

WIRELESS EXCELLENCE

Case Study

MobiNil selects CableFree for GSM network expansion
Cellular Wireless Networks



About Wireless Excellence

Founded in 1995 and with headquarters in Oxford UK, Wireless Excellence Limited is a leading designer and supplier of outdoor and indoor Broadband Wireless communication products.

With a complete range of solutions including Radio, Microwave, Millimeter-Wave, Free Space Optics, WiFi and WiMax solutions, customers in over 60 countries have chosen Wireless Excellence as the "one stop shop" solution of choice for dependable wireless networking.

The Customer Requirement

Cellular operator MobiNil is the largest GSM operator in the Middle East, with a network covering 91.1% of Egypt. Jointly owned by Orascom Telecom and Orange™, MobiNil has over 8 million subscribers and the latest GPRS and EDGE services.



For country-wide and rural coverage, GSM operators use “Macrocells” with Base Station installations covering 10-20km radius. However, to offer complete coverage in busy cities, airports and resort areas, cellular operators use a “Microcell” concept. Microcells are required for the network to cope with high density of users in cities, and RF “black spots”. Microcells cover a small area of a city, often under 1km diameter, and take traffic away from the Macrocells which would otherwise become congested, causing dropped calls, “network busy” signals and lost revenue. Microcells now create a specific problem: how to connect back all the network traffic to the main base sites.



Traditionally, cellular operators use licensed microwave links or leased E1 telecom circuits for Microcell connectivity – however, there are drawbacks: microwave links suffer from interference, limited spectrum available in busy cities, and high cost of spectrum licenses; copper E1 circuits are expensive to lease, are not available in all locations and can suffer interruption with digging or water in ducts.

Starting in 2005 MobiNil planned a major network expansion with hundreds of new Microcell sites due to go live in Cairo and other major cities in Egypt. Requiring innovative, cost-effective and reliable transmission solutions, MobiNil turned to CableFree.

The CableFree Solution

CableFree FSO products are ideally suited to the task. Unlike microwave, Free Space Optics (Optical Wireless, Infrared) does not suffer interference or require hugely expensive frequency licenses. CableFree FSO includes many features designed to increase reliability and uptime beyond that found in older solutions that had been experienced previously. Though radio and microwave solutions are offered for longer distances, Wireless Excellence confidently recommends FSO for the short links required to GSM Microcells.

Solution

A CableFree wireless solution offers the following features and benefits:

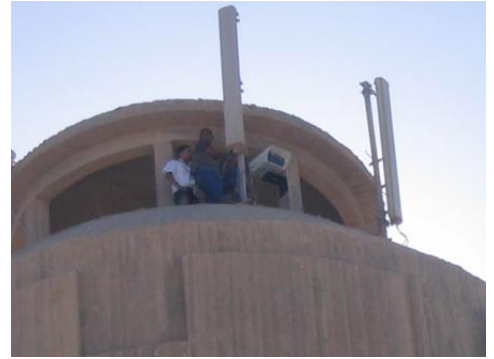
High Performance	1xE1, 2xE1, 4xE1, E3, STM-1/4, Gigabit Ethernet (1.25Gbps) on FSO, MMW, and Microwave, 220Mbps on Radio
Rapid installation:	3 hours achievable, 15 minutes temporary
Highly reliable:	99.999% availability achievable
License-free Operation:	No fees to pay on license free bands
No monthly rental fee:	Low maintenance solution
Diverse technology options:	Complete range of FSO, Broadband Radio, Microwave, MMW, WiFi
Fully manageable:	Advanced software tools
Resilient solutions:	1+1 Hybrid FSO+RF resilient link options
Highly Secure:	Proven inherently secure technologies
Low Total-Cost-of-Ownership (TCO):	Low CAPEX, no OPEX, Moveable asset
Safe & Environmentally friendly:	Low disruption during installation

CableFree products are field-proven, with thousands of deployments in over 60 countries since 1997. Excellence in performance and reliability are not sacrificed in providing highly competitive priced solutions together with a comprehensive range of support services.

Installation Requirements & Features

Installations on cellular GSM base sites have a few specific requirements worth noting.

