

Selbstbau von USB Messtechnik



Themen

Allgemeines

Leistungsmesser

Entwicklung

Aufbau

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Messgeräte, Messplatz

Messvorführung

Der Werkzeugkasten



Schaltplan- und Layoutprogramm



HF-Simulationprogramm



Entwicklungssoftware Windows



Entwicklungssoftware Mikrocontroller

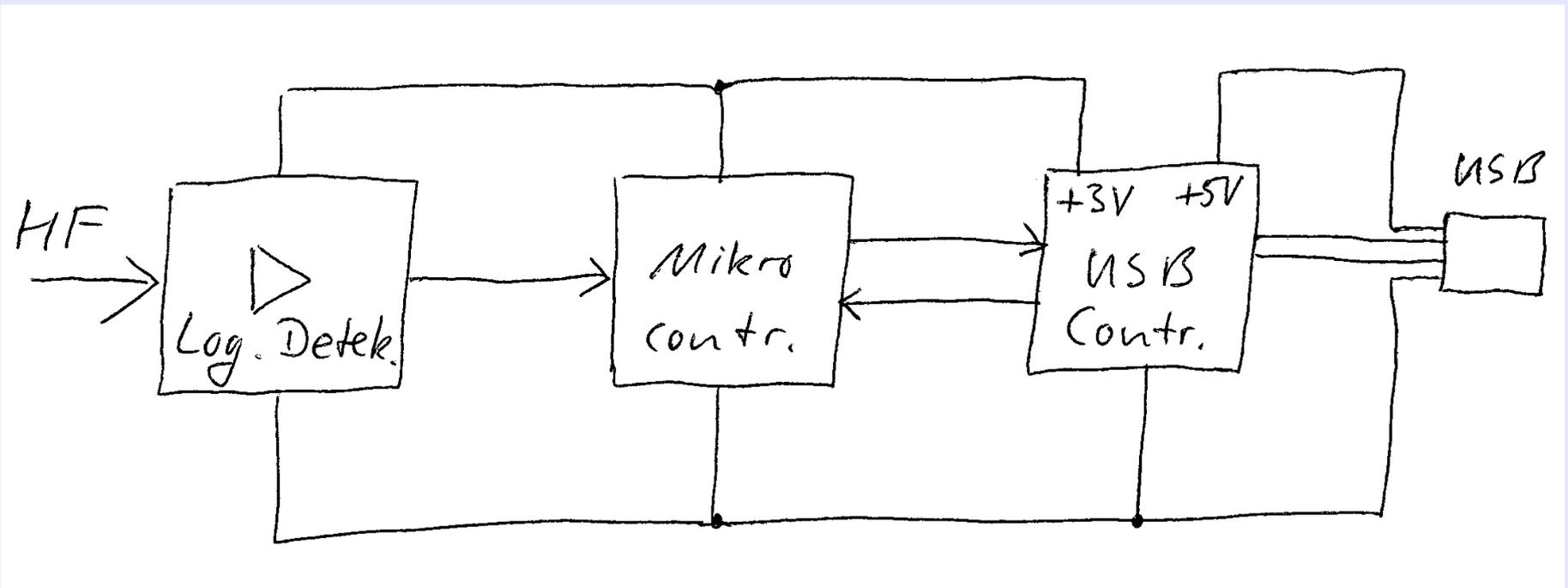


Programmiersoftware USB-Controller

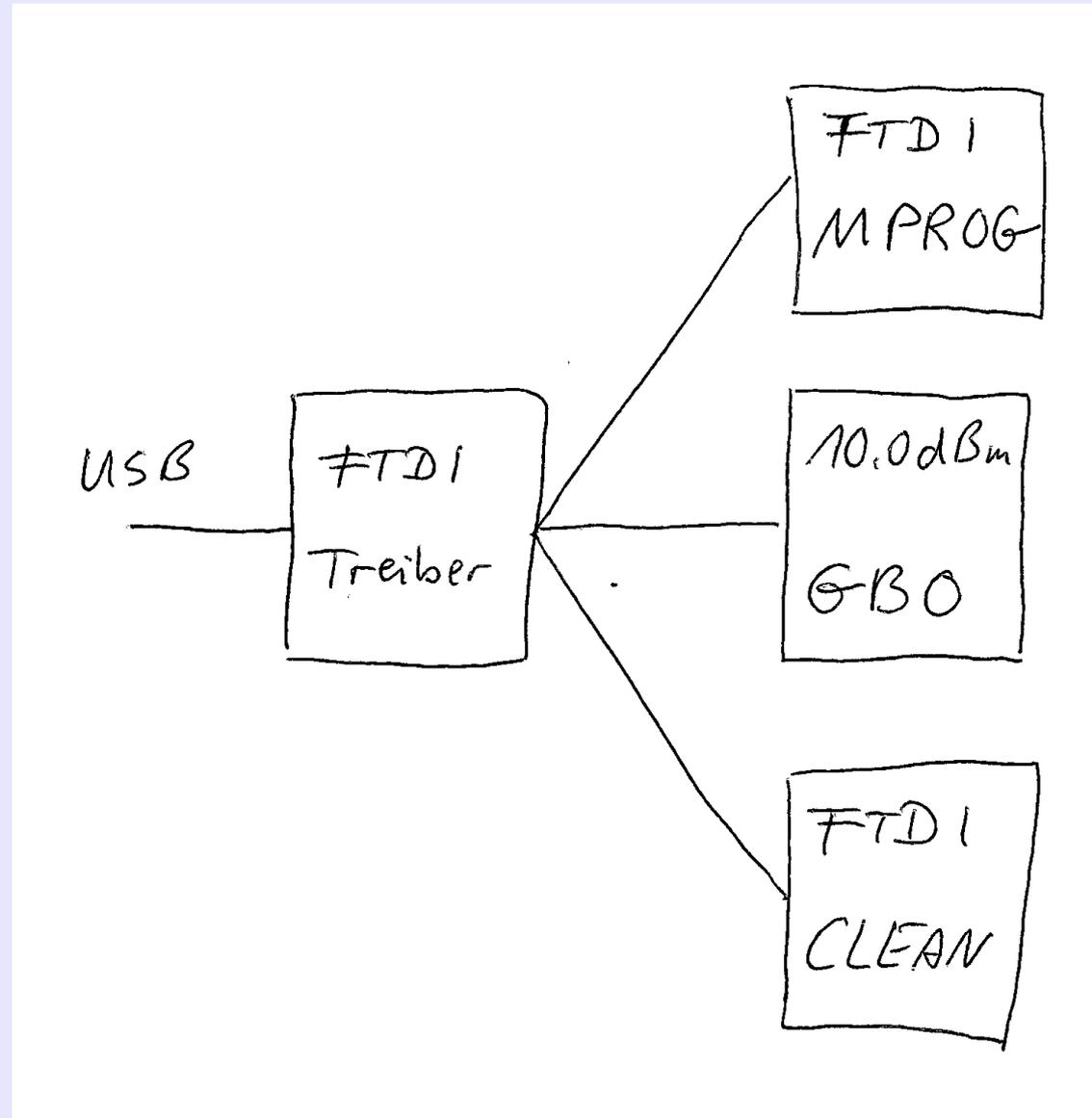


Internetbrowser

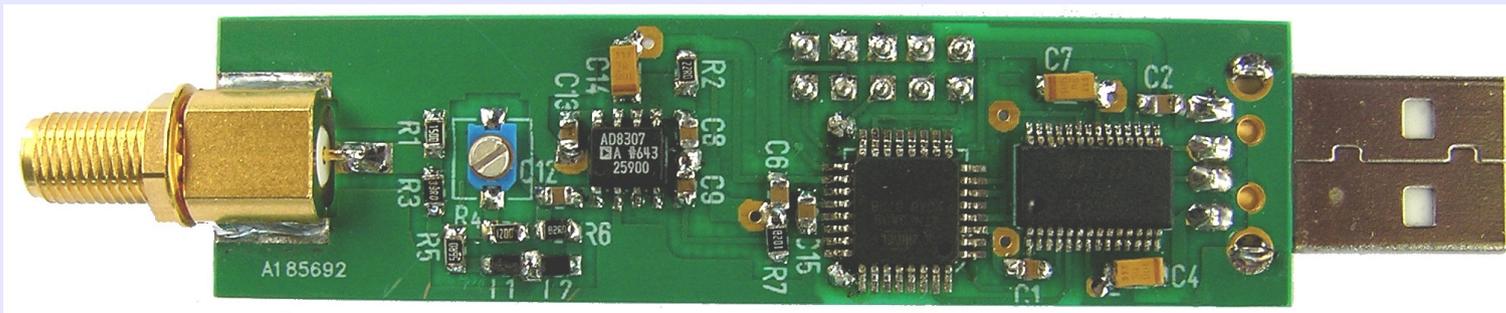
Die Idee



Software auf dem PC



Das Ergebnis



Themen

Allgemeines

