TD-LTE Industry Briefing

China Mobile
February, 2011 | No. 8
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD-LTE Industry Progress Snapshot</td>
<td>03</td>
</tr>
<tr>
<td>TD-LTE E2E Products Progress</td>
<td>04</td>
</tr>
<tr>
<td>TD-LTE Test: Functionality and Performance Ready for Large Scale Deployment</td>
<td>05</td>
</tr>
<tr>
<td>TD-LTE Global Market Boosts in 2011</td>
<td>06</td>
</tr>
<tr>
<td>China TD-LTE Large-Scale Trial Officially Kicked Off in Beijing</td>
<td>07</td>
</tr>
<tr>
<td>Barcelona LTE TDD/FDD International Summit— Creation of Global TD-LTE Initiative</td>
<td>08</td>
</tr>
<tr>
<td>LTE TDD/FDD Demo during MWC 2011</td>
<td>09</td>
</tr>
<tr>
<td>Global TD-LTE Initiative— A Big Step toward TD-LTE Globalization</td>
<td>10</td>
</tr>
<tr>
<td>Introduction to 2.6GHz TD-LTE Terminal Field Test in TD-LTE Technical Trial</td>
<td>11</td>
</tr>
<tr>
<td>SON— The Key to Improving the Performance of Future Network</td>
<td>12</td>
</tr>
<tr>
<td>TD-LTE Backhaul Accelerating PTN Evolution</td>
<td>13</td>
</tr>
<tr>
<td>In Brief</td>
<td>14</td>
</tr>
<tr>
<td>TD-LTE Conformance Test Cases Validation Made New Progress</td>
<td>14</td>
</tr>
<tr>
<td>3GPP Approved the Optimized CSFB Implementation Solution</td>
<td>14</td>
</tr>
<tr>
<td>Welcome to Join GTI</td>
<td>15</td>
</tr>
</tbody>
</table>
TD-LTE Industry Progress Snapshot
TD-LTE E2E Products Progress

**TD-LTE Infrastructure**
- 2010.Q2: 2.3GHz products released
- 2010.Q3: 2.6GHz products released

<table>
<thead>
<tr>
<th>Features</th>
<th>No. of support vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Band 40 (2.3GHz)</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>Frequency Band 38 (2.6GHz)</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>Bandwidth 20MHz</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>2T2R MIMO</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>Beamforming</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>FDD/TDD Common Platform</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>2G/3G Interworking PS-HO</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>Synchronization by 1588</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>Tx Power 40W</td>
<td>★★★★★★★★★★</td>
</tr>
<tr>
<td>Self configuration</td>
<td>★★★★★★★★★★</td>
</tr>
</tbody>
</table>

**TD-LTE Test Equipment**
- Most instruments have common platform for LTE TDD/FDD
- Test Environment has been built up

<table>
<thead>
<tr>
<th>RF</th>
<th>Baseband</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>Signaling Monitor</td>
</tr>
<tr>
<td>Performance</td>
<td>Channel Measurement</td>
</tr>
<tr>
<td>Field Test</td>
<td>Terminal Related</td>
</tr>
</tbody>
</table>

**GCF**
- Protocol test: synchronized with FDD
- RF/RRM test: To be ready before Q1 11

<table>
<thead>
<tr>
<th>Test Case</th>
<th>FDD/TDD Validation Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol P1&amp;P2</td>
<td>&gt;80% &gt;80%</td>
</tr>
<tr>
<td>RF P1</td>
<td>&gt;80% &gt;40%</td>
</tr>
<tr>
<td>RRM P1</td>
<td>&gt;80%</td>
</tr>
</tbody>
</table>

**TD-LTE Terminal & Chipsets**
- 7 pre-commercial Data Cards released
- Various types of other data terminals released

<table>
<thead>
<tr>
<th>Qualcomm</th>
<th>ST-Ericsson</th>
<th>Sequans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hisilicon</td>
<td>Innofidei</td>
<td>Altair</td>
</tr>
<tr>
<td>ZTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CoolPad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pad and Booklet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quanta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nokia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPE</td>
<td>HiSilicon</td>
<td>Innofidei</td>
</tr>
</tbody>
</table>

**TD-LTE Industry**

- Infrastructure vendors: No of vendors = 9
- Terminal & Chipset vendors: No of vendors > 15
- Test Equipment vendors: No of vendors > 20

Incomplete Listed
# TD-LTE Test: Functionality and Performance Ready for Large Scale Deployment

