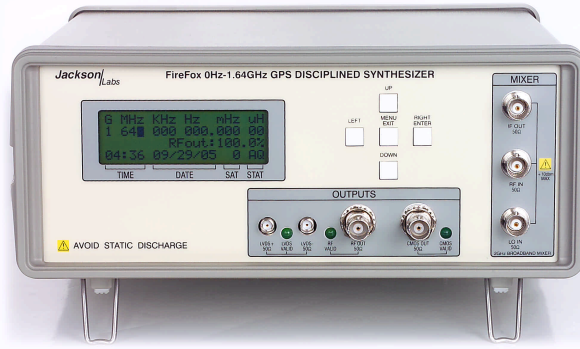


FireFox Desktop Broadband Synthesizer

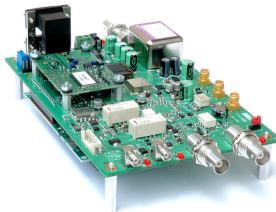
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KEY FEATURES

- 10 μ Hz to 1640MHz operation
- 10 μ Hz (15-digit) resolution
- \pm 10 μ Hz basic precision
- GPS Disciplined OCXO and 1PPS output with <20ns 6-Sigma average Accuracy to UTC
- 2MHz to 1.64GHz, >+10dBm typ. RF output with 50dB adjustment range
- <10MHz to 1.64GHz LVDS outputs
- DC to 398MHz 3.3V/5V CMOS output
- Ultra low phase-noise Crystal Oscillator reference with 10MHz CMOS output
- Built in general purpose 2GHz mixer with >350MHz IF BW
- Internal 1Gs/s DDS 10bit DAC
- Better than 10E-12 long term accuracy
- 100-240V @ <20W
- Desktop form factor
- RS232 operation/control



HIGHLY ACCURATE GPS-DISCIPLINED BROADBAND FREQUENCY SYNTHESIZER



The FireFox synthesizer uses the Motorola M12+ timing receiver and an OCXO to exceed 10E-12 Stratum-1 long term UTC-locked performance.

“ *Setting new standards in frequency generation for engineering, test & measurement, broadcast, defense, and research.* ”

The FireFox Synthesizer presents unprecedented frequency accuracy and resolution by combining industry-proven GPS timing performance (USNO lab test report available) with the very latest in DDS synthesizer technology in one cost-effective desktop unit. An ultra-stable GPS disciplined frequency reference is combined with a broadband synthesizer. Virtually any Frequency from 10 μ Hz to 1640MHz can be generated with 10 μ Hz resolution (15-Digits) by using the built-in LCD and keypad, or via RS232 control. Settings and calibrations are automatically stored in non-volatile memory. RF, LVDS, and CMOS outputs are standard. The RF output provides 50dB (typ.) adjustable range and more than +10dBm typical output power. Outputs can be continuous wave (CW) or swept.

Unmatched price/performance

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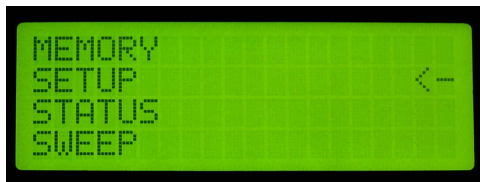
Operation

The FireFox Synthesizer is controlled via the built-in keypad, or via serial port SCPI commands (Q1/06). Frequencies are entered with up to 15 Digits of resolution. The RF output amplitude can be varied in relative mode from 0 to 100% (equals ca. -44dBm to +18dBm at the extremes) or in absolute mode from -40dBm to +8dBm. The LCD display shows frequency, RF amplitude, and GPS status information:



All settings and auto-calibration data are stored in non-volatile memory and are automatically loaded upon power-up.

A multi-level menu structure allows access to system status-information and setup options, and is easily navigated:



Resolution and Accuracy

The revolutionary proprietary 47bits effective DDS clock generator of the FireFox Synthesizer allows any frequency between 10 μ Hz and 1640MHz to be generated with 10 μ Hz resolution and better than \pm 10 μ Hz precision relative to the internal 10MHz crystal oscillator.

