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The KW201

Philip Moss M0PBM describes the KW Electronics KW 201 amateur bands receiver.

The particular radio I describe here is in the collection of the British Vintage Wireless & Television Museum, Dulwich. The KW201 was specifically intended for amateurs using SSB, but also catered for CW and AM. I think it fair to say that in the sixties SSB was still more a coming than fully arrived mode, so the KW 201 and other KW sets were ahead of their time. Britain was slow to adopt SSB despite the fact it was a British invention in about 1929. It was developed by Rediffusion, not for conventional broadcast but for power-line transmission of radio, to consumers. The idea was that the listener could have a simpler radio, by using signals sent along power lines, and it would be possible to get more signals into a given bandwidth if only one sideband was used. By only partially suppressing the carrier, it could be regenerated in the receiver. The idea didn't catch on, and I suspect that with the technology of the day, the receiver would be more, not less complicated. There was another objection, and one that remains today for radio with a short range, and that is that governments that like to keep their populations ignorant of views other than their own don't like international radio reception.

The Americans took SSB up in the Second World War, and used it very effectively for communications from North Africa to the USA, where more powerful British sets failed to reliably get back here. I assume that they used it elsewhere also. So typical that a British idea is exploited elsewhere.

KW Electronics

The KW company was started by **Rowley (Roland) Shears G8KW** and **Ken Ellis G5KW**, hence the company name. It appears this was in 1956. The company was relatively short-lived, and situated in Dartford. A reason for this was that the designs failed to successfully integrate receiver and transmitter, making it harder to achieve quick and easy changeover between receive and transmit, where competitors did this better. Growing infiltration from foreign imports from low-cost countries was probably also a factor, even after they did have a properly integrated product.

The company was taken over in the 1970s by Granger Associates who used the plant to assemble their products. They discontinued the amateur gear, and made professional MF and HF radios.

Circuit Description

So, to the set in question, **Fig. 1**. It covered the 80 to 10m bands as they were then, the actual bands being 1.8 to 2.0, 3.5 to 3.7, 3.7 to 3.9, 7.0 to 7.2, 14.0 to 14.2, 14.2 to 14.4, 21.0 to 21.2, 21.2 to 21.4, 28.0 to 28.2, 28.4 to 28.6 and 28.6 to 28.8Mc/s. Note the strange gap at 28.2 to 28.4Mc/s, unless the specification was printed incorrectly. A disadvantage of this architecture is the many narrow bands to cover the range. A wider VFO and first IF could make it easier to use, though at the expense of likely more trouble with unwanted signals getting through. A tunable first IF would counter that at the expense of, well, more expense. There was a matching transmitter, though the only interconnection was the muting line. It was the KW2000A at £220. In the absence of being able to find a circuit, I have drawn a block diagram of the set, **Fig. 2**.

This is a best-effort attempt and will not be either complete or entirely accurate. For example, I have not shown all the tuned circuits as this would be hard to determine, but I have shown the general layout and essential detail to enable it to be understood in principle. This is required because it is not a conventional superhet: even as dual-conversion sets go, though it is also not unique, and similar architecture was/is used in other sets.

Who got there first, I don't know. It is a dual-conversion superhet, with a wide first IF, at a fairly high frequency of between 2.955 and 3.155Mc/s, and a second IF of 455kc/s. The high first means that image frequency rejection is much better than if a low IF were used, and then a 'normal' second IF where it is easy to get the required bandwidth with sensibly attainable *Q* of the filters. All active devices are valves, with power and signal rectifiers being solid-state.

The first local oscillator (LO) is fixed for each band by a crystal, so there is a bank of them. This gives high stability with easy circuitry. The crystals plug into the PCB, there is no oven, but that is good enough. The set does not dissipate much power, 60W, and the crystals are away from the transformer and output valve. The case as can be seen, **Fig. 3**, is designed for easy heat loss. The set is entirely built on a PCB, front panel controls excepted. The options are also on PCBs if fitted. Our set has the crystal calibrator, but not the *Q*-multiplier.

