

GTI Industry Briefing

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GTI Successfully Held GTI Summit Shanghai 2017

Organized by GTI and supported by GSMA, GTI Summit • Shanghai 2017 was successfully held on June 28th 2017, at Mobile World Congress Shanghai (MWCS) 2017 in Shanghai, China. This summit attracted more than 600 executives globally from government, leading telecommunication organizations, operators, vendors, service providers, media and consulting companies.



Mr. Craig Ehrlich, Chairman of GTI

'After just a short one year, amount of work that is going on in connected cars, healthy industry, and agriculture industry is amazing. And GTI is playing its significant role in the innovation work'



Ms. Chen Jiachun, Deputy Director, Communication Development Department of MIIT China

GTI has played a very much positive role in promoting global telecommunication technology evolution and industry development. GTI could contribute more in cross-industry collaboration in the future.



Mr. Sunil Bharti Mittal, Chairman of Bharti Airtel, Chairman of GSMA

GTI's endeavor to propel TD-LTE and LTE TDD/FDD significantly contributed to the success of global 4G development, and facilitate 4G commercialization in emerging markets and technical development including HPUE on band 40 to safeguard the commercial success.



Mr. Li Zhengmao, Executive Vice President, China Mobile

Embracing the era of everything connected, China Mobile will focus on Ubiquitous Perception, Ubiquitous Connection and Ubiquitous Intelligence to facilitate big connectivity strategy and 5G development. we would like to do joint innovation towards 5G with cross-industry partners to foster open and innovative ecosystem.



Mr. Cheng Jinglei, Chief Engineer, SAIC MOTOR

"5G+Autonomous Driving" Exploration: 5G, with its low latency, high reliability and wide bandwidth, is born to enable cars as intelligent IoT terminals.



Mr. Ulf Ewaldsson, Chairman, KTH Royal Institute of Technology, Group CTO, Ericsson

We will by applying Triple Helix way working with government, industry, and universities collaborating with coopetition, we use 5G innovation platform, these cooperation models are going to develop the industry into next era with 5G.

Dialogue

This is not only the dialogue between government and industry, but also the idealistic collision between 5G innovation and Smart City development.



5G Innovation Panel

This panel gathered the most influential companies in each field of the vertical industry, such as IoV and IoT, to discussed the profound changes brought by 5G Joint Innovation.

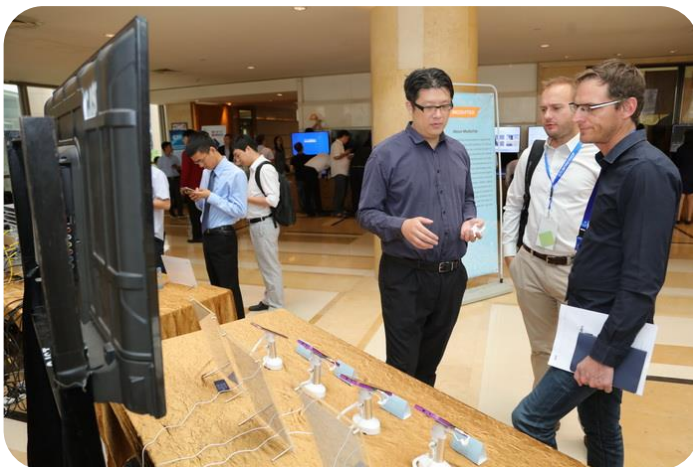


GTI Held 19th Workshop in Shanghai, Consistently Practicing GTI 2.0

The 19th GTI Workshop took place during Jun. 26-27, 2017 in Shanghai, China, gathering more than 160 industrial leaders and experts from over 17 operators and 29 industrial partners and organizations to share the latest progress and discuss key issues on Massive-MIMO commercialization, HPUE on band 40, 5G end-to-end R&D and trial, 5G spectrum and coexistence, C-IoT chipset and module solutions and use cases, cloud robot whitepaper and etc.



Meanwhile, the workshop demonstrated HPUE and TD-LTE uplink/downlink enhancement technologies, Sub 6GHz 5G RF module prototype, and NB-IoT test systems and innovative applications, showcasing footprints of GTI 2.0 and substantial progress jointly made by the industry.



Spectrum Planning, the Key to 5G Success

– GTI Spectrum Highlight during MWCS 2017

5G Spectrum and Policy Forum

Following on from last year's successful event at MWCS on collaboration on spectrum in Asia, GSMA, GSA and GTI host the 5G Spectrum and Policy Forum, aiming to examine the progress in Asia surrounding 5G. There is a strong belief that common ground on policy and regulation for 5G from the region will have a positive impact and accelerate development and adoption of 5G technologies for both the region and at global level. This session showcases the 5G use cases and progress to date on trials and commercial services. Spectrum issues also be highlighted, looking at what IMT spectrum is being discussed for 5G and what progress is being made on future spectrum prior to WRC-19.

