The real beauty of the Collins KWM-380 is behind the panel, not on it.

At Collins, we know serious amateurs won't settle for less than professional performance. So we build every KWM-380 to commercial rather than amateur standards. For example, our PC boards are connected by ribbon cables with gold-plated pinfield connectors. The boards themselves are all glass epoxy, and virtually unaffected by temperature and humidity which cause intermittents in the more commonly used phenolic boards.

Once built, every KWM-380 undergoes 24-hour burn-in, then is aligned and tested to meet or exceed every spec on the data sheet. Which makes us very confident about warranting your KWM-380 for one full year.

The result is a radio with superior performance and lasting quality, not front-panel glitter. Frequency stability is just one example of its beauty: typically, drift is as low as 10-12 Hz per hour for normal ham shack environments. Other companies haven't matched our performance because they don't match our quality behind the panel.

Add some real beauty to your station. See the KWM-380 at your nearest authorized dealer. Collins Telecommunications Products Division, Defense Electronics Operations, Rockwell International, Cedar Rapids, IA 52498. Phone (319) 395-5963. Telex: 464-435.

Rockwell International

...where science gets down to business

CIRCLE 50 ON READER SERVICE CARD

Parameter	Specifications
Physical	
Size	394 mm (15.5 in.) wide; 190 mm (7.5 in.) high, including 25 mm (1 in.) feet; 457 mm (18.0 in.) deep
Weight	27.2 kg (50 lb.), max
Environmental	
Operating temperature	0 to 50°C (32 to 122°F)
Operating humidity	0 to 90% relative humidity
Operating altitude	0 to 3049 m (0 to 10,000 ft.)
Vibration	2 g's, 10 to 33 Hz
Electrical	
Primary power	Strappable for: 105, 115, 125/210, 220, 230, 240, 250 V ±5%, 50 to 60 Hz; or 12 to 15 V dc, negative ground: 120 watts max in receive, 600 watts max in transmit
Receiver	
Frequency	0.5 to 30.0 MHz, tunable in 10 Hz steps
Modes	u.s.b., l.s.b., a.m., and c.w.
Sensitivity (Using "soft μV measurement)	0.5 μV or better for 10 dB (s + n)/n, 2.0 to 30.0 MHz, s.s.b. and c.w.; 1.0 μV or better for 1.8 to 2.0 MHz.
Selectivity (3 dB bandwidth)	Selectable: 8 kHz *1.7 kHz *6 kHz *360 Hz 2.1 kHz *140 Hz *Optional Filters
I.f. and image rejection	Greater than 60 dB
Intermodulation distortion	−50 dB or better for two signals of −10 dB mW each, 20 kHz apart
AGC	Audio output variation not more than 8 dB for 4 μV to 200 mV open circuit r.f. input variation
Audio output	Not less than 3 W into 4 ohm load, at 1 kHz, at not more than 10% total harmonic distortion Line audio output not less than −10 dB mW nominal into 600 ohms Frequency response: 300 to 2400 Hz with not more than 5 dB variation
Transmitter	
Frequency	160 through 10 m amateur bands, tunable in 10 Hz steps 160 m 1.800 to 2.000 MHz 80/75 m 3.500 to 4.000 MHz 40 m 7.000 to 7.300 MHz 20 m 14.000 to 14.350 MHz 15 m 21.000 to 21.450 MHz 10 m 28.000 to 29.700 MHz
Modes	u.s.b., l.s.b., and c.w. (RTTY by AFSK on l.s.b.)
Output power	90 W pep, min (100 W, nominal) In c.w. or RTTY: 50% duty cycle; key down 15 minutes, max. Automatic turndown to 50 W after 10 seconds. With optional blower kit installed, power is 100 W average, 50% duty cycle, key down 1 hour max at 25°C; 30 minutes max at 50° C for all modes.
Unwanted signal suppression	
Carrier	−50 dB or better
Undesired sideband, 1 kHz ref	−55 dB or better
Harmonics (all)	−40 dB or better
Mixer products	−50 dB or better
Third order distortion	25 dB below each tone of 2-tone test
Synthesizer accuracy and stability	Accuracy within ±5 Hz after 10 minutes warmup when 39.6 MHz and 455 kHz oscillators are set to within ±3 Hz. Stability within ±150 Hz over temperature range of 0 to 50°C (32 to 122°F) if oscillator's set within 10 Hz at 25°C (77°F)
Antenna impedance	50 ohms, nonreactive. (Full transmitter power output with v.s.w.r. of 2:1 or less. Automatic power output turndown with v.s.w.r. greater than 2:1.)
Audio inputs	
Microphone	Low or high impedance, dynamic; 3.3 kΩ nominal impedance
Line	600 ohm, unbalanced; 40 mV input sufficient for full r.f. power output

Table I– Manufacturer's specifications.

various specific functions. An examination of slightly more detailed receive and transmit signal path block diagrams should help to clarify the situation.

For instance, fig. 2 shows details of the receive signal path. The "front-end" of the KWM-380 is unique in several respects. There is no r.f. amplifier stage, and there are none of the usual bandpass filters as are usually associated even with transceivers having a "high" first i.f. (above 30 MHz). The filter blocks that an incoming signal goes through before being amplified are not quite what one would expect. The first filter block is a 0.5–1.6 MHz rolloff one, simply designed to protect the transceiver from BC band overload. The high-pass filter block works in conjunction with a following 30 MHz low-pass filter block. The latter is fixed in frequency at 30 MHz, while there is a selection of three high-pass filter cutoffs of about 20, 14, or 7 MHz. So, an incoming signal can be "bracketed" between 7–30 MHz, 14–30 MHz, or 20–30 MHz.

The reason for this arrangement is not simply to provide image signal rejection; the very high first i.f. frequency takes care of that. The high-pass filters ensure that the transceiver does not generate second order intermodulation products of commercial/broadcasting stations. For instance, in the European area the "breakthrough" of 13–15 MHz signals on "simple" transceivers operating on 10 meters can be a very severe problem. The problem doesn't exist with the KWM-380. In between the high- and low-pass filter blocks one can see a PIN diode attenuator (CR104). This diode is controlled by a voltage from a.g.c. amplifiers in the KWM-380. Essentially, the diode performs the same function in an automatic fashion as the manual r.f. attenuator switches one finds on many h.f. transceivers.

The 39.145 MHz i.f. signal is produced by the first "U100" mixer. This i.f. signal is amplified, passes through an optional noise blanker unit, and then goes on to mixer "U102," where the i.f. signal is translated to 455 kHz and routed to a passband tuning assembly. An up/down frequency translation takes place in this assembly in that the 455 kHz i.f. is translated to an i.f. of 6.255 MHz and then back down again to 455 kHz. True signal selectivity takes place in crystal filters associated with the 6.255 MHz i.f. The final 455 kHz i.f. signal is demodulated to provide an audio output and rectified to provide the control voltage for an elaborate "hang" a.g.c. loop which controls both the incoming signal attenuation (PIN diodes between the high-pass and low-pass filter blocks) and the final 455 kHz i.f. signal attenuation (PIN diodes before the "U700" stage shown in fig. 2). The **800 Hz Spot Tone** input shown in the lower left-hand corner of fig. 2 provides for a convenience feature, in that in the c.w. mode only, one can enable an 800 Hz test tone

