Michael Kuhne, DB 6 NT

A UHF-SHF Marker Generator

The marker generator described below is intended to simplify and facilitate the monitoring of frequencies and the calibration of SHF transverters in ranges from the 23cm band right up to the 3cm band.

1. INTRODUCTION

The active radio amateur is always faced by the same problem - the precise frequency of his or her SHF station has to be checked. However, all that is usually available is a frequency meter with a good 10 MHz oscillator - which can be used only on measurements up to 2 GHz.

Now, if a 10 GHz transverter has to be measured, things are already getting difficult. So a frequency which the frequency meter can still process has to be included in the multiplier chain. Very few units have provided for corresponding outputs at which measurements could be taken, so the unit has

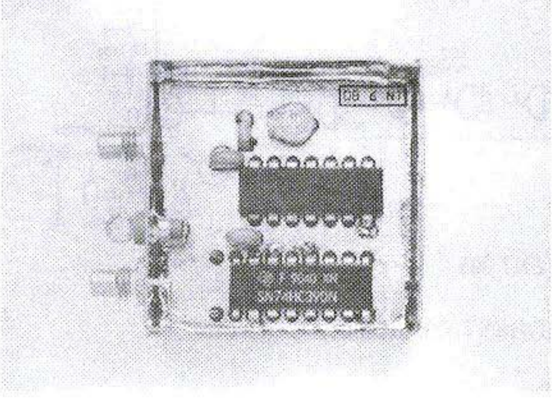


Fig.1: The Marker Generator

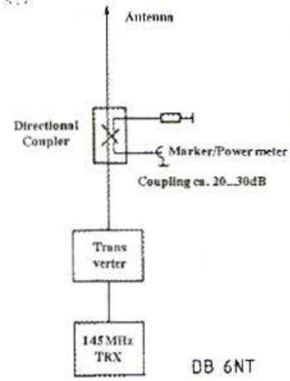


Fig.2: Measurement Rig with Directional Coupler

to be opened up for this purpose and possible taken apart, to provide better access to the individual assemblies. Receiving an SHF radio beacon is a considerably easier option. Of course, if there are no beacons within a suitable distance, it makes sense to use a marker generator (Fig.1).

2. USING THE GENERATOR

The marker uses an external 10 MHz timebase as a control source. Since, as already mentioned, commercial meters are often available with high-precision TCXO's or OCXO's, which almost always have a 10 MHz output, it is not necessary to take on the additional work of constructing a precise time-base.

At intervals of 1 MHz, the marker generates signals which can be received with a good signal-to-noise ratio up to 10 GHz. The precision of the marker stands or falls with the precision of the external 10 MHz timebase.

A directional coupler looped into the antenna feed (Fig.2) makes it possible to monitor the frequency even during the station's normal operation. To this end, the marker's signal is fed into the coupler. The output power of the station can thus also be monitored using the coupler.

Since the marker generates a wide frequency spectrum, you must also make sure that only the desired frequencies are received, without any of the intermediate frequency break-through. It would also make sense to use a suitable band filter between the marker and the test piece.