The highlights of this meeting are as follows:

- Discussed the 5G spectrum and the difference between 5G spectrum management and existing spectrum management.
- In terms of spectrum, it has reached a consensus that **C-Band will become the main band of 5G**.
- For spectrum management, attendees generally believed that **spectrum management in 5G era will be different from the existing spectrum management**.



GTI Future-oriented Spectrum Roundtable

The future-oriented spectrum roundtable, co-hosted by GTI and Huawei, with the theme of "Maximizing 4G spectrum value and spectrum ready to bring 5G into reality", aims to promote the distribution and industry chain construction of Band 41 and C-Band in the Asia-Pacific region.



Highlights of attendees

- Continuously release **large bandwidth of TDD spectrum** to facilitate the smooth evolution of 4G toward 5G.
- Adopt technologies like **M-MIMO** to reuse network infrastructure and then maximize investment value.
- Promote global and regional spectrum synergism to avoid market differentiation.
- **5G system needs to support multi-bands** and **C-Band will become the main band of 5G**, especially suitable for the preliminary deployment of 5G, which should be better utilized by the government, operators, satellite TV and the public.
- The band **below 1GHz** is preferred in **MTC** cases.
- Softbank and Sprint shared the experience in the deployment of Band 41, **HPUE enables the coverage of 2.5GHz equivalent to that of 1.9GHz**. Band41 has covered 85% population in Japan and Sprint plans to deploy 5G on Band41 in 2019.

Newly Released Deliverables

Promoted Commercialization of High Power UE

In 2017, the **4 types of B41 HPUE** have been released. More is coming.



Samsung GS8



Samsung GS8+



LG G6

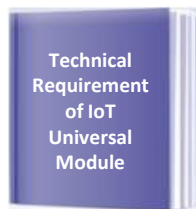


ZTE-MAX

Promoted Maturity of IoT Universal Module

In 2017, GTI promoted the maturity of **IoT Universal Module** which is the bridge of communication capability and service capability.

- The **Technical Requirement of IoT Universal Module** is published for the very first time giving specific guidance to the whole industry
- Jointly developed the world's smallest **NB-IoT Universal Module (16mm*18mm)**



Why Universal Module?

- ✓ Break the fragmentation of IoT industry to further expand IoT market
- ✓ Make the integration of C-IoT technology and terminal more convenient and ease the application in vertical industry
- ✓ Lower the cost of terminals

Published White Papers and Technical Reports on Key Issues

GTI also released white papers technical reports to facilitate maturity of the industry and guide TD-LTE performance improvement and its evolution, as well as lead operators to innovative services and new business growth.



To introduce key concepts, technologies and business forecast of cloud robotics, in the era of 5G mobile communication systems, in order to facilitate further discussions and business investigations between robot players and telecom players.

To define the test cases and test method for NB-IoT module, including interconnection testing, power consumption testing, RF performance testing and positioning testing, and to promote the maturity of NB-IoT module development.



Huawei Wireless X Labs and GTI Jointly Release Cloud Robotics White Paper

GTI jointly issued the "5G & Cloud Robotics White Paper" with China Mobile, SoftBank, Huawei Wireless X Labs, CloudMinds, and Skymind. The white paper discusses the concepts, technologies, market trends, value chain, and business models of cloud robotics, while also performing a detailed analysis of how 5G will unlock latent potential for commercial success.

Cloud robotics will become increasingly popular within the next few years as cloud-based artificial intelligence (AI) progresses and robotics grow increasingly competent. According to the white paper, the global shipment of cloud robotics will reach 50 million between 2016 and 2020. In 2025, domestic cloud robotics will boast a penetration rate of 12%, substantially altering people's way of life. The benefits of cloud robotics in comparison to stand-alone ones will manifest themselves in a vast many areas ranging from logistics, monitoring, entertainment, and education, to the tasks involved in housekeeping.

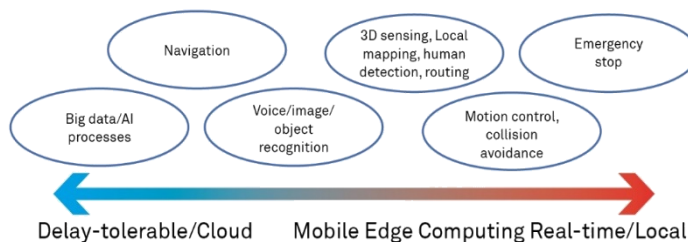


Figure 1: Cloud robot function deployment according to latency

While traditional robotics accept the commands of local controllers, cloud robotics are linked via networks to cloud-based control centers. The combination of AI, big data, and ultra-high-performance computing capability reduces cost and the energy consumption requirements of cloud robotics. According to the white paper, the robot platform, AI, and mobile networks are three key enabling technologies for cloud robotics.

