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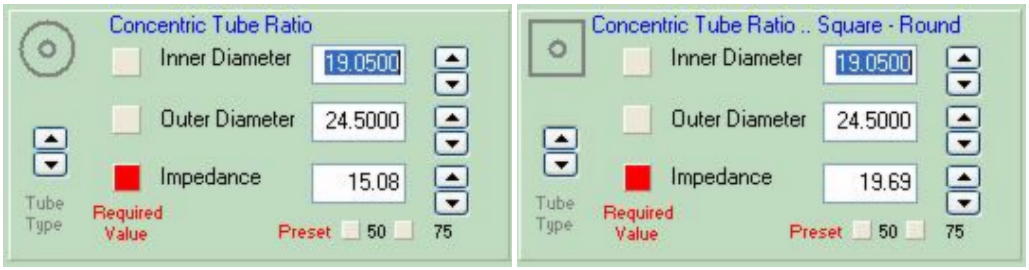
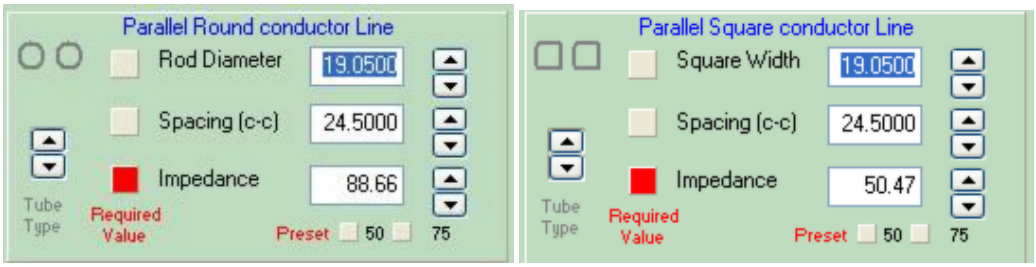
Concentric Tube Ratio

This will calculate the unknown value given two of the following known's, Impedance, Inner Diameter of Outer Conductor, Outer diameter of inner conductor. In the case of parallel round conductors, the two of the three (distance between the conductors, their centre to center spacing and the impedance) is required.

Calculations are provided for the following configurations





Calculation procedure

The default option is the *round tube outer with round tube inner*. (#1)

To select the other two options click on the up or down arrow directly above tube type. The display will change to illustrate graphically the option selected.

- Click on the required value to be calculated. Inner Diameter… Outer Diameter … Impedance

or in the case option of the parallel Conductor line

Rod diameter … Spacing (c-c = centre to centre) or impedance

The required value indicator will turn red.

- Next change the known values by typing in the figures or changing the value with the associated up/down arrows.

- Preset impedance values for 50 and 75 ohm are provided by clicking on the associated value which will turn red when selected or input the desired value from the keyboard.

The required value will be displayed and updated as the values are changed.

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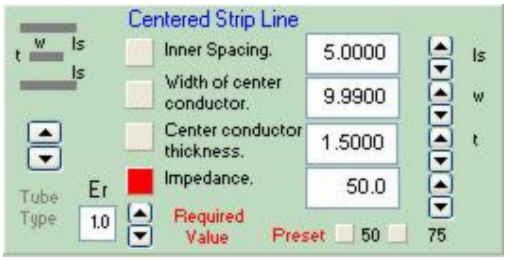
Centered Strip Line



This option provides calculations for a *centered strip line*. It has an application in the design of directional couplers and similar type applications. The value of Er (Relative Permittivity) may be varied as required. The default value is 1.00 (air). The *calculation procedure* is the same as that used for the *concentric tube* options.

Note … the *inner spacing* value is the distance between the inner conductor and the inside of the tube. In this application the inner conductor is central to the tube.

Range for valid parameters,
- the width of the centre conductor / inner spacing - thickness < 0.35,
- the thickness of the centre conductor / inner spacing <0.25 and,
- when Er is within the range of 1 to 15.

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Quarter Wave transition.

This option calculates the impedance transition value that is required for any number of Ports for any given value of input and output impedance.

Calculation procedure.

- Type in the required value of input impedance (Zin) and output impedance (ZOut)

- Select the number of Ports with the up / down arrows.

The required impedance transformation is calculated as Z required.

