**VHF BEAM POWER AMPLIFIER**

### GENERAL DATA

**Electrical:**

- **Heater, for Unipotential Cathode:**
  - Voltage: $6.3 \pm 10\%$ ac or dc volts
  - Current: 1.25 amp

- **Transconductance, for plate volts = 200, grid-no.2 volts = 200, and plate ma. = 100:** 7000 $\mu$mhos

- **Mu-Factor, Grid No.2 to Grid No.1 for plate volts = 200, grid-no.2 volts = 200, and plate ma. = 100:** 4.5

**Direct Interelectrode Capacitances:**

- Grid No.1 to Plate: 0.022 max. $\mu$f
- Input: 13.5 $\mu$f
- Output: 8.5 $\mu$f

**Mechanical:**

- **Mounting Position:** Any
- **Overall Length:** 3-11/16" $\pm$ 1/8"
- **Seated Length:** 3-1/8" $\pm$ 1/8"
- **Maximum Diameter:** 1-23/32"
- **Bulb:** T-12
- **Cap.:** Small (JETEC No.C1-1)
- **Base:** Large-Wafer Octal 8-Pin Micanol with Sleeve No.R-6876 (JETEC No.B8-B6)

**AF POWER AMPLIFIER & MODULATOR—Class AB**

**Triode Connection—Grid No.2 Connected to Plate**

| Pin 1—Cathode, Grid No.3, Internal Shield | Pin 4—Same as Pin 1 |
| Pin 2—Heater | Pin 5—Grid No.1 |
| Pin 3—Grid No.2 | Pin 6—Same as Pin 1 |
| | Pin 7—Heater |
| | Pin 8—Base Sleeve |

**Cap—Plate**

**Bulb Temperature (At hottest point):** 220 max. °C

### Maximum Ratings, Absolute Values:

| DC PLATE VOLTAGE | 400 max. | 400 max. volts |
| PLATE CURRENT** | 90 max. | 90 max. ma |
| SIGNAL PLATE INPUT** | 35 max. | 35 max. watts |
| PLATE DISSIPATION** | 20 max. | 25 max. watts |

* With no external shielding and base sleeve connected to ground.

†, ‡, 3**: See next page.

MAY 1, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
### VHF BEAM POWER AMPLIFIER

#### PEAK HEATER-CATHODE VOLTAGE:
- Heater negative with respect to cathode: 135 max. volts
- Heater positive with respect to cathode: 135 max. volts

#### Typical Operation:

<table>
<thead>
<tr>
<th>Values are for 2 tubes</th>
<th>CCS*</th>
<th>ICAS**</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Plate Voltage</td>
<td>250</td>
<td>400</td>
</tr>
<tr>
<td>DC Grid-No.1 Voltage</td>
<td>-50</td>
<td>-100</td>
</tr>
<tr>
<td>Peak AF Grid-No.1-to-</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Grid-No.1 Voltage°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero-Signal DC</td>
<td>110</td>
<td>80</td>
</tr>
<tr>
<td>Plate Current</td>
<td>144</td>
<td>136</td>
</tr>
<tr>
<td>Max.-Signal DC</td>
<td>5000</td>
<td>8000</td>
</tr>
<tr>
<td>Effective Load Resistance</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max.-Signal Driving</td>
<td>5</td>
<td>4.6</td>
</tr>
<tr>
<td>Output (Approx.)</td>
<td>8</td>
<td>19</td>
</tr>
</tbody>
</table>

#### Maximum Circuit Values (CCS or ICAS Conditions):
- Grid-No.1-Circuit Resistance:\(^\circ^\circ\)
  - With fixed bias: 0.1 max. megohm
  - With cathode bias: 0.5 max. megohm

#### AF POWER AMPLIFIER & MODULATOR—Class AB\(_1\)†

#### Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th>Values are for 2 tubes</th>
<th>CCS*</th>
<th>ICAS**</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC PLATE VOLTAGE</td>
<td>600</td>
<td>750</td>
</tr>
<tr>
<td>DC GRID-No.2 (SCREEN) VOLTAGE</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>MAX.-SIGNAL DC PLATE CURRENT**</td>
<td>125</td>
<td>135</td>
</tr>
<tr>
<td>MAX.-SIGNAL PLATE INPUT**</td>
<td>60</td>
<td>85</td>
</tr>
<tr>
<td>MAX.-SIGNAL GRID-No.2 INPUT**</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PLATE DISSIPATION**</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

† Subscript 1 indicates that grid-No.1 current does not flow during any part of the input cycle.

