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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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1 Scope

The present document gives the principles on which the detailed interface specifications in the rest of the 3GPP TS 48.0xx series of Technical Specifications are based.

The set of fixed equipment accessed from the MSC through one particular instance of the interface will be later referred to as a Base Station System (BSS). A BSS ensures the coverage of n cells, where n can be 1 or more.

The function of a BSS may be further subdivided into a control function, performed by one Base Station Controller (BSC) and a transceiving function, performed by "n" Base Transceiver Station equipments (BTS), one for each cell. However, the study of such a split is outside the scope of the 48.0xx series of Technical Specifications, where the BSS will be considered as a whole.

The BSS-MSC interface defined in the 3GPP TS 48 series of Technical Specifications is designed to support a wide range of possible architectures on both sides. Characteristics like location of the transcoders/rate adaptation to the MSS or inside the BSS (either physically integrated into the transceivers or very near to the MSC) or the use of traffic or signalling concentration at either side are left to the operators' choice. Annex A to the present document contains guidance information concerning the use of remote mobile switching units, which for the purposes of the present document are considered as part of the MSC.

The BSS-MSC interface is commonly called "A-Interface". It is subdivided into the Control Plane (signalling) and the User Plane (traffic). Throughout this document the term "MSC" is used to reflect both planes of the Mobile Core Network, although in some architecture the Mobile Core Network is split into MSC-Server (MSC-S) and Media Gateway (MGW).

Direct connection between two BSSs is not supported by this A-Interface.

This A-Interface may be based on

- TDM using 1 or more 2 048 kbit/s digital transmission system interfaces. Each 2 048 kbit/s interface provides 31*64 kbit/s channels which can be used for traffic (User Plane) or signalling (Control Plane) as the operator requires, and/or

- IP supporting User Plane and/or Control Plane (SIGTRAN).The signalling is layered, terminology similar to that in the OSI reference model is used in this series, however the layers referred to are not identical to the equivalently named layer in the OSI model.

This A-Interface User Plane is defined at the boundary of the MSC and

- in case of TDM, it has a per channel bit rate of 64 kbit/s, but the net radio path traffic channel is at a rate of less than 16 kbit/s. A speech transcoder or data rate adapter function is thus needed for the rate conversion. The interface is designed such that the transcoding or rate adaptation function may be geographically situated at either the MSC site or the BSS site, however the transcoder is considered to be part of the BSS

- in case of IP, it has a flexible channel bit rate, adapted to the payload size. The speech transcoding function can be part of either the BSS or the Core Network or can be omitted (transcoding free operation), allowing e.g. for use of both, PCM encoded speech and compressed speech, over the A-Interface. The data rate adapter function is always located inside the BSS, using a 64kbit/s unrestricted digital interface (Clearmode) over IP.

The A-Interface has been designed around the aims of 3GPP TS 48.001 allowing each component and the system as a whole to evolve.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.009: "Handover procedures".

[3] 3GPP TS 23.910: "Circuit switched data bearer services".

[4] 3GPP TS 43.020: "Security related network functions".

[5] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".

[6] 3GPP TS 48.001: Base Station System - Mobile services Switching Centre (BSS - MSC) interface; General aspects".

[7] Void.

[8] 3GPP TS 48.006: "Signaling transport specification mechanism for the Base Station Subsystem – Mobile-services Switching Centre (BSS - MSC) interface".

[9] 3GPP TS 48.008: "Mobile-services Switching Centre – Base Station System (MSC-BSS) interface; Layer 3 specification".

[10] Void.

[11] Void.

[12] Void.

[13] Void.

[14] Void.

[15] Void.

[16] Void.

[17] Void.

[18] 3GPP TS 52.001: "Common aspects of GSM Network Management (NM)".

[19] 3GPP TS 23.236: " Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes ".

3 Definitions and abbreviations

Abbreviations used in the present document are listed in 3GPP TS 21.905.

