MOBIUS NETWORKS

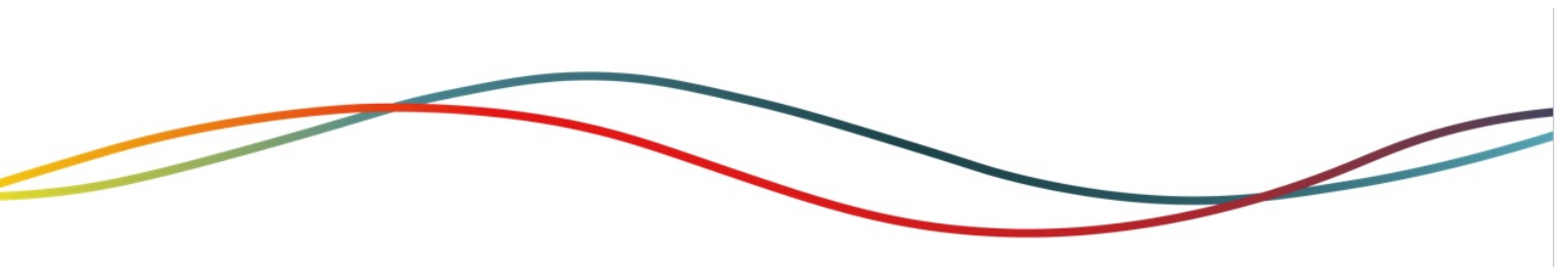# Everything that you need to know about Mobile Data but didn't know what to ask.

Brief Synopsis:

Using mobile data has been fraught with difficulties over the years for UTMC applications. This has resulted in only a few success stories.

Added to this, the world has just got more complicated and more dangerous with cyber-attacks on the increase, and a plethora of new methods to communicate with remote devices over the Mobile networks, based around the 5G standards. Where security has not been at the core of the design

A basic understanding of what is going to happen to the mobile network in the next 12 months and what is planned for the next 20 years, would be a good starting point for anyone who is considering upgrading any kind of traffic system within those time scales.

Armed with the right set of questions for suppliers, you can drastically improve the odds of delivering a successful project.

Background

I have had a varied career in the public sector. For the last 21 years it has revolved around data transmission, using radio frequencies instead of the traditional fixed wire approach. I have been involved in projects that have worked well and those that have failed. I have amassed a useful catalogue of anecdotal evidence of what has or has not worked.

During the presentation and this paper, I will share some of the common mistakes I have made and highlight the dangers and pitfalls 5G will bring.

The common threads throughout many projects and deployments have been, that the next big thing will be better and fix all the issues and little niggles, instead of examining why the technology is not delivering as expected. So 3G will give better connectivity and throughput than 2G/GPRS. Coverage and connectivity will be better with 4G than 3G. Now 5G will fix connectivity and reliability.

The second most common thread is the difficulty to commit revenue spend, regardless of the capital spent on a project or scheme (Planning, Design, Consultation, Infrastructure, Civils), There is the constant pressure to keep revenue spend to a minimum, this results in the cheapest data sim being sourced. This might seem reasonable but very often impacts the performance of the whole installation or project.
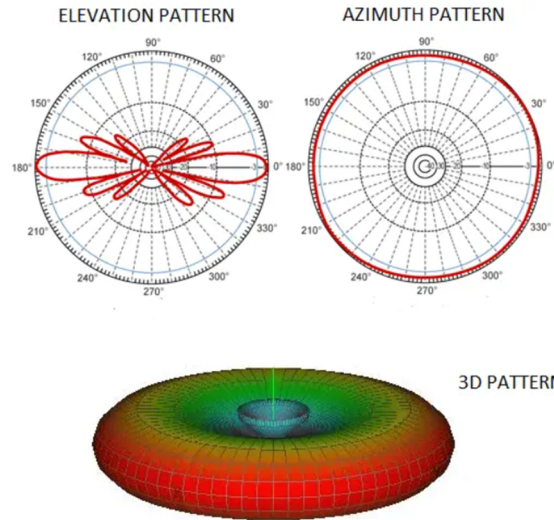
The Basics

Fig 1.

Antenna

If you plotted an antenna array signal it would appear like **Fig 1**. The signal would form a torus with some shaping of a beam through the centre of the ring. The antennas are designed to receive signal in the same manner. When siting the antenna this should be a consideration.

Below **Fig 2** shows placement of a puck antenna on top of a cabinet. The puck is designed to be mounted horizontally. This gives full 360° reception and transmission, giving the signal the best chance of being sent and received.

