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Generic terms for relevant telecommunication technologies potentially applicable to the maritime domain   
and brief guide to relevant ITU documentation

# Summary

This document provides a survey of generic terms for relevant telecommunication technologies that are potentially applicable to the maritime domain. Also this document provides a brief guide to relevant ITU documentation in this regard, in an overview or introductory manner. Some remarks are offered to highlight technology application options already covered by relevant ITU documents. While great care has been taken to reference correctly and to cover the topic to some degree, this compilation has been established without any aspiration of being complete, and the present author would be receptive of any indication in this regard by Committee members.

# Background

The need for such a contribution emerged at WG2 meetings at ENAV26, and the present author agreed to compile such a contribution to the Committee as a more elaborate version compared to an ad-hoc-submission made by him at ENAV26.

The benefits of using generic terms when it comes to telecommunication technologies as defined in particular by ITU as opposed to colloquial terms or even brand names became apparent at ENAV26 in order to keep IALA’s work clear of ambiguities on one hand and IPR issues on the other hand. Also, it was recognised that IALA might benefit from the outset by referencing a well-established corpus of terminology when engaging in or maybe even taking again the initiative in the application of relevant (emerging) telecommunication technologies to the maritime domain by (future) submissions to IMO, ITU, and other international bodies. Based on that rationale, it was also concluded to use generic terminology for the next edition of the MRCP.

This document reflects some of the work done by the present author in preparation for his IALA Symposium Rotterdam contribution entitled: *“Is ‘5G’ for VTS and e-Navigation?”* that was originally scheduled for May 2020 but has now been re-scheduled to April 2021.

# Discussion

## International Mobile Telecommunication (IMT)

The fifth generation of mobile telecommunication technology (‘5G’) is called ‘IMT for 2020 and beyond‘ by the International Telecommunication Union (ITU) – ‚International Mobile Telecommunication for 2020 and beyond’, to be precise. ‘IMT for 2020 and beyond’ is abbreviated to read ‘IMT-2020.’

The generic term ‘IMT-2020’ should be used instead of ‘5G’: ‘5G’ is a designator for a certain development stage of telecommunications technology and also tends to be used as a marketing term. ‘IMT-2020’ is an ITU term correlated with a substantial specification documentation that sets the requirement threshold for any and all applicable ‘5G’ technology candidates; i.e. industry developed ‘5G’ technology candidates need to meet the requirements of IMT-2020. Hence, IMT-2020 is the stronger term, too.

Note that IMT-2020 comprises essential features of IMT-Advanced, better known as ‘LTE-Advanced’ or ‘4G’ (and its derivatives).

The summary term for all the different stages of the development up to IMT-2020 at ITU is ‘IMT-Systems.’

ITU has published many documents dealing with many different facets of the various IMT-Systems, including IMT-2020, and their interdependencies. From a strategic, operational and overview perspective a good entry point into that bulk of documents is provided by a few documents, though: **[ITU-M2083]** together with **[ITU-M2441]** provide the IMT-2020 use cases and the requirement base in an overview manner, i.e. the ‘promises’ of IMT-2020; **[ITU-M2373]** focusses on the audio-visual capabilities while **[ITU-M2440]** focusses on the use of IMT-2020 for Machine Type Communications (MTC); **[ITU-M2370]** provides IMT-systems traffic estimates 2020-2030; **[ITU-M2320]** introduces the radio communication technologies supporting IMT-2020 in an overview manner; **[ITU-M2375]** shows the technical architecture and topology – here it starts to get sophisticated (but still worthwhile to digest for all system architects amongst us ☺); so we stop short of venturing into this.

A comprehensive list of IMT related documents at ITU alone is contained in **[ITU-M1036]**, Attachment 3.

**[ITU-M2376]** explores the feasibility of in particular broadband applications by using frequency bands above 6GHz, i.e. those frequency bands for which ‘5G’ has become iconic and for which the (flawed) image in the public mind has already associated them with range and applicability ‘limitations of 5G’ in total: It should be noted that there is an inherent trade-off between mobility requirements on one hand and achievable reliable coverage on the other hand: While vessels certainly will not even come close to exploiting the mobility parameter promise of IMT-2020 – consider the speeds of even High Speed Crafts compared to those of high speed trains for which the IMT-2020 mobility requirement was set up in the first place –, the margin thus gained may be used for exploiting the ‘seamless wide area coverage’ promise; compare ‘macro rural’ deployment scenario (**[ITU-M2101]**, §2.2).

For the satellite component of IMT-2020 compare **[ITU-M2176]**.

The required frequency arrangements have been made by ITU **[ITU-M1036]** and national authorities **[ITU-M2480]**.

In order to fulfil the ‘promises’ of terrestrial part of IMT-2020 by real technological implementations, ITU invited industry globally to submit their technology proposals as candidates for evaluation **[ITU-Circ 59]**. The results of the first evaluation round for ‘promise-delivering’ technologies recognized as part of the terrestrial part of the IMT-2020 are given in **[ITU-M2050]**.

## Relevant Non-Voice Technologies

Machine-Type-Communications (MTC) is the term used at ITU instead of the colloquial term Internet of Things (IoT), and that fact might be slightly more to the point.

### Short-Range Radiocommunication Devices (SRD) and Low Power Wide Area Networks (LPWAN)

The ITU generically calls this group of technologies Short-Range Radiocommunication Devices (SRD) on one hand **[ITU-SM2153]** and Low Power Wide Area Networks (LPWAN) on the other hand **[ITU-SM2423]**. Due to their design purpose, these technologies fall into the broader category of MTC aka IoT, i.e. they intend to support similar or even identical use cases in the MTC domain as the terrestrial IMT-2020 Radio Access Technologies, but with a different technological approach. For an overview compare **[ITU-M2479]** and **[ITU-M2440]** together.

According to **[ITU-SM2153]**, SRD comprise such diverse technologies as Broadband Radio Local Area Networks (Broadband-RLANs), balise and loop transmission systems at railways, inductive loop systems, wireless audio applications and radio microphones, RF identification (RFID) systems, medical implant communication systems and radar level gauges. SRD technologies ‘are permitted to operate on a non-interference and non-protected basis’ (**[ITU-SM2153]**, §2; compare also §5 regarding specific frequency bands) and are generally not allowed on any frequency band that is allocated to ‘safety of life services, including radio navigation’ (**[ITU-SM2153]**, §5).

### Maritime Mesh networks with Broadband-RLAN technology

The range of the above technologies is small, in particular when considering the adverse propagation characteristics over sea. Hence, the idea was investigated in two testbeds in 2006/2007 and 2010 to use multi-hop communications, using one or more vessels as relay stations, thus creating a Maritime Mesh network based on Broadband-RLAN technology **[ITU-M2202]**.

### The notion of ‘voiceless VTS’

The notion of a ‘voiceless VTS’ has been around for decades, making its appearance in documents now and then (compare e.g. **[ITU-M2010]**, Annex 1, section 1), but only with the advent of the communication technologies under discussion here, it has gained fresh momentum.

## Overcoming the Voice gap – voice technologies

Digital voice transmission has not been addressed as intensively by the maritime community as digital data transmission over the past decades. There have been some initial considerations, though, based on the ‘simple fact,’ that voice can always be resembled as ‘data’ and thus ‘any’ appropriate broadband radio transmission technology could be used ‘in principle;’ it would serve the purpose of digital voice transmission.

### Application of voice encoding concepts of RLAN to the maritime domain

Already by 2013, **[ITU-M2288]** applied the voice encoding concepts of RLAN to the maritime MF/HF frequency band within the GMDSS, which would have had also the benefit of being a protected frequency band (RR, Appendix 17). However, **[ITU-M2288]** remained bound by usage of existing MF/HF shipboard equipment and thus failed to consider e.g. the vocoder technology application to any other relevant maritime frequency band (beyond the scope of GMDSS).

### Conventional Digital Land Mobile Radio applied to the maritime domain

The terrestrial IMT-2020 Radio Access Technologies have in common that they are based on the digital cellular concept. Hence, this prompts the question whether there are technologies not using a cellular setup that may render candidates for maritime applications.

There is such a family of technologies which also stems from the land telecommunications sector, and which was designed of delivering voice and data channels concurrently. This generically is called Conventional Digital Land Mobile Radio (CDLMR) by ITU, and **[ITU-M2474]** provides an up-to-date generic system survey to a variety of different system approaches (together with references to more specific documents in many cases). Due to the fact, that a single voice channel of the CDLMR technologies introduced there, may require a minimum bandwidth of 6.25kHz (FDMA) or 12.25 kHz (TDMA), only, these technologies are compatible with the existing frequency channel spacing options of the Maritime VHF frequency band **[ITU-M1084]** and thus render candidates for maritime application when thus mapped to it – in fact, this notion was first introduced for one of those CDLMR as early as 1997 (**[ITU-M2010]**, §2.2 +Annex 2)!

