Crystal Selection

For Proper FSK Modulation

With Melexis Transmitter ICs

A crystal that meets FSK modulation requirements in terms of spurious suppression

- Closest crystal spurious response is more than 100kHz away from main response.
- All spurious responses are least > 10 dB below main response.
- FSK modulation at data rates higher than 5 kbits/s is no problem.
- FSK deviation can be ± 15 kHz and higher.

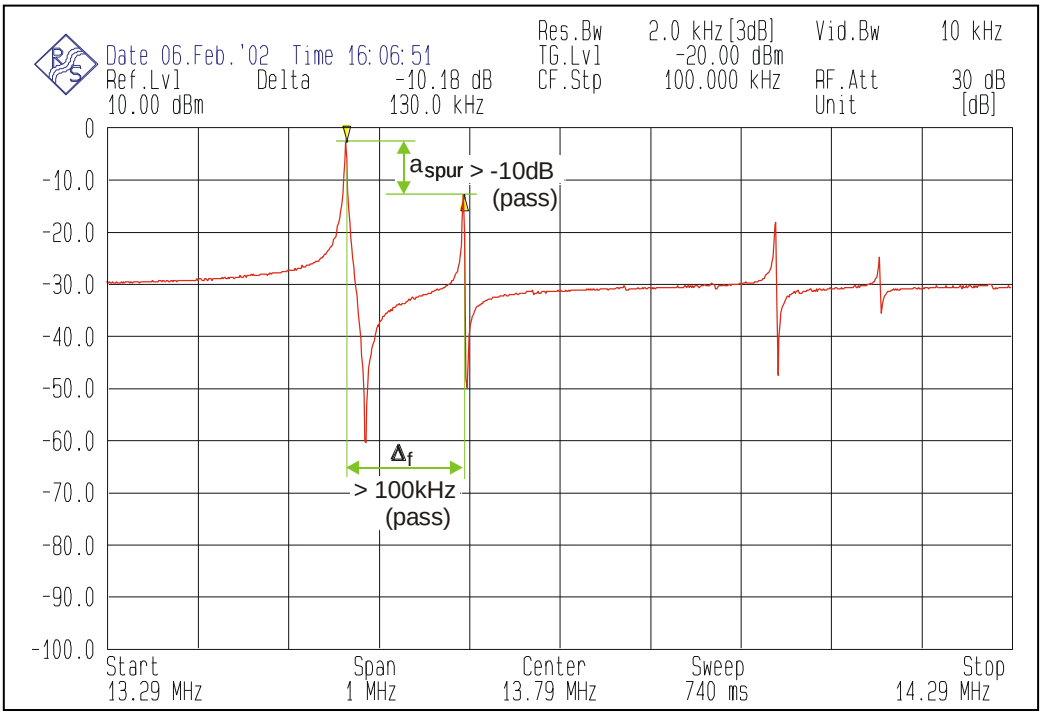

Figure 1: Crystal Type 13.56000 MHz / HC-49-SMD

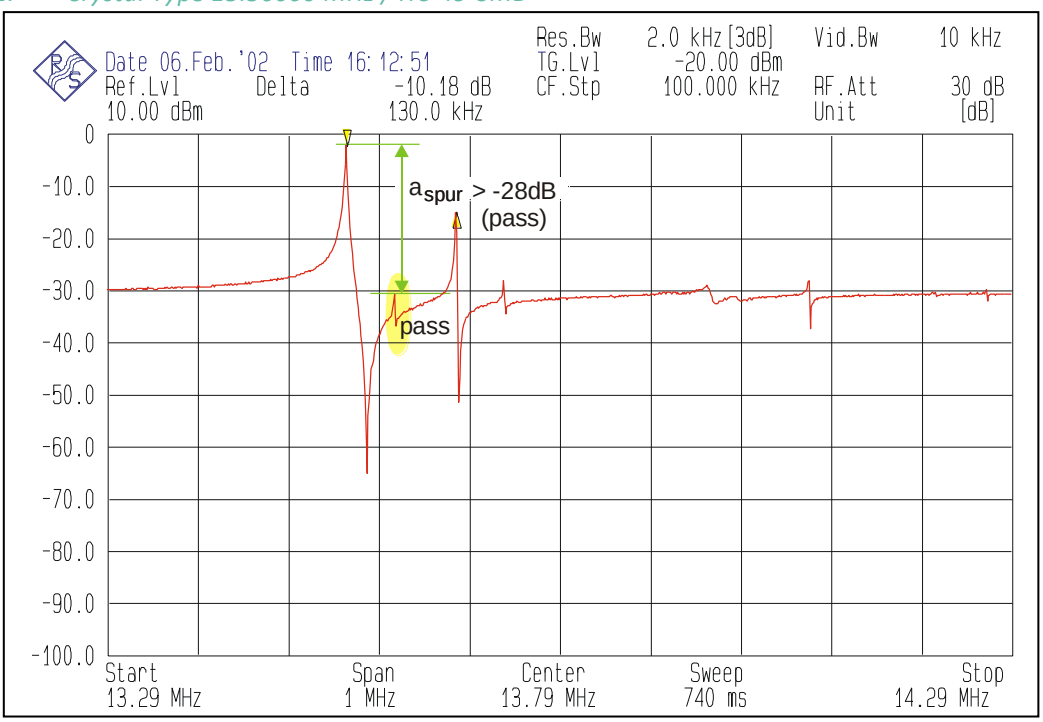

Figure 2: Crystal Type 13.56000 MHz / HC-49-SMD

Further Examples of proper crystals

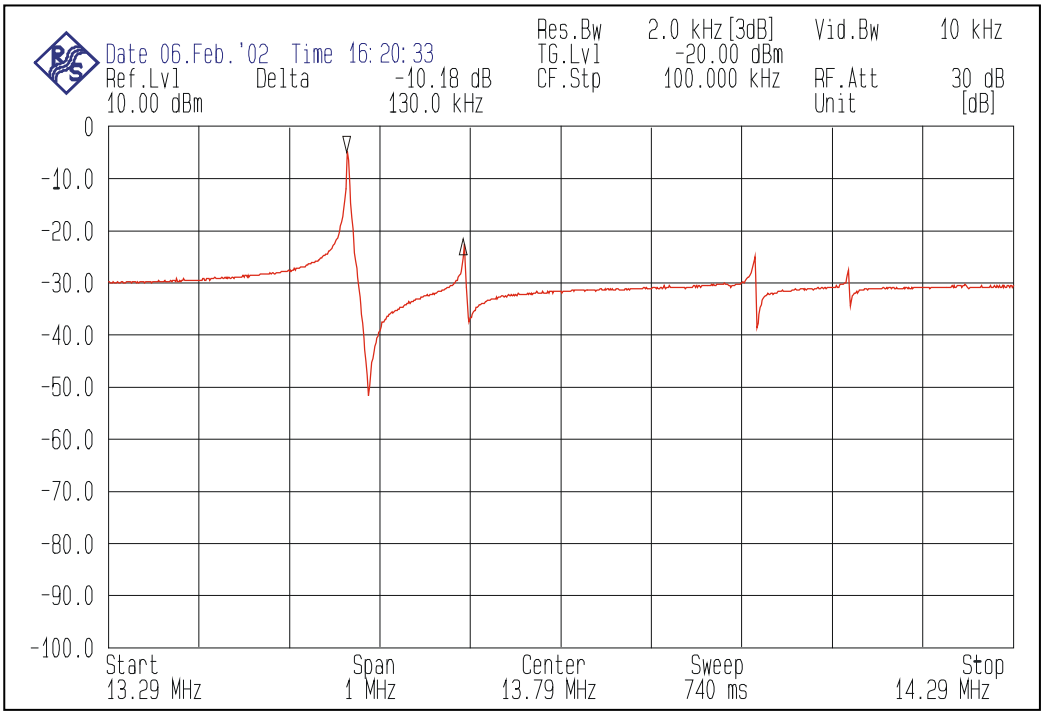

Figure 3: Crystal Type 13.56000 MHz / HC-49-SMD

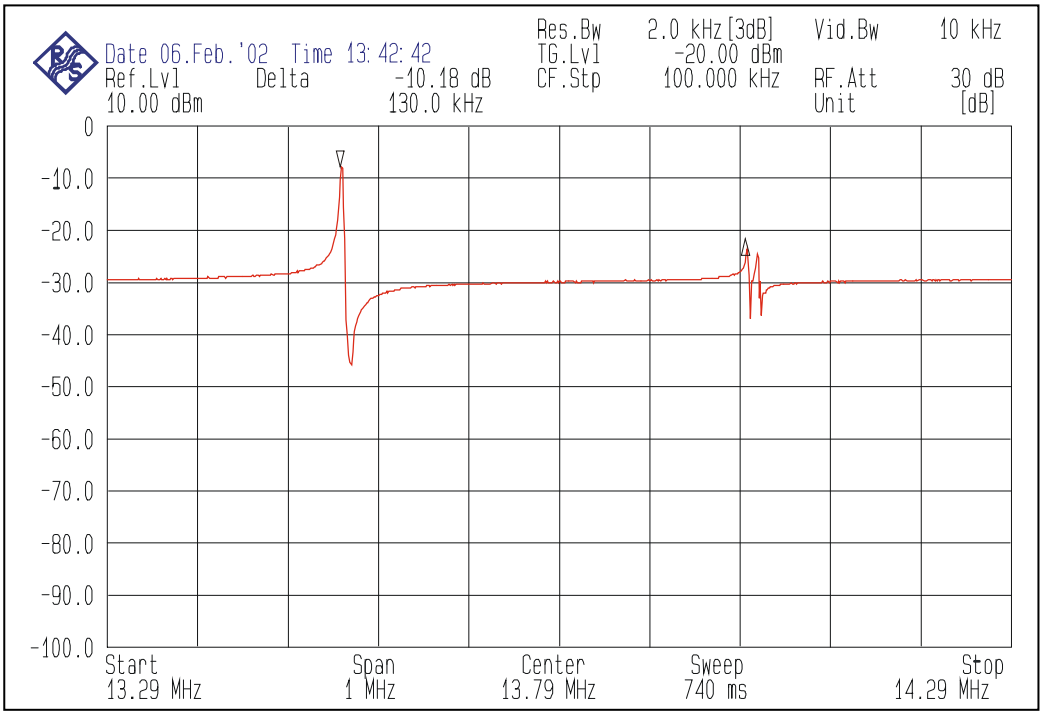

Figure 4: Crystal Type 13.56000MHz / 06-03-SMD

