

CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

New requirement, immunity to proximity magnetic fields based on IEC 61000-4-39

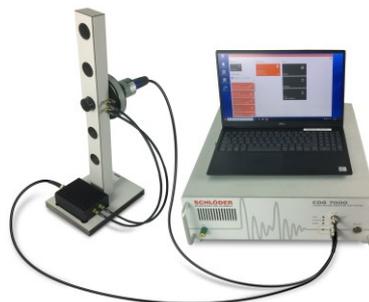
IEC / EN 60601-1-2 Ed. 4.1,
IEC / EN 61000-4-39

- Coil sets with matching network, stand and corresponding cables for different frequency ranges
- With the CDG 7000-75-10 and preamplifier as a complete test set for above mentioned medicine standards

Structure coil set
MGA RL 120



Coil set for new requirements for medical devices!



Structure with CDG 7000-75-10

Overview

The IEC 60601-1-2 standard is the international standard for testing medical equipment to EMC. The latest update adds a new test as more transmitter products are present in homes, offices (locations where medical equipment may be used), and hospitals. Three frequencies that are in use are: 30 kHz, 134.2 kHz, and 13.56 MHz.

The standard IEC 61000-4-39 for testing fields in close proximity is referenced for this testing. With our IEC 60601-1-2 setup these test fields can be produced.

Requirements: IEC 60601-1-2

Test frequency	30 kHz	134.2 kHz	13.56 MHz
Modulation	Continuous wave	Pulse modulation 2.1 kHz	Pulse modulation 50 kHz
Immunity test level (A/m)	8	65	7.5

Requirements: IEC 61000-4-39

Frequency range	9 kHz to 150 kHz	150 kHz to 26 MHz
Level	Test field strength (A/m)	Test field strength (A/m)
1	1	0.1
2	3	0.3
3	10	1
4	30	3
X	Special	Special
Modulation	Amplitude modulation	Pulse modulation
Frequency	1 kHz	2 Hz, 1 kHz
Parameter	80%	50% duty cycle

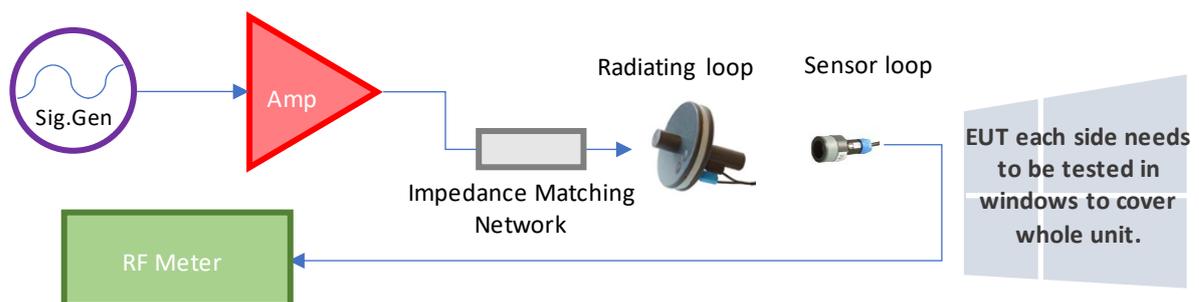


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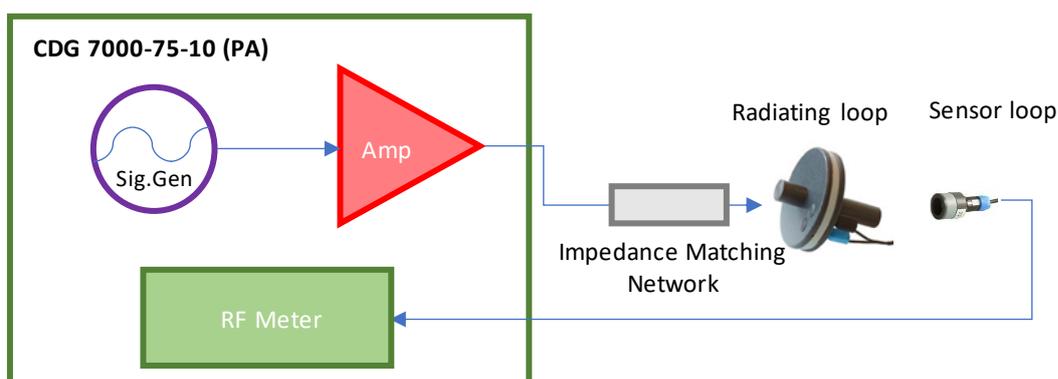
New requirement, immunity to proximity magnetic fields based on IEC 61000-4-39