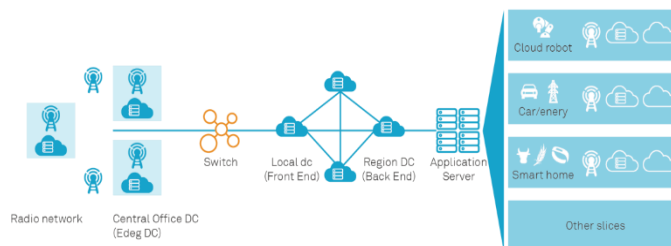


Figure 2: 5G cloud architecture to support multiple applications

Cloud robotics pose unique requirements for networks. The cloudification of real-time tasks relies upon ultra-reliable and ultra-low-latency connections. Sensor data collection demands stable uplink bandwidth. In addition, the network architecture must be highly flexible to accommodate diversified services. 5G, with its large bandwidth and low latency, is an ideal choice for cloud robotics' data transmission. Moreover, 5G network slicing and mobile edge computing (MEC) can provide robotic applications with customizable end-to-end support. Therefore, 5G is set to assume the role of a crucial element aimed at the success of cloud robotics.

GTI cloud robotics working group aims to cultivate a cross-industry ecosystem to remove any barriers while promoting the converged development of communication and robotics. Huawei actively participates in GTI cloud robotics working group projects, while eagerly developing and testing various 5G-oriented application prototypes. The release of GTI cloud robotics white paper marks the successful cooperation among communication, robotics, and AI industries. Huawei looks forward to extending the level of communication and cooperation with the current achievements forming a solid foundation to help propel the future development of cloud robotics.

Datang Mobile Makes Solid Progress toward NB-LOT Commercial Network

Innovation and contribution

Datang Mobile accomplished some innovation algorithm to promote NB-IoT network performance.

- Innovative mobile enhancement algorithm.
- Special system information update algorithm.
- Unique paging message resource allocation algorithm.
- The first to do IoT with two chip manufacturers.
- The first to complete the Multiple-tone function and the test.
- The first to completed the CQI adaptive function.

The memorabilia of NB-IoT technology promotion

JUN 2016

Datang Mobile helped CCSA to work out the NB-IoT specification related to NB.

JUL 2016

Datang Mobile fulfilled the demonstration of NB-IoT air signal for China Mobile as the first manufacturer.

AUG 2016

Datang Mobile took the lead to complete the NB-IoT FDD dual mode RF test with the instrument.

SEP 2016

Datang Mobile completed the debugging with chip manufacture named Extradimen and Spreadtrum.

JAN 2017

Datang Mobile completed the hardware and softare test in China Mobile Research Institute. It's the third manufacturer to complete the test.

April 2017

Datang Mobile will start the trial test in the commercial network.



Intelligent agriculture



Intelligent parking



Intelligent lamppost

China Mobile and ZTE Hit Record High Commercial 3D-MIMO 16-Stream Peak Rate of 2.1 Gbps

14 June 2017, China Mobile and ZTE announced the commercial deployment of 3D-MIMO (namely, Pre5G Massive MIMO) in Quanzhou. With 16 commercial terminals connected, the single-carrier downlink peak cell rate increased to 730 Mbps and for the first time, the single-carrier 16-stream downlink peak rate of 3D-MIMO reached 700 Mbps, with the three-carrier rate up to 2.1 Gbps. This rate once again hit a record in the commercial environment as the three-carrier eight-stream downlink rate of commercial 3D-MIMO reached 1 Gbps following the joint efforts of ZTE and China Mobile.



Figure1: ZTE MWC TDD MM2.0

Due to a boom in mobile Internet, video services account for an increasingly large share in 4G+ networks. By using the key 5G technology, Massive MIMO, on the same bandwidth, 3D-MIMO base stations achieve a peak throughput seven times higher than existing 4G macro stations, greatly enhancing user experience and guaranteeing big video transmission. Quanzhou Mobile and ZTE conducted the commercial deployment of 3D-MIMO in big video environments and verified the peak cell rate, which will be an important milestone in the commercialization process of Massive MIMO technology. Moving forwards, both partners will continue to deepen their cooperation to expand the 5G-like Internet experience to a larger pool of users, and therefore herald the arrival of the big video era.

Huawei Showcases 5G Live Demo Using 39 GHz mmWave Radio Technology with NTT DOCOMO at Tokyo Bay in Japan

Recently, at the 3rd Global 5G Tokyo Bay Summit, Huawei successfully showed 39 GHz mmWave technology based on 3GPP standard 5G New Radio (NR) current agreements in cooperation with NTT DOCOMO, INC. The cell coverage reached up to 2.0 kilometers with Gbps peak throughput for a single user in the mmWave. With this system, a real-time 3-way 4K video conference was demonstrated. The result of the field test represents the 5G joint innovation between Huawei and NTT DOCOMO, who have achieved a new milestone. This breakthrough will have a significant impact in moving 5G a step closer to commercialization.

