

V 0.0

# KU PA 440500 – 40 LIN



## Manual

## Specification

### Specifications (Ta = 25 °C):

Frequency range 4400 ... 5000 MHz  
 Input signal bandwidth 1.2 ... 75 MHz

### Input power

Normal operation -5 ... 0 dBm  
 Maximum 0 dBm

### Output power

Output power COFDM +36 ... 37 dBm  
 Output power COFDM 4 ... 5 W

### Gain

Flatness with ALC (small signal) typ. +/- 1 dB

### Harmonics

Harmonic rejection @ 37 dBm typ. 50 dB

### Protection

Output protection Isolator

ON voltage +3 ... 14 V DC  
 Supply voltage +23 ... 38 V DC

Quiescent power consumption typ. 45 W

Power consumption typ. 75 W @ 37 dBm

### Monitor output

Forward detection yes  
 Reverse detection yes

Operating case temperature range -20 ... +55 °C

### Mechanics

Input connector / impedance SMA-female, 50 ohms  
 Output connector / impedance SMA-female, 50 ohms  
 Case milled aluminium  
 Dimensions (mm) 184 x 100 x 40  
 Weight typ. 750 g

### Features:

- GaN technology
- High linearity (built-in linearizer)
- Good harmonic rejection
- Isolator for protection against high VSWR
- Monitor outputs for forward and reverse power detection (DC voltage)
- ON / OFF control with DC voltage (ON at 3 ... 14 V) or serial command
- Adjustable ALC (automatic level control)
- Serial interface

### Applications:

- Multichannel Multipoint Distribution Service (MMDS)
- Digital broadcast systems (DVB-T, DVB-S)
- COFDM systems using modulation types QPSK, QAM

### Amplifier should be mounted on heat sink!

### CE Konformität / CE Conformity

EMC directive 2014/30/EU  
 Low voltage directive 2014/35/EU  
 RoHS directive 2011/65/EU



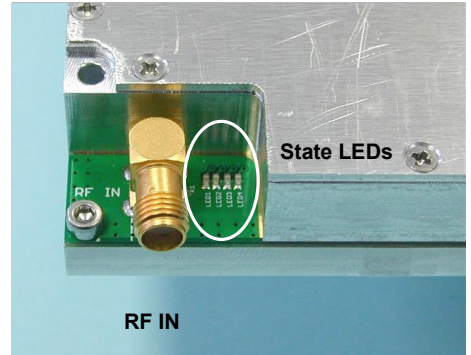
## Connectors

### RF IN

RF input (-5 ... 0 dBm)

#### State LEDs

- LED 1 LED is ON if supply voltage is attached to CON 2
- LED 2 Linearizer state - LED flashes during analyzing the signal - LED is ON as soon as the PA is linearized and in tracking state
- LED 3 With every OFF to ON transition the linearizer in the PA will be reseted and the input level will be internally optimized for the linearizer. This LED is ON as soon as the input level is optimized.
- LED 4 Warning LED - the LED flashes if the input signal is out of frequency range



### CON 1

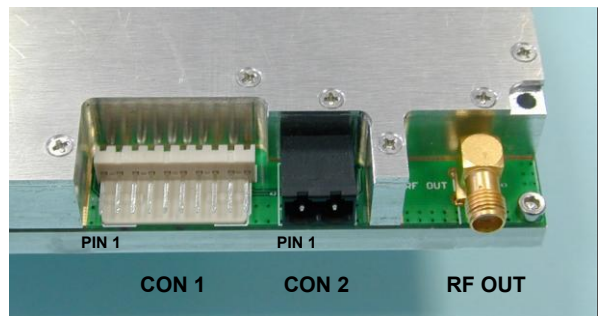
- PIN 1 ON (+3 ... 14 V DC)
- PIN 2 GND
- PIN 3 TEMP output - DC voltage of the internal temperature sensor
- PIN 4 OVERTEMP output - The amplifier switches off at about +65 °C, this will be indicated with +5 V on this PIN
- PIN 5 ON / OFF control (GND = ON, open = OFF)
- PIN 6 Serial interface - TX
- PIN 7 Serial interface - RX
- PIN 8 GND
- PIN 9 Output which monitors forward power (DC voltage). The MON pin is not calibrated and no linear function. It is intended for observing the output power - not for exact measurements.
- PIN 10 Output which monitors reverse power (DC voltage). The VSWR MON pin is not calibrated and no linear function. It is intended for observing the reverse power - not for exact measurements.

