



**Title**      **3G Essential Features**

**Version**    **2.0.1**

**Date**        **6<sup>th</sup> October 2003**

**GSM Association Classifications**

**Non-Binding**

**Core**

<b>Security Classification Category*:</b>		
<b>Unrestricted - Industry</b>		<b>X</b>

<b>Information Category</b>	3 <sup>rd</sup> Generation
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## Executive Summary

The current 3GPP standard includes so many options that it is impossible to implement and test all their combinations. On the other hand, one can implement a subset of them without reducing capabilities, or performance, or flexibility, but, to guarantee interoperability and roaming, any equipment and network must be interoperable with a common set. The “3G Essential Features” Task Force identifies such a set of options, which are called “Essential Features”.

The Essential Features primarily represent features and capabilities the operators want to have implemented in the User Equipment. The Excel files report the “Essential” marks in that light. Of course, to guarantee a proper level of roaming, any infrastructure should be interoperable with the Essential Features that impact the delivery of services.

Manufacturers can focus on the “Essential” features to save time and resources in the implementations and testing processes, and reduce the equipment complexity. However, any player will be able to develop, implement, and deploy any option he likes.

The 3G Essential Features Task Force in fact does not aim at proposing any change to the 3GPP standards, neither to the frozen releases (R99, R4, and R5) nor to those under development. Consistently, any feature or parameter value not covered in the Essential Features set maintains the importance it has in the 3GPP standard. That is the case, for instance, of some features intrinsic to the communications system, or clearly indispensable or “essential by nature”, that have not been examined for sake of brevity.

FDD and TDD access mode have been examined separately. The TDD Essential Features are to be considered as provisional, and should be revised in future follow-up activities, because few operators had plans to deploy TDD in a short term and contributed to the topic.

The implementation of the Essential Features is proposed in a “phased” approach: the Essential Features set is split into two subsets that could be implemented in subsequent phases. Roughly, out of a total of about 5,500 features and parameters values examined, for phase 1 only about 1,100 are marked as “Essential”.

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## Introduction

The '3G Essential Features' represent a minimum set of 3GPP features and parameters that should be tested with priority in all user equipment provided to the market. In any case, the user equipment should implement all the 3GPP mandatory features and any operator in his own network can implement any feature he likes and put forward any requirement to his vendors.

This document will be forwarded to the GCF and GCF is asked to ensure consistency of testing priorities with respect to 3G activities.

To be successful, mobile communications systems must rely on economies of scale and large footprints. Both aspects need good standards, interoperability among equipment and networks, and roaming capabilities. However, the current 3GPP standard includes so many options from which User Equipment manufacturers, Network Equipment manufactures, and operators can choose that it is impossible to implement and test all their combinations, therefore each manufacturer and each operator is forced to select a subset of features for their implementations. This may lead to interoperability and roaming difficulties and hinders business related to the 3GPP standard deployment.

On the other hand, a lot of 3GPP standards options are alternatives or technological duplications. One can implement a subset of them without reducing capabilities, or performance, or flexibility. In fact, as the implementation alternatives are many, just by not implementing the clearly unnecessary ones the number of their combinations diminishes by a huge amount.

But, to guarantee interoperability and roaming, any equipment and network must be interoperable with a common set. As no single player on its own can define such a common set, on February 17<sup>th</sup>, 2003 the GSM Association established the "3G Essential Features" Task Force, with the objective to identify and agree a subset of the UMTS standard options that should include a minimum number of alternatives while allowing the delivery of the mobile services across any network and any terminal type. This set of options are called "Essential Features". Testing of these Essential Features will ensure interoperability and a proper level of roaming.

With the aim to minimise the number of the "Essential Features", some features that, for user equipment, are "mandatory" in the 3GPP standard have been marked as "Non-Essential", because the Task Force considered that they do not impact the delivery of any service and are not strictly needed for implementing a good performance network. This does not reduce the substance of the 3GPP standard, as no change of the 3GPP standard is proposed and any player can implement any feature he likes.

Most 3GPP standard options have no impact on capabilities to deliver services (they could eventually influence network efficiencies aspects) therefore they do not require assumptions on the deliverable services. The selection of some features, however, has to take into account services aspects. For those cases the service requirements are taken from outputs of other groups, SerG in particular, to be consistent with decisions of other fora and not to duplicate works. For the cases in which needed requirements were missing, the 3G Essential Features Task Force has elaborated the working assumptions reported in Chapter 2. Chapter 3 and the Annexes illustrate and list in detail the "Essential Features".