The magnetic loops are specified in IEC 61000-4-39 and are readily available. However, producing a field through the loops might not be straight forward. The loop impedance changes over its frequency range, and the amplifier being used will not match this impedance. The result would be a much higher power requirement. In this case, we are not covering a frequency range but individual frequency points. This allows a matching network to be created to match the loop to the amplifier's impedance.

Basic Setup



Schlöder has created a system to match this requirement. The system is computer-controlled to set the field level and perform testing with report generation. In combination with the CDG 7000-75-10 (PA) and a complete set for the corresponding frequency range, international standards (IEC 60601-1-2 ED. 4.1 / IEC 61000-4-39) for testing medical devices for electromagnetic compatibility can be carried out. These complete sets include a radiating loop, a loop sensor, the matching network for the impedance and a corresponding stand for the loops.



Added system advantage

EUT monitoring: with Digital TTL signals & analog 0-10 VDC (automate threshold and report)

EUT Fail port: Stop test or mark report

SCPI interface control for universal support (11452-4)

Conducted immunity testing to **IEC 61000-4-6, ISO, MIL, and other standards** with the use of additional accessories CDNs, EMC clamps, BCI clamps



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EN 61000-4-39 describes magnetic field tests in the near field in two frequency ranges from 9 kHz - 150 kHz and from 150 kHz - 26 MHz. For both ranges, complete sets are offered for operation on a typical RF broadband amplifier. (Take the required sets for your tests from the "Equipment or complete sets.." compilation).

