**Hittite Microwave**

14 to 16-bit Resolution scaling utilizing
HMCAD1520

Resolution scaling with HMCAD1520

✓ *When operated in Dual or Quad channel modes, the crosspoint switch can be utilized to resolution scaling*
✓ *This presentation focus on using resolution scaling to achieve 15 and 16 bits in Precision mode*
✓ *Resolution scaling is performed by connecting more than 1 channel to 1 single input with the cross point switch*
    ✓ *15-bit resolution is achieved by adding 2 14-bit outputs*
    ✓ *16-bit resolution is achieved by adding 4 14-bit outputs*
✓ *Resolution scaling will also work for High Speed Mode*
✓ *This presentation will show the performance enhancement obtained by resolution scaling*
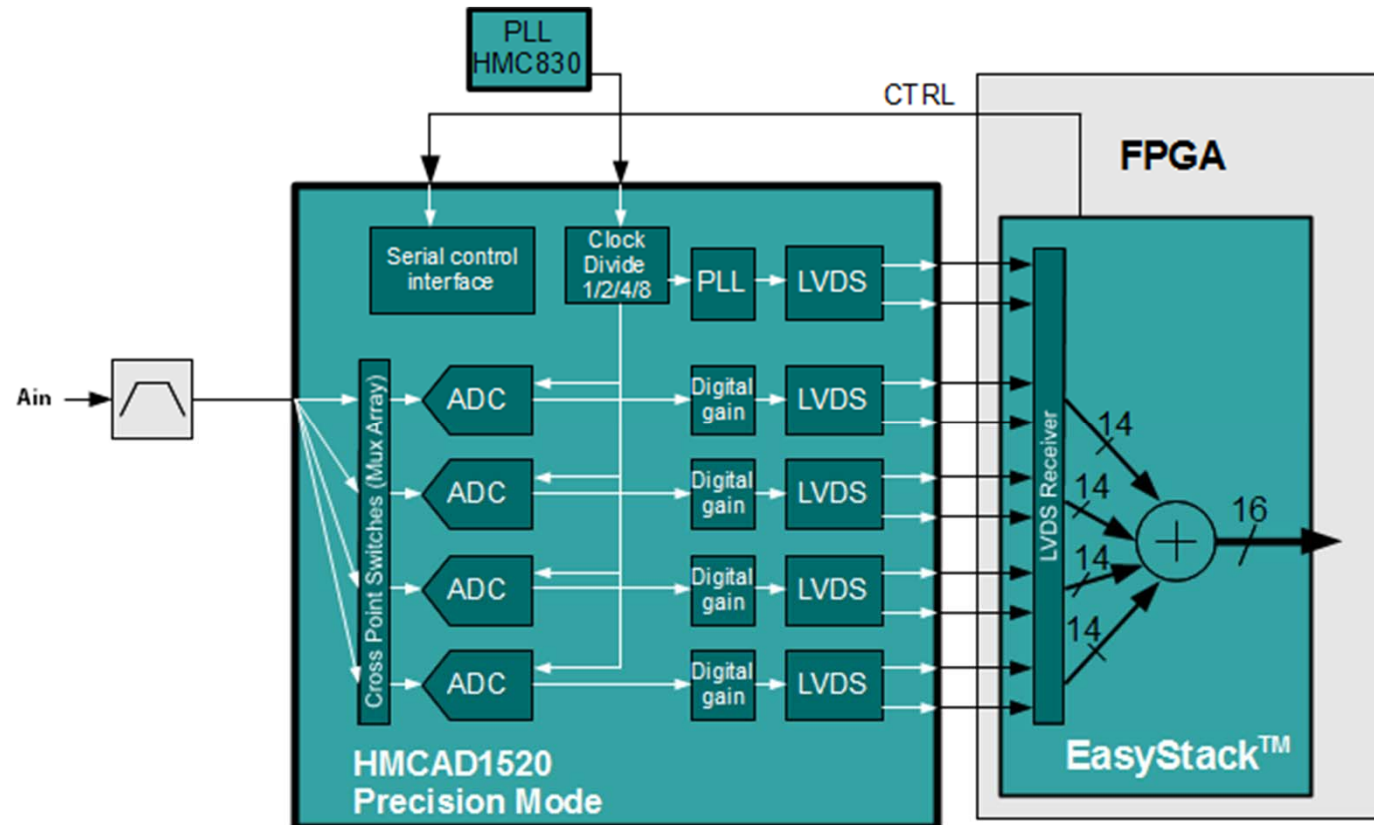
SNR and SNDR performance

