

Grant agreement no: 101097101

## TERahertz ReconfigurABle METAsurfaces for ultra-high rate wireless communications

# TERRAMETA

## Deliverable D7.1 Dissemination Plan

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<i>Dissemination level</i>		
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<b>CO</b>	<b>Confidential, only for members of the consortium (including the Commission Services)</b>	

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Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union, SNS JU or UKRI. The European Union, SNS JU or UKRI cannot be held responsible for them.

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## Change register

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C	13-06-2023	Luis Pessoa	INESC TEC	Minor corrections and formatting
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## 1. Statement of independence

The work described in this document is genuinely a result of efforts pertaining to the TERRAMETA project: any external source is properly referenced.

Confirmation by Authors: Thomas Kürner  
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## 2. Abbreviations

3GPP – 3rd Generation Partnership Project  
5GPPP – 5G Infrastructure Public Private Partnership  
6G – 6th Generation  
EC – European Commission  
EM – Electro-Magnetic  
ETSI – European Telecommunications Standards Institute  
EU – European Union  
GDPR – General Data Protection Regulation  
H2020 – Horizon 2020  
HTTP – HyperText Transfer Protocol  
IEEE – Institute of Electrical and Electronics Engineers  
IC – Integrated Circuit  
ITU – International Telecommunications Union  
KDT – Key Digital Technologies  
HTTPS – HyperText Transfer Protocol Secure  
PCB – Printed Circuit Board  
PMT – Project Management Team  
SME – Small and Medium-sized Enterprise  
SNS-JU – Smart Networks and Services Joint Undertaking  
TSB – Telecoms Systems Business-Unit  
RFIC – Radio Frequency Integrated Circuit  
RIS – Reconfigurable Intelligent Surfaces  
THz – TeraHertz  
UI – User Interface  
WP – Work Package



### **3. Executive summary**

This deliverable presents the TERRAMETA's plans and measures to ensure the successful dissemination and exploitation of its project results and explains the opportunities to increase the impact of the project results by influencing standardisation. In its first 6 months, TERRAMETA has set-up the key dissemination channels (web page, newsletter template, social media accounts in LinkedIn and Twitter), identified the relevant conferences, e.g. EuCNC, EuCAP, EuMW and IMS and journals to publish project results and the possible paths toward standardisation. Furthermore, TERRAMETA has identified means to inform the general public and has defined its plans to exploit the project results.

## 4. Scope of the Document

The scope of this document is to discuss TERRAMETA's plans for dissemination, exploitation and standardisation. These three aspects are dealt in separate chapters complemented by a last chapter on plans for collaboration with other 6G SNS-JU projects.

## 5. Scientific Dissemination and Training

### 5.1. Overview of dissemination policy

The TERRAMETA consortium has implemented a clear policy in terms of its dissemination activities. In this section, the identified activities in terms of dissemination and communications are outlined, along with the necessary coordination actions and provisions for the long-term dissemination of the project, after the end of its duration.

#### 5.1.1. Target audience

As a first step in presenting that policy, the intended groups of audiences are identified. This characterisation is helpful for defining appropriate activities that are designed to successfully reach and attract the interests of each particular group.

- As a research project, one of the main categories of target audience is the wider academic community. This includes individual researchers, research centres and institutions, and universities from around the globe. The broader fields of research relevant to TERRAMETA include signal processing, communications engineering, electromagnetics and wave propagation, wireless communications, integrated (IC and RFIC) and printed (PCB) circuit and hardware design, networking, as well as antennas and metamaterials.
- Industrial entities are a core target of the project's dissemination outputs. Research-oriented enterprises, SMEs, manufacturing companies, network operators, software companies, and large industrials of the information and technology sector present key opportunities for industrial exploitation and widespread adoption of the foreseen technological advancements.
- Since the project aims to have a recognisable impact on various standardisation actions, European (as well as global) standardisation and pre-standardisation bodies are of special interest. Examples of such bodies are ETSI, 3GPP, and IEEE.
- Wider partnerships and collaborations with similar research areas such as the 5G PPP, SNS-JU/H2020, KDT or other projects and consortiums. Establishing communication channels with such entities is of particular interest due to expected synergies and collaborations.
- The outputs of the project are also relevant to the European Commission (both as a funding and operational agency) and legislative bodies (national or international). 6G networks, and their key enablers of THz communications and metamaterial surfaces, constitute some of the most highly anticipated technologies of the transition to beyond-5G infrastructure, and will inevitably be subject to societal, political, legislative, and economic policies. Bringing high-level technical knowledge to such bodies is therefore important for the longevity of the results produced by this project.
- The Public audience will be informed, for example through open days at the universities.

#### 5.1.2. Objectives

The dissemination policy of this Consortium has the overall vision of establishing TERRAMETA as one of the leading innovators and proponents of THz communications, Reconfigurable Intelligent Surfaces, and 6G networks. To achieve this goal, a number of relevant objectives have been identified:

- Engagement in EU activities (e.g. clusters, networks)
- Grow a community of interested parties (200+ members) to raise the profile of the project.
- Regular appearance of the senior members on public media for broad audiences.
- E-learning resources distributed for integration into university curricula.

- Training program for young scientists to promote and disseminate the generated knowledge: staff exchange and relocation between interdisciplinary partners to transfer and exchange know-how.

Through precisely orchestrated actions and well-organised items, as described below, the project aims to align its efforts toward the fulfilment of the set objectives, and subsequently, the achievement of its vision.