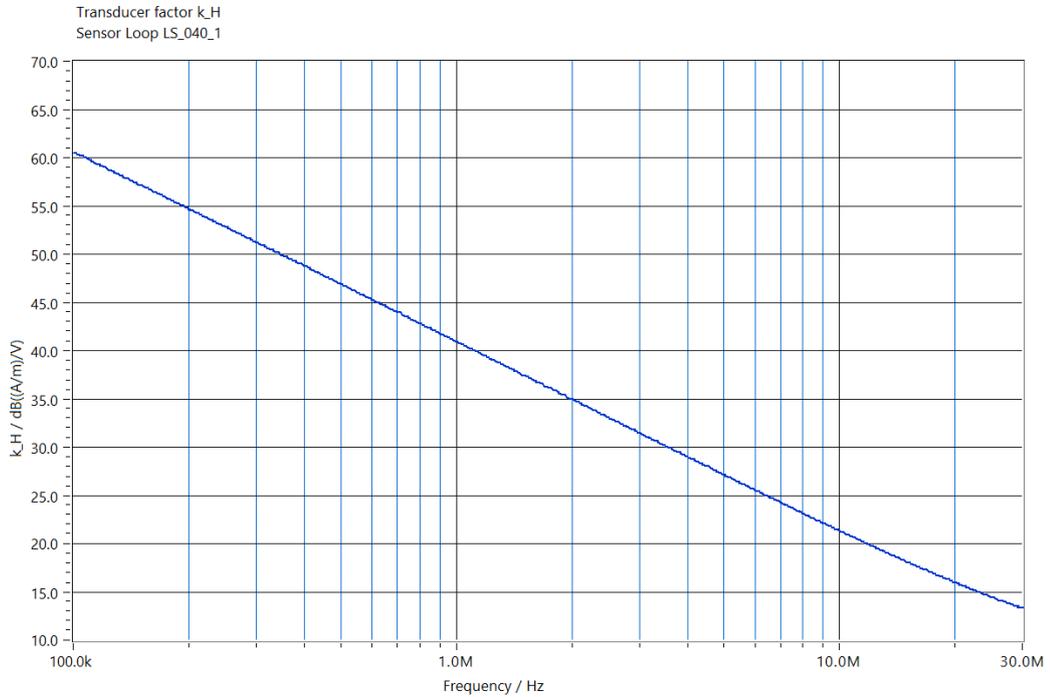
Frequency range 9 kHz – 150 kHz	Frequency range 150 kHz – 26 MHz
<p>IEC 61000-4-39</p> <p>RL 120 transmitting coil with LS 040 loop sensor (electrostatic shielded) from MIL-STD-461:</p> <ul style="list-style-type: none"> Field strengths 1 ... 30 A/m Modulation AM 80% 1 kHz sine Illumination area 100 x 100 mm Distance 50 ±3 mm Test frame with coil mounting holes on 150, 250, 350, 450 mm Matching network with 2x10 Ω series resistors for matching to RF amplifiers at low frequencies Power consumption < 46 dBm (just under 40 W) at 150 kHz and 30 A/m incl. modulation 	<p>IEC 61000-4-39</p> <p>For the upper frequency range, the 61000-4-39 defines a new 100 mm transmitting coil with 3 turns. The generated field is measured with a loop sensor, also newly defined, with a diameter of 40 mm and only 1 turn. In the standard, only the loop sensor is electrostatically shielded. To prevent the radiation of an electric field at higher frequencies, the RL 100-3 is also electrostatically shielded and symmetrically controlled via a balun:</p> <ul style="list-style-type: none"> Field strengths 0.1 ... 3 A/m: A preamplifier (PA) is required to measure this low field strength! Pulse modulation with 50% duty cycle and 2 Hz or 1 kHz modulation frequency Illumination area 80 x 80 mm Test frame with coil mounting holes on 120, 200, 280, 360, 440 mm Matching network with balun for balanced drive and 2 x 10 Ω series resistors for matching to RF amplifiers at low frequencies Power consumption < 44 dBm (appr. 25 W) at 26 MHz and 3 A/m
<p>IEC 60601-1-2</p> <p>In 60601-1-2, magnetic field tests are required with RL 120, but only at two defined frequencies with modified levels and modulations:</p> <ul style="list-style-type: none"> 30 kHz with 8 A/m continuous wave 134.2 kHz with 65 A/m, 2.1 kHz pulse-modulated <p>The required power here is max. 46.3 dBm (approx. 43 W).</p> <p>To reduce the power to approx. 43.1 dBm (approx. 20 W), an optional resonant capacitor can be connected in series.</p>	<p>IEC 60601-1-2</p> <p>In 60601-1-2, magnetic field tests are required with RL 100, but only at 13.56 MHz. Level and modulation have also been changed here.</p> <ul style="list-style-type: none"> 13.56 MHz with 7.5 A/m, 50 kHz pulse modulation <p>Without resonant network, more than 49.3 dBm (approx. 85 W) is required. With resonant network, the power requirement is reduced to about 35 dBm (approx. 3.2 W).</p> <p>Thus, 30 A/m can be achieved for a short time with about 50 W amplifier power.</p> <p>VSWR is < 1:2 in resonance.</p>



CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

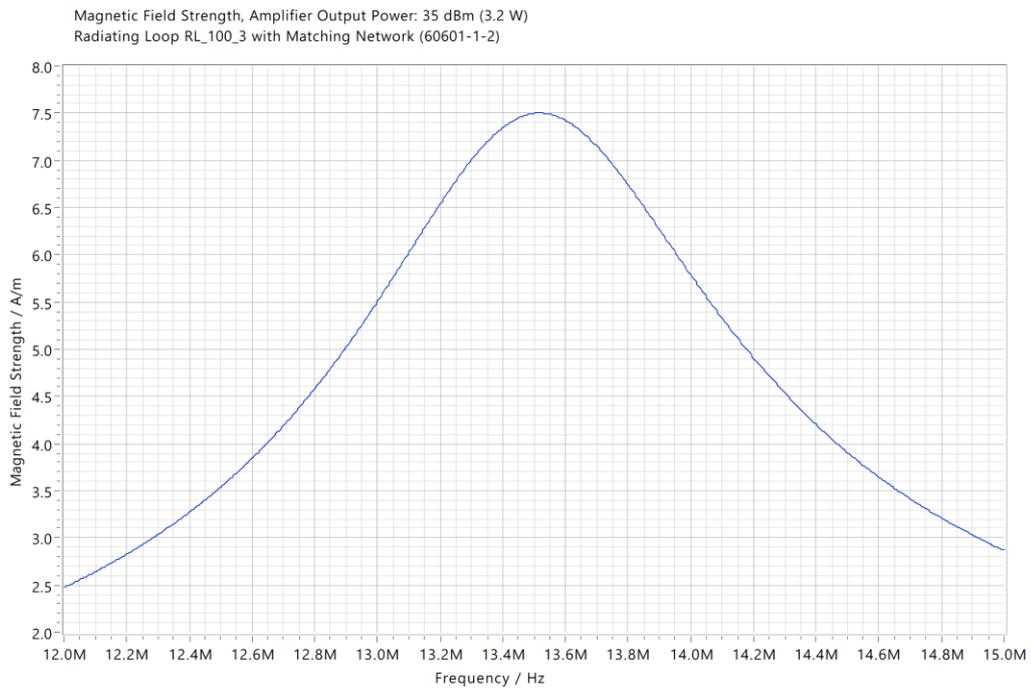
New requirement, immunity to proximity magnetic fields based on IEC 61000-4-39

