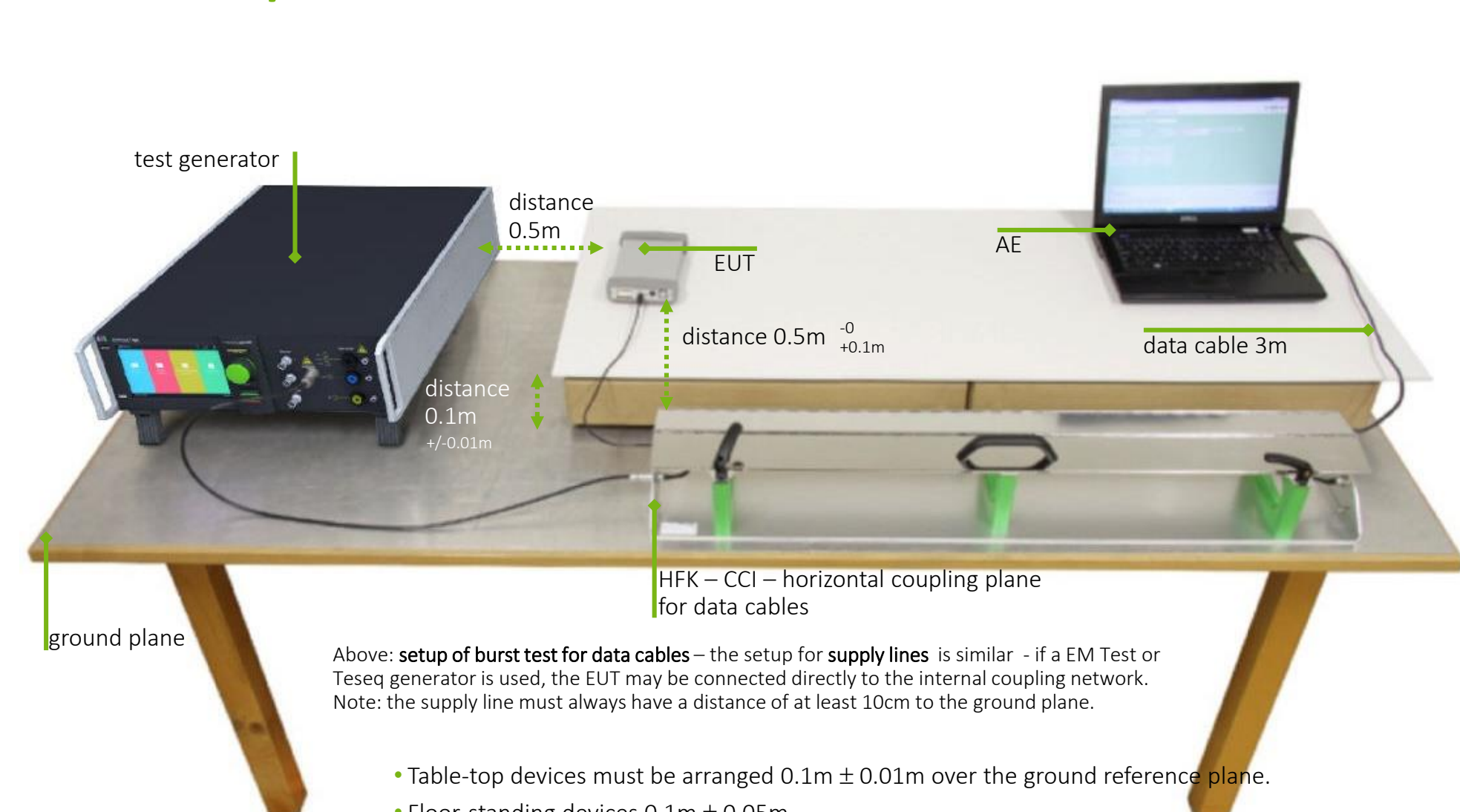


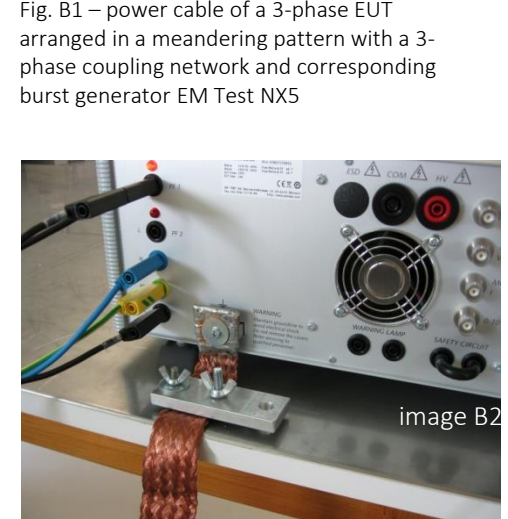
emitec - your partner for EMC since 1993

