Digital Receiver Technology, Inc.

Approved for Public Release

REF3 / REF3-40 Reference Modules, 3rd Generation

DESCRIPTION

The REF3 and REF3-40 third-generation reference modules support existing DRT systems, providing the system time base and fixed local oscillators to DRT tuners in the system, such as the RFT3 and RFT4 modules. It also contains a GPS receiver and a programmable-modulation BIT/CAL source.

- Improved system phase noise, relative to the REF2A module, particularly at small offsets important to FDOA/TDOA applications (for example, 1-Hz offset).
- BIT/CAL source, 0.5 to 3000 MHz, with programmable modulation to load a custom pattern (up to 64k I/Q pairs).
- Built-in ovenized precision low-noise time base.
- Commercial GPS receiver allows REF3 or REF3-40 to be locked to GPS via an external antenna or a 1 PPS signal fed by another GPS receiver. Can also generate a 1 PPS signal for synchronization with other modules and systems.

BIT/CAL Source

This digitally-controlled source allows the user to select a tunable CW signal or various preloaded pseudo-random wideband test signals, or to load a custom pattern. Precision timing allows this source to be used to characterize an entire multi-channel tuner system, including antenna distribution and cabling, for compensation of delays and interchannel phase and amplitude imbalance.

GPS

The REF3 or REF3-40 can receive and lock to GPS antenna and 1 PPS signals, as well as accept standard GPS time code data. The REF3 and REF3-40 provides timestamp (tagging) capabilities in DRT systems.

Specifications

BIT/CAL Source

Frequency Range	0.5-3000 MHz (RF CAL OUT and BIT OUT ports) 0.5-32 MHz (HF CAL OUT port)
Flatness	± 2.5 dB
Output Power Maximum	–20 dBm (single-tone CW signal)
Attenuation Range	0-120 dB
Attenuator Step Size	1 dB
Spur-Free Dynamic Range	60 dB

BIT/CAL IF Input REF3

IF Input Center Frequency	87.5 MHz
D/A Clock Frequency	70 MHz
3-dB Bandwidth, minimum	30 MHz

BIT/CAL IF Input REF3-40

IF Input Center Frequency	120.0 MHz
D/A Clock Frequency	96 MHz
3-dB Bandwidth, minimum	40 MHz

System Data/Sample Clock REF3 70 MHz
±10 ppb max over temperature, ±50 ppb/year max aging

System Data/Sample Clock REF3-40 96 MHz
±10 ppb max over temperature, ±50 ppb/year max aging

Operating Temperature Range –20º to +60ºC (–4° to +140°F) (inlet air temperature of any DRT system in which the REF3 or REF3-40 is installed) [1]

Size Single-slot 3U CompactPCI
approximately 0.8” wide x 4” high x 7” deep
(2 cm wide x 10 cm high x 17.5 cm deep)

Weight < 1.4 lbs (630 g)

Power Consumption 18 watts (typical, All On mode)
20 watts maximum

Digital Interfaces General Control and Status: Standard 33-MHz PCI bus via Compact PCI J1 connector

[1] The REF3 and REF3-40 components were chosen to withstand +85ºC temperatures, so the systems in which REF3s are installed must maintain an internal temperature rise of 85 – 60 = +25ºC (+45°F) or less.

Front Panel I/O

Port Label	Connector Type	Function	Electrical Characteristics
10 MHz IN	SMA jack	10 MHz time base input (optional)	Sine wave, –10 to +5 dBm
10 MHz OUT	SMA jack	10 MHz time base output	Sine wave, 0 dBm
GPS IN	SMA jack	GPS Antenna Input	–148 dBm acquisition, –158 dBm tracking Antenna bias: +3.3VDC nominal at 5 to 30 mA
FIXED LO OUT	SSMC jack	2nd and 3rd LO signals	4 GHz, 0-4 dBm 157.5 MHz, 0-4 dBm
BIT OUT	SSMC jack	RF built-in-test signal for direct connection to tuners	500 kHz – 3 GHz –20 dBm max, 0-120 dB atten, 30-MHz BW REF3, 40-MHz BW REF3-40
RF CAL OUT	SMA jack	RF calibration signal, for connection to antenna distribution or other system hardware	500 kHz – 3 GHz –20 dBm max, 0-120 dB atten, 30-MHz BW REF3, 40-MHz BW REF3-40
HF CAL OUT	SSMC jack	HF calibration signal	500 kHz – 32.5 MHz, –20 dBm max, 0-120 dB atten
IF CAL IN	SSMC jack	User calibration signal input, converted to desired frequency band for output on HF CAL OUT or RF CAL OUT ports	500 kHz – 32.5 MHz (when directed to HF CAL OUT) 72.5 – 102.5 MHz (when directed to RF CAL OUT, after frequency conversion into the 20-3000 MHz range REF3) 100 – 140 MHz (when directed to RF CAL OUT, after frequency conversion into the 20-3000 MHz range REF3-40)
I/O	37-pin Nano D	Multi-pin I/O: • RS-232 (Time Code) • CAL Sync Out • 1 PPS In • 1 PPS Out • 1 Fast Scan In • 1 GPIO Out • 1 Analog Out • 5 Antenna Control Outputs • Audio Output	• Bi-directional asynchronous RS-232 NMEA, 4800 baud • LVCMOS (compatible with CMOS and TTL) • LVCMOS (compatible with CMOS and TTL; 5V tolerant) • LVCMOS (compatible with CMOS and TTL) • LVCMOS (compatible with CMOS and TTL; 5V tolerant) • LVCMOS (compatible with CMOS and TTL) • 12-bit DAC, 200-kHz sample rate, -3V to +3V • Differential LVCMOS (compatible with CMOS and TTL) • Two channels per left and right headphones with individual volume and balance controls. 8 Ω impedance. 100 mW max drive level.
1 PPS IN	SSMC jack	GPS 1 PPS input, can train the on-board 10 MHz time base	• LVCMOS (compatible with CMOS and TTL; 5V tolerant) • Active high, must be high for a minimum of 28.5 nsec
1 PPS OUT	SSMC jack	1 PPS output	• LVCMOS (compatible with CMOS and TTL) • Can drive 50 Ω cable • Programmable to be active high for 1 clock cycle or for 1 msec • Locked to on-board time base

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