Test Report EMC

Test site:

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Angaben zum Prüfauftrag:

Applicant:	Jacob GmbH; Gottlieb-Daimler-Strasse 11; D-71394 Kernen
Licence Holder:	-
Manufacturer:	Jacob GmbH; Gottlieb-Daimler-Strasse 11; D-71394 Kernen
File number:	7157-1492-0003/3297A
Order number:	3297A
Device description:	cable entry
Type:	Perfect KV; Perfect-EMV-KV; Perfect-Ex-EMV-KV
Date of receipt (sample):	14.06.2000

Standards:
The tests have been carried out according to the german military standard VG 95373 part 40. The deviations from this standard are described in the report.

This is a translation of the german test report with order no. 3297A. In any case the german version will prevail.

Date of issue:	08.08.2000	
Prüfer/Prüferin:	Hr. Gossmann	
Kontrolliert:	Dr. Kloska	

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1 Description of the sample

Description of sample:

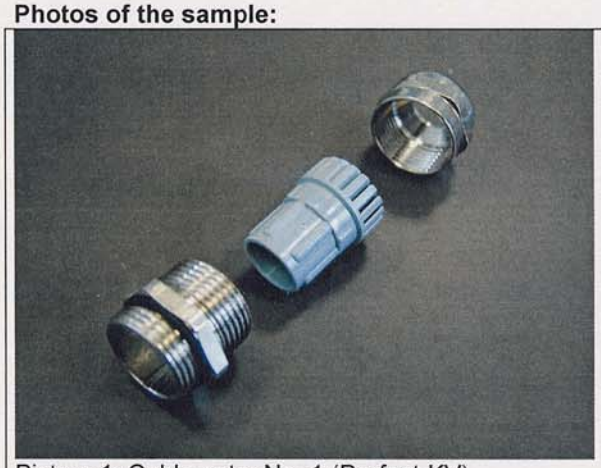
Type of sample:	Cable entry
Model:	1. Perfect KV: Cable entry without EMC-Contact for cable shield PG 13,5 2. Perfect-EMV-KV: Cable entry with EMC-Contact for cable shield PG 13,5 3. Perfect-Ex-EMV-KV: Cable entry with EMC-Contact for cable shield PG 13,5 Ex. M50 x 1,5
Serial number:	Articel No.: 1. 50.013; 2. 50.013/EMV; 3. 50.650 M/EMV/EX

Used cable type:

Specification:	A. Protoflex-EMV-2ySLCY-J (4x 1,5 mm²) B. Copper tube 22 mm diameter, with braid from cable C soldered to one end of the tube. C. Protoflex-EMV-2ySLCY-J (4x 35 mm²). Only the braid has been used.

Further remarks:
The use of the cable type C was not possible due to practical reasons. The diameter of the cable was bigger than the diameter of the clamping device inside the measurement tube. Therefore a measurement with a copper tube together with the removed braid of the cable No. C has been done (see **Picture 3**).

Photos of the sample:



Picture 1: Cable entry No. 1 (Perfect-KV)

Picture 2: Cable entry No. 2 (Perfect-EMV-KV)

Picture 3: Copper tube with braid soldered and cable entry No. 3

2 Method for determining the quality of cable entries for shielded enclosures.

For the valuation of the quality of cable entry into enclosures there are no civil standards available. Therefore a military standard has been used as base.

Standard: VG 95373 Teil 40 "Messverfahren für geschirmte Steckverbinder"
(Measuring method for screened connectors)

The method is modified in a way that the connector is replaced by a cable entry. The cable entry is used as a termination of the screened cable inside. The cable with the cable entry is then measured in the triaxial tube (see picture), as it is described in the VG 95373 part 40. The general method is known as the mesurement method for the transfer impedance of cables.

Valuation:

The different cable entry systems are intended for the use with different cable shield qualities. Therefore the valuation of the cable entry system is done allways together with a certain shielding quality of the cable. The valuation is based on the minimum disturbance of the shielding quality of the cable. The less the shielding effect of the cable is disturbed, the better the cable entry system works.

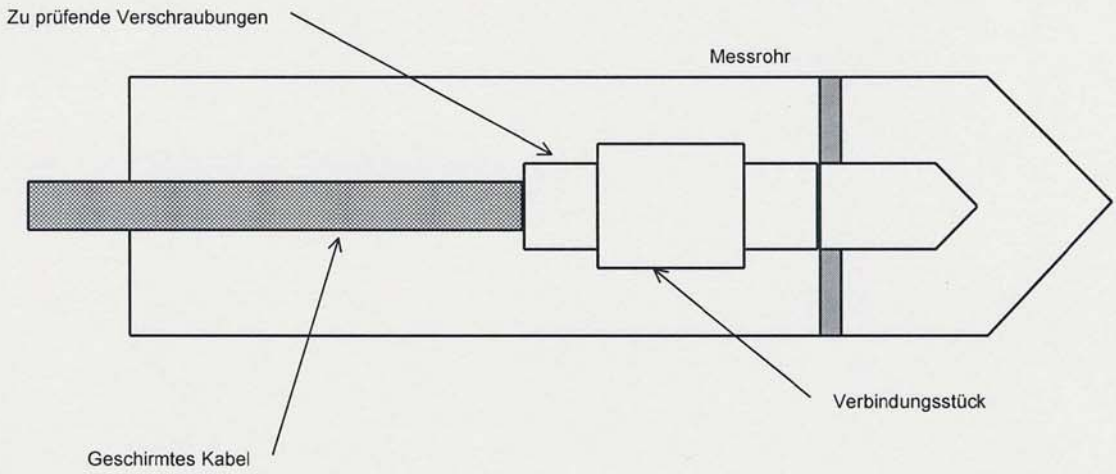
2.1 Measurement procedure

The measurement is done by the following steps:

1. Assembly of the cable.
2. Mesurement of the cable without cable entry system in the triaxial tube. The result of this measurement gives the quality of the used cable/shield.
3. Assembly of the cable with the cable entry system according to the manufacturers specifications.
4. Mesurement of the cable with cable entry system in the triaxial tube. The result of this measurement gives the quality of the used cable/shield together with the cable entry system.
5. Comparison of the measurement results in a diagram.

If the cable is used with the cable entry system there should be no significant degradation of the shielding performance.

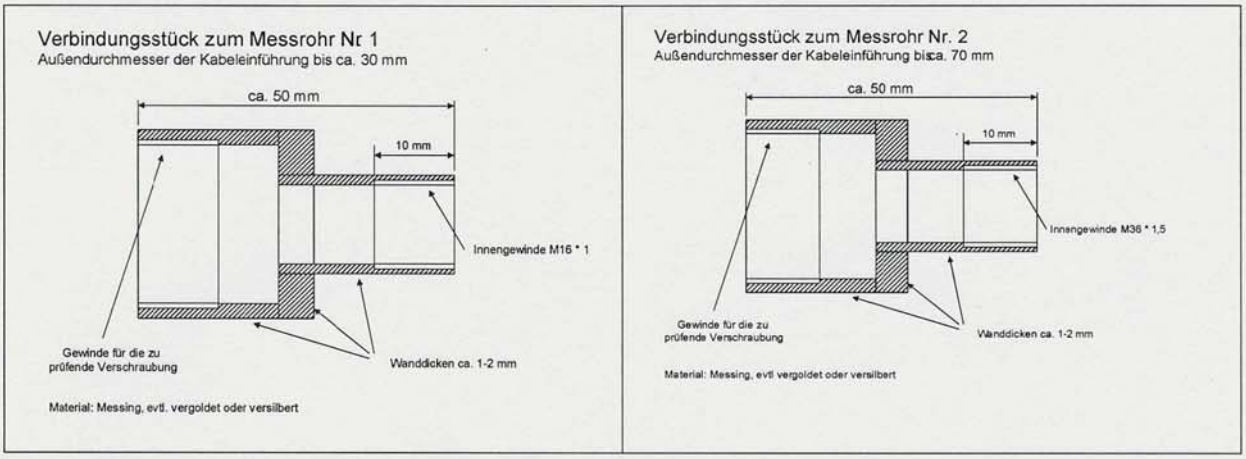
2.2 Test instrumentation



Geschirmtes Kabel = shielded cable
Verbindungsstück = adaptor
Zu prüfende Verschraubung = cable entry system under test.

For the test there is the need of two adaptors.

For the measurement there are two triaxial tubes with different diameters are available. The adaptors are therefore limited in diameter (see sketches). The adaptors are manufactured by lathe tooling.



The inner thread for the tube no. 2 is a special thread!

3 Measurement procedure

Information concerning the test:

Tested by:	Gossmann
Test date:	2000-08-03

Test instruments:

Test room:	Kabine 2		
Inventory no.	Description	Manufacturer	Type
5110250	Netzwerkanalysator	Rhode & Schwarz	ZVRE
1800094	Messrohr	Bedea	60 mm
1800099	Messrohr	Bedea	120 mm

Test set-up:

Test set-up according to the description in chapter 2.2.

Assembly of the cable and the cable entry.

The samples no. 1 and 2 were assembled according to the manufacturers specifications together with the cable A.
The sample no. 3 was assembled on the braid of a cable from type C. This braid was soldered on the tube ("cable type" B) (**Picture 3**). The cable entry has been assembled on this braid according to manufacturers specifications.

Protocol:

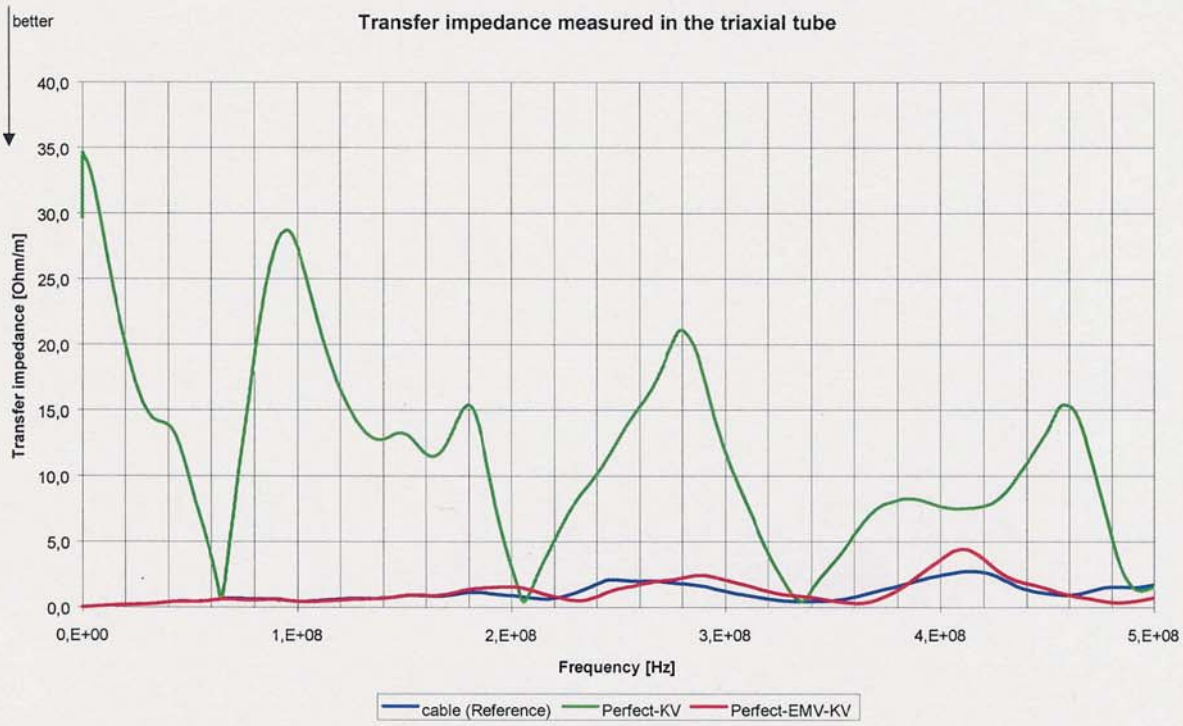
see chapter 4

4 Measurement results

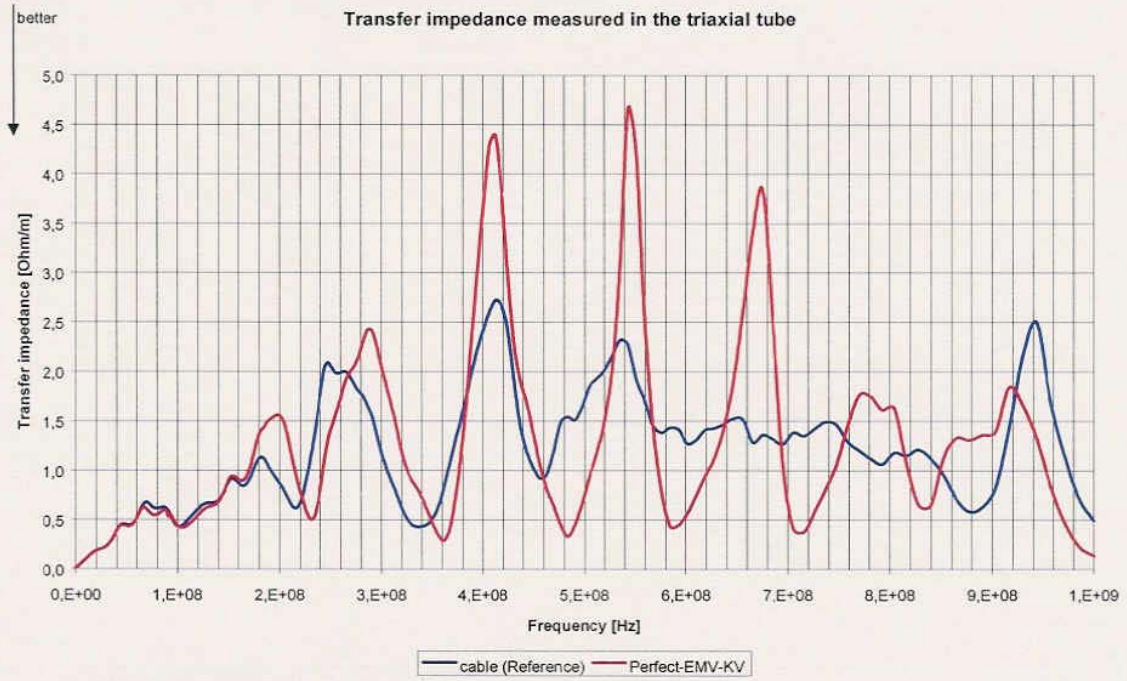
4.1 Transfer impedance

The transfer impedance is expressed in terms of Ohms/meter, because it is allways related to the length of the cable. The length of the cable during mesurement was 1 meter. The main result of the measurement is that the cable entry is not incleasing the value of the transfer impedance of the cable shield. The absolute value is not considered here.

