

## LTE Patents for Standards Data 4Q 2015

LTE Patents for Standards Data 4Q 2015 is a custom research of TechIPm, LLC ([www.techipm.com](http://www.techipm.com)) based on LTE patents analysis for the market leaders among LTE UE (cellular phones, smart phones, PDAs, mobile PCs, etc.) and base station (eNB) product manufactures and innovators.

### Methodology

#### 1. Search for LTE related patents.

- Search the current ETSI and USPTO database for the LTE patents issued as of 4Q 2015
- 3GPP Release 10 technical specifications (LTE-Advanced) for LTE RAN (Radio Access Network):
- PHY: TS 36.101, 211, 212, 213, 305
- L2/L3 Protocols: TS 36.300, 304, 321, 322, 323, 331, 355
- 3GPP Release 11 technical specifications for CoMP (TR 36.819), 3GPP Release 12 technical specifications for EPDCCH (TS 36.211, 213) and D2D (Device to Device; TR 36.843) Communications.
- \* LTE RAN products: LTE UE (cellular phones, smart phones, PDAs, mobile PCs, etc.) and base station (eNB) baseband modem and radio SW products

#### 2. Review the searched patents for essential patent candidates.

- Review the patents
- Categorize the identified patents through the evaluation process by technology in the standard specifications  
Key technology components for an implementation of the LTE baseband modem: OFDM/OFDMA (Frame & Slot Structure, Modulation), SC-FDMA (PUSCH, PUCCH), Channel Estimation (UL RS, DL RS, CQI), Cell Search & Connection (PRACH, DL SS), MIMO (Transmit Diversity, Spatial Multiplexing), Resource Management (Resource Allocation, Scheduling), Coding (Convolution, Turbo), Power Control, HARQ, Carrier Aggregation, Relay, and Positioning Technology.  
Key technology components for an implementation of the LTE radio protocol: Random Access, HARQ, Channel Prioritization, Scheduling (Dynamic, SPS), Protocol Format (PDUs, SDUs), Radio Link Control (ARQ), PDCP Process (SRB, DRB, ROHC), Security (Ciphering, Integrity), System Information, Connection Control, Mobility (Handover, Inter-RAT, Measurements), QoS, MBMS, and Carrier Aggregation.
- Evaluate the level of essentiality  
Patent disclosures in claims and detail description for patent are compared to the standard specifications.  
Essentiality Index (EI):  
E1 : Patent disclosure is weakly related to LTE technical specifications  
E2 : Patent disclosure is partially related to LTE technical specifications  
E3 : Patent disclosure is related to LTE technical specifications overall  
E4 : Patent disclosure is strongly related to LTE technical specifications  
\*To be a potential standard essential patent (SEP) candidate, EI should be E3 or E4.

- E4 Example  
A patent has one or more claims that cover completely some part of the standard specification.

Claim	Specification
<p>1. An apparatus for transmitting a <b>random access signal</b> comprising:</p> <p>a CAZAC root sequence selector coupled to a CAZAC root sequence generator, wherein the CAZAC root sequence generator <b>generates at least one CAZAC root sequences</b>, and wherein the CAZAC root sequence selector selects a preamble root sequence from the at least one CAZAC root sequences.</p> <p>2. The apparatus of claim 1 wherein: the CAZAC root sequence generator is a prime-length <b>Zadoff-Chu sequence</b> generator.</p>	<p>3GPP TS 36.211 V8.9.0 (2009-12)</p> <p>5.7.2 Preamble sequence generation</p> <p><b>The random access preambles</b> are generated from <b>Zadoff-Chu sequences</b> with zero correlation zone, <b>generated from one or several root Zadoff-Chu sequences</b>. The network configures the set of preamble sequences the UE is allowed to use.</p>

## Deliverables

**MS excel file** for current assignee, patent number (USPTO & EPO Families hyperlinked to Google Patent), standard specifications series & section number, technology category, and Essentiality Index

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