Final Report
by the 5G subgroup- EGTI

July 30th, 2021

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1. Objectives and scope

- The subgroup on 5G in 2021 is the extension/ follow- up of the previous work of the subgroup dedicated to 5G indicators established in 2019. During the 2019-2020 period the subgroup discussed different indicators to measure developments with 5G/ IMT-2020 and agreed to propose one indicator to EGTI in the September 2020 meeting. The indicator proposed and approved in September 2020 was: **Percentage of the population covered by a 5G mobile network,** for which a definition, scope and other methodological issues was as well provided.

- After this indicator was discussed and approved at the 2020 EGTI meeting it was suggested to continue the work on 5G/ IMT-2020 indicators given the relevance of the new spectrum assignments and deployments taking place in many parts of the world. The main objective was to discuss and if convenient, to propose, to the next EGTI meeting planned for September 2021 further indicators or refinements to existing indicators to be collected.

- The subgroup was formed by participants from 16 countries and international institutions and organizations, including the OCDE, GSMA, Statistics Canada, Intel, Ericsson and Axon Partners. 3 countries from Africa, 4 from Asia and the Pacific, 3 Arab States, 4 from Europe and 2 from the Americas participated.

2. The collection of 5G Questionnaire run by ITU among member countries

- The subgroup decided to send a small Questionnaire on 5G/ IMT-2020 developments to all member countries in order to know the degree of deployment of 5G networks,

existence of commercial offers and bands and capacities of spectrum already assigned for 5G uses.

- The main inference based on the high number of replies received are the following:

- 48+ countries replied to the Questionnaire (4 in Middle East, 18 in Europe; 4 in America; 2 in Africa; 6 in Asia)
- Some deployment of 5G ready networks was observed in general. in the big majority of countries 5G networks and services was already a reality; only 4 countries showed limited deployment- only for “trials” going on- and 2 countries declared no 5G deployment yet
- Most commercial offers provide mobile broadband connectivity with higher speeds than the one obtained with 4G ready networks directed mainly to individual users (with 5G capable devices)
- A few commercial offers supplied as well Fixed Wireless Access (fixed broadband) to final users, e.g., broadband connectivity to a fixed location using the 5G networks in the "last mile".
- There is a variety of commercial offers many embedded in the same tariffs as before with the 4G/LTE standard, even if some imply a higher price when unlimited data usage is allowed. Many offers on 5G bundle together data + voice services in the same tariff.

- Regarding indicators being collected (or envisaged to be collected), there is interest by Ministries or national regulatory authorities (NRAs) to collect indicators on 5G. The main indicators being collected (or planned to be) were:

- Coverage (over population and in some cases area coverage)
- Subscriptions to 5G
- QoS parameters (speed, latency, throughput)
- Number of 5G Base stations

- One problem encountered by many participant countries was the lack of clear and homogeneous definitions when requiring operators to gather data on any dimension of 5G activity

- In a different note some exploitation of the replies received to this Questionnaire will be provided.

3. Discussion and proposal to EGTI: refinements and indicators on 5G

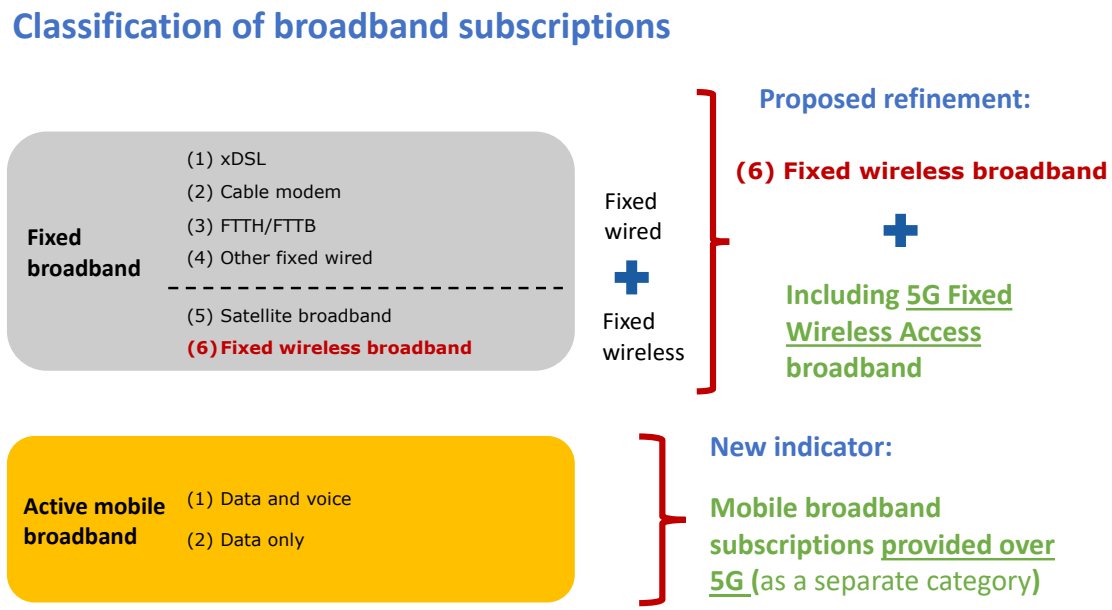
- The subgroup has discussed the following indicators and possible refinements or additions:

