Received: 27 September 2021

Source: Document 5D/716, Chapter 3, Annex 3.3

Document 5D/817-E
27 September 2021
English only

GENERAL ASPECTS

ITU-APT Foundation of India (IAFI)

FURTHER UPDATES TO WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW REPORT ITU-R M.[IMT.INDUSTRY]

Applications of IMT for [Specific] Industrial and Enterprise Usages

1 Introduction

In its 38th meeting, Working Party (WP) 5D continued work on a draft new Report ITU-R M.[IMT.INDUSTRY] Applications of IMT for specific industrial and enterprise usages. This work was initiated in WP 5D in response to Question ITU-R 262/5 which calls upon ITU-R to study specific industrial and enterprise applications, their emerging usages, and their functionalities, that may be supported by IMT.

It is worth noting that WP 5D had earlier developed and published Report ITU-R M.2441 in 2018. That report provided an initial compilation of usage of IMT in specific applications.

2 Discussion

In order to further develop this report, it is desirable to seek further inputs from external organisations, in particular from 3GPP, which has been developing standards for use of IMT in various applications. For this purpose, a LS is proposed to be sent to these external organizations.

3 Proposal

At this stage, IAFI is proposing to send a liaison statement (LS) to External Organizations as per draft enclosed. Further the working document has been slightly updated to include some regulatory information in section 7.

Attachment 1: Updated working document

Attachment 2: Draft LS to External Organizations

ATTACHMENT 1

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT
NEW REPORT ITU-R M.[IMT.INDUSTRY]

Applications of IMT for [specific] societal, industrial and enterprise usages

(Question ITU-R 262/5)

TABLE OF CONTENTS

1 Scope

This report addresses the usage, technical and operational aspects and capabilities of IMT for meeting the [specific] needs of societal, industrial and enterprise usages.

2 Introduction

[Editor's Note : Following text is taken from contribution 5D/639 and is just used as place holder. Contributions are invited for further text in this and other sections of this working document]

Report ITU-R M.2441, published in 2018, provides an initial compilation of usage of IMT in specific applications. Further, it introduces potential new emerging applications of IMT in areas beyond traditional voice, data and entertainment type communications as envisaged in the vision for IMT-2020. PPDR, one of the specific applications of IMT is addressed in Report ITU-R M.2291.

This report has been developed in response to Question ITU-R 262/5 which calls upon ITU-R to study specific industrial and enterprise applications, their emerging usages, and their functionalities, that may be supported by IMT.

[Today's industrial automation is powered by ICT technology and this trend will increase manifold with advent of new broadband mobile technologies such as IMT-2020, leading to increased business efficiencies, improved safety, and enhanced market agility. Industry 4.0 enables industries to fuse physical with digital processes by connecting all sensors and actuators, machines and workers in the most flexible way available. Tethering them to a wired network infrastructure is expensive and, ultimately, it will limit the possible applications of Industry 4.0. Industrial grade private wireless will unleash its real potential by providing the most flexible and cost-effective way to implement a wide range of Industry 4.0 applications. Current IT based automation solutions are well adapted for day-to-day business communications but are limited in reliability, security, predictable performance, multiuser capacity and mobility, all features which are required for operational applications that are business or mission critical. Similarly, applications in mines, port terminals or airports require large coverage area, low latency and challenging environments, which so far only two-way mission critical radios could meet. In both mining and port terminals, remotely operated, autonomous vehicles, such as trucks, cranes and straddle carriers are used requiring highly reliable mission critical mobile communications.

Taking manufacturing, with thousands of factories with more than 100 employees, as an example, typical business cases revolve around controlling the production process, improving material management, improving safety, and introducing new tools. Research has shown that manufacturers can expect to see a tenfold increase in their returns on investment (ROIs) with IMT-2020, while warehouse owners can expect a staggering fourteenfold increase in ROI. Fortunately, IMT-2020 is available in configurations perfectly suited to building industrial-strength private wireless networks to support Industry 4.0. They bring the best features of wireless and cable connectivity and have proven their capabilities both in large consumer mobile networks area as well as in many industrial segments. The time is ripe for many industries to leverage private and captive IMT-2020 to increase efficiencies and automation. In simple terms –

(i) A private network is a dedicated network of the enterprise involving connections of the people, systems and processes of the enterprise.

(ii) A private network is a dedicated network by the enterprise setup internally in the enterprise by internal IT teams or outsourced.

