**INTRODUCTION**

The 4-way Short Haul Control Station Combiners are broadband combiners which are used to reduce the number of antennas required on a communications site by enabling several radios to use just one antenna. Because the Control Station Combiners provide a high level of isolation between T/R ports, radio-to-radio isolation is maintained irrespective of antenna isolation characteristics. Also, radios operating on various bands, in either Tx or Rx mode, can be combined without risk of interference. Up to 64 radio can be combined by interconnecting various models of 4-way and 8-way Control Station Combiners.

**Mounting**

The Control Station Combiner is designed for indoor mounting only. It is dimensioned to fit a 1U rack space and should be mounted clear of any equipment that generates excess heat. Do not mount the unit inside small unventilated enclosures. Continuous operation with high power levels, exceeding the recommended power ratings and duty cycle ratings, will elevate the Combiner's operating temperature above the recommended maximum level which may lead to premature failure of the combiner.

**Earthing**

Connect an earthing strap from the chassis earth stud to an appropriate earth point to protect the Control Station Combiner from being exposed to high transient voltages.

**ANT Port**

The maximum signal level at this port should not exceed 0.5 W or 27 dBm. Please ensure that the antenna cable is properly grounded to prevent lightning transients causing damage to the unit.

**T/R Ports**

The maximum signal level at these ports should not exceed 50 W or 47 dBm. If a 50 W radio is connected to a T/R port then its duty cycle must be restricted so that the total power handling of the Control Station Combiner is not exceeded. Table 1 and the Derating Curves should be used to make sure that the Combiner will operate within its specified limits.

Unused T/R ports on the High Power Combiner can be left unterminated without affecting the performance of the Combiner.

Unused T/R ports on the Combiner Expander must be terminated to maintain a flat frequency response and good return loss at the antenna port.
Specifications

High Power Combiner
Frequency range: 40 - 960 MHz
Ins Loss – ANT to T/R ports: 27 ± 0.5 dB at 380 MHz, 28.5 dB max at 960 MHz
Isolation between T/R ports: > 60 dB typical
Maximum power levels: T/R ports - 50 W (47 dBm) - see Table 1
Temperature range: -30 to +50 °C (for 50 W dissipation)
- see Derating Curves for > 50 °C

Combiner Expander
As above except:
Ins Loss – ANT to T/R ports: 7 ± 0.5 dB @ 380 MHz, 8.5 dB max at 960 MHz
Isolation between T/R ports: > 20 dB typical
Maximum power levels: All ports - 0.5 W (27 dBm)

Power Handling
The High Power 4-way Control Station Combiner can dissipate a total of 50 Watts of power at an operating ambient temperature of 50 °C. This could be 4 inputs of 12.5 W continuous power or 4 inputs of 50 W power at 25% duty cycle. Other combinations of number of inputs, power and duty cycle are shown in Table 1 and can be calculated from the formulas below. For operation above 50 °C refer to the Derating Curves.

Table 1 - For operation up to an ambient temperature of 50 °C.

<table>
<thead>
<tr>
<th>Number of Inputs (N)</th>
<th>Power per Input (P)</th>
<th>Duty Cycle (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>25W</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>50W</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>20W</td>
<td>83%</td>
</tr>
<tr>
<td>3</td>
<td>50W</td>
<td>33%</td>
</tr>
<tr>
<td>4</td>
<td>12.5W</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>25W</td>
<td>50%</td>
</tr>
<tr>
<td>4</td>
<td>50W</td>
<td>25%</td>
</tr>
</tbody>
</table>

Formulas for calculating operating parameters for combiner operation at an ambient temperature of 50 °C:

\[ D = \frac{5000}{(N \times P)} \]
\[ P = \frac{5000}{(N \times D)} \]
\[ N = \frac{5000}{(P \times D)} \]

Where:
\[ D \] = Duty Cycle – in percentage (0 to 100)
\[ N \] = Number of inputs (1 to 4)
\[ P \] = Power per input - in Watts (1 to 50)

Derating Curves
The following derating curves specify the power that can be applied to each T/R input of the High Power Control Station Combiner for various duty cycles and various operating ambient temperatures.

Example: If four 25 W transmitters are operating at a duty cycle of 50% then the recommended maximum operating ambient temperature of the Control Station Combiner is 50°C.

Rack Mounting Considerations
For the High Power Control Station Combiner to achieve specified performance it should be mounted in a rack with a vacant 1RU space above and below the unit.
If only one 1RU space can be left vacant, either above or below the unit, then the combiners operating temperature will rise by an additional 5 °C.
If no 1RU spaces can be left vacant then the combiners operating temperature will rise by an additional 10 °C.