1. Subscriptions to fixed broadband- add Fixed Wireless Access to broadband with 5G/ IMT-2020?
2. Subscriptions to mobile cellular- add mobile subscriptions with 5G/ IMT-2020?

3. Subscriptions to mobile broadband- add mobile broadband with 5G/ IMT-2020?
4. Spectrum assigned for 5G purposes?
5. Any other indicator being affected by the emergence of 5G/ IMT-2020?
5.1. Subscriptions to M2M- any enlargement?
5.2. Traffic of mobile broadband: measure in 5G networks?

3.1. Subscriptions to fixed broadband- add FWA?

- Existing and proposed changes to subscriptions to either fixed- or- mobile broadband are depicted in the next figure.



- In the technological split of Fixed Broadband subscriptions (FBB) there exists the subcategory: *(6) Fixed wireless broadband*. It is proposed to specifically define the sub-category "Fixed wireless broadband when provided with a 5G network" (i271fw) as a component of Fixed Wireless Access to broadband, inside the Fixed broadband subscription indicator.

- The indicator on Fixed Broadband subscriptions then would become (in red the new component):

Indicator: Fixed broadband subscriptions, by technology

Definition:

- it refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than 256 kbit/s.

- it includes

Cable modem Internet subscriptions
DSL Internet subscriptions
Fibre-to-the-home/building Internet subscriptions
Satellite broadband subscriptions
Terrestrial fixed wireless broadband subscriptions
Other fixed-broadband subscriptions
Fixed Wireless Access subscriptions using a 5G network

- From the Questionnaire sent to all member countries, it was clear that a number of countries were observing already commercial offers to broadband access to a fixed location (as a household) based in the newly deployed 5G networks. These connections belong to fixed broadband and should be embedded in the indicator.

3.2. Subscriptions to mobile cellular- add as well subscriptions with 5G

- In many markets services are offered based on 5G networks. These offers very often consist of packages of services (bundles) that combine in one single tariff voice services (minutes of calls), messaging as well as data (broadband) service that allow for mobility. These offers are marketed as "5G offers" in that they provide very high data connection speed, as well as other services when the user is located under a 5G coverage area.

- It is clear that subscribers to mobile cellular services can now contract services (voice, messaging and data- broadband) with 3G/UMTS standard, with 4G/LTE, or with the newly deployed 5G/ IMT-2020 standard, and all and any of these subscriptions must be counted as "mobile cellular subscription".

- The existing indicator "Mobile cellular telephone subscriptions by postpaid/ prepaid" must be accommodated now to include as well any such subscription that runs over a 5G network (in red color the refinement proposed).

Indicator 2.2: Mobile-cellular telephone subscriptions, by technology (i271)

Definition:

- the number of mobile-cellular subscriptions can be broken down by the technology or standard used:

  2.2a. subscriptions with access to 2G
  2.2b. subscriptions with access to 3G/UMTS, and
  2.2c. subscriptions with access to 4G/LTE
  2.2d. subscriptions with access to data communications with 5G/ IMT- 2020

- both residential and business subscriptions should be included

3.3. Subscriptions to mobile broadband- add with 5G

- Currently the set of indicators that ITU collects on mobile cellular services and mobile broadband are depicted in the next graph.

