Channel Combiners and Filters

A channel combiner is a passive RF device devoted to sum on a common output the signals produced from several different sources, keeping a high isolation between them, and minimizing ohmic and return loss.

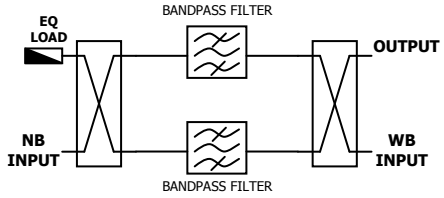
RYMSA manufactures channel combiners for all broadcast frequency ranges (B-I, B-II, B-III, B-IV/V), for analog and digital radio and TV applications, from low power to very high power applications, and displaying several different construction techniques. These techniques are frequently involving the use of filters, which type and response are key factors of the combiner performances.

RYMSA broadcast catalogue is compiling detailed information of a wide range of the most common standard products related to the field of channel combiners, though RYMSA's capabilities are not limited to them but also extended to provide custom solutions to any possible particular request, either modifying well-proven designs or developing brand new ones.

Constant Impedance Combiners

A constant impedance combiner, also known as balanced combiner or directional filter type, is composed by two identical filters, two 3 dB hybrids and a balancing load (equilibrium load), interconnected as shown in the figure. This single device is also known as diplexer "module" or "cell".

Narrowband input (NB) corresponds to the filters resonant frequency, whilst the wideband input (WB) admits any other signal within the working bandwidth, provided it is enough spaced from the resonance.



CONSTANT IMPEDANCE CONFIGURATION

The filters are usually bandpass type, either coaxial (TEM) or waveguide, and their selectivity is the parameter that defines the combiner behaviour in terms of channel spacing. An additional bandpass filter is sometimes used at the WB input of the cell, in order to achieve greater isolation between inputs.

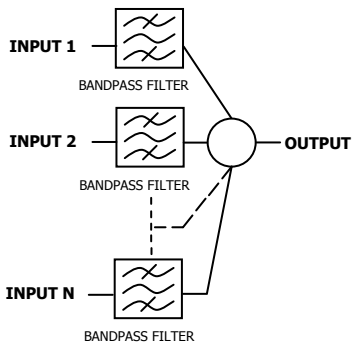
Due to their expandable nature by the cascade connection of several cells, constant impedance combiners are the most versatile solution, and offer the best performances from medium to high power levels. Generally speaking, almost any complex combining system, as those related to digital applications, are implemented using this technique.

Star Point Combiners

A star point combiner of N channels is built as the parallel connection of N bandpass filters to a common point where the output is located, each one tuned to one of the desired channel frequencies.

The system is able to work provided that at each filter output, all the N-1 remaining filters present an open circuit impedance. This normally leads to the use of transmission lines of different lenghts to connect the filters to the common output.

This sort of combiner results in a cost-effective solution, keeping many of the performances related with the use of filters, though without the expandable nature of the constant impedance type. Moreover, for a great number of channels, the system performances become difficult to achieve, and the star point topology starts to appear less attractive.



STAR POINT CONFIGURATION

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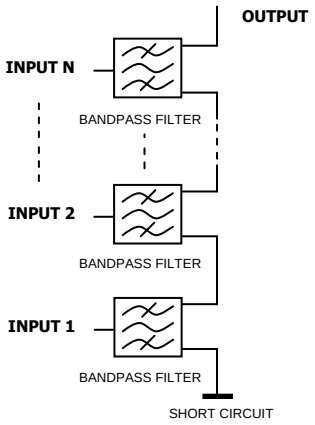
Channel Combiners and Filters

Manifold Combiners

In a manifold combiner of N channels, N filters are connected in parallel to a common transmission line, which displays one short circuit at one end and the system output at the other end. The overall performances depend on the position of the filters along the transmission line and on the distance to the short circuit.

The manifold is a lower cost solution than the constant impedance configuration, displaying the advantage of room saving, and retaining many of the performances related to the use of filters. It is expandable to a higher number of channels, but in a less easy way than constant impedance type, since the length of the transmission line and the filters allocation have to be recalculated.

The number of channels able to be implemented is greater than that achieved with the star-point configuration.



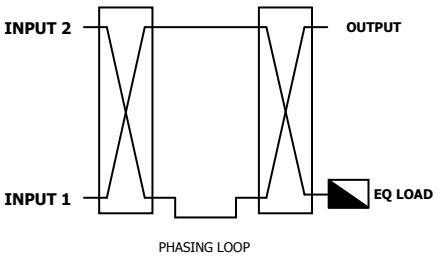
MANIFOLD MODULAR CONFIGURATION

Stretch Line Combiners

Stretch line combiners, also known as commutating line or loop-style, display a very simple approach built without the use of any filter.

The elementary two channels combiner is composed by two 3 dB hybrid couplers and a balancing load, connected as shown at the attached sketch. One of the two transmission lines interconnecting the hybrids contains a loop that supplies the phase shift required to produce the signal additions and cancellations that make the system work. The isolation between inputs is directly related to that of the hybrids.

With the advantage of neither showing group delay nor thermal drift, they are expandable only with limited versatility, since the spacing between contiguous channels must be constant. Additionally, their transmission performances are distorted the closest are the channels to combine.



STRETCH LINE CONFIGURATION

Filters

The previous description of RYMSA techniques to build channel combiners involve the use of a wide range of filters, which constitute by themselves a full line of RYMSA products.

Bandpass filters, coaxial (TEM) and waveguide, are the most frequent types forming RYMSA channel combiners. Iris-coupled, comb-line and interdigital are among the available design approaches. Dual mode technique for waveguide, and inter-cavity feedback coupling are applied when critical response is needed, as for digital applications. Other models such as lowpass, reject (notch type) and harmonic filters are available.

RYMSA develops the filters with the aid of several in-house and commercial software packages. First pre-serial units are submitted to stringent electrical and thermal tests in order to guarantee the response and stability of the series units.

This catalogue is offering technical information about RYMSA broadcast filters mainly through the channel combiners sheets. Additionally, specific sheets are also included for digital TV bandpass filters, which are the range most likely of being required today as an individual supply separated of the combiners.

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