Leistungsmesser

Entwicklung

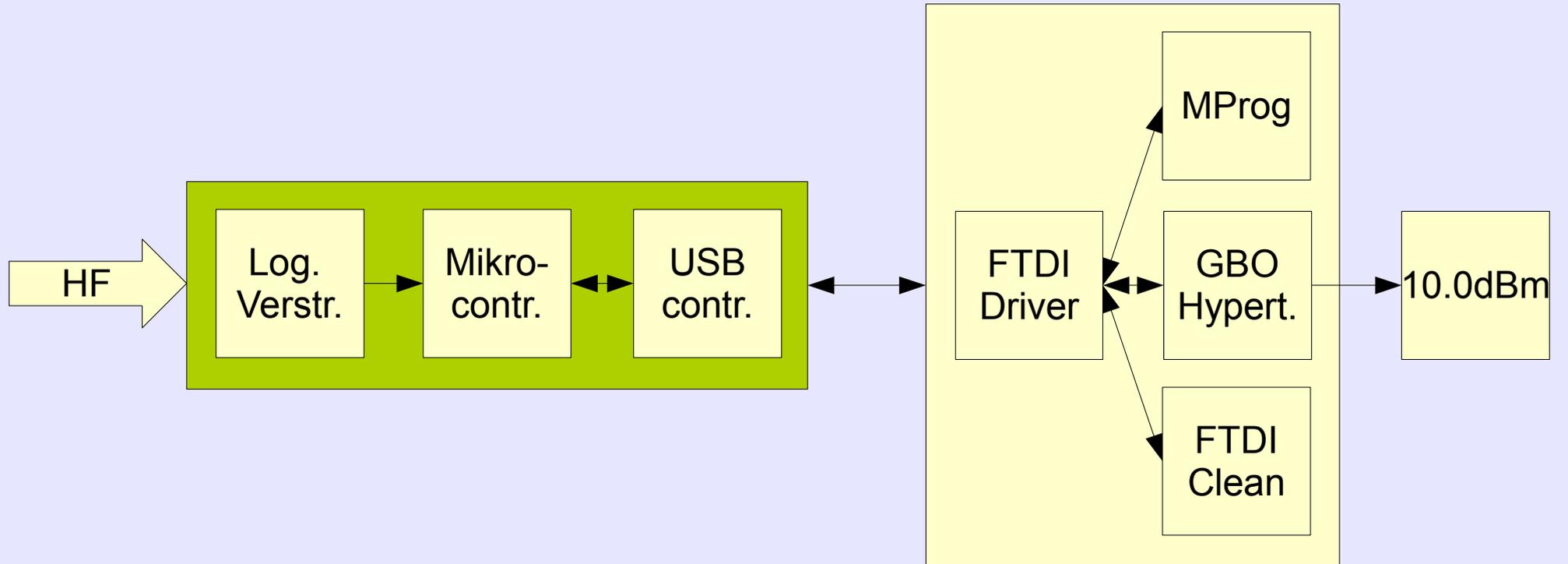
Aufbau

Inbetriebnahme

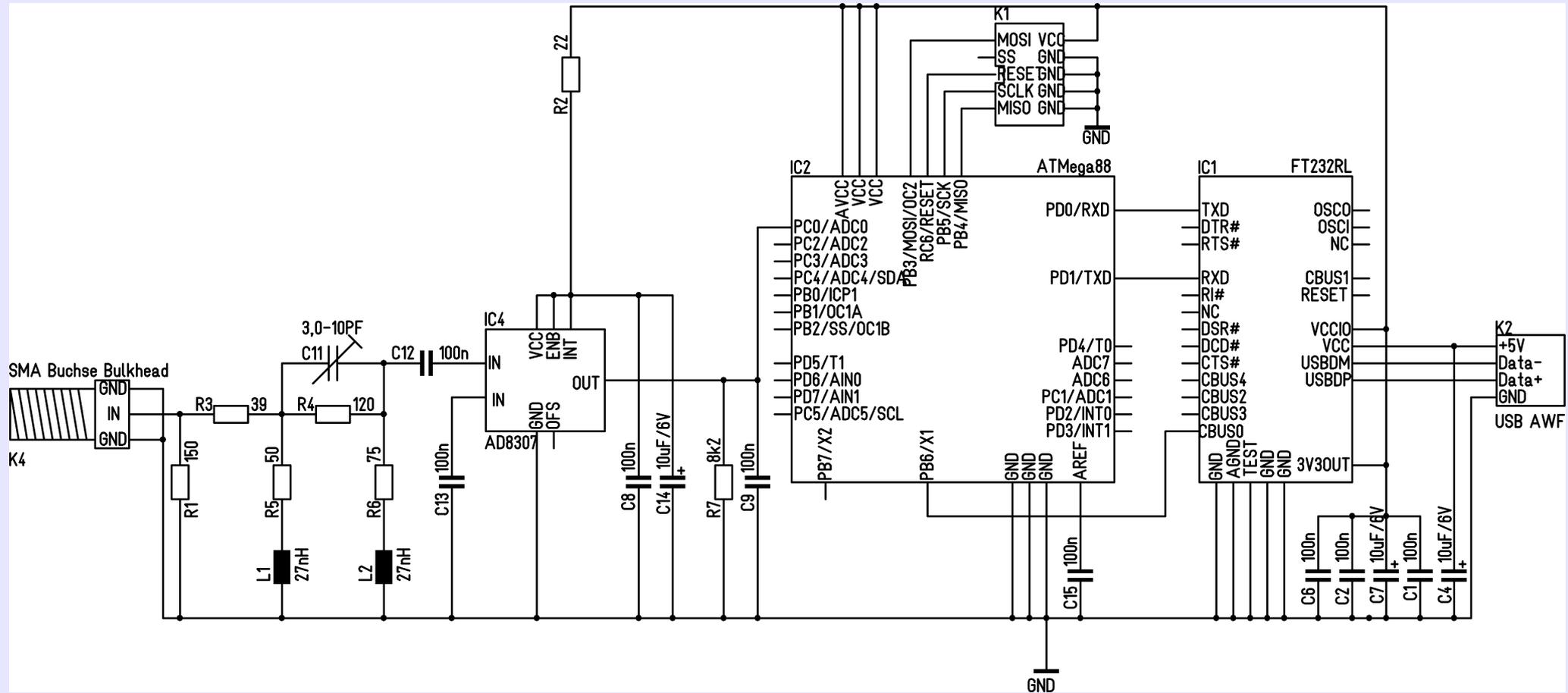
Messgeräte, Messplatz

Messvorführung

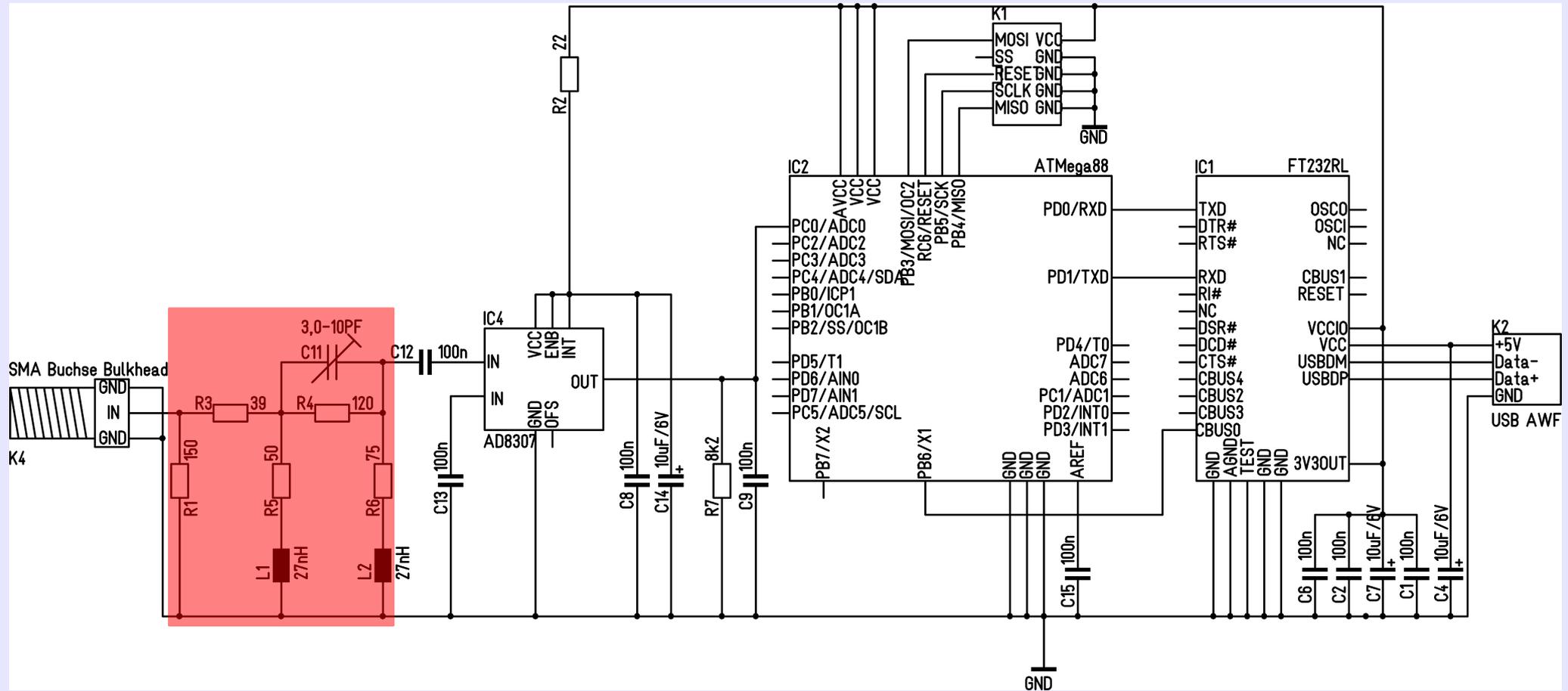
Konstruktion USB-Stick



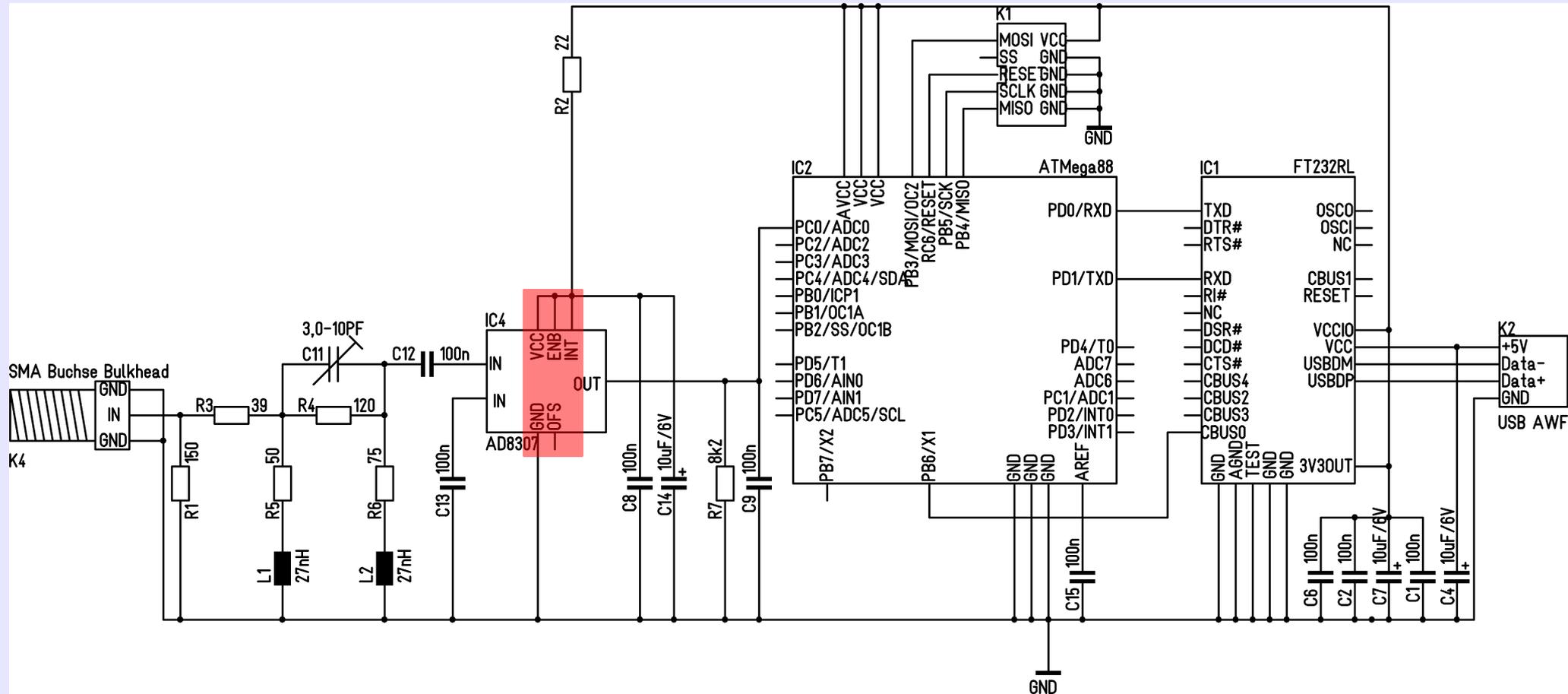
Schaltplan USB Leistungsmesser



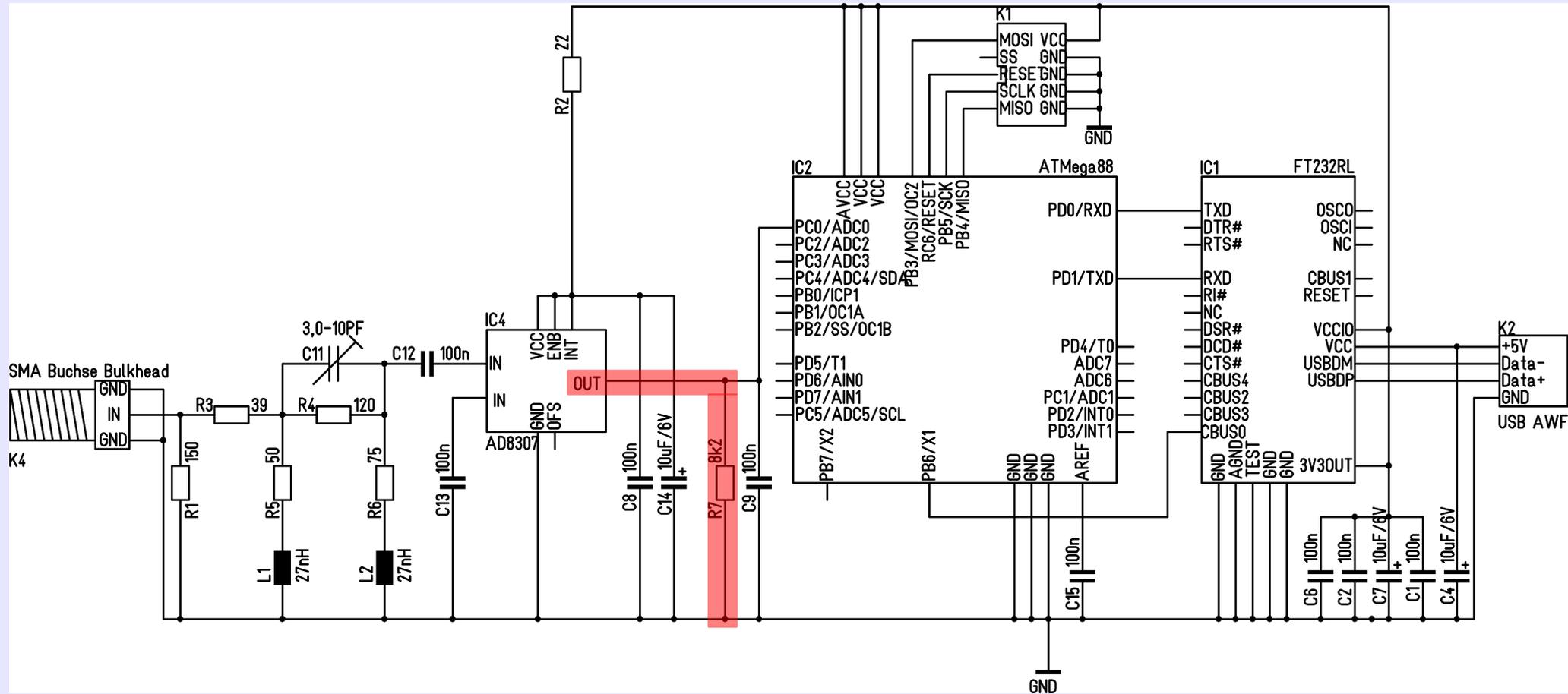
Eingangnetzwerk



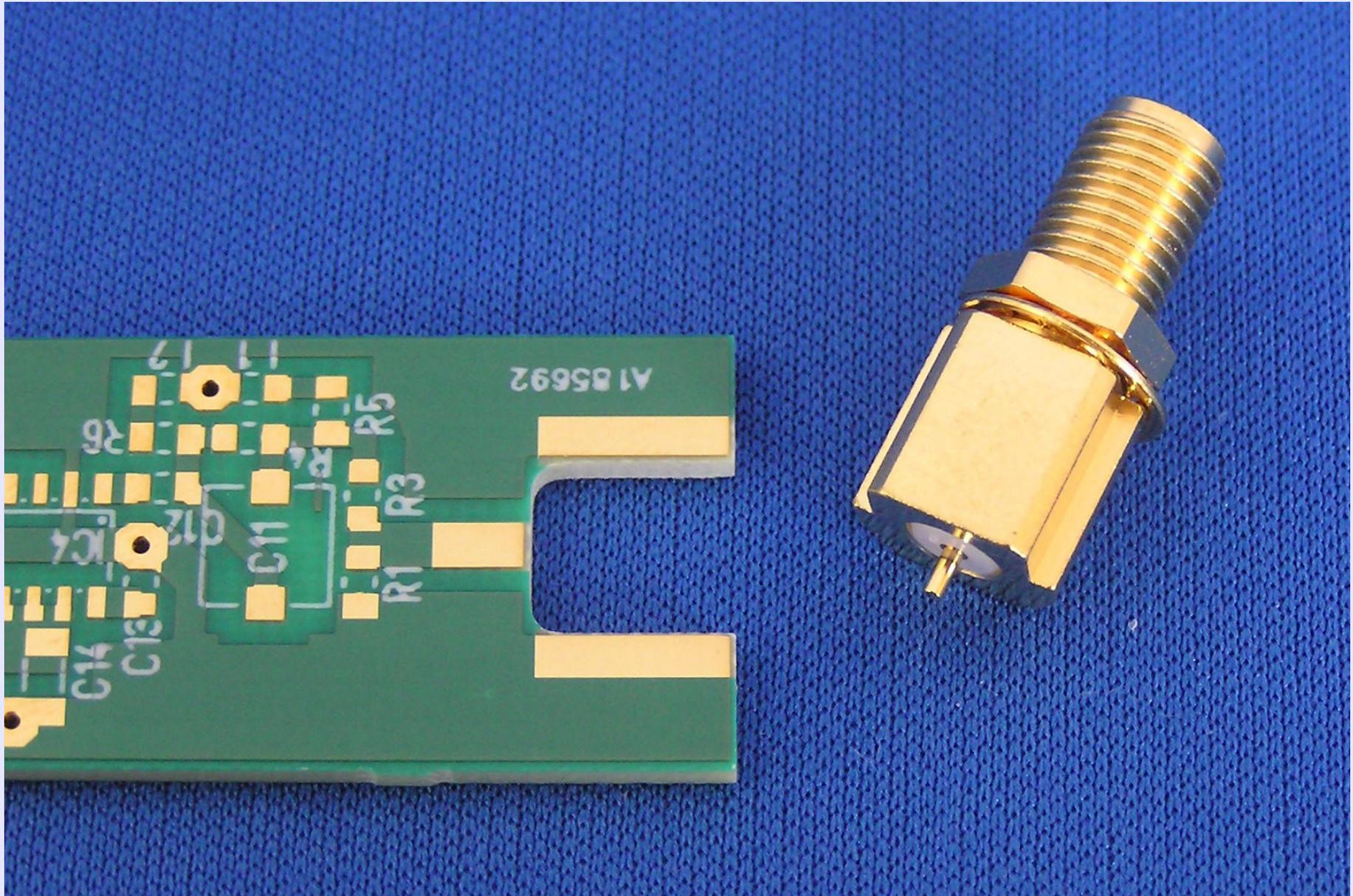
Intercept und Offset haben feste Werte



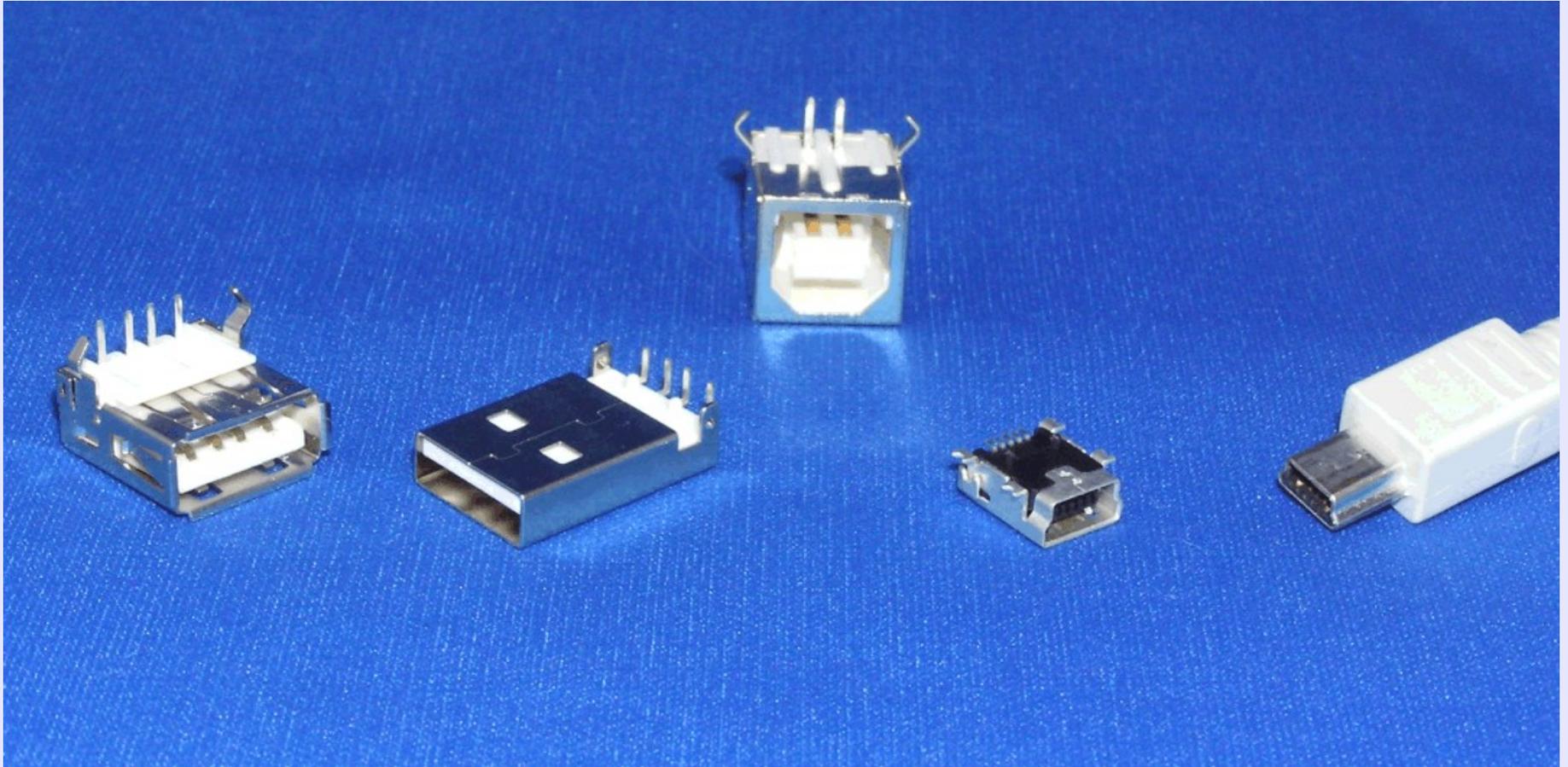
Slope mit R7 auf Uout max. 1.1Volt



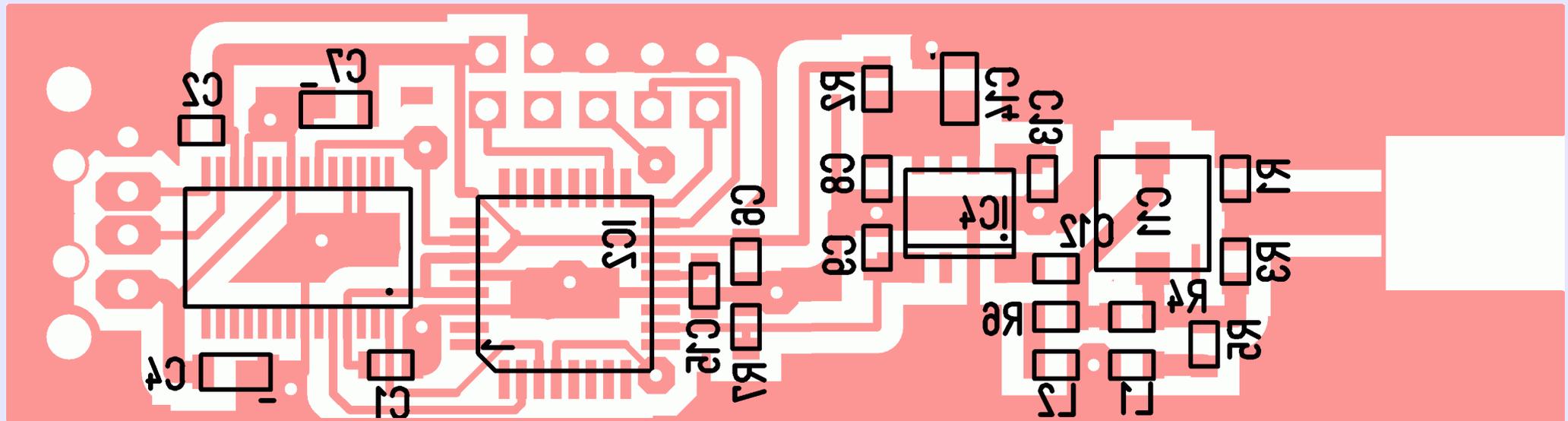
