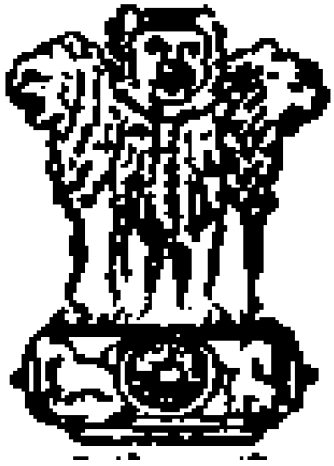

SPECIFICATION FOR

DTMF BASED ELECTRONIC BLOCK BELL & BLOCK TELEPHONE EQUIPMENT

(Tentative)

Version 0

Number of Pages 23

SPECFICATION No. RDSO/SPN/ 191/2005

SIGNAL DIRECTORATE
RESEARCH DESIGN& STANDARDS ORGANISATION

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Title of Document **DTMF BASED ELECTRONIC BLOCK BELL & BLOCK TELEPHONE EQUIPMENT** (Tentative)			
Authors: Sudip Mukhopadhyay Designation: Director/Signal/RDSO			
Approved by Name: Shri G.D. Bhatia Designation: Sr. Executive Director/Signal, RDSO			
Abstract: This document defines specification for DTMF based Electronic Block Bell & Block Telephone equipment			

DOCUMENT CONTROL SHEET

NAME	ORGANISATION	FUNCTION	LEVEL
Sudip Mukhopadhyay	**RDSO**	**Member**	**Prepare**
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AMENDMENTS

Version	Chapter/Annexure	Amendment	Effective date
0	**--**	**First issue**	01.06.2005

SPECIFICATION FOR

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INDEX

ABBREVIATIONS:

1	dB	Decibel
2	DC	Direct Current
3	DIP	Dual Inline Package
4	DTMF	Dual Tone Multi Frequency
5	Hz	Hertz
6	IC	Integrated Circuit
7	IR	Insulation Resistance
8	IRS	Indian Railway Specification
9	IS	Indian Standards
10	KHz	Kilo Hertz
11	Km.	Kilometer
12	LCSO	Electronic Components Standardization Organization
13	LD	Lightning Discharger
14	LED	Light Emitting Diode
15	MOVR	Metal Oxide Varistor
16	PCB	Printed Circuit Board
17	PIJF	Polyethylene Insulated Jelly Filled
18	RH	Relative Humidity
19	RMS	Root Mean Square
20	Rx.	Receive
21	S/N Ratio	Signal to Noise Ratio
22	SPN	Specification
23	TC	Telecom
24	Tx.	Trans
25	VF	Voice Frequency

GENERAL

1.0 INTRODUCTION :

This document covers the technical requirements, constructional features, electrical characteristics, and provisions of tests & inspection of DTMF BASED ELECTRONIC BLOCK BELL & TELEPHONE EQUIPMENT for use over Indian Railways and is issued under the serial **No. RDSO/SPN/191/2005**

1.1 This specification requires reference to the following Indian Railway Standards/Indian Standards/Joint Services Standards specifications.

IRS: S-23 : Electrical Signaling and Interlocking equipment.

IRS: TC 60: 4Wire/2Wire Train Traffic Control Equipment with DTMF Signaling.

IRS/TC/37: Two Wire Control Telephone.

IS: 177: Colour Schemes

IS: 9000(Series): Basic environmental testing procedures for electronic and electrical items.

Wherever in this specification any of the above mentioned specification is referred, it shall be as reference to the latest issue of the specification, otherwise, the particular year of the issue has to be taken as reference.

1.2 This specification is intended chiefly to cover the technical provision and does not include all the necessary provisions of a contract.

1.3 TERMINOLOGY:

1.3.1 For the purpose of this specification terminology as given in IRS: S-23 shall be applicable.

1.3.2 The terms referred to in the specification but not covered in IRS: S-23 are defined below.

1.3.3 LOT:

A lot is constituted by “DTMF based Electronic Block Bell & telephone Equipment” of the same type manufactured in the same factory during the same period using the same process and materials.

2. GENERAL TECHNICAL REQUIREMENTS :

2.1 This specification covers general design features and performance requirements of "DTMF based Electronic Block Bell & Block Telephone Equipment" including procedure for testing.

