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OsmoBTS Abis Protocol Specification

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The Asciidoc source code of this manual can be found at http://git.osmocom.org/osmo-gsm-manuals/

HISTORY			
NUMBER	DATE	DESCRIPTION	NAME
DRAFT	unknown		NH

Contents

1 Introduction

This document describes the A-bis interface of **OsmoBTS**. Based on 3GPP TS 12.21 and 08.58, this document indicates which of the 3GPP specified A-bis messages and IEs are implemented according to 3GPP specifications, which of these are not or not fully implemented, as well as OsmoBTS-specific extensions to the A-bis interface not specified by 3GPP.

Extensions to the A-bis interface specific to OsmoBTS are detailed in this document. For details on the messages and IEs that comply with above mentioned 3GPP specifications, please refer to those documents.

Table 1: 3GPP document versions referred to by this document

3GPP TS 08.56	version 8.0.1 Release 1999
3GPP TS 08.58	version 8.6.0 Release 1999
3GPP TS 08.60	version 8.2.1 Release 1999
3GPP TS 12.21	version 8.0.0 Release 1999

Table 2: IETF documents referred to by his document

IETF RFC 768	User Datagram Protocol
IETF RFC 791	Internet Protocol
IETF RFC 793	Transmission Control Protocol
IETF RFC 1889	RTP: A Transport Protocol for Real-Time Applications
IETF RFC 3551	RTP Profle for Audio and Video Conferences with Minimal Control
IETF RFC 4867	RTP Payload Format and Files Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs
IETF RFC 5993	RTP Payload Format for Global Systems for Mobile Communications Half Rate (GSM-HR)

2 Overview

The OsmoBTS A-bis interface consists of traffic management messages (RSL, Radio Signalling Link) and network management messages (OML, Operation & Maintenance Link), encapsulated in an IPA multiplex.

OML and RSL each use a separate TCP connection.

Table 3: TCP port numbers used by OsmoBTS Abis/IP

TCP Port Number	Usage
3002	A-bis OML (inside IPA multiplex)
3003	A-bis RSL (inside IPA multiplex)

Both TCP connections for OML and RSL are established in the BTS → BSC direction, i.e. the BTS is running as a TCP client, while the BSC is running as a TCP server.

The BTS first establishes the TCP connection for OML. Via OML, the BSC instructs the BTS to which IP address the RSL connection shall be established.

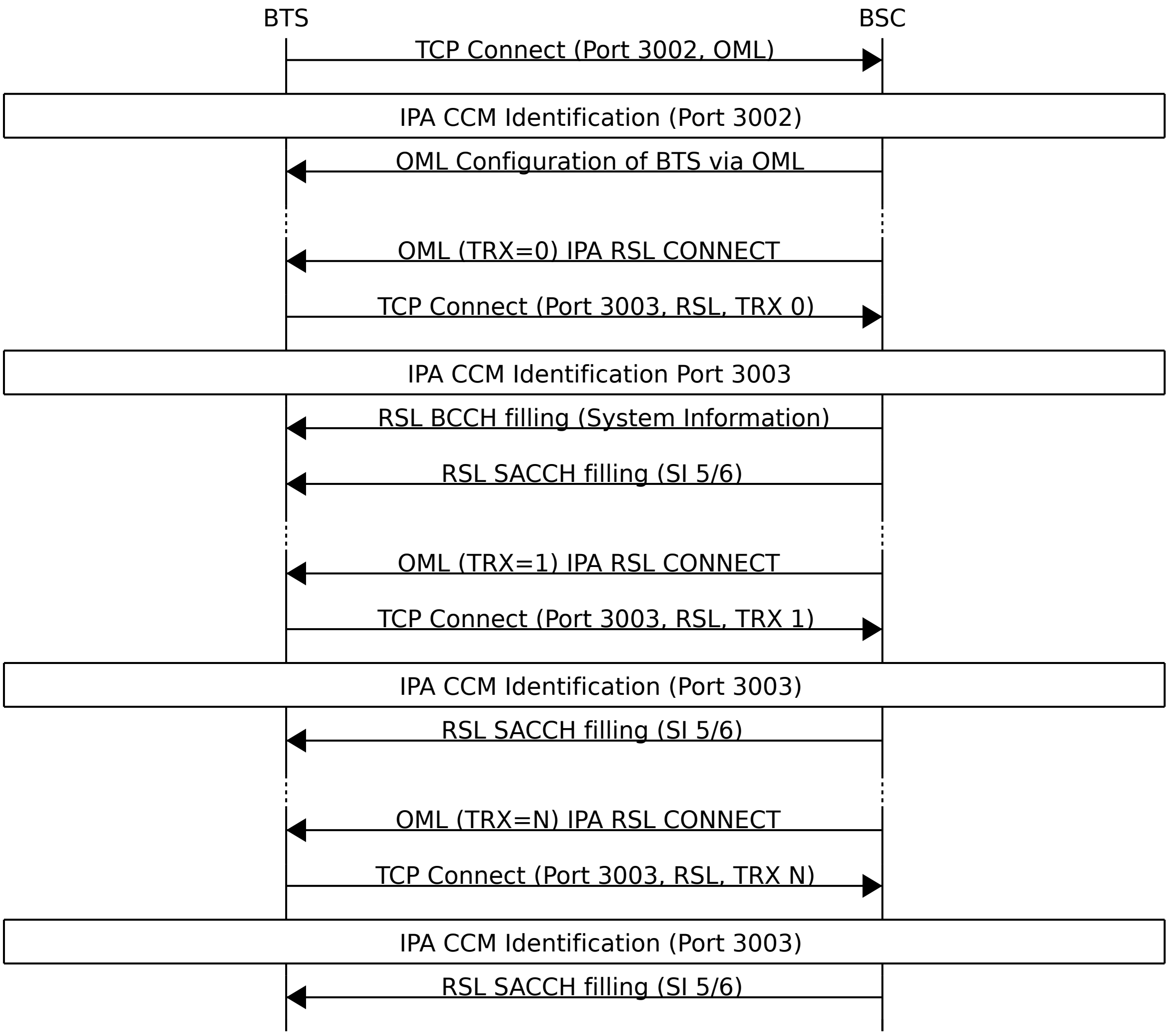

Figure 1: Overview of A-bis connection establishment

2.1 Identities

The BTS is locally configured (via administrative means, out of band of this specification) to have a Unit ID. The Unit ID consists of three parts:

- The Site Number
- The BTS number at the site
- The TRX number within the BTS

3 IPA Multiplex

The ETSI/3GPP specifications for A-bis transport (ETSI/3GPP TS 08.56) specify the transmission of RSL and OML messages over a LAPD based framing on top of 64kBit/s signalling times slots (B-channels) on E1 lines.

OsmoBTS does not implement this LAPD based transport, but instead implements A-bis over IP in a flavor first observed by ip.access nanoBTS products. The OsmoBTS implementation is a clean-room re-implementation based on the observation and dissection of protocol traces.

LAPD as used in E1 signalling channels provides in-order transmission and reliable delivery. This is why TCP was chosen as Layer 4 transport protocol on top of IP. TCP however, is a stream based transport protocol, which doesn't preserve the boundaries of messages.

To work around this shortcoming, an additional framing layer called the IPA multiplex was introduced between TCP and the RSL and OML messages.

Table 4: Protocol Stacking

RSL + OML (this document)
IPA (this document)
TCP (IETF RFC 793)
IP (IETF RFC 791)
Ethernet (IEEE 802.3)

3.1 IPA Header

Each higher-layer PDU is encapsulated by a three-byte IPA header with the following structure:

Table 5: IPA Header Structure

Offset (Octets)	Length	Name	Description
0	2	Length	Length of the variable-length payload section in network byte order (excluding the length of the IPA Header)
2	1	Stream Identifier	Identifies the stream of the payload
3	Variable	Payload	higher-layer PDU (i.e. RSL or OML message)

3.2 IPA Stream Identifiers

The IPA Stream Identifier serves to differentiate different streams within the multiplex. In the context of A-bis, it can be seen as analogous to the LAPD TEI on classic A-bis over E1.

The following IPA stream identifiers are being used in A-bis/IP:

Table 6: IPA Stream Identifiers

Value (Hex)	Name	Description
0x00	RSL	A-bis RSL according to this document, TRX 0
0x01	RSL	A-bis RSL according to this document, TRX 1
0x0n	RSL	A-bis RSL according to this document, TRX n
0xfe	CCM	IPA Connection Management
0xff	OML	A-bis OML according to this document

3.3 IPA Connection Management (CCM)

The IPA Connection Management is a sub-layer underneath the IPA multiplex which is used to manage the connection itself. It supports functions like Identity Management and Keep-Alive.

3.3.1 Identity Management

When a BTS connects to the BSC, the BSC must identify the connected BTS somehow. In ETSI/3GPP A-bis, the E1 multiplex + signalling timeslot number is used for this. In IP, there is no similar usable identity. Hence, the Unit ID is used for this purpose.

Table 7: Procedure for IPA peer identification is as follows

Direction	Operation
BTS → BSC	BTS connects the TCP connection to be used with IPA
BTS ← BSC	BSC requests BTS identity with ID_GET
BTS → BSC	BTS responds BTS Unit ID with ID_RESP
BTS ← BSC	BSC responds with ID_ACK, if the Unit ID is known to the BSC

Following the above peer identification procedure, transfer of higher-level messages such as OML or RSL commences.

3.3.2 IPA CCM Messages

IPA CCM supports the following messages

Table 8: IPA CCM Messages

Value	Name	Purpose
0x00	PING	Request a PONG from the peer
0x01	PONG	Response to a PING
0x04	ID_GET	Request Identity from peer
0x05	ID_RESP	Response to ID_GET
0x06	ID_ACK	Identity Acknowledged

4 Organization & Maintenance Link (OML)

4.1 List of Messages

The following tables list the OML messages used by OsmoBTS, grouped by their level of compliance with 3GPP TS 52.021 (previously 3GPP TS 12.21).

4.1.1 Messages Compliant With TS 52.021

Specific limitations apply, see the linked sections.

Table 9: Messages compliant with TS 52.021

TS 52.021 §	type code (hex)	This document §	Message	←/→	Received/Sent by OsmoBTS
SW Download Management Messages:					
8.3.7	0x10	Section 4.2.1	SW Activated Report	→	Sent
Air Interface Management Messages:					

Table 9: (continued)

TS 52.021 §	type code (hex)	This document §	Message	←/→	Received/Sent by OsmoBTS
8.6.1	0x41	Section 4.2.2	Set BTS Attributes	←	Received
	0x42		Set BTS Attributes Ack	→	Sent
	0x43		Set BTS Attributes Nack	→	Sent
8.6.2	0x44	Section 4.2.3	Set Radio Carrier Attributes	←	Received
	0x45		Set Radio Carrier Attributes Ack	→	Sent
	0x46		Set Radio Carrier Attributes Nack	→	Sent
8.6.3	0x47	Section 4.2.4	Set Channel Attributes	←	Received
	0x48		Set Channel Attributes Ack	→	Sent
	0x49		Set Channel Attributes Nack	→	Sent
State Management and Event Report Messages:					
8.8.1	0x61	Section 4.2.5	State Changed Event Report	→	Sent
8.8.5	0x69	Section 4.2.6	Change Administrative State	←	Received
	0x6A		Change Administrative State Ack	→	Sent
	0x6B		Change Administrative State Nack	→	Sent
Equipment Management Messages:					
8.9.2	0x74	Section 4.2.7	Opstart	←	Received
	0x75		Opstart Ack	→	Sent
	0x76		Opstart Nack	→	Sent
Other Messages:					
8.11.1	0x81	Section 4.2.8	Get Attributes	←	Received
	8.11.3	0x82	Section 4.2.9	Get Attribute Response	→
	Sent	8.11.1	0x83		Get Attributes Nack

4.1.2 Messages Specific to OsmoBTS

Table 10: Messages specific to OsmoBTS, not found in 3GPP TS 52.021

This document §	Message	←/→	Received/Sent by OsmoBTS
Section 4.3.1	Set Attribute	←	Received

4.1.3 Messages Not Implemented by OsmoBTS

Table 11: 3GPP TS 52.021 messages not implemented by OsmoBTS

TS 52.021 §	type code (hex)	Message
SW Download Management Messages:		
8.3.1	0x01	Load Data Initiate
	0x02	Load Data Initiate Ack
	0x03	Load Data Initiate Nack

Table 11: (continued)

TS 52.021 §	type code (hex)	Message
8.3.2	0x04	Load Data Segment
	0x05	Load Data Segment Ack
8.3.3	0x06	Load Data Abort
8.3.4	0x07	Load Data End
	0x08	Load Data End Ack
	0x09	Load Data End Nack
8.3.5	0x0A	SW Activate Request
	0x0B	SW Activate Request Ack
	0x0C	SW Activate Request Nack
8.3.6	0x0D	Activate SW
	0x0E	Activate SW Ack
	0x0F	Activate SW Nack
A-bis Interface Management Messages:		
8.4.1	0x21	Establish TEI
	0x22	Establish TEI Ack
	0x23	Establish TEI Nack
8.4.2	0x24	Connect Terrestrial Signalling
	0x25	Connect Terrestrial Signalling Ack
	0x26	Connect Terrestrial Signalling Nack
8.4.3	0x27	Disconnect Terrestrial Signalling
	0x28	Disconnect Terrestrial Signalling Ack
	0x29	Disconnect Terrestrial Signalling Nack
8.4.4	0x2A	Connect Terrestrial Traffic
	0x2B	Connect Terrestrial Traffic Ack
	0x2C	Connect Terrestrial Traffic Nack
8.4.5	0x2D	Disconnect Terrestrial Traffic
	0x2E	Disconnect Terrestrial Traffic Ack
	0x2F	Disconnect Terrestrial Traffic Nack
Transmission Management Messages:		
8.5.1	0x31	Connect Multi-Drop Link
	0x32	Connect Multi-Drop Link Ack
	0x33	Connect Multi-Drop Link Nack
8.5.2	0x34	Disconnect Multi-Drop Link
	0x35	Disconnect Multi-Drop Link Ack
	0x36	Disconnect Multi-Drop Link Nack
Test Management Messages:		
8.7.1	0x51	Perform Test
	0x52	Perform Test Ack
	0x53	Perform Test Nack
8.7.2	0x54	Test Report
	0x55	Send Test Report
	0x56	Send Test Report Ack
8.7.3	0x57	Send Test Report Nack
8.7.4	0x58	Stop Test
	0x59	Stop Test Ack
	0x5A	Stop Test Nack
State Management and Event Report Messages:		
8.8.2	0x62	Failure Event Report
8.8.3	0x63	Stop Sending Event Reports
	0x64	Stop Sending Event Reports Ack
	0x65	Stop Sending Event Reports Nack
8.8.4	0x66	Restart Sending Event Reports
	0x67	Restart Sending Event Reports Ack

Table 11: (continued)

TS 52.021 §	type code (hex)	Message
	0x68	Restart Sending Event Reports Nack
8.8.6	0x6C	Change Administrative State Request
	0x6D	Change Administrative State Request Ack
	0x6E	Change Administrative State Request Nack
8.8.7	0x93	Report Outstanding Alarms
	0x94	Report Outstanding Alarms Ack
	0x95	Report Outstanding Alarms Nack
Equipment Management Messages:		
8.9.1	0x71	Changeover
	0x72	Changeover Ack
	0x73	Changeover Nack
8.9.3	0x87	Reinitialize
	0x88	Reinitialize Ack
	0x89	Reinitialize Nack
8.9.4	0x77	Set Site Outputs
	0x78	Set Site Outputs Ack
	0x79	Set Site Outputs Nack
8.9.5	0x90	Change HW Configuration
	0x91	Change HW Configuration Ack
	0x92	Change HW Configuration Nack
Measurement Management Messages:		
8.10.1	0x8A	Measurement Result Request
8.10.2	0x8B	Measurement Result Response
8.10.3	0x8C	Stop Measurement
8.10.4	0x8D	Start Measurement
Other Messages:		
8.11.2	0x84	Set Alarm Threshold
	0x85	Set Alarm Threshold Ack
	0x86	Set Alarm Threshold Nack

4.2 Details on Compliant OML Messages

4.2.1 SW Activated Report

OsmoBTS will send an *SW Activated Report* when RF has been activated successfully. The message is compliant with 3GPP TS 52.021 § 8.3.7.

Upon RF activation, two *SW Activated Report* messages will be sent, for the Object Classes

- Radio Carrier (0x02)
- Baseband Transceiver (0x04)

4.2.2 Set BTS Attributes

OsmoBTS will receive a *Set BTS Attributes* message and reply with a corresponding ACK message on success. IE handling is fully compliant to TS 52.021, except that a change of BCCH ARFCN or BSIC while in operation is not supported, and hence the *Starting Time* IE is rejected.

Table 12: *Set BTS Attributes* IEs not handled by OsmoBTS

TS 52.021 §	IE Name	Handling
9.4.52	Starting Time	not supported (provokes NACK cause 0x10)

4.2.3 Set Radio Carrier Attributes

This message conforms to 3GPP TS 52.021, with the following limitation, as frequency hopping is not supported by OsmoBTS:

Table 13: *Set Radio Carrier Attributes* IE limitations

TS 52.021 §	IE Name	Handling
9.4.5	ARFCN List	ignored

4.2.4 Set Channel Attributes

This message conforms to 3GPP TS 52.021, with the following limitation: the following 3GPP TS 52.021 IEs provoke a NACK response when sent to OsmoBTS, as frequency hopping is not supported:

Table 14: *Set Channel Attributes* IE limitations

TS 52.021 §	IE Name	Handling
9.4.21	HSN	not supported (provokes NACK cause 0x10)
9.4.27	MAIO	not supported (provokes NACK cause 0x10)
9.4.52	Starting Time	not supported (provokes NACK cause 0x10)

4.2.5 State Changed Event Report

This message is compliant with 3GPP TS 52.021. Exactly these IEs are sent by OsmoBTS:

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message Type (0xf5)	3GPP TS 52.021 9.1	M	V	1
Object Class	3GPP TS 52.021 9.2	M	V	1
Object Instance	3GPP TS 52.021 9.3	M	V	3
Operational State	3GPP TS 52.021 9.4.38	O	TV	2
Availability Status	3GPP TS 52.021 9.4.7	O	TL16V (with length of 1)	3

4.2.6 Change Administrative State

This message is compliant with 3GPP TS 52.021 § 8.8.5. It applies to all of the Object Classes defined in 3GPP TS 52.021 § 9.2 as well as Section 4.4.