## 5.2. Coordination of activities

- **Individual:** Activities that are carried out by individual Partners, without the explicit participation of the rest of the consortium. Such actions provide the highest amount of flexibility, while requiring the minimum amount of coordination. Notification to and approval from the involved partners (or the WP7 leader) must be granted. Examples of such actions are publications from authors affiliated with a single partner, interviews, invited/keynote talks, workshop organizations, technical committee chairing, and special session management.
- **Partner-level collaboration:** Activities that are the result of a close cooperation between a subset of the Partners, centred around a specific (usually technical) contribution to the project that will be communicated externally. This level of collaboration may include most planned publications, tutorials, workshops, and is designed to allow for autonomous operation to the respective teams, while still achieving inter-Partner collaboration.
- **WP-level collaboration:** Centrally organised actions that target very important technical novelties and outcomes of the project. They are to be coordinated primarily by the respective WP leader(s).
- **Project-level collaboration:** This level has been specified to include actions that are expected to have the highest outreach to the community and require the joint effort of all Partners. Their coordination plays a crucial role and is to be handled by the WP7 leader and the PMT. Specific examples at this level include magazine/technical publications that showcase the importance of the project and its main results (e.g. field trials), or setting up booths and field trials in conferences, summer schools, and webinars.

The above levels are presented in increasing order of expected impact. At the same time, the flexibility decreases and the management overhead increases in the higher levels. To that end, the project will aim at achieving the right balance in terms of dissemination activities. The intention is for numerous low-level activities to take place at the early stages of the project (with a limited number of very important high-level actions), before making a transition to pursuing higher levels of outreach efforts as the project progresses and results become available.

### 5.2.1. Internal recording and reporting

To facilitate seamless record-keeping, relevant repositories will be established in the shared project storage, along with the pertinent protocols and procedures for management and coordination of the dissemination and communication actions. Each of the work packages has its own folder with a similar easy-to-follow sub structure. All actions not directly managed by the WP7 leadership will be communicated through the WP7 e-mailing list, and the relevant material (e.g., presentation slides, manuscripts) will be stored to the designated locations. The WP leadership is responsible for listing the communicated activities according to their type.

## 5.3. Communication Infrastructure

### 5.3.1. Dissemination Package

To facilitate a unified dissemination image as a project, TERRAMETA has prepared a number of items and guidelines that altogether comprise the project's "dissemination kit". Those include graphical material and templates that are intended to showcase a curated brand image around the project, visually convey information, and enhance awareness. The dissemination package is centred around the

following items. The graphical material has been developed by following standard design rules and guidelines<sup>1</sup> and the aim of the dissemination package as a unit is to increase<sup>2</sup>.

### Colour Palette



Figure 5-1: The colour palette specified for the TERRAMETA visuals.

The palette (Figure 5-1) has been compiled following guidelines from colour theory. Specifically, shades of dark blue – black have been used to convey power, elegance, and formality while being different from the strict black tone. On the contrary, the shade of dark-red colour used conveys the ideas of novelty, speed, and passion. The complementary shades of grey and blue provide a visually pleasing contrast.

### Typefaces

**Headings, Articulat Bold, 32**

**Subheadings, Articulat DemiBold, 18**

Body, Articulat, 12

Figure 5-2: Typefaces used by TERRAMETA in other visual content.

Instances of the “Articulat” typeface (Figure 5-2) are used for the graphical dissemination material and the logos. This font has been selected to showcase a modern, yet professional image – which reflects the Consortium’s ideals.

### Logo

The logo has been designed by the WP7 team after careful considerations of logo design practices<sup>3</sup>. Its square form factor conveys trust and authority. It is based on two distinct icons, that (a) comprise the two parts of the TERRAMETA acronym and (b) are instantly recognisable by the intended audience. As stated above, the colour choices express formality/power and speed/novelty. Their application to the individual elements has also been done on purpose: The EM waves are painted red since THz signals offer higher data rates, whereas the metamaterial surface is posed to bring increased network stability and reliability. Many different versions of the logo have been provided (Figure 5-3) by alternating the primary and secondary colours of the palette to allow for better integration with the background visuals of each case.

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<sup>1</sup> <https://www.interaction-design.org/literature/topics/design-guidelines>

<sup>2</sup> <https://blog.hubspot.com/marketing/brand-awareness>

<sup>3</sup> <https://www.customlogocases.com/blog/logo-design-tips/>



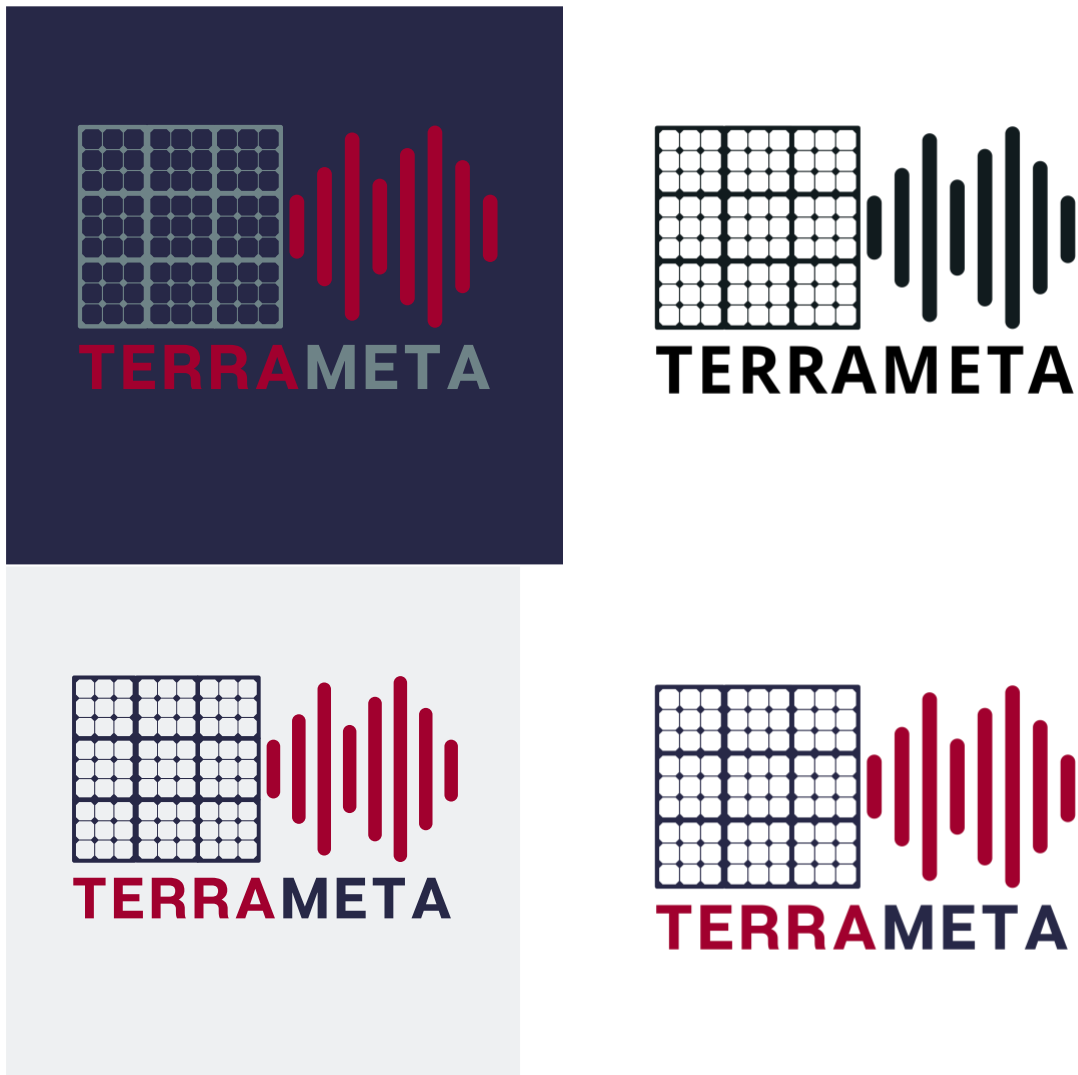


Figure 5-3: Variations of the TERRAMETA logo under different colouring options facilitating different usages.

### Banner Images

Using the same visual aesthetics, different versions of a banner images have also been prepared (Figure 5-4). The pattern is composed of squared shapes, denoting metasurfaces, arranged in a sinusoidal pattern to denote wireless signals. Therefore, the banner is designed to implicitly contemplate the contents of the logo. The use of the banner is intended as a default background in web and electronic material, such as the website, social media profiles, newsletter, etc.



Figure 5-4: Background banner images that integrate and extend the visual elements of the TERRAMETA logo.

#### **Presentation Slides Template**

To further establish a harmonised view of the TERRAMETA “brand”, a template for presentation slides has been prepared in Microsoft PowerPoint. The guideline is to use that template both for internal, but also for external presentations about the project – if applicable under the specifications of the presentation venue and media.

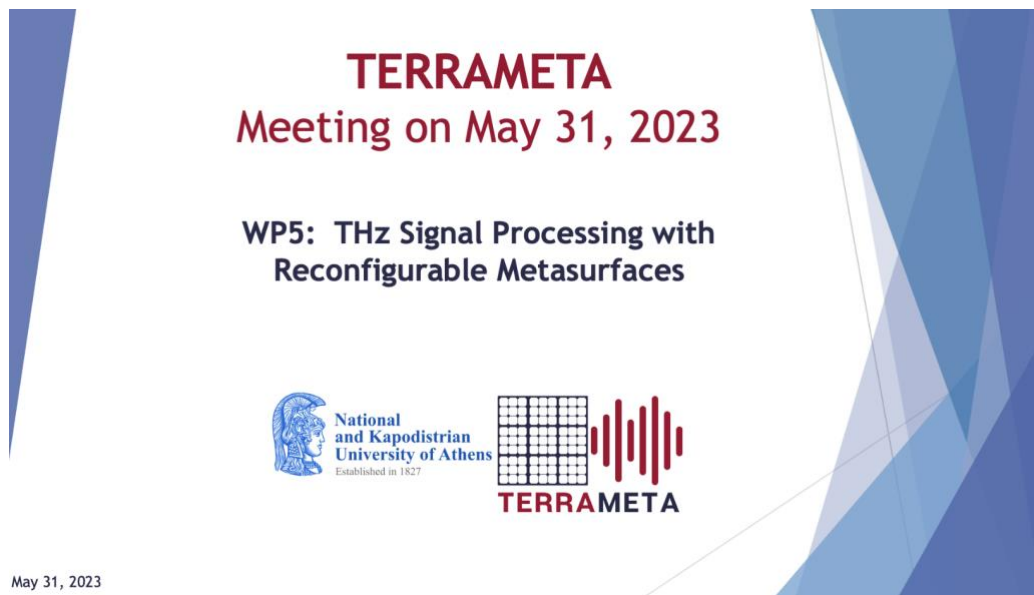


Figure 5-5: Example title slide of the prepared TERRAMETA power point template - to be used both for internal as well as external (dissemination) presentations.

**Single-Slide Project Presentation**

On a similar manner, provide readily available content for brief presentations of the project, a single-slide presentation has been prepared by the WP7 team (Figure 5-6). While Partners are encouraged to prepare their individual presentations, so as to be better aligned with the venue, medium, audience, speaker expertise, and objectives.

