Some electronic devices (usable as general purpose switches) can be used for HF up to 30MHz as high dynamic mixer, these are low cost components but it is possible to obtain high dynamic mixers. These components are FETs in quadruple configuration used as switches called 4 Bit Bus Switch, or quadruple logical ports used as switches too. Both are always driven by a C-Mos logical port on low level LO signal. We will not dwell on the explanation of these mixers (see Internet or magazines) the cost of these components is very low because they were developed for consumer market. The trick lies in selecting devices that, among all the many available products, have low parasitic capacity, fast switching times and very low R_{DS} series resistance.

original function		cod.	price € each 1 - 10 pcs
C Mos SMD , 4 bilateral switch	it is the simpliest and cheapest solution for H mode mixers	**CD 4066-SMD**	0,50 - 0,45
		CD 4066-DIL	0,80
SMD , 4 bit bus switch	Cin 3pF , 5 dB loss , OL only -10 dBm	**FST 3125 M**	2,00 - 1,80
DIL , 4 bit bus switch	tr + td(on) = 1 nS fast switching , CDG 0.3 pF , Cout 1.3 pF , +/- 10V , case DIL	**SD 5000**	7,50
Metallic TO72 , single FET, it is the single divice contained in the quad SD 5000N		**SD 215 DE**	**see FET**
SMD , 4 OR SMD	they are used as rectangular wave form LO, Schmidt trigger and 180° phase shifter for LO driver	**74 HC 86**	0,40 - 0,30
SMD , 4 OR SMD		**74 AC 86**	0,50 - 0,40

wide band, passive BALACED MIXERS

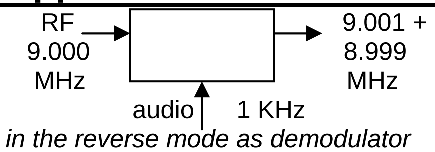
PASSIVE MIXERS useful informations

The passive mixers are versatile and extraordinary components, they are also suitable for other applications in addition to theirs classic, some of these applications are well known but others a little less.
In these few lines we will also give you some little tips on how to best use them.

examples of balanced mixers particular applications

Balanced Modulator Demodulator DSB

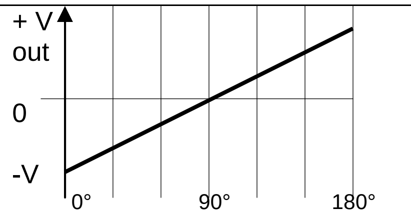
Balanced mixers and modulators are substantially equal, mixers are also used as audio modulators or demodulators provided that the IF port is DC coupled, in fact some years ago they were called also as balaced modulators (see VHF Comm 2-96).



in the reverse mode as demodulator

Phase detector

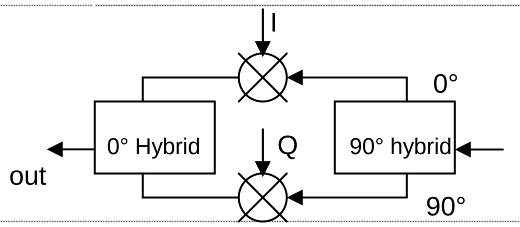
Applying two identical frequencies are identical to the RF and OL ports, in IF there will be d.c. voltage proportional to the phase difference of the two signals. This is obviously valid only for those mixers who have the IF port coupled in d.c.. The early synthesizers in the 60s had the phase comparator made by a balaced mixer. Some mixers have a positive polarity output other negative, eg. SBL1 and SRA 1 have negative polarity with offset of 1 mV.



relative phase between 2 signals

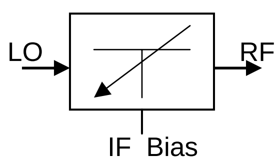
PSK QPSK Modulator Demodulator

In simple words we can say that two mixers, a 0° hybrid and a 90° hybrid can form a modulator or demodulator for digital signals, this happened for example at the beginning with the first GSM module. In this case, however, the bandwidth is limited to 10-15% of the mixer bandwdth.



Attenuator and Limiter

By applying a signal to the LO port with RF output port it is possible, through the IF input port, make an attenuation with typical range of 3 - 40 dB. The same function is as limiter, pulse modulator, etc.. For example, the mixer SRA 1 and SBL 1 have the minimum attenuation at 3 dB with 20 mA of bias.