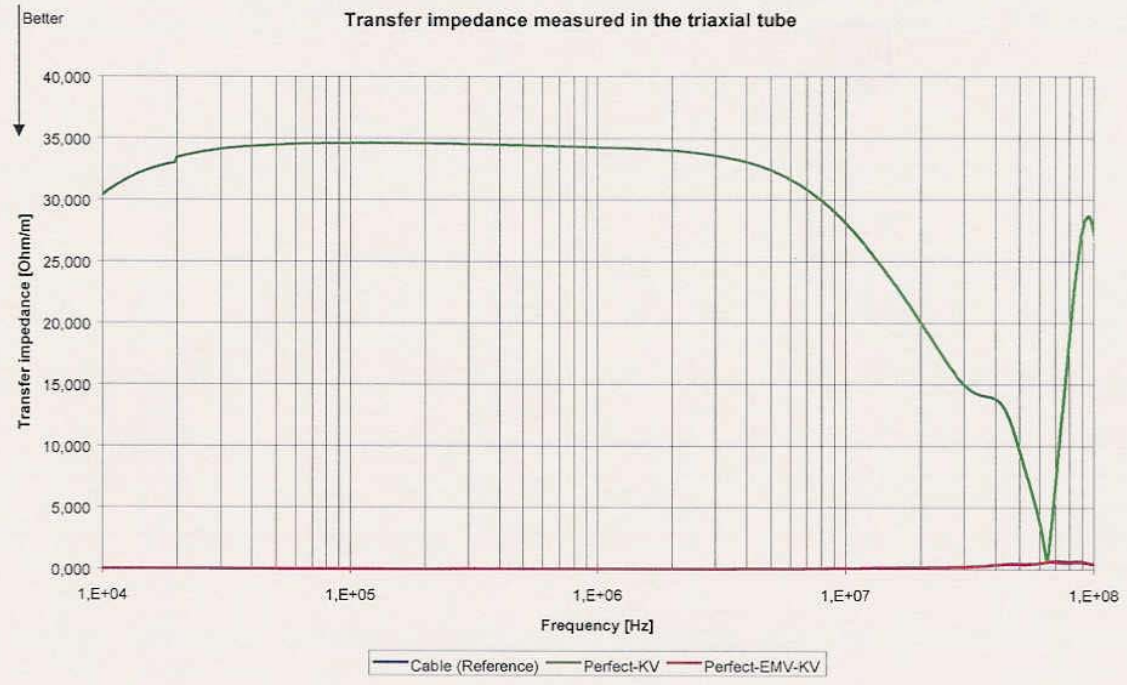
4.1.1 Comparison of the cable entries PG 13,5 (No. 1 and 2)



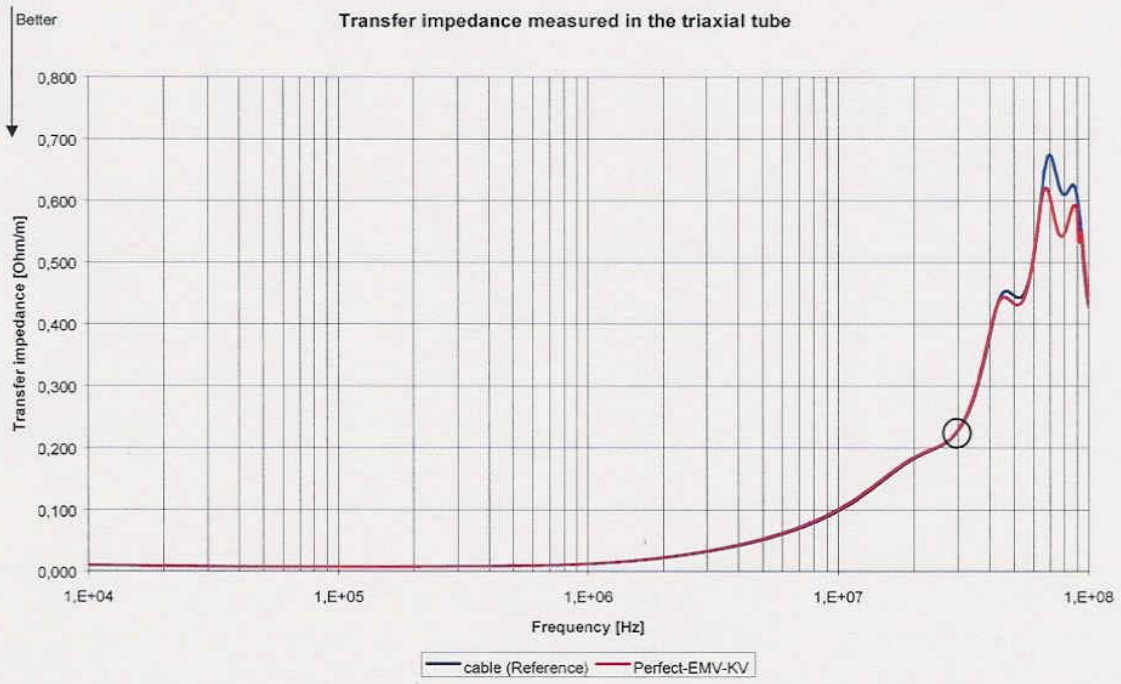
Picture 4 Transfer impedance cable and cable entries Perfect-EMV-KV and Perfect-KV



