



## **Integrated Project – EUWB**

**Contract No 215669**

# **Deliverable**

**D9.3**

## **Contributions to the updated ECMA standard**

<b>Contractual data:</b>	<b>M40</b>
<b>Actual data:</b>	<b>M40</b>
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<b>Work package:</b>	<b>WP9</b>
<b>Security:</b>	<b>PU</b>
<b>Nature:</b>	<b>Report</b>
<b>Version:</b>	<b>1.0</b>
<b>Total number of pages:</b>	<b>10</b>

### **Abstract**

The present document presents the planned contributions to the updated ECMA standard 368 on High Data Rate UWB system using the WIMEDIA PHY and MAC. The version 3 of the standard has been published in December 2008 without significant inputs from the EUWB project. Further originally planned updated towards a version 4 of the standard including the 1Gbit/s PHY layer have not been performed up to date.

The inputs from the EUWB project towards the originally planned ECMA standard update are included in the WIMEDIA PHY version 1.5 published in August 2009. In this version of the standard significant part developed in the scope of PULSERS II and the EUWB project have been included and are ready for the inclusion into a new version of the ECMA 368 standard.

### **Keywords**

UWB, standardisation, ECMA, WIMEDIA

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## Abbreviations

ECMA	European Computer Manufacturers Association (ECMA international – European association for standardising information and communication systems)
EIRP	Equivalent isotropically radiated power
EUWB	CoExisting Short Range Radio by Advanced Ultra-WideBand Radio Technology
LDC	Low Duty Cycle
LDR	Low Data Rate
MB-OFDM	Multi-Band OFDM
OFDM	Orthogonal Frequency Division Multiplexing
Q1/2/3/4	Quarter 1/2/3/4
UWB	Ultra-Wideband
UWB-RT	Ultra-Wideband Radio Technology

## 1 Executive Summary

The originally planned activities in the scope of the EUWB project have been based on the assumption of a close collaboration with the active WIMEDIA alliance responsible for the further development of the High Data Rate UWB standard beyond the version 1.5 published in August 2009. Due the reduced activities in the WIMEDIA alliance and thus the stop of the further evolution of the standard towards a version 2.0 no new version of the ECMA 368 [2] has been envisaged by WIMEDIA after 2008. The main focus of the remaining WIMEDIA group has been to update the WIMEDIA PHY and MAC standard to a version 1.5 including significant inputs from the EUWB partners based on results from the work performed in PULSERS II. Here the complete channel coding part has been updated including a new LDPC code class called Ultra-Sparse-(US)-LDPC codes for data rates starting from 160Mbit/s and above. These codes have been initiated in the scope of the PULSERS II project and partners of the EUWB project took care to include these codes into the actual WIMEDIA 1.5 standard from August 2009.

Further developments have been planned for inclusion like an optimised LDC operation and a standardised DAA operation in the network.

## 2 Introduction

Based on the developments and activities in the PULSERS II project and the first year of the EUWB project significant inputs towards the definition of an enhanced data rate UWB system based on OFDM have been prepared by EUWB partner for the inclusion into the ECMA international standard 368 version 4. Due to the reduced activities and the publicly availability of the WIMEDIA standards [2] the WIMEDIA board has decided to stop actually working on an updated version of the ECMA standard.

The partners in EUWB have been in standby to provide the needed inputs in case the ECMA standardisation work would have been started again. The original delivery date of the present deliverable was M30 but since no activities in ECMA has happened until then the delivery of the deliverable has been postpone until the end of the project with goal of being able to accommodate possible new activities in ECMA. This did not happen and thus no inputs to the ECMA standardisation have been done in the scope of the EUBW project. Nevertheless, the material planned for an inclusion into an updated version of the ECMA standard has been included into the newest version of the WIMEDIA standard published in August 2009.

