Dedicated Cinema Room - Dolby Atmos 7.1.4 Reference Design

RAMATUELLE V2

5th November 2021

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Design Introduction

This design for your home theatre / media room has been carefully considered and a huge amount of care has gone into the design process and equipment selection.

There are clear performance objectives for both audio and video and those are set out and mentioned throughout this document. Home theatre design is not a subjective engineering process, it has been clearly defined by many standards documents and trade organisation codes of practice.

This theatre design is based on CEA/CEDIA CEB-22 & CEB-23 Home Theatre standards for design as well as several ITU documents on audio and video criteria. The use of Dolby Atmos, DTS:X and Auro 3D configuration design guides have also been used to create a technically accurate room but like all rooms some design compromises must be made.

All home cinema designs require a careful mix of science & art. Every room has issues that need to be dealt with at the design stage and the best rooms are always those that have had the best application of intelligent compromises applied. We have followed all known standards and codes of practice in the creation of this design and as such have guaranteed a certain amount of predictability in the systems performance.

We are often requested to create several designs of the same room, with different equipment, configuration and performance objectives before finalising on one design. This is not unusual and it is this process that really adds value to the professional home theatre designer and installer.

Below you will not only see a full specification and bill of materials of loudspeakers, amplification, processing and projection systems amongst other things; but solid engineering reasons for why certain pieces of equipment have been selected.

Performance objectives have been set out to 105db reference level at the listening position for the audio system, as well as a minimum of 30 ftL for the front projection system in relation to the video image. It is also important to mention that the noise floor of the room itself is important to increase the perception of the dynamic range of the audio. The video also requires careful control of both natural and artificial light to increase the perception of the dynamic range of the video image.

Cinemas and media rooms also need to be well ventilated and comfortable places to spend your time as well as the requirement for a simple control interface that will allow you to enjoy the movie or game with the minimum of fuss.

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Room and Project Design

Codec and configuration is Dolby Atmos 7.1.4 Reference Design

Job   :   RAMATUELLE V2

Design Date   :   5th November 2021

Project Progress :   Project On Hold

Room Design Considerations

Room design and structural properties must be carefully considered. The challenge is to create an environment that is not only comfortable but that enhances the audio and video from a performance standpoint.

For sound, the room itself is very important. The room is more in control of sound at the lower frequencies, however, as the frequencies rise then so the loudspeakers take back more control from the room. This is never truer than with high quality loudspeakers and a good processor.

The room should be treated acoustically with fabrics and materials that will enhance the selected electronics. For instance, it may be required that we install some absorption, diffusion and maybe some reflective materials to create an interior that will enhance the system design set out in this document.

It is also recommended that post-installation calibration be carried out on both the audio and video system to truly gain the full potential from the electronics and loudspeakers that have been specified in this design.

HAA, ISF and THX calibrations are recommended on both the audio and video systems to finely tune the system to its most optimum potential.

Room Dimensions

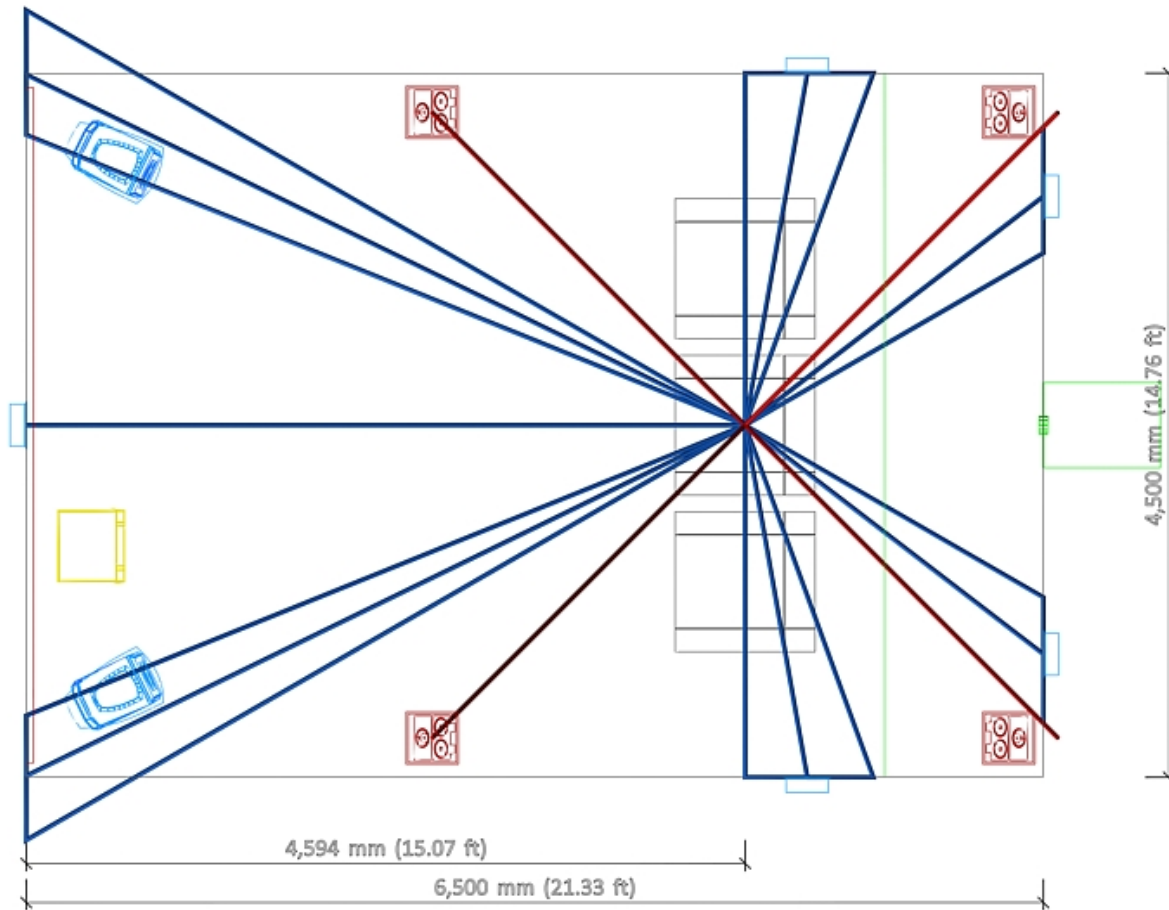Length: 6,500 mm x Width: 4,500 mm x Height: 3,500 mm (21.33 ft L x 14.76 ft W x 11.48 ft H)

Volume: 102 m³ (3,602 ft³)

Viewing Distance: 4,594 mm (15.07 ft)