4 Functional division between Base Station System (BSS) and MSC

Table 4: Functional split

Item/Task	BSS	MSC,MGW,VLR,HLR
Terrestrial Channel Management channel allocation blocking indication	 X X	 X X
Radio channel management Radio channel configuration management frequency hopping management idle channel observation power control	 X X X X	
TCH management channel allocation (choice) link supervision channel release	 X X X	 X (Invoked by MSC)
BCCH/CCCH management scheduling of messages	 X	
DCCH management link supervision channel release DCCH allocation	 X X X	 X (Invoked by MSC
Radio resource indication report status of idle channels	 X	
Channel coding decoding on the basis of call type	 X	MSC defines call type
Speech Transcoding	X	X
Data rate adaptation	X	
Interworking Function (data calls)		X
Measurements reported from MS uplink traffic	 X X 	 X
Handover internal (within one cell){if provided} internal (between cells) {if provided} external recognition radio reason external recognition traffic reason decision execution	 X X X X X 	 MSC informed MSC informed X X X
Mobility Management authentication location updating paging DRX paging (scheduling)	 X	 X X X
Call control		X
User data encryption Signalling element encryption	X X	Key and permitted algorithms from MSC Key and permitted algorithms from MSC
NNSF (NAS Node Selection Function)	X	

4.1 Terrestrial channel management

4.1.1 Terrestrial channel allocation

Terrestrial channel allocation will be handled in the following manner.

In case of TDM links, the link between the MSC and the BSS will be considered by the BSS and the MSC as a route on "n" circuits. Within this route, certain of the circuits may not be able to support all types of traffic (e.g., data calls or half rate connections). This can be managed, according to the configuration, either by the MSC or by the BSS for a given route. The entity in charge of circuit allocation chooses the terrestrial circuit, whilst ensuring that the chosen circuit is able to support the type of connection needed.

In case of IP links, the IP-link for the User Plane traffic is negotiated between BSS and MSC by exchange of IP Transport Layer addresses and necessary User Plane information (e.g. Codec Type, Codec Configuration, RTP Redundancy, A-Interface Type).

If an IP based A-Interface User Plane is supported by the MSC and/or the BSS and a terrestrical circuit is needed, then always the MSC, never the BSS, shall provide the terrestrical circuit (CIC).

4.1.2 Blocking of terrestrial channels

The entity not allocating the circuits shall be able to remotely block the terrestrial channel and remove it from service. This is signalled across the BSS/MSC interface using the appropriate signalling exchange as defined in 3GPP TS 48.008.

Local blocking of terrestrial channels on the side allocating the circuits may be supported and will result in the concerned channels not being chosen, no information need flow across the interface in these cases.

Blocking for IP-links is not explicitly needed, because no fixed relation between both endpoints of an IP link exists.

4.2 Radio channel management

4.2.1 Channel configuration management

The channel configuration management will be controlled between BSS and maintenance centre, the MSC holding no direct data concerning the allocation of radio timeslots etc.

4.2.2 Radio TCH management

4.2.2.1 Radio channel allocation

The BSS shall choose the radio channel to be used on the appropriate cell, based on information received from the MSC, which defines the radio channel type, speech codec type (if necessary), channel coding and all other parameters relevant to defining channel type. The chosen radio channel shall be connected to the terrestrial channel in order to support the call. This connection mechanism is not further defined in these Technical Specifications, except the negotiation of the A-Interface Type (TDM or IP), defined in 3GPP TS 48.008.

4.2.2.2 TCH radio link supervision

Radio link supervision of dedicated radio resources shall be the responsibility of the BSS. If communication with the mobile is lost then the BSS can request that the call be cleared.

4.2.2.3 Frequency hopping management

Frequency hopping management shall be performed by the BSS. That is the BSS shall store and transmit all hopping parameters for the cell(s) that it controls, the hopping shall be performed such that it is not visible on the BSS/MSC interface.

4.2.2.4 Idle channel observation

The quality of idle radio channels shall be measured by the BSS and a condensed form of the information passed back to the MSC.

4.2.2.5 TCH power control

All power control functions shall be performed between MS and BSS. No real time power control commands shall be sent across the BSS/MSC interface.

4.2.2.6 TCH channel release

The release of a dedicated resource is primarily controlled by the MSC. However for radio propagation reasons the BSS can request of the MSC that a call be released. The necessary protocols are defined in 3GPP TS 48.008.

