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Study of the calibration channel width for a Digital Sideband Separating system for SIS 2SB receivers

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Abstract

• Digital Sideband Separating (DSS):
  – Very promising concept for future (multipixel) heterodyne receivers.
  – Relaxes requirements for the Image Rejection Ratio (IRR) of analog receivers.
  – It improves the IRR substantially with simple hardware.
  – Ideal for spectral line surveys (it practically eliminates line confusion and atmospheric noise in the image band).
  – It is a potential option for a future ALMA upgrade.
• Recent work:
  – Applied to a full 2SB receiver (i.e. including the analog IF hybrid).
  – It allows reaching an IRR of 45 dB across the full band.
• Important question:
  – How wide should the calibration-channel width be in order to reach a desired IRR?  
  – It determines, for a large part, the calibration speed of the DSS system and influences the back-end architecture.

Concept of Digital Sideband Separating System

Implementation for ALMA Band-9 2SB receiver

Width of calibration channel to reach certain IRR level

Advantage compared to receiver without the IF hybrid

SUMMARY

- Digital Sideband Separating can strongly relax requirements for analog components of 2SB SIS receivers, providing at the same time the sideband rejection up to 40dB.
- Calibration stability proved stable on 24 hours and 9 mixer reset cycles (deflux, demagnetisation)
- The channel width of 46 MHz guarantees IRR above 30dB current ALMA receivers.

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