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

LOW-COST GPS SYNCHRONIZED FREQUENCY SYNTHESIZER MODULE

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 module. An ultra-stable GPS disciplined frequency reference is combined with a broadband synthesizer on one board. Virtually any Frequency from 10μHz to 1640MHz can be set quickly with 10μHz resolution (15-Digits) by using the built-in LCD and keypad, or via RS-232 control. Settings and calibrations are automatically stored in non-volatile memory. RF, LVDS, and CMOS outputs are standard. The RF output provides >50dB adjustable range and more than +10dBm typical output power (2MHz to 1640MHz). Outputs can be continuous wave or swept.
 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 3.3V/5V
- LVDS output: on two SMA’s, <10MHz-to-1.64GHz
- 10MHz OCXO GPS reference output: BNC, 3.3V CMOS
- General purpose 2GHz mixer output: SMA 4.5MHz-to-350MHz, can be disabled for power savings
- 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).
FireFox Broadband Synthesizer

Hardware Features
The FireFox board is fully self-contained and needs only an external +12.0V/1A power supply and a GPS antenna to operate (A Wall Wart supply and GPS antenna are included in the FireFox package). Customers may use the board as an OEM product inside their enclosure, or an optional metal enclosure may be ordered.

General Purpose RF Mixer Building Block
A general purpose 2GHz mixer building block is accessible on SMA connectors. The FireFox RF output can be used as a local-oscillator mixer-source for RF receiver/down-converter applications.

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).

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 relais. 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:

1000MHz output: 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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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 ± 10E-6 Hz. Built-in 10MHz reference standard.

Form Factor
Small 110x170mm OEM form-factor with single ±12V 1A power. Available in optional 19-Inch rack-mount or custom enclosure.

Built In Frequency Standard
Ultra-accurate Motorola 12 Channel GPS Timing receiver driving OCXO 10MHz Frequency Standard.

Applications
Any frequency such as 1622.123.456,78901Hz can be generated with 10E-12 accuracy. Ultra-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 <20ns (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, -160dbc/Hz at 10KHz offset. Short-term OCXO stability is 2x10E-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. ±10µHz 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 (Q3/06) set via user interface. Sweep controlled via software.

Output Signals

RF output
50Ohm BNC output 2MHz to 1600MHz, adjustable from –40dBm to +8dBm (+15dBm typ. in relative mode). Harmonics less than –30dB

CMOS output
DC to 398MHz CMOS output on BNC connector. 3.3Vpp or 5Vpp. Series terminated, or 50 Ohm parallel terminated (2.4Vpp)

LVDS output
Matched differential LVDS outputs on two SMA connectors. <10MHz to 1640MHz with >300mVpp single ended output amplitude. DC offset.

10MHz reference output
CMOS 10MHz Frequency standard output from GPS-disciplined OCXO. Low phase noise, 3.3V series terminated. Lock indicator LED.

User Interface

Keypad or SCPI RS232 (Q4/05)
Detachable, 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 gold-plated SMA connectors. RF and LO inputs from 4.5MHz to 2GHz. Filtered IF output bandwidth is 4.5MHz to >350MHz. –20dBm RF input and –10 to +5dBm LO input sensitivity. 0-3.5dBm conversion gain. 14dBm damage level.

Non Volatile Memory

GPS timing reference
Timing offsets, and auto-calibration data stored in EEPROM for fast cold boot.

System Controller Settings
All system settings including Frequency and Amplitude stored in EEPROM. Amplitude correction data (AMPCOR) stored in Flash.

GPS receiver
GPS receiver Almanac, position, hold-mode, time and offsets stored in maintenance-free battery-backed-up memory.

Miscellaneous

Optional Features
Cost reduced TCXO option. Cost-reduced option with 0–400MHz output range. Cost reduced option without GPS reference 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. RS-232 to USB converter included in FireFox package. Connects to Agilent E4418B type power meters for auto-calibration.

Electrical Characteristics

Power Requirements
+11.7V to +12.3V with 50mVp-p ripple (max) at 0.8A (operating) to 1.1A (warmup for 5 minutes).

Power Consumption
<13W during warm up, 10W typ. during operation.

Battery Backup
Maintenance-free Super Capacitor for GPS receiver almanac memory with >>2 Hour data retention.

Physical Characteristics

Dimensions
170 x 110 x 55mm (ca. 6.7 x 4.4 x 2.2 in.) excluding connector protrusions outside of typical enclosure.

Environmental Characteristics

Operating Temperature
0-50°C, with less than 1°C change per 24 hours recommended for full performance.

Storage Temperature
0-85°C

Operating shock and vibration
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 +12.0V power supply unless otherwise specified.