



**italtec**  
Technical Training Systems

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# Telecommunications



## EDUCATIONAL TRAINING EQUIPMENTS

### Analog Communication Trainer

- Second Order Active Filters,
- RF Oscillators
- AM Modulator, AM Demodulator
- DSB-SC Modulator, Demodulator
- SSB Modulator, Demodulator
- FM Modulator, Demodulator
- TDM Multiplexer, Demultiplexer
- FDM Multiplexer, Demodulator
- Analog-to-digital Converter
- Digital-to-analog Converter
- Frequency Converter, Signal Recovery

### High Level Digital Communication Trainer

- CVSD Modulator, Demodulator
- QPSK Modulator, Demodulator
- QAM Modulator, Demodulator
- DSSS Encoder, Decoder
- BCH Encoder, Decoder
- Convolutional Codes Encoder, Decoder
- GMSK Modulator, Demodulator

### Advanced Digital Communication Trainer

- CDMA DSSS Encoder and Decoder
- CDMA FHSS Encoder and Decoder
- OFDM Multiplexer and Demultiplexer

### Optical Fibers Communication Trainers

- Optical Fibers Transmitter & Receiver
- Optical Fibers Data Communication Controller
- AM and ASK Modulator/Demodulator
- FM and FSK Modulator/Demodulator
- CVSD Encoder and Decoder
- Manchester Encoder and Decoder
- TV Signal Modulator and Demodulator

### Digital Communication Trainer

- Line Code Encoder, Line Code Decoder
- PWM Modulator, Demodulator
- PCM Modulator, Demodulator
- DELTA Modulator, Demodulator
- ACTIVE DELTA Modulator, Demodulator
- ASK Modulator, Demodulator
- FSK Modulator, Demodulator
- PSK Modulator, Demodulator

### Electronics Communication Systems Trainer

- PAM Modulator, Demodulator
- PPM Modulator, Demodulator
- DPSK Modulator, Demodulator
- FHSS Modulator, Demodulator
- HF PLL & RF PLL circuit design
- MSK Modulator, Demodulator
- Noise Power Spectral Density Measurement

### Complementary Communication System Trainer

- Analog Signal Sampling and Reconstruction Circuit
- Noise Power Spectral Density Measurement
- DPCM Modulator and Demodulator

### Optical Fibers System Trainers

- 1310 nm Optical Fibers Transmitter
- 1550 nm Optical Fibers Receiver
- 1550 nm Optical Fibers Transmitter
- 1310 nm Optical Fibers Receiver
- Optical Fibers Audio Transceiver
- Optical Fibers Data Communications
- Optical Fibers Video Transceiver

## ANALOG COMMUNICATION TRAINER

### Module CTA300-01 Second Order Active Filters, RF Oscillators

Description:

- Second Order Active Low-pass Filter
- Second Order Active High-pass Filter
- Second Order Active Band-pass Filter
- Second Order Active Band-stop Filter
- Colpitts Oscillator
- Hartley Oscillator
- Crystal Oscillator
- Voltage Controlled Oscillator



**CTA300-01**

**CTA300-02**



### Module CTA300-02 AM Modulator/Demodulator

Description:

- Transistor AM Modulator
- MC1496 AM Modulator
- AM Diode Detector
- AM Product Detector

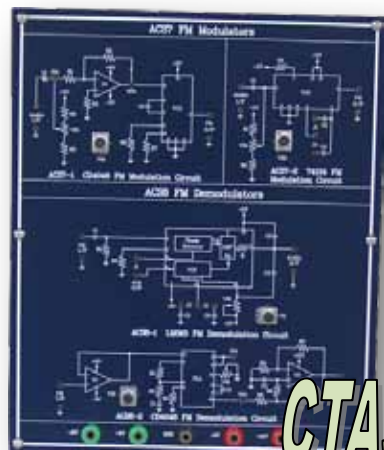
### Module CTA300-03 DSB-SC and SSB Modulator/Demodulator

Description:

- DSB-SC Modulator
- SSB Modulator
- DSB-SC Product Detector
- SSB Product Detector



**CTA300-03**



### Module CTA300-04 FM Modulator/Demodulator

Description:

- MC4046 FM Modulator
- SN74124 FM Modulator
- LM565 FM Demodulator
- CD4046 FM Demodulator

**CTA300-04**



**Module CTA300-05**  
**TDM Multiplexer/Demultiplexer**

Description:

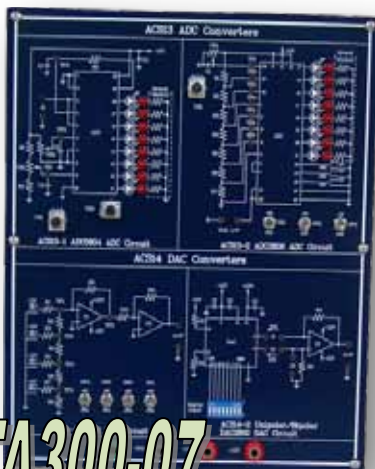
- Waveform Generator
- TDM Multiplexe
- TDM Demultiplexer



**Module CTA300-06 FDM Multiplexer/Demodulator**

Description:

- FDM Signal Generator
- DSB-SC Modulated Signal Generator
- FDM Multiplexer
- FDM Demultiplexer



**Module CTA300-07**

**Analog-to-digital Converter, Digital-to-analog Converter**

Description:

- ADC0804 Analog-to-digital Converter
- ADC0809 Analog-to-digital Converter
- R-2R Digital-to-analog Converter
- Unipolar DAC 0800 Digital-to-analog Converter
- Bipolar DAC 0800 Digital-to-analog Converter

**Module CTA300-08**

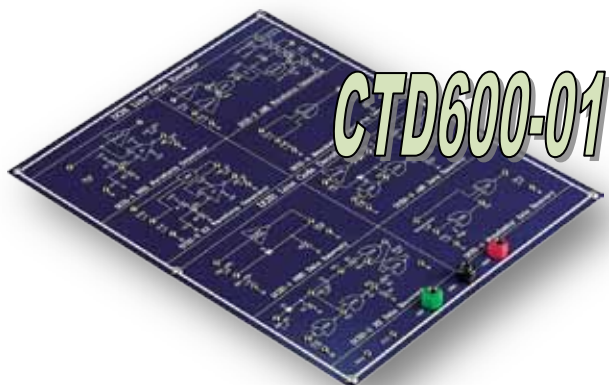
**Frequency Converter, Signal Recovery**

Description:

- Frequency Multiplier
- Up/Down Frequency Converter
- Carrier Signal Recovery Circuit
- Clock Recovery Circuit



## DIGITAL COMMUNICATION TRAINER



### Module CTD600-01 Line Code Encoder/Decoder

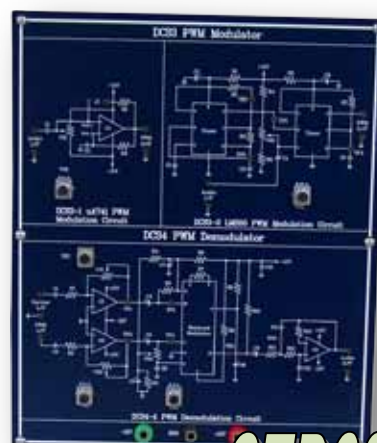
Description:

- Unipolar and Bipolar NRZ Signal Encoder
- Unipolar and Bipolar RZ Signal Encoder
- AMI Signal Encoder
- Manchester Signal Encoder
- Unipolar and Bipolar NRZ Signal Decoder
- Unipolar and Bipolar RZ Signal Decoder
- AMI Signal Decoder
- Manchester Signal Decoder

### Module CTD600-02 PWM Modulator/Demodulator

Description:

- uA741 Pulse Width Modulator
- LM555 Pulse Width Modulator
- Pulse Width Demodulator



### Module CTD600-03 PCM Modulator/Demodulator

Description:

- PCM Modulator
- PCM Demodulator



### Module CTD600-04 Delta Modulator/Demodulator

Description:

- Delta Modulator
- Delta Demodulator

## Module CTD600-05 Adaptive Delta Modulator/Demodulator

Description:

- Adaptive Delta Modulator
- Adaptive Delta Demodulator

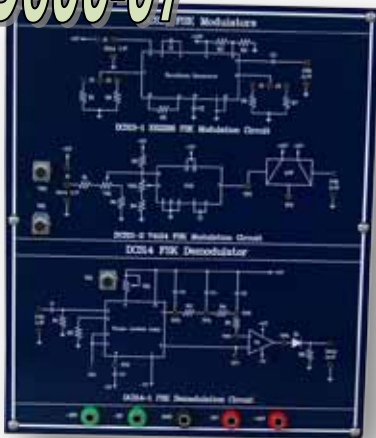
## Module CTD600-06 ASK Modulator/Demodulator

Description:

- XR2206 ASK Modulator
- MC1496 ASK Modulator
- Asynchronous ASK Demodulator ( I )
- Asynchronous ASK Demodulator ( II )
- Synchronous ASK Demodulator



CTD600-07



## Module CTD600-07 FSK Modulator/Demodulator

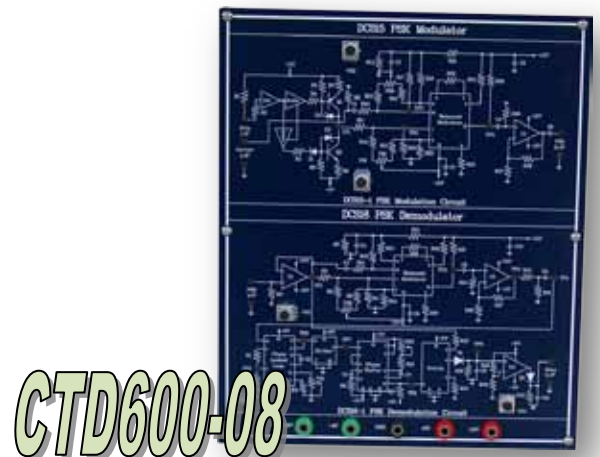
Description:

- XR2206 FSK Modulator
- SN74124 FSK Modulator
- FSK Demodulator ( I )
- FSK Demodulator ( II )

## Module CTD600-08 PSK Modulator/Demodulator

Description:

- PSK Modulator
- PSK Demodulator



## ELECTRONICS COMMUNICATION SYSTEMS TRAINER

### Module CTE650-A PAM Modulator/Demodulator

Description:

- PAM Modulator
- PAM Demodulator

### Module CTE650-B PPM Modulator/Demodulator

Description:

- PPM Modulator
- PPM Demodulator

### Module CTE650-C DPSK Modulator/Demodulator

Description:

- DPSK Modulator
- DPSK Demodulator



**CTE650-E**



### Module CTE650-D FHSS Encoder/Decoder

Description:

- FHSS Spread Spectrum Encoder
- FHSS Spread Spectrum Decoder

### Module CTE650-E HF/RF PLL circuit design

Description:

- HF PLL Circuit Design
- RF PLL Circuit Design

### Module CTE650-F MSK Modulator/Demodulator

Description:

- MSK Modulator
- MSK Demodulator



## HIGH LEVEL DIGITAL COMMUNICATION TRAINER

### Module CTD800-A CVSD Modulator/Demodulator

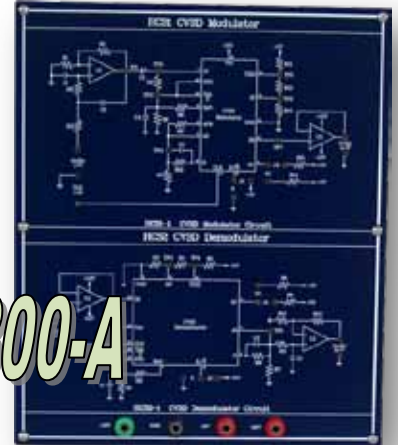
Description:

- CVSD Modulator
- CVSD Demodulator

### Module CTD800-B QPSK Modulator/Demodulator

Description:

- QPSK Modulator
- Bit Splitter
- QPSK Demodulator
- Signal squarer and PLL



**CTD800-A**

### Module CTD800-C QAM Modulator/Demodulator

Description:

- Digital Data Generator and Bit splitter
- QAM Modulator
- QAM Demodulator

### Module CTD800-D DSSS Encoder/Decoder

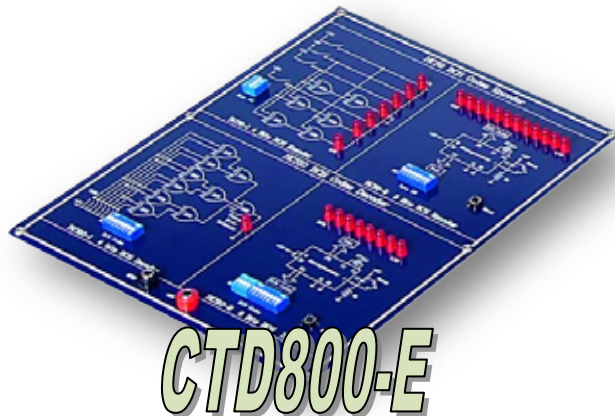
Description:

- Basic spread Spectrum Encoder
- 64 Bits Spread Spectrum Encoder
- Data Signal Decoder
- 64 bits Spread Spectrum Decoder

### Module CTD800-E BCH Encoder/Decoder

Description:

- 4 Bits BCH Encoder
- 8 Bits BCH Encoder (using MCU)
- 4 Bits BCH Decoder
- 8 Bits BCH Decoder (using MCU)



**CTD800-E**

### Module CTD800-F Convolutional Codes Encoder/Decoder

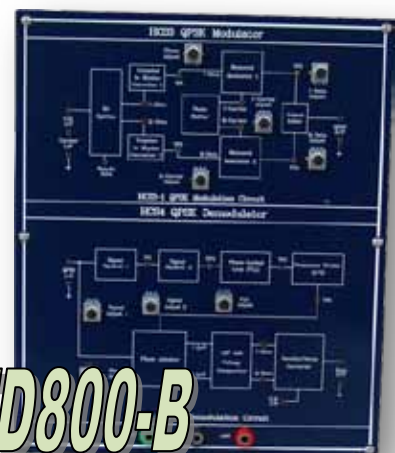
Description:

- 4 Bits Convolutional Codes Encoder
- 4 Bits Convolutional Codes Decoder

### Module CTD800-G GMSK Modulator /Demodulator

Description:

- Measurement of Gaussian Filter
- Measurement of VCO
- GMSK Modulator
- GMSK Demodulator



**CTD800-B**

## ADVANCED DIGITAL COMMUNICATION TRAINER

### Module CTH850-A

#### CDMA DSSS Encoder/Decoder

- Basic Spread Spectrum Encoder
- Original data length: 4 bits
- Data input mode: Dip switch
- Data length of spread spectrum code: 2 bits
- Spread spectrum code input mode: Dip switch
  
- Data length after encoding: 8 bits
- 64 Bits Spread Spectrum Encoder
- Original data length: 8 bits
- Data input mode: LED display
- Data length of spread spectrum code: 8 bits
- Spread spectrum code input mode: Dip switch
  
- Data length after encoding: 64 bits
- 64 Bits Spread Spectrum Decoder
- Data length before decoding: 64 bits
- Data length before encoding: 8 bits
- Original data display mode: LED display
- Data length of spread spectrum code: 8 bits
- Spread spectrum code input mode: Dip switch

**CTH850-A**



### Module CTH850-B

#### CDMA FHSS Encoder/Decoder

- Data setting length: 12 bits
- Data input mode: Press-button switch
- Data display mode: LED display
- Channel indicator: LED display
- Carrier frequency: 20 kHz, 40 kHz, 60 kHz
- Adopting ASK modulation structure
- Data display length: 12 bits;
- Data display format: LED display
- Channel indicator: LED display
- Carrier frequency: 20 kHz, 40 kHz, 60 kHz
- Adopting active mode structure demodulation

### Module CTH850-C

#### OFDM Multiplexer/Demultiplexer

- Built in AF modulating signal generator
- Waveform: Sinusoidal wave
- Frequency range: 300 Hz to 2 kHz
- Amplitude: 0 to 2 Vpp
- Built in sub-carrier signal generator
- Waveform: sinusoidal wave
- Frequency range: 20 kHz to 50 kHz
- Amplitude: 0 to 2 Vpp
- RF carrier frequency:
- Multiplexer type: Balanced modulators and low pass filters
- Sub-carrier frequency range: 20 kHz to 50 kHz
- RF carrier frequency range: 500 kHz
- LPF -3 dB frequency: 3 kHz
- Demultiplexer type: Balanced modulators and low pass filters

## COMPLEMENTARY COMMUNICATION SYSTEM TRAINER

### Module CTH900-A Analog Signal Sampling and Reconstruction Circuit

Description:

- Sampling Rate: 10 kHz ~ 50 kHz
- Sampling Signal Format: TTL Waveform
- Audio Signal Frequency: 1 kHz ~ 2 kHz
- Audio Input Format: Sine Waveform
- Sampling Methods: Sample and Hold, Flat Top Sampling, Natural Sampling
- Low-pass Filter -3 dB Frequency: 1 kHz ~ 3 kHz
- Seven Built-in Faults Shooting

### Module CTH900-B

#### Noise Power Spectral Density Measurement

Description:

- CLK Rate: 100 kHz ~ 1 MHz
- CLK Signal Format: TTL Waveform
- Built-in Audio Signal Generator
- Audio Signal Frequency: 500 Hz ~ 1.2 kHz
- Audio Input Format: Sine Waveform
- Low-pass Filter -3 dB Frequency: 100 kHz
- Amplifier Gain Ratio: 1 ~ 3
- Eight Built-in Faults Shooting



### Module CTH900-C

#### DPCM Modulator/Demodulator Circuit

Description:

- Built-in Sampling Rate: 8 kHz
- Sampling Signal Format: TTL Waveform
- Audio Signal Frequency: 800 Hz ~ 1.2 kHz
- Audio Input Format: Sine Waveform
- Quantizer: 8 Bits
- Built-in Sampling Rate: 8 kHz
- Sampling Signal Format: TTL Waveform
- Audio Signal Frequency: 800 Hz ~ 1.2 kHz
- Audio Input Format: Sine Waveform
- Inverse Quantizer: 8 Bits
- Low-pass Filter -3 dB Frequency: 1 kHz

## OPTICAL FIBERS COMMUNICATION TRAINERS

**CT0901-A**

### Module CT0901-A Transmitter Module

#### Description:

- Transmitted light wavelength: 660 nm and 820 nm.
- Data rate: 1 Mbps., Transmitter bandwidth: 1 MHz.
- Built-in microphone input terminal and audio amplifier.
- Amplitude: 2 Vpp; Frequency: 100 Hz ~ 2.5 kHz.
- Built-in digital data generator, used to produce TTL signal and CMOS level output.
- The wavelength of optical fibers transmission line: 500 nm ~ 1200 nm; ST and DIN connectors.



### Module CT0901-B Receiver Module

#### Description:

- Received light wavelength: 660 nm and 820 nm.
- Data rate: 1 Mbps., Receiver bandwidth: 1 MHz.
- Provided with tunable amplifier, which can drive the 8 W loud speaker.
- The wavelength of optical fibers transmission line: 500 nm ~ 1200 nm; ST and DIN connectors.

#### REQUIRED:

- **MODULE CTA600-ALIM**  
POWER SUPPLY/FUNCTION GENERATOR
- **OSCILLOSCOPE DSO100L**  
100MHz DIGITAL OSCILLOSCOPE
- **SPECTRUM ANALYZER BSA302**  
3GHZ SPECTRUM ANALYZER

**CT0901-D**



### Module CT0901-D

#### Analog and Digital Signal Modulations Modules

#### Description:

- AM Modulation and Demodulation
- FM Modulation and Demodulation:
- ASK Modulation and Demodulation
- FSK Modulation and Demodulation

### Module CT0901-E

#### Digital Signal Processing Module

#### Description:

- Signal Source Encoder and Decoder (CVSD)
- Channel Encoder and Decoder (Manchester)

### Module CT0901-C Computer Control Module

#### Description:

- Transmission interface: RS-232.
- Transmission Baud rate: 9600 bps.
- Type of display: LCD16X2 characters.
- Includes data transmission operation software.
- Keypad switch provides with normal open type.
- Provides with LED indicator function.

### Module CT0901-F

#### TV Signal Modulator and Demodulator

#### Description:

- TV Signal Generator:  
Built-in 4 MHz quartz crystal oscillator.  
Output frequency: 15.6 kHz.
- TV Signal Modulator:  
Audio signal: FM demodulating signal.  
FM carrier signal: 5.5 MHz.
- TV Signal Modulator:  
Audio signal: FM modulating signal.  
FM carrier signal: 5.5 MHz.  
Built-in audio signal generator.  
Output frequency: 100Hz ~ 1 kHz;  
Output amplitude: 600 mV ~ 1.2V.

