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# Information Sharing on ITU-R WP4B IMT-2020 Satellite Radio Interface Evaluation

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# WP 4B Organization

Chair: Mr. David E. WEINREICH (Globalstar),

Vice Chair: Ing. Fernando CARRILLO-VALDERRABANO (Echostar) and Dr. Sooyoung KIM (Jeonbuk National University, Korea)

Working Party 4B (WP 4B) - Systems, air interfaces, performance and availability objectives for the fixed-satellite service (FSS), broadcasting- satellite service (BSS) and mobile-satellite service (MSS), including IP-based applications and satellite news gathering.

## SWG 4B1: Performance issues

Dr. Sooyoung Kim (Korea, Rep. of)

Considered a proposed modification to Recommendation ITU-R S.2131-0

A method for the determination of performance objectives for satellite hypothetical reference digital paths using adaptive coding and modulation.

## SWG 4B2: Satellites in Next generation Access Technologies

Ms. Donna Bethea-Murphy (Inmarsat)

Task 1: To create a new report ITU-R M.[XYZ.ABC] on Vision and requirements for satellite radio interface(s) of IMT-2020

Task 2: To make progress on defining the timeline for IMT-2020 detailed specifications for the satellite radio interfaces.

## SWG 4B3: Internet of Things and network issues

Mr. David Weinreich (Globalstar)

Internet of Things and network issues.

Technical methods for improving performance and efficiency of FSS and MSS systems with machine-to-Machine/Internet of Things (M2M/IoT) applications.

The SWG is temporarily established based on the input contributions and will change before each WP 4B meeting

# ITU-R WP 4B IMT-2020 satellite component evaluation

- Background

- The IMT-2020 satellite component evaluation process is like the terrestrial IMT-2020 evaluation process in WP5D.
- To define satellite radio interface technologies for the satellite component of IMT-2020 in a new report ITU-R M.[XYZ.ABC]

- Meetings:

- WP4B #49 in 2021 July
- 2 CGs in 2021 September
- WP4B #50 in 2021 October

- Progress

- *Task 1: To create and progress the new report ITU-R M.[XYZ.ABC] on Vision and requirements for SRIs of IMT-2020*
  - The [vision and use cases](#) were reviewed and reached preliminary consensus. Open for further discussion.
- *Task 2: To make progress on defining the timeline for IMT-2020 detailed specifications for the SRIs.*
  - The discussion for the [timeline](#) was very controversial.

# Future Meeting Schedule

| Meeting           | Meeting Date    |
|-------------------|-----------------|
| CG Meeting #1     | 27 January 2022 |
| CG Meeting #2     | 10 March 2022   |
| CG Meeting #3     | 7 April 2022    |
| WP 4B meeting #51 | May 2022        |
| CG Meeting ...    | ...             |
| WP 4B meeting #52 | September 2022  |

# Task 1: IMT-2020 satellite vision and requirement report structure

1 Executive Summary

2 Introduction

3 Purpose and Scope

4 Structure of the Report

5 Related ITU-R and ITU-T documents

6 Acronyms and abbreviations

## 7 Vision on the satellite component of IMT-2020

7.1 Use cases

7.2 Capabilities

7.3 System

7.4 Radio interface

## 8 Requirements for the satellite radio interface(s) of IMT-2020

8.1 Service Aspects

### 8.2 Technical requirements

8.2.1 Technical requirement for eMBB infrastructure

8.2.2 Technical requirement for mMTC infrastructure

8.2.3 Technical requirement for uRLLC infrastructure

8.2.5 Average spectral efficiency

8.2.6 Area traffic capacity

8.2.7 Latency

8.2.8 Connection density

8.2.9 Energy efficiency

8.2.10 Reliability

8.2.11 Mobility

8.2.12 Mobility interruption time

8.2.13 Bandwidth

8.2.2 Technical requirements for mMTC

## 9 Guidelines for evaluation of the satellite radio interface(s) of IMT-2020

9.1 Evaluation criteria

9.2 Evaluation methodology

10 References

- Controversial issues

- Use case: eMBB (?), mMTC, uRLLC (?)

