

## Nomor 3GPP Newsletter – January 2008

### Latest progress in Long Term Evolution

Authors: Eiko Seidel, Sujuan Feng

#### General background on Long Term Evolution

At the 3GPP TSG RAN #26 meeting, the Study Item description on "Evolved UTRA and UTRAN", also known as "Long Term Evolution (LTE)", was approved.

The justification of the Study Item was that with enhancements such as HSDPA and Enhanced Uplink, the 3GPP radio-access technology will be highly competitive for several years. However, to ensure competitiveness in an even longer time frame, i.e. for the next 10 years and beyond, a long-term evolution of the 3GPP radio-access technology needs to be considered.

Important parts of such a long-term evolution include reduced latency, higher user data rates, improved system capacity and coverage, and reduced cost for the operator. In order to achieve this, an evolution of the radio interface as well as the radio network architecture should be considered.

By now the LTE core specification is approved and details have already been presented in previous newsletters. This month we will provide you a summary of items that are still open within the specification. Background on the terminology used in UMTS will be needed.

Long Term Evolution Release 8 is contributed to ITU as part of the IMT technology. Preparations are ongoing to develop so called 4G technologies called IMT Advanced. These might be realized in a next phase of Long Term Evolution as part of Release 9 or 10 of the specification as elaborated in the second part of this newsletter.

#### LTE Current Status

- The part dealing on LTE is now almost completed in terms of principle. Most of the RAN core specifications are now approved;
- A LTE work plan for each RAN WG that clarifies current completion level and time to freeze LTE specifications was approved;
- RAN agreed on the following definition for functional freezing of specifications: change proposals for agreed functions and new functional proposals shall not be treated and approved in WGs as Release 8 LTE unless it is essential;
- RAN has established and approved the list of open issues and their dependencies within and outside of the RAN.

Figure 1 shows the current completion level and future freezing time for LTE specifications for each RAN WG.

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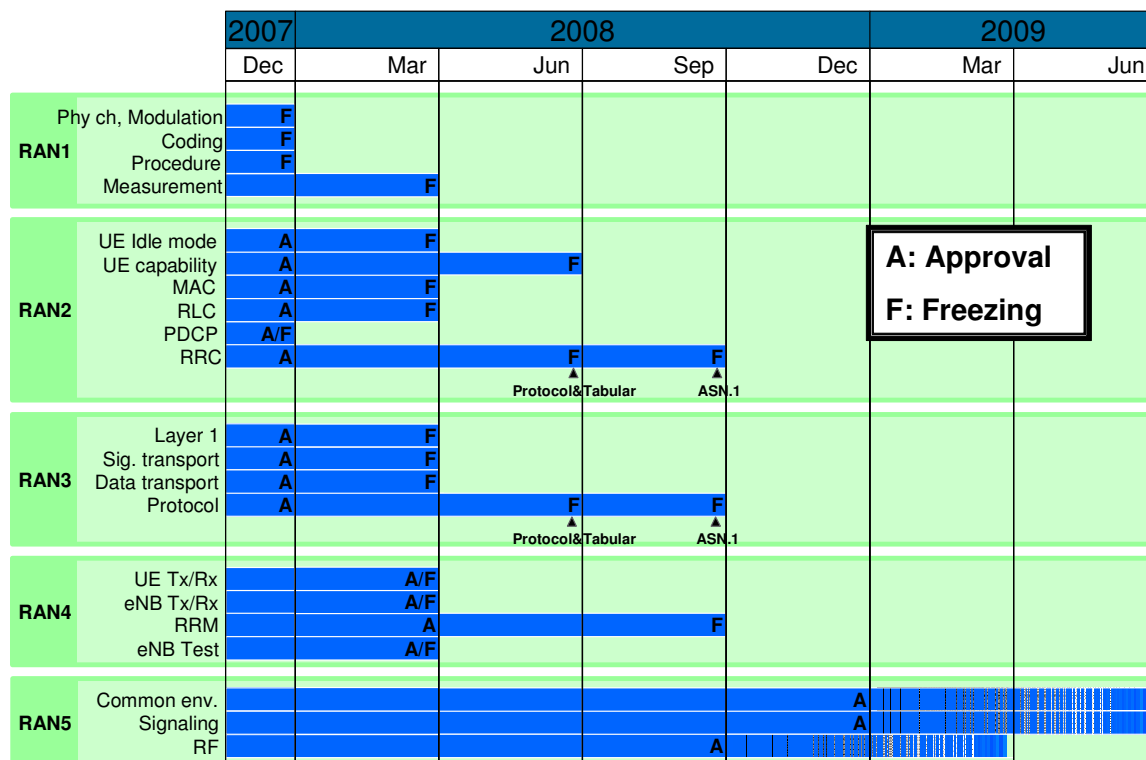