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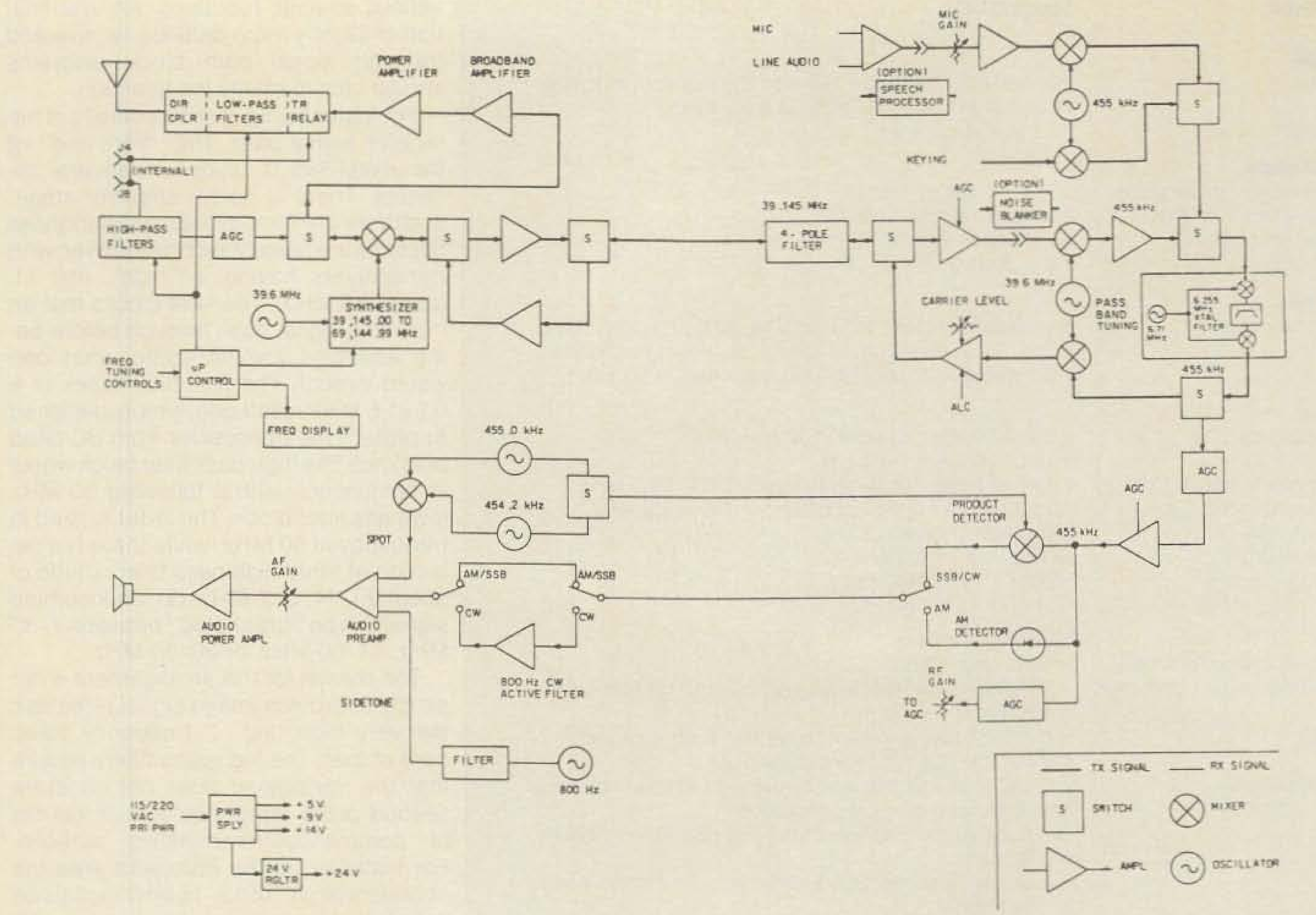


Fig. 1– Overall block diagram of the KWM-380.

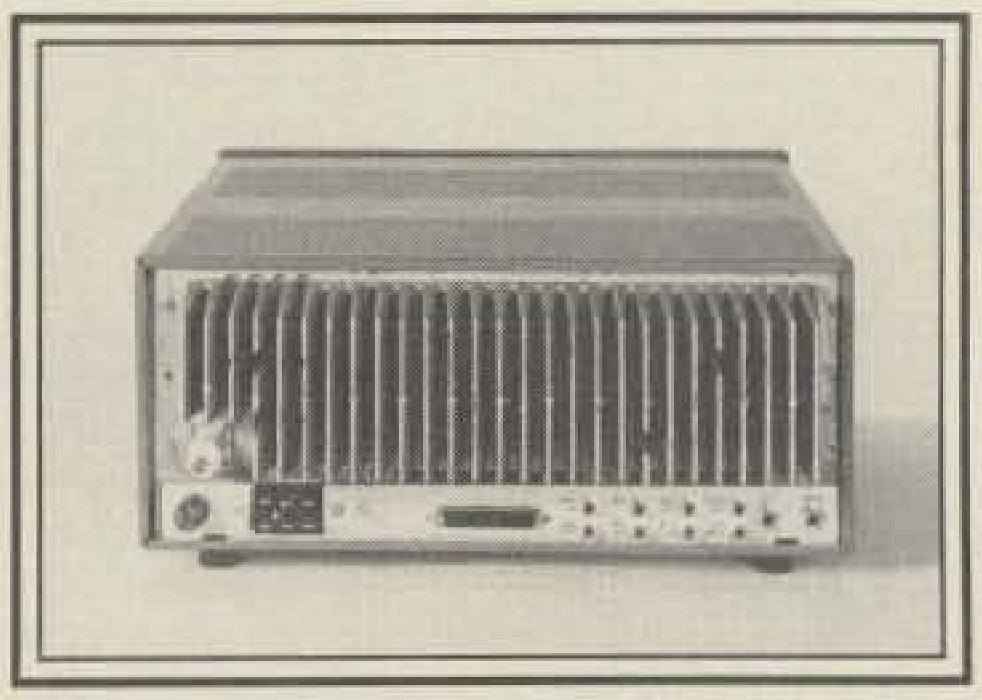
to which a received c.w. tone (centered on 800 Hz by a c.w. i.f. filter) can be matched for exact transmit/receive frequency coincidence.

It would be fun to highlight in detail numerous unique circuits used in the KWM-380. However, if one has to use a practical approach by both serving potential purchasers of the KWM-380 and giving readers some circuit ideas, the following should be of special interest.

The basic "front-end" of the KWM-380 is shown in fig. 3. This diagram shows in detail and with circuit values the various filter sections previously mentioned. The antenna signal first encounters the multiple-pole BC band rolloff filter shown as L800-804 and C800-801. The three high-pass filters are each composed of a similar number of components (e.g., five capacitors and two inductors). The 100 µh coils on each side of each filter are RFC's which are used for signal isolation in the PIN diode switching scheme used.

If one studies the diagram a bit, it should be clear that when point K(7) is grounded, the filters are bypassed by diodes CR800-801. When one of the points L(7), M(7), or N(7) is grounded, one of the three filters is selected. The incoming signal then passes on to the diode section between C825-C102. This diode section is an overload protector composed of zener diodes VR100-101 and limit at the 7 volt level. C104 is switched to ground by the variable resistance of PIN diode CR104, which in turn is driven by the chain of a.g.c. amplifiers shown at the bottom of this diagram. The incoming signal then goes through the fixed 30 MHz low-pass filter and on to mixer U100. U100 is a commercial diode ring mixer (type SRA1H from Mini-Circuits Lab., Brooklyn, N.Y. 11229). The signal is, of course, then translated to the first i.f., but note that only then does signal amplification take place. The whole "front-end," so far, has been passive.

The concept and practical usage of the passband tuning used in the KWM-380 is illustrated in fig. 4. The 455 kHz signal coming into mixer U4 has a bandwidth up to 8 kHz. After mixing, the resultant 6.255 MHz signal is routed to any one of five crystal filters: a standard s.s.b. filter (2.1 kHz), standard a.m. filter (8.0 kHz), an optional narrow filter for s.s.b. (1.7 kHz), or optional narow filters for c.w. (140 or 360 kHz). One also has the option of physically substituting an optional 6.0 kHz filter for a.m. for the standard 8.0 kHz one. These filters are all switched in and out by some diode/transistor switching circuitry as controlled by the front-panel selectivity control. The 6.255 MHz signal is then retranslated to 455 kHz in mixer Q1. Since mixers U4 and Q1 have a common injection oscillator, varying the frequency of that oscillator moves the selected filter bandwidth chosen within the overall incoming 8 kHz bandwidth of the incoming 455 kHz signal. The effect of all this is shown in fig. 4(B). It shows the passband tuning effect as one varies the passband tuning control when a standard s.s.b. filter has been selected. Two things should be noted: the filter bandwidth does not vary as its placement is varied, and the operator must set the passband tuning control so either l.s.b. or u.s.b. signals are passed.



The back panel of the KWM-380 consists almost entirely of a huge heat sink. No blower fan is necessary for normal s.s.b./c.w. operation. Various jacks for accessory connections are shown on the bottom of the panel. The r.f. output connector (left, bottom) is really an SO-239. A u.h.f./BNC adapter was left in place by mistake while taking the picture.

