

Gutachten Schirmdämpfung

Expert report screening attenuation

Messobjekt

Abschirmfarbe HSF54
mit Malerwalze

Datum der Messung

18.12.2019

Vorbemerkung

Die Prüflinge werden mit einer definierten Leistungsflussdichte S_1 bestrahlt, die durchdringende Leistungsflussdichte S_2 wird gemessen. Die Schirmdämpfung ist eine dimensionslose Messgröße in Dezibel (dB) und wird wie folgt berechnet:

$$dB = 10 \cdot \log_{10} \frac{S_1}{S_2}$$

dB	Dämpfung
10	90 %
20	99 %
30	99,9 %
40	99,99 %
50	99,999 %
60	99,9999 %
...	...

Konformität

Die Messung der Dämpfung elektromagnetischer Wellen von **40/600 MHz bis 40 GHz** wurde (wahlweise je nach Materialeigenschaften) in Übereinstimmung mit dem Standard **IEEE Std 299™-2006** oder in Anlehnung an den Standard **ASTM D4935-10** durchgeführt.

Ort der Messung

Eigenes EMV-Labor nach gängigen etablierten Standards, zur täglichen Qualitätssicherung und Produktentwicklung.

Messaufbau

Als Messgeräte verwenden wir zwei vektorielle Netzwerkanalysatoren Rohde & Schwarz **ZNB20** und **ZNB40** mit einer Messdynamik bis 140 dB.

Als Antennen für IEEE Std 299™-2006 verwenden wir breitbandige **Hornantennen**. Als Antennen für ASTM D4935-10 verwenden wir breitbandige **TEM-Zellen** mit radialer Polarisation.

Measuring object

Shielding paint HSF54
with paint roller

Date of measurement

2019/12/18

Preliminary Note

The test samples are irradiated with a defined power flux density S_1 , the pervasive power flux density is measured. The shielding attenuation is a non-dimensional measured variable in decibels (dB) and calculated as follows:

$$dB = 10 \cdot \log_{10} \frac{S_1}{S_2}$$

dB	Attenuation
10	90 %
20	99 %
30	99,9 %
40	99,99 %
50	99,999 %
60	99,9999 %
...	...

Conformity

The measurement of the attenuation of electromagnetic waves between **40/600 MHz – 40 GHz** (selectively depending on the material properties) has been conducted in accordance with standard **IEEE Std 299™-2006** or following to standard **ASTM D4935-10**.

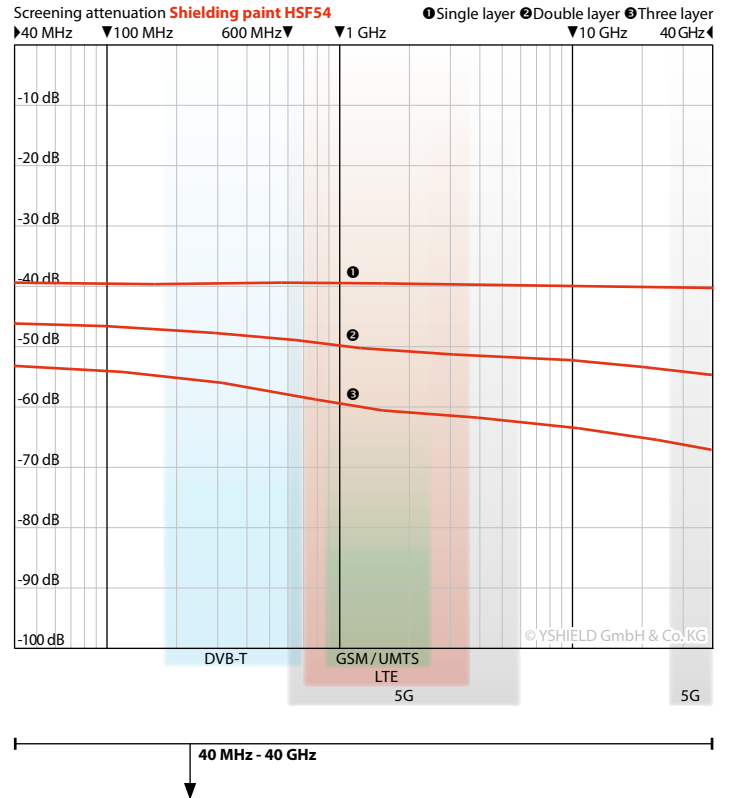
Place of measurement

In our own EMV laboratory according to prevalent established standards, for daily quality control and product development.

