
Source: 3GPP Evolution Ad hoc

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Abstract of document:

The document describes a long term, high level roadmap, intended to guide the future work of 3GPP. It is focussed on items pertinent to the evolution of 3GPP specifications, and identifies concepts and trends to be considered by 3GPP when defining future work items. It does not contain details of proposed technologies, but pointers to direct the activities of the appropriate TSGs in elaborating future releases of the 3GPP standard.

Changes since last presentation to SA

This is the first time the TR21.902 has been presented to SA.

Outstanding Issues:

Incorporation of changes agreed at 3GPP evolution ad hoc meeting #4. To be completed by June 20. Includes changes as follows:

1. Re-wording/re-structuring of text on ad hoc networks. Chapters 7 & 8.
 2. Clarification of short/long timescales. Chapter 5.
 3. Clarification 3GPP layered architecture approach and decoupling between horizontal layers. Chapter 5.
 4. Introduction of "Performance" as focus area. Chapter 6.
 5. Re-wording/re-structuring of Radio Technology text. Section 7.1.
 6. Re-wording/re-structuring/addition of Core Network, Service Provision, Operation Support Systems & User Equipment. Sections 7.2, 7.3, 7.4 & 7.5 respectively.
 7. Addition of text on regulatory and spectrum issues. Chapter 8.
 8. General re-structuring of document making chapter 5 introduction to technology evolution chapter and dividing that chapter into sections dealing with short/medium & long term evolution respectively.
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Contentious Issues:

Issues to be resolved by email include:

1. UICC/Security evolution.
2. Network Architecture Intrinsic Resilience.
3. UE manufacturer control of tests relating to terminal functionality.

3GPP TR 21.902 V1.0.0(2003-06)

Technical Report

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Evolution of 3GPP System; (Release X)



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3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

<http://www.3gpp.org>

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Contents

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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Introduction

At a time when the first release of the 3GPP 3G standard has stabilised, and the first 3GPP compliant networks are going live, the ITU is already working towards elaborating a vision of mobile network evolution beyond IMT-2000. In addition, a number of research initiatives worldwide are investigating technologies and techniques that might facilitate that vision. It is therefore timely, that 3GPP look at how its systems will evolve in the future to meet the requirements of the user and the industry, and to make use of emerging technologies.

1 Scope

The present document describes a long term, high level roadmap, intended to guide the future work of 3GPP. It is focussed on items pertinent to the evolution of 3GPP specifications, and identifies concepts and trends to be considered by 3GPP when defining future work items. It does not contain details of proposed technologies, rather it contains pointers to direct the activities of the appropriate TSGs in elaborating future releases of the 3GPP standard. As a result, not all of the topics covered herein are within the remit of 3GPP to discuss, and description of such items will not be extensively developed. E.g. Spectrum is really an ITU-R/WARC issue and therefore outside the scope of 3GPP. The document is designed to be a “living document” and will be updated accordingly over its lifetime (tbd) in order to reflect future developments and innovations.

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 TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the [following] terms and definitions [given in ... and the following] apply.

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

<ACRONYM> <Explanation>

4 The Current Scope of 3GPP and its releases

4.1 3GPP releases

The current scope of 3rd Generation Partnership Project (3GPP) is to produce globally applicable Technical Specifications (TSs) and Technical Reports (TRs) for:

- A 3rd Generation Mobile System based on evolved GSM core networks and the radio access technologies that they support (i.e., Universal Terrestrial Radio Access (UTRA) both Frequency Division Duplex (FDD) and Time Duplex (TDD) modes), and
- The Global System for Mobile communication (GSM) including evolved radio access technologies (e.g. General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE)).

In addition, 3GPP shall consider the long term evolution of its systems.

The 3rd Generation Mobile System and the Global System for Mobile communication (GSM) and their capabilities are developed in a phased approach. In the following the content of the 3GPP Releases is briefly outlined.

