Cooperation between CMCC 5G Trial and EU 5G-DRIVE

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5G Plan of China Mobile

<table>
<thead>
<tr>
<th>Year</th>
<th>Vision &amp; Requirements</th>
<th>Technology Development Strategy</th>
<th>Network Deployment Strategy</th>
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<tbody>
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<td>2013</td>
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<td>2019</td>
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<td>2020</td>
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</tbody>
</table>

- **Technology Development Strategy**
  - Key Technologies
  - Candidate Technologies for Standardization
  - Technology Enhancement

- **Standardization**
  - R14 Pre5G
  - 5G Phase I (R15)
  - 5G Phase II (R16)

- **Industry Development**
  - Key Tech. Validation
  - PoC Field Trial
  - Large-scale Trial

- **Cross-industry Ecosystem**
  - 5G Innovation Center
  - Central and regional labs of 5G Innovation Center to promote cross-sector collaboration

- Released 5G commercial license
Project Name: 5G Large-scale Trial
Vest in: National Major Project Number 2018ZX03001022
Leader: China Mobile
Participants: Huawei, BUPT (5G eMBB, C-V2X); Ericsson, Datang (5G eMBB); RIHMT, TMRI, Shanghai Automobile City (C-V2X)
Duration: 2018.06~2020.06

Application Requirements
Cities: ≥ 3
Sites: ≥ 50 per city
Fund: 500 million RMB
Terminal: ≥100, per city

Implementation Goals
5 Cities: Shanghai, Guangzhou, Hangzhou, Suzhou, Wuhan
Sites: ≥100 per city
Fund: ~485 million RMB
Terminal: ≥100, per city
The project consists of eight partners from industry and research institutes, of which RIHMT and TMRI are in charge of policies and regulations on C-V2X.
To strengthen the 5G collaboration between China and EU, 5G Large-scale Trial project has established the cooperation with EU 5G-DRIVE from November 2018 to June 2020.

At the first stage, the cooperation focuses mainly on joint trials:

- Conducting 5G trials on two specific scenarios:
  - scenario n° 1 - eMBB
  - scenario n° 2 - V2X
- Preparing joint trial specifications and trial reports
- Organizing joint seminars, workshops or showcase events
- Publishing joint publications, white paper, etc

- November 2018, signed the cooperation agreement and visited the trial sites in China
- March 2019, published joint trial specifications including basic performance, Massive MIMO, indoor coverage etc.
- May 2019, held the 2nd joint meeting and agreed the cooperation plan.
- May 2019, started joint eMBB trials in Hangzhou, China, to be finished in June 2019
### Trial info#1: Network Architecture of NSA Vs. SA

<table>
<thead>
<tr>
<th></th>
<th>NSA</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade of 4G network</td>
<td>Require to upgrade 4G RAN and EPC. Highly complex</td>
<td>Need upgrade to support interworking. Less complex</td>
</tr>
<tr>
<td>Capability</td>
<td>Only offer higher throughput than 4G. No support of slicing and MEC</td>
<td>Support slicing and MEC for vertical applications</td>
</tr>
<tr>
<td>Maturity timeline</td>
<td>Standard ready: Q4, 2017</td>
<td>Standard ready: Q2, 2018</td>
</tr>
<tr>
<td></td>
<td>NSA has been commercial-deployed</td>
<td>SA for commercial deployment may start at the end of 2019</td>
</tr>
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</table>

- China Mobile plans to deploy SA and NSA simultaneously - firstly NSA for smart phones and SA for verticals, later evolving to SA for both mass consumer market and verticals
- Thus the joint trials will conduct both NSA and SA test cases
- 100MHz@2.6GHz and 100MHz@4.9GHz are allocated to China Mobile for 5G trials
- The joint trials will conduct test cases in 2.6GHz and 4.9GHz

**Frequency Scheme Outdoor**
- Macro base station
- 2515~2615MHz(100M) and 4800~4900MHz(100M)

**Frequency Scheme Indoor**
- Pico sites and DAS sites
- 2575~2675MHz(100M)

**Trial info#2: Spectrum**

<table>
<thead>
<tr>
<th>Frequency Scheme Outdoor</th>
<th>Frequency Scheme Indoor</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPASS</td>
<td>CMCC</td>
</tr>
<tr>
<td>RADAR</td>
<td>China Telecom</td>
</tr>
<tr>
<td>Underutilized</td>
<td>Underutilized</td>
</tr>
<tr>
<td>15M guard band</td>
<td>25M guard band</td>
</tr>
</tbody>
</table>

Compass Air to Ground jammed, e.g. spurious emission, blocking by CMCC

CMCC is Jammed by Radar and Jams Radar reception
Trial info#3: Trial Sites

- 5 trial cities: Hangzhou, Suzhou, Wuhan, Guangzhou, and Shanghai
- Each city will build at least 100 sites

