

RADIO FREQUENCY TRAINING SYSTEMS



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RADIO FREQUENCY SYSTEM

The Radio Frequency Training system is one of the few comprehensive education Training system on the market today. It can be used for measuring, observing, and even designing RF circuits will cultivate students' first step understanding of characteristics and basic design theory behind of Radio Frequency. The Major components of the Radio Frequency Training System are outlined below.

1. RF Signal Sources
2. DDS Based RF Signal Source & Network Analyzer
3. RF Circuit Trainer
4. RF Circuit & Microwave Integrated Circuit Design Software
5. RF Oscillators
6. RF Filters
7. Antenna Trainers
8. USB Power Sensor
9. Transmission Line Trainer
10. Time Domain Reflecto Meter
11. Function Generators
12. Spectrum Analyzer
13. GPS - GSM Trainers
14. GSM/Mobile Communication Trainers
15. Satellite Communication Trainer1
16. E1/T1 Trainer
17. Satellite Communication Trainer2

TECHNICAL SPECIFICATIONS

1. RF SIGNAL SOURCES

1.1 RF SIGNAL SOURCE WITH DETECTOR [VRFT - 03]

- * 50-1000MHz RF synthesized signal generator
- * Programmable attenuator 5, 10, 20, 30 dBm
- * 40 x 2 LCD Display to display the frequency of the RF signal and RF signal level
- * Output level : 0 dBm
- * Output Impedance : 50 ohm
- * One RF Power Detector provided for 50-1000MHz frequency range and this output is measured by an ADC and display on the LCD Display
- * 6 Keys keypad provided to select the desired frequency, attenuation level, Sweep mode
- * Step Size : 100KHz,
- * Connectors:
 - # 2 Nos. of 'N' type connector for RF out and RF In
 - # One "BNC" type connector for RF Detector output

1.2 RF Signal Source with Detector [VRFT - 03A]

- * 50-400MHz RF synthesized signal generator
- * Programmable attenuator 5,10,20,30 dBm
- * 40x2 LCD Display to display the frequency of the RF signal and RF signal level
- * Output level: 0 dBm
- * Output Impedance: 50 ohm
- * One RF Power Detector for 50-400MHz frequency range and this output is available at the front panel.
- * 6 Keys keypad provided to select the desired frequency, attenuation level,
- * Step Size: 100KHz,
- * Connectors:
 - # 2 Nos. of 'N' type connector for RF out and RF In and
 - # One "BNC" type connector for RF Detector output

1.3 RF SIGNAL SOURCE WITH DETECTOR [VRFT - 03B]

- * 50-200MHz RF synthesized signal generator
- * Programmable attenuator 5,10, 20, 30 dBm
- * 40 x 2 LCD Display to display the frequency of the RF signal and RF signal level
- * Output level : 0 dBm
- * Output Impedance : 50 ohm
- * 6 Keys keypad provided to select the desired frequency, attenuation level, Sweep mode
- * Step Size : 100KHz,
- * Connector :
 - # 2 Nos. of 'N' type connector for RF out and RF In



2. DDS BASED RF SIGNAL SOURCE & ANALYSER

2a. Digital Synthesized RF Source & Network Analyser [VRFT - 03A-DDS]

- * 5-1000MHz RF signal generator
- * RF Output Power: -2dBm (Approx.)
- * Attenuation : 5dBm, 10dBm, 20dBm, 30dBm.
- * Direct Digital Synthesis (DDS) Method Based
 - # Since DDS Device is primarily digital, it offers
 - a. Fast switching between output frequencies
 - b. Fine Frequency resolution
 - c. Operation over a broad spectrum of frequencies.
- * 1KHz Channel step size
- * Automatic level control (ALC) incorporated so that, RF level output will be constant
- * Graphics LCD display to plot Filter, Amplifier etc characteristics
- * Resolution : 240x128 Pixels with backlight
- * Sweep/single frequency output ability.
- * One RF Power Detector provided for 10-1000MHz frequency range and this output is measured by a ADC and displayed on the Graphics LCD Display
- * 6 Keys keypad provided to select the desired frequency, attenuation level, Sweep mode
- * Connector :
 - # 2 Nos. of 'BNC' type connector for RF out and RF In
 - # One "BNC" type connector for RF Detector output
- * AM Modulation facility
- * One compact Directional coupler provided for Network Analyzer Measurements like,
 - i) Return Loss measurement
 - ii) VSWR Measurement
- * Measurement
 - # 60dBm Measurement range (-50 10dBm)
 - # Frequency measurement



2. b. Digital Synthesized RF Source & Network Analyser [VRFT - 03B-DDS]

- * 5MHz-400MHz RF signal generator
- * RF Output Power : -2dBm Accuracy.
- * Attenuation : 5dBm, 10dBm, 20dBm, 30dBm.
- * Direct Digital Synthesis (DDS) Method Based
 - # Since DDS Device is primarily digital, it offers
 - a. Fast switching between output frequencies
 - b. Fine Frequency resolution
 - c. Operation over a broad spectrum of frequencies.
- * 1KHz Channel step size
- * Automatic level control (ALC) incorporated so that, RF level output will be constant
- * Graphics LCD display to plot Filter, Amplifier etc characteristics
- * Resolution: 240x128 Pixels with backlight
- * Sweep/single frequency output ability.
- * One RF Power Detector provided for 1MHz-400MHz frequency range and this output is measured by a ADC and displayed on the Graphics LCD Display
- * 6 Keys keypad provided to select the desired frequency, attenuation level, Sweep mode
- * Connector:
 - # 2 Nos. of 'BNC' type connector for RF out and RF In
 - # One "BNC" type connector for RF Detector output
- * AM Modulation facility.
- * One compact Directional coupler provided for Network Analyzer Measurements like,
 - i) Return Loss measurement
 - ii) VSWR Measurement.
- * Measurement
 - # 60dBm Measurement range (-50 10dBm)
 - # Frequency measurement



