

Chapter 5

Signalling & Telecommunication

At Railway Board level, Director General is overall in-charge of Signalling & Telecommunication (S&T), a Department of Indian Railways who directly reports Chairman Railway Board. At Zonal level, the Chief Signalling and Telecom Engineer (CSTE) is responsible for overall supervision and maintenance of S&T assets.

For enhancing efficiency and safety in train operation, modern signaling plays a very vital role. The Signalling Department handles induction and maintenance of signalling systems such as Multi Aspect Colour Light signaling (MACLS), Panel Interlocking (PI), Route Relay Interlocking (RRI), Electronic Interlocking (EI), Automatic Block Signaling, Block proving by Axle Counter, enhancement of safety at level crossing by Interlocking of level crossings and provision of telephones at manned level crossings etc. The Telecom Department oversees the complete working of Telecom in Railways and takes care of all the telecommunication requirements of Railways.

The expenditure on repair and maintenance of plant and equipment of S&T department during the year 2016-17 was ₹ 2856.49 crore¹⁶¹. A capital expenditure of ₹ 966.58 crore was incurred on creation of S&T assets. During the year, apart from regular audit of vouchers and tenders, 180 offices of the Department were inspected.

This chapter includes a long paragraph on 'Implementation of Mobile Train Radio Communication (MTRC) system over Indian Railways'. In this paragraph, Audit reviewed the status of implementation of the MTRC system on Indian Railways and analysed reasons of sub-optimal/non-utilisation of the system. In addition there are two individual paragraphs highlighting non-utilisation of handsets procured for MTRC system and avoidable liability on account of Spectrum Charges due to failure to review the use of Walkie Talkie sets.

¹⁶¹ Minor Head 500, 600 and 700 of Grant no.07 – Repair and maintenance of plant and equipment

5.1 Implementation of Mobile Train Radio Communication (MTRC) system over Indian Railways

5.1.1 Executive Summary

The MTRC system has been introduced to replace the existing Very High Frequency (VHF) based communication system over IR. It aims at better traffic management over Indian Railways through data transfer (regarding location and movement of trains) and secured communication amongst drivers, guards, maintenance staff, etc. MTRC to be effective required implementation on complete routes, dedicated locomotives with cab radios for the routes, provision and maintenance of MTRC infrastructure, stakeholder identification and role assignment, skill identification and upgradation, revision of recruitment rules and change management. However, no road map for implementation of the system has been prepared by the railways. Due to absence of a comprehensive time bound road map, implementation of MTRC system could not take place. As on 31 March 2017, only on 1470 RKM's out of 19,512 RKM's planned, the MTRC project has been implemented. Wherever implemented, the system is not being utilised as complete routes have not been covered for implementation and dedicated locomotives with cab radios for the routes have not been provided. Besides, due to deficient support system in terms of maintenance contracts and faulty Mobile Service Switching Centre at Agra, the system remains unutilised. Thus, expenditure of ₹ 181.73 crore incurred on MTRC system so far has remained unfruitful. There is a need to review the requirement and architecture of the MTRC system as an independent telecom system within Indian Railways, particularly in view of the advancements made in the telecom field in the country during the last decade.

5.1.2 Introduction

Indian Railway is presently using 'Driver-Guard-Station-Controller System', generally known as 'Control Communication System' for communication to run trains. In this system, communication between Driver-Guard and Driver-Guard-Station Master is based on Wireless Fidelity (Wi-Fi) Technology through VHF¹⁶² (Very High Frequency) handsets; that uses radio waves to provide network connectivity. Communication between Station Master and Control offices is based upon land line phones. Under this system the communication through Wi-Fi is not retrievable, whereas communication through land line is retrievable.

Indian Railways decided to introduce Mobile Train Radio Communication based on GSM-R technology. The 'Gaisal Train Disaster', which occurred on 2 August 1999 due to the collision between the Avadh Assam Express from Dibrugarh and the Bramhaputra Mail from New Delhi, leading to more than 280 deaths and leaving over 320 people injured prompted the Indian Railways to expedite the changeover to MTRC system.

¹⁶²A system of communication through walkie talkies

Mobile Train Radio Communication (MTRC) system is being implemented as a dynamic and technologically *avant-garde* system of highly advanced system based on the 'Global System for Mobile Communications-Railway (GSM-R)' technology and is expected to play an intrinsic role in minimizing train accidents by aiding effective communication. It ensures safety of passengers by providing effective communication and instant and constant interaction of the train crew with the Control Centre and Station Master through the use of GSM-R technology.

In 2005, the MTRC project was sanctioned and Nokia Siemens Network was given the work of implementing MTRC based on GSM-R technology in India. The Nokia Siemens Network implemented the country's first GSM-R based MTRC system in May 2008 for Palwal-Mathura-Jhansi route of North Central Railways. As per the Action Plan for Vision 2020 and recommendation of the High Level Safety Review Committee, all 'A', 'B' & 'C' routes of Indian Railways consisting of 19,152 Route Kilometres (RKMs) out of 66,687 RKMs of Indian Railways network were to be provided with MTRC System. Accordingly, 19 MTRC projects (including one Kolkata Metro Project, three projects of 'D' and 'E' category routes) were taken up (31 March 2017). The MTRC project is being implemented by the Indian Railways Project Management Unit (IRPMU) over North Central Railway (NCR) as well as Kanpur-Lucknow section of Northern Railway.

Mobile Train Radio Communication (MTRC) system

MTRC system ensures switch over from analog communication to digital technology. It needs a specific frequency band pertaining to railway applications. For Indian Railways, the Telecom Directorate of IR has recommended 900 MHz frequency band for downlink and uplink signals respectively. They are essentially 935-960 MHz and 890-915 MHz, respectively.

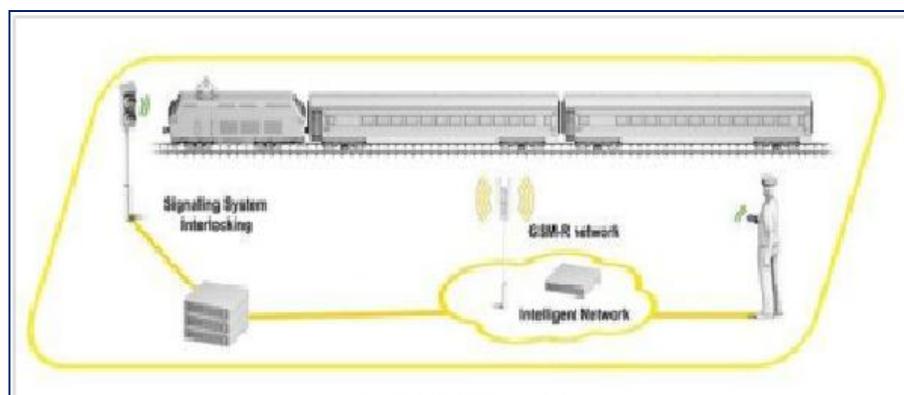


Figure 5.1: Departure Ready Message

The present day MTRC system has many advanced features, which enhance the safety of the overall system of railways operations and ensure that the optimum passenger safety conditions are met. The important components and equipment of MTRC based on GSM-R include Base Station Subsystem (BSS), Mobile Station (MS), Operating Subsystem (OSS), Network and Switching Subsystem (NSS), Cab

Radio¹⁶³, Dispatcher and Power Supply Arrangement. A pictorial representation of GSM-R systems is shown in **Figure 5.1**.

The system aims to provide complete detail about the train and its running status to the railway officials like information about the train's speed, its current direction of movement based on 'Global Positioning System (GPS)', time of train's arrival and departure, the current passenger strength on the train, the track details on which the train is running, amongst other advantages. It can be used to warn the drivers beforehand of the running trains as well as provide effective assistance to the railway officials involved in train related operations. In case of a safety concern, the concerned staff can immediately intimate the concerned officials of the railway establishment. If any accident takes place, it will ensure effective facilitation of the management of the post event activities. The salient features of MTRC system include the following:

1. The modern trains having MTRC system simultaneously calculate and communicate their running status through radio communication to the drivers and the control rooms. The communicated status includes important details about the running trains like the accurate position of trains, their speed, braking distance and the direction in which they travel in terms of their position coordinates.
2. The system allows the wayside equipment's¹⁶⁴ to highlight such points on the railway track which may be called as nodes, which should not be crossed by other trains moving on the same path.
3. The system calculates the ambient 'Safety Braking Distance' and greatly reduces this distance between two trains by providing continuous and accurate train location and speed details.
4. The system provides for easy switchover and up-gradation to driverless trains as it is based on a highly advanced communication technology.
5. The system, by calculating the most efficient train speed for minimum energy loss incorporates train costing (due to which the train runs down the track because of its own gravity, without making use of other energy forms like electric power). This helps save energy.

Even though the MTRC system has many advanced features to ensure maximum efficiency in railways operations and passenger safety, like any other

¹⁶³ As per Chapter XVIII of Indian Railway Telecom Manual, cab radio is on-board equipment suitable for voice and data communication. It can be used with European Train Control System (ETCS) for train control. It consists of three units Radio, Operating units on Man Machine Interface (MMI) and antenna. The cab radio is a part of the locomotive. It ensures seamless GSM-R communication and registration/de-registration at crew changing points is not required. The alternatives to cab radio are mobile handsets and Operational Purpose Handset (OPH). These require registration and de-registration at every crew changing point. Further, during a single journey of a locomotive the relationship of a locomotive to crew is one to many i.e. a number of crew will be required for completing a single trip of locomotive. Thus, alternative to a single cab radio will require multiple units of mobile equipment. Mobile Equipment (ME) used in MTRC system includes Operational Purpose Handsets (OPH) and General Purpose Handsets (GPH). OPH is useful for Guards, Train Superintendents, Station Masters, Shunting Teams, Controllers other than the Section Control and Drivers also when Cab Radios are not provided/functioning in loc. General Purpose Handset (GPH) is useful for trackside maintenance staff (Engineering, Signal & Telecom and Electrical for Railway Electrification areas, and Security patrols).

¹⁶⁴As per the Manual on Uniform Traffic Control Devices, 2009 given by the 'US Department of Transportation, Federal Highway Administration', wayside equipment includes the switches, signal systems, control devices, etc. for railway transit operations housed within one or more than one enclosures located on the railway tracks.

technology, it also has some drawbacks which need to be taken into consideration when designing or using the system for railways communication. The major risk is that if the communication between any of the trains fails or is hampered, then the MTRC system might fail, wholly or partially, endangering the safety of passengers. As the MTRC system uses Radio Communication for all applications, there can be communication failures due to weak signal strengths, attenuation, electromagnetic (EM) interference or glitch in the functioning of the hardware. As the system makes use of wireless communication, it can be subjected to unethical hacking, putting the passenger safety into question. Due to malfunctioning of equipment, there can be unexpected and unwanted application of emergency brakes, which can cause train accidents.

A pictorial representation of Automatic Train Supervision¹⁶⁵ is shown below:

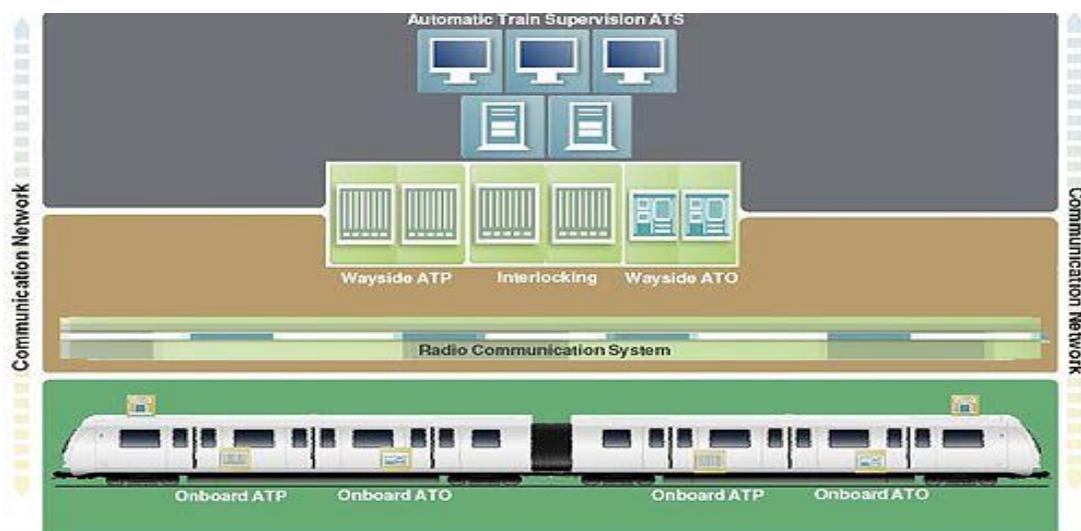


Figure 5.2: Automatic Train Supervision

Operational requirements for MTRC

The MTRC system has been introduced to replace the existing VHF based communication system over IR. It would lead to better traffic management over Indian Railways through data transfer (regarding location and movement of trains) and secured communication amongst drivers, guards, maintenance staff, etc. The following necessary minimum ingredients are necessary for obtaining benefits of implementation of MTRC over Indian Railways:

- i. **Complete route should be MTRC enabled:** MTRC system seeks to replace VHF based communication system over Indian Railways have trains travelling on long distance routes e.g. Delhi-Howrah, Delhi-Nagpur, Delhi-Kanpur, Delhi-Jammu etc. It requires availability of MTRC system on complete routes. If made available over small sections and sub-sections, the benefits of the system cannot be derived.

¹⁶⁵Automatic Train Supervision has two sub-systems: Automatic Train Protection is responsible for the safety-critical functions including train protection and Automatic Train Operation is responsible for the automatic operation of throttle and brake commands to move trains between stations and other stopping locations.

- ii. **Availability of dedicated locomotives for the MTRC enable routes:** The complete benefits of MTRC are available through a dedicated cab radio for each locomotive for data recording, transfer and communication. Thus, it is desirable that MTRC enabled locomotives with cab radios run on the routes with MTRC system.
- iii. Seamless uninterrupted network on MTRC route requires **sufficient number of Base Transceiver System¹⁶⁶ (BTS), Mobile Service Switching Centre¹⁶⁷ (MSC)**, absence of blind spot¹⁶⁸, maintenance facilities for hardware components and software applications.
- iv. Replacement of VHF based system by MTRC system requires **revision of operational instruction for operation of train, training, skill up gradation and change in working practices** including changes in recruitment rules.

Audit reviewed planning and execution of selected completed and ongoing projects for implementation of MTRC systems in Indian Railways. Audit findings are discussed below:

Audit findings

5.1.3 Status of various MTRC Projects undertaken by Indian Railways

Though planned since 1980, Indian Railways initiated the work of implementation of MTRC System in 1999-00 through different projects in different segments. Based on the recommendation of Railway Safety Review Committee's report (August 1999 and February 2001), Railway Board approved in-principle implementation of MTRC project covering 19,152 RKM of 'A', 'B', and 'C' routes. Vision 2020, envisaged covering 12000 RKM under MTRC by 31 March 2017. 19 MTRC Projects (15 projects of 'A', 'B' and 'C' routes, two projects of 'D' routes, one of E route and one project of Kolkata Metro Railway) were planned for implementation. Audit noticed that as on 31 March 2017, only 3,900 RKM have been covered under MTRC (**Annexure 5.1**), i.e. 20.367 per cent¹⁶⁹ of the total RKM planned. Audit observed that

- Only on 1470 RKM (12.25 per cent¹⁷⁰) the MTRC work has been completed by railways as on 31 March 2017:

S. no	Name of the section where MTRC Project implemented	RKM
1	New Delhi-Jhansi (excluding New Delhi-Palwal (57 RKM) and Palwal-Mathura (83 RKM))	270
2	Palwal-Mathura	83
3	Lucknow-Kanpur	75
4	New Delhi-Ambala-Ludhiana (Including New Delhi-Palwal section and Delhi area)	372
5	Mughalsarai – Dhanbad	400
6	Dhanbad – Howrah	270
Total		1470

¹⁶⁶It performs channel coding/decryption and contains transmitter and receivers, antennas

¹⁶⁷It is centre responsible for call processing, switching & routing traffic and supplementary services.

¹⁶⁸A blind spot is location where GSM network not working

¹⁶⁹3900 RKM /19152RKM *100

¹⁷⁰1470 RKM/12000RKM*100

- Out of 19 MTRC Projects planned, the following five projects have not been started as yet, even after a lapse of three to four years from the date of their sanction. The detailed estimate of these projects were yet to be sanctioned:

Table 5.2 – Sections where MTRC work is yet to be taken up		
S. no	Zonal Railway	Name of the section where MTRC projects were yet to be taken up
1	NFR	Kamakhya-Goalpara-New Bongaigaon section
2	NFR	Guwahati-Lumding section
3	WR	Churchgate-Virar-Replacement section (and integration with MTRC of Central Railway)
4	CR	Itarsi-Nagpur MTRC (without master switching centre)
5	NR	New Delhi-Ghaziabad including Delhi-Sahibabad section

- Though benefits of MTRC system could be derived only when it is implemented on the complete route and not in parts, the same was not ensured while taking up various projects. e.g. The MTRC project of New Delhi-Jhansi (270 kms) was taken up in the year of 2001-02. But, the middle section of Palwal-Mathura (83 kms) was taken up after more than three years in 2004-05. No reasons were found on record for the same.
- A cab radio for each locomotive for data recording, transfer and communication and dedicated locomotives for the MTRC enable routes were not provided, and OPH/GPH handsets were being issued, where MTRC was implemented.

Thus, railways have not planned for implementation of the MTRC system in a comprehensive manner. MTRC to be effective required implementation on complete routes, dedicated locomotives with cab radios for the routes, provision and maintenance of MTRC infrastructure, stakeholder identification and role assignment, skill identification and upgradation, revision of recruitment rules and change management. However, no road map for implementation of the system has been prepared by the railways. As on 31 March 2017, only on 1470 RKMs out of 19,512 RKMs planned, the MTRC project have been implemented.

5.1.4 Analysis of completed MTRC Projects

Audit undertook detailed analysis of MTRC projects completed/partly completed by Indian Railways. Detailed audit findings are discussed below:

5.1.4.1 Mathura –Jhansi and Palwal-Mathura sections

The MTRC projects were planned for Mathura-Jhansi section (270 RKM) and Palwal-Mathura section (83 RKM) by IRPMU in 2001-02 and 2004-05 respectively. The contract for these projects including survey, design, manufacture, supply, installation, testing and commissioning of MTRC system was awarded (April 2005) to M/s Siemens Public Communication Networks

(Pvt.) Ltd., Gurgaon, at ₹ 19.92 crore¹⁷¹. The project was to be completed within 12 months from the date of issue of letter of acceptance (April 2005).

These projects were finally completed in 2008 with a delay of nearly two years and at a cost of ₹ 37.62 crore till March 2017. The actual date of completion and reasons of cost overrun was not found on record. The project was taken over in June 2014 (after more than five years) by NCR, after issue of the directives by Railway Board in July 2013, with certain deficiencies as listed below:

- Isolation Transformer were not available at Datia, Antri, Sithouli and different other places.
- Faulty Isolation Transformer, defective Specific Transmission Module FIBCOM make and unavailable Duamco card at the Level crossing gate.
- Unavailable Base Transceiver Station (BTS) at tunnel (Antri-Sandalpur).
- Unavailable coverage due to dark zone between Antri-Sandalpur, Sithouli-Gwalior and Dholpur-Mania.
- Faulty communication devices (handsets) including 101 Operational Purpose Handsets (OPH), 31 General Purpose Handsets (GPH) and six mobile sets of Magicon make.

The reason and justification for not taking over of the above MTRC system in this section up to a period of five years were also not found on record.

Audit observed that

1. The comprehensive warranty and annual maintenance contract (AMC) of the MTRC system in this section expired on 31 March 2012. The two year warranty and three year AMC expired without any operation or utilisation of the MTRC system. Thereafter, the AMC could not be renewed. The system does not have any AMC coverage for the last five years.

Agra Division of NCR floated tender (April 2014, June 2014 and again in August 2014) for Comprehensive AMC of MTRC system in the section at an estimated cost of ₹ 4.90 crore. Against tender of August 2014, only one bidder viz. Original Equipment Manufacturer (OEM), M/s Nokia India, Gurgaon responded with offered price of ₹ 8.43 crore. This price included cost of repair charges for faulty items identified. Tender Committee discharged this tender on the ground of non-fulfilling of minimum qualifying/eligibility criteria and recommended to invite fresh tender after revision of the estimate. Thereafter, tenders with revised estimated (₹ 9.36 crore including cost of repair and maintenance of faulty spares) were invited four times (September 2015, January 2016, June 2016 and April 2017) without change/relaxation in eligibility criteria. Against the fifth, sixth and seventh tender, the offer received was discharged on the ground of non-fulfilling of minimum qualifying/eligibility criteria. Further, in November 2017 and December 2017, tenders were invited with change in eligibility criteria. The offer received against tender of December 2017 was under process and yet to be finalised.

¹⁷¹ ₹ 18.82 crore for Mathura-Jhansi and ₹ 1.10 crore for Palwal-Mathura section

As such, though response received against every tender was poor, Railways repeatedly invited tenders for AMC of this section without exploring any relaxation/change in the minimum qualifying/eligibility criteria. Also, a better response for AMC would have been received, if the same was not linked with repair work of faulty items.

2. The Mobile Service Switching Centre (MSC) at Agra is the prescribed Home Location Register (HLR)¹⁷² for NCR. All MTRC users of NCR are required to register at this MSC. Due to fault in the MSC at Agra, new subscribers cannot be added. Further, the communication taking place in MTRC system is also not retrievable over this section. The fault in MSC at Agra have not been rectified as AMC of MTRC system in Palwal-Mathura-Jhansi route is not in place since April 2014. Defects pointed out at the time of taking over the system in June 2014 continue to exist. No cab radio is installed or in use over locomotives running on the section for purpose of use of MTRC system. As an alternative OPH, GPH, mobile handsets to limited number of subscribers, who were registered before MSC at Agra, are being used in the MTRC system.

3. The operation of trains over Indian Railways are executed through directives contained in General and Subsidiary Rules (G&SR). Respective Zonal Railways issue amendments to G&SR to cater to local variations. The provision for MTRC over NCR was incorporated in G&SR through Amendment issued (4 December 2013), which provided that GSM MTRC, Tetra based mobile communication; trunking radio and CTCSS VHF are prescribed as a secured means of communication in regard to communication between station Master and Loco Pilot. The amendment further provides that wherever secured means of communication are not available, the loco pilot shall be advised through a written memo. Provision of MTRC through this amendment showed that MTRC system is prescribed as a standby system for communication between loco pilot and station master, whereas controllers, guards, maintainer and others are not included in the amendment to G&SR for communication through MTRC.

Thus, MTRC system is not being used with its full potentialities and objectives. G&SR prescribes its use as a supplementary communication to Wi-Fi Based communication. This is based on feature of MTRC where communication is recorded and is retrievable. However, since this aspect of MTRC is not working at present, the MTRC system in the section cannot be used for the purpose.

4. The basic features of GSM-R¹⁷³ allows various users to make point to point calls, groups of users to receive common information and make calls within/among the groups, allows a user or an application to be reached by means of a number, which identifies the relevant function and not the physical terminal, provides the routing of mobile originated calls to the correct controller e.g. relative to the geographic area and allows resource pre-emption for priority calls.

¹⁷²HLR contains pertinent user information including address, account status and preferences. It interacts with the MSC which is a switch used for call control and processing.

¹⁷³ As defined in Chapter 18 of Indian Railway Telecom Manual

To ascertain the extent of utilization and benefit of MTRC system on the above two sections, Audit collected feedback from 19 users/maintainers (consisting 10 of running staff (Loco Pilot), 03 maintainers (Technician and Engineers) and six others (control staff and Station Masters) by way of their opinion/experience. Audit observed that

- More than 90 *per cent* users were having ordinary mobile set or other type of simple equipment.
- All the MTRC system users are using only normal calling facility just like CUG calling system and were not acquainted with features of MTRC system in operation.
- 90 *per cent* of running staff and 11 *per cent* of other staff users expressed constraints over availability of signal strength and lack of connectivity as the main problem of MTRC system.
- All running staff have problem in registration/deregistration. The use of handsets in place of cab radios leads to requirement of registration/deregistration.
- No user or maintainer had been provided any training regarding use/maintenance of MTRC system.

As such, none of the users are in a position to use MTRC system for any purpose except as a standby to Wi-Fi system (Communication System in existence for the purpose at present). The crew on Indian Railways also have another stand by system for communication in form of Closed User Group (Communication facility) provided through a private telecom service provider.

Thus, defects and deficiencies in the MTRC system at the time of taking over, subsequent defects of MSC/Agra, failure in communication retrieval, absence of cab radios in the locomotives, absence of repair facilities and non-availability of an AMC have led to the sub-optimal utilization of MTRC system. The expenditure of ₹ 37.62 crore on implementation of MTRC project in Palwal-Mathura-Jhansi route remained unfruitful. Moreover, chances of technological obsolescence of MTRC equipment and accessories installed 10 years back cannot be ruled out, particularly due to non-finalization of AMC as on date.

5.1.4.2 Lucknow-Kanpur section

Audit reviewed the records relating to the MTRC work of Lucknow-Kanpur section and noticed that

- The above project consisting 75 RKM was planned by IRPMU in the year 2007-08 and is an extension of Ghaziabad-Kanpur route (which is a part of the Ghaziabad-Mughalsarai route over NCR).
- It was finally completed after 16 extensions granted and after a delay of more than six years at a cost of ₹4.57 crore as on 31 March 2017. Actual

date of completion of this project was not found on records made available to audit.

- The system was offered to Northern Railway (NR) with handsets on October 2015 by IRPMU, but the same did not materialise. The system remains unutilised as on date.
- CPM/IRPMU also recorded (October 2015) in the Minutes of the Meeting to review the operational and maintenance issue and progress of MTRC works that the system of Lucknow-Kanpur route has been commissioned, but is not in use. It will be come into use when the work in whole section from Ghaziabad-Kanpur will be completed.

Thus, the completed portion of 75 RKM of Lucknow-Kanpur route remained unutilised even after incurring an expenditure of ₹ 4.57 crore and after passage of more than eight years.

5.1.4.3 New Delhi-Ambala-Ludhiana (Including New Delhi-Palwal section and Delhi area)

The work was taken up in 2001-02. Though the work was completed, financial closing was pending. The project was commissioned in August 2013 and handed over Network Management organisation in November 2016 after three years. AMC for 29 locations of Palwal-Ludhiana section lapsed in February 2015, but contract for AMC for the period thereafter was finalised only in March 2017. However, none of the train being run in the section are using this system. The system on New Delhi – Palwal section was commissioned in August 2013.

5.1.4.4 Mughalsarai - Dhanbad (400 RKM)

The system has been commissioned in 2006-07 by M/s Nortel. However, the same is not being utilized due to the following reasons:

- MTRC system is very sophisticated and requires highly expert manpower for its maintenance and cannot be maintained departmentally. However, as the company, which commissioned the system in this section, closed down in the year 2010, the system could not be maintained. Due to lack of maintenance and want of spares etc., the system stopped working since the year 2013. AMC was awarded (October 2017) to M/s Nokia solution network Pvt. Ltd.
- ECR Administration confirmed that a blind spot between Koderma-Gujhandi section (0.5 km) was reported through drive test. The concerned division has approached (October 2017) the AMC contractor for rectification of the same.
- Out of 1150 handsets required, there was a shortage of 1113 equipment. Though requisitions for the same were made by the concerned division, the same were yet to be received.

Audit further observed that there was failure of connectivity on nine occasions during 2016-17 for 33.62 hours between Base Station Controller and Mobile Services Switching Centre, as provided by Railtel Communication India Limited

(RCIL). During 2017-18 (up to January 2018) link failure was noticed on four occasions for 21.25 hours. Thus, though commissioned ten years back, the system was not being utilised.

5.1.4.5 Dhanbad - Howrah (270 RKM)

The system was commissioned in (22 January 2007), but not operational as the company (M/s Nortel -OEM), which commissioned the system in this section, closed down in the year 2010, the system could not be maintained. MSC at Kolkata is not working and MSC (proposed) at Tundla is required to be relocated to Kolkata. The system is, thus, not being utilised.

5.1.4.6 Status of completed part project

Audit reviewed the records relating to the MTRC work of Ghaziabad-Kanpur section and noticed that

- The above project consisting 410 RKM was planned by IRPMU to be completed in the year 2002-03.
- Etawah-Aligarh consisting of 170 RKM was completed by M/s Ansaldo Signal Consortium in November 2013 without taking up any work from Ghaziabad to Aligarh and from Tundla to Kanpur. This middle section remained switched off upto March 2016. Later on, it was offered to Allahabad Division with handsets and SIM for use in October 2016. But due to defect in working of MSC at Agra, the system remains unutilised as on date. MSC at Agra is the home location register for all subscribers of NCR and no MTRC system over NCR cannot be put to use without the removal of defect in the MSC at Agra. The alternate is to procure, install and commission another MSC.
- The expenditure on the above project was incurred to the extent of ₹ 47.90 crore as of March 2017 without any utilisation so far.
- NCR also incurred an expenditure of ₹ 12.00 crore on procurement of items including OPH handsets for cab radio, cab radio hardware and software, etc. lying unutilized since 2011 at Tundla Depot.

Thus, the completed portion of 170 RKM on Ghaziabad-Kanpur section also remained unutilised, despite incurring an expenditure of ₹47.90 crore.

Thus, despite the fact that the MTRC system can be best utilised when it is implemented seamlessly on the complete intended routes, the MTRC system has not been implemented in full stretches. Wherever implemented, the same is not being utilised due to deficient support system in terms of maintenance contracts and faulty Mobile Service Switching Centre at Agra and Kolkata and non-availability of cab radios in the locomotives. The expenditure of ₹ 181.73 crore incurred on MTRC system so far has become unfruitful. In this regard, Audit noticed that Executive Director of Signal Directorate/Railway Board in 2002-03, proposed to the Chairman Railway Board and all the works sanctioned/processed for sanction may be dropped as the experience in this regard on sections where this was provided has been extremely discouraging. Member Electrical/Railway Board opined that arrangement of VHF sets and

walkie-talkie sets to driver and guard may serve as an interim arrangement, which at best can provide simple and limited communication in stationary and low speed mode. The view of Member Electrical was agreed to by the Chairman Railway Board. Thus, there is a need to review the policy in terms of its requirement and its relevance in the present scenario.

Audit recommends that a full scale review of the MTRC projects may be taken up by the Railway Board and completed within a reasonable time frame. Till such time all fresh procurements and agreements related to MTRC may be put on hold. This may exclude agreements/tenders which are necessary to maintain the health of existing assets. A road map indicating activities, time lines, stake holder identification with role assignment may be prepared, addressing issues of change in technology, support system and skill requirement etc. India has undergone a telecom revolution in the last decade and Railway administration should consider if the requirement of secured communication envisaged through MTRC could be met through specialized telecom providers (existing in India) in place of creating an independent telecom infrastructure for MTRC within IR.

The matter was brought to the notice of Railway Board on 2 February 2018; their reply is yet to be received (28 February 2018).

5.2 North Central Railway (NCR): Unwarranted procurement of Operational Purpose Handsets and General Purpose Handsets led to blockage of capital of ₹ 17.77 crore

Railway Administration procured costly Operational Purpose Handsets (OPH) and General Purpose Handsets (GPH) equipment worth ₹ 17.77 crore without proper and realistic need analysis and hence these could not be utilised. Quotes were called from the firm without any basis and rational. The Tender Committee went out of its way to obtain documentation pertaining to the earlier tender from RDSO, to prove the eligibility of the firm for the current tender.

Mobile Train Radio Communication (MTRC) is a dynamic and technologically *avant-garde* highly advanced system based on the Global System for Mobile Communications-Railway (GSM-R) technology. The system is expected to play an intrinsic role in minimizing train accidents by aiding effective communication. Operational Purpose Handsets (OPH) and General Purpose Handsets (GPH) are mobile equipment used for communication by drivers and for general use by railway personnel involved in train operations, such as guards, shunting and track side maintenance staff (Engineering, Signal & Telecom and Electrical for Railway Electrification and Security patrols) respectively, under MTRC system. This equipment function after registration/ de-registration in the specific Mobile Switching Centre (MSC) which is a telephone exchange that makes the connection between mobile users within the network, from mobile users to the public switched telephone network and from mobile users to other mobile networks.

Indian Railways procures these handsets either through a composite package of the MTRC project including design, manufacture, supply, installation and commissioning of the whole project or through procurement as a non-stock item based on cross acceptance approval¹⁷⁴ of Research Designs and Standards Organisation (RDSO). OPH equipment has two SIM cards for easy switch between Global System for Mobile Communication for Railways (GSM-R) and public subscription in order to achieve effective and efficient communication under MTRC system. GPH equipment has single SIM card system.

Audit reviewed the records of procurement of these OPH and GPH equipment in NCR. It was seen that on the basis of indents received (October 2014 and February 2015) from Jhansi Division for requirement of 507 OPH and 1000 GPH handsets for their usage in MTRC system over New Delhi- Jhansi section, NCR Administration (Controller of Stores, Allahabad), through open tender mode placed (July 2016) Purchase Order (PO) on M/s Vista Information System (VISPL). The contractual price for supply of 507 OPH and 1000 GPH was ₹ 17.77 crore¹⁷⁵ @ ₹ 1,36,100 and ₹ 74,599 for OPH and GPH respectively. The stipulated delivery schedule of start within two months and to be completed within four months thereafter. Audit observed that deficiencies in the process of assessment and procurement of these handsets. Detailed observations are given below:

A. Assessment of requirements of handsets

Jhansi division placed indents (October 2014 and February 2015) for requirement of 507 OPH and 1000 GPH handsets for their usage in MTRC system over New Delhi- Jhansi section. It was also seen that during the review of work of MTRC project of Jhansi-Bina section, Railway Board decided (October 2015) not to procure costly GPH/OPH and stated only to use ordinary GSM handsets with single SIM architecture in view of the current status of implementation of MTRC and acceptability of MTRC by users. They further suggested that introduction of special purpose OPHs can be considered as a step for value addition after the system gets wide acceptance and the staff become familiar.

The status of requirement of OPH/GPH against their actual utilisation as on June 2017 was as follows:

Name of Division of NCR	Modified Requirement		Remarks
	OPH	GPH	
Jhansi	125	944	Jhansi Division projected its requirement based on 25 per cent additional quantity towards spares.
Agra	382	415	Agra Division projected its requirement based on 25 percent additional quantity towards spares but without essentiality certificate and finance vetting.

¹⁷⁴ Cross-acceptance approval of a product is status when it has been accepted by one Authority and is acceptable to other Authorities without the necessity for further assessment.

¹⁷⁵ ₹ 14.38 crore for supply and ₹ 3.39 crore towards two year maintenance charges after three year warranty period

Name of Division of NCR	Modified Requirement		Remarks
	OPH	GPH	
Others (Returned to NR against taken on loan)	---	---	No projection for return to Northern Railway was reflected in the demand.
Total quantity procured	507	1000	<i>The indent for GPH was adjusted to 1000 against demand for 1359 handsets</i>

Audit observed that

- As of March 2017, 301 OPH and 321 GPH valuing ₹ 4.03 crore were lying idle at Tundla Depot since 2011. Audit noticed that Jhansi Division had not taken into account the availability of these items, while sending the indents for procurement of OPH/GPH in October 2014 and February 2015. While vetting the proposal, Finance division of Jhansi division suggested (July/August 2015) a reassessment of requirement afresh. No action was taken on this suggestion of Finance by the Signal and Telecommunication Department.
- The requirement and issue/ distribution was not consistent at Jhansi and Agra Division.
- The additional 25 per cent spare requirement was made without any basis by Jhansi Division.
- The requirement towards return of handsets taken on loan from NR was not projected earlier. Moreover, the model of 100 OPH and 285 GPH returned to NR has been found to be different from that received from NR.

Thus, procurement of OPH/GPH was done without any realistic assessment of requirement. NCR Administration in their reply stated (June 2017) that the requirement of OPH/GPH was justified as all indents of Jhansi Division were approved by competent authority and vetted by finance. The stock from Tundla Depot was not available for diversion to Palwal-Jhansi section as it is for Ghaziabad-Mughalsarai section being a separate work and is under commissioning. However, the Signal and Telecommunication Department did not undertake any reassessment of requirement as suggested by the Finance. Subsequently, it was seen that all these procured handsets could not be utilised and were lying idle.

B. Assessment of reasonability of rates

In response to this tender of March 2016, only one offer was received. Review of the process of assessment of reasonability of rates received by the Tender Committee (TC) was done in audit. It was seen that

- Jhansi Division estimated the price of OPH at ₹ 1,36,211 and GPH at ₹ 74,724 based on the accepted rate (April 2012) of works contract of Kolkata Metro, where M/s VISPL supplied 12 OPH and 22 GPH in October 2014. The TC did not correlate the quantity of meager supply in Metro Railway case involved in the total contract including system design, planning, supply, installation,

testing and commissioning of GSM-R based MTRC. Besides, rates of individual items in a works contract should not be taken as last accepted rates where consolidated rate for the entire work was accepted and individual items have be potential of being compensated by other items through lower rates for those items. To that extent, the decision of TC to use the rates quoted in a contract in Metro Railway, Kolkata was not judicious.

- The corresponding rates of handsets were also available with IRPMU for 2012-13 (₹ 66,915 and ₹ 29,194 for OPH and GPH respectively) of a discharged tender for Palwal-Mathura-Jhansi section. The tender was discharged on the grounds of non-compliance with the updated EIRENE¹⁷⁶ specification by the bidder and the OPH/GPH procured were lying idle in open condition/ unutilized supplied by the same firm for the past one year.
- NCR Administration issued open tenders for the purchase of OPH/GPH instead of global tender without recording any reason and proper justification for non-issue of global tenders. As the item was not available in India and was to be imported, the reason for floating an open tender was not justified.

Thus, estimates were not arrived at realistically and reasonability of the rates offered was not assessed. NCR Administration in their reply stated (June 2017) that the cost estimates were based on the Last Accepted Rates (LAR) of 2012 of Metro Railway and were appropriate as the rates of individual items are also assessed in works contract as per Railway Board letter (November 1972). The rates of discharged tender of 2012-13 were not reasonable to be compared (being a part of discharged tender).

However, the rates of April 2012 (Metro Railway's works contract) were only for 12 OPH and 22 GPH and were for the entire schedule of work¹⁷⁷ and it did not include acceptance of rates of individual items. Further, in case of this tender (June 2016), for assessment of reasonability of the price offered, the railways had the option to use RBI indices, with 2011-12 rates along with the change in exchange rate between Euro and Rupee. However, the same was not done. This was crucial as only a single response had been received. As regards, not considering the rates of a discharged tender, it is stated that the reason for discharging of the tender was not the reasonability of rates but change in specifications and as such, these rates could have been used as a reference.

C. Undue benefit to the supplier

On 25 November 2011, RDSO gave a certificate for Prototype Approval on Cross Acceptance basis for OPH (Model TiGR 350R) and GPH (Model TiGR 155R) of Sagemcom make issued to M/s NSN for IRPMU contract¹⁷⁸ dated February 2006. The Certificate of RDSO was with reference to the products meeting specification (EIRENE) as prevalent at that time. The prototype clearance was

¹⁷⁶ European Integrated Railway Radio Enhanced Network

¹⁷⁷ Total 23 items including supply of Trans Rate Adaptor, Supply of base station controller, supply of base station transceivers units etc.

¹⁷⁸ Against contract no. IRPMU/W/01/KfW/03-04/CA dated 01.02.2006 of IRPMU

valid in terms of this certificate till such time as there was no change in specification, design, process, raw material, components and source of raw material/components or in software whichever is earlier. Subsequently, RDSO issued its own specifications¹⁷⁹, which were applicable at the time of issue of the tender for the procurement of OPH/GPH of March 2016. These RDSO specifications were stated to have been issued based on EIRENE specifications, which had also undergone revisions between 2011 and 2016.

In December 2015, M/s VISPL sought clarification¹⁸⁰ from RDSO as exclusive distributor of M/s Sierra Wireless (earlier known as Sagemcom) in India that both the models and make i.e. OPH TiGR 350R and GPH TiGR 155R have Cross Acceptance from RDSO. In response RDSO issued a letter¹⁸¹ to M/s VISPL, informing VISPL about Prototype Approval (on the basis of Cross Approval) of OPH and GPH granted to M/s NSN.

Audit observed that

- Jhansi Division took a budgetary quotation from M/s VISPL on 20 October 2014, which was just one day before sending the indent to NCR. The rationale for taking the quote from the firm was not on record. As M/s VISPL was neither an OEM nor VISPL had any cross acceptance approval for this item from RDSO, the basis of taking a budgetary quotation from M/s VISPL was not justified.
- The TC accepted the letter of RDSO dated 04 January 2016 to M/s VISPL as meeting the requirement of Cross Acceptance. Though this letter was not submitted by the bidder (M/s VISPL), it was given cognizance by a Tender Committee Member after obtaining the same from RDSO. The letter of RDSO clearly stated that Prototype Approval for the product was specific to the IRPMU contract and further Prototype Approval for other railways required dispensation and the same could be issued only if make, model and version were not changed. This was thus, not a Cross Acceptance Certificate, which could meet the eligibility of tender terms in this tender.
- Further the information sought by M/s VISPL was relating to an earlier discharged tender and not the current tender. The Prototype Approval on Cross Acceptance basis (November 2011) was given to M/s NSN and was not applicable to M/s Sierra Wireless (the OEM) or M/s VISPL.
- TC however, interpreted the Prototype Approval given to M/s NSN on the basis of the following documents:
 - Certificate of Prototype Approval on Cross Acceptance basis issued to M/s NSN was for the model & make quoted by M/s VISPL.

¹⁷⁹latest being RDSO/SPN/TC/88/2015 Rev .1.0

¹⁸⁰Letter no. VISTA/RDSO/Handset/01 dated 28.12.2015 of M/s VISPL

¹⁸¹Letter no .STT/WL/MTRC/503/Misc/.Vol.IV dated 04.01.2016 of RDSO

- Photo copy of M/s Sierra Wireless (OEM) certificate (dated 11 September 2015) stating that related business of Sagemcom has been acquired by Sierra Wireless in August 2012.
- Photocopy of letter (dated 18 March 2016) by Sales Director of Sierra Wireless to Controller of Stores (CoS), NCR stating that M/s VSPL would represent Sierra Wireless in the said tender¹⁸².

Through this process, a certificate issued to M/s NSN specific to an earlier IRPMU contract, was linked and taken as valid for a different contract for M/s VISPL and its OEM. Also, Cross Acceptance over Ghaziabad-Mughalsarai MTRC project of IRPMU never evolved to a position, where its performance evaluation could have led to any satisfactory assessment made about M/s NSN or the equipment or its use over other railways in other contracts.

Audit further noticed that

- In the first tender¹⁸³ (December 2015), no tenderer responded and subsequently fresh tender¹⁸⁴ was issued in March 2016 with certain modifications, without seeking RDSO approval.
- The terms and conditions of the subsequent tender were modified in favour of supplier M/s VSPL. The condition of 'office establishment of OEM in India with maintenance spare part support' was changed to 'office establishment of OEM in India without maintenance/spare part support'.
- A letter of authorization by M/s Sierra Wireless (OEM) for Annual Maintenance Support in favour of M/s VISPL was submitted by M/s VISPL in its bid. The same was accepted by the TC as meeting the prescribed requirement in the tender. However, issuance of a letter of authorization by OEM in favour of M/s VISPL did not establish availability of appropriate Authorized Maintenance Support System in India. No details of maintenance documents in support being provided by M/s VISPL or OEM in India were sought by the TC.

The above indicates undue favour granted to M/s VISPL by the NCR Administration. Not only quotes were called from the firm without any basis and rational, the TC went out of its way to obtain documentation pertaining to the earlier tender from RDSO, to prove its eligibility for the current tender.

Also, in view of EIRENE specifications having undergone several revisions, the Cross Acceptance of the OPH/GPH was no longer valid as changes in EIRENE and RDSO specification implies changes in specification for the OPH/GPH. Thus, there was no assurance about the consistency of OPH/GPH with the specifications of both EIRENE as well as cross acceptance.

¹⁸² Tender no. 50155116-A

¹⁸³ Tender no. 50.15.5116 dated 10.12.2015

¹⁸⁴ Tender no. 50.15.5116A issued on 11.03.2016

D. Utilisation of OPH/GPH supplied

During the analysis of the status of utilisation of procured OPH and GPH, Audit observed that 457 OPH and 955 GPH remained unutilised till July 2017 as given below:

Table 5.4 - status of utilisation of procured OPH and GPH					
S.no		Agra	Jhansi	NR	Total
1.	OPH issued	207	200	100	507
2.	OPH distributed	205	50	0	255
3.	OPH undistributed	02	150	100	252
4.	OPH utilized	0	50	0	50
5.	OPH unutilized	207	150	100	457
6.	GPH issued	415	300	285	1000
7.	GPH distributed	45	0	0	45
8.	GPH undistributed	370	300	285	955
9.	GPH utilized	45	0	0	45
10.	GPH unutilized	255	300	300	955

Audit analyzed the reasons of non-utilization of OPH/GPH. The OPH/GPH equipment procured for Jhansi and Agra Divisions are required to be registered in the MSC placed at Agra for functioning under MTRC system. It was, however, observed that no new subscriber of OPH/GPH is possible at MSC/ Agra due to its defective and non-functional condition. Further, there is no AMC in place since July 2014 to address the same.

Thus, it can be seen that 457 pieces of OPH and 955 pieces of GPH remained unutilized as of July 2017. The objective of purchasing the handsets at the cost of ₹ 17.77 crore also remains to be achieved.

The matter was brought to the notice of Railway Board on 16 October 2017, their reply has yet to be received (28 February 2018).

5.3 South Eastern Railway (SER): Avoidable liability on account of Spectrum Charges due to failure to review the use of Walkie Talkie sets

Walkie Talkie sets are used in Railways as an emergency communication tool for which Railways have to pay spectrum charges to Department of Telecommunication. Consequent to proliferation of CUG mobile phone, Railway Board directed Zonal Railways to review the use of Walkie Talkie sets. Audit observed that SER Administration did not review the use of Walkie Talkie sets to declare the unusable and non-repairable sets as condemned. This has led to avoidable liability of ₹ 30.36 crore (₹ 21.60 crore on working sets and ₹ 8.76 crore on non-working sets) towards payment of Spectrum charges. As SER Administration has not paid the spectrum charges due as yet, there would also be liable to pay ₹ 20.29 crore towards surcharge on delay payment of spectrum charges.

Railways are using Walkie Talkie sets as an emergency communication tool since long. Ministry of Communication, Government of India decided (April 2004) to

levy spectrum charges (License fee and Royalty) from all wireless users including Central Government Ministries/ Departments from 1st June 2004. On the basis of reference made from the Railway Board, Ministry of Communication and IT and Law and Justice, Government of India had made (December 2006) a reference to the Department of Economic Affairs, Ministry of Finance on levy of spectrum charges. Ministry of Finance in their response stated that spectrum being scarce economic resources should be appropriately priced so that they are optimally utilized and the users should pay spectrum charges. Railway Board communicated (October 2007) that since levy of spectrum charges is a government decision, all Ministries of Government of India including Railways should follow it until decided otherwise.

As per the revised spectrum tariffs issued by DOT in March 2012, ₹ 12500 as Royalty and ₹ 250 as Licence fees per annum is being levied for every VHF Walkie Talkie set being used/procured on Indian Railways. In September 2014, Railway Board instructed for critical review of the number of VHF Walkie Talkie sets in use and bring it down to realistic levels. Accordingly, Chief Signal and Telecom Engineer, South Eastern Railway requested (September 2014) the departmental heads to review use of the Walkie-talkie sets consequent on proliferation of CUG mobile phones. Subsequently, Member Electrical, Railway Board intimated (February 2016) to the General Manager, South Eastern Railway that the issue to re-visit the requirement to pay spectrum charges by Indian Railways for VHF Walkie Talkie sets which are used purely to meet its operational requirement was taken up at appropriate level by the Railway Board with the Ministry of Communication and Information Technology (MoCIT), but the possibility of reduction in charges was remote as other Ministries including para military forces had paid similar charges. It was instructed to review the requirement of VHF Walkie Talkie sets and condemn unusable and non-repairable sets to avoid payment of spectrum charges on those sets. Accordingly, the General Manager, South Eastern Railway instructed (February 2016) the Divisional Railway Managers (DRMs) of four divisions of South Eastern Railway to act on the above lines.

Scrutiny of records revealed that South Eastern Railway Administration had never thoroughly reviewed the actual number of Walkie Talkie sets required for emergency communication or to declare the unusable and non-repairable Walkie Talkie sets as condemned for avoiding payment of spectrum charges on those sets. Except in two occasions (₹ 2.02 crore in July 2015 for 1581 numbers of 5 watt Walkie Talkie sets and ₹ 1.21 crore in February 2017 for 946 numbers of 5 watt Walkie Talkie sets), South Eastern Railway Administration never paid the spectrum charges at the time of new procurement as required.

Scrutiny in Audit further revealed that as on December 2015, South Eastern Railway was holding about thirteen thousand Walkie Talkie sets and spectrum charges were leviable on all those sets as none were declared condemned. As proper records were not maintained, Audit could collect information from 11 out of 33 user units. It was noticed that in 11 units during 2012-13 to 2016-17,

4241 to 7915 5 watt Walkie Talkie sets were available in which 764 to 3064 (18 to 39 *per cent*) sets were not in working condition. Excluding the payment of ₹ 3.23 crore made at the time of procurement of new sets, the liability of spectrum charges from 2012-13 to 2016-17 stood at ₹ 30.36 crore (₹ 21.60 crore on working sets and ₹ 8.76 crore on non working condition sets). In case of delayed payment of spectrum charges, there is also provision by MoCIT for levy of surcharge at the rate of 2 *per cent* per month or part thereof for delayed renewal of licence. As SER Administration is not paying the spectrum charges, surcharge has also accrued on the outstanding amount.

Thus, failure of SER Administration to review the use of Walkie Talkie sets resulted in avoidable liability of ₹ 30.36 crore towards payment of Spectrum charges (₹ 21.60 crore on working sets and ₹ 8.76 crore was on account of sets not in working condition). As the spectrum charges have not been paid by them, they would be liable to pay surcharge of ₹ 20.29 crore as well.

The matter was brought to the notice of Railway Board on 20 December 2017, their reply has yet to be received (28 February 2018).