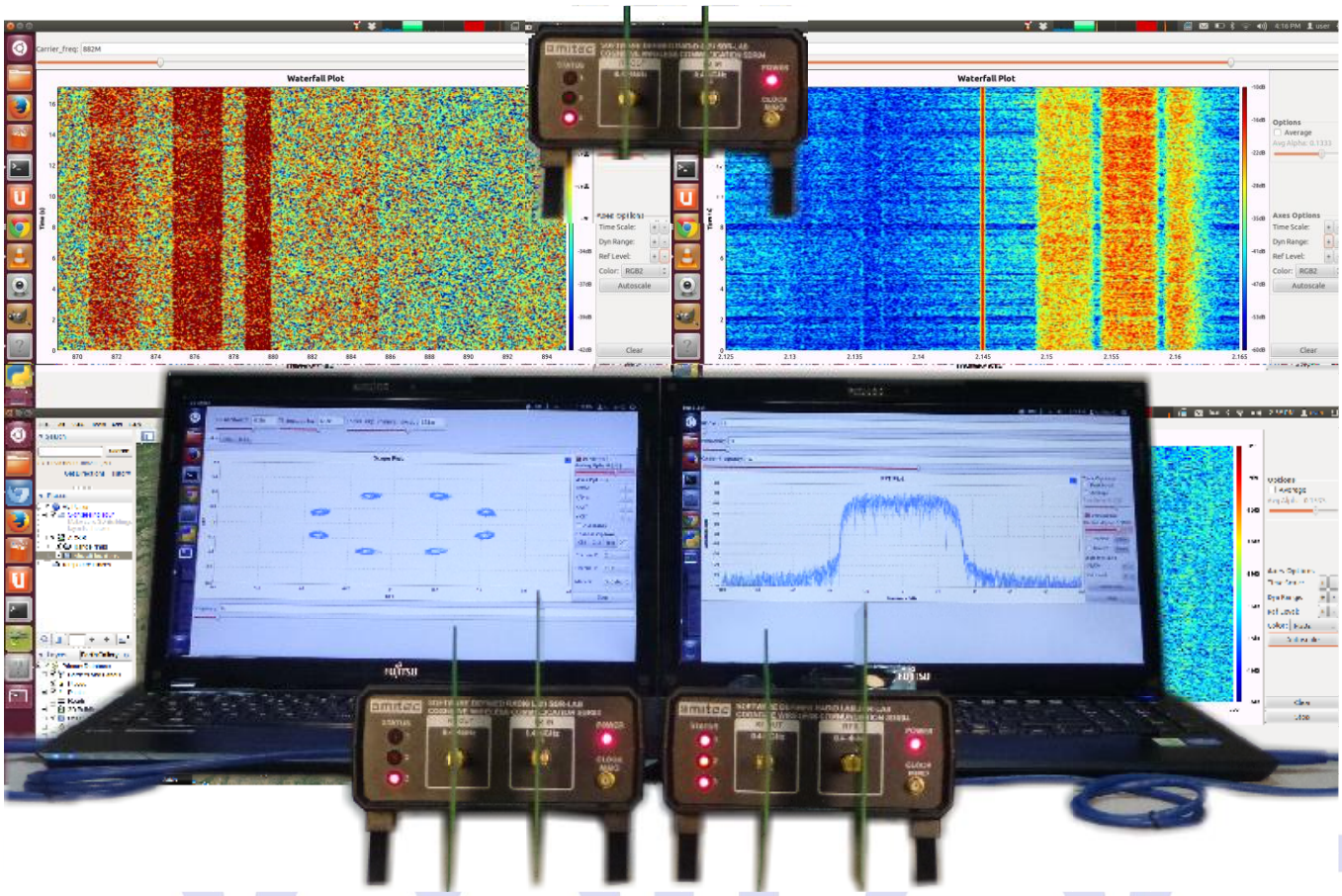

***In-built Computer (Laptops not provided)**

Features

- Learn the next generation of Satellite Communication technology with modular approach and complete flexibility in design and operation
- Based on latest generation of Software Defined Radio technology with complete control over frequency, modulation schemes and system design
- Emulate the functionality and characteristics of Earth Station Transmitter, Satellite Repeater and Earth Station Receiver
- Implement complete signal processing chain for transmission and reception of any kind of data such as voice, video, image, file, text messages or any other custom data
- Complete control over telemetry link
- Design any analog or digital modulation scheme for implementing data and telemetry links
- Use modern signal processing algorithms and observe the effect in real-time
- Modular system allows use of channel coding and error correction coding schemes
- Flexibility in inserting various real-world parameters such as noise, delay and effect of channel
- Implement complete end-to-end system using various Digital Video Broadcasting technologies and mimic a real satellite system
- Emulate GPS transmission and Reception by transmitting custom GPS data and decoding at receiver
- Control Satellite and its various parameters
- Test remote fault insertion, diagnostics and measure parameters such as Packet Error Rate (PER)
- Study link characteristics and Performance

Introduction

The Amitec Satellite Communication Training Lab SCT06 is a highly configurable and adaptable training and research and development system optimized to implement modern communication technologies. The complete system consists of Earth Station Transmitting Emulator, Earth Station Receiving Emulator and Satellite Emulator. All three sub-systems consist of Software Programmable Hardware transceiver which allows limitless satellite communication laboratory experiments to be performed on a single setup. Implement existing satellite communication standards using real-world modulation schemes and parameters. Software programmability of the system allows it to be upgraded, making it obsolesce-proof.

Study and implement a wide range of communication concepts such as various modulation schemes, including NBFM, WBFM, DBPSK, DQPSK, QAM and custom modulation, packetisation, whitening, scrambling, differential encoding, error correction coding schemes and channel models. Study real-time performance and measurement of parameters such as link budget, packet error rate and other concepts. Learn the use and implementation of telemetry signals.

Observe and measure the effect of different antennas and study the characteristics.

The entry barrier is lowered to include the under graduate students by providing a graphical programming environment. The burden on faculty is lowered by using courseware designed at Amitec from simple FM to most complex Modulation techniques. The systems offer high bandwidth and dynamic range.