## TD-LTE Technical Trial in China

<table>
<thead>
<tr>
<th><strong>Test Scope</strong></th>
<th><strong>Progress</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3GHz system test</td>
<td>• 7 vendors completed</td>
</tr>
<tr>
<td>2.6GHz system test</td>
<td>• 7 vendors completed</td>
</tr>
<tr>
<td>Lab IOT</td>
<td>PHY layer, RRC, NAS, basic applications</td>
</tr>
<tr>
<td>Field IOT</td>
<td>PHY layer, RRC, basic applications</td>
</tr>
<tr>
<td>2.3GHz key technology test</td>
<td>• 8 pairs (4 infra × 2 terminal chipset vendors) completed, including lab and field tests</td>
</tr>
<tr>
<td>2.6GHz key technology test</td>
<td>• Over 10 pairs, involving 5 chipset vendors, are ongoing</td>
</tr>
<tr>
<td>Networking test</td>
<td>• 7 vendors completed</td>
</tr>
<tr>
<td>Throughput (peak, stationary), latency (C-plane, U-plane, paging), mobility, multi-UE (scheduling, cell throughput), coverage, basic applications</td>
<td>• 1 infra vendor started, and others are under preparation, to be completed in Q1-Q2 2011</td>
</tr>
<tr>
<td>Beamforming and MIMO performance, multi-UE scheduling</td>
<td>• Under preparation, to be completed in Q1-Q2 2011</td>
</tr>
<tr>
<td>Coverage, KPI, network quality with multi UE (single cell, multi cell)</td>
<td></td>
</tr>
</tbody>
</table>

**Updated by March 12, 2011**

## TD-LTE Large Scale Trial in China

**Cities**
6+1 Cities with 83M population: Shanghai, Guangzhou, Shenzhen, Nanjing, Hangzhou, Xiamen, and Beijing

**Spectrum**
Indoor: 2350~2370 2570~2620 MHz  
Out door: 2570~2620 MHz

**Working Plan**

1. **Phase 1: 2010.12-2011.Q3**
   Test contents: Network plan and optimization, test of key technology, network performance test.

2. **Phase 2: 2011.Q4-2012.Q1**
   Test contents: Networking test, Inter-RAT test, e2e services, user experience.
TD-LTE Global Market Boosts in 2011

**TD-LTE Global Trial / Commercial Networks**

**TD-LTE Trial Networks**

*28 Trial Networks* **End of 2010**

- North America
- South America
- Europe
- Asia
- Australia

**TD-LTE Potential Commercial Networks**

- 2 publicly announced commercial contracts for LTE TDD/FDD
  - Hi3G: Sweden, Denmark
  - AERO2: Poland
- 10+ commercial TD-LTE networks in 2011 (estimated)

**TD-LTE Potential Operators**

- 75% of the 104 surveyed operators consider deployment of TD-LTE.

*Unlikely to use TD-LD 20%*

*Will use TD-LD at launch, or within 3 years 35%*

*will be used with FDD, but medium to long-term potential to use TDD 45%*
China TD-LTE Large-Scale Trial Officially Kicked Off in Beijing

Recently, TD-LTE large-scale trial kick-off meeting was held in Beijing by MIIT. Over 80 representatives from MIIT, CATR, local telecommunication management bureaus from large-scale trial cities, China Mobile, China Telecom, China Unicom and domestic & international industry attended the meeting.

During the meeting, Mr. Wen Ku, Director of Department of Science & Technology of MIIT, pointed out that this large-scale trial was organized by MIIT TD-LTE workgroup on behalf of Chinese government, targeting to boost the mature of TD-LTE industry.

“The successful kick-off of China large-scale trial will definitely play key roles on the mature of TD-LTE industrialization and globalization. Mr. Zhengmao Li, EVP of China Mobile said, “China Mobile will fully contribute to the deployment and testing of the large-scale trial following the lead of MIIT and try our best to promote a healthy TD-LTE eco-system”.

The success of this kick-off meeting indicates an official launch of TD-LTE large-scale trial project and more concentrated work would be carried out from this moment.

**Phase 1: 2010.12 - 2011.Q3**
Test contents: Network plan and optimization, test of key technology, network performance test.

**Phase 2: 2011.Q4 - 2012.Q1**
Test contents: Networking test, Inter-RAT test, e2e services, user experience.
During the period of Barcelona MWC 2011, a series of activities were organized by China Mobile to fully exhibit a fast growing of TD-LTE global eco-system and to further increase the confidence of international industries.

