



भारतीय दूरसंचार विनियामक प्राधिकरण  
**Telecom Regulatory Authority of India**

**Recommendations on**  
**Spectrum Requirements of**  
**National Capital Region Transport Corporation (NCRTC)**  
**for Train Control System for RRTS Corridors**

New Delhi, India

28<sup>th</sup> December 2022

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## CHAPTER- I: INTRODUCTION

### A. DoT's Reference dated 29.11.2021

- 1.1 The Department of Telecommunications (DoT), through its letter No. L-14001/01/2019-NTG (Pt.) dated 29.11.2021 (**Annexure**), sent a Reference to Telecom Regulatory Authority of India (hereinafter also referred to as "the Authority") under the clause 11(1) (a) of the TRAI Act, 1997 (as amended) on the subject- 'Seeking TRAI recommendations on the spectrum requirements of National Capital Region Transport Corporation (NCRTC) for their LTE technology based RRTS network'. The relevant extract of the said Reference is reproduced below:

*"Based on the TRAI recommendations dated 25.10.2019 on "Allotment of spectrum to Indian Railways for Public Safety and Security services", Government has assigned 5 MHz (paired) spectrum in 700 MHz band to Indian Railways for their LTE technology-based proposed network.*

*2. Subsequently, NCRTC has requested DoT for allotment of spectrum for Regional Rapid Transit System (RRTS) being implemented by them in 8 corridors including 3 rail corridors of approximate length of 350 km along Delhi-Ghaziabad-Meerut, Delhi-Gurugram-Alwar, Delhi-Panipat in Phase-I. Letters dated 06.11.2019 and 10.08.2021 received from NCRTC are enclosed herewith for ready reference.*

*3. In their request, NCRTC has also informed that delay in sharing of spectrum assigned to Indian Railways is adversely affecting their August-2022 timeline for commissioning of 17 km-priority section of RRTS during 75<sup>th</sup> Anniversary of India's Independence (Azadi ka Amrut Mahotsav) in 2022.*

*4. As in the case of Indian Railways, NCRTC also carries passengers and spectrum will be used for mission critical safety applications of signalling and train control. Separate spectrum is required since the services involve safety of life.*

5. *In view of the above, under the terms of clause 11(1)(a) of TRAI Act, 1997 as amended by TRAI Amendment Act 2000, TRAI is requested to provide:*

(i) *Recommendations on administrative assignment of spectrum to NCRTC and the quantum, pricing/ charging thereof and any other terms and conditions, for separate spectrum requirements of NCRTC in 700 MHz band.*

(ii) *Any other recommendations deemed fit for the purpose, including assignment of the same spectrum for other RRTS/ metro rail networks pan-India.”*

1.2 Before proceeding further, brief background information on the subject matter is being given below.

## **B. Background**

### **(1) Spectrum Assignment to Indian Railways for Railway Radiocommunication Systems between Train and Trackside (RSTT)**

1.3 In the year 2019, DoT, through its Reference dated 27.02.2019, requested the Authority to provide recommendations on administrative allotment of spectrum to Indian Railways (IR) and the quantum, price, appropriate frequency band (including 450-470 MHz band) and any other related issue. After a detailed consultation process, the Authority furnished its recommendations on 'Allotment of spectrum to Indian Railways for Public Safety and Security Services' dated 25.10.2019 to DoT. A summary of the said recommendations is given below:

- (a) In the 700 MHz band, 5 MHz (paired) spectrum may be allocated to IR for implementing ETCS Level-2<sup>1</sup>, MC PTT<sup>2</sup> + Voice, IoT<sup>3</sup> based asset monitoring services, passenger information display system and live feed of Video Surveillance of a few coaches at a time.
- (b) To implement the Video Surveillance System for all coaches of the Train (Security services), IR may explore other communications means such as:
  - (i) Dumping the Video Surveillance data to the system using high-capacity Wi-Fi when the train reaches a station.
  - (ii) Using Public Telecommunication Network (TSP's network) for sending continuous video surveillance data streams to its control center.
- (c) Efficient and timely utilization of spectrum be ensured through a process of periodical monitoring. Further, the 1.6 MHz spectrum already assigned to IR in 900 MHz band may be taken back from IR upon migration to LTE based network.
- (d) As IR would be using the assigned spectrum along its railway track network and stations only, DoT may explore the possibility of assigning the same spectrum in other areas for area-specific limited use to other entities for captive use. However, it should be ensured that there is no interference to the Railway's network from such use.
- (e) Spectrum may be assigned to IR on administrative basis for captive use only and not to offer any commercial services such as Wi-Fi onboard.
- (f) Spectrum charges may be levied based on formula basis as prescribed by DoT for Royalty Charges and License Fee for captive use.

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<sup>1</sup> European Train Control System (ETCS) Level 2 involves continuous supervision of train movement with constant communication between the train and trackside.

Source: [https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes\\_en#:~:text=Level%202%20involves%20continuous%20supervision,beyond%20the%20scope%20of%20ERTMS](https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes_en#:~:text=Level%202%20involves%20continuous%20supervision,beyond%20the%20scope%20of%20ERTMS)

<sup>2</sup> MC PTT is an acronym of mission critical push-to-talk. MC PTT is one of the mission critical services defined by 3GPP.

<sup>3</sup> IoT is an acronym of Internet of Things.

1.4 The afore-mentioned recommendations were accepted by the Government. Thereafter, DoT, through its letter No. L-14001/01/2019-NTG (Pt.) dated 22.10.2021 assigned 5 MHz (paired) spectrum in the 700 MHz band for Public Safety and Security Services for captive use along the Railway Track to the IR. Subsequently, IR surrendered 1.6 MHz (paired) spectrum assigned to it in 900 MHz band for GSM-R<sup>4</sup> based system in some of the States and Union Territories (UTs) in which it had not rolled out GSM-R based network.

## **(2) About NCRTC**

1.5 National Capital Region Transport Corporation (NCRTC) is a joint venture of the Government of India and the States of Haryana, Rajasthan, Uttar Pradesh, and Delhi. NCRTC was formally incorporated on 21.08.2013 under the Companies Act. NCRTC has one nominated director each from the participating States, and four nominee directors from the Government of India. It is under the administrative control of Ministry of Housing & Urban Affairs (MoHUA), Government of India. NCRTC is mandated for implementing the Regional Rapid Transit System (RRTS) project across the National Capital Region (NCR). RRTS comes under the Legal and Regulatory Framework of Metro Railway (Construction of Works) Act 1878, and Metro Railways (Operation and Maintenance) Act 2002.

1.6 NCRTC is implementing RRTS in eight rail corridors in NCR. In the first phase, NCRTC is developing three rail corridors of approximate length of 350 km along (i) Delhi-Ghaziabad-Meerut, (ii) Delhi-Gurugram-Alwar, and (iii) Delhi-Panipat. In the second phase, NCRTC will develop five rail corridors along (i) Delhi-Faridabad-Palwal, (ii) Ghaziabad-Khurja, (iii) Delhi-Bahadurgarh-Rohtak, (iv) Ghaziabad-Hapur, and (v) Delhi-Shahdara-Baraut.

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<sup>4</sup> GSM-R, Global System for Mobile Communications–Railway or GSM-Railway is an international wireless communications standard for railway communication and applications.

### **(3) NCRTC's request to DoT for allotment of frequency spectrum for RRTS**

1.7 NCRTC, through its letter dated 06.11.2019, requested DoT to allot frequency spectrum for implementation of its RRTS project in NCR. The relevant extract of the said letter is given below:

*"This railway based system is being designed for a speed of 180 Kmph, which will be the first of kind in the country. Public safety, security and efficient Train Control System are of paramount consideration in high-speed train operation. NCRTC has, therefore, decided to deploy ETCS level-2 signaling system<sup>5</sup>, mission critical voice, IoT based asset monitoring services and video surveillance from the train for captive use.*

*NCRTC has planned to deploy LTE<sup>6</sup> as its communication backbone for signaling system and associated functions to meet public safety and security requirements. For this purpose, NCRTC would require 10 MHz (paired) in either 700 MHz band or 900 MHz band. This requirement of NCRTC is same as of Indian Railways.*

*It is learnt that TRAI on 25.10.2019, has recommended that Indian Railways (IR) may be allocated 5 MHz (paired) spectrum in 700 MHz band for captive use for implementing ETCS level-2 MC PTT +Voice, IoT based asset monitoring services, PIDS<sup>7</sup> etc. TRAI has also recommended that DoT may explore the possibility of assigning the same spectrum in other areas for area specific limited use to other entities for captive use while ensuring that there is no interference to the Railways' network from such use.*

*The requirement of RRTS as brought out above, perfectly fits in these recommendations. In view of the requirement of RRTS signaling system as explained above and recommendations of TRAI for Indian Railways, NCRTC*

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<sup>5</sup> European Train Control System (ETCS) Level 2 involves continuous supervision of train movement with constant communication between the train and trackside.

Source: [https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes\\_en#:~:text=Level%20%20involves%20continuous%20supervision,beyond%20the%20scope%20of%20ERTMS.](https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes_en#:~:text=Level%20%20involves%20continuous%20supervision,beyond%20the%20scope%20of%20ERTMS.)

<sup>6</sup> Long-Term Evolution (LTE) is a standard for wireless broadband communication for mobile devices and data terminals.

<sup>7</sup> PIDS is an acronym of Public Information Display System.

*requests for allotment of 5 MHz (paired) spectrum instead of 10 MHz (paired) in either 700 MHz or 900 MHz band for captive use of NCRTC which is in line with allotment to Indian Railways.”*

- 1.8 Thereafter, through its letter dated 10.08.2021, NCRTC requested DoT for granting approval for sharing of 5 MHz spectrum in 700 MHz band, assigned to IR, with NCRTC for deployment of ETCS level 2 system in RRTS. The relevant extract of the said letter is given below:

*"2. On advice of Railway Board, NCRTC had engaged a group of eminent experts to conduct a "Study of feasibility of co-existence of two separate LTE networks of NCRTC and IR in the same spectrum without impacting ETCS and mission critical services". ... The expert group has given technical clearance for the sharing and co-existence of both the systems in the same frequency band without any interference. ...*

*3. ... It is in the best interest of the nation to utilize the spectrum as efficiently as possible, which LTE technology permits by enabling coexistence of two separate networks on the same spectrum.*

*4. Ordering of long lead LTE equipment requires confirmation of frequency band. Delay in consent for sharing of allotted spectrum by Indian Railways is adversely affecting the August 2022 project timeline.*

*5. We seek your kind intervention for early approval for sharing of allotted spectrum of 5 MHz in 700 MHz band with NCRTC for deployment of ETCS L2 systems for RRTS.”*

#### **(4) Additional information sought from DoT, Ministry of Railways and NCRTC**

- 1.9 Upon receipt of the DoT's Reference dated 29.11.2021 seeking recommendations on the separate spectrum requirement of NCRTC in 700 MHz band for deployment of LTE based network in its RRTS, the Authority, through a letter dated 28.12.2021, sought additional information/ clarification on the subject from DoT. Through the said letter dated 28.12.2021, DoT was



requested, *inter-alia*, to share - (a) the reasons for not exploring spectrum sharing between IR and NCRTC and instead seeking the Authority's recommendations on separate spectrum requirement of NCRTC in 700 MHz band, and (b) details regarding demand for spectrum requirement from other RRTS/ Metro rail networks in the country.

- 1.10 In response, DoT, through its letter dated 04.05.2022, provided the information/ clarification sought by the Authority. In respect of reasons for not exploring spectrum sharing between IR and NCRTC, DoT informed that *"With regard to NCRTC's request for assignment of spectrum in 700 MHz band, DoT has decided that as in the case of Indian Railways, NCRTC also carries passengers and spectrum will be used for mission critical safety applications of signalling and train control, therefore, separate spectrum may be required since the services involve safety of life."*
- 1.11 In respect of the details regarding demand for spectrum requirement from other RRTS/ Metro rail networks, DoT informed that *"No other requests for spectrum requirements from other RRTS/ metro/ rail networks have been received in DoT. However, Zero-Sum ITS Solutions India Pvt. Ltd., a subsidiary of a Japanese firm, have been granted Experimental license for implementation of fully automated ITS (Intelligent Transport System) solution in Ahmedabad city through collaboration with Ahmedabad Municipal Corporation and Ahmedabad Traffic Police and also granted Experimental license for implementation of fully automated ITS (Intelligent Transport System) solution in Trivandrum City. Experimental license were earlier granted in 700 MHz band and recently in 598-608 MHz band in both city i.e. Ahmedabad and Trivandrum. In case their experiments are found successful, there might be demand for regular assignment of spectrum in these bands or sub-1 GHz bands."*
- 1.12 Separately, through the letters dated 28.12.2021, the Authority sought inputs from the Ministry of Railways and NCRTC on the subject. The Ministry of

Railways was also requested to share its views on sharing of 5 MHz (paired) spectrum assigned to IR with NCRTC.

1.13 The Ministry of Railways, through its response dated 07.01.2022, informed, *inter-alia*, that based on the discussions held on the subject, NCRTC has been advised through a letter dated 08.11.2021, that due to strong possibility of interference in safety and security application and throughput requirements, IR is not in agreement to share the limited spectrum allotted for captive use.

