Microwave signal:
\[ f : \quad 300 \text{ MHz} \rightarrow 300 \text{ GHz} \]
\[ \lambda : \quad 0.1 \text{ cm} \rightarrow 100 \text{ cm} \]
\[ (\lambda = c/f) \]

Rectangular Waveguide

X-band waveguide
\[ a = 22.86 \text{ mm} \]
\[ b = 10.16 \text{ mm} \]
(called WG-16 or WR-90 or R-100)

\( TE_{10} \) mode is the dominant mode.

\( (f_c)_{TE_{10}} = \frac{u}{2a} = 6.6 \text{ GHz} \)

\( (f_c)_{TE_{01}} = \frac{u}{2b} = 14.8 \text{ GHz} \)

\( (f_c)_{TE_{20}} = \frac{u}{a} = 13.1 \text{ GHz} \)

\[ \text{operating range for single dominant mode} \quad 8.2 \rightarrow 12.4 \text{ GHz} \]
Gunn oscillator: our signal source. 
\[ f = 10.5 \text{ GHz}, \ P_{\text{out}} = 10 \text{ mW} \]

Gunn diode: GaAs or InP
usually placed inside a cavity.

\[ \text{Unstable region} \Rightarrow \text{emission of mm-wave signal} \]

\[ V_0 \] (threshold voltage)
\[ (E = 1000-2000 \text{ V/cm}) \]

will draw next week!

Upto 140 GHz Gunn diodes have been built. \( P_{\text{out}} = 100 \text{ mW} \) level.

The Gunn power supply is used to supply the voltage across the diode.
- Variable attenuator
  (Side vane attenuator)

  Used to reduce (control) power level.

  $A = 10 \log \left( \frac{P_1}{P_2} \right), \quad P_1 > P_2$

  Resistive coating on the fiberglass blade.

  Will calibrate in Exp. #4 & will explain its principle of operation.

- Thermistor mount:

  Thermistor is a semiconductor that has a negative temp. coeff.

  $R$ vs. $P_{\text{mW}}$

  As temp $\uparrow \Rightarrow R \downarrow$
. Movable short & matching screws are adjusted to match the thermistor to the waveguide (i.e., to get max. needle deflection on the meter).

. Discuss Fig. 2.2 in Ex. #2 !!

. Zeroing between readings & range changes has to be done. When zeroing is done, thermistor has to be connected to the power meter with power off.

\[ \mu \text{-wave} \]

. \( P (\text{dBm}) = 10 \log \frac{P}{1 \text{ mW}} \)

. \( P (\text{dBW}) = 10 \log \frac{P}{1 \text{ W}} \)

. \( P (\text{mW}) = 10 \left( \frac{P (\text{dBm})}{10} \right) \)

0.1 mW = -10 dBm, 1 mW = 0 dBm, 20 mW = 13 dBm.

Simplifies calculations !!