2.2 The **"DTMF based Electronic Block Bell & Block Telephone Equipment"** serves the purpose of both the conventional Block Bell Equipment and Block telephones and will consist of the following items :

1) **Tone & Speech Control Unit**
2) **Handset**
3) **Power Supply Unit** (optional)

2.2.1 "**Tone & Speech Control Unit** " is housed in an Aluminium Cabinet. This unit will generate standard DTMF tones, which will be transmitted through a 2-wire line through OFC or Quad cable to the other end station where the tone will be decoded and a piezo buzzer will be activated. The DTMF tones which are transmitted from the Tone control unit from the other end station will also be properly decoded. This unit may be housed inside the Control Panel of the Block instrument.

"**Tone & Speech Control Unit** " will also have proper speech amplifiers so that trans and recv speech signals are of proper amplitudes.

"" will have proper surge protection arrangement with "GDT, MOVR, Inductors and PTC resistors and will be suitably connected to a proper "Earthing" terminal to avoid damage due to lightning and other voltage transients.

2.2.2 **Handset** shall be provided with PTT switch and to be connected to the Tone & Speech control unit. The handset shall meet the requirements as per specification no. IRS; TC – 37.The cordage should be connected with the handset on one end with the plug in type 5 pin connector on the other end for connection with Tone & Speech Control Unit as per diagram at FIG. 7.

2.2.3 "**Power Supply Unit**" will have a 24V/7AH rechargeable maintencefree battery and charger and will be used to supply power to the "Tone & Speech Control Unit". This is an optional item and will be supplied if specially ordered by the Purchaser.

2.3 "Tone and speech Control units" will be of two types. One for "UP" side another for "DOWN" side communication. One UP set in a particular station will be connected to a DOWN set located at the other station and vice-versa.

2.4 The "DTMF based Electronic Block Bell & Block Telephone Equipments" will be connected back to back in "point to point" communication mode.

2.5 The system shall permit working of Voice Communication and signaling on two wire circuit for point to point communication.

2.6 It shall be possible to send the signaling code even when two parties are in conversation.

2.7 The telephone shall be protected from Surge and Transients by using “GDT”, “PTC” and “MOVR” based surge protection system.

2.8 The receiver of the telephone instrument shall be protected from acoustic shocks by providing two rectifiers in parallel and with opposite polarity across the receiver.

2.9 The layout of components and wiring shall be such that all parts are easily accessible for inspection, repair and replacement.

2.10 The telephones should work properly from DC Power source of 24 V DC + 20%, -30% with reverse polarity protection.

2.11 Current consumption by the telephones at 24V DC shall not be more than the limits mentioned below:

30 mA in idle condition.
50 mA in speech condition
75 mA during ringing of buzzer

2.12 **AUDIO-VISUAL INDICATIONS:**

“Power On” LED : “Power On” LED is of Green color which will be mounted on the body of the Tone and speech Control unit . This LED will glow when 24V DC is connected to the unit.

Call Indication LED: “Call Indication” LED is of Red color, which will also be mounted on the body of the Tone and speech Control unit. This LED will glow when the telephone is being called by the other end telephone.
A piezo buzzer will sound along with RED LED indication when the telephone is being called. Duration of buzzer sounding will be 225 msec. +/- 25 msec.
The telephone set should be able to identify and produce sounds for repeated calling signals as fast as 2 calls per second. (minimum call interval = 400msec).
The called set should not sound continuously even if the push switch of the caller telephone is kept pressed for a long duration.

2.13 **Ring back Tone:**

Ring Back Tone (RBT) will be available at the calling telephone when the other end telephone rings. This is a confirmatory tone to confirm that the other end telephone buzzer actually rings.

3. CONSTRUCTION AND MATERIALS:

3.1 The Equipment shall consist of the following parts/components: -

1) TONE & SPEECH CONTROL UNIT
   a) Aluminium Cabinet
   b) Speech and Tone Circuit PCB
   c) LED indications
   d) Connectors
   e) Piezoelectric Buzzer

2) HANDSET
   a) Handset with cordage
   b) Electrodynamic type transducers
   c) Press to talk switch on handset

3.2 **Body of the Tone and Speech Control Unit.**

3.2.1 The body of the equipment will be made of Aluminium sheet as per drawing shown in Figure-1 ; Annexure-B

3.3 **Tone Generator:**

3.3.1 Standard DTMF Tone Generator shall be provided to produce DTMF tones. It shall have provision to generate standard DTMF code 1 or 2 (selectable by dip switch).

3.4 **Decoder:**

3.4.1 Standard DTMF decoder shall be provided. It shall have provision to decode standard DTMF code 2 or 1 (selectable by dip switch).

3.4.2 On receipt of the valid code/tone, it shall be decoded and Piezo electric buzzer & LED shall be activated.

3.5 **Wiring and PCB**

3.5.1 The wiring shall normally be by means of coloured PVC insulated multi strand flexible wire of good quality and of suitable size.

3.5.2 Glass Epoxy PCB of minimum 1.6mm thickness shall only be used. The PCB shall be coated with epoxy based anti fungal varnish to provide protection against dust, humidity, fungal infection and mechanical abuses.

3.6 **Transformer:**

3.6.1 Ferrite material shall be used for core so as to obtain required electrical properties.

3.6.2 The complete winding shall be protected by proper insulation to avoid ingress of moisture.

3.7 **DC Blocking Capacitor:**

3.7.1 1.5 to 2.2 micro Farad Capacitor of operating voltage minimum 400 V shall be provided for blocking DC voltage on line.

3.7.2 Capacitor used shall be made of Metallised Polyester.

4. ELECTRICAL CHARACTERISTICS:

4.1 Insulation Resistance Test:

The insulation resistance between the body of the Tone & Speech Control Unit and all terminals connected together shall not be less than10 Mega ohm when tested with 500V DC Megger / Insulation tester. Hand set will remain in properly connected condition.

4.2 High Voltage Test:

A voltage of 1 KV, 50Hz AC sinusoidal r.m.s, shall be applied between the telephone body and all output terminals connected together for one minute. It shall withstand this voltage, no flash/smoke shall occur and no damage shall take place. Hand set will remain in properly connected condition.

4.3 Transmission Characteristics Tests:

4.3.1 The telephone will be subjected to following transmission tests. The test set up shall be as indicated in Figs. 2 to 5 of Annexure-I

i) **Send Efficiency**:

The test set up shall be as indicated in Fig.2.

T1 and T2 : Terminals for Transmitter Inset.
R1 and R2 : Terminals for Receiver
L1 and L2 : Line Terminals
B1 and B2 : Battery Terminals
LM : Level Meter

The transmitter of handset shall be removed and simulated by 100+ 100 Ohm non-Inductive resistance as shown and the Receiver replaced by a 200 ohm Non-Inductive Resistance. 24V battery shall be connected to the battery terminals. The oscillator level shall be adjusted such that it is –44dBm at 1000Hz measured across terminals T1 and T2. The line terminals shall be terminated by 600 ohm Non- Inductive Resistance. The level across 600 ohm resistance shall not be less than 0dBm and total harmonic distortion shall not be more than 3%.

ii) **Side Tone:**

The test set up shall be as indicated in Fig. 3.

The level measured at R1 and R2 across 200 ohm resistance shall not be more than –18dBm with the oscillator level maintained at –44dBm at TX terminal.

iii) **Receive Efficiency:**

The test set up shall be as indicated in Fig.4.

The line shall be simulated by 300+300 Ohm non-inductive Resistance. The level at 1000 Hz across terminals L1 and L2 shall be adjusted to –12dBm. The level across R1 and R2 shall not be less than –18dBm and total harmonic distortion shall not be more than 3%.

iv) **Insertion Loss:**

The test set up shall be as indicated in Fig.5

With the setup as in fig.5, oscillator level is adjusted to give 0 dBm across 600 ohms without the telephone being connected. The telephone shall then be connected and the drop in the reading of the level will be measured. Loss should not be greater than 1dB.

4.4 Test for Code/Tone Generator:

4.4.1 The output of the code generator shall be adjustable from 0 dBm to –7dBm when measured across 600 ohm resistance connected across line terminals L1 and L2.

4.4.2 It shall be possible to work the signaling system with a minimum input level of -25 dBm at the line terminals with the line S/N ratio of 15. The telephone shall work satisfactorily for input level of -25dBm to –2dBm.

4.4.3 **Noise immunity test**:

The telephone decoder should work satisfactorily even when 250 V, 50Hz external AC signal is injected to the 2-wire line through 2 nos.10K resistors connected to the line.

This test should be carried out when two block telephones will be connected back to back, and both should decode and ring each other's codes.(Fig. 6)

5. PERFORMANCE TEST:

5.1 Two Telephones (One UP and another DOWN) instrument will be connected back to back in point to point communication mode with 20 dB attenuation pad. There should be no ring failure and speech quality should be good.

6. INSPECTION:

6.1 The inspection shall be carried out to the satisfaction of the purchaser or his nominee.

6.2 The purchaser or his nominee shall have the right to be present during all the stages of manufacture and shall be accorded all reasonable / complete facilities to satisfy himself that the equipments are being manufactured in accordance with the terms and conditions of the specifications. The purchaser or his nominee shall have the right to reject any material that fails to conform to the specification.

6.3 When the inspection is carried out during the manufacturing process, the manufacturer shall supply the material and samples required for testing free of charges and shall at his own cost prepare and furnish the necessary test pieces and

appliances for such testing as may be carried out at his own premises in accordance with the specification. The manufacturer shall bear the cost of carrying out the tests at an approved test laboratory for conducting the tests for which firm is not having in-house test facilities.

6.4 Test certificates incorporating the results of the routine test and other manufacturing tests must be furnished prior to the inspection for the use of purchaser/ his nominee.

6.5 **Visual Inspection**:

6.5.1 The instrument shall be visually inspected to ensure that the cabinet and handset are free from cracks and other imperfections and that all the components are fitted properly.

6.5.2 Instruments shall be checked to satisfy general requirements .

6.5.3 The faulty sub assembly and / or samples failing in routine /acceptance tests shall be destroyed effectively. The exercise of effective destruction during the manufacture / routine tests shall also be shown to inspecting authority as and when asked for.

6.6 **Type Tests**

6.6.1 The type tests shall include complete tests in accordance with this specification including climatic and vibration tests.

6.6.2 Unless otherwise specified, all tests shall be carried out at ambient temperature.

6.6.3 Type test shall comprise of the following:

a) Visual Inspection (cl 6.5)
b) Electrical Characteristics Test (cl 4)
c) Performance Test (cl 5)
d) Climatic requirements (cl 9)

6.6.4 Number of samples for Type Tests shall be two. One UP and one DOWN Telephone .

6.6.5 The sequence of type tests shall normally be in accordance with Appendix-A.

6.6.6 Operating manual and Maintenance manual of the system shall be submitted along with samples during type tests.

6.6.7 Bill of materials indicating details of parts / components, their values and make shall be submitted along with samples for type tests.

6.7 **Acceptance Tests:**

6.7.1 Acceptance tests shall comprise of the following tests taken in sequential order as follows: -

a) Visual Inspection (cl 6.5)
b) Electrical Characteristics Tests (cl 4)
c) Performance Test (cl 5)

6.8 **Routine Tests:**

6.8.1 Following routine tests shall be conducted by the manufacturer on all the telephones:-

a) Visual Inspection (cl 6.5)
b) Electrical Characteristics Tests (cl 4)
c) Performance Test (cl 5)

7. **SAMPLING:**

7.1 Unless otherwise agreed to by the purchaser and the supplier, the double sample plan given below shall be adopted:-

Lot consisting telephone	1st sample size (NI)	2nd sample size (N2)	Combined sample size (N1 + N2)	Acceptance Number (C1)	Rejection Number (C2)
1	2	3	4	5	6
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

7.2 The number of Telephone (N1) as given in col.2 shall first be selected and subjected to the acceptance test/ If in the first sample, the number if defective Telephone, that is those failing 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 Telephone 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 Telephone 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 Telephones is less than (C2), the lot shall be considered as conforming to the requirements of acceptance test.

7.3 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 arranged in a serial order and every ‘r’ the package shall be selected until the requisite number of packages is obtained: -

‘r’ being the integral part of :$\frac{\text{Total number of packages in the lot.}}{\text{Total number of packages to be selected.}}$

8. REJECTION:

8.1 Any of the materials, which do not comply with the requirements of this specification may be rejected.

9. CLIMATIC AND ENVIRONMENTAL REQUIREMENTS:-

9.1 The Telephone shall function satisfactorily after subjecting to the following climatic and environmental conditions tested as per IS: 9000 series.

9.1.1 Change of Temperature Test :
Low temperature: 0 °C ± 3°C
High temperature: 55°C± 2°C
Rate of change of temperature over a period of not more than 5 minutes shall be 1°C per minute.
Duration of exposure : 3 Hours
Number of cycles : 2

9.1.2 Dry Heat Test: 55 ± 2°C
Duration: 12 Hours

9.1.3 Damp Heat (Cyclic) Test:
Duration: 12 + 12 hours
First Cycle of two cycles
Upper temperature: 40°C
Variant: 1

9.1.4 Cold Test (Part II Section 3)
Temperature: 0°C ± 3°C
Duration: 2 Hours

9.1.5 Damp Heat (Cyclic) Test:
Duration: 12 + 12 Hours
2nd Cycle of 2 cycles
Upper temperature: 40°C
Variant :1

9.1.6 Salt Mist Test (Part XI): Procedure 1
Duration: 48 Hours

9.1.7 Vibration (Sinusoidal) test as per IS: 9000 (Part VIII)
Frequency: 10 to 55Hz
Vibration Amplitude :0.35 mm
Duration at resonance: 30 minutes ± 1 minute on each of 3 co-ordinate axes.
Duration of endurance for sweep: 20 Sweep cycles between 10 Hz to 55 Hz.
Magnitude of “g”: 1

9.1.8 During Final Tests after climatic and vibration tests , there shall not be more than 10% deterioration in electrical characteristics values of inititial test results. However none of the parameter readings should go beyond the specified limis.

10. MARKING & PACKING:

10.1 Complete connection diagram showing the electrical connection of the instrument shall be fixed or printed by an appropriate process on a suitable locations.

10.2 The following information shall be clearly embossed / engraved / screen-printed at a conspicuous places.

a) Item Name
b) RDSO Specification Number
c) Name or monogram of the manufacturer.
d) Year of manufacture.
e) Serial Number

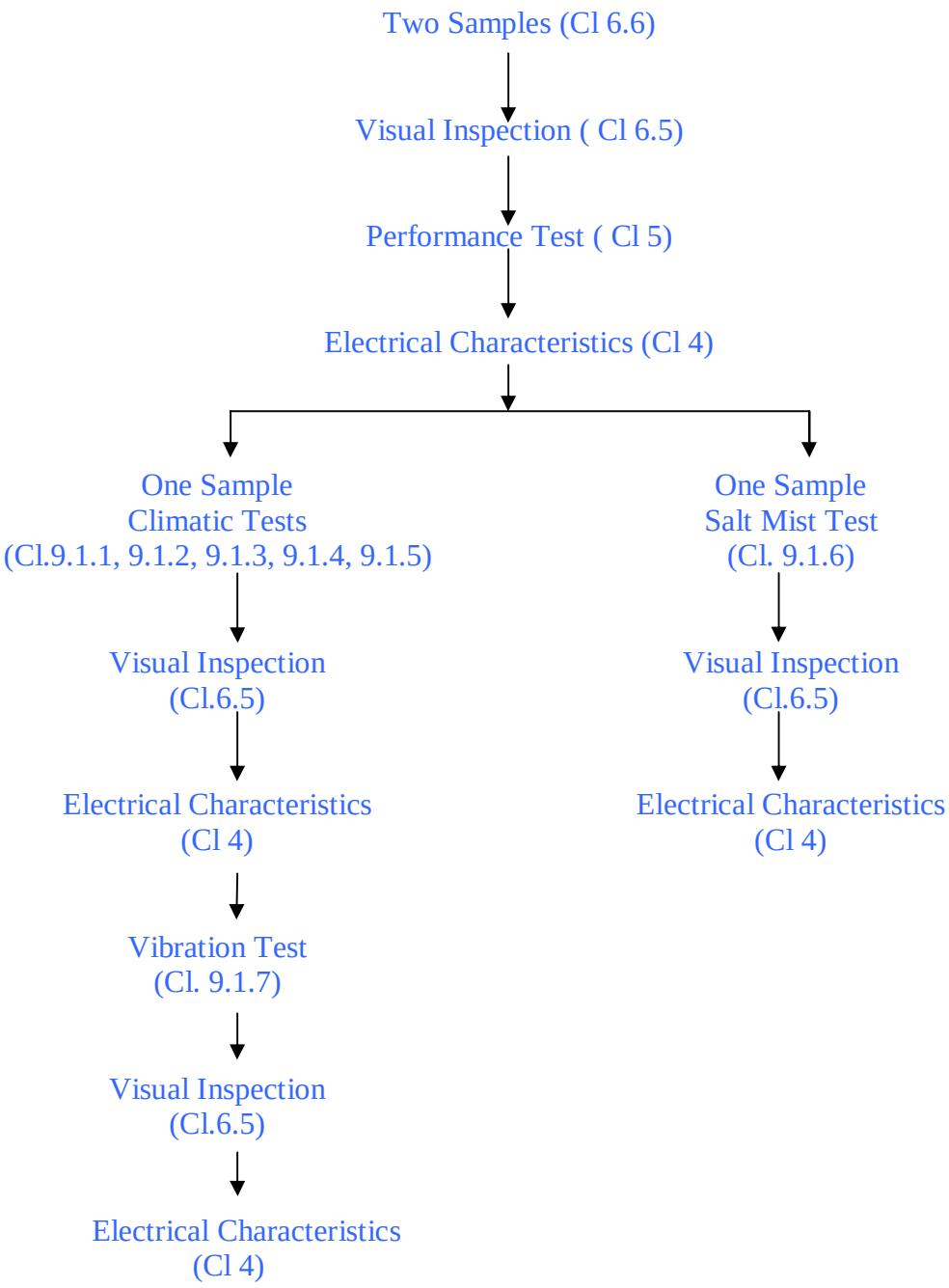
10.3 Any other information specially requested and required by purchaser should also be incorporated in the system.

10.4 **PACKING:**

The equipment shall be suitably packed so as to avoid any damage or deterioration during storage and transit.

ANNEXURE-A

SEQUECE OF TYPE TEST



ANNEXURE : B

BLOCK TELEPHONE WITH RINGER

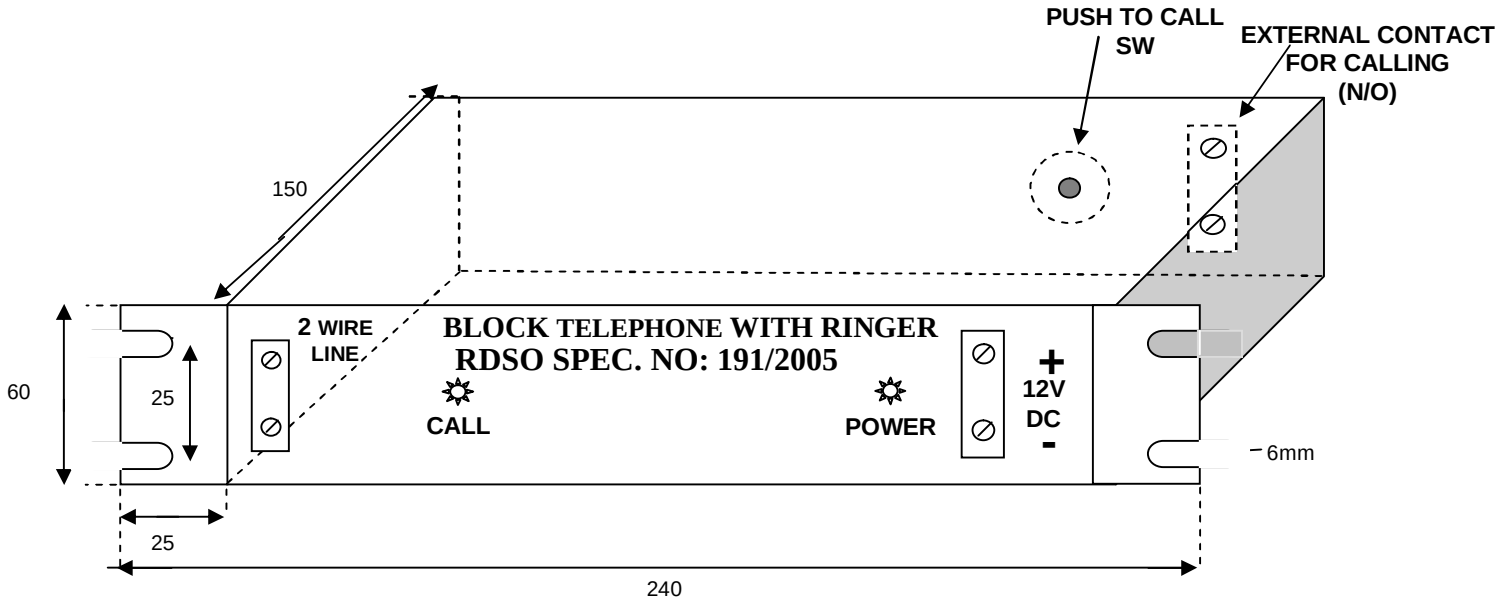


FIG : 1

NOTES :
1. Cabinet body : Aluminium
2. Thickness of Al Sheet = 2mm+/-0.2mm
3. Tolerance in dimensions = +/-2mm
4. Finish: Powder Coated
5. All dimensions in mm
6. The Piezo buzzer could be fixed in the front Panel from inside with suitable grill/hole.
7. The 5-pin socket could be suitably mounted on the front Panel.

TEST SET UP FOR SEND EFFICIENCY

(1) SEND EFFICIENCY (CL)

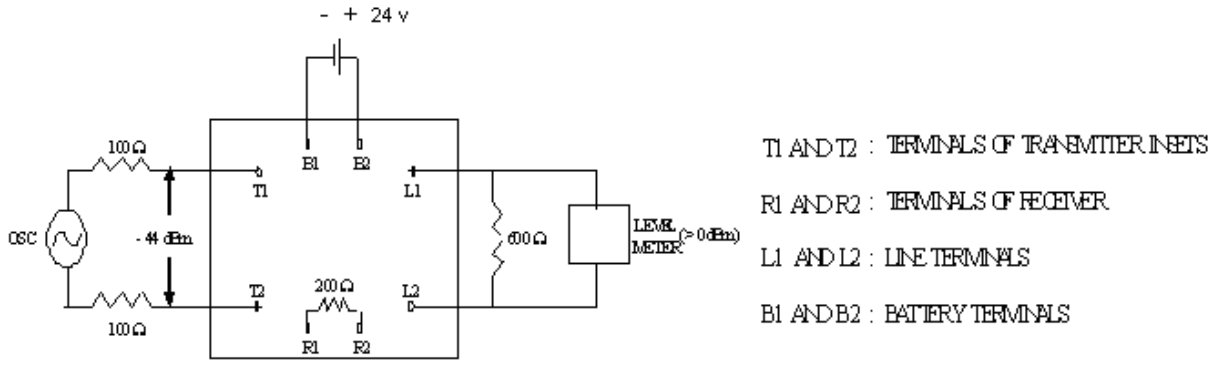


FIGURE - 2

TEST SET UP FOR SIDE TONE

(2) SIDE TONE (CL)

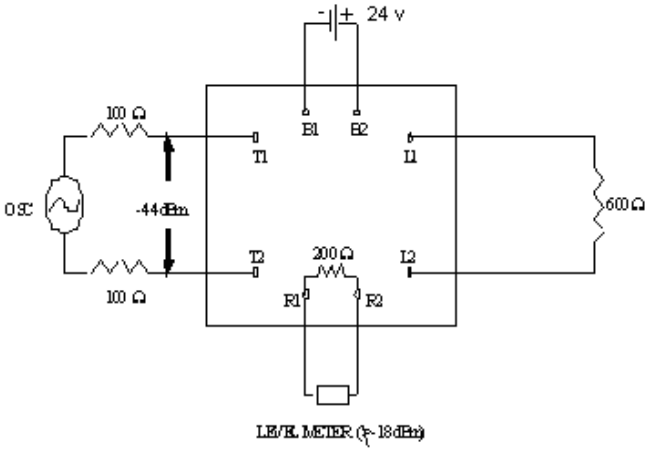


FIGURE - 3

TEST SET UP FOR RECEIVE EFFICIENCY

(3) RECEIVE EFFICIENCY(CL)

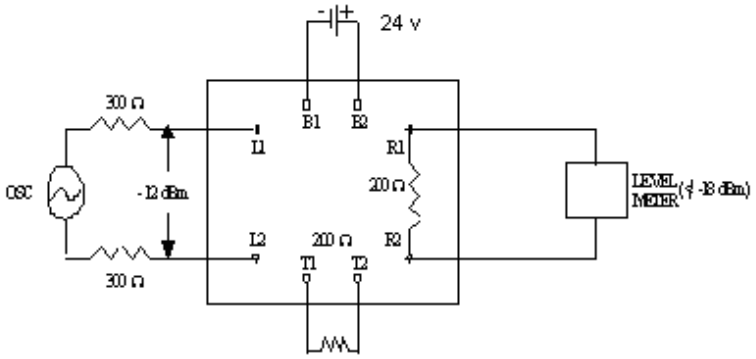


FIGURE-4

TEST SET UP FOR INSERTION LOSS

(4) INSERTION LOSS (CL)

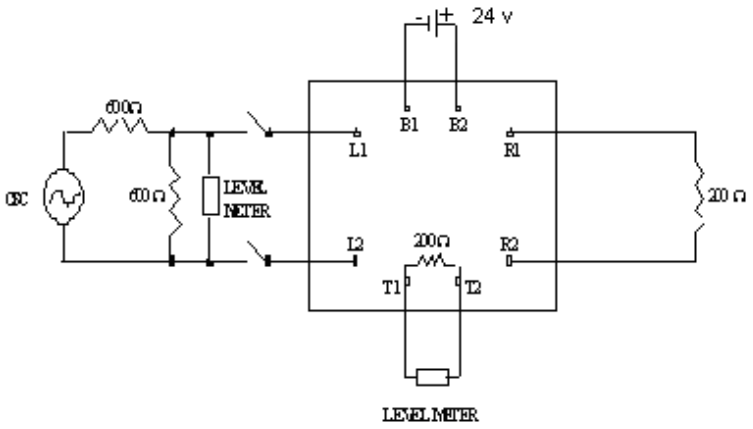
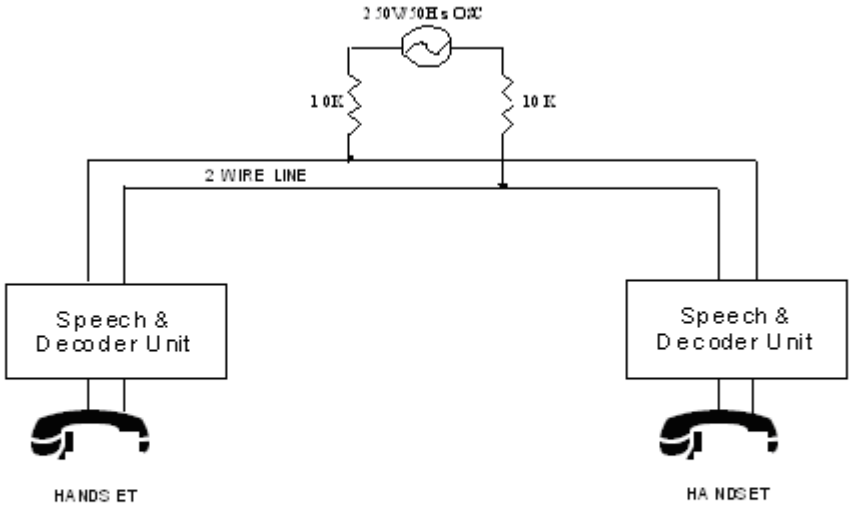
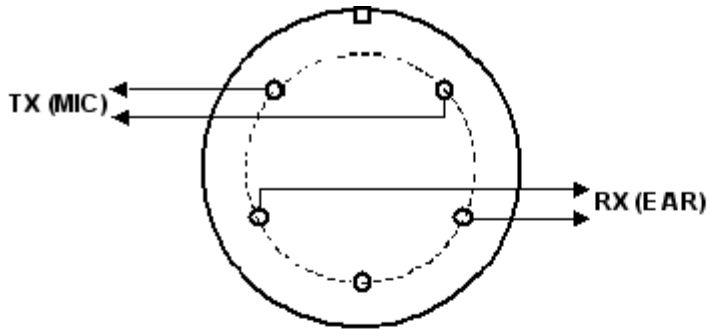


FIGURE-5



Noise Immunity Test

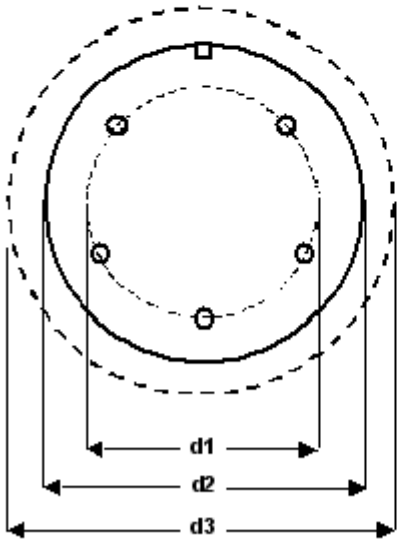
Fig. 6



NOTE :

CONNECTOR : INDUSTRIAL TYPE
MAKE : GILLARD

CONNECTION OF 5 PIN PLUG & SOCKET
FOR HANDSET OF BLOCK TELEPHONE



d1 ? 8 mm
d2 ? 12.5 mm
d3 ? 16 mm

PHYSICAL DIAGEAM OF 5 PIN PLUG & SOCKET