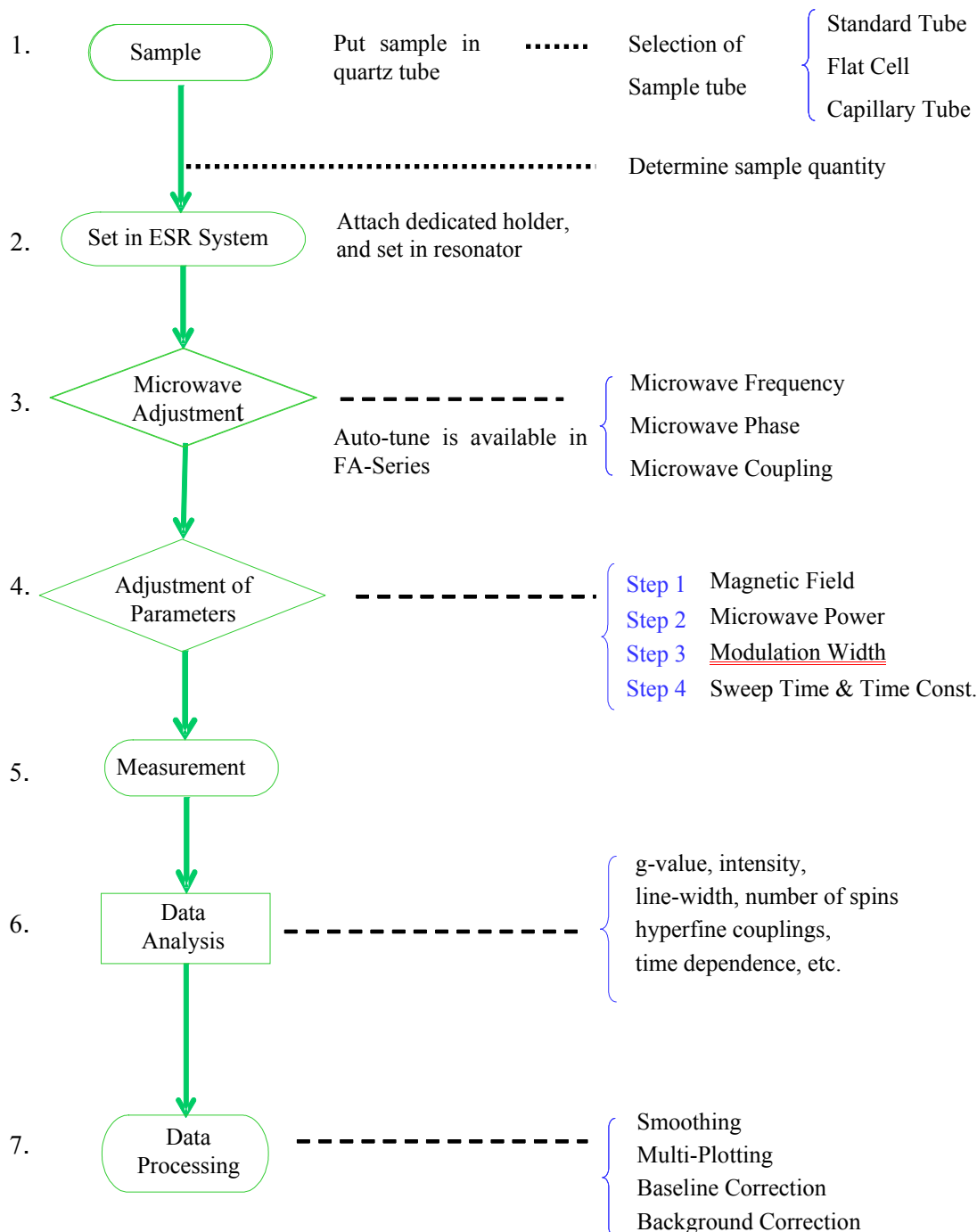


## Let's Use ESR VI – Adjustment of Modulation Width

ESR may be used to measure a wide range of samples. However, it is necessary to determine the most appropriate conditions for each sample. The following measurement flow chart gives a step-by-step approach. Here, we explain how to adjust the modulation width.

