D6.2

INTERMEDIATE REPORT ON DISSEMINATION AND EXPLOITATION ACTIVITIES

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DELIVERABLE D6.2 INTERMEDIATE REPORT ON DISSEMINATION AND EXPLOITATION ACTIVITIES

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Executive summary

This deliverable provides a broad overview of the communication, dissemination and exploitation activities implemented within the 5G-SMART project within the first 18 months of the project. After describing the Covid-19 measures taken by the consortium, this deliverable identifies important events, meetings and workshops by consortiums, alliances and government agencies in which the project contributed and participated.

More than 10 papers, 18 contributions to standards, 3 keynotes in major conference, the participation in 10 5G industrial events, 3 workshops and 5 demos, show the high implication of the project in the dissemination of achieved results.

A detailed exploitation strategy for the project, as well as exploitation plans for individual partners, was presented in the previous deliverable D6.1. Based on those plans, in this deliverable we carry out an evaluation of the 5G-SMART project's dissemination and exploitation activities made so far. Moreover, this deliverable provides information about the dissemination and exploitation activities planned for the rest of the project.

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1 Introduction

After describing the Covid-19 measures taken by the consortium, this deliverable presents important events, meetings and workshops by consortia, alliances and government agencies in which the project contributed and participated. This deliverable then describes the project's dissemination plan for the rest of the project implementation.

Communication, dissemination, and exploitation are tasks of high importance in 5G-SMART, as it is recognised that they are crucial elements to increase visibility and the impact of the project. With the outbreak of the Covid-19 pandemic, severe adjustments had to be made to the original plans of 5G-SMART for communication and dissemination. The quickly changing situation of decreasing possibilities to publicize the projects results through the usual channels such as conferences, trial open days, training activities, etc. during the pandemic outbreak, required a fast reaction of the project on finding alternative ways and creative solutions to continue to show the impact and benefits of the project.

In this deliverable, the following distinctions are made between communication, dissemination, and exploitation tasks:

- The communication plan aims to describe the planned efforts in terms of communication done by the 5G-SMART project. The goal is to reach out to society and show the impact and benefits of this project. This is achieved through different activities and communication channels, that are used to inform on and promote the project and its results to different audiences.
- The dissemination strategy provides a clear plan on how knowledge and results obtained in 5G-SMART are transferred to potential users, including, for instance, the scientific community, industrial partners, and policymakers.
- The exploitation plan of 5G-SMART provides a strategy on how the project results can be effectively used, not only by project partners themselves but as well other user groups, organisations, etc., outside the project. 5G-SMART has a special emphasis on assuring a high impact of the project on standardisation and regulatory bodies.

1.1 Objective of the document

The objective of this intermediate report on the communication, dissemination and exploitation activities is to provide a thorough overview of the executed activities from the start of the project until October 2020. This also includes a description and preliminary evaluation of the adjustments of the activities made due to the Covid-19 outbreak. Furthermore, the project's plans on communication, dissemination, and exploitation activities for the remainder of the project are outlined.

1.2 Target audiences of 5G-SMART

The target audiences of 5G-SMART can be split into four, possibly overlapping, groups. For each of the target audiences, adequate communication channels have been identified in D6.1 [5GS19-D61]. These are summarized in Table 1-1. Several of the mechanisms identified at the beginning of the project have been shown to be impossible during the Covid-19 pandemic. These include, fairs, conferences, trade shows, etc., that have been cancelled. Other conferences in the project were also replaced by online events, like IEEE (Institute of Electrical and Electronics Engineers) Wireless Communications and Networking

Conference (IEEE WCNC), IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (IEEE PIMRC) or the first 5G-SMART open day. Channels such as social media have received an increased emphasis.

Target Audiences	Mechanisms	Channels
Academia, Industry R&D, Public R&D (OT)	Peer reviewed journals, white papers, fairs	Including but not limited to IEEE Transactions on Industrial Electronics, IEEE Transactions on Instrumentation and Measurement, CIRP Journal of Manufacturing Science and Technology, CIRP annals of manufacturing technology
Academia, Industry R&D, Public R&D (ICT)	Peer reviewed scientific and technology conferences and journals	Including but not limited to IEEE Communications Magazine, IEEE WCNC, IEEE/IFIP international conference on dependable systems and networks
ICT and verticals business stakeholders	Trade shows	Including but not limited to Hannover Fair and Mobile World Congress, Control Fair in Stuttgart, EMO, IMTS and JIMTOF
General public	Press releases, social media	Project website, LinkedIn, Twitter, Facebook, YouTube

Table 1-1: Targeted 5G-SMART audiences and communication channels

1.3 Relation to other documents

This document builds on deliverable D6.1 [5GS19-D61], which provides a detailed overview of the project's dissemination, communication, and exploitation strategy at the project start. Since the main strategy remains the same, the reader is referred to D6.1 for the description of the original plans. This deliverable focuses on providing an overview of the progress and the adjustments made.

1.4 Structure of the document

This document is structured as follows: Section 1 provides a general introduction to the deliverable and lists the target audiences of 5G-SMART. Section 2 discusses the measures taken by the 5G-SMART consortium to adapt to the changed circumstances due to the Covid-19 outbreak. Section 3 summarises the status and updated plans with respect to 5G-SMART's communication activities, while section 4 focuses on 5G-SMART's dissemination activities. Section 5 presents the 5G-SMART exploitation plan and the exploitable results at partner and at consortium level. Finally, in the last section, the deliverable is summarised, and conclusions are presented.

2 Adjustments of the project's communication, dissemination, and exploitation strategy due to the Covid-19 pandemic

The Covid-19 crisis has had significant impact on 5G-SMART, not only on the execution of the project, but also on the way project results are communicated, disseminated, and exploited.

Due to the cancellation of several major events and conferences, 5G-SMART has missed important opportunities to be exposed to a wider audience. Table 2-1 lists all scheduled events of 5G-SMART project and gives more information about the status of the event if it was held or cancelled/altered due to Covid-19 restrictions.