This value (Z required) can be automatically transferred to the *required impedance* in the Concentric Tube calculator by clicking the button provided.

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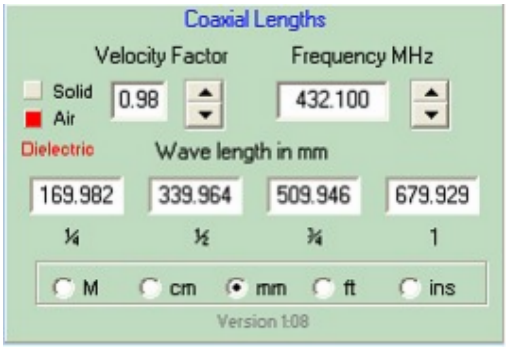
Coaxial Lengths

This option allows the user to calculate the physical length of a transmission line from ¼ wave length to one wave length.

- All Amateur bands are provided as well as the provision of being able to enter any specific frequency.

- Solid or Air dielectric are available as presets or any other specific value may be entered.

- Both Imperial and Metric calculations may be selected. Values provided are selectable as M .. cm .. mm .. ft .. ins.



Calculation procedure.

Select Solid or Air Dielectric by use the up / down arrow keys or enter from the keyboard the desired Velocity factor.

Select the frequency band of operation by the up / down arrow keys or enter from the keyboard the desired frequency.

Select the Imperial or Metric value most applicable to the calculation resultant display.

The length values for ¼ to 1 wavelength will be displayed above the respective designations.

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VSWR Calculator.

This option calculates the Reflected Power, Voltage Standing Wave Ratio (VSWR), and Return Loss given the inputs of Forward and Reflected Power.

In addition, by entering the Directional Coupler Directivity (in dB), the ± accuracy of the actual parameters is displayed as well as the Efficiency of the Directional Coupler in %.

In any Directional Coupler, Directivity (dB) = Isolation (dB) - Coupling (dB)

In a dual directional coupler where the

Input Port is P1

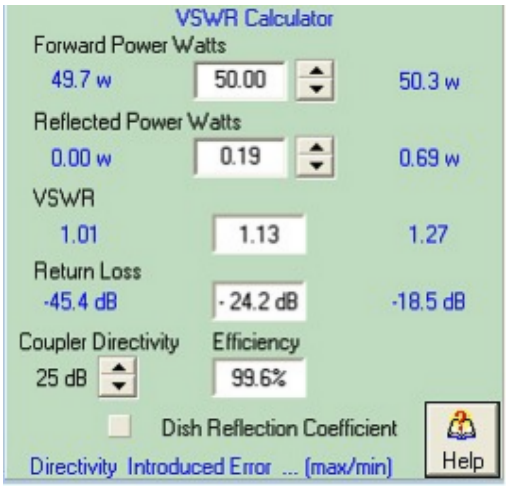
Output Port is P2

Forward Port is P3

Reflected Port is P4

then ... Isolation is measured between P1 and P3 (dB) Coupling factor is measured between P2 and P4 (dB)

In the case of Bird43 watt meter elements Directivity is quoted as being between 28dB to -25dB (worse case).



Calculation procedure.

Enter the Forward and Reflected Power indicated by the Directional Coupler.

Enter the Directional Couplers' Directivity with the associated up / down arrow keys.

The calculated values (Minimum error .. actual instrument reading .. Maximum error) for Forward and Reflective Power, VSWR and Return Loss are then displayed.

Note … the *Dish Reflection Coefficient* button selects that option.

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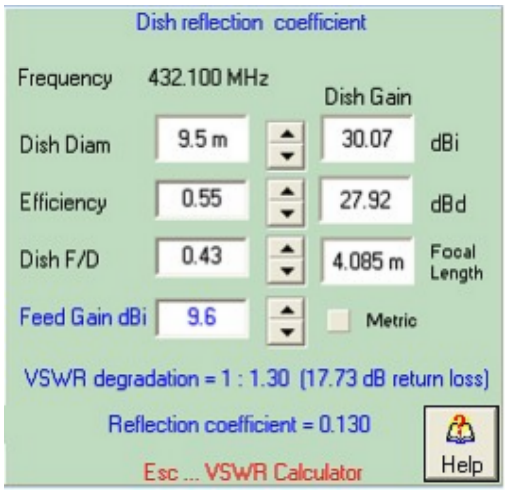
Dish Reflection Coefficient

(selected from VSWR Calculator screen)

This option calculates the values of Dish Gain in dBi and dBd, the Focal Length, the Reflection Coefficient and VSWR degradation in both VSWR and dB return loss.