SMA Buchse Kartenrand



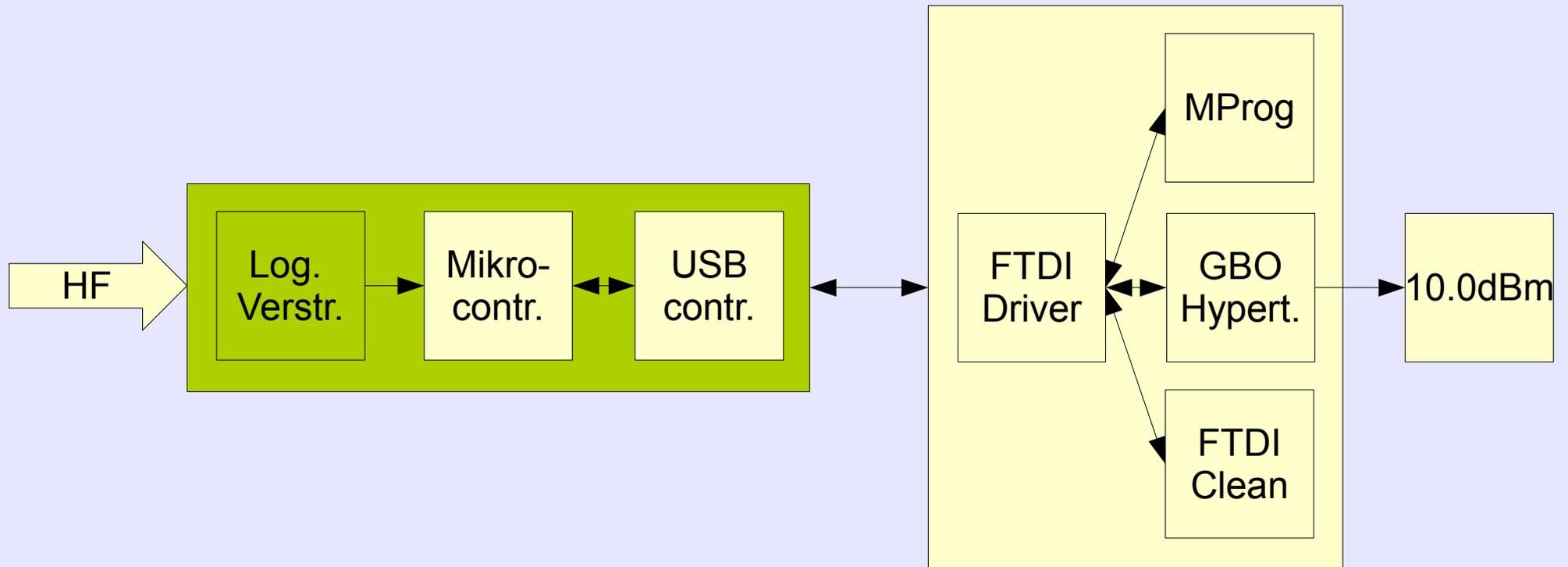
USB-Stecker/Buchsen



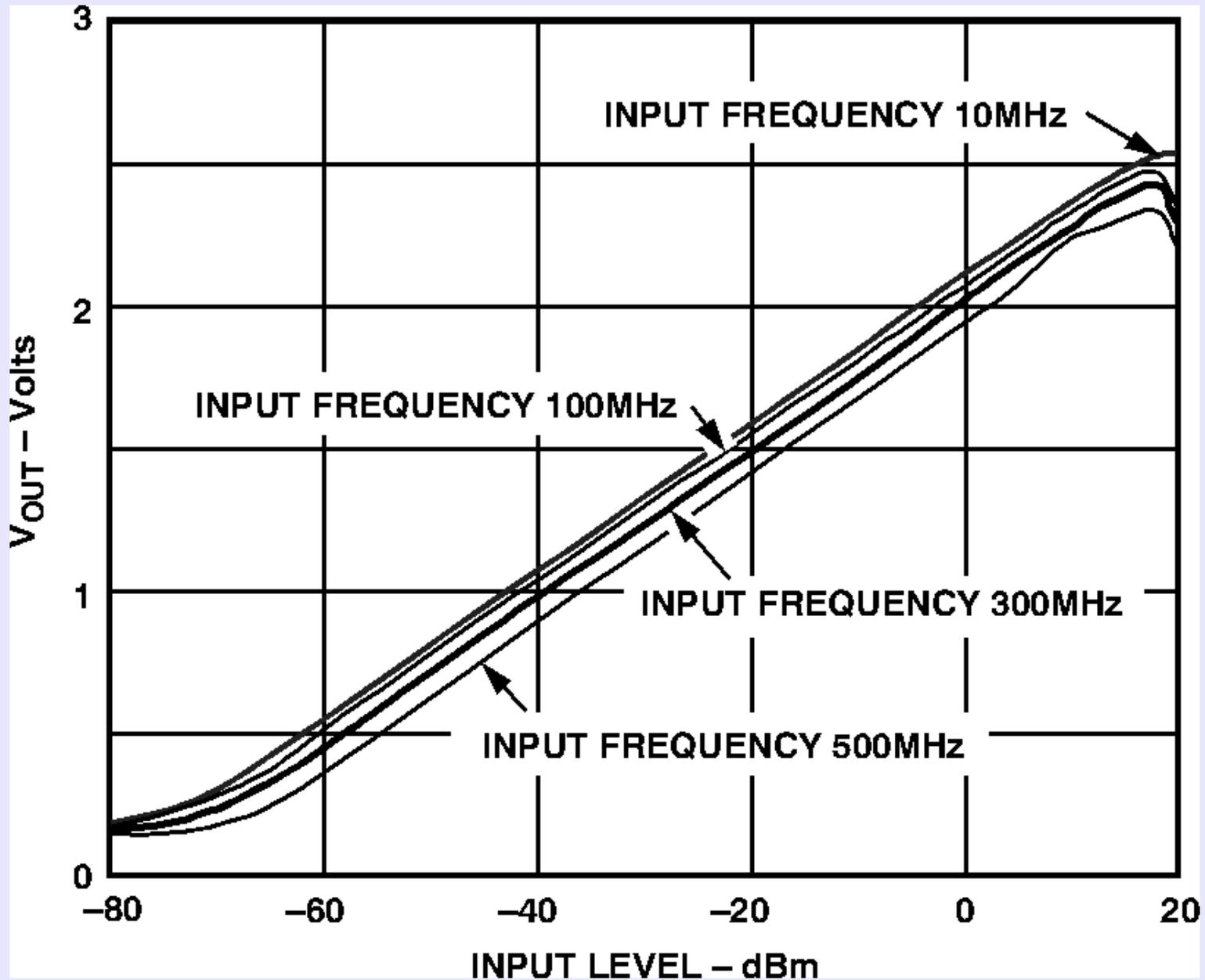
IC's, R und C als SMD



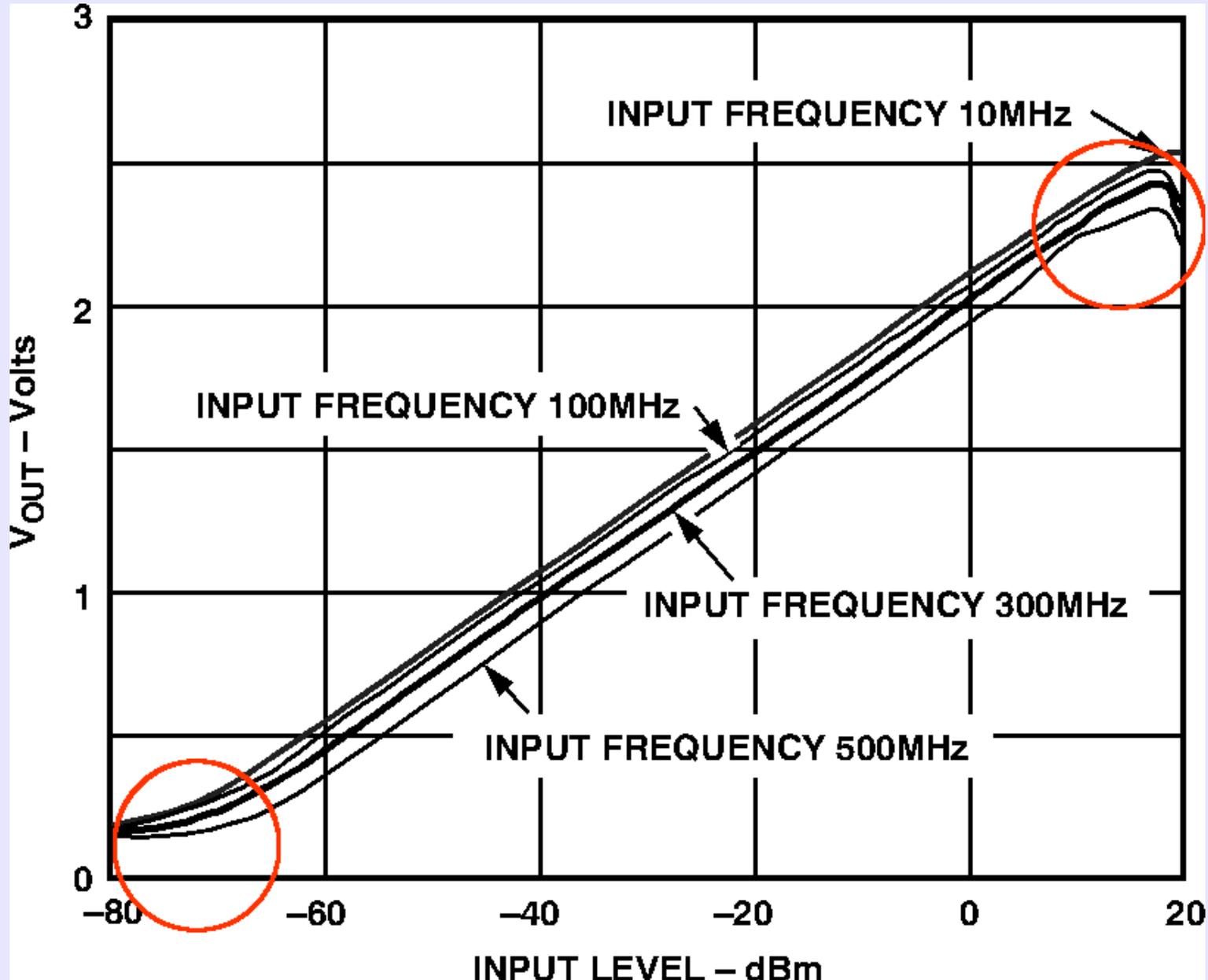
Kompensation Frequenzgang



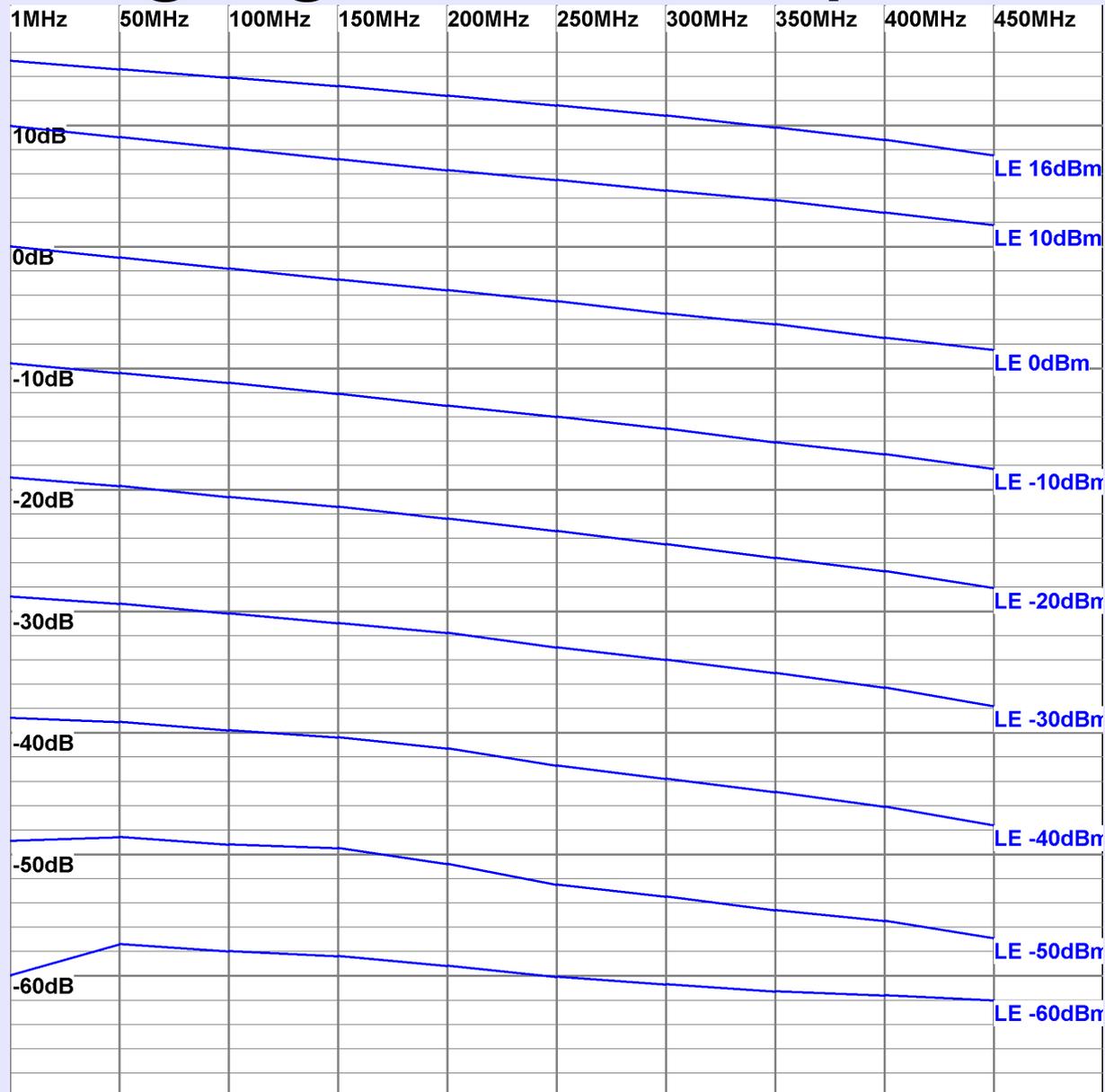
Kennlinien AD8307



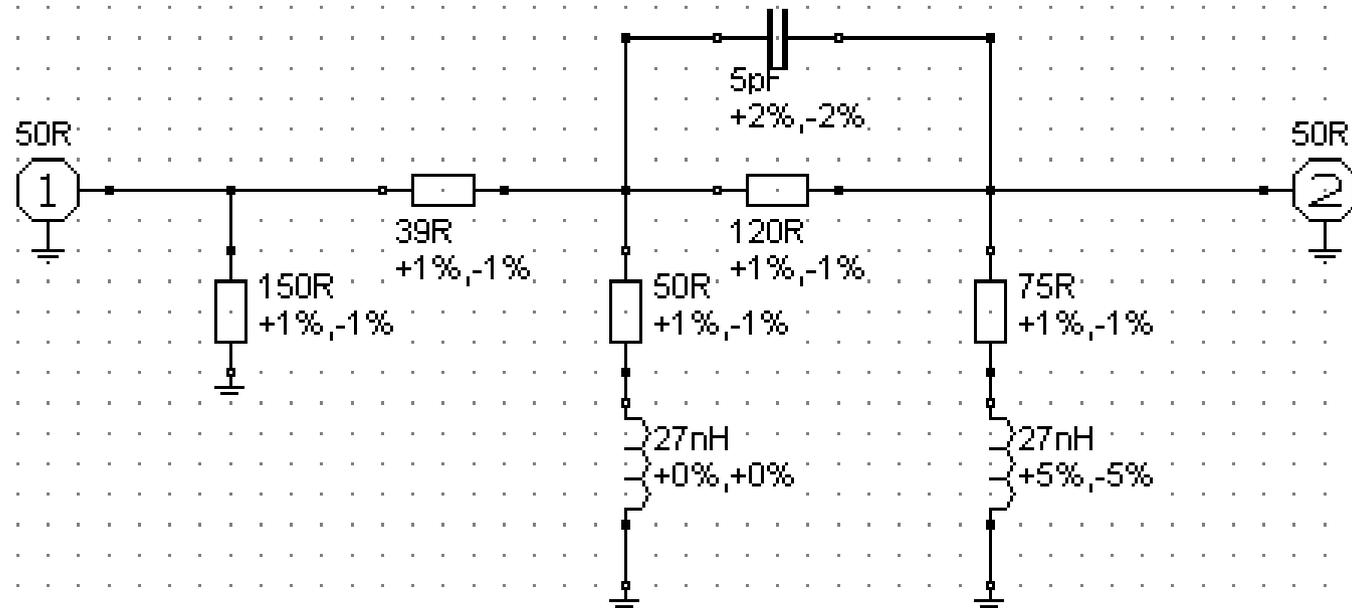
S-förmiger Bereich nicht linear



Schräglage vor Kompensation

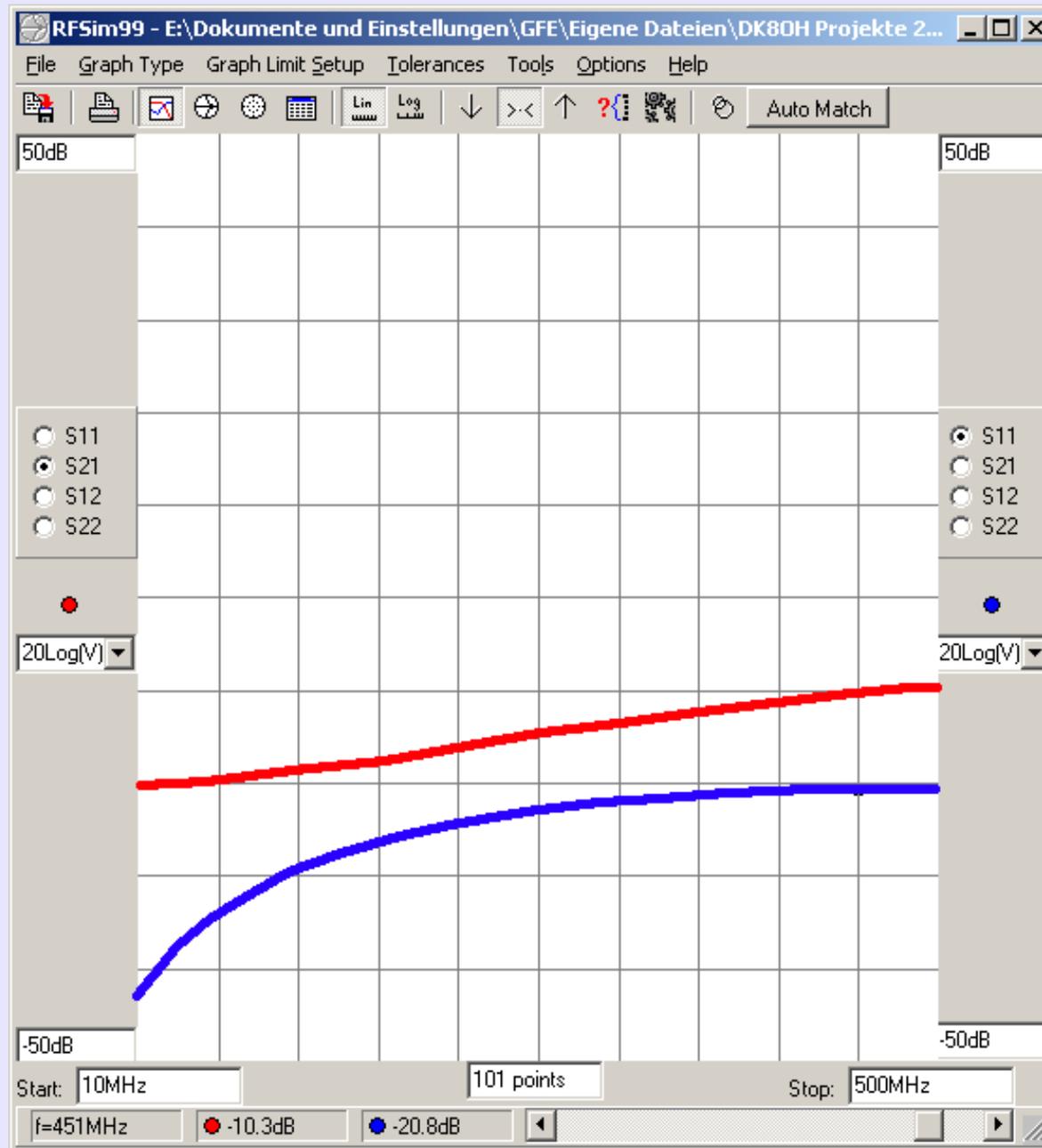


Anpassungs- und Schräglagenetzwerk



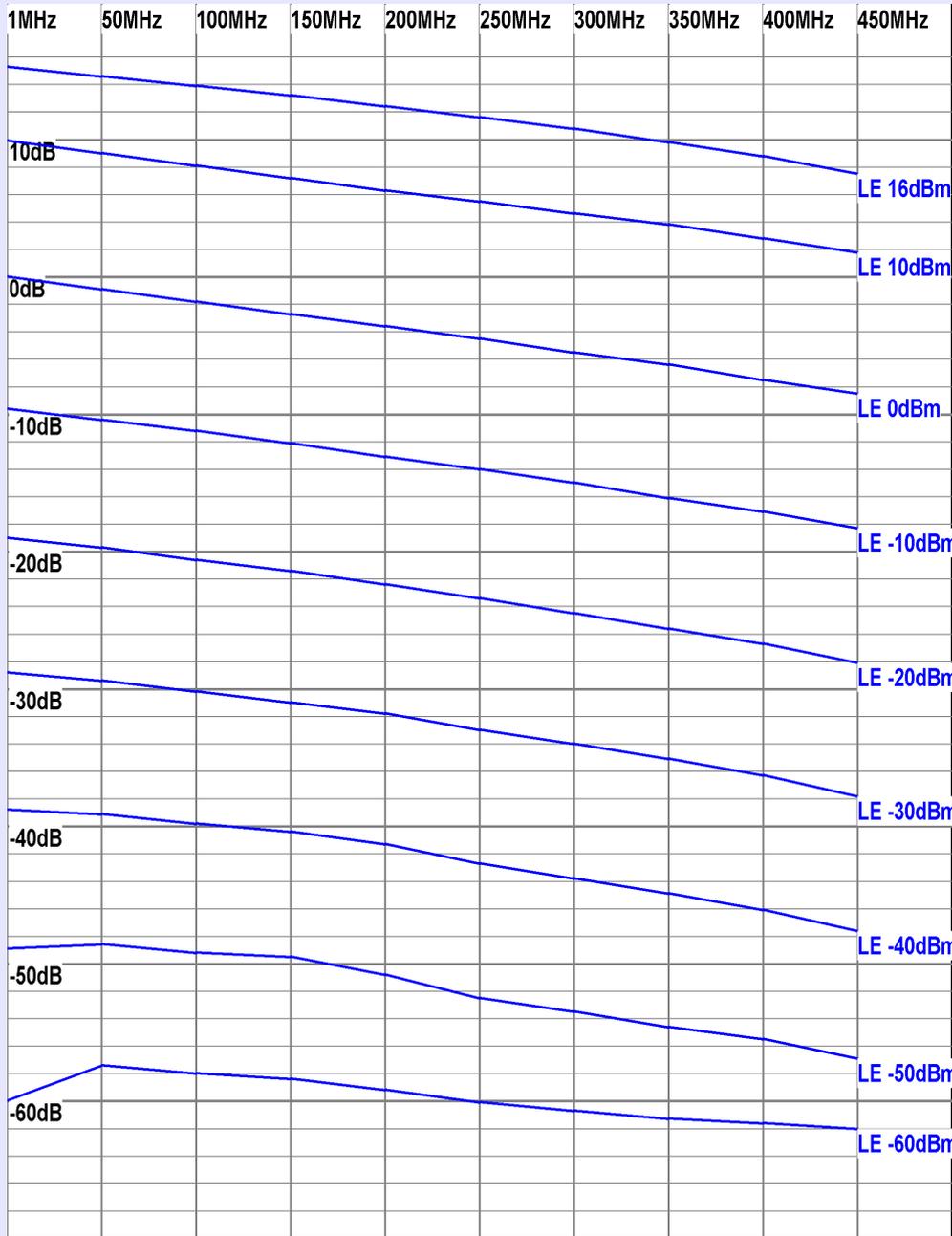
6dB			14dB		
R1	R2	R3	R4	R5	R6
150,5	37,3	150,5	74,9	120,3	74,9
150	39	150	75	120	75

