TSG-RAN WG1 meeting #2 ***TSG R1-99072***

Source: TSG RAN ITU Ad Hoc Contact Person

Title: Liaisons from ITU-R TG 8/1 WG5

This contribution contains the liaisons statements to SDOs and RTTs Proponents which were developed and approved by ITU-R TG 8/1 WG5 at the last meeting held in Kuala Lumpur (2-5 February 1999).

During the last meeting of ITU-R TG 8/1 WG5 the working document towards 'Key Characteristics for the IMT-2000 Radio Interface(s)' (IMT.RKEY) has been substantially progressed. The current draft document (which was not approved by ITU-R TG 8/1 WG5) is attached to the enclosed liaisons and it is brought to the attention of SDOs and RTTs Proponents in order to facilitate the preparation of contributions for the March meeting of TG 8/1.

Since ITU-R TG 8/1 will approve the Recommendation on 'Key Characteristics for the IMT-2000 Radio Interface(s)' at the next meeting (Fortaleza, Brazil, 8-19 March), it is considered extremely important to submit inputs based on 3GPP activity into the next ITU-R TG 8/1 meeting in order to ensure that the Recommendation approved by ITU is suitable for 3GPP.

In particular, IMT.RKEY contains two tables on RF and Baseband respectively. 3GPP TSG RAN WG1 should concentrate on the Baseband table trying to provide appropriate values. The outcome of 3GPP TSG RAN WG1 should be sent to ITU Ad Hoc who will merge it with the outcome of 3GPP TSG RAN WG4 (who focused particularly on the RF table) and submit it to the next meeting of ITU-R TG 8/1 by an Individual Member.

Chairman, ITU-R Task Group 8/1

LIAISON STATEMENT TO RTTS PROPONENTS AND SDOS
on
THE PROGRESS OF THE HARMONISATION OF CDMA RTTs

During the ITU-R TG 8/1 WG5 meeting held in Kuala Lumpur (February 2-5, 1999), two responses to the previous TG 8/1 liaison on the harmonisation of CDMA RTTs were received.

ITU-R TG 8/1 WG5 would like to thank 3GPP members for sending information on the structure and planned activities in the Third Generation Partnership Project (attached). ITU-R TG 8/1 WG5 would also like to thank ARIB and TIA for sending updated information on the harmonisation activities between ARIB and TIA (Attachment 2).TG 8/1 WG5 is encouraged to hear about the progress of thespecification activities in 3GPP, as well as the harmonisation progress between ARIB and TIA for 3rd generation wireless systems. Harmonisation of 3rd generation specifications among SDOs are steps in the right direction for achieving global 3rd generation standards and will expedite the standardisation work in ITU.

Moreover, ITU-R TG 8/1 WG5 also received contributions stressing the need to minimise the number of RTTs and maximise the commonality between them (Attachment 3, 4, and 5). These should provide guidance to the activities of SDOs and RTTs proponents.

It is important for ITU-R TG 8/1 to receive updated information from all SDOs and RTTs proponents on their activities in time for the 16th meeting of TG 8/1 (8-19 March 1999), when the Recommendation on Key Characteristics for the IMT-2000 Radio Interface(s) (IMT.RKEY) will be approved (see attached version).

Attachments: 6 [Contributions # 3, 22, 23, 25(front page) and 28 submitted to ITU-R TG 8/1 WG5 meeting and draft Rec. ITU-R IMT.RKEY prepared at the meeting]

Attachment 1
(Doc 8-1/WG5-028)

UNITED KINGDOM[1]

OUTLINE OF 3GPP STRUCTURE AND PLANNED ACTIVITIES

1. Introduction

3GPP members thank ITU-R TG 8/1 for its interest in our work related to the IMT2000 specifications, and especially the interest in 3GPP's view on the harmonization and convergence activities.

This liaison describes the current structure of 3GPP which will develop UTRA (Universal Terrestrial Radio Access) considering the following RTT proposals: UTRA (UMTS Terrestrial Radio Access) from ETSI, W-CDMA from ARIB, WP-CDMA from TIA/T1P1, Global CDMA II from TTA. TD-SCDMA from CATT will also be considered by 3GPP. This liaison also describes the planned activities in 3GPP.

2. 3GPP structure

Officially recognised Standardisation Organisations have agreed to work collaboratively for the production of Third Generation Mobile System specifications. The means for this collaborative activity has been provided in the form of a Partnership Project. This Partnership Project is entitled the "Third Generation Partnership Project" and it is known by the acronym "3GPP". The Partners have agreed to co-operate in the production of globally applicable Technical Specifications and Technical Reports 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 Division Duplex (TDD) modes). 3GPP is established for the preparation, approval, and maintenance of the above mentioned Technical Specifications and Technical Reports.

So far, five Organisational Partners have signed the Third Generation Partnership Project Agreement, namely: ARIB, ETSI, T1, TTA, TTC.

3GPP consists of

- A project Co-ordination Group (PCG); and
- Four Technical Specification Groups (TSGs) which have established Working Groups (WGs); their structure is as follows:
    - **TSG-SA** (Services and System Aspects)

        WG1 - Services

[1] This contribution was developed in 3GPP TSG RAN

WG2 - Architecture

WG3 - Security

WG4 - Codec

WG5 - Network Management

- **TSG-N** (Core Network)

  WG1 - MM/CC/SM

  WG2 - Camel/MAP

  WG3 - Interworking with External Networks

- **TSG-R** (Radio Aspects)

  WG1 - Layer 1

  WG2 - Layer 2 and layer 3 RR

  WG3 - Iu, Iub, Iur UTRAN, O&M Requirements

  WG4 - Specs for radio performance and protocol aspects

  ITU Ad Hoc - internal coordination toward ITU.

- **TSG-T** (Terminals)

  WG1 - MT conformance testing

  WG2 - MT services and capabilities

  WG3 - USIM

3GPP results should be submitted to the ITU as appropriate. 3GPP will not contribute directly to the ITU. Formal contributions to ITU Study Groups shall be made by Individual Members who are also members of the ITU. 3GPP Technical Specifications and Technical Reports may be taken as the technical content of such contributions.

In order to ensure a proper flow of information between 3GPP and ITU-R TG 8/1 via Individual Members, an ITU Ad Hoc Group has been established within TSG RAN with the task of co-ordinating inputs towards TG 8/1.

Further information on 3GPP can be found at http://www.3gpp.org.

3. Outline of activities within 3GPP TSG RAN

Based on SDO's agreement, the previous activities within individual SDO's are being transferred and merged within 3GPP in the development of the UTRA (Universal Terrestrial Radio Access) Specifications.

The results of the 3GPP TSG RAN work may form the basis of member contributions to

ITU-R TG 8/1. 3GPP's TSG RAN WG1 and WG4[2] respectively are addressing the Baseband and RF characteristics of UTRA. The intention is to agree the Key Characteristics, including values, at the next 3GPP TSG RAN meeting[2], in time for the Brazil meeting of Task Group 8/1.

3GPP TSG RAN appreciates the liaison statements from the last TG 8/1 meeting in Jersey, November 1998. 3 GPP TSG RAN WG1 and WG4 are intending to consider these liaisons in detail at their meetings in February 1999. As a natural part of its activity, 3GPP TSG RAN will consider TD-SCDMA technology in the development of the UTRA (Universal Terrestrial Radio Access) Specifications.

4. Conclusions

3GPP members welcome the opportunity to collaborate with ITU-R Task Group 8/1 and encourage contributions which will help in meeting these ambitious timescales.

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[2] 3GPP RAN TSG WG1 and WG4 met in Espoo, Finland, on January 21-22, 1999.

The next meeting of 3GPP TSG RAN WG4 will be in Turin, Italy, 15-19 February, 1999.

The next meeting of 3GPP TSG RAN WG1 will be in Tokyo, Japan, 22-25 February, 1999.

The next 3GPP RAN TSG meeting will be in Dallas, USA, March 1-5, 1999.

Attachment 2
(Doc 8-1/WG5-003 - Attachment)

ARIB-TIA IMT-2000 Harmonization Progress and Status

ARIB-TIA Joint Harmonization Status
December 11, 1998

ARIB-TIA Background

- ARIB developed ARIB W-CDMA RTT proposal
- TIA developed CDMA cdma2000 RTT proposal
- ARIB initiates global harmonization discussions
  - Companies represented all regions of the globe - NTT DoCoMo, DDI, IDO, KDD, NEC, Panasonic, Fujitsu, Hitachi, Ericsson, Nokia, Airtouch, LMNQS, …
  - ARIB CG (Coordination Group) forms Ad Hoc S for harmonization
  - Significant convergence was achieved on RL modulation and spreading (OQPSK, QPSK, TDM TPC, Coherent RL)
  - Companies made efforts to impact their regional standards bodies with respect to the ARIB Ad Hoc S harmonization studies
  - Ad Hoc S concluded their studies in March 1998
  - Since completion of the Ad Hoc S studies, significant work in development of RTTs has occurred

TR45.5 IMT-2000 Ad Hoc

- **TR45.5 IMT-2000 Ad Hoc formed in February 1998 to address global harmonization issues as related to TIA's cdma2000 RTT**
- **ARIB-TIA conduct meetings, where harmonization issues are discussed formally between TIA TR45.5 standards body and ARIB standards body**
  - **1st ARIB-TIA Meeting, April 1998, Harmonization Issues are introduced to TIA TR45.5 IMT-2000 Ad Hoc**
  - **2nd Meeting, July 1998**
  - **3rd Meeting, August 1998**
  - **4th Meeting, October 1998**
  - **5th Meeting, December 1998**
- **During ARIB-TIA discussions (i.e., as of April 1998) TIA and ARIB RTT's continue to mature and consequently harmonization issues evolve correspondingly**

ARIB-TIA Harmonization Issue - as of April 1998

- **Reverse Link**
  - **Modulation (QPSK, OQPSK, OCQPSK, HPSK)**
  - **Spreading Code (truncated, long)**
- **Forward Link**
  - **Pilot Structure (common CDM, dedicated TDM)**
  - **Channels (Fundamental/Supplemental, Transport/Physical)**
  - **Modulation/Spreading (Direct Spread, Multi-Carrier)**
- **Base Station Synchronization (Synchronous/Asynchronous)**
- **Chip Rate (4.096 Mcps, 3.6864 Mcps)**
- **FEC for High Speed Data (Concatenated, Turbo)**
- **Other**
  - **Power Control Rate (800 Hz, 1600 Hz)**
  - **Frame Rate (10 ms, 20 ms)**

Harmonization Progress (1)

- **Reverse Link Modulation**
  - **HPSK and OCQPSK introduced**
  - **HPSK and OCQPSK merged and accepted by TIA, TTA, ARIB, and ETSI***
- **Forward Link Pilot Structure**
  - **TIA's presents results showing the performance benefits of common pilot with respect to dedicated pilot**
  - **TIA's New performance results based on**
    - **Improved simulation platform, including system level performance**
    - **complete description of RTT's**
  - **ARIB-TIA continue to discuss issues with the possibility of reaching a joint recommendation for forward link pilot structure**
  - **These results have been submitted to ETSI SMG2 by the TIA for consideration**

*ETSI accepted HPSK/OCQPSK independently of TIA

Harmonization Progress (2)

- **MAC**
  - **ARIB and TIA logical channels are very similar, but naming conventions vary**
  - **ARIB and TIA MAC states are very similar, but naming conventions vary**
  - **Differences exist in channels and states:**
    - **TIA MAC contains dmch**
    - **TIA MAC contains Suspended state**
    - **ARIB ARQ function contained within the LAC**
    - **TIA supports ARQ in the MAC (RLP) and LAC**
  - **Comparative discussions on the MAC are ongoing**
- **Turbo Codes**
  - **TIA Turbo Code selection complete with the exception of the Turbo Interleaver**
  - **ARIB Turbo code selection has been finalized (MIL interleaver)**
  - **ARIB and TIA Turbo codes polynomials and states differ**

Harmonization Progress (3)

- **Forward Link Channels**
  - Channel structure discussion separated into three sub-topics:
    - » Bearer service mapping - Fundamental/Supplemental/Dedicated vs. Transport/Physical
    - » Soft handoff control
    - » Packet access control
  - Bearer service mapping between ARIB-TIA is found to have same fundamental capabilities
  - Packet access control is opened as new issue: “MAC” to be studied between ARIB-TIA
  - Soft handoff control within ARIB is under development - the methods of reduced active sets, and soft handoff messaging and triggers were introduced to ARIB as FYI
  - ARIB to report their results regarding soft handoff when available

Harmonization Progress (4)

- **Base Station Synchronization**
  - ARIB Identifies requirements for asynchronous operation
    - » Maximum flexibility in deployments
    - » Indoor and underground deployments
    - » Non-external timing source
  - TIA requests further clarification of requirements
  - ARIB to provide TIA technical data substantiating the selection of asynchronous mode including complexity as well as the other factors
  - TIA to continue studies regarding other solutions, for example, other means of synchronization without GPS, which satisfy the above requirements

Updated ARIB-TIA Harmonization Issues

- Reverse Link
  - ✓ Modulation (QPSK, OQPSK, OCQPSK, HPSK) - OCQPSK/HPSK selected by ARIB, TTA, ETSI, TIA
  - Spreading Code (truncated, long)
- Forward Link
  - ☐ Pilot Structure (common CDM, dedicated TDM) - analysis with advanced simulation platform
  - ✓ Channels (Fundamental/Supplemental/Dedicated, Transport/Physical)
  - ✧ Soft Handoff - ARIB to report soft handoff developments
  - Modulation/Spreading (Direct Spread, Multi-Carrier)
- ☐ Base Station Synchronization (Synchronous, Asynchronous) - revisit requirements and investigation of alternate solutions
- Chip Rate (4.096 Mcps, 3.6864 Mcps)
- ✓ FEC for High Speed Data (Concatenated, Turbo) - ARIB selects Turbo code for high speed data parameters differ from TIA's Turbo Code
- ✧ Turbo Code Parameters
- Other
  - Power Control Rate (800 Hz, 1600 Hz)
  - Frame Rate (10 ms, 20 ms)
- ✧ MAC