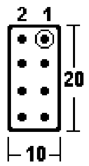
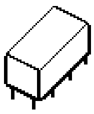
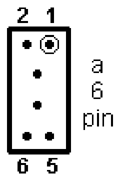


For more informations see the manufacturers' catalogues about balanced mixers like, Merrimac, MaCom, Anzac, RHG, MCL, etc… there are often available many application notes of considerable interest.

PASSIVE MIXERS , suggestions on how to use

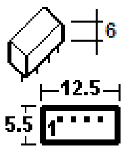
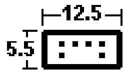
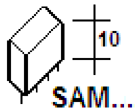
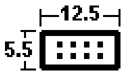
- The RF and IF ports can be freely swapped. For example in the case of conversion up (as in a spectrum analyzer or TX UP converter) RF port is exchanged with the IF as the RF port often has a larger range than IF.
- The passive mixers offer very large IMD dynamics, the IF port should be well adapted to broadband for example by a 2 - 4 dB attenuator on IF output to improve the matching (see page 'not connectorized attenuators').
- A mixer can be used also beyond its frequency specification, being a broadband aperiodic circuit the slope of degradation is slow. In practical experience degradation is the worsening of insulation between the ports (or of the balance if it is used as a balanced modulator) going up versus frequency the LO port would seem to be more tolerant to overcome its limits either at higher or at lower frequencies.

See on the previous page some suggestions on how to use passive mixers

case	frequency in MHz		1dB	LO	1 dB C.P. = Compression Point	cod.	price
	LO and RF	IF (or RF)	C.P.	dBm	at -1dB on RF input		€ each
	0.0005 - 10	dc - 10	+1	+7	for VLF-LF-MW-HF, LO + RF starting from 500 Hz , hermetic HI-REL case, 50dB insulation	**SRA 8**	on request
	0.003 - 100	dc - 250	+1	+7	for VLF-LF-MW-HF , HI-REL	**GRA 6**	on request
	0.01 - 250	dc - 250	+1	+7	for VLF-LF-MW-HF-VHF, hermetic HI-REL case	**TAK 5**	
big size	0.05 - 200	dc - 200	+1	+7	TAK 5 pin compatible, hermetic HI-REL case	**TAK 5R**	special offer 19,50
metallic	0.02 - 200	dc - 200	+1	+7	replaceale and pin compatible with TAK5R	**SBL 3**	see TAK5
case	0.05 - 200	dc - 200	+1	+7	Watkins-Johnson, 50 dB high insulation up to 30 MHz, 35 dB up to 200 MHz	**M6D 50**	18,50
	0.5 - 500	dc - 500	+1	+7	HI-REL ceramic case	**GRA 1**	16,00
	0.5 - 500	dc - 500	+1	+7	HI-REL version of SBL 1	**EMA 1S**	11,50
	1 - 500	dc - 500	+1	+7	hermetic case, replaceale and pin compatible with SBL 1 - IE 500 , or in plastic version ASK1	**HPF 505**	10,50
	1 - 500	dc - 500	+1	+7	same of HPF 505 and SBL 1	**IE 500**	see HPF500 or SBL1
	1 - 500	dc - 500	+1	+7	see also HPF505 100% compatible	**SBL 1**	11,60
	10 - 1000	5 - 500 (dc-1000)	+1	+7	replaceale and pin compatible with HPF 505X	**SBL 1X**	see HPF505X
					replaceale and pin compatible with SBL1X	**HPF 505X**	special offer 9,00 3pcs=8,00 ea.
	1 - 1500	dc - 1000	+10	+17	<u>HIGH DYNAMIC</u> pin compatible with SRA 1H	**EMA 220 X**	special offer 25,00
	0.5 - 500	dc - 500	>+8	+17	HI-REL version -54 / +100°C, high insulation typical 50 dB in HF and high dynamic IP +25dBm level of desensitization at -1dB = +17dBm	**M9BC** Watkins Johnson	33,00
	0.5 - 500	dc - 500	+10	+17	<u>HIGH DYNAMIC</u> , hermetic HI-REL case, see also EMA220X - TFM 3MH or SMD cheaper version RMS 1H	**SRA 1H**	not available
	10 - 3000	10 - 1000	+10	+17	<u>HIGH DYNAMIC</u> hermetic HI-REL case	**SRA 11H**	on request
	1 - 750	dc - 750	+10	+17	<u>HIGH DYNAMIC</u>	**SRA 1 WH**	33,00
GRA.... M9BC 25 x 12.7 mm	5 - 1200	dc - 1200	+10	+17	<u>HIGH DYNAMIC</u> hermetic HI-REL case, typical insulation 30-35 dB low loss typical 5.4-6 dB (list price MCL 36 €)	**SRA 173H**	special offer 29,00
	0.07 - 200	dc - 200	+15	+23	<u>VERY HIGH DYNAMIC</u> , hermetic HI-REL case	**RAY 3**	55,00
	1 - 500	dc - 500	+15	+23	<u>VERY HIGH DYNAMIC</u> ≅ RAY 1	**MD 138**	59,00
	100 - 2500	dc - 500	+15	+23	<u>VERY HIGH DYNAMIC</u>	**RAY 11**	88,00
	0.1 - 500	0.01 - 500	+20	+23	<u>VERY HIGH DYNAMIC</u> , hermetic HI-REL case, 40 dB insulation	**SAY 1**	66,00
					Vari-L	**CM-2**	on request