Simulation mit rfsim

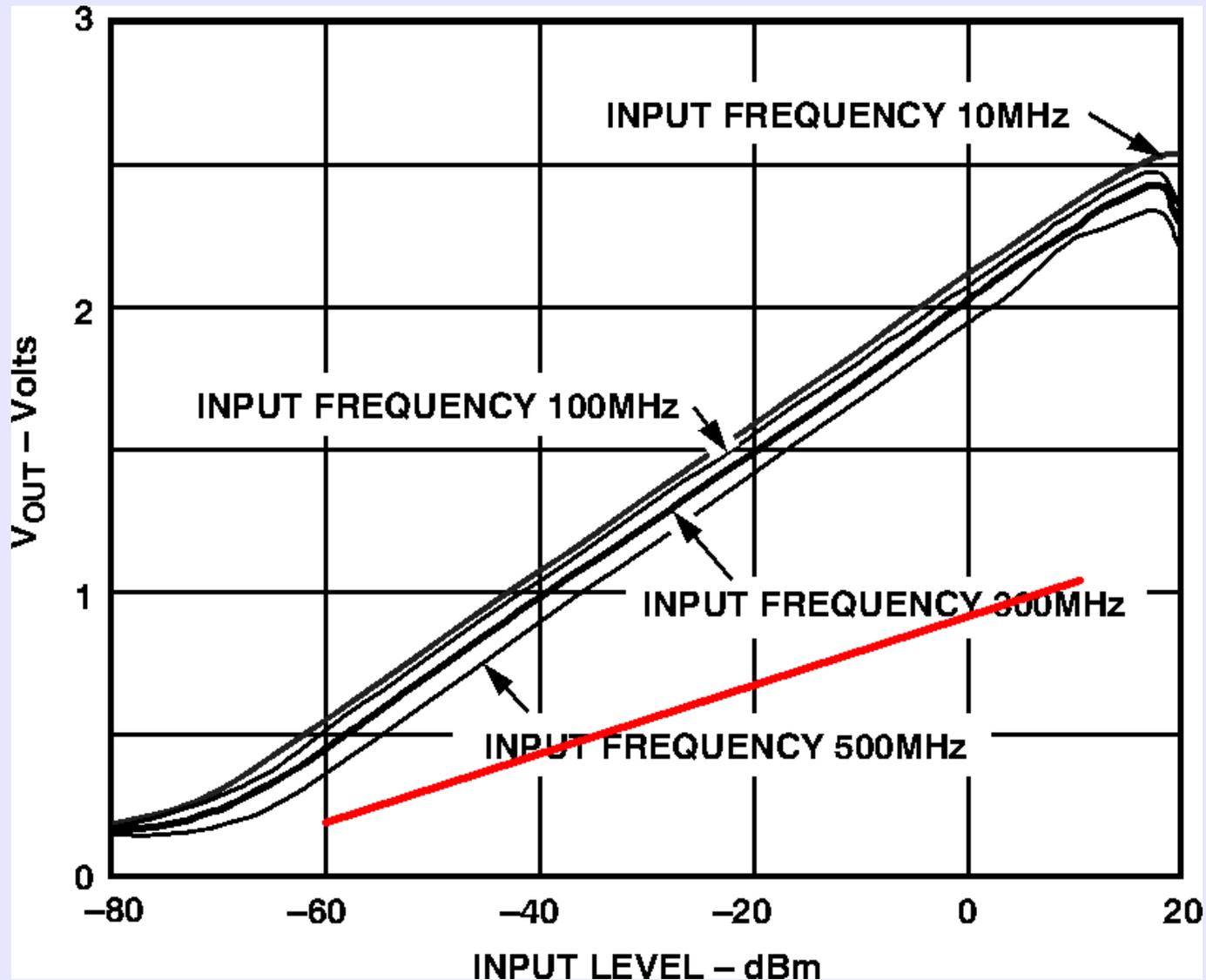


Schräglage nach Kompensation

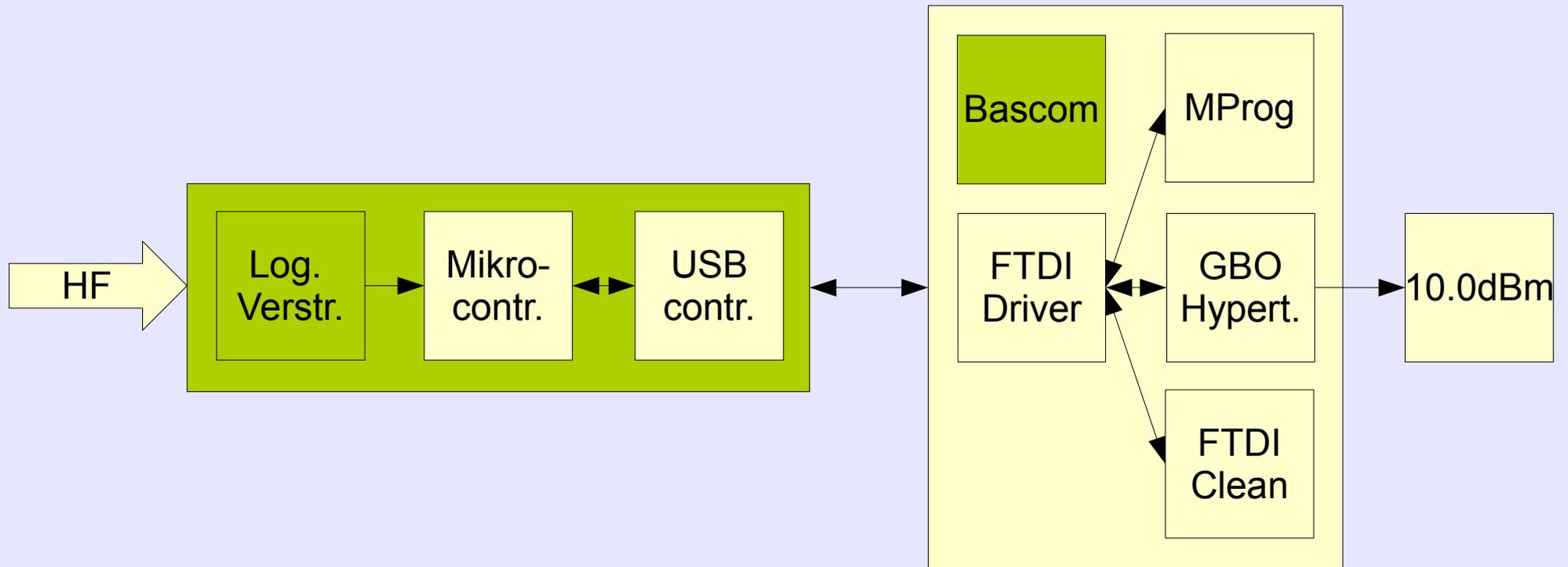




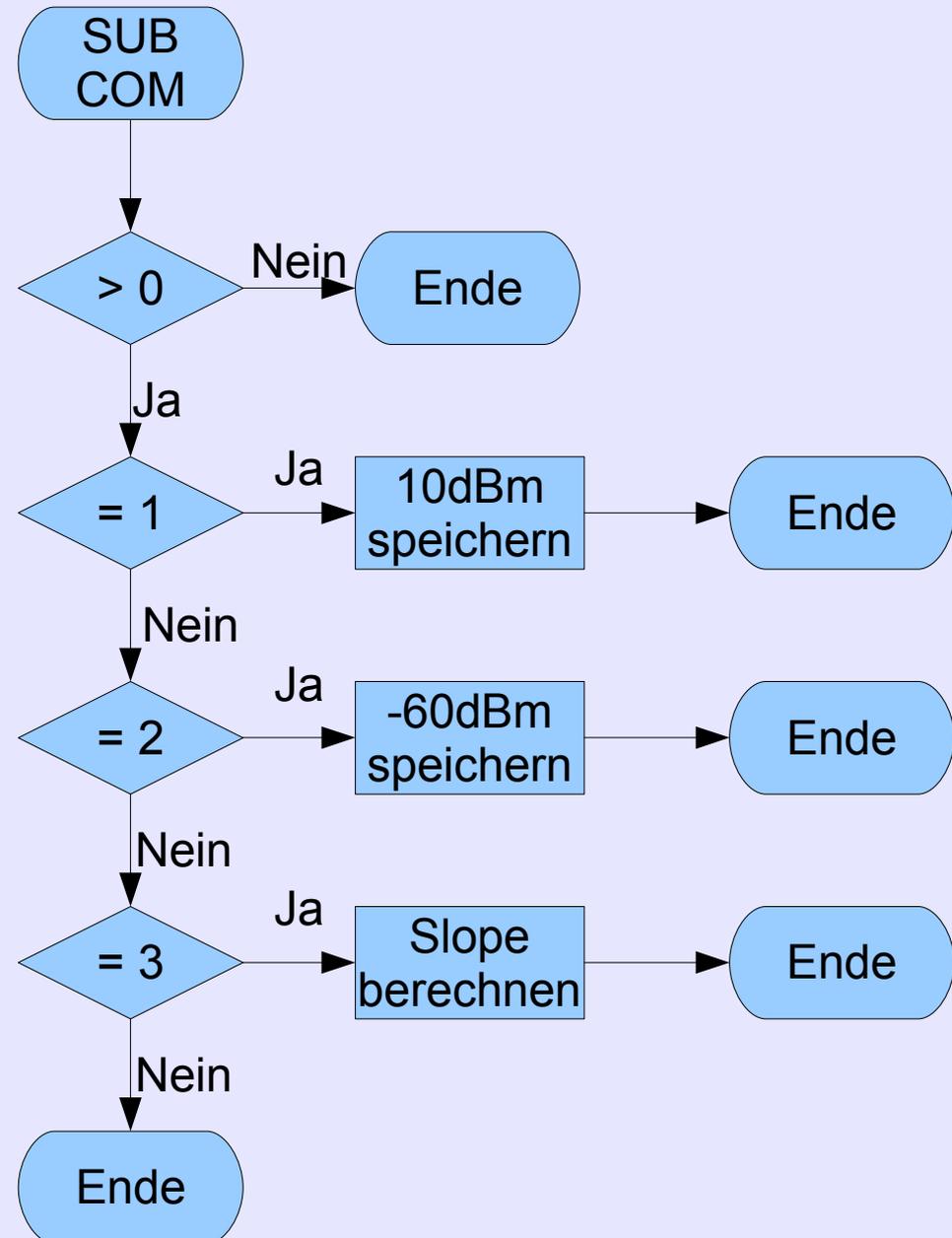
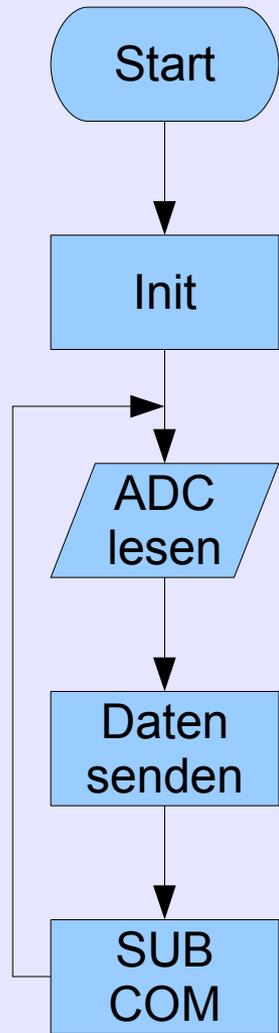
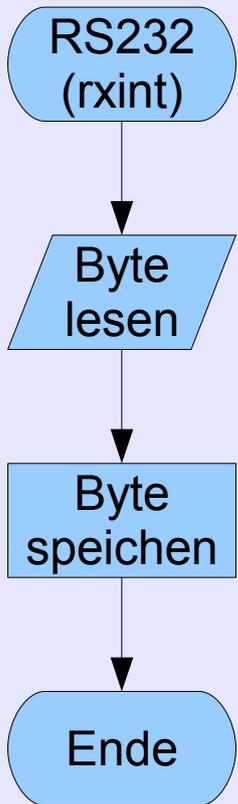
Kennlinie Netzwerk + AD8307



Softwareentwicklung Mikrocontroller



Programmablaufplan



Berechnungsformel

$$Pegel = \frac{U_{10dBm} - U_{ADW}}{Slope} + 10$$

Beispiel:

$$-7,2dBm = \frac{1050mV - 856mV}{-11,32mV / dB} + 10$$

Baud Error Rate

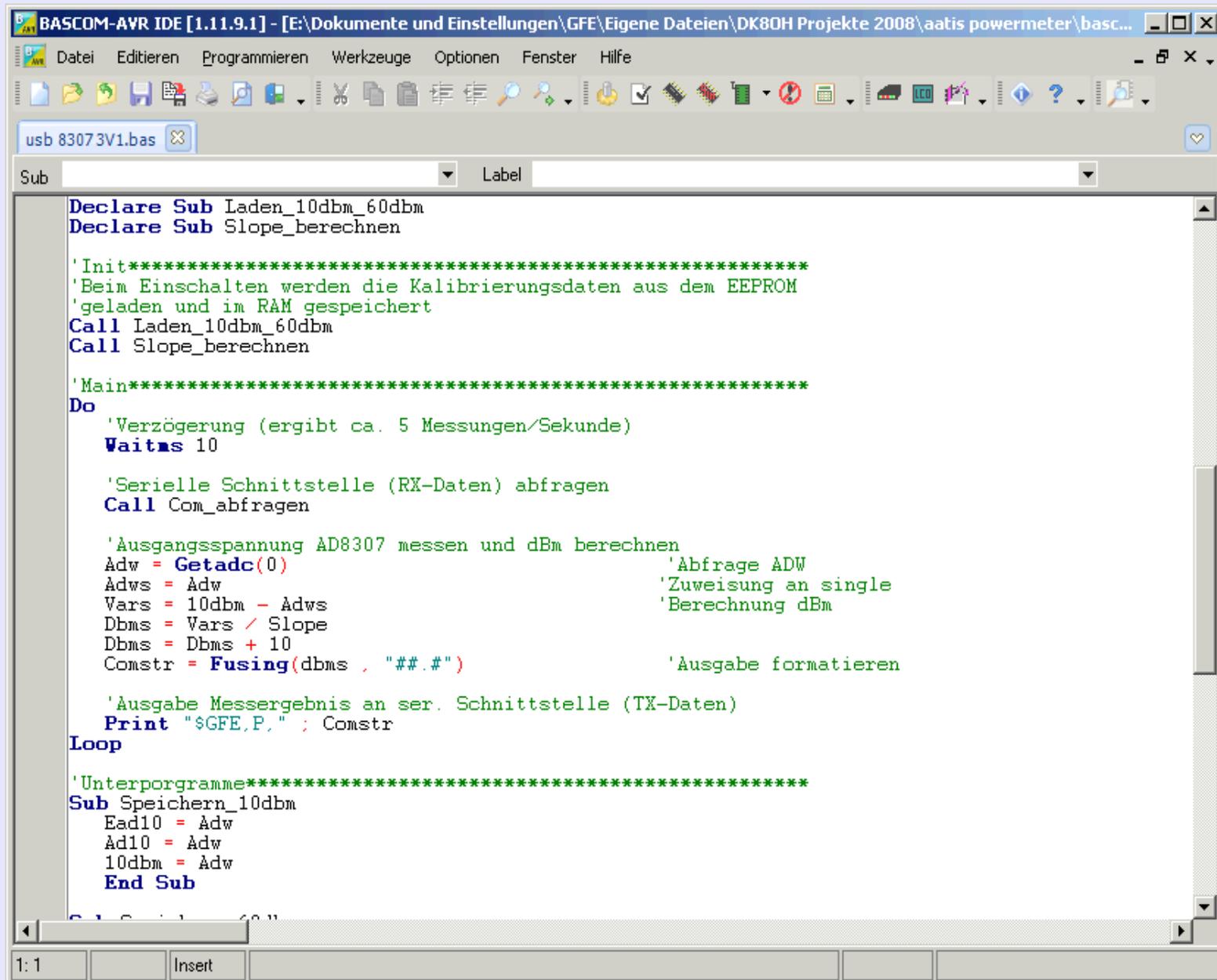
		Taktfrequenz													
		1000000	1843200	2000000	3686400	4000000	7372800	8000000	11059200	10000000	12000000	14745600	16000000	18432000	20000000
Baudrate	1200	0,1634	0	0,16181	0	0,16103	0	0,16064	0	0,160565	0	0,040064	0	0,064103	
	2400	0,16667	0	0,1634	0	0,16181	0	0,16103	0	0,160875	0,160772	0	0,160643	0	0,160565
	4800	0,17361	0	0,16667	0	0,1634	0	0,16181	0	0,161499	0,16129	0	0,161031	0	0,160875
	9600	10,2083	0	0,17361	0	0,16667	0	0,1634	0	0,16276	0,162338	0	0,161812	0	0,161499
	14400	11,3426	0	9,72222	0	2,25694	0	2,18855	0	0,958995	0,163399	0	0,653595	0	0,947712
	19200	12,7604	0	10,2083	0	0,17361	0	0,16667	0	1,780914	0,164474	0	0,163399	0	0,16276
	38400		0	12,7604	0	10,2083	0	0,17361	0	1,840278	2,951389	0	0,166667	0	1,780914
	57600		0	17,0139	0	11,3426	0	9,72222	0	9,45216	0,173611	0	2,256944	0	3,506944
	76800				0	12,7604	0	10,2083	0	1,971726	9,570313	0	0,173611	0	1,840278
	115200				0	17,0139	0	11,3426	0	10,63368	10,20833	0	9,722222	0	9,45216

$$\text{Baud} = \text{fosc}/16(\text{UBBR}-1)$$

$$\text{UBBR} = \text{fosc}/16\text{Baud} - 1$$

$$57692 = 12000000/16(14-1)$$

BASCOM IDE



The screenshot shows the BASCOM-AVR IDE interface. The title bar reads "BASCOM-AVR IDE [1.11.9.1] - [E:\Dokumente und Einstellungen\GFE\Eigene Dateien\DK80H Projekte 2008\aat powermeter\basc...". The menu bar includes "Datei", "Editieren", "Programmieren", "Werkzeuge", "Optionen", "Fenster", and "Hilfe". The toolbar contains various icons for file operations and development. The main window displays a BASIC program for an AD8307 power meter. The code includes subroutines for loading calibration data, calculating dBm, and saving data to EEPROM. Comments in German describe the program's operation, such as "Beim Einschalten werden die Kalibrierungsdaten aus dem EEPROM geladen und im RAM gespeichert".

```
usb 83073V1.bas
Sub
Label
Declare Sub Laden_10dbm_60dbm
Declare Sub Slope_berechnen

'Init*****
'Beim Einschalten werden die Kalibrierungsdaten aus dem EEPROM
'geladen und im RAM gespeichert
Call Laden_10dbm_60dbm
Call Slope_berechnen

'Main*****
Do
  'Verzögerung (ergibt ca. 5 Messungen/Sekunde)
  Waitms 10

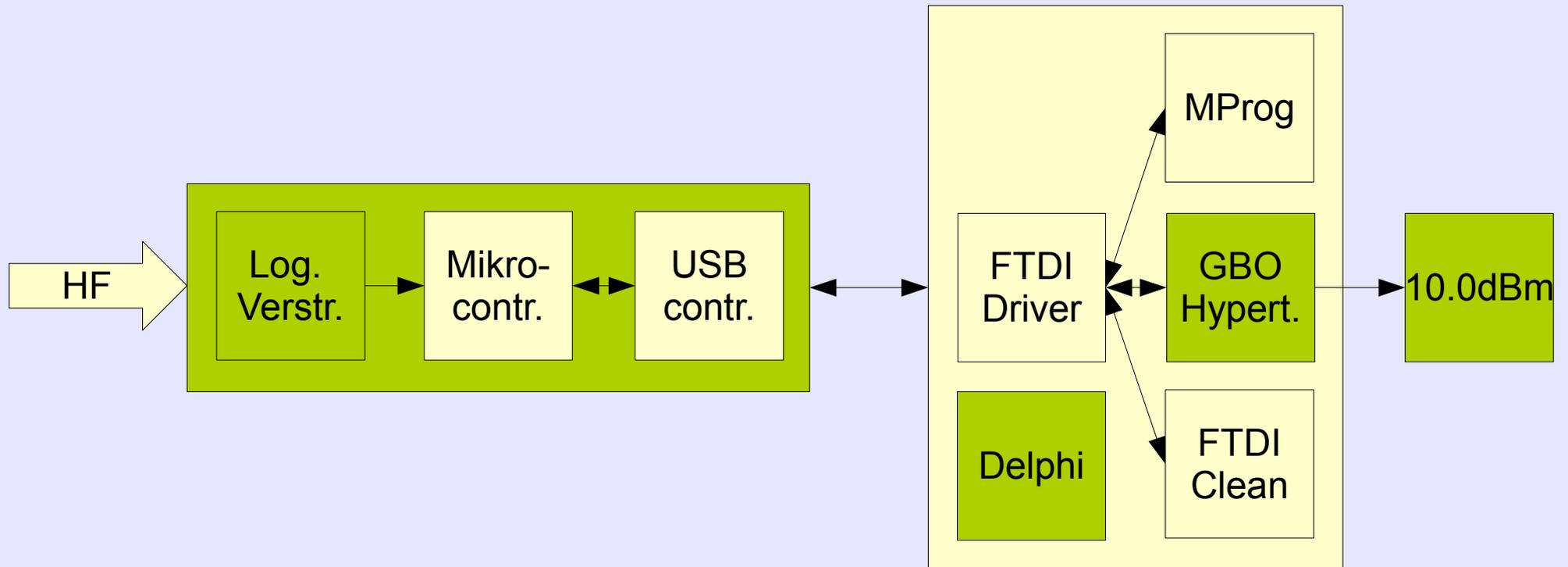
  'Serielle Schnittstelle (RX-Daten) abfragen
  Call Com_abfragen

  'Ausgangsspannung AD8307 messen und dBm berechnen
  Adw = Getadc(0)           'Abfrage ADW
  Adws = Adw                'Zuweisung an single
  Vars = 10dbm - Adws       'Berechnung dBm
  Dbms = Vars / Slope
  Dbms = Dbms + 10
  Comstr = Fusing(dbms , "##.#") 'Ausgabe formatieren

  'Ausgabe Messergebnis an ser. Schnittstelle (TX-Daten)
  Print "$GFE.P," ; Comstr
Loop

'Unterprogramme*****
Sub Speichern_10dbm
  Ead10 = Adw
  Ad10 = Adw
  10dbm = Adw
End Sub
```

Softwareentwicklung GBO

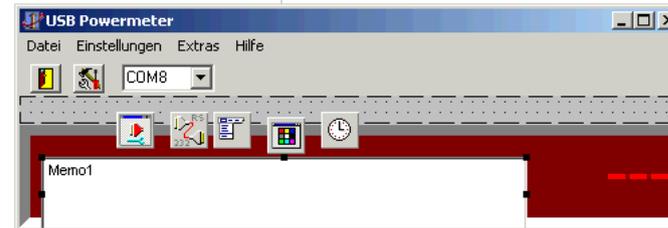


Delphi IDE

The screenshot displays the Delphi IDE interface. The main window is titled "Delphi 5 - USBMWM" and shows a menu bar with options like "Datei", "Bearbeiten", "Suchen", "Ansicht", "Projekt", "Start", "Komponente", "Tools", and "Hilfe". Below the menu bar is a toolbar with various icons for file operations and development tools. The "Objektspektor" (Object Inspector) is open on the left, showing the properties of a "Memo1: TMemo" component. The "Eigenschaften" (Properties) tab is active, displaying a list of properties such as "Align", "Alignment", "Anchors", "BIDMode", "BorderStyle", "Color", "Constraints", "Cursor", "DragCursor", "DragKind", "DragMode", "Enabled", "Font", "Height", "HelpContext", "HideSelection", "Hint", "ImeMode", "ImeName", "Left", "Lines", "MaxLength", "Name", "OEMConvert", "ParentBIDMod", "ParentColor", "ParentFont", "ParentShowHir", "PopupMenu", "ReadOnly", "ScrollBars", "ShowHint", "TabOrder", "TabStop", "Tag", "Top", "Visible", "WantReturns", "WantTabs", "Width", and "WordWrap".

