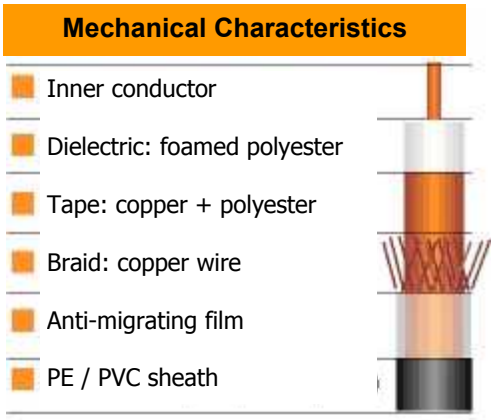
COAXIAL CABLE SHIELDING - GENERAL CONSIDERATIONS

Given the confusion surrounding the shielding and coverage percentage of coaxial cables, as well as when to use the different types, Televés would like to make the following points:

1. In general terms, the **electrical screening** refers to the capacity that the cable features to either cause interference by signal radiation or to be interfered by the ingress of external signals.
   It is a parameter that deals with the effectiveness of the elements that make up the screening.
   The screening is usually a combination of a **metallic laminated tape** and a **braid**.
   The electrical screening parameter is measured in **dB**s, and it is known also with other different names:
   - Screening (referring to the EN 50117 standard)
   - Screening efficiency
   - Screening attenuation
   - Shielding



2. Generally, the **metallic laminated tape** (foil) encircles the whole of the cable, however, this doesn't mean that the screening is perfect or that it cannot be improved. In fact most of the times, this is not even enough to comply with the EN 50117 standard (more than 75 dB from 30 to 1000 MHz).

   Depending on the type of cable, this foil is made of various different materials (copper/aluminum + polyester/polypropylene...).
   It is taped lengthways, and a shorting fold creates the effect of a solid metal conduit, providing metal-to-metal contact to improve the high frequency performance of the cable. The fold prevents a slot opening from being created in the shield, thus avoiding signal ingress or egress.

3. **The braid** consists of different groups of wires (strands), twisted over the foil shield. These strands can be made of different materials, depending on the

type of cable (copper, aluminum, copper-coated aluminum, copper-coated steel...).

3.1. The number of strands also changes depending on the cable.

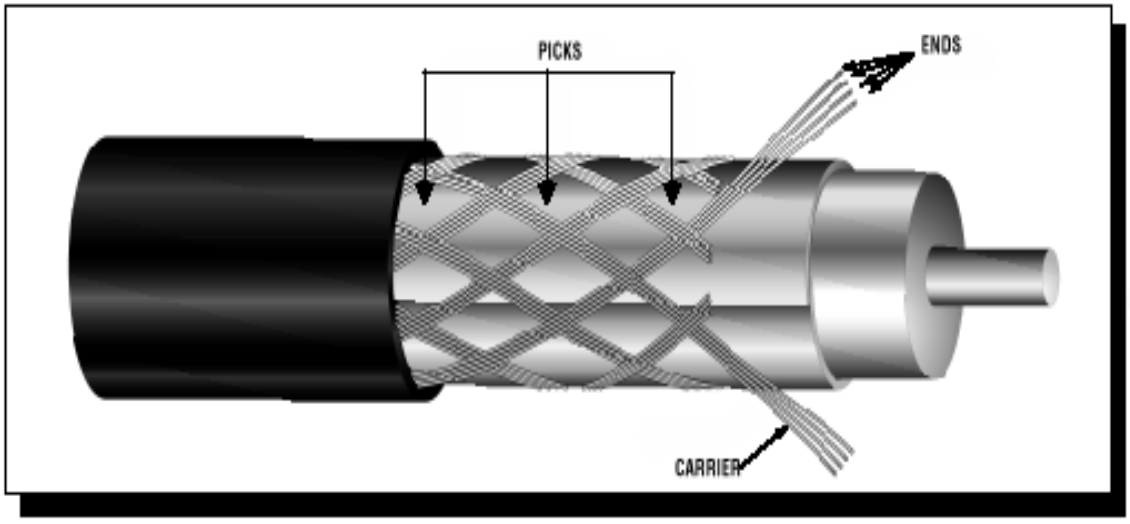
The braid improves:

- The cable's electrical screening.
- The cable's shield; it is one of the main protective elements of the foil.
- The metal-to-metal contact of the shorting fold.