✓Resolved/Converged
Open Issues:
- • Existing
- ✧ New Issue
- ☐ Modified Issue

Appendix 1 - TIA ARIB Harmonization Issues Table as of April 1998

ARIB-TIA Harmonization Table - April 1998 (1)

Harmonization Issue	Parameters	Comments
Reverse Link Modulation	QPSK (ARIB) OQPSK (TIA)	QPSK selected by ARIB and TIA
Reverse Link Spreading Code	Truncated Long Code (ARIB) Long Code 2^{42-1} (TIA)	Issues raised relative to Long Codes and compatibility with code sync for async base stations
Reverse Link Power Control Bit Transmission	TDM (ARIB) CDM (TIA)	TDM selected by ARIB and TIA as a result of Ad Hoc S studies
Forward Link Pilot Structure	Dedicated TDM (ARIB) Broadcast CDM (TIA)	Ad Hoc S adopts parameterized pilot structure with operating mode of dedicated TDM pilot. Evaluation continues within TR45.5 IMT-2000 Ad Hoc

ARIB-TIA Harmonization Table - April 1998 (2)

Harmonization Issue	Parameters	Comments
Forward Link Channels	Transport/Physical Chs (ARIB) Fund/Supp Chs (TIA)	Issues identified within Ad Hoc S and introduced to TR45.5 IMT-2000 Ad Hoc: • Soft Handover • Bearer Service Mapping • Packet Access Control
Forward Link Modulation/Spreading	Direct Sequence (ARIB) Direct Sequence and Multicarrier (TIA)	Further discussion to continue within TR45.5 IMT-2000 Ad Hoc contingent on Harmonization progress

ARIB-TIA Harmonization Table - April 1998 (3)

Harmonization Issue	Parameters	Comments
Base Station Synchronization	Synch/Async (ARIB) Synchronous (TIA)	Previous technical discussions within ARIB Ad Hoc S had chosen two modes operation. TIA based on synchronous operation.
Chip Rate	4.096 Mcps (ARIB) 3.6864 Mcps (TIA)	ARIB Ad Hoc CR concluded "no fatal impact" in changing chip rate. TIA chip rate based on requirements for frequency deployment and evolution.
High Speed Data FEC	Concatenated Codes (ARIB) Turbo Codes (TIA)	In April time frame ARIB evaluating Turbo Codes, however, RTT contains concatenated codes
Power Control Rate	1600 Hz (ARIB) 800 Hz (TIA)	Considered a secondary issue when introduced to TIA-ARIB
Frame Rate	n x 10 ms (ARIB) (n = 1, 2,4, 8) 20 ms (TIA)	ARIB selected 10 ms based on ITU delay requirements. TIA selected 20 ms frame size based on link performance and VOCODER reuse.

Attachment 3
(Doc 8-1/WG5-022)

NEW ZEALAND

HARMONISATION OF IMT-2000 TECHNOLOGIES

Purpose

The purpose of this paper is to urge and encourage TG 8/1 to undertake a convergence process between the proposed IMT-2000 technologies, and to work towards a single worldwide standard.

Background

The main objective of ITU-R TG 8/1 work is clearly contained in opinion ITU-R 92-1:

> “that the ITU, as a matter of policy, should make every effort to persuade regional bodies, national authorities and other appropriate entities to support the Radio Communications Sector in an explicit manner in its development of Recommendations on IMT-2000 and strongly encourage regional organisations to work together towards a single worldwide standard”.

As a consequence of the evaluation activity it was decided at the London and Jersey meetings to pass all the technologies submitted to step 7. WG5 is now at the stage of finalising Recommendation RKEY that will provide key parameters and their values for IMT-2000 technologies. The Recommendation RKEY is central to shaping the text of RSPC's which will provide detailed specifications. In effect, one could study RKEY and have a very good understanding of the main aspects of the IMT-2000 radio interface. Therefore, it is critical that in the preparation of RKEY one should not lose sight of the main objective of ITU-R TG 8/1 stated earlier. Specifically, RKEY should not lead to a plethora of radio interfaces as is the case with second generation systems today.

Benefits of a Converged Standard

The benefits of a converged standard may be gauged from the worldwide success of the GSM standard. All sectors of the industry including customers, operators and vendors are likely to benefit from a converged IMT-2000 standard. In particular, customers will benefit from the availability of low cost services and terminals. A converged standard will also enable easier roaming across national boundaries. There may also be efficiencies of spectrum resulting from easier interference management between adjacent systems.

If there is failure in achieving convergence, there appear to be many potential difficulties that could result from intellectual property rights and global trade problems.

Parameter Values for Key Characteristics

WG5 is now undertaking the task of preparing values for the key parameters. At the Jersey meeting there was much discussion on what constituted Key Characteristics. It was decided to divide Key Characteristics into RF Characteristics and Baseband Characteristics.

Definitions of the Key Characteristics were produced. Values or ranges of values for the Key Characteristics now need to be assigned where appropriate. In assigning values, the following general principles might be useful.

1. Parameters should be assigned values that will result in:
   - Superior technical performance;
   - Low cost.

2. Parameters should not be assigned ranges of values simply to accommodate the differing RTT's, unless there are sound technical reasons for having a range of values. Ranges of values may result in a number of incompatible air interfaces – a situation that is not in the spirit of TG 8/1's original objective.

3. The high level drivers discussed in the Jersey meeting should form the motivation to assign values to the parameters.

4. Converged parameters should enable inter working with the dominant core network standards to realise a truly global solution.

Conclusion

WG5 – TG 8/1 has a challenging task to harmonise the IMT-2000 technologies. Recommendation RKEY is a critical step towards harmonisation. If we are unable to arrive at a set of converged parameter values, the ideals of harmonisation and a benefits of a single world wide IMT-2000 technology will not be realised.

Attachment 4
(Doc 8-1/WG5-023)

China

TDD HARMONIZATION MEETING BEIJING

Recently, a TDD harmonisation meeting was held in Beijing, China in Jan. 11 to 12, 1999. Nokia, Ericsson, Siemens, Docomo, Arib, Panasonic, ChEG, and CATT attended this informal technical meeting. Accordance with the common interests in merged TDD RTT key parameters, the participants studied the presentations and the harmonisation proposal by China. The main topics discussed in the meeting are as follows:

1. Advanced technologies which may be adopted in TDD mode, such as smart antenna, uplink synchronisation, joint detection, software radio;
2. The relationship between chip rate and technologies;
3. Complexity related problems.

In this meeting, a common understanding is reached as follows:

1. Uplink synchronisation and baton handover provided in China TDD harmonisation proposal should be provided to ITU and 3GPP;
2. The technologies such as smart antenna, joint detection ,software radio, and etc. will greatly enhance the capacity and reduce hardware complexity, these technologies should be provided as optional features in TDD mode standard;
3. Parties agree to study the relationship between bandwidth and chiprate for TDD mode;
4. CATT should provide more detailed technical information to explain why lower chiprate is ensential for adopting new technologies;
5. The next TDD harmonisation meeting is scheduled to hold in Feb. 25-26, in Beijing.

Attachment 5
(Doc 8-1/WG5-025 - Front page)

China

THE OPERATORS DESIRE FOR A COMMON GLOBAL SPECIFICATION FOR 3G CDMA SYSTEMS

To develop a common global IMT-2000 Personal Wideband Wireless Standard, to be based on CDMA, which will maximise global economies of scale and coverage. The standard will form an integral part of IMT2000 and satisfy customer needs by offering greater capacity, higher data rates (up to 2Mbits/s) and help migrate smoothly from 2G services. China Telecom recently sponsored an Operators Workshop on "Harmonised Global 3G (G3G)" in Beijing, China from January 14-15, 1999. Forty delegates of eighteen key operators (**Asia Pacific:** China Telecom, NTT DoCoMo, DDI Corporation, IDO Corporation, Singapore Telecom, Hong Kong Telecom CSL. **North American:** AirTouch, Bell Atlantic Mobile, Bell Mobility, Bell South, GTE Wireless Mobiles, Sprint PCS. **Europe:** British Telecom, Cable and Wireless, De Te Mobil, France Telecom Mobiles, Telecom Italia Mobile, Telia Mobile) from eleven countries have attended this workshop.

This workshop has mainly discussed 2 documents,

1. Specification Framework for ITU IMT-2000 CDMA (see attachment)
2. Radio Access Technical Specification for ITU IMT-2000 CDMA

During 2 days meeting, all the operators exchanged viewpoints, and gave suggestions for the two documents. The agreement on specification framework has been achieved at this meeting, which is attached following this document. Although there have been a number of debates concerning the transition from 2nd generation to the 3rd generation and the workshop didn't reach the agreement on "Radio Access Technical Specification for ITU IMT-2000 CDMA", all operators agree to hold another meeting in LONDON at the end of February. At that meeting they will further discuss the Technical Specification for ITU IMT-2000 CDMA, all the detailed technical parameters should be pre-analysed and evaluated before the meeting. Beijing Operators Workshop is the good beginning that operators push the harmonisation of 3G mobile communications system forward.

China Telecom will continue to support one single IMT-2000 standard and will encourage all the operators to co-operate and make effort on this target.

Attachment: 1 *[not reproduced]*

LIAISON STATEMENT ON TDD MODES(CDMA & TDMA) ASPECTS

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1. GENERAL

ITU-R Task Group 8/1 WG5 received and acknowledges the many contributions received from the RTT proponents and SDO's on the TDD modes (CDMA & TDMA) aspects during its ITU-R TG8/1 WG5 meeting in Malaysia during 2-5 February 1999. TG8/1 believes that there is potential to have a single TDD mode and discussions so far have identified a number of issues and areas for potential harmonisation.

2. TDD MODE (CDMA & TDMA) CONSIDERATIONS

Several received contributions suggest considerable harmonisation potential across the TDD modes of all RTT proposals. The issues and areas for potential harmonisation identified so far have broken down into three areas of discussion and can be characterised as follows:

- The importance of the TDD mode
- The harmonisation & co-existence between different TDD RTT proposals
- The co-existence between TDD and FDD modes.

Importance of TDD mode

The TDD mode is particularily well suited to small cells and is expected to be deployed mainlyin the micro and pico cell environments for home and office deployments but it also has applications in the fixed wireless, pedestrian as well as vehicular environments.

Multimedia services, particularly IP based services, are expected to be an important feature of IMT2000 and many of these services are expected to result in asymmetric traffic flows for which the TDD mode is well suited in terms of its ability to handle traffic in a flexible and efficient manner.

Harmonisation & co-existance between different TDD mode proposals

An analysis of the different TDD proposals has identified some common areas for harmonisation although at this point in time the list is not exhaustive and other proposals are welcome:

- Basic Frame Length
- Time structure for the Up Link and Down Link Separation
- Channel Access "Rules" to be followed to support co-existence

Co-existance between TDD and FDD modes

Inter-system roaming has been identified as an important capability to allow the users of terminals to roaming between the different systems. For roaming to take place between different systems the support and availability of intra-system and possibly inter-system handover between appropriate FDD mode and/or TDD mode terminals is vital for calls in progress with secure location registration, authentication, encryption and charging mechanisms etc.

The co-existence of TDD and FDD modes has the potential to; wherever practical and appropriate, allow the user to have access to a consistent and coherent set of services and features across the different networks.

3. REQUEST FOR COMMENT

It is important for TG8/1 to receive updated information from all SDO's and RTTs proponents on the three areas identified above for the TDD mode (CDMA & TDMA) in time for the 16th meeting of TG8/1 (Brazil 8-19th March 1999) when the recommendation on Key Characteristics for the IMT2000 interface(s) (IMT RKEY) will be approved (see attachment). . Furthermore any other comments; not identified above, would be welcome.

INTERNATIONAL TELECOMMUNICATION UNION
RADIOCOMMUNICATION STUDY GROUPS

Document 8-1/230-E
12 February 1999
Original: English only

Received: 8 February 1999

Subject: Question ITU-R 39/8

Chairperson, Working Group 5

PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R [IMT.RKEY]

KEY CHARACTERISTICS FOR THE IMT-2000 RADIO INTERFACES

(Version 1)

This document is a revision of the outline structure and text for the preliminary draft new Recommendation on "Key Characteristics for the IMT-2000 Radio Interfaces".
The document collates into a single document the output from the Jersey meeting, and the outcome of the contributions to and discussions at the interim meeting of Working Group 5 in Malaysia.
This draft Recommendation will be further developed and approved at the 16th meeting of Task Group 8/1, in Brazil, 8-19 March 1999.

[Editor's note:

a) *It may be appropriate to find a new descriptor for the output of this process, i.e. the input proposals are called " RTTs" – what should the output be called ?*

b) *There are inconsistencies between the terminology used in different sections which requires tidying up.*

c) *Duplication needs to be avoided.*

d) *There are also areas which are generic to both satellite and terrestrial while there are some areas that are not – these will need clarifying]*

Attachment: 1

ATTACHMENT

PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R [IMT.RKEY]

KEY CHARACTERISTICS FOR THE IMT-2000 RADIO INTERFACES

1 Introduction

International Mobile Telecommunications-2000 (IMT-2000) are third generation mobile systems which are scheduled to start service around the year 2000 subject to market considerations. They will provide access, by means of one or more radio links, to a wide range of telecommunications services supported by the fixed telecommunication networks (e.g. PSTN/ISDN), and to other services which are specific to mobile users.

