

RadiField®

Product Manual



EMC Immunity Test System

Field Generator

Model(s):

RFS2018B

RadiField® Product Manual

This product manual pertains to the RadiField® system.

Model(s): RFS20018B

Made by DARE!! Instruments.

We ask that you read this manual carefully before operating your new product and adhere to any safety instructions it might contain.

A Quick Start Guide has been added to this product for your convenience. This double printed A4 sheet contains the basic start-up steps and the safety warnings for the RadiField®.

Please keep the Quick Start Guide (and this regular manual) close at hand when you operate your new RadiField® system.

Please contact DARE!! Instruments or your local reseller if you have any questions.

Supplier Information

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WARNINGS & PRECAUTIONS



Read the contents of the product manual (including the manual for the RadiCentre® system) and become familiar with the safety markings, instructions, operation and handling of the system.



Only qualified service personnel is allowed to carry out adjustments, maintenance or repairs on the equipment. During service, disconnect the mains cable(s) from the RadiField® PSU plug-in card and RadiCentre.



Verify that your mains voltage is within the operating range of the equipment. Connect the equipment to a fused (16 A max) mains network. Only use the supplied power cords for connecting the RadiField® PSU plug-in card and RadiCentre to the mains.



The RadiField® (PSU plug-in card) requires a protective earth connection. The mains power source for the equipment must supply an uninterrupted safety ground to the IEC input connector(s).



The RadiField® system is designed to be used for radiated immunity measurements in a shielded room or anechoic EMC chamber. Any other use is prohibited. Human exposure to the generated field may cause failure of medical implants which can result in fatality!



Do not modify the equipment in any way without consulting the manufacturer.



The RadiField® contains materials that can be recycled and reused to minimize material waste. At the 'end-of-life', specialized companies can dismantle the discarded system to collect the reusable and recyclable materials. If your product is discarded at its 'end-of-life', please return it to your local reseller for recycling.

WARNINGS & PRECAUTIONS



Please make sure that the airflow through the in- and outlets of the RadiField® are not restricted to maintain a constant temperature. The cooling system is designed to operate in the specified operating temperature range.



Please use a suitable coaxial cable to connect the PSU plug-in card with the RadiField®: fitted with an N-type connector on both sides, maximum allowed attenuation of 10dB at 18GHz and able to handle a DC current of 8 amps.



To make the RadiField® system as safe as possible, the RadiField® will only power on when all connections are properly made. In addition, the RadiField® will shut down if the interlock of the RadiCentre® is triggered.



Use two people to mount the RadiField® to the RTW2000 antenna mast. Take caution while translocating the mast.



During change of polarization (rotation) of the RadiField® with the RTW2000A antenna mast, there is a risk of entrapment. Keep a safe distance to moving parts of the antenna while the polarization is changed. Prior to and during movement an acoustic signal is audible.



Position the equipment in such a way that power cables are easily accessible or connect the equipment to a mains network that can be easily disconnected from the mains.



For cleaning, use a clean, dry cloth (or a damp cloth where needed) and wipe the surface of equipment.

1 Introduction

1.1 Product Introduction

In conventional EMC immunity systems, large amplifiers are needed to compensate for cable losses because the amplifiers are normally placed away from the radiating antenna. When generating large amounts of RF power, the power from multiple amplifiers needs to be added using power combiners, resulting in even more power loss.

The RadiField® has solved these problems by placing compact amplifiers right behind the antenna. This eliminates the use of long coaxial cables between the amplifier and antenna.

The RadiField® is controlled through the RadiCentre®, with the RadiMation® software. The use of RadiMation® software is optional.

1.2 Related Products



RadiCentre® system

The RadiCentre® is a modular EMC test system that serves as the user and computer interface for all the RadiCentre® plug-in cards and modules (such as the RadiField® system).



RadiMation® software

RadiMation® is the EMC software package from DARE!! Instruments used for remote control and automated testing of the RadiCentre® plug-in cards and modules (such as the RadiField® system).