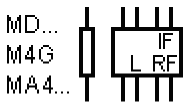
HPF 505 lab tests : P1dB = +2 dBm (input power) , IMD not very sensible at LO level (within +/- 3 dB)

See on the previous page some suggestions on how to use passive mixers

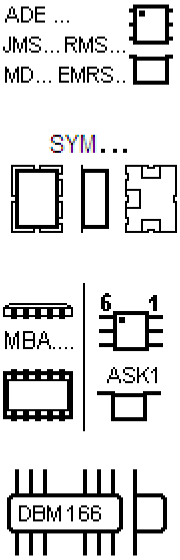
case	frequency in MHz LO and RF	IF (or RF)	1dB C.P.	LO dBm	1 dB C.P. = Compression Point at -1dB on RF input	cod.	price € each
small size metallic	1 - 250	dc - 250	+9	+13	high dynamic and excellent cheaper alternative to the type SRA1H , see note below	EMT 3 MH TFM 3 MH	special offer 20,00
	0.04 - 400	dc - 400	+1	+7	from VLF to UHF, positive polarity phase detector	TFM 3	24,00
solo 4 PIN	2 - 600	dc - 600	+1	+7		TUF 1	12,00
	1 - 1000	dc - 1000	+1	+7		TFM 2 = EMT 2	19,00
	5 - 1250	dc - 1250	+1	+7		EMT 4 = TFM 4	special offer 19,50
	5 - 1500	dc - 1000	+1	+7		EMT 5 = TFM5	special offer 19,00
	20 - 1500	dc - 1000	+1	+7	IP3 +13 dBm	CLP 311	special offer 18,00
	0.1 - 500	dc - 500	+1	+7	hermetic HI-REL 8 pins, case height: 10 mm	SAM 3	19,00
TFM 15-9 a 6 pin	10 - 3000	10 - 800	+5	+10	it is a variant of TFM15 with 6 pins instead of 4 pins, 2 pins further enhance the connection of GND, the case is 10 mm high	TFM 15-9	special offer 36,00
 SAM....	50 - 1000	dc - 1000	+9	+13	high dynamic	ETUF-2MH (sm) (= TUF-2MH)	11,00
a 8 pin 	5 - 1000	dc - 1000	+14	+17	high dynamic 4 dB more than SRA 1H	TFM 2H	38,00
	0.1 - 250	dc - 250	+14	+17	high dynamic 4 dB more than SRA 1H	TFM 3H	26,00
	50 - 1000	dc - 1000	+14	+17	it can be replaced with TFM 2H	TUF 2H	see TFM2H

HIGH DYNAMIC	high and medium dynamic miniature TFM series mixers at the same LO level, they have a higher dynamic than the SRA… SBL… models about +3 / +4 dB, see examples TFM 3MH and TFM 2H: - TFM 2H and TFM 3H with the same LO level of SRA 1H, they have a dynamic of 4 dB more - TFM 3MH with a LO level of 4dB less than SRA 1H type it has only 1dB less in dynamic and compression (it is usable alse at 430 MHz with +1 dB loss).

passive MIXER ultra flat metallic case

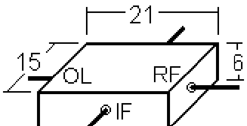
case size 13x10x3.5	frequency in MHz LO and RF	IF (or RF)	1dB C.P.	LO dBm	1 dB C.P. = Compression Point at -1dB on RF input	cod.	price € each
flat metallic case gold plated	10 - 1000	dc - 1000	+1	+7	more tolerant versus LO level	MD 113	on request
	10 - 1500	dc - 1500	+1	+7	more tolerant versus LO level	MD 149 (= LMX149)	40,00
	800 - 3000	dc - 1500	+1	+7	Watkins - Johnson , often usen in spectrum analyzers	M4G (= LMX156)	43,00
	10 - 1500	dc - 1000	+1	+7	Watkins - Johnson HI-REL QPL	MA4-100	40,00

