

Silec Cable Radiating Quad

1. Features

Silec Cable radiating quad is a new and unique leaky feeder specially designed for the optimisation of in-building radio coverage. It presents very good field homogeneity and performances though the entire operating frequency range (from 30 to 2400 MHz) together with easiness of installation and low costs. Moreover its installation mode offers a better physical radio coverage than antenna systems and then limits electromagnetic perturbations.



Silec Cable radiating quad

Small, light and flexible, easily installed along skirting boards or in ceilings, this product is ideally adapted for radio coverage in building, railway/subway station, commercial mauls, parking, etc.

2. Applications

Silec Cable radiating quad is designed for the optimisation of the radio coverage in buildings for a large number of applications. Its broadband operability enables applications from the FM radio band (80 MHz) to wireless LAN (2400 MHz) including security and railway services (150 and 450 MHz), GSM bands (900 and 1800 MHz) and UMTS (2200 MHz).

3. Theory

3.1 Definition

The cable structure is based on an original patented design of four foame/skin polyethylene insulated copper conductors, twisted in a quad structure. The four conductors are connected two by two on both extremities of the cable in order to constitute one single 50 Ohms

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composite circuit on which the electromagnetic wave propagates as quasi-TEM mode (same mode of propagation than coaxial cables).

The conversion of part of that propagating mode energy into a common radiating mode depends on the circuit unbalance. A tight control of this parameter is obtained by cable construction (i.e. twisting pitch of the cable).

A very good field homogeneity and performances through the entire frequency range (from 30 up to 2400 MHz) are obtained by two antagonist phenomena :

- At low frequencies, the common mode radiates more than at high frequencies
- At high frequencies, the radiating waves are more confined around the cable than at low frequencies, but the circuit unbalance increases leading to better radiating behaviour.

Note :

The physical phenomena involved are totally reversible implying that the cable operates as well as an emitting distributed antenna than as receiving distributed antenna.

3.2 Characteristics

The main electrical characteristics of the **Silec Cable** radiating quad are its longitudinal loss and its coupling loss. Of course the kind of installation and the surrounding near the cable (presence of metallic conductors) can affect the radiated field along the cable and then its electromagnetic field properties.

3.2.1 Longitudinal loss

Like all cables, the **Silec Cable** radiating quad attenuates the signal travelling inside in function of the frequency. The longitudinal attenuation is mainly influenced by the type of dielectric and the size of the cable.

For radiating cables, the surrounding of the cable has an influence on the longitudinal loss, because a part of the emitted electromagnetic field can be absorbed by the cable again. The longitudinal loss depends also from the cable structure (twisting pitch).

3.2.2 Coupling loss

The coupling of energy out of the cable, to the outer space to a receiving antenna, is described by the coupling loss. This coupling loss is defined as the ratio of the received power antenna, at a certain distance, to the power in the cable. Because of the reciprocity, similar considerations are valid for the transmission from antenna into the cable.

The coupling loss depends from the structure of the cable as well as interferences and reflections of the cable surrounding. Due to these latter, the coupling loss is generally characterised by two coverage types :

- The mean value (c50) is the coupling loss with 50 % probability : 50 % of the local values are smaller than this specific value,
- The 95 % coverage value (c95) : 95 % of the local values are lower than c95.

Mostly, the 95 % coverage (c95) is used to characterise digital communications.

3.2.3 System loss

The system loss represents the maximum loss authorised between the emitter and the receiver without interruption of communication. The system loss determines then the maximum length of a link without amplifier. This latter depends on :

- The system dynamic range (emitting and receiving sensibility),
- The system frequency.

For instance, at 900 MHz, 95 % of the total losses are below 100 dB for a link of 80 meters (see next paragraph).

4. Performances

The following tables summarize the performances of the sample of the **Silec Cable** radiating quad depending on different operating frequencies and system losses.

4.1 Main transmission performances

Frequency (MHz)	Longitudinal loss (dB/100 m)	Coupling loss 50 %	Coupling loss 95 %	Applications
150	-15,4	-53,5	-63,3	Security services
450	-25,1	-64,0	-75,3	Security and railway services
900	-35,4	-68,0	-71,7	GSM
1800	-71,2	-56,2	-68,4	GSM
2200	-76,0	-58,7	-71,7	UMTS
2400	-77,0	-60,3	-74,2	Wireless LAN

Coupling loss @ 2 m according to IEC 1196-4.

Note :

The coupling loss values represent the average of coupling losses measured with orthogonal, radial and axial polarisation antennas.

4.2 System performances

Frequency (MHz)	Achievable cable length (m) with coupling loss 95 % and system loss 100 dB	Achievable cable length (m) with coupling loss 95 % and system loss 120 dB	Applications
150	238	368	Security services
450	98	178	Security and railway services
900	80	137	GSM
1800	44	73	GSM
2200	37	64	UMTS
2400	34	59	Wireless LAN

Coupling loss @ 2 m according to IEC 1196-4.

Note : These measurements characterise only the sample supplied.

5. System structures

The **Silec Cable** radiating quad is designed to support a large number of applications. Therefore different network architectures are possible.

For GSM and UMTS applications, the **Silec Cable** radiating quad could be linked with a pico-repeater. This latter aims at receiving the outside GSM signal, amplifying it again and then emitting it indoors where the electromagnetic signal is too weak. In this case, the radiating quad could be directly connected to a pico-repeater .

For WiFi applications, the **Silec Cable** radiating quad could be linked with an access point. This latter aims at linking a local area network with a wireless local area network. In this case, each cable length could be connected to an access point (one extremity to the access point and the second one to a load) and each access point connected to one of RJ45 sockets of the local area network.

6. Silec Cable offer

The **Silec Cable** radiating quad can be delivered :

- Cables on drums and connectors to be fitted on site,
- Standard lengths of 30, 50 or 100 m equipped with connectors.

A specific connector fitted to the **Silec Cable** radiating quad is available. This connector proposes a mechanical fixing with the cable in order to fit easily to installation lengths.