

GTI Industry Briefing

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A New Journey of GTI: Joint Innovation towards 5G

With shifted focus to joint innovation towards 5G, the **GTI Summit 2017** was held on 28th Feb. at Mobile World Congress (MWC) 2017 in Barcelona, as a significant milestone for the GTI 2.0 that strives for further promoting 4G evolution and 5G development, to build everything connected world through cross-industry collaboration.



The Summit attracted top leaders from operators like Bharti Airtel, China Mobile, SoftBank, Vodafone, giving their insights and views on trending topics on 4G and its evolution, 5G strategy.



'GTI 2.0 will continue to be the primary global platform to shape this massive technology evolution and Bharti Airtel is proud to be a part of this.'

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



'This year (2017), 2.5 GHz HPUE debuts on top Sprint devices, and is approved to be able to cover 99% of 1.9 GHz LTE coverage. In September 2016, SoftBank announced the first commercialization of Massive MIMO worldwide.'

Mr. Masayoshi Son, Chairman & CEO of SoftBank Group Corp



'4G has greatly changed the lifestyle, while 5G will reshape the society. China Mobile have established 5G Innovation Center, by which we would like to do joint innovation towards 5G with cross-industry partners to embrace the Everything Connected World.'

Mr. Li Yue, President and CEO of China Mobile



'As 4G networks evolve towards 5G, it's important that the industry works together to ensure that new features and services are developed using common standards.'

Mr. Andy Macleod
Regional Technology Director for Africa, Middle East and Asia Pacific, Vodafone

Top leaders from vendors as well as vertical partners shared their insights and views on 5G strategy, and emerging opportunities enabled by 5G cross-industry innovation.



Mr. Eric Xu
Rotating CEO
Huawei



Mr. Risto Siilasmaa
Chairman
Nokia



Mr. Matthew S. Grob
CTO
Qualcomm



Mr. Luke Ibbetson
Board Member
5GAA



Mr. Martin Brandenburg
Director Europe
DJI

GTI Deliverables Release and GTI Awards 2016 Were Presented at GTI Summit 2017

At the GTI Summit 2017 in Barcelona, to promote 4G evolution towards 5G for laying solid foundation of cross-industry innovation, GTI released three major achievements including the white paper of **Future Spectrum Initiative** to guide efficient spectrum usage, **whitepapers on Massive MIMO and Fixed Wireless Broadband** to promote improvements in performance and system evolution, and facilitate operators with new business growth, and **High Power UE** products and solutions on Band 41, to improve cell edge performance and lower down carriers' investment cost.

In order to acknowledge significant contribution to the industry and GTI achievements in 2016, GTI Awards were also presented at the summit. Samsung, Qualcomm and R&S won awards on **Innovative Technical Product**, while Huawei, ZTE and Keysight won awards on **Innovative Solution and Application**, for their outstanding accomplishment on HPUE, Massive MIMO, uplink enhancement solution and etc. Besides, Bharti Airtel, KDDI and RJO were granted awards of **Market Development** for their significant achievement in promoting TD-LTE and LTE TDD/FDD global deployment. **Honorary Awards**, newly set up this year, were granted Mr. Prakash Bhat from Vodafone, Dr. Herkole Sava from Sprint, Mr. Eric Ekudden from Ericsson, and TDD teams of Nokia and Huawei, for their active contribution to the GTI and TDD industry as a whole.



GTI, 5GAA Take a Step in Cellular-V2X by Signing a MoU and Jointly Announcing a Statement

As connected-car has become one of the most inspiring area enabled by cellular network, the Global TD-LTE Initiative (GTI) and 5G Automotive Association (5GAA) signed a MoU during the GTI Summit 2017 held on 28th Feb. and jointly announced a statement for Cellular-V2X (C-V2X) industry development promoting a unified standard, innovative and converged ecosystem.



They declared their commitment to the promotion of a global unified C-V2X standard and E2E industry, and building a deep integrated and innovated C-V2X ecosystem among automotive, telecommunication and more vertical industry partners. To achieve this goal, they are committed to promoting and ensuring the completion of a unified, high quality and market meeting 3GPP C-V2X specification on time, and keeping technical competitiveness to satisfy new requirements; coordinating global C-V2X spectrum allocation and making clear C-V2X technical direction in V2X industry development; starting the large-scale C-V2X trial based on 3GPP Release 14 specification in China and Europe in 2017, and exerting the global market scale effect of the telecommunication and the automotive industry, to provide pre-commercial/commercial E2E product in 2018, and thereby to drive a global unified and mature C-V2X ecosystem.

