

# fDDL9324



## Femto Octa-Band Digital Data Link

The Femto Digital Data Link is a miniature, high power, Octa-Band wireless solution that delivers the throughput and range needed for complex data intensive applications. The fDDL9324 offers software selectable operation in eight frequency bands between 900 MHz and 2.5 GHz. The Femto DDL uses Maximal Ratio Combining (MRC), Maximal Likelihood (ML) decoding and Low-Density Parity Check (LDPC) to achieve robust RF performance. The fDDL9324 features secure and simultaneous Ethernet and Serial Data Communications.



Only 5.5 grams!

0.75" X 1.05" X 0.30"



Up to 21 Mbps

Octa-Band Frequency

Dual Ethernet, USB, Serial

DFS & Frequency Hopping

PTP | PMP | Relay | MESH

MANET MESH / Advanced MESH

Real Time Spectrum Analyzer

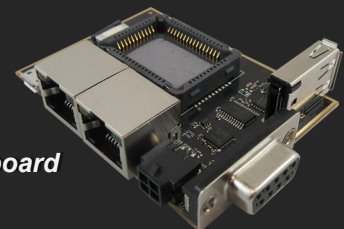
New Dynamic Frequency Selection on OFDM overlay and Frequency Hopping provide robust interference and antijam immunity!

### Features

- Eight Software Selectable Frequency Bands:  
902 - 928 MHz | 1350 - 1400 MHz | 1625 - 1725 MHz | 1780 - 1850 MHz  
2020 - 2110 MHz | 2200 - 2300 MHz | 2300 - 2390 MHz | 2400 - 2500 MHz
- Maximal Ratio Combining (MRC), Maximal Likelihood (ML) decoding
- Low-Density Parity Check (LDPC)
- Up to 21 Mbps Iperf Throughput @ 8 MHz channel (-78 dB)
- Up to 2 Mbps IPerf Throughput @ 4 MHz channel (-100 dB)
- Serial Data/Console Communication Port
- Dual 10/100 Ethernet Ports (LAN/WAN) & Serial Ports
- Point-to-Point, Point-to-Multipoint & MANET MESH Networks
- Master, Remote, Relay & MESH Operating Modes
- Adjustable total transmit power (up to 1W)
- AES256



SWP  
Enclosed



Motherboard

◆ Video ◆ Telemetry ◆ Ethernet ◆ Serial ◆ Security

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| Optimal Performance Specifications |                            |                                  |                         |                                  |                           |
|------------------------------------|----------------------------|----------------------------------|-------------------------|----------------------------------|---------------------------|
| Modulation                         | 8MHZ Channel               |                                  | 4MHZ Channel            |                                  | Total Tx Power<br>+/- 1dB |
|                                    | IPerf Throughput<br>(Mbps) | Optimal MRC<br>Sensitivity* (dB) | IPerf Throughput (Mbps) | Optimal MRC<br>Sensitivity* (dB) |                           |
| Frequency Band: 902 - 928 MHz      |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 30dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 30dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 30dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 30dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 30dBm                     |
| Frequency Band: 1350 - 1400 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 30dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 30dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 30dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 30dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 30dBm                     |
| Frequency Band: 1625 - 1725 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 30dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 30dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 28dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 28dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 27dBm                     |
| Frequency Band: 1780 - 1850 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 28dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 28dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 28dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 28dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 27dBm                     |

| Optimal Performance Specifications |                            |                                  |                         |                                  |                           |
|------------------------------------|----------------------------|----------------------------------|-------------------------|----------------------------------|---------------------------|
| Modulation                         | 8MHZ Channel               |                                  | 4MHZ Channel            |                                  | Total Tx Power<br>+/- 1dB |
|                                    | IPerf Throughput<br>(Mbps) | Optimal MRC<br>Sensitivity* (dB) | IPerf Throughput (Mbps) | Optimal MRC<br>Sensitivity* (dB) |                           |
| Frequency Band: 2020 - 2110 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 30dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 30dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 28dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 28dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 27dBm                     |
| Frequency Band: 2200 - 2300 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 28dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 28dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 28dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 28dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 27dBm                     |
| Frequency Band: 2300 - 2390 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 28dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 28dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 28dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 28dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 27dBm                     |
| Frequency Band: 2400 - 2500 MHz    |                            |                                  |                         |                                  |                           |
| BPSK_1/2                           | 3.1                        | -96.5                            | 1.57                    | -100                             | 30dBm                     |
| QPSK_1/2                           | 6.0                        | -95                              | 3.0                     | -98                              | 30dBm                     |
| QPSK_3/4                           | 8.4                        | -93                              | 4.3                     | -96                              | 30dBm                     |
| 16QAM_1/2                          | 10.7                       | -89                              | 5.4                     | -92.5                            | 28dBm                     |
| 16QAM_3/4                          | 14.8                       | -87                              | 7.4                     | -90                              | 28dBm                     |
| 64QAM_2/3                          | 18.1                       | -82                              | 7.8                     | -85                              | 28dBm                     |
| 64QAM_3/4                          | 19.0                       | -80.5                            | 8.0                     | -83                              | 28dBm                     |
| 64QAM_5/6                          | 21.0                       | -78                              | 10.0                    | -80.5                            | 27dBm                     |

\*RX Sensitivity +/- 1.5 dB. Bands starting at 2280 MHz and higher, subtract 1.5~3 dB.

# Specifications



|                                                                                                                                                           |                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency<br/>(Software Selectable)</b>                                                                                                                | 902 to 928 MHz<br>1350 to 1400 MHz<br>1625 to 1725 MHz<br>1780 to 1850 MHz<br>2020 to 2110 MHz<br>2200 to 2300 MHz<br>2300 to 2390 MHz<br>2400 to 2500 MHz                                          |
| <b>Error Detection</b>                                                                                                                                    | 32 bits of CRC, ARQ                                                                                                                                                                                 |
| <b>Encryption<br/>(Requires Export Permit)</b>                                                                                                            | 256-bit AES                                                                                                                                                                                         |
| <b>Ports</b><br>Serial Data/Console<br>Ethernet<br>USB                                                                                                    | RS232 TTL level (300bps to 921kbps)<br>Dual 10/100 IEEE802.3 (LAN/WAN)<br>2.0                                                                                                                       |
| <b>Firewall</b>                                                                                                                                           | Port Forwarding, Access Control, IP/MAC List.                                                                                                                                                       |
| <b>Operating Modes</b>                                                                                                                                    | Point-to-Point, Point-to-Multipoint, Repeater, MANET Mesh                                                                                                                                           |
| <b>Diagnostics</b>                                                                                                                                        | Remote Diagnostics, Ping, Traceroute, ARP table, DHCP active leases, IPerf, RSSI                                                                                                                    |
| <b>Management</b>                                                                                                                                         | Local Serial Port Console, Telnet, WebUI, SNMP, FTP Upgrade, TFTP, AT Command Interface                                                                                                             |
| <b>Rejection</b>                                                                                                                                          | Excellent strong signal interference & rejection characteristics                                                                                                                                    |
| <b>Input Voltage</b><br>OEM<br>Motherboard/Enclosed<br>SWP                                                                                                | Digital: 3.3V <sub>DC</sub>   RF = 5V <sub>DC</sub><br>9-30 V <sub>DC</sub><br>9-30 V <sub>DC</sub>                                                                                                 |
| <b>Connectors:</b><br>OEM<br>Motherboard/Enclosed<br>SWP                                                                                                  | Antenna: UFL<br>Data: 54 Pin SMT<br>RJ-45 x2 (Ethernet)<br>Female DB9 (Serial)<br>USB Type A<br>Micro-AB USB (Console)<br>4 PIN Interlock (Vin)<br>Power, Data: 10-Pin (GHR-10V-S)<br>Antenna: MMCX |
| <b>Environmental</b><br>Temperature<br>Humidity                                                                                                           | -40°F to 185°F (-40°C to +85°C)<br>5-95%, non-condensing                                                                                                                                            |
| <b>Weight</b><br>OEM<br>Motherboard<br>Enclosed<br>SWP                                                                                                    | ~ 5.5 grams<br>~ 43 grams<br>~ 165 grams<br>~ 38 grams                                                                                                                                              |
| <b>Dimensions</b><br>OEM<br>Motherboard<br>Enclosed<br>SWP                                                                                                | ~ 19 x 27 x 7.5 mm<br>~ 51 x 76 x 19 mm<br>~ 77 x 55 x 28 mm<br>~ 30 x 40 x 18 mm                                                                                                                   |
| <b>Approvals/Compliance</b>                                                                                                                               | FIPS140-2 Compliant Pending                                                                                                                                                                         |
| <b>Order Options</b>                                                                                                                                      |                                                                                                                                                                                                     |
| <b>Model</b><br>fDDL9324<br>fDDL9324-DEV-KIT<br>fDDL9324-SWP                                                                                              | <b>Part Number</b><br>MHKXXXXXX<br>MHKXXXXXX<br>MHKXXXXXX                                                                                                                                           |
| <b>Description</b><br>fDDL9324 FEMTO Octa-Band OEM Digital Data Link<br>fDDL9324 FEMTO Development Kit<br>fDDL9324 FEMTO Octa-Band SWP Enclosed Data Link |                                                                                                                                                                                                     |
| <b>fDDL Motherboard</b><br><b>fDDL OEM Socket</b><br><b>fDDL Socket Cover</b>                                                                             | <b>MHK105800</b><br><b>MHS106040</b><br><b>MHS106050</b>                                                                                                                                            |
| <b>fDDL Motherboard</b><br><b>fDDL OEM Socket</b><br><b>fDDL Socket Cover</b>                                                                             |                                                                                                                                                                                                     |

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Preliminary



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