ASIA-PACIFIC TELECOMMUNITY

The 28th Meeting of the APT Wireless Group (AWG-28)

22 – 30March2021, Virtual/Online Meeting

Document No: AWG-28/INP-IAFI-02

28 August 2021

ITU-APT Foundation of India (IAFI)[1]

UPDATE TO WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW APT REPORT ON EMERGING CRITICAL APPLICATIONS OF IMT FOR INDUSTRIAL, SOCIETAL AND ENTERPRISE USERS

1. Introduction

At the 27th meeting of AWG, the proposed working document towards a preliminary draft new report on "Emerging Critical Applications of IMT for Industrial, Societal and Enterprise Users" was further progressed. AWG-27 considered the input contribution AWG-27/INP-60 and incorporated the changes into the working document from the AWG-26 meeting. The meeting also agreed to request all APT members to submit further contributions to the next AWG meeting on this work item. It was also agreed to send a liaison statement to 3GPP from the next AWG meeting, once the working document has been further developed. Updated working document contained in AWG-27/TMP-08 which was carried forward is the base working document for the AWG-28 meeting on this work

2. Discussion

In many countries in Asia Pac and elsewhere around the world, an entirely new market segment, being loosely named as "Private LTE/5G" or Local area Licensed LTE/5G " is evolving rapidly to meet enterprise and Industry demands to keep up with competition and digitalization of the industries, with the advent of the fourth industrial revolution - Industry 4.0 trends. So far most Industries have depended on latest Wi-Fi networks that can meet signal propagation, speed and QoS requirements when supporting a moderate number of endpoints and classic applications, but - these Wi-Fi and related unlicensed technologies are far too limited in responding to the needs of Industry 4.0

Cutting-edge manufacturing sites, distribution centres and numerous other campus environments can benefit from the deployment of a private 5G infrastructure supporting either 4G or 5G radio access networks. From algorithmic updates to a production process, predictive maintenance of machinery and real-time interaction with autonomous distribution vehicles, private 5G networks afford numerous advantages for modern enterprises.

3. Proposal

[1] ITU-APT Foundation of India (IAFI) is a new Affiliate member of APT. Details of IAFI can be seen at itu-apt.org

Contact: Name Organization, Country Email:

Given the ongoing progress on this work, further modifications are proposed to the working document contained in AWG-27 -TEMP-08 in the attachment. Changes proposed in attachment are in track change mode in attachment 1. While these revisions aim to progress the work on the draft APT Report, it is understood that the completion of the draft APT Reports will depend on further inputs from APT members as well as external organisations. Accordingly a draft LS to external organizations, in particular 3GPP is proposed in attachment 2

ATTACHEMENT 1

ASIA-PACIFIC TELECOMMUNITY

The 27th Meeting of the APT Wireless Group (AWG-27)

22 – 30 March 2021, Virtual/Online Meeting

Document No: AWG-27/TMP-XX

25 March 2021

Task Group PPDR

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW APT REPORT ON EMERGING CRITICAL APPLICATIONS OF IMT FOR INDUSTRIAL, SOCIETAL AND ENTERPRISE USERS

1. Scope

Development of a new APT Report on new/emerging critical applications of IMT-Advanced and IMT-2020 for industrial, societal and enterprise users, in particular in private networks[2].

2. Introduction

The integration of information technology (IT) to build an automated, agile and intelligence driven manufacturing and services Industry will require high speed mobile connectivity. Today's industries, society and enterprises generate and use a huge amount of data in real time, which is moved and consumed at enormous rates so as to harness the advantages of digital technologies. Until now, connectivity has remained a critical barrier to realizing the full potential of what is collectively known as Industry 4.0.

A new generation of private mobile broadband networks is emerging to address real-time reliable wireless communication requirements in the operations of industries and critical infrastructure. Users of private networks include government entities, private enterprises, public utilities and local communities. Today's industrial automation is powered by ICT technology and this trend will increase manifold with advent of new IMT technologies such as 3GPP New Radio (NR), 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, 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 can provide a 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 areas, resilient and direct mode and isolated operations and challenging environments, which so far only two-way land mobile mission critical radio technology 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 data communications. Efficiencies of these type of users can be enhanced substantially by supplementing the mission critical voice communications with high-quality video and data support that is likely to become available from Releases 17/18 onwards in 3GPP IMT-2020. Report ITU-R M.2291 provides details of support provided by 3GPP IMT and IMT-2020 for meeting these requirements.

