Simulation Tools in Sound Reinforcement: Multichannel Digital Audio Cinema Design

Athens Course UPM94
17-21 November 2014
Madrid

INDEX

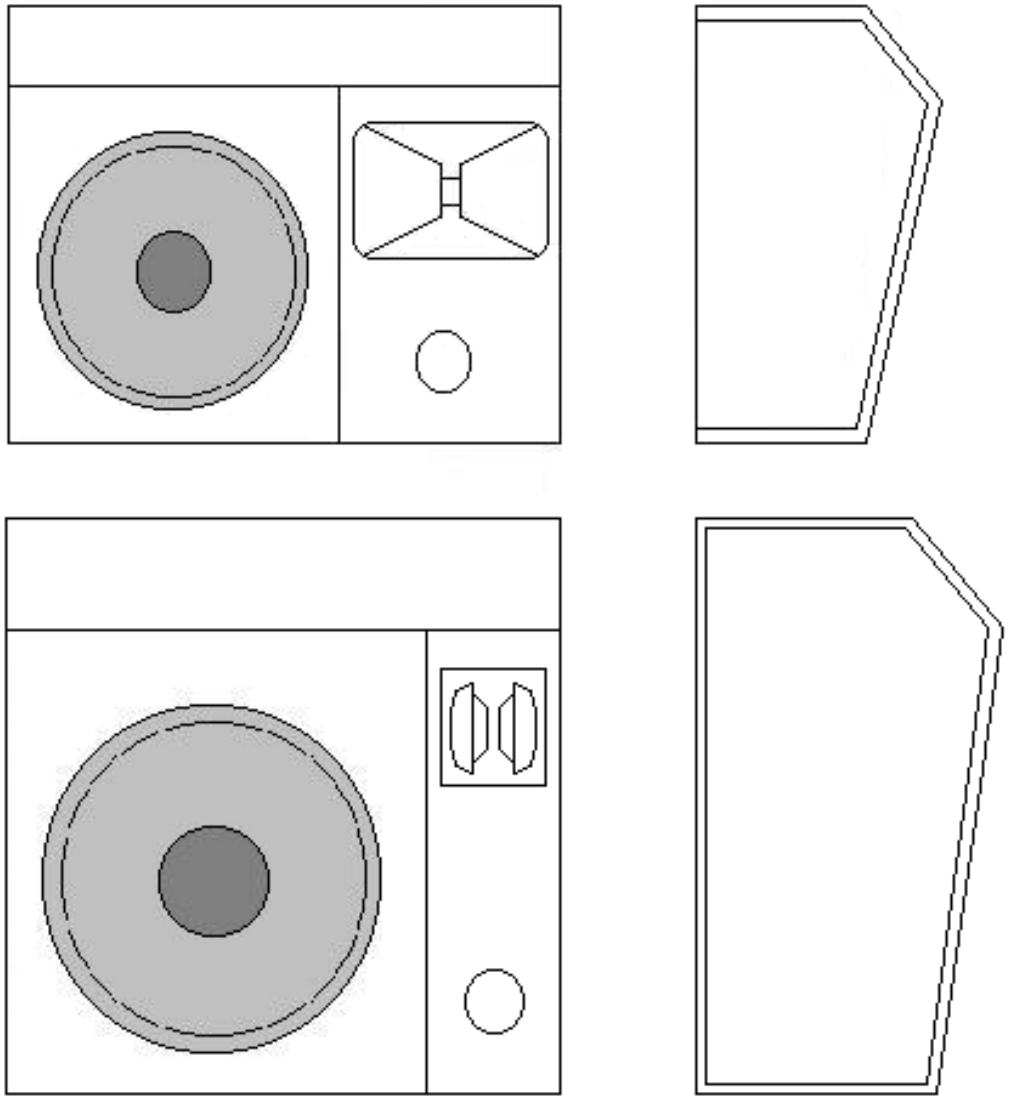
SURROUND CHANNELS

- The speaker system's surround, as a whole, should produce in the room the same sound power than producing each unit of screen channels.
- A of conventional screen system provides a sound power of about 28 W. A surround speaker provides a sound power of about 2 W.
- The number of surround speakers tends to be between 12 and 16 speakers. Usually always focuses on multiples of 4.
- The inclination of the surrounds will be at least 15°.

SURROUND CHANNELS

- Normally, on the back wall are placed 4 surround speakers.
- In very small rooms, 2 speakers on the back wall will only be placed.
- The system may be designed to be functional with Dolby Digital EX, DTS and SDDS, systems with surround back divided into two channels.
- The amplification systems will be designed with a power amplifier by at least two surround speakers.
- The field created by the surround system should be uniform, with variations of ±2 dB.

SURROUND CHANNELS



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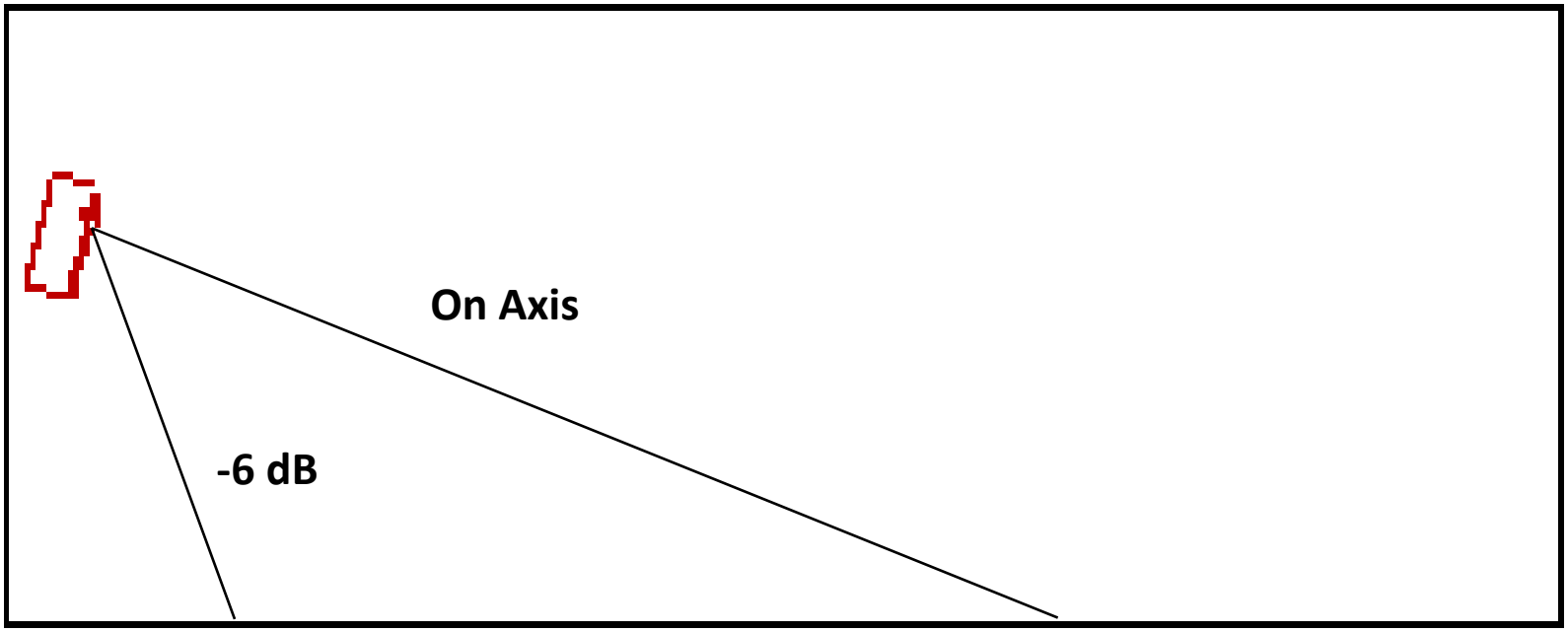

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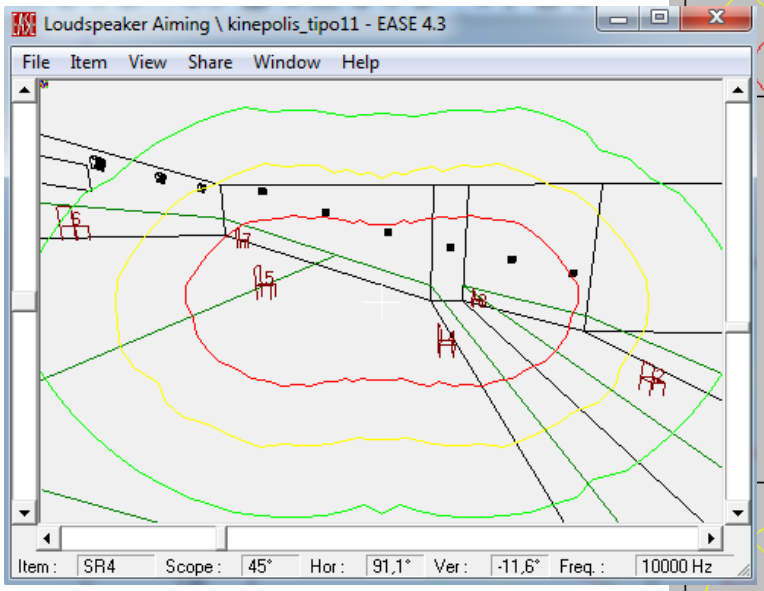

