

# TS430 REVIEW

**Trio TS 430S Multimode HF Transceiver**  
By Angus McKenzie MBE, C.Eng, FIERE, G3OSS



Many readers will have used Trio's earlier *TS120* and *130* SSB/CW LF and HF band transceivers, and will probably have admired them for their simplicity of operation coupled with good ergonomics and reasonable performance. Despite constant criticism over the years, Trio have never incorporated an FM facility on their HF rigs before, but at last we have in the *430* one in which an FM transmit and receive capability is complemented by AM, upper and lower single sideband and CW. Most unfortunately, the FM facility together with narrow SSB and CW filters are optional extras, at £31 to £35 each, but this review sample was loaned to the magazine by Ham International, who could not supply accessories at the time.

## Facilities and Ergonomics

The *TS430* is basically a 13V DC rig which draws up to around 16A peak current on transmit. It will work equally satisfactorily as a home station with a suitable external power supply (around £100) or in the car. On receive the rig covers from 150kHz up to 30MHz, stepping up or down in 1MHz steps or from one amateur band to the next, dependent on the position of a switch labelled '1MHz'. Two rates of tuning are provided, with 10 or 100Hz per step, but unfortunately the 'kHz per rev' is not quite constant across each 1MHz band. For example, we measured anywhere between 8.5 and 9.5kHz per revolution

on the smaller step position, despite Trio's claim in the manual that it should be 10kHz. To the left of the main tuning knob is a row of five push buttons selecting LSB, USB, CW, AM and FM modes. On the left hand side is the 13V on/off switch and rockers for TX/RX, VOX controlled TX, processor on/off, ALC or current metering, narrow/wide IF filter (only wide supplied for review). The normal multipin Trio microphone socket is on the bottom left, and a Trio hand mic with PTT and 'up and down' buttons was supplied with the review sample. On the left side is also ¼" headphone jack (plenty of volume here) and concentrically mounted rotary gain controls for mic and carrier insertion levels. A fluorescent green digital frequency readout above the tuning knob displays the nearest 100Hz, (or to the nearest 10Hz if an internal jumper is cut). To the left is the meter which on receive is a normal S meter but on TX reads total current of ALC. Behind another window, to the right, is the display showing the selected memory channel.

Unlike Trio's earlier models, this latest *TS430* has very many push buttons to the right of centre, as well as some rotary switches, which can provide some most useful facilities, but perhaps also a few that you may well never use. The main memory switch selects any one of eight memory channels, insertion of any frequency into these requiring just the touch of the MEMORY IN button. The 6th and 7th memory positions also serve a select start and stop frequencies for continuous scanning, another button putting the box into the scanning mode, with an accompanying button to hold the scan. Two separate VFOs are provided, a four-position rotary switch selecting either of these of a criss-cross arrangement allowing you to transmit on one and receive on the other, or vice versa.

## Poor documentation

Additional buttons provide facilities for inserting VFO B's frequency into A, frequency lock, small or large frequency steps, memory recall (this sets the chosen VFO to the selected memory frequency from which the VFO can then move), fixed memory channel, and memory scan. Large up and down buttons shift the band either to the next amateur band, or to the next 1MHz band, determined by another switch. Further switches select receiver incremental tuning (the pot for this is concentrically mounted with the 1F shift control which has a centre indent), noise blanker, 20dB antenna attenuator and finally a very good notch filter, the pot for which is concentrically mounted with a squelch control which acts on all modes. The only other controls on the front panel are concentrically mounted rotaries for RF and audio gain.

On the top of the rig are four very

small slide faders allowing adjustment of VOX gain, VOX delay, anti-VOX and scanning speed (this is also controlled by the 10/100Hz step switch). The loudspeaker is mounted in the top, and whilst this will usually be convenient, it could be a nuisance in some positions in a car. You might have to plug in an external speaker. Underneath the front of the rig is a level tilt bar which lifts the front of the rig up when it is resting on a table, and this was rather nice. On the back of the rig is a heavy duty 13V power socket (lead supplied with heavy duty fuse), ¼" key jack, external speaker 3.5mm jack, an SO239 RF in/output socket and a large wing nut terminal for earth connection. Three multi-pin standard Trio DIN type sockets are provided. The REMOTE socket has seven pins with interconnections for external ALC, loudspeaker output, a pin which shorts to deck on TX for controlling an external linear (for example) and an external PTT line. The ACCESSORY socket had eight pins, and this can be connected to external equipment requiring logic information from the TS430 regarding the band in use. A 12V DC voltage on TX only is available on one of the pins, and another pin, when grounded externally, reduces the rig's output power to about 50W. Amongst the eight pins on the TRANSVERTER socket are provisions for input/output and controlling an external transverter.