3. RF CIRCUIT TRAINER [VRFT - 02]

We offer various RF Experiment modules which can be linked together for setting up a RF Down converter link (or) Up converter link. Any individual equipment can also be conducted. This trainer consists of many individual modules to study the complete RF circuits. These modules can be linked by RF cables to form a FM modulated Transmitter and a RF Receiver link. We can offer you 433 MHz. frequency range of operation.

RF RECEIVER BUILDING MODULES (RF DOWN CONVERTER LINK KIT):

a) Rf Tuned Amplifier Module

- * Frequency of operation : Freq.
- * Can be used to study the tuned amplifier Characteristics
- * Can also be used at the front end of a Radio Receiver
- * Input & Output signals are terminated at RF BNC connectors



b) RF Mixer

- * IF output Frequency: DC-500MHz
- * RF Frequency
 - Local Oscillator: 1-500MHz



c) Local Oscillator:

- * [Frequency -10.7]MHz
- * RF Signal generator
- * Used along with Mixer to generate IF Frequency of 10.7MHz
- * Input & output terminals are terminated at BNC connectors



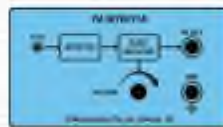
e) 10.7 Mhz IF Amplifier

- * Designed for IF Signal amplifier
- * Designed for 10.7 MHz IF Frequency



f) FM Detector Module

- * Used for demodulating the base band signals contained in the IF Signal (10.7MHz)



g) AM Detector Module

- * Used for demodulating the base band signals contained in the IF Signal
- * BNC Connector provided for input and output (455KHz)



h) Audio Amplifier Module:

- * Speaker provided
- * Amplitude can be adjustable
- * BNC Connector and EB Socket provided for input and audio output 810 based Amplifier



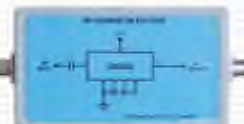
i) Receiver Antennas

- * Dipole Antenna
- * Yagi Antenna
- * Monopole Antenna.



j) RF Power Detector

- * Designed for RF power detection
- * Frequency Range : 1MHz to 1GHz
- * Output power level : 1dBm



RF TRANSMITTER BUILDING MODULES:

a) Voltage Controlled Oscillator Module

- * Designed as VCO
- * Operating frequency at 100 MHz
- * Provision for FM Modulation



b) Rf Power Amplifier

- * Designed for power Applications of RF Signal
- * Can be directly connected to a RF Antenna



Accessory:

- * One RF Antenna Provided.

c) Low Frequency Sine Wave Generator

- * 300-3KHz frequency
- * Sine Wave output
- * Used as modulating signal (0-2)Vpp



d) Pre Amplifier With Microphone

- * Pre-amplifier
- * One band pass filter provide for 0-3.3KHz
- * Microphone
- * Used as modulating signal for the VCO Module
- * EB Socket & BNC provided for MIC I/P & O/P



e) Transmitting Antenna

- * Gain : 2dB
- * Impedance : 50Ω ohm
- * Dipole type.
- * BNC Connector termination



f) Attenuator Modules

- * Separate Attenuators for 10dB, 20dB & 30dB attenuation.
- * 1 Watt (30 dBm) power handling capacity.
- * BNC Connector terminations.



4. RF CIRCUIT & MICROWAVE INTEGRATED CIRCUIT DESIGN SOFTWARE

a) RF Design Software Package [VRFT - 04]

RF Design software facilitates in the design with Filter, Amplifier, Attenuator, Matching network, Inductor and Microstripline. Sample hardware module provided to prove the theoretical design of this RF software.

- * Filter Design:
 - # This software facilitates in the design of LC Element LP, HP and BP Filters from 10 MHz to 1000MHz. Both Butterworth and Chebyshev designs are possible.
- * Amplifier Design:
 - # This software is used to design Amplifiers including Low Noise type.
- * Attenuator Design:
 - # This software facilitates in the design of attenuators for both 50 ohm and 75 ohm characteristics impedance structures.
- * Matching Network design:
 - # Matching Network to neutralize the mismatched load/source can be designed
- * Inductor Design:
 - # This software computes the inductance value for the chosen
 - # SWG, number of turns and Internal diameter of the coil.
- * Micro strip line Design:
 - # Micro strip line is a planar transmission line. Provides the width for any chosen value of characteristic impedance and propagation factor which is essential to determine the length of the line required for a unit wave length in the medium.
- * Hardware Demo PCB:
 1. Band pass filter PCB (Chebyshev)
 2. Attenuator PCB
 3. RF Components (Capacitors, Inductors)



b) Microwave Integrated Circuit Design Software

i) Microstrip Filter Design:

By feeding various parameters of the filter (BPF & LPF) and Dielectric parameters of the PCB, this package will give all the dimension of Micro strip PCB for the particular filter. If the PCB is made as per the dimension, the student can practically verify the design.

