



Exhibit 12: Tuning Procedure

**External Radio Frequency
Power Amplifier ACOM 2100**

Model 2100

Tuning Procedure

Tuning is possible only in operate mode, so you may need to press the OPER button in order to illuminate the LED above it (unless Auto-Operate is active).

a) Preliminary information.

Tuning the amplifier is a procedure of matching the impedance of the currently used antenna to the optimum tube load resistance. This will ensure maximum plate efficiency and RF gain at nominal output power, with minimum IMD at that.

Please note, that the REFLECTED POWER readings and the measured VSWR depend on the antenna impedance only, and not on the amplifier tuning. If the antenna impedance is different from 50-Ohm pure resistive (nominal), the REFLECTED POWER reading will always indicate reflected power presence (even at a perfect tuning). Proper tuning will allow operation at greater power without distortion or danger to the amplifier.

Note also that the real OUTPUT POWER in the load is equal to the difference between the FORWARD- and REFLECTED- readings. For instance, at a reading of FORWARD 1500W and REFLECTED 250W, the real OUTPUT POWER will be equal to their difference - 1250W (into a 2.4:1 VSWR load). At very high VSWR (no antenna or badly mismatched antenna), the FORWARD and REFLECTED readings will be almost equal, while the real OUTPUT POWER (the difference between them) will be practically zero.

The amplifier can operate safely if the following rule is obeyed: "REFLECTED POWER < 400W". Matching is assured for loads with VSWR up to 3:1. Nevertheless, for some loads and bands matching is possible at even higher VSWR. The maximum usable forward power at VSWR 3:1 is 1500W with 375W reflected. For higher than 400W reflected power you'll get the ** REFLECTED POWER ** soft-fault protection trip.

CAUTION

Using a feeder of coaxial cable at VSWR > 3:1 on HF, and particularly on the 4 and 6 meters bands, is not recommended. At such high values of VSWR, the high voltages, high currents, and heat associated with line losses, risk to permanently damage your coaxial cable or antenna switch.

Update amplifier tuning when you change the band or between CW and SSB segments within the same band. Update it each time when you change the antenna, even in the same band, as well as periodically, even though you may have not changed band or antenna. Be on the alert in particular when a significant change in the environment occurs (rain, snow, ice, newly appeared or removed massive objects, alien wires nearby etc.) that would cause significant changes in the antenna impedance and eventually an increased VSWR.

NOTE

If you use more than one antenna per band, it is necessary that you select the proper antenna BEFORE the next step. Retune after selecting a different antenna for the same band, since the impedances may differ substantially (unless their VSWR is excellent, i.e. below 1.2:1 for both).

CAUTION

Do not switch the BAND switch knob while transmitting with the amplifier! Hot switching (while transmitting) will eventually destroy the band switch, not covered by the warranty!

CAUTION

When tuning, do not apply continuous drive longer than one minute and after that pause 1-2 minutes for tube cooling.

We recommend that you tune-up at the center frequencies of the preferred frequency band. First select the band switch and the correct antenna number (never with RF applied!). Then use table 4-I "Approximate tuning presets" which is shown in the Operating Manual in order to achieve an approximate preset for both TUNE and LOAD capacitor knobs. If you have no other clues then start at 50/50 dials.

b) Selecting the plate-load True Resistance Indicator (TRI) tuning aid.

You may select TRI scale in three different ways:

- By pressing simultaneously the PREV+NEXT buttons shortly. This will insert a 6dB attenuator between the driver and the amplifier's input (the ATT LED will light), so you'll not need to reduce the drive power during tuning. Press PREV+NEXT buttons momentarily again to switch the attenuator off the input and to return to the old screen. If you use any of PREV or NEXT buttons only, the attenuator would be switched off too, but the information screen would change to respectively previous or next.
- By pressing repeatedly either PREV or NEXT button (whichever is nearest), until you reach the TRI scale. This will not insert the attenuator, so you'll have to use less than 20W drive (unless the amplifier is near correct tuning), otherwise the next step would be executed automatically:
- By simply applying a normal working (50-85W) drive power, while the amplifier is not yet tuned. This will automatically invoke the TRI tuning aid and will insert the input attenuator (the ATT LED will light) after one second. The attenuator will be switched off, and the old screen will be returned automatically, after you release the PTT shortly. If you have achieved meanwhile a nearly good tuning, the attenuator would not be inserted again. If the old screen was the same (TRI, selected manually earlier), you'll then be able to precisely tune the amplifier also at nominal power, without changing drive at all. Use this hint to shorten the tuning process duration.

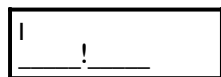
c) Tuning Procedure.

While a continuous (CW) signal at the desired frequency is still applied:

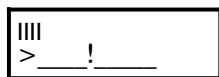
- Look at the right scale (forward power); obtain maximum power using the upper (TUNE) knob;
- Look at the left (Load Cap) scale and turn the lower (LOAD) knob in order to center the triangle marker at the "!" mark.
- Release the PTT shortly in order to disable the attenuator, then repeat both steps at nominal power. Always finish by peaking with the TUNE knob.

NOTE

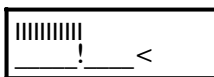
Appearance of an arrow on either left or right TRI scale edges means that the LOAD knob is too far from the proper position. To correct this, turn the LOAD knob to the prompted direction until the triangle marker appears inside the scale field.



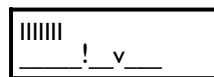
no marker:
use TUNE knob for
max. P to get any
marker.



marker is a far left:
turn LOAD knob
pointer to right until
marker inside.



marker is a far right:
turn LOAD knob
pointer to left until
marker inside.



marker inside:
turn LOAD knob
slightly left to
center it.



LOAD is tuned:
turn TUNE knob
to peak Forward
Power & finish.

Fig. 4-I. Using TRI tuning aid

Please note also, that the TRI mark will not appear until at least 5W drive is applied, and at least 20W forward power is achieved.

If, for some reason, matching cannot be accomplished successfully, check the BAND switch position and proper antenna selection. Then check the antenna VSWR at the same drive frequency.

d) Tuning hints.

While turning the knobs, you'll note that both tunings would be virtually independent. This is a benefit of the TRI. The plate-load resistance increases to the right and decreases to the left of the TRI center.

The scale center corresponds to the proper LOAD capacitor tuning, which presents an optimum load resistance to the tube.

If you tune to the right, you'll obtain more gain, but less undistorted output power will be attainable. You may prefer to use this hint when your drive power is insufficient or when you need less output but better efficiency, for instance at heavy duty modes (RTTY, SSTV etc) where less heat is wanted (not only in the amplifier but also in the transceiver).

Tuning to the left of the center would lead to the opposite: less gain and more power attainable. Of course, this requires more drive power, more plate current, and more plate heat, which shortens tube's expected life, as its cathode would be faster exhausted.

You might use the off-center tuning hint also to compensate for mains voltage variations in order to maintain tube efficiency: tune to the right when mains is higher, or tune to the left if it's lower than the nominal voltage. Please see S.2-2 (Line Voltage Selection) in the Operation Manual for more than 5% difference from the nominal.