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Implementation of Wireless Sensor Networks for Long Range

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Abstract: **the wireless sensor implementation is mainly on low power applications. It is a short range communication over the protocols. To improve the range of wireless networks by using sensor technology. Here, adeptave technology is require to achive the long range Wireless networks form the backbone of the ICT infrastructure supporting a smart sustainable city. This chapter looks at the infrastructure elements of a wireless network.**

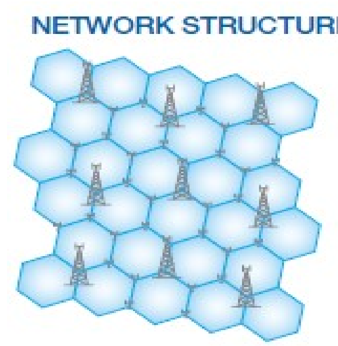
Keywords: **long range comm., wireless sensor network, multi level comm.,**

1. INTRODUCTION

Infrastructure overview: Wireless networks utilise various wireless technologies to connect ICT devices to a common platform or core network. In many cases the ICT devices through a core network are connected to the internet enabling true global access and interconnection.

Mobile network base stations and antennas: Mobile networks rely on a network of base stations that send and receive data from the ICT devices. Base stations need to be located close to users to maximise efficiency providing a good quality connection, low RF EMF. Each base station consists of an equipment cabinet with transmitters and receivers that are connected to external antennas mounted on a supporting structure.

Figure.1. Example wireless network structure and antenna sites distributed across a city



Macro, micro, femto-cell, in-building base stations. Wireless base stations consist of various types depending primarily on the required coverage and service area.

Macro Base Station - A Macro base station utilises antennas mounted on a tower, pole or building rooftop and typically covers a larger geographic area.

Micro Base Station – A micro base station utilises small antennas mounted on a structure close to the ground. Micro base stations typically cover a small geographic area.

In Building Base Station – ICT systems can be connected inside buildings such as multi-storey office buildings, shopping centres, apartments, and underground railway systems by installing specially designed “In-Building” systems. These systems are sometimes referred to as Distributed Antenna Systems (DAS) or In-Building Coverage (IBC) and operate in a similar way to external base stations but at much lower power levels.

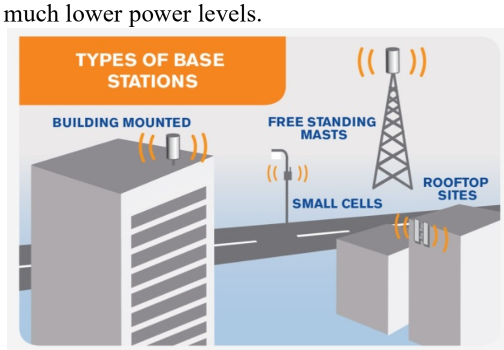


Figure 1 Micro base station on street light and macro base station on building and tower

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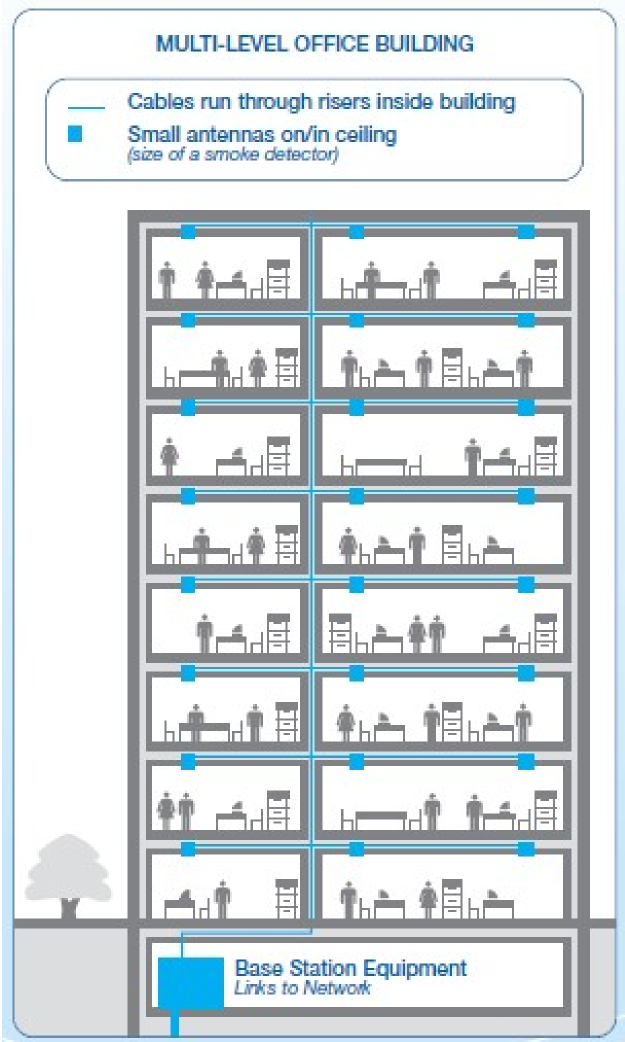

