

# STORZ

KARL STORZ—ENDOSKOPE

en Instructions for use  
LED Headlight KS70



03-2021

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## 1 General information

### 1.1 Read the instructions for use

If the instructions for use are not followed, patients, users, and third parties may be injured or the product may be damaged.

- ▶ Read the instructions for use carefully and follow all the safety notes and warnings.
- ▶ Keep the instructions for use clearly visible next to the product.

### 1.2 Read the instructions for use of combinable products

If the instructions for use of combinable products are not followed, patients, users, and third parties may be injured or the product may be damaged.

- ▶ Read the instructions for use of the combinable products carefully and follow all the safety notes and warnings.

### 1.3 Scope

These instructions for use are valid for:

Product name	Item number
Headband for LED headlight KS70	078770
LED headlight KS70, white light	094203
LED headlight KS70, yellowish light	094204
Control unit for LED headlight KS70	094207
Battery box for LED headlight KS70	094208
LED headlight KS70, white light, set	094220
Battery pack for LED headlight KS70	094224
USB power supply unit for KS70 and 11301 DL	094229
LED headlight KS70, yellowish light, set	094230

### 1.4 Description of warning messages

To prevent any injury to persons or damage to property, the warnings and safety notes in the instructions for use must be observed. The warning messages describe the following levels of danger.

**⚠ WARNING****WARNING**

Designates a possible imminent risk. If this is not avoided, it could lead to death or serious injuries.

**⚠ CAUTION****CAUTION**

Designates a possible imminent risk. If this is not avoided, it could lead to minor injuries.

**NOTICE**

**ATTENTION**

Designates a possibly harmful situation. If this is not avoided, the products could be damaged.

## 2 Normal use

### 2.1 Intended use

#### Intended use – headlight

The headlight is used for illuminating body surfaces, cavities, and body or surgical orifices. The headlight is non-invasive and is designed for short-term use in non-surgically invasive procedures and surgical procedures.

#### Intended use – headband

The headband is used for holding the individual components of the headlight, making it possible to carry the headlight on the head. The headband is non-invasive and is designed for short-term use in non-surgically invasive procedures and surgical procedures.

### 2.2 Indications

The use of the headlight is indicated if it is indicated in the opinion of the responsible physician. This includes, amongst other things:

- Otorhinolaryngology
- Urology
- Heart, vascular, and thoracic surgery

### 2.3 Contraindications

The use of headlights is contraindicated if, in the opinion of the responsible physician, the surgical method is contraindicated.

### 2.4 Target user populations

The medical device may only be used by doctors and medical assistants with a relevant specialist qualification.

### 2.5 Patient population

There are no restrictions in terms of patient groups for this product.

## 3 Safety

### 3.1 Serious incidents

According to the Medical Device Regulation (MDR), a “serious incident” includes incidents that directly or indirectly had, could have had, or could have any of the following consequences (MDR, Art. 2, No. 65 [1]):

- Death of a patient, user, or another person
- Temporary or permanent serious deterioration in the medical condition of a patient, user, or another person
- A serious threat to public health

► The manufacturer and appropriate authority must be notified of all serious incidents.

### 3.2 Unsterile product

The product is not sterile when delivered. The use of non-sterile products poses a risk of infection for patients, users, and third parties.

► Reprocess the product in line with the reprocessing instructions before initial use and every subsequent use.

### 3.3 Correct handling

If the product is not handled correctly, patients, users, and third parties may be injured.

- Only persons with the necessary medical qualification and who are acquainted with the application of the product may work with it.
- Check that the product is suitable for the procedure prior to use.
- Check the product for the following points before and after every use:
  - Completeness
  - Good working order
  - Rough surfaces left inadvertently
  - Sharp corners
  - Burred edges
  - Correct assembly of the components
  - Functionality
- Do not leave broken-off components inside the patient.
- Do not overload the product with mechanical stress.
- Do not bend bent products back to their original position.

### 3.4 Damaged products

Damaged products can result in injury to patients, users, or third parties.

► Before each use, check all components of the product for damage.

