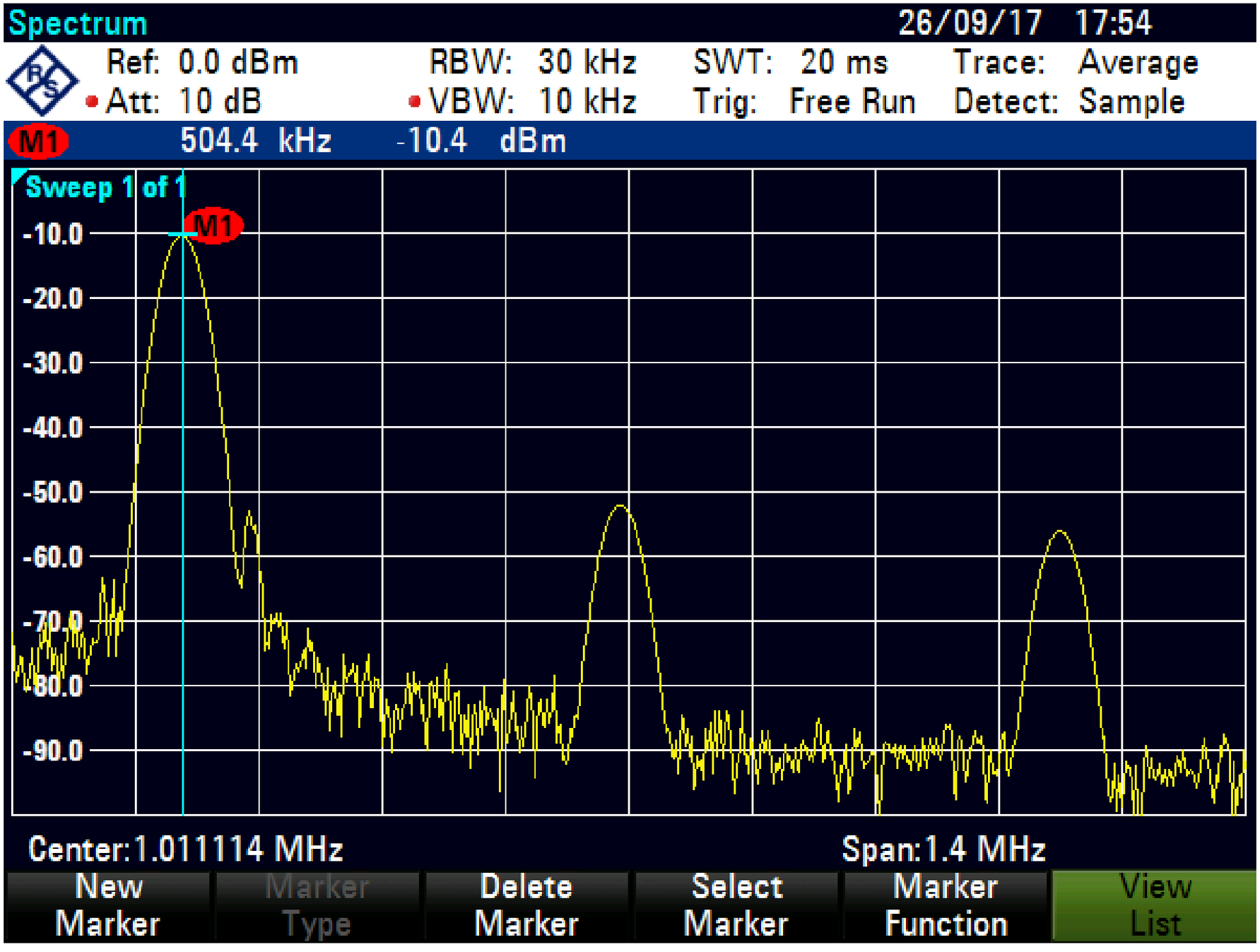
Activity 1.1. We set up the signal generator & SA as requested. The marker verifies the result we got in question 1.2.:



The SA produces higher order harmonics because the mixer that calculates the product of the input and local oscillator signals isn't ideal and has some amount of harmonic distortion.