Considering the benefits of C-V2X, the telecom and automotive sectors are working together on C-V2X use cases and scenarios, solutions and trials, standardization and spectrum, business model and go-to-market strategies to achieve the success of thriving C-V2X market and create a new era of Internet of Vehicles.

Christoph Voigt, Chairman of the 5GAA board said, *"5GAA was created to connect telecom industry and vehicle manufacturers and work closely together to develop end-to-end solutions for future mobility and transportation services. We look forward to working with GTI and the other relevant organizations to create a successful C-V2X ecosystem."*

Craig Ehrlich, Chairman of GTI said, *"C-V2X is one of the key areas in GTI 2.0. We are very glad to cooperate and communicate with 5GAA in the fields of C-V2X technology, standard and business models, and take advantages of our own industry and platform to speed up the global commercialization of C-V2X."*

GTI 2.0 Technical Work: A Significant Shift to Foster Joint Innovation towards 5G

Objective

Focus on key technical issues, provide solutions and guidance to the whole industry and ensure commercial success

Goal-Oriented

To stay goal-oriented with clearly defined objectives and plans to ensure efficient operation and collaboration

Concrete Deliverables

With concrete deliverables to ensure substantial progress of the industry

Win-win Cooperation

To encourage more active participation and contribution from all partners to unleash synergy and benefit the industry as a whole

Programs

4G& Evolution

Objective

Facing the rapid development of data requirements on new service & applications, efficient utilizing LTE to enhance performance and service capability

Projects

Massive-MIMO
Uplink Enhancement
Smooth Evolution
Innovative Business & Service
eMBMS

5G eMBB

Objective

Defining 5G eMBB requirements/use case, validating system solution, defining product requirement and promoting commercial deployment among GTI partners and with wider industry partners

Projects

Sub 6GHz
New Device
Architecture
Test Equipment

IoT

Objective

Promoting development of cellular IOT technology and its commercialization

Projects

Pilot and Trial
Wireless Solution
Network Architecture
Chipset and Module
Device Certification
Open Platform
Market & Business

IoV

Cooperation with other international organizations, like 5GAA, and automotive industry to better promote the development of V2X

Cloud Robot

Objective

Enabling the development of Cloud Robot and jointly exploring the market

Projects

Whitepaper
Prototype demo
5G integration
Pre-5G demo

DELIVERABLES

Requirement
Whitepaper

Test/Technical/Business &
Service Report

Prototype/
Product

Trial/
Showcase

Participants

Program 1: 4G &Evolution

Arete M, CMCC, PCCW, RJO, Sprint
Baicells, Datang, Ericsson, MediaTek, Huawei, Keysight,
Nokia, Qualcomm, Rohde-Schwarz, ZTE

Program 3: IoT

CMCC, Sprint,
Datang, Ericsson, Huawei, Keysight, Nokia, Qualcomm,
Rohde-Schwarz, ZTE

Encourage more
active participation
and contribution from
all partners to
unleash synergy and
benefit the industry
as a whole

Program 2: 5G eMBB

CMCC, Sprint, Vodafone
Datang, Ericsson, Huawei, Keysight, MediaTek, Nokia,
Qualcomm, Rohde-Schwarz, Skyworks, Qorvo , ZTE

Program 5: Cloud Robot

SoftBank
Cloud Mind, Huawei

GTI Held Workshop in Barcelona, Refocusing to Echo the GTI 2.0

The 18th GTI Workshop took place during Feb. 23-24, 2017 in Barcelona, Spain, gathering more than 200 industrial leaders and experts from over 30 operators and 36 industrial partners and organizations to share the latest progress and discuss key issues as 4G evolves towards 5G, such as 4G/5G spectrum planning and coexistence, uplink enhancement, massive MIMO and smooth evolution, 5G Sub-6GHz networking and terminal, cellular IoT industry and trials, cloud robot requirement and solution and etc.