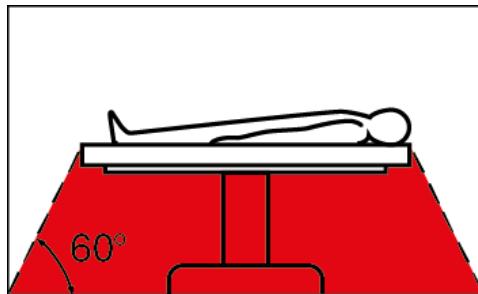
► Do not use damaged products.

### 3.5 Risk of explosion

The product can generate sparks, which cause combustible or flammable gases and liquids to ignite or explode. This may cause injuries to patients, users, and third parties.

► The product must not be operated in oxygenated environments.

- ▶ Do not operate the product in explosive atmospheres.
- ▶ Do not operate the product in environments with combustible gases such as inhalation anesthetics and mixtures thereof. Observe the hazard zones:



- ▶ Only connect or disconnect the power plug to or from the power supply outside explosive atmospheres.
- ▶ Combustible and flammable gases must be allowed to escape, be extracted, or be displaced with CO<sub>2</sub> before use.
- ▶ Combustible and flammable liquids must be allowed to vaporize or be extracted before use.
- ▶ Only start the application when combustible or flammable gases and liquids are no longer present.

### 3.6 Hot components

The high level of light intensity produced by the light source may cause the distal end, the light connections, and adjacent components to heat up. This can cause burns to patients, users, and third parties.

- ▶ Set the light source output to a level that is just high enough to ensure optimal illumination of the operating area.
- ▶ Avoid contact with the distal end and light connections.

### 3.7 High light intensity

The high level of light intensity produced by the light source may lead to permanent eye damage or blindness, and may cause tissue and items facing the light output to heat up.

- ▶ Do not look into the light output.
- ▶ Set the light source output to a level that is just high enough to ensure optimal illumination of the operating area.
- ▶ Make sure the light output is sufficiently far away from tissue and operating accessories.

### 3.8 Failure of products

The product may fail during use.

- ▶ Have a replacement product ready for each application or plan for an alternative surgical technique.

