MRI DC Field Test Method for MRI Scanner Rooms

European EMC Products

Technical Datasheet

1. DC Field Measurement Test Method

1.1 Introduction

The aim of the test method is to outline the test procedures employed to verify the magnetic shielding of an MRI room meets the attenuation requirements when tested as detailed below.

1.2 Pre-Requisites

The MRI scanner is located in the room and on field.

1.3 Specifications

There is no national or international standard for the measurement of DC fields around MRI scanner room. The test procedure detailed below will meet the requirement of DC field mapping.

1.4 Object

The purpose of testing is to ensure the MRI DC fields have been contained as required in the specification.

The empirical results established during testing will be recorded on EEP test record sheets and then transferred into an official test report.

1.5 Test Equipment

1.5.1 General Description

The METRO*LAB* 3-axis Hall Teslameter "ETM-1" is an instrument using HALL elements to measure magnetic fields. The main feature of the ETM-1 is the simultaneous measurement of the 3 axis, X, Y, Z, which are set at 90° angle, allowing a direct measurement of the magnetic field intensity, **without a particular orientation of the sensor (isotropic).**

The ETM-1 calculates and displays the modulus of the magnetic field as per the equation :

$$B = \sqrt{Bx^2 + By^2 + Bz^2}$$

The magnetic field value is displayed in (mT) on a 3½ digits Liquid Crystal Display.

The ETM-1 and its probe provide a portable magnetic field measuring system. The keyboard gives the operator complete control over the different measurement modes as well as over the zeroing of the probe.

All the functions of the ETM-1 (controls and measurements) can be accessible to a computer (supplied by the user) via a RS 232c serial interface.

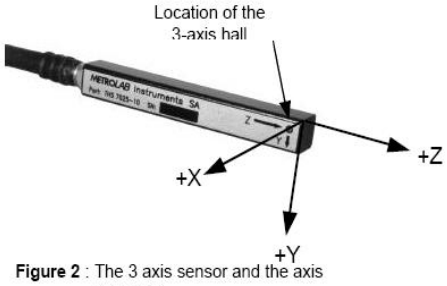


Figure 2 : The 3 axis sensor and the axis direction

1.5.2 Specifications

Ranges:	19.99 mT, 199.9 mT, 1999 mT "DC" full scale ranges Automatic or manual ranging
Resolution:	0.01 mT, 0.1mT, 1mT
Accuracy:	±2 % of reading or ±3 digits
Temperature coefficient of the gain:	±0.05% / °C (from 25°C)
Display:	3 ½ Digits LCD, mTesla units
Update rate:	0.4 sec or hold
Measurement mode:	3-axis or one axis, i.e. Bz (or Bx, By)
Operation:	Temperature: 0°C to +40°C Magnetic field: Main unit only: 0.1T (1.5T when battery is removed)
Storage temperature:	-20°C to +60°C
Size - main unit:	160 x 80 x 30 mm - sensor: 12 x 12 x 100 mm
Weight:	250 g
Interface:	RS 232c
Battery:	9 Volt, type SLM9V, Lithium, 22h duration (display reads "BAT" when battery is low)

1.5.3 Safety

The ETM-1 can measure magnetic field up to 2 Tesla.

We strongly WARN and URGE the user to take into consideration the effects of such strong magnetic fields.

The ETM-1 unit is powered by a 9 Volt battery which is partly made out of iron.

Meaning that strong mechanical forces are applied to the battery and therefore to the ETM-1 unit.

The main unit, WITH THE BATTERY INSIDE, should not be exposed to magnetic field stronger than 0.1 Tesla.

By neglecting this warning, the ETM-1 might be pulled away from the operator's hands.

EVEN WHEN BATTERY IS REMOVED, the main unit should not be exposed to magnetic fields stronger than 1.5 Tesla.

The operation and the accuracy of the ETM-1 cannot be guaranteed as long as it remains in the magnetic field. Without excluding that permanent damage can occur to the instrument.

When battery is removed and the plug-in power supply is being used, be aware of the similar danger, since the transformer of the power supply contains a mass of iron.

Therefore, the plug-in power supply should never by exposed to magnetic field stronger than 0.1 Tesla.

2. Test Procedure

2.1 Identify and map areas to be tested.

Test area to cover area of magnetic field shielding, plus a minimum of 1 m beyond.

A minimum of 1 wall area NOT shielded to be measured as a reference against the MRI scanner manufacturers predicted field line.

Soffit Shielding: measurements taken on 1 m x 1m grid at 50mm and 500 mm from shield

