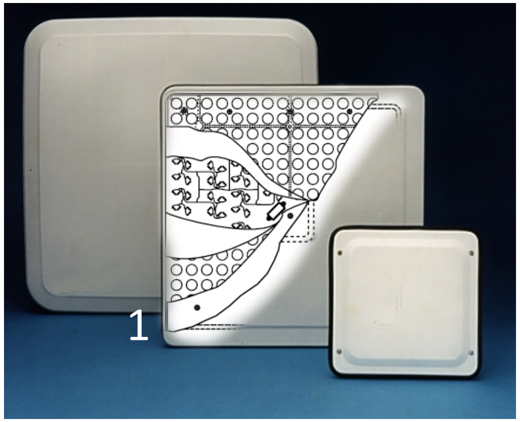
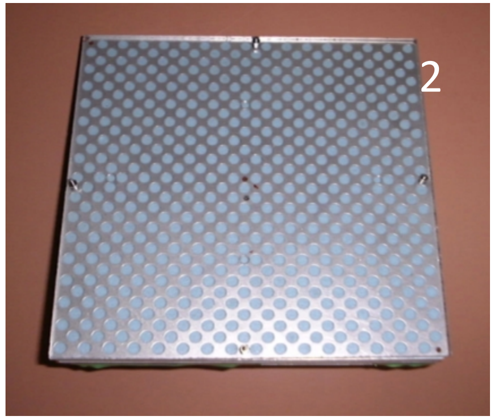
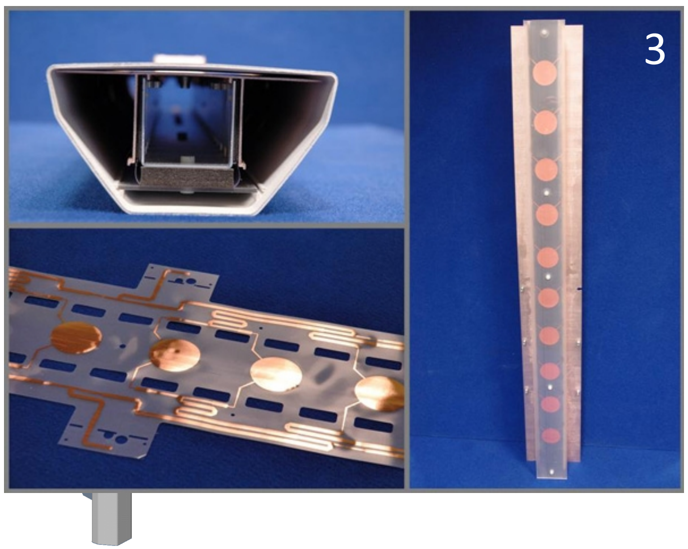
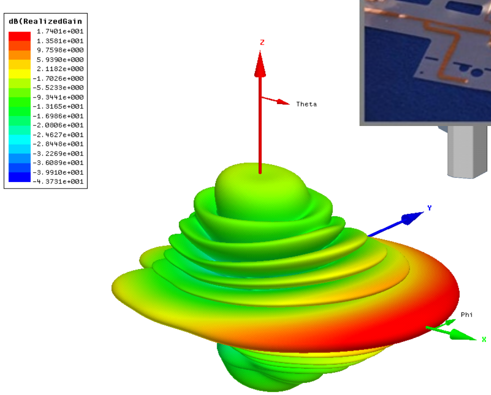
Low Cost Antennas – Cheap but not too nasty





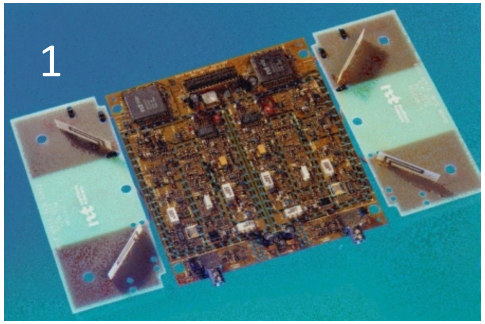


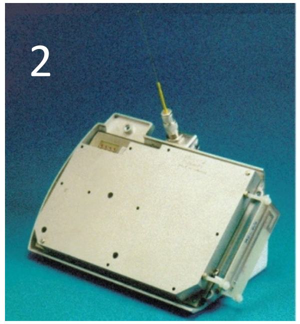


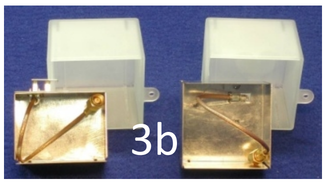
- **‘Flat Plate Antenna’ technology was first developed by STC in 1989 and used low cost printed flexible pcbs sandwiched between perforated ground planes to form large planar arrays. The first antennas targeted 12GHz DBS TV reception for BSB and included dual linear and circularly polarised solutions. In later years the same principles were used at millimetric frequencies and more recently for cellular basestation antenna products and technology demonstrators.**
- **The early DBS antennas were developed before the days of sophisticated CAD tools and many iterations (~40!) of the designs were required before the specification was met. Nowadays 3D RF modelling packages allow physical prototyping to be reduced to a minimum with the resulting designs often being essentially ‘right first time’**