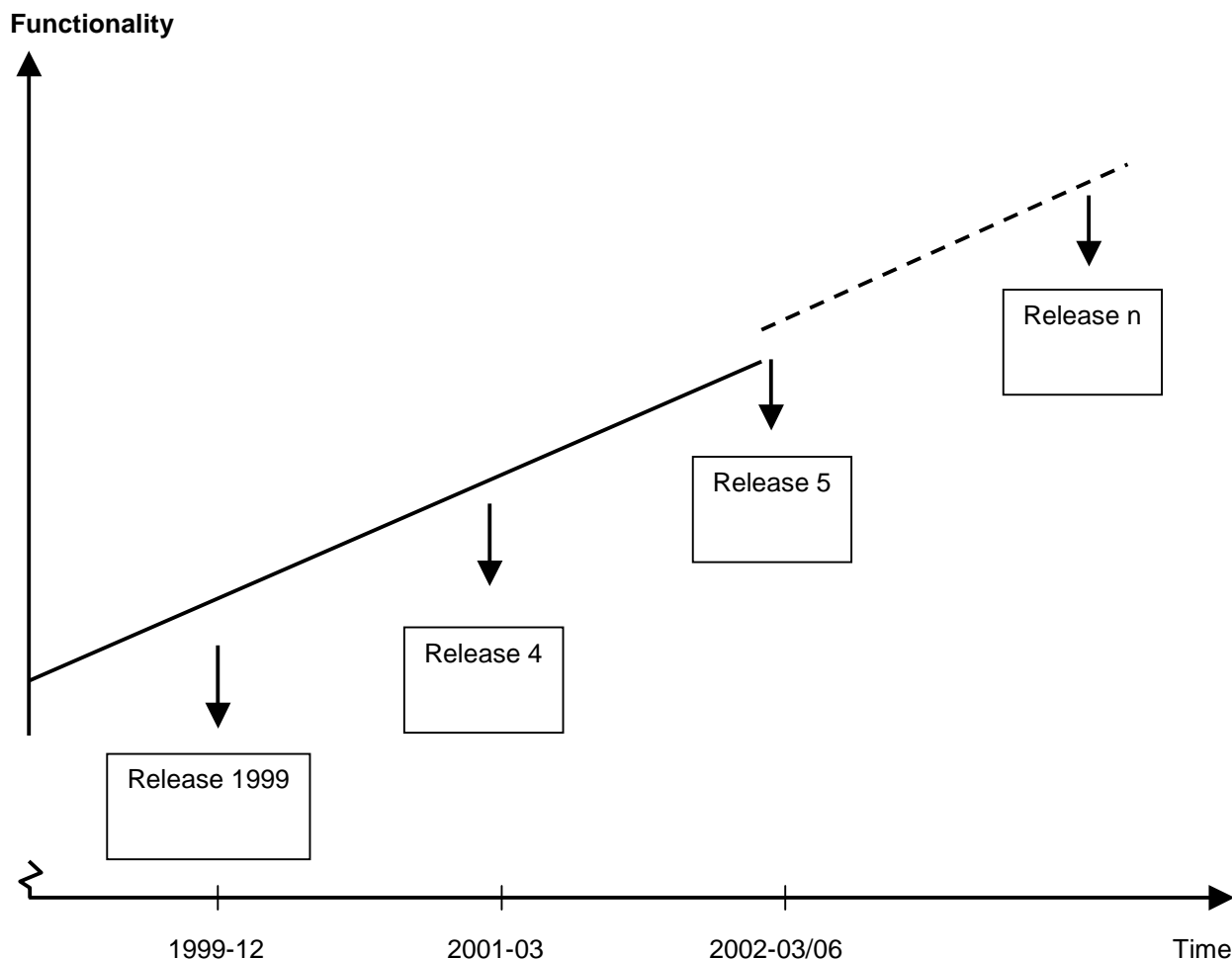


Figure 1 3GPP Releases for enhancements/improvements of the 3GPP Mobile Network

4.1.1 3GPP Release 1999

3GPP Release 1999 is the first release from 3GPP and covers specifications for a complete mobile system. The Release 1999 constitutes the full basic functionality needed for a roll-out of WCDMA.

