REPLACEMENT OF RT-24/246 TRANSMITTER TUBES BY TRANSISTOR INSERTS.

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NOTICES

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Replacement of RT-521/216 Transmitter Tubes by Transistor Inserts

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VHF-FM radio
Vehicular radio
AN/VRC-12
RT-521
RT-216

Transmitter tube replacement
Transistorized VHF Power Amplifier

The RT-521 and RT-216 VHF vehicular radios are in the field in large numbers. These will have to be maintained for the next 10-20 years or longer. In order to assure maintainability, and also to increase the reliability of the radio, replacement of transmitter tubes by transistor inserts was explored. A model was successfully designed, constructed and tested.

(Continued on reverse)
In addition to improved reliability, another advantage is that the noisy fan does not operate under normal conditions. Therefore, the position of the radio is not given away in a quiet environment. A further advantage is that a 100% transmit duty cycle is possible.
The RT-52h and RT-2lA6 are vehicular FM radio transceivers used in large quantities by the US Army. These radios provide 920 synthesized radio channels within the range of 30 to 75.95 MHz. The minimum transmitter output power specified is 35W. The RT-2lA6 is similar to the RT-52h, but, in addition, it has 10 frequency presets. Except for the receiver front end and the transmitter power amplifier, the radio is fully transistorized.

The objective of the work described in this report was to explore the feasibility of replacing the tubes in the transmitter by transistor inserts.

PREVIOUS WORK:

Previous work, R&D Technical Report ECOM-2836, and ECOM-3209, describe an approach which rather than replacing only the tubes, replaces the entire power amplifier modules A6100 and A6200 by a broadband transistor amplifier module. A similar approach was taken by RF Communications Inc., Contract Number DAAB07-72-C-0153.

In all three cases, the design was not adopted because excessive broadband output noise levels in transmit prevented use of the equipment in radio relay configurations. Typical noise levels 10 MHz off carrier and measured in a 32 kHz bandwidth were in the order of -68 ... -73 dBm. However, for a vehicular radio relay operation, -95 ... -98 dBm are required. These levels were marginally met by the tube version. Another disadvantage was that back intermodulation performance of the transistor model was much worse than that of the tube version. Back intermodulation results when two collocated transmitters are transmitting simultaneously. The signal transmitted by $T_1$ enters the antenna of $T_2$ and mixes with the second harmonic of $T_2$ in the amplifying transistor or tube of $T_2$. The resulting mixing product is re-radiated and may jam a nearby receiver which is tuned to that particular frequency. The problems of previous transistor versions were caused by the lack of tuning elements. Tuned circuits are used in the tube version and in the approach described in this report.

NEW APPROACH:

In the new approach, tuning elements were used in the transistor power amplifier train. The question arose whether the same tuning elements now in the tube version could be used for that purpose. As will be shown in this report, this was found possible. The old tube module with its gear trains, tuning elements, and many of the components were reused. As a result, this solution will be very cost effective for retrofit of
equipment now in the field. In addition, the installation of the transistor inserts can be achieved without any machining. Therefore, only simple hand tools are required to perform the modification.

**DESCRIPTION:**

1. **The Driver, Module A6100**

   a. **Concept.** The driver tube V6101, type 5686 was replaced by a two stage transistor amplifier, see schematic, Figure 1. This amplifier connects into the socket of V6101 using a nine pin tube socket adapter and is clamped to the former tube heat sink by two brackets. The grid and plate tuned circuits are used as they are, except that choke L6105, which is easily accessible, must be removed. The signal is coupled by a 6 pF capacitor from the tube socket point, where the tube grid had been connected, to the base of transistor Q1(2N23866). The diode DL prevents peak rectification by the base emitter diode. The 2N3866 was selected according to test setup shown in Figure 2, for a minimum of 160 mA dc collector current. A second transistor Q2(2N3866) forms a cascode configuration with the first one in order to increase the gain and reduce the Miller effect.  

