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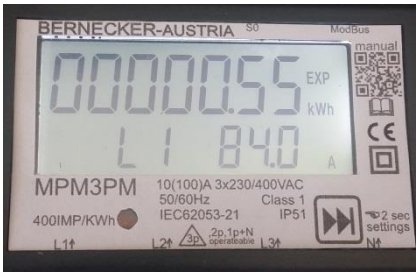
Boosting Electronics®

MECHATRONIC

User manual

Part: MPM3PM (Modbus)
Three phase four wires energy meter
10(100)A direct, 35mm DIN Rail
four module, 4TE, 70mm width
With RS485 Modbus Protocol RTU
Manual Revision: 1V12

Product Picture



removed sealable protection covers

Enclosure in anthracite grey RAL7016

EAN: 798003850837
ASIN: B073K11PPQ

Notes:
Customs code HS/TARIC 9028 30 19 00

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Contents

1. Foreword

The MPM3PModBus series meter is produced according to EN50470-3 and fulfils strict quality inspection.
Under normal conditions your product should give you years of benefit and pleasure. In case there is a problem with the energy meter you should contact your dealer immediately. All energy meters are sealed with a special seal. Once this seal is broken there is no possibility to claim for warranty. Therefore NEVER open meter by yourself or break the seal of the energy meter. The warranty time is 12 months after installation, and only valid for construction faults.

2. Installation

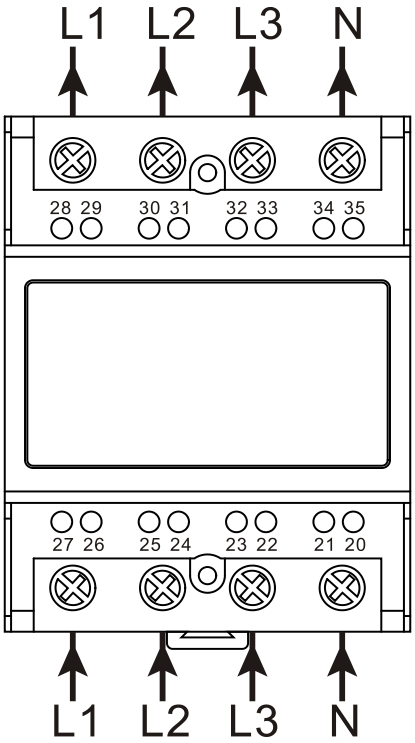
⚠ CAUTION
♦ Turn off all the power before working on it. ♦ Always use a properly rated voltage sensing device to confirm that power is off.
⚠ WARNING
♦ Installation should be performed by qualified personnel familiar with related procedures and regulations. ♦ Use insulating tools to install the meter. ♦ Fuse or thermal cut-off or single-pole circuit breaker can't be fitted on the supply line and not the neutral line. ♦ The case is sealed, do not broken it

- ✧ We recommend that the connecting wire which is used to connect the meter to the outside circuit should be sized according to local codes and regulations for the capacity of the circuit breaker or over current device used in the circuit.
- ✧ An external switch or a circuit-breaker should be installed on the inlet wire, which will be used as a disconnection device for the meter. And there it is recommended that the switch or circuit-breaker is near the meter so that it is more convenience for the operator. The switch or circuit-breaker should comply with the specifications of the building electrical design and all local regulations.
- ✧ An external fuse or thermal cut-off which will be used as a over-current protection device for the meter must be installed on the supply side wire, and it is recommended that the over-current protection device is near the meter so that it is more convenience for the operator. The over-current protection device should comply with the specifications of the buildings electrical design and all local regulations.
- ✧ This meter can be installed indoor directly, or in a meter box which is waterproof outdoor (IP67), subject to local codes and regulations.
- ✧ To prevent tampering, secure the meter with a padlock or a similar device.
- ✧ The meter has to be installed against a wall which is fire resistant.
- ✧ The meter has to be installed in a good ventilated and dry place.
- ✧ The meter has to be installed in a protection box when placed in dangerous or dusty environment.
- ✧ The meter can be installed and used after being tested and sealed with a letter press printing.
- ✧ The meter can be installed on a 35mm DIN rail.
- ✧ The meter should be installed in an available height so that it is easy to read.
- ✧ When the meter is installed in an area with frequent surges due to e.q. thunderstorms, welding machines, inverters etc, protect the meter with Surge Protection Devices.
- ✧ After finishing installation, the meter must be sealed to prevent tampering.

2.1. Connection

Connection of the wires should be done in accordance with the underneath connection diagram.

connection diagram	
L1	L1 phase wire IN,OUT
L2	L2 phase wire IN,OUT
L3	L3 phase wire IN,OUT
N	Neutral wire IN,OUT
32	active pulse ouput contact "-"
33	active pulse ouput contact "+"
34	RS485 B "-"
35	RS485 A "+"



Screw terminals L1,L2,L3,N:

maximum Torque is 1.2Nm !

Wire range 0.8-35(50)mm²

(cage opening size min. 7.5x8.0mm)

Screw terminals 20-35:

maximum Torque is 0.2Nm !

Wire range 0.12-1.5mm²

3. Performance criteria:

Operating humidity	≤ 75%
Storage humidity	≤ 95%
Operating temperature	-10°C - +50°C
Storage temperature	-30°C - +70°C
International standards	
Active energy meters of class 1	IEC62052-11,IEC62053-21
Reactive energy meters of class2	IEC62053-23
Active energy meters class A,B	EN50470-1,EN50470-3
	Accuracy class
Voltage, LN & LL (Phase1,2,3)	±0.5%
Amps (Phase 1,2,3)	±0.5%
PF (Phase 1,2,3 &Σ)	±0.2%
Active power (Phase 1,2,3&Σ)	±0.5%
Reactive power (Phase 1,2,3&Σ)	±0.5%
Apparent power (Phase 1,2,3&Σ)	±0.5%
Frequency	±0.2%
Active energy	±1%
Reactive energy	±2%
Protection against penetration of dust and water	IP51

4. Meter specifications:

Meter type	MPM3PModbus
Nominal voltage (Un)	230/400V AC (3~)
Operational voltage	161/279 – 300/520V AC (3~)
Insulation capabilities:	
- AC voltage withstand	4KV for 1 minute
- Impulse voltage withstand	6KV – 1.2µS waveform
Basic current (Ib):	
Directly connect	10A
Maximum rated current (Imax)	
Directly connect	100A
Power loss of current path	<1,5W per phase at Maximum rated current
Operational current range	0.4% Ib- Imax
Over current withstand	30Imax for 0.01s
Operational frequency range	50Hz ±10%
Internal power consumption	≤1W / 1VA
Consumption indicator	
PULSE LED	400imp/kWh
SO Output	400imp/kWh
each impulse 1/400[imp/kWh]=0,0025kWh Power [W]=2.5Wh*pulse frequency[Hz=1/s]*3600[s/h]	
	SO Pulse length 80ms
! Info: energy flow through the meter, independent on current scale other than 1:1 Eg when using external current transformer.	
Communication indicator symbol	🖧 twinkle on LCD Display
Data communication port	RS485 and far infrared (option)
Data save retention	more than 20 years, power off

4.1. RS485 communication specifications:

Bus type	RS485
Protocol	MODBUS RTU with 16 bit CRC
baud rate	1200,2400,4800,9600
Address range	1-255 user settable
Bus Loading	64 meters per bus
Rage	1000m

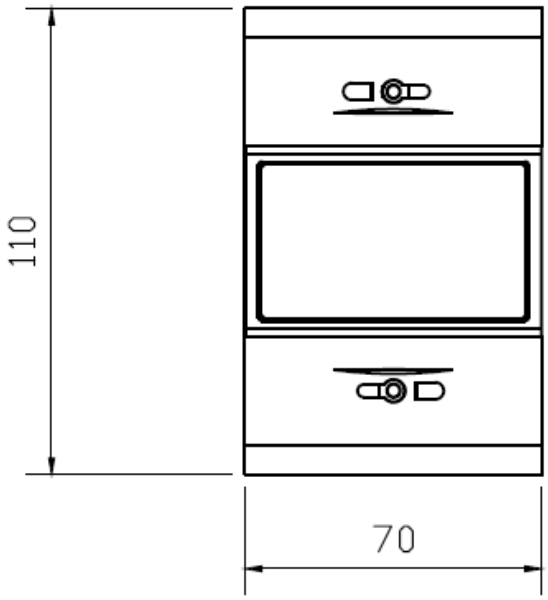
4.2. Far Infrared communication specifications(optional feature):

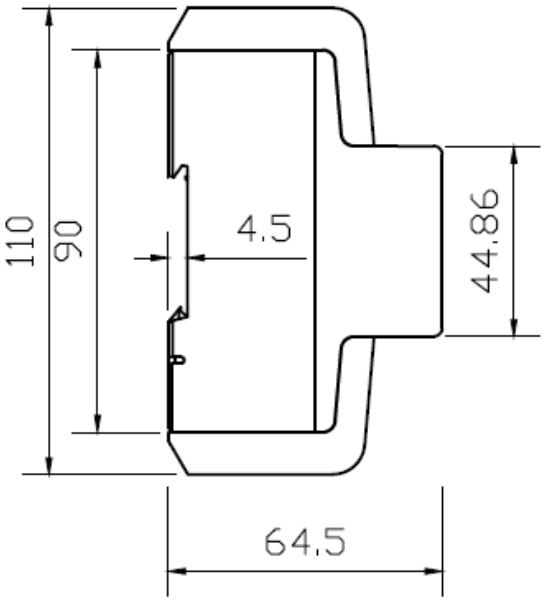
infrared wavelengths	900- 1000nm
baud rate	1200bps
communication distance	5m
communication angle	-15°~+15°
protocol	ModBus RTU with 16 bit CRC

4.3. Basic errors:

Current value	Active class 1.0		Reactive 2.0	
	Power factor COSΦ	Error %	Power factor SINΦ	Error %
0.05Ib≤I<0.1Ib	1.0	±1.5	1.0	±2.5
0.1Ib≤I<Imax	1.0	±1.0	0.5L or 0.8C	±2.0
0.1Ib≤I<0.2Ib	0.5L or 0.8C	±1.5	1.0	±2.5
0.2Ib≤I<Imax	0.5L or 0.8C	±1.0	0.5L or 0.8C	±2.0

5. Dimension





Weight 0.355 kg (net)
0.385 kg (packed in carton)

5.1.1. Material

Front panel	PC inflammable retarding
Cover	ABS inflammable retarding
Base	ABS inflammable retarding

6. Operating

Consumption indication:

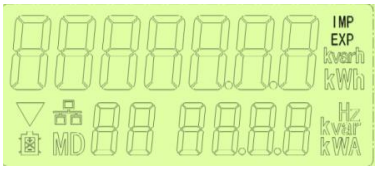
The LED flashes when Power flows through the meter, independent of power flow direction. The more quickly LED flash, the more consumption there is.

6.1. Reading the meter:

Digits of display: 7 digits for the main display items (6+1 or 5+2)
6 digits for the sub display items

LCD display, the display is as below when power on :

Content	Display format
The display of full screen	
The constant (Pulse / kWh)	

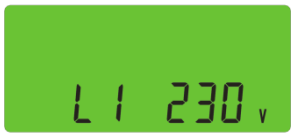
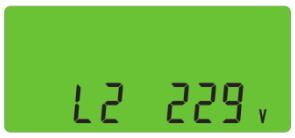


6.2. Main display items

Active kWh absolute (import total-export total)		**import Active total kWh**	
Reactive kvarh Absolute (import-export)		**export Active total kWh**	

Info: Display is set 2 decimal coma: when become greater 99999.99 it will show 100000.0 (switch to one coma) and when become greater 999999.9 it will show 1000000 (no coma).

6.3. Sub display items

Content	Format of display	LCD display
L1 voltage		Display in cycle
L2 voltage		Display in cycle

L3 voltage	L3 231 V	Display in cycle
L1 current	L1 9.9 A	Display in cycle
L2 current	L2 11.3 A	Display in cycle
L3 current	L3 10.0 A	Display in cycle
Active power	P 2.30 kW	Display in cycle
Reactive power	q 2.50 kvar	Display in cycle
Power factor	PF 1.00	Display in cycle
Frequency	F 50 Hz	Display in cycle

6.4. Alarming display

Display of reverse phase	▼ L3 -20.6 A	▼ will flash to indicate that the value of current is negative
Display of phase loss	▼ L2 0 V	▼ will flash to indicate that the value of display is zero

It is used as recording consumption and can't be reset to zero. The reading accuracy is 1/100 kWh.

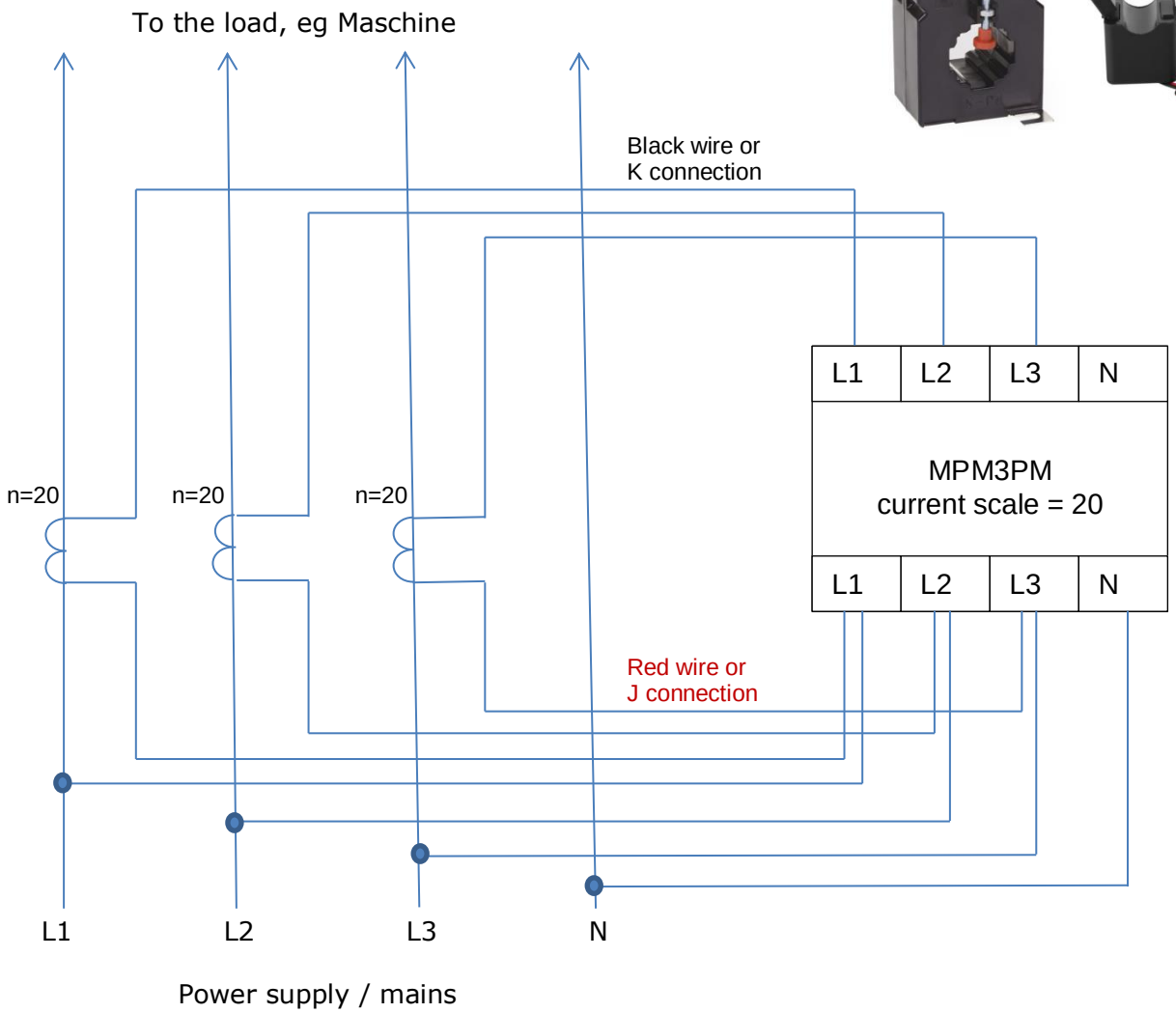
7. Pulse output S0

The meter is equipped with a pulse output which is fully separated from the inside circuit. That generates pulses in proportion to the measured energy for accuracy testing.
Output performance: Voltage range 5-27V DC, Current maximum 20mA.