Activity 1.2. The annotations seen on the screen are:

Ref The reference level, the highest decibel value shown in the screen. It corresponds to the value at the top of the Y viewport axis.

Att The amount of attenuation applied to the input signal before the mixer. More attenuation reduces the harmonic distortion but increases the noise floor.

RBW The resolution bandwidth, the bandwidth of the IF bandpass filter.

VBW The video bandwidth, adjust the cutoff frequency of the smoothing filter applied to the trace before being displayed (or averaged).

SWT The time it takes to do a full sweep to get a trace of the frequencies shown at the viewport. This isn't directly modifiable, it's calculated from the other parameters.

Trig The trigger mode, this determines when to start a swipe (constantly, when an external signal indicates it, etc.).

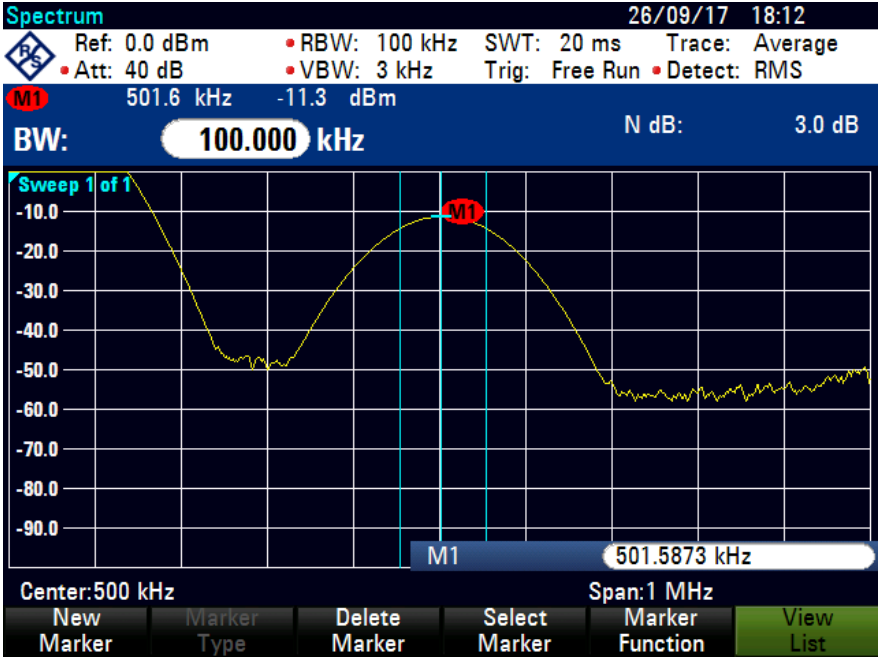
Trace The operation applied to the trace, if any, just before displaying (i.e. averaging with previous traces).

Detect The type of detector used to get the trace (sample the smoothened signal, capture the maximum or minimum peaks, show the RMS, etc.).

Center The frequency that is displayed at the center of the X viewport axis.

Span The length of the displayed frequency interval, from start to end of the X viewport axis.

