

HF Modem

2G ALE

3G ALE

V/UHF Modem

56b, 2400 Vocoder



Fig 1.a:  
TC2 Top view

Size:  
22 x 33 mm x 3.5 mm



Fig 1.b:  
TC2 Bottom view

(Actual Size)

### FEATURES & BENEFITS:

- **Narrowband Data Modem:** Up to 16000 bps
- **Wideband Data Modem:** Up to 128000 bps
- **Forward Error Correction:** Coded modems
- **SWAP-C:** Optimal size, weight, power and cost
- **Activation Keys:** Unlock Functionality
- **Low Power:** N/B: 150 mW, W/B: 600 mW (typ.)
- **Very Compact Size:** 22 x 33 x 3.5 mm

### OTHER SOFTWARE OPTIONS (DATASHEETS AVAILABLE):

- **HF Modem:** Up to 9 600 bps SSB, 19 200 bps ISB
- **2G ALE:** MIL-STD-188-141B/C App A & B
- **3G ALE:** STANAG 4538 FLSU
- **Packet Modem:** STANAG 4538 xDL
- **Digital Voice:** 2400 bps Vocoder
- **Encryption:** 56-bit for Data/Voice

### RELATED PRODUCTS (DATASHEETS AVAILABLE):

- **EF-256 Embedded Functions for Secure Voice & Data:**
  - AES-256 Encryption
  - Vocoder (600 – 4800 bps) TWELP\* or MELPe\*\*
  - AUTO Data Rate Change
  - Extended Range, const. amplitude modulation

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

\*\* MELPe for US customers only

### V/UHF VOICE & DATA MODEM

The TC2 is a voice and data modem for narrowband and wideband V/UHF radios. The TC2 has very low power consumption. The module has DC coupled A/D inputs which are suitable to detect squelch break whilst the processor clock rate is very low.

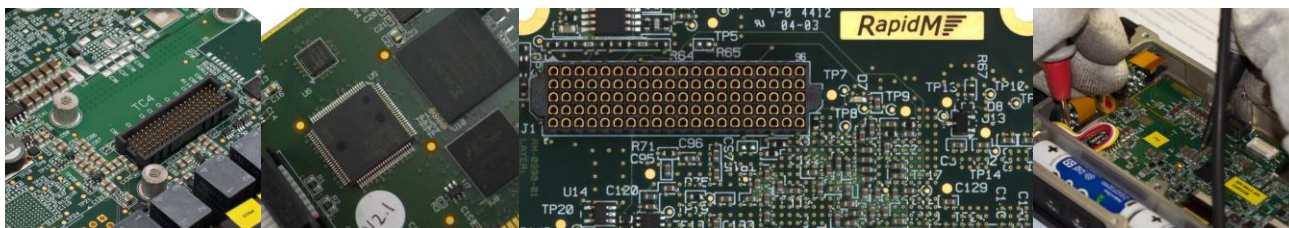
The modem features a high performance adaptive equalizer to deal with dynamic multi-path distortion associated with mobile communications. Doppler tracking capability ensures operation at relative speeds up to 250 km/h.

### NARROWBAND DATA MODEM – OPTION

The TC2's narrowband modem option has a maximum coded data transfer rate of 16000 bps in a 3 kHz V/UHF channel. The power consumption for V/UHF (FM) receive is then as low as 150mW and as low as 50mW (deepsleep / standby). The modem is suitable for messaging, data and position transfer applications.

### WIDEBAND DATA MODEM – OPTION

The TC2's wideband modem option can scale to the required bandwidth. The maximum coded rate is 128 000 bps in a 24 kHz channel. These modes are intended for integration into high-capacity V/UHF radios.



## L1 TO L4: V/UHF DATA MODEM OPTIONS – FEATURES AND BENEFITS

The TC2 can host either narrowband or a wideband V/UHF data modem. The narrowband modem has a fixed 3 kHz bandwidth. The wideband modem offers a number of bandwidths (3, 6, 9, 12, 18 or 24 kHz). The low data rates (non-QAM) are suitable for use with a non-linear power amplifier (PA). Higher rates require a linear PA or can work with wideband FM or AM radios. FEC up to CL-9 is included, depending on the bandwidth and modulation used. All modes support AUTOBAUD. The *Ultra Short* interleaver is intended for IP traffic and *Medium* is for video streaming; *Long* is for high-capacity data traffic at low vehicle speeds (slow fading channels). The maximum Interleaver data block in each bandwidth corresponding to the highest data rate is indicated in the table below.

