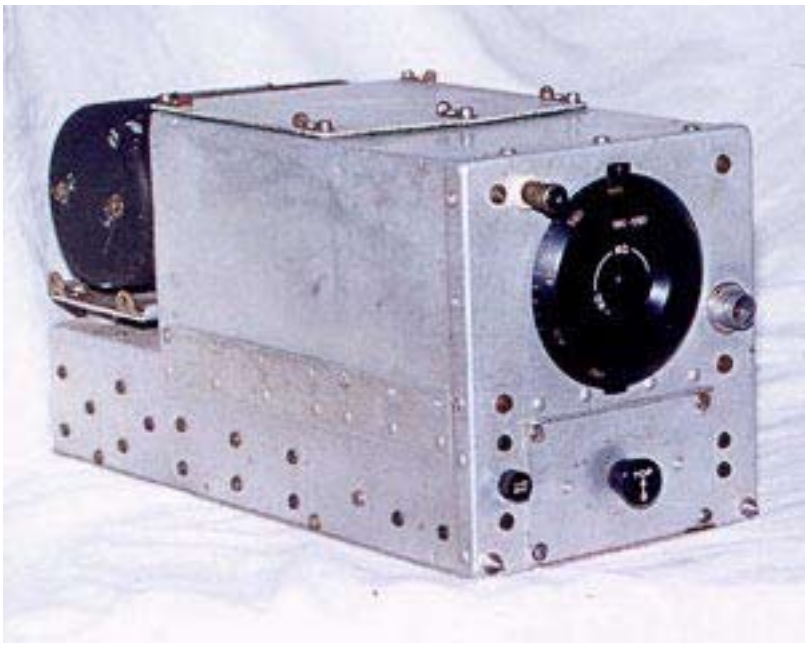
The BC453 plus Receiver Type 78

By Derek, G3GRO

Most "Old Timers" active in the late 1940's and early 50's in those halcyon days of abundant availability of ex-government "surplus" at low prices will remember a little receiver often called "The Q5-er " but more properly known as the BC453. This was one of a set of similar receivers covering different frequency bands for airborne use and known as the "Command Receivers" – The BC453 covered 150Khz to 560Khz, the BC454 covered 1.5 to 4.5Mhz and the BC455 4.5 to (I think) 9.0 Mhz. I seem to remember that there was also a version covering the medium wave band but they were fairly rare. These compact receivers were beautifully designed and made in the USA by Bendix in large quantities together with the matching transmitters and were fitted in aircraft such as the Liberator etc.



The receivers were designed for remote tuning control via a bowden cable although it was possible to remove the cable attachment and fit a tuning knob adapter on the front panel which had an engraved calibrated dial. Each of the 3 receivers had a similar line-up of small metal cased, octal based 12-volt heater type valves with as I recall it a 12SJ7 RF stage, 12SK8 mixer, 2 x 12SK7 IF stages, 12SQ7 detector and BFO, and finally a 12A6 audio output stage. Each receiver had it's own little "dyna-motor" rotary DC-DC converter on the back to produce +250V HT supply from the 26V aircraft supply. The 12 volt heaters of the valves were connected in series- parallel across the +26V supply. The two higher frequency band versions were quite useful for covering the 160m, 80m and 40m bands but having a fairly high IF frequency, they were not very selective even for those days when double side band AM was the normal phone mode. However, the BC453 was a horse of a different water! It found considerable popularity as an add-on adaptor to a main receiver to enhance the selectivity of the average receiver which by modern standards was pretty poor especially in the case of many of the ex-government receivers commonly in use. It also found favour as an IF and audio "back-end" for use with purpose-built converters for different bands.

The BC453 was convenient in that it covered the common IF frequencies at around 455hz as well as tuning up to 560Khz. The key thing about the receiver however was that it had an unusually low IF of 85Khz with 3 double-tuned high-Q circuits in the IF chain. It was also possible to mechanically adjust the spacing and hence magnetic coupling between primary and secondary windings in each of the 3 double-tuned IF transformers so as to vary the overall selectivity. This was achieved by unscrewing a black plastic cover on top of each of the IF cans which gave access to a small fibre rod which when moved in and out, increased or reduced the coupling accordingly. It was possible to reduce the bandwidth when the coils were under-coupled down to well under 1Khz – very useful indeed for CW! Alternatively, by increasing the coupling to slightly over-coupled one could achieve a classic slightly double–humped response with about 3Khz bandwidth and very good skirt selectivity – probably only bettered at that time by a pair of half-lattice crystal filters or a Collins mechanical filter which were fairly rare at that time and of course the Collins filters were very expensive (as they are even now!)

