

FERROXCUBE - your global partner

Australia: Contact Ferroxcube Taiwan
Tel. +886 2 86650099, Fax: +886 2 86650145

Austria: Contact Ferroxcube Germany
Tel: +49 (040) 527 28 305, Fax: +49 (040) 527 28 306

Benelux: Ferroxcube Netherlands, EINDHOVEN
Tel: +31 (0)40 27 24 216, Fax: +31 (0)40 27 24 411

Canada: Contact Ferroxcube USA
Tel: +1 915 599 2513/2328, Fax: +1 915 599 2555

China: Ferroxcube Hong Kong, SHANGHAI
Tel. +86 21 6380 0607 / 3121, Fax. +86 21 6380 0910

Czech Republic: Contact Ferroxcube Poland
Tel: +48 46 834 00 07, Fax: +48 46 834 00 35

Denmark: Contact Ferroxcube Sweden
Tel: +46 8 580 119 76, Fax: +46 8 580 121 60

Finland: Contact Ferroxcube Sweden
Tel: +46 8 580 119 76, Fax: +46 8 580 121 60

France: Ferroxcube France, NANTERRE
Tel: +33 (01) 5551 8422, Fax: +33 (01) 5551 8423

Germany: Ferroxcube Germany, HAMBURG
Tel: +49 (040) 527 28 302, Fax: +49 (040) 527 28 306

Greece: Contact Ferroxcube Italy
Tel: +39 02 241131 1, Fax: +39 02 241131 11

Hungary: Contact Ferroxcube Poland
Tel: +48 46 834 00 07, Fax: +48 46 834 00 35

Hong Kong: Ferroxcube Hong Kong, HONG KONG
Tel: +852 2319 2740, Fax: +852 2319 2757

Indonesia: Contact Ferroxcube Singapore
Tel: +65 6244 7815, Fax: +65 6449 0446

Ireland: Contact Ferroxcube UK
Tel: +44 1306 646200, Fax: +44 1306 646222

Israel: Arrow\Rapac Ltd., PETACH TIKVA
Tel: +972 3 9203480, Fax: +972 3 9203443

Italy: Ferroxcube Italy, SESTO S. GIOVANNI (MI)
Tel: +39 02 241131 1, Fax: +39 02 241131 11

Malaysia: Contact Ferroxcube Singapore
Tel: +65 6244 7815, Fax: +65 6449 0446

Mexico: Contact Ferroxcube USA
Tel: +1 915 599 2513/2328, Fax: +1 915 599 2555

New Zealand: Contact Ferroxcube Taiwan
Tel. +886 2 86650099, Fax: +886 2 86650145

Norway: Contact Ferroxcube Sweden
Tel: +46 8 580 119 76, Fax: +46 8 580 121 60

Philippines: Contact Ferroxcube Singapore
Tel: +65 6244 7815, Fax: +65 6449 0446

Poland: Ferroxcube Polska, SKIERNIEWICE
Tel: +48 46 834 00 07, Fax: +48 46 834 00 35

Portugal: Contact Hispano Ferritas, Spain
Tel: +34 (93) 317 2518, Fax: +34 (93) 302 3387

Singapore: Ferroxcube Singapore, SINGAPORE
Tel: +65 6244 7815, Fax: +65 6449 0446

Slovak Republic: Contact Ferroxcube Poland
Tel: +48 46 834 00 07, Fax: +48 46 834 00 35

Spain: Hispano Ferritas, BARCELONA
Tel: +34 (93) 317 2518, Fax: +34 (93) 302 3387

Sweden: Ferroxcube Sweden, JÄRFÄLLA
Tel: +46 8 580 119 76, Fax: +46 8 580 121 60

Switzerland: Contact Ferroxcube Germany
Tel: +49 (040) 527 28 305, Fax: +49 (040) 527 28 306

Taiwan: Ferroxcube Taiwan, TAIPEI
Tel. +886 2 86650099, Fax: +886 2 86650145

Turkey: Contact Ferroxcube Italy
Tel: +39 02 241131 1, Fax: +39 02 241131 11

United Kingdom: Ferroxcube UK, DORKING
Tel: +44 1306 646200, Fax: +44 1306 646222

United States: Ferroxcube USA, EL PASO (TX)
Tel: +1 915 599 2513/2328, Fax: +1 915 599 2555

For all other countries apply to closest regional sales office:

■ HAMBURG, Germany
Tel: +49 (040) 527 28 302, Fax: +49 (040) 527 28 306
e-mail: saleseurope@ferroxcube.com

■ EL PASO (TX), USA
Tel: +1 915 599 2513/2328, Fax: +1 915 599 2555
e-mail: salesusa@ferroxcube.com

■ TAIPEI, Taiwan
Tel. +886 2 86650099, Fax: +886 2 86650145
e-mail: salesasia@ferroxcube.com

© Ferroxcube International Holding B.V. 2003

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.
The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Visit our web-site for the latest information on new products, application info as well as updated phone- and fax numbers

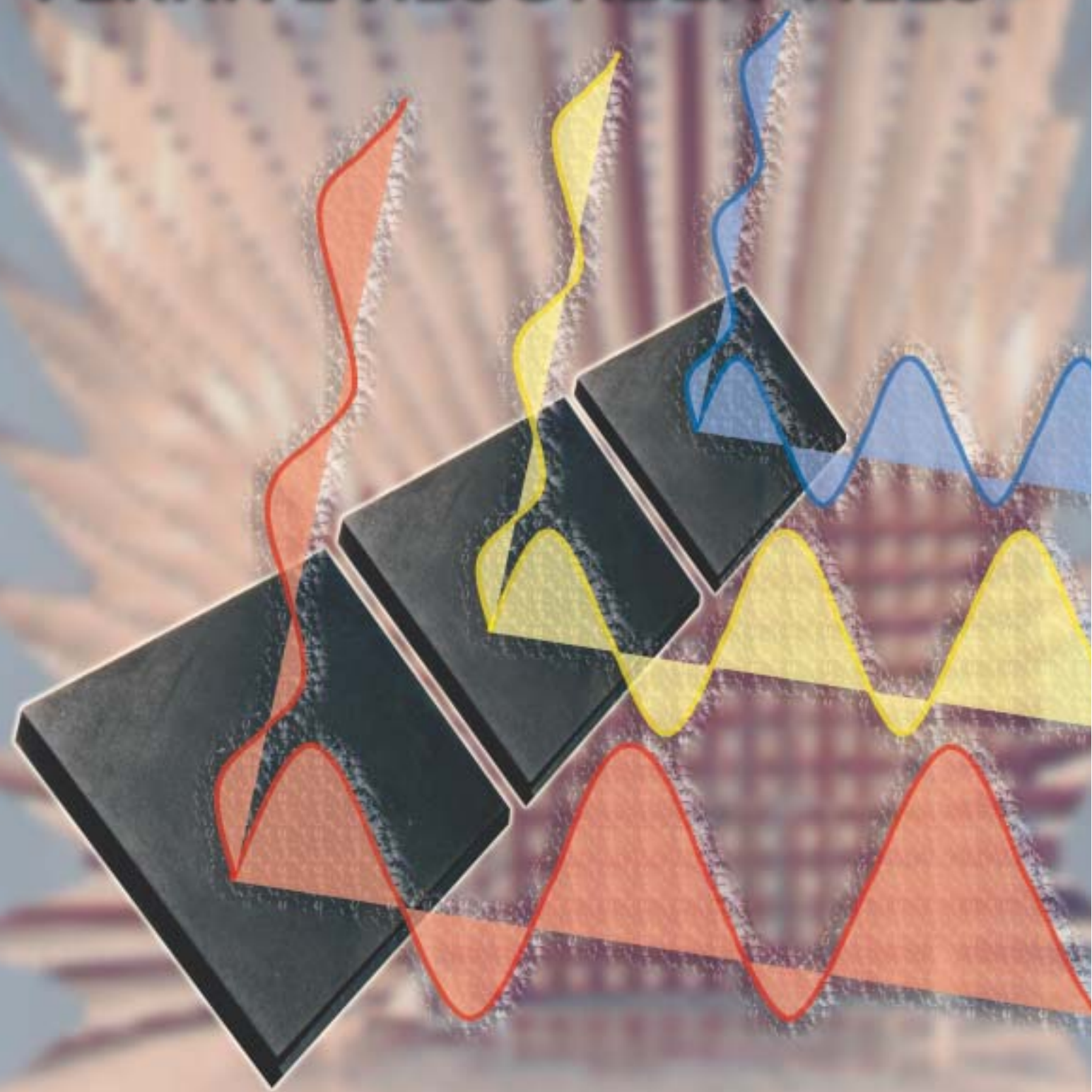
Internet: www.ferroxcube.com

Printed in The Netherlands

9398 288 01011

Date of release: January 2003

FERRITE ABSORBER TILES





EMC measurements
Due to the increasing use of electronic equipment in homes and offices, there is a growing concern about electromagnetic pollution.