- Transparent and regenerative system architecture: SRI?

- Integrate and/or interoperate between the satellite and terrestrial interfaces

- Candidate spectrum type

- Service and Technical requirement

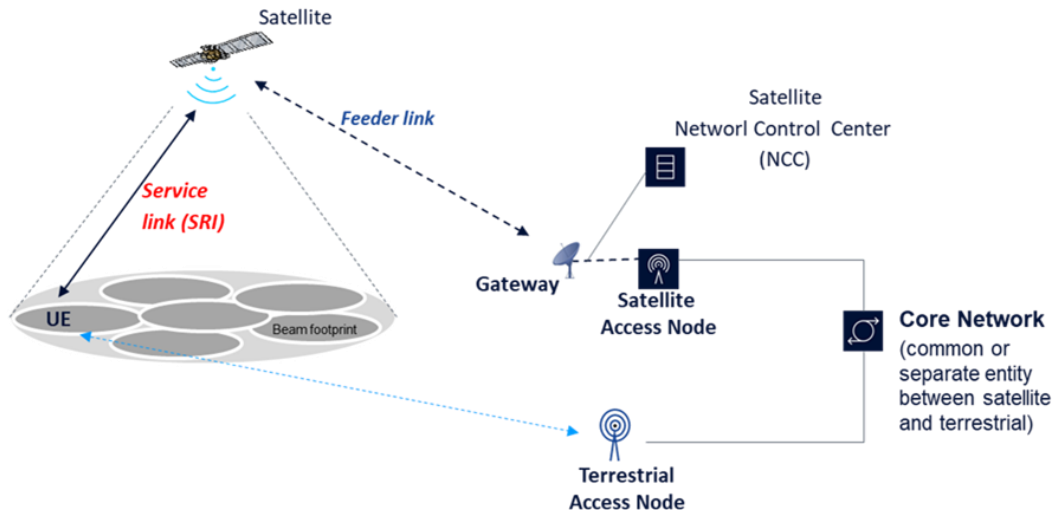
# Task 1: Vision on satellite radio interface

- The satellite radio interface should have a high degree of commonality with, the IMT-2020 terrestrial radio interface, including:
  - support service continuity
  - support key features such as end-to-end network slicing
  - prevent performance degradation with the IMT-2020 security framework.
- For the definition of the satellite radio interfaces of IMT-2020, re-use full or part of the IMT-2020 terrestrial radio interfaces should be considered.
  - Recommendation ITU-R M.2150 provides detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020).