Referring back to fig. 1, one can note that the microprocessor control block

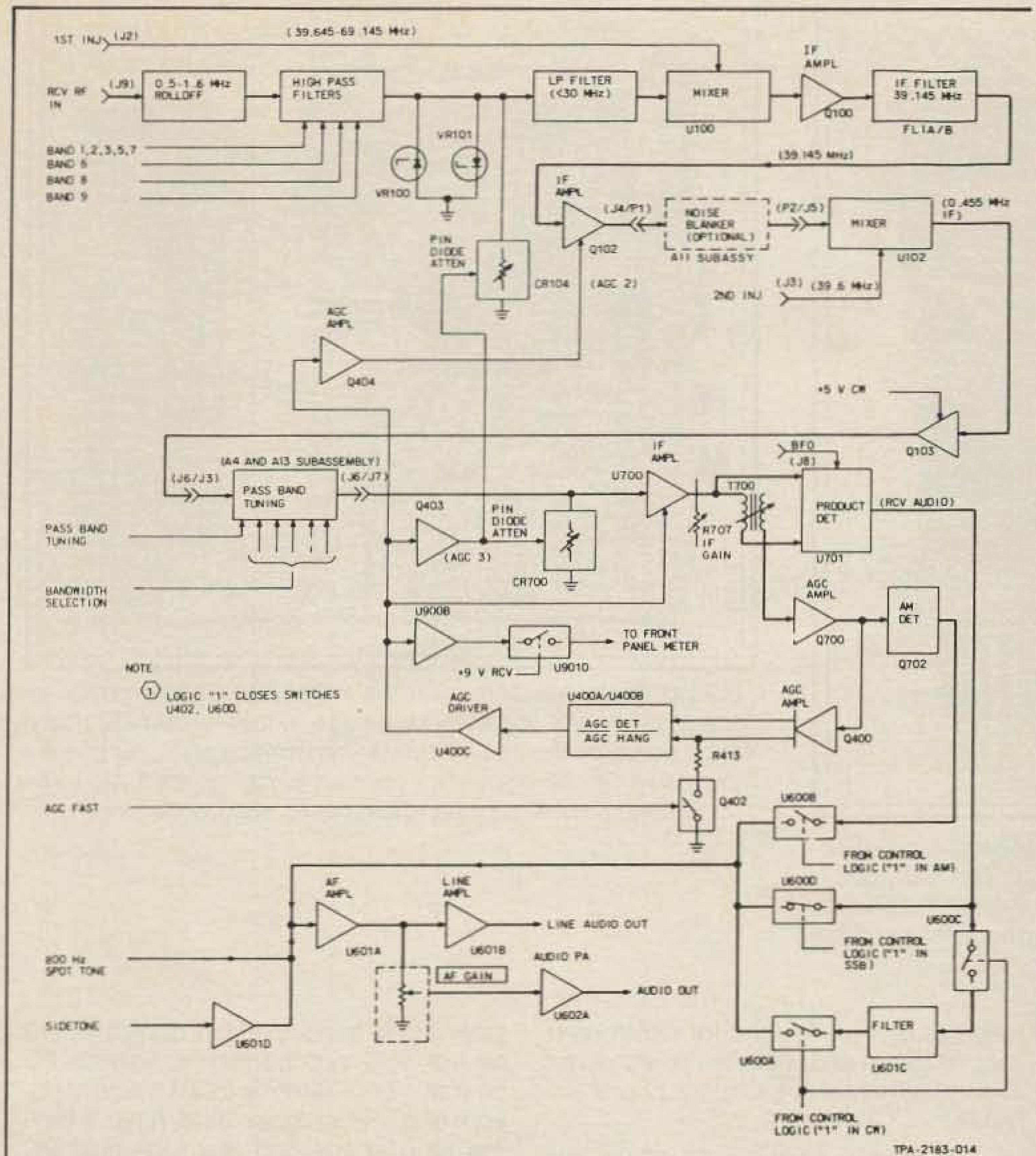
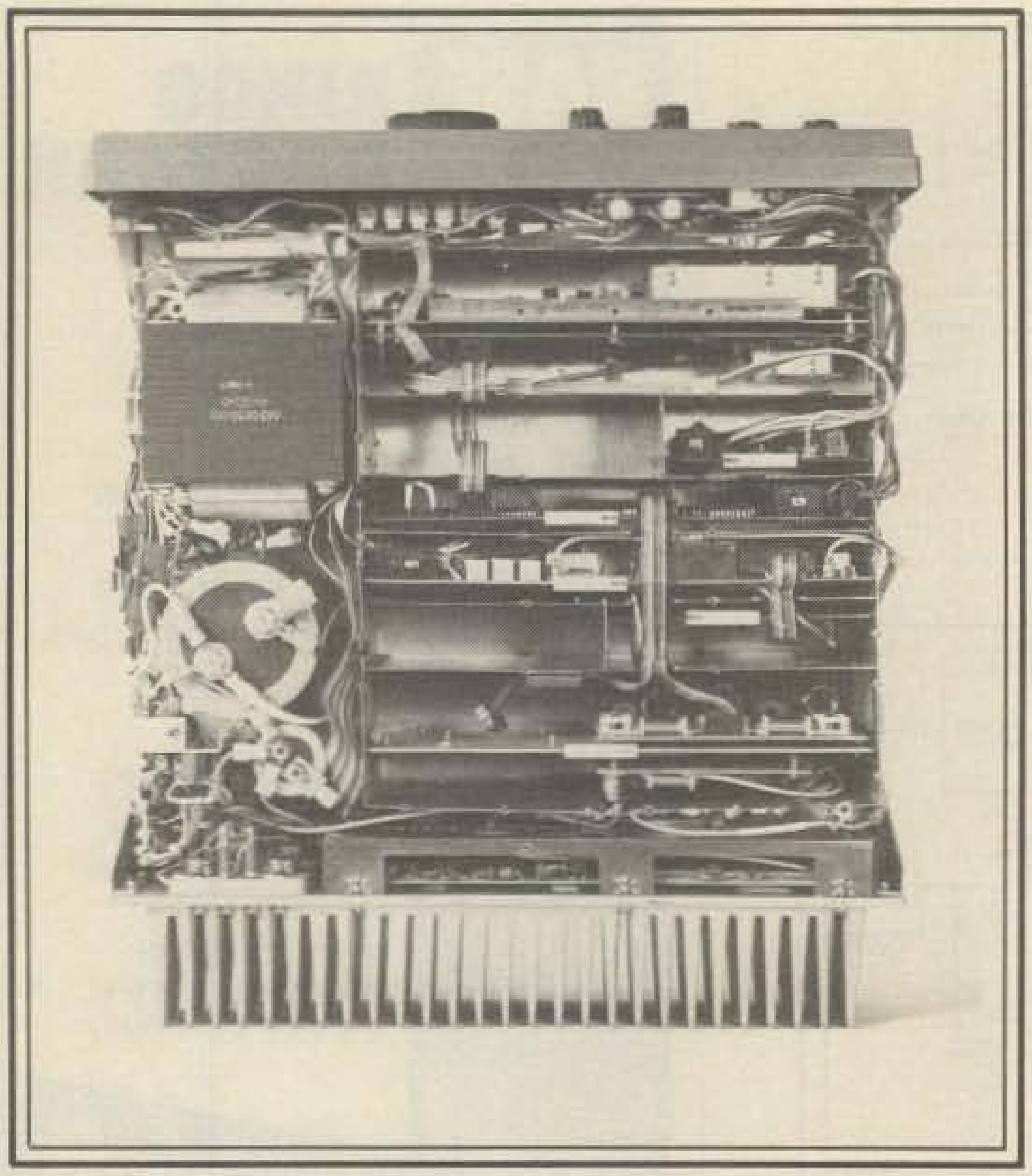


Fig. 2– Block details of the receive chain in the KWM-380.

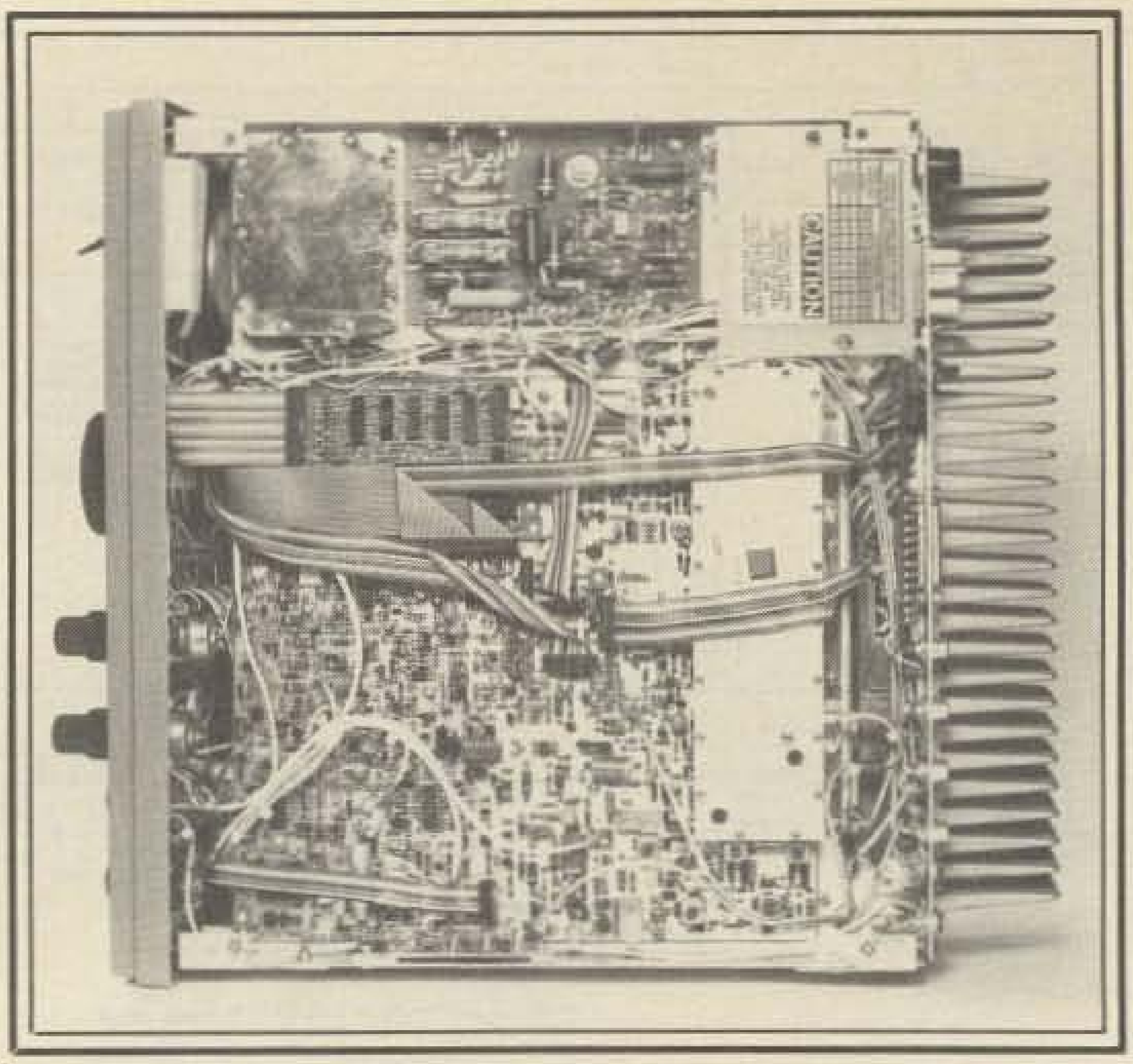
commands a central position as regards accepting input commands from the frequency tuning controls and then sending out data to various blocks such as those for the synthesizer, frequency display, and high-pass and low-pass filters. The CPU itself is a type 6802. There would be no point in going into all the complex circuitry within the microprocessor and its associated blocks. For example, there are several complex PLL loops within the synthesizer. But, the general concept of control exercised by the microprocessor is interesting. It accepts tuning information from the main tuning knob via photochoppers and senses if the tuning knob rotation is *up* or *down.* It also accepts tuning rate control information from switch settings. It then supplies this data to the synthesizer for frequency generation in 10 Hz steps and to the frequency display for readout to 10 Hz steps. When certain frequency limits are reached, it sends controls to diode switch *in* or *out* high-pass filters in the receive signal chain and relay switch low-pass filters in the transmit signal chain.

Frequency set information is stored for the two A/B v.f.o.'s in the KWM-380 during operation, and the two frequencies can be anywhere within the operating range of the transceiver. However, when power is turned off and then turned on again, the v.f.o.'s are always reset to 15 MHz. The frequency generation and control is arranged such that frequency coverage is continuous without any break for "bands." That is, if the fastest tuning rate is chosen, three revolutions of the tuning knob will completely set the transceiver on any desired frequency between 3.000.00 and 29.999.99 MHz (receive mode; transmit mode is limited to amateur band segments). The other selectable tuning rates are 200 kHz, 20 kHz, and 2 kHz for one main tuning knob revolution.

Fig. 5 shows a few details of the transmit chain in the KWM-380. The basic modes generated are s.s.b. and c.w. For s.s.b. generation a d.s.b. signal is generated at 455 kHz in balanced modulator U501. The signal is then routed through the 2.1 kHz filter contained in the passband tuning circuit used on receive and translated again to 455 kHz as an s.s.b. signal. On transmit, a front-panel mode switch automatically sets the variable oscillator in the passband tuning circuit so a selected l.s.b. or u.s.b. signal is generated. In this manner, and considering the action of the passband tuning control on



Removing the overall shell cover on the KWM-380 plus an internal shield cover, this is what one will see. The individually shielded compartments on the right contain various PC boards, while the internal power supply components (transformer, filter capacitor, etc.) are seen to the left.



Looking inside the bottom of the KWM-380 with its cover removed, one sees basically one huge, double-sided PC board which contains the basic receive/transmit circuitry (excluding filters, oscillators, frequency readout circuitry, etc.). Note the extensive use of ribbon-type cable with connectors.

receive, one has independent control of sideband selection for transmit/receive. The 455 kHz s.s.b. signal is further frequency translated up to the final operating frequency by the same mixer/oscillator circuits active in the receive mode. The signal reaches the 100 mW level in broadband amplifier stage Q202-204 and is fed on to a power amplifier block.

For c.w. operation, the 455 kHz carrier signal normally injected into the balanced modulator is diode switched into the 455 kHz i.f. chain preceding the passband tuning block. This 455 kHz carrier signal is also gated for c.w. keying by a diode switch, Q503, which is controlled by a pulse shaping circuit, U500C, which provides for controlled rise and decay times during c.w. keying. The c.w. keying circuitry also activates a sidetone oscillator feeding the microphone preamplifier stage. This is provided so the VOX circuitry can also be used on c.w. for receive/transmit switching. The sidetone output is not used to generate a c.w. carrier. The VOX circuitry provides for separate "delay" control settings in the c.w. and s.s.b. modes.

On both s.s.b. and c.w. the output level essentially can be adjusted for QRP levels to full output. On s.s.b. this is accomplished by control of the microphone amplifier gain and on c.w. by circuitry which directly controls the r.f. carrier level via controlled biasing of the a.l.c. loop.

Metering provides for monitoring the a.l.c. level, using the same scale as for S readings on receive, and for direct reading of forward and reflected power levels as sampled at the output of the power amplifier.

Physical Construction

As was mentioned before, the KWM-380 is not a "light-weight" unit. But, the weight, besides deriving from a built-in power supply, comes about from absolutely solid construction. This is initially apparent from the front-panel controls and switches which are all well-dimensioned and of excellent quality. Taking a look at the back of the KWM-380 (see photo), one sees a massive cast aluminum heat sink which covers most of the rear of the unit. It wasn't measured, but I would easily estimate that it contains more square inches of cooling area than are contained on the heat sinks of some 1 kw conduction-cooled linear amplifiers. The back panel view also shows the nice layout of the connectors used, ranging from the antenna and a.c. power connectors on the left to the various connectors for linear amplifier control, speaker, key, etc., on the right side. The special connector in the center is for a special keyboard control option (described later).

To get at the inside of the KWM-380, one has to unscrew and slip off a complete wrap-around, perforated steel shell as can be seen in the rear view photo. Looking inside from a top view, one sees the power supply components on the left side and a multi-shielded compartment on the right side containing various PC boards. Very extensive use is made of ribbon cable interconnecting runs, which are long enough so any individual PC board can be removed for test/replacement without using extender cards. Although it is not too easy to point out, the single internal crystal oscillator which locks the frequency synthesizer is in its own separately shielded compartment on one of the front PC boards. The power amplifier is in a separately shielded compartment at the rear of the unit.