(REF: RF CIRCUIT DESIGN by REINHOLD LUDWIG & PAVEL BRETCHKO)

Micro Strip BPF Design:

- * Input Parameter of BPF : f_0 (Centre frequency) Bandwidth & Number of elements.
- * Input Parameter of PCB : Dielectric constant, Thickness of Dielectric & Thickness of copper clad.
- * Output of Software : Width & length of resonating will be provided to fabricate the PCB.



Micro Strip LPF Design:

- * Input Parameter of LPF : f_0 (Centre frequency) Bandwidth & Number of elements
- * Input parameter of PCB : Dielectric constant, thickness of dielectric & Thickness of copper clad.
- * Output of Software : Width & length of resonating elements will be provided to fabricate the PCB.



ii) Microstrip Coupler Design:

By feeding various parameter of the coupler and Dielectric parameter of the PCB this package will give all the dimension of Microstrip PCB for the particular coupler. If the PCB is made as per the dimension, the student can practically verify the design.

(REF: RF CIRCUIT DESIGN by REINHOLD LUDWIG & PAVEL BRETCHKO)

Branch-Line Coupler:

- * Input Parameter of Coupler : f_0 (Centre frequency)
- * Input Parameter of PCB : Dielectric constant, Thickness of dielectric & Thickness of copper clad.
- * Output of Software : Width & length of resonating elements will be provided to fabricate the PCB.



Ring Coupler :

- * Input Parameter of Coupler : f_o (Centre frequency)
- * Input Parameter of PCB : Dielectric constant, Thickness of dielectric & Thickness of copper clad.
- * Output of Software : Width, length 1 of $70.71n$ line and length 2 of $70.71n$ line of the resonating elements will be provided to fabricate the PCB

Wilkinson Divider :

- * Input Parameter of Coupler : f_o (Centre frequency)
- * Input Parameter of PCB : Dielectric constant, Thickness of dielectric & Thickness of copper clad.
- * Output of Software : Width & length of resonating elements will be provided to fabricate the PCB.

Directional Coupler :

- * Input Parameter of Coupler : f_o (Centre frequency)
- * Input Parameter of PCB : Dielectric constant, Thickness of dielectric & Thickness of copper clad.
- * Output of Software : Width & length of resonating elements will be provided to fabricate the PCB.

Transmission Line :

- * 50 ohm impedance Transmission Line

Hardware Demo PCB :

1. Band pass Filter PCB
2. Ring Coupler PCB.



5. RF OSCILLATORS

a) Colpitts Oscillator

- * It is harmonics type sinusoidal oscillator
- * Tank circuit determine the output frequency of oscillation
- * Capacitor based voltage divider provides the feedback signal
- * Colpitts oscillator generate frequency above 1MHz
- * Frequency Range ~ 14MHz



d) Crystal Oscillator

- * Quartz crystal is placed instead of conventional circuit
- * Large improvement in frequency stability
- * The oscillator frequency is determined by crystal
- * Frequency Range ~ 30MHz



b) Butler Oscillator

- * Quartz crystal is placed instead of conventional circuit
- * Large improvement in frequency stability
- * Frequency Range : 12MHz



e) Clapp RF Oscillator

- * It is series tuned version of the colpitts oscillator
- * Series Resonance circuit determined the frequency of oscillation



c) Hartley Oscillator

- * It is simplest sinusoidal oscillator
- * Tank circuit determine the output frequency of oscillation
- * Inductor based voltage divider provided the feedback signal
- * Frequency Range ~ 14MHz



f) Pierce Oscillator

- * Quartz crystal is placed instead of tank circuit
- * Improvement in frequency stability
- * Builtin amplifier
- * Frequency : 12MHz



g) RF Oscillator Design Module

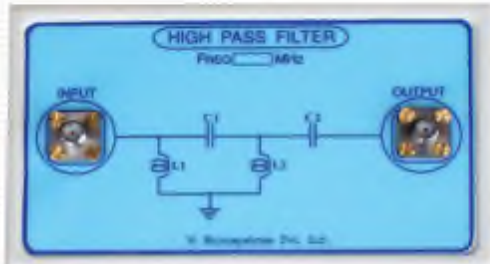
- * Bare PCB and components will be given separately.

6. RF FILTERS

Various types of filters like high pass, low pass, band pass, of Butterworth and Chebyshev can be designed for various filter characteristics using the "RF Design Software". Bare PCB & RF components provided. The student can assemble the PCB and test its filter characteristics using the RF Signal generator. Also the following filters are supplied in a shielded box to study the individual filter characteristics

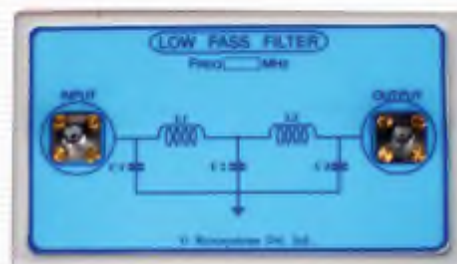
a) High Pass Filter Module (Butterworth)

- * Cut off Frequency : 100MHz.
- * No. of Order : 6
- * Impedance : 50 ohm



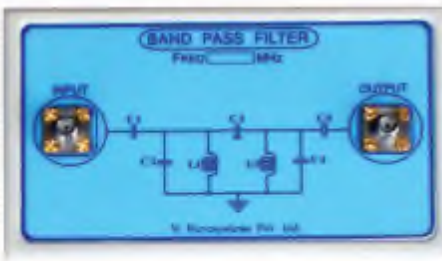
b) Low Pass Filter Module (Butterworth)