A range of mobile terminal types is encompassed, linking to terrestrial and/or satellite based networks, and the terminals may be designed for mobile or fixed use.

Key features of IMT-2000 are:

– high degree of commonality of design worldwide;

– compatibility of services within IMT-2000 and with the fixed networks;

– high quality;

– use of a small pocket-terminal with worldwide roaming capability;

– capability for multimedia applications and a wide range of services.

IMT-2000 are defined by a set of interdependent ITU Recommendations of which this one is a member.

This recommendation forms part of the process of specifying the radio interface(s) of IMT-2000 and will be used as an input into the development of the IMT-2000 Radio Specification (IMT.RSPC) recommendations. IMT.RSPC is expected to provide sufficient detail to ensure worldwide compatibility and international roaming.

This Recommendation is primarily based on the principles, requirements and framework of the IMT-2000 radio interface(s), as outlined in IMT-2000 Recommendations ITU-R M.687, ITU-R M.819, ITU-R M.1034, ITU-R M.1035, ITU-R M.1038, ITU-R M.1225 and ITU-R M.1311.

In order to be in a position to recommend radio transmision technologies for IMT-2000, the ITU invited proponents to submit their design to meet a defined set of requirements and timings.

This recommendation identifies the “key characteristics” for the IMT-2000 radio interfaces and addresses the rationale by which these key characteristics are identified. Generic key characteristics applicable to both satellite and terrestrial are identified. The terrestrial key characteristics are split into RF, baseband, and system characteristics. The satellite key characteristics are split into architectural, system, RF and baseband.

2 Scope

This Recommendation defines the key radio technology characteristics for the IMT-2000 Terrestrial and Satellite Radio Transmission Technologies, for subsequent use in the detailed specification of IMT-2000 in the IMT.RSPC Recommendation(s), based on the application of the evaluation procedures given in Rec. ITU-R M.1225 to the radio transmission technology proposals.

The key characteristics have been identified based on consideration of the evaluation results and consensus building, recognising the need to minimise the number of different radio interfaces and maximising their commonality, while incorporating the best possible performance capabilities in the various IMT-2000 radio operating environments.

These characteristics are [sufficient / needed] to define the major performance and design parameters to allow further detailed definition by the ITU and others.

[Editors note: the WG 5 chairman and sub-group chairman considered it appropriate to add the [..] in the final sentence above for further consideration at the next meeting.]

3 Related Recommendations

The existing IMT-2000 recommendations that are considered to be of importance in the development of this particular recommendation are as follows;

Rec. ITU-R M.687 – International Mobile Telecommunications 2000 (IMT-2000)
Rec. ITU-R M.816 – Framework for services supported on IMT-2000
Rec. ITU-R M.817 – IMT-2000 Network Architectures
Rec. ITU-R M.818-1 – Satellite operations within IMT-2000
Rec. ITU-R M.819-2 – IMT-2000 for Developing Countries
Rec. ITU-R M.1034-1 – Requirements for the Radio Interface(s) for IMT-2000
Rec. ITU-R M.1035 – Framework for the Radio Interface(s) for IMT-2000
Rec. ITU-R M.1036 – Spectrum Considerations for Implementation of IMT-2000 in the bands 1 885–2025 MHz and 2 110–2 200 MHz
Rec. ITU-R M.1167 – Framework for the Satellite Component of IMT-2000
Rec. ITU-R M.1224 – Vocabulary of Terms for IMT-2000
Rec. ITU-R M.1225 – Guidelines for Evaluation of Radio Transmission Technologies for IMT-2000
Rec. ITU-R M.1308 – Evolution of Land Mobile Systems Towards IMT-2000
Rec. ITU-R M.1311 – Framework for Modularity and Radio Commonality within IMT-2000
Handbook on Principles and Approaches on Evolution of to IMT-2000/FPLMTS - Volume 2 of Handbook on Land Mobile (including Wireless Access)

NOTE – IMT-2000 was formerly known as Future Public Land Mobile Telecommunications Systems (FPLMTS).

4 Considerations

The ITU Radiocommunication Assembly,

considering

4.1 The Goals of Consensus Building

The main purpose of consensus building is to achieve a global system with a minimum number of IMT-2000 RTTs, with maximum commonality among them. The resulting set of RTTs should support a range of mobile terminals for mobile and fixed use, and permit access to terrestrial and/or satellite based networks. Maximum commonality will enable the goals of a small lightweight terminal, simplify the task of building multi-mode terminals for international roaming, and reduce complexity and facilitate flexible access.

4.2 The RTT Evaluation Process

A number of radio interfaces for IMT-2000 were proposed in response to an invitation by the ITU. These were evaluated in accordance with a process defined in Recommendation ITU-R M.1225, and to a defined time scale. An intermediate step in the process concluded that all ten proposals for terrestrial RTTs and all six proposals for satellite RTTs met the relevant minimum performance capability requirements. See Annex A. [*Editor's note: this Annex may not be carried through to the final Recommendation.*]
Nine terrestrial RTTs covered all the terrestrial test environments. As expected each satellite proposal was optimised for a set of the overall service requirements.
In the final step of this process, commonalities were sought among the terrestrial proposals, making use of the emerging key characteristics, and some proposals were merged. It was concluded that there was little to be gained from any merging of the satellite proposals although benefits might be obtained from seeking commonalities among elements of satellite and terrestrial RTTs.

4.3 Impact of Evolution on the development of the Key Characteristics for IMT-2000

IMT-2000 was initially conceived as a concept integrating the then variety of disparate mobile communications technologies and services. Proposals to date have been largely technology driven, although Recommendation ITU-R M.1225 does recognise that non-technological issues such as risk, commercial viability, etc, must be taken into account in the IMT-2000 standards. This technology driven approach tended to assume deployment of IMT-2000 in a "green-field" environment, which is now increasingly unlikely bearing in mind the extensive deployment of pre-IMT-2000 systems and the major changes in regulatory policies since IMT-2000 was first conceived. As a result, the need for an evolution or migration path from present systems has been extensively studied within the ITU. In particular, Recommendation ITU-R M.1308 "Evolution of Land Mobile Systems Towards IMT-2000" indicates that:

a) there is a need to support terminal roaming between pre-IMT-2000 and IMT-2000 systems;

b) that evolution and migration may occur in discrete steps and these steps may occur at different times in different regions and at different times for different operators;

c) that the standards for IMT-2000 should be adopted as soon as possible to support the timely evolution of existing systems to IMT-2000;

d) that a key feature of IMT-2000 is the incorporation of a variety of systems.

It is expected that global demand for IMT-2000 within a competitive operating environment will escalate the demand for additional spectrum. Depending on the needs of administrations, some operators may have access to this additional spectrum for IMT-2000 deployment while other operators may have to utilise their existing spectrum. To enable all operators to deploy IMT-2000 services rapidly, those operators that have no access to new spectrum, and wish to evolve their existing systems to IMT-2000 should have the ability to select the kind of systems that:

a) are backwards compatible with their current systems, [where possible]

b) can be deployed within their current available spectrum, [where possible]

c) can co-exist with their or other operators' current systems,

d) have the ability for incremental deployment and incremental use of spectrum according to the incremental growth in the market demand for IMT-2000 services, and

e) provide graceful and resource-efficient migration path(s) for the evolution from pre-IMT-2000 systems to IMT-2000

This set of evolution capabilities will help reduce the business risk substantially and encourage the operators to deploy IMT-2000 services rapidly. This reinforces the following section in that a limited range of standards will be needed to encourage rapid deployment of IMT-2000 services globally.

4.4 Impact of Modularity

The principles, requirements and framework for the IMT-2000 radio interface(s) are outlined in Recommendations ITU-R M.687, ITU-R M.1034 and ITU-R M.1035. These Recommendations indicate that IMT-2000 must have the capability to support more than one radio interface if necessary. The need to interface to multiple core networks has also been identified.

Recommendation ITU-R M.1311 makes some significant statements that have an impact on the development of the key characteristics of IMT-2000, and in particular the relevance of defining a RF/baseband split in identifying the key characteristics of the IMT-2000 radio interface(s).

Recommendation ITU-R M.1311 recognises that since the technologies for wireless networks, including IMT-2000, are evolving, it is important to have the flexibility to easily reconfigure the access network by plugging in different radio modules.

Important design objectives for IMT-2000 are to minimize the number of radio interfaces, to maximize the commonality between them and to be able to flexibly adapt different services onto these radio interface(s). These design objectives should be met in order to minimize costs and to ease service and network deployment.

[A number of objectives have been established which place requirements upon IMT-2000 system design and the design of networks implementing IMT-2000. The key aspects for the purpose of Recommendation ITU-R M.1311 are:

a) to facilitate evolution to IMT-2000 from existing fixed and mobile systems;

b) to provide a common platform/framework for the support of various categories of services;

c) to be adaptable to the service providers' and network operators' needs to differentiate their service offerings;

d) to facilitate the deployment of the system in a manner consistent with the individual needs of service providers and network operators.

Each of these requirements could have a significant impact upon IMT-2000 system, network and protocol design.

The modularized functional and physical architecture envisaged by Recommendation ITU-R M.1311 needs to satisfy these requirements:

a) future evolution;

b) interworking between a variety of access technologies/standards, core transport and core control standards/networks;

c) technology-independence of telecommunications standards;

d) service differentiation options for operators and/or service providers;

e) standards which provide scope, within a generic framework, for proprietary enhancements to meet specific needs;

f) support for a variety of radio operating environments;

g) backwards compatibility.

The purpose of Recommendation ITU-R M.1311 is to facilitate the development of a modular framework which can be used as a basis for specific architectures, enabling these to be combined in various ways to meet operators' needs.]

Thus for modularity reasons and evolution reasons alone, the RF/Baseband split may be useful in order to enable the varying evolutionary paths. RF evolution is dependent on international agreements and the deployed mobile technology base, which affect changes in RF parameters, spectrum allocations, power classes, emissions, and other factors; whereas Baseband evolution relies on advances in technology, innovation and industrial competition.

4.5 High Level Drivers

[Editor's note: It may be relevant to address generic terrestrial and satellite high level drivers in a separate sub-section at the beginning of this section or in the exisiting separate sections but identified as generic.]

4.5.1 Terrestrial

Based on an analysis of the IMT-2000 Key Features and Objectives, there are four different distinguishable classifications that can be identified. These classifications are:

a) Key Service Aspects

b) Key Design Principles

c) Key Attributes

d) Key Parameters.

The Key Service Aspects for IMT 2000 resulting from that analysis are:

a) Worldwide Roaming

b) Improved Voice

c) Significantly Higher Bit Rates

d) Internet Packet data

e) High Speed Packets

f) Asymmetrical Data

g) Bandwidth On Demand

h) Multi-Media.

The Key Design Principles for IMT-2000 resulting from that analysis are:

a) Pursue a Global Standard through Commonality.

b) Emphasize small power efficient modular user terminals.

c) Use modular approach to achieve lower costs and simpler designs.

d) Provide quality, integrity and coverage similar to the public fixed network.

e) For a broader market make the equipment user friendly.

f) Provide evolution path from the 2G systems to the 3G systems.

g) Provide compatibility of services across all current and future telecommunications networks (emphasizing wideband services).

h) Provide standard interfaces to design for evolution.

i) Provide the structure to allow 2G and 3G systems to co-exist in the same coverage area and interwork with each other.

j) Provide a path for terrestrial and satellite integration.

k) Accommodate a wide range of environments and user densities where the users are employing both fixed and mobile terminals.

l) Cater to the needs of developing countries by providing a modular structure that can start small and grow as needed.

m) Improved Security.

The Key Attributes for IMT-2000 derived from that analysis are:

a) Optimized Power Control

b) Controlled Margin

c) Error Correcting Codes

d) Interleaving

e) Diversity

f) Handover

g) Multi-Carrier

h) Adaptive Equalizer

i) Framing & Protocol

j) Dynamic Channel Allocation

k) Control Channel Signaling

l) Encryption

m) Key Distribution

n) Asynch/Synch Base Stations

o) Integrated System Monitoring

p) Interference Control

q) Roaming

r) Cell Planning

s) Network Structure

t) Status Reporting (update Data-Bases)

u) Channel Evaluation

v) Control of RF Parameters

w) Modulation

x) Multiple Access

y) Power Control (Interference)

z) Detection.

The Key Parameters for IMT-2000 derived from that Analysis are:

a) Multi-Code

b) Doppler Range

c) Frequency Reuse

d) Spreading Code

e) Pilot Structure

f) Chip Rate

g) Variable Spreading

h) Out-of-Band Emissions.

The Key Service Aspects for IMT-2000 are beyond the scope of this Recommendation which addresses the key characteristics of the IMT-2000 radio interfaces and therefore do not need to be considered further in this Recommendation. The Key Design Principles are important considerations throughout the entire design phase and are addressed in this sub-section. Key Attributes and Key Parameters are equally important and it would be appropriate that they be combined into a common list of key characteristics.

For ease of implementation and to achieve economy of scale this list of key characteristics is divided into three categories reflecting the potential modular structure of the system. The radio portion of the system is divided to give a radio frequency front end module and a baseband module. This results in two lists of key characteristics. The list of RF Front-End key characteristics describes the radio frequency module and the list of Baseband key characteristics describes the baseband module. The key characteristics that are more general in nature and apply across multiple modules are classified as system key characteristics and are listed separately in this Recommendation.

4.5.2 Satellite

[*Editor's note: Contributions are requested on this item. Note that some material may be generic.*]

4.6 Other Issues

IMT-2000 should offer better more efficient use of the radio spectrum than pre-IMT-2000 systems consistent with providing services at acceptable [cost], taking into account the differing demands for data rates, symmetry, channel quality, and delay.

