



**The First Step Toward 3D Audio:  
DTS Neo:X™**

White Paper

Document No. 9302K06500  
Revision C  
Effective Date: June 2012

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## Executive Summary

To complement the increasing amount of 3D video content now available, consumers need audio that goes beyond 2D 5.1 and 7.1 surround sound. They need sound that envelopes them overhead and side-to-side across an immersive, semi-spherical sound field, enabling them to track and experience all the action in movies, music and video games. DTS Neo:X™ is the first step in our multi-tiered plan to take audio into the third dimension. It offers up to 11.1 channels and the ability to deliver discrete audio content to new Front-Height and Wide speakers. Studios can produce this discrete content, and consumers can enjoy it along with their legacy audio recordings, played back with natural sound imaging on audio/video receivers (AVRs), separate audio components (e.g., preamps), and automotive audio systems.

*"DTS Neo:X brings the audio experience to new heights. This technology is a must-have and delivers an unprecedented multi-dimensional audio experience, even with existing multi-channel soundtracks."*

**Patrick Leonard, record producer and composer**

## Why 3D Audio?

Despite the growing popularity of 3D video content in movies, video games, and TVs, audio has largely remained a 2D experience. Because human ears have the ability to pinpoint sound direction with remarkable accuracy and detail, the audio listening experience can be significantly improved by adding more sound sources with proper steering of directional cues. This is especially true when audio sources are positioned in front of, compared to behind, the listener. Therefore, a tremendous opportunity exists to take audio into the next dimension and greatly extend the listening experience with discrete, location-specific audio content for Front-Height and Wide channels.

A few systems already exist with Front-Height or Wide speakers for home theater. None, however, currently enable discrete content that channels realistic sound cues to another plane in the soundstage - even when audio is mixed specifically for these speakers. Most systems simply duplicate front left and right channel content. This can result in unnatural audio imaging, where musical instruments are heard in strange locations and/or shift location from one speaker to another. Such issues can be particularly pronounced during playback of planar 5.1 or 7.1 surround sound.

## The Next Dimension in Home and Car Audio

Technology that represents a real first step toward 3D audio should enable consumers to take legacy recordings to the next dimension of surround sound. It should also give artists and sound engineers a way to create new recordings with discrete audio for speakers positioned beyond the traditional listening plane. Doing all this simultaneously gives listeners the ability to enjoy older recordings with added realism and new recordings with discrete content developed for Front-Height and Wide channels.

The move from planar to 3D sound will take place first in the home and automobile, since people spend the most listening time in these environments. Audio enthusiasts will embrace more immersive listening, and the chance to improve 3D movie watching and gaming experiences with more immersive sound. Even without video, audio that moves into this new dimension offers a very marketable improvement of the listening experience.

