#### High quality products made in Germany





Englisch 2005 - Main catalogue





Innovative high quality products using advanced technology for microwave communications

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#### Super low noise selective PHEMT preamplifiers for 144 MHz and 432 MHz Model LNA 144 A - LNA 432 A

Our low noise amplifiers are built with the newest PHEMT from Agilent. Because of this special device and the unique circuit design it provides unequalled performance needed for serious 144 MHz and 432 MHz weak signal operation like EME, Meteor Scatter, Aurora, Satellite and Tropo DX. The preamps do not contain coaxial relays.

- Selective preamplifier include a double helical- bandpass filter
- · Low noise figure and high gain
- High IP3, designed for contest operation
- Milled aluminium case
- Unconditionally stable. No parasitic oscillations in case of poor antenna match.,
- Important note: The preamplifiers do not contain built-in coaxial relays!

Туре	LNA 144 A	LNA 432 A
Center frequency	144,2 MHz	432,2 MHz
Gain	min. 25 dB	20 dB
Noise figure	0,35 dB +/- 0,05	0,4 dB +/- 0,05
Input return loss	> 3 dB	typ. 5 dB
Output return loss	typ. 15 dB	> 15 dB
IP3 out	typ. + 24 dBm	typ. +27 dBm
Stability k	>1	> 1
Operating voltage	+1214 V DC	+1214 V DC
Current consumpt.	typ. 70 mA	typ. 70 mA
Dimensions mm	30 x 50 x 25	30 x 50 x 25
Case	milled aluminium	milled aluminium
Input connector	N-male	N-male
Output connector	N-female	N-female



## **Overview 23 / 13 cm preamplifiers**

All amplifiers typ. 0.7dB NF



Preamplifier

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#### Super low noise HEMT preamplifiers with helical filters MKU 132 A / B MKU 132 A2 23 cm amateur band MKU 152 A INMARSAT 1.55 GHz • MKU 232 A2 with built-in notch filter for the 23 cm band. Developed for duplex operation with 1.3 GHz TX and 2.3 GHz RX. MKU 172 A METEOSAT 1.7 GHz

#### MKU 232 A2 / B 13 cm amateur band

 Male connector at the input for direct connection to a coaxial relay to avoid adapter losses.

 Remote power supply via coaxial cable or externally via the feed-trough capacitor. (built-in bias tee)

Provides highly sensitive 23 cm ATV reception when combined with a satellite receiver.

 Low noise figure, 0.7dB (typ.) NF and high gain (>35 dB) allow installations with long feed lines.

Multilayer ceramic filter - and German silver case. MKU 232 TM is mounted in a waterproof case.

· High-pass filter at the input and helical filter after the first stage in order to avoid saturation of the second stage and the following receiver by out of band signals.

 Unconditionally stable. No parasitic oscillations in case of poor antenna match.

 MKU 132 A2 includes a notch filter for 13 cm Band for cross band mode, MKU 132 A2 TM and MKU 232 A2 TM are mounted in a waterproof case.

• Important note: The preamplifiers do not contain built-in coaxial relays!

Specifications	Amplifier MKU 132 Frequency range 127 MH		<b>132 A2</b> - 1275 +/-	<b>132 B</b> 1296 +/-	<b>152 A</b> 1550 +/-	<b>172 A</b> 1695 +/-	<b>232 A2</b> 2350 +/-	<b>232 B</b> 2320 +/-
Versions can be supplied	Gain min.	35 dB	35 dB	15 dB	35 dB	35 dB	35 dB	15 dB
for other frequencies on request!	Noise figure Operating voltage Current consumpt Dimensions mm Case	ion	typ. 0.7 dB NI +918 V DC 15 / 30 mA 30 x 38 x 120 German Silve	incl. connec	ctors	Mł Mł Built case	(U 132 A2 <sup>-</sup> (U 232 A2 <sup>-</sup> -in a water <sub>l</sub> e for moun on a tower	TM TM proof ting
	Coaxial connector Coaxial connector Weight. approx	s s 132 A	Input N-male Input N-male <120 g	/ Output N- / Output F	female / C <b>-female</b>	Other coaxia	l connectors	s on request



## Super low noise HEMT preamplifiers

Our super low noise microwave preamplifiers are proven in practical use and many contests over the years.

Small size

Specifications

- · Low noise figure and high gain
- Milled aluminium case, professional construction.
- Male-connector at the input of the amplifier for direct connection to a coaxial relay typ. "A"
- Unconditionally stable. No parasitic oscillation in case of poor antenna match.
- Important note: The preamplifiers do not contain built-in coaxial relays!

## MKU 101 B WINNER! Noise figure contest Dayton USA 1998



NEW NEW

Туре	131 A	131 B	231 A	231 B	341 A HEMT	341 B HEMT	342 A	342 B	571 A	571 B	101 AS	101 BS	102 A HEMT	102 В НЕМТ
MHz	1296	1296	2320	2320	3400	3400	3400	3400	5760	5760	10368	10368	10368	10368
NF max	0.5 dB	0.5 dB	0.6 dB	0.6 dB	0.7 dB	0.7 dB	0.7 dB	0.7 dB	0.7 dB	0.7 dB	typ 0.7 dB	typ 0.7 dB	typ. 0.8 dB	typ. 0.8 dB
Gain dB	18	18	16	16	12	12	28	28	12	12	12	12	22	22
SMA in	male	female	male	female	male	female	male	female	male	female	male	female	male	female
l in typ.	15 mA	15 mA	80 mA	80 mA	15 mA	15 mA	15 mA	15 mA	30 mA	30 mA				

Output connector	SMA-female
Operating voltage	+915 V DC
Dimensions mm	50 x 30 x 18 without connectors
Weight approx.	40 g
Case	milled aluminium
Option "N"	Input connector N- male, output connector N- female, on request.

Versions can be supplied for other frequencies!



## Super low noise HEMT preamplifiers for the 23 & 13 cm band

#### Model MKU 131 AH HEMT - MKU 132 AH HEMT - MKU 231 AH HEMT - MKU 232 AH HEMT

- Male connector at the input for direct connection to the coaxial relay to avoid adapter losses.
- Remote power supply via coaxial cable or externally via the feed-trough capacitor (built-in separating filter)
- Provides highly sensitive 23 cm ATV reception when combined with a satellite receiver
- Low noise figure 0.7 dB (typ.)
- Low noise figure and high gain (>35 dB) allow long feed lines
- High-pass filter at the input and helical filter after the first stage to avoid saturation of the second stage and the following receiver by signals outside the band.
- Unconditionally stable. No parasitic oscillations in case of poor antenna match.
- Important note: The preamplifiers do not contain built-in coaxial relays!

# Winner of the noise figure contest at the round table convention Martlesham - 2002!

#### Super low noise HEMT preamplifier for EME!

- DANE SUPER LOW WORS

NINT electronic Gmbi



### Specifications

8

Туре	MKU 131 AH HEMT	MKU 132 AH HEMT	MKU 132 AH HEMT-SMA	MKU 231 AH-HEMT	MKU 232 AH-HEMT
Center frequency	1296 +/- MHz	1296 +/- MHz	1296 +/- MHz	2304-2320 MHz	2304-2320 MHz
Noise figure NF	0,4 dB NF +/- 0,05	0,4 dB NF +/- 0,05	0,4 dB NF +/- 0,05	typ. 0,4 dB @ 18 °C	typ. 0,5 dB @ 18°C
_	@ 18 °C	@ 18 °C	@ 18 °C	max. 0,5 dB	max. 0,6 dB NF
Gain	min. 17 dB typ. 20 dB	min. 29 dB typ. 33 dB	min. 29 dB typ. 33 dB	typ. 16 dB	typ. 30 dB
In	N-male	N-male	SMA-male	N-male	N-male
Out	N-female	N-female	SMA-female	N-female	N-female
Operating voltage	+915 V DC	+915 V DC	+915 V DC	+ 9 15 V DC	+ 9 15 V DC
Current consumption	approx. 15 mA	approx. 65 mA	approx. 65 mA	approx. 15 mA	approx. 65 mA
Dimensions mm	50 x 30 x 22	70 x 30 x 22	70 x 30 x 22	50 x 30 x 18	73 x 30 x 22
Case	milled aluminium	milled aluminium	milled aluminium	milled aluminium	milled aluminium
IP 3 out	-	typ. 27 dBm	typ. 27 dBm	-	typ. 27 dBm
Weight	approx. 45 g	approx. 80 g	approx. 80 g	approx. 105 g	approx. 80 g
Options	other connectors on re	equest			

## Super low noise HEMT preamplifiers for radio astronomy Modell KU 141 AH HEMT - KU 142 AH HEMT

- Small size
- · Low noise, high gain
- Milled aluminium case
- · Male connector at the input of the amplifier for direct connection to the antenna
- · Unconditionally stable. No parasitic oscillation in case of poor antenna match
- · Important note: The preamplifiers do not contain builtin coaxial relays!

#### Specifications

Туре	KU 141 AH HEMT	KU 142 AH HEMT
Frequency range	13501450 MHz	13501450 MHz (1200-1600 MHz)
Noise figure NF @ 18° C	max. 0.4 dB NF +/- 0,05 or. 27° KELVIN	max. 0.4 dB NF +/- 0,05 or 27° KELVIN
Gain	min. 17 dB Gain	min. 33 dB (min. 29 dB)
In	N-male	N-male
Out	N-female	N-female
Operating voltage	+915 V DC	+915 V DC
Current consumption	approx. 15 mA	approx. 65 mA
Dimensions mm	50 x 30 x 22 without connectors	73 x 30 x 22
Weight	approx. 110 g	approx. 140 g
Case	milled aluminium	milled aluminium
Options	other connectors on request	other connectors on request
Weight	approx. 100 g	approx. 140 g





MICROWAVE COMPONENTS



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## Super low noise HEMT preamplifiers and power splitter for GPS 1575 MHz

- BAND SUPER LOW NOISE

UHNE electronic 5mbH

NEW

1575 MHz +/- 10 MHz

KU 1575-50

tvp. 55 dB

> 20 dBm

> 10 dBm

N-female

max. 0.5 dB

+9...18 V DC

typ. 100 mA

102 x 45 x 29

milled aluminium

#### Model KU 1575/4 SMA - KU 1575-50

- · 12 V suplly of active antennas is possible via preamp input connector
- Low noise figure, 0.7 dB (typ.)

UNAT electronic

SUPER LOW NOISE GPS AMPLIFIER

MARCE B.

24 44

Type

Gain

IP3 out

**Specifications** 

**Frequency range** 

Noise figure

**Output power** 

**Operating voltage** 

Dimensions mm

Connectors

Current consumption

· Low noise figure and high gain (47 dB) allow long feed lines

CUT-A

OUT - R

OUT-C

COL-D

KU 1575/4 SMA

47 dB +/- 3 dB

typ. 0.7 dB

+12 V DC

typ. 300 mA

111 x 55 x 30

SMA-female

German silver case

1575 MHz +/- 10 MHz

- 4 separate output stages with SMA-female connectors
- High-pass filter at the input and a helical filter after the first stage in order to avoid saturation of the second stage and the following receiver by signals outside the band.
- Unconditionally stable. No parasitic oscillation in case of poor antenna match.
- Important note: The preamplifiers do not contain built-in coaxial relays!

#### Model KU 1575 DIV

- Passive **power splitter** with DC-coupling for active GPS-antennas
- Connection of two GPS-receivers to one antenna is possible. The active antenna is supplied by one of the receivers One receiver supplies the active antenna with the DC voltage



#### **Specifications**

Type RF center frequency Insertion loss Isolation Impedance DC path Dimensions mm Case Connectors KU 1575 DIV 1575 MHz +/- 50 MHz typ. 3 dB typ. 25 dB 50 Ohm +0...24 V DC / max. 0.5 A 37 x 37 x 30 Tin plate N-female

Special versions for other frequencies can be supplied on request!



Case

## Super low noise HEMT preamplifiers (two stages) Model MKU 572 A - MKU 572 B - MKU 572 AF - MKU 572 BF

Our super low noise microwave preamplifiers are proven in practical use and in many contests over the years.

- Small size
- Low noise figure and high gain
- Milled aluminium case
- Male connector at the input of the amplifier for direct connection to a coaxial relay typ. "A"
- Unconditionally stable. No parasitic oscillation in case of poor matched antenna
- Important note: The preamplifiers do not contain built-in coaxial relays!

#### **Specifications**

Type	MKU 572 A	MKU 572 B	MKU 572 AF	MKU 572 BF
Center frequency	5760 MHz	5760 MHz	5760 MHz	5760 MHz
Gain	min. 25 dB	min. 25 dB	min. 25 dB	min. 25 dB
Noise figure @ 18° C	max. 0.7 dB	max. 0.7 dB	max. 0.7 dB	max. 0.7 dB
Operating voltage	+915 V DC	+915 V DC	+915 V DC	+915 V DC
Current consump.	30 mA	30 mA	30 mA	30 mA
Dimensions mm	74 x 30 x 18			
Case	milled aluminium	milled aluminium	milled aluminium	milled aluminium
In	SMA-male	SMA-female	SMA-male	SMA-female
Out	SMA-female	SMA-female	SMA-female	SMA-female
In	SMA-male	SMA-female	SMA-male	SMA-female
Out	SMA-female	SMA-female	SMA-female	SMA-female
Incl. bandpass	no	no	yes	yes
Weight	approx. 75 g	approx. 75 g	approx. 80 g	approx. 80 g







## Super low noise HEMT preamplifiers for the X-Band Model MKU 102 S-EME - MKU 102 S-EME R 120 - KU 8000 A





#### **Specifications**

Type **Center frequency** Noise figure Gain min. 23 dB **Operating voltage** +9...15 V DC **Current consumption** tvp. 30 mA **Dimensions mm** Weight approx. 110 g Case Waveguide MKU 102 S-EME R120 R120 Waveguide MKU 102 S-EME Coaxial output SMA-female

#### MKU 102 S-EME / R 120 10368 MHz radio amateur band typ. 0.7 dB @ 18°C min. 23 dB +9...15 V DC typ. 30 mA 20 x 40 x 83 mm incl. connectors approx. 110 g milled aluminium R120 R100 / WG16 / WR90 SMA-female

#### Deep space communication preamplifier



- Small size
- · Low noise figure and high gain
- Milled aluminium case, professional construction

MKU 102 S- EME. Winner of the Noise figure contest at EME-conference in Prague 2002

- Male connector at the input of the amplifier for direct connection to a coaxial relay - typ. "A"
- Unconditionally stable. No parasitic oscillation in case for poor antenna match
- Use of latestest GaAs HEMT FET's
- Direct transition from waveguide to pcb
- Important note: The preamplifiers do not contain built-in coaxial relays!



(12)

Special versions for other frequencies on request!

## Super low noise HEMT amplifiers for 24 GHz

#### Model MKU 243 WS2 - MKU 243 CS2

- Small Size
- · Low noise figure and high gain
- Milled aluminium case
- Male connector at the input of the amplifier for direct connection to coaxial relay (MKU 243 CS2)
- Unconditionally stable. No parasitic oscillation in case of poor antenna match.
- Important note: The preamplifiers do not contain built-in coaxial relays!

