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BNC PRODUCT LAUNCH | 22GHZ COMPACT MULTI-CHANNEL PHASE-COHERENT FREQUENCY SYNTHESIZER

Blog Post

Berkeley Nucleonics (BNC) presents a new compact frequency synthesizer, the MODEL 805, that delivers precise and stable frequencies from 100 kHz to 22 GHz. One of its standout features is the ability to link multiple units for phase coherence and multi-channel capabilities in various applications. The MODEL 805 is user-friendly and its compact design makes it suitable for integration into various forms and layouts of RF/microwave systems.

SINGLE-CHANNEL PERFORMANCE

The MODEL 805 frequency synthesizer covers a range of 100 kHz to 22 GHz with a resolution of 10 mHz using graphical control software and higher resolution with SCPI commands. It has a fast switching time of just 5 µs and a calibrated frequency accuracy of ±30 ppb with ±0.5 ppm aging in the first year thanks to its precise OCXO. The adjustable output power ranges from -40 to +25 dBm with an accuracy of ±1.5 dB and a resolution of 0.5 dB. The phase can be adjusted from 0 to 360 degrees with a resolution of 0.1 degree. Its phase noise at a 20 kHz offset from a 1 GHz carrier is -132 dBc/Hz and -110 dBc/Hz at 100 Hz offset. Subharmonics and spurious signals are below -55 dBc. **Figure 1** shows a comparison of measured single-sideband (SSB) phase noise at 1 and 10 GHz.
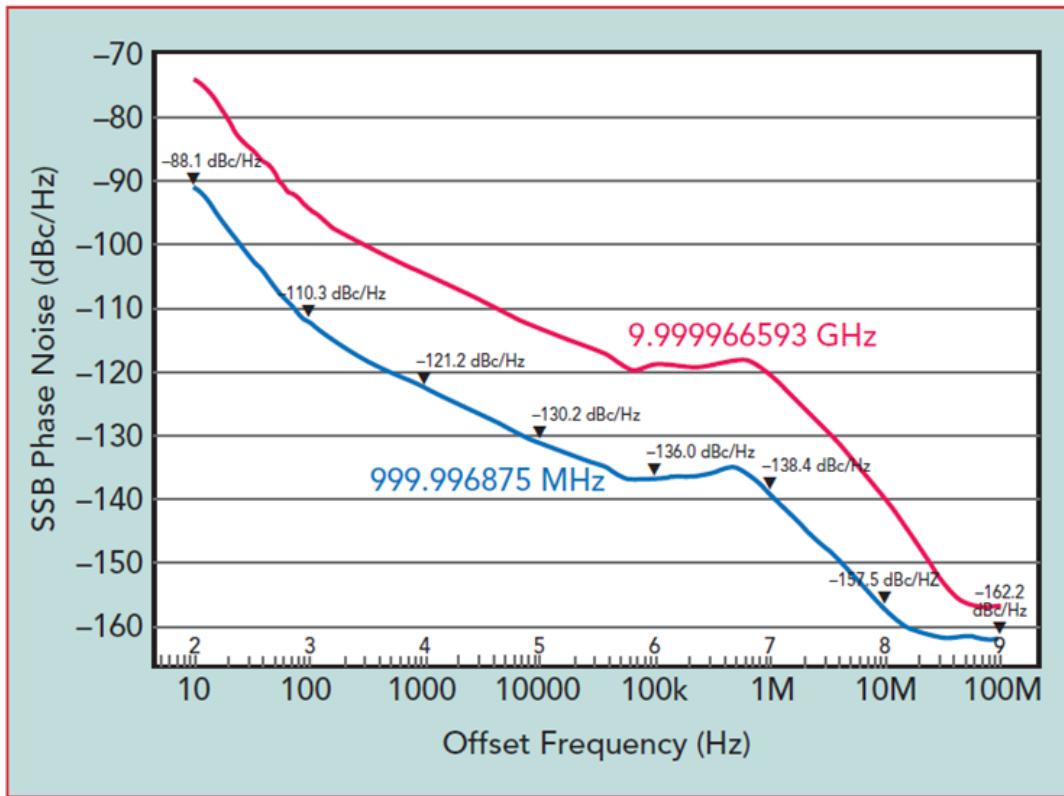
▲ Fig. 1 SSB phase noise measurement.