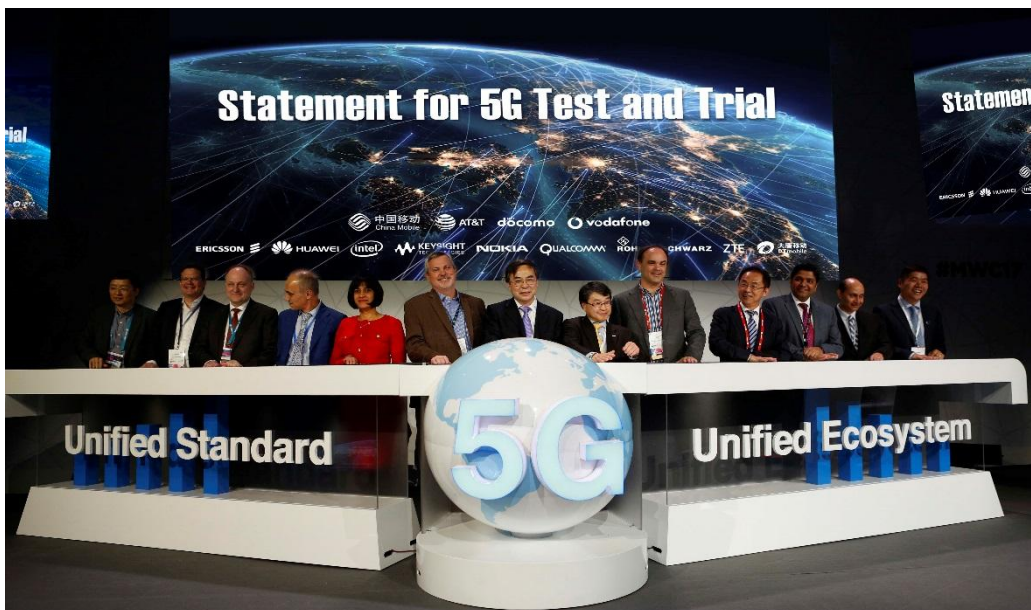


As a practice of the refined GTI 2.0 technical work, the workshop also discussed prioritized projects and tasks under programs of 4G and evolution, 5G eMBB, Cellular IoT and Cloud Robot, aiming at concrete outputs by joint effort of the industry to promote substantial development and joint innovation towards 5G.



A Statement Jointly Declared at Global 5G Test Summit for a Unified Standard, Unified Ecosystem

At the Global 5G Test Summit held on 28th Feb., AT&T, China Mobile, NTT DOCOMO, Vodafone, Ericsson, Huawei, Intel, Keysight, MediaTek, Nokia, Qualcomm, Rohde & Schwarz, ZTE, Datang jointly declared a statement promoting unified, global 5G standards achieved through 5G testing, trials and cooperation between telecom operators, vendors and vertical industry partners to build a unified end-to-end (E2E) ecosystem.



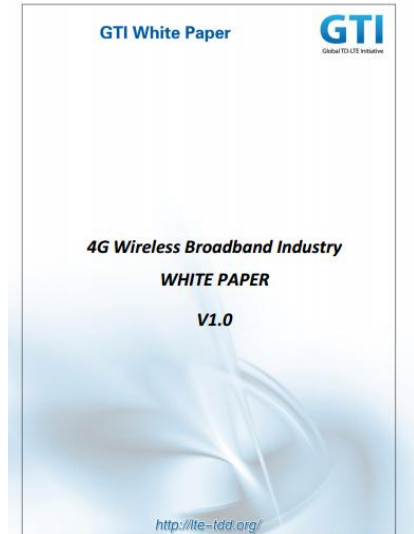
At the Summit, hosted by four leading telecom operators and supported by ITU, GSMA, 3GPP, NGMN and GTI, all participants declared their commitment to the promotion of unified global 5G standards, a unified E2E ecosystem and a thriving 5G market. After standardization, testing and trials are vital to the success of 5G technologies, ecosystem development and cross-industry innovation. To achieve this goal, all participants committed to facilitating and ensuring a unified, high-quality and competitive 3GPP 5G specification by June 2018 for Release 15 and December 2019 for Release 16, building a unified 5G E2E ecosystem (including chipset, terminal, network, test instrument, etc.) for seamless global roaming, and enlarging the global market scale for low cost.

Participants are starting the early trial and interoperability testing for a variety of use cases, including mobile broadband, for 3GPP Release 15 specifications to drive a mature 5G ecosystem and to ensure a quick and efficient time to market. They also appealed to inspire innovations on 5G key technology and to validate the smooth evolution capability of technologies towards 5G, including 3D-MIMO LTE, NB-IoT/eMTC, and C-V2X.

Releasing 4G Wireless Broadband Whitepaper, WTTx 2.0 Promotes Industry and Network Evolution

Mrs. Kathleen Leach, Chairman of the GTI Business and Services Working Group, introduced 4G wireless broadband whitepaper. This WP described the advantage of wireless broadband compared with fixed broadband, mature ecosystem and continuous evolution of 4G WBB, shared key commercial cases globally.