2 The RadiField®

2.1 Product Characteristics

Eliminate Power Loss - Due to the integrated design of the RadiField®, the RF-power loss is at a minimum, reducing energy consumption and eliminating the need for expensive, high power amplifiers.

Integrated Power Meters - Each amplifier has a built-in coupler with forward and reflected RadiPower® power meters, eliminating the need for separate external coupler and power meters.

Easy to Use - By using only one coaxial cable for the transport of the RF signal, the communication signals and DC-power supply of the RadiField® system is easy to set up. Saving time and costs, as well as reducing the risk of equipment damage due to incorrect equipment connections.

High Value for Money - The RadiField® is not only cost effective due to its effective use of the generated RF power, because of the integrated coupler and power meters, the RadiField® is a complete EMC immunity testing setup. This reduces calibrations costs since the RadiField® does not need to be calibrated.

RadiCentre® Integrated - The RadiField® is integrated in the RadiCentre® system, which allows for easy touchscreen operation and several control interfaces such as GPIB, Ethernet and USB. This also allows for control by the RadiMation® software which is fully compatible with the RadiField® system.

2.2 System Safety Features

To ensure the safety of the RadiField® system, the RadiField® will only be able to power on if all connections are properly made. In addition, the RadiField® will shut down immediately if the interlock of the RadiCentre® is triggered.

2.2.1 RadiField® start-up procedure

The start-up procedure consists of three phases that ensure the safe use of the RadiField®. If the RadiField® is not connected correctly, or if there are any other irregularities, the safety measures of this start-up procedure will be triggered. In each phase the supply power is increased, building up to the DC-power needed for normal usage.

1) The probing phase

When the start-up command is given to the RadiField®, a safe, 'probe signal' is sent through the coaxial cable to the RadiField®. If the RadiField® does not respond correctly to the probe signal, the start-up procedure is aborted. This probe signal is harmless to other equipment and will therefore not cause defects to other instruments in case of an incorrect connection.

2) Communication phase

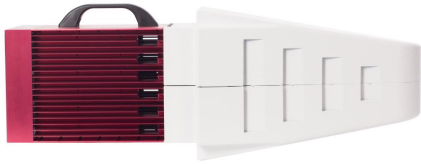
After a successful probing phase, the plug-in card will attempt to communicate with the intelligent backplane of the RadiField®. If the intelligent backplane does not respond, the start-up procedure is aborted.

3) Final start-up

When communication is established, the final DC-power will be applied on the coaxial cable to power the RadiField®. The amplifier(s) in the RadiField® can now be switched on and are ready to operate.

2.3 Components

The RadiField® system is delivered with the following items:



RadiField18®

Model: RFS10018B

The active field generator



RadiField® PSU2400B plug-in card

Power supply plug-in card (for the RadiCentre®) to power the RadiField18. Communicates with the RadiField18 and transfers the RF-signal to the RadiField 18.

This card is plugged into the RadiCentre® and fills two adjacent slots.

Supporting documentation in the form of:

- USB stick containing the (digital) User Manual and Quick Start Guide.
- Hardcopy of the Quick Start Guide.

REMINDER - A RadiCentre® modular test system is required to operate the RadiField® system. RadiCentre®, model: CTR1009B (or CTR1004B), serves as a user and computer interface for the RadiField® system. This allows for touchscreen operation and several communication interfaces.

2.4 Optional Accessories



Transport Pelicase

Product number: RFP1000A.

This transport Pelicase is designed for short distance transportation, for example on-site or between facilities. The RadiField® must be stored in this protective case when it is shipped between different locations.



Antenna stinger mount boom

Product number: RFB1040A.

This custom antenna boom can be mounted on the back of the RadiField®.

It is 35 cm long and has a diameter of 40 mm.



Coaxial N-type cable

Product number: CBL2018N#010.

To connect the RadiField® with the RadiField® PSU2400B power supply plug-in card. Color may differ from the actual delivery.



Antenna mast with polarizer

Product number: RTW2000A.

Antenna mast with fixed height and automatic polarizer for the RadiField®. The actuator of the polarizer connects directly to the RadiField® and is controlled through this unit. Polarization can be moved between horizontal and vertical position.

