

# PINPOINTING IN A CIRCLE - AN EFFECTIVE AND RELIABLE SYSTEM FOR THE PRECISE LOCATION OF DEEP BURIALS

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## ABSTRACT and INTRODUCTION:

### Definition of terms:

- A **maximum** ( maximum amount of volume ) is defined as a point which fulfils the following condition: when moving away from the point the signal will decrease irrespective of the direction taken.
- A **misleading maximum** is a maximum which does not lead to the burial.
- A **real maximum** is a maximum which does lead to the burial.

When searching for avalanche victims with transceivers, up to ten misleading maximum amounts of volume which do not lead directly to the victim, can occur. The quantity of those misleading maximums depends on the relative antenna orientation. The distance between the real position of the victim and the misleading maximum is approx. equal to the burial depth. This effect does not influence the search strategy for an average burial depth, but it has an important impact on deep burials. Although spot probing helps in checking the exact position, it takes longer when the probing area is larger or not clearly defined. In this case, a transceiver-based pinpointing system is faster and more reliable.

"Pinpointing in a Circle", which I developed in 1994 for advanced and professional users, has become part of the official training material of Switzerland's Federal Office of Sports.

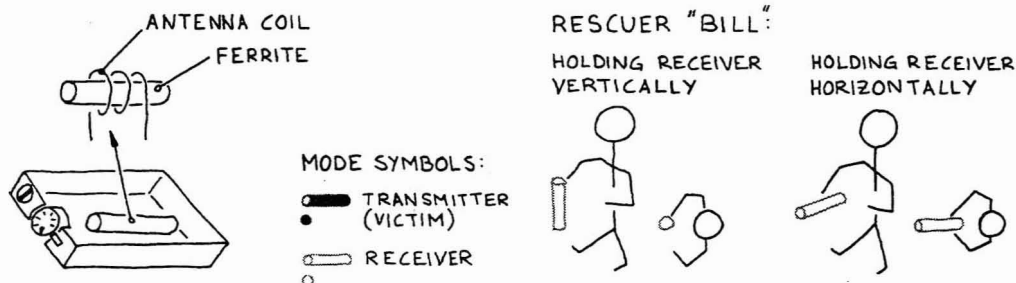
**KEYWORDS:** avalanche rescue, pinpointing system, deep burials

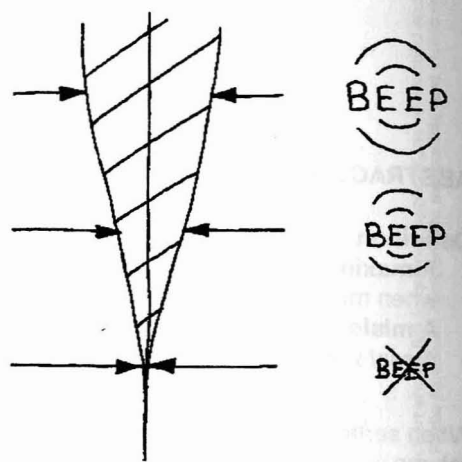
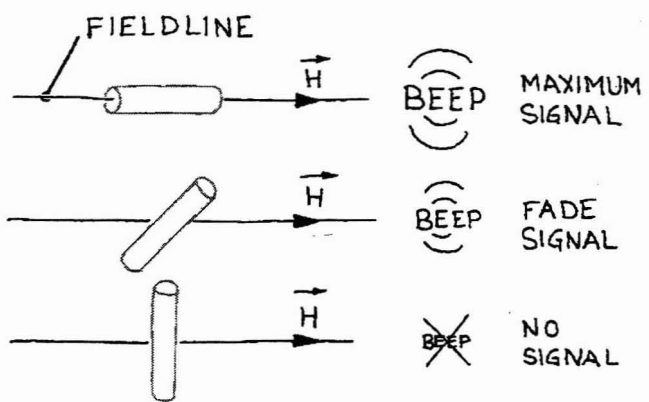
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## PROBLEM – THE 10 MISLEADING MAXIMUMS:

### Definition of elements used in the graphics:

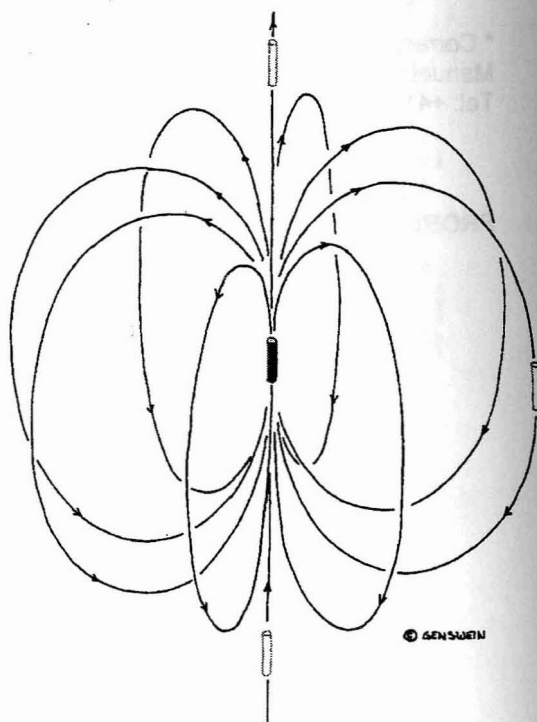
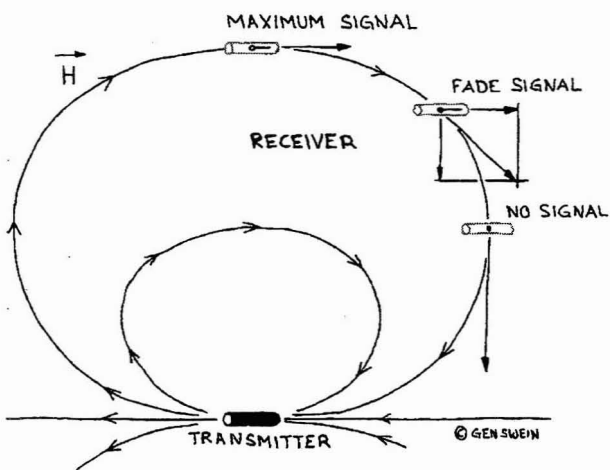




**Practical consequences:**

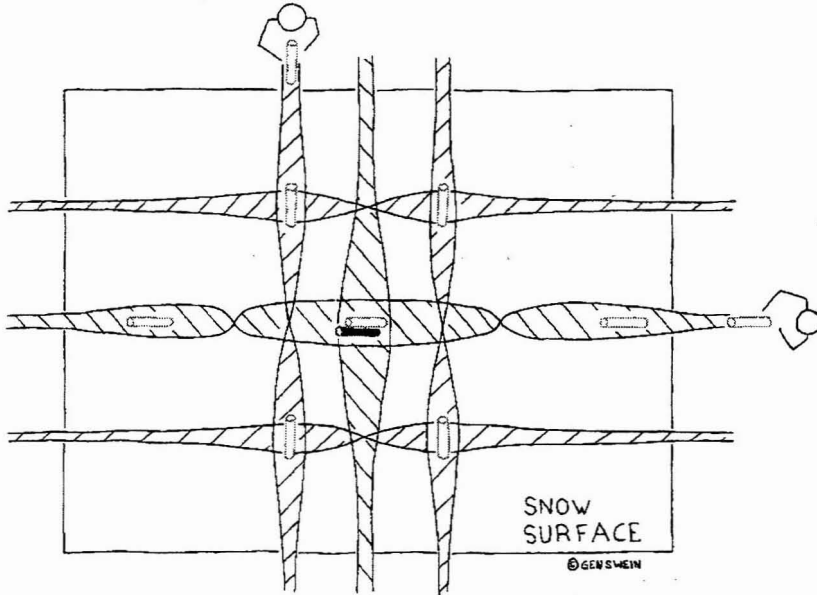
**Three real maximums:**

- two in coaxial antenna orientation
- one in parallel antenna orientation



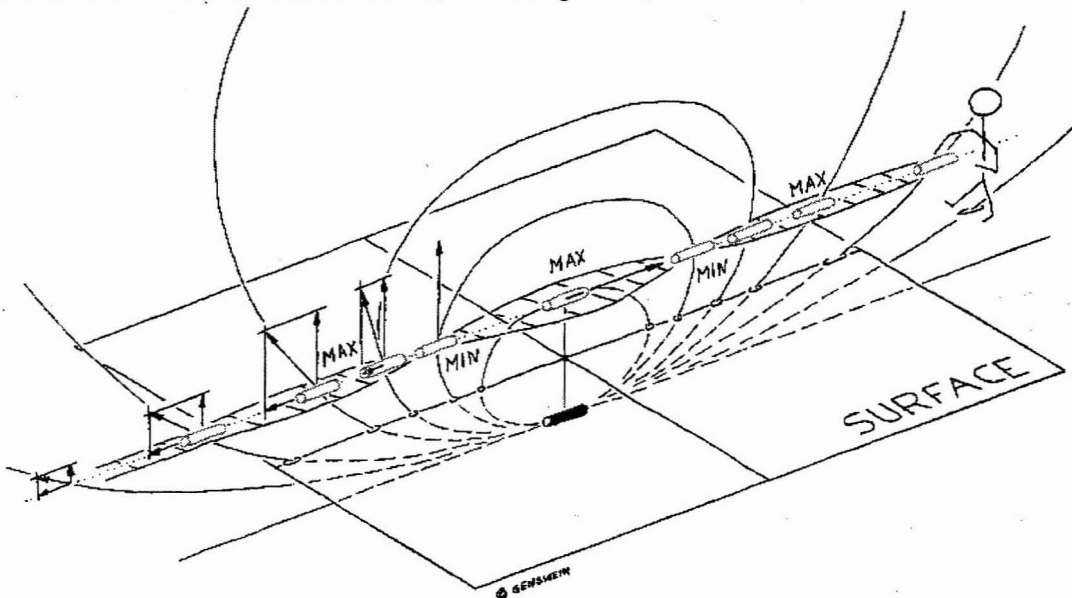
### Maximums holding receiver in a horizontal position:

This situation creates the highest amount of misleading maximums. It is therefore an important point of a pinpointing system to avoid this situation under any circumstances. The only real maximum, the one a pinpointing system has to work out, is in the centre.



Top view of a burial scenario holding receiver in a horizontal position – 6 misleading maximums are surrounding the real one

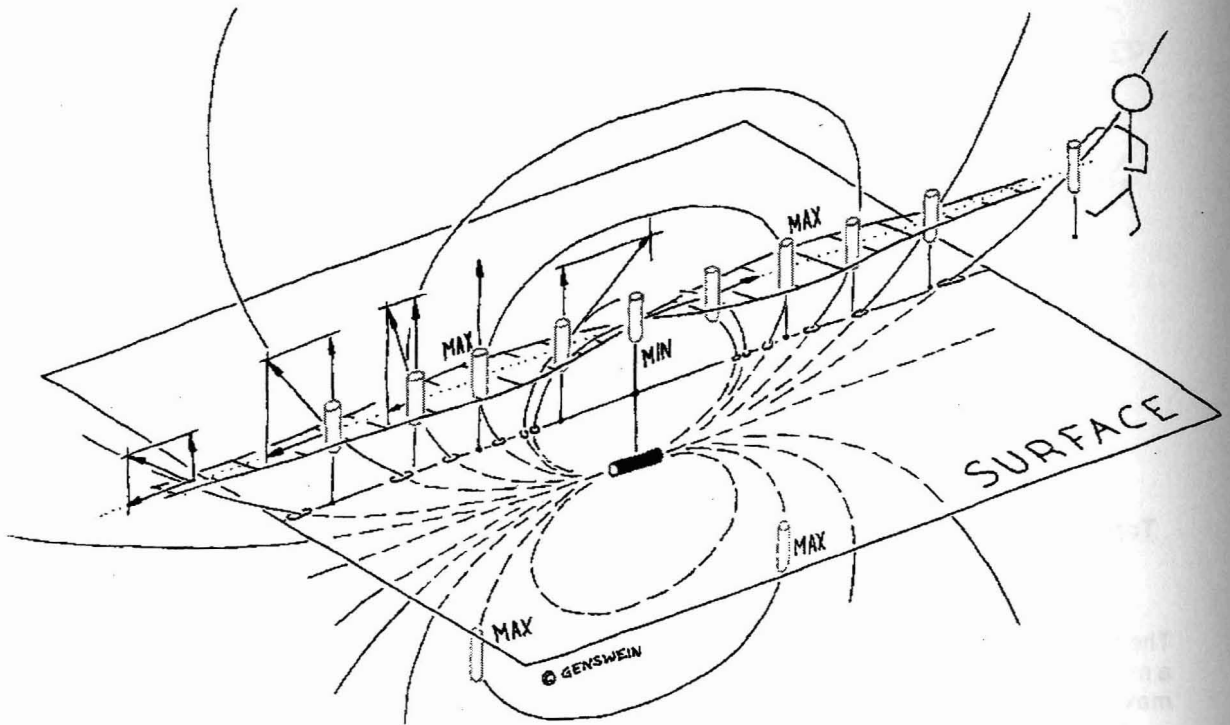
The following situation represents the most common trap for rescuers using the field line method. They hit a misleading maximum on their way to the real one. For this reason, one should always walk over the first maximum to check if there is not a second, and stronger one, the real one, around.



Typical trap for rescues using the field line method

### Maximums holding receiver in a vertical position:

This situation creates four misleading maximums. Two of them are above the victim and can be easily detected. The other two are below the victim and therefore do not influence the search unless the avalanche debris are on a very steep slope, which is a very unlikely situation. It is interesting to note that there is no real maximum in this situation. Above the victim there is no signal at all.



**Burial scenario holding receiver in a vertical position**

### Pinpointing in a Circle – theory

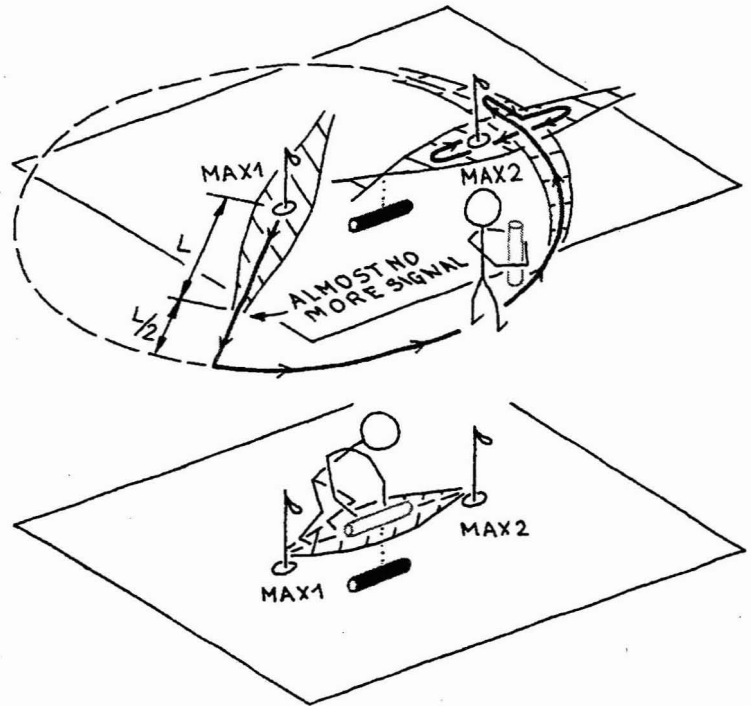
When designing a simple and reliable pinpointing system, it is important to reduce the number of misleading maximums. By holding the receiver vertically, six out of ten maximums will be eliminated. Out of the remaining four, two occur only on very steep avalanche debris. This is a relatively rare occurrence. This leaves two

maximums to be handled. The victim is always somewhere between these two maximums. At the end of the grid search, the first of these two maximums will have been localised. "Pinpointing in a Circle" helps now, in whatever antenna orientation or burial depths the victim might be, to find the second maximum.

## Pinpointing in a Circle – search strategy

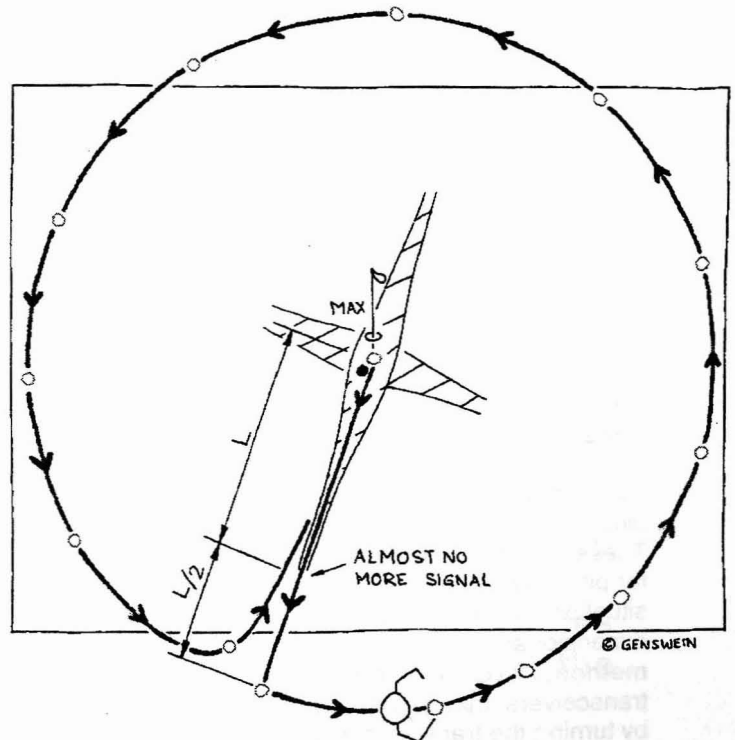
### Short step-by-step instructions:

- Hold transceiver vertically and search for first maximum ( bracketing method )
- Mark this point
- Leave volume on normal level; walk away from this point until the signal is almost gone ( L ) and then increase your distance from the marked point by another 50% ( L/2 )
- Proceed in a circle around the first maximum. If you hear a signal again, search for a second maximum (bracketing method)
- Mark the second maximum
- Hold transceiver **for the first time horizontally** on the snow surface and in axis to the two maximums. Search for the strongest signal between the two maximums
- You are now above the victim
- Check by spot probing
- Recover burial



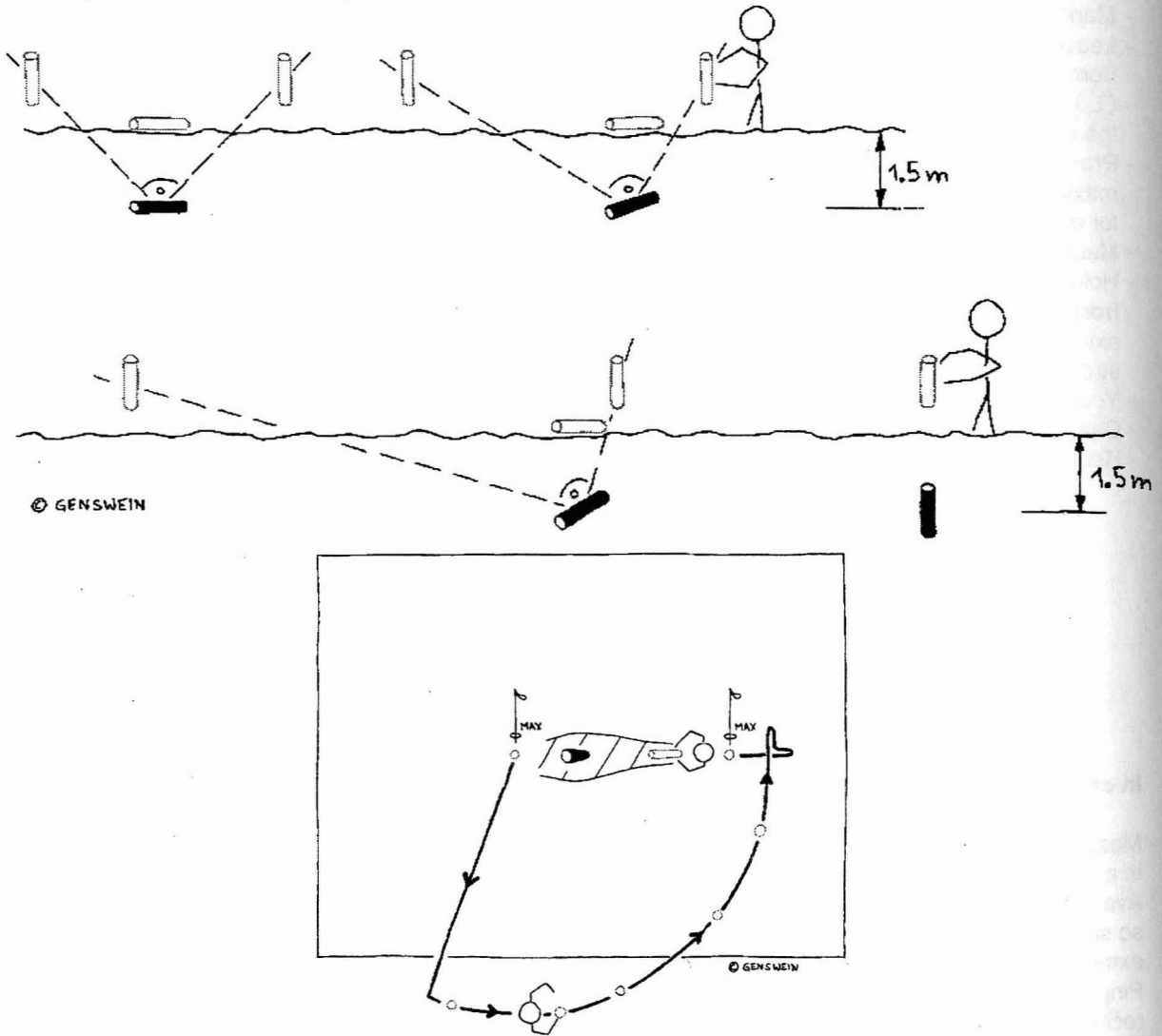
### In case there is only one maximum:

Most people wear their transceiver ( antenna ) in a parallel position to their own body axis. Avalanche victims rarely get buried vertically, so searching for a vertical transceiver is extremely unusual. However, using Pinpointing in a Circle, this situation can be recognised as there will not be any signal on the circle. In this case, the victim is below the first maximum.



## The Influence of different transceiver positions

Although it is very unlikely that transceivers get buried in a vertical position, all angles between  $0^\circ$  and  $90^\circ$  are possible. The graphics below show some possible scenarios. Pinpointing in a Circle works reliable with all situations. The graphic at the bottom shows how it influences the last step of Pinpointing in a Circle. ( maximum is off center )



## Remarks concerning digital dual antenna transceivers

Digital dual antenna transceivers calculate a two-dimensional vector to indicate the search direction. These systems work well as long they are not used for pinpointing for deep burials. In the deep burial situation a three antenna transceiver ( -> three-dimensional vector ) might be helpful. The "tilt" method, designed for digital dual antenna transceivers, tries to simulate the third dimension by turning the transceiver into the x-z plane.

Although it is possible to work out a three-dimensional vector, it is extremely difficult to imagine how this elliptical field line, whose radius gets smaller the closer it gets to the burial, proceeds in the snow pack.

For all those reasons, **the only solution for pinpointing for deep burials stays a single antenna analog transceiver**, or a digital dual antenna transceiver which still supports analog mode ( e.g. Barryvox ).