The input variables are Frequency (selected from Coaxial Lengths panel), Efficiency, Dish f/d (focal length / dish diameter) and Feed Gain.

Metric and Imperial values can be selected by clicking the associated Button.



Calculation procedure.

Select or enter the frequency required from the Coaxial Lengths Panel.

Enter, using the up / down arrow keys, the Dish Diameter, Efficiency, f/d, and Feed Gain values as appropriate.

The Dish Gain in both dBi and dBd, Focal Length, the Reflection Coefficient and VSWR degradation, in terms of VSWR and dB return loss, are then displayed.VSWR degradation is a result of the **reflection coefficient** introduced by the presence of a paraboloid. It is derived from,**reflection coefficient = Gain of the feed * wavelength/4*Pi*focal length**

Reference ... Peter Blair (G3LTF) Modified Dual Dipole Dish feed for 432 MHz EME Conference, Trenton 2002.

In designing a feed this figure is helpful to modify the feed impedance to match the reflection coefficient and thus obtain a unity match. This can take the form of dielectric stubs when dipoles are used.

Additional information

The Gain of the feed (radiation pattern) is important so that the illumination of the dish commensurate with its size and f/d. It should be chosen to provide the correct illumination of the dish. Too high a gain will under-illuminate the dish and

result in a lower gain. However this will result in a lower antennae noise temperature which may offset the decrease in Antennae gain but an improvement in usable System sensitivity. Too little gain will over illuminate and result in a higher degree of spillover and thus will decrease the noise temperature of the dish. Radio Astronomers prefer to under illuminate their dishes whilst most Amateurs strive for maximum gain. A 10dB edge taper is considered as a good compromise for Amateurs with smaller dishes but those with larger reflectors often use a 11-15dB taper for lower Antennae temperature and thus achieve a better overall system performance. In this calculation Dish Gain is not effected.

It should be noted that the **feed gain** as used in the above calculation **does not necessarily relate** to the **antenna pattern and illumination taper**.

To return to the VSWR screen use the [Esc] key.

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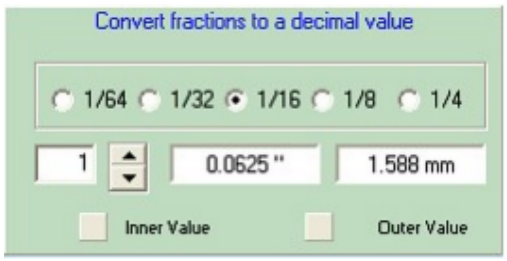
• Convert Fractions to a decimal value.

This option provides a means of converting fractional values to decimal values and transferring the value to the Concentric Tube calculator.



Calculation procedure.

- First select the fractional denominator from the five options available.(1/64 to ¼)

- Next select the numerator value of that fraction with the up / down arrows.

The value will be displayed in Imperial and Metric in the boxes provide.

Should you require a value greater than 1 unit, then use numerator multiples greater than the denominator to derive the required value.

E.g. 12/4 = 3.000” .. 76.200 mm

Click on the Inner Value or Outer Value buttons to transcribe that value into the Concentric Tube calculator.

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Author

This program is written by Doug McArthur (VK3UM) ©

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Author Doug McArthur and 28ft Kenedy High Performance dish with dual 23 and 70cm feeds, shack and working platform.

This dish is mounted on a Centurian Tank mount with speed proportional controlled Azimuth Motor (24v @ 85A) and Elevation consistiong of 2 x 12 ton hydraulic rams.

Tracking by VK3UM Autotrack with US Digital Absolute encoders providing 0.1 degree absolute resolution. Weight in excess of 2 ton with 18cM of concrete foundations.

Designed to with stand winds of > 160kph (and has!). Situated on a ridge line 15 meters wide sloping at 60 degrees for 200 meters. Two degree blockage on Moon rise and zero

degrees on Moon set. (Hills in background are to the South)

Updated ... January 2009

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Acknowledgements

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