3GPP Release 1999 contains, but is not limited to, UTRA FDD and TDD modes, UTRAN Iu, Iub and Iur interfaces, GSM based evolved core network, USIM, AMR speech codec, Multimedia Messaging Service (MMS), Location services, a broad range of supplementary services, Customized Applications for Mobile network Enhanced Logic (CAMEL); Open Service Access (OSA) and telecommunication management.

The 3GPP Release 1999 was functionally frozen in December 1999.

4.1.2 3GPP Release 4

3GPP Release 4 is a further enhancement of 3GPP Release 1999.

3GPP Release 4 contains, but is not limited to, UTRA FDD repeater function, low chip rate TDD option, 700 MHz support for GERAN, e2e transparent packet streaming service, Tandem Free Operation, Transcoder Free Operation, IP transport of CN protocols, bearer independent CS core network, CAMEL enhancements and OSA enhancements.

The 3GPP Release 4 was functionally frozen in March 2001.

4.1.3 3GPP Release 5

3GPP Release 5 is a further enhancement of the previous releases.

3GPP Release 5 contains, but is not limited to, the initial phase of the IP Multimedia Subsystem (IMS), High Speed Downlink Packet Access (HSDPA), UMTS in 1800/1900 MHz bands (release independent), Wideband AMR, IP transport in the UTRAN, Iu for GERAN, Gb over IP, header compression in UTRAN and GERAN, CAMEL enhancements, OSA enhancement, Global Text Telephony (this is a Release independent Feature, not a Rel-5 Feature), Location Services enhancements, UTRAN sharing in connected mode and security enhancements.

The 3GPP Release 5 was functionally frozen in March 2002 and the remaining part in June 2002.

4.1.4 3GPP Releases 6

Work is currently ongoing for 3GPP Release 6. The following features are planned to be part of 3GPP Release 6, but not limited to: Multimedia Broadcast/Multicast Service (MBMS), network sharing, priority service, Wireless LAN/UMTS interworking, IMS phase 2, push services and presence.

4.1.5 Future 3GPP Releases

TR 21.902, on Evolution of 3GPP System addresses the evolutionary aspects of subsequent 3GPP releases.

4.2 Interactions with other industry fora

4.2.1 Internet Engineering Task Force (IETF)

With the introduction of the IP Multimedia CN Subsystem, the dependence on IETF RFCs has significantly increased, with 3GPP defining requirements that impact the IETF work. The relationship with IETF is moving away from just 3GPP adopting the protocols as applicable (R99 and R4), through 3GPP participating in the develop of the protocols (R5) and more towards 3GPP defining the system requirements, from which the protocol requirements can be determined and passed to IETF to provide the solution (R6). To coordinate that work, 3GPP has put in place the following:

- An IETF Liaison Rapporteur to work with the officials of IETF
- Tracks the dependencies on work in IETF through the 3GPP Workplan
- Provides 3GPP requirements drafts into IETF through contributions from individuals

4.2.2 Open Mobile Alliance (OMA)

OMA is a new industry forum, which is working on service enablers for mobile systems. The working relationship between 3GPP and OMA is still being developed. Currently, 3GPP is dependent upon work within OMA that was formerly being done with fora such as WAP and LIF. In this case, the requirements have been defined by 3GPP and the protocols are being defined by OMA e.g. for LCS and MMS.

In the future there is the possibility that OMA will be defining service enablers that 3GPP will need to:

- provide interworking to,
- provide network capabilities to support the service.

5 Statements and Assumptions

A number of basic assumptions are made for this high level roadmap as follows:

- Future is evolution not revolution
- Where possible, re-use existing techniques/technologies (potential through co-operation with external fora)
- Improve requirement setting, e.g., include commercial considerations
- Separate fundamental technology (evolutionary part) from dynamic applications (to ensure rapid development of applications)
- The description of the 3GPP System Future Evolution is split in two parts:
 - 3G Enhancements (short to medium term evolution).
 - 3G Long Term Evolution.

