ACS

Analog Communication Training System

FEATURES

- Self-contained Analog Communication System trainer.
- Helps understand analog communication concepts.
- Includes onboard modulating signals and carrier generators.
- Functional blocks can be interconnected using patch cords.
- Supports building and studying different modulation and receiver schemes.

SPECIFICATIONS

ACS Tx - Analog Communication Training System

a) Generator Block

- **Function Generator (2 Nos.):** Waveform: Sine, Square & Triangular · Frequency: 1Hz to 100 KHz, Variable · Amplitude: 0 to 2V, Variable
- **Carrier Generator (2 Nos.):** Waveform: Square wave · Frequency: 1 KHz to 20 KHz & 1 KHz to 30 KHz Variable · Amplitude: 2V, Fixed
- **Voltage Controlled Oscillator (VCO) & FM Modulator (2 Nos.):** Frequency: 500 KHz to 1500 KHz , Variable Amplitude: 0 to 2V, Variable

b) Modulator Block

- **Balance Modulator 1:** Modulation: Amplitude modulation, Double sideband, single side band (USB and LSB) · Carrier Input: 1-1000 KHz · Modulation Input: 0.1 - 100 KHz · Carrier Null: Adjustable · Output Amplitude: Adjustable
- **Balance Modulator 2:** Modulation: Amplitude modulation, Double side band, Single side band (USB and LSB). · Carrier Input: 1 MHz · Modulation Input: 400-500 KHz · Carrier Null: Adjustable · Output Amplitude: Adjustable
- **Colpitt's Oscillator:** 1 MHz Sine Wave with variable amplitude 0 to 2V
- **Ceramic Filter:** Central Frequency 460KHz · Bandwidth 10 KHz + / - 3 KHz
- **Band Pass Filter:** Central Frequency 1.455MHz · Bandwidth 10 KHz + / - 3 KHz
- **FDM Transmitter:** Input 1 Band Pass Filter: 7KHz to 11KHz Fc = 9KHz · Input 2 Band Pass Filter: 18KHz to 22KHz Fc = 20KHz · Pilot Carrier 256KHz
- **Pre-emphasis:** Time Period with 50us
- **Armstrong Modulator:** Indirect Method of FM Generation
  1) Integrater
  2) Phase Shifter (90 Degree)
  3) Adder
  4) Frequency Multiplier
- **Phase Modulator:** Adjustable to 400 KHz to 500 KHz
- **Reactance Modulator:** Reactance modulator with variable amplitude

c) Noise Generator & Filter Block

- **Noise Generator & Adder:** PSEUDO RANDOM NOISE SOURCE, 32 bit, Output Amplitude : 0 to 1V, Noise Bandwidth : 2 MHz
- Adjustable from 0 to the maximum of value Signal + Noise Adder Stage
- **Sweep Generator:** Sweep frequency-10Hz, Sweep depth - Adjustable Output for oscilloscope - X axis
- **RF/Spectrum Detector:** Minimum. Input -100mVpp, Adjustable
- **Band Pass Filter:** Frequency Range 7KHz to 13KHz
- **High Pass Filter:** Cut off Frequency 3.4 KHz
- **Band Reject Filter:** Frequency Range 7KHz to 13KHz
- **Matched T Filter:** Cut off Frequency 20 KHz
- **Matched II Filter:** Cut off Frequency 20 KHz

d) Transmission via Antenna and Application Block

- **Antennas:** Ferrite Rod & MW coil
- **Output Amplifier:** 600 KHz to 1650 KHz with adjustable gain
- **Audio Pre-amplifier:** Audio pre-amplifier with Microphone and adjustable gain