Mr. Takehiro Nakamura, General Manager of NTT DOCOMO's 5G Laboratory said, "The successful field tests and showcase of the real-time 3-way 4K video conference conducted at 39 GHz high frequency band technology is an important achievement of the 5G joint innovation and field trial between Huawei and DOCOMO, which we will push forward for the development of 5G industry collaborating with Huawei."

The field test was performed in Yokohama Minato Mirai 21 District, which is one of the largest commercial areas in Japan. The test system was made up of one base station that works in the 39 GHz band with 1.4 GHz bandwidth, and 2 UEs (User Equipment). According to the test, 1.3 Gbps (MAC Layer) peak throughput for a single user in the high band was achieved at a distance of 1.5 kilometers. The test employed key 5G technologies, such as the MMFA (Meta-Material Focal Array) and Polar Code.

After signing a MoU on partnership in 5G joint field trials in December 2014, Huawei and DOCOMO successfully conducted the world's first large-scale outdoor field trial of Massive MIMO in Chengdu, China in October 2015. Currently, the two companies continue the systematic verification of 5G key technologies such as Massive MIMO, ultra-reliability and low latency, mixed numerology using f-OFDM (filtered OFDM), and combined performance of SCMA (Sparse Code Multiple Access), Polar Code and f-OFDM. In November 2016, The trial achieved 11.29 Gbps aggregated User Throughput with Less than 0.5 Millisecond One Way User Plane Latency in Yokohama, Japan.

Dr. Wen Tong, Huawei Fellow and CTO of Huawei Wireless Networks, said, "The successful field test of the 39 GHz band is an important technical contribution to the 5G community for the two companies, and it will help to lay the foundation work for 5G tests and deployment globally. Huawei will continue investing in R&D and enhance its cooperation with partners to make progress in 5G technology and the development of an industry ecosystem."

5G can provide an excellent user experience with its high transmission speed and low latency, and will enable the next generation of eMBB applications such as VR (virtual reality) and AR (augmented reality). 5G will fundamentally change society and daily life..

ZTE and China Mobile Showcase 5G eMBB Scenario in Live 5G Field Test

28 June 2017, China Mobile and ZTE announced at Mobile World Congress (MWC) Shanghai the launch of a live 5G field test in Guangdong, deployed with China Mobile, and showcasing an enhanced 5G Mobile Broadband (eMBB) user experience scenario to the world.

The ultra-high rate in low-frequency 5G network coverage was demonstrated live at the show. At the 100 MHz bandwidth, the single-user rate reached 2Gbps.

China Mobile and ZTE conducted the 5G field test in Guangzhou University Town, which is one of the most typical high-traffic scenarios and also a key 'pilot field' for enhancing user experience in 5G eMBB scenarios. ZTE's 3.5GHz NR base station product was used in the 5G field test in Guangzhou. For the next stage, multi-site networking tests will be deployed to test wireless coverage, throughput, mobility, delay, and other 5G network indicators.



Figure1: ZTE& CMCC joint 5G field demo @ MWCS

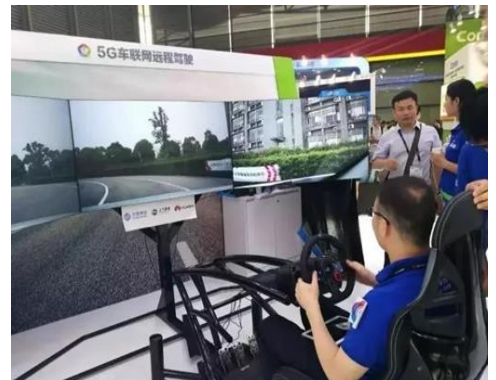
This 5G field test jointly conducted by China Mobile and ZTE indicates that the industry has made a step forward and plays a significant role in driving 5G evolution from laboratory testing to commercial use. A multitude of key technologies, solutions, and network models will be verified on the pilot network.

Huawei Demonstrates 5G-based Remote Driving with China Mobile and SAIC Motor

Today at Mobile World Congress Shanghai 2017, China Mobile, SAIC Motor, and Huawei Technologies jointly demoed the world's first 5G-based remote driving technology with a consumer car. Their demonstration verified the high-bandwidth, low-latency potential in C-band frequency, laying a foundation for future development of connected smart vehicles. This demo marks an important milestone in improving the reliability of autonomous and driverless vehicles, and also a major step forward in commercial application.