4.2.7 Opstart

This message is compliant with 3GPP TS 52.021 § 8.9.2. It applies to all of the Object Classes defined in 3GPP TS 52.021 § 9.2 as well as Section 4.4.

4.2.8 Get Attributes

This message is compliant with 3GPP TS 52.021 § 8.11.1.

For a list of supported attributes, see Section 4.2.9.

4.2.9 Get Attribute Response

This message is compliant with 3GPP TS 52.021 § 8.11.3.

The following attributes are provided by OsmoBTS:

3GPP TS 52.021 chapter	description	see
9.4.61	SW Configuration	Section 4.6.21
9.4.30	Manufacturer Id	Section 4.6.22

4.3 Details on OsmoBTS Specific Messages

4.3.1 Set Attribute

The message type is 0xf5. This message is sent to OsmoBTS to set attributes on instances of managed objects of the non-standard additional Object Classes (see Section 4.4).

The message specifics depend on the Object Class and are detailed in Section 4.4.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message Type (0xf5)	3GPP TS 52.021 9.1	M	V	1
Object Class	3GPP TS 52.021 9.2	M	V	1
Object Instance	3GPP TS 52.021 9.3	M	V	3
Object Class specific IEs follow, see Section 4.4…				

4.4 Additional Object Classes

In addition to 3GPP TS 52.021 Chapter 9.2, the following managed objects are supported:

Table 15: Additional Managed Object Classes

Value	Name	Description
0xf0	GPRS NSE	GPRS-NS Entity
0xf1	GPRS CELL	GPRS Cell Entity
0xf2	GPRS NSVC	GPRS NS Virtual Circuit

4.4.1 GPRS-NSE Managed Object

There is one NS Entity per BTS. It supports the **Set Attribute** message with the following Information Elements:

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message Type	3GPP TS 52.021 9.1	M	V	1
Object Class	3GPP TS 52.021 9.2	M	V	1
Object Instance	3GPP TS 52.021 9.3	M	V	3
GPRS NSEI	Section 4.6.11	O	TL16V	>= 5
GPRS NS Configuration	Section 4.6.16	O	TL16V	>= 10
GPRS BSSGP Configuration	Section 4.6.15	O	TL16V	>= 14

4.4.2 GPRS Cell Managed Object

There is one GPRS Cell entity per BTS. It supports the **Set Attribute** message with the following Information Elements:

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message Type	3GPP TS 52.021 9.1	M	V	1
Object Class	3GPP TS 52.021 9.2	M	V	1
Object Instance	3GPP TS 52.021 9.3	M	V	3
GPRS Routing Area Code	Section 4.6.9	O	TL16V	>= 4
GPRS Paging Configuration	Section 4.6.10	O	TL16V	>= 5
GPRS RLC Configuration	Section 4.6.17	O	TL16V	>= 12
GPRS Coding Schemes	Section 4.6.18	O	TL16V	>= 5
GPRS RLC Configuration 2	Section 4.6.19	O	TL16V	>= 8
GPRS RLC Configuration 3	Section 4.6.20	O	TL16V	>= 4

4.4.3 GPRS NS-VC Managed Object

There are two GPRS NS-VC instances per BTS. It supports the **Set Attribute** message with the following Information Elements:

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message Type	3GPP TS 52.021 9.1	M	V	1
Object Class	3GPP TS 52.021 9.2	M	V	1
Object Instance	3GPP TS 52.021 9.3	M	V	3
GPRS NSVCI	Section 4.6.13	O	TL16V	>= 5
GPRS NS Link Configuration	Section 4.6.16	O	TL16V	>= 11

4.5 Information Elements Overview

All of the IEs handled by OsmoBTS are listed below, with limitations and additions to TS 52.021 specified in more detail.

4.5.1 IEs Conforming to TS 52.021

The following Information Elements are accepted by OsmoBTS.

IEs marked *ignored* may be sent to OsmoBTS without causing error conditions. These IEs are skipped during message parsing and are never evaluated.

IEs marked *ignored* and additionally marked as being received by OsmoBTS (←) are in fact parsed and their values are stored by OsmoBTS, but these stored items are currently not used in the OsmoBTS code base.

Table 16: IEs conforming to TS 52.021

tag (hex)	**TS 52.021 §**	**IE name**	←/→	**Received/Sent by OsmoBTS**
0x00	9.4.1	Abis Channel		*ignored*
0x01	9.4.2	Additional Info		*ignored*
0x02	9.4.3	Additional Text		*ignored*
0x03	9.4.4	Administrative State	← →	Received & Sent
0x04	9.4.5	ARFCN List	←	Received, with exactly 1 ARFCN: see Section 4.6.2; ignored by *Set Radio Attribute* message (Section 4.2.3)
0x05	9.4.6	Autonomously Report		*ignored*
0x06	9.4.7	Availability Status	→	Sent
0x07	9.4.8	BCCH ARFCN	←	Received
0x08	9.4.9	BSIC	←	Received
0x09	9.4.10	BTS Air Timer	←	Received
0x0a	9.4.11	CCCH Load Indication Period	←	Received
0x0b	9.4.12	CCCH Load Threshold	←	Received
0x0c	9.4.13	Channel Combination	←	Received, with additional channel combinations: see Section 4.6.3
0x0d	9.4.14	Connection Failure Criterion	←	Received, with limitations see Section 4.6.4
0x0e	9.4.15	Destination		*ignored*
0x0f	9.4.16	Event Type		*ignored*
0x11	9.4.17	File Data		*ignored*
0x12	9.4.18	File Id		*ignored*
0x13	9.4.19	File Version		*ignored*
0x14	9.4.20	GSM Time		*ignored*
0x16	9.4.22	HW Configuration		*ignored*
0x18	9.4.24	Intave Parameter	←	
0x19	9.4.25	Interference level Boundaries	←	
0x1a	9.4.26	List of Required Attributes		*ignored*
0x1c	9.4.28	Manufacturer Dependent State		*ignored*
0x1d	9.4.29	Manufacturer Dependent Thresholds		*ignored*
0x1e	9.4.30	Manufacturer Id		*ignored*
0x1f	9.4.31	Max Timing Advance	←	Received
0x20	9.4.34	Multi-drop BSC Link		*ignored*
0x21	9.4.35	Multi-drop next BTS Link		*ignored*
0x22	9.4.36	Nack Causes	→	Sent
0x23	9.4.37	Ny1	←	Received
0x24	9.4.38	Operational State	→	Sent
0x25	9.4.39	Overload Period	←	*ignored*
0x26	9.4.40	Physical Config		*ignored*
0x27	9.4.41	Power Class		*ignored*
0x28	9.4.42	Power Output Thresholds		*ignored*
0x29	9.4.43	Probable Cause		*ignored*
0x2a	9.4.44	RACH Busy Threshold	←	Received
0x2b	9.4.45	RACH Load Averaging Slots	←	*ignored*
0x2c	9.4.46	Radio Sub Channel		*ignored*
0x2d	9.4.47	RF Max Power Reduction	←	Received
0x2e	9.4.48	Site Inputs		*ignored*
0x2f	9.4.49	Site Outputs		*ignored*
0x30	9.4.50	Source		*ignored*
0x31	9.4.51	Specific Problems		*ignored*
0x33	9.4.53	T200	←	*ignored* (1s on DCCH, 2s on ACCH)
0x34	9.4.54	TEI		*ignored*
0x35	9.4.55	Test Duration		*ignored*

Table 16: (continued)

tag (hex)	TS 52.021 §	IE name	←/→	Received/Sent by OsmoBTS
0x36	9.4.56	Test No		*ignored*
0x37	9.4.57	Test Report Info		*ignored*
0x38	9.4.58	VSWR Thresholds		*ignored*
0x39	9.4.59	Window Size		*ignored*
0x40	9.4.60	TSC	←	Received, with limitations: see Section 4.6.5
0x41	9.4.61	SW Configuration	→	Sent, see Section 4.6.21
0x43	9.4.63	Perceived Severity		*ignored*
0x44	9.4.64	Get Attribute Response Info	→	Sent, see Section 4.6.22
0x45	9.4.65	Outstanding Alarm Sequence		*ignored*
0x46	9.4.66	HW Conf Change Info		*ignored*
0x47	9.4.32	Measurement Result		*ignored*

4.5.2 IEs Not Conforming to TS 52.021

Table 17: IEs not conforming to TS 52.021

tag (hex)	TS 52.021 §	IE name	Description
0x15	9.4.21	HSN	presence causes NACK response
0x17	9.4.23	HW Description	*ignored* by OsmoBTS, but coding may differ, see Section 4.6.1
0x1b	9.4.27	MAIO	presence causes NACK response
0x32	9.4.52	Starting Time	presence causes NACK response
0x42	9.4.62	SW Description	not supported
0x48	9.4.33	Measurement Type	not supported

4.5.3 Additional Attributes and Parameters

The following Information Elements are defined in addition to those specified in 3GPP TS 52.021 Chapter 9.4.

All of these additional IEs are *received* by OsmoBTS.

These attributes are not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

Table 18: Additional IEs handled by OsmoBTS but not defined in TS 52.021

tag (hex)	IE name	Description
0x80	RSL Destination IP Address	Section 4.6.6
0x81	RSL Destination TCP Port	Section 4.6.7
0x85	RSL IPA Stream ID	Section 4.6.8
0x9a	GPRS Routing Area Code	Section 4.6.9
0x9c	GPRS Paging Configuration	Section 4.6.10
0x9d	GPRS NSEI	Section 4.6.11

Table 18: (continued)

tag (hex)	IE name	Description
0x9e	GPRS BVCI	Section 4.6.12
0x9f	GPRS NSVCI	Section 4.6.13
0xa0	GPRS NS Configuration	Section 4.6.14
0xa1	GPRS BSSGP Configuration	Section 4.6.15
0xa2	GPRS NS Link Configuration	Section 4.6.16
0xa3	GPRS RLC Configuration	Section 4.6.17
0xa8	GPRS Coding Schemes	Section 4.6.18
0xa9	GPRS RLC Configuration 2	Section 4.6.19
0xac	GPRS RLC Configuration 3	Section 4.6.20

4.6 Details on IEs

4.6.1 HW Description

TS 52.021 suggests a series of 5 length-value pairs for the *HW Description* IE. Instead, OsmoBTS interprets it as a single TL16V. The value of this IE is ignored by OsmoBTS, yet the coding may affect message parsing.

Attribute Identifier (0x17)	1
Length	2-3
Ignored	N

4.6.2 ARFCN List

Since OsmoBTS does not support frequency hopping, the *ARFCN List* must contain exactly one ARFCN.

4.6.3 Additional Channel Combinations

In addition to 3GPP TS 52.021 Chapter 9.4.13, the following channel combinations are supported:

Table 19: Additional Channel Combinations

Value	Description
0x0b	Reserved for PBCCH + PCCCH + PDTCH/F + PACCH/F + PTCCH/F
0x0c	Reserved for PBCCH + PDTCH/F + PACCH/F + PTCCH/F
0x0d	PDTCH/F + PACCH/F + PTCCH/F
0x80	ip.access style Dynamic TCH/F / PDCH
0x81	Reserved for Dynamic TCH/F / TCH/H
0x90	Osmocom style Dynamic TCH/F / TCH/H / PDCH

The *Reserved* combinations are not actually supported/implemented yet, but merely reserved for such functionality, if it is eventually implemented.

For more information on how the different dynamic channel combinations work, please see the Section 5.4.

4.6.4 Connection Failure Criterion

3GPP TS 52.021 Chapter 9.4.14 specifies two different options for the *Connection Failure Criterion*. OsmoBTS only implements the option coded as 0x01, i.e. based upon uplink SACCH error rate (RADIO_LINK_TIMEOUT).

4.6.5 TSC

Due to limitations in the currently supported PHY implementations, OsmoBTS supports only one global TSC for all channels on one TRX, rather than a separate TSC for each timeslot, as expected by 3GPP TS 52.021.

4.6.6 RSL Destination IP Address

The value part of this attribute has a length of 4 octets and is encoded as IPv4 address in network byte order.

Attribute Identifier (0x80)	1
IPv4 Address (MSB first)	2-5

4.6.7 RSL Destination TCP Port

The value part of this attribute has a length of 2 octets and contains the TCP destination port for the RSL connection, encoded in network byte order.

Attribute Identifier (0x81)	1
Port number (MSB first)	2-3

4.6.8 RSL IPA Stream ID

The value part of this attribute has a length of one octet and specifies the IPA stream ID to be used for the RSL connection of this TRX.

Attribute Identifier (0x85)	1
Stream ID	2

4.6.9 GPRS Routing Area Code

The value part of the GPRS Routing Area code consists of a single octet encoding the GPRS Routing Area Code.

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.10 GPRS Paging Configuration

The value part of this attribute consists of two octets encoded as follows:

Offset	Description
0	GPRS Paging repeat time in units of 50ms intervals
1	GPRS Paging repeat count

4.6.11 GPRS NSEI

The value part of the GPRS NSEI is encoded as 16bit integer value in network byte order.

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.12 GPRS BVCI

The value part of this attribute consists of two octets encoding the BSSGP Virtual Circuit Identifier (BVCI) as unsigned 16 bit integer in network byte order.

4.6.13 GPRS NSVCI

The value part of the GPRS NSVCI attribute is a 16bit unsigned integer in network byte order, encoding the GPRS NSVCI as specified in 3GPP TS 08.16.

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.14 GPRS NS Configuration

The value part of the GPRS NS Configuration consists of an array of 7 octets, each describing one GPRS NS related timer:

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.15 GPRS BSSGP Configuration

The value part of the GPRS BSSGP configuration consists of an array of 11 octets, each describing one GPRS BSSGP related timer:

Offset	Description
0	Blocking Timer (T1)
1	Blocking Retries
2	Unblocking Retries
3	Reset Timer (T2)
4	Reset Retries
5	Suspend Timer (T3) in units of 100ms
6	Suspend Retries
7	Resume Timer (T4) in units of 100ms
8	Resume Retries
9	Capability Update Timer (T5)
10	Capability Update Retries

The detailed description of the meaning of those timers is given in the GPRS BSSGP specification 3GPP TS 08.18.

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.16 GPRS NS Link Configuration

This attribute is 8 octets long and encoded as follows:

Offset	Length	Description
0	2	GPRS-NS Remote UDP Port Number (SGSN side)
2	4	GPRS-NS Remote IPv4 Address (SGSN side)
6	2	GPRS-NS Local UDP Port Number (BTS side)

All values are encoded in network byte order.

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.17 GPRS RLC Configuration

The value part of the GPRS RLC Configuration consists of an array of 9 octets, each describing a RLC timer:

Offset	Description	Unit
0	GPRS RLC Timer T3142	s
1	GPRS RLC Timer T3169	s
2	GPRS RLC Timer T3191	s
3	GPRS RLC Timer T3193	10ms
4	GPRS RLC Timer T3195	s
5	GPRS RLC Timer T3101	s
6	GPRS RLC Timer T3103	s
7	GPRS RLC Timer T3105	s
8	GPRS RLC CV Countdown	-

The meaning of the RLC timers are specified in 3GPP TS 04.60.

The countdown value specifies the RLC CV value from which the countdown procedure is started.

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.18 GPRS Coding Schemes

The value part of the GPRS Coding Schemes consists of two octets encoding the available GPRS and EDGE coding schemes.

bit	7	6	5	4	3	2	1	0
byte at offset 0	MCS9	x	x	x	CS4	CS3	CS2	CS1
byte at offset 1	MCS8	MCS7	MCS6	MCS5	MCS4	MCS3	MCS2	MCS1

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.19 GPRS RLC Configuration 2

The value part of this attribute is 8 octets long and encoded as follows:

Offset	Length	Description	Unit
0	2	Downlink TBF Extension Timer	10ms
2	2	Uplink TBF Extension Timer	10ms
4	2	Initial GPRS Coding Scheme	-

The Initial GPRS Coding Scheme is encoded as follows:

Value	Description
1	CS 1
2	CS 2
3	CS 3
4	CS 4

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.20 GPRS RLC Configuration 3

This attribute contains information about the initial MCS used for new EDGE TBFs.

It is encoded as follows:

Value	Description
1	MCS 1
2	MCS 2
3	MCS 3
4	MCS 4
5	MCS 5
6	MCS 6
7	MCS 7
8	MCS 8
9	MCS 9

This attribute is not used by OsmoBTS, but simply passed to OsmoPCU connected to the PCU socket.

4.6.21 SW Configuration

The SW Configuration IE is compliant with 3GPP TS 52.021 9.4.61: it contains a number of SW Description IEs (9.4.62).

Table 20: Coding of SW Configuration IE

octet	value
1	NM_ATT_SW_CONFIG IEI (0x41)
2-3	length of value part
4	NM_ATT_SW_DESCR IEI (0x42)
5	NM_ATT_FILE_ID IEI (0x12)
6-7	length of file name
8-N	ASCII coded file name (without terminating nul)
N+1	NM_ATT_FILE_VERSION IEI (0x13)
N+2 - N+3	length of file content
N+4 - M	file content
M+1	NM_ATT_SW_DESCR IEI (0x42)
M+2	NM_ATT_FILE_ID IEI (0x12)
. . .	

Table 21: File names and content sent in the SW Configuration IE

file name	content
osmobts	ASCII coded OsmoBTS version number like "1.2.3" or "1.2.3.4-abcd"
BTS_TYPE_VARIANT	one of "osmo-bts-lc15", "osmo-bts-oc2g", "osmo-bts-octphy", "osmo-bts-omldummy", "osmo-bts-sysmo", "osmo-bts-trx", "osmo-bts-virtual"
BTS_SUB_MODEL	This file may be omitted; if present, may contain an ASCII coded model number like "sysmoBTS 1002"

4.6.22 Manufacturer Id

The coding of the Manufacturer Id attribute is a sequence of bit flags (a bit vector), where a zero flag indicates absence and a set flag indicates presence of a specific BTS feature.