Info: the pulse rate is based on energy flow through the meter, independent on current scale other than 1:1 (can be modified by ModBus).
Eg 100A/5A current transformer is used; the current scale is set to 1:20 the pulse rate need to multiplied by 20 on detector side. Meter C400=400imp/kWh→0,0025kwH/imp will be then C20=20imp/kWh→0,05kWh/imp.

8. External Current Transformer

For higher power demands means higher currents than the allowed 100Arms or when main energy path can not be switched off for meter installation a typical application is to use current transformers or snap on current measurement transformers.
Example shows for 100A/5A current scale as be used with n=20
Take care of input polarity most shown with an arrow and of J K or red/black wires of current transformer output.



9. Technical supports

Problem	Check	Solution
No light for the consumption indicator.	Is there current ? Maybe there is a fault in the inside circuit.	Only when there has current, this LED will flash. . Please contact your technical supporter to replace this meter.
The register can't run.	Is there a power supply inside the meter? Is the operating power too low? Maybe there is a fault in the inside circuit.	Check that the power supply If the operating power is too low, the spacing interval of the pulses will take some more time, this is why it seems like the meter won't count. Please contact your technical supporter to replace this meter.
No pulse output.	Is the connecting correct ? Maybe there is a fault in the inside circuit.	Check correct connecting: Check polarity of Anode and Cathode of S0 output, Voltage range 5-27V DC. Please contact your technical supporter to replace this meter.
Pulse output rate wrong.	Maybe there is a fault in the inside circuit.	Please contact your technical supporter to replace this meter.

9.1. Your technical supporter

TEL: **OEM phone number**

Email: **OEM email address**

OEM Website

10. ModBus Communication Protocol

10.1. format of byte RS485

1 starting bit	8 data bit	(1 parity bit)	1 stop bit
„0 “	Lowest digit first	„1 “ or „0 “	„1 “

10.2. Frame format

ID, address of device	function code	data field	CRC

ID, address of device： 1 byte. Value range 0～255,
among which 0 is broadcast address.

Function code：1byte. Please refer to the followed for more information.

Data field： it changes with the different function codes. The max is 252 bytes. The high bytes come first.

CRC：The schooling field of frame, 2 bytes, the lower bytes come first.

10.3. function codes

Function code	Operation	Command of broadcast
0x04	Reading the register	Allowed
0x10	Setting several registers	Allowed

10.4. Read command of register value （04H）

Request of master device:

ID, address of device		1 byte	01H～F7H
function code		1byte	04H
starting register address to be read	reg high	1 byte	xx
	reg low	1 byte	xx
numbers of registers to read		2 byte	N [low, high]
CRC		2 bytes	CRC_Lo, CRC_Hi

Return:

ID, address of device	1 byte	01H～F7H
function code	1 byte	04H
number of data, following	1 byte	N
content of data	N byte	
CRC	2 bytes	CRC_Lo, CRC_Hi

10.5. command to set the value of several registers（10H）

The request from master device：

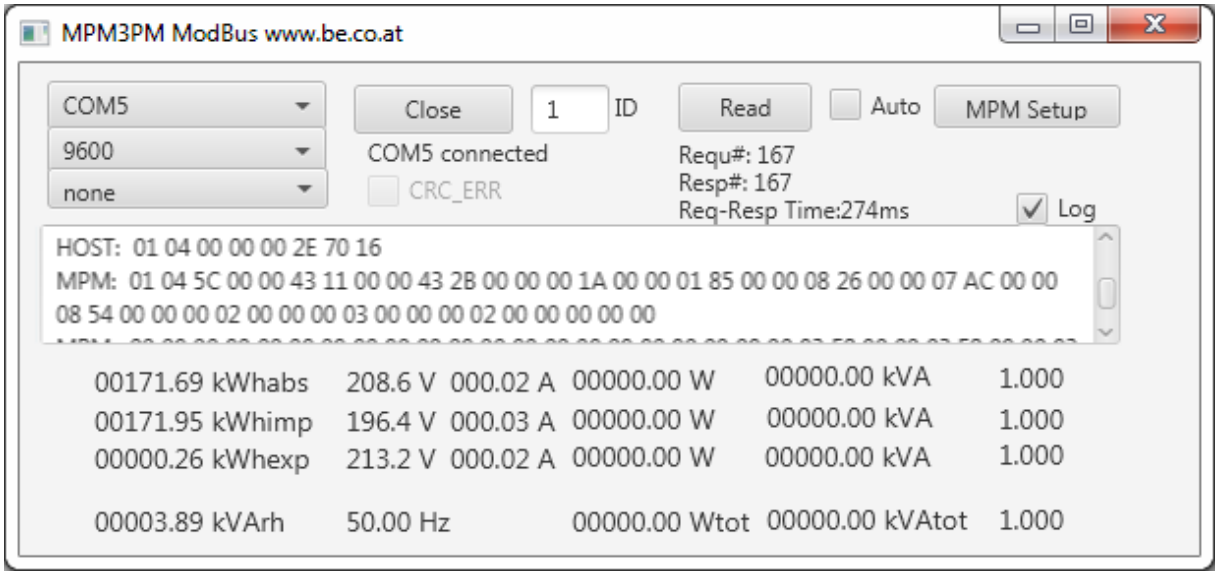
ID, address of device		1 byte	00H～FFH
function code		1 byte	10H
starting register address to be written	reg high	1 byte	xx
	reg low	1 byte	xx
number of registers to be written		2 bytes	N
number of following data bytes		1 byte	2×N
Register value		2×N	xxxx
CRC		2 bytes	CRC_Lo, CRC_Hi

Return：

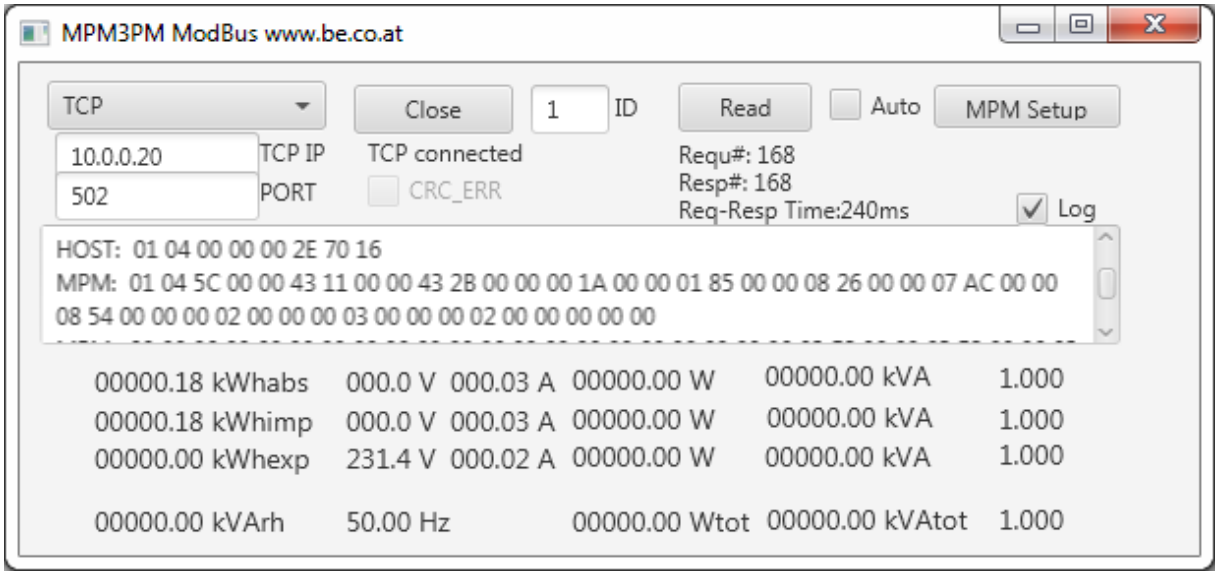
ID, address of device		1 byte	00H～F7H
function code		1 byte	10H
starting register address to be written	reg high	1 byte	xx
	reg low	1 byte	xx
number of data bytes, which where written and confirmed		1 byte	2×N
CRC		2 bytes	CRC_Lo, CRC_Hi

11. Free Software for Winows, Linux and Apple

www.qrck.info/modbus.jar
requires Java Runtime



Can connect with any serial com port with RS485 or with USB-RS485 interface (with virtual com port driver like FTDI…) or
with ModBus TCP to ModBbus RTU Interface



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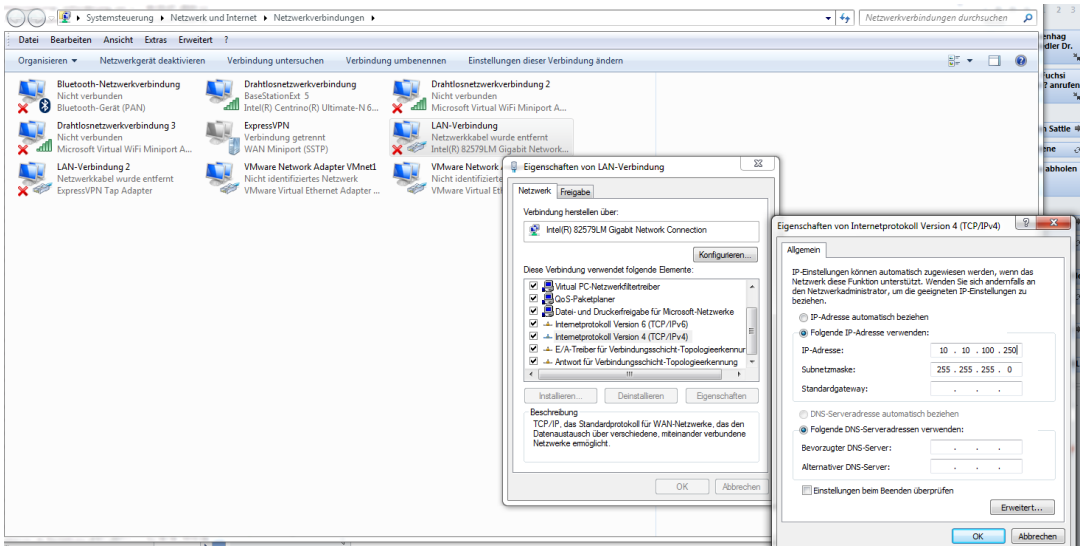
12. Setup ModBus TCP to ModBus RTU converters

Short instruction for use of these:

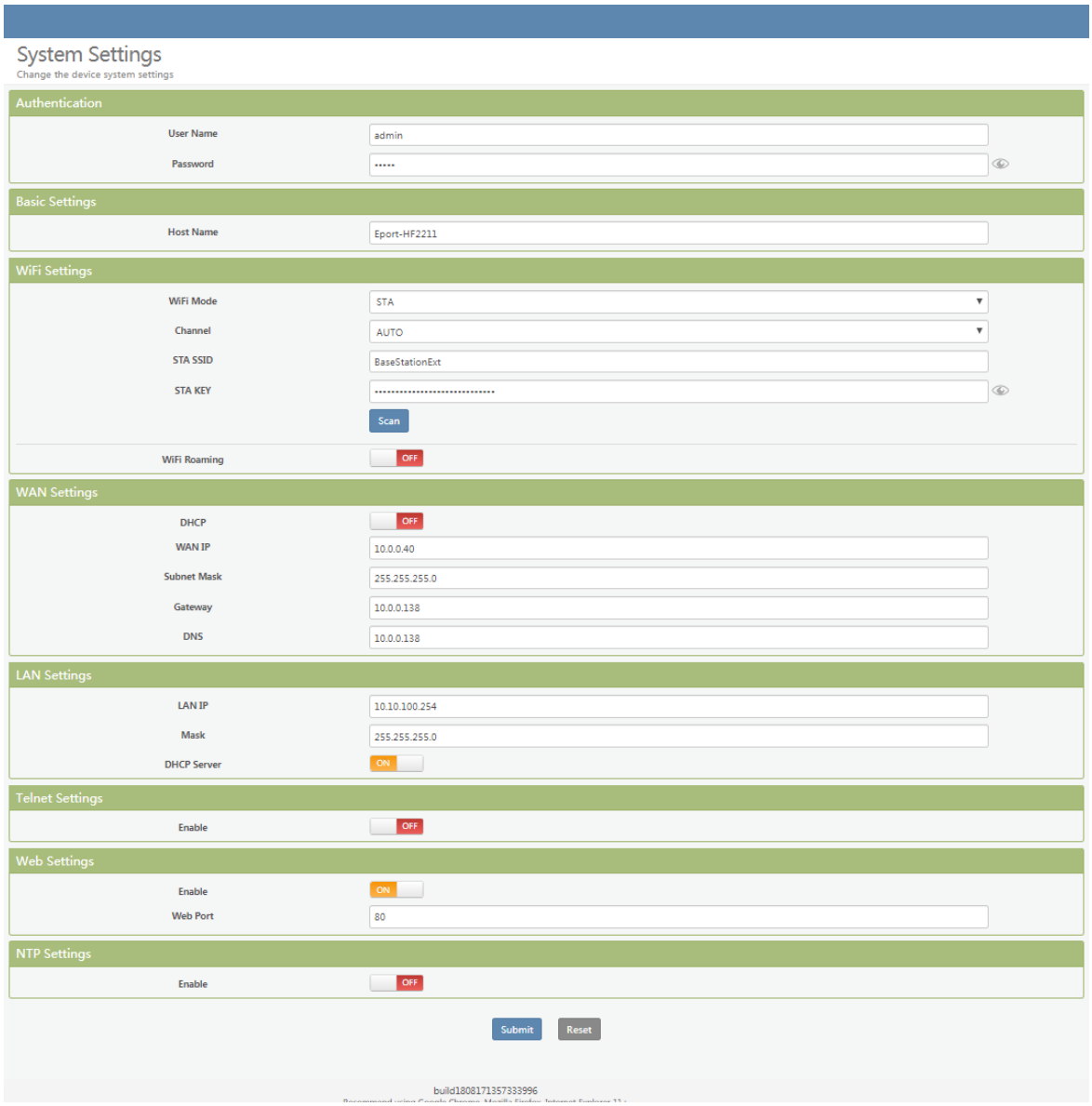
12.1. HF2211

First connect Ethernet socket from HF2211 to Laptop with short patch cable.
In case you have no DHCP client enabled (means the IP address is given from the access point) on your computer you can assign a static address IP in same network mask the HF2211 is:



Then open the browser and enter http://10.10.100.254
Default password is admin / admin

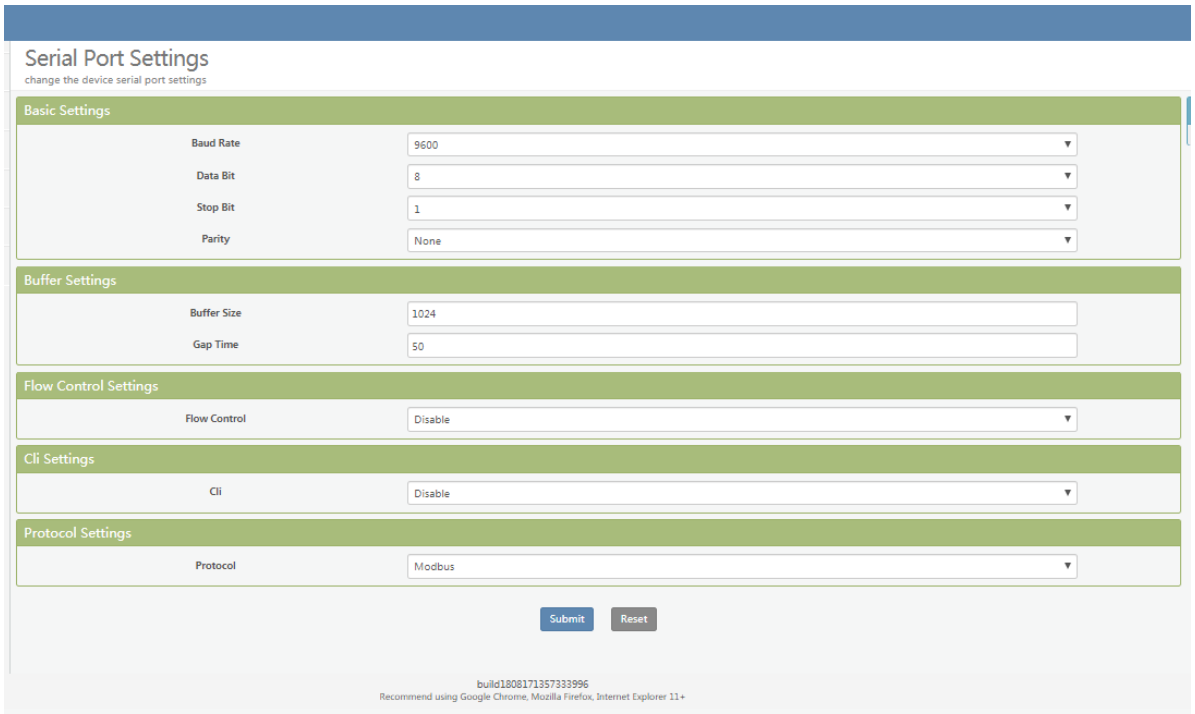
SYSTEM SETTINGS:



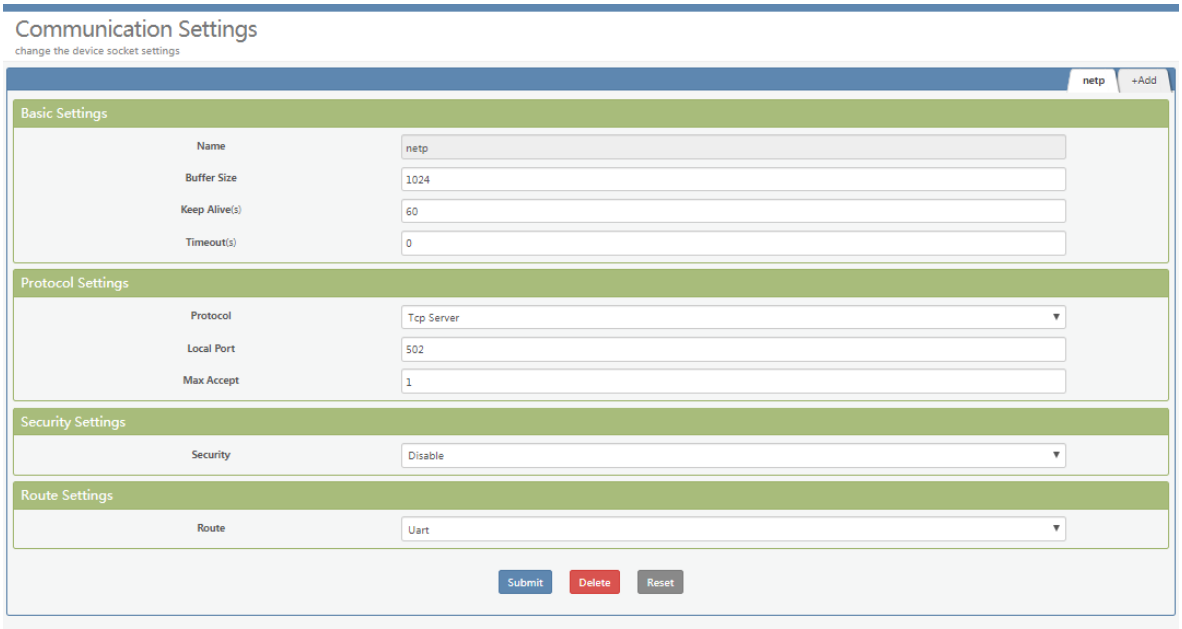
You can connect either to LAN (Ethernet socket) or WLAN (WiFi)
WLAN mode: WiFi Mode STA, channel AUTO, then click on Scan and select the desired Acces Point and enter the STA password (WPA Key, WPA2….)

WAN IP is recommended to assign a static IP, this address need to be in the WiFi IP range and not collision with other devices. Best is to use a high IP address.
eg the DHCP server of the access point ranges from 10.0.0.1 to 10.0.0.50 then best assign on the top range like 10.0.0.40.
In this example the future ModBus TCP access is at 10.0.0.40:502

SERIAL PORT SETTINGS:

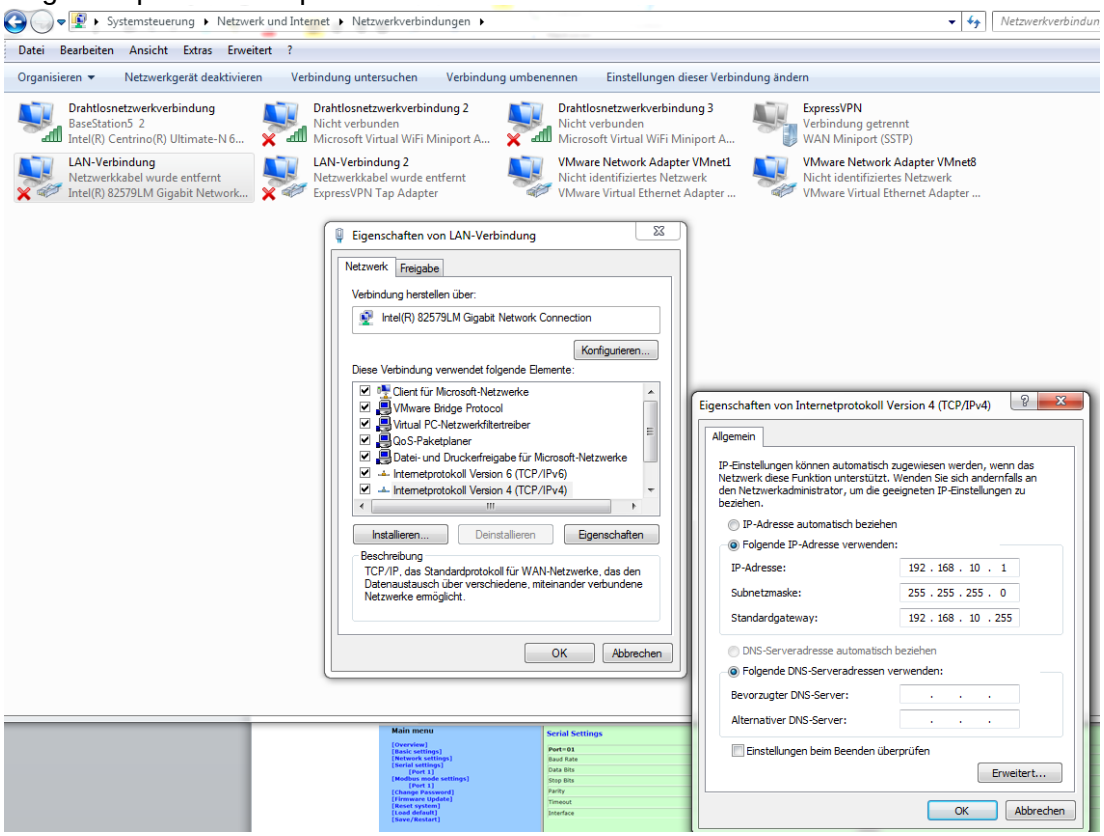


COMMUNICATION SETTINGS:



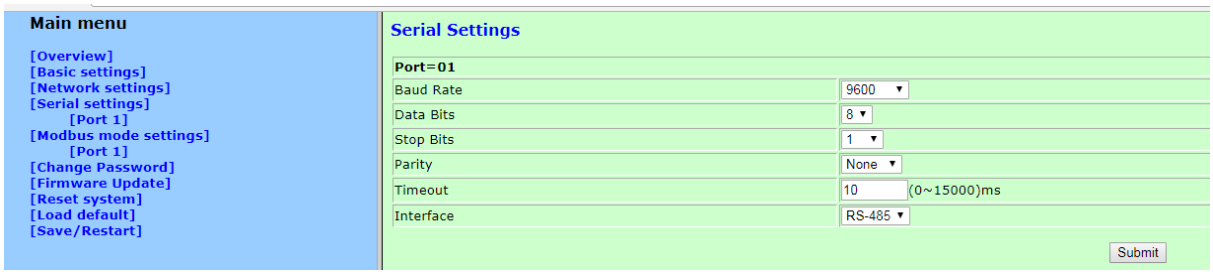
12.1. Volison ADM-5850G

Set the PC to a static IP address for Ethernet connection. Connect the Volison to the PC using a simple ethernet patch cable.

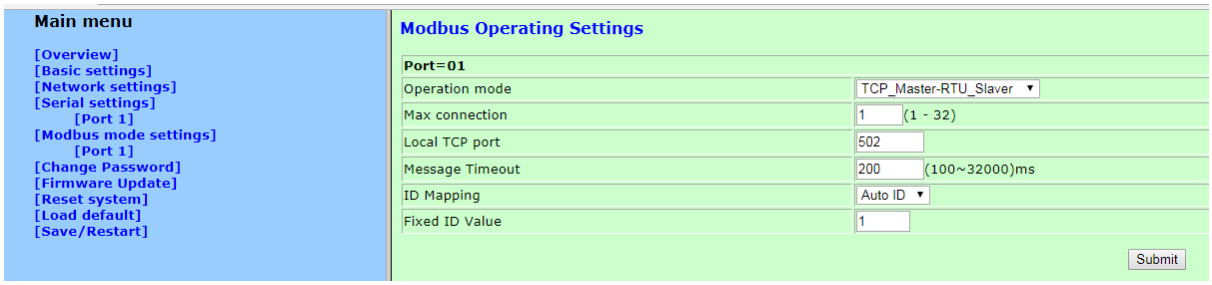


Start the browser http://192.168.10.245

SERIAL SETTINGS:

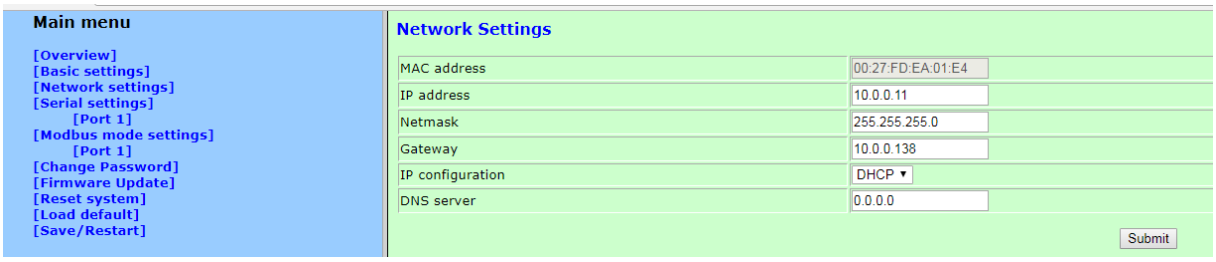


ModBus OPERATION SETTINGS



Auto ID → request ID is response ID
Fixed ID → maped eg Request ID 03 becomes ID 01

NETWORK SETTINGS:



Setup a static IP matching the application network or in case of using DHCP set up the router or DHCP server to assign a static IP.
In this case we use 10.0.0.11 (Host Name: http://Volison-GW)
For ModBus TCP the access is 10.0.0.11:502

Now we can place the Volison device into the application network.