The calibrator can be seen as the small PCB standing vertically with what appears to be two valves horizontal, but the taller one is the high-quality crystal. If it had the *Q*-Multiplier too, the bandwidth would be variable down to 200c/s, from the standard 3.1kc/s. That was optimised for SSB, and a bit narrow for broadcast AM, but then this set was not designed for that use, and any AM broadcasts received were a bonus, assuming that they didn't come as break-ins to the amateur reception! The crystal calibrator was £6 extra, the *Q*-Multiplier was £8-10s. I have no details on the latter. The radio itself was £105.

So, to the circuit detail. The aerial signal is manually tuned for peak using the calibrated control. This is not the tuning control though, that comes later. The signal is fed to an EF183 high-slope low-noise pentode (of TV fame), whose amplified output is again tuned before going to the first mixer. There is only one coil used for each of these circuits covering the whole range in as-

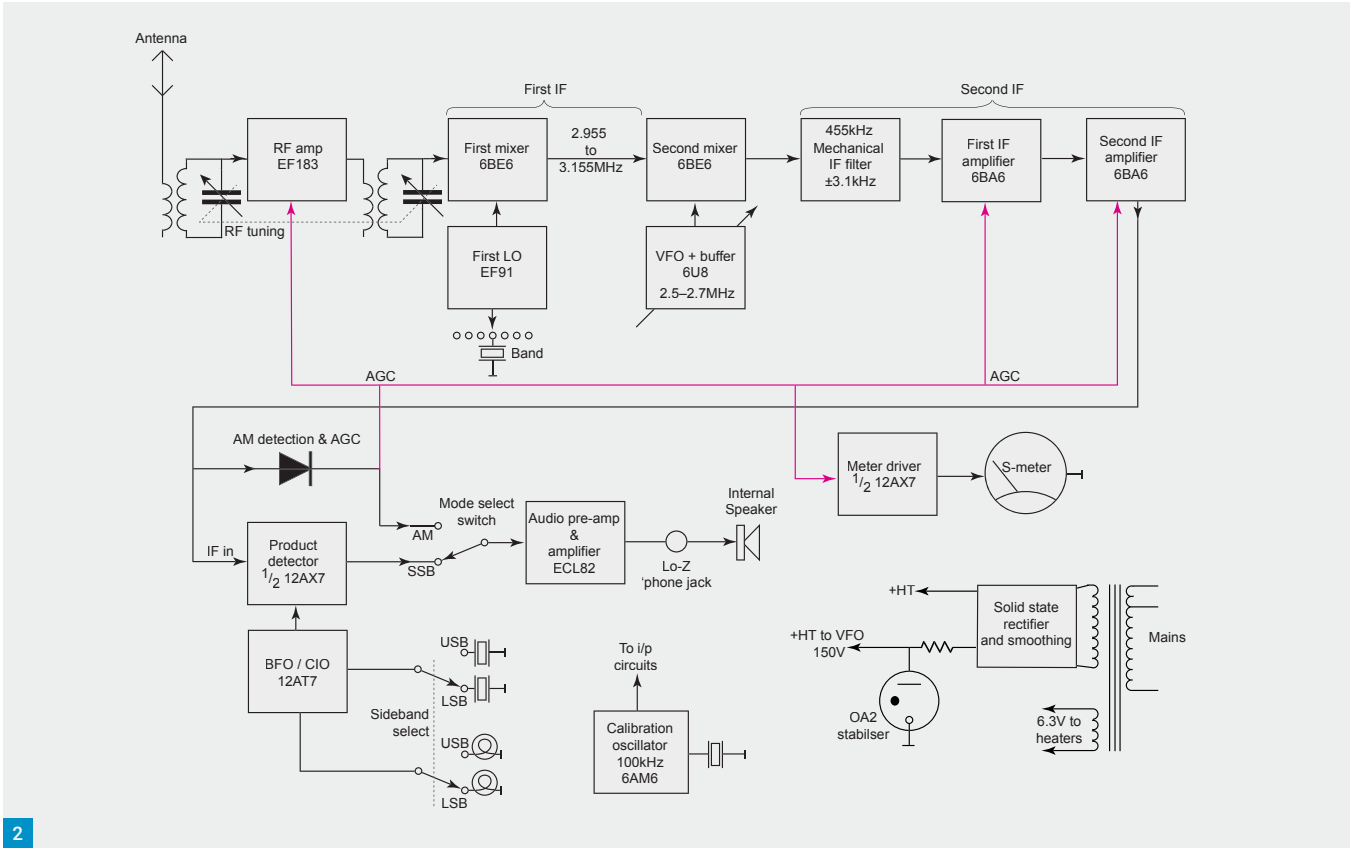

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Fig. 1: The KW201. Fig. 2: Block diagram of the circuit. Fig. 3: Top view, note the perforations in the case for easy heat loss.

sociation with the tuning capacitor. Tuning is attained by first selecting the band, which selects the crystal for the first LO, then tuning the required frequency with the VFO within its 200kc/s range. This comprises a 6U8 (ECF82), with a pentode oscillator and triode buffer. The VFO was imported from Italian manufacturer Geloso, who are thought to have influenced the design of the radio.

Here I note that all but two valves are given their American style numbers, despite this being a UK set, using UK or European valves. I have added the familiar numbers in brackets after the original numbers. The first mixer is a 6BE6 (EK90) heptode. The crystal oscillator is a 6AM6 (EF91, Z77). This is the 'straight' version of the 6BA6 (EF93) variable-mu pentode. Again, the EF91 is of TV fame. The output from the first mixer goes to the second mixer, again a 6BE6. Its output goes to