

BrainVision MOVE Operating Instructions

Version 001

Valid as of August, 17 2011



Imprint

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Preliminary version

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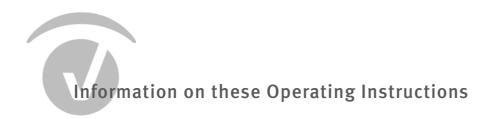
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These Operating Instructions describe the MOVE wireless transmission system and its accessories. They form an integral part of the system and contain all the information required in order to use it safely and correctly.

The structure of the Operating Instructions

The MOVE Operating Instructions have 6 chapters:

- ▶ Chapter 1 provides an overview of all the system components.
- ► In <u>Chapter 2</u> you will find information on handling the system and associated accessories safely when setting up your experiments.
- ► <u>Chapter 3</u> describes the individual installation steps you need to perform before taking the system into operation.
- ▶ The basic functions of the system are described in Chapter 4.
- ▶ <u>Chapter 5</u> contains notes on the maintenance, cleaning and disposal of the equipment.
- ► Chapter 6 contains the terms of the warranty.

Target group of the Operating Instructions

The Operating Instructions are intended for users in the psychophysiological and neurological fields.

Conventions used in the Operating Instructions

The Operating Instructions use the following typographical conventions:

italic ltalic text is used to identify menus, menu commands, dialog boxes, options,

the names of files and folders and the labels on the devices. Italic font is also

used to highlight portions of running text.

underscore Underscored text indicates a cross-reference or a web address.

The blue dot indicates the end of a chapter.



The Operating Instructions also use the following symbols to help you find your way around:



The Personal Injury symbol indicates that incorrect use of the devices may result in a health hazard to the test subject, the user and/or a third-party. Incorrect use means non-adherence to the stipulations set out in these Operating Instructions.



The Damage to property symbol indicates that the incorrect use of the devices may bring about a risk of damage to property.



The Stop symbol indicates that you should not carry out a particular action.



A note draws your attention to important (technical) information.



A cross-reference refers to a section of the Operating Instructions or an external document that has a bearing on the running text at this point.

Troubleshooting and support

If you require technical support or if you discover a mistake in the Operating Instructions, in the equipment or during operation, please contact:

Brain Products GmbH Zeppelinstraße 7 D-82205 Gilching Tel. +49 8105 73384 - 0

Fax: +49 8105 73384 - 33

Email: techsup@brainproducts.com



What is MOVE and what advantages does it offer?

MOVE is a wireless transmission system with up to 64 channels for the wireless acquisition of EEG data. During data transmission, the cables between the amplifier and electrode cap are replaced by a wireless connection.

The system ensures optimum signal quality combined with a low sensitivity to disturbance and great ease of use.

The data obtained via the electrodes is amplified by a transmitter, digitized and transmitted wirelessly to the receiver unit. This then converts the digital signals back to analog signals. Since the gain is 1:1, your amplifier receives exactly the same data as in the case of "conventional" recording using cables.

MOVE is compatible with practically every EEG amplifier available on the market as well as with active and passive electrodes. This means that you can keep your existing recording configuration and experimental setup, upgrade it quickly and easily with the MOVE system and carry on working in a more convenient wireless environment. All you have to do is disconnect the electrode cap from your amplifier, connect the cap to the MOVE transmitter and then connect the MOVE receiver to your amplifier.

Because test subjects are able to move around freely, MOVE greatly simplifies studies in the fields of BCI, neurofeedback and motor learning: Paradigms which were difficult or impossible to implement in cable-based data transmission environments can now become an established part of psychophysiological research. Of course, the MOVE system also makes the conduct of your current standard experiments a lot more comfortable and easier for test subjects and experimenters alike.

Intended use: What can MOVE be used for and what can it not be used for?

MOVE may be used exclusively for research purposes.

MOVE is not designed as a medical product as understood by EU Directive 93/42/EEC, is not marketed as such and may not be used as such. It is expressly forbidden to use the product for medical diagnosis or therapy of any kind.

MOVE may be used within the context of a neurophysiological research laboratory. It must be used by appropriate specialist personnel in the application environment defined by the manufacturer and in accordance with the safety regulations and instructions for use set out in these Operating Instructions.