1.14 NCRTC, through its response dated 07.01.2022, informed, *inter-alia*, that in view of the urgent requirement of spectrum, a meeting was held on 11.12.2021 chaired by Hon'ble Minister of Railways and Minister of Communications which was attended by the Secretary DoT, Secretary MoHUA, Chairman Railway Board, Managing Director NCRTC and other senior officials of IR, DoT and NCRTC wherein it was decided that:

- (a) Allocation of new spectrum of 5 MHz (paired) spectrum in 700 MHz band will be made to NCRTC/ Metro expeditiously. TRAI has been requested to commence the consultation for the same.
- (b) As an interim measure, NCRTC will be allocated 1.4 MHz (paired) spectrum presently allocated to IR for GSM-R in 900 MHz band for setting up LTE network to enable commissioning of priority section of RRTS in Azadi ka Amrut Mahotsav.

## **(5) RSTT**

As per a Report on 'Description of Railway Radiocommunication Systems between Train and Trackside (RSTT)' released by ITU-R<sup>8</sup>, RSTT provides improved railway traffic control, passenger safety and improved security for train operations. RSTT systems carry train control, voice dispatching,

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<sup>8</sup> Source: ITU-R's report [ITU-R M.2418-0 (11/2017)] on 'Description of Railway Radiocommunication Systems between Train and Trackside (RSTT)' published at [https://www.itu.int/dms\\_pub/itu-r/opb/rep/R-REP-M.2418-2017-PDF-E.pdf](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2418-2017-PDF-E.pdf)

command, operational information as well as monitoring data between on-board radio equipment and related radio infrastructure located along the trackside. Apart from the core network and other supporting equipment, a typical RSTT comprises of the following main elements:

- (a) Radio access unit consisting of antenna and base station, to provide radio access to the terminals.
- (b) On board radio equipment consisting of radio equipment installed on train as well as handsets; and
- (c) Other trackside radio infrastructure.

1.15 The following diagram depicts a generic architecture of RSTT.

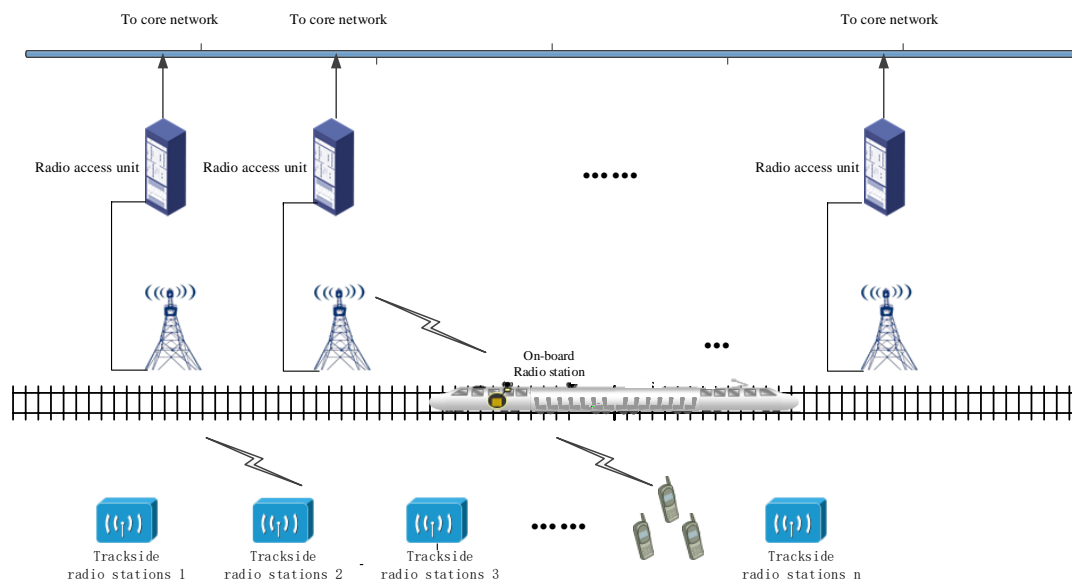


Figure 1.1: Generic Architecture of RSTT<sup>9</sup>

## (6) Requirement of LTE-based networks in railway systems

1.16 For the past many years, the railway industry has been using wireless communication systems<sup>10</sup> for its operational applications. Many long distance

<sup>9</sup> Source: ITU-R's report [ITU-R M.2418-0 (11/2017)] on 'Description of Railway Radiocommunication Systems between Train and Trackside (RSTT)' published at [https://www.itu.int/dms\\_pub/itu-r/opb/rep/R-REP-M.2418-2017-PDF-E.pdf](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2418-2017-PDF-E.pdf)

<sup>10</sup>[http://www.apr.int/sites/default/files/Upload-files/AWG/APT-AWG-REP-78\\_APT\\_Report\\_RSTT\\_System\\_Description.docx](http://www.apr.int/sites/default/files/Upload-files/AWG/APT-AWG-REP-78_APT_Report_RSTT_System_Description.docx)

and high-speed trains have deployed GSM-R<sup>11</sup> and TETRA<sup>12</sup> based railway communication systems for voice communication between train drivers and train controllers etc. With a view to enhance the railway radiocommunication system with broadband capabilities in order to get a greater degree of graphical, and real-time audio-visual functions, along with extensive real-time train monitoring and control, many countries have begun to deploy LTE-based railway communication systems. LTE characterizes high speed, high security and high-bandwidth capacity that allows it to carry voice and data for train control, on-board video surveillance etc. Due to low latency of LTE (about 10 millisecond), time-sensitive applications may easily be supported in LTE-based networks.

- 1.17 In India, IR has been assigned 5 MHz (paired) spectrum in 700 MHz band for deploying LTE based public safety and security services at stations and in the trains for captive use. NCRTC has requested DoT to allocate 5 MHz (paired) spectrum in either 700 MHz band or 900 MHz band for operating mission critical services on RRTS corridors in NCR. In support of its request for allotment of 5 MHz (paired) spectrum, NCRTC has stated as below:
- (a) The uplink throughput requirement per sector for NCRTC is 3.015 Mbps; and
  - (b) As per 3GPP calculation (TS 36.213), 5 MHz bandwidth is required for 3 Mbps uplink throughput on cell edge.

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<sup>11</sup> Global System for Mobile Communications-Railway (GSM-R) is an international wireless communications standard for railway communication and applications. It is used for communication between train and railway regulation control centers.

<sup>12</sup> Terrestrial Trunked Radio (TETRA) is a European Telecommunications Standards Institute (ETSI) standard for land mobile radio. It is used in public safety networks, rail transport, transport services etc.

1.18 The following table provides the uplink throughput requirement per sector for NCRTC, as submitted by NCRTC:

**Table 1.1: Uplink throughput requirement per sector for NCRTC**

Service	Uplink throughput requirement (in kbps)	No. of users	Total uplink throughput requirement (in kbps)
MC PTT	25 kbps	15	375 kbps
ETCS Signaling	10 kbps	8	80 kbps
Rolling Stock Health Monitoring	1000 kbps	1	1000 kbps
On-Board Surveillance	500 kbps	2	1000 kbps
Trackside Health Monitoring (IoT)	56 kbps (lower end)	10	560 kbps
Total Uplink Throughput Requirement (kbps)			3015 kbps

**C. The consultation process with respect to DoT’s Reference dated 29.11.2021**

1.19 On 09.06.2022, the Authority issued ‘Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors’ (hereinafter, referred to as, “the CP dated 09.06.2022”), through which various issues related to the subject were raised for soliciting inputs of stakeholders. Written comments and counter comments on the CP dated 09.06.2022 were invited from the stakeholders by 07.07.2022 and 19.07.2022 respectively. After considering the request of Industry Association for extension of time for submission of comments, the last

date for submission of written comments and counter comments were extended up to 14.07.2022 and 28.07.2022 respectively. The Authority received comments from 20 stakeholders and counter comments from one stakeholder. The comments and counter comments are available on the Authority's website [www.trai.gov.in](http://www.trai.gov.in). An Open House Discussion (OHD) on the CP dated 09.06.2022 was also conducted on 25.08.2022.

- 1.20 Based on the inputs received from stakeholders and its internal analysis, the Authority has finalized these recommendations. The recommendations comprise of three chapters. This chapter provides an introduction and background of the subject. Chapter-II discusses the issues, the comments received from stakeholders and the analysis based on which the recommendations have been framed. Chapter-III provides a summary of the recommendations.

## CHAPTER- II: EXAMINATION OF ISSUES

2.1 Through the CP dated 09.06.2022, the Authority solicited comments of stakeholders on a range of issues related to spectrum requirement of NCRTC for train control system for RRTS corridors. An analysis of the issues, in light of the comments received from stakeholders, is being presented below:

### **(i) Suitable frequency band, and quantum of spectrum for assignment to NCRTC**

2.2 In the CP dated 09.06.2022, the Authority observed that as spectrum requirement for signaling purpose in railway networks is of the nature of low bandwidth and high coverage, spectrum in sub-1 GHz bands will be suitable to meet the requirement. Further, as NCRTC is deploying LTE-based networks for implementation of ETCS level-2 signaling system and some part of the phase-I network is almost ready for commissioning, it will be prudent that spectrum is assigned to NCRTC in a spectrum band where LTE ecosystem already exists. In this background, through the CP dated 09.06.2022, the stakeholders were requested to furnish their comments on the following questions:

*Q1. In which band, spectrum should be assigned to NCRTC for their LTE-R technology based Train control system for RRTS rail corridors?*

*Q2. How much spectrum in the spectrum band(s) suggested in response to Q1, should be assigned to NCRTC to meet its requirement for its RRTS LTE-R based network?*

#### **(1) Responses of stakeholders to the Q1**

2.3 In response to the Q1 of the CP dated 09.06.2022, quite divergent views were expressed by stakeholders. Many stakeholders opined that spectrum in 700 MHz band should be assigned to NCRTC. A summary of the reasons cited by these stakeholders is given below:

- (a) The Mission Critical Voice, Mission critical Data and Video requirements of NCRTC are same as that of IR.
- (b) In view of the criticality of train operations and public safety, efficient non-interfering bandwidth would be advisable to be used, like IR.
- (c) Vendor ecosystem is already available in 700 MHz band for radio access network (RAN) and user equipment (Train Radio, Handheld and Fixed Radio Terminals). 700 MHz band offers better coverage and reduces capex cost.
- (d) If the allotted spectrum is in the same band for IR, RRTS and metro rails, it will lead to economies of scale and sharing of spares.

2.4 A few other stakeholders suggested that frequency spectrum preferably in the sub-1 GHz bands and contiguous to operate LTE as a bearer, may be assigned. One of these stakeholders was of the view that spectrum should be assigned in Ultra High Frequency (UHF) range (600 MHz to 800 MHz) for better coverage.

2.5 One of the stakeholders submitted that from the long-term perspective, the spectrum allocation in 600 MHz, which has 40 MHz (paired) spectrum, or similar allocation in 440-470 MHz band can be considered.

2.6 On the other hand, some of the stakeholders opined that separate spectrum in 700 MHz band should not be assigned to NCRTC. They suggested for coexistence of railway communication systems of NCRTC and IR. The key submissions made by these stakeholders are given below:

- (a) The first preference should be to efficiently utilize frequency spots assigned to IR and the same should be assigned to NCRTC, as the group of eminent experts have stated that co-existence is possible between IR and NCRTC in the 5 MHz block already assigned to IR.
- (b) There is no requirement for a separate spectrum assignment as delays in inter-departmental co-ordination have prompted this demand by NCRTC, especially considering the deadline to launch their services. The Authority



should encourage the DoT to resolve the issue between the entities instead of fragmenting this commercially important spectrum to meet such demands.

- (c) Since IR and RRTS have similar applications, they can have common network and this would result in complete re-use of spectrum and infrastructure, and devices used would also be common helping economies of scale.
- (d) 700 MHz band is a prime band for 5G services and has a wide device ecosystem and is crucial for coverage and penetration of mobile services both in the urban and rural areas. Lesser inventory of access spectrum availability in 700 MHz band will result in fewer option for telecom service providers to deploy the services at quickest possible time and will adversely impact strategic objective. Given the importance of 700 MHz band for IMT, allocation of spectrum to NCRTC in this band is opposed. Alternatively, non-IMT bands should be looked into and band/ frequencies where retail device ecosystem is not available should be utilized for such purposes. In case separate frequency block is to be assigned to NCRTC, then it should be from spectrum bands identified for PPDR including 380-387.5 MHz/ 390-397.5 MHz, 410-417.5 MHz/ 420-427.5 MHz, 440-470 MHz, 806-811 MHz/ 851-856 MHz and 4940-4990 MHz.
- (e) Assignment of 5 MHz of sub-1 GHz spectrum at the current reserve price will cost the exchequer in excess of Rs. 4000 crore as per the current reserved price. Therefore, the assignment of spectrum shall be kept to minimum extent possible.