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Room Plan

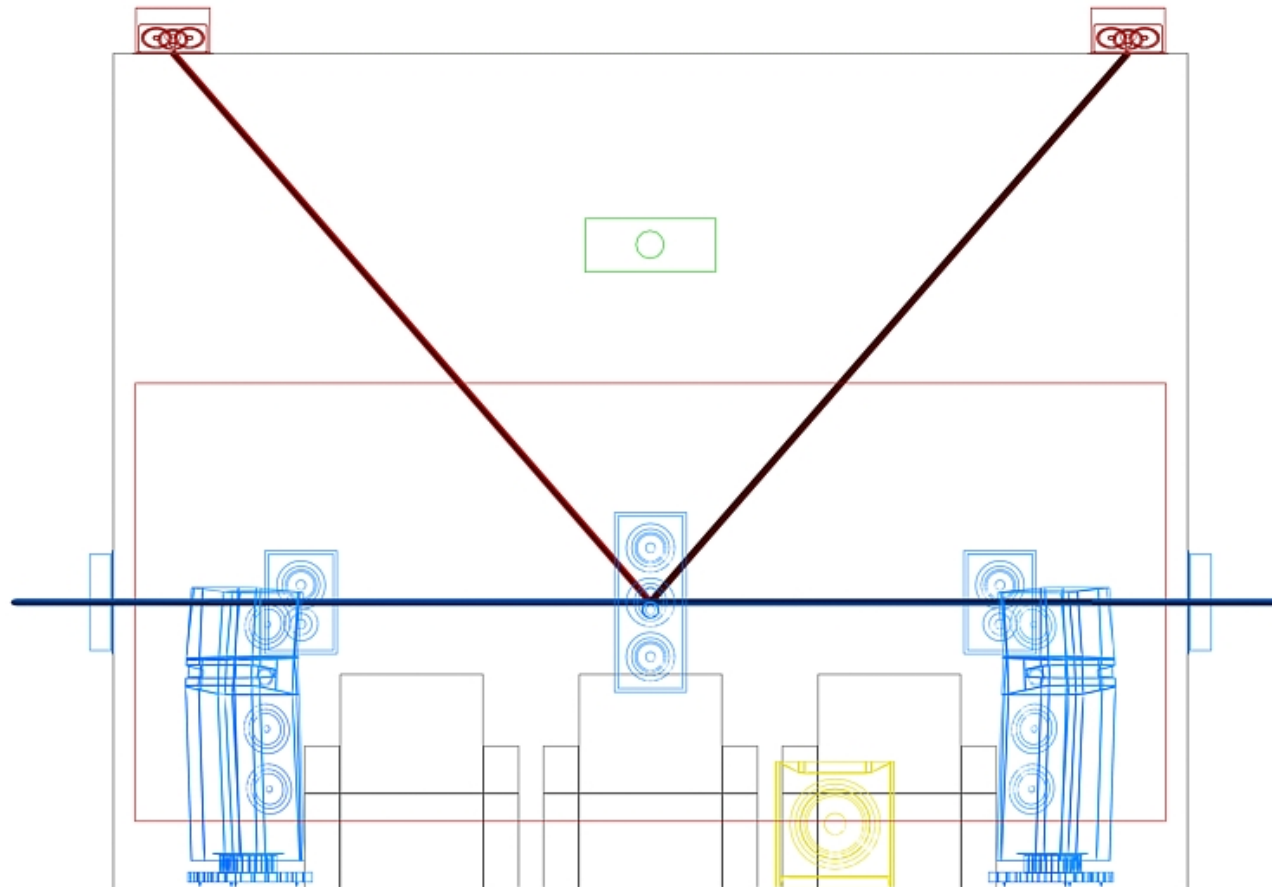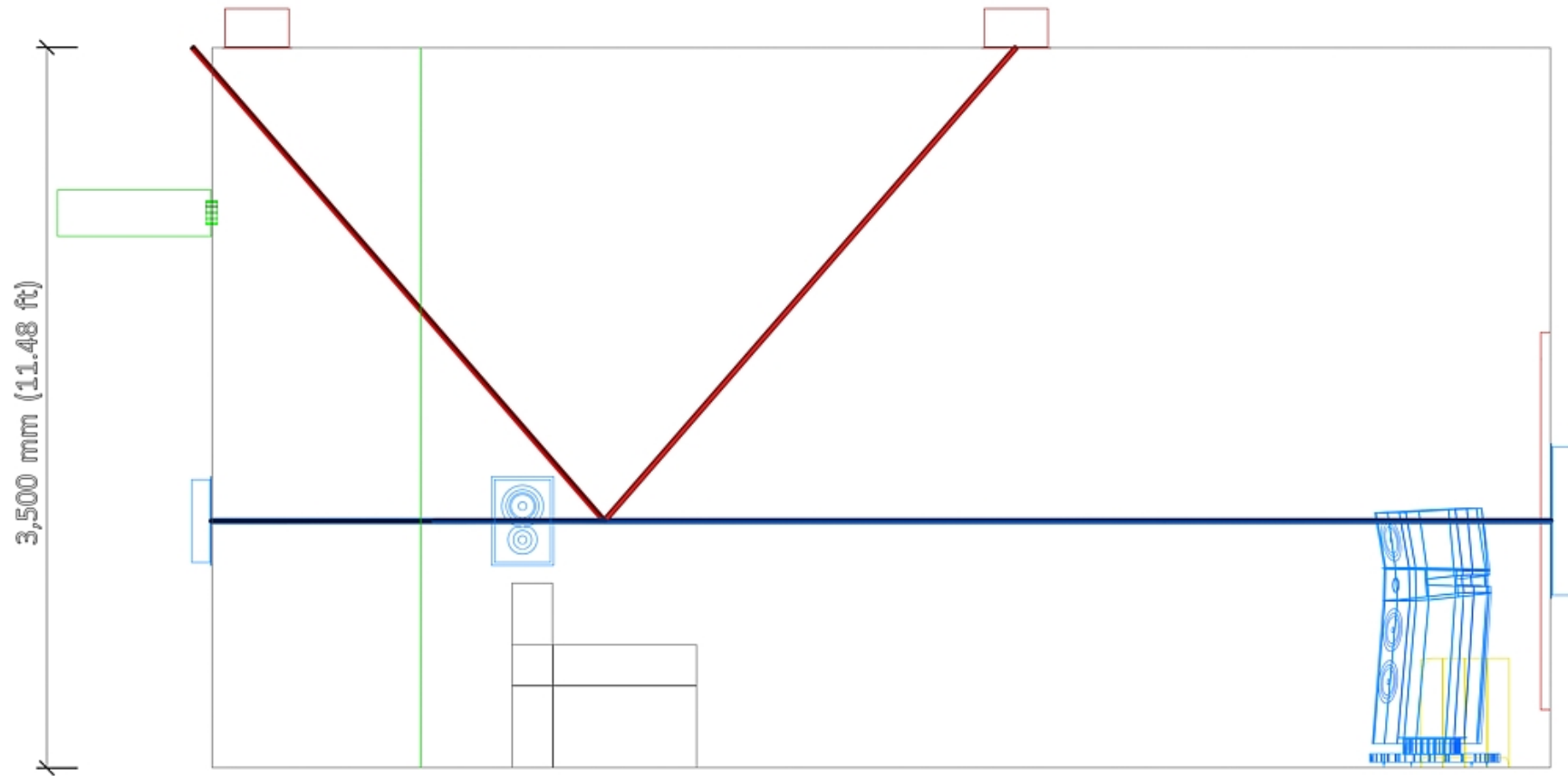# RAMATUELLE V2