Huawei provided the 5G wireless solution that connected SAIC Motor's smart concept car, the iGS. China Mobile provided the connectivity. Working closely together, the three companies successfully demonstrated the world's first remote driving field test for a real consumer vehicle on a 5G network.

In the test, the driver was located over 30 kilometers away from the vehicle. Several high-definition video cameras installed in the vehicle sent multiple real-time HD video feeds to the driver, providing him with a 240-degree view of the vehicle's surroundings over a high-bandwidth 5G network. (Including peripheral vision, without turning their head, an average person has a binocular visual field of around 180-190 degrees). Control signals for the steering wheel, gas pedal, and brakes were also transmitted over the 5G network, which provided the ultra-low latency needed to support instant response to different roadside conditions. From his remote position, the driver was able to maintain full control over the vehicle at all times.



The low latency and high bandwidth of 5G networks are essential to meeting the requirements of remote driving applications for HD video streaming, fast response, and reliable connections. In this particular test, 5G's ultra-high bandwidth provided the required speed for flawless HD video connections between the vehicle and the driver at all times. End-to-end latency for all vehicle control functions was less than 10 milliseconds (the latency for the 5G new air interface itself was less than one millisecond). This means that, when the vehicle was traveling at 30 km/h, the distance it traveled between braking and actual deceleration was only eight centimeters. In extreme conditions, immediate emergency braking is critical to ensuring safety.

Remote driving has a broad range of potential applications in the future, especially in particularly harsh or dangerous environments like mining sites and waste disposal sites, or when remote work is more efficient, like compacting large swaths of soil with a remote-controlled steamroller. Remote driving can also be used to complement autonomous vehicles. For example, with remote driving, a single person can control an entire fleet of vehicles or manually intervene in situations that require human input, such as remote management of car-sharing resources, or in emergency situations, such as rescue missions in disaster zones.

As digital transformation picks up pace around the world, connected smart cars will become a primary focus of the information and communications technology industry. China Mobile, SAIC Motor, and Huawei are actively engaged in the research, development, and field-testing of solutions for real-life 5G autonomous driving applications, work that is essential to making next-generation transportation infrastructure a reality.

ZTE Releases the Intelligent Energy Management System Based on NB-IoT

At Mobile World Congress (MWC) Shanghai in late June 2017, ZTE demonstrated its NB-IoT Intelligent Energy Management System installed in Zhangjiang Intelligent Park. This system uses the innovative IoT technology for the management of energy-saving and emission reduction.

The energy-saving control terminals in the Intelligent Energy Management System use the NB-IoT technology. Through a built-in chip module developed by ZTE, users and managers can easily carry out remote control and strategy customization, implement personalized management for each device, and minimize energy consumption. This system features low investment costs, high return rates, high coverage rates, wide coverage, fast construction and easy operation.

Low construction cost and high return on investment

The Intelligent Energy Management System can introduce tangible economic benefits to users. In a typical wireless base station test room, for example, there are 50 sets of test environments. The power consumption of each environment is 3,000 watts. If energy-saving control terminals are installed, the Intelligent Energy Management System automatically shuts down the terminals at 23:00 pm every working day and powers them on at 8:00 am the next day. Terminals are automatically shut down at 19:00 pm every Saturday and do not operate on Sunday. With this system, 12,300 kilowatts can be saved every week. The electricity saved can be up to 50,000 kilowatts every week, saving tens of thousands of yuan. The electricity charge saved in a month is close to the investment in 50 energy-saving control terminals. Thus, the rate of return is extremely high.



High coverage rate and wide coverage

Restricted by transmission control technology, traditional energy-saving control terminals can only be placed in buildings. There are no proper remote control methods for high energy-consumption equipment in fields including drainage pumps, exhaust fans, and high-power lights. With the help of operators' NB-IoT networks covering the whole country, the terminals supported by this system can control energy-saving and reduce energy consumption for a larger amount of equipment. The Intelligent Energy Management System will effectively help industrial units achieve their goals as soon as possible. The system can be widely used for energy-saving and emission reduction in government agencies, public utilities, all types of units and families, and can improve the quality of the living and natural environment.

Reliable use, easy operation, and fast construction

To achieve remote control, traditional IoT control technologies need complex configurations. However, network quality cannot be guaranteed, and responses are often lost. Through operators' high-quality networks and technical support, this system allows operators to complete remote control once they access the Internet. In addition, the system is very easy to use.

When the NB-IoT standard core agreement was frozen in June 2016, ZTE became the first worldwide to use the standard NB-IoT POC demonstration. In November of the same year, ZTE was the first in the industry to launch its self-developed NB-IoT end-to-end system at the World Internet Conference in Wuzhen. In 2017, ZTE has continually been leading in the NB-IoT commercial process, helping customers build NB-IoT networks. The NB-IoT Intelligent Energy Management System aims to help customers generate profits, save costs, save energy, and reduce emission. By integrating ZTE's strength in the IoT field and based on the keys to NB-IoT industry development, this system can create an example of a win-win situation.

