

AMR in GSM

Operation, Procedures & Testing

Course Duration:

- ▶ 2 days

Course Description:

- ▶ This course addresses the needs of engineers and technicians who are already experienced in GSM.
- ▶ This course focuses on all aspects of developing, testing and introducing AMR into an existing GSM network.
- ▶ Starting with a generic description of the GSM speech coders (including the AMR-coders) the course continues with the detailed analysis of the AMR-operation (setup, adaptation, ...)
- ▶ The course also outlines in detail RATSCCH-signaling functions and the course concludes with an in-depth description of the AMR-coding options for TCH/AFS and TCH/AHS.
- ▶ We also focus on testing the AMR-functionality which is important for all involved parties.

As in all our courses we integrated several interactive exercises for a perfect learning experience.

Pre-Requisites:

- ▶ Very good understanding of GSM networks, protocols, operation and parameters. If required, we advise our courses "Introduction to GSM" and "GSM-Signaling" to be taken upfront.

Course Target:

- ▶ The student will understand all relevant details of activating and managing AMR.
- ▶ The student will gain a thorough comprehension of AMR in the mobile station, the BTS and the TRAU.
- ▶ The students obtain the capability to implement AMR to their specific hard- and software platform.

Some of your questions that will be answered:

- ▶ How can I optimize the usage of the GSM Air-Interface capacity without degrading the speech quality?
- ▶ What is the meaning of the various new parameters, logical channels and counters like: ACS, CMI, CMR, CMC, RATSCCH, convolutional coding, puncturing... ?
- ▶ What is the meaning of the various new messages that have been defined for AMR?
- ▶ How can I decode hexadecimal AMR inband signaling messages?
- ▶ What is the impact of AMR introduction for TRAU, BTS and mobile station?
- ▶ What are the effects of TFO, DTX, Handover,... on AMR?
- ▶ How and where can we test AMR in the GSM-Network and mobile station?
- ▶ Depends the function of AMR on the speaker's language?

Who should attend this class?

- ▶ Design engineers who shall develop AMR for the BSS or for the mobile station.
- ▶ Test engineers who need a thorough understanding of AMR-signaling procedures (inband and outband)
- ▶ Network operators who require a detailed understanding of the technical realization and implications of AMR

Table of Contents:

Adaptive Multirate Encoding in GSM-Networks

Speech Signal Transmission in GSM

- ⇒ Source and Channel Coding
- ⇒ GSM Full Rate Speech Coder
 - GSM Speech Codec Family
 - Discontinuous Transmission (GSM – DTX)
- ⇒ Mean Opinion Score

AMR Speech Codec

- ⇒ AMR Coding Modes
 - GSM EFR & AMR versus C/I
 - Transmission Delay
 - AMR Complexity
- ⇒ AMR Discontinuous Transmission (DTX)

Tandem Free Operation

- ⇒ Cross Codec Tandeming

Controlling the AMR Operation

Mode Adaption

- ⇒ AMR Modes Bit Rates
- ⇒ Active Codec Set
 - Thresholds and Hysteresis Values

In Band Signaling

- ⇒ Signaling for AMR Configurations
- ⇒ S
 - Alternating Transmission of Codec Modes Parameters **Fehler!**
 - Textmarke nicht definiert.**ignaling for Codec Mode Adaptat

TRAU Frame for AMR

- ⇒ AMR Parameter Transmission in TRAU

Channel Coding Procedures for AMR

Overview on Channel Coding Principles

- ⇒ Block Codes
- ⇒ Convolutional Codes
 - Example
 - Tail Bits
- ⇒ Puncturing
- ⇒ Interleaving

TCH/AFS (Traffic Channel, Adaptive Full rate Speech)

- ⇒ S
- ⇒ Channel Coding of SID_FIRST Frame **Fehler! Textmarke nicht definiert.**peech Frame Channel Coding
- ⇒ Channel Coding for SID_UPDATE Frame (AFS)
- ⇒ Channel Coding for SID_UPDATE Frame (AFS)
- ⇒ Channel Coding of ONSET Frame (AFS)
- ⇒ Channel Coding of RATSCCH Frame

TCH/AHS (Traffic Channel, Adaptive Half Rate Speech)

- ⇒ S
- ⇒ Channel Coding for SID_FIRST_P1 Frame **Fehler! Textmarke nicht definiert.**peech Frame Channel Coding
- ⇒ Channel Coding for SID_FIRST_P2 Frame
- ⇒ Channel Coding for SID_FIRST_INH Frame
- ⇒ Channel Coding for SID_UPDATE Frame (AHS)
- ⇒ Channel Coding for SID_UPDATE_INH Frame
- ⇒ Channel Coding of ONSET Frame (AHS)
- ⇒ Channel Coding of the RATSCCH_MARKER Frame
- ⇒ Channel Coding of the RATSCCH_DATA frame

Signaling Procedures for AMR

(1) Overview of level 3 and inband signaling procedures

- ⇒ AMR in Radio Resource Management (layer 3 signaling)
- ⇒ RR-messages with AMR configuration parameters
 - (1) The Multi Rate Configuration IE and the initial AMR set-up
 - Practical Exercise
 - Example for Codec Mode transitions during Handover
 - Practical Exercise

RATSCCH Protocol

- ⇒ AMR_CONFIG_REQ
- ⇒ THRESH_REQ
- ⇒ CMI_PHASE_REQ

- ⇒ ACK Messages
- ⇒ REQUEST – ACKNOWLEDGEMENT CYCLE

Tandem Free Operation

Comparison of Tandem Operation with TFO

Codec mode adaptations and inband signaling in MS, BTS and TRAU in TFO (Tandem Free Operation)

- Decreased Uplink Quality
- Decreased Downlink Quality
- Increased Downlink Quality
- Increased Uplink and Downlink Quality
- Practical exercise

TFO Frames mapped to PCM

- TFO Frames for 16 kbit/s and 8 kbit/s sub-multiplexing
- Full Rate TFO Frame for AMR (AMR_TFO_16k)
- (1) Half Rate TFO Frame for AMR (AMR_TFO_8+8k)

TFO Signaling

- ⇒ T
 - TFO Message Generic Layout **Fehler! Textmarke nicht definiert.**FO
 - Inband Signaling Chan
- ⇒ TFO Message Types
 - TFO Message Structure
 - (1) Generic Extension Blocks
 - AMR Extension Blocks
 - Message Transfer and In-Path-Equipment

(1) TFO Elementary Procedures and Operation Phases

- Codec Mismatch Resolution / Codec Optimization
- Handover during TFO

Solution of the Practical Exercises

List of Acronyms