The number of flags transmitted depends on the software version of OsmoBTS and the BTS backend in use. More flags may be added in the future. The flag bits transmitted are followed by zero bits up to the next full octet boundary.

These features are currently defined:

Table 22: coding of BTS feature flags sent in the Manufacturer Id attribute

octet	bit	feature name	description
0	7	HSCSD	High-Speed Circuit-Switched Data
	6	GPRS	General Packet Radio Service
	5	EGPRS	Enhanced GPRS (EDGE)
	4	ECSD	Enhanced Circuit-Switched Data
	3	HOPPING	Frequency Hopping
	2	MULTI_TSC	Multi-TSC
	1	OML_ALERTS	OML Alerts
	0	AGCH_PCH_PROP	AGCH/PCH proportional allocation
1	7	CBCH	Cell Broadcast Channel
	6	SPEECH_F_V1	Fullrate speech V1
	5	SPEECH_H_V1	Halfrate speech V1
	4	SPEECH_F_EFR	Fullrate speech EFR
	3	SPEECH_F_AMR	Fullrate speech AMR
	2	SPEECH_H_AMR	Halfrate speech AMR
	1	ETWS_PN	ETWS Primary Notification via PCH
	0	PAGING_COORDINATION	BSS Paging Coordination
2	7	IPV6_NSVC	NSVC IPv6
	6	ACCH_REP	FACCH/SACCH Repetition
	5	CCN	Cell Change Notification
	4	VAMOS	Voice services over Adaptive Multi-user channels on One Slot
	3	reserved for future use, sent as zero	
	2		
	1		
	0		

4.7 A-bis OML Initialization / BTS bring-up

At the time an Abis/IP BTS connects to via OML to the BSC, it is initialized according to the procedures described in 3GPP TS 52.021 as amended by this document.

Each Managed Object (MO) is separately initialized. The initialization sequence and parameters differ slightly depending on the MO involved.

Some parts of the sequences described below are optional, such as the Software activation. In the OsmoBTS case, the software is not modular and thus all MOs start with the software fully activated. In effect, no *Software Activate Request* is being sent by the MO to the BSC, nor does the BSC need to initialize the *Activate Software* procedure.

Still, the full sequences are shown in order to explain the Abis/IP protocol.

Also, the initial state of the MOs at time of OML connection initialization is not always guaranteed to be *Disabled/Notinstalled*. Rather, the BSC implementation has to deal with the initial state as reported by the MOs at time of re-connection.

4.7.1 Site Manager MO Initialization

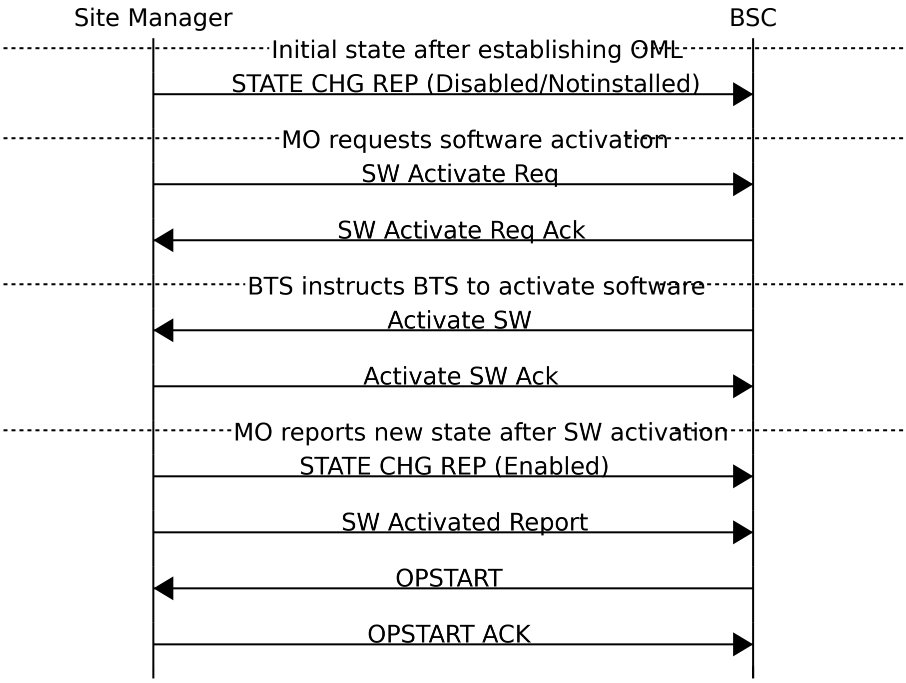

Figure 2: A-bis OML Initialization of Site Manager MO

The Site Manager MO does not depend on other MOs, nor does it have an Administrative state (*Locked/Unlocked*), thus it immediately commences in the *Enabled* state.

4.7.2 BTS MO Initialization

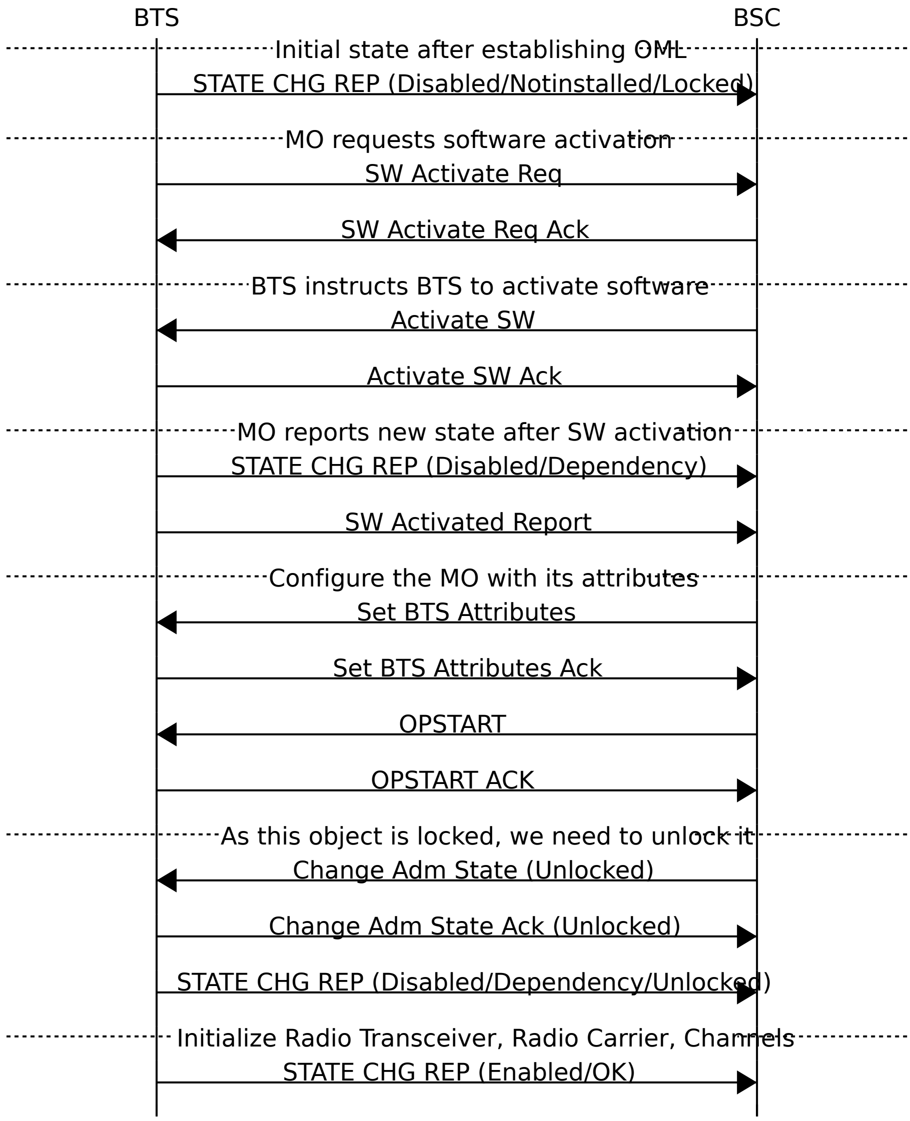

Figure 3: A-bis OML Initialization of BTS MO

As shown in the BTS MO, its state is

- Availability state *Dependency*, meaning it depends on other MOs to be initialized before becoming enabled.
- Administrative state *Locked*, as the object is first waiting to receive attributes in the *Locked* state, before the *Change Administrative State (Unlocked)* procedure is used to request transitioning into Unlocked state.

4.7.3 Baseband Transceiver MO Initialization

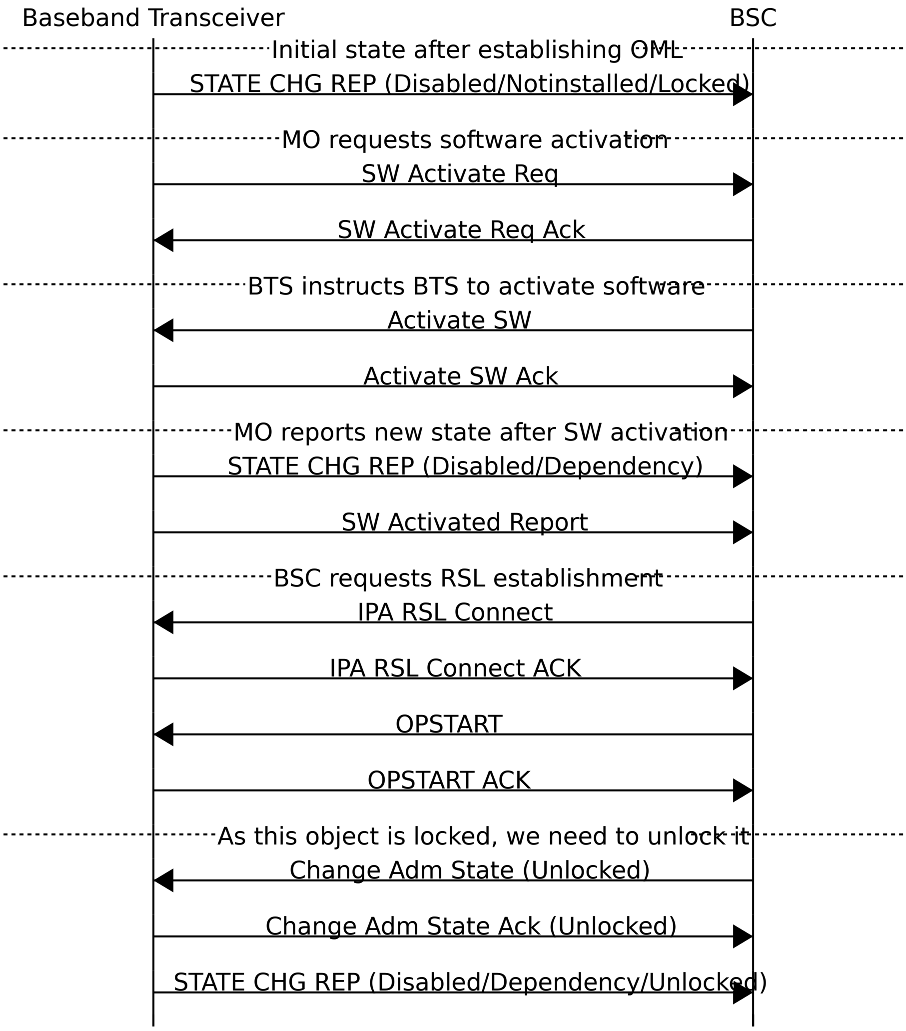

Figure 4: A-bis OML Initialization of Baseband Transceiver MO

There is one Baseband Transceiver MO per TRX in the BTS. For a multi-TRX BTS, the above procedure must be repeated for each TRX.

4.7.4 Radio Carrier MO Initialization

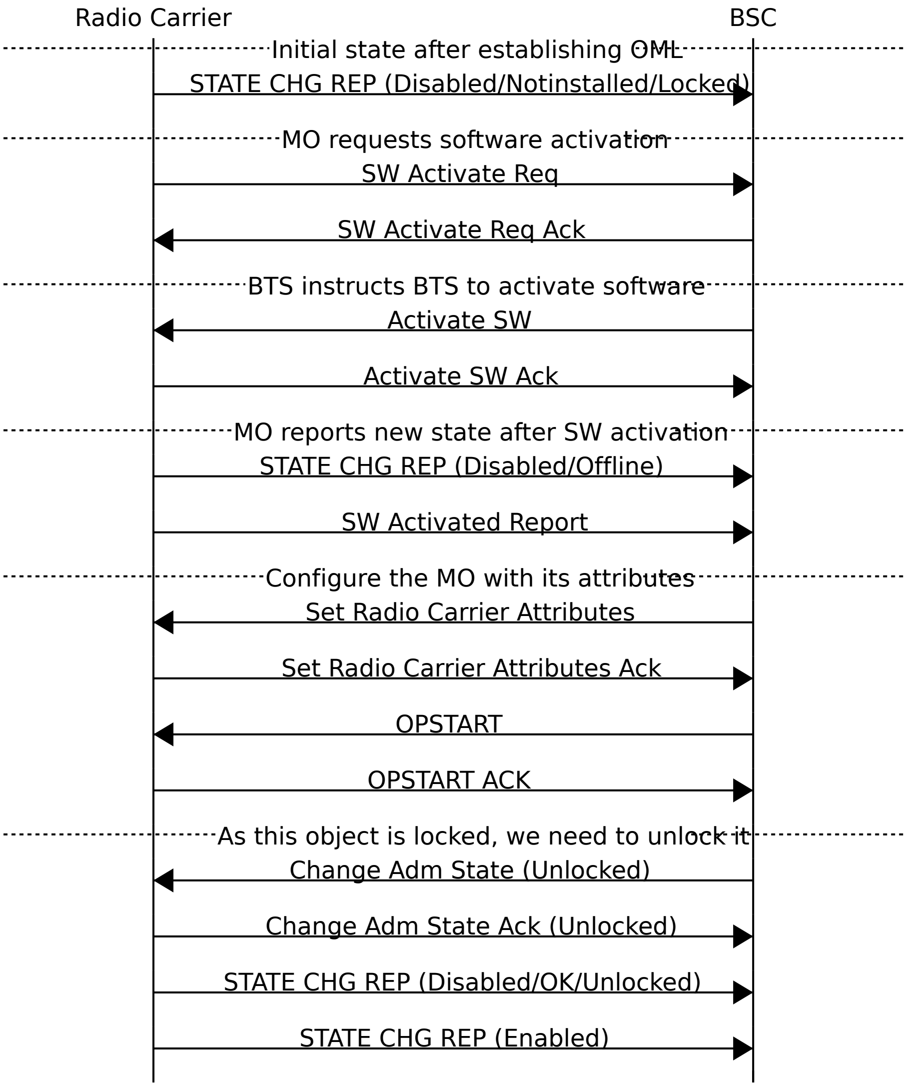

Figure 5: A-bis OML Initialization of Radio Carrier MO

There is one Radio Carrier MO per TRX in the BTS. For a multi-TRX BTS, the above procedure must be repeated for each TRX.

4.7.5 Channel MO Initialization

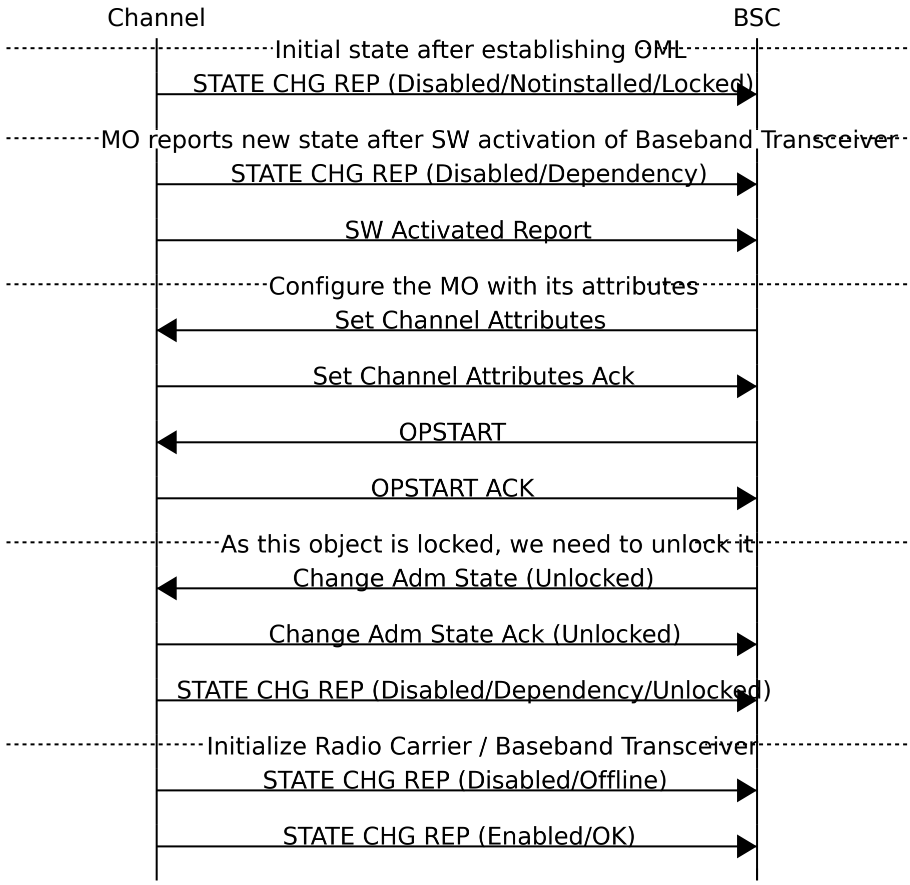

Figure 6: A-bis OML Initialization of Radio Carrier MO

There are 8 timeslots in each TRX, and correspondingly 8 Channel MOs in every TRX. The above procedure must thus be repeated for each timeslot in each transceiver of the BTS.