Date	Title	Status
13th October 2020	Trial open days	1 event held as an online event
2021- no date yet	Orange Research Exhibition	Cancelled
June 2021	Mobile World Congress	Cancelled
2021- no new proposed date yet	Hannover Fair	Cancelled
24-26th November 2020	Smart Production Solutions Drive in Nuremberg	Held as an online event
4-7th May 2021	Control Fair in Stuttgart	Cancelled
26-29th October 2020	Fraunhofer Solution Days	Held as an online event
15-18th June 2020	EuCNC	Held as an online event
2021- no date yet	EMO, IMTS, JIMTOF	Cancelled
14-17th October 2020	BI-MU	Held
14th October 2020	5G-PPP event	Held as an online event
11-12th November 2020	5G Techritory 2020	Held as an online event
24-26th November 2020	5G-ACIA at the SPS connect- The digital automation hub event	Held as an online event
3-5th November 2020	5G-ACIA 15th Plenary Meeting	Held as an online event

Table 2-1: All scheduled participations of 5G-SMART

With respect to the conferences that moved to an online format, allowing for the event to take place, it is still noticed that the number of participants and the type of interaction at these events is negatively

impacted by the Covid-19 crisis. For that reason, the focus was put on the dissemination through webinars, and publications in journals and white papers.

5G-SMART realized early on that alternative plans are needed to be made quickly to assure a continued progress with respect to communication, dissemination, and exploitation. Therefore, the following adjustments were made:

- In March 2020, some budget was shifted to reinforce communication activities. With this budget, filming activities have been started, that document the progress and results of the project at the trial sites. Until October 2020, professional photos and movies have been taken from the 5G deployment and channel measurement activities at the Reutlingen trial site. Furthermore, initial photos and movies have been taken at the Kista trial site. The overall goal is to use these photos and movies during the rest of the project to better illustrate the project's results and activities, especially when trial site visits are not possible. The filming activities will continue during the remaining project times, being an asset also when physical meetings are possible again.
- With tradeshows and fairs being cancelled, another emphasis of the project has been to organize live demos in connection with webinars and other activities. To reach a wide audience, all of these have been published on the project's YouTube channel. The project will continue using social media to increase the outreach of project's activities and results.
- To compensate for the lower number of dissemination and communication activities, 5G-SMART has started a series of webinars that focuses both on research aspects as well as trial activities. So far two such webinars have been held.
    - The "5G for smart manufacturing – Industry and 3GPP RAN latest status" was the first webinar meeting held by 5G-SMART on 22 September 2020. Approximately 95 participants connected, coming mainly from the ICT field, and we received several requests for additional information through our social media with more than 250 views. The recording is available via https://youtu.be/5hatXCmMcPc.
    - The "5G-SMART Webinar on 5G Process Monitoring in Manufacturing" was held on the 13th of October 2020. Approximately 82 attendees were online during the live stream and the recording is available via https://www.youtube.com/watch?v=puoFAayVpZk .
    - The project has concrete plans on continuing the series with webinars on the results of new 5G features, as well as demos from the trial sites.
- Due to the frequent cancellation of conferences during the pandemic outbreak, the project has encouraged partners to focus their dissemination from conference papers to journal papers. Furthermore, whenever possible, conference presentations are uploaded on the project's YouTube channel to increase the reached audience. Following this approach, several conference paper presentation given at PIMRC 2020 have been published on the project's YouTube channel: https://www.youtube.com/channel/UCdhRYuUuSfT97tIivMGLRIg

3 Communication strategy

The communications strategy of the 5G SMART project aims to share the goals and methods of the consortium's outreach activities, with the target audience. The following goals were set in the communication strategy:

1. To communicate to our audience why 5G-SMART's results are relevant to them:
    - To give visibility to the project vision, aims, activities and results at all levels.
    - To promote the exchange of knowledge regarding the introduction of 5G into the manufacturing industry.
    - To raise public awareness about the project key facts and findings while demonstrating the readiness of 5G in the manufacturing context.

2. To reach the specific target audience, where the project findings are mostly relevant, and can have the most impact:
    - To identify the best channels of communication where these audience groups can be reached.
    - To build a project network that involves relevant stakeholders throughout Europe.
    - To attract the project's audience to our online platform for dissemination via webinars.

3. To reflect our project's goals and values:
    - To facilitate the transferability and applicability of the project results for organizations and stakeholders outside of the project.
    - To promote transparency and accountability throughout the project.

In the following subsections, the status of the communication activities of the project up until October 2020 are presented.

3.1 Printed materials and press releases

The project poster and leaflet were designed during the first five months of the 5G-SMART implementation and have been used at various occasions by all partners. All materials contain references to the online sources of 5G-SMART. Concerning the press, contacts were established with the relevant trade press (see Table 3-1 for the specific press sources) to extend the reach of the communications activities, and several press releases have been made by the project and partners. A first periodic newsletter was published including information about the latest achievements of the project and links to recent public deliverables and forthcoming events. Newsletters are published on a yearly basis. The first newsletter is available online via the following URL: https://5gsmart.eu/wp-content/uploads/2020-newsletter-5G-SMART-v1.0.pdf

All press releases made in relation with 5G-SMART since the beginning of the project are listed in Table 3-1. More press releases are planned for the remainder of the project.

Date	Title	Links
11/06/2019	EU-project 5G-SMART shows how 5G boosts smart manufacturing	https://www.marposs.com/eng/news/eu-project-5g-smart
12/05/2020	Elektronik online journal	http://www.elinor.se/borja-5g-resan-redan-idag-med-4g-lte.html/
20/05/2020	L'embarque	http://www.lembarque.com/lancez-vous-dans-la-5g-des-aujourdhui-mais-avec-la-4g/lte_010009
18/06/2020	ETN journal	http://www.etn.fi/10897
22/06/2020	Enterprise IoT Insight	https://enterpriseiotinsights.com/20200806/channels/news/bosch-ericsson-hone-5g-for-manufacturing
26/06/2020	Seminet Korea	https://www.opensignal.com/reports/2020/06/southkorea/mobile-network-experience-5g
01/08/2020	5G PPP Progress Monitoring Report – 2019	https://5g-ppp.eu/wp-content/uploads/2020/10/5G-PPP-PMR2019v1-6.pdf
06/08/2020	Bosch launches 5G tests at Reutlingen	https://www.bosch-presse.de/pressportal/de/en/bosch-launches-5g-tests-at-reutlingen-wafer-fab-209216.html?fbclid=IwAR0swS5l7-jdEKchZ5Uv7DnoYw3p2Gydfh6knZ4xdwPSM3-ob5esDYaKRb0
17/08/2020	1st year 5G-SMART newsletter	https://5gsmart.eu/wp-content/uploads/2020-newsletter-5G-SMART-v1.0.pdf

Table 3-1: 5G-SMART press releases

3.2 Project website

The 5G-SMART public website is the central hub for communication with different parties, and is hosted behind the following URL: https://5gsmart.eu/. The public website presents the 5G-SMART project, including news, events, project description, consortium information and public deliverables of the project. Information about the project is provided on different levels of technical detail, thus addressing multiple groups of audiences at the same time. In compliance with the European Commission (EC) open access policy [EU19], open access to all scientific publications created in the project will be ensured through the

website, and when publishers are involved, the submitted papers will be made available in compliance with the rules of the publisher.

