Application Brief

LMX2820 with Internal Doubler versus LMX2594

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Introduction

The LMX2594 RF synthesizer operates with a fundamental frequency range from 7.5GHz to 15GHz. The LMX2820 RF synthesizer operates with a fundamental range of 5.65GHz to 11.3GHz. The LMX2820 includes an internal doubler to extend the frequency range up to 22.6GHz.

Generally speaking, the LMX2820 is a newer device and provides improved phase noise compared to the predecessor. However, there is an ambiguous overlap of 3.7GHz (from 11.3GHz to 15GHz) where one device operates within the fundamental range and the other uses a doubler. Within that high frequency overlap, which option provides the best phase noise performance?

Phase Noise Comparison

Both devices were tested at 13.2GHz. This represents a common frequency that is externally doubled to reach K-band (for example, 26.4GHz). The reference frequency is 100MHz supplied from a Rohde and Schwarz SMA100B signal generator. The 100MHz reference signal is internally multiplied by two to set the PFD (Phase Frequency Detector) to 200MHz. Both devices are set up with the same frequencies and configuration.

Figure 1 shows the phase noise performance comparison of LMX2594 and the LMX2820 operating with an internal doubler at 13.2GHz.

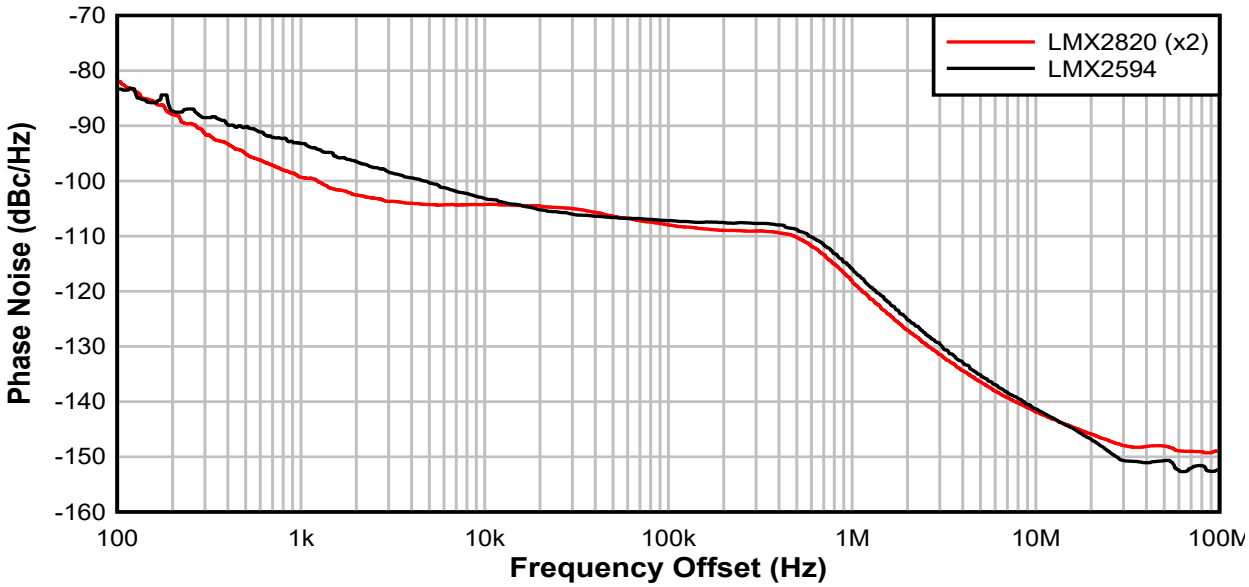

Figure 1-1. Phase Noise Comparison of LMX2594 vs LMX2820 with Internal Doubler at 13.2GHz

Sub-Harmonics

One of the key concerns with using a doubler is that the fundamental frequency of the VCO bleeds through to the output and manifest as a sub-harmonic spur. Table 1 lists the sub-harmonic spur data of the LMX2820. The sub-harmonic spur performance of the LMX2820 is good as a result of the integrated sub-harmonic filtering. Since the LMX2594 operates within the fundamental range, the device does not generate a sub-harmonic spur.

Table 1. Sub-Harmonic Spur Performance

Device	Frequency (GHz)	Spur (dBc)
LMX2820 with internal doubler	6.6	58

Conclusion

In general, the newer LMX2820-with-internal-doubler performs better than the LMX2594 operating within the fundamental range. Specifically, the phase noise performance at close-in frequencies from under 1kHz to 10kHz is better. Phase noise between 10kHz and 10MHz offset is roughly equivalent. The LMX2594 wields a slight advantage at high frequency offsets above 10MHz with a better noise floor. This is expected as the doubler in the LMX2820 introduces an additional thermal noise component. Sub-harmonic performance of the LMX2820 with internal doubler is reasonable and can be filtered if additional rejection is required.

References

1. Texas Instruments, *External Doubler Extends LMX2820 Operation to 44 GHz*, application brief.

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