

# Combiners and Filters for FM Broadcast and TV Systems



**KATHREIN**

Antennen • Electronic

## Quality leads the way



ISO 9001 Certificate

“**Quality leads the way**“ is our company motto - and this best describes the product philosophy of KATHREIN-Werke KG.

Kathrein’s **quality assurance system** is certified in accordance with ISO 9001. It covers not only development, production and marketing, but also other areas, such as administration and the correct delivery of products to our customers.

Our customers are invited to benefit from Kathrein’s **expertise** and to discuss any special requirements with us.

*Use our know-how!*

This catalogue gives details of our standard filters and combiners and also of our many customized versions.

The following features are variable:

- number of inputs
- connections and colour
- type of mounting (e.g. with an additional frame)
- frequency spacing.

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Catalogue issue 06/01

**Cover:** 10 kW Filter Combiner for feeding a Multipattern Antenna System

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# Introduction

# Introduction

Filters and combiners are essential components of many broadcasting antenna systems. They are used for selecting frequencies, suppressing disturbing emissions and noise sidebands, avoiding interference products, combining several channels into one common antenna with low loss and for separating channels. In certain cases, separate antenna diagrams for individual channels can also be generated.

## Selection of parameters

According to their use as elements of a system, filters are constructed as two-port networks and are matched to the impedance of the other system elements (e.g. transmitter, receiver, antenna or connecting cables) at both the input and the output.



$$P_2 = P_1 - P_r - P_v$$

$P_1$  = Input power  
 $P_r$  = Reflected power  
 $P_v$  = Power loss through filter  
 $P_2$  = Power transmitted

Fig. 1: Filter with connections

## Frequency response

The attenuation usually depends on the frequency used. This relationship is shown graphically by the following diagram of a typical attenuation curve for a filter.

A plot of the attenuation VS frequency shows the typical filter curve. The attenuation is the logarithmic ratio between input power and transmitted power.

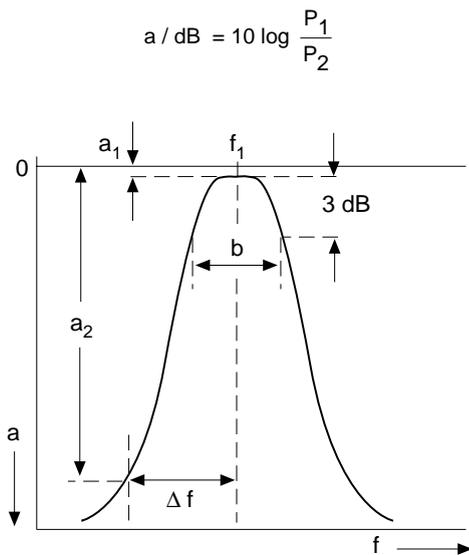


Fig. 2: Frequency response of a filter tuned to frequency  $f_1$  with insertion loss  $a_1$ , stop band attenuation  $a_2$  at the frequency of  $f_1 - \Delta f$  and with bandwidth  $b$  at 3 dB.

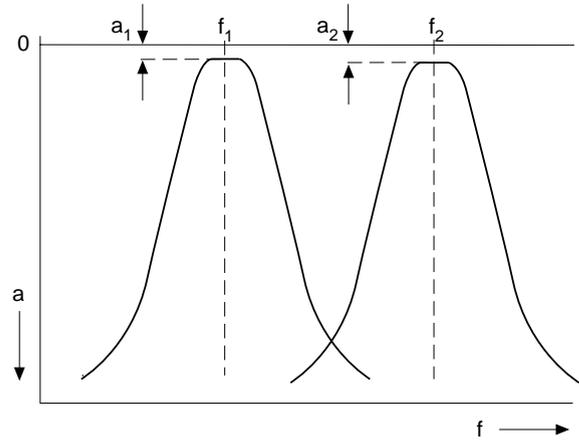


Fig. 3: Frequency response of 2-way combiner with insertion losses of  $a_1$  and  $a_2$  at the frequencies  $f_1$  and  $f_2$ .

## Matching

As a measurement of how a filter is matched the return loss  $a_r$ , which is the logarithmic relationship between the input and reflected power, is displayed.

$$a_r / \text{dB} = 10 \log \frac{P_1}{P_r}$$

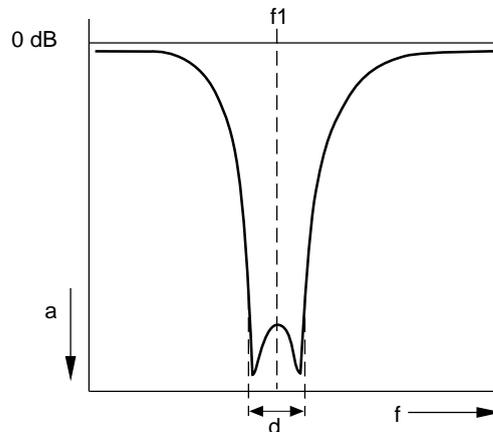


Fig. 4: Return loss of a 2-pole bandpass filter tuned to the frequency  $f_1$  and with pass band bandwidth  $d$ .

The return loss  $a_r$ , reflection coefficient  $r$  and VSWR factors are all related according to the following formulas:

$$a_r = -20 \log |r|$$

$$s = \frac{1 + |r|}{1 - |r|}$$

## Filters

Where used in broadcasting systems, filters are normally set up as a combination of several  $\lambda/4$  resonators. The Q factor of the resonators is very important with regard to the electrical data and is influenced by the shape and volume of the filter as well as by the conductivity of the material used.

The selectivity of the filters used for combiners has a decisive influence on the minimum spacing required between the transmitters to be connected into one common antenna. If the frequency spacing is narrow then the filters must similarly be tuned in a very narrow way. But this will cause an increase in the insertion loss (see fig. 5) resulting in the filters becoming hot. This problem can be avoided if filters of greater volume are used which have a relatively lower insertion loss.

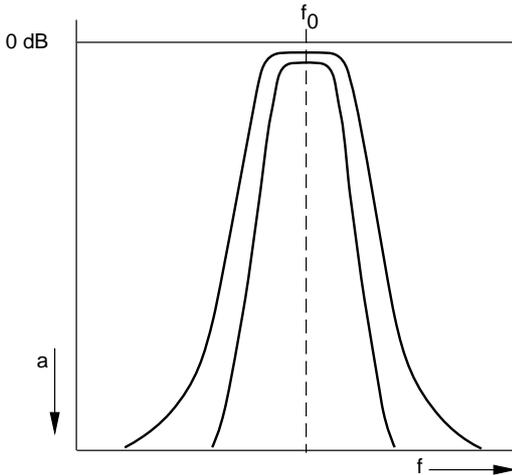


Fig. 5: Examples of two different tuning possibilities for a bandpass filter. Narrower tuning will result in higher insertion loss.

## Directional couplers

A directional coupler is a reciprocal four-port construction, whereby two of the ports are isolated from each other. For example, the power entering port 1 (see fig. 6) is split up to ports 2 and 3, whereas port 4 is isolated. The power fed into the other ports is similarly split.

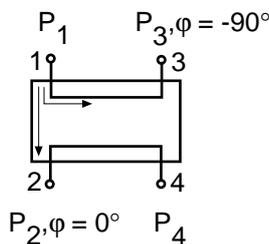


Fig. 6: Directional coupler with two coupled lines.

If every port is terminated with a reflection-free load, then the following formulas apply:

Coupling attenuation

$$a_k = 10 \log \frac{P_1}{P_2}$$

Directivity

$$a_d = 10 \log \frac{P_2}{P_4}$$

If the coupling range of a transmission-line coupler is  $\lambda/4$  at the center frequency  $f_m$  then the coupling attenuation over a frequency range of  $f_1/f_2 = 2$  is almost independent of the frequency. For example, with a 3-dB directional coupler there is a divergence of  $\pm 0.4$  dB and phase difference of  $90^\circ$  occurs between the signals at ports 2 and 3, which is also almost independent of the frequency.

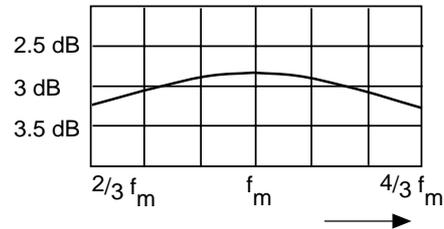


Fig. 7: Coupling attenuation for 3-dB transmission-line coupler of  $\lambda_m/4$  length.

## Combiners

Combiners are a combination of frequency-selecting components (e.g. filters, stretchlines) with nodes and connecting elements (e.g. directional couplers, starpoints). In high quality combiners bandpass filters are used in preference to stop band filters.

## Starpoint combiners

Starpoint combiners for  $n$  channels consist of  $n$  bandpass filters with outputs that are connected to a common starpoint.

The individual bandpasses are tuned to the respective frequencies. Since the bandpass filters are mismatched outside their pass bands (with inductive coupling the impedance almost approaches a short-circuit) the impedance can be transformed up to very high levels by selecting the appropriate length for the connecting cables between the filters and the starpoint. This means that for every input the transformed impedances of all the other inputs are very high at the starpoint which produces a very low parallel load at the antenna output.

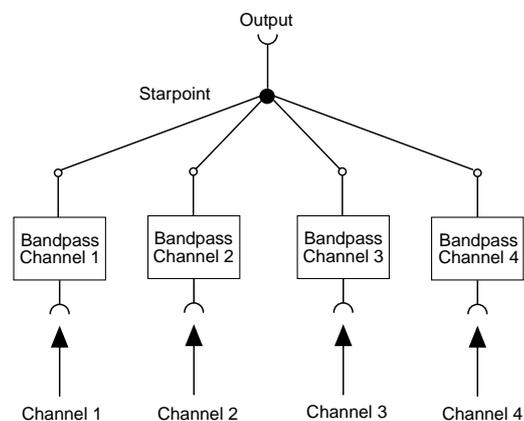


Fig. 8: Starpoint combiner for 4 channels

### Directional filter combiner

Directional filter combiners are a combination of filters and 3-dB couplers. One module consists of two band-pass filters, two 3-dB couplers and a load (see fig. 9). One input is narrowband (NB), corresponding to the band-pass curve of the band-pass filter. The other input is broadband (BB), corresponding to the operating range of the 3-dB coupler.

Compared to other types of combiners that can be produced at less expense, directional filters offer a number of useful advantages:

- Simple set-up of multiple combiners through cascading several modules
- Very high isolation between the narrowband inputs of a cascade
- Broadband matching at all inputs
- Easy extension of existing combiners by adding new modules.

### Function of module

The signal fed into the narrowband input (NB) is split into two halves by the 3-dB coupler (1), both of which pass through one of the band-pass filters to the 3-dB coupler (2) and are then added in equal phase at its output due to the 3-dB coupler's function. At the broadband input (BB) the two partial signals are anti-phase and therefore practically no signal appears at this port. The broadband input is isolated from the narrowband input by the directional coupler, but this also depends on the band-pass filters being identically tuned.

The frequency of a signal fed into the broadband input (BB) lies within the stop band of the band-pass filters. The signal is split into two halves by the 3-dB coupler (2) and reflected completely by the band-pass filters and proceeds to the output after co-phase addition. The narrowband input is isolated from the broadband input by the directional coupler, as described above, but there is additional isolation due to the stop band attenuation of the band-pass filters.

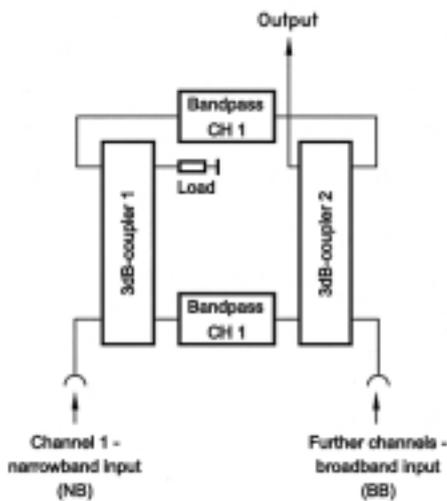


Fig. 9: Diagram of a directional filter

### Cascading of modules

Multiple combiners are easily set up by using several modules with the output of each module feeding the broadband input of the next module. The number of channels possible in a given frequency band is limited only by the minimum spacing between the signals. But practical limitation can also arise because the insertion loss for each additional module increases by 0.05 – 0.1dB and can assume intolerable values. The power rating of the 3-dB coupler at the output also can limit the number of channels in practice.

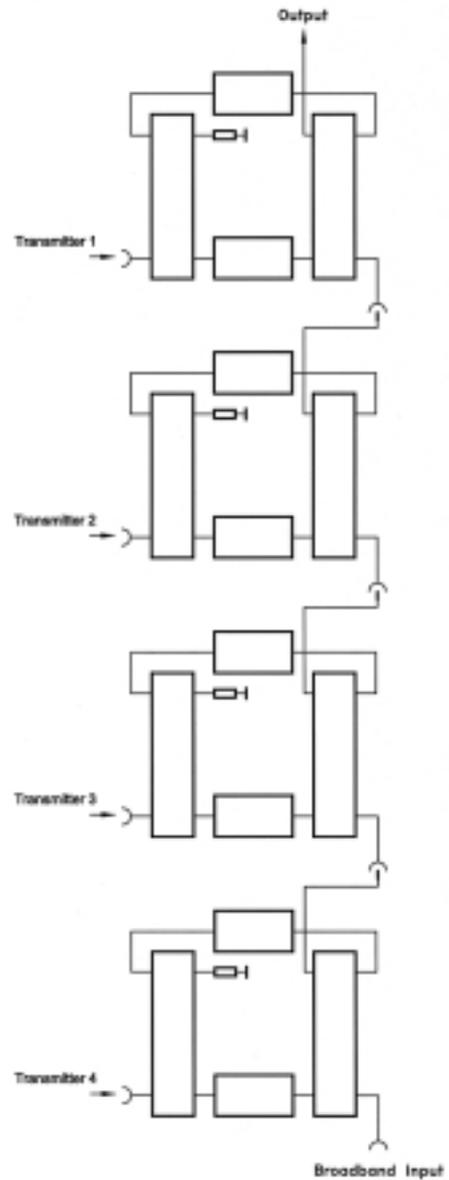
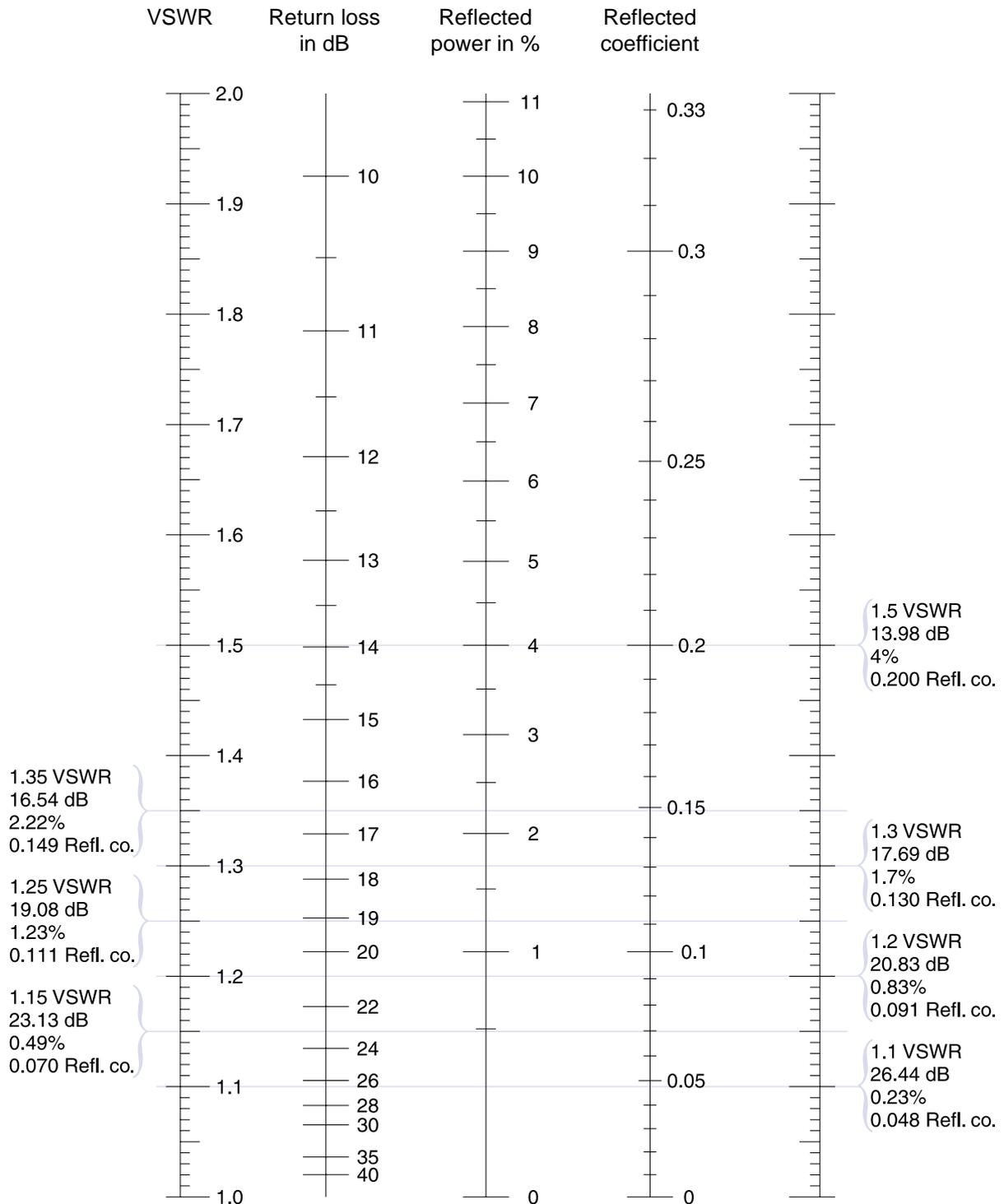


Fig. 10: Diagram of a directional filter combiner with four modules

# VSWR, Return Loss Reflected Power, Reflection Coefficient



Locate the known value on the appropriate scale, then read across horizontally to find the equivalent values as shown in the examples above.