At the 2016 Global MBB Forum, Huawei introduced WTTx 2.0, it features significant improvements from the dimensions of broadband capability, network convergence, O&M, and service provision, upgrading WTTx 1.0 to WTTx 2.0. Huawei considers these dimensions as four forces propelling WTTx 2.0.



Expand the WTTx industry and introduce new services to WTTx.

Three WTTx industry activities have taken place. WTTx industry circle has expanded to ITU, GTI, TDIA, Qualcomm Technologies, Inc., Huawei, more than 25 operators, and various industry partners.

WTTx can bring fast ROI with overlaying on the existing MBB network, reusing network resource such as spectrum and transmit equipment, etc. Key technologies like massive MIMO unlock network potential of WTTx, full-bands CPE support network expansion and upgrade naturally. New services such as video and smart home with WTTx will bring additional revenue for Operators.

Mature industry chain, healthy chip supply environment

Currently, more than 37 manufacturers provide more than 230 models of CPEs to meet various requirements, greatly maturing the WTTx industry chain. Huawei, MitraStar, and Gemtek have developed CPEs that support features such as 4x4 MIMO and Carrier Aggregation, etc. The peak rate of the most advanced CPE can reach up to 2 Gbit/s.

According to an ITU Connect 2020 report, by 2020 an additional 430 million households are expected to have broadband access, while broadband rates will be accelerated for 380 million households." said by representative of ITU. "Wireless broadband will help operators further expand the boundaries of HBB and accelerate the growth in broadband."

Whitepaper Download Link:

<http://gtigroup.org/Resources/rep/2017-03-01/10186.html>

China Mobile, Huawei, Deutsche Telekom and Volkswagen Reveal 5G Vision Based on 5G Service guaranteed Network Slicing New White Paper

At the Mobile World Congress 2017 (MWC 2017) in Barcelona, China Mobile, Huawei, Deutsche Telekom, and Volkswagen have released their shared vision for the 5G era in their 5G Service guaranteed Network Slicing White Paper as all parties prepare to attend the 2017 Mobile World Congress (MWC) in Barcelona. In this white paper, the world-leading vendor, operators, and vertical industry partner explore new business models for mobile networks and share their insights into the evolution of the current mobile network towards an "All Cloud" 5G era.

Distinct from the user-oriented 4G mobile broadband network, 5G will enable for the first time the Internet of Everything (IoE), generating new industries on an unprecedented scale and injecting infinite vitality into the mobile communications industry. Enormous growth of service types will be empowered by 5G, such as mobile healthcare, Internet of Vehicles, smart home, industrial control, and environment monitoring.



The white paper presents industry-leading viewpoints on 5G network slicing, with topics ranging from industry development trends, vision and definition for the 5G Service guaranteed Network Slicing, End-to-End (E2E) architecture, key technologies, and example use cases. Network slicing plays a significant role in 5G via offering a service guaranteed E2E network solution. Based on a shared infrastructure, network slicing provides vertical industries with an economical operation mode, shorter Time-to-Market (TTM), performance comparable to dedicated-networks, and better technical support and evolution.

"Faced with new technological requirements and challenges, global operators, vendors and partners from vertical industry should work together to investigate and promote network slicing usability by leveraging technologies that will guarantee E2E network slicing services." said Wang Xiaoyun, General Manager of Technology Department of China Mobile.

"We hope to work with global operators, vendors, and vertical industry partners to facilitate the development of service guaranteed network slicing in terms of application scenarios, technologies, standards, and the industry chain." said Dr. Tong Wen, CTO of Huawei Wireless Network Product Line.

"Network slicing is envisaged as a key innovation in 5G technology to flexibly and efficiently support the enormous growth in service types. We have already demonstrated in trials the feasibility of 5G slicing to support multiple services as virtual networks on a common infrastructure." said Bruno Jacobfeuerborn, CTO, Deutsche Telekom.

"Connected Vehicles will become one of the key enablers for the next generation of mobility. We will introduce safety-related warning functionality based on the IEEE 802.11p / ITS-G5 standard. The 5G technology can be used to implement use cases which improve the comfort and efficiency of automated driving." said Johann Jungwirth, Chief Digital Officer at Volkswagen.