R.F. elettronica di Rota F. www.rfmicrowave.it info@rfmicrowave.it tel ++39.02.99 48 75 15 fax ++39.02.99 48 92 76

case	frequency in MHz LO and RF	IF (or RF)	1dB c.p.	OL dBm	1 dB C.P. = Compression Point at -1dB	Cod.	price € each
SMD or Plastic	1 - 1000	dc - 1000	+1	+7		**ADE 2ASK**	9,50
	1600 - 3500	dc - 1500	+1	+7		**ADE 35**	off 12,00
	1 - 600	dc - 600	+1	+7	miniature, specifications as SBL1	**ASK 1**	7,00 - 6,40
	2 - 500	dc - 500	+1	+7		**JMS 1**	7,00
	0.5 - 500	dc - 500	+1	+7	they are exactly the same	**RMS 1**	9,00
						EMRS 1	6,50 - 5,90
	5 - 1000	dc - 1000	+1	+7	SMD , see MD4007X cheaper	**RMS 2**	on request
	5 - 1500	dc - 1000	+1	+7	they are exactly the same special offer	**EMRS 5** **RMS 5**	9,00 3pcs = 8,00 ea. 10pcs = 7,00 ea.
	5 - 1900	5 - 1000	+1	+7		**RMS 11 X**	5,50 - 4,85
	1 - 1000	dc - 1000	+1	+7	100% = RMS 2	**MD 4007X**	special offer 5,90
	200 - 3000	dc - 1000	+1	+7		**RMS 30** (= EMRS 30)	special offer 9,50 3 pcs = 8,50 ea. 10 pcs = 7,50 ea.
	2400-6700	dc - 1000	+1	+7	good insulation L-R typ. >32 dB L-I typical >23 dB	**MBA 671**	12,00
	2 - 500	dc - 500	+5	+10	very good insulation	**RMS 1LH**	9,50
	5 - 2500	5 - 1500	+9	+13	very wide bandwidth , very good insulation LO-RF and LO-IF typical 30 dB Mil M-28837 -55 / +100°C	**EMRS 25 MH** (= RMS 25MH)	special offer 9,50 3 pcs = 8,50 ea. 10 pcs = 7,50 ea.
	2 - 500	dc - 500	+11	+17	HIGH DYNAMIC	**RMS 1H**	12,00
	50 - 2000	50 - 2000	+10	+17		**SYM-11H**	19,00
LO = 200 – 1300 RF or IF = 300 – 1000 RF or IF = dc – 1000			+1	+7	special offer	**RMS 45**	6,00 3 pcs = 5,00 ea.

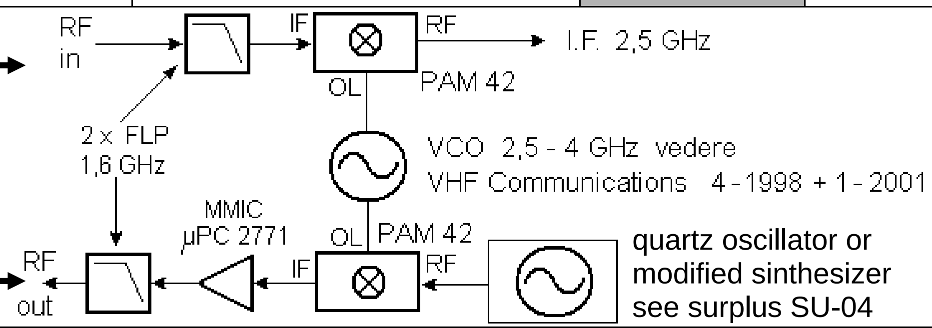
PAM 42: a very particular mixer

This passive double-balanced mixer is very special since it was especially made for UP converters, a so strange frequency range makes it useful for building spectrum analyzers or tracking generators. The case is professional gold plated and it is very particular but well-suited for RF assemblies.

			cod.	price
	LO + RF fequency	2 - 4.2 GHz	**PAM-42**	42,00 €
	IF frequency (or RF)	dc - 1.3 GHz		
	LO level	+ 7 dBm (suggested + 9 dBm)		
	1 dB C. P.	+ 1 dBm		

Simplified spectrum analyzer front-end up to 1.5 GHz that uses a double-balaced PAM 42 mixer

Simplified tracking generator up to 1.5 GHz for spectrum analyzer using double-balaced PAM 42 mixer



quartz oscillator or modified sinthesizer see surplus SU-04

other parts available from us are also listed, as an example, in the scheme up here

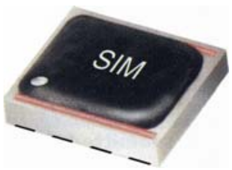
This is a new family of double balanced passive mixers from Minicircuits with a wide bandwidth , both in RF-OL (up to 15 GHz) and in IF (up to 4 GHz) .