Taking a look at the exposed underside of the transceiver (see photo), one again sees the very extensive use of interconnecting cables between PC boards. The PC boards in themselves are quite interesting to study. They are of a high-quality glass epoxy type with fully plated-through holes, where applicable. Someone at Rockwell/Collins must have given "orders" that no component may be diagonally mounted on a PC board, and even disc ceramic capacitors have to be absolutely lined up at "attention" rather than being allowed to find their often rather natural, helter-skelter mounting state.

Seriously, however, the physical construction of the KWM-380 has to be rated as excellent. Any constructional feature that one looks at augurs for a very long service life for the unit along with reasonably easy service possibilities should a component or board require replacement. Not to detract from the foregoing

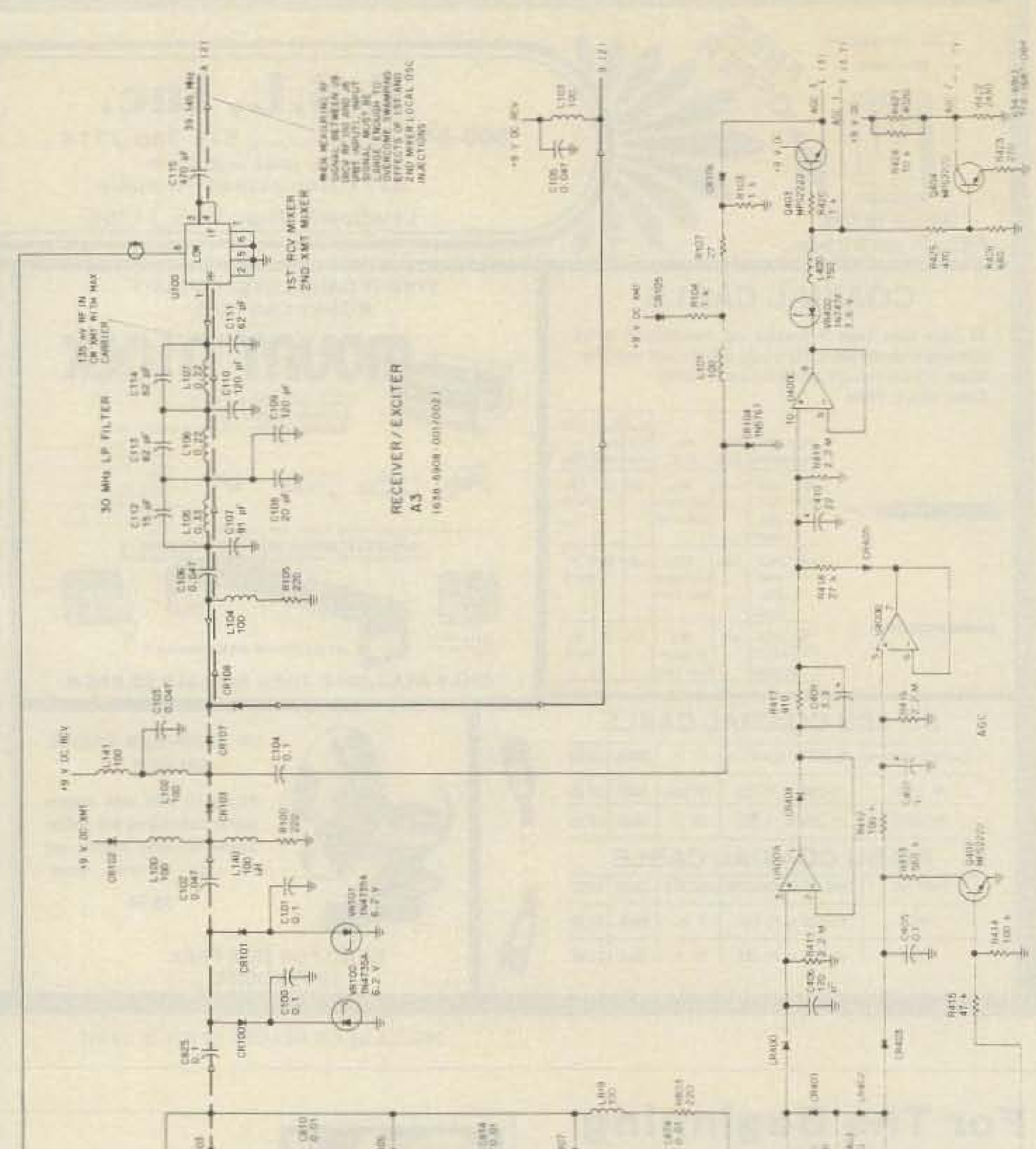


Fig. 3– Unusual "front-end" circuitry used in the KWM-380.

but yet to give the reader a complete picture of the KWM-380, one should mention two things. If one is going to use the KWM-380 under extreme environmental conditions, one has to take note of the perforated covering used. Obviously, operating placements subject to conditions such as a heavy salt-water-laden atmosphere give rise to possible problems. The other point—an extremely minor one to be sure—concerns the microphone input jack. It requires a special PJO-68 plug

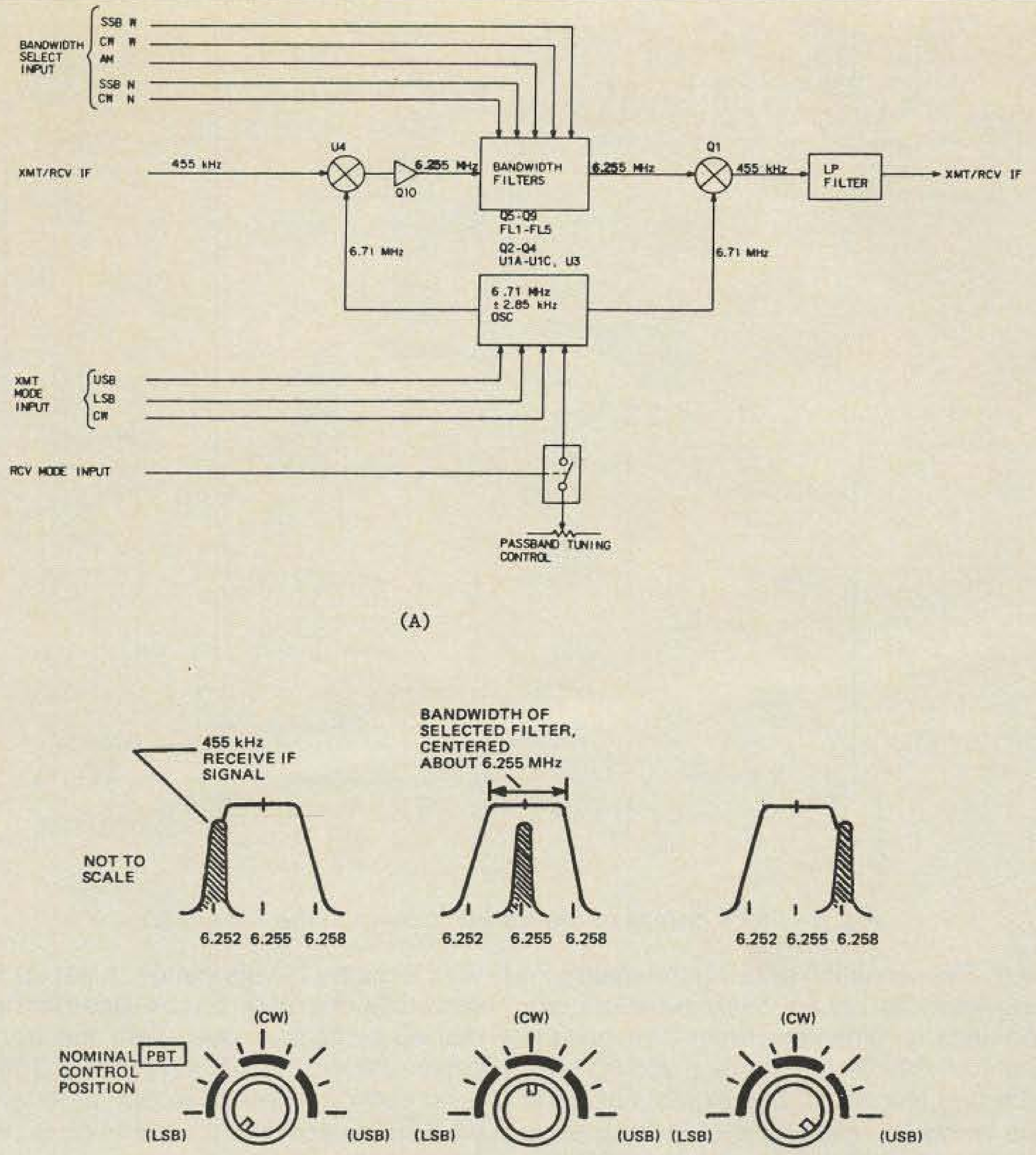


Fig. 4– (A) Basic passband tuning scheme used in the KWM-380. (B) An illustration of how an incoming signal is affected.

fairly common in military and commercial communications spheres but practically unused by radio amateurs. It has been the standard Collins plug for many years.

