

10-INCH SUBWOOFER COMPARISON »

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AND ELECTRONICS



High-end
Car Audio

Alpine SWX-1242D

MOREL

» Art, Technology and Sound

ELATE 6



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MOREL ELATE 6

» Art, Technology and Sound

TEST REPORT *alberta*

TEXT BY PATRICK TURNMIRE & ERIC HOLDAWAY + TESTING BY REDROCK ACOUSTICS + PHOTOGRAPHY BY CASEY THORSON

Morel introduced their Elate series with a statement that they are designed to “maximize sound quality without compromising style.” Stylistically, they certainly achieve that goal. The series features a zoomy woofer with Morel’s famous 3” coil and internal motor design integrated into a very open basket that resembles the control tower at LAX; grilles that follow the basket cues with a very open and fresh design; one of the best looking tweeters I have seen in car audio—swooping lines, easy to install and obviously high-quality materials; a very impressive and artistic crossover that uses the same open, ribbed cosmetics as in the woofer and grille; even the packaging, which uses a corrugated cardboard box turned inside out, is cool.

So the industrial design is absolutely top notch, but how do they perform?

IN THE LAB

My testing starts with “small signal parameters” for the woofer. Some engineers, including myself, question the validity of traditional small signal parameters. This test is usually done at very small voltage levels (hence the “small signal”). This is so that the speaker is in its (theoretically) most linear range for the test. The coil is centered in the gap, compliance parts are at their most linear, and the coil isn’t getting enough current to make it get warm and change the wire resistance. The problem with this test method is that it doesn’t actually reflect how the speaker is used. For a small signal test on this woofer, the highest voltage that produced acceptable levels of distortion was 0.2 volts.

Of course, 0.2 volts (0.01 watts) is not consistent with how we use speakers, so is it really valid to use these measurements for performance predictions? The answer is an obvious no! This is because the physical aspects of a speaker that drive these parameters are changing over the operating range of the speaker. Two key values, Bl and Cms (representing magnetic force and the speaker’s compliance), change dramatically as the speaker moves. Bl drives Qes , Qts and efficiency; and Cms drives Fs , Vas and efficiency.

Parameter	Small signal 2.5 watts
Re (Ohms)	3.69
Qms	0.95
Qes	0.36
Qts	0.26
Fs (Hz)	35.9
Vas (l)	28.95
Cms	1.45
Efficiency at 2.83 volts (dB)	87.7

The following chart shows a comparison of traditional small signal measurements for the Elate 6 woofer and the start of large signal values taken at 15 watts.

These differences are at the two extremes of performance, but it is easy to see how much the parameters vary over the working range of the speaker.

Klippel offers another way to look at “small signal.” Instead of a maximum distortion limit, it looks at a point where the speaker is *most* linear over its working range. This is much closer to the average operating range of the speaker and the parameters fall between the two extremes in the chart above.

For the Elate 6 woofer, these values are taken at 2.5 watts and are listed in the chart below.

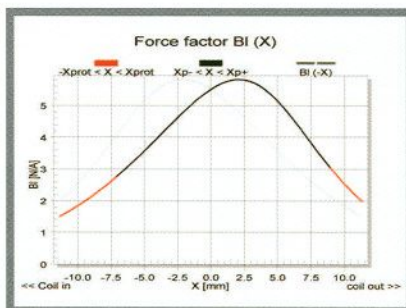
So how do these stack up?

Really low Qts means a very flat and dry

Parameter	Small signal 0.01 watts	Large signal 15 watts
Qms	1.31	0.7
Bl	5.63	5.51
Qes	0.39	0.32
Qts	0.30	0.22
Cms	0.94	1.93
Fs (Hz)	44.5	31.1
Vas (l)	18.91	38.57

and 2) show really terrible centering and symmetry. This means that the suspension is probably shifted back in the basket from its ideal point. A quick look at the spider on the woofer confirms that the spider is dished in. Typically, this is a sign that the mechan-