EMC is the legal compliance with product standards - more important: EMC is the quality certificate of my products for the customer

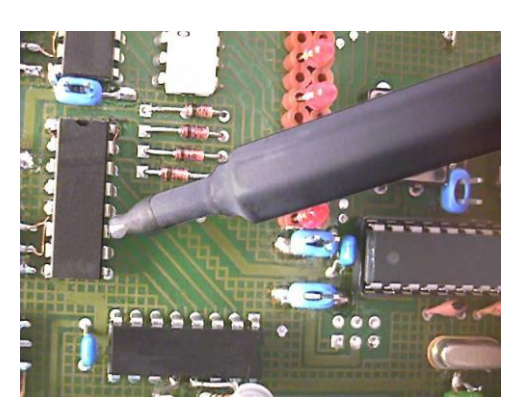
Burst IEC / EN 61000-4-4



Above: setup of burst test for data cables – the setup for supply lines is similar – if a EM Test or Teseq generator is used, the EUT may be connected directly to the internal coupling network.
Note: the supply line must always have a distance of at least 10cm to the ground plane.



Inoculate your product



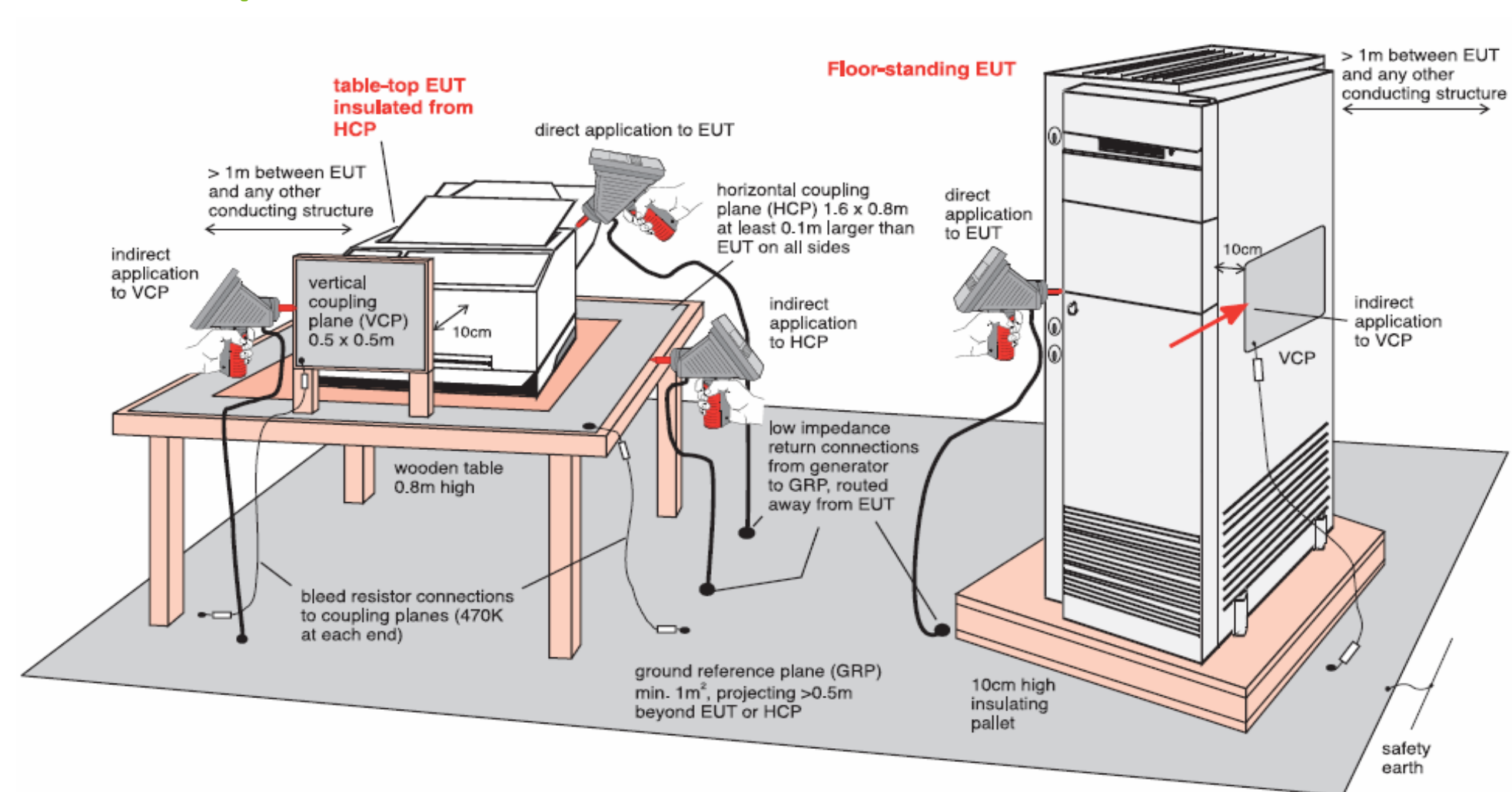
- Table-top devices must be arranged 0.1m ± 0.01m over the ground reference plane.
- Floor-standing devices 0.1m ± 0.05m
- The metal reference ground plane made of copper or aluminium is at least 0.25mm thick, otherwise at least 0.65 mm.
- The minimum size of the reference mass plate is 0.8 m x 1 m and towers over the EUT by at least 0.1 m.
- Devices that usually are ceiling- or wall-mounted are treated like table-top devices.
- The test generator and the coupling network are supposed to be placed directly on the ground plane and shall be connected with the ground plane with as short a connection as possible (low impedance) – see figure B2