**FM Band  
87.5 – 108 MHz**

# Band-pass Filter

## 100 W

### 87.5 ... 108 MHz

#### Band-pass filters can be used for:

- to improve the input selectivity of receivers and amplifiers,
- to increase the isolation of transmitters, whose respective antennas are mounted close together,
- to suppress noise side bands and inter-modulation products,
- as a combiner component.

#### Design and construction:

The band-pass filter consists of three capacitively coupled resonators. Special version in 19" drawer is available upon request.

#### Characteristics:

The operating frequency, the coupling between the resonators and also the input and output couplings are adjustable.

#### Tuning:

The band-pass filter must be tuned to the operating channel. Upon request, this tuning may be performed at our factory (in this case please state the required operating channels when ordering) or it can be undertaken on site.

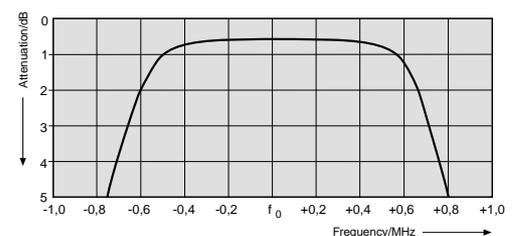
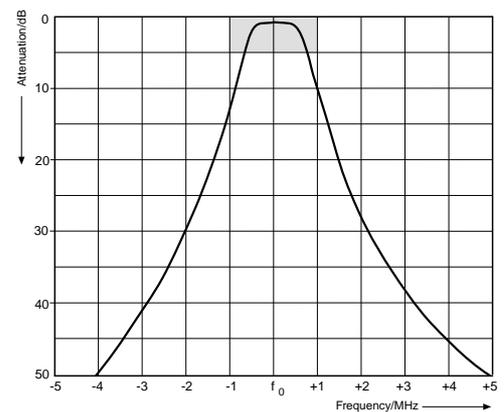
Clear tuning instructions and also any special tools necessary are supplied along with the band-pass filter.



719 118

#### Technical Data

Type No.	719 118
Frequency range	87.5 ... 108 MHz
Insertion loss	0.6 dB
VSWR	< 1.1 (at the operating frequency)
Impedance	50 Ω
Max. power	100 W
Temperature range	- 20 ... + 50 °C
Connectors	7-16 female
Material	Outer conductor: Aluminium Inner conductor: Brass, silver-plated
Weight	12 kg
Packing size	562 mm x 185 mm x 372 mm
Dimensions (w x h x d)	460 mm x 100 mm x 312 mm (with connectors)



# Band-pass Filter

## 1 kW

### 87.5 ... 108 MHz

#### Band-pass filters can be used for:

- to improve the input selectivity of receivers and amplifiers,
- to increase the isolation of transmitters, whose respective antennas are mounted close together,
- to suppress noise side bands and inter-modulation products,
- as a combiner component.

#### Design and construction:

The band-pass filter consists of three capacitively coupled resonators.

#### Characteristics:

The operating frequency, the coupling between the resonators and also the input and output couplings are adjustable.

#### Tuning:

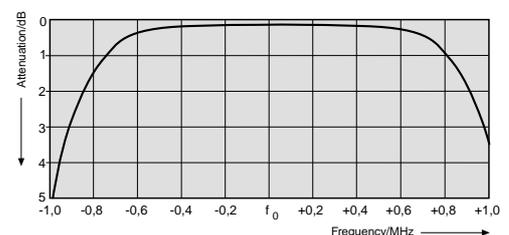
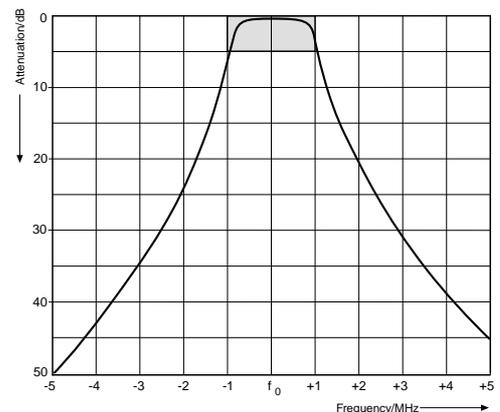
The band-pass filter must be tuned to the operating channel. Upon request, this tuning may be performed at our factory (in this case please state the required operating channels when ordering) or it can be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the band-pass filter.



716 596, shown with additional frame

#### Technical Data

Type No.	716 596
Frequency range	87.5 ... 108 MHz
Insertion loss	0.3 dB
VSWR	< 1.1 (at the operating frequency)
Impedance	50 Ω
Max. power	1 kW
Temperature range	- 20 ... + 50 °C
Connectors	7-16 female
Material	Outer conductor: Aluminium Inner conductor: Brass, silver-plated
Colour	Grey (RAL 7032)
Mounting	Suitable for mounting in 19" drawer
Mounting position	Vertical
Weight	35 kg
Packing size	735 mm x 1000 mm x 315 mm
Dimensions (w x h x d)	604 mm x 790 mm x 190 mm (with connectors)



# Band-pass Filter

## 3 kW

### 87.5 ... 108 MHz

#### Band-pass filters can be used for:

- to improve the input selectivity of receivers and amplifiers,
- to increase the isolation of transmitters, whose respective antennas are mounted close together,
- to suppress noise side bands and inter-modulation products,
- as a combiner component.

#### Design and construction:

The band-pass filter consists of three capacitively coupled temperature-stabilized resonators.

#### Characteristics:

The operating frequency, the coupling between the resonators and also the input and output couplings are adjustable.

Any heat produced is dissipated into the surroundings via heat sinks.

The band-pass filter is convection-cooled so no ventilation is required. Thus the band-pass filter is maintenance-free and especially safe to operate.

#### Tuning:

The band-pass filter must be tuned to the operating channel. Upon request, this tuning may be performed at our factory (in this case please state the required operating channels when ordering) or it can be undertaken on site.

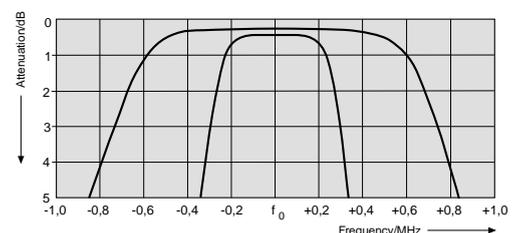
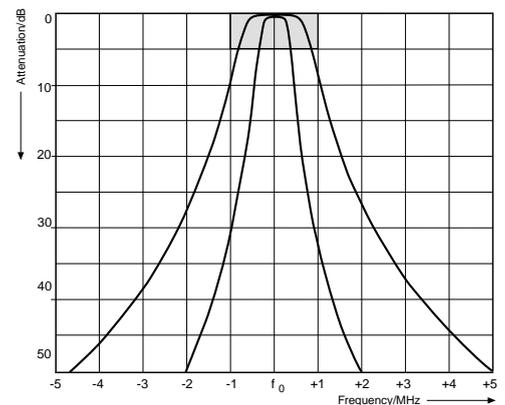
Clear tuning instructions and also any special tools necessary are supplied along with the band-pass filter.



728 726

#### Technical Data

Type No.	728 726
Frequency range	87.5 ... 108 MHz
Insertion loss	0.25 ... 0.5 dB
VSWR	< 1.1 (at the operating frequency)
Impedance	50 Ω
Max. power	3 kW
Temperature range	- 20 ... + 50 °C
Connections	7/8" EIA
Material	Outer conductor: Aluminium Inner conductor: Brass, silver-plated
Colour	Grey (RAL 7032)
Mounting	Freely mountable
Mounting position	Vertical
Weight	55 kg
Packing size	735 mm x 1460 mm x 315 mm
Dimensions (w x h x d)	680 mm x 1320 mm x 220 mm (with connectors)



# Band-pass Filter

## 5 kW

### 87.5 ... 108 MHz

#### Band-pass filters can be used for:

- to improve the input selectivity of receivers and amplifiers,
- to increase the isolation of transmitters, whose respective antennas are mounted close together,
- to suppress noise side bands and inter-modulation products,
- as a combiner component.

#### Design and construction:

The band-pass filter consists of three capacitively coupled temperature-stabilized resonators.

#### Characteristics:

The operating frequency, the coupling between the resonators and also the input and output couplings are adjustable.

Any heat produced is dissipated into the surroundings via heat sinks.

The band-pass filter is convection-cooled so no ventilation is required. Thus the band-pass filter is maintenance-free and especially safe to operate.

#### Tuning:

The band-pass filter must be tuned to the operating channel. Upon request, this tuning may be performed at our factory (in this case please state the required operating channels when ordering) or it can be undertaken on site.

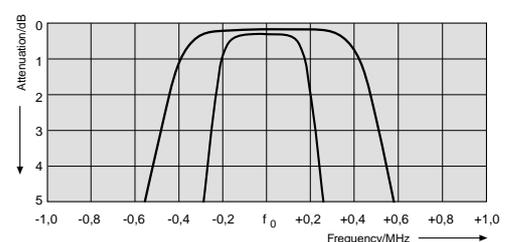
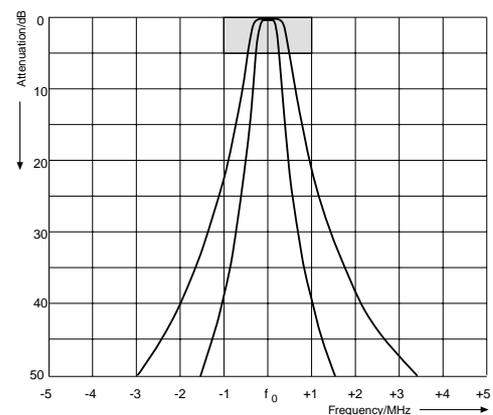
Clear tuning instructions and also any special tools necessary are supplied along with the band-pass filter.



730 150

#### Technical Data

Type No.	730 150
Frequency range	87.5 ... 108 MHz
Insertion loss	0.25 ... 0.4 dB
VSWR	< 1.1 (at the operating frequency)
Impedance	50 Ω
Max. power	5 kW
Temperature range	- 20 ... + 50 °C
Connections	1 5/8" EIA
Material	Outer conductor: Aluminium Inner conductor: Brass, silver-plated
Colour	Grey (RAL 7032)
Mounting	Freely mountable
Mounting position	Vertical
Weight	100 kg
Packing size	1080 mm x 1430 mm x 460 mm
Dimensions (w x h x d)	975 mm x 1260 mm x 285 mm (with connectors)



# S-P Filter

## 200 W

### 87.5 ... 108 MHz

The S-P filter (Stop-Pass filter) is used to attenuate interfering signals located extremely close to the operational frequency.

#### It can be used:

- in the transmission path to suppress side band noise and to attenuate inter-modulation products at the receiving frequencies,
- in the receiving path to attenuate transmitting frequencies,
- as a component for combiners with very low frequency spacing.

#### Design and construction:

The S-P filter is designed as a high Q temperature stabilized  $\lambda/4$  coaxial resonator. Using a special temperature stabilized coupling, high stop band attenuation can be adjusted very close to the pass band frequency.

#### Characteristics:

Narrow pass band with low insertion loss, high stop band attenuation at the stop band frequency. Even in case of very small spacing between the pass band and the stop band frequency a high stop band attenuation is achieved, which can not be achieved using standard band-pass filters of the same size.

#### Combination of several S-P filters:

Several S-P filters can be interconnected by cables with an electrical length of  $\lambda/4$ .

Insertion loss of the filter combination =  
Sum insertion loss of the individual filters + cable attenuation of the interconnecting cables (about 0.1 dB per cable).  
Stop band attenuation of the filter combination =  
Sum stop band attenuation of the individual filters + additional stop band attenuation.

If the stop band attenuation of the individual filters exceeds 10 dB, approximately the following applies:

additional stop band attenuation =  
(n - 1) x 5 dB;

n = number of individual filters.

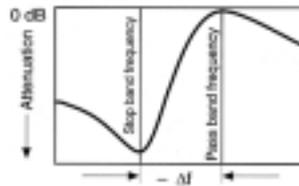
For special applications S-P filters can also be interconnected with band-pass filters.

#### Tuning:

The S-P filter is tuned to the desired pass band and stop band frequency at the factory. Please specify desired pass band and stop band frequency when ordering.

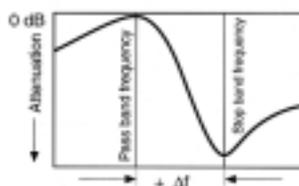
The S-P filter can also be tuned on site using the supplied tuning instructions.

#### Pass band frequency above the stop band frequency



If the pass-band frequency lies above the stop band frequency, then type no. 718 270 should be ordered.

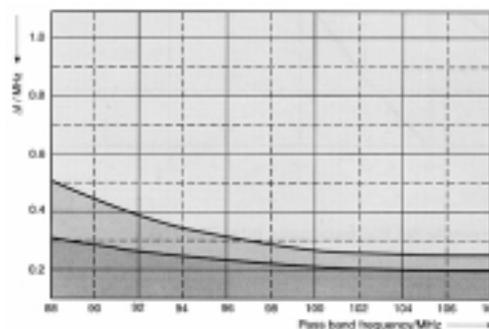
#### Pass band frequency below the stop band frequency



If the pass-band frequency lies below the stop band frequency, then type no. to be ordered depends on the pass-band frequency and the desired spacing  $\Delta f$  from the stop-band frequency (see diagram).