The height of the antennae can be fixed between 50 cm and 200cm. The mast is provided with wheels for easy movement in a chamber.

The 40mm antenna boom is part of the mast.

2.5 RadiField18®

The RFS20018B is the field generating element of the system. This module contains the amplifier(s), power meters, couplers, antenna and control logic. The active devices are located in the red aluminum housing, the antenna is mounted in the white foam cone.

2.5.1 Cooling system

The RadiField18 is air-cooled. Air is drawn in at the back of the RadiField18 and blown out along the external cooling ribs, through the side air outlets and then out of the openings in the white foam cone. The cooling system keeps the internal amplifier(s) at a constant operating temperature. Failure to meet the specified environmental temperature range might result in a too high or too low amplifier temperature.

2.5.2 Connections

The DC power, RF input and communication connection of the RadiField18 run through one coaxial cable. This cable is connected at the back of the RadiField18 through an N-type connector.

2.5.3 Mounting

The RadiField18 has a standard ¼-20" UNC-1B thread on the bottom. This can be used to mount the RadiField18 on a tri-pod, antenna tower or boom mount.

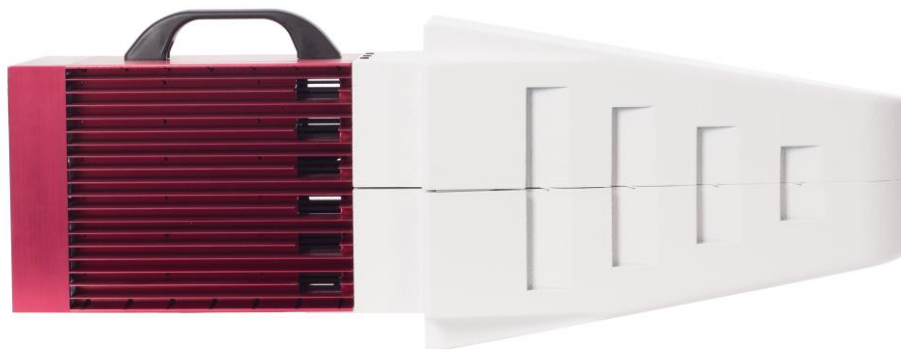


Figure 1: The RadiField®

2.6 RadiField® PSU2400B

The PSU2400B is a (two slot) plug-in card for the RadiCentre®. The PSU2400B combines power, RF input and communication within the coaxial cable to the RadiField18.

2.6.1 Connections

The PSU2400B has a separate mains input connection to power the RadiField®.

A SMA connector is used for the RF input and an N-type connector for the connection to the RadiField18.