[2]Private networks may be designed for local-area coverage or virtual private networks on a public mobile operator network

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Organization, Country
Email:

The emergence of ultrafast mobile broadband technologies across low mid bands and in higher millimeter wave frequency bands provide manufacturers with the ability to deploy using common IMT platforms across multiple bands including licensed, lightly licensed and shared access spectrum. This flexibility and technology convergence enables 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. 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. Fortunately, 5G is available across multiple bands and is being designed and developed to support deployment and use case configurations for private wireless networks to support Industry 4.0. The time is ripe for many industries to leverage private and captive mobile broadband to increase efficiencies and automation.

Apart from manufacturing, many other industries are also looking at IMT-2020 (5G) as the backbone for their equivalent of the Fourth Industrial Revolution. The opportunity to address industrial connectivity needs of a range of industries, including diverse segments with diverse needs, such as those in the mining, port, energy and utilities, automotive and transport, public safety, media and entertainment, healthcare, and education industries, among others.

Some recent trials of IMT in port operations demonstrated the “New Radio” capabilities such as ultra-reliable low-latency communication (URLLC), enhanced mobile broadband (eMBB) and network slicing with the use of 5G to support traffic light 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. Similarly, in mining exploration sites, the drilling productivity could be substantially increased through automation of its drills alone and the use of real time video analytics for operating and controlling machines remotely. 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.

3. Acronyms, Terms and Definitions

[Text to be developed]

Pubic IMT network: An IMT network which provides services to the general public.

Private IMT network: An IMT network which provides services to a specific set of users only.

4. References

[1] APT/AWG/REP-67: APT SURVEY REPORT ON AUTHORIZED/LICENSED SHARED ACCESS AS A NATIONAL SOLUTION TO ACCESS SPECTRUM FOR IMT

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4.5. Required capabilities of IMT for new/emerging applications.

[Text to be developed]

IMT is the root name that encompasses IMT-2000, IMT-Advanced, and IMT-2020 collectively. IMT-2000 was to support data transmission rates[3] of up to 2 Mbps for fixed stations and 384 Kbps for mobile stations.

At Radiocommunication Assembly (RA-12), in Geneva, 16-20 January 2012, consensus on ´IMT-Advanced´ was reached to expand the IMT Radio Interface family by establishing the

[3] ITU-R M.1455-2: FDD: 2 × 5 MHz; 144 kbit/s for vehicular, 384 kbit/s for pedestrian, 2 048 kbit/s for indoor

new IMT-Advanced standard. Initially peak data rates of 100 Mbit/s for high and 1 Gbit/s for low mobility were established as targets for IMT-Advanced systems.

[4]In early 2012, ITU–R embarked on a programme to develop “IMT for 2020 and beyond”, setting the stage for 5G research activities that were emerging around the world. In September 2015, ITU–R finalized its “Vision” of IMT for 2020 5G mobile broadband connected society”. IMT-2020 use cases can be grouped into three classes: enhanced mobile broadband (eMBB), massive machine-type communication (mMTC), and ultra-reliable and low-latency communication (URLLC). There will be use cases that may not fit into one of these classes. For example, there may be some applications that require very high reliability but with latency requirements that are not aslow as 1 millisecond.

Industrial, societal and enterprise users of private networks have use cases that are not readily or not fully supported by public networks. The reasons to deploy private networks include:

- Coverage: By deploying private networks users can ensure coverage at their facilities or locations. This is necessary when the locations have no or poor coverage by public networks. For example: in remote locations in mines or farming areas; indoor locations in schools, campus, factories, warehouses, power utilities, etc.)
- Capacity: Private networks provide exclusive access to available capacity. They can be configured to specific capacity demands (e.g. support high definition video streaming)
- Control: Operators of private networks can determine which users connect, how resources are utilized and how traffic is prioritized. They also have control over the security of their data and can ensure that sensitive information remain within their premises.

