
# Turbo Coding Technology Solutions @ University of South Australia

Dr S. A. Barbulescu

adrian.barbulescu@unisa.edu.au

# Turbo Coding Technology Solutions @ University of South Australia

The Institute for Telecommunications Research at the University of South Australia has developed very strong capabilities in:

- State of the art Turbo Codec-Modems that operate at very low bit error rates ($< 10^{-10}$), high data rates (2 Mbit/s), using QPSK modulation scheme.
- Single chip Turbo Decoder solutions.
- Expertise in designing turbo coded systems optimised for specific applications (e.g., INTELSAT services)
- Expertise in efficient implementation of turbo decoders.

# ***Turbo Codec - QPSK Modem***

The Turbo Codec - QPSK Modem is a state of the art satellite receiver/transmitter equipment which was developed under an R&D Contract "**Study and Development of a Turbo Codec/Modem for Digital Services**" awarded to the Institute for Telecommunications Research by INTELSAT.

The project was executed in collaboration with DSpace Pty Ltd and OKI Techno Centre (Singapore) Pte Ltd.

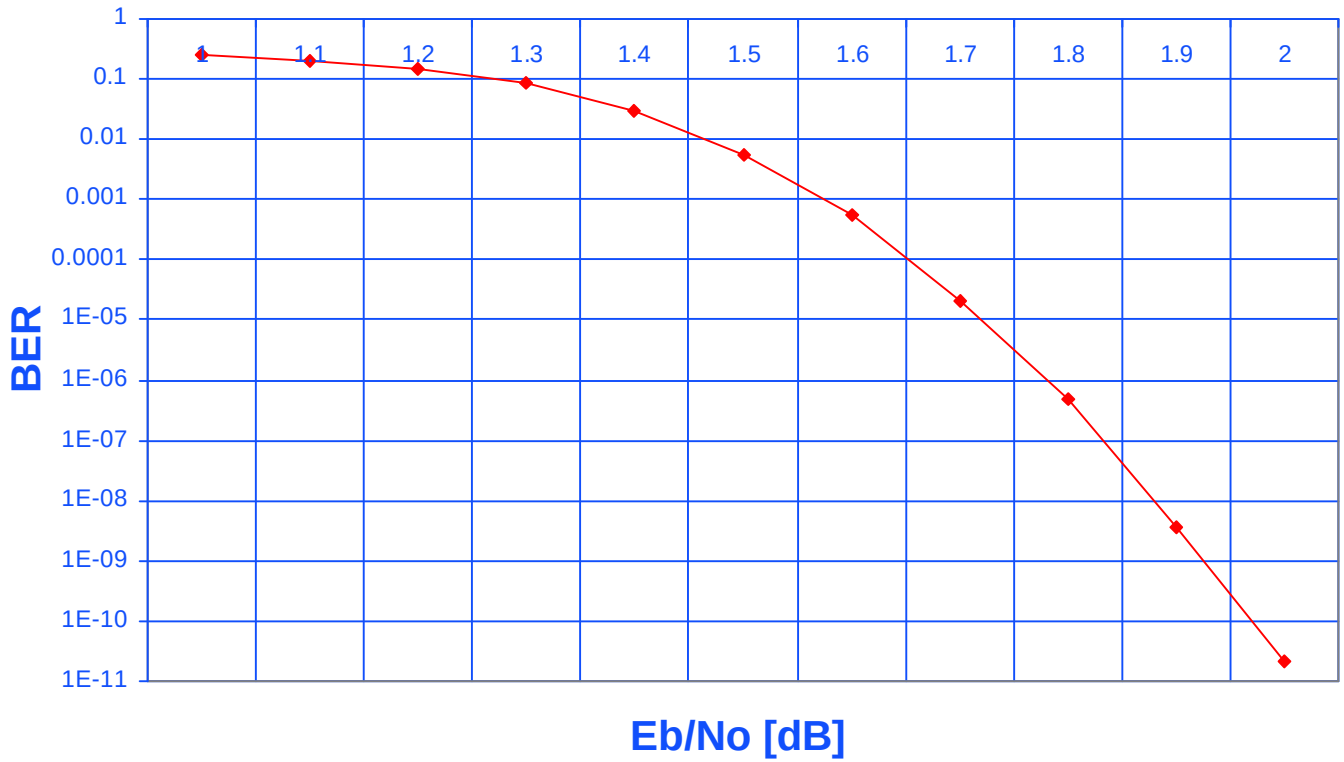
# *Turbo Codec - QPSK Modem*

The *Turbo Codec - QPSK Modem* is designed to work in a closed VSAT network, unframed, with no overhead. The basic model operates at data rates up to 2 Mbit/s and QPSK modulation.
The Forward Error Control (FEC) scheme used is a Serial Convolutional Concatenated Scheme that operates at coding rates of 1/2 and 3/4.