Study Orbital mechanics with a license-free tool. Configure various orbits, launch sites and parameters to implement a real-world system and adapt the system in real-time.

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Hardware Technical Specifications:	
Earth Station Transmitter	
Data Transmit/Uplink Frequency Range	100 MHz to 6 GHz
Telemetry Transmit/Uplink Frequency Range	100 MHz to 6 GHz
Telemetry Receive/Downlink Frequency Range	100 MHz to 6 GHz
Frequency Band Upgradable	Upgradable to DC on lower Side and 60 GHz on upper side
Wireless transmission and reception	Over the air transmission through SMA connector
Computer	In-built quad core computer with Spectrum, Scope and Constellation Display
Signal Capture	The IQ Vectors at any part of signal chain. User can process the IQ data
Data Modulations supported	Any, Custom Modulations possible
RF Output Power	+5 dBm Max., customizable
Transmission Data rate	Any sampling rate, Max. 40 MSPS
TX/RX SMA Impedance	50 Ohm
Mode	Full Duplex, TDD, FDD
Data Type	Voice, Video, Chat, File
Telemetry Modulations supported	Any, Custom Modulations possible
Telemetry Link	Full Duplex
DVB-S Transmitter	In-built
Satellite Emulator	
Data Receiver/Uplink Frequency Range	100 MHz to 6 GHz
Data Transmit/Downlink Frequency Range	100 MHz to 6 GHz
Telemetry Transmit/Downlink Frequency Range	100 MHz to 6 GHz
Telemetry Receive/Uplink Frequency Range	100 MHz to 6 GHz
Frequency Band Upgradable	Upgradable to DC on lower Side and 60 GHz on upper side
Wireless transmission and reception	Over the air transmission through SMA connector
Computer	In-built quad core computer with Spectrum, Scope and Constellation Display
Signal Capture	The IQ Vectors at any part of signal chain. User can process the IQ data
Data Modulations supported	Any, Custom Modulations possible
Transmit Baseband Bandwidth	30 MHz
RF Output Power	+5 dBm Max., customizable
Transmission Data rate	Any sampling rate, Max. 40 MSPS
TX/RX SMA Impedance	50 Ohm
Mode	Full Duplex, TDD, FDD
Data Type	Voice, Video, Chat, File
Telemetry Modulations supported	Any, Custom Modulations possible
Telemetry Link	Full Duplex
Earth Station Receiver	
Data Receiver/Downlink Frequency Range	100 MHz to 6 GHz
Data Transmit Frequency Range	100 MHz to 6 GHz
Frequency Band Upgradable	Upgradable to DC on lower Side and 60 GHz on upper side
Wireless transmission and reception	Over the air reception through SMA
Signal Capture	The IQ Vectors at any part of signal chain. User can process the IQ data
Data Modulations supported	Any, Custom Modulations possible
RF Receiver Sensitivity	-120 dBm
Reception Data rate	Any sampling rate, Max. 40 MSPS
Computer	In-built quad core computer with Spectrum, Scope and Constellation Display
TX/RX SMA Impedance	50 Ohm
Mode	Full Duplex, TDD, FDD
Data Type	Voice, Video, Chat, File
DVB-S Receiver	In-built
Antennas	Directional LPDA 0.4-6 GHz X3, Omni Directional Dipole 0.4-6 GHz X3, High-gain Dish X2 Circularly-polarized Patch X2
Shipping List Deliverable	Earth Station Transmitter, Satellite Emulator, Earth Station Receiver, Antennas X10, SMA-SMA Cables X 6 pcs, Attenuator 20dB X 3pcs