- * Cut off Frequency : 100MHz.
- * No. of Order : 7
- * Impedance : 50 ohm



c) Band Pass Filter Module (Butterworth)

- * Cut off Frequency : 98 MHz to 100MHz.
- * No. of Order : 3
- * Impedance : 50 ohm



d) High Pass Filter Module (Chebyshev)

- * Cut off Frequency : 100MHz.
- * No. of Order : 7
- * Impedance : 50 ohm



e) Low Pass Filter Module (Chebyshev)

- * Cut off Frequency : 100MHz.
- * No. of Order : 7
- * Impedance : 50 ohm



f) Band Pass Filter Module (Chebyshev)

- * Cut off Frequency : 100MHz.
- * No. of Order : 3
- * Impedance : 50 ohm



g) Notch Filter

- * Cut off Frequency : 100MHz.
- * Impedance : 50 ohms

7. ANTENNA TRAINERS

a) Antenna Trainer [VRFT - 06VA]

Vcom-04Ant, the Antenna Trainer has been designed for class room experimentation on various types of Antennas. This equipment comprises two towers, one being a low power transmitter, controlled by the synthesized RF Transmitter. The second contains a "Synthesized RF Receiver". The antenna to be investigated is mounted on top of the Receiver Tower. The "Synthesized RF Receiver" controls the Receiver tower and rotates it through 360° and displays various characteristics on the Built-in Graphics LCD display (240 x 128) Pixel or it can transmit all data to the PC via RS232 interface and plots all characteristics on the PC Screen. Vcom-04Ant consists of

- i) Synthesized RF Transmitter
- ii) Synthesized RF Receiver with Stepper motor Interface.
- iii) Windows based software and accessories, whose details are given below.

i) Synthesized Rf Transmitter

- * Frequency Range : 50-1000 MHz
- * Resolution : 100KHz
- * Accuracy : 0.01%
- * LCD Display : 2 x 40 LCD to display
 - a) Frequency
 - b) Resolution
 - c) RF Level
 - d) Sweep mode
- * Modulation : FM, Internal 1KHz sine wave source with condenser Microphone
- * Automatic level control (ALC) incorporated. So that, RF level output will be constant.
- * RF Level : 0dBm
- * Attenuator : Variable
- * Output Impedance : 50 ohm



ii) Synthesized Rf Receiver:

- * Frequency Range : 50-1000 MHz
- * PLL Based VCO incorporated
- * Resolution : 100KHz
- * Accuracy : 0.01%
- * LCD Display : 240x128 pixel resolution Graphics LCD to display
 - a) Frequency
 - b) Resolution
 - c) RF Level
 - d) Sweep mode
 - e) Modulation
- * RF Measurement : The RF Level from test antenna is measured and displayed on the Graphics LCD display or transmitted to RS232 Interface.
- * PC Interface : Connected to PC through RS232 for sending measured RF data & position for polar plotting, Cartesian plotting.
- * Output Impedance : 50 ohm
- * Stepper Motor controller interface
 - i. Angular position
 - ii. Step in various graphics format
 - # Angular Step : 1 - 9 Degrees
 - # Memory : 2K bytes for storing data



iii) Antenna Characteristics Plot Software:

- * Windows 98,2000, XP compatible
- * Plotting in polar & Cartesian planes with cursor

b) Antenna Trainer [Vcom-04Ant-fix]

Vcom-04Ant-fix, the Antenna Trainer has been designed for class room experimentation on types of Antennas, RF Signal source and other circuits related are provided. It includes various antenna configurations. Vcom-04Ant-fix consists of

- i) RF Transmitter
- ii) RF Receiver
- iii) Antenna characteristics Plot software
- iv) Types of antennas.

i) RF Transmitter:

- * Frequency Range: 850 MHz
- * LCD Display: 4x20 LCD to display
 - a) Frequency
 - b) RF Level
- * RF Level : 0dBm
- * Output Impedance : 50 ohm

ii) RF Receiver :

- * Frequency Range : 850 MHz
- * RF Output : The RF Level from test antenna is measured and made available to the PIC controller's ADC
- * Output Impedance: 50 ohm
- * Stepper Motor controller:
 - # Micro Controller: Based on powerful PIC Microcontroller PIC78F8720
 - # One Centronics printer port
 - # 128x64 pixels Graphics LCD with Backlight to display
 - i) Angular position
 - ii) RF Level
 - iii) Polar & Cartesian plot.
 - # Angular Step: 1-9 Degrees
 - # Memory: 2K bytes for storing data
 - # PC Interface: Connected to PC through RS232 for sending measured RF data & position for polar plotting, Cartesian.



iii) Antenna Characteristics Plot Software :

- * Windows 98, 2000, XP compatible
- * Plotting in polar & Cartesian planes with cursor.

c) Antenna Trainer [Vcom-04ant/DDS]

Vcom-04Ant, the Antenna Trainer has been designed for class room experimentation on various types of Antennas. This equipment comprises two towers, one being a low power transmitter, controlled by the DDS synthesized RF Transmitter. The second contains a "DDS Synthesized RF Receiver". The antenna to be investigated is mounted on top of the Receiver Tower. The "DDS Synthesized RF Receiver" controls the Receiver tower and rotates it through 360° and displays various characteristics on the Built-in Graphics LCD display (240 x 128) Pixel or it can transmit all data to the PC via RS232 interface and plots all characteristics on the PC Screen. Vcom-04Ant/DDS consists of

- i) DDS Synthesized RF Transmitter
- ii) DDS Synthesized RF Receiver with Stepper motor Interface.
- iii) Windows based software and accessories, whose details are given below.