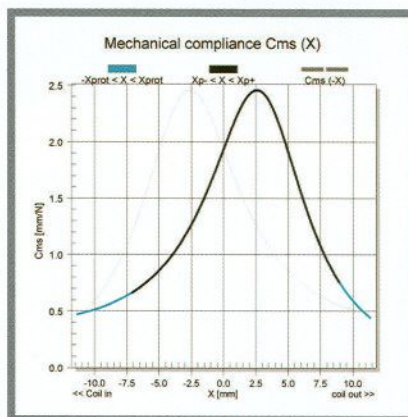
My testing setup has changed dramatically with the addition of the Klippel Distortion Analyzer. I still use the ACO Pacific 1/4” microphone, lab amplifier and IEC baffle; however, all of the testing is done through the Klippel now. It is the “be all, end all” analysis tool for the loudspeaker engineer. You can test: distortion in any flavor you want, *non-linear* Thiele Small (T/S) parameters, impedance at any voltage and of course *simple* frequency response (with any input signal you can imagine). The Klippel is revolutionizing loudspeaker design in virtually every application. Check it out at www.klippel.de.



Graph 1

response. These speakers aren’t going to have much boom, but with an Fs of 36Hz they are going to have a good sense of bass at least up to their excursion limits (more later). The efficiency of 87.7dB is quite good. Ultimately, the low frequency performance of a speaker is best judged by how linear the Bl and Cms are over the working range of the speaker. This can easily be seen in the $Bl(x)$ and $Cms(x)$ curves generated by Klippel. Both of these curves should be centered on the 0 point on the X (mm) axis and have essentially the same shape on either side of this point. The dashed lines on the graphs are the mirrors of the actual test and make it easy to see if the curves match the ideal.

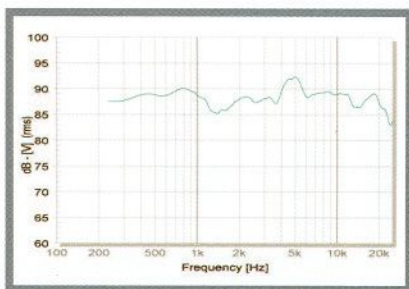
Both the $Bl(x)$ and $Cms(x)$ curves (see Graphs 1



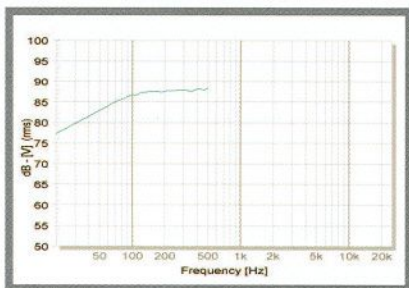
Graph 2

ical parts don’t fit together correctly after they have been broken in. This asymmetry will cause significant distortion at relatively low levels. It’s not clear if we can hear asymmetrical distortion; however, the speaker’s performance would be improved if this problem were corrected.

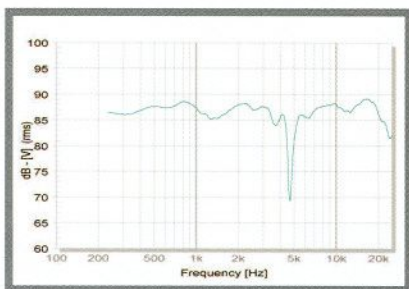
The $Bl(x)$ and $Cms(x)$ curves can also be used to predict the maximum excursion for the speaker ($Xmax$). Klippel defines the $Xmax$ as the point at which the compliance or Bl nonlinearities create 10 percent harmonic or intermodulation distortion. For