The web design is structured to make it intuitive and easy to navigate. The current version is consistent with the project's graphical identity. The website was launched in August 2019 and is constantly expanding with news, links, events, communication materials, deliverables, and publications.

A summary of the visitors is a part of this report. Since mid-October 2019 statistics are being collected, which allow us to detect during the lifetime of the webpage an average of 10 visitors per day, mainly from the USA, followed by Germany and France. This statistic demonstrates that the project website represents a reference point for partners, stakeholders and public audience who want to get or give information on the project activities and is a well-accepted means of communication.

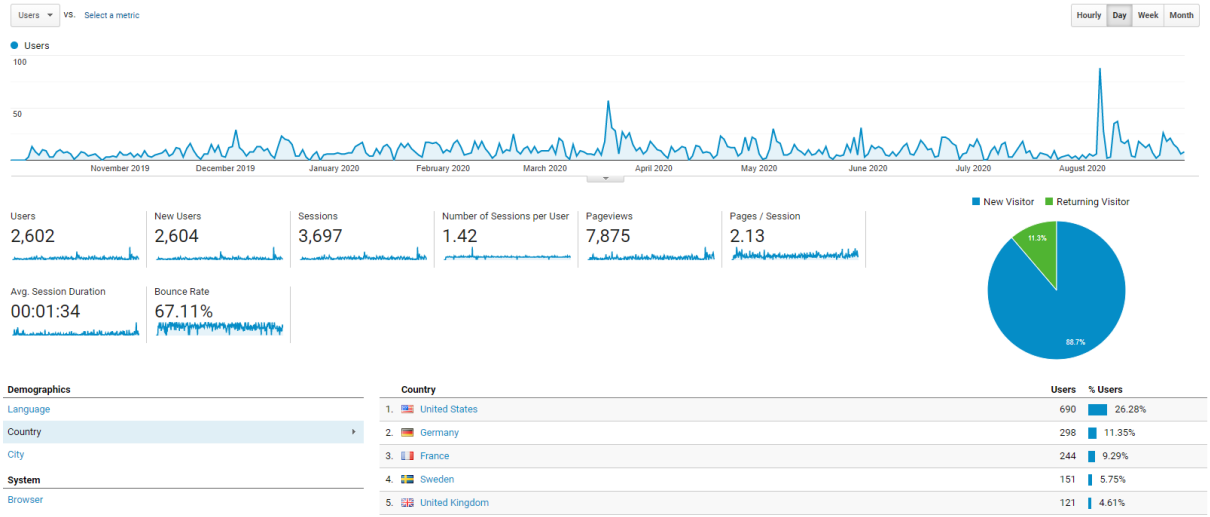

Figure 3-2: Summary of 5G-SMART website visitors

3.3 Social media

To ensure the largest possible exposure of the project to a wide audience, and to build a community, different social media and networking tools have been used in the project, including LinkedIn and Twitter. Considering the development of the Covid-19 pandemic, this early decision was quite beneficial and publishing on social media platforms has become even more important than anticipated. The project's YouTube channel captures presentations from e.g. industry forum demonstrations, workshops, and test-bed trials. The chosen media and networking tools allow two-way interaction with the project and are, therefore, particularly interesting for 5G-SMART. Moreover, social media is considered of major relevance for the project to reach younger scientists who are in an early stage of their career. To improve the search engine ranking, all social media accounts are interconnected with the project website. The success of the social media presence of 5G-SMART is continuously monitored and regularly evaluated using both quantitative measures obtained through numbers, e.g. by Twitter Analytics, and qualitative measures, e.g. by evaluating the types of comments received.

The activity in 5G-SMART's social media platforms as of October 2020 is summarized in Table 3-3. As shown in Table 3.3, there are inputs, interactions, and impressions expressed in numbers. Inputs mean the number of posts, tweets or videos posted until November 2020 on the project's social media platforms. Social interactions measure the effectiveness of our social media campaigns. It represents communication (i.e.: comments, messages, etc.) between visitors of a 5G-SMART social media channel. Every platform has specific interactions such as 'mentions' on Twitter or 'likes', 'comments', and 'shares' on LinkedIn or YouTube. Impressions mean the total number of times the 5G-SMART content was displayed to people, regardless, whether it was clicked on or not.

	LinkedIn	Twitter	YouTube
Inputs	14	33	6
Interactions	1.5K	642	22
Impressions	4.2K	13.7K	1.0K

Table 3-3: Activity on 5G-SMART social media channels

A further analysis per medium is given in the following sections.

3.3.1 Twitter

The project is using Twitter as a key tool for communication. The Twitter channel can be accessed via:

https://twitter.com/5g_smart

Here, short comments, announcements, news, and other content relevant for a larger audience are shared. The engagement rate on the project's Twitter channel is relatively high (interactions/impressions are over 4%) with 181 current followers, and 33 inputs which shows that the news, videos, and other contents uploaded to this platform are mostly reaching the relevant users.

The goal for the rest of the project is to increase the number of followers with relevant content uploaded to the channel regularly. Furthermore, with the number of project results increasing due to advanced stages of the project implementation, the increase in the number of uploads is also expected.

3.3.2 YouTube

The project's YouTube channel called 5G-SMART is accessible via:

https://www.youtube.com/channel/UCdhRYuUuSfT97tIivMGLRIg

The channel has gained over 7875 page views, from the time it was started, which is a relatively high reach, considering the amount of content currently available, and relatively short time being in use. Since the YouTube channel of the project is used for sharing the presentations and raising project awareness in general, a relatively high 'New Visitor' number is desirable. The 67,11% bounce rate (meaning the average number of bounces across the entire site divided by the total number of visits on the site in the first 18 months of the project) is considered an average ratio, which means that the 5G-SMART YouTube channel content is attracting mostly the audience, and provides interesting content to these users.

For the remainder of the project, the aim is to slightly reduce the bounce rate, increasing the number of page views, and the average session lengths. This will be achieved by constantly refreshing the site with the newest presentations, videos from the webinars, workshops, and testbed trials.

3.3.3 LinkedIn

A business channel on LinkedIn has been created under the following URL:

https://www.linkedin.com/company/5gsmart/

Here, news, events, and relevant information are shared on a regular basis targeting a professional audience. Similar to the Twitter channel of the project, the LinkedIn one also performs well in terms of engagement rate compared to a relatively low amount of content, which signals that the posts are relevant to the followers. Therefore, for the remainder of the project the goal will be to keep on uploading the news regarding the 5G-SMART project regularly.