MOVE is approved in accordance with IEC 60601-1 for use in the test subject environment. It is the responsibility of the operator to meet the requirements of the 3rd edition of IEC 60601-1.

MOVE must not be used in rooms in which explosive gases may be used (this can be the case in research laboratories).

Operation by non-professionals, untrained or unsuitable personnel as well as use in nonprofessional environments is prohibited.

Use in MR scanners is prohibited.

The simultaneous use of a defibrillator while MOVE is in operation is prohibited.

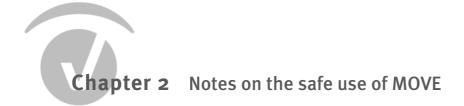
Brain Products GmbH accepts no liability for incorrect use or misuse of MOVE. The use of the equipment beyond the boundaries of pure scientific research applications is deemed to be incorrect use or misuse.



We recommend that you make yourself familiar with the functions of the MOVE wireless transmission system before using it for the first time.

The system is supplied with the following components as standard:

- ▶ One transmitter (32 or 64 channels)
- One receiver (32 or 64 channels)
- One trigger cable
- Two antennas
- Two batteries
- One battery charger
- (Optional) adapter for EEG amplifier
- (Optional) adapter for electrode cap



Please read the following safety information carefully since it will help prevent personal injury and damage to property. It is assumed you have the required specialist knowledge in handling the system and its accessories.

To ensure that the MOVE wireless transmission system is used in a safe manner, please pay particular attention to the following points:

Only connect equipment explicitly approved for this purpose by Brain Products to the system (electrode caps and EEG amplifiers).



- ▶ Use only original accessories that were supplied by Brain Products together with the system
- Damage to property
- ► To make it possible to detect data transmission errors between the transmitter and receiver, the trigger output of the MOVE transmitter must be connected to the amplifier (see also Section 4.4 on page 28). The trigger output of the transmitter is not galvanically isolated from the test subject. You must therefore always make sure that your amplifier's trigger input possesses the corresponding galvanic isolation. If you have any questions concerning this requirement, please contact our technical support team. You will find the contact details on page 12.



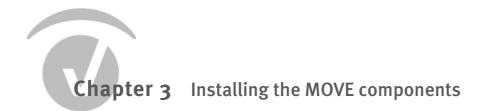
If you disconnect the wireless connection, and want to reconnect the electrode cap directly to your amplifier, you must first completely remove the MOVE system from your installation:

- 1 Disconnect the MOVE receiver from the amplifier.
- 2 Disconnect the MOVE transmitter from the electrode cap.
- 3 Reconnect the electrode cap to the amplifier.

In this way, you avoid any potential risks to the test subject.

Please note that we will not accept any liability for loss or damage resulting from a failure to follow these Operating Instructions and, in particular, the safety instructions.





To install the MOVE system, proceed as follows:

- First of all, securely screw the two antennas to the corresponding threaded sockets Antenna 1 and Antenna 2 at the front of the receiver (see Figure 3-1).
- 2 Insert one of the supplied rechargeable batteries in the battery compartment at the rear of the receiver (see Figure 3-2).

You will also find installation instructions on our Web site at www.brainproducts.com/ downloads.php?kid=21&tab <u>=4</u> (document named "How to Set-Up the MOVE System").

Figure 3-1. Mounting the antennas on the receiver (front view)

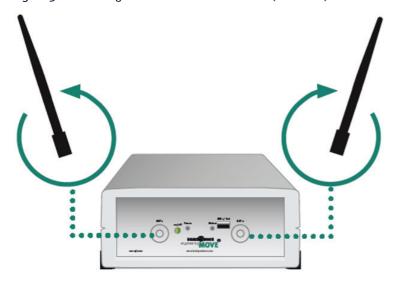
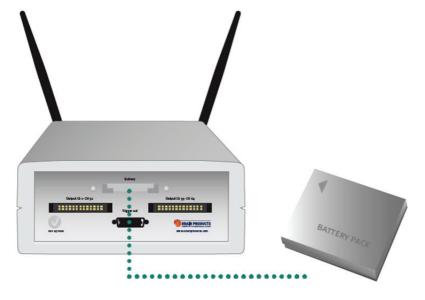


Figure 3-2. Inserting the rechargeable battery in the receiver (rear view)



3 Insert the second rechargeable battery in the transmitter. To do this, open the transmitter's battery compartment by pressing down on the compartment cover with a screwdriver (see Figure 3-3). Once the cover is loose, you can easily pull it out in order to insert or remove the rechargeable battery.