above – representation of burst packages – along with the traditional repetition frequency (f) of 5 kHz, 100 kHz are near to reality. The product committees can choose to define more relevant repetition frequencies (f). It is advised to do test with 100kHz repetition frequency as early as today to avoid costly recalls.
td = Time Duration – during this time, 75 burst pulses each are generated with the corresponding repetition frequency (f)
tr = Time Repetition – this time defines when the next burst package will be generated – set tr and td to the same value in order to obtain a permanent burst to put the EUT „under pressure“

Developing with less interference

- burst generator interferences are coupled to the housing or supply lines during the test
- Pulse-shaped interferences flow through the EUT on unknown paths and generate a malfunction
- Exact localisation of the weak point
- Using near-field probes the exact position of the weak point can now be localised. The burst pulses are coupled to the print, components and cables using the near-field probe in order to search and localise the weak point.
- In the process, the burst frequency shall also be varied; the burst generator is set to permanent burst.
- Broad-band interference reduces emission
- Due to the anti-interference measures the product will now emit less interference.

ESD IEC / EN 61000-4-2



Direct discharge

- All accessible points (that the user can touch).
- Housing: corners, edges, surfaces, slots, display elements.
- Operating elements: switches, buttons, plugs etc.
- In case of test sites/points with metallic surface the ESD test will be made via **contact discharge**.
- In case of test sites/points with insulating surface the ESD test will be made via **air discharge**.
- In certain cases, product standards may also require the discharge onto pins or even explicitly prohibit it (e.g. measuring devices)

Our handy & ergonomic ESD generators



Indirect discharge

- Edge of the VCP (Vertical Coupling Plane) in a distance of 10 cm each to each side of the EUT.
- Edge of the HCP (Horizontal Coupling Plane), EUT with each side in a distance of 10 cm to the point of discharge.

Procedure of ESD testing

- Start at the lowest degree of severity
- 1 discharge / s
- At least 10 discharges in a more severe polarity

Prüfschweregrad	Kontaktladung Prüfspannung [kV]	Luftentladung Prüfspannung [kV]
1	2	2
2	4	4
3	6	8
4	8	15
x	Special	Special

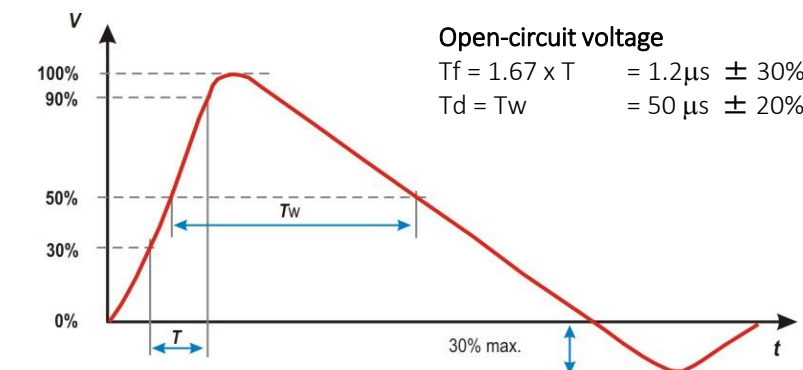
xxx is an open test severity degree which is defined by product standard bodies.