(iii) A private network is a dedicated network for the enterprise to enable communication infrastructure for the systems and people associated with the enterprise.

The emergence of ultrafast IMT-2020 technology in higher (mmWave) frequency bands as well provides manufacturers with the much-needed reliable connectivity solutions, enabling critical communications for wireless control of machines and manufacturing robots, and this will unlock the full potential of Industry 4.0

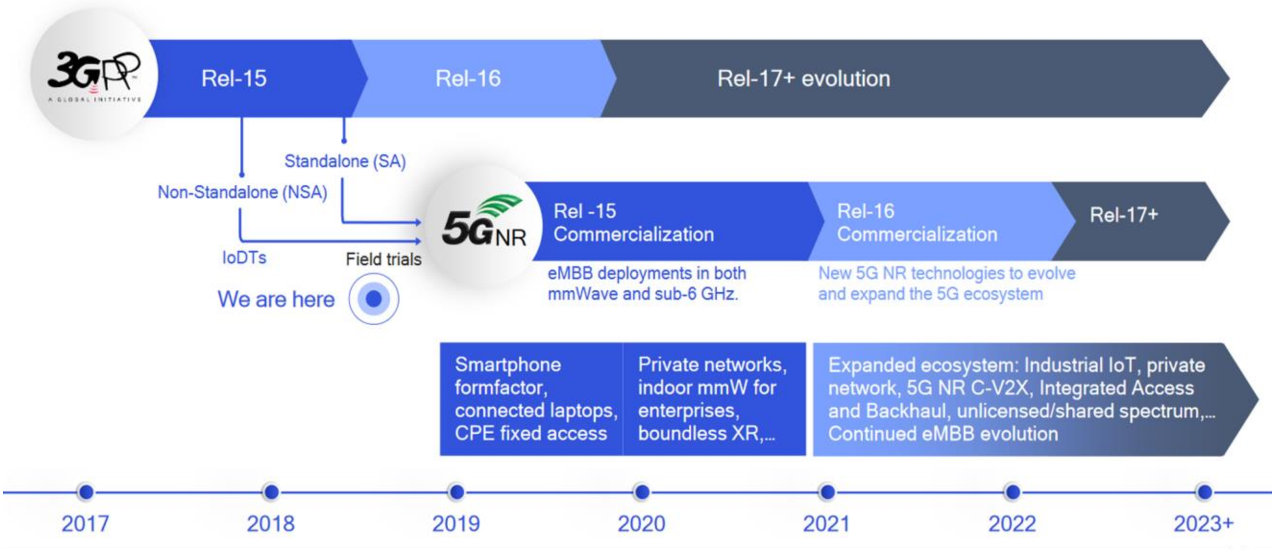
Apart from manufacturing, many other industries are also looking at IMT-2020 as the backbone for their equivalent of the Fourth Industrial Revolution. The opportunity to address industrial connectivity needs of a range of industries include diverse segments with diverse needs, such as those in the mining, port, energy and utilities, automotive and transport, public safety, media and entertainment, healthcare, agriculture and education industries, among others.

Some recent trial of IMT in port operations demonstrated the “New Radio” capabilities for critical communications enablers such as ultra-reliable low-latency communication (URLLC), enhanced mobile broadband (eMBB) to support traffic control, AR/VR headsets and IoT sensors mounted on mobile barges and provides countless possibilities to improve efficiency and sustainability in seaports and other complex and changing industrial environments. In response to the impact of COVID-19 pandemic some ports are increasing/accelerating their adoption of digital processes, automation and other technologies to enhance efficiency and resiliency to crises such as a global pandemic.

Similarly, in mining exploration sites, the drilling productivity could be substantially increased through automation of its drills alone. Additional savings from increased usage of equipment could also lead to lower capital expenditures for mines (CapEx) as well as a better safety and working environments for their personnel.