3.2. **Braid coverage**. Apart from the shielding foil that surrounds all of the cable, another important aspect is the braid coverage, which contributes to the efficiency of the screening.
Certain parameters affect the screening efficiency of the braid, for example, the diameter and number of strands, ...
However, the better the quality of the screening inner layers, the less important the braid coverage.
In most cases the higher the number of strands, the greater the braid surface coverage.
But, this is not always so, as the covered cable surface differs depending on the way the braid strands are twisted.
Thus, in certain cases there may be less strands, but better screening efficiency.

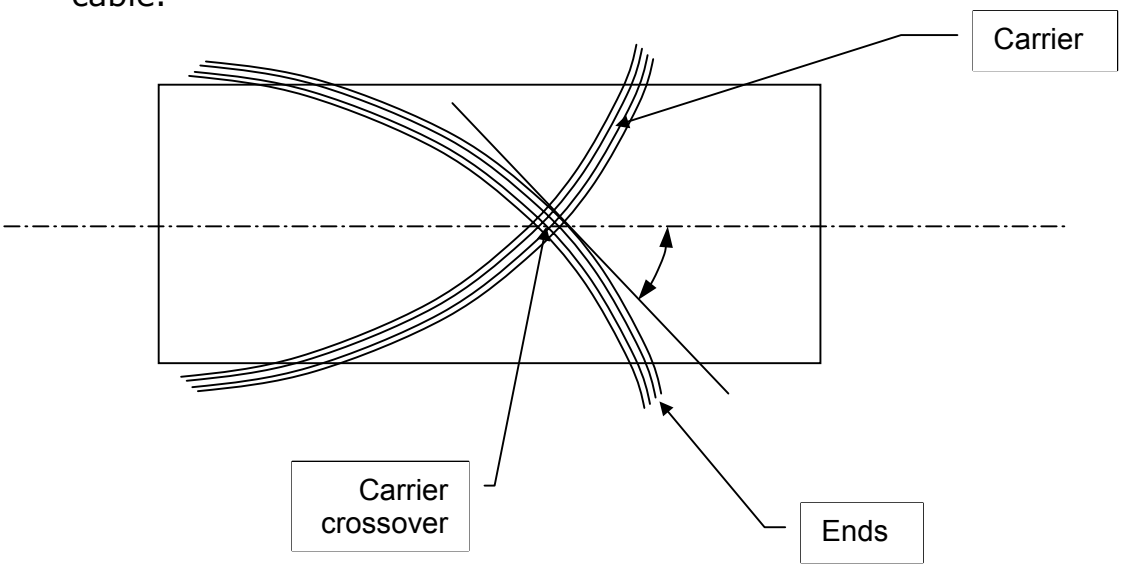
However, the following is always the case:

the higher the coverage => the higher the number of strands => the heavier the cable => the greater the cost.



Greater coverage means:

- The larger the angle between the group of strands and the axis of the cable.



- The greater the number of groups of strands (*carriers*)
- The greater the number of strands (*ends*).
- The greater the number of carrier crossovers.

The braid coverage can be calculated using the following formula:

Coverage percentage = $(2F - F^2)\cdot 100$

Where:

$$F = \frac{N\cdot P\cdot \varphi}{\sin(A)}$$

$$A = \tan^{-1} 2\pi\cdot(\Phi + 2d)\cdot(P/C)$$

Being:
C = Number of groups
N = Number of wires/group
P = Number of crossovers/inch (it is possible to see that in all of the cables, the number of crossovers in one inch is an exact number)
φ = Diameter of the strands in inches.
Φ = Diameter of the structure underneath the braid.

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Practical results using the coverage formula for the braid.

