

## Application Note

### Third Order Intercept Point Versus Sensitivity

DSI-600 EMI Test Measurement Receiver System

Application No. 1.01

### Third Order Intercept Point Versus Sensitivity

When comparing receivers, spectrum analyzers and RF amplifiers, the third order intercept point, which is a measure of the linearity, is an important factor, but so is the sensitivity.

Figure 1 describes the two parameters:

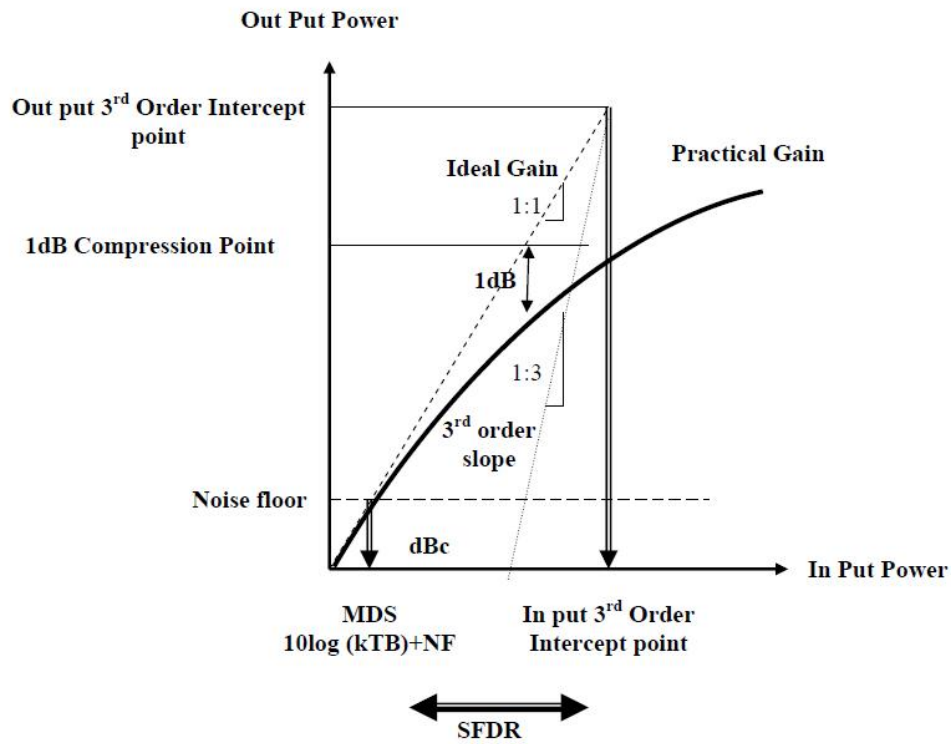


Figure 1. 3<sup>rd</sup> order Intercept point, 1 dB compression point, Spurious Free Dynamic range and sensitivity

When comparing two receivers, having about the same practical gain curve shape, but different sensitivities, the

3<sup>rd</sup> order intercept point (and other parameters) will be different too, as depicted in figure 2:

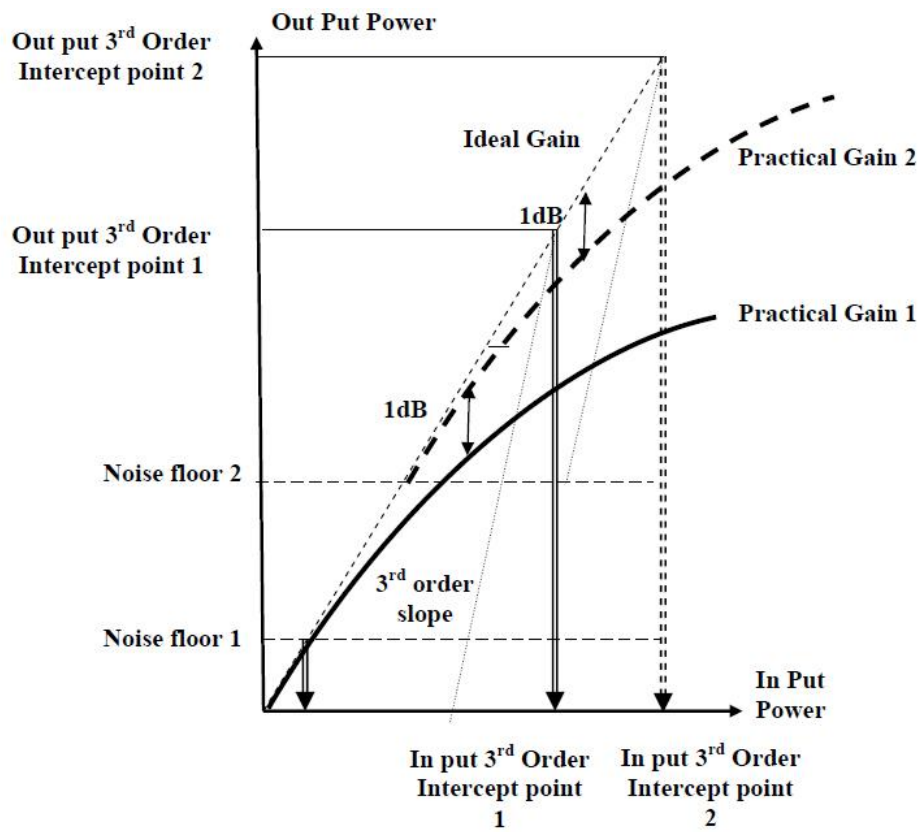


Figure 2. Comparison between the parameters of two receivers with different sensitivities

A receiver (1) with a better sensitivity=lower noise floor, will, in most cases, have a lower 3<sup>rd</sup> order intercept point than a receiver (2) which has lower sensitivity=higher noise floor., when the Spur Free Dynamic Range of both for this example is about the same.

## Comparison of DSI-600 and R&S ESIB in Receiver modes of operation typical values

**R&S ESIB** f<2GHz, Sensitivity @ BW=1kHz, -115dBm, with preamp, -130dBm  
2-40GHz, -100dBm, with preamp, -125dBm

<sup>rd</sup>  
3<sup>rd</sup> order intercept=+2dBm, with preamp, -18dBm

**DSI-600**, f<2GHz, Sensitivity @ BW=1kHz, -130dBm, no preamplifier.  
2-40GHz, -130dBm,

<sup>rd</sup>  
3<sup>rd</sup> order intercept to 2GHz=+0dBm, to 40GHz=-15dBm

It can be seen that even though the sensitivity of the DSI-600 is better by 15dB (typical) than that of the R&S ESIB without a pre amplifier, the <sup>rd</sup>3<sup>rd</sup> order intercept point of R&S is just 2 dB above that of DSI-600. This means that the spur free dynamic range of DSI-600 is better by about 13dB to 2GHz and about the same above 2GHz, when R&S ESIB requires a pre amplifier.

The tradeoff between sensitivity and <sup>rd</sup>3<sup>rd</sup> order intercept point has been explained here. The benefit of DSI-600 is in its sensitivity, without the need for external expensive pre amplifiers.