Whitepaper Download Link:

<http://www-file.huawei.com/~media/CORPORATE/PDF/white%20paper/5g-service-guaranteed-network-slicing-whitepaper.pdf>

Telefónica Germany Launches the World's First 3.5GHz Massive MIMO Field Trial

Telefónica launched the world's first 3.5 GHz LTE TDD Massive MIMO outfield trial, running 16 terminals simultaneously over 20MHz spectrum on the 3.5 GHz band with a peak downlink rate of 650 Mbps on the German O2 sub network in Munich. Throughout the trial, the Telefónica Group verified the performance of TDD Massive MIMO, which is an important milestone of the Munich TechCity project by Telefónica and Huawei.

Massive MIMO is a large-scale, multi-antenna technology. Through the antenna array, it can focus the signal on a more precise set of layers making transmission more efficient and its accuracy beam would extend the coverage further. Massive MIMO is capable of 'full three-dimensional beam forming', allowing the antenna to directly cover the areas where a high capacity for customers is needed.



Thereby achieving an extraordinary peak rate and a five-fold spectrum efficiency compared to traditional 4G 2T2R technology. It is very well suited to be used to cover e.g. the dense urban hot area, train stations, squares, stadium, town center, shopping malls and skyscrapers. By owning 84MHz spectrum resource on 3.5 GHz frequency, and having benefited from the previous improvement on both capacity and coverage that Massive MIMO can achieve, Telefónica will be able to provide customers with new applications such as WTTx (wireless home broadband), 4K video, etc. So 3.5 GHz Massive MIMO may become an interesting component of Telefónica's network in the 5G future.

In addition to Massive MIMO, Telefónica and Huawei also make great progress in other TechCity projects in Munich, e. g. maximizing spectrum utilization, indoor digitalization and NB-IoT. Telefónica is dedicated to provide a better service experience to the customers and pave the way to 5G with more cutting-edge technologies. It will continuously cooperate with Huawei to research and practice more joint innovation. About the TechCity project With TechCity, which was founded in early 2016 in the north of Munich, two leaders of technology, Telefónica and Huawei, started a strong cooperation in research and development on their way to 5G. Different projects have already been started – all of them are based on 4.5G, which is a technology step based on LTE Advanced. TechCity is a network of eight eNodeBs around the O2 headquarter.

Qualcomm, China Mobile and ZTE Announce Collaboration on 5G NR Trials at 3.5 GHz to Accelerate Wide-scale 5G Deployments in China

— Trials will be compliant with the 5G NR 3GPP specification, the global 5G standard; driving the ecosystem towards rapid pre-commercialization at scale —

Qualcomm Technologies, China Mobile and ZTE announced plans to conduct interoperability testing and over-the-air field trials based on the 5G New Radio (NR) specifications being developed by 3GPP in 2018. The trials will operate in sub-6 GHz spectrum at 3.5 GHz and intend to drive the mobile ecosystem toward rapid validation and pre-commercialization of 5G NR technologies at scale, enabling timely pre-commercial network launches based on 3GPP Rel-15 standard compliant 5G NR infrastructure and devices.



In the trials, the Companies will showcase 5G NR technologies to efficiently achieve multi-gigabit per second data rates at significantly lower latency than today's network, amongst other capabilities.

The trials will follow the China Mobile's guideline of 5G NR and utilize device prototype and base station solutions from Qualcomm Technologies and ZTE respectively, to simulate real-world scenarios across a broad set of use cases and deployment scenarios. The focus of the trials will be on 5G NR operation in sub-6 GHz spectrum at 3.5 GHz, which is a critical band in China for achieving coverage and capacity to address the large number of envisioned 5G use cases. The trial will make use of advanced 3GPP 5G NR technologies including Massive Multiple-Input Multiple-Output (MIMO) antenna technology, new frame structure, beamforming techniques, scalable OFDM-based waveforms to support wider bandwidths, advanced coding and modulation schemes, and a new flexible, low-latency slot structure based design.

Nokia Maximizes Network Speed and Capacity on Path to 5G with Launch of 4.9G Technology and AirScale Active Antennas

Nokia will introduce its 4.9G technologies by the end of 2017, allowing operators to dramatically enhance their network performance and manage the significantly higher infrastructure demands on the path to 5G. A 4.9G massive MIMO Adaptive Antenna will also increase cell capacity by up to five times, while a new 4.5G Pro AirScale Micro Remote Radio Head (RRH) will allow operators to take advantage of unlicensed spectrum to enable Gigabit speeds.