## **1.1 Scope and objectives**

The target is to define a set of “Essential Features”, with as few options as practical, to ensure roaming and interoperability. Interoperability is considered from a broad point of view, not only to retain any capability to deliver services, but also to preserve network performance and system flexibility. One can, for instance, run a network without the Inter-Frequency Handover and guarantee full roaming capability and service delivery; nevertheless the Task Force considers the Inter-Frequency Handover functionality as “Essential” (even though not all the related implementation options have been marked as “Essential”), because, from a certain point in time on, most operators would like to have it implemented in any terminal type for a good management of their network resources. Therefore the choice of features marked as essential has been driven not only by the need to give an acceptable roaming experience, but also by the need to have user equipment (UE) supporting capabilities required to exploit and manage networks resources in an efficient way.

The Essential Features primarily represent features and capabilities the operators want to have implemented in the User Equipment. Of course any infrastructure should be interoperable with the Essential Features that impact the delivery of the services the infrastructure operator offers.

The 3G Essential Features Task Force does not aim at proposing any change to the 3GPP standards, neither to the frozen releases (R99, R4, and R5) nor to those under development. To ensure the task force represents operators’ views, manufacturers were not invited to the Taskforce meetings, but they were kept informed on the progress through documents and seminars.

The Essential Features significance is in the guarantee that any network will be capable of interworking with equipment compliant with them, even though they are a reduced set of the 3GPP specifications. By making it clear that the operators will require and test the Essential Features, manufacturers should realize that primarily they can focus on them, so that they can save time and resources in the implementations and testing processes, reduce the equipment complexity, and be sure that their products will meet their customers’ expectations. However, any player will be able to develop, implement, and deploy any option he likes, but he should ensure interoperability with the “Essential Features” set.

Finally, it is to be emphasized that the identification of the “Essential Features” does not limit the differentiation between operators, as the operator’s differentiation occurs at the service level and the “Essential Features” do not involve any limitation on services. They only indicate a common set, among different technical alternatives, by which services can be delivered.

## **1.2 Covered areas**

The analyses cover all the specifications of the 3GPP standard, including the interface between UE (User Equipment) and RAN (Radio Access Network), the interface between UE and CN (Core Network). The features relevant to the TDD access mode have been examined separately, and are included into separated spreadsheets, because few operators had plans to deploy TDD in a short term and contributed to the topic. Therefore the TDD Essential Features marks are to be considered as provisional, and should be revised in future follow-up activities.

Some features intrinsic to the communications system, or clearly indispensable or “essential by nature”, have not been examined for sake of brevity. Therefore, as a rule, any feature or parameter value not covered in the Essential Features set maintains the importance it has in the 3GPP standard, i.e., if it is mandatory it is to be considered as mandatory, while if it is optional it is to be considered as optional. On the other hand, it was considered beneficial to analyze features that could impact the forward compatibility in order to reduce the probability of incorrect behaviour on the early released terminals, when additional features will be later introduced in the network. For instance, if a UE without “essential” Tx diversity functionalities camps on a cell where Tx diversity is activated, the connection with that UE would involve channel estimation errors and, as a consequence, significant capacity losses and performance degradations.

Though not in the scope of the Task Force, some concerns have been risen during the core network work regarding the multimedia call service. In particular, it has been identified as essential requirement on the network-to-network interface (NNI) that any transit network is able to transfer and correctly process the “multimedia call information” with the ISUP signalling (low and high layer capabilities in the ISUP-IAM message), as already specified by existing ITU-T and 3GPP (3GPP TS 29.007 v3.11.0 “General Requirements on Interworking between the PLMN and ISDN or PSTN”) standard. The 3G Essential Features Task Force recommended this issue is handled in other groups (IREG, SerG) in charge of these topics.

### **1.3 Relationship with other bodies**

The 3G Essential Features Task Force did not want to duplicate any work and assumed as an agreed basis what was produced by other groups. In particular it took into account results produced by SerG, IREG, 3GPP/T1, and GCF.

For the same reason basically it did not consider the core network features that apply to both 2G and 3G (e.g., GPRS procedures that apply to GPRS over GERAN and UTRAN) and that have been already agreed, and perhaps implemented, by operators and manufactures, except some particular cases, where the differences in the system characteristics imply that different implementation alternatives could serve better. A typical example is the Gs interface between SGSN (Service GPRS Support Node) and VLR (Visitor Location Register): it is essential for GPRS in order that 2G class B terminals be able to detect CS (Circuit Switched) paging during a GPRS data transfer, whereas it is not necessary with 3G, because UMTS terminals can in any case detect paging without the need of Gs.