4.2.3 BCCH CCCH management

All BCCH data shall be either stored at or derived locally by the BSS.

CCCH random accesses shall be controlled autonomously by the BSS, paging messages shall be received from the MSC via the BSS/MSC interface.

4.2.3.1 Scheduling of BCCH and CCCH messages

The scheduling for all BCCH and CCCH messages shall be performed by the BSS.

4.2.4 DCCH Management

4.2.4.1 DCCH link supervision

Radio link supervision of dedicated radio resources shall be the responsibility of the BSS. If communication with the mobile is lost then the BSS can request that the call be cleared.

4.2.4.2 DCCH channel release

The release of a dedicated resource is primarily controlled by the MSC. However for radio propagation reasons the BSS can request of the MSC that a call be released. The necessary protocols are defined in 3GPP TS 48.008.

4.2.4.3 DCCH power control

All power control functions shall be performed between MS and BSS. No real time power control commands shall be sent across the BSS/MSC interface.

4.2.4.4 Radio Channel Allocation

The BSS shall choose the DCCH to be used on the appropriate cell. This shall be performed initially after the random access to the CCCH has been made by the MS. The chosen DCCH may at a later stage in the call be connected to the terrestrial channel in order to support the service, this is controlled by the appropriate indications in an assignment message from the MSC.

4.3 Resource indication

The status of idle radio channels is reported to the MSC using the protocol described in 3GPP TS 48.008.

4.4 Channel coding decoding

The encoding decoding and interleaving shall be performed by the BSS. The type of channel coding and interleaving is derived from the information in the assignment message from the MSC.

4.5 Transcoding/rate adaptation

Data rate adaptation shall be performed by the BSS. Speech transcoding may be performed by the BSS or may be omitted by the BSS, depending on the A-Interface Type negotiated between MSC and BSS. The selection of the appropriate function shall be based on information received from the MSC.

4.6 Interworking function (data calls)

The interworking function required for data calls to other networks shall be performed on the MSC side of the MSC/BSS interface.

4.7 Measurement information

4.7.1 Measurement information reported from the MS

Measurement information reported from MSs with dedicated radio resources shall be processed by the BSS.

4.7.2 Uplink measurement information

The BSS shall process uplink information.

The results of the processing of the "Measurement information reported from the MS" and the "Uplink measurement information" may be transmitted to the MSC as described in 3GPP TS 48.008.

4.7.3 Traffic information

Traffic information concerning the traffic environment outside a BSS is not passed from MSC to BSS.

4.8 Handover

Handovers (both internal and external) can occur for one of several reasons e.g. radio propagation, traffic distribution, O and M activity, equipment failure.

4.8.1 Internal handover within one cell

Internal handover within one cell can be supported within a BSS. It is optional for a BSS to be able to perform autonomous internal handover.

The MSC will be informed when an autonomous internal handover has been completed (see 3GPP TS 48.008).

4.8.2 Internal handover between cells

Intra-BSS Handover between cells on the same BSS can be supported within a BSS. Multi cell BSSs would normally be expected to support internal inter cell handover, however it is optional that they do so.

Intra-BSS handover may be performed autonomously by the BSS as long as neither the A-Interface Type is changed (e.g. from TDM to IP) nor the Codec Type nor the Codec Configuration are changed on the A-Interface to incompatible ones. The MSC will be informed when an autonomous internal handover has been completed (see 3GPP TS 48.008).

If the Intra-BSS handover needs a modification of the A-Interface Type (e.g. a change from TDM to IP) or a change of the Codec Type or Codec Configuration on the A-Interface, then the MSC shall be involved before the handover is executed.

4.8.3 External handover

This type of handover includes inter-BSS handover as discussed in 3GPP TS 48.008 and inter-MSC handover as discussed in 3GPP TS 23.009. In all external handover cases the MSC is involved.

4.8.3.1 Recognition that a handover is required for a radio reason

The BSS shall be able to generate an indication that a handover is required to the MSC using the protocols defined in 3GPP TS 48.008.

No additional guidance is given in the 3GPP TS 48.0xx series concerning the algorithm within the BSS that generates either an internal handover, or an indication to the MSC that an external handover is required.

4.8.3.2 Recognition that a handover is required for a traffic reason

The BSS shall be able to generate an indication to the MSC that a handover is required for traffic reason (e.g. directed retry) using the protocols defined in 3GPP TS 48.008.

Within a multi BSS area only the MSC has a perspective of the overall traffic loading. The MSC may therefore originate inter BSS traffic handovers due to traffic reasons.

4.8.3.3 Decision of Target Cell

The choice of the target cell in an external traffic handover shall be made by the MSC, based on information received from the BSS.

4.8.3.4 Execution

Having received an indication from a BSS that an external handover is required, the decision of when and whether an external handover should take place shall be made by the MSC.

4.9 Mobility management

All transactions concerning mobility management (as specified in 3GPP TS 44.018) shall take place transparently between the MS and MSC/VLR/HLR, using the protocols described in Technical Specifications 3GPP TS 48.008 and 3GPP TS 48.006. The only exception to this rule is that of paging which is scheduled by the BSS on the appropriate cell.

4.10 Call control

Call control will be the responsibility of the MSC/HLR/VLR.

4.11 Security features

Information on security aspects are found in 3GPP TS 43.020. The BSS/MSC interface supports all of the required interchange of encryption keys.

4.11.1 User data confidentiality

Encryption and decryption of user data (e.g. speech) takes place within the mobile station and within the BSS. In order to decrypt/encrypt user data the encryption device used for the call must be loaded with the relevant key and algorithm. The key and the permitted algorithms are supplied by the MSC.

4.11.2 User identity confidentiality

This feature is supported by using a TMSI rather than an IMSI, over the radio path. The translation between TMSI and IMSI is performed at the MSC and within the mobile. Both TMSI and IMSI are carried transparently by the BSS-MSC interface as far as possible.

4.11.3 Signalling information confidentiality

As for user data.

4.11.4 Authentication of users

Authentication is carried out at the mobile and at the MSC/VLR/HLR. The MSC to BSS interface is required to transport the necessary challenge and response messages.

4.12 Global Text Telephony

Interworking between cellular text telephone modem (CTM) and text telephony standards (e.g. V.18) used in external networks can be performed by the BSS. It can also be performed by separate entities in the core network.

4.13 NAS Node Selection Function

The optional NAS Node Selection Function (NNSF) enables the BSC to initially assign a MSC to serve a MS and subsequently setup a signalling connection to the assigned MSC.

The method by which the BSC initially assigns a MSC is implementation dependent.

The NAS Node Selection Function is needed when the feature Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes is used.

The NNSF is described in detail in [19].

5 Transcoder/rate adapter integration

5.1 TDM based A-Interface

The speech transcoder and the data rate adaptor will be functionally integrated into the BSS. It is not considered to be a stand alone piece of equipment. The control of the transcoder or rate adaptor will therefore take place directly via the BSS, an explicit control interface between BSS and transcoder and rate adaptor will not be defined.

Dependent on the relative costs of transmission plant for a particular administration, there is an economic benefit, for larger cells and certain network topologies, in having the transcoder or rate adaptor positioned geographically at the MSC site. However, for smaller cells there may actually be a cost penalty due to special multiplexing.

When the transcoder or rate adaptor is geographically sited at the MSC site, it shall still be considered part of the BSS, and as such is on the BSS side of the BSS-MSC interface.

5.2 IP based A-Interface

The speech transcoder can be functionally integrated either into the BSS or the core network. It is not considered to be a stand alone piece of equipment. If the speech transcoder is within the BSS, then it is controlled by the BSS, regardless of its geographical location. If the speech transcoder is within the core network, then it is controlled by the MSC. In certain call cases speech transcoders are not necessary at all.

The data rate adaptor is always part of the BSS and therefore always controlled by the BSS.

6 Multiplexing of common and dedicated control channels

Common and dedicated control channels will be used for the same call on the radio path. These control channels will be multiplexed onto one or more common signalling channel(s) between the BSS and MSC. This multiplexing function will reside at the BSS.

It should be noted therefore that the data links across the air interface are terminated at the BSS.