Sensor Loop LS 040-1, Transducer Factor



Radiating loop RL 100-3, Magnetic Field Strength

Magnetic field strength, amplifier output power: 35 dBm (3.2 W)
Radiating loop RL 100-3, with matching network (60601-1-2)



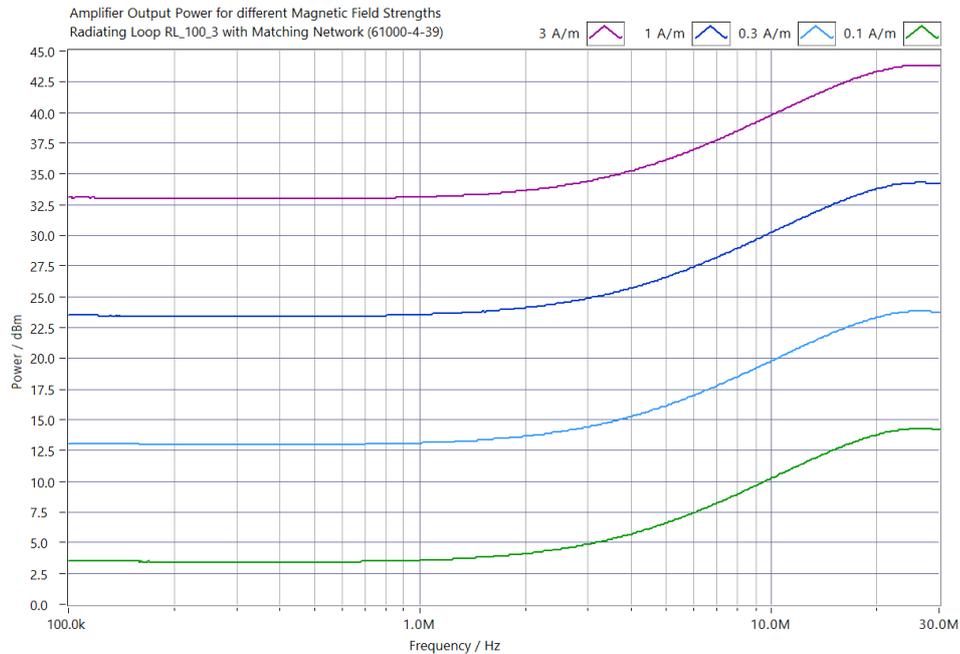
CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

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Radiating loop RL 100-3, Amplifier Output Power for different Magnetic Field Strengths

Amplifier output power for different magnetic field strengths

Radiating loop RL 100-3, with matching network (61000-4-39)