Reference	Diameter of the strands in the braid.	Diameter of the structure under braid.	Nº of strands per group	Nº of groups in the braid	Nº of crossovers in the groups per inch.			**% COVERAGE**	CABLE DESCRIPTION / OBSERVATIONS
	d<mm>	**D<mm>**	**N**	**C**	**P**	**A**	**F**	**% Med.**	
2140	0,16	11,4	4,5	24	7,5	42,1756	0,3166	53,3	1/2"
2149	0,16	7,4	5	16	5	30,8272	0,3073	52,0	TR165
2141	0,1	4,9	4	16	5	21,5161	0,2147	38,3	T100PLUS
2155	0,1	4,8	4	16	5	21,1318	0,2184	38,9	T100PE
2150	0,12	4,9	4	16	5	21,6693	0,2559	44,6	T100AL
2152	0,16	4,7	2	16	5	21,2088	0,1741	31,8	CXT
2153	0,12	4,8	3	16	7	28,6097	0,2072	37,1	CXT-1
2138	0,12	4,9	2	16	6	25,4915	0,1317	24,6	CXT Cu
xxxx	0,16	3,9	5	16	7	24,5459	0,5307	78,0	RG-59
xxxx	0,16	7	8	16	5	29,5031	0,5116	76,2	RG-11

4. There are two different categories as regards the braid coverage (although some manufacturers make three distinctions):

- 30% to 60% coverage
- 60% to 90% coverage

Regarding the number of shielding layers, we can differentiate between:

- Standard: Tape and braid.
- Tri-shield: Uses the standard shielding design, plus an additional outer tape.
- Quad-Shield: Adds a second outer layer of braid to the Tri-Shield design.

The most important manufacturers specify the coverage of the inner and outer layer of braids separately.

There are even more possible combinations when various other parameters are taken into account:

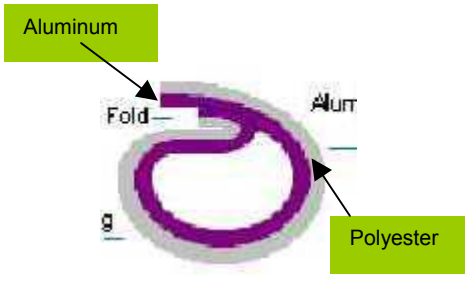
- Sheath materials: PVC, PE...
- Type of dielectric: PE, PEG, solid, foamed, air-spaced...
- Type of inner conductor: copper, copper-coated steel...
- Type of shielding foil: copper/polyester, aluminum/polyester, aluminum/polyester/aluminum...
- Different diameters of the cable.
- Types of protection (grease/gel against corrosion and moisture, polyester laminated tape...).
- With Messenger wire.
- Siamese configuration.
- Different sheath colours.
- Names…

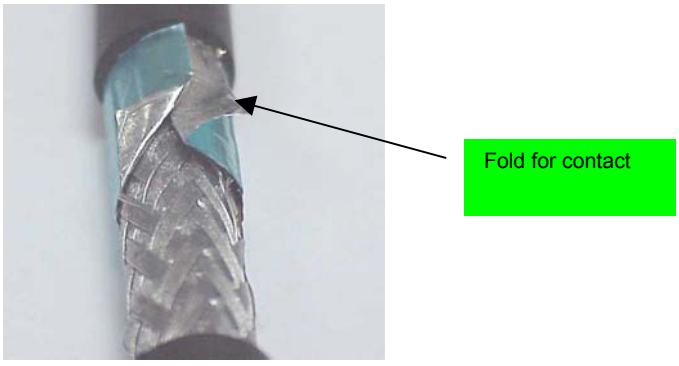
There can be **hundreds** of different cables. Technically, it would be very hard to choose between them, and therefore we think that: *the best choice is the customer's choice.*

5. Some details in certain cables provide an indication of how they will perform.

   For example, it is important that the overlapping of the shielding foil (the part that overlaps lengthways onto itself) represent a high percentage of the surface. Values between 15% and 30% would be worrying.

   In order to guarantee the proper screening of the shielding foil (when it is laminated on a single side) all along the cable, there is a shorting fold that provides a good metal-to-metal contact thus avoiding the isolation that the polyester film would produce.
   This can be seen in the following picture and drawing:





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6. Anticorrosive protection:
   This is normally known as "Flooding" and it is highly recommended for burial cables.
   It is a low viscosity compound that is easily inserted into the external braid and sheath.
   It prevents moisture from getting in through any small rupture in the sheath, and acts as an automatic repairing agent.
   It is composed in such a way so that it doesn't cause any harm to the different cable elements, mainly avoiding any chemical reactions, oxidization and UV resistance.
   It also sticks well to aluminum, polyethylene and PVC, obtaining a uniform protection all over the cable.