Nokia 4.9G will provide significant increases in capacity and several Gigabits of speed-per-second on the path to 5G. The introduction of the AirScale massive MIMO Adaptive Antenna is a milestone in the delivery of 4.9G, driving capacity increases for megacity deployments.

The AirScale massive MIMO launch complements Nokia 4.9G Cloud RAN technology. At Mobile World Congress, Nokia will give a world-first demonstration of Cloud Single RAN running virtualized 2G, 3G, 4G and 5G radios and 2G and 3G network controllers over commercial AirScale and AirFrame platforms.

A range of AirScale Active Antennas will complement Nokia's existing commercial Radio Antenna System. In addition to the AirScale massive MIMO Adaptive Antenna, the AirScale Compact Active Antenna will provide an even leaner site solution that increases performance and lowers operators' costs.

As cities grow and the world's population becomes increasingly urban, operators need to rapidly densify networks in city locations while slashing costs and CO2 emissions. Nokia is introducing enhancements to its [AirScale base station](#) that will allow them to do this with the most compact footprint while reducing operational costs by up to 40 percent. The new AirScale multiband remote radio heads include the world's first triple-band example, while Nokia is also launching new frequency variants. [Nokia Zero Emission 3.0](#) will reduce operators' energy consumption by up to 50 percent using new hardware and software features while the [Intelligent Deployment Platform](#) uses automation to accelerate AirScale deployment life cycle by up to 40 percent.

Nokia continues to innovate using 4.5G Pro and 4.9G technologies and will highlight many of its ultra-broadband developments at Mobile World Congress, including:

- World-first demonstration of 4.9G AirScale technology to achieve 3 Gbps peak rates
- World-first demonstration of 4.5G Pro CBRS-FDD four carrier aggregation connected to Nokia Bell Labs Spectrum Access System (SAS) using a test device from Qualcomm Technologies, Inc.*
- Nokia Bell Labs Liquid Cooling demonstration converting 80 percent of base station waste into useful heat to reduce site power costs.

Frank Weyerich, head of Mobile Networks Products at Nokia, said: "Nokia introduced 4.5G Pro and 4.9G last year to allow operators to implement network capacity increases where and when it made sense for them. Now we are delivering features that will maximize their resources, speed up deployment times and cut power and costs especially in the most densely populated locations. We are making 4.5G Pro a commercial reality now and working with customers to innovate with solutions to their network densification and evolution challenges in 4.9G and beyond."

Pre5G Product & Commercialization Manifesting a New Stage, First Pre5G Trials in Spain and in Southeast Asia Completed

28 February 2017, ZTE announced that its Pre5G TDD Massive MIMO(multiple-input multiple-output) 2.0 product has demonstrated its high-speed service in multi-user scenario, reaching 2.1Gbps and setting a new single-site peak rate record at a demonstration held at Mobile World Congress (MWC), Barcelona 2017.



ZTE's Pre5G TDD Massive MIMO 2.0

The power-on service of ZTE's Pre5G TDD Massive MIMO 2.0 product provides an ultra-high speed through 16-stream spatial division multiplexing, 3 CA (carrier aggregation), and 256 QAM (Quadrature Amplitude Modulation) manifesting a new stage of Pre5G R&D.

Recently, ZTE has completed a lot of Pre5G trials worldwide. In December 2016, Telefónica and ZTE announced that they have successfully completed Pre5G Massive MIMO live testing in Madrid, Spain. This is Telefónica's first Pre5G Massive MIMO trial in Europe. One month later, Smartfren Telecom together with ZTE successfully completed the Pre5G Massive MIMO service test. This is Southeast Asia's first field commercial trial of Pre5G technology that could support technology evolution from 4G to 5G.

Huawei and Vodafone Showcase the Future Connected Car Experience at MWC 2017

At the Mobile World Congress 2017 (MWC 2017) in Barcelona, Huawei and Vodafone, with the support of Audi, demonstrate for the first time in Europe the use of cellular technology to connect cars to each other, to people, and to roadside infrastructure enhancing safety and delivering a better driving experience. Using a new technology called Cellular V2X (C-V2X) the live demonstration takes place in front of invited guests at the world famous Circuit de Barcelona-Catalunya race track.

As part of the 4G evolution towards 5G, the new C-V2X technology enables rapid exchange of information between vehicles, other road users and infrastructure promising to bring about a transformational change to driving, vehicle safety, traffic management and road efficiency. This latest development follows the successful live trial by Huawei, Vodafone and Bosch of a 5.9 GHz C-V2X connection purely between vehicles on the A9 motorway in Germany in February 2017.