4 Status and updates of the dissemination plan

In this chapter the objectives based on the deliverable D6.1 are reviewed, and the current status of dissemination activities is presented. Furthermore, the updated plans in terms of dissemination are described. 5G-SMART has a multi-fold dissemination strategy to provide relevant information to all stakeholders and facilitate market adoption of the project's results. The main strategies highlighted from D6.1 are to:

- Cooperate with other 5G-PPP research projects and disseminate the project results through the 5G-PPP and 5G-ACIA associations.
- Create synergies with the OT players, putting together the telecommunications industry and the industrial communities. This is achieved by working with relevant industrial alliances and related standards development organisations, and through demonstrations at relevant trade events that are specialized in Industry 4.0.
- Communicate with the research community through scientific publications and presentations at scientific conferences and workshops.
- Communicate with the regulators and standardisation bodies to raise awareness of the project results.

To have a clear goal, these dissemination activities have been translated into target values, which are listed in Table 4-1.

Dissemination activities	Target values	Current status
Journal papers, white papers and international conference papers	20	10
Contributions to standards and regulatory bodies	30	18
Keynotes and panels in major conferences	10	3
Participation in 5G for industry events and forums in Europe and worldwide	10	10
Workshops in major conferences	5	3
Training activities	5	2
5G demos and validations events	3	5

Table 4-1: Planned dissemination activities with target and current values

Dissemination status shows good progress, apart from participation in major conferences, for obvious reasons. Several training activities are planned and held by 5G-SMART, to attain a thorough cross-domain knowledge and understanding of communications and operation management. Both academic and industrial partners contributed to these training activities, but some of the previous ideas such as the whole student community would have the chance to join an academic event, can come true only within a framework of an online platform. The courses are planned to be recorded and broadcasted via the project's YouTube channel to maximise the audience and impact on the training activities.

5G-SMART dissemination targets are kept unchanged, despite the pandemic situation, but events are run online.

Another aspect of the dissemination activities includes interacting with other projects within H2020 and beyond. Of course, all 5G-SMART partners are subscribed to cooperation in the framework of 5G-PPP and specific links of communication will be established due to the interrelation among the topics with 5Gang, H2020 SERENA, H2020 PRIMO-5G, H2020 FORCE and ICT-17 projects on automation.

Tables 4-1 to 4-5 list all the dissemination work by 5G-SMART since the beginning of the project.

4.1 Accepted papers/book chapters

Authors	Title	Event	Status
Meriem Mhedhbi, Mira Morcos, **Ana Galindo-Serrano**, Salah Eddine Elayoubi	Performance Evaluation of 5G Radio Configurations for Industry 4.0	WiMob 2019	Published
Saúl Inca, Danaisy Prado, David Martín-Sacristán, **Jose F. Monserrat**	Channel Modelling based on Game Engines Light Physics for mmW in Indoor Scenarios	EuCAP 2020	Published
Gábor Soós, Dániel Ficzere, **Sándor Veress**, Pál Varga	Discussion on Private Campus Networks - Privát mobil hálózatok az iparban	Life and Science magazine	Published
Gábor Soós, Dániel Ficzere, Pál Varga	Investigating the network traffic of Industry 4.0 applications – methodology and initial	IEEE Conference of Network and Service Management , 2020	Published
Pierre Kehl, Dirk Lange, Felix Maurer, **Gábor Németh**, Daniel Overbeck, Sven Jung, **Niels König**, Robert Schmitt	Comparison of 5G Enabled Control Loops for Production	PIMRC'20, London, 31 August-3 September 2020, Virtual Conference	Published
Sarah S. Schmitt, Praveen Mohanram, Roberto Padovani, Niels König, Sven Jung, Robert Schmitt	Meeting the Requirements of Industrial Production with a Versatile Multi-Sensor Platform Based on 5G Communication	PIMRC'20, London, 31 August-3 September 2020	Published

Raphael Kiesel, Robert Schmitt	Requirements for Economic Analysis of 5G Technology Implementation in Smart Factories from End-User Perspective	PIMRC'20, London, 31 August-3 September 2020, Virtual Conference	Published
István Gódor, Michele Luvisotto, Stefano Ruffini, Kun Wang, Dhruvin Patel, Joachim Sachs, Ognjen Dobrijevic, Daniel P. Venmani, Olivier Le Moult, **Jose Costa-Requena, Aapo Poutanen, Chris Marshall, and János Farkas**	A Look Inside 5G Standards to Support Time Synchronization for Smart Manufacturing	IEEE Communications Standards Magazine	Published

Table 4-2: 5G-SMART published papers and book chapters

4.2 White papers and technical reports

The white paper 5G E2E Technology to Support Verticals URLLC Requirements was published by NGMN on the 31st of October 2019. It was co-authored by Ana Galindo-Serrano and Berna Sayrac, among others. A second white paper on vertical industries was also published in conjunction with other projects from 5G-PPP in August 2020.

Date	Organization	Title
31/10/2019	NGMN	5G E2E Technology to Support Verticals URLLC Requirements
20/08/2020	5G PPP	Empowering Vertical Industries through 5G Networks - Current Status and Future Trends

Table 4-3: 5G-SMART white papers

4.3 Standard contributions

Date	ID	Body	Title	Contributors	Status
17/06/2019	[C1250]	ITU-T	Proposal for G.8271.2	Orange, Huawei Technologies Co., Ltd.	Private
17/06/2019	[C1253]	ITU-T	Proposal for the scope of G.8275.1, G.8273.2 and G.8275.2	Orange, Huawei Technologies Co., Ltd.	Private
18/06/2019	[C1500]	ITU-T	G.8271.1 Appendix: Generalized HRMs for fronthaul cluster synchronization	Orange	Private
18/06/2019	[C1501]	ITU-T	G.8271.1 Appendix XII.5: Relative Time error allocation	Orange	Private
18/06/2019	[C1503]	ITU-T	Recommendation to use of UTC time scale in ITU-T Q13 documents	Orange, Deutsche Telekom AG	Private
02/10/2019	[WD13-15]	ITU-T	Noise accumulation of Cascaded media converters - G.8273.2 Appendix V	Orange, Microsemi, Deutsche Telekom, A1 Telekom Austria, China Mobile Communications Corporation	Private
02/10/2019	[WD13-16]	ITU-T	WD-GNSS edits	u-blox, Orange, Microsemi, Nokia	Private
02/10/2019	[WD13-33]	ITU-T	Fiber wander reduction [G.8261]	Orange, Huawei Technologies Co. Ltd., Ministry of Industry, and Information Technology (MIIT)	Private