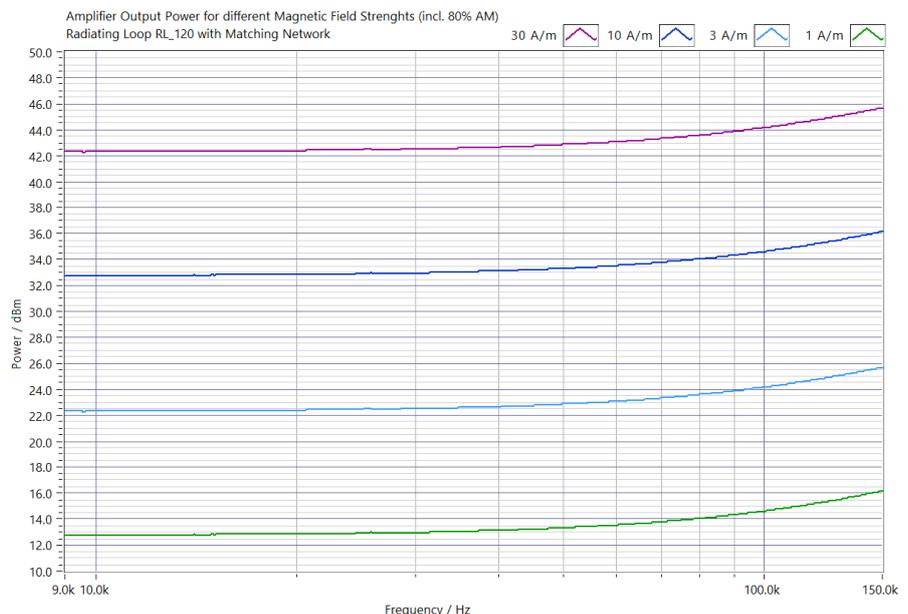


Radiating loop RL 120, Amplifier Output Power for different Magnetic Field Strengths

Amplifier output power for different magnetic field strengths (incl. 80% AM)

Radiating loop RL 120, with matching network

For IEC 60601-1-2, approximately 46.3 dBm is required for 65 A/m at 134.2 kHz with the same setup. This can be realized with the 75W-10 kHz amplifier. With a resonance capacitor in series with the matching network, this required power can be halved to 43.1 dBm



CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

New requirement, immunity to proximity magnetic fields based on IEC 61000-4-39

Technical data		
Loop sensors for IEC/EN 61000-4-39		
	MGA LS 040	MGA LS 040-1
Frequency range	9 kHz - 1 MHz	100 kHz - 30 MHz
Load	50 Ω	50 Ω
Diameter	40 mm	40 mm
Body material	POM	POM
Wire	7-41 litz wire	0.33 mm ² PTFE
Number of windings	51	1
Shielding	electrostatic	electrostatic
Connector	Speakon	Speakon
Connection cable		
Type	Mikrophon cable	RG223
Length	1.5 m	1.5 m
Coil connector	Speakon	Speakon
Power meter connector	TNC	TNC or SMA (Preamplifier)
Radiating loops for IEC/EN 61000-4-39 (use with suitable matching network)		
	MGA RL 120	MGA RL 100-3
Frequency range	9 kHz...500 kHz	100 kHz...30 MHz
DC-Resistance	typ. 40 mΩ	typ. 35 mΩ
Coil factor (50 mm)	typ. 75.0 m ⁻¹	typ. 10.1 m ⁻¹
Connection schema	asymmetrical via load resistors	symmetrical via Balun
Diameter	120 mm	100 mm
Body material	POM	POM
Wire	3.14 mm ² copper wire	0.61 mm ² PTFE strand
Number of windings	20	3
Shielding	none	elektrostatic
Connector	2x 4 mm MC socket	2x SMA
Connection cable to matching network		
Type	2x 1.5 mm ² Litze	2x flexible H155
Length	0.5 m	0.5 m
Coil connector	2x 4 mm MC connector	2x SMA (straight)
Matching network connector	2x 4 mm MC connector	2x SMA (right angle)
Matching networks (use with typical broadband RF-Amplifier)		
Continuous Input Power	30 W	30 W
Short term power (1 min)	50 W	50 W
RF-Amplifier connector	BNC	BNC



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The following complete sets or equipment is required for the tests:

**Generator,
software and
measurement**

- **CDG 7000-75-10** - 10 kHz - 250 MHz, 75 Watt, amplifier, RF Generator, RF Meter x3 (monitored level, forward & reverse power) **only IEC 60601-1-2**
- **Option: PreAmp 150kHz-26MHz -4-39**
Preamplifier for CDG 7000-75-10 for tests according to **IEC 61000-4-39** (sensor coil LS 040-1 provides too low an output level for the CDG 7000 for the lowest standard levels at low frequencies)
- **HELIA 7-MGA software:** The system includes all cabling and HELIA 7 software required to meet the standard's requirements.

**Complete set for
frequency range:
9 kHz – 150 kHz**

Article No.: Set 9kHz-150kHz -1-2/-4-39

Coil set RL-120 & LS-040 incl. stand and matching network for tests according to **IEC 60601-1-2 Ed. 4.1 (30 kHz, 134.2 kHz) and IEC 61000-4-39 (9 kHz to 150 kHz)**

Scope of delivery:

- **MGA RL 120** – radiating loop 120 mm as specified in IEC 61000-4-39 for 9 kHz – 150 kHz, IEC / EN 60601-1-2 and MIL-STD-461 / RS101, 3 m cable
- **MGA RL 120 NW** – matching network for MGA RL 120, matches loop to 50 Ohms of the CDG 7000 amplifier acc. to IEC 61000-4-39 and IEC/EN 60601-1-2 for immunity to magnetic fields 9 kHz - 150 kHz
- **MGA RL 120 stand** – stand for MGA RL 120 for tests
- **MGA LS 040** – loop sensor 40 mm
- **Cable set:**
 - Connection cable between MGA RL 120 and matching network (0.5 m, 1.5 mm², MC - MC connector)
 - Connection cable between matching network and generator (3 m, RG223, N - BNC connector)
 - Connection cable to MGA LS 040 (1.5 m, RG223, Speakon - TNC)
 - *Optional resonant capacitor for 134.2 kHz (IEC/EN 60601-1-2)*
- **User manual**



CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

New requirement, immunity to proximity magnetic fields based on IEC 61000-4-39

Complete set for frequency range: 150 kHz – 26 MHz	Article No.: Set 150kHz-26MHz -1-2/-4-39 Coil set RL-100-3 & LS-040-1 incl. stand and matching network for tests according to IEC 61000-4-39 (150 kHz to 26 MHz) and IEC 60601-1-2 (13.56 MHz)
	Scope of delivery: <ul style="list-style-type: none">▪ MGA RL 100-3 – radiating loop as specified in IEC 61000-4-39 and IEC / EN 60601-1-2 for 150 kHz – 26 MHz▪ MGA LS 040-1 – loop sensor 40 mm that attaches to MGA RL 100-3 at the correct distance of 50 mm as specified in IEC 61000-4-39 and IEC / EN 60601-1-2▪ MGA RL 100-3 stand – for tests in stronger magnetic fields▪ MGA RL 100-3 NW-60601 – matching network 60601 for MGA RL 100-3, matches MGA RL 100-3 to the IEC 60601-1-2 requirements▪ MGA RL 100-3 NW-61000 – matching network 61000 for MGA RL 100-3, matches MGA RL 100-3 to the IEC 61000-4-39 requirements▪ Cable set:<ul style="list-style-type: none">- 2x connection cable to MGA RL 100-3 (2x 0.5 m RG316), SMA - SMA connector)- 1x connection cable to the matching network (3 m RG223, N - BNC plug)- 1x connection cable to MGA LS 040-1 (1.5 m, RG223, Speakon - TNC connector)▪ Optional preamplifier LS 040-1 with connection cables: PreAmp 150kHz-26MHz-4-39 (1.5 m, RG223, Speakon - SMA) and (1.5 m, RG223, SMA - TNC connector)▪ User manual

Set -4-39 for frequency range: 150 kHz – 26 MHz	Article No.: Set 150kHz-26MHz -4-39 Coil set RL-100-3 & LS-040-1 incl. stand and matching network for tests according to IEC 61000-4-39 (150 kHz to 26 MHz)
	Scope of delivery: <ul style="list-style-type: none">▪ MGA RL 100-3 – radiating loop as specified in IEC 61000-4-39 and IEC / EN 60601-1-2▪ MGA LS 040-1 – loop sensor 40 mm that attaches to MGA RL 100-3 at the correct distance of 50 mm as specified in IEC 61000-4-39 and IEC / EN 60601-1-2▪ MGA RL 100-3 stand – for tests in stronger magnetic fields▪ MGA RL 100-3 NW-61000 – matching network 61000 for MGA RL 100-3, matches MGA RL 100-3 to the IEC 61000-4-39 requirements▪ Cable set<ul style="list-style-type: none">- 2x connection cable to MGA RL 100-3 (2x 0.5 m RG316, SMA - SMA connector)- 1x connection cable to the matching network (3 m RG223, N - BNC plug)- 1x connection cable to MGA LS 040-1 (1.5 m, RG223, Speakon - TNC connector)▪ Optional preamplifier LS 040-1 with connection cables: PreAmp 150kHz-26MHz-4-39 (1.5 m, RG223, Speakon - SMA) and (1.5 m, RG223, SMA - TNC connector)▪ User Manual



CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

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**Set -1- for
frequency range:
150 kHz – 26 MHz**

Article No.: Set 150kHz-26MHz -1-2

Coil set RL-100-3 & LS-040-1 (incl. stand and matching network) for tests according to **IEC 60601-1-2 (13.56 MHz)**

Scope of delivery:

- **MGA RL 100-3** – radiating loop as specified in IEC 61000-4-39 and IEC/EN 60601-1-2
- **MGA LS 040-1** – loop sensor 40 mm that attaches to MGA RL 100-3 at the correct distance of 50 mm as specified in IEC 61000-4-39 and IEC/EN 60601-1-2
- **MGA RL 100-3 stand** – for tests in stronger magnetic fields
- **MGA RL 100-3 NW-60601** – matching network 60601 for MGA RL 100-3, matches MGA RL 100-3 to the IEC 60601-1-2 requirements
- **Cable set:**
 - 2x connection cable to MGA RL 100-3 (2x 0.5 m RG316, SMA - SMA connector)
 - 1x connection cable to the matching network (3 m RG223, N - BNC connector)
 - 1x connection cable to MGA LS 040-1 (1.5 m, RG223, Speakon - TNC connector)
- Optional preamplifier LS 040-1 with connection cables: PreAmp 150kHz-26MHz-4-39 (1.5 m, RG223, Speakon - SMA) and (1.5 m, RG223, SMA - TNC connector)
- **User manual**



CDG Test Setup (IEC 60601-1-2 ED. 4.1 / 61000-4-39)

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Optional Accessoires

**Upgrade for
frequency range
9 kHz – 150 kHz**

*(with existing equipment
RL 120 / LS 040)*

Article No.: Upgrade 9kHz-150kHz -4-39

Stand and matching network for coil set RL-120 & LS-040 for tests according to IEC 61000-4-39 (9 kHz to 150 kHz)

Scope of delivery:

- **MGA RL 120 NW** – matching network for MGA RL 120, matches loop to 50 Ohms of the CDG 7000 amplifier acc. to IEC 61000-4-39 and IEC/EN 60601-1-2 for Immunity to magnetic fields 9 kHz - 150 kHz
- **MGA RL 120 stand** – stand for MGA RL 120 for tests
- **Cable set:**
 - Connection cable between MGA RL 120 and matching network (0.5 m, 1.5 mm², MC - MC connector)
 - Connection cable between matching network and generator (3 m, RG223, N - BNC connector)

Capacitor

Article No.: Capacitor 1/2W 134,2 kHz -1-2

Capacitor in housing (resonance matching) for RL-120 with matching network BNC male/ BNC female. When testing for IEC 60601-1-2: 134.2 kHz, 65 A/m, the required power can be halved from 46.3 dBm / 43 W to 43.1 dBm / 20 W with the optional resonance matching. The capacitor in the housing is plugged in front of the matching network.

**PreAmp
150kHz-26MHz -4-39**

Preamplifier for CDG 7000-75-10 for tests according to IEC 61000-4-39

(Loop sensor MGA LS 040-1 provides too low an output level for the CDG 7000 for the lowest standard levels at low frequencies)

- Frequency range 100 kHz...30 MHz
- Gain @ 100 kHz ~ 40 dB, decreasing towards high frequencies to ~ -10 dB @ 30 MHz
- Input for MGA LS 040-1, output for 50 Ohm load
- Max. input power +0 dBm @ 100 kHz, after high frequencies increasing to 20 dBm @ 30 MHz
- Max. output power: + 18 dBm
- Connector SMA
- Supply voltage +28 V (internal in CDG)
- For the whole frequency range 3 A/m can be measured with the preamplifier without overload.
- Downwards, only the noise value is the limit, but 0.1 A/m can be measured safely.

All information regarding appearance and technical data correspond to the current state of development at the time of release of this data sheet. We reserve the right to make technical changes.

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