Measurement setup

The measuring devices we use are two Vector Network Analysers Rhode & Schwarz **ZNB20** and **ZNB40**, with a measuring dynamics up to 140 dB.

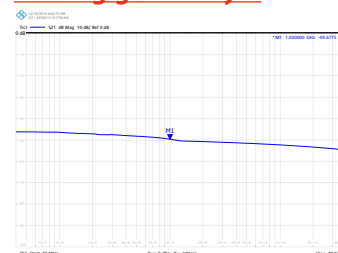
The antennas we use for IEEE Std 299™-2006 are broadband **horn antennas**. The antennas we use for ASTM D4935-10 are broadband **TEM cells** with radial polarisation.



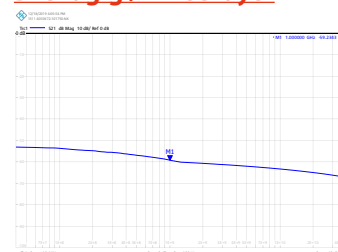
Einlagig / Single layer



Zweilagig / Two layer



Dreilagig / Three layer



Technical data sheet - Shielding paints 2020/06

	HSF54	HSF64	MAX54	PRO54	TEC54	NSF34	
Brief description	Standard shielding paint with the best allround properties. One paint for almost all applications. TÜV-SÜD certified. High shielding, adhesion and hardness with fine pigmentation.	Standard shielding paint without preservatives on basis of dispersion silicate, minimalistic formulation. TÜV-SÜD certified. High ecology with fine pigmentation. Limitations at adhesion and shielding.	Special shielding paint with the focus on maximum shielding, if every single dB counts. Limitations at hardness and abrasion resistance. Because of the sweetish smell, usage only in rooms that are occupied at first after application.	Special shielding paint with the focus on hardness and abrasion resistance due to carbon fibers. TÜV-SÜD certified. Limitations at shielding. Because of the sweetish smell, usage only in rooms that are occupied at first after application.	Special carbon paint with the focus on technical application procedures. With the fine 5 µm pigmentation for screen printing, blanket and roller coating, dipping, rinsing, airless.	Standard shielding paint for low-frequency electrical fields. TÜV-SÜD certified. To shield electrical devices, fuse boxes, power lines, etc.	

As shielding paint to shield electromagnetic fields

Usage	Room / building shielding.	Room / building shielding.	Room / building shielding.	Room / building shielding.		Room / building shielding.
Screening HF / LF	HF /LF	HF /LF	HF /LF	HF /LF		- /LF
Screening 1 layer ①	39 dB	32 dB	43 dB	32 dB	30 dB	40 dB (99%)
Screening 2 layers ①	49 dB	40 dB	53 dB	40 dB	38 dB	---
Screening 3 layers ①	59 dB	48 dB	63 dB	48 dB	46 dB	---
Coverage	5 - 7.5 m ² /l	5 - 7.5 m ² /l	5 - 7.5 m ² /l	5 - 7.5 m ² /l		7.5 - 10 m ² /l
Scope of application	Interior, exterior	Interior	Interior, exterior	Interior, exterior		Interior, exterior
Substrates	Almost all	All absorbent	Almost all	Almost all		Almost all
Moisture-resistance	High	Normal	High	Very high		High
Sd-value	0.1 m	0.05 m	0.1 m	0.1 m		0.1 m
Applicable with	Paint roller, airless (> 0.2 mm)	Paint roller, airless (> 0.2 mm)	Paint roller, airless (> 0.4 mm)	Paint roller, airless (> 0.4 mm)		Paint roller, airless (> 0.1 mm)

As coating in technical applications

Application	Screen printing, roller / blanket coating, spraying				Screen printing, roller / blanket coating, spraying	Screen printing, roller / blanket coating, spraying
Thickness 200 µm ②	~ 1.5 Ω/□	~ 2.7 Ω/□	~ 0.8 Ω/□	~ 2.7 Ω/□	~ 2.5 Ω/□	~ 30 Ω/□
Thickness 150 µm ②	~ 2.5 Ω/□				~ 3.5 Ω/□	~ 40 Ω/□
Thickness 100 µm ②	~ 4 Ω/□				~ 7 Ω/□	~ 70 Ω/□

Ecology and certifications

Ecology	High	Very high	Normal	Normal	Normal	High
Odor	Dispersion typical, after drying free of odor	Very low, after drying free of odor	Sweetish, after drying free of odor	Sweetish, after drying free of odor	Sweetish, after drying free of odor	Dispersion typical, after drying free of odor
VOC content ③	0.18 g/l	0.17 g/l	0.19 g/l	0.19 g/l	0.18 g/l	0.20 g/l
Full declaration ③④ preservation	64 ppm BIT 34 ppm INN 3 ppm MIT	0 ppm BIT 0 ppm INN 0 ppm MIT	64 ppm BIT 34 ppm INN 3 ppm MIT	58 ppm BIT 15 ppm INN 2 ppm MIT	64 ppm BIT 34 ppm INN 3 ppm MIT	69 ppm BIT 9 ppm INN 2 ppm MIT
Certification	TÜV-SÜD	TÜV-SÜD	---	TÜV-SÜD	---	TÜV-SÜD
Fire behaviour	DIN EN 13501-1	DIN 4102-1	---	DIN 4102-1	---	---

Physical and chemical properties

	Black	Gray	Black	Black	Gray	Black
Binder	Acrylate	Silicate, acrylate	Acrylate	Acrylate	Acrylate	Acrylate
Pigmentation d90	50 µm	50 µm	100 µm	100 µm	5 µm	5 µm
Adhesive strength	5.7 N/mm²	3.6 N/mm²	3.5 N/mm²	8.4 N/mm²	8.4 N/mm²	12.2 N/mm²
Viscosity (Brookfield)	~ 2800 mPas	~ 2000 mPas	~ 2600 mPas	~ 2600 mPas	~ 2600 mPas	~ 1200 mPas
Temperature max.	60° C	60° C	60° C	60° C	60° C	60° C
pH value	8	11.6	8	8	8	8
Density	1.22 kg / l	1.26 kg / l	1.21 kg / l	1.13 kg / l	1.11 kg / l	1.06 kg / l
MFFT	5° C	5° C	5° C	5° C	5° C	5° C
Frost-/thaw resistance	5 cycles	5 cycles	5 cycles	5 cycles	5 cycles	5 cycles
Delivery sizes	1 / 5 liter	1 / 5 liter	1 / 5 liter	1 / 5 liter	1 / 5 liter	1 / 5 liter
Shelf life	12 months	12 months	12 months	12 months	12 months	12 months

① dB = screening attenuation: 10 dB = 90 %; 20 dB = 99 %; 30 dB = 99.9 %; 40 dB = 99.99 %, 50 dB = 99.999 %; ...

② Film thickness given as wet film; Measured with Schütz-Messtechnik MR-1 and 4-point-probe.

③ Values taken from the inspection report YSHIELD-191203 from TÜV-SÜD.

④ ppm = parts per million (millionth percentages); Permitted value according to TÜV-SÜD from 2020 are 500 ppm.

Product features

Intended use

Electro-conductive base coatings to shield high-frequency electromagnetic fields and/or low-frequency electric fields. Low-frequency magnetic fields are not shielded.

Area of application

Walls and ceilings: Unlimited possible. You will find the suitability for interior or exterior application in the table on the first page.

Floor areas: ● Loose or floating floor coverings (carpets, laminate, etc.) can be laid directly onto the shielding paints. Pay attention, that the shielding paints are not damaged! ● In case of glued floor coverings (carpets, cork, laminate, etc.) the shielding paints have to be aftertreated with our primer GK5 to improve the adhesion. ● We advise against bonding e.g. real-wood parquets.

Under plaster: Due to high adhesive tensile strenghts applicable directly under pure organic plasters.

Corrosion resistance

All shielding paints don't contain metal particles. Based on carbons they are long-term durable and not oxidizing.

Ready for 5G

Our shielding paints have an almost linear screening attenuation for a very large frequency range including both 5G frequency spectrums FR1 (600 MHz - 6 GHz) and FR2 (24 GHz - 40 GHz).

Safety up to 40 GHz

We have a professional EMC-laboratory according to various standards up to 40 GHz on site. You'll find the measuring curves and reports from 40/600 MHz - 40 GHz in the internet on the corresponding product pages.

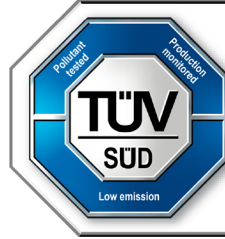
No nanotechnology

Our shielding paints are developed in accordance with strict ecological criteria. We use the carbon black with the lowest emission possible on the market and untreated natural graphite. We consciously do not use graphene, a nanomaterial where the hazard potential is still completely unknown.