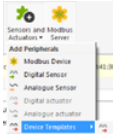
13. Loxone Server Configuration

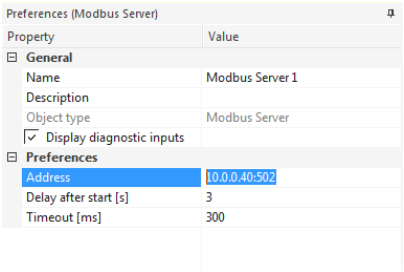
When you use the ModBus RTU interface from Loxone, please read this first:
https://www.loxone.com/dede/kb/kommunikation-mit-modbus-rtu/

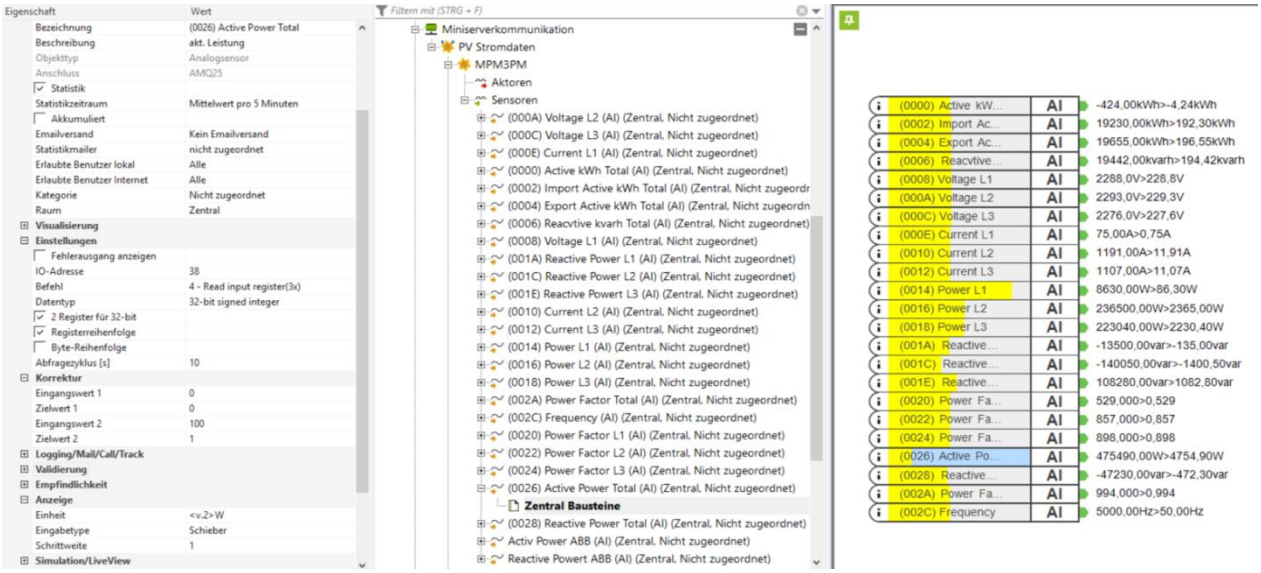
When you use standard ModBus TCP RTU converter, like listed in previous chapter please read this first:
https://www.loxone.com/dede/kb/kommunikation-mit-modbus-tcp/

13.1. XML code for Loxone

Download www.qrck.info/MB_MPM3PM.xml and copy the file into
C:\ProgramData\Loxone\Loxone Config 10.2.3.26\Templates\Comm
Restart the Loxone Config Software and find under
Modbus Server → Sensors and Actuators → Device Templates → MPM3PM







14. ModBus Register, Address and Data format

Function	Register Address	Register Number	Byte	Format	Access (R/W)	Note
Active kWh Total	0x0000	2	4	Signed 32	R	Unit: 0.01kWh Import-Export
Import Active kWh Total	0x0002	2	4	Unsigned 32	R	Unit: 0.01kWh
Export Active kWh Total	0x0004	2	4	Unsigned 32	R	Unit: 0.01kWh .9
Reactive kvarh Total	0x0006	2	4	Unsigned 32	R	Unit: 0.01kvarh Import+Export
Voltage L1	0x0008	2	4	Unsigned 32	R	Unit : 0.1V
Voltage L2	0x000A	2	4	Unsigned 32	R	Unit : 0.1V
Voltage L3	0x000C	2	4	Unsigned 32	R	Unit : 0.1V
Current L1	0x000E	2	4	Unsigned 32	R	Unit : 0.01A
Current L2	0x0010	2	4	Unsigned 32	R	Unit : 0.01A
Current L3	0x0012	2	4	Unsigned 32	R	Unit : 0.01A
Power L1	0x0014	2	4	Signed 32	R	Unit : 0.01W
Power L2	0x0016	2	4	Signed 32	R	Unit : 0.01W
Power L3	0x0018	2	4	Signed 32	R	Unit : 0.01W
Reactive power L1	0x001A	2	4	Signed 32	R	Unit : 0.01var
Reactive power L2	0x001C	2	4	Signed 32	R	Unit : 0.01var
Reactive power L3	0x001E	2	4	Signed 32	R	Unit : 0.01var

Power Factor L1	0x0020	2	4	Unsigned 32	R		Unit: 0.001		
Power Factor L2	0x0022	2	4	Unsigned 32	R		Unit:0.001		
Power Factor L3	0x0024	2	4	Unsigned 32	R		Unit::0.001		
Active Power Total	0x0026	2	4	Signed 32	R		Unit ：0.01W		
Reactive Power Total	0x0028	2	4	Signed 32	R		Unit ：0.01var		
Power Factor Total	0x002a	2	4	Unsigned 32	R		Unit: 0.001		
Frequency	0x002c	2	4	Unsigned 32	R		Unit ：0.01Hz		
Baud rate	0x002e	1	2	Unsigned 16	R & W	Parity	**E**ven Bit Sum 0,2,4…	**o**dd Bit Sum 0,2,4…	**n**one
						1200	0x0004	0x0104	0x0204
						2400	0x0008	0x0108	0x0208
						4800	0x0010	0x0110	0x0210
						9600	0x0020	0x0120	**0x0220**
ID (Modbus)	0x002f	1	2	Unsigned 16	R & W		01-255 **(01 default)** Broadcast is 00.		
Cycle display screen number	0x0030	1	2	Unsigned 16	R & W		1-15 **(10 default)**		
Display time of each screen	0x0031	1	2	Unsigned 16	R & W		Unit 0.5 second Value=1-20 (0.5-10Seconds) **(05 default)**		
Digits number of Energy	0x0032	1	2	Unsigned 16	R & W		01: xxxxxx.x 02: xxxxx.xx **(01 default)**		
Serial Number	0x0033	2	4	Unsigned 32	R		SH+SL unique number		

14.1. Cycle display items: one display item with one data format.

Function	Register Address	Register Number	Byte	Format	Access (R/W)	Note
Cycle display Item	0x0035-0x0042	14	28	struct	R & W	write all entry in one write cycle

Function code	Code Instruction	Access (R/W)	Cycle Display Item Code	Data Format
0x00,0x10,	Voltage L1	R	Item 1	Hex
0x00,0x20,	Voltage L2	R	Item 2	Hex
0x00,0x30,	Voltage L3	R	Item 3	Hex
0x00,0x40,	Current L1	R	Item 4	Hex
0x00,0x50,	Current L2	R	Item 5	Hex
0x00,0x60,	Current L3	R	Item 6	Hex
0x00,0x70,	Active power	R	Item 7	Hex
0x00,0x80,	Reactive power	R	Item 8	Hex
0x00,0x90,	Power factor	R	Item 9	Hex
0x00,0xA0,	Frequency	R	Item A	Hex
0x00,0xB0,	Baud rate	R	Item B	Hex
0x00,0xC0,	ID	R	Item C	Hex
0x00,0xD0,	Serial Number of High	R	Item D	Hex
0x00,0xE0,	Serial Number of Low	R	Item E	Hex

Function	Register Address	Register Number	Byte	Format	Access (R/W)	Note
SW Version	0x0043	1	2	Unsigned 16	R	Software Version Firmware
Current Scale ratio	0x0044	1	2	Unsigned 16	R & W	**(01 default)** 1A:1A, no external current transformer Example 100A:5A, value to be set 20

14.2. Modify the parameters of meters

14.2.1. modify the baud rate, parity setting

Sending data: 01(ID) 10 00 2E 00 01 02 02 20 (baud rate status word） CRC0,1

Example to set 9600 baud, parity even:

Baud rate register 0x002E = 0x00 20

Raw Data

```
[RTU]>Tx > 07:12:46:479 : 01 10 00 2E 00 01 02 00 20 A1 C6
[RTU]>Rx > 07:12:46:604 : 01 10 00 2E 00 01 61 C0
Sys > 07:12:46:604 : values written correctly.
```

Possible baud rate settings:

	parity		
baud	even	odd	none
1200	0x0004	0x0104	0x0204
2400	0x0008	0x0108	0x0208
4800	0x0010	0x0110	0x0210
9600	0x0020	0x0120	**0x0220**

14.2.2. modify the number of decimal digits

Sending data：01(ID）10 00 32 00 01 02 00 01 (1 decimal digit for kWh）+CRC0,1

Returning data：01(ID) 10 00 32 00 01 A0(CRC0) 06(CRC1)

Sending data：01(ID)10 00 32 00 01 02 00 02 (2 decimal digits for kWh） +CRC0,1

Returning data：01(ID) 10 00 32 00 01 A0(CRC0) 06(CRC1)

The number of decimal digits 01: 999999.9

The number of decimal digits 02: 99999.99

14.2.3. modify the item displayed in cycle

For example, you need the meter to display the voltage of phase L1/L2/L3 , current of phase L1/L2/L3, active power, reactive power, power factor, frequency, baud rate, ID ,high digit of serial number, low digit of serial number. 14 items = 0x0E

The first step: modify the number of screen displayed in cycle：

Sending data： 01(ID) 10 00 30 00 01 02 00 0E 22(CRC0) 64(CRC1)

Returning data：01(ID) 10 00 30 00 01 01(CRC0) C6(CRC1)

The second step: modify the item displayed in recycle, struct data：

IT IS NECESSARY TO SEND a multiple register write with 14 entry values!

Sending data：

01(ID) 10 00 35 00 0E 1C 00 10 00 20 00 30 00 40 00 50 00 60 00 70 00 80 00 90 00 A0 00 B0 00 C0 00 D0 00 E0 89(CRC0) 34(CRC1)

Returning data:01(ID) 10 00 35 00 0E 51(CRC0) C3(CRC1)

14.2.4. To read the data module

Sending data : 00(ID) 04 AA AA 00 BB CRC0 CRC1

AA AA The starting add of register

BB The number of registers read by you

For example, reading the voltage of phase L1, L2, L3 and current of phase L1, L2, L3. Read the Voltage of L1, l2, l3.

Sending data : 00(ID) 04 00 08 00 08 CRC0 CRC1

15. ABB23 compatible registers:

These registers are shadow registers, to be compatible to ABB23 meters

15.1. Data format

Register Number 2 and Unsigned 32 means 0 digit is 0x0000 0000 and the highest possible value is 0xffff ffff

Example Register 0x5B00 Res 0.1 unit V, voltage 237,3V is 2373digits and is 0x0000 0945

Register Number 2 and Signed 32 means 0 digit is 0x0000 0000 and the highest possible value is 0x7fff ffff and minus 1 is 0xffff ffff, lowest negative value is 0x8000 0000

Example Register 0x5B14 Res 0.01W unit W, 1234,67W is 123467digits and is 0x0001 e24b,

Negative power -136,82W is -13682digits and is 0xffff ca8e

15.2. Register BLOCK 1

Function	Register Address	Register Number	Unit	Format	Access (R/W)	Note
Active import kWh	0x5000	4	0,01 kWh	Unsigned 64	R	
Active export kWh	0x5004	4	0,01 kWh	Unsigned 64	R	
Active net kWh	0x5008	4	0,01 kWh	Signed 64	R	=Active import kWh - Active export kWh
Reactive inductive kvarh	0x500C	4	0,01 kvarh	Unsigned 64	R	Independ import-export
Reactive capacitive kvarh	0x5010	4	0,01 kvarh	Unsigned 64	R	Independ import-export
Reactive total kvarh	0x5014	4	0,01 kvarh	Unsigned 64	R	Inductive +capacitive
Apparent import kVAh	0x5018	4	0,01 kVAh	Unsigned 64	R	Not implemented, readout 0xffff ffff ffff ffff
Apparent export kVAh	0x501C	4	0,01 kVAh	Unsigned 64	R	Not implemented, readout 0xffff ffff ffff ffff
Apparent net kVAh	0x5020	4	0,01 kVAh	Signed 64	R	Not implemented, readout 0xffff ffff ffff ffff

15.3. Register BLOCK 2

Function	Register Address	Register Number	Unit	Format	Access (R/W)	Note
Active net L1	0x5478	4	0,01 kWh	Signed 32	R	Not implemented, readout 0xffff ffff ffff ffff
Active net L2	0x547C	4	0,01 kWh	Signed 32	R	Not implemented, readout 0xffff ffff ffff ffff
Active net L3	0x5480	4	0,01 kWh	Signed 32	R	Not implemented, readout 0xffff ffff ffff ffff

15.4. Register BLOCK 3

Function	Register Address	Register Number	Unit	Format	Access (R/W)	Note
Voltage L1-N	0x5B00	2	0,1 V	Unsigned 32	R	
Voltage L2-N	0x5B02	2	0,1 V	Unsigned 32	R	
Voltage L3-N	0x5B04	2	0,1 V	Unsigned 32	R	
Voltage L1-L2	0x5B06	2	0,1 V	Unsigned 32	R	=sqrt((L1-N)^2+(L2-N)^2+(L1-N)*(L2-N))
Voltage L3-L2	0x5B08	2	0,1 V	Unsigned 32	R	=sqrt((L2-N)^2+(L3-N)^2+(L2-N)*(L3-N))
Voltage L1-L3	0x5B0A	2	0,1 V	Unsigned 32	R	=sqrt((L1-N)^2+(L3-N)^2+(L1-N)*(L3-N))

Function	Register Address	Register Number	Unit	Format	Access (R/W)	Note
Current L1	0x5B0C	2	0,01 A	Unsigned 32	R	
Current L2	0x5B0E	2	0,01 A	Unsigned 32	R	
Current L3	0x5B10	2	0,01 A	Unsigned 32	R	
Current N	0x5B12	2	0,01 A	Unsigned 32	R	Not implemented, readout 0xffff or 0x0000, to be calculated extern
Active Power Total	0x5B14	2	0,01 W	Signed 32	R	
Active Power L1	0x5B16	2	0,01 W	Signed 32	R	
Active Power L2	0x5B18	2	0,01 W	Signed 32	R	
Active Power L3	0x5B1A	2	0,01 W	Signed 32	R	
Reactive power Total	0x5B1C	2	0,01 var	Signed 32	R	
Reactive power L1	0x5B1E	2	0,01 var	Signed 32	R	
Reactive power L2	0x5B20	2	0,01 var	Signed 32	R	
Reactive power L3	0x5B22	2	0,01 var	Signed 32	R	

Function	Register Address	Register Number	Unit	Format	Access (R/W)	Note
Apparent power Total	0x5B24	2	0,01 VA	Signed 32	R	
Apparent power L1	0x5B26	2	0,01 VA	Signed 32	R	
Apparent power L2	0x5B28	2	0,01 VA	Signed 32	R	
Apparent power L3	0x5B2A	2	0,01 VA	Signed 32	R	
Frequency	0x5B2C	2	0,01 Hz	Unsigned 32	R	
Unused registers	0x5B2D-0x5B39	1				Not implemented, readout 0xffff or 0x0000
Power factor Total	0x5B3A	1	0,001	Unsigned 16	R	0.000-1.000
Power factor L1	0x5B3B	1	0,001	Unsigned 16	R	0.000-1.000
Power factor L2	0x5B3C	1	0,001	Unsigned 16	R	0.000-1.000
Power factor L3	0x5B3D	1	0,001	Unsigned 16	R	0.000-1.000

16. CE approval

The risk assessment

We

Bernecker Engineering

at

Fichtenstrasse 16
4611 Buchkirchen
Austria / Europe

ensure and declare that the apparatus:

MPM3PM series

With the measurement range

3x230/400VAC, 50 Hz, 10(100)A 400imp/kWh

Complies with all applicable directives and harmonized standards or normative documents, and therefore all applicable risks that are imposed by the instrument are covered and will be labelled with logo.

