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OsmoPCU Gb Protocol Specification

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DRAFT

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

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NUMBER	DATE	DESCRIPTION	NAME
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1 Introduction

This document describes the Gb interface of **OsmoPCU**. Based on 3GPP TS 48.016 and 48.018, this document indicates which of the 3GPP specified Gb messages and IEs are implemented according to 3GPP specifications, which of these are not or not fully implemented, as well as OsmoPCU-specific extensions to the Gb interface not specified by 3GPP.

Extensions to the Gb interface specific to OsmoPCU 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
3GPP TS 48.016	version 15.0.0 Release 15
3GPP TS 48.018	version 15.0.0 Release 15

Table 2: IETF documents referred to by his document

IETF RFC 768	User Datagram Protocol
IETF RFC 791	Internet Protocol

2 Overview

The OsmoPCU Gb interface consists of the NS (Network Services) and BSSGP (Base Station Subsystem Gateway Protocol), encapsulated in UDP (User Datagram Protocol) and IP (Internet Protocol) version 4. Use of other underlying protocols (e. g. Frame Relay) is not supported.

Table 3: UDP port numbers used by OsmoPCU Gb/IP

TCP Port Number	**Usage**
23000	NS over UDP (default port)

The NS-over-UDP link is established in the PCU → SGSN direction, i.e. the PCU is running as client while the SGSN is running as server.

Establishment of the NS-over-UDP link is only possible after OsmoPCU has been configured via the **PCU socket** interface from OsmoBTS.

OsmoBTS in turn receives relevant configuration parameters from OsmoBSC or the BSC component inside OsmoNITB.

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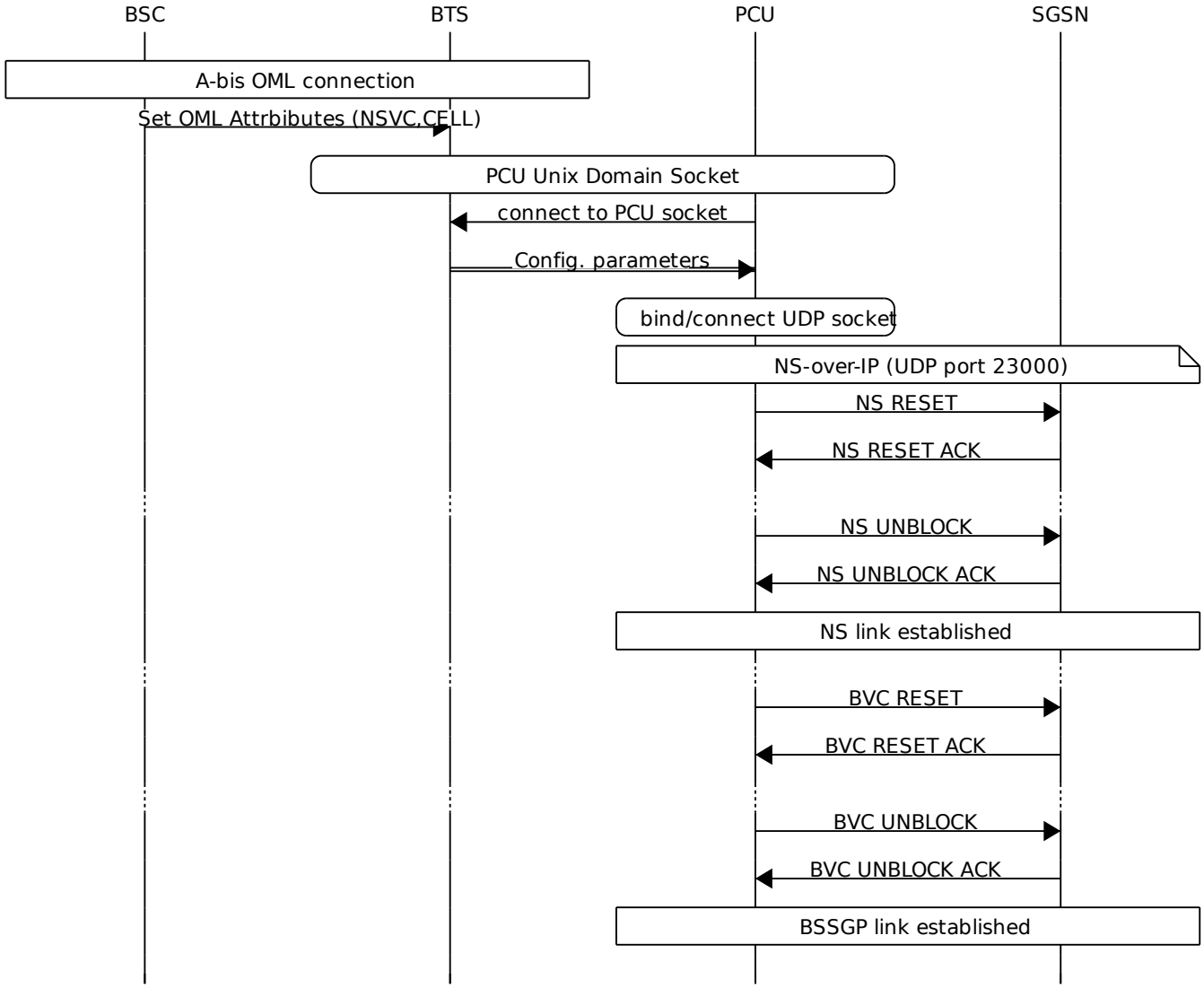