   The output of this cascode amplifier is coupled to the next stage, Q3(2N3632) by transformer T1. Figure 3 shows the transformer. Resistors R3 and R4 prevent nonlinear instability.

   T1 couples to the second driver stage, which uses a 2N3632 to drive the output tuned circuit. This circuit was formerly connected to the plate of the driver tube. Transformer T2 couples to this tuned circuit. This transformer must have a low stray factor, proper inductivity, and low winding capacity. Figure 4 shows this transformer. Inductor L2 improves the efficiency and resistors R10 and R8 help prevent nonlinear instability. L2 and R10 are one unit as shown in Figure 5. Capacitors C5 and C6 determine the matching between transistor and tuned circuit.

   b. **Current limiting.** Transistors Q4(2N3791) and Q5(2N3867) act as a current limiter and automatic level control. They limit the current to 1.75A, such that the driver assembly cannot be damaged by improper operating conditions during tests and repairs. The control current is supplied thru R18 by the ALC circuit. R17 and C8 act as damping circuit for the control loop. Resistors R15 and R16 prevent linear oscillations of the final power amplifier after removal of the drive signal from the driver amplifier. Figure 6 shows the output vs frequency of this driver.

   c. **Heat Transfer.** The thermal resistance between driver insert and module wall (see Figure 7), points A and B, was measured to be 1.1° C/W. With a maximum total power dissipation in the driver assembly of 13W, this will cause a temperature differential of 11°C. This is considered satisfactory. For improvement of heat transfer, Thermal Joint Compound, type Thermacote by Thermalloy Company was used.

   1. **Miller Effect:** Increase of input capacity by $C_{cb} \left(1 + \text{voltage gain}\right)$ where $C_{cb}$ is the collector-base capacity.
However, with the present construction, the tolerances in the tube socket position do not always allow a perfect match of the heat sinks, with a consequent increase in the heat transfer resistance. Hence, the tube socket connector in the next model should be mounted floating, such that it may move in parallel to the socket surface.

d. Hardware Sketches. (See Figures 8 thru 12) As mentioned above, changes are required in Figure 9 in order to let the tube socket float. Figure 13 shows a photo of this Driver Insert, with the core removed.

2. The Power Amplifier, Module A6200.

a. Concept. The tube socket of lighthouse tube V6201, type 7B43 and its BeO heat sink block are removed using a screw driver and cutters. In its place, the transistor power amplifier insert is installed by bolting it into the position where the BeO heat sink block had been. No machining, drilling or thread cutting is required. This power amplifier insert contains:

1. Two transistors 2N5643 in push-pull
2. Input-output matching and feeding circuits
3. Band switch
4. Low pass filter for the high band to improve harmonic suppression.
5. VSWR detector
6. The current limiter transistor and its preamplifier transistor.
7. The ALC and high/low power control circuit.

b. Mechanical. The band switch is operated by the switch lever which operates the output tank switch. A new switch lever must be installed which is shaped slightly differently and carries a nose. The nose operates the forked lever of the band switch in the insert. The switch wafer on the printed circuit board of the amplifier is limited in its movement by stops on the printed circuit board; since the wafer is driven by a spring which takes up excess movement. As a result, no high amount of accuracy of the band switch drive is required.

The original plan to add some contacts on existing band switch S6202 was abandoned in favor of placing the switch into the insert. The insert can simply be screwed in and the leads connected. This way the modification is easier to implement in the field.

The High Band Low Pass Filter, the VSWR detector and the ALC circuit are housed in a sheet metal box installed on top of the amplifier. The box is suspended by hinges such that all components are easily accessible for production and service. The potentiometers for level adjustments are accessible with the entire plug-in installed in the radio frame.
c. Heat Transfer. The thermal resistance between the insert and the main heat sink of the power amplifier module A6200 was measured to be \(0.32^\circ\text{C/W}\). Thermacote was used between the surfaces. At an ambient temperature of \(65^\circ\text{C}\) and with a 30V d.c. supply voltage, the fan maintained the main heat sink at \(75^\circ\text{C}\). The following junction temperatures were calculated for the rf transistors and for the current limiter transistor.