At this point I would like to criticise rather heavily the unhelpful manual since it is very difficult to find out more details of these pin connections and there seems to be generally a considerable lack of basic information as compared with Yaesu and Icom instruction books. On the back panel of the rig is an enormous heat sink, and built into this is quite a powerful fan which comes on as and when the temperature of the heat sink demands it.

The rig is reasonably compact, and contains a remarkable number of facilities and has room for many options

when one considers its size and weight. (275 × 105 × 335mm abd 6.5 kg).

### Subjective comments

I used the rig on SSB, and briefly on CW, over a period of two weeks on a number of bands, and found it very easy to use, although it took some time to work out how to operate all the facilities. Transmitted audio quality frequently received favourable comments, the compressor being liked as well. The transmission seemed to have a good deal of punch to it, and was very clean, all listeners finding the transmission quite narrow even when the processor was in use. It was such a pity that Ham International could not supply the FM board because I would have liked to have tried the rig on 29.6 MHz, the international 10m FM calling frequency. The three new bands, in the 10, 18 and 24MHz segments were not supplied 'enabled', although ones supplied by Lowe electronics normally have this provision.

Although I was concerned that the tuning rate was not exactly 10/100kHz per rev, the tuning ergonomics were very good indeed. The scan buttons on the microphone operated in the same way as usual, again the scanning speed being controlled by the slider on the top of the rig, and the step switch. Even when the rig is in the 'amateur bands only' mode, rather than the general coverage 1MHz up/down steps mode, complete receive coverage is possible by continuing tuning below or above the appropriate amateur band. I tuned all the way from 30MHz down to 0Hz to check on this, not quite wearing out my finger in the process. However, the absence of a slip ring around the finger hole, (such as on the TS830) is a pity. This makes it possible to whizz up and down very rapidly. On my scan across the frequency coverage of the rig I noticed a large number of minor sprogs, and one extremely bad major one,

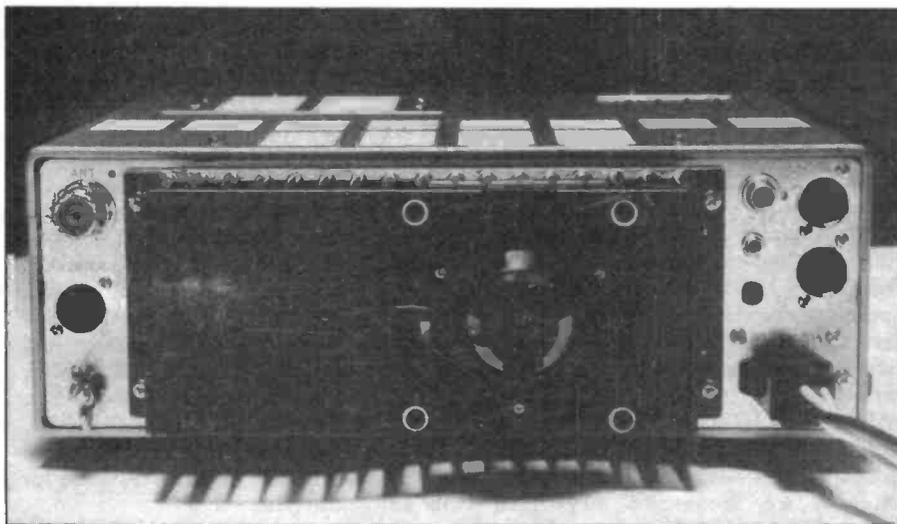
this check being carried out with a screened dummy load screwed onto the aerial socket, and even with a ferrite ring close to the set on the 13V lead. The bad sprog was audibly over S9 at 21.562MHz, although the meter only read S3 on it. The minor 'birdies' would not be disturbing on lower frequencies, but you might be very slightly disturbed by one or two which were equivalent to an audible S3 to S5 or so on the 10m band, which did not, however, register on the S meter. The worst ones were on 28.888, and 28.921MHz.