They are fabricated using the LTCC technology , **L**ow **T**emperature **C**o-fired **C**eramic , with multilayer circuits , using multiple layers of ceramic substrate tape . The benefits of LTCC are :
- Super small size , this is very important for the microwave technology .
- High repeatability and high performances using low loss ceramic substrate .
- Low cost for high volume production .

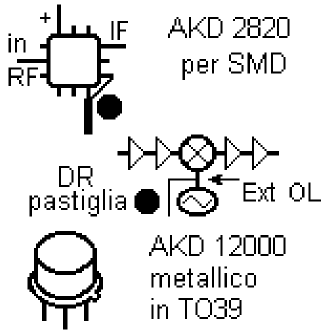
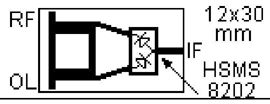
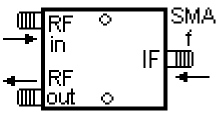
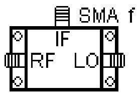
LTCC is a repeatable process , it can reliably produce large quantities of microwave components , measuring a fraction of the size of components fabricated with conventional substrate materials .

Thanks to wide IF bandwidth they are usable as up and down converter , covering a large number of applications to 15 GHz . With 8 different models , the frequency range is from 750 MHz to 15 GHz and OL level from +4 to +10 dBm .

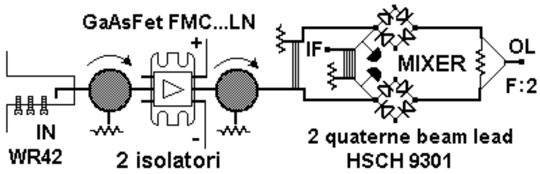
High isolation typical 25 dB (20 to 35 dB) , not so bad for very wide bandwidth devices .

case SMD 5 x 4.5 mm	Frequency in MHz		1dB c.p. dBm	IP3 dBm	OL dBm	Cod.	price € each
	LO - RF	IF (or RF)					
Minicircuits 	2.400 - 7.000	dc - 3.000	+1	+12	+4	**SIM-73L**	17,90
	3.700 - 10.000	dc - 4.000	+1	+13	+7	**SIM-14**	16,80
	750 - 4.200	dc - 1.500	+1	+12	+7	**SIM-43**	14,90
	2.300 - 8.000	dc - 3.000	+1	+15	+7	**SIM-83**	14,40
	3.400 - 15.000	dc - 4.000	+1	+10	+7	**SIM-153**	19,60
	750 - 6.000	dc - 1.500	+3	+12	+10	**SIM-63LH**	16,80
	1.700 - 8.000	dc - 3.000	+3	+18	+10	**SIM-83LH**	14,40
	3.200 - 15.000	dc - 4.000	+3	+18	+10	**SIM-153LH**	19,60

Hittite ceramic case C8 	6.000 - 15.000	dc - 2.000	+10	+20	+15	**HMC 142 C8**	on request