**RF Transistors**

1. The power supplied to the rf transistors: \(2.2A \times 2 \times 22.5V = 99W\).
2. The rf output power delivered is 45W, hence the transistors dissipate \(99 - 45 = 54W\), ie 27 watts each.
3. The thermal resistance of the 2N5614 is \(2.92^\circ\text{C/W}\). Therefore, the junction temperature is \(2.92 \times 27 = 79^\circ\text{C}\) above the insert temperature.
4. The loss in the current limiter will be \(6A \times 7.5V = 45W\). Hence the total loss dissipated on the insert will be \(45W + 54W = 99W\). Then the temperature difference between the main heat sink and the insert will be: \(99W \times 0.32^\circ\text{C/W} = 32^\circ\text{C}\).

Therefore, at 30V input and 65\(^\circ\text{C}\) ambient temperature, these temperatures are predicted:

- Main Heat Sink: \(75^\circ\text{C}\)
- Insert: \(107^\circ\text{C}\)
- Junction: \(186^\circ\text{C}\)

**Current Limiter Transistor**

Thermal resistance of 2N3412: \(175^\circ\text{C} / 117W = 1.5^\circ\text{C/W}\).

The mica insulator, with Thermacote, will have \(1.9^\circ\text{C/W}\) adding to a total of \(1.9^\circ\text{C/W}\). The temperature differential between junction and insert will then be \(1.9^\circ\text{C/W} \times 45W = 86^\circ\text{C}\).

The junction temperature of the current limiter transistor, at 65\(^\circ\text{C}\) ambient temperature and with 30V supply voltage will then be:

\[
T_J = 107 + 86 = 193^\circ\text{C}.
\]

d. Hardware. Sketches for the hardware of the power amplifier insert are shown in Figures 14 to Figure 22.
e. Electrical

Power amplifier. The two transistors 2N56U3 are used in a push-pull configuration in emitter-base switched mode. Two transformers are used to match the input impedance of the transistors to the source and also obtain the 180° phase shift required for push-pull. Figure 23 shows identical construction for transformers T3 and T4. For the transformers, 14 mm dia. ferrite cup cores are used. However, smaller cores will possibly also be usable. Figure 24 shows the input impedance vs. frequency of the transistor under load, on the fundamental. From these measurements, the equivalent circuit shown in figure 24 was derived. It approximates the input impedance of the transistor between 30 and 75 MHz.

Stray and parallel inductance of transformer T3, together with capacitors C31-C37 transform this impedance to a nominal value of 100 ohms (two in parallel yield 50 ohms). The measured values are shown in figure 25.

Resistors R33, R34, R35, R36, and inductors L31, L32 supply d.c. current to the collectors. The arrangement of L31 and R34 or L32 and R36 is shown in figure 26. The resistors prevent nonlinear instability. Resistors R51, R52 and Capacitors C40 .. C43 serve the same purpose.

Switch S1/1-3 is located on the printed circuit board of the insert. It switches the amplifier to the Low or Hi Band Tuned Circuits. Section 3 of switch S1 breaks before S1/1 or S1/2 break. It serves to remove power from the amplifier during band switching.

Transformers T5 and T6 match the transistor output to an unsymmetric load line.

Transformer T5 Construction: Wind 6 turns #22 Formvar Magnet wire on ¼" diameter cylindrical coil form. Apply thin sheet of epoxy and let set. This is the secondary (output) winding. Wind primary tightly on top of secondary in the same winding direction, four turns #20 magnet wire (primary, input). Turn the coils such that primary and secondary leads are offset by 180°. Cement in place. Use cup core #B655H1-R-0020-A-012.