	AMF	PLIFIER	
IN	MOD	EL 243 WS	OUT
Kun	NE elect	COMPONENTS	MADE IN GERMAN
	MICROWAVE	COMPONENTS	MADE IN GERMANY



#### **Specifications**

Type Center frequency Noise figure Gain Output power Operating voltage Current consumption Dimensions mm Weight Case Input Output

#### MKU 243 WS2

24048 MHz (24,0 - 24,25 GHz) max. 1.5 dB at 18°C min. 26 dB typ. 10 mW sat. +9...15 V DC ca. 60 mA 50 x 30 x 18 approx. 85 g milled aluminium R220 / WR42 / WG20 R220 / WR42 / WG20

#### **Specifications**

Type Center frequency Noise figure Gain Output power Operating voltage Current consumption Dimensions mm Weight Case Input connector Output connector

#### MKU 243 CS2 24048 MHz (24,0 - 24,25 GHz) max. 2.0 dB at 18°C min. 24 dB typ. 10 mW sat. +9...15 V DC approx. 60 mA 50 x 30 x 18 without connectors approx. 40 g milled aluminium SMA-male SMA-female



# Super low noise HEMT amplifiers for 24 and 47 GHz

#### Model MKU 243 RX2 - MKU 472 B

- Use of the most advanced GaAs HEMT FET and HEMT FET chips
- Small size for assembling compact 24 and 47GHz stations
- Low noise figure and high gain due to direct coupling between waveguide and printed circuit board
- · Commercial construction in a milled aluminium case
- Unconditionally stable. No parasitic oscillation in case of poor antenna match.
- Important note: The preamplifiers do not contain built-in coaxial relays!







U - BAND 47 GHz

#### **Specifications**

Type Center frequency Noise figure Gain Output power Operating voltage Current consumption Dimensions mm Weight Case Waveguide Input Coaxial output

#### MKU 243 RX2

24048 MHz (24,0 - 24,25 GHz) max. 1.5 dB at 18°C min. 26 dB typ. 10 mW sat. +9...15 V DC approx. 60 mA 20 x 30 x 72 incl. connector approx. 62 g milled aluminium R220 / WR42 / WG20 SMA-female

#### **Specifications**

Type Center frequency Noise figure Gain Output power Operating voltage Current consumption Dimensions mm Case Waveguide In Waveguide Out

#### MKU 472 B

47088 MHz (47,0 - 47,25 GHz) max. 5.0 dB at 18°C min. 27 dB min. 30 mW sat. +10...14 V DC approx. 110 mA 30 x 50 x 20 milled aluminium / brass R500 / WR19 / WG24 R500 / WR19 / WG24



## Super low noise broadband amplifiers

This super low noise wideband amplifier is designed for the 1...2.5 GHz frequency range. The noise figure is max. 1 dB at 35 dB gain. The amplifier is coupled via a high pass filter to suppress frequencies below 900 MHz. The module is also available with N-connectors. Remote power supply is possible via the coaxial cable or externally via the built-in bias tee.

#### **Specifications**

Туре	KU 2000 LSF - SMA	KU 2000 LSF - N
Frequency range	1.02.8 GHz	1.02.8 GHz
Noise figure NF	max. 1 dB	max. 1 dB
Noise figure @ 2,4 GHz	typ. 0.6 dB	typ. 0.6 dB
Gain	typ. 35 dB +/- 3 dB	typ. 35 dB +/- 3 dB
Supply voltage	+1215 V / 30 mA	+1215 V / 30 mA
Dimensions mm	73 x 30 x 18 mm	73 x 30 x 18 mm
Input connector	SMA-female	N-male
Output connector	SMA-female	N-female
Weight	approx. 80 g	approx. 85 g
Case	milled aluminium	milled aluminium
	Built-in bias tee	Built-in bias tee

This super low noise wideband amplifier was designed to cover the 1...7000 MHz frequency range. The noise figure is max. 4 dB at 23 dB gain. The amplifier is available with SMA- or N-connectors. Other connectors on request.

#### **Specifications**

Туре	
Frequency range	
Gain	
Noise figure	
Operating voltage	
Connectors	

Case P1/dB Output IP3 RL In Dimensions mm Weight Option KU 0180 A / B 1...7000 MHz 23 dB +/- 3 dB typ. 4.0 dB +12 V DC / typ. 90 mA KU 0180 A - SMA-female KU 0180 B - N-female milled aluminium typ. 7 dBm typ. 25 dBm >10 dBm 30 x 50 x 20 approx. 84 g Bias tee possible



This super low noise broadband amplifier is designed for the 5 ... 1500 MHz frequency range. The noise figure is max. 1.7 dB at 20 dB gain. The brodband amplifier provides a high IP3 and an output power of > 100 mW. This performance allows the use for many applications. A high pass filter supresses frequencies below 5 MHz.

#### **Specifications**

Type Frequency range Gain Noise figure IP 3 @ 20 MHz IP 3 @ > 100 MHz Output power @ 1 dB comp. In- and Outputimpedance Case P1/dB Output IP3 RL IN Connectors

Operation voltage Current consumption Dimensions mm Weights Option

#### KU 0515 A / B 5...1500 MHz 20 dB; min. 17 dB @ 1500 MHz max. 2,0 dB; typ. 1,2 dB 33 dBm > 35 dBm > 21 dBm 50 (75) Ohm milled aluminium typ. 21 dBm typ. 33 dBm typ. 6 dBm KU 0515 A - SMA-female KU 0515 B - N-female typ. 85 mA

+12 14 V DC

50 x 30 x 20

approx. 45 g

Bias tee possible



## Super low noise broadband amplifier

#### Model LNA 1018 A - LNA 3050 A

The LNA 1018 A is a high linear preamplifier for applications in the VHF communication band and the LNA 3050 A is for applications in the UHF communication band. They are suitable especially for applications where a very high intermodulation distortion ratio and at the same time a high input sensitivity are used. The coupling happened through 3dB hybrids, which guarantee an excellent input SWR and linearity of the preamplifiers. The voltage supply via coax cable (remote power supply) or direct at the case is possible. Both are balanced amplifiers.

Specifications		• High IP3 • Low noise figure	S21 FORWARD TRANSM	LNA	1018 A	CH 3 - S21
Type Frequency range	LNA 1018 A (100) 120180 MHz	Milled aluminium case	LOS MAGNITUDE	.REF-0.000 dB	10.000 dB/DIV	REFERENCE PLANE 0.0000 mm MARKER 3
Gain Noise figure @ 18°C IP3 out IP3 in Input return loss Output return loss Operating voltage Current consumption Coaxial connectors Dimensions mm	>20 dB (max. +/- 2dB) typ. 1,0 dB; max. 1,3 dB typ. +44 dBm @ 140 MHz typ. +22 dBm @ 140 MHz max. 10 dB better 15 dB + 1214 V DC typ. 230 mA SMA-female 78 x 41 x 21 - approx 100 d	<ul> <li>Protects against statics at preamplifier-in</li> <li>Remote power supply via coaxial cable or externally at the feed-trough capacitor (built-in bias tee)</li> <li>Very good input return loss</li> </ul>	•	2		<ul> <li>0.179558 GH2 19.101 dB</li> <li>MRAKER TO MAX</li> <li>MRAKER TO MAX</li> <li>MRAKER TO MIN</li> <li>0.899858 GH2</li> <li>19.269 dB</li> <li>0.139758 GH2</li> <li>21.422 dB</li> </ul>
Case	milled aluminium					MARKER READOUT
Frequency range Gain Noise figure @ 18°C IP3 out IP3 in Psat P1dB Input return loss Output retrun loss Operating voltage Current consumption Coaxial connectors Dimensions mm Case	LNA 3050 A (300) 350500 MHz 20 dB (max. +/- 2,5dB) typ. 1,0 dB; max. 1,3 dB typ. +40 dBm @ 400 MHz typ. +22 dBm @ 400 MHz >30 dBm @ 400 MHz 28 dBm @ 400 MHz 28 dBm @ 400 MHz max. 15 dB better 15 dB + 1215 V DC typ. 380 mA SMA-female 78 x 41 x 21 - approx. 100 g milled aluminium		e.e75988  S21 FORWARD TRANSM LOS HAGNITUDE	GHz ISSION LNA 3 +REF-0.000 dB	e.19958 0050 A 1e.eee db/DIV	FUNCTIONS CH 3 - 521 REFERENCE PLANE 8.0000 mm + 400500 GHz 20.017 d0 MARKER TO MAX MARKER TO MAX MARKER TO MAX 1 0.299700 GHz 20.6250 GHz 17.746 d0

0.250350

GHz

HARKER READOUT

FUNCTIONS

8.549688



## Super low noise broadband amplifier

#### Model LNA 1020 A - LNA 2227 A

The high linear preamplifier LNA 1020 A and LNA 1522 A were developed for directional radio link systems. The LNAs are ideal for applications which require high spurious response rejection and high input sensitvity. For example, the LNA 1020 A can be used as a RADAR preamplifier or for digital directional radio links. The amplifiers are coupled by 3dB hybrids which guarantee an excellent input SWR and high linearity.

The LNA 2227 A is designed for directional radio link applications at 2.5 GHz. Typical applications are DVB-T, DVB-S and other COFDM systems with I/Q modulation. Effective suppression of out-of-band signals is achieved by a 5-pole band pass filter, which is placed between first and second amplifier stage.

Due to a good large-signal performance and the low noise figure, the preamplifiers are usable for many applications.



## Linear power amplifiers for 23 cm with MOSFET modules

#### MKU 0850 N MKU 1301 A *- 1 Watt* MKU 133 HY2 - *30 Watt* MKU 1360 HY - *60 Watt* MKU 13120 HY - *120 Watt*

These new power amplifiers are equipped with LD-MOSFET modules. They are characterised by high linearity and high efficiency (up to 55 %). The amplifier modules are thermally stable and because of their high linearity they can be used for all operating modes, expecially SSB / DATV / DVB-S / DVB-T. The MOSFET technology has startet a new generation of linear power amplifiers for the 23 cm band.



L. BAND CONVER AMPLIANS

NEV

Specifications		GaAs	MOSFET Modul	MOSFET Modul	MOSFET Modul
Туре	KU 0850 N	MKU 1301 A	MKU 133 HY2	MKU 1360 HY	MKU 13120 HY
Frequency range	800900 MHz	12401300 MHz	12401300 MHz	12401300 MHz	12401300 MHz
Input power	3050 mW	< 50 mW	typ. 0.1 W	typ. 0.2 Watt	typ. 0.4 W
In maximum	50 mW	50 mW	0.2 W	0.4 W	0.8 W
Output power @ 50 Ohm		1 W	>30 W CW	>60 W CW	>120 W CW
Gain	typ. 15 dB				
Saturation output power	typ. 1 Watt	> 1 W	>35 W	typ. 70 W	typ. 150 W
Efficiency			typ. 30 %	typ. 30 %	typ. 30 %
Harmonic supression	28 dB@ 1 W	> 6 dB	- 50 dB	- 50 dB	- 50 dB
Input S11	_		> 4,5 dB	> 12 dB	> 16 dB
SWR of load	1,8 : 1	1.8 : 1	1.8 : 1	1.8 : 1	1.8 : 1
Maximum case temperature	55° C	55° C	55° C	55° C	55° C
Monitor output	No	No	Yes	Yes	Yes
Supply voltage	+ 12 14 V	+1214 V	+1213.8 V	+1213.8 V	+1213.8 V
IDQ	typ. 0.35 A	typ. 0.3 A	typ. 4 A	max. 8 A	typ. 14 A
Switching voltage	-	+1214 V	+1213.8 V	+1213.8 V	+1213.8 V
Current consumption	typ. 0.35 A	max. 0.45 A	max. 11 A	max. 20 A	max. 40 A (max.50)
Input connector	N-female	SMA-female	SMA-female	SMA-female	SMA-female
Output connector	N-female	SMA-female	SMA-female	SMA-female	N-female
Dimensions mm	50 x 30 x 22	30 x 50 x 22	60 x 130 x 20	80 x 124 x 22	152 x 190 x 26
Case	milled aluminium	milled aluminium	milled aluminium	milled aluminium	milled aluminium
Convenient power supply	-	-	S 150 W 12	S 300 W 12	S 500 W 12
Convenient heatsink	-	-	SK 150-62	SK 200-80	2x SK 200-80
Weight	approx. 90 g	approx. 65 g	approx. 270 g	approx. 400 g	approx. 1300 g
/ \			1 Contraction of the second		

#### Special versions for other frequencies can be supplied on request!

(18)

## 23 cm MOSFET power amplifiers

MKU 1330 A - *30 Watt* MKU 1350 A - *50 Watt* MKU 13100 A - *100 Watt* MKU 13100 B - *100 Wat* 

NEW



# Special versions for other frequencies can be supplied on request!

3

#### **Specifications**

Type Frequency range Input power In maximum Output power @ 50 Ohm Saturation output power Efficiency IM3 IM3 Harmonic supression Input S11 SWR of load Maximum case temperature Monitor output Supply voltage IDQ Switching voltage Current consumption Input connector Output connector Dimensions mm Case	MKU 1330 A 12401300 MHz 1 W 1.5 W >30 W typ. 40 W typ. 55 % 30 dB @ 30 W PEP 48 dB @ 10 W PEP 37 dB @ 30 W typ. 10 dB 1.8 : 1 55° C Yes +26 V typ. 0.5 A +1214 V max. 3,5 A SMA-female 60 x 130 x 20 milled aluminium	MKU 1350 A 12401300 MHz 2.5 W max. 5 W >50 W typ. 60 W typ. 45 % 28 dB @ 50 W PEP 48 dB @ 20 W PEP 39 dB @ 50 W typ. 7 dB 1.8 : 1 55° C Yes +26 V typ. 0.5 A +1214 V max. 5 A SMA-female SMA-female 60 x 130 x 20 milled aluminium	MKU 13100 A 12401300 MHz 0,3 W max. 0.4 W >100 W typ. 120 W typ. 120 W typ. 40 % 27 dB @ 100 W PEP 38 dB @ 30 W PEP - 39 dB @ 100 W typ. 10 dB 1.8 : 1 55° C Yes +26 V typ. 2 A +1214 V max. 14 A SMA-female N-female 80 x 192 x 22 milled aluminium	MKU 13100 B 12401300 MHz 5 W max. 10 W >100 W typ. 120 W typ. 120 W typ. 40 % 27 dB @ 100 W PEP 28 dB @ 30 W PEP - 39 dB @ 100 W typ. 10 dB 1.8 : 1 55° C Yes +26 V typ. 2 A +1214 V max. 14 A SMA-female N-female 80 x 135 x 22 milled aluminium
Case	milled aluminium	milled aluminium	milled aluminium	milled aluminium
Weight	approx. 240 g	approx. 240 g	approx. 570 g	approx. 370 g
Convenient power supply	S 150 W 24	S 150 W 24	SP 320 W 24	SP 320 W 24
Convenient heatsink	SK 150-75	SK 150-62	SK 200-80	SK 200-80



## Linear power amplifier for 1,3 GHz

#### Modell MKU 13200 A - MKU 13200 B - MKU 13500 A

These new power amplifiers use LD-MOSFETs. They provide high linearity and high efficiency. Because the amplifiers are thermally stable and high linear, they can be used for all operating modes. Typical examples are SSB, DVB-S, DVB-T or DATV. Four amplifier stages are combined via 90° hybrid couplers. This provides very high linearity and good input and output matching at the same time.

If two amplifier modules ((Type MKU 13500 A) are combined via 90° couplers, an output power of 1 kW is possible. The ideal amplifier for EME!

#### Important note: The amplifier modules don't contain built-in coaxial relays!

Built-in sequence control

• Incl. high-temperature-protection

Output for TX-LED

#### Output for driving an antenna relay

## Specifications

opcomotions			
Туре	MKU 13200 A	MKU 13200 B	MKU 13500 A
Frequency range	12401300 MHz	12401300 MHz	1296 MHz (12401300 MHz)
Input power	0.5 W	>10 W	20 W
In maximum	max. 1,0 W	<20 W	30 W
Output power @ 50 Ohm	200 W	200 W	500 W
Saturation output power	typ. 220 W	typ. 220 W	> 550 W
Efficiency	typ. 40 %	typ. 40 %	typ. 40 %
Harmonic supression	typ. 10 dB	typ. 10 dB	min. 10 dB
SWR of load	1.8 : 1	1.8 : 1	1,8 : 1
Maximum case temperature	55° C	55° C	55°C
Monitor output	Yes	Yes	Yes
Supply voltage	+26 V	+26 V	+ 28 V
IDQ	typ. 4 A	typ. 4 A	typ. 6 A
Switching PTT	ground @ TX	ground @ TX	ground @ TX
Current consumption	max. 26 A	max. 24 A	max. 50 A
Input connector	SMA-female	SMA-female	SMA -female
Output connector	N-female	N-female	N-female
Dimensions mm	152 x 192 x 26	152 x 190 x 26	190 x 152 x 38
Case	milled aluminium	milled aluminium	milled aluminium
Weight	approx. 1300 g	approx. 1300 g	approx. 1550 g
Convenient power supply	SP 500 W 24	SP 500 W 24	
Convenient heatsink	SK 200-160	SK 200-160	SK 200-160
Convenient fans	2x Fan 80x80	2x Fan 80x80	4x Fan 80x80







**Power Amplifier** 

## Linear power amplifiers for 1.4 GHz

#### Model MKU 1401 A - MKU 1401 B - MKU 1430 A - MKU 1430 B

The new GaAs-FET power amplifiers MKU 1401 A and MKU 1401 B provide high linearity. Because the amplifiers are thermally stable and high linear, they can be used for all operating modes. Typical examples are DATV, DVB-S, DVB-T, COFDM and QPSK. The amplifier modules are designed as driver amplifiers for HIGH POWER MOSFET AMPLIFIERS.