Guests invited to the showcase are passengers in an Audi vehicle specially fitted with C-V2X technology. The driver of the car then demonstrates four scenarios of how connected vehicles can enhance driving:

- See through – connected cars can see a video feed from a vehicle in front in situations where it will help them to have visibility of other traffic, upcoming entry roads or other issues to negotiate.
- Traffic light warning – the driver will be alerted if a traffic light is about to change enabling them to better anticipate when to slow down.
- Pedestrian warning – mobile connectivity can alert vehicles to a pedestrian crossing the road ahead, even before they are visible to sensors or the driver.
- Emergency brake – an algorithm will determine if there is a risk from other connected vehicles suddenly braking or changing lanes and will sound an alarm to alert the driver.

The demonstration also shows how direct communication between vehicles based on C-V2X can enable these use cases and provide the basis for future enhancements towards autonomous driving.

Luke Ibbetson, Vodafone Group's Head of Research & Development and Technology Strategy, said: "C-V2X will be a core component for connected and autonomous vehicles as it enables better anticipation and negotiation of road risks. This is an example of how Vodafone is evolving our fast and reliable 4G networks on the road to 5G."

Edward Deng, President of Wireless Network Product Line at Huawei, said: "Intelligent transport is set to be one of the key application scenarios of future mobile communication systems. With our long history of successful joint innovation, together with Vodafone, Huawei is very pleased to pioneer the Cellular V2X solution development to serve the needs of future ITS systems, and pave the way to a Better Connected World with fully intelligent transport systems."

The Test and Certification Progress of NB-IoT

The completion of NB-IoT phase 1 test specification in 3GPP RAN5, first activation of NB-IoT work item in GCF, and first GCF certified NB-IoT module. Recently, there are exciting progress in NB-IoT test and certification

Thus far, the work of NB-IoT test specification in 3GPP RAN5 led by China Mobile has achieved exciting progress. RAN5 has almost completed the phase 1 NB-IoT test case and targets to complete the whole NB-IoT work item in June 2017.

Subsequently three NB-IoT work items in GCF, including protocol conformance test (WI-257), RRM conformance test (WI-258) and RF conformance test (WI-259) created by China Mobile as rapporteur in 2016. At GCF CAG#49 in January 2017, the NB-IoT RF conformance work item for band 8 (WI-259-08) was first activated, which means the start of global certification of NB-IoT device. By the time of CAG #49ter in March, the NB-IoT protocol conformance work items for Band 8 and Band 5 have been successfully activated. Based on the first activated work item, GCF has completed the first certification of NB-IoT module from Quectel in March.

The work in GCF has received strong support from StarPoint. StarPoint SP8630 Integration test system, which has reached the Test Platform Approval Criteria (TPAC) for NB-IoT RF and Protocol conformance test in GCF, is the world's first GCF validated instrument supporting 3GPP NB-IoT R13 conformance test. Furthermore, SP8630 could be smoothly upgraded to support eMTC and R14 LPWA technology. SP8630 also supports flexible system configuration, providing the tester with the industry's richest one-stop test solution. As a leader in the field of NB-IoT terminal test, StarPoint will continually focus on the NB-IoT to export more valuable test instruments and solutions.