The "Source Editor" is open in the center, showing the source code for a unit named "gbofz.pas". The code defines an interface and a type for a form, along with various components and procedures. The code is as follows:

```
unit gbofz;  
  
interface  
  
uses  
  Windows, Messages, SysUtils, Classes, Graphics, Controls, Forms, Dialogs,  
  Serial, StdCtrls, Menus, ExtCtrls, Buttons, Mask, inifiles, ComCtrls;  
  
type  
  TForm1 = class(TForm)  
    Serial1: TSerial;  
    MainMenu1: TMainMenu;  
    Datei1: TMenuItem;  
    Beenden1: TMenuItem;  
    SerStdDlg1: TSerStdDlg;  
    COM1: TMenuItem;  
    Config1: TMenuItem;  
    Panel2: TPanel;  
    Extras1: TMenuItem;  
    KalibrierenOdBm: TMenuItem;  
    Hilfe1: TMenuItem;  
    About1: TMenuItem;  
    Panel1: TPanel;  
    Label1: TLabel;  
    Memo1: TMemo;  
    ComboBox2: TComboBox;  
    SpeedButton1: TSpeedButton;  
    SpeedButton2: TSpeedButton;  
    Slopeberechnen1: TMenuItem;  
    KalibrierungAD830750dBm1: TMenuItem;  
    ColorDialogFont: TColorDialog;  
    N1: TMenuItem;  
    Schriftfarbe1: TMenuItem;  
    Hintergrundfarbe1: TMenuItem;  
    Image1: TImage;  
    Timer1: TTimer;  
    procedure Serial1Data(Sender: TObject);  
    procedure Beenden1Click(Sender: TObject);  
    procedure Config1Click(Sender: TObject);  
    procedure About1Click(Sender: TObject);  
    procedure ComboBox2Change(Sender: TObject);  
    procedure ComboBox2DropDown(Sender: TObject);  
    procedure FormCreate(Sender: TObject);  
    procedure Slopeberechnen1Click(Sender: TObject);  
    procedure KalibrierenOdBmClick(Sender: TObject);  
    procedure Kalibrierung50dBmClick(Sender: TObject);  
  end;  
end;
```



TSerial

Toolbox Inhalt

Ausgabe 1'2009



ab 7. Januar 2009

Neu: unsere
Dauerbrenner TSerial,
TXPrint, TXPrintSet,
FreeBase und der
Hintergrundkalender mit
[eigener Internet-Präsenz](#)

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Ausgabe 1'2009

Editorial

Morfik-Pascal

*Ein moderner Pascal-Dialekt für
Webanwendungen*

Vorschau

Toolbox Club-CD

Toolbox Jahresausgaben

Toolbox Special

Toolbox-Archiv

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Illegale Kopien

Bücher bei C&L

*Herausgegeben von der
Redaktion Toolbox*
Tips und Tricks zu Delphi
Delphi 6 in Team
Kylix in Team

Bestellen

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Nachbestellen
Jahresausgabe
Bücher bei C&L
Bestellformular

Autoren gesucht

Über Toolbox (Impressum)

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Hilfe

Haftungsausschluß

[Auf der DVD: 12 Jahre
Toolbox: Online-Ausgabe
1997-2008](#)

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Entwicklung

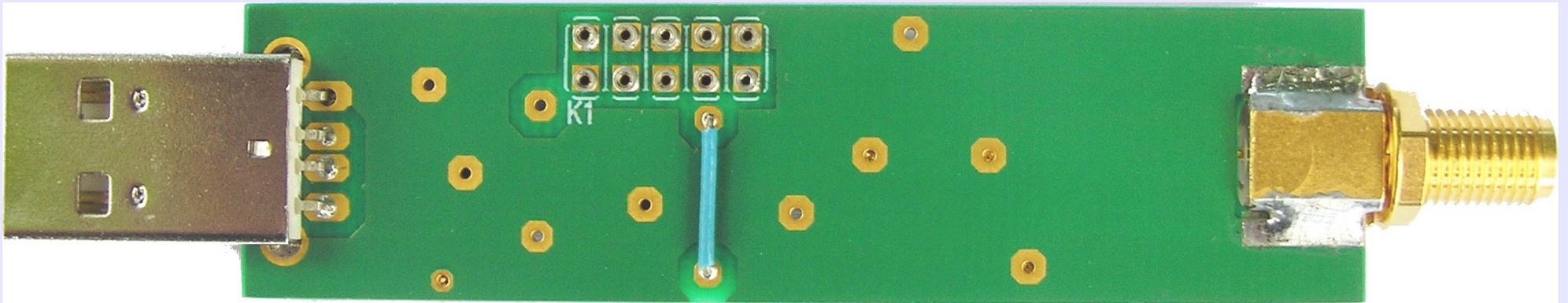
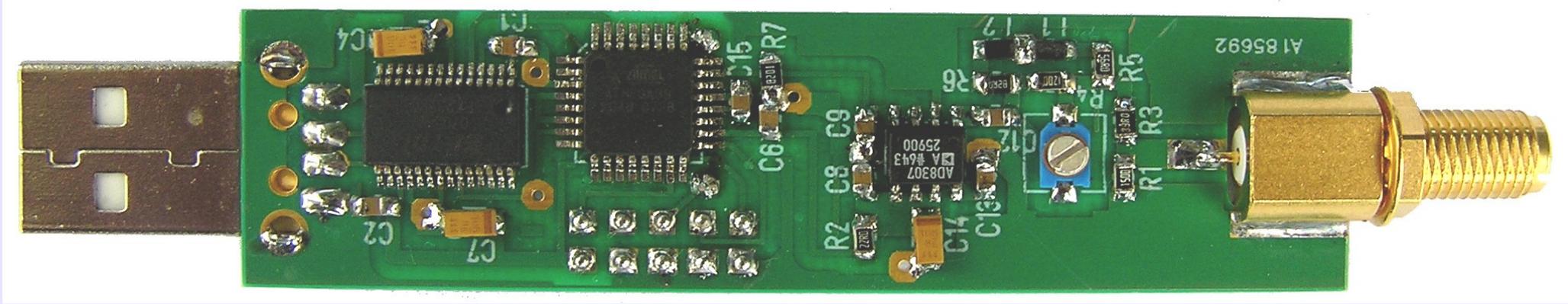
Aufbau

Inbetriebnahme

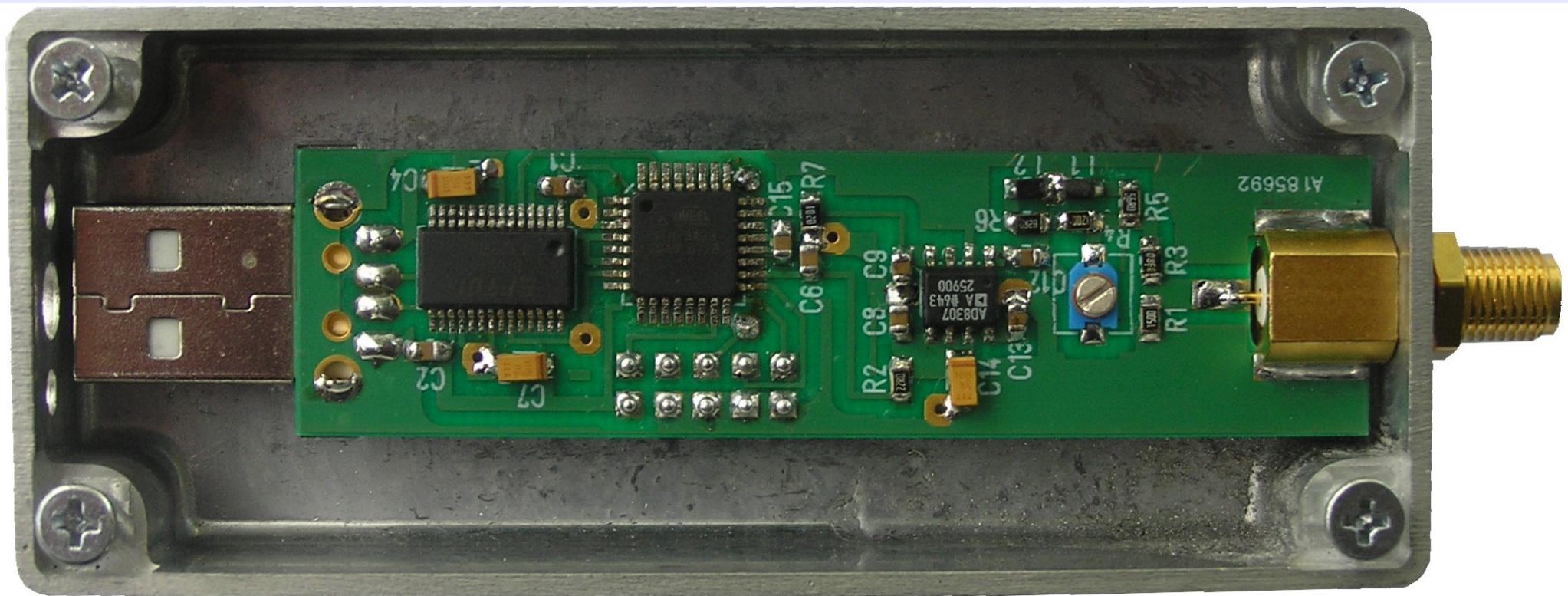
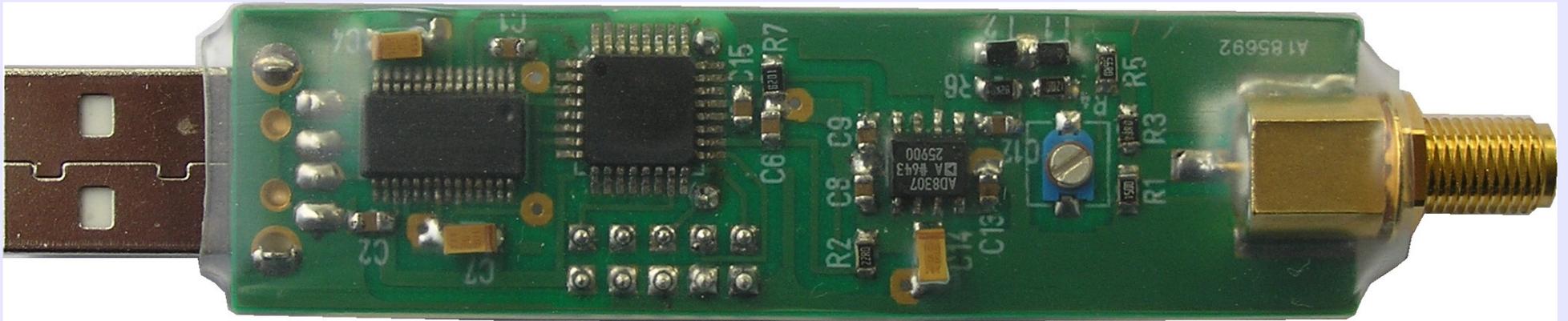
Messgeräte, Messplatz

Messvorführung

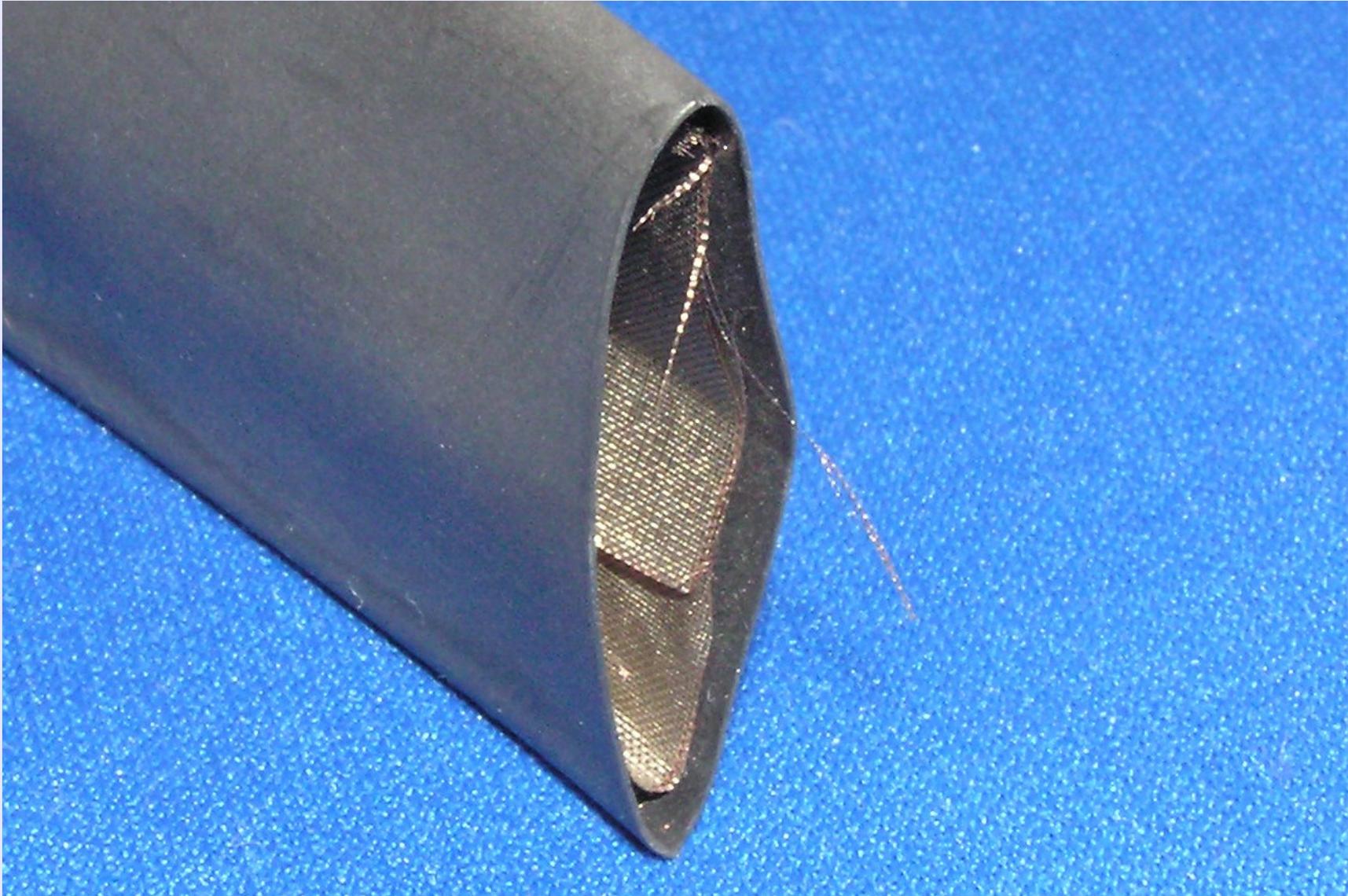
Bestückung der Leiterplatte



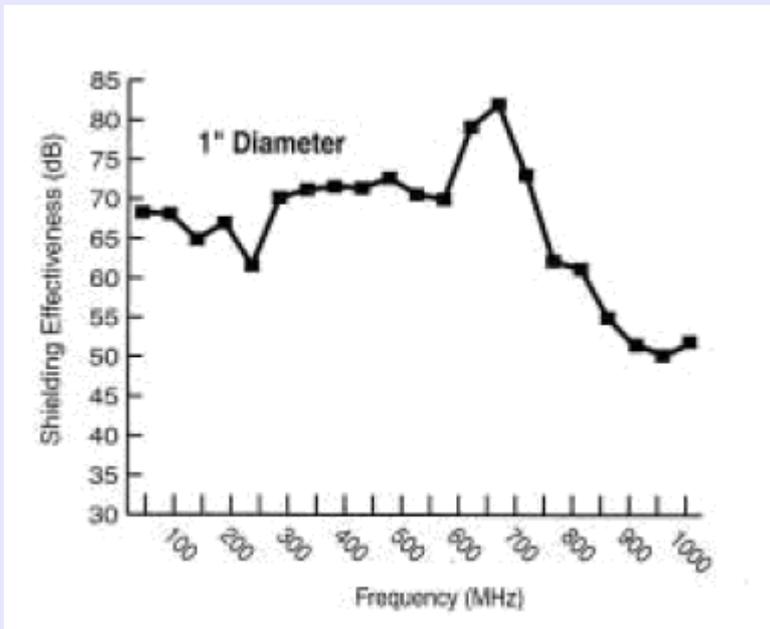
Stick oder Gehäuse



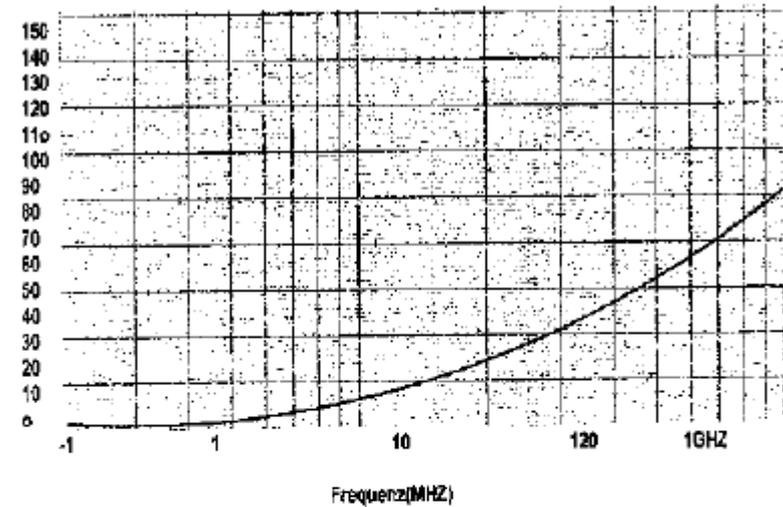
EMV Schumpfschlauch



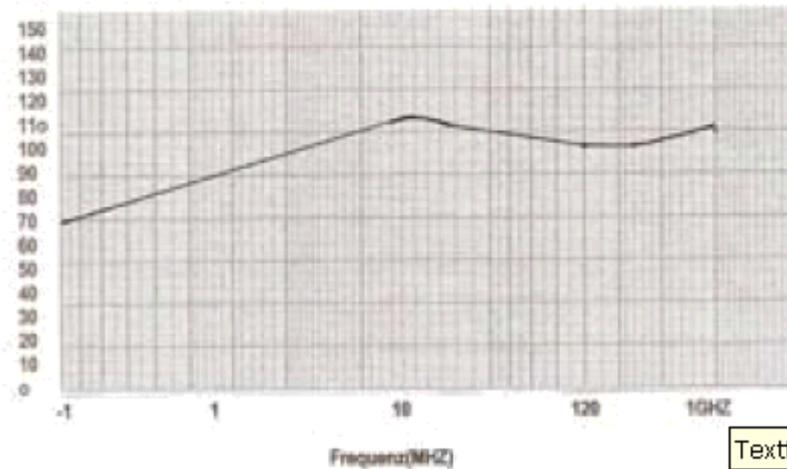
Schirmungsmaß



Abschirmeffekt (dB)-magnetisch



Abschirmeffekt (dB)-elektrisch



Textfeld:

Themen

Allgemeines

Leistungsmesser

Entwicklung

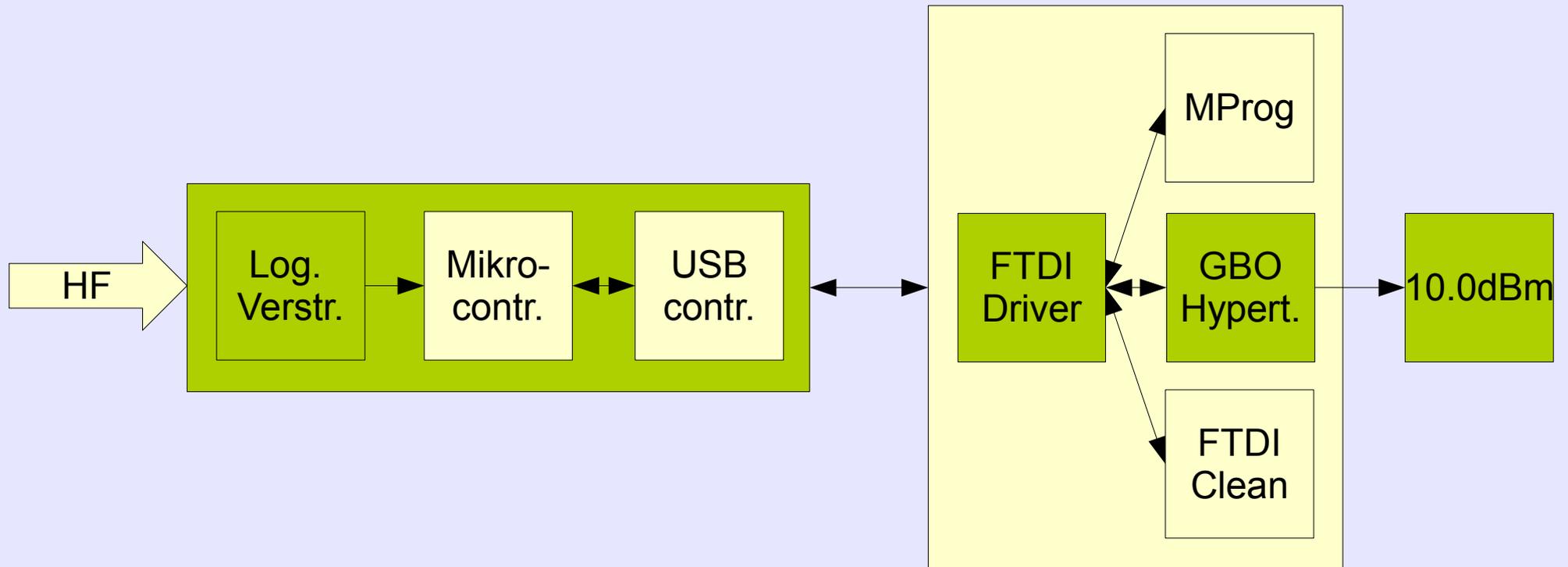
Aufbau

Inbetriebnahme

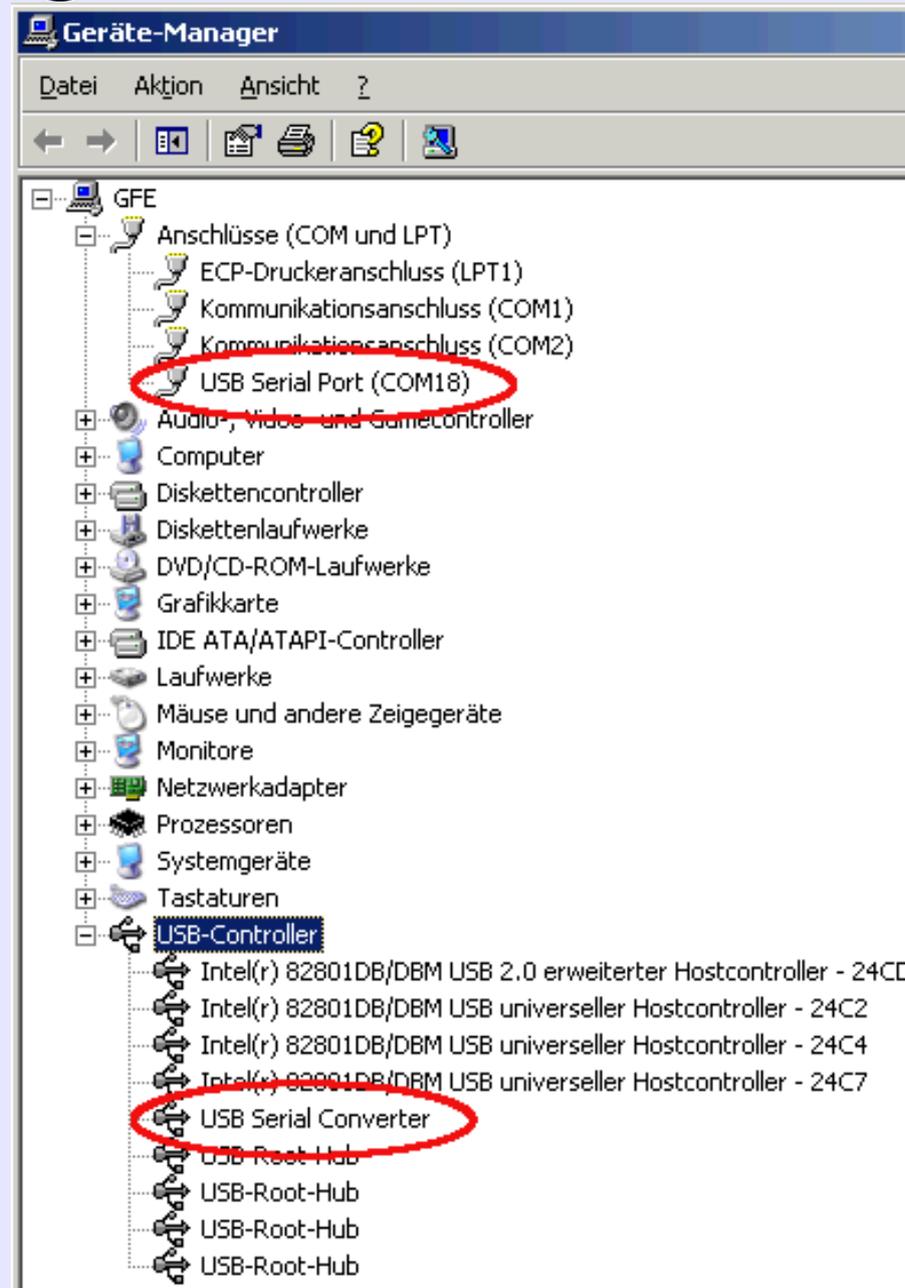
Messgeräte, Messplatz

Messvorführung

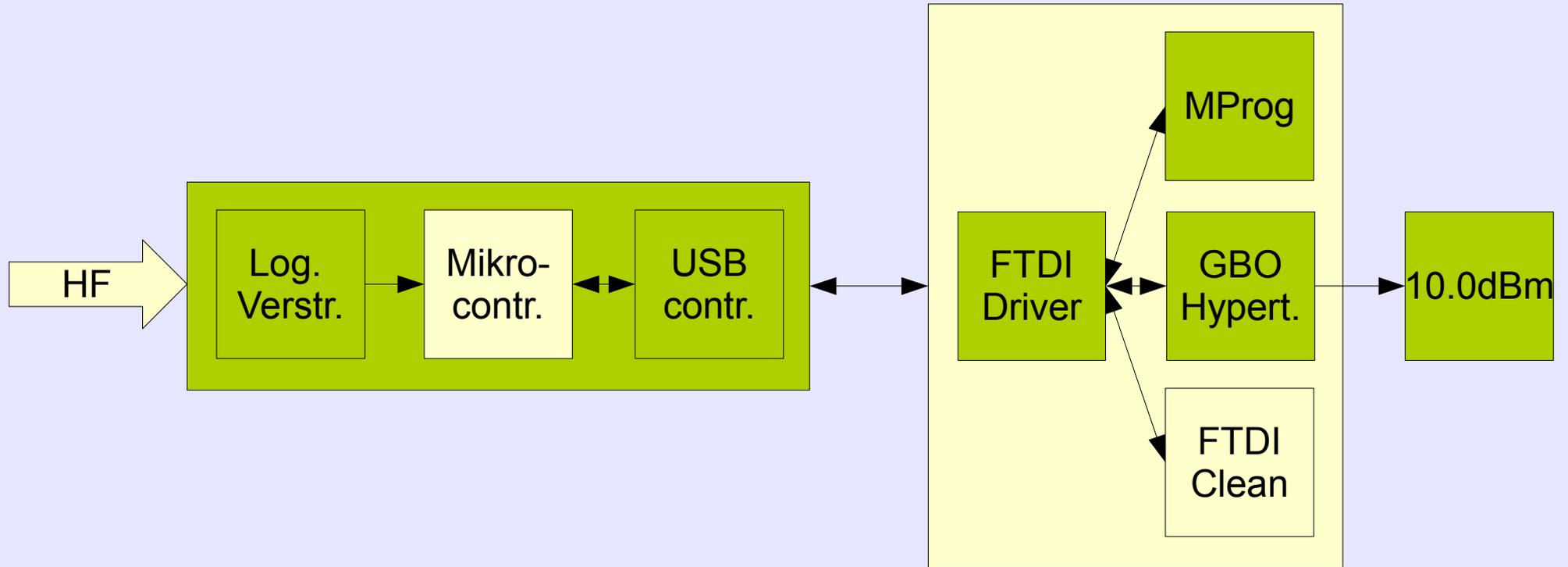
Installation Schnittstellentreiber



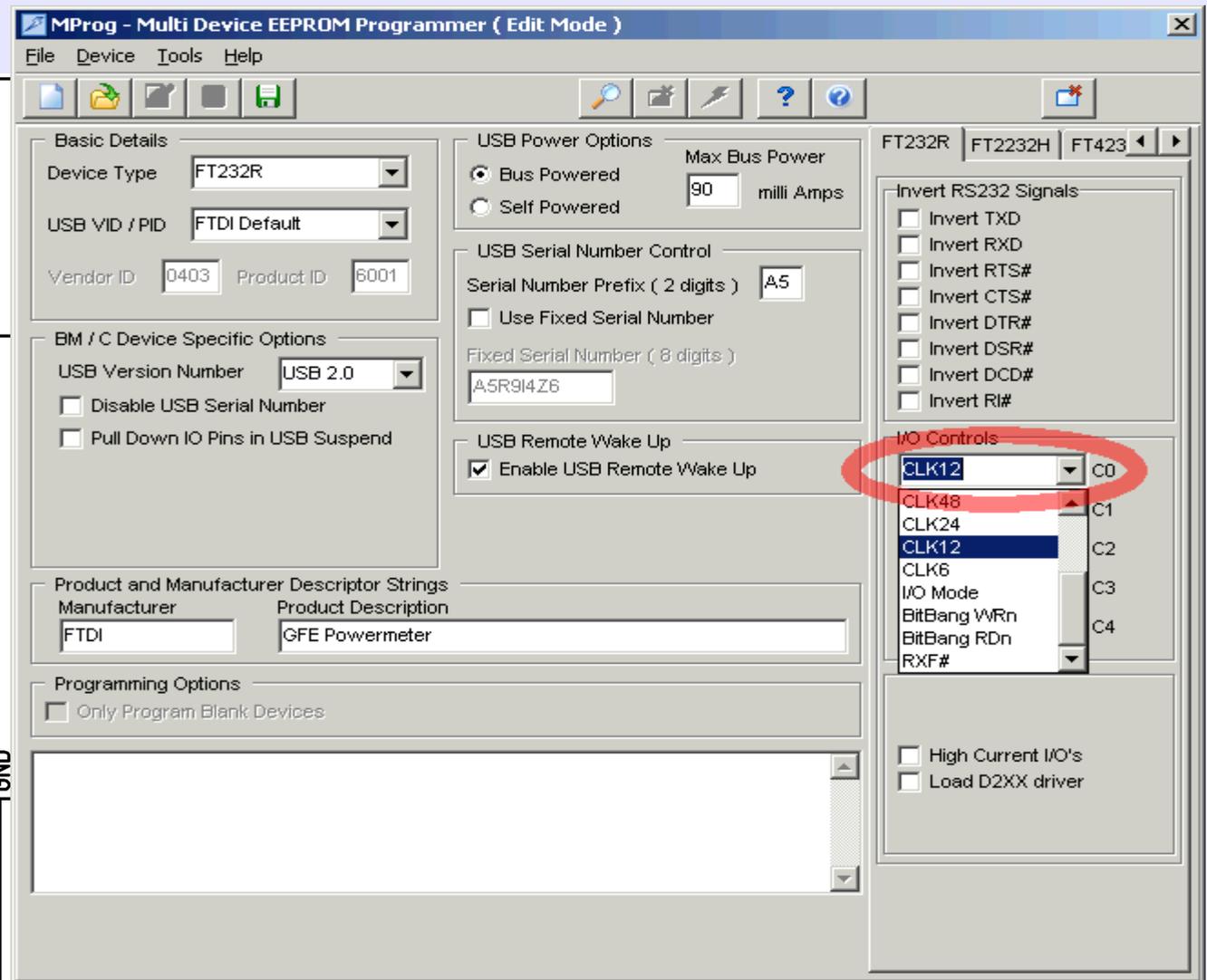
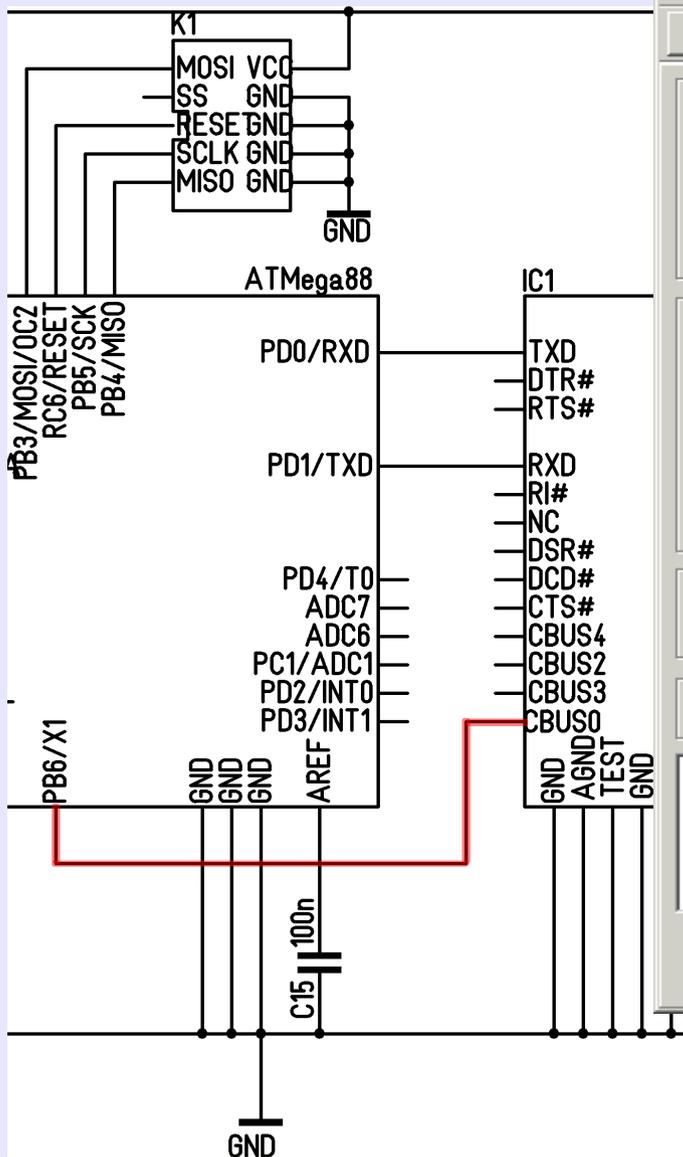
Einträge im Gerätemanager



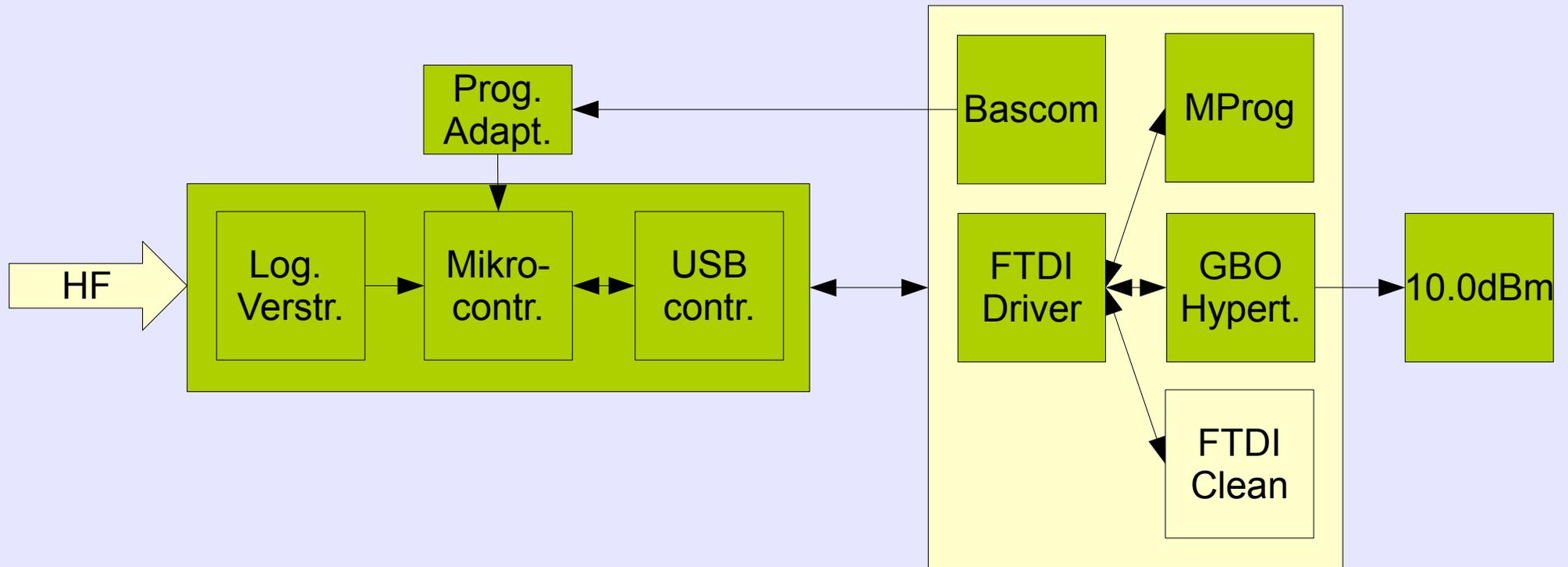
Programmierung USB-Controller



Taktleitung einschalten



Programmierung Mikrocontroller



Programmierung Mikrocontroller

**** AVR ISP Programmer ****

File Buffer Chip

Chip: ATmega88

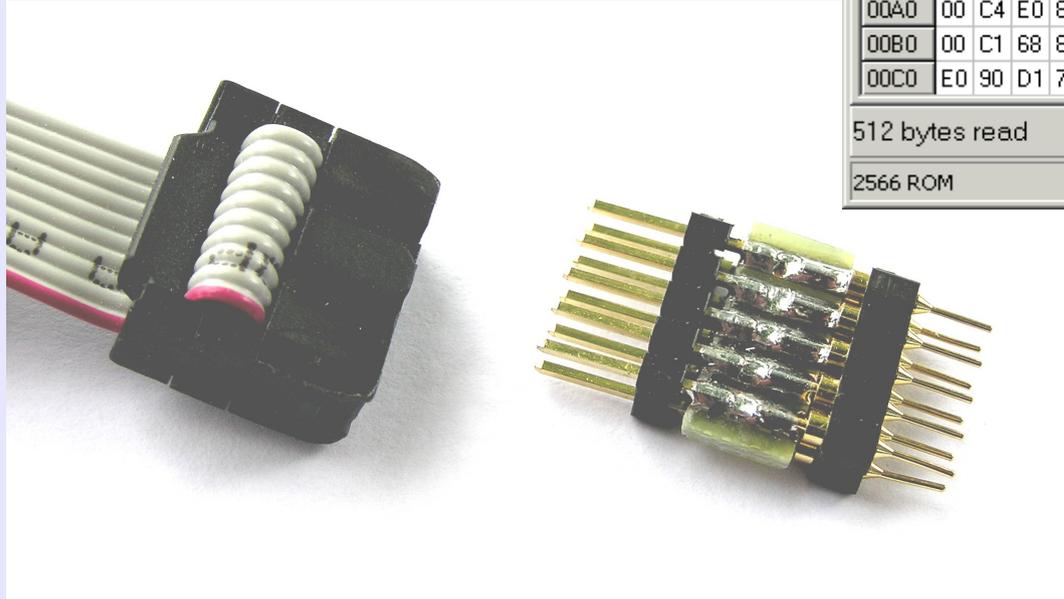
Manufacturer: Atmel
Chip: ATmega88
Flash ROM: 8 KB
EEPROM: 512
Size: [Slider]
Programmed: 300

FlashROM | EEPROM | Lock and Fuse Bits

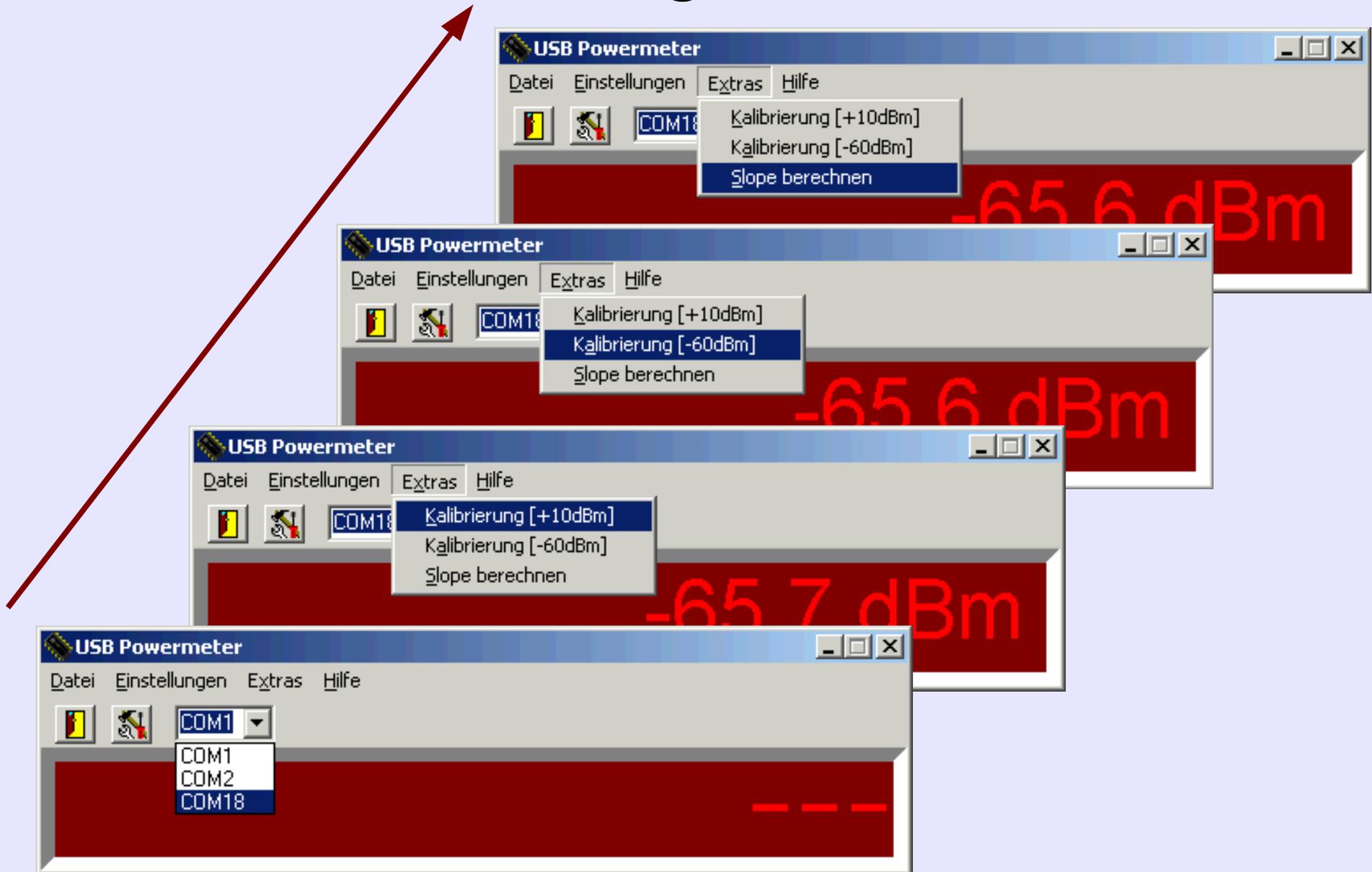
	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	
0000	C0	19	95	18	95	18	95	18	95	18	95	18	95	18	95	18	À.À.À.À.À.À.À.À.
0010	95	18	95	18	95	18	95	18	95	18	95	18	95	18	95	18	À.À.À.À.À.À.À.À.
0020	95	18	95	18	C4	1C	95	18	95	18	95	18	95	18	95	18	À.À.À.À.À.À.À.À.
0030	95	18	95	18	EF	8F	BF	8D	EC	C0	E7	E0	2E	4E	E0	84	À.À.À.À.À.À.À.À.
0040	BF	8E	E0	D4	E0	F4	2E	5F	EF	EE	E0	F3	E0	A0	E0	B1	À.À.À.À.À.À.À.À.
0050	95	A8	B7	84	2E	08	7F	87	BF	84	E1	88	27	99	93	80	À.À.À.À.À.À.À.À.
0060	00	60	93	90	00	60	27	88	93	8D	97	31	F7	E9	E1	83	À.À.À.À.À.À.À.À.
0070	93	80	00	C4	E0	80	93	80	00	C5	E1	88	93	80	00	C1	À.À.À.À.À.À.À.À.
0080	24	66	94	F8	98	38	E8	86	93	80	00	7A	EC	80	93	80	À.À.À.À.À.À.À.À.
0090	00	7C	91	70	00	7A	68	70	93	70	00	7A	E0	8C	93	80	À.À.À.À.À.À.À.À.
00A0	00	C4	E0	80	93	80	00	C5	E0	86	93	80	00	C2	91	80	À.À.À.À.À.À.À.À.
00B0	00	C1	68	80	93	80	00	C1	94	78	D0	87	D0	93	E0	8A	À.À.À.À.À.À.À.À.
00C0	E0	90	D1	76	D0	B6	91	00	00	7C	7F	00	60	00	93	00	À.À.À.À.À.À.À.À.

512 bytes read

2566 ROM | 0 EPROM | USB 8307 3V1.BIN



Abgleich



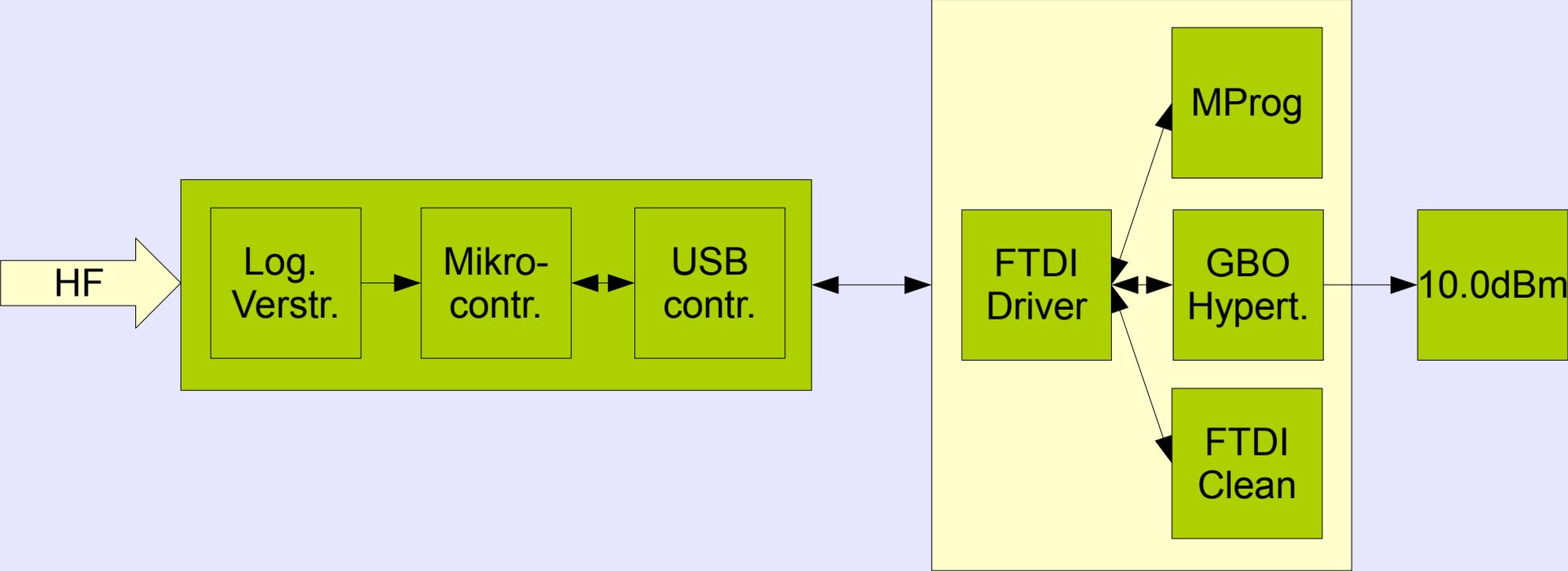
Fertig



Datentelegramme in Hyperterminal

```
aatis powermeter - HyperTerminal
Datei Bearbeiten Ansicht Anrufen Übertragung ?
$GFE, P, -65.9
$GFE, P, -66.0
$GFE, P, -65.9
$GFE, P, -65.9
$GFE, P, -66.0
$GFE, P, -65.9
$GFE, P, -65.9
$GFE, P, -66.2
$GFE, P, -66.0
$GFE, P, -66.0
$GFE, P, -65.9
$GFE, P, -66.2
$GFE, P, -65.9
$GFE, P, -66.1
$GFE, P, -66.0
$GFE, P, -65.9
$GFE, P, -66.0
$GFE, P, -66.0
$GFE, P, -66.0
$GFE, P, -65.9
$GFE, P, -66.0
Verbindung getrennt Auto-Erkenn. 38400 8-N-1
```

Treiber löschen mit FTDI Clean



Deinstallation FTDI-Treiber



Themen

Allgemeines

Leistungsmesser

Entwicklung

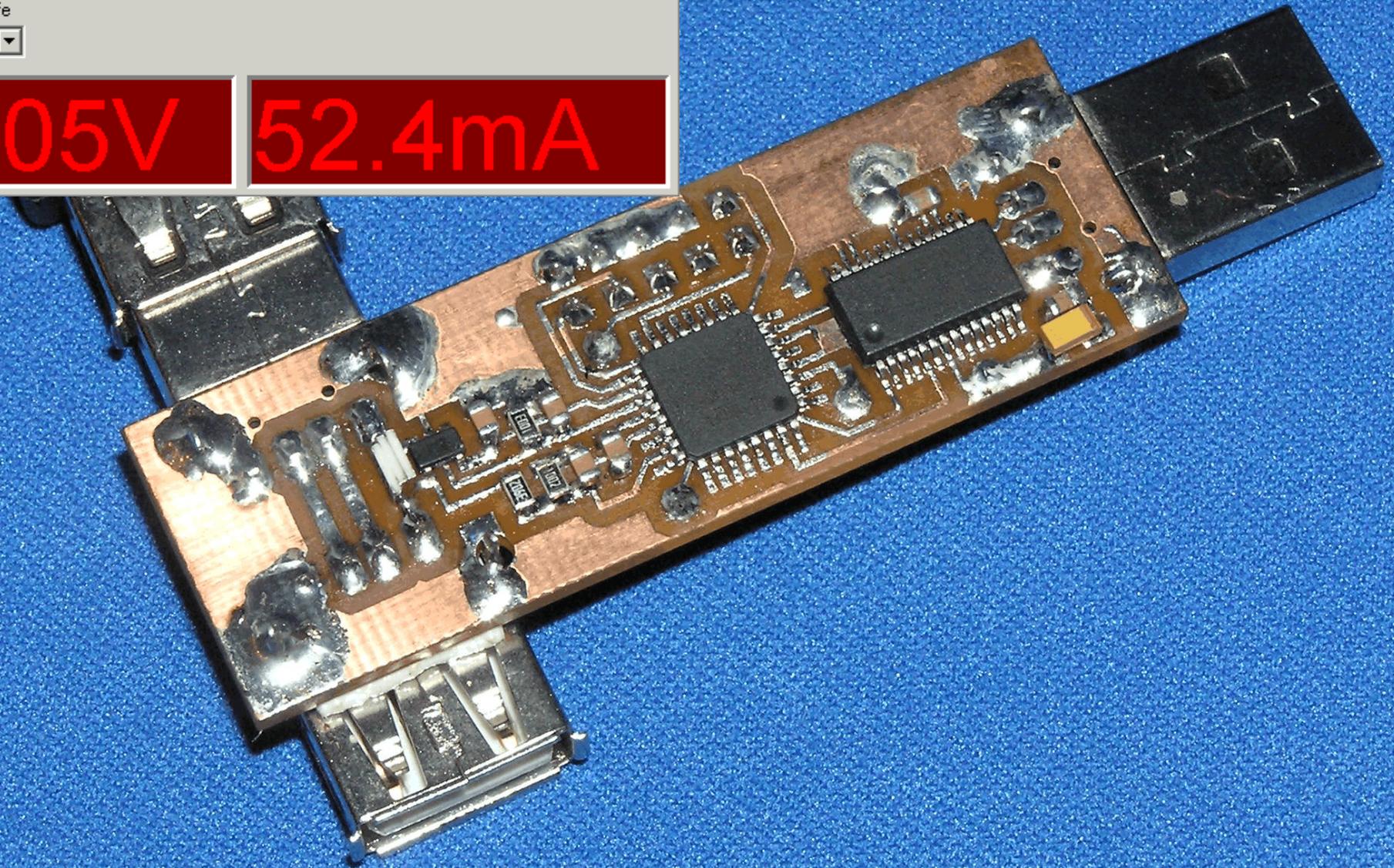
Aufbau

Inbetriebnahme

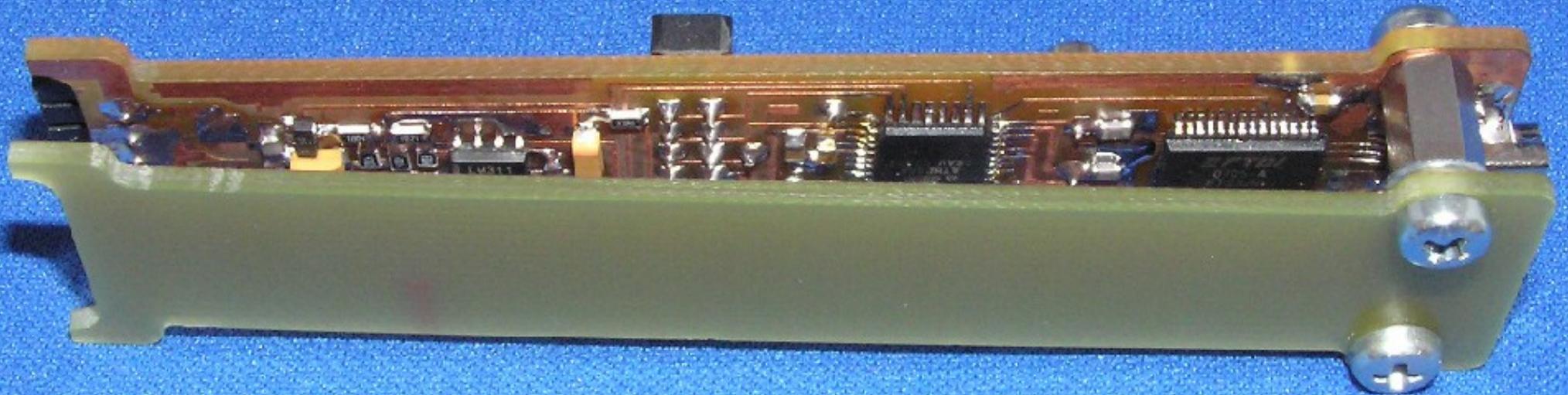
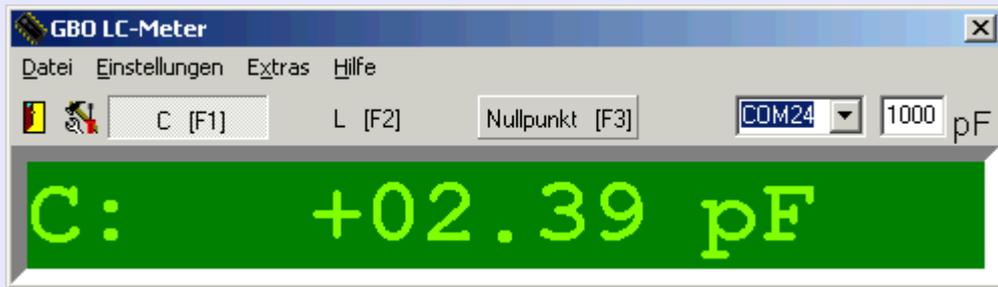
Messgeräte, Messplatz

Messvorführung

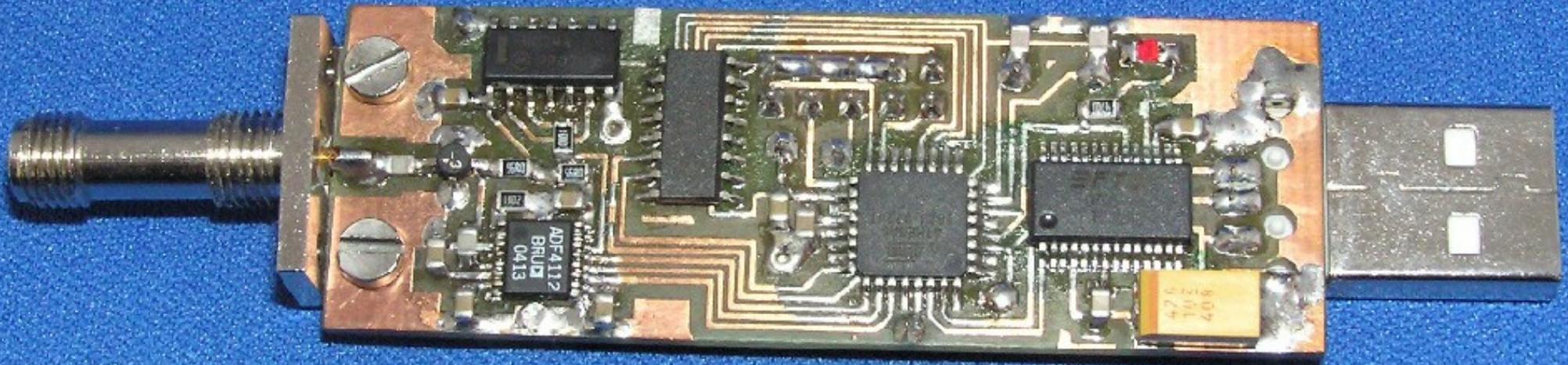
VA Meter



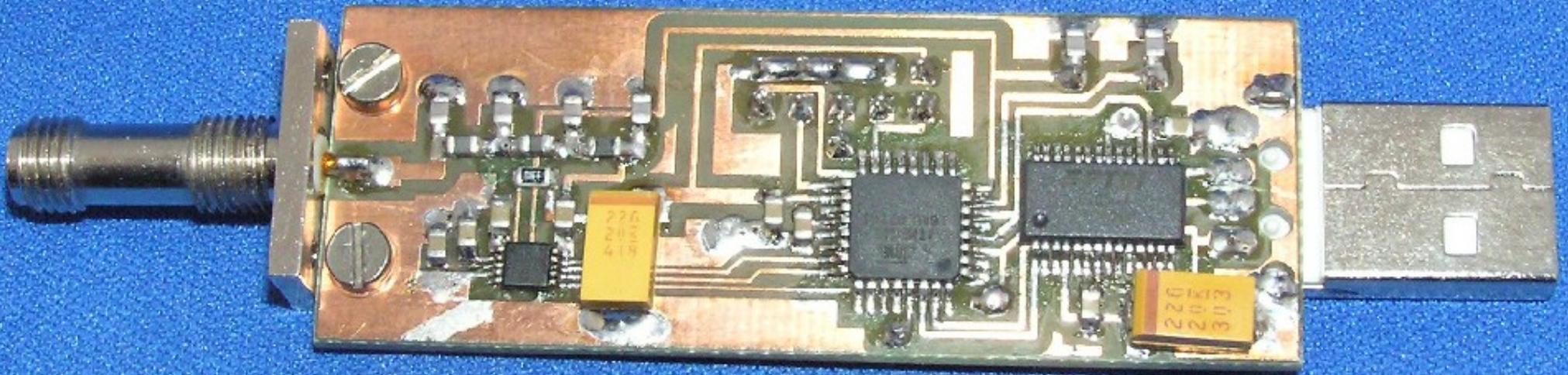
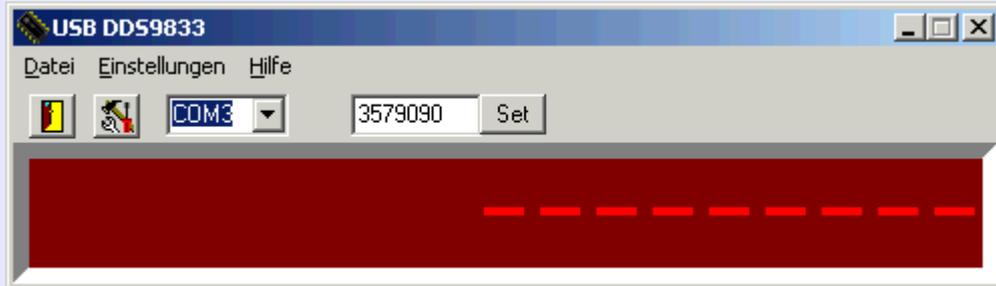
LC-Meter



