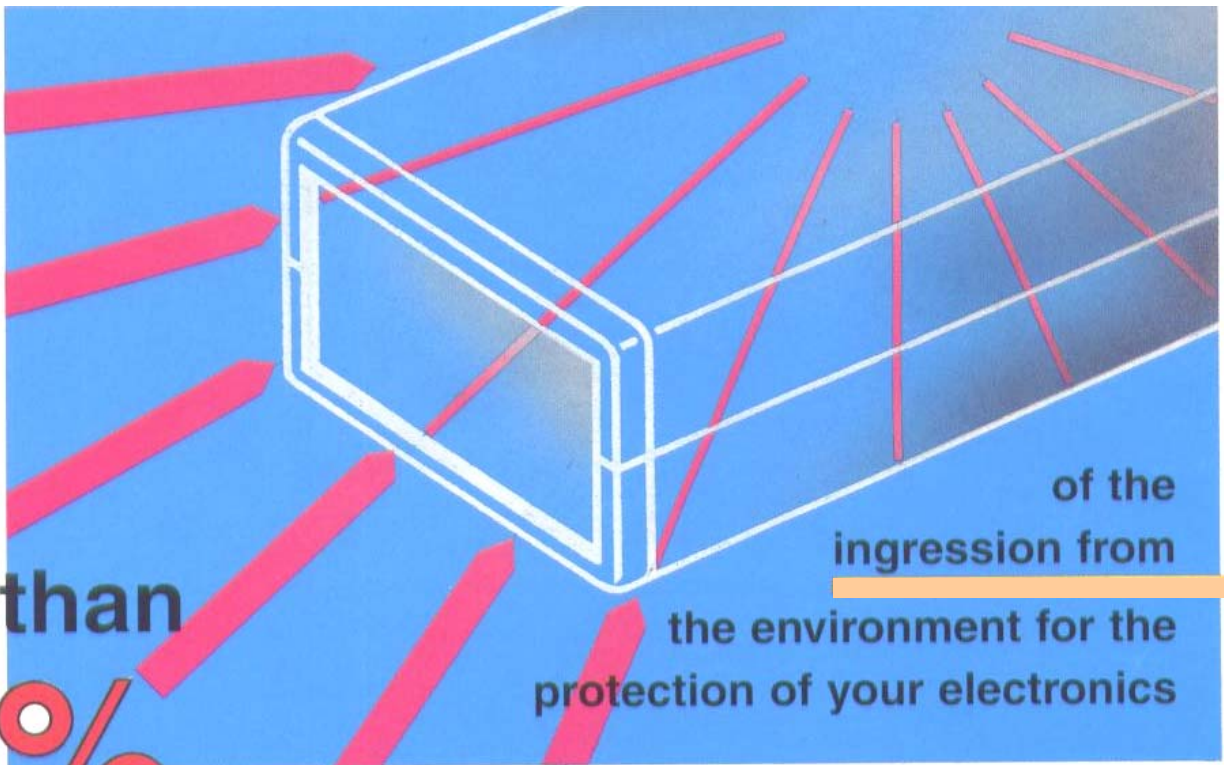
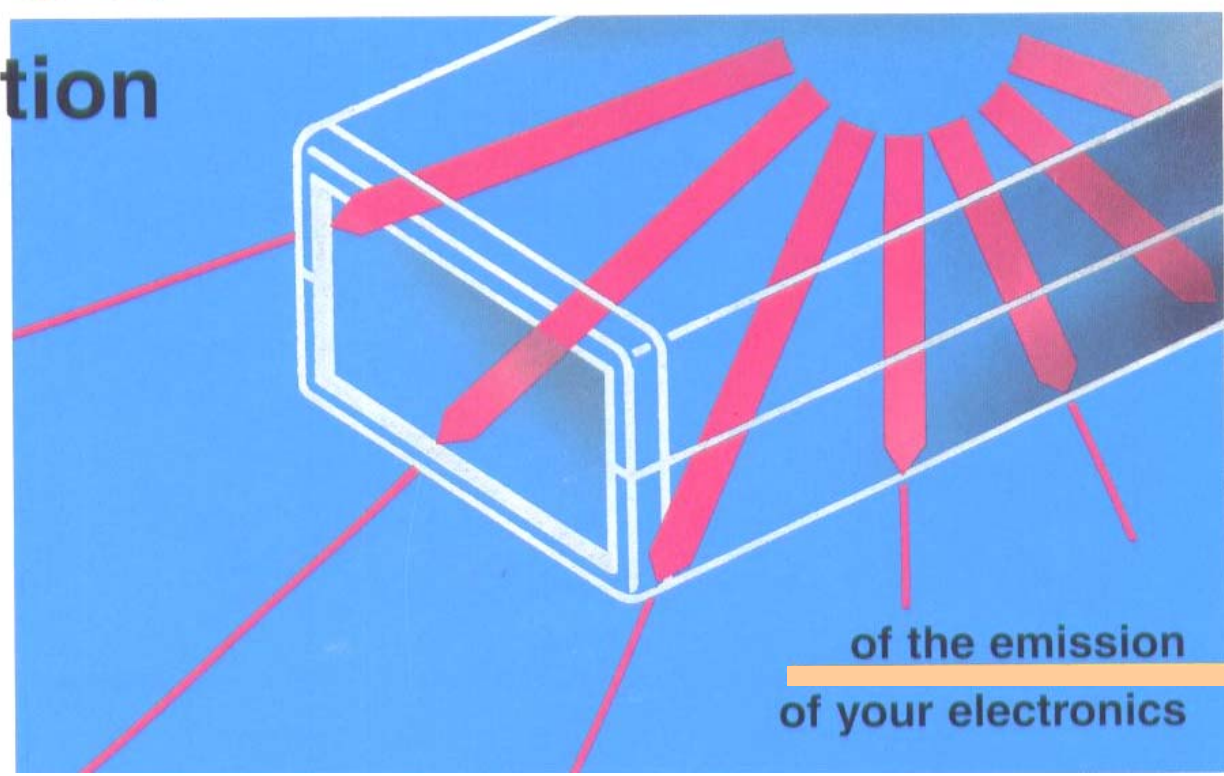


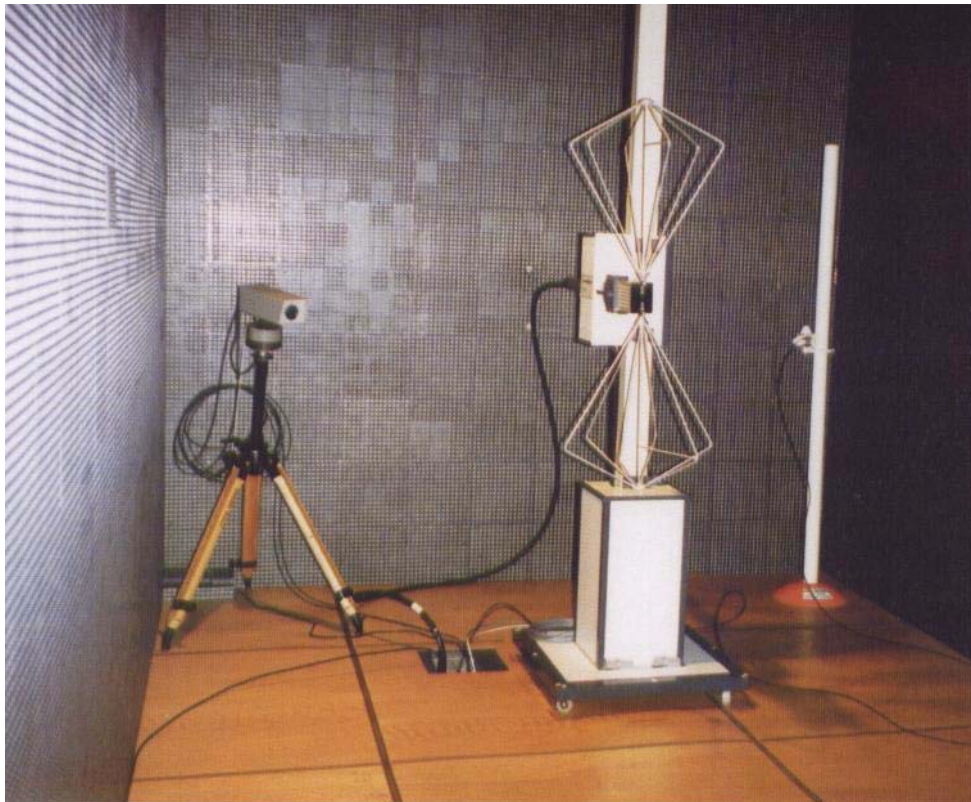
BOPLA Enclosures



more than
90%
reduction



Information for RFI protection.



Testing laboratory of Phoenix EMV-Test GmbH in Blomberg

E M C - Screening by BOPLA

This brochure is meant to help you choose the best possible EMC protection for your electronic equipment.

Some of the graphs in the following diagrams show strong fluctuations due to resonances occurring.

These resonances will disappear, change, or weaken as the position of source of interference is shifts slightly.

The screening attenuation values received from standard empty enclosures are not conduted to fully assembled electronic equipment.

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1. E M C - Technical Information



A Phoenix Mecano Company

The screening effect (SE) is defined as the ratio of the field intensity before/after the shield.

SE (dB)	Screen factor	Attenuation in %
20	10 : 1	90,0
40	100 : 1	99,0
60	1000 : 1	99,9
80	10000 : 1	99,99
100	100000 : 1	99,999

The law on electromagnetic compatibility of 9 November 1992 requires all manufacturers of electrical and electronic products to prove and ensure that their equipment meets the EMC regulations. The purpose of this is:

- to prevent the equipment or system from emitting impermissible levels of radiated noise.
- to prevent the malfunctioning of a product due to electromagnetic fields from outside

To prove that equipment is EMC standardised, the CE sign is to be used in all member states of the European Community. Manufacturers have been given a transition period, starting on 1st January 1996, to comply with these regulations. This period is rather short, and it is causing considerable problems for many manufacturers, particularly with existing products. In the past, little attention has been paid to EMC requirements in the design stage, although here lie the best opportunities.