Picture 5 Transfer impedance without Perfect-KV

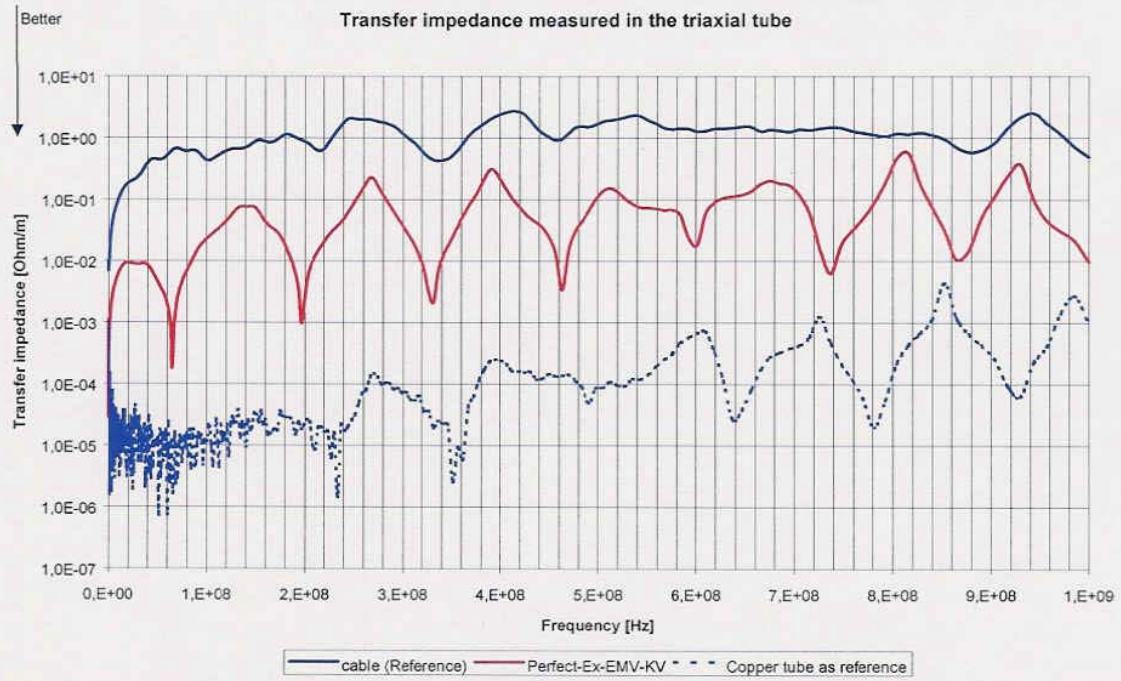


Picture 6 Transfer impedance up to 30 MHz, logarithmic scaling

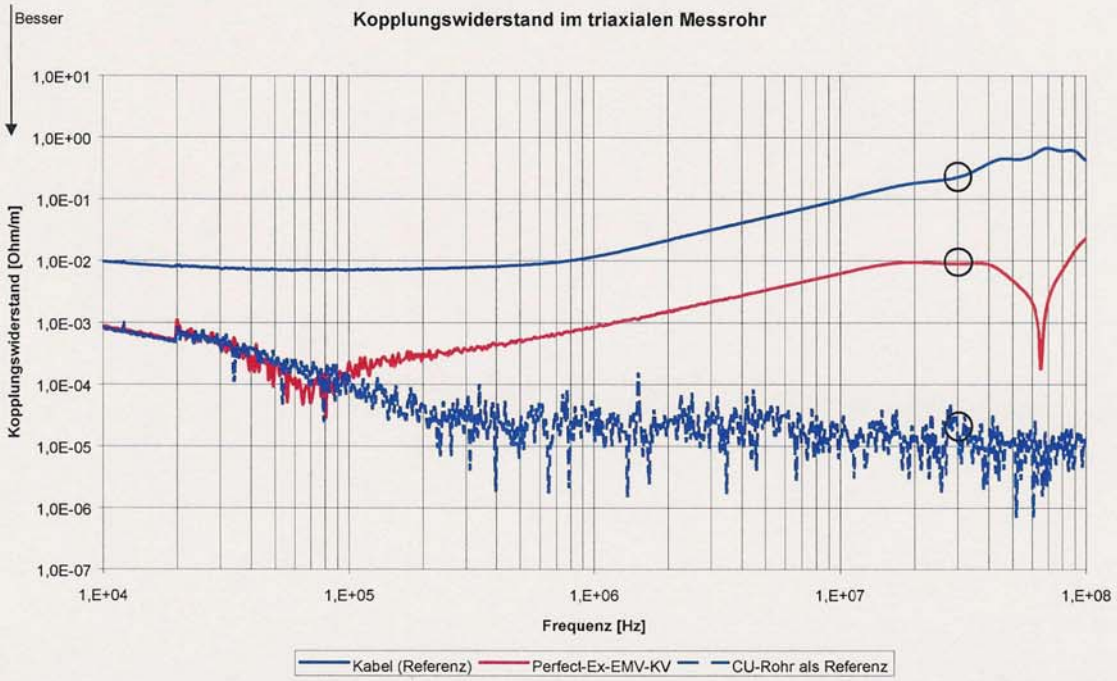


Picture 7 **Transfer impedance up to 30 MHz, logarithmic scaling without PERFECT-KV**