### CON 2

- PIN 1 Supply voltage input (+23 ... 38 V DC)
- PIN 2 Supply GND

### RF OUT

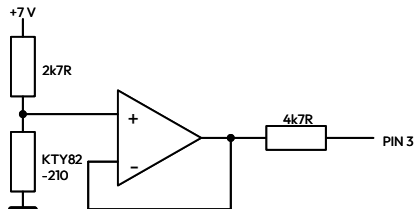
RF output protected with an isolator



## Details

### CON1

PIN 3 TEMP output - DC voltage of the internal temperature sensor



### Start-up sequence

1. Connect the serial interface with your controller (CON 1 / PIN 6, 7)
2. Connect RF input cable and RF output load to the amplifier
3. Apply +23 ... 38 V (CON 2)
4. Apply RF input signal to the amplifier (4400 ... 5000 MHz / -5 ... 0 dBm)
5. Switch the amplifier ON
6. Set the output power via the serial interface
7. Is the output power correct send a reset to the power amplifier
  - The input level for the linearizer will be adjusted with the input ALC
  - The output signal will be corrected
  - This adjustment procedure needs a few seconds
9. If correction is done and all is OK LED 1, LED 2, and LED 3 are ON

### Serial interface (RXD / TXD)

Commands and the state of the PA can be read out and controlled with the built-in serial interface

- TTL level
- 9600 BAUD data rate
- 8 data bits
- 1 stop bit

Command structure for all commands

```
Start command (
Command       X
Data Highbyte 8 bit
Data Lowbyte  8 bit
Stop command  ) or CR
```

Depending on the command the controller returns „A“ (acknowledge) as soon as the command is executed or values in readable ASCII.

If the controller returns „B“ (busy), the amplifier ignores the command. Wait about 500 ms and try it one more time

## Serial commands

### R (Answer „A“)

Resets the linearizer and the input ALC. After sending this command the input ALC will be set from the internal controller and the linearizer optimizes the output signal. A reset is recommended after changing the input frequency or the output power.  
Send „(R00)“

### P + value (Answer „A“)

Send P and the wanted output power in dBm. Send the value in the range from 0 ... 400 to set the output power.  
For example the value 370 means 37.0 dBm output power.  
Send „(P370)“

### W (Answer „A“)

The actually set output power can be saved in the EEPROM. At a new power up the power amplifier starts with the saved output power.  
Send „(W00)“

### O (Answer „A“)

Switches the amplifier ON if config is set to 1.  
Send „(O00)“

### X (Answer „A“)

Switches the amplifier OFF if config is set to 1.  
Send „(X00)“

### C + value (Answer „A“)

This command saves the ON PIN configuration of the amplifier. After sending the command the configuration will be saved in the EEPROM. At a new power up the power amplifier starts with the new ON PIN configuration.

There are four configurations for the ON PIN

Case 0: Hardware ON/OFF. The power amplifier must be switched ON with a control voltage (CON 1 / PIN 1). The commands „O“ and „X“ are deactivated.  
Send „(C00)“

Case 1: The power amplifier can be switched ON or OFF via the serial interface. Use the commands „O“ or „X“ to switch the amplifier ON or OFF.  
Send „(C01)“ **Important: Do not connect (CON 1 / PIN 1) if you use case 1.**

Case 2: After power up the amplifier is always ON. The commands „O“ and „X“ are deactivated.  
Send „(C02)“ **Important: Do not connect (CON 1 / PIN 1) if you use case 2.**

Case 3: Hardware ON/OFF. The power amplifier must be switched ON with a GND connection (CON 1 / PIN 5). The commands „O“ and „X“ are deactivated.  
Send „(C03)“ **Important: Do not connect (CON 1 / PIN 1) if you use case 3.**

## Serial commands

### Readable values

#### **p** (Answer ASCII value)

The controller returns the measured forward power in dBm. The answer 300 means 30.0 dBm.  
 Send „(p00)“

#### **r** (Answer ASCII value)

The controller returns the measured reflected power in dBm. The answer 300 means 30.0 dBm.  
 Send „(r00)“

#### **t** (Answer ASCII value)

The controller returns the temperature of the power amplifier  
 Send „(t00)“

#### **c** (Answer ASCII value)

This command reads the ON PIN configuration.  
 The controller returns 0, 1, 2 or 3 regarding the three cases of the „C“ command.  
 Send „(c00)“

#### **y** (Answer ASCII value)

This command reads the currently used LO frequency of the amplifier. The controller returns the value in MHz.  
 Send „(y00)“

#### **s0x** (Answer ASCII value)

This command reads different states of the amplifier. P1OK -> s00, SC1894 state -> s01, Freq. error  
 The controller returns the value in ASCII. Send „(s00)“, „(s01)“, „(s02)“ or „(s03)“

RF input power : (s00)

0 = input power not in range, 1 = input power in range

SC1894 state: (s01)

0 = INIT, 1 = FSA (Full Speed Adaptation), 3 = TRACK (Tracking), 6 = CAL (Calibrating), 9 = PDET (Calibrating)

Frequency error: (s02)