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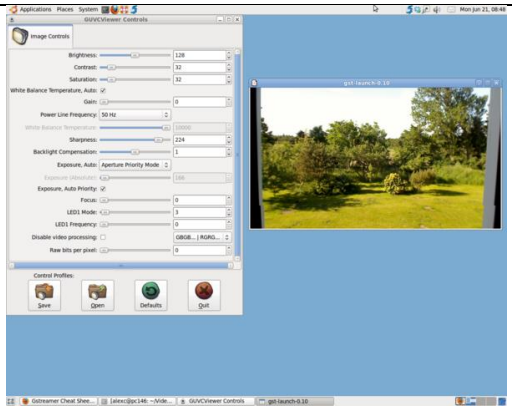
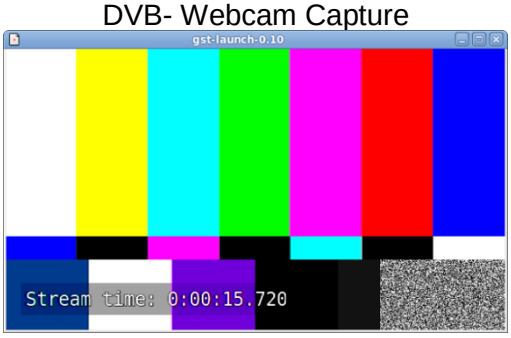
Scope of Experimentation

- GPS Satellite Emulation. Transmit GPS satellite data and Receive GPS emulated data
- Receive data from real GPS satellite and decode the data
- Transmit video using DVB-S and receive video over satellite link
- Emulate satellite channel conditions and observe the effect of Doppler shift, free-space path loss, attenuation due to atmospheric gases and rainfall and antenna pointing loss
- Implement Satellite Earth Station with complete control over signal processing chain and telemetry link
- Implementing On-air Transmission and Reception using Digital Modulation and Demodulation techniques like NBFM, WBFM
  ASK, FSK, BPSK, DBPSK, MSK, GMSK, DQPSK, QPSK, OQPSK, pi/4QPSK, 8PSK,16QAM, 64QAM, 256QAM, CPFSK, GFSK, and other variants,
- Spread spectrum techniques like CSS, DSSS, FHSS, THSS
- Study the performance of satellite communication link in presence of:
  Analog Channel Models like Noise (Uniform, Linear, Laplacian, Gaussian, Phase noise),
  Interference (Cross talk, Co-channel, Inter symbol),
  Distortion (Inter modulation),
  Frequency response (Attenuation & phase shift),
  Group delay, Propagation Doppler shift,
  Fading modeling slow, fast, selective/dispersive,
  Multipath, Rayleigh, Rician),
- Implement Channel Coding & Decoding such as- Convolutional, Viterbi, Trellis
- Channel performance measurements such as:
  Spectral bandwidth, Symbol Rate, Bit Rate,
  Channel Capacity, Channel Utilization
  Signal to Noise ratio, Bit Error Rate BER, Latency, Jitter
- Visualize the data using Constellation diagram, Oscilloscope, Spectrum Analyzer, Waterfall display
- Emulate Satellite with complete uplink and downlink characteristics. Implement complete signal processing chain and telemetry link
- Implement Satellite Receiver with custom algorithms
- Transmit telemetry data and control the satellite from earth station
- Receive various types of data from Earth station including Voice, Video, Chat and File
- Study the block level implementation of commercial Digital Video Broadcasting(DVB) system. Implement end-to-end video transmission link over DVB
- Simulate GPS satellites by generating and transmitting custom GPS data and receive and decode the data at the earth station