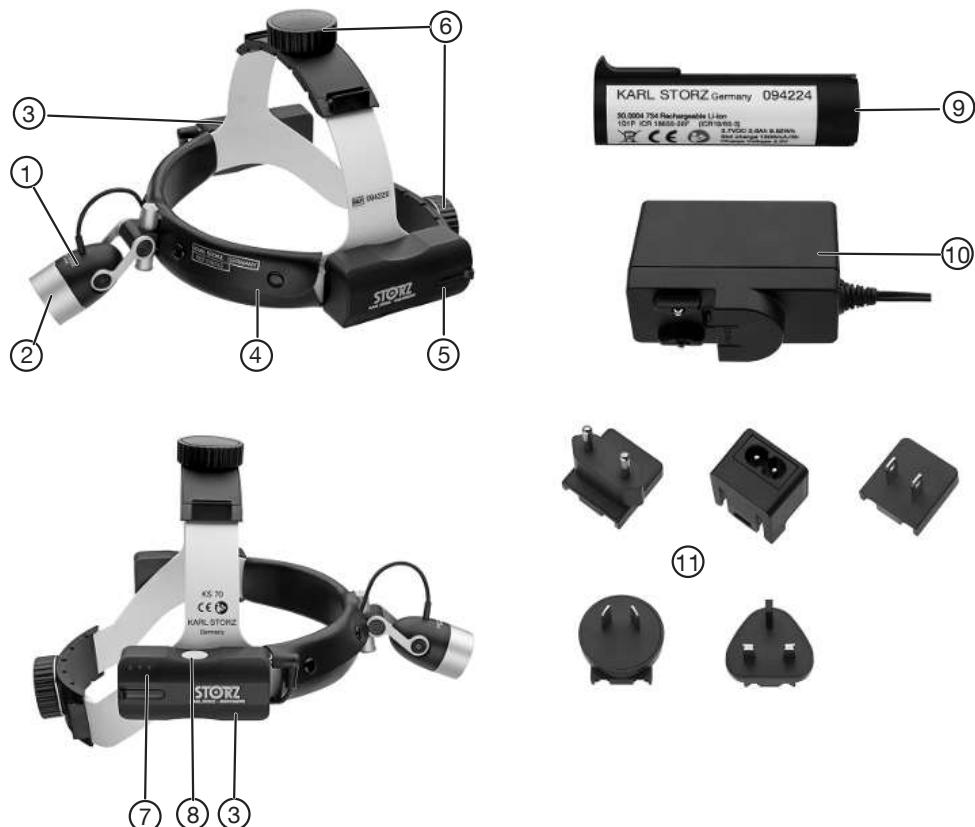
### 3.9 Electromagnetic interference

The product creates an electromagnetic field. This can impair or damage other electronic devices and active implants (such as pacemakers).

- ▶ Observe the information on electromagnetic compatibility.
- ▶ In case of uncertainties, seek expert advice from KARL STORZ.

## 4 Product description

### 4.1 Product overview



1	Lamp head with connecting cable to the control unit	2	Rotating ring for setting the diameter of the illuminated field
3	Control unit incl. button (on/off/brightness intensity, see 8) and connection socket for charging the battery pack	4	Forehead cushion with press fasteners
5	Battery box	6	Rotary knob for size adjustment
7	Status LEDs	8	Button (on/off/brightness intensity)
9	Battery pack for LED headlight KS70	10	Power supply unit
11	Various power supply unit adaptors		

## 4.2 Technical data

<b>Lamp head</b> <b>094203 (white light) / 094204 (yellowish light)</b>	
Illumination LED	Power LED OSRAM OSLON
LED service life	≥ 50,000 h
Weight	70 g
Diameter of illuminated field	At a distance of 400 mm, diameters of between 30 mm and 150 mm can be set with the rotating ring
LED color temperature	094203: approx. 5,000 K; 094204: approx. 3,600 K
Light intensity 094203	At a distance of 400 mm, a minimum diameter of 30 mm can be achieved with the smallest spot  High setting (3), approx. 32 kLux  Mid setting (2), approx. 23 kLux  Low setting (1), approx. 13 kLux
Light intensity 094204	At a distance of 400 mm, a minimum diameter of 30 mm can be achieved with the smallest spot  High setting (3), approx. 29 kLux  Mid setting (2), approx. 19 kLux  Low setting (1), approx. 11 kLux
Operating conditions	Temperature: 0°C ... +45°C; rel. humidity: 30% ... 70%; air pressure: 700 hPa ... 1,060 hPa
Storage conditions	Temperature: -20°C ... +45°C; rel. humidity: 10% ... 85%; air pressure: 500 hPa ... 1,060 hPa

<b>Control unit and battery box 094207/094208</b>	
Operating time	Batteries charged: <ul style="list-style-type: none"><li>– High setting (3): approx. 2.5 h per battery, with two batteries approx. 5 h</li><li>– Mid setting (2): approx. 4.5 h per battery, with two batteries approx. 9 h</li><li>– Low setting (1): approx. 9 h per battery, with two batteries approx. 18 h</li></ul>
Charge time	With power supply unit 1.5 A, 5 VDC: two battery packs via USB approx. 6 to 7 hours
Housing temperature	No significant warming during charging and when in operation
Weight	Approx. 22 g each
Battery type	Lithium-ion battery 3.7 V, 2,600 mAh, with protective circuit and overcurrent protection
Power supply	Nominal 3.7 V, max. 4.2 V, min. 2.75 V

**Control unit and battery box 094207/094208**

Total discharge/over-charging	Protected by protective circuit
Battery temperature range	Storage: -20°C ... +45°C; charging: 0°C ... +45°C; operation: -20°C ... +60°C
Weight	56 g

**Battery pack 094224**

Battery type	Lithium-ion battery 3.7 V, 2,600 mAh, with protective circuit and overcurrent protection
Power supply	Nominal 3.7 V, max. 4.2 V, min. 2.75 V
Total discharge/over-charging	Protected by protective circuit
Battery temperature range	Storage: -20°C...+45°C; charging: 0°C...+45°C; operation: -20°C...+60°C
Air pressure	Operation: 700 hPa – 1,060 hPa; storage: 500 hPa – 1,060 hPa
Weight	Approx. 55 g
Standard compliance	UL1642, IEC 60601-1/A2:1995

**Power supply unit 094229**

Power supply	100 VAC ... 240 VAC
Line frequency	50 Hz or 60 Hz
Max. current	500 mA
Max. standby	0.3 W
Output voltage	5.0 VDC
Max. output current	2.0 A
Connecting cable	1.8 m with Micro-B USB plug
Operating conditions	Temperature: 0°C ... +45°C; rel. humidity: 30% ... 70%; air pressure: 700 hPa ... 1,060 hPa
Storage conditions	Temperature: -20°C ... +45°C; rel. humidity: 10% ... 85%; air pressure: 500 hPa ... 1,060 hPa
Weight	Approx. 130 g

### 4.3 Symbols on the packaging

Symbol	Meaning
	Manufacturer
	Date of manufacture
	Article no.
	Number of products in the product packaging
	Batch code
	Medical device
	Unique Device Identifier
	Fragile, handle with care
	Keep dry
	Unsterile
	Consult the printed or electronic instructions for use
	Federal (USA) law restricts this device to sale by or on the order of a physician.
	CE conformity mark With this mark, the manufacturer declares the compliance of the products with the applicable regulation (EU) 2017/745. A code number after the CE mark indicates the responsible notified body.

## 5 Preparation

### 5.1 Unpacking the product

1. Carefully remove the product and accessories from the packaging.
2. Check the delivery for missing items and evidence of shipping damage.
3. In the case of damage, hidden defects, and short deliveries, document their nature and extent and contact the manufacturer or supplier immediately.

### 5.2 Inspecting the product

1. Inspect products for visible contamination. Do not use contaminated products.
2. Inspect the products for the following characteristics:
  - Good working order
  - Functionality
  - Correct assembly of the components
  - Completeness
- Inspect the product for damage, e.g.:
  - Rough surfaces
  - Sharp corners
  - Burred edges
  - Protruding parts

### 5.3 Assembling the product

1. Place the forehead cushion with press fasteners onto the inside of the headband and close the press fasteners.
2. Insert the charged batteries into the battery pack.



3. Adjust the size and fit of the headband using both rotary knobs.



4. Set the orientation of the LED light and the diameter of the illuminated field using the rotating ring on the lamp head.



**i** The LED headlight does not offer any electric insulation against radio frequency (RF) voltages. Protection against RF voltage must be ensured through the use of correct RF instruments. For this please follow the instructions for use of the RF applied part used.

## 6 Application

### 6.1 Using the product

#### Switching on the LED headlight

1. Switch on the LED headlight using the pushbutton on the control unit.



2. Press the pushbutton again to switch off the LED headlight.

**i** Two fully charged batteries enable an operating time of approx. 5 hours at luminous intensity setting 3. If the battery is empty, the light flashes briefly 3 times every 2 minutes. The brightness of the headlight does not change during operation.

#### Setting the luminous intensity

- ✓ The LED headlight must be switched on.
- To set the required luminous intensity, press the pushbutton on the control unit repeatedly. Three different brightness intensity settings can be set.
  - ⇒ The luminous intensity set in each case is shown by the status LEDs which light up for approx. 3 seconds: 1 LED = luminous intensity 1, 2 LEDs = luminous intensity 2, 3 LEDs = luminous intensity 3. The LEDs then change back to green to indicate the battery's charging capacity.
- i** The sequence of luminous intensity settings does not start at intensity setting 1, but is 2 - 3 - 2 - 1 - 2 - 3 ...
- i** When switched on, the headlight is set to the last luminous intensity setting used.

### 6.2 Monitoring the battery charge state

The battery pack capacity is indicated by the status LEDs on the control unit.