✓ *When SNR and SNDR are limited by thermal noise, these parameters are expected to improve by 3dB every time the number of ADCs are doubled, which with the HMCAD1520 Resolution Scaling technique means adding one bit of resolution*

✓ *The measurement results show that the measured improvement is following the equation*

✓ *At 16-bit resolution HMCAD1520 will have >80dB SNDR up to 115MSPS, and 79dB at 122.8MSPS*
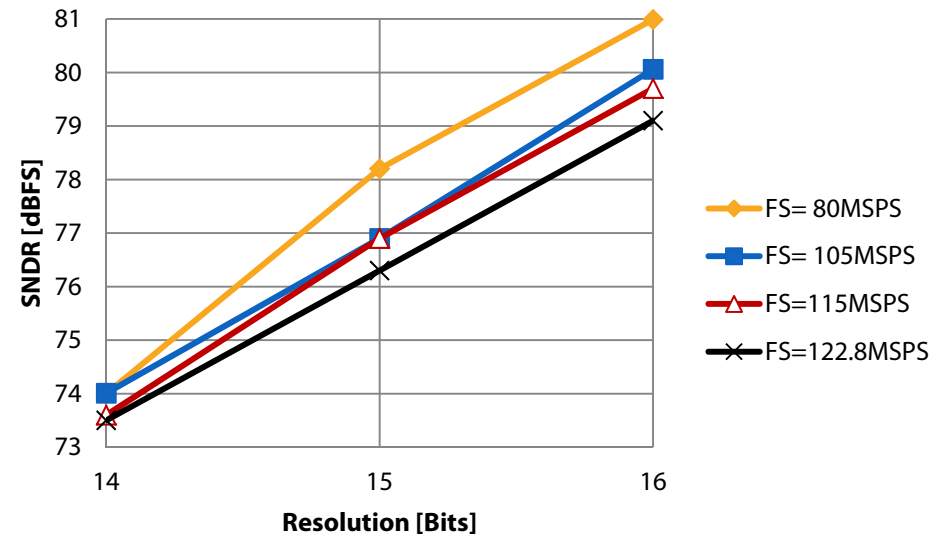
SNR vs Resolution
Fin=82MHz

SNDR vs Resolution
#### Fin=82MHz

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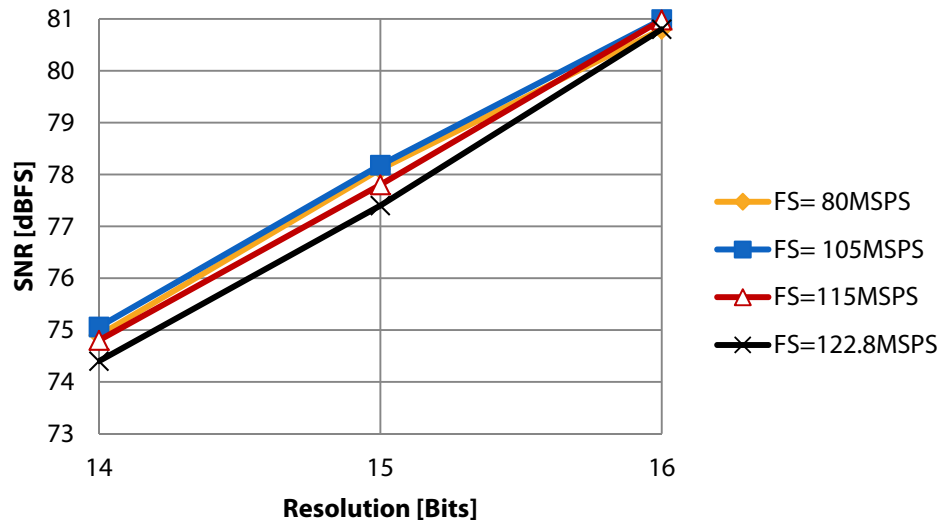
SFDR performance