I checked the performance audibly on 160, 80 and 40 metres, both during the day and at various times in the evening, and I was impressed with the clean reproduction of DX and local stations, with no apparent cross mod or RFIM problems, the 20dB attenuator taking good care of this when signal strengths were way up well after dark. The RF sensitivity appeared to be adequate even on 10 metres, although the IC740, for example, is slightly better. Selectivity seemed to be good, but rejection of extremely strong CW well off channel did not seem to be as good as that on one or two competitive rigs. The T-notch filter was extremely good, indeed one of the best that I have measured in some time.

It is unfortunate that only one AGC speed is available, and I felt that this was sometimes rather fast, particularly on strong 80 metre stations. If, however, you consider putting in the attenuator during the daytime on 80 metres, then even fairly strong signals will become a little hissy with the attenuator in. Turning the RF gain control down (with attenuator out) improved the sound quality. What upsets me a little about an AGC that acts a little too quickly is that voices tend to pump, and background noise in the shack, including reverberation, becomes too audible. I cannot remember a receiver built specifically for amateur use that had an AGC facility that I would have regarded as too slow. I do like the option of twiddling with the recovery speed, which is what is lacking here. I also note that there is no apparent way of turning the AGC off, a useful facility for CW reception sometimes.

The IF shift control, which is usefully centre indented, and thus marking a nominal centre position, was very useful. Sometimes this facility is termed 'bandpass tuning', and basically alters the position of the filter with reference to where an injected carrier would have to be correctly inserted to demodulate the SSB at the right pitch. It can, for example, give you the pass band from say 100Hz to 2.5kHz, or from 500Hz to 2.9kHz if you prefer male voices to change sex! It can also be used more seriously to filter out, or at least to reject more efficiently, carriers or interference just off frequency. As the narrow SSB filter and CW filters were not

Rear view showing heatsink and quiet cooling fan



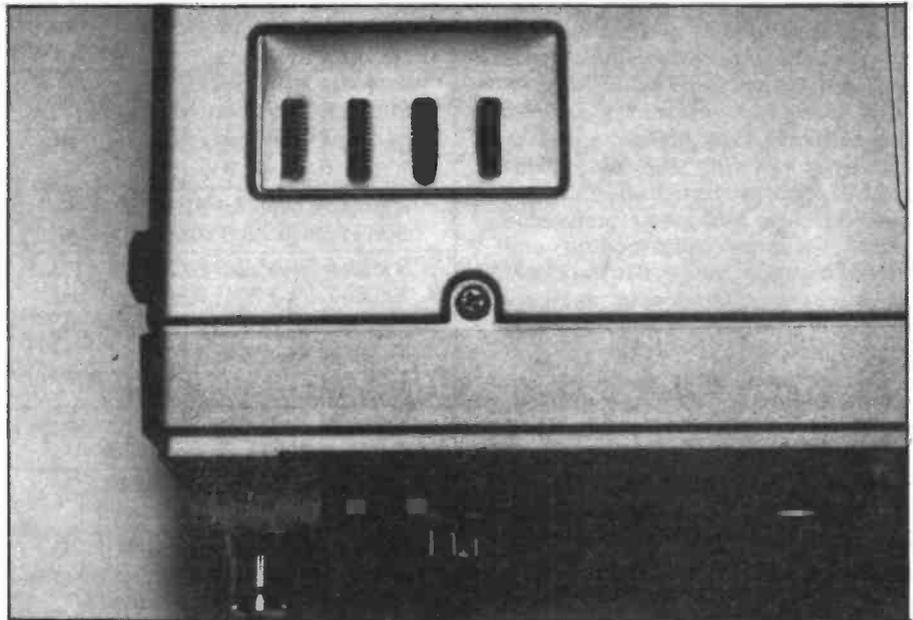
supplied, I cannot comment on their performance.

## Memory function

Squelch action on SSB signals operated well, provided the signals were reasonably strong, and no problems were experienced with the RIT. Memorising frequencies and recalling them, particularly when I wanted to move the VFO either way from a memory frequency, operated superbly well. This facility is most useful, although I cannot see that there would be much use for punching in the memory channel button and operating exactly on a memory frequency without the facility for VFO'ing, unless you were using the FM option on fixed 10metre channels. Memory 8 will be useful here, for it allows the memorising of separate TX and RX frequencies for 10m repeater operation. The scanning, defined by memories 6 and 7, would probably be found when you want to scan relatively small frequency areas continuously, but I don't expect many would want to use the scanning for continuously monitoring large chunks of spectrum other than to leave the receiver running on a large section of 10 or 15M when the bands is closed to indicate the first signal that pops through after band opening.