717 756 or 718 270



718 270  
717 756 and 718 270  
717 756

#### Technical Data

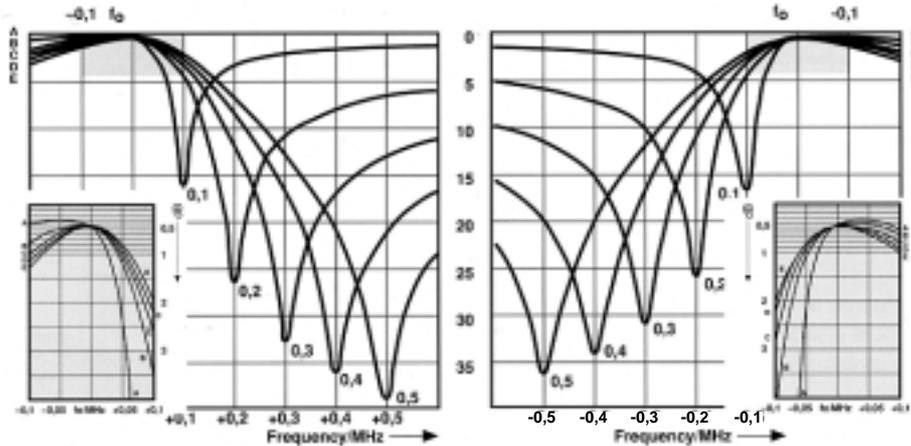
Type No.	717 756 or 718 270
Frequency range	87.5 ... 108 MHz
Insertion loss	0.5 ± 0.15 dB
VSWR	< 1.5 (at operating frequency)
Impedance	50 Ω
Max. power	200 W
Temperature range	-20 ... +50 °C
Effect of temperature	< 0.2 kHz / °C
Connectors	N female
Material	Outer conductor: Aluminium Inner conductor: Brass, silver-plated
Installation	Freely or wall mountable
Attached hardware	S-P filter with 2 mounting angles and 2 connecting pieces
Weight	14 kg
Packing size	207 mm x 1325 mm x 207 mm
Dimensions (w x h x d)	190 mm x max. 1137 mm x 190 mm (with tuning rod)

**Examples of different stop band to pass band frequency spacings for individual resonators**

Pass band frequency below stop band frequency

Pass band frequency above stop band frequency

Curve	Frequency spacing Operating channel/ Interfering channel
A	0.1 MHz
B	0.2 MHz
C	0.3 MHz
D	0.4 MHz
E	0.5 MHz

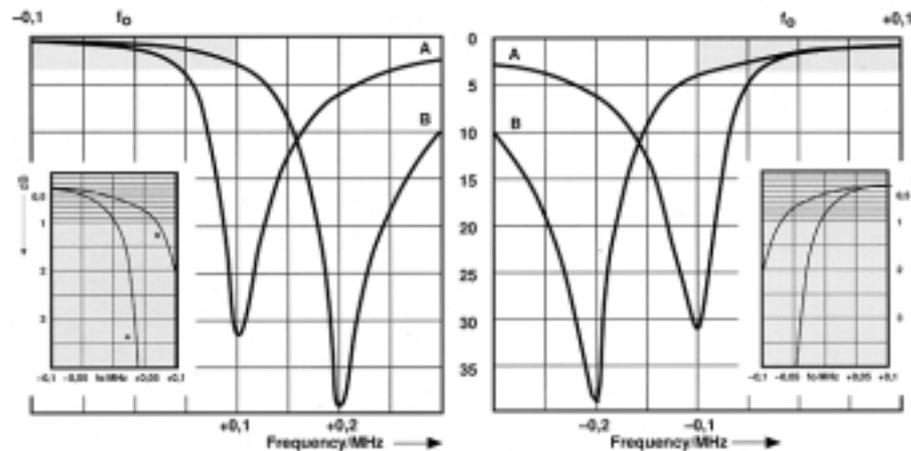


**Examples of different stop band to pass band frequency spacings for two individual resonators connected up together**

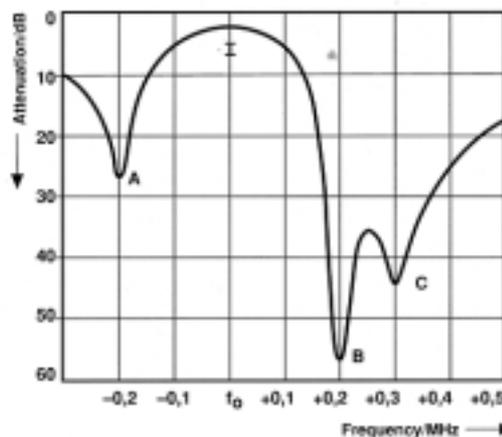
Pass band frequency below stop band frequency

Pass band frequency above stop band frequency

Curve	Frequency spacing Operating channel/ Interfering channel
A	0.1 MHz
B	0.2 MHz



**Examples of an attenuation curve for a combination of several individual resonators**



**Combinations**

- I: Operating frequency
- A: Interfering frequency 1
- B: Interfering frequency 2
- C: Interfering frequency 3

# Starpoint Combiner, 100 W with 2, 3 or 4 Inputs 87.5 ... 108 MHz

This starpoint combiner enables several transmitters or receivers to be connected into one common antenna.

### Characteristics:

This starpoint combiner consists of one three-pole band-pass filter per channel. The combiner is maintenance-free and especially safe to operate.

The inputs of the band-pass filters are narrowband. The output is connected via pre-defined cable length onto a common starpoint. This starpoint then forms the output of the combiner.

The starpoint combiner may be extended by adding further band-passes and by exchanging the starpoint.

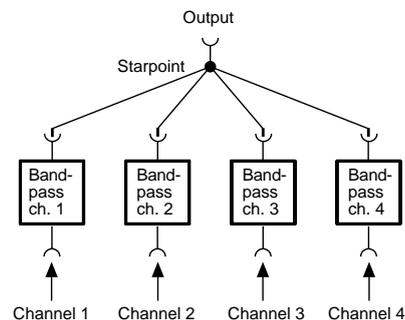
### Tuning:

The band-pass filters must be tuned to the individual operating channels. Upon request this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



793 196



### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs	Max. Power	Weight	Height (height units)	Packing size (mm x mm x mm)
793 192	2	2 x 100 W	31 kg	8	654 x 593 x 450
793 194	3	3 x 100 W	43 kg	8	654 x 593 x 450
793 196	4	4 x 100 W	55 kg	12	654 x 558 x 625
Frequency range	87.5 ... 108 MHz				
Min. frequency spacing	2 MHz				
3-dB bandwidth	> 1 MHz				
Insertion loss	< 1 dB				
Isolation	> 30 dB				
VSWR	< 1.1 (at operating frequency)				
Impedance	50 Ω				
Temperature range	-20 ... +50 °C				
Connectors	7-16 female				
Dimensions	19" drawer, depth: 550 mm				
Colour of front plate	Grey (RAL 7032)				

# Starpoint Combiner, 1 kW with 2, 3 or 4 Inputs 87.5 ... 108 MHz

This starpoint combiner enables several transmitters to be connected into one common antenna.

### Characteristics:

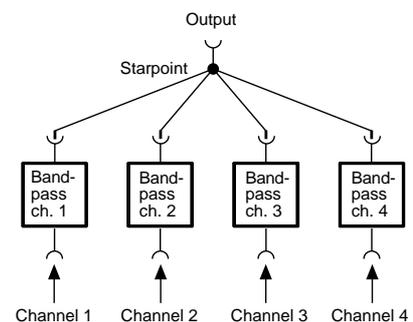
This starpoint combiner consists of one three-pole band-pass filter per channel. Any heat produced is dissipated into the surroundings so no ventilations are required. The combiner is maintenance-free and especially safe to operate. The inputs of the band-passes are narrow-band. The outputs are connected via pre-defined cable length onto a common starpoint. This starpoint is then the output of the combiner. The starpoint combiner may be extended by adding further band-passes and by exchanging the starpoint. The starpoint combiner is suitable for mounting in 19" racks.

### Tuning:

The band-pass filters must be tuned to the individual operating channels. Upon request this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



717 165, shown with additional frame.



### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs	Insertion loss	Max. Power	Connections		Weight	Height (height units)	Packing size (mm x mm x mm)
				Input	Output			
717 165	2	< 0.3 dB	2 x 1 kW	7-16 fem.	7-16 fem.	80 kg	20	815 x 615 x 1100
790 862	3	< 0.4 dB	3 x 1 kW	7-16 fem.	7/8"	140 kg	40	1x 735 x 315 x 1000 1x 815 x 615 x 1100
725 036	4	< 0.5 dB	4 x 1 kW	7-16 fem.	7/8"	160 kg	40	2x 815 x 615 x 1100
Frequency range	87.5 ... 108 MHz							
Min. frequency spacing	2.5 MHz							
3-dB bandwidth	> 1 MHz							
Isolation	> 30 dB							
VSWR	< 1.1 (at operating frequency)							
Impedance	50 Ω							
Temperature range	-20 ... +50 °C							
Dimensions	19" drawer*, depth: 630 mm							
Colour	Grey (RAL 7032)							

\* without front panel

# Starpoint Combiner, 3 kW with 2, 3 or 4 Inputs 87.5 ... 108 MHz

This starpoint combiner enables several transmitters to be connected into one common antenna.

### Characteristics:

This starpoint combiner consists of one temperature-stabilized three-pole band-pass filter per channel. Any heat produced is dissipated into the surroundings via heat sinks so no ventilations are required. The combiner is maintenance-free and especially safe to operate.

The inputs of the band-passes are narrow-band. The outputs are connected via pre-defined cable length onto a common starpoint. This starpoint is then the output of the combiner.

The starpoint combiner may be extended by adding further band-passes and by exchanging the starpoint.

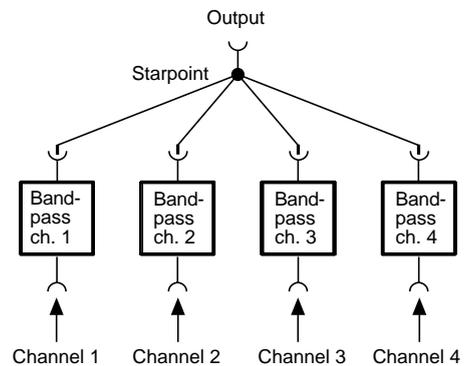
### Tuning:

The band-pass filters must be tuned to the individual operating channels. Upon request this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



728 868



### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs	Insertion loss	Max. Power	Connections		Weight	Dimensions (mm x mm x mm) length, width, height	Packing size (mm x mm x mm) length, width, height
				Input	Output			
728 868	2	< 0.5 dB	2 x 3 kW	7/8" EIA	1 5/8" EIA	110 kg	790 x 482 x 1320	1015 x 615 x 1400
730 040	3	< 0.6 dB	3 x 3 kW	7/8" EIA	1 5/8" EIA	180 kg	1553 x 482 x 1320	1x 1015 x 615 x 1400 1x 735 x 315 x 1460
730 041	4	< 0.7 dB	4 x 3 kW	7/8" EIA	1 5/8" EIA	250 kg	1553 x 482 x 1320	2x 1015 x 615 x 1400
Frequency range	87.5 ... 108 MHz							
Min. frequency spacing	1.5 MHz							
3-dB bandwidth	> 600 kHz							
Isolation	> 30 dB							
VSWR	< 1.1 (at operating frequency)							
Impedance	50 Ω							
Temperature range	-20 ... +50 °C							
Material	Outer conductor: Aluminium; Inner conductor: Brass, silver plated							
Colour	Grey (RAL 7032)							

# Starpoint Combiner, 5 kW with 2, 3 or 4 Inputs 87.5 ... 108 MHz

This starpoint combiner enables several transmitters to be connected into one common antenna.

### Characteristics:

This starpoint combiner consists of one temperature-stabilized three-pole band-pass filter per channel. Any heat produced is dissipated into the surroundings via heat sinks so no ventilations are required. The combiner is maintenance-free and especially safe to operate.

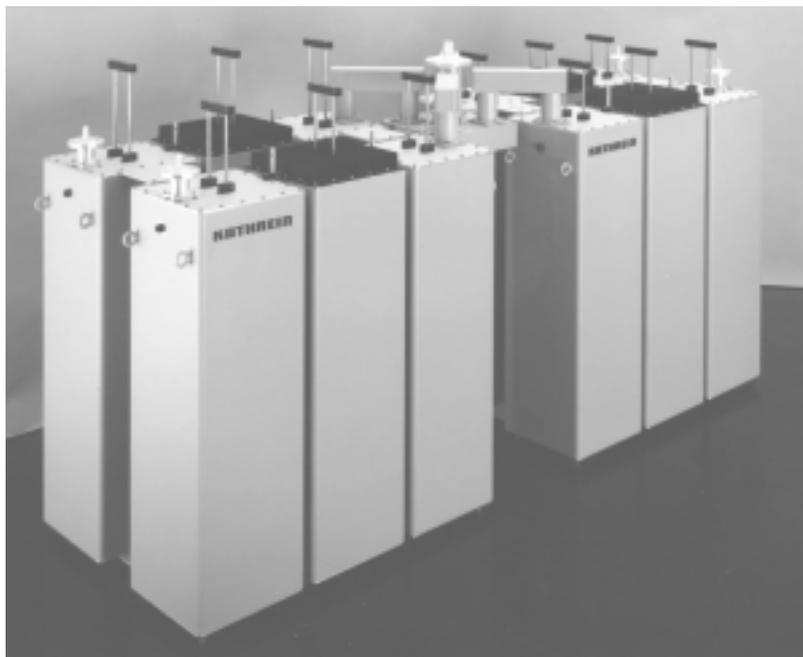
The inputs of the band-passes are narrow-band. The outputs are connected via pre-defined cable length onto a common starpoint. This starpoint is then the output of the combiner.

The starpoint combiner may be extended by adding further band-passes and by exchanging the starpoint.

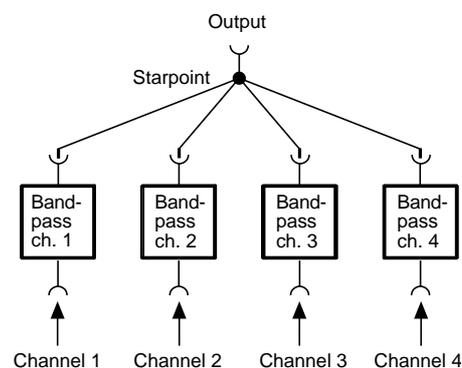
### Tuning:

The band-pass filters must be tuned to the individual operating channels. Upon request this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



790 719



### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs	Insertion loss	Max. Power	Connections female		Weight	Dimensions (mm x mm x mm) length, width, height	Packing size (mm x mm x mm) length, width, height
				Input	Output			
790 717	2	< 0.4 dB	2 x 5 kW	1 5/8" EIA	1 5/8" EIA	220 kg	975 x 695 x 1275	1080 x 870 x 1500
790 718	3	< 0.5 dB	3 x 5 kW	1 5/8" EIA	3 1/8" EIA	330 kg	2185 x 695 x 1260	1x 1080 x 460 x 1500 1x 1080 x 870 x 1500
790 719	4	< 0.6 dB	4 x 5 kW	1 5/8" EIA	3 1/8" EIA	440 kg	2185 x 695 x 1260	2x 1080 x 870 x 1500
Frequency range	87.5 ... 108 MHz							
Min. frequency spacing	1.5 MHz							
3-dB bandwidth	> 600 kHz							
Isolation	> 35 dB							
VSWR	< 1.1 (at operating frequency)							
Impedance	50 Ω							
Temperature range	-20 ... +50 °C							
Material	Outer conductor: Aluminium; Inner conductor: Brass, silver plated							
Colour	Grey (RAL 7032)							

# Directional Filter Combiner, 200 W with 2 Inputs 87.5 ... 108 MHz

The directional filter combiner enables two transmitters to be connected into one common antenna. Additional transmitters may be connected by cascading further directional filter modules.

## Characteristics:

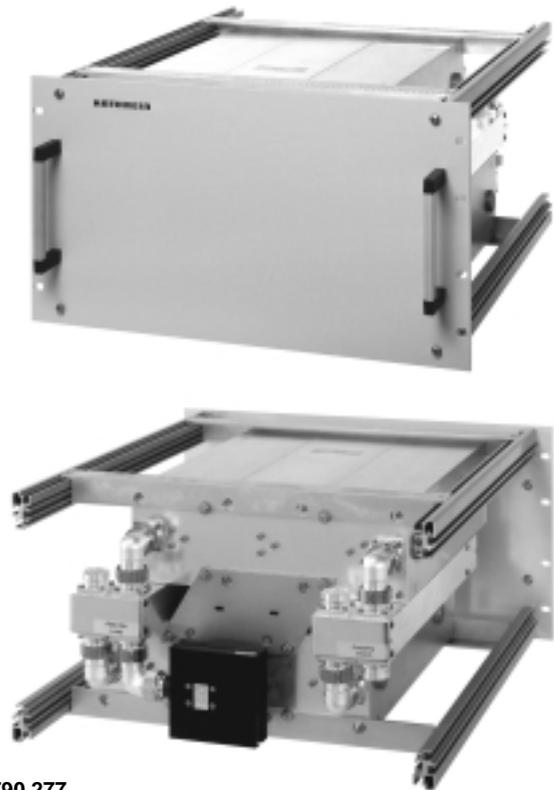
The combiner consists of two three-pole band-pass filters, two 3-dB couplers and a load. One input is narrowband in accordance with the response curve of the band-passes. The other input is broadband in the operating frequency range of the 3-dB coupler. Any heat produced is dissipated into the surroundings so no ventilators are required. The combiner is maintenance-free and especially safe to operate.