Figure 3-3. Inserting the rechargeable battery in the transmitter



- You will find information on displaying the transmitter and receiver battery charge levels in Section 4.3 on page 27.
- 4 Switch on both the transmitter and receiver using the off/on switch on both devices (see Figure 3-4).

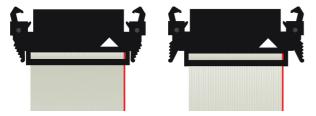
Figure 3-4. Switching on the receiver and transmitter



5 Use the supplied ribbon cable (see Figure 3-5) to connect your electrode cap or Electrode Input Box to the corresponding transmitter inputs (see Figure 3-6). (For all electrode caps apart from the BrainCap, you will also need a special adapter for the connection to the transmitter.)

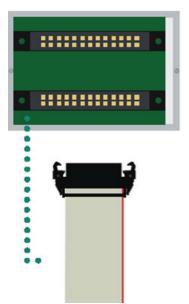
The plugs on the ribbon cables are fitted with clamps and are self-locking. Ensure that the clamps are open before you insert the plug (see Figure 3-5, left). As soon as you push the plug into the socket, the clamps automatically engage to prevent the plug from becoming disconnected inadvertently, e.g. if the ribbon cable is pulled. Always ensure that the plug is pushed home fully: The clamps must be engaged and point outwards (see Figure 3-5, right). To remove the plug from the socket, press both clamps at the same time. The plug is released automatically.

Figure 3-5. Open (left) and engaged (right) clamps on the ribbon cable plugs



The plugs also have an arrow indicating the direction in which the plug is inserted into the socket. You must always make sure that the arrow on the plug is aligned with the arrow on the socket.

Figure 3-6. Connecting the electrode cap or cap adapter to the transmitter via ribbon cable



- 6 Connect the receiver to your amplifier via the ribbon cable (see Figure 3-7). (You will need a special adapter for all amplifiers except the BrainAmp¹ family of amplifiers.)
- 7 To detect data transmission errors, you should also connect the supplied trigger cable to the trigger output of the receiver and the trigger input of your amplifier (see also Figure 3-7).

Please note that the receiver's trigger output is not galvanically isolated from the test subject. For more detailed information on avoiding personal injuries in this situation, please refer to Chapter 2 on page 17.

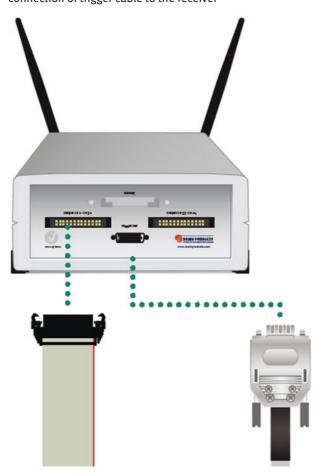


For information on dealing

with errors during data

transmission, refer to

Figure 3-7. Connection between receiver and amplifier or amplifier adapter via ribbon cable, connection of trigger cable to the receiver



Family of amplifiers from Brain Products with 32 channels each (can be extended) that can be used in different fields (laboratory acquisition, combined EEG-fMRI measurements, EEG-TMS measurements,

Make sure that there are no sources of interference between the two devices. When all the status LEDs at the transmitter and receiver glow green, the batteries are fully charged and the wireless connection between the two devices is optimal (see Figure 3-8 and Figure 3-9).

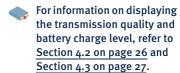


Figure 3-8. Displaying the wireless connection between the transmitter and receiver

8 Position the transmitter in the proximity of the receiver within a radius of 6 m.



Figure 3-9. MOVE in combination with the BrainAmp EEG amplifier and the actiCAP active electrode system²



^{2.} Electrode system (including control software) from Brain Products featuring active electrodes which is used for acquiring EEG signals and can be combined with all amplifiers available from Brain Products.