These new developed power amplifiers MKU 1430 A and MKU 1430 B, equipped with LD-MOSFET's are characterised by high linearity of the output signal and by high efficiency (up to 55 %). These amplifier modules are thermally very stable and can be used due to their high linearity for all operating modes, especially COFDM / QPSK / DATV / DVB-S / DVB-T

Specifications	GaA	s-FET	Specifications	LD-MO	DSFET
Type Frequency range	MKU 1401 A	MKU 1401 B	Type Frequency range	MKU 1430 A	MKU 1430 B
Input power	$50 \ 80 \ mW$	50 80 mW	Input power	1 Watt	1 \\
Gain	tvn 13 dB	tvn 13 dB	Maximum input power	1 5 Watt	1 5 \//
Output power @ 50 Ohm	typ. 10 0D	typ. 10 0D	Output power @ 50 Ohm	30 40 W	tvp 30 W
Saturation output nower	> 1 Watt	> 1 W	Saturation output power	tvp 40 W	typ. 30 W
IM 3	> 32 dB	> 32 dB	Efficiency	typ. 55 %	typ. 55 %
Maximum case	55°C	55°C	IM 2	27 dB @ 30 Watt PEP	27 dB @ 30 Wott DED
temperature	55 0	55 0	IM 3		41 dB @ 10 Watt PEP
Supply voltage	+ 12 14 \/	+ 12 14 \/	Harmonic supression	- 37 dB @ 30 Watt	- 37 dB @ 30 Watt
	$12 \dots 14 V$	typ 0.35 A	Input S11	tup 10 dB	- 57 0D @ 50 Watt
Current consumption	100,000	130.0,55 A	SWD of load	1 0 . 1	
	SMA fomalo	SMA fomalo	SWR OI IOdu	1,0.1 55°C	1,0.1 55°C
Output connector	SMA-lemale	SMA fomale	Maximum case temperature		55 C
Dimensione mm	SIVIA-TEITIALE				
Dimensions mm			Supply voltage	+ 20 V	+ 20 V
				typ. 0,5 A	typ. 0,5 A
vveignt	approx. 65 g	approx. 65 g	Switching voltage	12 - 14 V	12 - 14 V
			Current consumption	max. 3,5 A	max. 3,5 A
	0 0	8 8 9	Input connector	SMA-female	SMA-female
	In Desite L - BAND MOSFET LIN	EAR POWER AMPLIFIER	Output connector	SMA-female	SMA-female
at 1	тур: МК	U 1430 A	Dimensions mm	60 x 130 x 20	60 x 130 x 20
L - BAND POWER AMPLIFIER	1 1	F	Case	milled aluminium	milled aluminium
NOCELL (401 A OUT	LINNE PLP	ctronic Scubi	Convenient power supply	S 120 W 24	S 120 W 24
UHNE electronic limit	S Notwo	THANAN TY FORT	Convenient heatsink	SK 120-75	SK 120-75
The submitted to the state of t		8 8 5	Weight	approx. 245 g	approx. 245 g



## Linear high power amplifiers for S-band

reliable. For years, many media concerns use these amplifier modules successfully.

#### For Multichannel Multipoint Distribution Systems MMDS / DVB-S / DVB-T / WLL / WCS / COFDM Highly linear Class A GaAs FET broadband amplifiers for professional applications

NEW

- Harmonic suppression > 60 dB
- Over / reverse voltage protection
- Logic on / off control
- VSWR protection via built-in isolator
- Forward / reverse power detection
- Single DC supply

ND GAAS EFT LINEAR POWER AMPLIFIER W KU 1517 A 1500-1700 H UNNE electronic amb

This series of power amplifiers features highest linearity at a large bandwith. The Class-A amplifiers were originally developed for applications with a digital modulation (e.g. QPSK) and for multichannel applications (e.g. MMDS). They are carefully produced with highest accuracy and as a result super Typ: KU 2325 D 1300-2500 HH UNNE electronic limbl

#### Specifications

Frequency range 21002300 MHz 23002500 MHz 25002700 MHz Input power Output power Saturation output power IM3 @ 10 W PEP IM3 @ 20 W PEP Operating voltage Current consumption Dimensions mm Case	Type KU 2123 A KU 2325 A KU 2527 A typ. 0,1 mW min @ 1 dB - 20 W 2530 W > 47 dB 1114 V DC typ. 8.0 A 213 x 63 x 22 milled aluminium	Type KU 2123 B KU 2325 B KU 2527 B typ. 15 mW min @ 1 dB - 20 W 2530 W > 47 dB 1114 V DC typ. 6.5 A 178 x 60 x 20 milled aluminium	Type KU 2123 C KU 2325 C KU 2527 C typ. 2 W min @ 1 dB - 20 W 2530 W > 47 dB 1114 V DC typ. 6.0 A 130 x 60 x 20 milled aluminium	Type KU 2123 D KU 2325 D KU 2527 D typ. 5 W min @ 1 dB - 50 W Min. 60 W - > 47 dB 13 V DC typ. 10.0 A 130 x 60 x 20 milled aluminium
Case temperature Coaxial connector In Coaxial connector Out Ripple Weight	max. 55°C SMA-female SMA-female +/ - 1 dB approx.500 g Built-in ALC Level Control	max. 55°C SMA-female SMA-female max. +/ - 1 dB typ. +/- 0.5 dB approx. 350 g	max. 55°C SMA-female SMA-female max. +/ - 1 dB typ. +/ - 0.5 dB approx. 250 g	max. 55°C SMA-female SMA-female max. +/ - 1 dB typ. +/- 0.5 dB approx. 260 g High-temperature- protection

## Linear power amplifiers for S-Band

#### For Multichannel Multipoint Distribution Systems MMDS / DVB-S / DVB-T / WLL / WCS / COFDM Highly linear Class A GaAs FET broadband amplifiers for professional applications

NFV

This series of power amplifiers features highest linearity at a large bandwidth. The Class-A amplifiers were originally developed for applications with a digital modulation (e.g. QPSK) and for multichannel applications (e.g. MMDS). They are carefully produced with highest accuracy and as a result super reliable. For years, many media concerns use these amplifier modules successfully.

- Harmonic suppression > 60 dB
- Over / Reverse voltage protection
- Logic on / off control
- VSWR protection via built-in Isolator
- Forward / reverse power detection
- Single DC supply

#### Specifications

Frequency range	Type	Type
2100 2300 MH <sub>7</sub>	KII 2123 E	KII 2325 E
21002500 MILE		
23002500 MHZ	KU 2325 E	KU 2527 F
25002700 MHz	KU 2527 E	
Input power	typ. 15 Watt	typ. 15 Watt
Output power	typ. 100 Watt	typ. 150 Watt
Saturation output power	> 100 Watt	> 150 Watt
IP3	54 dBm	59 dBm
Operating voltage	13 V DC	13 V DC
Current consumption	typ. 22,0 A	typ. 30,0 A
Dimensions mm	172 x 100 x 22	172 x 100 x 22
Case	milled copper silver-plate	milled copper silver-plate
Case temperature	max. 55°C	max. 55°C
Coaxial connector In	SMA-female	SMA-female
Coaxial connector Out	N-female	N-female
Ripple	max. +/ - 0,8 dB	max. + / - 0,8 dB
Weight	approx. 2000 g	approx. 500 g
-	High-temperature-	High-temperature-protection
	protection	

A CHINA AND A CHIN

Specifications			LD-MOS	FE
Frequency range	Ту	ре		
20002100 MHz	KU	20	21 LD 200	
21002200 MHz	κu	J 21:	22 LD 200	
22002300 MHz	κu	J 22	23 LD 200	
22502350 MHz	κu	J 23	23 LD 200	
Input power	typ	. 15	Watt	
Output power	20	0 W	att	
Spurious and harmonic	typ	. 40	dB	
wave suppression				
Switch on voltage	+ 1	2 V		
IDQ	typ	. 4 A	4	
Operating voltage	28	VΟ	С	
Current consumption	ma	ıx. 2	2 A	
Dimensions mm	13	0x14	40x26	
Case	mil	led	aluminium	
Case temperature	ma	ıx. 5	5°C	
Coaxial connector In	SN	1A-fe	emale	
Coaxial connector Out	N-1	fema	ale	
Weight	ca.	850	) g	6

Power Amplifier



## Linear power amplifiers for S-band

#### For Multichannel Multipoint Distribution Sustems MMDS / DVB-5 / DVB-T / WLL / WCS / COFDM Highly linear Class A GaAs FET broadband amplifiers for professional applications

This series of power amplifiers features highest linearity at a large bandwidth. The Class-A amplifiers were originally developed for applications with a digital modulation (e.g. QPSK) and for multichannel applications (e.g. MMDS). They are carefully produced with highest accuracy and as a result super reliable. For years, many media concerns use these amplifier modules successfully.



SMA - female

approx. 140 g

+ / - 1,5 dB

SMA - female

approx. 240 g

+ / - 1 dB

SMA - female

approx. 240 g

+ / - 1 dB

SMA - female

approx. 236 g

+ / - 1,5 dB

Coaxial connectors Ripple

Weight

24

SMA - female

approx. 140 g

+ / - 1 dB

SMA - female

approx. 140 g

+ / - 1 dB

Power Amplifier

## Power amplifiers for the 13 cm band

### Model MKU 231 TX - MKU 232 TX - MKU 233 TX MKU 231 XL - MKU 233 XL - MKU 234 XL MKU 232 AL

- Small mechanical dimensions
- · Commercial construction in a milled aluminium case
- Built-in directional coupler with detector for monitoring the output power MON -
- Built-in circuit for protection of the GaAs-Power-FET
- Class "A" linear amplifier
- Useable with low input power for DATV





#### Specifications

Туре	MKU 231 TX	MKU 232 TX	MKU 233 TX	MKU 231 XL	MKU 233 XL	MKU 234 XL	MKU 232 AL
Output power typ.	5 W	5 W	5 W	10 W	10 W	10 W	0.81 W
Input power typ.	700 mW	80 mW	10 mW	1 W	50 mW	2 mW	5 mW
Current consumption typ.	0.8 A	1.3 A	1.5 A	2.5 A	3.2 A	3.3 A	0.35 A
Weight approx.	140 g	140 g	250 g	140 g	260 g	260 g	120 g
	-		-	-	-		-
Center frequency	2350 MHz						2350 MHz
Frequency range typ.	23002400 M	Hz					23002400 MHz
Operation voltage	1213.8 V D0	2					13.8 V DC
Dimensions mm	80 x 60 x 20*	0 x 60 x 20130 x 60 x 20					
Case	milled aluminiu	illed aluminium					
Coaxial connectors	SMA-female						SMA-female

Special amplifiers can be supplied on request!



## High power linear amplifiers for the 13 cm band

#### MKU 231 HXL - KU 232 HXL - KU 231 XXL - KU 232 XXL KU 233 XXL - KU 2325 BLK - KU 2325 DLK

- Small mechanical dimensions
- · Commercial construction in a milled aluminium case
- Built-in circuit to protect the GaAs-Power-FET
- Built-in directional coupler with detector for monitoring the output power MON -
- Class A linear amplifier
- Usable for DATV with low input power









Specifications						For DATV applic	ations
Amplifier Type	MKU 231 HXL	KU 232 HXL	KU 231 XXL	KU 232 XXL	KU 233 XXL	KU 2325 BLK	KU 2325 DLK
Output power typ.	1820 W CW	1820 W CW	6080 W CW	6080 W CW	120140 W CW	> 30 W CW	> 50 W CW
Input power typ.	1 W	80 mW	10 W	1 W	1 W	typ. 15 mW	typ. 0.1 mW
Current consum.	typ. 5 A	typ. 5 A	typ. 18 A	typ. 20 A	typ. 38 A	typ. 8 A	typ. 6.5 A
Dimensions mm	80 x 60 x 20	80 x 60 x 20	80 x 60 x 20	130 x 60 x 20	100 x 180 x 25	178 x 60 x 20	130 x 60 x 20
Case	milled alu.	milled alu.	milled copper	milled copper	milled copper	milled alu.	milled alu.
Input connector	SMA	SMA	SMA	SMA	SMA	SMA	SMA
Output connector	SMA	SMA	SMA	SMA	N-female	SMA	SMA
Center frequency	2350 MHz						
Frequency range typ.	23002400 MHz	Z				2300-2450 MHz	2300-2450 MHz
Operating voltage	1213.8 V DC					1	

26

## High power linear amplifiers for the 9 cm band

#### MKU 342 AXL - MKU 342 XL - MKU 341 A MKU 342 XLB - MKU 342 HXL

- Small mechanical dimensions
- Commercial construction in a milled aluminium case
- Built-in circuit for protection of the GaAs-Power-FET
- Built-in directional coupler with detector for monitoring the output power - MON -
- Class A linear amplifier
- Usable for DATV with low input power









#### **Specifications**

Amplifier type	MKU 342 AXL	MKU 342 XL	MKU 341 A	MKU 342 XLB	MKU 343 HXL	MKU 34120 A
Output power typ.	>4 VV	>13 VV	typ. 4 vv	>20 VV	50 W	>120 VV
Input power typ.	typ. 40 mW	typ. 100 mW	200 mW	typ. 200 mW	typ. 200 mW	typ. 0.51 W
Cur. consumption	typ. 1.5 A	typ. 3 A	typ. 1.2 A	typ. 7 A	typ. 15 A	typ. 34 A
Dimensions mm	130 x 60 x 23	130 x 60 x 23	40 x 75 x 22	130 x 60 x 23	180 x 60 x 23	100 x 180 x 25
Case	milled alu.	milled alu.	milled alu.	milled alu.	milled alu.	milled copper
Input connector	SMA-female	SMA-female	SMA-female	SMA-female	SMA-female	SMA-female
Output connector	SMA-female	SMA-female	SMA-female	SMA-female	SMA-female	N-female

Center frequency 3400 MHz Option USA Operation voltage

3456 MHz 12...14 V DC



## Linear power amplifiers for the 6 cm band Model MKU 601 - MKU 602 - MKU 602 H - MKU 602 XH - MKU 604 HXL

- Small mechanical dimensions
- Milled aluminium case
- Built-in circuit for protection of the GaAs-Power-FET
- Built-in directional coupler with detector for monitoring the output power MON -
- Class "A" linear amplifier

Speci

• Usable for DATV with low input power





fications Type	<b>MKU 601</b>	<b>MKU 602</b>	<b>MKU 602 H</b>	MKU 602 XH	<b>MKU 604 HXL</b>
Output power typ.	>4 W	>4 W	>8 W	>15 W	35 W
Input power typ.	600 mW	max. 100 mW	200 mW	300 mW	50 mW
Current consumption typ.	1.2 A	1.6 A	3,5 A	5 A	10 A
Weight	approx. 160 g	approx. 180 g	approx. 180 g	approx. 180 g	approx. 360 g
Center frequency Operation voltage Dimensions mm Case Coaxial connectors	5760 MHz +/- +1214V DC 55 x 80 x 22 w milled aluminiu SMA-female	180 x 60 x 23			