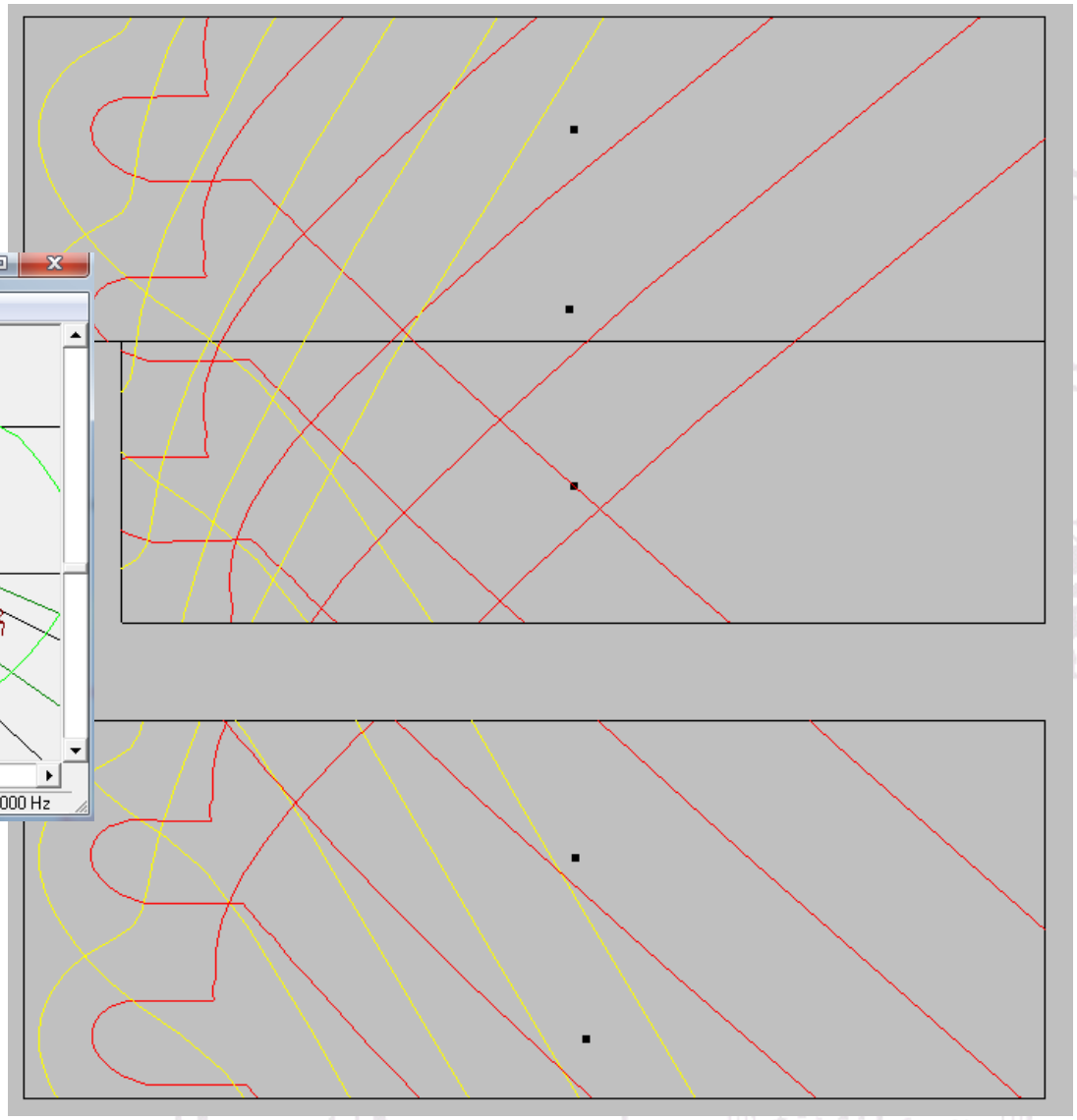

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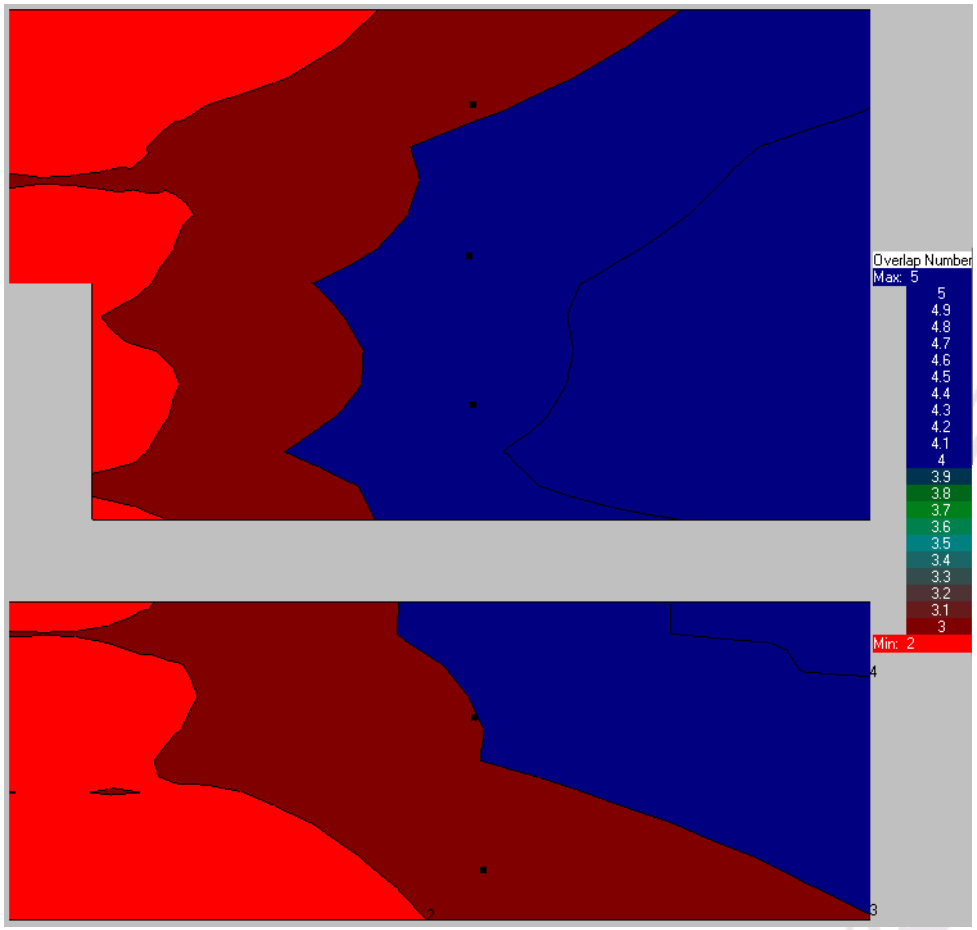

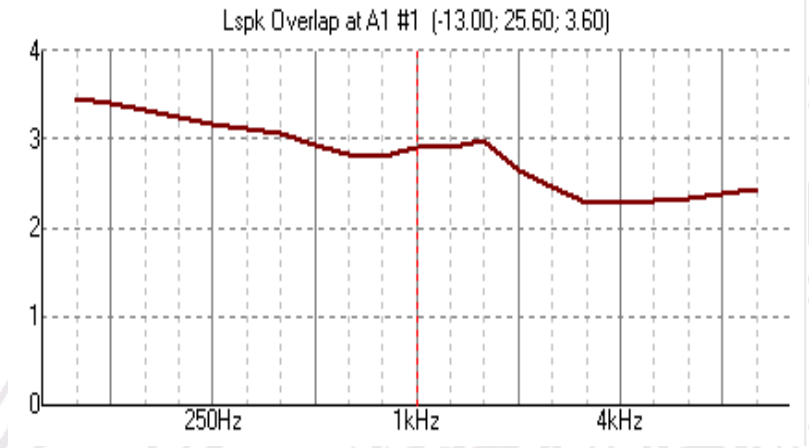

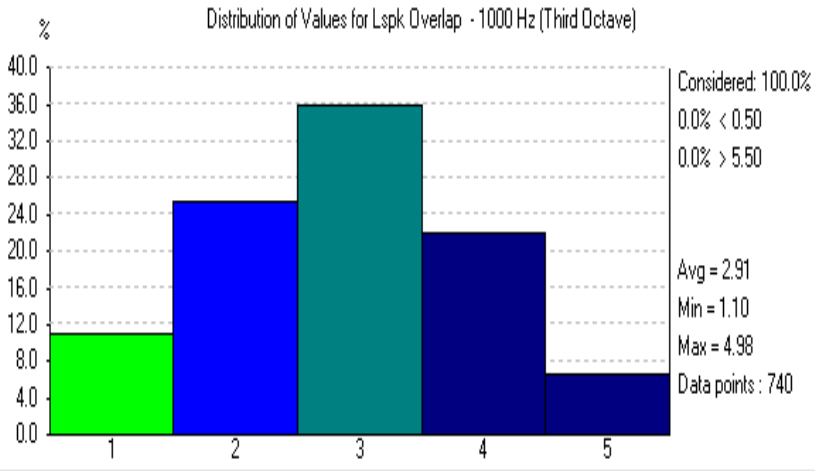

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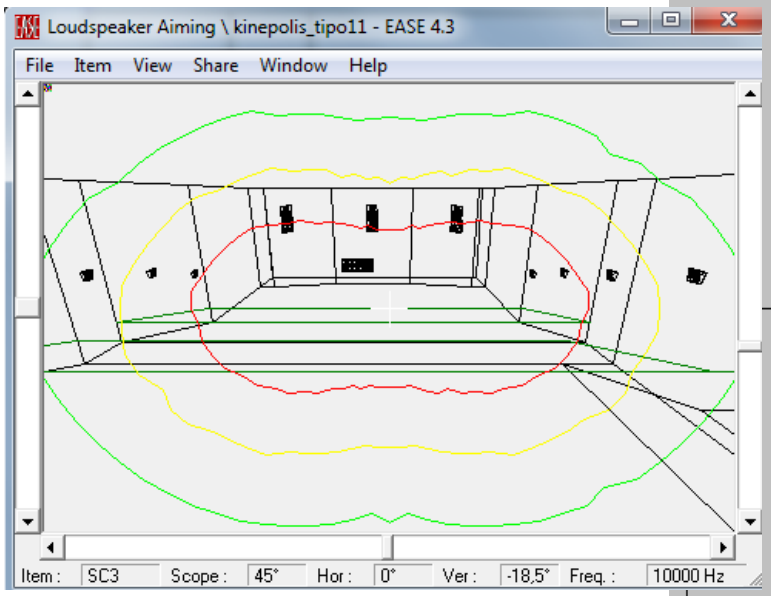

