New Standards and Screening Classes for Fly Leades

By Bernhard Mund, bedea Berkenhoff & Drebes *

The keyword "Digital Dividend" stands for no longer needed frequency capacity due to the digitization of broadcast signals.

This situation occurred when moving from analogue to digital modulation:

Terrestrial AM (PAL) ➡ DVB-T (-T2),
Satellite FM (PAL) ➡ DVB-S (-S2),
Cable AM (PAL) ➡ DVB-C (-C2).

The frequency band in the upper UHF in Europe (790 MHz – 862 MHz) and the bands 17 and 13 in United States (704 – 787 MHz) is now assigned to broadcast and mobile radio services of 4G/LTE, (Long Term Evolution). These broadband mobile radio systems were originally intended to supply rural areas with high bit-rate internet accesses but for commercial reasons they are presently mostly built for urban areas.

The co-existence of broadcast transmissions via terrestrial and cable networks and the new mobile radio services in the same frequency bands may cause disturbances due to insufficient electromagnetic screening or shielding (EMC) characteristics of:

- TV sets, SetTopBoxes etc.,
- Cable networks in total,
- Active and passive cable network equipment,
- Coaxial cables,
- Receiver leads (coaxial cable assemblies respectively fly leads),
- Excessive transmitter power of LTE base stations and cell-phones,
- Too small a distance between "broadcast" and LTE equipment, (especially in-house and in-home!)

The following report details problems of TV receiver leads (fly leads) as well as revised standards and screening classes for these cords.

The screening classes are specified in the series EN 50117 for CATV cables and of EN 60966 series for cable assemblies and fly leads.

Correction:
The table of the **"Screening classes for CATV cables"** in the article "EMC of passive CATV components with Triaxial Cell", edition 2/2013 of Cable!vision, shows wrong values for the transfer impedance. The corrected table is given below.

Different studies on cables and broadcast networks have shown that for trouble-free TV reception the use of cables and cords which have at least the screening class A (85 dB from 30 MHz to 1 GHz, see table 1) is required. In view of the LTE interference problems, cables and cords with screening class A+ for in-home networks are recommended.

Frequency range MHz	Limit value			Test procedure
Transfer impedance	Class A+	Class A	Class B	Triaxial procedure [1])
5 to 30	≤ 2,5 mΩ/m	≤ 5 mΩ/m	≤ 15 mΩ/m	IEC 62153-4-3
Screening attenuation				
30 to 1 000	≥ 95	≥ 85	≥ 75	IEC 62153-4-4
1 000 to 2 000	≥ 85	≥ 75	≥ 65	
2 000 to 3 000	≥ 75	≥ 65	≥ 55	
[1]) Only one test set-up in the whole frequency range				

Table 1: Screening classes of CATV-cables according to EN 50117-2-1 to -2-5 and EN 50117-4-1

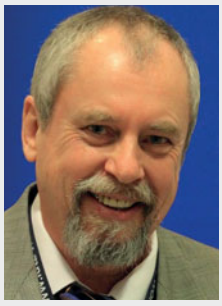
Problems with receiver leads

TV receiver leads in many cases do not have the required shielding effectiveness of the Screening-class A or class A+.

According to several cable operators poorly shielded fly leads cause about 70% of reported incidents of CATV systems.

This problem is confirmed by a study of the German authority Bundesnetzagentur (BNetzA) in connection with the interference problems in Germany, the Netherlands and in Switzerland; a study of cords under the title, Trilateral benchmark on ready-made connecting devices (receiver leads) 2012.

Figure 1: Fly leads with different connectors



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Beside his work for bedea he is chairman of the German NC UK 412.3 Koaxialkabel as well as secretary of IEC SC 46A and of CENELEC SC 46XA, Coaxial cables.

Further standardisation activities include the membership of IEC TC 46/WG 5, Screening effectiveness and of IEC TC 46/WG 9, Cable assemblies.

