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At the last RAN plenary ITU Ad Hoc was tasked to draft the initial material to be submitted to to ITU-R WP8F#5 toward the incorporation of UTRAN updates into Rev. 1 of Rec. M.1457 ("Detailed specifications of the radio interfaces of IMT-2000"). ITU Ad Hoc was also tasked to provide to WGs the initial relevant material for comment/approval before the discussion at RAN level.

This contribution contains the preliminary technical material prepared within ITU Ad Hoc and put forward to WGs. It basically consists of some info on the latest developments on some relevant WI/SI. Each WG is kindly asked to review the attached material in order to check whether it provides a fair overview of the current situation.

In particular, the following items are under WG1 main responsibility:

A1.1 1.28 Mcps TDD option

A1.4 Node B synchronozation for TDD

A1.6 Terminal power saving features

A1.11 Improvement of inter-frequency and inter-syste measurements

A1.15 DSCH power control improvement in soft handover

A1.16 Radio link performance enhancements (feasibility study)

A1.18 USTS (feasibility study)

ANNEX 1

Update information on technical areas as indicated in the Roadmap

In this Annex updated information on the main technical areas indicated in the Roadmap is provided. This is indeed living material: the most updated list of technical areas under investigation within 3GPP TSG RAN, together with a description of the current status of the activities, can be found on the 3GPP web site www.3gpp.org. The information included in this Annex is put forward to ITU-R WP 8F in order to provide a picture as complete as possible of all the technical activities currently ongoing within 3GPP TSG RAN; this would facilitate discussion in ITU-R WP 8F, taking into account the objective of convergence between radio interfaces. As indicated in the Roadmap, some of the activities described in the following may therefore continue beyond the deadline for inclusion in Rev. 1 of Rec. M.1457, thus not necessarily being submitted for incorporation in Rev. 1 of Rec. M.1457.

A1.1 1.28 Mcps TDD option

Rationale: The joint UTRA TDD concept with the two options (1.28 Mcps TDD and 3.84 Mcps TDD) will accommodate the various needs of the different Regions in a flexible way.

The 1.28 Mcps TDD has recently been introduced in the 3GPP specification suit.

A1.2 Base Station classification

Rationale: Current 3GPP TSG RAN specifications have been done with the same requirements for all types of base stations (Node Bs). For the UTRA evolution requirement specifications for other types of base stations are needed as well to take into account different use scenarios and radio environments.

The objectives of the BS classification activity can be divided into:

- definition of base station classes according to deployment scenarios
- identification, review and possible update of radio parameters dependent on deployment scenarios
- identification, review and possible update of UTRAN (Node B) measurement requirements and conformance where the maximum base station output power is reflected, dependent on deployment scenarios
- review and possible update of conformance test specifications
- recording of related information into the “RF System Scenarios” technical report

The radio parameters that shall be considered for different base station classes in the technical specifications should, at least, include:

- Frequency error
- Spectrum emission mask
- ACLR minimum requirement
- Reference Sensitivity Level
- ACS
- Blocking Characteristics
- Intermodulation Characteristics

- Performance requirement for multipath fading

A1.3 Hybrid ARQ II/III

Rationale: This feature has been shown to have the potential of efficiently enhancing the performance of packet data transmission by transmitting incremental redundancy at the request of the receiver.

HARQ II/III techniques will be covered within the HSDPA (see A1.17). For additional information, please refer to Spec. No. 25.835 and 25.837 available on the 3gpp web site (www.3gpp.org).

A1.4 Node B Synchronization for TDD

Rationale: NodeB synchronisation is beneficial in UTRA TDD to minimise cross-interference in neighbouring cells. The following benefits of the introduction of NodeB synchronisation by means of internal resources are seen:

- A substantial reduction of the cost of the transmission network.
- An autonomous synchronisation procedure without the need of external references.
- An easily extendable method for the purpose of inter-system NodeB synchronisation.

The purpose of this new work item is to enable the synchronisation of NodeBs in UTRA TDD by means of UTRAN's and UE's internal resources such as air interface signals and NodeB cross measurements. NodeB synchronisation involves

- radio frame und multi frame synchronisation and
- intra-system and inter-system synchronisation.

The Node B Synchronization has been included into the specifications for 3.84 Mcps TDD and will be completed for 1.28 Mcps TDD. For additional information, please refer to Spec. No. 25.836 and 25.838.

