NCRTC/DS&O/DoT/32 Date: 28.07.2022

To,
Mr S T Abbas
Principal Advisor TRAI
Mahanagar Doorsanchar Bhawan (next to Zakir Hussain College)
Jawaharlal Nehru Marg (Old Minto Road)
New Delhi: 110 002

Sub: Counter comments on TRAI Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors.

Ref: TRAI Press Release No. 41/2022.

With regards to TRAI Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors, NCRTC has submitted the response vide letter no: NCRTC/DS&O/DoT/31 dated 05.07.2022 and total 19 other stakeholder responses have been uploaded on the TRAI website.

2. NCRTC has reviewed the comments submitted by the other stakeholders and our counter comments are enclosed.

Yours Sincerely,
28/7/2022
(Dayanand)
GGM/S&T-II

Encl:

1. Counter comment on GSMA at annexure 1
2. Counter comment on Cellular Operators Association of India (COAI) at annexure 2
3. Counter comment on Broadband India Forum at annexure 3
4. Counter comment on ITU-APT Foundation of India at annexure 4
5. Counter comment on Gujarat Metro Rail Corporation Ltd (GMRC) at annexure 5
6. Counter comment on Uttar Pradesh Metro Rail Corporation Ltd (UPMRCL) at annexure 6
7. Counter comment on L&T Metro Rail (Hyderabad) Limited (LTMRHL) at annexure 7
8. Counter comment on Maharashtra Metro Rail Corporation Ltd (Maha-Metro) at annexure 8
9. Counter comment on Kerala Rail Development Corporation Ltd (KRDCL) at annexure 9
10. Counter comment on RADWIN Wireless Solutions India Pvt Ltd at annexure 10
11. Counter comment on Chennai Metro Rail Limited (CMRL) at annexure 11
12. Counter comment on Bangalore Metro Rail Corporation Limited (BMRCL) at annexure 12
13. Counter comment on Delhi Metro Rail Corporation Limited (DMRC) at annexure 13
14. Counter comment on Rail Infrastructure Development Company (Karnataka) Limited (KRIDE) at annexure 14
15. Counter comment on Kolkata Metro Rail Corporation (KMRC) at annexure 15
16. Counter comment on Reliance JIO Infocomm Limited at annexure 16
17. Counter comment on Bharat Sanchar Nigam Limited (BSNL) at annexure 17
18. Counter comment on Bharti Airtel Limited at annexure 18
19. Counter comment on Vodafone Idea Limited at annexure 19

Annexure - 1

Counter comments on submission of GSMA on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

At the outset, the GSMA thanks the Authority (TRAI) for issuing this consultation paper to seek views of the stakeholders on various vital aspects related to Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors.

Mobile connectivity has been a catalyst for economic and social development in the daily lives of Indian citizens, from enabling digital payments and e-commerce to providing access to education, health and essential public services through mobile applications during the pandemic. Today, India is one of the highest data consuming markets globally, with more than 1.1 Bn mobile subscribers by the end of Apr'2022.

Mobile broadband usage is expected to grow further with launch of 5G services in next few years. The GSMA estimates monthly mobile data usage to grow from 18.4 GB per subscriber at present to 50 GB per subscriber by 2027. Additionally, there are a wide of enterprises and industries that are set to benefit from 5G rollout for digital transformation of business processes and introduction of new industrial applications.

To keep pace with the increasing demand of mobile broadband, it is essential that sufficient amount of spectrum in globally harmonised bands across low, mid and high bands, is made available to mobile network operators facilitate cost-efficient rollout and widespread availability of high quality 5G connectivity to all users in India.

NCRTC Reply: No comments

Requirement of Spectrum Roadmap: There is clearly a need to define a long-term spectrum roadmap, which will provide a regulatory certainty for promoting investment in the sector and also help operators to take informed decisions about acquiring spectrum and invest in networks. Based on international best practices, the GSMA recommends such roadmap to consider a timeframe of at least 10 years in order to better accommodate emerging spectrum needs, technological evolution and international developments.

NCRTC Reply:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public

transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.

Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

<u>Role of Low Band Spectrum (sub-1 GHz)</u> for 5G

Low-band spectrum below 1 GHz, is the cornerstone of digital equality and a driver of broad and affordable connectivity2. It is a crucial national asset that can build bridges towards digital inclusion and ensure the impact of mobile's economic and social benefits are available to all communities. Low-band capacity will be at the core of ensuring that 5G is available to everyone. More spectrum in this range is vital to giving rural communities equitable access to 5G services available in urban areas and pushing towards digital inclusion goals and helping to unlock new use cases for all. At the same time, low-bands can help improve the quality of enhanced mobile broadband coverage for hard-to-reach places, such as deep indoors or narrow alleys.

Benefits of low-band spectrum:

As per the recent study by Coleago Consulting, wider sub-1 GHz channels – ideally 2x20 MHz or more, are beneficial in several ways, namely:

• Improving cost efficiency – deployment in a wide channel reduces the cost per MHz deployed and cost per connection.

• Enhanced spectral efficiency – wider channels enable higher resource utilisation and performance gains relative to 5 MHz or 10 MHz channels.

• Implementation of MIMO technology – larger channels are better suited for MIMO technology and can significantly increase cell-edge capacity and performance.

The 700 MHz is one of the prime bands for 5G and it is a key band to enable the benefits of 5G for all users in India. Any such band where end-user/mobile device ecosystem has been developed, principally should not be utilized for any purposes where such device ecosystem is not required. Many countries in the Asia Pacific region have released the full 2x45 MHz for IMT and operators are starting to deploy it for 5G. Among the other sub-1 GHz frequencies, the 850 MHz and 900 MHz bands are still needed to support legacy 2G and 3G networks services while the 600 MHz band is still at a very nascent stage and the ecosystem will take time to emerge.

Further reservations of sub 1-GHz spectrum for Railways/NCRTC/any other Rail agency will lead to sub-optimal outcomes and risk India's digital ambitions.

Out of available 700 MHz mobile spectrum in India (2x45 MHz), 10 MHz is already assigned/ reserved for government use and 5 MHz spectrum has been assigned to Indian Railways for LTE-based RSTT network. If another 5 MHz is assigned/ reserved for Railways/NCRTC or any other RRTS/metro rail networks or similar government/ PSU agencies who are also commercial enterprises, **the remaining spectrum (25 MHz) in the 700 MHz band may not be enough to meet the future IMT requirements and would lead to sub-optimal assignments for mobile operators.**

The reduced bandwidth is unlikely to provide a balanced distribution of spectrum assets in a key coverage band, resulting in reduced 5G coverage and slower networks especially in rural areas. The scarcity of sub-1 GHz will artificially inflate the prices paid for spectrum and risks leading to lower network investment and, further delayed rollouts, and limited coverage. This would result in missed opportunities for increased economic activity arising from optimum mobile broadband capacity available to operators and consumers. Additional set-asides in this band risks inefficient spectrum use, particularly as deployments are only likely to be in certain, fixed locations.

The GSMA's view is that the economic benefits of countrywide mobile broadband in 700 MHz outweigh those of set-asides for application-specific uses, and therefore we do not recommend reserving any further 700 MHz spectrum for railways or any other similar applications.

Alternative options are available for RSTT based applications for Railways

It is not necessary to set aside spectrum specifically for RSTT based applications as their needs can be met through other means. Firstly, **other bands are available for use by Indian Railways, NCRTC and any other rail agency** (i.e. 150, 300, 400, 450-470 MHz) and should be considered in first instance in order to avoid undue costs, technical complexities and missed economic opportunities. We submit that the authority shall consider allocation of spectrum to NCRTC from those frequency bands where end-user/mobile device ecosystem does not play a key role.

Alternatively, **mobile operators are also well-positioned to provide industrial applications, including for railway operators**, making use of their spectrum holdings. For example, in Australia, Telstra has been supplying railway communications to the Australia Rail Track Corporation using its 850 MHz spectrum and has plans to upgrade to 4G using its 700 MHz network. Such approach can be considered for NCRTC and would help mitigate the complexities of interference planning between public mobile networks and RSTT applications.

Further the introduction of 5G in India would further expand mobile operators' capabilities to offer such industrial grade applications and to meet the safety and security requirements, without a need for spectrum reservations for specific applications.

Since demands for spectrum is now coming from various PSUs, government agencies like Indian Railways (IR), latest being NCRTC, and in future such demands may come from other users as well – it thus becomes critical for TRAI and DoT to plan out a clear roadmap for such users as to what bands can be made available for their usage. This is an important factor for India MNOs for predictability and consistency of network planning and investments.

Also, TRAI in its recommendations dated 25-Oct-2019 had recommended that "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." In view of the same, we request TRAI to take cognizance of its earlier recommendations also while making any further recommendations to DoT in this regard

NCRTC Reply:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

Annexure – 2

Counter comments on submission of Cellular Operators Association of India (COAI) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

1. We thank the Authority for giving us the opportunity to provide our comments on the TRAI Consultation Paper on "Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors".
2. Spectrum is the key resource for telecom services and availability of adequate spectrum across low (sub-GHz), mid and high range bands at affordable price is crucial for sustainability of mobile networks, good quality of service and customer experience. Spectrum allocation impacts the growth of mobile services and its associated benefits to the overall economy.
3. It is well-established by multiple credible agencies such as the World Bank, London School of Economics, NERA Economic Consulting and Indian Council for Research on International Economic Relations (ICRIER) that spectrum can be an extremely powerful engine of socio- economic growth, with strong quantitative relationships firmly established.

NCRTC Reply for 1, 2, 3: No comments

4. **Necessity of Spectrum Roadmap**:

   a. The NDCP-2018 has recognized that Spectrum is a key natural resource for public benefit to achieve India's socio-economic goals, ensure transparency in allocation and optimize availability and utilization. Some of these provisions are given below:

      i. *Developing a transparent, normative and fair policy for spectrum assignments and allocations.*
      ii. *Identifying and making available new Spectrum bands for Access and Backhaul segments for timely deployment and growth of 5G networks.*
      iii. *Making available harmonized and contiguous spectrum required for deployment of next generation access technologies.*
      iv. *Coordinating with Government departments for freeing underutilized/ substitutable spectrum, and its assignment along with unutilized spectrum for efficient and productive use.*
      v. *Optimal Pricing of Spectrum to ensure sustainable and affordable access to Digital Communications.*
      vi. *Monitoring efficient utilization of spectrum by conducting systematic audits of the spectrum allocated to both commercial and government organizations.*

   b. It is important to have a clear Spectrum Roadmap for both short and long term (at least 10 years) including Quantum of Spectrum and timelines for availability of the bands.

For all Spectrum needs in India, NFAP provides a broad roadmap showing spectrum earmarked for various technologies. However, there is a need to define a clear roadmap to cater to ongoing demands of various stakeholders, or if any in future, especially from users from various segments of Railways such as Indian Railways, Rapid Rail, Metro or any other such users.

c. Even TRAI in its Recommendations on 'Auction of spectrum in frequency bands identified for IMT/5G' dated April 11, 2022 has mentioned the need for spectrum roadmap stated as below:

> *"Considering that there are certain additional bands which are already identified by ITU for IMT services and few additional bands are under consideration in WRC- 23 for IMT identification, the Authority recommends that DoT should explore the possibility to make these bands available for IMT services at the earliest* ***and come out with a spectrum roadmap for opening up of new bands for IMT to meet the future demand. At least a 5-year roadmap on spectrum likely to be made available for IMT in each year and likely date/month of auction should be made public. Such a spectrum roadmap will provide certainty, enable the bidders to take informed decisions and may also encourage new entrants."***

d. Even in this case, earlier the demand came from Indian Railways (IR), now from NCRTC and in future other demands may also come from other users. It is thus important to have a clear roadmap for the understanding of all stakeholders that whether separate spectrum will be made available to such organizations and if yes, then what bands will be made available for their usage without pulling out spectrum from IMT bands.

NCRTC Reply to 4:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme

Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.
Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

5. **<u>Identification of Spectrum Bands for IMT</u>**:

a. It is pertinent to note that for any spectrum band to be identified for IMT usage, it has to go through a rigorous cycle of detailed deliberations at a global level within the ITU. For years altogether, these bands are discussed, deliberated, sharing studies are conducted, consensus amongst various stakeholders and regions are built and then that band is identified for IMT. Once a band is identified for IMT, the same has to go through another rigorous cycle within the 3GPP for standardization so that harmonization and economies of scale are achieved in a particular band. This would help in realizing the actual potential of the band and also providing the socio-economic benefits.

b. Regarding spectrum for mobile services in India, it is pertinent to note that the NFAP-2018 has already identified various spectrum bands for IMT, which are based on ITU and 3GPP deliberations and agreement by the Indian Administration at these international forums.

c. It is disheartening to see that after various activities as enumerated above, once the band is identified for IMT, various stakeholders keep coming up with their own demands in these particular bands, rather than looking at non-IMT bands, which are capable of meeting their demands.

6. **Protection of IMT Bands**:

a. In order to realize the potential benefits of digital economy, India should plan timely availability of sufficient and affordable spectrum for mobile services, considering that these are key factors for most of the critical and high bandwidth applications. Therefore, it is important that key spectrum bands are not only identified but also earmarked and protected for IMT.

b. 700 MHz band is extensively used for commercial mobile services globally and a comprehensive eco-system is available for this band. Many countries have already deployed 5G/ IMT in this band.

c. TRAI itself in its Consultation Paper on Auction of Spectrum in frequency bands identified for IMT/5G dated 30th November 2021 had noted:

The 700 MHz (3GPP band plan B28) band is being adopted as a prime coverage band for deployment of LTE/5G technology.

As per GSA report10 on "Low Band Spectrum for LTE and 5G: May 2021", 205 operators were investing in LTE across the key 700 MHz bands. Among these, 145 operators have been identified as investing in APT 700 MHz spectrum (Band 28 and Band n28: 703– 748 MHz/758–803 FDD), including 139 with licences, of which 66 have launched commercial LTE or 5G services in the band. Three operators have launched both, 55 have launched LTE and eight have launched 5G.

As regards device ecosystem for APT 700 (Band n28) band, as per the report published by GSA11, as of May 2020, there were 2,531 LTE devices out of which 57.5% accounted for phones and in May 2021 this has increased to 3,463 LTE devices out of which 51.03% accounts for phones. In case of 5G, as per May 2021 report, there were 270 announced devices and out of which 58.10% accounts for phones.

d. In India, 700 MHz band has already been identified for IMT. Given the importance of this band, it has also been identified as one of the key bands for deployment of 5G in India by the 5G High Level Forum constituted by DoT.

e. 5G is designed to serve various use-cases by deploying it over a wide range of spectrum bands. For instance, sub-GHz bands are essential for providing coverage, while mid-band and high-bands are primarily used for increasing the capacity of the network. All the bands have a complementary role in a 5G network for efficient designing of the network and to deploy various use cases supported by 5G.

f. 700 MHz band with its developed ecosystem is the prime choice of operators for their

5G/ IMT usage in the sub-1 GHz band.

g. It is important to understand that in India, out of 45 MHz (paired) of 700 MHz band, 10 MHz (paired) has already been assigned to MoD and 5 MHz (paired) to Indian Railways. The remaining 30 MHz is already grossly inadequate. Thus, it would not be appropriate to fragment the band any further by giving away another 5 MHz to RRTS.

h. We appreciate that the Authority has also noted this concern in their present Consultation Paper, which is given below:

"As per the 3GPP band plan B28 adopted by India for 700 MHz band, 45 MHz (paired) spectrum can be utilized in this band. However, 10 MHz (paired) spectrum has been earmarked for government use and 5 MHz (paired) spectrum has been assigned to Indian Railways for LTE-based public safety and security services (train signalling system for safety and security) across the railway track. Therefore, 30 MHz (paired) spectrum is available for commercial purpose in each of the 22 LSAs in this band. In case 5 MHz (paired) spectrum is earmarked for NCRTC and other RRTS/metro rail networks pan India, only 25 MHz (paired) spectrum will be left for commercial use. One view could be that since 700 MHz band is a prime coverage band for 5G, the remaining spectrum may not be enough for the TSPs for commercial purpose."

i. With regard to the statement on this spectrum band not been picked up by operators in the previous auction, it is submitted that availability of 'adequate spectrum' at the 'right price' is central to the growth of the telecom sector. Right price means that prices should be at a level that should ensure financial sustainability of the mobile industry and affordability of the services. When the TSP participates in an auction, they have to evaluate both availability and pricing of a spectrum band before making a bid on it. The pricing of 700 MHz has been extremely high till date. Also, the availability of all the bands put up for auction do affect the overall pricing. Reduction in availability in one band may artificially end up inflating the price of other bands. Also, it may be noted that commercial terms of offering the 700MHz band through auction to TSPs is different than being offered to Railways.

j. During the 5G trials being conducted by the TSPs in the past year, one of the operators had tested certain rural use cases using 700 MHz band. This clearly shows that the TSPs are interested in utilizing the 700 MHz band for 5G/IMT, hence entire 30 MHz (paired) should be made available to the TSPs. Just because the spectrum, having extremely high reserve price was not picked up in one auction does not mean that such precious spectrum band should be given to other non-telecom licensee entities by way of administrative allocation. Globally as well as in India, there is a clear precedence that TSPs buy spectrum over a period of years, for augmenting their capacities and provide more enriched services to consumers. In case of 4G also, the spectrum was purchased in 2021 auction as well indicating that if spectrum is not bought in first auction, it does not diminish its requirement in future.