Activity 1: LTE TDD/FDD International Summit
On Feb. 14, 2011, over 400 top-executive officers and representatives from more than 60 operators, 30 vendors and several international communication organizations were present during the Summit. The successful organization of this summit states that TD-LTE, as a new technology, is getting well-known and accepted by more and more global industries.

Activity 2: Global TD-LTE Initiative (GTI)
As one of the key events at the Summit, Global TD-LTE Initiative (GTI) was kicked off by Mr. Houlin Zhao, Deputy Secretary-General of ITU, Mr. Jianzhou Wang, Chairman of China Mobile, Mr. Sunil Mittal, Chairman of Bharti Airtel and Mr. Masayoshi Son, Chairman of Softbank whom were also joined hands by representatives from Vodafone, Clearwire, Aero2 and E-Plus together with Mr. Craig Ehrlich, former-chairman of GSMA and chairman of GTI Steering Committee. GTI announced to promote the deployment of TD-LTE technology and encourage cooperation among global operators and vendors. Other operators and technology vendors interested in joining the convergence initiative would be welcomed. (More details please make reference to “Global TD-LTE Initiative— A Big Step toward TD-LTE Globalization” in this briefing issue).

Activity 3: LTE TDD/FDD Demo
During MWC 2011, China Mobile and Vodafone set up the first LTE TDD/FDD converged network live demo in Barcelona for demonstrating the excellent performance of TD-LTE network in outdoor mobile environment and its convergence with LTE-FDD network. The driving tour states that LTE TDD/FDD technology would be a promising leading standard for next-generation wireless communication to realize global seamless roaming.
On the other hand, China Mobile also organized several global-leading terminal/chipset vendors to show the new progress of TD-LTE terminals on the same floor as the Summit location on Feb. 14. (More details please make reference to “LTE TDD/FDD Demo during MWC 2011” in this briefing issue).

Activity 4: High-level Bilateral Meeting
China Mobile had bilateral face-to-face meetings separately with high-level officers from more than 20 operators all over the world, focusing on different topics relating TD-LTE. The sharing of TD-LTE experience and discussion on further cooperation also strongly promoted the international development of TD-LTE technology.
LTE TDD/FDD Demo during MWC 2011

TD-LTE Terminal Demo during LTE TDD/FDD international Summit

During LTE TDD/FDD International Summit in Barcelona, 12 chipset/terminal vendors from Altair, Coolpad, Huawei Hisilicon, Innofidei, Nokia, Qualcomm, Quanta, Samsung, Sequans, Sony-Ericsson, ST-Ericsson and ZTE demonstrated their diversified TD-LTE products including data card, Pad, Booklet, dual-mode dual stand-by cell phone and PCIe. Hundreds of guests from the Summit visited those stands and highly evaluated the demo and those manufactures’ contribution to the development of LTE TDD/FDD convergence.

The demo was divided into three parts: terminal static display, applications demo and GCF test cases demo with Rohde-Schwarz and Anite. By co-working with Motorola, ZTE, Nokia Siemens Networks, Ericsson and Alcatel-Lucent, multiple mobile broadband applications were exhibited to the guests, such as 24-channel high-definition VOD, 3D movie, VoIP, TD-LTE concept car, mobile video call and high-speed internet surfing. Particularly applications running on Qualcomm LTE TDD/FDD co-platform data card won applause of the guests.

LTE TDD/FDD Driving Tour during MWC 2011

During Barcelona MWC 2011, CMCC and Vodafone deployed LTE TDD/FDD converged network live demo together in order to display the newest achievement of TDD/FDD convergence from infrastructure and terminal sides.

Infrastructure vendors Huawei (Single BTS) and Nokia Siemens Networks (Flexi MultiRadio BTS), as suppliers of network equipments, provided platforms to support both LTE TDD and LTE FDD. On the other side, chipset manufactures Qualcomm and Huawei Hisilicon also attended the live demo and both companies provided data cards to support both LTE TDD and LTE FDD.

Over 120 VIP guests and specialists from more than 30 operators and consulting companies took the driving tour to experience several attractive mobile broadband applications, such as HD VOD, 3-party HD video conference, IMS video call, on-line game and 3D VOD. During the driving tour, high peak rate, low-delay, excellent handover performance and mature of LTE TDD/FDD converged terminals were fully verified by the network.

The success of the live demo shows that a converged global wireless communication network is becoming true. With the appearance of a mature global 4G standard, LTE TDD/FDD international market will achieve a rapid development in the next few years.
Global TD-LTE Initiative— A Big Step toward TD-LTE Globalization

On Feb. 14 2011, a Global TD-LTE Initiative (GTI) was kicked off by 7 operators including Bharti Airtel, China Mobile, Softbank, Vodafone, Clearwire, E-Plus and Aero2. GTI is a platform to advocate multilateral cooperation among global operators and vendors to promote TD-LTE, a standard for mobile broadband developed by the standards body 3GPP.

GTI Objectives  GTI aims to bring together the leading operators and vendors to steer the TD-LTE ecosystem as a major standard in mobile broadband technology and drive early development of next generation mobile broadband networks. Its objectives are:

- energizing the creation of a world-class and a growth-focused business environment
- delivering great customer experience and bring operational efficiencies
- promoting convergence of TDD & FDD LTE modes in order to maximize the economy of scale
- facilitating multilateral cooperation between and/or among operators and vendors.

GTI Activities  GTI will organize a series of activities to bring TD-LTE operators and vendors together for sharing strategies of development and technology know-how, expediting the development of terminals and fostering the global roaming and low-cost terminals, etc. GTI will have close relationship with both GSMA and Next Generation Mobile Networks (NGMN) to speed the development of a global LTE ecosystem.

Following the kick-off ceremony, GTI has received several applications from world-wide operators and vendors. As an open initiative, GTI welcomes all the industry partners to join GTI and work together.
Introduction to 2.6GHz TD-LTE Terminal Field Test in TD-LTE Technical Trial

With MIIT’s official approval of launching TD-LTE large-scale trial in China, TD-LTE technical trial led by MIIT also speed up the field test of 2.6GHz TD-LTE terminals. The test is based on both 2.6GHz TD-LTE technical trial-Terminal chipset Field Test Specification and 2.6GHz TD-LTE technical trial-Uu IOT Field Test Specification with the most important test contents as follows:

2.6GHz TD-LTE technical trial-Terminal chipset Field Test
• Single UE test
  • Access system test, Peak rate, Time-delay test, Service maintenance test
• Multi-user test
  • At least 20 dongles in one cell
  • Access system test, Service maintenance test

2.6GHz TD-LTE technical trial-Uu IOT Field Test
• Function test
  • Basic functional test of physical layer, Multi-antenna technology, RRC layer, Service capability test, Mobility management test

More and more TD-LTE chipset/device vendors have finished lab test and joined MIIT 2.6GHz TD-LTE Field test

Currently there are at least 7 international and domestic chipset vendors providing ASIC dongles for TD-LTE demo and test and 5 of them have officially kicked off lab tests. Among these vendors, 2 of them have finished lab test and joined TD-LTE Field test in Beijing.
SON — The Key to Improving the Performance of Future Network

**Vision of SON**

**Self Organization Network**
- Alleviate network operations while improving network quality
- Minimize manual intervention in network operations
- Reduce the difficulty and cost of network maintenance and optimization

**Self Planning**
- Site, capacity and coverage planning
- New eNB parameters planning
- Neighbor node data planning

**Self Configuration**
- Transmission set up, node authentication, OAM link set up
- Automatic asset management
- Automatic SW download/update

**Self Maintain**
- Cell/service fault detection
- NE fault mitigation
- Automatic alarm processing

**Self Optimization**
- Neighbor cell list optimization
- Interference coordination
- Handover parameter optimization
- Load balancing

**CMCC SON Roadmap & Trial**

**Have done**
- eNB Self-configuration, PCI Optimization, ANR
  - have been specified in CMCC SON specification
- Lab Test has been done and features, self-configuration and PCI optimization have been verified

**To be done**
- Solutions of more SON features, including MRO and self-healing will be discussed. More SON features will be specified in CMCC SON specification.
- CMCC urges extensive cooperation on SON study

<table>
<thead>
<tr>
<th>2010</th>
<th>2011</th>
<th>Later</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMCC SON Roadmap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eNB Self-configuration</td>
<td>Mobility Robustness Optimization (MRO)</td>
<td>Minimization of Drive Trials (MDT)</td>
</tr>
<tr>
<td>PCI Planning</td>
<td>Self Healing Functionality</td>
<td>Energy Savings using SON</td>
</tr>
<tr>
<td>PCI Optimization</td>
<td>Inter-RAT ANR</td>
<td>Coverage &amp; Capacity Optimization</td>
</tr>
<tr>
<td>Automatic Neighbour Relations (ANR)</td>
<td></td>
<td>RACH Optimization</td>
</tr>
</tbody>
</table>

**Lab Test: 2010.9-2011.Q2**

1. eNB Self-configuration & PCI Optimization Functionalities have been tested during lab test.
2. Main vendors including Alcatel-Lucent, Datang, Ericsson, Huawei, Motorola, Nokia Siemens Networks and ZTE support these functionalities well.
3. It takes about 5 mins from eNB power-on to OAM link setup.
4. eNB can be set up almost without human intervention.
5. eNB can take self-test during its setup to locate the errors quickly and improve the success rate of setup.
6. PCI confliction detection can be triggered by event.
7. PCI can be optimized when conflicted.