Figure 1: Overview of Gb link establishment

2.1 Identities

The Gb interface identities of the PCU are configured via BSC → OsmoBTS → PCU Socket. They consist of

NSEI
NS Equipment Identifier

NSVCI
NS Virtual Connection Identifier

BVCI
BSSGP Virtual Connection Identifier

For an explanation of those identifiers and their use in the NS and BSSGP protocols, please see the relevant 3GPP specifications for NS (TS 48.016) and BSSGP (TS 48.018).

In most cases, all above identities belong to different namespaces and must be unique within their respective namespace and within the SGSN they connect to.

This means that typically each OsmoPCU has one unique set of NSEI, NSVCI and BVCI in your network.

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3 Network Service (NS)

3.1 List of Messages

The following tables list the NS messages used by osmo-pcu and osmo-gbproxy, grouped by their level of compliance with 3GPP TS 48.016.

3.1.1 Messages Compliant With 3GPP TS 48.016

The NS protocol is implemented inside libosmogb so none of the messages below are sent by OsmoPCU explicitly. Instead corresponding functions from libosmogb are called which send and receive messages as necessary. See Section 3.5 for details on establishing NS connection.

Table 4: Messages compliant with 3GPP TS 48.016

TS 48.016 §	type code (hex)	This document §	Message	←/→	Received/Sent by OsmoPCU
9.2.1	0x0a	Section 3.2.9	NS-ALIVE	←/→	Received/Sent
9.2.2	0x0b	Section 3.2.10	NS-ALIVE-ACK	←/→	Received/Sent
9.2.3	0x04	Section 3.2.4	NS-BLOCK	←/→	Received/Sent
9.2.4	0x05	Section 3.2.5	NS-BLOCK-ACK	←/→	Received/Sent
9.2.5	0x02	Section 3.2.2	NS-RESET	←/→	Received/Sent
9.2.6	0x03	Section 3.2.3	NS-RESET-ACK	←/→	Received/Sent
9.2.7	0x08	Section 3.2.8	NS-STATUS	←/→	Received/Sent
9.2.8	0x06	Section 3.2.6	NS-UNBLOCK	←/→	Received/Sent
9.2.9	0x07	Section 3.2.7	NS-UNBLOCK-ACK	←/→	Received/Sent
9.2.10	0x00	Section 3.2.1	NS-UNITDATA	←/→	Received/Sent
9.3.1	0x0c	Section 3.2.11	SNS-ACK	←/→	Received/Sent
9.3.2	0x0d	Section 3.2.12	SNS-ADD	←/→	Received/Sent
9.3.3	0x0e	Section 3.2.13	SNS-CHANGEWEIGHT	←/→	Received/Sent
9.3.4	0x0f	Section 3.2.14	SNS-CONFIG	←/→	Received/Sent
9.3.5	0x10	Section 3.2.15	SNS-CONFIG	←/→	Received/Sent
9.3.6	0x11	Section 3.2.16	SNS-DELETE	←/→	Received/Sent
9.3.7	0x12	[?]	SNS-SIZE	←/→	Received/Sent
9.3.8	0x13	Section 3.2.18	SNS-SIZE-ACK	←/→	Received/Sent

3.1.2 Messages Specific to OsmoPCU

There are no OsmoPCU specific NS messages.