Figure 1: LTE Completion Level and Freezing Time for RAN WGs

### LTE Open Issue List

#### Physical Layer:

- L1 Control Signaling
  - † Exact information and corresponding exact number of bits carried on PDCCH (RAN2, RAN4)
  - † Exact information and corresponding exact number of bits carried on PUCCH (RAN2, RAN4)
  - † Channelization of PUCCH (RAN4)
  - † Remaining details on CQI reporting for non-MIMO (RAN4, RAN2)
  - † CQI reporting for MIMO (RAN4, RAN2)
  - † HARQ timing relations and signaling for TDD and FDD HD (RAN2)
  - † CQI reporting on PUSCH for non-MIMO (RAN2, RAN4)
- Remaining details for specification of TDD and FDD HD (RAN2, RAN4)

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- Need for DL interference coordination (RAN3, SA5)
- L1 Measurements
  - † Need for MRSRP UE measurement (RAN4)
  - † UE measurements for cdma2000/HRPD handover (RAN4)
  - † Further eNB measurements (RAN3, SA5)

#### Radio Protocol:

- Control plane
  - † System information:
    - ⌋ Support for Concatenation; Mapping of SIBs to SUs; MIB content; SIB / SU content; which SIBs shall be acquired when
  - † RRC connection (re-) establishment:
    - ⌋ Especially RRC connection re-establishment details missing (e.g. how to continue RB's)
  - † RRC connection reconfiguration:
    - ⌋ Details to be completed, including failure handling
  - † Measurements:
    - ⌋ Structure of the measurement configuration information; support for inter-freq/RAT measurement without measurement gap pattern
  - † Bearer management:
    - ⌋ Detailed parameters to be configured per RB; need for preconfiguration; Control signaling for semi-persistent allocations
  - † Handovers (both intra-LTE and inter-RAT):
    - ⌋ Details to be completed for both intra-LTE (e.g. what UE specific RRM information at handover) and inter-RAT handovers (detailed signaling aspects, security handling)
  - † Security
    - ⌋ what parameters need to be exchanged between UE and network at IDLE->CONNECTED and handover (SA3 input requested)
  - † Protocol data units, formats and parameters:
    - ⌋ Completion of message definitions
    - ⌋ Details for IE definitions

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- † RRC specification aspects:
  - ‡ Discussion ongoing about the structure of the procedural definition
  - ‡ ASN.1 (including discussion on specification approach)
  - ‡ RRC Failure handling (in how much detail should it be specified)
- Idle mode mobility
  - † Inter-freq cell reselection: how to handle equal priority layers. Need for load control info
  - † Inter-RAT cell reselection: detailed aspects of priority scheme
  - † Paging: detailed paging DRX formulas
  - † Speed dependant cell reselection details
- Unicast user plane
  - † QOS handling (input from SA2 requested on priority/PBR)
  - † Detailed aspects related to RACH, Buffer Status Reporting, Semi-persistent scheduling
  - † SDU discard (input from SA2/SA4 requested)
  - † Need for RLC reset
- MBMS
  - † SA2 status to be verified
  - † Need for MICH
  - † MCCH messages, message structure/contents
  - † Structure of scheduling information at MSAP occasion
  - † User plane stage-3
- Closed Subscriber Groups
  - † Stage-2 aspects: handling of distributed CSG deployments (“Case D”)
  - † Stage-3 description