While IMT-2000 may build upon second generation system technologies it is also recognised that second generation systems themselves will continue to evolve and advance in terms of new services and flexibility to support multi-environment capabilities, even while IMT-2000 is being implemented.

5 Recommendations

5.1 Definition and Rationale

The set of key characteristics are those characteristics that are required to [adequately] define an RTT.
[Editors note: the WG 5 chairman and sub-group chairman considered it appropriate to add the [..] in the final sentence above for further consideration at the next meeting.]

The Tables [RF and Baseband tables from SWG 5-2] be adopted as the key charcateristics of the IMT-2000 radio interfaces.

For each RTT characterised in Tables [RF and Baseband tables from SWG 5-2], the detailed specification will be developed in IMT.RSPC.

Figure 2 shows a general block diagram of an IMT-2000 device that is implementation independent, and can be used for both Terrestrial and Satellite Radio Transmission Technologies. The use of common components for the RF section of the devices can provide the functionality needed for the various radio interfaces, while providing the economy of large-scale production. Depending upon spectrum allocations, the RF part can also be designed for backward compatibility to second-generation systems as well. The RF part will cover the required band allocation for IMT-2000. As an example of an RF front end, a filter bank or a tuneable RF filter can be implemented. Further, the use of a broadband IF filter may provide the bandwidth to accommodate a software defined receiver. Such a software defined radio may allow the bandwidths of different RTT proposals to be addressed.

The rationale behind grouping the key characteristics into RF and Baseband is to achieve as much commonality as possible in the RF portion, which is where most of the hardware complexity resides. For the baseband characteristics, the level commonality must satisfy market needs.

Specific requirements on either RF or baseband characteristics are developed in the following sections. It should be noted that characteristics from one group could have cross-impacts on the other group.

Some of the characteristics may be grouped as system characteristics, which refer to functions and procedures of the system which are useful for radio resource management, and have some impact on all layers of the radio interface.

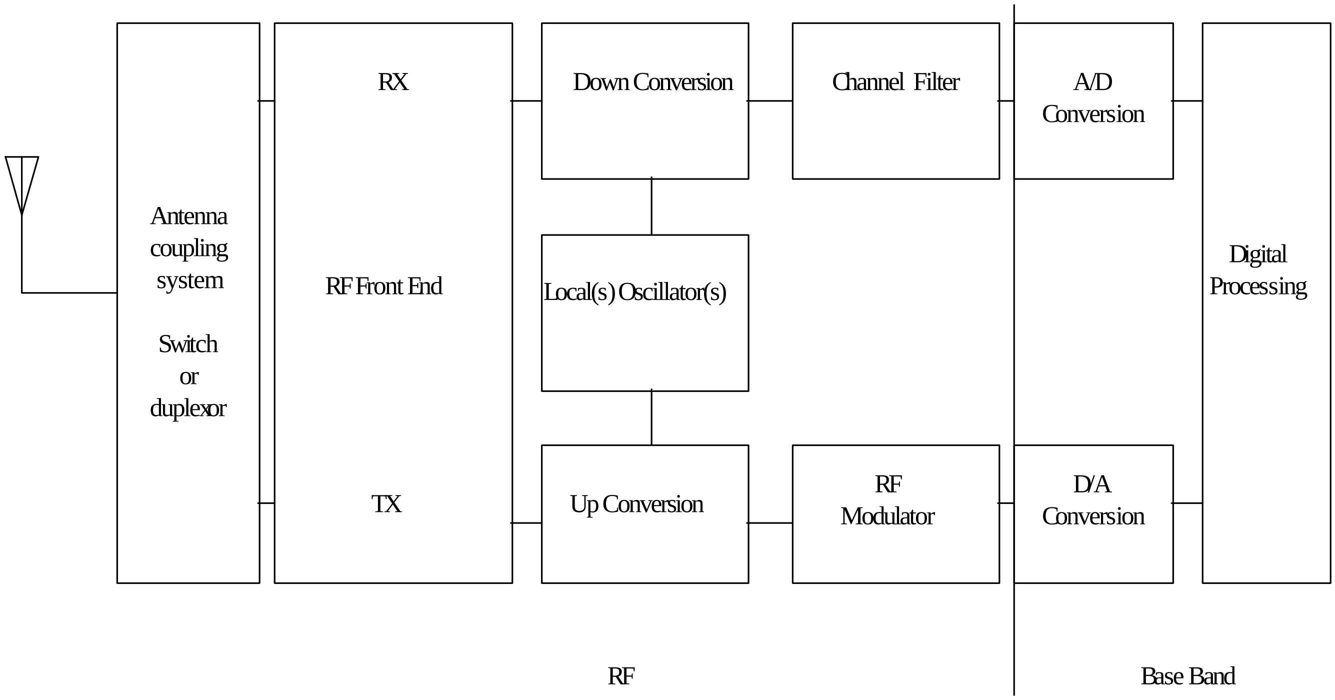

FIGURE 2

General block diagram of an IMT-2000 device

[The system characteristics relevant for RKEY are:

– Handover

– Power Control

– Inter base station asynchronous/synchronous operation

– Dynamic Channel allocation]

[Editor's note : there may be common or generic key characteristics between terrestrial and satellite components. These may be indicated either by listing in a separate table or by designating entries in the appropriate terrestrial and satellite tables.]

5.2 Terrestrial

5.2.1 RF Key Characteristics

TABLE 1

RF Front-end Key Characteristics

	Name of Key Characteristic	**Definition**[3]	**remarks**[4]	**List of proposed values** [5]	
				Mobile Station Value	**Base Station Value**
	Transmitter characteristics	The transmitter characteristics are specified at the antenna connector of the equipment. If there is no antenna connector, appropriate measuring mechanism should be defined. For example antenna emission power can be measured at the test site or at the RFCD (Radio-Frequency Coupling Device) calibrated at the test site.	MODIFIED DEFINITION		

[3] Editor's note: The columns "Name of Key Characteristic" and "Definition" are quite stable and are to be frozen.

[4] Editor's note: This column is for information purpose only and will be deleted at 16th TG 8/1 meeting.

[5] Editor's note: The column "List of proposed values" is a compilation of input contributions at WG 5 meeting in Malaysia. Some of the definition of "RF key characteristics" were changed during the meeting. The listed values in these columns were proposed based on the definitions in Doc. 8-1/TEMP/126. Therefore, the listed values in this column may not be consistent to the revised definition of the "RF key characteristics".

	Transmit power				
1.1	Power classes (A1.2.16)[6]	The power classes define the maximum average output transmitter power level, measured over a unit time. The power classes together with the service type (bit rate, QoS etc.) define the coverage. An operator can use this for planning its network. For multi-standard terminals the highest power class level that needs to be supported will set the power amplifier requirements. The accuracy of the power may depend on appropriate regional regulations.	**New definition**	Max. output power ≤ 33 dBm Maximum 30 dBm Mobile A1.2.16 The maximum power levels are expected to be similar to TIA/EIA-95-B EIRPs per class (1.9GHz Band): Class I: 28 dBm <EIRP < 33 dBm Class II: 23 dBm <EIRP < 30 dBm Class III: 18 dBm <EIRP < 27 dBm Class IV: 13 dBm <EIRP < 24 dBm Class V: 8 dBm <EIRP < 21 dBm The maximum power level is subject to constraints from regulatory agencies. For 800 MHz: Class I 36 dBm max, 8 dBm min Class II 32 dBm max, 8 dBm min Class III 28 dBm max, 8 dBm min Class IV 28 dBm max, -4 dBm ± 9 dB min For 1 900 MHz: Class II 30 dBm max, -4 dBm ± 9 dB min Class IV 28 dBm max, -4 dBm ± 9 dB min For 136 HS Indoor: 28 dBm max, -15 dBm min 0/10/21/24/27/33 dBm Peak power Level 1: 2,5 mW Level 2: 250 mW	N/A Peak power Level 1: 2,5 mW Level 2: 250 mW

[6] Editor's note: Notation (A1.X.Y.Z) indicates reference attribute of Annex 1 of Recommendation ITU-R M.1225. The reference would be deleted when draft new Recommendation IMT.RKEY is finalized.

1.2	Dynamic range (A1.2.22.3)	The output power dynamic range is the difference between the maximum and the minimum transmitted power for a specified reference condition.	No change	The value depends on terminal power class and may be up to 80 dB. Minimum controlled output power should be less than -44 dBm/ 4.096 MHz UL: 80 dB DL: 30 dB A1.2.22.3 Expected to be similar to TIA/EIA-95-B Open loop: ± 40 dB Closed loop: ± 24 dB (around open loop estimate) 136 HS Outdoor: 32 - 34 dB 136 HS Indoor: up to 50 dB	30 dB Expected to be similar to TIA/EIA-95-B. Open loop: +/- 40 dB Close loop: +/- 24 dB (around open loop estimate) 136 HS Outdoor: 32 - 34 dB 136 HS Indoor: up to 50 dB
1.3	Power Control Steps (A1.2.22.1)	The power control step is the minimum step change in the transmitter output power in response to a power control command.	No change	≥ 0.25 dB 1 dB Step size 0.25 – 1.5 dB A1.2.22.1 1.0 dB nominal 0.5 dB and 0.25 dB are available as options. 136 HS Outdoor: 4 dB 136 HS Indoor: 0.5 dB to 4 dB	≥ 0.25 dB 1 dB 1.0 dB nominal 0.5 dB and 0.25 dB are available as options. Infinitely adjustable
1.4	Frequency stability (A1.4.1)	The ability of mobile and base station to maintain the transmission frequency at the assigned carrier frequencies.	New definition	0.1 ppm (locked to the system) 0.1ppm 0.05 ppm 0.08 ppm (assuming approx. ± 150 Hz MS transmit accuracy) The mobile station obtains its frequency for the BS. The mobile station's transmit frequency is required to be within 150 Hz of the ideal transmit frequency. At an RFP the transmitted RF carrier frequency corresponding to RF channel c shall be in the range Fc ± 50 kHz at extreme conditions. The maximum rate of change of the centre frequency at both the RFP and the PP while transmitting, shall not exceed 15 kHz per slot.	0.05 ppm At an RFP the transmitted RF carrier frequency corresponding to RF channel c shall be in the range Fc ± 50 kHz at extreme conditions. The maximum rate of change of the centre frequency at both the RFP and the PP while transmitting, shall not exceed 15 kHz per slot.

	Output RF spectrum emissions				
1.5	3 dB Bandwidth (A1.2.5)	Bandwidth is the frequency range of the transmitter power per RF channel measured at the 3 dB down points.	Modified definition	4.1 MHz (8.2 MHz and 16.4 MHz for the higher chip rates) Occupied Bandwidth:1.25/5/10/20 MHz 8.192 MHz (UL + DL) A1.2.5 FDD: 1X: 2 x 1.23 = 2.46 MHz 3X: 2 x 3.69 = 7.38 MHz 6X: 2 x 7.37 = 14.74 MHz 9X: 2 x 11.1 = 22.2 MHz 12X: 2 x 14.74 = 29.48 MHz TDD: 1X: 1 x 1.23 = 1.23 MHz 3X: 1 x 3.69 = 3.69 MHz 6X: 1 x 7.37 = 7.37 MHz 9X: 1 x 11.1 = 11.1 MHz 12X: 1 x 14.74 = 14.74 MHz For 136 HS Outdoor: 180 kHz x 2 (Q-O-QAM) For 136 HS Indoor: 1.1 MHz x 2 1 MHz	4.1 MHz (8.2 MHz and 16.4 MHz for the higher chip rates) Occupied Bandwidth:1.25/5/10/20 MHz FDD: 1X: 2 x 1.23 = 2.46 MHz 3X: 2 x 3.69 = 7.38 MHz 6X: 2 x 7.37 = 14.74 MHz 9X: 2 x 11.1 = 22.2 MHz 12X: 2 x 14.74 = 29.48 MHz TDD: 1X: 1 x 1.23 = 1.23 MHz 3X: 1 x 3.69 = 3.69 MHz 6X: 1 x 7.37 = 7.37 MHz 9X: 1 x 11.1 = 11.1 MHz 12X: 1 x 14.74 = 14.74 MHz For 136HS Outdoor: 180 kHz x 2 (Q-O-QAM) For 136 HS Indoor: 1.1 MHz x 2 1 MHz

	Out of band emissions (A1.4.2)		Merged into item 1.7		
1.6	Adjacent Channel Leakage power ratio *[Editor's Note: Prior name was Adjacent Power Protection.]*	Adjacent channel leakage power is the interference power at adjacent channels that are outside the assigned channel and is defined as the power that is radiated within a specified bandwidth. Adjacent channel leakage power ratio is the ratio of the leakage power and total radiation power. Note: The modulation and power level switching spectra can produce significant interference in the adjacent channel bands. The effects on the spectrum due to continuous modulation spectrum and due to the switching transient spectrum do not occur at the same time.	New name New definition	*[Editor's note: Following values are proposed for the prior definition of 'Adjacent Power Protection'.]* Protection ratio is 45 dB A1.2.15 ACPR=35 dBc Next ACPR = 45 dBc At 3.75 MHz, it is estimated to have adjacent channel power at +12 dBc for equal in and out of band energy (processing gain provides an additional protection). At 5 MHz, adjacent channel powers can be in the order of +50 dBc for mobile and base station due to full protection of baseband filters. For 136 HS Outdoor: 20 dB For 136 HS Indoor: 30 dB 1. channel: 160 μW 2. channel: 1 μW 3. channel: 40 nW >3. channel: 20 nW	*[Editor's note: Following values are proposed for the prior definition of 'Adjacent Power Protection'.]* -45 dBc At 3.75 MHz, it is estimated to have adjacent channel power at +12 dBc for equal in and out of band energy (processing gain provides an additional protection). At 5 MHz, adjacent channel powers can be in the order of +50dBc for mobile and base station due to full protection of baseband filters. For 136 HS Outdoor: 20 dB For 136 HS Indoor: 30 dB 1. channel: 160 μW 2. channel: 1 μW 3. channel: 40 nW >3. channel: 20 nW