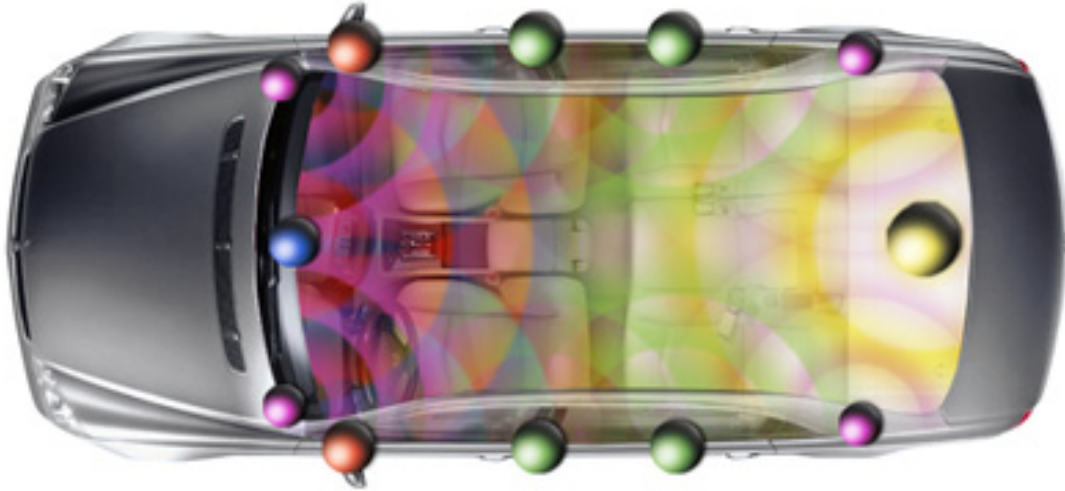


Figure 1: 11.1-channel DTS Neo:X speaker layout for automotive audio

Once listeners hear the thrilling reality of Front-Height and Wide channels, it will be difficult to return to flat, two-dimensional listening. Jets soar directly overhead, as imaged by Front-Height speakers, and bullets whizz seamlessly from Front to Wide, Side and Rear speakers. Ambient sounds, like rain pouring from the sky, seemingly fall on top of and around the audience. By synchronizing audio cues with their natural sound locations, discrete content fed to Front-Height and Wide channels can fill a gaping hole in today's audio listening experience.

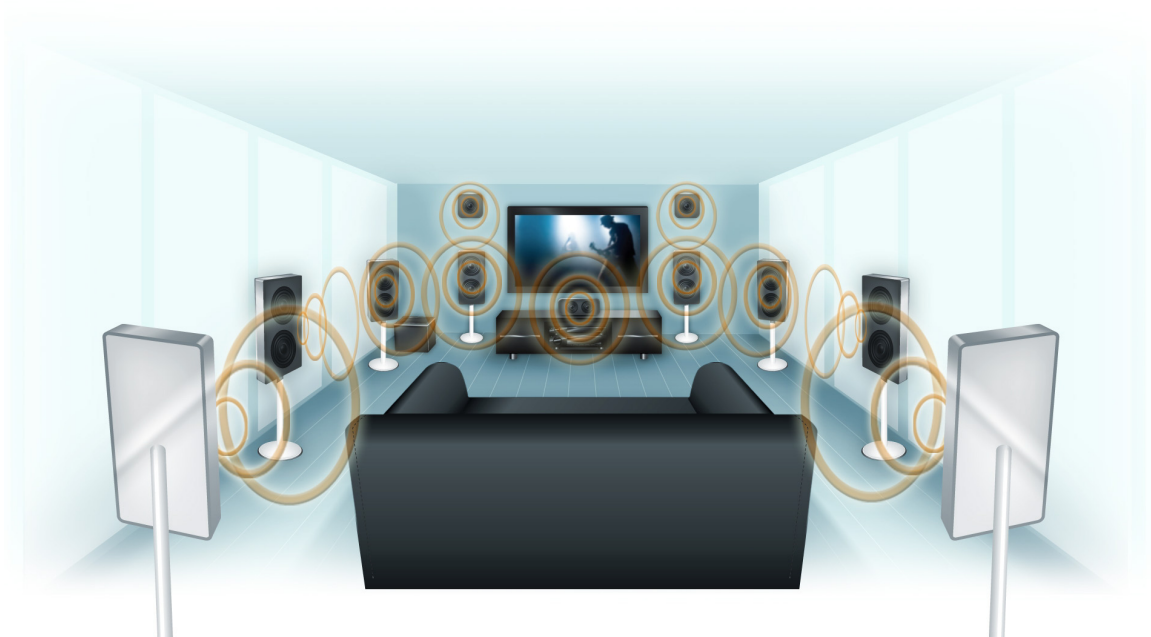


Figure 2: DTS Neo:X 11.1 sound field for home audio/video with Front-Height and Wide speakers

### The DTS Neo:X Solution

DTS Neo:X is a comprehensive audio upmixing solution that is fully prepared to deliver the next dimension in surround sound, beginning with audio/video receivers (AVRs), separate audio components (e.g., preamps), and automotive audio systems. Using a new mixing technique, it provides natural sound imaging from legacy content. It also enables discrete audio mixes developed for DTS Neo:X to deliver the most immersive surround sound experience available.

### Bigger Sound is Better: 11.1 Surround

For existing audio recordings, there are no limitations on the application or usage of DTS Neo:X. The solution offers the most flexible upmixing available for high-end home theater systems and automotive audio systems. With flexible output channel configurations (up to 11.1) from various sources and various inputs (2.0 to 7.1), DTS Neo:X supports the widest range of speaker layouts - from stereo to 7.1, 9.1 and 11.1 surround.

The Front-Height speakers (see figure below: Lh/Rh) should be positioned 30-degrees from center and directly above the Front left and right speakers. This enables them to introduce a vertical sound location that is appropriate for ambient sounds, such as rain and wind, and for dramatic overhead directional effects, such as aircraft soaring overhead. Wide channels (see figure below: Lw/Rw) expand the multi-channel soundstage and introduce yet another front- and side-facing sound location that is 60-degrees wide of the Center channel. This provides seamless tracking of front-to-side action, like the sound of an automobile passing by - from the front to the side of the audience.