It is to be underlined that there are not real overlaps with 3GPP/T1, TWG, and GCF. T1 and GCF deal with test cases for conformance testing to check implementation of features. Many parameters used for conformance testing, e.g. default message contents in 34.108, are selected taking into account efficient testing process. Moreover the GCF subdivision of the test cases into four batches considers not only the need to deal first with the most critical features, but also availability of development resources, relationships among test cases, and the need to align efforts of terminal manufacturers, testing equipment manufacturers and test houses. Therefore on many aspects 3GPP/T1, TWG, and GCF do not provide agreed indication on what the operators consider actually “essential”.

The 3G TF has however taken into account the GCF work. For some features the consistency with is very clear, for some others it could be not so apparent, because some test cases involve different Essential Features and, conversely, some Essential Features require a number of

different test cases. On the other hand, the Essential Features concept is different from conformance testing.

Moreover the 3GEF had contributions by experts with a sound knowledge of T1 and a wide expertise on infrastructures

## **2 Working assumptions**

Working assumptions are defined only for the requirements that impact the Essential Features selection and are not available from the work of other bodies. Moreover the Task Force assumes that its active members express their classification of options with the “Essential” mark taking into account the service requirements defined inside their respective companies. So in the cases in which the Task Force members agree on classification there is no need to explicitly define the related service requirements.

### **2.1 Services requirements**

The approach to UMTS specifications has been to standardize service capabilities rather than defining new teleservices. Service capabilities consist of bearers defined by QoS parameters and the mechanisms needed to realize services such as the functionality provided by various network elements, the communication between them and the storage of associated data.

The 3G Essential Features Task Force approach was to identify the services, which could be hampered by there being different implementations within the standards. As an example, the 3G Essential Features Task Force has analysed Videotelephony in order to identify the Essential Features and parameters values which will lead to successful roaming and interoperability of Videotelephony services. The basic for this document has been the SerG document SE.34 on Videotelephony, with which the “Essential” and “Non-Essential” marks listed in the annexes are consistent.

### **2.2 Roaming**

This chapter aims at summarizing the relevant roaming scenarios and at highlighting the working assumption for the work of the 3G Essential Features Task Force. It does not intend replacing or repeating work carried out in other working groups, and where possible, will reference existing documents. Specifically, PRD IR.50 is taken into account and as soon as the output from the 3GIR Task Force concerning the Roaming Scenarios Reduction of Options is available, reference will be made to that document.

The availability of services to roaming users is out of the scope of this work, as it will be subject to roaming agreements and other commercial criteria that are covered the “3G International Roaming” Task Force.

#### **2.2.1 Current situation**

Hereafter we summarize the relevant current development of the work within GSMA that was reviewed before drafting this document:

- PRD IR.50: the first version of this document was approved by IREG Plenary in February 2003 and is in the process of formal GSMA approval. PRD IR.50 gives an overview of the services and bearers available to a roaming subscriber based on the VPMN capabilities independently of UE and subscription, highlights operational

issues and gives a list of tests to be performed prior to opening a 3G<sup>1</sup> roaming agreement;

- PRDs AA.12, AA.13 and AA.14: BARG is currently reviewing the changes proposed from the Legal Group of the GSM Association. Changes aim at defining a technology neutral main agreement that only focuses on the general aspects of a radiomobile roaming relation. Technology specific aspects shall be dealt with in the confirmation letter that substantially gives start to the agreement. Each service/set of services will be tested and agreed upon separately, thus giving the possibility of launching just part of the possible services. 3G IR is also reviewing the drafts, to provide BARG with an input document that should ease discussion and decision-making.

### 2.2.2 Roaming scenarios

The following aspects determine the services and capabilities available to the roaming subscriber:

1. User Equipment
2. VPMN network capabilities
3. HPMN HLR/HSS capabilities
4. SIM/USIM
5. Roaming agreements and network configuration of both VPMN and HPMN (including interconnection between the two networks)

It is the scope of this document to summarize the roaming scenarios based on the VPMN capabilities, the HLR/HSS subscription and the roaming agreements. The working assumptions are:

- wa-rs 1. *a VPMN 3G network may accept registration and authentication from a 2G SIM card as specified in 3GPP TS 33.102 v3.13.0*<sup>2</sup>
- wa-rs 2. *(E)GPRS only PMN (without GSM) are not taken into account*
- wa-rs 3. *A UMTS network will support both PS and CS services (no UMTS PS only or UMTS CS only)*
- wa-rs 4. *Only international roaming is taken into consideration because national roaming usually implies specific issues and integration level that are out of scope*

After analyzing the roaming scenarios, an overview of the status of the roaming agreement issue is provided.

#### 2.2.2.1 Network capability

The roaming scenarios from a network capability point of view take into account the RAN and CN features of the VPMN and the HLR/HSS user profile within the HPMN. In fact a

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<sup>1</sup> With 3G roaming agreement, the document means both a 2G-3G roaming agreement, and a 3G-3G roaming agreement.

<sup>2</sup> this issue is currently being discussed within the 3GIR TF – whatever decision taken therein will be adopted by the 3GEF TF task force



HPMN doesn't necessarily have to support a feature in order to offer it to its customers while roaming: as an example a network could manage (E)GPRS within their HLR/HSS without necessarily having a GPRS(E)GPRS network.

Based on the working assumptions, the "types" of network that are taken into account are the following:

- tn-rs 1. GSM CS only
- tn-rs 2. GSM CS and (E)GPRS
- tn-rs 3. UMTS (PS+CS) only
- tn-rs 4. GSM + UMTS (PS+CS)
- tn-rs 5. GSM + (E)GPRS + UMTS(PS+CS)

The services and features available to the subscriber are configured in the HLR/HSS. However, there is no such thing as a "GSM subscription" or "UMTS subscription" in the HLR/HSS: the services are defined in terms of bearer services, teleservices and supplementary services. In this document the following definitions will be used:

1. **GSM CS subscription:** the HLR/HSS subscription includes Teleservices (i.e. Speech, Short Message, Facsimile) and 2G Bearer Services (i.e. Asynchronous, Synchronous Mode as for BS20 and BS30 series)
2. **(E)GPRS subscription:** "*GPRS Subscription Data*" field in HLR/HSS filled in
3. **UMTS subscription:** GSM CS subscription + (E)GPRS subscription + new high speed bearers available for *BS2G - CS Data for Asynchronous Mode* and *BS3G - CS Data for Synchronous Mode* (used for "Multimedia call") and enhanced QoS .

Based on these definitions, Table 1 summarises the service available to a customer with specified HLR/HSS subscription type in a VPMN with specified network capabilities. The table doesn't take into account UE capabilities. In other words, it is taken for granted that the end user has all required terminal capability.

VPMN NETWORK TYPE HPMN SUBSCRIPTION TYPE	UMTS only	UMTS & GSM CS & (E) GPRS	UMTS & GSM CS	GSM CS & (E)GPRS	GSM CS only
<b>UMTS subscription</b>	All services	All services if registered on UTRAN, Only GSM services if registered on BSS	All services if registered on UTRAN, Only GSM services if registered on BSS	GSM standard services and GPRS service	GSM standard services
<b>GSM + (E)GPRS</b>	GSM	GSM	GSM	GSM	GSM

<b>subscription</b>	standard services and GPRS service	standard services and GPRS service	standard services and GPRS service	standard services and GPRS service	standard services
<b>GSM subscription</b>	GSM standard services	GSM standard services	GSM standard services	GSM standard services	GSM standard services

*Table 1 – Service capability available to end user according to subscription and VPMN capability*

### 2.2.2.2 Roaming agreements

Table 2 represents the possible contractual roaming scenarios, between operators with different technologies.

IRA stands for International Roaming Agreement, that traditionally disciplines GSM roaming and, recently, (E) GPRS roaming also. If 2 operators have signed an older version of IRA, disciplining GSM roaming only, in order to introduce (E) GPRS roaming they will need to sign a specific addendum to the IRA (PRD AA.31).

Most recent versions of the IRA (PRDs AA.12, AA.13 and AA.14) also include references to 3G roaming but it is not yet clear whether these newest versions provide a sufficient legal background to the 3G roaming agreements. The competent GSM Association's groups (BARG and legal groups) are still discussing this. Also, discussion is ongoing as regards a possible UMTS addendum, to be signed between operators that only have a GSM and/or (E) GPRS agreement.

Network 2	Network 1				
	UMTS only	UMTS+GSM CS	UMTS+GSM CS +(E) GPRS	GSM	GSM CS +(E) GPRS
UMTS only	UMTS agreement <sup>3</sup>	UMTS agreement	UMTS agreement	UMTS agreement <sup>4</sup>	UMTS agreement <sup>2</sup>
GSM + Adding new UMTS	UMTS agreement	If GSM IRA is in place THEN Sign UMTS addendum <sup>5</sup> ELSE UMTS agreement	If GSM IRA is in place THEN Sign UMTS addendum <sup>3</sup> ELSE UMTS agreement	If GSM IRA is in place THEN Sign UMTS addendum <sup>3</sup> ELSE UMTS agreement	IRA

<sup>3</sup> For clarity of the table it is assumed that the UMTS agreement covers GSM and GPRS cases.

