

# EMONA TIMS SDR – QUICK EXPLANATION

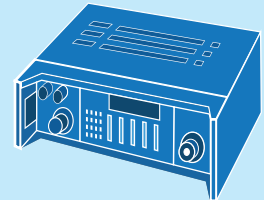
## SDR IS THE FUTURE OF COMMUNICATIONS

### WHAT IS SOFTWARE DEFINED RADIO (SDR) AND WHAT MAKES TIMS-SDR “EDUCATIONAL”?

#### 1 THIS IS TRADITIONAL RADIO

Each radio has its own fixed electronic circuits.  
e.g. AM/FM radio, UHF radio, Cell phone, Walkie-talkie, Satellite radio.

**FIXED  
ELECTRONIC  
CIRCUITS**



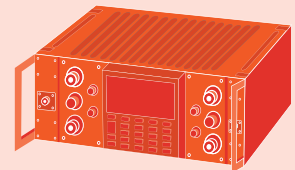
#### 2 THIS IS SDR RADIO MODERN INDUSTRIAL/COMMERCIAL/MILITARY

The electronic circuits are now controlled by the SOFTWARE. Different software is LOADED for each type of radio.  
Used extensively today in military and commercial radios.  
e.g. AM/FM radio, UHF radio, Cell phone, Walkie-talkie, Satellite radio.

**ELECTRONIC CIRCUIT**

**+ COMPUTER**

**+ SDR SOFTWARE**



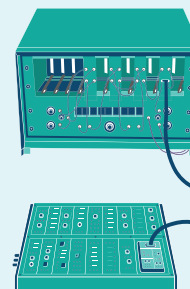
#### 3 THIS IS EMONA TIMS/ETT SDR FOR TEACHING

Emona “TIMS-SDR” opens up the commercial / military / research SDR as a HANDS-ON teaching application.  
TIMS / ETT lab equipment teaches the student both the INNER WORKINGS of the SDR HARDWARE and the flexibility of the SDR SOFTWARE programmability.

**TIMS/ETT  
TRAINER**

**TIMS/ETT  
SDR BOARD**

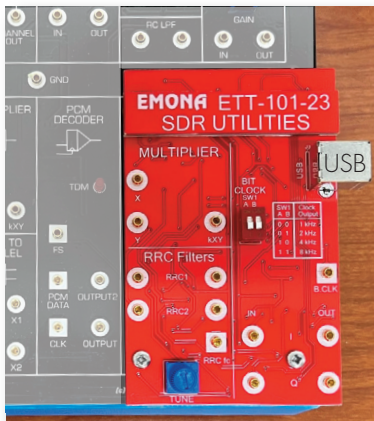
USB



# ETT-101/C Optional Expansion Boards (cont.)

**NEW**

## SDR UTILITIES BOARD : ETT-101-23



**Plug-and-play.  
No Install.  
Complete LINUX  
with GNURadio.**



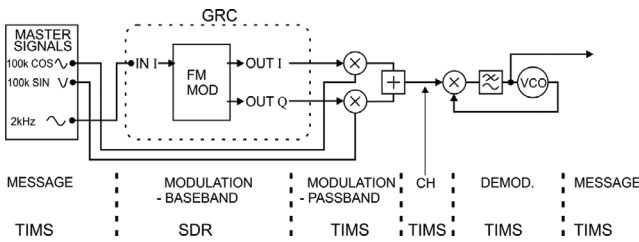
The ETT-101-23 SOFTWARE DEFINED RADIO BOARD is supplied as a complete, zero install solution. One step boot-and-run USB thumb drive has pre-installed LINUX with the full GNU Radio.

A simple, practical student introduction to Software Defined Radio, with experiments implemented utilizing the popular, open source GNU Radio SDR software.

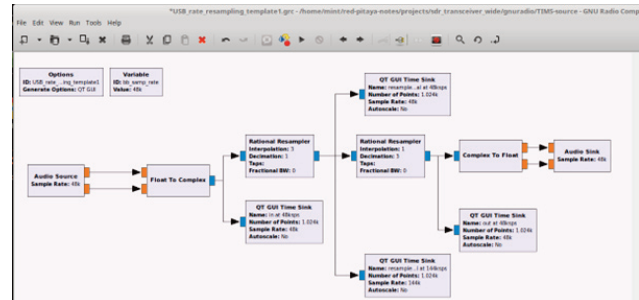
Detailed experiments include:

- Familiarization with SDR software and hardware
- TX with SDR and RX with ETT-101 hardware blocks
- Exploring sampling and resampling
- TX with ETT-101 hardware blocks and RX with SDR
- Exploring digital modulation schemes in SDR

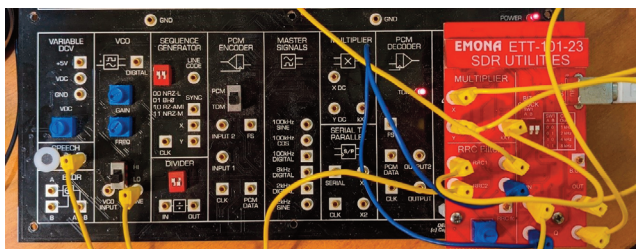
## SIMPLE EXAMPLE



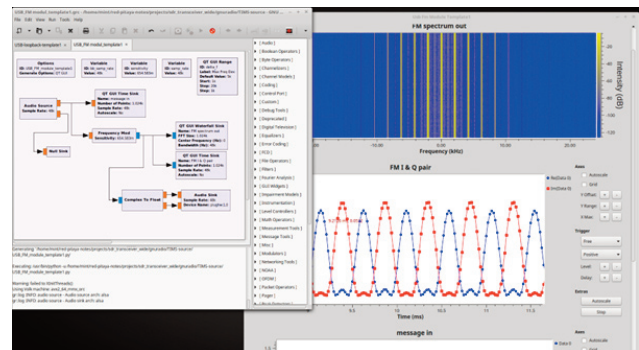
1 - SDR Experiment block diagram



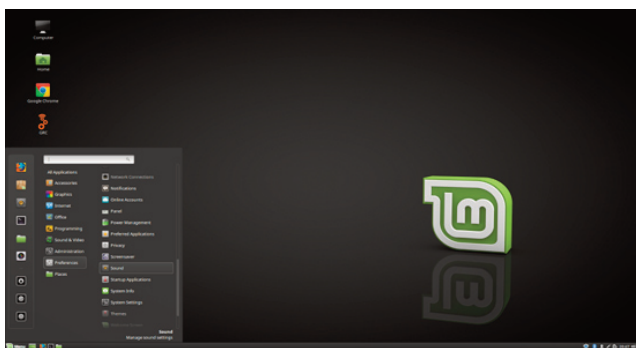
4 - Launching GNURadio



2 - SDR Experiment patching on the hardware

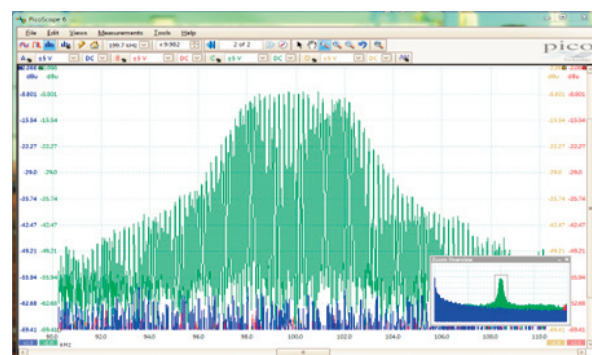


5 - Run/execute GNURadio program



3 - Launching LINUX

**COMPLETE, ZERO-INSTALLATION  
EXPERIENCE !**



6 - View live, real-time signals and spectra

# ETT-101/C Lab Manuals

## 7 Volumes of Fully Documented Student Experiments

### MANUALS INCLUDED AS STANDARD WITH EACH ETT-101/C :

#### ETT-101 LAB MANUAL - Volume 1

(22 Chapters, 362 pages)

- Setting-up an Oscilloscope
- An Introduction to the ETT-101
- Modelling Equations
- Amplitude Modulation AM
- Double Sideband DSB Modulation
- AM Demodulation
- DSB Demodulation
- SSB Modulation & Demodulation
- FM Modulation
- FM Demodulation
- Sampling & Reconstruction
- PCM Encoding
- PCM Decoding
- BW Limiting & Restoring Signals
- ASK Modulation & Demodulation
- FSK Modulation & Demodulation
- BPSK Modulation & Demodulation
- QPSK Modulation & Demodulation
- Introduction to Spread Spectrum - DSSS modulation
- Undersampling in Software Defined Radio
- FM Demodulation - Discriminator Method
- QAM Modulation & Demodulation