Figure.3. Multi level office building

A dedicated in-building system usually consists of:

- Base station equipment, often located in a Facilities room or other service area; and
- Cables which run from the base station through the building risers connecting the base station equipment to antennas; and
- Small antennas located on ceilings or walls in strategic locations.

Sharing & Co-Location

There is an increasing trend for mobile network operators to adopt a variety of infrastructure models. This is being driven mainly by commercial and efficiency considerations, rather than regulatory mandates. Sharing can also permit the collocation of smart city infrastructure with the equipment of wireless network operators. Infrastructure sharing may be passive or active.

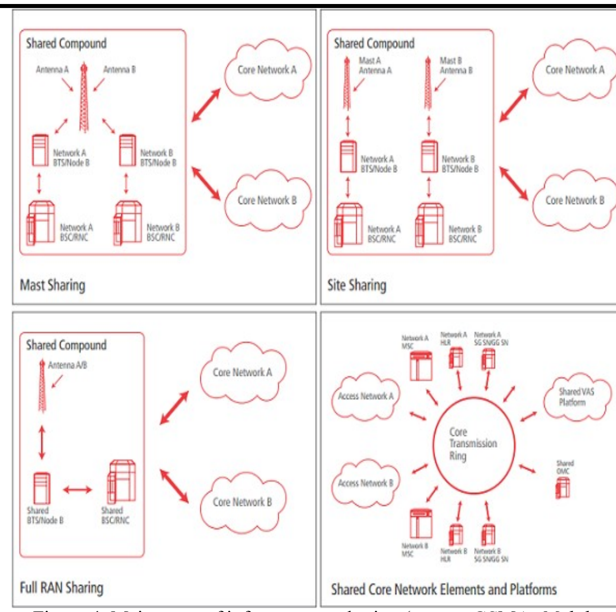

Figure.4. Main types of infrastructure sharing (source, GSMA, *Mobile Infrastructure Sharing*, 2008)

Passive sharing includes site sharing, where operators use the same physical components but have different site masts, antennas, cabinets and backhaul. A common example is shared roof-top installations. Practical challenges include availability of space and property rights. A second type of passive sharing is mast sharing where the antennas of different operators are placed on the same mast or antenna frame but the radio transmission equipment remain separate.

In active sharing, operators may share the radio access network (RAN) or the core network. The RAN sharing case may create operational and architectural challenges. For additional core sharing, operators also share the core functionality, demanding more efforts and alignments from operators. Again there may be issues of compatibility between the technology platforms used by the operators.

Infrastructure sharing has the potential to:

- Lead to faster and wider roll-out of coverage into new and currently underserved geographical areas
- Strengthen competition
- Reduce the number of antenna sites
- Reduce the energy and carbon footprint of mobile networks
- Reduce the environmental impact of mobile infrastructure on landscape
- Reduce costs for operators
- Active sharing of the frequencies optimizes the use of the RF spectrum and increases data speeds.