4x4 MIMO Releases China Mobile Network Potential to Build the Best 4G User Experience

Mobile communications have entered the 4G era, and the ultimate experience of 4G users is the key to building operators' brands. China Mobile has deployed the world's largest 4G network, with the world's largest 4G users. 4x4 MIMO is one of the key technologies of multi antenna, users can achieve double peak rate, with 4G to enhance the user experience and enhance the network capacity demands, 4x4 MIMO hence come to be one of the key mobile weapons continued to build 4G advantages, has been widely deployed in the country and pilot scale.

The global industry is ready.

For the terminal, 4x4 MIMO's terminal industry capacity has been highly equipped. In 2016, the mainstream terminal chip, such as Qualcomm, HiSilicon have been released for commercial chipset supporting 4x4 MIMO, in 2017, HUAWEI P10 plus, Samsung S8 mobile phone business has also announced supporting for 4x4 MIMO, 4x4 MIMO will be able to believe is a key configuration of high-end mobile phone in 2017. For the network, overseas operators have found great value of 4x4 MIMO technology, there are 66 networks to achieve commercial deployment and pilot.

China Mobile unique advantage

China Mobile 4G network based on 3G evolution deployment, the whole network inherited the 8T8R multi antenna network capacity, is the world's largest 8 antenna networking 4G network. Therefore, for China Mobile, its 4G network deployment 4x4 MIMO, without hardware changes, only through the software upgrade to enable the functionality, it can be described as "overnight" can be achieved throughout the network deployment.



Figure 1: China Mobile builds the world's largest 8T8R 4G network



Figure 2: 4x4 MIMO terminal and common 4G terminal experience contrast

Extensive deployment throughout the country

In 2017, China Mobile has found great value for users of MIMO 4x4, whether it is the capital city of Beijing, Fuzhou, Guiyang, Hangzhou, Shenzhen, Xi'an, Shanghai, Chengdu and other cities have been implemented pilot and commercial deployment.

Commercial network verification, the use of HUAWEI P10 plus mobile phones, China Mobile 4G user rate doubled, matching 2CC CA capabilities, the highest peak user experience up to 400Mbps.

To build a better mobile user experience for future

4x4 MIMO is a network a key component of the enhanced experience for 5G implementation , combined with the existing spectrum resources of China Mobile, a common user Gbps capability is achieved with multi carrier aggregation and 256QAM high order modulation scheme, to build the best user experience.

The scale of commercial deployment of 4x4 MIMO, will help China Mobile opens the door of 5G experience, open the road toward the future network.

Pre5G Massive MIMO in Singapore by ZTE

In early August, ZTE announced that it has teamed up with Singtel to complete live deployment of the 2.6GHz Pre5G Massive MIMO network at one Marina Bay site in Singapore. This Massive MIMO solution will be able to enhance Singtel's 4G user speed experience in time for Singapore's National Day celebrations held in the Marina Bay area.

Pre5G Massive MIMO, which is ideal for high-density scenarios, will play an important role in guaranteeing service quality in the case of high data traffic resulting from the vast crowd gathered during Singapore National Day. Following the site commissioning, the Pre5G Massive MIMO cell witnessed a sharp increase in throughput, shared the traffic volume of super-busy macro-station cells, and significantly improved the network speed on user terminals as well as the user experience, thereby increasing the overall service throughput in the region.

Bai Yanmin, VP of ZTE, GM of ZTE's 5G&TDD products, said: "Although the 5G standard has not yet been determined, the 5G user experience requirement and key 5G technologies have been relatively clear. We are devoting our efforts to promote the product development and commercial use of Pre5G, aiming to bring a 5G-like user experience to existing end users through Massive MIMO, arguably the most important 5G technology."

By using core 5G technologies that have met commercial conditions on 4G networks, ZTE's solution helps operators achieve smooth evolution from 4G networks, continuous improvement of network performance and user experience, and innovations in business models and services.