Country	No. of samples	fulfils all requirements of screening attenuation/tensile stress 2nd screening attenuation (after tensile test)
DE	42	11 samples, (26.2 %)
CH	22	17 samples, (72.3 %)
NL	21	08 samples, (38,1 %)
Sum	85	36 samples, (42,4 %)

Table 2: Research of Bundesnetzagentur (BNetzA) on TV receiver leads
Source: Bundesnetzagentur, (BNetzA)

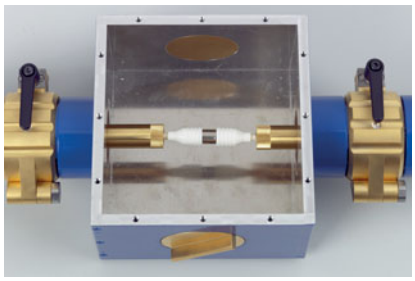

Figure 2: Measuring of screening effectiveness with triaxial cell and with tube in tube procedure according to IEC 62153-4-7

Of forty-two cords tested in Germany under appropriate load tests only 11 samples or 26% showed the required shielding effectiveness (85 dB from 30 MHz to 1 GHz according to table 1).

A total of 85 samples were selected and evaluated as shown in Table 2.

Especially critical are cords with plugs according to IEC 61169-2 (IEC-connector). Cords with F-connectors usually show better values. Currently, the cords listed in Table 3 in the EN 60966 series are standardized:

The screening classes of TV receiver leads are as follows:

As can be seen from Table 4, the values of the screening classes for the various cords according to EN 60966 are different from the classes of the cables according to EN 50117 as well as different within the classes for the cords themselves.

The class A for the cords according to 60966-2-6 in the range of 30 MHz to 1 GHz, for example, requires 95 dB while class A for the strings according to 60966-2-5 in the same frequency range is only 85 dB.

This issue was discussed during the meeting of the responsible group for the standards of these cords, IEC TC 46/WG9, cable assemblies, on 11 April 2013 in Lyon with Guy Perrot as the convenor of this group.

During the meeting, WG 9 decided that the generic standard IEC/EN 60966-1 Cable assemblies as well as the detail specifications for cable assemblies for radio and TV receivers, IEC/EN 60966-2-n, parts 2-4, -2-5 and -2-6 should be revised. Screening classes should be matched to the screening classes of CATV-cables according to IEC 61196 and EN 50117.

The author of this article is the project leader for these tasks.

Test procedure for transfer impedance and screening attenuation

Transfer impedance and screening attenuation of the cords is to be measured exclusively in accordance with the new edition of the triaxial test procedure according to IEC 62153-4-7. Compared with the clamp procedure and the injection wire procedure, the triaxial procedure according to IEC 62153-4-7 offers higher sensitivity and better reproducibility as well as the possibility to measure transfer impedance and screening attenuation from DC up to and above 3 GHz with one test set-up.

The draft standard for the cords with F-Quick connectors, IEC 60966-2-7 respectively 46/414/CD already meet the

	Radio frequency and coaxial cable assemblies	
IEC/EN 60966-1, Ed.2	Part 1: Generic specification - General requirements and test methods	1999-04-23, tbd, 46/442/RM
IEC/EN 60966-2-4, Ed.3 **IEC-Connector**	Part 2-4: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 MHz to 3000 MHz, IEC 61169-2 connectors	2009-01-12
IEC/EN 60966-2-5, Ed.3 **IEC-Connector**	Part 2-5: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 MHz to 1000 MHz, IEC 61169-2 connectors	2009-01-12
IEC/EN 60966-2-6, Ed.3 **F-Connector**	Part 2-6: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 MHz to 3000 MHz, IEC 61169-24 connectors	2009-01-12
IEC/EN 60966-2-7, Ed.1 **F-Quick-Connector**	Part 2-7: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 MHz to 3 000, IEC 61169-47 connectors	46/414/CD 2012-07-06

