

Subject: **Railway's Counter comments over the Comments given by Various Stakeholders on TRAI Consultation paper on allotment of spectrum to Indian Railways for Public Safety and Security services** Date: 05/08/19 07:28 PM

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COUNTER COMMENTS By Indian Railways.pdf (671kB)

Summary of Railway Comments TRAI.pdf (789kB)

Dear Sir,

Please Find attached herewith the Counter Comments from Railways over the Comments given by various stakeholders on TRAI Consultation paper on allotment of spectrum to Indian Railways **for Public Safety and Security services. There are two files attached**

- 1. One Containing the Summary of Indian Railways' Counter Comments**
- 2. Second Containing the Individual Indian Railways' Counter Comments to the 12 stakeholders/entities that put their Comments on the referred Consultation Paper**

With Regards,

Dharmendra Singh
Jt. Director/Telecom
Railway Board
Ministry of Railways

भारतीय रेल राष्ट्र की जीवन रेखा...
INDIAN RAILWAYS Lifeline to the Nation...

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INDIAN RAILWAYS Lifeline to the Nation...

Summary of Counter Remarks of Ministry of Railways

Q. No.	Question	Counter Remarks of Ministry of Railways
1	Whether spectrum in 700 MHz band should be assigned to Indian Railways for RSTT in India? Please provide justification for your response.	<p>(i) The views of the stakeholders are not correct. 10 MHz in this band has already been allotted to Ministry of Defence.</p> <p>(ii) The requirement of railway is for safety, security of railway passengers, besides other applications such as train operations to improve speed and punctuality of the trains.</p> <p>(iii) Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Preferred frequency Bands to operate 5G technologies include: <u>Millimeter wave</u> bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive <u>MIMO</u> (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;” “Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds..</p> <p>(iv) Better Rural coverage is possible even in lower frequency bands like 600 MHz, 450-470 MHz while In-building solutions in urban areas having higher data throughput services will require High Frequency band in GHz instead of 700 MHz.</p> <p>(v) There has been consolidation of Mobile operators in India and their numbers have already come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz. This could be one of the reason due to which previous DOT’s auction for spectrum in 700 MHz frequency band did not receive any response.</p> <p>(vi) Social gains realized from improvement in safety and security of the passengers as well as faster train operations could be far more than the amount indicated by stakeholders.</p> <p>(vii) Allotment of 10 MHz spectrum in the 700 MHz band to Ministry of Defence was done in the national interest of the country.</p> <p>(viii) Hon’ble Prime Minister Of India and many reputed economists have time and again stressed that the Indian Railways (IR) have the potential to boost the Indian economy and GDP in a big way. However IR is currently facing a huge bottleneck in augmenting the train carrying capacity of the available infrastructure even in the face of increasing demand for both</p>

		<p>Passenger and freight traffic. Through the adoption of Modern Train Control system based on LTE, IR will not only be able to enhance Passenger Safety but will also be able to augment train carrying capacity of the available infrastructure due to increased speed and less fixed distance between the trains(both possible only through Modern Train Control System). Thus the allotment of 10 MHz spectrum in 700 MHz band to IR will bring significant socio-economic benefits for the country.</p> <p>(ix) Another driving force is the ability in 700 MHz spectrum of LTE to provide efficient high speed, low latency, low setup time, and high-security data connectivity, which is the precondition to provide mission critical communication for safety and security application on Railways.</p> <p>(x) As already accepted by some stakeholders, GSM-R will be supported until 2030, such technology can't be accepted on IR. Besides</p> <ul style="list-style-type: none"> a) GSM-R provides legacy circuit switched data connectivity having low speed for train control messaging as known as ETCS (European Train Control System). Because of this and other shortcomings GSM-R may not provide the same functionalities as by LTE. b) GSM-R has limited capabilities as it is channelized. Its narrow band performance unable to provide services beyond voice and limited train signaling. LTE is packet based using Resource Block Allocation which is many times more efficient. c) GSM-R is subject to adjacent band interference with public operators using the 900 MHz spectrum now for LTE and UMTS. d) GSM-R uses a very primitive coding technique causing poor spectral efficiency. LTE has advanced 64QAM coding leading to efficient use of spectrum GSM-R is capable of carrying only 2 services, voice and signalling. LTE is capable of carrying voice, ETCS and an extensive package of services (CCTV) limited only by the spectrum available. e) GSM-R has a primitive prioritization and pre-emption technique call EMLP with limited capability. LTE QoS policy technique allows 17 levels of prioritization assigned to individual bearers. f) GSM-R and the 1.6 MHz GSM-R spectrum (in 900 MHz band) allotted to IR are inadequate for the following needs of IR: <ul style="list-style-type: none"> • Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR. • Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics
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		<p>for Passenger Security.</p> <ul style="list-style-type: none"> Faster data network Communication for voice, video and other related application such as IOT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications <p>(xi) The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea. Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has already been deployed by South Korea in 700 MHz band. LTE-R in 700 MHz band is tested and proven. Thus, LTE portfolio provides a solution to all the drawbacks of GSM-R. Also, according to 3GPP, GSM-R is facing a number of challenges, as the system life-cycle is coming to an end, with vendor support uncertain beyond 2030. Extra capacity is required in some areas to support railway operations and the rollout of European Rail Traffic Management System (ERTMS) has increased the strain on the GSM-R network. The proposed LTE system on IR will be upgradable to FRMCS, whereas GSM-R system is not upgradable to FMRCS.</p> <p>(xii)The ecosystems for 450-470 MHz band Radio and hand held devices in this band are not available. Functionality like PTT is not available, which is must for critical communication services.</p> <p>(xiii) Limited market and few commercial networks working on LTE in 450-470 MHz band, are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications</p> <p>(xiv) Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. 10 Mhz in this band has already been allotted to Ministry of Defence without auction, on free of cost basis.</p> <p>(xv) Ministry of Law and Justice has already agreed for allotment of this spectrum in 700 Mhz band to Railways</p>
<p>2.</p>	<p>In case your answer to Q1 is in affirmative, how much spectrum should be assigned to Indian Railways?</p>	<p>Detailed comments already given question 1.</p>
<p>3.</p>	<p>In case your answer to Q1 is negative,</p>	<p>1. As already detailed in counter-comments in Q 1 above, 450-470 MHz band is not suitable for Railway's requirements.</p>

	<p>i) What are the other bands (including 450-470 MHz) in which spectrum can be assigned for RSTT?</p> <p>ii) How much spectrum should be assigned to Indian Railways?</p>	<ol style="list-style-type: none"> 2. Allotment of 10 MHz spectrum in 700 MHz band to Ministry of Defence has already been done without waiting for the outcome of WRC. The progress and development of the nation and compromise with enhancing the safety and security of train operation can't be delayed for future expectations 3. As also elaborated in one of the responses, ecosystem devices (Cab radio/ Modem, Handsets etc.) are not available in 450-470 MHz band. Non-standardized/proven system cannot be tried for safety applications. 4. Some of the responses may be to suit their products and not on the merits of the requirements of Indian Railways. 5. One responder has mentioned that JAPAN has allocated 400 MHz band for RSTT in 1960s. But he has not put any evidence of its implementation for LTE in Japan. 6. LTE is 4th Generation (4G) Mobile Communication System and is emerging as Global Standard for all new train control and Railway Signaling applications replacing the incumbent 2nd Generation (2G) GSM-R technology and is likely to see the broadest deployment of any new wireless technology over the next decade in Railway Safety, Security and Passenger experience applications. 7. Mixing PPDR use with RSTT use in the 800 MHz band is likely to result in interference along the path of Railways, which has also been brought out by some stakeholders. This is not advisable for Mission Critical Passenger Safety Services. 8. In china, a trial RSTT system for railway based on LTE using comprehensive broadband digital mobile communication technology is under study. It is planned to carry out system trial test in a high-speed railway line in the frequency band 450 MHz for this new system. Thus there is not tested and proven system for RSTT in 450 MHz band.
4.	<p>In case it is decided that spectrum in IMT bands which have already been earmarked for mobile services, be assigned to Indian Railways for RSTT in India, what should be the methodology (including price) of allotment of spectrum?</p>	<ol style="list-style-type: none"> 1. Allotment of exclusive 10 MHz spectrum in 700 MHz band will not lead to any issues such as interference, as indicated in some response. 2. Regarding pricing mechanism for spectrum allocation, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. 3. 10 MHz Spectrum in this band has already been allotted to Ministry of Defence on free of cost basis. Thus the assertions of the principle of service neutrality, assessment of economic spectrum in allotment do not hold good. 4. The methodology of allotment of spectrum in 700 MHz band to IR is a policy matter, to be decided by Govt. of India.

		5. The proposal of allotment of 10 MHz spectrum in 700 MHz band to IR has already concurred by Ministry of Law & Justice.
5.	In case it is decided to assign spectrum in other spectrum bands (including 450-470 MHz band), what should be the methodology (including price) of allotment of spectrum?	Same response as given in response to question 4 above.
6.	Do you foresee any challenges, if IR makes internet services available onboard i.e. within the train using spectrum allocated for signaling purpose?	<ol style="list-style-type: none"> 1. It is not possible to run mission critical communication applications and safety related train control application on commercial network of mobile operators. It may endanger the safety of trains. This was also the reason for GSM-R roll out. 2. IR agrees that any commercial use of spectrum can only be undertaken by a licensed telecom service provider. Indian Railways (not as a service provider for internet services) requires captive 10 MHz spectrum in 700 MHz band, free of cost, as this proposal is devoid of any commercial gain, and is only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. 3. This spectrum is not for the purpose of providing On-board internet services in trains for commercial purposes.
7.	<p>Whether the requirement of IR for RSTT can be fulfilled using the following alternate methods:</p> <p>i) Alternate method suggested in Para 4.47, wherein a TSP could build, deploy and maintain LTE-R network for IR; while the control, use and operation of the LTE-R network may be with IR.</p> <p>OR</p> <p>ii) Alternate method suggested in Para 4.48, wherein there could be a common integrated network (with common spectrum) for Public Safety i.e. Public Protection</p>	<ol style="list-style-type: none"> 1. It is not possible to run mission critical communication applications and safety related train control applications on commercial network of mobile operators. It may endanger the safety of trains. This was the reason for roll out of GSM-R on Railways in the world. 2. Mixing PPDR use with RSTT use in the 800 MHz band is likely to result in interference along the path of Railways, which has also been brought by some stakeholders. This is not advisable for Mission Critical Passenger Safety Services. Further no ecosystem is available for LTE-R in 800 MHz band. 3. The 700 MHz band is being widely used for Public Safety Services e.g. North America and Korea. Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has already been deployed by South Korea in 700 MHz band. LTE-R in 700 MHz band is tested and proven. Thus, LTE portfolio provides a solution to all the drawbacks of GSM-R. Also, according to 3GPP, GSM-R is facing a number of challenges, as the system life-cycle is coming to an end, with vendor support uncertain beyond 2030. 4. There has been consolidation of Mobile operators in India and their numbers have already come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even

	<p>and Disaster Relief (PPDR) and Railways, using PS-LTE and LTE-R technology respectively.</p> <p>OR</p> <p>iii) Any other method as may be suggested by the stakeholders. (Please provide detailed response with justifications and required enabling provisions.)</p>	<p>without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz. This could be one of the reason due to which previous DOT's auction for spectrum in 700 MHz frequency band did not receive any response.</p>
<p>8.</p>	<p>If there are any other issues/suggestions relevant to the subject, stakeholders may submit the same with proper explanation and justification.</p>	<p>All the aspects, raised by some stakeholders, have been covered in responses to earlier questions.</p>

Railway's comments over the remarks given by stakeholders on consultation paper on allotment of spectrum to Indian Railways for Public Safety and Security services are as under:

S.N.	Que no	Stakeholder	Stakeholder's comments	Railways' Comment
1	1.	GSMA	<p>1.1 GSMA is of the view no spectrum in the 700 MHz band should be assigned to railways or any other application specific uses.</p> <p>1.2 Spectrum below 1 GHz in general, and the APT700 digital dividend band specifically, has been a key part of the mobile operators' drive to connect everyone, given the wide area coverage advantages of 700 MHz. 700 MHz is set to become the biggest LTE ecosystem globally. All three ITU regions have adopted this mobile band. Most advanced markets have already Licensed, deployed or planned to license this band for 4G/5G IMT.</p> <p>1.3 There are 1,789²APT700 (band 28) devices comprising phones, tablets, CPE and related devices announced by many suppliers across all price points (compared to 861 devices two year ago). This represents CAGR of 44% over 2 years.</p> <p>1.4 Using the 700 MHz band for purposes other than for mobile broadband LTE/5G will pose significant social-economic losses to India, given the benefits of widespread mobile broadband using sub GHz- particularly in countries with large rural areas.</p>	<p>The views of GSMA are not correct. 10 MHz in this band has already been allotted to Defence. The requirement of railway is for safety, security of railway passengers, besides other applications such as train operations to improve speed and punctuality of the trains.</p> <p>Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Preferred frequency Bands to operate 5G technologies include: <u>Millimeter wave</u> bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive <u>MIMO</u> (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;” “Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>There has been consolidation of Mobile operators in India and their numbers have already come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz. This could be one of the reason due to which previous DOT's auction for spectrum in 700 MHz frequency band did not receive any response.</p> <p>Social gains realized from improvement in safety and security of the passengers as well as faster</p>

				<p>train operations could be far more than the amount indicated by GSMA.</p> <p>Hon'ble Prime Minister Of India and many reputed economists have time and again stressed that the Indian Railways(IR) have the potential to boost the Indian economy and GDP in a big way. However IR is currently facing a huge bottleneck in augmenting the train carrying capacity of the available infrastructure even in the face of increasing demand for both Passenger and freight traffic. Through the adoption of Modern Train Control system based on LTE, IR will not only be able to enhance Passenger Safety but will also be able to augment train carrying capacity of the available infrastructure due to increased speed and less fixed distance between the trains(both possible only through Modern Train Control System). Thus the allotment of 10 MHz spectrum in 700 MHz band to IR will bring significant socio-economic benefits for the country.</p>
	2.		2.1 No spectrum should be assigned to railways in the 700 MHz band.	<p>The decision to allot spectrum in the 700 MHz band to Indian Railways is for broader national interest.</p> <p>Indian Railways requires 10 MHz spectrum for enhancing safety, security and IoT based predictive maintenance and assets reliability. The spectrum will be used for:</p> <ul style="list-style-type: none"> (i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signalling system on IR. Modern Train Control system to augment trains carrying capacity on Railway network because of increased speed and less fixed distance between the trains. This will allow more number of trains to be operated & run on same fixed infrastructure. (ii) Video Surveillance (Live feed) through CCTV networks in trains along with Video Analytics for Passenger Security. (iii) Faster data network Communication for voice, video and other related applications like IoT based Asset reliability Monitoring and Train and

			<p>way side Telemetry through Mobile communications.</p> <p>These requirements are also important similar to the need of the Defence for which spectrum has already been allotted in this band.</p>
	3.	<p>3.1 The band 450-470 MHz should be considered for RSTT. Also, the recent AWG report shows the band 150 MHz and 400 MHz have been widely used for RSTT in Asia Pacific countries.</p>	<p>Not Agreed. 450-470 MHz band is not suitable for the requirements of Indian Railways. The relative merits/demerits of this band vis a vis 700 MHz band have been studied by an expert committee involving IIT Madras.</p> <p>The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea. Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by South Korea in 700 MHz band.</p> <p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available. Limited ecosystem, no handheld devices available and functionality like PTT is not available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. To the best of our knowledge, no Railway has deployed LTE based communication in 400-500 MHz band. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.</p>
	4.	<p>4.1 GSMA has no specific views about the mechanism and price for spectrum that is not allocated to IMT services. However, any costs arising from spectrum management and interference mitigation mechanism between railways and LTE/5G network should not be passed on the mobile operators.</p> <p>4.2 Moreover, we note that mixing LTE/5G use with RSTT use in the 700 MHz band is likely to require interference mitigation to coordinate the two systems along the path of railways – this is likely to result in unprintable costs. Any</p>	<p>Allotment of exclusive 10 MHz spectrum in 700 MHz band will not lead to any issues such as interference, as indicated by GSMA.</p> <p>As GSMA has no specific view about mechanism and price of spectrum. Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based</p>

		<p>ongoing risk of interference or need for preemptive interference mitigation measures will have an impact also on the price of IMT spectrum in 700 MHz.</p> <p>4.3 GSMA also notes that spectrum set-aside for application specific uses create spectrum fragmentation and break the principle of service neutrality.</p> <p>4.4. Spectrum set-asides for railways in a commercial mobile band would require an assessment of economic spectrum would result in increased economic benefits.</p> <p>4.5 The allocation methodology should support fair and non-discriminatory access to spectrum principle and without creating artificial scarcity for mobile operators, avoiding a limit performance and inflated spectrum costs.</p>	<p>assets monitoring.</p> <p>Spectrum in this band has already been allotted Defence and thus the GSMA's assertions for principle of service neutrality, assessment of economic spectrum etc do not hold good.</p>
	5.	<p>As per our response above in paragraph 4.5</p>	<p>Not correct, as there is no artificial scarcity for mobile operators because it is a fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz which was unsold in last auction.</p> <p>Also, even after allocation of 10 MHz spectrum to Indian railways, 25 MHz will be still available for IMTs applications.</p>
	6.	<p>6.1 The railway company should facilitate the process to allow mobile operators to deploy their own infrastructure to provide high quality internet services.</p>	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <ul style="list-style-type: none"> (i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR. (ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security. (iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications.

				It has amply cleared that the spectrum will be used for non-commercial activities.
	7.		<p>7.1 Mobile operators have provided services to vertical industries for years, notably in 3G and 4G, and will also provide dedicated services using 5G. This allows for competition between operators in order to secure the best financial deal possible via commercial arrangements.</p> <p>7.2 Network slicing will allow mobile operators to dedicate a portion of their spectrum to provide best quality of service for application specific uses.</p>	It is not possible to run mission critical communication applications and safety related train control applications on commercial network of mobile operators. It may endanger the safety of trains. This was the reason for roll out of GSM-R on Railways in the world.
	8.		<p>8.1 DoT is encouraged to explore how mobile operators could enable access to spectrum resources via voluntary spectrum sharing/leasing.</p> <p>8.2 Mobile operators have access to a wide range of frequencies across their spectrum portfolio, which can cater for different approaches required by application specific uses and depending on the regional situation.</p>	No comments.
2	1.	BIF	<p>BIF is of the clear opinion that 700MHz band should neither be reserved nor assigned to Indian Railways for Railway Radio communication System between Train and Track side (RSTT). The reasons for the same are elaborated below:</p> <p>1. With increased demand of data services & rapid consumption of data, which is exploding in India, with an annual growth rate of 23 per cent, the country requires sufficient spectrum in multiple bands for achieving the objectives of 'Digital India' as enunciated in NDCP-2018. 700 MHz is one of the prime spectrum bands which is proposed to be used for deployment of 5G services. It is very suitable for coverage purposes due to its excellent propagation characteristics & therefore it is one of the most sought after band for deployment of 5G.</p> <p>2. TRAI in its recommendation dated 1 August 2018 for "Auction of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300-3400 MHz and 3400-3600 MHz Bands" considered this band for the next spectrum auction, recognizing the vibrant and continuously growing ecosystem in the 700 MHz band to be used for 5G services in alignment with what is being deployed globally.</p> <p>3. The 700Mhz band is a prime IMT band and is centric to Rural Broadband applications and for bridging the 'Digital</p>	<p>The views of BIF are not correct. .</p> <p>10 MHz in this band has already been allotted to Defence. The requirement of railway is for safety, security of railway passengers, besides other applications such as train operations to improve speed and punctuality of the trains.</p> <p>Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Preferred frequency Bands to operate 5G technologies include: <u>Millimeter wave</u> bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive <u>MIMO</u> (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;” “Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p>

		<p>Divide. Not only is the 700MHz band suitable for rural broadband solutions, it is also extremely suitable for In-building solutions in urban areas too.</p> <p>4. The Band has been identified for IMT 2020 (5G) by ITU as well as NFAP.</p> <p>5. 700 MHz Band is globally harmonized for IMT usage and many countries have deployment of mobile services in the band.. The 700 MHz Band plan 703-748/758-803 MHz has been adopted by APT countries occupying a total of 45 MHz paired spectrum. India too has followed this band plan. As such, the complete 45 MHz is required to be auctioned so that at least each operator gets 10+10 MHz for deployment of 5G.</p> <p>6. Defence, which has been allocated 10Mhz paired spectrum in this band, may be requested / coordinated to vacate this band, keeping in view the national interest. In lieu of this spectrum, alternate frequency bands viz. 450-470 MHz or 2.5 GHz may be considered. In case of inescapable requirement of Defence, then only 5+5 MHz may be considered in this band.</p> <p>7. The Govt's own 5G High Level Forum for implementation of 5G has also recommended 700 MHz for 5G deployment</p> <p>8. Hence, it is imperative that each of the 4 Telecom Service Providers (including the Govt. Operator BSNL/MTNL) must be provided at least 10Mhz paired spectrum (10+10) Mhz. to make effective use of the band for delivering 5G. Given this scenario, the total spectrum required will be 40+40 MHz, thereby leaving 5+5 MHz paired spectrum available for alternate use. This remaining portion of the band may be provided to Defence instead of the assigned 10MHz paired spectrum (10+10) MHz. If the same is found inadequate, it is requested that Defence be requested to shift to an alternate band</p> <p>9. GSM-Railway is a wireless communications standard for railway communication and applications. It is based on European standards of European Rail Traffic Management System (ERTMS). GSM-R is built on GSM technology, and benefits from the economies of scale of its GSM technology. GSM-R is a secure platform for voice and data communication between railway operational staff, including drivers, dispatchers, shunting team members, train engineers, and station controllers. It delivers features such as group calls (VGCS), voice broadcast (VBS), location-based</p>	<p>Better Rural coverage is possible even in lower frequency bands like 600 MHz, 450-470 MHz while In-building solutions in urban areas having higher data throughput services will require High Frequency band in GHz instead of 700 MHz.</p> <p>There has been consolidation of Mobile operators in India and their numbers have already come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz. This could be one of the reason due to which previous DOT's auction for spectrum in 700 MHz frequency band did not receive any response.</p> <p>Another driving force is the ability in 700 MHz spectrum of LTE to provide efficient high speed, low latency, low setup time, and high-security data connectivity, which is the precondition to provide mission critical communication for safety and security application on Railways.</p> <p>Social gains realized from improvement in safety and security of the passengers as well as faster train operations are of paramount important. Allotment of 10 MHz spectrum in the 700 MHz band was done in the national interest of the country.</p> <p>As already accepted by BIF, GSM-R will be supported until 2030, such technology can't be accepted on IR.</p> <p>GSM-R and the 1.6 MHz GSM-R spectrum (in 900 MHz band) allotted to IR are inadequate for the following needs of IR:</p> <p>(i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR.</p>
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			<p>connections, and call pre-emption in case of an emergency. This will support applications such as cargo tracking, and passenger information services. According to the GSM-R industry, GSM-R will be supported until 2025-2030. In view of the above, it is proposed that Railways should continue to deploy GSM-R based Radiocommunication Systems for Public Safety and Security till such time that a new alternate proven technology in a globally harmonized spectrum band for Railways is identified by WRC-19 of ITU and then subsequently cost effective solutions are deployed in other Railway administrations</p> <p>10. Given the fact that this requirement of the Railways is for the purpose of Public Safety & Security, no untested or unproven spectrum band should be allocated for this purpose. While GSM-R is globally proven technology, the emerging technologies for Next Generation RSTT are still yet to be proven. We understand that Global Spectrum Band harmonization for emerging technologies for RSTT has not been completed yet and is likely to take some direction, post conclusion of WRC -19 (Agenda Item 1.11). Also the proposed band is required to be harmonized with the development initiatives from the railways signaling community which is working to introduce ETCS LEVEL 2 in the Indian Railway network.</p> <p>In view of the above, we once again reiterate that NO SPECTRUM in 700Mhz band should be assigned nor reserved for Railways. In fact, it would be more prudent for IR to wait for the outcome of WRC-19 for global harmonization of the bands(s) for Future Mobile Communication Systems for Railways and wait thereafter for subsequently cost effective solutions to be deployed by other Railway administrations and proven & cost-effective equipments to be made available in these chosen bands before being adopted in India.</p>	<p>(ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security.</p> <p>(iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has already been deployed by South Korea in 700 MHz band. LTE-R in 700 MHz band is tested and proven.</p>
	2.	BIF	Not Applicable. As mentioned in response to Q1 above, BIF feels that spectrum in the 700 MHz band should not be considered for RSTT.	Same as above response of Q.1.
	3.	BIF	We once again reiterate that the correct approach would be to wait for the outcome of WRC-19 of ITU for regional or global harmonization of the bands(s) for RSTT. It may be prudent to wait for the spectrum bands to be chosen for global harmonization. Also the chosen band is required to be harmonized with the development initiatives from the railways	Not agreed with the assertion of BIF. Outcome of WRC-19 of ITU will always remain uncertain. The progress and development of the nation and compromise with enhancing the safety and security of train operation can't be delayed for future expectations. Besides, ecosystems in 450-

			signaling community which is working to introduce ETCS LEVEL 2 in the Indian Railway network.	470 MHz band are not available and it may take long time in their development and proliferation. Indian Railways has to start the works related to safety and mission critical activities immediately. Allotment of 10 MHz spectrum in 700 MHz band to Defence has already been done without waiting for the outcome of WRC.
	4.	BIF	We once again strongly recommend bands already considered for IMT 2020 viz. 700Mhz band should not be reserved/ assigned to Railways, as mentioned in Response to Q1 above. We need precious 700MHz band to cater to the growing data needs of Digital India. We are a high population and a highly dense country unlike other countries and need this precious spectrum band to cater to the growing coverage and capacity needs of broadband penetration across the country. In the unlikely event that some part of the IMT band is assigned to IR, they must either participate in the auction or be asked to match the auction price	Same as above response of Q.1. Allotment of 10 MHz spectrum in 700 MHz band has already been done to Defence. The methodology of allotment of spectrum in 700 MHz band to IR is a policy matter to be decided by Govt. of India. Besides, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.
	5.	BIF	We once again reiterate that the correct approach would be to wait for the outcome of WRC-19 of ITU for regional or global harmonization of the bands(s) for RSTT. It may be prudent to wait for the spectrum bands to be chosen for global harmonization. In case IMT band, is allocated, then IR may be asked to either participate in the auction or be asked to match the auction price. If in case the auction price is not available in some band, then the nearest band price may be taken. For example, in case of 450Mhz band, the nearest band price that must be selected is the 700Mhz for which price is available. In case the 450 MHz is auctioned in future, then any difference in price (between the 450 MHz & 700 MHz) must be paid later.	Same as responses of Q.3 & Q.4.
	6.	BIF	Already several IFMC License Service Providers are available who are licensed to provide these services over air, water & land. It is preferred that IR use the services of these commercial operators instead of trying to do everything themselves However, in case they decide to provide the services by themselves, then they must obtain the license by paying the	It cannot be possible to run mission critical communication applications and safety related train control application on commercial network of mobile operators. It may endanger the safety of trains. Railways are demanding the spectrum for Mission Critical Passenger Safety Services and various other services as explained above.

		<p>requisite License Fees and also purchase the requisite spectrum through auction or must match the auction price. If in case the auction price is not available in some band, then the nearest band price may be taken. For example, in case of 450Mhz band, the nearest band price that must be selected is the 700Mhz for which price is available. In case the 450 MHz is auctioned in future, then any difference in price (between the 450 MHz & 700 MHz) must be paid later.</p> <p>Railways can consider providing internet after taking necessary ISP license from DOT within the assigned spectrum but in that scenario, Railways have to pay the spectrum fee at the rate of auction value paid by TSPs for same amount of spectrum.</p>	
7.		<p>Alternate Method i) suggests that one could get the LTE-R based network built and deployed through one of the existing TSPs who may have acquired spectrum in the 700 MHz band. In this case, the TSP will build the network for IR along the railway track for ETCS Level 2 based on LTE-R standards and at the same time utilize the same frequencies for its commercial operation elsewhere. This will take care of the effective utilization of the spectrum and state of art LTE-R network for IR. The control, use and operation of the LTE-R may be with IR only whereas the maintenance and SLA could be maintained by the concerned TSP.</p> <p>Method suggested above in Para 4.47 may not be acceptable to Railways as they have to bear a proportional part of the cost of the assigned /used spectrum besides spectrum usage charge annually, while they may be interested in allocation of free spectrum as it relates to public safety.</p> <p>Alternate Method ii) suggests that we could have an integrated network for Public Safety i.e. Public Protection and Disaster Relief (PPDR) and Railways, though it must be clearly mentioned that this is not a proven solution and not implemented anywhere as per the requirement of our Railways which needs a cost effective and proven solution in an established and globally harmonized spectrum band with implementation of ETCS Level 2 Signaling along with quad play LTE-R based solution working in Railway networks for a few years.</p> <p>As per Method ii), PPDR and Railways, both have the requirement of a robust communication system. Since requirement of Railways is limited to the rail network, it could be possible that a common network is put in place which can</p>	<p>It is not possible to run mission critical communication applications and safety related train control applications on commercial network of mobile operators. It may endanger the safety of trains. This was the reason for roll out of GSM-R on Railways in the world.</p> <p>Mixing PPDR use with RSTT use in the 800 MHz band is likely to result in interference along the path of Railways, which is not advisable for Mission Critical Passenger Safety Services..</p>

			<p>be used both for PPDR as well as for providing Public Safety & Security Services in the Railways. TRAI in its recommendations on “Next Generation Public Protection and Disaster Relief (PPDR) communication networks” has also recommended that Government should set up Pan-India integrated Broadband PPDR (BB-PPDR) Communication Network (to be called “National BB-PPDR Network”) based on 3GPP PS-LTE technology, 2x10 MHz of dedicated spectrum should be allocated nationwide to the Special Purpose Vehicle (SPV) under Ministry of Home Affairs (MHA) on no-cost basis for LTE based broadband PPDR networks, 814-824/859-869 MHz should be assigned for nationwide BB-PPDR services.</p> <p>From the above, it can be seen that TRAI has recommended that 10 MHz (paired) spectrum in 800 MHz spectrum band be allocated for nationwide PPDR network. This 10 MHz (paired) spectrum could be used for both PPDR as well as for Railway communication. A single TSP may deploy integrated network using 10 MHz (paired) spectrum having PS-LTE deployment for PPDR agencies and LTE-R deployment for Indian Railways. This will require coordination and Standard Operating Procedures (SOP) between Ministry of Home Affairs and Indian Railways. For this to be enabled, RAN Sharing, resource allocation rules and standard interworking procedures needs to be in place.</p> <p>In view of the merits of cost and resource optimization including spectrum requirements in Alternate Method ii), we feel that this may be a more viable option, though this method will have its implementation challenges as it is required to roll out a nation-wide network on the scale of Bharat Net.</p>	
	8.	BIF	Nil	NA
3.	1.	COAI	<ol style="list-style-type: none"> 1. 700 MHz band is extensively used for commercial mobile services globally and a comprehensive eco-system is available for this band. Many countries are also carrying out 5G trials in this band. 2. 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. 3. 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. This leaves only 355 	<p>The views of COAI are not correct.</p> <p>The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea.</p> <p>10 MHz in this band has already been allotted to Defence. The requirement of railway is for safety, security of railway passengers, besides other applications such as train operations to improve speed and punctuality of the trains.</p>

		<p>MHz (paired) amongst four TSPs. In case any new TSP plans for 5G in this band in India, then 35 MHz(Paired) is grossly inadequate. Thus, it would not be appropriate to fragment the band any further.</p> <p>4. It is recommended that principle of global harmonization be kept in mind before assigning spectrum for any such other service like RSTT. Currently, WP5A of Study Group 5 (ITU-R) is studying these requirements vide PDN RECOMMENDATION ITU-RM[RSTT-FRQ] on harmonization of frequency bands for railway radiocommunication systems between train and trackside.</p> <p>5. It is pertinent to note that work is also going on in WRC-19 cycle on RSTT under Agenda item 1.11:-</p> <p>1.11 to take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution 236(WRC-15).</p> <p>6. Therefore, COAI strongly recommends that no spectrum from 700 MHz band which has for long been identified for IMT in India should be given to Railways for any kind of services.</p>	<p>Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Preferred frequency Bands to operate 5G technologies include: <u>Millimeter wave</u> bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive <u>MIMO</u> (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;” “Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz.</p> <p>Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>There has been consolidation of Mobile operators in India and their numbers have already come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz. This could be one of the reason due to which previous DOT’s auction for spectrum in 700 MHz frequency band did not receive any response.</p> <p>Social gains realized from improvement in safety and security of the passengers as well as faster train operations could be far more than the amount indicated by GSMA.</p>						
	2.	NA	NA						
	3.	<p>1. As mentioned above, there is work in progress in ITU-R regarding harmonization of spectrum bands for RSTT. In the current draft recommendation for RSTT in WP5A, most common bands in use on Global Basis are as tabulated below:-</p> <table border="1" data-bbox="655 1344 1394 1409"> <thead> <tr> <th>Application</th> <th>Band</th> <th>Spectrum</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Application	Band	Spectrum				<p>Not agreed.</p> <p>Outcome of WRC-19 of ITU will always remain uncertain. The progress and development of the nation and compromise with enhancing the safety and security of train operation can't be delayed for future expectations. Besides, ecosystems in 450-470 MHz band are not available and it may take</p>
Application	Band	Spectrum							

			<table border="1"> <tr> <td>Train Radio</td> <td>150 MHz</td> <td></td> <td>long time in their development and proliferation. Indian Railways has to start the works related to safety and mission critical activities immediately.</td> </tr> <tr> <td></td> <td>400 MHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td>700 MHz</td> <td></td> <td>Allotment of 10 MHz spectrum in 700 MHz band to Defence has already been done without waiting for the outcome of WRC.</td> </tr> <tr> <td></td> <td>900 MHz</td> <td></td> <td></td> </tr> </table>	Train Radio	150 MHz		long time in their development and proliferation. Indian Railways has to start the works related to safety and mission critical activities immediately.		400 MHz				700 MHz		Allotment of 10 MHz spectrum in 700 MHz band to Defence has already been done without waiting for the outcome of WRC.		900 MHz		
Train Radio	150 MHz		long time in their development and proliferation. Indian Railways has to start the works related to safety and mission critical activities immediately.																
	400 MHz																		
	700 MHz		Allotment of 10 MHz spectrum in 700 MHz band to Defence has already been done without waiting for the outcome of WRC.																
	900 MHz																		
			<p>1. We would like to recommend that the Authority should wait for the outcome of WRC-19 (scheduled to be held between 28th October 2019 to 22nd November 2019) so that Indian Railways can get benefitted with globally harmonized spectrum bands for meeting their requirements of RSTT. As shown in the table above, most commonly used band is the 400 MHz band and Railways should plan their requirements accordingly.</p>	<p>Another driving force is the ability in 700 MHz spectrum of LTE to provide efficient high speed, low latency, low setup time, and high-security data connectivity, which is the precondition to provide mission critical communication for safety and security application on Railways.</p>															
	4.		<p>1. We submit that as per the directions of Hon'ble Supreme Court, if any IMT commercial spectrum band is assigned to any agency/entity, it should be put up for auction.</p> <p>2. In case of allotment of spectrum to Indian Railways, the primary utility of this strategic resource would be to deploy LTE based RSTT and not for any commercial usage. Hence, we are of the view that the spectrum in 400 MHz band may be allocated on administrative basis. Any spectrum identified for commercial services and recommend by administrative basis. Any spectrum identified for commercial services and recommend by TRAI to be kept for sale in upcoming auction shall be allocated via auction process only.</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>10 MHz in this band has already been allotted to Defence without going to auction route.</p> <p>As no commercial gain is involved, hence, no need to adopt auction route. The proposal of allotment of 10 MHz spectrum in 700 MHz band to IR has already concurred by Ministry of Law & Justice.</p>															
	5.		- Do -	-do-															
	6.		<p>1. It is submitted that the provision of Internet services is part of the licenses issued to TSPs/ISPs. If Railways 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 communication / Internet services. The same model may be replicated for Railways too in case the intention is to provide internet to the onboard passengers.</p> <p>2. COAI strongly recommends that Railways should seek</p>	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <p>(i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR.</p> <p>(ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security.</p> <p>(iii) Faster data network Communication for voice, video and other related application such as IoT</p>															

			spectrum for RSTT purpose only and provision all commercial services be left to authorized licensees (TSPs/ISPs)	based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications. It has amply cleared that the spectrum will be used for non-commercial activities.
	7.		IR can approach any TSP for building, deploying and maintaining RSTT basis the tender given by Railways. The LTE based network shall be used by railways only for the requirement of RSTT and not for providing the internet services. The created infrastructure should be allowed for sharing with existing telecom service providers for installation of their equipment for providing their mobile internet services to the passengers. However, as recommended in response to Q1, commercial bands such as 700 MHz should not be assigned for captive use by Indian Railways for LTE based RSTT.	It is not possible to run mission critical communication applications and safety related train control applications on commercial network of mobile operators. It may endanger the safety of trains. This was the reason for roll out of GSM-R on Railways in the world.
4	1.	VISTA	<p>Wireless technology evolution is an important facet of modern day railway signaling. Before we decide on any particular spectrum it is very important to understand the evolution of technology vis-a- vis the requirements of the railway organization.</p> <p>Background Indian Railways follows the European train signaling and wireless telecom standards. Early 90s saw the evolution of GSM based railway standard called GSM-R (GSM for Railways). For commercially adapting GSM based standard for railways, the European Integrated Radio Enhanced Network (EIRENE) project was initiated in 1992 by UIC. Aim of the EIRENE project was to develop specifications for a GSM-based railway communication network. EIRENE project ended in 1995 with the publication of Functional Requirements Specification (FRS) and System Requirements Specification (SRS). The EIRENE project was followed by Mobile Oriented Radio Network (MORANE) project, whose goal was to run three GSM-R networks for testing and validating the performance of the technology. This project finished in 2000, with a delivery of the final specifications of GSM-R. Success of GSM-R is largely attributed to the allocation of same 4MHz (876–880 MHz in the uplink band, while 921–</p>	<p>Not agreed with the views of Vista as GSM-R provides legacy circuit switched data connectivity having low speed for train control messaging as known as ETCS (European Train Control System). Because of this and other shortcomings GSM-R may not provide the same functionalities as by LTE:</p> <ul style="list-style-type: none"> • GSM-R is a technology dedicated to railways with the ensuing limited economies of scale. Whereas LTE is used globally by billions of users. Consequently, the cost of radio networking equipment is much lower. R features are available in Rel 15 onwards. Rel 14 is already available commercially and upgradation to future releases till Rel 17 is possible through software. • GSM-R has limited capabilities as it is channelized. Its narrow band performance unable to provide services beyond voice and limited train signaling. LTE is packet based using Resource Block Allocation which is many times more efficient. • GSM-R is subject to adjacent band interference with public operators using the 900 MHz spectrum now for LTE and UMTS. • GSM-R needs very complex cell planning

		<p>925 MHz in the downlink band) spectrum across Europe. The common band used across the whole EU is one of the important elements allowing for “cross-border interoperability”.</p> <p>India also adopted GSM-R technology in mid 90s. Due to the limited availability of spectrum, only 1.6 MHz (8 spots of 200 KHz) were allocated to Indian railways in 900 MHz band (907.8- 909.4 in the uplink band, while 952.8–954.4 MHz in the downlink band where 908.6/953.6 not allocated). Since “Manual Signaling” system was operational at the time of introduction of GSM-R in India, the limitation of frequencies did not have a major impact on network design, economies of scale and implementation of railway specific functionalities.</p> <p>GSM-R brought in a lot of positives for Indian railways as it was already standardized, proven technology on 900 MHz spectrum with certified interoperability across various OEMs enabling economies of scale and with live networks across various countries, GSM-R systems support various railway specific features and functionalities (Voice Broadcast Calls, Voice Group Calls, functional numbering etc.) following the highest levels of safety in network and product design.</p> <p>Current Status</p> <p>With the advancement in railway signaling technology from manual to automatic (ETCS Level 2 and ETCS Level 3), UIC along with various railway operators, signaling & telecommunication OEMs is working on the evolution of GSM-R.</p> <p>GPRS is being deployed along with GSM-R to support automatic railway signaling (ETCS – Level 2 @ 2.4 Kbps). There are various countries (as mentioned in the consultation paper) which are implementing ETCS Level 2 on GPRS.</p> <p>ETCS Level 2 is being followed primarily in Europe and Asia (except China, Japan & Korea). China, Japan and Korea have their own proprietary signaling systems. E.g. China follows CTCS Level 3.</p> <p>Indian Railways is also planning to deploy ETCS Level 2. Because of limitation of the availability of frequencies in 900 MHz band the Indian railways is not able to fully deploy ETCS Level 2.</p> <p>Looking Ahead</p> <p>Most of the European Operators are targeting to maintain their existing GSM-R deployments till 2035 and possibly beyond. It is in their interest to protect their existing</p>	<p>as the same reuse of a channel cannot be made closer than 5 cells. LTE has self-optimizing neighbor planning making the cell planning trivial by comparison</p> <ul style="list-style-type: none"> • GSM-R uses a very primitive coding technique causing poor spectral efficiency. LTE has advanced 64QAM coding leading to efficient use of spectrum GSM-R is capable of carrying only 2 services, voice and signalling. LTE is capable of carrying voice, ETCS and an extensive package of services (CCTV) limited only by the spectrum available • GSM-R has a primitive prioritization and pre-emption technique call EMLP with limited capability. LTE QoS policy technique allows 17 levels of prioritization assigned to individual bearers. <p>Thus, LTE portfolio provides a solution to all the drawbacks of GSM-R, TETRA and Wi-Fi solutions including that it has broadband capabilities allowing services such as CCTV passenger surveillance to be addressed. Also, according to 3GPP, GSM-R is facing a number of challenges, as the system life-cycle is coming to an end, with vendor support uncertain beyond 2030. Extra capacity is required in some areas to support railway operations and the rollout of European Rail Traffic Management System (ERTMS) has increased the strain on the GSM-R network.</p> <p>The proposed LTE system on IR will be upgradable to FRMCS, whereas GSM-R system is not upgradable to FMRCS.</p>
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		<p>investments.</p> <p>UIC is the nodal agency which is involved in development of railway wireless standards. UIC along with 3GPP, ETSI, ERA and others is in the process of writing the specifications for the next generation railway communication deployments thru FRMCS (Future Railway Mobile Communication Systems) project. FRMCS addresses the complex topics like implementation of standards based full IP network, its co-existence with GSM-R and support of evolved railway signaling to name a few. The timelines for FRMCS are attached as annexure.</p> <p>Almost all European & Asian countries (including China & Korea) have endorsed FRMCS. FRMCS is moving towards 5G and beyond. Various Railway operators in Europe and Asia are still continuing their investments in GSM-R till the time FRMCS specifications are finalized and the products available.</p> <p>Almost all the OEMs working on FRMCS standards are European companies. Europe is taking the lead in development of the prototypes and in putting up the pilot networks based on FRMCS standards. European OEMs and Railway operators are thus expected be the first movers to deploy FRMCS in a live railway network.</p> <p>We believe that India has two options to follow.</p> <p>Option 1:</p> <p>We recommend allocation of 4 MHz in 900 band (i.e. 2.4 MHz allocated in addition to 1.6 MHz already allocated in 900 band) to Indian railways. This will be an immediate solution for full deployment of ETCS Level 2. Advantages we get here are multifold which include a) Protection of existing investment b) Standardized & Proven technology with certified interoperability amongst signaling and telecom OEMs c) Economies of scale and established ecosystem d) Guaranteed support till 2035</p> <p>Option 2:</p> <p>We recommend that India should follow</p> <p>a) UIC standards for FRMCS</p> <p>b). Harmonization of spectrum in line with the European countries / operators</p> <p>This will help our country to have a safe approach in adopting a proven field tested technology which has the consensus of UIC, railway signaling OEMs and the European railway operators. It will ensure high level of Interoperability</p>	
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			<p>between signaling and telecom products and also help us to achieve economies of scale for the deployed products. It will also ensure full availability of ecosystem (FRMCS handsets, Cab Radios / Modems, Dispatcher systems, recording systems etc.)</p> <p>To achieve the harmonization of spectrum with the European operators, we believe that India should wait for the outcome of WRC 2019 where the FRMCS bands will be finalized. India should not rush in allocation of 700 MHz or any other band (like 450 to 470 MHz) for the Indian Railways. India should adopt the FRMCS frequency bands as adopted by the European operators.</p>	
	2.	VISTA	NA	NA
	3.	VISTA	<p>In addition to our response to question 1, we would like to state the following:</p> <ul style="list-style-type: none"> • There is no live reference of deployment of ETCS Level2 in main line railway using 450 to 470 MHz spectrum. • Ecosystem of devices (Cab Radio / Modem, Handsets, Dispatcher etc.) does not exist in 450 -470 MHz. • Because of limitation of availability of OEMs in 450MHz - 470MHz band there will not be any economies of scale. • Railway signaling systems are normally designed with highest level of safety features. Since deployment of ETCS Level 2 signaling in 450-470 MHz will be non-standardized and without proper references, we would not recommend the same. • Chinese Railways has not tested CTCS Level 3 (Chinese own Train Control System equivalent to ETCS level 2) on 450-470 Mhz. Therefore, nowhere in the world, there is any reference of ETCS Level 2 or its equivalent working on band 450-470 Mhz. <p>>>The Spectrum to be assigned for RSTT has already been elaborated in the response to Question 1.</p>	Agreed.
	4.	VISTA	Since Railways will be using the spectrum for deployment of Mission Critical Voice and Data for the safety of the passengers, it should be provided free of cost to the railways.	Agreed.
	5.	VISTA	Please refer to our response to Question 1 & Question No. 4	Agreed.
	6.	VISTA	Allocation of spectrum for mission critical voice and data for the Railways should not be used for any other purposes. IR network should work as a stand-alone Island network with no connectivity to any public network. This will secure the	Agreed

			network from any external IP threats and also the network will not be overloaded in case of any disaster / accident.	
	7.	VISTA	Nil	NA
	8.	VISTA	Nil	NA
5.	1.	Samsung	<p>The 700 MHz Band [i.e. 713-748 MHz Uplink (UL) and 768-803 MHz Downlink (DL)] the entire spectrum shall be auctioned to Telecom Service Provider (TSP) according to the 1st August 2018 recommendations. This band also referred as APT700 or 3GPP Band 28, which is paired FDD spectrum of 2x35 MHz is available in all 22 Licensed Service Areas (LSA) within India. The Authority has recommended a block size of 5 MHz while bidding for the spectrum during the auctions by the (TSP). Considering the total availability of 35 MHz FDD spectrum, 3 private TSPs and one state TSP, the premium pricing of the spectrum, each TSP participating in auctions most likely would like to secure at least 2 blocks i.e. 10 MHz spectrum. Furthermore, 5G High Level Forum (HLF) has also recommended the 700MHz band in the Announce Tier for 5G. For the TSPs to fulfill the National Digital Communication Policy (NDCP) 2018 objectives on Connect India Mission the 700 MHz band, which is a coverage band is very crucial. If 10 or 15 MHz is assigned to Indian Railways from the available 35 MHz then 20 to 25 MHz spectrum may not be sufficient for the TSPs to fulfil the NDCP 2018 objectives. Based on the TRAI and 5G HLF recommendation administrative allocation of 700 MHz band doesn't seem feasible for RSTT.</p>	<p>Not Agreed with the views of Samsung. Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Frequency Bands to operate 5G technologies include: <u>Millimeter wave</u> bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive <u>MIMO</u> (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;” “Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>In the past DOT’s auction for spectrum in 700 MHz frequency band did not receive any response.</p> <p>It has also been a well known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p>
	2.	Samsung	We do not provide specific comments, however, please refer to our response to Q.3.	NA
	3.	Samsung	Samsung recommends 2x10 MHz block size from 800 MHz spectrum band i.e. 3GPP Band 26 should be assigned to Indian Railways. The Indian Railways requirement of 10 MHz spectrum for RSTT can be met in 800 MHz band. The 800 MHz band has similar radio propagation	LTE is 4 th Generation (4G) Mobile Communication System and is emerging as Global Standard for all new train control and Railway Signaling applications replacing the incumbent 2 nd Generation (2G) GSM-R technology and is likely to see the

			<p>characteristics as 700 MHz band. According to 4th June 2018 recommendations on Next Generation Public Protection and Disaster Relief (PPDR) communication networks³, the authority has recommended 2x10 MHz spectrum of 3GPP Band 26 on no-cost basis for LTE based nationwide broadband PPDR network. This band also referred as PPDR band or 3GPP Band 26 is paired Frequency Division Duplex (FDD) spectrum of 2x10 MHz i.e. 814-824 MHz (UL) and 859-869 MHz (DL) can be harmonized to meet the Indian Railways spectrum requirement for RSTT. The provisioning of RSTT features/services based on LTE-R and PPDR features/services based on PS-LTE has great degree of commonality (for quick review please refer to the Informative Annex at the end). Also deploying communication networks based on LTE technology on harmonized spectrum for both RSTT and PPDR allows easy co-ordination and interworking between the two networks during disaster situation, which is essential and best practice worldwide. This approach of harmonizing the Band 26 spectrum for PPDR and Indian Railways is in the national interest to judiciously utilize scarce national assets.</p>	<p>broadest deployment of any new wireless technology over the next decade in Railway Safety, Security and., disaster management and IOT based assets monitoring.</p> <p>As per our knowledge, there is no spectrum is available in 800 MHz band in India.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p> <p>Mixing PPDR use with RSTT use in the 800 MHz band is likely to result in interference along the path of Railways, which is not advisable for Mission Critical Passenger Safety Services.</p> <p>Another driving force is the ability in 700 MHz spectrum of LTE to provide efficient high speed, low latency, low setup time, and high-security data connectivity, which is the precondition to provide mission critical communication for safety and security application on Railways.</p>
	4.	Samsung	We do not provide specific comments, however, please refer to our response to Q.5.	NA
	5.	Samsung	Spectrum with 2x10 MHz block in Band 26 having similar radio propagation characteristics as 700 MHz band is recommended by the Authority on no-cost basis for PPDR, the same approach should be extended to Indian Railways while harmonizing the spectrum requirement for PPDR and RSTT.	Not agreed as explained in above Ans- 3
	6.	Samsung	The main spectrum requirement for Indian Railways is RSTT i.e. signaling purpose. This requirement concerning railway safety and passenger safety shall not be compromised for providing complementary internet services onboard. If the objectives of Connect India mission spelt out in NDCP 2018 are fulfilled by TSPs, there will be no need by Indian Railways to duplicate the efforts for providing internet services onboard. Regardless of that, onboard internet services shall be made available using unlicensed spectrum using WiFi technology as access and spectrum assigned to Indian Railways as backhaul. For backhaul carrying internet traffic, additional spectrum may be required other than the	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <ul style="list-style-type: none"> (i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR. (ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security. (iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry

			RSTT requirement of 2x10 MHz which will be needed for signaling purpose.	through Mobile communications. It is amply clear that the spectrum will be used only for non-commercial activities.
	7.	Samsung	<p>We share the view of the Authority that the alternate method suggested in para 4.48 i.e. common integrated network for RSTT and PPDR on harmonized PPDR spectrum i.e. Band 26 based on LTE-R and PS-LTE is a good option to consider. The radio resource allocation for RSTT should not overlap with the radio resource allocation for PPDR to avoid interference problems. To optimize interference, the concerned ministries i.e. Indian Railways, Department of Telecom & PPDR SPV under MHA shall establish Standard Operating Procedure (SOP). Such network topology deployment is technically feasible through proper network planning. This approach avoids the interference from PPDR network to the RSTT network but at the same time PPDR agencies first responders can roam in the RSTT network in case of emergency scenarios like accidents to coordinate and handle the relief operations. The build out of such common network topology for both RSTT and PPDR should be through appropriate tendering procedure. The operational control of the RSTT network and PPDR network rests with Indian Railways and PPDR SPV under MHA respectively through a dedicated core or dedicated slice of the common core. The maintenance of the network can be taken care by a third party.</p> <p>Samsung reiterates that deploying common communication network using LTE technology on harmonized spectrum for both RSTT and PPDR as suggested above is best strategy in national interest of all stakeholders. This allows easy coordination, optimal spectrum usage, smooth scaling up and interworking between the two networks during disaster situation.</p> <p>We do not provide specific comments, however, please refer to our response to (ii).</p>	<p>It cannot be possible to run mission critical communication applications and safety related train control application on common integrated network for RSTT and PPDR. It may endanger the safety of trains</p> <p>Mixing PPDR use with RSTT use in the 800 MHz band is either likely to result in interference along the path of Railways or may result in inadequate coverage for RSTT/PPDR, which is neither advisable for Mission Critical Passenger Safety Services nor for Disaster Relief.</p>
	8.	Samsung	We do not provide specific comments, however, please refer to Informative Annex.	NA
6	1.	Prof Rekha Jain & others from IIM Ahmedabad	<p>The 700 MHz spectrum band is the most appropriate spectrum band for LTE technology.</p> <p>Importance of 700 MHz band :</p> <ul style="list-style-type: none"> ● It Possesses excellent propagation characteristics. Thus, it can easily penetrate to buildings and walls (urban setup) and 	Not agreed. Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Frequency Bands to operate 5G

		<p>can cover relatively larger geographic areas without losing signal. This would also reduce the burden of deploying base stations as it requires lesser infrastructure to serve larger areas as compared to higher frequency bands.</p> <ul style="list-style-type: none"> ● It has wider coverage which results in low deployment cost. This would be beneficial, particularly in rural areas. ● Global harmonization- alleviate interference along national borders <p>Apart from this, it is also critical for the new generation telecom services. Therefore, if the spectrum in this band is assigned to the Indian Railways (IR), there will be very less left for the telecom industry. The lesser spectrum available in 700 MHz frequency band would mean a downward shift in telecom industry growth. It would also inflate the prices at auctions.</p> <p>The 700 MHz band is important as LTE needs to be harmonized for efficient deployment. If no spectrum is available in this band, there will be no incentive for investment in LTE. As a result, there will be a negative impact on Foreign Direct Investments (FDI) and productivity (business).</p> <p>Further, Spectrum available for commercial 5G services in India is already limited. Thus the allocation of 700 MHz to Railways, will further limit the scope of implementing 5G technology in India by making it impossible for operators to fight for already limited spectrum, resulting in inflated prices through auctions. Even the 5G committee (5G HLF) of the DoT, has recommended the use of 700 MHz band for 5G in India based on its significance towards 5G deployment. Adding to this, it is approximately 70% cheaper to provide mobile broadband coverage in this frequency band, making a strong case for using it for 5G deployment in light of the current condition of the Indian telecom sector.</p> <p>Available spectrum is insufficient to serve the growing demand of spectrum across sectors. The spectrum available in India is significantly lower than the USA, France, etc. It is even lower than that available in countries like Brazil and China. The spectrum available for each subscriber is as low as 0.2 Hz per subscriber, as given in table no 1. Further, the spectrum available in various bands, is also amongst the lowest for India when compared to most other countries.</p> <p>Due to the rapidly growing telecom sector, there is a steep</p>	<p>technologies include: <u>Millimeter wave</u> bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive <u>MIMO</u> (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;”</p> <p>“Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>In the past DOT’s auction for spectrum in 700 MHz frequency band did not receive any response.</p> <p>It has also been a well known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p>
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		<p>rise in spectrum requirement by the sector. Spectrum bands allocated and unutilized by other sectors is now being considered for use due to the technical developments leading to the expansion of telecommunication applications in bands allocated for other services.</p> <p>Therefore, it is not sustainable for DoT to assign spectrum in the 700 MHz band to IR for RSTT deployment. Other spectrum bands must be looked upon for allocation to IR for this purpose</p>	
	2.		NA
	3.	<p>In China, a framework for the development of LTE-R is under process and is scheduled to be introduced by 2022. As a high-frequency band has larger propagation loss and more severe fading, therefore, the low-frequency bands, such as 450–470 MHz, 800 MHz, and 1.4 GHz, have widely been used. The 450–470-MHz band is already well adopted by the railway industry in China; therefore, dedicated bandwidth for professional use can still be allocated from local regulators.</p> <p>Therefore, for RSTT, 10 MHz spectrum must be provided to IR initially, in the 450-470 MHz band. This may be increased in the future based on requirements and utilization of allocated spectrum. It can be either provided at a lower price or free of cost, based on DoT's discretion.</p>	<p>In china, a trial RSTT system for railway based on LTE using comprehensive broadband digital mobile communication technology is under study. It is planned to carry out system trial test in a high-speed railway line in the frequency band 450 MHz for this new system..</p> <p>The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p> <p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available.. No handheld devices available and functionality like PTT is also not available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.</p> <p>To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band.</p>

4. 5.		<p>NA</p> <p>Supreme Court's February 2012 judgment³ on "WRIT PETITION (CIVIL) NO. 423 OF 2010", allows for using natural resources (spectrum in our case) for "larger public good" with reference to the following point, as mentioned in the judgment: "In conclusion, we hold that the State is the legal owner of the natural resources as a trustee of the people and although it is empowered to distribute the same, the process of distribution must be guided by the constitutional principles including the doctrine of equality and larger public good."</p> <p>The Union Government, later, had opted for a Presidential Reference asking a series of questions seeking clarity on the 2G judgment. The basic question was whether auction as a mode of disposal of natural resources under the government's control was a constitutional requirement. The Supreme Court's response to this was in negative.</p> <p>While there was an argument in favor of auctions stating that revenue maximization during the sale or alienation of a natural resource for commercial exploitation is the only way of achieving public good since the revenue collected can be channelized to welfare policies and controlling the burgeoning deficit. But the court rejected this view stating- "we are not persuaded to hold so. Auctions may be the best way of maximizing revenue but revenue maximization may not always be the best way to subserve the public good. 'Common good' is the sole guiding factor under Article 39 (b) for distribution of natural resources". Thus, when the endeavors of state policy is to attain social good, an auction cannot be considered the sole criteria for allocation of natural resources.⁴</p> <p>Therefore, the spectrum in the 450-470 Mhz band may be administratively allocated to the IR. This is further supported by the fact that to accelerate the pace of investment in telecom infrastructure in the North East and Jammu & Kashmir, TRAI had previously recommended discounting the reserve price of the spectrum by 50% even for the TSP's. Following a similar approach, the spectrum may be allocated to IR at a discounted price or can even be given free of cost, considering the fact that the purpose of deployment of the spectrum, in this case, is for public benefit. For additional</p>	<p>NA</p> <p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. The allotment of spectrum to Railways is not for commercial purposes. 10 Mhz in this band has already been allotted to Defence without auction. Ministry of Law and Justice has already agreed for allotment of this spectrum in 700 Mhz band to Railways.</p> <p>It is believed that TRAI should have clearly put up the question of methodology (pricing). Most of the responses have been limited on auction or free allotment. Allotment to Railways will be on similar lines, as to that of allotment to Defence.</p> <p>Hon'ble Prime Minister Of India and many reputed economists have time and again stressed that the Indian Railways (IR) have the potential to boost the Indian economy and GDP in a big way. However, IR is currently facing a huge bottleneck in augmenting the train carrying capacity of the available infrastructure even in the face of increasing demand for both Passenger and freight traffic. Implementation of Modern Train Control system based on LTE, IR will not only be able to enhance Passenger Safety but will also be able to augment train carrying capacity of the available infrastructure due to increased speed and less fixed distance between the trains(both possible only through Modern Train Control System). Thus the allotment of 10 MHz spectrum in 700 MHz band to IR will bring significant socio-economic benefits for the country. The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence.</p>
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		requirement, IR can team up with TSPs on case to case basis	
6.		No comments	No comments
7.		<p>In case of assignment of spectrum to Railways, there are two main areas of deployment highlighted by IR:</p> <p>A. Public communication network (making communication and internet service available to passengers onboard). B. Railway operations (signaling, security, etc.)</p> <p>A. For public communications network: IR may collaborate with TSP's towards developing and maintaining the network as this involves a larger framework. The TSP's already have a robust communication network along the railway routes and there is no need for IR to build a new one. A study showed that almost 63% of the railway route had mobile connectivity by the year 2016.5 Also, there is no merit in allocating bandwidth to the railway for their internal communication as IR already has a nationwide contract with Reliance Jio for providing communication services to railway officials (1.95Lakh CUG mobile connections)6. They can expand the contract if additional capacity is needed.</p> <p>A 2009 survey in Belgium, concluded that onboard internet does not appeal to a mass market, but will attract a rather limited but heavily interested niche. In addition, the study showed that the willingness to pay for these services was quite low. This would burden the railways with increased costs if such passenger services are provided for free.7</p> <p>On the other hand, a certain section would be willing to pay a higher fee for access to premium internet services. The train is a mobile office for many passengers and for companies and persons who charge by the hour, work on the train can often cover the cost of their fare. The train is widely considered an integral part of the working day. This, therefore, suggests that rail services are more likely to appeal to business travelers if they are offered high-quality broadband. This can be done by providing a reserved quality of broadband onboard. Such passengers would be willing to</p>	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <p>(i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR.</p> <p>(ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security.</p> <p>(iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications.</p> <p>It is clear that the spectrum will be used for non-commercial activities.</p>

			<p>pay extra to get access to extra facilities and services. It will also prove to be a revenue source to telecom operators providing a particular service.⁸</p> <p>B. For railway operations: 10 MHz spectrum must be provided to IR initially, in the 450-470 MHz band. This may be increased in the future based on requirements and utilization of allocated spectrum. It can be either provided at a lower price or free of cost, based on DoT's discretion.</p> <p>IR must collaborate with TSP's for passenger communication purposes (considering future 5G developments) and the RSTT network must be developed and governed by the IR. Keeping two separate network infrastructures would prevent under-utilization of any spectrum allocated solely to IR, reduce infrastructure rollout time and would result in better spectrum management. Such a structure would prove sustainable for both the Railway operators as well as the TSPs</p>	<p>The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea. Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p> <p>There is very limited availability of LTE radios in 400-500 MHz band. To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band.</p> <p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available. Limited ecosystem, handheld devices available and functionality like PTT are not available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.</p>
	8.		No comments	No comments
7	1	Vodafone Idea	<p>We concur with the views of the DoT: (i) that 700 MHz is a globally harmonized and is being used worldwide for deployment of 4G and evolution of 5G services, (ii) that for achieving the objectives of 'Digital India', availability of sufficient spectrum is crucial, (iii) that if spectrum from 700 MHz band were to be reserved for Indian Railways, there will be insufficient spectrum left for 4G/5G services considering that 3 to 4 service providers will be providing services in each service area, which may jeopardise the growth plans of the telecom operators, and (iv) that frequency bands below 700 MHz are not available for allotment of IMT services in India</p>	<p>Not agreed as increased demand for data services Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Frequency Bands to operate 5G technologies include: Millimeter wave bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive MIMO (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G</p>

		<p>thus making the 700 MHz band the prime band for providing better coverage in rural areas.</p> <p>We submit that the available 2*35 MHz of spectrum in 700 MHz band should be allocated and utilized only for IMT services</p>	<p>networks;” “Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>In the past DOT’s auction for spectrum in 700 MHz frequency band has not received any response.</p> <p>It has also been a well-known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p>
	2	NA	NA
	3	<p>At the outset we submit that no spectrum should be reserved/assigned/allocated to Indian Railways for commercial purposes to meet the communication needs of the railway passengers, which will be served through the telecom service providers’ networks. The Indian Railways may avail and utilize the spectrum for their captive/internal purposes such as for passenger safety, train positioning and security purposes/requirements.</p> <p>Further, we would like to submit that the outcome of the WRC-19 (scheduled to be held between 28th October 2019 to 22nd November 2019) be examined so that Indian Railways can get benefitted with globally harmonized spectrum bands for meeting their requirements of RSTT, if these are not served through existing spectrum allotments. The Authority has noted in its consultation paper that the frequency ranges under consideration in ITU for a possible regional/global spectrum harmonization for RSTT cover 335.4 – 470 MHz and that studies in China were undertaken on the 450 MHz band, which may possibly become the globally harmonized band for RSTT during WRC-19.</p>	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <ul style="list-style-type: none"> (i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR. (ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security. (iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications. <p>It has amply cleared that the spectrum will be used for non-commercial activities. The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea.</p> <p>Railway Radio Communication System between Train and Trackage (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band. The ecosystems for 450-470 MHz band Radio and</p>

				hand held devices are not available. Limited ecosystem, no handheld devices available and functionality like PTT is not available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.
	4		<p>We reiterate our submission that no spectrum in IMT bands which have already been earmarked/identified for IMT and which have been globally harmonised for mobile services, should be considered for RSTT in India. It is submitted that DoT, vide notification no. R-11014/15/2012-NT dated 1st October 2013, had stated that allotment/assignment of spectrum in non-IMT bands may be made administratively as an interim measure, pending the final decision of the Government on allotment of all spectrum only through auction process.</p> <p>There is no such exception, as of now, for IMT bands where all aspects related to IMT bands pricing should be seen.</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>The allotment of spectrum in this band to Indian Railways is a policy matter of Government of India, on the lines of allotment to Ministry of Defence.</p>
	5		<p>We would like to submit that the outcome of the WRC-19 (scheduled to be held between 28th October 2019 to 22nd November 2019) be examined so that Indian Railways can get benefitted with globally harmonized spectrum bands for meeting their requirements of RSTT, if these are not served through existing spectrum allotments</p>	<p>We cannot defer our plan by awaiting the outcome of the WRC-19. The project to implement ETCS Level-II with LTE is required to be implemented as early as possible to augment train capacity on Indian Railways.</p>
	6		<p>We submit that any commercial use of spectrum can only be undertaken by a licensed telecom service provider and hence, we do not agree with the provision of internet services using the spectrum allocated for signalling/captive use. The right to provide service in trains should be open for all operators and it cannot be the case that service is given only by one operator.</p> <p>On-board Wi-Fi/internet services in trains can be provided by any/all TSPs or ISP as per the license.</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost, as this proposal is devoid of any commercial gain, and is only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p>
	7		<p>We reiterate our submission that no spectrum in IMT bands which have already been earmarked/identified for IMT and which have been globally harmonised for mobile services,</p>	<p>In the past DOT's auction for spectrum in 700 MHz frequency band has not received any response.</p>

			<p>should be considered for RSTT in India. Subject to this, in our view an approach similar to option 1 can be followed where different TSPs can associate with IR for different areas, which will result in more efficiency and innovation in setting up of RSTT.</p>	<p>It has also been a well-known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p> <p>It is not possible to run mission critical communication applications and safety related train control applications on commercial network of mobile operators. It may endanger the safety of trains. This was the reason for roll out of GSM-R on Railways in the world.</p>
	8		NA	NA
8	1	Bharti Airtel	<p>As rightly highlighted in the consultation paper, 700 MHz band is a globally harmonized band identified for deployment of IMT applications in the telecommunication services by various countries. The key advantages of this band include wider coverage area with fewer base stations and higher penetration inside buildings. The global harmonization of 700 MHz band as laid out in WRC-15 would provide several benefits such as global roaming, higher capacities and affordable services.</p> <p>Any allotment of spectrum resources identified for the commercial mobile services should be allocated in a fair and transparent manner. Given the advantages and key benefits of 700 MHz band spectrum, this strategic resource should be allocated first to the licensed telecom service providers through the proper allocation mechanism i.e. auction. Keeping in view the goals of Digital India, TRAI has also recommended that the entire spectrum available should be put in auction for all the identified bands and it may not be right to assume that only the existing licensees will participate in the auction process.</p> <p>It is observed that only 35 MHz of spectrum is available for</p>	<p>Not agreed. Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Frequency Bands to operate 5G technologies include: Millimeter wave bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive MIMO (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;”</p> <p>“Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>In the past DOT’s auction for spectrum in 700 MHz frequency band has not received any response.</p> <p>It has also been a well-known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date.</p>

		<p>allocation in 700 MHz band, after reserving 10 MHz for meeting the demands of Ministry of Defence. Allocating further 10-15 MHz to Indian Railways would result in availability of only 20-25 MHz for commercial IMT services. This is grossly inadequate considering the current number of operators and new operators that may plan to 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.</p> <p>Hence, we are of the view that Spectrum in 700 MHz band should not be allocated to Indian Railways. It should only be made available to the licensed TSPs via due auction process.</p>	<p>With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p> <p>As Indian railways demand for spectrum is for non commercial , safety and security related activities. Therefore, in national interest , allotment shall be made as made to defence.</p>
	2	No comments	No comments
	3	<p>Worldwide, the analogue based RSTT systems are getting replaced by digital systems. The Resolution 236 of WRC -15 recognized the need to conduct timely studies on various technologies that can be used to provide radiocommunication services for railways. This resolution also considered that there is a need to integrate different technologies to facilitate various functions and meet the needs of high speed railway environment. Before allocation of any further spectrum resources to Indian Railways, it is prudent to wait for the outcome of WRC-19 which will help to identify and facilitate global or regional harmonized frequency bands to support RSTT.</p> <p>Several countries such as Japan have allocated 400 MHz band for RSTT 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 RSTT 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 FDD LTE based RSTT system currently tested in this band.</p> <p>Similarly, Indian Railways can be allocated the 450-470 MHz for deployment of LTE based RSTT. We are also of the view that the spectrum in Band 71 (i.e. 663 – 698/ 617 – 652 MHz) may also be explored in the case of Indian Railways. To begin with, 5 MHz FDD or 10 MHz TDD may be assigned to Indian Railways subject to feasibility in the above band.</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, and is only for enhancing safety of trains, security of passengers; disaster management and IOT based assets monitoring.</p> <p>As no commercial gain is involved, hence, no need to adopt auction route.</p> <p>There is very limited availability of LTE radios in 400-500 MHz band. To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band. The 700 MHz band is being widely used for Public Safety Services e.g North America and Korea.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p> <p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available. There is limited</p>

			It is again reiterated that the spectrum in 700 MHz band as recommended by TRAI for being put up in the upcoming auction should not be allocated/ reserved for RSTT applications.	ecosystem, non availability of handheld devices and functionality like PTT available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.
	4		<p>Mobile services are provided by licensed TSPs who invest huge amounts in acquiring the spectrum through open market process i.e. auction.</p> <p>Any commercial spectrum band earmarked for mobile services should be assigned via auction irrespective of the type of agency/entity desiring to use the same for providing any services. Since the 700 MHz band has a huge potential for being used for provision of commercial IMT services and for providing improved coverage to the subscribers, it is recommended that any entity desiring to have spectrum in this band should pay the market determined price as determined in auction.</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>As no commercial gain is involved, hence, no need to adopt auction route.</p>
	5		For serving the needs of LTE based RSTT, the existing process followed by DoT for assignment of spectrum administratively for captive usage can be followed for allotment of spectrum in Band 71/ 450-470 MHz band. The allotted spectrum shall be used only for captive RSTT services and not for providing Internet services or any other services which are provided by licensed TSPs in India.	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <p>(i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR.</p> <p>(ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security.</p> <p>(iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications.</p> <p>It has amply cleared that the spectrum will be used for non-commercial activities</p>
	6		The primary motive of the allotment of spectrum to Indian Railways is for the "Development of Ultra-high-speed	In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this

			<p>wireless corridor for Train-ground and Train-Train communication” including mission critical, interoperable and safety-related applications. The usage of spectrum assigned for such captive use should be limited to non-commercial usage only.</p> <p>We do not support any provision of Internet services by Indian Railways with the use of spectrum assigned for signaling purpose, since this would result in unfair competition and direct substitute to the services provided by existing licensed operators who acquire spectrum through auction.</p> <p>Any provision of Internet services onboard should be done by facilitating the TSPs to install their own infrastructure.</p>	<p>proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p>
	7		<p>For the creation of LTE based RSTT network, Railways should allow all the existing TSPs to install their commercial network, directly or in shared mode. Only the licensed TSPs holding valid license should be allowed to provide the mobile Internet services to the passengers.</p> <p>Further, as indicated in response to Q1, commercial bands such as 700 MHz should not be assigned for captive use by Indian Railways for LTE based RSTT. Any assignment of commercial bands for any services should be as per market determined process/ auction.</p>	<p>It cannot be possible to run mission critical communication applications and safety related train control application on common commercial network. . It may endanger the safety of trains</p> <p>The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence.</p>
	8		No comments	No comments
9	1	MTNL	<p>As 700 MHz band can serve India’s rural needs for advanced mobile broadband, MTNL is of the view that no spectrum in the 700 MHz band should be assigned to railways or any other application specific uses.</p> <p>1.2 It has been widely noted by Government at various forums that 5G shall be the catalyst for the new age Socio Economic reforms in the country and India shall not miss any opportunity to launch 5G technology along with other developed nations. To achieve this ambitious target 700 MHz spectrum shall be a key asset. Spectrum below 1 GHz in general, and the APT700 digital dividend band specifically, has been a key part of the mobile operators’ strive to connect everyone, given the wide area coverage advantages of 700 MHz. 700MHz is set to become the biggest LTE ecosystem globally. All three ITU regions have adopted this mobile band.</p>	<p>Not agreed as increased demand for data services Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT), Industry Automation, and Business Critical use cases. Frequency Bands to operate 5G technologies include: Millimeter wave bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive MIMO (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;”</p> <p>“Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p>

		<p>Most advanced markets have already licensed, deployed or planned to license this band for 4G/5G IMT.</p> <p>1.3 Using the 700 MHz band for purposes other than for mobile broadband LTE/5G will be pose significant socio-economic losses to India, given the benefits of widespread mobile broadband using sub 1GHz – particularly in countries with large rural areas. Therefore premium band like 700 MHz should be allocated to telecom PSU operators BSNL and MTNL so as to ensure rapid proliferation and penetration of mobile broadband into remotest corner of the country.</p> <p>1.4 It would be important for government to undertake a cost-benefit analysis to determine the long-term economic gains for India and the trade-offs likely to emerge by constraining mobile broadband spectrum in 700 MHz as a result of the set-aside for rails. 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 assigning 700 MHz spectrum for railways.</p>	<p>In the past DOT’s auction for spectrum in 700 MHz frequency band has not received any response.</p> <p>It has also been a well-known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p>
	2	<p>No spectrum should be assigned to railways in the 700 MHz band</p>	<p>Not agreed , in Railways’ view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence.</p>
	3	<p>Other bands are available for use by rails and should be considered in first instance in order to avoid undue costs, technical complexities and missed economic opportunities (i.e. 150, 300, 400, 450-470 MHz). Indian Rails would benefit from undertaking a cost-benefit comparative analysis amongst these options, especially if the concern of the proposals by Rails is to put spectrum to use by railways for the purpose of public safety. Public safety applications for rails should avoid planning operational robustness based on the effectiveness of interference mitigation between rails and other spectrum users. As explained in point two above, Indian Rails will require coordinating its networks with commercial mobile broadband to achieve interference</p>	<p>There is very limited availability of LTE radios in 400-500 MHz band. To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p> <p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available. There is limited ecosystem, non availability of handheld devices</p>

			<p>mitigation, which is not an effective platform to begin planning a public safety use.</p> <p>3.2 The band 450-470 MHz should be considered for RSTT. Also, the recent AWG report shows the band 150MHz, 300MHz and 400MHz have been widely used for RSTT in Asia Pacific countries.</p> <p>3.3 Depending on implementation in India, the bands B26 and B27 in the 800MHz spectrum could also be considered for railways, if PPDR is not implemented in these bands.</p> <p>3.4 TRAI must consider the large investments required by operators to serve the public with mobile infrastructure and the investment-intensive nature of wide area rural broadband – constraining the availability of spectrum in 700 MHz is likely to undermine this vision.</p>	<p>and functionality like PTT available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications</p> <p>Hon'ble Prime Minister Of India and many reputed economists have time and again stressed that the Indian Railways (IR) have the potential to boost the Indian economy and GDP in a big way. However, IR is currently facing a huge bottleneck in augmenting the train carrying capacity of the available infrastructure even in the face of increasing demand for both Passenger and freight traffic. Implementation of Modern Train Control system based on LTE, IR will not only be able to enhance Passenger Safety but will also be able to augment train carrying capacity of the available infrastructure due to increased speed and less fixed distance between the trains(both possible only through Modern Train Control System). Thus the allotment of 10 MHz spectrum in 700 MHz band to IR will bring significant socio-economic benefits for the country.</p>
4			<p>4.1 Any spectrum allocation meant for larger public good should be done by Government administratively so as to maximize the benefits, therefore if at all it is decided that spectrum in IMT bands which have already been earmarked for mobile services, be assigned to Indian Railways for RSTT in India, then allotment should be done free of cost and administratively. The same approach needs to be applied while allocating spectrum to public sector undertakings.</p> <p>4.2 Moreover, mixing LTE/5G use with RSTT use in the 700 MHz band is likely to require interference mitigation to coordinate the two systems along the path of railways – this is likely to result in unpredictable costs. Any ongoing risk of</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>As no commercial gain is involved, hence, no need to adopt auction route.</p>

		<p>interference or need for pre-emptive interference mitigation measures will have an impact also on the price of IMT spectrum in 700 MHz.</p> <p>4.3 Any costs arising from spectrum management and interference mitigation mechanisms between railways and LTE/5G networks should not be passed on to mobile operators.</p>	
	5	As per our response above in paragraph 4.1	Same as above
	6	<p>6.1 Railway should facilitate the process to collaborate with Telecom PSU Operator BSNL and MTNL to deploy their own infrastructure to provide high-quality internet services. This will reduce the requirement of spectrum for railways, reduce the causes of interference and better specialist services could be offered to public by and large.</p> <p>6.2 License exempt solutions like Wi-Fi should be considered for providing internet services, or the railway company should facilitate the process to allow mobile operators to deploy their own infrastructure to provide high-quality internet services</p>	<p>Not Agreed,</p> <p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <p>(i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR.</p> <p>(ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security.</p> <p>(iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications.</p> <p>It has amply cleared that the spectrum will be used for non-commercial activities</p>
	7	<p>7.1 Telecom PSU Operator BSNL and MTNL have played key role in introduction of latest technologies and making them available to common people at most affordable prices, which made significant impact in overall digital transformation of Society by and large. Without having considered business viability, these PSUs have extended</p> <p>its services to every nook and corner of the country. Therefore, Alternate method suggested in para 4.47 is recommended with one modification that Telecom PSU Operator BSNL and MTNL could build, deploy and maintain LTE-R network for IR; while the control, use and operation of the LTE-R network may be with IR.</p>	<p>It cannot be possible to run mission critical communication applications and safety related train control application on common commercial network .. It may endanger the safety of trains.</p>

			7.2 Network slicing will allow Telecom PSUs to dedicate a portion of their spectrum to provide best quality of service for application-specific uses.	
	8		<p>8.1 The digital revolution triggered by MTNL has led to creation and development of a unique multidimensional ecosystem full of new age opportunities making a lasting impact not just over socio-cultural aspects of masses but also over business world making it better, more attractive and full of opportunities than ever before.</p> <p>8.2 Administrative allocation of 700 MHz spectrum to Telecom PSU Operator i.e. BSNL and MTNL shall lead to a wave of enormous socio-economic reforms with 5G Technology. Estimation of benefits due to this growth shall be far more than the monetary benefits to government by commercially exploiting the spectrum.</p>	No comments
10		BSNL	<p>1. 700 MHz Band provides better cellular penetration (i.e. in-building reception) and best coverage with fewer deployed cell sites. Allocating 700 MHz to railways will limit the usage of the band along the railway tracks, therefore the band will remain unutilized along all Himalayan region extending from J&K to North East. The band can be utilized in a better if given to Telecoms. The band is useful for PPDR communication network in view of public safety & security where real time exchange of data communication is required among various agencies. Even if Indian Railways request is being conceded, then in view of better utilization of the spectrum, the allotment of 700 MHz band may also be given to BSNL free of cost for improving the services and launching 5G services in future in the areas not covered by Railway Track.</p> <p>700 MHz is a best radio waves for long distance communication services so this spectrum must be auctioned and Indian Railways should participate in the same.</p> <p>Moreover, European are pushing ahead with awarding the 700 MHz band to mobile operators by 2020, 700 MHz may be largely be used for Mobile in</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>Indian railways is having pan India rail network and expanding to far flung areas including Himalaya region, J&K and North East. Hence , the proposed spectrum will be used on pan India basis.</p> <p>There is no artificial scarcity for mobile operators because it is a fact that in India there has been consolidation of Mobile operators and their numbers</p>

			<p>Europe. In coming 6-8 years, 700 MHz band could be used for mobile services across world. Therefore, choking this band, by giving to IR is not recommended.</p>	<p>have come down from 10 to just 4. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz which was unsold in last auction.</p> <p>Also, even after allocation of 10 MHz spectrum to Indian railways, 25 MHz will be still available for IMTs applications.</p>
			<p>2. BSNL is not in favour of assigning of 700 MHz spectrum for limited use, instead it should be used on Pan India basis including providing Broadband wireless coverage in unserved area.</p> <p>At present Railways has already been assigned some spectrum in 1800 MHz which is under harmonization. A possibility may be explored to utilize existing spectrum allotted by assigning additional spectrum for LTE. Any other spectrum which is not having much commercial value can be assigned free and railways may have dedicated equipment for use safety related issues.</p>	<p>IR shall use it Pan India basis for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>No spectrum is assigned in 1800 MHz to Indian railways.</p>
			<p>3. The spectrum in 450-470 MHz available may be given to Indian Railways for RSTT services, However, same to be given where it can be used by Railways. Being a lower frequency band, this can also meet coverage requirement of IR.</p>	<p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available. There is limited ecosystem, non availability of handheld devices and functionality like PTT available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.</p>

				<p>To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p>
			<p>4. If it is decided that spectrum in IMT bands which have already been earmarked for mobile services, be assigned to Indian Railways for RSTT in India then auction should be there, Indian Railways along with other Telecoms should be allowed to participate in auction as it is planning to give Wi-Fi services to on board passengers and this is a commercial activity which will affect the revenue of Telecoms.</p>	<p>In Railways' view, Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>As no commercial gain is involved, hence, no need to adopt auction route.</p> <p>The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence.</p>
			<p>5. May be given administratively only for specific use as non-liberalized.</p>	<p>Agreed</p>
			<p>6. Surely this is a commercial activity or in case its given free than the services being provided to public are to be made free as national resources are being made available freely therefore, services being provided using spectrum also to be free. However, this will be a direct hit on revenue of TSPs and chances of interference would also be there.</p> <p>Railway can implement LTE Radio through any of the TSP.</p>	<p>Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>It cannot be possible to run mission critical communication applications and safety related train control application on common commercial network .. It may endanger the safety of trains.</p>
			<p>7. Method (i) is a good option wherein TSP-BSNL could build, deploy and maintain LTE-R network for IR; while the control, use and operation of the LTE-R network may be with IR.</p>	<p>Same as above.</p>
			<p>8. No comment.</p>	<p>No comments</p>
11.		JIO	<p>1. At the outset, we submit that spectrum in 700 MHz may not be assigned to Indian Railways for RSTT services as this spectrum is of immense commercial value and will be the backbone of the digital inclusion</p>	<p>Not agreed as increased demand for data services Globally, 5G services are considered in place of 4G for traditional coverage applications and new specific usages such as Internet of Things (IoT),</p>

			<p>envisaged under various national schemes like 'Digital India'. As highlighted by DoT and agreed by the Authority, the spectrum resources in 700 MHz band are limited and to utilize this spectrum in an optimum manner, it should be auctioned.</p>	<p>Industry Automation, and Business Critical use cases. Frequency Bands to operate 5G technologies include: Millimeter wave bands (26, 28, 38, and 60 GHz) as these offer performance as high as 20 gigabits per second; Massive MIMO (Multiple Input Multiple Output – 64-256 antennas) offers performance “up to ten times current 4G networks;”</p> <p>“Low-band 5G” and “Mid-band 5G” use frequencies from 600 MHz to 6 GHz, especially 3.5-4.2 GHz. Thus high-frequency bands are preferred band in 5G for much higher speeds.</p> <p>In the past DOT's auction for spectrum in 700 MHz frequency band has not received any response.</p> <p>It has also been a well-known fact that in India there has been consolidation of Mobile operators and their numbers have come down from 10 to just 4 on date. With the consolidation the spectrum available with the operators who have gone out has been acquired by the working operators. Thus even without purchasing spectrum in 700 MHz, they have been able to manage all their requirement including 4G services. Therefore, this may be one the reasons for subdued demand of 700 MHz.</p> <p>Hon'ble Prime Minister Of India and many reputed economists have time and again stressed that the Indian Railways (IR) have the potential to boost the Indian economy and GDP in a big way. However, IR is currently facing a huge bottleneck in augmenting the train carrying capacity of the available infrastructure even in the face of increasing demand for both Passenger and freight traffic. Implementation of Modern Train Control system based on LTE, IR will not only be able to enhance Passenger Safety but will also be able to augment train carrying capacity of the available infrastructure due to increased speed and less fixed distance between the trains(both possible only through Modern Train Control System). Thus the allotment of 10 MHz spectrum in 700 MHz band to IR will bring significant socio-economic benefits for</p>
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				the country.
			<p>2. We further submit that Railways is a commercial organization and safety and control system are part of operation of the system. As the Railways is planning to upgrade these systems and wishes to use most advance telecommunication technology leveraging commercial spectrum, it should be prepared to win the right to use this spectrum in an open auction. As administrative allocation of this valuable national resource, at zero cost, will be a travesty of Hon'ble Supreme Court's landmark judgment at 2G case.</p>	<p>Not agreed , Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence. Also Indian Railways ' proposal for allotment of spectrum has already cleared by Ministry of Law & Justice.</p>
			<p>3. Further, as highlighted by the Authority in the Consultation Paper, the Railways do not intend to limit the use of this spectrum and new system to offer conventional RSTT services. Instead they propose to use the following applications/facilities by deploying LTE technology in 700 MHz:</p> <ul style="list-style-type: none"> (i) Faster data network communication for voice, video and other related application. (ii) More network-enabled devices (IOT) based Asset reliability Monitoring)_. (iii) Providing Wi-Fi facility in trains. 	<p>Indian Railway shall use the spectrum to cater the needs of the following uses: (i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR. (ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security. (iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications. It has amply cleared that the spectrum will be used for non-commercial activities</p>
			<p>4. Clearly, the proposal by Railways is encroaching upon the licensed telecommunication activities under various authorization of Unified License. The Authority is requested to strictly forbid using these facilities and application by a Government organization without appropriate licensing.</p>	<p>Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. . The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence as it is related to safety & security and no commercial gain is involved, hence, no need to adopt auction route.</p>
			<p>5. We further submit that, if at all, Railways feels that providing such services are desirable to enhance its</p>	Same as above

			customer experience, then it should follow the legitimate route of obtaining an appropriate license and acquiring spectrum through auction to offer the same.	
			6. Further, we agree that with the DoT view that it would be prudent to take decision on proposal of spectrum assignment to the Indian Railways based on the outcomes of WRC-19 to be held in November-2019. As many other issues like identifying globally harmonized frequency bands for the implementation of RSTT along with existing mobile service allocations are under consideration. It is also not out of place to mention that so far ITU has not proposed this band for RSTT. Further, as per table 2.1 of the consultation paper, this band is not even in consideration in ITU for a possible global spectrum harmonization for RSTT proposed from within regional groups.	<p>We cannot defer our plan by awaiting the outcome of the WRC-19. The project to implement ETCS Level-II with LTE is required to be implemented as early as possible to augment train capacity on Indian Railways.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p>
			7. As highlighted in our General Comments, if at all this spectrum is allocated then DoT would be compelled to not use the spectrum in non-Railway track areas due to interference issues and would be a very inefficient deployment, which will go completely against the Govt's objective of efficient utilization of spectrum.	It cannot be possible to run mission critical communication applications and safety related train control application with common commercial network on the same spectrum . . It may endanger the safety of trains.
			8. We would also take the opportunity to highlight another vital related point. As the Authority is aware, Railways are most inflexible in acting upon the request for Right of Way permissions and permission to install mobile towers in their areas. We submit that in case the permission to install towers is accorded by Railways as per provision of " Right of way Rules" notified by the Government, the quality of communication coverage inside the moving train will anyways improve tremendously besides increasing the Government's revenue in terms of license fee and SUC by increased usage in trains. Further, Railways would be left to manage only core STT services. We submit that enhanced co-operation with TSPs will boost coverage in nearby areas and can be used for telemetry.	No agreed as explained above
		2.	Not Applicable	-

		3.	<p>1. We agree with the DoT view that spectrum in 450-470 MHz may be considered for assignment for RSTT. This spectrum is not identified for commercial use and these spectrum frequency ranges are also being considered for harmonization by regional group on Global basis as mentioned in Table 2.1 of the Consultation paper. The use of globally harmonized band is always better from operational feasibility.</p>	<p>The ecosystems for 450-470 MHz band Radio and hand held devices are not available. There is limited ecosystem, non availability of handheld devices and functionality like PTT available, which is must for critical communication services , very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.</p> <p>To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band.</p> <p>Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band.</p>
			<p>2 This LTE band seems to be the optimum option for RSTT. The device eco-system for this band is also evolving and there are international used cases are also available for use of this band by Railways, for instance in Australia.</p>	
			<p>3. We submit that instead of allocating the entire spectrum in 450-470 MHz band, the spectrum should be allocated in tranches of 10 MHz. The initial 10 MHz should be allocated to start with and the remaining 10 MHz should be allocated, post determining that more spectrum is required to meet RSTT needs. Further, as mentioned earlier, this spectrum should be strictly allocated for Railway's operational and signaling requirement.</p>	
		4.	<p>1. We submit that in view of the Hon'ble Supreme Court's landmark judgement in 2G case, commercially deployable mobile spectrum can not be allocated to any entity below the market price. The Authority is aware that, hitherto, all spectrum allocation has been carried out on the same principle and there is no reason to alter this approach just because the beneficiary would be a commercial organization belonging to Government.</p>	<p>Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring.</p> <p>The allotment of spectrum in 700 Mhz to Railways is a policy matter on the lines of allotment to Ministry of Defence as it is related to safety & security and no commercial gain is involved, hence, no need to adopt auction route.</p> <p>Also Indian Railways'proposal for allotment of spectrum has already cleared by Ministry of Law & Justice.</p>
			<p>2. We reiterate that Railway is a commercial organization and safety and control system are part of operation and would be part of the cost of operation. The cost of spectrum would be an inalienable part of the cost of providing safety and security of Railways and Railways should bear this cost. It is pertinent to mention here that that when 3G and BWA spectrum was allocated to</p>	

			BSNL/MTNL, administratively in 2010, they were also required to pay the market price of the said spectrum.	
			3. Thus, in case it is decided that spectrum in IMT bands which have already been earmarked for mobile services, be assigned to Indian Railways for RSTT, it should be allocated at market price. In case market price is not available, it should be based on the reserve price recommended by TRAI. Indian Railways should be asked to pay difference of reserve price and market price to be discovered in next auction from date of assignment.	
		5.	1. We submit that the allocation of the spectrum in non-commercial bands like 450-470 MHz band will depend on the proposed usage by Railways. In case the Railways undertake to use this spectrum only for RSTT services with no infringement of the scope of services under the Unified License, then the spectrum can be assigned administratively, at the administrative price determined by the Government.	The ecosystems for 450-470 MHz band Radio and hand held devices are not available. There is limited ecosystem, non availability of handheld devices and functionality like PTT available, which is must for critical communication services, very limited market and very small number of commercial networks working on LTE in 450-470 MHz band are some of the drawbacks for consideration of 400 MHz band for RSTT. Further the use of 450 MHz in comparison to 700 MHz will create more co-channel interference by frequency reuse and is therefore not advisable for Mission Critical Passenger Safety Services & Applications.
			2. However, in case the Railways is desirous of offering commercial services being offered under Unified License then it should not only be required to obtain appropriate license, it should be charged at market price available for next higher band or as per the market price of commercial spectrum band with similarly characteristics.	To the best of our knowledge, No Railway has deployed LTE based communication in 400-500 MHz band. Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band. Indian Railways requires 10 MHz spectrum in 700 MHz band, free of cost as this proposal is devoid of any commercial gain, but only for enhancing safety of trains, security of passengers, disaster management and IOT based assets monitoring. As no commercial gain is involved, hence, no need

				to adopt auction route.
		6.	<ol style="list-style-type: none"> 1. We do see licensing and jurisprudential challenges, in case Indian Railways provided internet services onboard. We submit that provision of internet service by any entity is permissible only on obtaining license under section 4 of Indian Telegraph Act. Thus, we reiterate our submissions in the previous responses that to provide commercial service like Internet, Railways should obtain the appropriate authorization under Unified License and necessarily obtain their spectrum resources through auctions and comply with the applicable Regulation and Quality of service norms. 2. We submit that using spectrum allocated for signaling purposes for internet services will not only be a violation of allocation terms but will also disturb the level playing field. 	<p>Indian Railway shall use the spectrum to cater the needs of the following uses:</p> <ul style="list-style-type: none"> (i) Mission Critical Passenger Safety Services & Applications through a Modern Train Control System for Railway Signaling system on IR. (ii) Video Surveillance (Live Feed) through CCTV networks in trains along with Video Analytics for Passenger Security. (iii) Faster data network Communication for voice, video and other related application such as IoT based Asset reliability Monitoring, Guard driver communication and Train & way side Telemetry through Mobile communications. <p>It has amply cleared that the spectrum will be used for non-commercial activities</p>
		7.	<ol style="list-style-type: none"> 1. We submit that the alternate method suggested in para 4.47, wherein a TSP could build, deploy and maintain LTE-R network for IR; while the control, use and operation of the LTE-R network may be with Indian Railways is a feasible option. Under this option, while the RSTT related services can be controlled by Railways, the commercial and monetization part can be left to the partner TSP. The TSP can be permitted to offer the onboard Wi-Fi and other services. Additionally, the TSP can use the towers built the onboard Wi-Fi and other services. Additionally, the TSP can use the towers built for this network, to provide service to nearby areas, as well, thus becoming a win-win situation. Therefore, we submit that this option can be the appropriate option and all its modalities should be explored further. This option will ensure effective and efficient utilization of spectrum and at the same time will provide state of art LTE network for Indian Railways. 	<p>Not Agreed, It cannot be possible to run mission critical communication applications and safety related train control application on common commercial network It may endanger the safety of trains</p>
			<ol style="list-style-type: none"> 2. The alternate suggested in para 4.48 wherein there could be a common integrated network (with common spectrum) for Public Safety i.e. Public Protection and Disaster Relief(PPDR) and Railways can also be explored. However, such a utility will require a detailed discussion and agreement with the 	

			PPDR agencies as well, as there is a possibility of operational issues due to multiple Authorities using the same network or same frequency spots in overlapping geography. The possibility of congestion related issues in the areas where Railways is passing through congested areas can not be ruled out as well.	
			3. We further submit, going by Authority's existing recommendation of PPDR, this proposal will lead to a very complex situation involving multiple Government agencies using common network resources, which is provided majorly by BSNL/MTNL and partially by a private TSP. One simpler way would be to let private TSP provide the network for PPDR and Railways both, while using the spectrum resources for commercial use in remaining areas.	
		8.	NIL	Nil
12	1	UpphoktaSankrashan and KalyanSamiti	Now,At present, IR is using GSM-R based networks similar to various Railway networks deployed around the world. In India, 1.6 MHz (paired) spectrum in 900 MHz band has been assigned to Indian Railways for deployment of its GSM-R based network. There has always been a demand for increase in speed of trains. A new system is required to fulfill High Speed Rails (HSR)operational needs, with the capability of being consistent with LTE, offering new services but still coexisting with GSM-R for a long period of time.	Once, proposed system with LTE is rolled out, GSM-R shall be phased out and respective frequency spectrum in 900 MHz shall be given back to DOT.
	2		The GSM-R: Future spectrum options for GSM-R to consider are: Extension of the UIC band width: UL: 873-876 MHz; DL: 918-921 MHz;UL: 698-703 MHz, DL: 753-758 MHz and/or UL: 733-736 MHz, DL: 788-791 MHz3.1The GSM-R system is planned to be replaced when it has reached "end of life" around 2030. The successor of GSMR is unknown at the moment and is currently defined by the FRMCS (Future Radio Mobile Communications System) program under the UIC.	Not agreed, Railway Radio Communication System between Train and Trackside (RSTT) based on LTE communication backbone has been deployed by Korea in 700 MHz band. The proposed LTE system by Indian railways is upgradable to FRMCS.
	3		it is affirmative as above.	Same as above
	4		The Resolution 236 (WRC-15)3recognized that timely studies are required on technologies providing for railway radiocommunication and that international standards and harmonized spectrum would facilitate worldwide	We cannot defer our plan by awaiting the outcome of the WRC-19. The project to implement ETCS Level-II with LTE is required to be implemented as early as possible to augment train capacity on

			deployment of RSTT. Further, it invited ITU Radiocommunication Sector (ITU-R) to study the spectrum needs, technical and operational characteristics and implementation of RSTT. Consequently, ITU-R Study Group 5 is studying relevant technical and operational characteristics for railway radiocommunication systems	Indian Railways.
	5		DoT commented that LTE based communication is proposed to be used along the Rail tracks laid by IR for which 15 MHz of 700 MHz spectrum has been demanded from DoT. If this quantum of spectrum is reserved for Railways network, the same spectrum cannot be reused by Telecom operators in respective service areas.	Agreed.
	6		No	-
	7		Long Term Evolution (LTE) is 4th Generation (4G) Mobile Communication System and is emerging as Global Standard for all new Train Control and Railway Signalling applications replacing the incumbent 2nd Generation (2G) GSM-R technology and is likely to see the broadest deployment of any new wireless technology over the next decade in Railway Safety, Security and Passenger experience applications. Installing an Ultra-high-speed LTE based communication corridor along IR network would cater to the current and future data and voice needs for Train-Ground and Train-Train communication for improved train operations, passenger safety and passenger security services and remote rail asset monitoring & management. The applications of LTE can be classified under the following three broad categories	Agreed
	8		The ITU-R has identified the digital dividend spectrum in the frequency band 698-806 MHz for IMT in Region-3 (Asia-Pacific). This frequency range can provide effective mobile broadband services for Public Safety network and thus is most suitable for Indian Railways requirement. Adoption of 700 MHz frequency spectrum is growing across world's railways because of its inherent advantages such as wide coverage, low Capex, efficient network utilization etc. Another driving force is the ability in 700 MHz spectrum of LTE to provide efficient high speed, low latency, low setup time, and high-security data connectivity, which is the precondition to provide multimedia and especially mission critical multimedia	Agreed

			communication for safety and security application on Railways.	
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