The impedance at both inputs is 50 Ω, irrespective of the frequency.

## Tuning:

The band-pass filters must be tuned to the channel fed into the narrowband input. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

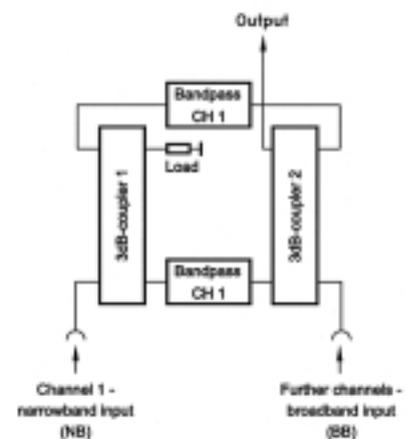


790 277

## Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	790 277		
Inputs/output	Narrowband input (NB)	Broadband input (BB)	Output
Frequency range	87.5 ... 108 MHz Tuned to one channel	87.5 ... 108 MHz Free choice of channel	—
Max. power	200 W	800 W	1000 W
Min. frequency spacing		1.5 MHz	
3-dB bandwidth		> 1 MHz	
Insertion loss	< 0.7 dB (from NB to output) < 0.2 dB (from BB to output)		
Isolation	> 30 dB (from NB to BB) > 50 dB (from BB to NB)		
VSWR	< 1.1 (at the pass band) < 1.25 (at the stop band)		
Impedance	50 Ω		
Temperature range	- 20 ... + 50 °C		
Connectors	7-16 female		
Weight	34 kg		
Dimensions	19" drawer, depth: 550 mm, height: 6 HU		
Packing size	654 mm x 593 mm x 350 mm		
Colour	Grey (RAL 7032)		



# Directional Filter Combiner, 1 kW with 2 Inputs 87.5 ... 108 MHz

The directional filter combiner enables two transmitters to be connected into one common antenna. Additional transmitters may be connected by cascading further directional filter modules.

## Characteristics:

The combiner consists of two three-pole band-pass filters, two 3-dB couplers and a load. One input is narrowband in accordance with the response curve of the band-passes. The other input is broadband in the operating frequency range of the 3-dB coupler. Any heat produced is dissipated into the surroundings so no ventilators are required. The combiner is maintenance-free and especially safe to operate.

The impedance at both inputs is 50 Ω, irrespective of the frequency.

The combiner is suitable for mounting in 19" racks.

## Tuning:

The band-pass filters must be tuned to the channel fed into the narrowband input.

Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



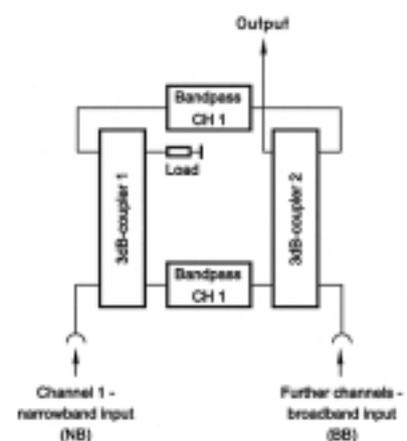
718 165, shown with additional frame

## Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	718 165		
Inputs/output	Narrowband input (NB)	Broadband input (BB)	Output
Frequency range	87.5 ... 108 MHz Tuned to one channel	87.5 ... 108 MHz Free choice of channel	
Max. power	1 kW	7 kW	8 kW
Min. frequency spacing		2 MHz	
3-dB bandwidth		> 1 MHz	
Insertion loss		< 0.3 dB (from NB to output) < 0.15 dB (from BB to output)	
Isolation		> 30 dB (from NB to BB) > 45 dB (from BB to NB)	
VSWR		< 1.1 (at the pass band) < 1.25 (at the stop band)	
Impedance		50 Ω	
Temperature range		-20 ... +50 °C	
Connectors		7-16 female (NB) 13-30 female (BB and output)	
Weight		90 kg	
Dimensions		19" drawer*, depth: 710 mm, height: 20 HU	
Packing size		815 mm x 615 mm x 1100 mm	
Colour		Grey (RAL 7032)	

\* without front panel



# Directional Filter Combiners, 1 kW

## with up to 6 Inputs

### 87.5 ... 108 MHz

The directional filter combiners enables several transmitters to be connected into one common antenna. Up to six transmitters may be connected by cascading directional filter modules.

#### Cascaded combiners have a number of advantages:

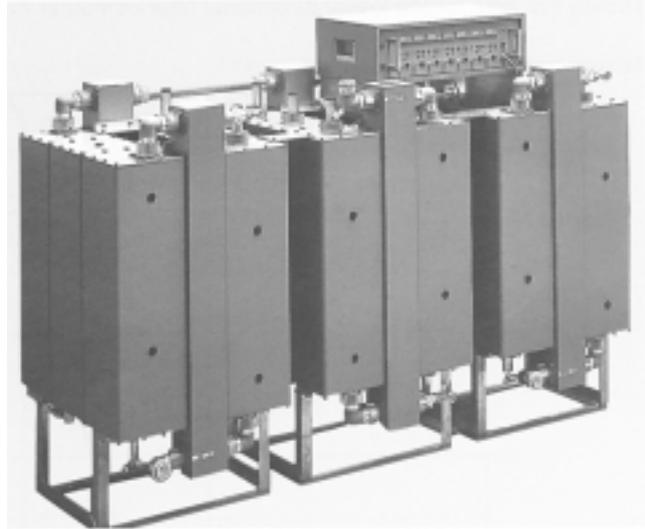
- The impedance at all inputs is independent of the frequency.
- The frequency at the broadband input may be altered without having to retune the combiner.
- If only narrowband inputs are used one can achieve particularly high isolation values, even with very small frequency spacing. The broadband input is then available for any further extensions without alterations to the existing combiner being necessary.

#### Characteristics:

Each module consists of two three-pole band-passes, two 3-dB couplers and a load.  
Any heat produced is dissipated into the surroundings so no ventilators are required. The combiner is maintenance-free and especially safe to operate.  
The impedance at all inputs is 50 Ω, irrespective of the frequency.

#### Tuning:

The band-passes of a module must be tuned to the channel fed into the individual narrowband inputs. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.  
Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

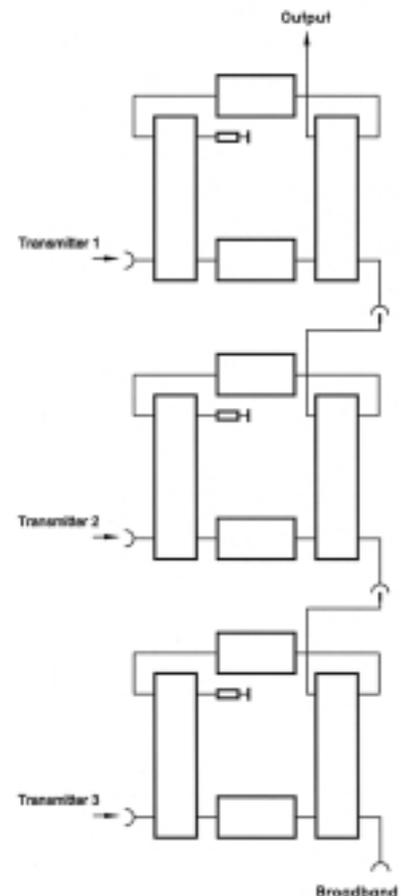


Four-way directional filter combiner with additional frame and control unit.

#### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs		Insertion loss	Max. Power			Weight
	NB	BB		NB	BB	Output	
717 488	2	1	< 0.4 dB *	1 kW	6 kW	8 kW	170 kg
717 599	3	1	< 0.5 dB *	1 kW	5 kW	8 kW	255 kg
725 848	4	1	< 0.6 dB *	1 kW	4 kW	8 kW	340 kg
726 335	5	1	< 0.7 dB *	1 kW	3 kW	8 kW	430 kg
Inputs	2 – 5 Narrowband inputs (NB)			1 Broadband input (BB)			
Frequency range	87.5 ... 108 MHz Tuned to operating channels			87.5 ... 108 MHz Free choice of channel			
Min. frequency spacing	2 MHz						
3-dB bandwidth	> 1 MHz						
Isolation	> 30 dB (from NB to BB) > 45 dB (from BB to NB)						
VSWR	< 1.1 (at the pass band) < 1.25 (at the stop band)						
Impedance	50 Ω						
Temperature range	- 20 ... + 50 °C						
Connectors	7-16 female (NB) 13-30 female (BB and output)						
Dimensions	19" drawer**, depth: 710 mm, height: 20 HU (for each module)						
Packing size	815 mm x 615 mm x 1100 mm (for each module)						
Colour	Grey (RAL 7032)						



\* The figures quoted are maximum values. The insertion losses of the individual inputs vary. Minimum insertion loss: 0.3 dB.

\*\* Without front panel

# Directional Filter Combiner, 5 kW with 2 Inputs 87.5 ... 108 MHz

The directional filter combiner enables two transmitters to be connected into one common antenna. Additional transmitters may be connected by cascading further directional filter modules.

Thus existing systems may easily be extended without having to alter the cabling to the antenna or to the transmitters.

### Characteristics:

The combiner consists of two temperature-stabilized three-pole band-pass filters, two 3-dB couplers and a load. One input is narrowband, in accordance with the response curve of the band-passes. The other input is broadband in the operating frequency range of the 3-dB coupler. Any heat produced is dissipated into the surroundings via heat sinks – so no ventilators are required. The combiner is maintenance-free and especially safe to operate.

The impedance at both inputs is 50 Ω, irrespective of the frequency.

### Tuning:

The band-pass filters must be tuned to the channel fed into the narrowband input. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

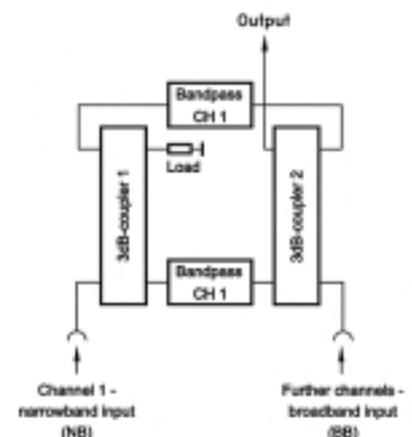


726 473

### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	726 473		
Inputs/output	Narrowband input (NB)	Broadband input (BB)	Output
Frequency range	87.5 ... 108 MHz Tuned to one channel	87.5 ... 108 MHz Free choice of channel	–
Max. power	5 kW	10 kW	15 kW
Connections	7/8" EIA	1 5/8" EIA	1 5/8" EIA
Min. frequency spacing		0.8 MHz	
3-dB bandwidth		> 0.6 MHz	
Insertion loss		0.35 ... 0.5 dB	
Narrowband input		< 0.1 dB (at frequency spacing > 2 MHz)	
Broadband input		< 0.2 dB (at frequency spacing > 0.8 MHz)	
Isolation		> 30 dB (from NB to BB) > 50 dB (from BB to NB)	
VSWR		< 1.1 (at the pass band) < 1.25 (at the stop band)	
Impedance		50 Ω	
Temperature range		- 20 ... + 50 °C	
Weight		140 kg	
Dimensions (L x W x H)		850 mm x 560 mm x 1320 mm	
Packing size		1015 mm x 615 mm x 1400 mm	
Colour		Grey (RAL 7032)	



# Directional Filter Combiners, 5 kW with 3 and 4 Inputs 87.5 ... 108 MHz

The directional filter combiners enables several transmitters to be connected into one common antenna. Up to four transmitters may be connected by cascading directional filter modules.

### Cascaded combiners have a number of advantages:

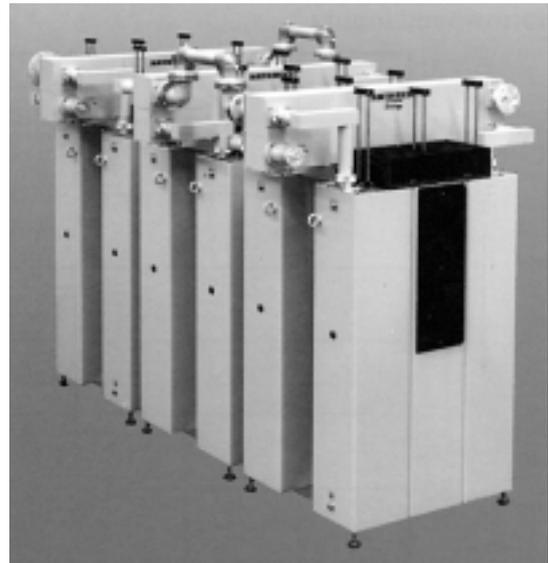
- The impedance at all inputs is independent of the frequency.
- The frequency at the broadband input may be altered without having to retune the combiner.
- If only narrowband inputs are used one can achieve particularly high isolation values, (attenuation of directional coupler plus stop band attenuation of the filter) even with very small frequency spacing. The broadband input is then available for any further extensions without alterations to the existing combiner being necessary.

### Characteristics:

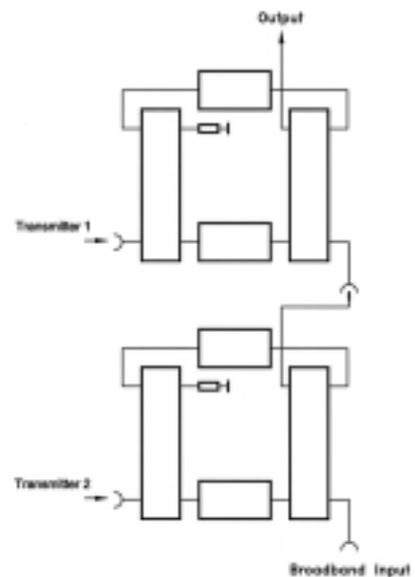
Each module consists of two temperature-stabilized three-pole band passes, two 3-dB couplers and a load. The impedance at all inputs is 50 Ω, irrespective of the frequency. Any heat produced is dissipated into the surroundings via heat sinks so no ventilators are required. Thus the combiner is maintenance-free and especially safe to operate.

### Tuning:

The band-passes of a module must be tuned to the channel fed into the individual narrowband inputs. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



730 048 similar



### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs		Insertion loss	Max. Power			Dimensions (length, width, height) mm x mm x mm	Packing size mm x mm x mm	Weight
	NB	BB		NB	BB	Output			
728 917	2	1	< 0.7 dB *	5 kW	10 kW	15 kW	2000 x 560 x 1320	2x 1015 x 615 x 1400	280 kg
730 048	3	1	< 0.8 dB *	5 kW	-	15 kW	3000 x 560 x 1320	3x 1015 x 615 x 1400	420 kg
Inputs/output	Narrowband inputs (NB)			Broadband input (BB)			Output		
Frequency range	87.5 ... 108 MHz Tuned to one channel			87.5 ... 108 MHz Free choice of channel			-		
Connections	7/8" EIA			1 5/8" EIA			1 5/8" EIA		
Min. frequency spacing				0.8 MHz					
3-dB bandwidth				> 600 kHz					
Isolation				> 30 dB (from NB to BB) > 50 dB (from BB to NB) > 50 dB (from NB to NB)					
VSWR				< 1.1 (at the pass band) < 1.25 (at the stop band)					
Impedance				50 Ω					
Temperature range				- 20 ... + 50 °C					
Colour				Grey (RAL 7032)					

\* The figures quoted are maximum values. The insertion losses of the individual inputs vary. Minimum insertion loss: 0.3 dB.

# Directional Filter Combiner, 10 kW with 2 Inputs 87.5 ... 108 MHz

The directional filter combiner enables two transmitters to be connected into one common antenna. Additional transmitters may be connected by cascading further directional filter modules.

Thus existing systems may easily be extended without having to alter the cabling to the antenna or to the transmitters.

## Characteristics:

The combiner consists of two temperature-stabilized three-pole band-pass filters, two 3-dB couplers and a load. One input is narrowband, in accordance with the response curve of the band-passes. The other input is broadband in the operating frequency range of the 3-dB coupler. Any heat produced is dissipated into the surroundings via heat sinks – so no ventilators are required. The combiner is maintenance-free and especially safe to operate.