- Information data rates (kbit/s): 64, 128, 256, 512, 1024, 2048.
- Bit Error Rate: $< 10^{-10}$
- Measured $E_b/N_0$ for rate 1/2: < 2.0 dB
- Measured $E_b/N_0$ for rate 3/4 : < 3.5 dB

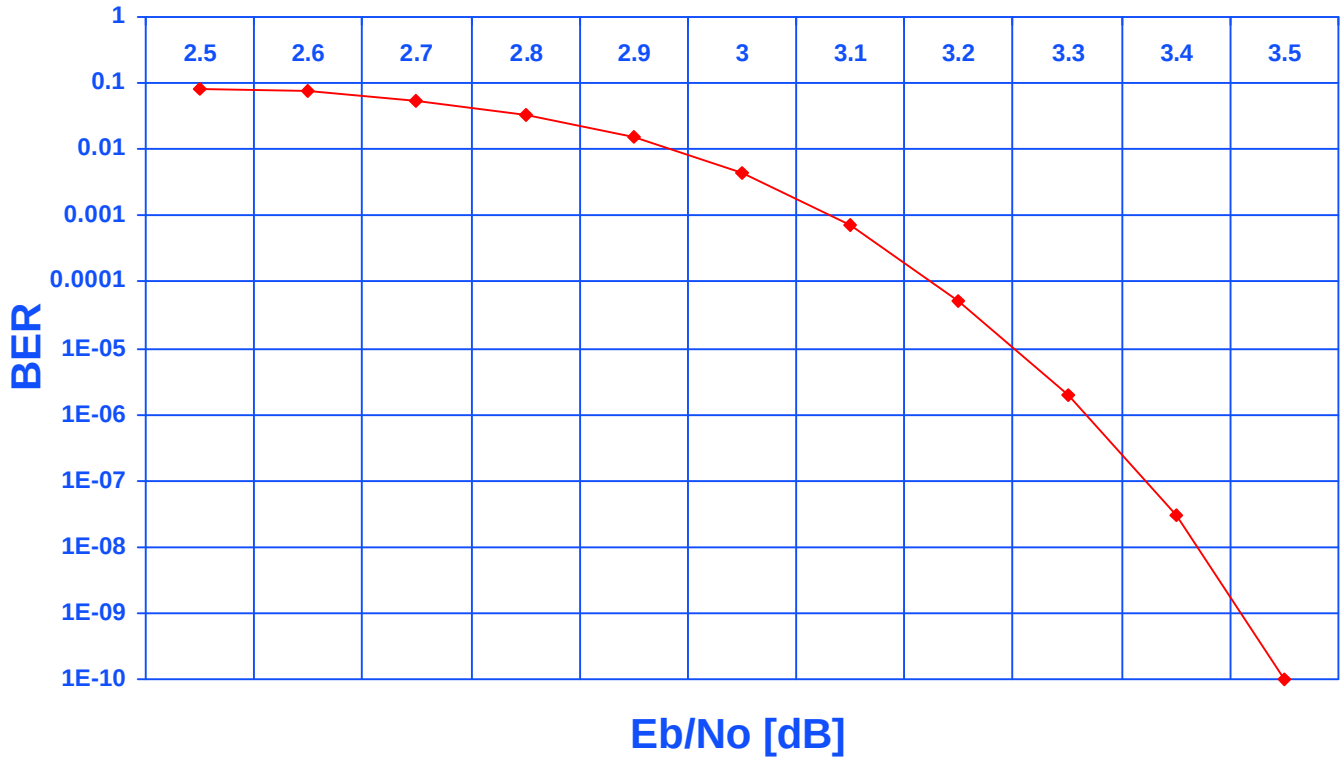
# Turbo Codec - QPSK Measured Results

## Measured Performance for FEC 1/2

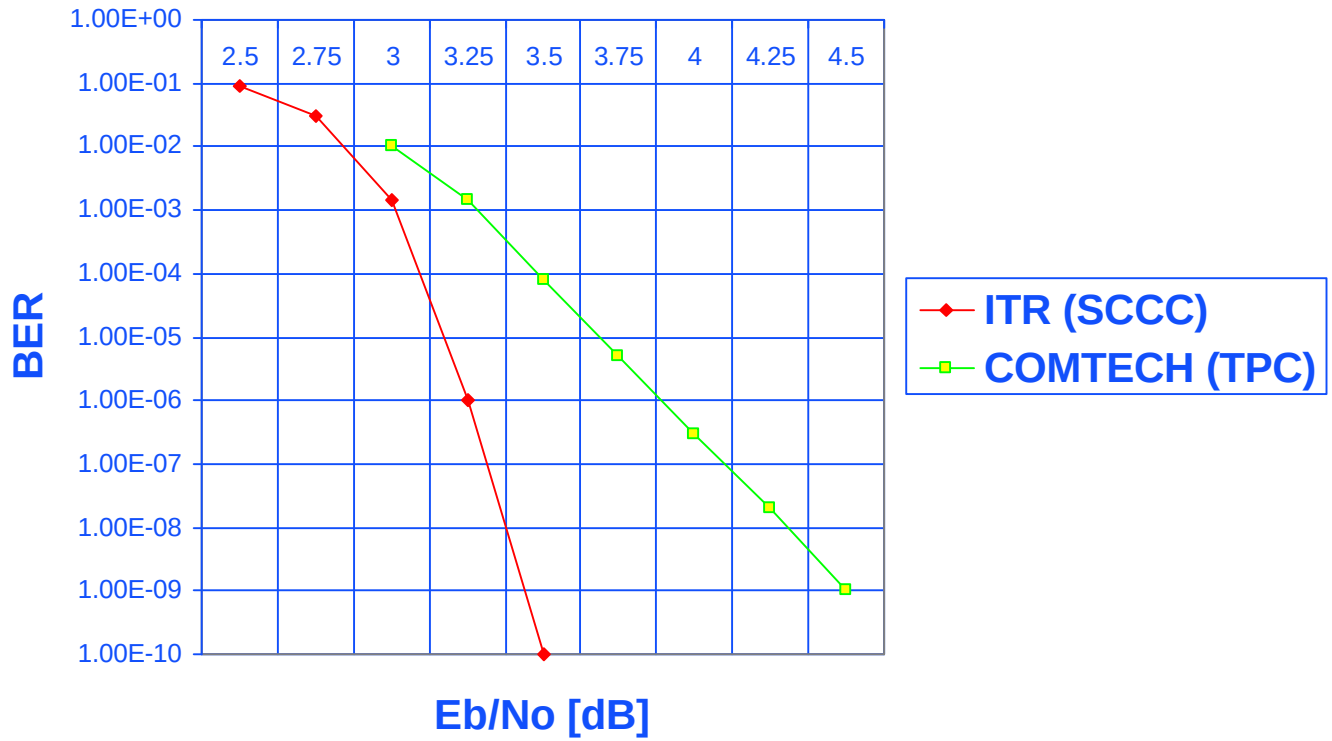


# Turbo Codec - QPSK Measured Results

## Measured Performance for FEC 3/4



# ITR vs COMTECH CDM-550T Performance



# Front and Back View

# Modulator Specifications:

- Modulation: QPSK
- Data Rates: 64, 128, 256, 512, 1024, 2048 kbit/s
- Rate 1/2 Symbol Rates: 64.5, 129, 258, 516, 1032, 2064 ksym/s
- Rate 3/4 Symbol Rates: 43, 86, 172, 344, 688, 1376 ksym/s
- Output Frequency: 70 MHz
- Output Power: 0 to -30 dBm, ± 0.5 dB
- Rolloff Factor: 0.2, 0.25 or 0.3

# Modulator Specifications:

- Transmit Filtering: 44 tap root raised cosine
- Transmit Frequency stability: ± 10 PPM standard
- Timing Jitter: G.823 & G.824
- Timing Accuracy: ± 50 PPM internal clock
- Output Spurious/Harmonics: -45 dBc
- Output Return Loss: > 14 dB
- Connector: BNC, female, 75 Ω (RG59)

# Demodulator Specifications:

- Modulation: QPSK
- Data Rates: 64, 128, 256, 512, 1024, 2048 kbit/s
- Rate 1/2 Symbol Rates: 64.5, 129, 258, 516, 1032, 2064 ksym/s
- Rate 3/4 Symbol Rates: 43, 86, 172, 344, 688, 1376 ksym/s
