

GSM/EGPRS Overview

Course Number: GSM2000-01EN | Duration: 3 Days

Target Audience

- MS & GERAN Development Staff
- Network Engineering & Optimisation Personnel
- System Design Engineering Staff, IOT & System Test Engineers
- Technical Sales and Marketing people

Prerequisites

- None

Learning Objectives

After completing this course, the students will be able to:

- Describe the services offered by GSM and GPRS/EGPRS.
- Understand the differences between dedicated and shared timeslot.
- Explain the necessary overhead and need for QoS once resources are shared.
- Understand what delays involved to get an IP-frame transmitted/received.
- Why is there different handling of connected mode mobility between CS and PS?
- Estimate the maximum cell size for speech and EGPRS services.

Course Outline

1. Introduction to GSM Network
 - 1.1 Services offered by GSM & GPRS
 - 1.2 Network Elements & Interfaces
 - 1.3 MS Classes & Network Modes
 - 1.4 GERAN Networks
2. Radio Frequency Transmission & Reception
 - 2.1 Transmit Power and Receive Level
 - 2.2 Pathloss and Coverage
 - 2.3 Bit Error Detection & Correction
3. Frames & Timeslots – Traffic Theory
 - 3.1 TDMA Frame & Timeslots
 - 3.2 Erlang B – Offered & Blocked Traffic
 - 3.3 Beacon, Signaling & Traffic Timeslots
 - 3.4 Multiframe & Channels
4. Physical Layer Fundamentals
 - 4.1 GSM Bands & ARFCN's
 - 4.2 Bursts Transmission
 - 4.3 Interleaving
 - 4.4 Frequency Hopping
 - 4.5 RXLEV & RXQUAL Measurement
5. CS Idle Mode & Connected Mode Procedures
 - 5.1 PLMN / Cell Selection
 - 5.2 Location Update
 - 5.3 Call Setup & Release (MTC/MOC)
6. EGPRS Frames & Timeslots Handling
 - 6.1 Timeslot Sharing & Overhead
 - 6.2 TBF Allocation & Release
 - 6.3 RLC/MAC Block Transmission
 - 6.4 Modulation & Coding Scheme
 - 6.5 Multiframe & Channels
7. GPRS Mobility & Session Management
 - 7.1 GPRS Attach & Routing Area Update
 - 7.2 PDP Context & IP Address Allocation
 - 7.3 Need for QoS ?
 - 7.4 GPRS Suspend & Resume
8. RLC/MAC Functionality
 - 8.1 Block Transmission & Retransmission
 - 8.2 Sequence Numbering & Window Size
 - 8.3 LLC Frame Segmentation & Reassembly
9. GSM / GPRS Mobility
 - 9.1 Reselection & Handover (CS)
 - 9.2 Reselection & Cell Update(PS)

GSM/EGPRS Air Interface

Course Number: GSM2200-01EN | Duration: 4 Days

Target Audience

- Network Planning/ Performance Engineering Staff
- System Test / IOT Test Engineers and Optimisation Personnel

Prerequisites

- GSM/EGPRS Overview (GSM2000-01EN)

Learning Objectives

After completing this course, the students will be able to:

- Evaluate features like power control, HO control and UL/DL DTX on speech timeslots.
- Understand how AMR Codec adaptation is performed and when TrFO is possible.
- Analyse the RXLEV and RXQUAL measurements and reasons for handover.
- Know how final ACK is delayed to identify with the global TFI the setup of a new TBF.
- Judge the performance of EGPRS link adaptation & resource allocation.