Often the Macrocell (BSC/BTS) is located on a tall building or a mast, to give optimum wireless coverage. Mounting an FSO/laser system there can create challenges if the structure has any inherent movement. An example is shown here: A 30m tall water tower in the Red Sea resort of Sharm-El-Sheik. The height of the structure, solar heating effects and strong winds from the Red Sea all create low-frequency movement of the structure. However, the CableFree A2000 system shown here has 0.5degree beamwidth which is more than adequate to compensate for this. The unit has been carefully located to minimize any additional wind-loading effects, and in the customer experience is extremely good. Macrocell sites usually have -48V DC power available, which is preferred to ensure network uptime even in the case of AC power loss. Wireless Excellence has 48V DC power options to connect directly to these feeds.



The remote end of the link is usually connected directly to a GSM Microcell. Microcells are small "briefcase-sized" units which contain an entire miniature GSM base station. Network connectivity to the CableFree link is directly using E1 cables. Modern Microcells can be connected using a 2xE1 link which improves the network efficiency and cost by enabling "grooming" for daisy-chained links, inserting the GSM data in the correct timeslots. Microcells are typically connected to AC power along with the CableFree FSO unit; typically 115-240V depending on the specific country.

PCM data Cabling depends on the specific GSM equipment, either twisted-pair 120ohm balanced or coax 75ohm. CableFree supports both standards and also either E1 (2.048Mbps, Europe) and T1 (1.544Mbps, North America) data rates. The CableFree line cards perform full "3R regeneration" of the signal including jitter suppression so that timing is preserved across the link. This is important as certain Microcell devices use the E1/PCM signal timing to derive the RF transmit carrier frequencies.

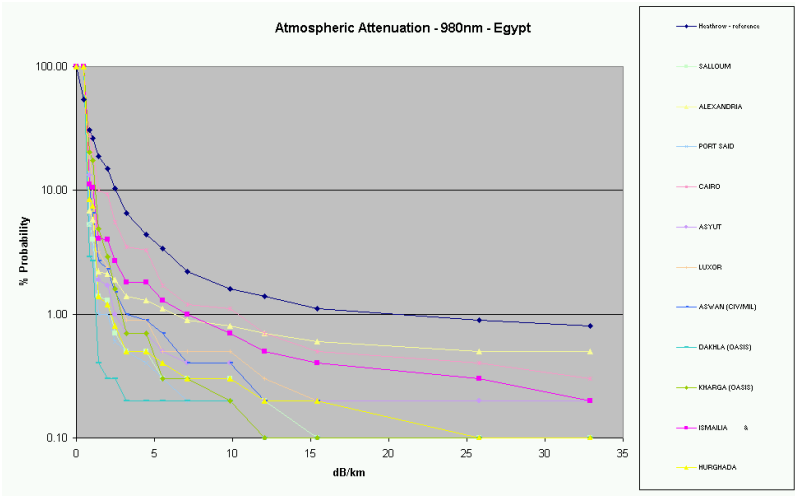


Weather and Availability

Specifically for the MobiNil project, CableFree was asked to predict link performance in Egypt. CableFree has a global weather database with over 2,700 cities worldwide to derive planning data. An example of modest dust storm in Cairo can be seen below. Visibility is still 2-3km, and the rule-of-thumb for CableFree FSO is "twice the visible distance" which translates to a potential 4-6km of transmission potential.



Dusty weather in Cairo, Egypt. "El Khamseen" brings dust from the Sahara desert which hangs in the air for days at a time.



Sample data from CableFree's Global Weather Database – 2,700 major cities from round the world are covered.

Performance of Optical links is determined by Visibility, which includes fog, dust and all other forms of loss, and then converted into dB/km of attenuation.

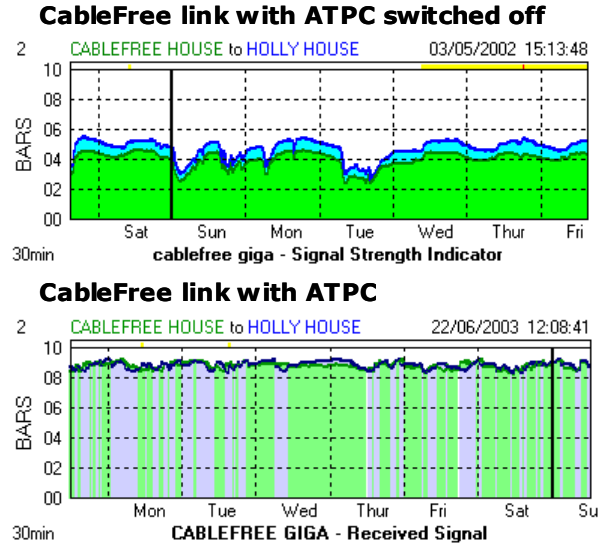
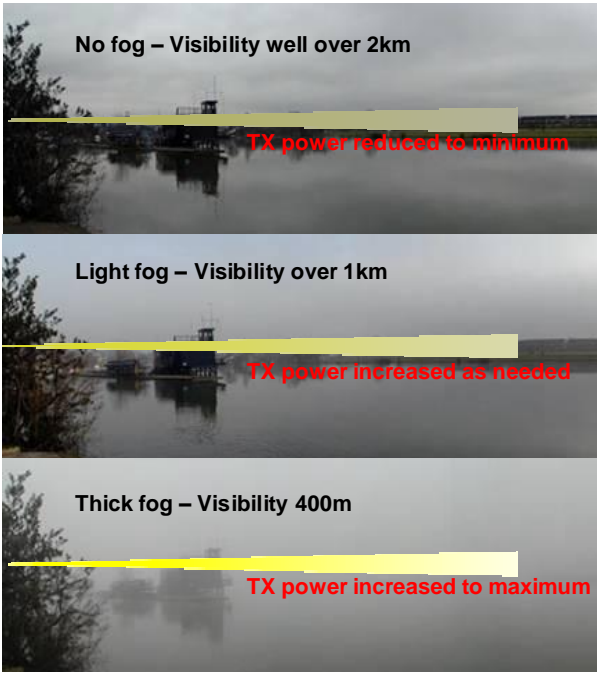
This data feeds into the Link Availability Calculator tool, seen below

CableFree has developed a complete range of planning tools including the Link Availability Calculator (seen on the right) which can predict link performance % for any product variant, link length and location.

System Specification		Link Availability Calculation	
Product Code	A2000	Country	UK
Bandwidth	155 Mbps	Location	London
Wavelength	980 nm	Derating Effect	Normal (none)
Range of Version	2000 m	Deployed Distance	2000 m
TX Power	350 mW +25.4 dBm	Link Margin	+23.6 dB
TX Beam Divergence	0.45 deg	Wavelength	980 nm
System Losses	-1.4 dB	Allowable Attenuation	+11.8 dB/km
RX Sensitivity	-38.0 dBm	Wavelength Factor	0.4
RX Overload	+0.0 dBm	Effect Derating Factor	1
Link Parameters		Allowable Attenuation (dB)	+29.5 dB/km
Deployed Distance	2000 m	Lookup Factors	0.954 0.946
Free Space Loss	-39.4 dB	Predicted Unavailability	0.2069 %
Power at Receiver	-14.4 dBm	Predicted Availability	99.793 %
Link Margin	+23.6 dB		

Automatic Transmit Power Control – up to 12dB more link margin

Early on CableFree realised that weather can have significant affect on FSO links. Earlier attempts by vendors to build FSO systems had often resulted in poor up-time due to limited link margins and other deficiencies. CableFree developed a unique technology Automatic Transmit Power Control (ATPC) which in addition to the natural dynamic range of the link adds an extra 12dB (16x) capability to combat "fade" conditions such as thick fog and dust storms.



CableFree links without (top) and with (above) ATPC turned on. The received signal level varies greatly without ATPC, due to fog and rain storms. With the system switched on, TX power is adjusted to produce near constant power at the receiver, making a huge improvement to link performance, availability and BER

Future-proof network upgrades

Note that the CableFree FSO units have modular, removable network interfaces. Simple card-swaps enable upgrade from 1xE1, 2xE1, 4xE1, E3 and STM-1 capacities. The link can be upgraded to allow for future expansion, for example additional capacity for GPRS, or overlay of 3G or WiFi hotspot services using additional E1 or Ethernet services. Unlike Microwave or older FSO products, this upgrade can be implemented in minutes, does not require significant CAPEX or require any link re-alignment.