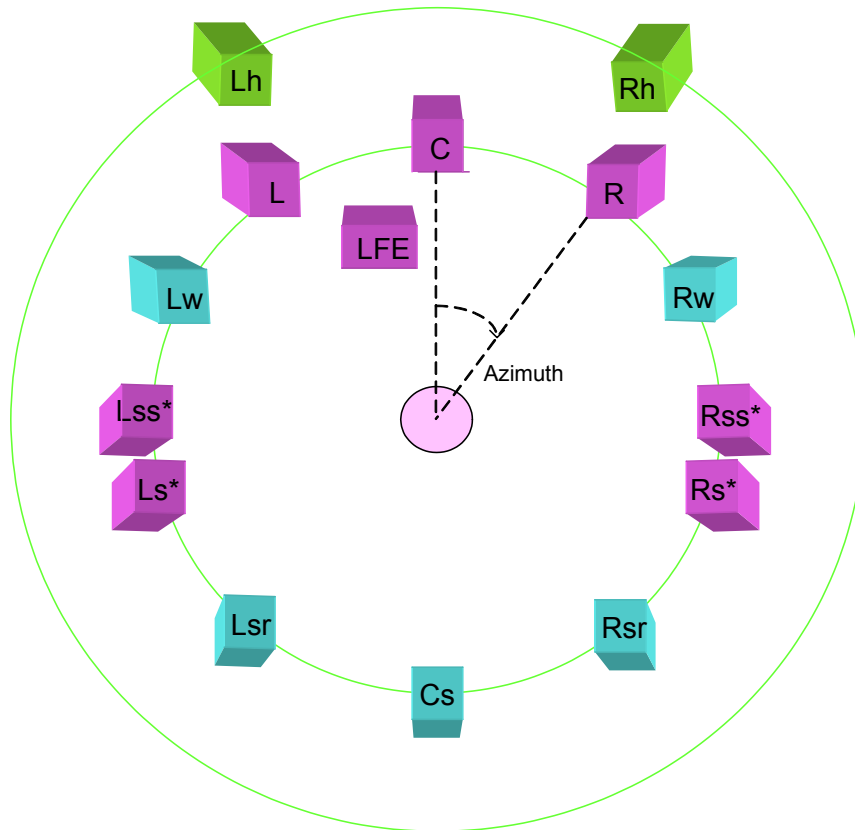


Figure 3: DTS Neo:X speaker layout

**Table 1: DTS Neo:X speaker codes**

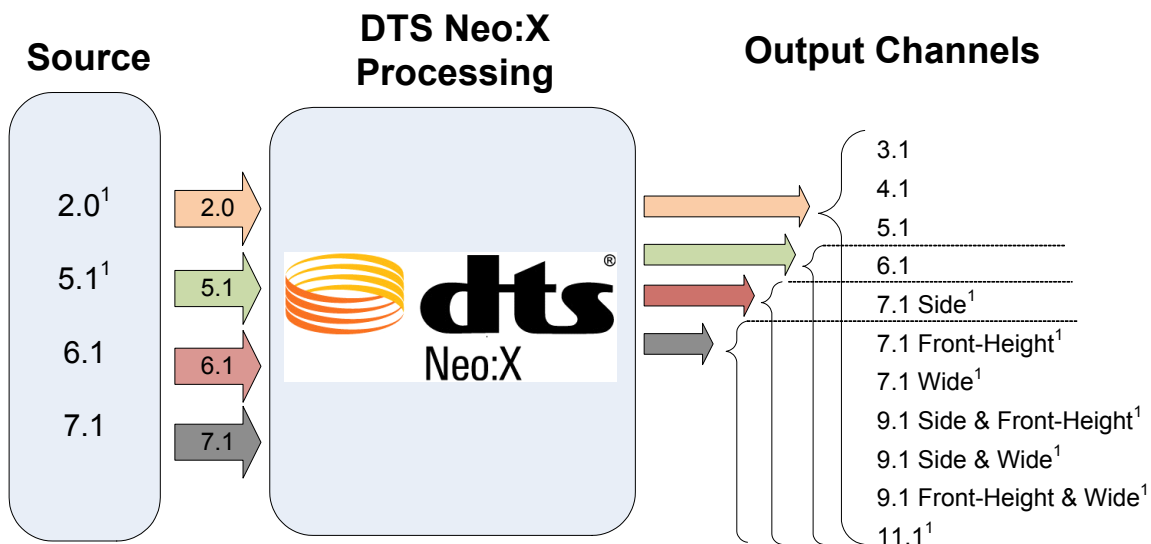
L = Left Front	Lss = Left Side Surround
R = Right Front	Rss = Right Side Surround
C = Center	Lsr = Left Surround Rear
Lw = Left Wide	Rsr = Right Surround Rear
Rw = Right Wide	Cs = Center Surround
Ls = Left Surround	Lh = Left Height (front)
Rs = Right Surround	Rh = Right Height (front)
	LFE = Low Frequency Effect