1.7	Out of band and Spurious emissions (A1.4.2)	Out of band and Spurious emissions are the emissions at frequencies that are outside the assigned channel, as a function of frequency offset.	Merged item Modified definition[7]	*[Editor's note: Since this item was re-defined merging two items during the Malaysia meeting, the following includes two kinds of values.]* Requirements will be based on applicable tables from Recommendations ITU-R SM.329 and from the ERC Recommendations that are currently under progress. Other regulatory bodies will also have recommendations to this requirement. –40 dBm 40 dB @ 5 MHz; 55dB @ 10 MHz. Emission limits established by local radio regulatory agencies generally apply (e.g. FCC in the U.S.) The limits given below are representative for a chip rate of 3.6864 Mcps. Freq. Offset (MHz) Power 2.5 < |Δf| < 3.5 -13 dBm/37 kHz |Δf| > 3.5 -13 dBm/1 MHz where Δf= center frequency of the CDMA signal - closer measurement edge frequency. The exact specifications are yet to be defined. For 136 HS Outdoor: 30 dB in adjacent channel 60 dB in alternate channel 60 dB in second alternate channel For 136 HS Indoor: 30 dB in adjacent channel 50 dB in alternate channel 70 dB in second alternate channel For 136 HS Outdoor: -36 dBm in 30 kHz offset 1.8 MHz -36 dBm /1kHz (9 kHz<f<150 kHz) -36 dBm /10 kHz (150 kHz<f<30 MHz) -36 dBm/100 kHz (30 MHz<f<1 GHz) -30 dBm/1 MHz (1 GHz<f<(fc-NB* 14.5) MHz : except PHS band) -36 dBm/300 kHz ((fc-NB*14.5) MHz <f<(fc+NB*14.5) MHz and PHS band) -30 dBm/1 MHz ((fc+NB*14.5) MHz	*[Editor's note: Since this item was re-defined merging two items during the Malaysia meeting, the following includes two kinds of values.]* Requirements will be based on applicable tables from Recommendations ITU-R SM.329 and from the ERC Recommendations that are currently under progress. Other regulatory bodies will also have recommendations to this requirement. –55 dBm 55 dB @ 5 MHz; 60 dB @ 10 MHz. Emission limits established by local radio regulatory agencies generally apply (e.g. FCC in the U.S.) The limits given below are representative for a chip rate of 3.6864 Mcps. Freq. Offset (MHz) Power 2.5 < |Δf| < 3.5 -13 dBm/37 kHz |Δf| > 3.5 -13 dBm/1 MHz where Δf = center frequency of the CDMA signal - closer measurement edge frequency. The exact specifications are yet to be defined. For 136 HS Outdoor: 30 dB in adjacent channel 60 dB in alternate channel 60 dB in second alternate channel For 136 HS Indoor: 30 dB in adjacent channel 50 dB in alternate channel 70 dB in second alternate channel For 136 HS Outdoor: -36 dBm in 30 kHz offset 1.8 MHz -16 dBm/1 MHz (Total Power ≤ 25W)- 60 dBc/1 MHz and +13 dBm/1 MHz (Total Power > 25 W) NOTE – All frequency bands excluding same system's bands The peak power level of any RF emissions outside the radio frequency band allocated to DECT, when a radio end point has an allocated

[7] Editor's note: It should be noted that the draft new Rec. IMT.TERM would define this characteristic for mobile stations. In order to keep consistency among ITU Recommendations, the next TG 8/1 meeting should check this observation.

				<f<11 GHz) -40 dBm/300 kHz (PHS band: 1 893.5-1 919.6 MHz) Notes NB: Necessary Bandwidth (1.25/5/10/20 MHz) Fc: Center frequency of carrier The peak power level of any RF emissions outside the radio frequency band allocated to DECT, when a radio end point has an allocated physical channel, shall not exceed 250 nW at frequencies below 1 GHz and 1 µW at frequencies above 1 GHz. The power shall be defined in the bandwidths given in the table below. If a radio end point has more than one transceiver, any out of band transmitter intermodulation products shall also be within these limits. Frequency offset, Measurement fo from edge of band bandwidth 0 MHz ≤ fo < 2 MHz 30 kHz 2 MHz ≤ fo < 5 MHz 30 kHz 5 MHz ≤ fo < 10 MHz 100 kHz 10 MHz ≤ fo < 20 MHz 300 kHz 20 MHz ≤ fo < 30 MHz 1 MHz 30 MHz ≤ fo < 12,75 GHz 3 MHz	physical channel, shall not exceed 250 nW at frequencies below 1 GHz and 1 µW at frequencies above 1 GHz. The power shall be defined in the bandwidths given in the table below. If a radio end point has more than one transceiver, any out of band transmitter intermodulation products shall also be within these limits. Frequency offset, Measurement fo from edge of band bandwidth 0 MHz ≤ fo < 2 MHz 30 kHz 2 MHz ≤ fo < 5 MHz 30 kHz 5 MHz ≤ fo < 10 MHz 100 kHz 10 MHz ≤ fo < 20 MHz 300 kHz 20 MHz ≤ fo < 30 MHz 1 MHz 30 MHz ≤ fo < 12,75 GHz 3 MHz

1.8	Transmit linearity requirements (A1.4.10)	Transmit linearity characterises the linear and broadband transmitter power amplifier requirements to meet spurious and out of band emissions. This is primarily characterized by peak to average power ratio (A1.2.11) which dictates the power amplifier backoff from the saturation point.	Modified definition	Linear transmitters required A1.4.11 Linear transmit power amplifier as TIA/EIA-95 required. The exact specifications are yet to be defined. (A.1.4.11) does not apply to transmitters. (A.1.4.10) Linearity: 5 dB backoff with Q-O-QAM, and 3 dB backoff with B-O-QAM, 0 for GMSK, pi/4 DQPSK 3 dB backoff, 8PSK, 3.5 dB backoff. -35 dBc at 5 MHz offset-45 dBc at 10 MHz offset The power level of intermodulation products that are on any DECT physical channel when any combination of the transmitters at a radio end point are in calls on the same slot on different frequencies shall be less than 1 µW. The power level is defined by integration over the 1 MHz centred on the nominal centre frequency of the afflicted channel and averaged over the time period.	Linear transmit power amplifier as TIA/EIA-95 required. The exact specifications are yet to be defined. (A.1.4.11) does not apply to transmitters. (A.1.4.10) Linearity: 5 dB backoff with Q-O-QAM, and 3 dB backoff with B-O-QAM, 0 for GMSK, pi/4 DQPSK 3 dB backoff, 8PSK, 3.5 dB backoff. The power level of intermodulation products that are on any DECT physical channel when any combination of the transmitters at a radio end point are in calls on the same slot on different frequencies shall be less than 1 µW. The power level is defined by integration over the 1 MHz centred on the nominal centre frequency of the afflicted channel and averaged over the time period.
1.9	Standby RF output power	Standby RF output power is the nominal Mobile Station RF power output while in idle state.	New item[8]		

[8] Editor’s note: Keep this item to invite contributions for next TG 8/1 meeting.

	Receiver characteristics				
2.1	Reference sensitivity	The RF sensitivity is the minimum receiver power measured at the antenna port at which the FER/BER does not exceed the specified values. The parameter will therefore depend on the bit rate and QoS requirement, but also implementation factors such as Noise Figure (NF) according to the following equation: $$P_{Rx\ Sens} = kT \cdot NF \cdot \frac{E_b}{N_0} \cdot R_b$$ where kT is the thermal noise density –174 dBm/Hz, NF is the receiver noise figure, Eb/N0 is the receiver information bit energy to noise density threshold (at the given QoS) and Rb is the information bit rate. Since Eb/N0 and Rb (andf hence PRx Sens) will vary with the service, it is only NF that can be considered a key RF parameter. PRx Sens will set the coverage for an unloaded traffic case. If different noise figures are used in different radio interfaces, then the lowest noise figure applies for a multi-mode terminal implementation.	Modified name and definition	Based on NF ≤ TBD As required -104 dBm as specified in IS-98. The exact specifications are yet to be defined. 136 HS Outdoor: -93.41 dB (Q-O-QAM ECS-3) 136 HS Indoor: -99.28 dB -117 dBm for 12.2 kbps measurement channel -83 dBm	Based on NF ≤ TBD for normal BTS, higher NF for micro and pico BTS -119 dBm as specified in IS-97. The exact specifications are yet to be defined. 136 HS Indoor: -101.84 -83 dBm

2.2	Receiver dynamic range (A1.4.12)	The difference, in decibels, between the overload level and the minimum acceptable signal level in a transmission system.	Modified name and definition	Maximum level: –25 dBm 80 dB for Automatic Gain Control 79 dB The exact specifications are yet to be defined. 85 dB Maximum usable input level :-25 dBm	52 dB The exact specifications are yet to be defined 85 dB ≥30 dB
2.3	Intermodulation sensitivity (A1.4.11)	The intermodulation sensitivity is the receiver's ability to receive a signal on its assigned channel frequency in the presence of two interfering RF signals. These RF signals are separated from the assigned channel frequency and from each other such that the third order mixing of the two interfering RF signals can occur in the non-linear elements of the receiver, producing an interfering signal in the band of the desired signal. The receiver performance is measured by the frame error rate or bit error rate.	Modified name and definition was changed.	Deployment of service (co-ordinated / uncoordinated networks), and implementation complexity will determine the requirement. Linear receivers required; the 3 rd Order intercept point will be specified between 10 dBm and 5 dBm. IIP3 = -12 dBm The exact specifications are yet to be defined. Not expected to be significantly increased above 2 nd generation systems. The level of the interfering signal : -46 dBm 33 dB at -80 dBm	The exact specifications are yet to be defined. Not expected to be significantly increased above 2 nd generation systems 33 dB at -80 dBm

2.4	Spurious response and Blocking	The spurious response and receiver blocking level are the signal level that causes the receiver to mute due to interferering RF signals. Receiver blocking level is generally not sensitive to frequency differences between the out of band signal and the receive center frequency.	Modified name and definition	UTRA services and implementation complexity will determine the requirement. Similar to IS-98-C Band Class 1 single tone desensitization requirements: 71 dB The exact specifications are yet to be defined. Not expected to be significantly increased above 2 nd generation systems.. In-band: -44 dBm (over 15 MHz offset)Out of band:-30 dBm (2 025-2 070 MHz and 2 210-2 225 MHz)-15 dBm (other frequency) With the desired signal set at -80 dBm, the BER shall be maintained below 0,001 in the presence of any one of the signals shown in table below, for TX-band 1 880 MHz-1 900 MHz. Frequency / interferer level for radiated measurements (dBµV/m) / interferer level for conducted measurements (dBµV/m) 25 MHz<f<1780 MHz 120 -23 1 780 MHz<f<1 875 MHz 110 -33 /f-Fc/>6 MHz 100 -43 1 905 MHz<f<2 000 MHz 110 -33 2 000<f<12,75 GHz 120 -23	Similar to IS-97-C Band Class 1 single tone desensitization requirements: 90 dB The exact specifications are yet to be defined. Not expected to be significantly increased above 2 nd generation systems With the desired signal set at -80 dBm, the BER shall be maintained below 0,001 in the presence of any one of the signals shown in table below, for TX-band 1 880MHz-1 900MHz. Frequency / interferer level for radiated measurements (dBµV/m) / interferer level for conducted measurements (dBµV/m) 25 MHz<f<1 780 MHz 120 -23 1 780 MHz<f<1 875 MHz 110 -33 /f-Fc/>6 MHz 100 -43 1 905 MHz<f<2 000 MHz 110 -33 2 000<f<12,75 GHz 120 -23
2.5	Adjacent channel selectivity	Adjacent channel selectivity is the receiver ability to receive a desired signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the center frequency of the assigned channel. Receiver selectivity performance is measured at a specific frame error rate or bit error rate.	Modified definition[9]	UTRA services and implementation complexity will determine the requirement. Not requested in RTT and should not be a key characteristic. Similar to IS-98-C Band Class 1 single tone desensitization requirements: 71 dB The exact specifications are yet to be defined. Not expected to be significantly increased above 2 nd generation systems. 48 dB for 12.2kbps measurement channel -60 dBm with a received wanted signal strength of -73 dBm	Not requested in RTT and should not be a key characteristic. Similar to IS-97-C Band Class 1 single tone desensitization requirements: 90 dB The exact specifications are yet to be defined. Not expected to be significantly increased above 2 nd generation systems. -60 dBm with a received wanted signal strength of -73 dBm

[9] Editor’s note: Keep this item to invite contributions for next TG 8/1 meeting.