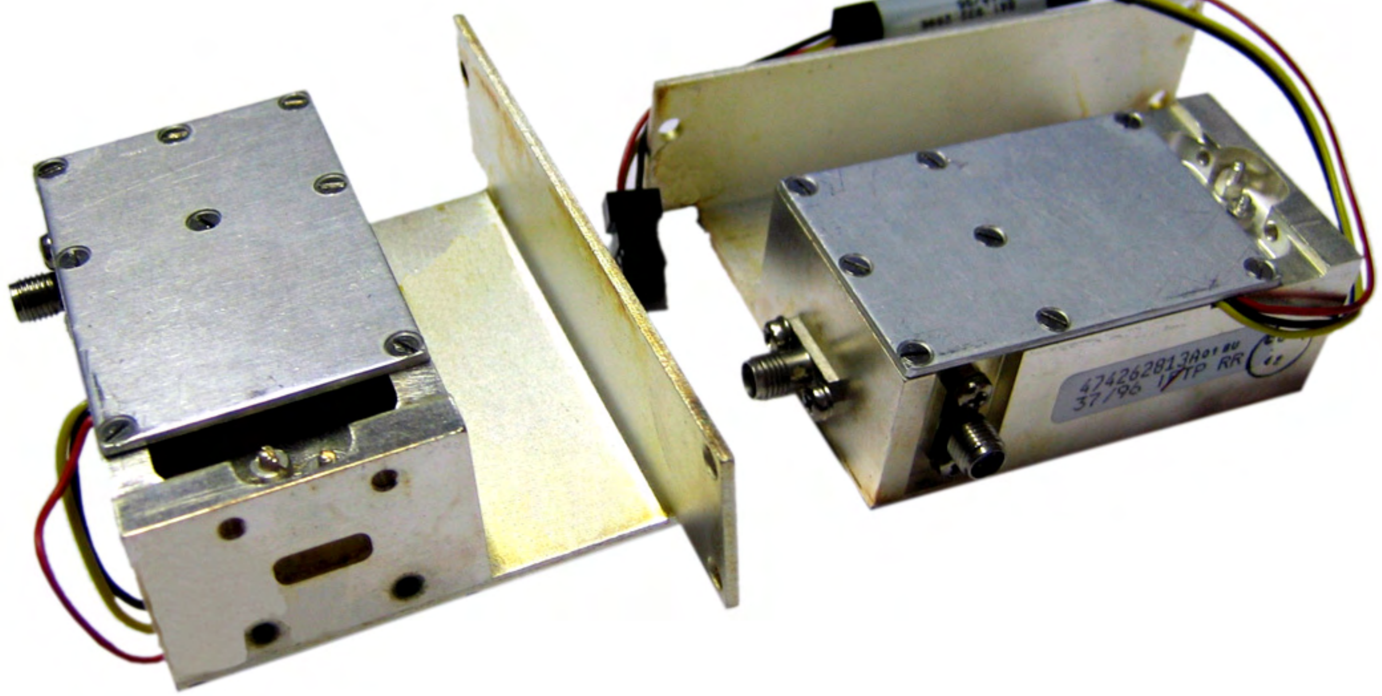
type or family	microwave MIXERS -- special types			cod.	price € each
	RF 9 - 12 GHz LO 9 - 12 GHz IF 400-2300 MHz	Anadigics, the LO can be either with internal DR puck oscillator or by external injection with +10 dBm, it is suitable to work with very extended temperature range -55 / +85 ° C. It is a low-cost high-gain X-band mixer	> 30dBG , 6dBNF , OL phase noise -105dBC/Hz @ 100 KHz	**AKD 2820AX**	1- 3 pcs 4,50 € 4 -9 pcs 4,00 € 10 + pcs 3,50 €
	RF 9 - 12 GHz (30 dBG) 4-13GHz(25 dBG) LO 4 - 13 GHz IF 100-2000 MHz		100 MHz IF band with 20dBG and 200 MHz with 30 dBG , internal LO 8 - 12GHz band	**AKD 12000**	1- 3 pcs 5,00 € 4 -9 pcs 4,50 € 10 + pcs 4,00 €
example of 10GHz mixer from Agilent - HP app. note 	they are a couple of Schottky diodes in series in a single SMD case suitable for mixers up to 16 GHz, the picture aside shows an Agilent - HP - Avago application note that is an example of X-band mixer built without any other external components			**HSMS 8202** or **MA4E1245**	see SMD Schottky diodes
chip die for bonding 0.55 x 0.85 mm	double-balanced passive chip die mixer for bonding RF + OL 25 - 40 GHz LO + 13 dBm IF dc - 8 GHz IP3 +19 dBm			**HMC 329**	on request
	if used as UP converter (or modulator) : IF (or modulation) dc - 400 MHz , LO (RF in) 2 - 4 GHz +10 dBm , RF out 2 - 4 GHz , with SMA f connectors, size 60 x 60 mm			**ANAREN 70666**	80,00
	Minicircuits RF + LO 10 - 1.000 MHz - LO +7dBm IF dc - 1.000 MHz , Insertion Loss 6 - 8.5 dB high insulation 25-50 dB , with SMA f connectors very small size 32 x 21 mm			**ZEM-2B**	on request

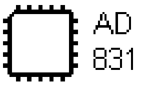
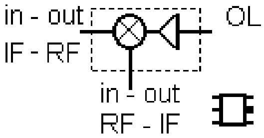
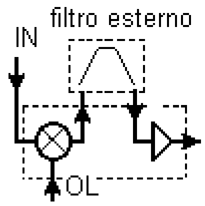
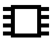
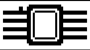
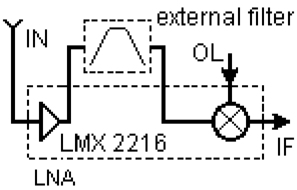
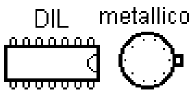
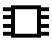
Mixer + Front-end 21 - 24 GHz