Surge IEC / EN 61000-4-5

- Per setting (level, coupling, angle, polarity) 5 test impulses are realised.
- The time interval between subsequent impulses can be 60 seconds or less.
- Test levels (open-circuit voltage) must be realised with cable against cable against earth.
- All voltages of lower levels must be tested.

Level	Open Circuit test Voltage Line to Line [kV]	Line to Ground [kV]
1	—	0.5
3	1	2
x	Special	Special

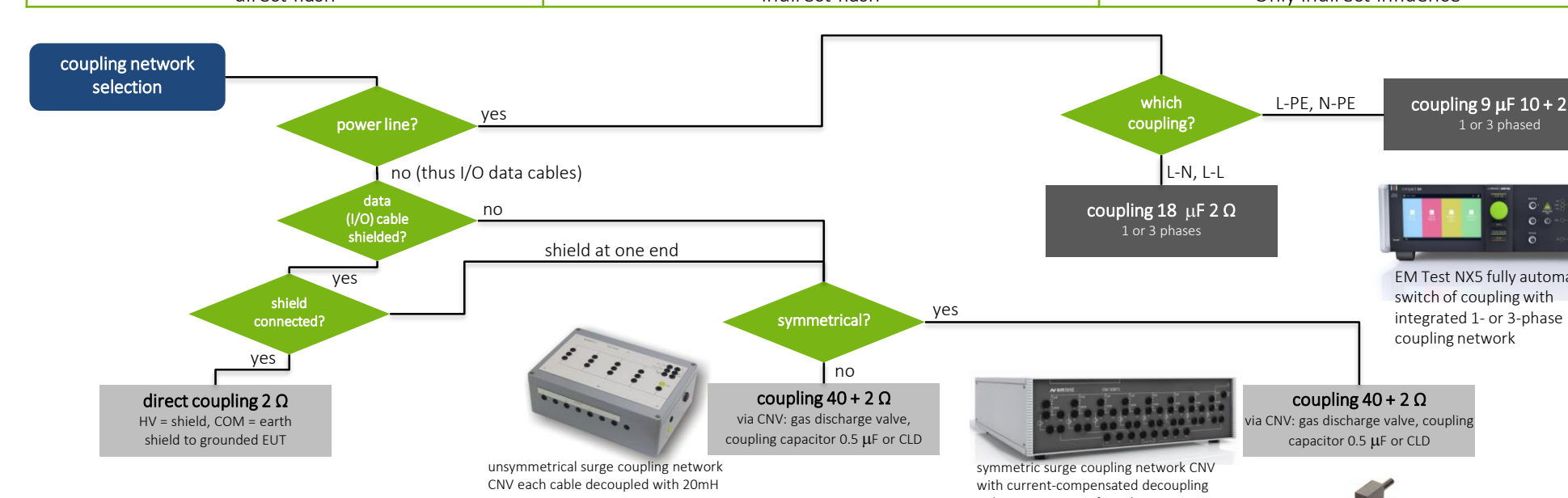
Definition of surge pulse shape



Source impedance of surge generators

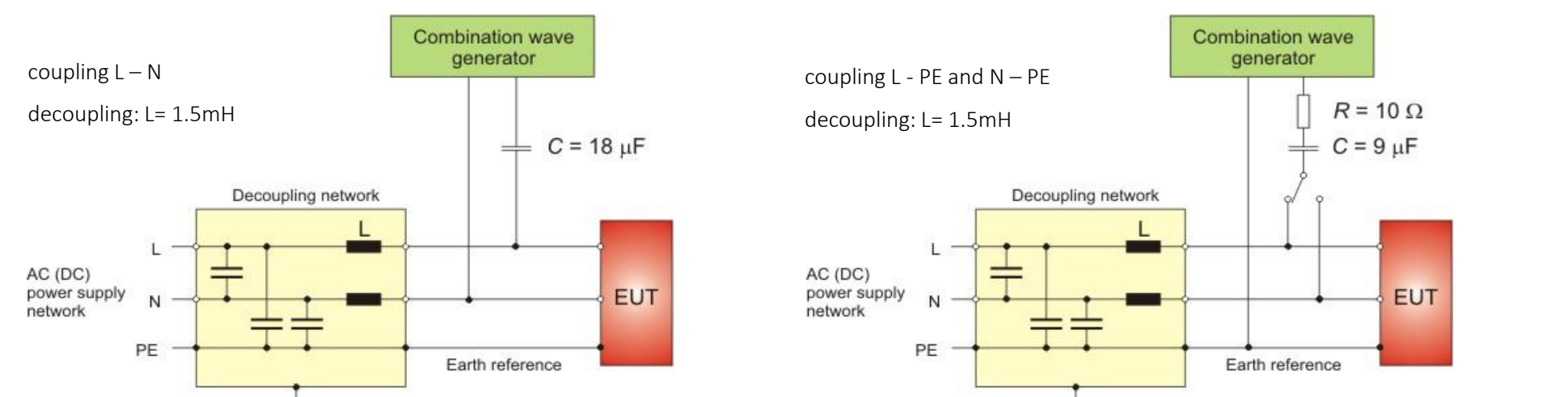
Due to the diverse occurrence and coupling mechanisms of the interference, the standard defines the below source impedances of the generators to be used. The EM Test surge generators switch fully automatically so that incorrect handling and resulting misinterpretations can be excluded. The generator has a source impedance of 2 Ohm; 10 or 40 Ohm will be additionally connected.