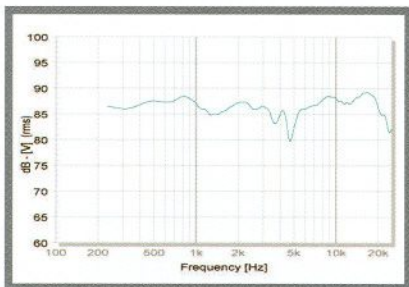
Graph 3



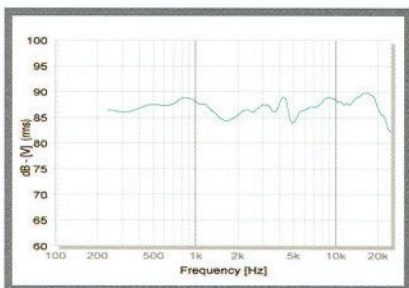
Graph 4



Graph 5

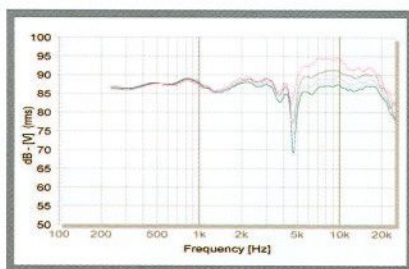


Graph 6

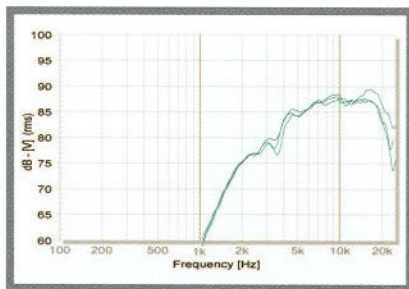


Graph 7

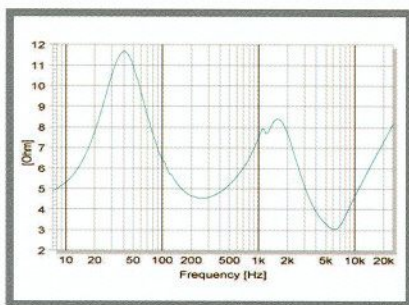
BI, this happens when the BI has dropped to 82 percent of its $x=0$ value (XB) and Cms has dropped to 75 percent (Xc). For the Elate 6 woofer, the XB point is 2.7mm and the Xc point is 1.7mm. If the dish problem were to be resolved, these values would be very close to the 4.2mm values listed in the owner's man-



Graph 8



Graph 9



Graph 10

uals.

Another factor influencing the quality of a woofer is its non-linear inductance. Like $Bl(x)$ and $Cms(x)$, the inductance of a speaker changes as it moves. This can actually have as great an influence on the perceived sound quality as $Bl(x)$ and $Cms(x)$. This value can also be related to where it causes 10 percent distortion and is defined as Xl or $Xmax$ limited by inductance. A conventional speaker may hit this limit after 1mm or 2mm excursion. The Elate 6 uses a motor structure that greatly reduces the inductance change. The Xl value for the Elate is greater than 7mm.

I tested the speaker's frequency response on-axis and 30 degrees off-axis with the speaker to the side and on top. This gives a good approximation of how well the speakers can be expected to work within their huge range of mounting positions. If you can make them work well in all of these tests, you should be able to do the same in your car.

The Morel crossover features woofer/tweeter crossover options of 6dB/6dB, 6dB/12dB, 12dB/6dB and 12dB/12dB. It also offers tweeter level adjustments from +4 to -4dB. This should be enough range to get an ideal response in pretty much any install.

For the on-axis response I got the best response with 12dB/12dB, reverse tweeter phase and -4dB tweeter setting (see Graph 3). The response was also good with the 6dB/6dB, tweeter in-phase with the attenuation set at -4dB, but I was concerned about using such a shallow crossover slope (6dB) on the tweeter.

(Note that all of the responses are shown from

200Hz to 25kHz, as this is the limit of the IEC baffle used for testing. The response below this range is typically very linear and can be tested using near-field technique as shown with this graph.)

The 30-degree off-axis response with the tweeter mounted next to the woofer showed a very interesting dip in the 12dB/12dB response that, at first, looked like a phase cancellation at the crossover point (see Graph 5). I tried reversing the phase and this caused a much larger problem. The cause of the dip appears to be an interaction between the woofer and tweeter's relative time delay. As a testimony to the versatility of the crossover, you can see that it is reduced in the 6dB/12dB configuration (Graph 6) and eliminated in the 6dB/6dB configuration (Graph 7).

The bottom line is that you can achieve a smooth response by using the options available in the crossover. Doing this by ear will be almost impossible. Go to a good specialty shop that has an RTA and have it done for you.

