

Fig 1.a:  
TC5 Top view

Size:  
22 x 33 mm x 3.5 mm



Fig 1.b:  
TC5 Bottom view

(Actual Size)

#### FEATURES & BENEFITS:

- **MIL-STD 110C Compliant:** Up to 120 kbps in 24 kHz
- **SSB Data Modem:** 9600 bps in 3 kHz
- **ISB Data Modem:** 19200 bps in 2 x 3 kHz
- **Standards Compliance:** MIL-STD & STANAG
- **SWAP-C:** Optimal size, weight, power and cost
- **Low Cost:** Hardware Installation
- **Activation Keys:** Unlock Functionality
- **Low Power:** Hunt 650 mW, Lock 1100 mW (typ. WBHF)
- **Very Compact Size:** 22 x 33 x 3.5 mm

#### OTHER SOFTWARE OPTIONS (DATASHEETS AVAILABLE):

- **4G ALE / WALE<sup>(F)</sup>:** 141D App. G, incl. 2G & 3G
- **Digital Voice:** 700 to 2400 bps Vocoder
- **Encryption:** 56-bit for Data/Voice
- **VHF Modem:** Robust Mobile & LOS, up to 256 kbps, 50 kHz

#### RELATED PRODUCTS (DATASHEETS AVAILABLE):

- **EF-256 Embedded Functions for Secure Voice & Data:**
  - AES-256 Encryption
  - Vocoder (600 – 2400 bps) TWELP\* or MELPe\*\*
- **EF-300V Embedded 300 bps Voice:** TWELP\* Vocoder
- **4G-R<sup>(F)</sup> WB Modem:** LSU and Pkt (HF / VHF)
- **4G-R<sup>(F)</sup> WB Modes:** FF / ECCM

\* TWELP voice coding by DSP Innovations Inc.(www.dspini.com)

\*\* MELPe for US customers only

(F) Future feature.

#### WIDEBAND HF DATA MODEM

The TC5 module is intended for radio manufacturers seeking to fully exploit the available spectrum for the highest speeds of BLOS and HF surface wave communications.

The TC5 can host Wideband HF Modem functions that fully comply with MIL-STD-188-110C App. D up to 24 kHz audio bandwidth. The TC5 is intended for integration into Wideband HF and V/UHF radio designs.

The modem receiver engine has advanced WB tone excision capability coupled with agile channel estimation and high-performance equalization functions with expanded Doppler and multi-path spread envelopes. The modem BER performance exceeds the specifications by a healthy margin.

#### NARROWBAND HF DATA MODEM

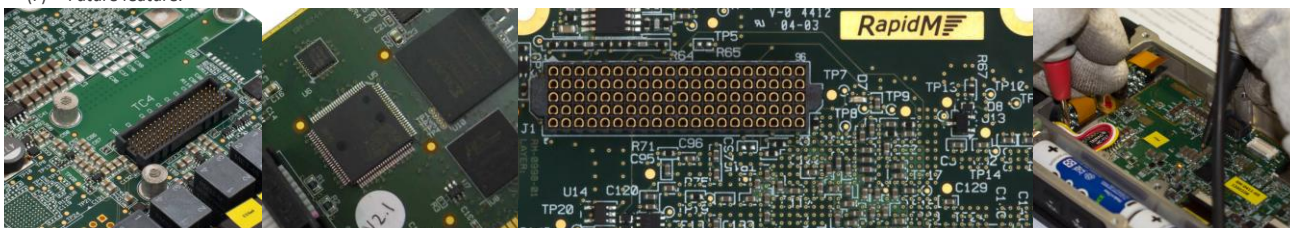
The wideband modem includes pre-existing 3kHz SSB and 2x3 kHz 2-ISB modem modes for backward compatibility with MIL-STD-188-110B, STANAG 4539, 4415 and 4285 modems.

#### ULTRA-COMPACT HARDWARE

The TC5 hardware is based on RapidM's new ultra-compact module footprint. The module is a plug-in replacement to the TC2. The TC5 extends the capabilities offered by the TC2 by also offering Wideband HF capabilities up to 24 kHz bandwidth. The TC5 also features very low power consumption for a Wideband HF Modem.

