



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



**Consultation Paper on  
Assignment of Additional Spectrum to Indian Railways  
for its Safety and Security Applications**

New Delhi, India

7<sup>th</sup> February, 2024

**Written Comments on the Consultation Paper are invited from the stakeholders by 6<sup>th</sup> March 2024 and counter-comments by 20<sup>th</sup> March 2024. Comments and counter-comments will be posted on TRAI's website [www.trai.gov.in](http://www.trai.gov.in). Comments and counter-comments may be sent, preferably in electronic form, to Shri Akhilesh Kumar Trivedi, Advisor (Networks, Spectrum and Licensing), TRAI on the email ID [advmn@traigov.in](mailto:advmn@traigov.in).**

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# CONTENTS

<b>CHAPTER I: INTRODUCTION .....</b>	<b>1</b>
<b>CHAPTER II: EXAMINATION OF ISSUES.....</b>	<b>6</b>
<b>CHAPTER III: ISSUES FOR CONSULTATION .....</b>	<b>33</b>
<b>ANNEXURES.....</b>	<b>36</b>
<b>LIST OF ACRONYMS .....</b>	<b>56</b>



## CHAPTER I: INTRODUCTION

### A. DoT's Reference dated 26.07.2023

- 1.1 Through the letter No. L-14001/13/2023-IMT dated 26.07.2023 (**Annexure-1.1**), the Department of Telecommunications (DoT) has sent a reference to Telecom Regulatory Authority of India (hereinafter also referred to as "TRAI", or "the Authority") seeking recommendations on allotment of additional spectrum to Indian Railways for its safety and security applications in the 700 MHz band. The relevant extract of afore-mentioned letter dated 26.07.2023 is reproduced below:

*"This is to inform that Indian Railways has requested for additional 5 MHz of paired spectrum in the 700 MHz band to be allocated free of cost for enhancing its safety and security systems (Annexure - I).*

*2. Based on an earlier request from Indian Railways, the recommendations of TRAI were sought in the matter and TRAI provided its recommendations on this subject on 25-10-2019.*

*2.1. Later, based on the approval of Cabinet, Indian Railways was assigned 5 MHz of paired spectrum in the 700 MHz band on 22-10-2021 (Annexure - II). IR was also intimated about the withdrawal of its GSM-R spectrum holding in the 900 MHz band in 14 LSAs, upon migration to LTE based network. The Indian Railways is yet to confirm the migration to the LTE based network.*

*3. Meanwhile, the request of National Capital Region Transport Corporation (NCRTC) for 5 MHz of paired spectrum in the 700 MHz was also considered in the Department. Subsequently, the TRAI recommendations were sought and based on the recommendations dated 28-12-2022, DoT provisionally assigned 5 MHz of paired spectrum to NCRTC and the roll out of the LTE network is under process. The assignment of spectrum to NCRTC shall be regularized after the approval of the Union Cabinet.*

4. Recently, based on the request from BSNL, the Cabinet has approved the reserving of paired spectrum in 700 MHz band in lieu of the 10 MHz of paired spectrum already reserved in the 600 MHz band. After considering this request of BSNL, only 5 MHz of paired spectrum is presently available as vacant spectrum in the 700 MHz band. The present spectrum holding of the various TSPs/ users in the 700 MHz band is placed at Annexure-III.

5. Recently, the Indian Railways has sought additional 5 MHz of paired spectrum, free of cost, in the 700 MHz band citing the following points –

(i) IR's indigenous development of Radio based Train Collision Avoidance System (TCAS) Kavach became successful. Radio based TCAS shall be the IR's ATP instead of ETCS level 2. Hence It is requested that Railways be allotted additional 5 MHz spectrum for design optimization of the network, when IR implements LTE network in 700 MHz band for safety & security applications.

(ii) The recent Balasore incident has shown that for the purpose of safety, it is important to capture large scale data & videos from moving trains on a real time basis. Dumping at a stopping station, which has high-capacity WiFi, shall not serve the objective. Further, during exigencies, the TSP's network gets choked thereby adversely affecting the relief and restoration operations.

(iii) When Railways implements its LTE network & Kavach over LTE, it shall surrender frequencies in the 146-174 MHz presently being used for driver-guard & driver/ guard to station communication as well as in the 400 MHz band being used for Kavach and consolidate all its requirements in 700 MHz band provided adequate bandwidth is available.

(iv) Utilization of this spectrum by other users can be done provided the same does not cause any interference to the network of IR.

6. Further, as per the TRAI recommendations on assignment of spectrum to Indian Railways, 5 MHz of paired spectrum has been assigned to Indian Railways on administrative basis and spectrum charges are to be paid annually

*on the formula basis similar to other captive users. However, for NCRTC, TRAI has recommended to levy .5 times the Auction Determined Price based on the area of LSA and on pro rata basis for the assignment of spectrum for a period of 10 years. Thus, the per km spectrum charges for NCRTC shall vary from LSA to LSA based on the Auction Determined Price (ADP), whereas for IR charges are fixed irrespective of the LSA. An indicative calculation sheet highlighting the difference in spectrum charging across each LSA is attached herewith (Annexure -IV).*

*6.1 From the above it is evident that spectrum charges for NCRTC is many fold greater than that of IR in the LSAs having more ADP, whereas in some LSAs where ADP is less and LSA area is more, spectrum charges for IR is many fold greater than that of NCRTC. Hence TRAI may be requested to recommend a uniform spectrum valuation and charging methodology considering similar usages in the same spectrum band.*

*7. In view of the above, TRAI is requested to examine and provide its recommendations on –*

- (i) the assignment of 5 MHz of additional spectrum to Indian Railways in view of its earlier recommendations dated 25-10-2019 and also in the context of its earlier recommendations with respect to NCRTC dated 28-12-2022 and auction of spectrum dated 11-04-2022.*
- (ii) While providing the recommendations, TRAI may also consider the possibility of sharing of the spectrum between IR/ NCRTC/ RRTS/ Metro and other similar networks to ensure the efficient utilization of spectrum.*
- (iii) Considering the different spectrum valuation methodology as recommended by TRAI for the 5 MHz of paired spectrum in the 700 MHz band, assigned to Indian Railways and for NCRTC, TRAI may examine and if found necessary recommend a uniform spectrum valuation and charging methodology considering similar usages in the same spectrum band.*
- (iv) Any other recommendations deemed fit for the purpose.*

## **B. Background**

- 1.2 In the year 2019, DoT sent a reference dated 27.02.2019 seeking recommendations of TRAI on administrative allotment of spectrum to Indian Railways for public safety and security services at stations and in trains and the quantum, price, and appropriate frequency band (including 450-470 MHz band). After consultation with stakeholders on the subject, TRAI sent its recommendations on 'allotment of spectrum to Indian Railways for public safety and security services' dated 25.10.2019<sup>1</sup>. DoT, after considering the recommendations of TRAI, assigned 5 MHz (paired) spectrum in 700 MHz band to Indian Railways for public safety and security services for captive use on 22.10.2021.
- 1.3 In the year 2021, DoT sent a reference dated 29.11.2021 seeking TRAI's recommendations on the spectrum requirement of National Capital Region Transport Corporation (NCRTC) for their LTE technology based RRTS network. After consultation with stakeholders on the subject, TRAI sent its recommendations on 'spectrum requirements of National Capital Region Transport Corporation (NCRTC) for train control system for RRTS corridors' dated 28.12.2022<sup>2</sup>. Through the instant reference letter dated 26.07.2023, DoT has conveyed that DoT has provisionally assigned 5 MHz of paired spectrum to NCRTC.
- 1.4 Through the DoT's reference dated 26.07.2023, TRAI has been requested to provide its recommendations on -
- (a) Assignment of 5 MHz of additional spectrum to Indian Railways;
  - (b) TRAI may also consider the possibility of sharing of the spectrum between IR/ NCRTC/ RRTS/ Metro and other similar networks to ensure the efficient utilization of spectrum.

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<sup>1</sup> Source: [https://www.trai.gov.in/sites/default/files/Recommendations\\_25102019.pdf](https://www.trai.gov.in/sites/default/files/Recommendations_25102019.pdf)

<sup>2</sup> Source: [https://www.trai.gov.in/sites/default/files/Recommendation\\_28122022.pdf](https://www.trai.gov.in/sites/default/files/Recommendation_28122022.pdf)

- (c) Considering the different spectrum valuation methodology as recommended by TRAI for the 5 MHz of paired spectrum in the 700 MHz band, assigned to Indian Railways and for NCRTC, TRAI may examine and if found necessary recommend uniform spectrum valuation and charging methodology considering similar usage in the same spectrum band.
- (d) Any other recommendations deemed fit for the purpose.

### **C. The Present Consultation Paper**

1.5 In this background, the Authority is issuing this consultation paper on assignment of additional spectrum to Indian Railways for its safety and security applications. Chapter I provides introduction and background information on the reference received from DoT. Chapter II examines the issues related to assignment of additional spectrum to Indian Railways. Chapter III summarizes the issues for consultation.