Test Results

Table I gives the claimed specifications for the KWM-380. To say the least after bench testing a unit, one should regard them as very conservative if not downright deliberately understated.

On the receive side, the KWM-380 greatly exceeded almost all of its claims. The sensitivity ranged around the 0.3 to 0.4 microvolt range for 10 dB STN/N ratio on s.s.b. throughout its tuning range. However, much more significant was the excellent dynamic range. The third order intercept point for 20 kHz spaced signals plotted consistently out in the range of + 14 to + 18 dBm (usually the latter). The synthesizer noise floor could hardly be found with the test equipment available. An educated estimate has to remain at better than – 100 dB.

The synthesizer design is undoubtedly a big part of the secret of the KWM-380's performance. Among other things, it allows the excellent shape factor of the s.s.b. filter to provide meaningful results in practice. The stability was only measured at room temperature rather than over the temperature range specified. A variation of only a few Hertz could be discerned over an operating period from turn-on to an hour or so later. I.f. and image rejection exceeded 70 dB. And, where did all the "birdies" and spurious responses go that one often accepts as being normal with amateur radio equipment designs? I got tired of searching for them. Perhaps there are a few of mini-microvolt proportions someplace, but certainly none are apparent. The S meter requires about 100 microvolts to indicate S9. This is more than the 50 microvolt standard for S9 frequently used, but of more importance is that the S meter response of the KWM-380 is linear within a few dB as signal levels change. So, one can provide a meaningful report to another station when testing antennas, audio devices, etc.

On the transmit side, there is no question that the KWM-380 will deliver a good 100 watts output over all of the amateur bands. It probably could be adjusted to provide 1½ times that power level and for normal s.s.b. operation would run just as cool. There is no fan included in the standard KWM-380, nor is one needed for normal c.w. or s.s.b. operation thanks to the huge PA heatsink on the rear of the unit. For AFSK RTTY operation over extended periods, there is an optional blower kit available which allows 100 watts average output with a 50% duty cycle to be maintained for one hour under keyed conditions! The power amplifier stage contains all sorts of protective circuitry, including the usual thermal and s.w.r. protection. It also contains a rather different forward power averaging circuit. This circuit senses forward power with a long time constant. If the forward power averages too high for too long, it activates a.l.c. circuitry to reduce the PA output in steps down to 20 watts. Output spurious products, including harmonics, were always below – 50 dB and sometimes ranged down to – 70 dB.

However, the most interesting aspect of the transmitted signal was the third-order IMD products. They measured – 32 to – 35 dB from PEP using a two-tone test signal. So, for all practical purposes, the KWM-380 IMD products are as good as any 100 watt class power amplifier using the ubiquitous 6146B tubes, and there is no tuning. The KWM-380 contains an internal power supply which can be strapped for input voltages ranging, in steps, from 105 to 250 volts. It can also operate directly from a 12–15 v.d.c. source. Using the latter, about 3 amperes are drawn in the receive mode and up to 18–20 amperes for 100 watt c.w./s.s.b. operation.

Operating Impressions

As was mentioned before, the transceiver is reset to 15.000.00 MHz when it is turned on. So, one first sees those digits appear rather impressively in their approximate 1 inch height above the main tuning knob. The group of push buttons above the knob controls the tuning rate, locks-out the tuning knob from changing the frequency which has been set, and can be used to synchronize the frequencies of the two built-in v.f.o.'s. Once one gets used to the rather strange symbols used for the tuning-rate buttons, it is rather easy to set up for operation, for example, on 21.195.00 MHz. One presses the ⌉ button for 1 MHz increments and turns the tuning knob less than a full turn until a reading of about 21 MHz appears. One then would normally press one of the ⌈ buttons for a 20 kHz/knob revolution rate to quickly finalize the frequency at 21.195.00 MHz. It takes longer to write about it or to read about it than it takes to accomplish it.

The **Mode** switch is used to select the desired transmit mode, and the **Passband**

Tuning/Selectivity control is set to the desired receive sideband and i.f. bandwidth. There is nothing more to set up or tune on the transceiver, and it is "ready to go" assuming that one has previously chosen VOX or MOX (PTT) mode, a.g.c. speed, speed processor in/out, etc. If one has to adjust an antenna tuner, the **Mode** switch on the KWM-380 can temporarily be set to **CW** and the **Mic/Carrier Level** control used to increase carrier output while the reversed power reading is observed and the antenna tuner is adjusted for minimum indication.

The tuning "feel" of the main tuning knob is extremely good. It feels slightly "heavy," yet turns easily. The other knobs are also very well dimensioned. For instance, the concentric **AF/RF Gain** control knobs are not the disaster found on some receivers. The **RF Gain** knob can readily be manipulated, which c.w. buffs should greatly appreciate.

If one set up the transceiver as mentioned for 21.195.00 MHz (with the v.f.o. switch at **A**) and then suddenly remembered a net on 3.897.50 MHz, it's a simple matter to set the v.f.o. switch to **B**, switch-in the appropriate tuning rate buttons, manipulate the main tuning knob a bit, and be set up on 3.897.50 MHz. One can then switch back and forth between the v.f.o. **A** and **B** settings for actual operation or for just monitoring purposes. The v.f.o.'s can also be set so one controls only the transmit frequency. In other words, half-duplex operation can be carried on between any two amateur bands. If one presses the **Sync** button, the two v.f.o. frequencies align themselves, yet one can be used to control transmit and the other to control receive. In fact, this can be used as a very sophisticated RIT option since the digital display will indicate the exact transmit/receive frequencies and one has independent tuning of each. One only has to remember that the KWM-380 will transmit in the s.s.b. mode as set by the **Mode** switch and receive l.s.b. or u.s.b. as set by the **Passband Tuning** (PBT) control. Of course, once one gets used to the very flexible dual-v.f.o. capability of the KWM-380, one wishes there were a half dozen more such v.f.o.'s so one could store various frequencies within a band and various general-coverage frequencies. In reality, such a provision is provided (see accessory items described next).

The impression that one gets as one uses the KWM-380 on receive both within and outside the amateur bands is its extremely "clean" performance. There is absolutely no hint of overload under the strongest weekend signal conditions, and its uniform sensitivity makes it a completely realistic general-coverage receiver as well as an amateur band transceiver. The "hang" a.g.c. action is excellent, being long enough in time constant to combat QSB, yet not being too delayed to provide full sensitivity once a signal drops out. The sensation of using the main tuning knob to continuously tune is quite something. When one tunes from an indicated 5.999.99 to exactly 6.000.00 MHz the first few times, one expects all sorts of relays to resound, etc. In fact, all is quiet and "bands" for the operator in a practical sense no longer exist.

