

ETSI TR 101 362 V8.4.0 (2005-06)

Technical Report

Digital cellular telecommunications system (Phase 2+); Radio Network Planning Aspects (3GPP TR 03.30 version 8.4.0 Release 1999)

GSM®
GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS



Reference

RTR/TSGG-000330v840

Keywords

GSM

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:

http://portal.etsi.org/chaicor/ETSI_support.asp

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2005.
All rights reserved.

DECTTM, **PLUGTESTS**TM and **UMTS**TM are Trade Marks of ETSI registered for the benefit of its Members.
TIPHONTM and the **TIPHON logo** are Trade Marks currently being registered by ETSI for the benefit of its Members.
3GPPTM is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://webapp.etsi.org/IPR/home.asp>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

Contents

Intellectual Property Rights	2
Foreword.....	2
Foreword.....	5
1 Scope	6
1.2 References	6
1.3 Abbreviations	6
2 Traffic distributions.....	6
2.1 Uniform.....	6
2.2 Non-uniform.....	7
3 Cell coverage.....	7
3.1 Location probability	7
3.2 Ec/No threshold.....	7
3.3 RF-budgets	7
3.4 Cell ranges.....	8
3.4.1 Large cells.....	8
3.4.2 Small cells.....	9
3.4.3 Microcells	9
4 Channel re-use.....	10
4.1 C/Ic threshold	10
4.2 Trade-off between Ec/No and C/Ic.....	10
4.3 Adjacent channel suppressions.....	11
4.4 Antenna patterns.....	11
4.5 Antenna heights.....	11
4.6 Path loss balance	11
4.7 Cell dimensioning.....	11
4.8 Channel allocation.....	12
4.9 Frequency hopping	12
4.10 Cells with extra long propagation delay	12
5 Propagation models	12
5.1 Terrain obstacles	12
5.2 Environment factors	13
5.3 Field strength measurements	13
5.4 Cell adjustments	13
6 Glossary.....	13
7 Bibliography.....	14
Annex A.1: (GSM 900 class 4) Example of RF-budget for GSM 900 MS handheld RF-output peak power 2 W.....	15
Annex A.2: (class 2) Example of RF-budget for GSM MS RF-output peak power 8 W	17
Annex A.3: (DCS1800 classes 1&2) Example of RF-budget for DCS 1800 MS RF-output peak power 1 W & 250 mW	18
Annex A.4: Example of RF-budget for GSM 900 Class4 (peak power 2 W) in a small cell.....	19
Annex A.5: Example of RF-budget for GSM 400 Class4 (peak power 2 W) in a (small) cell	20
Annex A.6: (DCS1800 class 1) Example of RF link budget for DCS 1800 MS RF-output peak power 1 W Handheld with External Low Noise Amplifier (LNA) connected to BTS	21
Annex B: Propagation loss formulas for mobile radiocommunications	23

B.1	Hata Model [4], [8].....	23
B.1.1	Urban.....	23
B.1.2	Suburban.....	23
B.1.3	Rural (Quasi-open).....	23
B.1.4	Rural (Open Area).....	23
B.2	COST 231-Hata Model [7].....	23
B.3	COST 231 Walfish-Ikegami Model [7].....	24
B.3.1	Without free line-of-sight between base and mobile (small cells)	24
B.3.1.1	Lo free-space loss	24
B.3.1.2	Lrts roof-top-to-street diffraction and scatter loss	24
B.3.1.3	Lmsd multiscreen diffraction loss.....	24
B.3.2	With a free line-of-sight between base and mobile (Street Canyon)	25
Annex C:	Path Loss vs Cell Radius	26
Annex D:	Planning Guidelines for Repeaters.....	30
D.1	Introduction	30
D.2	Definition of Terms	30
D.3	Gain Requirements	31
D.4	Spurious/Intermodulation Products	31
D.5	Output Power/Automatic Level Control (ALC).....	32
D.6	Local oscillator sideband noise attenuation.....	32
D.7	Delay Requirements	32
D.8	Wideband Noise	33
D.9	Outdoor Rural Repeater Example	33
D.9.1	Rural repeater example for GSM 900.....	33
D.9.1.1	Intermodulation products/ALC setting	33
D.9.1.2	Wideband noise	34
D.10	Indoor Low Power Repeater Example	34
D.10.1	Indoor repeater example for DCS 1800.....	34
D.10.1.1	Intermodulation products/ALC setting	34
D.10.1.2	Wideband noise	35
D.11	Example for a Repeater System using Frequency Shift	35
D.11.1	Example for GSM 900	35
D.11.1.1	Intermodulation products/ALC setting and levelling criteria	36
D.11.1.2	Wideband noise	37
D.11.1.3	Multipath environment	37
D.12	Repeaters and Location Services (LCS).....	37
D.12.1	Uplink-TOA positioning method.....	37
D.12.2	Enhanced Observed Time Difference positioning method.....	38
D.12.3	Radio Interface Timing measurements.....	39
Annex E:	Change history	41
History		42

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:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This 3GPP Technical Report (3GPP TR) is a descriptive recommendation to be helpful in cell planning.

1.2 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] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 05.02: "Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path".
- [3] GSM 05.05: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception".
- [4] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".
- [5] CCIR Recommendation 370-5: "VHF and UHF propagation curves for the frequency range from 30 MHz to 1000 MHz".
- [6] CCIR Report 567-3: "Methods and statistics for estimating field strength values in the land mobile services using the frequency range 30 MHz to 1 GHz".
- [7] CCIR Report 842: "Spectrum-conserving terrestrial frequency assignments for given frequency-distance separations".
- [8] CCIR Report 740: "General aspects of cellular systems".

1.3 Abbreviations

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

Abbreviations used in this TR are given clause 6 (Glossary) and in GSM 01.04 [1].

2 Traffic distributions

2.1 Uniform

A uniform traffic distribution can be considered to start with in large cells as an average over the cell area, especially in the country side.