Table 3: Radio frequency and coaxial cable assemblies for CATV-applications

	Screening class	Transfer impedance	Screening attenuation			Screening class EN 50117
		5 - 30 MHz	30 -1000 MHz	1 GHz – 2 GHz	2 GHz – 3 GHz	
IEC/EN 60966-2-4, Ed.3 **IEC-Connector**	B	15 mOhm/m	75 dB	55 dB	55 dB	(B)
	A	5 mOhm/m	85 dB	65 dB	65 dB	(B)
IEC/EN 60966-2-5, Ed.3 **IEC-Connector**	B	15 mOhm/m	75 dB	-	-	B
	A	5 mOhm/m	85 dB	-	-	A
IEC/EN 60966-2-6, Ed.3 **F-Connector**	B	uc	85 dB	75 dB	75 dB	(A)
	A	5 mOhm/m	95 dB	85 dB	85 dB	(A+)
IEC/EN 60966-2-7, Ed.1 **F-Quick-Connector**	B	15 mOhm/m	75 dB	65 dB	55 dB	B
	A	5 mOhm/m	85 dB	75 dB	65 dB	A

Table 4: Screening classes according to IEC/EN 60966-2-n

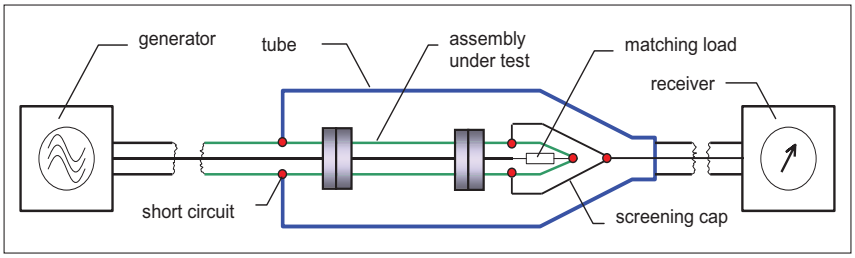

Figure 3: Principle configuration to measure transfer impedance and screening attenuation of cable assemblies with the triaxial test set-up

continued from page XIII:

new requirements as discussed above.

Special thanks to Dr Lauri Halme, Finland, for support and correction reading. Questions and further information: bmund@bedea.com

Literature

[1] Bernhard Mund: bedea with new test procedure, Cable!Vision 2/2013

[2] Lauri Halme, Report from TC 46, 2013

[3] Bernhard Mund: Messen mit der Triaxialen Zelle, Cable!Vision 4/2012

[4] Bernhard Mund: Measuring the EMC on RF-connectors and connecting hardware, Tube in tube test procedure, IWCS (International wire and cable symposium) 2004

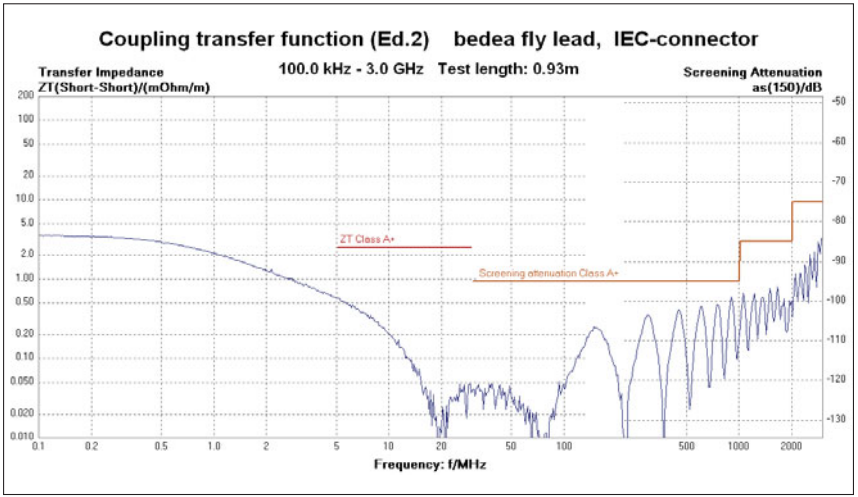

Figure 4: Coupling transfer function of a fly lead with IEC Connector