

# WHY INSTRUMENT DETECTION LIMIT IS A BETTER METRIC FOR GC/MS/MS PERFORMANCE

More Accurate Verification  
of the Complete GC/MS/MS System

Even though **Signal-to-Noise Ratio (S/N or SNR)** has been the industry standard for chromatography system performance for years, Agilent is leading the way for a new standard that provides a much more accurate and reliable performance metric for ultra-low noise GC/MS: **Instrument Detection Limit (IDL)**. Although SNR still holds value for most GC/MS applications where matrix sources of baseline noise can be easily measured, IDL is a better, statistically based performance metric that eliminates the uncertainty associated with low noise SNR.

## Why Agilent considers IDL a better industry standard

- **IDL follows the guidelines of many respected organizations.** IUPAC, USEPA and many other organizations use similar calculations to determine minimum detection limits for analytical methods.
- **IDL estimates typical performance from a series of automated injections, not a single manual injection.** A series of 8 consecutive measurements yields a more representative view of system performance. IDL demonstrates the repeatability that you need for your methods.
- **IDL is based upon well established statistical formula.** Using a 99% confidence interval, Student-t test is applied to the %RSD from 8 consecutive injections to calculate IDL.
- **IDL is not biased by clever manipulation of the ultra-low noise baselines.** Today's high-performance mass spectrometers demonstrate very little or no noise for a simple standard like 100 fg/ $\mu$ L octafluoronaphthene (OFN). Noise measurements for these simple standards are not consistent, and the calculated SNRs have questionable validity. IDL eliminates this source of variability.
- **IDL confirms performance of every component in the GC/MS system.** A series of automated injections confirms the precision of every component in the GC/MS from the autosampler and inlet to the mass spectrometer. All the instrument components that you use for your methods are tested as a completely integrated system.
- Learn more about the science and statistics behind IDL here: [www.agilent.com/chem/IDLtechnicaloverview](http://www.agilent.com/chem/IDLtechnicaloverview)



- Do you use RSD to check your analysis?
- Do you report your analysis result as detected amount instead of signal to noise?
- Is repeatability critical to your results?
- Do you want system-installation checkout to be more aligned with your daily analysis?
- Do you want complete confidence that your system will provide similar results every run?
- Is low concentration measurement variation in your analytical result important to you?

Then IDL based on area RSD is for you. **Read on.**



## Answers to Frequently Asked Questions

### When is Agilent making this change to IDL from the tradition of Signal to Noise?

The ultra-low noise 7000B Triple Quadrupole GC/MS will be the first Agilent MS system to use IDL as the primary sensitivity performance specification. SNR will still be listed for the system, but Agilent will no longer emphasize SNR as a good metric to evaluate or compare performance. 7000B instruments installed on or after November 15, 2011 will be validated using the IDL test criteria under EI-MS/MS mode.

### Can you show me an example why IDL is a better metric than SNR for ultra-low noise MS/MS?

Figure 1 shows 8 consecutive injections of 1 µl, 100fg/µl OFN. The peaks virtually overlap and the baseline noise is very low for every plot. Calculating SNR for each of the 8 OFN injections yield:

Minimum SNR = 2480  
Maximum SNR = 244035  
Average SNR = 39996  
SNR RSD = 207%

Visual inspection of the response of the 8 injections would not indicate a factor of 100 fold difference in SNR. But a small difference in the ultra low noise baseline can result in extreme difference in the calculated SNR, making it a poor measure of instrument performance. The SNR RSD is 207%, indicating that the SNR measurement is out of control, and the values generated are not reliable.

### What if I still want to see the SNR?

SNR can always be calculated for each injection of the OFN standard, but Agilent Customer Engineers will use the result of the IDL calculation to confirm appropriate system performance. Since IDL requires precise injection technique, IDL can only be performed when an autosampler (ALS or PAL) is present. If no autosampler is present, manual injections and calculated SNR will be compared against the secondary reference specification.

### Will IDL be measured on my GC/MS at the time of installation?

IDL will be used in the Manufacturing Final Test and during installation at your laboratory. Each of your system's components (autoinjector, inlet, column oven, GC pneumatics and MS) will be tested as an integrated system.

For the Agilent 7000B Triple Quadrupole GC/MS, the area RSD is specified at less than 4%, which calculates as an IDL 12 fg OFN.

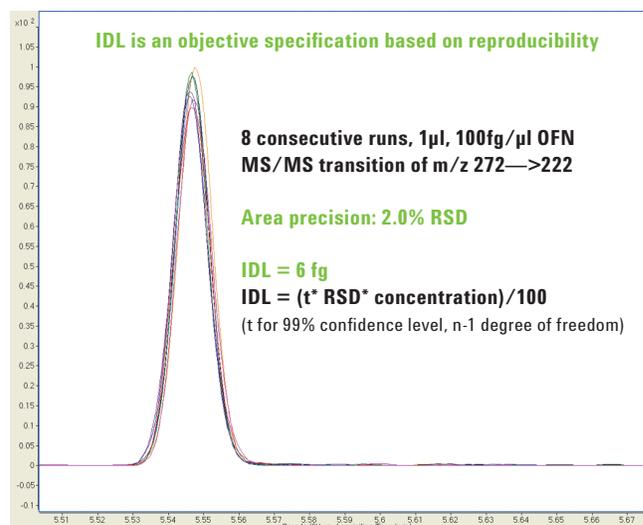


Figure 1. In MS/MS baselines with very little noise, the dubious selection of the noise region highly influences and inflates the S/N values. IDL is a true reflection of the whole system performance and a more accurate expression of achievable detection limit than the customary S/N specification.

### Will other Agilent mass spectrometer change to the new IDL specifications?

When a stable, certified, low concentration standard for PCI mode is available, PCI MS/MS will be validated against an IDL reference specification. Other instruments like the 7200 GC/Q-TOF and 5975C will also be phased into the IDL specification in the future. Watch for these changes in each instrument's specification sheet.

[www.agilent.com/chem/IDLtechnicaloverview](http://www.agilent.com/chem/IDLtechnicaloverview)  
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