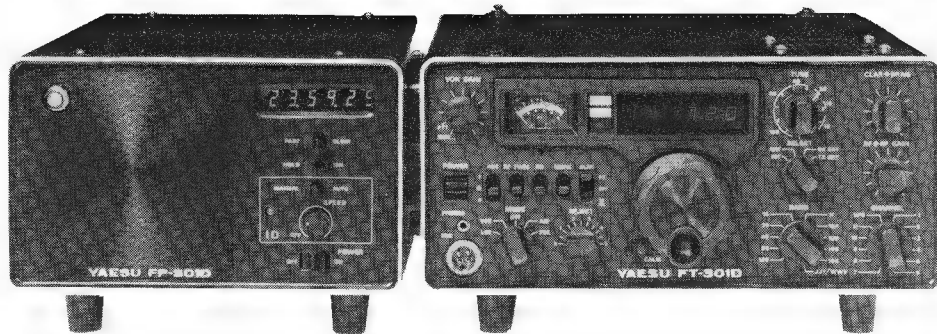


# REVIEW OF THE YAESU FT301D TRANSCEIVER



It seems that the future is getting closer all the time. The Yaesu FT301D is a case in point. Contained in a package only 280 mm wide, 125 mm high, and 370 mm deep is a fully solid state, 200 watt input, all band HF transceiver with just about every feature that the imagination could conjure up.

However, back to the beginning. The advent of fully solid state HF transceivers for the amateur market has been slow and surprisingly from the United States rather than from Japan. Prior to the new Yaesu FT301 series there have been at least four different American models available in this country over the last year or two. One can only guess the reasons for the rather late appearance of the Japanese equivalent.

The Yaesu Musen Co. are to be congratulated on their new product which will undoubtedly set the pace for other manufacturers to follow.

The FT301 series consists of four models: either 20 or 200 watts input, with or without digital dial readout. The model to be reviewed has the full 200 watts input and the digital readout. Certain other features are optional and these will be itemised later.

## TECHNICAL FEATURES

The FT301D transceiver covers all the HF amateur bands in 500 kHz segments. These are 1.5 to 2.0, 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 27.0 to 27.5 and 28.0 to 30.0 MHz in four segments. Operation is provided for SSB with upper or lower sideband, CW, FSK, and AM. The transceiver is supplied with the normal 2.4 kHz filter for SSB operation but it is possible to install both a 600 Hz filter for CW and a 6 kHz filter for double sideband AM operation. As far as is known this is the first time that a full bandwidth AM filter has been available in an HF transceiver.

Following in the tradition of the FT101E an RF speech processor is included. Another first in HF rigs of this type is a receiver notch rejection filter. Naturally all the other normal features that one expects are there. These include, noise blanker, calibrator, clarifier for receive or both transmit and receive, VOX, external VFO switching and fixed channel operation with eleven crystal positions provided. Three different AGC time constants are switch selected from the front

panel and allow fast, medium, and slow decay times.

In addition to the band coverage mentioned above, a bandswitch position is allocated for WWV reception on 5 MHz. This is slightly different to normal in two aspects; firstly in the frequency chosen, and secondly that it is fixed tuned to exactly 5 MHz, with an internal trimmer to set the actual zero beat point.

The transceiver requires a source voltage of 13.5 and is therefore all ready for mobile or portable operation from a normal car battery. For home station use the matching FP301 AC power supply is recommended. This unit is capable of delivering 13.5 volts at 25 amps with excellent regulation.

As the photo of the FT301 shows, it bears a strong resemblance to the FT221 two metre transceiver reviewed in the June issue of this magazine. It does indeed share the same front panel and cabinet as well as the plug-in printed board internal layout.

Another design feature of the FT301D is the broadband transmitter driver and output stages. This eliminates the need for the usual final tuning and loading controls. However, in common with all circuits of this type, a close 50 ohm match is required for the output stage to deliver maximum power. Perhaps to satisfy doubts that the receive front end is really peaked up for maximum signal a 'Drive' control calibrated for each amateur band is brought out to the front panel. This operates a permeability system similar to that in the FT101 series transceivers and tunes the receiver front end and the low level transmitter stages. There is no doubt, it's a good feeling to peak this up and know everything is on the nose.

## THE FT301D CIRCUIT

After looking at the technical features, we will now see just how it's all done. The FT301D is of single conversion design. With an IF frequency of 9 MHz the conversion scheme is rather like the FT200. The FT101 on the other hand is a double conversion design with a second IF and sideband filter at 3180 kHz. The receiver front end of the 301D uses the now almost standard 3SK40M dual gate FET as the RF amplifier and also as the first mixer. The IF amplifier section starts off with a  $\pm 10$  kHz monolithic filter which

helps to improve the receiver front end performance in such aspects as cross modulation. This is followed by two stages of amplification before the main filter section is reached. As mentioned before, three filters can be installed and these are diode switched along with the function switch. Unfortunately, the FSK position on the function switch is not explained in the instruction book and it is not clear whether an RTTY filter is available, and if it can be installed. Our review sample had only the standard SSB filter installed and this was in circuit in all positions of the function switch.