The most common arrangement was to take a "sniff" of IF signal from just after the mixer or first IF in the main receiver and feed it to the input of the BC453 which was then tuned to the centre of the IF of the main RX and then left tuned at that frequency thus converting the overall system to a double superhet.

When it initially appeared on the surplus market, the BC453 was of course used in the AM and CW modes. It was only in about 1954/55 that SSB started to appear and of course put greater demands on the receiver requirements in terms of selectivity and stability etc. to achieve the full potential of the mode. The BC453 performed very well indeed in the SSB mode. By offsetting the BFO to just down the upper or lower skirt of the IF it was possible achieve a very good single-signal type response with good unwanted sideband rejection. Unusually, the BFO injection level was high enough to get good audio without distortion which was not the case with many receivers of the time and very few receiver had a so-called "product detector " specially designed for SSB mode.

The BC453/Type 78 Combination

I initially acquired my BC453 brand new and boxed in around

1950 around the time when I was first licensed at the princely sum of twenty five shillings in old money – worth at least £ 25 at today's values I guess. I used it initially with a home-brew converter but shortly after I acquired another surplus unit of which there were not many around called Receiver Type78 made I think by STC. It was in fact just a down converter covering the frequency range 2.0 to 12Mhz in two bands with an IF output of 560Khz feeding an external main IF receiver unit. The thing which immediately drew attention was the illuminated translucent circular tuning dial about 5 inches diameter on which were engraved two concentric spiral calibrated frequency scales, one in green and the other in red for the two frequency bands. These scales were each effectively about a metre long calibrated every 10Khz giving an excellent frequency resolution down to at least a couple of kHz which was very unusual for those days when band-spread scales were a rarity. There was also a 100Khz crystal calibrator to ensure a high degree of absolute accuracy. The local oscillator tuning was also unusual in that it was via a rotary "roller coaster" inductor with the whole LC circuit temperature compensated to give good frequency stability. The valve line-up in the type 78 was again unusual in that it employed the famous red metal can EF50 valves used by the million in wartime radar sets. The high IF at 560Khz gave quite a good image rejection on the 40m and 80m bands which were my main interest at the time. One other unusual feature was the inclusion of a device called a "Desynn Trimmer" mounted in a round metal can which appeared to be a type of a DC servo controlled variable capacitor to enable a degree of remote frequency tuning if required.

With the advent of SSB around 1955 greater demands were placed on receivers to enable the full advantages of the mode to be achieved. The BC453 and Type 78 performed very well on this mode. One modification I devised for the BC453 in particular was very worth while. This was the introduction of sideband switching achieved via a front panel toggle switch which connected a small trimmer capacitor across the BFO coil in order to move the BFO frequency from one side of the IF pass band to the other and at the same time, switched in a small trimmer across the local oscillator circuit to introduce an equal and opposite frequency shift so the nominal suppressed carrier frequency remained the same. It was therefore possible to switch sidebands to check for sideband suppression or distortion products etc. on an incoming signal without the need to move the main tuning dial. This was a facility, which many more expensive receivers at that time did not have.

I used this receiver set-up to very good effect until the early 1960's and only replaced it by a completely home-brew receiver with a high dynamic range front end and twin half-lattice crystal filters with excellent shape factor to combat the appearance of another amateur only 200 yards away from my QTH also active on 80m with 400W PEP!! He of course was having the same problem from me since I was also QRO with 250W PEP and he had to follow a similar course of action. This led to a joint interest in high performance receiver design!

One final comment. I very rarely ever saw another Receiver Type 78 in the surplus shops but only a few years ago whilst looking around a vintage Sunderland flying boat in the new aircraft museum at the marina in Southampton, there in the HF radio bay, large as life, was the full set-up comprising the Type 78 and associated transmitter units apparently in full working order. The aircraft had been converted to carry 45 commercial passengers with a high degree of comfort and was still airworthy having flown into Southampton Water from Australia. A few months later I saw it again on TV taking off for the USA destined for a private museum. Only a few months ago I saw the same aircraft yet again on TV featured in a programme about this millionaire who owned a fleet of vintage aircraft and there in his hanger was the same Sunderland. - Small world !

73 de Derek G3GRO