## High power amplifier for the 6 cm - Band Model MKU 5750 A - MKU 57100 A

- Small mechanical dimensions
- Milled aluminium case
- Built-in circuit for protection of the GaAs-Power-FET
- Built-in directional coupler with detector for monitoring the output power MON -
- Class A linear amplifier
- Usable for DATV with low input power





#### **Specifications**

Type Center frequency Input power Output power Operating voltage Current consumption Dimensions mm Case Coaxial connectors Coaxial connectors PTT-Circuit incl. Temperature range Temperature protection

#### KU 5750 A 5760 MHz max. 200 mW typ. 50 Watts + 12 V DC typ. 13 A 158 x 64 x 22 milled aluminium case SMA -female SMA -female + 12 V @ TX -20 ... + 55°C Case temperature Yes

KU 57100 A 5760 MHz typ. 200 mW; max. 350 mW typ. 100 Watts + 12 V DC typ. 28 A 158 x 64 x 22 milled aluminium case SMA-female N-female + 12 V @ TX -20 ... + 55°C case temperature Yes





## Linear 10 GHz power amplifiers

#### Model MKU 101 N - MKU 101 H - MKU 102 C - MKU 102 AL

- Small mechanical dimensions
- Milled aluminium case
- Built-in circuit for protection of the GaAs-Power-FET
- Built-in directional coupler with detector for monitoring the output power MON -
- Class "A" linear amplifier
- Usable for DATV with low input power



# Power Amplifier

Sp

ecifications	Amplifier type	MKU 101 N	MKU 101 H	MKU 102 C	MKU 102 AL
	Output power typ.	>1 W	>2 W	>1 W	>200 mW
	Input power typ.	200 mW	230 mW	50 mW	<10 mW
	Saturation power typ.	1.3 W	>2.4 W	1.3 W	>250 mW
	Current consumption typ.	450 mA	800 mA	500 mA	250 mA
	Dimensions mm	60 x 30 x 20	60 x 30 x 20	75 x 30 x 18	75 x 30 x 38
	without con.				
	Center frequency	10368 MHz			10368 MHz
	Frequency range	1010.5 GHz	Amateur radio ban	d	1010.5 GHz
	Operating voltage	1214 V DC			1214 V DC
	Weight	approx. 48 / 60	) g		approx. 70 g
	Case	milled aluminiu	ım		German silver case
	Coaxial connectors	SMA-female			
	FTC's for operating voltage	and monitorin	a -MON		





## High power linear amplifiers for 10 GHz Model MKU 101 X - 102 X - 102 XL - KU 104 XL - KU 103 XLC - KU 1050 A

- Small mechanical dimensions
- Milled aluminium case
- Built-in circuit for protection of the GaAs-Power-FET
- Built-in directional coupler with detector for monitoring the output power MON -
- Class A linear amplifier
- Usable for DATV with low input power









# **50 Watt!**

#### **Specifications**

Туре	MKU 101 X	MKU 102 X	MKU 102 XL	KU 103 XLC	KU 1025 A	KU 1050 A
Output power typ.	>4 W	>4 W	>8 W	1620 W	25 W	50 W
Input power typ.	800 mW	150 mW	200 mW	typ. 200 mW	max. 200 mW	typ. 200 mW
Saturation power typ.	5 W	5 W	10 W	> 16 W	> 25 W	> 50 W
Current consumption typ.	1.2 A	1.5 A	4 A	typ. 8 A	8 A	20 A
Dimensions without con.	80 x 60 x 20	70 x 45 x 20	130 x 60 x 20	170 x 60 x 20	158 x 64 x 22	158 x 64 x 22
PTT-Input	-	-	-	+12 V @ TX	+12 V @ TX	+12 V @ TX
Frequency range	1010.5 GHz a	mateur band			incl. high-tempe	erature-protection
	(center 10.368 C	GHz +/-)			0 1	·
Operating voltage	1214 V DC					
Case	milled aluminiun	า				
Temperature range	-20 + 55°C ca	ise temperature				
Coaxial connectors	SMA-female					

Connectors for operation voltage and monitoring -MON-.





## Linear power amplifiers for 24 GHz

#### MKU 241 PAC - MKU 242 PAC MKU 245 PAC2 - MKU 244 CH MKU 243 C - MKU 2403 A MKU 2410 A

- Small mechanical dimensions
- Milled aluminium case
- Built-in directional coupler with detector for monitoring the output power MON -
- Class A linear amplifier
- Usable for DATV with low input power



#### Specifications

Туре	MKU 241 PAC	MKU 242 PAC	MKU 245 PAC2	MKU 244 CH	MKU 243 C	MKU 2403 A	MKU 2410 A
Saturation pwr. typ.	340 mW	580 mW	typ. 1,3 Watt	> 90 mW	> 30 mW	> 3 W	> 10 W
Output power. typ.	300 mW	500 mW	1,2 W	80 mW	> 20 mW@ 0,1 mW in	3 W	10 W
Input power. typ.	50 mW	150 mW	8 mW	8mW	0,1 mW	20 mW	20 mW
						max. 50 mW	max. 50 mW
Current con. typ.	320 mA	650 mA	850 mA	300 mA	typ. 70 mA	3 A	14 A
Dimensions mm	30 x 35 x 18	40 x 40 x 18	50 x 65 x 23	60 x 30 x 18	50 x 30 x 18	50 x 30 x 18	119 x 63 x 22
Output SMA	male	male	female	male	female	female	female
Input SMA	female	female	female	female	female	female	female
Operation power	+1015 V DC					+912 V DC	+912 V DC
Frequency range Case	2424,25 GHz milled aluminiur	amateur band n				NEW	NEW

32

**Power Amplifier** 

## Linear power amplifiers for 24 GHz

#### Model MKU 244 WH MKU 244 TX MKU 241 PAW MKU 2410 AW

- Small size for assembling a compact 24 GHz station
- High gain and high output power due to direct coupling between waveguide and the printed circuit board
- Milled aluminium case, professional construction
- Built-in directional coupler with detector for monitoring the output power -MON-



#### **Specifications**

Туре	MKU 244 TX	MKU 241 PAW	MKU 244 WH	MKU 2410 AW
Saturation power. typ.	100 mW	340 mW	100 mW	> 10 W
Output power typ.	>90 mW	> 300 mW	80 mW	10 W
Input power. typ.	8 mW	50 mW	8 mW	20 mW, max. 50 mW
Current consumption typ.	300 mA	320 mA	300 mA	14 A
Dimensions mm	30 x 82 x 20	30 x 47 x 20	65 x 30 x 27	119 x 63 x 22
Input	SMA-female	SMA-female	waveguide R220 / WG20 / WR42	SMA-female
Output	waveguide R220	) / WG20 / WR42	waveguide R220 / WG20 / WR42	waveguide R220 / WG20 / WR42
Weight	approx. 85 g	approx. 60 g	approx. 80 g	approx. 305 g
Operating voltage Frequency range Case	+1215 V DC 2424,25 GHz milled aluminium	1		+1012 V DC 2424,25 GHz milled aluminium



## Low noise HEMT amplifier for 24 GHz

#### Model MKU 245 HP - MKU 245 W

- Small mechanical dimensions
- Low noise figure and high gain
- Milled aluminium case
- This four-stage amplifier has been developed for operation with the DB 6 NT Transverter MKU 24 G together witch a waveguide filter and a waveguide switch
- Built-in directional coupler with detector for monitoring the output power -MON-



# Power Amplifier

Specifications	

Type Frequency range Noise figure Gain Output power

Operating voltage Current consumption Dimensions Weight Case Input Output

#### MKU 245 HP

24.0 - 24.25 GHz amateur band typ. 2.5 dB @ 18°C min. 30 dB typ. 80 mW sat. @ 0.2 mW in approx. 70 mW out +10...15 V DC approx. 210 mA approx. 74 x 30 x 17 mm without con. approx. 60 g milled aluminium SMA-male SMA-female

#### MKU 245 W

24.0 - 24.25 GHz amateur band typ. 2.5 dB @ 18°C min. 30 dB typ. 80 mW sat. 2 mW in approx. 70 mW out +10...15 V DC approx. 210 mA 77 x 30 x 28 mm approx. 120 g milled aluminium waveguide R220 / WR 42 / WG 20 waveguide R220 / WR 42 / WG 20



## **Broadband power amplifier** Model KU 233 BBA - KU 2025 A

Applications examples:

- test amplifier for high dynamic range applications.
- power amplifier for EMC checks of devices (single beam measuring)
- power amplifier to increase the output level of standard signal generators or sweep signal generators
- Power amplifier for amateur radio bands. Typically 3 watts in 13-cm band with 5 mW drive.

These amplifiers are placed in a milled aluminium case. An appropriate heat sink is required whilst operation



#### **Specifications**

Туре
Frequency range
Output power
Saturation power by 2.3 GHz
Gain
Noise figure NF
Current consumption
Operating voltage
Dimensions mm
Coaxial connectors

KU 233 BBA 500...2500 MHz 1 Watt typ. typ. 3 Watt min. 30 dB typ. 6 dB approx. 1 A +12...14 V DC 130 x 60 x 20 SMA-female



## Specifications

Type Frequency range Gain Saturation power (50...500 MHz) Saturation power (500...2500 MHz) 1 dB Compression Point (50...500 MHz) 1 dB Compression Point (500...2500 MHz) SWR NF @ 18° C Supply voltage Dimensions mm Coaxial connectors Weight

NEW

#### BROADRAND GAAS FET POWER AMPLIFIER Typ: KU 2025 A KUNE electronic sund KUNE electronic sund COMPACT AND A COMPACT AND A COMPACT

KU 2025 A 50...2500 MHz min. 35 dB typ. 3 W typ. 2 W > 2 W typ. 1,5 W < 2:1 < 4 dB + 24...26 V DC / typ. 700 mA 80 x 60 x 20 SMA-female approx. 140 g

## Transverter for the 2 m band - TR 144 H +40

The high-performance transverter TR 144 H with its outstanding characteristics is the result of a special circuit design. It is based on Kuhne electronic's long experience in the design of microwave transverters. The TR 144 H was originally designed for VHF amateur radio applications, e.g. for high performance contest stations. It can be modified for professional use in the 140 MHz frequency range. Large signals and interference from other transmitters are no problem for the receiver.

Transverters with the option +40 are designed for the use together with short wave transceivers like TEN-TEC ORION, FTDX-9000, IC7800, IC756 PRO III or other high end transceivers.

#### Oscillator

A temperature-compensated low-noise butler oscillator generates the 116 MHz LO signal for transmitter- and receiver-mixer. The circuit uses a thermostat crystal with a 40 °C precision crystal heater. An MMIC amplifier rises the power to 100 mW. The output signal is connected to the transmitter- or receiver-mixer via PIN diode switch. Single side band noise of the oscillator output signal is far below 156 dBc/Hz @ 10 kHz. This value is better than that of most other short wave transceivers.

#### Receiver

The TR 144 H uses only one RF amplifier stage with two power GaAs FETs to achieve optimum large signal performance and low intermodulation levels. The prestage reaches a noise figure of 0.9 dB and an output IP3 of > 40 dBm. A helical band pass filter provides optimum rejection of out-of-band signals. A high-level ring mixer (LO power of +20 dBm) converts the input signal to the IF at 28 MHz. The mixer is followed by an output diplexer. The overall gain of the receiver path is limited to 25 dB to avoid overdriving of the transceiver. Internally, gain can be switched to 30 dB. The preamplifier in the short wave transceiver is turned off.

For EME or DX operation and in case of long antenna cables the use of a preamplifier, e.g. the LNA 144 A Low Noise Amplifier, is recommended. The preamplifier has to be mounted directly at the antenna. Separate receive and transmit cables and a high-quality coaxial relay are needed. The TR 144 H provides a separate receiver input (N-connector).

#### **Transmitter**

The transmitter path uses a 17 dBm ring mixer for upconversion from 28 MHz to 144 MHz. Two cascaded helical bandpass filters guarantee an almost spuriousfree signal. State-of-the-art LDMOS transistors are used in the driver and power amplifier stages. The available output power is 60 W. To achieve optimum transmitter intermodulation performance, an integrated ALC loop with overdrive indicator limits the peak output power to 25 W. An output low pass filter provides harmonic suppression of more than 60 dB. A directional coupler with a schottky diode permits the indication of the calibrated output power on the built-in meter.

#### Sequence Controller

The built-in sequence controller allows time-controlled operation of a high-quality power amplifier and a coaxial relay with a preamplifier, which is placed directly at the antenna. The required connectors are on the back panel of the transverter.


#### Transverter for the 2 m band TR 144 H +40 Some technical characteristics

- Aluminium case with a big heat sink
- Inside wiring with silver plated Teflon coaxial cable
- Antenna relay with 70dB cross-talk attenuation
- Converter can process large signals
- Extension with additional filters and other components
- Built-in directional coupler for calibrated power output control
- 5-pole low-pass filter for harmonic wave suppression
- Spurious and harmonic wave suppression better 60dBc

### Specifications

Туре	TR 144 H +40	
VHF Frequency range	144 146 MHz	
IF Frequency range	2830 MHz	
IF Input power	150 mW	
PTT control	contact closure to ground	
Output	25 Watt @ 50 Ohm	
	IM3@20Watts 32 dB - IM3@5Watts 39 dB	
Operating voltage	13,8 V DC (12 - 14 V)	
Current consumption	typ. 6 A (TX)	
RX Gain	typ. 25 dB	
IP3 out	typ. 40 dBm, min. 38 dBm	
Blocking	> -106 dBc @ 3 kHz BW	
IM-Dynamic	> 102,5 dB SFDR @ 3 kHz BW	
	(Spurious free dynamic range)	
Noise figure	typ. 1,2 dB NF	
Dimensions mm	270 x 260 x 80	oc m
Case	aluminium	F
IF connectors	BNC - female	-
RF connectors	N - female	INT
DC supply and control	SUB-D 9-pole	₹
connector		-
Weight		
Possible options	- 02: TX IF input power –20 dBm / 10200 μV	V
	<ul> <li>04: drive gain control on the front panel</li> </ul>	
	- 05: IF frequency 1416 MHz	
	<ul> <li>- 06: common IF-connector for RX/TX Opt. 06</li> </ul>	j
	(common IF-connector) and Opt. 04 (drive ga	in
	control on the front panel) are not compatible.	

- Sideband noise of the oscillator better -156dBc/Hz@10kHz
- Built-in sequence control
- Handbook
- Including dc-power and control cable





## Transverter for the 2 m band - TR 144 H

The high-performance transverter TR 144 H with its outstanding specifications is the combined result of a circuit design using state-of-the-art components and of Kuhne Electronic's long experience in microwave transverters. The TR 144 H is specially designed for demanding VHF Amateur Radio applications like high performance contest stations, but can be modified for professional use in the 140 MHz frequency range.

#### Oscillator

The 116MHz local oscillator signal for transmit- and receive-mixer is derived from a temperature-compensated low noise butler oscillator. The circuit uses a thermostat crystal with 40°C precision crystal heater. The signal is boosted to 100 mW in a MMIC amplifier and applied to the receiver or transmitter mixer via a PIN switch. The single side band noise of the output signal lies at far under -156dBc/Hz@10kHz which is better as the mostly used short wave transceivers.

#### Receiver

The receiver path is able to cope with very large interference levels from other transmitters, a situation common to contest sites with other high-power transmitters in the neighbourhood. To achieve optimum intermodulation and large-signal performance, the TR 144 H uses only one PHEMT RF amplifier stage with a noise figure of 0.3 dB and an output intercept point of >25 dBm. A triple resonator helical band pass filter provides optimum rejection of out-of-band signals and a high-level ring mixer (LO + 17 dBm, 50 mW) with output diplexer converts the input signal to the IF band at 28 MHz. The overall gain in the receiver path was deliberately set to only 15 dB, as even high-performance HF transceivers have still large signal problems at 28 MHz. For EME and DX work or for long antenna feed cables we recommend a preamplifier like the LNA 144 A Low Noise Amplifier mounted directly at the antenna feed point, using separate receiver and transmit cables. Here you need only one additional high-quality coaxial relay as the TR 144 H provides a separate receiver input (N-female).