3.1.3 Messages Not Implemented by OsmoPCU

All the NS protocol messages from 3GPP TS 48.016 are implemented in OsmoPCU.

3.2 Details on Compliant NS Messages

3.2.1 NS-UNITDATA

This PDU transfers one NS SDU (specified in 3GPP TS 08.18) between OsmoPCU and SGSN. Upon receiving it OsmoPCU passes it to BSSGP implementation to handle. It is also sent by BSSGP as necessary - see Section 4 for details.

It contains BVCI (Section 3.4.5) and NS SDU (Section 3.4.4) IEs.

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3.2.2 NS-RESET

This message is send by OsmoPCU in order to initiate reset procedure described in 3GPP TS 48.016 § 7.3. The expected reply is NS-RESET-ACK (Section 3.2.3) message. If no expected reply is received in 3 seconds than the sending is retried up to 3 times. When this message is received it is replied with NS-RESET-ACK (Section 3.2.3). It might be ignored under conditions described in 3GPP TS 48.016 § 7.3.1.

The message conforms to 3GPP TS 48.016 § 9.2.5 specification.

It contains Cause (Section 3.4.1), NSVCI (Section 3.4.2) and NSEI (Section 3.4.6) IEs.

3.2.3 NS-RESET-ACK

This message is sent as a response to proper NS-RESET (Section 3.2.2) message initiating reset procedure.

The message conforms to 3GPP TS 48.016 § 9.2.6 specification.

It contains NSVCI (Section 3.4.2) and NSEI (Section 3.4.6) IEs.

3.2.4 NS-BLOCK

Upon receiving this message corresponding NS-VC is marked as blocked by OsmoPCU and NS-BLOCK-ACK (Section 3.2.5) reply is transmitted. When this message is sent by OsmoPCU corresponding NS-BLOCK-ACK (Section 3.2.5) reply is expected before NS-VC is actually marked as blocked. This behavior follows the blocking procedure described in 3GPP TS 48.016 § 7.2.

The message conforms to 3GPP TS 48.016 § 9.2.3 specification.

It contains Cause (Section 3.4.1) and NSVCI (Section 3.4.2) IEs.

3.2.5 NS-BLOCK-ACK

This message is sent by OsmoPCU automatically upon reception of correct NS-BLOCK (Section 3.2.4) message. It is expected as a reply for NS-BLOCK (Section 3.2.4) message sent by OsmoPCU.

The message conforms to 3GPP TS 48.016 § 9.2.4 specification.

It contains NSVCI (Section 3.4.2) IE.

3.2.6 NS-UNBLOCK

Upon receiving this message corresponding NS-VC is unblocked by OsmoPCU and NS-UNBLOCK-ACK (Section 3.2.7) reply is sent. When this message is sent by OsmoPCU corresponding NS-UNBLOCK-ACK (Section 3.2.7) reply is expected before NS-VC is actually marked as unblocked. This behavior follows the blocking procedure described in 3GPP TS 48.016 § 7.2.

The message conforms to 3GPP TS 48.016 § 9.2.8 specification.

3.2.7 NS-UNBLOCK-ACK

Receiving this message notifies OsmoPCU that NS-VC unblocking request is confirmed and thus NS-VC is marked as unblocked. This message is also sent as a reply to NS-UNBLOCK (Section 3.2.6) message.

The message conforms to 3GPP TS 48.016 § 9.2.9 specification.

3.2.8 NS-STATUS

This message is sent to inform other party about error conditions as a response to various unexpected PDUs or PDUs with unexpected/missing data. If this message is received for unknown NS-VC it is ignored in accordance with 3GPP TS 48.016 § 7.5.1, otherwise the error cause is logged if present in NS-STATUS.

The message conforms to 3GPP TS 48.016 § 9.2.7 specification.