This Antenna Trainer uses the latest Technology of "Direct Digital Synthesis".

i) DDS Synthesized RF Transmitter

- * Frequency Range: 5-1000 MHz
- * Accuracy: 0.01%
- * LCD Display: 4x20 LCD to display
- a) Frequency
- b) Sweep mode
- * Automatic level control (ALC) incorporated. So that, RF level output will be constant.
- * RF Level: 0dBm
- * Attenuator: Variable
- * Output Impedance: 50 ohm



ii) DDS Synthesized RF Receiver

- * Frequency Range : 5-1000 MHz
- * DDS Based Synthesizer.
- * Accuracy: 0.01%
- * LCD Display: 240x128 pixel resolution Graphics LCD to display
 - a) Frequency
 - b) Modulation
- * RF Measurement : The RF Level from test antenna is measured and displayed on the Graphics LCD display or transmitted to RS232 Interface.
- * PC Interface : Connected to PC through RS232 for sending measured RF data & position for polar plotting, Cartesian plotting.
- * Output Impedance: 50n
- * Stepper Motor controller interface
- # i. Angular position ii. Step in various graphics format
- # Angular Step : 1 - 9 Degrees
- # Memory : 2K bytes for storing data



iii) Antenna Characteristics Plot Software

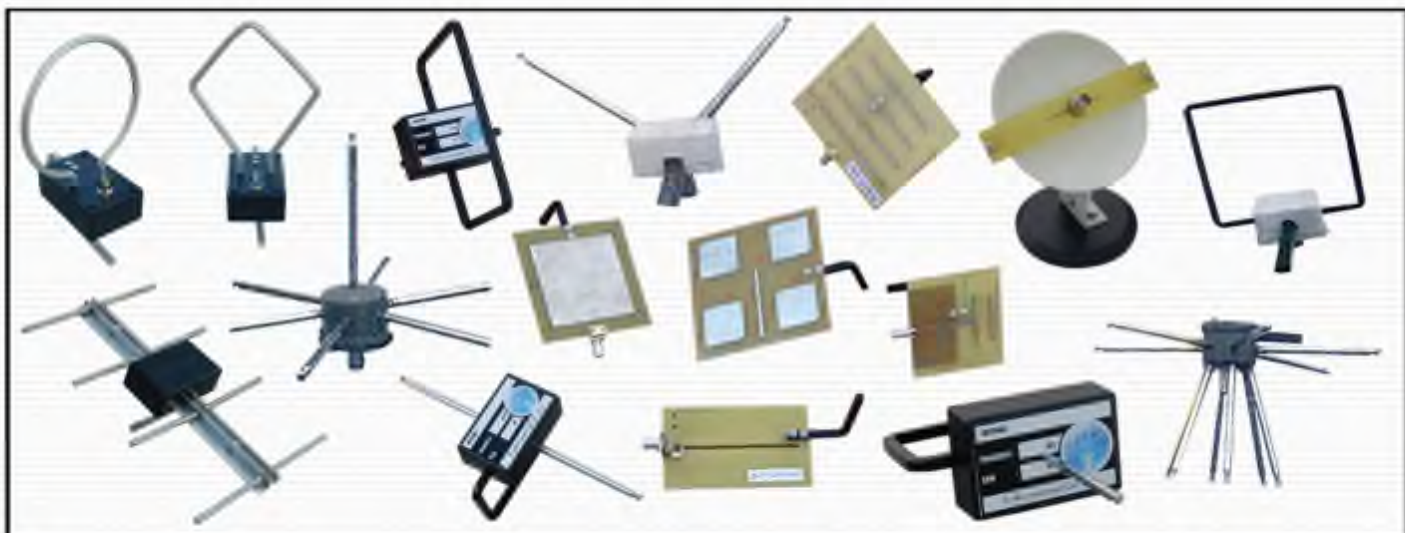
- * Windows 98,2000, XP compatible
- * Plotting in polar & Cartesian planes with cursor

iv) Antennas for 2.4GHz frequency Range

- * Yagi Antenna
- * Monopole
- * Patch Antenna
- * Dipole

v) Types Of Antennas (For 5-1000 MHz Frequency Range)

- | | | |
|---------------------------|----------------------------|---|
| 1) Dipole | 12) Micro strip Antenna | 5) Patch |
| 2) Folded Dipole | 13) Half wave dipole | 6) Horizontal End Fed Hertz Antenna |
| 3) Yagi Uda Folded Dipole | 14) Whip Antenna | 7) Horizontal End Fed Zeppelin Antenna |
| 4) Monopole | 15) Loop Antenna | 8) Ground Plane Antenna |
| 5) End Fire Array | 16) Helix (RHCP) | 9) Ground Plane with reflector & Director |
| 6) Crossed Dipole (RHCP) | 17) Helix (LHCP) | 10) Slot Antenna |
| 7) Crossed Dipole (LHCP) | | 11) Phase Array |
| 8) Yagi (3 Element) | Optional Antennas | 12) Combined Collinear Array |
| 9) Yagi (4 Element) | 1) Stacked Yagi | 13) Log Periodic Antenna |
| 10) Bi Conical | 2) $\lambda/4$ Phase Array | 14) Rhombus Antenna |
| 11) Discone | 3) Helix Normal Mode | |
| | 4) V Antenna | |



8. USB POWER SENSOR

General Description

Mini-Circuits PWR-6G+ USB Power Sensor has a 50 dB dynamic range and is used with a PC via USB interface. The PWR-6G+ does not require any reference signal calibration. All specifications provided in the data sheet apply to continuous wave (CW) signals. The Mini-Circuits USB Power Sensor comes with Power Meter software that turns the PC into a Power Meter. It also comes with an N-Type female to SMA male adapter for enhanced utility.