4. **BSB 12GHz ‘squarial’ Flat Plate Antenna (FPA)**
5. **Millimetric FPA**
6. **A lightweight 2.5GHz basestation antenna using plastics, films and extruded aluminium along with its modelled radiation pattern**

Integrated Antennas – Out of sight out of mind



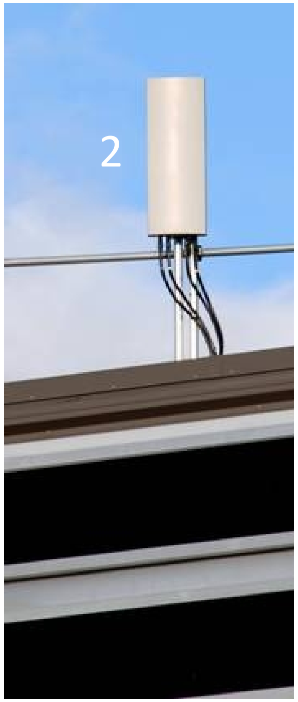




- **Antennas must often be integrated into a device – a handset, a wall or desk mounted telephone basestation, an access point, a laptop**
- **Antenna and system performance has to be maintained and optimised in the presence of electronics, chassis, case and often the user**
- **Other factors must also be considered. 'Uncorrelated' performance will be required of multiple antenna systems to provide diversity against multipath fading and supports MIMO in 4G systems. For handsets radiated levels inside the users body must be controlled requiring modelling and measurement techniques**
- **The antenna is often the poor relation when it comes to being allocated room inside a device and this inevitably leads to challenges in meeting bandwidth and efficiency. Innovation is often required!**

6. **CT2 basestation – twin radios with antenna diversity**
7. **450MHz Fixed Wireless Access terminal**
8. **5GHz transit link (3a) and 2.4GHz access link (3b) antennas for Wireless Mesh product**
9. **4-antenna MIMO laptop concept**

Multi-beam antennas – Bigger can be better



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- Multibeam antennas played a significant part in STC/Nortel's plans from the mid 1990's onwards and a variety of designs were developed for different applications
- An initial 20-beam solution helped provide the principal of beamforming for cellular deployments whilst later developments aimed to reduce the size and complexity of the antenna. A compromise has to be struck between potential performance gains and the size, weight and complexity of the antenna and other issues such as handing mobile traffic from one beam to another as it passes through a cell site
- A three column 4-beam design was trialled in Haifa (see other poster), a six column 3-beam product (AABS) was developed for North America and in 2009 Nortel was developing a three column 2-beam solution for 4G systems

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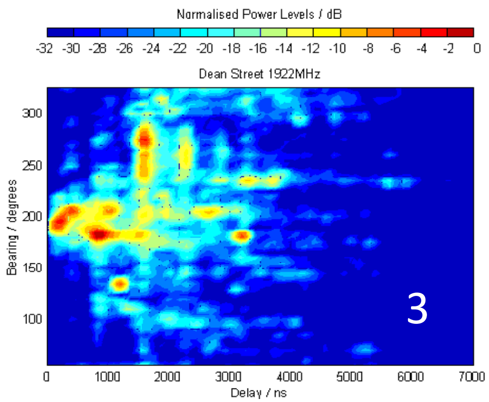
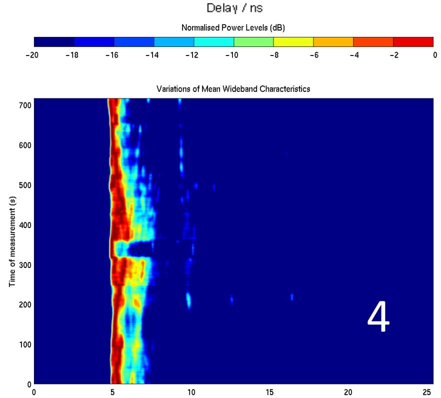
- Prototype 8 column, 5-beam array in Harlow Anechoic Chamber
- AABS 6-column, 3-beam product
- Fiona Wilson contemplates the 3-column 4-beam 850MHz array deployed in Haifa
- AABS 'disguised' as a tree

RF Propagation





- To be most effective antennas must be matched to the RF channel in which they are to operate
- The Harlow group had a long history of conducting propagation trials in a variety of environments around the UK. These characterised the channels in question so a fundamental understanding could be developed. This in turn allowed the antenna to be optimised and system performance to be determined through modelling
- Trials always introduce the chance of the unexpected occurring: being mistaken for a TV detector van, being asked to stop selling burgers in Hyde Park, setting off every BMW car alarm in the street, and loitering on street corners in Soho, all in the cause of science

- Andrew Urquhart sets up the aperture analyser Edinburgh
- What not to do with a Landrover (26GHz FWA)
- A scatter map from central London showing angle of arrival, signal level (dB) and delay (nanoseconds)
- The wideband channel as a function of user location, central London. Signal strength (colour/dB) is plotted vs delay in microseconds. The vertical axis shows user moving through street: direct line of sight apparent at ~330s