The output of the VFO unit is premixed with the output of the heterodyne oscillator to produce the transmit frequency, or to convert the input frequency to the 9 MHz IF, on all bands except on 80 metres where the 5.5 MHz VFO is subtracted directly from the 9 MHz IF to produce 3.5 MHz. The crystal frequencies in the heterodyne oscillator range from 16 MHz for the 160 metre band to 44 MHz for the 29.5 MHz segment of the 10 metre band. An interesting feature of the audio section of the receiver is the inclusion of a top cut filter with a sharp cut-off above 2.6 kHz. This provides very clean audio with a complete absence of high frequency hiss.

The rejection filter works very much like the old single crystal filter common in communications receivers of the early post war years. A single crystal of about 9 MHz nominal frequency is series tuned with a small variable capacitor to vary its resonant point across the band pass of the transceiver. In all a very simple but effective idea. It's a wonder someone has not thought of it before. The idea should be adaptable to most existing transceivers.

A separate AM detector is provided, however it was unfortunate that the optional AM filter was not installed so that we could check out the AM performance.

While the transmitter circuitry is fairly conventional a few interesting design points are worthy of mention. The RF processor is designed to produce similar results to the one installed in the Yaesu FT101E. It is, however, operated at the 9 MHz IF frequency of the FT301D rather than 2180 kHz. A second 9 MHz filter is

included to remove the distortion products produced in the clipping process.

The 301D output stages consist of two broadband amplifiers in cascade. The output of the 10 watt driver stage is connected via a BNC coax fitting to the 100 watt final stage which is attached to the rear of the cabinet as a separate unit. The output of the final is routed back into the transceiver proper via a second BNC connector to the output filter section. If low power operation, or drive an external transverter is required, it is simply a matter of taking output from the appropriate BNC socket.

The digital display as fitted to the FT301D is set up to read the VFO frequency. The 5.0 to 5.5 MHz of the VFO is converted to 13.0 to 13.5 MHz which is the frequency at which the display counts. The MHz prefix for each band is produced by a diode matrix switched by the band switch. Although the display reads to 100Hz points the counter itself reads down to the 10 Hz points. This is to eliminate flicker which would otherwise occur on the last digit.

Front panel indicator lights set between the dial readout and the 'S' meter show clarifier operation, and VFO or fixed channel selection.

#### THE FP301 POWER SUPPLY

This supply will be available in two versions. The FP301D also includes an LED digital clock which can be switched to give either a 12 or 24 hour readout. It also has an automatic CW identifier into which the owner's call sign can be programmed. As a sample of this supply was not available at the time this review was compiled we cannot comment on its operation.

The standard FP301 supply is capable of delivering 13.5 volts at a maximum current of 25 amps. The regulation from no output to 20 amps is better than 1/2 volt. A total of five transistors, four in the output, one driver plus one IC to provide overload protection, and a heavy duty diode bridge make up the solid state component.

As Yaesu suggest this supply could be very handy around the shack to power other pieces of gear — even that old valve FM rig.

#### THE FT301D ON THE AIR

Setting up the 301 and getting on the air is a very simple procedure. The power input from either the AC power supply or the 12 volt DC source is via a 12 pin Jones socket on the rear of the transceiver. The antenna connector is a standard SO239. Yaesu supply a good quality push-to-talk dynamic microphone fitted with the now standard four pin screw-on connector. As soon as the power switch is closed the set comes instantly to life — both on transmit and receive. After providing a 50 ohm antenna, bands can be selected by simply setting the band switch and peaking the 'TUNE' control for maximum receiver output near the calibrated point for that particular band.

The main tuning control, which is a combination of gear and planetary drive, is extremely smooth. A finger hole is provided to fast tune from one band section to another and this is of adequate size to really spin the knob at a fast rate.

The digital readout is very clear and indicates frequency to the 100 Hz points. There are five digits on 80 and 40 metres and six digits on 20 metres and above. The actual size of the readout is 60 mm wide and 10 mm high. Tuning a transceiver with a digital readout takes getting used to. The initial tendency is to overshoot when aiming at a specific frequency and it takes quite a bit of practice to stop at a predetermined point.

Receiver performance is excellent. The fast-medium-slow AGC selection enables the correct amount of delay to be set to suit the strength of the incoming signal. For instance on 80 metres at night with a moderate static level and fairly strong signals, the slow AGC setting gives a marked increase in signal to noise ratio.

The receiver rejection filter was most effective in removing heterodynes of stations tuning up on or near the operating frequency. An interfering signal reading 20 dB over 'S'9 could be reduced to about 'S'3 and this amount of rejection remained much the same regardless of the actual beat frequency.