Electrical values measured at 50 MHz

- Primary Inductance, 254 nH
- Primary Inductance, sec. shorted 46 nH
- Secondary Inductance, 462 nH
- Secondary Inductance, prim. shorted 83 nH

The capacitance between the windings is 21 pF. Figure 27 shows the input impedance of transformer T5 when terminated with 50 ohms and with series and parallel capacity added. Since in the actual circuit stray inductance is added, C45 was reduced from 390 pF to 220 pF.
The cup cores of the transformers were filled with Thermacote and mounted on a heat sinking copper plate. Thereby, maximum heat conduction is obtained.

The High Band Low Pass Filter has three poles. The measured filter characteristics are shown in figure 28. In the passband, 30-76 MHz, with a 50 ohm load, the absolute value of the input impedance is within 5 ohms. Figure 29 shows the filter components and figure 30 shows the p.c. board layout.

The filter provides at least 40 dB harmonic suppression. This, together with the second harmonic suppression by the push-pull amplifier, (10...20 dB), and the effect of the tuned tank circuit (15 dB) provides 60 dB of harmonic suppression with ample margin. For filtering in the Low Band, the FL 401 filter now in existence is being retained. This approach provides substantial cost savings for retrofit.

For both bands, one VSWR detector is being used. The trimmers, C54 and C55 shown in Figure 1 can be replaced later by fixed capacitors. Redesign of the mechanical layout of this section is required.

The tuned circuit tank assembly for Band A and B (Low and High Band) is essentially used without change. The tank coils are tapped, and the outputs from the VSWR detector are connected to these taps.

**Selection of taps on tank coils:** Feed 3 Vrms at 50 MHz to high point of tank coil. Leave J6201 open. Connect a 50 ohm cable, terminated with 50 ohms, at the tapped end of the coil, with the shield connected to the ground end of the coil. Adjust the tap such that .6V rms are measured at the 50 ohm terminal of the cable. Then the 50 ohm load is disconnected from the cable and adjust output coupling and tuning until 50 ohms real are obtained. The High Band tank tapping procedure is analogous.

Figure 31 shows the input impedance of the tank when loaded with 50 ohms. Figure 32 to 35 show measured values of the input impedance of the tank with J6201 being loaded with 50 ohms. For various dial settings, the input impedance was measured for various input frequencies. For the input frequency equal to the dial frequency, the impedance should be close to 50 ohms. Figure 36 and 37 show the measured attenuation characteristics of the tanks, tapped as described.

Inductor L36 (7 H) and capacitor C59 (12 pF) are substituted for the feeding choke L5202 and the plate capacity of the removed power tube V6201.

The ALC circuit, fed by the VSWR detector and the overload current control, regulates the supply voltage for the driver module. It also reduces power when the set is operated in the "Low Power" mode.
The current limiting transistor together with its driver is mounted on the insert heat sink. The current and voltage limiting circuitry is essentially the same as that used in contract DAAB07-72-C-0153. The circuitry is on a printed circuit board located in the space at the rear of the tube socket mounting of former tube V6201. The power zener diode, 1N2988 and the .15 ohms power resistor are mounted below on an aluminum heat sink. The heat sink, shown in Figure 38, is installed in place of R6204. (R6204 is removed.)

Current Limiting. The current limiter maintains the power amplifier supply current in the range of 5 to 6 Amps and regulates the voltage to 23V. However, if some malfunction should occur, the entire current concentrates on one power amplifier transistor, and breakdown may result. Therefore, the circuit should be modified such that dc voltage reduction is initiated if the dc current in any one of the two PA transistors is exceeded. Figure 39 shows the electrical performance of the power amplifier insert. Figures 39A and 39B show the completed laboratory model of the power amplifier assembly.

3. Miscellaneous: The fan is turned on only if thermostat S6201 closes. This happens if the temperature on the main heat sink rises above 70°C. The power supply changes (Module A9000) are the same as described in report ECOM 2836. Essentially, the dc to dc converters are disabled. The 100 Hz, 115 Vac power supply is kept as is. However, it is recommended that the Germanium switching transistors, Q9101 and Q9102 be replaced by silicon types on module A9100. Retaining this power supply also allows the modifications to be used in the RT-246 for automatic tuning.