In some cases, site sharing increases competition by giving operators access to key sites necessary to compete on quality of service and coverage; sharing improves roaming. Governments may also consider positive incentives to roll out into underserved areas.

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In both passive and active sharing it is necessary to consider possible effects on RF exposure levels and compliance boundaries. As discussed in section 7.2.2 antennas that are close together or operating at higher powers may have overlapping compliance zones leading to a combined zone that is larger than the individual antenna zones. Antennas that are shared by more than one operator may have higher combined transmitter powers.
Nearby residents may be considered that more antennas in the surroundings will lead to higher exposure levels at the ground in publicly accessible areas. Measurements in Germany demonstrated that neither distance to the antenna nor the number of visible antennas were good predictors of RF exposure instead it is the orientation of the antenna main lobe that is the main factor influencing exposure (Bornkessel et al., 2007).
Wireless communication antennas should be positioned so that locations where the public exposure limits may be exceeded are not reasonably accessible to the general public. This can be achieved by choice of the antenna location or the use of barriers to restrict access.
Low power antenna installations and wireless access points have simplified position requirements and guidance may be provided by the equipment manufacturer.
Higher power antennas are generally mounted above head height (sometimes on a short antenna mounting pole) or on the outer surface of buildings where it is not possible for the public to access areas in front of the antennas. Such antennas have directive antenna patterns that substantially decrease the exposure to directions above the horizon and to the ground near the antenna tower. In locating antennas information from the assessment of compliance may be used to determine whether compliance zones could reach adjacent buildings. This could require a change in antenna position or reduction in transmitter power.
In considering the use of physical barriers to restrict access a number of options are possible:

- Rooftop access controls: This may include a locked ladder or rooftop door with permission required and information available for persons needing to access the rooftop.
- Physical Barriers: Non-metallic screens, fences or chains can be used to indicate areas that should not be entered by members of the public.

In some cases painted lines may also be used to indicate compliance boundaries but their effectiveness depends on the awareness of persons who may access the area.
The building owner is often provided with information on how to arrange access for persons such as maintenance personnel who may need to work in areas close to or in front of antennas.

2. SIGNAGE

In general signage requirements should be appropriate to the technical parameters of the wireless equipment/antenna and the accessibility of the site.
Low power installations where the compliance zone is within the equipment will generally not require signage. For other installations signs should be placed near to the compliance zone boundaries. The IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz [C95.7-2005] provides guidance on the installation of signs. Depending on the region RF EMF safety signs may require multiple languages to ensure understanding.

3. Wi-Fi

Wi-Fi, short for Wireless Fidelity, is the term used to describe high speed wireless network connections over short distances between mobile computing devices such as laptops and the internet. These are sometimes termed wireless local area networks or WLAN's.

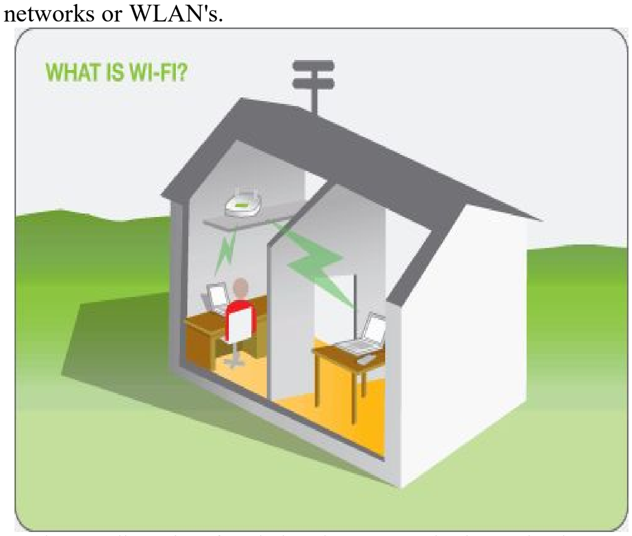

Figure.6. Illustration of a Wi-Fi modem connected to laptops in a home

4. WiMAX

WiMAX, the Worldwide Interoperability for Microwave Access, is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways. WiMAX provides an alternative internet wireless access technology to broadband cables and digital subscriber lines (or DSL). WiMAX networks enable a variety of options for broadband connections. WiMax networks are essentially a larger version of a Wi-Fi network.