\* DTS Neo:X supports either the left and right surround (Ls/Rs) channels or the left and right side surround (Lss/Rss) channels, but not both at the same time.

### Upmixing to 3D

An important goal of DTS' multi-tiered plan is to enable content creators to produce 3D audio and provide it to consumers without changing the delivery chain. With DTS Neo:X's capability for discrete Height/Wide output, studios can produce directional cues intended only for these speakers, with no audible leakage into other channels. Studios can also produce soundtracks optimized for DTS Neo:X that offer a compatible listening environment in “standard” multi-channel playback configurations.

To match the user's speaker layout, DTS Neo:X separates input frequencies into sub-bands and then creates additional output channels. As it adds depth and intensity, it maintains the integrity of the original audio, keeping elements in their intended locations.



<sup>1</sup> Also available for Automotive applications

**Figure 4: DTS Neo:X inputs and outputs**



Table 2 summarizes all DTS Neo:X upmixing configurations.

**Table 2: DTS Neo:X upmixing configurations (required and optional)**

Input Channels		2.0	5.1	6.1	7.1 Side
Output Channels					
3.1 <sup>1</sup>		✓			
4.1 <sup>1</sup>		✓			
5.1 <sup>1</sup>		✓			
6.1		Optional	Optional		
7.1	Side <sup>1</sup>	✓*	✓*	✓	
	Front-Height <sup>1</sup>	✓*	✓*	✓	✓
	Wide <sup>3</sup>	✓*	✓*	✓	✓
9.1	Side & Front-Height <sup>2</sup>	✓*	✓*	✓	✓
	Side & Wide <sup>3</sup>	✓*	✓*	✓	✓
	Front-Height & Wide <sup>3</sup>	✓*	✓*	✓	✓
11.1 <sup>3</sup>		✓*	✓*	✓	✓

\* Also available for Automotive applications

<sup>1</sup> Required for DTS Neo:X logo

<sup>2</sup> Required for logo if end product supports 9.1 configuration

<sup>3</sup> Required for logo if end product supports 11.1 configuration

### Unique Movie, Game and Music Mixing

To create the best experience for all listening situations in the home and car, DTS Neo:X adjusts the soundstage in three ways.

- **Movie mode** (Enhanced immersion for movie soundtracks): This mode offers a clear and enhanced Center channel that makes center stage action stand out during movie viewing, with a firm position for dialogue. It also enables listeners to experience the full audio effect across a wider range of audience seating.
- **Music mode** (Enhanced immersion for music): In this mode, use of the Center channel is more controlled to prevent narrowing of the front of the soundstage.
- **Game mode** (Enhanced directionality and immersion for an interactive gaming experience): This mode provides the greatest degree of channel-to-channel separation, delivering discrete sound localization cues from Front-Height or Wide channels.



## Conclusion

With the introduction of the DTS Neo:X audio upmixer, DTS has taken a leadership role in addressing the growing demand for audio that complements 3D video. It creates an immersive, semi-spherical soundstage, adding extra channels that can play discrete content. With DTS Neo:X, Front-Height and Wide speakers provide greater audio dimension in the home and automotive listening environment.

DTS Neo:X gives studios the ability to produce discrete directional cues that can only be heard on Front Height and Wide speakers, with no audible leakage, in soundtracks optimized for DTS Neo:X. It is also compatible with “standard” multi-channel playback. This provides a clear 2D to 3D upgrade path that will be further developed by DTS in the future.

For consumers, DTS Neo:X both moves legacy content toward the next dimension of surround sound and enables them to enjoy an unprecedented, semi-spherical soundstage with content developed specifically for this breakthrough technology.

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