A study on EMC as a cost factor has shown the following:

EMC measures	Cost factor
In the design stage	1
During series production	100
While in use	1000

For the choice of an enclosure this means that an electrical component subject to the EMC regulations can be installed in any desired enclosure without any extra costs in 90% of cases. So to achieve screening, the essential advantages of plastic enclosures need not to be sacrificed.

- an elegant design
- considerable price savings
- lightness and versatility

Screening with plastic enclosures

It is generally easy to screen plastic enclosures effectively as well. You can still benefit from the advantages of a plastic enclosure.

At present, screening is achieved by applying a metal coating on the inside or outside of the enclosure. Metal coatings on plastics can be galvanized, vaporized, or enamelled. We offer the following standard procedures:

Screening by aluminization

Aluminization is performed in high-vacuum machinery. We provide a standard coating thickness of at least 2.5 μm . A greater thickness is, however, always possible, if required, depending on the enclosure material.

The aluminium coating adheres evenly and well on almost all plastics and remains stable for long periods.

The mechanical properties of the plastic are not altered by vaporization, and no brightness or cracking will result. When vaporizing, areas that should not or may not be coated must be covered or masked.

Screening by enamelling

- a) with copper
- b) with copper metallised with silver

Coating with EMC conductive lacquer applies a 50 μm thick conductive layer (copper) respectively a 25 μm thick layer (silver metallised copper) to the enclosure parts.

Prior to coating, the enclosure can be covered or masked according to our specification or at customer's request, to keep those areas that are not to be coated free of lacquer.

Coating the plastic enclosure achieves a good degree of attenuation. Should the degree of attenuation still give inadequate protection, the use of conductive seals will enhance shielding.

In addition to the above screening methods, enclosures can be made of metal-filled plastics. However, due to high material costs and the uncertain screening performance these materials are only of interest in some cases.

Screening with aluminium enclosures

Aluminium enclosures may under certain circumstances in themselves offer some EMC attenuation owing to the material.

However, the joints (tongue and groove) need to be fitted with the appropriate seals for optimal EMC performance, and it must be remembered to bridge the laquer coating.

This can be done with appropriate seals or by removing the laquer coating. The measures involved must be determined while clarifying your requirements.

1. E M C - Technical Information

Screening of aluminium profiles and aluminium plates

Chromating the surface, as against anodizing it, gives the surface excellent conductivity that is virtually equivalent to the original conductivity of aluminium. By chromating, aluminium's natural oxide film is converted into a very thin an-organic layer. Compared with the anodized layer, the chromated surface is more sensitive.

Aluminium plates offer the option of chromating on one side, so that the side exposed to the operator has an anodized layer which is less sensitive.

Screening of display windows

This technique involves applying a conductive transparent foil to the display window. To produce a conductive connection to the enclosure's shield, terminal lugs can be attached to the foil.

Screening of cable ducts

Unshielded cable ducts on EMC enclosures result in a substantial sacrifice of screen attenuation. To prevent this happening, the end of the shielded cable must be inserted into an EMC cable gland. Ensure the contact is good between the cable gland and the enclosure screen. To obtain a ground connection, a conductive shim with grounding clips can be inserted between cable gland and enclosure screen.

However, if it is not possible to obtain screening by using metallic connections and shielded cables, use a duct designed for the wavelength. Duct apertures smaller than $1/30^{\text{th}}$ of the wavelength have an extremely small influence on the screening effect. With higher field intensity values, the length of the aperture should not be greater than $1/30^{\text{th}}$ of the wavelength.

Screening of key pads

There are two options available:

- Laminating the polyester foil, coated with aluminium or copper, into the keyboard by sandwiching it under the front pane foil. To grounding to the enclosure wall or mother board, use foil with at least one attached terminal lug.
- The other alternative is to integrate foil, coated by the screen printing technique, into the keyboard. With this option, conductive silver is printed on the polyester foil, to cover its surface fully or in a lattice-shaped pattern. In this case, the foil should be grounded directly to the PCB via the plug and socket connection.

Other EMC measures

EMC seals

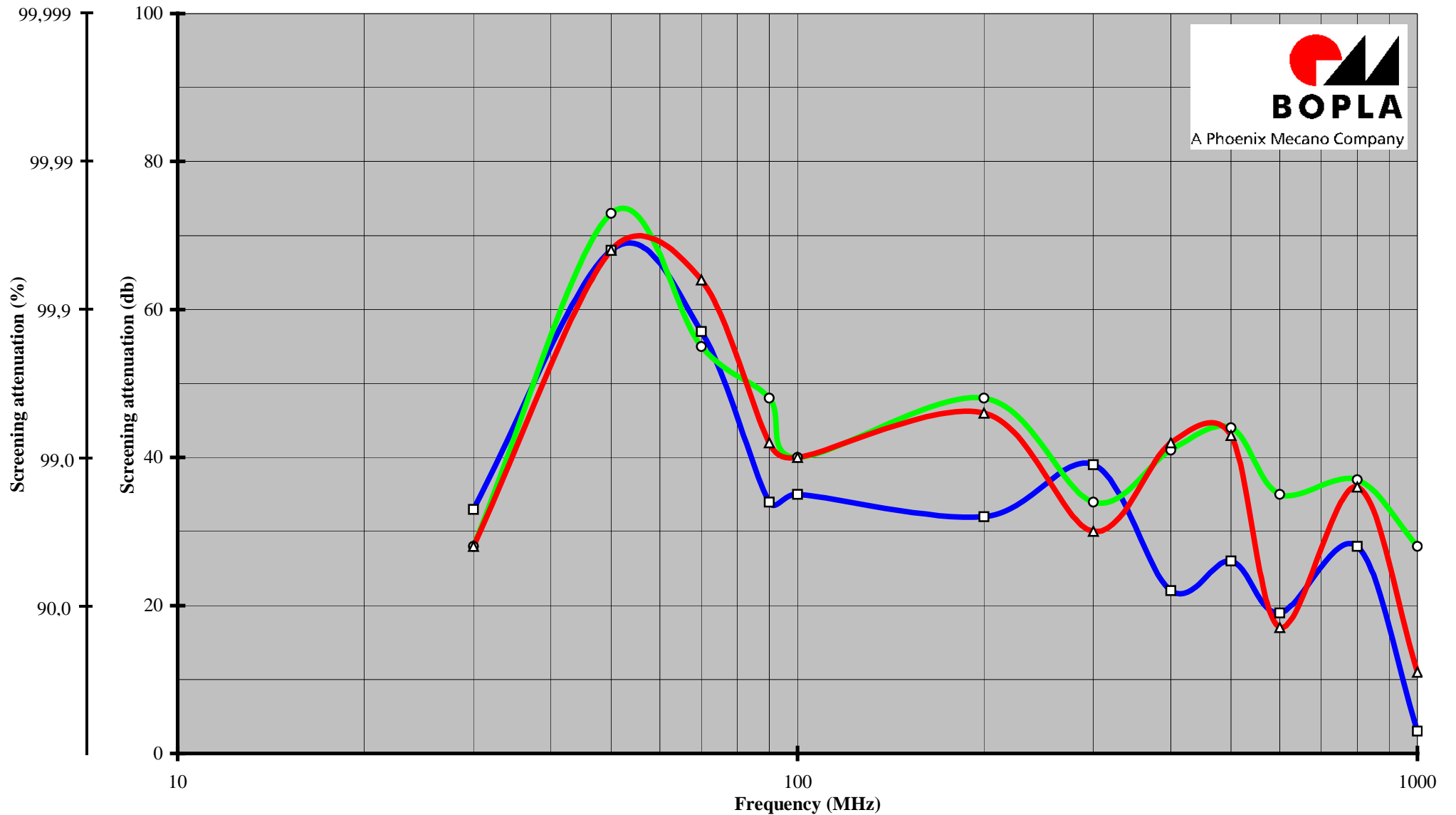
In any other cases, where the screening techniques already described prove to be inadequate, contact seals can be used to enhance screening performance. If necessary, we will suggest or specify these special seals to suit your requirements and type of enclosure.

Interior encasing

A further effective screening measure is offered by the possibility of surrounding components, sub-assemblies or entire electronic systems that are sensitive to radiation interference, with a metallic casing inside the enclosure. In addition to the measures already described, a further enhancement of the screening performance can be achieved with interior encapsulation.

For several years, BOPLA has worked with competent EMC suppliers and institutes that will also assist you with EMC problems, carry out measurements and tests, or issue certificates for you. We shall be pleased to give you addresses and the names of contact persons.