#### **Transmitter**

The transmitter path uses a second 17 dBm ring mixer for up conversion from 28 MHz to 144 MHz, and two cascaded triple resonator helical band pass filters are used to achieve an exceptionally "clean" transmit signal. The transmit amplifier uses state-of-the-art LDMOS transistors in the driver and PA stage and is designed for 60W output. To achieve optimum transmitter intermodulation performance, an integrated ALC loop with overdrive indicator limits the peak output power to 25 W. An output low pass filter provides a harmonic suppression of more than 60 dB. A directional coupler with a Schottky-diode makes the calibrated indication of the output power possible at the built-in meter.

#### Sequence Controller

The built-in sequence controller makes a time controlled operation of a high-quality power amplifier and a coaxial relay possible with preamplifier directly at the antenna. Connections for this are at the equipment back side.



### Transverter for the 2 m band TR 144 H - TR 222 H for 222 MHz band

#### Some technical characteristics

- Aluminium case with a big heat sink
- Inside wiring with silver plated Teflon coaxial cable
- Antenna relay with 70dB cross-talk attenuation
- Converter can process large signals
- Extension with additional filters and other components
- Built-in directional coupler for calibrated power output control
- 5-pole low-pass filter for harmonic wave suppression
- Spurious and harmonic wave suppression better 60dBc

TR 144 H

144 146 MHz

contact closure to ground

03: RX IF Amplifier +10 dB

typ. 15 dB. output IP3 typ. +11 dBm

25 Watt @ 50 Ohm

13.8 V DC (12 - 14 V)

28...30 MHz

typ. 6 A (TX)

max. 0.8 dB NF

270 x 260 x 80

BNC - female

SUB-D 9-pole

aluminium

N - female

- Sideband noise of the oscillator better -156dBc/Hz@10kHz
- Built-in sequence control
- Including dc-power and control cable
- Handbook

Frequency range

IF Input power

Output power

PTT-control

RX gain

Case

Noise figure

Dimensions mm

DC-supply and

Coaxial connect. IF

control connectors Possible Options

Coaxial connect. VHF

IF Frequency range

Operation voltage

Current consumption

Type

### **Specifications**



ransverter

## Transverter for the 70 cm band - TR 432 H

The high-performance Transverter TR 432 H with its outstanding specifications is the combined result of a circuit design using state-of-the-art components and of Kuhne Electronics long experience in micro-wave Transverter. The TR 432 H is specially designed for demanding UHF Amateur Radio applications like high performance contest stations, but can be modified for professional use in the 400 MHz frequency range.

#### **Oscillator**

The local oscillator signal for both transmit and receive mixer is derived from two switch able temperature compen-sated low noise butler oscillators and a frequency multiplier chain. The circuit uses a thermostat crystal with 40 °C precision crystal heater. The second oscillator is intended for non-standard output frequencies, using a customer-provided crystal. In the TR 432 H Option 01 the second oscillator is equipped with a crystal for satellite operation. The single side band noise of the output signal lies at far under -148 dBc/Hz@10kHz which is better as the mostly used shortwave transceivers. After frequency multiplication, the LO signal is filtered in a double-tuned helical filter, boosted to 100 mW in a MMIC amplifier and applied to the receiver or transmitter mixer via a PIN switch.

#### Receiver

The receiver path is able to cope with very large interference levels from other transmitters, a situation common to contest sites with other high-power transmitters in the neighbourhood. To achieve optimum intermodulation and large-signal performance, the TR 432 H uses only one PHEMT RF amplifier stage with a noise figure of 0.4 dB and an output intercept point of 30 dBm. A triple resonator helix band pass filter provides optimum rejection of out-of-band signals and a high-level ring mixer (LO + 17 dBm, 50 mW) with output diplexer converts the input signal to the IF band at 28 MHz. The overall gain in the receiver path was deliberately set to only 20 dB, as even high-performance HF transceivers have still large signal problems at 28 MHz. For EME and DX work or for long antenna feed cables we recommend a preamplifier like the LNA 432 A Low Noise Amplifier mounted directly at the antenna feed point, using separate receiver and transmit cables. Here you need only one additional high-quality coaxial relay, as the TR 432 H provides a separate receiver input (N-female).

#### Transmitter

The transmitter path uses a second 17 dBm ring mixer for up conversion from 28 MHz to 432 MHz, and two cascaded triple resonator helix band pass filters are used to achieve an exceptionally "clean" transmit signal. The transmit amplifier uses state-of-the-art LDMOS transistors in the driver and PA stage and is designed for 40 W output. To achieve optimum transmitter intermodulation performance, an integrated ALC loop with over-drive indicator limits the peak output power to 20 W. An output low pass filter provides a harmonic suppression of more than 60 dB. A directional coupler with a Schottky-diode makes the calibrated indication of the output power possible at the built-in meter.

#### Sequence Controller

The built-in sequence controller makes a time controlled operation of a high-quality power amplifier and a coaxial relay possible with preamplifier directly at the antenna. Connections for this are at the equipment back side.



## Transverter for the 70 cm band - TR 432 H

#### Some technical characteristics

- Aluminium case with a big heat sink
- Inside wiring with silver plated Teflon coaxial cable
- Antenna relay with 70dB cross-talk attenuation
- Converter can process large signals
- Extension with additional filters and other components
- Built-in directional coupler for calibrated power output control
- 5-pole low-pass filter for harmonic wave suppression
- Spurious and harmonic wave suppression better 60dBc
- Sideband noise of the oscillator better -148dBc/Hz@10kHz
- Built-in sequence control
- Including dc-power and control cable
- Handbook



### Specifications

Туре	TR 432 H
UHF Frequency range	432434 MHz (Standard), 435437
	MHz (Oscar), no sideband inversion
IF Frequency range	2830 MHz
IF Input power	150 mW, adjustable
PTT control	contact closure to ground
Output	20 Watts @ 50 Ohm
Operating voltage	13.8 V DC (12 - 14 V)
Current consumption	typ. 6 A
RX Gain	min. 20 dB
Noise figure	typ. 1,0 dB NF
Dimensions mm	270 x 260 x 80
Case	aluminium
IF connectors	BNC - female
RF connectors	N - female
DC supply and control	SUB-D 9-pole
connector	
Weight	approx. 2,7 kg

## Transverter for the 23 cm Band - TR 1296 H

#### Some technical characteristics

- Aluminium case with a big heat sink
- Inside wiring with silver plated Teflon coaxial cable
- Antenna relay with 60dB cross-talk attenuation
- Converter can process large signals
- Extension with additional filters and other components
- Built-in directional coupler for calibrated power output control
- 5-pole low-pass filter for harmonic wave suppression
- Spurious and harmonic wave suppression better 60dBc
- Sideband noise of the oscillator better -138dBc/Hz@10kHz
- Built-in sequence control
- Including dc-power and control cable
- Handbook

#### **Specifications**

#### Accessories to order

for TR 1296 H - 144



(coaxial connecting cable 2m transceiver-transverter)

### Accessories to order





for TR 1296 H - 28

**RX-cable** 



- 04: drive gain control on the front panel

- 06: common IF-connector for RX/TX Opt. 06 (common IF-connector) and Opt. 04 (drive gain control on the front panel) are not compatible.



## Transverter for the 13 cm Band - TR 2320 H

#### Some technical characteristics

- Aluminium case with a big heat sink
- Inside wiring with silver plated Teflon coaxial cable
- Antenna relay with 45 dB cross-talk attenuation
- Converter can process large signals
- Extension with additional filters and other components
- Built-in directional coupler for calibrated power output control
- 5-pole low-pass filter for harmonic wave suppression
- Spurious and harmonic wave suppression better 50dBc
- Sideband noise of the oscillator better -132dBc/Hz@10kHz
- Built-in sequence control
- Including dc-power and control cable
- Handbook

### Specifications



### Accessories to order

Tuno	TD 2220 H 2220	TD 2220 H 2204	TD 2220 H 2400	
LIHE-frequency range	2320 2322 MHz (Standard)	2304 2306 MHz (Standard)	2400 2402 MHz (Standard)	
IE froquency range	144 146 MH-	144 146 MU-	144 146 MH-	
IF-frequency range	0.5 2Watt adjustable	0.5 2Watt adjustable	0.5 2Watt adjustable	
BTT control	0.5 – Svall, adjustable	0.5 – Svall, adjustable	0.5 – Svall, adjustable	
PII-control	ground to transmit or +12V on	ground to transmit or +12V on	ground to transmit or +12V on	
_	the IF-cable at TX	the IF-cable at TX	the IF-cable at TX	T 23
Power output	15 Watt@50 Ohm	15 Watt@50 Ohm	15 Watt@50 Ohm	RX-Kabel
Operation voltage	13,8 V DC (12-14 V)	13,8 V DC (12-14 V)	13,8 V DC (12-14 V)	(coaxial connecting
Current consumption	typ. 6 A (TX)	typ. 6 A (TX)	typ. 6 A (TX)	cable 2m transceiver-
RX gain	> 20 dB	> 20 dB	> 20 dB	transverter)
Noise figure Dimensions	typ. 1,5 dB	typ. 1,5 dB	typ. 1,5 dB	transverter)
mm	270 x 260 x 80	270 x 260 x 80	270 x 260 x 80	
Case	Aluminium	Aluminium	Aluminium	
Coaxial connector IF	BNC-female	BNC-female	BNC-female	
Coaxial connectors UHF	N-female	N-female	N-female	
Operation voltage and	SUB-D 9-pole	SUB-D 9-pole	SUB-D 9-pole	
control connector	·		·	
Possible Options	Opt.01:Band1 23042306 MHz	No additional options possible.	No additional options possible.	

## Transverter blockdiagram TR 1296 H - TR 2320 H



## Transverter for the 23 cm band Model MKU 13 G2

This 23 cm transverter was developed employing advanced components. Despite its small size it exhibits excellent performance. It was possible to design the circuit in a 50-Ohm SMD technique using MMIC's, a helical filter and a ring mixer. This module is suitable for building a small portable station or to be part of a powerful home station. The circuit is a further development of MKU 13 G Transverter.

- German silver case, compact construction
- Built-in transmit / receive IF switch
- Built-in 3 Watt IF attenuator for direct operation with a 2 m transceiver
- Control output for further stages monitoring output

#### **Specifications**

Туре	MKU 13 G2
Frequency range	12961298 MHz amateur radio band
IF-Frequency range	144146 MHz
2 m IF input power	max. 3 W can be tuned
RX-Gain	min. 20 dB can be tuned
Noise figure	max. 0.8 dB NF
TX-Output power	> 1,5 W HF
Operating voltage	+1214 V DC approx 1 A @ TX
Dimensions mm	30 x 82 x 82 incl. heatsink and connectors
Coaxial connectors	SMA-female

Transverter with 28...30 MHz IF = MKU 13 G2-28 External filter necessary





## Transverter for the 13 cm band

### Model MKU 23 G2

This 13-cm transverter was developed employing advanced components. Despite its small size it exhibits excellent performance. It was possible to design the circuit in a 50-Ohm SMD technique using MMIC's, a helical filter and a ring mixer. This module is suitable for building a small portable station or to be part of a powerful home station. The circuit is a further development of the MKU 23 G Transverter.

- · German silver case, compact construction
- Built-in transmit / receive IF switch
- Built-in 3 Watt IF attenuator for direct operation with a 2 m transceiver
- DC output for control antenna relays and power amplifiers



max. 3 W

### **Specifications**

Type MKU 23 G2 Frequency range IF 144...146 MHz - RF 2320...2322 MHz amateur radio band IF 144...146 MHz - RF 2304...2306 MHz option USA IF 144...146 MHz - RF 2400...2402 MHz option OSCAR 2 m IF input power max. 3 Watt adjustable **RX-Gain** min. 20 dB adjustable Noise figure max 0.8 dB NF TX-output power min. 1 Watt RF 13 cm Transverter with pre- and power amplifier Operating voltage +12...14V DC 0.6 A at TX Dimensions 30 x 82 x 158 mm incl. heatsink and connectors Preamplifier Antenna + 12 V **Coaxial connectors** SMA-female Antenna MKU 231 A/B MKU 232 B MKU 23 G2 MKU 23 G2 Power amplifier Transverter Transverter 1 Watt MKU 231 TX - 5 W coax relay The modules with a coax relais MKU 231 XL - 10 W MKU 231 HXL - 20 W can be built-in a waterproof IF / ZF 12 V @ TX case for mounting on a tower. + 12 V + 12 V 144... IF / ZF coax relav + 12 V +D Because of that the loss of the 146 MHz 144...146 MHz FUSE / Sicherung FUSE long coax cable will be avoid. 12 V @ TX 2m Band 2m Band Transceiver

The component scan be attached along with the coaxial relay in a weather-proof case direct at the antenna. This reduces cable losses





# Transverter for the 9 cm band

Two 9 cm Transverters were developed using of modern components, with outstanding technical specifications despite their small mechanical dimensions. The circuits are implemented using MMICs, Helical-filters and ring mixers in SMD. The Transverter-version with 144 MHz IF uses silver tuned high Q cavity resonators for selection. With the version with 432 MHz IF a multipolar stripline filter is used. These modules are suitable for the setting up of a small portable station as well as a basic transverter for a high performance home station. With the power amplifier MKU 341 A the power can be increased to 4 Watts and with MKU 342 XL to 15 Watts RF Power.

- · German silver case, compact construction
- Built-in transmit / receive IF switch
- Built-in 3 Watt IF attenuator for direct operation with a 2 m transceiver
- · Control output for further stages
- Monitoring output





#### **Specifications**

Type Frequency range RF Option USA Frequency range IF 2 m IF input power RX - Gain Noise figure TX - Output power Operating voltage Dimensions mm Coaxial connectors Case

#### MKU 34 G2

3400 - 3402 MHz 3456 - 3458 MHz 144 - 146 MHz max. 3 Watt adjustable min. 20 dB adjustable max. 0.9 dB NF min. 0.2 Watt RF +12...14 V DC <0.4 A @ TX 35 x 60 x 150 without connectors SMA-female German silver case

#### **Specifications**

Type	MKU 34 G2 432
Frequency range RF	3400 - 3402 MHz
Option USA	3456 - 3458 MHz
Frequency range IF	432 - 434 MHz
70 cm IF input power	max. 3 Watt adjustable
RX - Gain	min. 20 dB adjustable
Noise figure	max. 0.9 dB NF
TX - Output power	min. 0.2 Watt RF
70 cm IF input power	max. 3 Watt adjustable
RX - Gain	min. 20 dB adjustable
Noise figure	max. 0.9 dB NF
TX - Output power	min. 0.2 Watt RF
Operating voltage	+1214 V DC <0.4 A @ TX
Dimensions mm	35 x 60 x 150 without connectors
Coaxial connectors	SMA-female
Case	German silver case

Transverter



## The 5.7 GHz transverter

#### The 3rd generation - Model MKU 57 G2

This transverter with its outstanding specifications is the result of circuit design using state of the art components. The module is useful for a high performance EME-station, but due to its small mechanical dimensions, may also be used for portable operation.





### **Specifications**

Type Frequency range RF Frequency range IF IF-Input power RX-Gain Noise figure TX-Output power Spurious frequency suppresion Harmonic suppresion OCXO can be coupled in PTT input 12 V - output Monitor output Operating voltage Case Dimensions mm Coaxial connectors

#### MKU 57 G2

5760 - 5762 MHz amateur radio band 144 - 146 MHz (432...434 MHz) max. 3 Watt adjustable >20 dB adjustable typ. 1 dB NF min. 200 mW RF min. 40 dB typ. 50 dB tvp. 30 dB 117 MHz@144 MHz / 111 MHz@432 MHz / 1 mW via IF-cable or contact to ground for antenna relay and PA, max. 0.6 A output power monitoring approx. +1.0 V out. +12...14 V DC typ. 350 mA/TX German silver case 33 x 60 x 150 without connectors SMA-female

Option 01: No built-in oscillator. SMA connector for the input of an external OCXO.