2.7 Through its counter comments, NCRTC furnished, *inter-alia*, the following arguments in support of allotment of spectrum to it in 700 MHz band:

- (a) Availability of ecosystem of equipment in the allotted spectrum is an important criterion. The vital and proven telecommunication equipment required for safe train operations are readily available in 700 MHz band.

(b) As per Metro Railways (Operation and Maintenance) Act 2002, "Central Government", in relation to technical planning and safety of metro railways, means the Ministry of the Government of India dealing with Railways. Further 'In principle approval of Broad Technologies for Regional Rapid Transit System (RRTS)' was approved by Railway Board for using 700 MHz (LTE) band for communication backbone. To honour the project deadlines, set by the Government of India, all the planning, designing and procurement of equipment has been done according to 700 MHz band.

## **(2) Responses of stakeholders to the Q2**

2.8 In response to the Q2 of the CP dated 09.06.2022, most of the stakeholders opined that 5 MHz spectrum should be assigned to NCRTC. One of the stakeholders mentioned that 5 MHz spectrum may be identified for RRTS and Metro Railways; only in metro cities where multiple metro railway systems operate, additional spectrum bands would be required to cater to various metro railway systems. A few stakeholders mentioned that railways and metro rails in South Korea and Dhaka metro rail have been allotted 10 MHz (or more) spectrum for setting up similar mission critical LTE networks. One of the stakeholders submitted that 10 MHz spectrum optimizes the hardware for the projected bandwidth. Another stakeholder submitted that 10 MHz spectrum is required for driverless system operations of metro rails as it would require even more live CCTV video bandwidth to remotely monitor passenger activity.

## **(3) Analysis and Recommendations with respect to the issues raised through Q1 and Q2**

2.9 A good public transport not only provides mobility but also improves the quality of life of the public, at large. It generates jobs, drives economic development, and helps in bridging the gap between urban and rural areas. International Telecommunication Union (ITU) has recognized that the railway transportation contributes to economic and social development, especially for developing countries. With increasing urbanization, the load on the urban areas has

increased and so has the traffic. Provision of fast, safe, and reliable public transport at reasonable cost could help in easing traffic on roads.

- 2.10 It is expected that RRTS project of NCRTC (and such other future projects) will enable the people to travel safely and comfortably in relatively lesser time. From the standpoint of passengers, train safety is of utmost importance. The proposed deployment of LTE-based railway communication network for train signaling system (ETCS level-2) by NCRTC in its RRTS project will not only enhance safety of passengers and trains but will also provide improved operational efficiency. Therefore, NCRTC should be assigned frequency spectrum for deploying LTE-based railway communication network. The question however remains as to in which frequency band and how much frequency spectrum should be assigned to NCRTC for this purpose.
- 2.11 As spectrum requirement for signaling purposes in railway networks is of the nature of low bandwidth and high coverage, it appears that frequency spectrum in sub-1 GHz bands where LTE ecosystem already exists, will be suitable to meet the requirement of NCRTC. Further, the throughput requirement of NCRTC is quite similar to that of IR. As IR has been assigned 5 MHz (paired) spectrum, it appears that 5 MHz (paired) spectrum will be sufficient to meet the requirement of NCRTC, as well.
- 2.12 In response to the CP dated 09.06.2022, NCRTC, various metro rail operators and a few other stakeholders contended that separate spectrum should be assigned in 700 MHz band to NCRTC. On the other hand, telecom service providers (TSPs) are broadly of the view that the spectrum in 700 MHz band already assigned to IR should be used by NCRTC on sharing basis.
- 2.13 As indicated in the Chapter-I of these recommendations, upon receipt of the DoT's Reference dated 29.11.2021, the Authority had requested DoT to provide reasons for not exploring spectrum sharing between IR and NCRTC and instead

seeking the Authority's recommendations for separate spectrum requirements of NCRTC in 700 MHz band. In response, DoT informed that as in the case of IR, NCRTC also carries passengers, and frequency spectrum will be used for mission critical safety applications and train control; therefore, separate frequency spectrum may be required since the services involve safety of life.

- 2.14 While recommending that 5 MHz (paired) spectrum in 700 MHz band be assigned to IR, through the recommendations on 'Allotment of spectrum to IR for Public Safety and Security Services' dated 25.10.2019, the Authority had also recommended that *"[a]s Indian Railways would be using the assigned spectrum along its railway track network and stations only, DoT may explore the possibility of assigning the same spectrum in other areas for area-specific limited use to other entities for captive use. However, it should be ensured that there is no interference to the Railways' network from such use."* It was also recommended that efficient and timely utilization of frequency spectrum be ensured through a process of periodical monitoring.
- 2.15 The Government has assigned 5 MHz spectrum in 700 MHz band to IR along the railway track for its network spread across the country. Sharing of this frequency spectrum over two different networks may not be feasible at all places due to overlapping area of operation as sharing of spectrum might cause interference. However, interference issues can be mitigated by deploying common radio access network (RAN) using multi-operator core network (MOCN)<sup>13</sup> functionality. Considering the criticality of the IR/ RRTS/ Metro rail networks, spectrum sharing by using common RAN through MOCN functionality in such networks needs to be tested thoroughly before arriving at a decision on sharing of spectrum between IR and RRTS/ Metro rail networks. In view of the current implementation stage of the RRTS project and in order to meet the

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<sup>13</sup> MOCN functionality allows a network operator to provide access to a single radio access network by other operators. Each operator operates its own core network.

immediate requirement of NCRTC, the Authority is of the view that separate spectrum should be assigned to NCRTC.

- 2.16 At present, amongst the sub-1 GHz bands, a good LTE ecosystem exists in the 700 MHz, 800 MHz and 900 MHz frequency bands. However, 5 MHz (paired) spectrum pan-India is available in neither 800 MHz band nor 900 MHz band. It is worth mentioning that through the DoT's Reference dated 29.11.2021, recommendations have been sought for assignment of the same spectrum to other RRTS/ metro rail networks pan-India.
- 2.17 It is noted that India has adopted APT 700 band plan (3GPP B28: 703–748 MHz/ 758–803 MHz FDD) for 700 MHz band. This band has a total of 45 MHz (paired) spectrum. Out of this, 10 MHz spectrum has already been earmarked for government use and further 5 MHz for IR. Besides, in the recent spectrum auction held in July/ August 2022, DoT had set aside another 5 MHz (paired) spectrum in 700 MHz band for NCRTC. One may contend that while 25 MHz (paired) spectrum in 700 MHz was put to auction in the spectrum auction of July/ August 2022, only 10 MHz (paired) was sold; leaving the valuable spectrum idle is an economic loss for the nation. Contrary argument could be that 700 MHz band is a prime coverage band for 5G, and as the TSPs begin to roll-out 5G technology in their networks, the need for spectrum in this band may be felt by the TSPs. Having said that, as IR has been assigned 5 MHz (paired) spectrum in 700 MHz band, in case other rail networks are also assigned spectrum in 700 MHz band, the development of ecosystem for railway communication networks for RRTS/ Metro rails in 700 MHz band could be faster, resulting in economies of scale and thereby benefit to the citizens at large.
- 2.18 In view of the advantages of assigning spectrum in 700 MHz band to NCRTC at this stage and possibility of sharing of spectrum in overlapping areas, as described in the following section, the Authority is of the view that NCRTC should be assigned spectrum in 700 MHz band. Therefore, **the Authority**

**recommends that 5 MHz (paired) spectrum in 700 MHz band be assigned to NCRTC for use in RRTS corridors along the railway tracks. The frequency spectrum to be assigned to NCRTC, shall be adjacent to the frequency spectrum assigned to Indian Railways in 700 MHz band.**

**(ii) Issues related to assignment of the same frequency spectrum to other RRTS/ Metro rail networks**

2.19 Through the Reference dated 29.11.2021, DoT also requested the Authority to provide recommendations on assignment of the same spectrum (that will be assigned to NCRTC) to other RRTS/ metro rail networks pan-India. In this regard, the Authority, through its letter dated 28.12.2021, requested DoT to share the details of demand for spectrum requirement received from other RRTS/ Metro rail network service providers, if any. In response, DoT, through its letter dated 04.05.2022 informed that no other requests for spectrum requirements from other RRTS/ Metro rail networks have been received. While no request for spectrum requirements from other RRTS/ Metro rail networks have been received so far by DoT, the possibility of such demand arising in future cannot be ruled out. It is noted that the spectrum that will be assigned to NCRTC for RRTS will be used in eight corridors spreading across four States/ UT of India viz. Haryana, Rajasthan, Uttar Pradesh, and Delhi. One may argue that considering the future spectrum requirement in RRTS/ Metro rail networks coming up in other parts of the country, it may be prudent to keep the same spectrum reserved for such rail networks in India. In this background, through the CP dated 09.06.2022, the comments of stakeholders were solicited on the following set of questions:

*Q3: Do you see any challenge, if the same spectrum is assigned to different RRTS/ metro rail networks, operating in geographically separated areas/ corridors in the country? If yes, kindly provide details and possible solutions.*

*Q4: In case more than one RRTS Metro/ rail networks are to operate in overlapping geographical areas, will it be appropriate for RRTS Metro/ rail networks to share the Radio Access Network (RAN) in the overlapping areas using Multi-Operator Core Network (MOCN)? any other feasible mechanism for using same spectrum in overlapping areas may also be suggested with detailed explanation. Kindly justify your response.*

*Q5: In case it is decided that RRTS Metro/ rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),*

*(a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?*

*(b) Whether certain guidelines for coordination mechanism need to be issued or it should be left to the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN sharing? In case, guidelines need to be prescribed, kindly suggest the points to be included in the guidelines.*

*(c) Whether commercial arrangements between two RRTS/ Metro rail networks for RAN sharing needs to be regulated or left to the mutual arrangement?*

*(d) Whether any other conditions need to be prescribed for such RAN sharing? Kindly provide detailed justifications.*

### **(1) Responses of stakeholders to the Q3**

2.20 There was a consensus view amongst stakeholders that there is no challenge in case the same frequency spectrum is assigned to different RRTS/ Metro rail networks, operating in geographically separated areas/ corridors in the country.

## **(2) Responses of stakeholders to the Q4**

2.21 Many stakeholders have opined that the same frequency spectrum should be assigned to different RRTS/ Metro rail networks operating in overlapping areas.

A summary of their supporting arguments is given below:

- (a) MOCN is a proven technology for RAN sharing in public network and is also being used in South Korea and many commercial networks in the world. The RAN deployed by one operator may be shared securely by other operators in the areas of overlap.
- (b) Multiple RAN sharing techniques help mitigate the interference issues.
- (c) Possible solutions for RAN sharing need to be explored. MOCN should be encouraged to help reduce network costs and improve the utilization of spectrum.

2.22 On the other hand, many stakeholders have stated that it is preferable to assign separate spectrum to different RRTS/ Metro rail networks in overlapping areas.

A summary of the arguments provided in support of their viewpoint is given below:

- (a) For mission critical networks such as railways in India, there is no RAN sharing using MOCN in overlapping geographical areas. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
- (b) Separate 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for RRTS operations associated with passenger safety. The Authority during the consultation for allotment of spectrum to IR, highlighted that 5 MHz spectrum is the bare minimum spectrum required for the proposed use cases of railway operations and the same is applicable for RRTS and metro rail networks.
- (c) It is preferred to have separate spectrum for RRTS and Metros as there will be multiple sections overlapping.



- 2.23 One of the stakeholders suggested that 10 MHz in homogeneous band be allocated for IR/ RRTS/ Metro and thereby overlapping locations can be handled with minimal coordination in system design to prevent interference at converging and parallel locations; thus, the frequency spectrum can be utilized more effectively by the individual Rail networks (IR/ RRTS/ Metro). Another stakeholder suggested that Spectrum allocated to IR can be used by NCRTC to build the sites around their corridors and the same network, spectrum, PLMN<sup>14</sup> can be used by IR in future. Their application servers or APN can be different, which would help routing the traffic from the single core network towards application servers of RRTS and IR respectively. Correspondingly, if IR deploys wider network (beyond RRTS corridor), the same can be used for expansion of RRTS. Single network can be deployed by Railtel along with leveraging active and passive infrastructure of the existing cellular operators as well.
- 2.24 One stakeholder opined that to cater to the long-term requirement of spectrum the Railways, RRTS, Metro Rails and other such entities, Railway Ministry and MoHUA may set up a Special Purpose Vehicle (SPV) acting as an umbrella to provide network-as-a-service (NaaS) to these organizations. The SPV will ease the planning, coordination and implementation of the projects based on the requirements.

### **(3) Responses of stakeholders to the Q5**

- 2.25 Through Q5 (a), the Authority sought inputs of stakeholders on the suitability of including a clause in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom the Government decides to assign the same spectrum frequencies on sharing basis. In response, many stakeholders supported inclusion of such a clause in the terms and conditions for assignment of spectrum. One of the stakeholders suggested that MoHUA (Nodal Ministry for RRTS and Metro Rail) should govern the terms and conditions for RAN sharing

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<sup>14</sup> PLMN is an acronym of 'Public Land Mobile Network'.

between RRTS and other rail networks. A couple of stakeholders mentioned that suitable terms and conditions should be defined so that the users are aware of these scenarios right from the beginning and are able to design their networks accordingly. Another stakeholder mentioned that a broad guiding principle for such spectrum sharing should be included. One of the stakeholders opined that the RAN sharing should be mandatory for all spectrum allocated administratively to the Government entities. The terms and conditions for allocation of spectrum should clearly prescribe that in case of overlapping usage, the entities will be required to share RAN on non-discriminatory basis.