#### EMBEDDED FUNCTIONS FOR SECURE VOICE/DATE, ECCM

The TC5 hardware will be able to host RapidM's own 4G-R embedded software functions in future. The RapidM 4G-R will offer secure voice and data in fixed frequency as well as ECCM modes. The suite will offer HF and VHF waveforms with far greater resistance to noise, adverse channel conditions, interference, detection and jamming.



## WIDEBAND HF MODEM SPECIFICATIONS – MS110C APPENDIX D (24 kHz)

| B/WIDTH                              | WBHF CIRCUIT SWITCHED DATA MODEM (MIL-STD-188-110D APPENDIX D) |           |           |           |           |           |                                          |            |             |             |              |              |               |            | SOFTWARE<br>OPTION<br>W1<br>(24 kHz) |
|--------------------------------------|----------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|------------------------------------------|------------|-------------|-------------|--------------|--------------|---------------|------------|--------------------------------------|
|                                      | 0<br>Walsh                                                     | 1<br>BPSK | 2<br>BPSK | 3<br>BPSK | 4<br>BPSK | 5<br>BPSK | 6<br>QPSK                                | 7<br>8-PSK | 8<br>16-QAM | 9<br>32-QAM | 10<br>64-QAM | 11<br>64-QAM | 12<br>256-QAM | 13<br>QPSK |                                      |
| 3 kHz                                | 75                                                             | 150       | 300       | 600       | 1200      | 1600      | 3200                                     | 4800       | 6400        | 8000        | 9600         | 12000        | 16000         | 2400       | ✓                                    |
| 6 kHz                                | 150                                                            | 300       | 600       | 1200      | 2400      | 3200      | 6400                                     | 9600       | 16000       | 16000       | 19200        | 24000        | 32000         |            |                                      |
| 9 kHz                                | 300                                                            | 600       | 1200      | 2400      | -         | 4800      | 9600                                     | 14400      | 19200       | 24000       | 28800        | 36000        | 48000         |            |                                      |
| 12 kHz                               | 300                                                            | 600       | 1200      | 2400      | 4800      | 6400      | 12800                                    | 19200      | 25600       | 32000       | 38400        | 48000        | 64000         |            |                                      |
| 15 kHz                               | 300                                                            | 600       | 1200      | 2400      | 4800      | 8000      | 16000                                    | 24000      | 32000       | 40000       | 48000        | 57600        | 76800         |            |                                      |
| 18 kHz                               | 600                                                            | 1200      | 2400      | 4800      | -         | 9600      | 19200                                    | 28800      | 38400       | 48000       | 57600        | 72000        | 90000         |            |                                      |
| 21 kHz                               | 300                                                            | 600       | 1200      | 2400      | 4800      | 9600      | 19200                                    | 28800      | 38400       | 48000       | 57600        | 76800        | 115200        |            |                                      |
| 24 kHz                               | 600                                                            | 1200      | 2400      | 4800      | 9600      | 12800     | 25600                                    | 38400      | 51200       | 64000       | 76800        | 96000        | 120000        |            |                                      |
| Skywave Receivable (Fully Compliant) |                                                                |           |           |           |           |           | Groundwave Only Design (Fully Compliant) |            |             |             |              |              |               |            |                                      |

## NARROWBAND HF MODEM SPECIFICATIONS

| ADDITIONAL MODEM WAVEFORMS (INCLUDED WITH WIDEBAND HF MODEMS) |                                                                                                                                                                                            |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2-ISB (2x3 kHz)                                               | STANAG 4539 / MIL-STD-188-110B Appendix F                                                                                                                                                  |
| SSB (3 kHz)                                                   | STANAG 4539 / MIL-STD-188-110B App. D (TDMA),<br>STANAG 4539 / MIL-STD-188-110B App. C (QAM),<br>MIL-STD-188-110B (QAM), 110A (8-PSK),<br>STANAG 4415, 4481, 4285, 4529, 5065 (LF) and FSK |