ACS Rx - Analog Communication Training System

a) RF Ampifier Block
- **RF Amplifier:** 600 KHz to 1650 KHz with adjustable gain

b) Local Oscillator Block
- **Output signal:** Sine wave for local oscillator input
- **Frequency:** 900 KHz to 1650KHz variable
- **Amplitude :** Adjustable from 0 ~ 2Vp-p
- **Output Impedance :** 50 Ohms

c) Mixer Block
- Dual gate MOSFET IN
- Inputs : Local oscillator and RF Signal
- Output Frequency : 455KHz adjustable
- Filter : Dual tune LC

d) IF Amplifier & Filter Block
1st IF and 2nd IF amplifier
- **Central frequency :** 455KHz
- **Load impedance :** Variable R-L-C
- **Gain :** 32dB with automatic gain control

e) Demodulator Block
Beat Frequency Oscillator:
- Central Frequency: Adjustable to 457KHz
- Amplitude: 0 to 2V variable

Diode Envelope Detector:
- Detection of Positive & Negative envelope with variable RC filter DSB

Limiter:
- 455 KHz central Frequency 1.5V output amplitude

Quadrature / Product Detector:
- Frequency : Adjustable from 400KHz ~ 500KHz SSB
- Input amplitude : 1Vp-p

Foster Seeley / Ratio Detector:
- Frequency : Adjustable from 400KHz ~ 500KHz SSB
- Input amplitude : 1Vp-p

PLL Detector:
- Frequency : Adjustable from 400KHz ~ 500KHz SSB
- Input amplitude : 1Vp-p

Detuned Resonance Detector:
- Frequency : Adjustable from 400KHz ~ 500KHz SSB
- Input amplitude : 1Vp-p
- De-emphasis: Time Period with 50us

FDM Receiver:
- Band Pass Filter: 7 KHz to 11 KHz , Fc = 9 KHz ,
- Band Pass Filter: 18 KHz to 22 KHz , Fc = 20 KHz

Power Meter with Integrator and Dump Circuit:
- 2 Digit Seven Segment Display with 1 - 15 sec Timer
- Input signal Amplitude 0 to 2V

Low Pass Filter (2 Nos.):
- With cut-off frequency 3.4Khz & 1.5Khz.

f) Radio Receiver Block
- Frequency Bands: AM (MW), FM
- AM / MW Frequency Range: 522 kHz - 1440 kHz
- AM / MW Antenna: MW Coil
- FM Frequency Range: 88 MHz - 108 MHz
- FM Antenna: External telescopic whip antenna

g) Reception via Antenna and Application Block
- Antenna : Ferrite Rod & MW coil, Telescopic Antenna
- Audio Amplifier: Audio Amplifier with headphone and adjustable gain .

h) Switch Faults
- Switch Faults are provided to simulate fault condition.

i) Power Supply
- Power Supply: GND, +5V, + 12V, -12V

EXPERIMENTS

Module 1 : Linear Modulation
- Amplitude Modulation
- Frequency Spectrum of AM
- Generation of AM signal
- Modulation Index of AM
- Observed Linearity Curve of AM Modulator
- SSB-SC, DSB-SC
- AM Demodulation - Envelope and Square Law Demodulation
- Phase Discriminator Method
- Armstrong Modulation and Demodulation

Module 2 : Frequency Division Multiplexing
- FDM

Module 3 : Angle Modulation
- Principle of frequency and phase modulation - Relation between FM and PM waves
- Frequency deviation & Modulation Index of FM
- Bandwidth and spectrum of FM

Module 4 : Demodulation of Angle Modulated Signals
- FM detectors – slope detectors
- Ratio detectors
- The Phase Locked Loop
- Pre-emphasis and de-emphasis.

Module 5 : Receivers and Noise in Analog Communication
- Observed Frequency Response of Ceramic Filter
- Study of Selectivity & Sensitivity of AM Receiver
- Effect of Noise on Analog Systems
- Noise Power Spectral Density Measurement
- SNR and Noise Figure measurement

Module 6 : Filters
- Study of Different filters

Module 7 : AM/FM Radio Receiver
- To study the AM/MW Radio Receiver
- To study the FM Radio Receiver