- 2.26 Through Q5(b), the Authority sought comments of stakeholders on the question as to whether guidelines for coordination mechanism need to be issued for MOCN RAN sharing. In response, most of the stakeholders were of the view that a broad framework may be prescribed, and coordination mechanism may be left to the mutual agreement. One of the stakeholders suggested that certain guidelines to establish Standard Operating Procedure (SOP) for coordination between the RRTS/ Metro rail network operators should be mandated for MOCN RAN sharing. A couple of stakeholders suggested that guidelines for coordination mechanism be made under a Central Agency like the wireless Planning and Coordination (WPC) Wing of DoT. Another stakeholder opined that new operator should be responsible for the interfacing, managing the integration of assets etc. One of the stakeholders suggested that the basic guidelines should be issued by the Authority and the finer details of coordination can be left to the network operators. Another stakeholder suggested that the guidelines should be issued covering the aspects of quality of service (QoS), responsibility of maintaining the sites and cost sharing. A few other stakeholders suggested that coordination mechanisms may be decided through mutual agreement by the concerned parties. However, one stakeholder suggested that in case of unnecessary delay beyond 30 days by any party, the other party should be entitled to approach the WPC Wing of DoT for resolving the impasse.

- 2.27 Through Q5(c), the Authority sought comments from stakeholders on the need for regulation of commercial arrangements between two RRTS/ Metro rail networks for RAN sharing. In response, some stakeholders suggested that commercial arrangements should be best left to the RRTS/ Metro Rail Network Operators. However, a few stakeholders mentioned that commercial arrangements should be regulated with clear pricing. One stakeholder suggested that in case of a disagreement between the parties, DoT should be the adjudicator.
- 2.28 Through Q5(d), the Authority sought comments from stakeholders on the need for any other conditions to be prescribed for RAN sharing. In response, one stakeholder suggested that there is no need for extensive conditions considering the type of communication and networks between two RRTS/ Metro rail networks. A few stakeholders suggested that in case of disagreement between two entities, MoHUA (Nodal Ministry for RRTS and Metro Rail) and IR may govern the terms and conditions of RAN sharing between two entities if it involves IR, otherwise MOHUA can govern the terms and conditions.

#### **(4) Analysis and recommendations with respect to the Q3**

- 2.29 As mentioned earlier, in response to the Authority's letter dated 28.12.2021 seeking, *inter-alia*, the details of demand for spectrum requirement from other RRTS/ Metro rail networks in the country, DoT, through its letter dated 04.05.2022, informed that no other requests for spectrum requirements from other RRTS/ Metro/ rail networks have been received in DoT. However, it is quite likely that demand for spectrum from other RRTS/ Metro rail networks could arise in the future. For instance, Kerala Rail Development Corporation Limited (KRDCL), in its written submission to TRAI in response to the CP dated 09.06.2022, has submitted that it is a Joint Venture company of the Ministry of Railways, Government of India and Government of Kerala; KRDCL has been formed to take up railway development projects in the state of Kerala; the

Government of Kerala has proposed to take up construction of third and fourth lines from Thiruvananthapuram to Kasaragod for a Semi High Speed Rail Project, named as SilverLine project along the length of Kerala to provide fast, safe, comfortable and affordable means of intra-state travel; the feasibility report for the SilverLine project and the proposal of the Government of Kerala has got the in-principle approval from the Ministry of Railways; the detailed project report (DPR) has been submitted for the approval of the Ministry of Railways and sanction from Central Government; KRDCL will make a request to DoT for allotment of spectrum as soon as the Railway Ministry clears the DPR.

- 2.30 As NCRTC and KRDCL will be operating in geographically separated areas, the same spectrum can be assigned to both of these entities. Similarly, if different RRTS/ Metro rail networks are operating in different geographies, the same spectrum can be assigned to them because such assignment will not cause any interference to one another. It is likely that many RRTS/ Metro rail networks will come up in future. Besides, the existing metro rail networks might also plan to migrate to LTE based railway signaling system. Therefore, the Authority is of the view that the frequency spectrum that will be assigned to NCRTC can also be used by any other RRTS/ Metro rail network in different geographical areas without causing any interference to one another. It will also result in better utilization of the frequency spectrum.
- 2.31 Further, as NCRTC and other RRTS/ Metro rail networks will require spectrum only along the railway track with some protection distance on both sides of the railway track, in the remaining areas, the same spectrum can be assigned to other users including government agencies, captive users, and telecom service providers, provided such users do not cause any interference to the RRTS/ Metro rail networks.
- 2.32 Considering the above, the Authority is of the view that while assigning the frequency spectrum to NCRTC or other RRTS/ Metro rail networks, it would be

proper to include a clause in the terms and conditions that the same frequency spectrum can be assigned for other RRTS/ Metro rail networks and any other users, on non-interference basis.

2.33 Further, the Authority has always been of the view that since spectrum is a scarce natural resource, all steps must be taken in the direction of efficient utilization of spectrum. With proliferation of RRTS/ Metro rail networks, utilization of spectrum allocated to RRTS/ Metro rail networks will increase. However, as spectrum will be utilized only along the railway tracks, there could be some places where frequency spectrum might remain unutilized. While making recommendations for allotment of spectrum for IR, the Authority had recommended that as IR would be using the assigned spectrum along its railway track network and stations only, DoT may explore the possibility of assigning the same spectrum in other areas for area-specific limited use to other entities for captive use. The Authority is of the view that a similar provision should be made in respect of the 5 MHz spectrum that will be assigned to NCRTC, and other RRTS/ Metro rail networks.

2.34 The Authority is also of the view that to further increase the spectrum utilization, the possibility of assigning the same spectrum to the telecom service providers on non-interference basis should also be explored. To ascertain the feasibility of assigning the same spectrum (assigned to NCRTC and other RRTS/ Metro rail networks) to the telecom service providers on non-interference basis, a field trial may be conducted involving the Ministry of Railways and the telecom service providers under the supervision of DoT. Based on the outcome of the field trial, further modalities of assignment of the same frequency spectrum to telecom service providers on non-interference basis may be worked out.

2.35 In view of the above, **the Authority recommends that-**

**(a) The frequency spectrum assigned to NCRTC may also be assigned to other RRTS/ Metro rail networks, which are geographically**

**separated and not likely to cause any interference to one another.**

- (b) While assigning frequency spectrum to NCRTC and other RRTS/ Metro rail networks, which are geographically separated, it should be included in the terms and conditions that the same frequency spectrum may be assigned to other RRTS/ Metro rail networks or any other users on non-interference basis.**
- (c) To ascertain the feasibility of assigning the same frequency spectrum (assigned to NCRTC and other RRTS/ Metro rail network) to the telecom service providers on non-interference basis, a field trial may be conducted involving the Ministry of Railways and the telecom service providers, under the supervision of DoT. Based on the outcome of the field trial, further modalities of assignment of the same frequency spectrum to the telecom service providers on non-interference basis may be worked out.**
- (d) Efficient and timely utilization of frequency spectrum should be ensured through a process of periodical monitoring.**

**(5) Analysis and recommendations with respect to the Q4**

- 2.36 As long as the RRTS/ Metro rail networks are operating in geographically separated areas, same spectrum frequencies can be assigned to them for operating their RRTS networks. However, there could be a case that two RRTS/ Metro rail networks are generally geographically separated but overlap in certain areas (crossover or parallel route for certain distance, etc.). In such cases, while the same frequency spectrum can be used by both the networks for the geographically separated part of the network, other options need to be explored for the overlapping part.
- 2.37 For instance, if RRTS/ Metro rail network 'A' is planned to operate in NCR region and has some overlapping areas with NCRTC, frequency spectrum assigned to

NCRTC can be assigned to the network 'A' in the non-overlapping area; in the areas overlapping with NCRTC, the Government can assign the frequency spectrum which has been assigned to IR, if the geographical area of the network 'A' is different and away from IR's rail network.

2.38 In this regard, the Authority vide its letter dated 08.09.2022 had requested NCRTC to provide the keep-off distance (protection distance) on both sides of the railway track in the proposed LTE based RRTS network of NCRTC to avoid interference if the same spectrum is assigned to another user for similar/ other purpose. In its response dated 10.09.2022, NCRTC submitted as below:

*"Coverage dimensioning of the radio signal is dependent upon various factors as listed below:*

- i. Service Type (Guaranteed Bit Rate (GBR), Mission Critical Services etc.)*
- ii. Propagation environment (dense urban, urban, sub-urban, rural, foliage etc.)*
- iii. Equipment performance (Antenna beam width, Gain, Antenna Length etc.)*
- iv. Site configuration (Transmit power, Antenna height, angle, down tilt etc.)*

*NCRTC is deploying LTE masts on the viaduct along the track and utilising narrow beam antennas to limit the transmission along the RRTS track. Our designed network signal strength reduces to -110 dBm at a distance of 2.5 km from the RRTS track centre on both sides. It is also important to mention that if same spectrum is shared between two agencies the network design of the other agency should ensure minimum interference with NCRTC. Minimum interference can be ensured between the two agencies by close coordination and adopting the interference mitigation measures."*

2.39 As can be seen from the above response of NCRTC, the signal strength reduces to (-110 dBm) at a distance of 2.5 km from the RRTS track center on both sides, as per their network design. As RRTS/ Metro rail networks are likely to design their networks in a similar manner, the same frequency spectrum could

be assigned to two different RRTS/ Metro rail networks, provided they are apart by a suitable distance. Having said that, since IR has a rail network size of about 68,000 route km spread across the length and breadth of the country, the possibility of an RRTS/ Metro rail network coming up in an area where it can operate on frequency spectrum assigned to IR, may not be very high. Moreover, there could be instances whether RRTS, Metro and IR networks are operating nearby. Therefore, while the option of assigning frequency spectrum already assigned to NCRTC and/ or IR to upcoming RRTS/ Metro rail network, on non-interference basis (considering the geographical separation between the upcoming rail network and NCRTC/ IR), is available with the Government; however, for instances where IR, NCRTC, and the upcoming rail network may be operating nearby, mechanisms for sharing of frequency spectrum between different overlapping RRTS/ Metro rail networks need to be explored.

2.40 One option to avoid interference between two RRTS/ Metro rail networks in overlapping geographical area could be through sharing of RAN. In case more than one RRTS/ Metro rail networks are to operate on the same frequency spectrum in overlapping geographical area, the RRTS/ Metro rail networks may share the RAN in the overlapping area, using MOCN. As already mentioned, MOCN is one of the widely used feature which allows RAN sharing by multiple core networks of different operators. This allows full availability of bandwidth to multiple networks without interference. Each operator operates its own core network, including one or more independent nodes.

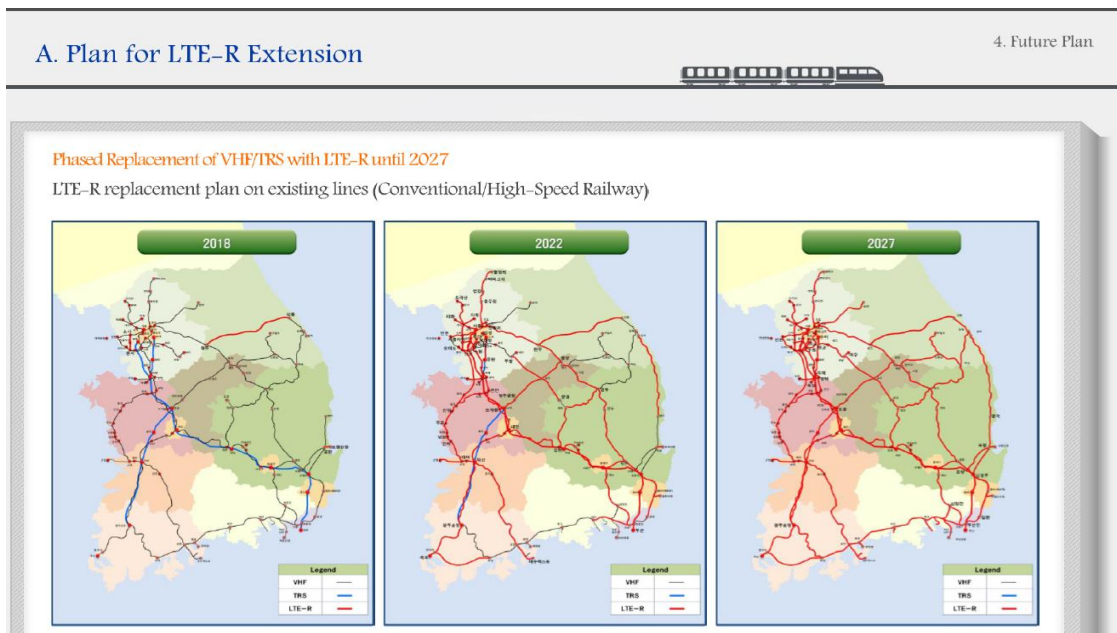
2.41 It is noted that in the year 2017, South Korea deployed MOCN based integrated public network for LTE-Public Safety, LTE-Maritime and LTE-Railway<sup>15</sup>. Separate Mobile Network Code (MNC) were assigned to different networks viz. LTE-PS, LTE-R (Subway), LTE-R (Railway) and LTE-M. Resource allocation rules

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<sup>15</sup> [https://www.itu.int/dms\\_pub/itu-r/oth/0a/0E/R0A0E0000C40001PDFE.pdf](https://www.itu.int/dms_pub/itu-r/oth/0a/0E/R0A0E0000C40001PDFE.pdf)



and standard interworking procedures were laid down to ensure smooth RAN sharing between these networks. The project also included plan for phased replacement of the legacy 1G based (voice only) and 2G based (voice and small data (below 200 kbps)) railway wireless communication systems in 150 MHz and 800 MHz bands, respectively with LTE-R in 700 MHz band as shown below:



- 2.42 While MOCN is prevalent in commercial public mobile networks, there are not many examples of the deployment of MOCN for mission critical networks such as that of Railways. One example is South Korea, where RAN sharing has been used using MOCN between LTE-Public Safety, LTE-Maritime and LTE-R (Railway) and LTE-R (Subway).
- 2.43 Considering the above, the Authority is of the view that as the requirement and criticality of RRTS and metro rail networks are of a similar nature, sharing of RAN amongst them through MOCN may be possible. However, considering the apprehensions regarding sharing of RAN and the fact that the Ministry of Railways is responsible for the technical planning and safety of rail-based transport systems (including Metro railways), the Authority is of the view that

a field trial of RAN sharing may be conducted by the Ministry of Railways involving IR and NCRTC, under the supervision of DoT. Based on the outcome of the field trial, the necessary guidelines/ standard operating procedure (SOP) can be framed on the lines of the model adopted by South Korea. However, while assigning the spectrum to NCRTC and other RRTS/ Metro rail networks, the terms of spectrum assignment should include a condition that in case it is determined through field trials that RAN sharing is implementable, the RRTS/ Metro rail networks will have to implement RAN sharing through MOCN in the overlapping areas and the same should be governed through the guidelines issued by DoT. The guidelines for RAN sharing should include the process and defined timelines for entering into the RAN sharing arrangement. Since the Ministry of Railway is the nodal Ministry for Rail Networks, the responsibility of creation of SOP and its adherence by the RRTS/ Metro rail networks, should be entrusted with the Ministry of Railways in consultation with DoT. The Authority concurs with the views expressed by some of the stakeholders that the commercial arrangement for RAN sharing through MOCN should be left to the RRTS/ Metro rail networks.

- 2.44 In view of the above, **in case of overlapping RRTS/ Metro rails networks, the Authority recommends that:**
- (a) For an upcoming RRTS/ Metro rail network, a part of which overlaps with NCRTC, or any other RRTS/ Metro rail networks to whom the same frequency spectrum has already been assigned, the same frequency spectrum may be assigned to such RRTS/ Metro rail network in the non-overlapping part of the network. For the overlapping part of the network, the frequency spectrum already assigned to IR may be assigned to such RRTS/ Metro rail network subject to non-interference to IR.**
  - (b) To ascertain feasibility of RAN sharing, a field trial of RAN sharing through MOCN may be conducted by the Ministry of Railways involving IR and NCRTC, under the supervision of DoT. Based on**

**the outcome of the field trial, a decision on implementation of RAN sharing through MOCN for the overlapping areas, can be taken.**

- (c) While assigning the frequency spectrum to NCRTC and other RRTS/ Metro rail networks, the terms of frequency spectrum assignment should include a condition that in case it is determined through field trial that RAN sharing is feasible,**
  - (i) the same frequency spectrum may be assigned to other RRTS/ Metro rail networks in the same geographic area on a sharing basis.**
  - (ii) The RRTS/ Metro rail networks shall implement RAN sharing through MOCN in the overlapping areas and the same shall be governed through the guidelines issued by DoT. The guidelines for RAN sharing through MOCN should include the process and timelines for entering into the RAN sharing arrangement.**
  - (iii) The commercial arrangement for RAN sharing through MOCN should be left to the RRTS/ Metro rail networks.**
- (d) As the Ministry of Railway is the nodal Ministry for Rail Networks, the responsibility of creation of SOP and its adherence by the RRTS/ Metro rail networks, should be entrusted with the Ministry of Railways. SOP should be created in consultation with DoT.**

### **(iii) License requirement**

2.45 NCRTC and other RRTS/ Metro rail networks will be using the frequency spectrum for captive purposes and not for offering any commercial telecommunication services. However, for establishing captive wireless network using specifically assigned spectrum, an entity should have a permission/ license under Section 4 of the Indian Telegraph Act, 1885. The entities holding such permission/ license under section 4 of the Indian Telegraph Act, 1885 may

obtain frequency spectrum from DoT for establishing Captive wireless network. In this background, stakeholders were requested to furnish their comments on the following set of questions:

*Q6. What should be the permission/ licensing regime for operation of wireless networks for NCRTC and other RRTS/ metro rail networks? Kindly justify your response with justification.*

*Q7. What should be the broad terms and conditions, which may be included in the Permission/ License. Kindly provide detailed response with justification.*

### **(1) Responses of stakeholders on Q6 and Q7**

- 2.46 With respect to the permission/ licensing regime and broad terms and conditions for operation of wireless networks for NCRTC and other RRTS/ Metro rail networks, a few stakeholders have mentioned that since NCRTC and other RRTS/ Metro rail networks would be using licensed spectrum, they should be required to take an appropriate license under the Indian Telegraph Act, 1885; however, spectrum may be allocated administratively as was done in the case of IR. They have also been suggested that Captive Non-Public Network (CNPN) Permission/ License should be made applicable for NCRTC and other RRTS/ Metro rail networks; however, the Permission/ Licensing regime for Captive Wireless Networks for Train Signaling System may be kept very simple and light touch.
- 2.47 Another stakeholder mentioned that all types of commercial/ non-commercial, public/ non-public communication services in the country should be offered only under the Unified License framework. Therefore, a new Chapter on 'Captive Wireless Networks for Train Signaling System' should be introduced under Unified License.
- 2.48 With respect to the broad terms and conditions to be included in the permission/ license, a few stakeholders have suggested that the conditions of

such license need to clearly state that the spectrum will be used for the intended use only and not for any commercial activity, directly or indirectly; any spectrum assignment to NCRTC or IR should have clear restriction that the said spectrum can neither be used to provide voice, data, SMS or any other commercial services to consumers or its employees, nor the entity can seek connectivity with public networks; the use of spectrum should be strictly regulated and not allowed to give any services, commercial or non-commercial, which otherwise can only be given through a license under section 4 of Indian Telegraph Act, 1885 or through spectrum acquired through auction. They have also opined that if any entity needs voice, data, SMS or any other commercial services, then that should be provided by the authorized licensees (TSPs/ ISPs) similar to the provision of In Flight and Maritime Connectivity (IFMC); the same model may be replicated for Railways/ RRTS, etc. too in case the intention is to provide voice telephony/ Internet to the onboard passengers.

2.49 A few stakeholders suggested that the license for operating wireless network for NCRTC should have a condition that such license will be used for providing communication services in a captive network on a non-commercial basis, and all the operating and security conditions, which apply to Unified License with access services authorization, will be applicable on such license; owing to the non-commercial and essentially machine-based usage, the subscriber related provisions can be removed; all other requirements and levies should be applicable. One of these stakeholders also submitted that no connectivity to public networks for data, SMS or voice should be permitted; also, they should be mandated to ensure that no such services are extended to their consumers or employees as well.

2.50 Another stakeholder suggested that the license for operation of wireless network for NCRTC should have conditions relating to non-offering of any commercial telecom services to the public in general, spectrum being granted

on sharing basis, and use of trusted sources only for telecom equipment to be used in the network.

- 2.51 Many stakeholders suggested that the current licensing regime for spectrum allocated to IR in 700 MHz band should be made applicable for the NCRTC and other RRTS/ Metro rail networks as well.
- 2.52 Another stakeholder suggested that the license for operation of wireless network for NCRTC should be similar to the other captive licenses like TETRA; however, license and royalty fees may be reviewed for government organizations providing public transport; the terms and conditions of captive licenses like TETRA are suitable for LTE also; however, consideration for spectrum allotment should be done based on bandwidth requirement and coverage distance.
- 2.53 NCRTC in its counter-comments submitted that its services will be for captive use similar to that of IR; hence the same policy as adopted for IR for operation of wireless networks may be made applicable for NCRTC as well; no commercial business for telecommunications services will be carried out over NCRTC's captive LTE Network. NCRTC further mentioned that through DoT's letter dated 27.06.2022, the policy for CNPN has been circulated; it is understood that for establishing captive LTE networks, the CNPN licensing regime will be followed; therefore, NCRTC has submitted its application for CNPN license to DoT.

## **(2) Analysis and Recommendations in respect of Q6 and Q7**

- 2.54 As already mentioned, prior to assignment of spectrum to any entity, the entity must have requisite permission/ license under Section 4 of the Indian Telegraph Act, 1885. Based on the Authority's recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11.04.2022, DoT issued the 'Guidelines for Captive Non-Public Network (CNPN) License' dated 27.06.2022 for CNPN License to be issued under Section 4 of the Indian Telegraph Act,

1885. On 20.10.2022, DoT issued a sample copy of the 'License Agreement for CNPN' on its web-site. NCRTC, in their written submissions, informed that it has already submitted its application for CNPN License to DoT. However, it is felt that the CNPN License may not be suitable for RRTS owing to the following provisions of the guidelines of CNPN License:

*4(3)(a) CNPN License shall be valid within such locations in the country where CNPN licensee is occupant of the geographical area(s)/ property(ies) either owned or leased on which such captive Non- Public Network(s) to be established.*

...

*5(4) Interference: it shall be the responsibility of the CNPN licensee to ensure that the radio signals are restricted indoors/within the occupied geographical area. CNPN licensee shall not cause or allow to cause harmful interference to other authorised users of radio spectrum.*

While the RRTS/ Metro rail networks would be running on the railway tracks laid on the geographic area owned or leased by it, the radio signals will not remain restricted in such geographical areas. Therefore, the Authority is of the view that a separate category of Permission/ License for Captive Non-Public Network for Railway (CNPN-R) could be created. However, the Permission/ Licensing regime for CNPN-R may be kept very simple and light touch. DoT should come out with the guidelines for grant of Permission/ License for CNPN-R in line with the Guidelines for Captive Non-Public Network (CNPN) dated 27.06.2022. The application process and format along with the terms and conditions of CNPN-R should be clearly defined in the guidelines. These guidelines should be available on the DoT's website. The submission of application and its processing should be done through an online portal in a time bound manner.

2.55 In view of the above, **the Authority recommends that:**

- (a) A separate category of Permission/ License for Captive Non-Public Network for Railway Networks (CNP-N-R) may be created. However, the permission/ licensing regime for CNPN-R may be kept very simple and light touch.**
- (b) DoT should come out with the guidelines for grant of Permission/ License for CNPN-R. The application process and format along with the terms and conditions for establishing CNPN-R should be clearly defined in the guidelines. These guidelines should be available on the DoT's website. Application submission and processing should be done through an online portal in a time bound manner. The key elements to be included in the guidelines are given below:**
- (i) A company registered under the Companies Act, 2013, will be eligible to apply for CNPN-R permission/ license.**
  - (ii) The applicant should submit a copy of the requisite approvals from the Ministry of Railways/ MoHUA/ State Governments/ any other authority, as per the extant requirement.**
  - (iii) The guidelines should clearly specify a list of required documents to be submitted by the applicant through online portal only. The portal should accept the application (including renewal) only if all the necessary documents have been uploaded by the applicant. Entire application and approval process including the signing of permission/ license agreement should be paperless.**
  - (iv) While applying for permission/ license, the network details, (such as proposed map of rail track, track length along with geographical coordinates etc.) should be provided in a specified format.**
  - (v) Timelines for the grant of permission/ license should be specified and it should not be more than a period of 30 days**



from the date of filing of application, if the information/ documents submitted by the applicant are found fit.

- (vi) Any change in the details (such as name of the enterprise, ownership, address, contact details, etc.) provided at the time of obtaining the permission/ license, will be required to be intimated through the online portal within 15 days of such change.
- (vii) Any change in the network details (such as the proposed map of rail track, track length along with geographical coordinates etc.) provided at the time of obtaining the permission/ license, will be permitted subject to approval by DoT. The application and approval process should be through online portal and timeline of 30 days for its approval should be prescribed in the guidelines.
- (viii) The permission/ license for CNPN-R will be granted for a period of 10 years. However, there will be provision for renewal of the same through the online portal.
- (ix) Application processing fee for permission/ license should be specified as Rs. 50,000. There will be no entry fee for permission/ license.
- (x) Spectrum shall be assigned to the CNPN-R permission/ license holder along the railway track only. The same frequency spectrum may be assigned to other RRTS/ Metro rail networks or any other users on non-interference basis. The spectrum charges will be levied as per the policy of DoT.
- (xi) The spectrum will be used only for captive use for the specified services such as, MCPTT, ETCS signalling, Rolling Stock Health Monitoring, On-Board Surveillance, Trackside Health Monitoring (IoT). The permission holder/ licensee of CNPN-R shall not be permitted to provide any kind of commercial telecommunication service to consumers.

- (xii) CNPN-R should not be connected to public network in any manner. The public network includes PSTN, PLMN, GMPCS and public internet.**
- (xiii) SACFA clearance requirements and applicable charges should be clearly specified.**
- (xiv) Equivalent isotropic radiated power (EIRP) limits and electro-magnetic field (EMF) compliances should be clearly specified.**
- (xv) Permission holder/ licensee of CNPN-R will deploy network elements as per TEC standards, wherever made mandatory, else as per relevant standards set by International Standardization bodies.**
- (xvi) Relevant network security conditions and instructions regarding procurement of telecom equipment from trusted sources may be specified.**
- (xvii) The Licensor will be having the right to inspect the established CNPN-R and its *bonafide* use.**

#### **(iv) Spectrum Charges**

2.56 As discussed earlier, NCRTC is a joint venture company of the Government of India and states of Haryana, Rajasthan, Uttar Pradesh and Delhi. NCRTC was formally incorporated on 21<sup>st</sup> August 2013, under the Companies Act. As a partnership project between the Center and the States, NCRTC has one nominated Director each from the participating States, and four nominee Directors from the Government of India. NCRTC also has the flexibility of forming separate subsidiary companies for implementing specific projects.

2.57 DoT, in its reference dated 29th November 2021, has informed that as in the case of Indian Railways, NCRTC also carries passengers and spectrum will be

used for mission critical safety applications of signalling and train control. Further, it is mentioned that separate spectrum is required since the services involve safety of life. DoT has requested the Authority to provide recommendations on administrative assignment of spectrum to NCRTC, pricing/charging thereof and other terms and conditions for separate spectrum requirements of NCRTC in 700 MHz band.

- 2.58 With this background, the stakeholders were asked to give their inputs on the following issues: -

*Q.8 Would it be appropriate if the spectrum be allocated on the same analogy as Indian Railways, for the same reasons as argued by DoT? If not, what should be the spectrum charging mechanism for spectrum that will be assigned to NCRTC? Kindly provide detailed response with justification.*

*Q.9 Whether the terms & conditions and spectrum charges that will be applicable for NCRTC, should be made applicable to the other RRTS/Metro rail networks that may come up in future? If no, what terms & conditions and spectrum charges should be made applicable for the other RRTS/Metro rail networks? Kindly justify your response.*

- 2.59 In response to the above questions, a majority of stakeholders have stated that the use cases of RRTS and Indian Railways (IR) are identical, hence the spectrum allocation for NCRTC may be made on the same analogy as that of Indian Railways and for all RRTS in present as well as in future. These stakeholders have favored the administrative allocation of spectrum and spectrum charges using formula-based charging, on the same lines as in the case of allocation of spectrum in the 700 MHz band for IR, stating that both are using the spectrum primarily for passenger safety. A few of these stakeholders while favoring the administrative allocation methodology have stated that license fee should be kept minimal to only cover cost of managing spectrum or a license-free mechanism may be adopted.

- 2.60 On the other hand, a few stakeholders have argued not to allocate any additional spectrum to NCRTC, stating that the spectrum allocated to railways should also be considered for allocation to NCRTC in its area of operation. They have also argued that the spectrum charges should be sufficient to cover the loss of revenue to government. One stakeholder has stated that an appropriate formula must be derived for the allocation of spectrum. Another stakeholder stated that there must be some reasonable administrative usage recovery mechanism for making use of spectrum by the railways segment, even if for the captive signalling purposes, especially given that these entities are commercial enterprises and, thus have the mechanism to recover the cost of spectrum from their end-users.
- 2.61 One stakeholder has stated that NCRTC be mandated to use spectrum as a closed network by not providing services to customers & its employees.
- 2.62 Regarding the applicable terms & conditions the stakeholders opined that the terms & conditions as applicable for NCRTC, should also be applicable to the other upcoming RRTS/Metro rail networks to ensure consistency in approach.
- 2.63 The responses received from the stakeholders indicate a mix of opinion wherein a section of stakeholders have favored administrative allocation to NCRTC as in the case of Indian Railways, while as, another section has stated that the spectrum charges on NCRTC should be sufficient to cover revenue loss to the exchequer arising due to non-auctioning of spectrum and some suitable charging formula must be designed for the same.

## **Analysis**

- 2.64 The Authority has carefully considered the views of the stakeholders. The Authority notes that spectrum is a natural resource and has utility in various sectors such as defense, transport, telecommunications etc. Thus, it has a composite demand. Also, it must be considered that spectrum does not have a direct demand, rather it has a derived demand. It implies that its demand is derived from the net gains/utility received from the services for which it is used and subsequently the net gains from the service also act as an input in determining the value of the spectrum. At the same time, determining the available supply and assignment / assignment of spectrum lies in the realm of government, so as to ensure efficient distribution and usage of spectrum.
- 2.65 In the present context, NCRTC's demand is for utilizing the spectrum for mission critical safety applications (signalling and voice & asset monitoring) along the RRTS Corridor and train control. Thus, the spectrum usage by NCRTC is primarily captive. Hence, it is essential to design an optimal assignment and charging mechanism for spectrum allocation to NCRTC.
- 2.66 Regarding assignment of spectrum, past judicial pronouncements have insisted on the method of auction. Moreover, Economic theory<sup>16</sup> also suggests that pricing of a public resource should reflect, as far as possible, its current economic value, so as to encourage its most efficient, optimal and equitable use. Therefore, whenever and wherever possible, the prices may be determined through market mechanisms, such as auctions etc.
- 2.67 However, auctions presume possible bidding by more than one entity for the desired outcome. In the instant case, the spectrum is to be allotted to only one entity viz. NCRTC for its captive use for specified services viz. signalling and train control, and no other entity can utilize this spectrum in that particular

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<sup>16</sup> Arrow, Kenneth J. "An Extension of the Basic Theorems of Classical Welfare Economics," in *Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability* (Berkeley & Los Angeles: University of California Press, 1951), pp. 507—532.

geographical area. Thus, in the instant case, the optimality conditions of the market mechanisms, such as auctions which are generally considered the “Best Option” for allocation of economic goods, are not fulfilled. Therefore, assigning spectrum on administrative basis with spectrum charges based on a parameter that would reflect the ‘Economic Value’ of spectrum might prove to be the second-best option to enhance assignment efficiency.

- 2.68 Economic value<sup>17</sup> is the value that a person places on an economic good based on the benefit that they derive from the good. It is often estimated based on the person’s willingness to pay for the good, typically measured in units of currency. Economic value is subjective and dependent on a person’s intentions. It cannot be directly measured, therefore, the classic method that economists use to estimate how much people value an economic good is to look at the price they pay for it.
- 2.69 Considering auctions as a legitimate market mechanism having sound basis in economic theory and practice, the Auction Determined Price (ADP) can be considered as market discovered price resulting from inter play of market forces of demand and supply and therefore optimal. The ADP thereby reflects economic value of spectrum, given the supply of spectrum which is put to auction and the willingness to pay of service providers.
- 2.70 In view of the discussion above, the Authority feels that ADP should be factored in the spectrum charging mechanism as it is the price discovered through a market mechanism process and thereby, reflects the best economic value of the spectrum. Hence, the feasibility of Auction Determined Price as a benchmark for deriving spectrum charges can be explored.

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<sup>2</sup> Analyzing the Economics of Financial Market Infrastructures :[Martin Diehl](#), [Biliana Alexandrova Kabadjova](#) , [Richard Heuver](#) and [Serafín Martínez-Jaramillo](#) et al

2.71 It may be mentioned that TRAI, vide its 2019 Recommendations, has recommended that the spectrum in 700 MHz band may be assigned to Indian Railways on administrative basis for captive use only and not to offer any commercial services such as Wi-Fi onboard and that the spectrum charges may be levied based on formula basis. However, it may be noted that the present scenario of spectrum assignment to NCRTC is distinct from that of assignment of 700MHz to IR as at the time of spectrum assignment to railways, although the Reserve Prices of 700 MHz spectrum band were available, the Auction Determined Prices of spectrum of 700 MHz band were not available. But at present, the Auction Determined Prices (ADP) for 700MHz are available across all Licensed Service Areas (LSAs), reflecting the actual market value of the spectrum as paid for by the stakeholders. The Reserve Price is estimated from a valuation exercise based on statistical models and other market analysis, without factoring in the amount which market players are / may be willing to pay. Thus, Reserve Prices, though based on well recognized statistical methods and market analysis of economic factors, being an estimate, may not be the best representative of the economic value of spectrum. Moreover, DoT's order dated 13.07.2022 states that the wireless users would be required to give an undertaking to pay the revised spectrum charges, as finally determined through market related mechanism or otherwise as may be applicable, from the date of Letter of Intent (LoI) for provisional assignment of spectrum. Thus, it is all the more appropriate that the market-determined price (ADP) is factored in for the spectrum charging mechanism, even if the spectrum is assigned on an administrative basis.

2.72 Internationally also, the spectrum for railroad industry applications has been assigned on administrative basis, even though the spectrum-charging mechanism has varied. Some illustrative cases are given as below:

- In Australia<sup>18</sup> spectrum licenses in 1800MHz were assigned to Australian Railway Association by Australian Communications and Media Authority (ACMA) and the spectrum charge for these licenses were linked with Auction Discovered Price of 1800MHz spectrum band
- Spectrum license was assigned to Railway Association of Canada (RAC) on administrative basis and a nominal spectrum license fee based on distance is charged annually<sup>19</sup>
- The Federal Communications Commission (USA) assigned spectrum to The American Association of Railroads (AAR) on administrative basis. The spectrum charges are levied using a spectrum fee methodology<sup>20</sup>
- In Europe, a particular frequency is dedicated for railroad applications and there is exemption from individual licensing of GSM-R mobile terminals operating within these dedicated frequency bands.<sup>21</sup>

2.73 In the light of the foregoing discussion, the Authority is of the view that the spectrum in 700 MHz band may be assigned to NCRTC on administrative basis. However, the charging for such an assignment may be done by linking it with the 700 MHz band Auction Determined Prices of the recent 2022 spectrum auction.

2.74 The base for the Auction Determined Prices, that is the Reserve Prices, were arrived at by undertaking spectrum valuation exercise based on commercial parameters and from a viewpoint of 5G/IMT services. Whereas, NCRTC requires spectrum for signalling purpose and the use cases of spectrum for NCRTC may

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<sup>18</sup> <https://www.legislation.gov.au/Details/F2013L00010>; <https://www.acma.gov.au/auction-summary-800-1800-mhz-pcs-allocation-1-1998>; <https://www.itnews.com.au/news/government-saves-1800-mhz-spectrum-for-rail-351217#:~:text=Grants%20reprieve.,already%20made%20in%20the%20project>

<sup>19</sup> <https://www.railcan.ca/safety/radio-spectrum-services/#:~:text=The%20railway%20industry%20primarily%20uses,161.5800%20MHz%E2%80%94for%20voice%20communications>; [https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h\\_sf01713.html](https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf01713.html)

<sup>20</sup> <https://aar.com/standards/pdfs/AAR%20Freq.%20Coord%20Fees%20effective%2006.01.2020.pdf>

<sup>21</sup> [https://www.uic.org/com/enews/nr/143/article/the-gsm-r-frequency-workshop?page=thickbox\\_enews](https://www.uic.org/com/enews/nr/143/article/the-gsm-r-frequency-workshop?page=thickbox_enews);



not be same as in case of 5G/IMT or access services, i.e. as NCRTC will not be offering similar services as access service providers. Accordingly, Authority is of the view that using the same ADP for spectrum assignment to NCRTC may not be appropriate, and must be adjusted on a pro-rata basis, based on a rational parameter.

- 2.75 Presently, in case of IMT spectrum, in certain LSAs spectrum is not available in a part of the LSA, while the bids are sought for spectrum in the entire LSA. In such cases, the amount payable is restricted to the spectrum available in the LSA proportionately. The payable amount is calculated on a pro-rata basis. In the instant case, NCRTC requires spectrum in areas along the track only, while the available ADP is for the entire geography of the LSA. Therefore it would be logical to adjust the ADP on a pro-rata basis by considering the area, i.e, corridor area, for which the spectrum is required by NCRTC, relative to the total geographical area of the particular LSA. The Authority is of the view that considering the nature of services for which spectrum is required by NCRTC, the area-based adjustment criteria is the most appropriate. Thus, a spectrum charging formula based on LSA-wise ADP and adjustment factor based on corridor area relative to total geographical area of LSA needs to be developed.
- 2.76 As mentioned in the preceding para 2.55, the permission/ license for CNPN-R will be granted for a period of 10 years. Accordingly, the spectrum will be assigned to NCRTC for 10 years, whereas the LSA-wise ADP is for a period of 20 years. Thus, the LSA-wise ADP must be suitably adjusted for the time difference of assignment for factoring in the charging mechanism formula. In its April 2022 Recommendations, the Authority observed that the valuation of spectrum for the increased allocation period of 30 years should be proportionately higher than the valuation of the same spectrum for an allocation period of 20 years and recommended that the Reserve Price of spectrum allocation in case of 30 years should be equal to 1.5 times (one-and-a-half

times) the Reserve Price of spectrum allocation for 20 years for the respective band.