✓ *When SFDR is limited by mismatch effects, it is expected to improve with 3dB per bit of resolution (as for SNR/SNDR)*

✓ *However, many effects can cause non linearity, and for high sample frequencies speed saturation will limit the resolution scaling gain*

✓ *At lower signal magnitude, the performance SFDR enhancement will be better compared to full scale signal*

✓ *For -1dB FS, resolution scaling gives clear improvement up to 105MSPS. At 115 and 122.8MSPS, the resolution scaling is improved*

✓ *When smaller magnitude is applied to the ADC (-20 to -10dBFS) the resolution scaling enhancement improves at 122.8MSPS.*
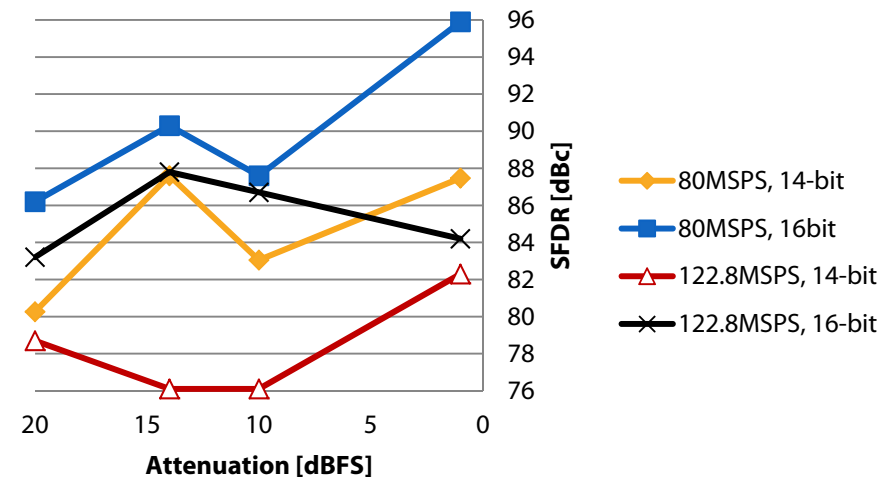

SFDR vs Resolution
**Ain=-1dBFS, Fin=70MHz**
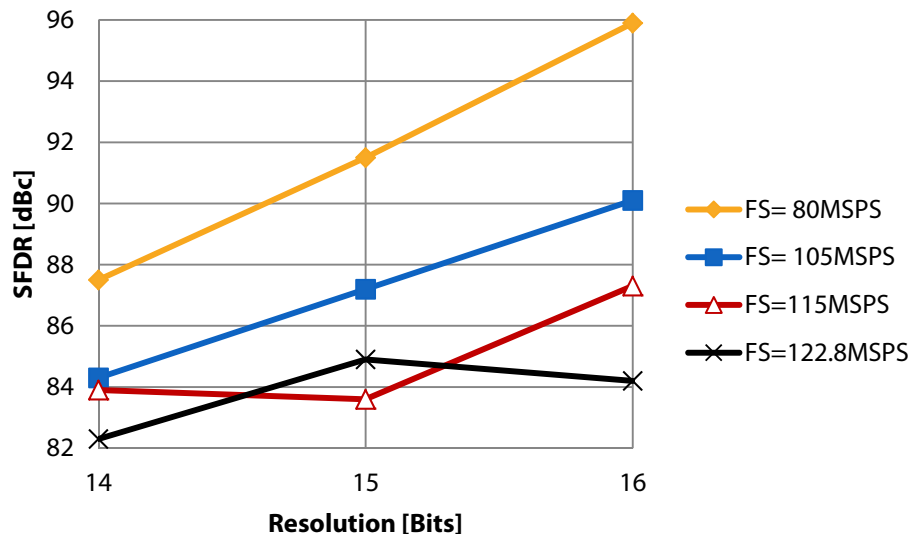
SFDR vs Signal magnitude
Fin=70MHz

