



5TONIC

5TONIC startups ecosystem



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Introduction

One of the 5TONIC objectives is to promote **joint project development and entrepreneurial ventures that enrich the 5G ecosystem**. Since created in 2015, 5TONIC has been engaged with several startups in order to help them to develop technologies and products related to 5G, and this is an area in which laboratory members want to step up their activity.

In this White Paper, we review the initiatives 5TONIC has undertaken for promoting the 5G ecosystem with new companies and startups. They have been oriented towards two objectives:

- Support the development of **new technological solutions for 5G**.
- Support the **implementation and deployment of new use cases** that take advantage of 5G capabilities.

In the following sections of this White Paper, we list some of the projects that have been undertaken in the last three years for achieving both objectives above, identified by the startup that was/is/will be involved.

5TONIC is committed to continuing and intensifying this collaboration with other startups, expanding the current ecosystem with new players. For these purposes, interested startups can contact with us at

<https://www.5tonic.org/contact/collaborate-with-us>



New technological solutions for 5G

5TONIC collaborates with new companies in order to test technologies that may be used either for 5G or for future evolutions of mobile communications.



Cohere Technologies is a company founded in 2009 that has developed OTFS (Orthogonal Time Frequency and Space), a patented new modulation that promises to address the most critical issues facing wireless communications today – capacity, coverage, and cost. Cohere was a member of 5TONIC in 2017 and 2018, but after a change in the ownership, the new strategy did not fit with their involvement with 5TONIC.

5TONIC helped Cohere to carry out 3 sets of trials in collaboration with University Carlos III of Madrid and Telefónica during 2017 and 2018. In each trial, new technical features were tested, starting with point to point links, point to multipoint uplink and point to multipoint uplink and downlink. The tests showed OTFS extremely high spectral efficiency and capacity to cope with very challenging propagation conditions, due to high delay spread and Doppler shift.

In the latest and more complete set of tests, carried out at Telefonica headquarters, real time bi-directional multiuser MIMO, with 16 layers, was demonstrated with 16x16 advanced Tomlinson Harashima nonlinear precoding in the downlink, and 16x16 advanced nonlinear joint equalization in the uplink. Cohere also tested the use of Luneburg lens antennas, which provide a low cost implementation of beamforming, as well as centralized baseband processing, which takes advantage of OTFS latency tolerance.

The results obtained demonstrated that OTFS can achieve spectral efficiencies higher than those established for 5G systems (more than 50 bit/s/Hz measured in the tests, versus a target of maximum spectral efficiency defined by 3GPP of 30 bit/s/Hz). Also, it was demonstrated that OTFS can allow increasing the area capacity by just adding additional base stations, using the same frequency resources almost in a linear way.



luzwavelabs

[Luz WaveLabs](#) is a spin-off from University Carlos III of Madrid (UC3M) created in 2013 and is involved in several projects, with both national and European funding. In 2017, Luz Wavelabs was the winner of the first Start-up Competition organized by 5TONIC, aimed at identifying breakthrough technologies with the potential to enhance 5G services and applications, and become a 5TONIC collaborator. The innovative high frequency radio signal generation technology developed by Luz Wavelabs offers tremendous potential to deliver high quality and high bandwidth applications.

5TONIC, with the support of Rohde & Schwarz (also a 5TONIC collaborator), facilitated the testing of Luz Wavelabs pure/ technology, which is a flexible and scalable optoelectronic technology able to generate carrier frequencies in the range 50 to 1000 GHz with bandwidths of 40 Gbps per carrier.

Due to its unique optoelectronic nature, this technology can transfer the modulation capabilities and advances of optical communications to wireless communications, giving great potential for scalability at a reduced Cost of Ownership. The tests demonstrated a usable analog bandwidth of 70 GHz over a carrier of 80 GHz, measured to great accuracy on the Rohde & Schwarz R&S FSW85 high-end signal and spectrum analyzer.

Luz Wavelabs is no longer an independent company but has been recently acquired.



Saguna Networks was founded in 2009 in Israel, with the objective of helping mobile operators monetize, optimize and accelerate their networks with Multi-access Edge Cloud Computing (MEC) solutions.