4.7.6 Complete BTS Initialization Procedure

Some of below steps are optional, as is their detailed ordering. In practice, the procedures for different MOs may overlap. The message sequence charts in this document have been hand-crafted to avoid such overlap for the sake of clarity.

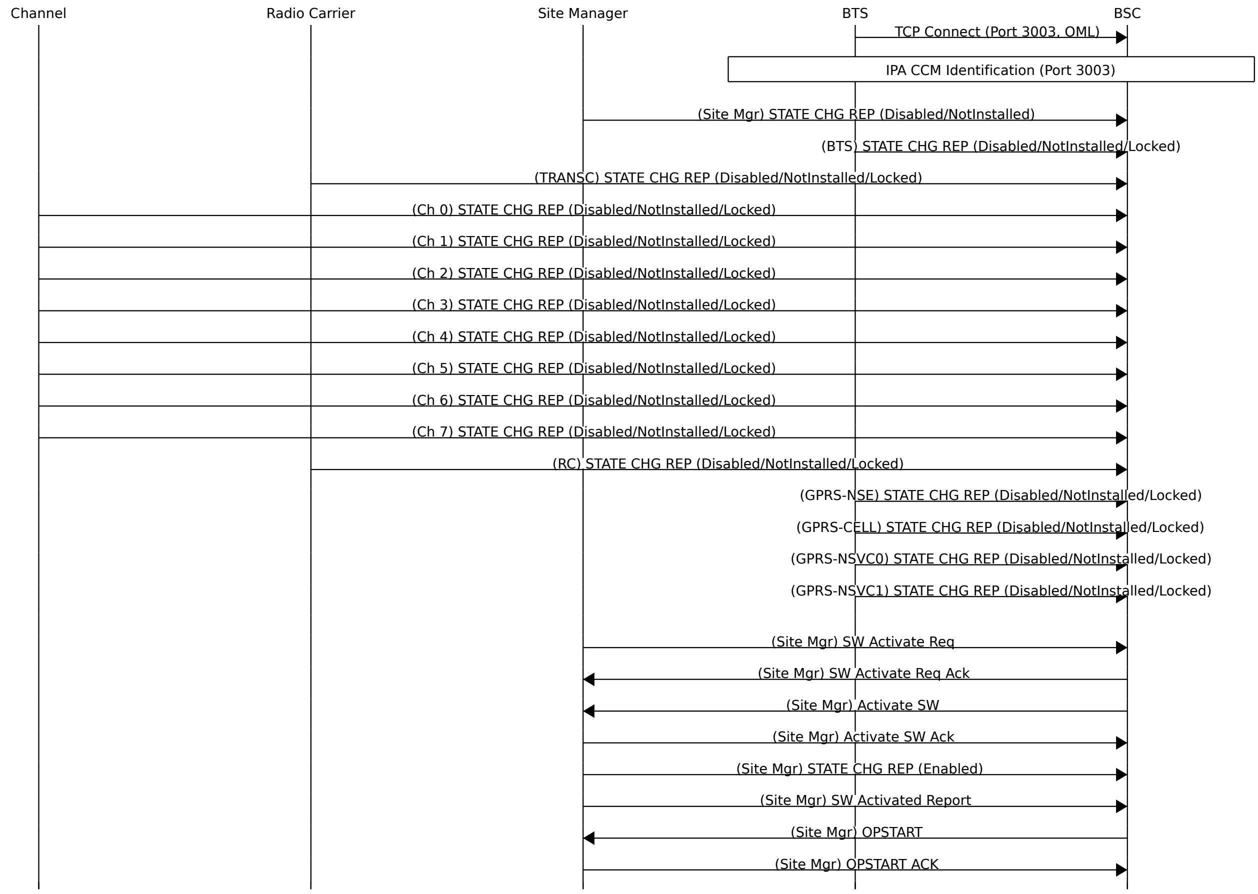

Figure 7: A-bis OML BTS bring-up (1/3)

As shown in Figure 7, after the OML TCP connection is established,

1. the identity is exchanged via IPA CCM,
2. the BTS sends an *OML EVENT STATE CHANGED REPORT* for every Managed Object, and
3. the BTS subsequently requests the activation of its *Site Manager* Object which the BSC performs by the *Activate SW* command.
4. After successful activation of the software in the Site Manager,
    a. the state changes to *Enabled*, and an event report is generated accordingly, and
    b. the BSC is notified about the SW activation in an associated report.
5. Finally, the BSC requests the start of the Site Manager
    a. using the *OPSTART* command,
    b. which is subsequently acknowledged by the Site Manager.

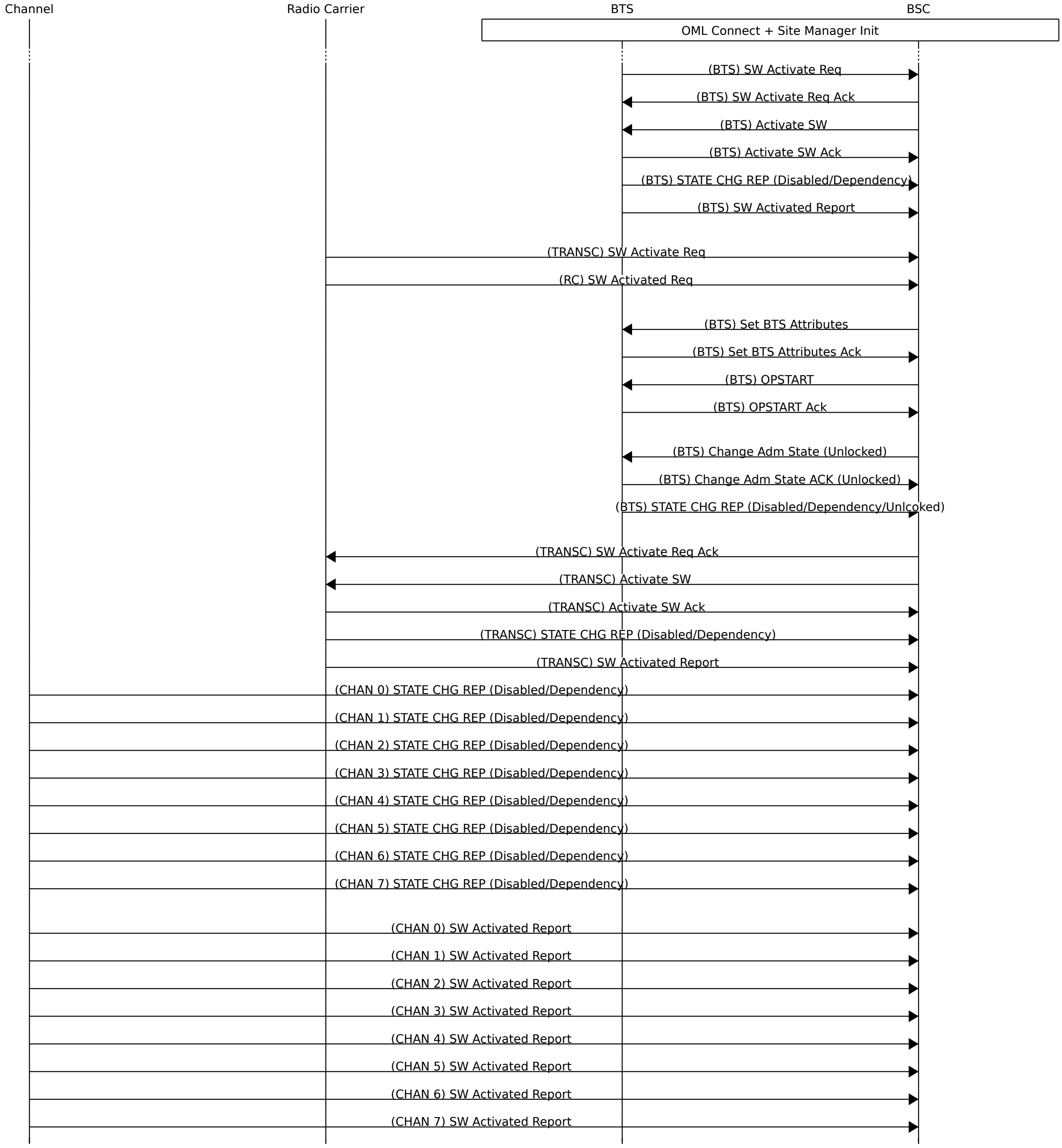

Figure 8: A-bis OML BTS bring-up (2/3)

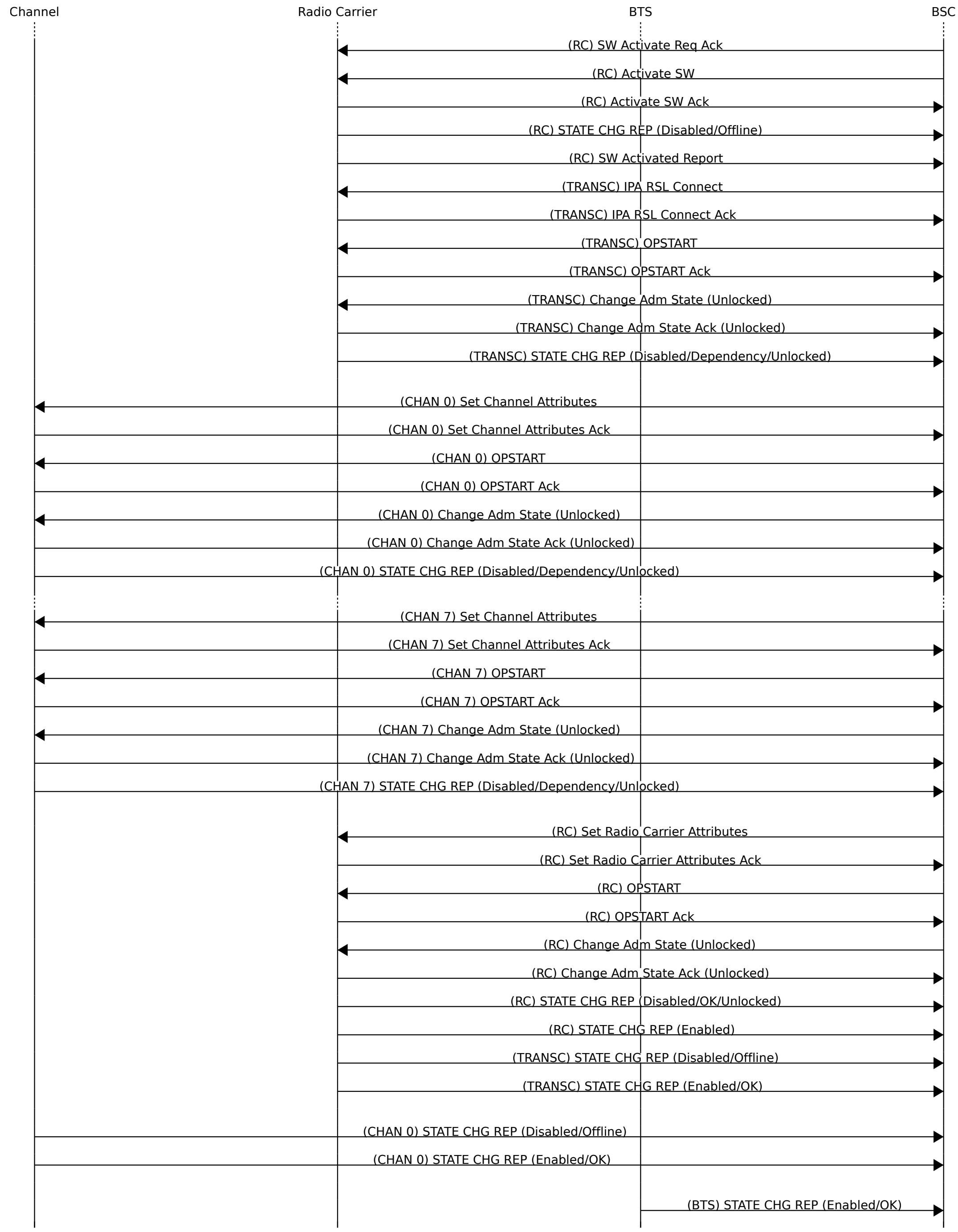

Figure 9: A-bis OML BTS bring-up (3/3)

Figure 8 shows:

1. Software Activation and associated state transitions of the BTS MO;
2. Setting of the BTS Attributes followed by OPSTART;
3. Software Activation and associated state transitions of the *Baseband Transceiver* MO;
4. Software Activation and associated state transitions of the *Radio Carrier* MO;

5. Once the *Baseband Transceiver* MO has its software activated, the *Channel* MOs (one for each timeslot) indicate their state change as well as software activation.

Figure 9 shows:

1. The *Radio Carrier* MO Software Activation;
2. The Request to the *Baseband Transceiver* MO to establish the RSL signalling connection to the BSC;
3. Subsequent OPSTART and Change of Administrative State on the *Baseband Transceiver* MO;
4. The following procedure takes place for each of the *Channel* MOs:
   a. Set the Channel Attributes (such as channel combination),
   b. OPSTART,
   c. change the Administrative State to Unlocked,
   d. followed by a State Change Event Report with the new state.
5. After all *Channel* MOs are initialized, the Radio Carrier goes through a similar procedure:
   a. Set attributes,
   b. OPSTART,
   c. change Administrative State to Unlocked,
   d. followed by a State Change Event Report with the new State (Enabled/OK)
6. All *Channel* MOs now also report their state as Enabled/OK.
7. Finally, the BTS reports its state as Enabled/OK.

5 Radio Signalling Link (RSL)

5.1 List of Messages

The following tables list the RSL messages used by OsmoBTS A-bis/IP, grouped by their level of compliance with 3GPP TS 48.058.

5.1.1 Messages Compliant With TS 48.058

Specific additions and limitations apply, see the linked sections.

Table 23: Messages compliant with TS 48.058

TS 48.058 §	This document §	Message	←/→	Received/Sent by OsmoBTS
Radio link layer management messages				
8.3.1	-	DATA REQUEST	←	Received
8.3.2	-	DATA INDICATION	→	Sent
8.3.3	-	ERROR INDICATION	→	Sent
8.3.4	-	ESTABLISH REQUEST	←	Received
8.3.5	-	ESTABLISH CONFIRM	→	Sent
8.3.6	-	ESTABLISH INDICATION	→	Sent
8.3.7	-	RELEASE REQUEST	←	Received
8.3.8	-	RELEASE CONFIRM	→	Sent

Table 23: (continued)

TS 48.058 §	This document §	Message	←/→	Received/Sent by OsmoBTS
8.3.9	-	RELEASE INDICATION	→	Sent
8.3.10	-	UNIT DATA REQUEST	←	Received
8.3.11	-	UNIT DATA INDICATION	→	Sent
DEDICATED CHANNEL MANAGEMENT MESSAGES				
8.4.1	Section 5.2.1	CHANNEL ACTIVATION	←	Received
8.4.2	Section 5.2.1	CHANNEL ACTIVATION ACKNOWLEDGE	→	Sent
8.4.3	Section 5.2.1	CHANNEL ACTIVATION NEGATIVE ACKNOWLEDGE	→	Sent
8.4.4	-	CONNECTION FAILURE INDICATION	→	Sent
8.4.5	-	DEACTIVATE SACCH	←	Received
8.4.6	-	ENCRYPTION COMMAND	←	Received
8.4.7	-	HANDOVER DETECTION	→	Sent
8.4.8	Section 5.2.2	MEASUREMENT RESULT	→	Sent
8.4.9	Section 5.2.3	MODE MODIFY	←	Received
8.4.10	-	MODE MODIFY ACKNOWLEDGE	→	Sent
8.4.11	-	MODE MODIFY NEGATIVE ACKNOWLEDGE	→	Sent
8.4.14	-	RF CHANNEL RELEASE	←	Received
8.4.15	Section 5.2.4	MS POWER CONTROL	←	Received
8.4.16	-	BS POWER CONTROL	←	Received
8.4.19	-	RF CHANNEL RELEASE ACKNOWLEDGE	→	Sent
8.4.20	Section 5.2.5	SACCH INFO MODIFY	←	Received
COMMON CHANNEL MANAGEMENT MESSAGES				
8.5.1	Section 5.2.6	BCCH INFORMATION	←	Received
8.5.2	-	CCCH LOAD INDICATION	→	Sent
8.5.3	Section 5.2.7	CHANNEL REQUIRED	→	Sent
8.5.4	-	DELETE INDICATION	→	Sent
8.5.5	Section 5.2.8	PAGING COMMAND	←	Received
8.5.6	-	IMMEDIATE ASSIGN COMMAND	←	Received
8.5.8	-	SMS BROADCAST COMMAND	←	Received
8.5.9	-	CBCH LOAD INDICATION	→	Sent
TRX MANAGEMENT MESSAGES				
8.6.1	Section 5.2.9	RF RESOURCE INDICATION	→	Sent
8.6.2	Section 5.2.10	SACCH FILLING	←	Received
8.6.4	-	ERROR REPORT	→	Sent

5.1.2 Messages Specific to OsmoBTS

Table 24: Messages specific to OsmoBTS, not found in 3GPP TS 48.058

This document §		Message	←/→	Received/Sent by OsmoBTS
User Plane Transport Management (Section 5.3)				
Section 5.3.1	Section 5.7.1	RSL Create Connection (CRCX)	←	Received
	Section 5.7.2	RSL Create Connection (CRCX) ACK	→	Sent
	Section 5.7.3	RSL Create Connection (CRCX) NACK	→	Sent
Section 5.3.2	Section 5.7.4	RSL Modify Connection (MDCX)	←	Received
	Section 5.7.5	RSL Modify Connection (MDCX) ACK	→	Sent
	Section 5.7.6	RSL Modify Connection (MDCX) NACK	→	Sent

Table 24: (continued)

This document §		Message	←/→	Received/Sent by OsmoBTS
Section 5.3.3	Section 5.7.8	RSL Delete Connection (DLCX)	←	Received
	Section 5.7.9	RSL Delete Connection (DLCX) ACK	→	Sent
	Section 5.7.10	RSL Delete Connection (DLCX) NACK	→	Sent
Section 5.3.4	Section 5.7.7	RSL Delete Connection (DLCX) Indication	→	Sent
IPA style PDCH Management (Section 5.4.1)				
Section 5.4.1.1	Section 5.7.11	RSL PDCH Activation	←	Received
	Section 5.7.12	RSL PDCH Activation ACK	→	Sent
	Section 5.7.13	RSL PDCH Activation NACK	→	Sent
Section 5.4.1.2	Section 5.7.14	RSL PDCH Deactivation	←	Received
	Section 5.7.15	RSL PDCH Deactivation ACK	→	Sent
	Section 5.7.16	RSL PDCH Deactivation NACK	→	Sent
COMMON CHANNEL MANAGEMENT MESSAGES				
Section 5.5	Section 5.7.17	Osmocom ETWS Command	←	Received

5.1.3 Messages Not Implemented by OsmoBTS

Table 25: 3GPP TS 48.058 messages not implemented by OsmoBTS

TS 48.058 §	Message
DEDICATED CHANNEL MANAGEMENT MESSAGES	
8.4.12	PHYSICAL CONTEXT REQUEST
8.4.13	PHYSICAL CONTEXT CONFIRM
8.4.17	PREPROCESS CONFIGURE
8.4.18	PREPROCESSED MEASUREMENT RESULT
8.4.21	TALKER DETECTION
8.4.22	LISTENER DETECTION
8.4.23	REMOTE CODEC CONFIGURATION REPORT
8.4.24	ROUND TRIP DELAY REPORT
8.4.25	PRE-HANDOVER NOTIFICATION
8.4.26	MULTIRATE CODEC MODIFICATION REQUEST
8.4.27	MULTIRATE CODEC MODIFICATION ACKNOWLEDGE
8.4.28	MULTIRATE CODEC MODIFICATION NEGATIVE ACKNOWLEDGE
8.4.29	MULTIRATE CODEC MODIFICATION PERFORMED
8.4.30	TFO REPORT
8.4.31	TFO MODIFICATION REQUEST
COMMON CHANNEL MANAGEMENT MESSAGES	
8.5.7	SMS BROADCAST REQUEST
8.5.10	NOTIFICATION COMMAND
TRX MANAGEMENT MESSAGES	
8.6.3	OVERLOAD
LOCATION SERVICES MESSAGES	
8.7.1	LOCATION INFORMATION

5.2 Message Limitation Details

5.2.1 Channel Activation

When used on a timeslot using the non-standard channel combination *NM_CHANC_OSMO_DYN* as configured by OML, the regular RSL channel activation procedures can not only be used for activation of circuit-switched channels, but also for activation of a PDCH.