It contains Cause (Section 3.4.1) and might (depending on actual error) contain NSVCI (Section 3.4.2), NS PDU (Section 3.4.3) and BVCI (Section 3.4.5) IEs.

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3.2.9 NS-ALIVE

This message is sent periodically to test connectivity according to 3GPP TS 48.016 § 4.5.3. The expected response is NS-ALIVE-ACK (Section 3.2.10). If no such response arrives within given amount of time (3 seconds) than another NS-ALIVE message is sent and failed test attempt is recorded. After 10 failed attempts NS connection is considered dead and OsmoPCU tries to reconnect.

The message conforms to 3GPP TS 48.016 § 9.2.1 specification.

3.2.10 NS-ALIVE-ACK

This message is sent automatically in reply to NS-ALIVE (Section 3.2.9) message.

The message conforms to 3GPP TS 48.016 § 9.2.2 specification.

3.2.11 SNS-ACK

3.2.12 SNS-ADD

3.2.13 SNS-CHANGEWEIGHT

3.2.14 SNS-CONFIG

3.2.15 SNS-CONFIG-ACK

3.2.16 SNS-DELETE

3.2.17 SNS-SIZE

3.2.18 SNS-SIZE-ACK

3.3 Information Elements Overview

All of the IEs handled by OsmoPCU are listed below, with limitations and additions to 3GPP TS 48.016 specified in more detail.

3.3.1 IEs Conforming to 3GPP TS 48.016

The following Information Elements are accepted by OsmoPCU.

Table 5: IEs conforming to 3GPP TS 48.016

tag (hex)	TS 48.016 §	IE name	←/→	Received/Sent by OsmoPCU
0x03	10.3.1	BVCI	←/→	Received/Sent
0x00	10.3.2	Cause	←/→	Received/Sent
-	10.3.2a	End Flag	←/→	Received/Sent
0x0b	10.3.2b	IP Address	←/→	Received/Sent
0x05	10.3.2c	List of IP4 Elements	←/→	Received/Sent
0x06	10.3.2d	List of IP6 Elements	←/→	Received/Sent
0x07	10.3.2e	Maximum Number of NS-VCs	←/→	Received/Sent
0x08	10.3.2f	Number of IP4 Endpoints	←/→	Received/Sent
0x09	10.3.2g	Number of IP6 Endpoints	←/→	Received/Sent
0x02	10.3.3	NS PDU	←/→	Received/Sent
0x01	10.3.5	NSVCI	←/→	Received/Sent
0x04	10.3.6	NSEI	←/→	Received/Sent

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Table 5: (continued)

tag (hex)	TS 48.016 §	IE name	←/→	Received/Sent by OsmoPCU
-	10.3.7	PDU Type	←/→	Received/Sent
0x0a	10.3.7a	Reset Flag	←/→	Received/Sent
-	10.3.8	Spare Octet	←/→	Received/Sent
-	10.3.10	Transaction ID	←/→	Received/Sent

3.3.2 IEs Not Conforming to 3GPP TS 48.016

Table 6: IEs conforming to 3GPP TS 48.016

tag (hex)	TS 48.016 §	IE name	←/→	Notice
-	10.3.9	NS-SDU Control Bits	←/→	Not implemented yet

All other IEs defined in 3GPP TS 48.016 § 10.3 are supported by OsmoPCU.

3.3.3 Additional Attributes and Parameters

There are no OsmoPCU specific additional Attributes and Parameters.

3.4 Details on IEs

3.4.1 Cause

This IE contains reason for a procedure or error as described in 3GPP TS 48.016 § 10.3.2.

3.4.2 NSVCI

This IE represents NSVCI identity described in Section 2.1 and 3GPP TS 48.016 § 10.3.5.

3.4.3 NS PDU

This IE contains PDU (possibly truncated) which cause error described in NS-STATUS message (Section 3.2.8) as described in 3GPP TS 48.016 § 10.3.3.

3.4.4 NS SDU

This IE contains BSSGP data - see Section 4 for details.

3.4.5 BVCI

This IE represents BSSGP identity described in Section 2.1 and 3GPP TS 48.016 § 10.3.1.

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3.4.6 NSEI

This IE represents NSEI identity described in Section 2.1 and 3GPP TS 48.016 § 10.3.6.

3.5 Gb NS Initialization / PCU bring-up

OsmoPCU binds and connects an UDP socket for NS using port numbers and IP information given by OsmoBTS via the PCU socket. OsmoBTS in turn receives this information from the BSC vi A-bis OML.

Following successful initialization of the UDP socket, the reset procedure is initiated as described in Section 3.2.2.

4 BSS GPRS Protocol (BSSGP)

4.1 List of Messages

The following tables list the BSSGP messages used by OsmoPCU, grouped by their level of compliance with 3GPP TS 48.018.

4.1.1 Messages Compliant With TS 48.018

Table 7: Messages compliant with TS 48.018

TS 48.018 §	type code (hex)	This document §	Message	←/→	Received/Sent by OsmoPCU
RL and BSSGP SAP Messages:					
10.2.1	0x00	Section 4.2.1	DL-UNITDATA	←	Received
10.2.2	0x01	Section 4.2.2	UL-UNITDATA	→	Sent
10.2.3	0x02	Section 4.2.3	RA-CAPABILITY	←	Received
GMM SAP Messages:					
10.3.1	0x06	Section 4.2.4	PAGING PS	←	Received
10.3.2	0x07	Section 4.2.5	PAGING CS	←	Received
10.3.7	0x0c	Section 4.2.6	SUSPEND-ACK	←	Received
10.3.8	0x0d	Section 4.2.7	SUSPEND-NACK	←	Received
10.3.10	0x0f	Section 4.2.8	RESUME-ACK	←	Received
10.3.11	0x10	Section 4.2.9	RESUME-NACK	←	Received
NM SAP Messages:					
10.4.9	0x21	Section 4.2.10	BVC-BLOCK-ACK	←	Received
10.4.12	0x22	Section 4.2.11	BVC-RESET	←/→	Received/Sent
10.4.13	0x23	Section 4.2.12	BVC-RESET-ACK	←	Received
10.4.10	0x24	Section 4.2.14	BVC-UNBLOCK	→	Sent
10.4.11	0x25	Section 4.2.13	BVC-UNBLOCK-ACK	←	Received
10.4.4	0x26	Section 4.2.17	FLOW-CONTROL-BVC	→	Sent
10.4.5	0x27	Section 4.2.16	FLOW-CONTROL-BVC-ACK	←	Received
10.4.7	0x29	Section 4.2.15	FLOW-CONTROL-MS-ACK	←	Received
10.4.1	0x2a	Section 4.2.18	FLUSH-LL	←	Received
10.4.15	0x40	Section 4.2.19	SGSN-INVOKE-TRACE	←	Received
10.4.14	0x41	Section 4.2.20	STATUS	←/→	Received/Sent

4.1.2 Messages Specific to OsmoPCU

There are no OsmoPCU specific BSSGP messages.

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4.1.3 Messages Not Implemented by OsmoPCU

Table 8: 3GPP TS 48.018 messages not implemented by OsmoPCU

TS 48.018 §	type code (hex)	Message
RL (relay) and BSSGP SAP Messages:		
10.2.4	0x03	PTM-UNITDATA
GMM (GPRS mobility management) SAP Messages:		
10.3.3	0x08	RA-CAPABILITY-UPDATE
10.3.4	0x09	RA-CAPABILITY-UPDATE-ACK
10.3.5	0x0a	RADIO-STATUS
10.3.6	0x0b	SUSPEND
10.3.9	0x0e	RESUME
NM (network management) SAP Messages:		
10.4.8	0x20	BVC-BLOCK
10.4.6	0x28	FLOW-CONTROL-MS
10.4.2	0x2b	FLUSH-LL-ACK
10.4.3	0x2c	LLC-DISCARDED
PFM (packet flow management) SAP Messages:		
10.4.16	0x50	DOWNLOAD-BSS-PFC
10.4.17	0x51	CREATE-BSS-PFC
10.4.18	0x52	CREATE-BSS-PFC-ACK
10.4.19	0x53	CREATE-BSS-PFC-NACK
10.4.20	0x54	MODIFY-BSS-PFC
10.4.21	0x55	MODIFY-BSS-PFC-ACK
10.4.22	0x56	DELETE-BSS-PFC
10.4.23	0x57	DELETE-BSS-PFC-ACK

4.2 Details on Compliant BSSGP Messages

4.2.1 DL-UNITDATA

This message conforms to 3GPP TS 48.018 § 10.2.1, with the following limitations:

- OsmoPCU does not support QoS
- all optional IEs except for IMSI and old TLLI are ignored.