Mobile network subscriptions	Indicators
Mobile cellular subscriptions (voice and SMS)	**2.1.** prepaid/ contract **2.2.** by technology
Machine-to-Machine subscriptions (M2M)	
Mobile broadband subscriptions	**2.3. Total mobile broadband subscriptions** **2.4. Active mobile broadband subscriptions with 4G/LTE**
Mobile number portability	**2.9.** Mobile cellular numbers ported

- Regarding mobile broadband subscriptions two indicators exist: (1) total mobile broadband subscriptions (i271mw), and (2) active mobile broadband with 4G/LTE (i271mwa).

- It is proposed to clarify in indicator "Total mobile broadband subscriptions" the fact that 5G supported subscriptions are explicitly included and counted for under this total. In the next table in red color the proposed addition to the current definition.

Indicator 2.3: Active mobile-broadband subscriptions

Definition:
it refers to the sum of active handset-based and computer-based (USB/dongles) mobile-broadband subscriptions that allow access to the Internet

subscriptions must include a recurring subscription fee or if in the prepayment modality, pass the usage requirement, i.e., users must have accessed the Internet in the last three months.

it is composed of two sub-indicators:

1. Data and voice mobile-broadband subscriptions
2. Data-only mobile-broadband subscriptions

Clarifications and scope:

- to be considered broadband, a connection that is capable of using at least a 3G/UMTS network must be advertised, so that a nominal downloading speed of 256 kbit/s is at a minimum expected, i.e., subscriptions that are only to use GPRS and EDGE technologies are to be excluded.

- all subscriptions using any technology allowing mobile broadband connections regardless of device used should be included. Hence, standards as 3G/UMTS, 4G/LTE or 5G/ IMT-2020 are included

- It is proposed as well a further refinement or clarification to the exiting indicator "Active subscriptions to LTE/4G/ WiMax mobile broadband". Just for completeness purposes, it is to be added a reference to the fact that the 4G/LTE subscriptions to broadband include as well any kind of USB/ dongle/ model or computer-based subscriptions that individuals may contract (either in the prepayment or in the contract/ post-payment modality). In red color the addition/ clarification proposed on the existing 4G/LTE indicator.

Indicator 2.4: Active subscriptions to LTE/WiMAX mobile broadband

Definition:

- It refers to subscriptions that have generated Internet traffic in the last 90 days in LTE/mobile WiMAX and *other advanced mobile-broadband networks*, such as LTE-Advanced and Wireless MAN

- it excludes subscriptions having generated Internet traffic only in HSPA, UMTS, EV-DO and previous 3G networks, and also excludes fixed WiMAX subscriptions.

……

- it includes any subscription based on USB/ modem/ dongles or computer based that uses the data connection

* New indicator for 5G subscriptions to mobile broadband:

- As 5G commercial offers are a reality already in many countries and they offer much higher speeds and QoS that those based on previous standards, it is proposed to create a new indicator that focuses on mobile broadband offered solely by 5G/ IMT-2020 networks.

- The discussion on this new indicator centered around especially two points. First of all, in Canada and in some other countries this indicator is being collected already. One possible problem mentioned has to do with the activity: some users may contract a 5G tariff/ plan, but maybe they don´t have a 5G able- device, and hence, cannot make any 5G connection at the end. It may happen that some users are counted as "5G subscriptions", while they have not made any 5G connection.

- It was suggested that there are two criteria (that may be combined) in order to account a subscriber as a 5G active user: (1) the device is 5G enabled (or not), and (2) that subscription has made a 5G traffic in the network in the last 3 months. Suggested that 5G is much more than individual users making broadband connections, as for example, making phone/ video calls as well.

- Until now, ITU when introducing the "Mobile broadband with 3G", or the indicator "Mobile broadband subscription with 4G/LTE" based the distinction not on the type of device used by the final user, but based on the *traffic that that smartphone has generated in the last 3 months*, if it was 3G traffic, or 4G/LTE traffic. The same logic, it is argued, would apply in this case for 5G. It is mentioned that for telecom operators it is easier to monitor the traffic going through a specific network, rather than having reliable measures on the stock of 5G- capable devices in the market.