A1.5 UTRA FDD repeater Specifications

Rationale: Repeaters have proven to be useful for extending the coverage into buildings, train/car tunnels, subways, highways, etc in 2nd generation systems. Also, by installing repeaters at the sector borders or in highly dense areas, the transmitted power from the UE and the base station (Node B) could possibly be lowered, leading to an improvement in C/I and thereby capacity. For the installation of repeaters in cellular networks a specification is needed in e.g. Europe due to regulatory requirements. For operators without the capability of handover to 2nd generation systems, extending the coverage of UTRA will be of importance especially at the initial rollout stage. For operators with capability of handover to 2nd generation systems, user requirements (e.g. high data rates) may not be met by those systems and extended UTRA coverage might be needed.

Extensive work has been carried out on this work item and 3GPP TSG RAN succeeded to complete the UTRA Repeater specification for Release 4. The following work has been performed

- The core specification TS25.106 "UTRA Repeater; Radio transmission and reception" comprising the RF performance requirements has been created.
- The test specification TS25.143 "UTRA Repeater; Conformance testing" has been created.
- The Repeater EMC requirements are included in the TS25.113.
- Repeater co-existence simulations including Downlink and Uplink have been performed to investigate the system effect of Repeaters.
- A new technical report TR25.956 with the title “UTRA Repeater; Planning Guidelines and System Analysis” has been created to include several aspects of Repeaters.

The remaining work is in the conformance testing specification TS25.143. The intent is to align it with the part of the work in TS25.141 in the measurement uncertainties and test tolerances.

A1.6 Terminal power saving features

Rationale: The UE battery saving, UL/DL interference reduction, and capacity increase are important for deploying the UMTS services.

This activity aims at improving the terminal power saving features, UL/DL interference reduction, and capacity increase. For more detail information, please refer to Spec. No. 25.840, available on the 3gpp web site (www.3gpp.org).

A1.7 PS-Domain handover for real-time services

Rationale: It is expected that real-time services from the PS domain, such as voice over IP would benefit from fully optimised handover.

This activity aims at designing handover in RAN (mainly Iu) that supports real-time services from PS domain in an optimised way. Appropriate solutions are included in the specifications (for further information, please refer to Spec. No. 25.936 available on the 3gpp web site – www.3gpp.org).

A1.8 RAB QoS Negotiation/Renegotiation over Iu

Rationale: For services that could accept looser QoS requirements than those requested by the CN in the RAB establishment request, this feature enables UTRAN to propose alternative (looser) QoS. This feature also allows the UTRAN to renegotiate RAB/QoS parameters for on-going calls/session. Since the UTRAN is responsible for managing the radio resources, it is necessary for the UTRAN to be able to initiate RAB renegotiation for efficient use of the radio interface.

This activity aims at enhancing the Radio Access Bearer setup to something more sophisticated using e.g. QoS profiles to align with the already existing CN solution used in GPRS. This activity should also enhance the management of Radio Access Bearers for on-going calls/session so that QoS parameters can be renegotiated by the UTRAN. Appropriate solutions are included in the specifications.

A1.9 RRM optimisation for Iur and Iub

Rationale: The RRM optimisation for Iub/Iur is aimed at optimising the existing UTRAN procedures thereby increasing the efficiency of UTRAN and the quality of service to the end user.

Already several RRM related optimisations has been introduced since the first version of RSPC:
1) Congestion handling for Dedicated Transport Channels over Iur
- This work task introduced the DRNC capability to perform rate control;
2) DPC rate reduction in soft handover
- This work task introduced the support for DPC-Mode 1 in the UTRAN (already defined for the Uu in R99);
3) Introduction of common measurements over Iur
- This work task enabled an RNC to obtain (cell) load information for a cell in another RNS;
More work is ongoing continuing on further optimisations. Currently two separate work tasks have been started by TSG-RAN:
1) RL Timing adjustment
This work task aims at providing the possibility to adjust the timing of an individual Radio Link (e.g. in soft handover);
2) Separation of resource reservation and radio link activation
This work task aims at separating internal UTRAN resource reservation and radio link activation on the Uu, thereby e.g. improving performance for procedures like channel switching;

A1.10 Radio Access Bearer support enhancements

Rationale: The increasing interest in IP based services demands special optimisation of the means by which a radio access bearer can be provided by UTRAN.

Under the work item Radio Access Bearer Enhancements, the work on header compression for IP packets suitable for a wireless environment has been completed in 3GPP and IETF during year 2000 and beginning of 2001.
The IETF WG ROHC has completed the work on the RObust Header Compression (ROHC) protocol and the Internet Engineering Steering Group (IESG) has approved ROHC as proposed standards in RFCs (RFC 3095: RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed; RFC 3096: Requirements for robust IP/UDP/RTP header compression).
In 3GPP RAN the support of ROHC has been included and the work on ROHC is completed (3GPP TR 25.844 v4.0.0 "Radio Access Bearer Support Enhancements").

