

# Product Review - Sunfire Subwoofer Signature (12") - July, 1998

John E. Johnson, Jr.



## Sunfire Subwoofer Signature

**Two 12" Drivers - One Active, One Passive Radiator**

**2,700 Watt RMS Amplifier**

**Manufacturer's FR Specs: 16 Hz - 100 kHz + 0, - 3 dB**

**Size: 13" H x 13" W x 13" D**

**Weight: 53 Pounds**

**MSRP: \$1,895 USA**

Sunfire Corporation, P.O. Box  
1589, Snohomish, Washington  
98291; Telephone 425-335-4748;  
Fax: 425-335-4746; E-Mail:  
sales@sunfire.com; Web:  
<http://www.sunfire.com>.

When Bob Carver introduced his Sunfire Subwoofer a couple of years ago, other companies quickly jumped on the wagon with their own versions of big bass in a small box. The 10" long throw active driver with a 10" passive radiator, coupled with a massive power amplifier, changed the way we look at subwoofers. No longer was it necessary to buy a large box to have deep, powerful bass. We, along with a lot of other people, have been very happy with these subs, and the Sunfire Subwoofer remains the "King of Clever".

It was only a matter of time - and a short time at that - for us to see a larger version to come from Sunfire, and it has arrived. The Sunfire Subwoofer Signature is a 12" model. It has two drivers, one of which is active, and the other being a passive radiator. The same powerful amplifier is there, with the Tracking Downconverter to maintain the rail voltage at 6 Volts above the signal demand voltage. The amplifier is rated at 2,700 watts rms. That amount of output is possible since the incoming 120 volts AC is directly coupled to the power supply capacitors after passing through the full wave rectifier diodes (no transformer). With such a high voltage, and a 4 Ohm driver, enough current could be drawn to result in the 2,700 watts. Even this industrial strength driver would not take that kind of power very long, however, so just a few hundred watts are required to get it to full output levels. But even so, the amplifier is capable of much more, and to get lots of deep bass from a relatively small

box, it takes three things: A driver capable of long excursion, a powerful amplifier, and most importantly, good engineering design. All three of these factors have been realized with the Sunfire Subwoofers. I measured 1.5 inches of excursion, peak to peak, with the Sunfire Signature Sub (active driver), and that is a heck of a lot for a 12" driver. Bob used the same tracking downconverter from his Sunfire Stereo Amplifier in the amp for his subwoofers, providing very efficient, and very high, power. So, that takes care of two factors.

The third is engineering, and Bob Carver has always been very good at this. First, comes the mathematics and head scratching. After that comes the fun part...fiddling around in the laboratory with various designs. You get yourself a tall soda from BK or whatever, and you try things out. The passive radiator is no simple item either. The weight on the back is critical to good performance. A little solder (for weight) is added to the back, bit by bit, until the active - passive coordination is matched just right. Both drivers on the Sunfire have flat membranes on the front, rather than being shaped like a cone. This makes the driver act more like a piston. A huge rubber surround tops off the unique appearance to the drivers. They are both very stiff out of the box, and I ran the subwoofer with intense low frequency sinewaves (10 Hz - 100 Hz) to break them in.



The rear panel of the Signature is like the 10" version, except that Bob's signature is there. A red LED indicates power on/standby. There is no on/off switch, since the amplifier is so efficient. Rotary controls include volume, crossover frequency (30 Hz - 100 Hz), and phase (continuously adjustable between 0° and 180°). This is a rare example of a subwoofer with a 30 Hz low pass selection. There are four gold plated RCA jacks, two for line-level input, and two for high pass (80 Hz) line-level output (to drive amplifiers for satellite speakers). There is also a pair (right and left) of speaker-level inputs. A "Flat/Video Contour" toggle lets you roll off frequencies below 40 Hz if you wish (40 Hz is about the limit of many films), but this subwoofer does so well with intense sound effects at all low frequencies, I kept it set to "Flat".

The Sunfires are designed to be placed in corners. This way, when the signal passes from the active driver to the passive radiator (at about 20 Hz and lower), the sound continues to be corner loaded, rather than change output directions from one side of the room towards the other. It keeps the frequency response flat, rather than simply making the bass louder.