FIGURE 1

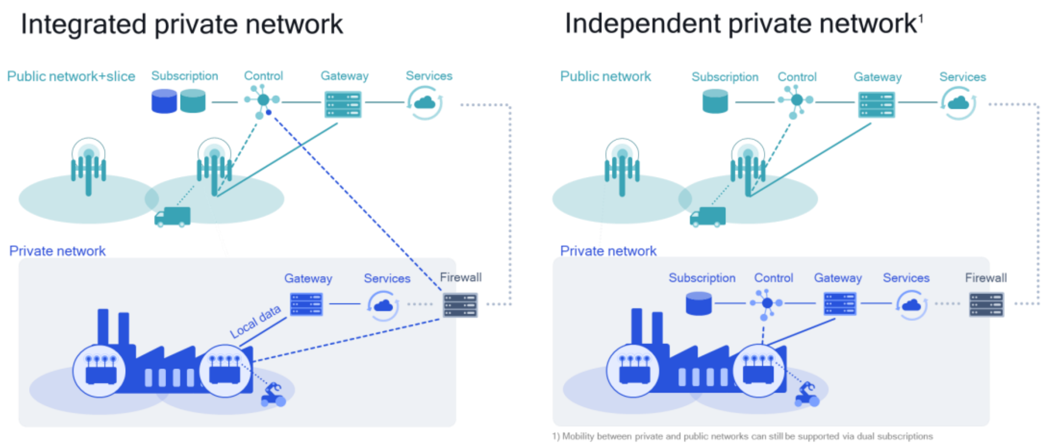
IMT Technology Evolution



Even the most advanced factories of today still largely depend on inexpensive unlicensed wireless networks that have several drawbacks, such as lack of protection and potential interference in dense settings and complex fixed connections that are difficult to manage in large industrial settings. While the unlicensed spectrum is freely available, it is severely limited in quality of service (QoS) and support for mobility. In smart manufacturing, such networks cannot support the mobile requirements of automated guided vehicles (AGVs) or the even some of the faster moving arms of robots. It also does not support low power requirements of sensors and other IoT devices. Further, it cannot support the high density of sensors, devices, robots, workers and vehicles that are operating in a typical manufacturing plant.

FIGURE 2

Examples of private network architectures depending on regulatory aspects and deployments needs



An example of an application in health care that need critical communications that is supported by new capabilities of IMT is remote robotic surgery. A latency of 1 millisecond is critical in providing haptic feedback to a surgeon that is connected through a mobile connection to a surgical robot. A high data rate is needed to transfer high-definition image streams. As an ongoing surgery cannot be interrupted an ultra-reliable communication is needed to keep connection down-time and packet loss very low.

A new generation of private IMT networks is emerging to address critical wireless communication requirements in public safety, manufacturing industries, and critical infrastructure. These private IMT networks are physical or virtual cellular systems that have been deployed for private use by a government, company or group of companies. A number of administrations took the lead to enable locally licensed or geographically shared IMT spectrum available for enterprise use and have begun to recognize spectrum sharing and localised broadband networks in providing flexibility and meeting the needs of critical communications by vertical industries and enterprises. Some administrations have decided to partition the IMT spectrum between commercial carriers and private broadband and others enabled opportunistic use and dynamic access to IMT spectrum that is licensed to commercial carriers.]

3 Related ITU-R documents

[1] Question ITU-R 262/5 - Usage of the terrestrial component of IMT systems for specific applications. (Copy reproduced in Attachment 2).

[2] Recommendation ITU-R M.2083 – Framework and overall objectives of the future development of IMT for 2020 and beyond.

[3] Report ITU-R M.2440 – The use of the terrestrial component of International Mobile Telecommunications (IMT) for Narrowband and Broadband Machine-Type Communications.

[4] Report ITU-R M.2441 – Emerging usage of the terrestrial component of International Mobile Telecommunication (IMT).

[5] Report ITU-R SM.2404 - Regulatory tools to support enhanced shared use of the spectrum

[6] Report ITU-R SM.2405 - Spectrum management principles, challenges and issues related to dynamic access to frequency bands by means of radio systems employing cognitive capabilities

4 Acronyms and definitions

5 Technical and operational aspects and capabilities of IMT for meeting the specific needs of industrial and enterprise usages

TBD

[Editor's Note: LS to 3GPP TSG and other external organizations needs to be sent to get information for this section.]

6 Case studies

Annex 1 Case study of airports/ ports/ logistics

Annex 2 Case study of construction, mining and similar usages

Annex 3 Case study of enterprises/ retail/ healthcare/ utilities

Annex 4 Case study of local community/ education

Annex 5 Case study of manufacturing/ oil refineries/

7 Regulatory and spectrum aspects

7.1 Spectrum aspects

Private broadband IMT networks need to operate in frequency bands identified for IMT in order to benefit from the economies of scale of the global IMT ecosystem. The choice of which frequency band(s) to use for local area networks is determined at the national level.