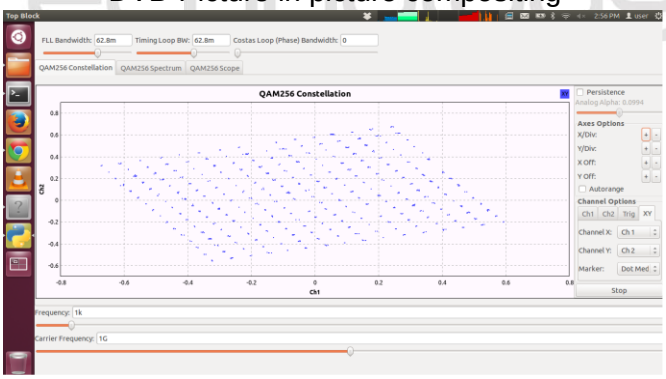


DVB- Webcam Capture

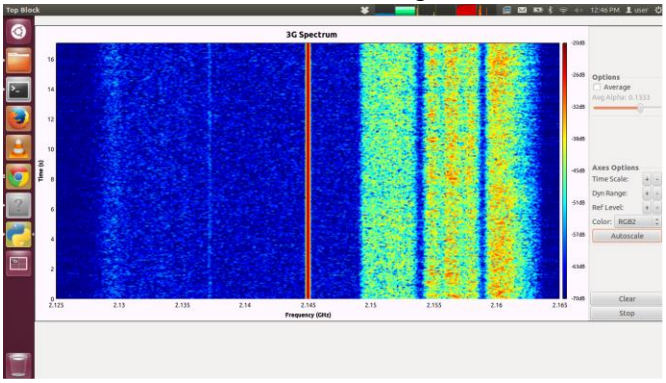


DVB- Time Overlay over Video

DVB-Picture in picture compositing



Constellation Diagram



Waterfall Display

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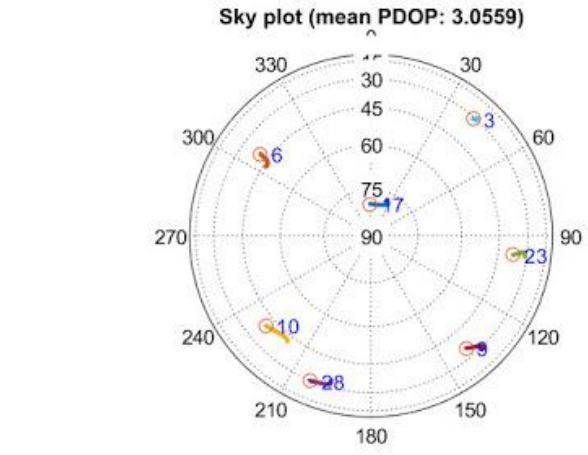
List of Experiments