## OPTICAL FIBERS SYSTEM TRAINERS



- To understand the 1310nm and 1550nm of transceiver
- Textbook includes the expected experiment results for reference
- Problems discussion attached together with answers for instructor
- Only need oscilloscope and spectrum analyzer to obtain the measured results

### Included Accessories:

- nr 10 DC power line
- nr 06 Signal Connecting line
- nr 01 SC-SC Simplex-3mm M-SM optical fiber communication line
- nr 05 Short connector
- nr 01 Microphone
- nr 01 USB video cam
- nr 01 Network cable
- nr 01 Adaptor



## OPTICAL FIBERS SYSTEM TRAINERS

**CTO9000A-B**



**REQUIRED:**

- **MODULE CTA600-ALIM**  
POWER SUPPLY/FUNCTION GENERATOR
- **OSCILLOSCOPE DSO100L**  
100MHz DIGITAL OSCILLOSCOPE
- **SPECTRUM ANALYZER BSA302**  
3GHZ SPECTRUM ANALYZER

**Module CTO900A-A**

**1310 nm Optical Fibers Transmitter/1550 nm Optical Fibers Receiver**

Description:

- Transmitter Data Rate : 100 - 500 kbps
- Receiver Data Rate : 115.2 kbps
- Input Signal Format : TTL (Transmitter ) and UART (Receiver) Waveform
- Full Duplex Transmission Structure
- Connector Type : SC Connector

**Module CTO900A-B**

**1550 nm Optical Fibers Transmitter/1310 nm Optical Fibers Receiver**

Description:

- Transmitter Data Rate : 115.2 kbps
- Receiver Data Rate : 100 – 500 kbps
- Input Signal Format : TTL ( Receiver) and UART (Transmitter) Waveform
- Simple Wavelength Division Multiplexing (WDM)
- Connector Type: SC Connector

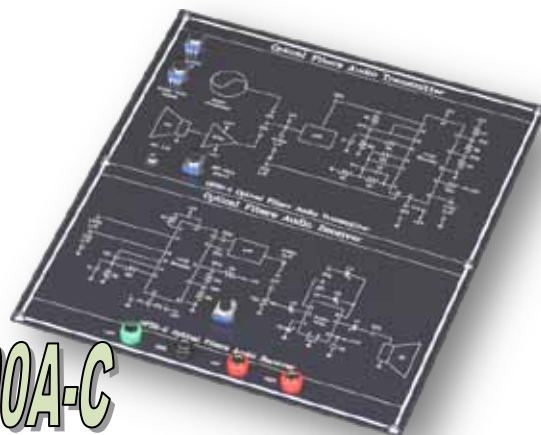
**Module CTO900A-C**

**Optical Fibers Data Audio Transceiver**

Description:

- Built-In Audio Generator
- Built-In Microphone Audio Input
- Input Signal Format : Sinusoidal Waveform
- Built-In 8  $\Omega$  Loud Speaker
- ADC Encoder and DAC Decoder
- Sampling Rate : 40 kbps

**CTO9000A-C**



**Module CTO900A-D**

**Optical Fibers Data Communications**

Description:

- Remote Control by using 4-key Simulator
- 256 Types Data Set-Up
- 8 LEDs Receiving Data Instructor
- 4 LEDs Display For Remote Control Status
- Reciprocal (Interchangeable) Function For Transmitter And Receiver

**Module CTO900A-E**

**Optical Fibers Video Transceiver**

Description:

- Operating System : Microsoft Windows
- Video Source : USB Camera
- Video Transmission Type : Digital
- Transmission Data Rate : 100 Mbps
- Transmission Wavelength : 1310 nm and 1550 nm

## SUGGESTED INSTRUMENTS

### Module CTA600-ALIM

#### Function Generator and DC Power Supply

##### Specification

##### Function Generator

- Two signal output ports
- Frequency range 10 Hz ~ 100 kHz and 100 Hz ~ 1 MHz
- Waveforms: Sine, Triangle, Square and TTL Pulse
- Amplitude: 10 Vpp
- Built-in 6-digit frequency counter
- Large 0.5" LED display
- Accuracy:  $\pm$ Time Base Accuracy  $\pm$  Count
- Time Base: Oscillation Frequency 60 Hz
- Resolution: 0.1 Hz, 1Hz, 10 Hz, 100 Hz, 1 kHz

##### DC Power Supply

- Constant Voltage Output:  $\pm$ 5V &  $\pm$ 12V
- Variable Voltage Output: 0V to  $\pm$ 15V

Power requirement: AC/DC adapter 230V/15V, 1.5A



### BSA130 - 3GHz SPECTRUM ANALYZER

##### Description:

- All-digital IF technology
- Frequency Range: 9kHz - 3GHz
- DNAL: -140dBm Typ.
- Phase Noise: -80dBc/Hz (10kHz offset)
- Amplitude Resolution:  $\pm$ 1.0 dB
- RBW: 10Hz to 1MHz, step 1-3-10
- Standard EMI filter
- Quasi-Peak Detector
- Channel power/Adjacent Channel power/Occupied bandwidth measurement
- *Tracking Generator (optional)*
- 7" TFT LCD
- USB Host, USB Device, LAN, RS232



### DSO100L - 100MHz DIGITAL STORAGE OSCILLOSCOPE

##### Description:

- Bandwidth: 100MHz
- Equivalent sampling: 50GSa/s
- Real time sampling: 1GSa/s
- Channels: 2 channels plus EXT trigger
- Memory depth: 2M pts
- Rise time: <5ns
- Input impedance: 1Mohm // 17pF
- Time base: 5n à 50s/div
- Vertical sensitivity: 2mV à 10V /div
- Vertical resolution: 8bit
- Trigger source: Ch1, ch2, EXT, EXT/5, AC line
- Trigger types: Edge, pulse, video, slope, alternative
- Math operations: +, -, \*, /, FFT
- Digital filter: High pass, low pass, band pass, band impedance
- Max input voltage:  $\pm$  400V pk-pk CATI, CATII



## COMBO METER S2/T2

Routine maintenance, verification of the correct alignment of the antennas, verification of the main parameters of reception: These are some of the situations where the Combo Meter HD can be of help to the installer in the daily work. This model offers compatibility with the HD signals in DVB-T2 and S2 as well as the measurement of the optical power of a fiber-distributed signal. The 4.3 "Display is bright and displays the main parameters such as power, quality, BER, MER and C/N. In addition, the SCR unicable functions are present, to evaluate the operation of a Sat system with a multiswitch SCR and DISEQC 1.1/1.2. In addition to the constellation in QPSK, COFDM, 8PSK and 16apsk modulations, this tool also displays images of the tuned program, both DTT and SAT, both SD and HD. The 2.0 USB port allows you to play content in WMA, MP3, MP4, avi, JPG, JPEG, BMP and IMG formats formatted in NTFS, FAT32 and FAT16. There are also two HDMI and AV ports (3.5 mm jacks), for input and output.



- Combo Meter HD, DVB-S/S2 and T/T2, with spectrum and constellation.
- Display 4.3 ". View the main parameters such as power, quality, BER, MER and C/N.
- Measures FIBER OPTIC, HDMI, USB.

