iSEMcon EMX-7150 Measurement Microphone

Photo 1: My own well-used EMX-7150.

Is it possible to have a Class 1 frequency response measurement microphone for a reasonable price? Get to know the EMX-7150 from iSEMcon, which offers trusted, affordable measurements.

By
Bennett Prescott
(United States)

The EMX-7150 is a 0.25" capsule omnidirectional measurement microphone with Class 1 frequency response from German manufacturer iSEMcon GmbH. It features a stainless steel body, a water-tight XLR connector, and low output impedance for driving long cables. Phantom power operation from 12 to 52 V means it can be used with essentially any power source, including wireless systems. Each serial-numbered microphone comes in an attractive carrying pouch with a mic clip and serialized calibration data on a USB drive. Available from the manufacturer in matched pairs, triplets, and quads, it lists in the US for $346.

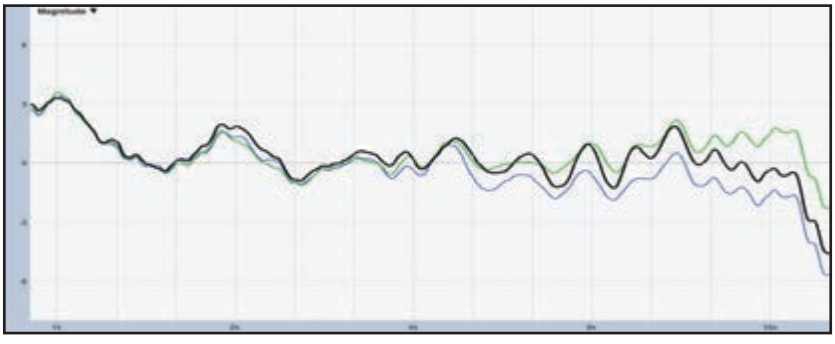

Figure 1: This high-frequency response compares the measurements of the same speaker, using three different microphones. The results of the EMX-7150 is shown in black.

The Design

The microphone's design is carefully targeted to professional users. The 0.25" capsule diameter fits in most calibrators, and a 0.5" calibrator adapter is included. The long neck prevents microphone stand and clip reflections from affecting the measurement, and the 0.75" microphone body fits in many clips and shock mounts. Sensitivity of 6 mV/Pa matches that of industry standard microphones from well-known European and Japanese manufacturers. Its sturdy construction is designed to provide decades of reliable operation, even when used outdoors and transported frequently.

I first became aware of the EMX-7150 while looking to replace an inexpensive microphone I'd dropped. At the time, I had two kinds of microphones: $80

models that I used for field measurement specifically in case they were damaged, and a matched pair of $2,000 laboratory-grade microphones with titanium diaphragms. The former couldn't be trusted for absolute measurements, and the latter were too precious to use except for calibrating control room monitors where there was little risk of being disturbed. While talking with the folks at Rational Acoustics (the manufacturer of the industry-standard Smaart acoustic measurement software) about a replacement, they mentioned having seen excellent results—including batch-to-batch consistency—from this affordably priced German microphone. On their advice, I added one to my collection (see **Photo 1**).

The Application

My primary interest when judging any microphone is its application to the measurement of concert sound reinforcement systems. This work has taken me everywhere from small music clubs with a few speakers to outdoor line array systems and delay towers covering thousands of feet. The key in any of those situations is to simultaneously compare frequency response at different audience locations to see the effects of equalization and alignment decisions in real time. I run multiple microphone inputs at once, not only to save a lot of running around, but also to get a better picture of low-frequency buildup around a space. Since I usually bring four microphones with me, you can imagine my interest in a trustworthy, calibrated microphone that doesn't cost as much as a used car.

The first thing I did after receiving the new EMX-7150 was compare it to my existing microphones. A quick semi-scientific test is to measure a loudspeaker with reasonably flat frequency response from the same position with each microphone. Deviations in response between the measurements will demonstrate what "EQ" each microphone is applying to the measurement. By comparing to a known baseline, I can see where the new microphone lies.

Figure 1, a screen capture of my measurements, shows that all three microphones have similar frequency response to around 4 kHz. After that they begin to differ. The EMX-7150's response fits right between my least expensive microphone (green) and my best microphone (blue). If I take my best microphone as the baseline, then my inexpensive microphone is about 3 dB hot at 16 kHz, which means if I took its measurements as gospel I would tend to equalize a bit dark.

If an $80 microphone can offer frequency response similar to a cost-is-no-object microphone, you may ask: Why spend more? The easy answer is you may not want to. Using multiple microphones is a huge boon to system technicians, and being able to afford many channels of good-enough microphones is fantastic. On the other hand, there are advantages to the more expensive iSEMcon microphone that are not indicated by its frequency response alone. In many aspects, the EMX-7150 bears more similarity to expensive microphones than it does those that cost less.

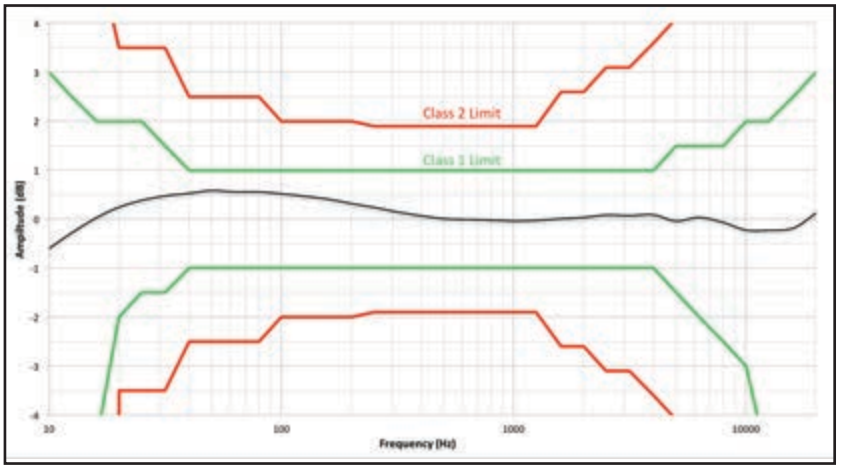

Figure 2: The EMX-7150 frequency response (black) is compared to the IEC61672 Class 1 (green) and Class 2 (red) tolerance limits.

EMX-7150 Performance

One of the first failings of an inexpensive microphone is distortion. It is not uncommon for me to take measurements at concert sound pressure levels (SPLs). Subwoofers, especially, may subject the microphone to energy in excess of 130 dB. Our ears are much less sensitive to these frequencies, so that kind of output isn't objectionable to the technician. But to the microphone, 30 Hz is the same

Photo 2: The EMX-7150 microphone is being used during the setup for a Zac Brown Band concert at Comerica Park in Detroit, IL. (Photo courtesy of Chris Demonbreun)

as 3 kHz when it's being driven to overload. My $80 microphone begins to exhibit significant distortion at about 100 dB, which coincidentally is about the same point my iPhone's mic begins to distort. So, I can't trust its frequency response if it's any louder than that. The EMX-7150, on the other hand, only exhibits 4% distortion at 145 dB, which is probably enough for any application I can imagine using it in!

Another area where the EMX-7150 really shines is consistency. iSEMcon rates this microphone as having a Class 1 frequency response, a stringent standard used around the world for instrumentation microphones. **Figure 2** shows the limits imposed by this certification. The EMX-7150's response is in black. Each vertical division in this graph is just one decibel. In fact, this microphone is so flat that I don't bother using the supplied calibration curve.

Photo 3: The iSEMcon EMX-7150 microphones were used during the setup for a Zac Brown Band concert. (Photo courtesy of Preston Soper)

Most importantly, every EMX-7150 ever made conforms to this specification. I can trust that my microphone will match someone else's, or one bought years ago, so I don't have to worry about deviations between microphones affecting my results. If that's not enough, when iSEMcon ships matched sets of microphones, it certifies that every microphone will be within ±0.5 dB of any other.

Diaphragm aging is another issue that you won't find on the specification sheets of many microphones. Outside of physical damage, how long can I trust the microphone's response to stay within specifications? What if I put on a waterproof windscreen and leave the microphone outside in the elements for years to measure SPLs at a concert venue? This kind of environmental testing is expensive and time consuming, so results aren't available for most lower priced microphones.

Fortunately for us, the EMX-7150's capsule has been extensively tested. An example was kept in a climate-controlled environment for more than 28 years. When tested, it still met current production specifications. Accelerated humidity and temperature testing has estimated that, after being exposed to an outdoor environment for 30 years, the capsule will lose 3 dB of sensitivity. This seems like a high level of scrutiny for my needs, but I am impressed that this microphone is really up to laboratory standards.

So, what's the catch? How can a microphone held to these high standards be so reasonably priced? It comes down to the material that forms the diaphragm. The Class 1 specification extends beyond frequency response, demanding high sensitivity and low self-noise, and requires even greater stability in extreme temperature and humidity. The complete specification can only be met by diaphragms made of metal. The best microphones are usually titanium. Metal diaphragms can provide response within 0.1 dB from -20°C to over 100°C, in 20% or 100% humidity, and show less than a 1 dB change in sensitivity over hundreds of years.

The Diaphragm

Like almost every measurement microphone priced less than $1,000, the iSEMcon EMX-7150 is based around a plastic diaphragm electret condenser capsule. The plastic is manufactured with the tightest tolerances, and pre-aged to ensure the microphone

About the Author

Bennett Prescott is the North American Sales and Operations Manager for B&C Speakers, a professional audio transducer manufacturer. He is also co-founder of SoundForums.net, a pro audio discussion site. He lives in Boston, MA, with his tolerant wife, zero dogs, zero cats, really great speakers, and a lot of hiking and camping equipment. You can reach him at bennettprescott@gmail.com.

will continue to provide factory new performance for decades, but there are limitations to how durable even the best plastic diaphragm can be. Exposure to very high temperatures (e.g., those found on the dash of a car in the middle of summer) could permanently change the microphone's response by melting the plastic. Contrary to popular belief, plastic also absorbs atmospheric moisture so response will change in high-humidity environments. For my needs, these constraints aren't a big concern, a little caution keeps my microphones out of extreme temperatures. Also, changes in humidity will affect my microphones equally so my measurements will all track together.

The Results

Of course, the above caveats apply to all plastic diaphragm microphones at any price point. That includes my $80 microphone as well as the EMX-7150, and all models manufactured by a very well-regarded manufacturer from New Hampshire. If your measurement will be used in a court of law or needs to be absolutely comparable over decades, you should probably consider spending the money to get a true Class 1 microphone that is designed from the start for extraordinary stability.

For myself, and almost everyone working in professional audio, the EMX-7150 represents an extraordinary value. After hundreds of hours of field use, I trust this microphone as much as my more expensive metal diaphragm microphones. In fact, I have sold them to purchase more of the iSEMcon units.

This microphone fills a much-needed niche between microphones of questionable quality from the Far East and truly instrumentation-grade microphones that you'd have to take out a bank loan to fill your measurement rig with. As a result, the EMX-7150 can be found in some of the world's finest concert venues (see **Photo 2**) and the gig bags of some of the world's best system technicians (see **Photo 3**).

If you're looking for an affordable first-rate measurement microphone, I suggest you give it a try. For more information about the EMX-7150, visit www.isemcon.net/en/emx-7150.htm. To purchase the iSEMcon EMX-7150 in North America, contact Rational Acoustics at www.rationalacoustics.com/store/microphones.html.