2.77 The above is based on the theory of property rights recognized by the Authority in its April 2022 Recommendations for IMT/5G, which draws very useful analogy of comparing the property rights in spectrum to property rights in real estate<sup>22</sup>. Further, it states that considering the example of real estate, if the property rights are vested for 30 years instead of for 20 years, the owner of the property would enjoy the fruits for a longer period, the value at which the alienation would be done for the longer period would be proportionately higher. Using the same analogy, the vesting of property rights in spectrum for a longer duration, will lead to proportionate increase in value derived by the buyer. By the same analogy of proportionality of the term value of spectrum acquired by an entity, the price for 10 years spectrum allocation should be half of the prices available for 20 years. Even the payment terms proposed in the April 2022 recommendations for IMT/5G recognized this concept of proportionality by giving the bidder the option to avail moratorium for the number of years for which the buyer makes the upfront payment. Thus, it stands to reason that the spectrum charges for assigning spectrum for 10 years should be half of the ADP for 20 years.

2.78 Thus, the Auction Determined Price of the respective LSAs through which the RRTS/metro rail network passes will be used as a benchmark. This ADP will be adjusted considering the corridor area (i.e. the track length in an LSA multiplied by twice the Minimum Protection Width where the Minimum Protection Width is the distance from the Regional Rapid Transit System (RRTS) track center to one side of the track, wherein no signal interference is desired for the safety

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<sup>22</sup> See 'Box 4.3: To Allocate Spectrum, Study Real Estate' in Varadharajan Sridhar (2012), *The Telecom Revolution in India: Technology, Regulation, and Policy* (New Delhi: Oxford University Press).

and security of the train services) of the RRTS/Metro rail network in that LSA, relative to the total geographical area of a particular LSA on a pro-rata basis.

2.79 For the purpose of using the formula, the Minimum Protection Width shall be determined by DoT by undertaking a Proof of Concept (PoC) study. However, the spectrum for setting up LTE network may immediately be allotted to NCRTC, considering 2.5 Km Minimum Protection Width<sup>23</sup> on each side of the track. In case of any change in Minimum Protection Width determined by DoT, the difference in amount may be adjusted at a later date.

2.80 The formula for spectrum charging is as given below: -

$$\text{Total Payment for 5MHz} = \sum_{i=1}^n \left( \frac{(T_i * 2 * P)}{AR_i} \right) * ADP_i$$

where

n is number of LSAs through which the RRTS/Metro rail network passes

T<sub>i</sub> is track length in LSA<sub>i</sub>

P is the Minimum Protection Width along one side of the track center. Multiplying it by 2 will give the Total Protection Width along both sides from the RRTS track center

AR<sub>i</sub> is area of LSA<sub>i</sub>

ADP<sub>i</sub> is ADP of 5MHz for 10 years in LSA<sub>i</sub>

2.81 The Authority could have determined the per km pricing of the 700 MHz spectrum for assignment to NCRTC and other RRTS/Metro rail networks, but it is hampered by the lack of information regarding the coordinates of the geographical boundaries of the respective LSAs. The Service Area (Telecom Circles/Metros) and the areas covered by the licensees are given in ANNEXURE-V of the Unified License Agreement. For determining the area of the LSAs in

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<sup>23</sup> Based on information provided by NCRTC

the case of CNPN-R license/permission, the same may be suitably considered by DoT.

2.82 The Authority is also of the view that for other RRTS/Metro rail networks, a similar methodology may be adopted, as in the case of NCRTC. For other RRTS/Metro rail networks the latest Auction Determined Price (less than one year old) of 700 MHz spectrum band may be used as a base for calculating spectrum charges. In case ADP is not available for the current year, the last discovered ADP (in case the ADP is more than a year old) may be duly indexed using applicable MCLR. For existing RRTS/Metro rail network , in case of future spectrum requirement in other LSAs and/or in case of change in track length in existing LSAs, the ADP may be adjusted in a similar manner as discussed above in para 2.78. Moreover, it must be noted that the permission/ license for CNPN-R will be granted for a period of 10 years. Accordingly, validity of the spectrum assigned to NCRTC will be 10 years from the date of initial assignment. Thus, the validity for spectrum assigned in new LSAs, or the same assigned to the new track lengths in existing LSAs, will be co-terminus with the validity of the initial spectrum assignment. However, the base ADP in this case will be adjusted for the remaining time period/validity. This has been suitably illustrated in the example given below.

2.83 Since NCRTC requires spectrum for limited usage, the feasibility of assigning the same spectrum, being assigned to NCRTC and other RRTS/ metro rail networks, to the telecom service providers (TSPs) on non-interference basis should also be explored, to further increase the spectrum utilization. In this regard, the Authority's Recommendations at para 2.35 above may be referred.

2.84 In view of the discussion above, **the Authority recommends the following spectrum charging mechanism: -**

a) **The Auction Determined Price for 10 years allocation should be equal to 0.5 times (half times) the Auction Determined Price discovered in the latest 2022 Auction for 700 MHz spectrum band for the respective LSA.**

b) **The spectrum charges should be calculated using following formula: -**

$$\text{Total Payment for 5MHz} = \sum_{i=1}^n \left( \frac{(T_i * 2 * P)}{AR_i} \right) * ADP_i$$

**where**

**n is number of LSAs through which the RRTS/Metro rail network passes**

**T<sub>i</sub> is track length in LSA<sub>i</sub>**

**P is the Minimum Protection Width along one side of the track center. Multiplying it by 2 will give the Total Protection Width along both sides from the RRTS track center**

**AR<sub>i</sub> is area of LSA<sub>i</sub>**

**ADP<sub>i</sub> is ADP of 5MHz for 10 years in LSA<sub>i</sub>**

**The Minimum Protection Width should be determined by DoT by undertaking a Proof of Concept (PoC) study. However, the spectrum for setting up LTE network may immediately be allotted to NCRTC, considering 2.5 Km Minimum Protection Width on each side of the track. In case of any change in Minimum Protection Width determined by DoT, the difference in amount may be adjusted at a later date.**

**c) For other RRTS/Metro rail networks, a similar methodology should be adopted, as in the case of NCRTC. The latest Auction Determined Price (less than one year old) of 700 MHz spectrum band may be used as a base for calculating spectrum charges. In case ADP is not available for the current year, the last discovered ADP (in case the ADP is more than a year old) may be duly indexed using applicable MCLR. For existing RRTS/Metro rail network, in case of future spectrum requirement in other LSAs and/or in case of change in track length in existing LSAs, the ADP may be adjusted in a similar manner as discussed above in para 2.78. Moreover, it must be noted that the permission/ license for CNPN-R will be granted for a period of 10 years, accordingly, the validity of the spectrum assigned to NCRTC will be 10 years from the date of initial assignment. Thus, the validity for spectrum assigned in new LSAs, or the same assigned to the new track lengths in existing LSAs, will be co-terminus with the validity of the initial spectrum assignment. However, the base ADP in this case will be adjusted for the remaining time period/validity.**

**2.85 For payment terms, the Authority recommends that: -**

**a) NCRTC shall make the payment in accordance with any of the following two options:**

**Option 1: Full or part upfront payment of the final amount for 10 years within 10 days of declaration of assignment price.**

**Where part upfront payment has been made, NCRTC shall have the option of availing moratorium for the corresponding number of years for which the upfront payment has been made, and the balance amount shall be payable in equal annual instalments over the remaining period, payable in advance at the beginning of each year, after the period of moratorium if any, duly protecting the Net**

**Present Value (NPV) of the total amount at the applicable rate of interest. The annual instalments shall become due and payable on the same date of each following year.**

**Option 2: Payment of 10 equal annual instalments of the total amount, duly protecting the NPV of the total amount at the applicable rate of interest, in advance at the beginning of the year, the first instalment becoming payable within 10 days of declaration of assignment price. The balance 9 instalments shall become due and payable on the same date of each following year.**

**b) For other RRTS/ Metro Rail Networks, similar payment terms should be adopted.**

2.86 The spectrum charging formula and payment terms are explained using an illustrative example: -

#### **Illustration for spectrum charging and payment**

- Let us assume the ADP and the track lengths in the LSAs in which an RRTS passes are as follows:

<b>LSA</b>	<b>ADP for 20 years (Rs Crore)</b>	<b>Track Length (Km)</b>
I	60	15
II	50	25
III	46	30
IV	30	12

<b>Considering 2.5 Km Minimum Protection Width on each side of the track</b>						
<b>LSA</b>	<b>Area (sq Km) (A)</b>	<b>Track Length (Km) (B)</b>	<b>Total corridor Area (C=B X 2.5 Km X 2)</b>	<b>Adjustment factor (D=C/A)</b>	<b>ADP - 10 years (Rs crore) (E)</b>	<b>Adjusted ADP (D X E)</b>
I	1,000	15	75	0.07500	30	2.3
II	1,300	25	125	0.09615	25	2.4
III	1,700	30	150	0.08824	23	2.0
IV	2,500	12	60	0.02400	15	0.4
<b>Total for 1 MHz (Rs. crore)</b>						<b>7.0</b>
<b>Total Upfront payment for 5MHz (Rs. crore)</b>						<b>35.22</b>
<b>Annualized Payment for 5MHz (Rs crore)</b> <b>(Assuming discounting factor of 7.2% and 10 equal installments)</b>						<b>4.72</b>

- Option I: In case upfront payment option is availed, the entity has to pay Rs 35.22 crore for acquiring 5 MHz of spectrum in all 4 LSAs
- Option II: In case of annual payment option, the entity has to pay Rs. 4.72 crore as annual installment in 10 equated installments
- The Minimum Protection Width of 2.5 Km on each side of the track, has been taken based on information provided by NCRTC. However, DoT must undertake a Proof of Concept study (PoC) to determine Minimum Protection Width required for the RRTS/Metro Rail network.
- NPV discounting factor has been assumed as 7.20%. However, DoT may decide appropriate discounting factor.
- Both Options I and II are subject to change due to change in corridor area based on change in track length.

### **Change in Track length/ Corridor Area**

#### **Case-I: New ADP available**

- Assuming the track length in LSA I increases to 20 Km (i.e., by 5 Km further), at the end of 3 years. The following will be the impact on the payments under both the options:



- Assuming new ADP (less than 1 year) for 20 years is Rs 70 crore for LSA I, ADP to be used as base is adjusted for 7 years  $=70*(7/20)=$  Rs 24.5 crore

<b>Additional Payment due to change in corridor area when new ADP is available</b>						
<b>LSA</b>	<b>Area (sq Km) (A)</b>	<b>Additional Track Length (Km) (B)</b>	<b>Total corridor area (C=B X 2.5 Km X 2)</b>	<b>Adjustment factor (D=C/A)</b>	<b>ADP-7 years (Rs crore) (E)</b>	<b>Adjusted ADP (for new corridor) (D X E)</b>
LSA I	1,000	5	25	0.02500	24.5	0.61
<b>Total Upfront payment for 5MHz (Rs. crore)</b>						<b>3.06</b>
<b>Annualized Payment for 5MHz (Rs. crore) (Assuming discounting factor of 7.2% and 7 equal installments)</b>						<b>0.53</b>

- Option I: In case upfront payment option is availed, the entity has to pay additional Rs. 3.06 crore
- Option II: In case of annual payment option, beginning from fourth year, the entity has to pay the initial amount of installments plus Rs 0.53 crore. Thus, in this case, since beginning of fourth year, the entity will pay Rs 5.25 crore (4.72+0.53) as annual installment in next 7 equated installments.
- The total spectrum assignment duration remains 10 years.

### **Case– II: No New ADP available**

- Considering the entity who has made upfront payment, shall make additional payment for the increased corridor area in LSA I, considering next 7 years.
- ADP for 7 years used as base  $= 30*7/10 =$  Rs 21 crore
- ADP to be used as base for calculating spectrum charges  $= 21*(1+ 0.072)^3=$  Rs 25.87 crore, assuming 7.2% as applicable MCLR.

<b>Additional Payment due to change in corridor area when no new ADP is available</b>						
<b>LSA</b>	<b>Area (sq Km) (A)</b>	<b>Additional Track Length (Km) (B)</b>	<b>Total corridor area (C=B X 2.5 Km X 2)</b>	<b>Adjustment factor (D=C/A)</b>	<b>Indexed ADP-7 years (Rs crore) (E)</b>	<b>Adjusted ADP (for new corridor) (D X E)</b>
LSA I	1,000	5	25	0.02500	25.87	0.65
<b>Total Upfront payment for 5MHz (Rs. crore)</b>						<b>3.23</b>
<b>Annualized Payment for 5MHz (Rs. crore) (Assuming discounting factor of 7.2 % and 7 equal installments)</b>						<b>0.56</b>

- Option I: In case upfront payment option is availed, the entity has to pay additional Rs. 3.23 crore
- Option II: In case of annual payment option, beginning from fourth year, the entity has to pay the initial amount of installments plus Rs 0.56 crore. Thus, in this case, since beginning of fourth year, the entity will pay Rs 5.28 crore (4.72+0.56) as annual installment in next 7 equated installments.
- The total spectrum assignment duration remains 10 years.

## **CHAPTER- III: SUMMARY OF RECOMMENDATIONS**

**3.1 The Authority recommends that 5 MHz (paired) spectrum in 700 MHz band be assigned to NCRTC for use in RRTS corridors along the railway tracks. The frequency spectrum to be assigned to NCRTC, shall be adjacent to the frequency spectrum assigned to Indian Railways in 700 MHz band.**

**[Para 2.18]**

**3.2 The Authority recommends that-**

- (a) The frequency spectrum assigned to NCRTC may also be assigned to other RRTS/ Metro rail networks, which are geographically separated and not likely to cause any interference to one another.**
- (b) While assigning frequency spectrum to NCRTC and other RRTS/ Metro rail networks, which are geographically separated, it should be included in the terms and conditions that the same frequency spectrum may be assigned to other RRTS/ Metro rail networks or any other users on non-interference basis.**
- (c) To ascertain the feasibility of assigning the same frequency spectrum (assigned to NCRTC and other RRTS/ Metro rail network) to the telecom service providers on non-interference basis, a field trial may be conducted involving the Ministry of Railways and the telecom service providers, under the supervision of DoT. Based on the outcome of the field trial, further modalities of assignment of the same frequency spectrum to the telecom service providers on non-interference basis may be worked out.**
- (d) Efficient and timely utilization of frequency spectrum should be ensured through a process of periodical monitoring.**

**[Para 2.35]**

**3.3 In case of overlapping RRTS/ Metro rails networks, the Authority recommends that:**

- (a) For an upcoming RRTS/ Metro rail network, a part of which overlaps with NCRTC, or any other RRTS/ Metro rail networks to whom the same frequency spectrum has already been assigned, the same frequency spectrum may be assigned to such RRTS/ Metro rail network in the non-overlapping part of the network. For the overlapping part of the network, the frequency spectrum already assigned to IR may be assigned to such RRTS/ Metro rail network subject to non-interference to IR.**
- (b) To ascertain feasibility of RAN sharing, a field trial of RAN sharing through MOCN may be conducted by the Ministry of Railways involving IR and NCRTC, under the supervision of DoT. Based on the outcome of the field trial, a decision on implementation of RAN sharing through MOCN for the overlapping areas, can be taken.**
- (c) While assigning the frequency spectrum to NCRTC and other RRTS/ Metro rail networks, the terms of frequency spectrum assignment should include a condition that in case it is determined through field trial that RAN sharing is feasible,
  - (i) the same frequency spectrum may be assigned to other RRTS/ Metro rail networks in the same geographic area on a sharing basis.**
  - (ii) The RRTS/ Metro rail networks shall implement RAN sharing through MOCN in the overlapping areas and the same shall be governed through the guidelines issued by DoT. The guidelines for RAN sharing through MOCN should include the process and timelines for entering into the RAN sharing arrangement.****

- (iii) **The commercial arrangement for RAN sharing through MOCN should be left to the RRTS/ Metro rail networks.**
- (d) **As the Ministry of Railway is the nodal Ministry for Rail Networks, the responsibility of creation of SOP and its adherence by the RRTS/ Metro rail networks, should be entrusted with the Ministry of Railways. SOP should be created in consultation with DoT.**

**[Para 2.44]**

### **3.4 The Authority recommends that:**

- (a) **A separate category of Permission/ License for Captive Non-Public Network for Railway Networks (CNPN-R) may be created. However, the permission/ licensing regime for CNPN-R may be kept very simple and light touch.**
- (b) **DoT should come out with the guidelines for grant of Permission/ License for CNPN-R. The application process and format along with the terms and conditions for establishing CNPN-R should be clearly defined in the guidelines. These guidelines should be available on the DoT's website. Application submission and processing should be done through an online portal in a time bound manner. The key elements to be included in the guidelines are given below:**
  - (i) **A company registered under the Companies Act, 2013, will be eligible to apply for CNPN-R permission/ license.**
  - (ii) **The applicant should submit a copy of the requisite approvals from the Ministry of Railways/ MoHUA/ State Governments/ any other authority, as per the extant requirement.**
  - (iii) **The guidelines should clearly specify a list of required documents to be submitted by the applicant through online portal only. The portal should accept the**

**application (including renewal) only if all the necessary documents have been uploaded by the applicant. Entire application and approval process including the signing of permission/ license agreement should be paperless.**

- (iv) While applying for permission/ license, the network details, (such as proposed map of rail track, track length along with geographical coordinates etc.) should be provided in a specified format.**
- (v) Timelines for the grant of permission/ license should be specified and it should not be more than a period of 30 days from the date of filing of application, if the information/ documents submitted by the applicant are found fit.**
- (vi) Any change in the details (such as name of the enterprise, ownership, address, contact details, etc.) provided at the time of obtaining the permission/ license, will be required to be intimated through the online portal within 15 days of such change.**
- (vii) Any change in the network details (such as the proposed map of rail track, track length along with geographical coordinates etc.) provided at the time of obtaining the permission/ license, will be permitted subject to approval by DoT. The application and approval process should be through online portal and timeline of 30 days for its approval should be prescribed in the guidelines.**
- (viii) The permission/ license for CNPN-R will be granted for a period of 10 years. However, there will be provision for renewal of the same through the online portal.**
- (ix) Application processing fee for permission/ license should be specified as Rs. 50,000. There will be no entry fee for permission/ license.**

- (x) Spectrum shall be assigned to the CNPN-R permission/ license holder along the railway track only. The same frequency spectrum may be assigned to other RRTS/ Metro rail networks or any other users on non-interference basis. The spectrum charges will be levied as per the policy of DoT.**
- (xi) The spectrum will be used only for captive use for the specified services such as, MCPTT, ETCS signalling, Rolling Stock Health Monitoring, On-Board Surveillance, Trackside Health Monitoring (IoT). The permission holder/ licensee of CNPN-R shall not be permitted to provide any kind of commercial telecommunication service to consumers.**
- (xii) CNPN-R should not be connected to public network in any manner. The public network includes PSTN, PLMN, GMPCS and public internet.**
- (xiii) SACFA clearance requirements and applicable charges should be clearly specified.**
- (xiv) Equivalent isotropic radiated power (EIRP) limits and electro-magnetic field (EMF) compliances should be clearly specified.**
- (xv) Permission holder/ licensee of CNPN-R will deploy network elements as per TEC standards, wherever made mandatory, else as per relevant standards set by International Standardization bodies.**
- (xvi) Relevant network security conditions and instructions regarding procurement of telecom equipment from trusted sources may be specified.**
- (xvii) The Licensor will be having the right to inspect the established CNPN-R and its *bonafide* use.**

**[Para 2.55]**

**3.5 The Authority recommends the following spectrum charging mechanism: -**

**a) The Auction Determined Price for 10 years allocation should be equal to 0.5 times (half times) the Auction Determined Price discovered in the latest 2022 Auction for 700 MHz spectrum band for the respective LSA.**

**b) The spectrum charges should be calculated using following formula: -**

$$\text{Total Payment for 5MHz} = \sum_{i=1}^n \left( \frac{(T_i * 2 * P)}{AR_i} \right) * ADP_i$$

**where**

**n is number of LSAs through which the RRTS/Metro rail network passes**

**T<sub>i</sub> is track length in LSA<sub>i</sub>**

**P is the Minimum Protection Width along one side of the track center. Multiplying it by 2 will give the Total Protection Width along both sides from the RRTS track center**

**AR<sub>i</sub> is area of LSA<sub>i</sub>**

**ADP<sub>i</sub> is ADP of 5MHz for 10 years in LSA<sub>i</sub>**

**The Minimum Protection Width should be determined by DoT by undertaking a Proof of Concept (PoC) study. However, the spectrum for setting up LTE network may immediately be allotted to NCRTC, considering 2.5 Km Minimum Protection Width on each side of the track. In case of any change in Minimum Protection Width determined by DoT, the difference in amount may be adjusted at a later date.**



**c) For other RRTS/Metro rail networks, a similar methodology should be adopted, as in the case of NCRTC. The latest Auction Determined Price (less than one year old) of 700 MHz spectrum band may be used as a base for calculating spectrum charges. In case ADP is not available for the current year, the last discovered ADP (in case the ADP is more than a year old) may be duly indexed using applicable MCLR. For existing RRTS/Metro rail network, in case of future spectrum requirement in other LSAs and/or in case of change in track length in existing LSAs, the ADP may be adjusted in a similar manner as discussed above in para 2.78. Moreover, it must be noted that the permission/ license for CNPN-R will be granted for a period of 10 years, accordingly, the validity of the spectrum assigned to NCRTC will be 10 years from the date of initial assignment. Thus, the validity for spectrum assigned in new LSAs, or the same assigned to the new track lengths in existing LSAs, will be co-terminus with the validity of the initial spectrum assignment. However, the base ADP in this case will be adjusted for the remaining time period/validity.**

**[Para 2.84]**

**3.6 For payment terms, the Authority recommends that: -**

**a) NCRTC shall make the payment in accordance with any of the following two options:**

**Option 1: Full or part upfront payment of the final amount for 10 years within 10 days of declaration of assignment price.**

**Where part upfront payment has been made, NCRTC shall have the option of availing moratorium for the corresponding number of years for which the upfront payment has been made, and the balance amount shall be payable in equal annual instalments over**

**the remaining period, payable in advance at the beginning of each year, after the period of moratorium if any, duly protecting the Net Present Value (NPV) of the total amount at the applicable rate of interest. The annual instalments shall become due and payable on the same date of each following year.**

**Option 2: Payment of 10 equal annual instalments of the total amount, duly protecting the NPV of the total amount at the applicable rate of interest, in advance at the beginning of the year, the first instalment becoming payable within 10 days of declaration of assignment price. The balance 9 instalments shall become due and payable on the same date of each following year.**

- b) For other RRTS/ Metro Rail Networks, similar payment terms should be adopted.**

**[Para 2.85]**

**DoT's reference dated 29<sup>th</sup> November 2021 (without enclosures)**

Government of India  
Ministry of Communications  
Department of Telecommunications  
Wireless Planning and Coordination (WPC) Wing  
6<sup>th</sup> floor, Sanchar Bhawan,  
20, Ashoka Road, New Delhi – 110001.

No.: L-14001/01/2019-NTG (Pt.)

Date: 29.11.2021

To,

The Secretary  
Telecom Regulatory Authority of India  
Mahanagar Doorsanchar Bhawan  
Jawahar Lal Nehru Marg (Old Minto Road)  
New Delhi – 110 002.

**Subject: Seeking TRAI recommendations on the spectrum requirements of National Capital Region Transport Corporation (NCRTC) for their LTE technology based RRTS network.**

Sir,

Based on the TRAI recommendations dated 25.10.2019 on “Allotment of spectrum to Indian Railways for Public Safety and Security services”, Government has assigned 5 MHz (paired) spectrum in 700 MHz band to Indian Railways for their LTE technology-based proposed network.

2. Subsequently, NCRTC has requested DoT for allotment of spectrum for Regional Rapid Transit System (RRTS) being implemented by them in 8 corridors including 3 rail corridors of approximate length of 350 km along Delhi – Ghaziabad – Meerut, Delhi – Gurugram – Alwar, Delhi – Panipat in Phase-I. Letters dated 06.11.2019 and 10.08.2021 received from NCRTC are enclosed herewith for ready reference.

3. In their request, NCRTC has also informed that delay in sharing of spectrum assigned to Indian Railways is adversely affecting their August-2022 timeline for commissioning of 17 km-priority section of RRTS during 75<sup>th</sup> Anniversary of India's Independence (Azadi ka Amrut Mahotsav) in 2022.

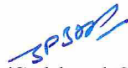
4. As in the case of Indian Railways, NCRTC also carries passengers and spectrum will be used for mission critical safety applications of signalling and train control. Separate spectrum is required since the services involve safety of life.

5. In view of the above, under the terms of clause 11(1)(a) of TRAI Act, 1997 as amended by TRAI Amendment Act 2000, TRAI is requested to provide:

(i) recommendations on administrative assignment of spectrum to NCRTC and the quantum, pricing/charging thereof and any other terms and conditions, for separate spectrum requirements of NCRTC in 700 MHz band.

(ii) Any other recommendations deemed fit for the purpose, including assignment of the same spectrum for other RRTS/metro rail networks pan-India.

This issues with the approval of Hon'ble Minister for Communications.

  
(Sukhpal Singh)  
Joint Wireless Adviser

Enclosures:

- (1) NCRTC's letters dated 06.11.2019 and 10.08.2021 regarding allotment of frequency spectrum to NCRTC for implementation of Train Control System for Regional Rapid Transit System.
- (2) Brief note on RRTS, as provided by NCRTC.