	DVB-T/T2	DVB-S/S2
<b>CONNETTORE</b>	IEC FEMALE 9.5mm/ FEMALE TYPE	F TYPE
INPUT FREQ.	48÷862 MHz	950÷2150 MHz
<b>SIGNAL INPUT LEVEL</b>	-79.5 dBm (MAX)	-65÷-25 dBm
ALIMENTAZIONE ANTENNA	5V/12V/17V, IMAX 100mA	
<b>DEMODULAZIONE</b>	QPSK, 16QAM, 64QAM, 256QAM	
TIPO SINTONIA	LCN on/off	
<b>VALORI</b>	PWR, LEVEL, C/N, BER, MER, ERROR, COSTELLATION T/T2	PWR, C/N, BER, MER, COSTELLATION S/S2
BAND SWITCH CONTROL		22KHz
<b>LNB SUPPLY &amp; TYPE</b>		13V/18V, IMAX 400mA, SCR, UNIVERS.
SYMBOL RATE		2 < RS < 45 M BAND(SCPC/MCPC)
<b>TYPE OUT/IN</b>		HDMI, AV
CONNETTORE AV		3.5mm JACK
<b>VIDEO</b>		CVBS
VIDEO OUT		FINO 1080
<b>AUDIO</b>		STEREO AUDIO L/R OUTPUT
DECOMPRESSIONE VIDEO	MPEG-2 MP@HL, MPEG-1 Decoding, MPEG-4 ASP@L5 HD resolution, H.264 MP&HP@L4, HW JPEG decoding	
<b>RESOLVING RATE</b>	PAL-25 frame@720*576, NTSC-30 frame@720*480,	
VIDEO FORMAT	4:3, 16:9, By Pan & Scan and Letter Box conversion	
<b>DECOMPRESSIONE AUDIO</b>	MPEG-1 Layer I/II, MPEG-2 Layer I/II	
AUDIO OUTPUT MODE	Stereo, Mono, R/L	
<b>PORTA DATI</b>	USB	
• PROTOCOLLO	INTERFACCIA USB 2.0	
• SISTEMA GESTIONE FILE	NTFS, FAT32, FAT16	
• FORMATO FILE	wma, mp3, mp4, avi, jpg, jpeg, bmp, img	
<b>PROCESSORE/SDRAM</b>	NOVATEK/ 1Gb DDR3	
OPTICAL TYPE	InGaAs	
• <b>OPERATING WAVELENGTH</b>	800-1700nm	
• PHOTO SURFACE DIAMETER	500um	
• <b>RESPONSIVITY</b>	0.8-0.95 (V <sub>e</sub> =5v, λ = 1310nm)	
• MEASUREMENT RANGE	-70-10dbm	
<b>ALIMENTAZIONE E CONSUMO</b>	Batteria litio 7.4V/3000mAh / max 10W	
DIMENSIONI e PESO	9.5x15x4.5 cm / 0.5Kg	

The HD Combo Meter comes with a protective silicone case, as well as a padded carrying bag. In the package there are also: power supply/charger, car cigarette lighter cable, adapters for all types of fiber optic connection, HDMI and AV cables to display a video source like a CCTV camera. Finally, there is also the AV output required to verify the correct functioning of an AV modulator.



## RF AND MICROWAVE CIRCUITS DESIGN

### IT.TEL800

#### 800 MHz Wireless Transceiver Kit

##### Objectives:

- To understand the applications and measurements of communications and products
- Design and implementation ability training for RF module circuit
- To understand the theory of RF transmitter
- To understand the theory of RF Receiver

##### Technical features

1. Type of oscillator: PLL frequency synthesizer
2. Carrier frequency range: 700 MHz ~ 900 MHz
3. 16 tunable frequency bands
4. Using 9 V Battery
5. Dynamic range: > 70 dB
6. Signal-to-noise ratio: > 100 dB
7. Stability: +/- 75 kHz
8. THD: < 1%
9. Frequency response: 400 Hz ~ 8 kHz



##### Transmitter Specification

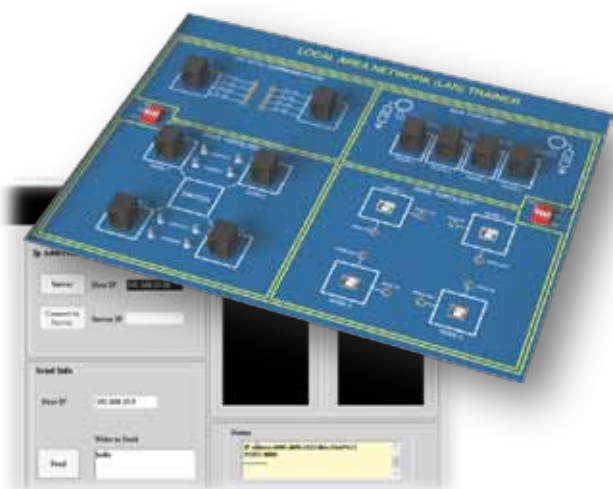
1. Transmitter mode: Direct up conversion transmission
2. Transmitter power: > -5 dBm
3. Carrier-to-noise ratio: > 100 dB
4. Type of antenna: Spiral antenna
5. Spurious: < -60 dBc
6. High sensitivity microphone

##### Receiver Specification

1. Receiver mode: Super homodyne receiving
2. Sensitivity: < -80 dBm
3. Image-rejection: > 60 dB
4. Audio output power: 0.5 W



## LAN403 Local Area Network (LAN) Trainer



*The trainer is a comprehensive training system provides the understanding of all the fundamentals of networking. Experiments are designed to understand the user about the knowledge regarding the network layers. The user can understand and actually implement various topologies. The user will understand the protocols, topologies used in networking. The software provided with the trainer is used to perform all the experiments and it will assist the user to observe the various effects and configurations on network along with the graphical Representation.*

### Features:

- Power Supply Included
- Required Circuits Tested
- Each Section Clearly Marked for Input and Output
- Each Section Works as an Independent Unit
- Built-in USB – UART Convertor
- Built-In 10/100 Switch
- Each Section Clearly Marked for Easy Understanding

### Technical Features:

#### Hardware:

- PC to PC using RJ45
- Star topology using RJ45 Connector
- Bus topology using RJ45 Connector
- Ring topology using USB – UART
- Data transmission speed: 10/100 Mbps
- Nodes: 4

#### Experiments included:

- Study & implementation of cable designs in networking
- Implementation of PC to PC with IEEE 802.3
- Implementation of Star topology using 100BaseTx
- Implementation of Bus topology using 10Base2
- Implementation of Ring topology using DB9
- Implementation of Peer to Peer network
- Implementation of Client- Server network
- Study of protocols CSMA/CD, CSMA/CA
- Study of flow control Stop-N-wait, Sliding window, Go back to N, Selective repeat Token ring & Token bus
- Measurement of throughput & effect of bit errors on various protocols

#### Software:

Star, Bus & Ring selection

#### Protocols:

CSMA/CD, CSMA/CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring

#### Packet size:

128, 256, 512, 1024, 2048, 4096, 8192, 16384

#### Inter Packet delay:

1000 – 5000 ms

#### Error generation:

Acknowledgment lost, bad packet, auto error generation, Data encryption & decryption

#### Graphical Representation:

Data on software screen with packet details

#### Network details:

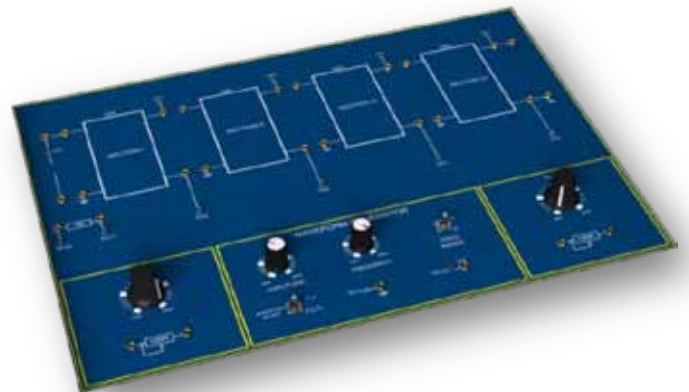
Computer name, IP address, Port number, Network Status, MAC address and OS on computer.