See Section 5.4.2.

NOTE

Do not confuse this with the IPA style *PDCH ACT* type dynamic PDCH protocol employed by nanoBTS devices (Section 5.4.1).

5.2.2 Measurement Result

Conforms to 3GPP TS 48.058 § 8.4.8 with this limitation:

Table 26: *Measurement Result* IE limitations

TS 48.058 §	IE Name	Handling
9.3.37	MS Timing Offset	never sent by OsmoBTS

5.2.3 Mode Modify

Conforms to 3GPP TS 48.058 § 8.4.9 with these limitations:

Table 27: *Mode Modify* IE limitations

TS 48.058 §	IE Name	Handling
9.3.45	Main channel reference	*ignored*
9.3.53	MultiRate Control	*ignored*
9.3.54	Supported Codec Types	*ignored*

5.2.4 MS Power Control

Conforms to 3GPP TS 48.058 § 8.4.15 with these limitations:

Table 28: *MS Power Control* IE limitations

TS 48.058 §	IE Name	Handling
9.3.31	MS Power Parameters	*ignored*

5.2.5 SACCH Info Modify

Conforms to 3GPP TS 48.058 § 8.4.20, with these exceptions:

Table 29: *SACCH Info Modify* IE limitations

TS 48.058 §	IE Name	Handling
9.3.30	System Info Type	See below for available types
9.3.23	Starting Time	not supported, provokes an *Error Report* response

Table 30: *System Info Type* values that can occur on the SACCH

Value	Name
0x05	RSL_SYSTEM_INFO_5
0x06	RSL_SYSTEM_INFO_6
0x0d	RSL_SYSTEM_INFO_5bis
0x0e	RSL_SYSTEM_INFO_5ter
0x0f	RSL_SYSTEM_INFO_10
0x47	RSL_EXT_MEAS_ORDER
0x48	RSL_MEAS_INFO

5.2.6 BCCH Information

Conforms to 3GPP TS 48.058 § 8.5.1, with these limitations and extensions:

Table 31: *BCCH Information* IE details

TS 48.058 §	IE Name	Handling
9.3.30	System Info Type	See Section 5.2.5 for available types
9.3.11	L3 Info	This IE may be included instead of a 9.3.39 *Full BCCH Info* IE. The *Full BCCH Info* takes precedence over *L3 Info*. To stop SI transmission, both of these IEs must be omitted.

5.2.7 Channel Required

Conforms to 3GPP TS 48.058 § 8.5.3, with these limitations:

Table 32: *Channel Required* message IE details

TS 48.058 §	IE Name	Handling
9.3.16	Physical Context	never sent by OsmoBTS

5.2.8 Paging Command

Conforms to 3GPP TS 48.058 § 8.5.5, with these limitations:

Table 33: *Paging Command* message IE details

TS 48.058 §	IE Name	Handling
9.3.49	eMLPP Priority	*ignored*

Note
If adding the identity to the paging queue fails, the BSC is not notified in any way.

5.2.9 RF Resource Indication

For all osmo-bts variants, except osmo-bts-trx, this message does not conform to 3GPP TS 48.058 § 8.6.1, in that it omits the *Resource Information* IE that would contain the actual payload data, which renders this message void.

Table 34: *RF Resource Indication* message IE exceptions

TS 48.058 §	IE Name	Handling
9.3.21	Resource Information	DSP based osmo-bts variants omit this IE, though TS 48.058 specifies it as mandatory.

5.2.10 SACCH Filling

Conforms to 3GPP TS 48.058 § 8.6.2, with these limitations:

Table 35: *SACCH Filling* message IE limitations

TS 48.058 §	IE Name	Handling
9.3.30	System Info Type	See Section 5.2.5 for available types
9.3.23	Starting Time	*ignored*

5.3 User Plane Transport Management

This chapter defines the A-bis/IP specific RSL procedures that are introduced in addition to the 3GPP TS 48.058 standard procedures.

In classic A-bis over E1, user plane traffic is carried over 16kBps sub-slots of 64kBps E1 time-slots according to ETSI/3GPP TS 08.60. As the E1 line is a dedicated line between BTS and BSC, no further addressing information is required.

In A-bis/IP as described by the present document, new RSL procedures have been introduced to deal with the different properties of the underlying IP based transport medium.

5.3.1 RSL Create Connection (CRCX)

This procedure is used by the BSC to request the BTS to allocate + bind to a BTS-local UDP port for the subsequent transmission of user-plane data via RTP.

To do so, the BSC sends the **Create Connection (CRCX)** message. In case of successful outcome, the BTS responds with **Create Connection (CRCX) ACK**. In case of any error, the BTS responds with **Create Connection (CRCX) NACK**.

See Section 5.7.1, Section 5.7.2, Section 5.7.3

5.3.2 RSL Modify Connection (MDCX)

This procedure is used by the BSC to request the BTS to modify an already-bound BTS-local UDP port for user-plane RTP. It is used in particular to configure the remote IP address and UDP port to which the BTS shall send user-plane RTP traffic. This remote address is normally either a Media Gateway (MGW) of some sort, but could also be the RTP socket of the corresponding other leg of a mobile-to-mobile call.

To modify a user-plane connection, the BSC sends the **Modify Connection** message. In case of successful outcome, the BTS responds with **Modify Connection (MDCX) ACK**. In case of any error, the BTS responds with **Modify Connection (MDCX) NACK**.

See Section 5.7.4, Section 5.7.5, Section 5.7.6

5.3.3 RSL Delete Connection (DLCX)

This procedure is used by the BSC to request the BTS to delete an already-existing BTS-local UDP port for user-plane RTP.

To delete a user-plane connection, the BSC sends the **Delete Connection (DLCX)** message. In case of successful outcome, the BTS responds with **Delete Connection (DLCX) ACK**. In case of any error, the BTS responds with **Delete Connection (DLCX) NACK**.

See Section 5.7.8, Section 5.7.9, Section 5.7.10

5.3.4 RSL Delete Connection (DLCX) Indication

When a BTS-local UDP connection for user-plane RTP is automatically released at the time of RF CHANNEL RELEASE, the BTS sends a unilateral, non-acknowledged **RSL Delete Connection (DLCX) Indication** to the BSC.

See Section 5.7.7

5.4 Dynamic Channel Combinations

In the classic data model established by ETSI/3GPP for A-bis, each timeslot (channel) is configured using a static channel combination by means of A-bis OML. Particularly in presence of GPRS services, this is very inflexible and leads to inefficient use of air interface resources.

As such, several methods have been implemented to overcome this limitation. The fundamental operation can be outlined like this:

- Configuration of a particular *dynamic* channel combination via OML
- activation of TCH works like on a classic TCH channel combination
- activation of PDCH requires some specific PDCH activation procedure

There are two variants implemented in the OsmoBTS A-bis dialect:

5.4.1 IPA Style Dynamic Channels

This method is used when OML uses *NM_CHANC_IPAC_TCHFull_PDCH* (0x80) as channel combination for the given time-slot.

IPA style refers to *ip.access* compatible PDCH activation and deactivation.

When the IPA style dynamic channel combination *TCH/F or PDCH* is set, the non-standard *PDCH ACTIVATE* (Section 5.4.1.1) and *PDCH DEACTIVATE* (Section 5.4.1.2) procedures are used for switching an idle channel into PDCH mode and back into idle mode.

When the channel is used as TCH/F, regular circuit-switched activation is performed, like on any traditional TCH/F. However, the BSC must make sure to first disable the PDCH on the timeslot, before activating it as TCH/F. Likewise, any circuit-switched TCH/F on the channel must be deactivated using standard RSL signalling, before the specific PDCH related procedures are used to enable the PDCH.

5.4.1.1 PDCH Activate

This procedure is used by the BSC to request the BTS to activate an IPA style dynamic TCH/F+PDCH channel in PDCH mode.

The operation is not supported on any other physical channel type.

See Section 5.7.11, Section 5.7.12, Section 5.7.13

5.4.1.2 PDCH Deactivate

This procedure is used by the BSC to request the BTS to deactivate an active PDCH on any an IPA style dynamic TCH/F+PDCH channel.

The operation is not supported on any other physical channel type.

See Section 5.7.14, Section 5.7.15, Section 5.7.16

5.4.1.3 IPA Style Dynamic Switchover Example

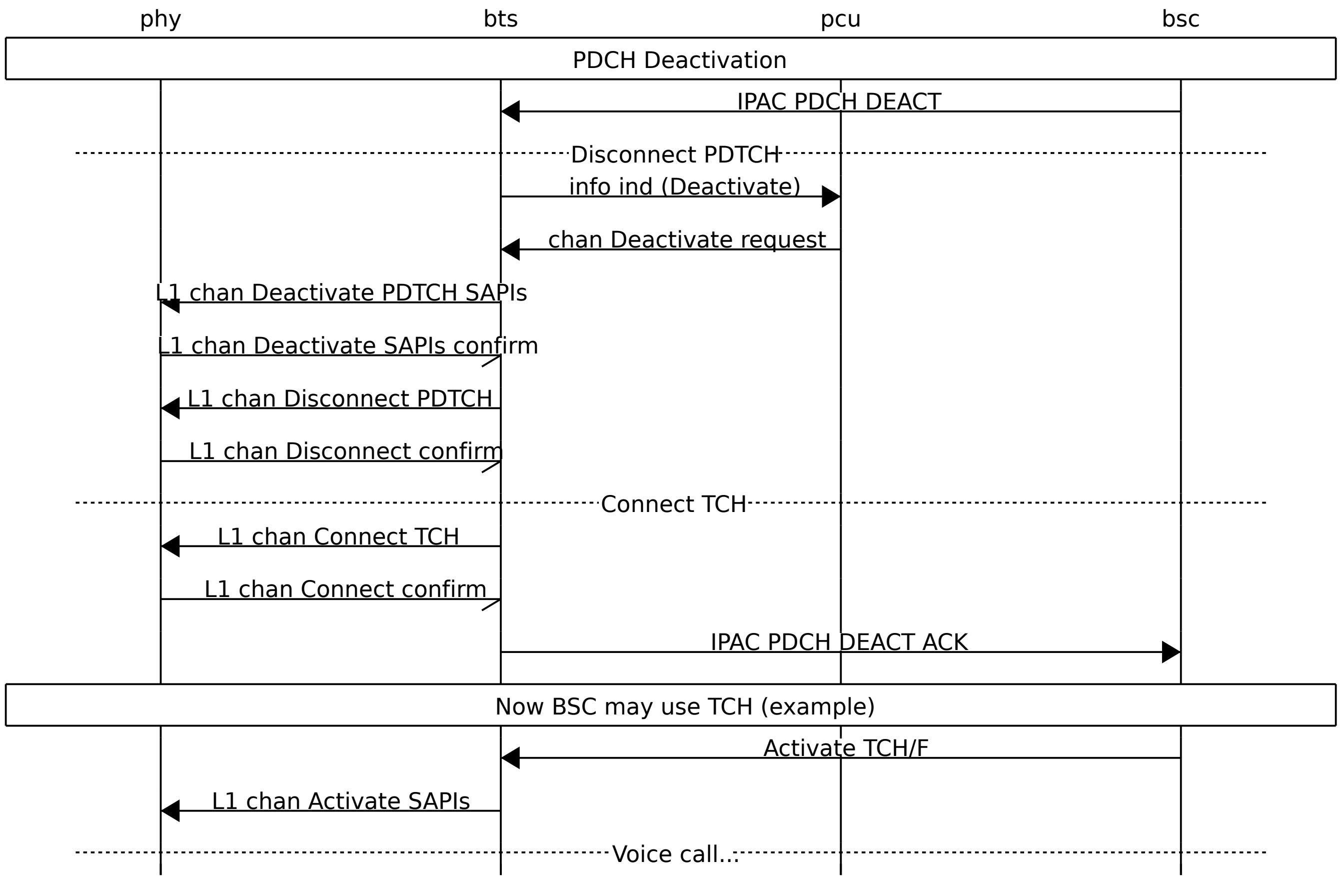

Figure 10: Part 1: example for dynamic channel switchover, for IPA style dynamic timeslots

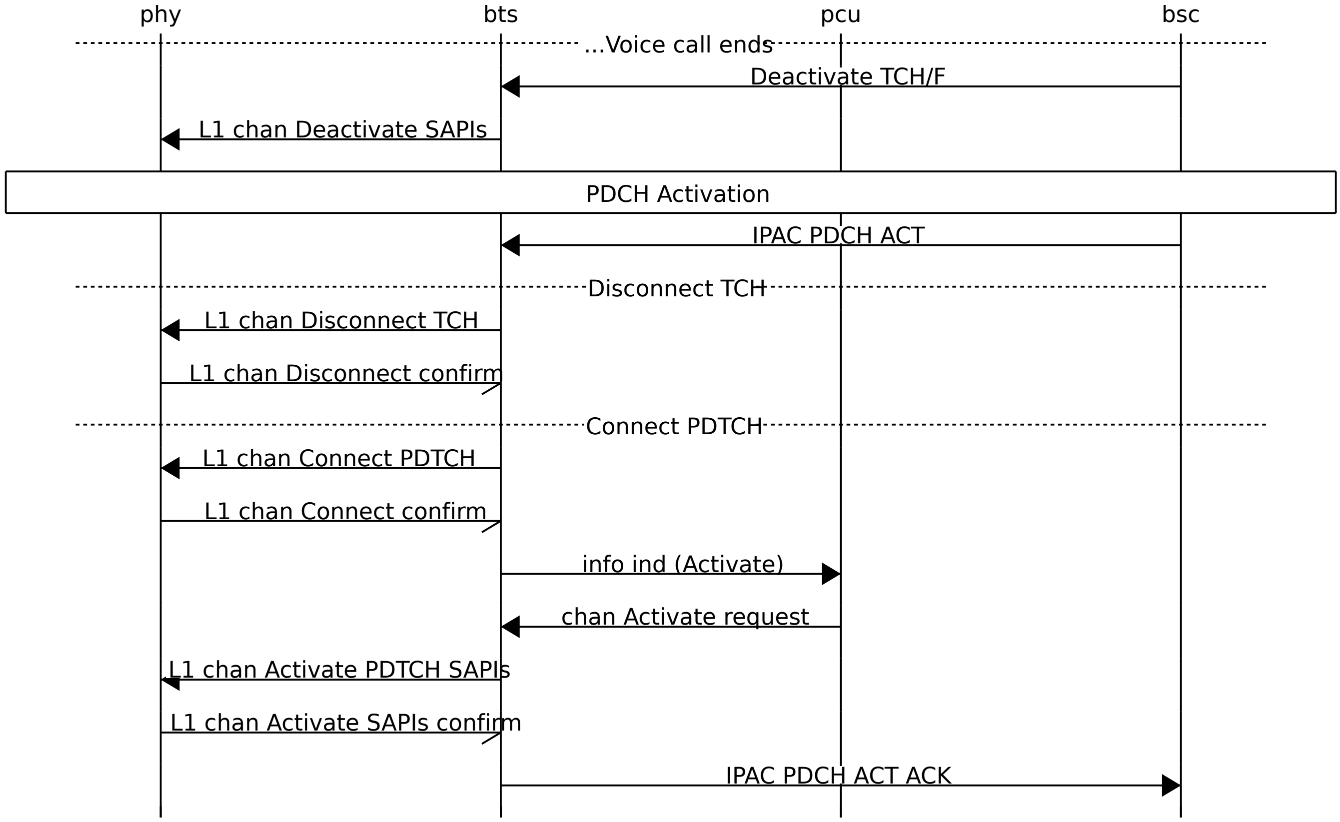

Figure 11: Part 2: example for dynamic channel switchover, for IPA style dynamic timeslots

5.4.2 Osmocom Style Dynamic Channels

This method is in use when OML uses *NM_CHANC_OSMO_DYN* (0x90) for the given time-slot.

