DSP Rx antenna combiner project 09112018

Proposal for DTU master project ‘DSP Rx antenna combiner’

Background:
“VSAT” equipment is used for maritime satellite communications. VSAT operates in the Ku or Ka microwave bands, and is based on an approx. 60-100 cm diameter reflector antenna. The modulated signal format is most often based on the DVB-S2 or DVB-S2X standard.

VSAT systems use very large and heavy aperture antennas in order to obtain high performance. Cobham is starting to investigate the possibility to combining multiple small maritime VSAT antennas on a ship to achieve better signal to noise ratio (C/N). By using two antennas it is possible to improve the performance by up to 3dB

Various signal processing techniques are today used to combined signals from multiple antennas. Examples are Equal Gain Combining [EGC] & Maximal Ratio Combining [MRC], but these algorithms have usually been applied in different contexts.

One of the specific challenges on a ship is that the antennas are typically placed far apart. There is accordingly a large signal delay between the antennas. This signal delay will follow the ships movements, ‘roll’, ‘pitch’ and ‘yaw’.
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Project elements:

- A simple simulation model of the physical path length difference between the satellite and the two antennas on a ship shall be developed.
- An optimal way to combine the two DVB-S2 satellite signals, using signal processing algorithms, shall be described and simulated together with the model for ship movements. Inspiration could be in existing algorithms (EGC, MRC).
- The project may include a prototype design.

The signal processing part shall include:

- Estimation and tracking of delay between the two modulated microwave signals, taking into account receiver noise.
- Estimation and tracking of the phase difference of the two modulated microwave signals, taking into account receiver noise.
- Delay and phase rotation of one signal before combining the signals.

If you would like to know more about projects, please feel free to contact Peter Madsen, Cobham or Prof. Søren Forchhammer, DTU Fotonik

Søren Forchhammer, DTU Fotonik, B.343/R.114, sofo@fotonik.dtu.dk, 45253622.

Peter Madsen
Director Technology R&D
Cobham SATCOM
T : +45 3955 8831
peter.madsen@cobham.com

Thrane & Thrane A/S trading as Cobham SATCOM, Lundtofegaardsvej 93 D, DK-2800, KGS. LYNGBY, Denmark. +45 3955 8800
www.cobham.com/satcom