LED status	Battery capacity
3 LEDs light up green	Approx. 65% – 100%
2 LEDs light up green	Approx. 30% – 65%
1 LED lights up green	≤ 30%
1 LED flashes continuously, headlight flashes briefly 3 times every 2 minutes	Battery empty

**i** When the headlight starts flashing, there is a maximum remaining battery life of 10 minutes. Switch off the headlight and charge the batteries. If the LED headlight is to be used further, the batteries must be replaced. It is not possible to charge the batteries during operation.

### Replacing the batteries

The batteries of the LED headlight can be replaced at any time, even during operation. When replacing during operation, make sure that both batteries are not removed from the LED headlight at the same time, otherwise the LED headlight will switch off.



### 6.3 Recharging the battery

- ⓘ The headlight batteries can only be charged when switched off. It is not possible to charge the batteries during operation.
- ⓘ Only the 094229 USB power supply unit or the KARL STORZ 11301DL charging station may be used for charging.
- ✓ The LED headlight is switched off.
- Insert the battery charger plug into the connector on the control unit and connect the battery charger to the power supply.



⇒ The charging process starts automatically.

Charging via the USB power supply unit takes approx. 6 to 7 hours when the battery is empty. The charging progress is indicated by the status LEDs on the control unit.

LED status	Battery capacity
1 LED flashes	≤ 30%
First LED lights up, second LED flashes	Approx. 30% – 65%
First and second LEDs light up, third LED flashes	Approx. 65% – 90%
3 LEDs light up	≥ 90%

## 7 Disassembly

### 7.1 Disassembling the product

1. Switch off the LED headlight using the pushbutton on the control unit.



2. Remove the batteries from the control unit and from the battery box.



3. Open the press fasteners on the forehead cushion and remove the latter.
4. Unplug the connecting cable under the forehead cushion from the control unit.
5. Pull the LED light upward off the headband.

## 8 Maintenance, servicing, repairs, and disposal

### 8.1 Repairing the product

Repair work may only be performed by KARL STORZ or by a company authorized by KARL STORZ. The interventions described in this instruction manual are exempt from this rule.

- Please contact your local KARL STORZ subsidiary or authorized dealer (see the list of subsidiaries).

Contaminated devices may not be shipped. To prevent contact infections and airborne infections, products must first be decontaminated. KARL STORZ reserves the right to send back contaminated products.

### 8.2 Disposing of the product

For disposal, the following measures are necessary:

1. Decontaminate the products prior to disposal.
2. Country-specific national laws and regulations must be observed.

## 9 Accessories and spare parts

### 9.1 Spare parts list

#### Spare parts for LED headlight 094220, 094230

Item	Order number
LED headlight KS70, white light, for 094220	094203
LED headlight KS70, yellowish light, for 094230	094204
Control unit	094207
Battery box	094208
Battery pack	094224
USB power supply unit	094229
Headband	078770
Neoprene forehead cushion, for headband	078513

## 10 Electromagnetic compatibility

### 10.1 General notes on the operating environment

The product is suitable for use in professional healthcare settings. Professional healthcare facilities include physician offices, dental offices, limited care facilities, freestanding surgical centers, freestanding birth centers, multiple treatment facilities, hospitals (emergency rooms, patient rooms, intensive care, surgical rooms, outside the HF-shielded room of an ME system for MRT).

- ⓘ The emission characteristics of this product make it suitable for use in professional healthcare facilities as well as in a residential environment (CISPR 11 Class B). This product offers adequate protection to radio communication service. In the rare event of interference to the radio transmission operation, the user might need to take mitigation measures, such as relocating or re-orienting the product.
- ⓘ Portable HF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm to any part of the device, including cables specified by the manufacturer. Otherwise, performance may be impaired.
- ⓘ The use of this device next to or with other devices should be avoided, as this can result in incorrect operation. If such use is necessary, this and the other devices should be observed to ensure that they are operating correctly.

#### **⚠ WARNING**

#### **Reduced immunity! Risk of injury!**

The use of accessories or cables other than those specified in the KARL STORZ instructions for use may result in increased emissions or decreased immunity of the product. The cables listed have been shown to comply with the requirements of IEC 60601-1-2.