CE

September 7th, 2017

Günther Bernecker DI(FH), Bernecker Engineering
(we sign with signature only)

e mv consulting
Elektromagnetische Verträglichkeit -•- Elektrische Sicherheit
Beratung -•- Planung -•- Projektbegleitung
Dipl. Ing. Wilfried Ottinger A 4872 Neukirchen, Hauptstraße 2
+43 (0)7682 - 7609 office@emvconsulting.at

EMV
Prüfbericht

Elektromagnetische Verträglichkeit

Report # EMVC 2017-08-15

Projekt: **3 Phasen Stromzähler**

Typ: **MPM3PM**

Hersteller: **Bernecker Engineering**

1 Prüfobjekt

1.1 Prüflingsidentifikation

Auftraggeber: Fa. Bernecker Engineering
Fichtenstrasse 16
4611 Buchkirchen
Email:
office@be.co.att

Kontaktperson: Hr. Günther Bernecker
Email:
g.bernecker@be.co.at
Phone.: +43 676 40 55
144

Prüfobjekt: 3 Phasen Stromzähler mit RS485 Ausgang

ohne PE Typ: MPM3PM

Seriennummer: 1003

Hersteller: Fa. Bernecker Engineering

Betriebsbedingungen: Normalbetrieb, RS485 sendet dauernd Prüf-

grundlage:

Generic: Emission EN61000-6-3:2007 + A1:2011

Ort der Messung: EMV - Labor EMV Consulting A-4872 Neukirchen

Datum der Messung: 25.7.2017

Bemerkungen: Die Messungen wurden in Anwesenheit von Hrn. Bernecker durchgeführt.

Ergebnis: Die Anforderungen der oben angeführten Fachgrundnorm werden erfüllt.

Umgebungsbedingungen: T = 22°C RH = 55.0%

Durchführung der Messung: Dipl. Ing. Ottinger Willy

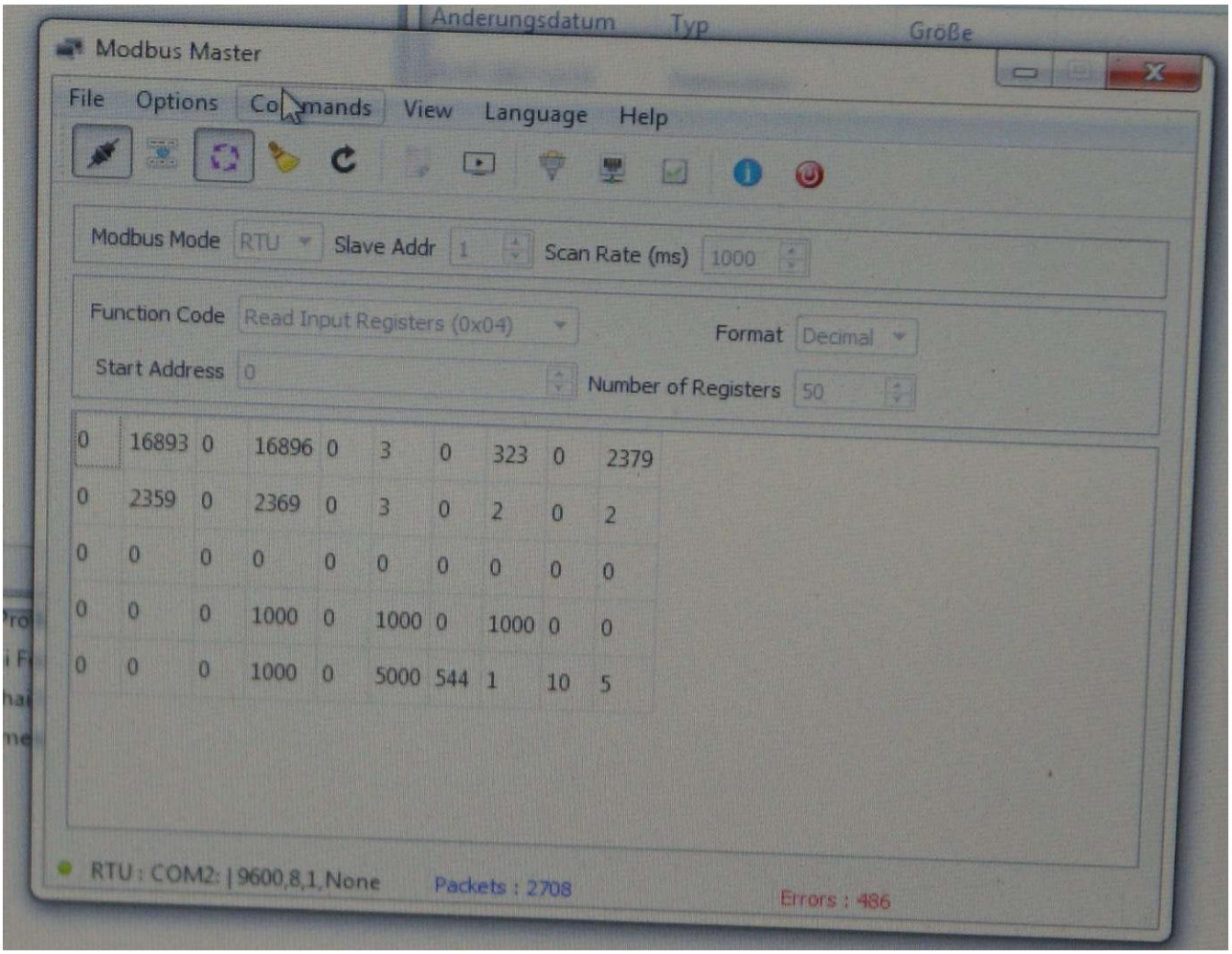
1.2 Anlagenkonfiguration: LL = Leitungslänge H/SF = Höchste Systemfrequenz

EUT: 3 Phasen Stromzähler
Typ: MPM3PM
SNR: 1003
H/W: V1.0
S/W: V1.06
H/SF: > 108MHz (141 MHz)
Versorgung: Einzel Diode in jeder Phase
Leitungen: 3x 400 V ac Zu- und Ableitung beliebig
1x RS485 LL < 30m keine Telekommunikationsnetz


BERNECKER-AUSTRIA
S0
ModBus
manual
MPM3PM
10(100)A 3x230/400VAC
50/60Hz
Class 1
IEC62053-21
IP51
400IMP/KWh
L1
L2
L3
N
2 sec settings
S1
S3
S4
PRO-SW
D14
IR
IO
S2
JTAG
UA
UB
UC

Hilfsgeräte:

USB auf RS485 Konverter und Auswertesoftware „QMODMASTER“ auf Laptop



1.4 Durchgeführte Modifikationen

- **keine**

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2 Zusammenfassung der Prüfungen :

Übereinstimmung mit der Störemissionsanforderung EN61000-6-3:2007

2.1 Störspannungsmessung 24Vdc (50 Ohm / 50 µH LISN) **EN55022 KL B**
150 kHz - 30 MHz erfüllt ☐✓ nicht erfüllt ☐

2.2 Elektromagnetische Feldstärke **EN55022 Kl B,**
Messentfernung 3m , Umrechnung auf 10 m mittels rückführbaren Hallenfaktors
10m: 30 - 230 MHz 30 dB µV/m, 230 - 1000 MHz 37 dB µV/m erfüllt ☐✓ nicht erfüllt
☐ 3m: 1000 - 3000 MHz 50 dB µV/m (AVG), 70 dB µV/m (PEAK), erfüllt ☐✓ nicht erfüllt
☐ 3m: 3000 - 6000 MHz 54 dB µV/m (AVG), 74 dB µV/m (PEAK), erfüllt ☐✓ nicht erfüllt
☐

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3 Zusammenfassung der Ergebnisse:

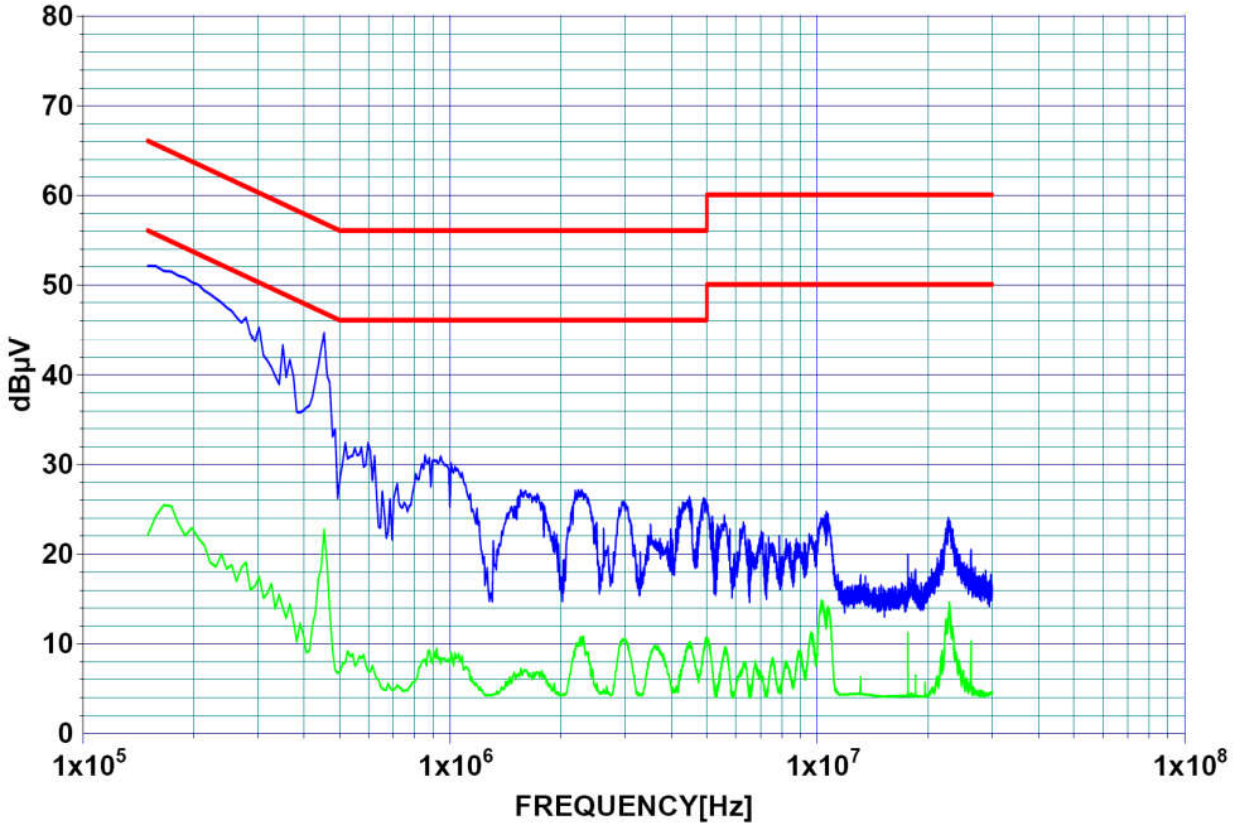
3.1 Leitungsgebundene Störungen:

Die Average Messwerte sind grün (Limit ist untere Grenzwertlinie), die Peak Messwerte blau und die Quasi Peak Werte mit blauen Sternchen (Limit ist obere Grenzwertlinie) im Diagramm dargestellt.

Die Grenzwerte für Quasipeak und Average gemäß EN55022 Klasse B werden

eingehalten. Prüflingsaufbau: Störspannung 3x400VAC Versorgung
Bild: CE

CE1 Störspannung 400Vdc CEL1 Limit EN55022 Klasse B siehe Bild:
CE Betriebsmode: Normalbetrieb, RS485 in Betrieb, Messung Neutralleiter



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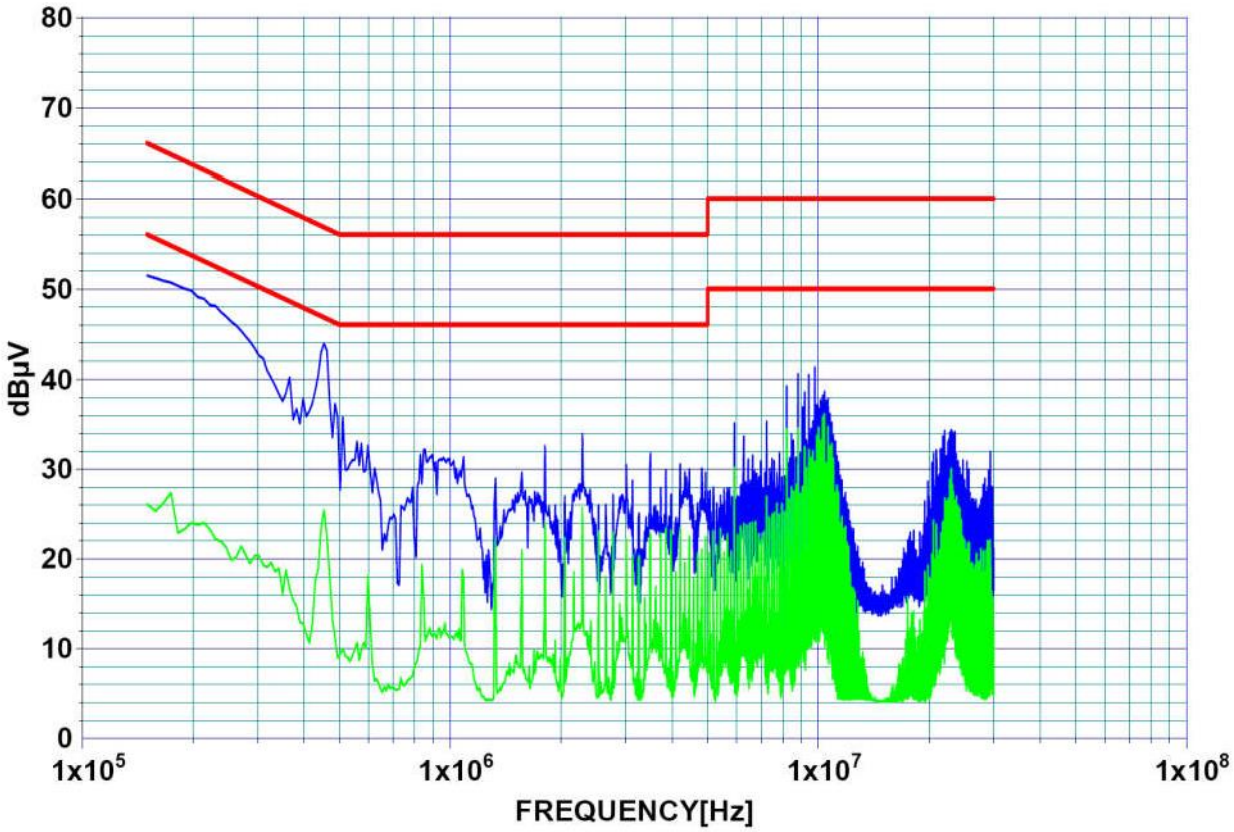
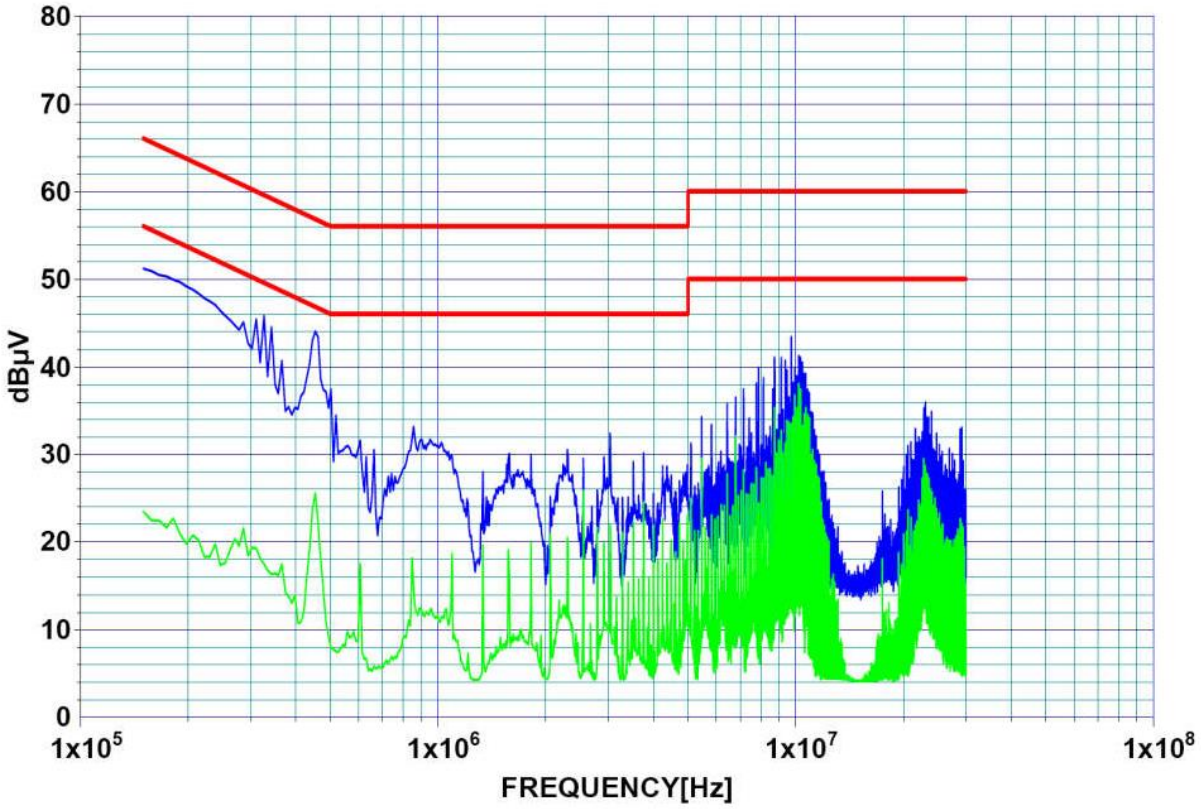
CE2 Störspannung 400Vac CEL2 Limit EN55022 Klasse B siehe Bild:
CE Betriebsmode: Normalbetrieb, RS485 in Betrieb, Messung L1