° The driver stage should be capable of supplying the No.1 grids of the class AB\(_1\) stage with the specified driving voltage at low distortion.

* * * °°: See next page.
# VHF Beam Power Amplifier

## PEAK HEATER–CATHODE VOLTAGE:
- Heater negative with respect to cathode: 135 max. volts
- Heater positive with respect to cathode: 135 max. volts

## Typical CCS Operation:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CCS</th>
<th>ICAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Plate Voltage</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>DC Grid-No.2 Voltage</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td>DC Grid-No.1 (Control–Grid) Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With fixed-bias source</td>
<td>-40</td>
<td>-40</td>
</tr>
<tr>
<td>Peak AF Grid-No.1-to-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Zero-Signal DC Plate Current</td>
<td>86</td>
<td>70</td>
</tr>
<tr>
<td>Max.-Signal DC Plate Current</td>
<td>228</td>
<td>200</td>
</tr>
<tr>
<td>Zero-Signal DC Grid-No.2 Current</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Max.-Signal DC Grid-No.2 Current</td>
<td>30</td>
<td>19.5</td>
</tr>
<tr>
<td>Effective Load Resistance (Plate to plate)</td>
<td>4000</td>
<td>5000</td>
</tr>
<tr>
<td>Max.-Signal Driving Power (Approx.)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Harmonic Distortion (%)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Max.-Signal Power Output (Approx.)</td>
<td>55</td>
<td>70</td>
</tr>
</tbody>
</table>

## Typical ICAS Operation:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CCS</th>
<th>ICAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Plate Voltage</td>
<td>600</td>
<td>750</td>
</tr>
<tr>
<td>DC Grid-No.2 Voltage</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>DC Grid-No.1 (Control–Grid) Voltage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From fixed-bias source</td>
<td>-50</td>
<td>-50</td>
</tr>
<tr>
<td>Peak AF Grid-No.1-to-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Zero-Signal DC Plate Current</td>
<td>52</td>
<td>57</td>
</tr>
<tr>
<td>Max.-Signal DC Plate Current</td>
<td>239</td>
<td>227</td>
</tr>
<tr>
<td>Zero-Signal DC Grid-No.2 Current</td>
<td>1.2</td>
<td>1</td>
</tr>
<tr>
<td>Max.-Signal DC Grid-No.2 Current</td>
<td>25.2</td>
<td>27.5</td>
</tr>
<tr>
<td>Effective Load Resistance (Plate to plate)</td>
<td>5500</td>
<td>8000</td>
</tr>
<tr>
<td>Max.-Signal Driving Power (Approx.)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Harmonic Distortion (%)</td>
<td>7.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Max.-Signal Power Output (Approx.)</td>
<td>94</td>
<td>120</td>
</tr>
</tbody>
</table>

## Maximum Circuit Values (CCS or ICAS Conditions):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-No.1 Circuit Resistance:</td>
<td>0.1 max. megohm</td>
</tr>
</tbody>
</table>

* See next page.
VHF BEAM POWER AMPLIFIER

AF POWER AMPLIFIER & MODULATOR—Class AB₂

Maximum Ratings, Absolute Values:

<table>
<thead>
<tr>
<th></th>
<th>CCS</th>
<th>ICAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC PLATE VOLTAGE</td>
<td>600 max.</td>
<td>750 max. volts</td>
</tr>
<tr>
<td>DC GRID-No.2 (SCREEN) VOLTAGE</td>
<td>250 max.</td>
<td>250 max. volts</td>
</tr>
<tr>
<td>MAX.—SIGNAL DC PLATE CURRENT**</td>
<td>125 max.</td>
<td>135 max. ma</td>
</tr>
<tr>
<td>MAX.—SIGNAL PLATE INPUT**</td>
<td>62.5 max.</td>
<td>90 max. watts</td>
</tr>
<tr>
<td>MAX.—SIGNAL GRID-No.2 INPUT**</td>
<td>3 max.</td>
<td>3 max. watts</td>
</tr>
<tr>
<td>PLATE DISSIPATION**</td>
<td>20 max.</td>
<td>25 max. watts</td>
</tr>
</tbody>
</table>