Receive audio through the speaker built into the matching power supply was very easy to listen to. The combination of very good AGC action, low distortion in the SSB detector and receiver audio section, and a well matched speaker all added up to much better than average results.

Transmitter tune up consists of advancing the 'DRIVE' control for a 10 amp reading on the meter, peaking the 'TUNE' control for maximum current and then further advancing the drive control for a 15 amp reading. So long as the final is properly matched this reading will indicate a full 200 watts input.

We checked the actual power output on each band with a Swan WM-1500 power meter and the FT301D connected to a Heath Cantenna 50 ohm dummy load. A Heath SB610 monitor scope was also in circuit to determine the PEP output. The following results were obtained.

| BAND | RMS OUTPUT | PEP OUTPUT |
|------|------------|------------|
| 160  | 100 watts  | 100 watts  |
| 80   | 110 watts  | 120 watts  |
| 40   | 150 watts  | 150 watts  |
| 20   | 75 watts   | 75 watts   |
| 15   | 125 watts  | 120 watts  |
| 15   | 100 watts  | 125 watts  |

No reason could be determined for the slightly lower output on 20 metres but the difference is small in practice. The output wave form on the scope was true copy book style in both the CW and SSB modes. In fact the CW carrier pattern was the cleanest of any transmitter so far tested.

It appeared that the transmitter could be run at full input in the CW mode almost indefinitely. After several minutes of such operation the heat sink of the transmitter

was only moderately hot but the power supply heat sink was very hot and could represent a hazard to unsuspecting people if in an exposed position. Under normal SSB operation it did not get quite as hot but after a lengthy period with continual use of the RF processor, the temperature built up to quite a high degree.

The action of the processor was quite satisfactory and appeared to produce about 20 dB of clipping. No panel control was provided for adjustment of the clipping level. In use on the air it produced results similar to clippers reviewed earlier this year.

On air reports of the transmitted audio quality were all most satisfactory and in all cases a great deal of interest was expressed in the unit.

VOX operation was quite smooth and an adequate degree of adjustment was provided on the delay and anti-trip controls to enable the most critical VOX enthusiast to set them to his liking. Mechanical noise from the relays was moderately high but no electrical clicks or plops were audible. The VOX was also satisfactory for CW operation however the delay required for this mode is usually much shorter and it is necessary to remove the transceiver lid and reach through a small hole with a fine screwdriver to make the change. The microphone gain control is also an internal preset. It is however provided with a plastic shaft to make adjustment easier.

The front panel controls are a mixture of good and bad so far as operation is concerned. The bad points were mostly covered in the review of the FT221 and unfortunately persist in the 301D. Although the lamp illuminating the meter has been increased in output, the scale is still hard to read. A return to the translucent type scale with rear illumination as used on the FT220 series is badly needed.

The panel knobs have no white indicator to show which way they point. Admittedly there is a small raised moulding but it is easy to miss this when the control is gripped in the normal way.

VFO stability was checked and found to easily meet the specified 100 Hz per half hour. Drift for the first half was almost exactly 100 Hz, and over the next hour and a half did not exceed 150 Hz. However, over the same period of time, the digital readout shifted 800 Hz. An interesting case where the VFO is more stable than the frequency counter.

Calibration of the dial to the marker oscillator was a little different to setting a normal type dial. The transceiver was tuned to zero beat and then the 'Calibrate' control adjusted to bring the readout to the zero point. As no offset shift is provided on the VFO with change of sideband, it is necessary to recalibrate when changing from upper to lower sideband. When the offset tuning is adjusted however the readout changes accordingly; you only have to remember what it was before.

Another unfortunate carry-over from the FT221 is the use of miniature 3.5 mm

sockets for the headphone and key connections. Perhaps Yaesu is trying to set the trend, but until this is established these miniature jacks are awkward to use.

### **INSTRUCTION MANUAL**

The manual supplied with the FT301D is presented in the typical Yaesu manner. Some forty-six pages cover the following subjects. General Description, Specification, Controls and Switches, Rear Panel Connections, Preparation for Operation, Operation, Block Diagram, Circuit Description, AC Power Supply, Frequency Counter Unit, Maintenance and Alignment, and Parts list.

The circuit description section provides a circuit diagram of each printed circuit board and a clear description of its operation and how it ties in with the whole set. The maintenance and alignment section provides adjustment information for the multitude of preset controls. Unfortunately no printed circuit layouts are included.

Each time I complete a review of a new transceiver I wonder how and who will service it in the future when the need arrives. There is no doubt that the modern transceiver is a very reliable piece of gear. It is also highly complex and requires more

than the old multi-meter to trouble shoot.

In this regard it's nice to know that competent service is available from the distributors of Yaesu gear in Australia. As of now Bail Electronic Services supply with every piece of gear sold a check list covering some 53 different points. A copy of this is retained by the distributor and so at any future date the performance can be compared with the original.

The FT301D used in our review was supplied by Bail Electronic Services from whom details of price and delivery can be obtained. ■