



**DIRECTORATE OF COORDINATION
POLICE WIRELESS
MINISTRY OF HOME AFFAIRS
GOVERNMENT OF INDIA**

***TECHNOLOGY EVALUATION OF
STATIC & MOBILE
HALF LOOP ANTENNA
FOR HF COMMUNICATION
IN SKIP ZONE***

**TECHNOLOGY EVALUATION
NO.DCPW/TE-HLA/01/13**

***TECHNOLOGY EVALUATION OF
STATIC & MOBILE
HALF LOOP ANTENNA
FOR HF COMMUNICATION
IN SKIP ZONE***

***TECHNOLOGY EVALUATION
NO.DCPW/TE-HLA/01/13***

**DIRECTORATE OF COORDINATION
POLICE WIRELESS
MINISTRY OF HOME AFFAIRS
GOVERNMENT OF INDIA**

**DIRECTORATE OF COORDINATION
POLICE WIRELESS
MINISTRY OF HOME AFFAIRS
GOVERNMENT OF INDIA
NO.DCPW/TE-HLA/01/13**

Standard Guidelines for Static and Mobile application of Half Loop Antenna for Short Range HF Communication.

Introduction

This document provides standard guidelines to CAPFs & States / UTs Police Organizations' for facilitating them to arrive at a solution to eliminate Skip Zone phenomena occurs in Short Range HF Communication due to conventional types of antennas. This solution will provide complete HF communication range up to thousands of kilometers.

Directorate of Coordination Police Wireless

Subject: Field trial Report of Half Loop Antenna for short range HF communication.

Directorate of Coordination Police Wireless is the advisory body to the Ministry of Home Affairs for the Police Telecommunication matters in the country and also laying down the technical specification for communication equipments to be inducted in the Police forces in the country. This Directorate also acts as a nodal agency for coordinating various Police communication services & activities of states / UTs/ CPAF in the country for execution of their modernization plans / scheme for upgrading their communication infrastructure and laying down the technical parameters/ specifications for communication equipments for use in Police forces, keeping in view the emerging trends in technological advancement in the field of Police Telecommunication.

Keeping pace with the emerging technological advancement and globally available technologies in the field of Telecommunication, this Directorate has conducted a field trial of Half Loop Antenna for short range HF Communication to access the capability & performance over coverage available through the conventional HF antenna on 4th & 5th December, 2012 between hilly terrains of Himachal Pradesh (Shimla) and New Delhi.

Capability of Conventional HF antenna & Half Loop Antenna:

1. Conventional Antenna:

Presently long distance communication is being established by employing HF Radios with conventional types of antennas. These antennas are having their inherited characteristic due to their design and orientation on installation for use i.e. depending on the direction of the Receiving as well as Transmitting stations. These antennas have a directional radiation pattern to transmit electromagnetic field towards

the selected stations which are on its line and other stations which are not on the line will hardly receive the transmitted signal. Apart from above property, these types of antenna also exhibits a non tolerable or non desirable condition known as **Skip Zone**. Skip Zone is a phenomena and a drawback in the HF communication, under which a dead zone appears between the Transmitting Station and the Receiving Station which is in the range of hundreds of Kilometers and resulting this no communication is possible between any HF Stations falling under this dead zone.

2. Half Loop Antenna:

To overcome such types of inherited properties of conventional types of antenna like skip zone phenomena and transmitting radio signal only in a particular direction due to the directional radiation pattern of electromagnetic radiation through this type of antenna can be overcome by using a specially designed antenna which can eliminate these types of limitation at a large extent.

The proposed antenna system known as Half Loop Antenna can overcome the limitation and shortcomings of the conventional type of HF antenna system. The basic characteristic of this antenna is that it radiates radio signals over the Skip Zone and maintains communication throughout thousands of kilometers without any break in communication. Secondly, its radiation pattern is Omni directional i.e. its electromagnetic radiation can be received by all the stations irrespective of their location of the earth's curvature.

3. Working mechanism of Half Loop Antenna:

The Half Loop Antenna operate in Near Vertical Incidence Sky wave (NVIS) mechanism i.e. it radiates its electromagnetic wave in almost vertical direction towards the ionosphere and same is refracted back evenly towards the earth's curvature covering about thousand kilometers and this radiation is picked up by all the receiving stations irrespective of their location at ground position.

4. Details of field trials on 4th & 5th December, 2012.

(i) Field trial on 4th December, 2012 in hilly terrains of Shimla:

On 4th December, 2012, a functional field trial of short range HF communication was conducted by using Half Loop Antenna between New Delhi and hilly terrains of Shimla, Himachal Pradesh. A HF Communication station was established at Central Police Radio Training Institute, New Delhi and another station was established in hilly terrains of Shimla, Himachal Pradesh. The HF Station at Shimla was established over a vehicle fitted with Half Loop Antenna over the rooftop of the Vehicle. The trial was started in Shimla by using day frequency 8193 KHz. The vehicle was moved all around the hilly terrains of Shimla by covering all types of the hilly terrains including valleys & jungles where the normal communication through the VHF / UHF & HF radios is not possible. The trail of communication over this region was successful throughout the day.

(ii) Field trial on 5th December, 2012

On 5th, the trial was conducted via road from Shimla to New Delhi. The distance between Shimla to New Delhi is 243 KMs. The communication trial was conducted while crossing hilly roads and jungles, which was remained uninterrupted throughout the journey. During the trial 8193 KHz and 3185 KHz was used as day and night frequency respectively. The details of call records between both the stations are placed at (F/A). During this trial the Mobile Station was also remains in contact with other Stations such as ISPW Station Jaipur, Bhopal, Lucknow, Chandigarh and Jammu. The speed of the vehicle was 30 to 40 Kms/hr in hilly terrains and at plain area the speed of the vehicle was between 60 to 80 KMs/hr.

5. Advantages of using Half Loop Antenna over conventional HF antenna:

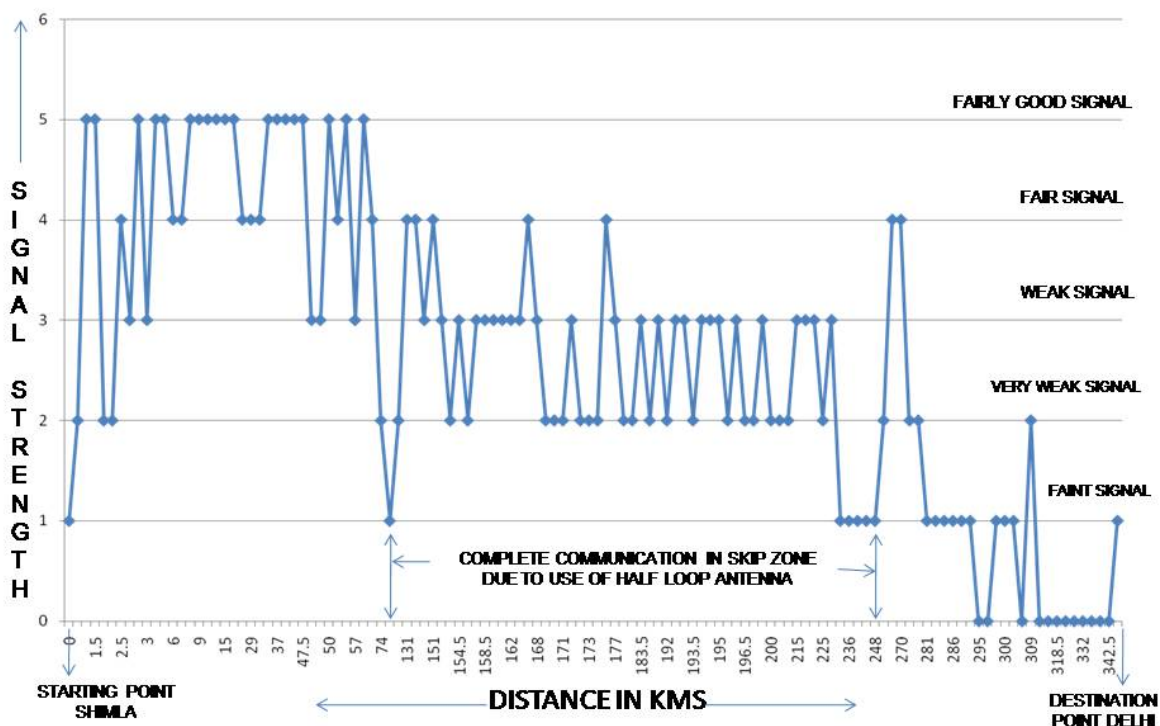
1. Covers the area which is normally in the skip zone.
2. Requires no infrastructure such as repeater or satellite.
3. Propagation is relatively free from fading.
4. Can receive signal in low areas and valleys.
5. The radio signal of this antenna do not suffers any path los & absorption as to and fro path is short and direct.
6. The technique of this antenna can dramatically reduce noise and interference, resulting in improved signal strength to noise ratio.
7. Antenna can be used in static and mobile operation (vehicle mounted)
8. Compatible with all types of Radios.
9. Its radiation pattern of RF energy is Omni directional.
10. Provides continuous coverage range up to 1000 KMs without skip zone.
11. Less effected by ignition, atmospheric and industrial noise due to narrow bandwidth.
12. Compatible for Auto Link Establishment (ALE)
13. Covert appearance of this antenna is added advantage for Police party engaged in search/surveillance operation.

6. Conclusion:

The deployment of Half Loop Antenna for carrying out short range HF Communication is most useful, where the HF communication fails due to Skip Zone phenomena and shadow effect over VHF / UHF communication. The best advantage of this type of antenna is that it can establish communication in any type of hilly terrains, Valleys and jungles. The HF Radio having the capability of ALE (Automatic Link Establishment) will have an added advantage to enhance the performance of communication.

These capabilities of Half Loop Antenna can be harnessed for jungle warfare application for Police Organizations' for immediate communication needs at the time of disaster & vehicle movement applications.

FIELD TRIAL OF HALF LOOP ANTENNA BETWEEN SHIMLA & CPRTI NEW DELHI



GRAPHICAL REPRESENTATION OF SIGNAL STRENGTH BETWEEN THE HF STATIONS
INSTALLED AT SHIMLA & NEW DELHI



ACTUAL HALF LOOP ANTENNA INSTALLED AT STATIC STATION IN NEW DELHI

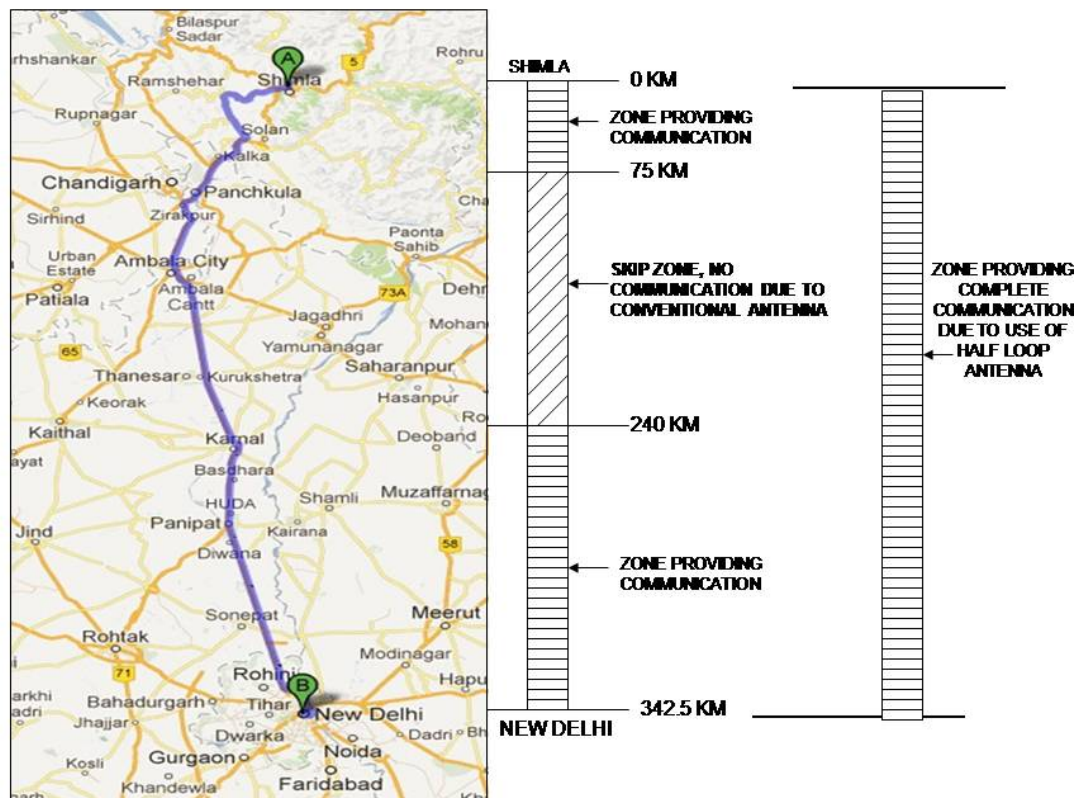
NO.DCPW/TE-HLA/01/13



HF MOBILE STATION USING HALF LOOP ANTENNA OVER A VEHICLE AT SHIMLA

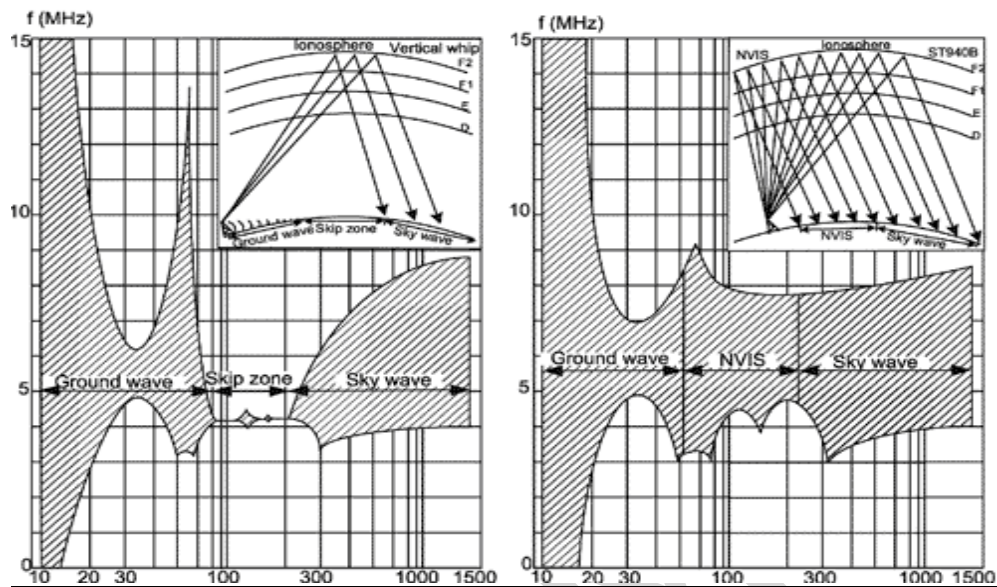
NO.DCPW/TE-HLA/01/13

DIRECTION FROM SHIMLA TO NEW DELHI



1. ROUTE MAP BETWEEN SHIMLA & NEW DELHI THROUGH VEHICLE.
2. THE GRAPH BAR INDICATING SKIP ZONE DUE TO CONVENTIONAL HF ANTENNA.
3. THE OTHER GRAPH INDICATING ELIMINATION OF SKIP ZONE DUE TO HALF LOOP ANTENNA.

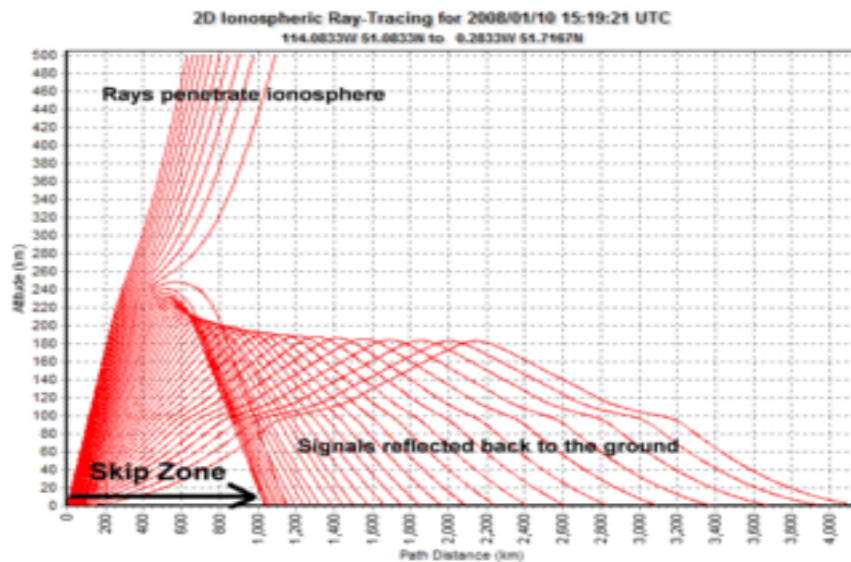
NO.DCPW/TE-HLA/01/13



Radiation pattern due to Conventional HF Antenna

Radiation pattern due to Half Loop Antenna

Sources: <http://www.stealth.ae/plugins/custompages/articles.php?id=10>



Source: http://en.wikipedia.org/wiki/Skip_zone

----- End of Document -----

NO.DCPW/TE-HLA/01/13

DCPW, MHA

For any query / clarification:
Directorate of Coordination Police Wireless, Ministry of Home Affairs
Block No.9, CGO Complex, Lodhi Road, New Delhi – 10003
Tel: 011- 24361562/ 24361344