Q.1 Whether spectrum in 700 MHz band should be assigned to Indian Railways for RSTT in India? Please provide justification for your response.

Wireless technology evolution is an important facet of modern day railway signaling. Before we decide on any particular spectrum it is very important to understand the evolution of technology vis-a- vis the requirements of the railway organization.

Background

Indian Railways follows the European train signaling and wireless telecom standards. Early 90s saw the evolution of GSM based railway standard called GSM-R (GSM for Railways). For commercially adapting GSM based standard for railways, the European Integrated Radio Enhanced Network (EIRENE) project was initiated in 1992 by UIC. Aim of the EIRENE project was to develop specifications for a GSM-based railway communication network. EIRENE project ended in 1995 with the publication of Functional Requirements Specification (FRS) and System Requirements Specification (SRS). The EIRENE project was followed by Mobile Oriented Radio Network (MORANE) project, whose goal was to run three GSM-R networks for testing and validating the performance of the technology. This project finished in 2000, with a delivery of the final specifications of GSM-R.

Success of GSM-R is largely attributed to the allocation of same 4MHz (876–880 MHz in the uplink band, while 921–925 MHz in the downlink band) spectrum across Europe.The common band used across the whole EU is one of the important elements allowing for “cross-border interoperability”.

India also adopted GSM-R technology in mid 90s.Due to the limited availability of spectrum, only 1.6 MHz (8 spots of 200 KHz) were allocated to Indian railways in 900 MHz band (907.8- 909.4 in the uplink band, while 952.8–954.4 MHz in the downlink band where 908.6/953.6 not allocated). Since “Manual Signaling” system was operational at the time of introduction of GSM-R in India, the limitation of frequencies did not have a major impact on network design, economies of scale and implementation of railway specific functionalities.

GSM-R brought in a lot of positives for Indian railways as it was already standardized, proven technology on 900 MHz spectrum with certified interoperability across various OEMs enabling economies of scale and with live networks across various countries, GSM-R systems support various railway specific features and functionalities (Voice Broadcast Calls, Voice Group Calls, functional numbering etc.) following the highest levels of safety in network and product design.

Current Status

With the advancement in railway signaling technology from manual to automatic (ETCS Level 2 and ETCS Level 3), UIC along with various railway operators, signaling & telecommunication OEMs is working on the evolution of GSM-R.

GPRS is being deployed along with GSM-R to support automatic railway signaling (ETCS – Level 2 @ 2.4 Kbps). There are various countries (as mentioned in the consultation paper) which are implementing ETCS Level 2 on GPRS.

ETCS Level 2 is being followed primarily in Europe and Asia (except China, Japan & Korea). China, Japan and Korea have their own proprietary signaling systems. E.g. China follows CTCS Level 3.

Indian Railways is also planning to deploy ETCS Level 2. Because of limitation of the availability of frequencies in 900 MHz band the Indian railways is not able to fully deploy ETCS Level 2.

Looking Ahead

Most of the European Operators are targeting to maintain their existing GSM-R deployments till 2035 and possibly beyond. It is in their interest to protect their existing investments.

UIC is the nodal agency which is involved in development of railway wireless standards. UIC along with 3GPP, ETSI, ERA and others is in the process of writing the specifications for the next generation railway communication deployments thru **FRMCS** (**Future Railway Mobile Communication Systems**) project. FRMCS addresses the complex topics like implementation of standards based full IP network, its co-existence with GSM-R and support of evolved railway signaling to name a few. The timelines for FRMCS are **attached** as annexure.

Almost all European & Asian countries (including China & Korea) have endorsed FRMCS. FRMCS is moving towards 5G and beyond. Various Railway operators in Europe and Asia are still continuing their investments in GSM-R till the time FRMCS specifications are finalized and the products available.

Almost all the OEMs working on FRMCS standards are European companies. Europe is taking the lead in development of the prototypes and in putting up the pilot networks based on FRMCS standards. European OEMs and Railway operators are thus expected be the first movers to deploy FRMCS in a live railway network.

We believe that India has two options to follow.

