

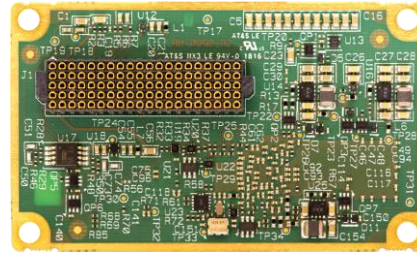
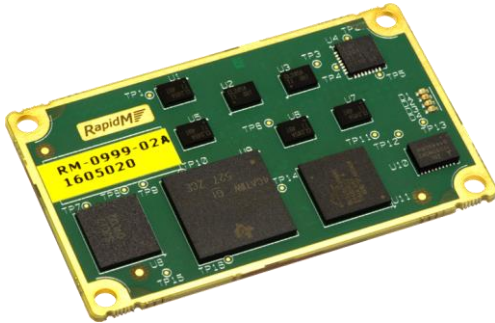
HF Modem

2G ALE

3G ALE

V/UHF Modem

56b, 2400 Vocoder



(Actual Size)

FEATURES & BENEFITS:

- **Narrowband Data Modem:** 16000 bps in 3 kHz
- **Wideband Data Modem:** 128000 bps in 24 kHz
- **Low Cost:** Hardware Installation
- **Activation Keys:** Unlock Functionality
- **Low Power:** N/B: 150 mW, W/B: 600 mW (typ.)
- **Compact Size:** 33 x 55 x 6 mm

OTHER SOFTWARE OPTIONS (DATASHEETS AVAILABLE):

- **HF Modem:** Up to 9 600 bps SSB, 19 200 bps ISB
- **MIL-STD 110C Modes:** 32,000 bps in 6 kHz
- **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 – 2400 bps) TWELP* or MELPe**
 - AUTO Data Rate Change, Best-in-class Modem
 - 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 **TC4-LP** is a voice and data modem for narrowband and wideband V/UHF radios. The **TC4-LP** has very low power consumption. The module has DC coupled A/D inputs which are suitable to detect squelch break whilst the processor's clock rate is very low.

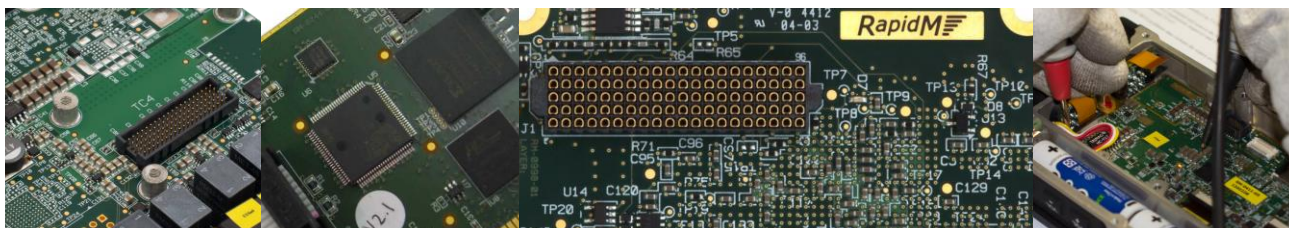
The modem features a high performance adaptive equalizer to deal with dynamic multi-path distortion associated with mobile communications. Doppler tracking capability ensures operation at relative speeds up to 250 km/h.

NARROWBAND DATAMODEM – OPTION (L4)

The **TC4-LP** 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 (L1 – L3)

The **TC4-LP** wideband modem options 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 TC4-LP 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.