## What cost?

The VOX control worked satisfactorily on transmit, and the setting of gain, delay and anti-trip was very simple. One strange feature provided by the rig is the ability to transmit on one band and receive on another, which I suppose could be useful to the odd person, but certainly not to me. I cannot help but feel that despite the excellent general ergonomics of this rig, Trio have made it too complicated, and thus the



VOX and Scan controls mounted on top panel

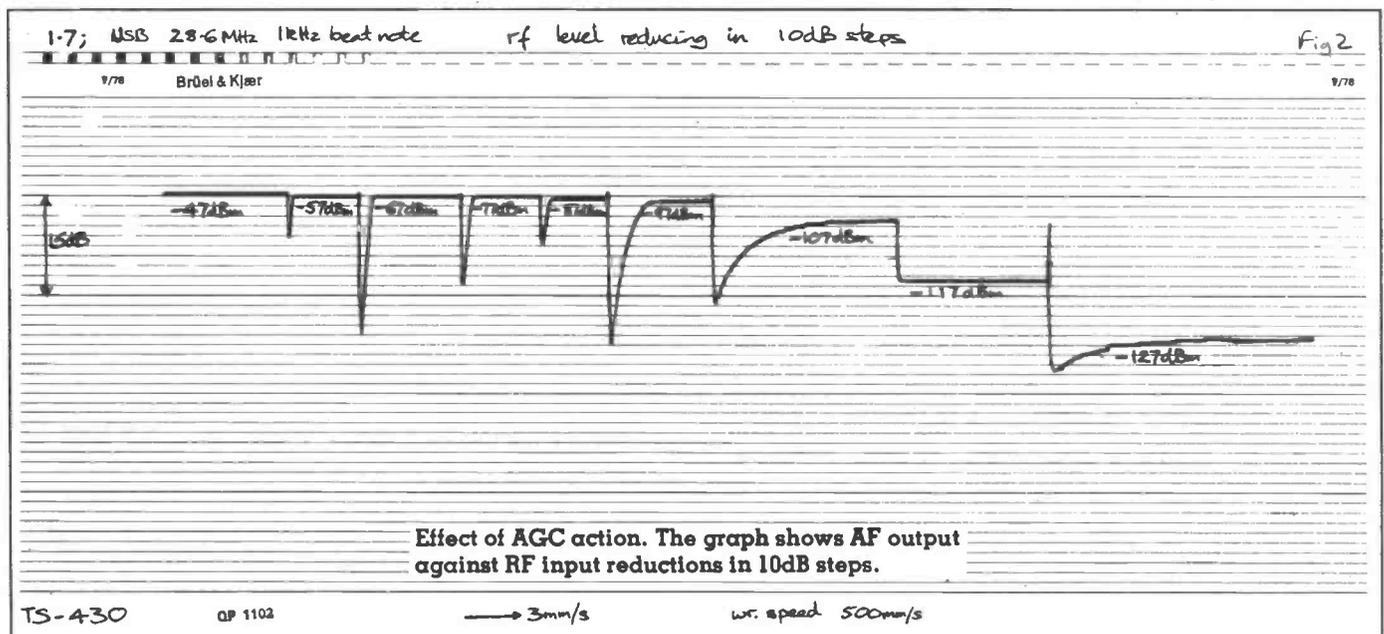
price is higher than it need have been. I would have preferred, to have had FM plus the filter options in with the price, but some of the esoteric microprocessor functions perhaps available as options, but I do realise that this suggestion rather defeats the design idea. Let's put my suggestion another way, then, that Trio ought to release a rig with identical specifications, including FM, CW and SSB, but without general coverage receive, and microprocessor functions, which overall would be regarded as an inexpensive successor to the TS130, at a lower price than the present rig, which, with options, will be typically around £800. Even if the average user does not want to use FM on 10m, and most certainly not on any of the lower bands, he is very likely to use a transverter with the rig up to 2metres for example, and in this case it will be very simple to cope with

repeaters, although you would have to either whistle your way in, or use an external tone burst generator. We were not able to try the rig into a transverter because of inadequate instructions, and time, but if the transverter feed is similar to that from the TS830, the level would be very low.