### E-UTRAN Interfaces

- context setup/management
  - † UE capability info, release, bearer setup interaction (partly RAN2, SA2)
- active mobility management
  - † completion of intra-LTE HO and details on inter-RAT HO (RAN2, SA2)

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- bearer management
  - † bearer/QoS parameterisation (SA2)
- c-plane routing
  - † necessary information on routable identifiers (definition / application /coding, e.g. LAI, NRI, cell Id's, node id's, ...) (CT, SA2, RAN2)
- paging
  - † Definition of paging group indicator
- AS security
  - † key update, security info provision during HO (intra and inter-RAT) and connection setup (SA3)
- S1/eNB overload handling
  - † discussions from concept work onwards necessary
- Location Services
  - † impacts from location services requirements for LTE/SAE (SA1, SA2)
- MBMS for E-UTRAN
  - † in principle all the topics necessary for interface specifications for M1, M2, M3 (mainly SA2 / RAN2 dependencies)
- CSG / Home eNB
  - † not yet identified protocol impacts, most probably connectivity issues to be looked at on stage 2 level
- network synchronisation
  - † stage 2/3 work
- SON, SCN, interference management
  - † ICIC on X2 (RAN1)
  - † load indication on X2 (RAN1)
  - † automatic neighbour detection and configuration (RAN2,4)
  - † further work on automatic S1/X2 setup
  - † other SON and SCN aspects, might result in further eNB measurements (RAN1) and/or impact to other groups (RAN WG1,2,4, SA5)
- S1/X2 signalling transport
  - † further properties of S1/X2 signalling transport (application of SCTP)
- deep stage 3

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- + S1/X2 procedure interactions
- + global node Id usage
- + IE coding, etc.

#### RF and Performance

- UE requirements:
  - + General
    - u R4 General and Additional Radio channel bandwidth for each operating band  
R4 assumes HD-FDD (Half Duplex-FDD)
  - + Transmitter requirement
    - u Power control requirements  
R1 and R4 coordination on impact on RB power change / transient
    - u R4 Out of synchronization handling of output power  
R1 definition of out synch criteria
    - u R4 RACH requirements  
R4 need to investigate SEM if this places constraint on RB
  - + Receiver requirement
    - u Performance requirement  
Need R1 to complete spec but not critical path
- BS requirements:
  - + Transmitter requirement
    - u Open issue what is the R1 assumed power variations across RB locations  
Impact R4 UE rx specification
- Performance requirement
  - + Need R1 to complete spec but not critical path
- RRM requirements:
  - + Need RAN2 outcome on mobility
  - + Need RAN1 interworking on measurement
  - + RRM remaining topics in RAN4

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- u General (Common) sections
    - Test conditions
    - Test Tolerances
  - u RRC\_IDLE mode mobility
  - u E-UTRAN RRC\_CONNECTED state mobility
  - u RRC Connection Mobility Control
  - u Timing and Signalling characteristics
  - u Measurements Performance Requirements for UE
  - u Measurements Performance Requirements for E-UTRAN
- LTE repeater requirements:  
[Under a separate Work Item and the study continues.]
  - Home Node B / eHome Node B:  
[Feasibility study on the radio aspect is going on.]

### 3GPP Workshop on IMT Advanced and collaboration with ITU-R

A workshop was held to prepare for further activities to be held following reception of the circular letter from ITU-R on IMT advanced. The following was agreed:

- The Study Item on IMT-Advanced is targeted to be approved at RAN#39.
- Technical workshop prior to the RAN#40 meeting to be held.
- Requirements to be solidified at RAN#40.

#### **Background on ITU-R work**

- Oct-2007 ITU-R restructured the Study Groups to better align mobile, fixed, terrestrial and satellite work
- Study Groups
  - + Study Group 1 (SG 1) - Spectrum management
  - + Study Group 3 (SG 3) - Radiowave propagation
  - + Study Group 4 (SG 4) - Satellite services
  - + **Study Group 5 (SG 5) - Terrestrial Services**
  - + Study Group 6 (SG 6) - Broadcasting service

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† Study Group 7 (SG 7) - Science services

#### SG5 Terrestrial Services

- Scope: Systems and networks for fixed, mobile, radio determination, amateur and amateur-satellite services.