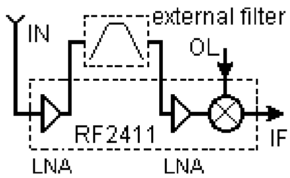
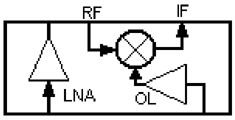
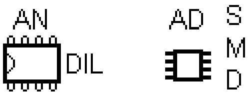
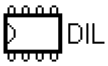
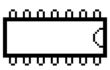
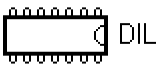
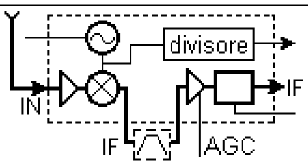


This is a 21 to 24 GHz receiving FRONT-END, the RF input is in WR42 waveguide with its input matching, it follows the first isolator in order to match the waveguide and the amplifier. The low noise amplifier is a GaAsFET internal matched MMIC already matched by the manufacturer on the lower 21-22GHz band, type FMC2122LN-03, or on the higher 22-23 GHz band, type FMC2223LN-03. The characteristic of this amplifier is a gain of 12-13 dB with a noise figure of 3-3.5 dB and an excellent stability and repeatability very hard to obtain at these frequencies. There is another insulator as matching to avoid the return of the LO signal towards the antenna. The mixer consists of 2 quads of Schottky beam lead HP HSCH 9301. This configuration, well known in microwave field, allows to use a LO at half frequency of the normally required simplifying the LO circuit. Here follows a wide band hybrid for the IF output centered at 1GHz but usable from 500 MHz to 1500 MHz.

		low band model	high band model
cod.		**RF-22WR42**	**RF-23WR42**
RF		21 - 22,7 GHz max 20.6 - 23 GHz	22,4 - 23,8 GHz max 22,2 - 24 GHz
LO	frequency	(freq RF - freq IF) : 2 (about 10-11 GHz)	(freq RF + freq IF) : 2 (about 11,8-12,6 GHz)
	level	from +12 to +13 dBm	
IF		±1 GHz max 400 - 1500 MHz	
Gain		3 - 6 dB	
Noise figure		4.5 - 6 dB	
Image rejection		about 15 dB , depending on IF and LO frequency	
RF and IF return loss		about -15 dB	
Connectors		LO and IF with SMA f -- RF input with WR42 waveguide	
Power supply		+8V 50mA -5V 10 mA	
Size		height: 26mm width: 60mm length: 91 mm	



Type or family	description	cod.	price € each 1 - 10 pcs
active double-balanced Analog Devices 	high dynamic + 24 dBm IP3 e +10 dBm 1dB C.P. , is one of the few mixers with dynamic (similar to a passive type +13/+17dBm), LO level only -10 dBm, it is used also as direct conversion of base band, image rejection mixer and modulator or demodulator I/Q complete with IF high dynamic post-amplifier and it doesn't need complicate diplexers with output terminations, SMD case	**AD 831 AP**	17,70
	**up - down converter ultralinear mixer** it is usabe both as up and down high dynamic converter IP3 up to + 26dBm, SMD MW-6 case LO + RF 500 - 2.500 MHz IF 10 - 2.500 MHz	**CMY 210**	7,80
QPSK I & Q modulator	I/Q modulator, RF out 25 - 250 MHz it is used in digital transmission combined with an UP converter (example HPMX 2006) it becomes a complete transmitter. Band I & Q > 40 MHz , LO level -12 dBm , RF out -5 dBm	**HPMX 2005**	8,50
2 GHz UP converter 	IF input dc - 1 GHz --- RF output 800 - 2500 MHz (max 3 GHz) it is an up converter for example it can be used as 2GHz transmitter with modulation on IF port or as spectrum analyzers with dc-1GHz RF input and first IF > 1GHz, with internal power amplifier up to +2 / +9 dBm, as LO it is enough -3dBm because it has a LO internal amplifier.	**HPMX 2006**	1 - 4 pcs **3,90** 5 - 9 pcs **3,50** 10-30 pcs **3,20** 31-99 pcs **2,90**
	RF port up to 5 GHz, IF port up to 1 GHz , IF and LO ports are amplified so -5dBm of LO are enough , it is optimized at 50-3000 MHz with 8 dBG , it is usable from 5 to 5.000 MHz with 0 dBG at 6 GHz	**IAM 81008**	special offer 1 - 4 pcs **3,30** 5 - 9 pcs **2,90** 10-30 pcs **2,60** 31-99 pcs **2,30**
	as above but with HI-REL golden glass case -55 / + 125°C	**IAM 81018**	19,50
	it is a complete RX front-end from 100 MHz to 2.5 GHz low noise , Vc = 3 V / 16 mA RF + LO : 100 MHz - 2.5 GHz LO 0 dBm LNA : 14 dBG @ 100 MHz - 8dBG @ 2.5 GHz IF : dc - 500 MHz, 16 pins SMD case	**LMX 2216 M**	special offer 1 - 4 pcs **3,30** 5 - 9 pcs **2,90** 10-30 pcs **2,60** 31-99 pcs **2,30**
	LO + RF + IF dc - 80 MHz , typical modulator and demodulator for SSB and CW receivers, it is also a frequency doubler etc... — metallic case	**MC 1496 MET**	2,90
	DIL case	**MC 1496 DIL**	2,60
	it is very wide band mixer both as Down and Up converter , RF input dc - 2.000 MHz IF and LO output 10 - 2.000 MHz LO with internal driver it needs only 0dBm , gain 10 dB	**PMB 2330 T**	1 - 9 pcs **2,90** 10 + pcs **2,40**