- Input Frequency: 70 MHz
- Input Power: -30 to -55 dBm, ± 0.5 dB
- Rolloff Factor: 0.2, 0.25 or 0.3

# Demodulator Specifications:

- Receive Filtering: 48 tap root raised cosine
- Receiver Bandwidth: Max. 3 MHz
- Carrier Acquisition Range: ± 16 kHz
- Timing Tolerance: ± 50 PPM
- Input Return Loss: > 20 dB
- Delay: 30 ms @ 2048 kbit/s, 8 iterations
- Synchronization threshold: 0 dB

# General Specifications:

- Single 19” x 3U unit
- Connector: BNC, female, 75 Ω (RG59)
- Graphical User Interface:
  - Runs on a PC under Windows 98
  - Implements all control and monitoring functions
  - Interface via a serial port (RS 232)
- Scrambling: as per INTELSAT IESS 309

# General Specifications:

- Power Supply:
  - 110V +/- 10% 47/63 Hz
  - 240V +/- 10% 47/63 Hz
- Terrestrial Data Interfaces:
  - RS 422, DB37 - RS449 connector
  - NRZ Tx/Rx_Data and Tx/Rx_Clock, BNC connectors

# Applications

- Direct-to-Home (DTH) - is the most exciting recent innovation in the television industry that brings TV channels via satellite directly to customers where ever they are located!

- Business Networks - for banking, retailing, news distribution, remote/rural public telecommunications, distance learning

- Closed VSAT Networks offer:
  - availability
  - flexibility
  - reliability
  - very competitive price
  - security