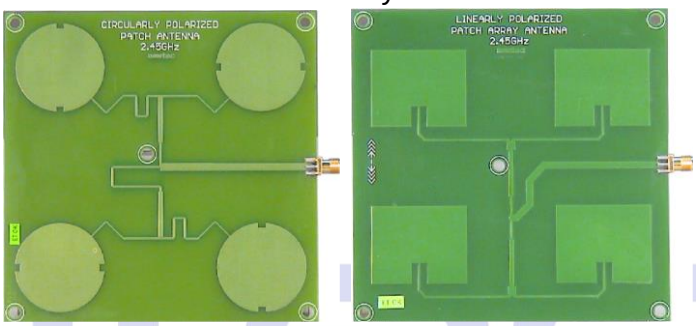
1. Design and Implement a complete real-time SATCOM link using Analog Modulation schemes such as NBFM and WBFM
2. Design and Implement a complete real-time SATCOM link using Digital Modulation schemes such as DBPSK, DQPSK, D8PSK, BPSK, QPSK, 8PSK
3. Design and implement an Audio transmission and reception SATCOM system using various codes and Frequency Modulation in real-time over a SATCOM link
4. Video transmission and reception using various modulation schemes with complete encoding and decoding in real-time over a SATCOM link
5. Design and implement a complete RF system using Digital Video Broadcasting(DVB) for audio and video transmission and reception over a SATCOM link
6. Design and implement a system to practically demonstrate and understand the concept of frequency offset correction, matched filtering and timing synchronization and phase offset correction modern communication system over a SATCOM
7. Design and implement a complete system to transmit and receive a Pseudo Random Sequence over a SATCOM link
8. Design and implement a complete system to transmit and receive data via TCP/IP over a SATCOM using different modulation schemes
9. Design and implement a complete system to understand and demonstrate the concept of Equalizers and Forward Error Correction(FEC) in a communication system
10. Design and Implement a complete real-time SATCOM link in the presence of different channel conditions
11. Design and implement a real-time system for Packet Error Measurement(PER) Measurement over a SATCOM link
12. Design and implement a real-time system using Spread Spectrum over a SATCOM link
13. Design and implement a real-time system for measurement of Signal to Noise Ratio (SNR) over a SATCOM link.

And Many More….

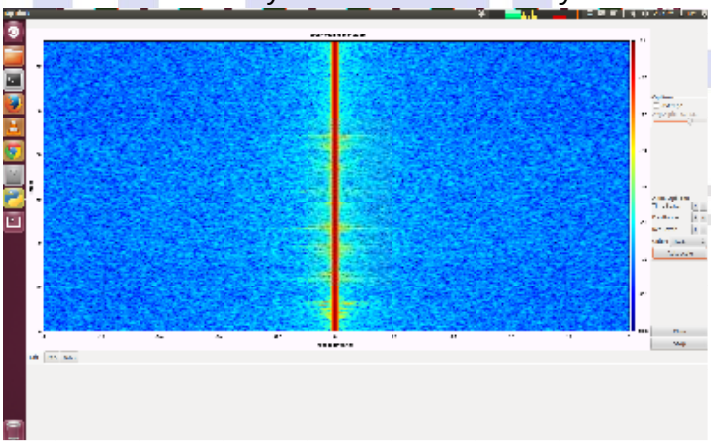
Dish Antenna



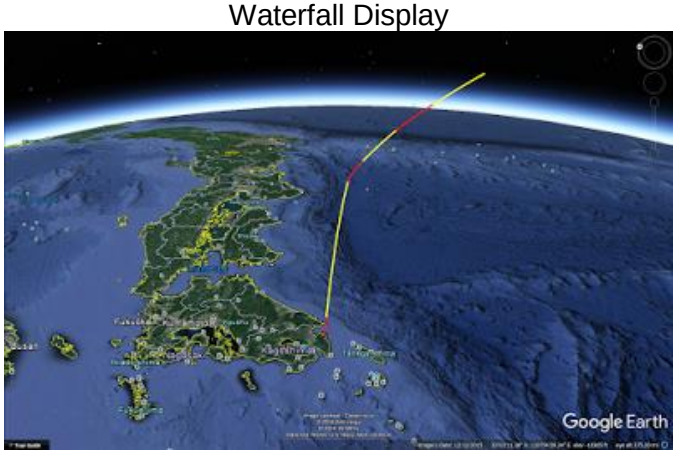
GPS Sky Plot



Circularly Polarized Patch Array



Waterfall Display



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