The impedance at both inputs is 50 Ω, irrespective of the frequency.

## Tuning:

The band-pass filters must be tuned to the channel fed into the narrowband input. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

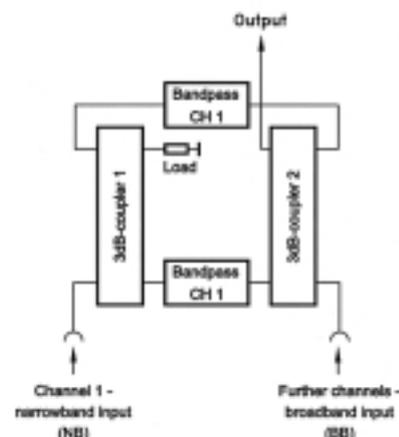


728 393

## Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	728 393		
Inputs/output	Narrowband input (NB)	Broadband input (BB)	Output
Frequency range	87.5 ... 108 MHz Tuned to one channel	87.5 ... 108 MHz Free choice of channel	–
Max. power	10 kW	50 kW	60 kW
Connections	1 5/8" EIA	3 1/8" EIA	3 1/8" EIA
Min. frequency spacing		0.8 MHz	
3-dB bandwidth		> 0.6 MHz	
Insertion loss		0.3 ... 0.4 dB	
Narrowband input		< 0.1 dB (at frequency spacing > 2 MHz)	
Broadband input		< 0.15 dB (at frequency spacing > 0.8 MHz)	
Isolation		> 35 dB (from NB to BB) > 55 dB (from BB to NB)	
VSWR		< 1.1 (at the pass band) < 1.25 (at the stop band)	
Impedance		50 Ω	
Temperature range		- 20 ... + 50 °C	
Weight		290 kg	
Dimensions (L x W x H)		1150 mm x 745 mm x 1435 mm	
Packing size		1350 mm x 870 mm x 1620 mm	
Colour		Grey (RAL 7032)	



# Directional Filter Combiners, 10 kW with up to 7 Inputs 87.5 ... 108 MHz

The directional filter combiners enables several transmitters to be connected into one common antenna. Up to seven transmitters may be connected by cascading directional filter modules.

### Cascaded combiners have a number of advantages:

- The impedance at all inputs is independent of the frequency.
- The frequency at the broadband input may be altered without having to retune the combiner.
- If only narrowband inputs are used one can achieve particularly high isolation values, even with very small frequency spacing. The broadband input is then available for any further extensions without alterations to the existing combiner being necessary.

### Characteristics:

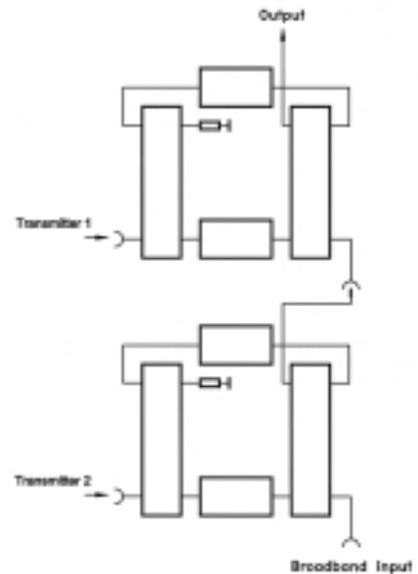
Each module consists of two temperature-stabilized three-pole band-passes, two 3-dB couplers and a load. The impedance at all inputs is 50 Ω, irrespective of the frequency. Any heat produced is dissipated into the surroundings via heat sinks - so no ventilators are required. Thus the combiner is maintenance-free and especially safe to operate.

### Tuning:

The band-passes of a module must be tuned to the channel fed into the individual narrowband inputs. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the combiner.



790 785



### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs		Insertion loss	Max. Power			Dimensions (length, width, height) mm x mm x mm	Packing size mm x mm x mm	Weight
	NB	BB		NB	BB	Output			
790 695	2	1	< 0.55 dB*	10 kW	40 kW	60 kW	2400 x 745 x 1435	2x 1350 x 870 x 1620	590 kg
790 709	3	1	< 0.65 dB*	10 kW	30 kW	60 kW	3600 x 745 x 1435	3x 1350 x 870 x 1620	890 kg
790 785	4	1	< 0.70 dB*	10 kW	20 kW	60 kW	4800 x 745 x 1435	4x 1350 x 870 x 1620	1190 kg
790 786	5	1	< 0.75 dB*	10 kW	10 kW	60 kW	6000 x 745 x 1435	5x 1350 x 870 x 1620	1490 kg
790 787	6	1	< 0.80 dB*	10 kW	10 kW	70 kW	7200 x 745 x 1435	6x 1350 x 870 x 1620	1790 kg

Inputs/output	Narrowband inputs (NB)	Broadband input (BB)	Output
Frequency range	87.5 ... 108 MHz Tuned to one channel	87.5 ... 108 MHz Free choice of channel	-
Connections	1 5/8" EIA	3 1/8" EIA	3 1/8" EIA (790 787: 4 1/2" EIA)
Min. frequency spacing		0.8 MHz	
3-dB bandwidth		> 600 kHz	
Isolation		> 35 dB (from NB to BB) > 55 dB (from BB to NB) > 55 dB (from NB to NB)	
VSWR		< 1.1 (at the pass band) < 1.25 (at the stop band)	
Impedance		50 Ω	
Temperature range		- 20 ... + 50 °C	
Colour		Grey (RAL 7032)	

\* The figures quoted are maximum values. The insertion losses of the individual inputs vary. Minimum insertion loss: 0.3 dB.

**VHF Band  
174 – 230 MHz**

VHF Band  
174 – 230 MHz

# Stretchline Combiner, 0.2 kW with 2 Inputs 174 ... 230 MHz

This stretchline combiner enables two transmitters to be connected into one common antenna.

### Characteristics:

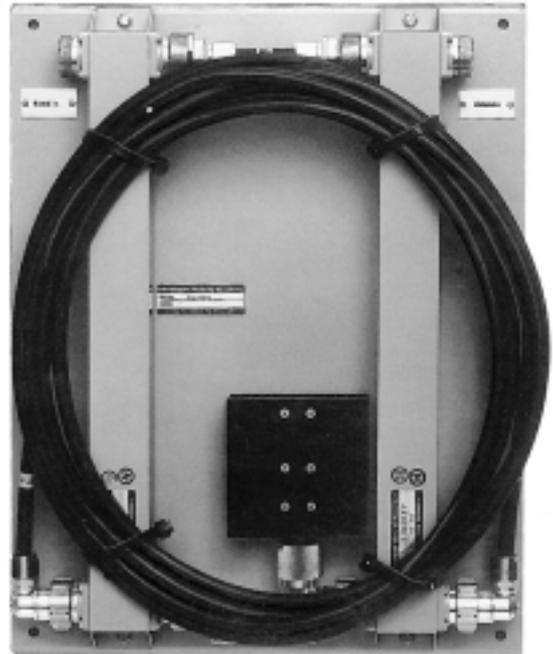
The stretchline combiner consists of two 3-dB couplers connected via a stretchline section.

The isolation is determined by the 3-dB couplers. In order to increase the isolation an additional filter or a circulator can be connected to each input.

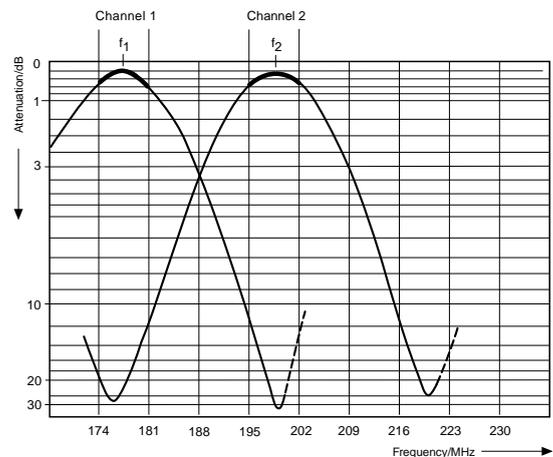
### Tuning:

This combiner is not tunable, but it may be modified for other channels by replacing the stretchline section.

Please state the required operating channels when ordering.

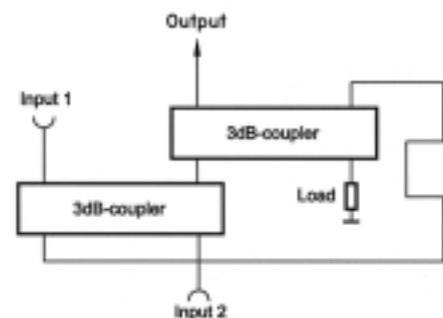


714 624



### Technical Data

Type No.	714 624
Inputs	2
Frequency range	174 ... 230 MHz
Max. power	200 W per input
Min. frequency spacing	3 channels (2 channels space between)
Pass band width	1 channel
Insertion loss	Typical < 0.5 dB (depends on the channel combination)
Isolation	> 30 dB
VSWR	< 1.06 (at the operating channels)
Impedance	50 Ω
Temperature range	- 10 ... + 50 °C
Connectors	7-16 female
Weight	3.5 kg
Dimensions (w x h x d)	450 mm x 350 mm x 80 mm
Packing size	534 mm x 458 mm x 180 mm
Colour	Grey (RAL 7032)



# Stretchline Combiner, 3 kW with 2 Inputs 174 ... 230 MHz

This stretchline combiner enables two transmitters to be connected into one common antenna.

### Design and construction:

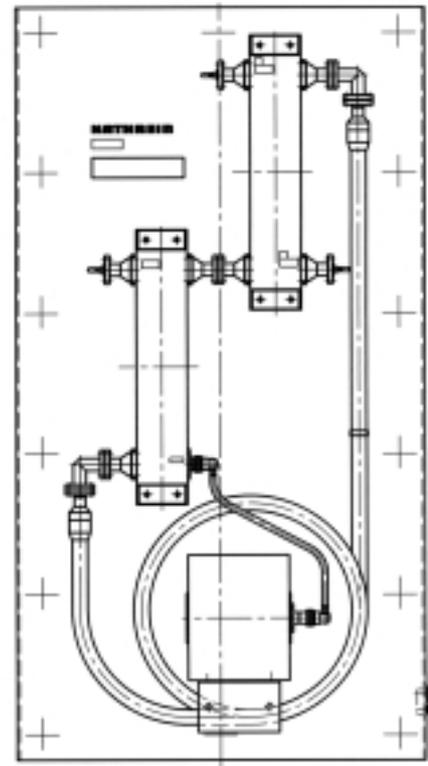
The 2-way combiner module consists of two 3-dB couplers connected via a stretchline section.

The isolation is determined by the 3-dB couplers.

### Tuning:

This combiner is not tunable, but it may be modified for other channels by exchanging the stretchline section.

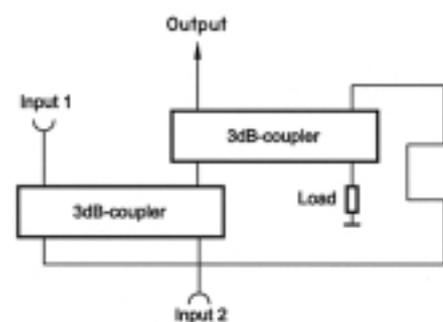
Please state the required operating channels when ordering.



792 462

## Technical Data

Type No.	792 462
Inputs	2
Frequency range	174 ... 230 MHz
Max. power	3 kW per input
Min. frequency spacing	3 channels (2 channels space between) smaller channel spacing upon request
Pass band width	1 channel
Insertion loss	Typical < 0.5 dB (depends on the channel combination)
Isolation	> 30 dB
Impedance	50 Ω
VSWR	< 1.06 (at the operating channels)
Temperature range	- 10 ... + 50 °C
Connections	7/8" EIA
Weight	Approx. 50 kg
Dimensions (w x h x d)	800 mm x 1500 mm x 200 mm
Packing size	Approx. 1500 mm x 1000 mm x 400 mm
Colour	Grey (RAL 7032)



# Stretchline Combiner, 5 kW with 2 Inputs 174 ... 230 MHz

This stretchline combiner enables several transmitters to be connected into one common antenna.

### Characteristics:

The stretchline combiner consists of two 3-dB couplers connected via a stretchline section.

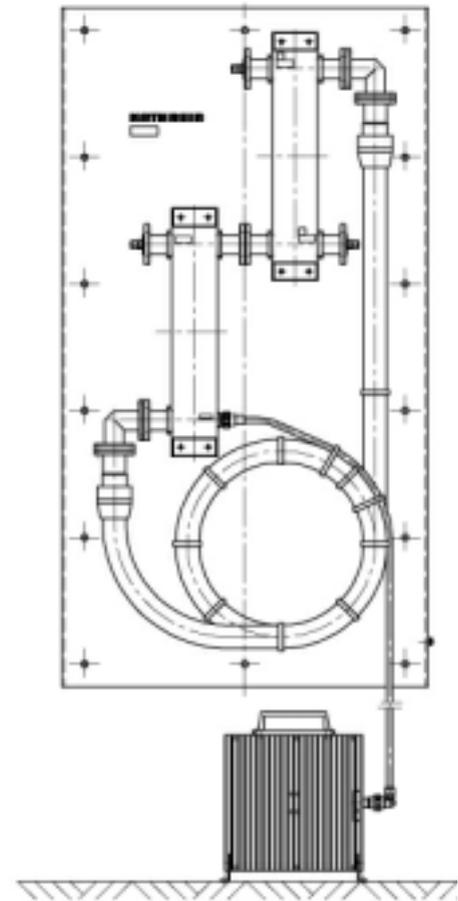
The isolation is determined by the 3-dB couplers.

The load has to be placed separately.

### Tuning:

This combiner is not tunable, but it may be modified for other channels by exchanging the stretchline section.

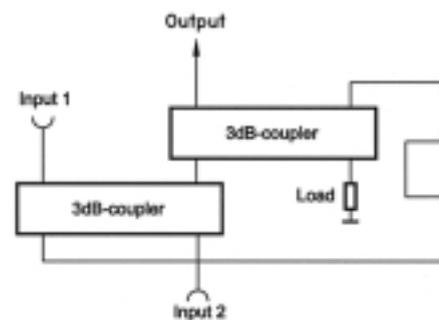
Please state the required operating channels when ordering.



791 365

## Technical Data

Type No.	791 365
Inputs	2
Frequency range	174 ... 230 MHz
Max. power	5 kW per input
Min. frequency spacing	3 channels min. (2 channels space between) smaller channel spacing upon request
Pass band width	1 channel
Insertion loss	Typical < 0.5 dB (depends on the channel combination)
Isolation	> 30 dB
Impedance	50 Ω
VSWR	< 1.06 (at the operating channels)
Temperature range	- 10 ... + 50 °C
Connections	1 5/8" EIA
Weight	Approx. 70 kg
Dimensions (w x h x d)	1500 mm x 800 mm x 210 mm
Packing size	Approx. 1800 mm x 1000 mm x 400 mm
Colour	Grey (RAL 7032)



**UHF Band  
470 – 860 MHz**

UHF Band  
470 – 860 MHz

# Directional Filter Combiner, 200 W with 2 Inputs 470 ... 860 MHz

The directional filter combiner enables two transmitters to be connected into one common antenna. Further transmitters may be added by cascading additional directional filter modules.

Existing systems can easily be extended without the cabling to the antenna or to the transmitters having to be altered.

### Characteristics:

The combiner consists of two three-pole band-passes, two 3-dB couplers and a load.

One input is narrowband corresponding to the pass-band curve of the filters, the other input is broadband (within the operating frequency range of the 3-dB coupler).

The combiner is convection-cooled so no ventilators are necessary. Thus the combiner is maintenance-free and particularly safe to operate.

The impedance at all inputs is 50 Ω, irrespective of the frequency.