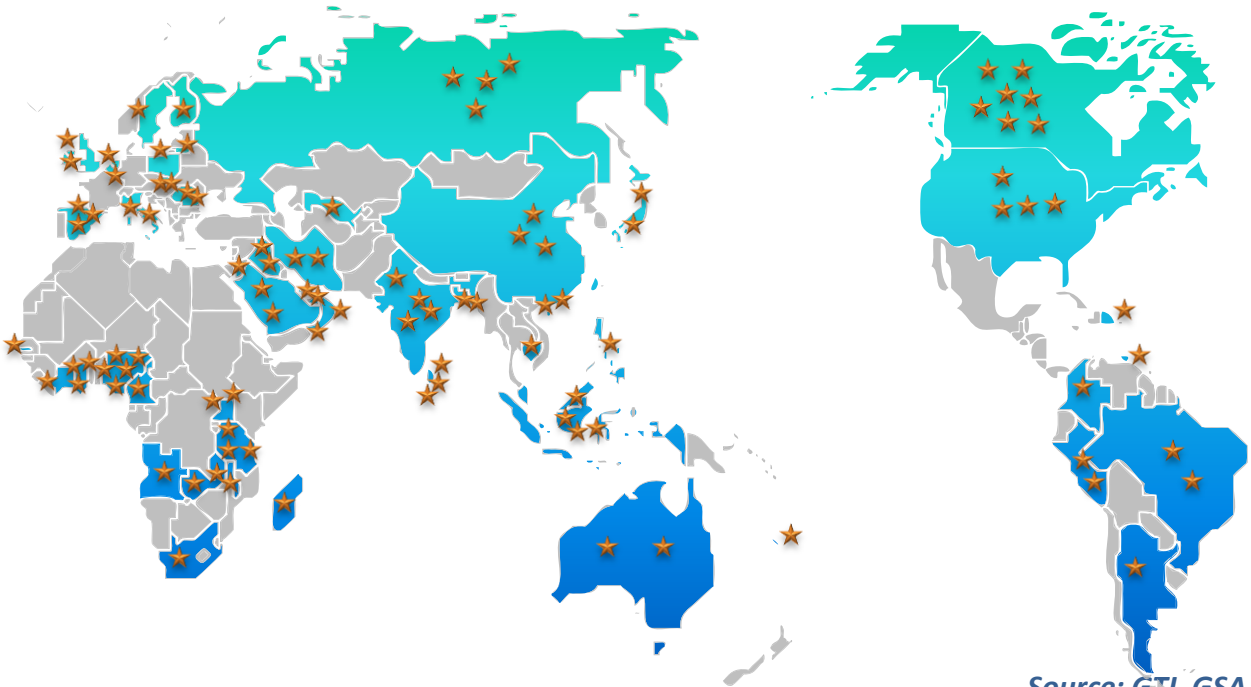


TD-LTE Global Market Overview

Global Deployment as the Mainstream Mobile Broadband Technology

99 TD-LTE commercial networks have been launched

Additionally, over 92 TD-LTE commercial networks are in progress or planned



Source: GTI, GSA
As of the end of 2016

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

**504+ suppliers have launched 4717+ TD-LTE terminals,
including 3672+ TD-LTE Smartphones.**

TD-LTE Device Type	Quantity	TD-LTE Device Type	Quantity
USB modems	136	Smartphones	3672+
MiFi/CPE	669	Mobile Tablets	124

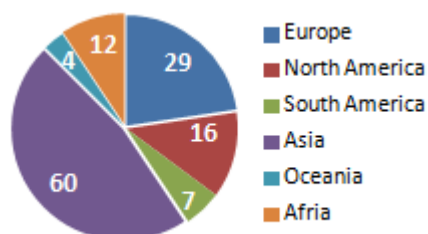
*Source: GTI, GSA, TDIA

*Note: Four Main Types
Of The TD-LTE Terminals

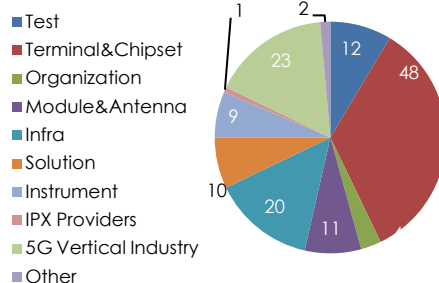
GTI Development Overview

128 Operators and 140 Partners Joined GTI by Mar. 2017

128 Operators



140 Industry Partners



6 MEMBERS ARE IN PROCESS



23 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 | |

GTI Activities

2017 Jan/Feb Mar/Apr May/Jun Jul/Aug Sep/Oct Nov/Dec

**Summit
(2)**

Time: 28th Feb.
(MWC)
Venue: Barcelona, Spain
GTI Summit
(including GTI Awards 2016)

Time: TBD (28th Jun.
(MWCS17)
Venue: Shanghai, China
GTI Summit

**Workshop
(3)**

Time: 23th-24th Feb.
(MWC)
Venue: Barcelona, Spain
The 18th GTI Workshop

Time: TBD (26th Jun.-27th Jun.)
(MWCS17)
Venue: Shanghai, China
The 19th GTI Workshop

Time: TBD (during 25th-28th Sep.)
(ITU Telecom World)
Venue: Busan, Republic of Korea
TD-LTE Technology and Spectrum Workshop

Time: TBD (in Sep.)
Canada/USA(TBD)
The 20th GTI Workshop

**Exhibition
(3)**

27th Feb. -2nd Mar
(MWC)
Barcelona, Spain

28th Jun.-1st Jul.
(MWCS17)
Shanghai, China

25th-28th Sep.
(ITU Telecom World)
Busan, Republic of Korea

**Others
(1)**

Time: 24th 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