4. Basic Electrical Performance of entire setup. Figure 40 shows output power vs. frequency for the entire radio at 25.5 V.d.c. power supply voltage. As can be seen, the output power falls slightly below the minimum specification at some points. The driver output power and the matching of the final stage need some additional work. The same is true for the ALC circuit.

The noise performance is shown in Figure 41. For a dial setting of 40 MHz, at +10 MHz off carrier, the carrier-to-noise ratio in a 30 kHz bandwidth was measured to be 113 to 115 dB; at 60 MHz dial setting, it was 115 to 117 dB. This shows that the design meets the requirements for retransmission.

Figure 42 shows a measurement of Back Intermodulation. Significant improvement over broadband designs was obtained. Curves in Figure 43 display harmonic suppression. In the high band, the 60 dB harmonic suppression is not quite met. However, the sum of the attenuations should exceed 60 dB. Improved shielding and grounding may eliminate this problem. Apparently, the fourth harmonic leaks past the filter.
5. Conclusions: The scheme of replacing the transmitter tubes in the RT-524 and RT-246 by transistor inserts appears technically feasible. Due to the minimum of changes required in the rest of the radio, and maximum use of components present in the radio, retrofitting will be economically attractive.
NOTES: 1. 2. 3. DISCONNECT RESPECTIVE PLUGS.
2. ELIMIATE CHOKE
3. REMOVE SOCKET OF V6201, LEAVE FEED "ACU FINDING POST IN PL.
4. REMOVE DIODE.
5. FIG 1
A 6200 HEAT SINK ASSY

RF OUTPUT BAND A 6201

RF OUTPUT BAND B

---

**PARTS LIST**

<table>
<thead>
<tr>
<th>ITEM QTY</th>
<th>PART OR NO.</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>SPECIFICATION NO.</th>
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</table>

**AUTHENTICATION**

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<th>DRAWN BY</th>
<th>CHECKED BY</th>
<th>NEXT ASSY</th>
<th>USED ON</th>
<th>VERIFIED</th>
</tr>
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</table>

**APPLICATION**

- NUMBER 20309
- SCALE 0.5

**NOTE**

- WHEN REFERENCING TO THIS DRAWING STATE DRAWING NO. APPLICABLE SCALE LETTERS. IF ANY."
FIG. 2. TEST SETUP
PRIMARY:
6 turns #22 mW, Formvar. Wind on \( \frac{1}{4} \)" dia rod, direction as shown, winding beside winding. Present spring-up, apply thin sheet of Easy Poxy, let set.

SECONDARY:
1 turn of Copper sheet metal, 4.5 mm wide, 5-10mil thick. Glue onto primary with Easy Poxy.

CORE:
CUP CORE B65541-K-0020-A012
MAT. : 20K12
MEASURE with Boonton RX METER 250A:
\[ C_p = 15.5 \text{pF, } R_p = 26 \text{k}\Omega \text{ @ 50MHz, SEC. OPEN} \]
\[ C_p = 6.5 \text{pF, } R_p = 9.4 \text{k}\Omega \text{ @ 75MHz, SEC. OPEN} \]
\[ C_p = 65 \text{pF, } R_p = 2.8 \text{k}\Omega \text{ @ 50MHz, SEC. SHORT} \]

FIG. 3 TRANSFORMER T1 IN DRIVE AMPLIFIER.
FIG. 4 TRANSFORMER T2 WITH DRIVER
MEASURE WITH BOONTON RX METER 250A

**PRIMARY:**

<table>
<thead>
<tr>
<th>f [MHz]</th>
<th>C_p [pF]</th>
<th>R_p [kΩ]</th>
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<tbody>
<tr>
<td>9</td>
<td>50.3</td>
<td>37</td>
</tr>
<tr>
<td>21</td>
<td>7.3</td>
<td>100</td>
</tr>
<tr>
<td>40</td>
<td>.2</td>
<td>200</td>
</tr>
<tr>
<td>40</td>
<td>24.8</td>
<td>3.4</td>
</tr>
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</table>

**SECONDARY:**

<table>
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<th>f [MHz]</th>
<th>C_p [pF]</th>
<th>R_p [kΩ]</th>
</tr>
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<tbody>
<tr>
<td>21</td>
<td>85</td>
<td>3</td>
</tr>
<tr>
<td>75</td>
<td>72</td>
<td>.52</td>
</tr>
</tbody>
</table>

**TRANSFORMER MATCHED WITH 50Ω AT OUTPUT**

**INPUT IMPEDANCE:**

<table>
<thead>
<tr>
<th>f [MHz]</th>
<th>C_p [pF]</th>
<th>R_p [Ω]</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>4.7</td>
<td>980</td>
</tr>
<tr>
<td>50</td>
<td>1</td>
<td>990</td>
</tr>
<tr>
<td>75</td>
<td>0</td>
<td>960</td>
</tr>
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</table>

**FIG. 4 CONTD.**

13
SOLDER (BOTH ENDS)

INDUCTOR { 47K \( \Omega \) FORM \( \frac{1}{2} \) WATT

\( \mathcal{L}_2 \) \{ 5\( \frac{1}{2} \) TURNS ON 47 K\( \Omega \) \( \frac{1}{2} \) WATT RESISTOR

WIRE USED - RESISTIVE WIRE 20 \( \Omega \)/FT 6 STRANDS IN PARALLEL, EACH 5" LONG WOUND ON A HIGH VALUE \( \frac{1}{2} \) WATT RESISTOR

FIG 5 COMBINATION L2 AND R10
NOTE: POWER IN (50-90mW INTO 50 Ω)

FIG. 6 POWER OUT VS FREQUENCY FOR RF DRIVE
FIG. 7 HEAT TRANSFER OF DRIVER
**HEAT SINK MOUNT**

**ALUMINUM**

- .25 DIA x CBORE $\frac{1}{2}$ DIA x 25 DEEP
- $\frac{4}{8}$ DIA x CBORE .20 DIA x 25 DEEP

**STAINLESS STEEL**

- Scale: 2/1

**CLAMP**

- .498 ± .001 R

**SPACERS**

- Scale: 2/1

**FIG. 8**
STAINLESS STEEL

HARD SOLDER

BRASS

FIG. 9. SOCKET ADAPTER
CSK FOR #0-80 FLAT HEAD SCREW
.067 DIA
3-HOLES

3/16

2-7/16

1/4 DIA
4-HOLES

15/16

4.000 +.005
-.000

.688

1.375 +.005
-.000

MATL.: ALUMINUM OR BRASS, .0209 THICK, #25 STD GAGE

FIG. 10 COVER, PREDRIVER & DRIVER AMPLIFIER RT/524 A
INSULATOR,
MATERIAL: BeO

MATL: ALUMINUM

FIG. 11 TRANSISTOR HOLDER
FIG. 12 BASE PLATE
FIG. 13  DRIVER ASSEMBLY
FIG. 14. TRANSISTOR MOUNT FOR P.A. INSERT FOR P.A. RT524/VRC12. MAT.: AL
FIG. 15. PART 524 TRANSISTOR VERSION
MILL FLAT TO FIT 18 OPEN END WRENCH

MATL: BRASS
SCALE 2:1

6 PIVOT ROD

MATL: ST. STEEL
SCALE 2:1

7 PIVOT PIPE

MATL: BRASS
SCALE 2:1

FIG. 16

25
**Activator**

- Material: Delrin, 1/8 thk.
- Scale: 4:1

**Top Lever**

- Material: Brass, 1/16 thk.
- Solder on top of pivot pipe
- Scale: 2:1

**Bottom Lever**

- Material: Brass
- Scale: 2:1
- Solder on bottom of pivot pipe

**Switch Lever**

- Material: Stainless steel, 1/16 thk
- Scale: 1:1
- Rivet on switch lever

**Fig. 17**

---

Note: The diagram includes measurements and dimensions for each component, indicating the specific parts and their interactions in the assembly.
1. **CONTACTS, MATL: COIN SILVER, .0115 THK.**