PEAK HEATER—CATHODE VOLTAGE:

Heater negative with respect to cathode... 135 max. 135 max. volts
Heater positive with respect to cathode... 135 max. 135 max. volts

Typical CCS Operation:

Values are for 2 tubes

| DC Plate Voltage     | 400  | 500  | 600 volts |
| DC Grid-No.2 Voltage | 175  | 175  | 165 volts |

From fixed-bias source... -40 -40 -45 volts

Peak AF Grid-No.1-to-Grid-No.1 Voltage... 86 87 99 volts

Zero-Signal DC Plate Current... 63 64 31 ma
Max.—Signal DC Plate Current... 232 242 207 ma
Zero-Signal DC Grid-No.2 Current... 1.5 1.2 0.7 ma
Max.—Signal DC Grid-No.2 Current... 28 26 31 ma
Max.—Signal DC Grid-No.1 Current... 0.3 0.3 0.5 ma

Effective Load Resistance (Plate to plate)... 4000 5000 7500 ohms

Max.—Signal Driving Power (Approx.)... 0.01 0.01 0.02 watt
Total Harmonic Distortion... 9.7 9.7 9.7 %
Max.—Signal Power Output (Approx.)... 60 81 90 watts

** Averaged over any audio-frequency cycle of sine-wave form.

The type of input-coupling network used should not introduce too much resistance in the grid-No.1 circuit. Transformer or impedance coupling devices are recommended. When grid No.1 is operated in the negative region with fixed bias, the dc grid-No.1 circuit resistance should not exceed the specified value of 0.1 megohm. For higher values of dc grid-No.1 circuit resistance, cathode bias is required. Under no circumstances should the total dc grid-No.1 circuit resistance exceed the specified value of 0.5 megohm.

# Subscript 2 indicates that grid-No.1 current flows during some part of the input cycle.

†, ‡, ‡‡ See next page.

MAY 1, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

TENTATIVE DATA 2
VHF BEAM POWER AMPLIFIER

Typical ICAS Operation:

Values are for 2 tubes

DC Plate Voltage ................. 600 750 volts
DC Grid-No.2 Voltage ............ 185 165 volts
DC Grid-No.1 (Control-Grid) Voltage:
From fixed-bias source .......... -50 -45 volts
Peak AF Grid-No.1-to-
Grid-No.1 Voltage ............ 113 101 volts
Zero-Signal DC Plate Current .......... 41 35 ma
Max.-Signal DC Plate Current ........ 270 240 ma
Zero-Signal DC Grid-No.2 Current .......... 0.9 0.6 ma
Max.-Signal DC Grid-No.2 Current ........ 29 21 ma
Max.-Signal DC Grid-No.1 Current ........ 0.8 0.7 ma
Effective Load Resistance
(Plate to plate) .............. 5500 8000 ohms
Max.-Signal Driving Power (Approx.)† 0.04 0.03 watt
Total Harmonic Distortion .......... 11 10 %
Max.-Signal Power Output (Approx.) .... 115 130 watts

Maximum Circuit Values (CCS or ICAS Conditions):

Grid-No.1-Circuit Resistance:
With fixed bias .................. 30000 max. ohms
With cathode bias .......... Not recommended

PLATE-MODULATED RF POWER AMPLIFIER--Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

CCS† ICAS‡

Maximum Ratings, Absolute Values:

DC PLATE VOLTAGE ................. 480 max. 600 max. volts
DC GRID-No.2 (SCREEN)
VOLTAGE ..................... 250 max. 250 max. volts
DC GRID-No.1 (CONTROL-
GRID) VOLTAGE ............ -150 max. -150 max. volts
DC PLATE CURRENT .............. 117 max. 125 max. ma
DC GRID-No.1 CURRENT .......... 3.5 max. 4.0 max. ma
PLATE INPUT .................. 45 max. 67.5 max. watts
GRID-No.2 INPUT ................ 2 max. 2 max. watts
PLATE DISSIPATION ............. 13.3 max. 16.7 max. watts