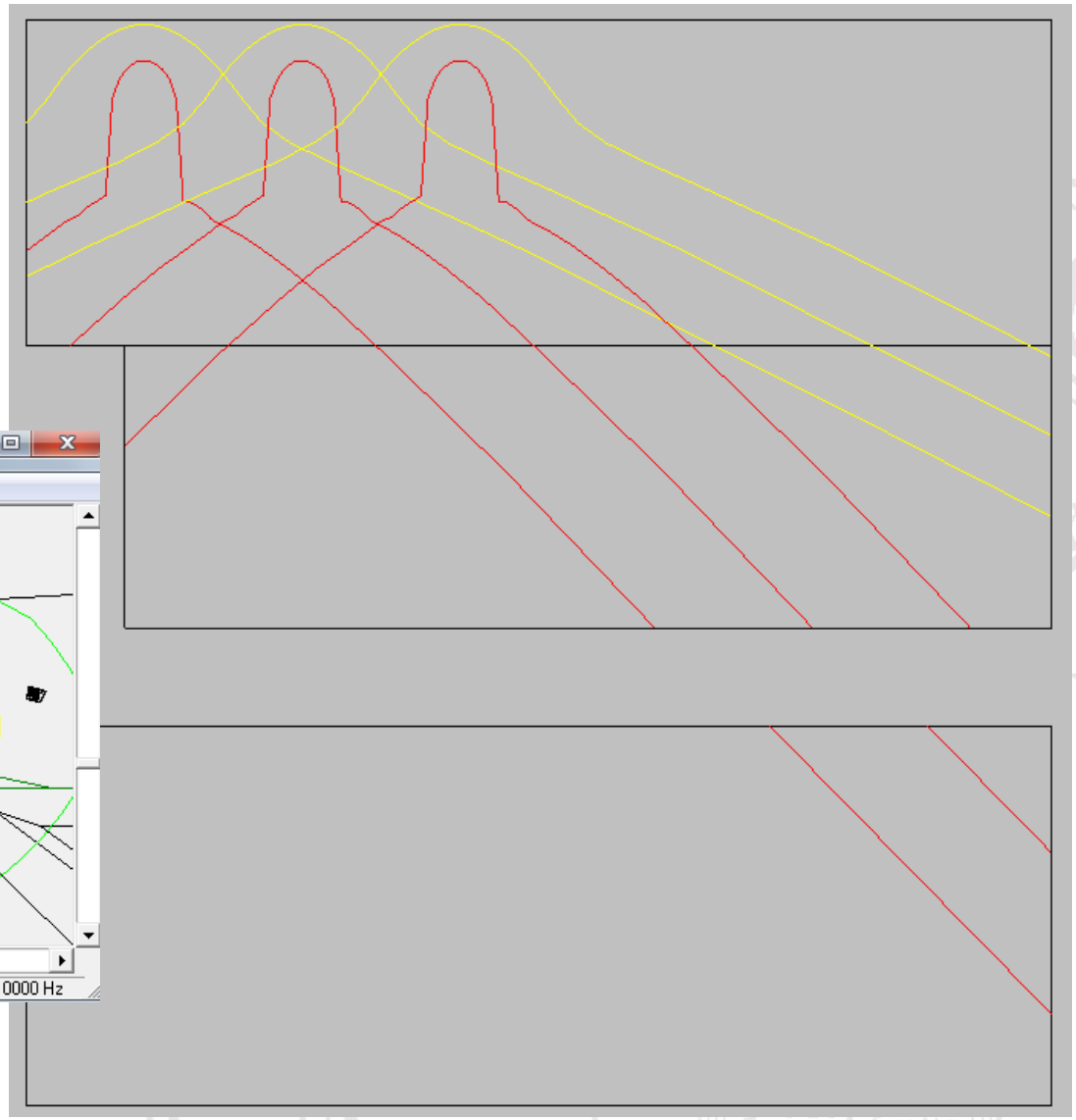

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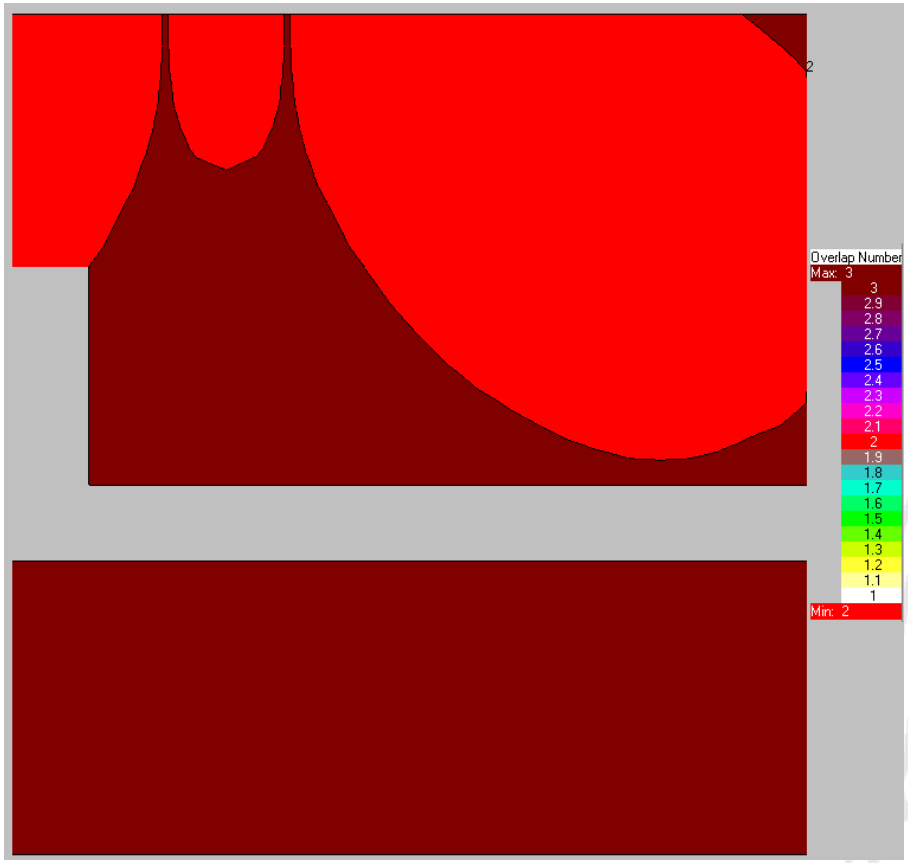

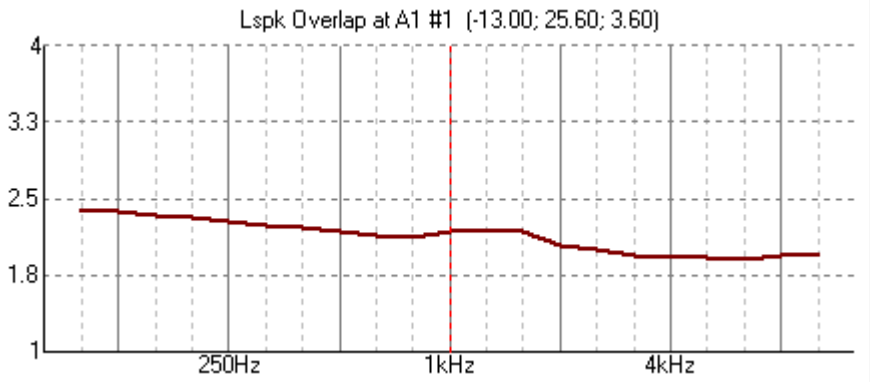

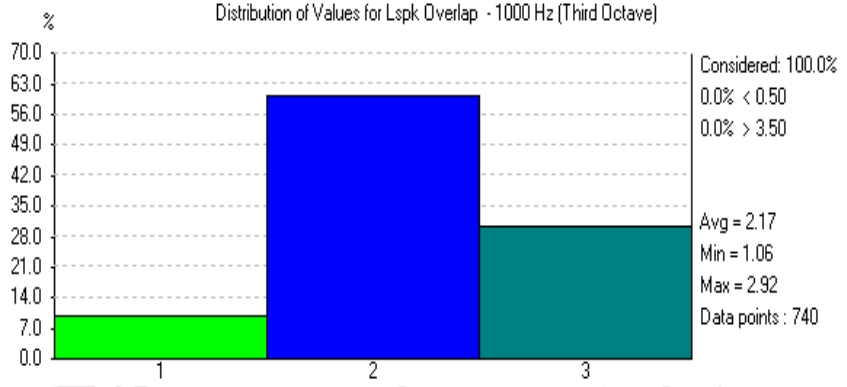

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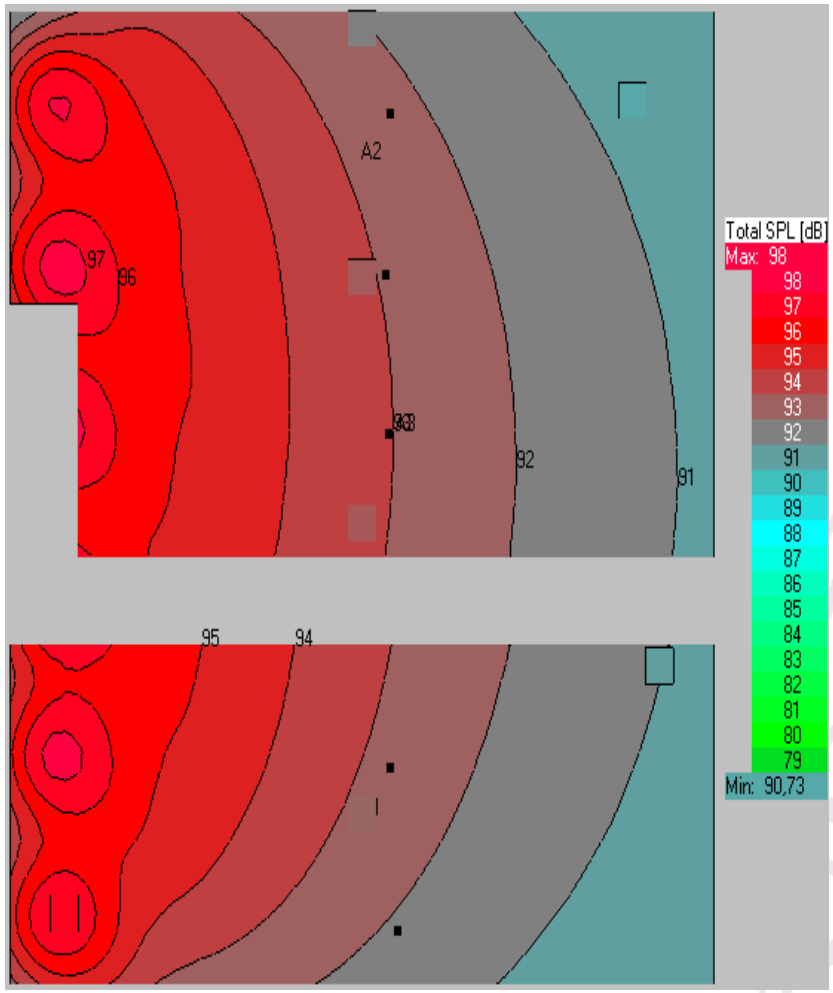
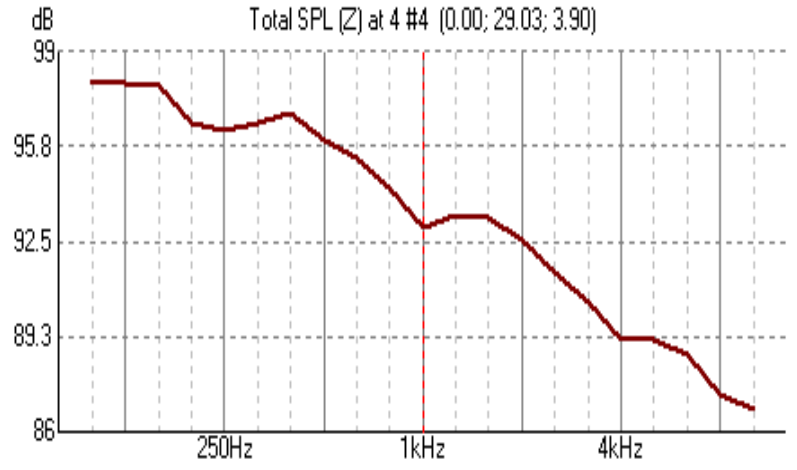
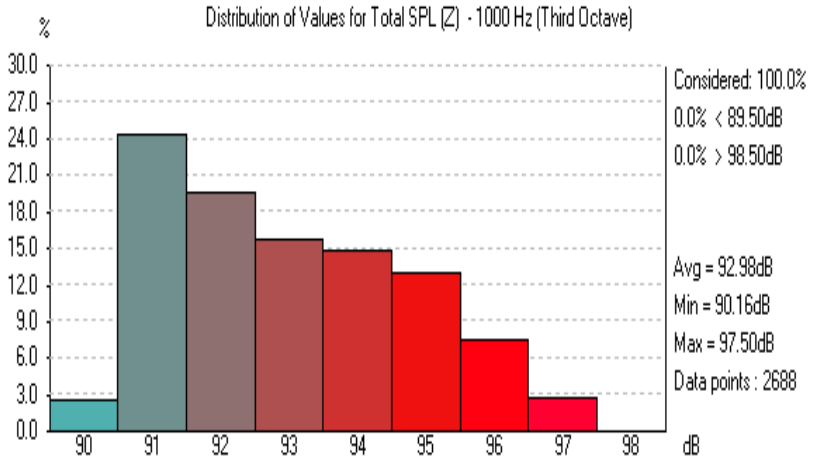
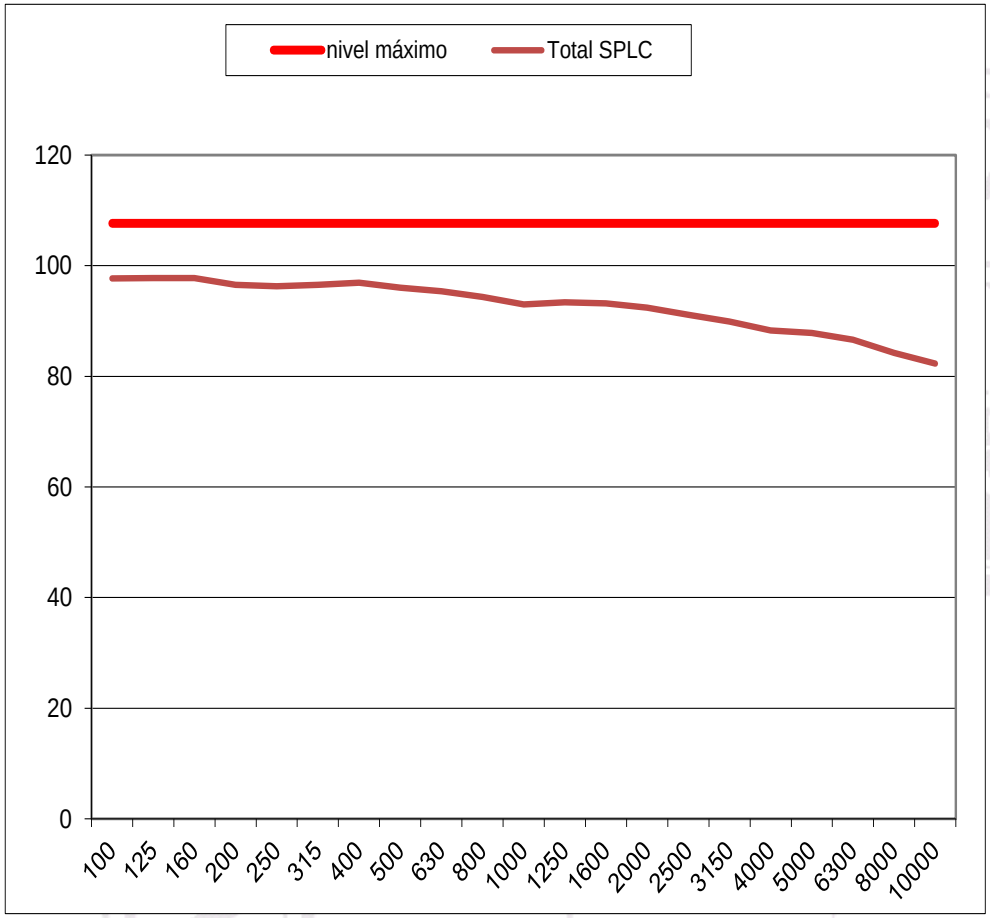






