MEASUREMENT OF A 10 GHZ GUN GENERATOR WITH A SPECTRUM-ANALYZER UP TO 6 GHZ

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Abstract: This article describes a method for measuring very high frequency generators when there are no the appropriate oscilloscopes and spectrum-analyzers - when the measuring equipment is with low frequency operating parameters.

Key words: UHF generators, spectrum-analyzers, mixers, frequency measurement

1. Introduction

Frequency meters or spectrum-analyzers for the relevant ranges often are not available for measuring frequencies from the SHF (Super high frequency) band. The most common ones are up to 6 GHz. The mixers come to help.

A number of companies produce broadband mixers with very good parameters that would do a great job.

2. Frequency Measurement of a 10 GHz Gun generator with a spectrum-analyzer up to 6 GHz

The idea is this: we have a spectrum analyzer operating at 6 GHz and generator up to 4 GHz with very good parameters. We have to measure the frequency of an unknown generator around 10 GHz. Measurement is carried out according to the scheme shown in Figure 1. At the mixer input (RF) of the mixer (MIXER) we feed the frequency from the generator (GEN) through an attenuator (ATT). At the second input (LO) we supply the frequency of the measuring oscillator (LO) (4 GHz). The mixer output (IF) is connected to the spectrum-analyzer (SA).

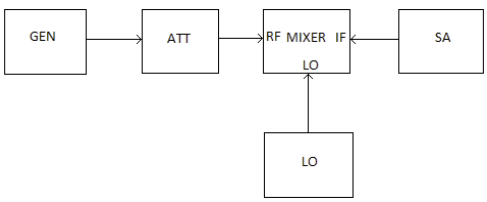

Fig.1. Scheme of the experimental layout

$$F_{RF} \pm F_{LO} = F_{IF}, \qquad (1)$$

from where the following occurs

$$10GHz - 4GHz = 6GHz$$

This method makes it possible to measure a 10 GHz frequency even with a spectrum-analyzer operating at 2 GHz. The scheme of the experimental layout is exactly the same as shown in Figure 1. From the measuring generator, a slightly higher level is fed to the mixer. The aim is to obtain a second harmonic at a frequency of 8 GHz, albeit with a small level, but sufficient after mixing to obtain a frequency of 2 GHz. It has a small level, but enough to be read by the spectrum-analyzer.

$$F_{RF} - (2F_{LO}) = F_{IF} \qquad (2)$$

After substitution the following result is obtained

$$10GHz - (8GHz) = 2GHz.$$

By this method, it is possible to measure generators with frequencies outside the range of the spectrum-analyzer. It is advisable to pre-select a mixer with the required input /output parameters.

For the experiment, we have chosen the ultra-wideband mixer (Figure 2) of the "Magnum Microwave" (now "API Technologies") type FSCM 59277 series MM9x -2 [2]. The selected mixer is triple balanced and its parameters are shown in Table 1.

Fig. 2. General appearance of the mixer

Table 1. Mixer parameters, type FSCM 59277, series MM9xx-2

Part Number	Frequency (GHz)			LO Pwr (dbm)	CL (db)	Input P1dB (dbm)	Input IP3 (dbm)	Package
	RF	LO	IF	+10 to +21	7.0	+5 to +15	+14 to +24	SMA Connectors
MM9xxG-2	2.00-18.00	2.00-18.00	1.00-12.00					

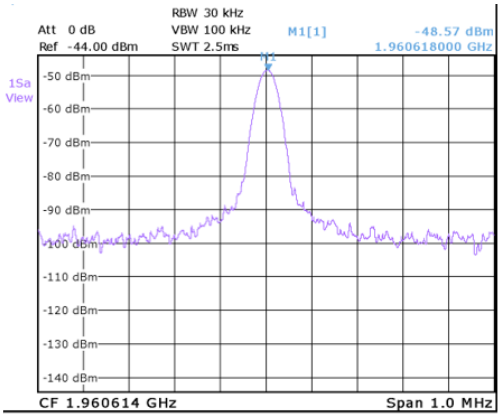

Fig. 3. Measured value from the spectrum-analyzer

Using a spectrum-analyzer at 2GHz, the measurement result is shown in Figure 3.

From the graph in Figure 3 it can be seen that the measured frequency with the spectrum-analyzer on the mixer output is 1.960614GHz.

Therefore, the generator frequency we are looking for is:

$$F_{RF} = (8GHz) + 1.960614 = 9.960614\ GHz.$$

5. Conclusion

The present method makes it possible to measure very precisely the frequency of a high frequency generator by simple means.

6. References

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