Incidentally Microwave Modules transverters can be supplied with extra sensitivity to work with modern low transverter feed level outputs, although you may have to modify older models.

## Feelings

To sum up my own feelings for the rig, I can report that I was impressed with its general performance, but would prefer something simpler for mobile use, but a little more comprehensive for fixed station use. Whilst Trio's provision of DIN



type sockets for many of the external facilities may lead to a tidier shack, I much prefer lots of phone sockets because I am, and always have been, rather a fiddler, liking to try all sorts of external combinations in a hurry. If I can avoid the necessity of soldering wires onto a DIN socket, at almost any cost, I will do so, but I must admit to being very prejudiced against them for longstanding and personal reasons! I used to like the larger old 'Granny-type' 8-pin octal auxiliary sockets, but terminals or phonos are even better.

I could find no actual snags in either the receive or transmit side which would stop me recommending at least a good look at the rig, which is therefore certainly worth consideration. Don't forget to ask about accessories and after sales service facilities before you commit yourself to purchase, for this may influence where you buy the rig, as well as perhaps minor differences of price.

### Lab test

Having had a play with the rig for several days we applied some very extensive tests to check performance in many areas, and probably the best way to comment on the test results is to first follow a received signal through from aerial input to loudspeaker out, and then in the same way have a look at the transmitter results.

The RF input sensitivity varied from band to band from excellent to good, to 10m sensitivity unfortunately being one of the poorest, although completely acceptable, equivalent to a noise figure of around 8dB or so. Ironically, the most sensitive band was 14MHz, on which you don't really need ultimate sensitivity. RF intermodulation performance was checked with two carriers 10 and 20kHz off channel at three levels, the two carriers always being at the same level relative to each other. The first level was that required to develop a third order 1m product of 12dB SINAD, whilst the second and third levels produced products reading S5 and S9 respectively. Our choice of such close in tones spaced only 10 and 20kHz is a difficult test indeed, and my interpretation of the results is that the TS430 comes out pretty well. The reciprocal mixing test involved checks on the local oscillator sideband noise at 20 and 100kHz off channel, and whilst the 100kHz test result was very good, the 20kHz one was average, some rigs being better by quite a few dB. This close-in noise was quite possibly a contributory factor to the disappointing selectivity measurement for -60db, although the filter was good down to around -40dB, and thus the shape factor which works out at around 2.9 is not good. During the selectivity test we heard a series of small whistles etc. while we were measuring the -60dB point, which we

Parameter		Comment
<b>RX Measurements</b>		
Sens. for 12dB SINAD SSB @ 28.6/21.3/14.25 MHz ( $\mu$ V p.d.)	0.17/0.14 /0.12	Good/V.good /excellent
Sens. for 12dB SINAD SSB @ 7.05/3.65/1.9 MHz ( $\mu$ V p.d.)	0.17/0.14 /0.14	Easily good enough
S meter: Levels for S1/S5/S9 + 20dB SSB @ 28.6 MHz ( $\mu$ V p.d.)	1.2/11 69/400	Excellent
S meter: Levels for S9 SSB @ 21.3/14.25/7.05/3.65/1.9 MHz ( $\mu$ V p.d.)	65/56/82 68/59	
Selectivity: SSB 3dB bandwidth /60dB bandwidth (KHz)	2.3 16.6	Fair
Selectivity: SSB shape factor	2.9	Fair
RFIM: Listening at 28.6 MHz. Sending + 10 and + 20 KHz	1.6/7.1/14	Good
Level from each for 12dB SINAD/ S5/S9 product (mV p.d.)		
Reciprocal mixing: Level @ + 20 and + 100 KHz for 3dB degrad. in 15db SINAD Signal (mV p.d.)	2.2 120	Fairly good
T-notch: Max rejection of 1.4 KHz rel. 1 KHz beat (dB)	33	Excellent
T-notch: Max rejection of 1 KHz rel. 1.4 KHz beat (dB)	32	Excellent
Audio output distortion @ 125mW into 8 $\Omega$ (%)	0.5	Excellent
Audio output power in @ 10% THD 8 $\Omega$ (W)	1.7	Slightly restrictive
Frequency accuracy of readout (Hz)	within 20	V. good.
Current @ 13.8 V D.C. supply audio gain min. (A)	1	
<b>TX Measurements</b>		
CW output power: 13.8 V.D.C. Supply 1.9/3.65/7.05 MHz (W)	85 /100/100	Good
CW O/P power @ 14.25/21.3/28.6 MHz (W)	100 /90/85	V. good
SSB O/P power @ 1.9/3.65/7.05 MHz (W P.E.P.)	140 /140/140	
SSB O/P power @ 14.25/21.3/28.6 MHz (W P.E.P.)	150 /140/140	
Current drawn on full power CW. 13.8 V supply (A)	16	Very efficient
Current drawn on SSB, mic gain min. (A)	2	Good
Harmonic O/P, CW @ 1.9/3.65/7.05 MHz (2nd/3rd) (dBc)	(-60/ -58) /(-66/ -54) /(< -68/ -49)	Good /Fairly good /Fair
Harmonic O/P, SSB @ 14.25/21.3/28.6 MHz (2nd/3rd) (dBc)	(-64/< -53) /(-64/< -65) /(< -65/< -65)	Fairly good /excellent /excellent
SSB Carrier rejection relative to full CW power: 28.6 MHz (dB)	-62	Superb!
Transmit freq. error on CW @ 28.6 MHz (Hz)	-160	Adequate