Option 1:

We recommend allocation of 4 MHz in 900 band (i.e. 2.4 MHz allocated in addition to 1.6 MHz already allocated in 900 band) to Indian railways. This will be an immediate solution for full deployment of ETCS Level 2. Advantages we get here are multifold which include a) Protection of existing investment b) Standardized & Proven technology with certified interoperability amongst signaling and telecom OEMs c) Economies of scale and established ecosystem d) Guaranteed support till 2035

Option 2:

We recommend that India should follow

a) **UIC standards for FRMCS**

b). **Harmonization of spectrum** in line with the European countries / operators

This will help our country to have a safe approach in adopting a **proven field tested technology** which has the consensus of UIC, railway signaling OEMs and the European railway operators. It will ensure high level of **Interoperability** between signaling and telecom products and also help us to achieve **economies of scale** for the deployed products. It will also ensure full **availability of ecosystem** (FRMCS handsets, Cab Radios / Modems, Dispatcher systems, recording systems etc.)

To achieve the harmonization of spectrum with the European operators, we believe that India should wait for the outcome of WRC 2019 where the FRMCS bands will be finalized. India should not rush in allocation of 700 MHz or any other band (like 450 to 470 MHz) for the Indian Railways. India should adopt the FRMCS frequency bands as adopted by the European operators.

Q.2 In case your answer to Q1 is in affirmative, how much spectrum should be assigned to Indian Railways?

Not Applicable

Q.3 In case your answer to Q1 is negative, i) what are the other bands (including 450-470 MHz) in which spectrum can be assigned for RSTT, ii) how much spectrum should be assigned to Indian Railways?

In addition to our response to question 1, we would like to state the following:

- There is no live reference of deployment of ETCS Level2 in main line railway using 450 to 470 MHz spectrum.
- Ecosystem of devices (Cab Radio / Modem, Handsets, Dispatcher etc.) does not exist in 450 -470 MHz
- Because of limitation of availability of OEMs in 450MHz -470MHz band there will not be any economies of scale.
- Railway signaling systems are normally designed with highest level of safety features. Since deployment of ETCS Level 2 signaling in 450-470 MHz will be non- standardized and without proper references, we would not recommend the same.
- Chinese Railways has not tested CTCS Level 3 (Chinese own Train Control System equivalent to ETCS level 2) on 450-470 Mhz. Therefore, nowhere in the world, there is any reference of ETCS Level 2 or its equivalent working on band 450-470 Mhz.

>> The Spectrum to be assigned for RSTT has already been elaborated in the response to Question 1.

Q.4 In case it is decided that spectrum in IMT bands which have already been earmarked for mobile services, be assigned to Indian Railways for RSTT in India, what should be the methodology (including price) of allotment of spectrum?

Since Railways will be using the spectrum for deployment of Mission Critical Voice and Data for the safety of the passengers, it should be provided free of cost to the railways.

Q.5 In case it is decided to assign spectrum in other spectrum bands (including 450-470 MHz band), what should be the methodology (including price) of allotment of spectrum?

Please refer to our response to Question 1 & Question No. 4

Q.6 Do you foresee any challenges, if IR makes internet services available onboard i.e. within the train using spectrum allocated for signaling purpose?

Allocation of spectrum for mission critical voice and data for the Railways should not be used for any other purposes.

IR network should work as a stand-alone Island network with no connectivity to any public network. This will secure the network from any external IP threats and also the network will not be overloaded in case of any disaster / accident.

Q.7 Whether the requirement of IR for RSTT can be fulfilled using the following alternate methods: i) Alternate method suggested in para 4.47, wherein a TSP could build, deploy and maintain LTE-R network for IR; while the control, use and operation of the LTE-R network may be with IR. OR ii) Alternate method suggested in para 4.48, wherein there could be a common integrated network (with common spectrum) for Public Safety i.e. Public Protection and Disaster Relief (PPDR) and Railways, using PS-LTE and LTE-R technology respectively. OR iii) Any other method as may be suggested by the stakeholders. (Please provide detailed response with justifications and required enabling provisions.)

.**Q.8 If there are any other issues/suggestions relevant to the subject, stakeholders may submit the same with proper explanation and justification**

FRMCS Timelines (2022-2023)