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Input paper for the following Committee(s): check as appropriate Purpose of paper:

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Agenda item [[2]](#footnote-2) 5.1

Technical Domain / Task Number 2 …………………………………

Working Group WG2

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Radio-free wireless communication based on Metal Surface Wave in the maritime sector

# Summary

Advancing the autonomy of maritime sector is required to ensure the safety and efficiency of the whole operational systems installed in ships and Aids to Navigation, and the requirement of broad communication will gradually increase in the near future.

Most of shipboard monitoring systems tend to connect several thousands of sensors for central control units by extensive lengths of cables. In case of wireless implementation of that the radio-based communication must overcome characteristics of ships or AtoN surrounded by metal material, in particular, suffering from severe reduction received signal power.

Radio-free wireless communication, Metal Surface at Magnetic Substance (MS @ MS wave), is introduced for more efficient and capable of overcoming the limitation of metal surrounding structure for wireless communication and for primarily applying to the wireless IoT network in maritime sector.

## Purpose of the document

The purpose of the document is to request review for the emerging of new technology, MS @ MS wave.

## Related documents

ENAV30-n.n.n Metal Surface at Magnetic Substance (MS@MS) wave

# Action requested of the Committee

The committee is kindly requested to consider and discuss the Annex, emerging technologies-review table.

1. Emerging Technologies – Review Table

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Question** | **Technology Candidate Response** | | **Working Group Response** | |  |  |  | | --- | --- | --- | | **Green** | **Amber** | **Red** | |
| **Infrastructure** | **User** |  | **Status** |
|  | Where has the referral come from? | Referral has come from research of Franklin Bien and Haksun Kim from UNIST |  |  |  |
|  | Name of technology and product name | The product name is Aurora using MS@MS wave | MS @ MS wave is base on theory of metal surface wave |  |  |
|  | Functional description | A kind of wireless communication technology based on Surface-wave to overcome the limitation of metal surrounding structure for wireless network and for primarily applying to the maritime IoT devices. |  |  |  |
|  | Proposed user group | Any spaces or environment, which is surrounded by metallic materials, and where wireless communication by radio is hardly limited. | Ship, Aid to Navigation like buoy, Ocean Plant, Ocean Wind Farm or any Manufacturing Process, Environmental monitoring management |  |  |
|  | What are its Key limitations | The resonator of Aurora must be attached to a metal.  The metals must be continuously connected. |  |  |  |
|  | Where is it currently used (geographic and/or industry)? | The Aurora solution has been applied to the vibration monitoring system in manufacturing process at Display factory in Korea.  It has been testing in ships by building a living lab and communication network. |  |  |  |
|  | How is it currently used? | Communication channel to monitor the vibration inside a Chamber in manufacturing process  Vibration and temperature monitoring of various space inside the ship from engine room and steering gear room to bridge for main monitoring location | User can feel the same to use any Wireless communication and/or RF based communication channel in aspects of speed and quality of communication. |  |  |
|  | How could it be used within the maritime sector? | The Aurora solution provides communication network in various areas, including the navigation management room, in ships which are covered of continuous metals. | Ship condition engineer, Ship machine engineer, AtoN engineer, communication system engineer, Ship management department, Ship sailor |  |  |
|  | Who developed it? | Sunny Wave Tech has developed the technology, researched by UNIST, for productization, and is in the productization stage.  Sunny Wave Tech is the product supplier.. |  |  |  |
|  | Is it commercial, non-commercial or military? | Used in commercial projects. |  |  |  |
|  | Is there an existing technology that meets the same requirements?  If so, what make this different? | Metal Surface @ Magnetic substance wave(MS@MS wave) is the world’s first technology.  PLC technology might be a similar technology, but it sends through an electric wire, not any metallic surfaces. |  |  |  |
|  | Ease of implementation? | Can be easily replaced with existing wired communication solutions applied in metallic environment. |  |  |  |
|  | What are the constraints for implementation? | The technology is suitable in areas which have continuous metals, but not suitable if the metals are discontinuous or separated. |  |  |  |
|  | what is the capability of the technology? (i.e. nominal range; data throughput; support for audio / video?) | When the surface wave solution is applied in the area which contains more than two septa (about 30m of distance) and supports Wi-Fi 802.11 n, the transmission speed is more than 30Mbps.If we use network technology, comm. Distance can be extended for audio, video, and digital data. |  |  |  |
|  | What is the scalability of the technology? | Can build the communication system independently.  Can expand the usages of the surface-wave communication system as it is compatible with existing wire/wireless communication systems | It is possible simple data communication(sensor) in local area.  In the large part, it can possible to configure communication network for the whole ship.  Include a simple data, audio, and HD video. |  |  |
|  | Is the technology backward compatible? | The Aurora devices expands the communication methods as it maintains existing network standards, such as Wi-Fi, but transmits signals in surface-wave form.  The system is compatible with any types of communication systems and maintains backwards compatibility. |  |  |  |
|  | Is the technology dependant on another technology? | independent to any technology |  |  |  |
|  | Can the technology be demonstrated? | Yes, technology has been being demonstrated by applying in ships. |  |  |  |
|  | Are there any results and test bed? Please List | See the results at <https://sunnywt.com/bbs/board.php?bo_table=en_notice&wr_id=3> |  |  |  |
|  | Is there a compliance summary? | There is no compliance in the MS@MS wave  But we have been conducting test to apply on ship.  The Compass safety distance test for interference of magnetic strength and IEC 60945 test  Also we prepare communication standard of MMW in near future |  |  |  |
|  | Are there legal issues associated with the implementation of the technology? | No specific legal issues |  |  |  |
|  | Are there any intellectual property rights (essential patents) associated with the technology? | The technology has obtained IPR. There is no problem related to IPR and commercialization. |  |  |  |
|  | Is the technology safe to use [note – safety could be understood in different ways] | There is no health and safety consideration to the use of surface wave equipment, given that it is non-radiative. |  |  |  |
|  | Does the use of the technology require extra training? | The Aurora devices are typically straightforward and easy to implement in various metallic environment. |  |  |  |
|  | Are there environmental considerations with the technology? | The devices must be attached on a metal surface for data transmission.  No other environmental consideration exists. |  |  |  |
|  | What are the financial considerations for implementation and use? | The Aurora equipment is about 10% more expensive than the existing wireless communication equipment. But reduce the total install cost about 80% compared to wire system. The system can build communication network in the areas where existing communication technology cannot be applied, and the reliability and the performance are greater than existing ones. |  |  |  |
|  | Is the technology secure (i.e. protected against hacking; privacy of data)? | The main difference of surface-wave communication and wireless one is that the signals are transmitted through metals as medium, not through the air.  There is no additional security consideration needed compared to existing wireless communication systems.  The MS@MS wave is less affective by signal interference since the signals are transmitted through metal surfaces. |  |  |  |
|  | Readiness (EU Technology Readiness level - TRL) (level of maturity of technology) | Currently in TRL 6  Desiring TRL 7-8 in 2023 |  |  |  |
|  | Can you provide independent References | <IET Microwaves, Antennas & Propagation> <https://sunnywt.com/bbs/board.php?bo_table=en_notice&wr_id=4>  <Scientific Reports> <https://sunnywt.com/bbs/board.php?bo_table=en_notice&wr_id=5> |  |  |  |

1. Annex Heading 1
   1. Annex heading 2
      1. Annex heading 3
2. ........
3. Appendix heading 1
   1. Appendix heading 2
      1. Appendix heading 3

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)