5.6. Use cases/applications

[Text to be developed]

5.1 Manufacturing

Even the most advanced factories of today still largely depend on inexpensive unlicensed wireless networks that have several drawbacks, such as 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 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.
[Editor’s note: Below text is deleted because it is repeated in the Introduction, 3rd paragraph]

5.2 Transportation/ Logistics

[Text to be developed]

[4]ITU News Magazine on 5G: https://www.itu.int/en/itunews/Documents/2017/2017-02/2017_ITUNews02-en.pdf

5.3 Construction

[Text to be developed]

5.4 Healthcare

[Text to be developed]

5.5 Mines

[Text to be developed]

5.6 Oil Refineries

[Text to be developed]

5.7 Container Ports

[Text to be developed]

5.8 Enterprises

[Text to be developed]

5.9 Utilities

[Text to be developed]

5.10 Retail

[Text to be developed]

5.11 Local community

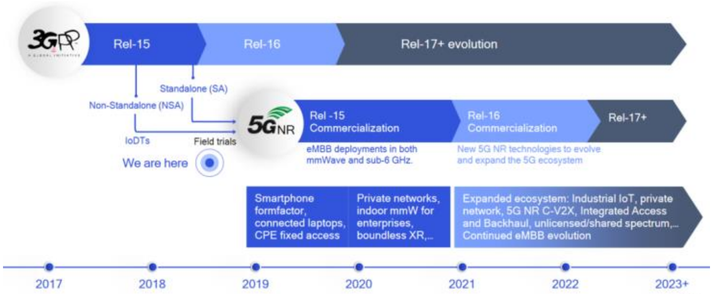
5.11.1 Connected schools

During the (Covid-19) pandemic, to curb local transmission of Covid-19 infection within communities, some governments had to close their schools and implement home-based remote learning for their students. This raised a new challenge in the form of ensuring all students have online access to learning materials, instructors, and support.

In the USA some schools have risen to the challenge by deploying their own private broadband networks to bridge the digital divide and provide Internet service to students who are learning remotely, enabling students to access online learning programs from their own homes

6. Roadmap and Ecosystem

[Text to be developed]



7. Examples of use IMT for new/emerging applications in APT countries (Attach annexes of examples from APT countries) -[Text to be developed]

8. Regulatory and Security Aspects.

[Text to be developed]

8.1 Spectrum access (allocation) for local private networks

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

New 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 an IMT band.

Spectrum access mechanism that have been implemented or being planned include:

8.1.1 Dynamic spectrum access

In USA, the FCC established the Citizens Broadband Radio Service (CBRS) and created a three-tiered access and authorization framework to accommodate shared use of the band 3550-3700 MHz. Access and operations is managed through the use of an automated frequency coordination system, called Spectrum Access System (SAS).

The three tiers are made up of [1]:

1st tier: Incumbent Access. Existing primary operations including authorized federal users and Fixed Satellite Service (FSS) earth stations. Federal users, e.g. Maritime Radars, will be protected from harmful interference from the CBRS users through geographic exclusion zones as well as dynamic blocking of CBRS use. FSS use will be protected by coordination zones around earth station installations, where CBRS use may be excluded or carefully monitored and regulated.

2nd tier: Priority Access License (PAL) users, such as mobile operators and other private entities such as enterprises can seek to receive priority authorization to operate within designated geographic areas based on census tracts and protected from harmful interference from the other 2nd tier users as well as 3rd tier General Authorized Access (GAA) users. Such PAL users are authorized using geographically delineated licenses that have 1-year terms and can be extended for up to 5 such terms.

3rd tier: General Authorized Access (GAA). Entitled to seek authorization from the SAS to use the spectrum on opportunistic basis and is not entitled to license guarantees or interference protection from other users. Users within certain Contained Access Facilities (CAF) such as hospitals, public safety buildings and local government buildings can reserve up to 20 MHz of spectrum from the GAA pool and need not seek 2nd tier status. These CAF can additionally restrict or deny third party use of the same spectrum within their premises.

The SAS is a cloud-based system and employs a database of all CBRS Service Devices (CBSD), including their tier status, geographical location, and other pertinent information from an environmental sensing capability (ESC) to coordinate channel assignments, manage potential interferences and authorize access to available shared spectrum. The ESC is a sensor network that detects transmissions from Department of Defense radar systems and transmits that information to the SAS. SASs will coordinate operations between and among users in the three tiers of authorization.