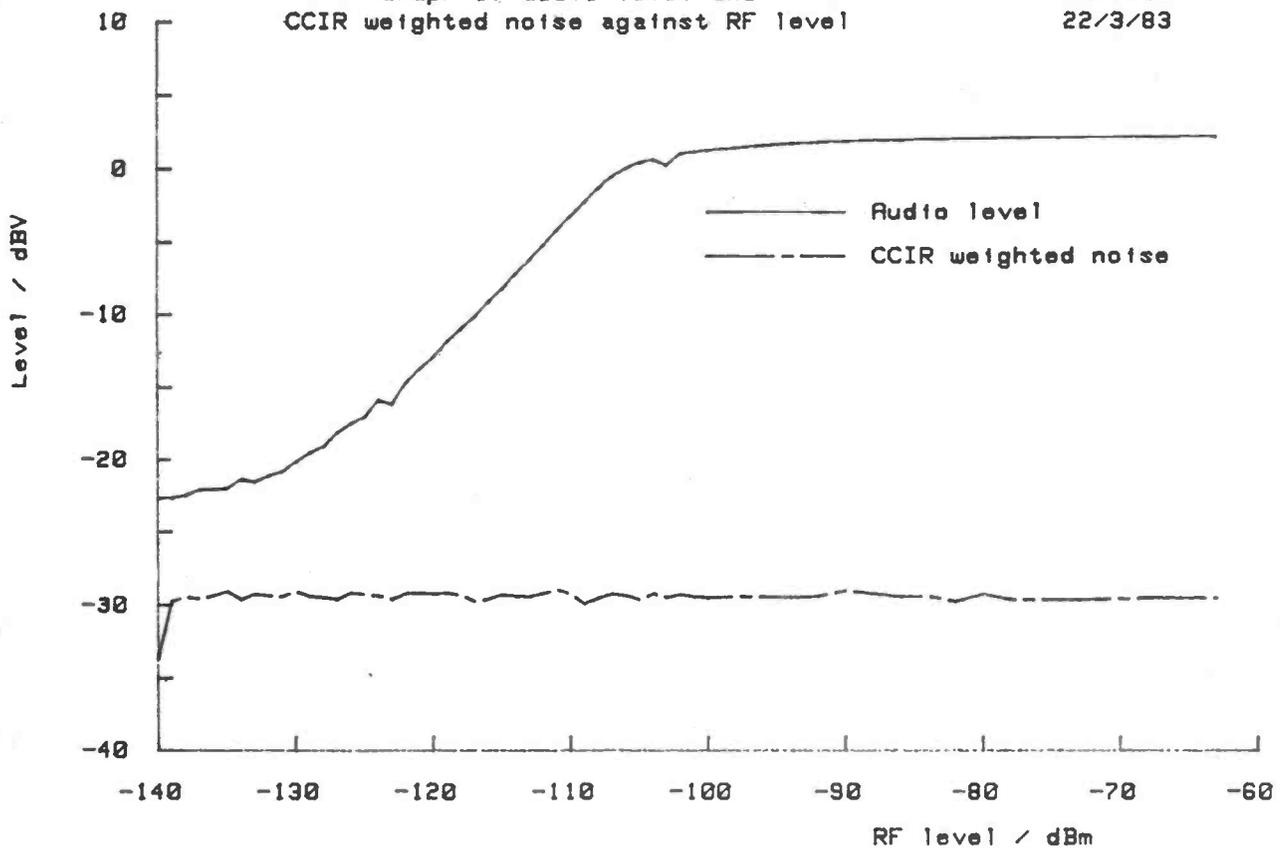
Table of Lab test results

assume to be synthesiser modulation components on the local oscillator. Selectivity was checked at two separate RF levels about 15dB apart with the same result. I must particularly praise the excellent S meter, characteristic of many