	Other characteristics				
3.1	Diversity techniques (A1.2.23)	[Diversity, as applied to the RF front-end, would imply combining or transmitting independent replicas of the same signal in space or time.] Note: IMT-2000 should not preclude the use of diversity schemes.	Modified definition	Time diversity Space diversity (optional) Frequency diversity Time, space, freq., code A1.2.23 Diversity techniques are used. Time diversity: symbol interleaving and error coding and correction. Path Diversity: RAKE receiver Space diversity: MS antenna diversity is optional Frequency Diversity: 1.2288, 3.686, 7.3728, 11.0592, or 14.7456 MHz spreading Delay transmit diversity: may be employed for both MC and DS Diversity combining: either maximal-ratio or equal gain combining may be used with multiple RAKE fingers. Minimum number of demodulators/receivers: 1 per MS minimum number of antennas: 1 per MS (antenna diversity is optional) 2-Branch MRC Time diversity (RAKE) Space diversity (optional) Handover diversity frequency and time diversity	Time diversity Space diversity Frequency diversity Macro diversity Transmitter diversity (optional) Diversity techniques are used. Time diversity: symbol interleaving and error coding and correction. Path Diversity: RAKE receiver Space diversity: BS uses 2 antennas. Orthogonal Transmit Diversity can be used on the forward link Frequency Diversity: 1.2288, 3.686, 7.3728, 11.0592, or 14.7456 MHz spreading Delay transmit diversity: may be employed for both MC and DS Diversity combining: either maximal-ratio or equal gain combining may be used with multiple RAKE fingers. Minimum number of demodulators/receivers: 2 per BS minimum number of antennas: 2 per BS 2-Branch MRC Time diversity (RAKE) Space diversity Transmit diversity (optional) Handover diversity Antenna, frequency and time diversity
3.2	Smart antennas (A1.3.6)	[Smart antenna is an advanced antenna technology composed by an antenna array and beamformed in baseband data processing.] Note: IMT-2000 should not preclude the use of smart antennas. [Smart antenna is one of main features to enhance QoS and to reduce complexity.]	Modified definition	Supported both in the up- and down link through dedicated pilots (optional). Can be employed A1.3.6 N/A Not required, but accomodated	Supported both in the up- and down link through dedicated pilots (optional). Smart antennas can be used to reduce interference from other mobiles and to direct beams to specific mobiles. Not required, but accomodated Adaptive antennas are supported through the use of connection detected pilot bits

3.3	Minimum operating bandwidth (A1.2.1 & A1.2.4)	Minimum operating bandwidth is characterised by RF channel spacing (A1.2.4) and the minimum bandwidth for deployment (A1.2.1).	Modified name and definition	FDD: Uplink 1 920-1 980 MHz, Downlink 2 110-2 170 MHz TDD: 1 900-1 920, 2 010-2 025 MHz. Deployment of TDD in the 1 920-1 980 MHz band is an open item. Operation in other bands is not precluded. Operating bandwidth: FDD 2 x 5 MHz or more, TDD 1 x 5 MHz or more. N x 5 MHz x 2 The cdma2000 standard can be employed in any frequency band. The duplex 3 dB operating bandwidth for the FDD implementation can vary from 2.46 MHz to 29.52 MHz. The 3 dB operating bandwidth for the TDD implementation varies from 1.23 MHz to 14.76 MHz. Channel spacing 136 HS Outdoor: 200 kHz 136 HS Indoor: 1.6 MHz Minimum frequency band: 136 HS Outdoor: 2 x 600 kHz 136 HS Indoor: 2 x 1.6 MHz 1,728 MHz	FDD: Uplink 1 920-1 980 MHz, Downlink 2 110-2 170 MHz TDD: 1 900-1 920, 2 010-2 025 MHz. Deployment of TDD in the 1 920-1 980 MHz band is an open item. Operation in other bands is not precluded. Operating bandwidth: FDD 2 x 5 MHz or more, TDD 1 x 5 MHz or more. The cdma2000 standard can be employed in any frequency band. The duplex 3 dB operating bandwidth for the FDD implementation can vary from 2.46 MHz to 29.52 MHz. The 3 dB operating bandwidth for the TDD implementation varies from 1.23 MHz to 14.76 MHz. Channel spacing 136 HS Outdoor: 200 kHz 136 HS Indoor: 1.6 MHz Minimum frequency band: 136 HS Outdoor: 2 x 600 kHz 136 HS Indoor: 2 x 1.6 MHz 1,728 MHz

5.2.2 Baseband Key Characteristics

TABLE 2

Baseband Key Characteristics

#	Names of the Key Characteristics	Definitions	Values
1	**Multiple access technique**	The multiple access technique allows multiple users to share transmission media without creating uncontrollable interference to each other. The multiple access techniques can be used individually or in a hybrid mode, for example, time, code and space multiplexing (TD/CD/SDMA). NOTE – Different multiple access schemes usually employ different radio techniques. For example, CDMA commonly uses fast power control; and TD/CDMA typically uses joint detection. Similarly, SDMA generally employs adaptive beamforming.	• TDMA • MC-TDMA • DS-CDMA • DS-CDMA/TDMA • MC-CDMA • TD/SCDMA
2	**Chip rate**	The rate at which information data is spread by pseudo random code modulation elements in a direct sequence CDMA system. Notes: The transmitted signal bandwidth is a function of the chip rate. It has key impact on multipath signal delay resolution capability and the processing gain of DS-CDMA systems.	0.916, 1.024, 1.2288, 3.6864, 4.096, 7.3728, 8.192, 11.0592, 14.7456, 16.384 Mcps
3	**Frame structure**	Frame Structure is a specified portion of time slots. Frame structure has two important aspects, one of which is number of time slots in a frame and another one is frame length. • Number of time slots in a frame • Frame Length NOTE – The frame structure is a key characteristic of baseband system, since it may be affected by parameters such as multiple access scheme, duplexing scheme, power control, interleaver size and vocoder scheme.	Number of time slots in a frame: 1, 2, 6, 8, 12, 16, 24, 48, 64 / frame Frame Length: 4.6, 5, 10, 20, 40 ms

4	**Variable length spreading factor**	A modification of a direct sequence spreading code that creates a family of orthogonal codes of variable length to support variable data rates in a DS-CDMA system. NOTES – The use of orthogonal variable spreading codes enables implementation of data rates greater than 8-16 kbit/s with minimal complexity & performance impact.	1-16, 1-512, 4-256, 4-1024
5	**Inter base station asynchronous/ synchronous operation**	System base stations whose relative time difference is determined and maintained to a very tight tolerance e.g., a chip period, by utilization of a common clock or timing source, are said to be synchronized. Asynchronous base stations may use a common timing source mainly for frequency stability purposes, but there is no requirement on the relative time difference between them. Notes: Synchronous systems are desirable for 2G/3G roaming within the same frequency band for existing 2G synchronized systems. Asynchronous systems facilitate multi-environment user roaming without accurate base station synchronization.	• synchronous asynchronous • combination of synchronous/asynchronous
6	*Inter-user synchronization*	A method used to synchronize all DS-CDMA user transmissions in a sector or cell at the base station receiver. Notes: This can simplify many advanced DSP implementation requirements such as joint detection, beam-forming and software radio design. It can also decrease fast power control requirements and inter users interference with orthogonal codes. Inter-user synchronization is used only for CDMA.	• used • not used • possible

7	**Handover**	In general, handover is the process of transferring the mobile station's communication from one radio channel to another when the mobile is moving between sectors or between cells. Note: Handover is an essential element of a mobile telecommunications system as it permits mobility through the coverage area of the network. There are two types of handover - hard and soft, depending upon whether there are simultaneous connections to more than one base station during the handover process. Soft handover has the benefit of allowing diversity combining of signals to enhance performance. Of particular importance when defining the handover mechanism are • the measurement method that triggers the handover, • whether the mobile station assists in the handover process by performing measurements, or initiates the handover, and the messaging between the mobile station and base station during the course of the handover.	• Hard handover • Soft handover • Inter- and intra-system handover (including between 2G and 3G) • Softer handover • Inter-frequency handover • Baton handover

8	**Channel coding and interleaving**	**Channel coding and decoding** is the process to introduce some redundancy in the information sequence in a controlled manner such that the redundancy can be used at the receiver to overcome the effects of noise and interference encountered in the transmission channel, thus increasing the reliability of the received data. Note: Channel coding techniques (e.g., convolutional codes, block codes, turbo codes) are essential in achieving low bit error ratios and/or coding gain. Turbo codes have recently been shown to improve system capacity and QoS for high data rate services. The components of a Turbo coder consist of recursive systematic coders and an interlever. The improvements resulting from Turbo codes are dependent on the design (generator polynomial) of the recursive systematic coders and interleaver matrix. **Interleaving and de-interleaving** is the process to permute the transmission sequences of coded bit stream prior to modulation and to reverse this operation following demodulation. It is used to separate and redistribute bursty errors over several codewords or constraint lengths for higher probability of correct decoding by codes designed to correct random errors. Note: Interleaving helps in randomizing error patters. The effectiveness of interleavers generally improves with size, representing a design trade-off with signal delay. The interleaver depth, to be effective, must be large compared with the mean duration of channel fades.	**Coding:** Convolutional code with k=9, R=1/2, 1/3, or 1/4 Turbo code with K=4, R=1/2, 1/3or ¼ Punctured convolutional code Convolutional code with K=9 R=1/2, 1/3 Turbo code under consideration Covolutional code with K=9 Turbo code with K=3 Convolutional code Turbo code **Interleaving:** User data: 20, 40 and 80 ms channel interleaving Signaling: 5, 10, 20 ms channel interleaving 136 HS Outdoor: over 4 TDMA frames 136 HS indoor: over 8 TDMA frames Block interleaving Inter-frame Multi-stage interleaving (MIL) (10/20/40/80 ms) Intra-frame MIL (10 ms) Inter-frame interleaving (20/40/80 ms) Intra-frame interleaving (10 ms) CRC, RS code

9	**Random access**	Random Access is the technique for multiple mobile stations to access radio channels without prior scheduling. NOTE – Because of the lack of pre-arrangement, collisions of the transmissions from different stations occur, at an average rate that depends on the traffic and re-transmission rules. An optimized random access design minimizes collisions among mobile stations, thereby throughput and reducing delay and interference.	• AiSMA • RsMA • Slotted ALOHA + Message(10 ms) • Random Access with shared control feedback also reserved access • Packet Random Access channel • Preamble + Message
10	**Modulation (up-link and down-link)**	The process of varying certain parameters of a digital code signal (carrier), through digital signal processing, in accordance with a digital message signal, to allow transmission of the message signal through IF and RF channels, followed by its possible detection. NOTES – Modulation is important because variation of the code signal parameters can impact QoS or lead to significant variations in system complexity.	Data modulation UL - BPSK UL and DL - QPSK, 8PSK, DBPSK, DQPSK, D8PSK, GFSK, GMSK, QOQAM, BOQAM, 16QAM Spreading modulation UL - HPSK UL and DL - BPSK, QPSK
11	**Channelization code (up-link and down-link)**	Channelization codes are set of orthogonal codes used for spreading and identification of any other channels. NOTE – It is important in CDMA systems to minimize the interference between users and between channels in the cell in down-link and between channels of a user in up-link	• Layered orthogonal code (real valued) 1 symbol length • N/A • Channelization codes (UL & DL): Orthogonal Variable Spreading Factor codes of length 2**k • DL: Variable length Walsh codes • UL: Variable length Walsh code • Walsh code • Type of code: Real OVSF Code length: - FDD: 4-256 chips (1 symbol) - TDD: 1-16 chips (1 symbol)

12	**Scrambling code (up-link and down-link)**	Scrambling code is used in DS-CDMA systems to identify BTS or sector in down-link, and MS in up- link. Note: It is important for multiple access system to correctly identify users.	• Gold sequence code (complex valued) FDD: 10 ms (down-link), 2^9 x 720 ms, 256 chips (optional) (up-link) TDD: 10 ms (down-link), 2^9 x 720 ms (up-link) • Long scrambling code (UL): Complex Mobile-specific code of length 10 ms. Scrambling code (DL): real Base station-specific code of length 10 ms. (10 ms equals 40960 chips for 4.096 Mcps.) • DL: QPSK time shifted Pseudo Noise code of duration 26.666…ms. UL: QPSK time shifted Pseudo Noise code of length 2^42-1 chips • M-sequence • FDD/DL: Complex code, 40 960 chips (10 ms) segments from Gold codes. FDD/UL: Complex code, 40960 chips (10 ms) segments from Gold codes, or 256 chips extended VL-Kasami codes. TDD: <To be filled in>, 1-16 chips • Not applicable
13	**Pilot structure**	The system pilot is used for channel searching, estimation, acquisition, demodulation and can also be used to assist soft handover. It can also be used to implement fast power control and adaptive antenna technologies. The pilot can be continuous and code multiplexed, or periodic and time multiplexed. Notes: A pilot channel or pilot symbols provide a phase reference for coherent detection. It also provides a means for signal strength comparison between the base stations. This makes soft handover possible. The downlink pilot can either be common to all users in a cell or a sector, or dedicated to each traffic channel. The pilot channel structure can impact overall system capacity and performance.	• Time-multiplexed dedicated pilot symbols • Time-multiplexed common pilot symbols on common control physical channel • Time-multiplex dedicated pilot sequence • Code divided continuous common pilot/auxiliary pilot • Code divided pilot • Not applicable

14	**Detection** **(up-link and down-link)**	The process performed by the receiver to recover the original signal in the presence of channel degradation and to transform the detected signal back to a digital signal. Notes: There are two common methods of detection. Coherent detection requires a reference waveform to be generated at the receiver that is matched in frequency and phase to the transmitted signal. When a phase reference can not be maintained, noncoherent detection is used. Most radio transmission technologies use coherent detection for both forward link and reverse link, which significantly increases the capacity for these systems and differentiates them from 2G systems. **Joint detection** is used to coherently detect the data in CDMA and TDMA time slots that are spread with a limited number of CDMA codes to cope with multipath propagation effects at the MS and BS and improve overall performance. **Multi-user detection** involves the joint detection of all users in a cell. This technique significantly helps in reducing intracell interference and thereby increases the capacity of the reverse link. The implementation of multiuser detection will have an impact on the base station receiver complexity and architecture.	Detection: Coherent Non-coherent • Joint detection: Optional • Multi-user detection: Optional
15	**Power control** **(up-link and down-link)**	The adjustment of the transmitted power in order to keep the received power from each station in a multiple-access communication system at the minimum power required to maintain a given QoS. NOTE – Such a strategy maximizes overall system capacity.	• Closed loop (dedicated channels) • Open loop (random-access channel)

