COM-4001-C/D DUAL-BAND 915 MHz / 2.4 GHz QUADRATURE RF MODULATOR

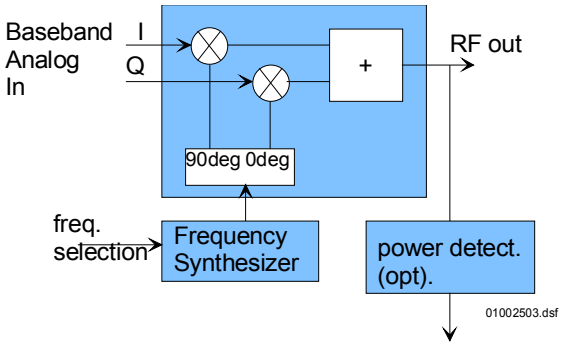
Key Features

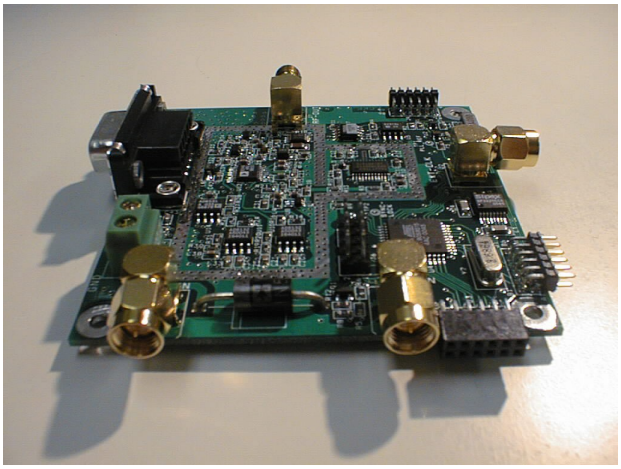
- Dual-band [902-928 MHz] or [2.025 - 2.5GHz], quadrature modulator. Software selectable. Designed for use in unlicensed bands.
- Low-noise frequency synthesizer can be tuned over entire range by steps of 100, 31.25 or 25 KHz.
- Optional output power measurement has 0.1 dB resolution.
- 8 preset frequencies for fast (<2ms) local oscillator frequency tuning.
- Selectable internal / external 10 MHz frequency reference for the frequency synthesizer.
- Single 5V supply
- Connectorized 3"x 3" module for ease of prototyping. SMA connectors.

For the latest data sheet, please refer to the **ComBlock** web site: http://www.comblock.com/download/com4001cd.pdf. These specifications are subject to change without notice.

For an up-to-date list of **ComBlock** modules, please refer to www.comblock.com/product_list.htm .

Block Diagram





Electrical Interface

Inputs / Outputs

Input Module Interface	Definition
ANALOG_I_IN	Modulated input signal, analog, baseband, real axis. 1Vpp max. 0.85V DC bias. SMA male connector, J8.
ANALOG_Q_IN	Modulated input signal, analog, baseband, imaginary axis. 1Vpp max. 0.85V DC bias. SMA male connector, J5.
EXT_REF_CLK	External 10 MHz frequency reference for frequency synthesis. Sinewave, clipped sinewave or squarewave. Minimum level 0.5Vpp. Maximum level: 3.3Vpp. Use square wave for best phase noise performances. SMA male connector, J2.
Output Signals	**Definition**
RF_OUT	Modulated RF output. 902 – 928 MHz band or 2.025 – 2.5 GHz band. Maximum output level (for 1Vpp input):

MSS • 845 Quince Orchard Boulevard Ste N • Gaithersburg, Maryland 20878-1676 • U.S.A.
Telephone: (240) 631-1111 Facsimile: (240) 631-1676 www.ComBlock.com
© MSS 2000-2015 Issued 4/27/2015