The activation of PDCH is performed by using the regular *RSL CHANNEL ACTIVATE* procedure according to Section 5.2.1, with these modifications:

- The *C-bits* part of the *Channel Number* IE take the non-standard binary value 11000 (C5 through C1 as seen in 3GPP TS 48.058 § 9.3.1).
- The *A-bits* part of the *Activation Type* IE take the non-standard binary value 1111, with an additional fourth bit (add A4 to A3 through A1 as seen in 3GPP TS 48.058 § 9.3.3; all remaining reserved bits as well as the *R* bit are coded as zero).
- The normally mandatory *Channel Mode* IE is omitted; none of the optional IEs are included.

Hence the message consists of exactly these IEs:

Table 36: PDCH type *Channel Activation* message IEs

TS 48.058 §	IE Name	Handling
9.1	Message discriminator	Dedicated Channel Management
9.2	Message type	CHANnel ACTIVation
9.3.1	Channel number	*C-bits* 11000, plus TS bits as usual
9.3.3	Activation type	*A-bits* 1111

5.4.2.1 Osmocom Style Dynamic Switchover Example

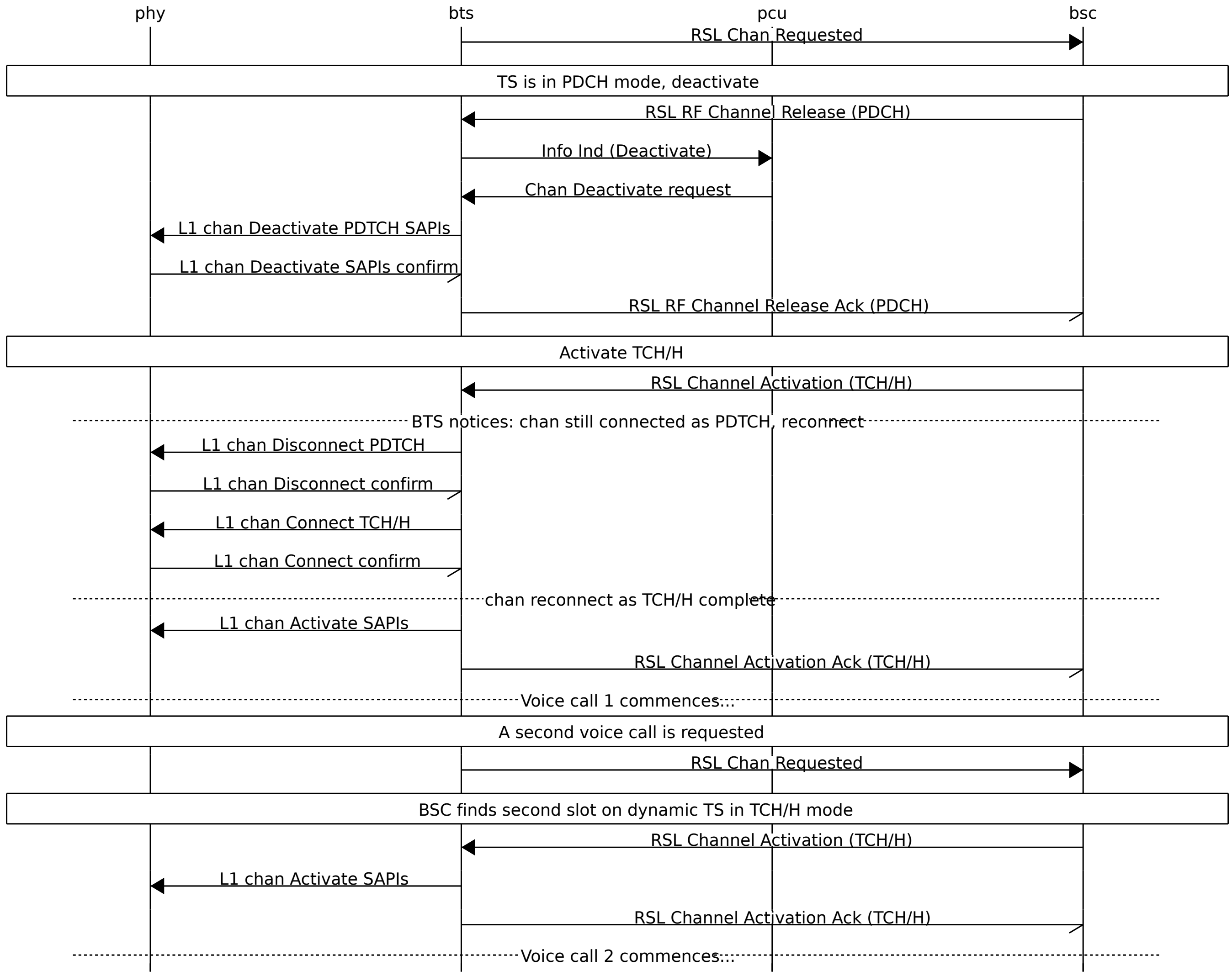

Figure 12: Part 1: example for dynamic channel switchover, for Osmocom style dynamic timeslots

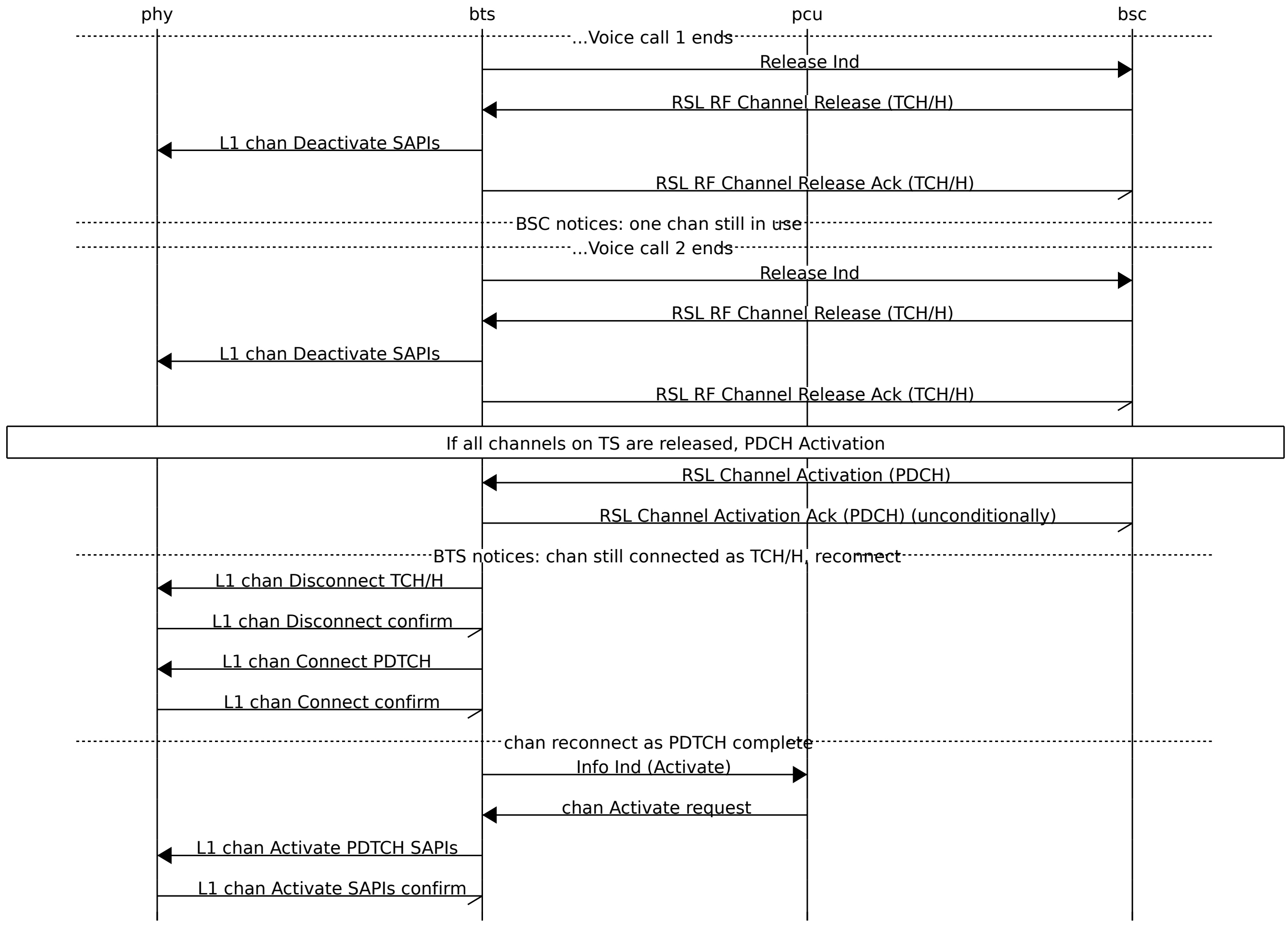

Figure 13: Part 2: example for dynamic channel switchover, for Osmocom style dynamic timeslots

5.5 ETWS (Earthquake and Tsunami Warning System)

ETWS as specified in 3GPP TS 23.041 includes not only notification via SMSCB, but also so-called Primary Notifications (PN). The ETWS PN are transmitted

- by the BSC to all subscribers with active dedicated channels
- by the BTS on the PCH to all subscribers in idle mode
- by the PCU on the PACCH to all subscribers with active TBF

Unfortunately, 3GPP forgot to update their specifications with any information as to how the ETWS PN is transmitted from BSC to BTS in a portable way, and Osmocom had to invent their own non-standard signaling for it.

See Section 5.7.17 for the Osmocom implementation.

5.6 BCCH carrier power reduction operation

According to 3GPP TS 45.008, section 7.1, the BCCH carrier (sometimes called C0) of a BTS shall maintain discontinuous Downlink transmission at full power in order to stay "visible" to the mobile stations. Because of that, early versions of this 3GPP document prohibited BS power reduction on C0. However, a new feature was introduced version 13.0.0 (2015-11) - "BCCH carrier power reduction operation".

This is a special mode of operation, in which the variation of RF power level for some timeslots is relaxed for the purpose of energy saving. In other words, the output power on some timeslots, except the timeslot(s) carrying BCCH/CCCH, can be lower than the full power. In this case the maximum allowed difference is 6 dB.

Unfortunately, 3GPP did not specify in which way the BTS is instructed to activate and deactivate the BCCH carrier power reduction mode. Osmocom had to invent their own non-standard approach: the BSC needs to send *BS POWER CONTROL* message with the *Channel Number* IE set to 0x80 (BCCH) and the *Message Discriminator* set to 0x06 (Common Channel Management messages).

5.7 Message Formats and Contents

5.7.1 Create Connection (CRCX)

This message is sent by the BSC to the BTS to request the creation of a user-plane RTP connection for the specified **Channel number**.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Destination IP Address	Section 5.8.4	O	TV	5
Destination IP Port	Section 5.8.5	O	TV	3
IP Speech Mode	Section 5.8.7	O	TV	2
RTP Payload Type 2	Section 5.8.11	O	TV	2
RTP CSD Format	Section 5.8.16	O	TV	2

5.7.2 Create Connection (CRCX) ACK

This message is sent by the BTS to the BSC to acknowledge the successful outcome of creating a user-plane RTP connection. It is sent in response to the **Create Connection (CRCX)**.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	M	TV	3
Source IP Address	Section 5.8.8	O	TV	5
Source IP Port	Section 5.8.6	O	TV	3
RTP Payload Type 2	Section 5.8.11	O	TV	2

5.7.3 Create Connection (CRCX) NACK

This message is sent by the BTS to the BSC to signal the unsuccessful outcome of creating a user-plane RTP connection. It is sent in response to the **Create Connection (CRCX)**.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Destination IP Address	Section 5.8.4	O	TV	5
Destination IP Port	Section 5.8.5	O	TV	3
Cause	48.058 9.3.26	O	TLV	>= 3

5.7.4 Modify Connection (MDCX)

This message is sent by the BSC to the BTS to modify the properties of a user-plane RTP connection.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	O	TV	3
Destination IP Address	Section 5.8.4	O	TV	5
Destination IP Port	Section 5.8.5	O	TV	3
IP Speech Mode	Section 5.8.7	O	TV	2
RTP Payload Type 2	Section 5.8.11	O	TV	2
RTP CSD Format	Section 5.8.16	O	TV	2

5.7.5 Modify Connection (MDCX) ACK

This message is sent by the BTS to the BSC to acknowledge the successful modification of a user-plane RTP connection. It is sent in response to a **Modify Connection (MDCX)**

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	O	TV	3
Source IP Address	Section 5.8.8	C	TV	5
Source IP Port	Section 5.8.6	C	TV	3
RTP Payload Type 2	Section 5.8.11	O	TV	2

5.7.6 Modify Connection (MDCX) NACK

This message is sent by the BTS to the BSC to signal the unsuccessful outcome of modifying the user-plane RTP connection for the specified Channel number. It is sent in response to the **Modify Connection (MDCX)**.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Cause	48.058 9.3.26	M	TLV	>= 3

5.7.7 Delete Connection (DLCX) Indication

This message is sent by the BTS to indicate the automatic deletion of a BTS-local UDP connection for user-plane RTP traffic at the time of RF Channel release.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	M	TV	3
Connection Id	Section 5.8.9	M	TV	3
Cause	48.058 9.3.26	M	TLV	>= 3

5.7.8 Delete Connection (DLCX)

This message is sent by the BSC to the BTS to request the disconnection of a user-plane RTP connection for the specified Channel number.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	O	TV	3

5.7.9 Delete Connection (DLCX) ACK

This message is sent by the BTS to signal the successful outcome of deleting the user-plane RTP connection for the specified Channel number. It is sent in response to the **Delete Connection (DLCX)**.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	O	TV	3
Connection Statistics	Section 5.8.9	C	TV	29

5.7.10 Delete Connection (DLCX) NACK

This message is sent by the BTS to signal the unsuccessful outcome of deleting the user-plane RTP connection for the specified Channel number. It is sent in response to the **Delete Connection (DLCX)**.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Connection Id	Section 5.8.10	O	TV	3
Cause	48.058 9.3.26	M	TLV	>= 3

5.7.11 PDCH Activate

This message is sent by the BSC to request the activation of a PDCH on a IPA style dynamic TCH/F+PDCH channel.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2

NOTE

This message is **not** used by Osmocom style dynamic channels

5.7.12 PDCH Activate ACK

This message is sent by the BTS to confirm the successful activation of a PDCH on a IPA style dynamic TCH/F+PDCH channel.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Frame Number	48.058 9.3.8	O	TV	3

NOTE
This message is **not** used by Osmocom style dynamic channels

5.7.13 PDCH Activate NACK

This message is sent by the BTS to reject the successful activation of a PDCH on a IPA style dynamic TCH/F+PDCH channel.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Cause	48.058 9.3.26	M	TLV	>= 3

NOTE
This message is **not** used by Osmocom style dynamic channels

5.7.14 PDCH Deactivate

This message is sent by the BSC to request the deactivation of a PDCH on a IPA style dynamic TCH/F+PDCH channel.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2

NOTE
This message is **not** used by Osmocom style dynamic channels

5.7.15 PDCH Deactivate ACK

This message is sent by the BTS to confirm the successful deactivation of a PDCH on a IPA style dynamic TCH/F+PDCH channel.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2

NOTE
This message is **not** used by Osmocom style dynamic channels

5.7.16 PDCH Deactivate NACK

This message is sent by the BTS to reject the deactivation of a PDCH on a IPA style dynamic TCH/F+PDCH channel.

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
Cause	48.058 9.3.26	M	TLV	>= 3

NOTE
This message is **not** used by Osmocom style dynamic channels

5.7.17 Osmocom ETWS Command

This message is sent by the BSC to transfer the ETWS Primary Notification (PN) from BSC to BTS and enable/disable transmission of ETWS PN by the BTS. For more information about ETWS, see 3GPP TS 23.041.

If the ETWS PN length is > 0, the BTS will immediately start transmission of the received ETWS PN on the PCH using P1 Rest Octets. It will also forward he ETWS PN to the PCU to enable the PCU to transmit it via PACCH on active TBF.

If the ETWS PN length is 0, the BTS will stop any ETWS PN broadcast via the PCH.

The Channel Number IE is set to the Downlink CCCH (PCH).