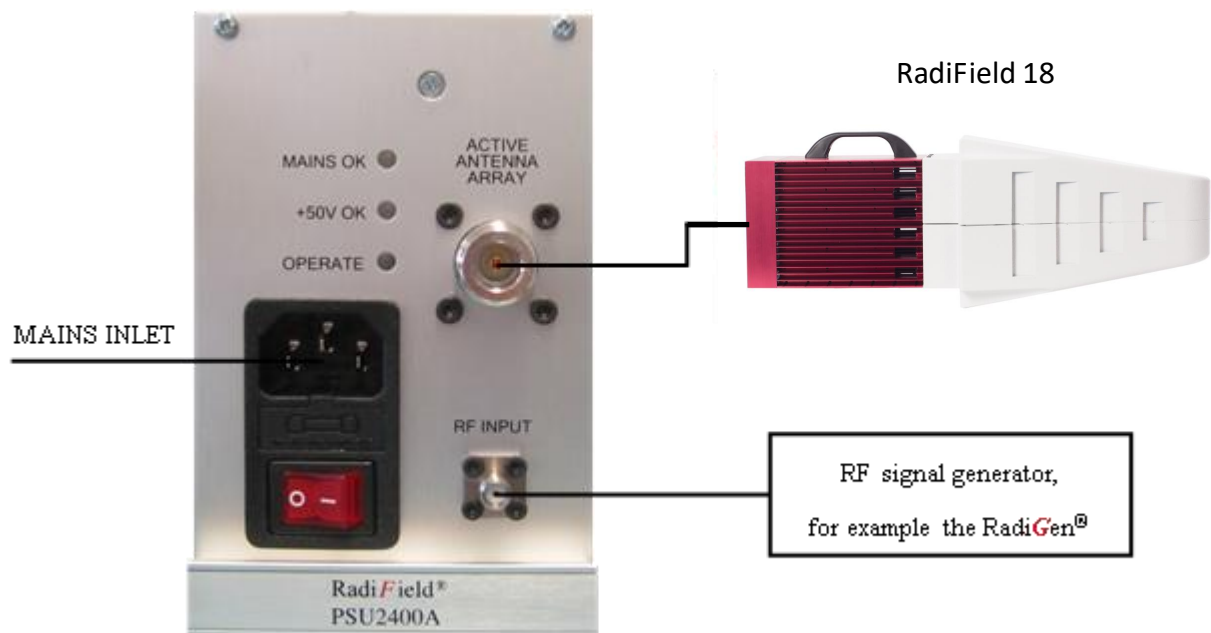


Figure 2: Overview of the RadiField® plug-in card connections

2.7 Transport Case

A transport case has been designed especially for the RadiField®. This transport case can be bought as an option, together with the RadiField® system.

The case is designed for on-site and facility transports. The RadiField® must be stored in the transport case when it is shipped between different locations. Be advised that if you do not buy this specially designed transport case, we recommend that you yourself provide an alternative method of protection for your RadiField®.

REMARK – This transport case is designed for short distance transportation. It does not provide sufficient protection for air travel or other long distance shipping. The RadiField® might be damaged if the transport case is handled in a rough manner. Additional or different (protective) packaging is needed in those situations.

2.8 Antenna Boom

A custom made antenna boom can be mounted on the back of the RadiField®. It is 50 cm long and has a diameter of 40 mm.

This antenna boom can be bought as an option, together with the RadiField® system.

2.9 Coaxial cable

A coaxial cable is used to connect the PSU plug-in card with the RadiField®. The coaxial cable needs to be fitted with an N-type connector on both sides. The maximum allowed attenuation of the cable for proper system operation is 10dB at 18GHz. The selected cable also needs to be able to handle a DC current of 8 amps.

Suitable cables can be bought as an option, together with the RadiField® system.

3 Installation

3.1 Hardware Configuration

The hardware configuration is carried out in the following steps:

1. Make sure that all connections to the plug-in card (PSU2400B) are made:

Connect a suitable N-type coaxial cable from the PSU2400B to the RadiField® and connect a coaxial cable from a RF signal generator to the RF input of the PSU2400B.

Please note that the maximum field is reached at an input power between -10 dBm and +10 dBm, depending on the frequency response and attenuation of the N-type cable used.

2. Make sure that the remote interlock connection of the RadiCentre® system is closed.
3. Plug the mains cords into the mains inlet of the RadiCentre® system and the mains inlet of the PSU2400B plug-in card.
4. Switch the main power switches on both mains inlets to the 'ON' position.
5. Touch the touchscreen on the front panel of the RadiCentre® to activate the RadiField®.

The system is now ready to be used.

The user can control the RadiField® through the touchscreen of the RadiCentre® system, or by external software, such as the RadiMation® EMC test software.

REMINDER – Please make sure that the airflow out of the grey foam openings is not restricted to prevent possible overheating of the RadiField®. The cooling system is designed to operate in the specified operating temperature range.

3.2 Field Polarization and Reference Point

In order to perform radiated immunity measurements, standards require a certain distance from the field generating antenna to the Equipment Under Test (EUT). In most immunity setups, the tip of the transmitting antenna is used to determine the distance to the EUT. While the tip is not visible, the tip of the white cone can be used. The exact tip position of the antenna is located 5 cm from the tip of the white cone.

For most test setups, it is also necessary to know the polarization of the field generated by the antenna.

Both the field polarization and reference point on the RadiField® are shown in the picture below.