2 Ω	12 Ω (2 Ω + 10 Ω)	42 Ω (2 Ω + 40 Ω)
Supply lines (low-voltage power supply grid)	UNSYMMETRICAL (L-N, L-L)	UNSYMMETRICAL (L-N, L-L)
Interference source in the same circuit	UNSYMMETRICAL (L-N, L-L)	UNSYMMETRICAL (L-N, L-L)
Interference source in another circuit	UNSYMMETRICAL (L-N, L-L)	UNSYMMETRICAL (L-N, L-L)
Interference source in another circuit	UNSYMMETRICAL (L-N, L-L)	UNSYMMETRICAL (L-N, L-L)

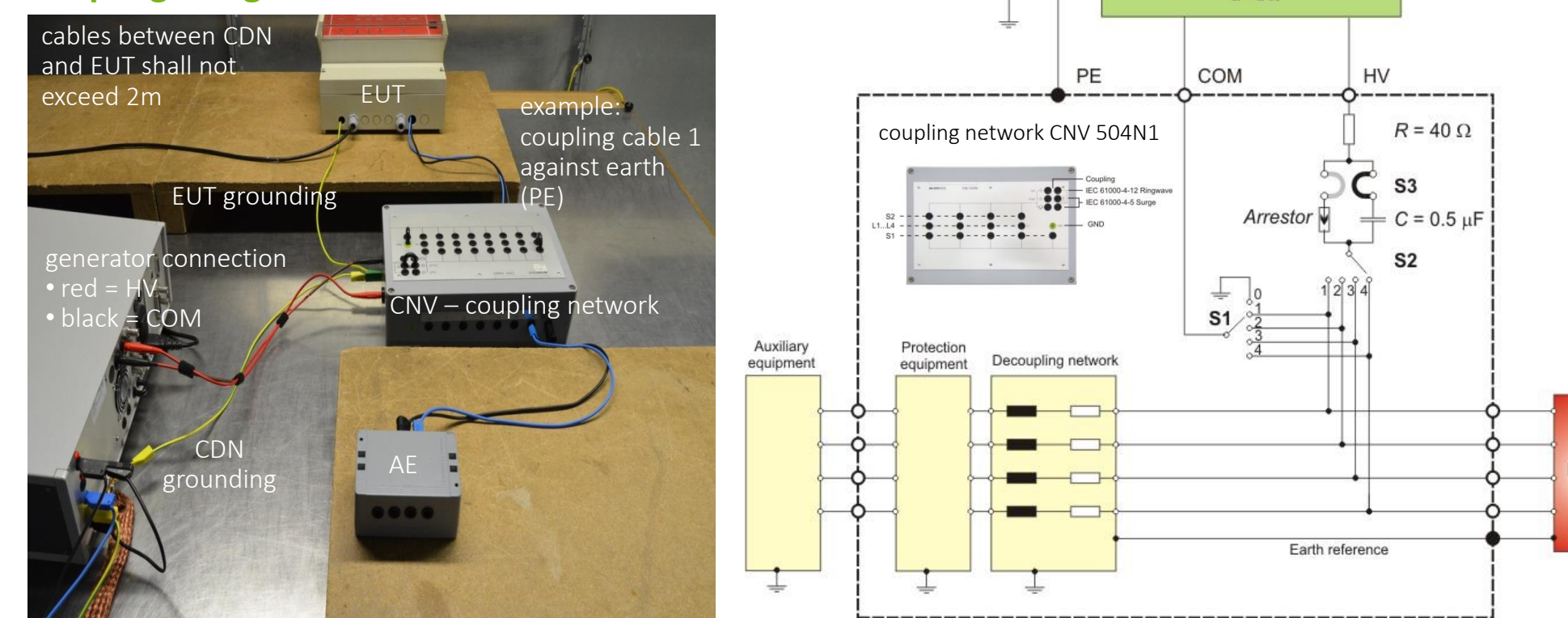


1-phase coupling application

Test setup for capacitive coupling on AC/DC supply lines – use internal coupling network with EM Test NX5