The long term accuracy of the 10MHz reference output is better than 10E-12 and is phase locked to UTC via a Motorola M12+ timing GPS receiver. Short term performance is typically better than 5x10E-11 over a 30 minute time period. The long term reference output accuracy is only limited by the quality of the reference signal provided by the GPS satellites.

UTC Frequency Reference Standard

The unit provides a 10MHz UTC-locked frequency standard available on a dedicated BNC connector. The output is locked to UTC via the GPS timing receiver and a phase-locked low-noise Crystal Oscillator Oven. Traditionally available only as an expensive separate unit from other vendors, this function provides the basis for the ultra-high frequency accuracy of the FireFox Synthesizer.



Outputs

The following seven output signals are available in the standard product configuration:

- RF output: BNC, 2MHz-to-1.64GHz, power -40dBm to >+10dBm typ. adjustable via keypad
- CMOS output: BNC, DC-to-398MHz 3.3Vpp or 5Vpp
- LVDS output: on two SMA's, <10MHz-to-1.64GHz
- 10MHz OXCO GPS reference output: BNC, 3.3V CMOS
- General purpose 2GHz mixer output: SMA 4.5MHz-to-350MHz, can be disabled to reduce interference
- 1PPS output: locked to UTC to within <20ns, 3.3V CMOS

The RF, LVDS and CMOS outputs are driven by the DDS synthesizer in parallel, and thus provide the same frequency (displayed on the LCD) within their respective operating ranges. LED's provide status information about individual connector output ranges, and light up when an output is active and valid. Frequencies can be automatically swept (Q1/06).

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Please call about custom options



FireFox Desktop Broadband Synthesizer



Operating Features

The FireFox Desktop unit is fully self-contained and needs only a GPS antenna and AC power to operate (a GPS antenna is included in the FireFox package). The unit is typically able to fully lock to the GPS signal within 5-8 hours, and the units' power consumption is low enough (<20W) that it will typically be left operating continuously. An optional 12V Battery power input is available upon request.

General Purpose RF Mixer Building Block

A general purpose 2GHz mixer building block with >350MHz IF bandwidth is accessible on three BNC connectors on the front panel. The FireFox main RF output can be used as the local-oscillator or RF input mixer-source for RF receiver/down-converter applications.

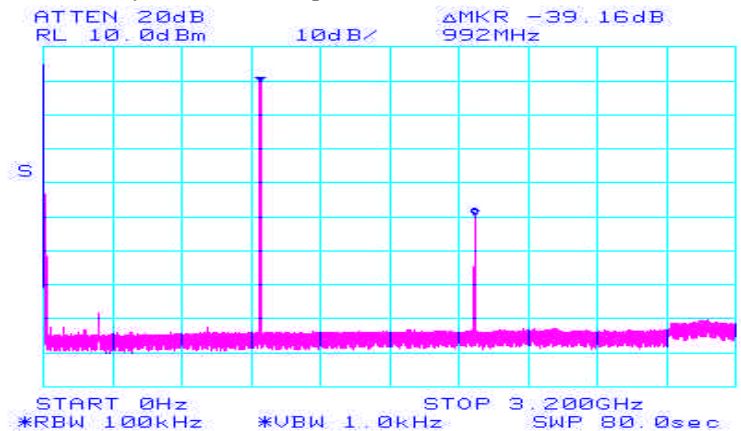
Option 001 provides an additional very low phase-noise, GPS disciplined 1.000GHz -13dBm BNC-connector RF-output on the back panel. This output can be used as the local oscillator input to the front-panel Mixer while connecting the main RF output to the Mixers' RF input. Selecting a main RF-output frequency between 1.002GHz and >1.4GHz will then generate signals from below 2MHz to over 400MHz on the Mixer IF output connector. The signal generated by the Mixer has lower spurs and harmonics than the DDS RF-output over this frequency range, at the expense of a slightly higher phase-noise floor.