02/10/2019	[WD13-78]	ITU-T	Inter-operator TDD synchronization - G.8271, Appendix VI	Orange, Deutsche Telekom	Private
02/10/2019	[WD13-79]	ITU-T	Synchronization Accuracy for OTDOA	Orange	Private
24/02/2020	S2-2002604	3GPP	MDBV mapping and configuration for TSC QoS Flow	Ericsson	Public
17/03/2020	SP-200094	3GPP	Study on enhanced support of Non-Public Networks	Ericsson	Public
20/04/2020	S2-2003228	3GPP	Alignment of traffic forwarding information	Ericsson	Public
01/06/2020	S2-2004639	3GPP	UE-UE communication based on generalized Ethernet model	Ericsson	Public
17/08/2020	Tdoc R1-2005517	3GPP	Propagation Delay Compensation Enhancements for Time Synchronization	Ericsson	Public
17/08/2020	Tdoc R2-2006701	3GPP	Enhancements for support of time synchronization	Ericsson	Public
19/08/2020	S2-2005884	3GPP	PSFP clarifications including IEEE LS response on TSN support	Ericsson	Public
19/08/2020	S2-2006004	3GPP	TSN stream information provisioning from CNC to 5GS	Ericsson	Public

Table 4-4: 5G-SMART standard contributions

4.4 Panels, workshops, and events

Date of event	Name	Title
21/06/2019	EuCNC Valencia	5G-SMART
24/06/2019	Ericsson Innovation Day	Wireless Tool Wear Monitoring
30/09/2019	5G World Forum	5G-SMART and Industry 4.0
10/10/2019	2nd 5G World Summit, Barcelona	5G Deployment Panel

15/10/2019	Vocational Evening Stories at ELTE university	5G-SMART
23/10/2019	MWC Los Angeles	IoT in Manufacturing: Automation, Optimisation and Robots
05/11/2019	Hungarian Science Festival organized by Hungarian Academy of Sciences	5G SMART
05/11/2019	European Industry Partnerships - Lighthouses to Thrive in the New Digital Age	5G for Smart Manufacturing
28/11/2019	5G Techritory - Riga	The Role of 5G for the Manufacturing Industry
21/01/2020	5G-ACIA Plenary Meeting	5G-SMART
28/01/2020	IRACON Meeting	Quo Vadis, Wireless: An Industrial Automation Perspective
30/01/2020	5G-ACIA kick-off meeting on "5G integration with TSN for industrial automation"	5G-SMART 5G Time Synchronization
23/06/2020	IIC Meeting	Industrial internet
01/09/2020	5G World 2020 Summit	5G-SMART

Table 4-5: 5G-SMART participation in panels, workshops, and events

4.5 5G Demos and validation events

To accelerate the adoption of 5G into manufacturing processes, an essential part of the dissemination activities is 5G demos and validation events. However, due to the Covid-19 outbreak most of the demo and validation events have been cancelled in 2020. In this section all targeted 5G demo and validation events are listed, commenting on in what way 5G-SMART has been able to or plans to participate in these events. While it is still unclear whether 5G-SMART will be able to organize or attend physical events during 2021, it is clear that any such event needs to follow guidelines guaranteeing maximum safety for works, organizers, exhibitors, visitors and suppliers.

4.5.1 Trial open days

5G-SMART planned at project start the organization of three trial open days targeting different communities, among these are standardisation organisations like 5G-ACIA, automation associations, and small and medium-sized enterprises (SMEs) across Europe within the manufacturing area. Trial open days are project events that include presentations of 5G-SMART results, workshops, and most importantly live

demonstrations of 5G trial use cases. The trial open days are meant to strengthen the 5G-SMART impact on standardisation work. Moreover, they create greater awareness of 5G integration into manufacturing use cases, and thus contribute to a faster adoption of 5G in the European manufacturing sector. Two trial open days were originally planned to take place at the Aachen trial site, while one trial open day was planned to take place at the Kista trial site.

Due to the Covid-19 outbreak, the first trial open day, at the Aachen premises, was moved to an online event and held in the format of a webinar: "5G-SMART webinar on 5G process monitoring in manufacturing ", on the 13th of October 2020. There were over 82 participants in the webinar. The topic was the inclusion of 5G in a factory and the demonstration of two examples of relevant application, including a drilling machine sensor and a multi-purpose 5G communication hub. A number of companies joined the event and the Q&A slot stressed the huge interest of the industrial players to move forward with the incorporation of the 5G into their manufacturing processes. The recording of the open day can be found at https://youtu.be/puoFAayVpZk. While the organization of a physical form of the next two trial open days of 5G-SMART is preferred and still planned for, the project has alternative plans ready to change these trial open days to an online format.

4.5.2 Orange Research Exhibition

Every year, Orange welcomes more than 4,000 visitors during its annual Research Exhibition that runs for three days at its innovation eco-campus in the Paris region. The exhibition, which hosts many discussions between Orange employees and external visitors, is an opportunity for Orange researchers to share their work. The 2019 edition showcased 37 presentations and 200 demonstrators over three days. The show in 2020 was cancelled, but the expectations are to make it again in 2021, either online or as a physical event.

Factories of the future, and particularly smart manufacturing, is one of those focus areas where Orange is putting significant emphasis through its research and development activities with the ambition of building new skills, engaging Orange in dynamic ecosystems, promoting high quality intellectual property, and developing or testing new technologies. In this context, Orange aims at showcasing a chosen set of 5G-SMART experimentations at its annual Research Exhibition in 2021 to promote the project's innovations both internally (Orange employees) and externally (B2B clients, suppliers, government agents, regulators, etc.).

4.5.3 Mobile World Congress 2021

The Mobile World Congress (MWC) is the largest exhibition for the mobile industry, featuring players from the end-to-end mobile ecosystem. Promotional material was provided for MWC 2020, although the event was finally cancelled. The edition of 2021 has been moved to June, and 5G-SMART is planning to participate actively in the event, although initially we were not registered as exhibitors since 5G-PPP opted for projects ending in 2020.

4.5.4 Hannover Fair 2021

Hannover trade fair is the largest industry trade show in the world. Since a few years back, digitalization aspects have gained importance for this trade show. In 2018, Fraunhofer IPT for the first time showed 5G in operation for a manufacturing application, followed by 2019 with a dedicated 5G arena, which was

positioned in a new hall. 5G-SMART was given the opportunity to present at the EU booth, but the edition of 2020 was cancelled without any online replacement. The project aims for a presence at the Hannover fair in 2021.

