

D06.3 Midterm Standardisation Report

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Abstract:	This deliverable defines the midterm standardisation plan for the Multi-Base project. It briefly describes the standardisation landscape in mobile communications and identifies standardisation groups relevant to the work done in Multi-Base.
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1 Introduction

Active monitoring of, and participation in, relevant standardization bodies are of vital importance for the Multi-Base project to be successful. The aim of this deliverable is to define the midterm standardisation plan for the Multi-Base project. The main emphasis will be in the description of the standardisation landscape in mobile communications and in identifying standardisation groups relevant to the work done in Multi-Base. The ability to have first hand information concerning standard developments is essential to steer the different research activities in the right direction. One of the goals of the Multi-Base project is to widely disseminate the results at different levels and to different communities in order to spread the culture and technologies in the field of design. One target for such dissemination is a set of standardisation working groups whose activities are or can be put in relation with the knowledge developed in Multi-Base.

Since the Multi-Base project is about supporting multiple standards within a terminal, rather than deriving new concepts targeting a specific standard, the interaction between the different standardization bodies and Multi-Base will be more of monitoring from a Multi-Base perspective. Although it is highly desired that results from the work performed within Multi-Base would be disseminated within one or more of the standards, it is not considered a must.

Relevant standards for Multi-Base have also been dealt with in the deliverables D1.1 and its revision D1.2 from the point of view of the selected Multi-Base functional architecture.

It should be noted, however, that even if some of the Multi-Base partners are also active in different standardization bodies, it is not necessarily so that all information available to these partners can be communicated openly within Multi-Base. This is due to that membership in different standardization communities is connected to certain regulations concerning confidentiality.

The remaining part of this report is organized as follows. In Section 2, the relevant standardization bodies are briefly discussed, and in Section 3, the standards considered in Multi-base are described. Section 4 gives an overview of how the different partners within Multi-base are engaged in different standardization activities and finally, in Section 5, brief conclusions are provided.

Standardisation is a part of T6.2 Dissemination and standardisation in work package 6, but only the coordinator TEC is officially participating in this work package. However, it is nevertheless clear that also other project partners – mainly big industrial companies – will actively participate in the standardisation activities, into which they have the best insight. The results will be achieved through the Multi-Base project partners; in fact many of them have strong and active links with relevant specification and standardisation bodies, which they will use to promote our work. The ways to perform such an activity may range from setting up working groups specifically targeted by the Multi-Base topics to the creation of formal liaisons between already existing committees and the Multi-Base consortium. Therefore this deliverable contains an overview of the standardisation involvement of all partners, who participate in standardisation activities within their RTD project work.

2 Standardisation bodies relevant for Multi-Base research area

2.1 Standardisation bodies

This chapter aims to provide an overview of the standardisation bodies, associations and initiatives that are relevant in the area of mobile communications and especially relevant for Multi-Base. Therefore the closer examination is for example focused on the working groups concentrating on the standards that have been selected for Multi-Base.

2.1.1 IEEE Standards Association

The Standards Association of the Institute of Electrical and Electronics Engineers (IEEE) is a leading developer of international industry standards in a broad range of industries.



Website: <http://standards.ieee.org>

- IEEE 802.11

The working group for Wireless Local Area Network (WLAN) standards. As defined in the deliverables D1.1 and D1.2, this standard (802.11n/g) was selected by the Multi-Base consortium as one of the most interesting for a closer examination for multi-standard implementation.



2.1.2 ETSI

The European Telecommunications Standards Institute (ETSI) produces globally applicable standards for ICT area, including mobile, radio, converged, broadcast and internet technologies.



Website: <http://www.etsi.org>

2.2 Alliances, Initiatives, Forums, Associations

2.2.1 3GPP

The 3rd Generation Partnership Project (3GPP) unites telecommunications standards bodies (ARIB, ATIS, CCSA, ETSI, TTA, TTC) to ...