IMT frequency bands in which local area private networks have been deployed or are being planned include:

- [Editor's note: Frequency bands, if any, can be added later from contributions]

7.2 Regulatory aspects

Increased use of local (small cell) private network deployments can expand wireless capacity within existing spectrum resources.

Alternative spectrum allocation mechanisms may be needed to grant spectrum access to local area private networks to enable spectrum sharing by multiple networks operating in a portion of a frequency band or share spectrum with incumbent networks.

National Table of Frequency Allocations (NTFAs) primarily specify the radio services authorized by a national administration in frequency bands and the entities which have access to them. Frequency bands may be allocated to certain services or application on an "exclusive" or "shared" basis. The Licensed Shared Access (LSA) concept has been originally introduced as an enabler to unlock access to additional frequency bands for mobile broadband under individual licensed regime while maintaining incumbent uses. It was also developed with the aim of making a dynamic use of spectrum possible, whenever and wherever it is unused by incumbent users.[5]

LSA offers a regulatory tool to make available additional spectrum resource for use by mobile broadband when spectrum refarming is not feasible or desirable. It is however defined as a general concept which does not specify the nature of the incumbents and LSA users. LSA licensees and incumbents operate different applications and are subject to different regulatory constraints. They would each have exclusive individual access to a portion of spectrum at a given location and time.[5]

Spectrum access mechanisms to enable spectrum sharing and deployment of local area private networks include:

7.2.1 Dynamic spectrum access

In the context of Report ITU-R SM.2405, dynamic spectrum access (DSA) stands for the possibility of a radio system implementing cognitive radio systems (CRS) capabilities to operate on a temporary unused/unoccupied spectrum and to adapt or cease the use of such spectrum in response to other users of the band. Cognitive Radio System (CRS) is defined as a radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained.[6]

In USA, the FCC established the Citizens Broadband Radio Service (CBRS) in April of 2015 and created a three-tiered access and authorization framework to accommodate shared use of the band 3550-3700 MHz between private organisations and incumbent military radar and fixed satellite stations. Access and operations are managed through the use of an automated frequency coordination system, called Spectrum Access System (SAS).

7.2.2 Spectrum leasing

[Text to be developed]

7.2.3 Administrative licensing

Administrative licensing, also known as apparatus licensing, is a traditional method of authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. This method of licensing is used for assigning frequencies to narrowband systems in a number of countries. Some countries have adapted this method to broadband systems operating in specific geographic areas or zones and within specific frequency band(s). This method of licensing can be facilitated by establishing geographic zones: e.g., metropolitan, suburban and rural; and designating the frequency bands and zones in which spectrum licences are issued through competitive bidding (e.g., spectrum auction). For example, a frequency band may be designated for spectrum auction in metropolitan and suburban areas, with administrative licensing to apply in areas/zones not covered by spectrum auction.

8 Summary

TBD

ATTACHMENT 2

Draft liaison statement to External Orgasnizations

ITU-R WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW REPORT ITU-R M.[IMT.INDUSTRY]

"[Specific] applications of IMT for societal, industrial and enterprise usages"

ITU-R WP 5D is developing a working document towards a preliminary draft new Report ITU-R M.[IMT.INDUSTRY] – "[Specific] Applications of IMT for societal, industrial and enterprise usages"

The scope of the report is on new/emerging applications and use cases of IMT-Advanced and IMT-2020 for industrial, societal and enterprise users, both 4G LTE and NR. Current draft working document being developed in the WP 5D is enclosed for reference.

External Organizations (Including3GPP TSG SA WG6 (SA6)) involved in standardization and development of applications of IMT are kindly invited to provide relevant materials, use cases and any other related material that would facilitate in completion of this Report.

Working Party 5D would appreciate external organizations including 3GPP TSG SA to provide any feedback before the next 40th meeting of WP 5D, scheduled in xx 2022, if any.

Working Party 5D will keep the responding external organizations informed of the progress and outcomes of relevant studies in future WP 5D meetings.

Status: For information and action

Contact: Mr Uwe LÖWENSTEIN
Counsellor, ITU-R SG 5 **E-mail:** uwe.loewenstein@itu.int

Attachment: ITU-R working document towards a preliminary draft new Report ITU-R M.[IMT.INDUSTRY] "[Specific] applications of IMT for societal, industrial and enterprise usages"

____