	<b>Proposed Working Party</b>	<b>Acting Chairman</b>
Land mobile other than IMT and amateur/amateur-satellite	WP 5A (former WP8A)	Mr. J. Costa
Maritime mobile, Aeronautical mobile, Radio determination	WP 5B (former WP8B)	Mr. T. Evers
Fixed wireless systems, HF systems in the FS and the land MS	WP 5C (former WP9B+9C+9D)	Mr. C. Glass
<b>Land mobile (IMT)</b>	<b>WP 5D (IMT)</b> <b>(former WP8F)</b>	<b>Mr. S. Blust</b>

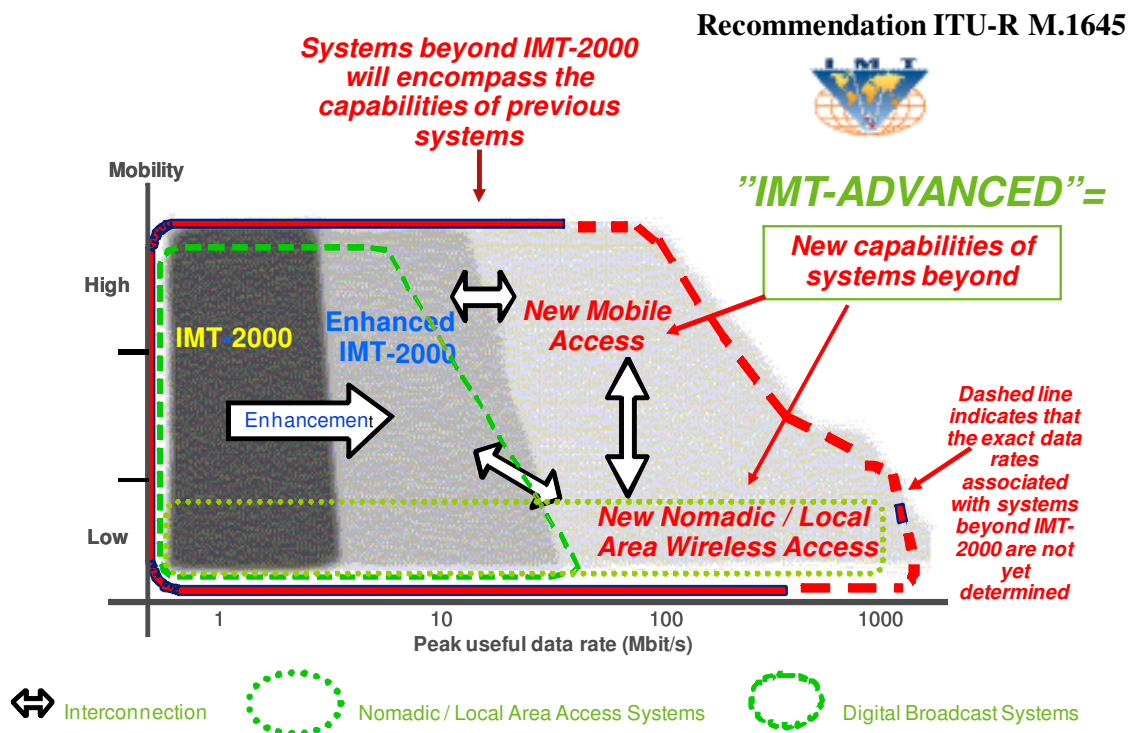
**Table 1: Overview ITU-R Working Party 5**



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**Figure 2: Overview of IMT Technologies from ITU**

### ITU-R Work on IMT Advanced

- ITU-R Foundation Activities Have Led The Way:
  - + "Vision" work for IMT-Advanced began in 2000
  - + "Spectrum" work for IMT-Advanced began in 2003
  - + "Process" work for IMT-Advanced began in 2006
- ITU-R Future Spectrum Decisions Are Important Aspect:
  - + World Radio Conference (WRC-07) took decisions in November 2007 impacting 3G and beyond 3G (that is IMT-2000, IMT-Advanced and/or collectively – "IMT")
- ITU-R and Industry Will Partner In The Next Steps:
  - + "Technology" work for IMT-Advanced will begin in 2008
- ITU-R Technology Specification Recommendations on IMT-Advanced is expected year end 2010