Table 9: *DL-UNITDATA* IE limitations

TS 48.018 §	IE Name	Handling
11.3.28	QoS Profile	*ignored*
11.3.22	MS Radio Access Capability	*ignored*
11.3.27	Priority	*ignored*
11.3.11	DRX Parameters	*ignored*
1.3.42	PFI	*ignored*
11.3.19	LSA Information	*ignored*
11.3.47	Service UTRAN CCO	*ignored*

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4.2.2 UL-UNITDATA

This message conforms to 3GPP TS 48.018 § 10.2.2, with the following limitations:

- OsmoPCU does not send optional IEs - PFI (§ 12.3.42) and LSA Identifier List (§ 11.3.18).
- QoS Profile (§ 11.3.28) IE is always set to 0x04.

4.2.3 RA-CAPABILITY

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.4 PAGING PS

This message conforms to 3GPP TS 48.018 § 10.3.1, with the following limitations:

- only IMSI and P-TMSI are parsed by OsmoPCU.

Table 10: *DL-UNITDATA* IE limitations

TS 48.018 §	**IE Name**	**Handling**
11.3.11	DRX Parameters	*ignored*
11.3.6	BVCI	*ignored*
11.3.17	Location Are	*ignored*
11.3.31	Routeing Area	*ignored*
11.3.3	BSS Area Indication	*ignored*
11.3.42	PFI	*ignored*
11.3.43	ABQP	*ignored*
11.3.28	QoS Profile	*ignored*
11.3.36	P-TMSI	treated as mandatory (in case of absence paging with 0-length P-TMSI will be sent)

4.2.5 PAGING CS

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.6 SUSPEND-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.7 SUSPEND-NACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.8 RESUME-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

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4.2.9 RESUME-NACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.10 BVC-BLOCK-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.11 BVC-RESET

OsmoPCU never transmits optional Feature bitmap (3GPP TS 48.018 § 11.3.40) IE.

Receiving BVC RESET will cause OsmoPCU to respond with "Unknown BVCI" status message.

4.2.12 BVC-RESET-ACK

This message conforms to 3GPP TS 48.018 § 10.4.13.

After receiving it OsmoPCU completes the RESET procedure for BVC according to 3GPP TS 48.018 § 8.4.

4.2.13 BVC-UNBLOCK-ACK

This message conforms to 3GPP TS 48.018 § 10.4.11.

After receiving it OsmoPCU completes the RESET procedure for BVC according to 3GPP TS 48.018 § 8.3.

4.2.14 BVC-UNBLOCK

This message conforms to 3GPP TS 48.018 § 10.4.10 and is send by OsmoPCU as part of UNBLOCK procedure described in 3GPP TS 48.018 § 8.3.

4.2.15 FLOW-CONTROL-MS-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.16 FLOW-CONTROL-BVC-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.17 FLOW-CONTROL-BVC

This message conforms to 3GPP TS 48.018 § 10.4.4, with the following limitations:

- OsmoPCU does not support Current Bucket Level (CBL) feature so Bucket_Full Ratio (TS 48.018 § 11.3.46) IE is not transmitted as part of this message.

4.2.18 FLUSH-LL

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.19 SGSN-INVOKE-TRACE

This message is received and logged but ignored by OsmoPCU at the moment.

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4.2.20 STATUS

This message conforms to 3GPP TS 48.018 § 10.4.14.

4.3 Information Elements Overview

All of the IEs handled by OsmoPCU are listed below, with limitations and additions to 3GPP TS 48.018 specified in more detail.

4.3.1 IEs Conforming to 3GPP TS 48.018

The following Information Elements are accepted by OsmoPCU. Not all IEs are actually evaluated.