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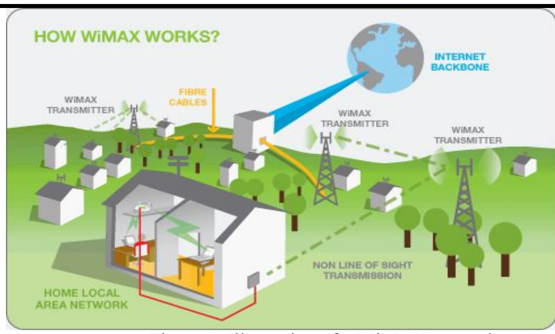

Figure.7. Illustration of a WiMAX network

Bluetooth: Bluetooth wireless technology is a short-range radio technology that uses radio frequency fields to transmit signals over short distances between telephones, computers and other devices. The technology offers simplified communication and synchronization between devices without the need for cables.

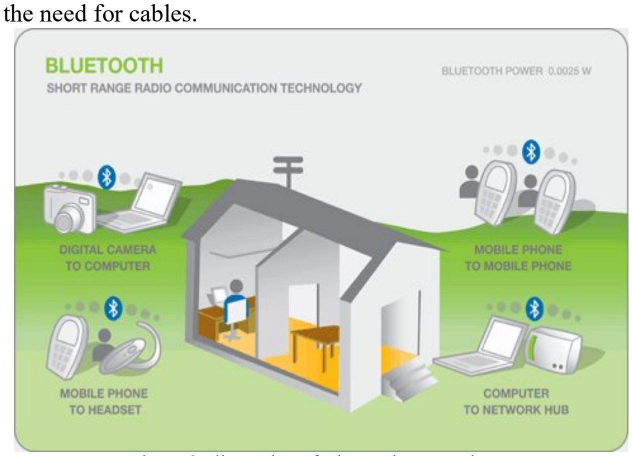

Figure.8. Illustration of Bluetooth connections.

5. DECT

DECT stands for Digital Enhanced Cordless Telecommunication. DECT is a common standard for cordless telephones and is a radio technology suited for voice, data and networking applications in residential, corporate and public environments. Many cordless phones used in residential homes use DECT technology.

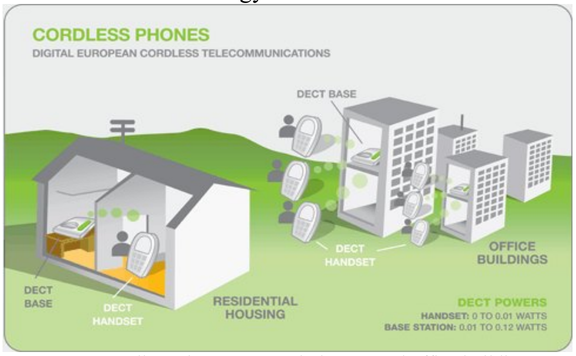

Figure.9. DECT cordless phone systems in homes and office buildings.

ICT Antenna siting approval requirements Public wireless communications and ICT systems are critical national infrastructure for today's society particularly in times of emergency and disaster. Consistent planning rules for ICT infrastructure are critical for the efficient deployment and operation of ICT systems. Fragmented planning authority rules may delay network deployments and lead to ICT systems not functioning or providing intermittent service which in some medical cases may be life threatening.

6. CONCLUSION

This report limits discussion of environmental impact assessment to matters related to the siting of wireless network infrastructure. This section is based largely on the New Zealand Ministry of the Environment National Environmental Standards for Telecommunication Facilities: Users' Guide (Ministry of the Environment 2009). The National Environmental Standards for Telecommunication Facilities (the NES) is a binding regulation and replaces certain existing rules in district plans and bylaws that affect the activities of telecommunications operators. Every local authority and consent authority in New Zealand must observe national environmental standards and must enforce the observance of national environmental standards to the extent their powers enable them to do so.

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