16	**Variable data rate (up-link and down-link)**	A feature that adapts the instantaneous transmission rate on a specific traffic channel to the instantaneous amount of data to be transmitted in accordance with the demands of a data source or the propagation conditions. **Symmetric/asymmetric data rate** The capability of a system to operate with equal (symmetric) or different (asymmetric) data rate on the downlink and uplink in order to support symmetric or asymmetric uplink/downlink traffic. NOTE – The efficient support of asymmetric rate allows for optimal usage of the radio resources, resulting in higher overall system capacity when the users' traffic is mixed, i.e., both symmetric and asymmetric.	• Supported • Not supported
17	**Diversity**	Diversity is the process by which several replicas of the same information-bearing signal are transmitted and received over multiple channels that exhibit independent fading. NOTE – There is a good likelihood that at least one or more of the received signals will not be in a fade at any given instance in time, thus providing adequate signal level to the receiver with reasonable transmitted power. Diversity techniques seek to generate and exploit multiple branches over which the signal shows low fade correlation. To obtain the best diversity performance, the multiple access scheme, modulation, coding and antenna design must all be carefully chosen so as to provide a rich and reliable level of well-balanced, low correlation diversity branches in the propagation environment. Successful exploitation of diversity leads to: – reduced power requirements – increased coverage – improved battery life – improved voice quality and handover performance.	• Time diversity • Frequency diversity • Space diversity • Polarisation diversity • Code diversity • RAKE diversity with MRC • Antenna diversity with MRC • Multi-carrier transmission diversity • Time domain transmit diversity for FDD mode • Selective transmit diversity or parallel trasnmit diversity for TDD mode • Handover diversity: Inter-sector - MRC Inter-cell - MRC (down-link) - Selection combining (up-link)

18	**Adaptive equalizer**	Time varying channel dispersion due to multipath propagation can cause inter-symbol interference, resulting in increased Bit Error Ratio (BER) or dropped calls on wireless communication systems. Active equalization is the process of reducing inter-symbol interference in a communication system by real-time adjustment of a filter that compensates for a time-varying multipath channel. NOTE – Adaptive equalization is essential for Time Division Multiple Access (TDMA) communication systems to meet the high data rate service requirements of IMT-2000, such as high spectral efficiency and reasonable costs for outdoor macrocellular environments. Adaptive equalization can also be utilized to increase TDMA system capacity. The effectiveness of adaptive equalization depends on the time-rate of change of the channel characteristics in comparison to the signal characteristics.	• Used • Not used
19	**Dynamic Channel Allocation**	DCA is the assignment of channels in real-time, in accordance with observed traffic/interference conditions, as opposed to a prearranged channel assignment. DCA avoids planning of the radio channels and is required for uncoordinated systems sharing the same frequency band.	• Supported • Not-supported
20	**Duplexing Scheme**	The duplexing scheme is the method by which the transmitter and the receiver share the limited sources, such as time and frequency. This can be achieved through the use of frequency (Frequency Division Duplexing – FDD) and time (Time Division Duplexing – TDD).	• FDD • TDD
21	**Multicarrier**	Muticarrier is a method to allow one transceiver to receive or transmit several carriers simultaneously. NOTE – Muticarrier can give flexibility of system planning and give backward compatibility, it also can help to easily use many new technologies.	• Required • Not required

5.2.3 System Key Charactersitics

Many of the key attributes and key parameters derived in Section 4.5 are included in the key characteristics lists of Sections 5.2.1 and 5.2.2. However, certain of the key attributes and parameters of Section 4.5 impact broader aspects of the system or they are not practical to implement with current technology. Therefore, it is expected that as IMT-2000 implementations evolve they will address these additional key attributes and parameters and will become increasingly more compliant to the IMT-2000 advanced features and objectives. A list of those key attributes and parameters that will be emphasized and enhanced in future implementations are included in the list of system key characteristics shown below.

a) Controlled Margin

b) Control Channel Signaling

c) Encryption

d) Key Distribution

e) Integrated System Monitoring

f) Roaming

g) Cell Planning

h) Network Structure

i) Status Reporting (update Data-Bases)

j) Channel Evaluation

k) Control of RF Parameters

l) Multi-Code

m) Doppler Range

n) Frequency Reuse

o) Co-existence of Systems

p) Frequency Sharing

The system key characteristics are not elaborated on further in this document. Standards for some of these key system characteristics are being developed by other ITU study groups. However, due to their pervasive nature, their design may impact the baseband key characteristics and should be considered.

5.3 Satellite

TABLE 3

Key Characteristics of the Radio Interfaces for the IMT-2000 Satellite Components

	Name	[RTT 1]	[….]	[….]	[RTT n]
	Proponent	[Prop 1]	[….]	[….]	[Prop n]
Architectural Key Characteristics					
A-1.	Satellite constellation				
A-1.1	Orbit type (e.g. LEO, MEO, GEO, HEO)				
A-1.2	Orbit altitude (km)				
A-1.3	Number of orbital planes				
A-1.4	Inclination (type, e.g. polar, equatorial, or degrees)				
A-1.5	Satellites per plane				
A-2.	Inter-satellite links (y/n)				
A-3.	On-board baseband processing (y/n)				
A-4.	Geographical coverage (e.g. global, near global, below xx degree lat, regional)				
A-5.	Number of spot beams per satellite				
A-6.	Radio operating environments (see M.1034-1)				
A-6.1	[M.1034 Sat env 1] (y/n)				
A-6.2	[M.1034 Sat env 2] (y/n)				
A-6.3	[M.1034 Sat env 3] (y/n)				
A-6.4	[M.1034 Sat env 4] (y/n)				
A-7.	Dynamic beam traffic distribution (y/n)				
System Key Characteristics					
S-1.	Handover technique (e.g. intra and inter satellite, soft or hard or hybrid)				
S-2.	Information rate for each service types (e.g. voice, data, messaging)				

S-3.	Service features				
S-3.1	Bandwidth on demand (y/n)				
S-3.2	Bit rate on demand (y/n)				
S-3.3	Asynchronous data (y/n)				
S-3.4	Asymmetric data (y/n)				
S-4.	Diversity (e.g. time, frequency, space)				
S-5.	Terminal features				
S-5.1	Terminal types (e.g. handheld, portable, nomadic, fixed)				
S-5.2	Multiple service capability (e.g. combined phone, pager, data terminal)				
S-5.3	Mobility restrictions for each terminal type (e.g. up to xx km/hr or yy m/s)				
RF Key Characteristics (at 2 GHz)					
RF-1.	User terminal transmitter EIRP				
RF-1.1	Maximum EIRP (dBW)				
RF-1.2	Average EIRP for each terminal type (dBW)				
RF-2.	Antenna gain for each terminal type (dBi)				
RF-3.	Maximum satellite EIRP (dBW)				
RF-4.	User terminal receiver sensitivity (dBm)				
RF-5.	Maximum satellite G/T (dB/K)				
RF-6.	Channel bandwidth for each terminal type (kHz)				
RF-7.	Power control				
RF-7.1	Range (dB)				
RF-7.2	Step size (dB)				
RF-7.3	Rate (Hz)				
RF-8.	Frequency stability				
RF-8.1	Uplink (ppm)				
RF-8.2	Downlink (ppm)				

RF-9.	Doppler compensation (y/n)				
RF-10.	Terminal transmitter/receiver isolation (dB)				
RF-11.	Maximum fade margins for each service type (dB)				
Baseband Key Characteristics					
BB-1.	Multiple access				
BB-1.1	Technique				
BB-1.2	Chip rate (where appropriate)				
BB-1.3	Time slots (where appropriate)				
BB-2.	Modulation type				
BB-3.	Dynamic channel allocation (y/n)				
BB-4.	Duplex method (e.g. FDD, TDD)				
BB-5.	Forward Error Correction				
BB-6.	Interleaving				
BB-7.	Synchronisation between satellites required (y/n)				

ANNEX A

IMT-2000 Radio Transmission technology (RTT) Proposals

(NOTE – This may not be included in the final Recommendation)

TABLE A.1

Radio Transmission Technology (RTT) Proposals

Proposal	Description	Environment				Source
		Indoor	Pedestrian	Vehicular	Satellite	
DECT	Digital Enhanced Cordless Telecommunications, TDMA	X	X	-	-	ETSI Project (EP) DECT
UWC-136	Time Division Multiple Access	X	X	X	-	TIA TR45
WIMS W-CDMA	Wireless Multimedia and Messaging Services Wideband CDMA	X	X	X	-	TIA TR46
TD-SCDMA	Time-Division Synchronous CDMA	X	X	X	-	China Academy of Telecommunication Technology (CATT)
W-CDMA	Wideband CDMA	X	X	X	-	ARIB (Japan)
Global CDMA II	Asynchronous DS-CDMA	X	X	X	-	TTA (Korea)
UTRA	UMTS Terrestrial Radio Access Harmonized Wideband CDMA (FDD), TD/CDMA (TDD)	X	X	X	-	ETSI SMG
W-CDMA:NA	Wideband CDMA: North American	X	X	X	-	ATIS T1P1
cdma2000	Wideband CDMA	X	X	X	-	TIA TR45

Global CDMA I	Multiband synchronous DS-CDMA	X	X	X	-	TTA (Korea)
SAT-CDMA	49 LEO sats in 7 planes at 2000 km	-	-	-	X	TTA (Korea)
SW-CDMA	Satellite wideband CDMA	-	-	-	X	ESA
SW-CTDMA	Satellite wideband hybrid CDMA/TDMA	-	-	-	X	ESA
ICO RTT	10 MEO sats in 2 planes at 10390 km	-	-	-	X	ICO Global Communications
Horizons	Horizons satellite system	-	-	-	X	Inmarsat
INX	INX mobile communications system	-	-	-	X	Iridium LLC

Technical information on IMT-2000 Radio Transmission technology (RTT) Proposals

The order of inclusion of the proposed RTTs in the tables does not imply any merit or rank order. For convenience and in order to simplify reference to the original submissions, proposed RTTs are identified by the name given by the original proponents

TABLE A.2

Technical Parameters of Terrestrial RTT Proposals

Technical Parameters	1	2	3	4	5	6	7	8	9	10
	UTRA: W-CDMA(FDD) / TDCDMA(TDD) (ETSI SMG)	W-CDMA (ARIB Japan)	cdma2000 (TIA TR45)	WCDMA/NA (ATIS T1P1)	Global CDMA II (Korea TTA)	WIMS W-CDMA (TIA TR46)	Global CDMA I (Korea TTA)	UWC-136 (TIA TR45)	TD-SCDMA (CATT)	DECT (ETSI Project DECT)
Multiple Access / Duplexing	FDD: DS CDMA TDD : DS CDMA+TDMA	FDD: DS CDMA TDD: DS CDMA with TDMA structure	FDD: DS or MC CDMA TDD: DS or MC CDMA	FDD: DS CDMA TDD : DS CDMA+TDMA	FDD: DS CDMA	FDD/TDD: DS CDMA	FDD: DS CDMA	FDD/TDD TDMA	TD-SCDMA TDD: DS CDMA+TDMA	TDD: MC TDMA
Chip Rate or Bit Rate	FDD: 4.096Mcps (8.192/16.384) TDD: 4.096	FDD: 4.096Mcps (1.024/8.192/16.384) TDD: 4.096 Mcps (1.024/8.192/16.384)	FDD/TDD: 3.6864 Mcps (1.2288xN, N=3) (Other chip rates : Nx1.2288, N=1, 6, 9, 12)	FDD: 4.096 Mcps (8.192/16.384) TDD: 4.096Mcps	FDD: 4.096Mcps (1.024/8.192/16.384)	FDD: 4.096, 8.192, 16.384 Mcps	FDD: 3.6864 Mcps (0.9216/14.7456)	Bit Rate: 48.6 kbps 72.9 kbps 270.8 kbps 361.1 kbps 722.2 kbps 2.6 Mbps 5.2 Mbps	1.1136 Mcps	Bit Rate: 1.152 Mbps 2.304 Mbps 3.456 Mbps
Minimum Carrier Spacing	Typically 4.2.- 5 MHz for 4.096 Mcps	4.2 – 4.6 MHz for 4.096 Mcps	3.75 MHz for 3.6864 Mcps	Typically 4.2-5 MHz for 4.096 Mcps	Typically 4.2.- 5 MHz for 4.096 Mcps	Typically 4.2.- 5 MHz for 4.096 Mcps	3750 kHz For 3.6864 Mcps	30/200/ 1 600 kHz	1.4 MHz	1.728 MHz
Inter Base Station Synchronization	FDD: not required TDD: required	FDD: not required TDD: required	FDD/TDD: required	FDD: not required TDD: required	not required	FDD: not required TDD: required	required	not required	required	not required