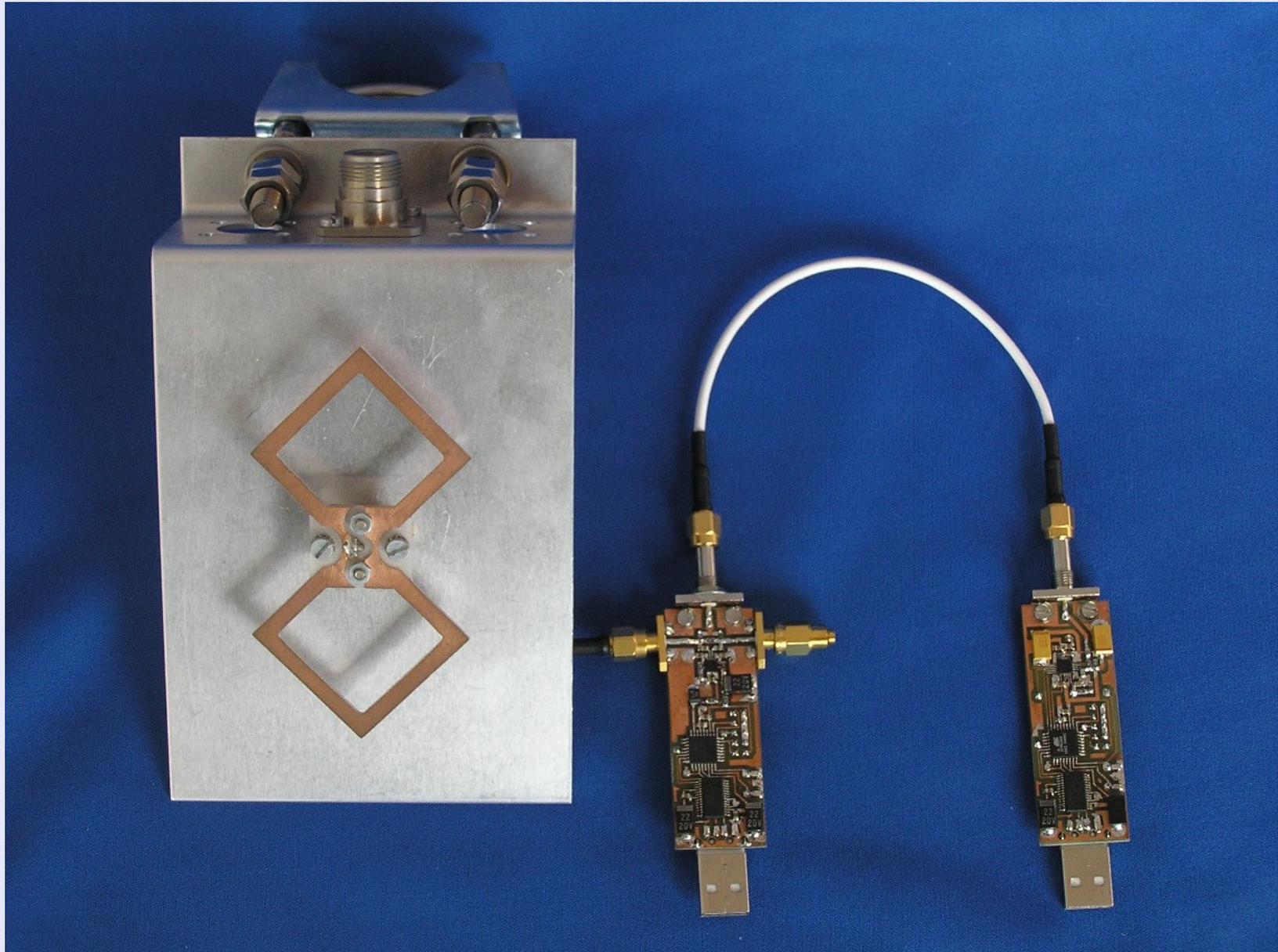
Frequenzzähler 3GHz



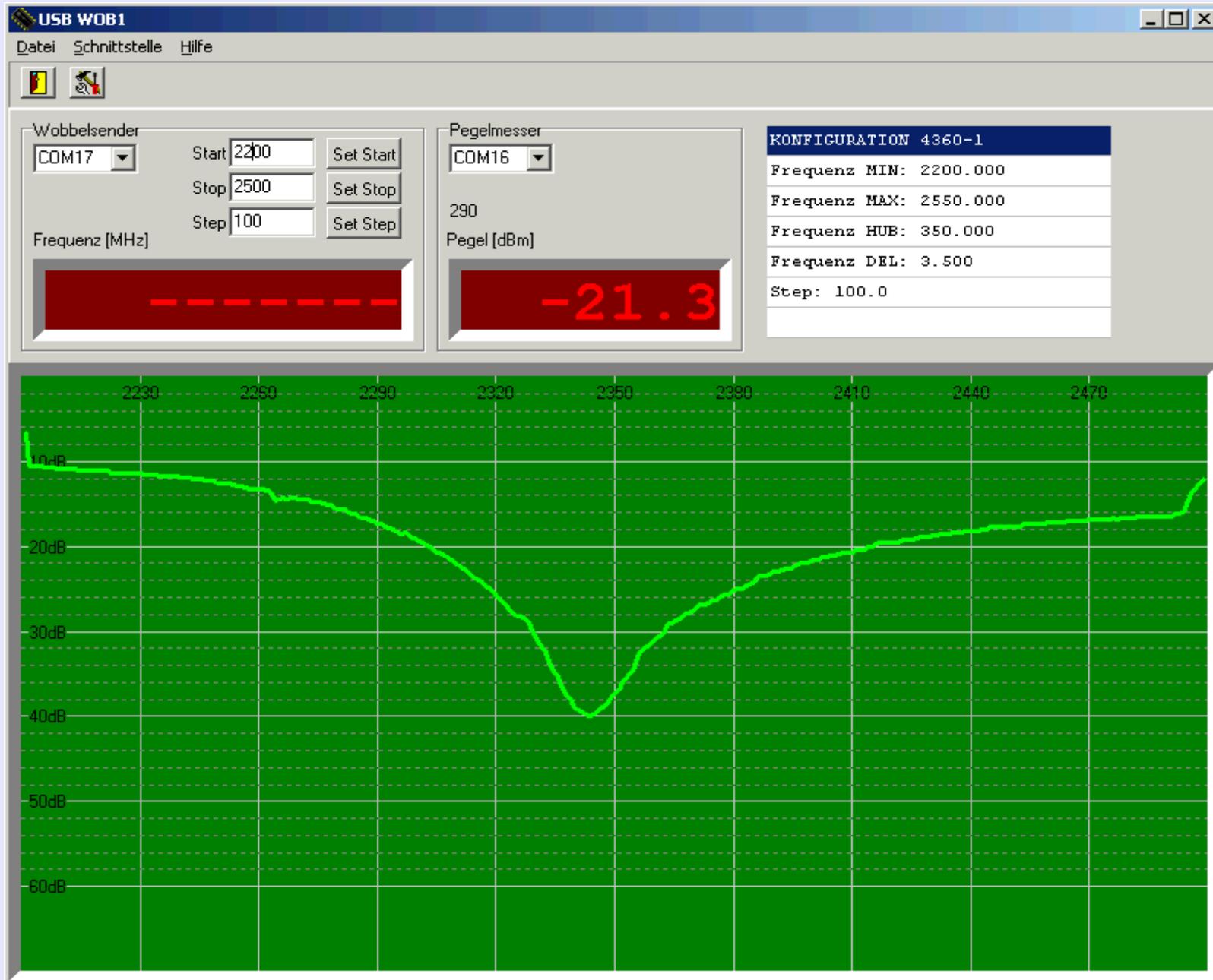
DDS-Signalgenerator



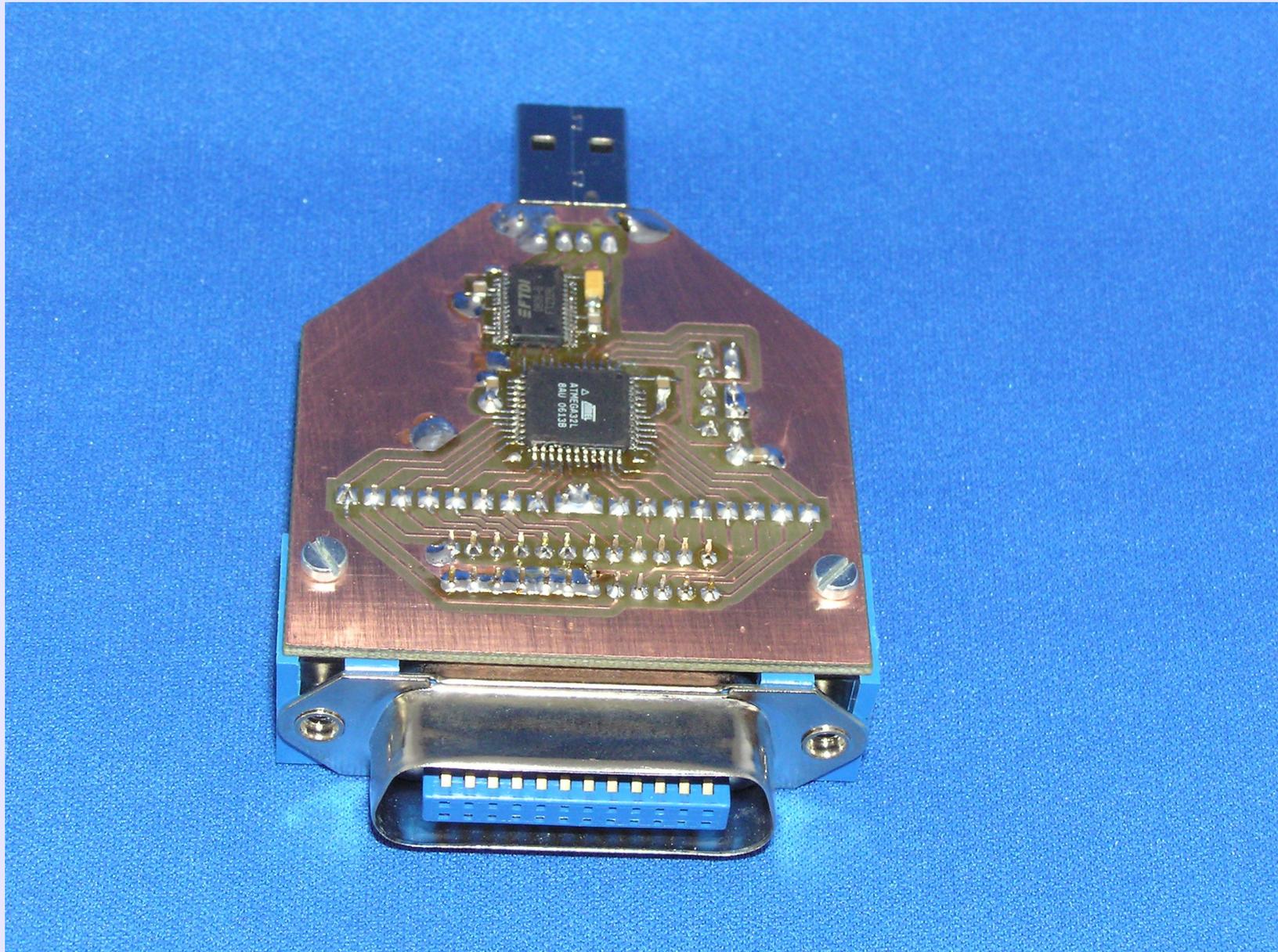
13cm Wobbler



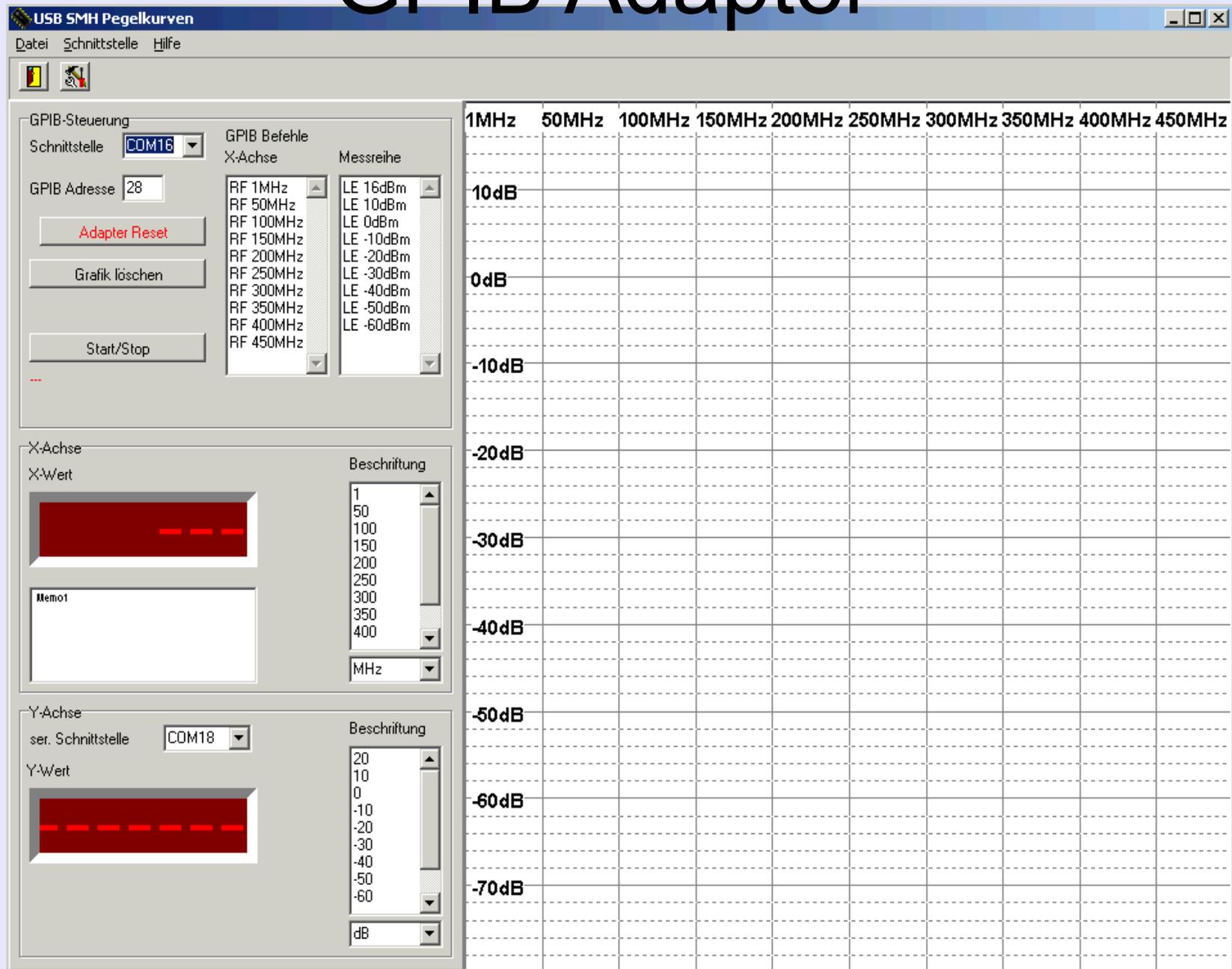
13cm Wobbler



GPIB Adapter



GPIB Adapter



Themen

Allgemeines

Leistungsmesser

Entwicklung

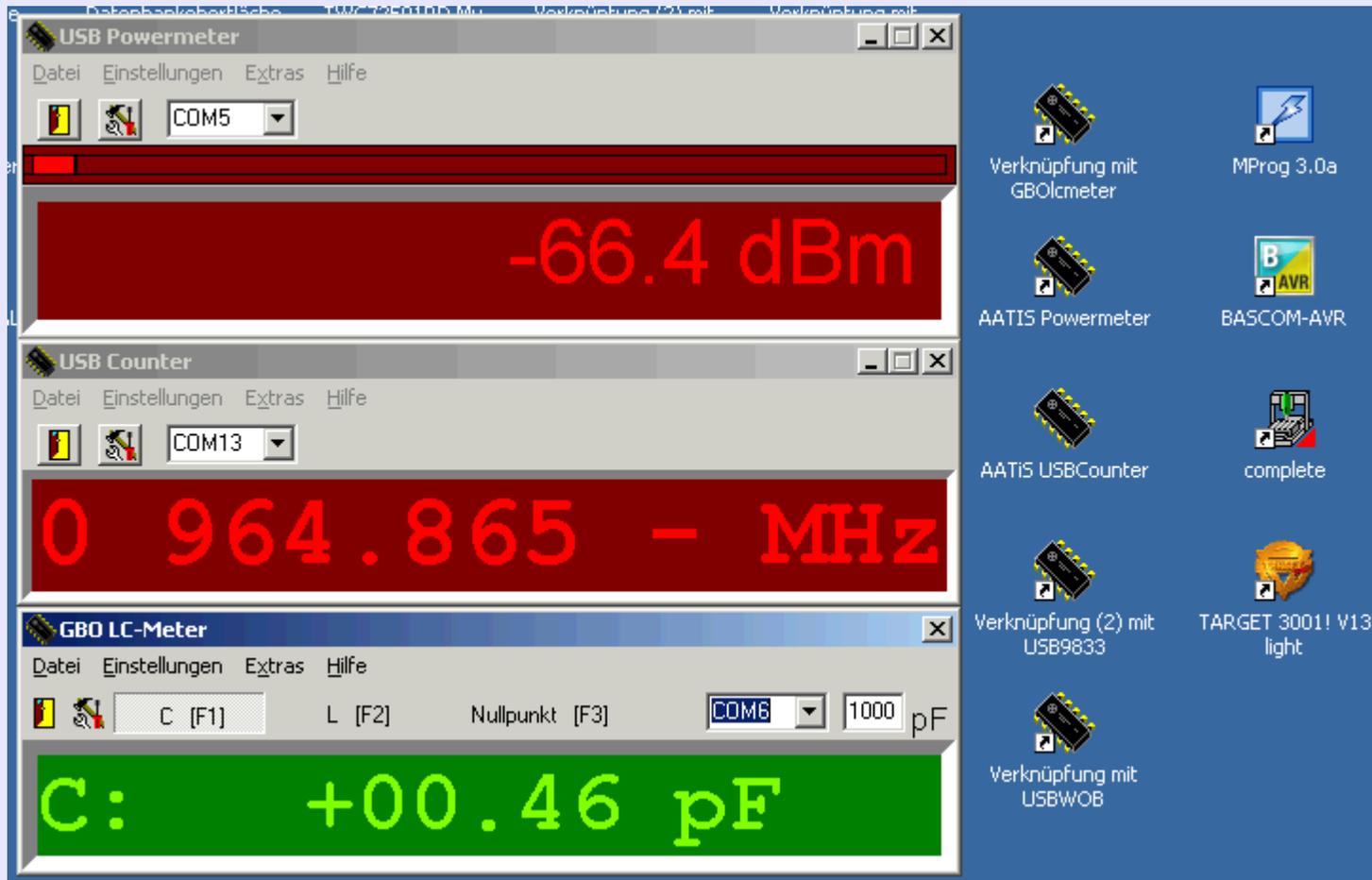
Aufbau

Inbetriebnahme

Messgeräte, Messplatz

Messvorführung

Bildschirmkopie



Experimentieren, Programmieren

- Schaltung, Layout, Firmware, Treiber, Schnittstellenbefehle, Windowssoftware sind offen, lizenzfrei

USB-Stick: Hardware ändern

- Firmware: Software BASCOM erweitern
- Windowsprogramm: Software DELPHI erweitern
- AATiS Praxisheft 19