4.5.5 Smart Production Solutions Drive in Nuremberg

Smart Production Solutions (SPS) is a major international trade show in the field of industrial automation, which is being held every year in Nuremberg, Germany. In 2018, the SPS hosted more than 1600 exhibitors and attracted more than 65,000 visitors from around the world. The event covers the latest technological trends around industrial automation, including, for example, industrial real-time control, industrial PCs, programmable logic controllers (PLCs), industrial Ethernet, TSN, and real-time industrial OS and hypervisors, which are all relevant topics with respect to the scope of 5G-SMART. Accordingly, SPS can serve as an important platform, for the OT partners in the project, to disseminate the achievements of 5G-SMART. The SPS Drive is held online from 24-26th November 2020 in an online format. The dates for this event have not been released for 2021, but 5G-SMART is planning to participate in this event.

4.5.6 Control Fair in Stuttgart

Control Fair is the largest trade show dedicated towards metrology and quality assurance in Germany. Fraunhofer IPT, as a member of the Fraunhofer Alliance Vision, takes part as an exhibitor since 1998, showing its current developments in metrology. For 2021, 5G-SMART is planning to demonstrate 5G sensor prototypes developed within 5G-SMART.

4.5.7 Fraunhofer Solution Days

Due to the cancellation of many exhibition events, Fraunhofer decided to organize its own virtual conference and exhibition on 26-29th October 2020. Part of the program is a presentation about the 5G-Industry Campus Europe, which will be held by Fraunhofer IPT together with Ericsson in Germany as well as a virtual booth, which also offers the possibility for live demonstration of the sensor solutions developed within 5G-SMART. The latter will also be mentioned during the presentation, which will take an exposed position directly after the keynote speech of the Fraunhofer President. A video on the event can be found at https://www.youtube.com/watch?v=pb0j2FIb-R4.

4.5.8 EuCNC

The European Conference on Networks and Communications (EuCNC) is one of the most prominent communications and networking conferences in Europe and is supported by the European Commission. 5G-SMART has been presented at EuCNC on 15-18th June 2020 (https://www.youtube.com/watch?v=YaTTPl5axk4&t=66s). A special attention will also be given to EuCNC 2021 in Lisbon by preparing not only 5G-SMART presentations but also demo material.

4.5.9 Other trade shows

EMO (European trade show for manufacturing in Hannover), BI-MU (Biennale della Macchina Utensile in Milan), IMTS (International Manufacturing Technology Show) and JIMTOF (Japan International Machine Tool Fair) are the most important trade shows for machine tools and production equipment in Europe, Italy, USA, and Asia, respectively. 5G as an enabler for manufacturing is well suited to be showcased in

connection with machine tool companies, e.g. Georg Fischer (GF), Makino, and DMG Mori. Apart from BI-MU, the exhibitions have been postponed to 2021. BI-MU was held in Milan, Italy, from the 14th to 17th of October 2020. 5G-SMART's poster was shown, and leaflets have been distributed. For the 2021 versions, 5G-SMART is planning to show sensors in live machining operation in a machine tool, as a guest exhibition at the booth of a machine tool supplier.

4.6 Scientific publications

The 5G-SMART partners are maximising the scientific visibility of the results obtained within 5G-SMART by publishing papers at major conferences organised by IEEE, as well as other relevant conferences, and in high impact journals. Depending on the targeted society, different conferences and journals are used for dissemination of the results. The list of journals specific for vertical industries and conferences of interests specified in D6.1 has not changed, and the project expects to continue submitting contributions also in the remainder of the project.

All accepted papers/book chapters and white papers/technical reports made by 5G-SMART during the first part of the project are listed in Table 4-2 and Table 4-3.

4.7 Workshops and presentations

Workshops and presentations are an important part of 5G-SMART's dissemination activities. The original plans on 5G-SMART's strategy have not been changed since the beginning of the project. So far, a workshop on 5G Mobile Communication System for Smart Factories (5G Smart Factories) was organized by 5G-SMART, collocated with PIMRC 2020 (see 5G-SMART YouTube channel for an extract of some of the presentations at the event). The project will continue to aim for organizing workshops in parallel with IEEE conferences and other relevant events. This includes for instance participation at EuCNC, 5G-PPP and 5G-ACIA events, as well as training and teaching activities.

Table 4-5 lists all panels, workshops, and event participations of 5G-SMART in the first project part.

4.7.1 5G-PPP events

The 5G Infrastructure Public Private Partnership (5G-PPP) is a joint initiative between the European Commission and European ICT industry. 5G-SMART is part of the technical board, steering board and represented in relevant working groups ("Trials" WG, "Pre-Standardization" WG, "Vision and Societal Challenges" WG, "5G Architecture" WG, "Test, Measurement and KPIs Validation" WG). Physical workshops and 5G-PPP events have been limited along 2020, but 5G-SMART participated in all suitable online events. For instance, 5G-SMART has been presented in the online workshop organized via 5G-PPP entitled "5G Experimentation Facilities and Vertical Trials" on the 14th October 2020 (see https://www.youtube.com/watch?v=yCpf8GH7KxI for more details).

4.7.2 5G-ACIA events

The 5G Alliance for Connected Industries and Automation (5G-ACIA) is a global forum, which brings ICT and OT players together, to ensure best possible applicability of 5G technology for connected industries, in particular the manufacturing and process industries. 5G-SMART is represented in the alliance with several project partners who are also board members. The project as a whole and two out of the three trial sites have been presented in a 5G-ACIA plenary. Online events of 5G-ACIA were held on November 3-

5 (15th Plenary Meeting), November 11-12 (5G Techritory 2020) and on November 24-26 (5G-ACIA at the SPS connect - The digital automation hub).

4.8 Specific standardization and regulation synergies

The consortium has identified a list of relevant standardisation and regulatory bodies where 5G-SMART findings and key results are expected to have significant impact. The 5G-SMART consortium monitors the outlined list of relevant standardisation bodies to align its technical work, 5G-SMART use cases and 5G features beyond the trials, with standardisation and to prepare relevant contributions to working groups. The bodies of interest remain the same since the project start, and more details can be found in deliverable D6.1. The below list states the current status.