4.1.2 Cable entry no. 3 Perfect-Ex-EMV-KV (M 50 x 1,5)



Picture 8 **Transfer impedance cable entry PERFECT-Ex-EMV-KV**



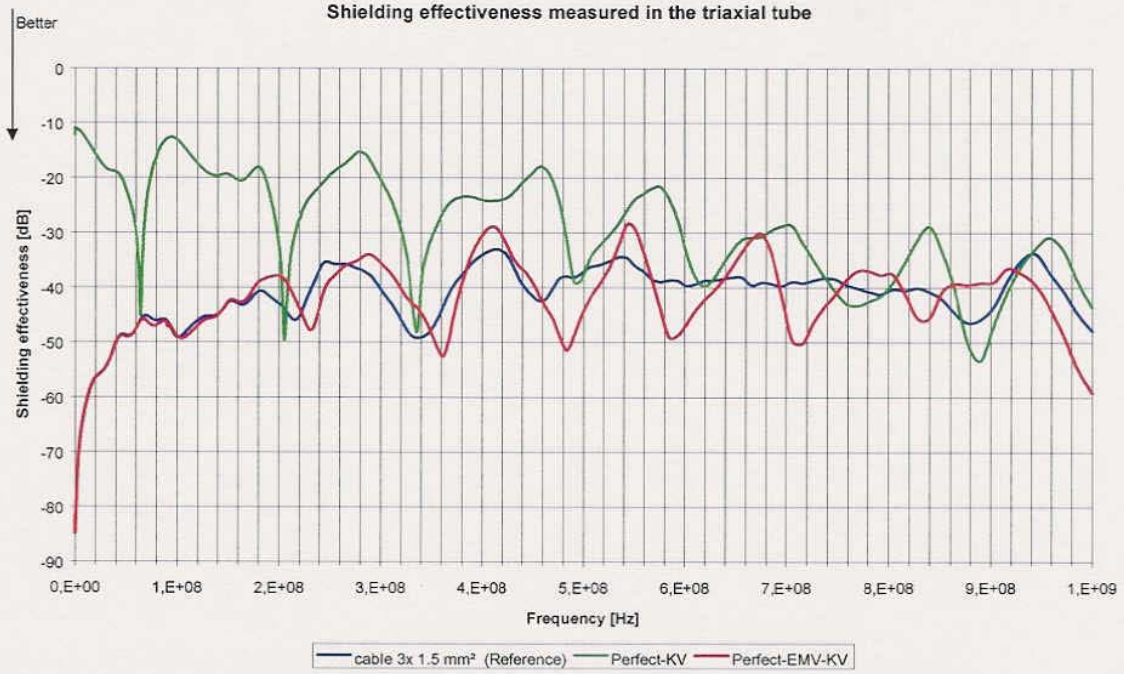
Picture 9 Transfer impedance cable entry no. 3 Perfect-Ex-EMV-KV up to 30 MHz, logarithmic frequency scaling. The 30 MHz-point is marked.

4.2 Screening effectiveness

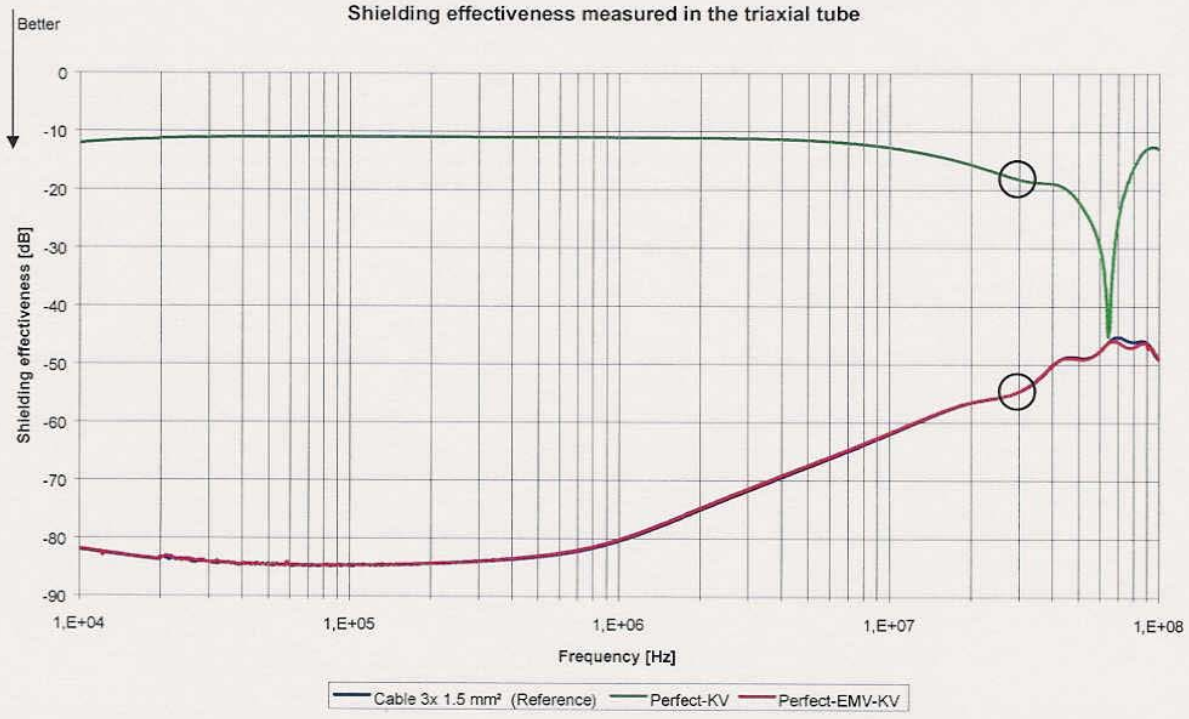
The values of the shielding effectiveness are calculated from the transfer impedance. The calculation is done by the used software.