† Preferably obtained from a separate source or from the plate-voltage supply with a voltage divider.
‡ Driver stage should be capable of supplying the specified driving power at low distortion to the No.1 grids of the AB2 stage. To minimize distortion, the effective resistance per grid-No.1 circuit of the AB2 stage should be held at a low value. For this purpose, the use of transformer coupling is recommended. In no case, however, should the total dc grid-No.1-circuit resistance exceed 30000 ohms when the 6146 is operated at maximum ratings. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

† ‡: See next page.

MAY 1, 1952
VHF BEAM POWER AMPLIFIER

PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode . 135 max. 135 max. volts
Heater positive with respect to cathode . 135 max. 135 max. volts

Typical Operation:
DC Plate Voltage . . : 400 475 600 volts
DC Grid-No.2 Voltage . : 150 135 150 volts

From a series resistor of : 21500 26500 37500 ohms
DC Grid-No.1 Voltage : -85 -85 -85 volts
From a grid resistor of : 28300 28300 28300 ohms
Peak RF Grid-No.1 Voltage : 100 99 100 volts
DC Plate Current . . : 112 94 113 ma
DC Grid-No.2 Current . : 11.6 12.8 12 ma
DC Grid-No.1 Current . (Approx.) . : 3 3 3 ma
Driving Power (Approx.) . : 0.3 0.3 0.3 watt
Power Output (Approx.) . : 34 33 52 watts

Maximum Circuit Values (CCS or ICAS Conditions):
Grid-No.1-Circuit Resistance‡ . . . . 30000 max. ohms

RF POWER AMPLIFIER & OSCILLATOR—Class C Telegraphy
and RF POWER AMPLIFIER—Class C FM Telephony

Maximum Ratings, Absolute Values:
DC PLATE VOLTAGE . . . 600 max. 750 max. volts
DC GRID-No.2 (SCREEN) VOLTAGE . . 250 max. 250 max. volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE . -150 max. -150 max. volts
DC PLATE CURRENT . . 140 max. 150 max. ma
DC GRID-No.1 CURRENT . 3.5 max. 4.0 max. ma
PLATE INPUT . . . . . . 67.5 max. 90 max. watts
GRID-No.2 INPUT . . . 3 max. 3 max. watts
PLATE DISSIPATION . . . 20 max. 25 max. watts

‡ Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.
§ Obtained from grid-No.1 resistor or from a combination of grid-No.1 resistor with either fixed supply or cathode resistor.
¶ Key-down conditions per tube without amplitude modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

* ** †: See next page.

MAY 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
# VHF Beam Power Amplifier

## Peak Heater-Cathode Voltage:
- Heater negative with respect to cathode: 135 max. volts
- Heater positive with respect to cathode: 135 max. volts

## Typical Operation as Amplifier up to 60 Mc:
- **DC Plate Voltage**: 500 600 600 750 volts
- **DC Grid-No.2 Voltage**: 170 150 180 180 volts
  - **From a series resistor of**: 29200 40200 28000 40100 ohms
  - **DC Grid-No.1 Voltage**: -85 -85 -85 -85 volts
    - **From a grid-No.1 resistor of**: 28300 28300 28300 28300 ohms
  - **From a cathode resistor of**: 570 670 510 620 ohms
- **Peak RF Grid-No.1 Voltage**: 99 100 102 100 volts
- **DC Plate Current**: 135 113 150 120 ma
- **DC Grid-No.2 Current**: 11.3 11.2 15 14.7 ma
- **DC Grid-No.1 Current**: (Approx.) 3 3 3 3 ma
- **Driving Power (Approx.)**: 0.3 0.3 0.3 0.3 watt
- **Power Output (Approx.)**: 50 52 69 69 watts