#### Network & protocol analysis:

Packet serial number, file name, file size, file number, receiver name, Workgroup, receiver IP address, total packets, packet length, time out, protocol, topology, receiver, MAC address, port number, file send start time, file sent completion time, transmission time data rate(Mbps), error.

## TLD500 Transmission Line Trainer

Transmission Lines are used to convey signals from one point to another. Understanding Transmission Lines in relation to the transmitted signals is very important in telecomm. This trainer provides basic concept of coaxial line and includes components to conduct experiments.



### Technical Features:

- Transmission Line: Four Sections of 25m Each
- Co-axial Cable: RG 174
- Impedance Matching Resistances: 0-100Ohm.
- Test Generators:
  1. Sine wave: 60 KHz – 4 MHz
  2. Square wave: 60 KHz – 4 MHz
- Interconnections: 2mm gold plated pins

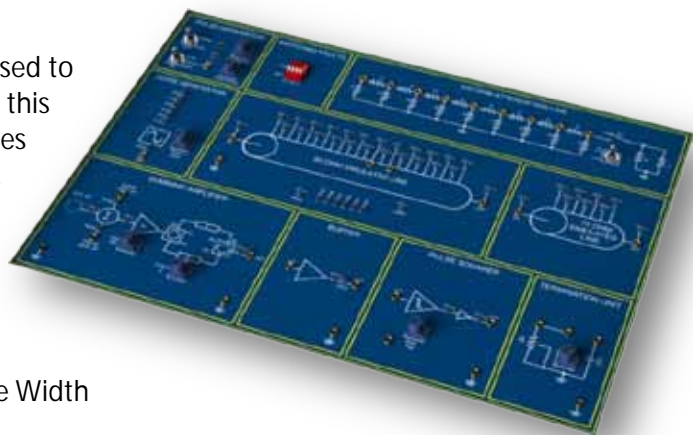
Accessories: Power cord, 2mm patch cords, Experimental Manual

### Experiments included:

- Basic Principles of Transmission Line
- Types of Transmission Line
- Equivalent Circuit Representation of a Transmission Line
- Losses in Transmission Line
- Characteristic Impedance of a Transmission Line
- Basic Properties of the Coaxial Cable (used in the trainer)
- Measuring the Characteristics of a Line
- Measuring the Attenuation of a Line
- Measuring the Input Impedance of the Line
- Phase Displacement Between the Current & Voltage at Input of Line
- Frequency Characteristic of the Line
- Study of Stationary Waves
- Signal Phase Shift along the Line
- Fault Localization within the Line
- Line under Pulsed Condition

## TLB500B Transmission Line Simulation Trainer

In the telecommunication field transmission line are used to convey the signals from one point to another. With this Trainer board you can teach transmission line principles and concepts with better & faster than ever before. Students quickly and easily develop a working knowledge of the basic and advance knowledge of transmission lines.



### Technical Features:

- Pulse Generator: Variable Frequency and Pulse Width
- Attenuation Line: 600 Ohm
- Simulated Line: 50 Ohm & 70 Ohm
- Termination Unit: 100 Ohm variable with reactive element
- Noise Generator: Variable Amplitude
- Standing Wave Display
- Pulse Squarer: Comparator level adjust
- Buffer
- Switched Faults
- BNC connector for external input
- Interconnections: 2mm gold plated pins

Accessories: Experiment Manual 2mm patch cords and Power Cord

### Experiments included:

- Recognize the function of each block of the Transmission line trainer
- DC voltage is attenuation along the 600 ohm line
- Delay Using Pulse Input
- Resistive Matching using Pulse Input
- Observe the effect of a reactive termination.
- Effect of Noise in Communication
- AC Coupling of Pulse Inputs
- Matching and Frequency Response
- Examine Standing Waves by plotting on graph paper
- Low Pass Filter Effect
- 50 Ohm Line as an Oscillator
- Time Domain Reflectometry
- The Effect of Transformer Matching on the Oscilloscope Display

## MWT505 Microwave Communication Trainer

Microwave Trainer is a High performance training system. It is designed to be used in two distinct ways; for teaching and demonstrating common waveguide configurations at all levels of study especially for Technical Colleges and Engineering Universities for undergraduate and graduate courses., It is also used as a design tool for those engaged in research and development of projects in communication..



### Features:

- Stand alone, Low cost system
- 11GHz Synthesized Source
- GUI Based control and monitoring
- Simple, robust stands mount
- More Microwave Accessories can be added on the users course requirement
- Bench-top operation
- Wavelength & Phase Velocity Measurements
- Brass flange with silver plating

### Technical Features:

#### X- Band

Center Frequency: 11 GHz  $\pm$  200 MHz

Output Power: 10 mW Typical

Pulse Mode

#### Receiver/Power Meter

Center Frequency: 11 GHz

Band width: 10-13 GHz

Sensitivity: -45 dBm

Dynamic range: 50dB

#### Hybrid Magic Tee

S11: > 10 dB

Isolation: 20 dB

Band Width: 11-13 Ghz

#### Waveguide to Coax Adopter

Return Loss >20 dB

Insertion Loss: 1dB

Connector: SMA

#### Phase Shifter

S11: > 15 dB

S12: > 15 dB

Calibration: 11GHz

#### Variable Attenuator

Return Loss > 20 dB

S12: 1-20 dB

Resolution: 1 dB

Accuracy:  $\pm$  1.5 dB

#### Horn Antenna

Gain: 16 dB

S11: 20 dB

Beamwidth: 30°

Type: Pyramidal

### Experiments included:

- Introduction of a microwave waveguide bench and measurement of source frequency and wavelength
- Measurement of Voltage and Standing Wave Ratio (VSWR)
- Measurement of dielectric constant of solid material using waveguide method.
- Measurement of unknown impedance and impedance matching
- Horn Antenna Investigation
- Use of a directional coupler in forward and reflected power transmission measurements
- Series, Shunt and Hybrid T junctions
- Waveguide to coaxial transition Microwave Radio link Investigations

### Accessories:

Waveguide Detector

Precision Variable Attenuator

Step variable Attenuator

Slotted Line

Cavity Resonator

Stub Tuner

Waveguide to Coax Adapter(2pcs)

Hybrid/ Magic Tee

Series E Plane Tee

Shunt H Plane Tee

Matched Termination

Waveguide short

Inductive/Capacitive Irises

Pyramidal Horn Antennas(2pcs)

Waveguide Directional Coupler

Waveguide Transition

Mounting stands

SMA Coaxial cable

Software CD with Manual

## ASD505 Antenna Trainer

### Description

*Antenna Trainer is a low cost high performance antenna training system. It is designed to be used in two distinct ways; for teaching and demonstrating common antenna configurations at all levels of study especially for Technical Colleges and Engineering Universities for undergraduate and graduate courses., It is also used as a design tool for those engaged in research and development of projects in communication.*