All scheduling of messages via the air interface is controlled by the base station, flow control is therefore required from BSS to MSC to prevent overload of the transmission buffers, this is further detailed in Technical Specifications 3GPP TS 48.008 and 3GPP TS 48.006.

7 Classes of signalling messages

The signals between BSS and MSC are classified under three headings:

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i)    DTAP messages   ------ BSSAP messages
ii)   BSS management ---+
iii)  BSS O&M
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Where DTAP BSSMAP and BSSAP are as defined in 3GPP TS 48.008.

Layer 3 call control messages will as far as possible pass transparently through the BSS. The discrimination between BSSMAP and DTAP messages is detailed in Technical Specification 3GPP TS 48.006.

8 Support of services and features other than speech

8.1 Data services

In order to ensure that the requirements of 3GPP TS 23.910 are met, the support of data services will entail the following 7 actions being taken:

i) the speech coder being deactivated in the mobile;
ii) a rate adaptation function being activated in the mobile;
iii) an appropriate channel coding being activated in the mobile radio subsystem;
iv) an appropriate channel coder being activated in the BSS;
v) a rate adaptation function being activated in the BSS;
vi) any echo control in the MSC being by-passed or disabled;
vii) an appropriate network interworking function being invoked.

The MSC to BSS interface will support all necessary signalling for this to be achieved.

8.2 Supplementary services

All signalling concerned with supplementary services is passed transparently through the BSS via the DTAP.