**Large-scale Trial: 2011.Q3-**

1. Test environment: there are about 10 test cells surrounded by 20-30 cells in large-scale trial to test SON performance
2. Main vendors including Alcatel-Lucent, Datang, Ericsson, Huawei, Motorola, Nokia Siemens Networks and ZTE will attend large-scale trial to test eNB performance with SON
3. More SON Functionalities including ANR and MRO will be tested during large-scale trial
4. The impact on network performance of SON functionalities will be mainly concerned. It will provide practical experience in future network operating
TD-LTE Backhaul Accelerating PTN Evolution

2 possible TD-LTE Backhauling Solutions in China Mobile

**Layer2 PTN + CE Router**
- PTN equipments in Metro Core, Aggregation and Access layer still apply the traditional L2 function.
- PTN is connected to SGW/MME via CE router in Metro Core.
- Traffic flow at S1 & X2 is forwarded by CE routers.

**E2E PTN (Layer2+Layer3)**
- PTN equipments in Metro Core are introduced L3 function for IP forwarding over X2 & S1-flex.
- L3 PTN is connected to SGW/MME directly if local, or via CE router.
- Traffic flow at S1 & X2 is forwarded by L3 PTN.

Large-scale trial for TD-LTE Backhauling based on PTN Technique

1. **Phase 1: Function and Performance Test**
   - PTN+CE solutions tests, PTN Layer 3 function and performance tests, backhauling networking performance tests
   - 5 PTN & CE vendors with 154 test terms

2. **Phase 2: Interoperability Test**
   - OAM, protection, QoS, Sync. interoperability tests between different PTN vendors for L3 networking
   - Only for E2E PTN scenario

3. **Phase 3: Large-scale trial**
   - Test the function, E2E performance, timing synchronization and interoperability of two scenarios in 6+1 cities: Shanghai, Guangzhou, Shenzhen, Nanjing, Hangzhou, Xiamen and Beijing
In Brief

TD-LTE Conformance Test Cases Validation Made New Progress

During CAG#25 meeting in Jan 2011, several validation and revalidation reports on TD-LTE have been approved. The obvious progress is on RF conformance test case validation. Until now, around 40% of RF priority 1 test cases have been validated for both Band 38 and Band 40. The protocol conformance test cases validation also progress smoothly.

All the priority 3 and priority 4 test cases have been added into the GCF WI descriptions for WI-091 and WI-092. In CAG#25 meeting, the work item completion date was adjusted to keep the TDD and FDD consistent. So for most TDD and FDD WIs, the WI completion date is set to Q2-2012.

ETSI MCC TF160 has launched priority 3 test cases verification. Until last 3GPP RAN5#50 meeting, 36% of TD-LTE priority 3 test cases have been verified, mostly including TD-LTE single mode test cases.

3GPP Approved the Optimized CSFB Implementation Solution

MT Roaming Retry was the only solution to support CSFB scenarios during which UE is redirected to a different MSC than the MSC which initiated SGs paging request. This requires corresponding support in all GMSCs and HLRs, even in parts of the networks not supporting LTE. Meanwhile this also implies long call setup time in particular for international calls.

During 3GPP CT4#52 and SA2#83 meetings, It was approved that a new MT Roaming Forwarding feature should be specified as an alternative to MT Roaming Retry.

The new MT Roaming Forwarding feature only requires to upgrade MSCs within LTE coverage in visiting PLMN. In addition, this feature reduces call setup time rather than MT Roaming Retry. As a result, operators are offered a better CSFB performance by little network upgrade.
Welcome to Join GTI

More things about GTI

How to join GTI

To find out more things about GTI, please email us.

SEND US YOUR FEEDBACK:

If you have a question, comment or suggestion regarding TD-LTE, please send your feedback to the contact persons of China Mobile.

Dr. Xiaoyu Liu
Email: liuxiaoyu@chinamobile.com

Dr. Jinxia Cheng
Email: chengjinxia@chinamobile.com

China Mobile Research Institute
Unit1, 28 Xuanwumenxi Ave, Xuanwu District, Beijing 100053, China
Phone (8610) 66006688