*ASD505 is completely computerized antenna trainer that performs PC based automated rotation of receiving antennas at predefined angles and GUI-based polar plots of radiation patterns of each antenna.*

*ASD505 comprises of C-Band microwave transmitter, receiver and set of eight different type of antennas.*

*ASD505 software provides signal level at receiver for each rotational step, azimuthal angle, polar plot of radiation pattern and beam width of each antenna.*

### Features

- Stand alone, Low cost system
- Motorized antenna rotation
- Bench-top operation
- 5.15GHz DRO Source
- Safe low power output
- Conveniently packed for inventory control
- No ancillary equipment required
- Simple, robust stands for antenna mount
- More antennas can be added on the users course requirement
- GUI-based Antenna Pattern Measurement by USB interface



### List of Experiments

- Familiarization with Antenna Trainer
- Study of Antenna Polarization, Axial Ratio and Tilt Angle of a circularly polarized antenna.
- Study of Dipole antenna and its radiation pattern
- Study of Horn antenna and its radiation pattern
- Measurement of the Gain of Horn Antenna
- Study of Yagi antenna and its radiation pattern
- Study of Helical antenna and its radiation pattern
- Study of Microstrip Antenna and its radiation pattern
- Study of Paraboloidal Reflector Antenna and its radiation pattern
- Study of Four Element Rectangular Patch Array Antenna
- Study of Double Dipole Array Antenna
- Study of slotted line and measurement of Wavelength and Frequency
- Measurement of VSWR using Slotted line
- Measurement of Unknown Impedance
- Study of Double Stub Tuner

### Accessories

- C-Band Transmitter
- C-Band Receiver
- Slotted Line
- Dipole Antenna
- Double Dipole Array Antenna
- Pyramidal Horn Antenna
- Yagi-Uda Antenna
- Helical Antenna
- Microstrip Antenna
- Paraboloidal Reflector Antenna
- 4 Element Microstrip Array Antenna
- Cables SMA (m) to SMA (m)
- 30 dB Attenuator
- USB interface with software CD



## ASD500 Antenna Trainer

ASD500 trainer introduces students to the fundamental principles of Antenna through a wide range of practical activities. A large variety of Antennas are included to familiarize the students with different types of Antennas. The most important topic covers in the experiment is to study of waveguides using X band frequencies. The microwave trainer consists of different components and peripherals equipment required to perform the experiments.



### Features:

- Industrial Grade Equipment
- Stable Source
- Modular Structure

### Technical Features:

VCO 2.2 – 2.72GHz (Tunable)

VCO 2.4GHz (Fixed)

Tuning Voltage: 1.2V – 16V

Display: V Tune, F.P. & R.P.

Modulation: 1KHz ASK

Output Power: +8dBm typical

RF Detector: 2 – 4GHz

Sensitivity: -5 – -45dBm typical

### Antenna Included with the Trainer:

Monopole	Rectangular Patch
$\lambda/2$ Dipole	Circular Patch
$\lambda/4$ Dipole	2x2 Rectangular Patch
Folded Dipole	Array
Helix	Circular Loop
3-Element Yagi-Uda	Square Loop
5-Element Yagi-Uda	$\lambda/2$ Monopole
7-Element Yagi-Uda	$3\lambda/2$ Dipole
5-Element Log	$\lambda/2$ Phase Array
Periodic	$\lambda/4$ Phase Array
7-Element Log	Broad Side Array
Periodic	Combined Co-Linear
9-Element Log	Array
Periodic	

### Experiments included:

Study of Antenna Polarization, Axial Ratio And Tilt

Angle Of a Circularly Polarized Antenna

Study of Dipole Antenna And Its Radiation Pattern

Study of Rectangular Patch Antenna

Study of Circular Patch Antenna

Study of 4 Elements Rectangular Patch Antenna Array

To Study the Behavior of Loop Antenna

Study of 3-Element Yagi-Uda Antenna

Study of 5-Element Yagi-Uda Antenna

Study of 7-Element Yagi-Uda Antenna

Study of 5-Element Log Periodic Antenna

Study of 7-Element Log Periodic Antenna

Study of 9- Element Log Periodic Antenna

Study of Folded Dipole Antenna

Study of Monopole Antenna

Study of Half Wavelength Monopole Antenna

To Study Phase Array End Fire Antenna

To Study Quarter Wavelength Phase Array End Fire Antenna

To Study Combined Co-Linear Array

To Study Broad Side Array

Accessories: Power cord, 2mm patch cords, Experimental Manual, SMA Male – Male Cable

## MST500 Microstrip Trainer

This trainer uses high precision components to allow students to investigate Microstrip Technology principles. The Complete Microstrip Communication Trainer MST500 needs no special test equipment. It is designed for use with the digital multi meter and dual dc power supply. A comprehensive manual provides users with detailed background material, theory and structured assignments, whilst avoiding unnecessary mathematical analysis.



### Features:

- Industrial Grade VCO source
- Modular Structure
- Complete theoretical background
- Stable RF Detector

### Technical Features:

#### Main Unit:

- S-Band Transceiver:
  - Voltage Controlled Oscillator: 2 – 4 GHz
  - Output Power: 9dBm
  - Tuning Voltage: 1.25 – 22V DC
  - Power Output Flatness:  $\pm 2$ dBm
- RF Signal Detector:
  - Frequency Range: 50MHz – 4GHz
  - Input Power: -5dBm – -45dBm
  - Modulation: 1KHz ASK
  - 2x Digital Multimeter LCD Type

### Experiments included:

- Introduction to the microwave VCO source and detector and action of 3-port circular
- Measurement of insertion loss of Low Pass Filter
- Measurement of insertion loss of Band Pass Filter
- Properties of Directional Coupler
- Measurement of Return Loss, Reflection Coefficient and VSWR
- Determination of an unknown resistive load
- Measurement of Effective Dielectric Constant using Ring Resonator
- Properties of Power Divider and Rat-Race Coupler
- Quadrature Hybrid Coupler Investigation
- DC biasing circuits and MMIC amplifier
- Microwave radio link and patch antenna

### Microstrip Components:

S-Band MMIC Amplifier	3-Port Circulator	Directional Coupler	Ring Resonator
DC Biasing Unit	Low Pass Filter	Hybrid Coupler	Wilkinson Power Divider
Patch Antenna	Bans Pass Filter	Rat Race Coupler	T-Divider
Matched Load			

### Accessories:

Termination(Short), Termination(50Ohm), SMA Male – Male Cables, SMA Male – Male Connectors, Experiment Manual, 2mm patch cords and Power Cord



## MST505 Microstrip Trainer

The increasing use of microwaves, in applications ranging from satellite and terrestrial communications to high-speed computing and data transmission, has resulted in a short-fall of appropriately trained engineers and technicians. Over three quarters of all microwave circuits are now non-waveguide. The swing towards microstrip technology must be reflected in the courses offered at engineering education institutes.

Microstrip Trainer comprises 18 passive circuit components, 2 active circuits and all the leads and connectors required to construct a variety of commonly used configurations, many of which incorporate microwave integrated circuits (MICs).