4.1 Transmitting and converting data

The data flow from the electrodes to the EEG amplifier comprises the following subprocesses: Data flow

- 1 The analog data acquired via the electrodes is sent to the transmitter.
- 2 The transmitter is a fully functional amplifier. It amplifies and digitizes the data.
- 3 The transmitter then sends the digital data to the receiver via a radio signal.
- 4 The receiver uses a D/A converter to convert the digital signal back into an analog signal.
- 5 The receiver transfers the analog data to your EEG amplifier.

The total gain of the input signal at the electrodes through to the output signal which the receiver supplies to the EEG amplifier is 1:1. This ensures that all electrode caps and all amplifiers can be used in combination with the MOVE system.

The MOVE system possesses two antennas for data reception. You should align these in different orientations to the transmitter. This allows the system to compensate for any disturbances or failures on the wireless transmission path by selecting the better of the two signals.

Diversity method

As standard, the MOVE system is able to process data from up to 64 channels with the ground and reference electrodes being transmitted separately.

Number of channels

We recommend you to get in touch with our technical support team before planning any experimental setup in which you want to use more than two MOVE systems in parallel.

You will find the contact details for our technical support team on page 12.

Displaying the transmission quality at the receiver 4.2

The transmission quality is indicated via the RX Status LED which is located on the front of the receiver:

- ▶ The LED glows green: Data transmission is taking place between the transmitter and the receiver and the wireless connection is optimal.
- ▶ The LED glows red: Data transmission between the transmitter and the receiver is defective. Possible causes are:
 - ▶ The distance between the transmitter and the receiver is too great (> 6 m).
 - ▷ Although the distance between the transmitter and the receiver is in the permitted. range (< 6 m), there are too many sources of disturbance close to the devices.
- ▶ The LED glows blue: No signal is being received or the signal is too weak. Possible causes
 - ▷ The transmitter is not switched on.

Displaying the battery charge level 4.3

Receiver 4.3.1

The status of the rechargeable battery in the receiver is indicated by means of the Battery Status LED on the front of the device:

- ▶ The LED glows green: The receiver is switched on and the battery is fully charged.
- ▶ The LED glows blue: Low battery charge level. You should recharge or replace the battery as soon as possible.
- ▶ The LED glows red: Low power; the battery is discharged.

Transmitter 4.3.2

The status of the rechargeable battery in the transmitter is indicated by means of the Status LED:

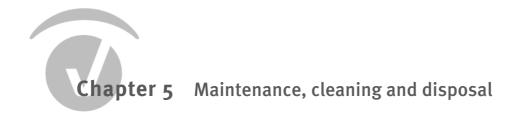
- ▶ The LED glows green: The transmitter is switched on and the battery is fully charged.
- ▶ The LED glows blue: Low battery charge level. You should recharge or replace the battery as soon as possible.
- ▶ The LED glows red: Low power; the battery is discharged.



Handling transmission errors 4.4

To make it possible to identify and, if necessary, reject incorrect data during the subsequent analysis of the EEG, the signaling of transmission errors must also be captured in the recording. To do this, the receiver sends a TTL pulse (trigger) to the EEG amplifier as soon as it receives defective data from the transmitter. The TTL level remains "high" (= +5 Volt) until the problem has disappeared. It then returns to "low" (= 0 Volt).

If a large number of transmission errors occur despite the correct installation and operation of the equipment, this indicates that WLAN networks are active in the immediate vicinity of your MOVE system. To eliminate this problem, you should switch off all WLAN devices. If the problem persists, please contact our technical support team. You will find the contact details on page 12.



5.1 Maintenance

In principle, the system is completely maintenance-free.

We do not define any particular intervals for safety-related measurements. The conduct of such measurements is also not obligatory.

You may regularly check the devices and accessories for external damage.

Repairs or repeat testing as laid down in VDE 0751-1/IEC 62353 may only be carried out by Brain Products.

If any connections on the devices are dirty or if you should notice any damage on the devices, return them to Brain Products. (You will find our contact details on page 12.)