Features

- * 50 dB Dynamic range, -30 to +20 dBm
- * Good VSWR, 1.1:1 typ.
- * Low cost replacement solution for conventional power meters
- * Easy installation and operation
- * Turns your laptop into a power meter
- * No need for a reference calibrator
- * No need for an external power supply
- * Temperature compensated
- * Fully loaded software for power data analysis
- * Averaging of measurements
- * Scheduled Data recording
- * Multi-Sensor support software
- * Compatible with LabVIEW™, Delphi,

Applications

- * Lab Test equipment
- * Portable Test capability
- * Remote location testing



9) TRANSMISSION LINE TRAINER

a) Transmission Line Trainer[Vcom-01TT]

This trainer is designed for study of co-axial cable characteristics like Impedance measurement, VSWR measurement etc. It is based

- i) The latest technology of DDS Based RF source
- ii) Directional coupler for VSWR Measurement
- iii) TDR to measure the cable fault.

* DDS RF Source

- # Frequency : 5 to 400 MHz
- # Step Size : 1KHz
- # Direct Digital Synthesis (DDS) Method Based
- # Since DDS Device is primarily digital, it offers

- a) Fast switching between output frequencies
- b) Fine Frequency resolution
- c) Operation over a broad spectrum of frequencies.



- * Display: Graphics LCD display of 240x128 pixels with backlight to plot VSWR, TDR characteristics etc.
- * One directional coupler provided for VSWR, Return loss measurement.
- * In-Built RF Detector for 5-400MHz Frequency range
- * In-Built TDR (Time Domain Reflectometer) to measure and study nature of discontinuation in the co-axial cable.
 - # Ranges short : Pulse rep.rate 10MHz typical, Pulse width<10ns typical Long : pulse rep. rate 100KHz typical
- * Output Impedance : 50 ohms
- * Co-axial cable : Various lengths of 50 ohm, 75 ohm cables supplied.
- * All relevant waveforms are displayed graphically in the Graphics LCD display.

b) Transmission Line Trainer[Vcom-01TT/A]

This trainer is designed for study of co-axial cable characteristics like Impedance measurement, VSWR measurement etc. It is based

- i) The latest technology of Based RF source
- ii) Directional coupler for VSWR Measurement
- iii) TDR to measure the cable fault.

* RF Source

- # Frequency : 50 to 250 MHz
- * 40x2 Digit LCD Display for displaying all parameters.
- * In-Built RF Detector for 50-250MHz Frequency range
- * In-Built TDR (Time Domain Reflectometer) to measure and study nature of discontinuation in the co-axial cable.
 - # Ranges Short: Pulse rep. rate 10MHz typical, Pulse width<10ns typical Long : pulse rep. rate 100KHz typical
- * Output Impedance : 50 ohms
- * Co-axial cable : Various lengths of 50 ohm, 75 ohm cables supplied.



10. TIME DOMAIN REFLECTO METER [VTDR - 01]

A Special module has been designed to work as time domain deflectometry to test the cable faults.

- * 24MHz frequency of operation
- * Pulse repeated at around 750KHz with pulse of 100ns for detecting discontinuation of a continuous cable
- * The source pulse and the reflected wave are terminated so that, these wave can be viewed in an oscilloscope and the difference can be calculated to diagnose the nature of problem in the co-axil cable.
- * 50m, 20m, 15m, 10m coaxial cables will be provided.
- * Two BNC connector to monitor incident & reflected signal
- * One BNC connector to connect co-axial cable.



11) FUNCTION GENERATOR

i. 1 MHz DDS Based Signal Generator [VDSG - 01]

- * Based on the latest technology, "Direct Digital Synthesizer"(DDS)
- * Digitally set Frequency & Waveform
- * 0.1Hz to 1MHz output frequency range
- * 0.1HZ Resolutions
- * Sinusoidal / Triangular / Square wave output
- * Single output is possible
- * Built-in micro controller with ADC to measure amplitude of the output waveform
- * 5V output with offset variation
- * 16 * 2 LCD display, to display the a) Frequency b) Waveform c) Amplitude
- * 5 Keys to select a) RESET b) UP c) DOWN d) SET e) ENTER Operations
- * Output is taken through BNC female connector
- * Two potentiometers provided for OFFSET adjustment & AMPLITUDE setting
- * Ideal for DSP based application.



ii. 3 MHz DDS Based Dual Signal Generator [VDSG - 02]

- * Based on the latest technology, "Direct Digital Synthesizer"(DDS).
- * Digitally set Frequency & Waveform.
- * 0.1Hz to 3MHz output frequency range.
- * 0.1HZ Resolutions.
- * Sinusoidal / Triangular / Square wave output.
- * Two channel independent outputs are possible.
- * Built-in micro controller with ADC to measure amplitude of the output waveform.
- * 10V output with offset variation.
- * 20 x 4 LCD display, to display the a) Frequency b) Waveform c) Amplitude
- * Keys are provided for proper selection.
- * Two TTL / analog input signals are provided.
- * Two TTL outputs are possible
- * Two potentiometers provided for OFFSET adjustment & AMPLITUDE setting.
- * Ideal for DSP based application.