SURROUND CHANNELS

Altavoz SR inicial				
Frequency	Direct SPL	Total SPL	curva C	Total SPLC
100 Hz	90,27	98,02	-0,30	97,72
125 Hz	90,46	97,95	-0,17	97,78
160 Hz	91,49	97,83	-0,08	97,75
200 Hz	91,30	96,58	-0,03	96,55
250 Hz	92,14	96,30	0,00	96,30
315 Hz	93,03	96,55	0,02	96,57
400 Hz	93,80	96,88	0,03	96,91
500 Hz	93,28	95,99	0,03	96,02
630 Hz	92,81	95,36	0,03	95,39
800 Hz	92,05	94,35	0,02	94,37
1000 Hz	90,93	92,98	0,00	92,98
1250 Hz	91,27	93,41	-0,03	93,38
1600 Hz	91,22	93,28	-0,09	93,19
2000 Hz	90,58	92,57	-0,17	92,40
2500 Hz	89,73	91,43	-0,30	91,13
3150 Hz	88,81	90,43	-0,50	89,93
4000 Hz	87,52	89,14	-0,83	88,31
5000 Hz	87,49	89,12	-1,29	87,83
6300 Hz	86,99	88,61	-1,99	86,62
8000 Hz	85,65	87,27	-3,05	84,22
10000 Hz	85,06	86,73	-4,41	82,32
	Nivel en banda ancha [dBC]			107,69



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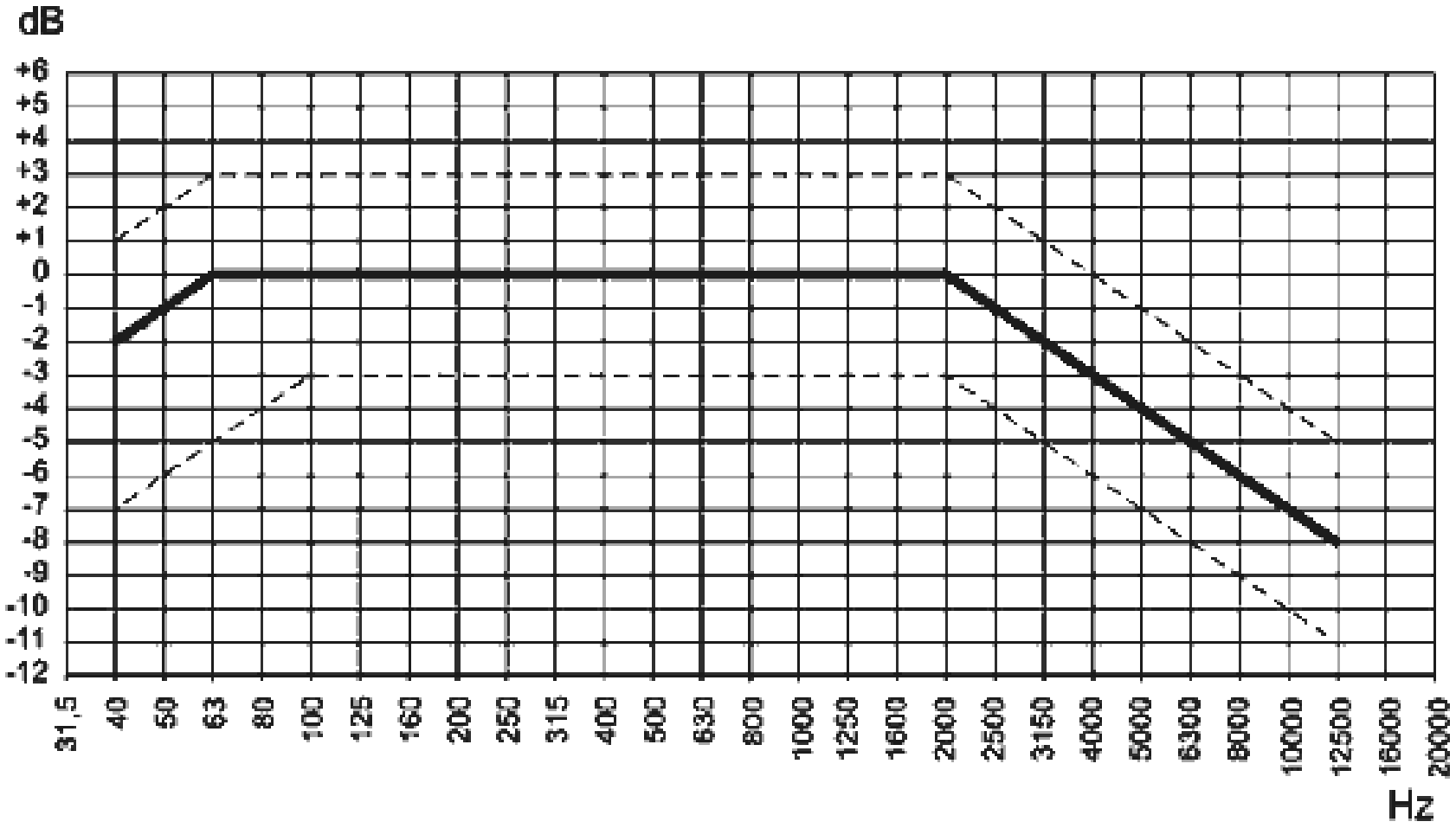
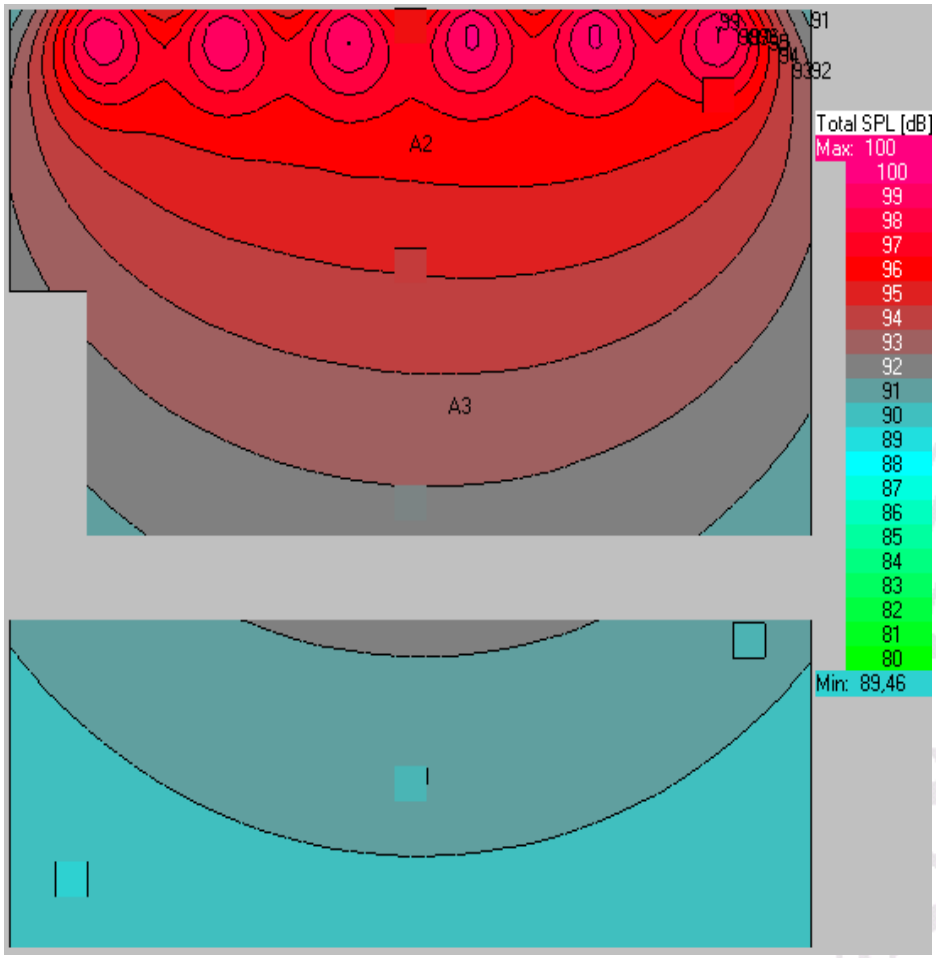
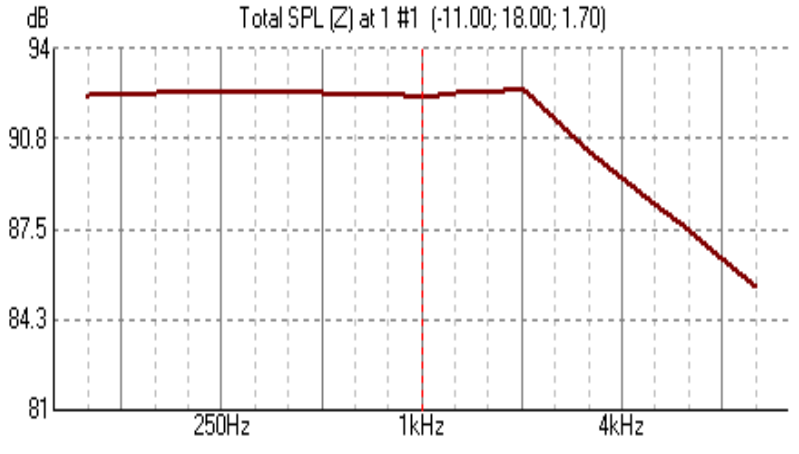
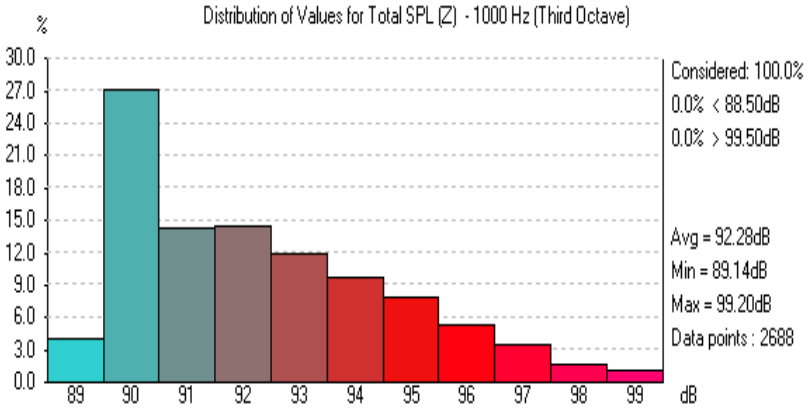


Ecualización ISO 2969 Curva-X

SURROUND CHANNELS

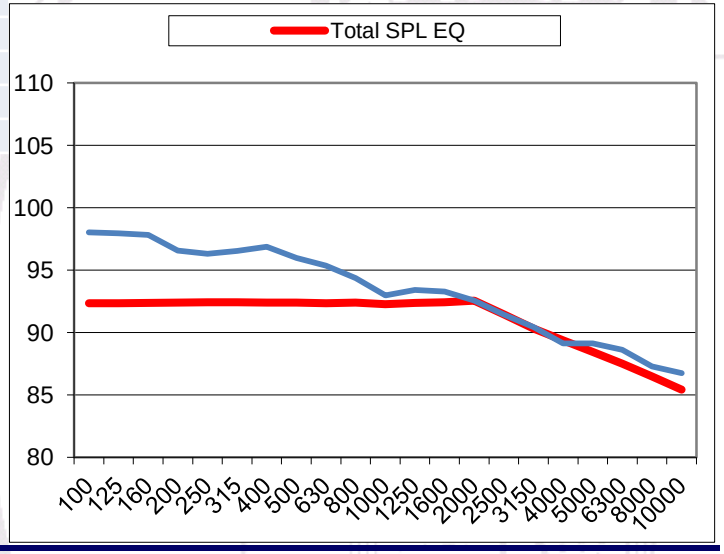






SURROUND CHANNELS

Frequency	Total SPL sin EQ	CurvaX	Atenueación	Total SPL EQ	SPL 1m sin EQ	SPL 1m EQ	Total SPL EQ
100	98,02	0	-5,88	92,14	107,22	101,34	92,34
125	97,95	0	-5,81	92,14	107,22	101,41	92,35
160	97,83	0	-5,69	92,14	108,22	102,53	92,38
200	96,58	0	-4,44	92,14	108,22	103,78	92,41
250	96,30	0	-4,16	92,14	109,22	105,06	92,43
315	96,55	0	-4,41	92,14	110,22	105,81	92,42
400	96,88	0	-4,74	92,14	111,22	106,48	92,41
500	95,99	0	-3,85	92,14	111,22	107,37	92,39
630	95,36	0	-3,22	92,14	111,22	108	92,35
800	94,35	0	-2,21	92,14	110,22	108,01	92,40
1000	92,98	0	-0,84	92,14	109,22	108,38	92,28
1250	93,41	0	-1,27	92,14	109,22	107,95	92,38
1600	93,28	0	-1,14	92,14	109,22	108,08	92,43
2000	92,57	0	-0,43	92,14	109,22	108,79	92,54
2500	91,43	-1	-0,29	91,14	109,22	108,93	91,44
3150	90,43	-2	-0,29	90,14	109,22	108,93	90,31
4000	89,14	-3	0,00	89,14	108,22	108,22	89,36
5000	89,12	-4	-0,98	88,14	108,22	107,24	88,44
6300	88,61	-5	-1,47	87,14	108,22	106,75	87,50
8000	87,27	-6	-1,13	86,14	107,22	106,09	86,47
10000	86,73	-7	-1,59	85,14	107,22	105,63	85,41



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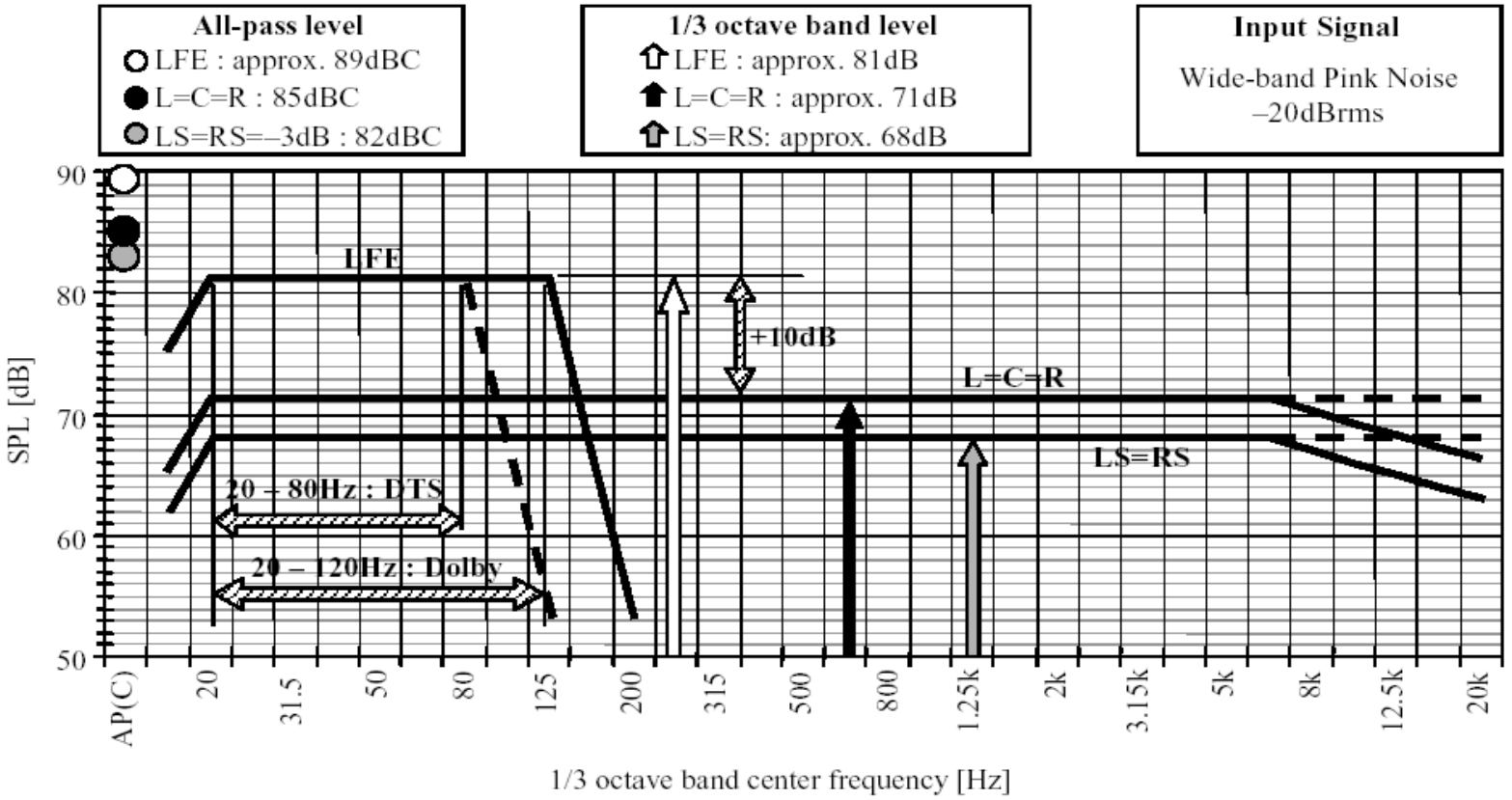
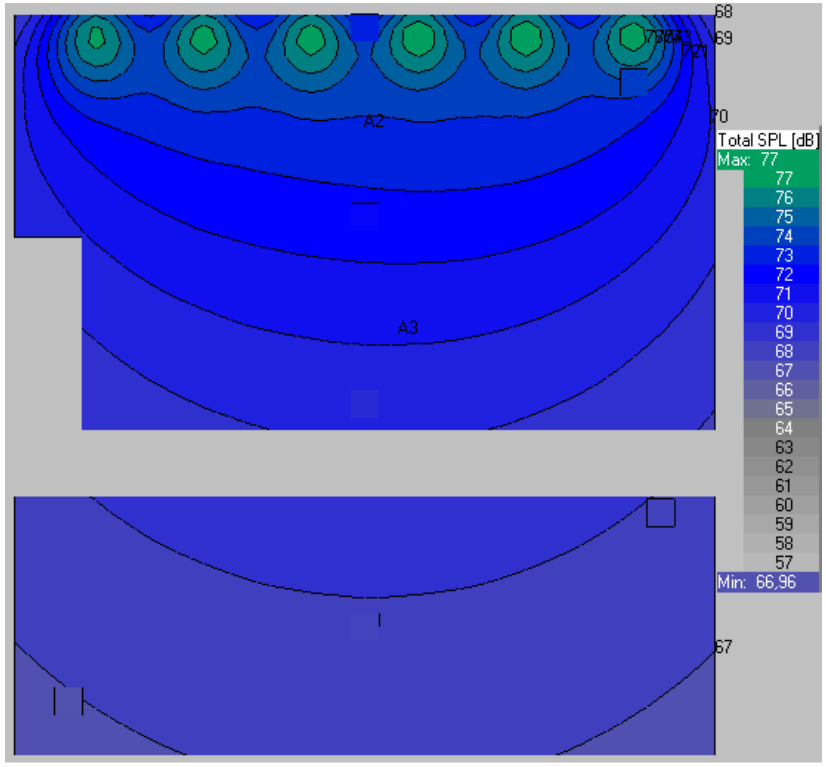
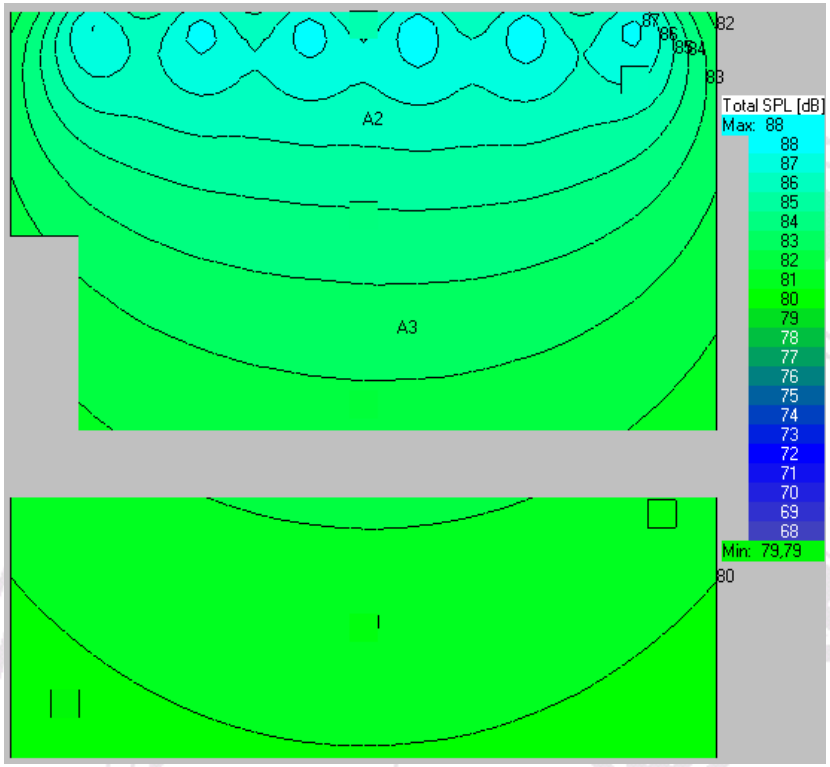


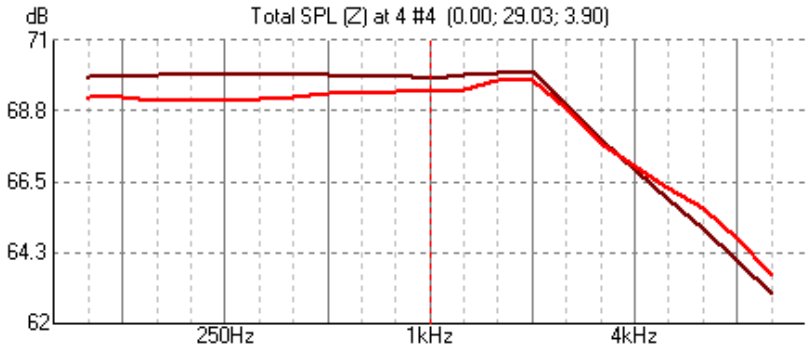
[Level balance of the surround channels]
For film productions, set the playback level of the surround channels at –3 dB relative to the front channels.
In the case of L = C = R = 85 dBC,
3-1: LS = RS = 82 dB; in other words, S (LS+RS) = 85 dBC
5.1: LS = RS = 82 dBC
6.1: LS = RS = BS = 82 dB

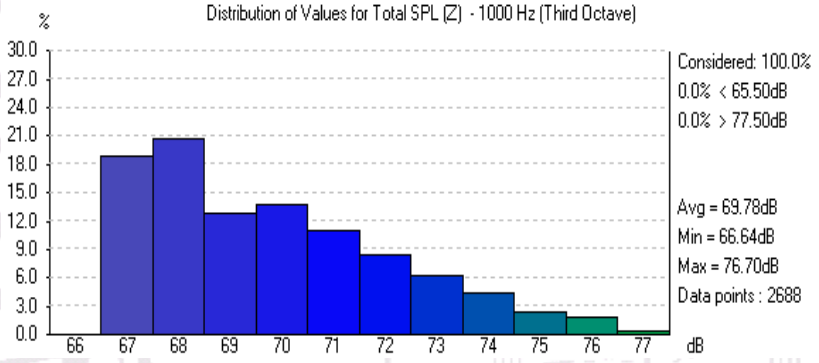
[X Curve of the B-Chain: SMPTE 202M-1998]

SURROUND CHANNELS









SURROUND CHANNELS

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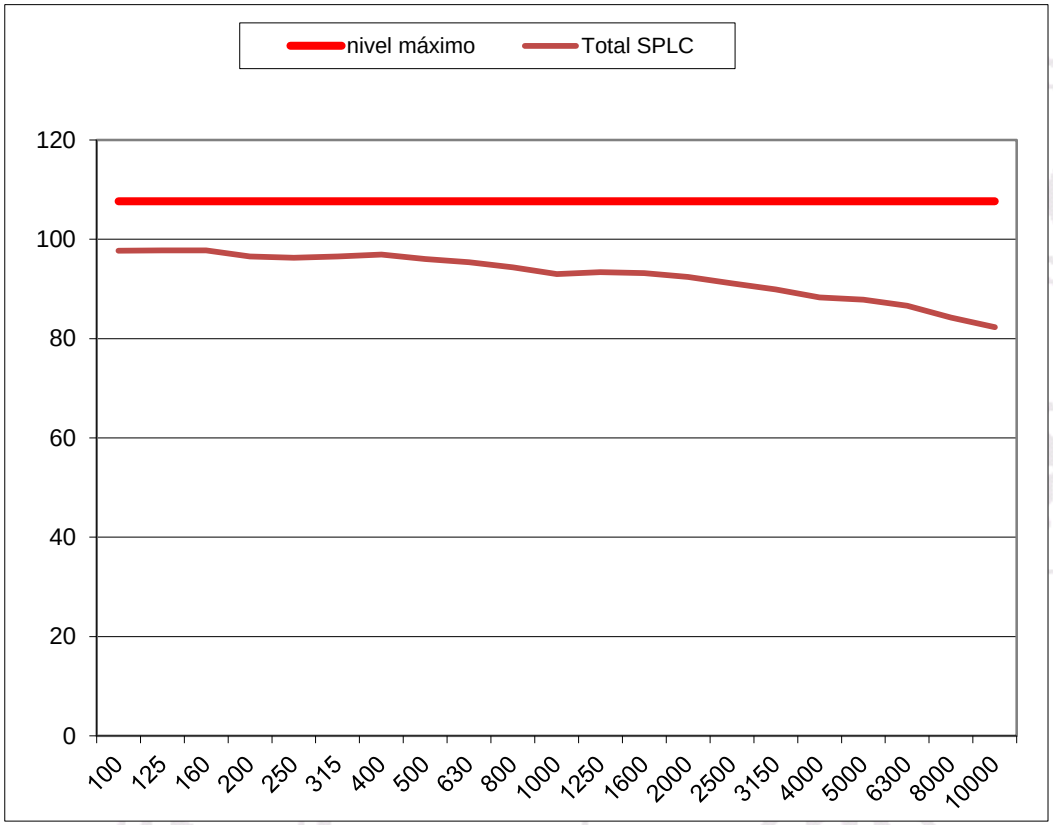


SURROUND CHANNELS

- There are two types of surround speakers:

  Moderate power (Cone/Dome)
  Sensitivity = 91 dB SPL; Power = 100 W

  High power (Cone/Horn)
  Sensitivity = 96 dB SPL; Power = 250 - 350 W

- The first ones may be used in rooms up to 200 seats. In the rooms of more than 200 seats must always be used the second ones.
- In the majority of rooms, surrounds number usually are 12 or 16 loudspeakers.

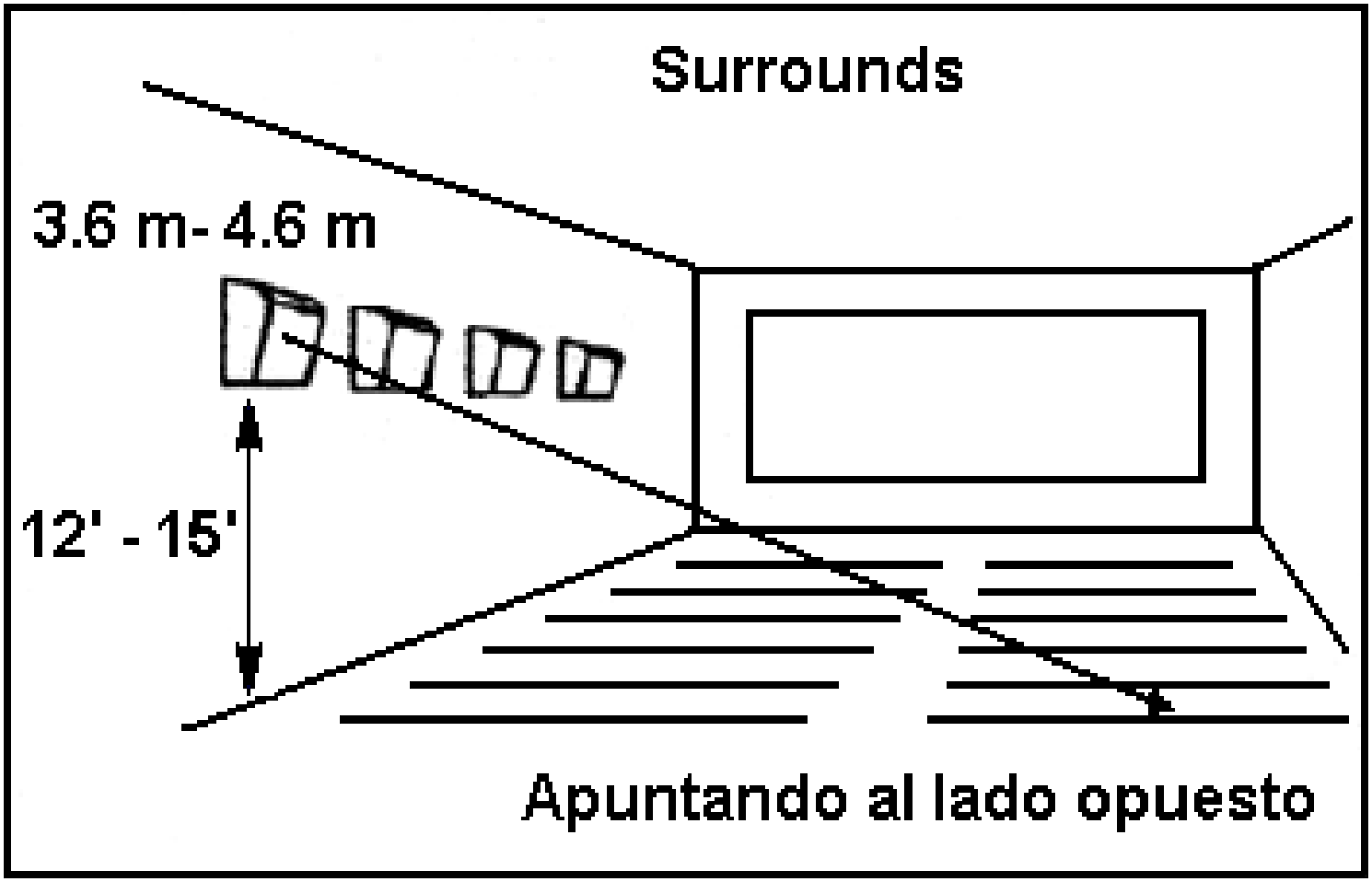
SURROUND CHANNELS

- On the back wall are usually specify at least 4 speakers, placed symmetrically with respect to the axis of the room.
- Surround speakers are placed on the 2/3 backs room, so that in the 1/3 above do not overlap with the screen.
- The last speaker of suuround is placed between 3 and 4 m (9-12 ft) from the back wall.
- The density of surround speakers will be with separations between 3 and 4 m (9-12 ft).