## HARDWARE SPECIFICATIONS

| TC5 HARDWARE       |                                                                                                        |                                                                                                          |                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| SIZE               | 22 x 33 x 3.5 mm (w x d x h)                                                                           | POWER                                                                                                    | 3.3 VDC, (Hunt < 650 mW), (Off < 1 mW), (Full-Power < 1100 mW) |
| TEMPERATURE        | -40°C to +85°C (operating); -40°C to +85°C (storage)                                                   |                                                                                                          |                                                                |
| CONNECTORS         | 3x40-way fine pitch connector, Module Side: Hirose DF40C-40DP-0.4V(51), Host Side: DF40C-40DS-0.4V(51) |                                                                                                          |                                                                |
| PRIMARY INTERFACES | NOMINAL USE                                                                                            | DETAILS                                                                                                  |                                                                |
| UART A             | Data, Config, Control (Typical) (Customisable)                                                         | Default Rate: 115200 bps (300 to 921600 bps)<br>Electrical: 3.3V LVCMOS                                  |                                                                |
| UART B             | Radio Control (Typical) (Customisable)                                                                 | Rate: 50 to 921600 bps, Electrical: 3.3V LVCMOS                                                          |                                                                |
| UART C             | Spare (Customisable)                                                                                   | Rate: 50 to 921600 bps, Electrical: 3.3V LVCMOS                                                          |                                                                |
| USART              | DTE (TX, RX, RTS, CTS, DTR, DSR, DCD, TCLK, RCLK, RTCLK)                                               | Rate: 256 000 to 50 bps in sync with modem<br>Electrical: 3.3V LVCMOS (for external EIA-530-A)           |                                                                |
| ETHERNET           | Data, Config, Control (Optional)                                                                       | On-board PHY, only requires external connector with integrated magnetics for full 10/100 Base T solution |                                                                |
| MCBSP 0            | Data, Config, Control (build option)                                                                   | Synchronous serial I/F MCBSP port                                                                        |                                                                |
| MCBSP 1 / McASP    | Digital Baseband Audio (build option), and/or<br>Digital Ear & Mic Audio (build option)                | Synchronous serial I/F MCBSP port                                                                        |                                                                |
| DISCRETES INPUTS   | PTT Sense<br>Deep Sleep                                                                                | Zeroise<br>PPS (GPS Time Sync.)                                                                          | Reset<br>Hold-up Battery (RTC, Mem)                            |
| DISCRETE OUTPUTS   | Radio Keyline Ready                                                                                    |                                                                                                          |                                                                |

| ORDERING INFORMATION                                       | STOCK NUMBER    | DESCRIPTION                             |
|------------------------------------------------------------|-----------------|-----------------------------------------|
| TC5 HF Wideband Modem W1 (MS110C, 24 kHz)                  | TC5-02-M-W1-V06 | Module: TC5 W1 (110C 24kHz 120kbps) V06 |
| OTHER SOFTWARE OPTIONS*                                    | STOCK NUMBER    | DESCRIPTION                             |
| 3G ALE Fast Link Setup (MS141C App C, S4538 FLSU)          | TC5-SW-O-3G-V06 | SW MDL-3G ALE 4538 FLSU, Rad. Ctrl V06  |
| 3G Packet Modem (S4538 xDL)                                | TC5-SW-O-3D-V06 | SW MDL-3G ALE 4538 xDL Pckt Modem V06   |
| 2G ALE (MS141B App A & B)                                  | TC5-SW-O-2G-V06 | SW MDL-2G ALE / MS 141B, App. A, B V06  |
| Digital Voice 700, 1200, 2400 bps (see EF-256 for 600 bps) | TC5-SW-O-D7-V06 | SW MDL-DV 700 to 2k4 bps Voc, Mdm V06   |
| Encryption 56-bit (see EF-256 for AES-256)                 | TC5-SW-O-ED-V06 | SW MDL-COMSEC 56bt HVM/xDL/Voc V06      |
| VHF Wideband Modem V5 (50 kHz Mobile & LOS, Proprietary)   | TC5-SW-O-V5-V06 | SW MDL-V5 (VHF 50kHz 256kbps CL9) V06   |
| VHF Wideband Modem V6 (25 kHz Mobile & LOS, Proprietary)   | TC5-SW-O-V6-V06 | SW MDL-V6 (VHF 25kHz 128kbps CL9) V06   |
| EVALUATION KIT*                                            | STOCK NUMBER    | DESCRIPTION                             |
| TC5 EVAL. KIT (CARRIER CARD, BREAK-OUT CABLE, PSU)         | TC2-EV-0011-SPC | Bundle: TC2 Eval Kit (TC2 excl.)        |

\* Contact RapidM for Datasheets

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