### ESR Measurement Flow



### Step 3. How to Set the Modulation Width

In this note we show how to set the modulation width. Magnetic field modulation is a procedure unique in ESR and a differential waveform is recorded not absorption. The merit is that resolution and S/N ratio improve as a result. However, if an inappropriate modulation width is selected, the resolution may decrease or the sensitivity may reduce instead.

Modulation width is optimised in the next operation.

1. Record the signal using the microwave power obtained in [Step 2.](#), measure the signal intensity.
2. Set the modulation width to double that used at 1, check and note the signal intensity.
3. Repeat step 2 several times, noting the signal intensity each time.
4. Set the modulation width to half that used at 1 and check and note the signal intensity.
5. Repeat step 4 several times, noting the signal intensity each time.
6. Plot the signal intensity against the modulation width as shown in Fig. 2.

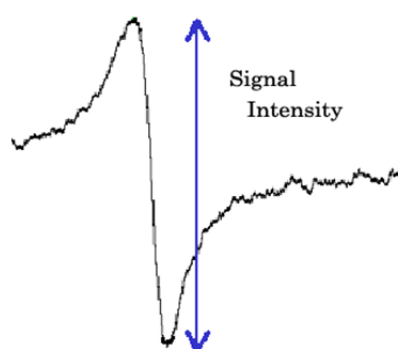


Fig 1. Signal Intensity

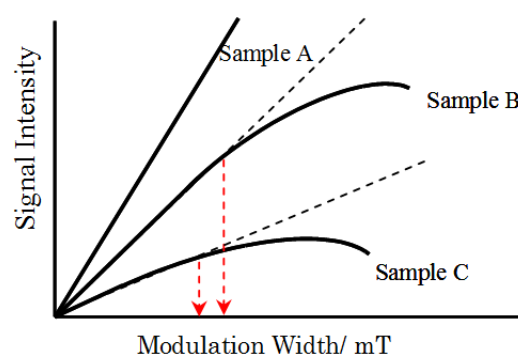


Fig. 2 Modulation Width Dependency on Signal Intensity

The operation is similar to setting the microwave power in [Step 2.](#) but here, the signal intensity is plotted against modulation width. As shown in Fig. 2, the signal intensity should increase in proportion to the modulation width. However, the linearity collapses at certain width, and the proportionality fails which is known as “over-modulation”. When you measure unknown sample, be sure to confirm its suitable modulation width.

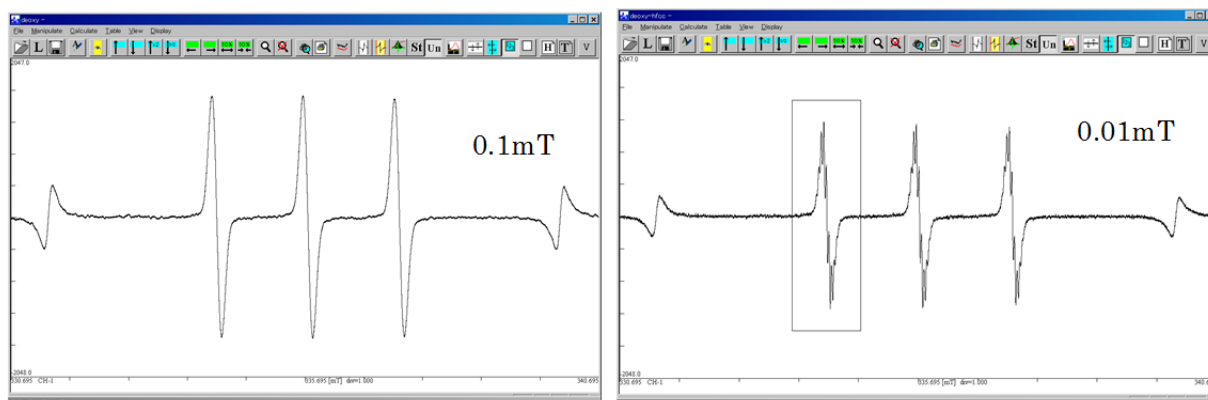


Fig.3 ESR spectrum of degassed TEMPOL obtained with different modulation widths.

With a degassed sample, TEMPOL shows good hyperfine structure. However, if the modulation width is too large, the hyperfine splitting disappears. In order to obtain reliable data, ensure the optimum modulation width is used.