- SOLDER CREVICE
- NO SOLDER ON CONTACT SURFACE

2. **SWITCH LEVER**

   - MATL: DELRIN

**NOTE:** ALL UNDERLINED DIMENSIONS ± .002

**FIG 18**

27
NOTE: ALL UNDERLINED DIMENSIONS, ± .002

P. C. BOARD, $\frac{1}{16}$ THK
P.A. RT524/VRC12

FIG 19
LEFT HINGE BRACKET  
MATL: STEEL

RIGHT HINGE BRACKET  
MATL: STEEL

FIG 21
ASSEMBLY

FIG 22
FIG 23 TRANSFORMER T3 OR T4
NAME: \text{NAME} \quad TITL\text{E: INPUT IMPEDANCE 2N5643, UNDER LOAD}

\textit{SMITH CHART Form 5301-7500-N} \quad \textit{GENERAL RADIO COMPANY, WEST CONCORD, MASSACHUSETTS}

\textbf{DATE:} 24

\textbf{Dwg. No.:} 24

\textbf{Impedance or admittance coordinates}

\textbf{Fig 24}

Radially scaled parameters

Center 33
<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>INPUT IMPEDANCE OF P.A., ONE SIDE</th>
<th>Dwg. No.</th>
<th>25</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>SMITH CHART FORM 330-7560-N</td>
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<td>GENERAL RADIO COMPANY, WEST CONCORD, MASSACHUSETTS</td>
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**IMPEDANCE OR ADMITTANCE COORDINATES**

**FIG 25**

**RADIAILY SCALED PARAMETERS**
3 TURNS RESISTANCE WIRE, .035 DIA, .5Ω/FT

13 TURNS
#25 FORMVAR
MAGNET WIRE

470Ω CARBON COMP. RESISTOR,
.562 LG, .233 DIA

COMBINATION L31 AND R34
OR L32 AND R36

FIG. 26 FEEDING CHOKE
IMPEDEANCE OR ADMITTANCE COORDINATES
58 nH 4 turns, #16 wire, inside diameter = 3/16"
192 nH 8 turns, #16 wire, inside diameter = 1/4"
(All capacitors are miniature glass type, rated at 300VDC)

FIG. 29 VALUES OF FILTER COMPONENTS
BOARD LAYOUTS

FIG 30
SMITH CHART Form 530-7500-N
GENERAL RADIO COMPANY, WEST CONCORD, MASSACHUSETTS

IMPEDEANCE OR ADMITTANCE COORDINATES
LOAD SEEN BY P.A. TANK
MATCHED WITH 50Ω LOAD
J62O1

FIG 31

RADIALY SCALED PARAMETERS
IMPEDELANCE OR ADMITTANCE COORDINATES

DIAL
- 45 MHz X
- 37 MHz O

z_0 = 50 \Omega
IMPEDANCE OR ADMITTANCE COORDINATES

DIAL 50

FIG 34

RADially SCALED PARAMETERS

CENTER 43
IMPEDEANCE OR ADMITTANCE COORDINATES

DIAL 52.95 X = CONST.
      33 O = CONST.

SIGNAL FREQ IS VARIED

FIG 35
FIG. 36 ATTENUATION OF LOW BAND TANK FOR VARIOUS DIAL SETTINGS
MATL: ALUMINUM, \( \frac{1}{4} \) THICK
ADD 2 MACH SCREWS 2-56 NC X \( \frac{1}{2} \) LG

FIG. 38 DIODE MOUNT
FIG 39 B  POWER AMPLIFIER
FIG. 40. OUTPUT POWER OF RT524 WITH TRANSISTOR DRIVER & PREAMP. REGULATOR & DRIVER CONNECTED TO P6204/1.
Fig. 42 Back intermodulation typical measured with CTC 2N6201 in P.A.