**MKU 57 G2 KIT** 

MKU 57 G2 KIT option 01 for extern. OCXO



## The 5.7 GHz transverter versions





2. Version

1. Version





#### Sequence controllers

Many coaxial- relays have a too little isolation between the transmitting and receiving ports. This problem during the change or process can do the destruction of the input transistor in the converter or the preamplifier. The relay should achieve an isolation of approx. 50 dB. The power on the RX input must not exceed 1 mW.

We highly recommend that a sequence controller is used.

SEQ 1 max. 1 A Power SEQ 2 max. 4 A Power SEQ 3 max. 18 A Power





## The 10 GHz transverter

### The 3rd generation - Model MKU 10 G2

This transverter with its outstanding specifications is the result of circuit design using state of the art components. The module is useful for a high performance EME-station, but due to its small mechanical dimensions, may also be used for portable operations.



### Rainscatter Contest EME Tropo BBT

- Noise figure typ. NF 1.2 dB
- Output power >200 mW
- 144 MHz IF --- 10368 MHz SHF (432 MHz IF available)
- Built-in IF and DC switch
- Selectivity achieved by helical filters, high Q resonators and microstrip filters
- individual adjustment of RX- and TX-gain
- Provision for coupling an external OCXO
- Switched output voltage for external PA and antenna relays
- Directional coupler with detector for monitoring the output power
- Ceramic printed circuit board
- rman silver case for ready made module
- run components integrated within one module.
- Dimensions only 150 x 55 x 30 mm!

- Option 01: No built-in oscillator. SMA connector for the input of an external OCXO requires 106.5 MHz / 1 mW
- Option JA: Export version for Japan 10450...10452 MHz 432...434 MHz IF



MKU 10 G2 KIT

#### MKU 10 G2 KIT option 01 for extern. OCXO



**Iransverter** 50



Type Frequency range RF Frequency range IF 2 m Input power RX-Gain Noise figure TX-Output power Spurious frequency suppression Harmonic wave suppression OCXO can be coupled in PTT input 12 V - output Monitor output Operating voltage Dimensions mm **Coaxial connectors** 

#### MKU 10 G2

10368...10370 MHz amateur radio band 144...146 MHz (432...434 MHz) max. 4 Watt - can be tuned typ. 20 dB - can be tuned typ. 1.2 dB NF min. 200 mW HF min. 40 dB, typ. 50 dB tvp. 30 dB 106.5 MHz / 1 mW via IF-cable or contact to ground for antenna relay and PA, max. 0.6 A output power monitoring approx. +1.2 V out. +12...14 V DC tvp. 350 mA/TX 30 x 60 x 150 without connectors SMA-female



All Transverters available in milled aluminium case: Option "professional"

## **10 GHz transverter versions**

1.) basic version





Transverter

## 24 GHz transverter

### Model MKU 24 GA waveguide MKU 24 GC coaxial

K - BAND TRANSVERTER 24 GHz MKU 24 GA KUHNE electronic gmbH MERIONALE COMPONENTS MADE IN COMMANY

- Built-in wide band IF amplifier 50...500 MHz
- Built-in IF transmit / receive switch
- Built-in 2 watt IF attenuator for direct operation with a 2 m transceiver





### **Specifications**

Type Frequency range Oscillator input LO power 2 m input power RX-Gain Noise figure TX - output power Current consumption Operating voltage Dimensions Weight Case 24 GHz connector IF connector LO input

**MKU 24 GA** 24.0-24.25 GHz amateur radio band 11952 MHz / 12024 MHz (144MHz IF) 25....50 mW max, 2 Watt tvp. 13 dB (144 MHz IF) tvp. 8 dB DSB (144 MHz IF) typ. 0,2 mW SSB (144 MHz IF) approx. 30 mA +12 14 V DC 30 x 60 x 20 mm without connectors approx, 90 g milled aluminium waveguide R 220 / WG20 / WR42 SMC SMA-female

MKU 24 GC 24.0-24.25 GHz amateur radio band 11952 MHz / 12024 MHz (144MHz IF) 25....50 mW max. 2 Watt tvp. 13dB (144 MHz IF) tvp. 8 dB DSB (144 MHz IF) typ. 0.2 mW SSB (144 MHz IF) approx. 30 mA +12 14 V DC 30 x 60 x 20 mm without connectors approx. 90 q milled aluminium SMA-female SMC SMA-female

#### MKU 24 RXO

24.0-24.25 GHz amateur radio band 11952 MHz / 12024 MHz (144MHz IF) 25....50 mW

min. 13dB (144 MHz IF) typ. 8 dB DSB (144 MHz IF)

approx. 10 mA +12...14 V DC 30 x 60 x 20 mm without connectors approx. 90 g milled aluminium waveguide R220 / WG20 / WR42 SMC SMA-female



## 24 GHz transverter versions





## **47 GHz transverter** Model MKU 47 G

- · Milled aluminium case
- Built-in wide band IF amplifier 50...435 MHz
- Built-in IF transmit / receive switch
- Built-in 4 Watt IF attenuator for direct operation to a 2 m transceiver
- Control output for further stages

# **PROCOM** waveguideflange available



### **Specifications**

Type Frequency range Oscillator input 2 m IF input power RX-Gain Noise figure TX-Output power Current consumption Operating voltage Dimensions mm Weight Coaxial connectors Waveguide MKU 47 G 47088 MHz amateur radio band 11736 MHz 20...40 mW (144 MHz IF) max. 3 Watt typ. 15 dB (144 MHz IF) typ. 8 dB DSB (144 MHz IF) typ. 0.15 mW SSB (144 MHz IF) approx. 100 mA +12...14 V DC 30 x 90 x 31 without connectors approx. 140 g SMA-female for LO; SMC for IF WR 19 / WG 24 / R 500

#### 47 GHz transverterversions



## **Ku-band oscillator** K-band oscillator Model MKU 12 LO - MKU 24 LO - MKU 95 LO

- · German silver case, compact construction
- · Clean output signal by using helical filters and microstrip resonators
- High frequency stability provided by a compensated crystal oscillator
- External OCXO input is possible



### Specifications

opcomoutic				opeeniedlene		
Oscillator unit Output frequency	MKU 12 LO 11952 MHz- for SSB & OSCAR 11736 MHz- for 47 GHz Transverters 12024 MHz- for SSB in USA *Other versions available on request*	MKU 24 LO 24192,9 MHz- Beacon frequency +/- 100 kHz	MKU 95 LO 9486 MHz for 76 GHz Transver.	Type Output frequency Output power Phase noise	MKU 2 OSC Band 1: 120,000 MHz Band 2: 120,889 MHz typ. 1 mW max156 dBc@10 kHz	
Output power	min. 35 mW RF	min. 5 mW RF	min. 35 mW	Frequency stability	typ. 1 ppm 040°C	
Current consumption	approx. 250 mA	•		Operating voltage	+ 12 14 V DC	
Operating voltage	+1214 V DC			Current consumption	180/100 mA	
Dimensions mm	111 x 55 x 30 mm without connectors			Dimensions mm	74 x 55 x 30	
Weigth approx	160 g			Case	German Silver	
Coaxial connectors	SMA-female			Coaxial connectors	SMA - female	
Option 01	No built-in oscillator. Instead a SMA-constrained a star and a sta	onnector for the		•		
Option 02	aluminum case					

Option 02



#### Versions can be supplied for other frequencies!

## Crystal oscillator Model MKU 2 05C

The MKU 2 OSC is a switch-selectable dual crystal oscillator for operating with a 2.3 GHz transverter on 2304 and 2320 MHz. The crystals are stabilized on 40,8°C with a precision crystal heater.

· German silver case, compact construction

UHNE electronic 6mbH MICHONAVE COMPONENTS

> Dual oscillator module MKU 2.05C

- Dual crystal oscillator
- · High frequency stability provided by a compensated crystal oscillator

DBGNT

Specification

## Low pass filter with directional coupler and detector

### Model MKU 13 LPF 1.3 GHz MKU 23 LPF 2.3 GHz

- Stripline 5 pole low pass filter for harmonic supression
- Integrated directional coupler with detector for monitoring the output power of transmitters
- Available with N- or SMA-connectors.





## **Beacon-transmitters**

Model MKU 13 BAKE	23 cm Band
MKU 23BAKE	13 cm Band
<b>MKU 34 BAKE</b>	9 cm Band
MKU 56 BAKE	6 cm Band
MKU 10 BAKE	3 cm Band
MKU 24 LO	1.2 cm Band

- · German Silver case, compact construction
- · Clean output signal by using helical filters and microstrip resonators
- High frequency stability provided by a compensated crystal oscillator
- External OCXO input is possible
- Input for F1 keying
- On request beacons in milled aluminium case available



24 LO

5 mW

no

yes

280 mA

24192.9 MHz 24048.9 MHz

ans	Specifications							
icon Tr	Type MKU	13 BAKE	23 BAKE					
	Center f.+/-	1296.9 MHz	2320.9 MHz					
Beo	Output typ.	0,8 W	1 W					
	Current typ.	500 mA	500 mA					
	A1 Keying	yes	yes					
	F1 Keying	yes	yes					

Operating voltage	+1214 V DC
Dimensions mm	111 x 55 x 30 without connectors. MKU 13 BAKE 30 x 56 x 74
Weight	approx. 160g
Coaxial connector	SMA-female
Option 01	No built-in oscillator. Instead a SMA-connector for input of an external OCXO

34 BAKE

200 mW

300 mA

yes

yes

3400.9 MHz

Special versions for other frequencies can be supplied on request!

57 BAKE

200 mW

360 mA

no

yes

5760.9 MHz

10 BAKE

200 mW

280 mA

no

yes

10368.9 MHz



## **Beacon transmitter**



## Super low noise converters

. Low noise converters for converting the UHF - SHF amateur radio bands to the 2 m / 70 cm IF range

- · Low noise figure and high gain
- Use of the most advanced GaAs HEMT FET's
- Ceramic printed circuit board

#### MKU 24 OSCAR 2

Includes 1268 MHz notch for L-Band uplink rejection





MKU 24 OSCAR

MKU 24 TM OSCAR in a waterproof case for mounting on a tower.

Specificatio	ns								NEW	
Type MKU	13 CON 28	13 CON 144	14 CON	15 CON	17 CON	17 CON2	2030 A	23 CON	24 OSCAR2	57 CON
Frequency ranges	12961298	1296 1298	1400 +/-	1550 +/-	1695 +/-	16951710	2000,53000	23202322	24002402	57605762
MHz										
Oscillator frequency	-	-	-	-	-	-	2000,0 MHz	-	-	-
Noise figure NF	typ. 0.6 dB	typ. 0.6 dB	typ. 0.6 dB	typ. 0.7 dB	typ. 0.7 dB	typ. 0.7 dB	typ. 2.5 dB	typ. 0.7 dB	typ. 0.7 dB	max. 1 dB
Gain	min. 20 dB	min. 60 dB	min. 30 dB	min. 26 dB	min. 30 dB	min. 20 dB				
IF Frequency MHz	2830	144146	VHF	VHF	138153	138153	0,51000	144146	144146	432434
Option 70								432434	432434	
<b>Current consumption</b>	cir. 100 mA	cir. 100 mA	cir. 100 mA	cir. 100 mA	cir. 250 mA	cir. 100 mA	cir. 130 mA	cir. 130 mA	cir. 130 mA	cir. 220 mA
Voltage supply via										
bias tee possible	Yes	Yes								
Dimensions mm	30 x 56 x 74	30 x 56 x 74								
Case	German silver	German silve								
Connector in	SMA	SMA	SMA	N	SMA	SMA	SMA	N	N	SMA
Connector out	BNC	BNC	BNC	N	BNC	N	BNC	N	N	BNC
										Option 01:
Operating voltage	+1215 V		14 CON2							Gain:
RF Input	50 Ohm		Gain 60 dB							typ. 40 dB
IF Output	50 Ohm									

Bias tee, please look at page 63, type MKU 270 N or SMA

At MKU 14 CON and MKU 15 CON IF specify frequency please



Converter

#### Versions for other frequencies can be supplied on request!

### Super low noise X-band converter Model MKU 10 CON - MKU 10 OSCAR - KU 8084 A

#### Specifications

Туре
Frequency range
Gain NF
Gain
IF frequency
Current consumption
Dimensions mm
Case
Input connector
Output connector

MKU 10 CON 10368...10370 MHz typ. 1.2 dB typ. 20 dB 432...434 MHz approx. 220 mA 30 x 56 x 74 German silver case SMA-female N-female MKU 10 OSCAR 10451...10453 MHz typ. 1.2 dB typ. 20 dB 432...434 MHz approx. 220 mA 30 x 56 x 74 German silver case SMA-female N-female

- Low noise converter for converting the UHF SHF amateur radio bands to the 2 m / 70 cm IF range
- · Low noise figure and high gain
- Use of the most advanced GaAs-HEMT-FET's
- Ceramic printed circuit board
- Including 1268 MHz notch for L-Band uplink rejection

Specifications					GmbH
Туре	KU 8084 A			KU 8084 A	
Center frequency	8420 MHz			8420 / 1270 MHz	
Bandwidth	typ. 300 MHz		NEL	+ 12 V LO: 7150 MHZ	BE IN
LO frequency	7150 MHz			IFOUT	8420
IF center frequency	1270 MHz			CAL 1270 MHZ MADE IN GERMANY BY DB6	NT MHz
Gain	min. 25 dB	typ. 30 dB		Law	
Noise figure	max. 1.4 dB NF	typ. 1.2 dB NF			
Operating voltage	+ 12 14 V DC				
Voltage supply via					
bias tee possible	yes				
DC current	approx. 100 mA		· Super low poise pro	amplifier available for KI	1 0000 A (pr
Dimensions mm	30 x 56 x 74		• Super low noise prea		0000 A (ba
Case	German silver		<ul> <li>Deep space commu</li> </ul>	nication converter	
RF connector	SMA-female		<ul> <li>Low noise figure and</li> </ul>	d high gain	
IF connector	N-female		<ul> <li>Use of the most adv</li> </ul>	anced GaAs - HEMT - F	ET`s

Ceramic printed circuit board

61

12)

## Super low noise ATV - converters

Model MKU 23 LNC 13 cm band MKU 34 LNC 9 cm band MKU 57 LNC 6 cm band

- Low noise converters for conversion of the 2.3 / 3.4 and 5.7 GHz Amateur radio bands to the SAT receiver range 1.3....1.8 GHz
- Unrestricted suitable for DATV
- Use of the most advanced GaAs HEMT FET's
- Build-in bias "T". For power feed up the coaxial cable
- MKU 23 LNC

ATV

Includes a notch filter for the 23 cm Band for cross band operation. It was possible by using 2 "Multilayered Ceramic Bandfilters" for optimum rejecton at 2,3 GHz, as well as Schottky-diode-mixer and SAW resonator to give high frequency stability of +/- 20 kHz and high dynamic range. The phase noise of the SAW-oscillator is better than -115 dBc/Hz @ 10 kHz

• The converter in the 2.5 GHz range is suitable for all high linearity modulation types like DATV DVB-S DVB-T MMDS etc. The converter LNC 2227 A was developed for MMDS-applications and converts the signal in the UHF-range 367-867 MHz.