Type or family	description	cod.	price € each 1 - 10 pcs
	it is a HBT high-performance technology I.C. that form a complete low-noise front-end for receiving from 400 to 2000 MHz, it is also usable from 10 to 2,500 MHz, 3 to 6V power supply, 14-pins SMD case **1st stage LNA**: 1.6 dBNF @ 800 MHz - 2.6 dBNF @ 1800 MHz 10-14 dBG , due to the fact that it is not connected to the second stage it is possible to insert an RF filter between the 2 LNA stages, reverse insulation > 25 dB **2nd stage LNA**: 12-16 dBG **Mixer**: LO = 0 dBm, LO-RF + LO-IF insulation typ. > 25dB **IF**: dc - 150 MHz , max 200 MHz	**RF 2411**	special offer 1 - 9 pcs **5,50** 10 + pcs **4,70** RF Microdevices List Price 9,6 $ each / 25 pcs
	it is a high performances front-end for RX from 400 to 1300 MHz with low noise first stage, in fact the total noise figure (fist stage + mixer) is about 2,7 dBNF that is equal to about -120/-118dBm of sesibility at 12 dBS/N , it has a good thermal compensation within +/-0.2dBG from -40 to +85°C -- LNA first stage : 1.6dBNF @ 900 MHz 12dBG 1.6dBNF @ 430 MHz 15dBG -- mixer : 5 - 9 dBG -- LO only -7dBm because it is with internal buffer, LNA stage and mixer are not connected so it is possible to add an external filter, SMD case. Many application notes are available, see AN1777+1000+95021	**SA 601 DK**	3,90
602 e 612 	RF port up to 500 MHz , LO port up to 200 MHz , double-balanced mixer with 15dBG in HF and 10dBG in VHF . NE 602 and 612 are obsolete and out of production, they can be replaced by SA602. NE...= old versions 0°C / +70°C SA…= new versions -40°C / +125°C DIL case	**SA 602 AN**	1 - 9 pcs **2,80** 10 + pcs **2,50**
	case smd SO8	**SA 602 AD**	3,00
	it is a double-balanced mixer up to 75 MHz for HF receivers or it can be used as balanced modulator for SSB transmitters, -30 / +85 ° C	**SL 1641 C**	7,80
DIL 	it is usable up to 200 MHz for HF and VHF, with external or internal self-oscillating LO, IF can be typically 10.7 MHz or 455 KHz, it is used also as limiter stage up to 50 MHz DIL	**SO 42 P**	3,00
	It is a general purpose mixer with RF an LO up to 200MHz, IF up to 30 MHz, it has an AGC out to drive some PIN diodes, internal LO	**TDA 1062**	2,00
	it is a complete front end from 500 to 2400 MHz with many functions: 1.3 - 2,7 GHz internal OL , IF amplifier with AGC , internal prescaler to drive a sinthesizer , etc… it was born as TV sat receiver, ultra-miniature SMD case	**TDA 8010 M**	1 - 9 pcs **3,00** 10 + pcs **2,60**