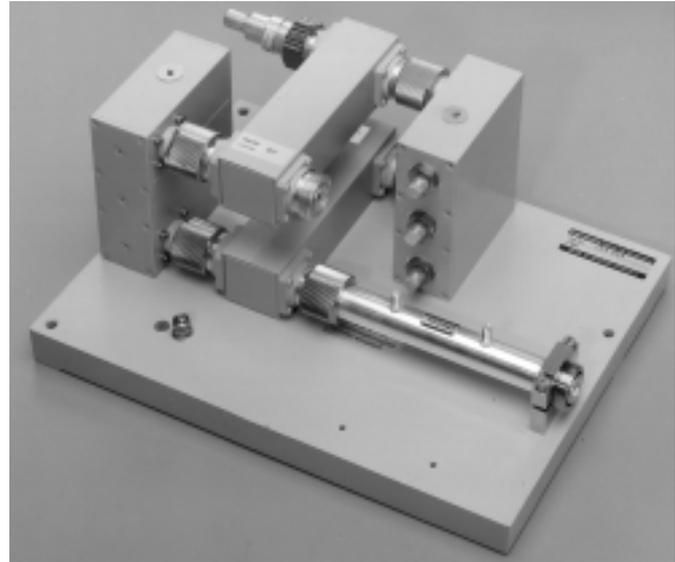
### Tuning:

The band-passes of a module must be tuned to the channel fed into the narrowband input. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site.

Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

### Note:

For channels 21 up to 30 fed in at broadband input, we recommend matching unit 793 942 to improve the respective return loss.

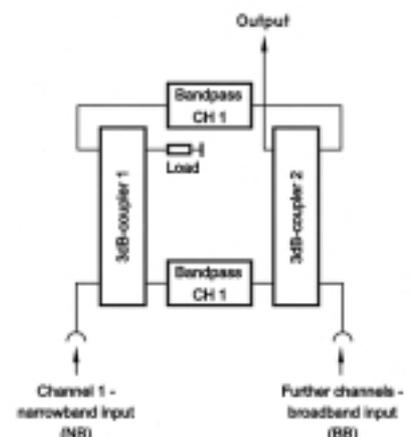


723 254 shown with additional matching unit 793 942

### Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	723 254		
Inputs/output	Narrowband input (NB)	Broadband input (BB)	Output
Frequency range	470 ... 860 MHz Tuned to one channel	470 ... 860 MHz Free choice of channel	–
Max. power	200 W	600 W	800 W
Min. frequency spacing	3 channels (2 channels space between)		
Pass band width	1 channel		
Insertion loss	< 0.7 dB		
Isolation	> 26 dB (from NB to BB) > 35 dB (from BB to NB)		
VSWR (NB)	< 1.05 (at the operating frequency)		
Impedance	50 Ω		
Temperature range	- 20 ... + 50 °C		
Connectors	7-16 female		
Weight	6.5 kg		
Dimensions (l x w x h)	325 mm x 240 mm x 155 mm		
Packing size	397 mm x 312 mm x 229 mm		
Colour	Grey (RAL 7032)		



# Directional Filter Combiner, 200 W with 2 Inputs 470 ... 860 MHz

The directional filter combiner enables two transmitters to be connected into one common antenna.

## Characteristics:

The combiner consists of three three-pole band-passes, two 3-dB couplers and a load.

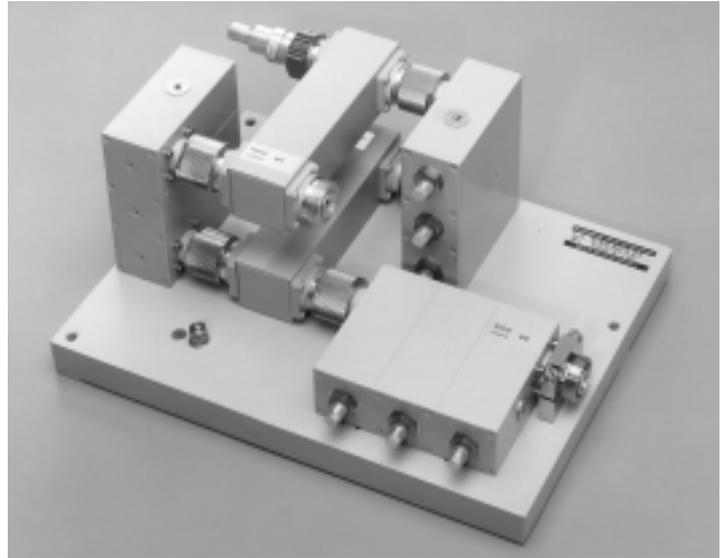
In order to increase the isolation an additional band-pass is connected up after the input for channel 2. Both inputs are thus narrowband, corresponding to the filter curve of the band-passes.

The combiner is convection-cooled so no ventilators are necessary. Thus the combiner is maintenance-free and particularly safe to operate.

The impedance at all inputs is 50  $\Omega$ , irrespective of the frequency.

## Tuning:

The band-passes must be tuned to the channel fed into the narrowband input. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

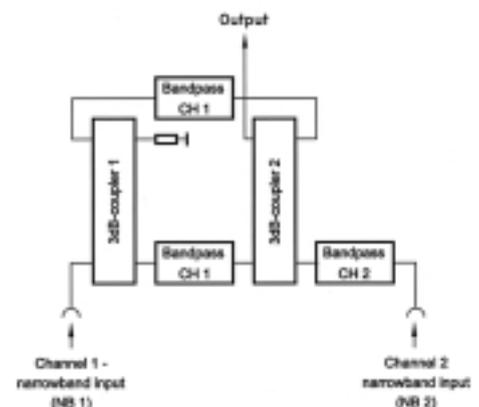


K 65 50 42 7

## Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	K 65 50 42 7
Inputs	2
Frequency range	470 ... 860 MHz
Min. frequency spacing	3 channels (2 channels space between)
Max. power	200 W per input
Pass band width	1 channel
Insertion loss	< 0.8 dB
Isolation	> 35 dB
VSWR	< 1.05 (at the operating channels)
Impedance	50 $\Omega$
Temperature range	- 20 ... + 50 °C
Material	Outer- and inner conductor: Brass, silver plated
Connectors	7-16 female
Weight	7 kg
Dimensions (l x w x h)	325 mm x 240 mm x 155 mm
Packing size	397 mm x 312 mm x 229 mm
Colour	Grey (RAL 7032)

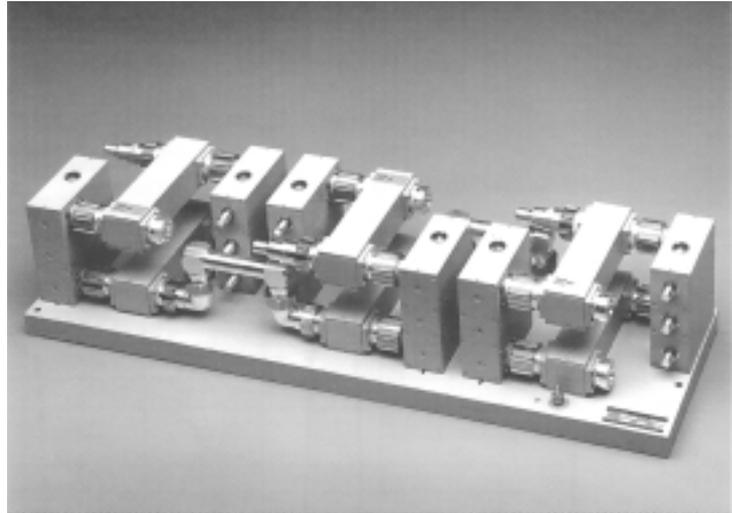


# Directional Filter Combiners, 200 W with 3 and 4 Inputs 470 ... 860 MHz

The directional filter combiner enables several transmitters to be connected into one common antenna.

**Cascaded combiners have a number of advantages:**

- The impedance at all inputs is independent of the frequency.
- The frequency at the broadband input may be altered without having to retune the combiner.
- If only narrowband inputs are used, one can achieve particularly high isolation values, even with very small frequency spacing. The broadband input is then available for any further extensions without alterations to the existing combiner being necessary.



723 876

Each module consists of two three-pole band-passes, two 3-dB couplers and a load. The impedance at all inputs is 50 Ω, irrespective of the frequency.

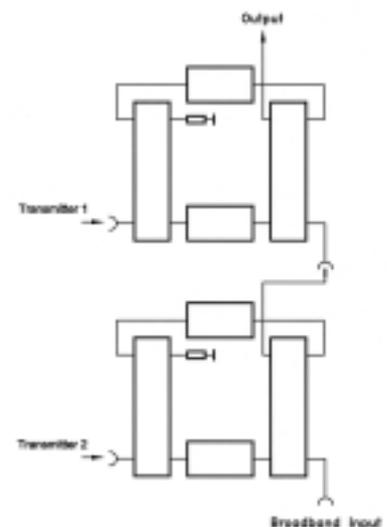
**Tuning:**

The band-passes of a module must be tuned to the channel fed into the individual narrowband inputs. Upon request, this tuning may be performed at our factory (in this case please state the operating channels when ordering) or it may be undertaken on site. Clear tuning instructions and also any special tools necessary are supplied along with the combiner.

**Technical Data**

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs		Max. Power			Packing size mm x mm x mm	Weight
	NB	BB	NB	BB	Output		
723 875	2	1	200 W	400 W	800 W	775 x 310 x 400	12 kg
723 876	3	1	200 W	200 W	800 W	775 x 310 x 400	17 kg
Inputs		Narrowband input (NB)			Broadband input (BB)		
Frequency range		470 ... 860 MHz Tuned to one channel			470 ... 860 MHz Free choice of channel		
Min. frequency spacing		3 channels (2 channels space between)			1 channel		
Pass band width							
Insertion loss					< 1 dB		
Isolation					> 35 dB (from BB to NB) > 26 dB (from NB to BB) > 35 dB (from NB to NB)		
VSWR (NB)					< 1.05 (at the operating channels)		
Impedance					50 Ω		
Temperature range					- 20 ... + 50 °C		
Connectors					7-16 female		
Material					Outer conductor and inner conductor: Brass, silver plated		
Dimensions (l x w x h)					690 mm x 200 mm x 155 mm		
Colour					Grey (RAL 7032)		



# Stretchline Combiners, 100 W and 1 kW with 2 or 3 Inputs 470 ... 860 MHz

This stretchline combiner enables several transmitters to be connected into one common antenna.

### Characteristics:

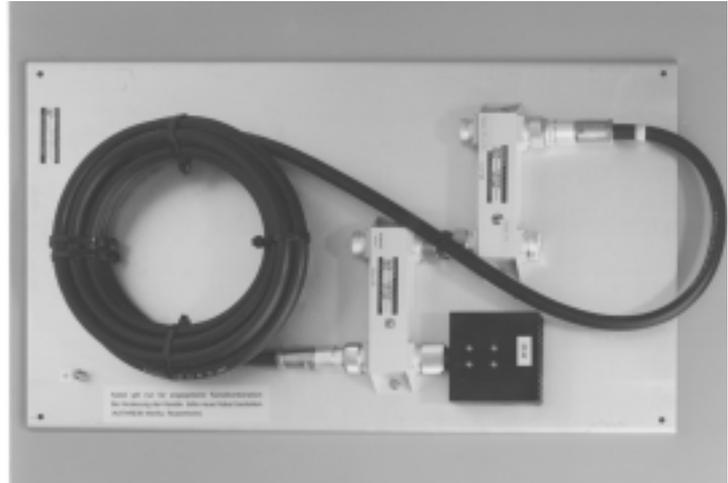
The 2-way combiner module consists of two 3-dB couplers connected via a stretchline section. The 3-way combiner consists of two 2-way modules.

The isolation is determined by the 3-dB couplers. In order to increase the isolation an additional filter may be connected to each input.

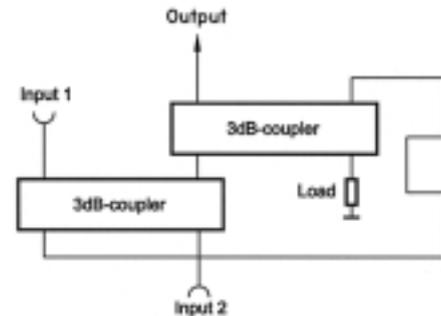
### Tuning:

This combiner is not tunable, but it may be modified for other channels by exchanging the stretchline section.

Please state the required operating channels when ordering.



726 341



## Technical Data

The insertion loss and isolation values apply to the minimum frequency spacing.

Type No.	Inputs**	Isolation	Max. Power per input	Connections	Dimensions mm x mm x mm (length, width, height)	Packing size mm x mm x mm
723 185*	2	26 dB	100 W	7-16 female	700 x 400 x 50	800 x 500 x 150
723 186	3	26 dB	100 W	7-16 female	700 x 400 x 90	800 x 500 x 150
726 341	2	30 dB	300 W	7/8" EIA	600 x 400 x 140	800 x 500 x 300
726 239	3	30 dB	300 W	7/8" EIA	600 x 400 x 230	800 x 500 x 300
725 955	2	30 dB	1 kW	7/8" EIA	1000 x 800 x 210	1200 x 900 x 300
724 602	3	30 dB	1 kW	7/8" EIA	1300 x 950 x 300	1500 x 1100 x 400
Frequency range	470 ... 860 MHz					
Min. frequency spacing	3 channels (2 channels space between)					
Pass band width	1 channel					
Insertion loss	Typical < 0.5 dB (depends on the channel combination)					
VSWR	< 1.1 (at the operating channels)					
Impedance	50 Ω					
Temperature range	- 20 ... + 50 °C					
Colour	Grey (RAL 7032)					

\* Customized design: In order to be able to feed two pre-defined channels into one input, this input can be provided as a broadband one.

\*\* More than three inputs upon request.

# Stretchline Combiners, 3 kW with 2 Inputs 470 ... 860 MHz

This stretchline combiner enables several transmitters to be connected into one common antenna.

### Characteristics:

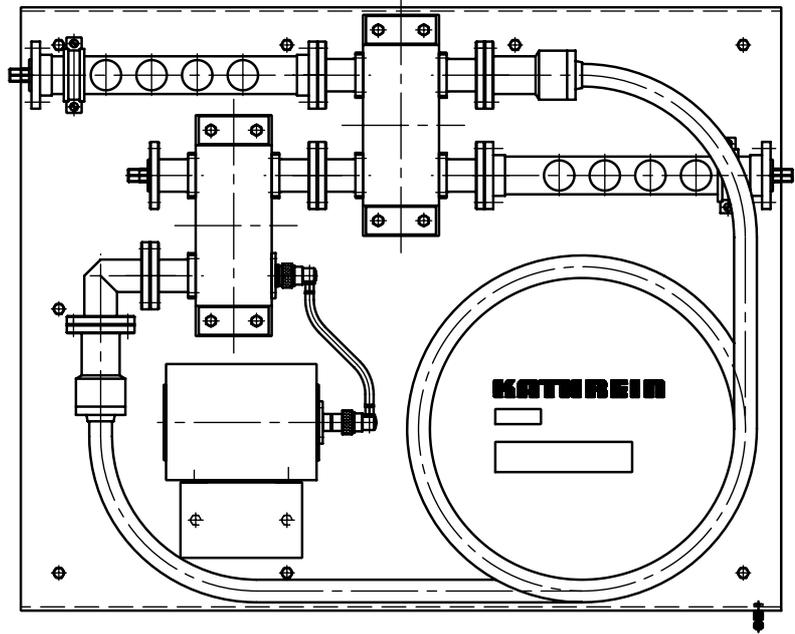
The stretchline combiner consists of two 3-dB couplers connected via a stretchline section.

The isolation is determined by the 3-dB couplers. In order to increase the isolation an additional filter may be connected to each input.

### Tuning:

This combiner is not tunable, but it may be modified for other channels by exchanging the stretchline section.

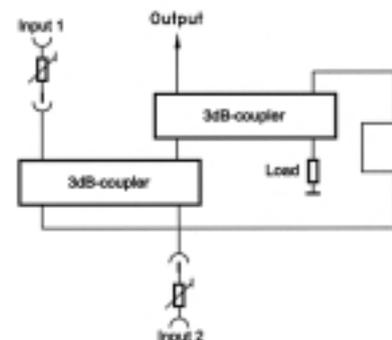
Please state the required operating channels when ordering.