- 3GPP
  - Several contributions have been made towards 3GPP by 5G-SMART (see Table 4-4).
- 5G-ACIA
  - 5G-SMART has made several important contributions to 5G-ACIA since the project start. These include contributions to 5G-ACIA working items. Furthermore, the 5G-SMART document on a common terminology between OT and ICT partners has proven to be a valuable document outside 5G-SMART and it has been provided to 5G-ACIA and other communities on request (please refer tohttps://5gsmart.eu/wp-content/uploads/5G-SMART-common-terminology.pdf).
- TSN
  - This standardization body is being monitored with activity from 5G-SMART partners.
- ETSI
  - This standardization body is being monitored with activity from 5G-SMART partners.
- IIC
  - This standardization body is being monitored. 5G-SMART has been presented to ICC.
- VDI/VDE GMA
  - This standardization body is being monitored.
- OPC
  - This standardization body is being monitored.
- ITU-R
  - Several contributions have been made towards ITU-R by 5G-SMART (see Table 4-4).
- CEPT
  - This standardization body is being monitored with activity from 5G-SMART partners.
- NGMN
  - 5G-SMART partners have contributed to relevant NGMN reports (see Table 4-3). Ericsson has been the editor of the NGMN report on “5G E2E technology to support verticals URLLC requirements”.

5 Exploitation plan

The 5G-SMART exploitation strategy consists of both an exploitation plan for the project as well as individual exploitation plans per partner. Different types of exploitable results are identified. Their direct value, indirect value and impact for different stakeholders will be considered to boost the actions of interested partners in the exploitation of them.

The exploitation plans both on consortium level as well as individual partner level have been described in D6.1 and remain valid. In this section more concrete plans on exploitation activities on individual partner level and individual partner contributions to the exploitation plans on consortium level are added. It is assumed that the reader is familiar with the overall project goals but still the structure of the project is summarized in the following table.

Work package number	Work Package Title	Lead Participant Name
WP1	Use cases, Business Models, Network Design	ORANGE
WP2	Testbed and Validation Trials for 5G-Enhanced Industrial Robotics	ABB
WP3	5G for Enhanced Industrial Manufacturing Processes	IPT Fraunhofer
WP4	Trials and Validation in Semiconductor Factory	BOSCH
WP5	5G Optimization for Manufacturing	Ericsson Germany
WP6	Impact and Dissemination	Polytechnic University of Valencia
WP7	Project and Technical Management	Ericsson Sweden and ABB

Table 5-1: List of Work Packages

Ericsson has designed and deployed the 5G networks at all 5G-SMART trial sites. The learnings from the deployment as well as the outcome of the co-existence and validation tests, starting in the second part of the project, will give important insights into 5G deployments for factories. Evaluation of network functionality, for example to ensure required performance for prioritized communication flows, will give further insights on what is required for 5G networks for factories. These insights will allow Ericsson to enhance products focused on operational technologies and industrial production as well as to develop future 5G products and services. Ericsson is driving the use case implementation of the cloud-based mobile robotic use cases. With the mobile robotics being brought on site and tested during the second part of the project, important insights will be gained to facilitate the exploitation of cloud controlled mobile robots in real factories. Ericsson has designed the test setup for conducting Electromagnetic Compatibility (EMC)

tests, which Bosch has performed the EMC measurements in the factory. The analysis of these results will provide insights into the 5G deployment suitability in factories.

Orange is driving the work on MNO business value creation in WP1 (Use cases, Business Models, Network Design) and has already started to investigate the Total Cost of Ownership of a 5G industrial network. This work, carried out in a collaborative manner, will feed important information into the business development of Orange and Orange Business Services. On the other hand, the forward-looking technical work in WP5 (5G Optimization for Manufacturing) where Orange is leading the activity on network architecture allows Orange to gain insights on future technological features and contribute to standards. Orange has already done a significant amount of contributions (15 contributions to ITU-T SG15 in 2020 so far and 4 contributions to 3GPP SA1 co-signed with Ericsson) and will continue in this direction.

ABB is leading the WP2 work on specifying, designing and implementing three novel use cases in industrial robotics. In that context, ABB continues to explore the cloudification of robotics software and services while collecting insights on the underlying 5G network performance and architectural capabilities of 5G technologies. Advanced robotics services are being prototyped including machine vision. Furthermore, new visualization features for robotics focusing on the factory floor will be explored. Evaluation of connectivity performance and other 5G capabilities will be done together with Ericsson at the factory site in Kista to validate their conformance to the use case requirements. ABB is driving the planning of a 5G-SMART webinar by WP2 that will target the identified audience groups and would exploit main findings from the ongoing research and technical work. After utilizing its competences from the vertical industries domain to contribute to several 5G-ACIA working items, such as on 5G exposure capabilities and 5G-TSN integration, ABB will feed back key project learnings to its Robotics business. This will allow to create a plan with respect to extending ABB's products and solutions portfolio with the capabilities provided by 5G.

Marposs as a multinational corporation co-operates in 5G-SMART through the two companies Marposs SpA (headquarters) and Marposs Monitoring Solution. The exploitation plan is necessarily coordinated into a single plan described herein. Marposs is actively developing the electronics systems, which are going to be used in the WP3 (5G for Enhanced Industrial Manufacturing Processes) trials at the Fraunhofer Institute premises, also its applicative knowledge was shared and used in the initial trial specifications. In the second part of the project, this work will be brought forward until completion and it will lead to the real experimentation, from which results we expect to get insights useful both to the IT partner's perspective and to our OT point of view.

Fraunhofer IPT is driving the research activities in WP3 (5G for Enhanced Industrial Manufacturing Processes). All findings will be actively disseminated among the many industrial partners of Fraunhofer IPT, including the International Community for Networked Adaptive Production (ICNAP) and its working group "Interfaces and Connectivity". An important part of the dissemination plan of Fraunhofer IPT is live demonstrations of the current results achieved in WP3. This has had its premiere in a tutorial session of PIMRC, where IPT has demonstrated two use cases on the Fraunhofer IPT shopfloor-based 5G-Area, followed by a Webinar on 5G for Process Monitoring, which involved several presentations as well as live demonstrations. Furthermore, Fraunhofer IPT will contribute with publications in journals and conferences. With regards to standardisation, Fraunhofer IPT has contributed to a 5G-ACIA working item

on TSN over 5G and will contribute in planned working items on 5G industrial devices as well as 5G edge-cloud integration together with other 5G-SMART partners of WP5 (5G Optimization for Manufacturing).