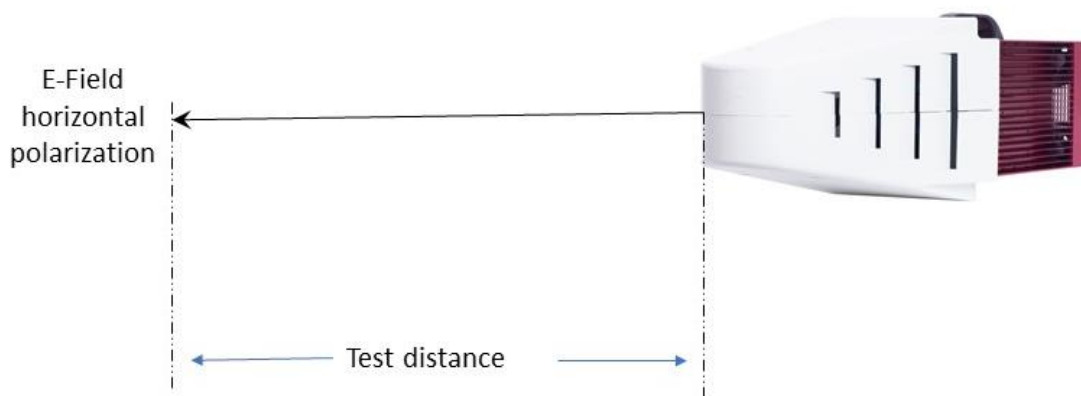


Figure 3: RadiField® field polarization and reference point

3.3 Software Configuration

In order to control the RadiField® from a computer, one can use either custom made software or the RadiMation® EMC software package from DARE!! Instruments (to be purchased separately).

In order to control the RadiField® (either manually or remote through software) the PSU2400B must be plugged into a RadiCentre®.

If the RadiField® is operated manually, this paragraph can be skipped.

If RadiMation® software is used; select the required device driver for the RadiField®.

3.3.1 RadiMation® software

1. Configure the RadiMation® software for a RadiField® / RadiCentre® field generator. Configure a device driver and select the correct communication port.
2. In the 'equipment list' that you are using, select the 'field generator' device driver.
3. Open a Test Set-up File (TSF) and click on the 'Outputs' button. Select the field generator(s) to be used.
4. Save the TSF.

RadiMation® is now ready for use with the RadiField® / RadiCentre® field generator.

The RadiMation® software package verifies the generator at the beginning of each test (if a field generator is selected).

4 Using the RadiField®

4.1 Manual Control of the RadiField®*

Once the RadiCentre® is switched on, the RadiField® can be activated from the 'main screen' on the RadiCentre®. An example of this screen is visible in Figure 4.

By pressing the 'status'-button preceded by the 'Ack'-button, the start-up procedure of the RadiField® will begin. Once this procedure has been completed successfully, the amplifier(s) in the RadiField® will be powered.



* Please note that the screenshots shown in this manual are related to RadiCentre® firmware v1.16.0. Other version may look different and support other functions.

In the RadiField® 'control screen' (visible in **Error! Reference source not found.**), the parameters of the system can be read. In order to generate an EM-field, the system must be switched to operate. It is important to enter the frequency of the generator driving the RadiField® to read the correct power meter level. Entering the actual frequency will automatically correct for the frequency dependent coupler and power meter response inside the amplifiers.

4.2 Remote Control of the RadiField®

The RadiField® can be controlled remotely through the interfaces of the RadiCentre®. The exact communication protocol can be found in the RadiCentre® manual. The specific commands for the RadiField® are shown in chapter 5 'RadiField® Command Set'.