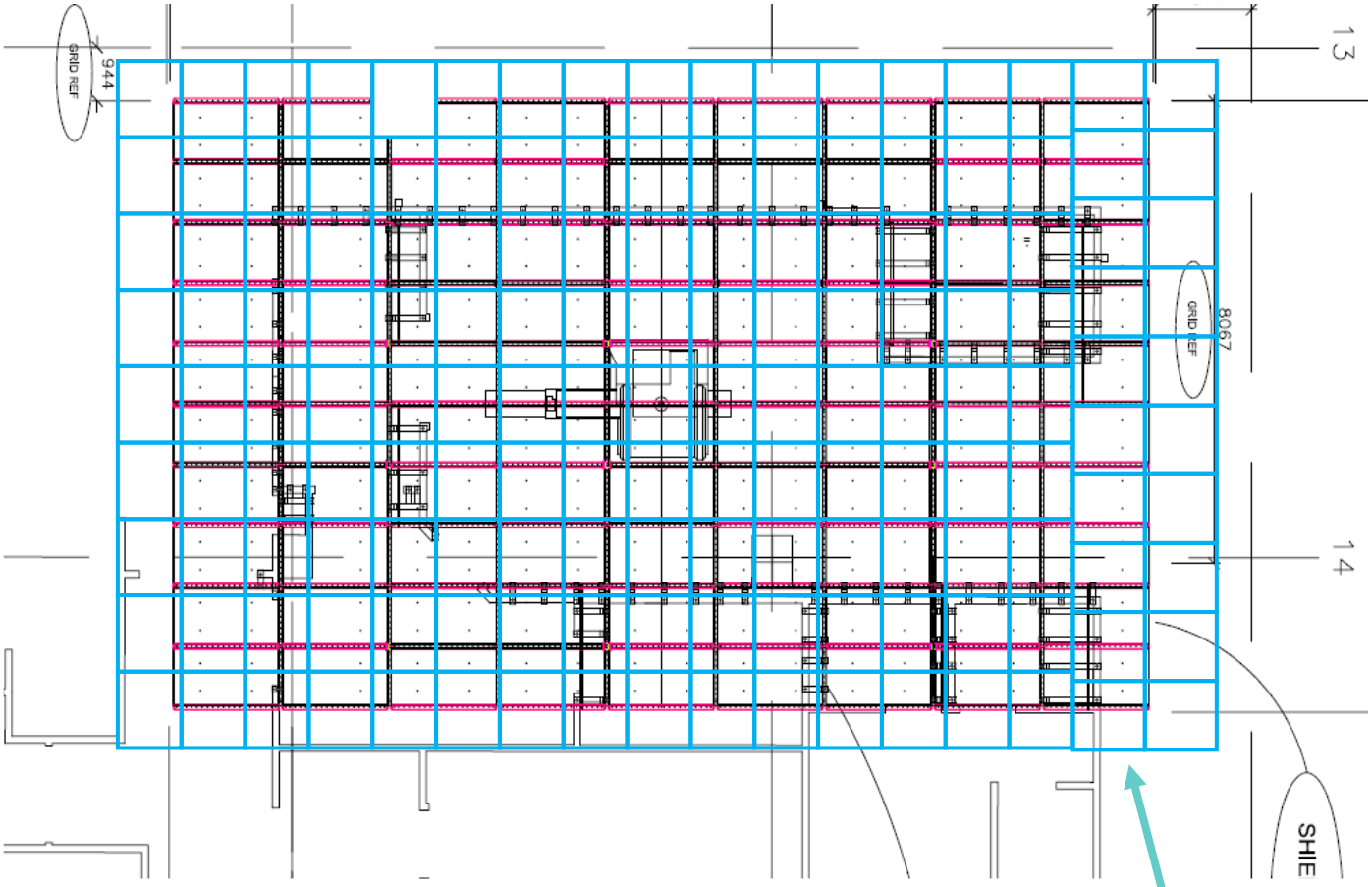
Wall shielding: measurements taken at floor level, 900mm above floor level and 1.8 m above floor level at 1m spacing. Readings at 50 and 500 mm from wall.

At each test point the measurement range will be selected (it is unlikely to change over most areas). The readings will then be noted on the test plot.

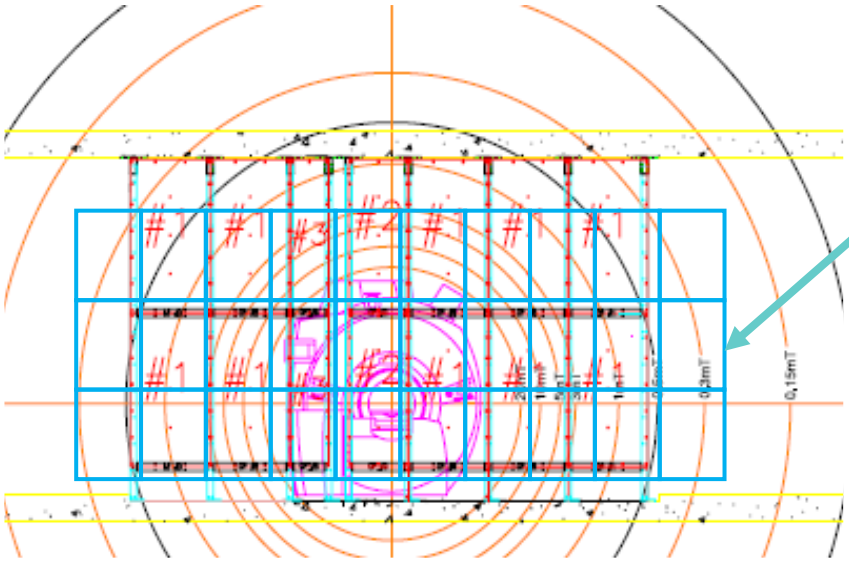
Where feasible, the sensor will be mounted on a non-metallic stand (see above). Where this is not possible the sensor will be held.

2.4 Test Positions (Typical)

Soffit Shielding



Wall Shielding



2.5 Test Results

Test results will be issued in tabular and graphical form for all test positions.

About Us

European EMC Products Ltd was formed in July 1996 to supply high quality products and services to the Electro-Magnetic Compatibility (EMC) market. The emphasis being on EMP and RF Shielded Chambers and associated products and services such as RF Shielded Windows, Shielded Doors and Shielding Effectiveness and EMP Testing.

Quality

European EMC Products are registered to BS EN ISO 9001:2015, Certificate No. FS 38901. License scope: The design, assembly, servicing and testing of RF Shielded structures and equipment including EMI shielding and thermal management materials; Gas tight doors; and specialised mobile electromagnetic pulse protected (EMPP) containers.

Disclaimer

NB: All of the information provided within this datasheet is for reference only. Product specifications are subject to change without notice.