- The proposal consists of adding a new indicator to the list of existing ones that measures the activity (in terms of subscribers) to mobile broadband based on 5G networks as follows.

Indicator new!!: Active mobile broadband subscriptions to 5G/ IMT-2020

Definition:

- it refers to subscriptions that have generated Internet traffic in the last 90 days in 5G / IMT- 2020 mobile-broadband networks

- it excludes subscriptions having generated Internet traffic only in LTE/4G, HSPA, UMTS, EV-DO and previous 3G networks, and also excludes fixed WiMAX subscriptions.

- it includes both postpaid and prepaid subscriptions, and as well both residential and business subscriptions

- it includes data only, USB/dongle subscriptions active subscriptions

- Note that this indicator aims at collecting all individual subscriptions to mobile broadband with 5G/ IMT-2020, hence, it excludes any other possible use of 5G/ IMT-2020 networks as IoT or massive M2M services.

3.4. Spectrum assigned for 5G purposes?

- ITU is collecting already two indicators that measure the amount of spectrum to be used. One of these indicators deals with the amount of spectrum made available for commercial use: Indicator "2.12: Amount of spectrum licensed for IMT systems, in MHz".

- The indicator is further declared not for each individual frequency band, but for a wide intervals of frequency bands, based on the following distinction or blocks:

(1) Block < 1 GHz;
(2) Block 1 GHz- 6 GHz, and
(3) Block > 6 GHz

- In order to monitor the evolution of 5G capacity of a country and the amount of spectrum put for 5G commercial uses it was discussed as well the convenience of inserting some note or clarification when declaring indicator 2.12 that will distinguish individual bands (and capacities) *made available for commercial purposes specifically for 5G/ IMT- 2020.*

- Hence, the proposal of this subgroup **is to flag** the spectrum assigned to 5G when reporting "2.12. Total spectrum licensed/ assigned for each of the three main blocks" and to accompany this reporting with the following two clarifications:

(1) **What specific band has been assigned for 5G (**i.e., 700 MHz, 1800 MHz, 2,1 GHz, 3,4 GHz, 3,8 GHz, 26 GHz…)- this can be a small comment added in the data notes corresponding to each spectrum block

(2) **How much total capacity has been assigned for 5G** (total of MHz)- this may be offered in the long questionnaire as a separate indicator or specified in a note

Proposal: to flag the spectrum assigned to 5G when reporting
"total spectrum assigned for each of the three main blocks"

(1) Block < 1 GHz;
(2) Block 1 GHz- 6 GHz
(3) Block > 6 GHz

} **existing indicator already**

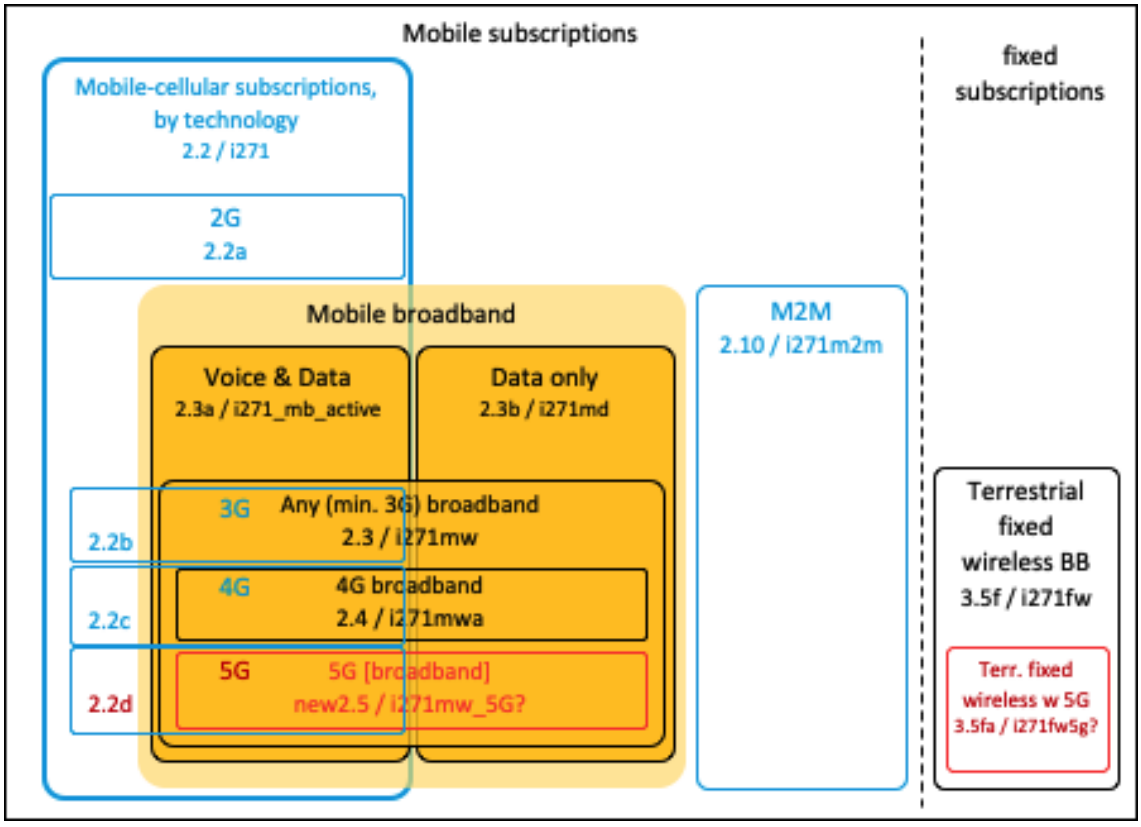
Specifying for each block the relevant **5G spectrum bands** and capacity assigned, as

1. **What specific band has been assigned for 5G** (i.e., 700 MHz, 1800 MHz, 2,1 GHz, 3,4 GHz, 3,8 GHz, 26 GHz…)
2. **How much total capacity has been assigned for 5G** (total of MHz)

} **New!!**

3.5. Relationship among all the mobile and fixed subscription indicators

The existing indicators for subscriptions and the newly proposed one would interact. Some indicators proposed just add a subcategory to an existing broader indicator. Some, add a specific category to be collected as a stand-alone indicator.



Relationships:
- Any mobile cellular subscriptions by technology: 2.2a + 2.2b + 2.2c + 2.2d = 2.2
- 3G/UMTS: 2.2b is a subset of 2.3 – (2.4 + 2.5) (the voice& data part of all 3G/UMTS subscriptions are broadband; data-only 3G broadband subscriptions are not included in 'any' mobile cellular subscriptions indicators)
- 4G/LTE: 2.2c is a subset of 2.4 /and 2.4 - 2.2c = NULL
- 5G: 2.2d is a sub-set of the new indicator 2.5
- Total of 5G = new 2.5 + new 3.5fa (5G broadband + terrestrial fixed wireless)

- Note that the proposed new indicator or sub-indicators cover some, but not all, of the expected uses that 5G may bring about. In this proposal we have advanced the following new indicators or refinements in the scope of existing indicators:

as new indicator:

a) Active mobile broadband subscriptions to 5G /IMT-2020

as refinements or extensions in the scope of existing indicators:

b) Mobile cellular subscriptions, including now as well 5G/ IMT-2020 supported individual subscriptions
c) Active mobile subscriptions with 4G/ LTE or any more advanced standard, i.e., including 5G/ IMT-2020

d) Active mobile broadband subscriptions, including now as well any subscription to broadband with 5G/ IMT-2020
e) Active fixed broadband subscriptions, including now 5G/ IMT-2020 supported subscriptions to fixed wireless broadband (FWA)

- 5G/ IMT-2020 shall have many uses, not only by individual users making use of the more enhanced broadband connection with mobility, but as well connections among machines, Internet- of -Things (IoT) and very low latency, higher quality connections over mobile networks. One classification of expected uses of 5G/ IMT- 2020 is discussed by the OECD (2019)[1] grouped the expected uses in the following categories:

(1) enhanced mobile broadband (eMBB),
(2) massive machine type communications (mMTC), and
(3) ultra-reliable and low latency communications (ULLC)

- Note that from the new indicators proposed by the subgroup on 5G or the refinements proposed basically the activity to be monitored and measured will be "enhanced mobile broadband", be it via mobility solutions or via fixed wireless broadband solutions.

- As services involving machines, devices, and different qualities attached to different services evolve, different indicators shall be needed in order to capture the rich environment of services offered and supported by 5G/ IMT-2020 networks. In a recent report made for 5G Observatory in Europe the following examples of services and corresponding indicators and dimensions were provided[2].

Table 3: Phase 2 indicators

Dimensions	Description	Indicators
1. Wide-area and hot-spot coverage	Coverage indicators	- Early deployment indicators - Number of 5G base stations (Base Stations using 5G pioneer bands) - Coverage & quality maps
2. QoS (Service quality level)	Service levels/service categories defined for monitoring purpose, in relation to the requirements they can meet	- Response time/latency - Reliability - Peak data traffic - User device mobility - Uplink/downlink symmetry - etc.
3. Focussed and local deployment patterns / Private networks	Geographical deployment pattern for main types of applications	- Coverage within each target deployment pattern - Number of private networks
4. Other service characteristics	"Network slicing", "mobile edge computing" (MEC), distributed cloud facilities, or enhanced reliability	- Percentage of target geographical areas offering MEC service - Capacity of communications services available for a given application type

[1] The road to 5G networks. Experience to date and future developments, OECD Digital Papers, July 2019, No.284.
[2] 5G Observatory, "Draft Concept paper- 5G Deployment", IDATE 2019

- One recommendation by the subgroup consist of monitoring he evolution and implementation of new services and its characteristics and adapt indicators already offered or design new indicators to capture the evolution of activity with 5G supported services.

4. Further work- a proposal

4.a. Subscriptions to M2M- any enlargement?

- Note that with the previous refinements and one additional indicator (5G mobile broadband subscriptions) we shall collect the activity related to individuals contracting and using 5G networks. We are not measuring under these indicators any machine- to-machine or Internet-of-Things (IoT) usage that does not involve humans subscribing to the service. 5G shall bring a massive amount of different services to play, for the individual, business and other users and we do not aim at measuring all its complexity and variety of services with one single indicator. We follow rather a step- by- step approach.

- But it is clear that 5G shall bring connectivity not only among people but among machines and devices in general. The IoT is expected to exploit in terms of devices being connected and traffic being transported.

- ITU collects since a number of years already one indicator (Machine-to- Machine subscriptions, M2M) that measures subscriptions that work among non- human interfaces, among machines or things being connected. The indicator as it stands embeds any kind of standard that may be used for traffic flows among machines or devices, hence, 2G/GPRS, 3G/UMTS, 4G/LTE and 5G/ IMT-2020 are to be included.

- Since this type of connectivity is expected to become very large in the near future, this subgroup would like to recommend to EGTI to create a group to discuss the M2M indicator as it is now, and possibly find ways to enlarge or adapt this indicator to the new rich variety of services and devices being connected.

4.b. Traffic of mobile broadband: measure as well traffic in 5G networks?

- ITU has been collecting internet traffic in fixed networks as well as internet traffic in mobile networks for some time. With a new technological standard, 5G/ IMT- 2020, more traffic and much higher volumes of internet traffic is expected to come soon. The indicators on internet traffic being collected are depicted in the table.

Internet traffic	
Fixed internet traffic	
	5.16. Domestic internet traffic
	5.17. Fixed broadband internet traffic
Mobile data traffic	
	5.18. Mobile broadband traffic within the country
	5.19. Mobile broadband traffic outside the country (data roaming- out)

- The refinements proposed both in the "Fixed broadband subscriptions, based on technology" indicator and in the "Mobile active broadband subscriptions" indicator have been proposed so that 5G subscriptions contracted by individuals are to be included. These new subscriptions shall create as well traffic flows that need to be collected.

- The exiting indicators on "Fixed internet traffic" and "Mobile domestic internet traffic" include in their scope any kind of open internet traffic flowing through any network, hence, they include as well any internet traffic managed by 5G networks.

- The subgroup recommends to follow traffic patterns and the evolution over different networks and analyze possible adaptations to the existing traffic related indicators when needed.