iii. 5MHz DDS Function Generator

- * Based on the latest technology of Wave form generation by "Direct Digital Synthesis."
- * Operating Modes : Sine, Square, Triangle,
- * Frequency Range : 0.2 Hz to 5 MHz Frequency Variable Control is available between steps.
- * Output : 10Vpp Open Circuit
- * Output Impedance : 50 Ohms
- * Attenuation : Variable
- * Internal Sweep : 20ms - 4s variable
- * Sine wave Distortion : 1.5% typical
- * DC Offset : Adjustable



12. SPECTRUM ANALYSER



- * Make : Atten (Model : AT5011)
- * Frequency range : 0.15 - 1050 MHz
- * Resolution of frequency display : 100 KHz (4.5 digit)
- * IF Bandwidth (-3dB) : 400 KHz and 20 KHz
- * Video - Filter (ON) : 4 KHz
- * Sweep rate : 43Hz
- * Amplitude range : 100 dBm to +13 dBm
- * Screen display range : 80 dB (10 db/div)
- * Sensitivity : Better than -90 dBm
- * Log scale fidelity : +2 dB (without attn.) 500 MHz
- * Input attenuator : 0 to 40 dB (4X10 dB steps)
- * Max.input level : +10 dBm, +25V DC(odB attn.) +20 dBm (40 dB attn.)
- * Output frequency : 0.15 MHz to 1050 MHz
- * Output attenuator : 0 to 40 dB (4X10 dB steps)
- * Output impedance : 50 (BNC)
- * Output level range : 50 dBm to + 1dBm (in 10 dB steps and var)

13. GPS - GSM TRAINERS

- * 16/32-bit ARM7TDMI-S Embedded controller
- * CPU Speed- 60MHZ maximum
- * 40KB of on-chip RAM and 512 KB of on-chip flash program memory.
- * 2 x UARTS ,2xFast I2C-bus
- * Very good acquisition and tracking sensitivity-148 dBm Fast reacquisition
- * NMEA0183 compatible message format for host communication
- * Built in GPS front end RF GPS Antenna provided separately.
- * One 20x4 Alphanumeric display to display Latitude / Longitude /Altitude Direction, Time and Date
- * One 128 x 64 bit graphics display to display any portion of map
- * The Modem can be controlled using ATCommand Interface
- * Uplink: 890-915MHZ, Downlink: 935-960MHZ
- * RS-232 through D-TYPE 9 pin connector
- * Power supply through Molex 4 pin connector
- * SMA antenna connector



14. GSM/MOBILE COMMUNICATION TRAINER

Mobile Communication Trainer

The mobile communication system consists of several E-blocks boards, which are connected together using connectors to form a mobile telephone that can be used for text messaging. The mobile communications system is controlled by a 89C51 microcontroller. Programs for this micro controller can be written in a variety of languages including Assembly and Flow charts. Flowchart programming is well supported using Flow code and pre-written high-level Flow chart Routines to allow designs using the Mobile communications systems. The use of Flow code for mobile communication technology is well supported with an Experimental manual and pre-written high-level routines for controlling all parts of the system. This also includes several Working procedures.

The standard product operates within commercial Sims

Technical Specification

GSM Transceiver Board

Hardware Specifications

- * Wireless CPU
- * Sim Card Holder
- * UART Interface
- * Power Supply Interface
- * Power Supply (9V AC)

Software Specifications

- * Dual Band EGSM 900/1800 MHz
- * Telephony, Emergency Calls, Full Rate and Half rate
- * Dual Tone Multiple frequency (DTMF)

Data	: Asynchronous-non-transparent up to 9.6kbs
Short Message Services:	: Test and PDU, point to point (MT/MO), Cell broadcast, Concatenation –up to 6 SMS.
GSM supplementary services:	: Call forwarding, Call barring, Multiparty, call waiting, And call hold, calling line identity, Advice of charge, USSD, closed user group, explicit call transfer.

Software Interface

General purpose RS-232 serial interface, remote control by AT commands (GSM 07.07 and 07.05), Serial Board rate from 300 to 115200 bits/s, Auto Bauding (300 to 38400 bits/s), software upgrade through X Modem protocol Real time clock.
Power supply : (GND, +12V)



List of Experiments :

- * Study of GSM Technology
- * Getting started with GSM TRAINER
- * Study of GSM MODEM and its components
- * Study of SIM
- * Introduction to AT commands
- * Voice communication using AT commands
- * Data communication using AT commands
- * Sending Test Message using flow cords

Extra Accessories Required

- * Computer with win98+ : 01 No
- * Active SIM card with credit on it : 01 No

Accessories

- * RS-232 serial cable : 01 No
- * RS-232 serial flat cable : 02 No
- * GSM antenna : 01 No
- * Handset : 01 No
- * Flow code software : 01 No
- * Experimental Manual : 01 No
- * Power supply : 01 No

15. SATELLITE COMMUNICATION TRAINER1

Satellite Communication Trainer [Vsat-01] (Uni-Directional)