Website: <http://www.3gpp.org>



2.2.2 Bluetooth Special Interest Group

The Bluetooth Special Interest Group (SIG) is a privately held, no-profit trade association that publishes Bluetooth specifications, protects trademarks and evangelises Bluetooth wireless technology.

Website: <https://www.bluetooth.org>



3 Relevant standards for Multi-Base

The standards relevant for Multi-Base were described in detail in the deliverables D1.1 and D1.2 (delivered M06 and M12, respectively). Here a brief overview is given of the most relevant standards. It should be pointed out, however, that from the current point of view the consortium does not consider it as feasible to influence these standards through the project directly. All the standards are very different as they have or are being developed for different purposes – for example the 802.11 standards aim at higher data bit rates, while the focus of LTE and DVB-H are mobility and improving broadcast, respectively. The chosen standards do have, however, also commonalities: the main common characteristic is that they all use OFDM and convolutional coding [1], [2].

3.1 *Relevant existing standards*

3.1.1 IEEE 802.11g

The 802.11g standard was finalized in 2003 [4]. The modulation scheme used is orthogonal frequency division multiplexing (OFDM) with data rates of 6, 9, 12, 24, 36, 48 and 54 Mbps. The system operates in the ISM band at 2.4 GHz frequency with a bandwidth up to 20 MHz and offers backward compatibility with 802.11b supporting Complementary Code Keying (CCK). 802.11g uses the same OFDM modulation and coding schemes of 802.11a. The 802.11g uses the modulations BPSK, QPSK, 16QAM, and 64QAM at a maximum transmission power of 100mW. When compared to 802.11a, the 802.11g offers the advantages of lower cost, backwards compatibility to existing 802.11b equipment, and less path loss than the 802.11a, due to the lower carrier frequency.

3.1.2 IEEE 802.11n

802.11n adds extra functionality and provides better spectral efficiency than its predecessors. The higher data rate is achieved through space division multiplexing (SDM) by the incorporation multiple input multiple output (MIMO) antenna configurations. Space time block coding (STBC) can also be used, which increases the coverage. Additionally, 802.11n uses a higher maximum code rate and slightly more data sub-carriers, resulting in a data rate increase from 54 Mbps to 65 Mbps per channel per antenna. An extra 20MHz bandwidth is optionally added to the standard making it possible to transmit in a 40 MHz bandwidth (channel bonding). 802.11n could hence offer raw data rates up to 600 Mbps [5]. Moreover, an improved forward error correction (FEC) based on LDPC is foreseen, which increase the coverage and link robustness at high spectrum efficiencies.

One of the most important features in the draft-n specification to improve mixed mode performance is aggregation. Rather than sending a single data frame, the transmitting client bundles several frames together. Thus, aggregation improves efficiency by restoring the percentage of time that data is being transmitted over the network.

3.2 *Relevant ongoing standardisation work*

3.2.1 ETSI DVB-T/H(2)

The Digital Video Broadcasting project (DVB) is an international industry-led consortium committed to develop technical standards related to broadcast. The DVB specification includes several different broadcast standards [6], of which DVB-H (handheld) is relevant for the Multi-Base concept. DVB-T (Terrestrial)/H standards are designed to function primarily in the UHF and VHF band. Even though the DVB-T is enough to for mobile reception, some factors have to be considered when the end device is running under limited power constraints. This was the major factor motivating the development a new

broadcast standard aimed for handheld devices, and which was based on the terrestrial approach already developed. This standard is denoted DVB-H. DVB-H contains two major additions to the DVB-T standard, namely time-slicing and an additional layer of coding. Given the additional features to the terrestrial approach, the standards now allows battery saving, mobility with high rates, increased robustness and support for seamless handover.

3.2.2 3GPP-LTE

LTE is a part of the third generation partnership project (3GPP) which aims at improving the Universal Mobile Telecommunications System (UMTS) to handle with the communication requirements of the future [1]. D1.1 and D1.2 contain a comprehensive description of this standard and therefore the main characteristics are listed here.

