

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**



**INDIAN RAILWAY
STANDARD SPECIFICATION**

FOR

**4WIRE/2WIRE TRAIN TRAFFIC CONTROL EQUIPMENT WITH DUAL
TONE MULTI FREQUENCY (DTMF) SIGNALLING**

SERIAL NO. TC-60/2007

ISSUED BY

**RESEARCH DESIGNS & STANDARDS ORGANISATION
LUCKNOW-226011**



INDIAN RAILWAY
STANDARD SPECIFICATION

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0.0 FOREWORD

- 0.1 This specification is issued under the fixed serial No. TC-60. The final number indicates the year of original adoption as standard, or in the event of revision, the year of last revision.

REVISED, 2007

- 0.2 This specification requires reference to the following Indian Railway Standard (IRS) and Indian Standard (IS) specifications:
- (i) IRS:S-23 Electrical Signaling and Interlocking Equipment.
 - (ii) IS-9000- Basic environment, testing procedures for electronic and electrical items.
 - (iii) IRS:TC-38 Four wire way station control telephone.
 - (iv) IRS:TC-37 Two wire way station control telephone.

1.0 SCOPE

- 1.1 This specification is intended to cover the requirements for train traffic control equipment with voice frequency signaling using Dual Tone Multi Frequency(DTMF) signals for 4 Wire and 2 Wire operation.
- 1.2 The train traffic control with DTMF voice frequency signalling under consideration is meant for use in omnibus speech circuits like Section, Traction Power and Deputy Controls used in Railways using 2 Wire or 4 Wire transmission circuits employing two tone in voice frequency band for selectively calling the station/location concerned.

- 1.3 The control office equipment is designed for 4 Wire operation which shall be converted into 2 Wire operation by provision of hybrid attachment. The way station equipment shall be different for 4 Wire and 2 Wire working.
- 1.4 The specification of Control Office Equipment caters to 4-Wire operation. For 2-Wire operation Hybrid attachment is required.
- 1.5 The way station equipment is specified separately for 4 Wire and 2 Wire section.
- 1.6 The schematic arrangement for 4 Wire and 2 Wire working with DTMF selective signaling is shown in Annexure I & II respectively.

2.0 GENERAL REQUIREMENTS

- 2.1 The system consists of the following four segments:
 - 2.1.1 **Control Office Equipment** : It shall consist of two-way voice communication circuit and code generator.
 - 2.1.2 **Way Station Equipment** : It shall consist of voice communication circuit, code reception and recognition circuit with ringing and ring back transmission facility.
 - 2.1.3 **Way Station Control Telephone** : 2-Wire or 4-Wire as per requirement.
 - 2.1.4 **Hybrid Attachment** : It shall consist of a suitable hybrid to convert 4wire operation to 2-Wire operation at control office.
- 2.2 The specification is divided in following four parts:
 - (i) Part-I : It covers the requirements of control office equipment for 4 Wire & 2 Wire territories.
 - (ii) Part-II: It covers the requirements of way station equipment for operation in 4 Wire territories.
 - (iii) Part-III: It covers requirements, of way station equipment for operation in 2 Wire territories.
 - (iv) Part-IV: It covers requirements of tests, marking, packing and data to be supplied to the manufacturer.

PART-I

3.0 CONTROL OFFICE EQUIPMENT

3.1 General Requirements:

- 3.1.1 The operating console to be provided in the controllers cubicle shall consist of push button key for selectively calling stations, visual display panel to display station codes, microphone, loudspeaker with volume control, hand set and necessary keys and switches. (Annexure IV A).
- 3.1.2 The operating console shall be electrically insulated and shall be provided with insulated resting pads.
- 3.1.3 The console should have aesthetic look. The dimensions and layout of the push buttons jacks, etc shall be as per Annexure IV A, & IV B.

- 3.1.4 The switches, connectors and the components used shall be of Industrial Grade/LCSO approved type or as per relevant Indian Standard Specification (IS) to the extent feasible.
- 3.1.5 All the indications on the console shall be of continuous type. The power ON indication shall be through red LED and other displays through seven segment LED red displays.
- 3.1.6 All the switches and connectors shall be suitably marked/embossed in bold legible alpha/numeric characters in English.
- 3.1.7 PCBs for code generators & V.F. circuits shall be housed inside the operating console (Ref: Annexure-IV B)

3.2 Operating Requirements:

- 3.2.1 The system shall permit working of voice communication and signaling on an omnibus circuit tapped at the way stations and other places, on 4-Wire or 2-Wire basis, as required.
- 3.2.2 It shall be possible to call a maximum of 99 stations with 2 digit code either one at a time or a nominated group at a time or all at the same time.
- 3.2.3 Audible indication to the controller that the called station has been rung shall be provided.
- 3.2.4 Every station shall be assigned a distinct calling code. In addition, a nominated group of stations may be assigned a group calling code. Four such groups should be provided in the system. The push buttons shall be designated A, B, C & D. The push button for general call shall be designated G for calling all stations at the same time.
- 3.2.5 Station code generation and transmission shall be accomplished by pressing two push buttons in a sequence. The group code/general call code generation and transmission shall be accomplished by pressing relevant push button twice.
- 3.2.6 The facility to repeat the last code transmitted by pressing one single push button designated "RT" shall be provided.
- 3.2.7. The duration of the ringing at way station shall normally be 4 ± 0.5 Sec. However, facility shall be provided to extend this period as long as desired by pressing a single push button designated "LR" by repeatedly sending the last transmitted code after every 4.5 Sec.
- 3.2.8. It shall be possible to send the signaling code even when two or more parties are in conversation and also to a station engaged in conversation.
- 3.2.9. The station code being transmitted shall be displayed on the console. The display shall continue till the next code is generated.
The two push buttons for station code should be pressed in sequence within 5(Five) seconds. The first digit remains displayed for 5(Five) seconds after which it gets erased automatically. It should be possible to cancel the first digit within five seconds by pressing a single push button designated "DL".
- 3.2.10 Facility to reset the system should be provided by pressing one single push button designated "RS".
- 3.2.11 Facility to check the row/column frequency shall be provided by pressing push button designated "RC" for Test Mode. (r1, r2...r4) and (c1,c2...c4) should be suitably displayed. (r1 to r4) corresponds to row (low group) frequencies 697 Hz to 941 Hz respectively. (c1 to c4) corresponds to column (high group) frequencies 1209 Hz to 1633Hz respectively.

3.3 Technical Requirements

- 3.3.1 Glass epoxy PCB 1.6 mm minimum thickness shall only be used. The PCBs shall be coated with epoxy base anti-fungal varnish to provide protection against dust, humidity, fungal

infection and mechanical abuses. The copper cladding thickness shall not be less than 35 microns and shall be suitably tinned.

- 3.3.2 The PCBs shall be of modular construction to facilitate maintenance suitable arrangements to ensure fixing of PCBs at its designated place in a correct manner in the lay out shall be provided. Means for easy extraction of PCB and locking arrangements to prevent loose contacts due to vibrations shall be provided.
- 3.3.3 The equipment shall be self checking. All status "OK" shall be displayed by displaying two illuminated dots on the 7 segments displays.

3.4 Operating Console-Communication Equipment

- 3.4.1 It shall consist of microphone amplifier, loudspeaker amplifier, handset and speech combiner circuit(and hybrid attachment for two wire operation).

3.5 Microphone

- 3.5.1 Standard AHUJA/PHILIPS/ MOTWANE make microphone shall be used.
- 3.5.2 The microphone shall be unidirectional, high sensitivity table mounted and protected against vibration and dust. It shall have flexible neck for easy positioning. Broad characteristic shall be:
- | | | |
|-------|-----------------|------------------|
| (i) | Frequency Range | 100-10,000 Hz. |
| (ii) | Sensitivity | 0.22 mV/microbar |
| (iii) | Impedance | 500 Ohms. |
- 3.5.3 "Low Noise" ON/OFF switch shall be provided on the body of microphone.
- 3.5.4 The connection of the microphone shall be provided by screened cable with standard audio frequency circular, self-locking connector.

3.6 Microphone Amplifier

- 3.6.1 The input impedance of the amplifier should be suitably matched to the microphone used.
- 3.6.2 There shall be provision to vary the output of the amplifier.
- 3.6.3 The output of the amplifier on a load of 1120 ohms shall be adjustable at least from -20dBm to 0dBm at the output of the console terminals for an input level of 5mVolt.
- 3.6.4 The level variation in the frequency range between 300 Hz to 3400 Hz shall be within ± 3 dB with reference to 1KHz across 1120 Ohm and output of 0dBm.
- 3.6.5 The total harmonic distortion should not exceed 3% at 1 KHz across 1120 Ohm and output of 0dBm.
- 3.6.6 The return loss at a frequency of 1KHz shall not be more than -20dBm with 1120 Ohms RE Cable.
- 3.6.7 The output impedance of the amplifier shall be matched with the line having nominal characteristic impedance as per the information supplied by purchase under Clause 16.1.

3.7 Handset

- 3.7.1 Plug arrangement for plugging-in the hand set shall be provided in the console as indicated in Annexure IV-A.
- 3.7.2 Transmitter & receiver shall be Electrodynamic Transducer type (CACT approved). The microphone amplifier as per Cl. 3.6(Part-I) shall be used for the transmitter also. If the Electrodynamic Transducers used for transmitter & receiver in the telephone is from CACT

approved sources whose type approval is currently valid or inspected by field inspection unit as per IRS: TC 74-97 and inspection certificate issued, then type test of Electrodynamic Transducers shall not be repeated.

3.7.3 Handset receiver shall be matched with the output of the receive amplifier.

3.8 Loudspeaker Amplifier

3.8.1 The input impedance of loudspeaker amplifier shall be 1120 ohms $\pm 10\%$ at 1KHz.

3.8.2 The nominal input level of the loudspeaker amplifier shall be -20dBm. The amplifier shall however be capable of giving an undistorted output at input variation of 0dBm to -30dBm. AGC shall be provided which shall be effective from -20dBm to 0dBm of the input level so that output level remains within 3dbm variation.

3.8.3 The output level of loudspeaker amplifier shall be 1Watt $\pm 10\%$ on a load of 4 Ohms at maximum setting of volume control. Facility for the adjustment of output level shall be provided on console.

3.8.4 The total harmonic distortion shall be within 3% at 1KHz across 4 ohms on a maximum output of 1watt.

3.8.5 The frequency response shall be flat and within ± 3 dB for the frequency ranging from 300Hz to 3400 Hz with reference to 1KHz across 4 Ohms and output of 0dBm.

3.9 Loudspeaker.

3.9.1 Standard PHILIPS/HARMAN/Bolton/Luxor, latest model (Dual cone, 4watts, 4 ohm ± 2 ohm) loudspeaker shall be used.

3.9.2 The loudspeaker shall be properly enclosed in a wooden cabinet with dark brown matt finish sun mica suitable for table mounting arrangement.

3.10 Code Generator

3.10.1 The output of the code generator shall be adjustable at least from 0dBm to -7dBm when measured at Tx output terminals across 1120 ohms (on 4 wire side).

3.10.2 The code generator shall produce standard, DTMF codes as per details shown in Annexure III for the selection of station.

3.10.3 The normal duration of code transmission on line shall be 500 millesec. ± 30 ms. The tone burst duration for 1st & 2nd digits shall be 200 ms ± 10 ms and pause between two tones bursts shall be 100 ms ± 10 ms.

3.11 HYBRID Arrangement For Two Wire Working

3.11.1 The hybrid arrangement shall be capable of being connected to the trans and receive pairs.

3.11.2 The output Impedance of hybrid shall be 600 Ohms $\pm 10\%$ on 2 wire side.

3.11.3 The leak between the trans and receive pairs due to introduction of the hybrid shall be less than -20 dB.

3.12 Power Requirement

3.12.1 Control Office Equipment : The system shall be capable of working on 12V DC supply, (with a ripple factor of 2mV) which can vary between +20% and -10% of the nominal value.

3.12.2 Fuses and reverse polarity protection shall be suitably provided. "MOVR" based surge protectors shall be provided.

3.12.3 The power supply fuses shall be easily accessible for inspection and replacement.

- 3.12.4 The current drain shall be less than 150mA in quiescent condition and the maximum working current shall be less than 500mA.
- 3.12.5 Protection against surges and short circuit conditions shall be provided.
- 3.12.6 The equipment shall not need manual resetting in case of momentary power interruption.
- 3.13 **(i) VF Transformer for Optical Fiber Communication System & Microwave Communication System** : 1120/ 600 VF Transformers shall be provided on trans and receive terminals for working on Optical Fiber/Microwave Communication System having a nominal characteristic impedance of 600 Ohms. The insertion loss of the VF transformer shall not be more than 0.6dB.
- (ii) VF Transformer for PET Quad Cable** : 1120/ 470 VF Transformers shall be provided on trans and receive terminals for working on PET Quad Cable having a nominal characteristic impedance of 470 Ohms. The insertion loss of the VF transformer shall not be more than 0.6dB.
- 3.14. **Lightening & Surge Protection** : The equipment shall have surge and lightening protection arrangement with GD tube, MOVR, Inductor and poly switch self restoring/fuse of appropriate ratings suitably connected to the equipment to avoid damage due to lightening and transients. It should also be suitably connected to proper earthing terminal.

PART –II

OPERATIONAL REQUIREMENT OF WAY STATION EQUIPMENT FOR 4WIRE TERRITORY

4.0 GENERAL

- 4.1 4-Wire operation of speech circuit is adopted on Indian Railways for Telecommunication Circuits in territories of Railway Electrification.

5.0 TRANSMISSION MEDIA

- 5.1 It shall normally be a non-conditioned voice grade telephone channel in loaded RE cable on 4 wire basis with characteristic impedance of 1120 ohms. It is terminated on VF transformers and nominal transmission loss of the circuit is 0.25dB per km. The maximum length of the circuit can be 300 kms, with repeaters at a nominal interval of 50Kms. In addition, isolation transformers at 12 to 16 Km intervals are provided. The system is tapped at way station locations through VF tapping transformers.

OR

The media can be Optic Fibre Communication System/Microwave Communication System.

OR

The media can be PET Quad Cable.

- 5.2 Systems shall be capable of working on radio patch on microwave on 4-Wire basis.

6.0 WAY STATION EQUIPMENT

6.1 General Requirements

- 6.1.1 The way station equipment shall consist of wall mounted cabinet containing signal reception, recognition ringing and ring back transmission circuit called collectively as decoder & voice communication equipment. (The dimensions shall be as per Annexure VA & VB).
- 6.1.2 Outer cover shall be free from electrical connections. Input and output cable connections to the equipment shall be by screw down terminal strips provided in the equipment.
- 6.1.3 PCBs used shall conform to clause 3.3.1 of Part-I.
- 6.1.4 Test points for measuring signal and speech levels shall be provided.

6.2 Decoder.

- 6.2.1 It shall be possible to work the signaling system with a minimum input level of -25dBm at the line terminals even when the line S/N ratio is down to 15dB. The decoder shall work satisfactorily for input level of -25dBm to -2dBm .
- 6.2.2 It shall be possible to assign any DTMF station group code to a station in a decimal system using DIP/Thumb switches. The switches should be procured from CACT approved sources.
- 6.2.3 On receipt of the valid code, it shall be decoded and a piezo-electric buzzer shall be activated even if the handset is off the cradle.
- 6.2.4 After the buzzer in the telephone is activated, a ring back tone shall be automatically transmitted to the control office in acknowledgment of the receipt of ring. The level of the ring back tone when measured across trans terminals of way station equipment shall not be less than -12dBm .
- 6.2.5 Along with the activation of the buzzer, a visual indication with LED shall be lit in the telephone. The LED indication shall continue to be lit until the hand set is lifted off the cradle.
- 6.2.6 The output level of the buzzer shall be adjustable by means of fixed pad.
- 6.2.7 The equipment shall not need manual resetting in case of momentary power interruption. Protection for transient in power supply to be provided.

6.3 Voice Communication Equipment :

- 6.3.1 It shall consist of Trans and Receive amplifiers and 4-Wire Control Telephone (as per IRS:TC-38). 0.6mm dia insulated copper conductor shall be used for wiring and distance of telephone instrument from decoder shall be limited to 140 meters.
- 6.3.2 The output speech level across trans terminals on a load of 1120 ohms shall be adjustable from at least from 0 to -20dBm for an input of 250mV at mike terminals of way station equipment. The output speech level across the receiver terminals on a load of 200 ohms shall be adjustable to -15dBm for an input level of 0 to -25dBm at the nominal impedance of 1120 ohms.
- 6.3.3 Frequency response shall be flat with a variation of $\pm 3\text{dB}$ in the frequency range of 300Hz to 3400Hz with reference to 1 KHz and output of 0dBm across 200-ohms/1120 ohm for receive/trans amplifier respectively.
- 6.3.4 The total harmonic distortion shall not exceed 3% at 1KHz across 200 ohms/1120 ohms and output of 0dBm for receive/trans amplifier respectively.
- 6.3.5 Bridging Loss Trans: For transmitting side the maximum bridging loss shall be 2.5Bbm when handset is taken off the cradle and Press to talk switch is pressed.
- 6.3.6 Bridging Loss Receive: For receive side, the maximum bridging loss shall be 1dBm, when handset is taken off the cradle and 0.1dbm when handset of the telephone is on the cradle.

- 6.3.7 The gain of the receive amplifier shall be adjustable by means of suitable pads.
- 6.3.8 The receive, trans amplifier and ring back tone circuit shall be isolated from the line by solid state switches.

6.4 Power Requirement

- 6.4.1 The system (way station equipment and the telephone) shall be capable of working on 12V DC supply, (with a ripple factor of 2mV) which can vary between +20% and -10% of the nominal value.
- 6.4.2 Fuses and reverse polarity protection shall be suitably provided.
- 6.4.3 The power supply fuses shall be easily accessible for inspection and replacement.
- 6.4.4 The current drain shall not exceed 25mA during quiescent period and maximum working current shall not exceed 150mA.

- 6.5 (i) **VF Transformer for Optical Fiber Communication System & Microwave Communication System** : 1120/ 600 VF Transformers shall be provided on trans and receive terminals for working on Optical Fiber/Microwave Communication System having a nominal characteristic impedance of 600 Ohms. The insertion loss of the VF transformer shall not be more than 0.6dB.
- (ii) **VF Transformer for PET Quad Cable** : 1120/ 470 VF Transformers shall be provided on trans and receive terminals for working on PET Quad Cable having a nominal characteristic impedance of 470 Ohms. The insertion loss of the VF transformer shall not be more than 0.6dB.

PART-III

OPERATIONAL REQUIREMENT OF WAY STATION EQUIPMENT FOR 2 WIRE TERRITORY

7.0 GENERAL

- 7.1 2-Wire circuit is generally adopted in non-electrified section where line side communication is on overhead alignment.
- 7.2 The working of DTMF equipment on 2wire system shall be confined to the areas where control circuit is originating in RE area and extending to non RE area.

8.0 TRANSMISSION MEDIA

- 8.1 The system shall generally be capable of working on overhead alignment having characteristic impedance of 600ohms. Equipments are directly connected to the line.
- 8.2 For satisfactory working of DTMF equipment in 2wire overhead line territory it should be ensured that overall loss on 2 wire does not exceed 12dB and 50Hz noise due to power line

does not exceed 0dBm and suitable filters shall be provided in decoder to eliminate frequencies out of speech band.

- 8.3 Equipment should be provided with solid state quick acting surge arrestors to prevent damage from lightning and other transients from the line circuit.

9.0 WAY STATION EQUIPMENT

- 9.1 Way station equipment shall consist of decoder conforming to clause 6.2 of Part-II and 2-Wire control telephone as per IRS:TC-37. The dimensions shall be as per ANNEXURE VA & VC.

- 9.2 The insertion loss of 2 wire way station equipment with power supply 'ON' should not exceed the value 0.5dB.

- 9.2.1 LED and Buzzer shall be provided in 2-Wire control telephone for audio visual indication of control calling.

- 9.2.2 A 10 way terminal strip (ANNEXURE VC) shall be provided for Buzzer/ LED/line and power supply connection in 2 wire way station equipment.

9.3 Power Requirement

- 9.3.1 The Way Station Equipment and Control Telephone should work with audio/visual indication of control calling. The arrangement shall be made in such a way that the 2 Wire Control Telephone shall work on 12V DC with +20% / -10% variation. This will facilitate energisation of both 2 Wire Control Telephone and associated Way Station Equipment by the same 12V DC power supply.

- 9.3.2 Fuses and reverse polarity protection shall be suitably provided.

- 9.3.3 The power supply fuses shall be easily accessible for inspection and replacement.

- 9.3.4 The current drain shall not exceed 20 mA during quiescent period and maximum working current shall not exceed 100 mA.

PART-IV

10.0 TESTS AND PERFORMANCE REQUIREMENT

- 10.1 Unless otherwise specified, all the tests shall be carried out under prevalent ambient atmospheric conditions.

10.2 Type Test

- 10.2.1 The following shall constitute Type Test:

A minimum of one sample of control office equipment and two samples of way station equipments are required for type test. These samples shall not form part of supply.

- a) Visual Inspection (Clause 10.4)
- b) Applied high voltage test (Clause 10.5)
- c) Insulation resistance test (Clause 10.6)
- d) Operation test (Clause 10.7)

- e) Performance test (Clause 10.8)
- f) Climatic severity test (Clause 10.9)
- g) Vibration test (Clause 10.10)

10.3 Acceptance Test.

10.3.1 The following shall constitute the acceptance test on way station equipment and shall be carried out as per sampling plan specified in Clause No. 15. For 4 Wire/2Wire DTMF control office equipment acceptance test shall be carried out on complete offered lot .

- a) Visual Inspection (Clause 10.4)
- b) Applied high voltage test (Clause 10.5)
- c) Insulation resistance test (Clause 10.6)
- d) Operation test (Clause 10.7)
- e) Performance test (Clause 10.8)

10.3.2 Any other tests as required by the inspecting authority to ensure that equipment is in conformity with the requirement of the specification shall also be done.

ROUTINE TEST

10.3.3 The manufacturer shall certify that all the tests given in para 10.3.1 have been successfully carried out on all the equipments offered for inspection. He shall produce those tests results at the time of inspection.

10.3.4 The manufacturer shall under take auditing of the components/devices for ensuring the reliability. Audit record shall be shown to the inspection authority.

10.4 Visual Inspection

Visual inspection shall be carried out as per clause 14.2 of IRS:S-23 to the extent applicable.

10.5 Applied High Voltage Test.

The equipment shall with stand without any damage a test voltage of 1KV, applied for a period of one minute, between the body and all the current carrying terminals looped together.

10.6 Insulation Resistance Test

The insulation resistance measured with 100V DC between the body and the current carrying terminals looped together shall not be less than 20 mega ohms.

10.7 Operation Test

The control office equipment shall be connected to way station equipment through an attenuator pad of 20dB and it shall be tested for:-

- (i) Ringing and ring back tone.
- (ii) Long ring
- (ii) Repeat ring.
- (iii) Group calling.
- (iv) Reset
- (v) Delete
- (vi) General Call
- (vii) Satisfactory speech.

10.8 Performance Test

10.8.1 This test shall be carried out for all equipment as per Annexure-VI

10.9 Climatic Test-degree of severity

This shall exclude microphone, loudspeaker, handset and telephone.

10.9.1 **Dry Heat Test** shall be done in two phases-operational and storage. Operation test shall be done at $55^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 16 hrs. and the operation of the equipment shall be tested after completion of the test as per clause no. 10.7 of Part IV. The storage test shall be conducted at $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 16 hrs with a recovery time of 8 hrs. The test shall be conducted as per IS:9000 Part III. Operation of the equipment shall be tested after completion of the test as per Clause 10.7 of Part IV.

10.9.2 **Damp Heat(study state)** : The equipment shall be subjected to $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ with RH not less than $93\% \pm -2\%$ for 24 hrs. On completion of the duration of the test the equipment shall be taken out and shall be wiped with dry cloth to remove the condensed water if any from the surface. The equipment shall then be kept in a recovery chamber at $27^{\circ}\text{C} \pm 5\%$ RH for 6 hrs and the insulation resistance shall be measured as per clause 10.6 pt. IV. The IR value shall not be less than 10M ohms. The operation of the equipment test shall be done as per clause 10.7 of Part IV.

10.9.3 **Cold Storage Test** shall be done at -10°C to $+3^{\circ}\text{C}$ for 16 Hours with the recovery time of 8 hrs. The test shall be conducted as per IS:9000 Part-II. The operation of the equipment shall be tested as per clause 10.7 after recovery period.

10.10 Vibration Test

1.10.1 The equipment shall be subjected to vibration test as per IS:9000 (Part VIII)

- | | | | |
|------|---------------------------------|---|-----------------------------------|
| (i) | Freq. Range | : | 10Hz to 55 Hz. |
| (ii) | Vibration amplitude | : | 0.35mm |
| iii) | Duration of endurance for sweep | : | 20 sweeps cycles(10Hz-55Hz-10Hz) |
| iv) | No. of axes | : | 3 coordinate axes. |
| v) | Duration at resonant frequency | : | 30 minutes+/- 1 minutes. |

10.11 After completion of climatic and vibration tests the equipment shall be visually inspected to check for any damaged or cracked parts and performance test shall be carried out as per Annexure-VI.

11.0 MANUFACTURE

11.1 The manufacturer shall ensure that in addition to all the provisions of this specification the requirements of other specifications referred to in this specification as far as they are applicable and any specification prescribed by purchaser are fully complied with.

11.2 Workmanship limits and fits insulating materials, electro-magnetic coils, electrical contacts, terminals, wiring, rejection, marking and identification, packing and warranty shall be in accordance with the requirements in IRS: S-23.

11.3 The manufacturer shall have suitable inspection facilities and testing equipment at their works.

11.4 The manufacturer shall provide training to Rly. Staff free of cost for one week at his works.

12.0 MANUFACTURER'S IDENTIFICATION

12.1 A metal plate containing the following information shall be firmly secured to the equipment:

- a) Manufacturer's Name and Address.
- b) Year of manufacture and serial number.
- c) IRS Specification No.
- d) Indian Railways.

13.0 PACKING

13.1 The equipment shall be so packed as to permit convenient handling and to protect against loss or damage during transit and storage. The following information shall be given on the packing case:

- a) Name of manufacturer
- b) Year of manufacture
- c) Arrow indicating top side.
- d) Fragile
- e) Address of consignee.

14.0 INSTRUCTION BOOKS, MEASURING INSTRUMENTS AND WARRANTY.

14.1 The following documents in booklet forms shall be supplied with each equipment:-

- a) Operating instruction manual
- b) Maintenance instruction and maintenance preventive schedule to be carried out.
- c) Technical instruction manual giving details of circuit and connection diagrams, values of rating of all components, PCBs wiring etc.

14.2 complete details of the measuring equipment required for servicing shall be provided.

14.3 List of the recommended lifetime spares shall also be provided with the equipment.

14.4 Unless and otherwise agreed between purchaser and manufacturer, the equipment shall have warranty for satisfactory working for a period of one year after installation or two years from the date of purchase, whichever is earlier.

14.5 All the components used in the equipment shall be of high grade quality from reputed manufacturer.

14.6 Data sheet for switches microphone loudspeaker shall be submitted by the manufacturer.

15.0 SAMPLING

- 15.1 Unless otherwise agreed to by the purchaser and the supplier the double sample plan given below shall be adopted.

Lot consisting of 4-Wire/2-Wire DTMF Way Station Control Equipment.	1 st Sample size	2nd Sample size	Combined Sample Size	Acceptance number	Rejection Number.
1	2(N1)	3(N2)	4(N1+N2)	5(C1)	6(C2)
Under 25	3	6	9	0	2
25 to 50	7	14	21	0	3
51 to 100	10	20	30	0	3
101 to 200	13	26	39	0	5
201 to 300	20	40	60	1	5
301 to 500	25	50	75	1	6

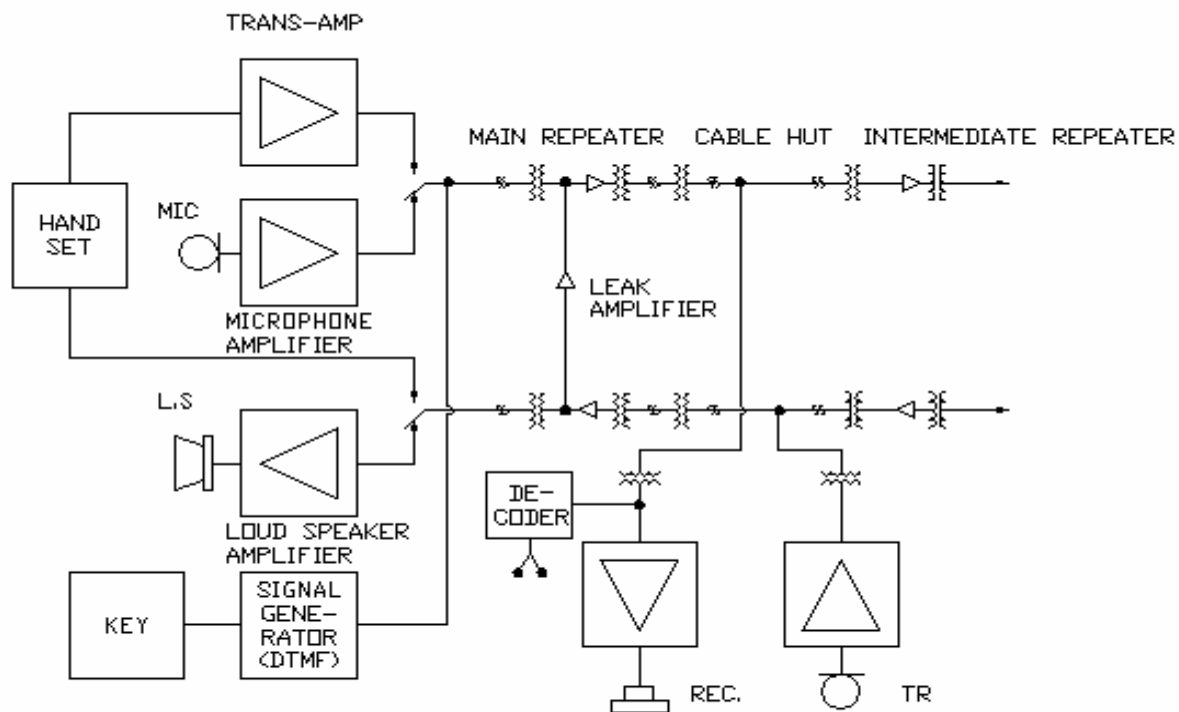
- 15.2 The number of 4Wire/2Wire DTMF way Stn control Eqpt (N1) as given in col.2 shall first be selected and subjected to the acceptance test. If in the first sample, the number of defective 4Wire/2Wire DTMF way Stn control Eqpt that is those falling in one or more acceptance tests is less than/equal to the corresponding number (C1) given in Col 5. The lot shall be considered as conforming to the requirements of the acceptance test. If the number of defective 4Wire/2Wire DTMF way Stn control Eqpt in the first sample is greater than or equal to the rejection number given in Col 6, the lot shall be considered as not conforming to the requirement of the acceptance test. If number of defective 4Wire/2Wire DTMF way Stn control Eqpt in the first sample lies between (C1) and (C2) a second sample of size (N2) as given in Col 3 shall be selected and subjected to acceptance test. If in the combined sample, the number of defective 4Wire/2Wire DTMF way Stn control Eqpt is less than (C2) the lot shall be considered as conforming to the requirements of acceptance test.
- 15.3 The sample shall be selected at random from at least 10% of the packages for random selection of packages, all the packages in the lot shall be managed in a serial order and every 't' the package shall be selected until the requisite number of packages is obtained.

't' being the integral part of $\left(\frac{\text{Total number of packages in the list}}{\text{Total number of packages to be selected}} \right)$.

16.0 INFORMATION TO BE SUPPLIED BY PURCHASER

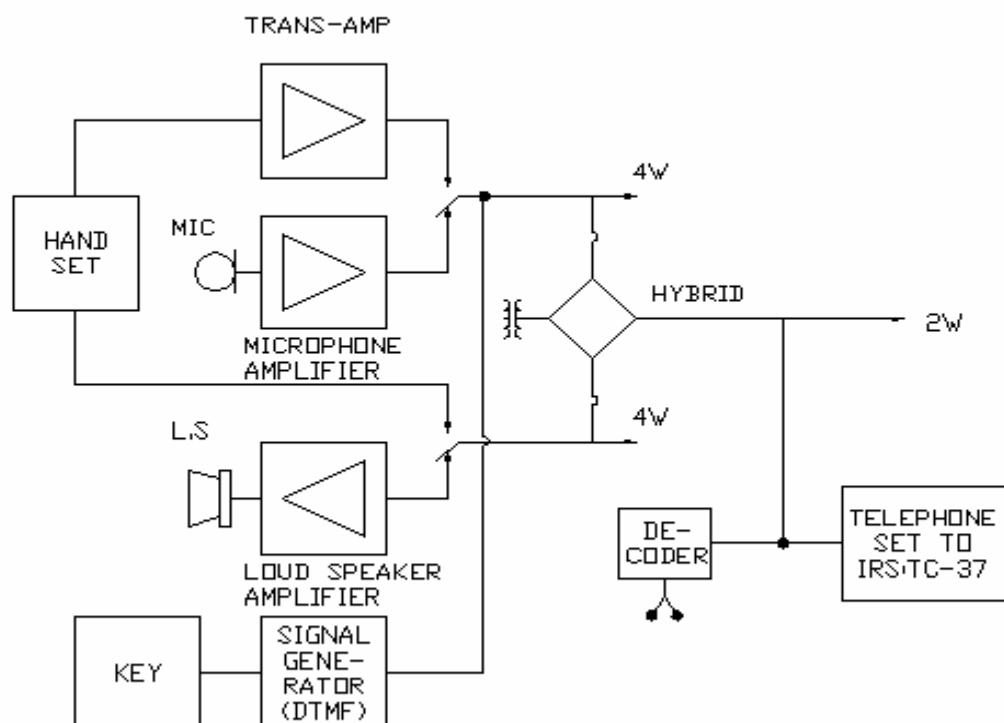
- 16.1 Characteristic Impedance of line(viz 1120 Ohms for RE Cable, 600 Ohms for Overhead Line, 600 Ohms for Optical Fibre Cable, 600 Ohms for Digital Microwave Link or 470 Ohms for 4/6 PET Quad Underground Cable) shall be supplied by the purchaser.

ANNEXURE-I



4-WIRE TRAIN TRAFFIC CONTROL EQUIPMENT WITH DUAL TONE MULTI FREQUENCY(DTMF) VOICE FREQUENCY SIGNALLING

ANNEXURE-II

**2-WIRE TRAIN TRAFFIC CONTROL EQUIPMENT WITH DUAL TONE MULTI FREQUENCY(DTMF) VOICE FREQUENCY SIGNALLING**

ANNEXURE-III

RS	DT	RT	RC	
1	2	3	A	697
4	5	6	B	770
7	8	9	C	852
G	0	LR	D	941

LOW GROUP
FREQUENCY (Hz)

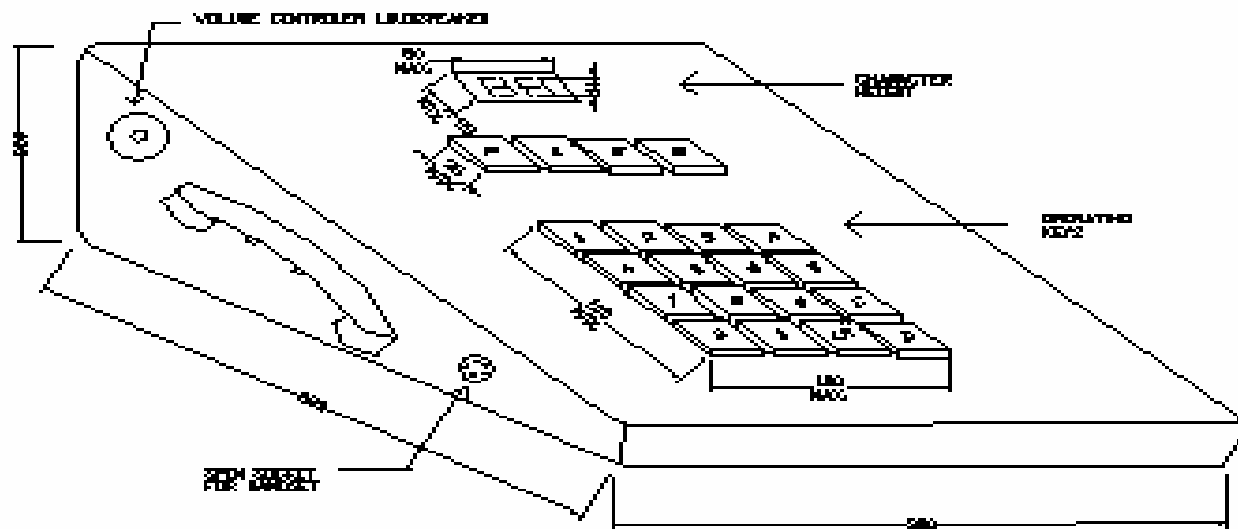
1209	1336	1477	1633
------	------	------	------

HIGH GROUP
FREQUENCY (Hz)

- NOTE: 1. THE FREQUENCY TOLERANCE IS $\pm 1.5\%$
 2. ABCD FOR GROUP CALLING
 3. LR FOR LONG RING (Refer C.L. 1.2.7 Pt.D)
 4. G FOR GENERAL CALL
 5. RS RESET
 6. DL CANCEL
 7. RT LAST CODE REPEAT
 8. RC ROW/COLUMN FREQUENCY

STANDARD DTMF FREQUENCIES

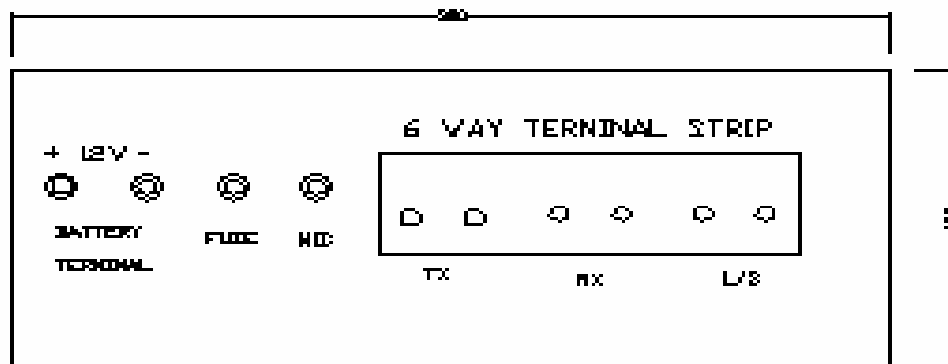
ANNEXURE-IVA



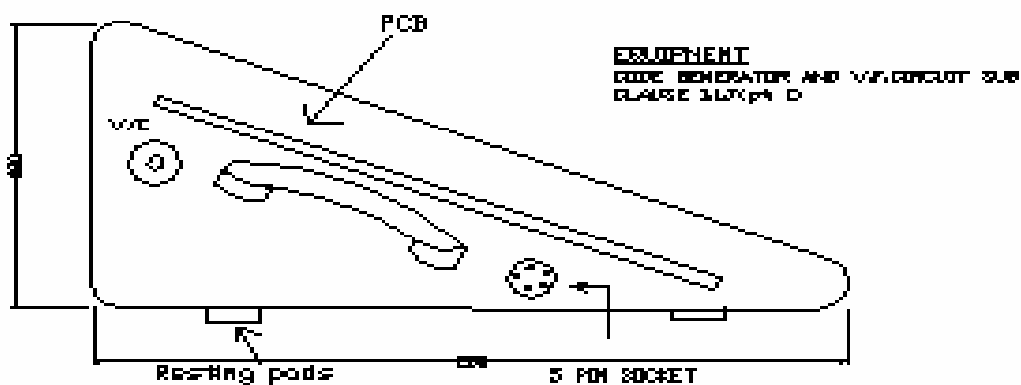
All dimensions are in mm.
General dk. tolerance ± 0.1 .

DTMF CONTROL ROOM EQUIPMENT

ANNEXURE-IVB



BACK VIEW
(Only for reference)

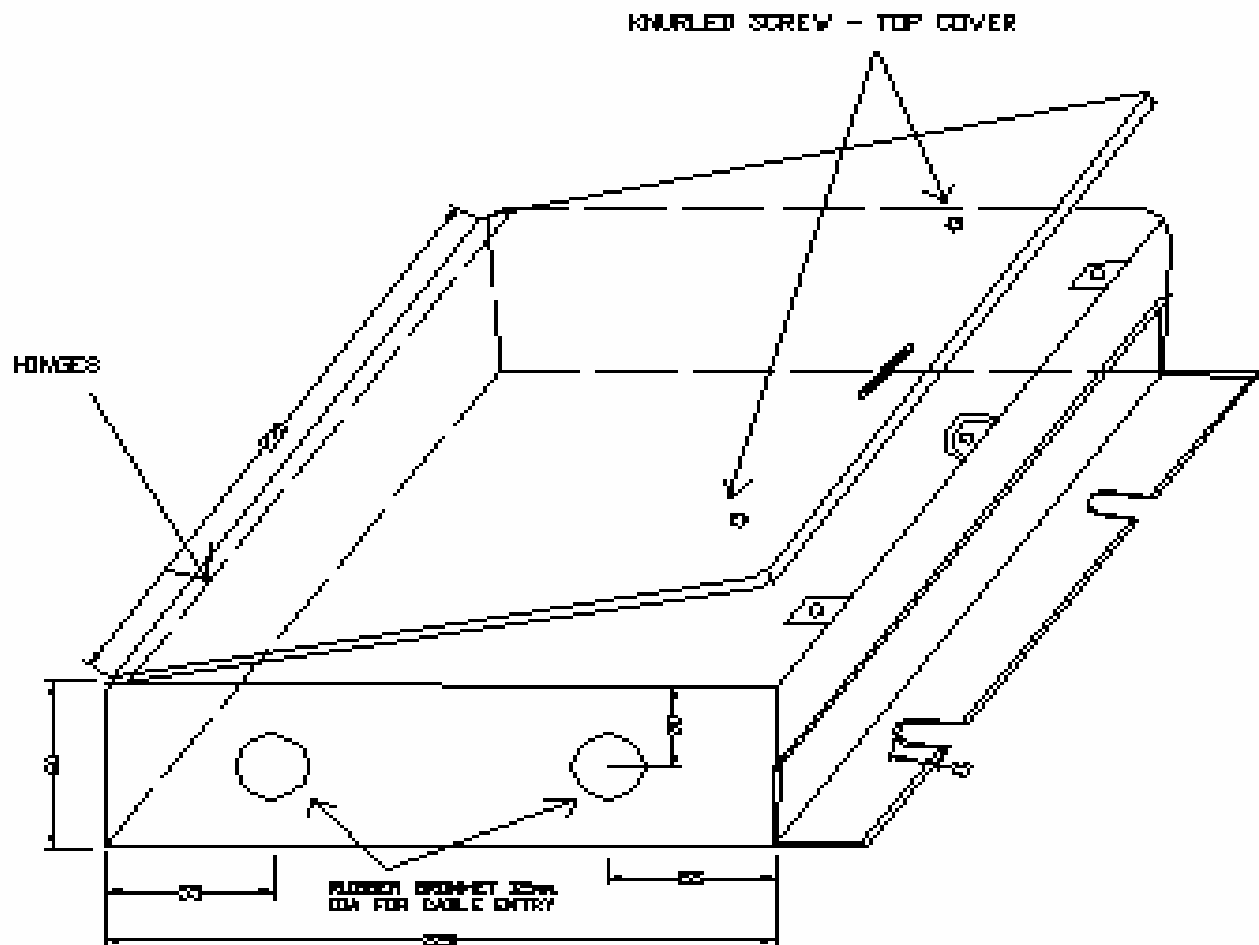


SIDE VIEW (Only for reference)

All dimensions are in mm.
General dia. tolerance ± 2 mm.

DTMF CONTROL OFFICE EQUIPMENT

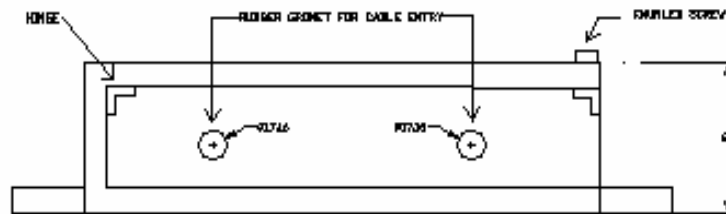
ANNEXURE-VA



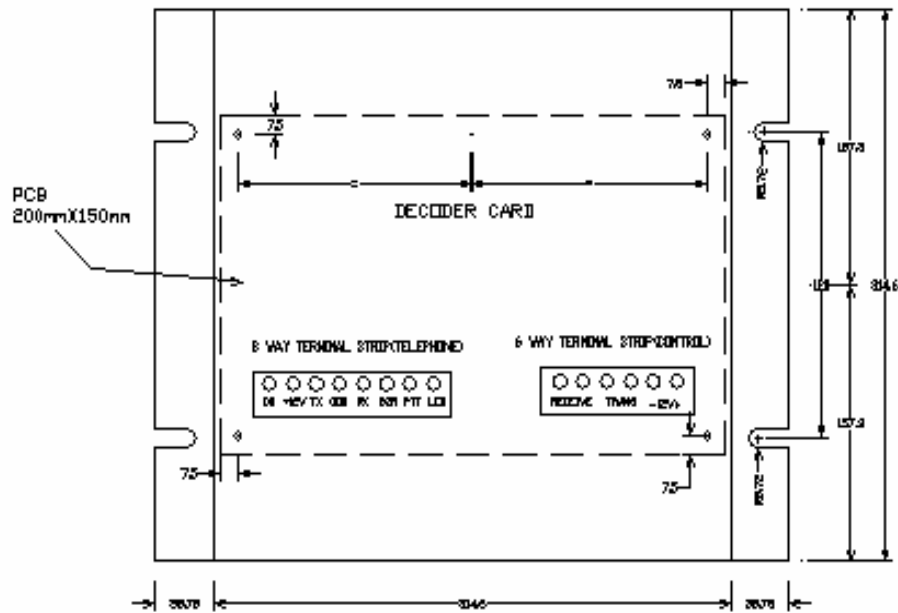
All dimensions are in mm.
General dia tolerance $\pm 2mm$.

DTMF(4W/2W) WAY STATION EQUIPMENT CABINET

ANNEXURE-VB



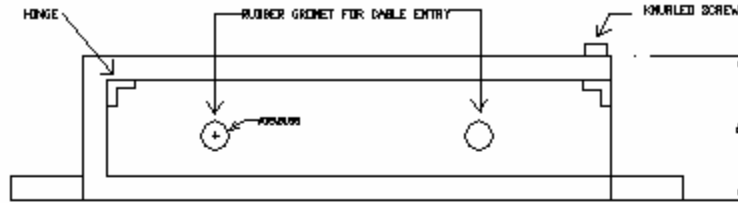
ELEVATION



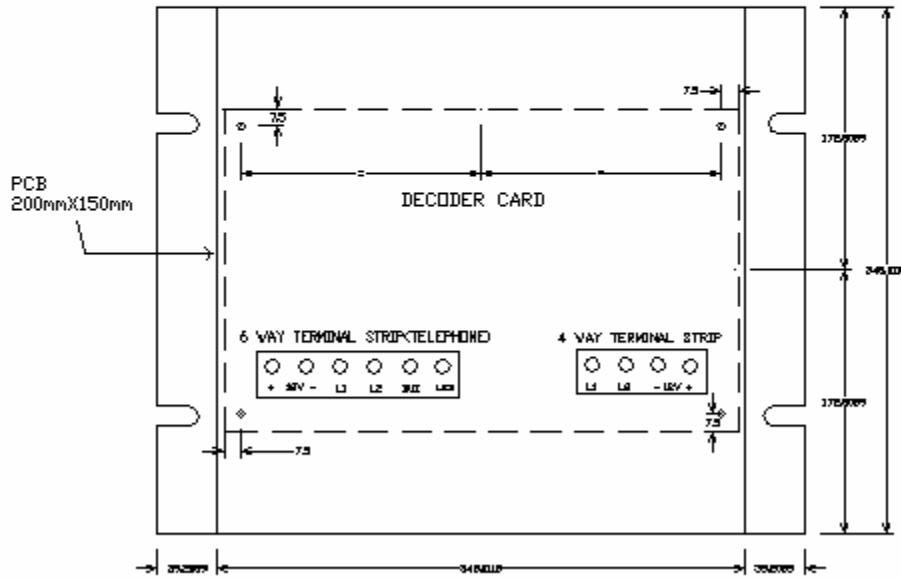
All dimensions are in mm.
General dia. tolerance ± 2 mm.

DTMF 4-WIRE WAY STATION EQUIPMENT

ANNEXURE-VC



ELEVATION



All diamentions are in mm.
General dia. tolerance ± 2 mm.

DTMF 2-WIRE WAYSTATION EQUIPMENT

ANNEXURE-VI

Performance Test (Clause 10.8) : The parameters to be tested for Control Office Equipment, 4-Wire Way Station Equipment and 2-Wire Way Station Equipment shall be as under:

S.No	Parameter to be tested	Type Tests		Acceptance
		Initial	After Climatic	
A	CONTROL OFFICE EQUIPMENT			
1.0	Code Generator			
1.1	DTMF Code Frequency	3.10.2	3.10.2	3.10.2
1.2	Max. Duration of Code Transmission	3.10.3	3.10.3	3.10.3
1.3	Duration of pulse and pause	3.10.3	3.10.3	3.10.3
1.4	Level of DTMF Tones.	3.10.1	3.10.1	3.10.1
2.0	Communication equipment			
2.1	Input Impedance	3.6.1		
2.2	Output Impedance of the Amplifier	3.6.6		
2.3	Frequency response	3.6.4	3.6.4	3.6.4
2.4	Harmonic distortion	3.6.5		
2.5	Output of the Amplifier	3.6.3	3.6.3	3.6.3
3.0	Headphone set			
3.1	Dynamic Microphone	It will be procured from reputed manufacturers and the Certificate/Bill shall be submitted by the vendor during Type Test/Acceptance Test.		
3.2	Electrodynamic Receiver	Electrodynamic Receiver shall be used and shall be procured from a CACT approved sources.		
4.0	Loud Speaker Amplifier			
4.1	Input Impedance	3.8.1		
4.2	Output Level Variation	3.8.2	3.8.2	3.8.2
4.3	Output Level	3.8.3	3.8.3	3.8.3
4.4	Frequency response	3.8.5	3.8.5	3.8.5
4.5	Harmonic distortion	3.8.4		
4.6	Loudspeaker	Loudspeaker shall be supplied as per Clause 3.9. Certificate/Bill shall be submitted by the vendors during Type Test/Acceptance Test.		
5.0	Hybrid Arrangement			
5.1	Output Impedance	3.11.2	3.11.2	3.11.2

5.2	Leak	3.11.3	3.11.3	3.11.3
6.0	Power supply Requirement	3.12.1 to 3.12.4		3.12.1
B	4-WIRE WAY STATION EQUIPMENT.			
1.0	Decoder			
1.1	Sensitivity	6.2.1	6.2.1	6.2.1
1.2	Ringback tone	6.2.4	6.2.4	6.2.4
1.3	Buffer level adjustability	6.2.6		6.2.6
1.4	Equipment Resetting	6.2.7	6.2.7	6.2.7
2.0	Trans amplifier			
2.1	Gain	6.3.2	6.3.2	6.3.2
2.2	Frequency response	6.3.3	6.3.3	6.3.3
2.3	Harmonic distortion	6.3.4	6.3.4	
2.4	Bridging Loss	6.3.5		6.3.5
3.0	Receive amplifier			
3.1	Gain	6.3.2	6.3.2	6.3.2
3.2	Frequency response	6.3.3	6.3.3	6.3.3
3.3	Bridging Loss	6.3.6		6.3.6
4.0	Way Station control Telephone	The Way Station Control Telephone shall meet the requirement of IRS: TC-38 for 4-Wire Territory.		
5.0	Power supply Requirement	6.4.1 to 6.4.4		6.4.1
C	2-WIRE WAY STATION EQUIPMENT			
1.0	Decoder			
1.1	Sensitivity	6.2.1	6.2.1	6.2.1
1.2	Ringback tone	6.2.4	6.2.4	6.2.4
1.3	Buffer level adjustability	6.2.6		6.2.6
1.4	Insertion Loss	9.2	9.2	9.2
2.0	Power supply Requirement	9.3.1 to 9.3.4		9.3.1
3.0	Communication equipment	The Way Station Control Telephone shall meet the requirement of IRS: TC-37 for 2-Wire Territory.		