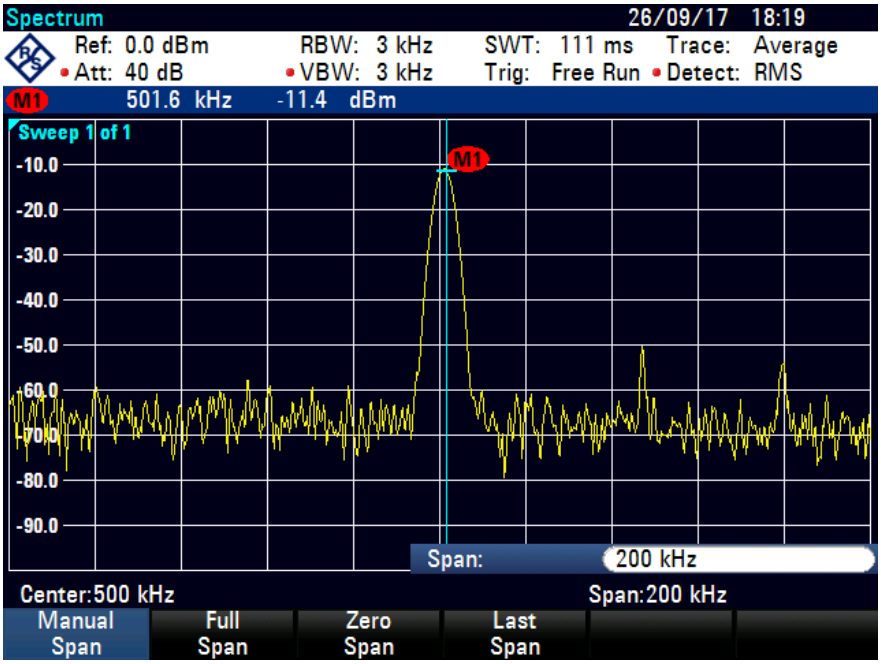
Activity 1.3. We have adjusted the SA to show the wide shape around 500 kHz when the resolution bandwidth is set to 100 kHz:



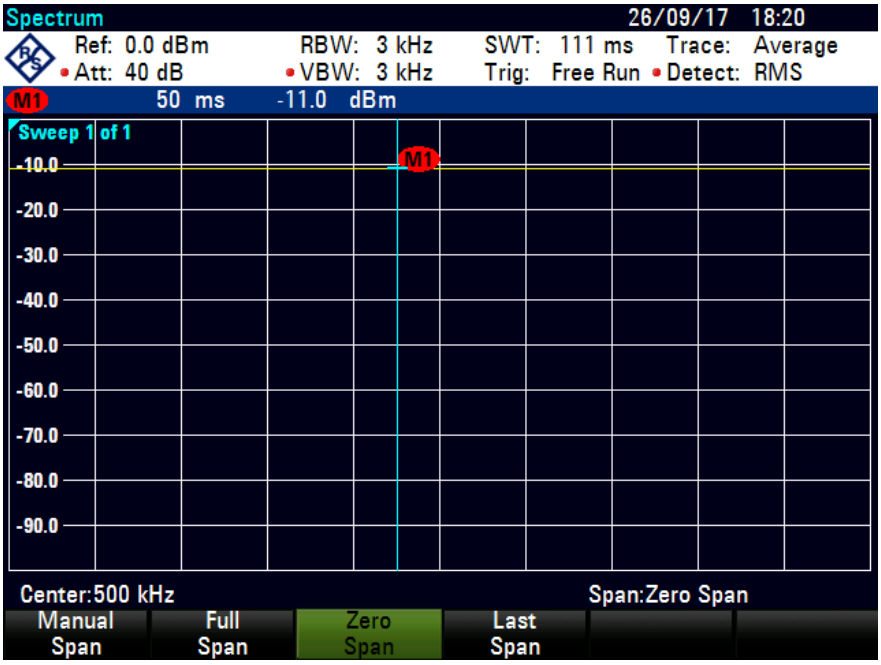
We can see how increasing the resolution bandwidth makes the shape wider. In fact, we can see that the resolution bandwidth equals de -3 dB bandwidth of the shape we see.

This matches our expectations, as what we're seeing is the actual delta replaced by a sinc or similar shape (the impulse response of the bandpass filter) whose bandwidth is controlled directly by the RBW.

Activity 1.4. We have reconfigured the SA as requested:

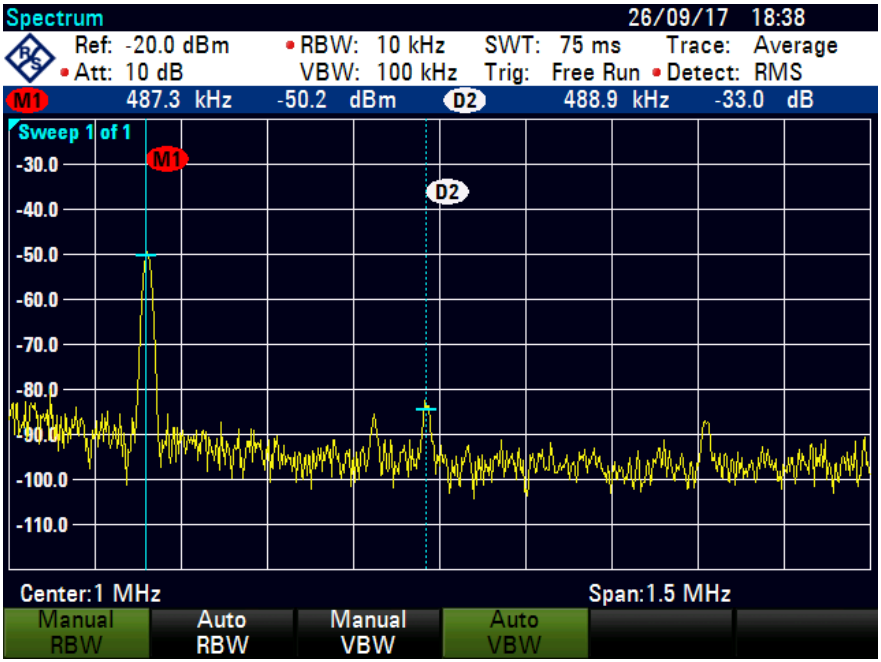


Then we enable zero span. This is what we see on screen:

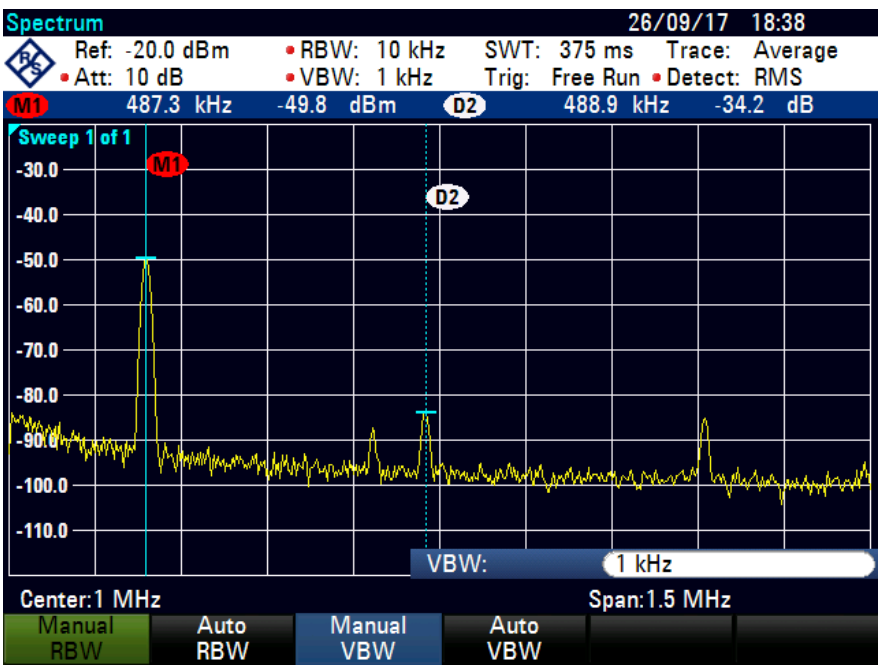


This trace represents the individual sample of the trace that was previously at the center of the screen, i.e. the local oscillator is set to this fixed frequency and no longer sweeps.

Activity 1.5. We have reconfigured the SA as requested. The harmonics are now close to the noise floor and this makes it difficult to measure their amplitude or exact frequency:



We have then reduced the video bandwidth to get a smoother trace:



Finally, we have restored VBW to its previous value and enabled trace averaging of the last 10 traces:

The first approach is *spatial* smoothing; it may not be as effective and it can increase the sweep time considerably, but changes in the spectrum are still displayed quickly. The second uses *temporal* smoothing; it gets smoother traces but changes in the spectrum may display gradually or get concealed.

For comparison, here's the same setup with attenuation set to 0 dB: