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**Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)**

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**Source:** Thomas Kürner Company TU Braunschweig

Address Schleinitzstr. 22, D-38092 Braunschweig, Germany

Voice:+495313912416, FAX: +495313915192, E-Mail: t.kuerner@tu-bs.de

**Re:** doc. 15-13-0636-01-0thz, doc. 15-13-0692-01-0thz

**Abstract:** Wireless backhauling/fronthauling is one of the potential applications for a standard on 100G. This documents contains information to answer some questions in doc. 15-13-0692-01-0thz, which have been raised during the discussion on doc. 15-13-0636-01-0thz

**Purpose:** Information of IEEE 802.15 SG 100G

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# Information on Backhauling/Fronthauling

Thomas Kürner

TU Braunschweig

# Scope

- This documents provides additional information on backhauling and fronthauling addressing some questions raised during discussion on doc. on doc. 15-13-0636-01-0thz.
- The information is based on the references given at the end of the document.

# CPRI (Common Public Interface) [1]

- CPRI™ ; publicly available specification for the key internal interface of radio base stations between the Radio Equipment Control (REC) and the Radio Equipment (RE).
- The Parties cooperating to define the CPRI Specification are Ericsson, Huawei, NEC, NSN and Alcatel-Lucent. Nortel contributed to thge first versions of CPRI
- The most recent version is version 6.0 including also LTE Advanced (LTE-A).

# CPRI Specification Overview [1]

- The interface is a digitized and serial internal base station interface.
- The necessary items for transport, connectivity and control are included in the Specification. This includes User Plane data, Control Plane transport mechanisms, and means for synchronisation
- The Specification covers Layers 1 and 2 of the OSI stack.
  - The physical layer (layer 1) supports both an electrical interface (i.e. what is used in traditional base stations), and an optical interface (e.g. for base stations with remote radio equipment).
  - Layer 2 supports flexibility and scalability
  - The specifications can be downloaded from [1].

# Ongoing Discussions on Fronthaul Service Case Studies [2]

- In [2] the term fronthaul service (managed CPRI) is introduced.
- Three basic models to explain fronthaul services are created and discussed:
  - Case 1: Fronthaul is carried natively over a dark fiber or a transport service. *Maintains the current concept.*
  - Case 2: Pseudo“ CPRI service: RE and REC continue to use CPRI as the interface but transport is achieved through Carrier Ethernet. *This would require a new CPRI/CE interface*
  - Case 3: Evolution of the RE and REC and replacement of CPRI by an Ethernet port. *This would require new developments into the RAN equipment with a longer roadmap.*

# CPRI Line Rates

- According to CPRI V6.0 [3], which includes the requirements for LTE-A the following line rates are defined:
  - CPRI line bit rate option 1: 614.4 Mbit/s
  - CPRI line bit rate option 2: 1228.8 Mbit/s
  - CPRI line bit rate option 3: 2457.6 Mbit/s
  - CPRI line bit rate option 4: 3072.0 Mbit/s
  - CPRI line bit rate option 5: 4915.2 Mbit/s
  - CPRI line bit rate option 6: 6144.0 Mbit/s
  - CPRI line bit rate option 7: 9830.4 Mbit/s
  - CPRI line bit rate option 8: 10137.6 Mbit/s

# Required Data Rate for Small Cell Backhaul

- In the literature the following indications for required data rates are given:
  - A 2.4 Gb/s GPON (Gigabit enabled Passive Optical Network) is shared among 16 small cells [4].
  - In [5] a range of 10 – 500 Mbps for the required backhaul capacity per small cell is given
- The above numbers are given for current cellular standards.
  - Future standards will provide higher data rates
  - Small cells may become more popular, which may yield the requirement of aggregated backhauling for more than 16 small cells



# Required Data Rate for Macro Cell Backhaul and Fronthaul

- [5] gives also some indications on the required capacity for macro cell backhaul and fronthaul.
- The highest numbers are given for the C-RAN case:
  - Backhaul: > 10 Gbps
  - Fronthaul: 1-10 Gbps

# References

- [1] <http://www.cpri.info> (visited on 18.1.14)
- [2] <http://backhaulforum.com/front-haul-service-use-cases/> (visited on 17.1.14)
- [3] CPRI Specification V6.0 (30.8.2013)
- [4] C. Ranaweera et. al, „Design and Optimization of Fiber Optic Small-Cell Backhaul Based on an Existing Fiber-to-the-Node Residential Access Network
- [5] <http://backhaulforum.com/cloud-ran-fronthaul-perspective/> (visited on 17.1.14). IEEE Communication Magazine, September 2013, pp. 62-69

# Technical Expectations Document (TED)

All information contained in this presentation is meant to be included in the technical expectations document 15-11-0745-13-0thz-thz-ig-technical-expectations-document-ted.doc.