792 461

## Technical Data

Type No.	792 461
Inputs	2
Frequency range	470 ... 860 MHz
Max. power	3 kW per input
Min. frequency spacing	3 channels (2 channels space between)
Pass band width	1 channel
Insertion loss	Typical < 0.5 dB (depends on the channel combination)
Isolation	> 30 dB
VSWR	< 1.06 (at the operating channels)
Impedance	50 Ω
Temperature range	- 10 ... + 50 °C
Connections	1 5/8" EIA
Weight	50 kg
Dimensions (w x h x d)	1000 mm x 800 mm x 190 mm
Packing size	1200 mm x 1000 mm x 250 mm
Colour	Grey (RAL 7032)



# Stretchline Combiners, 5 kW with 2 Inputs 470 ... 860 MHz

The stretchline combiner enables two transmitters to be connected into one common antenna.

### Characteristics:

The stretchline combiner consists of two 3-dB couplers connected via a stretchline section.

The inputs of the stretchline combiner are supplied with matching units.

The isolation is determined by the 3-dB couplers. In order to increase the isolation an additional filter may be connected to each input.

### Mounting:

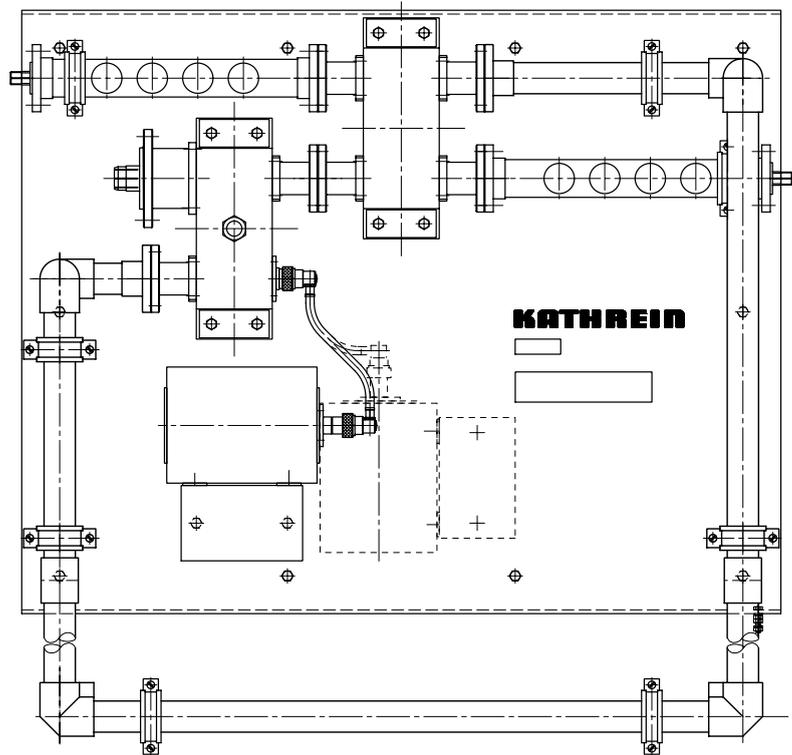
The stretchline combiner is designed for wall mounting. Depending of the operating channels fed in, the stretchline section can exceed the ground plate.

In this case the stretchline section has to be fixed by clamps which are part of the delivery extend.

### Tuning:

This combiner is not tunable, but it may be modified for other channels by exchanging the stretchline section.

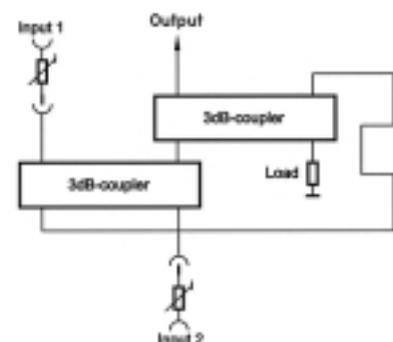
Please state the required operating channels when ordering.



792 560

## Technical Data

Type No.	792 560
Inputs	2
Frequency range	470 ... 860 MHz
Max. power	5 kW per input
Min. frequency spacing	3 channels (2 channels space between)
Pass band width	1 channel
Insertion loss	Typical < 0.5 dB (depends on the channel combination)
Isolation	> 30 dB
VSWR	< 1.06 (at the operating channels)
Impedance	50 Ω
Temperature range	- 10 ... + 50 °C
Connections	1 5/8" EIA (inputs) 3 1/8" EIA (output)
Weight	60 kg
Dimensions (w x h x d)	1000 mm x 800 mm x 190 mm
Packing size	1200 mm x 1000 mm x 250 mm
Colour	Grey (RAL 7032)





## Accessories

50-Ω loads are suitable for use as absorbers for small and medium power.

**They are used:**

- as termination for transmitters or amplifiers used for testing, measuring or tuning,
- as termination for circulators, directional couplers, hybrid ring junctions and decoupled power splitters.

**Special features:**

- very low VSWR within a wide frequency range,
- high stability and RF shielding due to the closed aluminium construction,
- arbitrary installation position because of convectional cooling,
- 50 W and 100 W models can be installed on front or rear panels of electrical equipment for heat dissipation.



**This device incorporates beryllium oxide, the dust of which is toxic!**

**0.5 Watt \***

Type No.	K 62 26 61 1
Connector	N male
Frequency range	0 – 2000 MHz
VSWR 0 – 1000 MHz	< 1.08
1000 – 2000 MHz	< 1.15
Weight	40 g
Packing size	90 mm x 60 mm x 25 mm
Dimensions	33 mm/21 mm dia.



**K 62 26 61 1**

**2 Watt \***

Type No.	K 62 26 11 1
Connector	N male
Frequency range	0 – 2000 MHz
VSWR 0 – 1000 MHz	< 1.08
1000 – 2000 MHz	< 1.15
Weight	40 g
Packing size	90 mm x 60 mm x 25 mm
Dimensions	33 mm/21 mm dia.



**K 62 26 11 1**

**10 Watt \***

Type No.	K 62 26 40 1	K 62 26 41 1
Connector	N female	N male
Frequency range	0 – 2000 MHz	
VSWR 0 – 1000 MHz	< 1.08	
1000 – 2000 MHz	< 1.15	
Weight	Approx. 250 g	
Packing size	50 mm x 90 mm x 100 mm	
Dimensions (w x h x d)	40 x 82 x 77 mm (with connectors)	40 x 82 x 85 mm (with connectors)



**K 62 26 40 1**

\* Rated power at 40 °C ambient temperature. The max. power rating increases or decreases with falling or rising ambient temperature.

### 25 Watt \*

Type No.	K 62 26 20 1	K 62 26 21 1	K 62 26 20 7	K 62 26 21 7
Connector	N female	N male	7-16 female	7-16 male
Frequency range	0 – 2000 MHz			
VSWR 0 – 1000 MHz	< 1.08			
1000 – 2000 MHz	< 1.15			
Weight	Approx. 500 g			
Packing size	50 mm x 100 mm x 135 mm			
Dimensions (w x h x d)	35 x 94 x 113 mm (with connectors)	35 x 94 x 121 mm (with connectors)	35 x 94 x 125 mm (with connectors)	35 x 94 x 124 mm (with connectors)



K 62 26 20 1

### 50 Watt \*

Type No.	K 62 26 30 1	K 62 26 31 1	K 62 26 30 7	K 62 26 31 7
Connector	N female	N male	7-16 female	7-16 male
Frequency range	0 – 2000 MHz			
VSWR 0 – 1000 MHz	< 1.08			
1000 – 2000 MHz	< 1.15			
Weight	Approx. 800 g			
Packing size	80 mm x 95 mm x 145 mm			
Dimensions (w x h x d)	67 x 90 x 130 mm (with connectors)	67 x 90 x 138 mm (with connectors)	67 x 90 x 134 mm (with connectors)	67 x 90 x 133 mm (with connectors)



K 62 26 30 1

### 100 Watt \*

Type No.	K 62 26 50 1	K 62 26 51 1	K 62 26 50 7
Connector	N female	N male	7-16 female
Frequency range	0 – 1000 MHz		
VSWR 0 – 1000 MHz	< 1.08		
Weight	Approx. 2.4 kg		
Packing size	130 mm x 195 mm x 180 mm		
Dimensions (w x h x d)	114 x 153 x 156 mm (with connectors)	114 x 161 x 156 mm (with connectors)	114 x 170 x 156 mm (with connectors)



K 62 26 50 1

\* Rated power at 40 °C ambient temperature. The max. power rating increases or decreases with falling or rising ambient temperature.

The 50-Ω load is used as termination at the absorber port of directional filter combiners.

Structural part number 169 2041 is equivalent to type number 724 334.



**This device incorporates beryllium oxide, the dust of which is toxic!**



724 334

## 500 W \*

Type No.	724 334
Connector	7-16 female
Frequency range	0 – 230 MHz
VSWR	< 1.08
Impedance	50 Ω
Weight	15 kg
Packing size	230 x 35 x 130 mm
Dimensions (w x h x d)	348 mm x 364 mm x 164 mm (with connectors)
Colour	Black coated

\* Max. input power at 40 °C ambient temperature.  
The max. input power increases or decreases  
with falling or rising ambient temperature.

# Circulator, 120 W

## 87.5 – 108 MHz

### The circulator can be used:

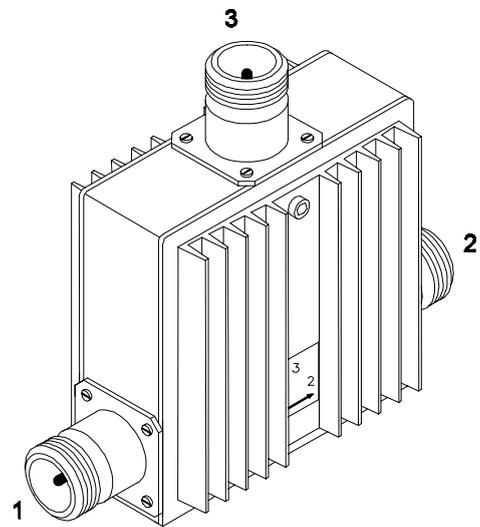
- to increase the coupling attenuation between transmitters, to reduce intermodulation products,
- to prevent adverse effects of unmatched load impedance on amplifier performance.

### Function:

The circulator is a non-reciprocal component with low insertion loss in the forward direction (1 → 2) and high attenuation in the reverse direction (2 → 1). The impedance at the input (1) of the circulator is constant and independent of the impedance of the components following. The reflected power at output (2) is passed to the absorber port (3), which must be terminated with an absorber.

### Dimensioning of the absorber:

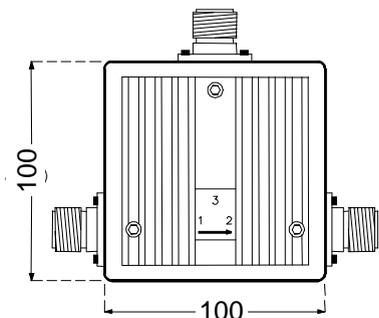
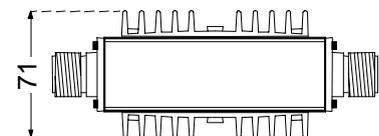
The absorber at port (3) must be dimensioned to be able to absorb the maximum power reflected at output (2).



792 452

### Technical Data

Type No.	792 452 *
Frequency range	87.5 – 108 MHz
Max. power	120 W
Insertion loss 1 → 2	< 0.7 dB
Isolation 2 → 1	> 18 dB
VSWR 1, 2, 3	< 1.28
Impedance	50 Ω
Temperature range	0 ... + 50 °C
Connectors	N female
Weight	1.7 kg
Dimensions (w x h x d)	See figure
Packing size	150 mm x 150 mm x 100 mm



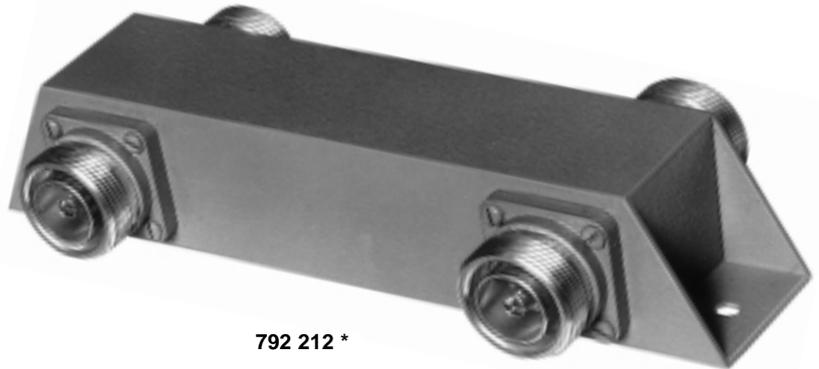
\* Structural part number 099 1849 is equivalent to type number 792 452.

# 3-dB Coupler (90° Hybrid)

## 87.5 – 108 MHz

### The 3-dB coupler can be used :

- as decoupled power splitter with a ratio of 1:1,
- for the decoupled combining of two transmitters with frequency spacing as narrow as desired (at 3 dB loss),
- for the decoupled combining of two receivers with frequency spacing as narrow as desired,
- for the decoupled combining of two transmitter/receiver units, whose integrated duplexers are within the same frequency range,
- as a frequency independent 90° phase shifter,
- as a combiner component.

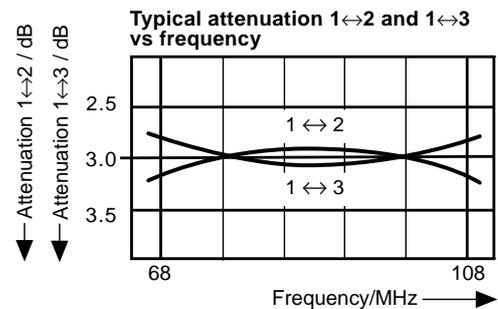
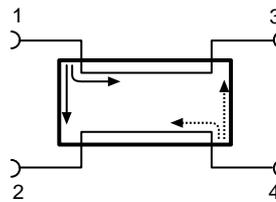


### Function:

The 3-dB coupler has four ports, two of which are decoupled from each other. For example effective power entering into port 1 is distributed into the ports 2 and 3. Port 4 is decoupled and without power if ports 2 and 3 are ideally matched. In practice an absorber of suitable power at port 4 is to be planned in accordance with the mismatch of ports 2 and 3.

Decoupled combining can be achieved via the diagonally opposite ports 2 and 3 respectively 1 and 4.

Any open ports must be terminated with suitable loads.



### Technical Data

Type No.	792 212 *
Frequency range	87.5 – 108 MHz
Max. power	1 kW
Attenuation	3 ± 0.4 dB
Directivity	> 35 dB
VSWR **	< 1.06
Impedance	50 Ω
Connectors	7-16 female, silver-plated
Material	Brass, silver-plated
Weight	2.3 kg
Dimensions (w x h x d)	885 mm x 40 mm x 84 mm (with connectors)
Colour	Grey (RAL 7032)

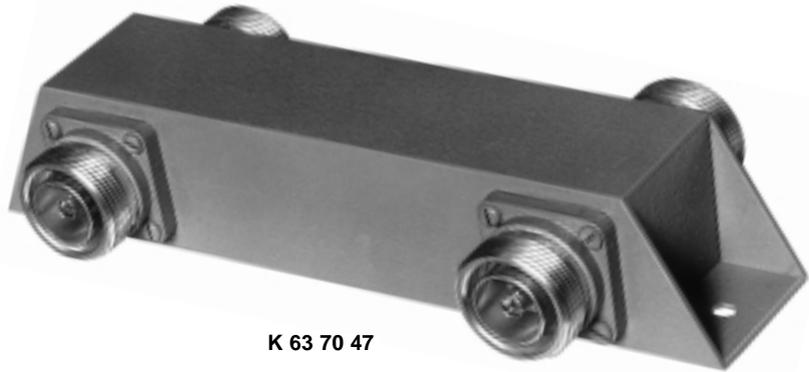
**Notes:** \* Structural part number 169 2139 is equivalent to type number 792 212.

\*\* VSWR and attenuation are measured when the remaining ports are terminated with 50 Ω loads.

# 3-dB Coupler (90° Hybrid) 470 – 860 MHz

**The 3-dB coupler can be used :**

- as decoupled power splitter with a ratio of 1:1,
- for the decoupled combining of two transmitters with frequency spacing as narrow as desired (at 3 dB loss),
- for the decoupled combining of two receivers with frequency spacing as narrow as desired,
- for the decoupled combining of two transmitter/receiver units, whose integrated duplexers are within the same frequency range,
- as a frequency independent 90° phase shifter,
- as a combiner component.