MKU 57 LNC

### **Specifications**

Туре	MKU 23 LNC	MKU 23 LNC3	MKU 25 LNC	LNC 2227 A	MKU 34 LNC	MKU 57 LNC	MKU 57 LNC2
Frequency range	23202450 MHz	21002600 MHz	23502550 MHz	22002700 MHz	34003475 MHz	56505850 MHz	56505850 MHz
LO-Frequency	916,5 MHz SAW	916,5 MHz SAW	916,5 MHz SAW	1833 MHz SAW	1837 MHz SAW	typ. 7,3 GHz DRO	typ. 7,3 GHz DRO
IF-Frequency	14041534 MHz	11841684 MHz	14341634 MHz	367867 MHz	15631638 MHz	14501650 MHz	14501650 MHz
<b>Frequency stability</b>	+/- 20 kHz	+/- 20 kHz	+/- 20 kHz	+/- 40 kHz	+/- 40 kHz	typ. 40 kHz/°C	typ. 40 kHz/°C
Gain	typ. 40 dB	typ. 40 dB	typ. 40 dB	typ. 30 dB	typ. 38 dB	typ. 50 dB	min. 40 dB
Noise figure	typ. 0,7 dB NF	typ. 1,0 dB NF	typ. 0,7 dB NF	typ. 1,0 dB NF	typ. 0,9 dB NF	max. 1,0 dB NF	max. 1,0 dB NF
Current consum.	ca. 70 mA	ca. 130 mA	ca. 70 mA	ca. 210 mA	ca. 100 mA	ca. 150 mA	ca. 100 mA
<b>Operationg voltage</b>	+918 V	+918 V					
Dimensions mm	30 x 56 x 74	30 x 56 x 74	30 x 56 x 74	ca. 100 g	ca. 100 g	ca. 120 g	ca. 120 g
RF-In-connector	N-female	N-female	N-female	N-female	N-female	SMA-female	N-female
IF-Out-connector	F-female	F-female	F-female	F-female	F-female	F-female	F-female
Supply via Sat receiver over the IE cable							

Supply via Sat-receiver over the IF-cable



## ATV - converter for 24 GHz

### Model MKU 24 A LNC

- Low noise converter for conversion of the 24 GHz amateur radio band to the SAT receiver range 1...1.25 GHz
- · Low noise figure and high gain
- Use of the most advanced GaAs HEMT FET's
- Waveguide input for the direct installation at the antenna Built-in bias 'T' for power feed up the coax cable

### Bias tee Model MKU 270





specifications	
Туре	MKU 24 A LNC
Frequency range	2424.25 GHz amateur radio band
LO - Frequency	23 GHz (SHM 11.5 GHz)
Gain	min. 45 dB
Noise figure	max. 2.5 dB NF
Current consumption	< 150 mA
Operating voltage	+1218 V supply via SAT- Receiver
	over the IF- cable
Dimensions mm	128 x 22 x 35 without connector
Weight	approx. 160 g
Waveguide-input	R 220 / WR 42 / WG 20
IF - output	F-connector

Voltage supply for preamplifier and converters facilitated via the coax cable by remote controlled switch. Built-in 1 Amp miniature fuse as well as protection against overvoltage and wrong polarity.

Specifications	5	
Туре	MKU	270
Frequency range	1030	000 MHz
Insert loss	typ. 0.	1 dB / 145 MHz
DC	015	V. max.: 1 A
Dimensions mm	30 x 3	8 x 120
Module with N-connect	ctor MKU	270 N
Module with BNC-con	nector Mł	KU 270 BNC

Special converters for other frequencies can be supplied on request!



## ATV Oscillator module for 1<u>2 GHz</u>

### Model MKU 12 ATV

Small size

**ATV** 

- Milled aluminium case, professional construction
- Direct base-band video input
- Frequency adjustment using a tuning screw

#### Ku - BAND DRO OSZILLATOR 1: 12,0 głz KUHIVE electronsic MICHIWAYE COMPONENTE MACE IN GERMANY

### **Specifications**

Type MKU 12 ATV Frequency range 12 - 12.125 GHz Frequency specification is required adjustment to the desired amateur radio frequency >20 mW Output power Input CVBS - baseband <1 Vpp **Output connector** SMA-female Input connector SMC-male Baseband max. 20 MHz **Operating voltage** +12...14 V DC Current consumption approx. 80 mA Dimensions mm 17 x 30 x 67 incl. connector Weight approx. 40 g Case milled aluminium case Option 01 without CVBS input

#### **ATV - TRANSMITTER**

antenna

Transmitter which can be frequency tuned 5.650...5850 GHz (3.402...3475)



#### Transmitter which can be frequency tuned 10...10.5 GHz



#### High-quality fixed frequency DRO - Transmitter for the 10 GHz band



#### High-quality fixed frequency DRO - Transmitter for the 24 GHz band



#### LNC (LOW NOISE CONVERTER) for the 6 and 1.3 cm Band





## ATV - transmitter for the 9 and 6 cm band

#### Model MKU 34 TV - MKU 57 TV

Using these modules in conjunction with baseband frequency processing, high performence 3.4 GHz and 5.7 GHz ATV transmitters can be constructed. Using the amplifier MKU 341 A (page 27) the power of the 9 cm transmitter can be increased to more than 4 Watts. For the 6 cm band you can select between different power amplifiers up to 15 Watt (page 28). By mounting them directly at the antenna, cable loss can be reduced. You only need the baseband signal and +12 V supply. Tuning is done by a voltage that controls a varicap diode in a coaxial DRO oscillator. An output jack for an external PLL is built-in.





#### **Specifications**

Transmitter type	MKU 34 TV	MKU 57 TV
Frequency range	3402 - 3475 MHz	5650 - 5850 MHz
Output power typ.	200 mW	200 mW
Current cons. typ.	200 mA	250 mA
Dimensions mm	30 x 37 x 111	30 x 55 x 111
Output for PLL *	1.7 GHz SMC connect.	1.4 GHz SMC connect.
(* only for PLL use) Video input Tuning voltage Operating voltage RF - output connector Case	Base band <1Vpp / 75 Of +112 V +1214 V DC SMA female German silver case	nm. SMC-connector male

SMC-connector for 3.2 mm cable available



## ATV - transmitter moduls for 10 GHz

### Model MKU 10 B-ATV - MKU 10 H-ATV

Using these modules in conjunction with baseband frequency processing, as well as a suitable antenna, high-quality 10 GHz ATV-Transmitter can be constructed. With other power amplifiers (page 23-24) there is a increase of the output power of approx. 50 Watts possible.

Using the amplifier MKU 341 A (page 20) the power of the 9 cm transmitter can be increased to more than 4 Watts. For the 6 cm band you can select between different power amplifiers up to 15 Watt (page 21). You only need the baseband signal and +12 V supply.

Small size

ATV

- Milled aluminium case
- Direct base-band video input
- Will be adjusted according to frequency specification and optimised for best linearity.
- Can be adjusted by tuning the gold plated precision screw - tuning range +/ - 50 MHz



Specifications			-	X - BAND VIDEO TRANSMIT MKU 108 - ATV center 10,42 GH	TER
Type Output power Current consumption Dimensions incl. connectors Weight Output connector SMA-female Frequency range Entry Entry connector Operating voltage Weight Case	MKU 10B - ATV >200 mW typ. 200 mA 20 x 30 x 95 mm approx. 60 g 10 - 10.5 GHz amateu Base band max.1 Vpp SMC-connector +1214 V DC approx. 60 g milled aluminium	MKU 10H - ATV typ. 1 Watt typ. 600 mA 20 x 30 x 117 mm approx. 100 g tr band - please specify fo (invert. neg.)	requency!	KUHNE Electronic MICROWAVE COMPONENTS	FREQUENCY ADJ

SMC-connector for 3.2 mm cable available



## ATV - transmitter for 24 GHz Model MKU 24 TV 100 mW RF MKU 24 TV2 300 mW RF

- Small size
- Milled aluminium case
- Direct base-band input
- Can be adjusted over the entire amateur radio band
- Will be adjusted according to frequency specification and optimitsed for high linearity
- Built-in directional coupler with detector for monitoring the output power MON -



#### **Specifications**

Output frequency Frequency range Output power	24.1 GHz 24 - 24.25 GHz amateur radio band MKU 24 TV: typ. 100 mW, waveguide R220, WR42 MKU 24 TV2: typ. 300 mW, waveguide R220, WR42 (SMA-out available on request)
Input	Base band max.1 Vpp (invert. neg.)
Input connector	SMC
Operating voltage	+1214 V DC
Current consumption	approx. 300 mA
Dimensions mm	123 x 30 x 45 incl. heat sink
Weight	approx. 220 g

Special versions for other frequencies can be supplied on request!



## **Frequency multiplier**

### Model MKU 34 TX - MKU 57 TX - MKU 10 TX

- Wide band frequency multiplier x 3 for generation of 3.4 GHz ATV signal
- Wide band frequency multiplier x 4 for generation of 5.7 or 10 GHz ATV signal
- The use of microstrip band-pass filters ensures the modules can be used over the entire amateur radio band without any fine adjustment

C - BAND FREQENCY TRIPLER 3,4 GHz

UHNE electronic

Modern circuit design with high spurious suppression

Typ: MKU 34 TX





Specifications		MKU 34 TX	MKU 57 TX	MKU 10 TX
	Output frequency Input frequency Input power Dimensions mm	3.43.475 GHz 1.131.16 GHz typ. 20 mW 30 x 37 x 111	5.655.85 GHz 1.4121.462 GHz 310 mW 30 x 56 x 111	1010.5 GHz 2.5 - 2.625 GHz 310 mW 30 x 56 x 111
	Output Operating voltage Current consumption Weight Case Coaxial connectors	>150 mW wide band +1215 V DC approx. 250 mA approx.120 g German silver case SMA-female	(200 mW mid-band)	

MADE IN GERMANY



ATV

#### Specifications

## 24 GHz Frequency doubler

47 GHz Frequency doubler

Type MKU 1224 / MKU 1224 W Input frequency 12 GHz Band: 20...40 mW **Output frequency** 23.544 / 24.192 GHz / 24.048 / please specify frequency! Output typ. 80...100 mW approx. 300 MHz Bandwidth +11...14 V DC **Operation voltage Current consumption** typ. 0,4 A Dimensions mm 30 x 116 x 24 Opt.W 30 x 116 x 52 Weight Opt.W approx, 250g approx. 130 g milled aluminium Opt.W incl. heatsink Case In- and Output connector SMA

Option W with waveguide output R220/WR42 for ATV or Beacon transmitter

MKU 2347 S

### Specifications

Туре
Input frequency
Input power
Output frequency
Output power
Dimensions mm
Weight
Case
Input connector
Waveguide

#### 23.544 GHz 100 mW 47.088 GHz typ. >15 mW 33 x 30 x 17 approx. 40 g milled aluminium SMA-male or female 47 GHz = WR 19

### **Specifications**

Input frequency

Output power

In connector

Isolation

Case Out connector

Output frequency Input power

Operating voltage

Dimensions mm

Type

## X - K-Band Frequency doubler

KU 1020 B 9...11 GHz 18...22 GHz -2 dBm +4 dBm >30 dB + 12 V / typ. 50 mA 30 x 50 x 17 milled aluminium SMA-female SMA-female



UHNE electronic

Fractionery Doctol

+:3.8 Y

K.Band out

SH LD

UHNE electronic

Frequency Doppler

UHNE electronic

Frequency Multiplier

23-475 SN:

X-Band in 13 dBm --- K-Band out 19 dBe

010

SNE ND

Frequency multiplier for other frequencies can be supplied on request!



## Transverter - mixer for satellite and DATV communication

### Model MKU 13 OTX - MKU 24 OTX - MKU 57 OTX - MKU 10 LTX

These tx-mixers convert the 144 MHz (436 MHz) band to the 1268, 2446 or the 5668 MHz O.S.C.A.R. uplink bands. Employing high "Q" cavity resonators and helical filters as well as state of art circuit design and using ceramic printed circuit board and modern semiconductors, these tx-mixers have outstanding specifications. By connecting a power amplifier the output power can be increased.

- Built-in control circuit with control voltage output for controlling power amplifiers and antenna relays.
- Built-in 3 Watt IF-attenuator for direct operation in connection with a 2 m transceiver
- Special Up-converter for other frequencies



opeomodiono				
Туре	MKU 13 OTX	MKU 24 OTX	MKU 57 OTX	MKU 10 LTX
Frequency range Input frequency	12681270 MHz 144146 MHz 436438 opt.	24462448 MHz 144146 MHz	56685670 MHz 144146 MHz (432 MHz) opt.	1010,5 GHz please select frequency 100500 MHz please select frequency
Output power	1 Watt RF	> 1 Watt RF	> 200 mW RF	> 200 mW RF
Current consumption	approx. 500 mA	approx. 600 mA	approx. 350 mA	approx. 350 mA
Dimensions without con.	30 x 56 x 74 mm	30 x 56 x 150 mm	30 x 56 x 150 mm	30 x 56 x 150 mm
DC - TX OUT	+12 V on TX	max. 3 Amp.	max. 3 Amp.	max. 0.5 Amp.
Monitor OUT	> +1 V			
2 m operation power Coaxial connectors	max. 3 Watt adjustable SMA-female	max. 3 Watt adj.	max.3 watt adj	1100 mW



Satellite

Specifications

## Packet link components

Converter for 2.3 GHz PR-band to 110 MHz IF. Alignment and crystal depend on the required input frequency. These Converters and TX-mixer convent the 5.7 GHz Link-band to a the 435 / 145 MHz IF. These modules use crystal that depend on the required frequencies.

#### **Specifications**

Type Frequency range IF- frequency Gain Noise Figure Current consumption Operating voltage Dimensions mm RF Input IFOutput

#### Link

MKU 23 LINK 2380 +/- as ordered 110.59 MHz for DK2DB IF- unit typ. 20 dB typ. 2 dB NF approx. 70 mA +12...15 V 30 x 56 x 74 without connector SMA - female 50 Ohm SMC - female 50 Ohm







### **Specifications**

Frequency range

Current consumption

Operating voltage

Dimensions mm

IF- frequency

Noise Figure

**RF Input** 

IF Output

Option 01

Type

Gain

#### Converter

MKU 57 LINK
5650 - 5850 MHz
435 MHz
typ. 20 dB
typ. 2 dB NF
approx. 220 mA
+1215 V
30 x 56 x 111 without connector
SMA-female 50 Ohm
BNC-female 50 Ohm
Gain typ. 40 dB



#### **Specifications** Transmitter MKU 34 LTX MKU 57 LTX Type Frequency range 3400 - 3475 MHz 5650 - 5850 MHz **IF- frequency** 435 MHz 144 or 435 MHz 10...300 mW adj. IF- Power in 10...300 mW adi. tvp. 200 mW RF typ. 200 mW RF Output power Current consumption approx. 300 mA approx. 300 mA Operating voltage +12 15 V +12...15 V Dimensions mm 30 x 56 x 150 mm W. co. 30 x 56 x 150 mm W. co. RF and IF connector SMA-female 50 Ohm SMA-female 50 Ohm Monitor for output power control



**Packet Radio** 

## Power supply

### Model 5 150 W 12 / 5 150 W 24

- AC input range selected by switch
- Protections: short circuit / over load / over voltage
- Approvals: UL / TUV / CB / CE
- Free air cooling convetion
- Fixed switching frequency at 25 kHz
- 100 % full load burn-in test



S 150 W 24

-10...+60 °C

105%...150%

115%...135%

20 ms at full load

and 230 V AC 800 g

88...132 V AC/ 176...264 V AC (47...63 Hz)

24 V +/- 1%

21...28 V

0...6,5 A

156 Watt

240 mVp-

85 %

3000 V AC

100 MΩ

1.6 A

35 A



#### **Specifications**

Type Operating temperature range Over load protection Over voltage protection Withstand voltage I/ -O/P Isolation-resistor (I/P-O/P, I/P-FG, O/P-FG: 500V DC) Set, rise, hold up time

Weight AC input voltage range

AC input current (at 230V) AC inrush current (cold start

#### Output Outputvoltage Adjust-range min. Output current range Output power Remaining ripple max.

FG: 500V DC)	10
ne	20
	an
	80
nge	88
	17
	(4
230V)	1.6
cold start)	35
	12
	10
e	0

-10+60 °C 105% 150% 115% 135% 3000 V AC	
100 MΩ 20 ms at full load and 230 V AC 800 g 88132 V AC/ 176264 V AC (4763 Hz) 1.6 A 35 A	
12 V +/- 1 % 10,613,2 V 012,5 A 150 Watt 180 mVp-p 82 %	

S 150 W 12




# Power supply

### Model SP 200 W 12

- Universal AC input / Full range
- PFC 0.98 @ 115 V AC; 0.93 @ 230 V AC
- Protections: short circuit / over load / over voltage / over temp.
- Built-in fan speed control
- UL / CUL / TUV / CB / CE / S-MARK
- Fixed switching frequency at 134 kHz
- Forced air cooling by built-in DC fan

-		<b>TE T</b>	Inn	
•	a 1 - 1 a			- )

Туре	SP 200 W 12
Operating temperature range	-10+60 °C
Over load protection	105%150%
Withstand voltage I/ -O/P	3000 V AC
Withstand-resistor	
(I/P-O/P. I/P-FG. O/P-FG: 500 V DC)	100 MΩ
Set, rise, hold up time	20 ms at full load
	and 230 V AC
Weight	800 a
AC input voltage range	85264 V AC
	(4763 Hz)
AC input current (at 230 V)	1.4 A
AC inrush current (cold start, at 230 V)	40 A
· · · · · · · · · · · · · · · · · · ·	
Output	
Outputvoltage	12 V +10 / -5 %
Adjust-range min.	10.813.2 V
Output current range	016.7 A
Output power	200 Watt
Remaining ripple max.	100 mVp-p
Effectivity	79 %







# Power supply

### Model 5P 300 W 12 / 5P 320 W 24

- Universal AC input / Full range
- PFC 0.98 @ 115 V AC; 0.93 @ 230 V AC
- Protections: short circuit / over load/ over voltage/ over temp.