NCRTC Reply 5 & 6:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

7. **<u>Efficient Utilization of Spectrum</u>**:

   a. We reiterate that in India, out of 45 MHz (paired) of 700 MHz band, 10 MHz (paired) has already been assigned to MoD and 5 MHz (paired) to Indian Railways. The remaining 30 MHz is already grossly inadequate. Thus, it would not be appropriate to fragment the band any further by giving away another 5 MHz to RRTS. This would make insufficient spectrum available for IMT services thus making it inefficient.
   b. It is critical for policymakers to carefully consider the options of spectrum assignment to various entities and consult stakeholders to ensure that they most efficiently utilize the spectrum without undermining other TSPs.
   c. In case of RRTS, it is amply clear that the spectrum allocated to Indian railways can

cater to the needs of RRTS. TRAI after careful evaluation while recommending 5 MHz in 700 MHz band to IR clearly stated that this may be given to other entities in other areas. The recommendation is given below:

"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."

d. It is pertinent to note that the demand from NCRTC was also for the same spectrum based on TRAI recommendations. The Authority in the Paper has also captured that NCRTC had engaged a group of eminent experts to conduct a feasibility study for co-existence of two separate LTE networks of NCRTC and IR in the same band. It is also important to note that this was the same expert group which was engaged by Indian Railways to study the feasibility of use of LTE technology on IR.

e. The report clearly stated that **co-existence is possible**. Relevant extract from the report is given below:

> The experts studied the NCRTC RRTS network alignment and deployment strategy. The report concludes "that both NCRTC and IR can use the same entire 5 MHz bandwidth for their critical operations in majority of the places without affecting the IR network, even with no coordination with IR, by employing the techniques which have been detailed in the report. However, minimal coordination during the network planned stages in certain locations NCRTC can benefit both, thus enabling the use of the entire bandwidth in all places. Even in the highly unlikely scenario of having any interference, other scheduling methods, transmit beamforming along with signal processing at the receiver using multiple antennas etc. are available to solve the problem. The ETCS operation can be performed with high reliability along with MCPTT and also CCTV surveillance data transfer can be done in majority of the corridor".

f. In view of the above, we are surprised and unable to understand that despite such a Report being given by eminent experts, what is the requirement of giving additional / separate 700MHz spectrum to NCRTC. As stated above, the NDCP also clearly states that it has to be ensured that spectrum is being efficiently used. However, giving away additional 5 MHz from 700 MHz band to NCRTC, neither the spectrum that is with IR, which can be used by NCRTC will be efficiently utilized, nor the remaining 700 MHz for IMT will be efficiently utilized.

g. It is pertinent to mention here that under the clause 11 (1)(a) of TRAI Act, 1997 as amended by TRAI Amendment Act 2000, the efficient management of available spectrum is one of Authority's primary functions. Hence, we request the Authority to ensure that such an important commercially sensitive spectrum in 700 MHz band, which has for long been identified for IMT in India and with developed global eco-system both on retail and network side, should not be further fragmented and the spectrum and spots in 700 MHz band already allocated to Indian Railways should be used for NCRTC requirements elsewhere. Further, the Authority is requested to recommend to DoT that 5 MHz spectrum of the 700 MHz spectrum band withheld from the Auction should be added in auction pool.

h. Furthermore, the argument of interference at some potential places within IR and

NCRTC systems is not tenable as it has been covered in the report that co-existence is possible. It is a natural expectation from a spectrum holder to ensure that it deploys appropriate interference mitigation tools and systems. Therefore, both, the IR and NCRTC (or any other such PSU/government user of same spectrum) should deploy such mitigation tools at such limited locations.

NCRTC Reply:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

Further, the issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

8. **<u>Consideration of Alternate Bands for NCRTC</u>:**

a. Despite the report by a group of eminent experts stating that co-existence is possible between IR & NCRTC, if the Government wants to allocate additional spectrum to NCRTC, then **it should be done in other bands**. Given that we expect many more such rail networks in future (e.g., High Speed Rail), it is now fundamental to identify

newer non-IMT bands for use of Railways or such users.

b. Since spectrum requirement for signalling purpose in Railway Networks is of the nature of low bandwidth and high coverage and spectrum in sub-1 GHz bands will be suitable to meet the requirement, there are various bands available through which these requirements could be met.

c. TRAI in its earlier recommendations of 2018 on "Next Generation Public Protection and Disaster Relief (PPDR) communication networks", had recommended that that 2x10 MHz of dedicated spectrum, 814-824/859-869 MHz, should be assigned for nationwide BB- PPDR services.

d. Also, as per the NFAP released by DoT in October 2018, spectrum bands identified for PPDR include 380-387.5/390-397.5 MHz, 410-417.5/420-427.5 MHz, 806-811/851-856 MHz and 4940-4990 MHz. In addition, NFAP 2018 also indicates that part of 440-470 MHz may be considered for PPDR.

e. Despite identification of these bands, no deployment of Next Generation PPDR Communication network has taken place so far. Further, spectrum in 800 MHz band is assigned / earmarked for PMRTS, which is migrating from analog to digital, enhancing spectrum efficiency. Therefore, there may be spectrum availability in 800 MHz band (i.e. 806-811/851-856 MHz), which may be sufficient to fulfill the requirement of NCRTC for RSTT. The same has also been noted by the Authority in the Paper.

f. As India is expected to have many more such rail networks (e.g. High Speed Rail), it is now critical to identify newer bands for use of Railways or such users, and clear separate roadmap is created for such users, without impacting the present and future spectrum needs/requirements of Telecommunications networks/ TSPs.

In view of the above, COAI strongly recommends that no spectrum from 700 MHz band which has for long been identified for IMT in India and with developed global eco-system should be given to NCRTC.

NCRTC Reply:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.
For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

Our issue wise response is as follows:

Q.1 In which band, spectrum should be assigned to NCRTC for their LTE-R technology based Train control system for RRTS rail corridors?

Q.2 How much spectrum in the spectrum band(s) suggested in response to Q1, should be assigned to NCRTC to meet its requirement for its RRTS LTE-R based network?

COAI Response

1. Since a group of eminent experts have already stated that co-existence is possible between IR & NCRTC in the 5 MHz block already assigned to IR. The first preference should be to efficiently utilize this block (same spots) and the same should be assigned to NCRTC.

2. However, in case separate block is to be assigned to NCRTC, then it should be from spectrum bands identified for PPDR including 380-387.5/390-397.5 MHz, 410-417.5/420- 427.5 MHz, 440-470 MHz, 806-811/851-856 MHz and 4940-4990 MHz.

3. While identifying usage for such purposes, it needs to be seen that bands which have lower retail device ecosystem are utilized.

4. **Therefore, given the importance of 700 MHz band for IMT, we strongly oppose any further allocation of spectrum to NCRTC in this band. Alternatively, non-IMT bands should be looked into. Also, band/frequencies where retail device ecosystem is not available should be utilized for such purposes.**

5. Regarding assignment of block, since the demand of NCRTC is of 5 MHz, the same should be allocated to them.

NCRTC Reply:

The Delhi-Meerut RRTS project is a flagship infrastructure project of the Government, included in the National Infrastructure Pipeline and is one of the 50 projects closely monitored by the PMO. The project has an extremely challenging timeline with a priority section of 17 Km targeted for completion in 2023 and the whole project in 2025.

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

Q.3 Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.

Q.4 In case more than one RRTS Metro/rail networks are to operate in overlapping geographical areas, will it be appropriate for RRTS

Metro/rail networks to share the Radio Access Network (RAN) in the overlapping areas using Multi-Operator Core Network (MOCN)? Any other feasible mechanism for using same spectrum in overlapping areas may also be suggested with detailed explanation. Kindly justify your response.

Q.5 In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),

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

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

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

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

<u>COAI Response</u>

1. The report of group of eminent experts has already demonstrated and stated that co-existence is possible between IR & NCRTC in the 5 MHz block already assigned to IR. Hence, the same spectrum will also be usable by future users like RRTS/Metro.

2. The experts have mentioned that for assignment of same spectrum to different RRTS/metro rail networks, which are operating in geographically separated manner such that, there is no interference, it can be easily done without any complications.

3. The same spectrum can easily be assigned to RRTS/ Metro which has been assigned to Indian Railways, if the geographical area of new RRTS/metro rail network is different and away from Indian Railways rail network.

4. The report also mentions that in case more than one RRTS Metro/rail networks are to operate on same spectrum frequencies in overlapping geographical area, the RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area, which is known as Multi Operator Core Network (MOCN). The Authority has already

noted the point and the same has already been implemented in South Korea.

5. Since options are available for all scenarios, the endeavor of the Government, in light of efficient utilization of spectrum, should be to assign same spots to all such users. Suitable terms and conditions should be defined so that the users are aware of these scenarios right from the beginning and are able to design their networks/ solutions accordingly.

6. Sharing of spectrum/Radio Network should be made mandatory for these licensees in case of overlap region, in the terms and conditions of the assignments, in order to prevent any issues in future.

NCRTC Reply:

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

Q.6 What should be the permission/licensing regime for operation of wireless networks for NCRTC and other RRTS/metro rail networks? Kindly justify your response with justification.

Q.7 What should be the broad terms and conditions, which may be included in the Permission/License. Kindly provide detailed response with justification.

COAI Response

1. The license conditions of such licensees need to clearly state that the spectrum is to be used for the intended use and not for any commercial activity directly or indirectly. It is submitted that the provision of Voice/ Internet services is part of the licenses issued to TSPs/ISPs. Therefore, any spectrum assignment to NCRTC or Indian Railways should have clear restriction that the said spectrum can neither be used to provide voice, data, SMS or any other commercial services to consumers or its employees, nor the entity can seek connectivity with public networks. The use of spectrum should be strictly regulated and not allowed to give any services, commercial or non-commercial, which otherwise can only be given through license under section 4 of Indian Telegraph Act or through spectrum acquired through auction.

2. If any entity needs these or similar other commercial services, then that should be provided by the authorized licensees (TSPs/ISPs) similar to the provision of In-flight connectivity.

The In-flight service providers use the Infrastructure of TSPs to provide the In-flight communication
/Internet services. The same model may be replicated for Railways/ RRTS, etc. too in case the intention is to provide voice/ internet to the onboard passengers.

NCRTC Reply:

NCRTC services are for captive use similar to that of Indian Railways. Hence same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable for NCRTC. No commercial business for telecommunications services will be done over NCRTC's captive LTE Network.

Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN License to DoT.

Railway systems are safety critical applications, and any unauthorized access and manipulation can result in breach of safety of train operations. The QCI requirements for Railway applications are more stringent than normal public networks. Hence TSP's are not well suited to provide network services for Railway applications.

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

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

COAI Response

1. There is no case of any additional spectrum allocation when the requirements can be met from current allocation as explained in previous response. Further, as commercial spectrum in 700 MHz has been allocated to commercial enterprises like Indian Railways, it is important that Exchequer should be duly compensated through adequate and appropriate spectrum charges.

2. Further, such terms and conditions shall be made part of the spectrum roadmap, to avoid any kind of ambiguities in future.

NCRTC Reply:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified

as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.
Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

Q.10 Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

COAI Response

Provide clear spectrum roadmap for Railways and similar new users

This increasing demand for spectrum from Railways, RRTS is likely to accelerate further from similar other users like Metros, Highspeed rails, etc. Hence a proper spectrum demand estimation study is necessary to set clarity for such users for at-least next decade. The study must identify new non-IMT bands for such railway purposes. This will help in long term planning for IR, NCRTC and similar Railways entities while mitigate risk to the IMT spectrum needs of mobile networks operators/TSPs. Besides, through such study, it should also be assessed that whether such demands can be met through licensed TSPs having spectrum acquired through auction.

NCRTC Reply:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

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In view of above, RRTS project should not be equated with other commercial entities such as

Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.
Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

Annexure 3.

Counter comments on submission of Broadband India Forum on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

BIF Response

NCRTC requires a contiguous 5 MHz (Paired) band for running Mission critical operations of high-speed trains using ETCS 2 & 3 European standard for high speed corridors which is much higher sensitive, efficient and secure system than even Indian railways has planned. Also, the use cases for NCRTC includes signalling, Group communication Location based Services, Real-time video surveillance and IoT devices for operation and maintenance services. A minimum contiguous 5 MHz bandwidth is required to perform all such operations. In view of the criticality of train operations and public safety, efficient non-interfering bandwidth would be advisable to be used, like Indian Railways.

The Spectrum Band may preferably be in the sub GHz bands and must be contiguous to operate LTE as a bearer. The Band can be shared with other regional transport systems using MOCN to mitigate any interference. It may be noted that LTE-R includes specifically designed algorithms to deliver superior Quality of Services at highest train speeds in this band.

NCRTC Reply: The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this

Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent

requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

BIF Response

Based on the response to Q1 above, it is suggested to use the minimum 5 MHz bandwidth for such Mission critical operations as explained in Q1. The Spectrum Band may preferably be in the sub GHz bands and must be contiguous to operate LTE as a bearer. The Band can be shared with other regional transport systems using MOCN to mitigate any interference.

NCRTC Reply: Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for same mission critical railway applications. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services. Hence NCRTC should be allotted 5 MHz spectrum in 700 MHz band.

3. Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.
   a. Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area
   b. Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographic

BIF Response

No challenge is anticipated as they would be non-interfering with each other, being in different geographically separated areas and corridors of the country. TRAI, in its Recommendations on 'Allotment of spectrum to Indian Railways for Public Safety and Security services', dated 25th October 2019, had already recommended that since IR would be using the assigned spectrum along its railway track network and stations only, DoT may explore the possibility of assigning the same spectrum in other areas for area specific limited use to other entities for captive use on a non-interference basis.

NCRTC Reply: No comment.

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

BIF Response

Yes – In case more than one RRTS Metro/rail networks are to operate on same spectrum frequencies in overlapping geographical areas, the RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area, which is known as Multi-Operator Core Network (MOCN). Active Infrastructure sharing using MOCN should be encouraged to help reduce network costs, spectrum sharing and better spectrum utilisation.
In case, it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN), to take care of a future situation, where another RRTS/Metro rail network may come up in the overlapping geographical area, while assigning the spectrum, it may be clearly mentioned that the same spectrum may be assigned to other RRTS/Metro rail networks in the same geographical area on sharing basis. Further, in MOCN, two or more RRTS/Metro rail networks may share the RAN in the overlapping geographical area, which will be connected to their individual core networks. If one RRTS/Metro rail RAN has already been deployed and another RRTS/metro rail network is assigned spectrum in overlapping area on sharing basis, it needs to be explored that what could be the practical difficulties and possible solutions for sharing of RAN.

NCRTC Reply: BIF response is in line with NCRTC comments. However, at present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

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

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

BIF Response: Yes.

NCRTC Reply: This is a policy matter to be decided by Govt. of India.

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

BIF Response

Coordination should be best left to the RRTS/Metro Rail Network Operators to be sorted out amongst themselves under some overarching principles/guidelines to be laid down by the Regulator/Licensor.

NCRTC Reply: Coordination mechanism maybe decided through Mutual Agreement.

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

BIF Response: Commercial arrangements should be best left to the RRTS/Metro Rail Network Operators.

NCRTC Reply: BIF response is in line with NCRTC comments.

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

BIF Response: RAN Sharing agreements should be best left to the operators themselves.

NCRTC Reply: BIF response is in line with NCRTC comments.

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

BIF Response

Since they would be using licensed spectrum, they should be required to take an appropriate license under Indian Telegraph Act 1885. However, spectrum maybe allocated administratively as was done in the case of IR.

TRAI, in its recent recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11th April 2022, under the Chapter on Spectrum for Private Cellular

Networks has, inter-alia, recommended that: *"...for establishing isolated captive wireless private network using licensed IMT spectrum, the entity/enterprise should be provided a Permission/license under Section 4 of the Indian Telegraph Act, 1885.* 3

The permission/license may be named as 'Captive Wireless Private Network (CWPN) permission/License'". Therefore, CWPN Permission/License be made applicable for NCRTC and other RRTS/metro rail networks also. However, the Permission/Licensing regime for Captive Wireless Networks for Train Signalling System may be kept very simple and light touch.,.

NCRTC Reply: Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

BIF Response

It should be similar to what has been recommended by TRAI in its recent recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11th April 2022. Under the Chapter on Spectrum for Private Cellular Networks, TRAI has, inter-alia, recommended that: "...for establishing isolated captive wireless private network using licensed IMT spectrum, the entity/enterprise should be provided a Permission/license under Section 4 of the Indian Telegraph Act, 1885. The permission/license may be named as 'Captive Wireless Private Network (CWPN) permission/License'".

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

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

BIF Response

Yes. The spectrum maybe allocated administratively and charged using formula based charging as prescribed by DoT for Royalty Charges and License Fee for captive networks, on the same lines as in the case of allocation of spectrum in the 700 MHz band for IR.

NCRTC Reply: BIF response is in line with NCRTC comments.

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

BIF Response

Yes. All future RRTS/Metro Rail Networks must be subject to the same Terms & Conditions as is made applicable to NCRTC.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges shall be applicable.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

BIF Response: No Comments.

NCRTC Reply: No Comments

Annexure-4

Counter comments on submission of ITU-APT Foundation of India on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   ITU-APT Response

   Spectrum in 700 MHz band using 3GPP band 28, commonly known as APT band should be assigned to NCRTC for their LTE-R technology-based Train control system for RRTS rail corridors.
   RRTS and metro rail need a wireless solution to be able to provide voice and data communication services to manage their operations with a clear vision. 3GPP LTE provides the best solution for meeting the needs of RRTS.

   NCRTC Reply: ITU-APT response is in line with NCRTC comments.

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

   ITU-APT Response

   10 MHz (5+5 MHz) in 700 MHz band using 3GPP band 28, commonly known as APT band should be assigned to NCRTC for their LTE-R technology-based Train control system for RRTS rail corridors.

   NCRTC Reply: ITU-APT response is in line with NCRTC comments.

3. Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.
   a. Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area
   b. Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographic

   ITU-APT Response

   Same spectrum in 700 MHz band when assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country can fully coexist and there is no challenge sharing of the same spectrum.

   The LTE systems are designed to reuse the same spectrum in geographically separated areas/corridors.

   NCRTC Reply: ITU-APT response is in line with NCRTC comments.

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

ITU-APT Response

We do not recommend sharing the spectrum between RRTS and Indian Railways network. However, sharing between RRTS, suburban and Metro rail network should be encouraged. Such sharing could be managed through MOCN or network slicing.

Interference is the main cause of concern while sharing the spectrum. However, the interference can be mitigated by appropriate transmission and reception techniques and through careful deployment of the RAN (Radio Access Network). RAN sharing through MOCN allows for deployment of two network with zero interference.

NCRTC Reply: ITU-APT response is in line with NCRTC comments.

5. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),
   a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?

ITU-APT Response

A broad guiding principle for such spectrum sharing should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS and Metro Rail networks to whom government decides to assign the same spectrum frequencies on sharing basis, furthermore it should be updated in an agenda format when assigning the same, so that there is minimal discrepancy regarding the same.

NCRTC Reply: This is a policy matter to be decided by Govt. of India.

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

ITU-APT Response

Yes, certain guidelines for coordination mechanism need to be issued for the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN sharing, there will be a need to establish Standard Operating Procedure (SOP).

NCRTC Reply: Coordination mechanism maybe decided through Mutual Agreement.

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

ITU-APT Response

To ensure that the RAN sharing between RRTS and Metro rail networks is done in a smooth manner, there may be a need to put in place guidelines for coordination mechanism, through mutual agreement between the two parties.

NCRTC Reply: Commercial arrangement maybe decided through Mutual Agreement.

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

ITU-APT Response: Nil.

NCRTC Reply: No comments.

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

ITU-APT Response

A permission/license under Section 4 of the Indian Telegraph Act, 1885, is required for establishing captive wireless network using specifically assigned spectrum., We believe that permission/licensing regime for Captive Wireless Networks for Train Signalling System may be kept very simple and straightforward and ordinary in nature.

We do not recommend any separate CMRTS license as no public service is to be provided and only wireless operating license is needed under section 4 of the Indian Telegraph Act, 1885.

NCRTC Reply: ITU-APT response is in line with NCRTC comments. Further, vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

ITU-APT Response

The broad terms and conditions that may be included in the permission/license could be

1) non-offering of any commercial telecom services to the public in general
2) spectrum to be granted on sharing basis.
3) Description relating to the rail/metro networks issues involved in public safety & security followed with the area of its operation.
4) use of trusted sources only for telecom equipment to be used in the network.

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive

wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

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

ITU-APT Response

Spectrum charging should be same for all captive wireless networks that are assigned on administrative basis and these should primarily cover the cost of managing the spectrum only.

NCRTC Reply: As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation may be made on the same analogy as that of Indian Railways.

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

ITU-APT Response

Spectrum charging should be same for all captive wireless networks that are assigned on administrative basis and these should primarily cover the cost of managing the spectrum only.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges as applicable to Indian Railways may be made applicable.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

ITU-APT Response

It should also be possible share the same spectrum for other captive networks such as ports, oil refineries, mines etc, which are far separated from the RRTS networks. WPC wing should consider such sharing.

NCRTC Reply: This consultation paper is for allotment of spectrum to NCRTC and Metro Rail networks.

Annexure 5.

Counter comments on submission of Gujarat Metro Rail Corporation Ltd (GMRC) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

GMRC Reply:

Spectrum for RRTS & Metro Rails should be allotted in 700 MHz band for the following reasons

1. 700 MHz band offers better coverage and reduces capex cost.

ii. If the allotted spectrum is in the same band for Indian Railways, RRTS & Metro Rails, it will lead to economies of scale and sharing of spares.

iii. Vendor ecosystem is already available in 700 MHz band for Radio Access Network and User Equipment (Train Radio, Handheld and Fixed Radio Terminals).

NCRTC Reply: GMRC Metro response is in line with NCRTC comments.

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

GMRC Reply:

RRTS and Metro Rails should be allotted minimum 5 MHz spectrum in 700 MHz band, since the Mission Critical Voice, Mission critical Data and Video requirements are same as that of Indian Railways.

Many new Metros are being designed from Driverless System Operations, which will require even more Live CCTV Video bandwidth to remotely monitor the passenger activity. They would require around 10 MHz spectrum as is being used in other Countries for Mission Critical LTE.

NCRTC Reply: GMRC Metro response is in line with NCRTC comments

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

a) Assignment of same spectrum for RRTS/Metro rail networks which are geographicallyseparatedarea.

GMRC Reply:

No challenges are expected in geographically separated regions, as interference is unlikely.

b) Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographical area.

GMRC Reply:

For sharing of spectrum between RRTS and Metro Rails in geographically overlapping areas, suitable experts' recommendations may be taken. Prima facie technological solutions like MOCN and other recommended by experts seem workable. This can be further optimized by using highly directive antennas and by better placement of Base Stations.

NCRTC Reply a & b: GMRC Metro response is in line with NCRTC comments. MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

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

GMRC Reply:

MOCN is proven technology for RAN Sharing in Public Network also being used in South Korea and commercial networks in the world.

NCRTC Reply: GMRC Metro response is in line with NCRTC comments. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

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

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

b) Whether certain guidelines for coordination mechanism need to be issued or it should be left to the mutual agreement between the RRTS/

Metro rail network operators mandated for MOCN RAN sharing? In case, guidelines need to be prescribed, kindly suggest the points to be included in the guidelines.

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

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

GMRC Reply:

a) This is a policy matter to be decided by Govt. of India.

b) Coordination mechanism may be decided through Mutual Agreement by the concerned parties.

c) Commercial arrangement may be decided through Mutual Agreement by the concerned parties.

d) In case of disagreement, MoHUA (Nodal Ministry for RRTS & Metro Rail) may govern the terms and conditions of RAN sharing between RRTS & Metro Rail.

NCRTC Reply: GMRC Metro response is in line with NCRTC comments.

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

GMRC Reply: For RRTS and Metro Rails the same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks needs to be made applicable.

NCRTC Reply: GMRC Metro response is in line with NCRTC comments. Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN License to DoT.

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

GMRC Reply:

Same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for RRTS and Metro Rails. Moreover, it is a policy matter to be decided by Govt. of India.

NCRTC Reply: GMRC response is in line with NCRTC comments.

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

GMRC Reply:

As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation may be made on the same methodology as that of Indian Railways. Presently all Metros are using Radio Technology in the free ISM Band for Mission Critical Train Control Systems (Communication Based Train Control) and hence for them to move to LTE Band which is the most likely future technology, it would be desirable to have free or minimal license free mechanism.

NCRTC Reply: GMRC Metro response is in line with NCRTC comments.

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

GMRC Reply:

It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges shall be applicable. Presently all Metros are using Radio Technology in the free ISM Band for Mission Critical Train Control Systems (Communication Based Train Control) and hence for them to move to LTE Band which is the most likely future technology, it would be desirable to have free or minimal license free mechanism.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges as applicable to Indian Railways may be made applicable.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

GMRC Reply:

As per the RRTS details provided in the document, it is felt that spacing of LTE Base Stations by NCRTC can be further increased, especially in the areas wherein there is geographical separation from the Indian Railways network.

NCRTC Reply: LTE Network has been designed considering all aspects of technical parameters.

Annexure 6

Counter comments on submission of Uttar Pradesh Metro Rail Corporation Ltd (UPMRCL) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   UPMRCL Response

   Spectrum for RRTS & Metro Rails (UPMRCL) should be allotted in 700 MHz band for the following reasons

   i. 700MHz band offers better coverage, reduces capex cost.
   ii. If the allotted spectrum is in the same band for Indian Railways, RRTS & Metro Rails, it will lead to economies of scale and sharing of spares may also be possible.
   iii. Vendor ecosystem is available in 700 MHz band for Radio Access Network and User Equipment (Train Radio, Handheld and Fixed Radio Terminals).

   NCRTC Reply: UPMCRCL response is in line with NCRTC comments.

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

   UPMCRL Response

   RRTS and Metro Rails should be allotted 5 MHz spectrum in 700 MHz band, since the Mission Critical Voice, Mission critical Data and Video requirements are same as that of Indian Railways.

   NCRTC Reply: UPMCRCL response is in line with NCRTC comments. The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

3. Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.
   a. Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area

      UPMRCL Response

      No challenges are expected in geographically separated regions if regions are sufficiently far away.

   b. Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographic

      UPMRCL Response

      For sharing of spectrum between RRTS and Metro Rails (UPMRCL) in geographically overlapping areas, suitable experts' recommendations may be taken.

NCRTC Reply: UPMCRCL response is in line with NCRTC comments.

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

UPMRCL Response

As MOCN is proven technology for RAN Sharing in South Korea and many commercial networks in the world, it may be used to operate in overlapping geographical areas for RRTS/Metro Rail Networks.

NCRTC Reply: UPMCRCL response is in line with NCRTC comments. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

5. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),
   a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?
   b) Whether certain guidelines for coordination mechanism need to be issued or it should be left to the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN (sharing? In case, guidelines need to be prescribed, kindly suggest the points to be included in the guidelines.
   c) Whether commercial arrangements between two RRTS/Metro rail networks for RAN sharing needs to be regulated or left to the mutual arrangement?
   d) Whether any other conditions need to be prescribed for such RAN sharing? Kindly provide detailed justifications.

UPMRCL Response

a) This is a policy matter to be decided by Govt. of India.
b) Coordination mechanism may be decided through Mutual Agreement.
c) Commercial arrangement may be decided through Mutual Agreement.
d) In case of disagreement, MoHUA (Nodal Ministry for RRTS & Metro Rail) may govern the terms and conditions of RAN sharing between RRTS & Metro Rail

NCRTC Reply: UPMCRCL response is in line with NCRTC comments.

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

UPMRCL Response

For RRTS and Metro Rails the same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable.

NCRTC Reply: UPMCRCL response is in line with NCRTC comments. Further, vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

UPMRCL Response

Same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for RRTS and Metro Rails. Moreover, it is a policy matter to be decided by Govt. of India.

NCRTC Reply: UPMCRCL response is in line with NCRTC comments.

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

UPMRCL Response

As the use case of RRTS/Metro Rails (UPMRCL) and Indian Railways is identical, hence the spectrum allocation may be made on the same analogy as that of Indian Railways.

NCRTC Reply: UPMCRCL response is in line with NCRTC comments.

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

UPMRCL Response

Yes, as the captive network use of RRTS and Metro Rail (UPMRCL) are similar, therefore terms & conditions and spectrum charges should be kept uniform.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges shall be applicable.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

UPMRCL Response: No suggestion.

NCRTC Reply: No Comments.

Annexure 7.

Counter comments on submission of L&T Metro Rail (Hyderabad) Limited (LTMRHL) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   We have implemented Captive Mobile Radio Trunking System (CMRTS) technology which is based on ETSI TETRA standard. Primarily CMRTS is deployed for establishing Voice Communication between Train Operator and Operational Control Centre. Voice communication is a Mission Critical application and thus CMRTS technology provides reliable & secure communication. Data Communication for Train Control & Monitoring has been established thru Fibre Optics Cable and Data Switches which are installed and connected across all Station. Since we have deployed CMRTS for Voice Communication we will not be in Position to provide our comments regarding the Frequency band assignment for LTE – R technology.

   NCRTC Reply: RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). LTE has been planned as the communication backbone for establishing the Mission Critical Communication Network for NCRTC for ETCS Signalling Data and Voice Communication.

   Wi-Fi over ISM Band cannot be used for establishing Mission Critical Voice Communication. Also, using ISM Band for CBTC is a non-interoperable communication backbone, whereas both ETCS Signalling, and LTE Communication are interoperable.

   After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services. Hence, NCRTC is requesting allotment of 5 MHz (paired) spectrum in 700 MHz band for NCRTC Train Operations.

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

   L & T MRHL Reply:
   We have been assigned Frequency band 380 to 400 Mhz. We cannot comment on spectrum band for LTE – R Network.

   NCRTC Reply: NCRTC is requesting allotment of 5 MHz (paired) spectrum in 700 MHz band for NCRTC Train Operations.

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

   a) Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area.

   L & T MRHL Reply: No challenges are expected in geographically separated regions.

   b) Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographical area.

   L & T MRHL Reply: We envisage PTT denial and communication loss issue due to frequency overlapping.

   NCRTC Replay: PTT denial and communication loss issue due to frequency overlapping can be resolved by suitable interference mitigation methods.

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

   L & T MRHL Reply:
   RRTS / Metro and rail networks can share same spectrum provided dedicated and required Bandwidth is available with full redundancy and with complete Data security features. Please note that we have no experience of sharing RAN through MOCN or any other mechanism

   NCRTC Reply: No challenges are foreseen in geographically separated regions.
   The sharing of spectrum between RRTS & Metro railways is a policy matter to be decided by Govt. of India.

   The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

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

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

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

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

L & T MRHL Reply: It is a policy decision to be taken by Govt. of India.

NCRTC Reply: L & T MRHL comment is in line with NCRTC comments.

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

L & T MRHL Reply: We recommend adoption of similar regime as applicable to CMRTS.

NCRTC Reply:

L&T MRHL Metro response is in line with NCRTC comments. Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

L & T MRHL Reply: Same terms and conditions as adopted for permission/licensing of captive wireless networks may be made applicable for RRTS and Metro Rails. Moreover, it is a policy matter to be decided by Govt. of India

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable for NCRTC. No commercial business for telecommunications services will be done over NCRTC's captive LTE Network.

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

   L & T MRHL Reply: It is a policy matter to be decided by Govt. of India.

   NCTRC Reply: NCRTC services are for captive use similar to that of Indian Railways. Moreover, it is a policy matter to be decided by Govt. of India.

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

   L & T MRHL Reply: It is a policy matter to be decided by Govt. of India.

   NCRTC Reply: As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation may be made on the same analogy as that of Indian Railways.

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

    L & T MRHL Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges shall be applicable.

    NCRTC Reply: L & T MRHL comment is in line with NCRTC comment.

11. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

    L & T MRHL Reply: No suggestion

    NCRTC Reply: No comments.

Annexure 8

Counter comments on submission of Maharashtra Metro Rail Corporation Ltd (Maha-Metro) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   MAHA Metro Response

   Spectrum for RRTS & Metro Rails should be allotted in 700 MHz band for the following reasons

   i. 700MHz band offers better coverage, reduces capex cost.
   ii. If the allotted spectrum is in the same band for Indian Railways, RRTS & Metro Rails, it will lead to economies of scale and sharing of spares may also be possible.
   iii. Vendor ecosystem is available in 700 MHz band for Radio Access Network and User Equipment (Train Radio, Handheld and Fixed Radio Terminals

   NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

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

   MAHA Metro Response

   RRTS and Metro Rails should be allotted 5 MHz spectrum in 700 MHz band, since the Mission Critical Voice, Mission critical Data and Video requirements are same as that of Indian Railways.

   Globally other Railways and Metros have been allotted 10 MHz or higher for setting up similar mission critical LTE networks. For example, South Korea and Dhaka Metro.

   NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

3. Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.
   a. Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area

      MAHA Metro Response

      No challenges are expected in geographically separated regions.

      NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

   b. Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographic

      MAHA Metro Response

For sharing of spectrum between RRTS and Metro Rails in geographically overlapping areas, suitable experts' recommendations may be taken. Prima facie technological solutions like MOCN and other recommended by experts from IIT Chennai seem workable.

NCRTC Reply: MAHA Metro response is in line with NCRTC comments. At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage. However, information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application.

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

MAHA Metro Response

MOCN is proven technology for RAN Sharing in Public Network also being used in South Korea and many commercial networks in the world.

NCRTC Reply: MAHA Metro response is in line with NCRTC comments. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

5. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),
   a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?
   b) Whether certain guidelines for coordination mechanism need to be issued or it should be left to the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN sharing? In case, guidelines need to be prescribed, kindly suggest the points to be included in the guidelines.
   c) Whether commercial arrangements between two RRTS/Metro rail networks for RAN sharing needs to be regulated or left to the mutual arrangement?
   d) Whether any other conditions need to be prescribed for such RAN sharing? Kindly provide detailed justifications.

MAHA Metro Response

a) This is a policy matter to be decided by Govt. of India.
b) Coordination mechanism may be decided through Mutual Agreement.
c) Commercial arrangement may be decided through Mutual Agreement.
d) In case of disagreement, MoHUA (Nodal Ministry for RRTS & Metro Rail) may govern the terms and conditions of RAN sharing between RRTS & Metro Rail

NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

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

MAHA Metro Response

For RRTS and Metro Rails the same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable.

NCRTC Reply: MAHA Metro response is in line with NCRTC comments. Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

MAHA Metro Response:

Same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for RRTS and Metro Rails. Moreover, it is a policy matter to be decided by Govt. of India.

NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

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

MAHA Metro Response

As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation may be made on the same analogy as that of Indian Railways.

NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

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

MAHA Metro Response

It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges shall be applicable.

NCRTC Reply: MAHA Metro response is in line with NCRTC comments.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

MAHA Metro Response: No suggestion

NCRTC Reply: No Comments

Annexure 9

Counter comments on submission of Kerala Rail Development Corporation Ltd (KRDCL) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   KRDCL Reply: The Spectrum should be assigned to NCRTC in the 700 MHz band. This shall be separate from the one allotted to IR and dedicated to RRTS projects exclusively.

   NCRTC Reply: KRDCL Metro response is in line with NCRTC comments.

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

   KRDCL Reply: It is felt that the safety and operational needs being the same as that of IR, 5 MHz (Paired) spectrum be allotted to NCRTC.

   NCRTC Reply: KRDCL Metro response is in line with NCRTC comments.

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

   KRDCL Reply: No challenges are expected, if operating in geographically separated areas/ corridors. It is felt that it will not be practically easy for RRTS/ Metro rail network to share the Radio Access Network in the overlapping area using Multi- Operator Core Network (MOCN) due to the multiple command and administrative set ups involved.

   NCRTC Reply: At present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
   However, information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

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

   KRDCL Reply: It is preferred to have separate spectrum for RRTS & Metros as there will be multiple sections / operators overlapping, especially Metros with RRTS at several points of intersections.

NCRTC Reply: The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

The sharing of spectrum between RRTS & Metro railways is a policy matter to be decided by Govt. of India. Moreover, MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

KRDCL Reply: Not recommended in view of the practical difficulties in the set up & administrative managements. However, if the Govt. decides RRTS/ Metro rail network may share the Radio Access Network (RAN) in the overlapping area using MOCN, then proper guidelines to be issued regarding:

I. Interface.
II. Management of the MOCN etc.
III. Considering the practical difficulties of management protocols between different operators.

NCRTC Reply: This is a policy matter to be decided by Govt. of India. Moreover, MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

KRDCL Reply: Yes, it should be included in the terms and conditions for assignment of Spectrum and should not be left to the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN sharing.
However, it is felt that the Spectrum bandwidth may be increased which should be sufficient to manage three/ multiple operators (RRTS/ Metros)

NCRTC Reply: This is a policy matter to be decided by Govt. of India.

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

KRDCL Reply: Certain guidelines need to be issued for coordination mechanism under a Central Agency rather than between the RRTS/ Metro rail network operators mandated for MOCN RAN sharing the same band width.
Should be regulated by a common Central Agency similar to WPC. New operator will be responsible for the interfacing, managing the integration of assets etc. within such controls

NCRTC Reply: Coordination mechanism maybe decided through Mutual Agreement.

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

KRDCL Reply: It is felt that Commercial arrangement needs to be regulated similar to the commercial telephone operators handling calls across the service providers.

NCRTC Reply: Commercial arrangement maybe decided through Mutual Agreement.

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

NCRTC Reply: In case of disagreement, MoHUA (Nodal Ministry for RRTS & Metro Rail) may govern the terms and conditions of RAN sharing between RRTS & Metro Rail

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

KRDCL Reply: Licensing is required to ensure authorised use and license fee may be levied, as the services are made for public safety & security. As in the case of IR, the licensing fee may be kept minimal as it is related to safety and not for commercial ventures.

NCRTC Reply: DMRC Metro response is in line with NCRTC comments. Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

7. What should be the broad terms and conditions, which may be included in the Permission/License. Kindly provide detailed response with justification.
KRDCL Reply: Same as above

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

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

KRDCL Reply: Yes, with separate bandwidth having same terms and conditions.

NCRTC Reply: As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation may be made on the same analogy as that of Indian Railways.

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

KRDCL Reply: Yes, as the proposed objective of all RRTS/ SHSR/ HSR are same and similar to IR except the fact that different RRTS/ SHSR/ HSRs caters for different regions and state governments are stakeholders in it.

NCRTC Reply: KRDCL response is in line with NCRTC comments.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

KRDCL Reply: For SHSR or HSR the lower band spectrum is preferred for larger propagation distances. This is already adopted by the railway industry in China.

NCRTC Reply: NCRTC requirement is 5MHz (Paired) in 700 MHz band.

Annexure 10.

Counter comments on submission of RADWIN Wireless Solutions India Pvt Ltd on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

RADWIN Suggestions

1. As current Tender of NCRTC for Delhi – Ghaziabad – Meerut Corridor already awarded and LTE Radio Signalling CBTC to be deployed in 700Mhz Band, hence department should consider release of spectrum in 700 MHz band for the Current Project however since the application for CBTC is Train Control with Safety of Passengers is Topmost Priority, DoT/TRAI can alternatively consider 4.9 GHz band to be used for Signalling applications. This band is for Public Safety and DoT can also evaluate the option of 4.9 GHz beside LTE in 700 MHz. The Radios are widely available in Global markets with operating frequency 4.9 GHz – 6.0 GHz.

   NCRTC Reply: RADWIN's suggestion for allocating 5 MHz (paired) in 700 MHz spectrum band for NCRTC's ETCS signalling application with LTE as a backbone is in line with NCRTC's comments. NCRTC has no comment on RADWIN's suggestion for alternate band for CBTC signalling application.

2. Further Allocation of Spectrum in 60 GHz frequency Band will help delivery of higher throughput for

   a. CAR to CAR Connectivity which could have earlier been wired connectivity (prone to more failures)

   b. Depot Offloading: Availability of Radio in 60 GHz band will provide higher throughput ~1 Gbps for offloading of Video Images in shorter span of time after Train has berthed the Depot.

3. Alternate Spectrum for CBTC and Depot Offload will reduce load on 5 GHz band which can then be utilized fully for VTS applications.

   Hence, we request DoT/TRAI to also evaluate alternate Spectrum for Signalling and for Depot Offloading.

   NCRTC Reply: NCRTC has no comment on RADWIN's suggestion for above mentioned CBTC signalling application. However, the 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway mission critical applications associated with passenger safety.

Annexure 11

Counter comments on submission of Chennai Metro Rail Limited (CMRL) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   CMRL Response

   Since already 5Mhz Paired spectrum is allotted in 700 MHz band for IR, allocations of similar paired spectrum for other Metros and NCRTC will be ideal as it will reduce cost of assets for Railway applications as similar critical applications are run in all the Rail transport sector and the know how can be shared among them being in the same industry.

   NCRTC Reply: CMRL response is in line with NCRTC comments.

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

   CMRL Response

   Critical data Applications are used for Metro transport such as Automatic Train operations, Driverless operation and Emergency communications between Train passengers and Central control, Live images from inside the trains to Central control which are mission critical. A min. of 5 MHz spectrum in 700 MHz band should be considered for allocation to Metro Railways.

   NCRTC Reply: CMRL response is in line with NCRTC comments for 5 MHz (paired) in 700 MHz spectrum band.

3. Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.
   a. Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area
   b. Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographic

   CMRL Response: No challenges is seen.

   NCRTC Reply: CMRL response is in line with NCRTC comments.

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

   CMRL Response

Since the locations where such overlap occurs are very few, an additional 5 MHz spectrum to the 5 MHz spectrum already allocated to IR can be allotted. It is suggested that instead of allocating heterogeneous 5 MHz bands, a 10 MHz homogeneous band be allocated for Indian Railways /Metro Applications/ RRTS.

Such locations can be handled with minimal coordination in system design to prevent interference at converging and parallel locations between the concerned organisations and homogeneous spectrum can be used more effectively/efficiently by the individual Rail networks (IR /RRTS/Metro).

In addition, if the interference mitigation steps are not effective, MOCN a proven technology for RAN Sharing in Public can also be considered for use.

NCRTC Reply:

The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

The sharing of spectrum between RRTS & Metro railways is a policy matter to be decided by Govt. of India. Moreover, MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

5. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),
   a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?

CMRL Response

It can be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/Metro rail networks, in overlapping / converging areas, to whom government decides to assign the same spectrum frequencies on sharing basis. Additional measures to prevent interference can also be specified.

NCRTC Reply: This is a policy matter to be decided by Govt. of India.

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

CMRL Response

Basic guidelines can be issued by TRAI. The finer details of coordination can be left to the network operators.

NCRTC Reply: Coordination mechanism maybe decided through Mutual Agreement.

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

CMRL Response

Broad guidelines can be issued by TRAI on RAN Sharing in overlapping area using MOCN.

NCRTC Reply: Commercial arrangement maybe decided through Mutual Agreement.

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

CMRL Response

In case of disagreement between two entities, MoHUA (Nodal Ministry for RRTS & Metro Rail) and IR may govern the terms and conditions of RAN sharing between two entities if it involves IR, otherwise MOHUA can govern the terms and conditions.

NCRTC Reply: In case of disagreement, MoHUA (Nodal Ministry for RRTS & Metro Rail) may govern the terms and conditions of RAN sharing between RRTS & Metro Rail.

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

CMRL Response

The same policy as adopted for Indian Railways for permission/licensing can be made applicable to Metros.

NCRTC Reply: CMRL response is in line with NCRTC comments. Further, vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

CMRL Response

Same terms and conditions as adopted for Indian Railways can be made applicable for Metro Rails.

NCRTC Reply: CMRL response is in line with NCRTC comments.

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

CMRL Response

Since both IR and METRO are using the spectrum for critical application of carrying the passengers safely, the same methodology can be adopted for Metros and Railways.

NCRTC Reply: CMRL response is in line with NCRTC comments.

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

CMRL Response

The same terms and conditions and spectrum charges can be made applicable.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges as applicable to Indian Railways may be made applicable.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

CMRL Response: No suggestion

NCRTC Reply: No Comments

Annexure 12

Counter comments on submission of Bangalore Metro Rail Corporation Limited (BMRCL) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

   Bangalore Metro Response

   It is recommended to allot frequency band in 700 MHz spectrum. This is suitable considering the coverage distance and the band width required.

   NCRTC Reply: Bangalore Metro response is in line with NCRTC comments.

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

   Bangalore Metro Response

   Spectrum band of 10 MHz is proposed. This optimized the hardware for the projected band width

   NCRTC Reply: Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for same mission critical railway applications. Hence NCRTC should be allotted 5 MHz (paired) spectrum in 700 MHz band.

3. Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.
   a. Assignment of same spectrum for RRTS/Metro rail networks which are geographically separated area
   b. Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographic

   Bangalore Metro Response

   No. However, Indian Railways spectrum shall be separate from RRTS/Metro, as IR is covering almost all the geographical area.

   NCRTC Reply: No challenges are foreseen in geographically separated regions.
   The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

4. In case more than one RRTS Metro/rail networks are to operate in overlapping geographical areas, will it be appropriate for RRTS Metro/rail networks to share the Radio Access Network (RAN) in the overlapping areas using Multi-Operator Core Network (MOCN)? Any other

feasible mechanism for using same spectrum in overlapping areas may also be suggested with detailed explanation. Kindly justify your response.

Bangalore Metro Response

MOCN is considered appropriate for overlapping areas. Administrative guidelines shall be laid down by suitable authority.

NCRTC Reply: At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

5. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),
   a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/ Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?

Bangalore Metro Response

Yes.

NCRTC Reply: This is a policy matter to be decided by Govt. of India.

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

Bangalore Metro Response

Guidelines shall be issued covering QoS, Responsibility of maintaining the sites, Cost sharing.

NCRTC Reply: Coordination mechanism may be decided through Mutual Agreement.

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

Bangalore Metro Response

Commercial arrangements shall be regulated with clear pricing.

NCRTC Reply: Commercial arrangement may be decided through Mutual Agreement.

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

Bangalore Metro Response

NIL.

NCRTC Reply: No comments.

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

Bangalore Metro Response

Similar licensing procedure followed by DoT for other captive licenses like TETRA. However, license and royalty fees may be reviewed for government organizations providing public transport.

NCRTC Reply: Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

Bangalore Metro Response

Terms and Conditions of captive licenses like TETRA are suitable for LTE also. However, consideration for spectrum allotment shall be done based on bandwidth requirement and coverage distance. In TETRA, utilization of spectrum and user base is considered, making it difficult to get the required licenses from coverage and bandwidth point of view.

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

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

Bangalore Metro Response

Yes.

NCRTC Reply: Bangalore Metro response is in line with NCRTC comments.

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

Bangalore Metro Response

Yes, Spectrum charges shall be standardized similar to TETRA. However, the pricing may be reviewed for government organizations providing public transport.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges as applicable to Indian Railways may be made applicable.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

Bangalore Metro Response

BMRCL currently uses the following technologies: -

1. Train Radio: TETRA in the band of 380-420 MHz
2. Train positioning information: - Audio Frequency Track Circuit (AFTC) (or) Communication Based Train Control System using 2.4 GHz/5 GHz band is suitable.
3. Train Remote: - This feature is not implemented in BMRCL. If considered for implementation, 2.4 GHz/5 GHz band is suitable.
4. Train Surveillance: - Implemented using 2.4 GHz/5 GHz spectrum. The current technologies being used are serving the purpose and BMRCL is not foreseeing the immediate operational requirement for LTE.

NCRTC Reply: No Comments

Annexure B

Counter comments on submission of Delhi Metro Rail Corporation Limited (DMRC) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

DMRC's Response:

From details available/provided in the consultation paper, it is seen that that spectrum has been allocated to Indian Railways (IR) in 700 MHz (5 MHz (paired)) inter-alia for its requirements pertaining to deployment of:

a) ETCS Level-2,
b) MC PTT + Voice
c) IoT based asset monitoring services,
d) Passenger information display system and
e) live feed of Video Surveillance of few coaches at a time

It is also observed that NCRTC has submitted its request for allocation of spectrum for its requirements pertaining to deployment of:

a) ETCS Level-2 Signalling System,
b) Mission Critical Voice
c) IoT based asset monitoring services and
d) Video surveillance from the train for captive use

From the above it is observed that the end objective of requirement of spectrum of both the organizations being same, therefore it is but natural to consider allotment of spectrum to NCRTC in the same band i.e. 700 MHz as has been allocated to IR.

Allotment of spectrum in the same band 700 MHz for all the organizations i.e. IR, NCRTC (RRTS) & Metro Railways would also result in:

a) increased coverage resulting in requirement of less BTSs which would result in reduced capex cost.

b) Vendor ecosystem is already available in 700 MHz band for Radio Access Network and User Equipment (Train Radio, Handheld and Fixed Radio Terminals)

c) Allocation of spectrum in the same band for all the organization (i.e., Indian Railways, RRTS & Metro Railways) will lead to economies of scale in manufacture of equipment.

NCRTC Reply: DMRC Metro response is in line with NCRTC comment

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

DMRC's Response:

Considering the applications for which spectrum is required for RRTS and Metro Railways i.e., Mission Critical Voice, Mission critical Data and Video requirements are same as that of Indian Railways., a min. of 5 MHz spectrum in 700 MHz band should be considered for allocation to NCRTC & Metro Railways.

Notwithstanding the above, globally other Railways and Metros in South Korea and Dhaka Metro have been allotted 10 MHz or higher for setting up similar mission critical LTE networks.

NCRTC Reply: DMRC Metro response is in line with NCRTC comments. The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

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

DMRC's Response:

There appears to be no challenge, if the same spectrum is assigned to different RRTS/Metro rail networks, operating in geographically separated areas/corridors in the country.

With this principle, specific spectrum bands of 5 MHz or as per requirement, can be identified for RRTS and Metro Railways. Only in metro cities where multiple Metro Railways operate viz. MMRDA/MMOCL in Mumbai and DMRC / NMRC /Rapid Metro in Delhi NCR, **additional spectrum bands would be required to cater for different Metro Railways.**

NCRTC Reply: The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

4. **In case more than one RRTS Metro/ rail networks are to operate in overlapping geographical areas, will it be appropriate for RRTS Metro/rail networks to share the Radio Access Network (RAN) in the overlapping areas using Multi-Operator Core Network (MOCN)? Any other feasible mechanism for using**

same spectrum in overlapping areas may also be suggested with detailed explanation. Kindly justify your response.

DMRC's Response:

On the issue of exploring spectrum sharing between IR & NCRTC, DoT in the consultation paper has inter-alia stated that:

"With regard to NCRTC's request for assignment of spectrum in 700 MHz band, DoT has decided that as in the case of Indian Railways, NCRTC also carries passengers and spectrum will be used for mission critical safety applications of signalling and train control, therefore, separate spectrum may be required since the services involve safety of life."

Further, Ministry of Railways has also inter-alia advised NCRTC that "***due to strong possibility of interference in safety and security application and throughput requirements, Indian railways is not in agreement to share the limited spectrum allotted for captive use.***

From the above it is observed Indian Railways & DoT both are in agreement of not sharing of spectrum between Indian Railways & NCRTC on Safety & security considerations.

Considering the fact that both RRTS & Metro Railways also require the spectrum for Mission Critical Safety Applications similar to that of Indian Railways, it is advised that the spectrum between RRTS & Metro Railways should also not be shared. It is worthwhile to note that DoT has also inter-alia not agreed to sharing of spectrum between NCRTC & Indian Railways and has decided to allocate separate spectrum to NCRTC.

Accordingly, as suggested in response to Ques. No. 3, it is suggested that specific/separate spectrum bands of 5 MHz or as per requirement, can be identified for allocation to RRTS and Metro Railways. In metro cities where multiple Metro Railways operate viz. MMRDA/ MMOCL in Mumbai and DMRC / NMRC /Rapid Metro in Delhi NCR, additional spectrum bands may be considered for allotment to cater for different Metro Railways operating in the same geographical area.

NCRTC Reply:

The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

Moreover, MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

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

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

DMRC's Response:

As detailed in response to Question(s) 3 & 4 above, and considering that DoT has also not agreed to sharing of spectrum between NCRTC & Indian Railways, it is not advisable to share the spectrum between RRTS & Metro Railways.

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

DMRC's Response:

Not Applicable in view of response to Question 5(a) above.

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

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

NCRTC Reply for a, b, c & d: The sharing of spectrum between RRTS & Metro railways is a policy matter to be decided by Govt. of India.
The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.
Moreover, MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

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

response with justification.

DMRC's Response:

For RRTS and Metro Railways also, the same policy as adopted for Indian Railways for permission/licensing pertaining to Operation of wireless networks, may be made applicable.

NCRTC Reply: DMRC Metro response is in line with NCRTC comments. Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

DMRC's Response:

Same terms and conditions as adopted for Indian Railways for permission/licensing of Captive wireless networks may be made applicable for RRTS and Metro Railways.

NCRTC Reply: DMRC response is in line with NCRTC comments.

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

DMRC's Response:

As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation to RRTS & Metro Railways including the charging may be made on the same Terms & Conditions as that of Indian Railways.

NCRTC Reply: DMRC Metro response is in line with NCRTC comments.

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

DMRC's Response:

It is a policy matter. However, for all Captive Wireless networks like Indian Railways, RRTS and Metro Railways, similar terms and conditions and spectrum charges as applicable for Indian Railways can be made be applicable.

NCRTC Reply: DMRC Metro response is in line with NCRTC comments.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

DMRC's Response:

Notwithstanding the above responses, it is brought out that if the government as a policy decides on spectrum sharing using sharing of Radio Access Network (RAN) in the overlapping area by way of Multi-Operator Core Networks (MOCN), then the sharing should be made applicable amongst all user agencies including Indian Railways , RRTS & Metro Railways and should not by limited only between RRTS & Metro Railways as the spectrum is proposed to be used for similar Mission Critical & Safety applications by all the stake holder railway organizations viz. IR, RRTS & Metro Railways.

NCRTC Reply: The sharing of spectrum between RRTS & Metro railways is a policy matter to be decided by Govt. of India. At present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage. However, information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper. However, the issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

Annexure - 14

Counter comments on submission of Rail Infrastructure Development Company (Karnataka) Limited (KRIDE) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

Rail Infrastructure Development Company (Karnataka) Limited - "KRIDE" is a Joint Venture Company established in year 2000 by Government of Karnataka (GoK) & Ministry of Railways (MoR). It has been created to boost "Rail Infrastructure Projects" in the state of Karnataka on the principle of cooperative federalism.

KRIDE is implementing 150 km greenfield Bengaluru suburban rail project (BSRP) in the city of Bengaluru in 4 corridors. As per Detailed Project Report (DPR), Communication Based Train Control (CBTC) signalling technology is recommended as a signalling and train control solution for the BSRP and Radio for CBTC shall work in license free ISM band. The design speed of train is 90 kmph and maximum inter-station distance is 4.905 km.

Currently all commercial CBTC projects are using the free ISM band (2.4 GHz and 5.8 GHz), we do not envisage any immediate requirement of dedicated frequency spectrum. However, CEWiT(Centre of Excellence in Wireless Technology) may kindly advise whether there will be any interference from other Wi-Fi sources and steps for mitigation.

NCRTC Reply:

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). LTE has been planned as the communication backbone for establishing the Mission Critical Communication Network for NCRTC for ETCS Signalling Data and Voice Communication.

Wi-Fi over ISM Band cannot be used for establishing Mission Critical Voice Communication. Also, using ISM Band for CBTC is a non-interoperable communication backbone, whereas both ETCS Signalling, and LTE Communication are interoperable.

Hence, NCRTC is requesting allotment of 5 MHz (paired) spectrum in 700 MHz band for NCRTC Train Operations.

Annexure 15.

Counter comments on submission of Kolkata Metro Rail Corporation (KMRC) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

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

KMRCL Reply:

KMRCL have implemented Captive Mobile Radio Trunking System (CMRTS) technology which is based on ETSI TETRA standard. Primarily, CMRTS is deployed for establishing Voice Communication between Train Operator and Operational Control Centre. Voice communication is a Mission Critical application and thus CMRTS technology provides reliable & secure communication. Additionally, DCS **(Data Communication System) is being used using free band i.e 2.4 GHz and 5.8 GHz for communication of On-Board Train CCTV data and Signalling communication from train to Operation centre.**

In NCR area, multiple metro rail networks are operational, additionally different spectrum are being used by Mobile operators, ISP (internet service providers) and by Indian Railways. However as per RRTS and assuming station to station longer distance, it is advised to use the UHF frequency (600 MHz to 800 MHz) for better coverage.

NCRTC Reply: RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). LTE has been planned as the communication backbone for establishing the Mission Critical Communication Network for NCRTC for ETCS Signalling Data and Voice Communication.

Wi-Fi over ISM Band cannot be used for establishing Mission Critical Voice Communication. Also, using ISM Band for CBTC is a non-interoperable communication backbone, whereas both ETCS Signalling, and LTE Communication are interoperable.

The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services. Hence, NCRTC is requesting allotment of 5 MHz (paired) spectrum in 700 MHz band for NCRTC Train Operations.

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

KMRCL Reply: This is to be based on the services that NCRTC requires like (Signalling, On-Board data of CCTV, internet services etc.). So, without having the actual requirements, It is not possible to specify the spectrum requirement.

NCRTC Reply: Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for same mission critical railway applications. Hence NCRTC should be allotted 5 MHz spectrum in 700 MHz band having similar applications as of Indian Railways.

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

(a). Assignment of same spectrum for RRTS/Metro rail networks which are geographicallyseparatedarea.

KMRCL Reply:

No challenges are expected in geographically separated regions.

NCRTC Reply: KMRCL Metro response is in line with NCRTC comments

(b). Assigning same spectrum to more than one RRTS Metro/rail networks operating in the overlapping geographical area.

KMRCL Reply:

Assigning same spectrum may be allowed in over lapping geographical area subject to, same frequency pair should not be operated in those over lapping areas and frequency reuse should be designed as per Hexa (Bee hive) pattern.

NCRTC Reply: The sharing of spectrum between RRTS & Metro railways is a policy matter to be decided by Govt. of India.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

KMRCL Reply: It is preferred to have separate spectrum for RRTS & Metros as there will be multiple sections overlapping. Also the channel occupancy, interfaces, Interconnectivity of MSO/MSC etc are to be taken care using Multi-Operator.

NCRTC Reply: The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

Moreover, MOCN is a technology used for RAN Sharing in Public Network. However, at present there is no RAN sharing using MOCN for commercial networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

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

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

KMRCL Reply:

If it has been decided by the Government that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN) then it should be included in terms and conditions before allotment of-Spectrum to avoid any conflict between multi vendors/OEMs at later stage

NCRTC Reply: This is a policy matter to be decided by Govt. of India.

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

KMRCL Reply:

Yes, guidelines need to be issued for coordination mechanism under a Central Agency rather than between the RRTS/ Metro rail network operators mandated for MOCN RAN sharing the same Spectrum.

NCRTC Reply: Coordination mechanism maybe decided through Mutual Agreement.

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

KMRCL Reply: Yes. It should be regulated similar to Mobile operators by TRAI or DoT.

NCRTC Reply: Commercial arrangement maybe decided through Mutual Agreement.

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

KMRCL Reply: MoHUA should govern the terms and conditions for RAN sharing between RRTS & other railnetwork.

NCRTC Reply: KMRCL Metro response is in line with NCRTC comments.

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

KMRCL Reply: Same terms and conditions as adopted for permission/licensing of captive wireless Networks may be made applicable for RRTS and Metro Rails.

NCRTC Reply: KMRCL Metro response is in line with NCRTC comments. Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN Licence to DoT.

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

License is required to ensure authorised use and license fee may be kept minimal as the services are made for public safety & security.

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

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

KMRCL Reply: As it is similar to Indian railways hence the spectrum allocation may be made on same methodology. License fee may be kept minimal as the services are made for public safety & security and not for any commercial use.

NCRTC Reply: NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive

wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

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

KMRCL Reply: Yes, License is required to ensure authorised use and license fee may be kept minimal as the services are made for public safety & security only.

NCRTC Reply: As the use case of RRTS and Indian Railways is identical, hence the spectrum allocation may be made on the same analogy as that of Indian Railways.

10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation
and justification.

KMRCL Reply: No Suggestions.

NCRTC Reply: No comments.

Annexure-16

Counter comments on submission of Reliance JIO Infocomm Limited on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

1. Reliance Jio Infocomm Limited (RJIL) thanks the Authority for issuing this consultation paper to deliberate on the allotment of spectrum to National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors.

NCRTC Reply to 1:
No Comments

2. At the outset, we submit that here is no doubt that suitable spectrum is required for setting up communication corridor along the network of Indian Railways and other regional and suburban railway networks. The evolving technology and the requirements of passenger safety, track-side communication, train and way-side telemetry, video surveillance etc. requires that these networks should be LTE based to deliver optimum services. However, it is imperative that this spectrum is chosen post considering all relevant factors.

NCRTC Reply to 2:
It has been rightly pointed out that LTE is the optimum solution to meet the requirements of passenger safety, track-side communication, train and way-side telemetry, video surveillance etc.
Considering this, the issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.
As per Metro Railways (Operation and Maintenance) Act 2002, "*Central Government", in relation to technical planning and safety of metro railways, means the Ministry of the Government of India dealing with Railways;".* Further 'In principle approval of Broad Technologies for Regional Rapid Transit System (RRTS)' was approved by Railway Board for using 700 MHz (LTE) band for communication backbone. To honour the project deadlines, set by the Government of India, all the planning, designing and procurement of equipment has been done according to 700 MHz.

3. We submit that the digital dividend spectrum in 700 MHz band has immense potential for coverage in wide and rural areas and should be reserved for IMT and 5G services in the country and regular and ad-hoc demands of Government entities and Public Sector Units for spectrum should be explored within the already allocated 5 MHz spectrum to Indian Railways and other non-IMT bands.

4. We submit that in the current instance, NCRTC demand has emanated from lack of co-ordination between Indian Railways and NCRTC, as the initial requirement was to build a

network for RRTS corridors using the 5 MHz spectrum already allocated to Indian Railways. Therefore, it is important that instead of exploring the possibility of allocating additional 5 MHz spectrum, the Department of Telecommunications (DoT) should ask the parties to explore a way to share the spectrum. This should not be a difficulty as an expert body report certifying lack of interference risk is already in place.

5. We reiterate our submission to the Consultation Paper on "Allotment of spectrum to Indian railways for public safety and security service" dated 24th June 2019 and submit that digital dividend spectrum in 700 MHz band, with a rapidly increasing device eco- system, is a vital IMT band and is being considered for deployment to enable better coverage of rural areas. This spectrum is being auctioned in U.S. and many other countries for a while now, Asia Pacific Tele community (APT) and many Latin American and African countries have also adopted the FDD 700 MHz band plan for this spectrum.

NCRTC Reply to 3, 4 & 5:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain

the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

6. In addition to its usage in coverage under 4G technologies, this band has an important role to play in deployment 5G new radio (NR) as wide-area coverage layer. We understand that this spectrum will be used extensively across the world to deliver '5G everywhere'. It is well recognized that the intermix of sub-GHz spectrum frequencies with spectrum in C-Band and mm Wave spectrum will help us deliver faster and cost-efficient 5G services.

7. Evidently, the vast commercial potential of spectrum 700 MHz band is undeniable and recognized by both the Authority and DoT. Therefore, it is needless to add that such valuable spectrum resource should be allocated very cautiously, especially when alternatives are available as well as feasible.

NCRTC Reply to 6 & 7:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services. Hence NCRTC should be allotted 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

Rail based transport systems are climate-smart and efficient way to move people. Railways promote economic growth while cutting greenhouse gas emissions. The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

Such Rail base projects like RRTS are essential infrastructure projects needed for the growth and development of the Nation. The advantages of these projects outweigh the cost of spectrum and should not be quantified in monetary terms.

Further, since NCRTC services are for captive use only for operation of train services, our project should not be equated with other commercial entities such as Telecom Service Providers which provide commercial services on their networks.

8. The Authority is also aware that India's aspirations to transform the entire country and all aspects of social and commercial life with digital services relying on a strong wireless

broadband backbone implies that all possible IMT spectrum is made available for TSPs. There is a plethora of international studies, including some by GSMA, indicating the India's spectrum requirements are going to increase substantially as more and more subscribers are added to high-speed broadband networks, therefore it is imperative that the IMT spectrum is kept reserved to meet the upcoming explosive data and enhanced capacity requirements, irrespective of uptake of a particular band in an auction or two.

NCRTC Reply to 8:

Rail based transport systems are climate-smart and efficient way to move people. Railways promote economic growth while cutting greenhouse gas emissions. The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

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Further, since NCRTC services are for captive use only for operation of train services, our project should not be equated with other commercial entities such as Telecom Service Providers which provide commercial services on their networks.

9. We submit that the already allocated spectrum in 700 MHz band for Indian Railways with the newest technology provides sufficient capacity for all Railway based connectivity networks and should be sufficient to meet all current and future requirements, especially considering that so far these requirements were being met by 1.4-1.6 MHz of spectrum in 900 MHz band using GSM technology. We believe that catering to each and every spectrum demand by administratively allocating spectrum in 700 MHz band would be very inefficient way to use this spectrum of immense commercial value.

NCRTC Reply to 9:

Indian Railways only used GSM-R for voice communication, hence the requirement of deploying Signalling System and Mission Critical Voice, Video and Data services on the network cannot be equated with bandwidth offered by GSM-R based systems.

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services. Hence NCRTC should be allotted 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

10. Already Railway's limited requirement of spectrum along the tracks has rendered 5 MHz of this spectrum unusable commercially as Railways pass through populated areas as well and allocating the same spectrum to any TSP in non-Railways areas will lead to interference issues impacting the provision of RSTT, thus the spectrum allocated to Railways cannot be used for any other purpose anywhere. Therefore, no more spectrum in this 700 MHz band should be allocated for any other type of captive use by any Government/non-Government agency.

NCRTC Reply to 10:
This is a policy matter to be decided by Govt. of India.

11. We further submit that while we agree that Railways and NCRTC requirements to provide mission critical passenger safety services & applications and video analytics for passenger security and way side telemetry through Mobile communications are valid and legitimate requirements, we strongly believe that the same can be met through already allocated 5 MHz spectrum in 700 MHz band. We further submit that the Authority has already suggested possibilities of Radio Access Network (RAN) sharing to manage the spectrum requirements in overlapping geographical regions. We submit that in addition to very feasible option of RAN sharing, the option of spectrum sharing, and network slicing can be used for such contagious geographical regions.

NCRTC Reply to 11:
The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

12. The Railways and NCRTC are commercial organization and while building communication networks, these entities should acquire Unified License under suitable authorization for they should compensate the Exchequer, suitably at commercial rates for using this spectrum in 700 MHz band. Further, as per allocation to Railways, the NCRTC should not be permitted to offer commercial services like Wi-Fi, voice. Video etc. onboard to its customers.

13. We further understand from the DoT's reference and this consultation process that this issue is not pre-decided and post the consultative exercise, DoT will add the 5 MHz spectrum in 700 MHz withheld from auction, in the auction being held July 2022 and forthcoming auctions. Furthermore, as the efficient management of available spectrum is one of Authority's primary functions under the terms of clause 11 (1)(a) of TRAI Act, 1997 as amended by TRAI Amendment Act 2000, we request the Authority to ensure that commercially sensitive spectrum in 700 MHz band is utilized in an optimum manner.

NCRTC Reply to 12 & 13:

NCRTC services are for captive use similar to that of Indian Railways. Hence same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable for NCRTC. No commercial business for telecommunications services will be done over NCRTC's captive LTE Network.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

Further, it is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing

economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.

Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Issue wise response:

Q1. In which band, spectrum should be assigned to NCRTC for their LTE-R technology-based Train control system for RRTS rail corridors?
and
Q2. How much spectrum in the spectrum band(s) suggested in response to Q1, should be assigned to NCRTC to meet its requirement for its RRTS LTE-R based network?

RJIL Response:

1. We submit that as already 5 MHz spectrum in 700 MHz band has been assigned to Indian Railways for similar purpose, there is no need for a separate spectrum assignment for NCRTC for their LRE-R technology-based Train control system for RRTS rail corridors, and NCRTC requirements should be met from the already assigned spectrum to Indian Railways.

2. The details of interaction between the entities and the expert report provided by the NCRTC, makes it evident that there is no requirement for a separate spectrum assignment and even the respective Authorities were clear on using the same spectrum, however, the delays in inter-departmental co-ordination have prompted this demand by NCRTC, especially considering the deadline to launch their services.

NCRTC Reply 1 & 2:

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

There are no inter-departmental coordination issues or delays. The 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for Railway applications associated with passenger safety and for projects of national importance.

3. Notwithstanding the urgency of NCRTC, it is pertinent to remember that spectrum allocation and subsequent network developments are not ad-hoc arrangements and need to be done with a long-term plan and objectives. Consequently, the Authority should encourage the DoT to resolve the issue between the entities instead of fragmenting this commercially important spectrum to meet such demands.

NCRTC Reply:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

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RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

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

RJIL Response:

1. We submit that one of the prime objectives of spectrum allocation is to ensure its optimum utilization. This makes it incumbent on the spectrum management Authorities to ensure that same spectrum is allocated to different entities, wherever technically feasible, in geographically separated areas and this practice is already been followed in allocation of spectrum to TSPs and other Government entities.

2. As the Government has already allocated 5 MHz of valuable spectrum in 700 MHz band to Indian Railways for Railway Radiocommunication Systems between Train and Trackside (RSTT) for exclusive use alongside the railways tracks, it is critical to optimally utilize this spectrum in the locations where Railways is not using the same.

3. Evidently, considering the length and breadth of Indian Railways, this spectrum will not be usable for commercial networks across the country. Therefore, it is important that this spectrum be used on for other Government captive and non-commercial use cases. Needless to add that once this spectrum has become unusable for commercial purposes across India, its optimum utilization can only be derived from parallel allocation to different entities in geographically separated areas and corridors. Further, even in geographically overlapping areas this same spectrum can be used by leveraging RAN sharing and other suitable options, as explained in subsequent response.

4. Therefore, same spectrum should be used for different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country as well as in geographically overlapping areas.

NCRTC Reply:

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

Separate 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for RRTS operations associated with passenger safety. NCRTC is of the view that the same spectrum can be allotted to other RRTS/Metro Rail entities.

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

RJIL Response:

1. Considering the diverse rail-based transport solutions being adopted in the country like Regional Rapid Transit System (RRTS), Metro, Monorail, Trams and other types of suburban railways, besides the behemoth of Indian Railways, it is inevitable that these

systems will overlap geographically, leading to the need for prior planning for efficient working of communication systems using same spectrum.

2. We submit Radio Access Network (RAN) sharing will be the most fruitful in such scenarios. As noted by the Authority, RAN sharing or Multi-Operator Core Network (MOCN), under the 3GPP Release 8 is widely used solution to optimize the spectrum resources and also to avoid interference.

3. Considering the current usage and capacity requirements for RSTT related activities, which have been so far met by using GSM technology over 1.6 MHz of spectrum in 900 MHz band. The 5 MHz spectrum in 700 MHz band using LTE technology would be sufficient to meet the requirements of all the parallel railway systems in a geographical location. The 3GPP implementation of MOCN would ensure full availability of this enhanced bandwidth to multiple networks without interference.

4. Although there is minimal possibility of capacity crunch, even this hypothetical scenario can be met by adding additional sector/cell in the section of potential interference. This will help optimal utilization of spectrum already allocated for Railways.

NCRTC Reply:

Separate 5 MHz (paired) spectrum in 700 MHz band has been considered most suitable for RRTS operations associated with passenger safety.

Indian Railways only used GSM-R for voice communication, hence the requirement of deploying Signalling System and Mission Critical Voice, Video and Data services on the network cannot be equated with bandwidth offered by GSM-R based systems.

It may be noted that during the TRAI consultation for allotment of spectrum to Indian Railways it was highlighted that 5 MHz spectrum is the bare minimum spectrum required for the proposed use cases of Railway Operations and the same is applicable for RRTS and Metro Rail Networks.

At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

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

a) Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?
b) Whether certain guidelines for coordination mechanism need to be issued or it should be left to the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN sharing? In case, guidelines need to be prescribed, kindly

suggest the points to be included in the guidelines.

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

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

RJIL Response:

The spectrum allocation to Railways and other Government entities or PSUs is being done on administrative level for societal purposes and consequently, they should not have an exclusive right to use the allotted spectrum. Further barring the increased efficiency for RSTT any other benefits, including commercial benefits are ruled out for the spectrum holders. In this context, our issue wise response is as below:

a) Inclusion of RAN sharing in terms and conditions: We submit that the RAN sharing should be mandatory for all spectrum allocated administratively to Government entities. The terms and conditions for allocation of spectrum should clearly prescribe that in case of overlapping usage, the entities will be required to share RAN on non- discriminatory basis.

b) Guideline for Coordination- We submit that the co-ordination should be left to mutual understanding between the entities, however, in case of unnecessary delay beyond 30 days by any party, the other party should be entitled to approach WPC-DoT for resolving the impasse.

c) Commercial arrangements: The cost-based commercial arrangements should be left to mutual understanding between the parties. In case of a disagreement, DoT should be the adjudicator.

d) Other Conditions: There is no need for extensive conditions considering the type of communication and networks between two RRT/Metro rail networks and the fact that these entities will be acquiring authorization under Unified License.

NCRTC Reply:

At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.

Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

Coordination mechanism and commercial arrangements maybe decided through Mutual Agreement. However, it is a policy matter, to be decided by Government of India.

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

RJIL Response:

We submit that all types of commercial/non-commercial, public/non-public communication services in the country should be offered only under the Unified License framework and the Authority as well as Government should refrain from creating layers of licenses/permission, as the same is counterproductive to Unification of License. Therefore, we submit that a new Chapter on 'Captive Wireless Networks for Train Signalling System' should be introduced under Unified License.

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

RJIL Response:

We submit that as this license will be used to provide communication services on a captive network on a non-commercial basis, all the operation and security conditions applicable for Unified License with access services authorization should be applicable. Further, owing to the non-commercial and essentially machine-based usage, the subscriber related provisions can be removed, all other requirements levies should be applicable.

NCRTC Reply 6 & 7:

NCRTC services are for captive use similar to that of Indian Railways. Hence same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable for NCRTC. No commercial business for telecommunications services will be done over NCRTC's captive LTE Network.

Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN License to DoT.

Q8. Would it be appropriate if the spectrum be allocated on the same analogy as Indian Railways, for the same reasons as argued by DoT? If not, what should be the spectrum charging mechanism for spectrum that will be assigned to NCRTC? Kindly provide detailed response with justification.

RJIL Response:

1. We reiterate that there is no need to allocate any additional spectrum. The DoT analogy of Indian Railways with NCRTC is accurate and should be considered in allocating same spectrum to NCRTC in its area of operation.
2. Further, we feel that as the commercial spectrum is being allocated to Government entities without any cost, it is imperative that the spectrum usage charges for this spectrum should be sufficient enough to compensate the exchequer for loss of revenue and appropriate formula should be derived for the same.

Q9. Whether the terms & conditions and spectrum charges that will be applicable for NCRTC, should be made applicable to the other RRTS/Metro rail networks that may come up in future? If no, what terms & conditions and spectrum charges should be made applicable for the other RRTS/Metro rail networks? Kindly justify your response.

RJIL Response:

1. We once again reiterate that there is no need to allocate any additional spectrum and the 5MHz spectrum already allocated to Indian Railways should be used to meet such requirements of other bodies. The requirements in geographically overlapping areas can be fulfilled by facilitating RAN sharing and spectrum sharing as mentioned in above responses.

2. With regards the charging mechanism, we submit that there should be a uniform formula-based charging designed in a manner to compensate Exchequer for loss of not-auctioning the spectrum.

NCRTC Reply 8 & 9:

Large infrastructure projects such as RRTS, which are built for the benefit of public, will not remain commercially viable if the cost of spectrum is also charged from the RRTS Infrastructure Manager. Unlike TSP's, NCRTC will not provide any commercial services on the LTE network. NCRTC will establish a captive LTE network. Hence the spectrum should be allotted free of cost to NCRTC RRTS project, in the same manner as is being adopted for Indian Railways.

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

Q10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

RJIL Response: None

NCRTC Reply: No comments

Counter comments on submission of Bharat Sanchar Nigam Limited (BSNL) on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

Issues for Consultation

Q.1 In which band, spectrum should be assigned to NCRTC for their LTE-R technology-based Train control system for RRTS rail corridors?

Q.2 How much spectrum in the spectrum band(s) suggested in response to Q1, should be assigned to NCRTC to meet its requirement for its RRTS LTE-R based network?

Q.3 Do you see any challenge, if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country? If yes, kindly provide details and possible solutions.

Q.4 In case more than one RRTS Metro/rail networks are to operate in overlapping geographical areas, will it be appropriate for RRTS Metro/rail networks to share the Radio Access Network (RAN) in the overlapping areas using Multi-Operator Core Network (MOCN)? Any other feasible mechanism for using same spectrum in overlapping areas may also be suggested with detailed explanation. Kindly justify your response.

Q.5 In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN),

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

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

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

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

BSNL Comments on Q1 to Q5:

1. Radio spectrum is a scarce natural resource. The demand for spectrum is derived from the demand for final goods and services that are produced using spectrum as an input. In the cellular industry there are millions of subscribers and high usage of voice, video and data results in constantly increasing demand for additional spectrum.

2. As far as the matter of development of the global standards for RSTT application and harmonization of the spectrum for Railways is concern, the Consultation Paper has brought out the fact, as:

Standards are still evolving and international or regional organizations, such as the 3rd Generation Partnership Project (3GPP), the International Union of Railways (UIC), the European Telecommunications Standards Institute (ETSI), the European Union Agency for Railways (ERA), etc., are developing specifications for technologies and new functions to evolve RSTT. The work on draft new Recommendation ITU-R M. [RSTT_FRQ] was not concluded in the WRC study cycle 2015-2019 and same is likely to be completed by 2023. Following aspects are yet to be studied:-

i. *What are the current and future technologies to maximize efficient and flexible use of spectrum to be used by RSTT?*
ii. *What are the capabilities of the applications of the four RSTT categories (Train radio, Train positioning information, Train remote and Train surveillance) in specific frequency bands?*
iii. *What are the possible solutions and implementation for global/ regional harmonization of frequency bands for RSTT focused on bands already allocated to the Mobile Service on a primary basis?*

3. Considering the reference from the Annexure 2.1 of TRAI Consultation Paper, it is clear that harmonization of the bands for Railway signaling and safety applications is still in progress. This implies that allocation of spectrum for the RSTT application should be adopted based on the international/ regional harmonization that will provide better visibility and ecosystem for deployment of such applications.

NCRTC Reply to 1, 2 & 3:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in

quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

4. As part of the National Frequency Allocation Plan (NFAP), 2018, as part of India Footnote IND 16, various bands including **700 MHz band have been identified for primary usage for IMT services**.
5. TRAI in its recommendations on *"Auction of spectrum in frequency bands identified for IMT/5G"* dated 11th April, 2022 has recognized that:

   India has adopted FDD configuration-based Band 28 or APT 700 band for 700 MHz spectrum. ***700 MHz spectrum band is also emerging as a prime coverage band for 5G.*** *Corresponding 5G band defined by 3GPP is n28, which uses the similar frequency arrangement as that of Band 28.*

NCRTC Reply for 4 & 5:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

6. -

7. Subsequent to the allocation of 10 MHz spectrum for government usage and 5 MHz (Paired) to Railways, the availability of the spectrum in **700 MHz band has already been reduced to 30 MHz for allocation to the TSPs** out of total available spectrum of 45 MHz in the band 28.
8. The key frequency bands to priorities for 5G are the 3.5 GHz range, 700 MHz and mm Wave. **700 MHz is much more widely harmonized for IMT services and there is substantial 4G deployment by a number of countries.**

9. As such, 700 MHz is crucial for coverage and penetration of mobile services both in the urban and rural areas. The lesser inventory of access spectrum availability in 700 MHz band will result in fewer option for TSP to deploy the services at quickest possible time and same will adversely impact the strategic objective and vision of the National Digital Communication Policy (NDCP), 2018 as such Broadband for all, connecting the unconnected areas and ensuring adequate spectrum for telecom services.

NCRTC Reply for 7, 8 & 9:

Rail based transport systems are climate-smart and efficient way to move people. Railways promote economic growth while cutting greenhouse gas emissions. The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

Such Rail base projects like RRTS are essential infrastructure projects needed for the growth and development of the Nation. The advantages of these projects outweigh the cost of spectrum and should not be quantified in monetary terms.

Further, since NCRTC services are for captive use only for operation of train services, our project should not be equated with other commercial entities such as Telecom Service Providers which provide commercial services on their networks.
The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications. Hence, NCRTC also requires 5 MHz (Paired) spectrum in 700 MHz band for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

10. Allocation of spectrum to the TSPs is through auction process or auction determined price. The investment made by the TSPs are substantial in acquiring the spectrum to rollout the services to the users. The bands in which services are launched are generally having adequate ecosystem and it is therefore important that the investment made by the TSPs are protected with availability of purposeful spectrum.

NCRTC Reply for 10:

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.
For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.
Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

11. Efficient utilization of radio resource is an important and prime aspect. The allocation of 5 MHz (Paired) spectrum to Indian Railways should cater to the requirement of NTRCT as well. Following are the arguments in support of the utilization of spectrum allocated to Indian Railways in co-existence with NCRTC:

a. Assigned spectrum will be utilized more efficiently at all across the country.
b. Based on the feasibility study on co-existence of the two separate LTE networks, the recommendations of Center of Excellence in Wireless Technology (CEWiT), IIT Madras and IIT Hyderabad are very thought-provoking and clear regarding the issue. As per the recommendations **co-existence of two separate LTE networks of IR and NCRTC is possible in the same frequency band by applying the interference mitigation methods**. In the study report it has been outlined that in majority of operation places 5 MHz spectrum can be utilized entirely by the each entity and at certain locations with minimal mutual coordination during network planning stage the issue of likely interference can be mitigated.
c. As per the Consultation Paper, it has been mentioned that there is no such demand from the organisations involved in **Metro Rail operations**. In such a scenario, it can be assumed that requirement of Metro operations are already been fulfilled with the exiting assignments through CMRTS licenses. It is a matter of fact that Metro Rail is already in place for the last many years in most of the Tier –I cities. Further expansion is happening in these cities and work is in progress in many of the Tier –II cities as well.
d. Assigning another 5 MHz in 700 MHz band to NCRTC will lead to loss of valuable spectrum by the TSPs for telecom operations. As such, unless and until the spectrum harmonization and standardization process is finalized, the decision on further assignment of spectrum to Railway operations (including RRTS, Metro Rail, Bullet Train etc.) should be kept on hold. India will be benefited with the spectrum assignments only when the harmonization is

concluded by the international bodies.

e. Even if another block of 5 MHz in 700 MHz band is assigned to NCRTC and considering the futuristic requirement from Metro Rail networks, the requirement of interference mitigation will still persist as since there may be possibility of existence ofIndian Railway, RRTS and Metro Network at the same place. Therefore, it will be prudent to evolve the network in such a way that spectrum assigned to IR is utilized in co-existence manner.

NCRTC Reply to 11:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.

Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

12. The idea to share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN) is very much feasible and should be adopted for implementation in coordination with IR and NCRTC.

NCRTC Reply for 12:
At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

13. In order to cater the long term requirement of spectrum the **Railways, RRTS, Metro Rails and other such entities, Railway Ministry and Ministry of Housing and Urban Affairs (MoHUA) may set up a Special Purpose Vehicle (SPV) acting as an umbrella to provide the Network-as-a-service (NaaS) to these organizations**. The SPV will ease the planning, coordination and implementation of the projects based on therequirements.

NCRTC Reply for 13: This is a policy matter to be decided by Govt. of India. Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

14. The spectrum assigned to Indian Railways for RSTT can be efficiently utilized by RRTS and other relevant entities with the broad guidelines of DoT/ Govt. Further, detailed planning and implementation should be left to the mutual coordination between the organizations.

15. NCRTC has submitted the calculations which indicates the spectrum requirement of around 3 MHz. TRAI Consultation Paper has indicated that due to migration of PMRTS services from Analog to Digital, some of the carriers in 800 MHz band (band pertaining to PMRTS/ CMRTS) will be vacated. BSNL is of the view that since the business of PMRTS is unlikely to expand and as such frequency allocation to NCRTC, if required, should be considered in the likely to be vacated spectrum of PMRTS. This will lead to win-win situation for all.

NCRTC Reply for 14 & 15:

The NCRTC Spectrum requirement calculations have already been shared with DoT, which are the similar to Indian Railway requirement, being the same use case. The requirement is 5 MHz (Paired) to support the mission critical use cases of RRTS.

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

16. For the long term perspective, the spectrum allocation in 600 MHz which has almost 40 MHz (paired) spectrum or similar allocation in 440-470 MHz band can be considered or outcome of the harmonization activities may be seen for any further action.

NCRTC Reply for 16:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications. Hence, NCRTC also requires 5 MHz (Paired) spectrum in 700 MHz band for mission critical applications.

Counter comments on submission of Bharti Airtel Limited on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

Preamble:

At the outset, we place our sincere thanks to TRAI for providing us an opportunity to submit our response to this Consultation paper. We hope that TRAI will consider our submissions favourably.

We believe this paper is crucial, not just for spectrum needs of NCRTC or other such commercial PSUs or Government agencies who as new users are increasingly seeking commercial IMT bands -the bands which have huge bearing on the larger public good - but also for TSPs since such demands is putting immense pressure on the entire mobile ecosystem, TSPs/ mobile networks' present and future spectrum needs.

Low-band spectrum below 1 GHz, is the cornerstone of digital equality and a driver of broad and affordable connectivity. It is a crucial national asset that can build bridges towards digital inclusion and ensure the impact of mobile's economic and social benefits are available to all communities.

Hence, it will be a defining paper in the sense whether the TRAI and DoT should continue to keep reducing the available 700MHz thus impacting the India's digital growth story and deployment for rural broadband, OR leverage this as opportunity to come out with a long term roadmap for spectrum needs of such users of railways segment, albeit in alternate and non IMT bands and thereby mitigating the negative impact onpublic good.

NCRTC Reply: NCRTC requires 5 MHz (Paired) spectrum in 700 MHz band for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Summary:

A. Full availability of 700MHz is critical for inclusion and India's digital ambition

It is well known that 700 MHz band globally harmonized and identified for deployment of IMT applications in the telecommunication services by various countries. The key advantages of this band include wider coverage area and higher penetration inside buildings. The low-band capacity will be at the core of ensuring that 5G is available to everyone. More spectrum in this range is vital to giving rural communities equitable access to 5G services available in urban areas and pushing towards digital inclusion goals and helping to unlock new use cases for all. At the same time, low-bands can help improve the quality of enhanced mobile broadband coverage for hard-to-reach

places, such as deep indoors or narrow alleys.

As a matter of fact, in India, out of 45 MHz (paired) of 700 MHz band, 10 MHz (paired) has already been assigned to MoD and 5 MHz (paired) to Indian Railways. **This has already reduced the availability in full band by 33%, thus making** remaining 30 MHz already grossly inadequate for TSPs. It would not be appropriate to fragment the band any further by giving away another 5 MHz to RRTS, **which would reduce the availability further by 16.67% from 30MHz or, on overall basis (45MHz) would have reduced availability by 44%.**

This is grossly inadequate considering the current number of operators and new operators that may enter the industry in future. Such scarcity would have a direct impact on the provision of services and realization of goals of NDCP viz. providing broadband to all and ensuring connectivity to all uncovered areas.
Hence, we are of the view that new Spectrum in 700 MHz band should not be allocated to NCRTC and rather, as earlier recommended by TRAI, the Indian Railways should share the spectrum allocated to it with NCRTC.

B. Railways segment's spectrum needs a new, clear roadmap than disruption in MNOs' spectrum needs: Railways should share existing 700MHz with NCRTC else find a new non-IMT band:

Spectrum, a public good, is an extremely powerful engine of socio-economic growth, therefore, it is important to have a clear roadmap for both short and long term including quantum of Spectrum and timelines for availability of the bands.

For all Spectrum needs in India, the NFAP-2018 provides a broad roadmap showing spectrum earmarked for various users and technologies. However, given the surge in demand from government / PSUs like Indian Railways, NCRTC etc., there is a need to assess their demands independently and define a clear roadmap to cater to their ongoing and future demands, while ensuring no risk to Mobile networks/TSPs spectrum needs. It becomes crucial since earlier the demand came from Indian Railways (IR), now from NCRTC and in future other demands may also come from other similar or new category of such users. It is thus important to have a clear roadmap for the understanding of all stakeholders as to what bands are made available for their non-commercial usage.

We appreciate and strongly support the Authority's concern noted in the present Consultation Paper, i.e.:

"As per the 3GPP band plan 828 adopted by India for 700 MHz band, 45 MHz (paired) spectrum can be utilized in this band. However, 10 MHz (paired) spectrum has been earmarked for government use and 5 MHz (paired) spectrum has been assigned to Indian Railways for LTE-based public safety and security services (train signalling system for safety and security) across the railway track. Therefore, 30 MHz (paired} spectrum is available for commercial purpose in each of the 22 LSAs in this band. In case 5 MHz (paired) spectrum is earmarked for NCRTC and other RRTS/metro tail networks pan India, only 25 MHz

(paired) spectrum will be left for commercial use. One view could be that since 700 MHz band is a prime coverage band for 5G, the remaining spectrum may not be enough for the TSPs for commercial purpose."

It is critical to carefully consider the options of spectrum assignment to various Railways entities without undermining or risking spectrum needs of TSPs/ Mobile networks.

In case of RRTS, it is amply clear that the spectrum already allocated to Indian Railways can cater to the needs of RRTS as well. TRAI after careful evaluation while recommending 5 MHz in 700 MHz band to IR, had clearly stated that this may be given to other entities in other areas. The relevant extract of TRAI recommendation is given below:

"...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...,,

It is evident that the demand from NCRTC was also for the same spectrum based on TRAI recommendations. The Authority in the Paper also notes that on the advice of the Railway Board, the NCRTC engaged a group of eminent experts to conduct a feasibility study for co-existence of two separate LTE networks of NCRTC and IR in the same band. Worthwhile that this was the same expert group which was engaged by Indian Railways to study the feasibility of use of LTE technology on IR. The expert group has given technical clearance for the sharing and co-existence of both the systems in the same frequency band without any interference. Relevant extracts from the report is given below:

After conducting the study, this project report was prepared for NCRTC. jointly by CEVVIT, IITM and IITH. The study has taken the expert opinion while evaluating the feasibility of co-existence of two separate L TE networks of NCRTC and IR using the same spectrum. The report was prepared based on general understanding of the experts in the subject matter. Nevertheless. when the deployment is done after careful planning, the Interference from the NCRTC network to IR network and vice-versa can be minimized/negligible to a considerable extent. Suitable deployment strategies to handle the interference caused in either networks are suggested in this report.

The study concludes that both NCRTC and IR can use the same entire 5 MHz bandwidth for their critical operations in majority of the places without affecting the IR network, even with no coordination with IR. by employing the techniques which have been detailed in the report. However. minimal coordination during the network planned stages in certain locations NCRTC can benefit both. thus, enabling the use of the entire bandwidth in all places. Even in the highly unlikely scenario of having any interference, other scheduling methods, transmit beam forming along with signal processing at the receiver using multiple antennas etc. are available to solve the problem. The ETCS operation can be performed with high reliability along with MCPTT and also CCTV surveillance data transfer **can be done in majority of the corridor. The study also concludes that the required throughput for these ETCS operations can be**

very well provided using the spectrum allotted for the purpose by employing the strategies mentioned in the report.

In view of the findings and conclusion of the experts in the above report, **we do not believe** there is need to give any separate additional spectrum to NCRTC, more so since co-existence between IR & NCRTC is possible.

While we strongly recommend that the Government allocates the same spots as given to IR in the 700MHz to NCRTC as well, **if at all any additional spectrum is required to be given to NCRTC, then it should be done in other bands.**

Since spectrum requirement for signalling purpose in Rail Networks is of the nature of low bandwidth, high coverage and spectrum in sub-1 GHz bands will meet the requirement, there are various bands available through which these requirements could be met. There are various **other bands available for use by Indian Railways, NCRTC and any other rail agency** (i.e. 150, 300, 400 MHz) and should be considered in first instance in order to avoid undue costs, technical complexities and missed economic opportunities.
Several countries such as **Japan have allocated <u>400 MHz band</u>** for RSTI since the 1960s. Japan has been experimenting with the 44 GHz band and have launched a system to be deployed in this band for RSTI maintenance services (using voice and data).

China has also deployed its RSTI system **<u>in 450 MHz</u>** band over its 80000Kms lines and proposed evolution of FDD LTE based RSTI system currently tested in this band.

In **Australia, Telstra has been supplying railway communications** to the Australia Rail Track Corporation using its 850 MHz spectrum and has plans to upgrade to 4G using its 700 MHz network.

Similarly, NCRTC can be allocated the 450-470 MHz for deployment of LTE based RSTI. This would help mitigate the complexities of interference planning between public mobile networks and RSTI applications.

C. **How does this natural resource serve public good better? By pricing it unsustainably high for TSPs who are keen to acquire in auctions and deploy it, OR, proposed to be given without any cost to Railways:**

There has been a view, also captured in TRAI paper that the 700MHz band remained unsold in the previous auction, could be a case for giving it to IR/ RSTI needs.

However, that is a simplistic argument and does not go at the root of the issue. **Who can better deploy this precious natural resource of 700Mhz band for larger public good?** The TSPs-who are ready to buy it in auction provided the exorbitant pricing of the band is drastically reduced, OR the Railways/NCRTC who need it just for the signalling purpose and been given free of cost?

The trade-off between significantly enhanced broadband coverage at lesser cost due to 700 MHz band's inherent propagation quality, improved quality of service and experience, thus wider digital inclusion; and; giving such a band for restrictive signalling (which is also critical) application for captive use - should not be tough choice to make, especially when for latter, alternate options exist (see previous section B).

It is submitted that availability of 'adequate spectrum' at the 'right price' is central to the growth of the telecom sector. Right price means that prices should be at a level that should ensure the financial sustainability of the mobile industry and affordability of the services. The. Pricing of 700 MHz for TSPs has been extremely high till date, and which is fundamentally different to the financial T&Cs of the same spectrum given to IR. Hence the argument that 700MHz has remained unsold, thus could be given to IR/NCRTC for free, does not hold water. If TSPs were to get 700MHz on same or competitively similar financial terms as given to IR, a good likelihood that spectrum in crucial 700MHz band would see uptake.

In-fact, in our response to TRAI's consultation paper on SG/IMT spectrum, we had submitted the following w.r.t 700MHz band, precisely understanding importance of this band for rural broadband expansion:

"...Considering this, the Government should consider a/locating the spectrum in the 700MHz band to TSPs at a cost which may only allow it to recover administrative costs (or nominal costs) via auction. The same should be tied up with role/out obligations, especially for rural towns and villages. At least 30-40MHz of sub-GHz spectrum per operator would be required for any meaningful SG service..."

In view of the above, we recommend that no further spectrum from 700 MHz band which has long been identified for IMT in India, has globally developed IMT ecosystem, but whose supply in India has already been reduced by 33% - should be given to NCRTC.
With the above context, we now provide our Questions wise response.

NCRTC Reply for a, b & c: It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public

transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.
Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

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

2. How much spectrum in the spectrum band(s) suggested in response to Ql, should be assigned to NCRTC to meet its requirement for its RRTS LTE-R based

Airtel Response: We recommend that the Government allocates the same spots as already given to Indian Railways in the 700MHz, to NCRTC as well. Given IR and RRTS have similar application, we suggest to have common network for these two systems. This would have two benefits:

- complete re-use of spectrum & infrastructure.
- devices used would also be common between these two networks, helping build economies of

scale.

Regarding block size, since the demand of NCRTC is of 5 MHz, the same should be allocated to them. Also since 5MHz has been found to be sufficient for IR application, and the same spectrum (same spots) can easily be used by NCRTC. At any point of time, there would be only one of the train systems generating traffic on the tracks - hence 5 MHz would be effectively used between RRTS & IR application. In fact, infrastructure deployed by NCRTC can be used by IR and vice versa.

However, for any reasons, and if at all any additional spectrum is required to be given to NCRTC, then it should be done in other bands.

There are various sub-GHz options available through which NCRTC/ IR's requirements of low bandwidth and high coverage could be met. Such **bands available for use by Indian Railways, NCRTC and any other rail agency** are 150MHz, 300MHz, 400 MHz, and should be considered in first instance in order to avoid undue costs, technical complexities and missed economic opportunities.

Several countries such as **Japan have allocated 400 MHz band** for RSTI since the 1960s. Japan has been experimenting with the 44 GHz band and they have launched a system to be deployed in this band for RSTI maintenance services (using voice and data).

China has also deployed its RSTT system in 450 MHz band over its 80000Kms lines and proposed evolution of FOO LTE based RSTI system currently tested in this band.

In Australia, Telstra has been supplying railway communications to the Australia Rail Track Corporation using its 850 MHz spectrum and has plans to upgrade to 4G using its 700 MHz network.

Thus, in case the stalemate continues between the two railways agencies, and a separate block of spectrum is to be assigned to NCRTC, then it should be allocated in the 450-470 MHz. This would help mitigate the complexities of interference planning between public mobile networks and RSTI applications.

We re-iterate that given the importance of 700 MHz band for rural coverage of broadband, we not in favour of any further allocation of spectrum to NCRTC in this band.

NCRTC Reply 1 and 2:

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

As per Metro Railways (Operation and Maintenance) Act 2002, "*Central Government", in relation to technical planning and safety of metro railways, means the Ministry of the Government of*

India dealing with Railways;". Further 'In principle approval of Broad Technologies for Regional Rapid Transit System (RRTS)' was approved by Railway Board for using 700 MHz (LTE) band for communication backbone. To honour the project deadlines, set by the Government of India, all the planning, designing and procurement of equipment has been done according to 700 MHz.

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.
For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

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

Airtel Response: No.

We do not see any such challenge if the same 700MHz spectrum (and spots) given to IR is shared with NCRTC/RRTS/metro rail networks. In-fact, this has been corroborated by the report enclosed in TRAI's extant consultation, given by a group of eminent experts that states that co-existence is possible between IR & NCRTC in the 5 MHz block already assigned to IR. The first preference should be to efficiently utilize this block and the same should be shared by IR with the NCRTC.

We see no reasons why IR would not like to share the same spectrum with NCRTC in non - overlapping areas. As regards very limited areas of operations where IR and NCRTC tracks may overlap, thus risk of interference, both the agencies can, and should deploy appropriate filters and tools to mitigate such risks. In-fact it is a natural expectation that users ensure co-existence, which, rather simply should be much easier to coordinate given both agencies operate under same ministry.

Again, the experts in their report have mentioned that for assignment of same spectrum to

different RRTS/metro rail networks, which are operating in geographically separated manner such that, there is no interference, it can be easily done without any complications.

The same spectrum can easily be assigned to RRTS/ Metro which has been assigned to Indian Railways, if the geographical area of new RRTS/metro rail network is different and away from Indian Railways rail network.

The report also mentions that in case more than one RRTS Metro/rail networks are to operate on same spectrum frequencies in overlapping geographical area, the RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area, which is known as Multi-Operator Core Network (MOCN). The Authority has already noted the point and the same has already been implemented in South Korea.

Here, we suggest single network (including PLMN and infrastructure) to be deployed using already allocated 5MHz of spectrum in 700 band. Spectrum allocated to IR can be used by NCRTC to build the sites around their corridors and the same network, spectrum, PLMN can be used by IR in future. Correspondingly, if IR deploys wider network (beyond RRTS corridor), the same can be used for expansion of RRTS. Single network can be deployed by Railtel along-with leveraging active & passive infra of existing cellular operators as well.

Since options are available for all scenarios, the endeavour of the Government, in light of efficient utilization of spectrum, should be to assign same spots to all such users. Suitable terms and conditions should be defined so that the users are aware of these scenarios right from the beginning and are able to design their networks/ solutions accordingly.

NCRTC Reply:
Yes, we also agree with the outcome of the report and is in line with the NCRTC comments. The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.
Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

NCRTC is being planned as a separate network and cannot have the same PLMN ID or Infrastructure with Indian Railway Network. Since the UE's of both networks have to latch onto their respective networks the PLMN ID have to be different.

4. In case more than one RRTS Metro/rail networks are to operate in overlapping geographical areas, will it be appropriate for RRTS Metro/rail networks to share the Radio Access Network (RAN) in the overlapping areas using Multi-Operator Core Network (MOCN)?

Airtel Response: Yes. As suggested previously, a single network should be build using 5MHz of 700MHz band spectrum. Devices from both of the network - RRTS and IR can use the same PLMN. Their application servers or APN can be different, which would help routing the traffic

from the single core network towards application servers of RRTS and IR respectively.

NCRTC Reply: NCRTC is being planned as a separate network and cannot have the same PLMN ID or Infrastructure with Indian Railway Network. Since the UE's of both networks have to latch onto their respective networks the PLMN ID have to be different.

The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

5. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN), what should be the commercial terms

Airtel Response: Single network to be built for both RRTS and IR by agency say Railtel. It should provide subscriptions to both of these network users on per user or traffic from respective systems.

Alternatively, the TSPs can be allowed to build and offer the necessary network capabilities on mutually negotiated commercial terms.

NCRTC Reply: NCRTC is being planned as a separate network and cannot have the same PLMN ID or Infrastructure with Indian Railway Network. Since the UE's of both networks have to latch onto their respective networks the PLMN ID have to be different. Railway systems are safety critical applications, and any unauthorized access and manipulation can result in breach of safety of train operations. The QCI requirements for Railway applications are more stringent than normal public networks. Hence TSP's are not well suited to provide network services for Railway applications

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

AND

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

Airtel Response: Current licensing regime for spectrum allocated to IR in 700 MHz band should be applicable for the NCRTC as well. In case for serving the needs of LTE based RSTT, alternate suggested bands (as indicated in response to Q1 above) are to be assigned (e.g. 450-470MHz), the same T&Cs may be extended for those bands as well.

The license conditions of such licensees need to clearly state that the spectrum is to be used for the intended use and not for any commercial activity directly or indirectly. It is submitted that

the provision of Voice/ Internet services is part of the access licenses/authorization issued to TSPs/ISPs.

If any entity needs these or similar other commercial services, then that should be provided by the authorized licensees (TSPs/ISPs) similar to the provision of In-flight connectivity. The In-flight service providers use the Infrastructure of TSPs to provide the In-flight communication /Internet services. The same model may be replicated for Railways/ RRTS, etc. too in case the intention is to provide voice/ internet to the onboard passengers.

NCRTC Reply:

NCRTC services are for captive use similar to that of Indian Railways. Hence same policy as adopted for Indian Railways for permission/licensing regime for operation of wireless networks may be made applicable for NCRTC. No commercial business for telecommunications services will be done over NCRTC's captive LTE Network.

Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN License to DoT.

Railway systems are safety critical applications, and any unauthorized access and manipulation can result in breach of safety of train operations. The QCI requirements for Railway applications are more stringent than normal public networks. Hence TSP's are not well suited to provide network services for Railway applications.

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

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

Airtel Response: We agree that there must be some reasonable administrative usage recovery mechanism for making use of spectrum by Railway segment, even if for the captive signaling purposes, especially given that these entities are commercial enterprises, **thus have the mechanism to recover the cost of spectrum from their end-users.**

Giving spectrum free of charge and not recovering the cost of administering its allocation and management, will only make the use inefficient. To that extent we believe that IR/NCRTC or similar users should pay for spectrum allocation and fairly contribute towards exchequer.

NCRTC Reply: It is a policy matter, however for all similar captive networks like RRTS and

Metro Rail the same terms and conditions and spectrum charges as applicable to Indian Railways may be made applicable.

10. **Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.**

Airtel Response:

Provide clear spectrum roadmap for Railways and similar new users - Now evidently there is increasing demand of spectrum from Railways, NCRTC/RRTS which is likely to further accelerate from similar users like Metros, Highspeed rails. Hence it becomes critical that a proper demand estimation study is done by the Authority and DoT for such users for at-least needs of next decade, and appropriate new non-IMT bands are identified and allocated/assigned for such purposes. This will offer the following advantages:

- Long term planning for IR, NCRTC, other similar Railways entities
- Mitigate and de-risk the spectrum needs of mobile networks operators/TSPs
- Mitigate risk of exclusion of rural/semi-urban users from not having broadband coverage in critical sub- GHz/700MHz band
- Railways/ ROSO and OEMs can invest in R&D and plan ahead equipment in newer bands specifically identified for such users.
- Save huge time, efforts and costs in coordination, consultations on same or almost similar issue, thereby reducing complexity, ambiguity in entire process.

NCRTC Reply: It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of

India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.
Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

Annexure – 19

Counter comments on submission of Vodafone Idea Ltd on "Consultation Paper on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors"

1. **Spectrum Roadmap:** We believe that prior to assigning any spectrum to any entity, there is a critical need to define the long-term spectrum roadmap, for at least a period for 10 years. This roadmap will help the industry in gaining a better understanding of the availability of the spectrum and target its business plans, customer acquisition and future spectrum management activities in the most optimum way, including identification of potential new spectrum sharing opportunities as well.

NCRTC Reply to 1:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC Regional Rapid Transit System (RRTS) project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a RRTS has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

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The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

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benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.

Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

2. **Identification and Protection of IMT Bands:** Any such spectrum band which is identified as the IMT band, is contemplated at international forums through various global conferences, studies and agreements. The same then also is standardized with 3GPP. In our view, for cases like the instant one related to NCRTC, only non-IMT bands should be considered. **Thus, we submit that no further allocation should be made from the 700 MHz band, and it should be utilized only for IMT services.**

3. **Alternative bands/frequencies:** As 700 MHz band is a prime band for 5G services with wide retail device ecosystem supporting it, principally, it should not be utilized for any such purpose where retail device ecosystem is not required. While we do not support allocation of spectrum from IMT bands for any other purposes, however, even if it is to be done, same should be allocated from the bands which have lower retail device ecosystem (like 500 MHz). We strongly recommend again that NO spectrum from 700 MHz band should be given to NCRTC or any other Government entity for similar purposes, as this band has been identified for IMT in India and also has a good retail device ecosystem.

<u>NCRTC Reply to 2 & 3:</u>

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment

of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

Question-wise Comments

Q.1: In which band, spectrum should be assigned to NCRTC for their LTE-R technology based
Train control system for RRTS rail corridors?
And
Q2. How much spectrum in the spectrum band(s) suggested in response to Q1, should be
assigned to NCRTC to meet its requirement for its RRTS LTE-R based network?

VIL Comments to Q. No. 1 and 2

1. **Spectrum Roadmap:**

a. We believe that prior to assigning any spectrum to any entity, there is a critical need to define the long term spectrum roadmap, for at least a period for 10 years.

b. Even TRAI in its Recommendations on 'Auction of spectrum in frequency bands identified for IMT/5G dated April 11, 2022 has mentioned the need for spectrum roadmap stated as below:

c. *"Considering that there are certain additional bands which are already identified by ITU for IMT services and few additional bands are under consideration in WRC-23 for IMT identification, the Authority recommends that DoT should explore the possibility to make these bands available for IMT services at the earliest* ***and come out with a spectrum roadmap for opening up of new bands for IMT to meet the future demand. At least a 5-year roadmap on spectrum likely to be made available for IMT in each year and likely date/month of auction should be made public. Such a spectrum roadmap will provide certainty, enable the bidders to take informed decisions and may also encourage new entrants."***

d. This roadmap will help clarify quantum and timeline of spectrum availability, facilitating the TSPs to plan their investments in near to long term. The roadmap may also include details regarding the harmonization of future spectrum which will be beneficial in reduction of equipment costs and limiting the possibility of interference.

e. Hence, we request that before recommending allocation of the IMT spectrum bands for any non-IMT usage, there is an urgent and critical need to define the long-term spectrum roadmap, in consultation with the industry and other stakeholders.

NCRTC Reply to 1:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC RRTS project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a Regional Rapid Transit System (RRTS) has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional

network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

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In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.

2. 700 MHz prime band for IMT with good device ecosystem:

a. 700 MHz band is a prime band for 5G services and has a wide device ecosystem for support.
b. As mentioned earlier, in India, 700 MHz band has already been identified for IMT. Given the importance of this band, it has also been identified as one of the key bands for deployment of 5G in India by the 5G High Level Forum constituted by DoT.
c. Also, as stated by TRAI in this paper, as per the 3GPP band plan B28 adopted by India for 700 MHz band, 45 MHz (paired) spectrum can be utilized in this band. With 5 MHz (paired) spectrum being kept for NCRTC and other RRTS/metro rail networks pan India, only 25 MHz (paired) spectrum will be left for commercial use which will be insufficient in long term.

d. Besides, reduction in quantity of spectrum available in an auction or to be made available in future auctions is a key factor related to pricing and participation in the auction in same band as well as other bands.
e. Further, it is well established from international as well as domestic scenarios, TSP(s) have bought spectrum for 4G services, in same and different bands during multiple auctions (almost over a period of 10 years), for technology evolution and capacity augmentation. Hence, the certainty of availability of spectrum in prime bands should be assured to the TSPs over a longer time period.
f. Therefore, no spectrum should be assigned from 700 MHz to NCRTC.

3. Alternate Spectrum Bands:

a. **Non-IMT Band:** As mentioned in TRAI's previous Consultation paper on "Allotment of spectrum to Indian Railways for Public Safety and Security services" dated June 24, 2019, TRAI had mentioned that spectrum in 450-470 MHz band can be assigned to IR, which is not intended to be assigned to the TSPs. It was also mentioned that DoT had also viewed that spectrum in 450-470 MHz is available and has not been earmarked for IMT services. Also, some countries are using this band for Railway Radio communication. 20 MHz spectrum is available in this band, which could be made available for IR and being a lower frequency band, this can also meet the coverage requirement of IR. Hence, the same can be executed in the case of NCRTC as their services will not be utilized for retail device ecosystem.
b. While we do not support allocation of spectrum from IMT bands for any other purposes, however, even if it is to be done, same should be allocated from the bands which have lower retail device ecosystem (like 500 MHz).

<u>NCRTC Reply to 2 and 3:</u>

The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network. Based on this Indian Railways has been allocated 5 MHz (paired) spectrum in 700 MHz band for similar mission critical railway applications.

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

The RRTS project is in advance stage of commissioning and the Signalling and Telecommunication including LTE equipment have been installed with temporary spectrum allotted by DoT for Sahibabad to Duhai stretch (17 Km) only. Therefore, there is urgent

requirement of permanent 5 MHz (paired) spectrum in 700 MHz band for subsequent sections.

To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.
For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

4. We would like to submit that the maximum spectrum allocated for the purpose shall not exceed 5 MHz and shall be shared across all RRTS. Assignment of 5 MHz of <1 GHz spectrum at the current reserve price will cost the exchequer in excess of INR 4000 Cr as per current reserved price for 5 MHz block. So, the assignment of spectrum shall be kept to minimum extent possible, and assignment shall happen from the non-IMT band to further minimize the impact.

NCRTC Reply to 4:
We agree that bare minimum 5 MHz (paired) spectrum is required for RRTS Operations.

Rail based transport systems are climate-smart and efficient way to move people. Railways promote economic growth while cutting greenhouse gas emissions. The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

Such Rail base projects like RRTS are essential infrastructure projects needed for the growth and development of the Nation. The advantages of these projects outweigh the cost of spectrum and should not be quantified in monetary terms.

Further, since NCRTC services are for captive use only for operation of train services, our project should not be equated with other commercial entities such as Telecom Service Providers which provide commercial services on their networks.

5. Considering all above, we recommend that no spectrum shall be assigned from 700 MHz to NCRTC. Alternatively, non-IMT bands should be looked into. If that is also not possible, then such band/frequencies where retail device ecosystem is not available (like 500 MHz) should be utilized for such purposes.

NCRTC Reply 5:

We do not agree with the observations made above that no spectrum should be assigned in 700 MHz to NCRTC. The issue of allotment of frequency Band for Railway Applications and availability of device ecosystem was discussed during meetings and representations for Consultation for Allotment of Spectrum to Indian Railways and it was concluded at highest level in Government of India that 700 MHz band is optimum for establishing Mission Critical LTE Network.

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

For RRTS/Metro projects telecommunications equipment requirements are limited in quantity as such to maintain the proper supply chain, matured ecosystem is required. The vital and proven telecommunication equipment, required for safe train operations are readily available in 700 MHz band which was considered at the time of allotment of spectrum to Indian Railways.

Rail based projects like RRTS are capital intensive, having a long gestation period and it is important for Metro/Regional rail system to be financially sustainable. Hence to contain the cost, the spectrum proposed should be such where sufficient ecosystem is available in order to help financial sustainability.

Even in US (FirstNet) and South Korea (LTE-R), 10 MHz (Paired) spectrum in 700MHz band has been allotted for mission critical services.

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

VIL Comments to Q. No. 3

1. As mentioned in this Consultation Paper, NCRTC had engaged a group of eminent experts to conduct a "Study of feasibility or co-existence of two separate LTE networks of NCRTC and IR in the same spectrum without impacting ETCS and mission critical services". NCRTC itself had mentioned that the expert group has given technical clearance for the sharing and co-existence of both the systems in the same frequency band without any interference.

2. Also, we do not foresee any challenge if the same spectrum is assigned to different RRTS/metro rail networks, operating in geographically separated areas/corridors in the country.
3. Hence, NCRTC shall be assigned the same spectrum band for RRTS rail corridors.

NCRTC Reply:
Yes, we also agree with the outcome of the report and is in line with the NCRTC comments. The issue of sharing of spectrum with Indian Railway, has been deliberated at highest level at Government of India, wherein it has been decided to allocate new spectrum of 5 MHz (paired) in 700 MHz band to NCRTC / Metro Rail Network.

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

Comments to Q. No. 4
1. Multiple RAN Sharing technologies does exist and already in use globally where network is setup by one operator and is same is shared securely by other operator in the area of overlap. This will help mitigate the interference issues if both the parties deploy their independent network on the same spectrum assets.
2. MOCN functionality that allows a network operator to provide access to a single radio access network by other operators. Each operator operates its own core network, including one or more independent nodes. Such technologies are tried and validated globally. Some of the examples of such mechanisms are Multi-Operator Core Network (MOCN), Multi-Operator RAN Sharing (MORAN), ICR, etc.
3. We recommend using MOCN, MORAN or other mechanisms highlighted above in the areas of overlap.

NCRTC Reply:
At present there is no RAN sharing using MOCN for commercial public networks and Mission Critical Networks such as Railways in India. MOCN technology for RAN sharing for mission critical applications can be explored at later stage.
Information is available in public domain regarding MOCN technology being used in South Korea for Mission Critical Railway application. References to this technology is available in the TRAI recommendation dated 25.10.2019 and current consultation paper.

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

a) **Whether it should be included in the terms and conditions for assignment of spectrum that the assigned spectrum may have to be shared with other RRTS/Metro rail networks to whom government decides to assign the same spectrum frequencies on sharing basis?**
b) **Whether certain guidelines for coordination mechanism need to be issued or it should be left to the mutual agreement between the RRTS/Metro rail network operators mandated for MOCN RAN sharing? In case, guidelines need to be prescribed, kindly suggest the points to be included in the guidelines.**
c) **Whether commercial arrangements between two RRTS/Metro rail networks for RAN sharing needs to be regulated or left to the mutual arrangement?**
d) **Whether any other conditions need to be prescribed for such RAN sharing? Kindly provide detailed justifications.**

VIL Comments to Q. No. 5

1. In case it is decided that RRTS Metro/rail networks may share the Radio Access Network (RAN) in the overlapping area using Multi-Operator Core Network (MOCN), interventions/regulations as is applicable in the case of other Licensees shall be adhered to. Also, existing flexibility shall be maintained as in the case of other Licensees to follow a common approach, based on terms and conditions of license agreement.
2. Sharing of spectrum/Radio Network should be made mandatory for these licensees in case of overlap region, in the terms and conditions of the assignments, in order to prevent any issues in future.

NCRTC Reply to 5:

Allotment of spectrum is a policy matter to be decided by Govt. of India. Coordination mechanism and Commercial arrangement may be decided through Mutual Agreement. In case of disagreement, MoHUA (Nodal Ministry for RRTS & Metro Rail) may govern the terms and conditions of RAN sharing between RRTS & Metro Rail.

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

And

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

And

Q8. Would it be appropriate if the spectrum be allocated on the same analogy as Indian Railways, for the same reasons as argued by DoT? If not, what should be the spectrum charging mechanism for spectrum that will be assigned to NCRTC? Kindly provide detailed response with justification.

VIL Comments to Q. No. 6, 7 and 8

1. Any spectrum allotted to such entities should adhere to the guidelines of UL (Access Authorization) and spectrum allocation scope shall be restricted.
2. In case the spectrum is allotted to NCRTC, they should be mandated to use it as a closed network with no connectivity to public networks for data, SMS or voice. Also, they should be mandated to ensure that no such services are extended to their consumers or employees as well.

NCRTC Reply to 6, 7 & 8:

NCRTC services are for captive use similar to that of Indian Railways. Hence same terms and conditions as adopted for Indian Railways for permission/licensing of captive wireless networks may be made applicable for NCRTC. Moreover, it is a policy matter to be decided by Govt. of India.

Vide DoT Letter No. 20-1333/2022-AS-I dated 27.06.2022, the policy for Captive Non-Public Network was circulated. It is understood that for establishing captive LTE networks the CNPN licensing regime will be followed. NCRTC has already gone ahead with submitting its application for UL CNPN License to DoT.

Q9. Whether the terms & conditions and spectrum charges that will be applicable for NCRTC, should be made applicable to the other RRTS/Metro rail networks that may come up in future? If no, what terms & conditions and spectrum charges should be made applicable for the other RRTS/Metro rail networks? Kindly justify your response.

VIL Comments to Q. No. 9

1. The terms & conditions that will be applicable for NCRTC, should definitely be made applicable to the other RRTS/Metro rail networks that may come up in future so that a common approach is followed between all the stakeholders. Further, the industry should be consulted before finalization of such terms & conditions.
2. Also, such terms and conditions shall be part of the spectrum roadmap to avoid any kind of ambiguities in the future.

NCRTC Reply:

It is a policy matter, however for all similar captive networks like RRTS and Metro Rail the same terms and conditions and spectrum charges as applicable to Indian Railways may be made applicable.

Q10. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

VIL Comments to Q. No. 10:

As explained in comments to Question no. 1 above, a predictable Spectrum Roadmap is urgently required and should be created for future assignments of spectrum especially in IMT

bands. This should be done in consultation with industry players to ensure fair and reasonable policies, providing long term certainty on available spectrum.

NCRTC Reply:

It is understood that spectrum is a valuable resource, and a long-term spectrum roadmap is essential. It may also please be noted that NCRTC RRTS project is also an essential infrastructure project needed for the growth and development of the Nation.

The requirement of better regional connectivity in the form of a Regional Rapid Transit System (RRTS) has been long identified as one of the most critical interventions required to achieve balanced and harmonized development of the National Capital Region of India (NCR).

RRTS is a first-of-its-kind, rail-based, high-speed, high-frequency regional transit system with design speed of 180 kmph and an average speed of 100 kmph (more than 3 times of metro rail). Being implemented for the first time in India, RRTS, once operational, will be the fastest, most comfortable, and safest mode of commuter transport in NCR.

The objective of the project is to address urgent issues of hazardous pollution and severe congestion in NCR including National Capital Territory of Delhi by incentivizing modal shift to public transport through high-speed, high frequency, comfortable, reliable and safe public transport alternative. Besides the timesaving induced modal shift, such high-speed regional network will also lead to balanced and sustainable polycentric urban development, thereby improving the quality of life for citizens of the region.

The issue of the RRTS corridor implementation has been listed in the Hon'ble Supreme Court of India in the "Issue of comprehensive plan for air pollution control of Report no. 87 submitted by EPCA" in the Writ Petition(s) M.C. Mehta vs. Union of India and others on 18.01.2019 wherein Hon'ble Supreme Court has observed that "...there should be no delay on the part of the concerned authorities".

RRTS Project will improve quality of life for citizens of NCR, improve productivity of labour and industry in NCR. The project will result in balanced and sustainable regional development of NCR including Delhi. RRTS will also bring in significant economy-wide benefits such as indirect and induced employment and increase in GDP, thus catalysing economic activity in NCR.

In view of above, RRTS project should not be equated with other commercial entities such as Telecom Service Providers who provide commercial services on their networks. Capital intensive Rail based projects like RRTS, meant for national and socioeconomic growth, are generally not self-sustainable.

Further the RRTS project is in advance stage of commissioning and there is urgent requirement of spectrum. To utilize the spectrum, the technology selected should also be mature as there is no time for development, experimentation, and harmonization of spectrum at international forums. Availability of ecosystem of equipment in the allotted spectrum is an important criterion.

After considering all factors, Indian Railways having exactly same use case, have been allotted spectrum in 700 MHz band.

Insisting that such large infrastructure projects also pay for the spectrum will make such projects unsustainable. These large infrastructure projects have long life spans and not just an outlook of 10 years. Spectrum once allotted should meet the future demands of ever increasing data and the new technological advancements will enable NCRTC to cater to those demands utilizing the allotted spectrum in the future.