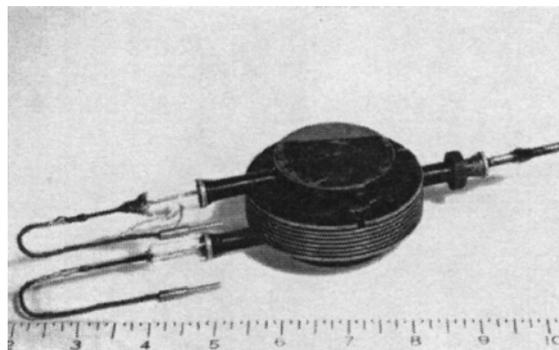


## NT98C – Early British S-Band Magnetron



NT98, Admiralty Pattern or A.P. W2510, was the early British cavity magnetron in production, directly derived from the [E-1189](#) prototype. E-1189 was designed by Eric Megaw at GEC, starting from the prototype assembled by Randall and Boot at the Birmingham University. The filamentary cathode, used in the first E-1189 six-cavity prototype, was replaced by more efficient oxide-coated cathode, taking advantage of the parallel work of Gutton at TSE, Paris. The design was modified to 8-slot. According to a **report by Megaw**, GEC had built 15 samples of E-1189 with 6-cavity anode block and 4 more with 8-cavity at 11 October 1940. The sample No. 12, the best one of the batch containing six and eight-slot samples, was brought to U.S. and Canada by the Tizard Mission in August 1940.

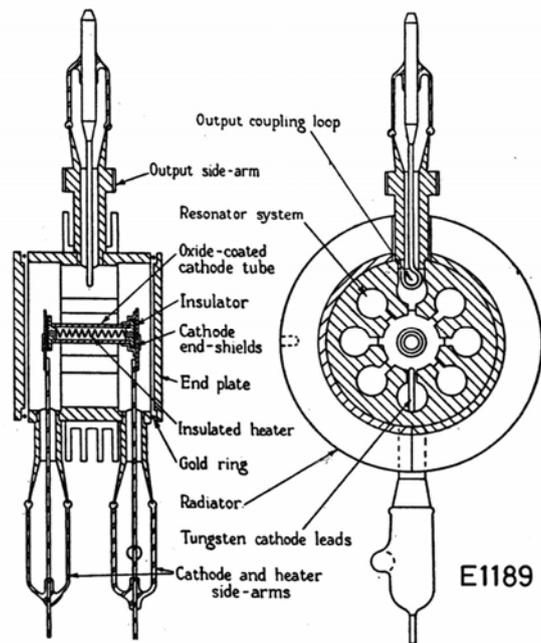


- Photo of the E1189 No. 12, brought to America by the Tizard Mission. It can be seen that the radiator has eight fins. The same type of radiator was used in the about 60 samples produced in USA by Bell around the late 1940.

About 60 copies of the sample no. 12 were built by Western Electric, some of which distributed to American research laboratories, headed by MIT Radiation Lab. Here the photo of the WE developmental type D-160052 S/N. 56 still surviving today in the collection of Jerry Vanicek, TCA.



Certainly other qualification copies were made by Raytheon, but their number is not known. Supposedly in the late 1940, being in very short supply copper and other imported materials used in the fabrication of magnetrons, the design was revised. In all the successive productions the original 8-fin copper radiator visible in the above photo was replaced by the 4-fin machined-brass one.



- Drawings of the E-1189 once released for production by GEC and BTH. The 4-fin radiator is clearly visible.

E-1189 was used in the S-band Naval radar Type 271, capable of detecting a ship at 12.000 yards and a submarine periscope at about 1300 yards. Still unstrapped, its typical output pulsed power was limited to less than 10 kW. The first radar prototype, by Admiralty workshop, was installed at the end of March 1941 in HMS Orchis. Radar Type 271 was fully operative by summer 1941. E-1189 was later standardized as NT98, Amiralty Pattern W 2510, and then approved as CV1255. As said below four frequency selections were then specified, suffix A to D, to prevent interferences between radar sets of different battleships in the same formation.

In Canada we find a direct equivalent of E-1189/NT98, the [REL 3D](#). Almost certainly this production derives from the Western Electric D-160052 prototypes. As

shown in the photo below, 3D magnetrons were built for REL by Northern Electric, the Canadian sister company of Western Electric.



Quite soon NT98 gave origin to four frequency selections, A to D, later approved as follows:

- NT98A = **CV1491**      3030 to 3060 MHz
- NT98B = **CV1492**      3005 to 3030 MHz
- NT98C = **CV1493**      2980 to 3005 MHz
- **NT98D** = **CV1494**      2940 to 2980 MHz

All the above types were still unstrapped. Their power was limited to about 10 kW peak, due to their tendency to oscillate at frequencies different from the pi-mode during the buildup of input pulses. Data given in the acceptance spec sheets for the CV types above talk of 8 kW typical peak and 5 kW minimum acceptable output power. As local oscillator in the receiving section was used the **CV35** klystron.

Since the late 1941 NT98 was superseded in new designs by the strapped version **CV56** which was also the first strapped magnetron to go into production. CV56 was capable of generating 100 kW typical output power, with an efficiency around 40%.

The development of E1189/NT98 proceeded in parallel with the development of the 9.1 cm variant E1198/CV38/**REL-3C**, designed for the airborne radar AI Mark VII.

Production volume for NT89 by GEC and BTH was very limited. According to Callick the two British industries built less than 2000 units of both NT89 and CV38 from the late 1940 to the end 1941. CV38 was certainly built in larger quantities, being fitted in many aircraft. Some thousands units were built in the following years to maintain radar sets still in service. No info available about the production quantities of Canadian 3D and 3C.

In the collection a sample of NT98C, dated 1943, still in its shock-proof shipping crate.



- The original shipping crate with a wooden box suspended inside. The magnetron was secured inside a hinged wooden frame, fastened to the internal wall of the box. On the right, the shipping label dated 1943.



- Side by side views of the British NT98 sample and of a Canadian 3D.

Museum exhibits the very early GEC laboratory prototype of 8-slot **E-1189** which was operated by the end of July 1940 plus samples of **NT98C**, **NT98D/CV1255**, **CV56** and its frequency variants **A**, **B** and **C**, plus Canadian **REL 3C** and **3D**.

Last edited in October 2021.