In considering the future evolution of the 3GPP system it is further recommended that:

- Decoupling between applications and access technologies is adopted as a design principle. Access technology specificities are considered and taken into account when justified by application and system performance gains
- The IP protocol suite is used as a mechanism to support this decoupling
- The decoupling should be applied in both the infrastructure and terminal specifications
- APIs and/or interfaces are standardised between Applications and the Access Technology in the infrastructure and terminals
- Mechanisms to manage the provision of third-party services over decoupled networks are introduced

6 Focus areas and Stakeholder expectations

A number of drivers have been identified for the evolution of the 3GPP system. These drivers can be categorised as expectations coming from a number of different “Stakeholders”, in that each Stakeholder has its own expectations of what evolution will deliver. Table 1 gives a summary of the stakeholders and their expectations. It is recognised that new services/functions shall provide new streams of revenue.

| End User | Network Operators | Manufacturer/Application Developer |
|--|---|--|
| 1 Ubiquitous mobile access | 1 Optimisation of resources (spectrum and equipment); | 1 Reduced cost of terminals and network equipment based on global economies of scale |
| 2 Easy access to applications and services | 2 QoS and Security | 2 Access to a global market |

| | | |
|---|--|--|
| 3 Appropriate quality at reasonable cost | management; | 3 Open physical and logical interfaces between modular and integrated subsystems |
| 4 Easily understandable user interface | 3 Ability to provide differentiated services; | 4 Programmable platforms that enable fast and low cost development |
| 5 Long equipment and battery life | 4 Flexibility in the network configuration; | |
| 6 Large choice of terminals | 5 Flexible charging; | |
| 7 Enhanced service capabilities | 6 Access type selection optimising service delivery; | |
| 8 User friendly charging capabilities | 7 Reduced cost of terminals and network equipment based on global economies of scale | |
| 9 Security of identity, personal data and "conversations" | 8 Maximized usage and sharing capabilities between 3GPP systems and systems beyond 3G (sharing of terminal, USIM, network elements, radio sites) | |
| | 9 Single authentication (independent of the access network) | |
| | 10 Limit number of options in order to ease deployment and network configuration for multi-vendor infrastructure, handsets and roaming | |

Table 1: Summary of Stakeholder Expectations for Evolution of 3GPP Systems

Many of the expectations of the different stakeholders are complementary and can be grouped together in focus areas from which *attributes* can be identified.

| Focus Area | End User Expectations | Network Operators Expectations | Manufacturer/Application Developer Expectations |
|---|--|--|---|
| Ubiquitous access for a core set of services, delivering IP based services at moderate data rates (hundreds of kb/s) over the widest possible proportion of the civilised world | 1 Ubiquitous mobile access 3 Appropriate quality at reasonable cost (including terminal cost) 4 Easily understandable user interface | 7 Reduced cost of terminals and network equipment based on global economies of scale 2 QoS and Security management; | 2 Access to a global market |
| Flexibility in services provision; including billing, ease of use | 2 Easy access to applications and services 4 Easily understandable user interface 6 Large choice of terminals | 3 Ability to provide differentiated services; 5 Flexible charging; | |

| | | | |
|--|--|--|---|
| | 7 Enhanced service capabilities | | |
| Cost containment; relates to cost savings as seen by each stakeholder | 3 Appropriate quality at reasonable cost 5 Long equipment and battery life 8 User friendly charging capabilities | 1 Optimisation of resources (spectrum and equipment); 4 Flexibility in the network configuration; 6 Access type selection optimising service delivery; 7 Reduced cost of terminals and network equipment based on global economies of scale 8 Maximized usage and sharing capabilities between 3GPP systems and systems beyond 3G (sharing of terminal, USIM, network elements, radio sites) 10 Limit number of options in order to ease deployment and network configuration for multi-vendor infrastructure, handsets and roaming | 1 Reduced cost of terminals and network equipment based on global economies of scale 2 Access to a global market 3 Open physical and logical interfaces between modular and integrated subsystems 4 Programmable platforms that enable fast and low cost development |
| Security related issues of services; including all aspects related to the protection of information, fraud prevention etc. | 9 Security of identity, personal data and "conversations" | 9 Single authentication (independent of the access network) | |

Table 2: Mapping of Stakeholder expectations to Focus Areas

7 Technology Evolution

7.1 Radio technology

7.1.1 3G Enhancements (short to medium term evolution).