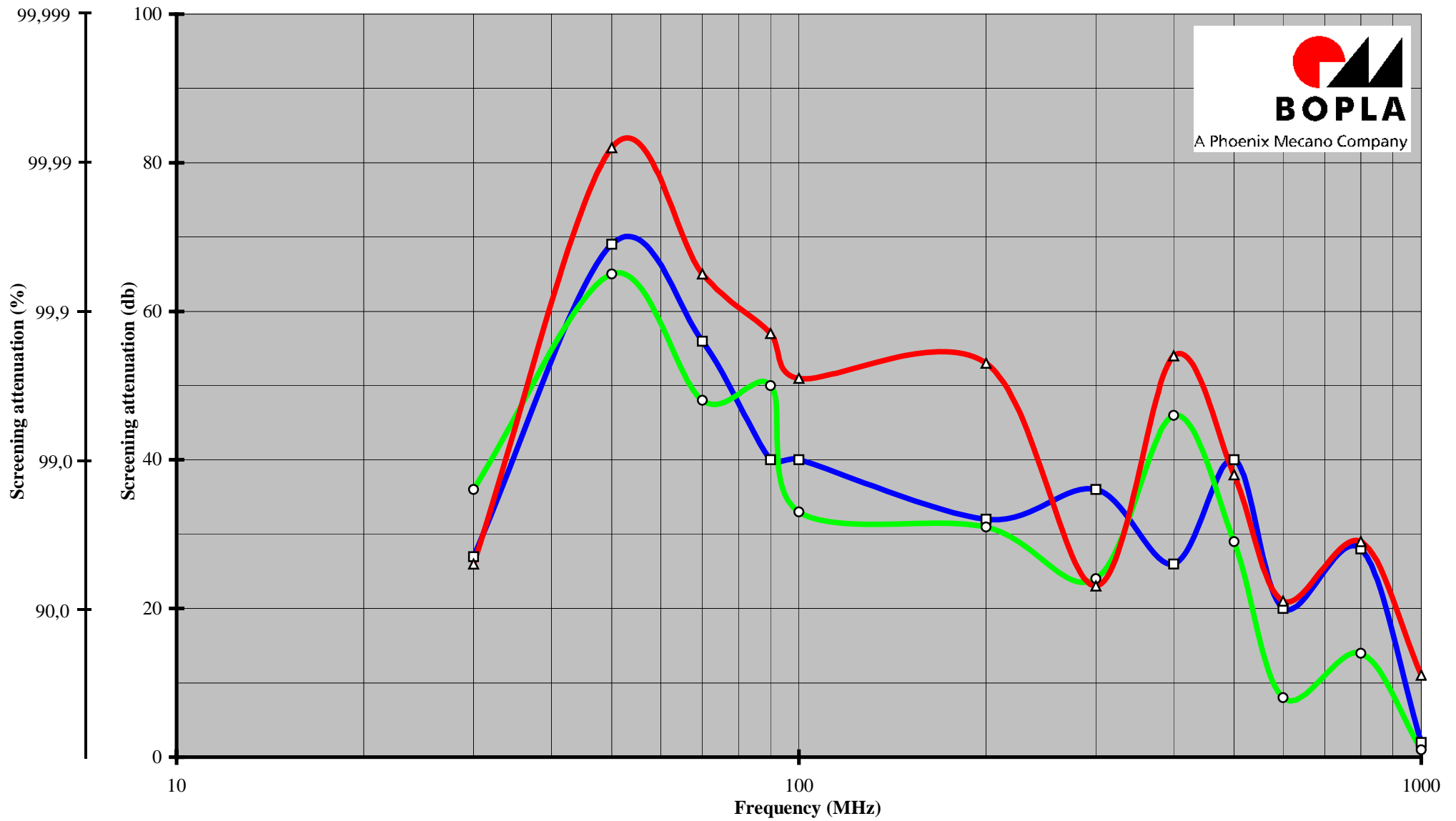
Measurement of screening attenuation



□ conductive copper lacquer ○ galvanized ▲ aluminized

2.1. CombiCard II with EMC seal without ventilation
Combination: FR 7000 + BC 7000-1,5 + RD 7000 K

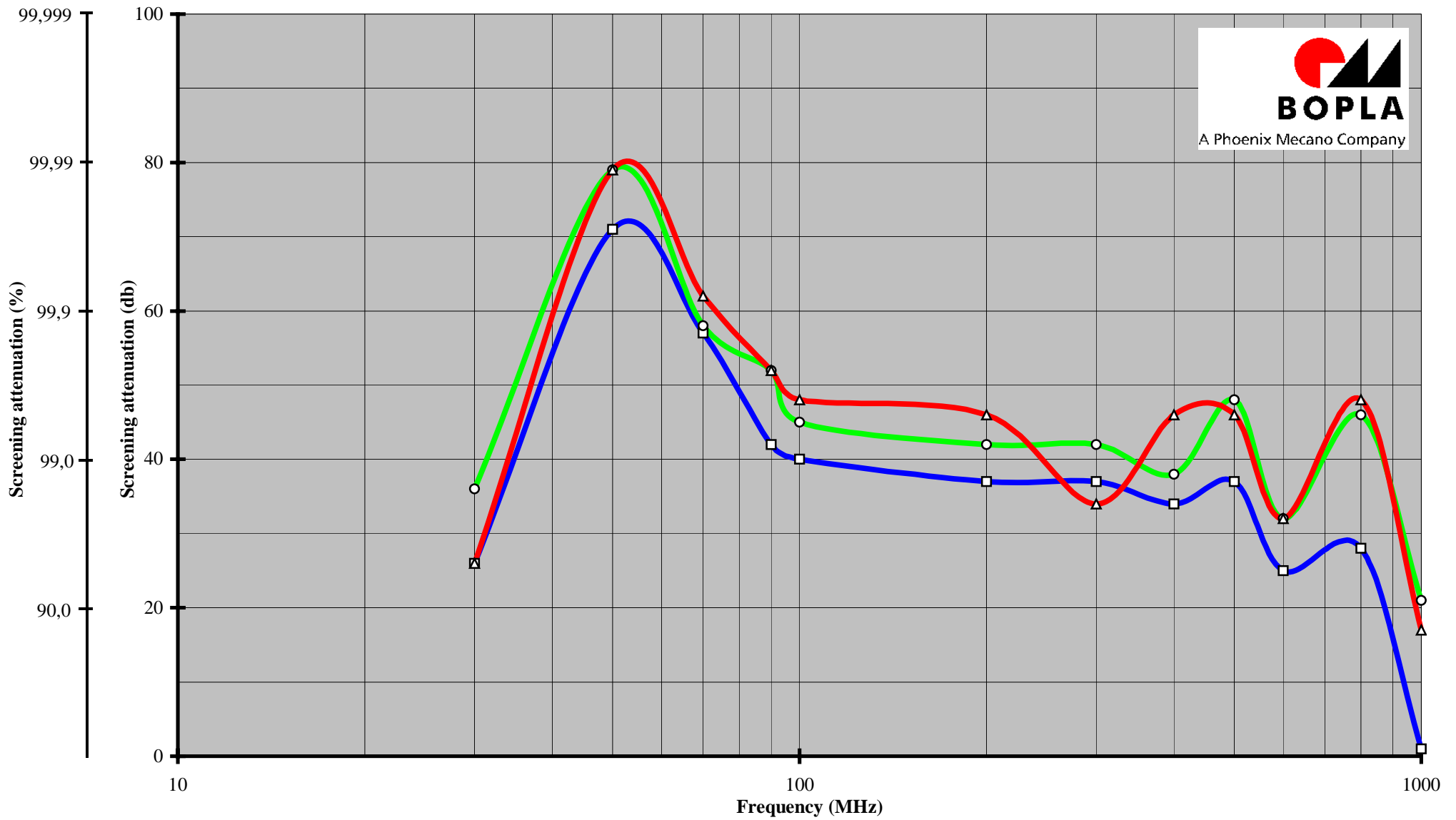
Measurement of screening attenuation



■ conductive copper laquer
 ○ galvanized
 ▲ aluminized

2.2. CombiCard II with EMC seal with ventilation
 Combination: FR 7000 + BC 7000 L-1,5 + RD 7000 K

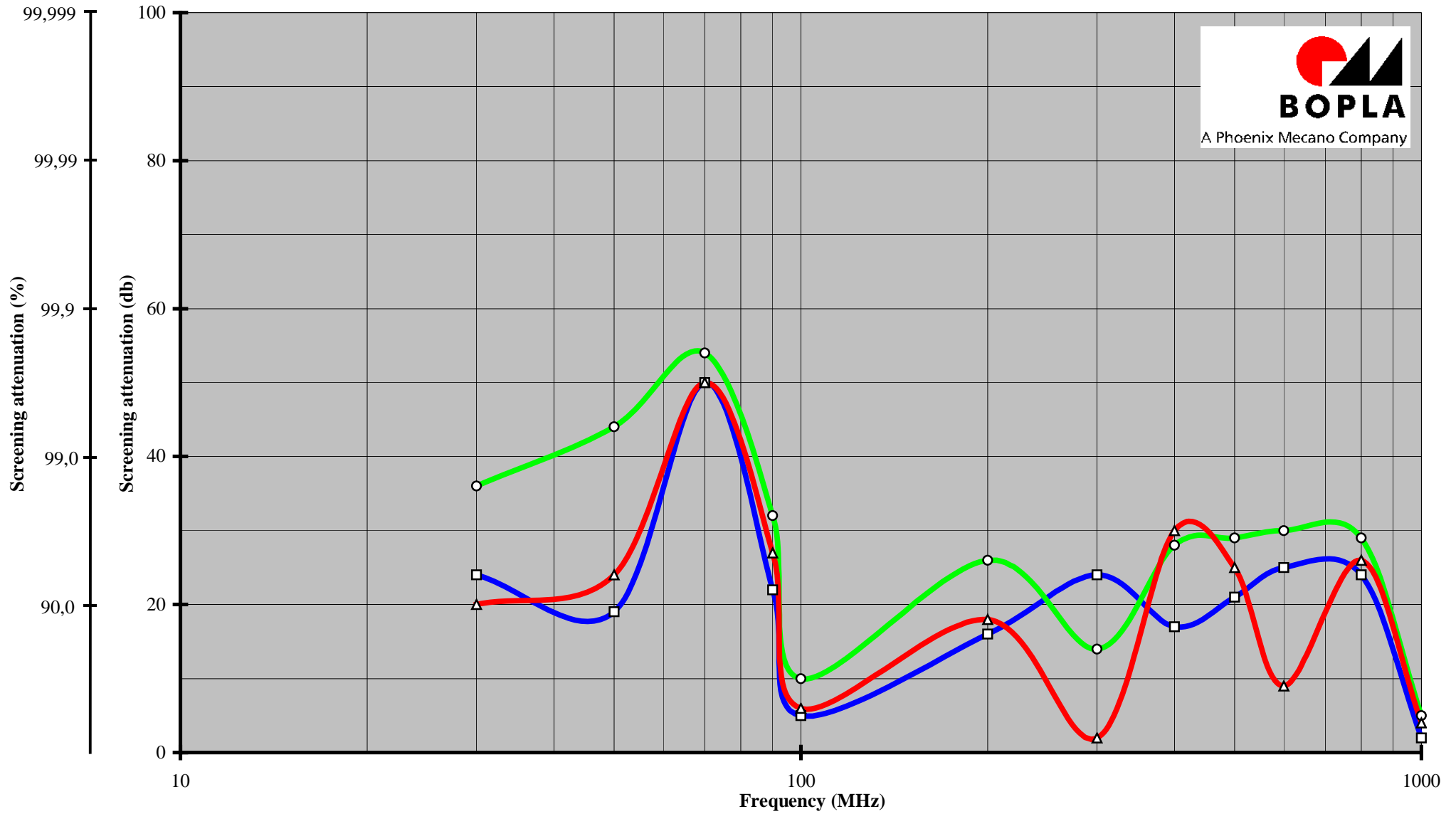
