Technical Case study

The Aprisa XE's near non-line-of-sight performance

It is often expected that high reliability point-to-point linking requires obstruction-free paths. The Aprisa XE is the exception. The design features and performance of the Aprisa XE allow the provision of carrier-class linking over paths with significant levels of obstruction, previously only considered linkable through alternative technologies, such as VSAT.

4RF has been very successful in linking near non-line-of-sight and heavily obstructed paths, often achieving performance in excess of previous installed analogue systems and other alternative technologies.

It is not possible to make every single link, but to achieve such high levels of performance, precision planning is key. Even where a link falls short of carrier-class availability, the improvement in throughput, latency and availability achieved compared to VSAT typically makes the Aprisa XE the preferred solution.

Challenges

There are many challenges in achieving a near non-line-of-sight link. Obstructions in the path cause the signal to diffract, distort and reduce in strength, and the radio equipment is faced with the challenge of mitigating the impacts of the obstructions. There are several aspects to consider when working with obstructed paths, the most important of which are:

- Type of obstruction: whether the obstruction is a Fresnel obstruction, a line-of-sight obstruction or a knife-edge obstruction
- Level of loss or diffraction caused: 4RF has design limits for the various types of loss, exceeding what is assumed possible within the industry. In some cases a link can overcome an obstruction loss in excess of 20 dB, and still achieve carrier-class performance
- Geoclimatic and other path factors: whether or not the path is located in a challenging linking environment

While heavily obstructed paths can limit the use of higher order modulation schemes, carrier-class performance is still possible with precise and detailed planning.

Overcoming obstructions

- Frequency bands of operation
- Modem adaptive equalization and forward error correction
- Extensive design experience and accurate link planning

What makes the Aprisa XE different?

There are a number of key factors that enable the Aprisa XE to perform effectively over heavily obstructed paths:

- Frequency bands of operation
- Modem adaptive equalization and forward error correction
- Extensive design experience and accurate link planning

Frequency bands of operation

The lower the frequency, the less effect an obstruction will have on a link. 4RF's use of sub-3 GHz bands provides the perfect balance of distance, capacity and availability for use in obstructed paths, particularly when compared with higher frequency bands.

Modem adaptive equalization and forward error correction

The Aprisa XE uses multi-tap adaptive equalization combined with forward error correction (FEC) to cancel phase distortion that can occur as a result of diffraction and then correct any resultant errors. This, combined with the high stability of the RF platform, provides a much higher level of performance than typically expected.

Extensive design experience and accurate link planning

4RF has significant experience in designing and deploying links with obstructed conditions. This is critical when predicting performance and making recommendations for the linking system. 4RF's design criteria allow for relatively high levels of obstruction loss, while other equipment providers can only provide links where there is very low or no obstruction loss at all.

4RF can provide detailed engineering reports for individual links, highlighting recommended solutions including performance expectations, any limitations and suggested improvements to maximise performance over these challenging paths.

Obstructed path examples

4RF has deployed radio links for a large variety of obstructed paths. Two such examples follow, both of which have been commissioned and are providing service. The two links discussed in this document are:

- A link for British Gas in Tunisia with Fresnel obstruction
- A link for Contact Energy in New Zealand, with knife-edge line-of-sight obstruction

Types of obstructions

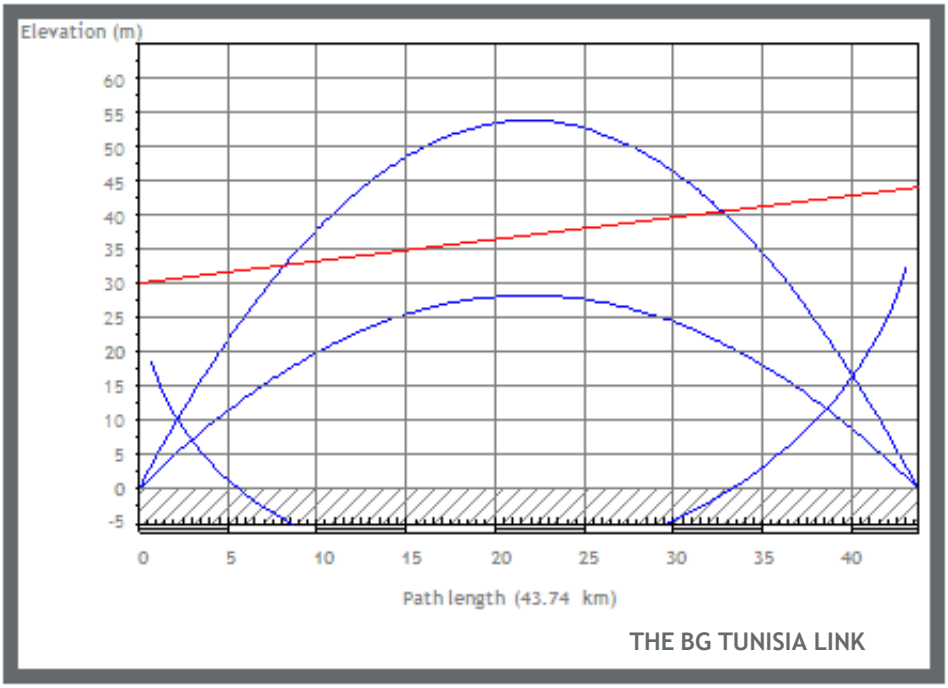
The Aprisa XE can overcome a variety of obstructions, including:

- Fresnel obstructions
- Line-of-sight obstructions
- Knife-edge obstructions

Aprisa XE

BG Tunisia

4RF has deployed an Aprisa XE link in the 1400 MHz band for British Gas Tunisia. The long, even nature of the Fresnel obstruction is a worst case scenario for microwave linking, as it results in a much greater amount of signal loss than sharp knife-edge obstructions. Despite the deployment obstacles, this over-water link off the Tunisian coast line in the Mediterranean Sea has consistently performed well throughout its six years of operation.



THE BG TUNISIA LINK

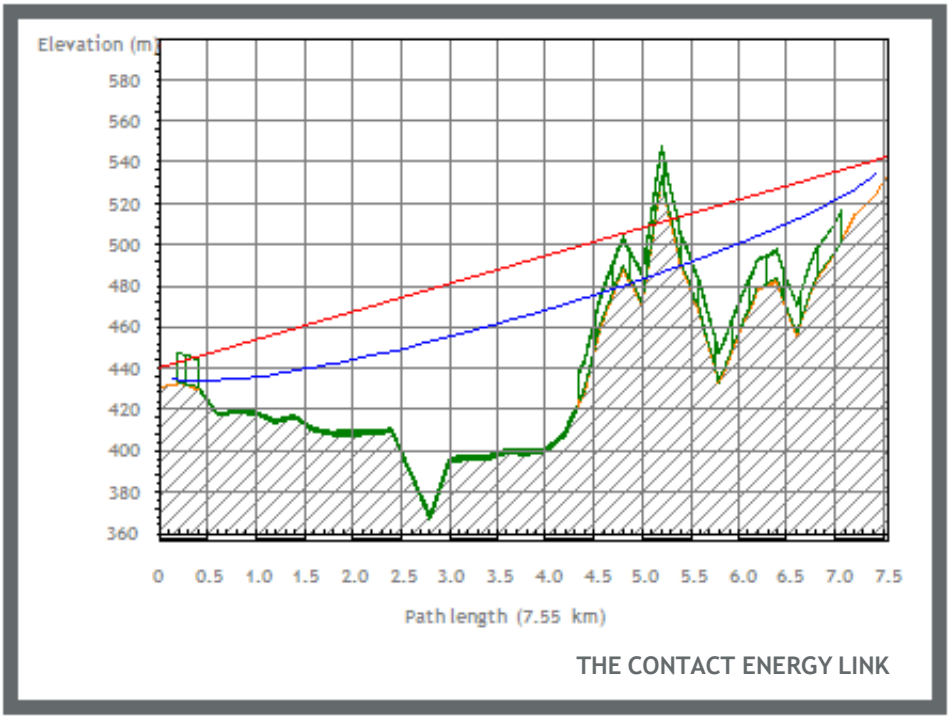
BG Tunisia's Miskar oil field in the Mediterranean Sea

BG Tunisia link details			
Frequency (MHz) = 1450.0			
K = 1.33, 0.70			
%F1 = 100.00			
Ashtart end of link		**Miskar end of link**	
Latitude	34 17 42.00 N	Latitude	34 22 33.90 N
Longitude	011 24 12.20 E	Longitude	011 52 06.80 E
Azimuth	78.00 degrees	Azimuth	258.26 degrees
Elevation	0 metres ASL	Elevation	0 metres ASL
Antenna CL	30.0 metres AGL	Antenna CL	44.0 metres AGL

Aprisa XE

Contact Energy in New Zealand

The link 4RF deployed for Contact Energy in New Zealand is an example of a knife-edge line-of-sight obstruction. Although the obstruction completely obscures line-of-sight, the diffraction loss achieved with the Aprisa XE radio system has fallen inside design limits. The link, operating in the 800 MHz spectrum band, has exceeded the target availability for more than three years.



THE CONTACT ENERGY LINK

Contact Energy link details			
Frequency (MHz) = 825.0			
K = 1.33, 0.55			
%F1 = 100.00, 100.00			
TH6 end of link		Trig A end of link	
Latitude	38 39 53.40 S	Latitude	38 36 52.20 S
Longitude	176 06 44.58 E	Longitude	176 03 14.70 E
Azimuth	317.73 degrees	Azimuth	137.77 degrees
Elevation	431 metres ASL	Elevation	533 metres ASL
Antenna CL	9.0 metres AGL	Antenna CL	9.0 metres AGL

ABOUT 4RF

Operating in more than 130 countries, 4RF provides radio communications equipment for critical infrastructure applications. Customers include utilities, oil and gas companies, transport companies, telecommunications operators, international aid organisations, public safety, military and security organisations. 4RF point-to-point and point-to-multipoint products are optimized for performance in harsh climates and difficult terrain, supporting IP, legacy analogue, serial data and PDH applications.

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