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A Marker Generator for 10MHz and 1MHz Markers

Marker generators are still used for all sorts of purposes, even today, in the age of the low-priced frequency counter. For spectrum analysers or sweep signal generators, for example, or to be able to check the accuracy of the frequency in receivers without electrical intervention.

The present article describes a simple circuit, which does not need costly calibration, and yet produces thoroughly usable data: 10-MHz markers between -40 and -60 dBm in a range between 10 and 900 MHz, 1 MHz markers between -55 and -65 dBm in a range between 1 and 300 MHz. Naturally, markers can still be indicated up to significantly higher frequencies, but the amplitudes decrease sharply.

1. FUNCTIONAL DESCRIPTION

A 74LS00 functions in a known manner as a quartz oscillator at 10 MHz (Fig.1). Naturally, the relatively high quartz stress through the simple oscillator circuit brings with it a certain ageing of the quartz. However, in this application the highest levels of frequency constancy are not required. But, on the other hand, a high-constancy 10 MHz signal with a TTL level can easily be fed in to take the place of the oscillator.

In the later 74LS690, the frequency is divided by 10, so as to generate markers at 1 MHz intervals as well. The two-way switch selects one of the two markers using the open collector technique.

The later NAND gate in the advanced low-power Schottky technology, a 74ALS00, has a very short gate transit time, and aims to produce a delay in the region of a few

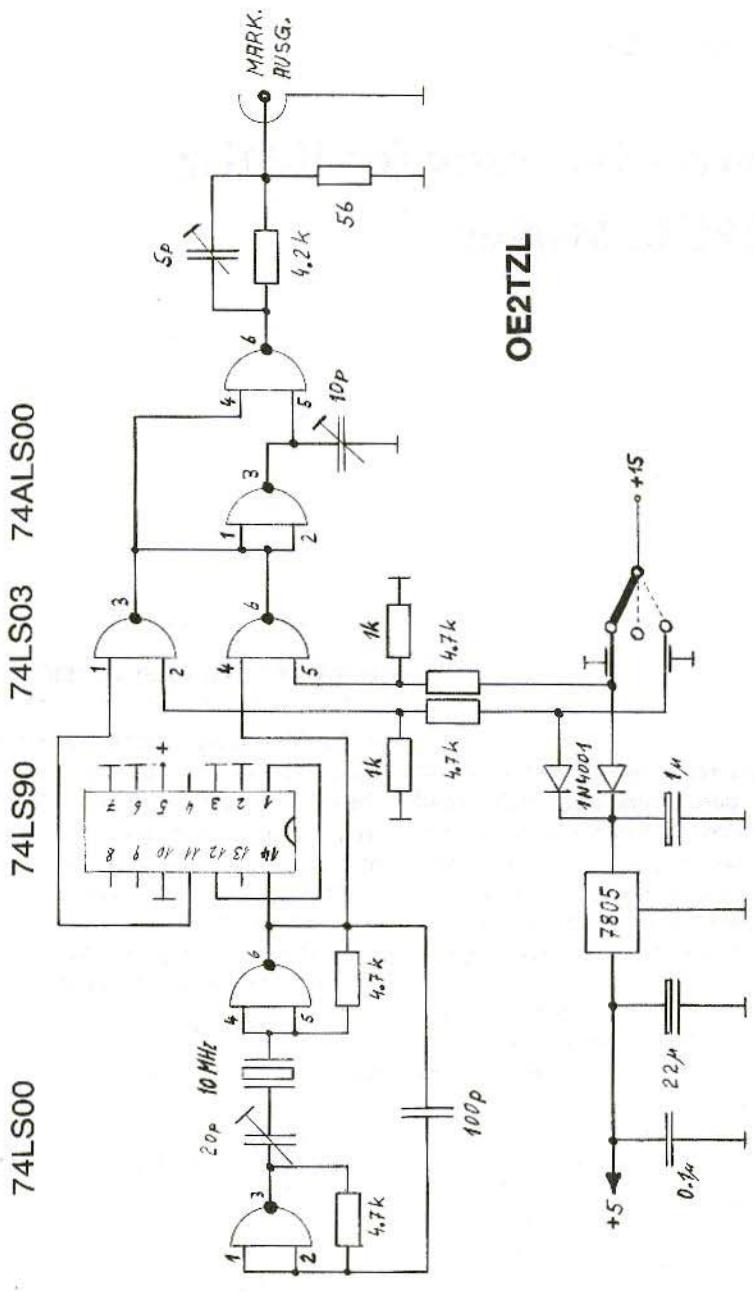

Fig.1: Circuit Diagram of the Frequency Marker Generator

nanoseconds, which can be adjusted, within limits, using the 10pF trimmer. This type of delay has led to better results than using 2 or 3 gates.

In the last gate, the delayed signal and the direct signal are combined to form a very short spike pulse. The skirt gradient decides the harmonic wave spectrum!

To obtain the highest possible limiting frequency, a 74ALS00 must be used, or, if applicable, even a 74F00.

Behind the last NAND gate, a compensated voltage divider provides an initial voltage, halfway independent of the frequency, which is tuned to 50 ohms. A 7805 voltage controller provides the four TTL integrated circuits.

2. ASSEMBLY

To keep the cost low, the development of a circuit board was dispensed with, since things move just as fast with a single-sided coated epoxy board.

Here the coated side is used as a continuous earth surface, since we are always dealing with frequencies in the UHF range here. The small number of connections are made on the underside, using thin wire. No mountings should be used.

Make sure the lead cable is as short as possible, especially in the section around the 74ALS00.

The obvious idea of using the remaining gates of the 74ALS00 for the oscillator, in order to save the need for an integrated circuit, can not be recommended, for two reasons. Firstly, using this type of equipment involves a considerable increase in the quartz stress, andsecondly connections within the integrated circuit lead to a sharp drop in the upper frequency limit.

3. CALIBRATION

First, the exact quartz frequency of 10 MHz must be set on the 20pF trimmer, either by monitoring the zero beat frequency on the short-wave receiver using one of the known normal frequency transmitters such as WWV, or by means of the frequency counter, which is connected to pin-6 of the 74LS00 through a small coupling capacity of approximately 10pF.

With a spectrum analyser, the two trimmers can be calibrated alternatively at the start to an amplitude spectrum of 10 MHz markers as constant as possible. If no spectrum analyser is available, the following trimmer setting is also adequate: 10pF trimmer to centre, 5pF trimmer almost turned off.

The complete little unit comes in a metal housing, with two 1nF feedthrough capacitors for the two-way switch. This is externally mounted, as it feeds in only DC. Any sockets, such as SMA, SMC or BNC, can be used for the HF output.