<table>
<thead>
<tr>
<th></th>
<th>NSA</th>
<th>SA</th>
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<tbody>
<tr>
<td><strong>Hangzhou</strong></td>
<td>Shangtang: dense urban areas, ISD 300~350m</td>
<td>Huaibei: dense urban areas, ISD 300~350m</td>
</tr>
<tr>
<td><strong>Guangzhou</strong></td>
<td>Zhujiang: dense urban areas, ISD 300~350m</td>
<td>Wanbo: dense urban areas, ISD 300~350m</td>
</tr>
<tr>
<td><strong>Suzhou</strong></td>
<td>Suzhou industrial park: dense urban areas, ISD 358m; sub urban areas, ISD 407m</td>
<td>Suzhou industrial park: dense urban areas, ISD 358m; sub urban areas, ISD 407m</td>
</tr>
<tr>
<td><strong>Wuhan</strong></td>
<td>Guanggu: dense urban areas, ISD 330~390m</td>
<td>Guanggu: dense urban areas, ISD 330~390m</td>
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<tr>
<td><strong>Shanghai</strong></td>
<td>Jiading: sub urban areas, ISD 334m</td>
<td>Jiading: sub urban areas, ISD 334m</td>
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<tr>
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<td>Hongqiao: dense urban areas, ISD 349m</td>
<td>Hongqiao: dense urban areas, ISD 349m</td>
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</tbody>
</table>

Hangzhou: Shangtang and Huaibei District
Suzhou: Suzhou industrial park
Wuhan: Guanggu District
Guangzhou: Zhujiang, University town, Wanbo, highway
Shanghai: Hongqiao, Jiading
Trial info#4: CN Construction

- CNs (EPC and 5GC) used in the trial are built for trial only and will not affect incumbent networks
- EPCs are constructed in five provincial centers
- 5GCs located in Beijing and Nanjing are built as a centralized resource pool, where the Beijing Pool is used to test functionalities of 5GC, and the Nanjing Pool for end-to-end test and pre-commercial services
Basic performance and key tech. tests to be completed before end of June 2019
More comprehensive test cases on SA, which will be completed before end of December 2019

Trial info#5: 5G Trial Plan and Progress

- NSA basic performance and key tech. (lab + field)
- Terminal and network IoT
- Network management and security test
- SA basic performance and key tech. (Radio)
- 5GC functionality
- SPN test
- Voice solution: VoNR or EPS FB
- Key tech.: Massive MIMO, slicing, MEC
- E2E IoT
Demonstration area

Major urban areas, Taihu new city, 240 intersections, 170+ square kilometers

Number of target users

Annual target 10,000 to 100,000 users, including rearview mirror users, APP users, corporate cooperative users etc.

Project initiators

Teslas, Huawei, CAICT, Intel, NAVINFO, DeepMotion, PSA, Volkswagen, Siemens, Sanyo,

Participants (23)

公安部交科所, 无锡交警支队

V2I use cases

Traffic light info. display, green lights optimal speed advisory, traffic jam warning, emergency vehicle warning etc.

Green lights optimal speed advisory

Emergency vehicle warning

V2N use cases

Traffic management optimization, illegal driving actions report etc.

Vehicle dynamic information report

Illegal driving actions report

V2P use cases

Vulnerable road user collision warning

Vulnerable Road User Collision Warning

V2V use cases

Intersection collision warning, emergency break warning, lane change warning etc.

Intersection collision warning

Emergency break warning

Trial info#6: City-wide C-V2X pilot
Current Trial Results of NSA eMBB

- DL peak rate is above 1.3Gbps for NR
- UL peak rate is ~90Mbps for NR (single TX)

- DL: 4G/5G use co-site, at the same location, 2.6GHz NR RSRP is 5~6dB less than 1.8GHz LTE. But 2.6G 5G NR DL rate is 3~12 times of 1.8GHz FDD LTE, depending on the environment
- UL: When NR RSRP > -95dBm, NR UL rate is about 2-3 times of 1.8GHz LTE FDD

- The latency is about 500~600ms from NSA phone’s initiate random access at LTE (sent MSG1) to random access complete at NR (received MSG2)

- NR air interface RTT is 4~10ms less than LTE, and slightly larger than TUE.
  - TUE: 9~12ms
  - Terminal: 10~14ms

- The local latency of transmission and core network is 1~3ms

**Single User Throughput**

- **DL Peak Rate**
  - Vendor 1: 1254 Mbps
  - Vendor 2: 1235 Mbps
  - Vendor 3: 1378 Mbps

- **UL Peak Rate**
  - Vendor 1: 93 Mbps
  - Vendor 2: 77 Mbps
  - Vendor 3: 93 Mbps

**Outdoor Station Coverage for Indoor**

- **U-Plane Latency**
  - Average: 15 ms
  - Vendor 1: 26 ms
  - Vendor 2: 12 ms
  - Vendor 3: 34 ms
  - Vendor 4: 17 ms

Note: Vendor 1&4: Hisilicon  Vendor 2&3: Qualcomm
• CMCC planed to construct 30~50k 5G sites before October 2019, and has completed about 10k before June 2019
• Some joint tests may be conducted on live 5G network
The cooperation of CMCC 5G trial with EU 5G-DRIVE is supported by the governments of China and EU Commission. The cooperation has made significant progress with mutual benefits. More joint activities are under planning, and more joint trials and research will be carried out. Under the spirit of open and collaboration, the joint projects can be a model of cross region cooperation.

**Joint Trials**
- Start the V2X joint test Q4, 2019 in Shanghai
- Start the joint test before Q2, 2020 in Europe
- Release the results of joint trials by the end of joint projects

**Joint Researches**
- eMBB
- 5G technology and service innovations
- V2X
- Technology in future 5G vehicular networks
Thank You!

http://www.cww.net.cn/article?id=442954