Coupling of signals and data lines



Switch S1:

- cable against earth: position 0
- cable against cable: position 1 to 4

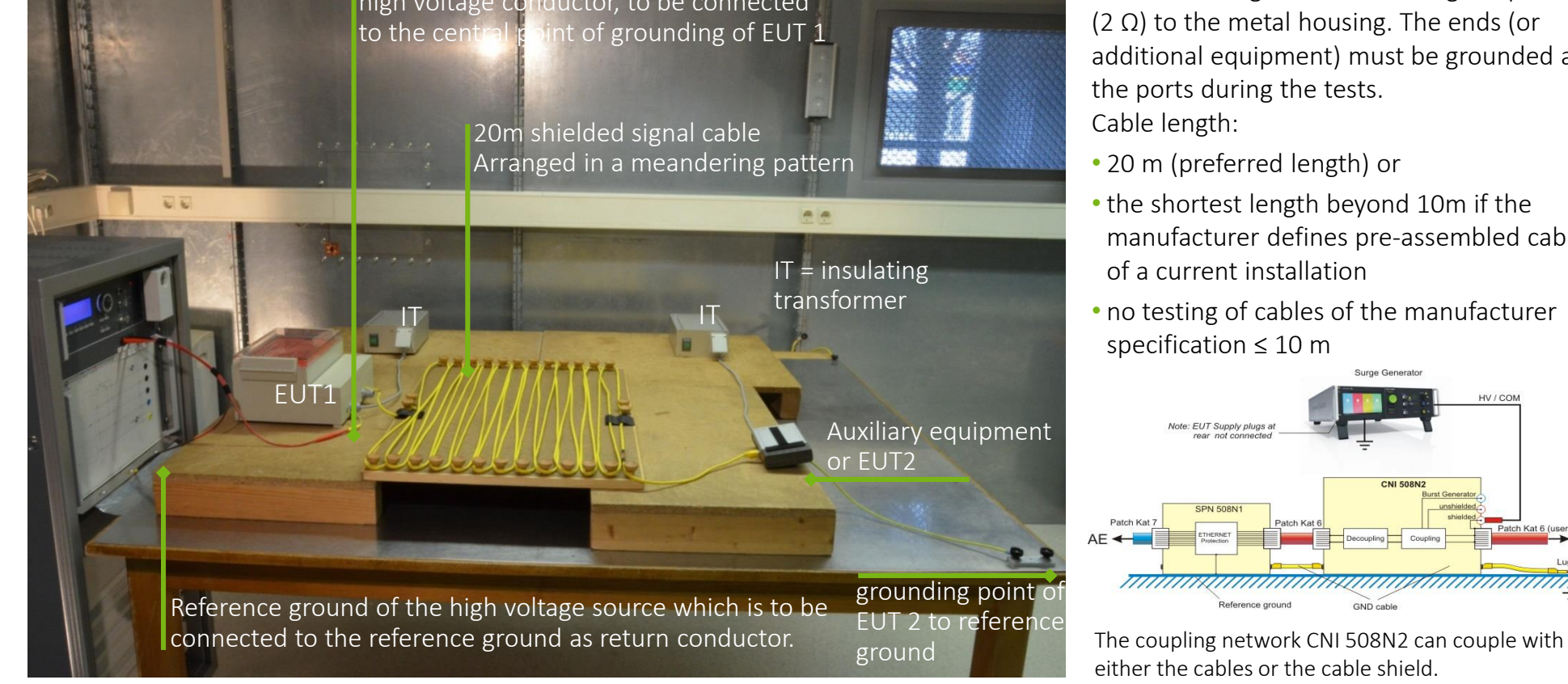
Switch S2:

- during tests: positions 1 to 4 but not in the same position as switch S1

Switch S3:

- Position coupling with gas discharge valve: V/O lines or
- Position capacitive coupling 0.5 μF V/O lines