Table 11: IEs conforming to 3GPP TS 48.018

tag (hex)	TS 48.018 §	IE name	←/→	Received/Sent by OsmoPCU
0x00	11.3.1	Alignment Octets	←/→	Received/Sent
0x01	11.3.2	Bmax default MS	→	Sent
0x02	11.3.3	BSS Area Indication	←	Received
0x03	11.3.4	Bucket Leak Rate	→	Sent
0x04	11.3.6	BVCI	←/→	Received/Sent
0x05	11.3.5	BVC Bucket Size	→	Sent
0x06	11.3.7	BVC Measurement	→	Sent
0x07	11.3.8	Cause	←/→	Received/Sent
0x08	11.3.9	Cell Identifier	→	Sent
0x09	11.3.10	Channel needed	←	Received
0x0a	11.3.11	DRX Parameters	←	Received
0x0b	11.3.12	eMLPP-Priority	←	Received
0x0c	11.3.13	Flush Action	←	Received
0x0d	11.3.14	IMSI	←/→	Received/Sent
0x0e	11.3.15	LLC-PDU	←/→	Received/Sent
0x0f	11.3.16	LLC Frames Discarded	→	Sent
0x10	11.3.17	Location Area	←	Received
0x11	11.3.20	Mobile Id	←	Received
0x12	11.3.21	MS Bucket Size	→	Sent
0x13	11.3.22	MS Radio Access Capability	←	Received
0x14	11.3.23	OMC Id	←	Received
0x15	11.3.24	PDU In Error	←/→	Received/Sent
0x16	11.3.25	PDU Lifetime	←	Received
0x17	11.3.27	Priority	←	Received
0x19	11.3.29	Radio Cause	→	Sent
0x1a	11.3.30	RA-Cap-UPD-Cause	→	Sent
0x1b	11.3.31	Routeing Area	←/→	Received/Sent
0x1c	11.3.32	R_default_MS	→	Sent
0x1d	11.3.33	Suspend Reference Number	←/→	Received/Sent
0x1e	11.3.34	Tag	←/→	Received/Sent
0x1f	11.3.35	TLLI	←/→	Received/Sent
0x20	11.3.36	TMSI	←/→	Received/Sent
0x21	11.3.37	Trace Reference	←	Received
0x22	11.3.38	Trace Type	←	Received
0x23	11.3.39	TransactionId	←	Received
0x24	11.3.40	Trigger Id	←	Received
0x25	11.3.41	Number of octets affected	→	Sent
0x26	11.3.18	LSA Identifier List	→	Sent
0x27	11.3.19	LSA Information	←	Received

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Table 11: (continued)

tag (hex)	TS 48.018 §	IE name	←/→	Received/Sent by OsmoPCU
0x28	11.3.42	Packet Flow Identifier	←/→	Received/Sent
0x3a	11.3.43	Aggregate BSS QoS Profile (ABQP)	←/→	Received/Sent
0x3b	11.3.45	Feature Bitmap	←/→	Received/Sent
0x3c	11.3.46	Bucket_Full Ratio	→	Sent
0x3d	11.3.47	Service UTRAN CCO (Cell Change Order)	←	Received

4.3.2 IEs Not Conforming to 3GPP TS 48.018

Table 12: IEs not conforming to 3GPP TS 48.018

tag (hex)	TS 48.018 §	IE name	Description
0x18	11.3.28	QoS Profile	Received value is ignored. Sent value is hard-coded to 0x4 (3 octets).

4.3.3 Additional Attributes and Parameters

There are no OsmoPCU specific additional Attributes and Parameters.

4.4 Details on IEs

4.4.1 BSS Area Indication

This IE is ignored by OsmoPCU.

4.4.2 Bucket Leak Rate

The value used by OsmoPCU for this IE can be set through configuration file or vty via "flow-control force-ms-leak-rate <1-6553500>" command.

4.4.3 BVC Bucket Size

The value used by OsmoPCU for this IE can be set through configuration file or vty via "flow-control force-bvc-bucket-size <1-6553500>" command.

4.4.4 Channel needed

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.5 for details.

4.4.5 DRX Parameters

This IE is ignored by OsmoPCU.

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4.4.6 eMLPP-Priority

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.5 for details.

4.4.7 Flush Action

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.18 for details.

4.4.8 LLC Frames Discarded

This IE is not available because entire message which contains it (LLC-DISCARDED) is not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.9 Location Area

This IE is ignored by OsmoPCU.

4.4.10 Mobile Id

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.11 MS Bucket Size

The value used by OsmoPCU for this IE can be set through configuration file or vty via "flow-control force-ms-bucket-size <1-6553500>" command.

4.4.12 MS Radio Access Capability

This IE is ignored by OsmoPCU.

4.4.13 OMC Id

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.14 Priority

This IE is ignored by OsmoPCU.

4.4.15 QoS Profile

No QoS is supported by OsmoPCU so this IE is ignored or safe default used when mandatory.

4.4.16 Radio Cause

This IE is not available because entire message which contains it (RADIO-STATUS) is not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.17 RA-Cap-UPD-Cause

This IE is not available because entire message which contains it (RA-CAPABILITY-UPDATE-ACK) is not implemented by OsmoPCU - see for Section 4.1.3 details.

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4.4.18 Routeing Area

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.19 Suspend Reference Number

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.20 Tag

This IE currently only used by OsmoPCU for Flow Control procedure (TS 48.018 § 8.2). In other cases it's either ignored or unavailable.

4.4.21 Trace Reference

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.22 Trace Type

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.23 TransactionId

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.24 Trigger Id

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.25 Number of octets affected

This IE is not available because the messages which contains it (FLUSH-LL-ACK and LLC-DISCARDE) are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.26 LSA Information

This IE is ignored by OsmoPCU.

4.4.27 LSA Identifier List

This IE is not implemented by OsmoPCU.

4.4.28 Packet Flow Identifier

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

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4.4.29 Aggregate BSS QoS Profile (ABQP)

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.30 Feature Bitmap

This IE is not implemented by OsmoPCU.

This IE is ignored by OsmoPCU when received.

Absence of Feature Bitmap automatically disables optional features for Network Service Entity (NSE) communicating with OsmoPCU.

4.4.31 Bucket_Full Ratio

This IE is not implemented by OsmoPCU.

4.4.32 Service UTRAN CCO (Cell Change Order)

This IE is ignored by OsmoPCU.

4.5 Gb BSSGP Initialization / PCU bring-up

The BSSGP initialization directly follows NS connection establishment described in Section 3.5.

OsmoPCU allocates a BVC context for the BVCI given by OsmoBTS, which in turn receives it from OsmoBSC or OsmoNITB via OML procedures.

In addition to the BVCI identifying the OsmoPCU side of BSSGP connection, there is also special BVCI which is accepted by OsmoPCU in accordance with 3GPP TS 48.018 § 5.4.1: BVCI = 0 represents signaling data between SGSN and PCU in contrast to PTP (Peer-To-Peer) user's data.

The mapping between BSSGP PDUs and signaling or PTP BVCIs is available in 3GPP TS 48.018 Table 5.4.

5 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* [?])

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

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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* [?] and *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* [?])

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* [?])

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)

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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* [?])

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

DSCP
Differentiated Services Code Point (*IETF RFC 2474* [?])

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

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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* [?])

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

Iu
Interface in 3G/UMTS between RAN and CN

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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* [?])

LAPDm
Link Access Protocol Mobile (*3GPP TS 44.006* [?])

LLC
Logical Link Control; GPRS protocol between MS and SGSN (*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* [?])

M2UA
MTP2 User Adaptation; a SIGTRAN Variant (*RFC 3331* [?])

M3UA
MTP3 User Adaptation; a SIGTRAN Variant (*RFC 4666* [?])

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

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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 [?] and *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* [?])

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 [?] and *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* [?])

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

OML
Operation & Maintenance Link (ETSI/*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

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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* [?])

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RTP
Real-Time Transport Protocol (*IETF RFC 3550* [?]); 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* [?])

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* [?])

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* [?] 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* [?])

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

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TCP
Transmission Control Protocol; (*IETF RFC 793* [?])

TFTP
Trivial File Transfer Protocol; (*IETF RFC 1350* [?])

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

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* [?])

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

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* [?]) 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* [?])

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

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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 13: 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
TCP	4275	telnet (VTY)	osmo-upf

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Table 13: (continued)

L4 Protocol	Port Number	Purpose	Software
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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