The tweeter attenuation graph shows that the steps are not really 2dB as stated on the crossover (see Graph 8), but the total range is +/- 4dB. The tweeter also features the ability to aim the response using its plastic housing. There is a significant change in the response above 10kHz, with the smoothest response with the lower side farthest from your ear, exactly the opposite of what I expected.

Finally, the system impedance response (see Graph 10) has a significantly low spot of 3 ohms at 6kHz. Most amps should handle this well, but be careful about using two sets in parallel on an amp with a recommended minimum impedance rating of 2 ohms.

RESULTS

On-axis response	7
Off-axis vertical	8
Off-axis horizontal mount	8
Flexibility (above 3 average)	7.6
XBI	4
XC	4
Distortion	6
Parameters	7
Total (out of 80)	51.6

With the exception of the dished parts causing the XBI and XC problems, I think this component set is pretty sweet. It looks great and the testing shows that it should sound great too. I will be curious to see what Eric thinks about the bottom end. It's a lot lower Fs than usual car speakers and the very low Qts means it will be very dry. I will also be curious if you can hear the distortion caused by the dished parts. So, Eric, how does it sound? —PT

SUBJECTIVE

This month I spent a great deal of time listening to and playing with the Morel Elate 6 2-ways. This 6 1/2" woofer and 28mm tweeter combo is one of the new "rare air," top-of-the-line separate systems that are being introduced with a retail price of \$1,150 a set. They are very impressive in a number of areas with a system power handling of 200 watts RMS and the woofer has an amazing 1,000 watts of maximum transient power handling! Wow!

INSTALLATION

While the Elate 6 isn't your typical 2-way component set, it does consist of a pair of woofers, tweeters and crossovers. Each of the 6 1/2" woofers has a massive 3" voice coil submersed into the motor struc-

ture that is entirely contained within the "Uniflow" frame. Their mounting depth is a moderate 2.37" so they should be shallow enough to fit into most vehicle doors.

In reproducing the high frequencies, the pair of MT-23 tweeters was simply beautiful. Morel uses a 28mm soft dome coated in what the company calls Acuflex. The mounting options are widely varied; they come with a flush mount and two surface mounts. Because the tweeters do not use an "eyeball" type of mount, the two surface options Morel supplies use a 30-degree and a 60-degree angle, respectively, to improve sound quality and imaging.

Morel's MX-22E crossover is designed to be very flexible in its applications. The system can be wired to a 2-channel amp with a standard hook-up by using the supplied jumpers to tie the highpass and lowpass together. It can also be hooked up in a bi-wire alignment or even a full bi-amplified system. Within the crossover, Morel incorporated up to 8dB of tweeter level adjustment, 4dB up or down! And if that is not enough for you, Morel has gone even further by giving you the option to adjust the crossover slope between a first order (6dB) and a second order (12dB) on the highpass and the lowpass independently.

LISTENING

I started off with Ramsey Lewis' "People Make the World Go 'Round" from the Boston Acoustics' *Music for Bottom Feeders* album. The piano came through flat and boxy just like a piano sounds; the midrange tonality was very good. The full body of the piano was a little weak on the bottom end; the bass guitar was snappy and taut. It came through with very good detail in the note change. The tom drums, which are tight and with "skinny" tonality, were excellent. The bass drum was hard to pick out beyond the mallet strikes. The wood block sounded pretty realistic with a good ring to it on the mallet strike and the decay was very nice. The tweeter response of the Elates was smooth and extended, reproducing a nice shimmer and ring on the high hats and cymbals, but it lacked some of the "air" of a few of the more expensive tweeters that we have tested. The overall image stability on this track was fixed and high. The piano was overly large and the percussion clicks and ticks were all good. Overall performance was enjoyable.