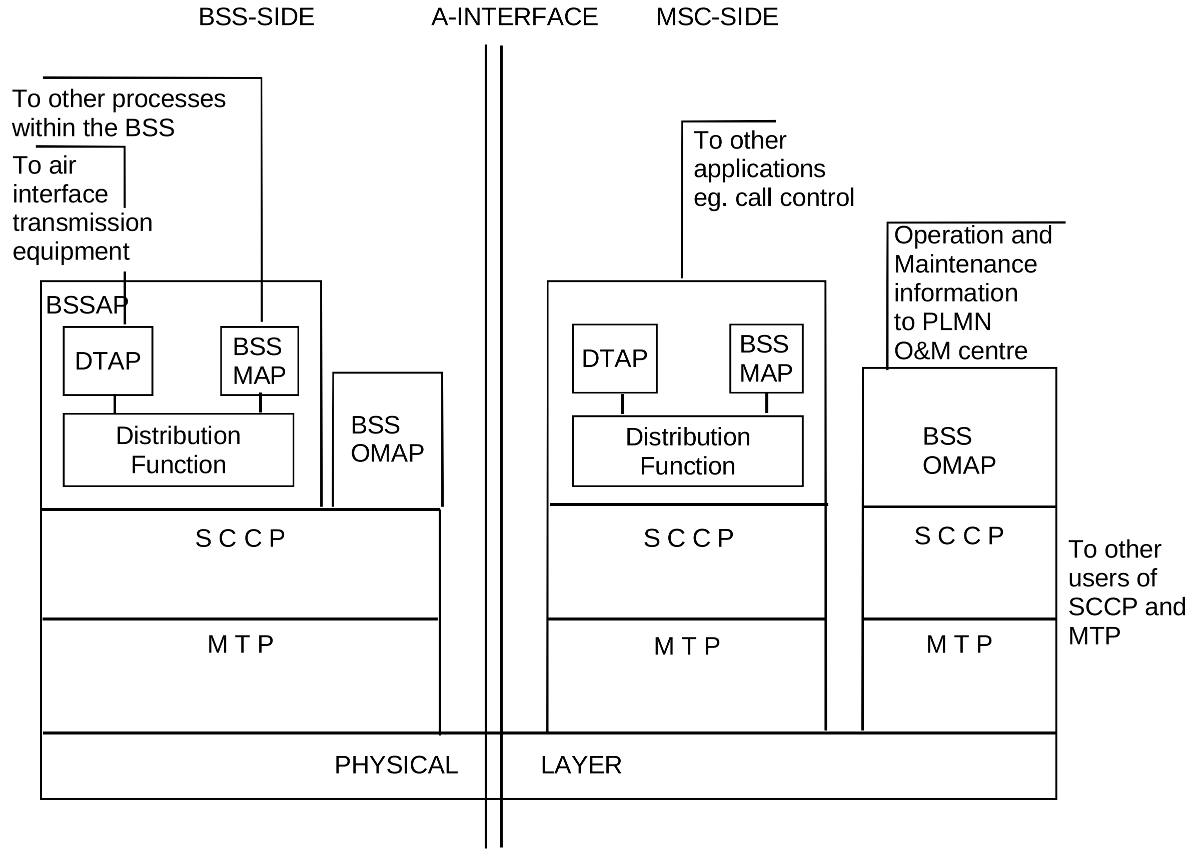
9 Interface structures

The definition of the MSC to BSS interface follows a layered approach. This is shown in figure 10.1.

In the case of a digital link being used between the BSS and MSC, the signalling will be carried in one of the 64 kbits/s timeslots.

10 Operation and maintenance

Operation and maintenance information is required to flow between the BSS and O & M functions. The BSS to MSC interface provides for this type of information see 3GPP TS 52.001.



Terminology:
- DTAP - Direct Transfer Application Part
- BSSMAP - BSS Management Application Part
- BSS OMAP - BSS Operation and Maintenance Application Part
- SCCP - Signalling Connection and Control Part
- MTP - Message Transfer Part
- BSS - Base Station System
- MSC - Mobile services Switching Centre

NOTE: X.25 can be used for transferring O and M information.

Figure 10.1: Signalling protocol reference model

Annex A (informative): Remote Mobile Switching Unit (RMSU)

A.1 Introduction

Between the MSC and some of the BSS sites served by this MSC , it may be advantageous to include a line concentrator, an RMSU. The main purpose of introducing this unit is to reduce the number of terrestrial circuits needed between BSS site and MSCs (signalling and traffic circuits). The benefits of introducing an RMSU will depend on:

- relative costs of the transmission plant for the particular administrations;
- the costs involved in operating the RMSU;
- the complexity of the RMSU, i.e. if it allows interworking with the ISDN or the PSTN for mobile originated calls.

In the GSM Technical Specifications the RMSU will be regarded as a remotely controlled part of the MSC, and therefore no detailed specification of the RMSU or the signalling functions needed between the RMSU and the MSC will be given.

A.2 Functions provided by the RMSU

Below is listed some examples of functions which may be provided by the RMSU:

- setting up and clearing of circuits to the BSS and the MSC (remotely controlled by the MSC);
- switching of the circuits between MSC and the various BSSs;
- blocking and unblocking of circuits;
- possibly interworking with the PSTN or ISDN for mobile originated calls, including information exchange with remote control from the MSC;
- Operation and maintenance functions of the RMSU.

A.3 General requirements

In order to be able to establish a BSS configuration without using an RMSU, and then later on introducing this unit, the interface between the BSSs and the RMSU should have the same characteristics as the interface between a BSS and an MSC.

The number of subscribers served by an RMSU will be large compared to the number of subscribers served by a single BSS. Therefore, if the RMSU or the signalling links between the RMSU and the MSC go down, this will have a serious impact on the mobile service in a large geographical area.

The implementation of the RMSU and the signalling between the RMSU and the MSC therefore has to be made in such a way that the overall reliability requirements specified for the MSC are fulfilled.

Some O and M facilities may be required in the RMSU, and the necessary signalling between the RMSU and the O and M functions has to be provided.

Annex B:
(void)

Annex C (informative): Change History

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January 2016	-	-	-	Release 13 version created based on v12.0.0	13.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-03	RP-75	-	-	-	-	Version for Release 14 (frozen at TSG-75)	14.0.0
2018-06	RP-80	-	-	-	-	Update to Rel-15 version (MCC)	15.0.0
2020-07	RP-88e	-	-	-	-	Upgrade to Rel-16 version without technical change	16.0.0
2022-03	RP-95e	-	-	-	-	Upgrade to Rel-17 version without technical change	17.0.0
2024-03	RP-103	-	-	-	-	Upgrade to Rel-18 version without technical change	18.0.0

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