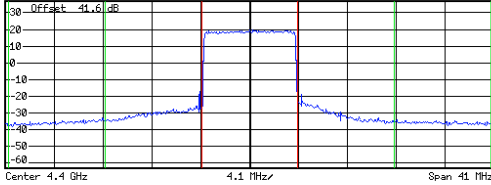
0 = no error, 1 = wrong input frequency

Overtemperature error: (s03)

0 = no error, 1 = overtemperature shutdown

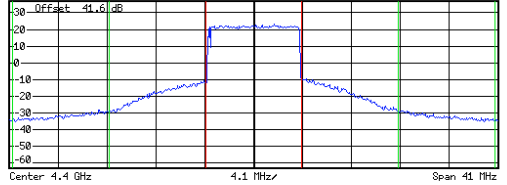
## Results @ 37 dBm Pout

### 4.4 GHz COFDM 8k QAM64



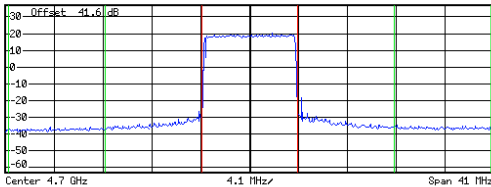
<b>Tx Channel</b>			
Bandwidth	8.1 MHz	Power	37.17 dBm
<b>Adjacent Channel</b>			
Bandwidth	8.1 MHz	Lower	-47.78 dB
Spacing	8.1 MHz	Upper	-47.43 dB
<b>Alternate Channel</b>			
Bandwidth	8.1 MHz	Lower	-54.07 dB
Spacing	16.2 MHz	Upper	-54.21 dB

## Results @ 40 dBm Pout

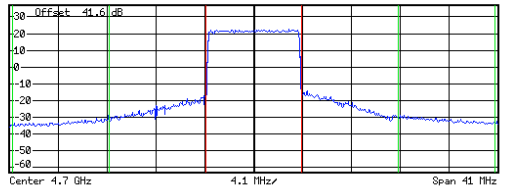


<b>Tx Channel</b>			
Bandwidth	8.1 MHz	Power	40.07 dBm
<b>Adjacent Channel</b>			
Bandwidth	8.1 MHz	Lower	-37.72 dB
Spacing	8.1 MHz	Upper	-36.87 dB
<b>Alternate Channel</b>			
Bandwidth	8.1 MHz	Lower	-53.12 dB
Spacing	16.2 MHz	Upper	-53.26 dB

### 4.7 GHz COFDM 8k QAM64

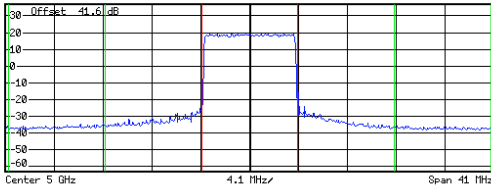


<b>Tx Channel</b>			
Bandwidth	8.1 MHz	Power	37.05 dBm
<b>Adjacent Channel</b>			
Bandwidth	8.1 MHz	Lower	-52.23 dB
Spacing	8.1 MHz	Upper	-50.63 dB
<b>Alternate Channel</b>			
Bandwidth	8.1 MHz	Lower	-55.41 dB
Spacing	16.2 MHz	Upper	-54.63 dB

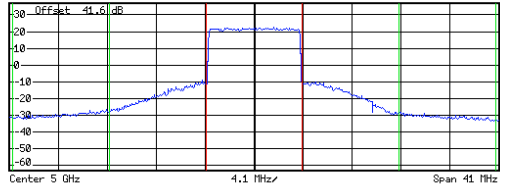


<b>Tx Channel</b>			
Bandwidth	8.1 MHz	Power	40.11 dBm
<b>Adjacent Channel</b>			
Bandwidth	8.1 MHz	Lower	-45.24 dB
Spacing	8.1 MHz	Upper	-42.52 dB
<b>Alternate Channel</b>			
Bandwidth	8.1 MHz	Lower	-54.68 dB
Spacing	16.2 MHz	Upper	-52.77 dB

### 5.0 GHz COFDM 8k QAM64



<b>Tx Channel</b>			
Bandwidth	8.1 MHz	Power	36.97 dBm
<b>Adjacent Channel</b>			
Bandwidth	8.1 MHz	Lower	-50.19 dB
Spacing	8.1 MHz	Upper	-49.53 dB
<b>Alternate Channel</b>			
Bandwidth	8.1 MHz	Lower	-54.65 dB
Spacing	16.2 MHz	Upper	-55.28 dB



<b>Tx Channel</b>			
Bandwidth	8.1 MHz	Power	40.03 dBm
<b>Adjacent Channel</b>			
Bandwidth	8.1 MHz	Lower	-37.03 dB
Spacing	8.1 MHz	Upper	-36.35 dB
<b>Alternate Channel</b>			
Bandwidth	8.1 MHz	Lower	-50.95 dB
Spacing	16.2 MHz	Upper	-52.20 dB

## Block chart