The screening effectiveness is given in negative values. This means that the effectiveness is calculated from the high frequency power measured in the outer system of the measuring tube over the power fed into the „inner" circuit (the measured vcable with ist shield) of the triaxial tube. This means that the cable entry is better if less HF-power comes out of the inner system into the outer system. The smaller the shielding effectiveness, the less HF-energy is coupling from the inner system to the outer system, the better the shield and the cable entry is. The shielding effectiveness can also be printed in positive values, ist only a term of presentation.

4.2.1 *Comparison of cable entries PG 13,5 (No. 1 and 2)*

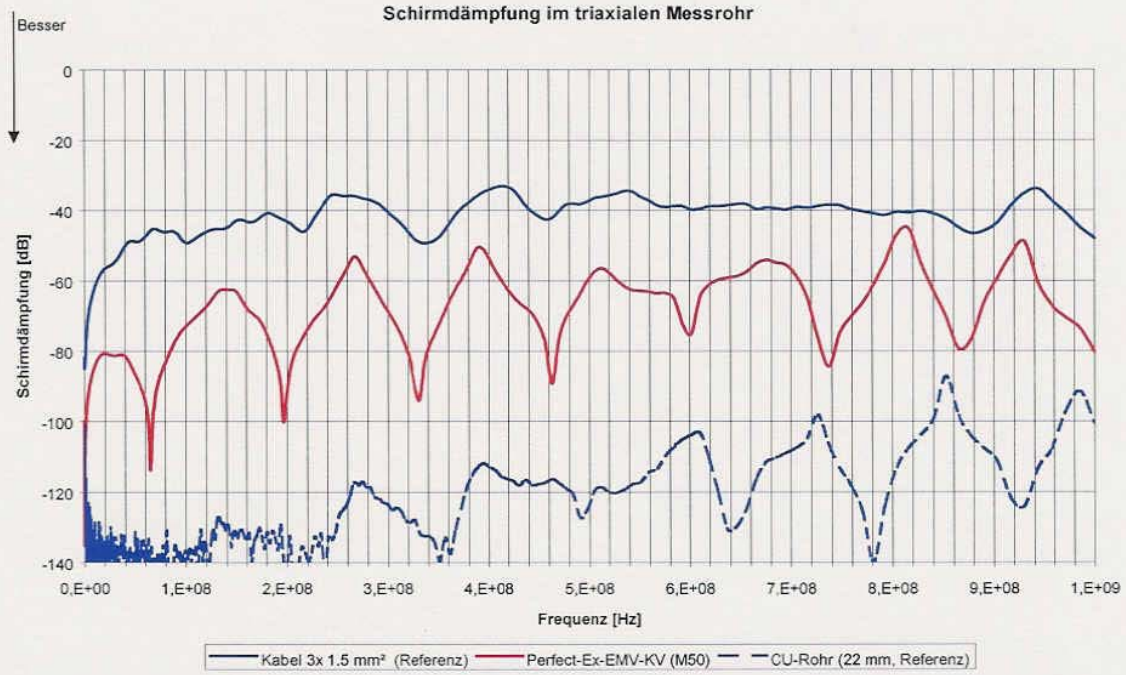


Picture 10 **Shielding effectiveness. Perfect-KV, Perfect-EMV-KV and reference cable.**