# References

1. **[ITU-M2083]** International Telecommunication Union (ITU). 2015. Recommendation ITU-R M.2083-0. IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond. Geneva.
2. **[ITU-M2441]** ITU. 2018. Report ITU-R M.2441-0. Emerging usage of the terrestrial component of International Mobile Telecommunication (IMT). Geneva.
3. **[ITU-M2373]** ITU. 2018. Report ITU-R M.2373-1. Audio-visual capabilities and applications supported by terrestrial IMT systems. Geneva.
4. **[ITU-M2440]** ITU. 2018. Report ITU-R M.2440-0. The use of the terrestrial component of International Mobile Telecommunications for narrowband and broadband machine-type communications. Geneva.
5. **[ITU-M2370]** ITU. 2015. Report ITU-R M.2370-0. IMT traffic estimates for the years 2020 to 2030. Geneva.
6. **[ITU-M2320]** ITU. 2014. Report ITU-R M.2320-0. Future technology trends of terrestrial IMT systems. Geneva.
7. **[ITU-M2375]** ITU. 2015. Report ITU-R M.2375-0. Architecture and topology of IMT networks. Geneva.
8. **[ITU-M2376]** ITU. 2015. Report ITU-R M.2376-0. Technical feasibility of IMT in bands above 6 GHz. Geneva.
9. **[ITU-M1036]** ITU. 2019. Recommendation ITU-R M.1036-6. Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations. London.
10. **[ITU-M2480]** ITU. 2019. Report ITU-R M.2480-0. National approaches of some countries on the implementation of terrestrial IMT systems in bands identified for IMT. Geneva.
11. **[ITU-M2101]** ITU. 2017. Recommendation ITU-R M.2101-0. Modelling and simulation of IMT networks and systems for use in sharing and compatibility studies. Geneva.
12. **[ITU-Circ-59]** ITU. 2016ff. Circular Letter 5/LCCE/59. Invitation for submission of proposals for candidate radio interface technologies for the terrestrial components of the radio interface(s) for IMT-2020 and invitation to participate in their subsequent evaluation; as amended by Addendi.
13. **[ITU-M2050]** ITU. 2021. Recommendation ITU-R M.2150-0. Detailed specification of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020). Geneva.
14. **[ITU-SM2153]** ITU. 2019. Report ITU-R SM.2153-7. Technical and operating parameters and spectrum use for short-range radiocommunication devices. Geneva.
15. **[ITU-SM2423]** ITU. 2018. Report ITU-R SM.2423-0. Technical and operational aspects of low power wide area networks for machine-type communication and the Internet of Things in frequency ranges harmonised for SRD operation. Geneva.
16. **[ITU-M2202]** ITU. 2010. Recommendation ITU-R M.2202. Maritime broadcast wireless mesh networks. Geneva.
17. **[ITU-M2479]** ITU. 2019. Report ITU-R M.2479-0. The use of land mobile systems, excluding IMT, for machine-type communications. Geneva.
18. **[ITU-M2010]** ITU. 1997. Report ITU-R M.2010-1. Improved Efficiency in the Use of the Band 156-174 MHz by Stations in the Maritime Mobile Service. Geneva.
19. **[ITU-M2288]** ITU. 2013. Report ITU-R M.2288-0. Digital voice communication system on MF/HF radio channels of the maritime mobile service for shore-to-ship/ship-to-shore applications. Geneva.
20. **[ITU-M2474]** ITU. 2019. Report ITU-R M.2474-0. Conventional digital land mobile radio systems. Geneva.
21. **[ITU-M1084]** (ITU). 2012. Recommendation ITU-R M.1084-5. Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime mobile service. Geneva.
22. **[ITU-M2176]** ITU. 2012. Report ITU-R M.2176-1. Vision and requirements for the satellite radio interface(s) of IMT-Advanced. Geneva.

# Action requested of the Committee

The Committee is requested to:

1. Note the information provided;
2. Use the ITU defined generic terms in a consistent manner when drafting or revising IALA documents instead of colloquial terms or brand names;
3. Consider introducing amendments to some of the ITU documents, or relevant sections of them, by liaison with ITU, in order to update their content to the present/anticipated future state of the art (if the topic at hand is still relevant) or suggest their deletion or even suppression (if topic at hand is no longer relevant).

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