Measurement of screening attenuation



□ conductive copper laquer ○ galvanized ▲ aluminized

2.3. CombiCard II with EMC seal without ventilation
Combination: FO 7000 + BC 7000-1,5 + RD 7000 K

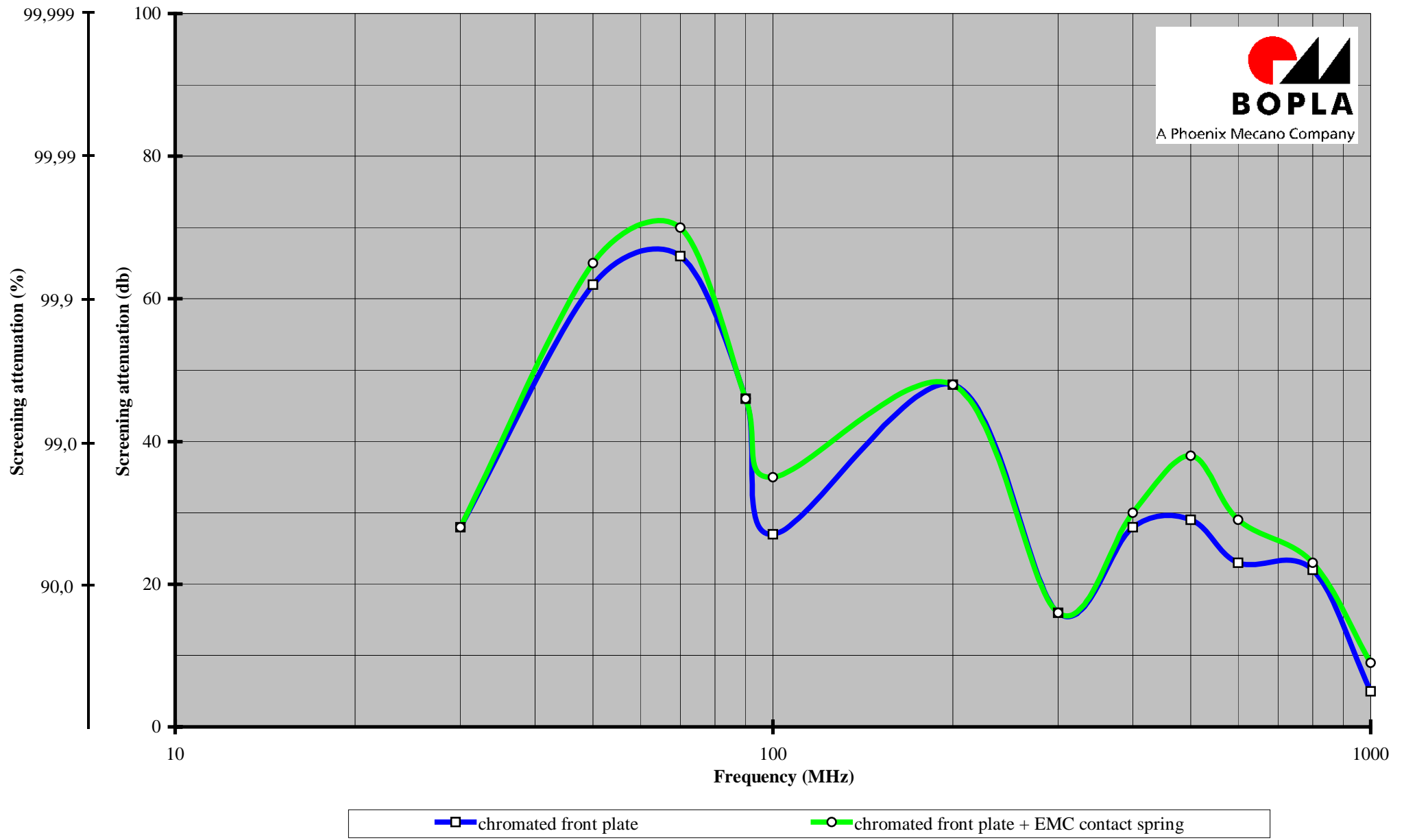
Measurement of screening attenuation



■ conductive copper laquer ● galvanized ▲ aluminized

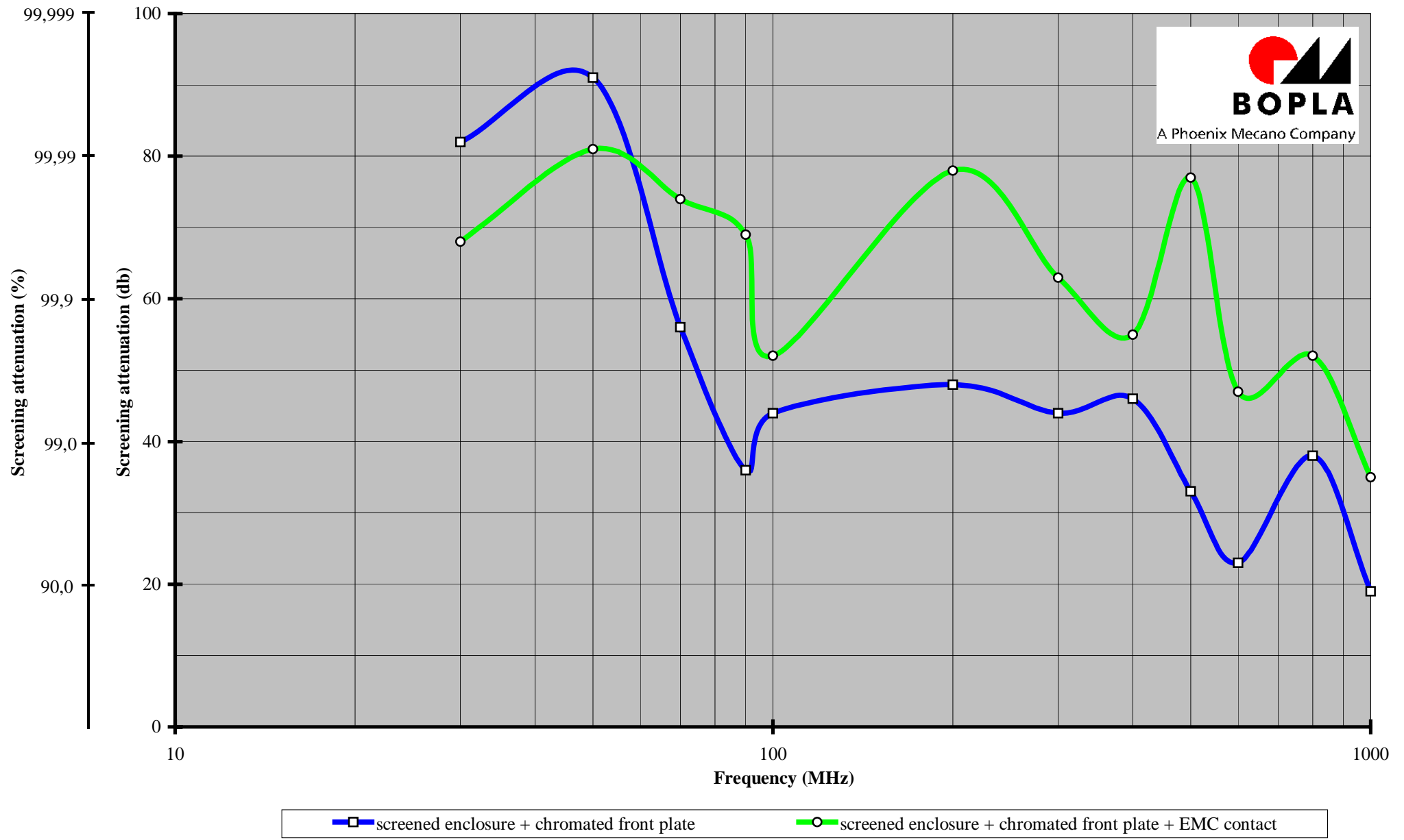
2.4. CombiCard II with standard seal without ventilation
Combination: FO 7000 + BC 7000-1,5 + RD 7000 K

