

Preliminary Probe Array Field Measurements

eLB001-004
26th February 2006

Background: First field test.

Aim:

To verify test equipment setup operation in preparation for the determination of the behaviour of different probe array configurations using stainless steel putty knives in real ground.

Equipment:

- DVM (as nominal 2048Hz signal source)
- Stainless steel putty knives (4 off)
- MZ-R70 MiniDisc recorder
- Spectran DSP Software

Method:

- Apply 1.9 Vrms @ nominal 2048Hz between a pair of putty knives spaced at 12cm apart
- Measure induced e.m.f. between a second pair of putty knives approx. 1m away
- Establish that recording setup is suitable for further more detailed tests
- Compare received potential for broadside (goal posts) configuration to in-line configuration

Results:

1. Two sets of measurements were made:- one for the broadside configuration and one for the in-line configuration. See Figure 1, which shows the array in the in-line configuration.
2. It was found in the test area that the AC voltage level induced between the receiving putty knives spaced by 12cm by background noise was sufficient to provide enough signal level into the MZ-R70 MiniDisc microphone input. The receiving putty knives were connected to a small audio transformer with a turns-ratio of ~ 11:1 (1000 ohms:8 ohms). The putty knives were connected to the 8-ohm winding while the 1000 ohms winding was connected to the MZ-R70 microphone input. The MZ-R70 recording level was set to Manual and maximum sensitivity.
3. A simple spectral analysis was done using Spectran. See Figure 2 for the broadside configuration results and Figure 3 for the in-line configuration results. In these tests the broadside configuration shows approximately 7dB less signal for the same spacing between the putty knives of each pair and the

same distance spanned compared to the in-line configuration. The nominal 2048Hz can be seen to be actually 2039Hz.

Conclusion:

In this test it appears that the in-line configuration (-18.4dB) provides nearly 7dB more signal than the broadside configuration (-25.1dB). It is worth noting that this is entirely consistent with theory where a difference of 7dB between the broadside and in-line configurations is calculated to occur with a ratio of about 3.5:1 between the distance between probe pairs and the spacing between probes. You can see this is roughly the case as shown in Figure 1. However, the distances covered are small (due to the low power of the DVM used as a signal source) and therefore no great importance should be attached to this result. The mere changing in configuration can be expected to alter the level of current flowing into the transmitter putty knife earth probe pair. The same variation can be expected to occur for the receiving earth probe pair when changed from one configuration to the other.

At distance/spacing ratios of 12:1, 25:1 and 50:1 the theoretical advantage of the in-line configuration over the broadside configuration is 10dB, 11dB and 11.5dB. The limit is 12dB advantage where distance >>>> spacing.

Valid confirmation of any advantage of the in-line configuration over the broadside configuration will have to be left for testing where the drive power is higher and the injected current is measured. Longer distances and multiple test sites will assist in minimising variations due to positional variations.

In any case, the receiving setup has been demonstrated to be useful where the convenience of field recordings using the MZ-R70 MiniDisc recorder has been instrumental in obtaining suitable recordings of signals.



Figure 1 In-line Configuration Measurement

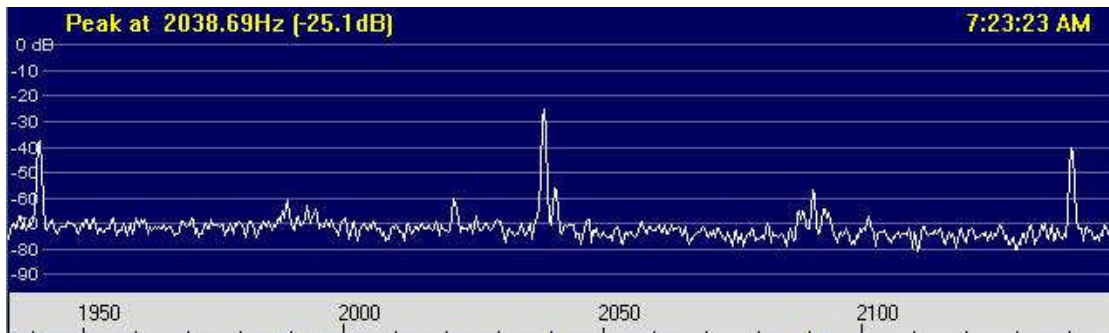


Figure 2 - Broadside Configuration Spectrum

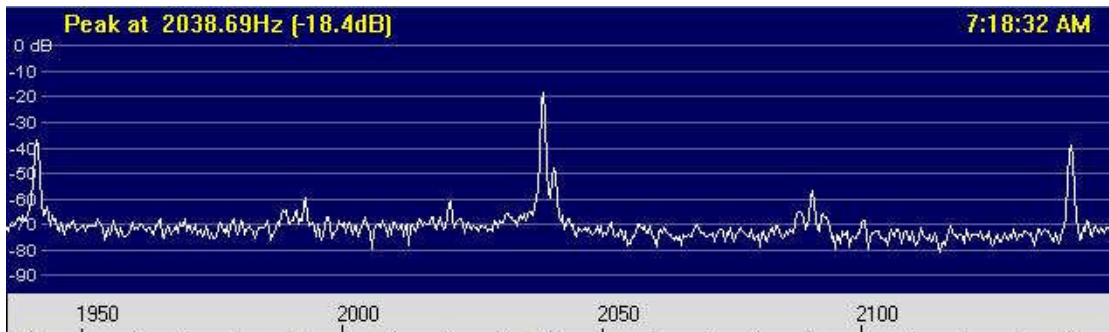


Figure 3 - In-line Configuration Spectrum