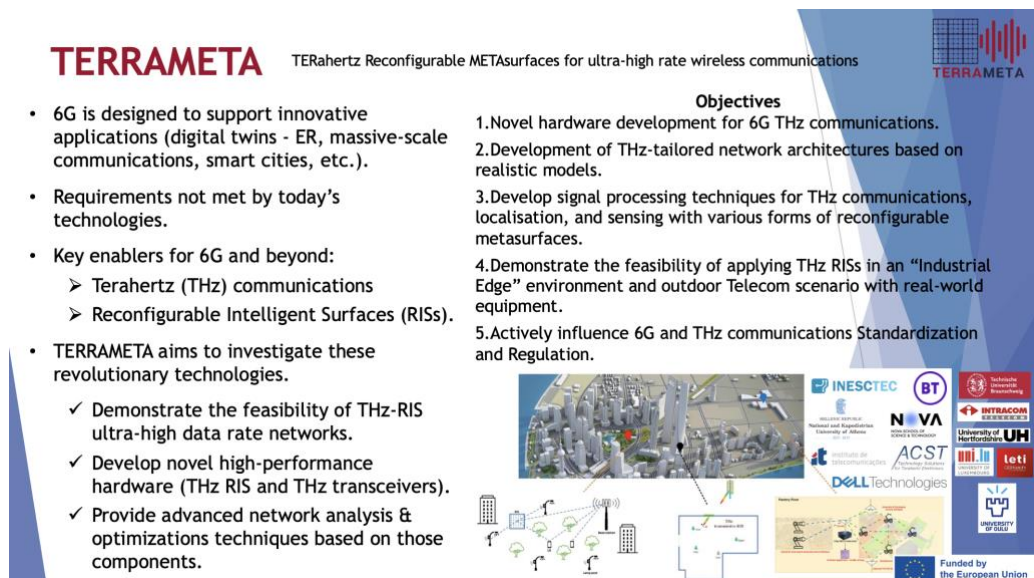


Figure 5-6: All-inclusive single-slide presentation of TERRAMETA.

**Project Acknowledgement Text**

Finally, a unified acknowledgement text has been agreed upon to be inserted into all Project’s outputs and results (such as publications, datasheets, etc.), as below:

*This work has been (partially) supported by the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101097101, including top-up funding by UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee.*

**5.3.2. Web Site (first version)**

To maximise the outreach of the Project, a lightweight version of the project's website will be designed and hosted internally by the Partners at the first months of its duration. This is intended to convey the necessary information and provide a contact point, while the full version is under preparation by a contracted company. At the time of writing the deliverable, this website is online at:

<https://terrameta-project.eu/>

The website is hosted on INESC TEC premises. Its contents are illustrated in Figure 5-7.

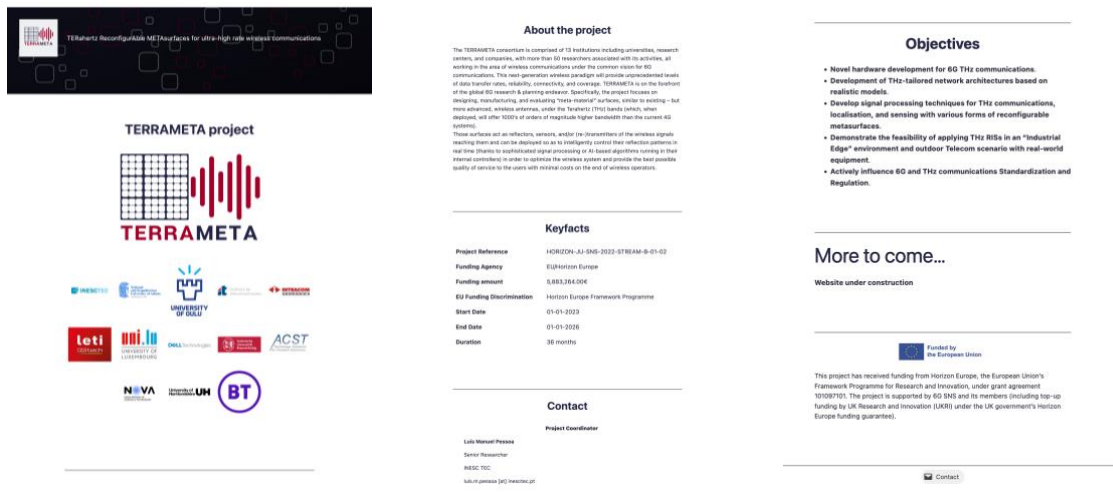


Figure 5-7: The first version of TERRAMETA website

**5.3.3. Web Site (specifications for full version)**

**Intended Use-Case and Expected Product**

The website constitutes an integral part of the project's overall dissemination plan and is mandated by the agreement made between the partners and the European Commission. It is intended to be as the one of the main outreach channels (along with the social media accounts). On the one hand, interested individuals are expected to visit the website seeking information about the project's goal and technical information, looking up information about the consortium partners, intending to contact the project's leadership, or with the intention of viewing and downloading the project's research output. The consortium, on its own end, will utilize the website in order to frequently post updates about its research and dissemination activities (via blogs, news, event announcements, etc.) as well as publicly host its results (in the forms of academic publications, report deliverables, technical datasheets, etc.). The

website will be evaluated by the external Reviewers assigned by the European Commission to the TERRAMETA project with respect to its functionality, aesthetics, and conformity with EU's e-Privacy regulations.

### Deployment & Operational Requirements

The development of the website is required to be based on Wordpress, with the theme and plugins to be selected by the developers. The website should be operational for at least up January 2029. The website will be hosted on a server on the premises of one of the partners. The domain name and the SSL certificate will be provided by us.

It is required that the website supports HTTP/HTTPS, has full compatibility with Chrome, Firefox, Edge, Safari, as well as great compatibility with the rest of the major browsers. The interface should be responsive to support mobile and tablet versions. All the software used should be to up to date (or recent stable) versions with no known security vulnerabilities at the time of the delivery.

The website should follow the EU's GDPR directives and policies regarding cookies and e-Privacy. Minimal user-tracking should be imposed with only anonymized data to be collected for statistical purposes. Furthermore, the website should conform with Portugal's national laws.

The full requirements will be specified in the pages below, but overall, the website will be consisted of a few static pages and a few pages with dynamic (custom) post-type contents (e.g., blog posts, announcements, academic article info). Items of the different post types should be able to be created and uploaded by the consortium partners via the Editor platform. The website should also support the functionality of document upload as part of the specified types, which will be downloadable by the users. Finally, contact forms should be supported and access should be given to administrative users to edit the contents of static pages.

