

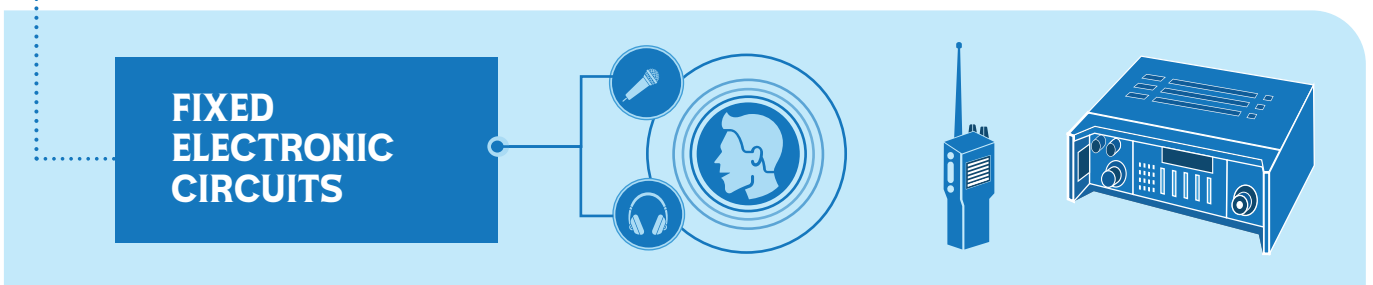
EMONA TIMS SDR – QUICK EXPLANATION

SDR IS THE FUTURE OF COMMUNICATIONS

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

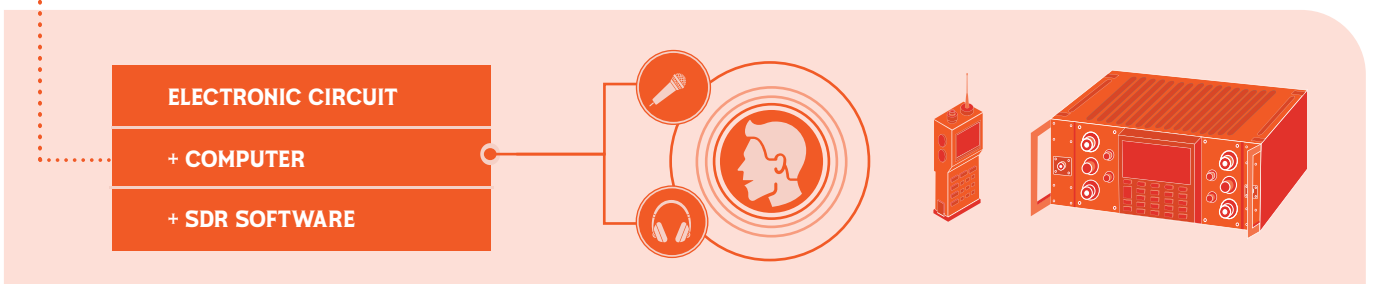
1 THIS IS TRADITIONAL RADIO

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



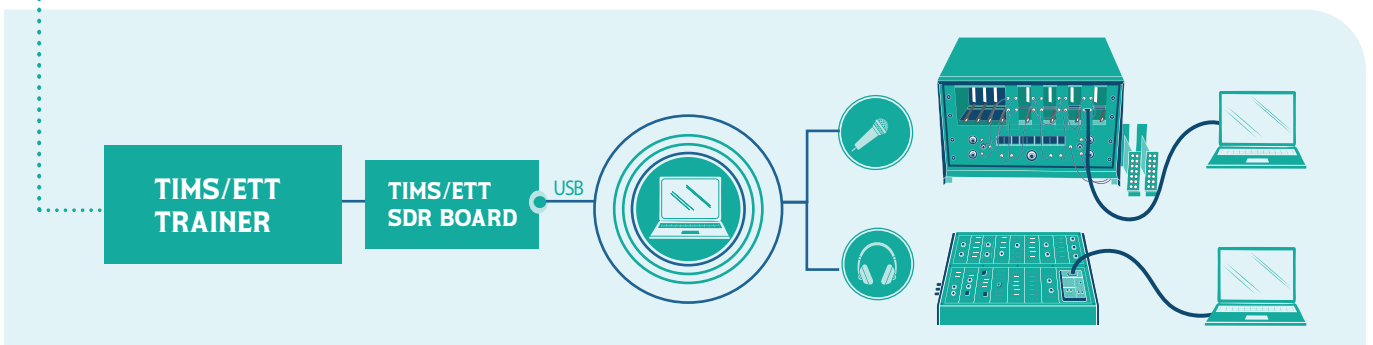
2 THIS IS SDR RADIO MODERN INDUSTRIAL/COMMERCIAL/MILITARY

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.



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.



EMONA **tims**

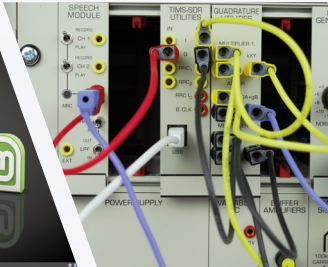
SOFTWARE DEFINED RADIO

Set up the complete GNU Radio
& run SDR in minutes

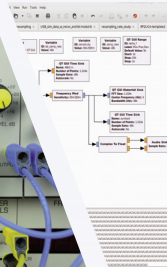
LINUX MINT



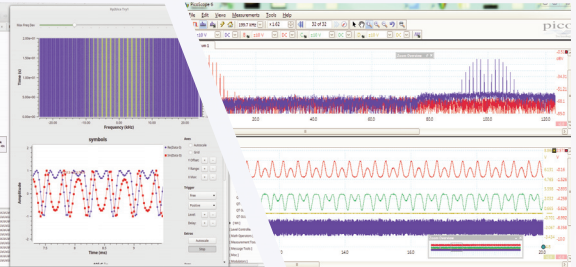
REAL HARDWARE



GNU RADIO



LIVE SIGNALS



The TIMS-SDR solution
Real Hardware plus
full LINUX and GNU Radio
on a USB STICK

Plug-and Play
Boot PC from this USB Drive
with LINUX Mint OS and
GNU Radio ready to go



SDR for Education: Tims explodes the common
"black box" implementation of SDR

✓ TIMS SDR "DESIGNED FOR TEACHING"

TIMS-451 SDR UTILITIES SOLUTION



The Hardware

The interface module between TIMS & GNU Radio

- Standard, single-slot, plug-in module for the TIMS-301C
- SDR UTILITIES MODULE interfaces to GNU Radio via USB port
- Dual I and Q baseband analog outputs
- Dual I and Q baseband analog inputs for IQ receiver
- Dual, variable cut-off RRC Low Pass Filters for reconstruction or receiver application



TIMS-451
TIMS-SDR UTILITIES module

Teach modern comms
in a hands-on manner
with close integration
between hardware & software

MOVE BEYOND THE AUDIO CARD WITH 4 ANALOG CHANNELS IN & OUT

And the Software

A Complete, Turn-key Solution - running in just 4 steps

1. Plug USB flash drive into PC
2. Boot the PC from the USB port
3. Linux Mint launches
4. Run GNU Radio

NO INSTALL
REQUIRED

STUDENTS IMMEDIATELY START RUNNING GNU Radio

TIMS-SDR Kit is a zero-install, plug-and-play, hardware and software package which enables the student to quickly and easily experiment with the graphical GNU Radio Companion software tools in the TIMS telecommunications platform with real signals.



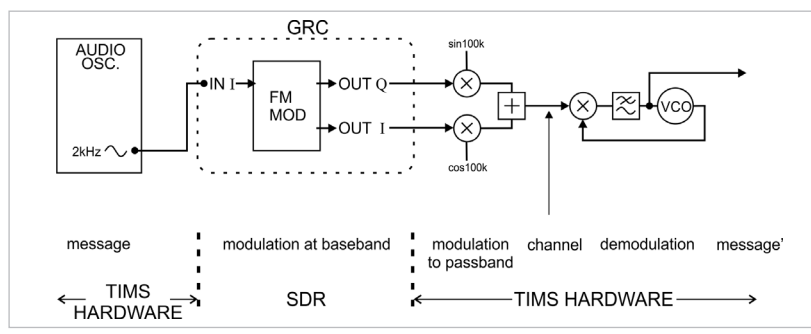
TIMS-SDR plug-and-play USB Drive

Insightful GNU Radio & SDR Experiment Examples

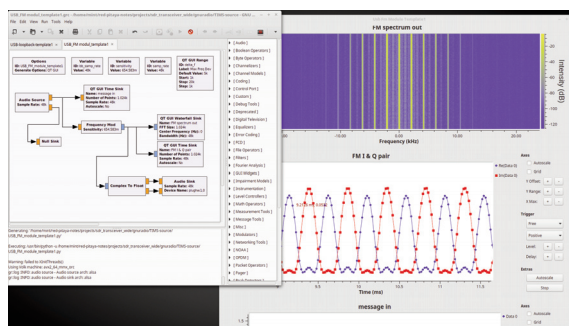


a) GNU Radio Modulator and TIMS Hardware Demodulator

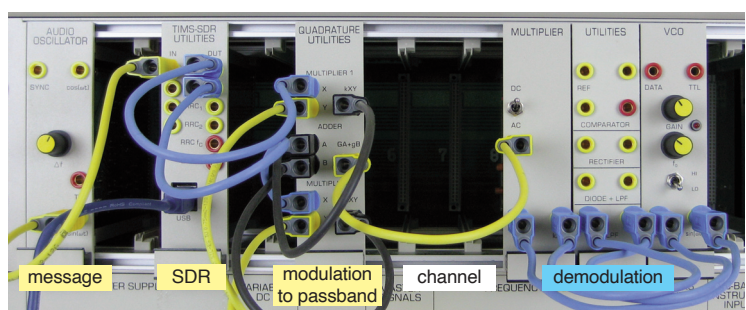
- SDR Software implementation of FM modulator generating I/Q baseband output signals
- TIMS Hardware modules translate I/Q output to TIMS passband signal
- TIMS Hardware modules implement the FM demodulator



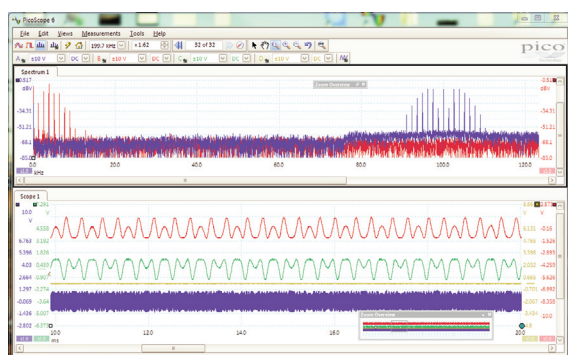
GNU Radio FM modulator + TIMS hardware demodulator



GNU Radio FM modulator



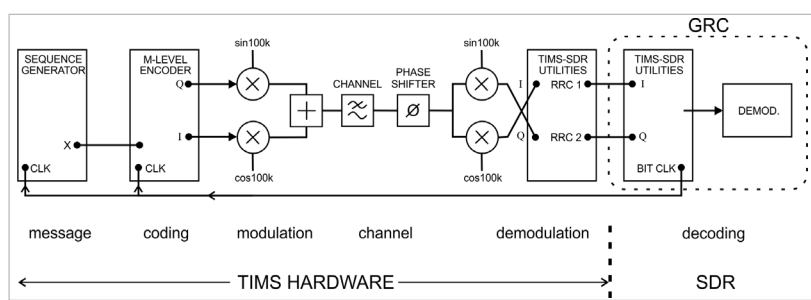
TIMS hardware implementation of the FM mod/demod



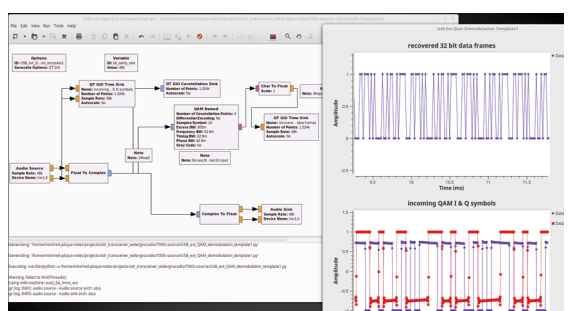
Real FM signals generated by TIMS-SDR

b) TIMS Hardware Modulator and GNU Radio Demodulator

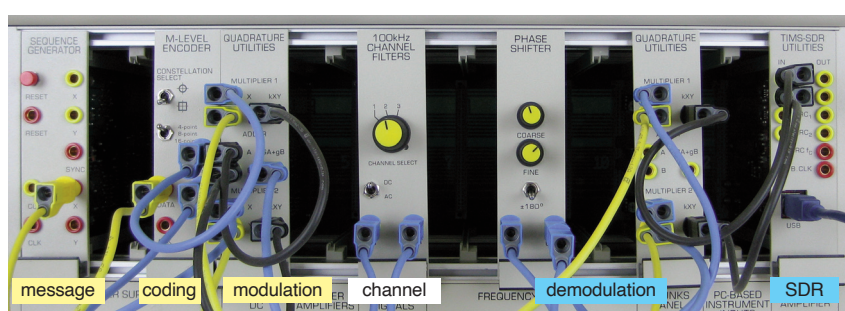
- TIMS Hardware modules generate passband QAM signal and implement the channel
- TIMS Hardware modules translate passband signal to baseband I/Q input to TIMS-SDR input
- SDR Software implementation of QAM demodulator generating recovered data