	-2 dBm @ 915 MHz typ -7 dBm.@ 2.025 GHz typ -8 dBm.@ 2.15 GHz typ -9 dBm.@ 2.4 GHz typ -10 dBm.@ 2.5 GHz typ Impedance: 50 Ohms. SMA female connector, J7.
Control Lines	**Definition**
ENABLE	Low-voltage TTL input control. Used to turn the modulator on/off. Level signal: 3.3V = ON, 0V = OFF Response time is typically in the range 5 to 10 µsec On/Off rejection > -60 dB for the signal. Note: the LO is still present at a levels ranging from –54 dBm (915 MHz) to –38 dBm (2.5 GHz) Connector J1 Pin B3. This control signal is enabled only when REG6 bit 1 = '1'.
PLL_STROBE	Low-voltage (3.3V / 0V) TTL input control. Used to increment the modulo- N_{freq} frequency pointer (where N_{freq} is defined in Register 35) RF frequency 0 ->RF frequency 1 ->RF frequency 2 ->RF frequency 0 > etc… Rising edge triggered. Minimum pulse width: 10 µsec. Connector J1 Pin A3.
TX_RXN_OUT	Low-voltage (3.3V / 0V) TTL output control to switch the COM-4102 transceiver between transmit (high) and receive (low) modes based on the REG5 bit 2 control register.
Serial Monitoring & Control	DB9 connector. 115 Kbaud/s. 8-bit, no parity, one stop bit. No flow control.
Power Interface	4.75 – 5.25VDC. Terminal block. Power consumption is 300mA max.

Important: digital I/O signals are 0-3.3V LVTTL. Inputs are NOT 5V tolerant!

Configuration (via Serial Link / LAN)

Complete assemblies can be monitored and controlled centrally over a single serial or LAN connection.

The module configuration parameters are stored in non-volatile memory.

The COM-4001 ignores any M&C message received within 1 ms of a transition on the PLL_STROBE and ENABLE signals.

Programmers developing custom applications (using the ComBlock API instead of the supplied ComBlock control center graphical user interface) should know that changes to multi-byte fields are enacted upon (re-)writing to the last register (REG35).

Parameters	Configuration
RF frequency 0	Preselected frequency 0. Valid range 902 MHz – 928or 2.025 to 2.5 GHz, steps 100, 31.25 or 25 KHz, expressed in Hz. REG0: bit 7:0 (LSB) REG1: bit 15:8 REG2: bit 23:16 REG3: bit 31:24 (MSB)
Gain control	10-bit control. Non-linear scale. Zero is lowest power. AGC range : 25 dB @ 915 MHz (typ.) 15 dB @ 2.45 GHz (typ.) REG4: bit 7-0 (LSB) REG5: bit 1-0 (MSB)
External power amplifier control	Digital control for the external COM-4102 power amplifier. Controls TX_RXN_OUT signal. 0 = transmit off, receive on 1 = transmit on, receive off REG5: bit 2
External/Internal frequency reference	0 = internal 1 = external. REG6: bit 0
External controls enabled/disabled	Enable or disable the PLL_STROBE and output ENABLE external controls on the J1 connector. 0 = external controls disabled 1 = external controls enabled REG6: bit 1
Modulator on/off	0 = modulator off 1 = modulator on Note: external control ENABLE may override this register. REG6: bit 2
Step size selection	Chose between 100, 31.25 or 25 KHz step size. 00 = 100 KHz step 01 = 31.25 KHz step 10 = 25 KHz step REG6 bits 4-3.

Frequency selection	Use to switch local oscillator frequency among preselected values. Note: the external PLL_STROBE control may override this selection. Range 0 through 7 REG6 bits 7-5.
RF frequency 1	Preselected frequency 1. Same format as RF frequency 0. REG7: bit 7:0 (LSB) REG8: bit 15:8 REG9: bit 23:16 REG10: bit 31:24 (MSB)
RF frequency 2	Preselected frequency 2. Same format as RF frequency 0. REG11: bit 7:0 (LSB) REG12: bit 15:8 REG13: bit 23:16 REG14: bit 31:24 (MSB)
RF frequency 3	Preselected frequency 3. Same format as RF frequency 0. REG15: bit 7:0 (LSB) REG16: bit 15:8 REG17: bit 23:16 REG18: bit 31:24 (MSB)
RF frequency 4	Preselected frequency 4. Same format as RF frequency 0. REG19: bit 7:0 (LSB) REG20: bit 15:8 REG21: bit 23:16 REG22: bit 31:24 (MSB)
RF frequency 5	Preselected frequency 5. Same format as RF frequency 0. REG23: bit 7:0 (LSB) REG24: bit 15:8 REG25: bit 23:16 REG26: bit 31:24 (MSB)
RF frequency 6	Preselected frequency 6. Same format as RF frequency 0. REG27: bit 7:0 (LSB) REG28: bit 15:8 REG29: bit 23:16 REG30: bit 31:24 (MSB)
RF frequency 7	Preselected frequency 7. Same format as RF frequency 0. REG31: bit 7:0 (LSB) REG32: bit 15:8 REG33: bit 23:16 REG34: bit 31:24 (MSB)
Number of RF frequencies N_{freq} in the scanning list	Each time a PLL_STROBE pulse is received, the frequency pointer increments modulo N_{freq}. N_{freq} is in the range 1 – 8. REG35: bit 7:0.

Baseline configurations can be found at www.comblock.com/tsbasic_settings.htm and imported into the ComBlock assembly using the ComBlock Control Center File | Import menu.

Monitoring (via Serial Link / LAN)

Parameters	Monitoring
Power measurement (option -D)	10-bit number. The higher the number, the lower the power. The power measurement linearity is shown below. SREG36 bits 7-0: bit 7-0 (LSB) SREG37 bits 1-0: bits 9-8 (MSB)

Operations

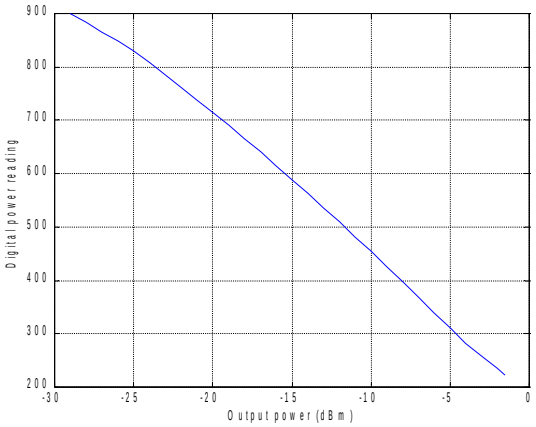
Internal vs External Frequency Reference

In order to use the external frequency reference, select external frequency reference by software command from the ComBlock control center. Then connect a 10 MHz sinewave, clipped sinewave or square wave to the SMA connector J2. Switching from internal to external frequency reference generally requires a power cycle (turn power off then on again).

In order to use the internal frequency reference, either physically disconnect the external 10 MHz signal at SMA connector J2, or place the external input signal in high impedance mode. Then select internal frequency reference by software command from the ComBlock control center.

Power Measurement (Option -D)

Output power measurement is provided as an option (-D). Output power measured with ± 0.2 dB accuracy and ± 0.1 dB resolution over a range from –30 dBm to the maximum output power. The 10-bit measurement linarity is shown below:



Test Points

Test points are provided for easy access by an oscilloscope probe.

Test Point	Definition
TP1 / PLL REF	Internal / External reference clock
TP2 / SYNC-LOCK	Frequency synthesizer PLL lock status. Active low: '0' when locked. Note: do not connect any long test cable to this test point as it may inject noise into the RF PLL.

Performance

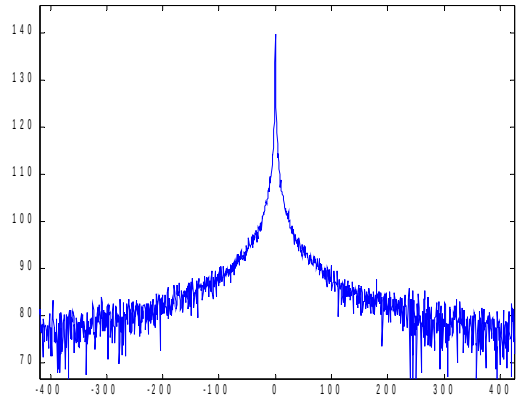
Quadrature phase error: 1. deg rms. typ
I/Q amplitude balance error: 0.2 dB.typ
ON/OFF rejection: > 80 dB

LO leakage (at output, maximum AGC gain):
-27 dBm @ 915 MHz, typ.
-30 dBm @ 2.4 GHz, typ.