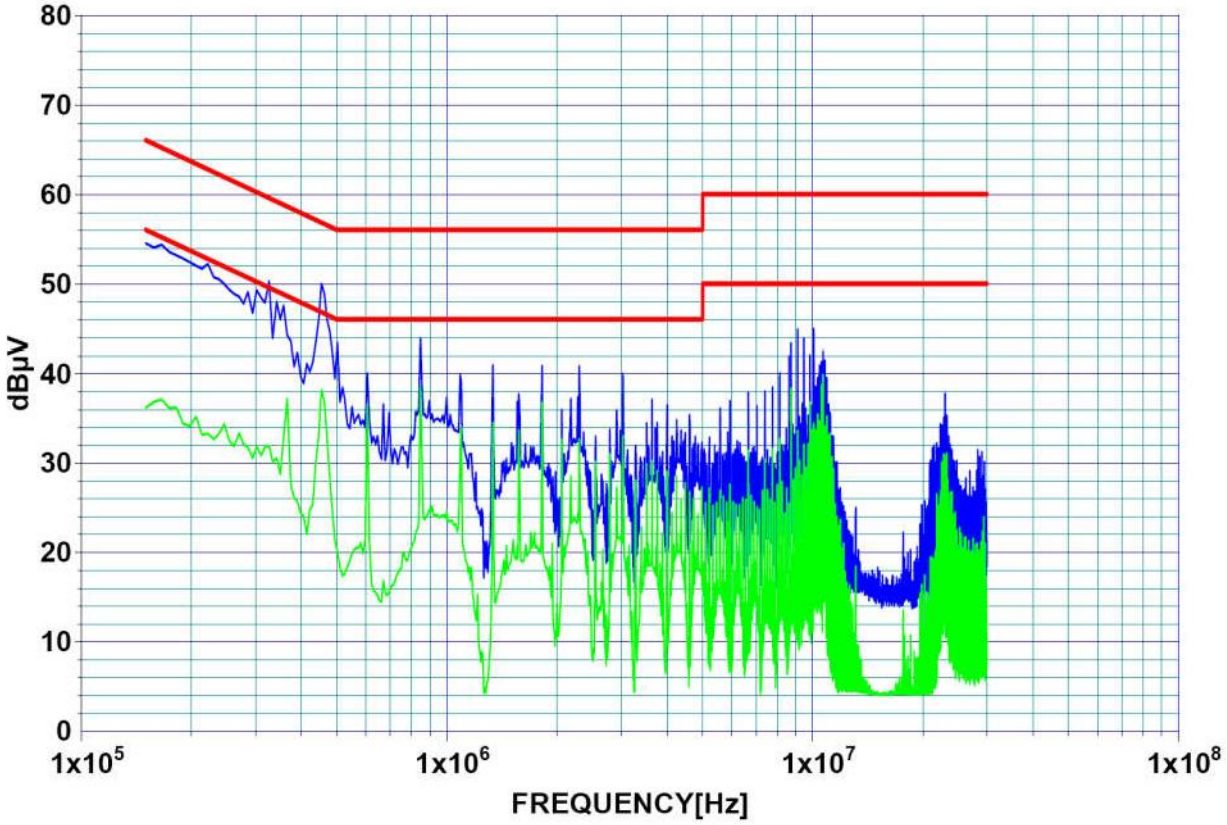


Die Anforderungen der EN61000-6-3 werden erfüllt.

CE3 Störspannung 400Vac CEL3 Limit EN55022 Klasse B siehe Bild:
CE Betriebsmode: Normalbetrieb, RS485 in Betrieb, Messung L2



CE3 Störspannung 400Vac CEN Limit EN55022 Klasse B siehe Bild:
CE Betriebsmode: Normalbetrieb, RS485 in Betrieb, Messung L3



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3.2 Abgestrahlte Störungen:

Es wurde je eine Messung mit horizontaler und vertikaler Polarisation durchgeführt. Der gesamte Messbereich von 30 MHz bis 6000 MHz wurde in 3 Teilbereiche (30 – 200 MHz, 200 - 1000 MHz und 1000 – 6000MHz) unterteilt.
Die Messentfernung betrug 3 m.

Die Grenzwerte für Quasipeak gem. EN55022 Klasse B werden ein-

gehalten. Prüflingsaufbau Emissionsmessungen:
Bild: RE1V

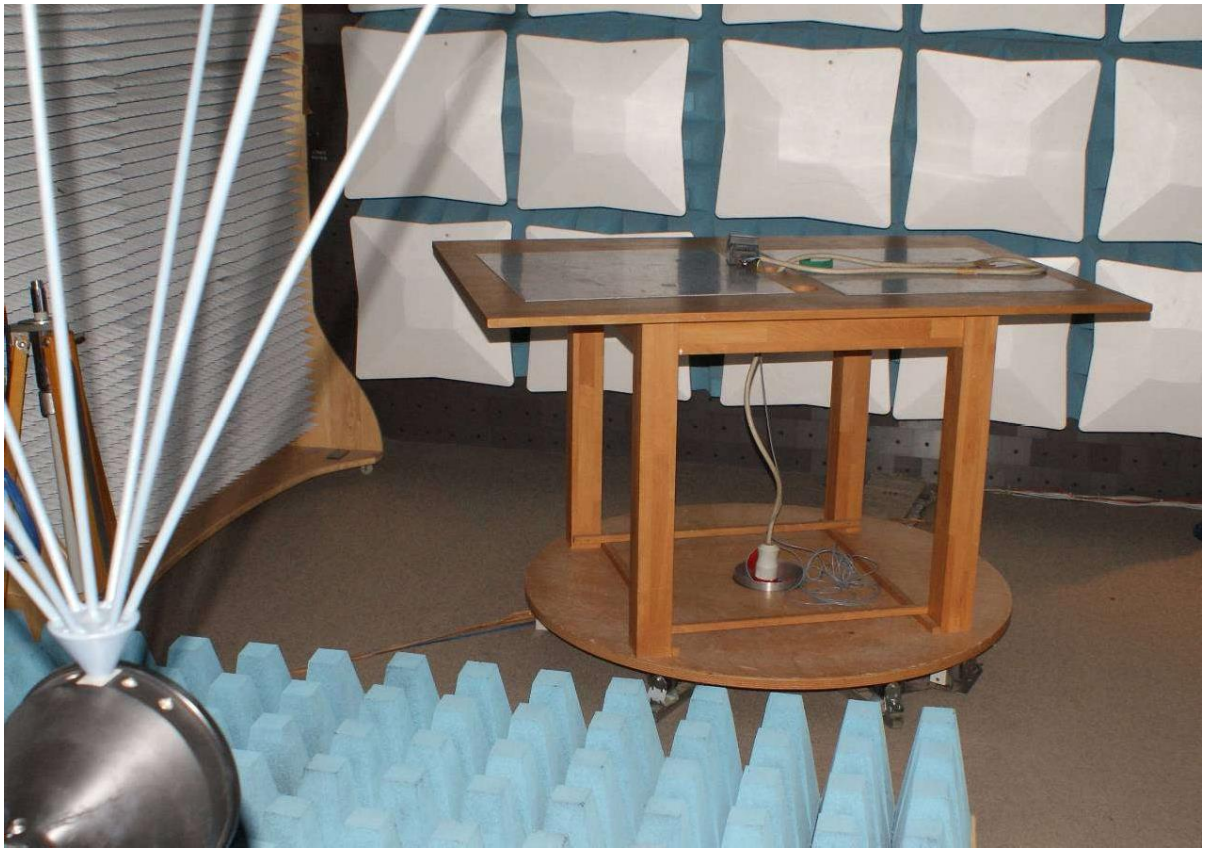

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Bild:

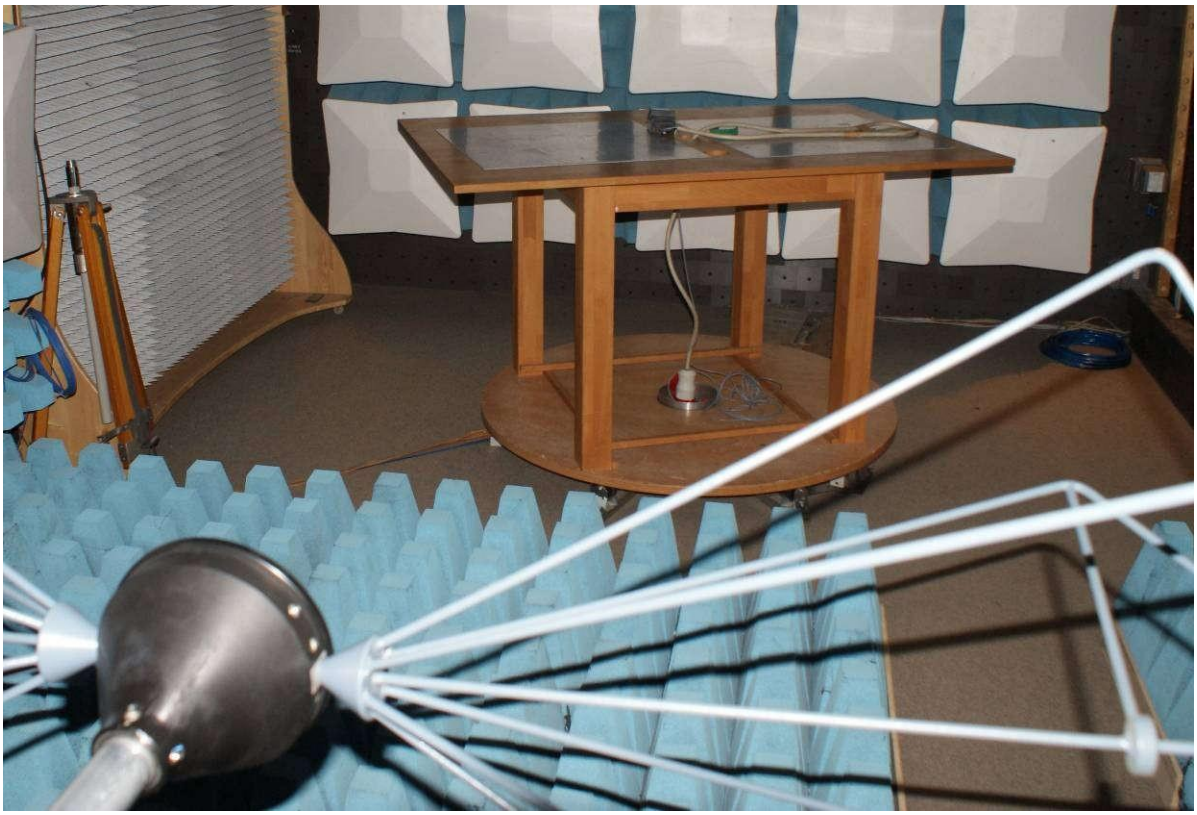

Bild: RE2V

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Bild:

Bild: RE3V

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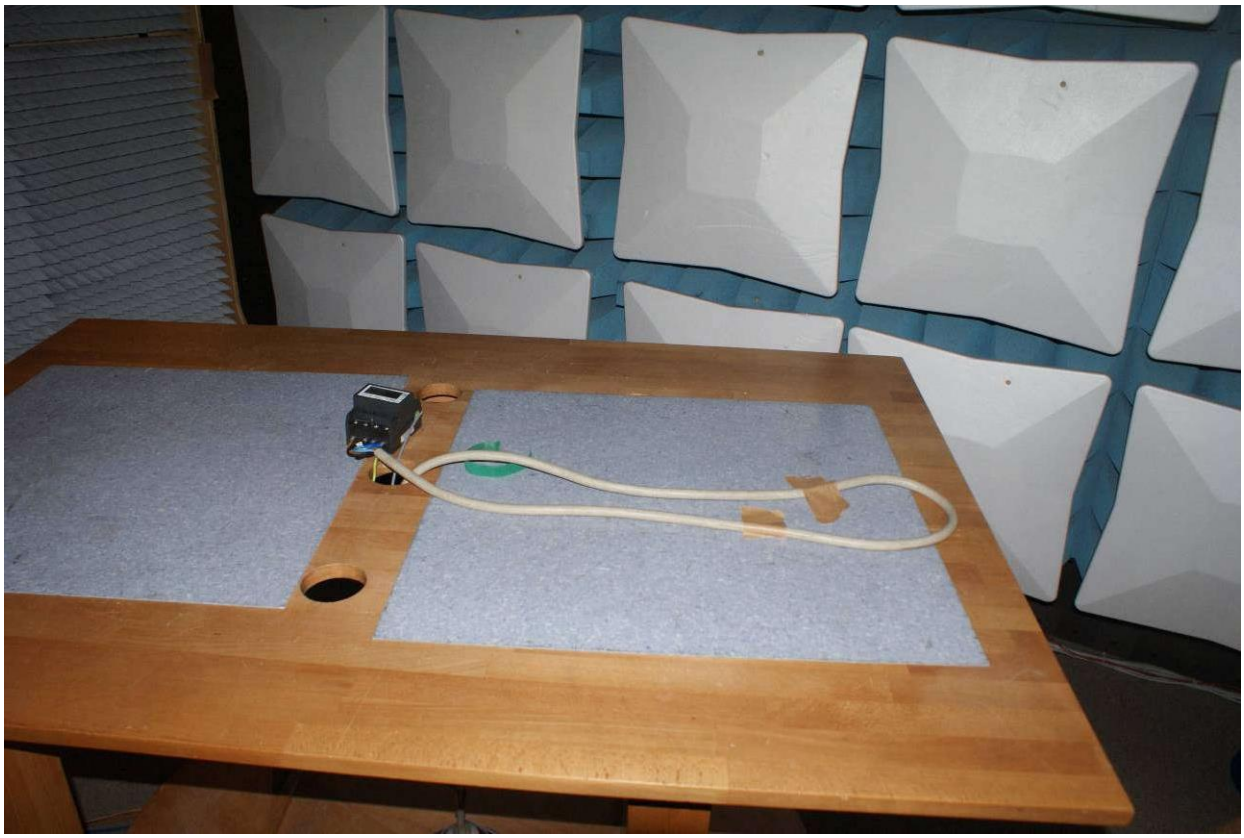
Bild:

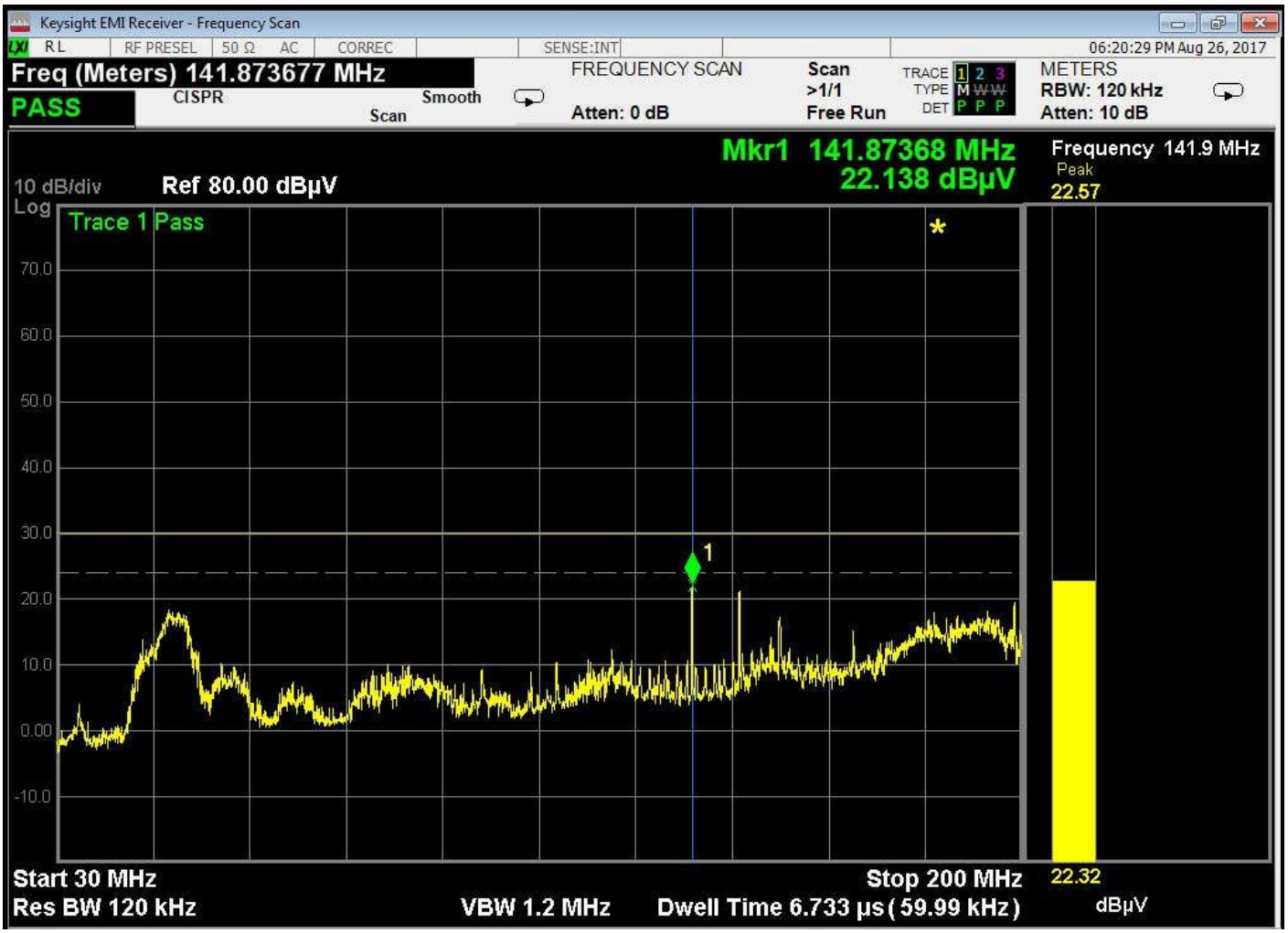
Bild: REx_1



Störfeldstärke 30 MHz – 200 MHz siehe Bild
RE1V vertikale Polarisation
Normalbetrieb, alles aktiv RS485 sendet dauernd

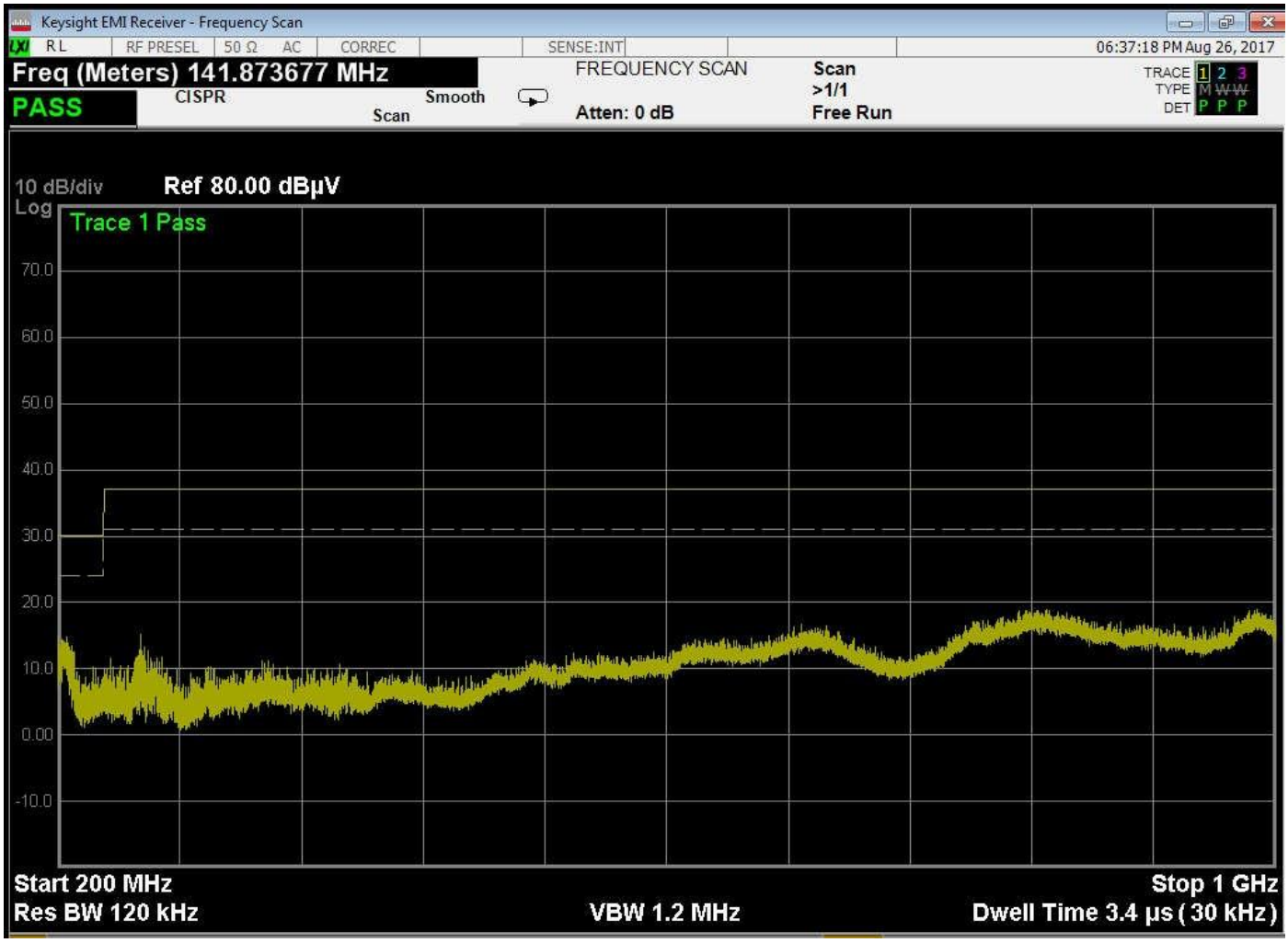
Signal	Frequenz [MHz]	Peak Amp [dB µV/m]	Q-Peak Amp [dB µV/m]	Limit Q-Peak Amp [dB µV/m]	Result Pass / Fail
1				30	
2				30	
3				30	
4				30	
5				30	

Störfeldstärke 30 MHz – 200 MHz siehe Bild
RE1H horizontale Polarisation
Normalbetrieb, alles aktiv RS485 sendet dauernd



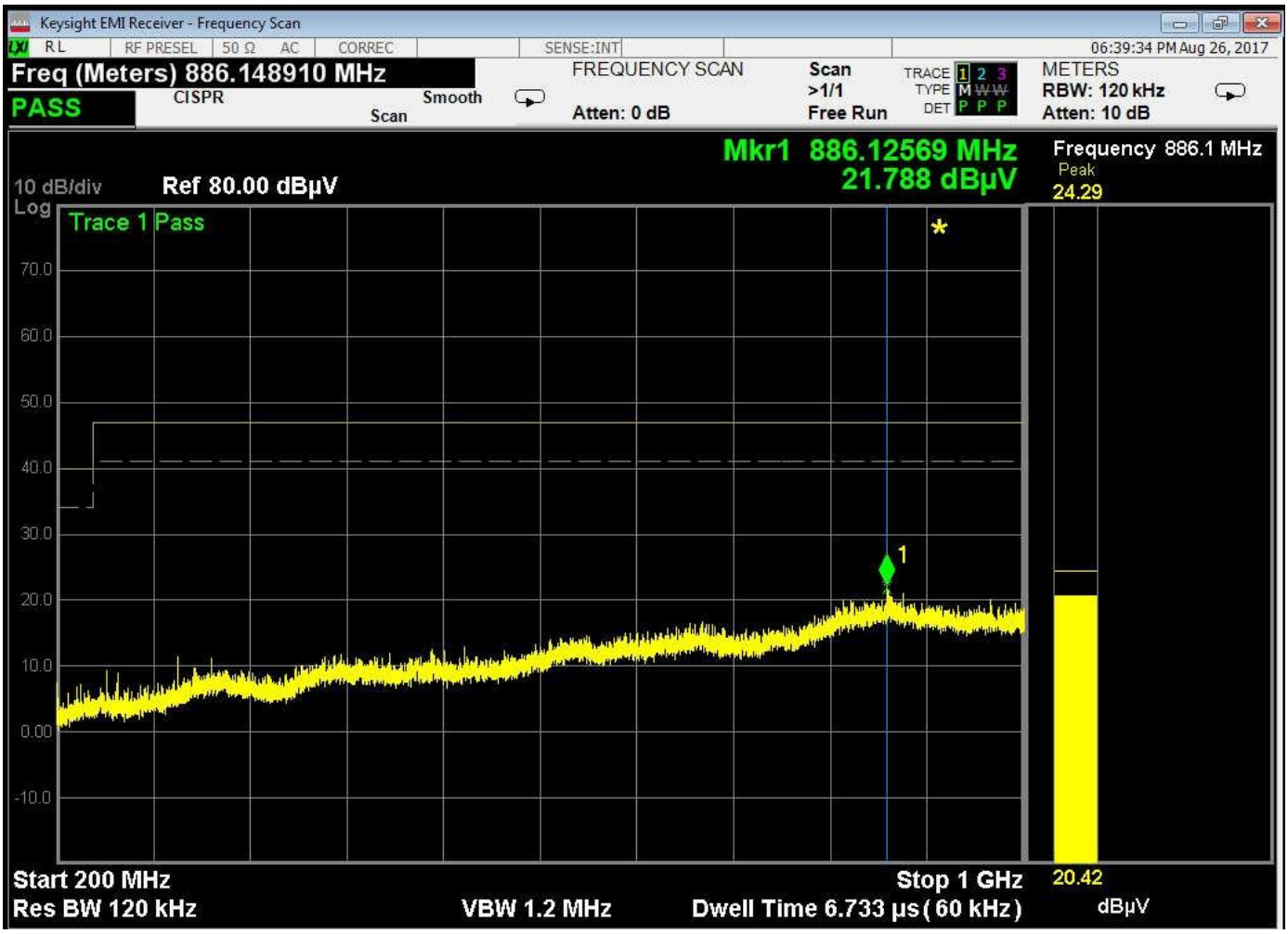
Signal	Frequenz [MHz]	Peak Amp [dB µV/m]	Q-Peak Amp [dB µV/m]	Limit Q-Peak Amp [dB µV/m]	Result Pass / Fail
1	79,981650	23,86	23,29	30	Pass
2	119,995938	23,32	22,29	30	Pass
3	159,996588	25,64	24,01	30	Pass
4				30	
5				30	

Störfeldstärke 200 MHz – 1000 MHz siehe Bild
RE2V vertikale Polarisation
Normalbetrieb, alles aktiv RS485 sendet dauernd



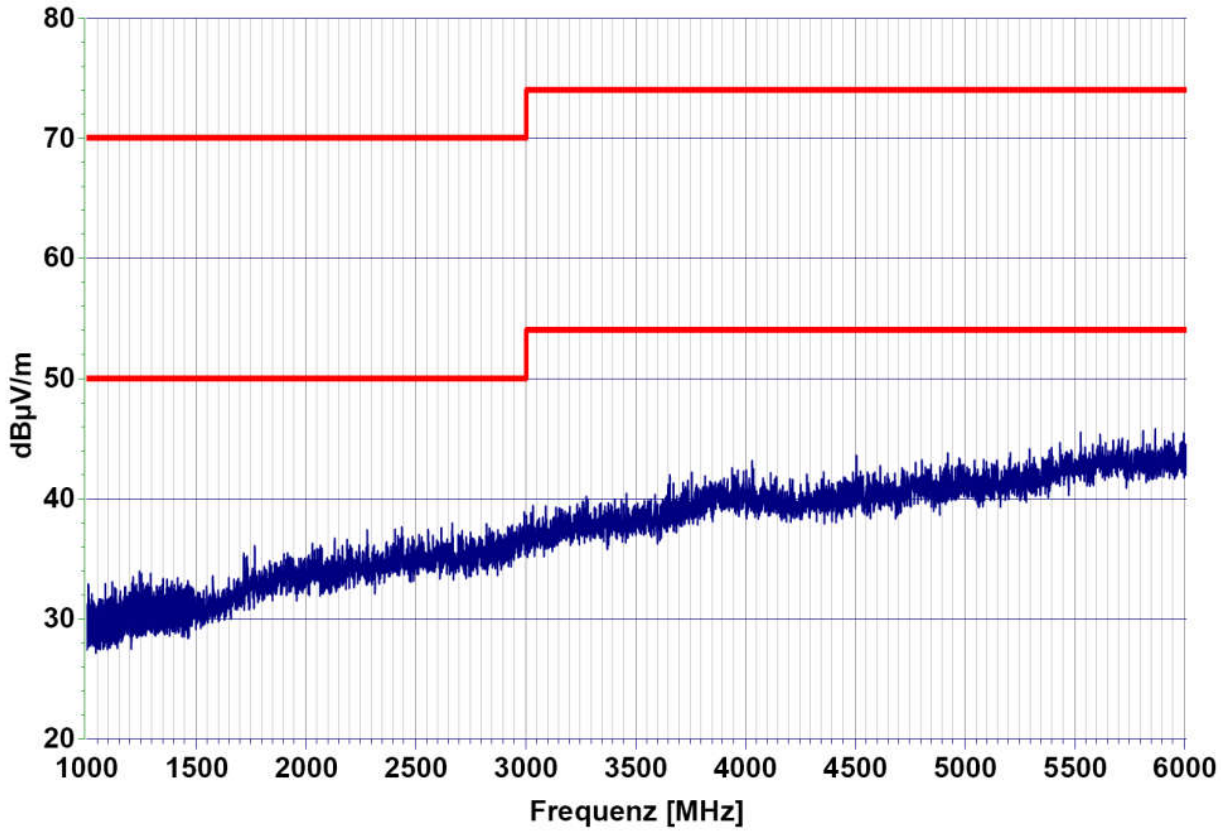
Signal	Frequenz [MHz]	Peak Amp [dB µV/m]	Q-Peak Amp [dB µV/m]	Limit Q-Peak Amp [dB µV/m]	Result Pass / Fail
1	79,981650	23,86	23,29	30	Pass
2				30	
3				30	
4				30	
5				30	

Störfeldstärke 200 MHz – 1000 MHz siehe Bild
RE2H horizontale Polarisation
Normalbetrieb, alles aktiv RS485 sendet dauernd

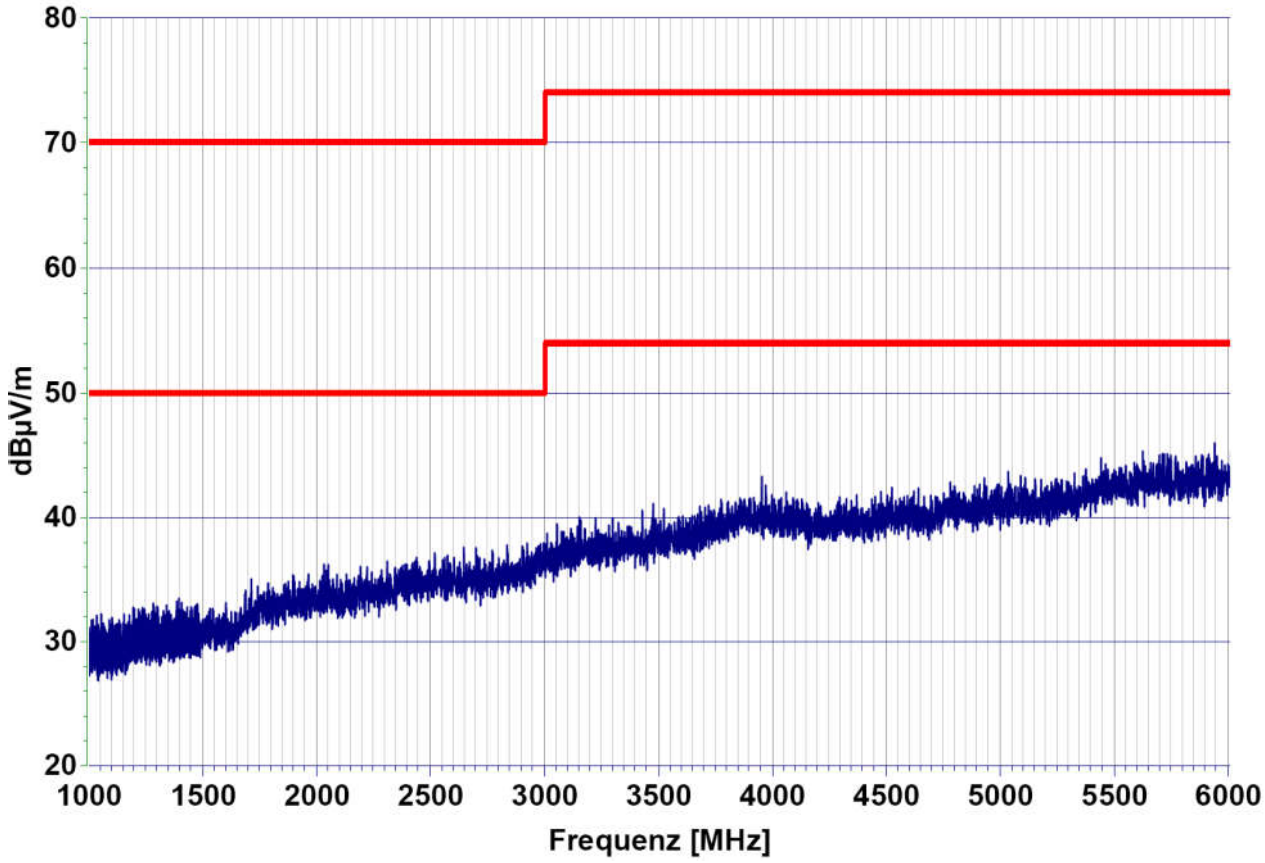


Signal	Frequenz [MHz]	Peak Amp [dB µV/m]	Q-Peak Amp [dB µV/m]	Limit Q-Peak Amp [dB µV/m]	Result Pass / Fail
1	119,995938	23,32	22,29	30	Pass
2				30	
3				30	
4				30	
5				30	

Störfeldstärke **1000 MHz – 6000 MHz** siehe Bild
RE3V vertikale Polarisation
Detektor = Peak (Grenzwert ist obere Grenzwertlinie)
AVERAGE (Grenzwert ist obere Grenzwert-linie)
Normalbetrieb, alles aktiv RS485 sendet dauernd



Störfeldstärke 1000 MHz – 6000 MHz siehe Bild
RE3H **horizontale Polarisation**
Detektor = Peak (Grenzwert ist obere Grenzwertlinie)
AVERAGE (Grenzwert ist obere Grenzwert-linie)
Normalbetrieb, alles aktiv RS485 sendet dauernd



Die Anforderungen der EN61000-6-3 werden eingehalten.

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4 Verwendete Messgeräte: STAND 08 / 2017

Gerät	Type	Hersteller	Seriennummer	Inventar Nr:	
Spektrumanalysator	hp8591EM	hp	3536A00453	EC 0002	☐
Spektrumanalysator	FSV_30	Rhode&Schwarz	100994	EC 0200	☐✓
Spektrumanalysator	hp8591EM	hp	310BU00256	EC 0078	☐
Vorverstärker	hp8447D Opt. 10	hp	2944A07193	EC 0031	☐✓
Messempfänger	N90038	keysight	MY53220120	EC 0263	☐✓
Vorverstärker	SFT84-1309 (1,5 8GHz)	Avantek	8544SN02	EC 0094	☐
Vorverstärker	AFT-18854 (5-18 GHz)	Avantek	8742-k409	EC 0095	☐
Vorverstärker	CSA-B70126 (2-8GHz)	Celeritek	2100	EC 0083	☐
Vorverstärker	145767Rev A(5-18GHz)	CTT	2250	EC 0084	☐
Vorverstärker	AM-2A-000110-N	MITEQ	369674	EC 0053	☐✓
Bikonische Antenne	HK116	Rohde&Schwarz	844416/003	EC 0032	☐✓
Log. per Antenne	HL223	Rohde&Schwarz	843990/020	EC 0033	☐✓
Ultralog Antenne	HL 562	Rohde&Schwarz	100027	EC0100	☐
DRG Horn 1-18GHz	3115	EMCO	2652	EC0077	☐✓
Loop Antenne	HFH2-Z2	Rohde&Schwarz	880665/7	EC0060	☐
Electrical Antenna	HFH2-Z1	Rohde&Schwarz	880563/022	EC0059	☐
Netznachbildung	NSLK 8127 (V2 Phasen)	Schwarzbeck	8127111	EC 00	☐
Netznachbildung	ESH2-Z5 (V3Phasen)	Rohde&Schwarz	881493/0010	EC 0001	☐✓
Netznachbildung	EZ10 (T-4Draht)	Rohde&Schwarz	816.1255.02	EC0081	☐
Pulslimiter	Model 3752	Pomona	n.a.	EC 0023	☐✓
Stromzange	ESV-Z1	Rohde&Schwarz	829.536/9	EC 0051	☐
Stromzange	ESV-Z1	Rohde&Schwarz	829/1001/20	EC 0079	☐
Fixdämpfungsglied	Spinner 10 dB	Spinner		EC 0071	☐✓
Signalgenerator	APN	Rohde&Schwarz	883873/006	EC 0064	☐
Signalgenerator	SMG. Opt 1,2	Rohde&Schwarz	830338/007	EC 0014	☐
Signalgenerator	SMH. Opt 1,2	Rohde&Schwarz	832311/015	EC 0082	☐
Signalgenerator	SMF100A	Rohde&Schwarz	100122	EC 0148	☐
Leistungsmesser	URY	Rohde&Schwarz	882.852/047	EC 0058	☐
Leistungsmesser	URV5	Rohde&Schwarz	879945/076	EC 0003	☐
Leistungsmesser	URV35	Rohde&Schwarz	864262/052	EC 0011	☐
Richtkoppler	DC 6180	AR	16549	EC0061	☐
Richtkoppler	DC 100 R	Kalmus	051195-3	EC0041	☐
Messkopf 10V	URV5-Z2	Rohde&Schwarz	825.938/015	EC 0040	☐
Messkopf 10V	URVY-Z2	Rohde&Schwarz	891.649/04	EC 0062	☐
Messkopf 18GHz	NRV-Z1	Rohde&Schwarz	890211/026	EC 0068	☐
Messkopf 18GHz	NRV-Z1	Rohde&Schwarz	860462/005	EC 0074	☐
Messkopf 100V	URV5-Z4	Rohde&Schwarz	890.922//2	EC 0038	☐
Messkopf	URV5-Z7	Rohde&Schwarz	891 931	EC00557	☐
HF-Verstärker	AR25W1000	Amplifi.Research	20721	EC 0034	☐
HF-Verstärker	AR30W250	Amplifi.Research	20667	EC 0035	☐
HF-Verstärker	3100LA	ENI	263	EC 0099	☐
HF-Verstärker	VZL 6940K1DHJ	VARIAN 1-2GHz	66634	EC 0069	☐
HF-Verstärker	8020H	Hughes 2-4GHz	Ohne	EC 0097	☐
HF-Verstärker	VZC 6990K1	VARIAN 4-8GHz	Ohne	EC 0098	☐
HF-Verstärker	VZM 6990K1	VARIAN 8-18GHz	5608	EC 0096	☐
Stripline	STPL 1	Kretz-Technik			☐
Feldsensor	EMR-20	Wandel-Golterm.	B0063	EC 0042	☐
Feldsensor	HI 4422	Holaday Industr.	89204	EC 0043	☐
Feldanzeige	HI 4416	Holaday Industr.	84554	EC 0044	☐
ESD Pistole	ESD 30	EM-Test	1094/27	EC 0050	☐
Burst, Surge, Pwrfail	UCS 500	EM-Test	0879-45	EC 0029	☐
Burstgenerator	EFT500	EM-Test	0195-02	EC 0048	☐
Koppelstrecke	HFK	EM-Test	1194-15		☐

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Messempfänger	ESHS10	Rohde&Schwarz	832970/004	EC 0052	☐✓
Messempfänger	ML422B	Anritsu	M42347	EC 0039	☐
Stromzange	TEK P 6302	Tektronix	B078174	EC0065	☐
Koppelnetzwerk	IEC1000-4-6 M3	MEB	11214	EC 0010	☐
Koppelnetzwerk	IEC1000-4-6 AF4	MEB	11373	EC 0003	☐
Koppelnetzwerk	IEC1000-4-6 S25	MEB	11317	EC 0012	☐
Koppelnetzwerk	IEC1000-4-6 M5	EM_Test	5100102330012	EC 0093	☐
Koppelnetzwerk	IEC1000-4-6 A150	TESEQ	33744	EC 0236	☐
Koppelnetzwerk	IEC1000-4-6 M4	Schlöder	A2460004	EC 02356	☐
Koppelnetzwerk	IEC1000-4-6 S4 USB	Schlöder	A5150035	EC 0258	☐
Koppelnetzwerk	IEC1000-4-6 S8 LAN	Schlöder	A3150070	EC 0257	☐
Helmholtzspule	IEC1000-4-8	EMVC			☐
Koppelzange	IEC1000-4-6 EM101	LÜTHI	35711	EC 0124	☐
Absorberraum	3 m FAR Chamber	Bell. Lee Intec Ltd	80541	EC	☐✓
Netzteil modulierbar	OPC 25-4M	Kepco	94255		☐
Voltmeter	Modell 45	Fluke	4875095	EC 0026	☐
Scope	64122	Agilent	MY0000657	EC 0063	☐
AC Quelle	AC1000	TTI	208472	EC0115	☐
AC Quelle	WP1200	California Instr.		EC0116	☐
Flicker/Harmonics	HA1600	TTI	208888	EC 0114	☐