- ▶ When using other cables, the operator is responsible for checking that they comply with IEC 60601-1-2:2014.

### 10.2 Table 1 – Compliance level for immunity tests

#### **Guidelines and manufacturer's declaration – electromagnetic immunity**

The product is intended for use in the electromagnetic environment specified below. The user of the product should make sure that it is used in such an environment.

Interference immunity tests	EN/IEC 60601 test level	Compliance level	Electromagnetic environment – guidelines
Electrostatic discharge (ESD) acc. to IEC 61000-4-2	± 8 kV contact discharge ± 15 kV air discharge	± 8 kV contact discharge ± 15 kV air discharge	Floors should be made of wood, concrete, or covered with ceramic tiles. If floors are covered with synthetic material, the relative humidity must be at least 30%.
Electrical fast transients/bursts acc. to IEC 61000-4-4	± 2 kV for power lines ± 1 kV for input and output lines	± 2 kV for power lines ± 1 kV for input and output lines	The power supply quality should be that of a typical commercial or hospital environment.

Interference immunity tests	EN/IEC 60601 test level	Compliance level	Electromagnetic environment – guidelines
	100 kHz repetition	100 kHz repetition	
Surges acc. to IEC 61000-4-5	± 1 kV voltage outer conductor – outer conductor ± 2 kV voltage outer conductor – ground	± 1 kV voltage outer conductor – outer conductor ± 2 kV voltage outer conductor – ground	The power supply quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations acc. to IEC 61000-4-11	<u>Voltage dip:</u> Dip to 0% for 1 cycle at 0° phase angle Dip to 70% for 25/30 cycles at 0° phase angle Dropout to 0% for 0.5 cycles @ 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315° phase angles <u>Voltage interruption:</u> 100% for 250/300 cycles	<u>Voltage dip:</u> Dip to 0% for 1 cycle at 0° phase angle Dip to 70% for 25/30 cycles at 0° phase angle Dropout to 0% for 0.5 cycles @ 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315° phase angles <u>Voltage interruption:</u> 100% for 250/300 cycles	The power supply quality should be that of a typical commercial or hospital environment. If the user of the product requires continued operation in the event of interruptions to the power supply network, it is recommended that the product be operated with an uninterruptible power supply or a battery.
Magnetic field at the power frequency (50/60 Hz) acc. to IEC 61000-4-8	30 A/m at 50 Hz / 60 Hz	30 A/m at 50 Hz / 60 Hz	If image distortion occurs, it may be necessary to install the product further from sources of electromagnetic fields or to install magnetic shielding. Before the product is installed, the electromagnetic field should be measured to ensure that it is sufficiently low.
Immunity test acc. to IEC 61000-4-3 for radiated, radio-frequency electromagnetic fields	3 V/m 80 MHz to 2.7 GHz * Refer to Table 2 for wireless proximity RF field test levels	3 V/m 80 MHz to 2.7 GHz	
Immunity to conducted disturbances, induced by radio-frequency fields acc. to IEC 61000-4-6	3 V <sub>rms</sub> on 150 kHz to 80 MHz 1 kHz 80% AM modulation 6 V <sub>rms</sub> in ISM band	3 V <sub>rms</sub> on 150 kHz to 80 MHz 1 kHz 80% AM modulation 6 V <sub>rms</sub> in ISM band	

### 10.3 Table 2 – Test levels for proximity fields from HF wireless communications equipment

Test frequency MHz	Frequency band MHz	Radio service	Modulation	Immunity test level V/m	Compliance level V/m
385	380 – 390	TETRA 400	Pulse modulation 18 Hz	27	27
450	430 – 470	GMRS 460, FRS 460	FM $\pm$ 5 kHz deviation 1 kHz sine wave	28	28
710	704 – 787	LTE band 13 & 17	Pulse modulation 217 Hz	9	9
745					
780					
810	800 – 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE band 5	Pulse modulation 18 Hz	28	28
870					
930					
1,720	1,700 – 1,990	GSM 1800, CDMA 1900, GSM 1900, DECT, LTE band 1, 3, 4, 25, UMTS	Pulse modulation 217 Hz	28	28
1,845					
1,970					
2,450	2,400 – 2,570	Bluetooth, WLAN 802.11 b/g/n, RFID 2450, LTE band 7	Pulse modulation 217 Hz	28	28
5,240	5,100 – 5,800	WLAN 802.11 a/n	Pulse modulation 217 Hz	9	9
5,500					
5,785					