5 RadiField® Command Set

5.1 Commands

5.1.1 General commands

Command	Description & Reply
ID_NUMBER?	Returns unique identifier number. Reply (for example): '1.58.95.146.21.0.0.124'
LOCAL	Return to local mode, the local display is used to set items. Reply: 'OK'
VERSION_HW?	Returns the hardware version. Reply (for example): '2'
*IDN?	Returns the ID of the system. Reply (for example): 'DARE!!, RadiField PSU2400B, 1.0.0'
RESET	Reset the module. This will clear all errors. Reply: 'OK'
CLEAR	All errors are cleared. Reply: 'OK'

**This table continues on the next page.*

General commands, part 2

Command	Description & Reply
MAINS?	Get the state of the mains. Reply: '1' = ON Reply: '0' = OFF
MAINS<space><value>	Turn the main power ON or OFF. <value> = 'ON' or 'OFF' Reply: 'OK' or error code
STANDBY	Set the AAA in the standby mode. Reply: 'OK' or error code
OPERATE	Set the AAA in the operate mode (RF path opened). Reply: 'OK' or error code
MODE?	Returns in which mode the AAA is. Reply (for example): 'Operate'
CURRENT?	Returns the current measured by the plug in card (in ampere). Reply (for example): '1.2'
TEMPERATURE?	Returns the temperature (in degrees Celsius). Reply (for example): '23.6'
POS<space><value>	Set the position of the polarizer. <pos> can be "HOR" for horizontal or "VER" for vertical. Reply: 'OK' or error code
POS?	Reply the status of the polarizer. <pos> can be: "ERROR <Error Code>" "HOR" (When stopped and in horizontal position) "VER" (When stopped and in vertical position) "STOP" (When stopped and not in horizontal or vertical position) "MOV,<percentage>" (When moving)
STOP	Stop the movement of the polarizer

The commands: POS, POS? and STOP can only be used if the polarizer is connected.

**This table continues on the next page.*

General commands, part 3

Command	Description & Reply
STATUS?	Returns a number which indicates what kind of error is occurred. This includes the following replies: <ul style="list-style-type: none"><li>• '0' = No error

5.1.2 Commands for the power meter

Command	Description & Reply
POWER<value>?	Get measure power level (in dBm). <value> = FWD, RFL or NET. Reply (for example): '-12.34'
FREQUENCY? MIN	Get the minimal frequency (in Hz). Reply (for example): '1000000000'
FREQUENCY? MAX	Get the maximum frequency (in Hz). Reply (for example): '6000000000'
FREQUENCY<space> <value>	Set the frequency. <value> = frequency (in Hz), for example: 500000000 Reply: 'OK' or 'ERROR'
FREQUENCY?	Get the frequency (in Hz). Reply (for example): '500000000'

5.2 Error Codes

The following tables show the generic error codes and the product specific error codes for the RadiField®. This includes the error codes for the amplifier, backplane and plug-in card that are part of the RadiField® system.

5.2.1 Generic error codes

Error code	Description
1	Wrong command
2	Parameter too high
3	Parameter too low
4	Invalid parameter
5	Buffer overflow
6	Already in progress
7	Parity error

5.2.2 Module specific error codes – Polarizer

Error code	Description
561	Polarizer not detected
562	Polarizer current too high
563	Polarizer H-bridge fault
564	Polarizer strength too high
565	Polarizer speed too low
566	Polarizer wrong direction

5.2.3 Module specific error codes - Backplane

Error code	Description
558	Received command length are no digits
559	Received command length incorrect

5.2.4 Module specific error codes – Plug-in card

Error code	Description
504	Hardware failure
575	Communication busy
576	Communication time-out
577	Power supply already on
578	Power supply off
579	Incorrect impedance

**This table continues on the next page.*

Module specific error codes – Plug-in card, part 2

Error code	Description
580	Impedance short
581	Impedance open
582	External unit is not connected
583	Unknown error
584	SW update – supply backplane not off
585	SW update – supply backplane not on
586	SW update – software download not started
587	SW update – sync retries failed
588	SW update – reboot unit failed
589	SW update – amplifier to off mode error
590	SW update – transparent mode on error
591	SW update – transparent mode off error
592	SW update –binary frame error
593	SW update –binary frame header error
594	SW update – binary frame header size error
595	Illegal backplane command length
596	Length error - received command length are no digits
597	Length error - received command length incorrect
598	Mains on sequence error – BPL supply switch error
599	Mains on sequence error – AMP startup error