a mechanical filter at 455kc/s, which has a bandwidth of 3.1kc/s at –6dB and 6kc/s at –60dB, then to two stages of amplification by 6BA6s. Thereafter depending on mode chosen, it either goes to a diode for AM reception, or a product detector in the form of a 12AX7 (ECC83), where it is mixed with another crystal-controlled oscillator, whose frequency is either above or below the IF to give either USB or LSB, whichever is selected. These can be seen on the right-hand side of the PCB, with the 12AT7 between them, and they are of the very high-quality glass-encapsulated type on B7G bases. Two crystals are needed for this as a single crystal cannot be 'pulled' far enough to cover both frequencies. The valve is a 12AT7 (ECC81). CW can be received on either a CIO (carrier insertion oscillator) or BFO (beat frequency oscillator) – really the same thing, except while a 'sniff' of BFO is all that is needed, for SSB reception without severe distortion, a very much higher level is needed. Ideally there would have been a very narrow filter for CW reception, but there is no dedicated filter in this design.

The designer was very keen to ensure you knew which sideband you were on, hence the two rather large, rectangular illuminated signs at the upper right-hand side of the front panel. In either green or red suggesting either go or stop, or safe or danger! Whichever demodulated/detected signal is chosen, it is then fed to an ECL82 triode-pentode audio pre- and power amp, then to an internal 2.5Ω speaker. A headphone socket intended for low-impedance 'cans is provided, which cuts off the speaker.

The S-meter is calibrated for 50µV at S9, and is driven by a 12AX7 (ECC83), which seems rather elaborate for the purpose. As there is only one 12AX7, only half is used for the product detector. Not on the list of valves in the manual is the OA2 voltage stabiliser, which is only used for the supply to the VFO. You might have thought that the same supply would be used for all the oscillators. The magnet for the speaker is just visible about in line with it, poking through the metalwork on the right-hand side.

Work

There were only two problems to get this set running. One was due to the failure of the manufacturer to mark connectors. The other was rather more awkward. The set was generally in good condition, and after having its face washed looked very respectable. But it was completely silent. Nothing. Suspicious. No smoke and heaters on, and HT was found. Also, a suspicious number of places had high negative volts on. I suspected that two very small sockets on the rear were mutes, but just shorting together two unknown sockets, one with this high (~50V) voltage and earth, seemed risky, I didn't want to be the cause of smoke… I used a 1kΩ resistor. The set came to life so I permanently wired the sockets together.

The higher ranges when peaked seemed too sensitive and too many signals, leading me to the correct conclusion that the RF amplifier was oscillating. Inspection revealed nothing. If there were 'stickys' as I call the old waxed-paper capacitors, I would suspect them and change them as a matter of course, but this is too new for them, and the decouplers were ceramic disc, generally very reliable. Soldering looked fine. The solution turned out to be to replace the 10Ω anode-stopper, which by the way had already more than doubled in value, to 100Ω. Problem solved. Not entirely satisfac-


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tory as I did not find the cause of the problem, but that could involve replacing a lot of components before finding a solution.

Although this set seemed lively enough, I have discovered that there is a potential future fault according to **Steve Shorey's** website (see Acknowledgements). That is the Kokusai mechanical filter is lined with foam rubber, which disintegrates into sticky goo, and causes the filter to increase its attenuation. It should not exceed 12dB. That seems a high value anyway. A crystal lattice filter would have an insertion loss more like 2dB.

This is a nice compact set, and for a short-wave listener with ideas of getting licensed, who wants to get the hang of how amateurs operate, on analogue signals that is, it is quite attractive if the price isn't too high. As a collectors' item, it is also an attractive set. It is quite complicated to understand for a beginner though, not being a simple superhet design. The performance seems very good: 1µV for 20dB signal-to-noise on all bands. The conditions are not stated, but I assume as it is specifically for SSB, that is the mode concerned.

Acknowledgements

I would like to acknowledge the following sources, which enabled me to write this article:

- **James Sawle MD0MDI**, whose website (below) has the handbook to the set, regrettably without the circuit, despite listing all the components etc. It appears to be complete though.

www.md0mdi.im

- The Radiomuseum website (below) has short-form information on the set and thousands of others! A very interesting site.

www.radiomuseum.org

- An advert for the set appeared among other dates in *Short Wave Magazine* in a 1967 copy. This was found at:

https://tinyurl.com/munhm9f8

- The site of Steve Shorey has many KW sets displayed with comments. Also, a history of the company and other content: I have found this very useful, and the site is a good read.

G3ZPS.com

The BVW&TM is in Dulwich:

www.bvwtm.org.uk **PW**

Radio News

CAISTER MARCONI RADIO STATION CONTACTS MORE THAN 160 AMATEURS IN 25 COUNTRIES: Radio amateurs at Caister Lifeboat in Norfolk managed 162 contact in 25 different countries on Saturday 23 April when they took part in the annual International Marconi Day (IMD) event to mark the inventor's birthday.

Using the call GB0CMS and a mixture of Morse code, telephony and data (FT8), contacts were made with other radio amateurs across the UK, Europe, the USA, Canada and Australia. Notable contacts were made with other IMD stations in Newhaven, East Sussex and Chelmsford – the home of Marconi's original factory.

Other long-distance contacts were made with Ian VK3MO near Melbourne in Victoria, Australia and John VK6WC in Chidlow, Western Australia.

The Norfolk Amateur Radio Club (NARC) ran the all-day special event station at Caister Lifeboat to commemorate the village's original Marconi Wireless Station, which was established at Caister in 1900. The station was in a house in the High Street known as Pretoria Villa and its original purpose was to communicate with ships in the North Sea and the Cross Sands lightship.

The equipment used was 200W maximum from a Kenwood TS-480 (20m) and 100W maximum from an Icom IC-7300 (40m). Antennas were a W5GI dipole on 40m and G0KYA-designed monoband end-fed half-wave vertical for HF.

The photo shows PW columnist Roger Cooke G3LDI operating the station.

LUNCH ON THE AIR: Radio amateurs in Staffordshire are invited to join Lunch on the Air, a new VHF net that will be held every Wednesday lunchtime, 12.30pm onwards, on 144.700MHz from 11 May 2022. Chaired from the county town of Stafford and launched by Daniel M7CFW, a member of Stafford and District ARS G3SBL, initial trial nets have been promising with a good uptake from amateurs, reaching most of the county at moderate power levels. Daniel says it's a friendly net aimed at those at home, working from home, caring from home or having lunch in the area who want to call in. Alternative frequency is 145.375MHz and web details are at:

https://2mfm.uk

CADET RADIO EXERCISE BLUE HAM 22-1: Across the UK Cadet Stations came together and took part in Exercise Blue Ham over the weekend of 26/27 March 2022. Blue Ham is a radio communications Exercise on the 5MHz (Shared) Band. The exercise has been running for a number of years and was introduced to broaden the Cadet experience of radio operation and to reach out to radio amateurs who may be interested in joining the Cadet Organisations as Radio Instructors. During the exercise, Cadet Forces Adult Volunteers (CFAV) and Cadets operated HF radio stations contacting radio amateurs with the purpose of exchanging specific information during their QSOs. The Blue Ham Co-Ordinator issued 25 MRE callsigns for the Exercise. This included ten Cadet stations that had never participated in Exercise Blue Ham before. This time around it was great to see and hear many cadets back behind the microphone with plenty of excellent teamwork going on at the stations to handle at times the pile-ups of people calling them.

Conditions on Saturday morning were a bit quiet but did pick up greatly after 10am when they improved a great deal, which continued throughout the rest of the weekend. On both days all the assigned frequencies within the band showed some excellent Inter-G and many stations also managed to work out to the Baltic coasts.

There were again many contacts with Portable stations, which may have been down to the good weather conditions. It was also noted that Cadet operating procedures and prowords were used by amateur radio participants, which helps out immensely with the new Cadets operators who may have been first time users of HF equipment – thank you.

The online log page has listed some 1225 QSOs made by Cadet stations during the period of operation, which is a great result but showed slightly down on the last couple of Exercises, which were run through Covid lockdown. The log also showed many amateur callsigns that had been logged on previous Exercises plus quite a flurry of new callsigns who gave their support, time and patience, which again indicates how popular the exercise has become.

There were four Data capable stations on air using mainly OLIVIA 16/500 with some switching to BPSK31 when asked to by amateur operators. This attracted a number of amateurs with some new callsigns appearing for their first go at Data modes. During the Exercise Amateurs were contacted across the UK, Republic of Ireland, Sweden, Norway, Denmark, Netherlands,reaching Jersey in the south and the Shetland Islands in the north.

The organisers would like to thank all of the Cadets, CFAVs and amateurs for their time and effort they put into exercise weekend. The next exercise is programmed for 11/12 June 2022 and the best place to find out more information is at:

https://tinyurl.com/ycx3rjpk

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Why Not Try 6m?

To coincide with the start of the summer Sporadic-E season in the Northern Hemisphere, **Colin Redwood G6MXL** encourages readers to explore the 6m band.

Before looking at the 6m (50MHz) band, I thought it would be a good idea to introduce readers to Sporadic E propagation. Every year amateurs in the northern hemisphere are blessed with some enhanced propagation known as Sporadic E. This rather erratic enhancement can result in much stronger signals and better propagation than is usually encountered at sunspot minimum on the 10m, 6m and 4m bands. A previously dead band can suddenly become alive with strong signals from distant stations. Occasionally the enhancement can extend as high as the broadcast FM band II frequencies and even up to the 2m (144MHz) band. Most years the Sporadic E season runs from about mid-May to early August. With this in mind, I thought it would be timely to look at the 6m (50MHz) band.