In addition to providing a CW signal, the MODEL 805 supports pulse modulation, either internally programmable or externally triggerable. The maximum modulation rate is 10 MHz and narrowest pulse width is 30 ns. A high speed triggered parameter sweeping function with flexible sweeping profiles is available with the shortest step time

of 5 μs. The synthesizer is well-shielded in a compact flange-mountable module measuring 134 × 95 × 25 mm. It weighs under 0.5 kg and consumes only 17 W, which enables it to use passive heat sinking, with easy and flexible mounting to a heat sink. Internal temperature monitoring is available to prevent the synthesizer from exceeding the recommended operating temperature range; if that occurs, the RF output stage will turn off.

The synthesizer has a standard Ethernet port for connecting to a PC and controlling the unit with BNC's graphical interface software or using SCPI commands.

MULTI-CHANNEL & PHASE COHERENT

The MODEL 805 frequency synthesizer supports external references of 100 MHz and 1 GHz with a frequency lock range of ±10 ppm. It also offers a 1 GHz reference output, allowing multiple units to be connected for phase-coherent sources. The first unit acts as the reference, with its 1 GHz frequency being looped through the other units. To lower costs, MODEL 805 modules can be ordered without the internal OCXO when used with other MODEL 805 modules or an external reference. Phase coherence can be determined by the relative phase difference variation between channels set to the same frequency, as shown in **Figure 2** where two daisy-chained MODEL 805 modules in a phase-coherent configuration were measured at 5 GHz. The relative phase difference variation was ±0.5 degree over 10 hours in a non-airconditioned room. The synthesizer utilizes a low-noise amplifier between the 1 GHz reference input and output, which has low additive phase noise, enabling the configuration of up to 16 phase-coherent channels.
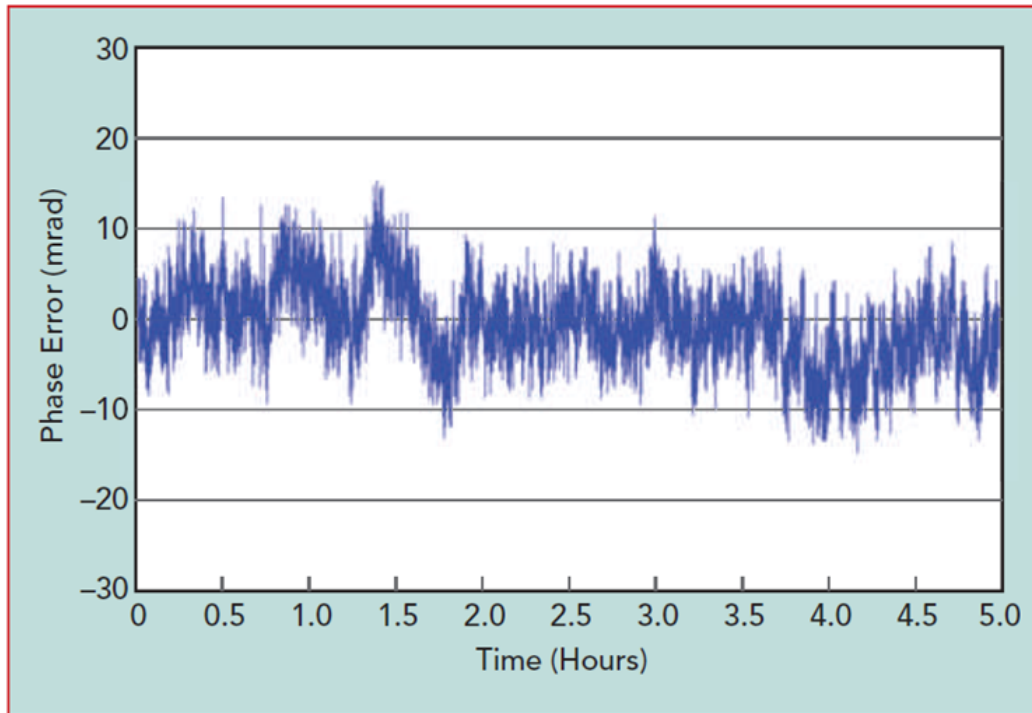
▲ **Fig. 2** Time stability of channel-to-channel phase difference, with both channels set to 5 GHz.

APPLICATIONS

The MODEL 805 frequency synthesizer has multiple applications. It serves as a suitable clock for RF/microwave systems, especially when multi-channel and phase-coherent local oscillators are required. Its ability to adjust individual channel phase provides precise timing alignment. Its phase-coherent, multi-channel configuration is ideal for designing and testing of radar receivers, phased array beamforming networks, I/Q modulators in quantum computing instrumentation, MIMO receivers, and heterodyne spectroscopic systems. Its phase-coherence and fast switching capabilities also support fast frequency hopping in agile electronic warfare systems.