6 RadiField® Specifications

Model	RFS2018B
Performance	
Frequency range	6 GHz – 18 GHz
Max. Field at 1m from tip	75 V/m
Harmonic Suppression	2nd harmonic: -15 dBc (typical -30 dBc) 3rd harmonic: -16 dBc (typical -30 dBc)
Input connector	N-Type
Max. input power to reach maximum field	+10 dBm (0 dBm typical)
Harmonic suppression	< -12 dBc
Number of internal power meters	2 (Forward & Reflected)
Power meter type	Integrated RadiPower
Directional Coupler	Integrated
Safety	
Safety circuit	Safe start & shutdown
Cable (dis)connect	Intrinsically safe
Voltage	55 VDC (Safe Voltage)
Interlock	Hardware interlock
Connections	
Tri-pod mount	¼-20" UNC thread

**This table continues on the next page.*

RadiField® Specifications, part 2

Model	RFS20018B			
Dimensions				
Length	715 mm			
Height	250 mm			
Width	250 mm			
Weight	9 kg			
Environmental conditions				
Temperature range	10° C – 40° C			
Relative humidity	10% - 90% (non-condensing)			
Sound level produced	< 70 dB(A)			
Maximum installation height	2000 meters above sea level			
Power consumption				
Supply voltage	115 VAC / 230 VAC			
Mains fuse of PSU	4 AT			
Max power consumption	<350 W			
Mains	Safety class I, Overvoltage category II			
Warranty				
Warranty	3 years (misuse excluded)			

WARRANTY CONDITIONS

DARE!! Instruments offers a standard warranty term of three years on their products, starting from the shipping date. This warranty is applicable to all EMC test & measurement products, such as:

- RadiCentre® modular / multifunctional EMC test systems
- RadiControl® antenna tower/turntable controllers
- RadiField® field generators
- RadiGen® signal generators
- RadiPower® RF power meters
- RadiSense® laser powered E-field probes
- RadiSwitch® RF coaxial switches

If a defect occurs within the warranty term, a Return Material Authorization (RMA) 'Warranty Repair' request can be issued using the RMA link at <http://rma.dare.eu>. The defective product can then be shipped to DARE!! Instrument for repair by our service department.

There will be no charge for repair services (materials or labor) within the warranty term. The customer will need to cover the costs for returning the product to DARE!!, such as shipping and/or any applicable duties and taxes. DARE!! Instruments will arrange the courier and cover the costs for the return shipment.

These warranty terms are not applicable to:

- Fiber optic cables
- Products that have been improperly used
- Products that have been used outside their specified range
- Products that have been improperly installed and/or maintained
- Products that have been modified without approval of DARE!! Instruments
- Calibration and/or re-calibration of the product
- Consumable products such as batteries, ink etc.

Repair services on products that are not covered by the DARE!! warranty will be charged to the customer. If a defect occurs to our product outside the warranty period, a RMA repair and/or re-calibration request must be issued using the RMA link at <http://rma.dare.eu>.

The repairs (outside the original warranty period) have a warranty limited to six months. Shipping conditions are the same as with repairs within the original warranty period.

EUROPEAN DECLARATION OF CONFORMITY

We, DARE!! Instruments, declare under our sole responsibility that the product;

RadiField[®]
Model RFS2018B

to which this declaration relates, is in conformity with the following standards or other normative documents;

- Emission: EN 61326-1:2013, Class A
Electrical equipment for measurement, control and laboratory use.
- Immunity: EN 61326-1:2013, Industrial level, performance criteria A
Electrical equipment for measurement, control and laboratory use.
- Safety: EN 61010-1:2010, Safety requirements for electrical equipment
for measurement, control, and laboratory use
EN 61010-2-81, Particular requirements for automatic and semi-automatic
laboratory equipment for analysis and other purposes

following the provisions of;

EMC-Directive 2014/30/EU
Low Voltage Directive 2014/35/EU

The Technical Construction Files are maintained at;

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Authorized by:



Title of authority: P.W.J. Dijkstra
Director