### Web pages

1. **"Home" page:** The home webpage should include:
  - a. The project's name (acronym)
  - b. The full acronym specification
  - c. The project's logo
  - d. All the logos of the project partners (placed discretely)
  - e. A short description of the project
  - f. Information about the key officers of the project (information & photos to be provided by us)
2. **"About" page:** This page will contain (technical) information about the TERRAMETA project. Specifically, it should contain (in that relevant order):
  - a. A banner at the top with a relevant stock image (to be selected by the designers) and a small quote/keyword/motto.
  - b. A text area titled "About the Project" which will include a technical description about TERRAMETA (to be provided by us).
  - c. A text area titled "Vision and Goals" which will include a text to be provided by us.
  - d. An area titled "Keyfacts" that contains "key" i.e., labelled information about the project. For example: Grant Agreement ID, Funding costs, Start-End date, Coordinator name.
  - e. A text area titled "Mission and Objectives".
  - f. A section called "Work packages". In this section, each of the 7 work packages (WPs) will be described. Each WP description will be an area/UI element.
  - g. Number of deliverables.
3. **"Announcements" page:** This page will contain a list of announcement posts (previews only) sorted as newest first. The preview should be included a UI design element (e.g., "card") and it should contain the following info:
  - a. Announcement Title
  - b. Visible link to the actual announcement post. The title could be the link.
  - c. Date of upload
  - d. Picture/Thumbnail (if inserted to the original announcement post, otherwise the logo of TERRAMETA).
  - e. Preview of the text appearing in the linked announcement post.

4. **“Blog” page:** This page will contain a list of “Blog Posts” (previews only) sorted as newest first. A banner with a stock image is optional. The preview should be included a UI design element (e.g., “card”) and it should contain the following info:
  - a. Blog Title
  - b. Visible link to the actual blog post (to be described below). The title could be the link.
  - c. The first image appearing within the linked blog post.
  - d. Date of upload.
  - e. Author (Name and thumbnail image if possible) – Multiple authors should be supported.
  - f. Preview of the text appearing in the linked blog post.
5. **“Outputs and Results” page:** This page should have three distinct sections, each containing a list with different types of posts. A banner with a stock image is optional. The section names are “Publications”, “Deliverables”, “Dissemination & Communication”.
  - The “Publications” section contains a list of “Publication posts”.
  - The “Deliverables” section contains a list of “Deliverable posts”.
  - The “Dissemination & Communication” section contains a list of “Dissemination posts”.
6. **“Partners” page:** This page contains a list of partners. A banner with a stock image is optional. Each partner should be a UI element (e.g., a “card”) containing the following information:
  - Partner Name
  - Partner Logo
  - (Optional) partner sub-entity (e.g., name of a Laboratory or Department within a University)
  - Partner description
  - Name of the leader person
  - (Optional) Names of the rest of the team
7. **“Contact” page:** The contact page should contain a form to be completed by the visitor. The contents of the form are to be submitted as an email to a specified email address. The form should have the following fields:
  - First Name (textbox)
  - Last Name (textbox)
  - Email (textbox) (required, to be validated as a valid email address)
  - Pronoun/Title (drop down list)
  - Company/Affiliation (textbox)
  - Message (large textbox) (required)

#### 5.3.4. Social Media

TERRAMETA will actively maintain two social media accounts/communities on LinkedIn and Twitter, as the main two platforms used by the targeted audience. The two accounts will have similar, but also complementary functionality:

- Announcement and media content will be posted by both accounts via the delegated social media manager or any partner. Those are foreseen to include:
  - Announcements regarding deliverables and publications.
  - Updates from the F2F, plenary and review meetings.
  - Announcements of media and other dissemination content (newsletter, posters, videos from demonstrations, etc.).
- The TERRAMETA page initiated on LinkedIn has an open-posting policy to encourage engagement by the broader community members – i.e., members not belonging to the TERRAMETA consortium. The intention is for such posts to play the role of a catalyst to a wider community and dissemination in terms of outputs of the project, as well as stimulus and inputs for the Project consortium from the community.
- On a similar manner, the Twitter account is intended to mostly “retweet” relevant tweets of followed accounts, such as the EU, the EC, SNS, field-specific conferences and organisations, other relevant projects, or individuals. This will have the effect similar to a creation of a “news-feed” that has the potential of both a central point of information for the Project Partners, as well as establishing TERRAMETA as an integral part of the wider community by mediating relevant information to the relevant audiences.

The LinkedIn page can be accessed at the following URL:

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<https://www.linkedin.com/company/terrameta>

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The Twitter account can be accessed at the following URL:

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[https://twitter.com/TERRAMETA\\_6GSNS](https://twitter.com/TERRAMETA_6GSNS)

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#### **5.3.5. Newsletters**

The project has committed in preparing, publishing, and disseminating via the aforementioned channels a number of newsletters (4-6 expected). Those will constitute few-page electronic documents that aim to visually illustrate outputs and details of the project. The contents of the foreseen issues include:

- Project overview, including presentation of the Partners, project's vision, goals, and objectives. (To be prepared after the second plenary meeting).
- Presentation of the Work Packages, including a detailed description of the methods, technical expertise, and research carried out by the Project.
- Presentation of the deliverables (first part).
- First and second year report of Project's results.
- Proof-of-Concepts, demonstrations, and RIS prototypes.
- Final deliverables and Project's results.

#### **5.3.6. Posters & Leaflets**

Posters and leaflets are planned as accompanying dissemination material to the physical presence in conferences, public talks, and other networking events. Their graphical design will share a similar tone between them and the newsletter issues, following the graphical guidelines set in Section 5.3.1, in order to follow standard brand-awareness guidelines. At least one two-page leaflet will be produced which is planned to expand on the contents of the one-page poster document. As the project progresses, both the leaflet and poster may change to include important project outputs.