A crystal that allow for narrow-band FSK modulation only

- Closest crystal spurious response is too close to main response (falls within the 100 kHz limit)
- FSK modulation possible, but only at data rates lower than 5 kbits/s
- FSK deviation should not exceed ± 5 kHz

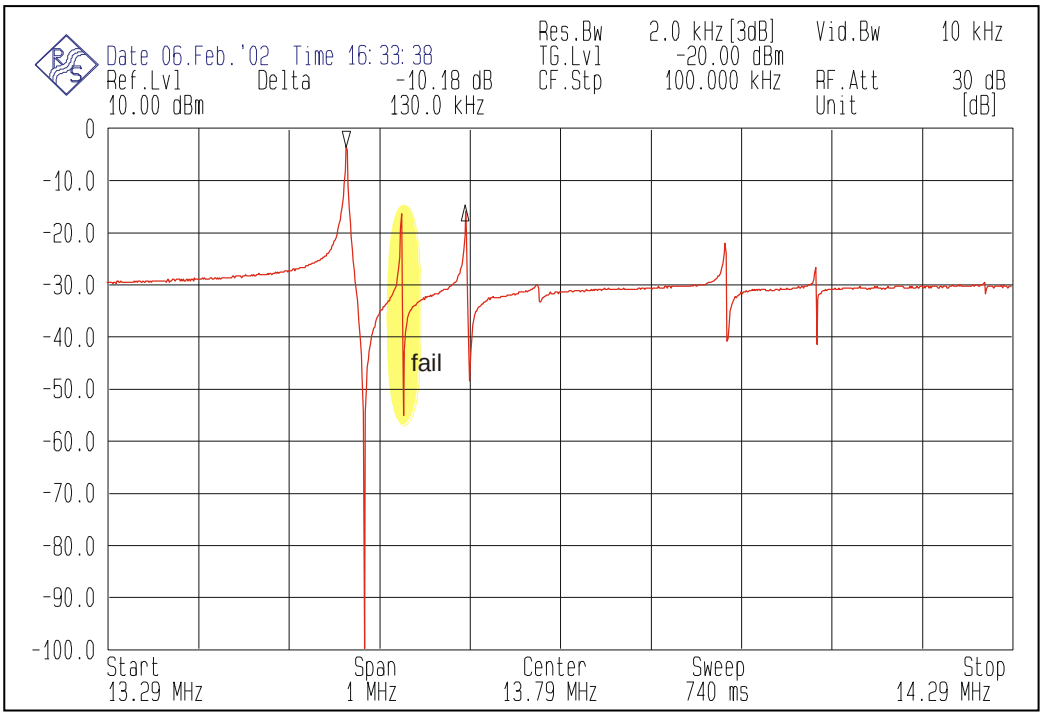

Figure 5: Crystal Type 13.56000 MHz / HC-49-SMD

Theory

The crystal response of figure 5 shows a significant spurious resonance not far away from the main peak. Based on the theory of FSK modulation via crystal pulling, a proper crystal must be spurious-free in the vicinity of the main response.

It can be read in the literature:
When using high modulation frequencies or fast digital modulation (typically over 10 kHz) there can be narrow band incursions and overshoots of the modulation index. This is caused by the interference of the crystal spurious responses with the side lobes of the Bessel spectrum of the frequency modulated RF signal. Therefore for low distorted modulation, the crystal should have no - or only very weak - side bands in the frequency range of f_0 +/- Δf_{mod},, so that interference with the 1st order Bessel lines will be prevented.

For a proper FSK modulation the frequency offset between main and spurious response should exceed 100 kHz.

Your Notes

Contact

For the latest version of this document, go to our website at www.melexis.com.

For additional information, please contact our Direct Sales team and get help for your specific needs:

Europe, Africa	Telephone: +32 13 67 04 95
	Email : sales_europe@melexis.com
Americas	Telephone: +1 603 223 2362
	Email : sales_usa@melexis.com
Asia	Email : sales_asia@melexis.com

Disclaimer