Checking in on some male vocals, I pulled up Lenny Kravitz's "I Belong to You" from his album entitled 5. Kravitz's vocals sound great. There were nice breath and lip details as Kravitz does this song at speech level singing (like the old crooners Bing Crosby and Frank Sinatra). In the opening 12 bars, the bass drum was all skin and no fundamental. This is where a subwoofer would come into play, picking up the really deep stuff which allows the 6 1/2" woofer to be really great on the midbass and midrange tones that are its job. The snare strikes were sharp and excellent. The cymbals and high frequency information were all very good. As I listened on, the cut ground on with the drum machine and repeating percussion and then at 02:49, in popped from nowhere this velvety, smooth acoustic guitar; it calmed and smoothed the waters. Great sounding string details and body sounds came through nicely.

Moving to female vocals, I started listening with Tracy Chapman's *New Beginnings* album, using the cut "Heaven's Here on Earth." It opens with a wood block, tambourine, bass drum and acoustic guitar. The wood block imaged with a fixed location and had a good hollow, woody tone, but lacked the decay on the overtones. The guitar was beautiful—nicely sized to the stage, with body and string details that gave the image life. The bass frequency reproduction had

MUSIC SELECTION

Artist	Title	Music Type	Points Possible	Morel Elate 6
Ramsey Lewis	"People Make the World Go 'Round"	Jazz	10	07
Lenny Kravitz	"I Belong to You"	Rock	10	08
Tracy Chapman	"Heaven's Here on Earth"	Folk/Rock	10	07
Schubert	Symphony No. 9 "The Great"	Classical	10	08
Diana Krall	<i>Love Scenes</i>	Jazz Trio	10	08
Total			50	38

Ratings: 00 Poor 05 Average 10 Superior



been a bit of a disappointment with the Elate 6's. Here, it was much the same story. The bass drum was very good on impact and featured fine mallet strike details, but there just was not much output below 60Hz.

Chapman's vocals were played back very naturally. Her image was a little too big, but the sound quality more than made up for any complaint. The tambourine bangles came through with a fine ring and acceptable shimmer. The bangles were nicely defined with some individuality, not on the level of the Alpine SPX-Z15M's or even the Morel Supremo's, but among the best that I have tested here, so I can recommend them pretty highly.

Since the Elates had done a great job on modern types of music, I wanted to hear what they could do on orchestral stuff. I plugged in Telarc's 20-bit recording of Schubert's Symphony No. 9, "The Great." With the French horns, the Elates sounded big, full and horn-like, just like a French horn should. The Elates were excellent and smooth sounding here. Even during the big brass section crescendos, the Elates did not get edgy and harsh. They get very high marks for their performance on the brass and string instruments. However, the oboes were not as "reedy" sounding as they should be and sounded more like the flutes, so some of the midrange detail

could be improved. The string sections were great sounding, very enjoyable to listen to. The timpani were not boomy, but were tight and had a bouncy, fun sound.

I finished off this test with my favorite jazz trio album, Diana Krall's *Love Scenes*. It features a string bass, guitar and piano, with Krall's phenomenal vocals. The big stand-up string bass was tight, bouncy and had some punch to it, but the deep fundamentals were light. This was where a subwoofer would round out the system. The closely mic'd piano was wonderful in the midrange and higher frequencies. The low frequency response was thin and lent a touch of a tin-pan-ish sound to the overall character of the piano, but as I suggested above, a subwoofer would most likely solve all of that. The guitar was smooth and excellent sounding. It had an excellent "lounging lizard" skip to it, which is a good thing on this recording. Krall's vocals sounded beautiful! Because she is a speech level singer, you should be able to hear a lot of breath and lip details and the Morel Elate 6's were able to reproduce these sounds and give a great sense of realism to the playback.

CONCLUSION

The Morel Elate 6's have a high level of quality in their build, design and performance. I fully enjoyed my time with them and can recommend them to anyone that enjoys a variety of music.—EH

SUBJECTIVE SCORE CHART

	Points Possible	Morel Elate 6
Overall Sound Quality	20	16
Tonal Balance (above 80Hz)	10	08
Low Frequency Extension	10	06
Clarity at Low Volume	10	08
Clarity at High Volume	10	08
Image Stability	10	07
Listening Fatigue (moderate volume)	10	09
Flexibility/Ease of Installation	20	16
Total Subjective Score	100	78

Ratings: 00 Poor 05 Average 10 Superior



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