InfiNet Wireless

units for the harshest environments & long range links

Application Notes

Abstract

Advancement of technology permitted the automation and close monitoring of many industrial and public sector activities. Many of those activities take place in remote areas, with scarce infrastructure and sometimes deployed in demanding climatic conditions.

Some of the wireless broadband deployments are done in order to carry SCADA (supervisory control and data acquisition), a telemetry control system, or to perform monitoring of infrastructures, such as oil or gas pipelines, road monitoring, many implementations requiring long range radio links in order to connect between remote locations.

Introduction

The purpose of this document is to highlight the features of InfiNet Wireless broadband wireless equipment, features required in implementations deployed in harsh environmental condition, high security areas and remote locations.

In these special scenarios, a wireless equipment must cope with high level of environmental stress, from low temperatures (as low as -55°C), elevated humidity, sand and high temperatures (as high as 60°C).
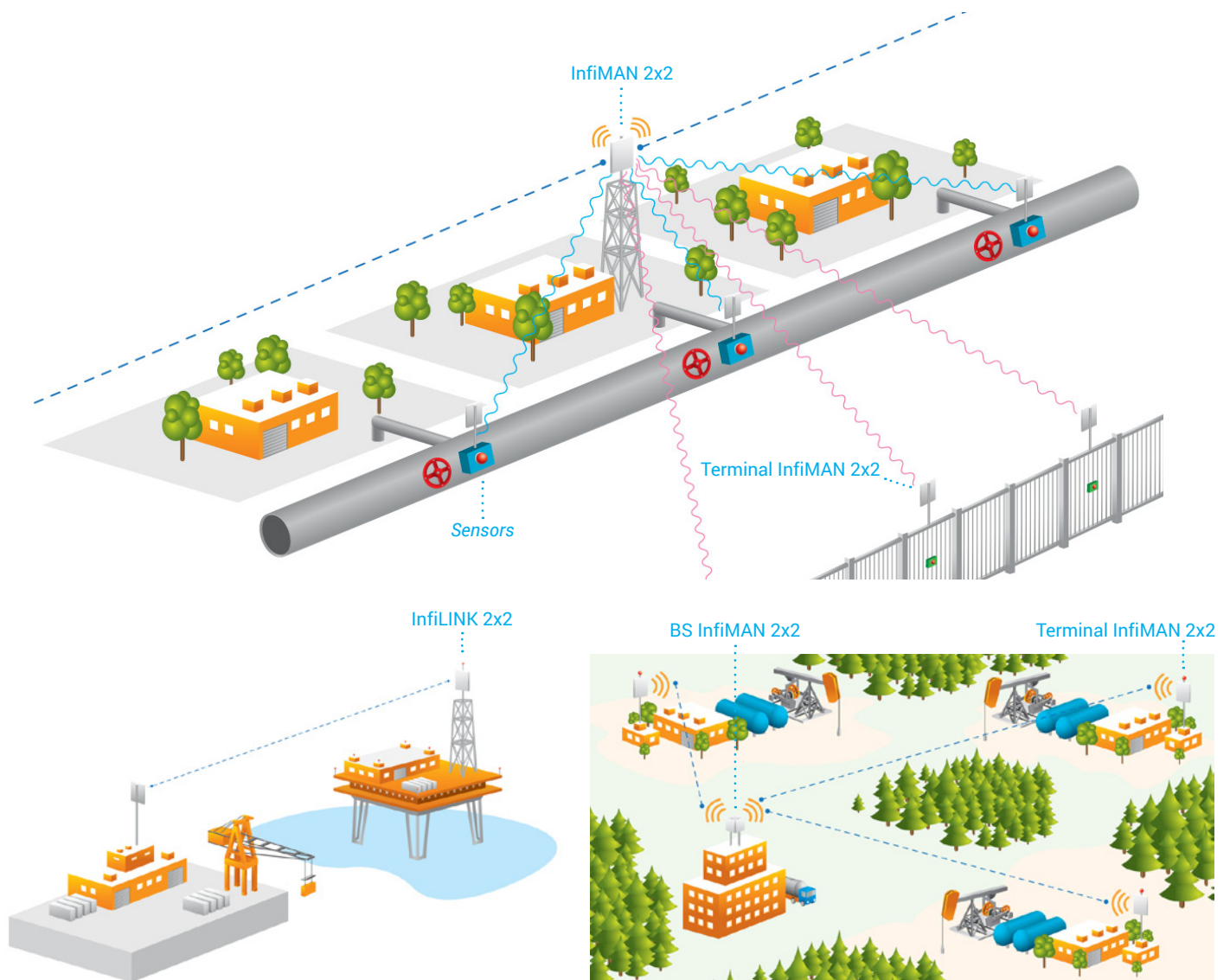
Figure 1 Remote areas connectivity and implementations for telemetry and monitoring in various industries

Remote monitoring and manipulation of industrial system are done through SCADA. In this case, the remote control system can be combined with data acquisition that can be used for displaying the online status of a remote equipment or logging various parameters (temperature, pressure, power consumption etc.). SCADA is a type of industrial control system that can be used to monitor and maintain public or private industrial, infrastructure and facility-based processes spread over multiple sites and over large distances. Industrial processes are represented by power generation, manufacturing, fabrication, production, refining, mining etc.

Infrastructure processes are oil and gas pipelines, electrical power transmission and distribution, water treatment and distribution, wastewater collection and treatment, wind farms, large communication systems etc.

Facility processes monitor and control facility access, energy consumption, heating, air conditioning systems, ventilation etc.

Why wireless infrastructure?

- Wireless networks can be deployed more easily compared with wired solution like optical fiber cost effective in areas where the data links are going over long distances

- Another advantage of wireless networks is that they can be easily adapted to new requirements if the area covered is changing, either if the propagation environment is changing or the end users are transferred to another region

- Point-to-point and point-to-multipoint connections are able to connect remote areas that can be located at more than 100 km away for point-to-point and more than 40 km for point-to-multipoint, in many scenarios the deployment being done in harsh environment

- One major advantage of wireless networks is that they can be deployed especially in remote areas with low spectrum utilization, in unlicensed frequencies, further improving the effectiveness and cost efficiency of the network

Why InfiNet Wireless?

In order to deliver high availability radio services in the long term, InfiNet Wireless has implemented for such extreme scenarios additional features needed to improve equipment's resilience and extend the geographical areas and activity sectors where such solution can be used.

- The rugged characteristics and capabilities to withstand harsh environments are guaranteed by specific certifications such as IP66 and IP67 which denotes that enclosures are able to protect the equipment against dust and powerful water jets with no harmful effects for at least 3 minutes, water volume of 100 liters per minute and pressure of 100 kPa at distance of 3 m. Another certification is ATEX compliance proving that the wireless solutions fully adhere to the Directive 94/9/EC which regulates equipment and protective systems intended for use in potentially explosive environments, such as in the oil and gas industry

- Another characteristic of this equipment is the "install and forget" concept: due to MTBF (Mean Time between Failures) figures spanning for decades with robust high-performance, fully ruggedized and cost-effective solution which enable customers save on OPEX and require low spare part supplies

- Temperature fluctuation can create serious problems for electronic equipment and proper care must be taken in designing a system to withstand such fluctuations. This can be obtained by the usage of high quality materials and by the introduction of heating and cooling mechanisms. InfiNet Wireless provides units with heating system and aluminum casing with embedded radiators, allowing a safe operation of equipment, either in the standard temperature range, between -40°C to +60°C, but also in extended temperature range, between -55°C to +60°C. Besides the heaters, InfiNet Wireless extended temperature units have a built in temperature sensor

Figure 2 InfiNet wireless units in very low temperatures

Built-in lightning protection system in the ODU (outdoor unit) and in the IDU (indoor unit) ensures protection for wired networking equipment when units are deployed in areas with frequent thunderstorms & lighting strikes.

Also, InfiNet Wireless provides several accessories for deployments in various scenarios, for example when the equipment draw energy from the renewable resources, like solar or wind:

▶ Injector IDU-LA-G can be used to power up ODU by third-party DC power source (for example to power the unit from solar power or wind power sources);

▶ AUX-ODU-INJ-G is an outdoor DC injector with built-in lightning protection compatible with all InfiNet Wirelss ODU units, serving as a first-line protection to the power supply and the outdoor unit or the network switch/ router connected to the radio. It reduces the complexity of the deployments in scenarios where DC power source is available on the rooftop eliminating the need of weather-sealed cabinets and lowering costs of implementation and maintenance

▶ AUX-ODU-LPU-G is an optional outdoor Lightning Protection Unit (LPU) designed to be used in demanding climatic scenarios and having GR-1089-grade protection certification greatly reducing the risk of replacing damaged devices operating in harsh environments or difficult-to-reach locations, protecting the ODU and

IDU from sudden power fluctuations induced by lightning strikes. Compared with the built in solution where the protection is suitable for indirect strikes the outdoor LPU is used for protection against direct lighting strikes where the electrical charge will seek a path to the ground either via the lightning protection system or any other metallic path, the behavior being mostly unpredictable, and this is why a proper planning for lightning protection is needed.

Proprietary developed advanced radio mechanisms ensure high link availability.

For long range scenarios the InfiNet radio products InfiLINK XG and InfiLINK 2x2 have a set of features that makes them the perfect candidates for such implemetations:

▸ Automatic modulation with several modulation types which ensures reliable data transfer even in area when signal strength is very low, such as BPSK ½ @-97 dBm Rx sensitivity with 5 MHz BW for InfiLINK 2x2 and QPSK@-95 dB Rx sensitivity (4.9 – 6.0 GHz) and QPSK@-93 dB Rx sensitivity (6.0 – 6.425 GHz) with 10 MHz BW for InfiLINK XG

▸ Flexible TDMA air frame duration (2 to 10 ms) and UL/DL transfer ratios

▸ High transmit power and system gain, for example up to 178 dB (based on a 28 dBi integrated antenna in 10 MHz channel width) for InfiLINK XG product

▸ High gain integrated antennas and support for high gain, high power external antennas

• 23 and 24 dBi antenna with recommended range up to 10-20 km and maximal range in excess of 30 km

• 27 and 28 dBi antenna with recommended range up to 15-50 km maximal range in excess of 60 km

Weatherproof enclosures, built-in lightning protection and built-in heater enable uninterrupted operation in the most extreme weather conditions, allow better cost savings installing the equipment across the globe without any need for additional equipment (i.e. thermal boxes, additional lightning arrestors, etc.).

Around The Globe Implementations

DONGYING OILFIELD, SHANDONG PROVINCE, CHINA PETROLEUM AND CHEMICAL CORPORATION
China

For this deployment, China Petroleum and Chemical Corporation required a reliable oil-well data collection and transfer and the implementation of a video surveillance system to maintain the on-site security. It was mandatory a wireless solution that could carrying video surveillance traffic reliably, having high capacity and availability in order to collect and transfer oil-well data. The implementation consisted of 34 point-to-point units of R5000-Mmx with 23 dBi integrated antenna gain, 28 R5000-Lmn units, 41 point-to-multipoint PTMP R5000-Omxb base stations and 113 R5000-Smnc and 65 R5000-Lmnc subscriber terminals deployed together with InfiMONITOR network management system.

Reliable wireless solution has been created by such deployment which met the beneficiary requirements, capable to carry telemetry and video surveillance traffic without jitter or delay, the entire oil filed being managed by one network management system.

EGYPTIAN ARMED FORCES, AIN SOKHNA FREE ROAD

Egypt

Egyptian Armed forces needed a high-capacity broadband infrastructure to provide real-time surveillance across the strategic Ain Sokhna Free Road, 120 km in length, including 24/7 monitoring of all of its 24 exit junctions and toll gates to meet the strict control, safety and security requirements. The network had to be able to provide a large number of data transmission channels, seamlessly combined into a single and manageable platform.

From InfiLINK 2x2 point-to-point family: Mmx and Smn units, obtaining radio links with a throughput ranging between 50 Mbit/s and 280 Mbit/s.

The network has been built on base of a flexible and easy to maintain platform, providing high capacity connection essential for real-time video and voice traffic, a scalable design, allowing for additional features to be quickly and easily added in the future; one such feature, which has been subsequently added, is the IP telephony system on all exit junctions.
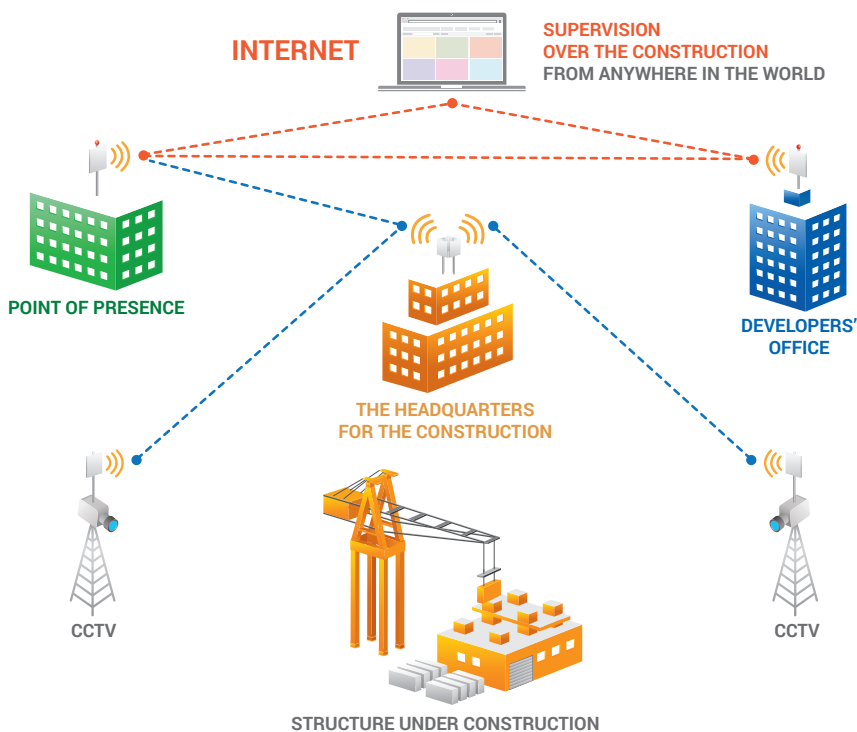
INTERNET

SUPERVISION
OVER THE CONSTRUCTION
FROM ANYWHERE IN THE WORLD

POINT OF PRESENCE

DEVELOPERS'
OFFICE

THE HEADQUARTERS
FOR THE CONSTRUCTION

CCTV

CCTV

STRUCTURE UNDER CONSTRUCTION

Figure 3 Wireless implementation for Donbassenergo power plants expansion and modernization

DONBASSENERGO

Ukraine

Donbassenergo, during the redevelopment project of the Starobeshivska and Slovianska thermal power plants, needed an advanced video surveillance solution for monitoring the construction site. In order to implement such solution, a new wireless infrastructure had to be deployed (which later, to be integrated in the company existing IT infrastructure).

The main requirement was 24/7 remote availability of video streams from the surveillance cameras in order to closely monitor the construction progress from anywhere on Earth.

The wireless network had to be flexible in order to modify the position of the subscriber terminals and cameras, depending on the site construction phase. It had also to be able to withstand high level of electromagnetic interference.

The solution which has been successfully implemented consisted of InfiLINK 2x2 PRO units for the point-to-point links and of InfiMAN 2x2 units for the point-to-multipoint links, with capacities of up to 280 Mbps; the wireless infrastructure permitted seamless integration with the local switching nodes.

SAMOTLORNEFTEGAZ, TNK-BP

Khanty-Mansyisk Region, Russia

TNK-BP needed to implement for Samotlor, oilfields situated in Khanty-Mansyisk autonomous region, a reliable network capable to transport existing SCADA applications and to provide Internet access and video surveillance.

Based on the results from an extensive field testing period, TNK-BP has chosen InfiNet Wireless technology due to resilience, capability to operate at temperatures that reached -50 °C, high link stability and ease of installation in harsh environments, high capacity with throughput of 60 Mbitps, flexibility, seamless VoIP and video streaming, subscriber terminals equipped also with high gain integrated antenna (28 dBi), high performance base stations and ability to support many remote terminals in a multipoint topology at ranges around 30 km.
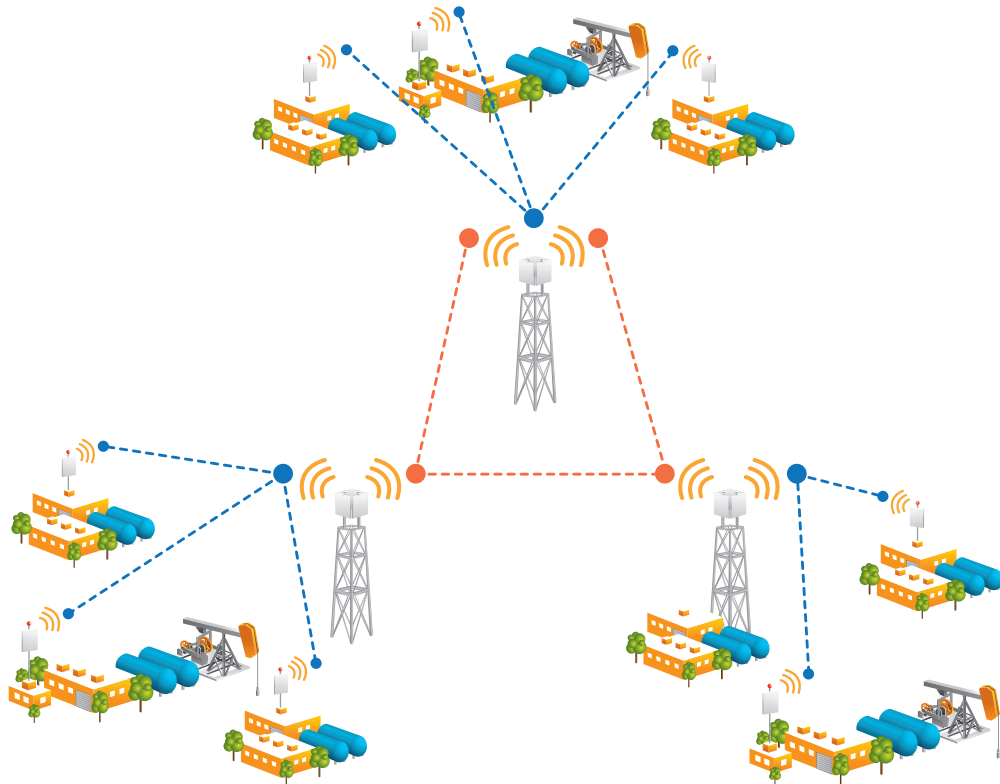
Cable technologies such as fiber optic were dismissed due to the high costs of implementation and concerns over the difficulties associated with laying cables in frozen soil and the difficulties in reaching the remote locations.

Figure 4 TNK-BP oil field surveillance and telemetry monitoring using InfiNet Wireless units

The solution implemented was based on the point-to-multipoint long range InfiMAN 2x2 base stations and high capacity subscriber terminals to cover the vast area of oilfield. The wireless infrastructure is capable to carry high quality voice transmission, corporate computing services, video surveillance and other security applications.

The deployed wireless solution consists on dozens of base stations and thousands of subscriber units and has enhanced the quality and reliability of monitoring remote sites and improved the production processes (based on the existing SCADA system). Now, the operators from the central control room can monitor parameters such as pressure in each individual oil well, oil consistence, temperatures, etc. and can remotely manipulate the relevant pumps to select alternative routes for the oil to be transported in the most appropriate pipelines to ensure these parameters stay within their safe ranges. New sites can appear on the oilfield, some old sites have been relocated or shut-down. With InfiNet Wireless solution, TNK-BP can now connect new sites quickly without moving or laying new cables, operations which would have added more costs and complexity to the implementation.
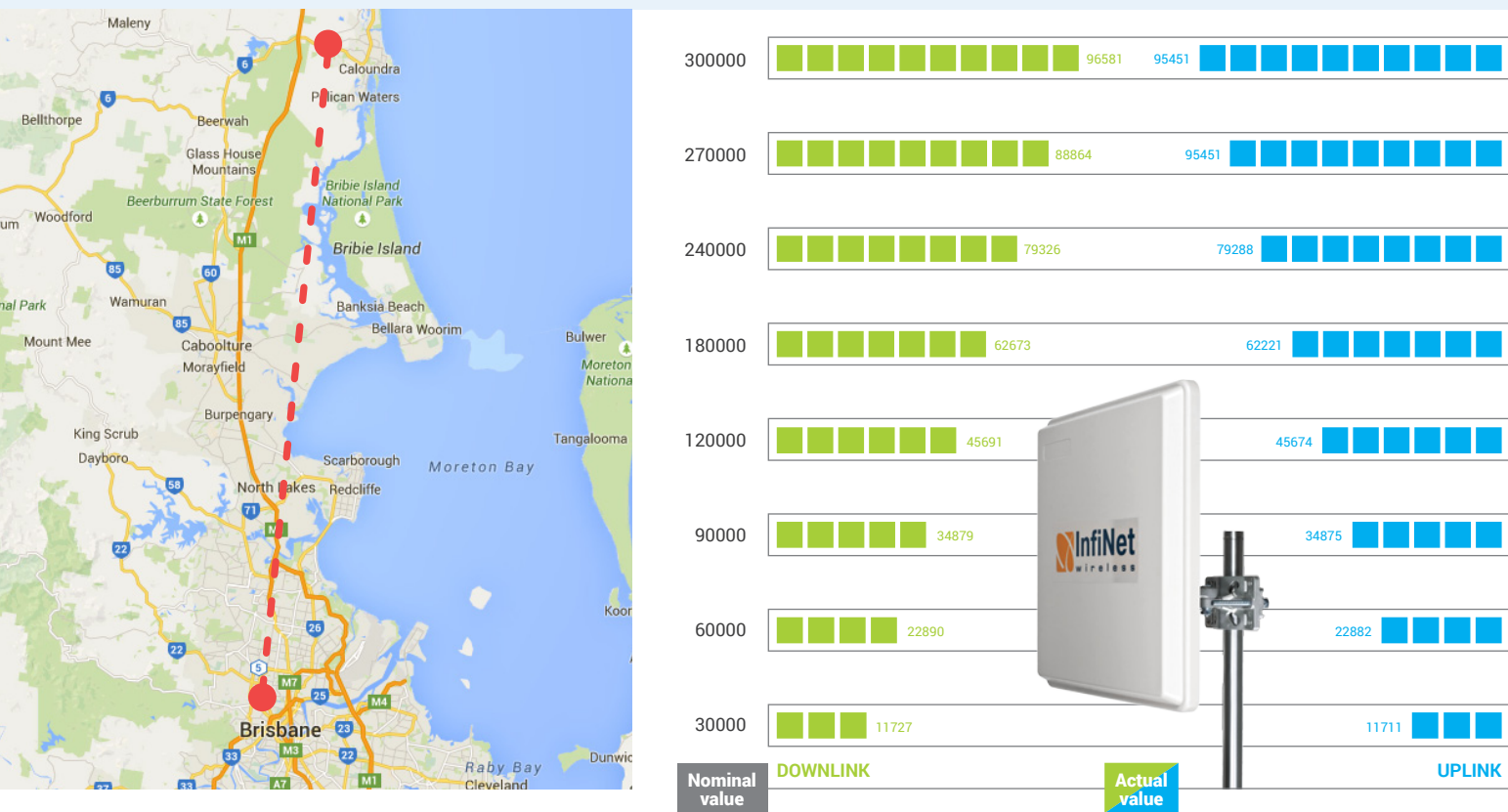
Figure 5 LUKOIL oil well telemetry monitoring using InfiNet Wireless units

LUKOIL

Russia

LUKOIL had a request to networking solution which can provide a real-time control of SCADA systems at well clusters in order for the extraction facilities to meet the latest industry ecological standards and safety policies. The equipment should be capable to operate in harsh environment with temperatures as low as -40 °C, support quality of service for traffic differentiation and cover for around 15 km.

The solution includes: a backhaul network with 3 InfiLINK 2x2 PRO units with more than 40 Mbps link throughput and a point-to-multipoint network designed with 12 InfiMAN 2x2 Mmt integrated antenna base stations to provide the requested coverage, 52 R5000-Smt and 25 R5000-Lmt subscriber terminals to ensure minimum 512 Kbps link capacity. At the same time it made possible better costs savings through licensing based on customer needs, smart spectrum utilization, QoS differentiation for data carried, very high MTBF operating all year round 24/7.

Nominal value   **DOWNLINK**   **Actual value**   **UPLINK**

Figure 6 Australia long range radio link details *(kbps)*

BRISBANE

Australia

In Australia a customer needed a long range solution to link two locations situated 76 km apart.

One equipment was installed in Brisbane and the other endpoint in Coloundra, connection being made possible using external 34 dBi high gain parabolic antennas Gabriel QuickFire with 1.2 meters diameter. The link provided a throughput of up to 200 Mbps aggregated traffic.

FLEX TELECOM

Moscow region, Russia

In Moscow region, Flex Telecom has set up two long range links location situated 52 km away and 30 km respectively, using InfiLINK XG model Xm/5.500.2x500.2x23 and has managed to obtain a throughput up to 308 Mbps for 40 MHz bandwidth for 52 km link and up to 214 Mbps at 40 MHz and 135 Mbps in the 20 MHz bandwidth for the 30 km non line of site link.

[**Figure 8** Cameroon long range link, with hop over Cameroon Mountain where solar power was used to supply electricity]

RINGO

Cameroon

In Cameroon, Ringo, a company specialized on providing accessible internet services and IT solutions in Central Africa. Ringo has implemented around 112 R500 units with integrated antennas in various areas of the country the longest range being 34 km.

For long range it has used R5000 units with 30 dBi gain external dish antennas reaching a distance of 84 km between endpoints. One of the record breaking links is a two hop link reaching 161 km needed for the implementation of the communication systems for Cameroonian coast guard. The destination site was an offshore platform at 70 km from shore, and 160 km from Douala, the height of the relay point was at 3300 m on the mountain in the area.

Conclusions

InfiNet Wireless point-to-point and point-to-multipoint products has been successfully used to connect remote locations, to create backbone for data transfer to the network control center, transporting voice, real-time video HD, telemetry and data streams, capable of link ranges in excess of 100 km for PtP and 40 km for PtMP configurations depending on the scenarios deployed, ensuring unprecedented resilience in harsh environments and delivering state of the art functionalities everywhere on the globe in hard to access areas where cable solutions are too expensive or physically impossible to reach.