### 10.4 Table 3 – Test levels for radiated and conducted immunity tests

#### Guidelines and manufacturer's declaration – electromagnetic immunity

The product is intended for use in the electromagnetic environment specified below. The user of the product should make sure that it is used in such an environment.

Interference immunity tests	EN/IEC 60601 test level	Compliance level	Electromagnetic environment – guidelines
Conducted HF disturbances acc. to IEC 61000-4-6	3 V <sub>rms</sub> 150 kHz to 80 MHz	3 V <sub>rms</sub>	Portable and mobile HF communications equipment should be used no closer to any part of the

Interference immunity tests	EN/IEC 60601 test level	Compliance level	Electromagnetic environment – guidelines
Radiated HF disturbances acc. to IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	<p>product, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distances:</p> $d = 1.2 \sqrt{P}$ <p>Where P is the rated power of the transmitter in watts [W] according to the information provided by the transmitter manufacturer and d is the recommended separation distance in meters [m].</p> <p>Field strengths from fixed HF transmitters as determined by an electromagnetic site survey <sup>a</sup> should be less than the compliance level in each frequency range <sup>b</sup>.</p> $d = 1.2 \sqrt{P}$ <p>80 MHz to 800 MHz</p> $d = 2.3 \sqrt{P}$ <p>800 MHz to 2.5 GHz</p> <p>Interferences may occur in the vicinity of equipment marked with the following symbol:</p> 
<p>Note: At 80 MHz and 800 MHz, the higher frequency range applies.</p> <p>Note: These guidelines may not apply in all situations. The propagation of electromagnetic waves is affected by absorptions and reflections of buildings, objects, and people.</p>			
<p><sup>a</sup> Field strengths from fixed transmitters, e.g., base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed transmitters, an electromagnetic site survey should be considered. If the measured field strength at the location where the device is used exceeds the above compliance levels, the device should be monitored to ensure proper function. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the product.</p> <p><sup>b</sup> Over the frequency range from 150 kHz to 80 MHz, field strengths should be less than 3 V/m.</p>			

## 10.5 Table 4 – Emission class and group

### Guidelines and manufacturer's declaration – electromagnetic emissions

The product is intended for use in such an environment as specified below. The customer or user of the device should ensure that it is used in such an environment.

Interference emission measurements	Conformity	Electromagnetic environment – Guidelines
RF emissions according to CISPR 11	Group 1	The product uses RF energy for its internal function only. Therefore, its RF emissions are very low and are not likely to cause any interference affecting nearby electronic equipment.
RF emissions according to CISPR 11	Class B	The product is suitable for use in all establishments including domestic establishments and those directly connected to the public low voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions acc. to IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions acc. to IEC 61000-3-3	Compliant	

## 10.6 Table 5 – Recommended separation distances between portable and mobile HF communications equipment and the product

The product is intended for use in an electromagnetic environment in which HF disturbances are controlled. The customer or user of the product can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile HF communications equipment (transmitters) and the product as recommended below, according to the output energy of the communications equipment.

Rated power of the transmitter [W]	Separation distance d [m] according to the transmitter frequency		
	150 kHz to 80 MHz $d = 1.2 \sqrt{P}$	80 MHz to 800 MHz $d = 1.2 \sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3 \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters whose maximum rated power is not listed in the table above, the recommended separation distance d in meters (m) can be estimated using the equation from the respective column, whereby P is the maximum rated power of the transmitter in watts (W) according to the transmitter manufacturer.

Note: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

Note: These guidelines may not apply in all situations. The propagation of electromagnetic waves is affected by absorptions and reflections of buildings, objects, and people.

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