

T.V. LISTENING DEVICES FOR THE HEARING IMPAIRED - A COMPARISON

REGISTER NO. M2K16

An independent project work submitted
in part fulfillment of the first year
M.Sc. (Speech and Hearing) to the University of Mysore

**ALL INDIA INSTITUTE OF SPEECH AND HEARING,
MANASAGANGOTHRI, MYSORE-570006**

MAY, 2001

Certificate

This is to certify that this independent project entitled "*T. V. Listening Devices For The Hearing Impaired - A Comparison*" is the bonafide work in part fulfillment for the degree of Master of Science (Speech & Hearing) of the student (Register No.M2K16).



(Dr. M. Jayaram)

Director

All India Institute of

Speech&Hearing,

Mysore -570 006

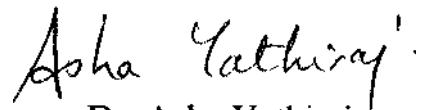
Mysore,

May, 2001

Certificate

This is to certify that this independent project entitled "*T.V. Listening Devices For The Hearing Impaired - A Comparison*" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any other Diploma or Degree.

Guide


Dr. Asha Yathiraj

Head of the Department & Reader

Mysore,

May, 2001

Department of Audiology,
AIISH, Mysore 570 006

Declaration

This independent project entitled "*T. V. Listening Devices For The Hearing Impaired - A Comparison* " is the result of my own study under the guidance of Dr. Asha Yathiraj, Head of the Department & Reader, Department of Audiology, All India Institute of Speech & Hearing, Mysore, and has not been submitted earlier in any other University for the award of any other Diploma or Degree.

Mysore,

May, 2001.

Register No. M2K16



*This project
is Dedicated
To
Ma & Baba*

ACKNOWLEDGEMENT

/ convey my sincere thanks to Dr. Asha Yathiraj, HOD & Reader, Department of Audiology, AIISH, Mysore for her valuable guidance and encouragement.

I would like to thank Dr. M.Jayaram, Director, AIISH, Mysore for permitting me to take up this project.

My sincere thanks to the staff members of the Audiology Department for helping me in the project.

I am thankful to my parents and sister for their love, affection, support and encouragement.

I would like to thank my friends for providing me moral support and courage.

My thanks to the Librarians, AIISH, Mysore.

I am thankful to the Mrs. Manjula and Mr. Madhusudan for helping me in typing the project.

TABLE OF CONTENTS

	Contents	Page Nos.
I.	INTRODUCTION	1- 8
II.	METHODOLOGY	9-13
III.	COMPARISON OF DEVICES	
	i) Available in India	14-17
	ii) Available abroad	18-62
IV.	RESULTS AND DISCUSSION OF	
	i) Devices available in India	63-68
	ii) Devices available abroad	69-75
V.	SUMMARY AND CONCLUSION	76-77

INTRODUCTION

An Assistive Listening Device (ALD) is defined as any non-hearing aid device which is designed to improve a hearing impaired persons ability to communicate more fully despite a hearing loss. This could be done either by transmitting amplified sound more directly from its source to the listener or by transforming it into a visual or a tactile signal (Mahon, 1985). The term ALD comprises of all systems which are meant to improve the communication ability of hearing impaired persons in difficult listening situations or to make them aware of the presence of environmental sounds (Kaplan, 1987). They are designed to solve one or more specific listening problems created by a hearing loss (Zelski, 1985).

The ALD helps a hearing impaired person to participate more fully in and to benefit from any social and cultural activities. Without such a system, people with hearing loss will feel neglected and would be unable to participate fully in all such activities. These devices are of great potential significance for people with hearing loss (Ross and Bakke, 2000).

Classification of the Assistive Listening Devices:

The ALD's can be classified based on their purpose or use as-

a. **Alerting devices** : These devices help a person to detect sound signals. Listening to environmental sounds at home is very difficult for hearing impaired persons. Alerting devices also work on the various modalities like:

- i. The visual alerting system,
- ii. The auditory alerting systems,
- iii. Tactile alerting systems.

The visual alerting systems uses a flashing light which may be attached to the devices sensors so that the individual is alerted of the particular sound. Example, alarm clocks.

An example of an alerting device using the auditory mode is a telephone ring indicator. These devices are attached to the telephone ringers for which a more audible loud gong or low pitched signal can be substituted. This is quite easily detected by hearing impaired persons.

There are devices which use the vibrotactile mode to detect sound signals. This type of devices are used with severe to profound hearing loss cases. The tactile aids convert the speech sounds into vibrations on the skin. This is achieved through a vibrator placed on the skin. Example, waist worn vibrotactile pagers, fans, where air stream is the stimuli and battery powered clocks etc. (Compton, 1993).

- b. **ALD's can be use for communication purposes-** These ALD's are the ones which help a person:
 - i. **To take part in face-to-face conversation with two or more people.** Example of these are personal amplifiers, FM transmission systems, induction loop systems, and the infrared systems

(Sanders, 1982).

ii. **To take part in distant conversation through telephone.**

ALD's for the voice telephone can be used with or without a hearing aid. TTY's and TDD's are used by people who cannot understand even amplified speech (Compton, 1993).

iii. **To take active part in the communication** through use of facsimiles, e-mails, pagers and videophones (Berger and Millin, 1989).

A second type of classifications of ALD's can be based on the modalities used, to receive the message i.e, auditory, visual or vibrotactile/tactual.

1. Auditory modality:

These devices are used for the purpose of communication by making use of the hearing ability of the individuals. The different types of devices making use of the auditory modality are direct input devices/hardwired systems, loop induction systems, infrared system, FM systems. These systems could also be used as TV listening systems when they are attached to the televisions.

The TV listening devices could be classified into two types.

- a. Direct Input Devices
- b. Wireless Devices.

a. Direct Input Devices :

In some of the televisions direct coupling is also possible due to presence of an audio, output jack. The TV volume is then adjusted at a normal level for non-hearing impaired listeners. Some of the units have options to allow for telecoil or direct audio input adaptation to hearing aid (Zelski, 1985).

b. Wireless devices :

Wireless personal listening systems include the infrared devices and FM-transmission devices which use the auditory modality. Due to inherent fidelity of the system and proximity of the microphone pickup to the sound source, these systems offer the best available TV listening. For the TV use an emitter/transmitter is placed on top of the TV with microphone suspended directly in front of the speaker (Zelski, 1985).

2. Visual Modality:

The device which are used for face-to-face communication and for television reception are used by both the hard of hearing people as well, as the deaf population. It can be widely used in conjunction with auditory technology, in speech readings or signed, oral or cued speech interpreters. Example of devices using the visual modality are real time captioning and close captioning in television. Live captioning in television is very much beneficial to the deaf population. Apart, from this open captioning is also used in which everyone who views the programme can get the captions at the bottom of the TV screen.

Closed captioning, which required special decoders to decode the captions that are otherwise not visible, is quite popular with the hearing impaired population (Caldwell, 1981; Vaughn and Lightfoot, 1987). Upton's eye glass can also be used for viewing television. It is mainly useful for speech decoding purpose. It has a special microphone placed on the temple of the spectacle. This microphone picks up the acoustical signals, which is sent to an analyzer. The analyzer extracts information regarding frequency and depending on it the different LED's fitted on the frame of spectacle lights up. The device has a mirror on the centre of the lens which reflects the light on the source. The listener can pick up the cues and thus speech read. These devices use the visual modality so it is a misnomer to call them "Listening Devices". These devices, however, do help in understanding the television programme, which is beneficial for the hearing impaired.

3. Vibrotactile/Tactual modality:

The vibrotactile aids transmit the speech sounds into vibrations on the speaker. This is achieved by means of a vibrator placed on the skin (Dercks, 1987). The aids using the vibrotactile modality are tended to transmit sound information to the tactile sensory systems. The vibrators which are placed on the skin can be at different parts of the body like the finger tips, palm and also on the wrist. The vibrotactile devices have electrodes which can be placed on the abdomen or sternum of the patient. Depending upon the number of vibrators it has been divided into single channel or multichannel. Example, waist-

worn vibrotactile pagers, battery powered clocks, bed shakers (Compton 1993).

There has been nothing reported in literature about the use of vibrotactile aids with television viewing.

AIM OF THE PROJECT

The aim of the project is to compile information on TV listening devices which are available in India as well as abroad. The following characteristics of each of the devices would be evaluated/ reported :

- (i) Type of the listening device being used and the method of amplification.
- (ii) Physical features of the device including its headset (receiver) features.
- (iii) Clarity of speech,
- (iv) Clarity of music.
- (v) The loudness of speech with reference to different volume control settings.
- (vi) The maximum distance up to which the signal is clear,
- (vii) Cost of the devices.

The project aims to compare the various devices with one another. The comparison will be made to enable selection of the most appropriate device for a

hearing impaired person.

An attempt will be made to describe the mode of operation of each of these devices, which have been categorized into:

- (i) Wireless systems
 - a) Infrared (IR).
 - b) Frequency modulation (FM).
 - c) Induction Loop (IL).
- (ii) Hard wired / Direct input systems

It has been mentioned how the devices could be connected to the television and then used for effective television listening.

NEED OF THE PROJECT

The need of this project is to make the professionals aware of the T.V listening systems which are available in India and abroad. This awareness will result in the proper selection of a device which is most suitable for the hearing impaired. The audiologists will know about the features and the characteristics of the devices, which will increase the pool of knowledge in them.

The project will be useful to those clients who want to get more information about the ALD's. They would have a larger and wider variety of options. The cost of the device would help the clients to select an appropriate device based on their financial status. The appropriateness of the device can be

further checked by the audiologists.

It would also help the students who wish to gain more information about the TV listening systems. They would get information about the various features present in the T.V listening system available in India and abroad.

METHODOLOGY

This study has been done to compare the different types of TV listening devices which are available in India as well as abroad. The devices, which were available in India were subjected to a listening test and were compared across various physical and perceptual parameters. Due to the non-availability of the devices that are marketed abroad, they were compared according to the specification available in the catalogues.

Evaluation of the devices available in India:

Test Environment:

The experiments were conducted in quiet rooms having dimension of 20 feet x 15 feet. The tests on the different devices were conducted in different rooms depending on the place where the devices were available. Four of the devices were evaluated in the same room while one was evaluated at the distributors shop. It also had approximately the same dimensions as of the other test rooms, but was not as quiet.

Instrumentation:

The following T. V listening devices were used for the experiment:

- i) Philips cordless infrared system**
- ii) Porta sound 2000-FM system**
- iii) Philips FM - Moby**

iv) **Onida 20" TV (candy)**

v) **Arphi push pull 650 VT**

All of these devices were evaluated one at a time. The ALD's were connected to the audio output of the TV using appropriate jacks. The transmitters of each of the above devices were connected to the TV and the head set receiver or the handheld receivers were adjusted accordingly. This was done so that the maximum clarity of sound was obtained.

Procedure:

The experimenter did the perceptual analysis of the quality of the sound of each of the devices. The physical features of the devices were also noted. All these devices were evaluated within a period of a week. The experimenter listened to the following signals :

1] Speech of males speaking English and Hindi language

2] Speech of females speaking English and Hindi language

3] Instrumental music.

This was done at different volume control setting. These included the 1/3rd turn and full on turn of the wheel of the volume control. The perceptual analysis was done at eight feet and 20 feet away from the T.V. Eight feet was selected as it is the average distance a person usually views television. The 20 feet distance was chosen, as it was the maximum distance that was permissible in

the test environment.

The following parameters were noted for each of the devices.

(I) *Type of listening device being used.* Devices were compared based on their mode of operation, i.e., whether they were frequency modulation systems, induction loop systems, infrared light emission systems, direct input systems or hard wire systems.

(II) *Devices were compared according to the headset (receiver) features.* The features include:

- a] Adjustable headband
- b] Comfort
- c] Portability
- d] Headphone type
- e] On off switch
- f] Fine-tuning control
- g] Volume control
- h] Antennae
- i] Type of battery used.

(III) *The distance where the signal could be heard clearly*

(IV) *Clarity of speech.* These devices have been compared according to

the clarity of speech of males and females.

(V) *The clarity of music from the television.*

(VI) *The loudness of speech when the volume control was in 1/3rd on or in the full- on position.*

(VII) *Cost of the device*

The information obtained for each of the Indian devices were noted on response sheet and it was tabulated for further comparisons.

Evaluation of the devices available abroad:

Those devices, which were not available for perceptual analysis were evaluated using information available in the catalogues provided by the manufacturers. This information was obtained through the catalogues of the companies and also from the internet.

The comparisons were done on the following parameters, which were specifically reported in the catalogues.

(I) The Physical features :

a] *Transmitter used*

b] *Receiver feature*

(i) Volume control

(ii) Tone control

- (iii) On-off switch
- (iv) Fine tuning control
- (v) Headphone type
- (vi) Adjustable headband
- (vii) Antenna
- (viii) Battery used
- (ix) Comfortable
- (x) Portability
- (xi) Size
- (xii) Weight.

- (II) The maximum distance where it may be used.**
- (HI) Clarity of speech.**
- (IV) Clarity of music.**
- (V) Suitability for different types and degree of hearing loss.**
- (VI) Cost of the devices.**

COMPARISON OF THE DEVICES

COMPARISON OF THE DEVICES AVAILABLE IN INDIA :

The five Indian devices had been evaluated and these were compared with each other. Only five of them were taken into account as these were the devices available at the time of the experiment. These devices were compared (Table 1) based on the following parameters.

- 1) Type of the listening device being used.
- 2) Headset (receiver) features including
 - a) Adjustable headband.
 - b) Comfort.
 - c) Portability.
 - d) Headphone type.
 - e) Fine tuning control.
 - f) Volume control.
 - g) Antenna.
 - h) Type of battery used.
- 3) The distance where signal could be heard clearly.
- 4) Clarity of speech.
- 5) Clarity of music.
- 6) Loudness of speech when volume control was at $1/3^{\text{rd}}$ on or in full on position.
- 7) Cost of the device.

Table 1: COMPARISON TABLE OF DEVICES AVAILABLE IN INDIA

Sl. No	Parameters Tested	Philips Cordless	Porta Sound 2000 -FM System	Philips FM-Moby	Onida 20" TV	Arphi push pull 650 VT
1.	Type of TV listening device being used	Infrared	FM	FM	FM	Direct input device
2	Headset (receiver) features					
	a. Adjustable headband	Yes	Yes	Yes	Yes	No
	b. Comfortable to wear	Yes	Yes	Yes	Yes	Yes
	c. Portable	Yes	Yes	Yes	Yes	Yes
	d. Headphone type	Supra aural	Supra aural	Supra aural	Supra aural	Custom made earmould
	e. On-off switch	Present	Present	Present	Present	Present
	f. Fine tuning	Absent	Present	Present	Present	Absent
	g. Volume control	Present	Present	Present	Present	Present
	h. Antenna	Absent	Absent	Absent	Absent	Absent
	i. Transmitter used	SBCM 122 Infrared AAAE-92	Porta sound 2000-FM AAAE-92	Super SBC 100FM E-92-LR03	In-built transmitter 2 batteries 1.5 V	No transmitter 2 batteries 1.5 V
	j. Battery used	LR03-AM4 1.5 V(Alkaline)	LR03.AM4 1.5V(Alkaline)	SBC-100- 1.5V(alkaline)		

Cont.

Sl. No	Parameters Tested	Philips Cordless	Porta Sound 2000 -FM System	Philips FM-Moby	Onida 20" TV	Arphi push pull 650 VT
3.	<p><i>Clarity of speed at</i></p> <p>a. 1/3rd on</p> <p>(i) Speech of males is clearly understood</p> <p>(ii) Speech of females is clearly understood</p> <p>b) At full volume</p> <p>(i) Speech of male is clearly understood</p> <p>(ii) Speech of females is clearly understood</p>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>	<p>Speech is not clear due to distortion.</p> <p>Speech is unclear due to distortion</p> <p>Gives high distortion which interferes with listening</p> <p>Very noisy due to distortion.</p>
4.	<p><i>Loudness of speech when volume control is set at</i></p> <p>(i) 1/3rd on</p> <p>(ii) Full on</p>	<p>Moderately soft</p> <p>Moderately loud</p>	<p>Moderately soft</p> <p>Moderately loud</p>	<p>Soft</p> <p>Moderate</p>	<p>Moderately soft</p> <p>Moderate</p>	<p>Very soft</p> <p>Very loud.</p>

Ccrxt;

Sl. No	Parameters Tested	Philips Cordless	Porta Sound 2000 -FM System	Philips FM-Moby	Onida 20" TV	Arphi push pull 650 VT
5.	<i>Music is heard clearly or not</i> (i) at 1/3 rd on (ii) At full on	Music is clear Music is clear	It is clear on fine tuning Music is clear	It is clear on fine tuning Music is clear	Clear on fine tuning Music is clear	The music is not clear due to presence of internal noise. Its not clear due to presence of internal noise.
6.	<i>Distance from the TV listening system can be used</i>	20 feet	20 feet	Maximum 20 feet	20 feet	Distance of the cable.
7.	<i>Cost of the device</i>	Rs.3000	Rs.2000	Rs.1500	Gives free along with TV and not available separately	Rs3575.

Moderately loud - About 65 - 75 dBSPL

Soft - About 35 - 40 dBSPL

Moderate - About 60 dBSPL.

Very soft - About 20 - 30 dBSPL

Moderately soft - About 45 - 55 dBSPL

COMPARISON OF THE DEVICES AVAILABLE ABROAD

The TV. listening devices that are available abroad have been classified under the following headings :

I Those using auditory modality like the

- a) hardwired systems.
- b) wireless systems which include the induction loop, FM systems, infrared system.

II Those using visual modality

- (i) Captioning.
- (ii) Teletext etc.

Prior to describing the features available for each of the devices, general information regarding the working of these devices is given.

A. INFRARED SYSTEMS

Infrared systems transmit sound signals in form of harmless light waves which are invisible to the human eye. The system has got four basic components: a pickup device (microphone or direct electrical connection), a transmitter (base station), an emitter and a receiver. The audio signal is picked up, conveyed to a subcarrier, in the base station and is then converted to infrared light through the air via Light Emitting Diodes (LEDs) which are distributed on emitter panel. A photosensitive cell on the receiver picks up infrared energy and converts it back to original audio signal. The receiver can be worn connected to earphones or earbuds or used with a hearing aid via induction pickup or Direct Audio Input (DAI) (Ross and Bakke, 2000).

Most of the TV listening devices use the infrared technology, as there is no seating restrictions. It can be used simultaneously in the adjacent rooms without any interference.

The infrared system used for television listening at home as well as other small group or one to one situations are mono systems. These mono systems transmits on a carrier frequency of 95 kHz. The performance of the infrared transmitter depends on the correlation between the number of transmitting diodes and the physical and lighting condition in a given room (Compton, 1993).

THE DEVICES AVAILABLE ARE :

1. MODEL NAME : Porta - IR™ Compact Portable Infrared transmitter.

COMPANY NAME : ALD's Inc Production, Canada

I *Physical Features:*

a) Transmitter used - It is the Porta IR™-Compact Portable Infrared transmitter.

(i) *Battery used* : It uses standard 9V rechargeable batteries which lasts upto about two hours. It has a special pack. The unit will work upto eight hours a day.

(ii) *Portable* : It is the size of an eyeglass and can be carried in pocket.

(Hi) *Size* : It is very small sized (4.1 x 2.4 x 0.9 inches) or (10.5 x 6.1 x 2.22cm).

(iv) *Weight*: It weighs 140 gms with battery.

b) **Receiver features** : It can be used with any standard receiver.

//. ***Maximum distance upto which it can be used:*** It can work if placed at a distance of 1-6 m/3-20 feet. The microphone range for working is 5 m/15 feet.

///. ***Clarity of speech*** : There is an inbuilt microphone which picks up sounds from all directions. It delivers clear speech signals.

IV. *Cost:* \$ 159.00.

V. *Comments :* It is connected to the audio output or earphone jack of the TV. The user can listen to the TV without disturbing the others. Used for, classrooms, desk tops, hospitals, court rooms, living rooms, restaurants. It can also work with an A.C. adaptor (Source : ALD's Inc catalogue).

2. **MODEL NAME : Porta - IR™ Portable Infrared Communication System**

COMPANY NAME : Assistive Listening Device Systems Inc., Canada

I *Physical Features :*

a) **Transmitter features :** It uses a standard 95 kHz or 250 kHz mode. A multichannel Porta IR™ is also available.

(i) *Battery used :* Has an inbuilt rechargeable batteries which would last for a minimum of seven hours. This can also operate with an AC adaptor if the electrical outlet is handy. It takes upto eight hours to recharge.

(ii) *Portable :* Yes.

(iii) *Size :* 12.7 x 18 x 41 cm (5x7.1 x 1.6 inches). It has a 3.5 mm external microphone jack.

(iv) *Weight:* The weight of the device is 1.1 kg/ 2.4 lbs.

b) Receiver features : It can be used with any standard receiver.

I. Maximum distance upto which it can be used: The Porta IR™ is to be placed within 20 feet of the speaker or other source of sound that is to be heard. The system has a unique dome technology, which best suits, the listening environment.

II. Clarity of speech : It delivers clear speech signals provided the built in microphone is within the specified range from the sound source. It is an excellent amplifier with superb sound quality.

III. Suitability for different types and degrees of hearing loss : It can be used with hearing impaired population. The degree is not specified.

IV. Cost: \$ 499.

V. Comments : It has an operating time of seven hours. Recharging time is approximately eight hours. The microphone range is approximately from 6 m/20 feet. It can be used in seminars, classrooms, desktops (Source of information : ALD'sInc. catalogue).

3. MODEL NAME : Porta-IR™ Panel Portable Infrared Transmitter/Emitter.

COMPANY NAME : Assistive Listening Device Systems Inc., Canada

I. Physical Features:

a) Transmitter used : The device is in the form of a transmitter

unit.

(i) *Battery used* : It uses a 12VDC phantom power for one attached microphone. To conserve electricity the panel has an energy saving mode to shut itself down in the absence of audio inputs and to return to normal operations when an audio input becomes active again.

(ii) *Portable* : Yes.

(iii) *Size* : The dimensions are 23 x 16x 5 cm (9x6.25x2 inches).

(iv) *Weight*: The weight of the device is 0.82 kg/ 1.80 lb.

b) Receiver : Can be used with any suitable receiver.

//. *Maximum distance upto which it can be used* : It can work upto a distance of about 7500 sq. feet.

///. *Clarity of speech* : Converts sounds to safe invisible infrared light which is then broadcast in the room to be picked up by any standard infrared receiver. It provides clear speech signals without any sort of distortion or background noise.

IV. *Suitability for different types and degrees of hearing loss* : It has not been specified in the catalogue.

V. *Cost*: \$ 649.00.

VI. *Comments* : It is used for TV viewing, in large halls, board rooms, theatres, concert halls. Has got single Porta IR panel which are chained to

additional REPEATER PANELS and finally to the main PANEL to accommodate large rooms. It can be switched to any of the few frequencies provided i.e., 95 kHz, 250 kHz or 2.3, 2.8 MHz. It can make use of 3 inputs simultaneously. An XLR type connector is plugged to MIC INPUT of the unit directly, hence no microphone amplifier is needed. LINE INPUT is used to connect it to a public address system. HIGH LEVEL input allows the device to be fed with high level source as output of audio amplifier (Source of Information: ALD's Inc., catalogue).

4. MODEL NAME : RIR100/95 and RIR100/250 (IR Receiver)

COMPANY NAME : Assistive Listening Device Systems Inc., Canada

1. Physical Features:

a) Receiver features :

(i) Volume control: Has an adjustable volume control.

(ii) Tone control : It has a tone control to customize the sound heard.

(iii) Headphone type : Uses headphones, earbuds, neckloops according to choice of user.

(iv) Adjustable headband : It is provided with a unique neckstrap which can be adjusted to whatever position it suits a person, when using a neckloop.

(v) *Battery used* : It uses two AAA rechargeable batteries and it operates 35 hours with Nickel-Cadmium batteries. With alkaline batteries it works upto 170 hours. A battery charger is available.

(vi) *Size* : It is 7 x 6.5 x 2.2 cm (2.75 x 2.5 x 0.9 inches).

// *Maximum distance upto which it can be used* : The distance depends on the transmitter being used.

/// *Clarity of speech* : It provides user with excellent amplification and clear intelligible sound. No distortion is present and it does not pick up any background noise. The Total Harmonic Distortion (THD) is 1% at 1 kHz frequency.

IV. Suitability for different types and degrees of hearing loss : Can be used with the hard-of-hearing. It is especially useful for profound hearing loss cases who require higher gain.

V. Cost: The cost of the RIR 100/95 and **RIR** 100/250 is \$ 119 each.

VI. Comments : Both these receivers have common features. The only difference is that RIR 100/95 works with any standard 95 kHz transmitter and the RIR 100/250 works with any standard 250 kHz transmitter. The frequency range within which it works is 100-10000 Hz. It has unique daylight "fitting lens" which cuts down interference from other light sources. It is cost effective and is easy to use. The device can be adjusted to the patient's needs (Source of information : ALD's Inc. catalogue).

5. **MODEL NAME : Sound plus TV listening system**

COMPANY NAME : Controlonics Corporation, USA

/. **Physical Features:**

a) **Transmitter used** : It has a light wave transmitter.

b) **Receiver features** :

(i) *Volume control:* It is present for personal level adjustment.

(ii) *Headphone type* : It has a dual element earphone.

(in) *Adjustable headband:* It is not present.

(iv) *Weight:* Light weight.

//. **Maximum distance upto which it can be used** : It works upto 4000 sq. feet.

///. **Clarity of speech** : The speech is clear. The system delivers speech signals without background noise or distortion.

IV. **Suitability for different types and degrees of hearing loss** : The degree and type has not been specified, but it can be used by hearing impaired individuals.

V. **Cost:** It has not been specified.

VI. **Comments** : Can be used with hearing loss population. It is simple and easy to use and is suitable for user. Can be used at public assemblies' theatres, auditorium, movies, places of worship etc. [(Source of

Information : ALD's Product Review, 1985, Hearing Instrument, 36 (2)].

6. MODEL NAME : Clear sounds 2000- Infrared listening system

COMPANY NAME : Hitec International, USA.

I *Physical Features:*

a) Transmitter used : The transmitter has to be plugged into the audio output jack of the television.

b) Receiver features :

(i) *Volume control* : The headset offers dual volume controls so that it can be adjusted for the best sound level which is required for the person.

(ii) *Adjustable headband* : It is not specified whether the headband is adjustable or not.

(iii) *Battery used* : The headset uses batteries, details of which are not specified.

(iv) *Portable* : It is completely cordless making, it is easier to carry anywhere.

(v) *Size* : It is supposed to be of small size which can be carried anywhere, but the dimension of the device is not specified.

II. *Maximum distance upto which it can be used* : Can be used at distances

suitable for viewing TV.

///. **Clarity of speech** : It delivers good quality sound from the TV system.

IV. **Suitability for different types and degrees of hearing loss** : It is not specified whether the device could be used with a particular degree and type of hearing loss.

V. **Cost** \$ 99.00.

VI. **Comments** : It is also available with an external microphone. Can also be used in movie, performing art centers and public facilities which use IR systems (Source of information: www.hitec.com).

7. **MODEL NAME : IR TV listening device**

COMPANY NAME : Hitec International, USA.

/. **Physical Features:**

a) **Transmitter used** : It uses a transmitter but name not specified.

b) **Receiver features** :

(i) **Volume control:** It has a volume control.

(ii) **Adjustable headband** : It is not specified whether it has an adjustable headband.

(in) **Battery used** : It uses two AA alkaline batteries which can operate for 50 hours.

(iv) *Portable* : It is compact and flexible.

(v) *Size* : Small sized.

// *Maximum distance upto which it can be used* : The distance is not specified.

/// *Clarity of speech* : It delivers clear speech signals. It also overcomes background noises.

IV. *Suitability for different types and degrees of hearing loss* : Suitable for the hearing impaired who have difficulty listening to the TV signals.

V. *Cost*. \$ 173.00.

VI. *Comments* : It is directly connected to the output jacks of the TV or audio equipment. Apart from the TV, it can be used with any audio source. It is an all in one unit which is quite easy to use. The system has good audio quality (Source of information www.hitec.com).

8. MODEL NAME : Direct Ear SET 250-TV Infrared listening system/250J

COMPANY NAME : Hitec International, USA.

1. Physical Features :

a) **Transmitter used** : It has a powerful TI 250 infrared transmitter with adaptor and audio cable RCA plug and 1/8" mono mini adaptor.

b) **Receiver features** :

- (i) *Volume control:* It has a suitable volume control which could be adjusted.
- (ii) *Tone control :* An adjustable tone control present on the receiver.
- (iii) *Headphone type :* The receiver has one mono R1250 stethoset and a pair of hypollergic ear cushions..
- (iv) *Battery used:* It uses two B A 151 rechargeable batteries.
- (v) *Comfortable :* It is comfortable to wear.
- (vi) *Weight:* It has a light weight receiver which weighs 1.6 oz.

//. ***Maximum distance upto which it can be used :*** It can be used upto a distance of 645 sq. feet.

///. ***Clarity of speech :*** It improves the sound transmission reliability and also reduces environmental interference.

IV. Suitability for different types and degrees of hearing loss : It could be used with different types and degrees of hearing loss. It has an output of 124 dBSPL, hence can be used with the hearing impaired who require considerable gain.

V. Cost: \$ 239.00.

VI. Comments : The device is quite easy to use. It was the first infrared TV listening system to use 2.3 MHz frequency broadcasting. The unit can be connected to audio output jack of VCR's, stereo equipment, caption

decoders and new television. The set 250J can be used with accessories like neckloops, silhouettes or direct audio input (Source of information : www.hitec.com)

9. MODEL NAME : Sound Wizard Plus System

COMPANY NAME : Hitec International, USA.

I. *Physical Features:*

a) **Transmitter used** : It uses an infrared transmitter.

b) **Receiver features** :

(i) *Volume control:* It has an adjustable volume control.

(ii) *Headphone type* : The type of headphone has not been specified. It can be used with stethoclip earphones, neck loop etc.

(Hi) *Comfortable* : Yes.

(iv) *Portable* : Yes.

(v) *Size* : Small in size.

(vi) *Weight:* It is not specified.

//. **Maximum distance upto which it can be used** : It can be used at a distance that is comfortable for TV viewing.

///. **Clarity of speech** : It provides with easy listening. There is no interference of background noises. The speech sounds and the environment sounds are clear.

IV. **Suitability for different types and degrees of hearing loss** : It has an output of 120 dBSPL, hence can be used with the hearing impaired who require considerable gain.

V. **Cost:** \$ 199.

VI. **Comments** : It has a high frequency boost and maximum power output of 120 dBSPL. It can be connected to the television. Person can listen to TV at a comfortable volume. The receiver is compatible with wide area infrared system (Source of information: www.hitec.com).

10. MODEL NAME : Sennheiser-Direct ear set 250

COMPANY NAME : Sennheiser Electronic Corporation, USA.

/ . **Physical Features** :

a) **Transmitter used** : The transmitter is jacked to the TV. It transmits at 2.3 MHz. It is easy to use and it can be attached to the VCR or the stereo.

b) **Receiver features** :

(i) **Volume control** : It has a volume control for each ear which provides an output upto 124 dB.

(ii) *Adjustable headband:* It is not specified.

(in) *Battery used:* It uses rechargeable batteries which provide upto six hours of listening time.

// *Maximum distance upto which it can be used:* It has not been specified but it is appropriate for TV viewing, hence, a minimum of about eight-12 feet it can be used.

/// *Clarity of speech :* It delivers clear speech signals which is free from any background noise as well as distortion.

IV. *Suitability for different types and degrees of hearing loss :* It can be easily used by the hearing impaired who require amplification upto 124 dB.

V. *Cost:* The cost of the device ranges from \$ 199.00 to \$ 249.00.

VI. *Comments :* For TV without an audio out jack or for those who wish to hear room conversation, an external microphone may be used. It can be also used with a neckloop (Source of information : www.sennheiser.com).

11. MODEL NAME : Set 100/ Set 100-J Direct Ear TM Set 100 mono system

COMPANY NAME : Sennheiser Electronic Corporation, USA.

1. Physical Features :

a) **Transmitter used** : It uses TI 100IR mono transmitter with a power adaptor.

b) **Receiver features** :

(i) *Volume control*: Receiver has a volume control.

(ii) *Tone control*: It has left and right balance tone control.

(iii) *Headphone type* : It has one RI 100-A IR mono stethophone receiver with EP40SL latex ear cushions.

(iv) *Adjustable headband* : The website does not specify the presence of an adjustable headband.

(v) *Battery used*: It uses a one BA 90 rechargeable battery.

(vi) *Weight*: It is light in weight.

II. **Maximum distance upto which it can be used**: The maximum distance of its use is about 435 sq feet.

III. **Clarity of speech** : It delivers clear speech signals.

IV. **Suitability for different types and degrees of hearing loss** : It has not been specified whether the device could be used by a particular degree and type of hearing loss.

V. **Cost**: The cost of the device is \$ 199 for Set 100 and \$ 219 for Set 100J.

VI. **Comments** : These two devices permits cordless TV listening, without

disturbing the others and high quality audio signal is transmitted on the 95 kHz spaced carrier frequency to the stethoscope receiver. The details of size, comfortability has not been specified. It has one AF connector cable (RCA and 4 1/8" mini plug adaptor) (Source of information www.sennheiser.com).

12. MODEL NAME : Infrared TV listening system

COMPANY NAME : Siemens Hearing Instruments Inc, USA.

I. Physical Features:

a) Transmitter used : It has an infrared transmitter.

b) Receiver features :

(i) Volume control : It has an on/off volume control which permits individual selection of loudness.

(ii) Battery used : A small battery on headset unplugs for overnight charging. Five hours of listening is available per charge.

(iii) Weight: It is light weight.

II. Maximum distance upto which it can be used : Has not been specified in the catalogue.

III. Clarity of speech : It delivers clear speech signals.

IV. Suitability for different types and degrees of hearing loss : It can be used with the hearing impaired population. The degree of loss has not been specified.

V. **Cost:** It has not been specified.

VI. Comments : It makes television listening easier for the hearing impaired individuals. It is easy to use [Source of information: ALD's Products Review, (1985), Hearing Instruments, 36 (2)].

13. MODEL NAME : Infrared cordless headphone system

COMPANY NAME : Nady Systems, Inc, USA.

/ . Physical Features :

a) **Transmitter used :** It uses an infrared transmitter.

b) Receiver features :

(i) *Volume control:* Adjustable headset volume control.

(ii) *Headphone type :* It has cordless headphones. Any number of headphones can be used in a room at once.

(iii) *Battery used:* Uses 9V battery with an approximate life of 100 hours.

(iv) *Portable :* Yes.

(v) *Size :* Small.

//. **Maximum distance upto which it can be used** : Can be used upto a distance of 3 5 feet.

///. **Clarity of speech** : Delivers clear speech signals without distortion.

IV. **Suitability for different types and degrees of hearing loss** : It has not been specified in the catalogue.

V. **Cost**: It has not been specified.

VI. **Comments** : It can be used with any TV or stereo. The TV stereo volume can be kept low and listener can adjust the headset volume as required. It has a microphone adaptor [Source of information: ALD's Product Review, (1985), Hearing Instruments, 36 (2)].

B FREQUENCY MODULATION SYSTEMS

The FM systems provides the greatest versatility of any of the wireless technologies. FM systems transmit the desired signals using an FM radio wave just like that used for commercial FM broadcasting stations.

The FM transmitter can be coupled directly to the audio output jack of the television or can pick up sounds via a microphone. As the transmitter signal is changed to an electrical signal and then into a FM radio wave, which is broadcast through the air. To receive the desired signal, the FM receiver used by the listener must be tuned to the same frequency as that of the FM transmitter (Compton, 1993).

They are easy to install. Through, the use of separate frequencies, several groups of FM users can function in the same room without interfering with each other's transmission. The transmission range is from 50 to 20 feet, ideal for T.V viewing which is about eight to 12 feet (Sanders, 1993).

Generally the FM systems provide excellent fidelity, because of their low distortion and broad band frequency response. Their signal strength is usually sufficient to help person with profound losses and many FM receivers are adjustable to accommodate different degrees and configuration of hearing loss (Kaplan, 1987).

Some of the FM systems contain hearing aids and some do not and the term "inology" traditionally used to describe these two types of systems can be confusing (Compton, 1993).

The major limitations of FM systems are that they can be expensive to maintain and are subjected to sporadic interference from other radio transmission that are allowed to use the same broadcast bands.

THE DEVICES AVAILABLE ARE :

1. MODEL NAME : Direct Ear & Direct Transmitter (Pro wide Band system Model PPA 250)

COMPANY NAME : Harris Communications, USA.

/ Physical Features:

a) Transmitter used : This system uses a T4 transmitter which uses an audio processor. Transmitter has an antenna.

b) Receiver features :

(i) *Fine tuning control :* The system is completely field tunable making it quick and easy to select from any of the 10 channels.

(ii) *Headphone type :* It has got 3 (R7E) receivers with earphones.

(Hi) *Adjustable headband :* Not been specified in the website information.

(rv) *Battery used :* Has not been specified.

(v) *Portable :* The device is portable as it is a personal device.

//. *Maximum distance upto which it can be used :* It operates over a 300-

500 feet (90-150 m) distance.

///. **Clarity of speech** : The speech can be clearly understood as there is no interference of the background noise, reverberations, etc.

TV. **Suitability for different types and degrees of hearing loss** : It has not been specified in the catalogue whether the device could be used for a certain type or degree of hearing loss.

V. **Cost**: \$ 877.00

VI. **Comments** : The model is quite useful and could be used in theatres, cinemas, auditorium and place of worship. It can accommodate any number of listeners using either single or multichannel receivers. Though not mentioned in the catalogue it could be effectively used for watching TV. Details regarding the comfort, size and weight are not mentioned in the website information (Source of information: www.harriscomm.com).

2. MODEL NAME : Basic listening System.

COMPANY NAME : Hare Mercantile, USA.

I Physical Features :

a) **Transmitter used** : It uses a transmitter but the brand name is not specified.

b) **Receiver features** :

- (i) *Volume control:* It is simple to use with adjustable volume control.
- (ii) *Tone control:* It has an adjustable tone control.
- (iii) *Fine tuning control:* It is present.
- (iv) *Headphone type :* It has got two head phones
- (v) *Adjustable headband :* Not been specified in the website information.
- (vi) *Antenna :* It uses antenna.
- (vii) *Battery used :* It uses two AAA batteries.
- (viii) *Portable :* The device is portable
- (ix) *Size:* The size is 2" x 4" x 1/2".
- (x) *Weight:* It is light weight.

II. *Maximum distance upto which it can be used:* The distance upto which it can be used is not specified but it can be easily used for TV viewing which requires a minimum of eight feet distance.

///. *Clarity of speech :* It delivers clear sounds to the listener. There is no distortion and no background noise which the system will pick up and so it delivers clear speech signals.

IV. *Suitability for different types and degrees of hearing loss :* The peak output of the device is about 120 dBSPL. So it can be used with the hearing impaired who require output SPLs upto 120 dB.

V. **Cost:** It has not been specified.

VI. **Comments :** It can be used in classrooms, meeting and also in group discussions. It is quite easy to use. It has a neck lanyard and a carrying case, can be used for T.V. viewing (Source of information: www.harcnmercantile.com).

3. MODEL NAME : Phonic FM system

COMPANY NAME : Phonic ear Inc., USA

/ *Physical Features:*

a) **Transmitter used :** It has an FM transmitter(PE471T) with a Lapel microphone.

(i) *Size :* 82 x 63 x 24 mm.

(ii) *Weight:* 106 gms.

(iii) *Battery used :* Nickel Cadmium 2.4 V, 25 mA which has 18 hours of battery life.

b) **Receiver features :**It has several different modes of receivers.

(i) *Fine tuning control:* It is not specified in the catalogue.

(ii) *Headphone type :* The type of headphone has not been specified but earlevel neckloop or cord and transducer with custom made ear mould can be used.

(iii) *Adjustable headband:* Not been specified in the catalogue.

(iv) *Battery used* : It uses a rechargeable battery.

(v) *Portable* : The device is portable.

(vi) *Size* : Not specified.

(vii) *Weight*: Light weight.

//. *Maximum distance upto which it can be used* : This has not been specified in the catalogue.

///. *Clarity of speech* : Improves the signal-to-noise ratio for better understanding of speech signals.

IV. Suitability for different types and degrees of hearing loss : They may be used with hearing loss ranging from minimal to profound degrees depending on receiver that is used.

V. *Cost*: \$ 599.90.

VI. *Comments* : It has not been specified whether it can be used for easy T.V. listening . It can be used with a neckloop or cord and transducer with custom earmold. It has several models suitable for different degrees of hearing impairment (Source of information : Phonic ear Inc. catalogue).

4. MODEL NAME : Phonic ear easy listener

COMPANY NAME : Phonic ear Inc., USA

I. *Physical Features :*

a) Transmitter used : It uses one of the FM transmitter. (PE4 71T)with a
Lapel microphone.

b) Receiver features :

(i) *Volume control:* The headset has volume control,

(ii) *Fine tuning control:* **It** is present.

(iii) *Headphone type :* Can be used with head phones, earbuds,
neckloop or cord and also custom made ear moulds.

(iv) *Adjustable headband:* Not been specified in the catalogue.

(v) *Antenna :* It is present.

(vi) *Battery used :* Uses rechargeable ones.

(vii) *Portable :* Is small and can be carried to different places.

//. ***Maximum distance upto which it can be used :*** The device will work
best at a distance of about eight feet which is suitable for T.V. viewing.

///. ***Clarity of speech :*** **It** improves the signal-to-noise ratio for the better
understanding of speech signal.

IV. Suitability for different types and degrees of hearing loss :

It has been specified that this can be used

with normals and minimal to mild hearing losses.

V. **Cost:** \$ 599.95

VI. **Comments :** It can be used both indoors and outdoors with optional earbuds, neck loops or cords. This device is quite useful for T. V viewing [Source of information : ALDs Product Guide, (1999), Hearing Journal, 52(2)].

5. MODEL NAME : Phonic microlink TM

COMPANY NAME : Phonak, USA

I. **Physical Features:**

a) **Transmitter used :** It uses a new TX3 transmitter

b) **Receiver features :**

(i) *Fine tuning control:* It is present.

(ii) *Headphone type :* This is not specified.

(iii) *Adjustable headband:* Not been specified in the catalogue.

(iv) *Antenna :* It is present.

(v) *Portable :* It is world's smallest receiver which has compact wireless design.

(vi) *Size :* Small sized.

(vii) *Weight*: It is not specified.

// *Maximum distance upto which it can be used* : It can be used for TV viewing which requires a distance of eight feet only.

/// *Clarity of speech* : It has the capacity to deliver clear speech signals effectively.

IV. *Suitability for different types and degrees of hearing loss* : It has not been specified in the catalogue.

V. *Cost*: It is not specified.

VI. *Comments* : It provides an invisible link between the sound source and the listener's ear for improved communication in a variety of environments [Source of information : ALD's Product Guide, (1999), Hearing Journal, 52(2)].

6. MODEL NAME : Personal FM System 3V Basic System (Model PFM 300/PFM 350)

COMPANY NAME : Williams Sound, USA

/. *Physical Features* :

a) *Transmitter used* : Small body pack FM transmitter.

b) Receiver features :

(i) *Headphone type* : It used mini earphones.

(ii) *Adjustable headband:* Not specified in website information.

(iii) *Antenna :* Details not mentioned.

(iv) *Battery used :* Uses two AA alkaline batteries.

(v) *Portable :* Portable since it is lightweight.

(vi) *Size :* Not specified in the web site information.

(vii) *Weight:* Light weight.

//. ***Maximum distance upto which it can be used :*** Has not been specified in the web site information.

III. *Clarity of speech :* It minimizes the background noise from the speech and maximize the clarity of speech.

IV. *Suitability for different types and degrees of hearing loss :* This has not been specified in the web site

V. *Cost:* Cost of the device is not specified.

VI. *Comments :* It has two different models of receivers . Though it has not been mentioned in the website information, it could be used with a TV system by placing the transmitter close to the speaker of the TV (Source of information: www.williamssound.com).

C. INDUCTION LOOP :

This is one of the oldest assistive listening devices. The basic component of an induction loop system is a loop of wire encircling a room and connected to the output of an audio power amplifier (Compton, 1993). The heart of this system is the "loop", or coil of wire, that surrounds the space to which the amplified sound is to be delivered (Kaplan, 1987). Once sound enters the system, its electrical signal is amplified and sent through the loop, which broadcasts the signal to the entire room in the form of electromagnetic energy. The magnetic field varies in direct proportion to the strength and frequency of the signal being passed through the loop. The receiver for this system is the telecoil circuit in an individual's hearing aid. Reception from a loop system is impossible unless the listener uses special telecoil receiver (Sanders, 1993).

A big advantage of the loop system is that they do not require maintenance of separate receivers, provided the listeners have telecoil equipped hearing aids. In the other wireless systems, a separate receiver and maintenance program are required even if listener uses a hearing aid. The loop user does not need to borrow a separate loop system.

The induction loop system are vulnerable to electromagnetic interference from various sources such as fluorescent light, transformers, and electrical wiring within a building. Electromagnetic energy from a loop system can travel through solid surfaces causing spillover of the signal in to the adjacent rooms and thus TV listening would be disturbed. To use an induction loop system while TV viewing, the person has to sit within or next to the loop for better sound quality (Compton, 1993).

The major disadvantages of the system includes.

1. Spill over : A magnetic field generated in one room can be received by a telecoil in a horizontal or vertically adjacent rooms; stronger the loop system farther it would travel.
2. Flourescent lights and other sources of magnetic energy might interfere with the speech signal by introducing noise into the system.
3. Many of the hearing aids have telecoils, which are too weak or are not positioned properly. It results in poor reception of magnetically induced signals.
4. A hearing aids frequency response characteristics in the microphone and telecoil modes often differ significantly (Kaplan, 1987).

THE DEVICES AVAILABLE ARE :

1. **MODEL NAME: TV and Radio inductor kit**

COMPANY NAME : Hal Hen Company Inc., USA.

/. Physical Features :

- a) The device has a connecting cable, one of which plugs into the inductor plate and other end to the TV.

//. Maximum distance where it may be used : The device will work best at distances of around eight feet, which is suitable for TV

viewing. The device has a connecting cable one of which plugs into the indicator plate and other end to the TV. The distance depends on the area covered by the induction loop.

///. **Clarity of speech** : The speech is quite clear without any interference of room noise or other noises.

IV. Suitability for different types and degrees of hearing loss : Can be used by hearing impaired individuals using BTE's having "T" coil.

V. **Cost**: The cost is not given in the catalogue.

VI. Comments : The device delivers good quality speech signals. It may be easily installed. It can be used with TV and radio sets [Source of information : ALD's Product Review, (1985), Hearing Instruments, 36(2)].

2. **MODEL NAME : Telepin System with TMX**

COMPANY NAME : Phonic ear Inc.,USA

I. Physical Features:

a) The system resembles a teleloop and box shaped amplifier unit.

//. **Maximum distance where it may be used** : Is not specifically given in the catalogue. The distance depends on the area covered by the induction loop.

///. **Clarity of speech** : The Telepin system is unaffected by noise from the environmental wiring and also lightning. It does not exhibit amplitude changes related to head movement.

IV. Suitability for different types and degrees of hearing loss : It can be used by the hard-of-hearing population, using their personal hearing aids which have telecoils.

V. **Cost**: The cost has not been specified in the catalogue.

VI. Comments : It delivers clear speech signals. It has less distortion. So it may not be a useful device for them. It is not specified whether it could be used with TV or not [Source of information: ALD's Product Guide, (1985), Hearing Journal, 52(2)].

3. MODEL NAME : Minicon

COMPANY NAME : Oticon Corporation, USA.

I. Physical Features:

a) The amplifier has an AGC unit which is said to automatically compensate for variations in sound from TV to eliminate any adjustments of the system.

//. **Maximum distance where it may be used** : Depends on the area that is fitted with the induction loop.

///. **Clarity of speech** : Delivers clear speech signal.

IV. Suitability for different types and degrees of hearing loss : It can be used by the hearing impaired who use hearing aids having telecoils.

V. Cost: It is not specified.

VI. Comments : For the purpose of installation a small microphone held in a clip is attached with pressure sensitive tape near the loudspeaker of the TV. A single wire is connected to the units' box [Source of information: ALD's Product Review, (1985), Hearing Instruments, 36(2)].

4. MODEL NAME : Mini Teleloop Type TS-100V

COMPANY NAME : Rastronics Inc.,USA.

/ Physical Features :

a) The amplifier can be connected to TV, radio or tape recorder. It has an adjustable volume control. It is portable, small sized and light weight.

//. *Maximum distance where it may be used :* It would depend on the area where the induction loop has been placed.

///. *Clarity of speech :* Delivers clear speech signals.

IV. *Suitability for different types and degrees of hearing loss :* It can be used with hearing impaired population. The volume control can

be adjusted to higher levels after switching hearing aid to "T" position.

V. *Cost:* The cost is not given in the catalogue.

VI. *Comments :* The hearing impaired can enjoy TV, radio or stereo without disturbing the others in the room at loud volume levels [Source of information: ALD's Product Review, (1985), Hearing Instruments, 36(2)].

5. MODEL NAME : Transett Favorit Communication Device

COMPANY NAME : Logitech International, Denmark.

I. Physical Features:

a) The device is meant to be used for face-to-face communication, using a microphone to pickup the signals, which are then amplified and sent to a headset, stethoclip or neckloop.

(i) *Battery used :* It uses IEC-LRC (Penlight) 1.5V, two pieces. The life of the battery is 220 hours.

(ii) *Portable :* It has a portable communicator which is ideal for persons with hearing problems.

II. Maximum distance where it may be used: When used with neckloop, then distance would depend on the length of the neckloop.

///. Clarity of speech : It delivers clear speech signals.

IV. Suitability for different types and degrees of hearing loss : It has an output of 125 dB SPL, hence it can be used with the hearing impaired who require considerable gain.

V. **Cost**: The cost is not given in the catalogue.

VI. Comments : It is robust, easy to use and can be used at home for TV viewing. It is available in black and gray colour. It works on frequency range of 200 Hz to 10 kHz. Can be used for face-to-face communication with the built-in microphone. Device is suitable for small group conversations. It is designed for those situations where people with hearing difficulties cannot wear their hearing aids (Source of information: Logitech International catalogue).

6. MODEL NAME: Neckloop Telecoil

COMPANY NAME : William Sound Corp., USA.

I. Physical Features:

a) It uses an amplifier for the amplification of signals.

II. Maximum distance where it may be used: Ten feet which is the length of the loop provided.

///. Clarity of speech : It has not been specified in the catalogue, but would probably be clear.

IV. Suitability for different types and degrees of hearing loss : It can be used with different degrees and types of hearing loss cases depending on the hearing aid used.

V. Cost: It is not specified.

VI. Comments : The device can be used with any audio device having an 8-16 ohm output through a 3.5 mm phone jack (Source of information: www.williamssound.com).

D. HARDWIRE SYSTEM / DIRECT INPUT SYSTEMS:

Hardwired systems connect the listener to the sound source. The sound source, which is the television, may be picked up via a remote hand held, lapel or velcro attached microphone. An electrical plug jack connection is used in case of the television that have an audio output. The signal is delivered to the listener's ears via a headset or earbuds or to a personal hearing aid via a direct audio input (DAI). The headset is separated by the television with a cord (custom cords or the extension cords) (Sanders, 1993).

There are two types of the hardwired systems. They are

- (i) Hearing aid dependent systems,
 - (ii) Hearing aid independent systems.
- (i) ***A hearing aid dependent system*** : The listening system can only be used only in connection with a hearing aid. It might occur in one of the two ways. Using DAI or using inductive coupling. The DAI systems are available with behind the ear aids. They are plugged in directly in to hearing aids via an audio shoe. These systems can be used to broadcast via a direct plug in connection or remote microphone (Compton, 1993; Berger and Millin, 1989).

Hearing aid dependent inductive system also include plug-in neckloops and silhouette inductors that, like DAI, connect directly into the earphone jack of the television.

- (ii) ***Hearing aid independent system***: They are the personal amplification

systems. These are battery powered hardwired systems having their own microphone, amplifier and earphone headset. The system can also be used with hearing aids. Some of the stand-alone systems have in-built telecoils which allow them to be used as induction loop receivers. Stand-alone amplifiers are ordered with corded microphone as well as extension cords to be used. With neckloops or headphones to allow for remote microphone placement. In some brands, the microphone and the volume control are built into the amplifier (Compton, 1993).

THE DEVICES AVAILABLE ARE :

1. MODEL NAME : Audio box

COMPANY NAME: Danavox

1. Physical Features:

a) It has an amplifier which has the following features

(i) *Volume control:* The volume controls are present on the receiver itself and are of two types, i.e., preset volume control and regular volume control.

(ii) *Headphone type :* The unit is connected to the TV or radio by a 15 feet cord and second cord runs from unit to a quick connect boot to connect it to specific Danavox hearing aids. The hearing aids make use of custom-made earmoulds.

(in) *Portable* : Yes.

(iv) *Size* : It has not been specified in the catalogues.

II. *Maximum distance where it may be used* : Can be used upto a distance of 15 feet, which is the length of the connecting cord.

///. *Clarity of speech* : It provides clear speech signal and also permits exclusion of any other noise in the room. It provides high quality sound.

IV. *Suitability for different types and degrees of hearing loss*: Not specified in the catalogue.

V. *Cost*: It is not specified.

VI. *Comments* : The user can adjust the volume control to his/her needs. It is used with Danavox series 115, 125 and 775 hearing aids [Source of information: ALD's Product Review, (1985) Hearing Instruments, 36(2)].

2. MODEL NAME: TV listener

DISTRIBUTED BY : National Hearing aid distributor, USA

***/.* Physical Features:**

(i) *Amplifier*: Is like a hearing aid with an extension cord.

(ii) *Headphone type* : It uses stethoclip/earphones.

//. *Maximum distance where it may be used* : It can be used upto a distance of 20 feet which is the length of the cable used.

///. Clarity of speech : The device delivers clear speech signals.

IV. Suitability for different types and degrees of hearing loss : It has not been specified in the catalogue.

V. Cost: The cost is not given in the catalogue.

VI. Comments: The device can be fastened to the loudspeakers of the TV set by removal of protection tape from a self sticking textile fastener and reportedly can be easily installed [Source of information: ALD's Product Review, (1985) Hearing Instruments, 36(2)].

3. MODEL NAME: **Williams sound pocket talker Pro**

COMPANY NAME : **Williams sound, USA.**

/. Physical Features:

a) It resembles a body level hearing aid with a cable attached to it.

(i) Volume control: It is an easy to operate volume control.

(ii) Tone control: It has not been specified whether tone control is used or not.

(Hi) Headphone type : It makes use of either a single ear phone or dual earphone.

(iv) Adjustable head band: Not been specified in the catalogue.

(v) Battery used: It uses a 9V battery.

(vi) *Comfortable* : Easy to use.

(vii) *Portable* : It is portable as it is small in size.

(viii) *Size* : 92 mm x 60.3 mm x 22.2 mm.

(ix) *Weight*: 99.2 gms.

// . ***Maximum distance where it may be used*** : The length of the extension cord is 4 m/12 feet, hence this is the maximum distance it can be used from the TV.

/// . ***Clarity of speech*** : It delivers distinct high quality sound.

IV. *Suitability for different types and degrees of hearing loss* : This device could be used with persons having mild to moderate hearing loss. It can be tuned to match the hearing loss.

V. ***Cost***: Range is from \$ 143 to \$165.

VI. *Comments* : A TV testing kit is available for use with a TV or radio. The kit has an extension cord and two microphone clips for attaching the microphone near a TV or radio. This extension cord plugs the pocket talker and the microphone (Source of information: www.williamssound.com).

4. MODEL NAME :Mega Ear

COMPANY NAME : Harc Mercantile, USA

I. *Physical Features:*

a) The amplifier it uses has dimensions of 72 x 42 x 16 mm.

b) Receiver features :

(i) *Volume control:* It has an adjustable volume control.

(ii) *Fine tuning control:* It is present.

(Hi) *Headphone type :* It can be used with dual headphones or with traditional headset.

(iv) *Adjustable headband :* Not been specified in the website information.

(v) *Antenna :* It is present.

(vi) *Battery used :* It uses a one AAA battery.

(vii) *Portable :* It can be easily carried wherever desired. So it is completely portable.

(viii) *Size :* It is small in size.

//. *Maximum distance upto which it can be used :* It has not been specified in the website information. It can be used for T.V viewing which requires a minimum distance of eight feet.

///. **Clarity of speech** : It has a feature of delivering clear speech signals and also it greatly increases the volume so that client enjoys television viewing.

IV. Suitability for different types and degrees of hearing loss : Not specified in website information.

V. Cost : The cost of the device is around \$ 120.95. The headset costs around \$ 29.95.

VI. Comments : It is easy to use and is comfortable as well as portable. It is also of low cost and is easily available. It perfectly fits in the pocket and can be clipped to the belt or lapel (Source of information : www.harcmercantile.com).

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION FOR THE INDIAN DEVICES :

The direct input device, the three FM systems and the infrared systems were compared. The findings of this comparison is given below.

Direct input devices vs. infrared system vs FM systems:

- (i) *Type of TV listening device being used* : The direct input device had to be connected to the television output jack with a cable. The other devices were wireless systems.
- (ii) *Adjustable headband* : The direct input device does not use an adjustable headband. All the other four devices had a receiver headset with adjustable headband.
- (in) *Comfortable* : The FM systems and the IR systems with adjustable headband make them comfortable to wear. The direct input device was comfortable provided a custom made earmould was used or a proper fitting eartip was used. Ill fitting moulds and tips make it uncomfortable to wear.
- (iv) *Portabl e* : All of these devices were easily portable.
- (v) *Headphone type* : The direct input device made use of a hearing aid receiver. The other four devices made use of supra-aural headphones.
- (vi) *On -off-switch* : All the devices had the switch.

- (vii) *Fine tuning knob* : The direct input device and the infrared system did not have a fine tuning knob. The three FM system had suitable fine tuning knob.
- (viii) *Volume control* : All the devices make use of volume control knobs, which could be set at the desired levels. The range of loudness was more with the direct input device.
- (ix) *Antenna* : The FM systems had in-built antenna compared to the others.
- (x) *Transmitter used* : The direct input device uses no transmitter. The Porta sound 2000 - FM uses a transmitter called Porta sound 2000FM. The Philips FM Moby uses a super SBC 100FM transmitter, Onida 20" TV uses an in-built transmitter. Philips cordless infrared system uses SBC M122 transmitter.
- (xi) *Battery used*: The direct input system and the Onida 20" TV uses two batteries each of 1.5V. The Philips cordless infrared system and the Porta Sound 2000-FM system uses two AAA E-92 LRO 3-AM-4 (1.5V) batteries. Philips FM-Moby uses one E-92-LR03 SBC-100(1.5 V) battery.
- (xii) *Clarity of speech at volume control*: In 1/3rd on position and fall on position. The speech of males and females was not clearly understood due to distortion produced in the direct input device at both the settings. Speech was clear at both the settings for the

other devices.

(xiii) Loudness of the speech with volume control set at

(1) 1/3rd position : The speech was very soft for the direct input compared to the infrared system, the Porta sound 2000-FM system and the Onida 20" TV which delivered moderately-soft sounds.

(2) Full on position : The direct input device was very loud when it was set at this position as compared to the infrared system and Porta sound 2000-FM system which delivered moderately - loud sounds. The other two devices delivered moderate sounds in comparison.

(xiv) Clarity of music : The music did sound clear is the direct input devices. It however sounded clear through the other devices.

(xv) Distance from the TV listening system it can be used : The distance where the direct input device was used depends on the length of the extension cord. The length of the cable was six to eight feet. The maximum distance where the other devices could be used was 20 feet.

(xvi) Cost of the devices : The Arphi push-pull 650VT costed Rs 3757 which is higher as compared to the other devices which costed as follows:

Philips cordless costs Rs. 3000

Porta Sound 2000-FM system costs Rs.2000

Philips FM-Moby costs Rs. 1500.

Onida 20" headset is provided with the television free of cost.

The results reveal that the direct input device was not so effective for TV listening for the hearing impaired population due to a number of limitations. The other devices are more sophisticated and easy to use. They provide clear amplification, which is required for a good TV listening. They would be more useful for hearing impaired individuals having losses of moderate to moderately- severe degrees. They probably would be of limited use for individuals with higher degrees of hearing loss.

Comparison of the FM systems with the infrared system:

(1) Headset receiver features:

(i) Fine tuning knob was absent in the infrared system as this feature was not required, but was present in all the other FM systems.

(ii) Loudness of speech when volume control is set at

(1) 1/3rd on position : The infrared system, the Porta Sound 2000-FM system and the Onida 20" TV delivered moderately soft sounds. This is in comparison to the Philips FM-Moby, which delivers softer sounds.

(2) Full on position : The infrared system and Porta Sound 2000 - FM system delivers moderately loud sounds as in comparison to Philips FM - Moby and Onida 20" TV.

(iii) *Cost of the devices* : The infrared system is of high price as compared to the FM systems.

The infrared system costs about Rs.3000.

Porta Sound 2000- FM system costs Rs. 2000.

Philips FM- Moby costs around Rs. 1500.

Onida 20" TV head set is provided with the television free of cost.

(iv) *Comments* : Despite the high price of the Philips cordless Infrared system it was the best. It can be effectively used by the hearing impaired population. The Porta sound 2000-FM system, is comparable with the philips and infrared systems in terms of loudness. However it provides fine tuning which is not very easy to do in hard of hearing population.

Comparison between the 3 FM systems:

The following FM system were compared.

- (1) Porta Sound 2000-FM system
- (2) Philips FM - Moby
- (3) Onida 20" TV

The comparison of the three devices had been based on the following

parameters:

- (a) Loudness of speech when volume control is set at
 - (i) 1/3rd on : Through the Philips FM- Moby, the sounds were soft as compared to the other FM devices through which the sounds were moderately-soft.
 - (ii) Full On : The Porta sound 2000-FM system produced moderately loud sound at this position as compared to the other two devices which produced moderate sounds.
- (b) Cost: The Onida 20" TV receiver is available free with the TV. It cannot be purchased separately. The combined cost of TV and the receiver is Rs. 9000. The Porta sound 2000-FM system has a cost of about Rs. 2000 and the Philips FM- Moby costs Rs. 1500.
- (c) Comments : The Porta Sound 2000 FM system would be probably more useful among the hearing impaired compared to the other devices, as the loudness of signals was more.

RESULTS AND DISCUSSION OF THE DEVICES AVAILABLE ABROAD:

The devices which are available abroad have been evaluated. In total 29 "TV listening devices" have been taken for the comparison. Out of these

- a) 13 are infrared systems.
- b) Six are FM systems.
- c) Six are induction loop systems.
- d) Four are hardwired/ direct input systems.

These devices were compared on the information provided in the catalogues and websites. Not all of the parameters, that are mentioned in the methodology, could be compared across the devices. The comparison was restricted to the information provided by the companies. All these devices which have been taken are from different companies manufacturing "TV listening devices" world wide.

(1) *Comparison within the infrared systems* : Thirteen of the devices were compared based on the following parameters.

- (i) *Size* : Most of the companies do not mention the transmitter and receiver dimensions, only one company has given the information about the receiver dimensions while two have given the transmitter dimensions.

- (ii) *Weight:*. Only one of the company has specified the weight of three of their transmitters. Most companies specify that their infrared receivers are light weighted but do not specify the exact weight.
- (iii) *Maximum distance upto which the devices could be used :* Most of the devices were suitable for " TV listening" requiring a minimum distance of eight feet. The maximum distance where one of these devices were used was 7500 sq feet.
- (iv) *Clarity of speech :* Almost all the devices reported that they delivered clear speech signals. Only one of the device reported that it had a distortion of 1%.
- (y) *Suitability for different types and degrees of hearing loss :* Two of the infrared devices reported that their maximum power output were 124 dBSPL (Direct Ear Set 250-TV Infrared listening system 250J, Hitec International, USA) and 120 dBSPL (Sound Wizard Plus System, Hitec International, USA). Thus they can be used with hearing impaired individuals who require considerable gain.
- (vi) *Cost:* The cost of the devices had varied considerably. It ranged from \$ 99 to \$ 649. The greater the area where signal is transmitted the cost is also high.
- (2) *Comparison within the FM systems :* Six of the FM systems had been taken up for comparison. The results of the comparison was based on the following parameters.

- (i) *Size* : As with infrared system most of the companies do not specify the dimensions of the transmitters or the receivers.
 - (ii) *Maximum distance upto which the device could be used* : The devices could be used within a range of eight feet to 300 feet.
 - (iii) *Clarity of speech* : All of the devices deliver clear speech signals as reported.
 - (iv) *Suitability for different types and degrees of hearing loss* : The devices could be used with the hearing loss ranging from minimal to profound degrees, depending on type of receiver used.
 - (v) *Cost* : The cost of most of the devices is not available in the catalogue. From the information available it is seen that the cost ranges from \$ 599 to \$ 877. The high priced devices works at larger distances because they have powerful transmitters as compared to the low priced ones.
- (3) ***Comparison within the induction loop systems*** : The comparison was done using six of the induction loop systems based on the following parameters.
- (i) *Maximum distance where it may be used* : The devices could be used upto distances which depends on the area of the loop. The area covered by the loop depends on its length which is different for different devices. The length of the loop would depend on the power of the amplifier. The latter is not mentioned in the product guide, from where the information was taken.

- (ii) *Clarity of speech* : Most of the companies report that the devices deliver clear speech signals without interference of background noise.
 - (iii) *Suitability for different types and degrees of hearing loss* : These devices could be used with hearing aids having telecoils. Depending on the gain of the hearing aid, it could be used with different degrees of hearing loss.
- (4) ***Comparison within the hardwired / direct input systems*** : Four of the hardwired / direct input systems had been compared based on the following parameters :
- (i) *Headphone type* : The Audio box is hearing aid dependant and has to be used with custom made earmould. The Williams Sound Pocket Talker Pro and Mega ear uses single or dual earphones, the TV listeners uses stethoclip/earphones so they are hearing aid independent devices. There are several other direct input devices using hearing aids which are available in the market but are not discussed in the project. The one which is mentioned can be used for TV listening.
 - (ii) *Maximum distance where it may be used* : The distance upto which the Audio box could be used was 15 feet. The TV listener and Williams Sound Pocket Talker Pro could be used upto a distance of 20 feet. For the other device the distance had not been mentioned.
 - (iii) *Clarity of speech* : All of the four devices deliver clear speech

signals.

(iv) *Suitability for different types and degrees of hearing loss* : The Williams Sound Pocket Talker Pro can be used with mild to moderate hearing loss cases. The Audio box can be used with different degrees depending on hearing aid used with it. The other devices do not specify as to the degree of loss it can be used.

(v) *Cost*: The cost of Williams Sound Pocket Talker Pro ranges from \$ 143 to \$ 165. The Mega ear costs \$ 129. The cost of the other devices has not been mentioned.

(5) *Comparison between infrared and FM systems* : The comparison was done based on these parameters :

(i) *Maximum distance upto which the devices could be used* : The FM systems could be used at a larger distance than the infrared systems.

(ii) *Fine tuning knob and Antenna* : The FM systems had both a fine tuning knob and an antenna but these were not present in infrared systems as they are not required.

(iii) *Clarity of speech* : The FM systems delivered clear speech signals only after fine tuning but this was not in case of infrared systems. Any obstacle between source and receiver would stop transmission of signals in IR. systems.

(iv) *Cost* : The cost of FM systems is higher in comparison to IR systems. The highest cost in the FM systems is \$ 877. The highest

cost in IR systems is \$ 649.

(6) Comparison between hardwired / direct input systems and induction loop

systems : This comparison was also based upon the following parameters :

(i) *Headphone type* : The IL systems make use of hearing aids with 'T' coil and custom made earmoulds as receivers. The hardwired systems do not need to use hearing aids specifically with 'T' coil. These systems can make use of any type of headset receivers or hearing aids.

(ii) *Maximum distance upto which the devices could be used* : This depends on the length of the cable in case of hardwired systems. In IL systems the area surrounded by the loop is where the device could be used most effectively.

(iii) *Clarity of speech* : The IL systems can be more noisy compared to the hardwired systems as they pick up other electromagnetic disturbances.

(iv) *Suitability for different types and degrees of hearing loss* : The suitability of the devices would depend on the hearing aid used in case of the IL systems and the hardwired systems which are hearing aid dependent. In case of the hardwired systems which are hearing aid independent it would depend on the amplifying capacity of the device.

Thus from the comparison we cannot say that one system is better than the

other. Some of the parameters may be better in one type of devices and some in the other types. So it is difficult to decide and come to a conclusion that one particular device is superior to the other ones. If a device can fulfill all the needs of the individual in terms of "TV listening" like comfort, portability, size, weight, cost, physical features then it can be called a good device. There is no such system which would fulfill all of these needs.

The system of choice depends on the situation in which it is to be used and many other factors such as available funding, maintenance and security requirements, presence of sources of interference, personal preference, and available technical expertise and service.

SUMMARY AND CONCLUSION

This project, has compiled information on TV listening devices available in India as well as abroad. The devices were evaluated based on certain specific parameters which are important to the devices.

The comparison of the Indian as well as devices available abroad has been based on certain specific parameters. The main purpose for the comparison was to select an appropriate device for the clients. The comparison has been done by dividing the devices into two parts with their respective parameters. The five devices, available in India, were evaluated based on specific parameters. On comparison a conclusion was reached that the infrared system and the three FM systems were more suitable for a particular degree of hearing loss.

The devices available abroad have been compared. No such conclusion had been achieved regarding one system is superior than the other one. No one system is superior to the others in terms of sound quality provided that the system itself is of good quality, installed properly, and the electroacoustic transducers used with each system are equivalent in terms of output, frequency response, equivalent noise level, distortion etc.

There were certain limitations in comparison of the devices available abroad. These devices could not be evaluated as the Indian ones in experimental situations. The information provided in the websites was limited and did not provide adequate information regarding the various parameters. Catalogues

provided by some of the companies gave more useful information. From these sources of information it was difficult to come to a conclusion about the superiority of one particular system. Unless a perceptual analysis is done, it is difficult to draw any conclusion regarding the clarity of the signal received, since all the companies claim that their device provides clear signals.

There are more devices available abroad making use of infrared transmission. This is probably because they are more suitable as TV listening systems, than FM or direct-input devices. FM systems require the receivers to be tuned, which is not always easy. The direct-input devices restrict the movement/seating of the user, within the room. Such disadvantages are not present in the infrared systems, thus making them more popular as "TV listening devices".

This project has certainly opened the door for further research into the "TV listening systems" which has not been done in depth. This project would help the clients to look for a device which is suitable to fulfill their needs in terms of all aspects. It also provides relevant information to students who would wish to know about the "TV listening devices".

BIBLIOGRAPHY

- Berger, K.W., and Millin, J.P. (1989). Amplification : Assistive devices for the Hearing Impaired. In R.L., Schow., & M A , Netbonne. (Eds), Introduction to Aural Rehabilitation, Needham Heights : Allyn & Bacon.
- Bergman, M. (1983). Assistive Listening devices - Part I: New Responsibilities, American Speech , Language and Hearing Association, 25, 19, 25.
- Compton, C.L. (1993). Assistive Technology for the Enhancement of Receptive Communication. In P.Alpiner (Ed), Rehabilitative Audiology Children and Adults, Baltimore : Lippincott Williams and Wilkins.
- Caldwell, DC. (1981). Closed captioned television and hearing impaired. Volta Review, 275-283.
- Dercks, I. (1987). Tactile aids : Where do they fit? Hearing Instruments, 38(2), 39-41.
- Kaplan, H. (1987). Assistive devices for the Hearing Impaired. Hearing Journal, 40, 13-17.
- Mahon, W.J. (1985). Assistive Devices and Systems. Hearing Journal, 38, 7-13.
- Ross, M., and Bakke, M. (2000). Large area assistive listening system: An overview and some recommendations. Hearing Journal, 53(6), 54-60.
- Sanders, D.A. (1982). Aural Rehabilitation : A Management Model, Englewood Cliffs, New Jersey : Prentice Hall Inc.
- Sanders, D.A. (1993). Management of Hearing Handicap Infants and Elderly, Englewood Cliffs, New Jersey : Prentice Hall Inc.

Vaughn, C.R., and Lightfoot, K. (1987). AIDS Pioneers : Past and Present. Hearing Instruments, 38(2), 6-12.

Zelski, R.F.L., and Zelski, T.(1985). What are Assistive Devices? Hearing Instruments, 36, 12-19.