### TC2 WAVEFORM SPECIFICATIONS

BANDWIDTH	DATA RATE [bps] (CODED)										INTERLEAVER [ms]			SOFTWARE OPTION			
	MODULATION										ULTRA SHORT	MEDIUM	LONG	L1	L2	L3	L4
	256-QAM	128-QAM	64-QAM	32-QAM	32-QAM	16-QAM	8-PSK	Q-PSK	BPSK	BPSK							
24 kHz	128000	96000	76800	64000	32000	25600	19200	9600	4800	2400	20	960	4800	✓			
18 kHz	96000	76800	57600	48000	25600	19200	9600	4800	2400	1200	40	960	4800	✓			
12 kHz	64000	51200	38400	32000	16000	12800	9600	4800	2400	1200	40	960	4800	✓	✓		
9 kHz	48000	38400	28800	24000	12800	9600	4800	2400	1200	600	80	960	4800	✓	✓		
6 kHz	32000	25600	19200	16000	8000	6400	4800	2400	1200	600	80	960	4800	✓	✓	✓	
3 kHz	16000	12800	9600	8000	4800	3200	2400	1200	600	300	160	960	4800	✓	✓	✓	✓

CL-3	CL-4	CL-5	CL-6	CL-7	CL-8	CL-9	LOS CHANNEL	MOBILE CHANNEL
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### HARDWARE SPECIFICATIONS

TC2 HARDWARE		
SIZE	22 x 33 x 3.5 mm (w x d x h)	
POWER	3.3 VDC, (Hunt < 650 mW), (Deep-Sleep < 50 mW), (Off < 1 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	Default Rate: 115200 bps (300 to 921600 bps) Electrical: 3.3V LVCMOS
UART B	Radio Control	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: 128 000 to 300 bps in sync with modem 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
ANALOGUE AUDIO	Baseband Audio In	Input: 1.4 Vp-p, ~ 20 kΩ input impedance
	Baseband Audio Out	Output: 2.2 Vp-p, ~ 16 Ω min. output load impedance
	Voice Microphone-In	Input: 1.4 Vp-p, ~ 20 kΩ input impedance
	Voice Headphone-Out (independent volume control)	Output: 2.2 Vp-p, ~ 16 Ω min. output load impedance
	Voice Line-Out	Output: 2.2 Vp-p, ~ 600 Ω min. output load impedance
	Microphone Bias	Analogue Input
McBSP 0	Data, Config, Control (build option)	Synchronous serial I/F McBSP port
McBSP 1	Digital Baseband Audio (build option), and/or Digital Ear & Mic Audio (build option)	Synchronous serial I/F McBSP port
DISCRETES INPUTS	PTT Sense Deep Sleep	Zeroise PPS (GPS Time Sync.) Reset Hold-up Battery (RTC, Mem)
DISCRETE OUTPUTS	Radio Keyline	Ready

ORDERING INFORMATION	STOCK NUMBER	DESCRIPTION
TC2 (Hardware only)	TC2-02-M-M0-6.5	Module: TC2 V2 SDM M0 (H/W) V6.5
Hardware Activation (Required)	TC2-02-HWAC-KEY	Key: TC2 H/W Activation (required)
V/UHF Modem L1 (Wideband)	TC2-SW-O-L1-6.5	SW MDL-L1 (VHF B≤24kHz ≤128kbps) V6.5
V/UHF Modem L2	TC2-SW-O-L2-6.5	SW MDL-L2 (VHF B≤12kHz ≤64kbps) V6.5
V/UHF Modem L3	TC2-SW-O-L3-6.5	SW MDL-L3 (VHF B≤6kHz ≤32kbps) V6.5
V/UHF Modem L4 (Narrowband)	TC2-SW-O-L4-6.5	SW MDL-L4 (VHF B≤3kHz ≤16kbps) V6.5
OTHER SOFTWARE OPTIONS*	STOCK NUMBER	DESCRIPTION
HF Modem M1 Software Option	TC2-SW-O-M1-6.5	SW MDL-M1 (HF 110B, ISB, 110C 6kHz) V6.5
HF Modem M2 Software Option	TC2-SW-O-M2-6.5	SW MDL-M2 (HF S4285, S4539 9600) V6.5
HF Modem M3 Software Option	TC2-SW-O-M3-6.5	SW MDL-M3 (HF 110A, 4415 2400 ) V6.5
HF Modem M4 Software Option	TC2-SW-O-M4-6.5	SW MDL-M4 (HF MdM S4539 9600 bps) V6.5
2G ALE	TC2-SW-O-2G-6.5	SW MDL-2G ALE / MS 141B, App. A, B V6.5
3G ALE Fast Link Setup	TC2-SW-O-3G-6.5	SW MDL-3G ALE 4538 FLSU, Rad. Ctrl V6.5
3G ALE xDL Packet Data	TC2-SW-O-3D-6.5	SW MDL-3G ALE 4538 xDL Pckt Modem V6.5
Digital Voice 2400 bps	TC2-SW-O-DH-6.5	SW MDL-SDVS 2400bps Vocoder, Modem V6.5
Encryption 56-bit	TC2-SW-O-ED-6.5	SW MDL-COMSEC 56bt HVM/xDL/Voc V6.5
EVALUATION KIT*	STOCK NUMBER	DESCRIPTION
TC2 EVAL. KIT (CARRIER CARD, BREAK-OUT CABLE, PSU)	TC2-EV-0011-SPC	Bundle: TC2 Eval Kit (TC2 excl.) V01

\* Contact RapidM for Datasheets

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