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

TC4-LP HARDWARE		
SIZE	33 x 55 x 6 mm (w x d x h)	
WEIGHT	9.1 g	
POWER	3.3 VDC, (Hunt < 650 mW), (Deep-Sleep < 50 mW), (Off < 2 mW)	
TEMPERATURE	-40°C to +85°C (operating); -40°C to +85°C (storage)	
CONNECTOR	Single 100-way fine pitch connector (Samtec YFT-20-xx-H-05-SB)	
PRIMARY INTERFACES	USE	DETAILS
UART A	Data, Config, Control, or Raw Data (build option)	Default Rate: 115200 bps (4800 - 115200) Electrical: 3.3V LVTTTL Flow Ctrl (Raw Data): CTS/RTS, XON/XOFF
UART B	Radio Control, or Config, Control (build option)	Rate: 4800 to 115200 bps Electrical: 3.3V LVTTTL Flow Ctrl: None
AUDIO 1	Baseband Audio SSB/USB (Analogue)	Tx (output): < 10 Ω unbalanced 2.0 V p-p Rx (input): ~ 20 kΩ unbalanced 2.2 V p-p
AUDIO 2	Baseband Audio LSB (Analogue), or Ear & Mic Audio (Analogue)	Tx (output): < 10 Ω unbalanced 2.0 V p-p Rx (input): ~ 20 kΩ unbalanced 2.2 V p-p
McBSP 0	Data, Config, Control (build option)	Synchronous serial I/F McBSP port
McBSP 1	Digital Baseband Audio (build option), or Digital Ear & Mic Audio (build option)	Synchronous serial I/F McBSP port
DISCRETE OUTPUT	Radio Keyline	Active high
DISCRETE INPUTS	PTT Sense Input	Active low
	PPS (GPS Time Sync.)	Rising edge
	Reset / Power Down	Active low
SPEED SELECT	Power Saving (Optional)	Active low, 4 pin input

ORDERING INFORMATION	STOCK NUMBER	DESCRIPTION
TC4-LP (Hardware only)	T4L-02-M-M0-6.5	Module: TC4-LP V2 SDM M0 (H/W) V6.5
Hardware Activation (Required)	T4L-02-HWAC-KEY	Key: TC4-LP H/W Activation (required)
V/UHF Modem L1 (Wideband)	TC4-SW-O-L1-6.5	SW MDL-L1 (VHF B≤24kHz ≤128kbps) V6.5
V/UHF Modem L2	TC4-SW-O-L2-6.5	SW MDL-L2 (VHF B≤12kHz ≤64kbps) V6.5
V/UHF Modem L3	TC4-SW-O-L3-6.5	SW MDL-L3 (VHF B≤6kHz ≤32kbps) V6.5
V/UHF Modem L4 (Narrowband)	TC4-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	TC4-SW-O-M1-6.5	SW MDL-M1 (HF 110B, ISB, 110C 6kHz) V6.5
HF Modem M2 Software Option	TC4-SW-O-M2-6.5	SW MDL-M2 (HF S4285, S4539 9600) V6.5
HF Modem M3 Software Option	TC4-SW-O-M3-6.5	SW MDL-M3 (HF 110A, 4415 2400) V6.5
HF Modem M4 Software Option	TC4-SW-O-M4-6.5	SW MDL-M4 (HF MdM S4539 9600 bps) V6.5
2G ALE	TC4-SW-O-2G-6.5	SW MDL-2G ALE / MS 141B, App. A, B V6.5
3G ALE Fast Link Setup	TC4-SW-O-3G-6.5	SW MDL-3G ALE 4538 FLSU, Rad. Ctrl V6.5
3G ALE xDL Packet Data	TC4-SW-O-3D-6.5	SW MDL-3G ALE 4538 xDL Pckt Modem V6.5
Digital Voice 2400 bps	TC4-SW-O-DH-6.5	SW MDL-SDVS 2400bps Vocoder, Modem V6.5
Encryption 56-bit	TC4-SW-O-ED-6.5	SW MDL-COMSEC 56bt HVM/xDL/Voc V6.5

EVALUATION KIT*	STOCK NUMBER	DESCRIPTION
TC4-LP Eval. Kit (Carrier Card, Break-out Cable, PSU)	TC4-EV-0000-SPC	Bundle: TC4 Eval Kit (TC4 excl.) V02

* Contact RapidM for Datasheets