Transmitters. Whether they are panel mounted or handheld, because they are part of an aviation transceiver we don’t think much about them—except when this complex, expensive device decides to act up. When the receiving half of a transceiver malfunctions, we know it immediately because what we hear is garbled—or unheard. Our only clue to a transmitter malfunction can be a more embarrassing difficulty when a controller reports a garbled transmission or asks, “Did you copy?” after we’ve read-back a clearance just issued.

Having an avionics technician root out the problem’s source can involve some time and money, but we can avoid this by doing our own investigation that more closely defines what’s not functioning correctly. If the receiver is working properly, we know that it, the antenna, and the cable that connects the two are in good shape. That leaves the transmitter.

The transmitter might be working correctly, but a defective microphone circuit might be the problem’s cause. The mike has two main components, a keying switch and a transducer, which is the device that changes the voice falling upon it into weak electrical signals. If we’re able to transmit after connecting a different mike, we’ve found the problem. If not, the problem might be defective cabling from the panel to the transceiver.

Radio Diagnosis

Testing a transmitter with a dummy load

WILLIAM RYNONE, PH.D., P.E.

Your testing device must be constructed to match the output of the transmitter. Left, a dummy load for testing a panel-mounted radio, and right, for a hand-held unit.

<table>
<thead>
<tr>
<th>Xmtr Load (Watts)</th>
<th>R (Ohms)</th>
<th>Watt(s) Qty</th>
<th>R2 (Ohms) Watt(s) Qty</th>
<th>Lamp No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>100</td>
<td>1</td>
<td>43</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>120</td>
<td>1</td>
<td>43</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>2</td>
<td>62</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>200</td>
<td>2</td>
<td>130</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>300</td>
<td>3</td>
<td>130</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>510</td>
<td>2</td>
<td>160</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1 - Parts List
pliances. The primary difference is that the frequency of the transmitter's RF energy is considerably greater (2 million) than the 60 cycles per second (Hertz) utility energy.

To measure the transmitter's output and determine if it's working correctly, we must attach a device to the antenna connector on the back of a panel-mounted transceiver or the top of a handheld unit to absorb and measure the radiated energy. If the device indicates that the transmitter is radiating energy, but we're not getting any words, we'd know that the transmitter is partially functioning. This would indicate that the transmitter's modulator, the device that mixes the voice with the carrier wave, isn't working.

---

**EAA's October Member Special**

**Shirt Alert!**

These two great-looking golf shirts feature the EAA logo and are made of comfortable and versatile cotton. They are perfect for weekend wear or corporate casual attire. Both shirts combine the popular colors of bronze, black and white--choose from horizontal or vertical stripes. Take advantage of fantastic member special savings today!

**A. EAA Horizontal Stripe Golf Shirt** (EO1606)

**B. EAA Vertical Stripe Golf Shirt** (EO1621)

<table>
<thead>
<tr>
<th></th>
<th>Non-Member Price</th>
<th>Member Price</th>
<th>Save</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$56.99</td>
<td>$36.99</td>
<td>$20</td>
</tr>
</tbody>
</table>

Please present EAA number and product code(s) when ordering. Prices effective October 1-31, 2000.

**Limited Quantities - Order Today!**

Order Online! **www.eaa.org**

To Order Call: **1-800-843-3612**

From US and Canada

(All Others Call 920-426-5912)

EAA Mail Orders, PO Box 3086

Oshkosh, WI 54903-3086

Major credit cards accepted. WI residents add 5% sales tax. Shipping and handling NOT included.
Before connecting the dummy load to a hand-held or panel-mounted radio, make sure the radio is de-energized.

If the transmitter isn’t radiating any energy, we could boldly tell the avionics technician that we think the RF oscillator or amplifier is defective or, if the transmitter is radiating a signal but not carrying our words, that we think the modulator is defective. I don’t know whether these announcements will “buy you” any brownie points with the service technician, but it gives the technician a more defined starting point, meaning he or she will spend less time (and time is money) evaluating the whole system.

The device we connect to the transceiver's antenna connection is a “dummy load,” so called because it serves no useful communication function (dummy) and because it absorbs all the RF energy (the “load”). Commercial dummy loads can be quite expensive, but for around $5 we can build one that will serve our needs, if we have about a half hour and the ability to solder. The parts, listed in Table 1, are available at local electronics stores and from mail order electronic parts distributors.

Compared to commercial units, our homemade dummy load has some limitations. It has a lower maximum operational frequency. But if we build it properly by keeping the lead lengths to a minimum, it will function well at aircraft communication frequencies (118 to 136 MHz). It must be constructed for the specific maximum output power it is to monitor. Handheld transceivers have 1.5 to 2 watts of output power, and panel-mounted transceivers have 8 or 10 watts. To determine your transmitter's output, check its operation manual.
Having an avionics technician root out the problem's source can involve some time and money, but we can avoid this by doing our own investigation.

Commercial dummy loads have a meter calibrated in watts that indicates the transmitter's output power. Our homemade dummy load doesn't include such a meter; an incandescent lamp monitors the amount of power being dissipated. Therefore, we only have a relative idea of the transmitter's power level. Table 1 lists the components necessary to build a dummy load that matches our transmitter output power.

**Construction**

Cut the 3-foot long cable with BNC connectors on each end into equal halves. This allows us to build dummy loads for a handheld and panel-mounted transceiver. Remove the outer rubber insulation from the first 4 inches of the cable, spread the wire braid apart where the braided cable meets the...
rubber insulation, and pull the insulated center conductor through the hole.

Solder the resistors as shown in Figures 1 or 2, depending on the number of resistors your unit requires. Be certain that the resistor leads are an absolute minimum in length. Leave sufficient cable length to solder to the lamp. Resistors are coded such that the color bands enable the resistance values to be "read." However the buyer does not need to know how to read these values because the packages are labeled.

**Use**

To become familiar with the lamp's brightness with the transmitter emitting full power, connect the dummy load to a properly functioning transmitter. When you test a suspected defective transmitter, you'll be aware of the proper lamp brightness.

Before disconnecting the antenna and connecting the dummy load, make sure the transceiver is turned off (de-energized). Disconnect the antenna cable for a panel-mounted unit or the antenna from a handheld and attach the dummy load for the corresponding transmitter load. To disconnect BNC connectors, push-in and rotate a quarter-turn counter-clockwise.

Energize the transceiver, key the mike, and note the lamp's brightness. If the transmitter is inoperative, the lamp remains dark. And if the lamp glows dimly, or less than the brightness you remember from your full-power test with a transmitter known to be operating properly, the transmitter with the dim bulb has low RF output. It's that simple!

Acknowledgments: Oscar Ramsey neatly constructed the prototype units and Dick Wilkinson kindly took photos.

Would you like to read more articles like this one? Let us know at editorial@eaa.org.

**Sources**

The following companies will sell small quantities with no minimum purchase requirements:

- Resistors: Mouser Electronics, 11453 Woodside Avenue, Santee, CA 92071-4795; 800/346-6873 or Mark Electronics, 11215 Old Baltimore Pike, Beltsville, MD 20705; 301/595-5040
- CBL-27 Cable: All Electronics, P.O. Box 567, Van Nuys, CA, 91408-0567; 800/826-5432
- Lamps: Baynesville Electronics, 1691 East Joppa Road, Towson, MD 21204; 410/823-0082

Note: If carbon composition resistors are unavailable, you can use metal oxide units if they are marked "Flame Retardant."