SURROUND CHANNELS

- The height varies between 3 and 4.5 m (9-15 ft), trying to follow the inclination of the audience.
- The elements of high-frequency axis will point toward the seats located on the wall opposite.
- In rooms with much depth will be necessary to apply delays to some surrounds in order to keep the precedence effect.
- Coverage in the 2/3 posterior parts of the room should be uniform with a variation of ±2 dB level.

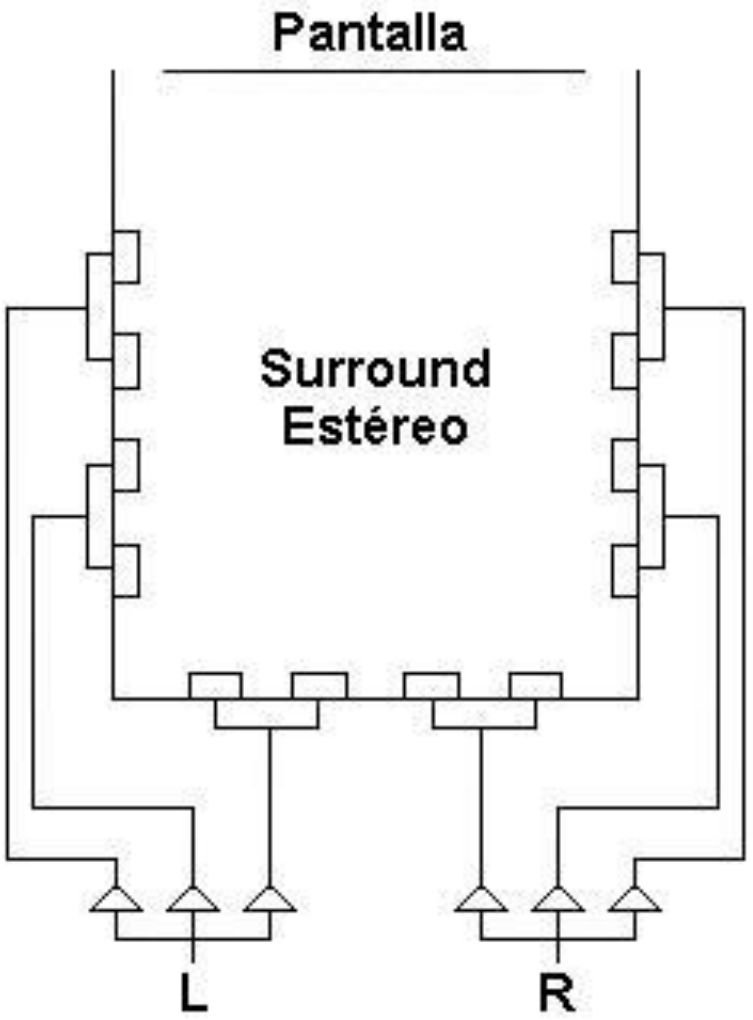
SURROUND CHANNELS

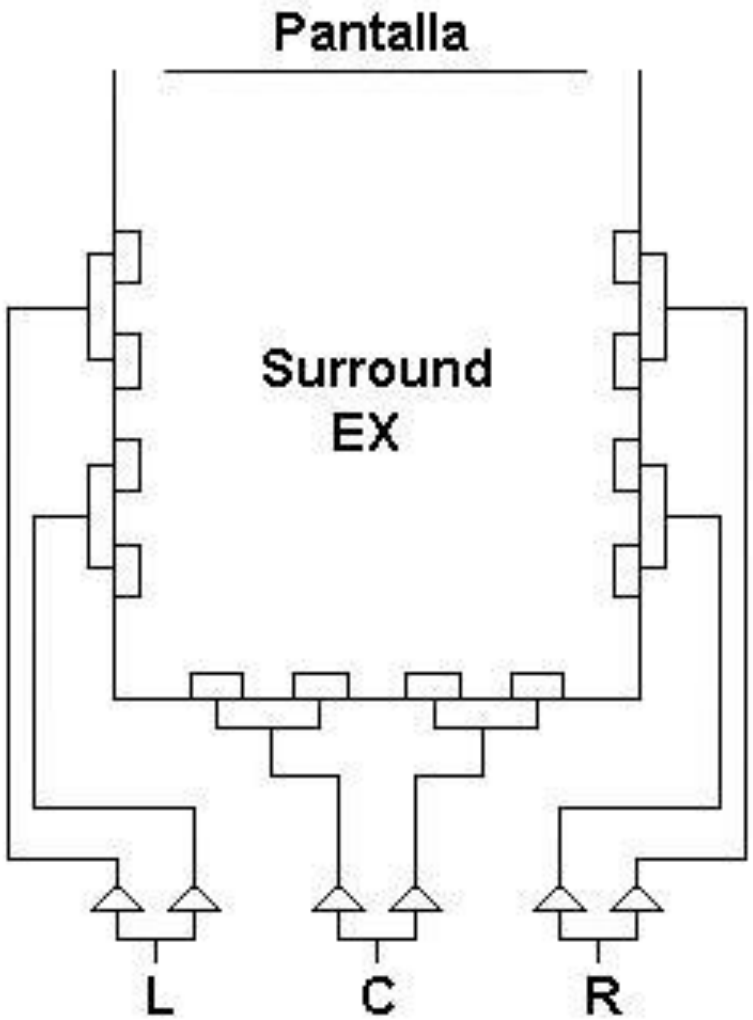


SURROUND CHANNELS

- Should be scheduled the installation of three channels of surrounds for the case that in the room will play a system will Surround EX.
- In this case, must always be the same number of surrounds per channel.
- In these rooms the number of surround will be specified as multiples of 6 (12, 18, 24), for the best possible balance the system.

SURROUND CHANNELS

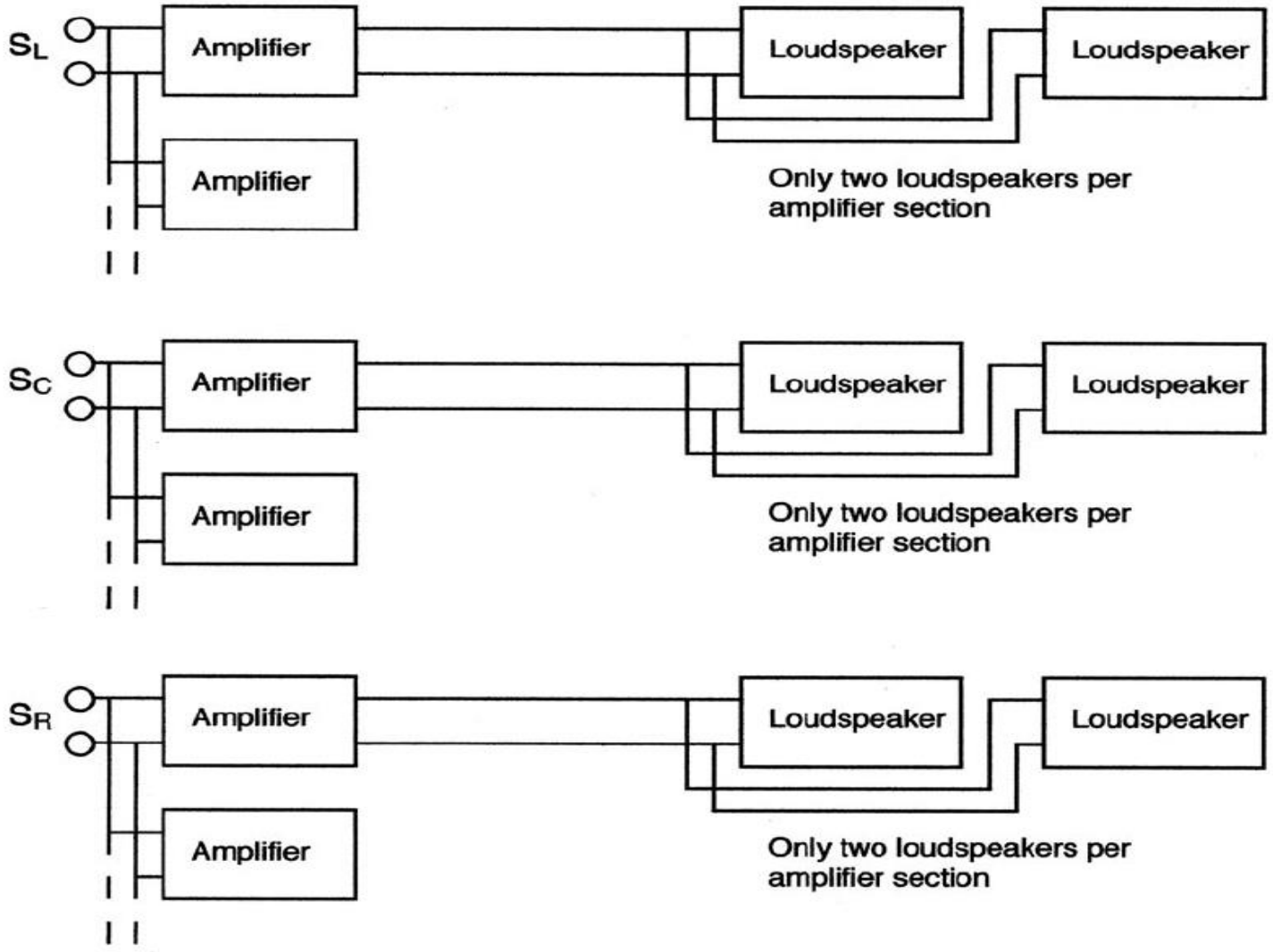




SURROUND CHANNELS

- Be selected amplifiers 4 Ω with twice the power of the individual power of each surround speaker.
- Two speakers can be connected for each surround amplifier. The connection is done in parallel between both speakers in the output of the power amplifier, akin to balance losses from the wiring.
- The number of amplifiers required will be the number of speakers of surround divided by 4.

SURROUND CHANNELS



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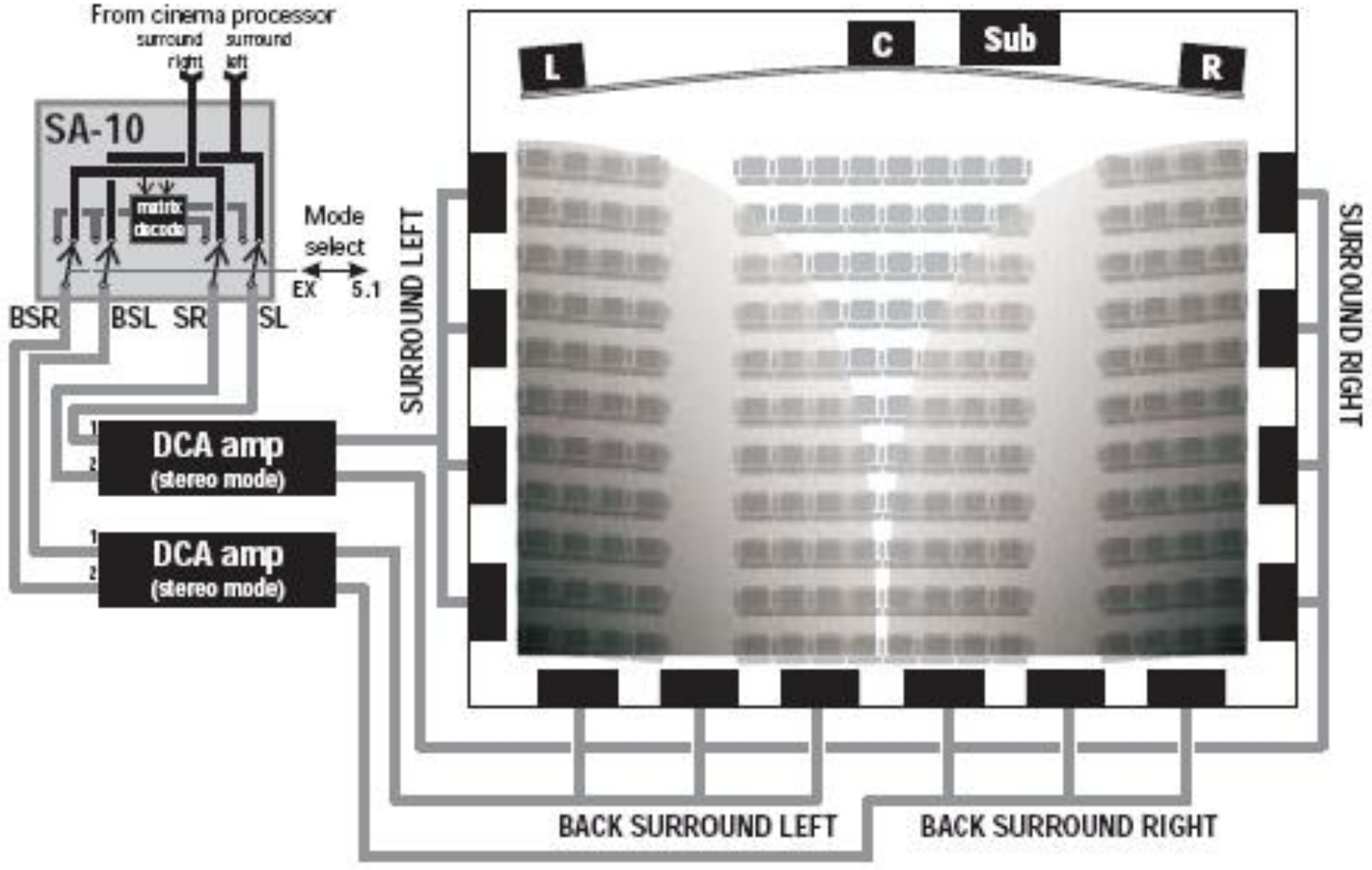
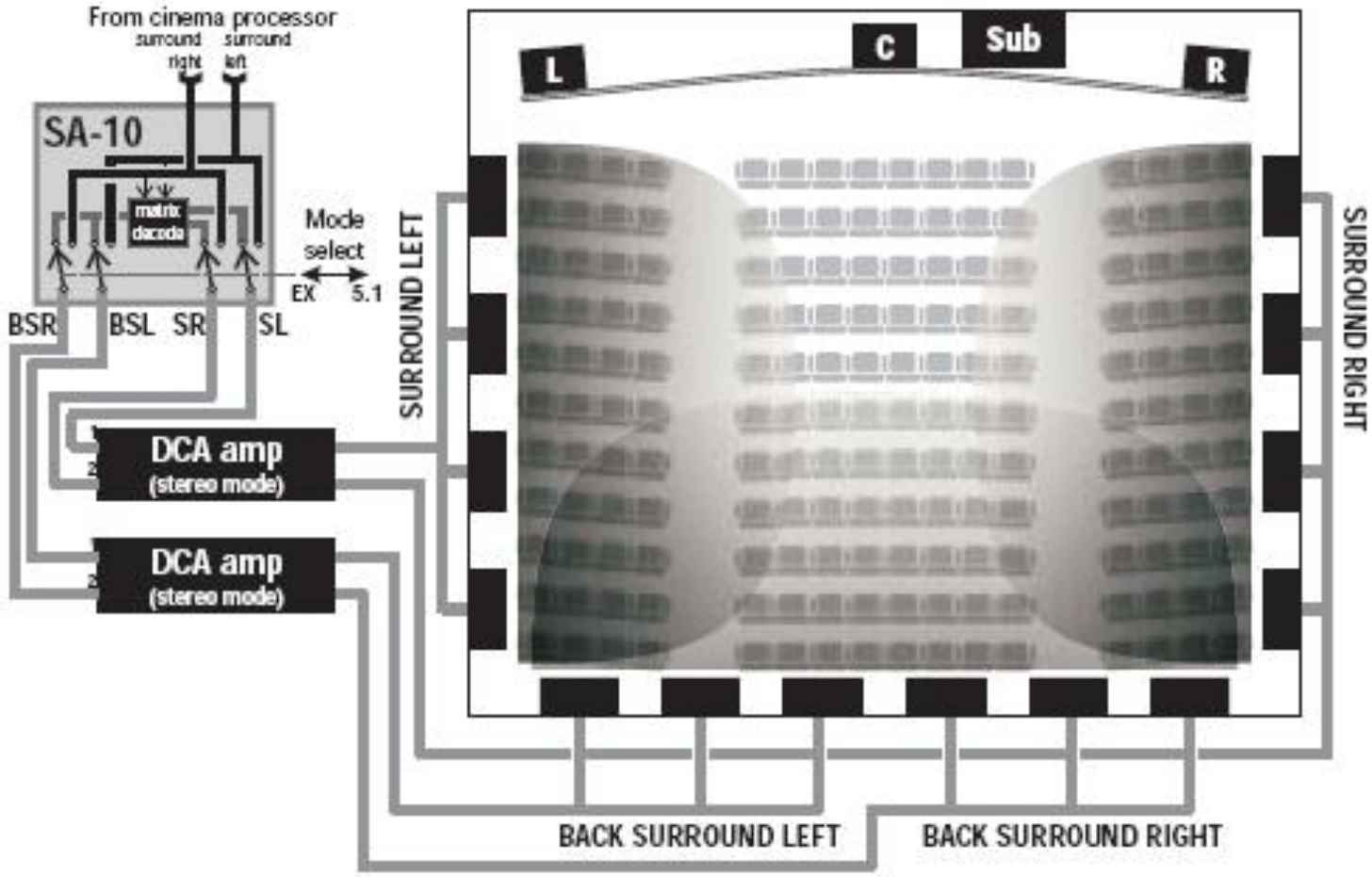


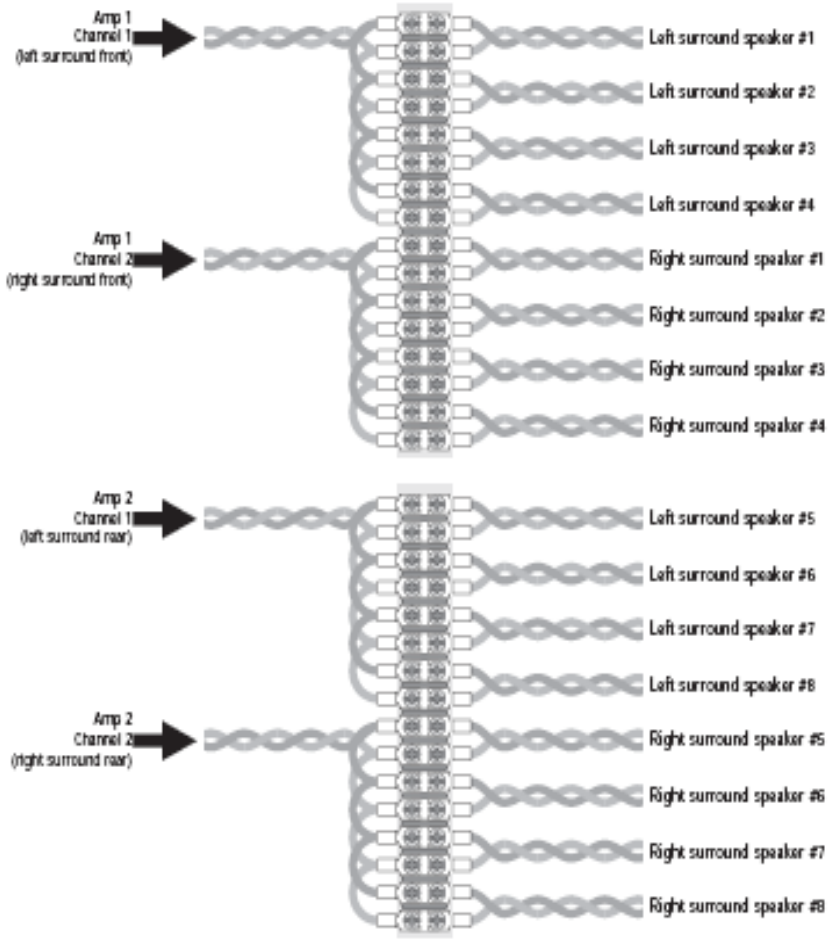
A Dolby Digital - Surround EX system in 5.1 mode

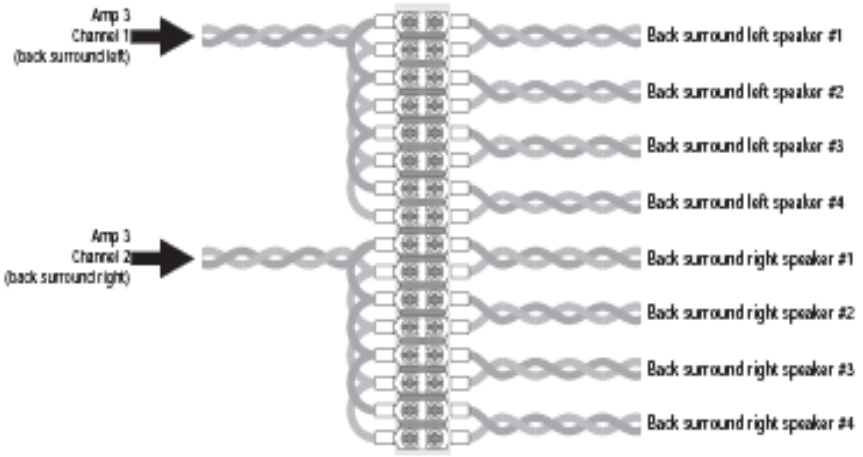
SURROUND CHANNELS



A Dolby Digital - Surround EX system in 6.1 mode

SURROUND CHANNELS





A terminal strip panel
for wiring surround speakers