8.1.2 Spectrum leasing

…

…

8.1.3 Administrative assignments

Administrative assignments, also known as apparatus licensing, is a traditional method of assigning frequencies to narrowband systems[5] in a number of countries. Some countries have adapted this method of assignment to broadband systems operating in specific geographic areas and within specific frequency band(s). This method of assignment 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. auction). For example, a frequency band may be designated for spectrum auction in metropolitan and suburban areas, with a sub-band designated for special economic areas, and administrative assignments to apply to the whole band in areas/ zones not covered by competitive bidding assignment. (See Figure 1)

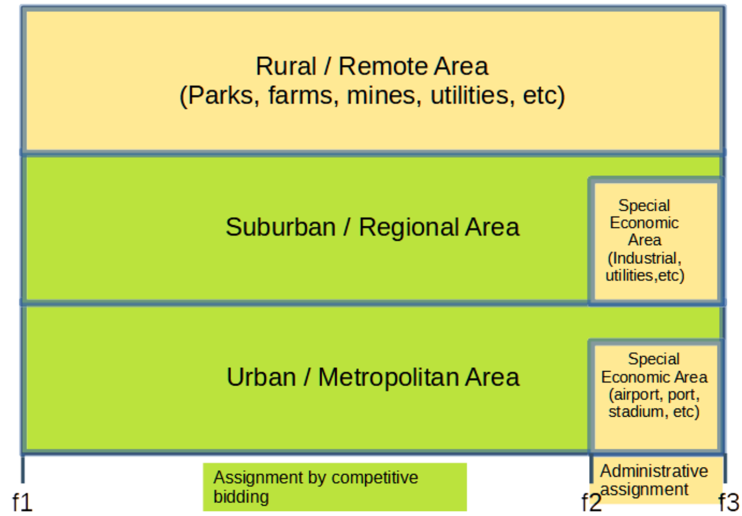


Figure 1. Assignment by competitive bidding in urban, suburban areas; administrative assignments in rural & special economic areas

[5]Conventional and trunked radio systems such as analog FM, APCO P25, DMR and TETRA

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9. Spectrum Aspects

[Text to be developed]

Frequency Bands identified for IMT (MHz)	Footnotes identifying the band for IMT in the Radio Regulations			Available Bandwidth (MHz)
	Region 1	Region 2	Region 3	
450-470	5.286AA			20
470-698		5.295, 5.308A	5.296A	228
694/698-960	5.317A	5.317A	5.313A, 5.317A	262
1 427-1 518	5.341A, 5.346	5.341B	5.341C, 5.346A	91
1 710-2 025	5.384A, 5.388			315
2 110-2 200	5.388			90
2 300-2 400	5.384A			100
2 500-2 690	5.384A			190
3 300-3 400	5.429B	5.429D	5.429F	100
3 400-3 600	5.430A	5.431B	5.432A, 5.432B, 5.433A	200
3 600-3 700	-	5.434	-	100
4 800-4 990	-	5.441A	5.441B	190
24 250-27 500	5.532AB			3250
37 000-43 500	5.550B			6500
45 500-47 000	5.553A			1500
47 200-48 200	5.553B			1000
66 000-71 000	5.559AA			5000

Table 1: Frequency band identified for IMT, as of 22nd November 2019[6]

9.1 IMT Frequency Bands

Private broadband networks need to operate infrequency 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.

In some frequency bands the operation of local area private networks in the portions that are adjacent to frequency bands use by the broadcast or satellite service may be possible for base stations operating at lower transmitter powers and the coverage areas are indoors.

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

- [Editor’s note: frequency bands can be added later; from contributions to Section 7 - Examples of use IMT for new/emerging applications in APT countries]
- …
- …

~~**9.2 Spectrum access (allocation) for local private networks**~~

~~A new approach may be needed to grant spectrum acces to local area private networks to enable spectrum sharing by multiple networks operating in a portion of an IMT band.~~

[6] Date of signing of the Final Acts of WRC-19,

~~One approach is the dynamic shared access system. [Editor's note: A description of dynamic shared access may be need]~~

10. Summary

[Text to be developed]