

## **Basic Antenna Experiments With a Cheap X Band Rectangular Waveguide Bench**

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In modern microwave and antenna courses, both at undergraduate and postgraduate levels, it is important to complement analytical and simulation techniques with laboratory experiments. The “hands on” laboratory activities provide an important and unique way of developing physical insight of the main antenna characteristics. There are many antenna laboratory guides available online. The complexity of the experiments depends on the associated course level (undergraduate, MSc or PhD), but the cost of the required equipment is always high if the main antenna parameters are measured.

X band rectangular waveguide benches have been used since long ago in microwave and antenna laboratories. Many and varied experiments can be conducted with very compact setups. However these traditional didactic benches are very expensive. Nowadays there are many manufacturers, mostly from India, offering didactic microwave benches at much lower and affordable cost. A typical configuration for basic microwave and antenna experiments can cost about 2000 USD, which is about a tenth of the cost of a similar bench bought from a traditional manufacturer. Inevitably, the cheaper equipment and components have a lower accuracy but it is good enough for most of the basic antenna and microwave experiments. Moreover, they are more fragile and less durable which requires extra care while manipulating them.

One of the above mentioned cheap X band rectangular waveguide benches have been bought and is used in an undergraduate antenna laboratory. The following characteristics are measured:

- Frequency
- Guided and free space wavelengths
- Input impedance
- Radiation pattern (for both E and H planes)
- Gain
- Polarization loss factor
- Bandwidth

Detailed information on the setup configuration and measurement procedures used will be presented at the conference. Assessment of the accuracy of the results obtained will also be given. A pyramidal horn and a half-wavelength dipole will be used as illustrative examples.