Observations on the reception of Ka band signals.

Problems, causes and their solutions.

Dr Richard Holliday,
Elite Antennas Ltd.

Observations.

- During the course of visits to six teleports in Europe all the users of Ka band receive systems expressed disappointment with the performance and spoke of the problems they experienced. These largely fell into three categories.

Problems

- The main problems expressed were:-
- Interference from adjacent cells.
- Lack of cross polar isolation.
- Weather outages.

Measured components.

- The problem of cross polar isolation from adjacent cells seems to be a common factor.
- We examined a number of commercial Ka band feed assemblies.
- All lacked good cross polar performance over the receive band showing cross polar isolation of only 10 to 15 dB over the majority of the band peaking at 25 to 30 dB over a very narrow part of the band.

Analysis of the problems.

- The common factor in all the feed assemblies examined was the dielectric plate polariser. These have narrow band properties and are more often than not being used outside their optimum frequency range.
- Poor wideband performance of the OMT's.
- Poor return loss of components over the band.

Implications for cross polar isolation.

- The performance of the polariser is affected by the match of the feed and the OMT.
- The phase and amplitude of the reflections from components adjacent to the polariser will alter the axial ratio as well as the frequency response of the feed assembly.

Solutions.

- Change the polariser type e.g. septum polariser, corrugated waveguide polariser, or other wideband structures; or a tunable polariser.
- Improve the return loss of all components over the whole band.

Results & Summary.

- Several solutions were tried but the best results were obtained by designing a corrugated waveguide polariser. This gave a good axial ratio over the whole receive band (17 GHz to 22 GHz) resulting in a minimum cross polar isolation of 28dB at the lower band edge rising to 60 dB at 18.75GHz and remaining >40 dB to 22GHz.

- A wideband feed was designed giving a return loss of >35dB over the band.
- The OMT was designed to have a return loss of >25dB over the band.

- Finally weather outages:-
- We suggest a larger Antenna with more gain to give a greater margin.