Part Number	Function / Mode	Resolution (bits)	Sample Rate (MSPS)	Power Dissipation[2][3]	SNR (dBFS)	SFDR (dBc)	Package
HMCAD1520	High Speed Single Channel	12	640	490 mW	70	60 / 75 [1]	LP7DE
	High Speed Dual Channel	12	320	490 mW	70	60 / 78 [1]	
	High Speed Quad Channel	12	160	490 mW	70	60 / 78 [1]	
	Precision Quad Channel	14	105	603 mW	74	83	
	Precision Quad Channel	14	80	530 mW	75	85	

Features

✓ *Multiple Modes*
   - ✓ *Single channel 12-bit up to 640 MSPS*
   - ✓ *Dual channel 12-bit up to 320 MSPS*
   - ✓ *Quad channel 12-bit up to 160 MSPS*
   - ✓ *Quad channel 14-bit up to 105 MSPS*
✓ *SPI Configurable Operational Modes*
✓ *SPI Configurable Number of Channels*
✓ *1µs Switching Time Between Configurations*
✓ *Internal 1X to 8X Clock Divider*
✓ *LVDS output*
   - ✓ *Full robustness inn RSDS (Low Current) Mode*
✓ *Ultra Low Power Dissipation*
   - ✓ *Dynamic power vs sample rate scaling*
✓ *Coarse & Fine Gain Control*
✓ *48 Pin QFN Package*
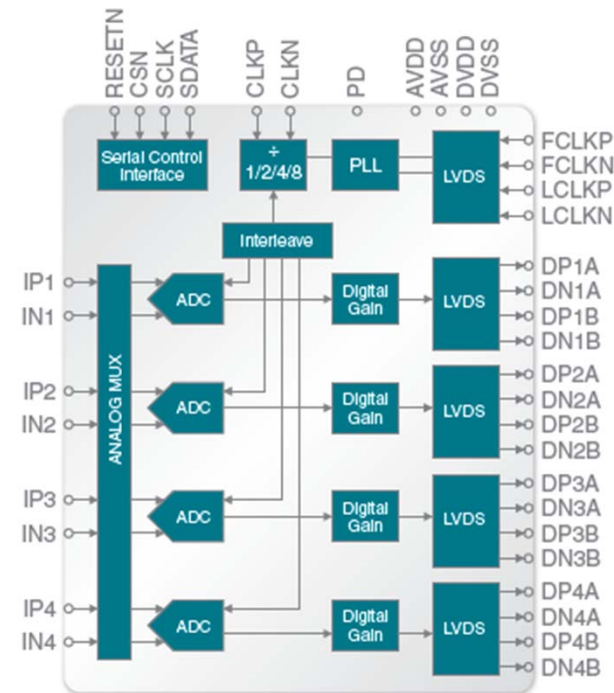
[1] Excluding Interleaving Spurs
[2] Supply Voltage (Vdd) +1.8 Vdc Analog Supply (Avdd) and +1.8Vdc Digital Supply (Dvdd)
[3] Output Supply Voltage (OVdd) +1.7 to +3.6 Vdc

Resolution scaling with HMCAD1520

✓ *It has been shown that for SNR and SNDR, the resolution scaling performance enhancement is very close to the 3dB/bit expectation*

✓ *>80dB SNR and SNDR is achieved at 16-bit level*

✓ *For SFDR the resolution scaling improves SFDR substantially up to 105MSPS*

    ✓ *Above 105MSPS, the reolution scaling enhancement is reduced for large signal input.*

    ✓ *For small input signals, SFDR is substantially improved vy resolution scaling*