TIMS hardware QAM mod + GNU Radio QAM demod



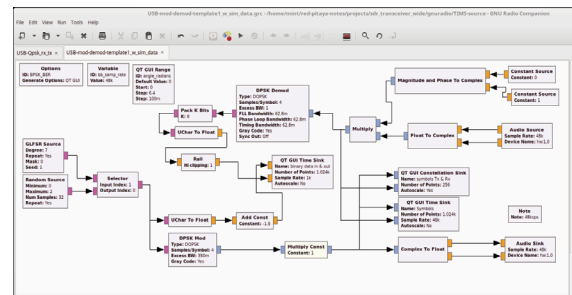
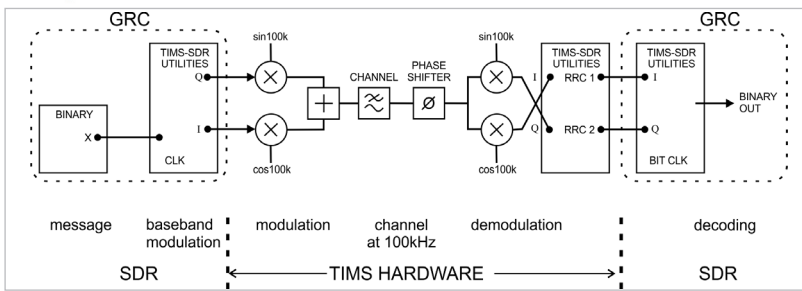
GNU Radio QAM demodulator



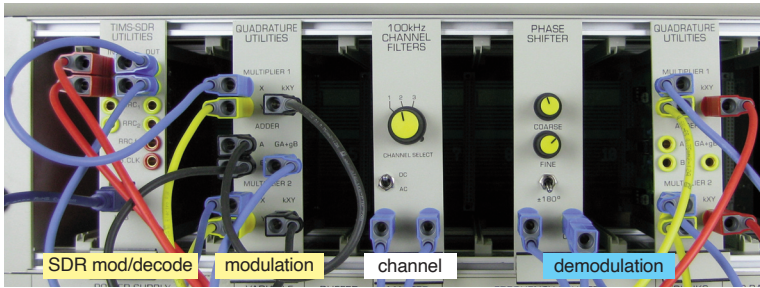
TIMS hardware implementation of the QAM modulation and SDR demodulation

GNU Radio and SDR Implementations (continued)

c) GNU Radio Modulator & Demodulator with TIMS Hardware

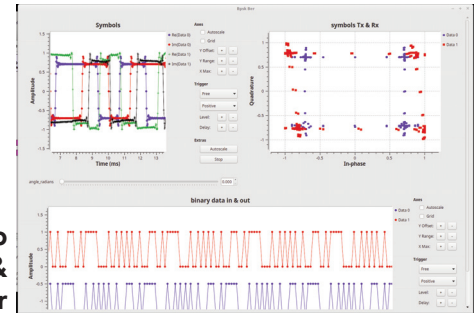


TIMS GNU Radio mod & demod with a real hardware channel



TIMS hardware implementation

GNU Radio modulator & demodulator



Comprehensive GNU Radio Experiments

Experiments included on the TIMS-SDR USB Flash Drive

EMONA TIMS-SDR EXPERIMENT MANUAL - Basic Experiments

- Getting Started and familiarization with GNU Radio software and hardware.
- Run a simple GRC loopback program.
- Expt 1: Introducing I/Q quadrature modulation with phasor representation.
- Expt 2: analog modulation in SDR: AM, DSBSC, Armstrong's Phase Modulator and PM Generation.
- Expt 3: Implementing baseband FM in SDR with hardware passband modulation and PLL demodulation.
- Expt 4: Exploring Sampling, Interpolation, Decimation and Resampling in SDR.
- Expt 5: Implementing BPSK in a noisy passband channel with Bit Error Rate measurements and Eye Diagram
- Expt 6: Quadrature baseband mod/demod in SDR with hardware passband channel using DQPSK and GMSK
- Expt 7: Frequency Division Multiplexing & Demultiplexing in SDR

EMONA TIMS-SDR Detailed Explorative Experiments

- Explorative ETE 1-10 FM reception using SDR
- Explorative ETE 1-11 ETE-11-OFDM for GNU v_3_10 OFDM transmission using SDR
- Explorative ETE 1-12 Modelling 5G PHY channel coding using polar codes
- Explorative ETE 1-13 Modelling 5G PHY channel coding using LDPC codes

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