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Screen Wall Elevation

Dolby Atmos 7.1.4 Reference Design
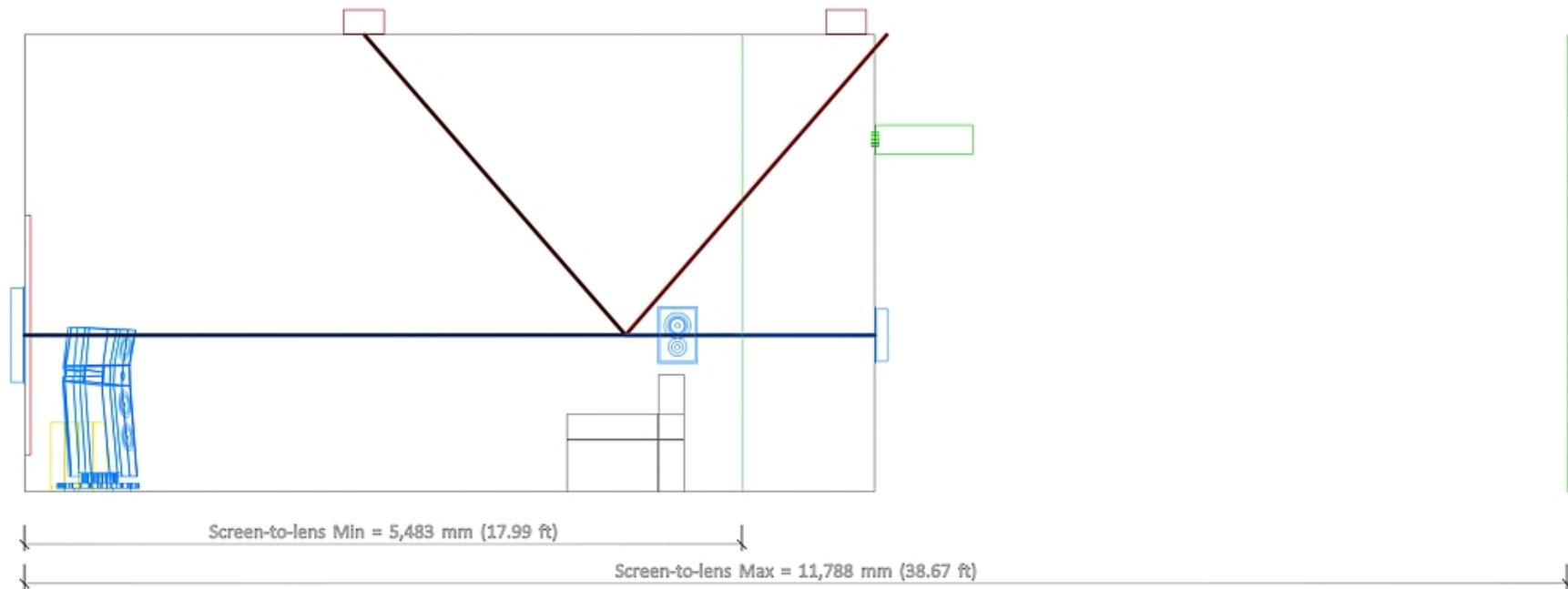
Left Side Elevation

3,500 mm (11.48 ft)
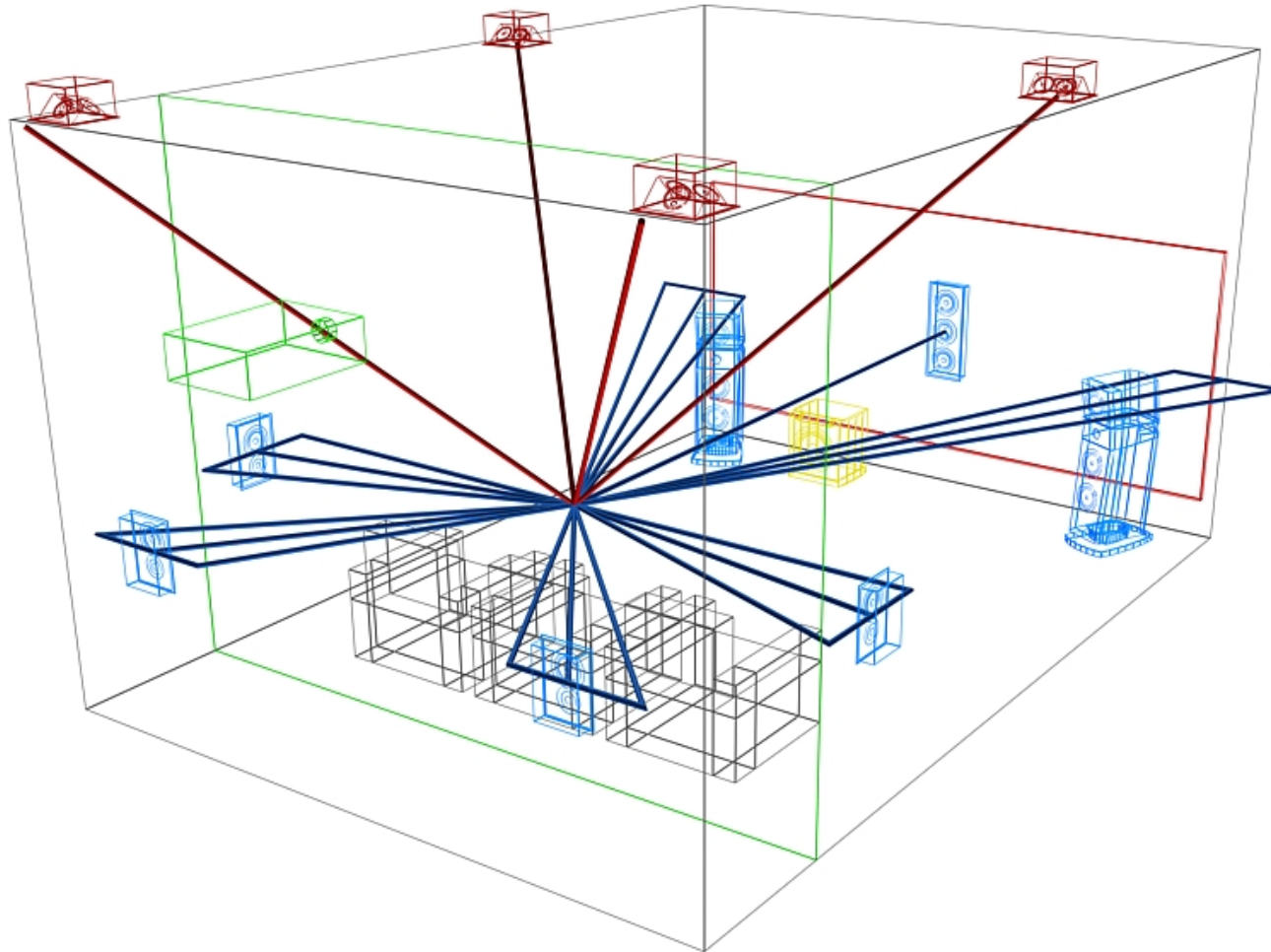
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Right Side Elevation

Green vertical plane(s) show the calculated Minimum and Maximum screen-to-lens projector throw ratio distances.