The following are considered to be enhancements to the 3GPP radio access system that could be realised in the short to medium term:

- Improvement of radio
- Radio Access improvements, e.g., improved spectrum efficiency, quality and coverage
- WLAN and other access handling
- Utilisation of alternative access technologies, e.g., for hotspot coverage (e.g. WLAN, HIPERLAN, 802.11 a+b, Bluetooth, new technology)

- Wide area wireless internet access
 - Higher data rate than wireless LAN/ HSDPA (e.g. few tens of Mbps)
 - Wider coverage than wireless LAN but smaller than UMTS (e.g. few hundreds of meters)
 - Limited mobility than cellular system but better mobility support than WLAN/BWA (e.g. mobile speed of less than few tens of km/h)
 - Considered as wireless ADSL/VDSL
 - 2.3 GHz is allocated for public wireless internet access in Korea. (previously WLL band)
- Wide provision of MBMS
 - Architecture for more efficient usage of radio resources
 - Mechanism for drastically reducing UE power consumption
 - Creation of new application services including text, audio and video contents
 - Coexistence/complementary with existing public broadcasting
 - Etc
- Moving networks (i.e., installed on train/ship)
 - effective limitation of mutual interference between “moving” and “fixed” coverage,
 - suitable wireless interface between moving networks and the fixed infrastructure.

7.1.2 3G Long Term Evolution

The following reflect a vision of longer evolution of the 3GPP radio access system:

- New & adaptive radio access techniques.- Higher data rates in multi-user and multi-cell environments, with target data rates up to 100 Mb/s for high mobility and even higher for low mobility.
- Efficient and effective use of spectrum (Dynamic spectrum sharing and allocation) - A global harmonised frequency range. - Convergence and integration between various systems towards a closer relationship between previously separate wireless platforms- Ad Hoc Networking Approach
 - A mobile ad hoc network can be formed by a group of wireless hosts without any pre-existing infrastructure and central administration. Since the nodes in the mobile ad hoc network can be served as routers and hosts, they can forward packets on behalf of other nodes and run user applications. Due to their many advantages such as potential ease of deployment, reconfiguration, and adaptability, etc., mobile ad hoc networks can be used in many practical applications as well personal area networking, home area networking, military environments, and search-and-rescue operations.
 - Within the existing 3GPP Mobile Network, 3G users may create an Ad-Hoc network among themselves for the purpose of playing games, chatting, etc To meet the requirements of 3G users, 3GPP needs to consider the use of the 3GPP Mobile Network as an Ad-Hoc network and/or to extend the 3GPP Mobile Network using the Ad-Hoc network concept.

7.2 Core network

7.2.1 3G Enhancements (short to medium term evolution).

The following are considered to be enhancement to the 3GPP core network system that could be realised in the short to medium term:

- A Harmonized CN between 3GPP and 3GPP2
- Heterogeneous core network is strongly needed by operators to provide the opportunity of service transparency, seamless roaming and common application across all evolving IMT-2000 systems.

- Adopt a single IMS reference model and consistent terminology to describe common IMS functional entities
- 3GPP and 3GPP2 should work to ensure interoperability between the 3GPP IMS terminals and 3GPP2 MMD terminals (a 3GPP IMS terminal can set up a session with a 3GPP2 MMD terminal and vice-versa)
- Application level intersystem IMS roaming (given that the terminal supports the visited network's access network, IP transport technology and IMS discovery mechanisms, a 3GPP IMS terminal should be able to roam into a 3GPP2 network and use the capabilities of visited P-CSCF to access home IMS and vice-versa)

7.2.2 3G Long Term Evolution.