The requirements placed on LTE target better performance, complexity, and inter-working, including for example [7].

- Data rate 100 Mbps in downlink (DL) and 50 Mbps in uplink (UL)
- At least 200 users per cell in 5 MHz bandwidth
- Optimised for low mobile speed (0 to 15 km/h), supports higher speed from 15 to 120 Km/h and is able to maintain link connection up to 500 Km/h
- Cell range up to 100 km.
- Spectrum flexibility in different frequencies spectrum allocations of different sized.
- Co-existence with GERAN/UTRAN in the same geographical area
- The architecture must be packet based

LTE uses OFDM in the downlink which results high spectral efficiency and SC-FDMA in the uplink in order to save power consumption in the terminal. It is also designed to be flexible in the channel allocation, and LTE will operate in various radio channel bandwidths ranging from 1.4 to 20 MHz. LTE also supports both FDD (Frequency Division Duplex) and TDD (Time Division Duplex). Ten paired and four unpaired spectrum bands have so far been identified by 3GPP for LTE.

3.3 Relevant standards for handover, cognitive radios and coexistence standards

Next to the relevant standards for single-mode operation, it is important for Multi-Base that handovers are supported. In that view, requirements are specified based on existing and emerging standards, both for single mode handover and media independent handover. For the first case, we focus on LTE handover, for the second case, handover between LTE and WLAN is selected.

In view of the evolution towards cognitive radio and coexistence, the following standards are followed up:

- 802.22 for reuse of the TV white spaces (primarily in the USA currently),
- SCC41 for dynamic spectrum access networks
- IEEE 802.19 for coexistence

In the following deliverables, the relevance for Multi-base scenarios and impact on platform solutions and multi-stream support are will be further detailed.

3.4 Future (high-throughput) extensions of wireless standards

While some standards are still being finalized and products are not yet on the market, initiatives to define future extensions towards even higher throughput and/or better performance are being taken. Specifically, the IEEE802.11 and 3GPP committees are launching new proposals:

- IEEE802.11: The ideas previously launched under the label of 'Very High Throughput' (VHT) have in recent meetings received much more attention, and have been split in two categories: 802.11ac for VHT below 6GHz, and 802.11ad for VHT at 60GHz. In order to achieve the VHT below 6 GHz, many organizations are considering MIMO with large number of antennas (>>4). Also, SDMA and Multi-user MIMO seem de-facto necessary.
- 3GPP-LTE advanced: In March 2009 a requirements document for further advancements for Evolved Universal Terrestrial Radio Access (E-UTRA) (LTE-Advanced) (Release 8) was launched.

4 Multi-Base standardisation plan

4.1 Organisation of standardisation work within Multi-Base

Standardisation is one of the key elements to ensure our project's long term technological impact. This ensures that the work done within Multi-base gets as large attention as possible when presented at different conferences and published in different scientific journals. A tight relation to other industry developments can be ensured through the project partners. The standardisation activities of each partner are elaborated below.

4.2 Contributions to the standardisation work

The contributions of the Multi-Base project partners to the standardisation work is described in the following chapter.

EAB is one of the major contributors to the development of LTE. Although no one of the standardization delegates are active in Multi-Base, their knowledge is beneficial. As an example, at the workshop held in Lund in January 2009, an overview seminar of the 3GPP standardization of LTE was presented to all partners of Multi-base by one of Ericsson's delegates. As another example, EAB work within multi-base is constantly making use of the close cooperation with the people participating in 3GPP standardization.

Leif Wilhelmsson is active in the Core Specification Working Group (CSWG) in Bluetooth SIG, focusing on coexistence between Bluetooth and LTE. Leif was active Bluetooth standardization 1998-2000, when the first version of the Bluetooth standard was developed and released. Since 2008, Leif is again active in Bluetooth standardization.

Leif Wilhelmsson has since 2004 been participating in standardization meetings concerning DVB-H and its successor. Furthermore, Leif has also closely followed the development of the new standard for terrestrial DVB, DVB-T2 by being a member of the DVB-T2 group and by that have access to all the relevant documents.