INFORMATION ELEMENT	REFERENCE	PRESENCE	FORMAT	LENGTH
Message discriminator	48.058 9.1	M	V	1
Message type	Section 5.8.1	M	V	1
Channel number	48.058 9.3.1	M	TV	2
SMSCB Message	48.058 9.3.42	M	TLV	2-58

5.8 Information Element Codings

5.8.1 A-bis/IP specific RSL Message discriminators

The following message discriminators are used in addition to those indicated in 3GPP TS 48.058 Section 9.1:

Table 37: OsmoBTS specific new message discriminators

Message Type	Message	This document §
0x70	Create Connection (CRCX)	Section 5.7.1
0x71	Create Connection (CRCX) ACK	Section 5.7.2
0x72	Create Connection (CRCX) NACK	Section 5.7.3
0x73	Modify Connection (MDCX)	Section 5.7.4
0x74	Modify Connection (MDCX) ACK	Section 5.7.5
0x75	Modify Connection (MDCX) NACK	Section 5.7.6
0x76	Delete Connection (DLCX) Indication	Section 5.7.7
0x77	Delete Connection (DLCX)	Section 5.7.8
0x78	Delete Connection (DLCX) ACK	Section 5.7.9
0x79	Delete Connection (DLCX) NACK	Section 5.7.10
0x7f	Osmocom ETWS Command	Section 5.7.17
0x48	PDCH Activate	Section 5.7.11
0x49	PDCH Activate ACK	Section 5.7.12

Table 37: (continued)

Message Type	Message	This document §
0x4a	PDCH Activate NACK	Section 5.7.13
0x4b	PDCH Deactivate	Section 5.7.14
0x4c	PDCH Deactivate ACK	Section 5.7.15
0x4d	PDCH Deactivate NACK	Section 5.7.16

5.8.2 A-bis/IP specific RSL IEIs

The following Information Element Identifiers (IEIs) are used in addition to those indicated in 3GPP TS 48.058 Section 9.3:

Table 38: A-bis/IP specific information elements

IEI	Name	This document §
0x01	RSL_IE_CHAN_NR	Section 5.8.3
0x60	RSL_IE_OSMO_REP_ACCH_CAP	Section 5.8.12
0x61	RSL_IE_OSMO_TRAINING_SEQUENCE	Section 5.8.13
0x62	RSL_IE_OSMO_TEMP_OVP_ACCH_CAP	Section 5.8.14
0x63	RSL_IE_OSMO_OSMUX_CID	Section 5.8.15
0xf0	RSL_IE_IPAC_REMOTE_IP	Section 5.8.4
0xf1	RSL_IE_IPAC_REMOTE_PORT	Section 5.8.5
0xf3	RSL_IE_IPAC_LOCAL_PORT	Section 5.8.6
0xf4	RSL_IE_IPAC_SPEECH_MODE	Section 5.8.7
0xf5	RSL_IE_IPAC_LOCAL_IP	Section 5.8.8
0xf6	RSL_IE_IPAC_CONN_STAT	Section 5.8.9
0xf8	RSL_IE_IPAC_CONN_ID	Section 5.8.10
0xf9	RSL_IE_IPAC_RTP_CSD_FORMAT	Section 5.8.16
0xfc	RSL_IE_IPAC_RTP_PAYLOAD2	Section 5.8.11

5.8.3 RSL_IE_CHAN_NR

This information element is coded as described in 3GPP TS 48.058 Section 9.3.1, but in addition supports the following vendor specific values:

Table 39: RSL Channel Number extensions

C5	C4	C3	C2	C1	Description
1	1	0	0	0	PDCH <1>
1	1	0	0	1	CBCH on SDCCH4
1	1	0	1	0	CBCH on SDCCH8
1	1	1	0	1	VAMOS TCH/F <2>
1	1	1	1	T	VAMOS TCH/H <2>

<1> This extension is only valid on an Osmocom-style dynamic channel, having configured the *NM_CHANC_IPAC_TCHFull_PDCH* channel combination by OML. <2> These Osmocom specific values are used by osmo-bsc to address logical channels on the shadow timeslots in VAMOS mode, iff the BTS is an osmo-bts and VAMOS capable.

The TN-Bits are not re-defined in this case but use the same encoding as specified in TS 48.058 Section 9.3.1.

5.8.4 RSL_IE_IPAC_REMOTE_IP

This information element contains the remote (MGW side) IPv4 address in network byte order. It is encoded as fixed-size element with one byte IEI followed by four bytes IPv4 address.

5.8.5 RSL_IE_IPAC_REMOTE_PORT

This information element contains the remote (MGW side) UDP port in network byte order. It is encoded as fixed-size element with one byte IEI followed by two bytes UDP port number.

5.8.6 RSL_IE_IPAC_LOCAL_PORT

This information element contains the local (BTS side) IPv4 address in network byte order. It is encoded as fixed-size element with one byte IEI followed by two bytes UDP port number.

5.8.7 RSL_IE_IPAC_SPEECH_MODE

This information element encodes the speech mode. It is set according to the voice codec used on the connection. It is encoded as a fixed-size element of two bytes, with one byte IEI followed by one byte Speech mode indicator.

Table 40: A-bis/IP Speech Mode Indicator Values

Value	Description
0x00	TCH/F with FR codec
0x01	TCH/F with EFR codec
0x02	TCH/F with AMR codec
0x03	TCH/H with HR codec
0x05	TCH/H with AMR codec

5.8.8 RSL_IE_IPAC_LOCAL_IP

This information element contains the local (BTS side) IPv4 address in network byte order. It is encoded as fixed-size element with one byte IEI followed by four bytes IPv4 address.

5.8.9 RSL_IE_IPAC_CONN_STAT

This information element contains statistics about the RTP connection.

It is encoded as 30 bytes, with the first byte as IEI, the second byte as length (=28), and 28 bytes fixed-length payload encoded as follows:

Table 41: A-bis/IP Connection Statistics

Offset	Size	Description
0	4	Total number of RTP packets sent
4	4	Total number of octets sent
8	4	Total number of RTP packets received
12	4	Total number of octets received
16	4	Total number of lost packets in Rx direction
20	4	Inter-arrival Jitter

Table 41: (continued)

Offset	Size	Description
24	4	Average transmission delay

All the above values are encoded in network byte order.

A detailed definition of the individual values is given in RFC 1889.

5.8.10 RSL_IE_IPAC_CONN_ID

This IE is a TV with a value length of two bytes. The value is a 16 bit connection ID in network byte order.

5.8.11 RSL_IE_IPAC_RTP_PAYLOAD2

This information element contains the RTP payload identifier, which is used in the PT (Payload Type) field of the RTP header in subsequent transmissions of the RTP flow.

5.8.12 RSL_IE_OSMO_REP_ACCH_CAP

This is a one byte length TLV IE that is used to enable or disable repeated ACCH capabilities on the BTS side during Channel Activation and Mode Modify.

The IE contains a bitfield in the lower nibble in order to set the ACCH repetition policy for each of the two channel types individually. Depending on the state of the bits (see table below) the ACCH repetition mode is either enabled or disabled completely.

The lower 3 bit of the higher nibble are used to signal an RXQUAL threshold to set the BER on which UL-SACCH or DL-FACCH repetition shall be turned on. If the field is set to 0, then UL-SACCH and DL-FACCH will be always on. DL-FACCH will also be turned on automatically as soon as the MS requests a DL-SACCH repetition.

If the IE is not present, then ACCH repetition completely is disabled.

bit	7	6 - 4	3	2	1	0
byte at offset 0	0	RXQUAL	UL-SACCH	DL-SACCH	DL-FACCH/ALL	DL-FACCH/CMD

(Bits 7 is reserved for future use and must be set to zero.)

5.8.13 RSL_IE_OSMO_TRAINING_SEQUENCE

This TLV IE instructs the BTS to use a specific training sequence set and training sequence code for a given lchan. It is sent by OsmoBSC in RSL CHANNEL ACTIVATION and MODE MODIFY messages to the BTS, iff the BTS is VAMOS-capable, i.e. if an Abis-over-IP connected BTS indicated BTS_FEAT_VAMOS in the OML BTS features (Manufacturer Id information element, see Section 4.6.22).

If this information element is present, the receiver shall ignore any other training sequence set and training sequence code bits from other information elements of the same RSL message.

This is an Osmocom-specific extension of the RSL layer, which was added to express more than two TSC sets. For VAMOS operation, OsmoBSC selects from one of four separate training sequence codings per modulation scheme, while usual RSL IEs are only able to express a single-bit TSC set number. For clarity, this IE contains both the TSC set and the TSC in one IE, and is defined as overruling any other IEs containing TSC or TSC set numbers.

The first value octet indicates the training sequence set, and the second octet indicates the training sequence code to be used. Receiving values from a reserved value range should be considered an error condition.

Table 42: RSL_IE_OSMO_TRAINING_SEQUENCE

IE octet	value
octet 1	RSL_IE_OSMO_TRAINING_SEQUENCE IEI (0x61)
octet 2	length of the value part (2)
octet 3	TSC set
octet 4	TSC

The training sequence set (TSC set) is coded like the *CS Domain TSC Set* bits, as defined in the *Extended TSC Set* IE in 3GPP TS 44.018 10.5.2.82 [3gpp-ts-44-018], and corresponds to the *TSC Set* as defined in 3GPP TS 45.002 [3gpp-ts-45-002]. The encoded training sequence set number ranges from 0 to 3, any other values are reserved for future use. The encoded 0 corresponds to TSC Set 1, see Table 43.

Table 43: TSC set (octet 3) coding

octet 3 value	interpretation
0	*TSC Set 1* as in 3GPP TS 45.002
1	*TSC Set 2*
2	*TSC Set 3*
3	*TSC Set 4*
4..255	reserved values

The training sequence code (TSC) corresponds to the *TSC* bits as defined in the *Channel Description 2* IE in 3GPP TS 44.018 10.5.2.5a [3gpp-ts-44-018]. The training sequence code ranges from 0 to 7, any other values are reserved for future use.

Table 44: TSC (octet 4) coding

octet 4 value	interpretation
0	*Training Sequence Code (TSC) 0* as in 3GPP TS 45.002
1	*Training Sequence Code (TSC) 1*
2	*Training Sequence Code (TSC) 2*
3	*Training Sequence Code (TSC) 3*
4	*Training Sequence Code (TSC) 4*
5	*Training Sequence Code (TSC) 5*
6	*Training Sequence Code (TSC) 6*
7	*Training Sequence Code (TSC) 7*
8..255	reserved values

5.8.14 RSL_IE_OSMO_TEMP_OVP_ACCH_CAP

FIXME: this IE has been defined, but remains to be documented.

5.8.15 RSL_IE_OSMO_OSMUX_CID

FIXME: this IE has been defined, but remains to be documented.

5.8.16 RSL_IE_IPAC_RTP_CSD_FORMAT

This information element contains the RTP Circuit Switched Data format.

Table 45: A-bis/IP RTP CSD Format

Offset	Size	Description
0	4	RTP CSD Format D
4	4	RTP CSD Format IR

Table 46: A-bis/IP RTP CSD Format D Values

Value	Description
0	External TRAU format
1	Non-TRAU Packed format
2	TRAU within the BTS
3	IWF-Free BTS-BTS Data

Table 47: A-bis/IP RTP CSD Format IR Values

Value	Description
0	8 kb/s
1	16 kb/s
2	32 kb/s
3	48 kb/s

5.9 A-bis RSL Initialization / BTS bring-up

Upon receiving the *IPA RSL CONNECT* OML message by the respective *Baseband Transceiver* MO, the BTS proceeds with establishing a separate TCP connection for the given TRX.

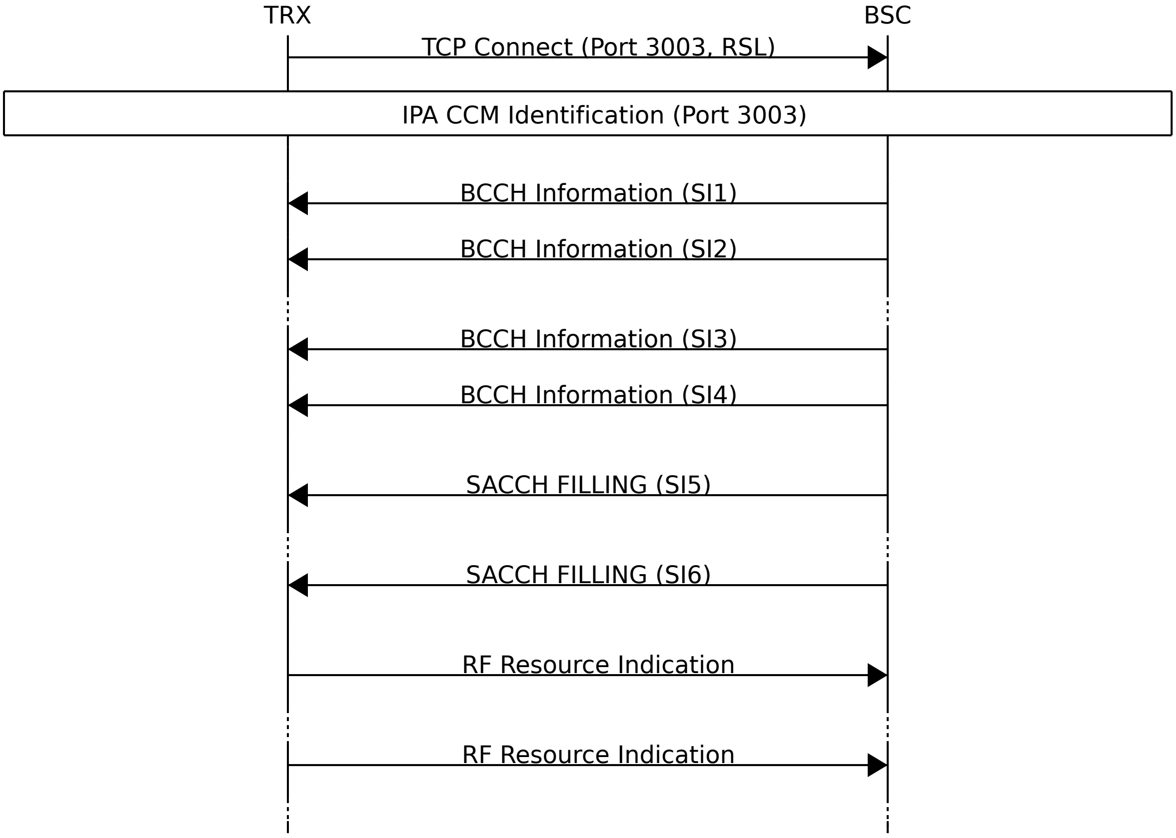

Figure 14: A-bis RSL BTS bring-up for primary TRX

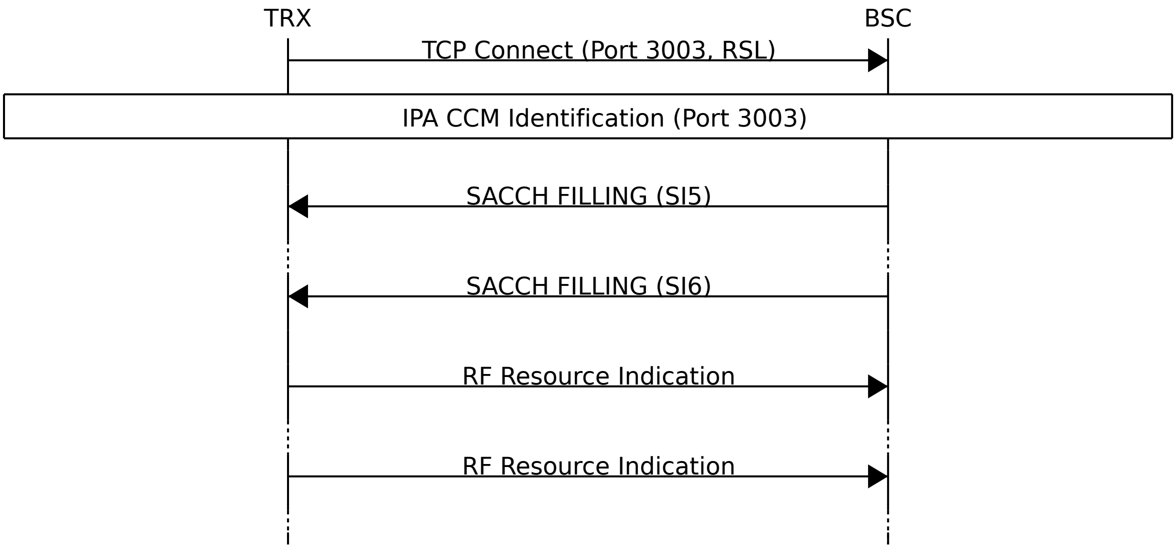

Figure 15: A-bis RSL BTS bring-up for secondary TRXs

The initialization of the primary and secondary TRX slightly differ, as illustrated by the differences of Figure 14 and Figure 15. Since the secondary TRX has no BCCH, it does not (need to) receive any *RSL BCCH INFORMATION* messages from the BSC.

6 User-Plane Traffic via RTP

RTP (Realtime Transfer Protocol) is a protocol for streaming audio and video data. It is specified by IETF RFC 1889.

OsmoBTS A-bis/IP implements RTP as transport medium for circuit-switched user-plane traffic, contrary to the E1 sub-slot based transport specified in 3GPP TS 08.60.

The RTP transport endpoint parameters are configured using the RSL User Plane Transport Management procedures described in Section 5.3.

RTCP is implemented in addition to RTP, on a UDP port number of the RTP port incremented by one.

6.1 RTP Payload Formats

The RTP payload format depends on the voice codec used on the radio channel. The OsmoBTS is simply passing the GSM speech frames between the Um radio interface channels and the RTP payload (and vice-versa).

No transcoding function is implemented in the BTS!

Table 48: RTP Payload formats

TCH	Codec	RTP payload format specification
TCH/F	FR	IETF RFC 3551 Section 4.5.8
TCH/F	EFR	IETF RFC 3551 Section 4.5.9
TCH/F	AMR	IETF RFC 4867
TCH/H	HR	IETF RFC 5993
TCH/H	AMR	IETF RFC 4867

7 Glossary

2FF
2nd Generation Form Factor; the so-called plug-in SIM form factor

3FF
3rd Generation Form Factor; the so-called microSIM form factor

3GPP
3rd Generation Partnership Project

4FF
4th Generation Form Factor; the so-called nanoSIM form factor

A Interface
Interface between BTS and BSC, traditionally over E1 (*3GPP TS 48.008* [3gpp-ts-48-008])

A3/A8
Algorithm 3 and 8; Authentication and key generation algorithm in GSM and GPRS, typically COMP128v1/v2/v3 or MILENAGE are typically used

A5
Algorithm 5; Air-interface encryption of GSM; currently only A5/0 (no encryption), A5/1 and A5/3 are in use

Abis Interface
Interface between BTS and BSC, traditionally over E1 (*3GPP TS 48.058* [3gpp-ts-48-058] and *3GPP TS 52.021* [3gpp-ts-52-021])

ACC
: Access Control Class; every BTS broadcasts a bit-mask of permitted ACC, and only subscribers with a SIM of matching ACC are permitted to use that BTS

AGCH
: Access Grant Channel on Um interface; used to assign a dedicated channel in response to RACH request

AGPL
: GNU Affero General Public License, a copyleft-style Free Software License

AQPSK
: Adaptive QPSK, a modulation scheme used by VAMOS channels on Downlink

ARFCN
: Absolute Radio Frequency Channel Number; specifies a tuple of uplink and downlink frequencies

AUC
: Authentication Center; central database of authentication key material for each subscriber

BCCH
: Broadcast Control Channel on Um interface; used to broadcast information about Cell and its neighbors

BCC
: Base Station Color Code; short identifier of BTS, lower part of BSIC

BTS
: Base Transceiver Station

BSC
: Base Station Controller

BSIC
: Base Station Identity Code; 16bit identifier of BTS within location area

BSSGP
: Base Station Subsystem Gateway Protocol (*3GPP TS 48.018* [3gpp-ts-48-018])

BVCI
: BSSGP Virtual Circuit Identifier

CBC
: Cell Broadcast Centre; central entity of Cell Broadcast service

CBCH
: Cell Broadcast Channel; used to transmit Cell Broadcast SMS (SMS-CB)

CBS
: Cell Broadcast Service

CBSP
: Cell Broadcast Service Protocol (*3GPP TS 48.049* [3gpp-ts-48-049])

CC
: Call Control; Part of the GSM Layer 3 Protocol

CCCH
: Common Control Channel on Um interface; consists of RACH (uplink), BCCH, PCH, AGCH (all downlink)

Cell
: A cell in a cellular network, served by a BTS

CEPT
: Conférence européenne des administrations des postes et des télécommunications; European Conference of Postal and Telecommunications Administrations.