The main focus of the work has been the development of a new class of LDPC codes call US-LDPC codes and the optimisation of these codes for the inclusion into an 1Gbit/s UWB system. Here the initial results from the PULSERS II project have been further enhanced by WISAIR. These new channel coding scheme is now part of the WIMEDIA 1.5 PHY. Initial implementations of these systems are expected until the end of 2011 or the beginning of 2012.

### 3 WIMEDIA PHY standard 1.5

The main target of the development of the WIMEDIA PHY 1.5 was the inclusion of a 1Gbit/s mode for distances up to around 2m. This has been achieved by the inclusion of a 64QAM like modulations scheme called MDCM into the original WIMEDIA 1.2 PHY standard. In order to improve the overall performance and here especially the range of the transmission a new channel coding scheme has been proposed by the PULSERS partner WISAIR and STMicroelectronics in close collaboration with the University of Kaiserslautern, Germany. This basic development of the PULSERS II project has been taken over by the EUWB project as the bases for the inclusion into the new standard.

The original idea was to include a traditional convolutional coder with an extended speed into the standard. The newly developed LDPC codes have shown a significant performance gain on system level including the RF frontends and the overall base band processing without an increased implementation complexity (in silicon area). Furthermore, a significant reduction in average power consumption could be reached. These characteristics have lead to the decision to included the new channel coding scheme not only into the new data rate classes above 500Mbit/s but also into the data rate starting from 160Mbit/s as an additional option to the convolutional coder. In Table 1 the channel coding schemes used in WIMEDIA 1.5 are depicted as copy from the original WIMEDIA standard (Table 6-17 in WIMEDIA 1.5 PHY standard)

TABLE 6-17. Rate Dependent Parameters

Rate (Mb/s)	Coding scheme used	R1 - R5
53.3	CC	00000
80	CC	00001
106.7	CC	00010
160	CC	00011
200	CC	00100
320	CC	00101
400	CC	00110
480	CC	00111
640	LDPC	01000
800	LDPC	01001
960	LDPC	01010
1024	LDPC	01011
Reserved		01100-10010
160	LDPC	10011
200	LDPC	10100
320	LDPC	10101
400	LDPC	10110
480	LDPC	10111
Reserved		11000-11111

Table 1: Channel coding schemes used in WIMEDIA 1.5 [1]

Based on the developments a new company (Creonic, Germany) has been created with the goal of commercialising the developed IP core [4]. The WIMEDIA 1.5 LDPC code core is one of the products in the portfolio of the company.

In further potential updates of the ECMA standard 368 these developments will be included.

## 4 Conclusion

The originally planned active participation in the further development of the ECMA standard covering the WIMEDIA based UWB systems did not take place since no further activities towards an updated version of the standard after 2008 took place.

Nevertheless, the results planned for an inclusion are available and included in the actual WIMEDIA standard 1.5. Initial implementations using these standards are announced for the end of this year or beginning next year.

Further developments towards a standardised solution for the DAA processes and the better definition of the LDC operation of the WIMEDIA system have been stopped due to the significantly reduced activities of the WIMEDIA alliance.

## References

- [1] WIMEDIA PHY 1.5: [http://www.wimedia.org/en/docs/10003r02WM\\_CRB-WiMedia\\_PHY\\_Spec\\_1.5.pdf](http://www.wimedia.org/en/docs/10003r02WM_CRB-WiMedia_PHY_Spec_1.5.pdf)
- [2] High Rate Ultra Wideband PHY and MAC Standard: <http://www.ecma-international.org/publications/standards/Ecma-368.htm>
- [3] ISO/IEC 26907:2009: Information technology – Telecommunications and information exchange between systems – High-rate ultra-wideband PHY and MAC standard; [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=53426](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=53426)
- [4] Creonic: <http://www.creonic.com/de/ip-core/wimedia-15-uwband>

## Acknowledgement

The EUWB consortium would like to acknowledge the support of the European Commission partly funding the EUWB project under Grant Agreement FP7-ICT-215669.