Placing the antenna on the side of the cabinet **Fig 3** the cabinet is shielding the antenna. The antenna is also in the wrong plane (vertical) for sending and receiving data from the mast.
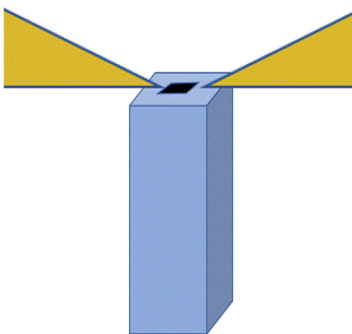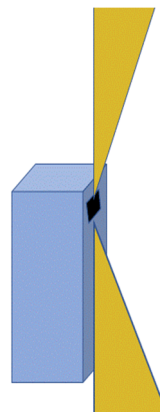

Fig 2

Fig 3

It is understandable that side mounting has found favour to prevent water ingress into the cabinet. All reputable antenna manufacturers' go to great lengths to ensure the antenna and seals provided will be water tight for the life of the installation. (Problems can occur when inferior quality antennas are deployed, because of either pure cost or they are poorly specified).

Over the years I have seen water ingress as a result of Silicon sealant being used as a failsafe in conjunction with the neoprene gaskets. The silicon adhesion has failed over time and allowed water to pass between the silicon and neoprene gasket which is not in direct contact with the surface of the cabinet, thus allowing water to ingress.

The final point on antennas is to be aware of cable lengths, even very low loss cable will result in -0.5 dB per metre. The antenna should be as close to the modem/router as possible. The illustration below shows the cable running from a cabinet to the nearest pole. The net result of the Router/Modem has a drop in signal of 7.5dB, in areas where signal strength is poor this can make the difference between a successful deployment and a poorly performing site. (See Fig 4 below).

Fig 4

Antenna 5dB gain

Cable loss 0.5 dB per M

5- (0.5 x 15M) = -2.5dB   5M

1M

9M
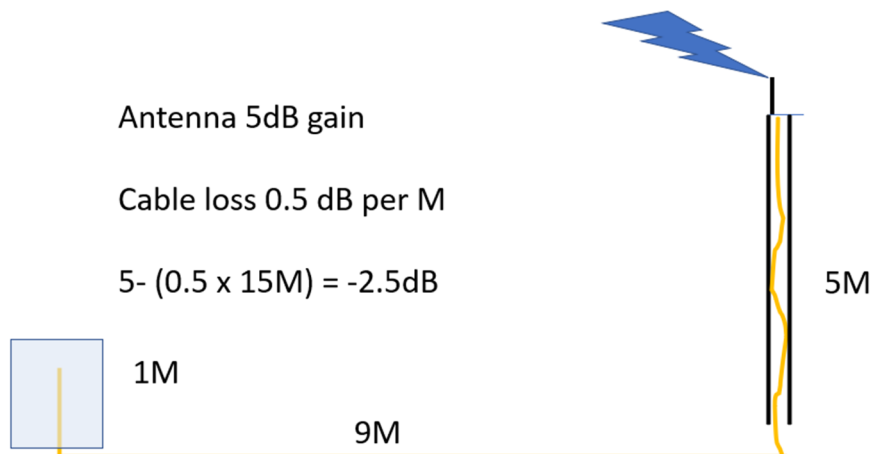
The unit would have performed better with no antenna fitted, than this common installation

Heinz Beans or Ford??

A SIM is a SIM and Mobile data is just Mobile Data. This is the most common held principle I have experienced over my years working with mobile data. Project teams and procurement professionals assume that they are buying a commodity when purchasing mobile data. One buyer compared it to Heinz beans, they could buy Heinz beans from the food hall in Harrods and it would cost 40% more than if he bought them from Asda. His point was that the product is the same, regardless of the price, Heinz beans are Heinz beans.

Mobile Networks, however, are not like Heinz they are more like Ford. Ford has many products that all sport the Ford badge, from a Ka to a tractor and HGV 's but all aimed at different markets. The analogy I use is that you want to move two sheep from one field to another, you know the farmer down the way uses a Ford. You are new to farming so you ask the guy who sorted your grain and combine harvester to get a Ford to move two sheep. The guy call's up his local ford dealer and says he needs to move some stuff, what is the cheapest thing they have? The dealer says he has a Ka that you can fold down the seats to get stuff in, and so your guy buys it and has it delivered. A Ka arrives on your drive, you look and it says Ford on the front, so you do not think to question the guy who has helped you out. You struggle to get the sheep in the Ka, but eventually you move them to the next field .

Later you have a pint with the next farmer along and you start to complain how hard it is to move sheep in the Ford. The other farmer is bemused as he just drops the tail gate and throws them in the back, and questions if you really have a Ford. You both walk outside and see your Ford Ka parked alongside a Ford Pickup. Both vehicles have Ford on the front, they will both carry sheep, one Ford is designed to carry any load, the other Ford can carry sheep, but is not really suitable to the task. While it may be less obvious, it is the same with Mobile networks, they have different products for different markets. There are three Pricing Models offered by the Mobile Network Operators (MNO's)

A SIM with a mobile voice tariff will carry data too. The Network will only offer 85% availability which is more than adequate for that market. If your mobile does not connect you will wait or move to another location until you can connect. (This data is the cheapest available, but the least reliable method to send and receive data). *(85% availability equates to over 14hrs a month off line)*

> **Data only** SIMs fall into two variants to serve two separate markets. The first is MBB (Mobile Broad Band) SIMs for, Laptops, smart devices and Wi-Fi hubs. The other market is M2M (Machine to Machine) or IoT (Internet of Things) also known as I IoT (Industrial Internet of things).