Signal Quality

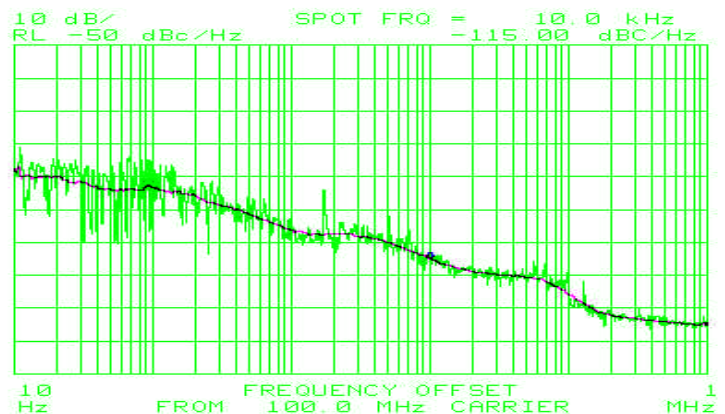
The performance of the FireFox synthesizer is exceptional and unparalleled in this price range and size, and is attributable to its innovative design:

A low-noise 1GHz PLL is phase locked to a 10MHz oven-enclosed crystal oscillator reference. This 1GHz signal drives a novel true 1Gs/s DDS system with 47 bits of effective resolution which is then frequency-multiplied to provide outputs ranging from DC to 1.64GHz, effectively increasing the DDS resolution to close to 48 bits (up to 15 digits of frequency can be entered). Frequencies ranging from DC to 398MHz are generated directly by the DDS 10bit DAC yielding very low phase-noise, while frequencies above 398MHz are generated by a VCO PLL phase-locked to the DDS DAC.

The FireFox synthesizer output signals are generated in three bands from DC up to 400MHz, 400MHz to 800MHz, and 800MHz to 1.64GHz. Bands are switched via high-quality non-reflective RF relays. Extensive low-pass filtering of all signals provides high harmonic suppression and reduces aliased spurs. The following Figures showcase the signal quality of the FireFox Synthesizer RF output:



100MHz 0dBm output: very low spurs and harmonic distortion



100MHz Phase Noise: very low spurs and noise floor

Calibration

The FireFox synthesizer does not require frequency calibration. An Agilent E4418B power meter can be connected to the units' output and RS-232 port to calibrate the RF output level. The FireFox will automatically calibrate its RF output to better than 0.5dBm by communicating with the power meter via RS-232.

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High quality analog RF, and digital outputs