**K 63 70 47**

**Function:**

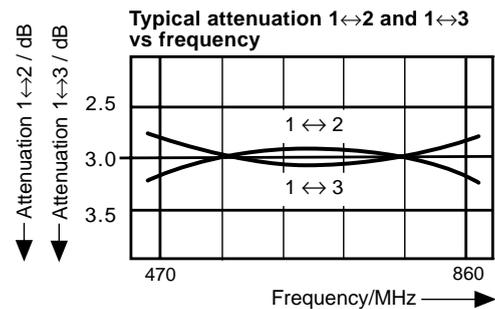
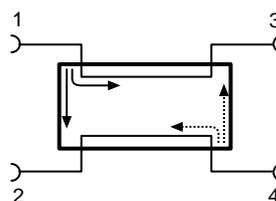
The 3-dB coupler has four ports, two of which are decoupled from each other. For example effective power entering into port 1 is distributed into the ports 2 and 3. Port 4 is decoupled and without power if ports 2 and 3 are ideally matched. In practice an absorber of suitable power at port 4 is to be planned in accordance with the mismatch of ports 2 and 3.

Decoupled combining can be achieved via the diagonally opposite ports 2 and 3 respectively 1 and 4.

Any open ports must be terminated with suitable loads.

**Customized version:**

On request couplers with a coupling attenuation between 3 dB and 10 dB are available.



**Technical Data**

Type No.	K 63 70 41	K 63 70 47
Frequency range	470 – 860 MHz	
Max. power	0.7 kW	
Attenuation	3 ± 0.6 dB	
Directivity	> 30 dB	
VSWR *	< 1.06	
Impedance	50 Ω	
Material	Brass, silver-plated	
Weight	0.7 kg	
Colour	Grey (RAL 7032)	
Packing size	215 mm x 115 mm x 47 mm	
Dimensions (w x h x d)	189 x 40 x 90 mm (with connectors)	189 x 40 x 84 mm (with connectors)
Connectors	N female, silver-plated	7-16 female, silver-plated

**Note:** \* VSWR and attenuation are measured when the remaining ports are terminated with 50 Ω loads.

# Switch-over Facility for 2 Switch Positions

The switch-over facility enables the reciprocal switching of two transmitters to either an antenna or a high power load.

The switch-over consists of a 19" front panel, four 1 5/8" EIA-flanges, corresponding interlock contacts as well as two 1 5/8" U-links.

The rearside points of connection are rigid line in design without an EIA-flange.

Interlock contacts are wired to the terminal block which is mounted at the rearside of the panel.

Switch position 1:

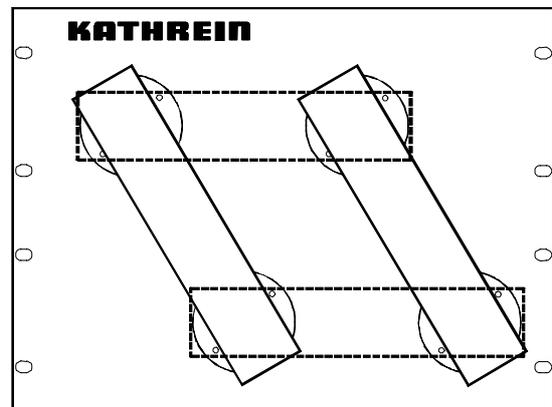
Transmitter 1 (active) – antenna

Transmitter 2 (passive) – high power load

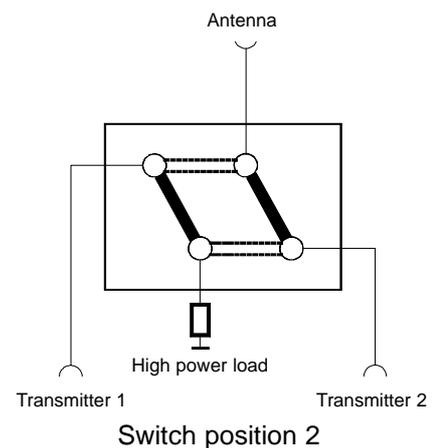
Switch position 2:

Transmitter 1 (passive) – high power load

Transmitter 2 (active) – antenna



793 162



## Technical Data

Type No.	793 162
Connections	4 x 1 5/8" EIA-flange (front) 4 x 1 5/8" rigid line, without flange (rear)
Interlock contacts	2 x change-over, per EIA-flange
Weight	15 kg
Dimensions	19" drawer (8 HU = 356 mm, depth = approx. 100 mm)
Packing size	600 mm x 400 mm x 200 mm
Colour	Grey (RAL 7032)

## **Customized Design**

Besides our standard versions we also manufacture many custom versions and combiner systems, which we adapt to your requirements or special operating conditions.



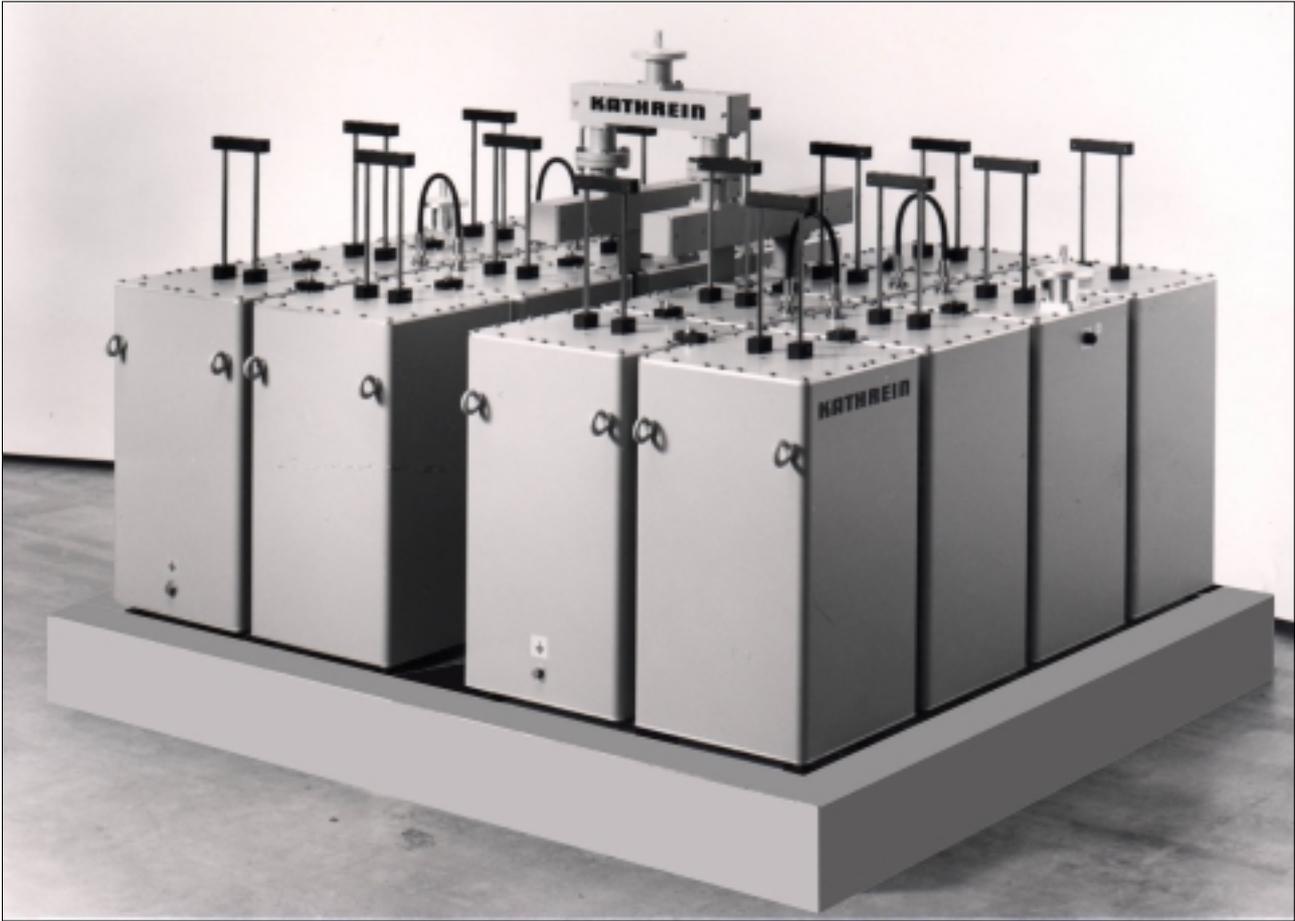
FM Starpoint Combiner, 6 x 3 kW



Directional Filter Combiner for Multipattern Application, 3 x 10 kW



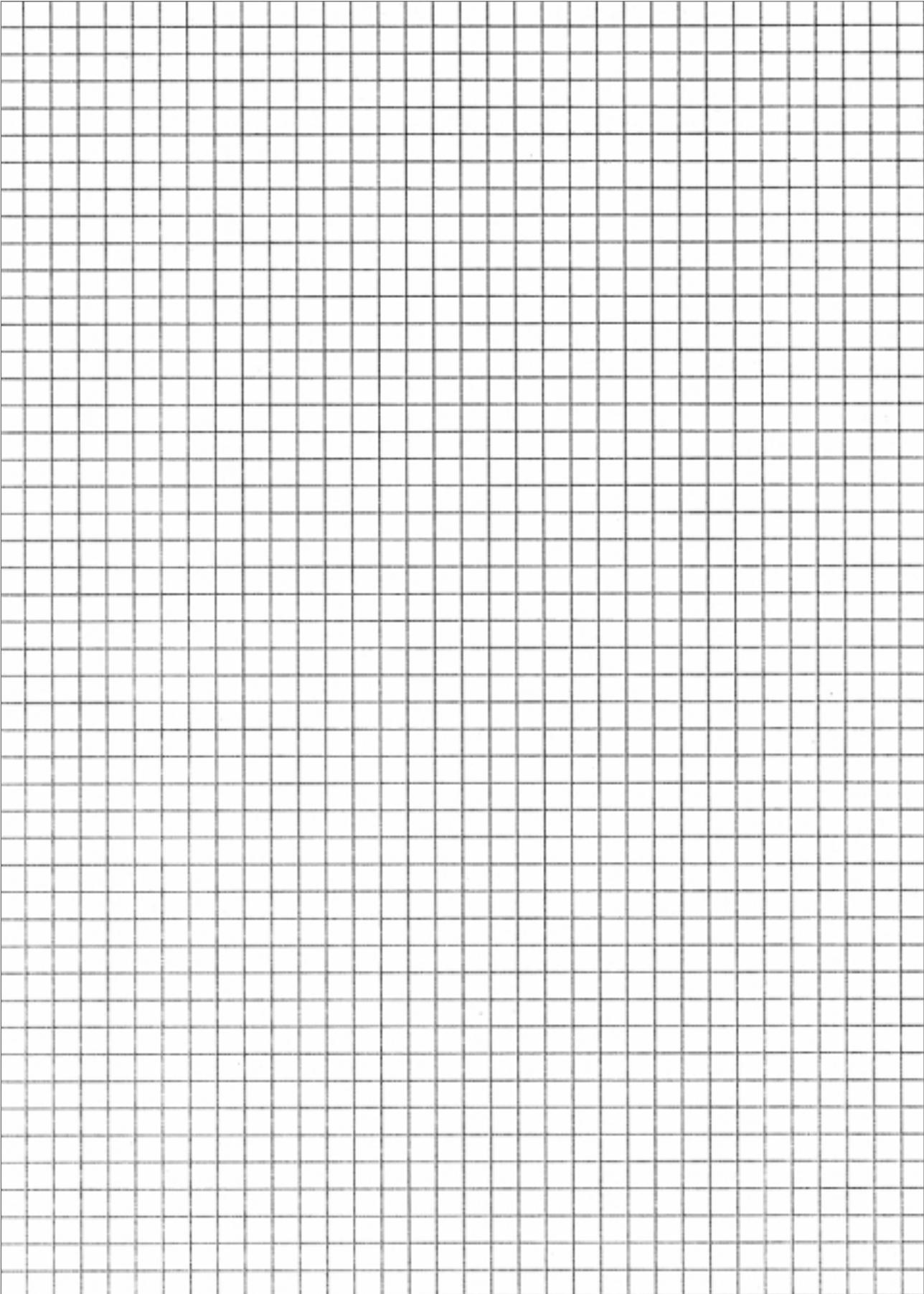
Directional Filter Combiner for Multipattern Application, 2 x 5 kW

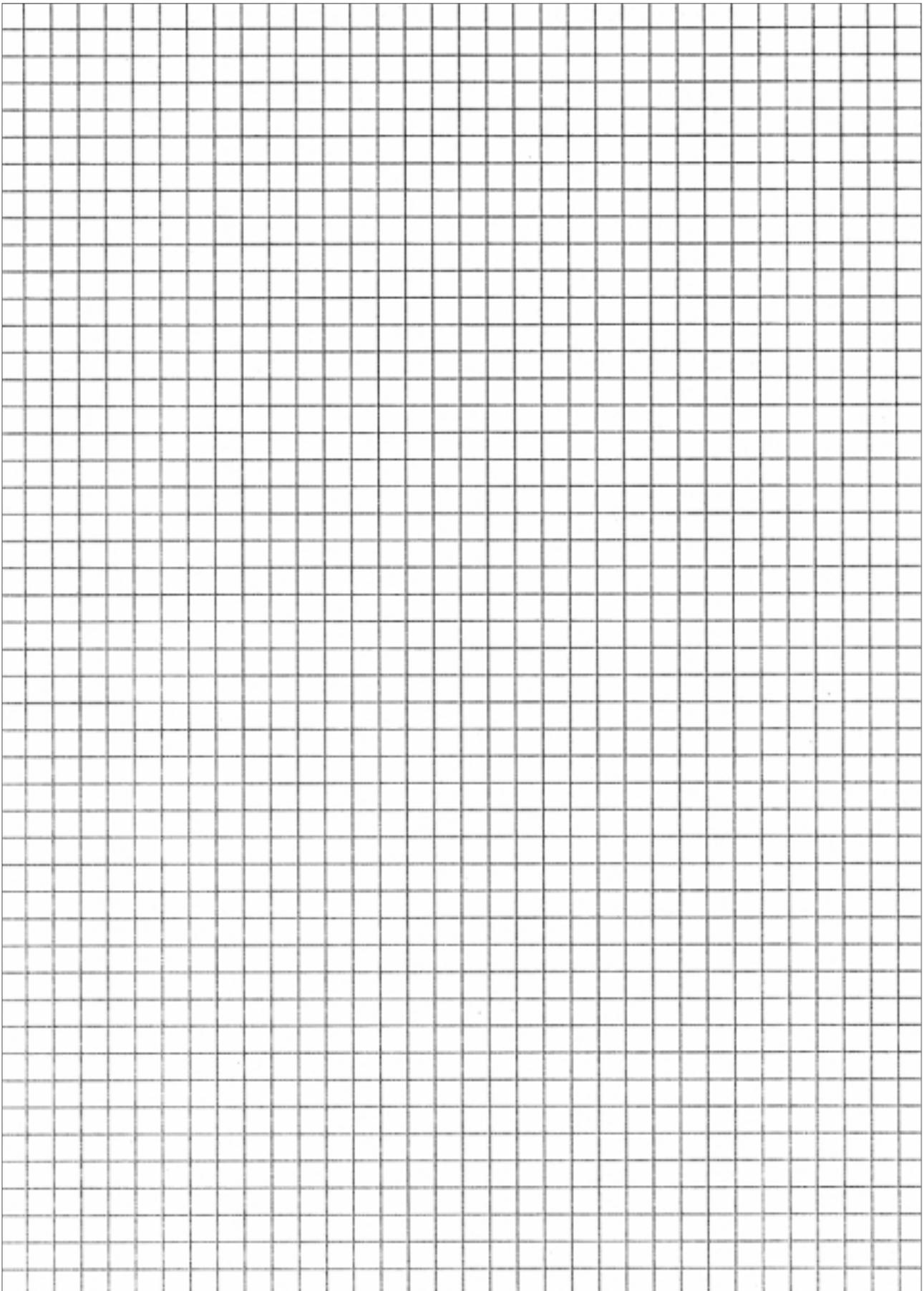


DAB Band III Starpoint Combiner, 2 x 2 kW, critical filter mask



UHF Stretchline Combiner 4 x 1 kW





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