EndRun TECHNOLOGIES
"Smarter Timing Solutions"

Low Phase Noise *Output Module*

Superior Low Phase Noise Specifications

The Low Phase Noise Output Module is an option available for the Meridian II and Tycho II product lines. These products can be configured with several high-performance, dual-frequency 5/10-MHz oscillators. The Low Phase Noise Output Option works with these disciplined oscillators to provide individually buffered, spectrally pure, sinewave outputs. The levels of the contributors to spectral impurity have been carefully controlled by the design of the oscillators that are offered, and by the design of the option module and its integration into the rackmount chassis. Very good channel-to-channel isolation has also been achieved in these modules.

FEATURES

- Extremely low close-in phase noise.
- High spectral purity.
- Very good channel-to-channel isolation.
- Up to 20 outputs in Meridian II or Tycho II.
- Up to 30 outputs in the Meridian II 2U chassis.

Spectral Purity

Spectral purity refers to the power spectral density (PSD) of a waveform relative to that of an ideal, pure sinewave having frequency f_0. Such a perfect waveform would have a PSD consisting of two delta functions located at $+/- f_0$ on the Fourier frequency axis. Real world waveforms do not attain this level of purity and exhibit a power spectrum that contains additional periodic and random PSD components. Spectral purity is important in a frequency standard when it is used as the reference for synthesizing a carrier signal for the purpose of broadcasting or receiving information. Any impurities in the spectrum will to some degree mask the information that is intentionally modulated onto the carrier prior to broadcast.

Periodic Impurities

The periodic impurity components are further sub-classified as harmonic and non-harmonic. The harmonic components reside at Fourier frequencies that are integer multiples of f_0. Their levels are generally minimized by using passive bandpass filtering and ultra-linear output drivers.

Non-harmonic components are also commonly called spurious components, or “spurs”. They can appear at any Fourier frequency and may arise from a variety of conditions. Usually they are generated externally to the oscillator, though not always, and are allowed to contaminate the output waveform due to inadequate shielding and power supply filtering or improper grounding techniques.

Random Impurities

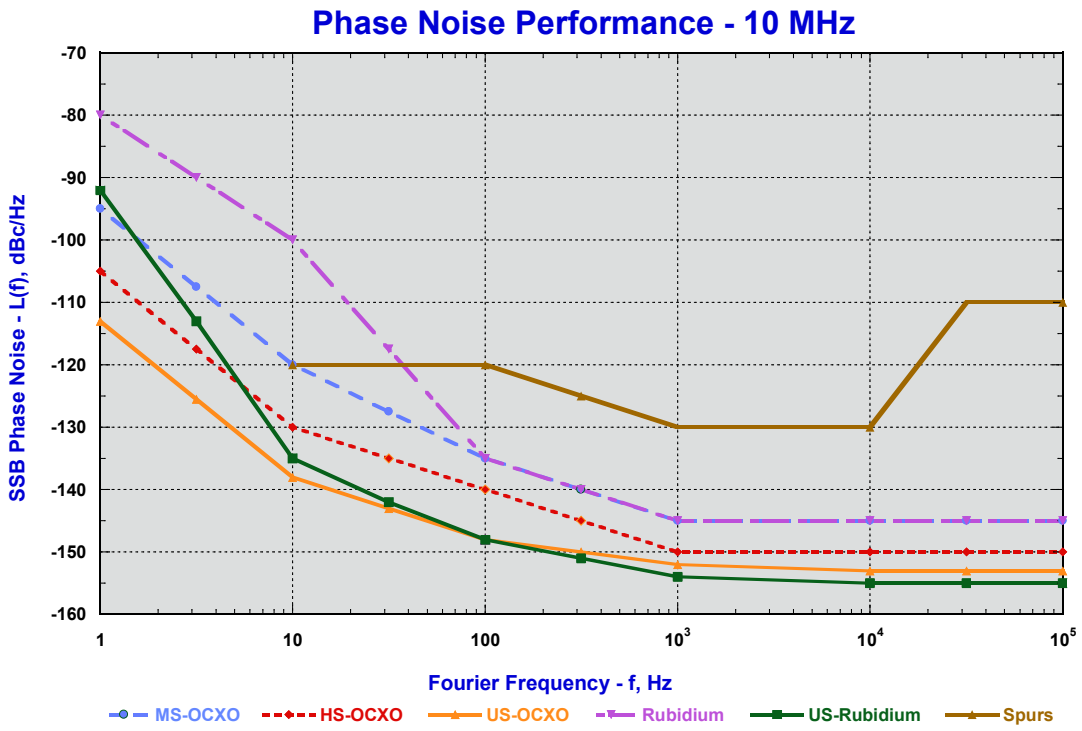
The random impurities are broadband in nature and make up the PSD “noise floor”. Because of the ubiquitous nature of noise, the PSD of a real world waveform is at no point equal to zero. Precision frequency sources based on quartz crystal resonators exhibit extremely low levels of random noise, but it is still easily measurable. The PSD measured close to the source frequency f_0, is generally produced within the oscillator itself, and depending upon the point at which the noise has entered the oscillating circuitry, exhibits different PSD signatures. Selection of high-quality oscillators is the only way to control this aspect of spectral purity.