Screen-to-lens Min = 5,483 mm (17.99 ft)

Screen-to-lens Max = 11,788 mm (38.67 ft)

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Perspective View

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Room Layout - view toward screen
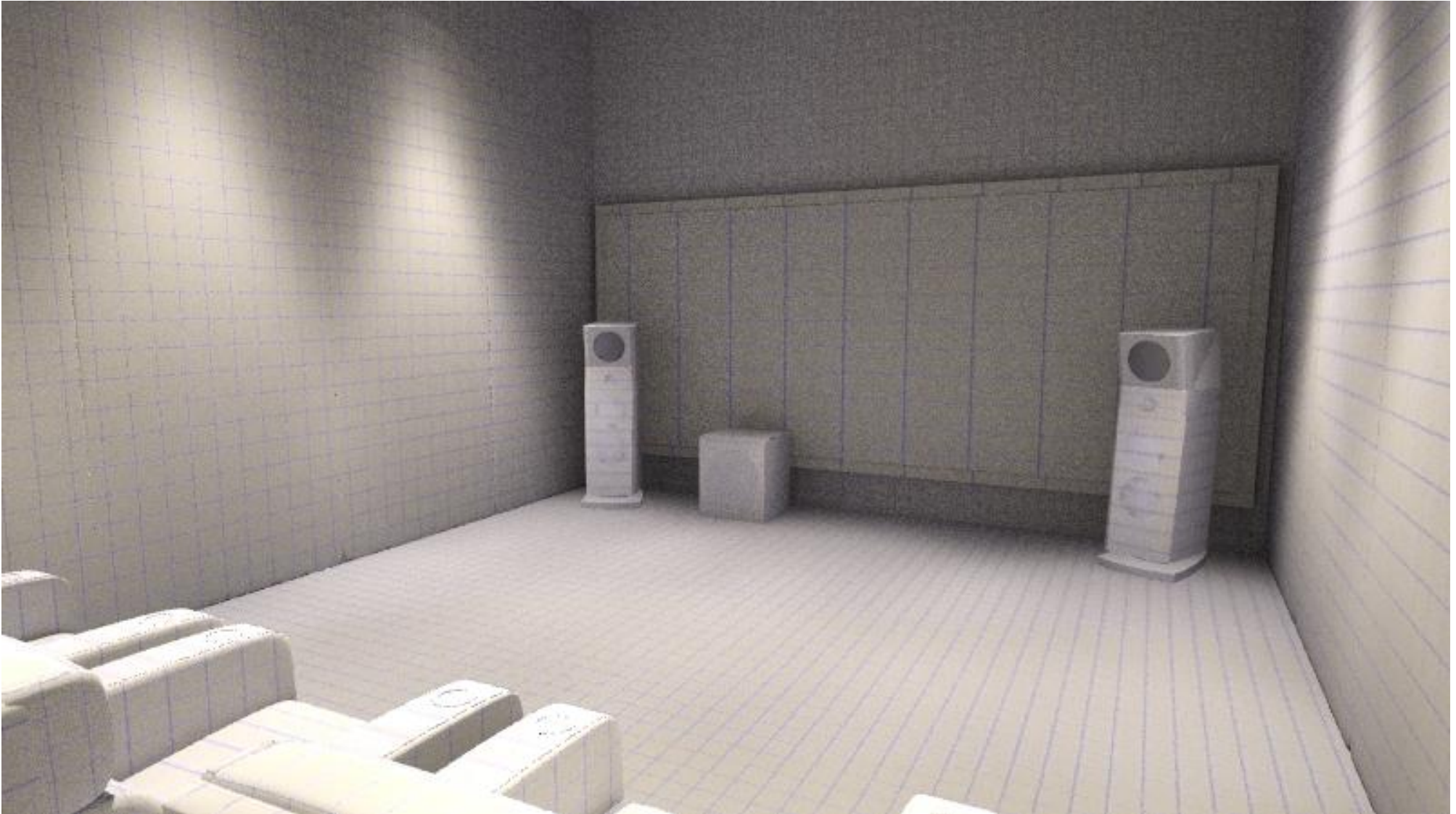
Dolby Atmos 7.1.4 Reference Design
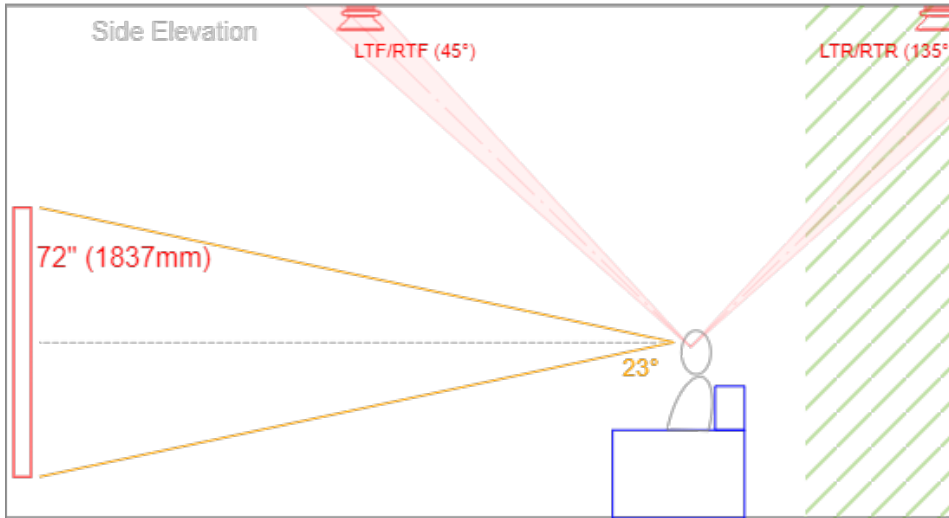
Room Layout - view toward seating

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Seating Plans, Sight Lines/Viewing Angles and Projector Placement

Any speaker angles shown below are standards-based recommendations. Actual speaker positions are tabulated on the Speaker Placement page.

Side Elevation

LTF/RTF (45°)   LTR/RTR (135°)

72" (1837mm)

23°

R (Narrower than recommended 26°)

181" (4594mm)

RS (100°)

RRS (142.5°)

1

C (0°)

170" (4318mm)

50°

2

3

LRS (-142.5°)

L (Narrower than recommended -26°)

LS (-100°)
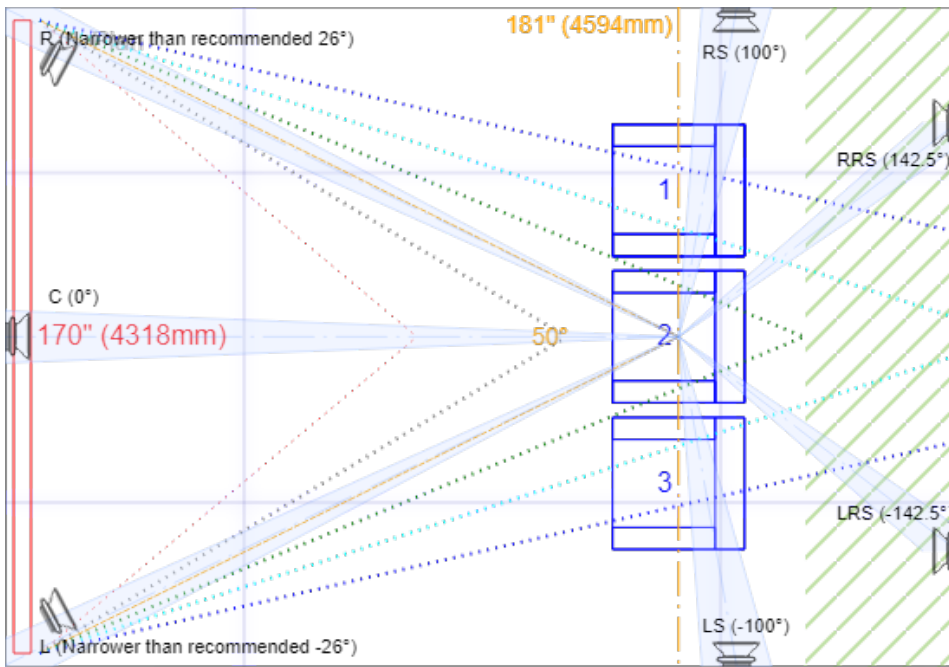
Fixed Screen Viewing Angle:

—— 50° Calculated Viewing Angle

Cinema Viewing Angles:

····· 80° Widest acceptable
        May lead to viewer fatigue
····· 62° Widest recommended SMPTE
····· 45° Reference angle THX / SMPTE
····· 36° Narrowest recommended THX
····· 26° Narrowest acceptable angle THX

Key:

⁄ ⁄ Projector lens throw range
—— Seating guides (bass frequency nulls)

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Audio Design - Our Approach

This object of this audio design is to ensure that the sound reproduction within your home cinema room/media room is faithful to the technical production of the movie (or music, show or game), to provide you with an immersive audio experience. This design is embedded with the correct engineering principles to ensure that your home cinema system delivers correct measurable audio performance.