Cleaning 5.2

Always remove the transmitter from your electrode cap and the receiver from your amplifier before cleaning the cap and amplifier.

Use a damp cloth to clean the transmitter and receiver.



Damage to property

Never use aggressive or corrosive cleaning agents to clean the transmitter and receiver.



Damage to property

It is particularly important to make sure that the connectors and pins on the receiver do not come into contact with moisture. This may cause corrosion.

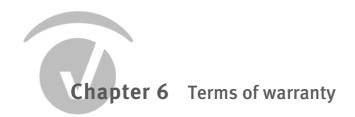
5.3 Disposal

As soon as the devices, accessories and cables have reached the end of their service life, dispose of them in accordance with the relevant national regulations. In Germany, for example, the legislation governing electrical and electronic equipment (known as the ElektroG) is applicable. In the EU and EFTA, the WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment applies.

Do not dispose of your devices, accessories and cables with ordinary household waste.



Subject to the proviso that only original equipment supplied by Brain Products is involved, Brain Products will accept return of the equipment and handle disposal on request.



Brain Products provides the statutory guarantees for the MOVE wireless transmission system. In Germany, a statutory minimum guarantee period applies for accessory components which are not explicitly listed here.

Guarantee

Brain Products GmbH provides a warranty of 24 months as of the date of purchase in respect of the MOVE wireless transmission system.

Warranty

The following are excluded from the manufacturer's warranty:

Exclusion from warranty

Supplied power and connecting cables,

Consumables such as rechargeable batteries,

Hardware upgrades,

Collateral or consecutive loss or damage of whatsoever nature and/or any costs resulting from a defect or functional impairment (e.g. data loss).

Please note that you are responsible for the operation of MOVE and its accessories and that the following influences and activities may damage the devices:



Effects of sand, dust, falls, impacts, pressure, humidity, liquids, extreme heat or cold, conductive extraneous matter and excessive radiation,

Severe vibrations,

Unstable power supply,

Incorrect transport,

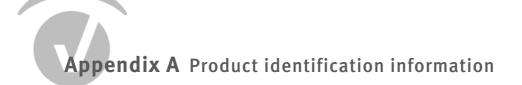
Defective packaging,

Leaked batteries,

Interventions, modifications, extensions, repairs and any other work of whatsoever type performed on the devices by the user.

Use of accessories or consumables other than original Brain Products parts.





Product designation: BrainVision MOVE (32/64-channel)

Manufacturer: Brain Products GmbH

Zeppelinstraße 7

D-82205 Gilching (Munich) Phone: +49 8105 73384 - 0 Fax: +49 8105 73384 - 33

Web site: http://www.brainproducts.com Email: techsup@brainproducts.com

Classification according to 1999/5/EC: Class I

FCC identification number: FCC ID: ZCZMOVE2011

IC identification number: IC: 9607A-MOVE2011

Receiver: Model MOVE

Canada 310

This device complies with RSS-310 of Industry Canada. Operation is subject to the condition that this device does not cause harmful interference.

Transmitter: Model MOVE

Accessories: Amplifier adapter

Electrode cap adapter



The following conditions must be satisfied for the use of MOVE:

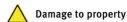
- ▶ Operation: +10 °C to +40 °C, rel. humidity 25 to 95%, non-condensing
- ► Storage: 0 °C to +60 °C, rel. humidity 25 to 95%, non-condensing

The following reduced values apply to devices with integrated battery that are stored for longer than a month: 0 to +35 °C, humidity 45 to 85%, non-condensing



► Air pressure: 700 hPa to 1050 hPa

Please note that exposure to heat, liquids, conductive extraneous matter and excessive radiation may damage the devices.





RF frequency: ISM band, 2.4 to 2.5 GHz, 2 switchable frequencies.

Please observe any differing national regulations

(e.g. USA).