A1.11 Improvement of inter-frequency and inter-system measurements

Rationale: The activity on this technical area will widen the set of methods of implementing the compressed mode for enabling measurements on other frequencies. This will improve the system capacity and operational flexibility in addition to the existing methods.

The purpose of this work item is to work on the compressed mode improvements for improved system performance. The following two technologies have been identified as candidates for compressed mode improvements:

1. Compressed mode with puncturing and flexible positions
2. Combination of the existing methods (including method in point 1)

This activity is still at an early stage of development.

A1.12 Evolution of the transport in UTRAN

Rationale: In order to cope with new requirement coming from new service definition, it is necessary to introduce mechanism to support new transport mechanisms or to improve the existing ones.

This work item intends to introduce mechanisms necessary to allow an evolution of transport mechanism in the RNS following requirement put by the core network. Typical examples of such mechanisms are the following: introduction of an IP transport inside the RNS and AAL2 QoS optimisation.
The main objective for this activity is to ensure that adequate mechanisms are provided to handle the different type of traffic (i.e. signalling and user flow) inside the RNS to ensure that requirements in terms of QoS and delay are taken into account. This shall be valid also for efficient O&M transport of the different interfaces inside the RNS. This includes the Iub, Iur and any protocol suites at the Iu reference point.

A1.13 Smart Antenna

Rationale: The advantage of smart antennas are well known in the literature. Therefore this activity verified that Smart Antennas are fully supported by UTRAN, verifying their impacts on the physical and high layers. In particular, Smart Antennas are an essential part of the 1.28 Mcps TDD option enhancing the system capacity.

The possibility to exploit the advantages of the use of Smart Antennas have been always included in UTRA TDD. Within the activity towards the integration of TD-SCDMA as the “1.28 Mcps TDD option” of a joint UTRA TDD concept, a specific emphasis was given to Smart Antennas. In particular, the frame structure developed for the 1.28 Mcps TDD option support Smart Antennas (beam forming) technology.

A1.14 UE (User Equipment) positioning

Rationale: UE positioning is a function of UE and UTRAN (Access Stratum) which can be utilised for a number of purposes:

- Radio Resource Management
- Support for location based services (LCS)

Different accuracy can be requested when positioning a UE for these purposes.
The purpose of this activity is to increase the accuracy of the UE positioning or define methods allowing UE positioning with less complexity for a given accuracy.

Currently, the following positioning methods are supported by UTRAN:
- Cell coverage based positioning
- OTDOA method with network configurable idle periods; and
- Network assisted GPS method

For 1.28 Mcps TDD the work is ongoing to incorporate OTDOA method with network configurable idle periods into the specifications.
The major new work for 3GPP TSG RAN is to specify an optional open interface between the RNC and a stand-alone SMLC. Two major functions of the SMLC have been identified:
- position calculation based on UE GPS/OTDOA measurements
- provision of assistance data for A-GPS/OTDOA.

The addition of the interface should be compatible with current Iu, Iur and Iub and radio interfaces. The addition of this interface does not preclude the positioning methods to be supported in the SRNC. Whether standalone SMLC is used or not needs to be transparent for the UE and will only impact the SRNC, which supports standalone SMLC.

A1.15 DSCH power control improvement in soft handover

Rationale: The purpose of this activity was to specify improvement for the DSCH power control operation. In particular, a method has been develop so that the DSCH can be sent with more accurate power level, as UTRAN would exploit the information from the SSDT.

DSCH (Downlink Shared Channel) has always been part of the UTRA/FDD specification. Typically the transmit power for DSCH can be set depending on the transmit power of the associated downlink Dedicated Physical Channel (DPCH).
The work of adopting this method and improve the DSCH power control in case of a UE in soft handover, i.e. when the associated downlink DPCH is transmitted from more than one cell, have been completed by 3GPP RAN and is described more in detail in (TR 25.841, “DSCH power control improvements in soft handover”).
The method uses the uplink signalling, already existing for SSDT (Site Selection Diversity Transmission), to better estimate the required DSCH transmit power. The method does not imply any UE hardware changes, compared to the current release of the specifications.
TR25.841 also describes some other methods that may further enhance DSCH power control in soft handover. These methods can be considered for future releases.