Course Outline

1. GSM & EGPRS Network Layout
 - 1.1 Network Overview
 - 1.2 Functionality of CS/PS CN
 - 1.3 Functionality of RAN
 - 1.4 Mobile Station Classes
2. Radio Frequency Planning Fundamentals
 - 2.1 Frequency Bands & ARFCNs
 - 2.2 Interference & Frequency Re-Use
 - 2.3 RF Propagation & Multipath
3. TDMA & FDMA Resources
 - 3.1 TDMA Frame & Timeslots
 - 3.2 Physical & Logical Channels
 - 3.3 CCH, TCH & PDCH Multiframes
 - 3.4 Need for Timing Advance
4. Physical Layer - Modulation
 - 4.1 GMSK versus 8-PSK Modulation
 - 4.2 Bursts – Structure & Timing
 - 4.3 Training Sequence & ISI
 - 4.4 Cell Search – FCCH & SCH Decoding
 - 4.5 RXLEV & RXQUAL Measurement
 - 4.6 SAIC & VAMOS – MIMO for GSM
5. CS Idle Mode & Connected Mode Procedures
 - 5.1 Cell Selection & Reselection
 - 5.2 Random Access – RACH for EGPRS
 - 5.3 Location Update
 - 5.4 Call Setup & Release (MTC/MOC)
 - 5.5 Power Control & DTX (Full/Sub Values)
 - 5.6 Handover Signalling & HO Types
 - 5.7 Call Waiting & Multiparty Call
 - 5.8 AMR Codec Adaptation
 - 5.9 Inter-RAT HO & Redirections
6. RAN Failure & Drops
 - 6.1 Downlink Signaling Failure
 - 6.2 Radio Link Timeout & Layer 2 Drops
 - 6.3 BSSMAP Clear Request Procedure
 - 6.4 HO Failure & Drops
7. PS Idle Mode & Connected Mode Procedures
 - 7.1 Ready & Standby States
 - 7.2 Cell Reselection & Cell Update
 - 7.3 Attach & Routing Area Update - NMO
 - 7.4 CS/PS Paging Coordination
 - 7.5 PDP Context Activation & Deactivation
 - 7.6 BVCI & MS Flow Control
 - 7.7 BSSGP Radio Status Signaling
 - 7.8 GPRS Detach and Rejects
8. EGPRS Resource Allocation & TBF Handling
 - 8.1 UL/DL TBF Setup & Concurrent TBF
 - 8.2 Dynamic UL TBF vs. EDA
 - 8.3 Normal & Abnormal TBF Release
 - 8.4 Extended Uplink TBF
 - 8.5 Delayed Downlink TBF Release
9. RLC/MAC Operation
 - 9.1 LLC Segmentation & Reassembly
 - 9.2 Polling for RLC/MAC Ctrl vs. Data Blocks
 - 9.3 RLC/MAC (E)PDAN & (E)PUAN
 - 9.4 RLC Window & Stalling
 - 9.5 ARQ and IR - MCS Family's
10. EGPRS Mobility
 - 10.1 Network Control Order & Cell Changes
 - 10.2 NACC & PCCO
 - 10.3 Packet SI Status & Serving Cell Data
 - 10.4 Inter-RAT Cell Changes

GSM/EGPRS Signaling & Protocols on Um Interface

Course Number: GSM2300-01EN | Duration: 4 Days

Target Audience

- MS & GERAN Development Staff
- Network Planning/ Performance Engineers
- Network Engineering and Optimisation Personnel

Prerequisites

- GSM/EGPRS Air Interface (GSM2200-01EN)

Learning Objectives

After completing this course, the students will be able to:

- Understand the call setup and release procedures for voice and packet.
- Analyse the various reasons for dropped calls in GSM.
- Identify the root causes for drops in EGPRS and be able to trace it on Gb-Interface.
- Decode downlink & uplink Ack/Nack packet and verify the correct block transmission.
- Determine the reasons for handover, handover failures and handover drops.

Course Outline

1. Fundamentals of GSM & EGPRS
 - 1.1 Network Architecture – RAN & CN
 - 1.2 GSM/EGPRS Feature Overview
 - 1.3 CS/PS RRC & (G)MM States
 - 1.4 Protocol Architecture Phase1 – R9
2. General Signalling Procedures
 - 2.1 MS & RAN/CN Identifiers
 - 2.2 SIM/USIM Functionality
 - 2.3 System Information Broadcasting
 - 2.4 Service Area Broadcasting - CBS
 - 2.5 CS/PS Paging – Paging Coordination
 - 2.6 Idle Channel Supervision
3. Registration (MM/GMM)
 - 3.1 PLMN & Cell Search
 - 3.2 Location Update & GPRS Attach
 - 3.3 Combined Attach for PS & CS
 - 3.4 Location & Routing Area Update
 - 3.5 CS/PS Detach Scenarios
4. RR (Re-)Establishment
 - 4.1 Random Access Procedure
 - 4.2 SDCCH & TCH Seizure
 - 4.3 Layer 1-3 Drop Reasons
 - 4.4 Call Re-establishment
5. TBF Establishment Methods - Rel. 9
 - 5.1 UL TBF Establishment (Standby & Ready State)
 - 5.2 DL TBF Establishment (Standby & Ready State)
 - 5.3 Concurrent TBF Establishment
 - 5.4 Normal/Abnormal TBF Release
 - 5.5 BSSGP Radio Status Signalling Cases
 - 5.6 PDCH Release & Reconfiguration
6. Call Setup Procedures
 - 6.1 Successful AMR/FR MOC
 - 6.2 Successful AMR/HR MTC
 - 6.3 Unsuccessful TCH Assignments
 - 6.4 Normal / Abnormal Call Release
7. Handover Procedures
 - 7.1 Emergency Intra-Cell HO
 - 7.2 Intra-Cell SDCCH HO
 - 7.3 Successful Intra-BSC HO
 - 7.4 Unsuccessful Intra-BSC HO
 - 7.5 Successful Inter-BSC HO
 - 7.6 Unsuccessful Inter-BSC HO
8. Other CS related Procedures
 - 8.1 Power Control & Timing Advance
 - 8.2 Inter-RAT HO (2G → 3G)
 - 8.3 Queuing & Preemption
 - 8.4 Directed Retry HO
 - 8.5 Traffic Reason HO
 - 8.6 USSD & Supplementary Services
9. EGPRS Mobility Scenarios
 - 9.1 NC0 – MS autonomous Cell Change
 - 9.2 NC2 – PCU controlled Cell Change
 - 9.3 NACC – with NC0 and NC2
 - 9.4 Inter-RAT Change (2G → 3G/4G)
10. DTM Procedures
 - 10.1 GTTP Scenarios
 - 10.2 CS Call with TBF Establishment
 - 10.3 Ongoing TBF with incoming CS Call
 - 10.4 DTM Release