### Features:

- Latest Microwave Technology
- 2.0-4.0 GHz VCO
- No costly test equipment required
- Safe low power output
- Conveniently packed for inventory control
- Gold Plated RF laminate with PTH

### Microstrip Trainer consists of:

#### PASSIVE COMPONENTS:

- 2 Patch antenna
- 1 DC Biasing unit
- 1 Three-port circulator
- 1 Hybrid ring (rat-race) coupler
- 1 Ring resonator
- 1 Band Pass Filter
- 1 Quadrature coupler
- 1 Unmatched load
- 1 Directional coupler
- 1 Wilkinson power divider
- 3 50 ohm loads
- 1 Short-circuit termination.
- 1 10dB/5dB attenuator
- 1 Crystal detector
- 1 Low-pass filter
- 1 Matched load

#### ACTIVE COMPONENTS

- 1 Voltage Controlled Oscillator (VCO)
- 1 S-band MMIC amplifier
- 1 Pin Diode Modulator

### Experiments included:

- Power Source and detector action
- Action of a 3-port circulator.
- Insertion loss measurement on low-pass filter And Band Pass Filter
- Measurement of return loss, reflection coefficient and VSWR of a filter, microstrip and commercial matched loads.
- Matching investigations: reflection coefficient of unknown resistive load and its matching by 1/4 transformer and shunt stub.
- Properties of a power divider and ratrace coupler.
- Measurement of effective dielectric constant and line loss using a ring resonator.
- DC biasing and MMIC amplifier investigations.
- Quadrature coupler investigations
- Microwave radio link and antenna investigations.

#### MISCELLANEOUS

- 8 SMA plug-plug connectors
- 1 BNC -dual Banana Pins
- 1 DB(9)-Circular lead
- 2 4mm Banana leads.
- 1 Spanner



## TMT182F

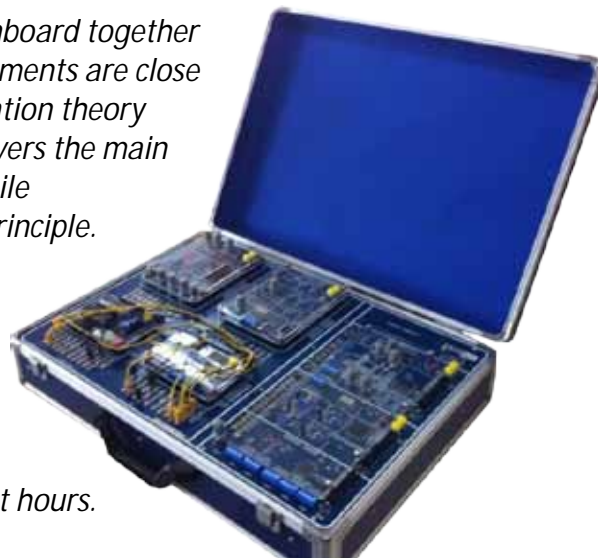
### OPEN MOBILE COMMUNICATION EXPERIMENT TRAINER

#### **Product Features :**

*Open Mobile Communication Experiment System closely follow the courses of "Mobile Communication" and "Spread Spectrum" etc, and integrates three types of multiple access communication methods: CDMA, TDMA and FDMA. By using open and transparent design, it demonstrates the principle and the composition of mobile communication system, and also its business process that can fully meet the needs of teaching and curriculum design and development of Experiment needs colleges and universities, vocational colleges communication related major mobile communication.*

*A. It uses the design of mainboard together with modules, and experiments are close to the mobile communication theory course content, which covers the main knowledge points of mobile communication system principle.*

*There are total 45 experiments including unit experiment, system experiment and development experiment to ensure adequate distribution of Experiment hours.*



*B. Functional circuits divided into pieces according to the circuit flow, accompanied by explanatory text, block diagram to help the experimenter to grasp the design and implementation process. The shipping CD provides the necessary circuit design schematic and reference material.*

*C. All open design, programming down load interface, free pin interface, as well as related software to facilitate the secondary development. Platform can be used for large scale design project, it's aimed at full exercise of student's self-development and practical ability start from simple function to develop large-scale design project step by step according to the easy-to-difficult teaching pattern. And it also recommends additional topics to stimulate student interests.*

*D. The system covers 2G, 2.5G and 3G mobile communication knowledge points, closely reflect the direction of mobile communication development, to guide the more in-depth study for the experimenter.*

*E. It provides the software, test routines, courseware, reference manuals and other means to assist the Experiment teaching.*

## PERFORMANCE PARAMETERS

### AC/DC power

- Input: AC220V±10%
- Output: DC+5V/3A, +12V/1A, -12V/0.5A

### Main board signal source

- Digital signal source: digital code type and code rate are set by the DIP switch
- Sine signal source: frequency 2KHz, amplitude adjustable
- Pseudo code signal source: 31 bits, 511 bits long pseudo-random sequence, code rate is set by the DIP switch
- Open the programming download interface, open 10 free I/O ports

### Main board modulation and demodulation

- MSK, GMSK, QPSK, OQPSK,  $\pi/4$ -DQPSK, 16QAM modem type is optional
- Baseband rate: 12kbps Carrier frequency: 10.7MHz
- Open the programming download interface, open 28 free I/O ports

### CDMA receiver module

- Spread spectrum sequence: Gold code, match up the DIP switch settings
- Spread spectrum code rate: 768kbps
- Spread spectrum gain: 64
- Spread spectrum Method: DSSS

### AMBE module

- Voice signal source: microphone input, headphone output
- Code: AMBE advanced multi-band excitation coding algorithm, speech encoding and decoding rate between 2400-9600bps, which is optional
- Open the programming download interface, open 32 I/O ports

### FPGA Module

- Advanced EP2C8T144C8 chip as the core FPGA, to achieve cyclic encoding and decoding, convolutional code encoding and decoding, Hamming code encoding and decoding, Turbo encoding and decoding, scrambling code and descrambling code, deinterleaver and interleaver, frequency meter, TDMA and other functions.
- Coding rate: 12kbps
- Open the programming download interface, open 32 free I/O ports

### Channel analog module

- It use the advanced digital signal processing technology to simulate the three kind softtypical mobile communication channel of white noise channel, slow fading channel and multi-path channel

### Frequency hopping module

- Fast frequency hopping: 20 jump/sec
- Slow frequency hopping: 2seconds/hop
- Jump spectrum width: 10.10MHz-11.59MHz
- Hopping interval: 10KHz
- Frequency hopping pattern: set by DIP switch

### Non-coherent demodulation module

- Demodulation object: MSK modulation signal, GMSK modulation signal
- Demodulation method: Baseband delay detection
- Sampling rate: 12KS/s

### FDMA module

- Emission signal: 45~45.475MHz 48~48.475MHz
- The first local oscillator signal: 37.3~37.775MHz 34.3~34.775MHz
- The first IF signal: 10.7MHz
- The second local oscillator signal: 10.245MHz
- The second IF signal: 455KHz

### Mobile communication terminal software

- According to the provisions of mobile communication protocol, the mobile communication terminal software of independent research and development sends out commands to control GSM/GPRS and CDMA mobile communication terminal, enabling phone calling, receiving calls, sending and receiving messages, file transferring and receiving, Internet network login, terminal information inquiry, engineering mode inquiry, AT command help and administration functions.