EAB is following the activities in relevant IEEE standards, but with considerably less effort.

IFAT is a major contributor to the ETSI TC RRS (Reconfigurable Radio Systems) working group which is chaired by Ericsson. Important topics in the focus of this working group are amongst other the definition of:

- "Handset SDR Reference Architecture"
- the development of a "Functional Architecture"
- the development of "Cognitive Pilot Channel", etc.

The TC RRS group is organized in the following way:

- System Aspects (top-down),
- Equipment Architecture (bottom-up, covering mainly SDR aspects),
- Functional Architecture (bottom-up, covering mainly CR aspects),
- Public Safety (bottom-up).

With ETSI TC RSS, it is expected that mobile phone platforms will be opened towards more diverse standards, such as WiMAX, and various WiFi flavours (IEEE 802.11n, IEEE 802.11VHT, etc.), etc.

IFAT is also active in other relevant standardization activities like IEEE LAN/MAN contributing to WLAN 802.11n, in Bluetooth-SIG, in WiMEDIA, DVB-T, 3GPP and in other ETSI and ANSI groups.

Other Multi-Base partners are also actively contributing to standardisation work:

TEC is involved in standardization work on the national (OENORM: OVE/ON-K IT-EG) and international level (ETSI: ERM TG25) and funnels results from Multi-Base into relevant discussions.

ULUND is following and contributing to both existing and emerging standardisation in the field of wireless communication. Main standardisation bodies in this context are 3GPP, ETSI and IEEE.

LIU follows existing and emerging standardisation in the field of broadband wireless communication such as IEEE 802.11a/b/g/n, 3gpp, 802.16x, and ETSI DVB-T/H(2).

IMEC is generally following all existing and emerging standardisation in the field of broadband wireless communication. Specifically, IMEC is following and sporadically contributing to the IEEE 802.11n, 802.15c and 802.16m TGs. IMEC is monitoring the 3GPP standardisation towards 3GPP-LTE and ETSI DVB-T/H(2).

5 Conclusion

As already stated in the introduction of this deliverable, since the Multi-Base project is about supporting multiple standards within a terminal, rather than deriving new concept targeting a specific standard, the interaction between the different standardization bodies and Multi-Base will be more of monitoring from a Multi-Base perspective. It is not considered as an obligatory outcome of the project that the project results would be disseminated within one or more of the standards, although it would be desirable.

The industrial partners EAB and IFAT have the most standardisation activities that have the potential of being relevant for the Multi-Base developments. Nevertheless, standardisation work is carried out by several partners in the consortium.

6 References

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- [5] Broadcom White paper, “802.11n: Next-Generation Wireless LAN
- [6] “History of the DVB Project” available at www.dvb.org
- [7] 3GPP-25.913 “Requirements for E-UTRA and E-UTRAN”, available in 3gpp.org

7 List of Project Partners and Abbreviations

TEC	Technikon Forschungs- und Planungsgesellschaft
EAB	Ericsson AB
IFAT	Infineon Technologies Austria AG
ULUND	Lunds Universitet
LIU	Linköpings Universitet
IMEC	Interuniversitair Microelectronica Centrum VZW
KULEUVEN	Katholieke Universiteit Leuven

CCK	Complementary Code Keying
DVB-T/H	Digital Video Broadcasting –Terrestrial/Handheld
EDGE	Enhanced Data rates for GSM Evolution
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
3GPP	Third Generation Partnership Project
GSM	Global System for Mobile communications
HSPA	High Speed Packet Access
LTE	Long Term Evolution
OFDM	Orthogonal Frequency Division Multiplexing
RAT	Radio Access Technology
SIG	Bluetooth Special Interest Group
TDD	Time Division Duplex
UMTS	Universal Mobile Telecommunications System
WiMAX	Worldwide Interoperability Microwave Access
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network
VHT	Very High Throughput
VoIP	Voice over IP
WP	Work Package