Resilient links and options for longer distances

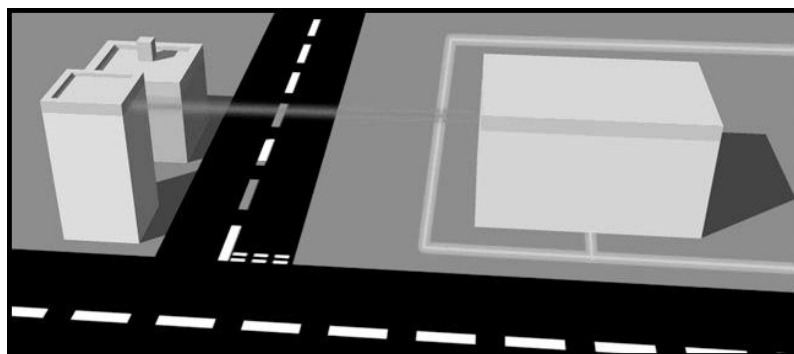
Wireless Excellence offers a complete range of wireless connectivity products, including Millimeter-wave, WiFi, WiMax and non-LOS OFDM radios in addition to FSO. Many operators are looking for alternatives beyond the traditional licensed microwave bands for transmission and also overlaying new broadband services using WiFi as well as WiMax.

For high reliability transmission, CableFree is promoting Millimeter Wave which can be used in addition to FSO for ultra high availability links. Millimeter Wave uses high frequency microwave technology above 40GHz, where the narrow beams and highly directional antennas mean that frequency re-use can be very high. Available bands include 65, 72, 86 and 95GHz. Millimeter-wave planning depends on rainfall, as opposed to the fog which dominates FSO. Customers can configure highly resilient 1+1 links with FSO plus Millimeter Wave to ensure extremely high uptime beyond that achieved by conventional microwave alone; more than 99.999% is achievable on modest path distances 3-4km or longer.

Training & Professional Services

For the MobiNil project CableFree worked extremely closely with local Cairo-based partner Wavecom Inc, to provide all aspects of training, installation assistance, network design, troubleshooting and network optimisation. CableFree believes strongly in close partnership and excellent technical support and supply of product is only one part of a successful project.

Application Diagram



Two or more vehicles or buildings are connected by CableFree wireless products. Clear Line-of-Sight (LOS) for FSO or Near-Line-of-Sight (NLOS) for radio is required.

Network connections (10/100/1000 Ethernet, E1/T1, video, voice) connect to the wireless units which can be mounted on tripods, rooftops, towers, poles or behind windows.

For permanent installation a site survey is recommended before installation, to determine suitable mounting points, location of cable runs etc. Installation involves physically mounting the equipment, aligning it, connecting data and power circuits and commissioning.

Recommended Products

CableFree Access	FSO Connectivity up to 155Mbps, range up to 4km
CableFree 622	FSO Connectivity up to 622Mbps, range up to 2km
CableFree Gigabit	FSO Gigabit Ethernet and Fibre Channel up to 1.5km
CableFree HPR-MIMO	Radio links up to 220Mbps, range up to 40km
CableFree HPR	Radio links up to 72Mbps, range up to 40km
CableFree MPR	Radio links up to 30Mbps, range up to 40km
CableFree MW	Licensed Microwave links up to 1Gbps, range up to 100km
CableFree MMW	60/70GHz Millimeter Wave links up to 1Gbps, range up to 100km

For More Information

Please contact Wireless Excellence Ltd for information on the complete range of CableFree products and services

T: +44 (0870) 495 9169
F: +44 (0871) 918 7618
E: sales@wirelessexcellence.com
W: www.wirelessexcellence.com

Wireless Excellence Limited
Sandford Gate
East Point Business Park
Sandy Lane West
Oxford OX4 6LB