Cell Search Scheme		3 step code acquisition based on non-scrambled symbols	3 step code acquisition based on non-scrambled symbols	Pilot channel	3 step code acquisition based on non-scrambled symbols	Two-Pilot scheme	3 step with search code	Pilot channel	L1 is power based L2 is parameter based L3 is service / network / operator based	Pilot channel	Synchronisation word
Frame Length		10 ms	10 ms / unit	5 or 20 ms	10 ms	10 ms	10 ms	10/20 ms	40/4.6 ms	10 ms	10 ms
VSF(spreading code)		4-256	FDD Downlink: 1-512 FDD Uplink: 1-256 TDD: 1-512	4-256 for N=3 4-512 for N=6 4-1024 for N=9, 12	4-256	4-256	64	4-256 for 3.6864 Mcps	N/A	16	N/A
Intra-carrier HO		SHO	SHO	SHO	SHO	SHO	SHO	SHO	HHO	SHO	Seamless HHO
Inter-carrier HO		HHO With compressed transmission	HHO With compressed transmission	HHO Without compressed transmission	HHO With compressed transmission	HHO Reduced transmission rate	HHO	HHO	HHO	SHO/HHO	Seamless HHO
DL	**Modulation**	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	$\pi/4$ DPSK $\pi/4$ QPSK coherent 8PSK GMSK QOQAM BOQAM	DQPSK (16 QAM for 2 Mbit/s)	GFSK (BT=0.5) $\pi/2$ DBPSK $\pi/4$ DQPSK $\pi/8$ D8PSK
	Spreading mod.	QPSK	FDD: QPSK TDD: QPSK	QPSK	BPSK	QPSK	QPSK	QPSK	N/A	BPSK	N/A
	Spreading code length	1 symbol	1 symbol	1 symbol	1 symbol	1 symbol	1 symbol	1 symbol	N/A	1 symbol	N/A

	Scrambling code length	10ms	10ms	Nx2^{15} chips N=1, 3, 6, 9, 12	10 ms	10 ms	20 ms	20 ms	N/A	5 ms	80 ms
	Pilot structure	TCH dedicated Pilot sym. Time multiplexed	TCH dedicated Pilot sym. Time multiplexed	Common Pilot symbols/ Auxiliary PL Code multiplexed	TCH dedicated Pilot sym. Time multiplexed	Common Pilot symbols Code multiplexed	Common Pilot Time Mux.	Common Pilot Code Mux.	N/A	Common Pilot Code/Time Mux.	N/A
	Detection	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent or non coherent
	Power control	Closed-loop based on dedicated ch SIR - 1.6 kbps	Closed-loop based on dedicated ch SIR - 1.6 kbps	Closed-loop based on SIR – 0.8 kbps	Closed-loop based on dedicated ch SIR - 1.6 kbps	Closed-loop based on Fund. ch SIR – 1.6 kbps	Closed-loop (1.6 kbps SIR based)	Closed-loop based on Fund. ch SIR – 1.6 kbps	Per slot &/or per carrier	0.2 kbps Closed loop SIR based	none
	Variable rate Accommodation	Orthogonal VSF + Multi-code (MC) + DTX	Orthogonal VSF + Multi-code (MC) + DTX	Orthogonal VSF + repetition + Multi-code (MC)	Orthogonal VSF + Multi-code (MC) + DTX	Orthogonal VSF + Repetition + DTX + Multi-code (MC)	Orthogonal Multi-code (MC) + Variable Time Slots (VTS) + DTX	Orthogonal VSF + repetition + Mulit-code (MC) + DTX	Slot aggregation	Variable_num_slots + Multi-code + Variable SF option (32 or 64)	Slot aggregation
UL	**Modulation**	FDD: BPSK TDD: QPSK	BPSK	BPSK	DQPSK	BPSK	QPSK	BPSK	$\pi/4$ DPSK $\pi/4$ QPSK coherent 8PSK GMSK QOQAM BOQAM	DQPSK	GFSK (BT=0.5) $\pi/2$ DBPSK $\pi/4$ DQPSK $\pi/8$ D8PSK
	Spreading mod.	FDD: HPSK TDD: QPSK	FDD: HPSK TDD: QPSK	HPSK	FDD: QPSK TDD: QPSK	HPSK	QPSK	HPSK	N/A	BPSK	N/A
	Spreading code length	1 symbol	1 symbol	1 symbol	1 symbol	1 symbol	1 symbol	1 symbol	N/A	1 symbol	N/A
	Scrambling code length	10ms/256chips	2^{16}x10ms	2^{42}-1 chips	10ms/256 chips	10ms	2^{42}-1 chips	2^{42}-1 chips	N/A	5ms/256 chips	80 ms

	Pilot structure	IQ/code mux	IQ/code mux	IQ/code mux	IQ/code mux	IQ/code mux	IQ/code mux.	IQ/code mux	N/A	IQ mux	N/A
	Detection	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent	Coherent or non-coherent
	Power control	Open-loop (initial, RACH) Closed-loop (1.6kbps DCH SIR based)	Open-loop(initial, RACH), Closed-loop (1.6kbps DCH SIR based)	Open-loop + Closed-loop (0.8kbps SIR based)	Open-loop (initial) + Closed-loop (1.6 kbps DCH SIR based)	Open-loop + Closed-loop (1.6kbps Pilot CH SIR based)	Open-loop + Closed-loop (1.6 kbps Pilot CH SIR based)	Open-loop + Closed-loop (1.6 kbps Pilot CH SIR based)	BS directed MS power control	Open-loop (initial, RACH) Closed loop (0.2 kbps DCH SIR based)	None
	Variable rate Accommodation	VSF + Rate Matching + Multi-code	VSF + Rate Matching + Multi-code	VSF + Rate Matching (repetition/Puncturing) + Multi-code	VSF + Rate Matching + Multi-code	VSF + Rate Matching + Multi-code	VTS + Multi-code	VSF Multi-code + rate matching + Multi-code	Slot aggregation	Variable_num_slots + Multi-code + Variable SF option (32, 64)	Slot aggregation
Channel Coding		Convolutional codes RS Codes Turbo codes under study	Convolutional codes Turbo codes	Convolutional codes Turbo codes	Convolutional codes RS Codes Turbo codes under study	Convolutional codes Turbo codes	Convolutional codes Turbo codes under study	Convulational codes Turbo codes	Punc. Convolutional codes Soft or hard decision decoding	Convulational codes Optional outer RS; Turbo codes optional	Cyclic Redundancy Check (CRC) RS Code
Interleaving periods		10/20/40/80ms	10/20/40/80ms	5/20ms	10/20/40/80ms	10 ms	10/20/40/80ms	10/20 ms.	0/20/40/140/240 ms	10-300 ms	No interleaving
Rate Detection		Explicit rate detection and blind rate detection	Explicit rate detection and blind rate detection	Fund. CH : Blind. Supp. CH : No Blind detection for rates > 14.4.	Explicit rate detection and blind rate detection	Rate Information on signaling channel	Explicit rate information	Voice: blind Data: scheduled	L3 signalling	Rate Information on signaling channel	N/A

FL Tx Diversity	OTD/TDTD under consideratio n	FDD: TDTD TDD: STD/PTD	Multi-carrier Transmit diversity (N>3) OTD for direct spread (N=1,3,6,12)	OTD/TDTD under consideration	TSTD STD under consideration	OTD/TDTD under consideration	TSTD STD under consideration	Time diversity / space diversity / freq diversity	Smart Antenna	Antenna diversity / freq diversity / time diversity
Random Access mechanism	Preamble(1 ms) + Message(10 ms, I-ch:data,Q-ch : PL+RI), SFof I-ch =256,128,64 ,32	Message(I -ch)+ Signature(Q-ch) SF of Q-ch = 128,32	Preamble(Nx1.2 5ms)+ Message (Nx5(10,20)ms)	Preamble(1ms) + Message(10ms, I-ch:data,Q-ch : PL+RI), SFof I-ch =256,128,64,32	Preamble + Message (10 ms)	Preamble(1 ms) + Message(10 ms,	Preamble(1ms) + Message(10ms)	Random access with shared channel feedback Reserved access	RACH dedicated slot	Preamble + message
Power control steps	FDD: 0.25-1.5 dB TDD: 1.5 - 3 dB	1dB	1dB (0.5,0.25 option)	FDD: 0.25-1.5 dB TDD: 2 dB	1dB	1 dB	0.5 or 1dB	4 dB	1 dB	None

Definitions: VTS = Variable Time Slot
VSF = Variable Spreading Factor
DTX = Discontinuous Transmission

TABLE A.3*

Technical Parameters of Satellite RTT Proposals

N/A Not Applicable

	1	2	3	4	5	6
Technical Parameters	**SW-CDMA**	**SW-CTDMA**	**TTA-SAT**	**ICO-RTT**	**Horizons**	**INX**
Multiple Access	DS-CDMA	W-OC-C/TDMA W-QS-C/TDMA	DS-CDMA	FDMA/TDMA	TDMA	CDMA/TDMA
Band Width			5 MHz	25 kHz	Nx(2x100kHz)	Min 1.25 MHz for CDMA Min 50 KHz for TDMA
Chip Rate	2.048 - 4.096 Mcps	2.048 / 4/096 Mcps	4.096 Mcps	N/A	N/A	1,2,4,6 Mcps
Duplexing	FDD	BS: FDD MS: FDD or F/TDD	FDD	FDD	FDD	FDD/TDD
Carrier Spacing	2.5 or 5 MHz		5 MHz	25 kHz	100kHz	Min 1.25 MHz for CDMA Min 50 KHz for TDMA
Base Station synchronization				Bit clock syncronisation required, to 1µs. GPS reference.	Yes	N/A
Frame Length	20 or 30 ms	20 ms (30 ms optional)	10 ms	40 ms	48ms	40 ms for TDMA
VSF(spreading code)	VSF 16 -256	16/32/64/128 or 32/64/128/256/	16 – 32	N/A	N/A	
HO			Soft and hard handovers for both intra- and inter-satellites handovers	Soft, via satellite diversity	Yes	Soft and hard handover for both intra- and inter-satellites handovers

* The elements in this table do not properly characterize the satellite RTTs and the table should not be used for any purpose other than this Report.

	Modulation		π/4 QPSK or CPM (PFM)	BPSK	GMSK	16QAM	BPSK/QPSK
	Spreading mod.			OCQPSK	N/A	N/A	BPSK
	Spreading code		Walsh-Hadamard OVSF		N/A	N/A	
	Detection		Pilot signal assisted quasi-coherent	Pilot signal aided detection	Coherent		Coherent
	Power control	Yes		Yes	Both CLPC and OLPC. 2 Hz.	Yes 0.5 dB steps	Yes
Channel Coding				Convolution code + RS code	Convolution code.	Half rate Terbo Coding	Convolution
Interleaving		Intra- and inter-frame		Intra- and Inter-frame	Intraburst only	Included in FEC	Intra and inter frame
Multi-Rate		Orthogonal variable Rate Multi-code		Orthogonal variable rate/multi-code	Supported by timeslot aggregation. Channel aggregation also	Yes;from 400 bit/s to 144 kbits	Yes
Other Features				Satellite path diversity	Space, time and frequency. Also satellite path diversity.		Multi-type diversities
Random Access mechanism			W-Asynchronous CDMA	W-Asynchronous CDMA		TDMA	
Power control steps				0.25 to 1 dB	1dB	0.5 dB	0.5dB for CDMA 2dB for TDMA
Circuit/packet-stream Mode Management		Dual mode packet access (common and dedicated)					
Slots/Frame			8	16	6	18	4 for TDMA

ANNEX B

Collation of submitted key characteristics (working purposes)

ANNEX C

Document Road Map

Generic Docs: WG5 13, WG5 20, WG5 30

Summary

TEMP/131(Rev.1) (Summary), TEMP/131(Rev.2) (Summary),

Introduction

WG 5 14, WG 5 21, WG 5 30, TEMP/131(Rev.1) (Intro), TEMP/131(Rev.2) (Intro),

1 Scope

WG 5 14, WG 5 21, WG 5 30, TEMP/131(Rev.1) (Scope), TEMP/131(Rev.2) (Scope),

2 Related Recommendations

WG 5 14, WG 5 30, TEMP/131(Rev.1) (Related Recs), TEMP/131(Rev.2) (Related Recs),

4 Considerings

4.1 Goals of consensus building

WG 5 1, WG 5 14, WG 5 15, WG 5 30, TEMP/131(Rev.1) 4.1, TEMP/131(Rev.2) 4.1,

4.2 The RTT Evaluation Process

WG 5 20, WG 5 21, WG 5 30, TEMP/131(Rev.1) 4.2, TEMP/131(Rev.2) 4.2,

4.3 Impact of Evolution on the development of the Key Characteristics for IMT-2000

WG 5 15, TEMP/131(Rev.1) 4.3, TEMP/131(Rev.2) 4.3,

4.4 Impact of Modularity

WG 5 15

4.5 High Level Drivers

WG 5 1, WG 5 17, WG 5 20, TEMP/126 4.5, TEMP/131(Rev.2) A.5.3

5 Recommendations

WG 5 2, WG 5 14, WG 5 15, WG 5 17, WG 5 19, WG 5 20, WG 5 21, WG 5 30, TEMP/131(Rev.1) 5, TEMP/131(Rev.2) A.5.1, TEMP/126 5.1, TEMP/126 5.2, TEMP/131(Rev.2) A.5.2,

5.1 Definition and Rationale

TEMP/126 5.4, WG 5 2, WG 5 19, WG 5 30

5.2 Terrestrial

5.2.1 RF

TEMP/131(Rev.2) A.5.4
SWG 5-2-1.DOC

5.2.2 Baseband

TEMP/131(Rev.2) A.5.5
SWG 5-2-BB-1-CLEAN.DOC

5.2.3 System

TEMP131(Rev.2) A.5.4
TEMP/131(Rev.2) A.5.5
SWG 5-2-4.DOC

5.3 Satellite

WG 5 21, TEMP/131(Rev.2) 2.5 (up to Annex A)

1 Annexes

A: RTT Proposals (working purposes) – WG 5 15, WG 5 30, TEMP/131 B

B: Collation of submitted key characteristics (working purposes) – WG 5 31 (to be provided by WG 5-2)

C: This roadmap