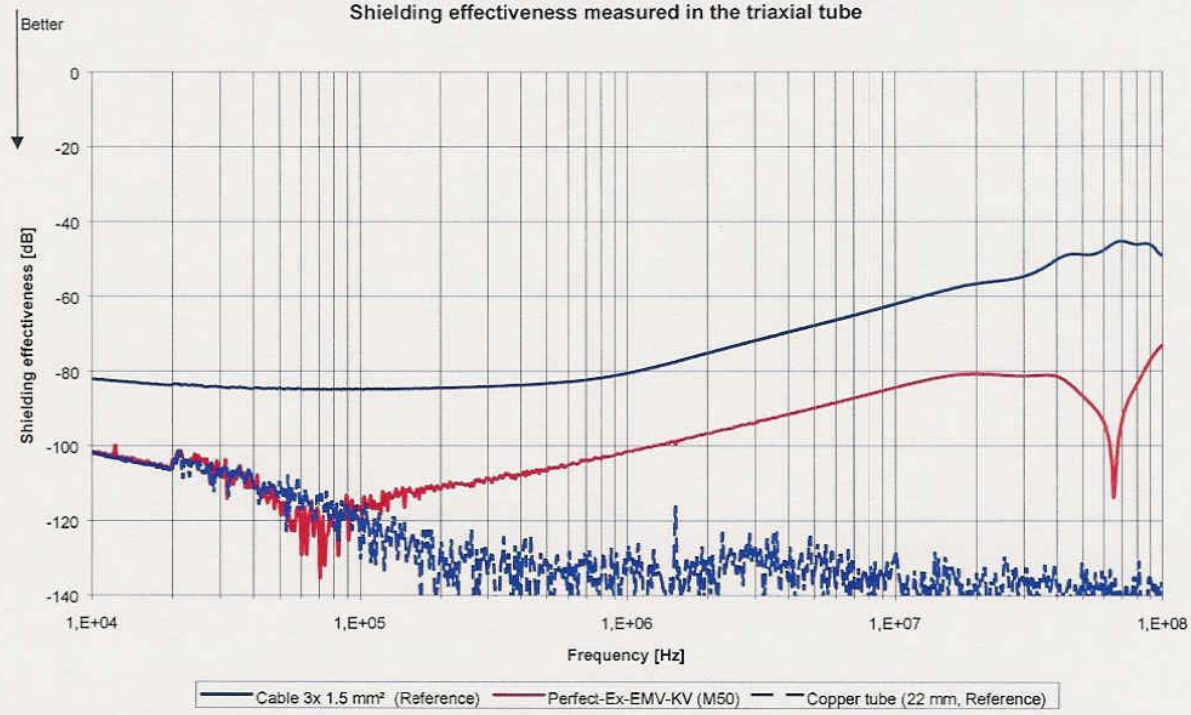


Picture 11 **Shielding effectiveness. Perfect-KV, Perfect-EMV-KV and reference cable up to 30 MHz logarithmic scaling. The 30 MHz-point is marked.**

4.2.2 Comparison cable entry 3 Perfect-Ex-EMV-KV with copper tube.



Picture 12 Shielding effectiveness. Comparison of Perfect-Ex-EMV-KV with the "ideal" Copper tube and Reference cable 3 x 1.5 mm² of the „small" cable entry.



Picture 13 Shielding effectiveness. Comparison of the Perfect-Ex-EMV-KV with the "ideal" Copper-tube and the reference cable 3 x 1.5 mm² of the „small" cable entry. Here up to 30 MHz and with logarithmic scaling of the frequency axis.

4.3 Interpretation of the measurement results

The evaluations must be done like this:
From 30 MHz on, only the maximal values of the transfer impedance and the screening effectiveness shall be evaluated. The Minima are created by the interference of the wave fronts in the triaxial tube. Therefore the minima are caused by the measurement method and should not be counted as characteristic of the shield or cable entry.

4.4 Evaluation of the results

1. The results of cable entry no. Perfect-KV shows that a connection where the shield is not connected, (Picture 4, Picture 10) shows much high transfer impedance and the screening effectiveness is poor.
2. The comparison of Perfect-EMV-KV and the reference cable (Picture 5, Picture 11) shows that the cable entry has a good effect. The shielding function of the cable shielding remains nearly unchanged.
3. The big cable entry shows the same good properties than the „small" cable entries (no. 1 and 2). The Picture 8, Picture 12, Picture 9 und Picture 13 shows with a red line the copper tube, wich is conneted via the soldered braid and the cable entry Perfect-Ex-EMV-KV. The red line shows a better shielding effectiveness than the blue line (reference cable). This is because of the short length (10 cm) of the soldered braid.
   The blue dotted line shows as a reference the cable with 3 x 1,5 mm² which is the reference for the „small" cable entries(PG 13,5). The dotted line shows the transfer impedance and the shielding effectiveness of the copper tube. This line gives the lower dynamic range of the instrumentation.

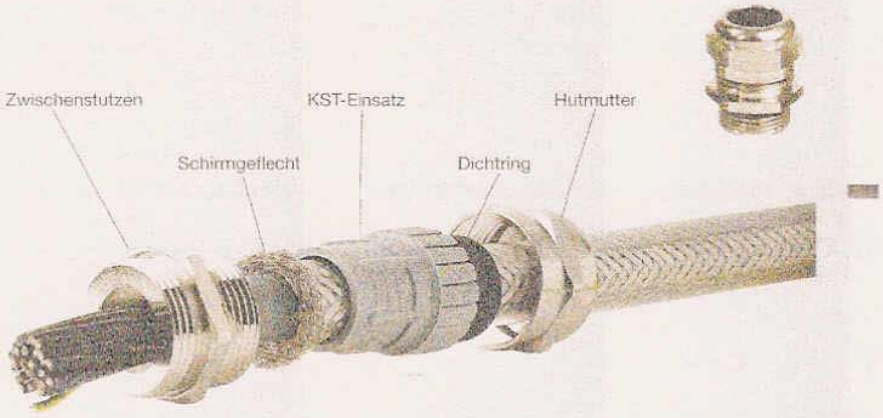
The used cable is a cable with single braid wich is not intended for the use as transmission line for high frequencies. It is usually a cable for control purposes in installations.

The mesured cable entries have shown no significant degradation of the quality of the used and similar cable types (except Perfect-KV). Therefore the measured cable entries are suitable to lead cables into enclosures without losing the performance of the cable shield.

5 Appendix

5.1 Installation manual for the cable entries (german language)

PERFECT-EMV-KABELVERSCHRAUBUNG
50.007/EMV – 50.048/EMV
Montagehinweise



Montageablauf

1. Außenmantel des Kabels ca. 10 mm abmanteln
2. Hutmutter und Kunststoffeinsatz mit Dichtring auf das Kabel schieben
3. Schirmgeflecht rechtwinklig (90°) nach außen biegen
4. Schirmgeflecht nach oben umfalzen, d. h. nochmals um 180° umbiegen
5. Zwischenstutzen bis zum Schirmgeflecht aufstecken und mehrmals hin- und herdrehen
6. Kunststoffeinsatz mit Dichtring in den Zwischenstutzen schieben, bis Verdrehschutz einrastet und Hutmutter aufschrauben