# Task 1: Discussion on system architecture for transparent and regenerative

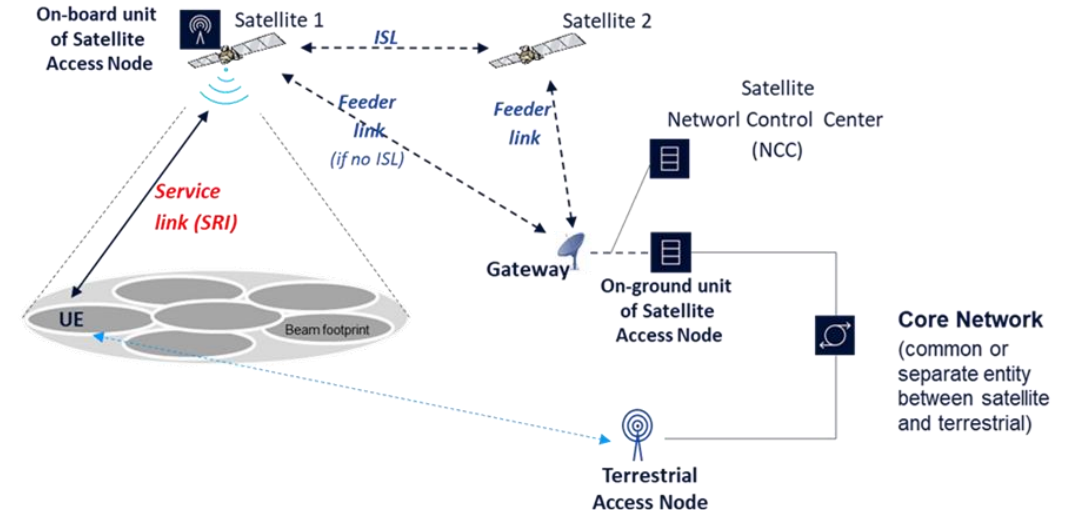
## Transparent

Satellite IMT-2020 typical scenario based on transparent payload



## Regenerative

Satellite IMT-2020 typical scenario based on regenerative payload



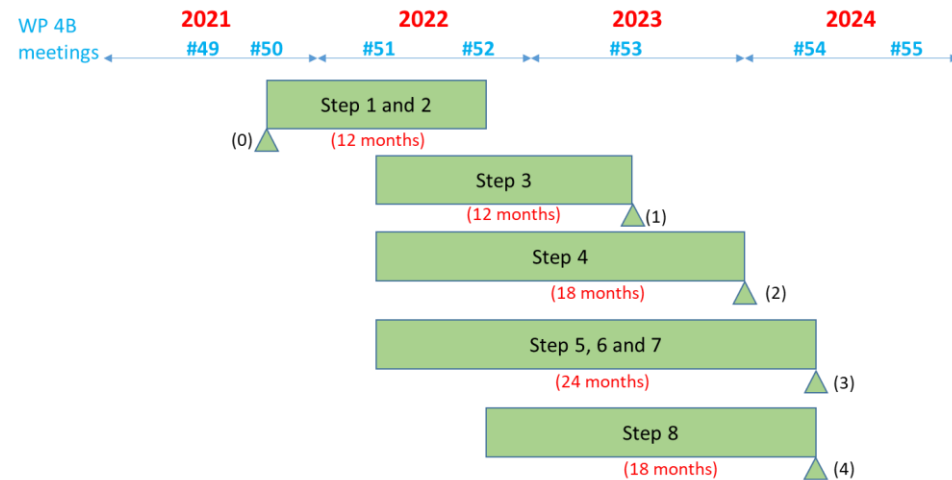
# Task 1: Technical Requirements for Handheld Terminal

| Parameter                               |  | USA  | Echostar and Inmarsat  | Russia  | China   |
|---|--|--|--|---|---|
| Peak data rate                          |  |  | DL [25 Mbps]<br>UL [2 Mbps]  |   | Terminal types Handheld with 30MHz BW<br>DL 75 Mbps<br>UL 36 Mbps   |
| Peak spectral efficiency                |  |  | DL [1.5] bit/s/Hz<br>UL [1] bit/s/Hz   |   | DL 2.5 bit/s/Hz<br>UL 1.2 bit/s/Hz  |
| User experienced data rate              |  | Dense Urban - eMBB test environment:<br>DL 100 Mbit/s.<br>UL 50 Mbit/s.  | DL [2] Mbps<br>UL [0.25] Mbps  |   | DL 1 Mbps<br>UL 100 kbps  |
| 5th percentile user spectral efficiency |  |  | DL [0.1] bit/s/Hz<br>UL [0.05] bit/s/Hz  |   | suggest to remove this requirement  |
| Average spectral efficiency             |  |  | DL [0.5] bit/s/Hz<br>UL [0.33] bit/s/Hz  |   | DL 1.1 bit/s/Hz<br>UL 0.7 bit/s/Hz  |
| Latency                                 |  | The minimum requirements for user plane latency are:<br>- 4 ms for eMBB<br>- 1 ms for URLLC<br>assuming unloaded conditions (i.e., a single user) for small IP packets (e.g., 0 byte payload + IP header), for both downlink and uplink. | User plane latency should be less than 4 ms + 2 x propagation delay.<br>Contribution of propagation delay to the Max Round Trip Delay:<br>541.46 ms for GEO,<br>95.19 ms for MEO,<br>25.77 ms for LEO 600, 41.77 ms for LEO 1200 | max round trip delay :<br>Transparent payload (service and feeder links)<br>15.46 ms (300 km)<br>48.62 ms (1500km)<br>Regenerative payload (service link)<br>7.73 ms (300km)<br>24.31 ms (1500km) |   |
| Connection density                      |  |  | Up to [1] per km <sup>2</sup> for eMBB   |   |   |
| Reliability                             |  |  |  |   | to support reliability as high as $1-10^{-3}$ assuming availability of the service.                             |
| Mobility                                |  |  | Max speed 250 km/h<br>(on board high speed car)  |   |   |
| Bandwidth                               |  | considering that possible satellite IMT bands are 1 980 to 2 010 MHz and 2 170 to 2 200 MHz for the return and forward links, respectively   | The RIT/SRIT should support a scalable bandwidth at least up to and including 30 MHz.  |   | The RIT/SRIT should support a scalable bandwidth at least up to and including 30 MHz for the handheld terminal. |