<sup>4</sup> If UMTS agreement covers GSM and GPRS, it seems more sensible signing the UMTS agreement and update services provided as networks upgrade.

<sup>5</sup> A kind of UMTS addendum seems necessary to cater for new services whilst in roaming. It has been considered that this addendum is not covering GPRS. GPRS will be covered either by the existing IRA or by AA.31.

<p><b>GSM+(E) GPRS + Adding new UMTS</b></p>	<p>UMTS agreement</p>	<p>If GSM IRA is in place THEN Sign addendum<sup>3</sup> UMTS ELSE UMTS agreement</p>	<p>If GSM IRA is in place THEN If GPRS IRA is in place THEN Sign addendum<sup>3</sup> UMTS ELSE Sign AA.31 plus UMTS addendum<sup>3</sup> ELSE UMTS agreement</p>	<p>If GSM IRA is in place THEN Sign UMTS addendum<sup>3</sup> ELSE UMTS agreement</p>	<p>If GSM IRA is in place THEN If GPRS IRA is in place THEN Sign UMTS addendum<sup>3</sup> ELSE Sign AA.31 plus UMTS addendum<sup>3</sup> ELSE UMTS agreement</p>
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Table 2 – Roaming agreements

### 2.2.3 Essential roaming scenarios

Table 3 summarizes the essential roaming scenarios as per the working assumptions listed above, where the columns identify the HPMN subscription capabilities and the rows identify the VPMN network technologies.

“I” and “O” indicate if the roaming scenario is considered in scope or out of scope of the 3GEF TF activity. In detail:

I = in scope: possible roaming scenarios taken into consideration for the activity of the 3G Essential Features Task Force.

O = out of scope: roaming scenarios not taken into consideration

	GSM	GPRS	UMTS (PS-CS)	GSM + GPRS	GSM CS + UMTS (CS+PS)	GSM + GPRS + UMTS (CS+PS)
<b>GSM</b>	O	O	I	O	I	I
<b>GPRS</b>	O	O	O	O	O	O
<b>UMTS (PS-CS)</b>	I	O	I	I	I	I
<b>GSM + GPRS</b>	O	O	I	O	I	I
<b>GSM + UMTS (CS+PS)</b>	I	O	I	I	I	I
<b>GSM + GPRS + UMTS (CS+PS)</b>	I	O	I	I	I	I

*Table 3 – Roaming scenarios in scope of the 3GEF TF*

### 3 The “Essential Features” spreadsheets

As said above, some features of the 3GPP standard (e.g., power control) are not considered for some reasons (e.g., they are features intrinsic to the UMTS systems). Consistently with the principle that the Essential Features set does not involve any change of the 3GPP standard, **any feature not covered in the Essential Features set maintains the importance it has in the standard**, i.e., if it is mandatory it is to be considered as mandatory, while if it is optional it is to be considered as optional.

#### 3.1 Phased implementation

The implementation of the Essential Features is proposed in a “phased” approach: the Essential Features set is split into two subsets that could be implemented in subsequent phases. This will allow early implementation of the most important capabilities and a suitable planning of sophisticated, non-urgent functionalities. Phase 1 includes the features required for the initial deployment, while Phase 2 includes features that the operators will require to improve system and service performance.

Each access mode, namely FDD and TDD, have their own implementation phases, defined in the relevant spreadsheets. The FDD phases and the TDD phases are not linked, as it is expected that TDD will be deployed later.

### 4 Abbreviations

CAMEL	Customised Applications for Mobile network Enhanced Logic
CS	Circuit Switched
GCF	Global Certification Forum
NNI	Network to Network Interface
RAN	Radio Access Network
SGSN	Service GPRS Support Node
UE	User Equipment
VLR	Visitor Location Register

## 5 Annexes

### 5.1 *Essential Features Lists*

#### 5.1.1 FDD access mode and core network

The attached file «FDD access.xls» reports the analysis carried out on the FDD access mode and core network features. The total numbers of features and parameters values examined are 5,500. Out of them, for Phase 1 about 1,100 are marked as essential.



FDD\_access.xls

#### 5.1.2 TDD access mode

The attached file «TDD access.xls» reports the analysis carried out on the TDD access mode. The total numbers of features and parameters values examined are 200. Out of them, for Phase 1 about 170 are marked as essential.



TDD\_access.xls