 10K		RCO7GF103J				2																												
164				RESISTOR 15K		RCO7GF153J			1																													
165				RESISTOR 18K		RCO7GF183J			1	12																												
166				RESISTOR 22K		RCO7GF223J			1		1																											
167				RESISTOR 33K		RCO7GF333J			1																													
168				RESISTOR 47K		RCO7GF473J					1																											
169				RESISTOR 68K		RCO7GF683J				2																												
170				RESISTOR 82K		RCO7GF823J				1																												
171				RESISTOR 100K		RCO7GF104J			1	1	1																											
172				RESISTOR 180K		RCO7GF184J					1																											
173				RESISTOR 270K		RCO7GF274J					1																											
174				RESISTOR 390K		RCO7GF394J				1																												
175				RESISTOR 680K		RCO7GF684J				1																												
176				RESISTOR 1000K		RCO7GF105J					1																											
177				RESISTOR SELECTED		RCO7GF___J		7		2																												
178																																						
179																																						
180				INDUCTOR TUNING	B	184989						1																										
181				INDUCTOR TUNING	B	184990						1																										
182				INDUCTOR TUNING	B	184991						1																										
183				INDUCTOR CRYSTAL SHUNT	B	183967-2			1																													
184				INDUCTOR IMAGE TRAP	B	183963-2			1																													
185				INDUCTOR		1537-22			1																													DELEVAN
186				COIL-RF CHOKE		184598			1		1																											
187																																						
188				POTTING COMPOUND		ECCOBOND SI			X	X	X					X	X																					EMERSON & CUMINGS
189				CATALYST		9			X	X	X					X	X																					EMERSON & CUMINGS
190																																						
191				POTTING COMPOUND		ECCOFOAM FP			X	X	X	X	X																									EMERSON & CUMINGS
192				CATALYST		12-6			X	X	X	X	X																									EMERSON & CUMINGS
193																																						
194				CONDUCTIVE CEMENT		4328							X																									HYSOL CORPORATION
195				HARDENER		3475							X																									HYSOL CORPORATION
196																																						
197				INSULATOR		PC12007A			X	X		X								X																		HYSOL CORPORATION
198				INSULATOR		PC12007B			X	X		X								X																		HYSOL CORPORATION
199																																						
200				CEMENT		910	X													X																		EASTMAN

C/N NO.																																						
DATE																																						
ISSUE																																						

MAKE OR BUY																																						
A/R																																						
ISSUE																																						

NOTES:

Figure 19E

ASSEMBLY PARTS LIST

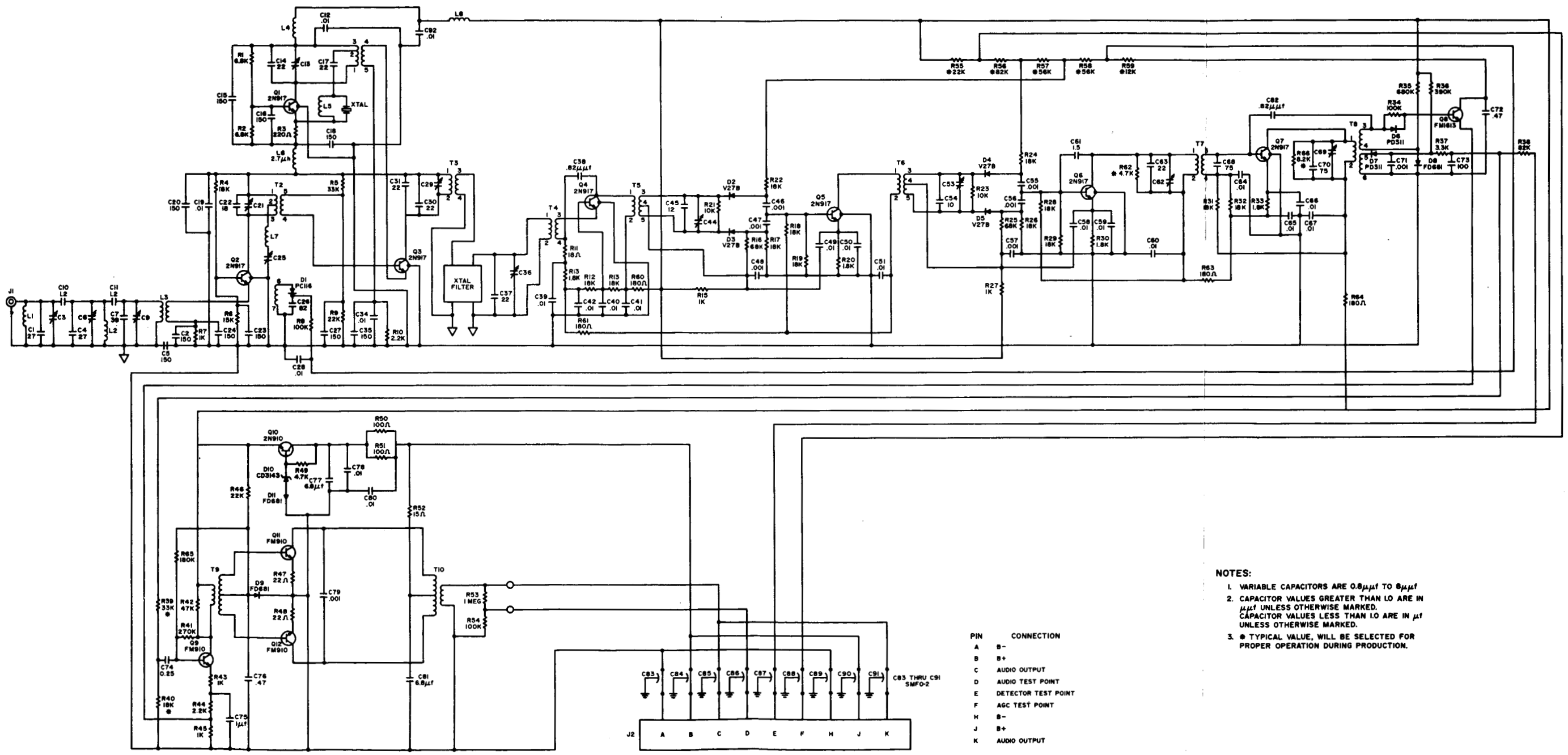
ITEM NO.	DUP. ITEM		ISSUE	DESCRIPTION	SIZE	* PART NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	INSP.	MAKE OR BUY	MFG. CODE	A/R	NO. REQ.	U/M	QUANTITY PER PART	REMARKS
201				WIRE #26 BARE IN INS		391253-26																																
202																																						
203				WIRE #26 TEFLON BLK IN INS	B	10422813-10																																
204				WIRE #26 TEFLON BRN IN INS	B	10422813-7																																
205				WIRE #26 TEFLON RED IN INS	B	10422813-14																																
206				WIRE #26 TEFLON ORG IN INS	B	10422813-6																																
207				WIRE #26 TEFLON GRN IN INS	B	10422813-9																																
208				WIRE #26 TEFLON BLUE IN INS	B	10422813-4																																
209				WIRE #26 TEFLON WHITE IN INS	B	10422813-1																																
210				WIRE #26 TEFLON GREY IN INS	B	10422813-2																																
211				WIRE #26 TEFLON LT BLUE IN INS	B	10422813-5																																
212				WIRE #26 TEFLON YELLOW IN INS	B	10422813-13																																
213				WIRE #26 TEFLON VIOLET IN INS	B	10422813-3																																
214				STRIPPER (FORMVAR)	A	10422817																																
215				TUBING TEFLON THIN WALL		VG #26																																CHEMPLAST INC
216				GLYPTAL	A	725039																																
217																																						
218				SOLDER 63/37 .030 DIA	B	231236-17																																
219				SOLDER 50/50 .030 DIA	B	231236-26																																
220																																						
221																																						
222																																						
223																																						
224																																						
225				CAPACITOR FIXED TUNING 10 PF		GTC-150-U-10-J			1	1																												GLENCO
226				CAPACITOR FIXED TUNING 12 PF		GTC-150-S-12-J			1																													GLENCO
227				CAPACITOR FIXED TUNING 12 PF		GTC-150-U-12-J				1																												GLENCO
228				CAPACITOR FIXED TUNING 18 PF		GTC-150-H-18-J			1																													GLENCO
229				CAPACITOR FIXED TUNING 22 PF		GTC-150-H-22-J			2																													GLENCO
230				CAPACITOR FIXED TUNING 22 PF		GTC-150-P-22-J				2																												GLENCO
231				CAPACITOR FIXED TUNING 27 PF		GTC-150-H-27-J						2																										GLENCO
232				CAPACITOR FIXED TUNING 39 PF		GTC-150-H-39-J						1																										GLENCO
233				CAPACITOR FIXED TUNING 68 PF		GTC-150-U-68-J				1																												GLENCO
234				CAPACITOR FIXED TUNING 75 PF		GTC-150-T-75-J				1																												GLENCO
235																																						
236																																						
237				INSULATOR IF TOP	B	185095				1																												
238				INSULATOR IF BOTTOM	C	185096				1																												
239				INSULATOR RF TOP	B	185097			1																													
240				INSULATOR RF BOTTOM	C	185098			1																													
241				INSULATOR AUDIO TOP	C	185107-2					1																											
242				INSULATOR AUDIO BOTTOM	C	185107-1					1																											
243				INSULATOR MASTER BOARD	C	185078	1																															
244				BOARD OUTLINE IF	C	185093-1				1																												
245				BOARD OUTLINE IF	C	185093-2				1																												
246				BOARD OUTLINE RF TOP	C	185099-1			1																													
247				BOARD OUTLINE RF	C	185099-2			1																													
248				BOARD OUTLINE AUDIO	B	185106-1					1																											
249				BOARD OUTLINE AUDIO	B	185106-2					1																											
250				BOARD OUTLINE MASTER	D	185118	1																															

C/N NO. DATE	
ISSUE	

MAKE OR BUY	
A/R	
ISSUE	

NOTES:

FIGURE 20
SCHEMATIC DIAGRAM



PIN	CONNECTION
A	B−
B	B+
C	AUDIO OUTPUT
D	AUDIO TEST POINT
E	DETECTOR TEST POINT
F	AGC TEST POINT
H	B−
J	B+
K	AUDIO OUTPUT

NOTES:

1. VARIABLE CAPACITORS ARE 0.8μμf TO 8μμf
2. CAPACITOR VALUES GREATER THAN 1.0 ARE IN μμf UNLESS OTHERWISE MARKED. CAPACITOR VALUES LESS THAN 1.0 ARE IN μf UNLESS OTHERWISE MARKED.
3. ⊛ TYPICAL VALUE, WILL BE SELECTED FOR PROPER OPERATION DURING PRODUCTION.