## CHAPTER II: EXAMINATION OF ISSUES

- 2.1 Indian Railways (IR) is India's national railway system operated by the Ministry of Railways. The rail network of IR is spread over 68,000 route Kilometers with more than 7,000 stations in the country. In the financial year 2021-22, 3,519 million passengers<sup>3</sup> were carried on the IR network. As on 31.03.2022, IR had deployed about 62,652 route Kilometer of Optical Fibre Cable (OFC) in its network.
- 2.2 Radiocommunication for railway operations is considered as “mission critical” for train operations and management of train emergency situations. The Railway Radiocommunication System between Train and Trackside (RSTT) provides improved railway traffic control, passenger safety and improved security for train operations. The main elements<sup>4</sup> of RSTT consist of on-board radio equipment, radio access units and other trackside radio infrastructure. The following figure depicts the schematic diagram of the architecture of RSTT.

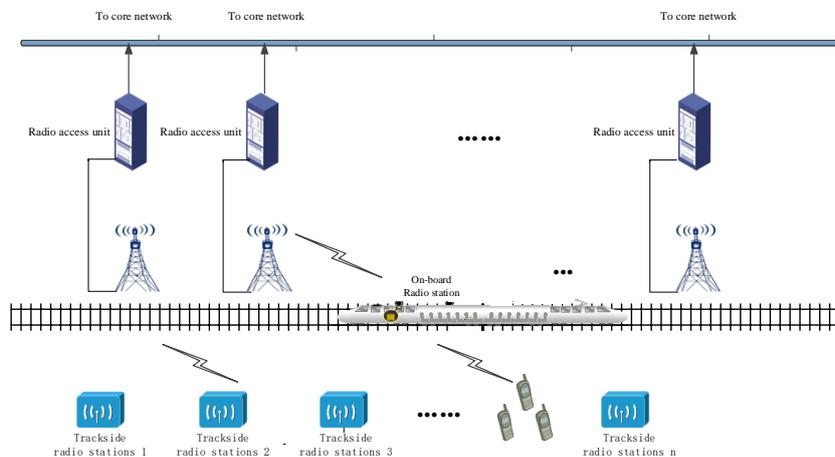


Figure 2.1: Schematic diagram of the architecture of RSTT (Source: APT)

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Source: [https://indianrailways.gov.in/railwayboard/uploads/directorate/stat\\_econ/pdf/Indian%20Railways%20Annual%20Report%20%26%20Accounts%20English%202021-22\\_web\\_Final.pdf](https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/pdf/Indian%20Railways%20Annual%20Report%20%26%20Accounts%20English%202021-22_web_Final.pdf)

<sup>4</sup> Source: [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)

2.3 In the year 2019, through the reference letter No. L-14001/01/2019-NTG dated 27.02.2019, DoT requested TRAI to provide recommendations on administrative allotment of spectrum to IR for public safety and security services at stations and in the trains and the quantum, price, appropriate frequency band (including 450-470 MHz band) and any other related issue. Through the said reference letter dated 27.02.2019, DoT informed, *inter-alia*, as below:

- (a) IR uses a GSM-R based network like various railway networks deployed around the world. 1.6 MHz (paired) spectrum in 900 MHz band has been assigned to IR on an administrative basis for captive usage of their GSM-R based network.
- (b) IR has proposed to install an ultra-high-speed Long Term Evolution (LTE) based communication corridor along its rail network for train-ground and train-train communication. Ministry of Railways had requested DoT to reserve 15 MHz of spectrum in 700 MHz band for this purpose and to begin with, 10 MHz to be allocated, free of cost, as the proposal is devoid of any commercial gain, but only for enhancing security and passenger amenities.

2.4 After consultation with stakeholders on the subject, TRAI, on 25.10.2019<sup>5</sup>, sent the following recommendations to DoT on 'allotment of spectrum to Indian Railways for public safety and security services':

Para 3.1:

- (a) Out of the 35 MHz (paired) spectrum available in 700 MHz band, 5 MHz (paired) spectrum may be allocated to Indian Railways for implementing ETCS Level-2, MC PTT + Voice, IoT based asset monitoring services, passenger information display system and live feed of Video Surveillance of few coaches at a time. The remaining 30 MHz (paired) in 700 MHz band may be put to auction in the forthcoming auction.*

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<sup>5</sup> Source: [https://www.trai.gov.in/sites/default/files/Recommendations\\_25102019.pdf](https://www.trai.gov.in/sites/default/files/Recommendations_25102019.pdf)

- (b) *To implement the Video Surveillance System for all coaches of the Train (Security services), Indian Railways may explore other communications means such as-*
- (i) *Dumping the Video Surveillance data to the system using high capacity WiFi when the train reaches a station.*
  - (ii) *Using Public Telecommunication Network (TSPs 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 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."*

Para 3.2:

- "(a) Spectrum 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.*
- (b) Spectrum charges may be levied based on formula basis as prescribed by DoT for Royalty Charges and License Fee for captive use."*

2.5 After considering the afore-mentioned recommendations dated 25.12.2019, DoT, through a letter dated 22.10.2021, assigned 5 MHz (paired) spectrum in 700 MHz band to IR for Public Safety and Security Services for captive use, with the following conditions:

- "(i) This spectrum assignment is being made for captive use along the Railway track only and not to offer any Commercial Services such as Internet/Wi-Fi onboard.*
- (ii) Annual spectrum charges for this assignment will be levied based on formula as prescribed by WPC Wing, DoT, from time to time for Royalty*

*Charges and License Fee for Captive usages. Addition of new base stations and mobile terminals shall be intimated by Indian Railways without any delay.*

*(iii) Efficient and timely utilization of spectrum will be ensured by Railways through a process of periodical monitoring.*

*(iv) The 1.6 MHz (paired) spectrum already assigned to Indian Railways in 900 MHz band will be taken back from Indian Railways upon migration to LTE based network.*

*(v) As Indian Railways would be using the assigned spectrum along its railway track network and stations only, DoT may consider assigning the same spectrum in other areas for area-specific limited use to other entities for captive use. However, it will be ensured that there is no interference to the Railways' network from such use.*

*(vi) Applicable procedures for Letter of Intent (LoI), Decision Letter (DL), SACFA clearance and Wireless Operating License (WOL), as being followed for GSM-R network, shall be followed by Indian Railways for all the base/mobile stations.*

*(vii) Operations should not commence without obtaining Wireless Operating License (WOL) for the network as per applicable procedure.*

*(viii) Connection of this network to Public Switched Telecom Network (PSTN) shall not be allowed."*

2.6 Subsequently, through the letter No. 2020/Tele/WL/2 Misc. dated 03.11.2021 IR informed DoT that it was utilizing 1.6 MHz (paired) spectrum in 900 MHz band for Mobile Train Radio Communication (MTRC) for operational, safety and maintenance requirements which was rolled out in six railway zones only. Through the said letter dated 03.11.2021, IR also surrendered 1.6 MHz paired spectrum in 900 MHz band in States/ Union Territories where GSM-R based MTRC was not rolled out. The surrender of spectrum resulted in availability of additional 1.6 MHz (paired) spectrum for commercial use in seven LSAs namely Andhra Pradesh, Himachal Pradesh, Karnataka, Kerala, North East, Orissa, Tamilnadu LSAs.

2.7 Thereafter, in the year 2021, DoT sent the reference letter No. L-14001/01/2019-NTG (Pt.) dated 29.11.2021 to TRAI, and informed, *inter-alia*, as below:

"2. 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.

...

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

2.8 Through the afore-mentioned reference letter dated 29.11.2021, DoT requested TRAI to provide 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; and any other recommendations deemed fit for the purpose, including assignment of the same spectrum for other RRTS/ Metro rail network pan-India.

2.9 In this regard, after consultation with stakeholders, TRAI sent its recommendations on 'spectrum requirements of National Capital Region Transport Corporation (NCRTC) for train control system for RRTS corridors' on 28.12.2022<sup>6</sup> to DoT. TRAI made, *inter-alia*, the following recommendations:

Para 3.1:

"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."

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<sup>6</sup> Source: [https://www.trai.gov.in/sites/default/files/Recommendation\\_28122022.pdf](https://www.trai.gov.in/sites/default/files/Recommendation_28122022.pdf)

Para 3.2:

- "(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 3.3:

- "(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 3.5:

- "(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 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 3.6:

- (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."*

- 2.10 Through the instant reference letter dated 26.07.2023, DoT has conveyed that *"based on the recommendations dated 28-12-2022, DoT provisionally assigned 5MHz of paired spectrum to NCRTC and the roll out of the LTE network is under process. The assignment of spectrum to NCRTC will be regularized after the approval of the Union Cabinet."*
- 2.11 As per the information available in public domain, NCTRC commenced commercial operations<sup>7</sup> in the priority section of the Delhi-Ghaziabad-Meerut RRTS corridor on 21.10.2023.
- 2.12 Through the reference letter dated 26.07.2023, DoT has informed that *"IR has sought additional 5 MHz of paired spectrum in the 700 MHz band citing the following points:*
- (i) IR's indigenous development of Radio based Train Collision Avoidance System (TCAS) Kavach became successful. Radio based TCAS shall be the IR's ATP instead of ETCS level 2.*
  - (ii) The recent Balasore incident has shown that for the purpose of safety, it is important to capture large scale data & videos from moving trains on a real*

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<sup>7</sup> Source: <https://nctrc.in/commercial-operations-of-indias-first-namo-bharat-train-kickstarts/>

*time basis. Dumping at a stopping station, which has high-capacity Wi-Fi, shall not serve the objective. Further, during exigencies, the TSP's network gets choked thereby adversely affecting the relief and restoration operations.*

*(iii) When Railways implements its LTE network & Kavach over LTE, it shall surrender frequencies in the 146-174 MHz as well as in the 400 MHz band and consolidate all its requirements in 700 MHz band provided adequate bandwidth is available.*

*(iv) Utilization of this spectrum by other users can be done provided the same does not cause any interference to the network of IR.”*

**A. Examination of IR's request for assignment of additional 5 MHz (paired) spectrum in the 700 MHz band**

2.13 In the earlier recommendations on 'allotment of spectrum to Indian Railways for public safety and security services' dated 25.10.2019, TRAI had made the following observations:

*"2.46 Indian Railways envisages to use the spectrum for the following services:*

*(a) Safety Services: Signalling (ETCS Level-2) [consist of communication between On-Board Equipment and Trackside Equipment]*

*(b) Voice Communication: MCPTT communication and voice calling on-board train*

*(c) IoT Based Asset Reliability Monitoring*

*(d) Security Services: Video Surveillance (Live Feed) through CCTV Cameras in trains*

*2.47 During the Open House Discussion, Professor Kiran Kuchi from IIT Hyderabad mentioned that they have carried out a study on data rate and spectrum requirement for implementing LTE based ETCS Level-2 signaling system by Indian Railways. Subsequently, the Report on the study was shared by IIT Hyderabad with the Authority through e-mail. The three key outcomes of the study are shown below:*

**a) Data rate requirement for various requirements of IR:**

<b>S. No</b>	<b>Application</b>	<b>Data rate requirement in download</b>	<b>Data rate requirement in upload</b>
1	ETCS Level-2	100 Kbps	100 Kbps
2	MC PTT + Voice	660 Kbps + 1000 Kbps	660 Kbps +1000 Kbps
3	IoT services	2 Mbps	2Mbps
4	Passenger information display system	100 Kbps	10 Kbps
	<b>Total Requirement</b>	<b>3.86 Mbps</b>	<b>3.86 Mbps</b>
5	On Board Video Surveillance (minimum per Train)	200 Kbps	Up to 40 Mbps
	<b>Total including Video Surveillance</b>	<b>4.06 Mbps</b>	<b>Up to 43.86 Mbps</b>

*In panic, bandwidth requirement for on-board video surveillance per coach: minimum 6 Mbps*

**b) Spectrum requirement in 700 MHz band**

<b>Functionality</b>	<b>Spectrum Requirement</b>
<i>ETCS Level-2 (train control, Safety, signalling etc.), MCPTT + Voice, Passenger Information and IoT based asset monitoring</i>	<i>5 MHz (paired)</i>
<i>Video Surveillance System</i>	<i>10 MHz or more (paired)</i>

**c) Ecosystem in 450-470 MHz band:** Only few chipset companies support the UE receivers while the base station radio ecosystem is weak in this band. Further, NB-IoT products are not available in the 450-470 MHz band.

2.48 From the reports published by Global mobile Suppliers Association (GSA), it is seen that the LTE device ecosystem in 700 MHz band has been increasing at a fast pace. ...

2.49 As can be seen from the outcomes of the study conducted by IIT Hyderabad, the data rate requirement for implementation of ETCS Level-2 based train signaling system, Mission Critical Push-To-Talk (MCPTT), Voice, IoT services for assets management and passenger information display is 3.86 Mbps, which can be easily met with 5 MHz (paired) spectrum. A larger bandwidth is required only on account of the requirement of uploading CCTV Video surveillance data from all the coaches of the train. For one coach, the upload data rate requirement for video surveillance is around 6 Mbps whereas for the entire train, it is up to 40 Mbps. As per the LTE throughput table given below, the downlink peak data rate for 5 MHz bandwidth is 36.7 Mbps with 2 x 2 MIMO and uplink peak data rate is 18.3 Mbps with 64 QAM modulation.

**Table 2.4: LTE FDD System Throughput**

<i>Transmission Mode/ System Bandwidth</i>	<i>No of Useable Resource Block</i>	<i>SISO</i>	<i>Transmit</i>	<i>MIMO 2x2</i>	<i>All Transmission Mode</i>	
		<i>Downlink Peak (Mbps)</i>	<i>Downlink Peak (Mbps)</i>	<i>Downlink Peak (Mbps)</i>	<i>Uplink Peak (Mbps) 16 QAM</i>	<i>Uplink Peak (Mbps) 64 QAM</i>
<i>1.4 MHz</i>	<i>6</i>	<i>4.4</i>	<i>4.4</i>	<i>8.8</i>	<i>3</i>	<i>4.4</i>
<i>3 MHz</i>	<i>15</i>	<i>11.1</i>	<i>11.1</i>	<i>22.1</i>	<i>7.5</i>	<i>11.1</i>
<i>5 MHz</i>	<i>25</i>	<i>18.3</i>	<i>18.3</i>	<i>36.7</i>	<i>12.6</i>	<i>18.3</i>
<i>10 MHz</i>	<i>50</i>	<i>36.7</i>	<i>36.7</i>	<i>75</i>	<i>25.5</i>	<i>36.7</i>
<i>15 MHz</i>	<i>75</i>	<i>55.1</i>	<i>55.1</i>	<i>110</i>	<i>37.9</i>	<i>55.1</i>
<i>20 MHz</i>	<i>100</i>	<i>75</i>	<i>75</i>	<i>150</i>	<i>51</i>	<i>75</i>

2.50 In view of the above, 5 MHz (paired) spectrum in 700/ 800/ 900 MHz bands will be sufficient for Indian Railways for all its requirements other than continuous Video surveillance system, namely, ETCS level-2 (train control, Safety, signaling etc.), MCPTT + Voice & IoT based asset monitoring. Though, 5 MHz spectrum may not be sufficient for continuous live feed of CCTV for video surveillance system, it will provide an uplink capability of 12 Mbps to 18 Mbps. Therefore, the Indian railways will be able to send live feed of CCTV Surveillance Cameras for two to three coaches at a time using the same 5 MHz (paired) spectrum, as the upload data rate requirement for video surveillance for a single coach is around 6 Mbps. The Video Surveillances data can be stored on-board and can be sent periodically/sequentially as per need. Further, the data rate can be further enhanced by increasing the number of BTSs, using MIMO and higher order modulation techniques [64 QAM]. It is further noted that 5 MHz (paired) spectrum is not available either in 800 MHz band or 900 MHz band on pan-India basis.

...

2.58 In view of the foregoing discussion, the Authority is of the view that 5 MHz (paired) spectrum in 700 MHz band may be allocated to Indian Railways

*for implementing ETCS Level-2, MC PTT + Voice, IoT based asset monitoring services, passenger information display system and live feed of Video Surveillance of few coaches at a time. To implement video surveillance of all coaches in the train, Indian Railways may explore other communications means such as:*

*(i) when the train reaches a station, high capacity WiFi system at Railway Stations can be used to transfer the video data dump to the system.*

*(ii) Use of public telecommunication network (TSP's network) for sending continuous video surveillance data streams to the Control Center."*

2.14 With respect to the instant reference letter dated 26.07.2023, TRAI held discussions with IR regarding its request for an additional 5 MHz of paired spectrum in the 700 MHz band. During the discussion, IR informed TRAI that the following functionalities are proposed to be put in place in the IR's network:

(a) Passenger Safety: Modern Train Control System

- Enhanced Safety

- Kavach (Train Collision Avoidance System-TCAS)
- Signal aspect in the loco cab
- Emergency Mobile communications Train to control, Train to Stations, within Train (MCPTT, EOTT, DPWCS)

(b) Improved Throughput

- Increased speed
- Augments train's running capacity

(c) Passenger Security: CCTV network

- Live Feed at Security Control Centers
- Video Surveillance
- Video Analytics

(d) Asset Reliability: IoT (Internet of Things)

2.15 During the discussion, IR stated that it requires 10 MHz of paired spectrum in the 700 MHz band to cater to the updated data rate requirement as given below:

<b>S. No.</b>	<b>Application</b>	<b>Bandwidth requirement in download</b>	<b>Bandwidth requirement in upload</b>
1	KAVACH	100 Kbps	100 Kbps
2	MC PTT + Voice	660 kbps + 1000 Kbps	660 Kbps + 1000 Kbps
3	IoT Services	2 Mbps	2 Mbps
4	Video Streaming	4 Mbps	50 Kbps
5	On Board Video Surveillance (minimum per Train) CCTV	200 Kbps	40 Mbps
			(8 x 25 = 200 x 200 = 40 Mbps)
6	Passenger information display system	100 Kbps	10 Kbps
7	EoTT & DPWCS	300 Kbps	300 Kbps
8	Data uses for other safety, security & train operations applications	4.7 Mbps	1.7 Mbps
	<b>Total Requirement</b>	<b>13.060 Mbps</b>	<b>45.820 Mbps</b>

2.16 As can be seen from the above table, the data rate requirement, conveyed by IR, is uplink centric. Within uplink, on-board video surveillance is the largest data consuming application. During the discussion, IR mentioned that for the purpose of safety, it is important to capture large scale data and videos from moving trains on a real time basis, for which, (a) dumping at a stopping station, which has high-capacity Wi-Fi, does not serve the objective and (b) during exigencies, networks of telecom service providers get choked thereby adversely affecting the relief and restoration operations. IR asserted that it needs an

additional 5 MHz spectrum in the 700 MHz band to serve the updated data rate requirement.

**B. Aspects related to sharing of spectrum IR/ NCRTC/ RRTS/ Metro and other similar networks**

2.17 Through the reference letter dated 26.07.2023, DoT has mentioned that *"[w]hile providing the recommendations, TRAI may also consider the possibility of sharing of the spectrum between IR/ NCRTC/ RRTS/ Metro and other similar networks to ensure the efficient utilization of spectrum"*.

2.18 Earlier, while examining the issue relating to spectrum assignment to NCRTC and other RRTS/ Metro rail networks in the year 2021, TRAI, through a letter dated 28.12.2021, had, *inter-alia*, requested DoT to share reasons for not exploring spectrum sharing between IR and NCRTC and instead seeking recommendations on separate spectrum requirement of NCRTC in 700 MHz band. In response, DoT, through its letter dated 04.05.2022, had informed, *inter-alia*, that *"[w]ith 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 signaling and train control, therefore, separate spectrum may be required since the services involve safety of life"*. After consultation with stakeholders, the Authority, through its recommendations on 'spectrum requirements of National Capital Region Transport Corporation (NCRTC) for train control system for RRTS corridors' dated 28.12.2022 recommended, *inter-alia*, as below with respect to the reuse and sharing of spectrum between IR, NCRTC, RRTS and Metro:

*"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.”*

*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."*

2.19 India has adopted frequency division duplex (FDD) configuration-based band 28 for LTE or APT 700 band (Uplink: 703-748 MHz/ Downlink: 758-803 MHz) For the 700 MHz frequency band. DoT, through the reference letter dated 26.07.2023, has provided the spectrum utilization of the 700 MHz frequency band as below:

<b>S. No.</b>	<b>Uplink Frequency (MHz)</b>	<b>Downlink Frequency (MHz)</b>	<b>Quantum (MHz)</b>	<b>TSP/ User</b>
1.	703 - 713	758 - 768	10	Government User
2.	713 - 718	768 - 773	5	Indian Railways
3.	718 - 723	773 - 778	5	NCRTC/ RRTS
4.	723 - 733	778 - 788	10	Reliance Jio
5.	<b>733- 738</b>	<b>788 - 793</b>	<b>5</b>	<b>Vacant</b>
6.	738 - 748	793 - 803	10	Reserved for BSNL

Table 2.1: The present spectrum utilization of the 700 MHz band

2.20 As can be seen from the above table, only 5 MHz (paired) spectrum is vacant in each of the 22 LSAs in the 700 MHz band. One may contend that considering

that the 700 MHz band is the prime coverage band for terrestrial mobile telecommunication services and only 5 MHz (paired) spectrum is vacant in the 700 MHz band, additional spectrum should be assigned to IR in some other frequency band. However, a contrary argument could be that if an additional spectrum is assigned to IR in a different spectrum band (other than 700 MHz band), IR will have to deploy radios in two separate frequency bands which will entail cost implications for IR. Besides, for considering assignment of spectrum in a different frequency band (other than 700 MHz band) to IR, it requires to be ascertained that the eco-system in such frequency band is adequately developed for the deployment of RSTT.

- 2.21 In case it is decided to assign an additional 5 MHz (paired) spectrum in 700 MHz band to IR, it may be deemed preferable to assign such spectrum in a frequency block which is contiguous to the existing assignment to IR. As can be seen from the information given in Table 2.1 above, the existing vacant frequency block is not adjacent to the frequency blocks already assigned to IR and reserved for NCRTC and other RRTS/ Metro rail networks. It needs deliberation on the need to harmonize the spectrum assigned in 700 MHz band to make the spectrum assigned to IR, and NCRTC and the other RRTS/ Metro Rail contiguous.
- 2.22 In view of the foregoing discussion, the stakeholders are requested to provide their comments on the following questions.

**Issues for consultation:**

**Q1. Whether an additional 5 MHz (paired) spectrum in the 700 MHz band should be assigned to Indian Railways (IR) in order to meet its requirement for safety and security applications? Kindly provide a detailed response with justification.**

- Q2. In case your response to Q1 is negative, -**
- (a) In what manner, the requirement of IR for its safety and security applications may be fulfilled?**
    - (i) Specifically, whether it would be appropriate to devise a framework, under which the 10 MHz (paired) spectrum [5 MHz (paired) assigned to IR, and 5 MHz (paired) reserved for NCRTC and other RRTS/ Metro rail network] in the 700 MHz band may be used by all types of rail networks on shared basis, subject to the outcome of the field trial recommended by the Authority in its recommendations on 'Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors' dated 28.12.2022? If yes, please suggest the key features which should be included in such a framework?**
    - (ii) Any other suggestion may be provided with detailed justification.**
  - (b) In case your response to Q(2)(a)(i) is affirmative, whether a frequency spectrum of 10 MHz (paired) in the 700 MHz band would be sufficient to meet the requirement of different rail networks in India particularly in the overlapping zones? Kindly provide a detailed response with justification.**
- Q3. In case it is decided to assign an additional 5 MHz (paired) spectrum in the 700 MHz band to IR, whether there is a need for harmonization of spectrum in the 700 MHz band to make the spectrum assigned to IR, and NCRTC and other RRTS/ Metro Rail Networks contiguous? Kindly provide a detailed response with justification.**

## C. Spectrum Valuation and Charging Methodology

2.23 DoT vide its reference dated 26.07.2023 has inter-alia stated that –

*"Further, as per TRAI recommendations on assignment of spectrum to Indian Railways, 5 MHz of paired spectrum has been assigned to Indian Railways on administrative basis and spectrum charges are to be paid annually on the formula basis similar to other captive users. However, for NCRTC, TRAI has recommended to levy 0.5 times the Auction determined price (ADP) based on the area of LSA and on pro rata basis for assignment of spectrum for a period of 10 years. Thus, the per km spectrum charges for NCRTC shall vary from LSA to LSA based on the Auction Determined Price (ADP), whereas for IR charges are fixed irrespective of the LSA.*

*From the above it is evident that spectrum charges for NCRTC is many fold greater than that of IR in the LSAs having more ADP, whereas in some LSAs where ADP is less and LSA area is more, spectrum charges for IR is many fold greater than that of NCRTC. Hence, TRAI may be requested to recommend a uniform spectrum valuation and charging methodology considering similar usages in the same spectrum band.*

*In the view of the above, TRAI is requested to examine and provide recommendations on-.....*

*(iii) Considering the different spectrum methodology as recommended by TRAI for the 5 MHz of paired spectrum in 700 MHz band, assigned to Indian Railways and for NCRTC, TRAI may examine and if found necessary recommend a uniform spectrum valuation and charging methodology considering similar usages in the same spectrum band.*

2.24 The Authority vide its Recommendations on 'Allotment of spectrum to Indian Railways for Public Safety and Security services' dated 25.10.2019 recommended that "spectrum 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 the spectrum charges may be levied based

*on formula basis as prescribed by DoT for Royalty Charges and License Fee for captive use”.*

2.25 The above TRAI’s Recommendations have been accepted by DoT and 5 MHz (paired) in 700 MHz band was assigned to IR on administrative basis for captive usage.

2.26 Further, for National Capital Region Transport Corporation (NCRTC), the Authority vide its Recommendations on ‘Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors’ dated 28.12.2022 recommended that:

*(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 CNPNR 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.*

2.27 Presently, for Indian Railways spectrum royalty charges are levied as per order no. P-11014/34/2009-PP (II) and P-11014/34/2009-PP(IV) dated 22nd March 2012 (**Annexure-2.1**) briefly given as follows:

$$\text{Annual Royalty (in Rs.)} = \sum_{i=1}^n M_i * W$$

*Where, n = no. of carriers*

M = Basic Royalty, value of M is dependent upon the maximum distance over which the network operates

W factor is dependent upon adjacent channel separation (Bandwidth in MHz)

2.28 The above said order has been revised by DoT vide order dated 11.12.2023 on 'Spectrum Charges for Assignment of Frequencies to Captive Users (being charged on formula basis) for different types of Radiocommunication Services and applications'. This revised order shall come into force w.e.f. 1st April 2024. A copy of the order is attached at **Annexure-2.2**.

- 2.29 In case of NCRTC and for other RRTS/ Metro rail networks, the spectrum charging methodology based on Auction Determined price (ADP) and other parameters has been recommended by the Authority. Due to the distinction in charging methodology, DoT has requested TRAI to examine the need for a uniform charging methodology considering similar usage in the same spectrum band and if found necessary, recommend uniform spectrum charging methodology.
- 2.30 Indian Railways has requested for additional 5 MHz of paired spectrum in 700 MHz band for enhancing its safety and security systems. NCRTC has also planned to utilize spectrum for mission critical safety applications (signalling and voice & asset monitoring) along the RRTS Corridor and train control. Thus, both Indian Railways and NCRTC will be utilizing spectrum in the 700MHz band for similar purpose. Considering the similar spectrum usage by these two entities, it may be examined whether a uniform spectrum charging methodology may be adopted for the entities.
- 2.31 It may further be noted that the present annual royalty formula as per aforementioned DoT Order dated 22.03.2012 is independent of the auction determined price. However, the spectrum charging methodology recommended for NCRTC and other RRTS/ Metro rail networks is broadly based on the auction determined price and it may be mentioned that the auction determined price for 700Mhz band is available for all 22 LSAs (Pan-India).
- 2.32 In view of the above discussion, the following issues arise for consultation:

**Issues for consultation:**

**Q4. Should a uniform spectrum charging methodology be adopted for Indian Railways as well as for NCRTC and other RRTS/ Metro rail networks? If yes, which of the following spectrum charging methodology be adopted in this regard:**

- (i) Spectrum charging methodology based on Auction Determined price (ADP) as recommended in the TRAI's recommendations on 'Spectrum requirements of National Capital Region Transport Corporation (NCRTC) for train control system for RRTS corridors' dated 28.12.2022.**
- (ii) Spectrum charges as levied for Indian Railways as per DoT's Order No. P-11014/34/2009-PP(II) and P-11014/34/2009-PP(IV) dated 22nd March 2012 (revised vide DoT's Order dated 11.12.2023).**
- (iii) Apart from the methodologies highlighted in (i) and (ii) above, any other uniform spectrum charging methodology that may be adopted in this regard? Details with justification may kindly be provided.**

**Q5. If answer to Q4 above is no, whether the existing charging methodology as per DoT's Order No. P-11014/34/2009-PP (II) and P- 11014/34/2009-PP(IV) dated 22nd March 2012 (revised vide DoT's Order dated 11.12.2023) be continued for Indian Railways or some other spectrum charging methodology may be adopted specifically for Indian railways? Please provide detailed response with justification.**

#### **D. Payment Terms**

2.33 As cited above in para 2.27 above, presently for Indian railways, spectrum royalty charges are levied as per order no. P-11014/34/2009-PP (II) and P-11014/34/2009-PP(IV) dated 22nd March 2012. On the basis of the aforementioned orders royalty charges are calculated on an annual basis. In addition, the fixed license fee is also levied on an annual basis based on the above orders.

2.34 The Authority in its Recommendations on 'Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors' dated 28.12.2022, recommended the following payment terms:

(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.*

2.35 For payment terms, the following issues arise for consultation:

### **Issues for consultation**

**Q6. If a spectrum charging methodology similar to NCRTC and other RRTS/Metro rail networks, is adopted for Indian Railways, what should be the payment terms and associated conditions relating to:**

- i. Upfront payment**
- ii. Moratorium period**
- iii. Total number of installments to recover deferred payments**
- iv. Rate of interest in respect of deferred payment and prepayment**

**Please support your answer with detailed justification.**

**Q7. Any other suggestions relevant to the subject may kindly be made with detailed justification.**

### **CHAPTER III: ISSUES FOR CONSULTATION**

Stakeholders are requested to respond to the following questions with detailed justifications. Stakeholders are strongly recommended to provide specific proposals and detailed technical data to support their proposals.

**Q1. Whether an additional 5 MHz (paired) spectrum in the 700 MHz band should be assigned to Indian Railways (IR) in order to meet its requirement for safety and security applications? Kindly provide a detailed response with justification.**

**Q2. In case your response to Q1 is negative, -**

**(a) In what manner, the requirement of the IR for safety and security applications may be fulfilled?**

**(i) Specifically, whether it would be appropriate to devise a framework under which the 10 MHz (paired) spectrum [5 MHz (paired) assigned to IR, and 5 MHz (paired) reserved for NCRTC and other RRTS/ Metro rail network] in the 700 MHz band may be used by all types of rail networks on shared basis, subject to the outcome of the field trial recommended by the Authority in its recommendations on 'Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors' dated 28.12.2022? If yes, please suggest the key features which should be included in such a framework?**

**(ii) Any other suggestion may be provided with detailed justification.**

**(b) In case your response to Q(2)(a)(i) is affirmative, whether a frequency spectrum of 10 MHz (paired) in the 700 MHz band would be sufficient to meet the requirement of different rail**

**networks in India particularly in the overlapping zones? Kindly provide a detailed response with justification.**

**Q3. In case it is decided to assign an additional 5 MHz (paired) spectrum in the 700 MHz band to IR, whether there is a need for harmonization of spectrum in the 700 MHz band to make the spectrum assigned to IR, and NCRTC and other RRTS/ Metro Rail Networks contiguous? Kindly provide a detailed response with justification.**

**Q4. Should a uniform spectrum charging methodology be adopted for Indian Railways as well as for NCRTC and other RRTS/ Metro rail networks? If yes, which of the following spectrum charging methodology be adopted in this regard:**

**(i) Spectrum charging methodology based on Auction Determined price (ADP) as recommended in the TRAI's recommendations on 'Spectrum requirements of National Capital Region Transport Corporation (NCRTC) for train control system for RRTS corridors' dated 28.12.2022.**

**(ii) Spectrum charges as levied for Indian Railways as per DoT's Order No. P-11014/34/2009-PP (II) and P- 11014/34/2009-PP(IV) dated 22nd March 2012 (revised vide DoT's order dated 11.12.2023).**

**(iii) Apart from the methodologies highlighted in (i) and (ii) above, any other uniform spectrum charging methodology that may be adopted in this regard?**

**Details with justification may kindly be provided.**

**Q5. If answer to Q4 above is no, whether the existing charging methodology as per DoT's Order No. P-11014/34/2009-PP (II) and P- 11014/34/2009-PP(IV) dated 22nd March 2012 (revised vide**

**DoT's Order dated 11.12.2023) be continued for Indian Railways or some other spectrum charging methodology may be adopted specifically for Indian Railways? Please provide detailed response with justification.**

**Q6. If a spectrum charging methodology similar to NCRTC and other RRTS/Metro rail networks, is adopted for Indian Railways, what should be the payment terms and associated conditions relating to:**

- i. Upfront payment**
- ii. Moratorium period**
- iii. Total number of installments to recover deferred payments**
- iv. Rate of interest in respect of deferred payment and prepayment**

**Please support your answer with detailed justification.**

**Q7. Any other suggestions relevant to the subject may kindly be made with detailed justification.**

## ANNEXURES

### Annexure-1.1: DoT letter dated 26.07.2023 (with Annexure-II and III)

Government of India  
Ministry of Communications  
Department of Telecommunications  
Wireless Planning & Coordination Wing

6<sup>th</sup> floor, Sanchar Bhawan,  
20, Ashoka Road, New Delhi-110001.

No.: L-14001/13/2023-IMT

Date: 26.07.2023

To,

The Secretary  
Telecom Regulatory Authority of India  
Mahanagar Doorsanchar Bhawan  
Jawahar Lal Nehru Marg (Old Minto Road)  
New Delhi - 110002.

**Subject: Seeking recommendations of TRAI on allotment of additional spectrum to Indian Railways for its safety and security applications in the 700 MHz band - reg.**

Sir,

This is to inform that Indian Railways has requested for additional 5 MHz of paired spectrum in the 700 MHz band to be allocated free of cost for enhancing its safety and security systems (Annexure - I).

2. Based on an earlier request from Indian Railways, the recommendations of TRAI were sought in the matter and TRAI provided its recommendations on this subject on 25-10-2019.

2.1. Later, based on the approval of Cabinet, Indian Railways was assigned 5 MHz of paired spectrum in the 700 MHz band on 22-10-2021 (Annexure - II). IR was also intimated about the withdrawal of its GSM-R spectrum holding in the 900 MHz band in 14 LSAs, upon migration to LTE based network. The Indian Railways is yet to confirm the migration to the LTE based network.

3. Meanwhile, the request of National Capital Region Transport Corporation (NCRTC) for 5 MHz of paired spectrum in the 700 MHz was also considered in the Department. Subsequently, the TRAI recommendations were sought and based on the recommendations dated 28-12-2022, DoT provisionally assigned 5 MHz of paired spectrum to NCRTC and the roll out of the LTE network is under process. The assignment of spectrum to NCRTC shall be regularized after the approval of the Union Cabinet.

4. Recently, based on the request from BSNL, the Cabinet has approved the reserving of 10 MHz of paired spectrum in the 700 MHz band in lieu of the 10 MHz of paired spectrum already reserved in the 600 MHz band. After considering this request of BSNL only 5 MHz of paired spectrum is presently available as vacant spectrum in the 700 MHz band. The present spectrum holding of the various TSPs/users in the 700 MHz band is placed at Annexure -III.

5. Recently, the Indian Railways has sought additional 5 MHz of paired spectrum, free of cost, in the 700 MHz band citing the following points -

(i) IR's indigenous development of Radio based Train Collision Avoidance System (TCAS) Kavach became successful. Radio based TCAS shall be the IR's ATP instead of ETCS level 2. Hence It is requested that Railways be allotted additional 5 MHz spectrum for design optimization of the network, when IR implements LTE network in 700 MHz band for safety & security applications.

(ii) The recent Balasore incident has shown that for the purpose of safety, it is important to capture large scale data & videos from moving trains on a real time basis. Dumping at a stopping station, which has high-capacity WiFi, shall not serve the objective. Further, during exigencies, the TSP's network gets choked thereby adversely affecting the relief and restoration operations.

(iii) When Railways implements its LTE network & Kavach over LTE, it shall surrender frequencies in the 146-174 MHz presently being used for driver-guard & driver/guard to station communication as well as in the 400 MHz band being used for Kavach and consolidate all its requirements in 700 MHz band provided adequate bandwidth is available.

(iv) Utilization of this spectrum by other users can be done provided the same does not cause any interference to the network of IR.

6. Further, as per the TRAI recommendations on assignment of spectrum to Indian Railways, 5 MHz of paired spectrum has been assigned to Indian Railways on administrative basis and spectrum charges are to be paid annually on the formula basis similar to other captive users. However, for NCRTC, TRAI has recommended to levy .5 times the Auction Determined Price based on the area of LSA and on pro rata basis for the assignment of spectrum for a period of 10 years. Thus, the per km spectrum charges for NCRTC shall vary from LSA to LSA based on the Auction Determined Price (ADP), whereas for IR charges are fixed irrespective of the LSA. An indicative calculation sheet highlighting the difference in spectrum charging across each LSA is attached herewith (Annexure -IV).

6.1 From the above it is evident that spectrum charges for NCRTC is many fold greater than that of IR in the LSAs having more ADP, whereas in some LSAs where ADP is less and LSA area is more, spectrum charges for IR is many fold greater than that of NCRTC. Hence TRAI may be requested to recommend a uniform spectrum valuation and charging methodology considering similar usages in the same spectrum band.

7. In view of the above, TRAI is requested to examine and provide its recommendations on -

(i) the assignment of 5 MHz of additional spectrum to Indian Railways in view of its earlier recommendations dated 25-10-2019 and also in the context of its earlier recommendations with respect to NCRTC dated 28-12-2022 and auction of spectrum dated 11-04-2022.

(ii) While providing the recommendations, TRAI may also consider the possibility of sharing of the spectrum between IR/NCRTC/RRTS/Metro and other similar networks to ensure the efficient utilization of spectrum.

(iii) Considering the different spectrum valuation methodology as recommended by TRAI for the 5 MHz of paired spectrum in the 700 MHz band, assigned to Indian Railways and for NCRTC, TRAI may examine and if found necessary recommend a uniform spectrum valuation and charging methodology considering similar usages in the same spectrum band.

(iv) Any other recommendations deemed fit for the purpose.

Encl: As above.

  
26.07.2023  
(Gulab Chand)  
Joint Wireless Adviser

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: 22.10.2021

To,

Executive Director (Tele Div)  
Railway Board  
Ministry of Railways

**Subject: Allotment of 5 MHz (paired) spectrum to Indian Railways in 700 MHz band for Public Safety and Security services at Stations and in the Trains for Captive use.**

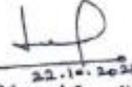
Reference: Ministry of Railways' O.M. No. 2017-Tele/14(1)/1 Pt. dated 23.06.2021.

Sir,

I am directed to refer to Ministry of Railways' Office Memorandum dated 23.06.2021 on the above subject and to inform that in accordance with the Cabinet decision taken in its meeting held on 09.06.2021, 5 MHz (paired) spectrum in the spectrum block 713-718/768-773 MHz is hereby assigned to Indian Railways for Public Safety and Security services for Captive use, with the following conditions:

- (i) This spectrum assignment is being made for captive use along the Railway track only and not to offer any Commercial Services such as Internet/Wi-Fi onboard.
- (ii) Annual spectrum charges for this assignment will be levied based on formula as prescribed by WPC Wing, DoT, from time to time for Royalty Charges and License Fee for Captive usages. Addition of new base stations and mobile terminals shall be intimated by Indian Railways without any delay.
- (iii) Efficient and timely utilization of spectrum will be ensured by Railways through a process of periodical monitoring.
- (iv) The 1.6 MHz (paired) spectrum already assigned to Indian Railways in 900 MHz band will be taken back from Indian Railways upon migration to LTE based network.
- (v) As Indian Railways would be using the assigned spectrum along its railway track network and stations only, DoT may consider assigning the same spectrum in other areas for area-specific limited use to other entities for captive use. However, it will be ensured that there is no interference to the Railways' network from such use.

- (vi) Applicable procedures for Letter of Intent (LoI), Decision Letter (DL), SACFA clearance and Wireless Operating License (WOL), as being followed for GSM-R network, shall be followed by Indian Railways for all the base/mobile stations.
- (vii) Operations should not commence without obtaining Wireless Operating License (WOL) for the network as per applicable procedure.
- (viii) Connection of this network to Public Switched Telecom Network (PSTN) shall not be allowed.



(Neeraj Juyal)

Assistant Wireless Adviser  
Phone: 2372 3595

**Annexure-III**

## Spectrum utilisation in the 700 MHz IMT band

SL No	Uplink		Downlink		Quantum (MHz)	TSP/User
	Start (MHz)	Stop(MHz)	Start (MHz)	Stop(MHz)		
1.	703	713	758	768	10	Government User
2.	713	718	768	773	5	Indian Railways
3.	718	723	773	778	5	NCRTC/RRTS
4.	723	733	778	788	10	Reliance Jio
5.	733	738	788	793	5	Vacant
6.	738	748	793	803	10	Reserved for BSNL
7.	748	758			10	Guard band

**Annexure-2.1: DoT's Order No. PP-11014/34/2009-PP (II) and  
Order No. PP-11014/34/2009-PP (II) dated 22.03.2012**

Government of India  
Ministry of Communications & IT  
Department of Telecommunication  
Wireless Planning & Co-ordination (WPC) Wing

Sanchar Bhavan,  
20, Ashoka Road,  
New Delhi-110 001

No. P-11014/34/2009-PP (II)

Date: 22<sup>nd</sup> March, 2012

**ORDER**

Subject: Royalty charges for Assignments of Frequencies to 'Captive Users' (users being charged on formula basis) including all Government Users, involving **Multi Channel Operations for Fixed/ Land/ Land Mobile Stations.**

In pursuance of Power conferred by section 4 of the Indian Telegraph Act, 1885(13 of 1885) and in supersession of this Ministry's Orders No. R-11014/26/2002-LR dated 06.05.2003, No. R-11014/26/2002-LR dated 01.04.2003, No. R-11014/4/87-LR (pt.) dated 20.07.1995 and No. R-11014/4/87-LR dated 09.12.1987, the Central Government has decided the following Royalty charges for Assignments of Frequencies to 'Captive Users' (users being charged on formula basis) including all Government Users, involving **Multi Channel Operations for Fixed/ Land/ Land Mobile Stations:-**

2. *Annual Royalty* is calculated as per the following formula and rules:

$$\text{Annual Royalty (in Rupees)} = \sum_{i=1}^n M_i \times W, \text{ where } n = \text{no. of carriers.}$$

- i. The Basic Royalty (M) given below is for *one* carrier frequency in a *Basic Link* (simplex) of 2 Fixed/ Land/ Land Mobile stations (1 station for broadcasting).
- ii. Duplex circuits (with two central frequencies) and Semi-duplex circuits shall be charged at twice the rate of simplex (single central frequency) circuits.
- iii. For multi-frequency circuits, even if operating in simplex mode, the Basic Royalty shall be charged for each frequency separately.
- iv. For the purpose of charging Royalty under Table-B, the *Bandwidth Factor W* shall be as per *Table-C*, given below.
- v. For all carrier frequencies, the chargeable bandwidth shall include the *Guard Bands* required to be provided as per *ITUs*.
- vi. The rates of Royalty apply to the specified *polarization(s)* of the assigned frequencies.
- vii. In addition to above, the explanatory "Notes" on the applicability of royalty charges, are as following:
  - To determine the "Maximum Distance" slab applicable to a case, the 'maximum power rating/ assigned' of the transmission equipment be considered, and expressly recorded in the assignment instrument Decision Letter, Agreement-in-Principle, or Wireless Operating License (DL/ AIP/ WOL).

**Royalty Charges for Multi-channel**

- The *duration* of a radio frequency assignment will normally be one or two years. If an applicant desires, and frequencies are available, the duration of assignment may be fixed as three or four or five years.
- Before issuing any DL/ AIP/ WOL, full amounts of Royalty shall be submitted by the applicant in advance for the entire duration of the DL/ AIP/ WOL.
- For all assignments of frequencies, all applicants or users shall pay the applicable Royalty, License Fee, etc. at the rates and terms in force from time to time, all previously paid amounts being adjusted on pro-rata basis.

**Table-B For The 'M' Factor**

Distance Cat.	"Maximum Distance (KM) Over Which the F/L/LM Network would operate"	Royalty Charges (in Rs.) for of the Basic Link.
		<i>M</i>
I	<= 2	1500
II	<= 5	3000
III	> 5 <= 25	6000
IV	> 25 <= 60	12000
V	> 60 <= 120	22500
VI	> 120 <= 500	37500
VII	> 500	50000

**Table-C for The 'W' Factor**

Slabs of Adjacent Channel Separation (BW), in MHz	Values of W
Up to and including 2	30
More than 2 but < = 3.5	40
More than 3.5 but < = 7	60
More than 7 but < = 14	90
More than 14 but < = 28	120
> 28	120+30 x (Excess bandwidth to 28 MHz / 7) @

@: That is, in steps of 7 MHz or part thereof.

- viii. Any "single channel service" that uses a channel bandwidth in excess of 375 KHz shall be covered by Charging Table-C above, where the Bandwidth Factor "W" is used from the lowest value of 30 onwards.

3. For Charging of "Licence fee and other fees, Surcharge/ late fee and Charging Methodologies for Royalty / licence fees, Order No. No. P-11014/34/2009-PP (IV) dated 22<sup>nd</sup> March, 2012 shall be applicable



Royalty Charges for Multi-channel

4. This issues with the concurrence of the Wireless Finance Division, vide this Dy. No.482/Sr.DDG(WPF), dated 19/3/12.
5. This Order shall come into force from 1st April 2012.

  
(Viresh Goel)

Deputy Wireless Advisor  
to the Government of India

Copy to:

1. All concerned
2. Wireless Finance Division
3. Wireless Monitoring Organisation
4. Director, IT DoT for uploading on DoT website
5. DWA(ASMS) for uploading on WPC Wing website

Government of India  
Ministry of Communications & IT  
Department of Telecommunication  
Wireless Planning & Co-ordination (WPC) Wing

Sanchar Bhavan,  
20, Ashoka Road,  
New Delhi-110 001

No. P-11014/34/2009-PP (IV)

Date: 22<sup>nd</sup> March, 2012

**ORDER**

Subject: Licence fee and other fees, Surcharge/ late fee and Charging Methodologies for Royalty / licence fees for 'Captive Users' (users being charged on formula basis) including all Government Users.

In pursuance of Power conferred by section 4 of the Indian Telegraph Act, 1885(13 of 1885) and in supersession of this Ministry's Orders No. R-11014/28/2004-LR dated 23.03.2005, and No. R-11014/4/87-LR dated 20.07.1995 the Central Government has decided the following rates of Licensee fees, and other fees, Surcharge/ late fee and Charging Methodologies for Royalty / licence fees for different types of Assignments of Frequencies to 'Captive Users' (users being charged on formula basis) including all Government Users. :-

**2. License Fees**

Sl. No.	Type of License	Annual License Fee, Rs.	Remarks
i.	Fixed/ Land Station	500	Per station
ii.	Land Mobile Station	250	Per station
iii.	Captive paging (Hub)	2000	Per Hub
iv.	Maritime Mobile Station (fishing trawlers)	500	Per trawler
v.	Maritime Mobile Station (Ships)	5000	Per ship
vi.	Aero-mobile Station	5000	Per aircraft
vii.	USR (short range)	250	Per station
viii.	Fixed station of Microwave links/ Radar Station/NLD station/BTS	1000	Per station
ix.	CMRTS fixed station	500	Per fixed station
x.	CMRTS Mobile Station	250	Per mobile station; vehicle mounted or hand-held
xi.	Fixed station in Satellite Network, e.g., DTH/ Teleport/ DSNG/ NLD/ ILD/ DCP/ IP-II	1000	Per Fixed Station
xii.	Captive V-SAT	500	Per Hub or Terminal
xiii.	INMARSAT	250	For Mobile terminal
xiv.	INMARSAT	500	For Fixed terminal

NOTE: License Fee for standby sets shall also be charged at the same rates.

Licence fee, late fee and Charging Methodologies

3. Fees for issuing duplicate copies and License Modification

Sl. No.	Type	Fee in Rupees
i.	Duplicate copy of License (Without Schedule)	500
ii.	Duplicate copy of Schedule(s) of a License	500
iii.	Duplicate copy of Renewal Certificate	250
iv.	License Modification	1000

4. Charging Methodologies for Royalty / licence fees:

- i. No radio frequency be assigned, reserved, or blocked through a Decision Letter, Agreement-in-Principle, or any other instrument of like nature unless the applicant pays, in advance, all applicable license fees and royalty charges for the full duration of authorization/ assignment of the radio frequency, or minimum of one year, whichever is less.
- ii. Upon successful processing of an application requesting for an assignment of radio frequency (RF), the applicant be informed about the License Fees and Royalty required to be deposited by him. These shall be calculated for the full period of the requested assignment. Where the period is greater than one year, the wireless user/ applicant has to pay the license fee and royalty in annual installments in advance every year.
- iii. Immediately thereafter, but in no case later than thirty (30) days from the date of issue of the said letter, the applicant shall pay the charges for issue of License/ DL/AIP, if otherwise permissible. If, on the other hand, the payment is not received within this period of 30 days, the application will be treated as *cancelled* and the frequencies shall be freed for being assigned to others. If the same applicant wants to subsequently pursue the application, he shall be required to submit a *fresh* application.
- iv. The amounts due for different periods may be determined as follows.

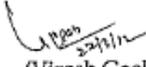
License Period	License Fee payable	Royalty payable from the date of DL/ AIP/ WOL, as the case may be	Method of payment
One month or less	At specified flat rate.	Annual royalty divided by 12.	Full license fee & royalty to be paid in advance at the time of issue of DL/AIP/ license.
More than one month but up to one year	At specified flat rate.	On pro-rata basis. However, part of a month shall be taken as one month.	-- do --
More than one year	At specified flat rate.	On pro-rata basis. However, part of a month shall be taken as one month.	Pay the L/fee plus Royalty for the entire duration in advance at issue of DL/AIP/ license, OR pay it in annual advance instalments.

- v. In case the licensee defaults on one of the annual installment payments, all the remaining installments shall become immediately payable.

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24/7

Licence fee, late fee and Charging Methodologies

- vi. A Licensee shall be responsible to apply for the renewal of his/ her existing frequency authorization or wireless operating license (WOL), within a period of thirty (30) days *before* the expiry of the said WOL/AIP/DL.
  - vii. **Surrender of a License/ AIP/ DL:** Spectrum charges are payable minimum for one month and thus on surrender of licenses the Royalty charges in excess of one month can be adjusted. However, any monetary refund can only be made if the payments have been received for more than one year and surrender results the Royalty charges in excess of 1 year. The word "surrender" in this paragraph shall mean surrender of a complete License/ AIP/ DL with all its frequency assignments.
5. **Surcharge/Late Fee for Late Renewal of Wireless Station Licenses:** Surcharge/ Late fee for delayed renewal of various licenses shall be levied on the total amount due (i.e. license fee *plus* royalty charges) @ 2% per month or part thereof, subject to the minimum of Rs. 250/- per license. In case the delay is more than one year the said late fee shall be applied in an *annually compounded* manner.
6. This issues with the concurrence of the Wireless Finance Division, vide this Dy. No.482/Sr.DDG(WPF), dated 19/3/12.
7. This Order shall come into force from 1st April 2012.

  
(Viresh Goel)  
Deputy Wireless Advisor  
to the Government of India

Copy to:

1. All concerned
2. Wireless Finance Division
3. Wireless Monitoring Organisation
4. Director, IT DoT for uploading on DoT website
5. DWA(ASMS) for uploading on WPC Wing website

**Annexure-2.2: DoT's Order No. P-11014/34/2009-PP dated 11.12.2023  
(with Schedule VI)**

Government of India  
Ministry of Communications  
Department of Telecommunications  
Wireless Planning and Coordination Wing  
20, Ashoka Road, Sanchar Bhawan, New Delhi

No. P-11014/34/2009-PP

Dated: 11.12.2023

**ORDER**

**Subject: Spectrum Charges for Assignment of Frequencies to Captive Users (being charged on formula basis) for different types of Radiocommunication Services and applications.**

In pursuance of the powers conferred under section 4 of the Indian Telegraph Act, 1885 (13 of 1885) and in supersession of this Ministry's Orders Nos. P-11014/34/2009-PP (I), (II), (III) & (IV) each dated 22.03.2012, the Central Government has decided that assignment of radio frequency spectrum to all users to whom radio frequency assignment is made through administrative process and spectrum charges are calculated based on a formulae, shall be made as per the methodology defined in this order.

2. Upon successful processing of application for assignment of radio frequency, a Letter of Intent (LoI) will be issued to the applicant which include, among others, information about the license fee and royalty charge (collectively called spectrum charges) required to be paid. Spectrum charges shall be informed for the full period of the assignment requested. If the request for assignment is for a period more than one year, the applicant can opt to pay the license fee and royalty annually, in advance for each year.

3. Immediately thereafter, but in any case not later than sixty (60) days from the date of issue of the LoI, the applicant shall pay the spectrum charges for issue of Decision Letter (DL), if otherwise permissible.

3.1 If the payment is not received within 60 days from the date of LoI, the application shall be treated as cancelled and the frequency shall be freed for assignment to other applicants. The applicant will have to submit a fresh application if they still want the frequency assignment.



4. A Construction Period of three months is permitted for the purpose of import of the equipment, site preparedness, deployment, etc. and spectrum charges be levied, after three months' period from the 1<sup>st</sup> day of the month of date of issue of Lol.

4.1 Three months' construction period shall not be applicable for temporary frequency assignment (assignment issued for the period less than one year). In such cases, spectrum charges shall be applicable from the 1<sup>st</sup> day of the month of date of issue of Lol.

5. Initially, DL shall be issued with a validity of 15 months (one year plus three months of construction period) from the 1<sup>st</sup> day of the month of date of issue of Lol that can be further extended for a period of another one year subject to payment of annual spectrum charges, in advance. For example: If date of issue of initial Lol is 20<sup>th</sup> August 2023, the spectrum charges will be levied from 1<sup>st</sup> November 2023 and the initial DL will be valid upto 31<sup>st</sup> October 2024. Further extension of one year will be expired on 31<sup>st</sup> October 2025.

5.1 In no case DL be renewed further, however, extension of another one year may be considered for Government users under certain circumstances subject to payment of annual spectrum charges, in advance.

6. The spectrum charges, comprises of Royalty and License fee, shall be calculated for following radiocommunication services as per the enclosed schedules:

Schedule No.	Radiocommunication Services and applications	Page No.
I	Terrestrial Broadcasting service	6-7
II	Land Mobile Service (up to 375 kHz)	8-13
III	Maritime Mobile Service	14-16
IV	Aeronautical Service	17-18
V	Radar under Radionavigation Service and Radiolocation Service	19-20
VI	Fixed and Mobile Service (Multi-channels Multiplexed)	21-23
VII	Satellite Based Services (FSS, BSS, MSS, EESS)	24-26

6.1 All the above services have been defined in the National Frequency Allocation Plan of India (NFAP). The latest NFAP is available in DoT's website ([www.dot.gov.in](http://www.dot.gov.in)).

*Push*

6.2 Spectrum charges, mentioned in all the schedules, are annual charges, unless otherwise specified.

6.3 Royalty charge has been made independent of numbers of equipment/set, unless otherwise specified. However, license fee will be applicable on them. Therefore, any increase/ decrease in the number of equipment (Fixed/ Mobile) in the existing frequency assignment shall require prior permission.

6.4 The spectrum charges due for different period shall be determined as follows:

License Period	License Fee Payable	Royalty payable after three months period from the 1 <sup>st</sup> day of the month of date of issue of LOI	Method of Payment
One calendar month or less	At specified rate given in various schedules	Annual Royalty divided by 12	Full License fee and Royalty to be paid in advance at the time of issue of DL/frequency assignment.
More than one calendar month but less than 12 months	At specified rate given in various schedules	On pro-rata basis. However, part of a month shall be taken as one month.	--do--
More than one year	At specified rate given in various schedules	On pro-rata basis. However, part of a month shall be taken as one month.	Pay the License Fee plus Royalty for the entire duration in advance at the time of issue of DL/frequency assignment or pay it in annual advance instalments.

7. Generally, there shall be no limit on number of frequency(ies) applied for any type of services. However, number of frequency(ies) shall be assigned subject to availability, technical justification, regulatory feasibility etc.

*Handwritten signature*

**8. Renewal of Frequency Assignment:**

8.1 The assignee shall be responsible for keeping the frequency assignment current and up to date until its surrender/ cancellation. To this effect, the assignee shall, at least 30 days before the end date of the validity of the frequency assignment, pay through Saral Sanchar Portal, the spectrum charges for the renewal of his/her existing frequency assignment.

**9. Frequency assignment/ authorization Modification Fee:**

9.1 Applicable fees for modification in the frequency authorization/ frequency assignment shall be charged at the rate of Rs. 1000/- per modification.

**10. Cancellation/ Surrender of Frequency Assignment:**

10.1 The assignee shall surrender the frequency assignment, if no longer required. To this effect the assignee shall apply for cancellation through Saral Sanchar Portal in accordance with OM No. L-14027/210/2020-WF dated 27.07.2023. Failure to surrender a frequency assignment within the stipulated time shall result in accrual of spectrum charges and late fee.

10.2 Non-purchase of equipment/ non-utilization of frequency assignment shall not be ground for exemption from payment of spectrum charges.

10.3 On surrender of frequency assignment, after adjustment of due spectrum charges, the balance amount will be either adjusted against other active frequency assignments or refunded to the applicant.

**11. Late fee for delayed payment of Spectrum Charges:**

11.1 Late fee shall be payable by the assignee on the frequency assignment for delay in payment of spectrum charges (Royalty and License fee) or any other dues payable against the frequency assignment. In this regard, any payment reflected in DoT's account after the midnight (2400 Hrs.) of the end date will be considered as a delay in payment irrespective of the date on which such transaction was initiated by the assignee of the frequency assignment.



11.2 The rate at which Late Fee is levied for a Financial Year shall be 2% added to one-year Marginal Cost of Lending Rate (MCLR) of State Bank of India, on the beginning of the Financial Year i.e. 1st April.

11.3 The Late Fee shall be compounded annually, subject to minimum annual Late Fee of Rs. 250/- per Frequency Assignment. A part of the month shall be considered as a full month for the purpose of calculation of Late Fee. A month shall be an English calendar month.

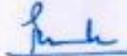
12. The applications for the frequency assignment shall continue to be processed through DoT's online portal (Saral Sanchar portal). Further, all renewals, cancellations, import permission, surrenders will also be issued through online portal (Saral Sanchar) as per prevailing instructions issued from time to time.

13. Any issue either arising due to interpretation of this Order or new uses/applications not covered in the said Order shall be referred to the Standing Committee constituted vide WPC Wing OM of even No. dated 11.12.2023.

14. This Order issues with the approval of competent authority.

15. This Order shall come into force with effect from 01<sup>st</sup> April 2024. However, the revised spectrum charges on existing frequency assignments shall be applicable from the date of next renewal cycle.

Enclosure: As above.

  
11.12.2023

(P S M Tripathi)  
Sr. Deputy Wireless Adviser to the Govt. of India

पी.एस.एम. त्रिपाठी / P.S.M. TRIPATHI  
सीनियर डेप्युटी वायरलेस आडिसेर  
Senior Deputy Wireless Adviser  
दूरसंचार विभाग, नया दिल्ली  
Deptt. of Telecom, Govt. of India  
नई दिल्ली / New Delhi

To,

1. All concerned.
2. Wireless Finance Division
3. Wireless Monitoring Organisation
4. IT cell, DoT - for publication on DoT Website
5. ITPC, BSNL, Pune to send text messages to all licensee informing them about the new orders on frequency assignment.

**Schedule-VI: Fixed and Mobile Services having Multiplexed Multi-channels**

**General:**

- (i) Charging methodology is based on  $M \times C \times W$  formula (M= Basic Royalty, C=No. Freq. Carriers, W=Bandwidth Factor). It will be used for calculation of royalty charges for the Fixed services and Mobile services having multiplexed multi-channels.
- (ii) The rate of M-Factor will be calculated based on the maximum Coverage distance as per Table-1
- (iii) The bandwidth factor will be calculated as per Table-2. Any fraction would be rounded up to the next integer.



**Part-I (Royalty Charges)**

1. Annual royalty Charges for radio stations in Fixed Services and Mobile services having multiplexed multi-channels for Captive use will be multiplication of the M-factor (Basic Royalty), C-factor (No. of frequency carriers) and W-factor (Bandwidth).

$$\text{Royalty (R)} = \text{MxCxW}$$

**Table-1: Rate of M-Factor**

Distance Category	Maximum Distance (Km)	Value of M Factor
I	<= 2	750
II	> 2= 5	1500
III	> 5 <= 25	3000
IV	> 25 <=60	6000
V	> 60 <=120	11000
VI	> 120 <=500	18750
VII	> 500	25000

**Table-2: Rate of bandwidth factor**

Slabs of Adjacent Channel Separation (BW), in MHz	Value of W factor
More than 375 kHz and including 2 MHz	30
More than 2 but <= 3.5	40
More than 3.5 but <= 7	60
More than 7 but <= 14	90
More than 14 but <= 28	120
More than 28 but <= 56	150
More than 56 but <= 112	180
More than 112 but <= 256	210
More than 256 but <= 512	240
> 512	240+ 30 x (Excess bandwidth / 256) *

\*That is, in steps of 256 MHz or part thereof



**Part-II (License fee)**

License Fee for wireless stations operating under Fixed and Mobile Services including Standby sets:

S. No.	Type of Wireless station License	Annual License Fee (in Rs.)
i.	Fixed station	1000 per station
ii.	Vehicle Mobile/ Handheld Mobile station	250 per station

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Page

## LIST OF ACRONYMS

ADP	Auction Determined Price
APT	Asia-Pacific Telecommunity
ATP	Automatic Train Protection
CCTV	Closed Circuit Television
CNPN	Captive Non-Public Network
CP	Consultation Paper
DoT	Department of Telecommunications
DPWCS	Distributed Power Wireless Control System
EoTT	End of Train Telemetry
ETCS	European Train Control System
FDD	Frequency-division duplexing
GSM-R	Global System for Mobile Communications-Railway
IoT	Internet of Things
IR	Indian Railways
LSA	Licensed Service Area
LTE	Long Term Evolution
MC PTT	Mission Critical Push-To-Talk
MCLR	Marginal Cost of Funds based Lending Rate
MHz	Megahertz
MIMO	Multiple Input Multiple Output
MOCN	Multi-Operator Core Networks
MTRC	Mobile Train Radio Communication
NCRTC	National Capital Region Transport Corporation
NPV	Net Present Value
OFC	Optical Fibre Cable
PoC	Proof of Concept
QAM	Quadrature Amplitude Modulation

RAN	Radio Access Network
RRTS	Regional Rapid Transit System
RSTT	Railway Radiocommunication Systems between Train and Trackside
SISO	Single Input Single Output
TCAS	Train Collision Avoidance System
TRAI	Telecom Regulatory Authority of India
TSP	Telecom Service Provider
Wi-Fi	Wireless Fidelity