The Polytechnic University of Valencia has significantly evolved its simulation capabilities. Together with Lund University and Bosch, they have reconstructed the Reutlingen factory and are improving the ray tracing tools to make an accurate characterization of the mmW air propagation in an industrial environment. With respect to the protection of results, they see that automatic planning could be a nice topic to focus, and they are currently exploring this alternative together with other partners. The dissemination through training events is also relevant, and in this direction they have participated in two events, one academic and another one with the agri-food industry of Valencia region, to motivate the inclusion of the 5G for industry boost. During the second part of the project, they intend to complete the development of our automatic deployment tools and look for business opportunities with several vertical industrial players.

u-blox has been supporting the partners in three areas: 1) provided connectivity components for the multi-sensor platform, providing technical know-how and recommendations on hardware prototyping and configurations. 2) contributing to the configuration of hardware and services for the communication components with precision timing function and the evaluation of time synchronisation on the factory floor, and 3) contributed with insights on positioning and timing, from standards perspective, on the state of art and gap analysis, co-signed a contribution with Orange to ITU-T SG15.

Bosch has taken important steps towards successful implementation of activities in 5G-SMART, which in turn lead to achieving the target exploitation plans. Bosch has led the design and execution of extensive sets of EMC measurements in its semiconductor factory in Reutlingen together with Ericsson. The collected results will be analysed in detail, which will provide insight into 5G deployment suitability within sensitive production areas. Having the same object in mind, Bosch has contributed to the design and execution of channel measurements in the semiconductor factory together with Lund University. Bosch has also contributed to the implementation of the cloud-based mobile robotic use case. Among other things, Bosch has analysed and provided realistic deployment scenarios and technical and functional requirements (e.g., including those related to the certification of the cloud-controlled AGV), which will in turn facilitate the exploitation of the cloud-controlled AGVs in a real factory environment. Additionally, Bosch has been working on the implementation of the TSN/Industrial LAN over 5G. In the implementation of this use case, we plan to directly connect an operational industrial machine in the semiconductor factory to the 5G network, which will help us gain valuable insights from 5G-based machine-type communications in real production scenarios.

Lund University has completed the planned multi frequency (3.7-3.8 GHz and 27.0-28.0 GHz) propagation measurements in the Bosch Reutlingen semiconductor fabrication plant. The 10-day measurement campaign was concluded on September 24, 2020. Following this, the next steps will be analysis of the measured results in both static and dynamic scenarios, which best capture the activity on the factory floor. The analysed results will be compiled into several journal publications to be submitted and disseminated. The results will also be used for other national and international meetings, workshops and conference presentations, where found appropriate, as well as for the development of new tertiary courses on the subject matter; for example, a training activity within the 5G-SMART project is planned in collaboration

with other partners who also form part of another H2020 EU project, titled MINTS. Furthermore, we will strive to explore opportunities to initiate follow-up projects within industry, academia, and government sectors, providing a meaningful continuation of the already achieved results.

T-Systems will continue to contribute, by investigating the possible use cases, MNO engagement options, their requirements and related KPIs, as well as evaluating different network design options considering the technical use cases and business-related KPIs. Furthermore, it will explore the state-of-art of the present regulatory framework and prepare policy recommendations for the EU based on the findings. T-Systems will also continue to support the ongoing dissemination activities in the project.

The Budapest University of Technology and Economics has completed the first phase of WP4 (Trials and Validation in Semiconductor Factory) AGV use case implementation. One commercial AGV (type MIR 100) and a custom-built model (built from HEBI smart servos) by Ericsson Hungary were integrated in a lab environment. The AGVs can cooperate in the sense that both share a common map. This common map can be used to share information on the working environment gathered by the sensory systems (lidars, cameras) of the robots. The mapping, localization and navigation tasks are performed on the network side, removing all control logic from the devices, making it possible to cloud-control the AGV fleet. The same scenario was implemented in a simulation environment using the ROS/Gazebo physical simulator.

Conclusion

The overall aim of this document has been to provide information on the 5G-SMART project's dissemination and exploitation activities implemented throughout the first 18 months of the project. 5G-SMART's communication, dissemination and exploitation plans have been described in D6.1. This report reflects on the necessary amendments and changes that have been made to these plans due to the current Covid-19 pandemic situation. The tasks of communication, dissemination, and exploitation are of high importance to 5G-SMART, as it is recognised that they are crucial elements to increase the impact of the project.

To make sure that the implementation of the dissemination events organized by 5G-SMART are conducted safely and effectively, the consortium will follow the recommendation of the WHO [WHO20], in the upcoming project period. Any decision to restrict, modify, postpone, cancel, or proceed with holding the scheduled events will be based on a rigorous risk assessment exercise, tailored to the specific event. The risk assessment will be undertaken by the event organizers with input from other relevant authorities.

Fortunately, as it is visible from the results of the project so far, most of the activities (i.e. workshops, presentations) as well as the outputs (i.e. white papers, publications) are currently being implemented according to the project schedule with the limitations stated in Section 2. More than 10 papers, 18 contributions to standards, 3 keynotes in major conference, the participation in 10 5G industrial events, 3 workshops and 5 demos, show the high implication of the project in the dissemination of achieved results. Therefore, the aim to create synergies with the operational technologies players, communicating with the research community through scientific publications and presentations at scientific conferences and workshops, and communicating with the regulators and standardisation bodies in order to raise awareness of the project results is being successfully implemented. In the second part of the project, the consortium will take special efforts to follow the trends and latest news regarding the pandemic situation and keep on adapting to the changes in due time. For the time being, the 5G-SMART open days are still planned to be executed in physical form, provided that enough time remains after the pandemic is over.

List of abbreviations

3GPP - 3rd Generation Partnership Project

5G – fifth generation cellular network technology

5G-ACIA – 5G Alliance for Connected Industries and Automation

5G-PPP – 5G Infrastructure Public Private Partnership

AGV – Autonomous Guided Vehicle

BI-MU – Biennale della Macchina Utensile in Milan

EC – European Commission

eMBB – enhanced Mobile Broadband

EMC – Electromagnetic Compatibility

EMO – Exposition Mondiale de la Machine-Outil

ICT – Information and Communication Technology

IMTS – International Manufacturing Technology Show

IoT – Internet of Things

IPR – Intellectual Property Rights

ITU – International Telecommunications Union

JIMTOF – Japan International Machine Tool Fair

KPI – Key Performance Indicator

LAN – Local Area Network

mMTC – massive Machine-Type Communication

MNO – Mobile Network Operator

NGMN – Next Generation Mobile Networks

OT – Operational Technology

SME – Small and Medium-sized Enterprise

TSN – Time-Sensitive Networking

URLLC – Ultra-Reliable Low-Latency Communication

WP – Work Package

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