Figure1: Singapore National Day

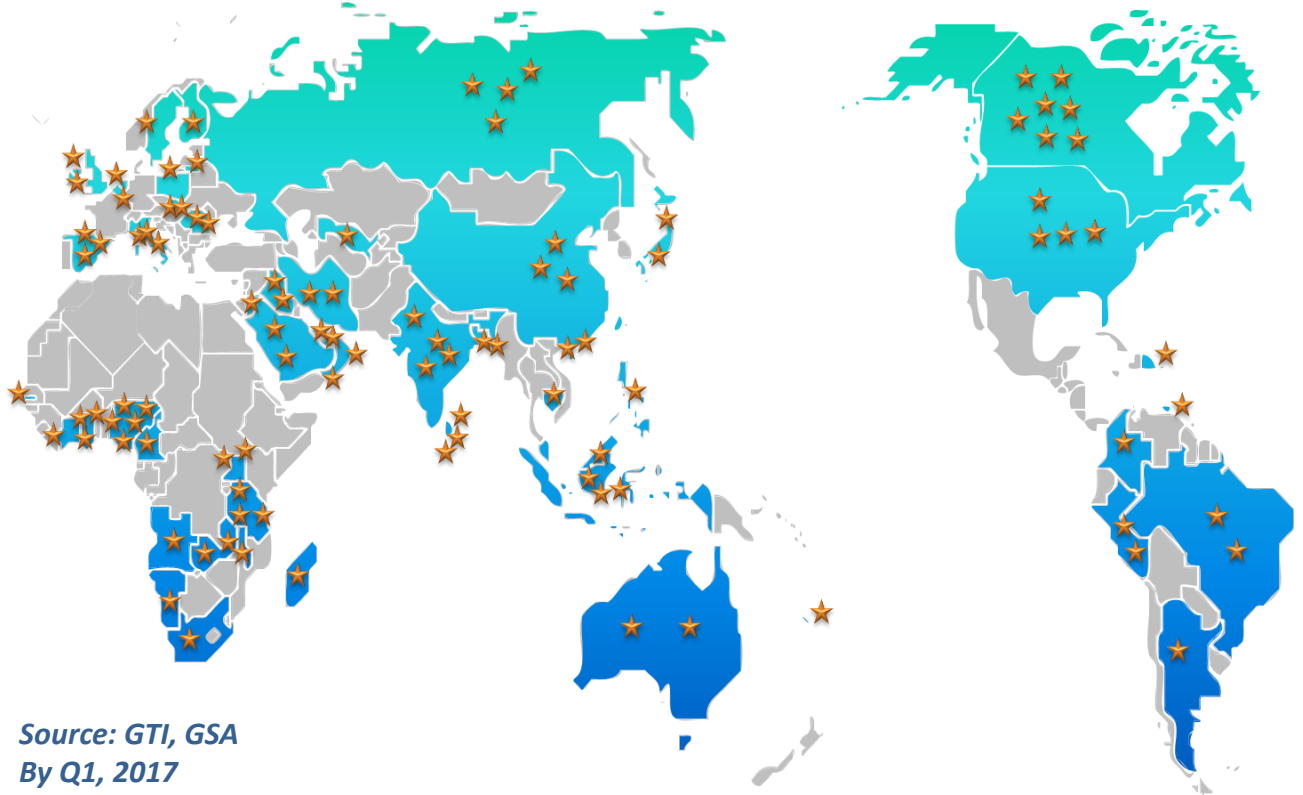
Source: <http://www.channelnewsasia.com/news/singapore/singtel-to-boost-mobile-data-speeds-during-national-day-parade-9089328>

TD-LTE Global Market Overview

Global Deployment as the Mainstream Mobile Broadband Technology

101 TD-LTE commercial networks have been launched

Additionally, over **91** TD-LTE commercial networks are in progress or planned



Source: GTI, GSA
By Q1, 2017

LTE Multi-mode Multi-band Terminals Have Reached Full Maturity

504+ suppliers have launched **4966+** TD-LTE terminals,
including **3861+** TD-LTE Smartphones.

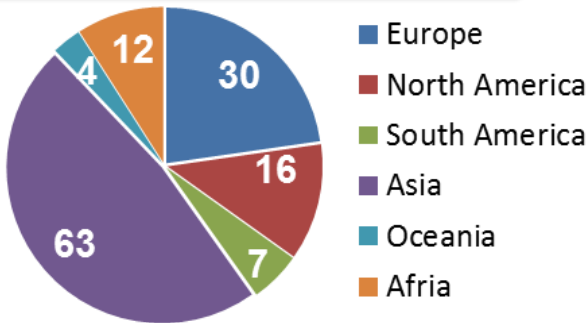
TD-LTE Device Type	Quantity	TD-LTE Device Type	Quantity
USB modems	178+	Smartphones	3861+
MiFi/CPE	691+	Mobile Tablets	143+