A1.16 Radio link performance enhancements (feasibility study)

Rationale: In order to improve the link performance it is felt necessary to continue related studies after Release –99 completion and to include possible agreed improvements to the coming UTRA releases. This is a permanent study item to be repeated for every UTRA Release.

Several different possible topics have been identified that could improve the radio link performance. These studies might include improvements to the coming UTRA releases. However, 3GPP RAN has not come to an agreement on topics to include in the current specifications.
One important factor impacting the performance of radio systems is the available diversity (time, frequency, multipath etc.). Due to wide bandwidth, WCDMA systems are especially effective in exploiting the multipath diversity existing in time dispersive radio environments. If little or no multipath diversity is available the performance can degrade quite considerably. One way of improving the situation without significantly increasing the complexity of terminals is to utilize 2 or more transmit antennas that effectively speaking introduce additional radio paths and thereby increase the available diversity. Several schemes for open and closed loop mode transmit diversity with 2 antennas are already specified.
During 2001, 3GPP is studying the possible performance gain from employing additional transmit diversity schemes with more than 2 TX antennas.

A1.17 High Speed downlink packet access

Rationale: This work item proposes to study enhancements that can be applied to UTRA in order to provide very high speed downlink packet access. It's aim is to identify a long term evolution path for the UTRA air interface. In particular, HSDPA allows the increase of throughput and peak data rates with reduction in concomitant delay.

HSDPA is extending UTRA with a new transport channel HS-DSCH (High Speed Downlink Shared Channel). Use of HS-DSCH will enhance the UTRA support for interactive, background, and, to some extent, streaming services, in terms of
- Higher peak data rates
- Improved overall cell throughput [kbps/MHz/cell]
- Reduced delay

HS-DSCH deployment should be possible in all kinds of environments. However, the focus in the development of the HS-DSCH functionality is on small-cell urban environments. An overview of the current status HS-DSCH can be found in (TR 25.950, "UTRA High Speed Downlink Packet Access"). Below, the principles of HS-DSCH are briefly described.
HS-DSCH will be specified for both the UTRA/FDD and UTRA/TDD modes. The basic principles of HS-DSCH operation is similar to current UTRA Downlink Shared Channel (DSCH), i.e. downlink transmission to multiple users based on a shared code resource. However, HS-DSCH will support the following techniques, currently not supported by UTRA
- Support for higher-order modulation. In addition to currently used QPSK, 8PSK, 16QAM, and 64QAM is considered to be supported for HS-DSCH.
- Fast link adaptation based on Adaptive Modulation and Coding
- Fast scheduling

- Fast Hybrid ARQ

The following techniques have also been considered for HS-DSCH:

- Fast cell selection
- Advanced antenna solutions based on multiple transmit and multiple receive antennas, so called multi-input-multi-output (MIMO) antenna processing.

However, according to the current plans, these techniques will not be part of the first release of HSDPA. However, studies are continued and these techniques will be considered for inclusion in later releases.

In order to support the above listed techniques, the following extensions will also be done the UTRA specification:

- Support for transmission time intervals (TTI) shorter than 10 ms.
- Extension of current MAC architecture with a MAC-hs located in the Node B. MAC-hs is responsible for Hybrid ARQ, transport format selection and fast scheduling for HS-DSCH.

A1.18 USTS (UL Synchronous Transmission Scheme) (feasibility study)

Rationale: The purpose of this activity is to increase the uplink capacity by means of making a cell receive orthogonalized signals from UEs. USTS is expected to provide good capacity in the uplink with low overhead and minimal impact on hardware and software resources at UE and in the UTRAN.

The feasibility study is still ongoing. For detail information, please refer to Spec. No. 25.839 and 25.854, available on the 3gpp web site (www.3gpp.org).

A1.19 Improved common DL channel for cell FACH state (feasibility study)

Rationale: This effort is motivated by the desire to provide an optimized wireless IP solution for interactive and real time applications. While the existing mechanisms are sufficient for non-real time uni-directional traffic, there is some need for optimization work for bi-directional real time or interactive traffic using Common Channels available in Cell-FACH state.

This activity will study the feasibility of approach, perceived benefits, and scope of work for affected specifications to provide an improved common DL channel for Cell-FACH state. The study may consider an optimised FACH in the CPCH/FACH sub-state, a new use of DSCH as CPCH/DSCH in Cell-FACH state, and a new DL-CPCH. The objective is to optimize the common channel mechanism for various IP traffic including VoIP and other IP applications. This feasibility study is still ongoing.