Surge test setup for shielded lines

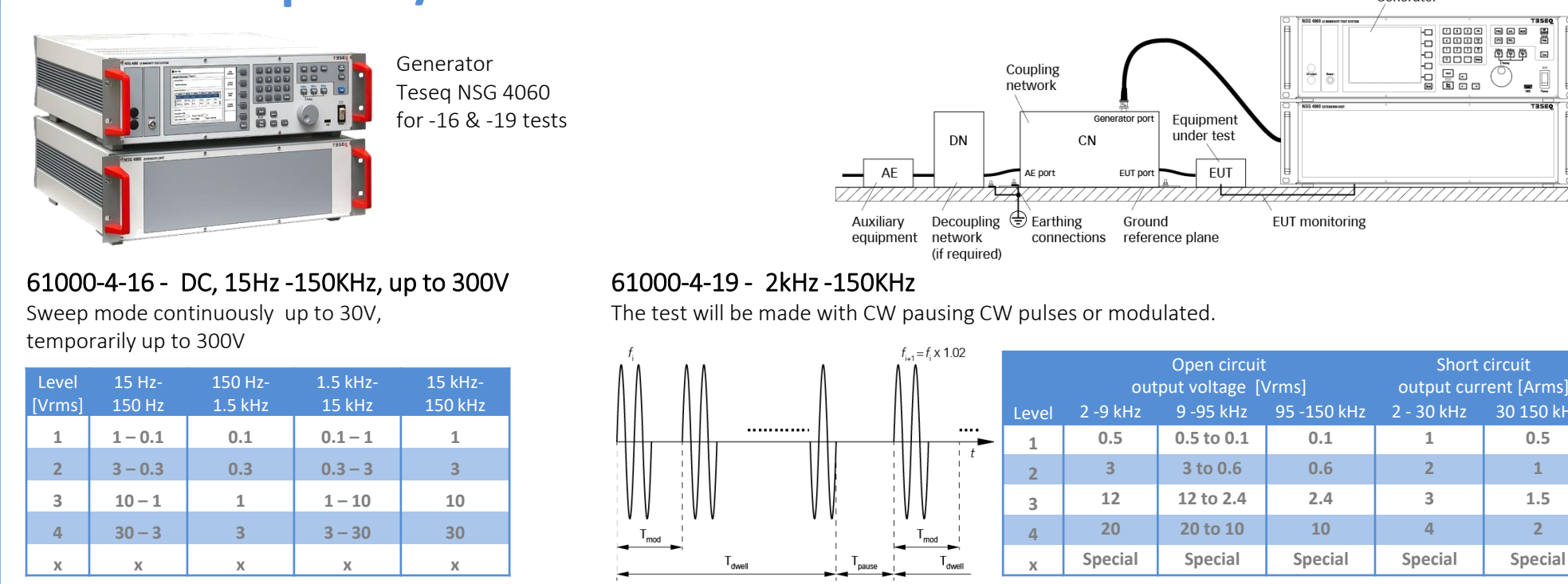


The EUT must be tested while insulated from the reference ground with a surge impulse (2 Ω) to the metal housing. The ends for (additional equipment) must be grounded at the ports during the tests.
Cable length:
• 20 m (preferred length) or
• the shortest length beyond 10m if the manufacturer defines pre-assembled cables of a current installation
• no testing of cables of the manufacturer specification ≤ 10 m

Immunity – Interferences DC up to GHz

DC	150kHz	80MHz	230MHz	1GHz	6GHz
EN61000-4-16 common mode interferences/tests frequency sweep 15Hz-150kHz test: 16.7V; 50; 60Hz dur. 30V shortly up to 300V	EN61000-4-6 conducted interference, induced by electromagnetic fields in the range of 150kHz – 80MHz (230MHz), typically with modulation 1kHz, 80%, AM	EN61000-4-3 electromagnetic RF fields in the range of 80MHz – 6GHz, typically with modulation 1kHz, 80%, AM			
EN61000-4-19 differential mode interferences/tests voltage: CW, pulses up to 20Vrms current: CW, pulses up to 4Arms					