# Task 2: Discussion on Timeline (highly compressed)

## Input from France



### Steps in radio interface development process:

Step 1: Issuance of the circular letter

Step 2: Development of candidate RITs and SRITs

Step 3: Reception of the RIT and SRIT submissions and acknowledgement of receipt : May 2023

Step 4: Evaluation of candidate RITs and SRITs by evaluation groups

Step 5: Review and coordination of outside evaluation activities

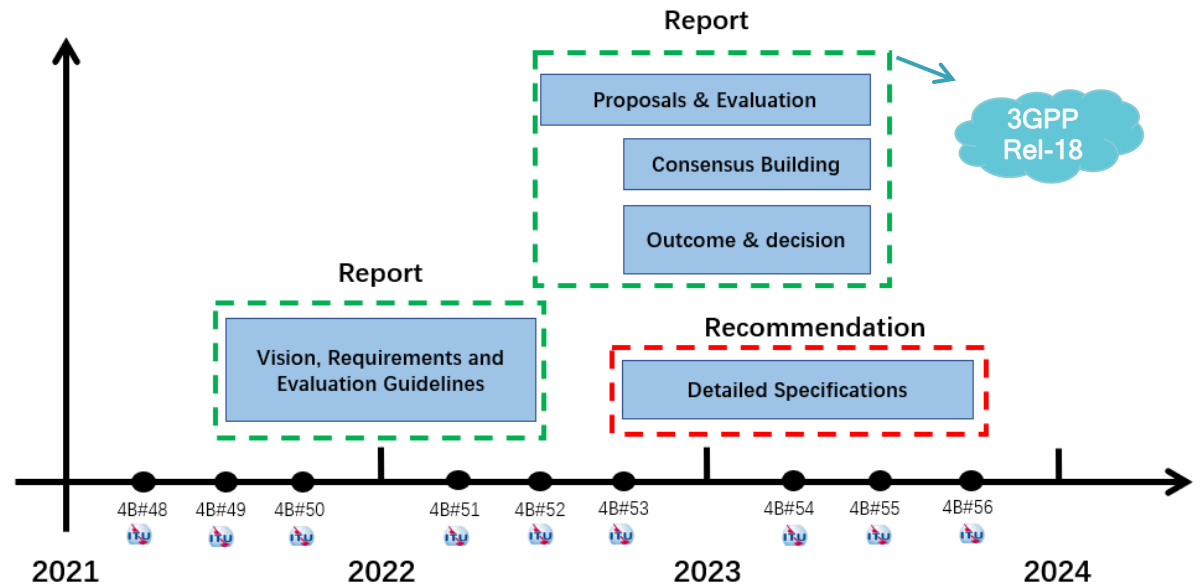
Step 6: Review to access compliance with minimum requirements

Step 7: Consideration of evaluation results, consensus building and decision

Step 8: Development of radio interface Recommendation(s) : May 2024



## Input from China







In general, the timeline can be divided into three phases i.e., vision and requirement, standards development and standards publication.

The specification of SRI of IMT-2020 will be completed no later than the year 2024.



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