#### ETT-101 LAB MANUAL - Volume 2

(23 Chapters, 476 pages)

- AM Method 2 & Product Detection
- Noise in AM Communications
- PCM and TDM
- Armstrong's Phase Modulator
- Phase Division Multiplex
- Pulse-Width Modulation & Demod.
- Message Translation & Inversion
- Carrier Acquisition using the PLL
- SNR and Eye Diagrams
- PCM and SNDR
- ASK Demod using Product Detect.
- FSK (switching method) & Demod.
- Principles of GFSK
- PN Spectra and Noise Generation
- Line Coding and Bit Clock Regen
- Delta Modulation & Demodulation
- Delta-Sigma Mod & Demod
- Observations of AM & DSBSC in the Frequency Domain
- Principles of superheterodyne
- Frequency synthesis with digital PLL

- Differential phase shift keying (DPSK)
- PAM-time division multiplexing (TDM)
- Pulse-Position Mod. & Demodulation

### LAB MANUALS INCLUDED WITH ADD-ON BOARDS :

#### ETT-101 LAB MANUAL - Volume 3

(6 Chapters, 184 pages)

- Full (IQ branch) Demodulation of a QPSK Signal
- Line Code Decoding and Hard Decision Making
- DPSK Modulation and Demod with a Noisy Channel
- FM Demodulation using the Phase-Locked Loop
- Signal constellation Diagrams

**NEW** • Bit error rate measurements in a noisy baseband channels

Vol.3 experiments require the ETT-101-20, ETT-101-21, ETT-101-22 or ETT-101-23 boards

#### ETT-101 FIBER OPTICS LAB MANUAL - Volume 4

(11 Chapters, 280 pages)

- An Introduction to Fiber Optic Signal Transmission and Reception
- Guiding Light Using Total Internal Reflection \*
- Losses in Fiber Optic Networks \*
- Polarization \*
- Bending Losses in Fiber Optic Systems \*
- Connectors \*
- PCM-TDM 'T1' Implementation
- Optical Signal Filtering, Splitting & Combining \*\*
- Fiber Optic Bi-directional Communication \*\*
- Wave Division Multiplexing (WDM) \*\*
- Optical Losses \*\*

\* Experiments require the ETT-101-32 Physics of Fibers Accessory Kit.

\*\* Experiments require the ETT-101-31 Coupler and Filters board.

#### **NEW** ETT-101 SDR Software Defined Radio USER & EXPERIMENT GUIDE

(150 pages)

- Familiarization with SDR software and hardware
- Run a loop-back demonstration
- Exploring sampling & resampling in SDR

- FM modulation in SDR, demodulation using ETT-101 hardware blocks
- SDR (IQ) mod. and demod., with ETT-101 hardware channel
- GMSK SDR (IQ) mod. and demod., with ETT-101 hardware channel
- FM reception using SDR
- Frequency Division Multiplexing (FDM) using SDR

### **LATEST** ETT-101 SIGNALS & SYSTEMS LAB MANUAL - Volume 5

(16 Chapters, 330 pages)

- Special signals - characteristics & applications
- Systems: Linear and non-linear
- Unraveling convolution
- Integration, correlation & matched filters
- Exploring complex & exponential functions
- A fourier series analysis
- Spectrum analysis of various signals
- Time domain synthesis of an RC circuit
- Poles & zeros in the Laplace domain
- Sampling and aliasing
- Analog-digital conversion
- Discrete-time structures: Finite Impulse Response (FIR) filters
- Poles & zeros in the z plane with IIR systems
- Practical aspects of discrete time structures
- Design & implement filters from specification
- Exploring different digital filter structures, and comparing floating point and fixed point implementations

### ETT-101-10 ELECTRONIC CIRCUITS PROJECTS MANUAL

(14 Projects, 50 pages total)

- RC Circuits • RL Circuits • RC & RL Low-Pass Filters • RC High -Pass Filters
- RC & RL Filters, Cut-off Frequency
- Measuring Filter Roll-off • Measuring Filter Phase Response • Series & Parallel RLC B-P Filters • RLC Band-Stop Filters • Effect of Components on Centre Freq. of Band-Pass & Band-Stop Filters • Effect of Component Values on Bandwidth of Band-Pass Filters
- The Hartley Oscillator • The Colpitts Oscillator • The Clapp Oscillator

Available from:

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Email: [sales@emona-tims.com](mailto:sales@emona-tims.com)

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