Trio rigs, for its far better than usual law from low to very high levels. As can be seen from the chart, there is 35dB difference between S1 and S9, S5 being reasonably half way in dynamic range between these two points. S9 however, at

Graph of audio level and  
CCIR weighted noise against RF level

TRIO430  
22/3/83



around  $70\mu\text{V}$  right across all the amateur bands, is perhaps a little insensitive, and I would have preferred it to have been at the more usual  $50\mu\text{V}$ . The T-notch filter gave a remarkable maximum notch with hardly any reduction of signal level 400Hz away, which is splendid. The AGC characteristics can be seen very clearly in the pen chart recording in which we knock down the RF level in 10dB steps from a very high to a very low level. Note the recovery time at the various levels, together with the fact that normal level is not restored on lower level signals. My colleague, Simon G8UQX, thought of a rather nice computer test to apply, in which computerised test equipment monitored the audio output level whilst stepping up the RF input level automatically from a Marconi 2019 signal generator, finally plotting the result.

Additionally, the CCIR/ARM weighted noise was plotted with unity gain held at 2kHz, this being the audio output noise at the test gain control setting for no RF input. It can be seen that full audio output is reached at around  $2\mu\text{V}$  input, above which the level is fairly constant, with just a gradual slope. At very low levels indeed there was slight computer noise breakthrough, but even so I would ideally have preferred full level to have been reached at a much lower RF

level, particularly for 10m where band noise can be so extremely low relatively.

I have already commented favourably on the good audio quality, and so it was not quite so surprising to see the very low distortion measurement at 125mW output from a carrier giving a 1kHz beat in the product detector. The loudspeaker was fairly sensitive, which is fortunate for the maximum available output into 8 ohms was slightly limited. The only other receiver measurement which seems very relevant is the high current drawn, which is easily sufficient to flatten a car battery if the rig is left on inadvertently for more than a day. I would have thought that with modern circuit design the standing current could have been a mere fraction of what it was.

The transmitter took around 16A peak which is very reasonable indeed, showing a high efficiency PA. The current drawn by the entire transmitter on transmit, but with mic gain at minimum, was considered quite low, only double that of the receiver, and so the average consumption from a car battery will be surprisingly low, unless speech compression is selected, which will, of course, greatly increase the DC duty cycle. Frequency accuracy on transmit was checked on CW, such that the output frequency measured 160Hz below that indicated, and this is perhaps just a little

bit further out than I might have expected, although the receiver was exceptionally accurate. Maximum power output on CW was either at, or only very marginally below, the legal limit, so you certainly can't grumble, and SSB peaks were well in excess of the CW output, which is very useful. No drift problems were noted, either on TX or RX, after a warm up period. We checked harmonic and spurious outputs on a spectrum analyser on all bands from top band to 10 meters, and must particularly praise the harmonic suppression on the latter. The worst band was 40 meters with 3rd harmonic just a little high, but fortunately the harmonic was in another amateur band! SSB carrier suppression was fantastically low, showing a very well designed balanced modulator. The microphone circuits seemed to have a good overload margin, and no problems were noted with the transmitter, which is praiseworthy.

Equipment used by Angus McKenzie Laboratories Ltd. for this review.

Two programmable Marconi 2019 signal generators, Marconi 995 generator, coaxial attenuators by Greenpar, Marconi, Rhode and Schwartz and Narda; hybrid transformer by Elcom; power meters by Racal and Bird; analysis equipment, including Hewlett Packard 8903 audio analyser, and 3580 spectrum analyser, an RF spectrum analyser; Hewlett Packard 8558B, a Takeda Riken eight digit frequency counter (four parts in  $10^9$  accuracy), a Bruel and Kjaer and HP pen charting/plotting equipment, and computer control were appropriate was with a Hewlett Packard 9816 computer with 82901 dual disc drive.