### Time schedule for IMT Advanced

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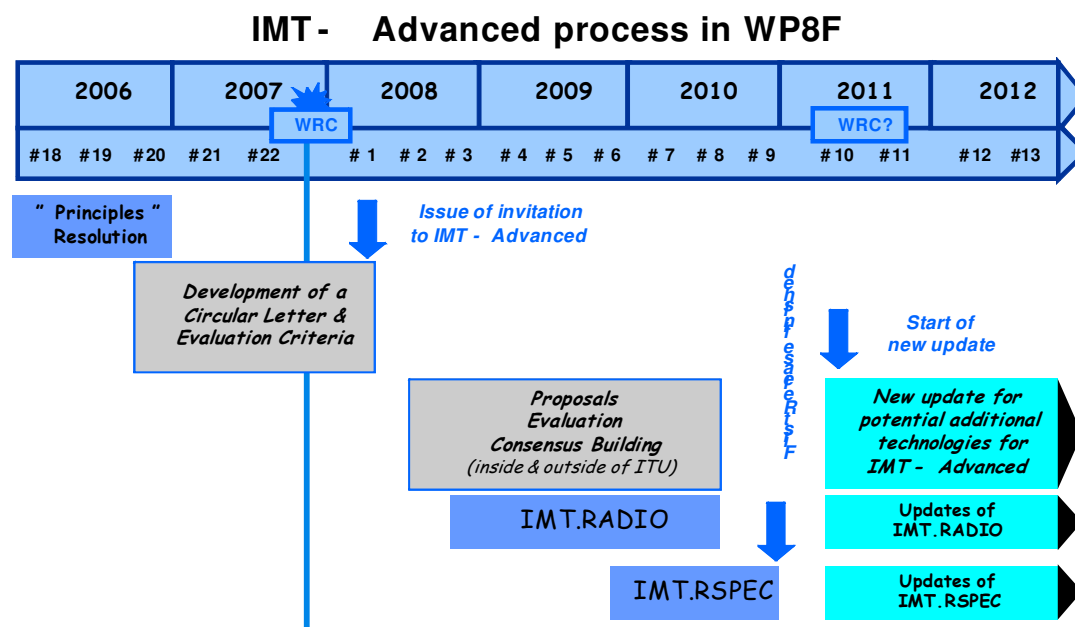


Figure 3: IMT - Advanced Process in WP8F

### Important Decisions at WRC'07

- IMT-2000 was changed to IMT (IMT = IMT-2000 and IMT-Advanced)
- In total around 400 MHz identified to IMT
- Out of this 136 MHz that was globally allocated to IMT
  - † Bands; 450-470 MHz, 790-806 MHz, 2300-2400 MHz
- Additional low frequency bands for wide area coverage
  - † Bands 698-790 MHz, 790-806 MHz, 806-862 MHz
- 3400-3600 MHz band allocated to mobile service in some countries in all the three Regions
  - † Band will be allocated to UMTS/LTE pretty soon
  - † 3GPP will start working on specification

### Our interpretation of the relation of LTE and IMT Advanced

- LTE is not equal to IMT Advanced or 4G
- The requirements of IMT Advanced are not defined yet

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- † ... but are likely to be same or higher compared to LTE requirements in 25.913
- There might an LTE Phase II or LTE Plus or LTE Advanced with technology enhancements
  - † Data rates up to 1Gbps in stationary scenarios
  - † Coverage enhancements for high frequency bands
  - † ...
- 3GPP work related to IMT Advanced
  - † first workshop held in Nov'07 at RAN#38
  - † 3GPP will influence ITU-R requirements on IMT Advanced
  - † 3GPP will contribute a new technology to ITU-R
  - † 3GPP will hold another workshop in April'08
  - † 3GPP will propose a study item will be proposed in Mar'08 at RAN#39

#### The next newsletter ...

After having focused on LTE for some time we will present you the current state and progress of **System Architecture Evolution** and latest work done in SA2.

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