#### **5.3.7. Press Releases & Interviews**

Project members will actively seek out opportunities to engage with relevant press, blogspots, podcasts, video-casts, panels, TV and radio, or other relevant venues in order to find public platforms for introducing TERRAMETA to the communities. The contents of each such activity are to be decided on an individual basis, since they need to conform to technical restrictions (e.g., audio only, text only, duration considerations) as well as be harmonized with the topic of each venue. Nevertheless, suggested contents include the general descriptions of the project from the Technical Annex, Website, Newsletters, Leaflets, and other dissemination material, as well as the executive summaries of the deliverables – for more technical content. Each such action will be accompanied by a relevant social media post and website announcement to maximise the outreach potential.

#### **5.3.8. Video & Multimedia & Blog Content**

TERRAMETA intends to make full use of video and other media content. Such content is expected to arise from:

- Demonstrations of prototypes.
- Proof-of-Concept demonstrations.
- Interviews, talks, lectures, tutorials.
- Plenary meetings.
- Participation in networking events.

Media in the form of images or short-duration videos will be posted on the social media accounts and the website.

Additionally, the Consortium will create the videos with at least the following content, which will be uploaded on TERRAMETA's YouTube account:

- A project-level overview.
- Presentations of the WPs.
- Proof-of-Concept demonstrations.

Finally, the Project intends to make use of the Website's "Blog" functionality for providing distilled, semi-technical written presentations.

#### 5.4. Dissemination Activities

##### 5.4.1. *Research, academic and educational community (publications)*

The academic results of the project will be communicated, apart from the deliverables, via (primarily) academic publications, data sets, technical data sheets, etc. Therefore, academic publishing constitutes the one of the main pillars of dissemination items. The publications and relevant material will be Open Access, either in Green or Gold form<sup>4</sup>. To enhance their potential outreach, each publication will be followed by an accompanying announcement by the project's social media accounts and the list of all publications will be visible on the website, with their respective access links. Conference publications will be further accompanied by a presentation and/or poster at their respective venues, as is standard practice by the organisers. Video material of selected presentations will be uploaded to the project's YouTube account – if permitted by the respective licenses. Simultaneously to the focus on highly technical publications, the Consortium will additionally orchestrate collaborations to prepare magazine articles, intended to communicate the project's vision, goals, advancements, and insights. Such publications are expected to arise, for example, from the contents of deliverables, prototypes, measurements and Proof-of-Concept campaigns.

##### 5.4.2. *Target Conferences and workshops*

Preliminary, intermediate, and final project results will be continuously published through articles and research papers at various international and national known conferences and workshops. Considering the huge number of such conferences, the coordinator and the technical manager will keep a critical eye on the quality of them while achieving a qualified selection of appropriate conferences to participate in.

1. **High profile conferences in communication and networking** domains will be primarily targeted:
  - IEEE International Conference on Communications (ICC)
  - IEEE Global Communications Conference (GLOBECOM)
  - IEEE International Conference on Computer Communications (INFOCOM)
  - IEEE European Microwave Week (EuMW)
  - IEEE EMC+SIPI and EMC Europe Symposium
  - IEEE Antennas and Propagation Symposium (APS)
  - IEEE International Microwave Symposium (IMS)
  - IEEE Radio Frequency Integrated Circuits Symposium (RFIC)
  - IEEE International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz)
  - International Symposium on Antennas and Propagation (ISAP)
  - URSI: General Assembly (GASS), EMTS and Atlantic Radio Science Meetings
  - 6G Wireless Summit
2. **Conferences focused on the European community:**
  - European Conference on Networks and Communications & 6G Summit (EuCNC & 6G Summit)
  - European Wireless Conference (EW)
  - European Signal Processing Conference (EUSIPCO)
  - European Conference on Antennas and Propagation (EuCAP)
  - European Microwave Week (EUMW)

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<sup>4</sup> For a detailed presentation of the Open Access initiative in terms of TERRAMETA, please refer to the Data Management Plan (D1.1).



3. **High profile conferences in the wider scientific domains** that are relevant to the TERRAMETA project:
- ACM Special Interest Group on Data Communication (SIGCOMM)
  - Conference on emerging Networking EXperiments and Technologies (CoNEXT)
  - IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)
  - IEEE Vehicular Technology Conference (VTC)
  - IEEE Wireless Communications and Networking Conference (WCNC)
  - IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)
  - IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)

#### **5.4.3. Target Journals**

- IEEE Transactions on Vehicular Technology
- IEEE Transactions on Communications
- IEEE Transactions on Wireless Communications
- IEEE Transactions on Antennas and Propagation
- IEEE Transaction on Microwave Technologies and Techniques
- IEEE Transaction on Terahertz Science and Technology
- IEEE Transactions on Signal Processing
- IEEE Wireless Communications
- IEEE Journal of Selected Areas in Communications
- IEEE Journal of Selected Topics in Signal Processing
- IEEE Access
- IEEE Open Journal of the Communications Society
- IEEE Open Journal on Antennas and Propagation
- Proceedings of the IEEE
- IEEE Communications Surveys & Tutorials
- IEEE Network
- IEEE Wireless Communications Letters
- IEEE Antennas and Wireless Propagation Letters
- IEEE Microwave and Wireless Components Letters
- IEEE Communications Letters
- IEEE Communications Magazine
- IEEE Signal Processing Magazine
- Review of Electromagnetics
- Scientific Reports
- Intelligent and Converged Networks
- ITU Journal on Future and Evolving Technologies

#### **5.4.4. Workshops / Webinars / Tutorials**

The project will organize two dedicated TERRAMETA workshops, special sessions or convened, organized as part of wider high-profile academic events during the 2<sup>nd</sup> and 3<sup>rd</sup> year of its lifetime. Additionally, tutorials and webinars will be given as part of the Partners' participation in conferences and other relevant events.

