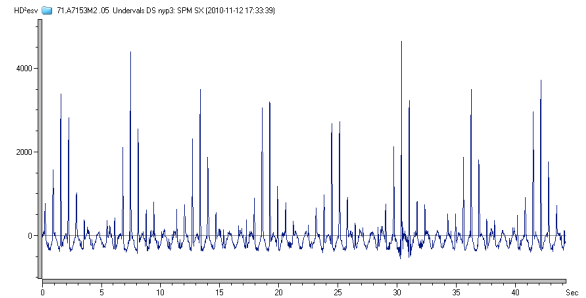
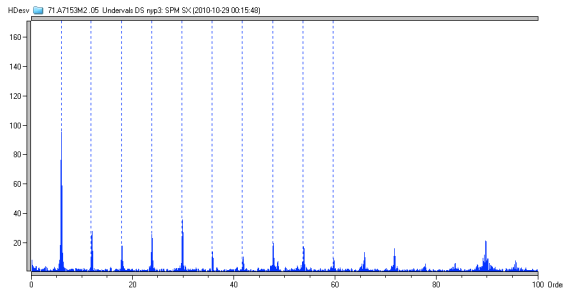


Above: An SPM HD Spectrum taken in a very early stage of the bearing deterioration process. The Y scale is linear and 5 harmonics to the BPFO line can be seen. The reading was taken on August 23, 2010 and RPM on this occasion was 9.39.

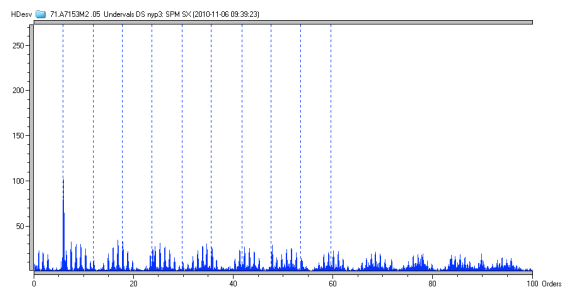


Above: An SPM HD Time signal with extraordinary sharpness. The reading was taken on November 12, 2010 and clearly shows an inner race and an outer race signal in combination. The RPM is 10.84. Note the inner race modulation where the distance between the "bursts" is exactly 1 revolution. Also note the smaller signals from the outer race.



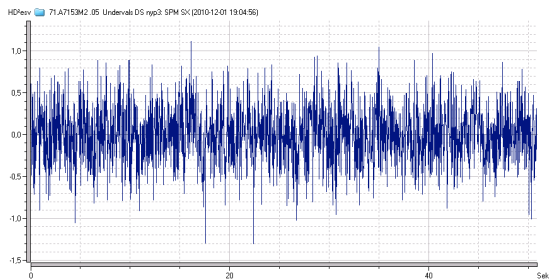
Above: An SPM HD Spectrum measured on October 29 at 10.84 RPM. The outer race signal is clear, with several harmonics. The amplitude has increased 20 times indicating more severe outer race damage.

The typical time signal pattern from an inner race damage as seen in this picture is explained by studying a bearing load zone. When the inner race damage enters the load zone, it will collide with the rolling elements. In the middle of the load zone, the forces are strongest, hence producing the strongest impacts. When the damaged area of the inner race leaves the load zone, the impacts will decrease again.



Above: On November 6, 2010, a new frequency component becomes visible in the spectrum, directly corresponding to BPFI. The outer race frequency is still there, and the typical 1X modulation of the inner race signal is obvious. This measurement is at 10.85 RPM. This behavior of an initial steady increase of the outer race signal, followed by a distinct inner race signal has been found in several places on this application.

The fact that the strongest impacts are not constant in amplitude is an interesting observation. Studying the picture above, it is clearly seen that the strongest impact from each "burst" exhibits a cyclic change. The explanation can be found in bearing geometry. Sometimes, the damaged area, the maximum load zone force and a rolling element coincide, producing a strong collision. Sometimes they will not coincide, resulting in a lower amplitude impact.



Above: SPM HD Time signal immediately before bearing replacement.