Measurement of screening attenuation



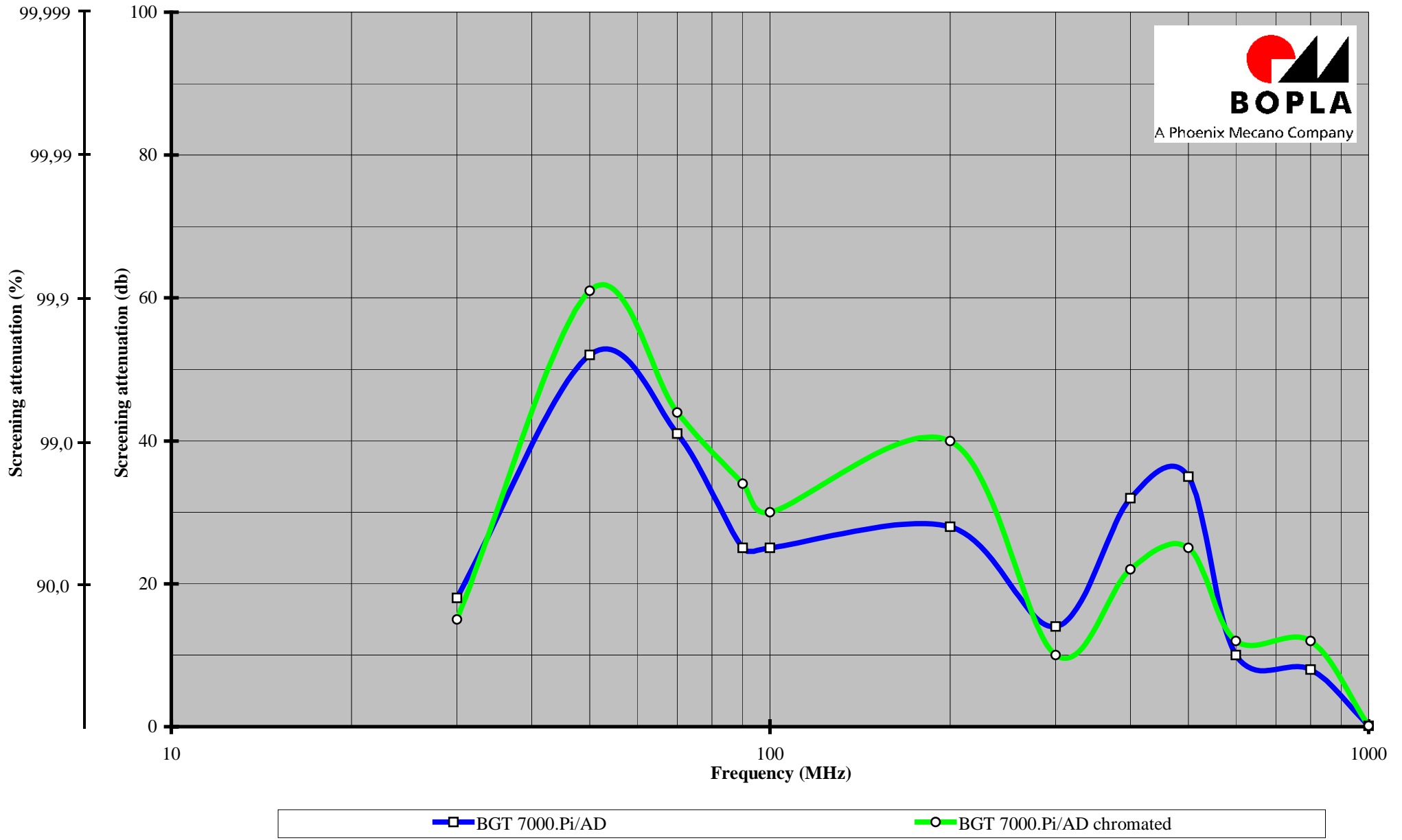
2.5. CombiCard II – aluminized with EMC seal and front plate (open front lid)
 Combination: (FD 7000 G) + FP 7000 + BC 7000-1,5 + RD 7000 K

Measurement of screening attenuation



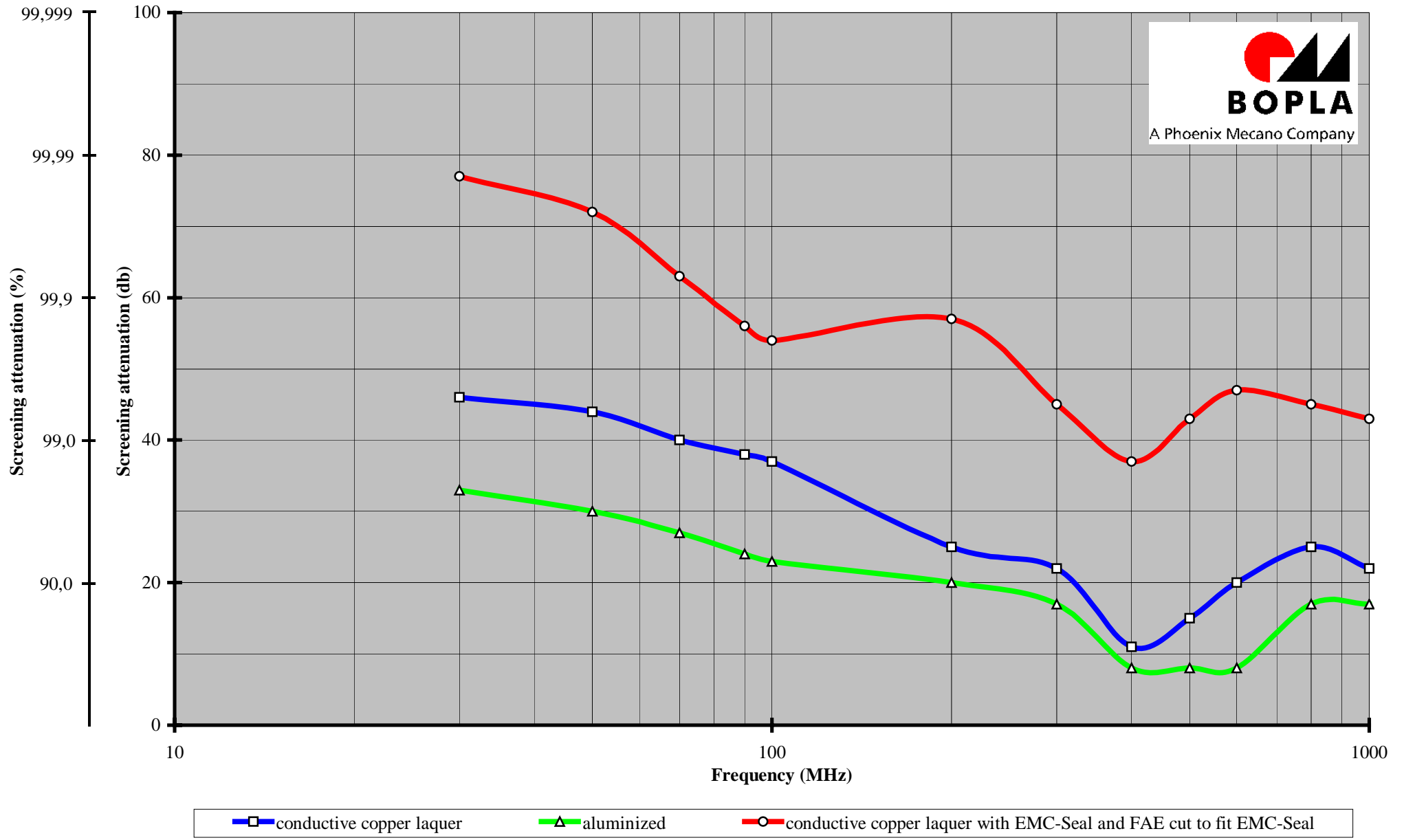
2.6. CombiCard II - Standard enclosure with screened enclosure + front plate
 Combination: FD 7000 G + Schirmgehäuse + FP 7000 + BC 7000-1,5 + RD 7000 K

Measurement of screening attenuation



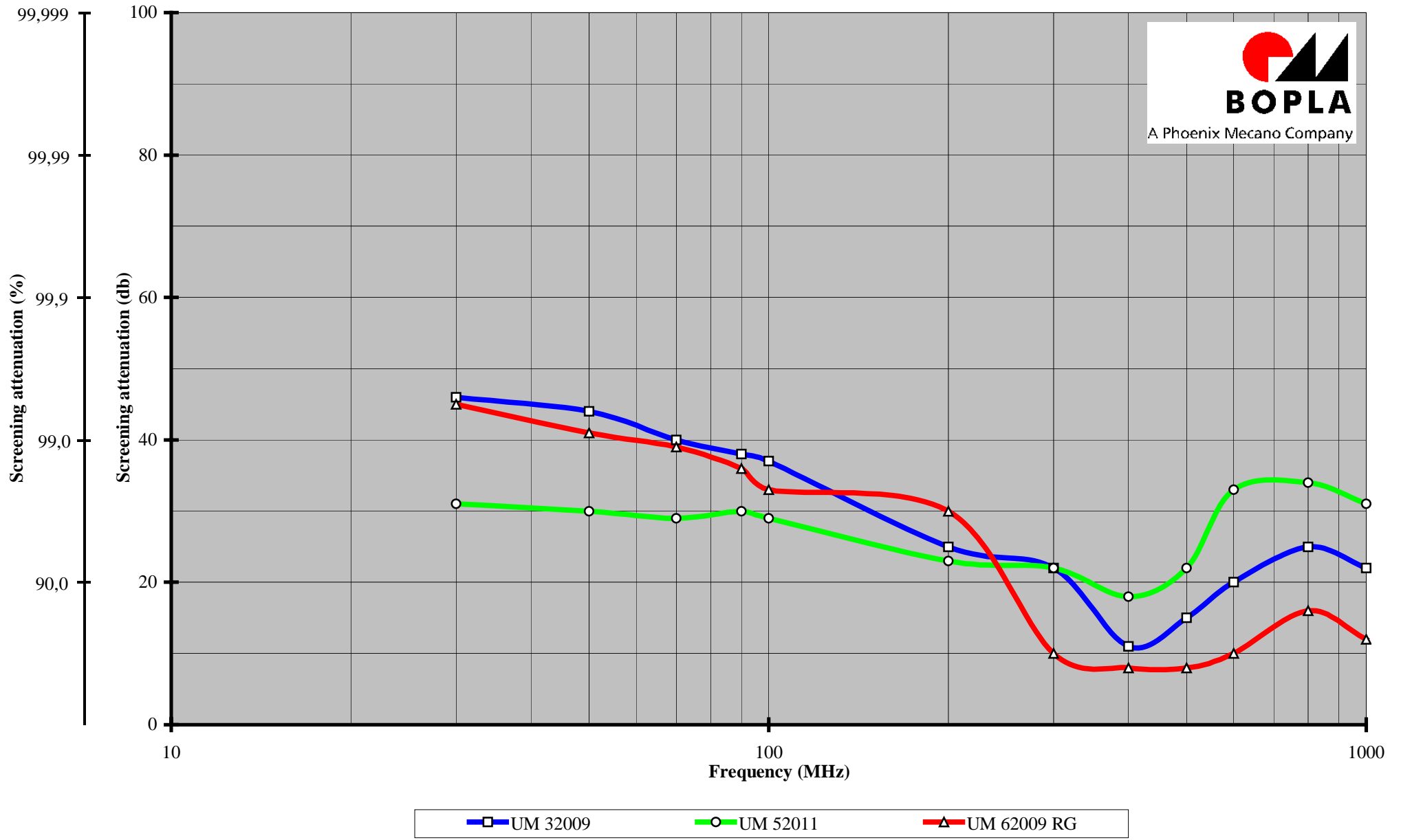
2.7. CombiCard II Standard enclosure with BGT 7000.Pi/AD
Combination: FD 7000 G + BGT 7000.Pi/AD + BC 7000-1,5 + RD 7000 K