Phase Noise

Random noise sources within a precision crystal oscillator circuit effectively modulate the signal. The modulation due to random noise is divided between amplitude modulation (AM) and phase modulation (PM). In most applications, the PM component, or phase noise, is of greatest importance. This is due to the multiplicative effect on phase noise that occurs when we multiply the frequency of a precision source in order to synthesize a carrier wave. For example, one milliradian of phase noise at the f_0 = 10 MHz source is multiplied to one radian of phase noise at the 10 GHz carrier frequency.

The oscillators manufactured at EndRun Technologies exhibit extremely low close-in phase noise. This close-in phase noise is typically classified as flicker frequency modulation (FM). The flicker FM component of quartz oscillators is minimized by using the highest quality crystals and a healthy dose of black magic in the oscillator circuitry.

Low Phase Noise Output Module
Specifications



	MS-OCXO	HS-OCXO	US-OCXO	Rubidium	US-Rubidium*
Phase Noise dBc/Hz:	**10 / 5MHz**	**10 / 5MHz**	**10 / 5MHz**	**10 / 5MHz**	**10 / 5MHz**
1 Hz	-95 / -100	-105 / -110	-113 / -118	-80 / -80	-92 / -92
10 Hz	-120 / -130	-130 / -135	-138 / -143	-100 / -100	-135 / -135
100 Hz	-135 / -140	-140 / -145	-148 / -152	-135 / -135	-148 / -148
1 kHz	-145 / -150	-150 / -155	-152 / -155	-145 / -145	-154 / -154
10 kHz	-145 / -150	-150 / -155	-153 / -155	-145 / -145	-155 / -155
100 kHz	-145 / -150	-150 / -155	-153 / -155	-145 / -145	-155 / -155

Note: Ultra-Stable Rubidium available in Meridian II 2U only.

OUTPUT FREQUENCY:
- 5 or 10 MHz
- Contact factory for other output frequencies.

OUTPUT LEVEL @ 50 OHMS:
- +13 dBm, +/- 2 dBm

HARMONICS @ 50 OHMS:
- < -45 dBc

CHANNEL-CHANNEL ISOLATION:
- > +75 dB

OUTPUT QUANTITY:
- 4 outputs per module Meridian II (1U) and Tycho II.
- 6 outputs per module Meridian II (2U).

MAXIMUM CHASSIS OUTPUTS:
- 5 modules for 20 outputs Meridian II (1U) and Tycho II.
- 5 modules for 30 outputs Meridian II (2U).

CONNECTOR:
- BNC

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