> **MBB** is aimed at occasional use even if it is sold as 'All you can eat.' However, it does have data limits outlined in the T&C's under the 'Fair use policy', it too offers 85% availability. As with the voice SIM, if you cannot connect, the application will buffer or you will wait and try again. This data offering at face value appears to be the cheapest priced data from the networks. The expectation of the networks

is that the SIM is not connected 24/7 (people sleep sometimes). It is the pattern of use, that the networks use to police the fair use policy.

M2M SIMs are expected to be connected all the time; the network expects them to be connected for long periods (Machines do not need sleep) . The networks offer 95% availability as a minimum for this market. (This is the most expensive tariff from the Networks but it is the most reliable method to send and receive data).

The few percentage points difference between the different products makes a real difference in performance over time. 99% availability means your service is down over 7 hours a month. 99.99% reduces that to around 7 minutes. This difference can save many hours and thousands of pounds trying to get around the fact that the wrong tariff is procured to the SIM you have supplied for your project.

Security

The world has changed dramatically over the last few years with the number of cyberattacks growing exponentially and from many sources. These range from straight on ransomware attacks, to more sinister Spy Bots or just to take down your network completely.

I do not want to be the harbinger of doom, but it is important now more than ever that we all take security seriously. Ticking boxes such as the supplier has ISO 27001 and so do we, so job done, is a recipe for disaster. With names as diverse as Sierra Wireless to KP Snacks and the BBC being hit this year, it is not going to be if you are attacked, but when. It would be very wrong to think our industry will be exempt from attack, because on the most part the attacks are not targeted, they are random events. The National Cyber Security Centre likens them to a burglar walking down a street trying door handles and looking for open windows to gain entry. Once in they will just take whatever presents itself to them.

Collaborating only with trusted partners and ensuring they only collaborate with trusted partners as well is the simplest strategy to maintain security. The Chain is only as strong as its weakest link. With its emphasis on third party penetration testing, Cyber Essential Plus should be the minimum standard that any organisation should accept from any partner.

Failing to think seriously about security, for a Public Authority, would be embarrassing at least. If all the Traffic Infrastructure stopped working, at the press of a button as part of a ransomware attack, for the Suppliers, the loss of reputation could wipe huge sums off the bottom line and share value.

Death of 3G and the implications for 2G

It may or may not be a surprise that at the end of 2022, 3G will start to be withdrawn by all the UK networks. I wish I could share with you an elegant carefully thought out plan for the sunsetting programme. Unfortunately, there is no coordination between networks or overall unifying strategy. Some networks will move very quickly to re-farm the frequencies of 3G and recover some of the 2G frequencies too. The networks will also be hollowing out 2G, as the networks anticipates the only users of 2G are low data meters and emergency call (999). Others will take a more measured approach, either way it would be prudent to be prepared for the worst case scenario that from 1st January 2023 your devices will see poor 3G coverage and a deterioration in 2G throughput. It may also be true that your devices may be connected all the way through to the eventual turn off sometime in 2024. But it will be a lottery.

Highlights of 5G

NB IoT
Narrow Band-Internet of Things (NB-IoT) is a standards-based low power wide area (LPWA) technology developed to enable a wide range of new IoT devices and services. NB-IoT significantly improves the power consumption of user devices. This will allow battery life of more than 10 years for a wide range of static monitoring applications.

The level of security offered by the mobile networks and the utilitarian nature of the service gives it an advantage over bespoke public frequency services like LoRaWAN or SigFox that do not have national coverage in the UK.

LTE -M
LTE-M is the simplified industry term for the LTE-MTC low power wide area (LPWA) technology standard which provides extended coverage. The through put is higher than NB IoT and represents a direct replacement for 2G/3G applications as the 2G&3G frequencies are re-farmed as part of the 5G upgrade rollout.

As with NB IoT all major mobile equipment, chipset and module manufacturers support this functionality. LTE-M networks will co-exist with 2G, 3G, and 4G mobile networks and benefit from all the security and privacy features of mobile networks., It offers far greater throughput and levels of Security than LoRaWAN and SigFox and supports mobile (moving) deployment.

Network Slicing
Is a separated, self-contained, independent, and secured part of the network, targeting different services with different requirements on speed, latency, and reliability. An Authority may want to buy a 'slice of the network' to run critical applications such as CCTV, thus having all the advantages of a private network (with guaranteed

through put and availability) without any of the down sides of trying to maintain their own dedicated hardware.

ULLC

Ultra-Reliable, Low Latency communications is a new function of 5G. It will deliver communications in under 5ms, with increased reliability. This will allow connected and autonomous vehicle applications to be operated safely.

The ultra-low latency and Gigabit per second transmission speeds are the head line figures often quoted. But what is not explained, by either the networks or hardware suppliers are the additional steps and infrastructure that needs to be in place to deliver them. Such as edge computing and dedicated data pathways.

ULLC could have it's own paper and presentation, such is the level of complexity and understanding that is required to deploy the technology. If ULLC is of interest, please contact me