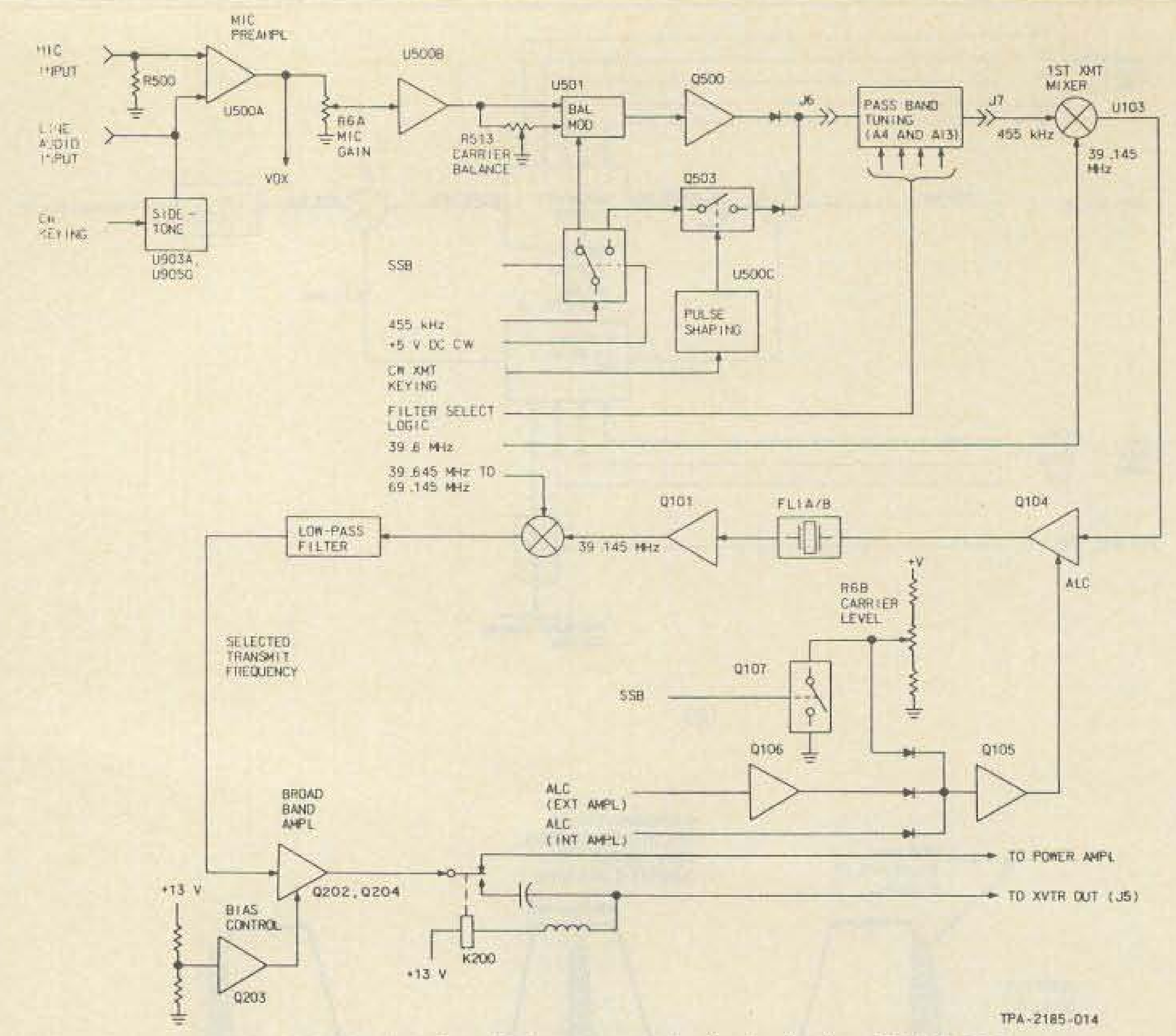


Fig. 5– Block details of the transmit chain in the KWM-380.

The audio quality produced by the front-panel-mounted speaker is perfectly adequate for normal station operation and obviates the need for any accessory speaker (none is offered for the KWM-380). The various optional filters provide for just about any selectivity problem. But, one must face the fact that the KWM-380 does not offer true variable bandwidth i.f. tuning nor a notch filter. Are they necessary? I would say no if one purchases the various optional filters available for the KWM-380, but of course, this does become a price question.

On transmit the KWM-380 consistently produced comments regarding its good audio quality. It has signal "punch" but with a "clean" sounding audio, used either in its basic configuration or with its optional speech processor (described under accessories). Perhaps one reason for this is its shaped frequency response of 300 to 2400 Hz on transmit with only a few dB's level variation within that passband. Another reason is undoubtedly the sophisticated a.l.c. system used, which keeps the average to peak level power level output closely linked. VOX operation was very smooth. C.w. operation was not tried as extensively as s.s.b. operation, but the KWM-380 appears to be as excellent a c.w. transceiver as an s.s.b. one. The separate **C.W. Delay** control on the VOX circuitry is very handy to set up for semi-QSK operation on c.w. Used for normal s.s.b. or c.w. operation, the transceiver will run "cool" indefinitely. There is no cooling needed (except for extended RTTY operation), so operation is perfectly quiet.

Accessory Items

There is an extensive line of optional and accessory items available for the KWM-380. The internal mount optional items include WARC conversion, various i.f. filters, a noise blanker, a speech processor, and a control interface. The outboard accessory items range all the way from different types of microphones and headphones to a blower kit for the heatsink. Some items have been mentioned in passing before, so only a few will be covered in detail.

The WARC conversion consists of replacing an ROM IC on a PCB within the transceiver. The conversion requires the removal of some 39 screws to get at the required PC board. Some versions of the PC board have the IC socketed and some do not. So, the conversion either can be extremely simple or require a bit of soldering. In any case, the conversion will result in the frequency coverage change shown in Table II. Note that the conversion not only provides for WARC coverage, but also expands the 80–15 meter bands for MARS transceive coverage.

The optional speech processor available for the KWM-380 is of a completely new design and a patent is pending on it. It is an audio processing type, but hardly a simple compressor or clipper. In its literature, Collins concedes that the gener-

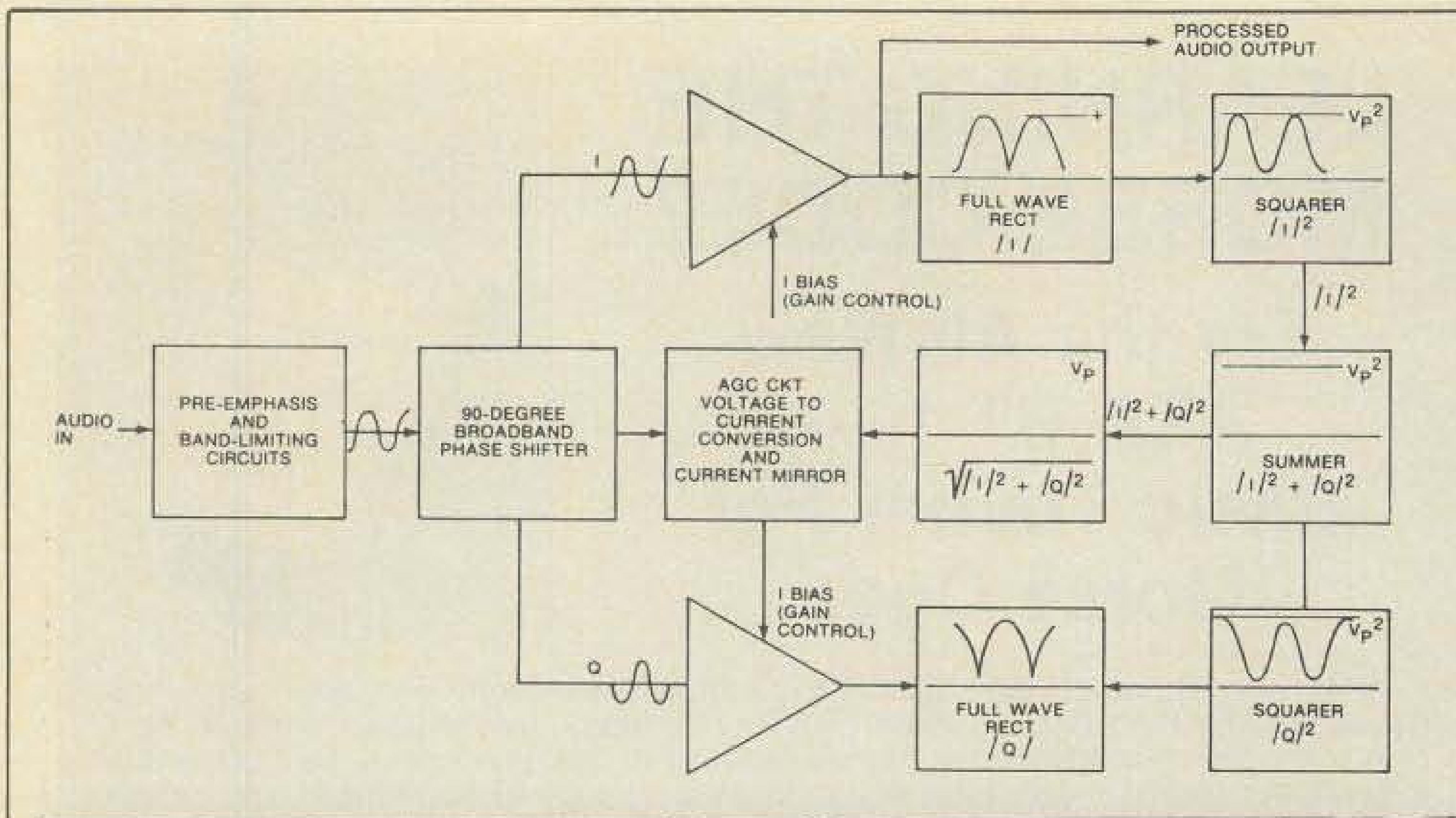


Fig. 6– Block diagram of the circuit functions in the new type of AF speech processor which is an option for the KWM-380.