Test setup IEC / EN 61000-4-16 & 19 tests

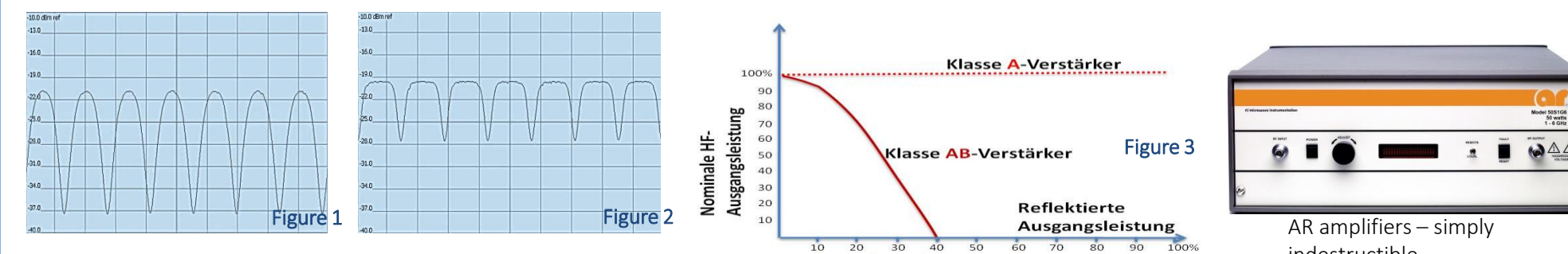


RF coupling IEC / EN 61000-4-6



RF fields IEC / EN 61000-4-3

The stray radiation requires a shielded room (EMC chamber) or cell (e.g.: GTEM) in order not to interfere with the environment. Emitec has long-standing experience regarding the selection of suitable chambers/cells.



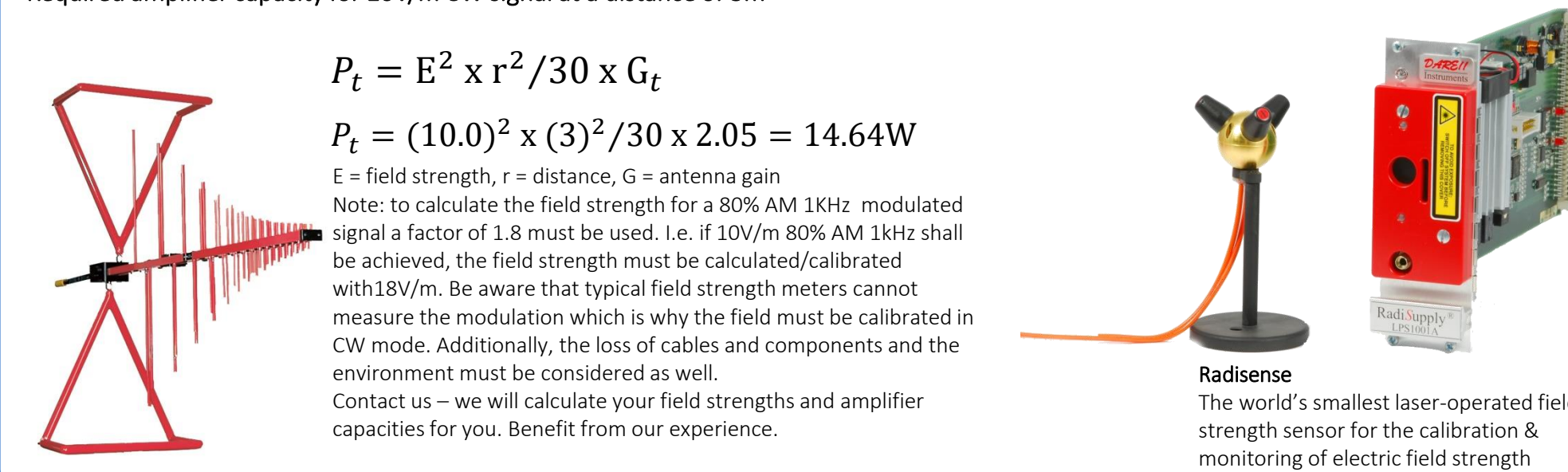
Amplifier selection criteria

The output power P_{out} is the power that is achieved at full scale of the amplifier. Further increasing the input level will not increase the output level, rather the signals will be distorted without distortion anymore. Harmonics occur (a multiple of the fundamental f) also exciting the transmitting antenna and thus also lead to field strengths at $n \times f$. These might then also involuntarily influence the EUT; figure 1: AM modulated signal at 1GHz carrier. Figure 2: shows the distorted CW signal during operation of the amplifier in the non-linear range. Therefore it is very important to calculate the capacity of the desired field strength. We will be happy to calculate the capacity for your desired field strength for you.

Missmatch result

In a part of the power generated by the amplifier being reflected. For example: a log-periodic antenna with a VSWR of about 2.5:1 reflects about 20% of the amplifier power. Class A amplifiers are tolerant against reflected power and are suitable to realise the measuring procedures; for ex. according to EN 61000-4-3. Class A amplifiers do not reduce the RF output power even under extreme mismatch. Class AB amplifiers require a protective circuit for mismatch operation. Such protective circuit leads to a reduction of the output power (see figure 3). Thus, insufficient power is available to achieve the required field strength. Therefore, it is important to purchase antennas with a „low“ VSWR.

Required amplifier capacity for 10W/m CW signal at a distance of 3m



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