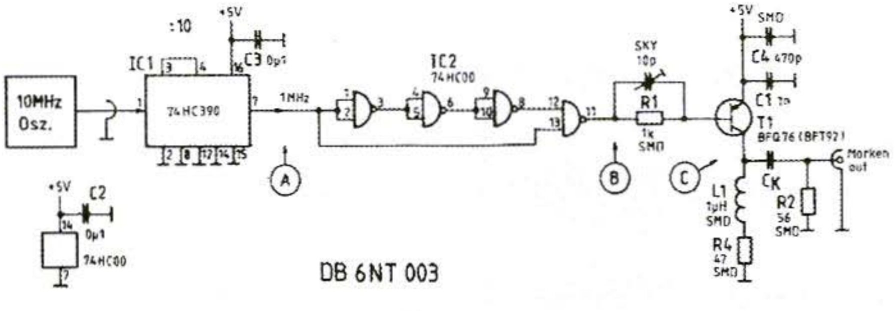


Fig.3: Circuit Diagram of the DB6NT 003 Marker Generator

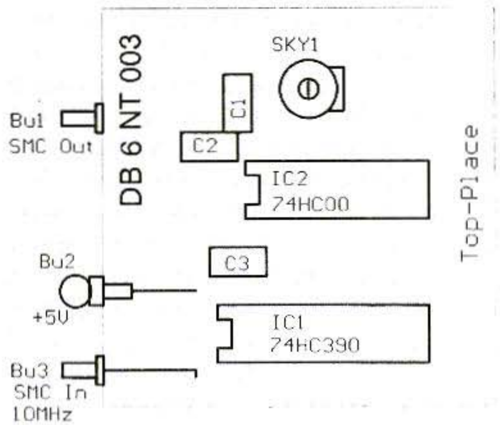


Fig.4: Component Overlay - top side

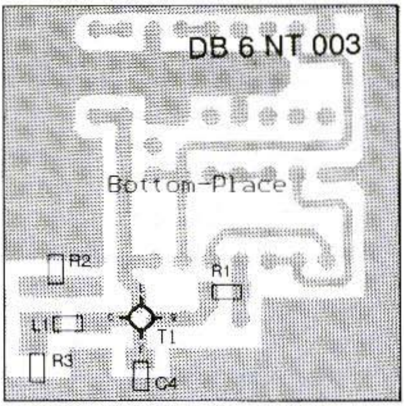


Fig.5: SMD Components - under side

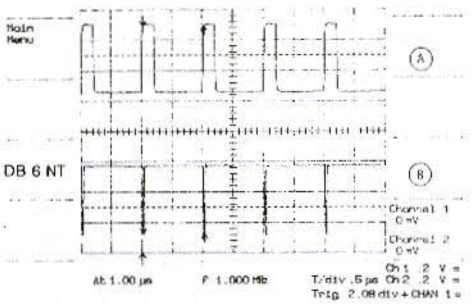


Fig6a: Signal at Test Points A and B

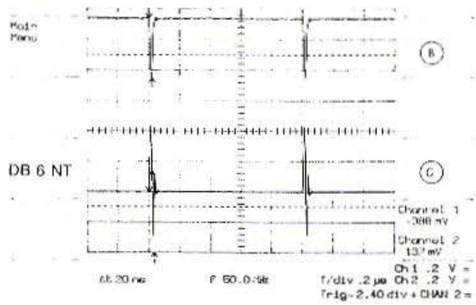
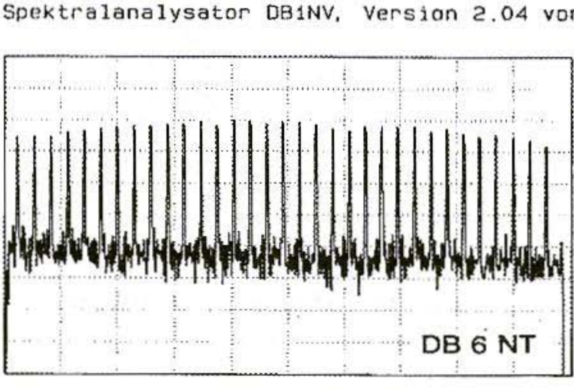


Fig6b: Signal at Test Points C and D



Vertical:	5dB / Div
Display Width:	30 MHz
Centre Frequency:	2320 MHz
Resolution:	3 MHz / Div
Video Filter:	100 kHz

Fig.7: A 30 MHz span plot of the Marker Generator around 2320 MHz

3. CIRCUIT DESCRIPTION

The 10 MHz signal supplied from outside arrives at the divider, IC1, a 74HC390, which divides the signal down to 1 MHz (Fig.3). The subsequent gates of the IC2 (74HC00) generate spike pulses from it, which are fed through the RC combination, consisting of a 10pF Sky Trimmer and a 1kΩ SMD resistor, on the base of T1 (BFQ 76). Here, the transistor generates the harmonic waves desired in this case. These are decoupled through a printed capacitor, which acts as a high pass filter. The 10pF Sky-Trimmer serves merely to set a constant marker amplitude. Apart from that, the capacitor is fully screwed in (max. capacity 10pF).

If the marker is to be used only for frequencies below 3 GHz, the BFT 92 type, in a plastic housing, can also be used as the transistor, T1.

4. ASSEMBLY INSTRUCTIONS

The entire circuit is mounted on a small epoxy printed circuit board measuring 35 x 35 mm. The printed circuit board is soldered into a suitable tinplate housing (37 x 37 x 30 mm). The conventional components, the feedthrough capacitor and the two SMC connectors, are mounted as per Fig.4. Fig.5 shows how the SMD components are mounted on the foil side. When all the components have been mounted and when the operating voltage of + 5 V has been fed in, the equipment should be ready to operate. Fig's.6a and 6b show the measurement curves which are obtained at the points marked A, B and C on the wiring diagram. Fig.7 shown the marker generator output signal on a Spectrum Analyser.

5. COMPONENT LIST

IC1	74HC390N
IC2	74HC00N
T1	BFQ76 (BFT92) SMD
SKY1	10pF SKY trimming capacitor, black
C1	1nF RM2.5 ceramic capacitor
C2/C3	0.1µF RM2.5 ceramic capacitor
C4	470pF RM 2.5 ceramic capacitor
R1	1kΩ SMD
R2	56Ω SMD
R3	47Ω SMD
L1	1µH SMD choke

1 off Tinplate housing, 37 x 37 x 30mm
2 off SMC flanged connectors
1off 1nF feedthrough capacitor