al consensus is that r.f. speech processing provides the best results, but with some undesirable harmonic distortion and r.f.i. as inherent in any clipping action. They claim their method is as good as r.f. processing without any of its disadvantages. A block diagram of the processor is shown in fig. 6. The actual physical unit is a PC board measuring about 4¼ " × 4½ " and contains some 13 IC's and 8 transistors. A later article may explore the concept of this item in depth, but the general idea, as shown in fig. 6, is that the microphone signal is divided into two 90 degree phase shifted signals which are detected and recombined and produce a d.c. signal proportional to the peak signal at the detectors. The gain of the phase amplifiers is regulated to produce an a.f. signal with *peaks* maintained at a preset threshold. Harmonic distortion is claimed to be about 1½ % across the 300–3000 Hz range for about 15 dB of voice processing. From tests made with the KWM-380 there is no doubt that the optional processor does add something in the order of 4 to 6 dB of apparent increased signal intelligibility with no apparent distortion. It works and works extremely well, but whether it is the ideal solution to the question of speech processing remains open. In any case, it is an outstanding advance in audio-type processing.

The Control Interface option is innocuous sounding, but it adds tremendous versatility to operation of the KWM-380. The option itself consists of a PC board assembly and a connector which is for inter-connection with a user-supplied external key pad (any sixteen button, two-out-of-eight device) or possibly a home computer with parallel interface capability. In any case, the interface allows for the digital selection, storage, or recall of frequencies (the storage/recall capability being either 10 or 11 frequencies, depending upon whether the WARC option is installed).

Using a key pad, the operating frequency can be selected from either the main tuning knob or the key pad. One simply enters the frequency desired digit by digit. The frequency being entered on the key pad is displayed, but the transceiver's operating frequency is only changed when an "enter" key is depressed. The interface PC board contains memory locations for 10 (or 11) frequencies inde-

Band (Meters)	Without SB 10 (MHz)	With SB 10 (MHz)
160	1.8 to 2.0	No change
80	3.5 to 4.0	3.25 to 4.25
40	7.0 to 7.3	6.75 to 7.55
30	—	10.10 to 10.15
20	14.0 to 14.35	13.75 to 14.60
16	—	18.060 to 18.170
15	21.00 to 21.45	20.75 to 21.70
12	—	24.890 to 24.990
10	28.0 to 29.7	No change

Table II– Transceive frequency coverages of the KWM-380 when the SB 10 WARC option ROM is installed.

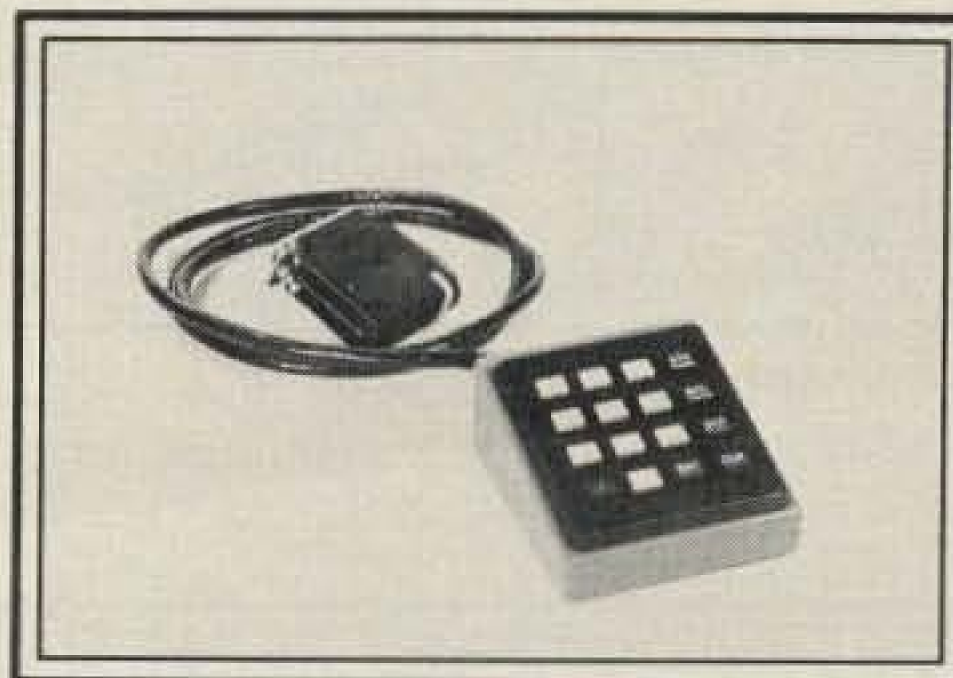
pendent of the two v.f.o. registers. To store any frequency, it is entered by keyboard selection and addressed to a desired memory location (e.g., 1, 2, 3, etc.). The transceiver can continue on its tuning knob selected operating frequency, if desired, during the process. Or, the current operating frequency can be stored by a store and memory location key pad command. Recalling a frequency consists of pressing a recall key and a memory location. This action loads the stored frequency into the v.f.o. register in use (A or B) and sets the transceiver's operating frequency to the recalled frequency. One can also use key pad commands to manually step the transceiver through each memory starting from the present memory location in use. Blank or cleared memory locations are skipped during the manual stepping process.

The key pad frequency control option obviously adds all sorts of operating possibilities to the KWM-380, ranging from serious DX chasing across several bands if desired (remember, there is no bandswitch) to switching to a news program during a boring net session. Removing power from the transceiver will clear all memory locations.

Manual and Service Notes

An operating manual does, of course, come with the KWM-380, and it contains very clear, practical information for getting the unit into operation. It has a multitude of photos and illustrations all directed towards telling the operator how to hook up the transceiver, which controls to turn for various functions, etc. It also contains a limited amount of information on maintenance and some PC board interconnection data, so if a PC board is exchanged, one can understand which interconnecting cables are involved.

A separate, quite elaborate service manual is available for about $40. This manual is extremely complete with thorough information on PC board layouts, schematic diagrams, alignment and test data, etc. Complete parts data is given along with the name and address in the U.S. of the manufacturer of every component used (except common resistors, capacitors, hardware, etc.). The manual also contains a complete set of service bulletins issued for the KWM-380 and a



The KWM-380 can be remotely controlled by a key pad such as the one shown here (or a similar one supplied by the user). A control interface option has to be installed in the KWM-380 to use the key pad, but then one will have key-pad control of frequency entry, storage, and recall. If one imagines the key pad on the right of the front-panel view of the KWM-380 showing the microphone on the left, one has a completely integrated, automated h.f. station.

postcard reply form which will put the purchaser on automatic distribution for all future service bulletins as long as the KWM-380 remains in production. Quite a few such service bulletins were issued up to January 1981. The last one contained in the manual reviewed was dated August 1981 and was only information on WARC conversion.

Dealer and factory service for the KWM-380 is available and there is a one-year warranty. Those restricted to certain APO/FPO addresses, however, might note that the KWM-380 is too large (with packing) for Parcel Post shipment, and freight shipment must be used.

Summary

The KWM-380 is an outstanding piece of equipment. It offers extremely sophisticated operating capabilities using state-of-the-art technology, but without a front panel so cluttered with knobs, push buttons, and switches that one misses out on the fun of operating while trying to figure out how to operate a transceiver. It is not inexpensive. But, its design concept is sound, and, as Rockwell/Collins is willing to put in black and white, "No yearly model changes. As circuit improvements and modifications are made to the KWM-380, its style does not become obsolete."

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