GSM/EGPRS Parameter Optimisation & Troubleshooting on Um Interface

Course Number: GSM2500-01EN | Duration: 5 Days

Target Audience

- MS & GERAN Development Staff
- Network Planning/ Performance Engineering Staff
- Optimisation Personnel & IOT/System Test Engineers

Prerequisites

- GSM/EGPRS Signaling & Protocols (GSM2300-01EN)

Learning Objectives

After completing this course, the students will be able to:

- Analyse reason for drops based on measurements from Um- and Abis-Interface.
- Understand the parameters controlling MS behavior in Packet Idle & Packet Transfer Mode.
- Conduct combined Abis- & A-interface traces as well Abis- & Gb-interface traces.
- Identify the call-trace & MS experiencing call setup problems or drops or HO failures.
- Perform parameter tunings and trials for improving radio network KPI's.

Course Outline

1. Capacity Optimisation on Um
 - 1.1 Dynamic CCCH Parameter Tuning
 - 1.2 Dynamic SDCCH Parameter Tuning
 - 1.3 Dynamic Half-Rate
 - 1.4 VAMOS Configuration & Setup
2. Capacity Optimisation on A- & Gb-Interface
 - 2.1 AoIP Parameter Settings
 - 2.2 Transcoder Free Operation (TrFO)
 - 2.3 Gb over IP Parameter Settings
3. BSS Parameter Optimisation
 - 3.1 Cell Selection & Reselection
 - 3.2 Power Control
 - 3.3 Handover Control
 - 3.4 DTX Parameterisation
 - 3.5 AMR Codec Adaptation
4. Interference Analysis & Reduction
 - 4.1 C/I Scanner Measurements
 - 4.2 HO due to Interference
 - 4.3 Idle Channel Supervision
 - 4.4 Antenna Tuning
 - 4.5 Frequency Tuning
 - 4.6 Frequency Hopping Configurations
5. Drop Call Analysis & Parameter Optimisation
 - 5.1 RLF Warning Tuning
 - 5.2 RLT Value Tuning
 - 5.3 T200 & N200 Tuning
 - 5.4 Repeated SACCH & FACCH
 - 5.5 Resilience to Abis-Interruption
 - 5.6 Clear Request per Cause Distribution
6. CCCH Capacity Planning & Optimisation
 - 6.1 RACH Load Analysis
 - 6.2 Dynamic CCCH (PCH vs. AGCH)
 - 6.3 Paging Issues – Missed Calls
 - 6.4 Location Area Dimensioning
7. Call Setup Failure & Optimisation
 - 7.1 NAS Failure Reasons (DISC Causes)
 - 7.2 User & MS Failure (e.g. CM Service Reject)
 - 7.3 Radio Quality Issues (SDCCH & TCH)
 - 7.4 Congestion Problems
8. EGPRS TBF Tuning
 - 8.1 Capacity of a PDCH-Timeslot vs. C/I
 - 8.2 UL TBF Establishment Performance
 - 8.3 Delayed TBF Release Optimisation
 - 8.4 PDTCH Upgrade/Downgrade Strategy
9. EGPRS RLC/MAC Optimisation
 - 9.1 EPDAN & EPUAN Analysis
 - 9.2 Link Adaptation & MCS Selection
 - 9.3 RLC/MAC Timer & Counter Tuning
 - 9.4 NCO & Cell Change Procedure
 - 9.5 Uplink & Downlink Power Control
10. BSSGP Layer Optimisation
 - 10.1 MS Flow Control Parameterisation
 - 10.2 GPRS Suspend & Auto Resumption
 - 10.3 Analysis of Radio Status
 - 10.4 Analysis of Flush Logical Link
11. GMM, SM & Other Parameter Optimisation
 - 11.1 BSS Paging Co-ordination vs. NOM-1
 - 11.2 Ready Timer vs. Cell Update Load
 - 11.3 QoS & Packet Flow Context
 - 11.4 Problems with DTM & Advantages