#### **5.4.5. Contributions to industry and research fora and associations**

The consortium will ensure that its results will be frequently communicated to various fora (industrial, academic, legislative, standardisation) and other relevant technical and non-technical bodies. Those contributions will focus on activities in the field of beyond 5G and 6G network declarations and definitions, such as, 5GIA, Wireless World Research Forum (WWRF), One 6G Association, Next Generation Mobile Networks (NGMN), RIS TECH Alliance (RISTA), NATO Communications and Information Agency (NCIA), AIOTI etc. These dissemination activities will be done through the partners, who are members in one or several of these organisations (INESC TEC, CEA, NKUA, TUBS, others).

To that end, TERRAMETA aims at capitalising its standardisation efforts (see Section 6 below) to extend its dissemination output.

### 5.1. Provisions for after the lifetime of the project

To achieve the goals set under the dissemination policy, it is important to ensure that the Project's results will be disseminated after the end of its lifecycle. At the very least, the project's results and as much of its dissemination material as possible shall be visible and openly accessible. The website, social media and YouTube accounts, and other public ports specified by the Data Management Plan are already implemented so as to exist long after the end of 2025. Similarly, the Project's results in terms of scientific publications and relevant documents, patents, deliverables, etc. will also remain available and openly accessible to the public.

On a more active basis, TERRAMETA will ensure that its dissemination actions have a tangible impact on the target audiences. First of all, contributions made to standardisation bodies, inputs to legislative bodies, and commercial activities have a longer lifespan by definition. Secondly, media shared in YouTube are expected to spark a continuous interest in the following years as the emerging technologies become increasingly implemented and deployed.

## 6. Standardisation and Regulation

In this task the project results relevant for standardization will be collected and input documents for various standardization bodies (e.g. IEEE 802, ETSI, 3GPP) will be created from this project. The main focus will be on use cases and channel models, but also results from the beam management considered in WP5 will be used to define interfaces to integrate RIS into THz communications. In IEEE 802 these activities may trigger the creation of a new task group considering the features of mobility and applications requiring beamforming. With respect to regulatory issues, the output of this project will be fed into the preparation of the World Radio Communication Conference (WRC) 2027 for which a potential new agenda item on shared use of frequencies for communication and sensing is discussed. In the following we will elaborate in more detail, how the contribution to standardisation and regulation will be organised.

### 6.1. ETSI / 3GPP

Standardisation of THz or RIS @ 3GPP has not started yet. However, ETSI has established two industry specification groups (ISG) to work on pre-standardisation of these two technologies. It is expected that output generated by these two groups will be a starting point for 3GPP once standardisation in these areas takes off.

The two groups are ETSI ISG RIS (ETSIa) and ETSI ISG THz [ETSIb, ETSIc]:

- ETSI ISG RIS has recently published a first Group Report on use cases, deployment scenarios, and requirements and plans further Group Reports on
  - o RIS technological challenges, architectures and impact on standardization, and
  - o RIS communication models, channel models, and evaluation methodology
- ETSI ISG THz is working towards four Group Reports on:
  - o Identification of use cases for THz communication systems;
  - o Identification of frequency bands of interests for THz communication systems;
  - o Channel measurements and modelling in THz bands;
  - o RF Hardware Modelling.

TERRAMETA is in a perfect position to contribute to the open Group Reports through its partners TUBS, NKUA and INESC TEC, who are members of these ISGs.

### 6.2. IEEE 802

In 2017 IEEE 802 has published its first THz standard operating between 252 and 321 GHz [IEEE802a]. The Task Group, which developed this standard, is a spin-off of IEEE 802.15 Standing Committee THz (IEEE 802.15 SC THz). The IEEE 802.15 SC THz is chartered to explore the feasibility of Terahertz for wireless communications and identify opportunities for further extensions

of this standard. Prof. Kürner (TUBS) is chairing this group. This opens opportunities for TERRAMETA to actively contribute to this group. A first presentation has been already done in March 2023 [Ter23].

### **6.3. Regulatory Issues towards WRC 2027**

At the World Radio Communications Conference (WRC) 2019 137 GHz of spectrum between 275 GHz and 450 GHz have been identified for the use by THz communications [RR19]. Since 2019 ITU-R has continued its work in this frequency range [ITU22]. In addition, this frequency range is also of interest for other active radio services like radiolocation service applications such as radar yielding a potential agenda item at WRC 2027 [ITU19]. All these activities may yield agenda items at the WRC 2027 relevant to TERRAMETA.

TUBS is following these developments. It brings in its experience from the active participation at the WRC 2019 preparation and is prepared to actively contribute to the preparatory process of WRC 2027. Through this channel TERRAMETA can contribute to the WRC 2027 process.

## **7. Industrial Exploitation**

This task focuses on gathering exploitable results generated during the project on THz RIS technology, and engagement with key Business Units (BU) within large enterprise sectors to determine the potential impact and adoption of THz technologies in their respective environments. In the following it is shown, how the exploitation at TERRAMETA's industrial partners DELL technologies, ACST, ICOM and BT is planned.

### **7.1 Dell Technologies**

Dell Technologies (EISI) has been actively engaged with many of its BU's on THz RIS technology, with keen interest from all of them on the potential of the technology.

#### **7.1.1. Manufacturing Business Unit and the THz RIS Use Case**

A significant part of Dell's effort in Industrial Exploitation is driven by the close collaboration between the Manufacturing BU and the CTO Research BU. The two divisions are synergistically defining a comprehensive THz RIS use case for demonstrating the full potential of the technology via simulation, and also the collaborative efforts of both business units are anticipated to culminate in a demonstrative project showcasing the advantages and feasibility of the THz RIS in a real-world industrial setting in Dell's manufacturing facility in Cork, Ireland.

The drive to develop a THz RIS use case emanates from the distinct advantages that the technology provides. The THz RIS technology, with its extreme data rates and versatility, enables dynamic and vastly improved wireless communication performance in the manufacturing sector. This large increase in mobile data rates is crucial for the future vision of manufacturing, with high-resolution sensing, AI digital twin, and a fully mobile software-defined factory. A flexible and very high-speed wireless solution is critical to enable this vision, with THz RIS technology being explored as the potential solution.

#### **7.1.2. Telecoms System Business Unit**

The interest in THz RIS technology extends beyond the manufacturing context within Dell. The Telecoms Systems BU (TSB) has expressed growing interest in exploring the potentials of this breakthrough technology. For TSB, the THz frequency band is an untapped resource that holds great potential for improving the performance of telecommunications systems, with TSB working closely with large industry Telco operators.

A significant attraction of THz and RIS technology for TSB lies in its capacity to enable high-speed, low-latency communication, a much sought-after aspect in the world of telecommunications. THz communication is expected to allow data transmission rates of several terabits per second, which would vastly improve the throughput of the current telecom systems. Meanwhile, RIS technology

offers the potential to address issues associated with high-frequency communication, such as propagation loss, thus boosting the effective range of THz communication.

In light of these considerations, ongoing discussions within TSB revolve around the incorporation of THz and RIS technology into future telecom system designs, aiming to exploit its high potential for improving the quality and efficiency of telecom services.

### **7.1.3. Advanced Wireless Technologies Business Unit**

In parallel, the Advanced Wireless Technologies BU (AWT) is also closely monitoring the developments in THz and RIS technology. Recognizing the transformative potential that this technology holds, AWT BU is actively engaging in discussions about its future application and exploitation. The AWT BU is also customer focused, intending to enable digital transformation for Dell's customers highly varied use cases through the exploitation in the latest of wireless technologies.

AWT envisages a future where THz technology is a core part of the wireless communication landscape. The application of RIS, particularly in shaping and steering THz waves, is foreseen as an innovative solution to address current limitations in wireless communication such as signal coverage, energy efficiency, and spectral efficiency.

The unit's vision, therefore, involves the exploration of THz and RIS technology to enhance existing wireless technology systems and develop new ones, thereby leading the way towards a new era of ultra-fast, efficient, and reliable wireless communications not just for the Telecoms sector, but any potential use case of Dell's customers.

As such, it is clear that Dell's endeavours to exploit THz RIS technology span multiple business units, with each seeing unique potential and applications for the technology. These parallel efforts and shared interest across units represent a collaborative ambition within Dell to remain at the forefront of technological innovation for wireless communications across many different sectors.

## **7.2 ACST**

With its expertise in Schottky-Diode and THz technology, ACST has the capability to support one of the first industry THz communication system demonstrators supporting high data rate transmission leveraging THz RISs, by developing the necessary hardware for the transmitter and receiver in the targeted frequency ranges.

The motivation for the development of a 300 GHz receiver, relies on the expansion of ACST's portfolio, that will potentially lead to the extension to other frequency bands. Regarding the development of the transmitter, it is expected to find an innovative solution able to use the available THz high-power Schottky-diode based sources. With that purpose, a study on the feasibility of a direct Schottky diode-based amplitude modulator will be performed, in order to determine the power handling capabilities and the modulation speed that such a device can reach, adding to ACST's portfolio.

Moreover, it is expected that the contributions in the TERRAMETA project will enable THz solutions applicable in the proposed industrial use cases and that it will trigger new potential high-power high-speed THz communication industrial applications.

## **7.3 BT**

Although, it may not be possible to predict all future uses of the Terahertz bands right now, it is likely that a mixture of active terrestrial uses and growing passive uses will emerge. One early use of Terahertz spectrum could be for communications fixed links. This includes capacity upgrades for some existing wireless data links and high capacity 5G small cells, avoiding the need for fibre optic cables, which is of high interest for BT. For communications applications, Terahertz spectrum has the potential to allow very high throughput and a very low latency but, typically, over relatively short distances. Narrow radio beams could enable very dense deployment of communications devices. Given that beams will be narrow, the addition of RIS to a THz network will enhance the overall coverage solution. Additional uses for THz RIS could be sensing and positioning. The terahertz

spectrum can provide centimetre and sub-centimetre level accuracy which could be exploited in robotics and autonomous vehicles, as well as improving communications links. It is important to understand the characteristics of the THz spectrum bands in BT's overall network strategy and road maps of future services

#### 7.4 ICOM

As a global telecom vendor, ICOM is significantly investing in R&D to develop cutting-edge products competitive at global level and has a strong presence in EU's research initiatives for 5G and 6G. One of the technologies that ICOM's R&D is monitoring, is RIS, and this was the main motivation for the company's participation in the project.

Within TERRAMETA, ICOM will exploit its mmWave expertise, focusing on the provision and adaptation of a baseband unit based on its E-band platform, with high resolution DAC/ADC boards, driving the TERRAMETA sub-THz transceiver modules and the RIS-based antennas. ICOM's participation in the RIS-based PoC demonstrator, is expected to assist in the early evaluation of the technology's potential and based on the results, promote its timely exploitation in the company's product lines, drastically influencing the company's technology roadmap for the next decade.

## 8. Collaboration with other SNS Projects

TERRAMETA intends to collaborate with other 6G-SNS projects through bilateral information exchange, joint workshop or joint publications.

TERRAMETA has identified the following 6G-SNS projects from the first call for a potential collaboration: TIMES, Tera6G, 6GTandem, Hexa-X-II. In addition TERRAMETA will collaborate with the Horizon 2020 project TERAWAY through project partner ICOM, who is participating in both projects. TERRAMETA will also investigate possible collaboration with successful proposals of the second 6G-SNS call.

As a first concrete measure it was agreed with 6G-SNS project TIMES to collaborate and join forces on channel measurements and modelling at 300 GHz. Also, joint proposals for workshops at two conferences are under preparation.

## 9. Conclusion

This deliverable has presented the TERRAMETA's plans and measures to ensure the successful dissemination and exploitation of its project results and explains the opportunities to increase the impact of the project results by influencing standardisation. In its first 6 months TERRAMETA has set-up a dissemination infrastructure (web page, newsletter template, social media accounts), identified the relevant conferences and journals to publish project results and the possible paths toward standardisation and has defined its plans to exploit the project results.

## 10. References

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