25 MHz standard frequency and time transmitter of MIKES

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Abstract
Digitalisation of TV links has degraded the accuracy of the frequency of TV synchronisation signal to the level which is not any more good enough for calibration of high quality oscillators. A new 25 MHz standard frequency transmitter and a special receiver have been developed by MIKES. The coverage area is estimated to be the capital region inside Kehä III.

Keywords: Time and frequency metrology, standard frequency, transmitter, receiver.

1. INTRODUCTION

Time and frequency laboratory of MIKES (earlier VTT/AUT) has taken care of Finnish official time and frequency since 1976. Finnish broadcasting company (YLE) as a partner disseminated time signal using audio channels and frequency with the aid on TV synchronisation signal. The accuracy of frequency obtained was better than 10^{-11} as a relative value.

Digitalisation of TV links caused random delays at every link station and the accuracy of the frequency is now 100 times worse than earlier when analogue links were used. Calibration of high quality oscillators needs better easily available reference. That is why MIKES has designed and constructed an own transmitter and a suitable receiver.

2. NEW 25 MHz TRANSMITTER AND RECEIVER OF MIKES

When looking tables of allocated frequencies for standard frequency transmitters, we selected 25 MHz (λ = 12 m) for several reasons. First, when using a high frequency the antenna size is convenient. Second, 25 MHz lies at short wave band, which means that one can use cheap, commonly available receivers. Earlier (1977) we have tried to use 250 MHz transmission, but with bad success due to lack of receivers. The third reason was that we could utilise 27 MHz citizen band components.

The transmitter is now on air for test cycles. Transmitter power is 100 W and antenna (vertical ¾ λ dipole) gain near 10 dB. Antenna height during test cycles is 20 m above sea level but it will be 40 m next year. The 25 MHz carrier comes from synthesised HP signal generator, which is locked to our atomic clock (Cs2). The relative accuracy of the carrier frequency is better than 10^{-13}. IRIG B 1 kHz time code amplitude modulates the carrier. This code includes full time code including day, hour, minute and second. The coverage area is estimated to be the circle inside Kehä III in the capital region when using outdoor antenna with preamplifier.

At first tests, signal level at Soukka, 12 km westward from the MIKES premises at Otaniemi, is about 0,5 mV when using a good outdoor antenna. Because of good conductivity of seawater, stable ground wave signal may be useable at Tallinn offering “international” frequency comparison.

A special receiver for the above mentioned signal has been developed. It consists of standard components like a conventional short wave receiver, an oven controlled crystal oscillator, and IRIG demodulator. Associated electronics takes care of phase locking etches.