6m

While Sporadic E may be the propagation mode that most newcomers to 6m will encounter during the next few months, just about every propagation mode that occurs on other HF and VHF bands may also be encountered, ranging from ground wave to EME (moonbounce). While many will think of the 6m band as a DXing band, there are also plenty of opportunities to make local contacts using ground wave and occasionally tropospheric enhancement.

UKSMG

If you get a real interest in the 6m band, then I'd certainly recommend joining the UK Six Metre Group (UKSMG). Besides a quarterly magazine, UKSMG organise a number of contests during the year. I'd also suggest visiting their website at: **www.uksmg.org**

Transceivers for 6m

These days most HF transceivers include the 6m band. It is worth checking whether any built-in ATU operates on 6m or not. This will inform your choice of antenna or the need for an external ATU. Some transceivers include a separate antenna socket for 6m, while others share a common antenna socket with the HF bands. With some transceivers the output power on 6m may be less than on the HF bands (perhaps 50W instead of 100W). If you like low-power (QRP) operation, models such as Yaesu's FT-817 and FT-818, Icom's IC-705 and Elecraft's KX3 all incorporate 6m.

Transverters

If you have a HF transceiver without 6m, then you could consider a transverter enabling you to operate on 6m with a low power 28MHz drive from your main HF transceiver. Remember to check the maximum power input your transverter can handle from your transceiver. In many cases this will be 5W, but it can be as little as 1mW. Transverters are available from a number of sources in the UK and abroad. Some are ready to use, while others are available in kit form. Unfortunately, one popular source of transverters is currently unavailable due to the war in Ukraine.

Antennas

I'd suggest avoiding pontificating over the 'best' antenna for your initial foray on 6m. To get on 6m simply and cheaply, a centre-fed wire-dipole that is 2.85m long (with insulators) or 2.90m long without insulators should do the job. I'd suggest cutting the wire a little longer and then pruning it a cm or two at each end until you get a reasonable match. If you are using an inverted-V configuration, then you'll probably find that the length will end up a few cm smaller than the suggested lengths above. Attach some RG58 or RG213 feeder at the feedpoint, not forgetting to seal the feeder against moisture ingress, and you'll have antenna that will be sufficient to get contacts when the band is open. Enjoy working whatever you can during the summer!

In comparison with the HF bands, antennas for 6m can seem relatively small. A simple dipole cut for the band will work surprisingly well. I've made 6m SSB contacts across the Atlantic Ocean using as little as 10W to a dipole. A Moxon or a Yagi will give better results, and enable a useful degree of directionality to be used – which can be helpful for more predictable propagation modes such as tropospheric enhancement, rather than Sporadic E, the favoured direction for which tends to drift. Designs can be found in one of the books referred to later. If you are planning on building your own Yagi for 6m, remember to cut the elements accurately to length if you want to get the very best performance. If you are planning to operate away from home, you need to consider boom and element lengths if you propose to transport them in the typical family car or on foot.

Commercial 6m antennas are available from many amateur radio dealers, including those advertising in *PW*. The May 2022 issue of *PW* included a review of a commercial 4-element Yagi for the 6m band. If you are also looking for a Yagi antenna for the 4m (70MHz) band, then you may wish to consider designs that incorporate both 6m and 4m elements on the same boom, such as that shown in **Fig. 1**.

If you are planning to add a 6m antenna to your existing VHF/UHF antenna mast and rotator, it is worth bearing in mind that 6m antennas are generally much bigger that their 2m counterparts, and thus heavier and present a greater wind loading on the mast and rotator. You'll also need to check that you have enough space at ground level when you luff (tilt) your mast over.

Polarisation

As with other VHF bands, by convention 6m operators generally use horizontal polarisation for SSB, CW and Data Modes, and vertical polarisation for FM. Sporadic E signals often get their polarisation changed during their passage through the ionosphere, so antenna polarisation is perhaps not too critical. For some other modes, such as ground-