83 %

- Cooling fan ON / OFF auto control
- Approvals: UL / CUL / TUV / CB / CE
- Fixed switching frequency at 110 kHz
- Forced air cooling by built-in DC fan



Specifications			30.5	150.0	
opecifications			52.5	1130.0	45.5
Туре	SP 300 W 12	SP 320 W 24	-	117.a	45,3
Operating temperature range	-10+50 °C	-10+50 °C	LED	• —	
Over load protection	105%135%	105%135%	+V ADJ-		3 8 9 8 1
Withstand voltage I/ -O/P	3000 V AC	3000 V AC	0 28	<b>a</b>	
Withstand-restistor			<b>1</b> 7		
(I/P-O/P, I/P-FG, O/P-FG: 500 V DC)	100 MΩ	100 MΩ		4-144	
Set, rise, hold up time	20 ms at full load	20 ms at full load	<u></u>	·····	
•	and 230 V AC	and 230 V AC	∞ <u> </u>		50
Weight	1200 g	1200 g		• <u> </u>	·• + + + + + + + + + + + + + + + +
AC input voltage range	85264V AC/	85264V AC/		E SO WI E EX I	
	(4763 Hz)	(4763 Hz)		0-20-W0-0104 / 1811	
AC input current (at 230 V)	2A ´	2A ´		215.0	) Bom FAN
AC inrush current (cold start, at 230 V)	36 A	36 A	32.5	5 150.0	2
Output					
Outputvoltage	12 V +/- 1%	24 V +/- 1%	1000	<b>•</b>	<u></u> •_do
Adjust-range min.	1013.2 V	2026.4 V	r=1111		
Output current range	024 A	012.5 A			
Output power	288 Watt	312 Watt			4-M4 1=6mm
Remaining ripple max.	150 mVp-p	150 mVp-p			

87 %



Effectivity

# Power supply

### Model **SP** 500 W 12 / **SP** 500 W 24

- Universal AC input / Full range
- PFC 0.98 @ 115 V AC; 0.95 @ 230 V AC
- Protections: short circuit / over load / over voltage / over temp.
- Cooling fan ON / OFF auto control
- Approvals: UL / CUL / TUV / CB / CE
- Fixed switching frequency at 110 kHz
- Forced air cooling by built-in DC fan
- 100 % full load burn-in test
- Built-in remote ON-OFF auto control

### Specifications

Туре	SP 500 W 12	SF
Operating temperature range	-10+50 °C	-1(
Over load protection	105%135%	10
Withstand voltage I/ -O/P	3000 V AC	30
Withstand-restistor		
(I/P-O/P, I/P-FG, O/P-FG: 500 V DC)	100 MΩ	10
Set, rise, hold up time	20 ms at full load	20
· · · ·	and 230 V AC	an
Weight	1800 g	18
AC input voltage range	85264 V AC/	85
	(4763 Hz)	(4
AC input current (at 230 V)	3.5 A	3.5
AC inrush current (cold start, at 230 V)	36 A	36
Output		
Outputvoltage	12 V +/- 1%	24
Adjust-range min.	1013.2 V	20
Output current range	040 A	0
Output power	480 Watt	48
Remaining ripple max.	240 mVp-p	24
Effectivity	84 %	85



NEW







120



4

# Heatsink

Specficatio	ns			W		Internet
Type Dimensions Material	<b>SK 120 - 75</b> 150 x 75 x 40 mm Aluminium black-anodized	<i>SK 200 - 80</i> 200 x 80 x 92 mm Aluminium blank	<b>SK 150- 62</b> 150 x 62 x 75 mm Aluminium blank	<b>SK 300 - 62</b> 300 x 62 x 75 mm Aluminium blank	<i>SK 200 - 125</i> 200 x 125 x 75 mm Aluminium blank	<i>SK 200 - 160</i> 200 x 160 x 85 mm Aluminium blank
K / W	1.25	flat milled base 0.13	flat milled base 0.21	flat milled base 0.15	flat milled base 0.09	flat milled base 0.065

# Fans incl. screen grids



# **Specfications**

Туре	Fan 60x60 12 V	Fan 60x60 24 V
Dimensions mm	60 x 60 x 25	60 x 60 x 25
Operating voltage	12 V	24 V
Current consumption	0.19 A	0.12 A
Airflow	40 m³/h	40 m³/h
Noise	34dBA	34dBA
Bearing System	Ball	Ball
Screen grid 60x60	incl.	incl.





## **Specfications**

Туре	Fan 80x80 12 V	Fan 80x80 24 V
Dimensions mm	80 x 80 x 25	80 x 80 x 25
Operating voltage	12 V	24 V
Current consumption	0.22 A	0.15 A
Airflow	71 m³/h	71 m³/h
Noise	34dBA	34dBA
Bearing System	Ball	Ball
Screen grid 80x80	incl.	incl.



# **Precision crystal heater**



This precision crystal heater provides temperature compensation for crystals, usually found within crystal oscillators. The assembled circuit, which is built on  $AL_2O_3$  ceramic substrate, should be mounted against the thermostat crystal using heat shrink tubing. The circuit heats the crystal to a temperature of 40.8° C with an accuracy of better than 0.1° C. This provides high frequency stability over the temperature range of -5 to +40° C. This crystal heater is a reasonable alternative to completly heated OCXO's, which values can not be reached.

### **Specfications**

Adjustment tolerance	40,8° C +/- 2,5° C
<b>Regulation accuracy</b>	better 0,1° C
Operating voltage	810 V (12 V) as possible use independent
	separate stabilize voltage
Inrush current	approx. 80 mA
Dimensions mm	10,5 x 14,0 x 3,5

# Speed control for KR400 Rotor series

### Waterproof case

Waterproof case for self mounting available

Dimension inside max. 40 x 90 x 57 mm incl. V2A - Mastclip





Discribed in UKW Berichte magazine or on our homepage. Epoxy - PCB available



### PCBs

PCB broadband amplifier 0,52,5 GHz typ. 1 W	UKW Ber. 2.97
PCB 12/24 GHz doubler	DUBUS 1-2.92
PCB 5,7GHz 8 W PA	DUBUS 3.92
PCB 10 GHz 4 W PA 2-stage	DUBUS 4.91
PCB 10 GHz 4 W PA 1-stage	
PCB 10 GHz 8 W PA 2-stage	
PCB 10 GHz HEMT-pre stage DK	DUBUS 3.95
PCB 10 GHz beacon	
PCB 12 GHz LO MK4	RO4003 through-connection
PCB 24 GHz HEMT ampl. coaxial	DUBUS 4.93
PCB 24 GHz HEMT ampl. waveguide	DUBUS 4.93
PCB 24 GHz PA ampl. coaxial	DUBUS 4.93
PCB 24 GHz PA ampl. waveguide	DUBUS 4.93
PCB 24 GHz HEMT amp. coax. only f.NE32584C!	DUBUS 3.96
PCB 24 GHz HEMT amp. waveguide only for "	DUBUS 3.96
PCB 24 GHz PA Amp. wg in-coax out > beacon	DUBUS 4/page 347
PCB 24 GHz HEPA 4-stage amplifier waveguide	Dorsten 2.97
PCB 24 GHz HEPA 4-stage amplifier coax.	Dorsten 2.97
PCB 24 GHz MK2 transverter	DUBUS 1.93
PCB 24 GHz MK3 Transverter waveguide	DUBUS 2.98
PCB 24 GHz MK3 Transverter coaxial	DUBUS 2.98
PCB 24 GHz LO	
PCB 47 GHz mixer	DUBUS 1.94
PCB 47 GHz IF	DUBUS 1.94
PCB 76 GHz mixer x 4	DUBUS 2.92
PCB 76 GHz IF	DUBUS 1.94
PCB 76 GHz mixer x 2	DUBUS 1.94
PCB 25.3/76 GHz tripler	DUBUS 1.94
PCB 120 GHz multiplier by 3	Dorsten 2005
PCB 120 GHz multiplier by 5	Dorsten 2005
PCB 23/47 GHz doubler	DUBUS 4.93
PCB 19/38 GHz doubler	DUBUS 1.94
PCB 120 GHz RX mixer	Dorsten 2005
PCB 145 GHz mixer	DUBUS 2.94
PCB 241 GHz mixer	DUBUS 2.94
PCB Speed control of KR400 Rotor series	UKW Berichte 2/99

#### Parts

Hybrid MKU 55 +/- 5 V supply	DUBUS	1.92
SMC-connector f. coaxcable 3,2 mm straight		
Diode BAT 15-03W		
Waterproof case for MKU 23 LNC / 34 LNC / 132A2 incl. m	astclip (not	
drilled)		
Replacement fuse for TR 144 / 432 H		
Procom waveguide flanges WR 19		
Precision crystal heater 40° QH40A		

PCB



### Kits

	Kit 1,3GHz 13G2	
	Kit 1,3 GHz 13G2-28	
	Kit 2 3CHz 23C2	
	KILZ, JGHZ ZJGZ USCAR	
	Kit 3,4GHz 34G2	
	Kit 5,7GHz 57G2	
	Kit 5,7GHz 57G2, Option for extern. OCXO	
1	Kit 10 GHz 10G2	
	Kit 10 GHz 10G2, Option for extern. OCXO	
	Kit 24 GHz HEMT ampl. coaxial vers.	
	Kit 24 GHz HEMT ampl. waveg. vers.	
	Kit 24 GHz MK2 transverter	
	Kit 24 GHz MK3 transverter coaxial	
	Kit 24 GHz MK3 transverter waveg	

transverter MK2 (all parts you need, description) transverter MK2 (all parts you need, description) 28 MHzIF addition filter necessary transverter MK2 (all parts you need, description) 2400 MHz transverter MK2 (all parts, description) transverter MK2 (all parts you need, description) transverter MK2 (all parts you need, description) transverter MK2 (all parts, description) transverter MK2 (all parts you need, description) transverter MK2 (all parts, description) (3 x NE32584 C + 1 PCB + 1 x Drawing/circuit) (3 x NE32584 C + 1 PCB + 1 x Drawing/circuit) (1 x PCB + 2 x BAT 15-W3 + 1 pF) (1 x PCB + 2 x BAT 15-W3 + 3 x BAR64-03W + 1 x BFP196) (1 x PCB + 2 x BAT 15-W3 + 3 x BAR64-03W + 1 x BFP196)





# **General Terms and Conditions**

### of Kuhne electronic GmbH, Berg/Oberfranken

#### 1. Validity

The following Terms and Conditions shall apply for all contracts, deliveries and other services - without any contradiction against the buyers conditions - provided altered conditions have previously been agreed. Only German law is applicable.

#### 2. Offer and Conclusion

With respect to price and delivery contingencies, offers are not always binding unless the seller has specifically given his obligation in writing. Verbal collateral agreements and undertakings exceeding the written sales contract always require the sellers confirmation in writing. In case the financial conditions of the customer deteriorate considerably after conclusion of the contract and if this fact becomes known after the conclusion we are entitled to request either advance payment or provision of security or may withdraw from the contract. Descriptions, drawings and illustrations of the products offered by us and price lists and catalogues are prepared as per the best knowledge. The details given therein are not binding provided certain properties are expressly warranted in writing.

#### 3. Delivery and Delay

Delivery periods are not binding unless the seller has expressly given a confirmation in writing. Part deliveries are admissible. In case of unforeseen delivery impediments such as act of God, strike, interruption of operations in our own company or in our suppliers company or transport problems etc., the seller is entitled to cancel the supply consignment partly or completely. Damage claims of the buyer are excluded.

#### 4. Dispatch and Delivery

Dispatch is made within the sellers discretion and without any guarantee of the cheapest way of dispatch. All consignments including possible returns are at the buyers risk and expenses. On request of the buyer, insurance is effected at the his expense. As for the rest, the risk is passed to the buyer when the goods are handed over to the forwarder or carrier, however, no later than when leaving the stock.

#### 5. Retention of title

In principle we deliver under extended retention of title. Until the buyers fulfilment of all claims we retain title to the delivered goods. Preceding pledging and assignment for security purposes are prohibited.

#### 6. Prices and Payment

Prices are not binding and are ex place of delivery in EURO € including the respectively valid rate of VAT. Freight, postage and packing are excluded. The price being valid at the day of dispatch will be charged. If not agreed otherwise in writing, payment has to be effected within 21 days upon invoice date without deduction. Supplies to customers who are unknown to the Seller are only made against cash on delivery or advance payment. At the day, the Seller has the money at his disposal without any loss, payments are regarded as effected. In case of delay in payment interest will be charged to the amount charged by the banks for appropriate loans. The withholding of payments due to the customers counterclaims which are not accepted by the seller and the offsetting of those claims are prohibited.

#### 7. Notice of Defects, Warranty

Notice of defects and complaints about quantity are to be asserted immediately by the customer in writing, at least within eight days upon receipt of the goods. The sellers responsibility will be set aside if notices of defects are not in due time. In case of a justified notice of defect the seller has the right either to remedy the defect or to take the product back against a relevant credit note or to replace the product without costs in a reasonable period of time. For private customers the legal guarantee period of 24 months is applicable, for trade and industry are 12 month applicable! Further claims are excluded. The guarantee will lapse if the devices are opened and modified. Supplied semiconductors will not be replaced.

#### 8. Repairs

An estimate of costs prior to the execution of a repair will only be furnished on the customers express request and at his expenses. It is within the sellers discretion whether the repair is carried out in his own workshop or in another one. The costs incurred by dispatch and packing are to the buyers account.

#### 9. Place of Performance and Court of Jurisdiction

Place of performance and court of jurisdiction is the place of the selling company for all deliveries and payments and for all differences between the contracting parties, including actions for cheques. Only German law is applicable. In the event that one of the clauses of the agreement become inoperative the validity of the remaining clauses will not be affected.

#### 10. Export

Deliveries abroad are only effected against advance payment. Upon receipt of your order we will send you the relevant invoice. As soon as the invoice amount in EURO € is transferred and credited to our account the ordered goods will be immediately dispatched ex Berg stock unless a delivery period has been agreed in writing. Bank charges are always to be taken over by the customer.







We develop and manufacture professional devices for the frequency range 0,1 ... 50 GHz according to customer's specifications. This includes amplifiers, mixers, oscillators and systems made according to the details required.