When I ran the Signature with some sinewaves, I noticed that there were no audible harmonics at testing frequencies of 16 Hz or 20 Hz, even at full output. This is testimony to the engineering. For a subwoofer that moves this much air to have no audible harmonics is nothing short of amazing. Bass harmonics are not as irritating as harmonics from midrange and high frequencies. In fact, some people like bass harmonics because they make the bass louder. I prefer clean accurate bass, even with action films where explosions have all sorts of frequencies rumbling away, and I found the Sunfire gave me lots of what I like with films such as "Die Hard" and "Tomorrow Never Dies". Especially with music though, clean bass is essential. Playing Natalie Cole's "Unforgettable" with the Sunfire resulted in the bass sounding clean and natural, each note blending with the music, rather than like a bass drum that simply booms with the notes.

Accelerometer chips are used on some subwoofer designs to reduce harmonics. The chips are mounted on the driver, and when the driver moves, the chip generates current which is fed back to a comparator, the difference between the original signal and the feedback is inverted, and passed through the amplifier. Another type of feedback is current sensing feedback. Speaker drivers are motors, but they are also generators. When the voice coil moves in the magnetic field, it generates voltage and current. This is called the "Back EMF". Since the drivers are producing distortion along with the original signal, the back EMF is not simply proportional to the input voltage, but varies from it according to the distorted movement of the cone. These variations are detected, separated from the waveform of the input voltage, inverted, and fed back into the amplifier. Accelerometer feedback systems detect changes in velocity (acceleration), while the current sensing feedback systems detect movement in general. But no feedback system will work if the driver has a large amount of inherent harmonic distortion. The Sunfire uses current sensing feedback, but the best design is one where you don't have a lot of harmonic distortion to start with, and the feedback just helps to reduce the low inherent distortion even further. That is obviously what is happening here with the Sunfire Subwoofer design.

Room Response - Sunfire Subwoofer Signature -- Set to 90 dB at 20 Hz -- (This is not maximum output, but rather just the response in an "average" room with the volume set to 90 dB at 20 Hz.)

1 meter	13 feet
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10 Hz		10 Hz	
12.5 Hz		12.5 Hz	
16 Hz		16 Hz	
20 Hz		20 Hz	
25 Hz		25 Hz	
31.5 Hz		31.5 Hz	
40 Hz		40 Hz	
50 Hz		50 Hz	

63 Hz		63 Hz	
80 Hz		80 Hz	
100 Hz		100 Hz	
125 Hz		125 Hz	
160 Hz		160 Hz	

I found a maximum output of 117.3 dB at 31.5 Hz (the highest we have ever measured in any subwoofer!), and 107.8 dB at 25 Hz, at 1 meter, using one Sunfire in a corner. This is excellent (astonishing, actually). 100 dB is plenty for bass, and the Sunfire can deliver this pretty much at all frequencies down to 20 Hz. Two Sunfires resulted in a 6 dB gain when they were side-by-side. For stereo subwoofer use, of course, the subs have to be separated. The continuously adjustable phase control on the Sunfire is very useful here, as I found about a 3 dB variation when using two Sunfire Signatures, and adjusting the phase control up and down. Most subwoofers have a switch for 0° or 180°, but for two subs, the setting might be 60°, 120°, or some other number, for the best bass. Also, it depends on the frequency (because phase shift varies as you move away from the selected frequency), so by having an adjustable phase control, you can set the phase for the frequency that most suits your needs, such as 40 Hz, or whatever. For subs with the 0° or 180° switch, it is a matter of moving the subs around the room to get the best result. Just because one Sunfire can produce very loud bass is no reason to have only one subwoofer. Although deep bass is non directional, stereo subs still give the user a three dimensional experience. It may be the tactile senses that are responsible for this. Whatever the reason, stereo subs do work, and with two subs, each one has to expend less effort.

In summary, Bob Carver scores again with this high performance subwoofer. The 13" cube will deliver great bass in places no other subwoofer will fit. Two are better than one (the same with all subwoofers), but one Sunfire Subwoofer Signature is certainly enough for just about any home theater. It will shake the rafters with movies, and soothe the savage beast with Beethoven. Highly recommended!