Measurement of screening attenuation



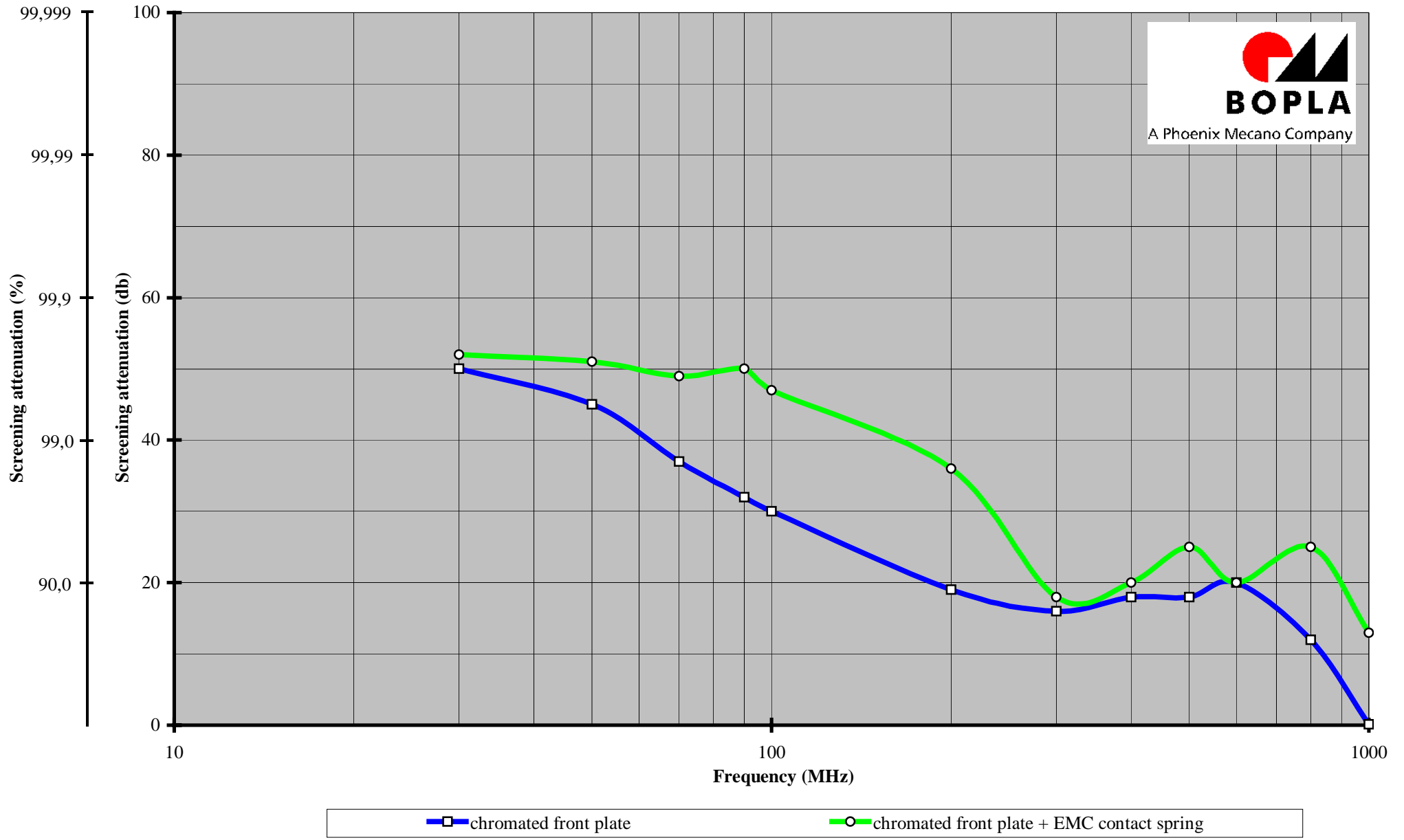
3.1. Ultramas 32009 with standard FAE

Measurement of screening attenuation



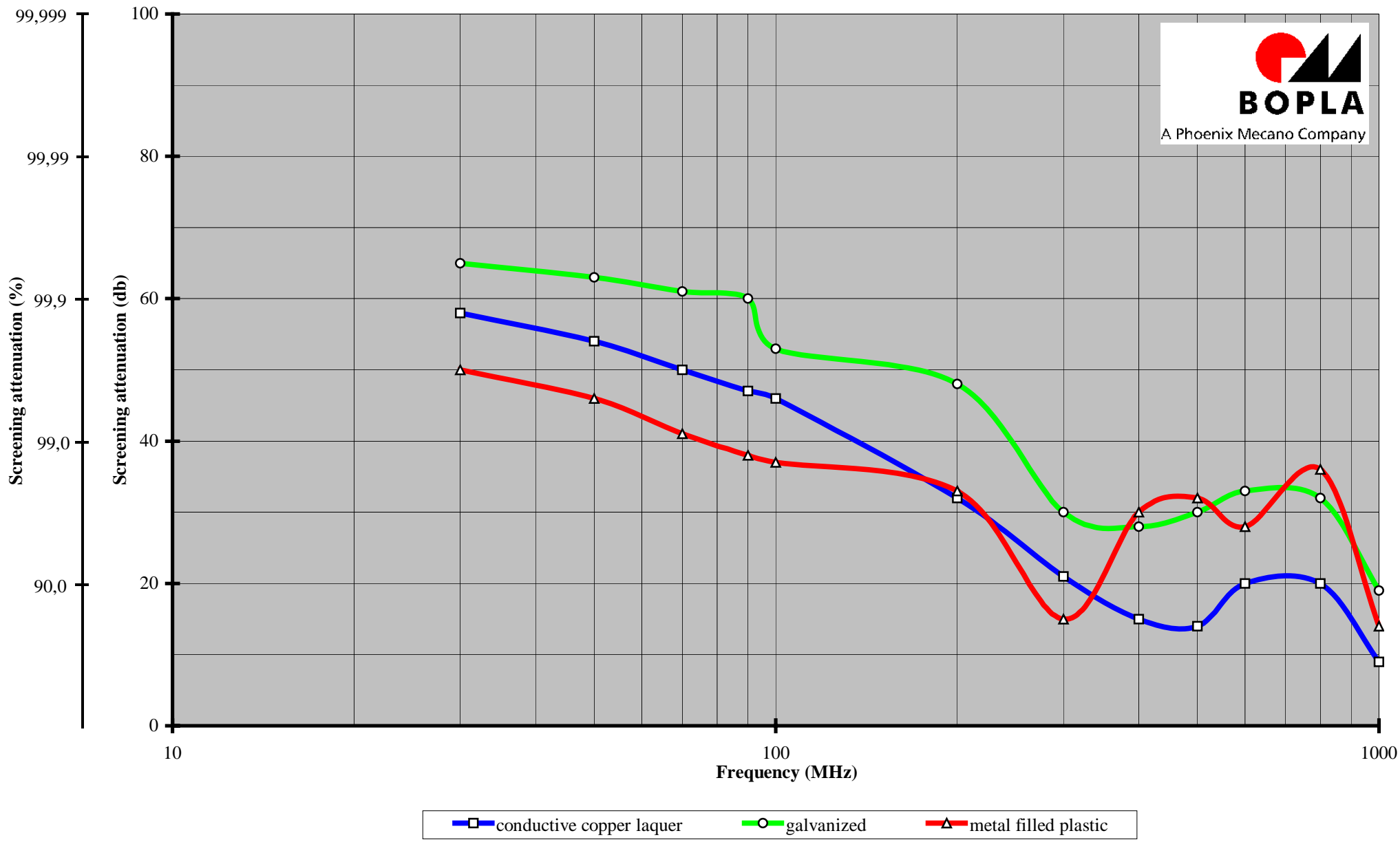
3.2. Ultramas with conductive copper laquer and standard FAE