*Source: GTI, GSA, TDIA
*Note: Four Main Types
Of The TD-LTE Terminals

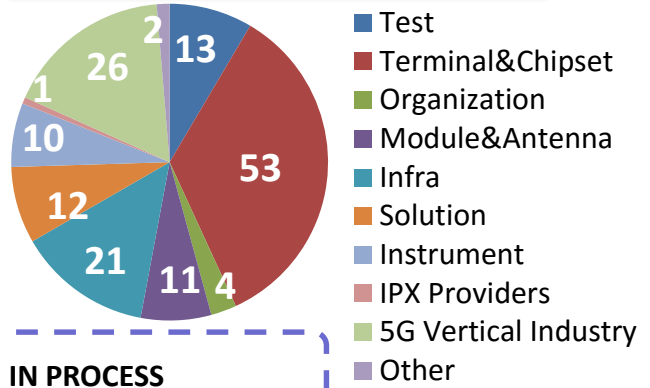
GTI Development Overview

132 Operators and 146 Partners Joined GTI by Q1, 2017

132 Operators



153 Industry Partners



5 MEMBERS ARE IN PROCESS



24 Vertical Industry Partners

Including IoT, IoV, Communication Capability, Industrial Internet, Cloud Robot, VR/AR

- | | | | | |
|-------------------------|--------------|-----------------------------------|--------------|---------------|
| ✓ BAIC | ✓ Changhong | ✓ CloudMinds | ✓ EVE Energy | ✓ Feitian |
| ✓ GAEI | ✓ Goertek | ✓ Haier | ✓ Hisense | ✓ IESLab |
| ✓ Jinan Towngas | ✓ LeAutolink | ✓ Neusoft | ✓ Oviphone | ✓ Canny Robot |
| ✓ Philips Lighting B.V. | ✓ SAFT SA | ✓ Shougang Automation Information | ✓ iStaging | |
| ✓ Taiyo Yuden | ✓ WapWag | ✓ Wireless Car | ✓ Xiaomi | ✓ Bettershine |

GTI Activities

	2017	Jan/Feb	Mar/Apr	May/Jun	Jul/Aug	Sep/Oct	Nov/Dec
Summit		Time: 28 th Feb. (MWC) Venue: Barcelona, Spain GTI Summit (including GTI Awards 2016)		Time: 28 th Jun. (MWCS17) Venue: Shanghai, China GTI Summit		Time: 12 th Sep. Venue: San Francisco, USA GTI 5G Innovation Summit	
Workshop		Time: 23 th -24 th Feb. (MWC) Venue: Barcelona, Spain The 18th GTI Workshop	Time: 26 th -27 th Jun. (MWCS17) Venue: Shanghai, China The 19th GTI Workshop	Time: 29 th Jun. (MWCS17) Venue: Shanghai, China 5G Spectrum and Policy Forum	Time: 29 th Jun. (MWCS17) Venue: Shanghai, China GTI Future-oriented Spectrum Roundtable	Time: 25 th Sep. (ITU Telecom World 2017) Venue: Busan, Republic of Korea TDD Spectrum and 5G Technology Workshop	Time: 13 th -14 th Nov. Venue: London, UK The 20th GTI Workshop
Exhibition		27 th Feb. -2 nd Mar (MWC) Barcelona, Spain		26 th -27 th Jun. (MWCS17) Shanghai, China		25 th -28 th Sep. (ITU Telecom World) Busan, Republic of Korea	
Others		Time: 24 th Feb. (MWC) Venue: Barcelona, Spain GTI Night					

Appendix 1 – Welcome to Join GTI (to operators)

More Information about GTI

To find out more information about GTI, please visit <http://gtigroup.org> or email us.

How to Join GTI

GTI Operators (with TDD Spectrum)

1. Fill out the application form (download from <http://gtigroup.org/joinUs.html>), and return to GTI Secretariat: GTI_Secretariat_list@lte-tdd.org and/or GTI@lte-tdd.org;
2. Sign the Accession Form and return the signed copy to 5 initiators;
3. Once the participation process finishes, a GTI website account and associated password will be assigned to the new participant.

GTI Observers (without TDD Spectrum)

1. Fill out the application form (download from <http://gtigroup.org/joinUs.html>), and return to GTI Secretariat: GTI_Secretariat_list@lte-tdd.org and/or GTI@lte-tdd.org;
2. Sign the declaration form and return the hard copy to GTI Secretariat;
3. Once the participation process finishes, a GTI website account and associated password will be assigned to the new participant.

Appendix 2 – Welcome to Join GTI Partner Forum (to non-operators)

More Information about GTI Partner Forum

*To find out more information about GTI and GTI Partner Forum,
please visit <http://gtigroup.org> or email us.*

How to Join GTI Partner Forum

1. Fill out the application form (download from <http://gtigroup.org/joinUs.html>), and return to GTI Secretariat:
GTI_Secretariat_list@lte-tdd.org and/or GTI@lte-tdd.org; GTI Secretariat and Working Group Chairmen will review;
2. Sign the Declaration Form and return the signed hard copy to GTI Secretariat;
3. Once the participation process finishes, a GTI website account and associated password will be assigned to the new participant.

CONTACT GTI:

If you have any questions, comments, suggestions regarding TD-LTE or general enquiries regarding GTI, please contact:

GTI@lte-tdd.org