CGI
: Cell Global Identifier comprised of MCC, MNC, LAC and BSIC

CSFB
: Circiut-Switched Fall Back; Mechanism for switching from LTE/EUTRAN to UTRAN/GERAN when circuit-switched services such as voice telephony are required.

dB
: deci-Bel; relative logarithmic unit

dBm
: deci-Bel (milliwatt); unit of measurement for signal strength of radio signals

DHCP
: Dynamic Host Configuration Protocol (*IETF RFC 2131* [ietf-rfc2131])

downlink
: Direction of messages / signals from the network core towards the mobile phone

DSCP
: Differentiated Services Code Point (*IETF RFC 2474* [ietf-rfc2474])

DSP
: Digital Signal Processor

dvnixload
: Tool to program UBL and the Bootloader on a sysmoBTS

EDGE
: Enhanced Data rates for GPRS Evolution; Higher-speed improvement of GPRS; introduces 8PSK

EGPRS
: Enhanced GPRS; the part of EDGE relating to GPRS services

EIR
: Equipment Identity Register; core network element that stores and manages IMEI numbers

ESME
: External SMS Entity; an external application interfacing with a SMSC over SMPP

ETSI
: European Telecommunications Standardization Institute

FPGA
: Field Programmable Gate Array; programmable digital logic hardware

Gb
: Interface between PCU and SGSN in GPRS/EDGE network; uses NS, BSSGP, LLC

GERAN
: GPRS/EDGE Radio Access Network

GFDL
: GNU Free Documentation License; a copyleft-style Documentation License

GGSN
: GPRS Gateway Support Node; gateway between GPRS and external (IP) network

GMSK
: Gaussian Minimum Shift Keying; modulation used for GSM and GPRS

GPL
: GNU General Public License, a copyleft-style Free Software License

Gp
Gp interface between SGSN and GGSN; uses GTP protocol

GPRS
General Packet Radio Service; the packet switched 2G technology

GPS
Global Positioning System; provides a highly accurate clock reference besides the global position

GSM
Global System for Mobile Communications. ETSI/3GPP Standard of a 2G digital cellular network

GSMTAP
GSM tap; pseudo standard for encapsulating GSM protocol layers over UDP/IP for analysis

GSUP
Generic Subscriber Update Protocol. Osmocom-specific alternative to TCAP/MAP

GT
Global Title; an address in SCCP

GTP
GPRS Tunnel Protocol; used between SGSN and GGSN

HLR
Home Location Register; central subscriber database of a GSM network

HNB-GW
Home NodeB Gateway. Entity between femtocells (Home NodeB) and CN in 3G/UMTS.

HPLMN
Home PLMN; the network that has issued the subscriber SIM and has his record in HLR

IE
Information Element

IMEI
International Mobile Equipment Identity; unique 14-digit decimal number to globally identify a mobile device, optionally with a 15th checksum digit

IMEISV
IMEI software version; unique 14-digit decimal number to globally identify a mobile device (same as IMEI) plus two software version digits (total digits: 16)

IMSI
International Mobile Subscriber Identity; 15-digit unique identifier for the subscriber/SIM; starts with MCC/MNC of issuing operator

IP
Internet Protocol (*IETF RFC 791* [ietf-rfc791])

IPA
ip.access GSM over IP protocol; used to multiplex a single TCP connection

Iu
Interface in 3G/UMTS between RAN and CN

IuCS
Iu interface for circuit-switched domain. Used in 3G/UMTS between RAN and MSC

IuPS
Iu interface for packet-switched domain. Used in 3G/UMTS between RAN and SGSN

LAC
: Location Area Code; 16bit identifier of Location Area within network

LAPD
: Link Access Protocol, D-Channel (*ITU-T Q.921* [itu-t-q921])

LAPDm
: Link Access Protocol Mobile (*3GPP TS 44.006* [3gpp-ts-44-006])

LLC
: Logical Link Control; GPRS protocol between MS and SGSN (*3GPP TS 44.064* [3gpp-ts-44-064])

Location Area
: Location Area; a geographic area containing multiple BTS

LU
: Location Updating; can be of type IMSI-Attach or Periodic. Procedure that indicates a subscriber's physical presence in a given radio cell.

M2PA
: MTP2 Peer-to-Peer Adaptation; a SIGTRAN Variant (*RFC 4165* [ietf-rfc4165])

M2UA
: MTP2 User Adaptation; a SIGTRAN Variant (*RFC 3331* [ietf-rfc3331])

M3UA
: MTP3 User Adaptation; a SIGTRAN Variant (*RFC 4666* [ietf-rfc4666])

MCC
: Mobile Country Code; unique identifier of a country, e.g. 262 for Germany

MFF
: Machine-to-Machine Form Factor; a SIM chip package that is soldered permanently onto M2M device circuit boards.

MGW
: Media Gateway

MM
: Mobility Management; part of the GSM Layer 3 Protocol

MNC
: Mobile Network Code; identifies network within a country; assigned by national regulator

MNCC
: Mobile Network Call Control; Unix domain socket based Interface between MSC and external call control entity like osmo-sip-connector

MNO
: Mobile Network Operator; operator with physical radio network under his MCC/MNC

MO
: Mobile Originated. Direction from Mobile (MS/UE) to Network

MS
: Mobile Station; a mobile phone / GSM Modem

MSC
: Mobile Switching Center; network element in the circuit-switched core network

MSC pool
: A number of redundant MSCs serving the same core network, which a BSC / RNC distributes load across; see also the "MSC Pooling" chapter in OsmoBSC's user manual [userman-osmobsc] and *3GPP TS 23.236* [3gpp-ts-23-236]

MSISDN
Mobile Subscriber ISDN Number; telephone number of the subscriber

MT
Mobile Terminated. Direction from Network to Mobile (MS/UE)

MTP
Message Transfer Part; SS7 signaling protocol (*ITU-T Q.701* [itu-t-q701])

MVNO
Mobile Virtual Network Operator; Operator without physical radio network

NCC
Network Color Code; assigned by national regulator

NITB
Network In The Box; combines functionality traditionally provided by BSC, MSC, VLR, HLR, SMSC functions; see OsmoNITB

NRI
Network Resource Indicator, typically 10 bits of a TMSI indicating which MSC of an MSC pool attached the subscriber; see also the "MSC Pooling" chapter in OsmoBSC's user manual [userman-osmobsc] and *3GPP TS 23.236* [3gpp-ts-23-236]

NSEI
NS Entity Identifier

NVCI
NS Virtual Circuit Identifier

NWL
Network Listen; ability of some BTS to receive downlink from other BTSs

NS
Network Service; protocol on Gb interface (*3GPP TS 48.016* [3gpp-ts-48-016])

OCXO
Oven Controlled Crystal Oscillator; very high precision oscillator, superior to a VCTCXO

OML
Operation & Maintenance Link (ETSI/*3GPP TS 52.021* [3gpp-ts-52-021])

OpenBSC
Open Source implementation of GSM network elements, specifically OsmoBSC, OsmoNITB, OsmoSGSN

OpenGGSN
Open Source implementation of a GPRS Packet Control Unit

OpenVPN
Open-Source Virtual Private Network; software employed to establish encrypted private networks over untrusted public networks

Osmocom
Open Source MObile COMmunications; collaborative community for implementing communications protocols and systems, including GSM, GPRS, TETRA, DECT, GMR and others

OsmoBSC
Open Source implementation of a GSM Base Station Controller

OsmoNITB
Open Source implementation of a GSM Network In The Box, combines functionality traditionally provided by BSC, MSC, VLR, HLR, AUC, SMSC

OsmoSGSN
Open Source implementation of a Serving GPRS Support Node

OsmoPCU
Open Source implementation of a GPRS Packet Control Unit

OTA
Over-The-Air; Capability of operators to remotely reconfigure/reprogram ISM/USIM cards

PC
Point Code; an address in MTP

PCH
Paging Channel on downlink Um interface; used by network to page an MS

PCP
Priority Code Point (*IEEE 802.1Q* [?])

PCU
Packet Control Unit; used to manage Layer 2 of the GPRS radio interface

PDCH
Packet Data Channel on Um interface; used for GPRS/EDGE signalling + user data

PIN
Personal Identification Number; a number by which the user authenticates to a SIM/USIM or other smart card

PLMN
Public Land Mobile Network; specification language for a single GSM network

PUK
PIN Unblocking Code; used to unblock a blocked PIN (after too many wrong PIN attempts)

RAC
Routing Area Code; 16bit identifier for a Routing Area within a Location Area

RACH
Random Access Channel on uplink Um interface; used by MS to request establishment of a dedicated channel

RAM
Remote Application Management; Ability to remotely manage (install, remove) Java Applications on SIM/USIM Card

RF
Radio Frequency

RFM
Remote File Management; Ability to remotely manage (write, read) files on a SIM/USIM card

Roaming
Procedure in which a subscriber of one network is using the radio network of another network, often in different countries; in some countries national roaming exists

Routing Area
Routing Area; GPRS specific sub-division of Location Area

RR
Radio Resources; Part of the GSM Layer 3 Protocol

RSL
Radio Signalling Link (*3GPP TS 48.058* [3gpp-ts-48-058])

RTP
Real-Time Transport Protocol (*IETF RFC 3550* [ietf-rfc3550]); Used to transport audio/video streams over UDP/IP

SACCH
Slow Associate Control Channel on Um interface; bundled to a TCH or SDCCH, used for signalling in parallel to active dedicated channel

SCCP
Signaling Connection Control Part; SS7 signaling protocol (*ITU-T Q.711* [itu-t-q711])

SDCCH
Slow Dedicated Control Channel on Um interface; used for signalling and SMS transport in GSM

SDK
Software Development Kit

SGs
Interface between MSC (GSM/UMTS) and MME (LTE/EPC) to facilitate CSFB and SMS.

SGSN
Serving GPRS Support Node; Core network element for packet-switched services in GSM and UMTS.

SIGTRAN
Signaling Transport over IP (*IETF RFC 2719* [ietf-rfc2719])

SIM
Subscriber Identity Module; small chip card storing subscriber identity

Site
A site is a location where one or more BTSs are installed, typically three BTSs for three sectors

SMPP
Short Message Peer-to-Peer; TCP based protocol to interface external entities with an SMSC

SMSC
Short Message Service Center; store-and-forward relay for short messages

SS7
Signaling System No. 7; Classic digital telephony signaling system

SS
Supplementary Services; query and set various service parameters between subscriber and core network (e.g. USSD, 3rd-party calls, hold/retrieve, advice-of-charge, call deflection)

SSH
Secure Shell; *IETF RFC 4250* [ietf-rfc4251] to 4254

SSN
Sub-System Number; identifies a given SCCP Service such as MSC, HLR

STP
Signaling Transfer Point; A Router in SS7 Networks

SUA
SCCP User Adaptation; a SIGTRAN Variant (*RFC 3868* [ietf-rfc3868])

syslog
System logging service of UNIX-like operating systems

System Information
A set of downlink messages on the BCCH and SACCH of the Um interface describing properties of the cell and network

TCH
Traffic Channel; used for circuit-switched user traffic (mostly voice) in GSM

TCP
Transmission Control Protocol; (*IETF RFC 793* [ietf-rfc793])

TFTP
Trivial File Transfer Protocol; (*IETF RFC 1350* [ietf-rfc1350])

TOS
Type Of Service; bit-field in IPv4 header, now re-used as DSCP (*IETF RFC 791* [ietf-rfc791])

TRX
Transceiver; element of a BTS serving a single carrier

TS
Technical Specification

u-Boot
Boot loader used in various embedded systems

UBI
An MTD wear leveling system to deal with NAND flash in Linux

UBL
Initial bootloader loaded by the TI Davinci SoC

UDP
User Datagram Protocol (*IETF RFC 768* [ietf-rfc768])

UICC
Universal Integrated Chip Card; A smart card according to *ETSI TR 102 216* [etsi-tr102216]

Um interface
U mobile; Radio interface between MS and BTS

uplink
Direction of messages: Signals from the mobile phone towards the network

USIM
Universal Subscriber Identity Module; application running on a UICC to provide subscriber identity for UMTS and GSM networks

USSD
Unstructured Supplementary Service Data; textual dialog between subscriber and core network, e.g. **100 → Your extension is 1234*

VAMOS
Voice services over Adaptive Multi-user channels on One Slot; an optional extension for GSM specified in Release 9 of 3GPP GERAN specifications (*3GPP TS 48.018* [3gpp-ts-48-018]) allowing two independent UEs to transmit and receive simultaneously on traffic channels

VCTCXO
Voltage Controlled, Temperature Compensated Crystal Oscillator; a precision oscillator, superior to a classic crystal oscillator, but inferior to an OCXO

VLAN
Virtual LAN in the context of Ethernet (*IEEE 802.1Q* [ieee-802.1q])

VLR
Visitor Location Register; volatile storage of attached subscribers in the MSC

VPLMN
Visited PLMN; the network in which the subscriber is currently registered; may differ from HPLMN when on roaming

VTY
Virtual TeletYpe; a textual command-line interface for configuration and introspection, e.g. the OsmoBSC configuration file as well as its telnet link on port 4242

A Osmocom TCP/UDP Port Numbers

The Osmocom GSM system utilizes a variety of TCP/IP based protocols. The table below provides a reference as to which port numbers are used by which protocol / interface.

Table 49: TCP/UDP port numbers

L4 Protocol	Port Number	Purpose	Software
UDP	1984	Osmux	osmo-mgw, osmo-bts
UDP	2427	MGCP GW	osmo-bsc_mgcp, osmo-mgw
TCP	2775	SMPP (SMS interface for external programs)	osmo-nitb
TCP	3002	A-bis/IP OML	osmo-bts, osmo-bsc, osmo-nitb
TCP	3003	A-bis/IP RSL	osmo-bts, osmo-bsc, osmo-nitb
TCP	4227	telnet (VTY)	osmo-pcap-client
TCP	4228	telnet (VTY)	osmo-pcap-server
TCP	4236	Control Interface	osmo-trx
TCP	4237	telnet (VTY)	osmo-trx
TCP	4238	Control Interface	osmo-bts
TCP	4239	telnet (VTY)	osmo-stp
TCP	4240	telnet (VTY)	osmo-pcu
TCP	4241	telnet (VTY)	osmo-bts
TCP	4242	telnet (VTY)	osmo-nitb, osmo-bsc, cellmgr-ng
TCP	4243	telnet (VTY)	osmo-bsc_mgcp, osmo-mgw
TCP	4244	telnet (VTY)	osmo-bsc_nat
TCP	4245	telnet (VTY)	osmo-sgsn
TCP	4246	telnet (VTY)	osmo-gbproxy
TCP	4247	telnet (VTY)	OsmocomBB
TCP	4249	Control Interface	osmo-nitb, osmo-bsc
TCP	4250	Control Interface	osmo-bsc_nat
TCP	4251	Control Interface	osmo-sgsn
TCP	4252	telnet (VTY)	sysmobts-mgr
TCP	4253	telnet (VTY)	osmo-gtphub
TCP	4254	telnet (VTY)	osmo-msc
TCP	4255	Control Interface	osmo-msc
TCP	4256	telnet (VTY)	osmo-sip-connector
TCP	4257	Control Interface	osmo-ggsn, ggsn (OpenGGSN)
TCP	4258	telnet (VTY)	osmo-hlr
TCP	4259	Control Interface	osmo-hlr
TCP	4260	telnet (VTY)	osmo-ggsn
TCP	4261	telnet (VTY)	osmo-hnbgw
TCP	4262	Control Interface	osmo-hnbgw
TCP	4263	Control Interface	osmo-gbproxy
TCP	4264	telnet (VTY)	osmo-cbc
TCP	4265	Control Interface	osmo-cbc
TCP	4266	D-GSM MS Lookup: mDNS serve	osmo-hlr
TCP	4267	Control Interface	osmo-mgw
TCP	4268	telnet (VTY)	osmo-uecups
SCTP	4268	UECUPS	osmo-uecups
TCP	4269	telnet (VTY)	osmo-e1d
TCP	4270	telnet (VTY)	osmo-isdntap
TCP	4271	telnet (VTY)	osmo-smlc
TCP	4272	Control Interface	osmo-smlc
TCP	4273	telnet (VTY)	osmo-hnodeb
TCP	4274	Control Interface	osmo-hnodeb

Table 49: (continued)

L4 Protocol	Port Number	Purpose	Software
TCP	4275	telnet (VTY)	osmo-upf
TCP	4276	Control Interface	osmo-upf
TCP	4277	telnet (VTY)	osmo-pfcp-tool
TCP	4278	Control Interface	osmo-pfcp-tool
UDP	4729	GSMTAP	Almost every osmocom project
TCP	5000	A/IP	osmo-bsc, osmo-bsc_nat
UDP	23000	GPRS-NS over IP default port	osmo-pcu, osmo-sgsn, osmo-gbproxy
TCP	48049	BSC-CBC (CBSP) default port	osmo-bsc, osmo-cbc

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