FireFox Desktop Broadband Synthesizer



Technical Specifications

General Characteristics	Synthesizer Architecture	Low-cost Broadband Synthesizer with 48 bit (eff.) DDS fractional-N control and GPS-disciplined OCXO reference. Three main outputs (CMOS, LVDS, RF). Over 160 Trillion individual frequencies, resolution to within $\pm 10E-6$ Hz. Built-in 10MHz reference standard.
	Form Factor	Desktop unit with sturdy metal case. Size: 270mm x 260mm x 120mm. Optional 19-Inch rack-mount and carrying handle available.
	Built In Frequency Standard	Ultra-accurate Motorola 12 Channel GPS Timing receiver driving OCXO 10MHz Frequency Standard. Typ. $< 5 \times 10E-11$ Frequency deviation.
	Applications	Any frequency such as 1622.123.456,78901Hz can be generated with 10E-12 long term accuracy. High precision CW fixed-frequency reference for * communications equipment * calibration labs * manufacturing * test&measurement * engineering * R&D * military applications (COTS). Sweep features allow applications traditionally served by expensive test equipment. Generate any frequency with the touch of a few buttons.
Reference Standard Characteristics		Uses 12 Channel Motorola GPS Timing receiver 1PPS signal output. Output locked to within < 20 ns (Six Sigma) to UTC. GPS Pulse sampled at 100MHz then phase-locked to 10MHz low phase-noise OCXO. Phase noise of OCXO module is -115 dBc/Hz at 10Hz offset, -160 dBc/Hz at 10KHz offset. Short-term OCXO stability is $2 \times 10E-11$ for one second. CMOS 3.3V output driver. Better than 10E-12 long-term accuracy.
DDS Synthesizer Characteristics	CW output and Sweep functions	48 effective bits DDS with fractional-N technology. DC to 1640MHz output. $\pm 10\mu$ Hz resolution over entire bandwidth (DC to 1640MHz). DC to 400MHz range output generated by 10-bit DAC. 400MHz to 1640MHz range output generated by low-noise PLL, phase-locked to DDS. CW output or Sweep functions (Q1/06) set via user interface. Sweep controlled via software.
Output Signals	RF output CMOS output LVDS/PECL output 10MHz reference output	50Ohm BNC output 2MHz to 1640MHz, adjustable from -40 dBm to $+8$ dBm ($+15$ dBm typ. in relative mode). Harmonics less than -30 dB DC to 398MHz CMOS output on BNC connector. 3.3Vpp or 5Vpp. Series terminated, or 50 Ohm parallel terminated (2.4Vpp) Matched differential LVDS outputs on two SMA connectors. < 10 MHz to 1640MHz with > 300 mVpp single ended output amplitude. DC offset. CMOS 10MHz Frequency standard output from GPS-disciplined OCXO. Low phase noise, 3.3V series terminated.
User Interface	Keypad or SCPI RS232 (Q1/06)	Backlit 20 character x 4 lines LCD display. 5-Button keypad. Menu system with over 19 sub-menus. Frequency and amplitude set via keypad. Settings stored in non-volatile memory. Frequency, amplitude, GPS timing, and status information displayed on LCD.
Mixer	General Purpose building block	General-purpose, non-dedicated mixer available via BNC front-panel connectors. RF and LO inputs from 4.5MHz to 2GHz. Filtered IF output bandwidth is 4.5MHz to > 350 MHz. -20 dBm RF input and -10 to $+5$ dBm LO input sensitivity. 0-3.5dBm conversion gain. 14dBm damage level.
Non Volatile Memory	GPS timing reference System Controller Settings GPS receiver	Timing offsets, and auto-calibration data stored in EEPROM for fast cold boot. All system settings including Frequency and Amplitude stored in EEPROM. Amplitude correction (AMPCOR) data stored in Flash. GPS receiver Almanac, position, hold-mode, time and offsets stored in maintenance-free battery-backed-up memory.
Miscellaneous	Optional Features	Option 001: 1GHz, -13 dBm low phase-noise output. Cost reductions: TCXO option, reduced 0-400MHz output range, removal of GPS receiver.
Serial Communication	Ports	2x RS232 ports, one for GPS receiver communication (to optional freeware Motorola WinOnCore12™ control and configuration), second port for system control. RS232 to USB converter included. Unit connects to Agilent E4418B type power meters for fully automated level calibration.
Electrical Characteristics	Power Requirements Power Consumption Battery Backup	100V – 240VAC, optional +12.0V Battery powered input < 20 W typ. during operation. Maintenance-free Super Capacitor for GPS receiver almanac memory with $>> 2$ Hour data retention.
Physical Characteristics	Dimensions	270 x 260 x 120mm (ca. 10.6 x 10.2 x 4.7 in.)
Environmental Characteristics	Operating Temperature Storage Temperature Operating shock and vibration	0-40°C, with less than 1°C change per 24 hours recommended for full performance. 0-85°C Unit should be shielded from any shock, vibration, rotation, magnetic flux, airflow, and movement for full performance.
NOTE		All specifications typical and quoted at 25.0°C after 1 day operation with GPS reception in still air with < 1 °C change with 110.0V power supply unless otherwise specified.

Lowest power consumption in class



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