- * 2400-2500 MHz PLL Microwave operation
- * Crystal control frequencies
- * Audio, Video, Digital data, Tone and Voice can be transmitted from satellite link and Received by the Receiver. This Demonstrates the Students the principle of Satellite Communication
- * 4 Frequencies provided so that the user can choose the Up linking and Down linking frequencies
- * Communication of external broad band digital and analog data & base band Signals
- * Facility to attach Analog/Digital Communication kits
- * One Satellite Up-link Transmitter
- * One Satellite Down-link receiver.
- * One Satellite Rx-Tx Link
- * Additional Accessories like DVD player, B&W TV, supplied as an Integrated satellite system.
- * Analog Transmission:
 - # 5 MHz Bandwidth
 - # Up to 2MHz with Modulation like AM, FM, PM, FSK,
 - # Provision for External Microphone
- * Digital Transmission:
 - # Digital data can be transmitted up to maximum bit rate of 2MBPS.
 - # (Optional) Provision for RS232 transmission & reception.
 - # (Optional) Communication with E1/T1 Kit



Analog Reception:

- * Receiver bandwidth: 5 MHz
- * Video signal received, can be fed to a color TV for viewing & analyzing the quality of reception
- * FG Signal received and terminated for viewing on an Oscilloscope
- * Microphone signal received and fed to a speaker for demonstrating voice communication through satellite

Accessories Supplied Along With This Module:

1. CD Player - 1 No.
2. Colour TV - 1 No.
3. Manual
4. Cables - 1 Set.

16. E1/T1 TRAINER (Trunk Link Through Satellite)



E1 link is a communication link protocol which can handle 30 PCM 16KBPS voice channels which are assigned to 30 time slots with one 64 KBPS signaling channel occupying one single time slot aggregating 2048 KBPS data rate. This protocol is basically followed by European countries for Trunk communication links between exchange to exchange or between access links. This is basically a time division multiplexed frame.

T1 link is a communication link protocol which can handle 24PCM 64KBPS voice channels which are arranged to 24 different time slots with one 64KBPS signaling channel occupying one single time slot aggregating 1544 KBPS data rate. This protocol is basically followed by American for Trunk communication link between exchange or between exchange and access links. This is demonstrated with the above 2 terminals supplied.

Two telephone lines from the EPABX (or from 2 telephone land lines) are connected to the E1/T1 terminal with the exchange interface called COT terminal. The voice signal from the lines are converted to PCM signals of 64 KBPS. This can occupy any two of the 30 times slots which is programmable from the keypad provided. The line signaling (like off hook, ringing) are connected to data signals which occupy the time slot meant for signaling. These signals are formatted as per E1 or T1 which can again be selected from the front panel keypad of the units.

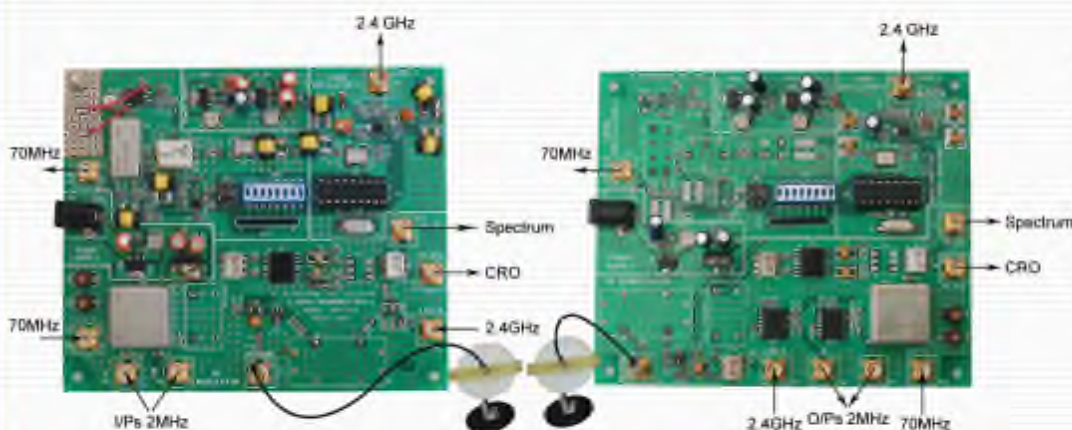
The aggregate 2048 (E1) or 1544 (T1) KBPS signal is line coded to HDB3 format before connected to the Copper Pair. The other E1/T1 terminal called RT terminal with subscriber interface is also similar to the above. These two terminals when they are interconnected through E1/T1 signals, with EPBAX connected to COT and telephones connected to RT can acts as an E1 or T1 link with 2 telephones on a single pair of wire.

Specification

* Max No.of Voice Channels	: 30/24 for E1/T1	* Selection of time slot	: Through keypad
* Available Voice Channel	: 2	* Signaling Channel Rate	: 64 KBPs
* Voice coding	: PCM	* Aggregate E1/T1 data rate	: 2048/1544 KBPs
* Voice channel data rate	: 64KBPS	* Line Coding	: HDB3
* Selection of E1/T1	: Through keypad	* Line Impedance	: 120 Ohms

17. SATELLITE COMMUNICATION TRAINER2

This Module is used to Transmit and Receive 2.4GHz Pass Band RF Signal, 2MHz Base Band Signal is used at the input



Specification

- * 2.4 GHz Operation for Transmitter and Receiver
- * 70 MHz IF output is able to view in 100 MHz CRO
- * I, Q Inputs and Outputs : 2 MHz
- * RF is linked through the Dish Antenna