Sideband suppression:
-40 dBc @ 915 MHz, typ.
-32 dBc @2.4 GHz, typ.

Out-of-band spurious spectral lines: < -60 dBc (Exception: a –40dBc spectral line may be present at 13 KHz from the center frequency).

Phase noise:
<-50 dBc @ 100 Hz
< -60 dBc @ 1 KHz
< -65 dBc @ 10 KHz
< -95 dBc @ 100 KHz



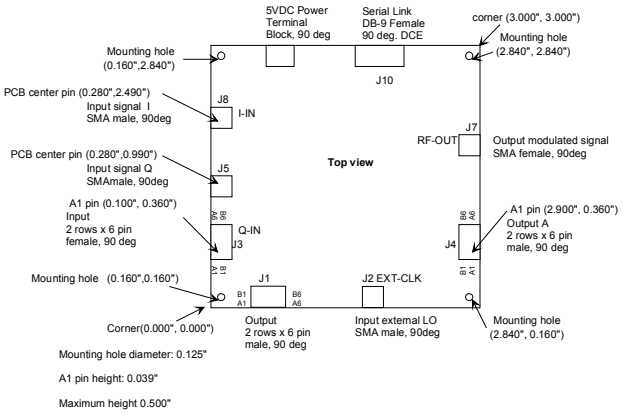
Back-to-back phase noise (COM3001 – COM4001) 915 MHz, 1Hz resolution bandwidth, +/-400Hz span. Internal reference clock.

Internal Clock Reference

The internal crystal performance is as follows:

- tolerance: ± 75 ppm max @25C
- temperature stability (-10C to +60C): ± 50 ppm max
- aging: ±5ppm/year max @25C

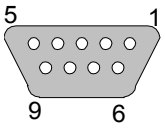
Mechanical Interface



Pinout

Serial Link J10

The DB-9 connector is wired as data circuit terminating equipment (DCE). Connection to a PC is over a straight-through cable. No null modem or gender changer is required.

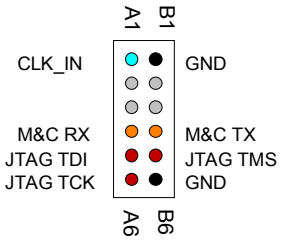


2 Transmit
3 Receive
5 Ground

DB-9 Female

Input Connector J3

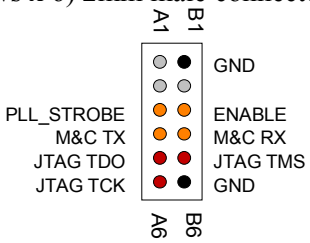
12-pin (2 rows x 6) 2mm female connector.



This module is is designed for direct connection to the COM-2001 baseband digital-to-analog conversion module.

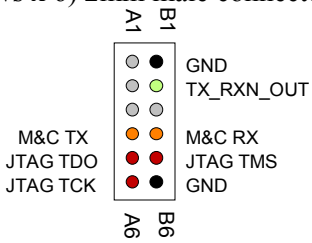
Connector J1

12-pin (2 rows x 6) 2mm male connector.



Output ConnectorJ4

12-pin (2 rows x 6) 2mm male connector.



I/O Compatibility List

(not an exhaustive list)

Input	Output
COM-2001 digital-to-analog converter (baseband).	COM-4102 2.4 GHz transceiver, 25 dBm power / 3.5 dB noise figure.
	COM-3001 Dual-Band 915 MHz / 2.4 GHz receiver (back to back with RF attenuation in-between)

ComBlock Ordering Information

COM-4001-C DUAL-BAND 915 MHz / 2.4 GHz QUADRATURE MODULATOR

COM-4001-D DUAL-BAND 915 MHz / 2.4 GHz QUADRATURE MODULATOR W/ OUTPUT POWER MEASUREMENT.

MSS • 845 Quince Orchard Boulevard Ste N • Gaithersburg, Maryland 20878-1676 • U.S.A.
Telephone: (240) 631-1111
Facsimile: (240) 631-1676
E-mail: sales@comblock.com