Measurement of screening attenuation



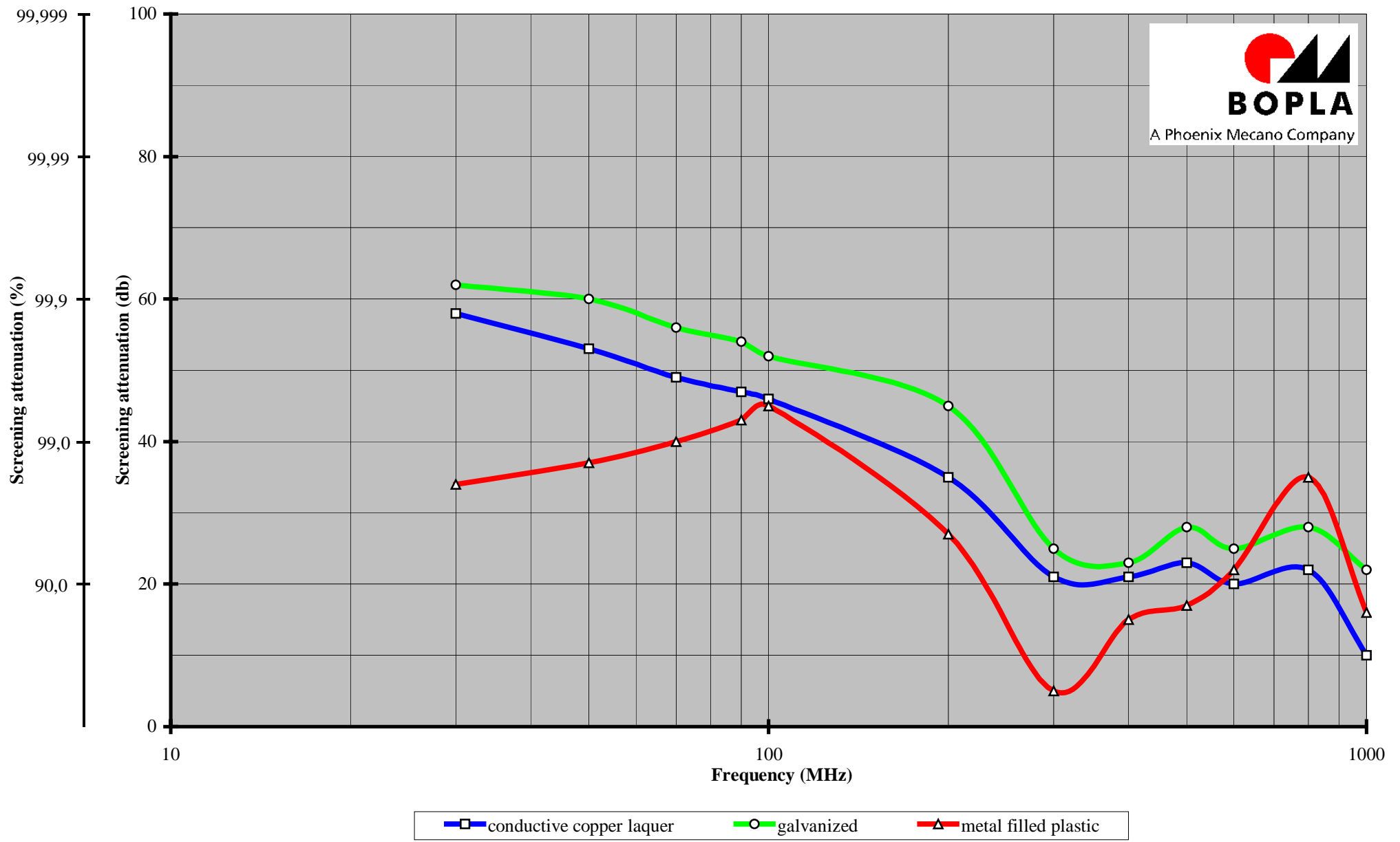
4.1. RCP 2000 with conductive copper laquer

Measurement of screening attenuation



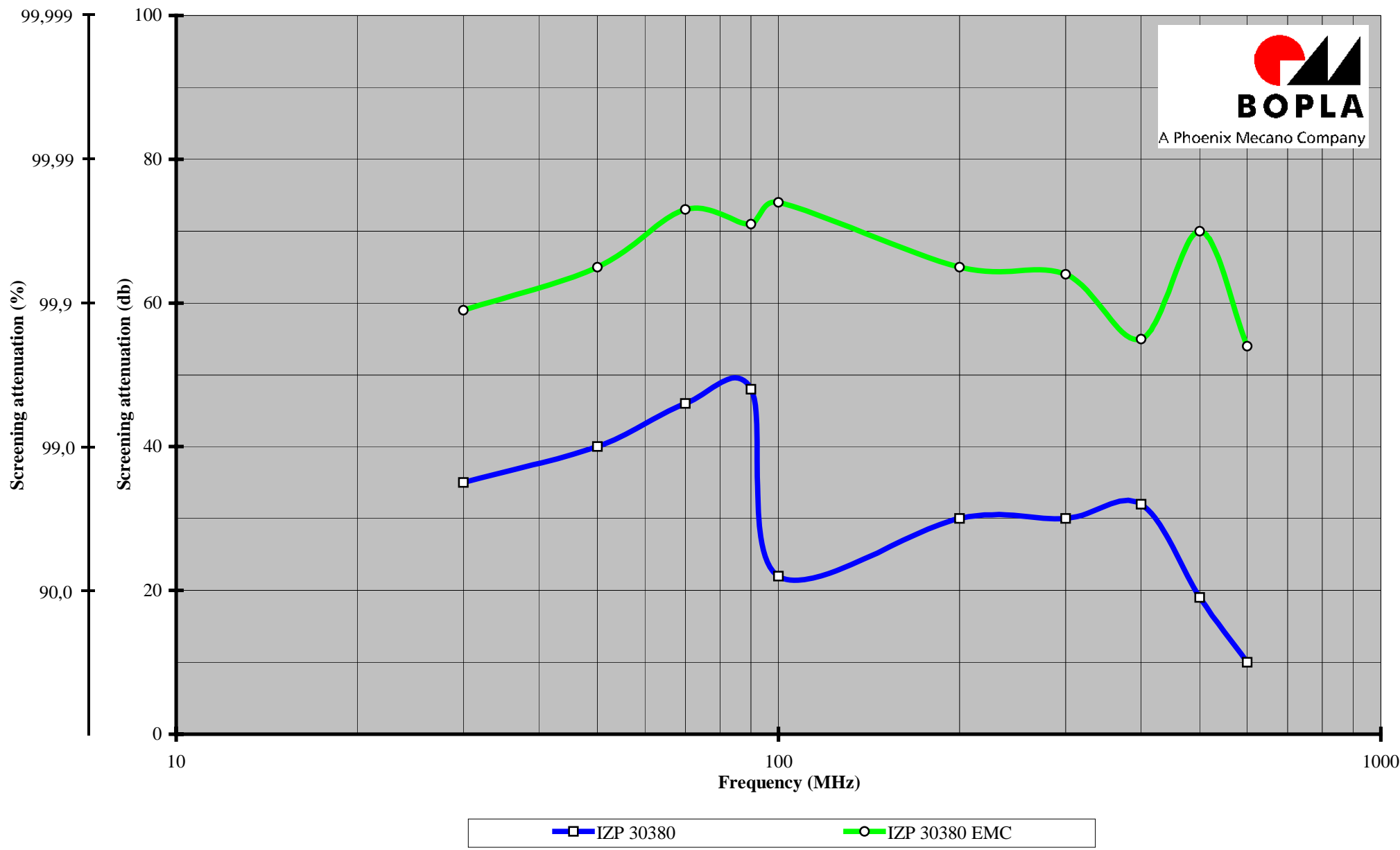
5.1. CombiNorm with horizontal PCB with AK 700/_V