TÜV-SÜD certification

We have our shielding paints **HSF54**, **HSF64**, **PRO54** and **NSF34** monitored by TÜV-Süd. The **production process** including **quality control**, **emission**

behaviour and economical use of **preserving agents** is subject to monitoring.



Pollutant tested building materials

- Testing of health-related contents and emissions
- Regularly product and process monitoring
- Control of the raw materials

www.tuev-sued.de/oekologische-produktpruefung

Safe material handling

Safety notes

All paints have a high coloring capability, so please proceed with care. Wipe off stains immediately with damp cloth. Do not let stains dry up. Do not inhale spray mist! Absolutely make sure, that all areas are well ventilated during use and drying time. Do not eat, drink or smoke during painting! Rinse thoroughly immediately after skin or eye contact!

VOC-content

Please refer to the table on the first page. The EU limit value for cat. A/a is 30g/l (by 2010).

Ingredients

HSF54: Water, natural graphite, pure acrylics dispersion, carbon black, additives, preservative (BIT, INN, MIT).

HSF64: Water, potassium silicate, natural graphite, carbon black, pure acrylics dispersion, additives, NO preservation agent.

MAX54: Water, natural graphite, pure acrylics dispersion, carbon black, additives, preservative (BIT, INN, MIT).

PRO54: Water, pure acrylics dispersion, carbon fibers, natural graphite, carbon black, additives, preservative (BIT, INN, MIT).

TEC54: Water, natural graphite, pure acrylics dispersion, carbon black, additives, preservative (BIT, INN, MIT).

NSF34: Water, pure acrylics dispersion, carbon black, natural graphite, additives, preservative (BIT, INN, MIT).

Preservative

If stated above, the shielding paint contains BIT (1,2-Benzisothiazolin-3-on), INN (Zink-Pyrithion) and MIT (2-Methyl-4-isothiazolin-3-on) for preservation. Zink-Pyrithion (INN) is a safe replacement for MIT, that is by legislature subject to labeling from 2020 over 15 ppm. Advisory service for allergic persons under telephone number 0049-(0)8531-31713-0.

Grounding

Grounding regulation

Large area shieldings executed with shielding materials are no electrical equipment but „new conductive parts“ according to IEC 826-03-03 or IEC 195-06-11 and thereby a new method of DIN VDE 0100-100:2009-06. By connecting the material(s) to the potential equalization they are an inherent part of the electrical system. Generally accepted rules of technology have to be respected.

According to the latest state of technology it is important to distinguish between protective equipotential bonding and functional equipotential bonding (FEB). The protective equipotential bonding (green/yellow cable) is a protective measure and ensures, in the event of contact voltage, the immediate action of safety devices (e.g. line safety switch). The function of the functional equipotential bonding (transparent cable) is the reduction of emission of low frequency electrical fields on large area shieldings (i.e. prevention of leaking electrical field).

Grounding accessories

To obtain an accurate grounding, we exclusively recommend our grounding accessories. For interior use: Grounding plate GW or GB in combination with grounding strap EB2. For exterior use: Grounding plate GE. **Please find more information in our “Technical data sheet - Grounding”.**

Processing

Interior approach

- Prepare the underground with our primer GK5.
- Drill holes for the grounding plate.
- The grounding strap has to be applied uninterrupted in one piece through all surfaces to be painted, as stated in our grounding instructions sheet.
- Apply the shielding paint in one or two layers, depending on the favored shielding attenuation. Apply second coat of shielding paint to the area where the grounding plate will be mounted.
- Allow the paint 24 hours to dry.
- Fix the grounding plate.
- For further procedure references please follow up at subitem „Final coat“.

Exterior approach

- Prepare the underground with our primer GK5.
- Level out the mounting surface for the grounding plate.
- Drill holes for the grounding plate.
- Apply the shielding paint in one or two layers, depending on the favored shielding attenuation. Apply second coat of shielding paint to the area where the grounding plate will be mounted.
- Allow the paint 24 hours to dry.
- Fix the grounding plate and glue the top cover.
- For further procedure references please follow up at subitem „Final coat“.

Application temperature

Minimum application temperature: 5°C / 41°F. This temperature also counts for the drying time!

Underground

HSF54, MAX54, PRO54, TEC54, NSF34: Excellent adhesion on almost all undergrounds like emulsion paints, dry construction boards, wallpaper, cement, plaster, masonry, wood, many plastics, etc.

HSF64: Good adhesion on all absorbent undergrounds. Important: With potassium silicate as ingredient not applicable on gypsum based undergrounds.

Common: The underground needs to be solid, clean, degreased and dry. Absorbent or porous surfaces must be prepared with a primer. Old coats of paint or old wallpapers which can be etched with water, should be removed.

Priming coat

Absorbent or porous surfaces necessarily must be prepared with our primer GK5. In case of not using a primer, the binding agent will infiltrate together with the water in the substrate. In addition, this will lead to an aggravation of the physical characteristics of the shielding paints. **Optical control:** Paint a small test area and let dry. When the surface is silver shimmering, the underground is too absorbent. When the surface is pure black, the underground is adequately primed.

Preparation

The conductive particles deposit on the bottom of the paint container. **Shake the paint container well and mix it thoroughly after opening with an electrical paint stirrer for at least one minute.** For our 1-liter bins please use our stirrer AR42.

Compatibility

All shielding paints are ready for use. **Never mix with water or other coating materials.**

Application

- Use a first-class paint roller with a pile height of 10-13 mm. To achieve a constant high attenuation, it is essential to apply the shielding paint with equal thickness, do not skip areas! Always soak the paint roller with the equal amount of paint and try to coat equal large surfaces with this amount!
- Limited usable are lacquer-rollers, foam-rollers or brushes, as the coating often gets applied too thin for a good attenuation!
- Airless spraying is possible, please find the minimum hole sizes in the table on the first page.
- Application methods in technical coatings: Knife coating, dip-coating, roll application, etc.

Drying time

- Allow to dry for 24-48 hours before overcoating.
- Protect from rain at least for 24 hours. • The coating is entirely cured after 7 days.

Final coat

To protect the soft, viscoplastic surfaces of the shielding paints against mechanical damage and humidity, we recommend to apply **2 top coats**. Worldwide variably paints are available, therefore we never can give a guarantee for specific combinations. In addition many pure mineral paints and ecologic paints often adhere bad on the graphite surface of the shielding paints. **We always recommend to apply a paint coat on a test area before processing.**

Interior: With high-quality, good covering, plastic bonded dispersion emulsion paints or dispersion silicate paints. Alternatively paste over with wallpapers, glass fabrics, etc.

Exterior: With high-quality, good covering, highly hydrophobic dispersion emulsion paints or silicon resin paints.

Under plaster (MAX54, HSF54, PRO54, NSF34):

Due to the high adhesive tensile strengths of the shielding paints, these are applicable (in conformity with ETAG 004 for EIFS-systems, minimum 0.08 N/mm²) after prior priming under plastic bonded plaster. Never use mineral plasters, no adhesion!

Consumption

The consumption depends on the character and absorbcency of the underground. **Typical coverage 5 - 7.5 m²/l.** Referring to customer feedbacks we know, that our shielding paints are often applied to thin. For a good levelling, our paints are of low viscosity and that's why our customers tend to a thin coating. The problem is, that **a coverage of more than 7.5 m²/l leads to a decrease in attenuation!** We advise to paint always quite thick.

Further information

Storage

Store cool and frost free. Keep safe from children. Once the paint container has been opened, close tightly after usage and store cool.

Period of storage

At least 12 months, see the batch sticker on the paint container.

Disposal

Utensils have to be cleaned immediately after use with water and soap. Containers must be absolutely empty for recycling. Dried up paint remainders may be disposed of with the household garbage. Do not let remains escape into sewerage, water bodies or ground.

Identification marks

Produktcode: M-DF01 (GISCODE)

Water hazard class: 1 (VwVwS)

Waste code: 08 01 12 (AVV)

Hazardous ingredients: –

ADR: –

UN-number: –

Transport hazard class: –

Environmental dangers: –

Safety data sheet

The safety data sheet is available upon request under telephone number 0049-(0)8531-31713-0.

Disclaimer

Preceding information has been asserted to the latest state of processing and application technology. As we dont have any influence on processing and application, no liability can be accepted out of the contents of this information sheet. Processors are in either case bounded to a skilled evaluation of the processing, in consideration of the product attributes and fitness. Details and notwithstanding details, transcending the content of this information sheet, require our confirmation in writing. Our general terms and conditons are valid as mentioned. With this newest edition of our technical data sheet all previous versions loose their validity.