As a result, regulations are being imposed on the permitted levels of radiation from electronic equipment, as well as its sensitivity to incoming radiation.

Verification of the EMC-performance of electrical and electronic products has to be carried out before bringing these on the market.

Immunity standards, e.g. IEC 801-3 and the European norm EN 55101-3 require homogeneous RF-fields over the EUT's surface area where deviation from the required fieldstrength shall be less than ± 3 dB or -0 ± 6 dB.

Measurements used to be performed in remote open-air sites to avoid incoming radiation from radio transmitters and reflections on walls. Indoor measurements are also possible in absorber-



lined anechoic rooms. Walls and ceilings of existing shielded rooms are covered with foam absorbers to attenuate reflected radiation.

A drawback of these absorbers, however, is that they have to be rather thick (1 to 2 m) to be effective in the lower frequency range below 100 MHz, thus limiting the usable space in the room. Also it is difficult to apply them on the floor.

Ferrite absorber tiles
A new approach is to cover the walls with ferrite tiles, which save space and improve the absorption quality of the room down to frequencies of 10 MHz.

The main advantages of the ferrite solution are:

- Space effective**
- Fire-retardant**
- Cost effective**

Impedance matching
A common problem is the impedance matching to free field. The dielectric constant of ferrite material is almost constant over the entire frequency range of interest, while the permeability changes. By proper tuning of this complex permeability, optimal matching and absorption can be obtained.

The EM-wave impedance of the ferrite material is given by:

$$\eta_{\text{ferrite}} = \eta_0 \sqrt{(\mu_r / \epsilon_r)}$$

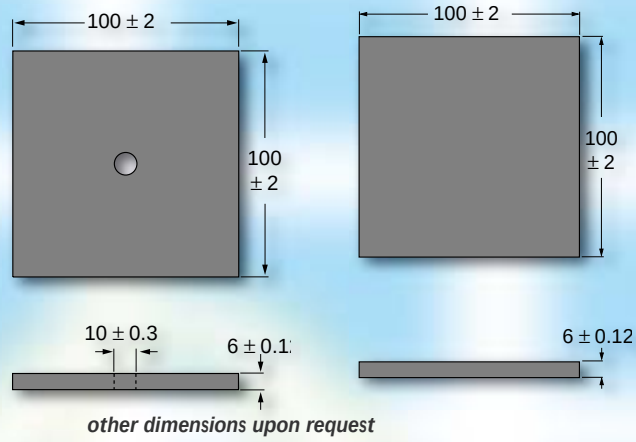
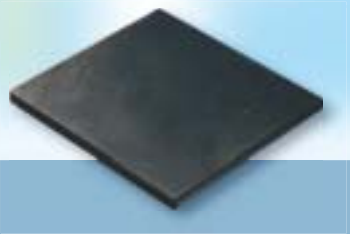
Optimal matching occurs when $\mu_r \approx \epsilon_r$

As ferrite material has a higher permittivity and permeability than air and therefore a lower propagation velocity, wave-diffraction always occurs towards the normal vector on the surface of the ferrite tile for the incident wave. The EM- energy which has entered the ferrite material will not be re-radiated again from a certain angle of incidence onwards.

This phenomenon makes the ferrite tiles very interesting because absorption is then determined by impedance matching only.

Ferroxcube 4S60 tiles
Our range of ferrite tiles was developed to give optimum absorption of impinging electromagnetic waves in the frequency range 30 MHz to 1 GHz. The damping graph below shows the normal incidence return loss of a 6 mm tile in 4S60 material, measured in a coaxial line. Attenuations between 10 and 30 dB are reached between 10 MHz and 1 GHz, sufficient to bring the characteristics of an EMC measuring room within ± 3 dB of open site conditions.

Ferrite tiles can also be effective in avoiding reflections from buildings or vehicles, and to screen parts of electronic equipment or bunches of cables.



Material	Frequency range	Mass (g)	Type number
4S60	10 - 1000	≈ 300	PLT100/100/6/H-4S60
			PLT100/100/6-4S60