Measurement of screening attenuation

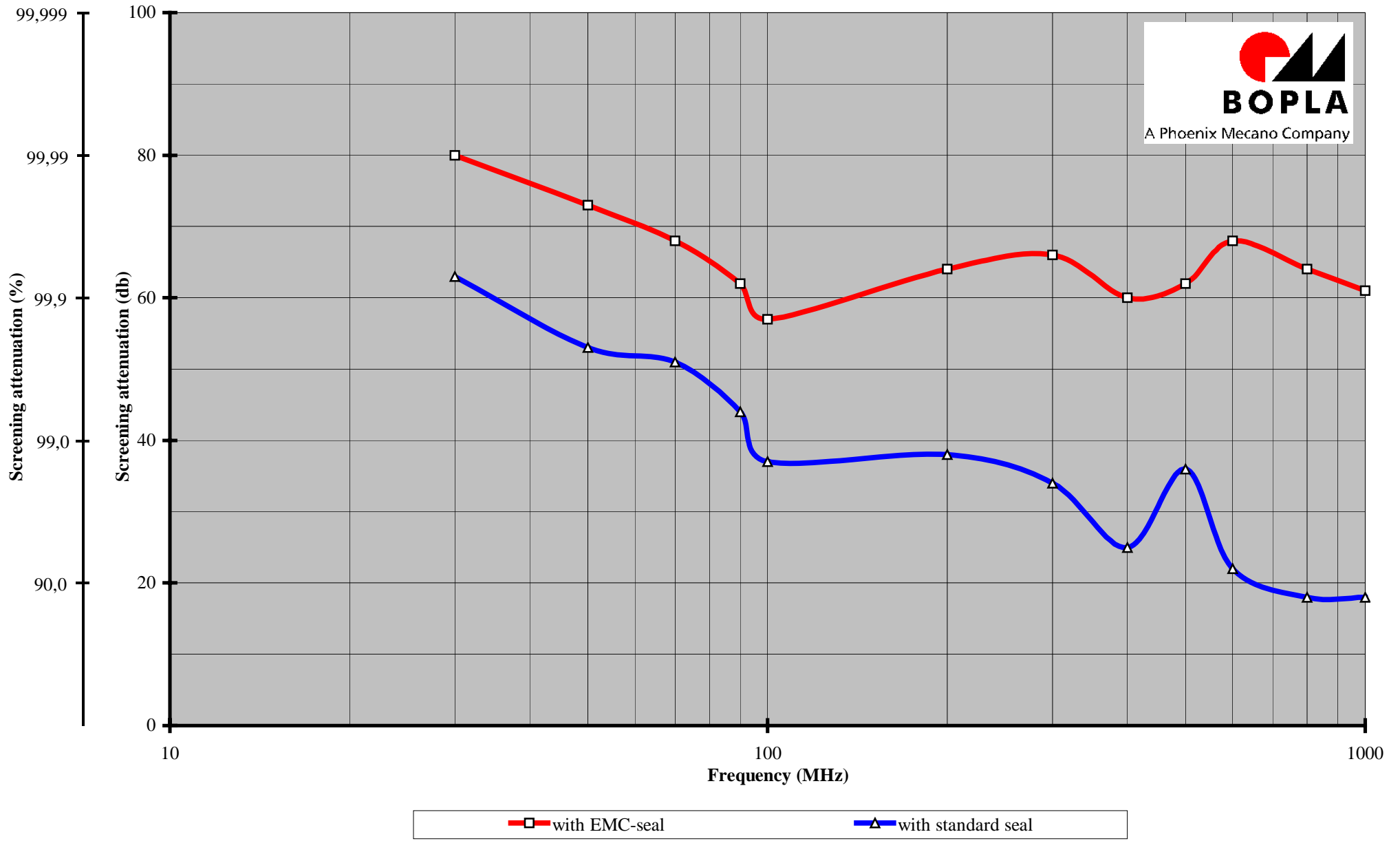


5.2. CombiNorm with vertical PCB with AK 700/_H

Measurement of screening attenuation

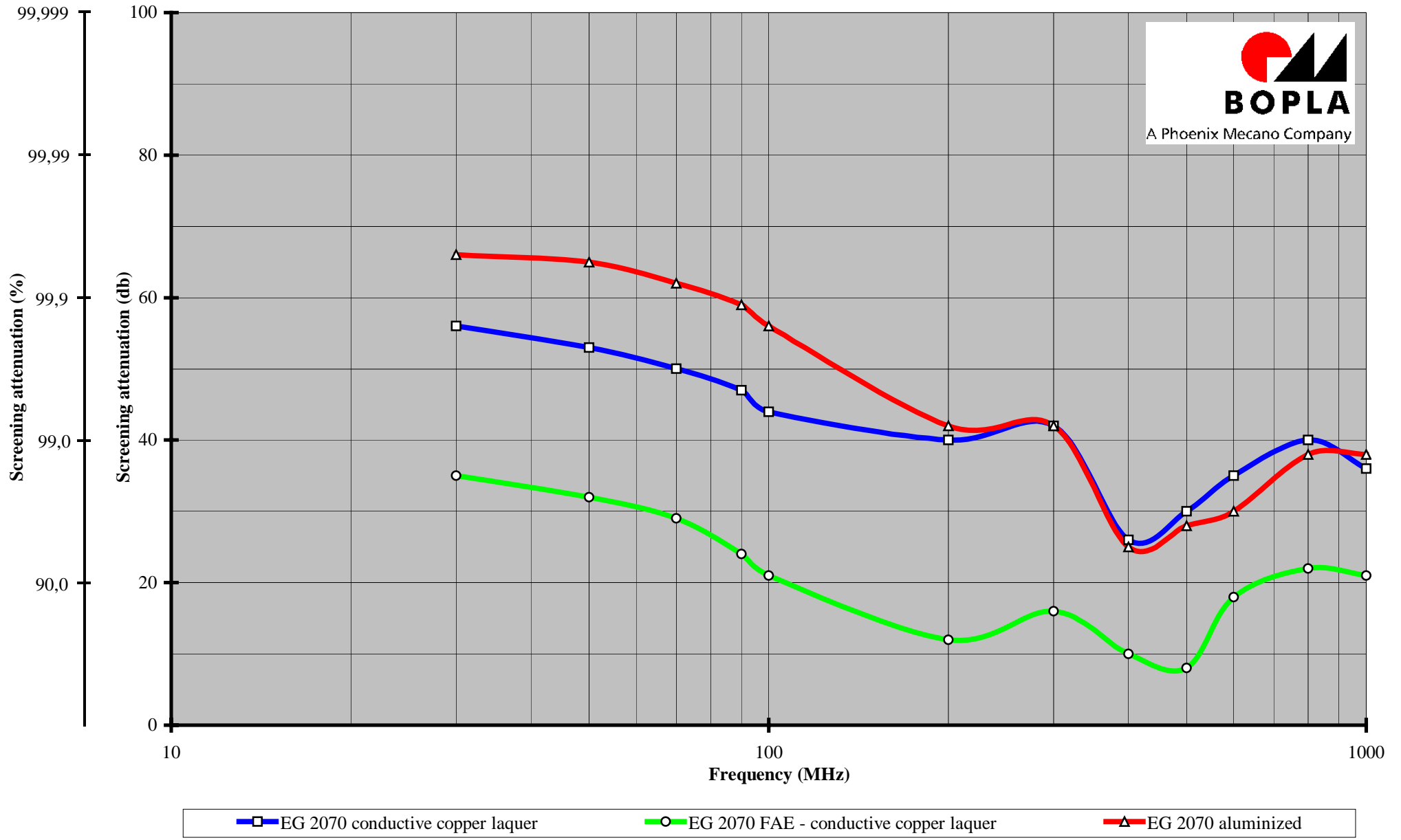


Measurement of screening attenuation



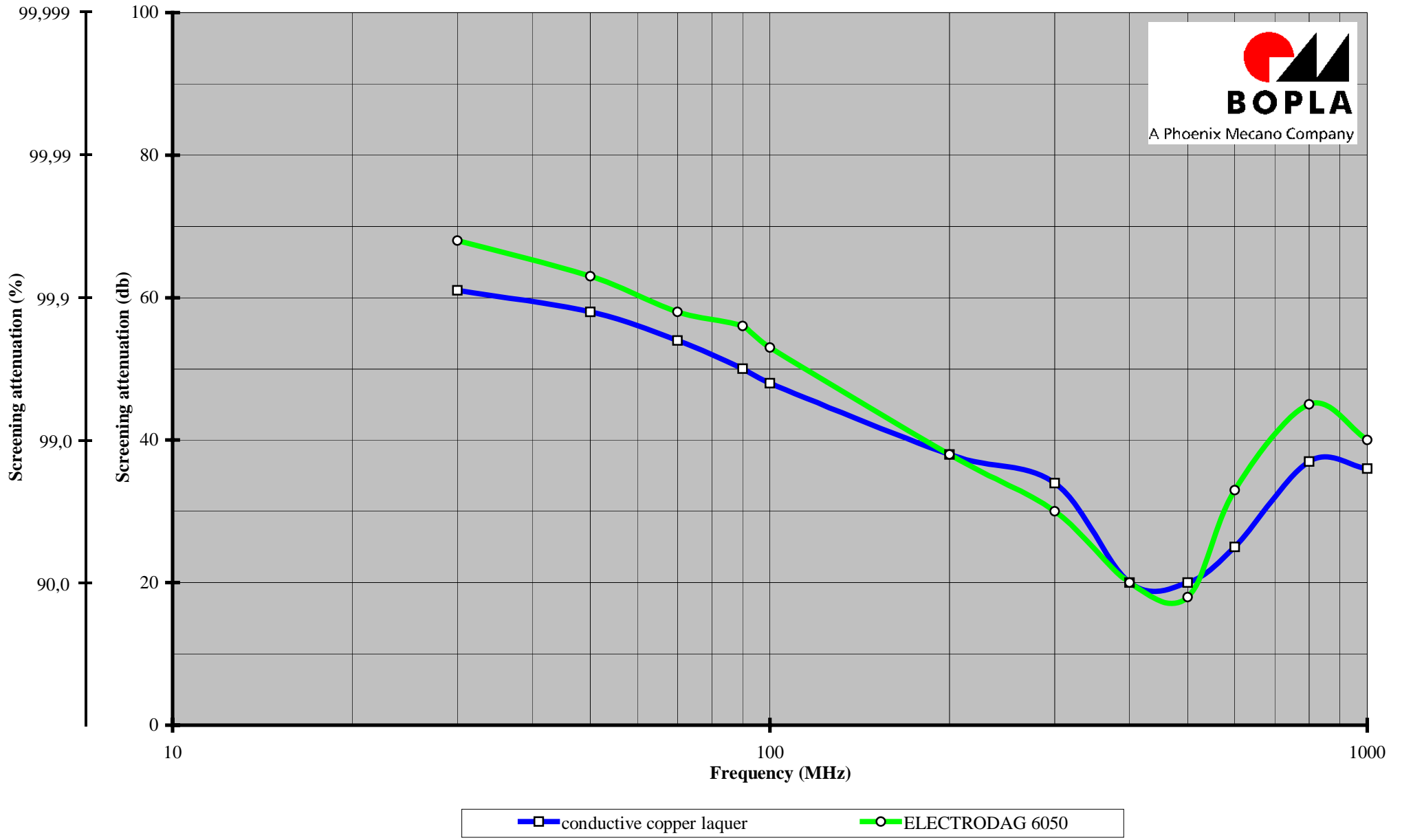
7.1. Euomas with conductive copper laquer

Measurement of screening attenuation



8.1. Elegant-enclosure

Measurement of screening attenuation



9.1. NGS 9616 with standard frontplate

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Sales addresses are valid as of 01.01.2008



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