The CEA/CEDIA guidelines accept that, whilst the objective is to simply adhere to movie technical production standards, in most installations, intelligent compromises will be needed to balance this aim with the physical, aesthetic and budgetary parameters of each installation.

To ensure accurate sound reproduction, the following performance objectives have been considered and embedded within the calculated design:

- No Colouration. The sound should not be coloured and sound from each loudspeaker should be tonally similar.
- Continuous Sound Stage. Continuous sound in the front sound stage, from the left speaker, through the centre and to the right. No bias to either side.
- Envelopment. The sound reproductions should give the user the sense of envelopment and immersion in non-directional sounds, except where sounds are deliberately directed to a particular channel/loudspeaker for a specific effect.
- Focus. The part of the loudspeaker alignment process that means the listener remains in the in direct focus of the loudspeakers horizontal and vertical dispersion characteristics.
- Dialogue Intelligibility. Dialogue intelligibility should not be degraded.
- No Perceptible Distortion. The audio should not be distorted when played loudly.
- Consistent Performance. The prime listening position will receive the best performance, but audio performance should be as consistent as possible over the whole seating area.
- Low Frequency Accuracy. The system should support the full frequency range consistently across all seats. Low frequency performance should not sound distorted or boomy.
- No Background Noise. Background noise should be as low as possible (inaudible) to be unobtrusive.
- Isolation. The cinema should not be affected by noises outside of the room and, conversely, the sounds made inside the cinema should not be disruptive to normal activities outside of the space.

Further activities within the implementation of the design, such as the installation, commissioning and calibration, will permit these criteria to be fully considered and achieved.

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Speaker Placement

Distances in the speaker channel positions table below are shown relative to the Master Listening Position (MLP) located at the Viewing Distance of 4,594 mm (15.07 ft) from the screen centre-line, at an elevation of 1,200mm (3.94 ft) from the finished floor level. X-plane, y-plane (room L-R) and z-plane offsets are listed.

Speaker Channel Positions					
Layer	Chnl. Name	Speaker-to-MLP Distances (mm / inches)			Speaker Selection
		3D-diagonal	x-plane offset	y-plane offset	z-plane offset	
Ear	L	4,862 / 191.4"	4,332 / 170.6"	1,853 / 73"	-1,199 / -47.2"	Focal SOPRA, SOPRA N°3
Level	C	4,594 / 180.9"	4,594 / 180.9"	0 / 0"	0 / 0"	Focal 1000 Series, 1000 IW LCR 6
Layer	R	4,862 / 191.4"	4,332 / 170.6"	1,853 / 73"	-1,199 / -47.2"	Focal SOPRA, SOPRA N°3
	RRS	2,402 / 94.6"	1,906 / 75"	1,463 / 57.6"	0 / 0"	Focal 1000 Series, 1000 IW 6
	LRS	2,402 / 94.6"	1,906 / 75"	1,463 / 57.6"	0 / 0"	Focal 1000 Series, 1000 IW 6
	RS	2,284 / 89.9"	397 / 15.6"	2,250 / 88.6"	0 / 0"	Focal 1000 Series, 1000 IW 6
	LS	2,284 / 89.9"	397 / 15.6"	2,250 / 88.6"	0 / 0"	Focal 1000 Series, 1000 IW 6
Upper	LTF	3,644 / 143.5"	1,999 / 78.7"	1,999 / 78.7"	2,300 / 90.6"	Focal 1000 Series, 1000 IC LCR 5
Layer	RTF	3,644 / 143.5"	1,999 / 78.7"	1,999 / 78.7"	2,300 / 90.6"	Focal 1000 Series, 1000 IC LCR 5
	LTR	3,482 / 137.1"	1,686 / 66.4"	1,999 / 78.7"	2,300 / 90.6"	Focal 1000 Series, 1000 IC LCR 5
	RTR	3,482 / 137.1"	1,686 / 66.4"	1,999 / 78.7"	2,300 / 90.6"	Focal 1000 Series, 1000 IC LCR 5

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Sound Pressure Level (SPL) Variation

The distance from each speaker to each viewing/seating position has been used below to calculate the expected effective SPL values.

Seat to Speaker SPL for 11 discreet channels																								
Row	Seat	L		C		R		RRS		LRS		RS		LS		LTF		RTF		LTR		RTR	
		Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)	Dist (m)	SPL(dB)
Row 1	Seat 1 L	4.58	101.8	4.7	101.5	5.32	100.5	3.11	102.1	1.96	106.1	3.27	101.7	1.31	109.6	3.21	104.8	4.28	102.4	3.02	105.4	4.14	102.6
	Seat 2	4.86	101.2	4.59	101.7	4.86	101.2	2.4	104.4	2.4	104.4	2.28	104.8	2.28	104.8	3.64	103.8	3.64	103.8	3.48	104.1	3.48	104.1
	Seat 3	5.32	100.5	4.7	101.5	4.58	101.8	1.96	106.1	3.11	102.1	1.31	109.6	3.27	101.7	4.28	102.4	3.21	104.8	4.14	102.6	3.02	105.4
Max Variance			1.3		0.2		1.3		4.0		4.0		7.9		7.9		2.4		2.4		2.8		2.8

	Front	Centre	Surround	Ceiling
Amplifier Power (W)	250	250	250	250
Sensitivity dB @ 1m from 1W	91	91	88	91

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Dolby Atmos 7.1.4 Reference Design

Speaker Requirements - Ear Level Layer

Front L/R   :   2 x Focal SOPRA SOPRA N°3

Sensitivity = 91dB, Impedance = 8Ohms

HxWxD = 1264mm x 402mm x 595mm (49.8" x 15.8" x 23.4"), Weight = 70.00kg (154.3lbs)

Sopra N°3 perfectly combines dynamics, space optimisation and harmonic richness. With its two 81 /4" (21cm) woofers, this loudspeaker offers solid, rich and perfectly defined bass for music lovers looking for optimum performance.

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Speaker Requirements - Ear Level Layer (Continued)

Front Centre   :   1 x Focal 1000 Series 1000 IW LCR 6

Sensitivity = 91.0dB, Impedance = 8Ohms

HxWxD = 726mm x 276mm x 99mm (28.6" x 10.9" x 3.9"), Weight = 10.95kg (24.1lbs)

High-end 3-way in-wall closed-back speaker for high-performance Home Cinema. Perfect for Left, Right, Center or surround channel, the medium-tweeter block can rotated to adjust the listening position.

Minimal impedance 2.9 Ohm.

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Speaker Requirements - Ear Level Layer (Continued)

Surround   :   4 x Focal 1000 Series 1000 IW 6

HxWxD = 406mm x 276mm x 99mm (16" x 10.9" x 3.9"), Weight = 6.75kg (14.9lbs)

2-way in-wall closed-back loudspeaker. Perfect for small rooms front speaker or surround effects. Tweeter (Beryllium) is adjustable to target the listening point. Simply angle them in any direction towards the optimum listening position.

Minimal impedance 7 Ohm.

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Dolby Atmos 7.1.4 Reference Design

Speaker Requirements - Upper Layer

Ceiling   :   4 x Focal 1000 Series 1000 IC LCR 5

HxWxD = 340mm x 340mm x 190mm (13.4" x 13.4" x 7.5"), Weight = 8.30kg (18.3lbs)

3-way reference in-ceiling closed-back speaker for Home Cinema. Perfect if there is no back wall. Medium ('W' cone) and tweeter (beryllium) are adjustable to target the listening point. Adopting Easy Quick install technology for easy installation without tools.

Minimal impedance 2.9 Ohm.

RAMATUELLE V2

Dolby Atmos 7.1.4 Reference Design

Speaker Requirements - LFE Subwoofers

Subwoofer   :   1 x Focal SOPRA SW 1000 BE

Configuration 'g'   HxWxD = 535mm x 500mm x 432mm (21.1" x 19.7" x 17"), Weight = 42.00kg (92.6lbs)

The SW 1000 Be is the redesigned version of the Electra Be subwoofer to ensure compatibility with the other loudspeakers in the Sopra line. It is equipped with a 13" (33cm) "W" cone speaker driver and a high-power 600 W RMS BASH® amplifier. The 24-bit digital processor offers a large control panel with settings for adapting the sub to various listening rooms. The SW 1000 Be offers very high performance with a bass cut-off frequency of 18 Hz and an SPL of 118 dB. This model is available in the Black Lacquer finish.

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Dolby Atmos 7.1.4 Reference Design

Amplification and Processor Requirements

Required SPL   :   105dB

Amp Headroom   :   3dB

Power Calculations   :   1,058W @ 105dB SPL

                                          334W @ 100dB SPL

                                          106W @ 95dB SPL

                                          33W @ 90dB SPL

                                          11W @ 85dB SPL

                                          3W @ 80dB SPL

                                          1W @ 75dB SPL

No power amplifiers have been selected.

RAMATUELLE V2

Dolby Atmos 7.1.4 Reference Design

Processor Manufacturer : Focal

Processor Model : Astral 16

HxWxD = 191mm x 479mm x 189mm (7.5" x 18.9" x 7.4"), Weight = 20.0kg (44.1lbs)

Astral 16 is a high-end audio-video processor and amplifier offering a unique Home Theatre experience. Equipped with 16 channels, 12 of which are amplified, 4 DSPs dedicated entirely to audio (filtering, equalisation, bass management). Managing all 3D audio flows (Dolby Atmos®, DTS:X™), and with unlimited channel configuration (bi-amplification, etc.), Astral 16 will truly enhance the connected audio system. Astral 16 already received many awards (EISA, Home Cinema Choice, AV Tech, Sound + Image) and more to come!

Astral 16 is delivered with a DIRAC LIVE license, a calibrated microphone as well as rack mounting kit.

Processor Specifications:

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Dolby Atmos 7.1.4 Reference Design

16 channel audio-video processor and amplifier	
Compatible formats	Dolby Atmos ®, DTS X, Auro 3D ®
Dirac Live® Room Calibration	
Remote Monitoring function	
16 output channels	
12 active (200W RMS @ 8 Omhs per channel (all channel driven simultaneous) + 4 XLR Outputs	
7 HDMI inputs / 2 HDMI outputs, all HDMI2.0 / HDCP 2.2	7 + 2
10 Audio inputs (4 analog, 6 digital)	4 x RCA, 3 x coaxial, 3 optical
Dedicated OS App for Ipad ®	Y
Delivered with calibrated measurement microphone, tripod and rack mounting kit	

Mutlichannel / Sourround Processing Specifications	
Output channels	16
Decoding / upmix channels	Up to 16 channels
Input sampling rate supported	Up to 192kHz
Stereo downmix	Yes
Bass Management	Fully flexible
Multi-subwoofer channels	Unlimited
Multi-way crossover	6-12-18-24-36-48dB/Octave filter slopes
20 parametric EQ per channel	

HDMI		
HDMI Inputs		7: HDMI 2.0 / HDCP 2.2
HDMI Outputs (mirror)	1 x HDMI 2.0 / HDCP 2.2 (with eARC) + 1 x HDMI 2.0 / HDCP 2.2	
Supported video format		Up to 4K UHD
High Dynamic Range		/ HLG
Color space and subsampling		4:4:4, 4:2:2, 4:2:0
Deep color		12 bpc
Max resolution supported		4K 60fps 4:4:4 8bpc
HDMI		3D / 4K / eARC

Audio inputs	
Digital inputs	3 x coaxial, 3 x optical
Analog stereo inputs	4 x RCA inputs

Processor Specifications (continued) :

Amplified main outputs	12
Analog main balanced outputs	4 x XLR
Stereo downmix outputs, balanced	2 x XLR
Technology	Class D
Amplified channel	12
Continuous power output, per channel, @ 0,1% THD	
3 channel driven simultaneous	250W@ 8Ohms, 500W@ 4Ohms, 725W@ 2.7Ohms
6 channel driven simultaneous	250W@ 8Ohms, 500W@ 4Ohms, 500W@ 2.7Ohms
12 channel driven simultaneous	250W@ 8Ohms, 300W@ 4Ohms
SNR (P-rated)	110dB

Set-Up Management	
Configurable multi-theater management	
Configurable audio zones management	
Unlimited theater and audio zones listening presets	
Backup and restore of Set-Up	
Firmware update via USB/network	

Control Inputs / Outputs	
USB type A	2
Ethernet	1
Output trigger control	4 (out)
IR remote ports, in + out	1 + 1

Control Custom Installation	
Web-based product configurator	
TCP/IP API based control	
Focal remote iPad control application	
Home automation	Crestron, Control4, Elan, Savant, RTI
Front panel display	TFT 4.3"

Power supply	
Voltage range	100V to 240V
Type	SMPS
Range selection	Universal

Processor Specifications (continued) :

Calibrated measurement microphone	1
Tripod for microphone	1
Dirac Live license	1
32.9ft (10m) cable with IR captor	1
Rack mounting kit	1

Dimensions & weight	
Net weight - with stands	20kg / 44.1lbs
Net weight - with rack mounting accessories	23kg / 50.7lbs
Dimensions with stands (h x w x d)	19.1 x 47.9 x 49 cm / 7.52 x 18.86 x 19.29"

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Room Modes

Speed of Sound 1,130 ft/s	Axial			Tangential			Oblique
	(Most Important)						
Dimensions (ft)	Height (ft)	Width (ft)	Length (ft)	H&W	H&L	W&L	H&W&L
	11.5	14.76	21.3	18.7	24.2	25.9	28.4
Baseline frequency (Hz)	49.1	38.3	26.5	30.2	23.3	21.8	19.9
EQ 6th octave steps (Hz)							
10.0							
11.2							
12.6							
14.1							
15.9							
17.8							
20.0							19.9
22.4					23.3	21.8	
25.2			26.5				
28.3							
31.7				30.2			
35.6							
40.0		38.3					39.8
44.9					46.7	43.6	
50.4	49.1		53.1				
56.6							59.7
63.5				60.4		65.4	
71.3					70.0		
80.0		76.6	79.6				79.6
89.8				90.6	93.4	87.3	
100.8	98.3		106.1				99.5
113.1		114.8			116.7	109.1	
127.0			132.6	120.9			
142.5	147.4						
160.0		153.1		151.1			
179.6							
201.6	196.5	191.4					
226.3							
254.0	245.7						

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Dolby Atmos 7.1.4 Reference Design

<u>Video Design - Our Approach</u>

This video design has been produced to ensure that the visual reproduction within your home cinema/media room is faithful to the technical production of the movie (or music, show or game).

 CEA/CEDIA guidelines accept that, whilst the objective is to simply adhere to movie technical production standards, in most installations, intelligent compromises will be needed to balance this aim with the physical, aesthetic and budgetary parameters of each installation.

 To ensure accurate video reproduction, the following criteria have been considered and embedded within the calculated design:

* Dynamic Range (contrast ratio). The ratio between the maximum and minimum measurable light intensities (black and white) that are created by the video system.
* Colourimetry. The measurement of colour and colour appearance and the prediction of perceptual matches on the basis of physical measurements.
* Gamut. The subset of colours which can be accurately represented.
* Resolution. The number of distinct pixels in each dimension that can be displayed.

In embedding these considerations within the video design, we have ensured that the characteristics of the display device are inherently matched to the related video components. This will provide an accurate and measurable video performance.

 Further activities within the implementation of the design, such as the installation, commissioning and calibration, will permit these criteria to be fully considered and achieved.

Video Considerations

Manufacturers claimed figures for video projectors are used as a guide only.

As a rule of thumb, lamp based projectors / light engines will slowly deteriorate over time and usage. They will also initially appear "less bright" after a professional calibration.

The requirement to hit 30ftL is a good starting point & nice bright image. After calibration and lamp degradation it is recommended that the initial figure is halved, and for proposed 3D view it should be halved again.

These are just guidelines but ones we follow to make sure that the correct projection system as well as screen gain are selected from the outset.

Video Requirements

Screen

Fixed screen vertical position is with screen C/L at the listening position of 1.2m (47.5") from floor level.

Screen size is 4,318mm W x 1,837mm H (170.0" W x 72.3" H)

Area = 7.93 m² (85.36 ft²)

Screen centre is 1,200mm (47.2") up from floor / 2,300mm (90.6") down from ceiling.

Screen edges are 91mm (3.6") from the walls.

|		
Screen Manufacturer	:	Stewart Filmscreen
Fabric / Model	:	Luxus Reference White StudioTek 100, 1.00, 180°
Size and Aspect	:	170" Screen Size, 2.35:1 @ 4k
Gain	:	1.00
Acoustically Transparent	:	Yes

Dolby Atmos 7.1.4 Reference Design

## Stewart Filmscreen Luxus Reference White StudioTek 100

Stewart Filmscreen Luxus Tab Tensioned Electric Retractable Below Ceiling, StudioTek 100 1.0 Gain Material with Wall or Ceiling Sliding Mounting Bracket, 12" Black Drop, 12 Volt Trigger, Plug and Play Smart Port for Infrared Remote Kit with Wall or Ceiling Sliding Mounting Bracket.
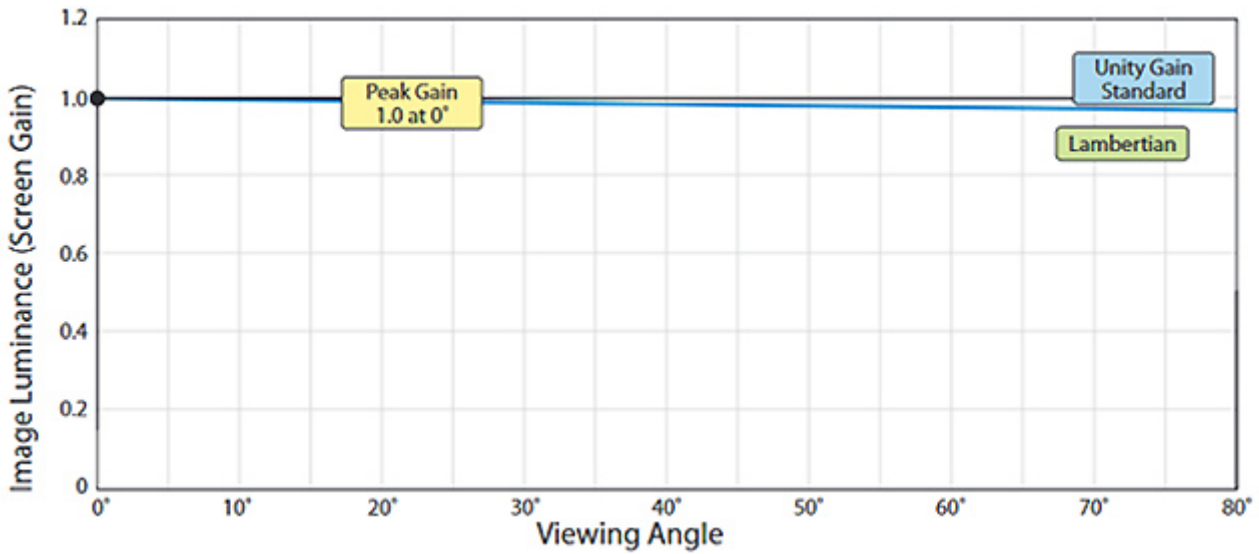
Stewart Filmscreen Luxus Reference White StudioTek 100 Sample

StudioTek 100

Gain: 1.0, Max. Size: 40'x90'
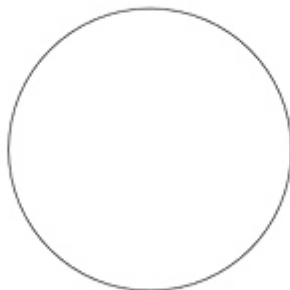
Superior performance, superb color
and excellent white field uniformity

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Dolby Atmos 7.1.4 Reference Design

Video Requirements

Projector

Calculated Luminance	:	58.58 ft/l (200.7 cd/m²) with ambient light at 0%
Projector Manufacturer	:	SONY Europe
Projector Model	:	VPL-VW5000ES, through rear wall viewing window, 6.5m (255.9") from screen to lens
Light Output	:	5,000 lumens
Lens	:	Part No. SONY, lens 1.27 - 2.73 : 1 zoom, focus range 5.7m - 12.3m
Throw Ratio Calculations	:	Screen-to-Lens distance between 5.483m and 11.788m (215.9" and 464.1")

Serious cinephiles need exceptional cinematic detail, color, and contrast. As the crown jewel of the Home Cinema Projector line, Sony's VPL-VW5000ES delivers the goods. This home cinema projector combines an advanced laser light source with the same Sony 4K technology found in professional cinema projectors. You get pulled right into the action with crisply detailed images and unprecedented clarity. You'll experience rich cinematic colors, smooth motion, and spectacular contrast with extremely powerful brightness, ensuring clear and sharp big-screen pictures, even on the largest home theater screens.
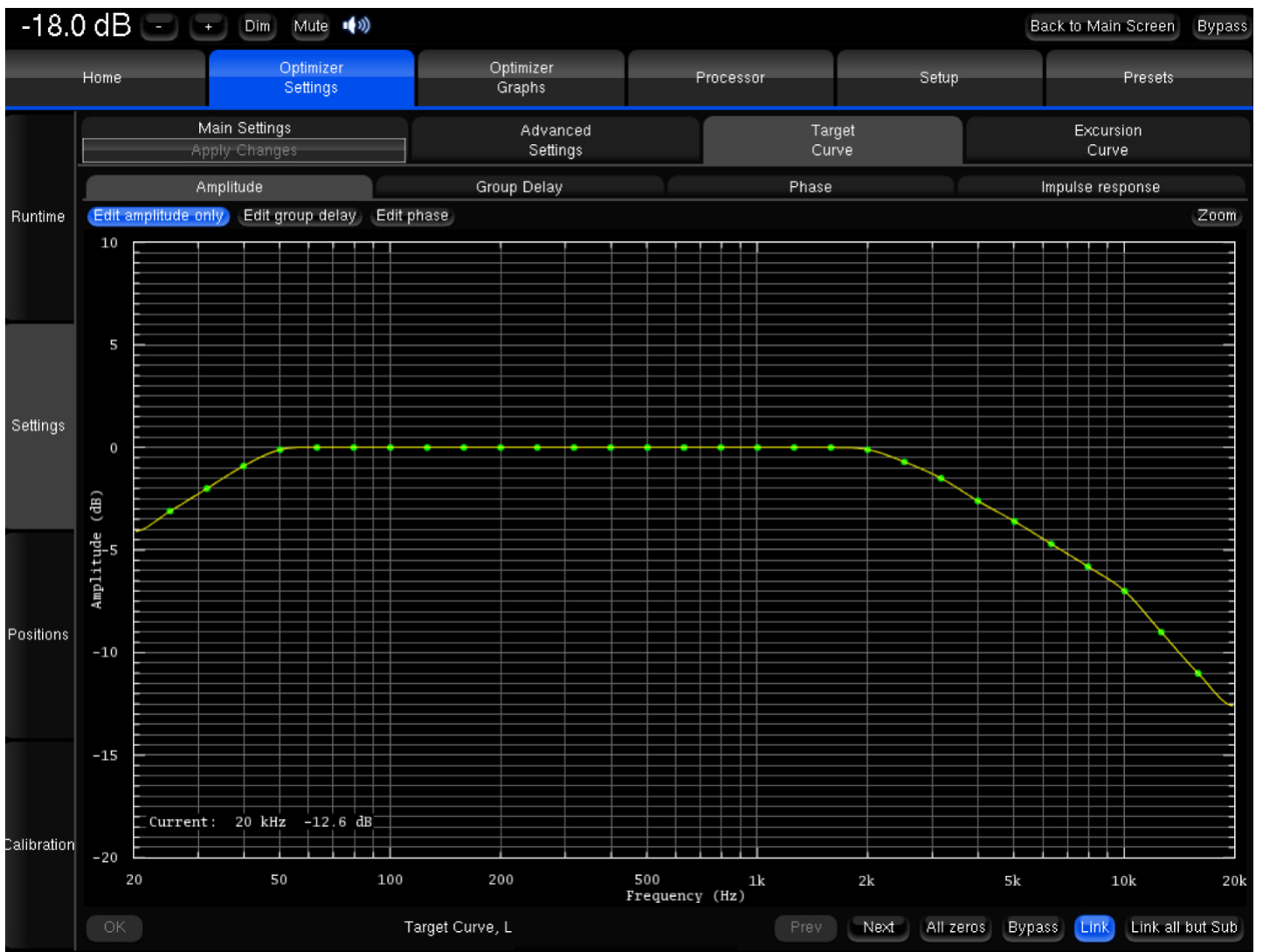
RAMATUELLE V2

Dolby Atmos 7.1.4 Reference Design

Reverberation and Acoustic Treatment

Interior acoustical treatments provide for the optimal reproduction of music and movies in stereo and multi-channel formats, as well as for relaxed conversation. Their usage is guided by two parallel requirements: reverberation time (RT60), and enhancement of sounds delivered by the loudspeakers; simply not to detract from the delivery of sound by these chosen loudspeakers while also achieving reverberation time objectives.

   We aim to design cinema rooms based around a RT time varying between 0.2 and 0.5 seconds, specifically working towards the sweet-spot of 0.39 for rooms with standard 5.1 and 7.1 configurations, and 0.32 for rooms where immersive audio layouts are implemented. We can in this way guarantee that immersion, dialog intelligibility and voice quality are of the best achievable for that room.

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Dolby Atmos 7.1.4 Reference Design

<u>Reverberation and Acoustic Treatment</u>

The table on the following page shows the selected acoustic treatments with the Sabine calculations for reverberation time (RT60) at 500Hz and other frequencies.

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Dolby Atmos 7.1.4 Reference Design

Reverberation Time 'RT60' 500Hz - Sabine Equations.

Wall/Surface	Area m² (ft²)	%	Material	RT @												RT60
				125Hz	RT125	250Hz	RT250	500Hz	RT500	1kHz	RT1000	2kHz	RT2000	4kHz	RT4000	
Front, 15.8m² (169.5ft²)	15.8m² (170.1ft²)	100%	Réfléchissant, contreplaqué (panneaux de 5 mm (3/16 po) sur un espace d'air)	0.38	5.985	0.24	3.78	0.17	2.678	0.10	1.575	0.08	1.26	0.05	0.788	2.678
Left, 22.8m² (244.9ft²)	22.8m² (245.4ft²)	100%	Réfléchissant, contreplaqué (panneaux de 5 mm (3/16 po) sur un espace d'air)	0.38	8.645	0.24	5.46	0.17	3.868	0.10	2.275	0.08	1.82	0.05	1.138	3.868
Right, 22.8m² (244.9ft²)	22.8m² (245.4ft²)	100%	Réfléchissant, contreplaqué (panneaux de 5 mm (3/16 po) sur un espace d'air)	0.38	8.645	0.24	5.46	0.17	3.868	0.10	2.275	0.08	1.82	0.05	1.138	3.868
Rear, 15.8m² (314.8ft²)	15.8m² (170.1ft²)	100%	Réfléchissant, contreplaqué (panneaux de 5 mm (3/16 po) sur un espace d'air)	0.38	5.985	0.24	3.78	0.17	2.678	0.10	1.575	0.08	1.26	0.05	0.788	2.678
Ceiling, 29.3m² (314.8ft²)	29.3m² (315.4ft²)	100%	Ceiling material, Sprayed cellulose fiber (32mm(1-1/4") on solid backing)	0.10	2.925	0.30	8.775	0.73	21.353	0.92	26.91	0.98	28.665	0.98	28.665	21.353
Floor, 29.3m² (314.8ft²)	29.3m² (315.4ft²)	100%	Floor materials, carpet	0.01	0.293	0.02	0.585	0.06	1.755	0.15	4.388	0.25	7.313	0.45	13.163	1.755
RT60 Calculation for Room:	0.454															

<u>**Seating Requirements**</u>

Seating Manufacturer : Unspecified

Range : Unspecified

Arrangement : 3 seat cinema (1 row of 3)

Seat pitch 1600mm (63"), cushion width 600mm (23.6"), arm width 150mm (5.9")

Rendered visualisation - view toward screen

Rendered visualisation - view toward seating