The following reflect a vision of longer evolution of the 3GPP core network system:

- A seamless integrated network comprising a variety of networking access systems connected to a common IP based network
- Broadband and multiple bearer service capability
- Service expandability and application service support
- Security support
- User platform support
- High performance and system efficiency
- System flexibility
- System scalability
- System interoperability
- System robustness
- Interworking between 3GPP Mobile Network and other Networks
- A similarity of services and applications across the different systems is beneficial to users, and this has stimulated the current trend towards convergence. In the future operators may deploy a mix of technologies that could incorporate cellular, WLAN, digital broadcast, satellite and other access systems. This will require the seamless interaction of these systems in order for the user to be able to receive a variety of content via a variety of delivery mechanisms depending upon the particular terminal capabilities, location and user profile.
- Different radio access systems will be connected via flexible core networks. In this way, an individual user can be connected via a variety of different access systems to the networks and services he desires.
- 3GPP should focus on the interworking between 3GPP Mobile Networks and other Networks considering mobility, high security and QoS management.
- Examples of other networks may include home networks, device networks and sensor networks etc.
- Ad hoc networking approach
 - identification, authentication and ciphering in the ad-hoc networking mode,
 - charging for ad-hoc networking
 - lawful interception for ad-hoc networking.

7.3 Service provision

Note: It has yet to be decided whether the following should be considered as 3G Enhancements (short to medium term evolution) or as 3G Long Term Evolution.

- Flexible billing capabilities
- The ability to adapt content to user requirements depending on terminal, location and user preferences
- Access to a very large market through a high similarity of application programming interfaces
- Fast, open service creation, validation and provisioning
- Enhanced QoS and security management
- Automatic service adaptation as a function of available data rate and type of terminal

7.3.1 3G Enhancements (short to medium term evolution).

A number of short to medium term enhancements have been identified from the service provision perspective. These include:

- Service Portability – Global Roaming.
- Define APIs
 - Define Generic APIs which allow application creation. The APIs should include interface with underlying QoS capabilities
 - Create a simple IMS interface towards external networks
 - Application delivery
- Seamless Service & Service Interworking
 - User access
 - Service interworking
 - Seamless service provision across environments
- High capacity for data stream
 - Improvement for PS domain (e.g., traffic increase)
- Service harmonization(or interoperability)
 - As varieties of application services are expected to explode every year, seamless application interoperability will be the key factors to satisfy users. It is undoubted that service interoperability can be fully supported on the common service platform but, 3GPP and other external bodies have their own services which already almost completed their technical works.
 - 3GPP should focus on developing common service platform and providing service interoperability for the work already being done, such as MMS service between 3GPP and 3GPP2.

7.4 Operations Support Systems

7.4.1 3G Enhancements (short to medium term evolution).

The following represent improvements of operation support that could be realised in the short to medium term:

- Improved O&M and customer care possibilities
- Exploitation of inherent network functions such as security, authentication billing etc.
- Inclusion of requirements from new functions
- Improved charging
- Improved security

- Improved testing

7.5 User equipment

7.6 Smartcards

- Support of UICC based identification and authentication for roaming between 3GPP and non-3GPP based networks,
- Support of secure download of both terminal and UICC applications,
- Establishment of the UICC as a cornerstone for all kind of trusted relationships (e.g. via powerful cryptoprocessors),
- Advanced high-speed communication protocols for the terminal ↔ UICC interface.

8 Other influences

8.1 Regulatory issues

8.2 Spectrum

- A global harmonized frequency range.
- Allocation of suitable spectrum for Ad Hoc Networks (cf. section 7.1.2).

Annex A: Change history

| Change history | | | | | | | |
|----------------|-------|----------|----|-----|-----------------|-----|-----|
| Date | TSG # | TSG Doc. | CR | Rev | Subject/Comment | Old | New |
| | | | | | | | |
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