Data transmission: PCM, 16 bits/channel, CRC16 data checking Safety: For research purposes only. not to be used for

diagnosis or medical applications

Use in MR scanner: No

Transmitter

Model: MOVE

Channels: 32 or 64 reference inputs

A/D resolution: 18 bit 100 nV Resolution: Input voltage range: \pm 3.276 mV ± 140 mV DC offset tolerance: Common-mode rejection (CMR): > 90 dB 10 MOhm Input resistance: Impedance measurement: No

Filter properties: 0.16 Hz / 10 s, 250 Hz Antialiasing filter: 250 Hz 3-pole Butterworth

2.461 GHz Carrier frequency: 0 dBm RF output power: $1 \mu V_{pp}$ Noise:

Power supply: CANON NB-4L 3.7 V 760 mAh rechargeable lithium

ion battery, can be replaced from the outside

Charging: Only using external charger

On switch: Rocker switch

Battery display: On = green, Batt-low = blue, Low power = red

Battery deep discharge protection: Yes

Power consumption: 40 mA (typical) Dimensions (H x W x D): 42.2 x 48.2 x 60 mm

Weight: 116 g

Antenna: Integrated in the housing

Receiver

Model: MOVE

Channels: 32 or 64 analog

D/A resolution: 16 bit

Output level: 1:1 transmission of transmitter input to receiver

output

Output filter: 250 Hz 3-pole Butterworth

Power supply: CANON NB-4L 3.7 V 760 mAh rechargeable lithium

ion battery, can be replaced from the outside

Charging: Only using external charger

On switch: Rocker switch

Battery display: LED: On = green, Batt-low = blue, Low power = red

Battery deep discharge protection:

Power consumption: 50 mA (typical)

Dimensions (H x W x D): 68 mm x 160 mm x 187 mm Weight: 590 g (without antennas)

2 antennas, can be screwed in from the outside Antennas: Transmission quality display: LED: green = good, changeover from green to red =

poor, red to blue = no signal

Digital interfaces: 2 x isolated trigger ports (do not ensure safety of

test subject)

Electromagnetic compatibility

The components of the MOVE wireless transmission system have been tested for electromagnetic compatibility (EMC) in accordance with IEC 60601-1-2:2007 and for radio safety in accordance with 1999/5/EC (for more information, see <a> Appendix D on page 41). On request, we can send you a corresponding CE certificate for non-medical products.



The following labels are affixed to the devices:



Observe the Operating Instructions.



This label indicates that defective devices must not be disposed of with household waste. Dispose of in accordance with national regulations or return the device and its accessories to the manufacturer.



This label indicates that the device is not suitable for MR.



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna. Increase the separation between the equipment and receiver. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. Consult the dealer or an experienced radio/TV technician for help.

FCC ID: ZCZMOVE 2011

The FCC identification number of the equipment is FCC ID: ZCZMOVE2011.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

IC: 9607 A-MOVE 2011

The "Industry Canada" identification number of the equipment is IC: 9607A-MOVE2011.



The CE mark confirms that the device meets the requirements of the EMC Directive.

The CE mark should not be confused with the CE mark for medical devices which is applied to medical products.



System

MOVE 32-channel wireless transmission system:

MOVE 64-channel wireless transmission system:

BP-08020

MOVE 96-channel wireless transmission system:

BP-08030

MOVE 128-channel wireless transmission system:

BP-08040

Accessories

MOVE trigger cable:

MOVE trigger cable with BNC connector:

BP-08170-BNC

MOVE battery charger:

BP-08160

MOVE rechargeable battery:

BP-08150

Antenna for MOVE receiver:

BP-08140

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List of abbreviations

A/DAnalog/Digital BCI Brain Computer Interface CE Conformité européenne (European Conformity) CMRCommon-mode rejection CRC Cyclic redundancy check D/A Digital/Analog EC European Community EEC European Economic Community EFTA European Free Trade Association EMC Electromagnetic compatibility EU European Union FCC Federal Communications Commission fMRIFunctional magnetic resonance imaging ICIndustry Canada ICESInterference-Causing Equipment Standard IECInternational Electrotechnical Commission MR Magnetic Resonance NMB Norme sur le matériel brouilleur PCMPulse code modulation RF Radio frequency RSSRadio Standards Specification



TMSTranscranial Magnetic Stimulation

πι	Transistor-transistor logic
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V. (German Association for Electrical, Elec tronic and Information Technologies)
WEEE	Waste Electrical and Electronic Equipment Directive

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