Saguna has cooperated with 5TONIC members Ericsson, CommScope, and Intel, as well as 5TONIC collaborator ASTI Mobile Robotics, in the implementation of a series of tests demonstrating the use of 5G technology to drive Automated Guided Vehicles (AGVs) around large factories. For these purposes, Saguna provided 5TONIC with its vEdge platform, whose highly integrated micro-services architecture and advanced data processing acceleration technologies helped to minimize the latency for remotely controlled AGVs.



Celling5G is a new telecom infrastructure operator focused in short reach equipment locations for wireless communications. Celling5G became a 5TONIC collaborator in 2019.

5TONIC members Telefónica, Ericsson, IMDEA Networks, and UC3M are collaborating in a joint proof of concept project with Celling5G, in order to test the solution proposed and help further in the development of any equipment required to support the initiative. The project includes the deployment of a small cell within the 5TONIC lab that will be supported by Celling5G's technology in order to carry out feasibility testing and a performance assessment of the solution, prior to any submission to a 5G standards testing authority.



Telcaria is an SME that offers services in SDN and NFV technologies, both in the 5G network environment and in the virtualization of network services. Telcaria has extensive expertise in architectures and protocols for communications networks, giving different solutions for network topology design, forwarding, routing, communication frameworks, etc.

Telcaria is involved in several Horizon 2020 European projects where 5TONIC members are also participating and the lab is a host for different activities, like 5G EVE, 5Growth and 5G Coral (in cooperation with Taiwan). As a result, SDN and NFV infrastructure, developed by Telcaria, is an essential part of the lab network infrastructure, where it has a major role in the management of transport services as well as network slicing.



New 5G use cases

5TONIC has opened up its 5G infrastructure and devices for start-ups to carry out tests and Proof of Concept demos of use cases that take advantage of 5G connectivity. Thanks to these collaborations, the start-ups can accelerate the development of new products and services, reducing costs and taking advantage of 5TONIC members expertise.



Unmanned Technologies Applications S.L. (UTEK), a Spanish start-up company backed by the European Space Agency's business incubator program, was founded in 2016 and became a 5TONIC collaborator in 2019. UTEK specializes in developing high-performance, high reliability, unmanned surface vessels for maritime and naval applications. Its unmanned vessels, known as USVs, are currently developed for environmental, commercial, and military training applications.

Working alongside 5TONIC member companies Telefónica, Ericsson, IMDEA Networks and University Carlos III Madrid, UTEK has already tested the use of LTE for the remote control of its USVs over the Telefónica commercial network in the Pantano de San Juan in Madrid. In the short term, there are also plans for testing the use of the 5G radio. The high bandwidth potential of 5G radio may help both to allow the evolution of USVs to incorporate new sensors that require a higher bit rate, as well as extend the capabilities of current and potential applications. 5TONIC and UTEK will also consider whether the use of processing capacity at the edge of the network could be a means of enabling new, very low latency, marine applications.



Yerba Buena VR is new startup based in Silicon Valley and Madrid, building the next generation Virtual Reality video distribution platform. YBVR has developed a real-time 360 live streaming distribution platform for Virtual Reality of up to 8K optimized for any available bandwidth.

In the context of the H2020 European project 5G EVE, YBVR is developing with SEGITTUR, two use cases related to tourism, video VR and 5G. “Immersive tourism” is the first use case, defined to give an immersive experience of a real event through VR video. YBVR technology is used to capture and replay the event and using streaming over 5G to broadcast the experience to different locations on live, or on demand models. “Virtual tickets” is the second use case to be defined. The limited capacity of venues cannot be more a limitation to sell tickets and get more audience. VR video streaming can give a first-row ticket without any numbering limitation.

Both use cases have been tested at 5TONIC lab before being placed in the field on January 2020 into FITUR, the first appointment of the year for the world’s tourism professionals and the leading trade fair for inbound and outbound markets in Latin America.



Visiona Ingeniería de Proyectos is a technology company, coming from the leading research in diverse technologies, specialized in converting that research into innovative products within the area for which they have been developed.