## Typical Operation as Amplifier at 175 Mc:
- **DC Plate Voltage**: 320 400 volts
- **DC Grid-No.2 Voltage**: 180 200 volts
  - **From a series resistor of**: 15500 22200 ohms
  - **DC Grid-No.1 Voltage**: -54 -54 volts
    - **From a grid resistor of**: 30000 30000 ohms
    - **From a cathode resistor of**: 360 335 ohms
- **Peak RF Grid-No.1 Voltage**: 70 70 volts
- **DC Plate Current**: 140 150 ma
- **DC Grid-No.2 Current**: 9 9 ma
- **DC Grid-No.1 Current**: (Approx.) 1.8 1.8 ma
- **Driving Power (Approx.)**: 2 3 watts
- **Power Output (Approx.)**: 25 35 watts

- Continuous Commercial Service.
- Intermittent Commercial and Amateur Service.
- Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should be used only when the 6146 is used in a circuit which is not keyed. Grid-No.2 voltage must not exceed 400 volts under key-up conditions.
- Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

†: See next page.
VHF BEAM POWER AMPLIFIER

Maximum Circuit Values (CCS or ICAS Conditions):
Grid-No.1-Circuit Resistance† . . . . . . . . . 30000 max. ohms

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN
(Preliminary)

<table>
<thead>
<tr>
<th>Note</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.175</td>
<td>1.325</td>
</tr>
<tr>
<td>2</td>
<td>0.22</td>
<td>μf</td>
</tr>
<tr>
<td>2</td>
<td>11.1</td>
<td>15.9</td>
</tr>
<tr>
<td>2</td>
<td>6.4</td>
<td>10.6</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>83</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>ma</td>
</tr>
<tr>
<td>4</td>
<td>47.5</td>
<td>-</td>
</tr>
</tbody>
</table>

Note 1: With 6.3 volts ac on heater.
Note 2: With no external shield. Base sleeve (pin No.8) is grounded.
Note 3: With 5.5 volts ac on heater, dc plate voltage of 300 volts, dc grid-No.2 voltage of 200 volts, and dc grid-No.1 voltage of 39 volts.
Note 4: In a single-tube self-excited oscillator circuit, and with 5.5 volts ac on heater, dc plate voltage of 600 volts, dc grid-No.2 voltage of 180 volts, grid-No.1 resistor of 0.030 ± 10% meghm, max. dc plate current of 100 ma., to 122 ma., dc grid-No.1 current of 2 to 2.5 ma., and frequency of 15 Mc.

† When grid No.1 is driven positive and the 6146 is operated at maximum ratings, the total dc grid-No.1-circuit resistance should not exceed the specified value of 30000 ohms. If this value is insufficient to provide adequate bias, the additional required bias must be supplied by a cathode resistor or fixed supply. For operation at less than maximum ratings, the dc grid-No.1-circuit resistance may be as high as 100000 ohms.

MAY 1, 1952
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
TENTATIVE DATA 4
AVERAGE PLATE CHARACTERISTICS
WITH $E_{C1}$ AS VARIABLE

$E_f = 6.3$ VOLTS
GRID-N# 2 VOLTS = 200

PLATE MILLIAMPERES
GRID-N#1 VOLTS: $E_C = 0$
GRID-N#2 VOLTS: $E_C = 0$
GRID-N#3 VOLTS: $E_C = -40$
GRID-N#4 VOLTS: $E_C = -10$
GRID-N#5 VOLTS: $E_C = -20$
GRID-N#6 VOLTS: $E_C = -30$

NOV. 21, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7707
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
GRID-N$\#2$ VOLTS = 200

GRID-N$\#1$ (IC1) OR GRID-N$\#2$ (IC2) MILLIAMPERES

PLATE VOLTS

NOV. 20, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7706
MAXIMUM RATINGS vs OPERATING FREQUENCY
CLASS C TELEPHONY

FREQUENCY - Mc

PLATE INPUT - WATTS

PLATE VolTS

INPUT - ICAS

VOLTAGE - ICAS

VOLTAGE - CCA

INPUT - CCE

NOV. 27, 1951
TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM - 7712
AVERAGE CHARACTERISTICS
TRIODE CONNECTION

GRID-N° 2 CONNECTED TO PLATE

E_F = 6.3 VOLTS

PLATE (I_B) MILLIAMPERES

NOV. 27, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY