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Mid Frequency Antennas Comparison in GaiaSpectrum® Standard

This is a short comparison survey of two commercially available antennas, the HBD-350 manufactured by Radarteam Sweden AB Boden, Sweden, and the RAMAC-500MHz manufactured by MALÅ GeoScience AB Malå, Sweden. We got access to data collected with both antennas in approximately similar conditions and with the radar systems they were designed to work with. Both data sets were not altered in any way and can be considered to be what is called "raw data".

Manufacturer's datasheets

First of all we decided to get some information about these devices, to get an idea of what to expect from the data sets. Our search for technical info was restricted solely to the respective websites of the antenna manufacturers.

This is a summary of what we could find:

Parameter	HBD-350	RAMAC-500 MHz
Manufacturer	Radarteam Sweden AB	MALÅ GeoScience AB
Web site	www.radarteam.se	www.malags.se
Available datasheet	YES	NO
Dimensions (LxWxH)	740x405x225 (mm)	0.5X0.33x0.16 (meters)
Weight	6 kg	5 kg
Type of antenna	Hemispherical butterfly dipole	Not Available
Center Frequency (-10dB BW)	334 MHz	Assumed 500 MHz
Bandwidth (-10dB BW)	80.8%	Not Available
Shielding	Top shielded	Shielded

Table 1 Brief datasheet for the devices

From Table 1 it is clear that both antennas are close in size and weight. The center frequency of the RAMAC-500 MHz is around 40% higher, but that is not a big problem due to the very broad bandwidths of ground penetrating antennas. The fact that the HBD-350 is only top shielded most probably had some effect on the signal to noise ratio. The data sets for the RAMAC-500 MHz were taken in a sandy area in

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Massachusetts, USA and the data sets for the HBD-350 were taken in a sandy location in northern Sweden. With all this done, it was time to put GaiaSpectrum® to work.

Comparing the data sets

The first thing to do was to import the largest data set collected with the RAMAC-500 MHz into GaiaSpectrum®. We set up a uniform window function because we didn't want the smoothing functions to distort or interfere with the results. Different manufacturers have different ways of setting up the beginning of the collection of the scan, resulting in a different position of the smoothing window with respect to the transmitted pulse.

Another thing to take into consideration is the fact that files collected with the RAMAC systems do not necessarily have a power of two amount of samples per trace. With that in mind we adjusted the collection of the data to be a power of two amount of samples per traces. Usually when working with only one device that's not needed because GaiaSpectrum® offers the possibility of importing a file with a non power of two number of samples per trace. The adjustment is then done by truncation or padding with zeroes. However, we wanted to avoid changing the raw data sets and to be as fair as possible in our comparison. Therefore we collected the data in both cases with the same amount of samples per trace.

When the file was already imported, we selected peak-hold mode in order to get as much of the data as possible in one screen. We selected to show the level as dBc to ease the interpretation of the resulting spectrum. And finally set the program to run.
The final result was stored as a reference file. This is simply done by calling the reference setup and pressing the set button. Since we were going to analyze the HBD-350 right after, we've set the spectrum in reference number one.

We closed the RAMAC-500 MHz antenna file and loaded the file collected with the HBD-350. Everything was done in the same way to get the results as accurate as possible.

Analyzing the data

With the final spectrum for the HBD-350 loaded in the spectrum data view, we loaded the results for the RAMAC-500 MHz that was previously saved as reference number one. In this way both results were loaded simultaneously in the spectrum data view and it was possible to make some measurements.

We didn't take advantage of the markers function because in GaiaSpectrum® standard that function is only available for the active file and not for the reference ones. The idea was to make the measurements as close as possible and using the markers for one file and not for the other would have defeated the purpose.

With the aid of the cross hair line and the upper side readings we could establish all the data necessary to find out the essential parameters for each antenna. The results are shown in table 2.

Parameter	HBD-350	RAMAC-500 MHz
-10 dB Lower Limit	187 MHz	189 MHz
-10 dB Upper Limit	477 MHz	429 MHz
-10 dB Band	290 MHz	240 MHz
-10 dB Center Frequency	332 MHz	309 MHz
-10 dB Bandwidth	87.3 %	77.6 %
Noise Floor (Average)	-25 dB	-32 dB
Bandwidth datasheet info to measurement error	-7.5%	N/A
Center Frequency datasheet info to measurement error	- 0.1 %	-38.2 % (No datasheet available, only by the 500 MHz in the device name)

Table 2 Obtained results

Conclusions

As we could see both devices are very similar in parameters with a few differences. First, the datasheets that Radarteam Sweden AB web site offered, turned out to be reliable and accurate. Since there was no datasheets for the RAMAC-500 MHz antenna we were forced to guess the center frequency from the name of the device. Although, in principle, we made a logical guess, it seems to be wrong, and the 500 MHz is just a generic name not explicitly related to the center frequency of the antenna.

At the end, the center frequencies of both devices were practically in the same spot considering the broad bandwidths of the devices. The HBD-350 antenna has a better bandwidth but as expected it has a bit lower noise floor.

Another thing to note about this measurement is that the HBD-350 antenna does not only have a broader bandwidth, but as it can be seen in figure two, it also has a much more flatter top. That is, the frequency components in the available bandwidth have much closer magnitudes to one another than in the case of a sharper terminated spectrum of the RAMAC 500MHz.

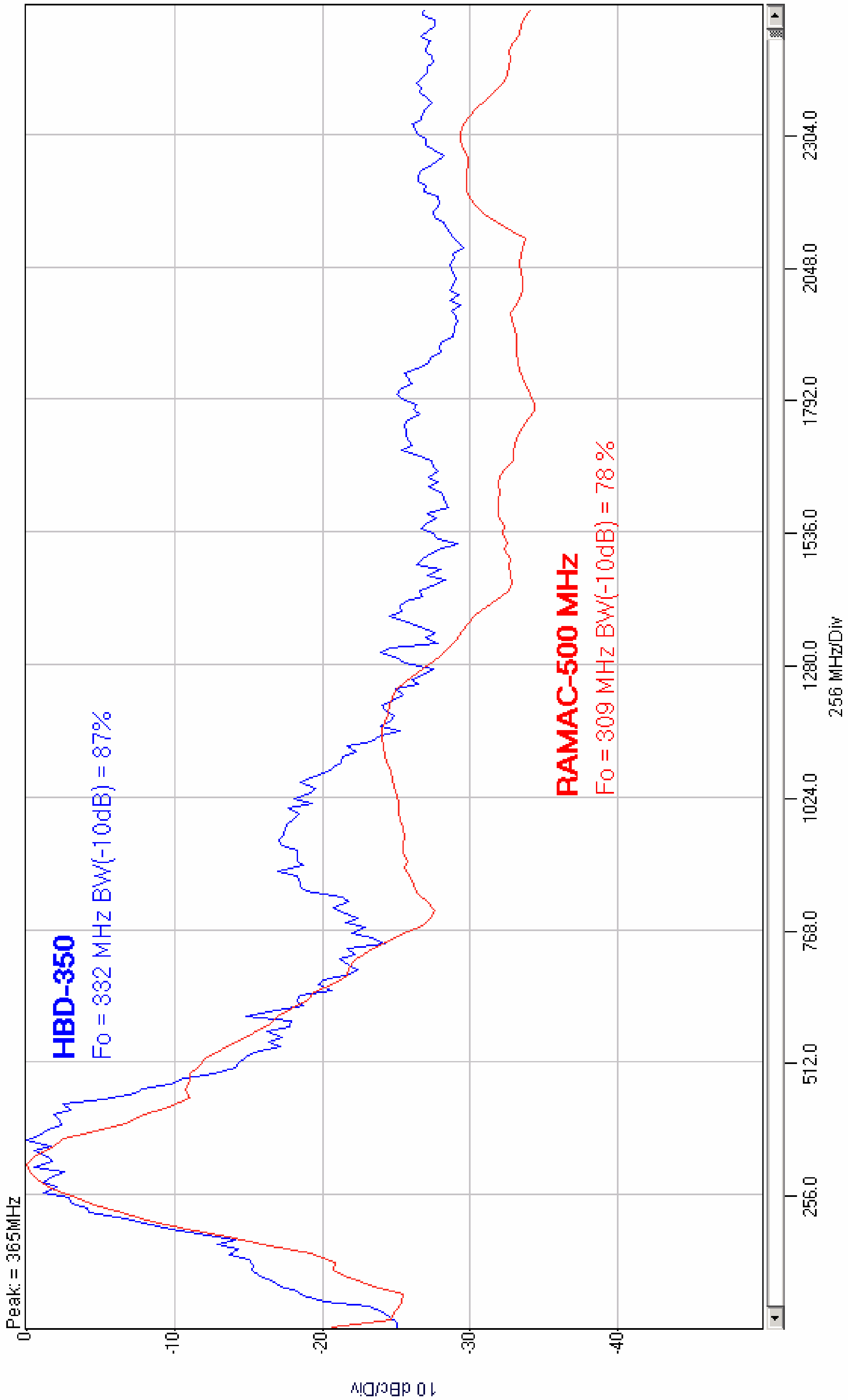

Figure 2 Spectrum data view saved file

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