5TONIC and Visiona IP are working towards collaborating in a use case related to image and video processing taken from drones. This project is still in a definition phase.



5TONIC engagement with startups

5TONIC is committed to continuing its already successful collaboration with startups. This is organically achieved when the search for the technology required for the implementation of a use case results in that it is only or better provided by a startup, or when the use case is proposed by the startup itself. But on top of this, for this purpose, 5TONIC has established several mechanisms that aim to systematize the collaboration establishment:

- The **5G Startup Competition**, that actively promotes the engagement of new businesses in pioneering innovation on Fifth Generation Networks. The first edition was launched in 2016, being awarded to Luz Wavelabs in early 2017. A second edition is scheduled for 2020.
- The cooperation on the context of **European Projects 5TONIC**, mainly those associated with the Horizon 2020 Framework Programme. Usually, EU projects reserve up to 20% of their budget for Small and Medium Enterprises (SMEs). 5TONIC, through its members, is one of the most successful 5G laboratories that aspire to become European testbeds for 5G use cases and can help startups to become part of a consortium if their proposal is of interest.
- The cooperation with the initiatives that some 5TONIC members have established for the support of startups, mainly through the provision of venture capital, but as well through other activities like mentoring, access to exclusive offers from commercial partners, provision of working space, etc. In this sense, we expect to enhance our cooperation with **Wayra**, the open innovation hub by Telefónica, in the short term.



On the other hand, there are some compelling reasons for startups engaging with 5TONIC, among them:

- **Access to world-leading 5G technology and expertise**, that otherwise would be impossible to access. 5TONIC can also provide general purpose processing capabilities and other IT resources for proof of concept tests that can help to lower the development costs for startups.
- Integration in an **open and collaborative environment** that, at the same time, can accommodate their requirements in terms of confidentiality and protection of intellectual property.
- Access to **additional financial resources** through the venture capital programs of its members or participation in European projects.
- **Higher visibility** for the results of the collaboration, given the presence of 5TONIC in events like the Mobile World Congress or the South Summit, as well as the communications resources of 5TONIC members.

For these purposes, 5TONIC is looking at establishing **new collaboration agreements with startups** that may be interested to explore 5G use cases and technology.

If you are interested to be part of 5TONIC startup ecosystem, please fill-up the collaboration request at our website:

<https://www.5tonic.org/contact/collaborate-with-us>

About 5TONIC

5TONIC is an open research and innovation laboratory focused on 5G technologies founded by Telefónica and IMDEA Networks based in Madrid.

The goal of 5TONIC is to create a global open environment where members of industry and academia work together on specific research and innovation projects related to 5G technologies in order to boost technology and innovative companies.

The laboratory promotes the development of joint projects, in addition to entrepreneurial projects, discussion forums, events and conferences in an international environment.

Among the members that are part of the laboratory are:

Founders:



Members:



As a fundamental part of their activity, 5TONIC scientists actively contribute to the development of 5G in a series of European research projects. This research is carried out in collaboration with the main infrastructure and equipment suppliers, international operators, research institutes and leading universities, as well as SMEs. These projects are aimed at empowering vertical industries such as Industry 4.0, Transportation or Energy. Some of these projects are: 5GROWTH, 5G-VINNI, 5G EVE, 5RANGE, 5GENFIRE or 5GTRANSFORMER.

About 5TONIC

5TONIC was founded by Telefónica and IMDEA Networks Institute with a clear vision to create an open research and innovation ecosystem laboratory in which industry and academia come together to boost technology and business innovative ventures. The laboratory promotes joint project development, joint entrepreneurial ventures, discussion fora, events and conference sites, all in an international environment of the highest impact. 5TONIC serves to show the capabilities and interoperation of pre-commercial 5G equipment, services, and applications, by leading global companies in the 5G arena. The laboratory was recently awarded Digital Innovation Hub status by the European Commission.

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5TONIC

5TONIC - IMDEA Networks Institute

Avenida del Mar Mediterráneo, 22

28918 Leganés (Madrid), Spain

Tel: +34 91 481 62 10

Fax: +34 91 481 69 65